FCC CFR47 PART 15 CERTIFICATION
CLASS II PERMISSIVE CHANGE
TEST REPORT

FOR

WLAN PC CARD

MODEL NUMBER: LA-4131

BRAND NAME: SPECTRUM-24

FCC ID: H9PLA4131M

REPORT NUMBER: 03U1960-1

ISSUE DATE: JUNE 05, 2003

Prepared for
SYMBOL TECHNOLOGIES, INC.
6480 VIA DEL ORO DRIVE
SAN JOSE, CA 95119
USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561 F MONTEREY ROAD
MORGAN HILL, CA 95037, USA
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1. TEST RESULT CERTIFICATION

COMPANY NAME: SYMBOL TECHNOLOGIES, INC.
6480 VIA DEL ORO DRIVE
SAN JOSE, CA 95119 USA

EUT DESCRIPTION: WLAN PC CARD

MODEL NUMBER: LA-4131

DATE TESTED: MAY 15 TO MAY 21, 2003

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

CHIN PANG
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The EUT is a WLAN operating over the 2400 to 2483.5 MHz band with an output power of 17.8 dBm (60 mW). Additional antennas and antenna types are added, as follows:

RF Exposure Antenna Summary

Network Systems Organization
Source Based

FCC ID: **H9PLA4131M** WLAN PC Card, 11 Mbps, T3
Output Power: 60 mW Class II Permissive Change

Mobile DC Factor: 0.720
Portable DC Factor: 0.710

Mobile Antennas

Ant No	Description	Symbol P/N	Type	Min Cable (In.)	Gain (dBi)	EIRP (mW)	MPE (cm)	TR Status	Device Type	Prof Install
01.	Panel 8.5, 120° Sector	ML-2499-11PNA2-01	Panel		8.5	427	4.9	See # 11	Fixed Pt - MultiPt	☐
02.	Panel 9.5, 65°	ML-2499-12PNA2-01	Panel		9.5	538	5.5	See # 11	Fixed Pt - MultiPt	☐
03.	Panel 6.3, 80°, Diverse	ML-2499-7PNA2-01	Panel		6.3	254	3.8	See # 11	Fixed Pt - MultiPt	☐
04.	Rubber Duck, Cushcraft	ML-2499-APA2-01	Dipole		2.0	95	2.3	See # 9	Fixed Pt - MultiPt	☐
05.	Pipe Bomb 11" x 48"	ML-2499-HPA3-01	Dipole		4.9	184	3.2	See # 9	Fixed Pt - MultiPt	☐
06.	Panel HD 6.3, 65°	ML-2499-PNAHD-01	Panel		6.3	254	3.8	See # 11	Fixed Pt - MultiPt	☐
07.	Patch, 2.3, 48"	ML-2499-SD3-01	Patch		2.3	101	2.4	Tested	Fixed Pt - MultiPt	☐
08.	Patch, Diversity	ML-2499-SDD1-01	Patch		2.3	101	2.4	See # 7	Fixed Pt - MultiPt	☐
09.	Dipole 25" x 7"	ML-2499-BMMA1-01	Dipole	120	3.9	148	2.9	Tested	Fixed Pt - Pt	☑
10.	Dish, 18, 10°	ML-2499-BPDA1-01	Dish	120	20.9	7426	20.6	Tested	Fixed Pt - Pt	☑
11.	Panel 14.5, 31°	ML-2499-BPNA3-01	Panel	120	11.4	833	6.9	Tested	Fixed Pt - Pt	☑
12.	Yagi, 13.6, 34°	ML-2499-BYGA2-01	Yagi	120	13.1	1232	8.4	Tested	Fixed Pt - Pt	☑

Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi. The highest fixed point-to-point antenna gain, including coaxial feed cable, is 20.9dBi.

(20.9 dBi – 6 dBi) / 3 = 5 dB, therefore the output power limit is 30 – 5 = 25 dBm, and the EUT output power is 17.8 dBm.

Except for point-to-point operations the output power must be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. The highest such antenna gain, including coaxial feed cable, is 9.5 dBi.

(9.5 dBi – 6 dBi) = 3.5 dB, therefore the output power limit is 30 – 3.5 = 26.5 dBm, and the EUT output power is 17.8 dBm.

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TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

3.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

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3.2. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	ELA-171
Taiwan	BSMI	CNS 13438	商檢 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

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4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

4.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Quasi-Peak Adapter	HP	85650A	2521A01038	7/16/04
SA Display Section	HP	85662A	2314A04793	7/16/04
SA RF Section	HP	85680A	2314A02604	7/16/04
Horn Antenna (1 - 18GHz)	EMCO	3115	6739	2/4/04
Antenna, Biconical	Eaton	94455-1	1214	3/06/04
Antenna, Log Periodic 200-1000MHz	EMCO	3146	9107-3163	3/06/04
Preamplifier	Miteq	NSP10023988	646456	4/26/04
Spectrum Analyzer	HP	8593EM	3710A00205	6/11/03
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.

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5. SUPPORT EQUIPMENT / EUT SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	PPL	NA	DoC
PCMCIA Extension Board	NA	NA	NA	NA
AC Adapter	Dell	DA-2	85391	NA

I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US115V	Un-Shielded	2m	NA
2	DC	1	DC	Un-Shielded	2m	NA
3	RF	2	BNC M	Un-Shielded	10cm	NA
4	RF	2	Coax	Un-Shielded	100m	NA
5	RF	2	BNC M - N M	Un-Shielded	30cm	NA

TEST SETUP

The EUT was operated as a standalone device, using an Ethernet connection to make setup adjustments. Each antenna is external.

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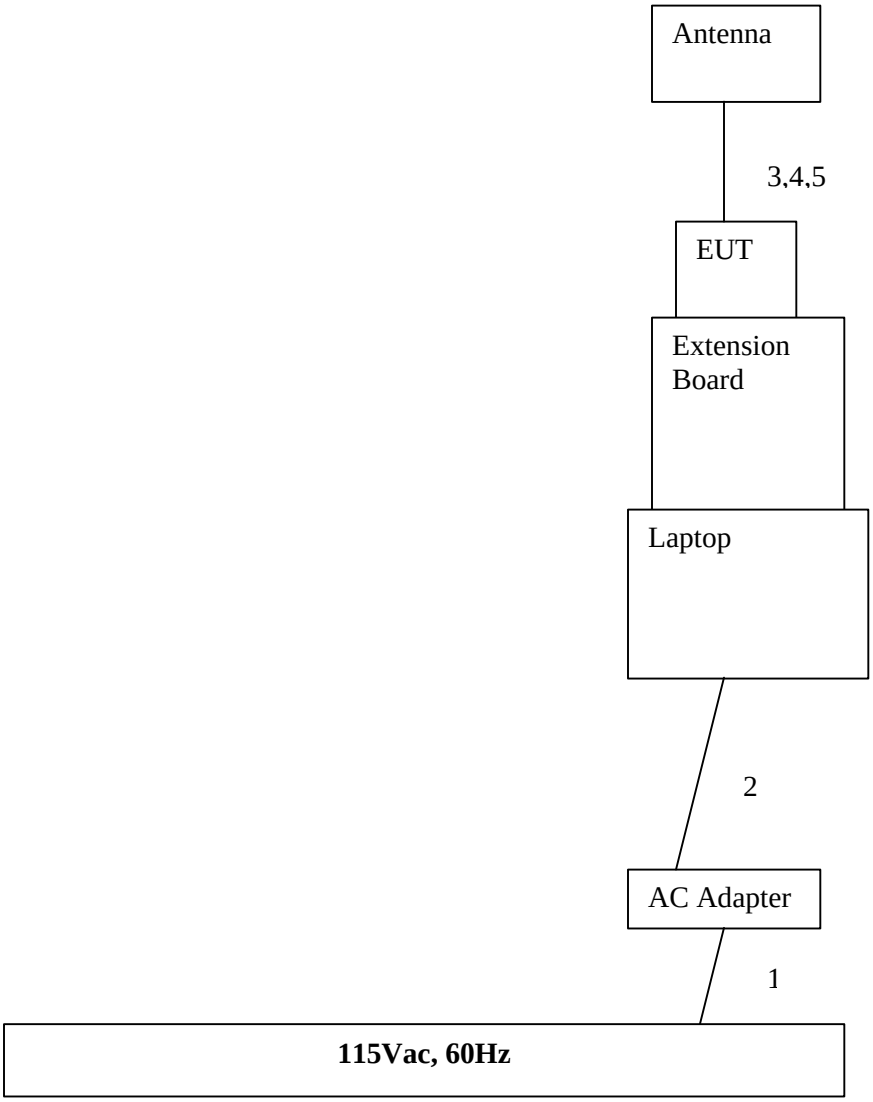
SETUP DIAGRAM



