



Product Technical Specification

FB 500 Series 4

Inmarsat FleetBroadband Terminal

Intellian Technologies, Inc.

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Korea

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1. Introduction

1.1 Purpose of the Document

This document describes the overall system design and architecture of the Intellian L-band maritime FB500 antenna system. In addition, this document specifies the baseline technical and functional requirements which the product complies with.

1.2 Overview of the Inmarsat FleetBroadband Terminal

Intellian's FB500 is designed for Inmarsat's L-band FleetBroadband service. The directional, 3-axis, planar 19 patch array antenna delivers highly efficient RF performance. While the majority of installations are likely to be configured as a VSAT companion, it can also be configured as a fully featured stand-alone terminal. The combination of easy installation and commissioning, reliability, features to reduce out of policy usage, security, and market leading warranty make it a terminal that provides market leading performance with a low total cost of ownership.

2. Key Features

The key technical features of the FB500 are as follows:

RF performance

The FB500 is Class 8 terminal with a state of the art patch array antenna and modern ATC/LTE filters to maximize gain and minimize loss, providing superior performance to older terminals. The EIRP and G/T are 22.0 dBW and -7.0 dB/K respectively.

BRM modem

The Intellian FB series 4 terminals are the only terminals available that incorporate Inmarsat's latest BRM modem. With packet switching for all communications the BRM modem provides increased resilience across networks.

Superior voice and data connection

With Inmarsat BGAN service, the FB500 supports high quality voice calls and IP streaming up to 256 kbps. (

Built in security and networking features

The FB500 comes with Intellian's intuitive yet powerful AptusLX terminal management software that can be used to enhance security, prevent out of policy usage, manage users and connected devices, and provide detailed usage reports. The terminal also has a comprehensive, documented API that can be used to configure and manage the terminal using 3rd party software.

Easy and quick installation

The FB500 is shipped without brackets. Having a direct cable connection at the bottom of the radome, and captive mounting nuts within the baseplate, eliminates the

need to remove the radome during installation or testing. Using MoCA protocol allows power, control signals and comms data to pass through the single co-axial cable that connects the BDU and ADU.

3. System Design

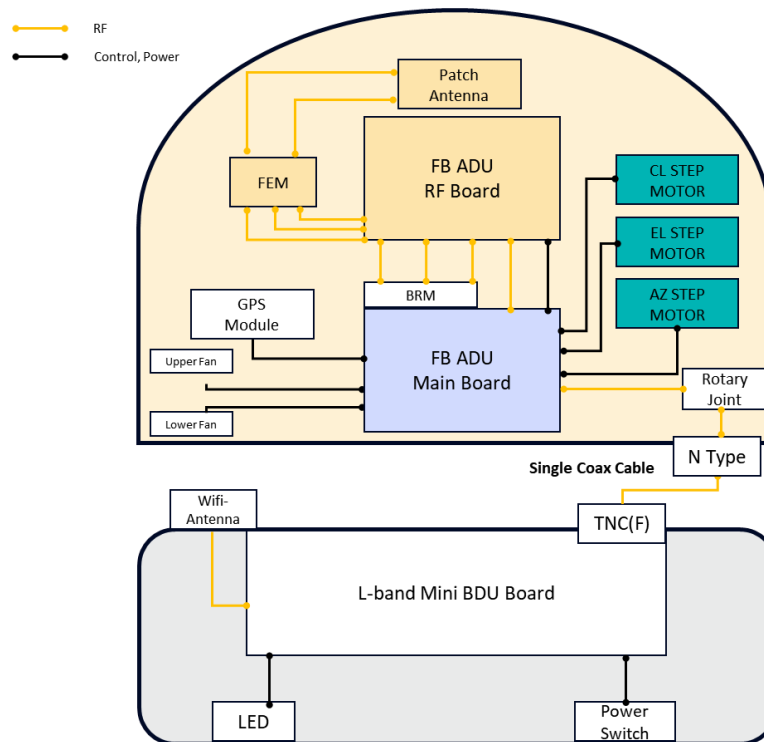


Figure 1 System Configuration

Intellian's FB500 is an L-band maritime antenna system with a mechanically steered patch array antenna.

3.1 Functional Blocks

Intellian's FB500 has a two-part subsystem containing an Above Decks Unit (ADU) and a Below Decks Unit (BDU) as follows.

