



**Universal Repeater LLC**  
**Satellite Media Access Extender**

1 Users Manual

Satellite Media Access Extender (SatMAX™) repeater is an exclusive, advanced communications system that offers, true “total” global voice and data communications coverage for multiple simultaneous users (for up to 3 simultaneous users) in non-line-of-sight environments (i.e. indoors).

Utilizing SatMAX technology, the SatMAX™ receives multiple non-line-of-sight RF signals, amplifies those signals, and rebroadcasts them to and from the global satellite constellation. The network then broadcasts those signals to and from the intended recipients within a building/ship/hangar or non line of site locations.

Traditionally, low-Earth-orbit satellite communications networks such as Iridium® require line-of-sight to an orbiting satellite. These systems typically require the user to be outdoors with a clear view of the sky in order to make a voice or data call.

For example, with the SatMAX™, users with a standard Iridium® handset can send and receive voice and data calls on an aircraft, in a building, or from virtually any location where it is difficult to physically gain line-of-sight to an orbiting Iridium® satellite. The SatMAX unit is ideally suited for both routine, everyday applications, as well as mission-critical communications.

The SatMAX unit enables highly reliable voice and data communications beyond the reach of cellular networks and extends satellite communications coverage to areas not traditionally available for service, including:

- Above or below deck on ships
- Within commercial buildings
- Within Aircraft Hangars
- On board vehicles
- From obstructed areas
- Within Disaster Recovery Control Centers

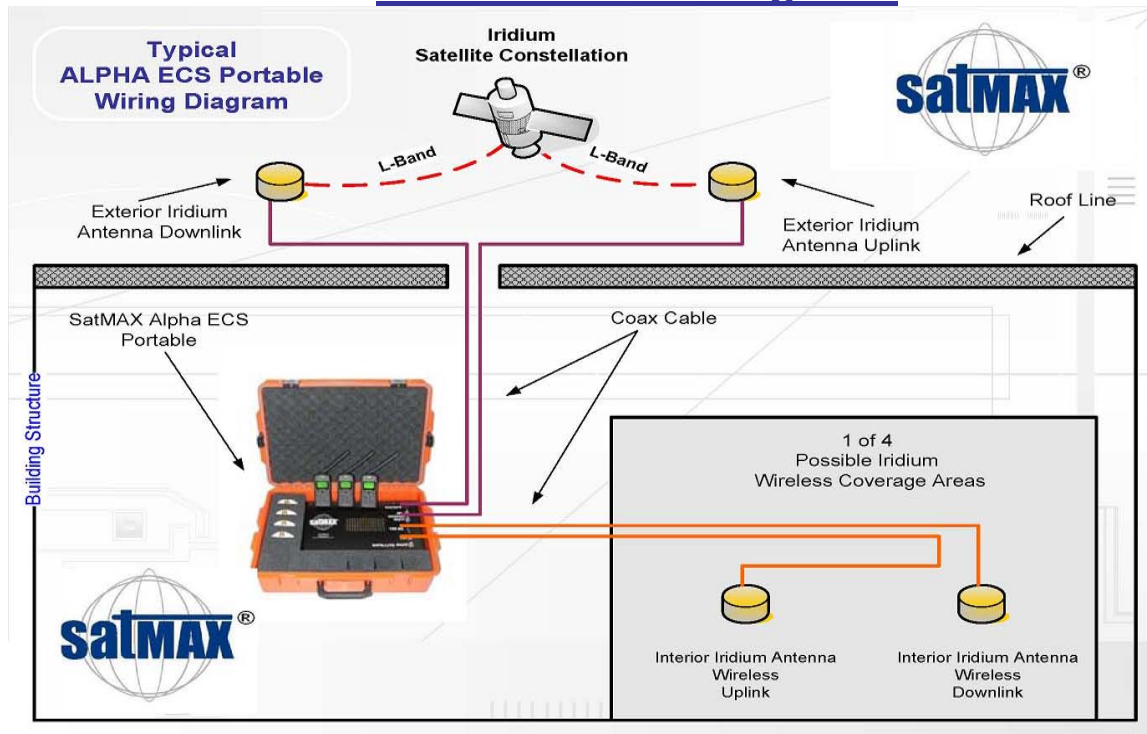
## 1.1 Introduction

This document covers the Universal Repeater SatMAX repeater

models and packaging configurations, fixed structure and portable versions for commercial, government and military applications. It is intended to be used to explain the functionality of the SatMAX products in conjunction with the Iridium Network.

