

SATEL-WEST

Private & Public GPS/GNSS corrections links for millimeter accuracy

Surveyors Guide

Second Edition



**Base Station
Repeater
Rover
RTK Bridge**

Private & Network RTK Data

Instant access to public and private RTK networks or direct to base station references, SATEL-WEST takes you further than ever before by bringing interoperability to PCC, TrimTalk, and Satel

If you use GPS

we are here to help you.



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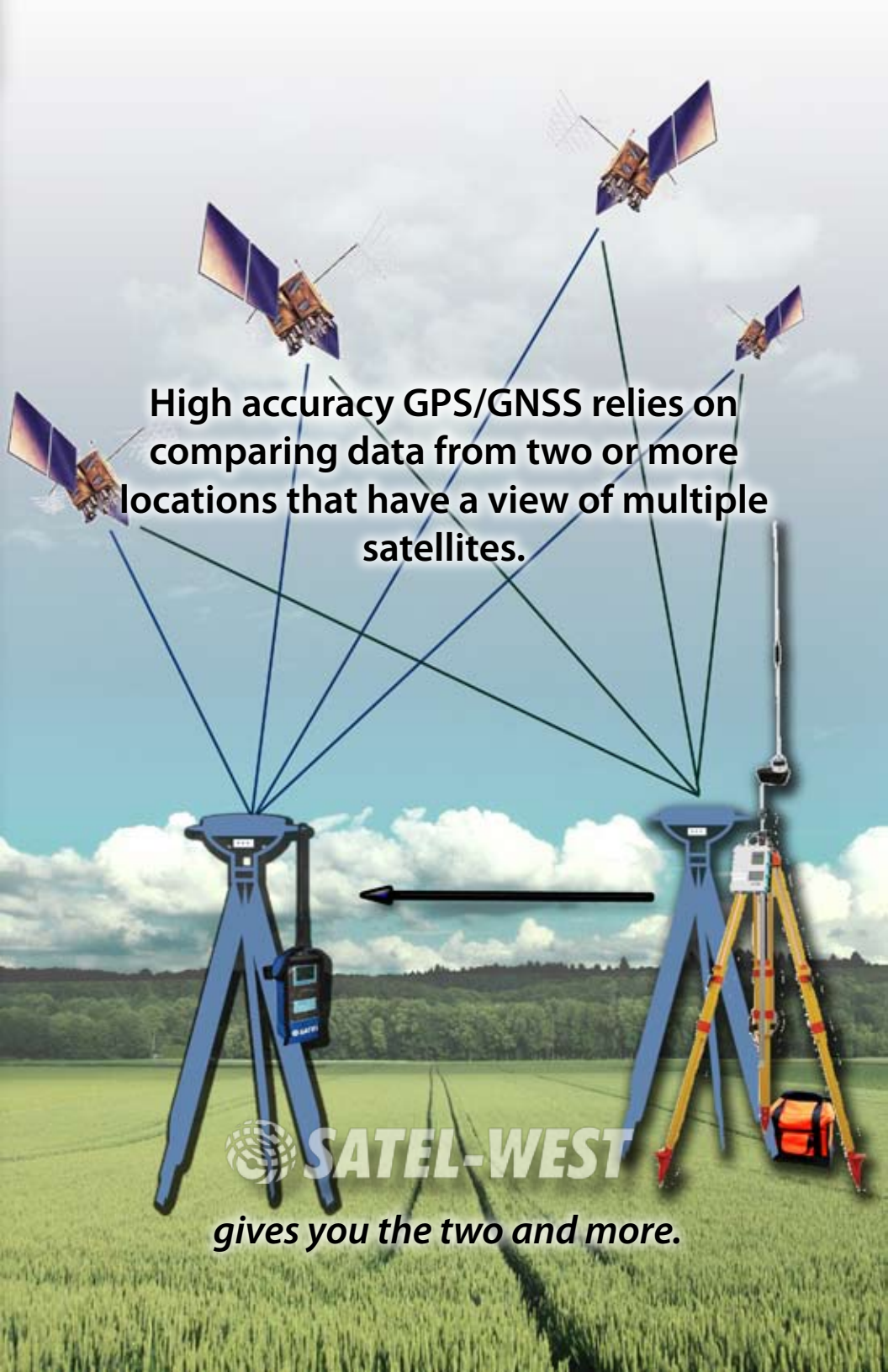
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High accuracy GPS/GNSS relies on comparing data from two or more locations that have a view of multiple satellites.

