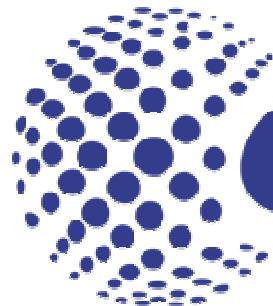




Proudly Designed and Manufactured in Spokane Valley, WA - USA



# CLEAR RF

TM

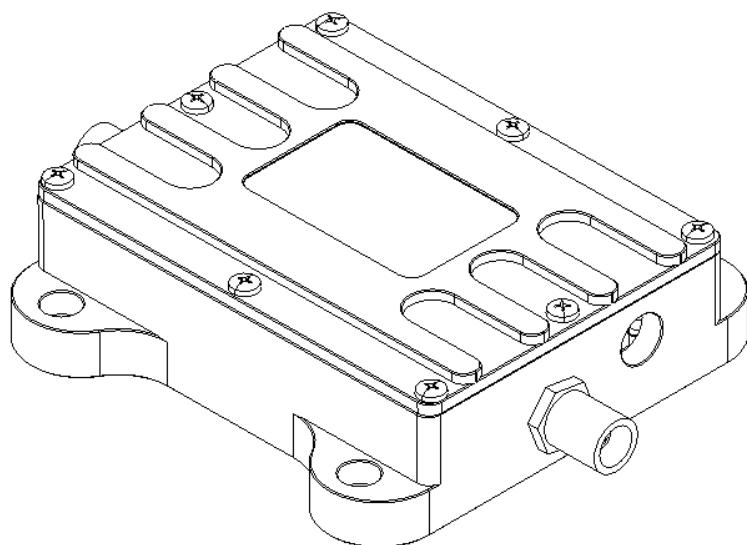
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## WRE2700 Operator's Manual and Installation Guide:

### Vehicle Installation Starter Kit

#### Overview

The WRE2700 Wireless Network Range Extender is a high performance, microprocessor controlled, bidirectional RF amplifier for the entire North American 850 MHz cellular and 1900 MHz PCS frequency bands. The amplifier has an automatic gain and oscillation control system that will automatically adjust the gain and the output power if a signal anomaly occurs. The amplifier is designed to operate as a *wireless unit*, with an outdoor and an indoor antenna, or as a tethered (direct connect) unit with the included inductive coupler for maximum performance in very remote coverage areas. The input power requirements for the amplifier are positive 8.0 to 36.0 volts DC (negative ground) providing a very wide range of compatibility with power systems found in automobiles, heavy trucks, boats and RVs.





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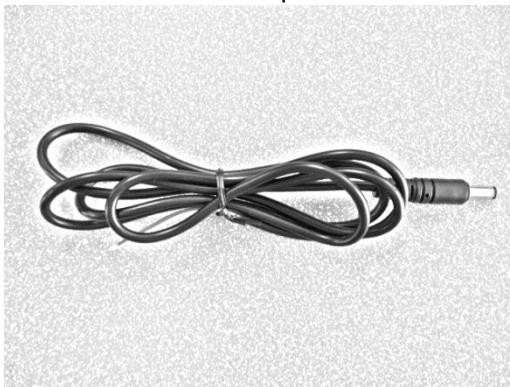
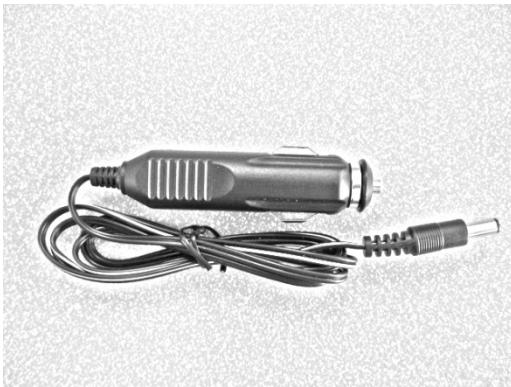
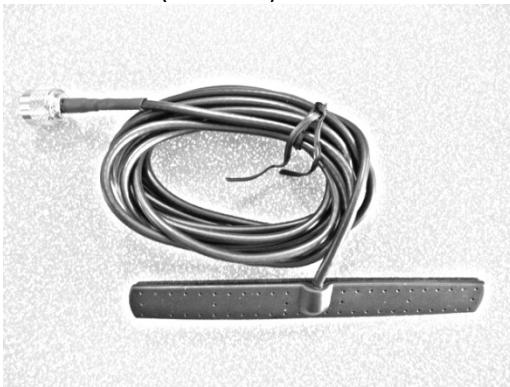
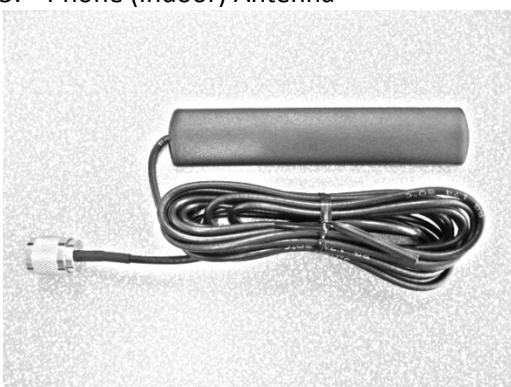
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## Parts List