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6. APPLICABLE RULES AND RESULT

6.1. RADIATED EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.
bands listed below:

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6.2. DISH ANTENNA RESULTS

SETUP PHOTOS

RADIATED FRONT PHOTO

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RADIATED BACK PHOTO

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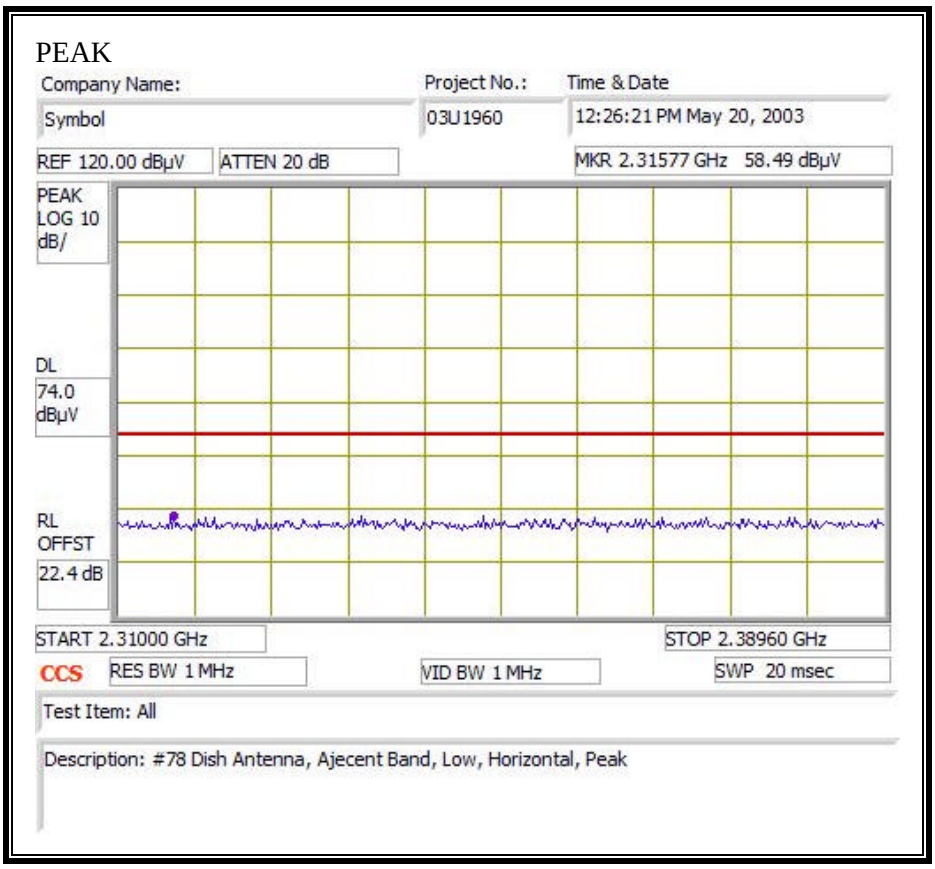
ADJACENT RESTRICTED BAND (LOW CHANNEL, HORIZONTAL)



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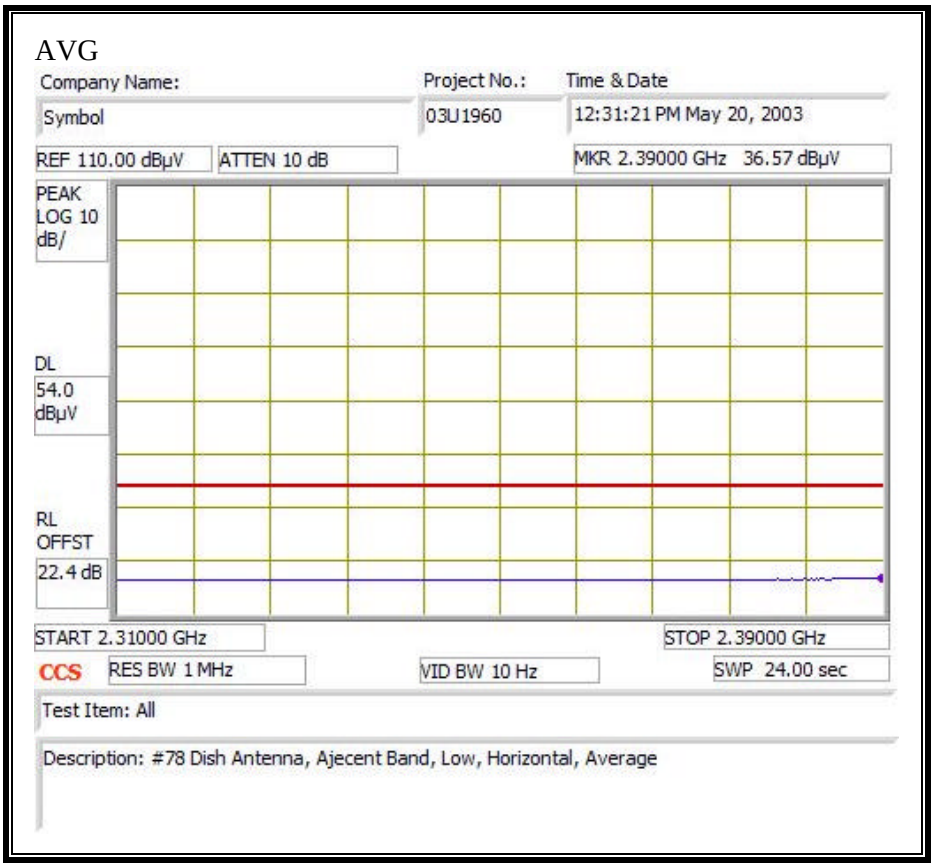