SATEL-WEST

gives you the two and more.

Introduction

Single GPS/GNSS receivers come in a variety of types as exact as a few meters, or perhaps even a few centimeters accuracy in determining an exact location. Land surveying, agriculture, mining, machine control and many other systems demand a much higher level.

High accuracy GPS/GNSS is capable of determining millimeter measurements on every axis by comparing the data of two or more locations. Modern GPS/GNSS and measurement advances have changed the world by revealing the true height of mountains, locations of lost historical artifacts, settling property disputes and more.

Using vital correction data from a permanent or semi-fixed reference point, or by comparing the data of two or more locations, field receivers are able to augment data and gain X Y Z axis accuracy to less than a millimeter. To this day there is no technology available that can deliver a 3 dimensional location fix more accurately than a Real Time Kinematic Global Positioning System.

For more than a decade, nearly every RTK GPS/GNSS equipment manufacturer has relied on Satel as a technology partner for precision tuned, maintenance free radio modems that deliver unparalleled reliability and coverage to make connections from base station to rovers. Now built into surveying and agricultural equipment around the world many people use Satel and Satel compatible radios every day without even realizing it.

RTK & DGPS with Satel-West

Designed specifically to meet the rugged demands of RTK in the land survey industry, Satel-West presents our RTK packages for high accuracy Real-Time Kinematic Global Positioning Systems and Differential Global Positioning Systems (RTK GPS/GNSS & DGPS). GPS/GNSS systems of all types reach their furthest with Satel-West.

In most instances satellite orbit error and atmospheric signal refraction create a functional limit for the correction data itself from a reference/ base station of about 20-30 kilometers; beyond that distance the corrections data may be inaccurate or incomplete.

Network RTK service providers can extend the range of reference stations to provide accurate correction data up to a few hundred kilometers away using cellular and network services, often times by sacrificing performance speeds and increased times to acquire a fix.

By offering several packages built upon the leading SATEL EPIC-Pro, SATEL 3ASd, and the Intuicom RTK Bridge, Satel-West provides the power and flexibility to maximize and expand any Single Baseline RTK or Network RTK system to its physical limits.

Whether expanding an existing system, replacing components, or creating an entirely new GPS/GNSS network, Satel-West has the right parts, packages and custom options to simplify data communications.

SATELLINE®-3ASd Epic Pro 35 W

EPIC-Pro's 35 Watt transmitting power increases connection distances up to 50 miles in ideal conditions.

FAST & EASY FIELD CONFIGURATION

LCD display, and keypad provide field access to all of the modem's features including Dual Frequency Band, Forward Error Correction, Free Channel Scanning, and Repeater.

HEAVY-DUTY TOOL FOR OUTDOOR USE

Sealed in a heavy-duty, IP67 (NEMA 6) housing, SATEL's 35 Watt UHF transceiver is built for mobile use in severe weather and proven to withstand excessive shock and vibration.

COMPATIBILITY WITH OTHER RADIO MODEMS

The SATELLINE-3ASd Epic Pro is compatible with other SATELLINE-3AS(d) and Epic models, as well as radio modems with PCC and TrimTalk communications protocols.

