

Type Acceptance Test Report

**Multimode PCS Repeater
FCC Rule Parts: 2, 15 & 24**

ACS Report Number: 03-0089-24TA

Manufacturer: EMS Wireless
Model: Link2Cell

Installation Guide



Link2Cell™-19 SOHO Signal Enhancer

Small Office – Home Office SIGNAL ENHANCER

OPERATOR'S MANUAL



A Division of EMS Technologies, Inc.

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Disclaimer

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**EMS Wireless
Norcross, Georgia**

WARNINGS, CAUTIONS, AND GENERAL NOTES

This product conforms to FCC Part 15. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help."

In accordance with FCC regulations regarding human exposure to radiofrequency energy, this device shall be installed such that a minimum separation distance of 20cm is maintained between it and general population.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other transmitter.

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

Safety Considerations

When installing or using this product, observe all safety precautions during handling and operation. Failure to comply with the following general safety precautions and with specific precautions described elsewhere in this manual violates the safety standards of the design, manufacture, and intended use of this product. EMS Wireless assumes no liability for the customer's failure to comply with these precautions.

WARNING

WARNING Calls attention to a procedure or practice, which if ignored, may result in damage to the system or system component. Do not perform any procedure preceded by a WARNING until described conditions are fully understood and met.

If You Need Help

If you need additional copies of this manual, or have questions about system options, or need help with installation and using of the system, please contact EMS Wireless' Sales Department.

**EMS Wireless Sales Dept.
2850 Colonnades Court NW, Norcross, GA 30071
Tel: 770 582 0555 Extension 5310**

Service

Do not attempt to modify or service any part of this product other than in accordance with procedures outlined in this Operator's Manual. If the product does not meet its warranted specifications, or if a problem is encountered that requires service, notify EMS Wireless' sales department. Service will be rendered according the EMS Wireless' warranty and repair policy. The product shall not be returned without contacting EMS Wireless and obtaining a return authorization number from the Sales department

When returning a product for service, include the following information: Owner, Model Number, Serial Number, Return Authorization Number (obtained in advance from EMS Wireless Customer Service Department), service required and/or a description of the problem encountered.

The EMS Wireless Quality Plan includes product test and inspection operations to verify the quality and reliability of our products.

EMS Wireless uses every reasonable precaution to ensure that every device meets published electrical, optical, and mechanical specifications prior to shipment. Customers are asked to advise their incoming inspection, assembly, and test personnel as to the precautions required in handling and testing ESD sensitive components. Physical damage to the external surfaces voids warranty.

These products are covered by the following warranties:

1. General Warranty

EMS Wireless warrants to the original purchaser all standard products sold by EMS Wireless to be free of defects in material and workmanship for the duration of the warranty period of one (1) year from date of shipment from EMS Wireless. During the warranty period, EMS Wireless' obligation, at our option, is limited to repair or replacement of any product that EMS Wireless proves to be defective. This warranty does not apply to any product, which has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.

2. Specific Product Warranty Instructions

All EMS Wireless products are manufactured to high quality standards and are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of a device found to be defective on incoming inspection by a customer must be made within 30 days of receipt of the shipment, or within 30 days of discovery of a defect within the warranty period.

This warranty is the only warranty made by EMS Wireless and is in lieu of all other warranties, expressed or implied, except as to title, and can be amended only by a written instrument signed by an officer of EMS Wireless. EMS Wireless sales agents or representatives are not authorized to make commitments on warranty returns.

In the event that it is necessary to return any product against the above warranty, the following procedure shall be followed:

- a. **Return authorization shall be received from the EMS Wireless Customer Service prior to returning any device. Advise the EMS Wireless Customer Service of the model, serial number, and the discrepancy. The device shall then be forwarded to EMS Wireless, transportation prepaid. Devices returned freight collect or without authorization may not be accepted.**
- b. **Prior to repair, EMS Wireless Customer Service will advise the customer of EMS Wireless test results and will advise the customer of any charges for repair (usually for customer caused problems or out-of-warranty conditions).**

If returned devices meet full specifications and do not require repair, or if non-warranty repairs are not authorized by the customer, the device may be subject to a standard evaluation charge. Customer approval for the repair and any associated costs will be the authority to begin the repair at EMS Wireless. Customer approval is also necessary for any removal of certain parts, such as connectors, which may be necessary for EMS Wireless testing or repair.

