EdgePoint PRO Installation Guide
Version 1.0

February 2011

FOR USE BY TRAINED TECHNICIANS ONLY

Revision History

Version	Date	Person	Description
0.1	01/04/2011	R MacLennan	Initial Draft Document
0.2	02/04/2011	R Campman	Added Plug and Play section
0.3	02/10/2011	A Sridhar	Added Cluster info, LED deciphering section
1.0			Review changes

Contents

1 Introduction

1.1 Proprietary Information Notice

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1.2 Purpose

The AirWalk EdgePoint Pro Femto Cells, called eFemto throughout this document, are small, easily installable miniature base stations designed to provide improved and enhanced coverage inside buildings. Typically the eFemto cells are connected to the public Internet and the operator's network via Cable, DSL, on-premise fiber optic link, or a similar IP backhaul technology. The eFemto cell offers benefits for both the subscribers as well the operators. The subscribers get better voice service coverage and higher data throughput while the operators are able to provide better coverage in spotty coverage areas and are able to off-load traffic from the macro cellular network. In addition, indoor coverage problems may be resolved by using the eFemto cell.

1.3 Scope

This document describes the installation procedure for the eFemto cell. The scope of this document covers the description, environmental specifications, equipment location, cabling, and installation followed by trouble shooting steps if required during the installation of the eFemto device.

2 Acronyms

1xEVDO	1x Evolution Data Optimized
1xRTT	1x Real Time Transmission
AAA	Authentication, Authorization and Accounting
AN	Access Network
BSC	Base Station Controller
BTS	Base Station Transceiver Subsystem
DHCP	Dynamic Host Control Protocol
DNS	Domain Name Server
DSCP	Differentiated Services Code Point
FCC	Federal Communications Commission
FSM	Femto cell Station Manager
FQDN	Fully Qualified Domain Name
GPS	Global Positioning System
IKEv2	Internet Key Exchange version 2
IMS	IP Multimedia Subsystem
IOS	Interoperability Specification
ISAKMP	Internet Security Association and Key Management Protocol
IPSec	IP Security
LAN	Local Area Network
LED	Light Emitting Diode
MGW	Media Gateway
O&M	Operation and Maintenance
PCF	Packet Control Function
RF	Radio Frequency
RN	Radio Network
RNC	Radio Network Controller
RTP	Real Time Protocol
SeGW	Security Gateway
SIP	Session Initiation Protocol
UDP	User Datagram Protocol
VPN	Virtual Private Network
WAN	Wide Area Network

3 eFemto Safety and Compliance Information

3.1 Statement of Intent

The AirWalk EdgePoint PRO Femto Cell is intended for use in a CDMA cellular infrastructure radio access network. The responsible body shall be made aware that, if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3.2 Safety Precautions

⚠ Power Sources

Use only power sources that are within the specified limits as designated on the equipment labels. Use of power sources outside the specified limits is hazardous and may cause personal injury or property damage.

⚠ Equipment Location

Equipment is meant for indoor use only and should be located inside the building. Use of unprotected equipment outdoors is hazardous and may cause personal injury or property damage.

3.3 Regulatory Compliance Information

The FCC regulatory compliance information provided in this section is applicable only to models equipped with an FCC Identification Number (FCC ID).

Enterprise Femtocell

MODEL: AWFExxxxxxx
FCC ID: R4HAWEPPRO
MAC ID:
0009D200000
SERIAL #:
AA00000A
DC IN: 12 VDC / 8A
AirWalk Communications., Inc Contact: +1-972-638-9400
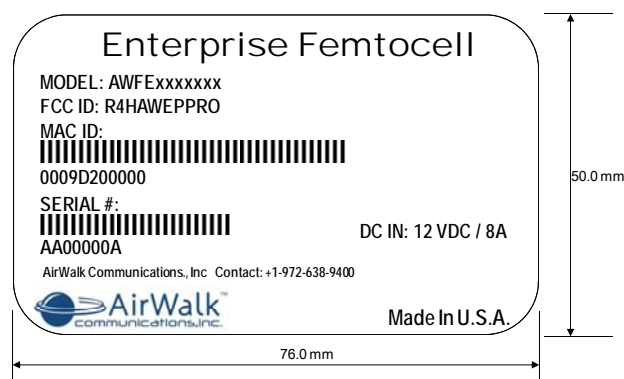Made In U.S.A.

