



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 100 mW or 250 mW versions. The LA3021-100 is a 100 mW version used in both Mobile and Portable device applications. Symbol Technologies, Inc. bases its conformance to safe RF exposure limits on its two worst case situations using the 250 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 1040 antenna used in the WWC1049 terminal for portable devices both using the high power version of the PC Card H9PLA3021-500.

In the case of the Parabolic Grid the MPE distance is 13.3 cm 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. For mobile devices Symbol will include a user/installation instruction to alert the user to the MPE distance. To minimize the confusion for the users we will state the MPE for all antennas to be the worst case for any one of the antennas as 15 cm or 6 inches. This is a rounding up of the actual distance from 13.3 cm to 15. The following safety statement is included with the user manuals for each of the mobile devices.

Symbol Safety Statement: “The maximum permissible exposure (MPE) limit for these antennas when used with a Spectrum24 device is 6 inches (15 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.

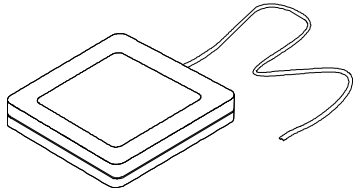
Symbol's portable devices can be broken down into two separate categories depending on how close the radiating element is to the user's body. Hand held devices have their antennas less than 20 cm but more than 8 cm. Because of range degradation when users get the antenna too close to their hand the device is designed so that the radiating element is as far from human tissue as possible.

Body worn devices are strapped to the user with an antenna to tissue distance for the WWC 1049 of 1.3 cm. Since all of our portable devices use the same F-element family of antennas with very similar patterns and gains the 1049 is the worst case for any portable device. Portable device WWC1040 is the same as WWC 1049 (the difference is in memory options) which was used for near field SAR measurements made by Iltiss America, Inc. The compliance test report was provided in a previous letter, September 16, 1998 reference number 3413 with respect to the H9PLA3020 application.

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

Connector Information: The LA3021 wireless LAN PC Card family is attached to its antenna via a MMCX style coaxial connector. It is available from Amphenol. 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 family of WLAN PC Cards.

Antenna # 1 Plane Antenna

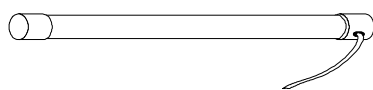


The Plane antenna is 0 dBi omnidirectional in azimuth plane. It would typically be mounted on top of

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. As such its MPE is less than the 1 mW/ cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know P = 100 mW, G = 1 (0 dBi) and R = 20 cm, $S = (100)(1) / ((4\pi)(20)^2) = 0.05$ mW/cm², 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.

<i>Location</i>	Horz Surface
<i>Pattern</i>	Omni
<i>Type</i>	Plane
<i>Gain</i>	0 dBi
<i>Physical</i>	2.5" x 2.5" x 0.75"
<i>Cable</i>	4 ft (Plenum-rated)
<i>Symbol P/N</i>	ML-2499-PSA1-00
<i>MPE Distance</i>	4.46 cm

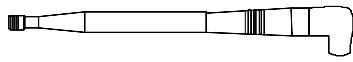
Antenna # 2 Ceiling Mount Dipole Antenna(s)



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/ cm² limit. $S = (PG)/(4\pi R^2)$, for the LA3020 we know P = 100 mW, G = 2 (3 dBi) and R = 20 cm, $S = (100)(2) / ((4\pi)(20)^2) = 0.10$ mW/cm²

<i>Location</i>	Horz Surface
<i>Pattern</i>	Omni
<i>Type</i>	Co Linear Dipole Array
<i>Gain</i>	3 dBi (4ft), 0 dBi (15ft)
<i>Physical</i>	14" (l) x 1.25" (dia.) pole
<i>Cable</i>	or 15 ft (Plenum-rated)
<i>Symbol P/N</i>	L-2499-HPA1-00 (4 ft)
	L-2499-HPA2-00 (15 ft)
<i>MPE Distance</i>	6.3 cm

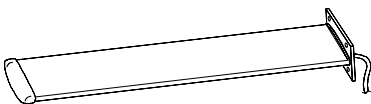
Antenna # 3 Rubber Duck Dipole antenna



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 antenna as such its MPE is less than the 1 mW/cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know $P = 100$ mW, $G = 1.25$ (1 dBi) and $R = 20$ cm, $S = (100)(1) / ((4\pi)(20)^2) = 0.063$ mW/cm². The antenna could in some less common situations be a mobile 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.

