Test Report Addendum

FCC ID#: H9PLA4111

Wireless LAN Card

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Connector Information:
The LA4111 wireless LAN PC Card is attached to its antenna via a MMCX style coaxial connector. It is available from Amphenol through distributors but not commercial electronic parts retailers. Special tools and advanced assembly skills are necessary to attach this connector to a cable. The Amphenol part number is 908-43300. Drawings of these connectors are attached. The other end of the coaxial cable is attached to a polarized BNC connector. The polarized BNC connector is similar to a regular BNC type connector but is made unique by swapping the inner conductor sex. This connector and its mate can be purchased from the manufacturer, M/A COM Inc. A drawing of this connector is attached. In some cases the coax cable is directly soldered to the antenna. The following antennas are options for antennas for the LA 3000/4000 family of WLAN PC Cards.

Spectrum 24© RF Exposure Safety:

Symbol Technologies, Inc. uses a uniform approach across our line of Spectrum 24© Wireless LAN devices. Spectrum 24© utilizes PC cards that can be purchased in either a 100mW or 350mW versions at 1 and 2 MB/s or 60 mW at 11 MB/s. All antennas in the Spectrum 24 family are compliant with exposure levels when used with the highest output power radios. Symbol Technoloiges, Inc. bases its conformance to safe RF exposure limits on its two worst case situations using the 350 mW version of the PC card using the same antennas as the 100 mW version. The worst case situations for RF exposure are the Parabolic Grid for mobile devices and the body worn WWC1049 terminal with internal1040 antenna. Both use the high power version of the PC Card H9PLA3021-500.

MPE distance Calculations

Calculations of the MPE distance for each antenna are based on using equation (3) of OET Bulletin 65. Equation (3) was used instead of equations (11) through (18) for ease of computation justified by the fact that equation (3) leads to calculations of higher field strength and a greater MPE distance. All distances are calculated using 350 mW, the worst case situation across the Spectrum 24© product line

$R=SQRT(PG/4\pi S)$ $S=1mW/cm2$
$P=350mW$ $G=10^{(9.5\ dBi/10)}=8.9$

$R=SQRT(350*8.9/4\pi)=15.7cm$

In the case of the Parabolic Grid the MPE distance is 15.7 cm.

Mobile Devices
For mobile devices Symbol will include a user/installation instruction to alert the user to the MPE distance. To minimize the confusion of users we will state the MPE for all antennas to be the worst case for any one of the antennas as 16 cm or 6.5 inches. This is a rounding up of the actual distance from 15.7 cm to 16. The MPE distance limit for mobile devices is 20 cm, which corresponds to a MPE of 1 mW/cm^2.

Symbol Safety Statement:
The following safety statement is included with the user manuals for each of the mobile devices.

"The maximum permissible exposure (MPE) limit for these antennas when used with a Spectrum24 device is 6.5 inches (16 cm). The MPE limit is calculated to reflect the distance a person should maintain from the antenna. The MPE distance does not apply to transient exposure due to incidental passage closer than the MPE limit."

This statement is for Spectrum24 non-hand held devices over 100 mW.

Portable Devices
Symbols portable devices can be broken down into two separate categories depending on how close the radiating element is to the user's body. Hand held devices have their antennas less than 20 cm but more than 8 cm from the body. Body worn devices have their antennas less than 8 cm from the body.

Hand Held
Because of range degradation when users get the antenna to close to their hand the device is designed so that the radiating element is as far from human tissue as possible to maintain this 8 cm antenna to tissue distance.

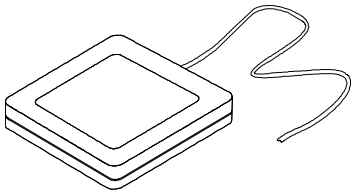
Body Worn
Body worn devices are strapped to the user with an antenna less than 8 cm from body tissue. The minimum antenna to tissue distance of 1.3 cm is the WWC 1049.

