PLS® Communications & Technology

PAC-550-MIL Antenna Controller

Product Sheet

Compliant with

STANDARD MIL-STD 461F

STANDARD MIL-STD 810G

STANDARD MIL-STD 188-164A

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1. PROPOSED ANTENNA CONTROLLER

Since 1995, PALS has been producing state of the art antenna systems thanks to its know-how and committed engineering team. We are therefore ready to find the most suited solutions for your communication needs.

The proposed antenna controller system in this document is PALS Antenna Controller 550 Military as known as PAC-550-MIL which PALS believes will fulfill customers' needs. PAC-550-MIL antenna is one of the most popular models PALS offers and many units are already deployed in the field for many years. PAC-550-MIL is a satellite antenna controller unit that can be mounted to a standard 19" Rack Unit with or without telescopic rail. PAC-550-MIL is compatible with all antenna series that PALS offers. This document also purposed to present technologies applied and to demonstrate why this system should be chosen over any competitor.

Figure 1 General View of PAC-550-MIL Antenna Controller

2. KEY FEATURES

PAC-550-MIL antenna controller is specifically designed for easy usage. Whether the 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.

Structural Features

- Integrated DVB-S/S2 Receiver *
- Integrated 10 MHz Generator with Auto External Switching
- Military Grade GPS and GLONASS Receiver
- Integrated Beacon Receiver (Optional)
- Integrated De-Ice Controller with sensors (Optional)
- Emergency stop button
- More than 5000 Hours MTBF (MIL-HNDBK-217)

**: Beacon receiver can be integrated and used simultaneously with DVB S/S2 receiver in the same unit.*

Firmware Features

- Fully responsive Web Interface (SNMP Support)
- User-configurable target pointing
- Satellite memory tracking
- 3 Level user access
- Event and alarm logging
- Build-in self-test

Compatibility

- MIL-STD-810
- MIL-STD-461
- MIL-STD-1472
- MIL-STD-188/124A
- Eutelsat Characterized Auto pointing

3. FEATURES

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

3.1. DIMENSIONS

PAC-550-MIL antenna is designed by our engineers who are experts in their fields. The antenna control unit can be mounted with a 19" rack telescopic rail and is 2 RU high. The technical drawing containing the dimensions of the antenna control unit is presented below.