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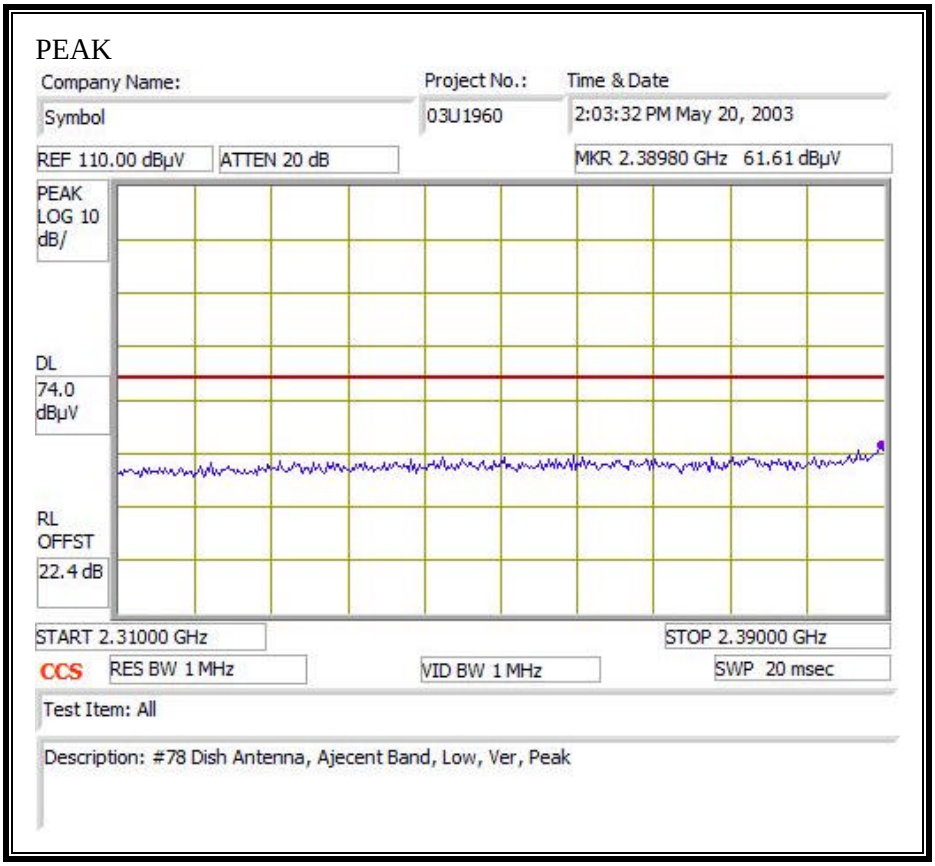
ADJACENT RESTRICTED BAND (LOW CHANNEL, VERTICAL)



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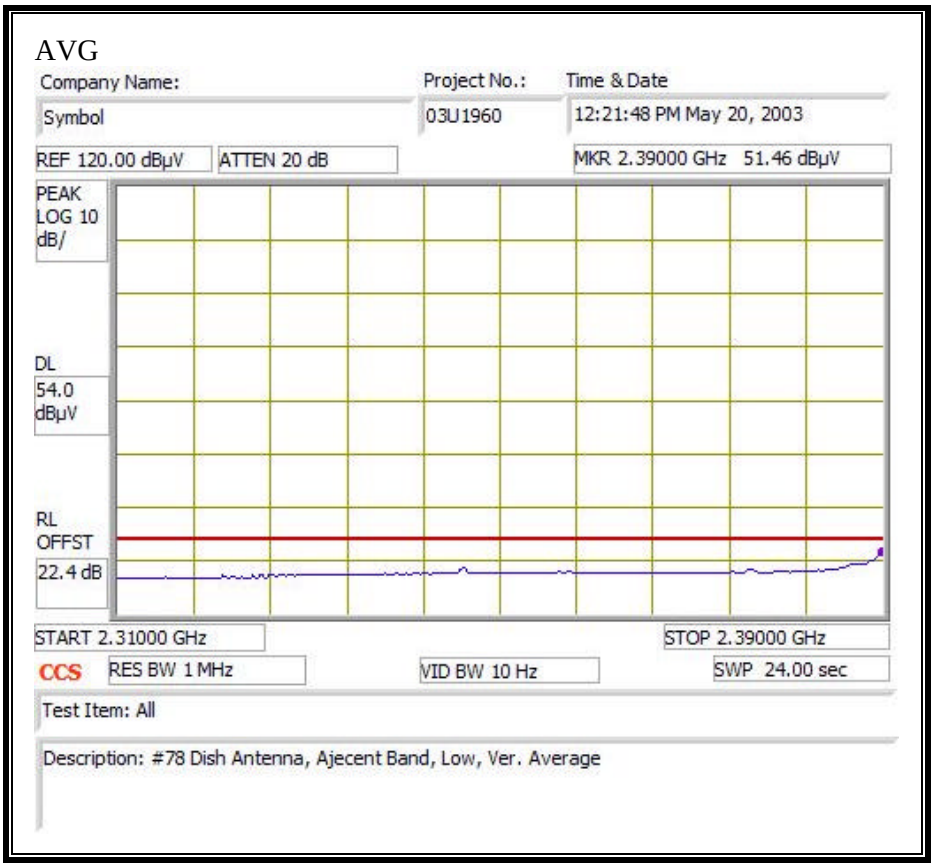

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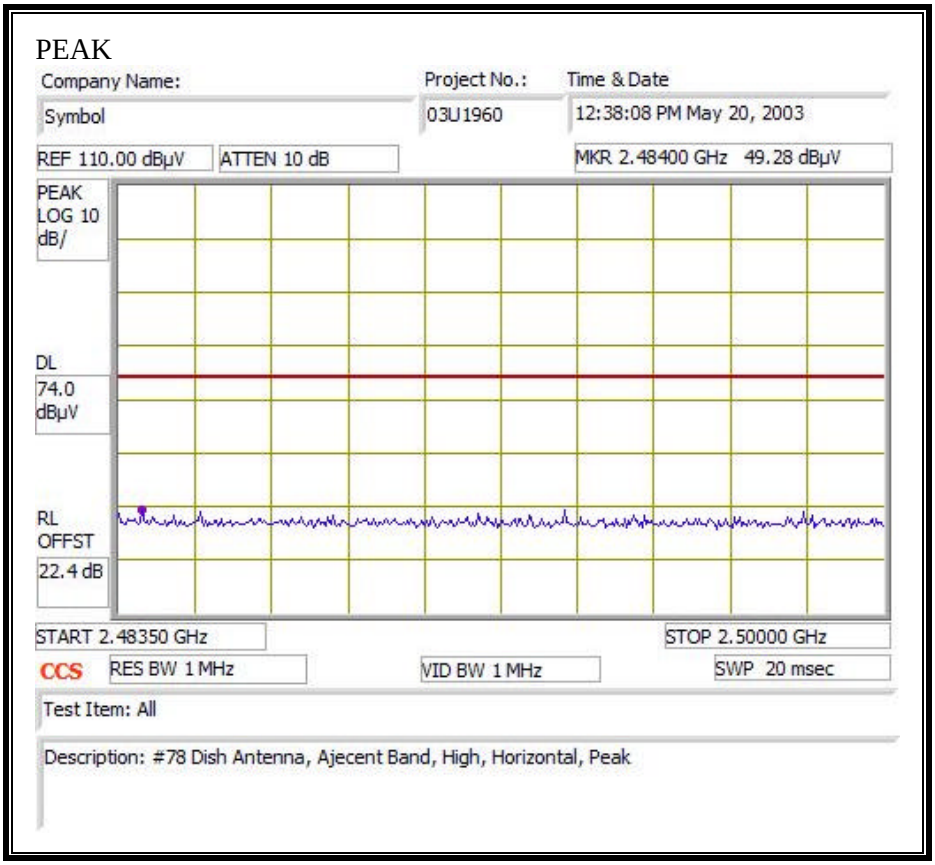
ADJACENT RESTRICTED BAND (HIGH CHANNEL, HORIZONTAL)