KEY FEATURES

- Heavy duty IP67 enclosure
- Forward Error Correction
- Push button Configuration
- Dual Band, Free Channel Scanning
- PCC compatible version available
- Shock & Vibration Resistant



3ASD EPIC PRO 35 W TECHNICAL SPECIFICATIONS		
TRANSCIVER		
Frequency Range	400 ... 470 MHz	
Channel Spacing	12.5 kHz / 25 kHz	
Number of Channels	320 / 160	
Communication Mode	Half-Duplex	
TX Duty Cycle *	100 % (22 °C / 35 °C)	40 %
35 W	20 min / 13 min	no limit
10 W	no limit / 50 min	no limit
TRANSMITTER		
Carrier Power	5, 10, 20, 25 or 35 W / 50 ohm (+/- 2 dB)	
RECEIVER		
Sensitivity	<-115 dBm (BER < 10E-3) **	
DATA MODEM		
Interface	RS-232	
Interface Connector	Waterproof IP67, 7-pin, ODU MINI-Snap Style G4, Size 0 or 8-pin LEMO HGA. 1B. 308. CLPP	
RS interface speed	300 - 38400 bps	
Radio interface speed	19200 bps (25 kHz channel) 9600 bps (12.5 / 20 kHz channel)	
Data format	Asynchronous RS-232	
FCC Call Sign ID	6 digits Morse code, once in 15 minutes	

GENERAL	
Antenna Connector	TNC, 50 ohm, female
Operating voltage	+9 ... +16 Vdc ***
Operating voltage feeding	4-pin ODU MINI-Snap Size 1
Power consumption	1.3 VA typical (Receive) 120 VA typical (Transmit)
Construction	Aluminium Enclosure
Size H x W x D	165 x 138 x 73 mm
Weight	1640 g
Operating Temperature	-25 °C ... +55 °C (tests acc. to ETSI standards) -40 °C ... +75 °C (absolute min/max)
Storage Temperature	-40 °C ... +85 °C
IP Classification	IP67 (NEMA 6)

SATELLINE®-3ASd 1W

Precision tuned for long range communication and rugged by design, SATEL's 3ASd 1 Watt radio modem is a long-standing cornerstone of GPS/GNSS communications worldwide. Capable of passing flawless data corrections at speeds up to 38,400 bps port speed across several miles of trees and rolling hills.

FAST & EASY FIELD CONFIGURATION

Satel radio modems are generally preset for instant use. If adjustments need to be made, simple to use push buttons and intuitive menus on an easy to read LCD display give instant field access to all important radio settings including: channel and frequency selection, Forward Error Correction, Error Check, Network Addressing, Free Channel Scan, Repeater Mode, and more.

FLEXIBILITY TO FULFILL ANY ROLE

Capable of acting as a low power base station, repeater or rover, Satel 3AS technology is integral to many instruments from Leica, Topcon, Sokkia, and others. Compatibility options for Pacific Crest PCC or Trimble TrimTalk can bring together diverse equipment, making the most of existing hardware investments.

KEY FEATURES

- Provides connection to RS-232, RS-422 and RS-485
- Compatible with SATELLINE-3AS(d) Epic
- Intuitive menus on LCD screen with push button configuration.
- Accommodates RTK data port speeds of 38,400 bps.
- PCC compatible version available



3ASD 1 W TECHNICAL SPECIFICATIONS	
TRANSCIEVER	
Frequency Range	360...470 MHz
Channel Spacing	12.5 / 20 or 25 kHz
No. Of Channels	160 /100 or 80
Communication Mode	Half-duplex
Transmitter Carrier Power	10 mW ... 1 W / 50 ohm
Receiver Sensitivity	<-115 dBm (BER < 10E-3)
Co-Channel Rejection	> - 12 dB
Data Modem	
Interface	RS-232 or RS-485, RS-422
Interface connector	Connector D 15, female
Data speed of RS Interface	300 - 38400 bps
Data speed of radio interface	19200 bps (25 kHz channel) 9600 bps (12.5 / 20 kHz channels)
Data Formats	Asynchronous data

GENERAL	
Antenna Connector	TNC, 50 ohm, female
Operating Voltage	+ 9 ... +30 Vdc
Power Consumption	1.8 VA typical (Receive) 6.0 VA typical (Transmit) 0.05 VA (When DTR is "0")
Size H x W x D	137 x 67 x 29 mm
Weight	260 g
Operating Temperature	-25 °C ... +55 °C (tests acc. to ETSI standards) -40 °C ... +75 °C (absolute min/max)
Storage Temperature	-40 °C ... +85 °C

Intuicom RTK Bridge

Get all the power of Network corrections without a base station receiver, including locations outside of cellular coverage and Internet access. The RTK Bridge gets the user the maximum performance from available GPS/GNSS Networks.