Since all of our portable devices use the same F-element family of antennas with very similar patterns and gains, conformance with exposure regulations are based on the SAR measurements made by Ilssan America, Inc. The compliance test report was provided in a previous letter, September 16, 1998 reference number 3413 with respect to the H9PLA3020 application. Portable device WWC1O4O is the same as WWC 1049 (the difference is in memory options) which was used for near field SAR

Where devices appear to be similar to either of these cases justification is given for relative exposure level differences.

Antenna Descriptions

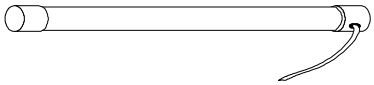
Antenna #1 Plane Antenna



The Plane antenna is 0 dBi omni-directional in azimuth plane. It would typically be mounted on top of a computer or on a ceiling. In its use on a computer it would probably not, but it could come, within 20 cm of a person. Therefore this antenna is probably most often a mobile antenna. The antenna could in some less common situations be a mobile within 20 cm of a user. In such usage it would produce lower SAR than the WWC 1049. Since the plane antenna has the same gain as the as the WWC 1049 but is not used as close as the WWC 1049 it's SAR will be lower than the WWC 1049 which is mounted in direct contact and has the same gain, 0 dBi.

Location	Horz Surface
Pattern	Omni
Type	Plane
Gain	0 dBi
Physical	2.5" x 2.5" x 0.75"
Cable	4 ft (Plenum-rated)
Symbol P/N	ML-2499-PSA1-00
MPE Distance	5.3 cm

Antenna #2 Ceiling Mount Dipole Antenna(s)



The ceiling mount dipole mounts on ceilings. The antenna will in this usage clearly be more than 20 cm from the user and so be classified as a mobile antenna. The ceiling mount dipole is *3* dBi. This antenna has a dipole style pattern. The MPE is less than the 1 mW/ cm^2 limit.

Location	Horz Surface
Pattern	Omni
Type	Co Linear Dipole Array
Gain	3 dBi (4ft), 0 dBi (15ft)
Physical	14" (l) x 1.25" (dia.) pole
Cable	4 or 15 ft (Plenum-rated)
Symbol P/N	ML-2499-HPA1-00 (4 ft)
	ML-2499-HPA2-00 (15 ft
MPE Distance	7.4 cm

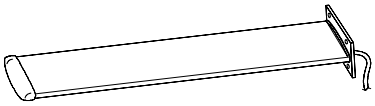
Antenna #3 Rubber Duck Dipole antenna

The Rubber Duck Dipole antenna is 1 dBi omni-directional in azimuth plane. It would typically be mounted in the back of a computer or on a ceiling. In its use on a computer it would probably not, but it could, come within 20 cm of a person. Therefore this antenna is probably most often a mobile

Location	Indoor
Pattern	Omni
Type	Dipole
Gain	1 dBi
Physical	7" (l) x 0.5" (dia.) pole
Cable	N/A
Symbol P/N	ML-2499-APA1-00
MPE Distance	5.9 cm

antenna. The antenna could in some less common situations be a portable in such usage it would produce lower SAR than the WWC 1049 that is mounted in direct contact. The Rubber Duck Dipole does have 1 dB (1 dBi versus 0 dBi) more gain than the WWC 1049. It could be argued that the SAR could be worse than the WWC 1049. However, it was the judgement of Symbol's engineering staff and the SAR measurement engineers at the lab that the distance difference (contact versus several inches) between the rubber duck dipole usage and the WWC 1049 usage would make the WWC 1049 SAR higher (worst case) than the rubber duck dipole.

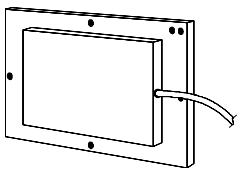
Antenna # 4 Yagi Antenna



The Yagi antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this usage clearly will be more than 20 cm from the user and so be, classified as a mobile antenna. The Yagi Antenna is 9 dBi when adjusted for cable loss from a 20 foot coaxial cable terminated in the polarized BNC connector.