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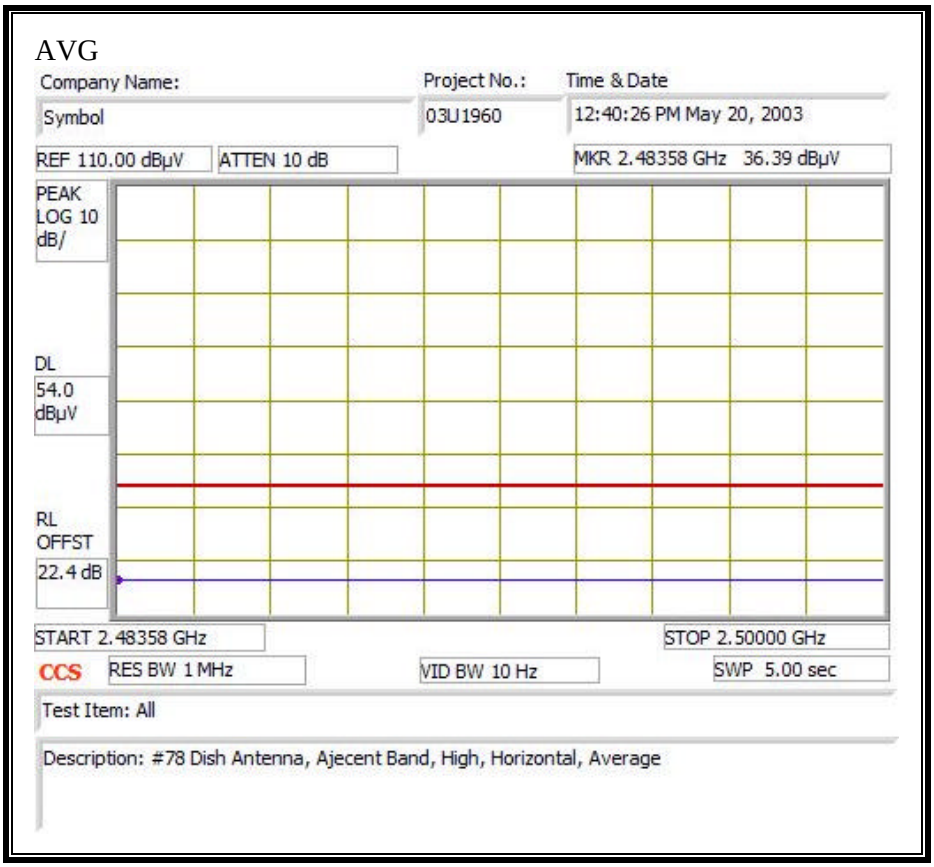

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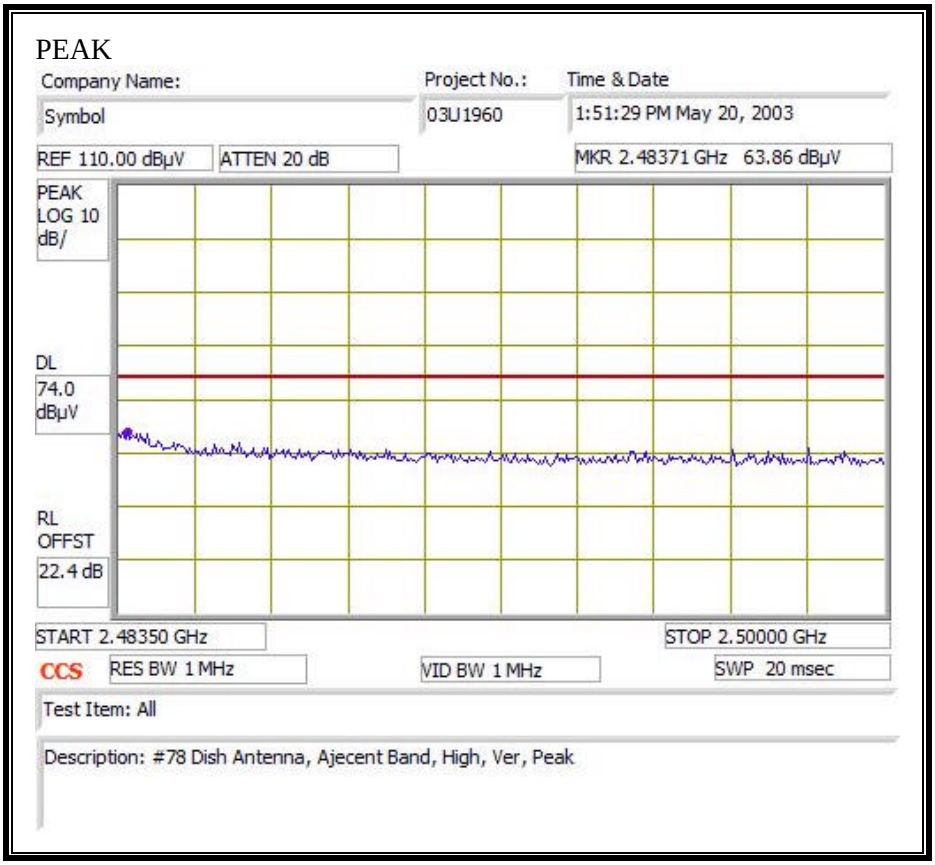
ADJACENT RESTRICTED BAND (HIGH CHANNEL, VERTICAL)



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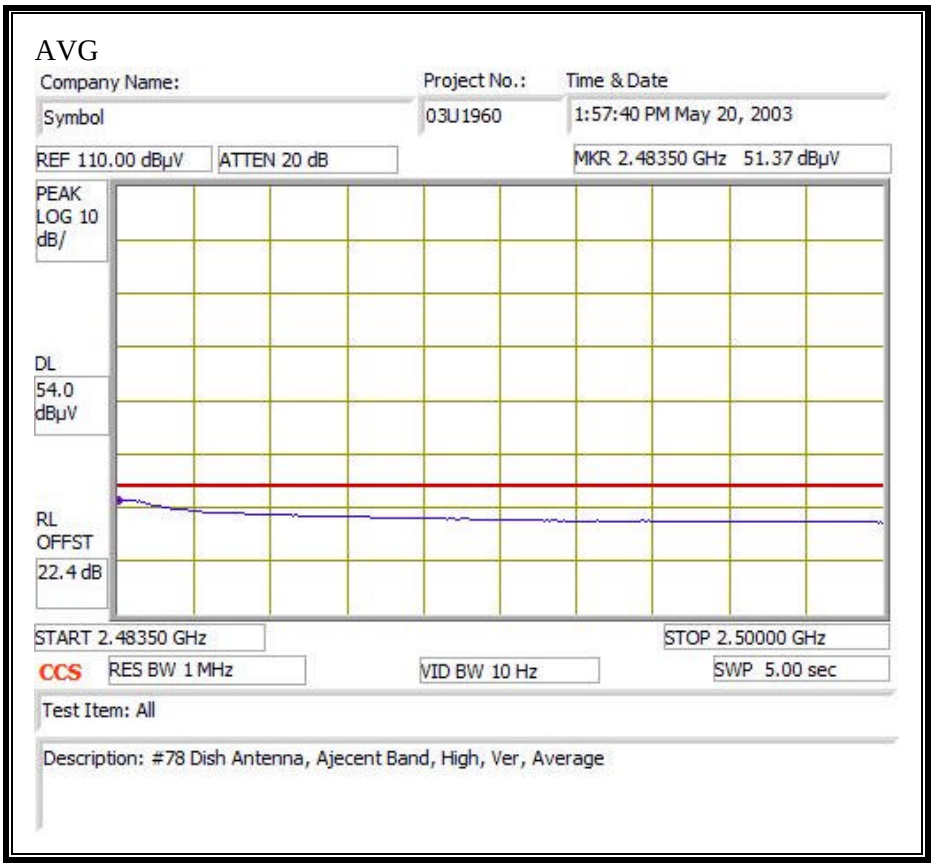