NETWORK READY, OUTDOOR RUGGED

Intuicom's RTK Bridge is a fully ruggedized network device that enables the broadcast of GPS/GNSS Network corrections over radio. The RTK Bridge replaces the GPS/GNSS base station and extends Network GPS/GNSS corrections to projects and areas where these corrections may not otherwise be available or easily accessible to share the connection with multiple users. The RTK Bridge interfaces to the Internet via cellular modem and automatically connects to GPS/GNSS Network servers, including Leica Spider and Trimble VRS, establishing connectivity.

DESIGNED FOR SIMPLICITY

RTK Bridge setup takes only minutes from the box to the field. Simply enter login parameters or NTRIP configurations and the message type to receive, and the RTK Bridge automatically authenticates and pulls the appropriate RTK correction data for its location. The corrections are broadcast over 35 EPIC-Pro radio modems to the roving GPS/GNSS receivers for accurate positioning.

FLEXIBILITY FOR EASY ACCESS

With the broadest end-to-end compatibility, Intuicom's RTK Bridge operates with Trimble, Topcon, Leica and all major precision GPS/GNSS instruments. Connecting to network RTK data with both NTRIP protocol & raw TCP sockets over cellular CDMA or GSM modems, or an Ethernet line; the RTK Bridge supports all primary correction formats including MAX, i-MAX, AutoMax, CMR+, and RTCM 2.0/3.x and transmits seamlessly to Satel, Pacific Crest Radios, Trimble® Radios, Freewave, Topcon Radios, ARWEST, Johnson and Motorola Radios.

Intuicom RTK Bridge Technical Specifications	
NETWORK INTERFACE	
Cellular Modem	CDMA or GSM/Edge
Cellular Service Providers	Verizon or AT&T (others avail.)
Alternate Network Connection	Ethernet (RJ-45)
Network Connection Types	NTRIP Protocol & TCP/IP

KEY FEATURES

- Eliminate GPS Base Stations
- Weatherproof & Ruggedized for Outdoor Use
- Available with CDMA, GSM or Ethernet Network Interface
- Transmits Correction Data to ANY Number of Remotes
- Wireless Connection to Virtually All RTK Hardware



RADIO TRANSMITTER PROTOCOL	
License Free	Freewave 902-928MHz FHSS, 2.4-2.435GHz
UHF	Satel UHF 403 -470 MHz with Satel, PCC and TrimTalk protocols
GENERAL	
Enclosure	Waterproof Ruggedized Aluminum
Operating Voltage	+ 6 ... +30 Vdc
Connectors	Radio Antenna: TNC (female) GPS Antenna: TNC (female) Cellular Antenna: TNC (female) Data Interface: RS-232 (LEMO)
Size H x W x D	53 x 167 x 143 mm
Weight	850 g
Operating Temperature	-40 °C ... +75 °C
Mounting	Tripod Hook Bracket

Deluxe Packages for RTK & DGPS Land Survey

DELUXE BASE/REPEATER & ROVER

This is the ultimate and complete starter kit. Designed to stretch the range limitations of RTK correction data, this all-inclusive deluxe package creates an instant private RTK system with the ADDITION OF 2 RTK RECEIVERS. Expand the range of an existing base station, as a repeater, or completely replace aging RTK communications with the latest-and-greatest.

The high powered 35 Watt SATEL EPIC-Pro base station, SATEL-WEST base station antenna package, and precision SATEL 3ASd receiver mobile remote package come together for a complete system that penetrates dense forestry, urban congestion, rolling hills and sprawling valleys. Heavy duty components last the rigors of long hours outdoors in extreme weather. Everything needed for a full day, simply connect the GPS/GNSS receivers.