This solution can be used for data communications coverage to both large and small groups of simultaneous users within buildings/ fixed structures, in obstructed areas, underground and in dense metropolitan areas. The Universal Repeater SatMAX unit is available as a portable version and 3 user group sizes for airborne, sea and ground-based applications.

**SatMAX Portable Figure 1**



**Portable Models: Model # Portable-003,** The Portable-xxx model of the SatMAX<sup>TM</sup> is intended for nonline-of-sight

applications requiring portability, battery operation, as well as rapid setup and installation.

### Equipment Description

The SatMAX satellite repeater is designed for use with the satellite constellations to serve as a lightweight, high-capacity, high-reliability, satellite repeater.

For example, a typical system level application of the SatMAX<sup>TM</sup> repeater in conjunction with the Iridium<sup>®</sup> network is shown in Figure-1.

### Package and User-Size Options

All SatMAX<sup>TM</sup> models are available in a variety of packaging and user-size options to suit the various user requirements.

The packaging option here is a pelican case portable enclosure, complete with deployable coaxial cable and antennas. This unit comes with a rechargeable battery power source that may be recharged from either standard AC power or a vehicle DC power source.

### SatMAX<sup>TM</sup>-003

**The L-Band SatMAX<sup>TM</sup>** is designed to serve as a lightweight, high-capacity, high-reliability, satellite repeater to provide satellite communications for up to three concurrent users in locations where the user cannot directly receive the satellite signal. Typical usage would be in buildings, aircraft, underground, or in locations where it would be difficult to go outside to utilize a satellite telephone.

**Portable SatMAX<sup>TM</sup>-003** is a high-performance L-band satellite link repeater housed in a lightweight, but rugged, easily transportable rugged suitcase style assembly. The unit comes fully self-contained with two exterior antennas that deploy, along with their easily

connected low-loss coaxial cables. Deployment is as simple as connecting the coaxial cables and placing the antennas in a convenient location where they have an unobstructed view of the sky. The interior antennas and their associated coaxial cables are included in the suitcase and, after deployment, are pointed in the direction where repeat of the signal is required. The unit is powered from a built-in rechargeable power source or alternatively, may be powered from standard electrical power. For example, this unit is ideal for non-permanent locations requiring interior Iridium® satellite communications when installation and setup time is limited. Normal usage is with any standard Iridium® handset.

## **Mechanical & Packaging**

**Weight:** approximately 39 Pounds

**Packaging:** Custom Pelican Case Enclosure

### SatMAX™-003: RF Characteristics Up-Link/Down-Link

(Link between SatMAX™ and Iridium® Satellite)

**Output Frequency Range:** 1616-1626.5 MHz

**Output Power:** (at -1dB Gain Compression) +37.0 dBm

**Input Frequency Range:** 1616-1626.5 MHz

**Signal Bandwidth:** 10.5 MHz

**Minimum Input Power:** (MDS) -118.5 dBm

**Overall Gain:** +92 dB

**Gain Variation:** N/A

**Gain Flatness:** Over any 2 MHz Bandwidth: +/- 0.4 dB

Over any 10MHz Bandwidth: +/- 0.5 dB

**Spurious Outputs @ 37 dBm Output Power:** -40 dBc, max

**Harmonics @ 37 dBm Output Power:** -60 dBc, max

**VSWR (Input & Output):** 1.8:1

**Voltage Input:** +15 VDC





**Standby Time:** Up to 24 hrs (Standard)/ 38 hrs (High Capacity)/ 80hrs\* (Extended Lithium Ion)

**Fast Charging Time:** Up to 2.5 hrs (Standard)

*\*Based on customer test data. Talk/Standby times are in addition to the Standard and High Capacity talk and standby times as indicated by Motorola for these batteries.*