Location	In/outdoor
Pattern	Directional 30°beam
Type	Yagi
Gain	9 dBi
Physical	27" x 4" x 1.5" blade
Cable	20 ft (Plenum-rated)
Symbol P/N	ML-2499-YGA1-01
MPE Distance	14.8 cm

Antenna # 5 Patch Antenna

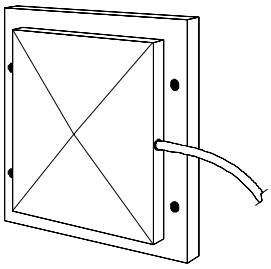


The Patch antenna mounts on walls near the ceiling or on rooftops with screws to a flat surface facing the desired coverage area. This antenna produces a wide (70°) coverage area while remaining unobtrusive.

Location	In/outdoor
Pattern	Directional 70°beam
Type	Patch
Gain	4 dBi
Physical	5" x 5" x 0.5" panel
Cable	6 ft (Plenum-rated)
Symbol P/N	ML-2499-PTA1-01
MPE Distance	8.3 cm

The antenna will, in this usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna. The Patch Antenna is 6 dBi when adjusted for cable loss from a 6 foot coaxial cable terminated in the polarized BNC connector.

Antenna # 6 Panel Antenna



Location	In/outdoor
Pattern	Directional 22°beam
Type	Patch
Gain	7 dBi (with cable)
Physical	8” x 7” x 1” panel
Cable	20 ft (Plenum-rated)
Symbol P/N	ML-2499-PNA1-01
MPE Distance	11.8 cm

The Panel antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna. The Panel Antenna is 7 dBi when adjusted for cable loss from a 20 foot coaxial cable terminated in the polarized BNC connector.

Antenna # 7 F-Element End Cap Antenna (Not certified with this radio)

Antenna # 8 Symbol 4140 Antenna (Not certified with this radio)

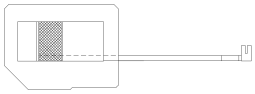
Antenna # 9 Symbol 4640 Antenna

Location	Hand Held
Pattern	Omni
Type	Patch
Gain	< 0 dBi
Physical	1.46”x1.44”x0.29”
Cable	9.12” w/Bead
Symbol P/N	21-17486-02
SAR	< WWC1049

Symbol 4640 Antenna is integrated in the Symbol Technologies PPT 4640 hand held computer. The gain is less than 0 dBi in all planes. The 4640 is held in a persons hand. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the 4640 hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC1O49 it’s SAR will be lower than the WWC1O49 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 10 Symbol 2140 Antenna

Location	Hand Held
Pattern	Omni
Type	F-Element
Gain	< 0 dBi
Physical	1.46”x1.09”x0.36
Cable	N/A
Symbol P/N	10-17577-01
SAR	< WWC1049



Symbol 2140 Antenna is integrated in the Symbol Technologies PDT 2140 hand held computer. The gain is less than 0 dBi in all planes. The 2140 is held in a persons hand. This usage will bring the user within 20cm but not as close as the WWC1O49 that is in direct contact with the body. Since the 2140 hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC1O49 it’s SAR will be lower than the WWC1O49 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 11 Symbol 6140 Antenna

Location	Hand Held
Pattern	Omni
Type	F-Element
Gain	< 0 dBi
Physical	2”x1.8”x0.35
Cable	N/A
Symbol P/N	10-35305-01
SAR	< WWC1049

Symbol 6140 Antenna is integrated in the Symbol Technologies PDT 6140 hand held computer. The gain is less than 0 dBi in all planes. The 6140 is held in a persons hand. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the 6140 hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC1O49 it’s SAR will be lower than the WWC1O49 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 12 Symbol 6840

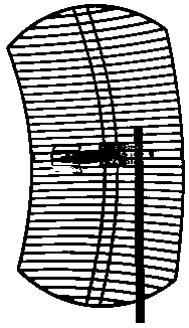
Location	Hand Held
Pattern	Omni
Type	F-Element
Gain	< 0 dBi
Physical	2”x1.8”x0.35
Cable	N/A
Symbol P/N	10-32290-01
SAR	< WWC1049

Symbol 6840 Antenna is integrated in the Symbol Technologies PDT 6840 hand held computer. The gain is less than 0 dBi in all planes. The 6840 is held in a persons hand. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the 6840 hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC1O49 it’s SAR will be lower than the WWC1O49 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 13 Symbol WWC1040 (Not certified with this radio)

Antenna # 14 Huber Suhner Dipole (Not certified with this radio)

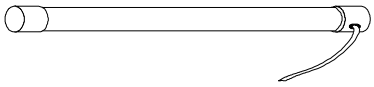
Antenna # 15 Parabolic Grid



The Parabolic Grid antenna mounts on walls near the ceiling, on rooftops, or a mast. The antenna will, in this usage clearly will be more than 20 cm from the user and so be, classified as a mobile antenna. The parabolic grid antenna has 9.5 dBi gain when adjusted for cable loss from a 50 foot coaxial cable.

