PALS®

Communications & Technology

Multi-Band Feeds
Changed in Minutes

Full De-Ice Option with
ACU Integrated Controller

PFA-370-MIL

ENGAGE THE EASY OPERATION

Assembled in less than
25 Minutes without Tools

Carbon-Fiber IATA
Compliant Flight-Cases

PAC-550-MIL
ANTENNA CONTROLLER

Integrated 10MHz
Generator with Auto Switch

Integrated DVB and
Beacon Tracking Receiver

Satellite Step
and Memory Tracking

STANDARD
MIL-STD
810G

STANDARD
MIL-STD
188-164A

STANDARD
MIL-STD
461F

Applied Methods of MIL-STD461F; CE102, CE106, CS101, CS114, CS115, CS116, RE102, and RS103.

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1. PROPOSED ANTENNA SYSTEM

PFA-370 is designed as a portable 3.7m antenna system. The reflector structure consists of lightweight carbon-fiber panels. The reflector is assembled with 19 carbon-fiber panels. It is designed to be lightweight and modular with robust components. This document also purposed to present technologies used and why this system should be chosen over any competitor.

Figure 1 General View of PFA-370-MIL Antenna System

With recent advancements in technology, mobility became a very popular demand within consumer groups of end-users as well as sector professionals. PALS developed an Earth Station (ES) with a very special structure to comply with popular demands. Satellite systems provide connectivity solutions in rural areas where you have no land connection options at all, due to their nature. It is an Earth Station, Fly-Away type of antenna with an aperture of 3.7 meters of the reflector.

2. KEY FEATURES

PFA-370-MIL antenna system is specifically designed for ease of use and practical installation. Whether its operator is a professional who has experience in satellite communication or an operator who has his first encounter with a satellite communication antenna with only some minor training.

Key features of the PFA-370-MIL antenna system that stands out against competitors are presented below **:**

- Ku, Ka, X and DBS Band options are available
- Strong yet lightweight Carbon-Fiber design which is rigorously tested to operate in the toughest environments (wind, rain, sun...)
- High capacity of gain, low loss, and state-of-art antenna signal acquisition
- 0,01° pointing accuracy with resolvers at 3 axes
- Fully motorized driving mechanism with zero backlash gear system
- Dual offset (dual optic) elliptical antenna and feed system
- Low power consumption De-Ice system (Optional)
- Supports SNMP ver. 2.0c for M&C
- Beacon and/or DVB-S/S2 Tracking Receiver (Optional)
- Manual drive tool kit for emergencies
- Optional hand-held control unit

Compatibility:

- MIL-STD-810G (Environmental Conditions)
- MIL-STD-461F (EMI-EMC)
- MIL-STD-1472 (Acoustic)
- MIL-STD-188-164A (RF)
- ITU-RS-580 (RF)
- ITU-RS-465-6 (RF)
- EUTELSAT ESOG120

3. MECHANICAL FEATURES

PALS knows the importance of mechanical design as well as other aspects of manufacturing a satellite antenna system. All features come from experience gained in the field or created thanks to well-designed working scenarios. Each design, product and their features are tested in our facilities as well as on the field.