<i>Location</i>	Indoor
<i>Pattern</i>	Omni
<i>Type</i>	Co Linear Dipole Array
<i>Gain</i>	1 dBi
<i>Physical</i>	7" (l) x 0.5" (dia.) pole
<i>Cable</i>	/A
<i>Symbol P/N</i>	ML-2499-APA1-00
<i>MPE Distance</i>	5.0 cm

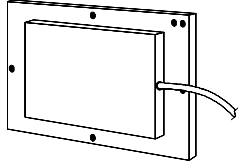
Antenna # 4 Yagi Antenna



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. The MPE is less than the 1 mW/cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3021 we know $P = 100$ mW, $G = 8$ (9 dBi) and $R = 20$ cm, $S = (100)(8) / ((4\pi)(20)^2) = 0.4$ mW/cm².

<i>Location</i>	In/outdoor
<i>Pattern</i>	Directional 30°beam
<i>Type</i>	Yagi
<i>Gain</i>	9 dBi
<i>Physical</i>	27" x 4" x 1.5" blade
<i>Cable</i>	20 ft (Plenum-rated)
<i>Symbol P/N</i>	ML-2499-YGA1-01
<i>MPE Distance</i>	12.57 cm

Antenna # 5 Patch Antenna

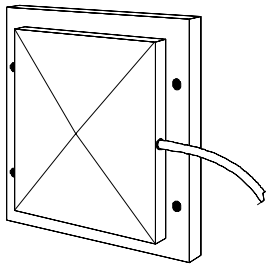


The Patch antenna mounts on walls near the ceiling or on rooftops with screws to a flat surface facing the desired coverage area. This antenna produces a wide (70°) coverage area while remaining unobtrusive.

<i>Location</i>	In/outdoor
<i>Pattern</i>	Directional 70°beam
<i>Type</i>	Patch
<i>Gain</i>	4 dBi
<i>Physical</i>	5" x 5" x 0.5" panel
<i>Cable</i>	6 ft (Plenum-rated)
<i>Symbol P/N</i>	ML-2499-PTA1-01
<i>MPE Distance</i>	8.9 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. The MPE is less than the 1 mW/ cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3021-100 we know P = 100 mW, G =4 (6 dBi) and R =20 cm, $S = (100)(4) / ((4\pi)(20)^2) = 0.2 \text{ mW/cm}^2$.

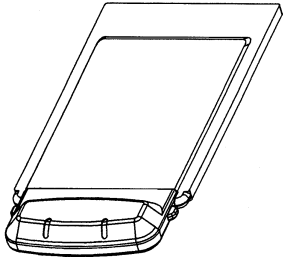
Antenna # 6 Panel Antenna



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. The MPE is less than the 1 mW/ cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3021 we know P = 100 mW, G = 5 (7 dBi) and R =20 cm, $S = (100)(5) / ((4\pi)(20)^2) = 0.25 \text{ mW/cm}^2$.

<i>Location</i>	In/outdoor
<i>Pattern</i>	Directional 22°beam
<i>Type</i>	Patch
<i>Gain</i>	7 dBi (with cable)
<i>Physical</i>	8" x 7" x 1" panel
<i>Cable</i>	20 ft (Plenum-rated)
<i>Symbol P/N</i>	ML-2499-PNA1-01
<i>MPE Distance</i>	10 cm

Antenna # 7 End Cap Antenna

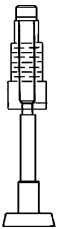


The End Cap made by Symbol Technologies is attached directly to the LA 3020 family PC Card. This antenna is less than 0 dBi in

<i>Location</i>	Laptop PC Card Slot
<i>Pattern</i>	Omni
<i>Type</i>	F-Element
<i>Gain</i>	0 dBi
<i>Physical</i>	2"x1"x0.35"
<i>Cable</i>	N/A
<i>Symbol P/N</i>	ML-3099-PCEC-01
<i>SAR</i>	< WWC1049

all planes. The End Cap Antenna uses an inverted F style antenna like the WWC 1049. The 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 WWC1049 but is not used as close as the WWC1049 it's SAR will be lower than the WWC 1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 8 Symbol 4140 Antenna

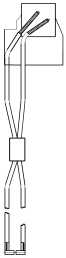


Symbol 4140 Antenna is integrated in the Symbol Technologies PPT 4140 hand held computer. The gain is less than 0 dBi in all planes. The 4140 is held in a persons hand. This usage will bring the user within 20cm but not

<i>Location</i>	Hand Held
<i>Pattern</i>	Omni
<i>Type</i>	Whip
<i>Gain</i>	< 0 dBi
<i>Physical</i>	L = 1.42"
<i>Cable</i>	N/A
<i>Symbol P/N</i>	DR10-2
<i>SAR</i>	< WWC1049

as close as the WWC 1049 that is in direct contact with the body. Since the 4140 hand held computer has the same gain as the as the WWC 1049 but is not used as close as the WWC1049 it's SAR will be lower than the WWC1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 9 Symbol 4640 Antenna

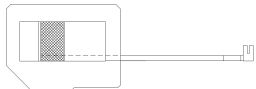


Symbol 4640 Antenna is integrated in the Symbol Technologies PPT 4640 hand held computer. The gain is less than 0 dBi in all planes. The 4640 is held in a persons hand. This usage will bring the user within 20cm but not as close as

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

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 WWC1049 it's SAR will be lower than the WWC1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 10 Symbol 2140 Antenna



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 WWC1049 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 WWC1049 it's SAR will be lower than the WWC1049 which is mounted in direct contact and has the same gain, 0 dBi.