## 1.4 Operating the SatMAX™

The operation of all SatMAX™ repeaters is basically identical. The user should install the SatMAX™ in accordance with the Installation Manual for that particular model. SatMAX also offers full installation services for satellite repeater customers at an additional charge. Once installed and powered-up, the SatMAX™ repeater will remain passive until it detects the presence of the satellite telephone signal in its vicinity. Once such a signal is detected, the SatMAX™ will remain active unless there is a lapse in the satellite signal for more than thirty seconds. If such a lapse is detected, the SatMAX™ returns to the inactive state until once again detecting the presence of an Iridium® satellite telephone signal. In addition, should an interfering signal not originating from a Iridium® satellite telephone activate the SatMAX™, the SatMAX™ will detect such interference within fifteen seconds and automatically deactivate itself until the interference is removed.

## 1.5 Safety Considerations

As with any RF device, users should take normal precaution to avoid undue exposure to RF radiation. In order to determine compliance with accepted safety standards, RF safety measurements have been taken at typical SatMAX™ installations for both office and industrial configurations. The maximum permissible exposure limit for RF radiation, as recommended by ANSI, is that the power density shall not exceed  $1 \text{ mw/cm}^2$  (one milliwatt per square centimeter) for an exposure time of

6 minutes. Results of both tests indicated that the SatMAX™ repeater posed no safety threat due to RF radiation if properly installed. The results of the tests also indicated that the exposure level was comparable to that of a typical cellular telephone.

The indoor antennas used with this repeater must be installed to provide a separation distance of at least 20 cm from all persons. The outdoor antennas used with this repeater must be installed to provide a separation distance of at least 1 meter from all persons. The antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

## 1.6 Installation and Startup

The installation and startup of all SatMAX™ repeaters should be done in strict compliance with the appropriate Installation Manual for that particular model. As an alternative, SatMAX offers complete site survey and installation services for satellite repeater customers at an additional charge.

# Functional Testing & Operation

During normal operation of the SatMAX™ repeater, the user should operate the Iridium® Satellite telephone in the nonline-of-sight location in the same manner as they would if outside. (Please see details on the initial functional testing in the Installation Manual for your particular model.) However, the user should remember that the SatMAX™ technology operates in a very similar manner to an 802.11 Wi-Fi “Hot Spot”. Therefore, if the user is not receiving a satisfactory signal on the Iridium® satellite handset, it may be due to absorption of the signal in the walls or structure of the building. If you are having difficulty obtaining a signal or establishing a call, you should move to a different location or nearer to the center of the “Hot Spot”. Similar to a cell phone, it may only be necessary to move a few feet in order to obtain and maintain a good signal.

## Interference Sources

All users of SatMAX™ equipment should use reasonable care to ensure that the location where the SatMAX™ is being installed does not contain sources of interference that fall within the Iridium® band of 1616 to 1626.5 Mhz. These sources of interference could be generated from other electronic equipment operating nearby, from motors or generators, or from other satellite equipment. The Iridium® band from 1616 to 1626.5 Mhz is licensed by the FCC exclusively for Iridium’s® usage and any interference sources in this band should be eliminated or reported to the FCC prior to the installation of the SatMAX™ unit.

All frequencies are significantly higher than standard ground-to-air (HF/VHF/UHF) communications. Likewise, aircraft electronics should not interfere with the SatMAX™ repeater since it employs filters to prevent such interference and the aircraft electronics frequencies are significantly separated from the Iridium® frequency band.

# FCC Requirements

The 3 user versions of SatMAX™ equipment is being submitted to obtain FCC approval. These requirements are intended to ensure that the equipment does not produce harmful emissions of any type and that it limits its functionality to the Iridium®-authorized frequency band of 1616 to 1626.5 Mhz.

