TRAINING COURSE

CONTROL AND MONITORING SYSTEM (CMS)

Primary Surveillance Radar Systems

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WARNING OF CONFIDENTIALITY

Warning of Confidentiality

DOCUMENTATION CONTROL

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DOCUMENTATION CONTROL

PAGE EDITION AND REVISION RECORD		
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DOCUMENT CHANGES RECORD				
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2	0	25/09/2013	All	Update.
3	0	25/08/2014	All	Update.
4	0	28/05/2015	All	Update.

ACRONYMS

ACP	**Azimuth Change Pulse**
ARP	**Azimuth Reset Pulse**
AST	**Asterix**
ASTERIX	**All Purpose STructured Eurocontrol suRveillance Information EXchange**
CFAR	**Constant False Alarm Rate**
CMS	**Control and Monitor System**
CPC	**Central Processor Computer**
BPSA	**Bulk Power Supply**
DRCG	**Dual Rotary Control Group**
EPG	**Exciter and Processor Group**
FLU	**Filter+LNA Unit**
GRPG	**Generator, Receiver and Processor Group**
IF	**Intermediate Frequency**
IFCSU	**Intermediate Frequency Control and Switch Unit**
IP	**Internet Protocol**
LAN	**Local Area Network**
LRU	**Line Replaceable Unit**
MSSR	**Monopulse Secundary Surveillance Radar**
MTI	**Moving Target Indicator**
MWCG	**MicroWave Control Group**
MWG	**Microwave Group**

ACRONYMS

NTP	**Network Time Protocol**
PA	**Power Amplifier**
PED	**Pedestal**
POL	**Polarization**
PPI	**Plan Position Indicators**
PRPA	**Preamplifier**
PSR	**Primary Surveillance Radar**
RF	**Radiofrequency**
RXG	**Receiver Group**
SAC	**System Area Code**
SIC	**System Identification Code**
SDG	**Signal Distribution Group**
SLG	**Local Control System**
SRG	**Remote Control System**
SSA	**Shelf Switch Assembly**
STC	**Sensitivity Time Control**
TGT	**Target Channel**
TSU	**Turning Signal Unit**
TXBA	**Transmiter Blower Assembly**
TXCU	**Transmission Control Unit**
TXG	**Transmitter Group**
UCS	**Supervision and Control Unit**

ACRONYMS

UDP	**User Datagram Protocol**
VSWR	**Video Standing Wave Ratio**
WAN	**Wide Area Network**
WCD	**Waveguide Compressor Dehydrator**
WGHF	**Waveguide Harmonic Filter**
WGD	**Waveguide Duplexer**
WGS	**Waveguide Switch**
WPD	**Waveguide Power Load**
WX	**Weather Channel**