Contains:

- (1) SWC-A Complete Hi-Power Base/Repeater Package (page 12)
- (1) SWC-A2 Complete Base/Repeater Antenna Package (page 13)
- (1) SWC-A3 Complete Hi-Power Base/Repeater Power Package (page 12)
- (1) SWC-B Complete Rover LPBRR Package (page 12)

Deluxe, All Inclusive Packages	
Part Number	Description
SWD-A	Deluxe Base/ Repeater & Rover
SWD-B	Deluxe RTK Bridge
SWD-C	Deluxe Low Power Pair

SWD-A



DELUXE RTK BRIDGE

Proxy Base Station! Dial into GPS or GNSS networks worldwide and broadcast corrections data for miles to multiple concurrent rovers. Combine the cellular power of the Intuicom RTK Bridge with the flexibility, power and durability of the 35W SATEL EPIC-Pro. Compatible with rover receivers from Pacific Crest, Trimble and others, Satel-West also offers its own complete rover radio package SWC-B (page X).

Contains:

- (1) SWC-C Complete RTK Bridge Package (Ethernet or with modem for Verizon or AT&T) (pages 14-15)
- (1) SWC-A Complete Hi-Power Base/Repeater Package (page 12)
- (1) SWC-A2 Complete Base/Repeater Antenna Package (page 13)
- (1) SWC-A3 Complete Hi-Power Base/Repeater Power Package (page 12)

SWD-B



DELUXE LOW POWER PAIR

Quickest setup!

Easily covers line-of-sight distances up to several miles. This package contains two complete Low Power Base/ Rover/ Repeater packages. Open the cases, connect the radios and get your first fix as quickly as the GPS/ GNSS allows. Increase distance with the optional Base Station Antenna Package. This package has long served with older model total stations and robotic survey equipment and doubles as 2 rovers when combined with a Complete HPBR Package.

Contains:

- (2) SWC-B Complete LPBRR Packages (page 12)

SWD-C



Modular Packages for Upgrades , Add-Ons & Customization

COMPLETE HI-POWER BASE/REPEATER PACKAGE

Package contains high power SATEL EPIC-Pro 35 Watt radio modem, basic rubber whip antenna, and all required data cables. Combine with a Base/ Repeater Antenna & Power Packages for a complete solution to provide miles and miles of uninterrupted coverage.

- Contains:
- (1) YM3030 EPIC-Pro 35W
 - (1) YA0103 Gainflex Antenna
 - (1) Various GPS/GNSS Data Cable Braided
 - (1) YCEP31 EPIC-Pro Power Cable, 2ft. Braided (SAE)
 - (1) YC0357 EPIC-Pro Programming Adapter
 - (1) YC0204 3ASd Programming Adapter
 - (1) YPC001 Universal Radio Kit Case



COMPLETE LOW POWER BASE/REPEATER OR ROVER (LPBRR)

Built using SATEL's 3ASd 1 Watt radio modem and ready-to-go RTK rover right out of the heavy duty carrying case, this package comes with a precision tuned radio modem, 12 in. rubber whip antenna, battery assembly in a heavy duty pole clamp pouch, all data cables and a battery charger. Tirelessly operates as a low power base station or repeater with the addition of a Base Station Antenna Package.

- Contains:
- (1) YM1017 3ASd Dual Band Radio Modem
 - (1) YA0103 Gainflex Antenna
 - (1) Various GPS/GNSS Data Cable Braided
 - (1) YCBD9S Serial Cable Braided (DB-9)
 - (1) YPPCB1 Pole Clamp Bag Battery Assembly
 - (1) YP3ASC Battery Charger
 - (1) YPC001 Universal Radio Kit Case
 - (1) YC0204 3ASd Programming Adapter



COMPLETE HI-POWER BASE/REPEATER POWER PACKAGE

Includes 33 Amp/hour sealed lead acid battery, cables, bag and charger. Designed for use with any brand of base station or GPS/GNSS receiver requiring auxiliary power, the connectors are available in a variety of configurations upon request.