Location	Mast/Wall
Pattern	Directional 8° Beam
Type	Parabolic Grid
Gain	9.5 dBi (with cable)
Physical	23.5”x39.25”x15”
Cable	50 foot
Symbol P/N	ML-2499-PGA1-00
MPE Distance	15.7 cm

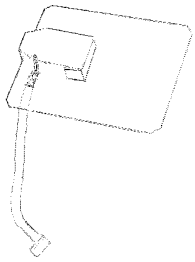
Antenna # 16 Cushcraft S2406



The S2406 dipole mounts on ceilings or walls in large warehouses. The antenna will in this usage clearly be more than 20 cm from the user and so be classified as a mobile antenna. The ceiling mount dipole is *2* dBi. This antenna has a dipole style pattern.

Location	Ceiling
Pattern	Omni
Type	Collinear Dipole Array
Gain	2 dBi (with cable)
Physical	25”x1.25”
Cable	20/30 ft. Plenum
Symbol P/N	ML-2499-WHA1-20/30
MPE Distance	6.6 cm

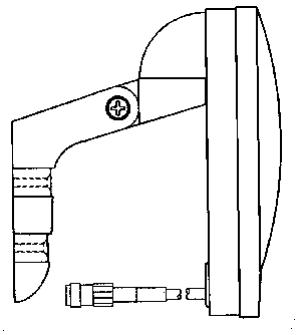
Antenna # 17 Criticare Terminal



Location	Hand Held
Pattern	Omni
Type	F-Element
Gain	0 dBi
Physical	2.0”x1.625”x0.290”
Cable	N/A
Tecom P/N	703443
SAR	< WWC1049

Criticare Antenna is integrated into a hand held computer made by riticare. The gain is less than 0 dBi in all planes. The Criticare computer is held in a persons hand. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the Criticare hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC 1049 it’s SAR will be lower than the WWC 1049 which is mounted in direct contact and has the same gain, 0 dBi.

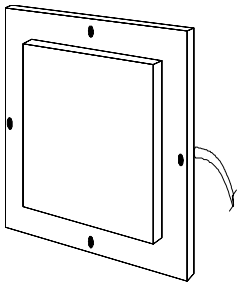
Antenna # 18 Corner Patch



Location	Wall / Ceiling
Pattern	Directional Beam
Type	Patch
Gain	5 dBi (with cable)
Physical	5.81”X5.75”X5.03”
Cable	6’ Plenum
Symbol P/N	ML-2499DLA1-06
MPE Distance	9.3 cm

The Corner Patch *7.5* dBi with coaxial cable. The DirectLink Corner Patch antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna

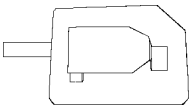
Antenna # 19 Ceiling Mount Panel



The Ceiling Mount Panel is 3.6 dBi with coaxial cable. The Ceiling Mount Panel antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna.

Location	Wall / Ceiling
Pattern	Omni
Type	Plane
Gain	3.6 dBi (with cable)
Physical	6”x6”x2”
Cable	6’ Plenum
Symbol P/N	ML-2499-SD24-06
MPE Distance	8.0 cm

Antenna # 20 Symbol 2040



The 2040 antenna is internally mounted in the model CST2040 hand held Customer Shopping Terminal. The gain is less than 0 dBi in all planes. The terminal is held in the user’s hand. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the 24040 antenna has the same gain as the as the WWC 1049 but is not used as close as the WWC 1049 it’s SAR will be lower than the WWC 1049 which is mounted in direct contact and has the same gain, 0 dBi.