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



Antenna # 11 Symbol 6140 Antenna

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

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

as the as the WWC 1049 but is not used as close as the WWC1049 it's SAR will be lower than the WWC1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 12 Symbol 6840

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

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

as the as the WWC 1049 but is not used as close as the WWC1049 it's SAR will be lower than the WWC1049 which is mounted in direct contact and has the same gain, 0 dBi.

Antenna # 13 Symbol WWC1040

Symbol WWC 1040 Antenna is integrated in the Symbol Technologies Wearable WWC 1040 computer. The gain is less than 0 dBi in all planes. The WWC1040 is the same as WWC 1049 (the difference is in memory options) which was used for near field SAR measurements made by IJssan America, Inc. The compliance test report was provided in a previous letter, September 16, 1998 reference number 3413. The WWC 1049 is mounted in direct contact to the body. It is the worst case since it has gain the same or greater than the other portable antennas (listed below) and is located the closest to the body (directly mounted to the body).

<i>Location</i>	Worn on Arm/Wrist
<i>Pattern</i>	Omni
<i>Type</i>	F-Element
<i>Gain</i>	< 0 dBi
<i>Physical</i>	
<i>Cable</i>	N/A
<i>Symbol P/N</i>	10-32447-01
<i>SAR</i>	

Antenna # 14 Huber Suhner Dipole



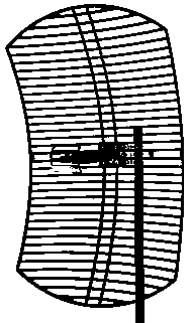
The antenna is a dipole with a gain of 1.8 dBi. The antenna is attached to a hand held computer. In such usage it would produce lower SAR than the WWC 1049 that is mounted in direct contact to the body. The Rubber Duck Dipole does have 1.8 dB (1.8

<i>Location</i>	Hand Held
<i>Pattern</i>	Omni
<i>Type</i>	Dipole
<i>Gain</i>	1.8 dBi
<i>Physical</i>	L = 79 mm
<i>Cable</i>	N/A
<i>Huber Suhner P/N</i>	9090.16.0001

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 Huber Shuner dipole usage and the WWC1049 usage would make the WWC 1049 SAR higher (worst case) than the Huber Shuner dipole.

Antenna # 15 Parabolic Grid



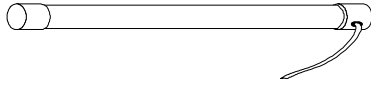
The Parabolic Grid antenna mounts on walls near the ceiling, on rooftops, or a mast. The antenna will, in this usage clearly will be more than 20 cm from the user and so be, classified as a mobile

<i>Location</i>	Mast/Wall
<i>Pattern</i>	Directional 8° Beam
<i>Type</i>	Parabolic Grid
<i>Gain</i>	9.5 dBi (with cable)
<i>Physical</i>	23.5"x39.25"x15"
<i>Cable</i>	50 foot
<i>Symbol P/N</i>	ML-2499-PGA1-00
<i>MPE Distance</i>	13.3 cm

antenna. The parabolic grid antenna has 9.5 dBi gain when adjusted for

cable loss from a 50 foot coaxial cable. The MPE is less than the 1 mW/ cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know $P = 100$ mW, $G = 8.91$ (9.5 dBi) and $R = 20$ cm, $S = (100)(8) / ((4\pi)(20)^2) = 0.44$ mW/cm².

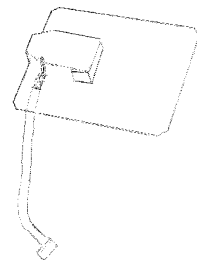
Antenna # 16 Cushcraft S2406



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. The MPE is less than the 1 mW/ cm² limit. $S = (PG)/(4\pi R^2)$, for the LA3020 we know P = 100 mW, G = 1.58 (2 dBi) and R = 20 cm, $S = (100)(1) / ((4\pi)(20)^2) = 0.08$ mW/cm².