50.0 mm
76.0 mm

Figure 1 - AirWalk eFemto FCC Label (SAMPLE)

3.3.1 FCC Radiation Exposure Statement

This device complies with FCC's RF radiation exposure limits set forth for an uncontrolled environment under the following conditions:

- This device should be installed and operated such that a minimum separation distance of 8 inches (20 cm) is maintained between the radiator (antenna) and the user's or nearby person's body at all times.

3.3.2 Radio Interference (FCC 15.19 Statement)

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.

3.3.3 Unauthorized Modifications (FCC 15.21 Statement)

Persons or parties responsible for operation of this equipment are cautioned that any changes or modifications not expressly approved by AirWalk Communications Incorporated could void the user's authority to operate this equipment.

3.3.4 Digital Device Interference (FCC 15.105 Statement)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

4 eFemto Device Installation

4.1 Overview

The eFemto is a compact cellular access point, supporting both cdma2000 1xRTT and 1xEVDO Rev0/Rev A subsystems. The combined functionalities of BTS, BSC, and PCF are supported within the cdma2000 1xRTT sub system. Further, the eFemto contains the capability for interworking standard IOS protocols to SIP messages on the back haul network for cdma2000 1xRTT handsets. For the 1xEVDO sub system, the eFemto supports the combined AN and PCF functionalities. The entire communication with the Operator's network goes through a secure IPSec tunnel. This tunnel originates from the eFemto and terminates at the SeGW. The eFemto expands 3G cellular services inside buildings so mobile users can experience full voice and data service in areas that have inconsistent or no cellular signal. Typical installations include office buildings, warehouses, high rises, convention centers and other in-building hot spots.

eFemto Advantages:

- **Security:** Secure and reliable connection into the operator's network. The eFemto uses a secure VPN tunnel to access an operator's internal network. The eFemto provides self as well as subscriber authentication to protect against fraud and illegal usage of the device.

- **Scalability:** Scalable to any number of Femto cells within an operator's network with minimal impact to the existing infrastructure. Each eFemto is easily configurable remotely from the operator's network using FSM.

- **Minimizing Interference:** The eFemto comes equipped with internal hardware and algorithms to minimize and mitigate RF interference towards existing networks.

- **Seamless Services Support:** The eFemto services are compatible with any standard-issue CDMA cellular phone or AirCard. The eFemto supports E911 emergency calls. Further it supports feature transparency with the CDMA Macro network.

- **Single Cell or Cluster Configuration Support with Mobility:** The eFemto can be deployed as a single RF cell or as a cluster of Femto cells. Peer-to-Peer soft handoff is supported within the clusters. Support for user mobility with soft handoff as well as hard handout from the Femto cell to the Macro.

- **Long Term Performance:** Once the device is installed, there is typically no reason to move, or update the eFemto. This unit is also maintenance free and requires no regular maintenance.