Location	Hand Held
Pattern	Omni
Type	F-Element
Gain	0 dBi
Physical	2”X1.8”X0.35”
Cable	N/A
Symbol P/N	10-17577-01
SAR	< WWC1049

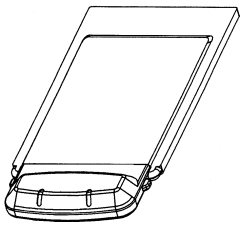
Antenna # X Trilogy AP

The Trilogy AP antenna is a integrated molded external antenna mounted in the model AP4111 Access Point The gain is less than 2 dBi in all planes. The unit either lies on a horizontal surface or is mounted to a wall. The antenna can swivel to maintain its vertical orientation. The antenna will, in this usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna.

Location	Table Top, Wall Mount
Pattern	Omni
Type	Spatial Diverse Dipoles
Gain	2 dBi
Physical	4.6”X2.6”X0.45”
Cable	4.5”
Symbol P/N	21-20667-01
MPE Distance	6.6 cm

Antenna #Y Popout integrated antenna (This antenna is withdrawn from certification)

Antenna #Z Chip Endcap Antenna



Location	Laptop Slot
Pattern	Omni
Type	Multilayer Chip
Gain	0 dBi
Physical	2”X1.8”X0.35”
Cable	N/A
Symbol P/N	ML-3099-PCDV-01
SAR	< WWC1049

The End Cap made by Symbol Technologies is attached directly to the LA 4111 PC Card. This antenna is less than 0 dBi in all planes. The End Cap Antenna uses a multilayer chip antenna as the radiating element. The chip end cap antenna attached to a PC Card is used plugged into a notebook computer. This usage will bring the user within 20cm but not as close as the WWC 1049 that is in direct contact with the body. Since the end cap has the same gain as the as the WWC1O49 but is not used as close as the WWC1O49 it’s SAR will be lower than the WWC 1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna Summary Table

Non Hand Held Antennas

Ant #	Model	Type	Gain	Usage	MPE Dist[1]	Symbol P/N	Mfgr.	Mfgr. P/N
1	Plane Antenna	Plane	0 dBi	Ceiling, Laptop	5.3 cm	ML-2499-PSA1-00		
2	Dipole Antenna (4' Cable),	Dipole Array	3 dBi	Ceiling	7.4 cm	ML-2499-HPA1-00 (4 ft)		
2.1	Dipole Antenna (15" cable)	Dipole Array	0 dBi	Ceiling	5.3 cm	ML-2499-HPA2-00 (15 ft)		
3	Rubber Duck	Dipole	1 dBi	Ceiling, Computer	5.9 cm	ML-2499-APA1-00		
4	Yagi	Yagi	9 dB	Mast/Wall	14.8 cm	ML-2499-YGA1-01		
5	Patch	Patch	4 dBi	Wall/Rooftop	8.3 cm	ML-2499-PTA1-01		
6	Panel	Patch	7dBi	Wall/Rooftop	11.8 cm	ML-2499-PNA1-01		
15	Parabolic Grid	Parabolic	9.5 dBi	Mast	15.7 cm	ML-2499-PGA1-00		
16	S2406	Dipole Array	2 dBi	Ceiling	6.6 cm	ML-2499-WHA1-20/30		
18	Corner Patch	Patch	5 dBi	Wall, ceiling	9.3 cm	ML-2499DLA1-06		
19	Ceiling Mount Panel	Plane	3.6 dBi	ceiling	8.0 cm	ML-2499-SD24-06		
X	Access Point		2 dBi	Table/Wall	6.6 cm	21-20667-01		
Z	End Cap	F-Element	0 dBi	Laptop Card Slot	5.3 cm	ML-3099-PCEC-01		

Hand Held Antennas

Ant #	*Model*	*Type*	*Gain*	*Usage*	*MPE Dist*	*Symbol P/N*	*Mfgr.*	*Mfgr. P/N*
9	4640	Patch	< 0 dBi	hand held computer	5.3 cm	21-17486-02		
10	2140	F-Element	< 0 dBi	hand held computer	5.3 cm	10-17577-01		
11	6140	F-Element	< 0 dBi	hand held computer	5.3 cm	10-35305-01		
12	6840	F-Element	< 0 dBi	hand held computer	5.3 cm	10-32290-01		
17	Criticare	F-Element	0 dBi	hand held computer	5.3 cm		Tecom	703443
20	2040	F-Element	< 0 dBi	hand held computer	5.3 cm	10-17577-02		