- Contains:
- (1) YPB33H 33 Ahr, 12V, SLA Battery
 - (1) YP33BB Battery Bag
 - (1) YP1233 Battery Charger
 - (1) YCEB6S Battery Cable, 6ft. Braided (SAE/ Fused)

- Variations:
- SWC-A3-B Basic Base or Repeater (HPBR) Power Package, NO BATTERY



COMPLETE BASE/REPEATER ANTENNA PACKAGE

Suitable for boosting the range of any UHF radio modem, the Complete Base Station Antenna Package comes with antenna, tripod, antenna mast, cable, and mounting adapter in an easy to carry, heavy duty bag.

- Contains:
- (1) K-YKIT-AK Antenna Mast (w/ tripod & bag)
 - (1) YPTMAM Antenna Mount
 - (1) YKAC08 8 ft. Antenna Cable
 - (1) YAS5MW 5dBi UHF Whip Antenna

- Variations:
- SWC-A2-B Complete Base Station Antenna Package, NO TRIPOD



Complete Modular Packages		
Part Number	Description	Parent Packages
SWC-A	Complete hi-power Base/Repeater Package	SWD-A, B
SWC-B	Complete Low Power Base/Repeater or Rover	SWD-C
SWC-C	Complete RTK Bridge Package	SWD-B
SWC-A2	Complete Base/repeater Antenna Package	SWD-A, B
SWC-A2-B	Complete Base Station Antenna Package, NO TRIPOD	SWD-A, B
SWC-A3	Complete Hi-Power Base/Repeater Power Package	SWD-A, B
SWC-A3-B	Basic Base or Repeater Power Package, NO BATTERY	SWD-A, B



COMPLETE RTK BRIDGE PACKAGE

SWC-C

Connect to network RTK correction data anywhere with Intuicom's RTK Bridge. Flexible network connections ranging from a simple Ethernet (RJ-45) port to choices of internal GSM or CDMA Modems from Verizon or AT&T provide the access anywhere network data corrections are available. Licensed, and license free radios hurl network corrections at the speed of light to remote GPS/GNSS receivers miles away. Over a dozen network and radio combinations are available to provide an open and virtually universal solution.



Each kit contains the RTK Bridge with waterproof enclosure, L1 GPS, TNC antenna connectors, two serial interfaces (LEMO), data cables, AC and DC power cables, GPS antenna, and all necessary communications antennas.

Intuicom RTK Bridge Configurations	
Part Number	Description
FIP1-900RTK-VKT	Intuicom RTK Bridge with Internal Verizon CDMA Modem and 902-928 MHz transceiver.
FIP1-900RTK-A2KT	Intuicom RTK Bridge with Internal AT&T GSM Modem and 902-928 MHz transceiver.
FIP1-900RTK-EKT	Intuicom Bridge with Ethernet network interface for RTK Corrections and 902-928 MHz transceiver.
FIP1-101RTK-EKT	Intuicom Bridge with Ethernet network interface for RTK Corrections (no radio modem)
FIP1-101RTK-VKT	Intuicom RTK Bridge with Internal Verizon CDMA Modem (no radio modem)
FIP1-101RTK-AKT	Intuicom RTK Bridge with Internal AT&T GSM Modem (no radio modem)
FIP1-400RTK-VKT	Intuicom RTK Bridge with Internal Verizon CDMA Modem and Satel UHF radio modem.
FIP1-400RTK-A2KT	Intuicom RTK Bridge with Internal AT&T GSM Modem and Satel UHF radio modem.

Spare & Replacement Components

All of our radio modems have a remarkable record for endurance and performance in harsh environments. With a 3 year manufacturers warranty and an astounding 70 year mean time between failures, hardware problems are few and far between.

In the event that equipment is damaged, lost or stolen we offer spare and replacement items individually.