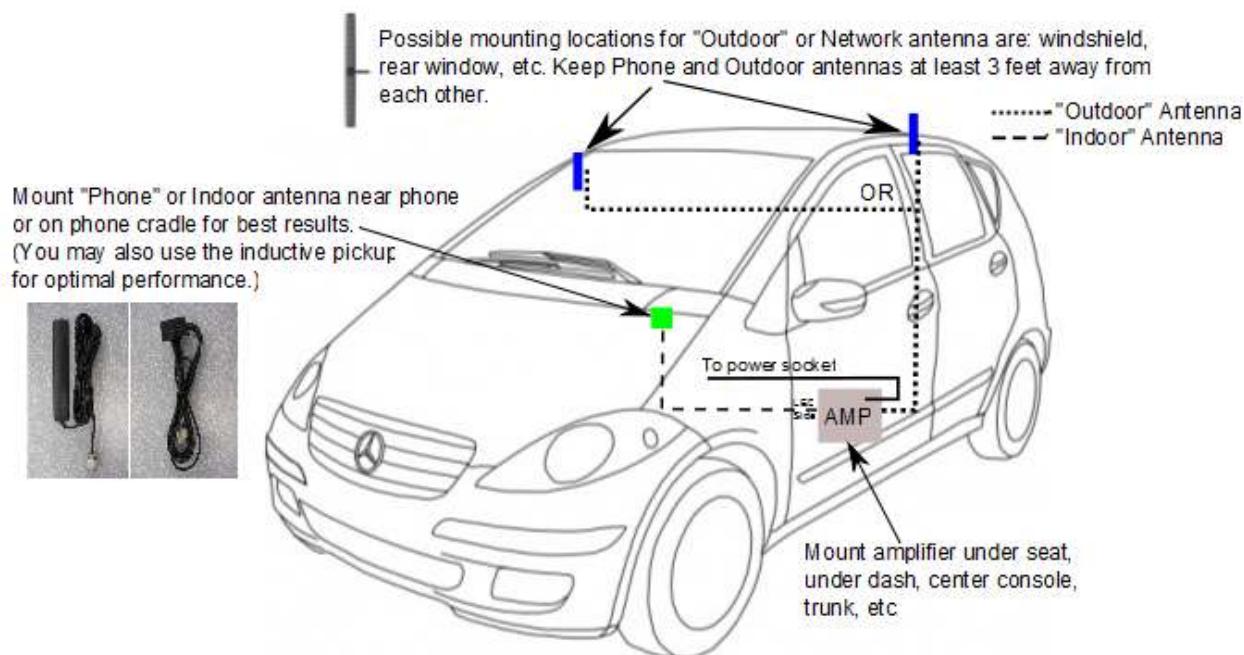
The WRE2700 is part of a complete kit intended for use in an automobile, light truck, RV or any type of heavy equipment or truck. Many optional antennas and accessories are also available to suite all types of installation preferences and applications. This complete kit includes the following:

1. WRE2700 Amplifier Unit		2. 12 volt bare ended power cable	
3. 12 volt CLA cable		4. Network (Outdoor) Antenna	
5. Phone (Indoor) Antenna		6. Phone (Indoor) Inductive Coupler	