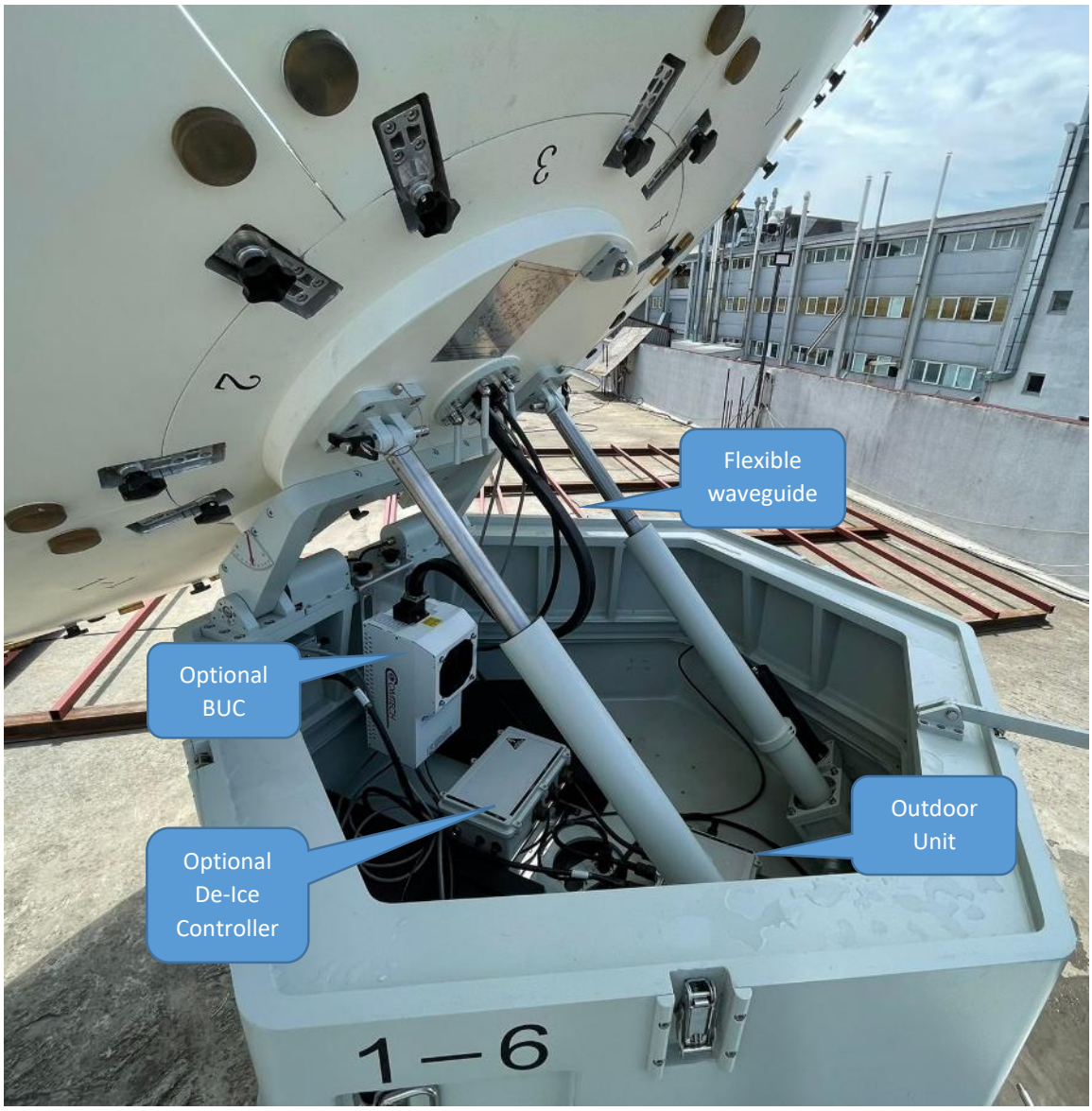

Figure 2 General View of PFA-370-MIL Rear side

3.1. CARBONFIBER REFLECTOR DESIGN

PFA-370 is an Earth Station antenna but with the feature of modularity, so the user can disassemble the antenna and transfer it to any other desired location. All parts of this Earth Station are designed and manufactured from Carbon-Fiber to be lightweight so an average person can assemble/disassemble, and most importantly, carry it around. The antenna reflector itself, which is the heaviest part, is made up of 19 individual pieces. Each piece is labeled with numbers so it would be easy to assemble. All parts are designed to be snapped on, so there would be no special tool requirements other than human hands.