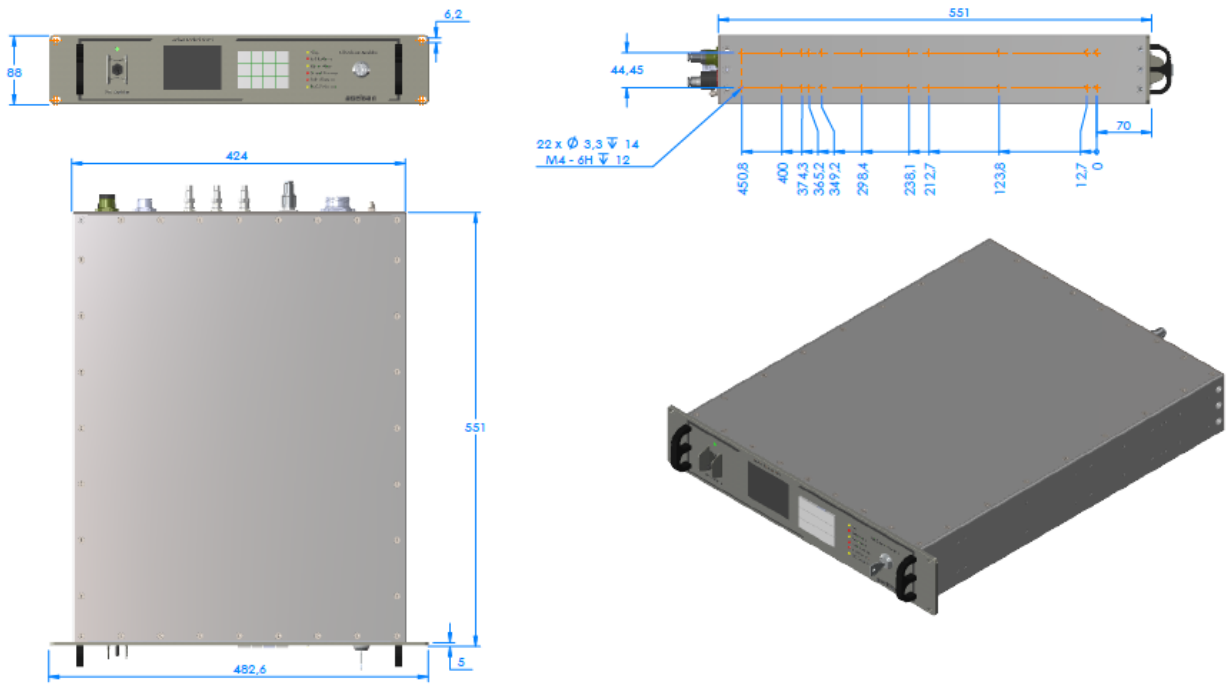


Figure 2 PAC-550-MIL Antenna Controller Dimensions in mm

3.2. FRONT AND BACK PANEL

Please note PALS offers many color options depending on customer requests although the antenna controller presented in this document is a military type and comes in grey color.

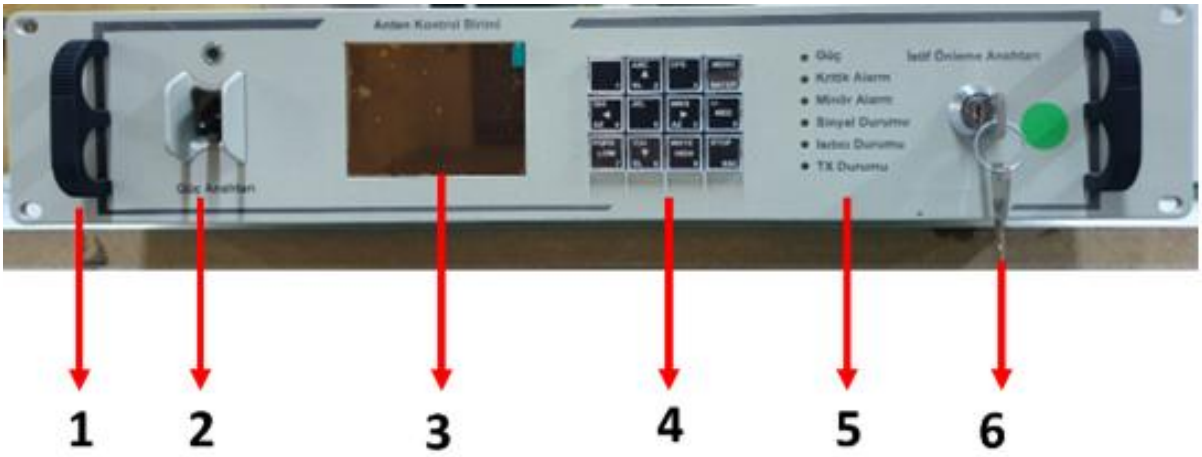


Figure 3 PAC-550-MIL Front Panel Elements

#	Part Name
1	Carrying Handle
2	On / Off Switch
3	Color Display
4	Keyboard
5	Alarm and Status Lights
6	Stow Prevention Key