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HARMONICS AND SPURIOUS EMISSIONS

06/05/03 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr:William Zhuang
Project #:03U1960-1
Company:Symbol Technologies Emea
EUT Descrip.:2.4 GHz PCMCIA Card 11MBPS DSSS
EUT M/N:LA4131 with Antenna # 78, Dish ML-2499-BPDA1-01
Test Target:FCC Part 15.247 Class II Permissive Change
Mode Oper:Tx On

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T73; S/N: 6717 @1m	T87 Miteq 924342	HP 8566B Analyzer	

Hi Frequency Cables
☐ (2 ft) ☐ (2 ~ 3 ft) ☑ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
4.824	9.9	47.4	36.2	33.9	5.0	-44.7	0.1	1.0	42.7	31.5	74.0	54.0	-31.3	-22.5	Low,V Noise
4.824	9.9	48.1	36.1	33.9	5.0	-44.7	0.1	1.0	43.4	31.4	74.0	54.0	-30.6	-22.6	Low,H Noise
4.874	9.9	49.1	36.8	33.9	5.0	-44.7	0.1	1.0	44.4	32.1	74.0	54.0	-29.6	-21.9	Mid,H
4.874	9.9	50.2	38.2	33.9	5.0	-44.7	0.1	1.0	45.5	33.5	74.0	54.0	-28.5	-20.5	Mid,V
4.924	9.9	46.6	35.5	34.0	5.1	-44.8	0.1	1.0	41.9	30.8	74.0	54.0	-32.1	-23.2	High,V Noise
4.924	9.9	45.9	35.7	34.0	5.1	-44.8	0.1	1.0	41.2	31.0	74.0	54.0	-32.8	-23.0	High,H Noise

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

Note: no other harmonics or spurious detected above 1 GHz.

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6.3. YAGI ANTENNA RESULTS

SETUP PHOTOS

RADIATED FRONT PHOTO

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RADIATED BACK PHOTO

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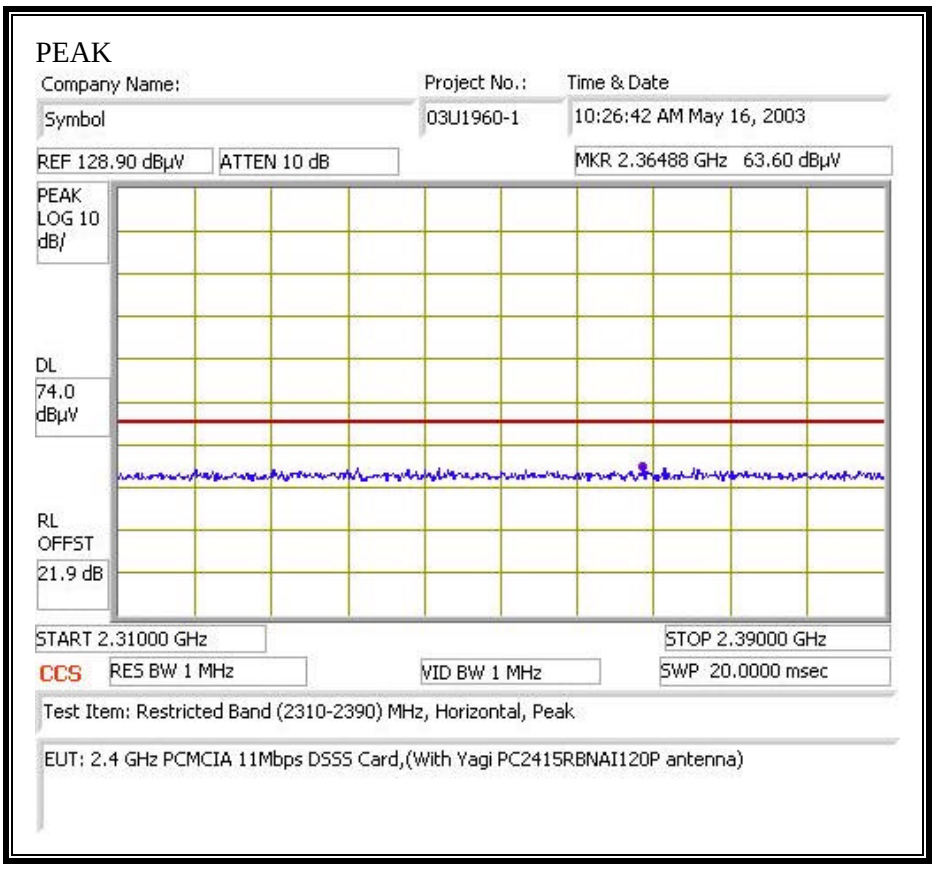
ADJACENT RESTRICTED BAND (LOW CHANNEL, HORIZONTAL)



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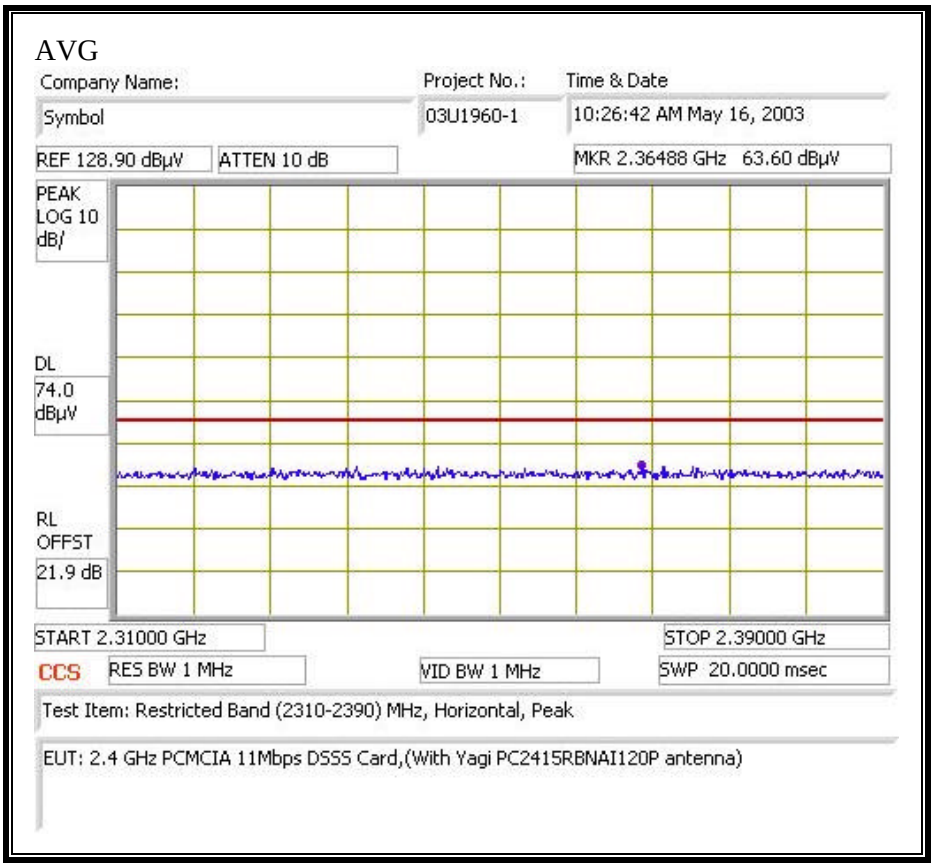