<i>Location</i>	Ceiling
<i>Pattern</i>	Omni
<i>Type</i>	Collinear Dipole Array
<i>Gain</i>	2 dBi (with cable)
<i>Physical</i>	25"x1.25"
<i>Cable</i>	20/30 ft. Plenum
<i>Symbol P/N</i>	ML-2499-WHA1-20/30
<i>MPE Distance</i>	5.6 cm

Antenna # 17 7034430 Criticare Terminal

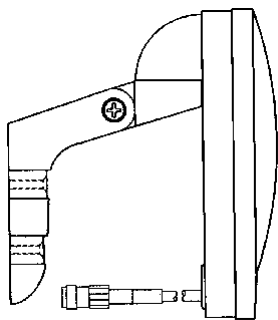


Criticare Antenna is integrated into a hand held computer made by riticare. The gain is less than 0 dBi in all planes. The Criticare computer is held in a persons hand. This usage will bring the

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

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

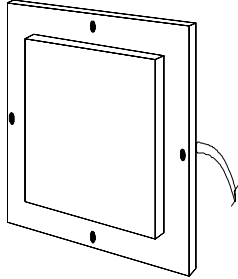


The Corner Patch 7.5 dBi with coaxial cable. The DirectLink Corner Patch antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this usage clearly will be more than 20 cm from the

<i>Location</i>	Wall / Ceiling
<i>Pattern</i>	Directional Beam
<i>Type</i>	Patch
<i>Gain</i>	5 dBi (with cable)
<i>Physical</i>	5.81"X5.75"X5.03"
<i>Cable</i>	6' Plenum
<i>Symbol P/N</i>	ML-2499DLA1-06
<i>MPE Distance</i>	10.6 cm

user and so, be classified as a mobile antenna. The MPE is less than the 1 mW/ cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know P = 100 mW, G = 3.16 (5dBi) and R = 20 cm, $S = (100)(3.16) / ((4\pi)(20)^2) = 0.16$ mW/cm².

Antenna # 19 Ceiling Mount Panel

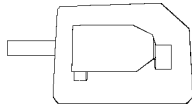


The Ceiling Mount Panel is 3.6 dBi with coaxial cable. The Ceiling Mount Panel antenna mounts on walls near the ceiling or on rooftops. The antenna will, in this

<i>Location</i>	Wall / Ceiling
<i>Pattern</i>	Omni
<i>Type</i>	Plane
<i>Gain</i>	3.6 dBi (with cable)
<i>Physical</i>	6"x6"x2"
<i>Cable</i>	6' Plenum
<i>Symbol P/N</i>	ML-2499-SD24-06
<i>MPE Distance</i>	6.75 cm

usage clearly will be more than 20 cm from the user and so, be classified as a mobile antenna. The MPE is less than the 1 mW/cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know $P = 100$ mW, $G = 2.2$ (3.6 dBi) and $R = 20$ cm, $S = (100)(2.2) / ((4\pi)(20)^2) = 0.109$ mW/cm².

Antenna # 20 Symbol 2040

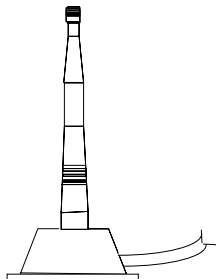


The 24040 antenna is internally mounted in the model CST240 hand held Customer Shopping

Terminal. The gain is less than 0 dBi in all planes. The terminal 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 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.

<i>Location</i>	Hand Held
<i>Pattern</i>	Directional Beam
<i>Type</i>	Patch
<i>Gain</i>	0 dBi
<i>Physical</i>	2"X1.8"X0.35"
<i>Cable</i>	N/A
<i>Symbol P/N</i>	10-17577-01
<i>SAR</i>	< WWC1049

Antenna # 21 Magnetic Mount Dipole Antenna



The Magnetic Mount Dipole antenna mounts to magnetic surfaces and is similar to the Rubber Duck Dipole except the gain is lower due to the long cable length. This antenna is

best used in temporary setups, or for

vehicle mounting. The MPE is less than the 1 mW/cm² limit. $S = (PG) / (4\pi R^2)$, for the LA3020 we know $P = 100$ mW, $G = 0.5$ (-3 dBi) and $R = 20$ cm, $S = (100)(5) / ((4\pi)(20)^2) = 0.109$ mW/cm².

<i>Location</i>	In/outdoor
<i>Pattern</i>	Omni
<i>Type</i>	Dipole
<i>Gain</i>	-3 dBi (with cable)
<i>Physical</i>	5" (tall) x 2" (base diameter)
<i>Cable</i>	2 ft (<u>NOT</u> Plenum-rated)
<i>Symbol P/N</i>	ML-2499-MGA1-01
<i>MPE Distance</i>	3.16 cm