## Installation Guide

**Disclaimer: Installation of this device requires knowledge of basic electrical and experience with installing electronic devices. We recommend seeking a professional installer if you are not accustomed to installing electronics or high tech devices. Installation of this device is at your own risk. Clear RF, LLC assumes no responsibility for the installation or improper operation of this device. Contact your dealer or [CustomerService@ClearRF.com](mailto:CustomerService@ClearRF.com) with "Installation Help" in the subject line for assistance.**



1. Unpack the shipping box and check the contents to make sure none of the components have any visual damage.
2. Installation Survey – The antennas and amplifier should be temporarily setup to ensure optimal system operation before permanently affixing the antennas. This is to prevent any problems caused by poor antenna location that may cause an oscillation or feedback between the antennas.
  - a. Temporarily mount the "Outdoor" or Network antenna in the vertical (Up/Down) position and the cable to the side where it may be concealed by the vehicle molding. Make sure the antenna is positioned so that it is at least 20 centimeters (8 inches) from the closest human at any time in accordance with FCC Radio Frequency Exposure Limits.
  - b. Temporarily mount the Phone "Indoor" antenna behind the dash so that it is facing the driver and passengers. The antenna should be mounted near where the phone is normally kept during driving, while using a hands free kit. If a cradle is used for the phone, the antenna may be mounted directly on the cradle for maximum performance. Household tape is acceptable to hold the antennas in place if needed. Make sure the



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antenna is positioned so that it is at least 20 centimeters (8 inches) from the closest human at any time in accordance with FCC Radio Frequency Exposure Limits.

**Note: For best performance see the Inductive Coupler Use and Installation section on the following page.**

- c. Install the amplifier in a dry location out of direct contact of wet or severe locations so the RF connectors and power plug are accessible. Ensure there is a 1 inch clearance around the amplifier housing for proper heat dissipation. You may also want to position the amplifier so the diagnostic LEDs are easy to see.
- d. Determine if you are going to use the 12 volt DC permanent power plug (wired to fuse block), or the Cigarette lighter plug to power your amplifier. If you chose the permanent power cable, then you must connect the red wire to a positive terminal from your fuse panel with a 3 ampere fuse rating. The black wire should be attached to a ground of the vehicle.
3. Connect the outdoor antenna to the RF connector on the amplifier that is on the same side as the power plug.
4. Connect the indoor antenna to the amplifier side that has the two red and green LED indicators.
5. Insert the DC power plug into the amplifier and watch the LED indicators. The LEDs will both turn on followed by the green LED flashing. The green LED will flash while the amplifier increases its gain to the optimum level. The red LED may also flash during this stage while the gain (power) is properly set on the amplifier. When power control is established, the green LED will remain constantly on. You may see the green and red LEDs flash back and forth, **THIS IS NORMAL**. In areas where the cellular network is adequate, the amplifier will maintain a maximum power level acceptable for normal operation and prevent overloading the wireless phone, as well as keeping RF signal levels at a minimum for a healthy environment. **If the red LED is constantly on and the green LED is off, the amplifier has detected a fault.** The amplifier will shutdown automatically and restart. If the fault persists, reposition the antennas until normal operation is achieved. - *The antennas should be as far apart as possible. Also, prevent the antennas from facing directly into a close by, metallic surface, where a reflection may occur.*
6. Once normal operation is established, you may permanently mount the antennas in the locations you chose in the prior steps.
7. If not already mounted, permanently mount the amplifier housing where it will be well protected and the RF cables will not be damaged by passenger movement or cargo, etc.

## Diagnostic LED definitions

1. Solid Green and Red – LED test, the unit is initializing
2. Solid Green – Normal operation
3. Flashing Green – Normal operation, increasing gain setting
4. Solid Green and Flashing Red – Normal operation, decreasing gain setting
5. Solid Red and no Green – Fault detected ( unit will shut down and restart )



## Inductive Coupler Use and Installation

If you wish to use the included inductive pickup for maximum range and performance complete the following.