- c. **Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.**

3. Limitations of Liabilities

EMS Wireless' liability on any claim of any kind, including negligence, for any loss or damage arising from, connected with, or resulting from the purchase order, contract, or quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contract, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, EMS WIRELESS MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY GOODS, PARTS AND SERVICES PROVIDED IN CONNECTION WITH THIS AGREEMENT INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. EMS WIRELESS SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

EMS Wireless test reports or data indicating mean-time-to-failure, mean-time-between-failure, or other reliability data are design guides and are not intended to imply that individual products or samples of products will achieve the same results. These numbers are to be used as management and engineering tools, and are not necessarily indicative of expected field operation. These numbers assume a mature design, good parts, and no degradation of reliability due to manufacturing procedures and processes.

Handling the Link2Cell™ -19

- 1. Use ESD precautions when dealing with the modules within the Link2Cell™ -19 so that units are not damaged.**
- 2. Opening the unit voids warranty.**
- 3. Disconnecting any component within the Link2Cell™-19 when powered can damage or destroy the equipment and will void the warranty.**

Link2Cell™-19 Manual

Description

The Link2Cell™-19 SOHO, (Small Office-Home Office) Signal Enhancer, is a PCS band, bi-directional amplifier unit and was designed to provide enhanced RF coverage for wireless systems in small facilities. Usage includes providing coverage in retail stores, offices, warehouses, restaurants, homes, etc.

The Link2Cell™-19 is housed in an indoor mountable enclosure, and is powered with a regulated wall mountable power supply.

The Link2Cell™-19 supports all system protocols including CDMA, GSM/PCS1900 and TDMA and a single model will cover all licensed 1.9 GHz PCS bands A through F. The Link2Cell™-19 features Auto set-up, lightweight compact enclosure with internal antennas, local alarming, and excellent electrical specifications, high reliability with cost effective pricing.

Functionality

The Link2Cell™-19 is capable of automatically adjusting its own signal gain levels up to the maximum output power levels. The Link2Cell™-19 detects the downlink output power and adjusts the level for 2 dBm composite output power and continues to monitor and reset the gain as required for proper system performance. For example, when CDMA protocol system is being amplified, there could be an error in set up initially resulting from only pilot sync, and paging Walsh codes being present on the RF carrier. The Link2Cell™-19 will reduce the system gain until no signal is received that will exceed the output power setting. This prevents the Link2Cell™-19 from setting up to a higher in power level than actually desired if all of the Walsh codes were present. The gain does not continually change to maintain an output power of 2 dBm AGC (Automatic Gain Control) since this would defeat the benefits of power control in the service providers system.

The Link2Cell™ has 40 dB of gain control in the uplink and downlink signal paths. This gain is controlled by a microprocessor that monitors the system operation on a real time basis. The uplink and downlink attenuators are controlled by the internal microprocessor to adjust for maximum gain in both paths. The uplink and downlink signal paths are adjusted to the same setting by the microprocessor unless the system determines this is not optimum for the units operation.

Alarming

Alarming monitoring is accomplished in the Link2Cell™ by the microprocessor, which will detect a failure in gain or a system oscillation. This is indicated to the user by a solid constant

Red indicator. User can try recycling the power which will allow the unit to go thru its automatic set up operation but if the problem persists contact your service provider.

Indicators

The Link2Cell™-19 is equipped with three LED indicators on the end of the unit which provide the following information:

During normal operation:

<u>Indicator</u>	<u>State</u>	<u>Description</u>
Green	Off	No DC Input Power Applied
	Solid Indication	DC Power on, normal function
	Flashing Indication	System Initialization, Auto Set Up
Red	Flashing Indication	Warning, fault condition (Unit will reset gain to stable operation)
	Solid Indication	Alarm (Contact your Service Provider)
Amber	Flashing Indication	No RF Signal Detected (<-90 dBm)
	Solid Indication	Weak RF Signal (>-85 dBm)

Initial System Automatic Set Up:

(First 2-3 minutes of DC power being applied)

<u>Indicator</u>	<u>State</u>	<u>Description</u>
Green	Flashing Indicator	System Initialization, Auto Set Up
Amber/Red	Solid On, Both	>76 dB Gain
Amber	Solid On Indication	>73 dB Gain
Red	Solid On Indication	>70 dB Gain
Amber/Red	Flashing Both	>67 dB Gain
Amber/Red	Off, both	<64 dB Gain

*Green Indicator will go to a solid indication once the initial set up is complete.