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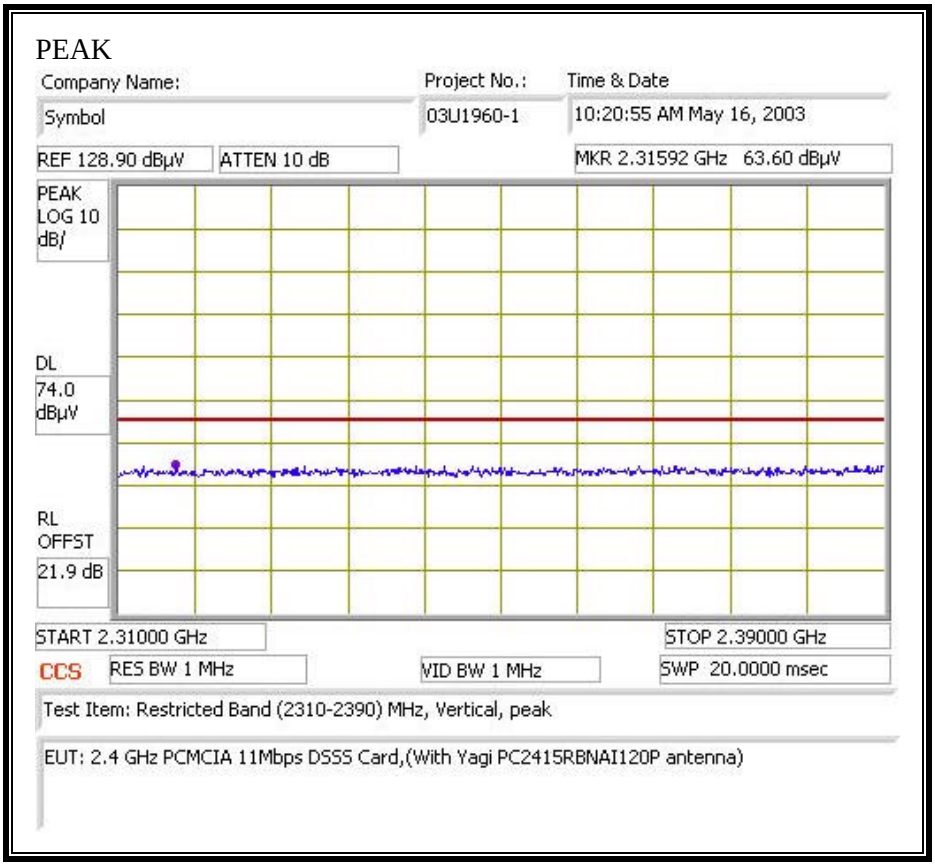
ADJACENT RESTRICTED BAND (LOW CHANNEL, VERTICAL)



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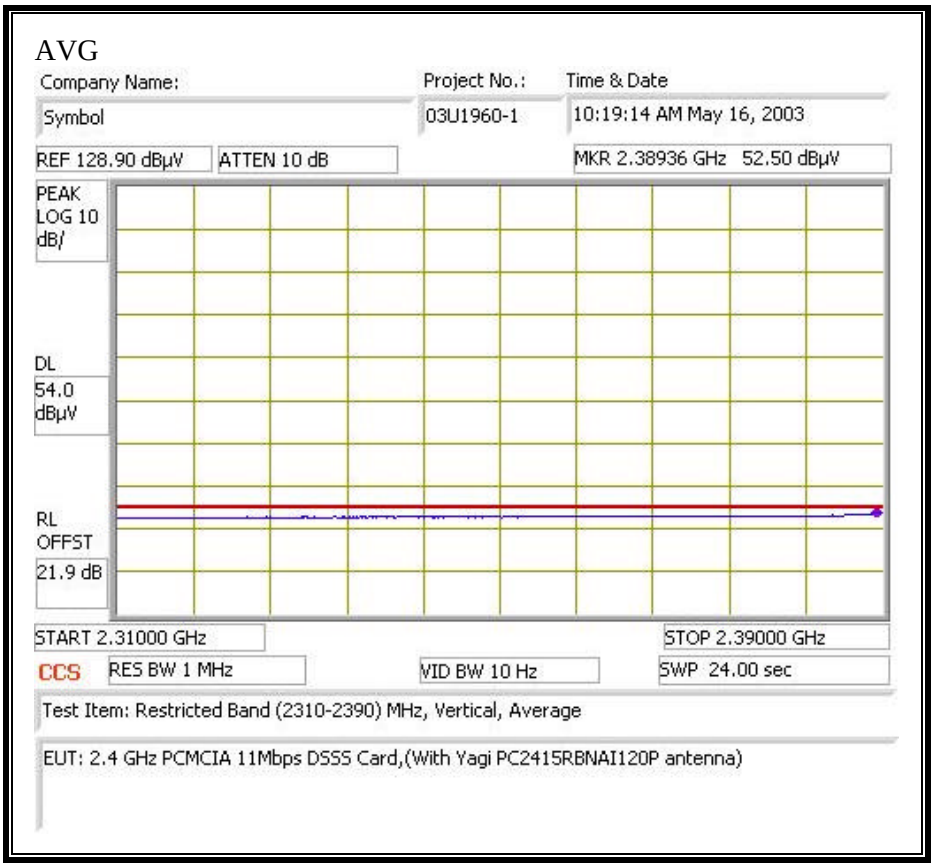