The Above Decks Unit (ADU) equipment includes

- L-Band 19 patch array antenna
- ADU control main board
- ATC/LTE, HPA and RF feed circuitry board
- Inmarsat BRM modem
- GNSS receiver
- Radome assembly

The Below Decks Unit (BDU) equipment

- BDU controller main board
- Ethernet switch
- Wi-Fi transceiver
- ATA circuitry for any analogue interface
- Ethernet PoE interfaces
- SIM interface
- System power supply

3.2 Interface Specification

3.2.1 External Interface

Item		Specification
ADU	RF Connector (To BDU)	N Type (female)
BDU	Power	4 pin
	RF Connector (To ADU)	TNC (female)
	RJ45	2 ea.
	RJ45 with PoE	7.5 W – 2 ea.
	RJ14	1 ea.
	GPIO	16 pins
	SMA RP (Wi-Fi)	1 ea.
	USIM slot	1 ea.

3.2.2 Internal Interface

Item		Specification
ADU	ADU Base to RJ	N to SMA
	RJ to Main	SMA to SMA
	Main to EL Step Motor	4 pin
	Main to AZ Step Motor	4 pin
	Main to CL Step Motor	4 pin
	Main to RF Board FFC	FFC
	Main to RF Power	10 Pin
	BRM RX to RF Board	UFL to MCX

	BRM TX to RF Board	UFL to MCX
	BRM Detect to RF Board	UFL to MCX
	Main to GNSS	4 pin
	FEM RX1 to RF Board	SMA to MCX
	FEM RX2 to RF Board	SMA to MCX
	FEM TX to RF Board	SMA to MCX
	FEM to Antenna 1	SMA to SMA
	FEM to Antenna 2	SMA to SMA
BDU	BDU Main to LED Board	4 pin
	BDU Main to Power Switch	2 pin
	BDU Main to Wi-Fi Antenna	UFL to SMA RP

4. Functional Specification

Item	FB500
RJ14 port	1 port
RJ45 port	4 ports (2 PoE)
WAN	Supported (1 port)
GPIO	Supported
Background Data	Supported (up to 432kbps)
Streaming Data	Supported (up to 256kbps)

4.1 User service profile management for BGAN connection

Intellian's FB500 allows user service profiles to be configured and assigned for devices connected to the BGAN network.devices

The table below shows settings that can be configured for each user service profile.

Category	configurable settings
User service profile	- Standard (background) data rate - Streaming data rate - Daily data limit - Monthly data limit

4.2 Networking interface & control

Intellian's FB500 BDU provides four RJ45 Ethernet ports and a wifi antenna connection (mini antenna supplied). The Ethernet ports can be used to connect wired devices to the terminal whereas wireless devices can be connected using WiFi (802.11b/g).

Functionality to enhance the security of the terminal include:

Category	Features
Managing connected devices	• Registering devices • WiFi configuration (including password protection) • Port, Protocol forwarding •

4.2.1 Connecting to the terrestrial 3G/4G/5G network

One of the three RJ45 ethernet ports can be used to connect a LTE antenna and modem. This can be used to provide connected devices with a data connection to the terrestrial 3G/4G/5G network when this is available.

4.2.2 DHCP

DHCP is supported for devices (laptop, VoIP phones, Smart phones) connecting to LAN ports and WiFi to give the devices dynamically allocated IP addresses.

The DHCP can be configured as follows::

- Enable/disable
- DHCP server IP address and mask
- DHCP range IP start and end
- Lease time

4.2.3 PoE

PoE is supported for two LAN ports: ports 1 and 2.

PoE for each of these ports can be turned on and off within the AptusLX terminal management software.

Each enabled PoE port supports class 2 power level (7.0 W from PSE).

4.2.4 Firewall for locally connected devices

The firewall is used to limit the IP addresses that can be accessed from the terminal. The firewall rules can be used to either "white list" or "black list" specific IP addresses/address ranges.

A firewall rule includes:

- Protocol of interest: ICMP, UDP, TCP
- Source IP range in the format of x.x.x.x/y
- Source port range (in case of UDP or TCP)
- Destination specifier: either one of
 - Destination IP range in the format of x.x.x.x/y
 - Domain name
- Destination port range (in case of UDP or TCP)

Specified IP ranges are matched against the source and destination IP addresses of the incoming packet from a connected device

4.2.5 MAC filters

MAC filters are provided to prevent malicious devices from connecting to the terminal. The MAC filter rules can either “white list” or “black list” MAC addresses.