Primary Power

The Link2Cell™ Unit operates on 9 VDC input power @ 1 Amp. This is supplied with a regulated wall mount supply, which is UL, and CSA listed. These are available to operate on AC input voltage of 115 VAC.

Donor/Server Antenna

Internal donor and server antenna are each 13 dB nominal gain. The donor antenna must be orientated to point in the direction of the Service Providers cell site location. Beam width of the antennas is approximately 60 degrees wide so it is necessary for the antenna to point toward the cell site. The indicators will provide a reference of the strongest RF power strength when the antenna is located in the optimum location.

Installation:

Note 1: The user is cautioned that modification or changes to this device not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note 2: Manufacturer's rated composite output power, individual channel power will vary depending on the number of channels and distance from each cell site being received

Note 3: This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

Introduction

Link2Cell™-19 is quick and easy to install, using a set of common tools. This section will provide the basic steps to performing the installation of Link2Cell™. *Please read complete instructions before beginning assembly.*

Placement of the Unit

Unit must be positioned with the donor antenna facing the direction of the cell site and the opposite side of the unit with LED indicators facing the intended coverage area. Signal strength at this location should be adequate to make a call with the subscriber unit for the SOHO, (Small Office-Home Office) signal enhancer to provide additional coverage and service in the facility. (See optional mounting configurations in figure 2.)

The signal enhancer provides improved signal performance by amplifying radio frequency signals being received from the base station and the subscriber unit (mobile phone). The model Link2Cell™ provides signal enhancement for the entire PCS band only, see the Link2Cell specifications for details on equipment.

Link2Cell™ is designed to automatically set up its own gain and will improve performance in most applications as long as a signal is received at the window location. Actual area of coverage that will be improved will vary depending on the signal level received, and blockage to the signals in the desired area of coverage. Blockages to RF signals include walls, people, equipment and furniture, etc. Amount of signal attenuation by each of these blockages will vary depending upon their size and composition.

If additional area of coverage is required, additional Link2Cell™ units can be cascaded inside of the facility to provide this. There is a practical limit to the number of signal enhancers that can be cascaded and provide enhanced system performance. If greater than three total Link2Cell units are required you should call your system provider for additional solutions that are available.

Getting Started:

Unpack all of the boxes and insure all of the material is included for your installation requirements and undamaged in shipment.

Quantity	Part Description
1	Link2Cell™ SOHO Signal Enhancer
1	Loctite Thread locker
1	Power Converter
1	Mounting Base
2	Mounting Posts
4	Wall Anchors
4	Mounting Screws