1. Remove power to the amplifier.
2. Place the inductive coupler unit head on the back of your handset in the area where the internal antenna is located. (In most modern phones the antenna will be near the bottom of the handset in order to comply with SAR requirements and to keep the antenna away from the operator's head.) Choose a place on your handset where the pickup will fit and not interfere with any moving parts, etc.
3. Separate the Velcro mounting pad from the main body of the coupler head. Peel the backing off of the Velcro mounting pad and place with the glue side down on the handset location you chose. Place the coupler head on the Velcro part so they are one and press down tightly so the Velcro portion is now firmly attached to the handset and the adhesive is activated properly.
4. Connect the RF connector on the inductive coupler cable to the phone antenna side of the amplifier with the two LED indicators.
5. Make sure the outdoor antenna is connected and then apply power to the amplifier. You should see the same reaction with the diagnostic LEDs as with the internal antenna.

## SAR Information

This section provides some explanation and resources regarding SAR. Additional information is available online from the FCC ([www.fcc.gov](http://www.fcc.gov)) and the AMTA. The following exurbs from the AMTA website are provided solely for public awareness of available information and resources.

### SAR (Specific Absorption Rate) Explained<sup>1</sup>

Radio frequency (RF) exposure from a mobile phone is typically localized depending on where the phone is placed. Exposure guidelines for mobile phones specify the maximum level of RF energy that can be absorbed by the head or body with a large safety margin.

The unit of measurement for the amount of RF energy absorbed by the body is the Specific Absorption Rate or SAR. Measurement of SAR is used for compliance of mobile phones, walkie talkies, or when working very close to transmitting antennas. SAR is expressed in units of watts per kilogram (W/kg).

The maximum SAR level for a mobile phone used against the head or body in accordance with the [ICNIRP International guidelines](#) is 2W/kg (using 10gm averaging mass). Mobile phones are tested for SAR compliance at the highest certified power level in laboratory conditions.

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<sup>1</sup> Australian Mobile Telecommunications Association (AMTA), <http://www.emfexplained.info/>



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**SPECIFIC ABSORPTION RATE (SAR) - MOBILE PHONE TESTS**

MOBILE PHONES ARE TESTED FOR SAR COMPLIANCE AGAINST THE HEAD AND BODY

CHECK USER GUIDE FOR ANY MINIMUM BODY SEPARATION REQUIREMENTS

Note: The international standard IEC62209.2 specifying the procedures for body worn SAR testing is scheduled for publication in 2009. Prior to this, manufacturers when testing for body worn SAR used the procedures specified by the US FCC.

Some countries, such as Bolivia, Canada, South Korea and the US, have adopted slightly different localized SAR limits for the head and trunk - 1.6 W/kg (using 1gm average mass).

Some mobile phones are designed to have a small minimum separation from the body when in use, typically 15 – 25mm depending on the phone. This is to ensure the phone operates more efficiently and also meets the SAR requirements.

A mobile phone can always be used up against the head without separation. This is because the antenna in the phone is designed to be far enough away from the head to meet the SAR requirements.

## SAR Limits<sup>2</sup>

The international EMF exposure guidelines are based on careful analysis of the entire scientific literature and are designed to offer protection for all persons, including children, against known health effects of EMF with a large built-in safety margin.

General Public SAR limits	Whole-body average SAR (W/kg)	Localized SAR head and trunk (W/kg)	Localized SAR limbs (W/kg)
General Public Exposure	0.08	2	4

- For mobile phones, the localised general public SAR limits of 2 W/kg for the head and body apply.
- SAR values are averaged over a 6 minute period and use a 10gm average mass
- Refer to [International EMF Exposure Guidelines](#) (table 4) for details including occupational SAR limits

<sup>2</sup> Australian Mobile Telecommunications Association (AMTA), <http://www.emfexplained.info/>



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Some countries, such as Bolivia, Canada, South Korea and the US, have adopted slightly different localized SAR limits for the head and trunk - 1.6 W/kg in a 1gm average mass in the shape of a cube.

Mobile phones are tested to ensure compliance with the SAR limit for the countries into which the phones are sold.