4.2.6 Internet connection

Intellian’s FB500 internet connection (or connection to external domain) is provided either through satellite connection or WAN connection (if an LTE modem and antenna are connected). The following data routing settings are available:

- Satellite only
- WAN only
- WAN preferred (terminal will automatically switch to satellite if WAN is not available – and revert when it becomes available again)

4.2.7 Port forwarding,

Port forwarding and protocol forwarding are supported in Intellian’s FB500 and they are configured as an array of entries. Note that protocol forwarding is only supported for the satellite connectivity channel.

Port forwarding entry is configured as follows.

- Protocol: TCP, UDP
- External port
- Internal IP
- Internal port

Protocol forwarding entry is configured as follows.

- Protocol: GRE, IPSEC-ESP
- Internal IP

4.3 Voice call support

A dedicated analog or IP phone can be connected to the terminal using the RJ14

(POTS) port and the ethernet ports respectively. Call recipients will see that the call has originated from the terminals unique phone number. When the terminals phone number is called then this phone will ring.

Inmarsat has not enabled multi-voice for these terminals and hence only one voice call at a time is supported. All voice calls made by terminal are transmitted as packet data over the satellite network. It is not possible to make a voice call from a dedicated phone over the WAN connection.

Note however that voice calls using apps such as WhatsApp can be made from a data session connected to either the satellite or the WAN – although these calls will not be associated with the terminals unique phone number.

Category	Features
Voice	• VoIP with PBX • 505 Emergency call • Supplementary Service

4.3.1 Analog phone support

Analog phones are connected to POTS port (RJ14). Up to 2 analog phones are supported if an RJ14 to 2 RJ11 adapter (splitter) is used.

The system assigns analog phone 1 the extension 101 and analog phone 2 (if any) the extension 102.

4.3.2 VoIP devices support

VoIP devices can be connected through the RJ45 ports or Wi-Fi. Supported VoIP devices include the usual desktop VoIP phones (including the ones powered by PoE port), Wi-Fi based VoIP devices, and VoIP client applications running on a smart phone connected through Wi-Fi, as long as they support the standard SIP, SDP, and RTP protocols.

Intellian's FB500 VoIP uses the G729 codec.

4.3.3 PBX capability

The analog phones are assigned the extensions 101 and 102, VoIP devices are assigned extensions in the form 2XX where X represents any digit. For VoIP devices users need to configure these extension numbers to the appropriate SIP property settings (usually SIP ID) and the password accordingly to the terminal PBX extension settings.

PBX provides the following capabilities

- Public line vs local extension mapping
 - Inbound mapping

- Outbound mapping
- CODEC translation (a.k.a. transcoding)

4.4 Terminal Management

Terminal management can be performed using either the AptusLX software or the comprehensive APIs. The APIs are REST and JSON based HTTP protocols.

4.4.1 Terminal management access control

User access to configure the terminal (either using AptusLX or the associated API) requires authentication of both the user ID and password (collectively user credentials).

There are two types of users, “admin” and “guest”. These two user types have different authorizations to make changes. Typically, the “admin” user has highest privilege and “guest” has limited access (often restricted to read-only).

The following table summarizes the permission mapping for the different user types.

Table 1 Permissions allowed for user types

Operations \ User types	admin	guest
Modify own password	O	O
Reset (other) guest user password	O	X
Configuration backup	O	X
Configuration restore	O	X
Browse configuration information	O	O
API accesses that incur configuration changes	O	X
Other API accesses that only involve monitoring information	O	O

4.4.2 Terminal management functionalities

The top-level functionalities provided by APIs & AptusLX is summarized in the following table.