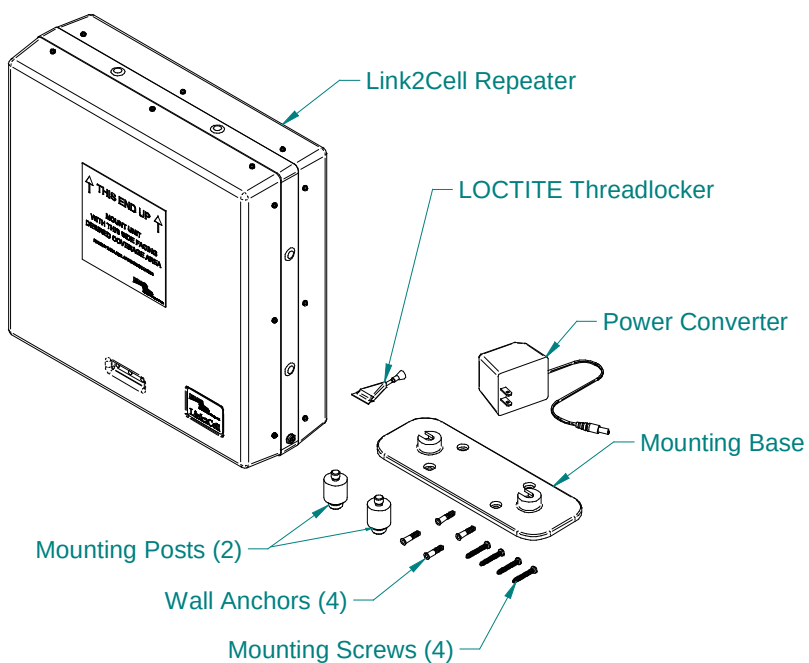


Figure 1
Package Contents

Link2Cell™-19 Unit Orientation & Installation

Link2Cell™ is designed for optimum use as an in-door signal enhancer. The housing is not weather resistant and the automatic set up procedure assumes sufficient isolation between antennas. Since the Link2Cell™ has a total of 53 dB active gain and an isolation of 73 dB must be obtained between the internal donor and the server antenna. Should adequate isolation not be obtained the unit will automatically reduce its gain until adequate isolation is obtained for the unit to operate properly. Isolation between the antennas is reduced by several conditions near or around the antennas, metal or conductive material, and movement of people near the antennas.

Mounting the Link2Cell™-19

Link2Cell™-19 must be mounted so the Donor antenna is orientated to receive and transmit to the cell site. The Donor antenna is located on the opposite side of the unit of the LED indicators of the Link2Cell™-19 with the LED's either at the bottom or the top to keep the orientation of the Donor antenna correct with respect to the direction of the cell site and which wall you desire to mount the unit on. 9 VDC input is located on the side of the Link2Cell™-19 housing shown above.

The Link2Cell™-19 may also sit on top of a book case, cabinet or on the floor as long as adequate signal is received by the unit to provide the desired coverage enhancement. As was previously discussed, these cabinets and bookcases should not be metal since this will effect the performance of the unit.