Table 1 PAC-550 Front Panel Elements

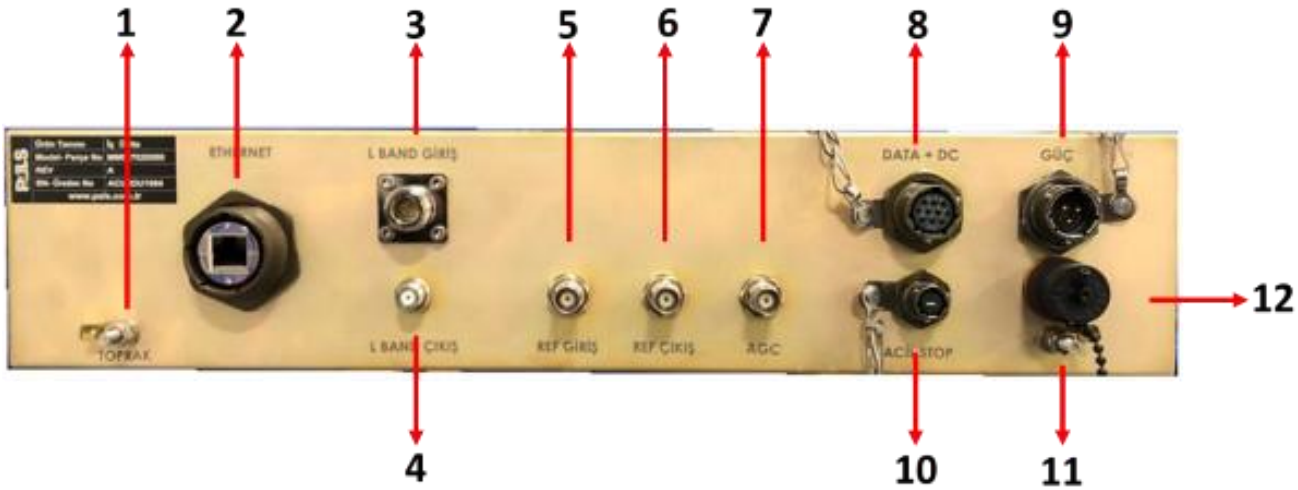


Figure 4 PAC-550-MIL Back Panel Elements

#	Element Name
1	Ground Screw
2	ETHERNET
3	L BAND INPUT
4	L BAND OUT
5	REF INPUT
6	REF OUT
7	AGE
8	DATA + DC
9	POWER
10	EMERGENCY STOP
11	Ground Screw
12	FUSE

Table 2 PAC-550-MIL Back Panel Elements

3.3. DE-ICING (OPTIONAL)

PAC-550-MIL offers de-icing controller for antenna systems. De-icing heater elements can be embedded in the surfaces of the system to prevent icing. Thanks to very low thermal expansion of Carbon Fiber, there is no shape change with temperature. PALS uses electrical de-icing via an embedded Carbon Fiber element in the surface behind the reflective layer. This operates at about 30-40W per sq. ft and heat can only be conducted forward to the reflector surface due to the core of the antenna structure having a low conductivity.

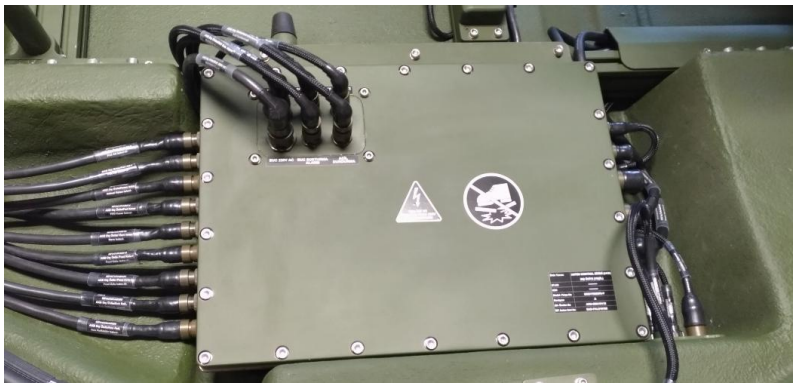


Figure 5 PAC-550-MIL Outdoor Unit and De-ice Controller

The rear face of the reflector is a slower-acting heat source but is economical in terms of energy consumption. The system is controlled via the ambient temperature and can be set by the user. De-icing is recommended for extremely cold environments these are subject to frequent heavy snowfall. Ambient temperature and current ice status are always monitored by the system thanks to the de-ice sensor and snow accumulation sensor.

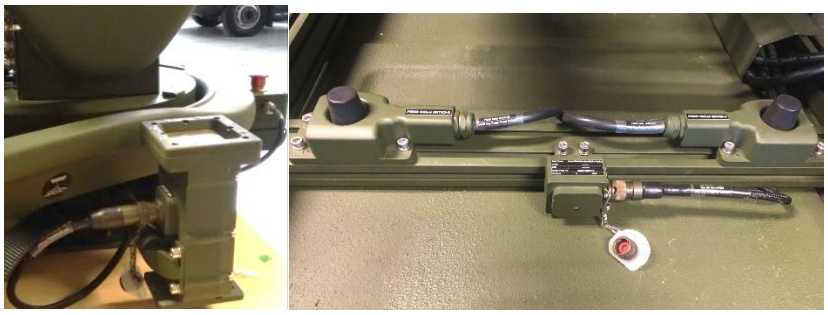


Figure 6 PAC-550-MIL Antenna De-ice System Parts (Left: De-ice Sensor, Right: Snow Accumulation Sensor)

Optional de-icing (frost prevention system) can be embedded into the antenna system to perform the following functions:

- To thaw frozen connections under snow and ice load before operating the antenna.
- To prevent snow and ice from accumulating on the reflector and feed horn so that the RF performance is not affected during operation.
- To ensure that units such as motors, sensors, etc. properly work down to -30°C degrees.
- To prevent accumulation of snow and ice in the pod during operation.