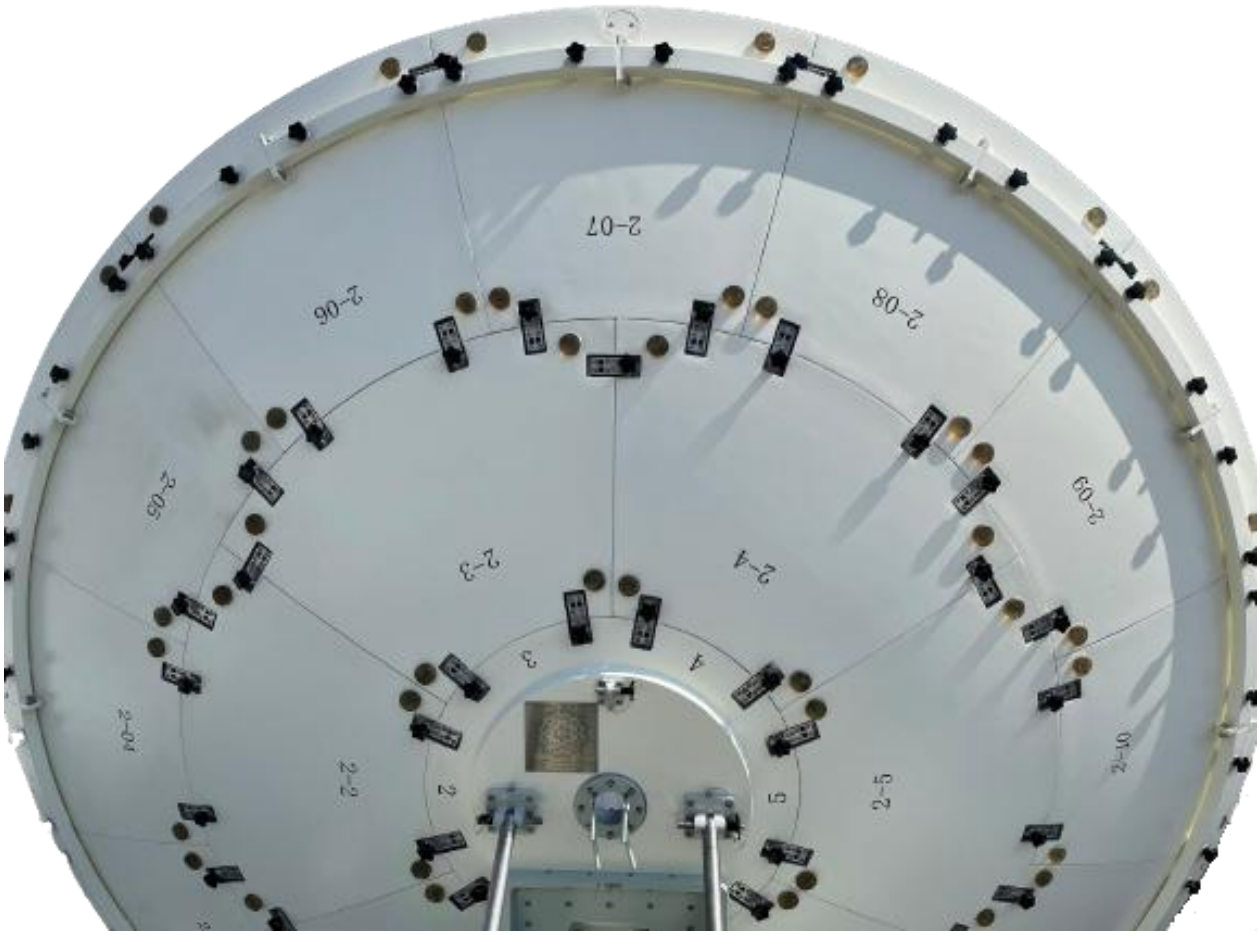

Figure 3 PFA-370-MIL Antenna Reflector Rear View with Labels

3.2. FLY-AWAY STRUCTURE

The whole system can be divided into 9 boxes total. Each part of the system has a designated spot in its boxes. Each box is IATA compliant, which means it is not too heavy for a person to carry, and box sizes are appropriate for transportation by commercial or by military aircraft. Fly-away boxes are part of the antenna mount which is called a pedestal. They also house antenna systems' motors and driver controllers. So you don't have to worry about thinking about where to put all the boxes after you took out parts. The total weight is less than 500 kg depending on mount and configuration options. It can be deployed by 2 people within 30 minutes. 9 transport cases are used for the package.

Figure 4 PFA-370-MIL Fly Away Carry Boxes (3 of 9)

3.3. DIFFERENT FEED OPTIONS

PFA-370-MIL allows the customer to choose between different feed options. PFA-370-MIL can operate on C, X, Ku, Ka and DBS bands in different configurations. Feed options can be Rx, Tx/Rx, 2-ports, or multiple ports. Polarization can be circular or linear according to feed options. Customized design and different feed arm options are possible to provide interchangeable feed structures.