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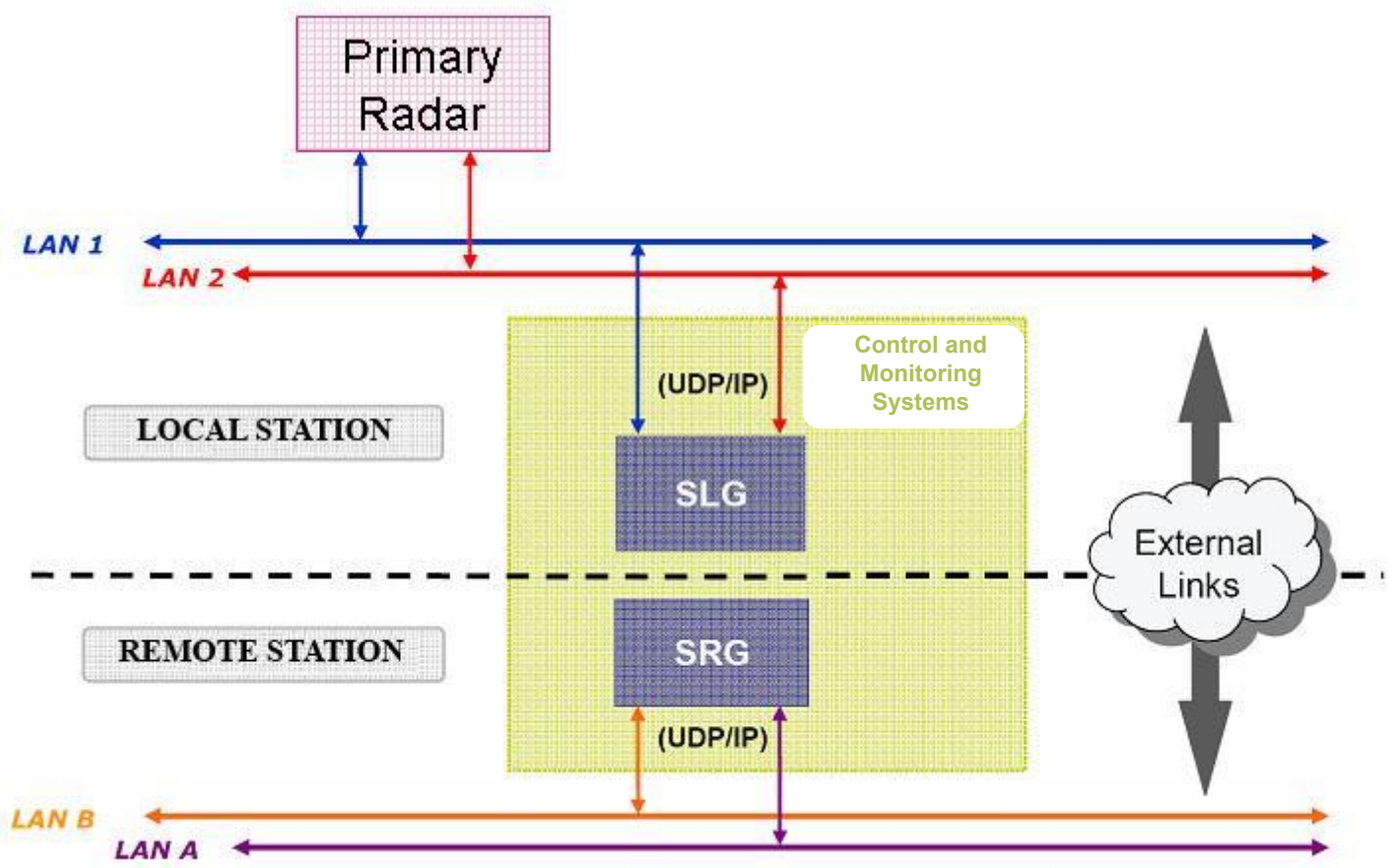