[1] MPE Distance is based on Symbol's worst case 350 mW H9PLA3021-500 for all antennas

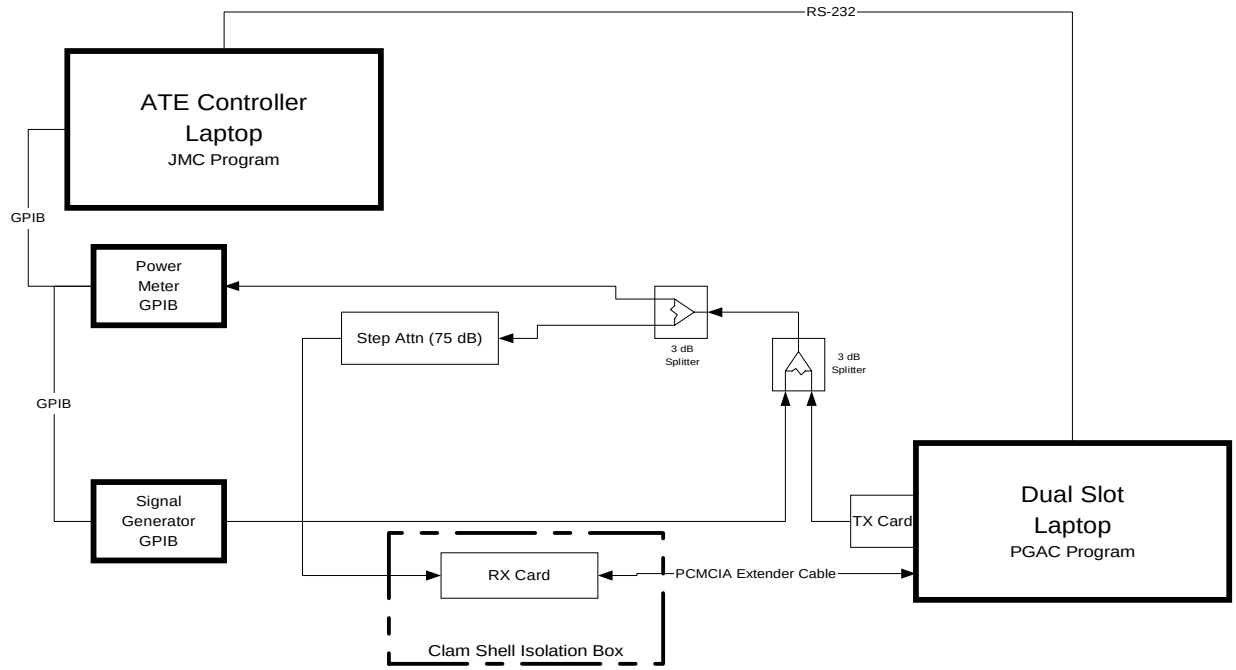
Processing Gain Calculation

Symbol calculated the processing gain from the jamming margin of the LA-4111 transceiver as specified in 15.247 (e)(2).

Test Setup

The purpose of the jamming test is to determine how effective the modulation, coding and decoding is at rejecting the corrupting influence of a CW jammer signal. Where as most setups us a BER to generate data and count errors because the modulator chip architecture prevents injecting data after chipping, Symbol chose to use another LA4111 as the transmitter and data generator. A link between the transmitter and receiver is made and path loss adjusted so that the BER is 10E-5. The path loss is then reduced by 10 dB so that the BER approaches zero. Finally a jamming signal is added to the receive signal to degrade the system performance. The jamming signal amplitude is then adjusted to the point that the BER is degraded to 10E-5.

The relationship between PER and BER is as follows. In order to get a good packet we need 8 x 1024 good bits. Stated mathematically. $1\text{-PER} = (1\text{-BER})^{(8*24)}$. Or $\text{BER}=1-(1-\text{PER})^{(1/(8*1024))}$.