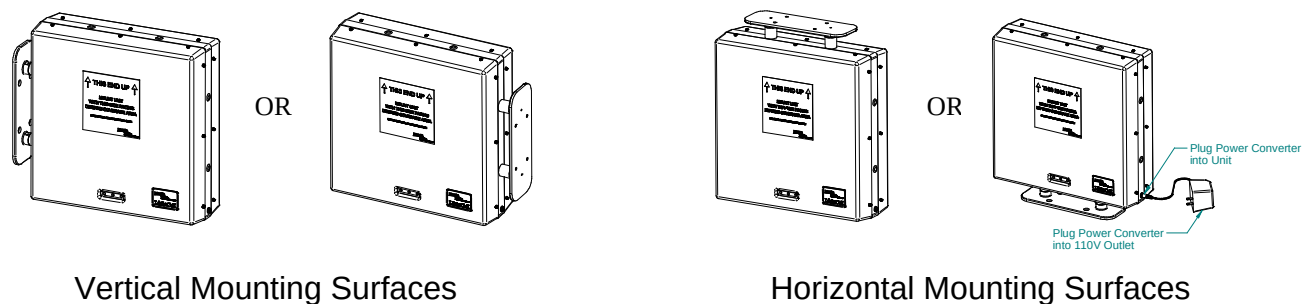


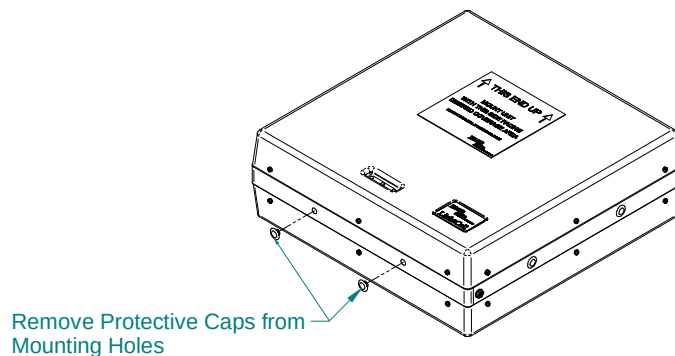
Figure 2

Optional Mounting Configurations

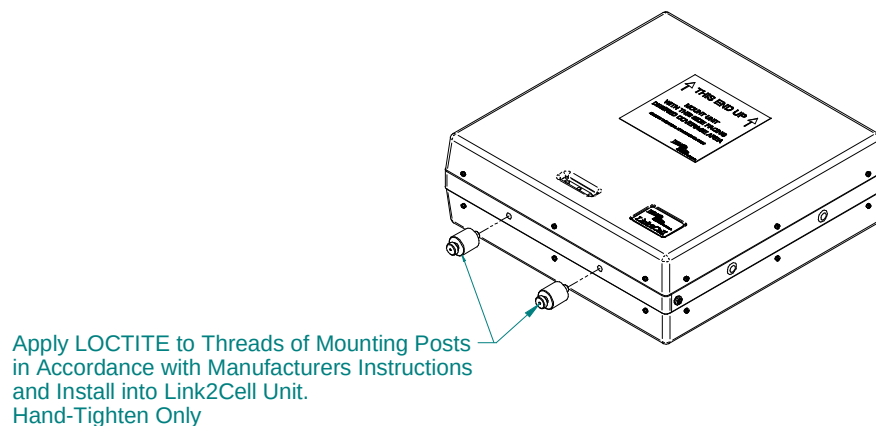
-Select the window that provides the strongest signal strength from the cell site to your portable phone by viewing the number of bars displayed on the face of the phone.

- Select the location in the window that provides the strongest signal strength from the cell site to your portable phone which will indicate how to position the Link2Cell™ (donor antenna) signal enhancer unit

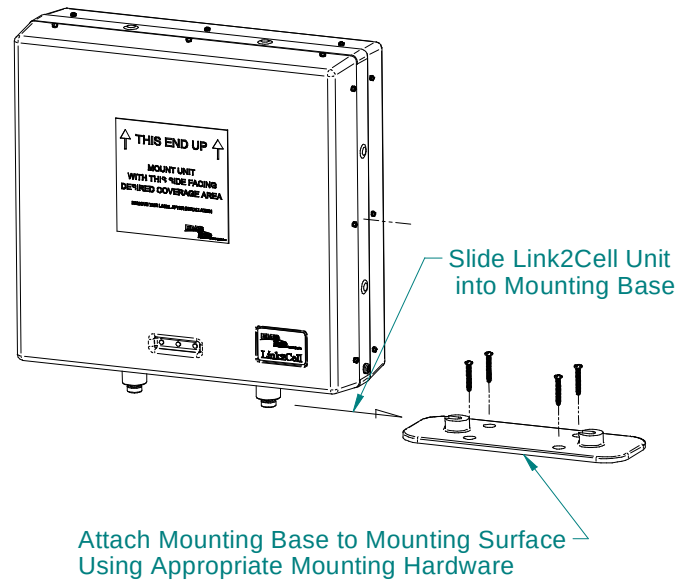
-Remove the 2 protective caps of the mounting holes from the selected side of the Link2Cell™, taking into consideration the 3 LED's must be facing you or the desired area of coverage.



-Apply Loctite to the threads of the mounting posts and install (hand tighten only) into the open mounting holes of Link2Cell™ unit.

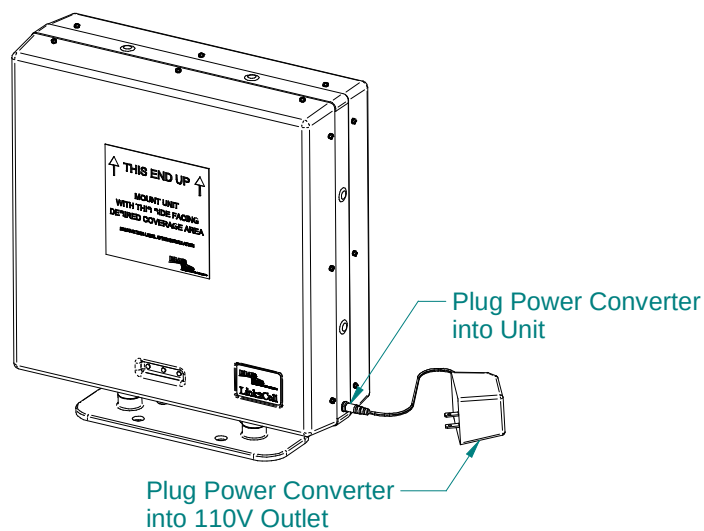


-Attach Mounting Base (with the open U portion in an upward ? position) to the selected position mounting surface area using the appropriate mounting hardware, (4 Wall anchors and 4 mounting screws).