Category	Detailed functions
API/Web UI User management	• Password management • Get user information
Voice & PBX	• SIP credentials management • manage extension – password tuples • Public line number – extension mapping management inbound / outbound • Monitor SIP clients’ registration status • Monitor call history

SMS	• Outbox • Inbox • Composing
Internet connection management	• Satellite connectivity settings & connection status • WAN connectivity settings & connection status • Routing policy between satellite and WAN • Port forwarding settings • Satellite selection • Configuration for satellite data connection
Local network management	• DHCP settings (refer to 4.2.2) • PoE settings enable/disable PoE per port (for PoE capable ports) current PoE status (enable/disable, power class)
Network security	• Firewall settings (refer to 4.2.4) • Wi-Fi MAC filters (refer to 4.2.5)
Advanced	• USIM pin • External GPIO Configuration • NSD (Network Service Device) • MST (Maritime Safety Terminal) future feature
System status and statistics	• Terminal operational mode operational mode boot status last warning/error • Terminal running status BDU status ADU status, Modem status, Physical status: voltage, temperature checks • Service status Satellite information, Azimuth, Elevation Signal strength, • USIM status USIM card detection status • GNSS position info • Satellite Data connection statistics
Maintenance	• Terminal identification Serial number IMEI MAC addresses • Package version info (with Modem SW version) • Software upgrade • Configuration management backup/restore factory reset
Logging, Diagnostics	• Log management: log (rotation, storage control), log download • Diagnostics test ADU – (Sensor, Azimuth motor, Elevation motor, Cross

	level motor, PHY, Communication) BDU - (MOCA, SLIC, WiFi, PoE, USIM)
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4.4.3 Configuration management

Intellian's FB500 is able to save and load configuration files so that a user can back up the current configuration and restore it later, or apply it to other FB500 terminals.

The following information is managed in the configuration.

- API/AptusLX user credentials
- VoIP & PBX
 - VoIP user credentials : extension number and password (refer to 4.3.3)
 - Public line vs local extension mapping (refer to 4.3.3)
- Internet connection (refer to 4.2.6, 4.2.7 for details)
 - Satellite selection
 - Configuration for Satellite data connection
 - Satellite connectivity settings
 - WAN connectivity settings
 - Routing policy settings
 - Port forwarding settings
- Network, Wi-Fi, network security (refer to 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.8 for details)
 - DHCP settings
 - PoE settings
 - Firewall settings
 - Wi-Fi settings: enable/disable, MAC filters
- ETC
 - External GPIO Configuration
 - NSD
 - MST future feature

4.4.4 Logging

Intellian's FB500 provides logs categorized as

- Event logs: warnings, errors and important system notifications
- Internal debugging information

Logs can be downloaded using AptusLX. A dedicated partition on the BDU is reserved for log files. When it is nearly full the logs are rotated so that the latest log files are available.

4.5 Control/peripheral interfaces and indicators

4.5.1 Power and reset button

The power button is a switch for powering the device on or off. This is present on the BDU. When the BDU is powered on with this switch, the ADU is also powered on (through power delivered through coaxial cable).

The reset button is provided for resetting the BDU and ADU while power is maintained. This can be used for trouble shooting purposes in case of a rare event where somehow the system seems to be mal-functioning.

4.5.2 GPIO connector

The BDU has a dedicated 10-pin connector to provide a GPIO (General Purpose Input/Output) interface to the external devices. All wires for the GPIO connector must use AWG 24 unscreened wire type.

The GPIO pin configuration is as follows:

Pin	Signal	Explanation	Pin	Signal	Explanation
1	External Power Input	Power input (DC 12 V ~ 24 V)	2	External Power Ground	Input/Output ground
3	Input 1	-Satellite data prevention -Force prevent RF activity	4		
5	Input 2		6		
7	n/a		8		
9	Output 1	-Incoming call alarm -Data connection indication -System event indication	10		
11	Output 2		12		
13	Output 3		14		
15	Remote Power On/Off+	Remote control of BDU power +	16	Remote Power On/Off-	Remote control of BDU power -

4.5.3 USIM interface

Intellian's FB500 provides a USIM card slot in which a provisioned USIM card is inserted.

4.5.4 LED indicators

Intellian's FB500 has 3 LED status indicators as follows:

Item		Specification
Power	Off	The BDU is powered off.
	Blinking	The BDU is booting a system.

		The BDU is calibrating a system. The system is in error. There is no USIM card inside BDU.
	Steady Green	The BDU is powered on.
Satellite	Off	The antenna is not connected to a satellite.
	Blinking	The antenna is acquiring a satellite. The antenna is searching for a satellite.
	Steady Green	The antenna is connected to a satellite.
Event	Off	The antenna has no event (call or data).
	Blinking	The antenna has an alert, an unread message, or an incoming call.
	Steady Green	The antenna has a voice or data.