Figure 5 PFA-370-MIL Feed Arm Carrying Case with Ku Band Option

3.4. WIND LOAD PERFORMANCE

PFA-370-MIL antenna is designed to perform properly under heavy wind-load conditions despite its weight and size. Wind is amongst major environmental factors causing RF performance losses. PALS presents the following wind load performances:

	Value	**With Optional Pedestal Mount**
Operational	60 km/h	72 km/h
Survival	120 km/h	150 km/h

Table 1 PFA-370-MIL Antenna Verified Wind Performance

These values can be achieved when the PFA-370-MIL antenna is properly installed on a flat surface. An optional pedestal mount can be provided as well. These mounts also allow the customer to use the system as an Earth Station.

Figure 6 PFA-370-MIL Optional Pedestal Mounts

3.5. DE-ICING (OPTIONAL)

PFA-370-MIL Antenna system offers half and full de-icing options. De-icing is recommended for extremely cold environments these are subject to frequent heavy snowfall. De-ice pads can be applied to the rear side of the PFA-370-MIL main reflector.

Figure 7 PFA-370-MIL Antenna Rear Side View with Optional De-ice Applied

Heater elements of de-ice system are designed to be easily mounted on the backside of the antenna. Easy hook-and-loop fasteners can be easily applied by hand.

Figure 8 PFA-370-MIL Heater Elements with Hook-And-Look Fasteners

PFA-370-MIL De-icing system contains total max. **2500 Watts** with half de-ice option. RMS heating elements make sure its operation won't be interrupted under any condition. The de-icing controller is

also undergoing military tests according to MIL-STD-810G. We make sure the system can be operated down to -30 °C and can be stored at -40 °C.

Figure 9 PFA-370-MIL Optional De-ice Controller

3.6. BUC MOUNT (OPTIONAL)

PFA-370-MIL allows users to mount an optional BUC inside its motorized housing. BUCs with different sizes and models are supported by PALS. Optional BUC mounts can be customized according to customers' needs.

Figure 10 PFA-370-MIL Optional BUC Mount

4. RF FEATURES

PFA-370-MIL antenna system, thanks to its mechanical design, ensures the best RF performance given on its similar models in the market. RF features presented in this section are real-time test results obtained during verification tests. Every unit is manufactured, tested and fine-tuned to verify its datasheet values according to PALS' Quality Assurance policies. The system is delivered only after successfully passing all these tests at our premises.

4.1. RF CHARACTERISTICS

PFA-370-MIL shows great RF characteristics. It has a low insertion loss, great VSWR, high cross-polar isolation, and a great G/T ratio. PFA-370-MIL RF Characteristics are presented below.

RF CHARACTERISTIC		
Frequency (GHz)	Tx 13.75 - 14.50 GHz	Rx 10.70 - 12.75 GHz
Antenna Gain (±0.2 dBi)	Tx 52.6 dBi @ Midband	Rx 51 dBi @Midband
Polarization	Linear (optional circular)	
Feed Insertion Loss	Tx 0.8 dB	Rx 0.3 dB
Waveguide Interface	WR - 75	
VSWR	1.3:1	
Cross Polar Isolation	35 dB	
G / T	28.5 dB/K	

PFA-370-MIL antenna comes with a variety of feed and frequency options. RF characteristics with other feed options are presented below.

OTHER FEED OPTIONS				
		C-Band	X-Band	Ka-Band
Frequency	Tx	5.850-6.425 GHz	7.90-8.40 GHz	27.50-31.00 GHz
	Rx	3.625-4.200 GHz	7.25-7.75 GHz	17.70-21.20 GHz
Gain (midband)	Tx	45.1 @6.00GHz	47.7 @8.15GHz	58.3 @30.00GHz
	Rx	41.6 @4.00GHz	47.0 @7.50GHz	54.8 @20.00GHz

4.2. RADIATION PATTERN PERFORMANCE

PFA-370-MIL antenna gain radiation pattern (Radiation Pattern) complies with **MIL-STD-188-164A / ITU-RS-580 / ITU-R S.465-6** criteria. The radiation pattern of the PFA-370-MIL antenna is given below.