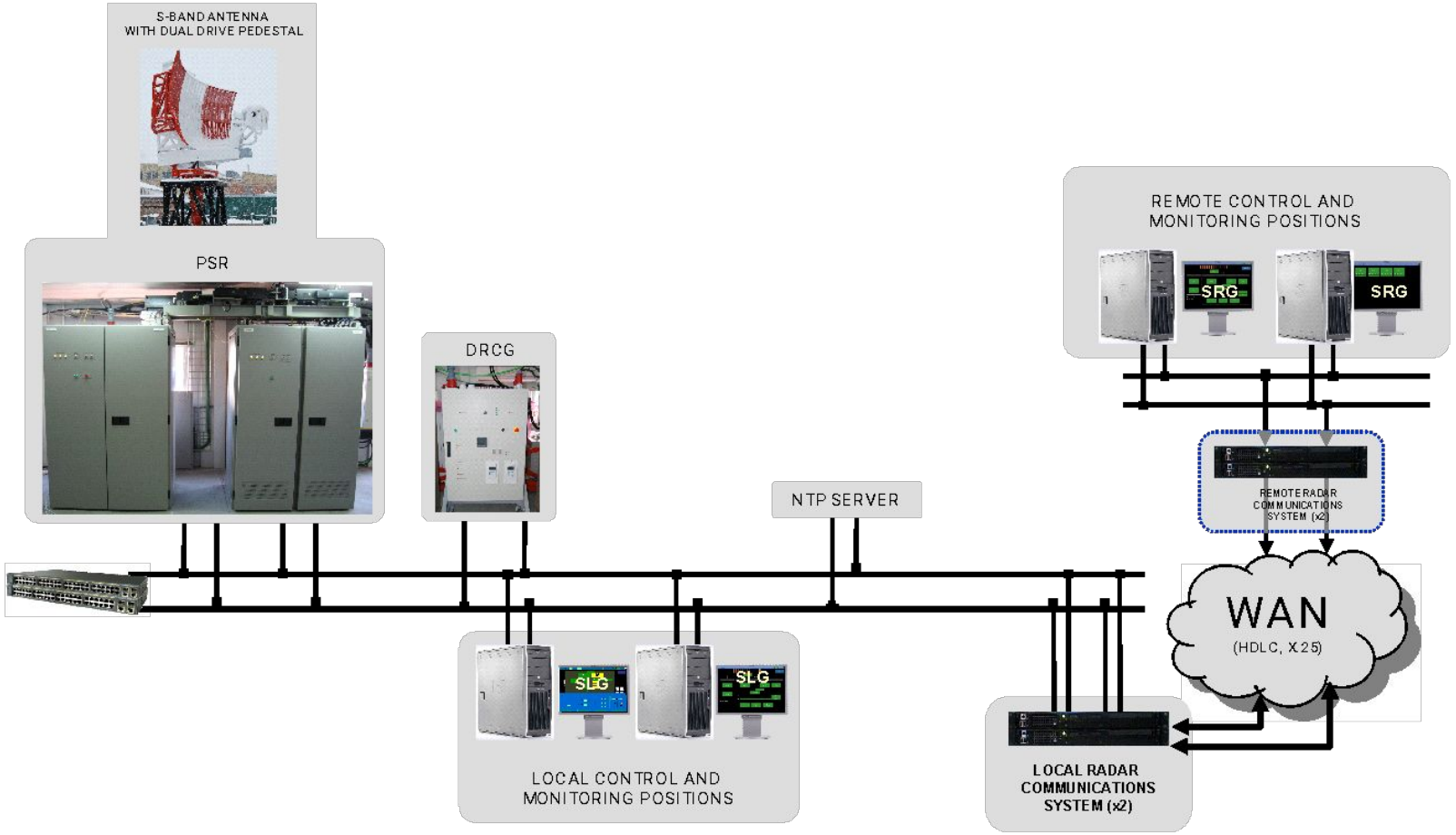
System Overview