4.1.1

4.2 eFemto Network Diagram

The eFemto may be deployed as a single cell or multiple eFemtos may be deployed as a cluster configuration. The device is IP-based and plugs in directly into an existing IP network within the customer's premises. The following diagram is a typical network diagram for a standalone eFemto device within a customer's premise.
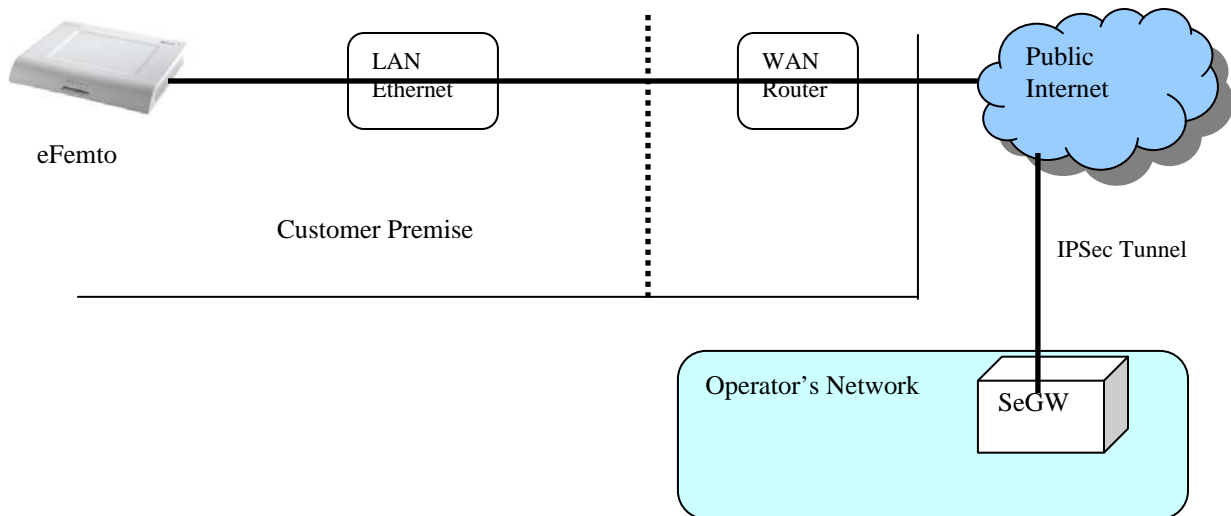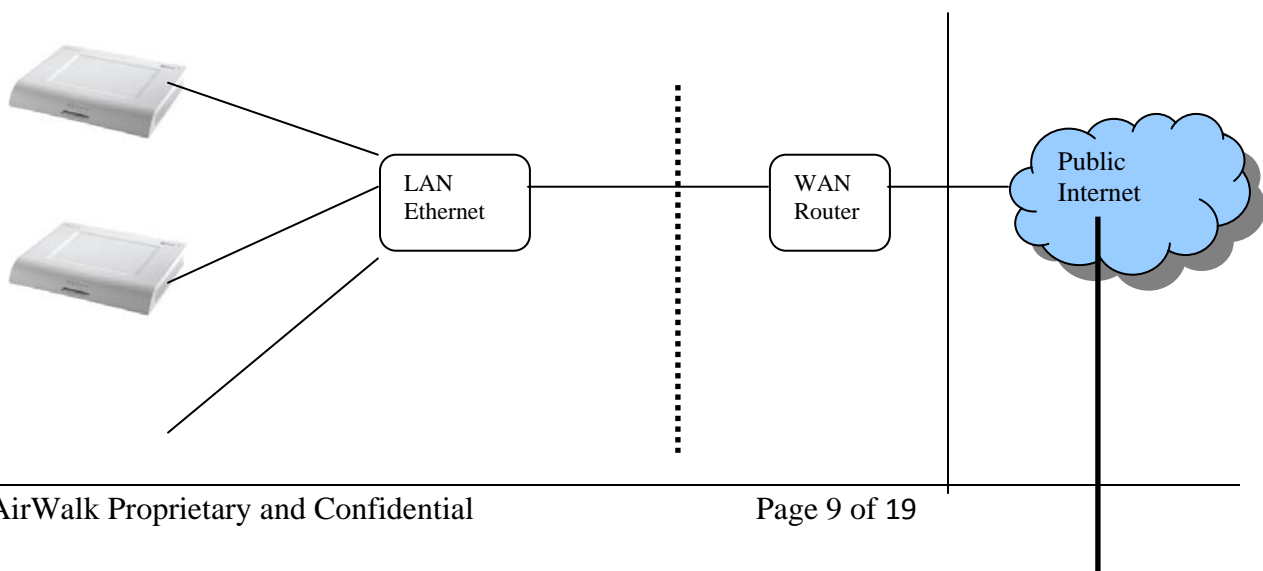

Figure 2 - Single eFemto deployment network diagram

The following is a typical network diagram for multiple eFemto devices within a cluster configuration in a customer's site. In a cluster configuration, it should be ensured that all the eFemtos within the cluster are reachable across the LAN. One way to do this is to connect all the devices with the same IP subnet. If different IP subnets are used for a cluster, then the routers must be updated accordingly for all subnets to be reachable.