-In a downward ? sliding motion, hook the Link2Cell™ Unit onto the secured mounting base.

-Connect the Power Converter into the Link2Cell™ unit and the plug power converter into an 110V outlet.



IMPORTANT: Before performing any maintenance or changing the position or location of the unit, make sure power plug is removed from the 110 AC wall socket. Once the unit is repositioned, the power should be plugged into the 110 wall socket, this will insure the unit is set to maximum gain and performance.

System Set Up Instructions:

-After installing unit, apply power and Link2Cell™ unit will *automatically* set up. The system initialization will require 1 – 2 minutes for setup completion.

-Note: Since the Link2Cell™ is a broadband unit, it will improve the service for all system providers with cell sites in the direction the donor antenna is positioned.

Specifications for Model: Link2Cell™-19

Downlink Operating Frequency,	MHz	1930 to 1990
Uplink Operating Frequency,	MHz	1850 to 1910
Downlink EIRP Transmit Power	dBm	15
Uplink EIRP Transmit Power	dBm	28
System Gain	dB	40 to 79
Gain Flatness	dB	+/- 2
Noise Figure	dB	≤ 6
Spurious Output @ Rated Power		
FCC Regulations	dB	≤ -13
@Fc +/- 885 KHz (CDMA only)	dBc	≤ 45
@Fc +/- 1.25 MHz	dBc	≤ 26
2 tone @ -1 dBm each, DL	dBc	≤ 60
1 dB Compression	dBm	UL 22, DL 22
IP3	dBm	UL 41, DL 41
Operating Temperature, degrees	C	0° to +50°
Power Source:		(115 VAC) 9 VDC@ 1 amp, External AC to DC
Mechanical Dimensions, H x W x D,	inches	14.25 x 14.25 x 6.0
MTBF	hours	80,000
Indicators, Green LED		Solid, Normal Operation
Red LED		Flashing, Signal Overdrive Solid, Auto Off, Contact Service Provider
Yellow LED		Flashing, No Signal Detected, ≤ 90 dB Solid, Weak Signal, ≤ 85 dB
Automatic System Set Up		Upon Power Up
System Gain Indications upon Power Up For first 3 minutes		Green, Flashing during set up Amber/Red ≥ 76 dB Solid Amber ≥ 73 dB Solid Red ≥ 70 dB Solid Amber/Red ≥ 67 dB Flashing Both OFF = 64 dB
Certifications,		FCC, UL, CSA
*Meets or exceeds the EIA/TIA system requirements for CDMA, TDMA or GSM system protocols.		

Trouble Shooting:

The Link2Cell™-19 has no field replaceable parts; repair is limited to improper mounting location with respect to the cell site, insufficient RF signal levels, and installation or defective units.

Problem	Check	Corrective Action
No Power	Power Source	Reconnect or repair
	Power Source OK	Replace Unit
Alarm Indication		Recycle AC Power
	No change	Replace Unit
Amber Flashing	No RF signal Detected	Recycle AC Power
	No Change	Check Antenna alignment with cell site
	No Change	Replace Unit
Amber Solid Indicator	Weak RF Signal	New Installation, Check Antenna alignment with cell site and recycle power
	Weak RF Signal	Previously working, recycle power.
	No Change	Replace Unit
Green Flashing Indication		Unit is in initial system initialization, if still flashing after 5 minutes replace unit
No signal improvement to subscriber unit	Recycle power to unit	Watch indicators for gain settings.
	Gain Settings, Amber or Amber/red	OK, check antenna alignment with cell site.
	Red, amber/red solid or flashing, or off	Insufficient isolation between antennas in the unit possibly. Move unit and try again. Unit operation can be effected if placed to close to metal objects or equipment.
	No Change	Consult your Service Provider

For Customer Service Call, Tel: 770 583-0555 Extension 5310