## How Your Clear RF™ Amplifier May Reduce SAR

Although the Clear RF Wireless Network Range Extender amplifier is primarily design for improving weak signal areas and reducing dropped calls, the SAR exposure to the operator may also be reduced when using the amplifier making it safer for the operator. When operating in weak coverage areas, a wireless phone must transmit at its highest power settings thus exposing the operator near the maximum SAR level for the specific wireless phone in use. The Clear RF amplifier reduces the need for the wireless phone to transmit at the high power setting because it amplifies or “boosts” the wireless phone signal and transmits it to the cell site. The operator is protected from the higher power level because the amplifier’s outdoor antenna is much further away than the wireless phone antenna to the operator. This process is similar to using a microphone to send your voice over a long distance without yelling. This process will also prolong your phone’s battery life because it doesn’t have to work as hard!





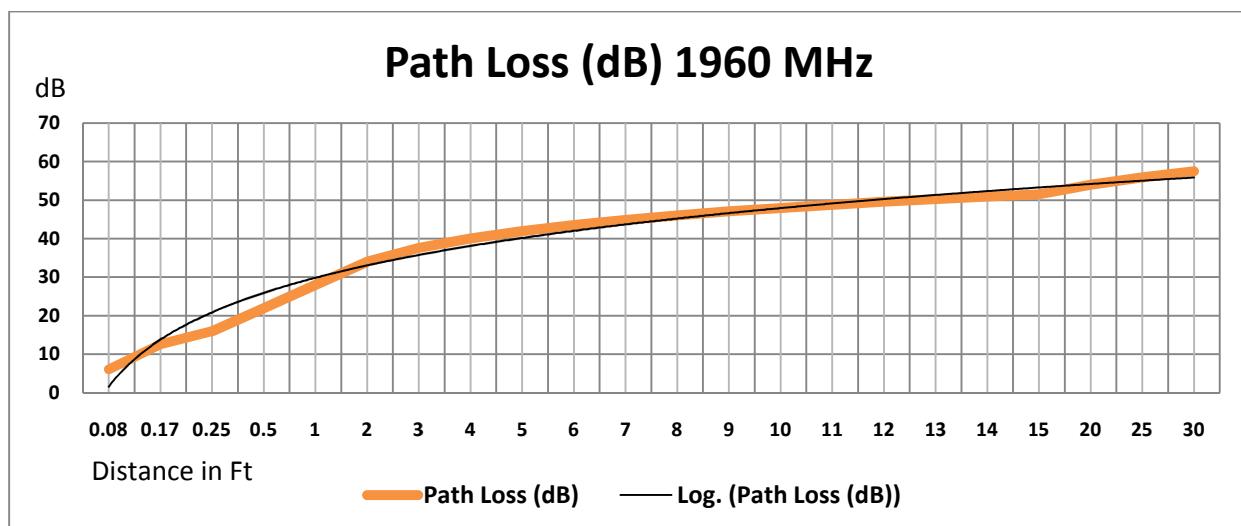
## Radio Frequency Path Loss

Radio signal strength is affected by many factors, one being path loss. This simply put, is the signal loss in free air space. Knowledge of path loss can help you to realize what to expect from your Clear RF™ amplifier or any signal booster amplifier. You don't have to know the details, just the logic behind amplifying a received signal and then retransmitting it from another antenna and how far away the signal may be used. This applies more so when you use your amplifier with the supplied "indoor antenna" in wireless mode. When an "outdoor" signal is amplified and retransmitted "indoors" your phone must be within a certain distance to the "indoor" antenna to realize any benefit by the laws of physics. In areas where the "outdoor" signal is very weak, this concept is especially important. The amplifier can only "boost" an existing signal by its rated dB gain and then transmit it "indoors." Your phone has a minimum signal strength it can use; therefore, you must remain close enough to the "indoor" antenna so the gain of the amplifier can keep the signal above the lower limit of your phone's receiver sensitivity. A dB is a relative unit so the actual distance may vary depending on the signal strength of the "outdoor" signal in the specific area of use. Your Clear RF™ WRE2700 will improve your signal strength by as much as 45 dB. You can see in the model below, you may see only slight signal improvement when operating with a weak "outdoor" signal and you are using your phone just a short distance away from the "indoor" antenna. The supplied inductive pickup is designed to provide full signal enhancement capabilities in this scenario. When the inductive pickup is used, a very weak signal may be improved to a "full bars" signal level in most cases.