Jamming Margin Test Setup

The major blocks of the jamming margin test are a transmitter, a receiver, and a jammer. The TX card formats and transmits packets of data. The RX card reads packets. The Signal Generator provides the jamming signal. The splitters combine the TX and jammer signals and provide a port to measure the power levels within the RF link. The Dual Slot Laptop controls the TX and RX cards. The ATE Laptop automates the test by controlling the Dual Slot Laptop, Signal Generator, and the Signal Generator.

Test Procedure

The key to this test is two software programs. Packet Generator and Counter (PGAC) runs on the Dual Slot Laptop and controls the RX and TX cards. The other Jamming Margin Controller (JMC) runs on the ATE laptop and controls the Signal Generator, the Power Meter, and PGAC running on the Dual Slot laptop.

PGAC commands the TX card to transmit a set of 1000 packets of 1024 bytes of data. The RX card receives the packets and PGAC sends the number of good packets received to the serial port. The functional purpose is the same as a BER meter. A new set is run every time a new trigger is received on the serial port from the ATE laptop.

JMC controls the jammer, the power meter, and the Dual Slot program. JMC sets the frequency and level of the signal generator that acts as a jammer. JMC then sends a trigger to PGAC on the Dual Slot laptop. The trigger causes PGAC to run another set of packets and report the number of good packets back to JMC. The packet error rate is then converted to BER and JMC adjusts the Jammer level appropriately. A search algorithm is built into JMC to have the jammer converge to the right level for a 10E-5 BER. The jammer resolution is .1 dB.

When the jammer level causes a BER of 10E-5 program JMC commands the power meter to read the jammer power level. It then turns off the jammer and turns on the TX card to measure its power. Then J/S is calculated from the two power measurements and recorded to disk.

The test is then repeated at the next jammer frequency. In this instance the test is conducted across the band of a single channel at 50KHz steps.

Test Results

Plot 1 is a graph of J/S vs F in MHz. The lower line shows the J/S as taken from the power ratios measured with the power meter. The upper line shows the processing gain G_p as calculated from the Jamming Margin data.

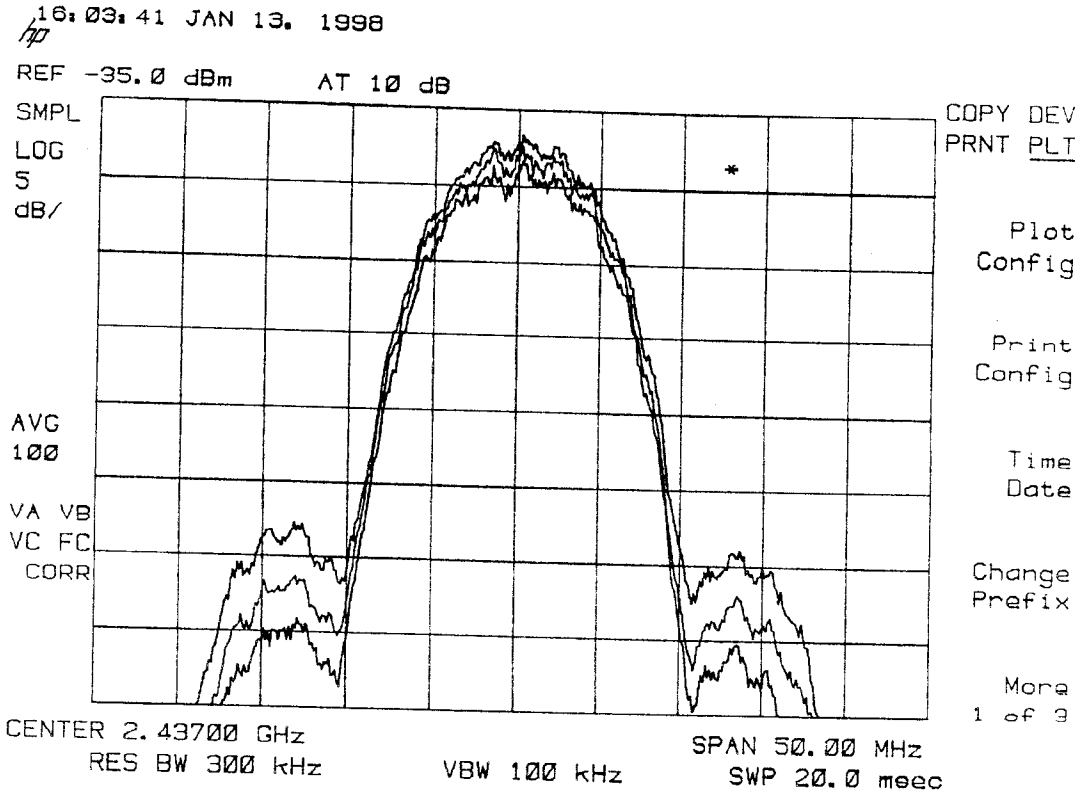
Per DOC:IEEE P802.11-98/47 page 55 (see attached pages)