3.4. AUTOPOINTING FEATURE

PAC-550-MIL antenna system has a state of 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 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. The auto pointing errors 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 7 EUTELSAT Characterized Logo

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

3.5. HPA OR BUC MUTE FEATURE

PAC-550-MIL Antenna controller contains a muting feature. It is required by many satellite service providers today to use their uplink services. HPA or BUC manufacturers provide a physical interface generally from their control connection. When it is connected to the PAC-550-MIL antenna controller, mute interface can be used. The aim is to mute BUC or HPA until the antenna controller system automatically or manually acquires a satellite signal. So, the earth station operator will not be able to accidentally send any signal using BUC or HPA and cause disruption of service. When satellite signal is acquired and the highest level of signal is found, BUC or HPA mute is turned off by PAC-550-MIL antenna controller and the operator receives the message “Ready to Transmit”. All process described here is done by the antenna controller automatically. BUC or HPA muting can be used in manual mode to make final adjustments with the satellite service provider as well.

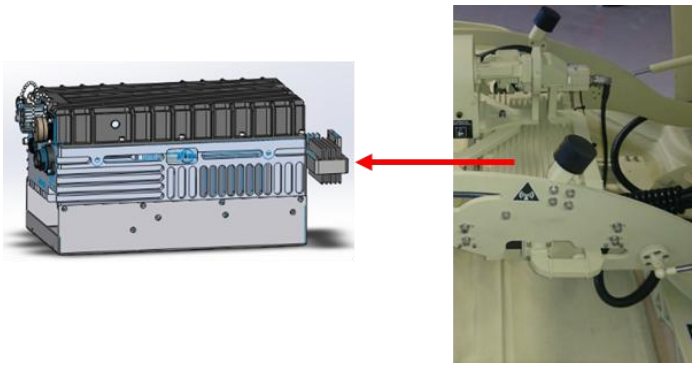


Figure 8 A BUC Integrated to PAC-550-MIL with Muting Feature (Demonstration Purposes Only)

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

A Beacon **and/or** DVB-S/S2 receiver can be embedded to the 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 only DVB options offered in the market when it comes to receivers.

Figure 9 PAC-550-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 analog voltage input for satellite signal acquisition to be used by the Beacon receiver or by the Modem.

3.7. TRACKING PERFORMANCE

PAC-550-MIL antenna controller 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.