Spare and Replacement Radio Components		
Part Number	Description	Parent Packages
YM1017	3ASd Dual Band Radio Modem	SWD-A, C & SWC-B
YM3030	EPIC-Pro 35W	SWD-A, B & SWC-A
Antennas & Accessories		
YA0103	UHF Gainflex Antenna	All
K-YKIT-AK	Antenna Mast (6 foot w/ tripod & bag)	SWD-A, B & SWC-A2
K-YKAM-1	Antenna Mast (6 foot w/ bag)	SWD-A, B & SWC-A2
YPTMAM	Antenna Mount	SWD-A, B & SWC-A2, A2-B
YKAC08	8 ft. Antenna Cable, LMR-200, TNC	SWD-A, B & SWC-A2, A2-B
YAS5MW	5dBi UHF Whip Antenna	SWD-A, B & SWC-A2, A2-B
YAGPSA	Dual Band GPS Antenna for RTK-Bridge	SWD-B, SWC-C
Power Accessories		
YPPCB1	3AS Pole Clamp Bag Battery Assembly	SWD-A, C & SWC-B
YP3ASC	3AS Battery Charger	SWD-A, C & SWC-B
YPB33H	33 Ahr, 12V, SLA Battery	SWD-A, B & SWC-A3
YP33BB	Battery Bag	SWD-A, B & SWC-A3, A3-B
YP1233	Battery Charger	SWD-A, B & SWC-A3, A3-B
YCEB6S	Battery Cable, 6ft. Braided (SAE)	SWD-A, B & SWC-A3, A3-B
YCEP31	EPIC-Pro Power Cable, 2ft. Braided (SAE/ fused)	SWD-A, B & SWC-A3, A3-B
Programming Adapters		
YC0357	EPIC-Pro Programming Adapter (Requires YC0204)	SWD-A, B & SWC-A
YC0204	3ASd Programming Adapter (DB-9)	SWD-A, C & SWC-B
YCA470	RTK-Bridge Programming Cable	SWD-B
Hard Cases		
YPC001	Universal Radio Kit Case	SWD-A, C & SWC-A, B, C
YPC002	RTK Bridge Case	SWD-B

Data Cables

Our specially constructed, heavy-duty, braided, double-reinforced data cables connect radios directly to almost any device. Constructed specifically to resist cuts, shorts, and withstand pulling.

Available with a variety of connectors in many standard and custom wiring configurations, SATEL-WEST has an expansive repertoire of radio device cables that include legacy robotic total stations, data collectors and GPS

Our most common cables are listed below. Please contact your Satel-West representative for other options.



Manufacturer	Model	EPIC-Pro	3ASd	RTK-Bridge
Altus	APS-3	YCSWK-A1	YCSWK-A2	YC-SWK-A3
Hemisphere	A220/ A221	YCSWK-H1	YCSWK-H2	YCSWK-H3
Leica	1200	YCSWK-L1	YCSWK-L2	YCSWK-L3
Magellan/ Ashtech	ProFlex & ProMark 500	YCSWK-M1	YCSWK-M2	YCSWK-M3
NavCom	SF-2040	YCSWK-N1	YCSWK-N2	YCSWK-N3
Sokkia	GSR/ GSX 1700	YCSWK-S1	YCSWK-S2	YCSWK-S3
Topcon	HiPer Series & GR-3	YCSWK-M1	YCSWK-M2	YCSWK-M3
Trimble	R Series	YCSWK-T1	YCSWK-T2	YCSWK-T3



In the United States, the best frequency bands for long distance device communication require use type specific licenses from the Federal Communications Commission.

Working with Frequency Coordinators, Dealers, End Users, and the FCC, we obtain licenses specifically tailored to Land Surveyors and RTK/DGPS, GPS/GNSS.

With our assistance, the frequency application (FCC 601 Main form) and supporting schedules are simplified to a few general questions and the frequency license granted matches the system's design assuring full legal compliance.

We provide complete licensing services for UHF channels used by private businesses, individuals, and public entities transmitting at powers 50 mW up to 300 Watts (ERP) for use in fixed, mobile, regional, or nationwide application types in the United States.

With years of FCC application experience and as a multiple license holder, Satel-West guarantees to find a frequency for use in any location, or there will be no charge for our services.

Contact a Satel-West dealer representative with any questions you have and get licensed today, it has never been simpler.

FCC Licensing



LAND SURVEYORS DON'T CHARGE FOR
HAMMERING IN THE STAKES,



IT IS FOR KNOWING WHERE THE STAKES SHOULD GO.



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