4.6 Security considerations

4.6.1 Network security

Network level security is accomplished in the following ways.

- Firewall, Wi-Fi mac filters (refer to 4.2.4, 4.2.5)
Network ports not in service (HTTP, HTTPS) are all closed to minimize window of hacker access

4.6.2 Sensitive internal data protection

Intellian's FB500 encrypts user credential data (Web UI/API user/password tuples) and only root (internal operating system administration authentication level) is allowed to access credential data to protect the password from exposure.

Package data is also encrypted and when the package is upgraded the internal process checks the integrity of the package data to protect against a tampered package image upgrade.

4.7 GMDSS support

Intellian's FB500 will support GMDSS according to the GMDSS specification which is expected to be open public in the near future.

5. Technical Specification

5.1 RF Performance Specification

Item		Specification
Frequency	Rx	1518.0 ~ 1559.0 MHz L-Band
	Tx	1626.5 ~ 1675.0 MHz L-Band
Gain		18 dBi
Antenna Polarization		RHCP
G/T		-7.0 dB/K
EIRP		22.0 dBW
Axial Ratio		<2 dB
Antenna Motion		-25 ~ 115°

5.2 Physical Specification

Item		Specification
Weight	Pedestal	20 kg
	Radome	9.5 kg
	Total	29.5 kg
Radome Size	Height	797 mm (31.4")
	Diameter	Ø733 mm (28.9")
Ship Motions	Roll	± 28° / 4 s
	Pitch	± 15° / 3 s
	Yaw	± 10° / 5 s
	Turning rate	36°/sec and 12°/s ²
	Headway	30 knots

5.3 Key Component Specification

5.3.1 MoCA

Item	Specification
Frequency Band	750 MHz
Throughput	500 Mbps in 100 feet on LMR200

Return Loss	8 dB
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5.3.2 Tx Module

Item	Specification
Frequency Range	1626.5 ~ 1675.0MHz
Output Power level	+34.0 dBm (2.5Watt)
Normal signal Gain	31 dB typ.

5.3.3 Power Specification

Item	Specification
Antenna Power	48 V DC supplied from BDU over Coax Cable
Antenna Power Consumption	Antenna Power 48 Vdc Max 80 W, BDU Power Max 40 W
BDU Power Input	10.8 ~ 30 V DC, 120 W

5.4 Below Deck Unit (BDU) Specification

5.4.1 Size & Weight

Item	Specification
Size (W x D x H)	315 mm x 190 mm x 42 mm
Size [with rack kit installed]	483.6 mm x 300 mm x 44 mm
Weight	1.5 kg (stand-alone)

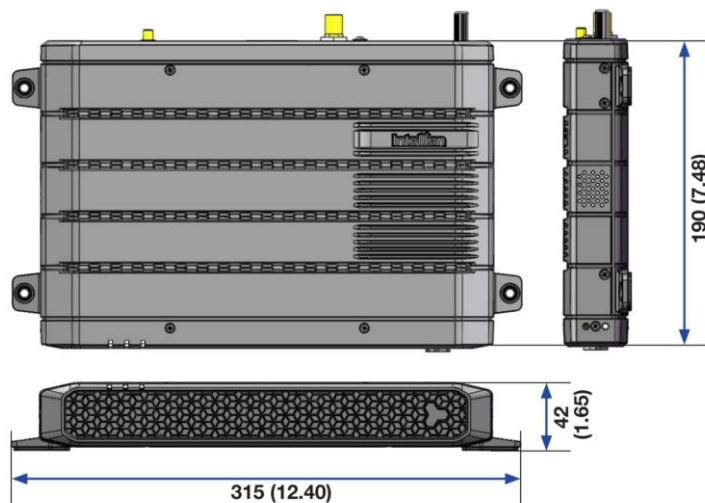


Figure 2. Below Decks Unit (BDU) [units: mm (in)]