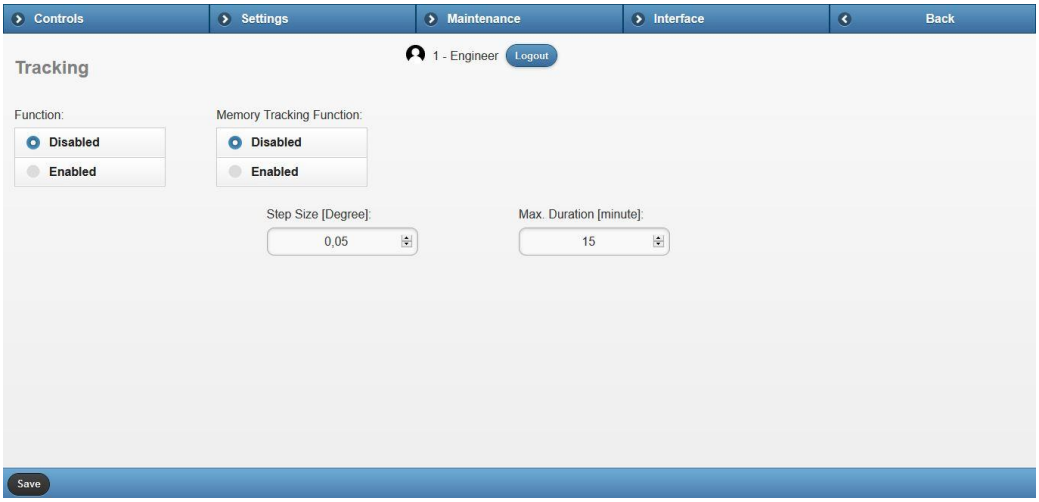


Figure 10 PAC-550-MIL Tracking Settings Web Interface

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

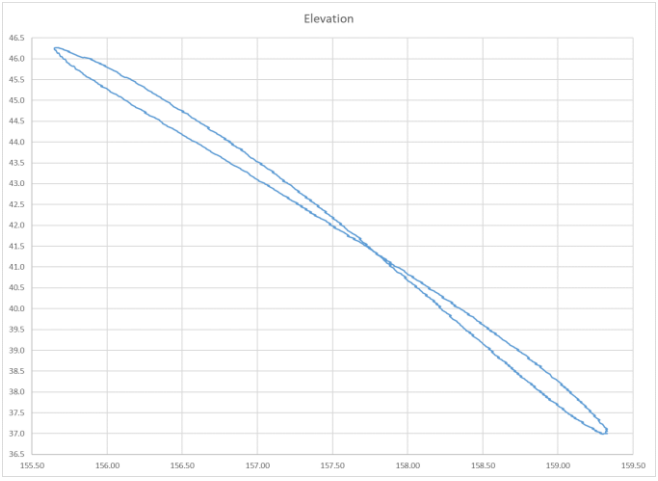


Figure 11 Inclined Orbit Satellite Tracking Plot

3.8. ALARM AND EVENT LOGGING

PAC-550-MIL antenna controller unit offers extensive alarm and event logging feature. The operator can check logs to learn who did what. This feature is a practical tool for system diagnosis. Logs are also exportable through .csv file.

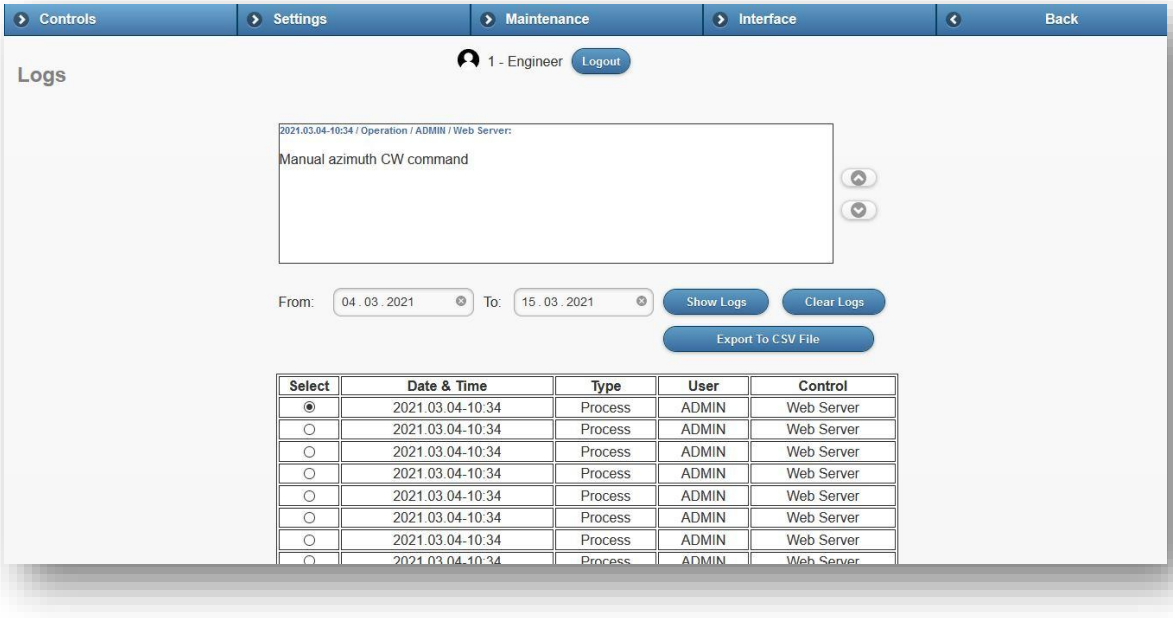
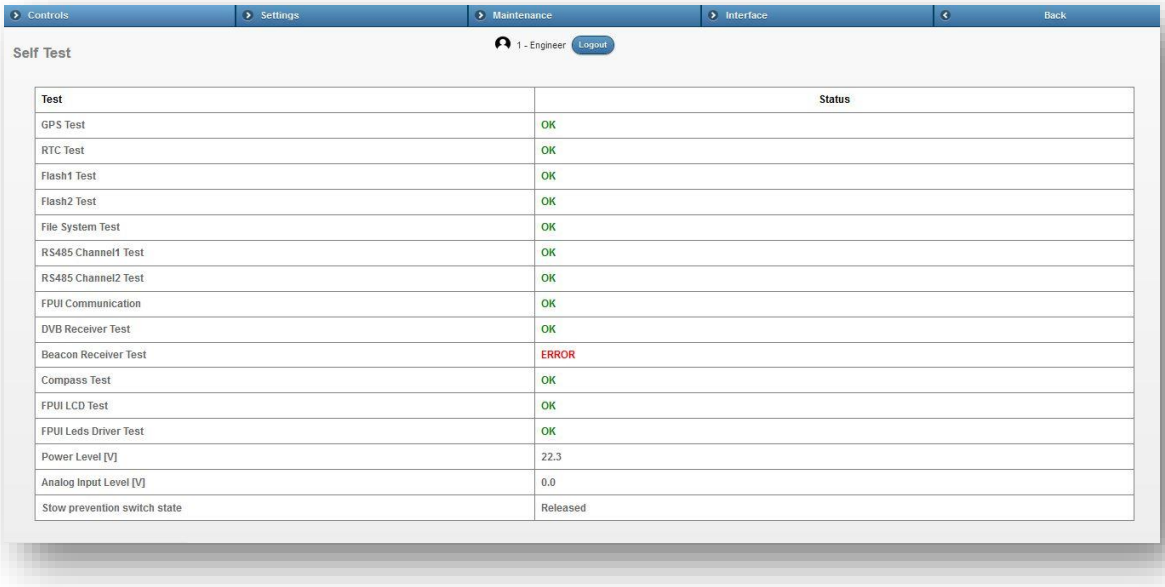