G_p=18.6 dB + (J/S)

Note that the lowest 20% of the data points were discarded as specified in 15.247 (e)(2). The processing gain G_p = 10.83 dB.

Read from JS File.vi
G:\LABVIEW\Project\Jamming\Read from JS File.vi
Last modified on 10/6/99 at 2:45 PM
Printed on 10/6/99 at 2:49 PM

Plot 1



6. Interference Immunity

This section includes interference immunity data taken empirically. The Harris PCMCIA radio design was used. This radio is an implementation of the basic waveform proposed by Harris. No architectural enhancements have been tested.

Three tests were used to test interference immunity.

A. A CW interference using the FCC CW test suggested for DS processing gain.

B. An FH (802.11) waveform jammer.

C. Broadband noise.

6.1 Interference using the FCC CW processing gain test

One of the interference immunity tests is the CW test recommended by the FCC for processing gain

6.1.1 Test Procedure

Obtain the simplex link as shown on the test configuration figure. Perform all independent instrumentation calibrations prior to this procedure. Set operating power levels using fixed and variable attenuators in system to meet the following objectives:

1. Signal Power at receiver approximately -60 dBm (above thermal sensitivity such that thermal noise does not cause bit errors).

2. Signal Power at power meter between -20 and -40 dBm for optimal linearity.

3. Use spectrum analyzer to monitor test.

4. Ensure that CW Jammer generator RF output is disabled and measure the power at the power meter port using the power meter. This is the relative signal power, S_r.

5. Disable Transmitter, and enable CW Jammer generator RF output. Set reference CW Jammer power level at power meter port 8.6 dB below S_r (minimum J/S, or 10 dB processing gain reference level), set frequency to signal carrier frequency. Note the power level setting on the generator, this is the reference CW Jammer power setting, J_r.

6. Disable CW Jammer, re-establish link. BER test set should be operating error-free.

7. Enable CW Jammer at a low power level and gradually increase the CW Jammer power until the BER test set indicates the reference BER level ($1 \bullet 10^{-5}$). Note nominal Jammer power setting, J_n.

This test is repeated for a fixed signal carrier frequency and for uniform steps in frequency increments of 50 kHz across the receiver passband with the CW Jammer. In this case the receiver passband is ±8.5 MHz. The procedure can be illustrated as follows:

For offset frequency - 8.5 MHz to carrier frequency + 8.5 MHz , Step 50 kHz.
Do:
Adjust Nominal Jammer Level setting.
Until:
Average BER is equal to reference BER.
Record Indicated Nominal Jammer Level setting.
Next offset frequency.

The nominal Jammer Level settings are tabulated versus offset frequency. The J/S ratio and the processing gain are then calculated as follows:

$$\left(\frac{J}{S}\right) = -\left[(S_r - J_n) - (S_r - 8.6\,dB - J_r)\right]$$

If $J_n = J_r$ then:

$$\left(\frac{J}{S}\right) = -\left[8.6\,dB\right]$$

is the J/S ratio associated with 10 dB processing gain.

The processing gain then is determined using the J/S ratio:

$$G_p = 18.6\ dB + \left(\frac{J}{S}\right)$$