IPSec Tunnel for
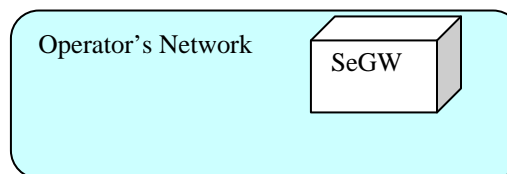each device

Customer Premise

Operator's Network

SeGW

Figure 3 - Multiple eFemto deployed within a Cluster Configuration

4.2.1 Network Requirements

To get the eFemto device operating in optimal conditions, a customer's IP network needs to meet the following bandwidth and capacity requirements:

Service Usage Type	Bandwidth Requirements	Capacity Description
Maximum Capacity	5 Mbps	29 voice calls and 32 active data users, simultaneous
Idle	20 Kbps	No active users
Voice Traffic Only	60 Kbps per call	Maximum of 29 concurrent calls
Data Traffic Only	3 Mbps per device (maximum)	Maximum of 32 simultaneous data sessions
If multiple devices are installed throughout a campus there will be an increase of IP traffic on the LAN		

LAN Installation Considerations:

- The eFemto device supports standard RJ 45 LAN connection (100BASE-TX Ethernet Switch/Router is recommended).

- The eFemto device supports DHCP as well as static IP addressing. The device is shipped from the factory with the DHCP IP addressing scheme.

- The LAN needs to be able to access the customer's WAN network to allow the eFemto to connect to the operator's network across the Internet.

- Signaling and traffic for Soft Handoff between cluster members goes across the LAN network.

WAN Installation Considerations:

- Must Open UDP Ports 500 and 4500 for ISAKMP signaling between the eFemto and the Security Gateway. Support for IPSec NAT-Traversal.

- Intrusion Prevention Systems should be properly configured for the device and Security Gateway communication if required.

- Support for DSCP marked IP packets if possible on the customer's IP network.

- For optimal performance of the device, a back haul bandwidth of 5 Mbits should be reserved for each device.

- For cluster configuration, each device within the cluster needs its own linear back haul bandwidth. All the devices within a cluster require the same back haul network for optimal performance.

Static IP Addressing Scheme

The eFemto supports static IP addressing for the device. The device is shipped from the factory using DHCP IP addressing scheme. The USB cable provided should be used to set static IP address for the device (see *EdgePoint PRO - USB Console User Guide* for more information).

When using static IP address for the device, along with the IP address, the Subnet Mask, default Gateway and DNS server information should also be provided to the device using the USB connection.

4.3   Hardware Configuration

The eFemto offers a unique combination of 1xRTT and EV-DO radio and controller in one physical platform that is differentiated from other systems. The eFemto comes equipped with a Network Listener module which aids the device in sniffing its RF environment to reduce interference to existing Macro networks. The device also has an in-built GPS receiver which is used to validate the position of the device once it becomes operational.

The following table lists the eFemto device specifications:

EdgePoint PRO Specifications		
	Technology	CDMA 1xRTT and 1xEV-DO Rev. A
	Frequency Bands	1900 MHz
RADIO	Simultaneous Calls	Up to 29 simultaneous voice calls Up to 32 active data sessions
	Transmit Power	200 mW
	Configuration	1 carrier / omni
CONTROLLER	Handoff	Soft / hard
	Integrated	BTS, BSC, RN, RNC, PCF and O&M
	Core Network Interface	SIP/IMS RTP/MGW
INTERFACES	PDSN	IP-10/100 Base T Ethernet – (A10, A11)
	AAA+HA	IP-10/100 Base T Ethernet – (A12)
	SeGW	IKEv2
POWER SUPPLY	AC	15 amps maximum / 120V AC
ENVIRONMENTAL	Temperature	Operating 0°C to 50°C (32°F to 122°F)
	Humidity	0 to 95% non-condensing
HARDWARE	Installation	Wall mount
	Dimensions (HxWxD)	12" x 14.6" x 2"

Weight	6.5 lbs (9 lbs with bracket)
Cooling	Forced air
Type	Indoor

5 Installation Steps

5.1   Contents within the Installation Kit

The contents of the installation kit are listed below:

1. EdgePoint PRO Femto Cell (1 unit)

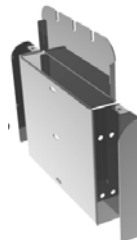2. Power Converter and Cable (1 unit each, 5 ft (1.5 m) cable)

3. GPS Antenna (1 unit)

4. RF Antenna (1 unit)

5. Ethernet Cable (1 unit, 16.4 ft (5 m) cable)

6. Mounting Bracket and Screws (1 unit, and 2 screws)

5.2   eFemto Location for Installation

The following list defines the eFemto location requirements for deployment inside the building:

- Flat 24″x24″ wall space so a physical clearance of 5″ on all sides of the device is observed to ensure efficient operation of the cooling fans and antennas
- A building support beam for mounting support (recommended)
- Access to a AC power source and breakers to accommodate up to 15 amps / 120 VAC (ceiling access is recommended)
- Access to an Ethernet port to connect the enterprise LAN line to the internet backbone (ceiling access is recommended)
- Must be within 15 ft (5m) from a window that has no metal sheeting with a clear view of the sky
- Moderate temperature between 32°F and 122°F
- Dry environment with relative humidity between 0 to 95% non-condensing

Equipment needed for installation:
- Drill or screwdriver with medium Phillips head
- Step ladder to install and connect the cables
- 3 screws size #10 pan head x 2″ with washer to install mounting plate
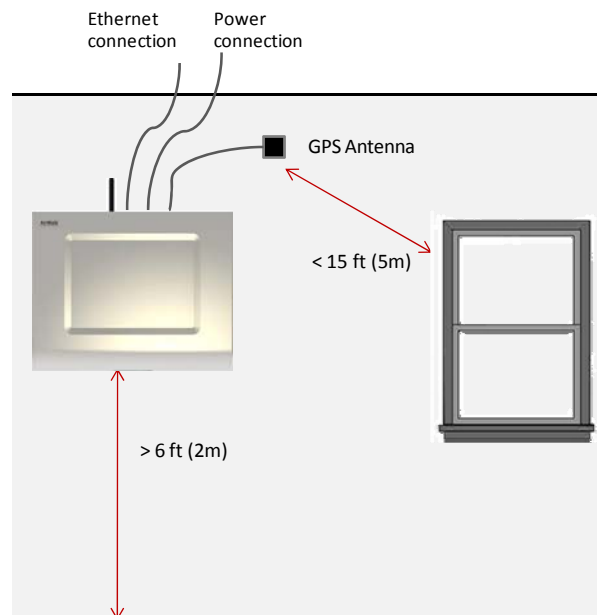- 3 wall anchors optional (if required for wall mounting)

Figure 4 - Possible Mounting Location for an eFemto device

5.3   Mount Bracket to Wall

Once the location has been selected, mount the bracket to the wall.

1. Mount eFemto at least 6ft (2m) from floor
    ➢ Do not mount above ceiling or on ceiling
2. Use mounting bracket as a template to determine hole positioning and level the bracket
3. Drill 3 wall anchors into the wall, if necessary. If mounting to a beam, no wall anchors will be necessary.
4. Position the bracket lined up with the holes
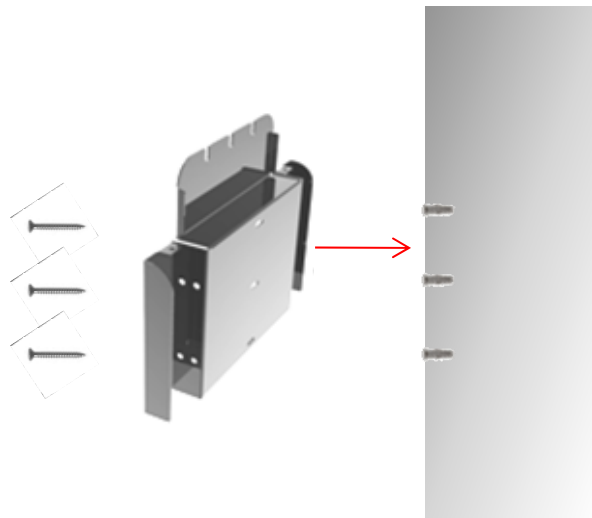5. Drive screws through the bracket to firmly secure it to the wall

Figure 5 - Mounting Bracket Installation

5.4   Position Power Supply, Cables and Antennas

Use the mounted bracket as a base support to:

1. Place power supply into designated location at top of bracket
2. Use side areas of bracket to roll excess cable slack and tie wrap access cable into position
3. In the right cable guide space, pull power cable through to secure to device with approximately 2″ of clearance
4. In middle space, place Ethernet cable through the cable guide with approximately 2″of clearance
5. In the left space, place GPS antenna cable through the cable guide with approximately 2″of clearance
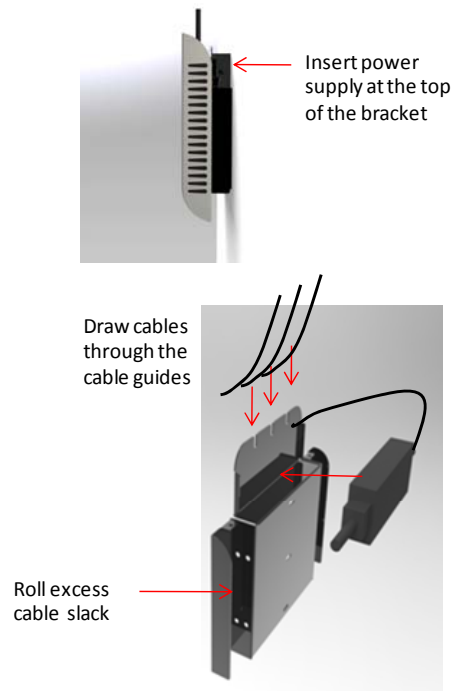6. Install the GPS antenna within 15 ft (5m) of a window with no metal sheeting and with an open view of the sky

Insert power supply at the top of the bracket

Draw cables through the cable guides

Roll excess cable slack

Figure 6 – Position Power Supply, Cables, and Antennas

5.5   Secure eFemto to Bracket and Connect Cables

Follow the steps below to secure the eFemto cables:

1. Position the device onto the mounting bracket in line with 4 pegs. Lock the device securely into the keyholes by sliding the device down.
2. Secure the cables from the cable guides on the mounting bracket and plug into the device
   - ➤ Connect RF antenna
   - ➤ Connect GPS antenna
   - ➤ Connect power
   - ➤ Connect Ethernet
3. Secure 2 lock bracket screws to top on either side to mount device to bracket

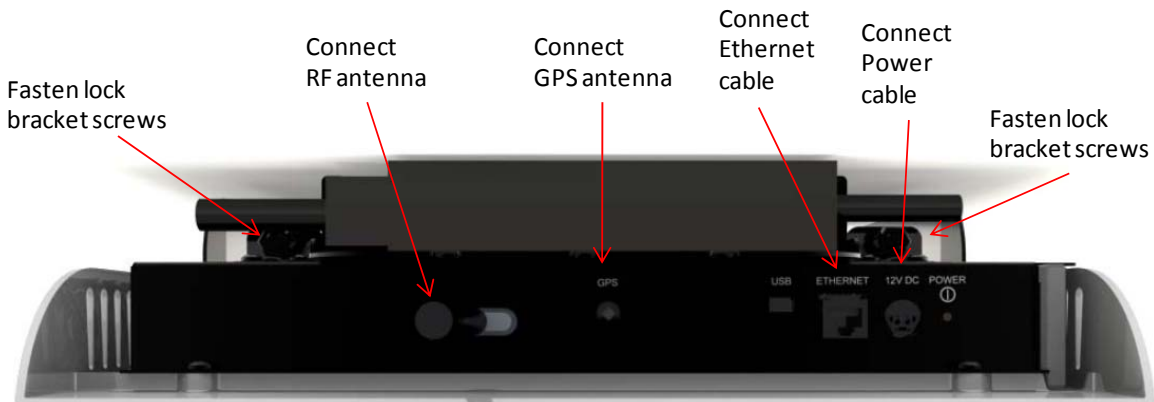**Note: The USB port will remain vacant

Connect
RF antenna

Connect
GPS antenna

Connect
Ethernet
cable

Connect
Power
cable

Fasten lock
bracket screws

Fasten lock
bracket screws

GPS   USB   ETHERNET   12V DC   POWER

Figure 7 – Top view of eFemto displaying Cable Connection Points

5.6   Powering Up the eFemto

Once the eFemto has been wall mounted and all the cables have been connected, press the power button on the top right side of the device. The device will take between 30 to 45 minutes to get ready for service when installed for the first time.

5.7   eFemto Plug and Play Feature

The eFemto works as a plug and play device when installed. The eFemto is shipped from the factory with a factory image as well as factory configuration parameters stored within its non-volatile memory location. The eFemto will automatically communicate with the operator's network to download a service image as well as perform various self authentication and self configuration steps before turning its RF on to service the mobiles.