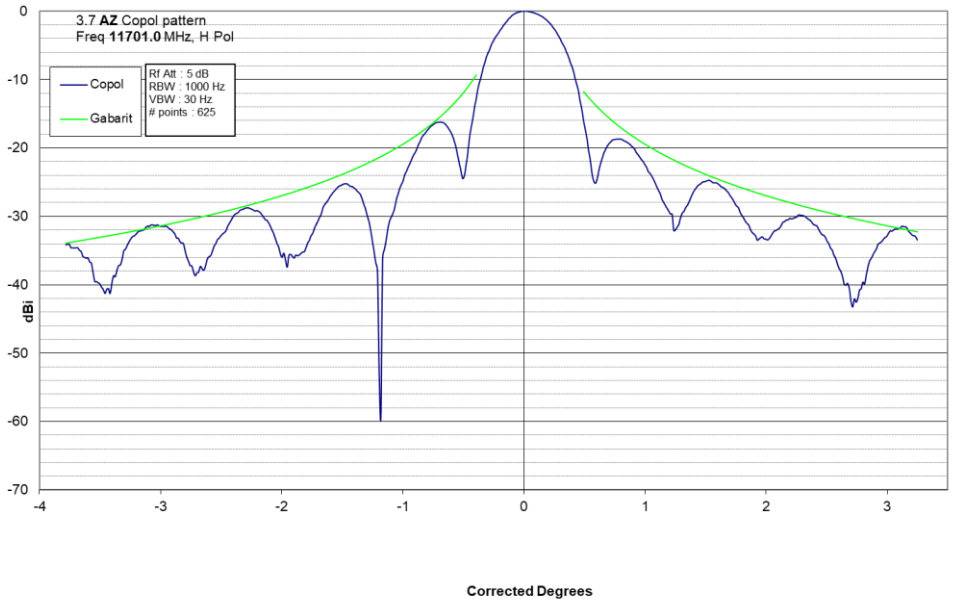

Figure 11 PFA-150-MIL Antenna Ku-Band Rx Pattern Cut with Envelope in Azimuth Axis

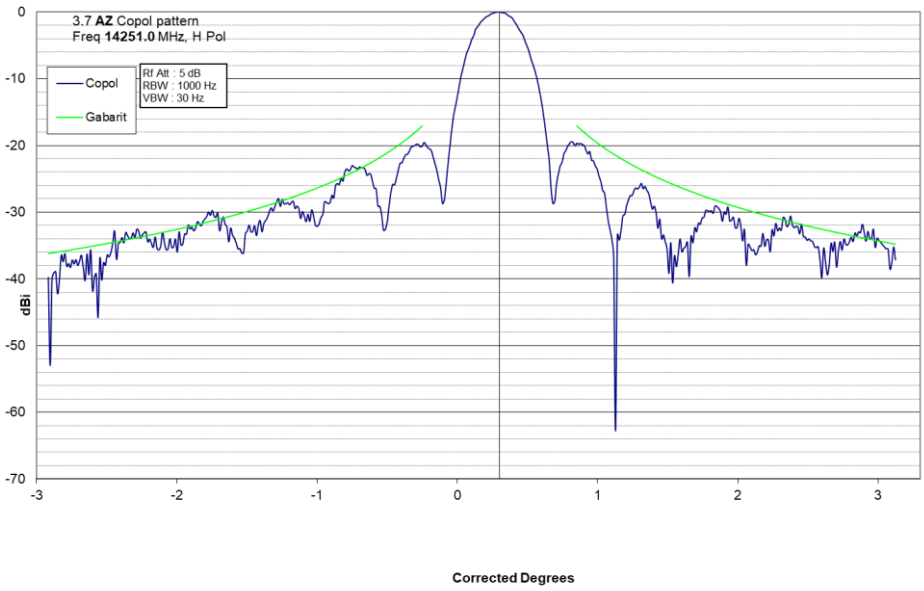

Figure 12 PFA-370-MIL Antenna Ku-Band Tx Pattern Cut with Envelope in Azimuth Axis

4.3. AUTOPOINTING FEATURE

PFA-370-MIL antenna, when used together with PAC-550-MIL antenna controller, gains a state of the art auto pointing algorithm. Combined with its RF performance given in this section, auto pointing performance is approved by EUTELSAT according to the ESOG120 standard. The algorithm also makes sure the antenna did not point to side-lobes of the satellite signal but pointed to the boresight of the satellite beam. The auto pointing test was conducted with three different satellites using two different DVB and a beacon signal four times. Every auto pointing error should be within <0.4 dB margin to pass tests. The error mentioned above means auto pointing should be within this margin compared to a human manually pointing antenna. This test procedure is applied to every unit manufactured, as part of PALS' Quality Assurance policy. As a result, PALS gained rightfully use of the following logo:

Figure 13 EUTELSAT Characterized Logo

Please note test results mentioned are open to the public on Eutelsat's web page and can be accessed any time.