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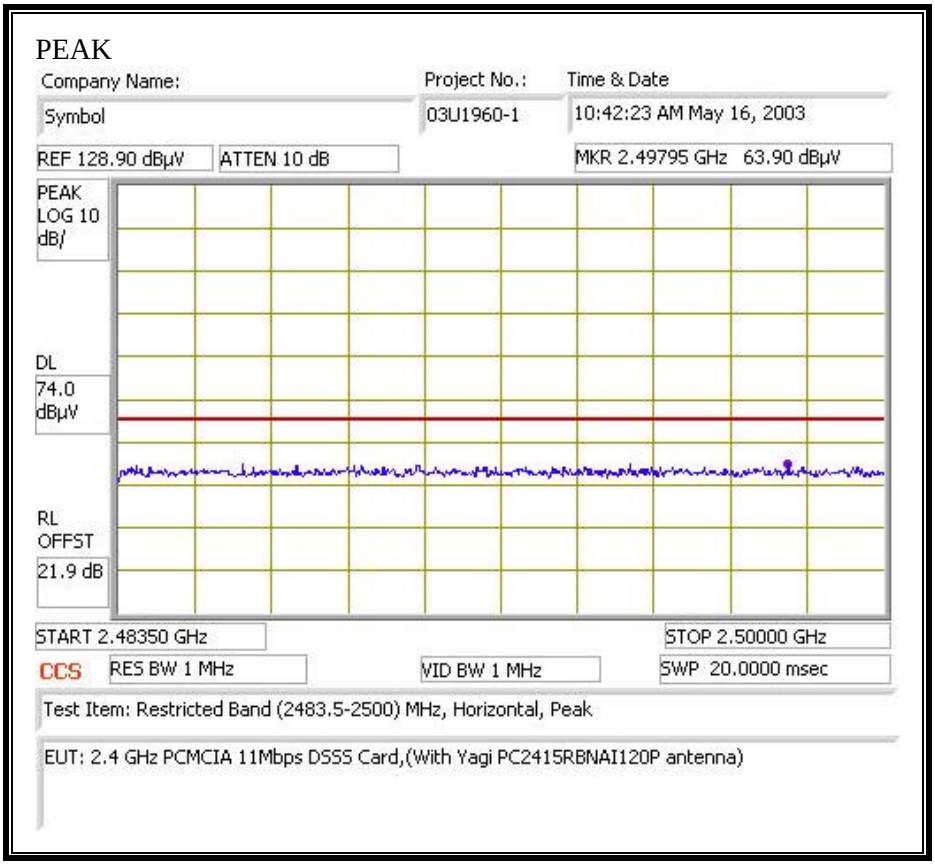
ADJACENT RESTRICTED BAND (HIGH CHANNEL, HORIZONTAL)



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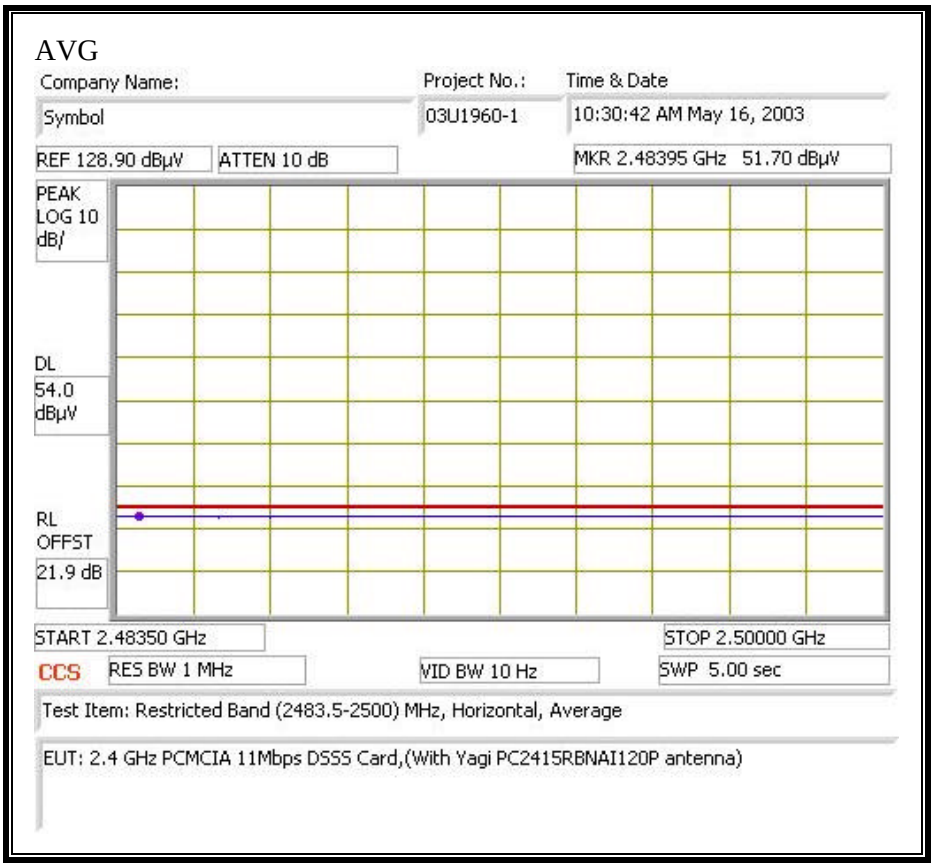

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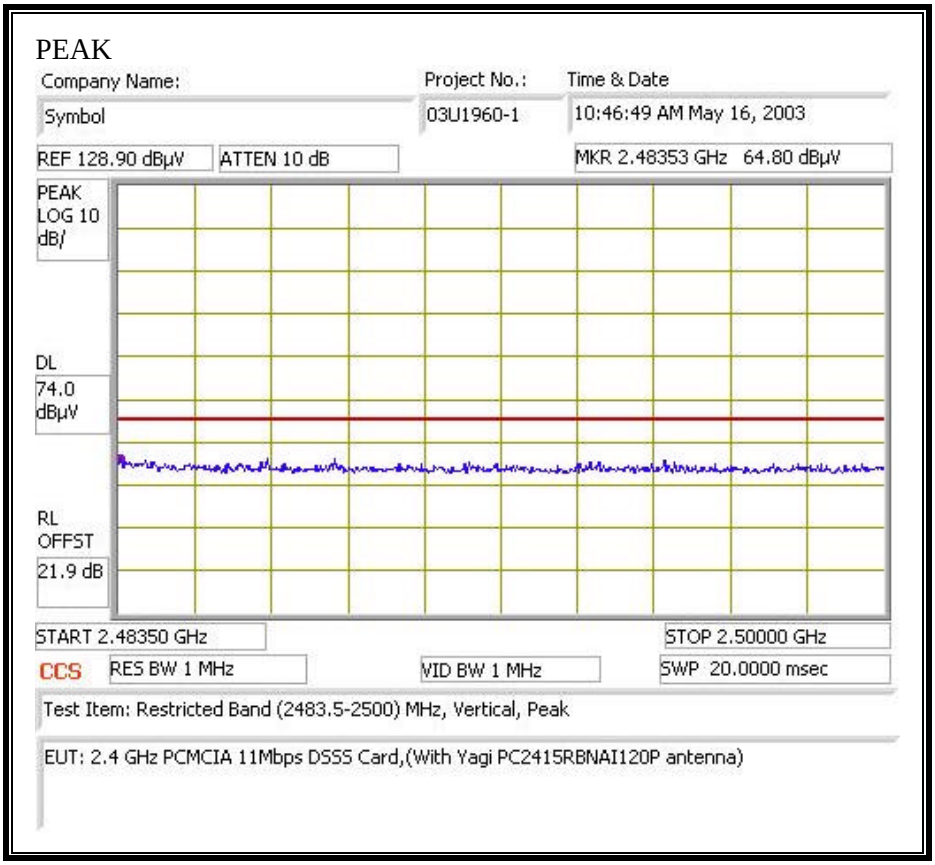
ADJACENT RESTRICTED BAND (HIGH CHANNEL, VERTICAL)