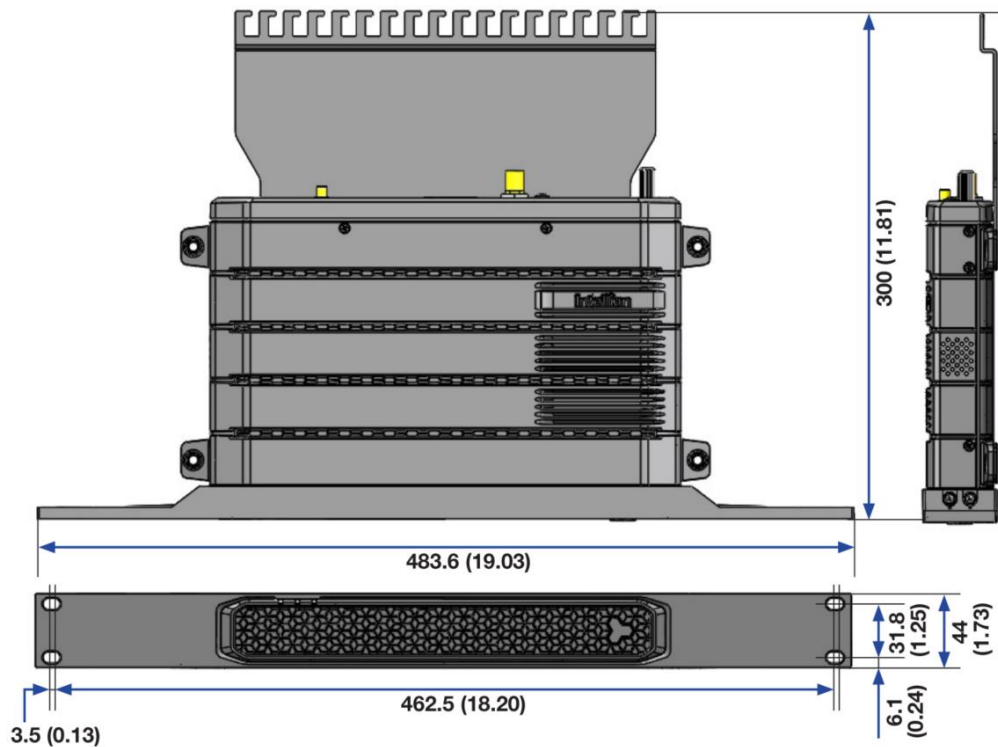


Figure 3. Below Decks Unit (BDU) [units: mm (in)]

5.4.2 LED Indicator & Display

Item	Specification
LED Indicator	3 LEDs for Power, Tracking, Event

5.4.3 I/O interface

Item	Specification	Feature	Location
USIM	1 ea. 2FF Push-Push type with locking structure	User Authentication	Rear
Ethernet	4x RJ45 female	TCP/ IP connection 2 port PoE	Rear
RF Interface	1 ea., TNC female	Sub-System connection to ADU	Rear
Analog	1 ea., RJ14 female	Analog phone	Rear
GPIO	1 ea. (16 pin)	General purpose I/O	Rear
Wi-Fi	1 ea., SMA female	External Wi-Fi antenna	Rear

On/Off switch	1 ea., power switch or toggle type	System power switch	Front
Reset	1 ea.	System reset	Rear
Ground	1 ea.	Grounding	Rear

5.5 Environmental Specification

Intellian FB500 antenna is qualified under reliability test standards as below.

Item	Specification	
Temperature (ADU)	Operational	IEC-60945 (-25°C to +55°C / Power On)
	Survival	IEC-60945 (-40°C to +80°C / Powered On and a non-functional state)
	Storage	IEC-60945 (-40°C to +85°C / Power off)
Temperature (BDU)	Operational	IEC-60945 (-25°C to +55°C)
	Survival	IEC-60945 (-40°C to +80°C)
	Storage	IEC-60945 (-40°C to +85°C)
Humidity	IEC-60068-2-30 Upper test Temp: +40°C(-3), Humidity 98% Lower test Temp.: +15°C(+3), Humidity 71% ~ 78%	
Vibration	Operational	IEC-60945
	Survival	IEC-60721-3-6 Class 6M3
Shock	Operational	IEC-60068-2-27 10g/11ms, 20g/7ms
	Survival (Transient)	IEC-60721-3-6 Class 6M3 (10g/11ms, 30g/6ms, 50g/3ms)
	Survival (Bump)	IEC-60721-3-6 Class 6M3 (25g/6ms)
Salt Mist	Saline solution: 5%NaCl, PH6.5 to 7.2 at 20°C ± 2°C Storage period: 7 Days (IEC-60945)	
Wind Load	200 km/hr	
Ingress Rating	ADU	IP56 (Water Proofing: IEC-60529)
	BDU	IP31

5.6 Regulatory Compliance

The FB500 shall comply with the following standard(s).