4.4. BEACON AND/OR DVB-S/S2 RECEIVER FEATURE (OPTIONAL)

A Beacon **and/or** DVB-S/S2 receiver can be embedded within PFA-370-MIL antenna and its PAC-550-MIL antenna controller. This means a beacon receiver can be used for antenna processes such as auto pointing, tracking, etc. as well as a DVB-S/S2 receiver in the same box without making physical changes. This feature makes the system superior compared to its competitors because there are only beacon or DVB options offered in the market when it comes to receivers.

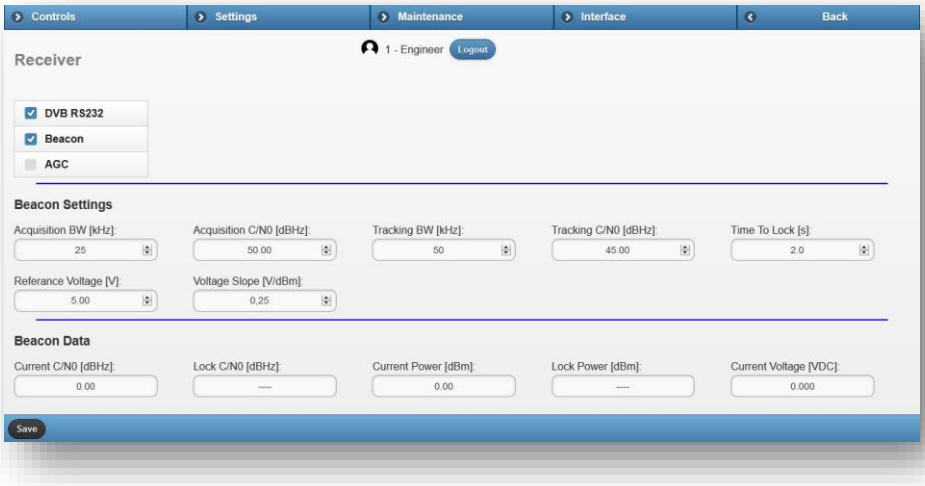

Figure 14 PFA-370-MIL Receiver Settings Web Interface

If customers desire to use an optional beacon receiver feature, that beacon could also be applied to the system along its operation via AGC input. The controller provides an analogue voltage input for satellite signal acquisition to be used by the Beacon receiver or by the Modem.

4.5. TRACKING PERFORMANCE

The PFA-370-MIL antenna system is equipped with two different tracking algorithms. When satellite signal is acquired and tracking is enabled, step track algorithm is deployed. The algorithm starts to register satellite position via a user-definable interface.