Figure 12 PAC-550-MIL Alarms and Event Logging Page

3.9. BUILT-IN SELF TEST FEATURE

PAC-550-MIL antenna controller comes with a build-in self-test feature. Software algorithm constantly checks parts and components and shows their results. It informs the operator about health status of any system components.



Test	Status
GPS Test	OK
RTC Test	OK
Flash1 Test	OK
Flash2 Test	OK
File System Test	OK
RS485 Channel1 Test	OK
RS485 Channel2 Test	OK
FPUI Communication	OK
DVB Receiver Test	OK
Beacon Receiver Test	ERROR
Compass Test	OK
FPUI LCD Test	OK
FPUI Leds Driver Test	OK
Power Level [V]	22.3
Analog Input Level [V]	0.0
Stow prevention switch state	Released

Figure 13 PAC-550-MIL Self-Test Page

4. 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 Defense (DoD) standard MIL-STD-810G. The latter's requirements are applied to PAC-550-MIL antenna system and to its subcomponents. Environmental condition tests conducted on the PAC-550-MIL system are presented in the table below.

ENVIROMENTAL SPECIFICATIONS		
Test Name	Specification	Limitations
Tempertaure	Compliant with MIL-STD-810G Method 501.5 and Method 502.5	Operational: -10 °C - +55 °C Survival: -20 °C - +60 °C
Humidity	Compliant with MIL-STD-810G Method 507.5	%95 Cycling Temp
Low Pressure	Compliant with MIL-STD-810G Method 500.5	Operational: 3000 meter Survival: 4500 meter
Thermal Shock	Compliant with MIL-STD-810G Method 503.5	-20 to +60 cyclic shock
Vibration	Compliant with MIL-STD-810G Method 514.6	Cat. 4 and Cat. 10 on all axes
Mechanical Shock	Compliant with MIL-STD-810G Method 516.5	20 G, 11 ms on all axes

Table 3 Environmental Condition Characteristics

Photographs taken before or after environmental condition tests of PAC-550-MIL are presented below.