Item	Specification
Safety	IEC 62368-1 IEC 60950-22
EMC	EN 301 489-1/17/19/20 IEC 60945 FCC CFR47 Part 15 B
RF Spectrum	EN 301 444 (Antenna) EN 303 413 (GNSS) EN 300 328 (WLAN) FCC CFR47 Part 25 (Antenna) FCC CFR47 Part 15 C (WLAN)
ROHS	RoHS 3 (EU Directive 2015/863) and all applicable
WEEE	WEEE 2 (Directive 2012/19/EU)

5.7 Homologation

The FB500 antenna system will perform homologation certification for potential countries where the systems are likely to be operated. This may include the following countries.

Country	Specification	Comply	Remark
USA	FCC	Comply	
Brazil	ANATEL	TBD	
Korea	KC	Comply	
Japan	TELEC	TBD	
Australia	C-tick	TBD	
EU	RED	Comply	

6. Package

The package is a paper type and contains the ADU, BDU, and various accessories required for installation.

The system package size is 910 (W) x 910 (D) x 1130.5 (H) mm / weight 85.0 kg

The system package contains the ADU package and the BDU package as follows.

ADU: 860 (W) X 860 (D) X 890 (H) mm / weight 63.5 kg

BDU: 505 (W) X 505 (D) X 115 (H) mm / weight 6.5 kg

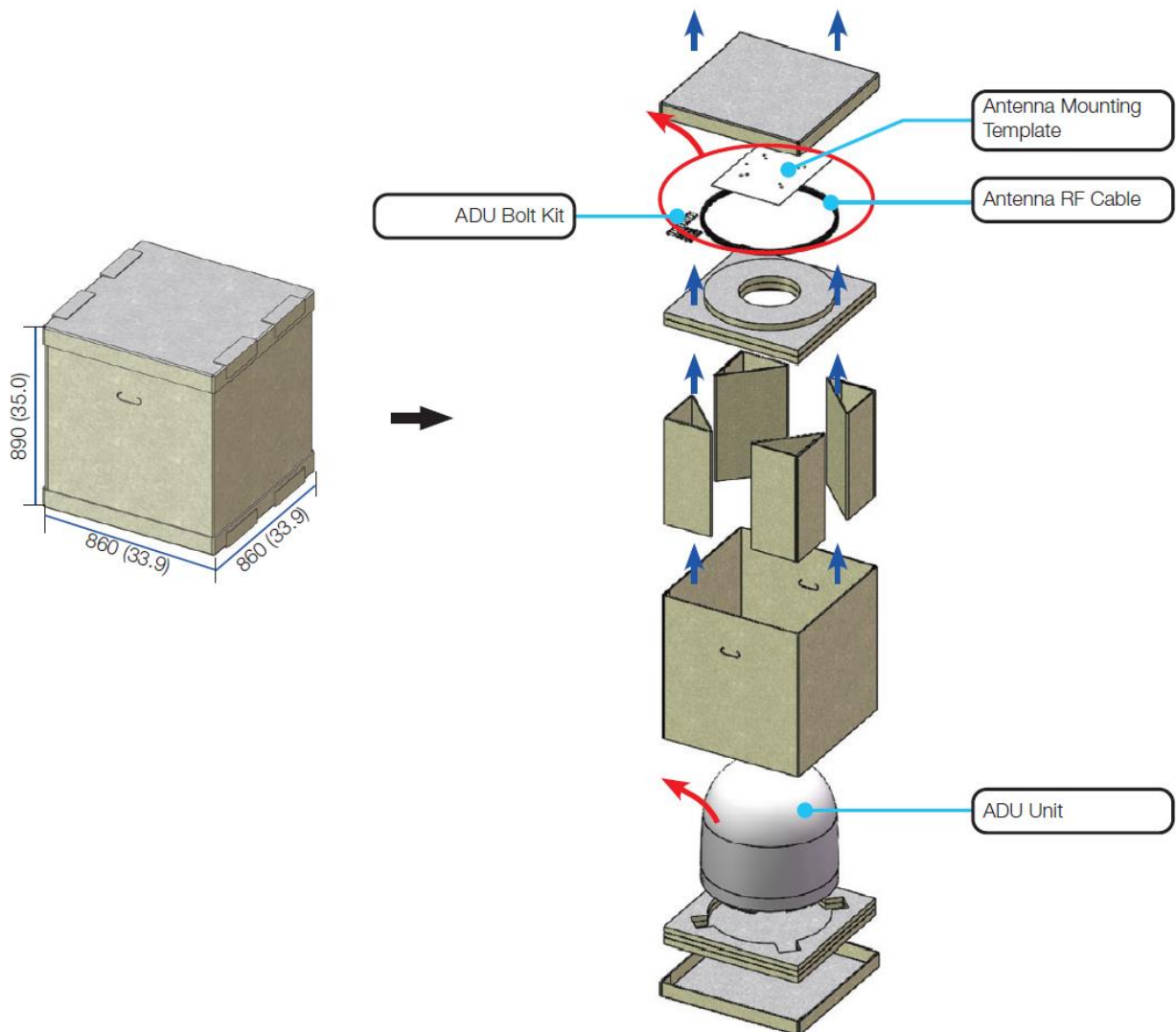


Figure 4. ADU Package

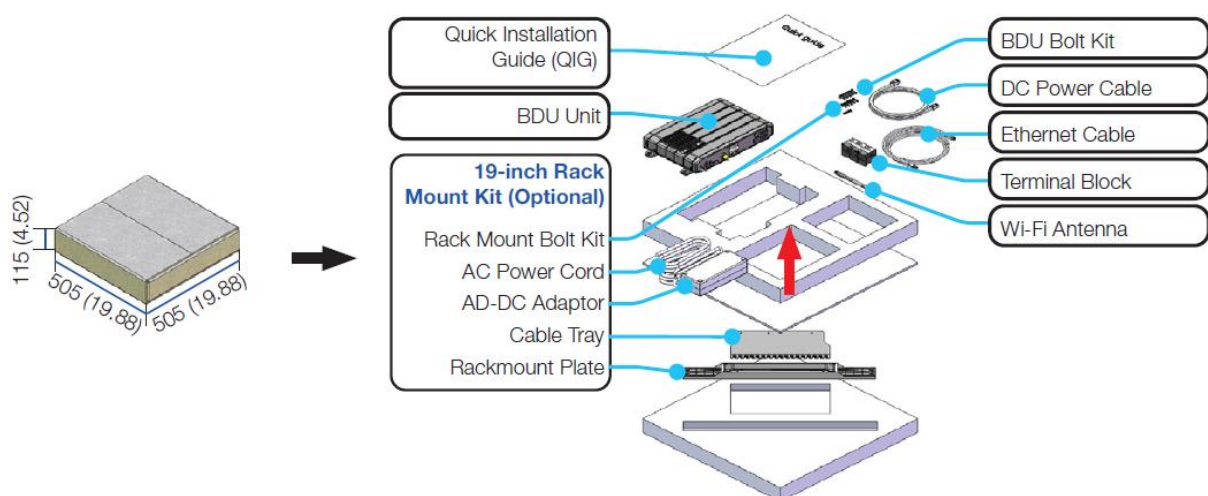


Figure 5. BDU Package

The contents of the FB500 package are as follows:

Main package:

No	Description	Qty	Size	Remark
1	Above Deck Unit	1		
2	Coaxial Cable	1	30 m	
3	ADU Bolt Kit	1		
4	ADU Mounting Template	1		
5	Below Deck Unit	1		
6	Quick Install Guide	1		User Manual in Web UI
7	Ethernet Cable	1	1 m	
8	DC Power Cable	1	1 m	
9	Terminal Block	1		For inter-connection of DC Power cables
10	Wi-Fi Antenna	1		
11	BDU Bolt Kit	1		

Extras included in rack mount option:

11	AC/DC adapter	1		150W
12	ACU power cable (US)	1		Type B
13	ACU power cable (EU)	1		Type F
14	Rack conversion bracket	1		Includes a Cable tray and screws

EOD