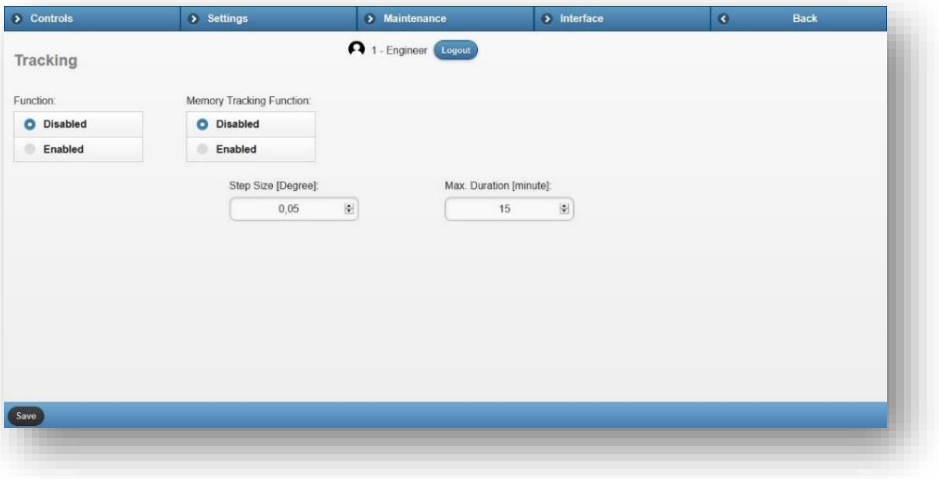

Figure 15 PFA-370-MIL Tracking Settings Web Interface

After 24 hours of position saving, memory track function can be used to track satellites. The memory tracking function allows users to track satellite even if the signal is missing. Memory tracking uses satellite positions saved beforehand during the last 24 hours using step tracking.

The tracking algorithm also allows users to successfully track inclined orbit satellites. An inclined orbit satellite tracking graphic is presented below as an example.

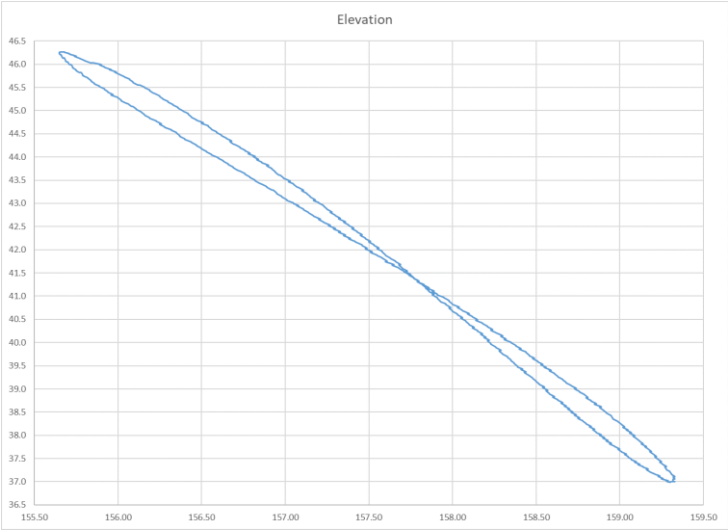

Figure 16 Inclined Orbit Satellite Tracking Plot

5. ENVIRONMENTAL CONDITION TESTS

PALS employs certified military standard experts specialized in their fields. The product's specifications are harmonized with sector defining American Department of Defence (DoD) standard MIL-STD-810G.

The latter's requirements are applied to PFA-370-MIL antenna system and its sub components. Environmental condition tests conducted on PFA-370-MIL system are presented in table below.

ENVIRONMENTAL SPECIFICATIONS			
Temperature	Compliant with MIL-STD-810g Method 501.5 and 502.5	Operational Survival	-30°C to 55°C -40°C to 70°C
Rain	Compliant with MIL-STD-810g Method 506.5	Survival in heavy rainstorm	
Humidity	Compliant with MIL-STD-810g Method 507.5	%95 Aggravated	
Solar Radiation	Compliant with MIL-STD-810g Method 505.5	1120 W/m2 (A1 Cycle)	

Table 2 Environmental Condition Characteristics

Photographs taken before or after environmental condition tests of PFA-370-MIL are presented below.

- **Temperature:** Compliant with MIL-STD-810g Method 501.5 and 502.5 — Operational: -30°C to 55°C, Survival: -40°C to 70°C

Figure 17 PFA-370-MIL Outdoor Unit And De-ice Controller Inside Temperature Test Chamber

- **Rain:** Compliant with MIL-STD-810g Method 506.5 — Survival in heavy rainstorm

Figure 18 PFA-370-MIL Outdoor Unit And De-ice Controller Inside Rain Test Chamber

- **Humidity**: Compliant with MIL-STD-810g Method 507.5 — %95 Aggravated

Figure 19 PFA-370-MIL Antenna System During Humidity Test (Actual Footage)

- **Solar Radiation:** Compliant with MIL-STD-810g Method 505.5 — 1120

Figure 20 PFA-370-MIL Outdoor Unit And De-ice Controller Inside Solar Radiation Test Chamber

6. CONTACT INFORMATION

Please do not hesitate to contact us for any inquiry or questions. We would be more than happy to help.

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