- **Temperature:** Compliant with MIL-STD-810g Method 501.5 and 502.5 — Operational: -10°C to 55°C, Survival: -20°C to 60°C

Figure 14 PAC-550-MIL Antenna Controller After Temperature Tests

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

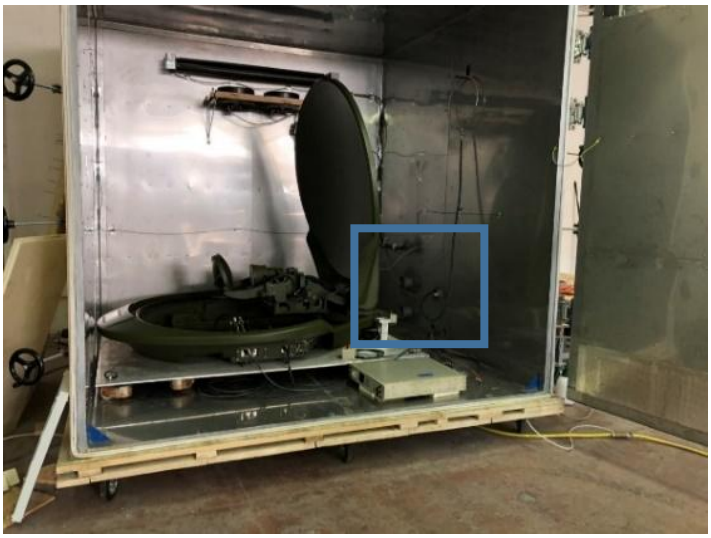


Figure 15 PAC-550-MIL Antenna Controller and PDA-150-MIL Antenna System During Humidity Test (Actual Footage)

- **Shock and Vibration:** Compliant with MIL-STD-810g Method 514.6, Compliant with MIL-STD-810g Method 516.5

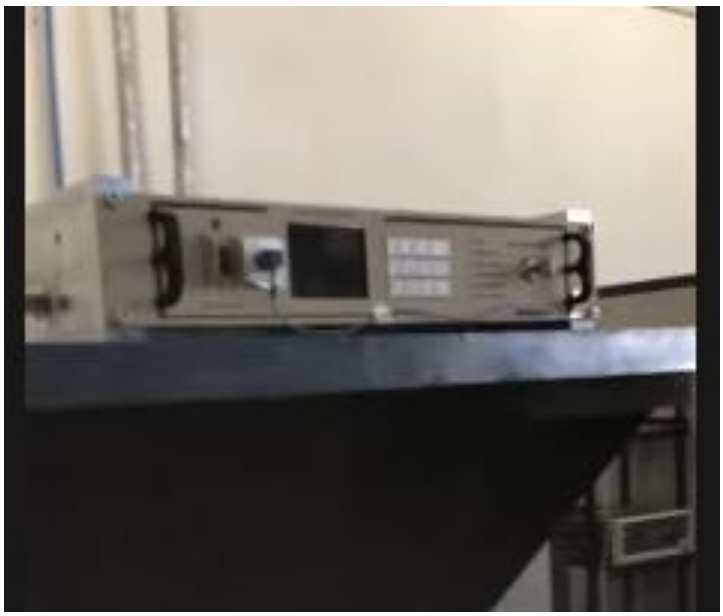


Figure 16 PAC-550-MIL Antenna Controller During Vibration Test (Actual Footage)

You can access to the video taken during tests from the following link:

https://www.youtube.com/watch?v=2fdHt2riFVY

- **Temperature Shock:** Compliant with MIL-STD-810g Method 503.5 — -40/70 Cyclic

Figure 17 PAC550-MIL Antenna Controller Before Temperature Shock

5. ELECTROMAGNETIC INTERFERENCE (EMI) AND ELECTROMAGNETIC COMPATIBILITY (EMC) TESTS

PAC-550-MIL antenna controller successfully passed by MIL-STD-461F electromagnetic performance tests. Therefore, PALS antenna controller is not disturbed by any electromagnetic interference caused by any devices neither by surrounding environment. In addition, connected via cable or air the PAC-550-MIL does not emit any electromagnetic interference disturbing nearby systems.

PAC-550-MIL passed following military-type EMI/EMC tests.

Standard	Test Name	Description
MIL-STD-461F	CE102	Conducted Emissions – Power Leads, 10 kHz to 10 MHz
	CS101	Conducted Susceptibility – Power Leads, 30 Hz to 150 kHz
	CS114	Conducted Susceptibility – Bulk Cable Injection, 10 kHz to 200 MHz
	CS115	Conducted Susceptibility – Bulk Cable Injection, Impulse Excitation
	CS116	Conducted Susceptibility – Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz
	RE102	Radiated Emissions – Electric Field, 10 kHz to 18 GHz
	RS103	Radiated Susceptibility – Electric Field, 2 MHz to 40 GHz

Table 4 EMI/EMC Test Table of PAC-550-MIL Antenna Controller Passed

6. CONTACT INFORMATION

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

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