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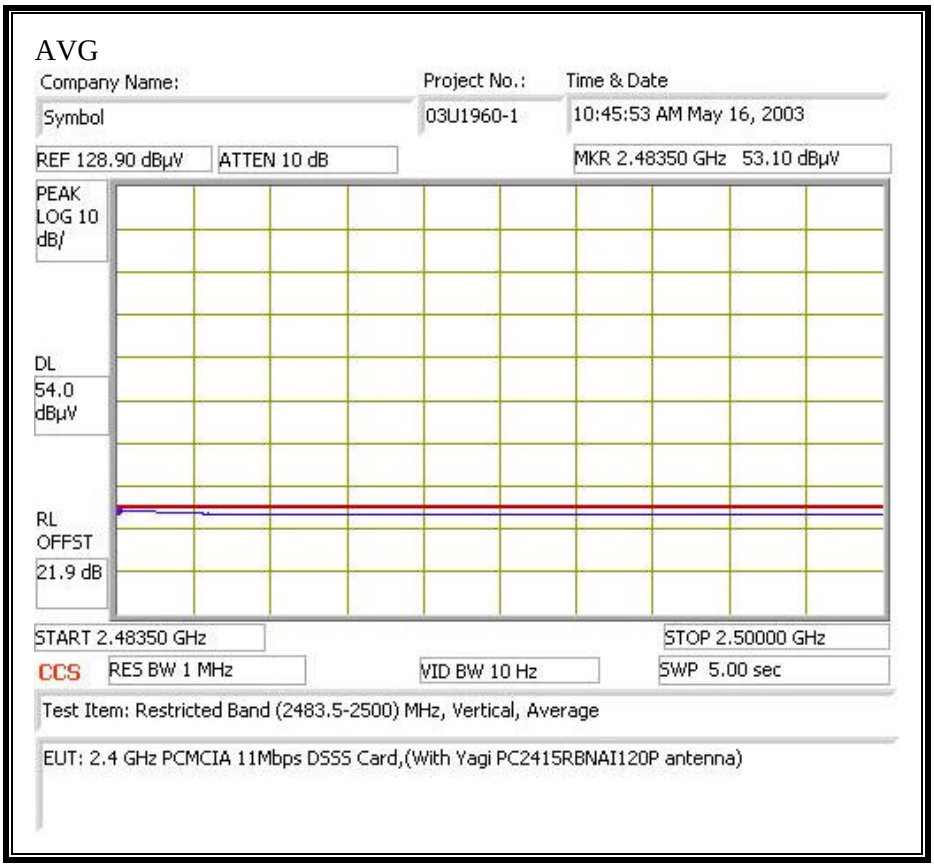

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HARMONICS AND SPURIOUS EMISSIONS

06/04/03 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Frank Ibrahim
Project #: 03U1960-1
Company: Symbol Technologies, Inc.
EUT Descrip.: 2.4 GHz PCMCIA 11Mbps DSSS Card, (With Yagi PC2415RBNAI120P antenna)
EUT M/N: LA4131
Test Target: FCC 15.247
Mode Oper: TX ON at Low Channel (2412MHz)

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T73; S/N: 6717 @3m	T87 Miteq 924342	HP 8566B Analyzer	T87; ARA 18-26GHz; S/N:1049

Hi Frequency Cables
☐ (2 ft) ☐ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
2.412	9.8	86.6	79.7	29.2	1.6	0.0	0.0	0.0	117.4	110.5					V
2.412	9.8	68.3	61.5	29.2	1.6	0.0	0.0	0.0	99.1	92.3					H

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

Note: no harmonics or spurious detected in the freq range of 1-25 GHz.

COMPLIANCE CERTIFICATION SERVICES DOCUMENT NO: CCSUP4031A
561F MONTEREY ROAD, MORGAN HILL, CA 95037 USA TEL: (408) 463-0885 FAX: (408) 463-0888
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EUT Descrip.: 2.4 GHz PCMCIA 11Mbps DSSS Card, (With Yagi PC2415RBNAI120P antenna)
EUT M/N: LA4131
Test Target: FCC 15.247
Mode Oper: TX ON at Middle Channel (2437MHz)

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T73; S/N: 6717 @3m	T87 Miteq 924342	HP 8566B Analyzer	T87; ARA 18-26GHz; S/N:1049

Hi Frequency Cables
☐ (2 ft) ☐ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
2.437	9.8	87.3	80.1	29.3	1.6	0.0	0.0	0.0	118.2	111.0					V
2.437	9.8	68.9	62.3	29.3	1.6	0.0	0.0	0.0	99.8	93.2					H

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

Note: no harmonics or spurious detected in the freq range of 1-25 GHz.

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HARMONIC AND SPURIOUS EMISSIONS

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Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Frank Ibrahim
Project #: 03U1960-1
Company: Symbol Technologies, Inc.
EUT Descrip.: 2.4 GHz PCMCIA 11Mbps DSSS Card, (With Yagi PC2415RBNAI120P antenna)
EUT M/N: LA4131
Test Target: FCC 15.247
Mode Oper: TX ON at High Channel (2462MHz)

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T73; S/N: 6717 @3m	T87 Miteq 924342	HP 8566B Analyzer	T87; ARA 18-26GHz; S/N:1049

Hi Frequency Cables
☐ (2 ft) ☐ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
2.462	9.8	85.7	80.0	29.3	1.6	0.0	0.0	0.0	116.6	110.9					V
2.462	9.8	67.9	62.0	29.3	1.6	0.0	0.0	0.0	98.8	92.9					H

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

Note: no harmonics or spurious detected in the freq range of 1-25 GHz.

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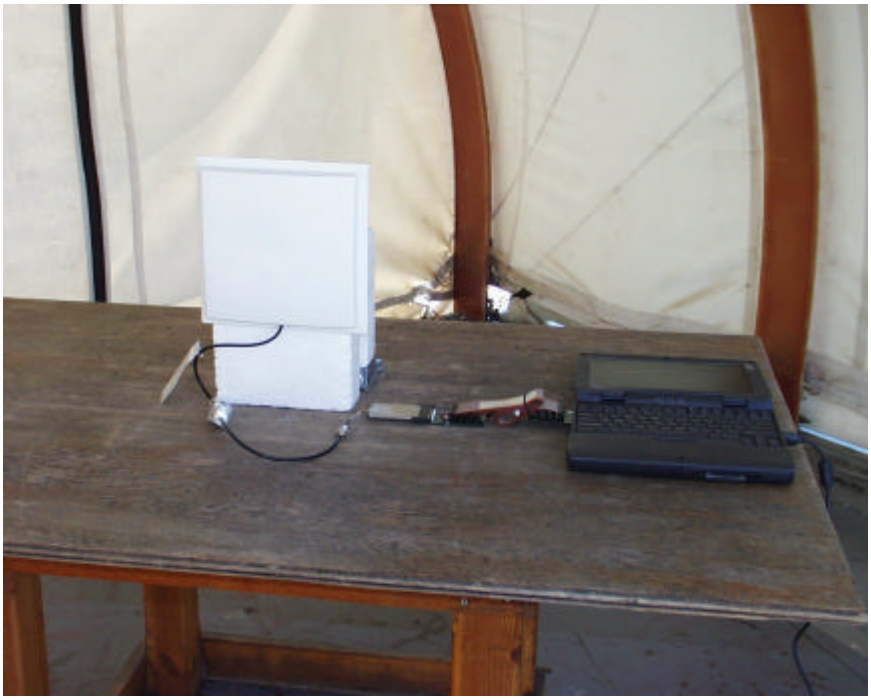
6.4. PANEL ANTENNA RESULTS

SETUP PHOTOS

RADIATED FRONT PHOTO



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