When the eFemto is powered on for the first time, it will follow the following steps:
- get an IP address assignment from LAN
- Initiate an IPSec tunnel establishment with the SeGW for communication with an operator's network
- Start the communication with the FSM to receive the service image from it
- Once a new service image has been downloaded from FSM, the eFemto will save this image to its non-volatile memory area and will perform a self reboot
- After the reboot, the eFemto will setup the IPSec tunnel again with the SeGW, start communication with the FSM and start acquiring a GPS lock
- It may take any time between 30 to 45 minutes for the eFemto to become operational the first time that it is installed

5.8   Deciphering eFemto LEDs

The eFemto device has five LEDs that indicate various operational status of the device. These five LEDs are as follows from left to right on the device:
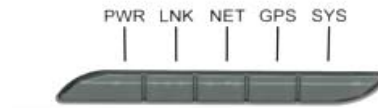
PWR: Indicates Power status of the device

LNK: Indicates the Ethernet access for the device

NET: Indicates the IP addressing as well as IPSec tunnel status

GPS: Indicates the GPS status of the device

SYS: System status

After power up, if all the five LEDs turn "Blue", this is an indication that the device has been configured by the FSM, all systems are ready and the RF on the device has been turned on for services.

The following section describes what steps may be taken if any of these LEDs turn "Red" during the power up of the device:

PWR: This LED is always "Blue" indicating that the device is receiving power. If this LED is not illuminated, check the following:
- Ensure that the power cable is plugged into a working wall socket
- Ensure that the power cable is plugged into the eFemto
- Check the power switch on top right corner of the eFemto
- If other LEDs are blinking, then it is possible that this LED is broken

LNK: This LED defines the device status regarding Ethernet connectivity to the customer's LAN network. If the Ethernet cable has been connected to the device and the device is able to access the LAN, then this LED will turn "Blue" and blink to indicate network activity.

This LED will turn "Red" if Ethernet cable is removed or not connected properly on the device.

If this LED is blinking or solid "Red", check the following:
- Ensure that the Ethernet cable is good
- Ensure that the LAN Ethernet Switch/Router is working
- Get help from customer's IT to resolve any LAN issues

NET: This LED defines the IP address and IPSec tunnel status of the device. On power up, this LED will be blinking "Red" until an IP address is obtained from the DHCP Server. The LED will be blinking "Blue" while IPSec tunnel is being established and will turn "Red" during the wait time due to a failure in establishing IPSec tunnel with the SeGW.

If this LED is blinking "Red", check the following:
- The DHCP server is accessible to the device on the LAN
- Get help from the customer's IT to resolve any DHCP server issues providing an IP address to the device on the LAN

If this LED turns "Red", check the following:
- The device is able to send and receive signaling messages with the SeGW using the WAN
- The SeGW has been configured with the valid information for this device
- Ensure that the DNS server information provided by the DHCP server is valid and the DNS server is able to resolve the SeGW FQDN

GPS: This LED defines the GPS lock status of the device. This LED will turn "Red" if there are not enough tracking satellites visible to the device. It will blink "Blue" when trying to fix a GPS lock and will turn "Blue" when GPS lock has been achieved on the device.

If this LED turns "Red", check the following:
- Ensure that the GPS cabling is connected on the device
- Reposition the GPS antenna

SYS: This LED defines different states of the device. This LED will blink "Blue" when the device is trying to register with the IMS Core. This LED will blink "Red" if the back haul bandwidth is not enough for calls.

ACTIVITY	POW	LNK	SYS	NET	GPS
Power on	**Blue**	Off	**Blue Flashing**	Off	Off
IP information Complete	**Blue**	**Blue**	**Blue Flashing**	Off	Off
[LINK] Blue if physically connected. Additionally, it will blink per network activity.					
IP Sec Tunnel Connected	**Blue**	**Blue**	**Blue Flashing**	**Blue**	Off
[NET] Red flashing until the eFemto gets the DHCP IP address. Blue flashing while IPSec tunnel is being established, Red if waiting due to earlier failure in making the tunnel establishment					
GPS Lock Established	**Blue**	**Blue**	**Blue Flashing**	**Blue**	**Blue**
[GPS] Red if there are not enough tracking satellites, Blue blinking with satellites but not yet locked, and Blue if locked					
System Reboot	**Blue**	Off	Off	Off	Off
IMS/SIP Registration & Calibration	**Blue**	**Blue**	**Blue Flashing**	**Blue**	**Blue**
[SYS] Blue flashing until SIP is registered for 1x and/or PDSN keep alive for DO, Red blinking if the bandwidth is not enough for a call					
Frequency Lock & System Ready	**Blue**	**Blue**	**Blue**	**Blue**	**Blue**