Do the math: The Friis Equation (H.T. Friis, 1946) gives a more complete accounting for all the factors from the transmitter to the receiver:

$$P_{Rx} = P_{Tx} \frac{G_{Tx} \cdot G_{Rx} \cdot \lambda^2}{16 \cdot \pi^2 \cdot d^2 \cdot L} \quad \text{where:} \quad \begin{aligned} G_{Tx} &= \text{transmitter antenna gain} \\ G_{Rx} &= \text{receiver antenna gain} \\ \lambda &= \text{wavelength (same units as } d) \\ d &= \text{distance separating Tx and Rx antennas} \\ L &= \text{system loss factor } (\geq 1) \end{aligned}$$

A model for visualization is provided in the following plots:

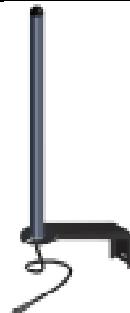




## Optional Accessories

Contact us on our website for pricing and availability or see your Clear RF™ dealer. Replacement parts and additional accessories may also be available.

### Approved Antennas

TBC3G	<ul style="list-style-type: none"><li>• 2 dBi Gain</li><li>• Glass mountable</li><li>• No holes required</li><li>• Ground plane independent</li><li>• 54mm Square</li><li>• Suitable for Network or Phone antenna use.</li></ul> 
GAPQ	<ul style="list-style-type: none"><li>• 2 dBi Gain</li><li>• Windshield / glass mountable</li><li>• No holes required</li><li>• Ground plane independent</li><li>• 100mm Height</li><li>• Suitable for Network antenna use</li><li>• Can be removed without a trace</li></ul> 
GAP	<ul style="list-style-type: none"><li>• 5 dBi 850MHz / 2dBi 1900MHz</li><li>• Windshield / glass mountable</li><li>• No holes required</li><li>• Ground plane independent</li><li>• 320mm Height</li><li>• Suitable for Network antenna use</li><li>• Can be removed without a trace</li></ul> 
MAR-C3G-2F	<ul style="list-style-type: none"><li>• 2 dBi Gain</li><li>• Magnetic mount</li><li>• 74mm Height</li><li>• Portable, strong magnetic retention</li><li>• Protective pad</li></ul> 
B2B-C3G-5F	<ul style="list-style-type: none"><li>• 2 dBi</li><li>• Suitable for marine use</li><li>• Universal bracket mount</li><li>• 212mm Height</li><li>• Suitable for Network antenna use</li><li>• Low loss URM76, 5 meter coax cable</li></ul> 



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## WRE-2700 Specifications

- Frequency Range: Cellular 850 (824MHz – 894MHz), PCS 1900 (1850MHz – 1990MHz)
- Maximum Output Power: Uplink; 1.84 Watts (32.64 dBm) Downlink; 0.31 Watts (24.97 dBm)
- Current Draw @ 12VDC: Idle: 350 milliamperes; Max: 2.0 amperes
- Power Requirement: 8.0 to 36.0 volts DC (negative ground), Connector is center positive
- Maximum Gain: Cellular 850: 40dB nominal, PCS 1900: 40dB nominal
- Input/output Impedance: 50 Ohms

FCC ID: XS7-WRE2700

IC ID: 8918A-WRE2700

This device complies with Part 15 of the FCC Rules. 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.

The term "IC:" before the radio certification number only signifies that Industry of Canada technical specifications were met. The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

## Warranty Information

### Limited Warranty

ClearRF L.L.C. warrants that this product is free from defects in materials or workmanship for one year from the date of purchase. Within this period, ClearRF, will, at its sole option, repair or replace any components which fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alterations or repairs.

Repairs have a 90 day warranty. If the unit sent in is still under its original warranty, then the new warranty is 90 days or to the end of the original one year warranty, depending upon which is longer.

ClearRF retains the exclusive right to repair or replace the product or offer a full refund of the purchase price at its sole discretion. Such remedy shall be your sole and exclusive remedy for any breach of warranty. ClearRF shall not be liable for any incidental or consequential damages for breach.

### Procedure for Claims under Limited Warranties

To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. To obtain warranty service, follow these two steps:

1. Contact ClearRF via email to receive authorization (RMA) number.  
[warranty@clearrf.com](mailto:warranty@clearrf.com)
2. Once you have obtained an RMA #, ship the unit, along with the RMA number to:

ClearRF

RMA #: {insert RMA number}

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