- Control and Monitoring System (CMS) consist of:
  - SLG equipments, located at the local station.
  - SRG equipments, located at the remote station.
- Allows user to control and monitor the operation of the different subsystems.
- The graphical interface consists of buttons, editing fields, graphical windows, etc. that allow the introduction of desired fields.
- SLG main screen is configurable depending on the systems installed in the Radar Station.

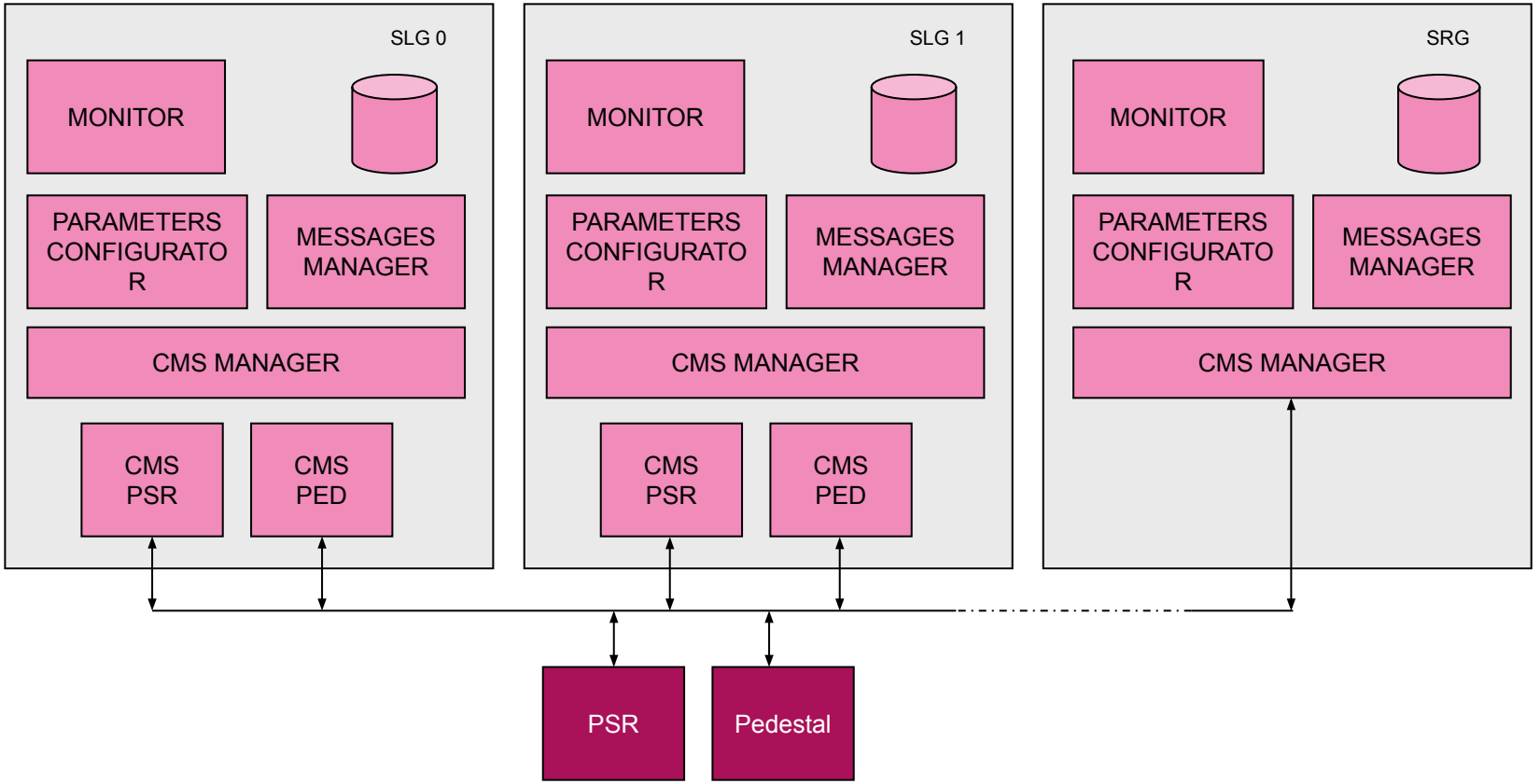
GENERAL DESCRIPTION
Block Diagram

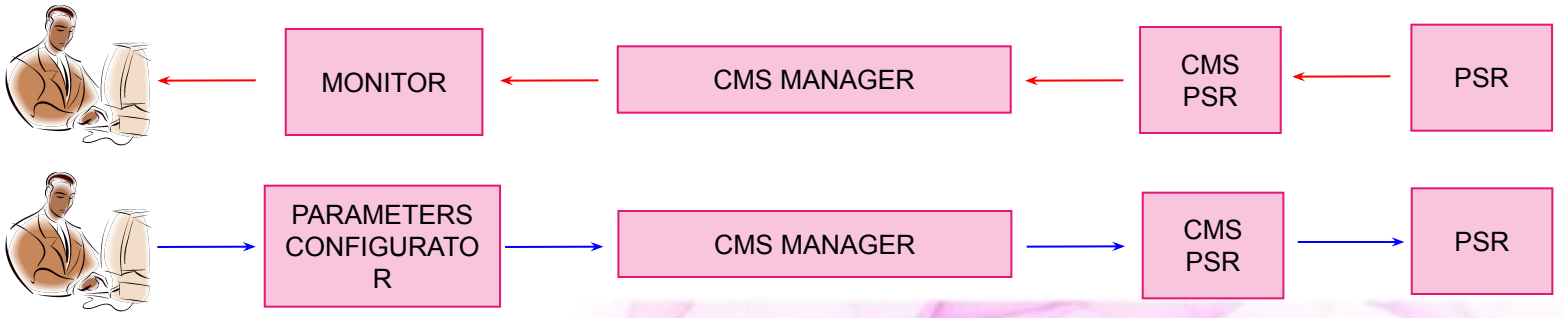


GENERAL DESCRIPTION
Block Diagram

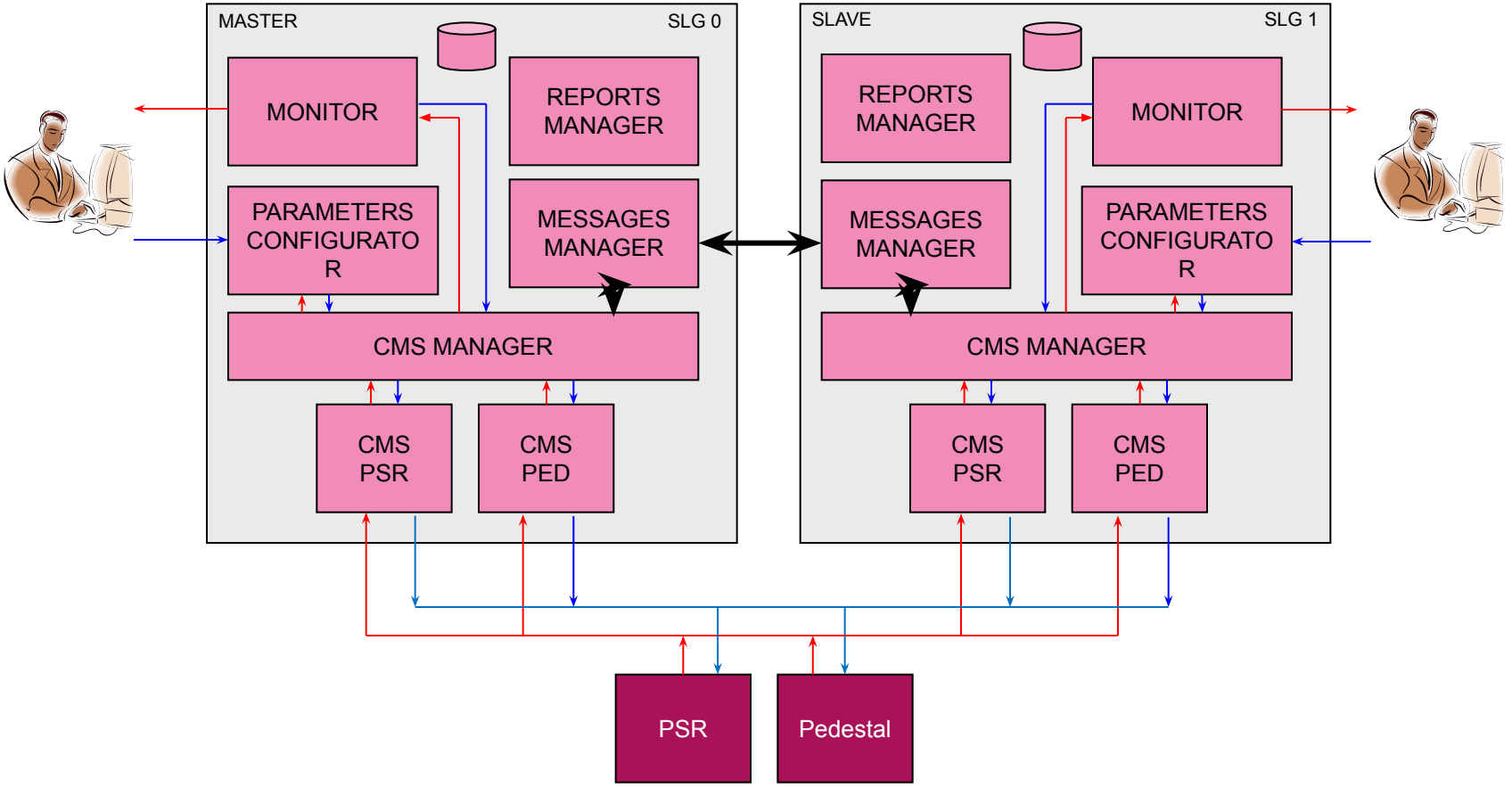


GENERAL DESCRIPTION
Functional Description





GENERAL DESCRIPTION
Functional Description



Functional Description

- The **main functions** of Local Management System are:
  - **CONTROL**: Allows user to change parameters and to configure management systems.
  - **MONITORING**: Displays the status of different subsystems in real time.

- In order to perform these functions, the main software applications are:
  - **CMS PSR**: Control and Monitoring Unit, allows modification of processing parameters and control of all the PSR system functions. It also displays the status of the system at LRU level.
  - **CMS Pedestal**: Common to SSR co-mounted system (if exists). It controls and monitors the Antenna and Pedestal Group.

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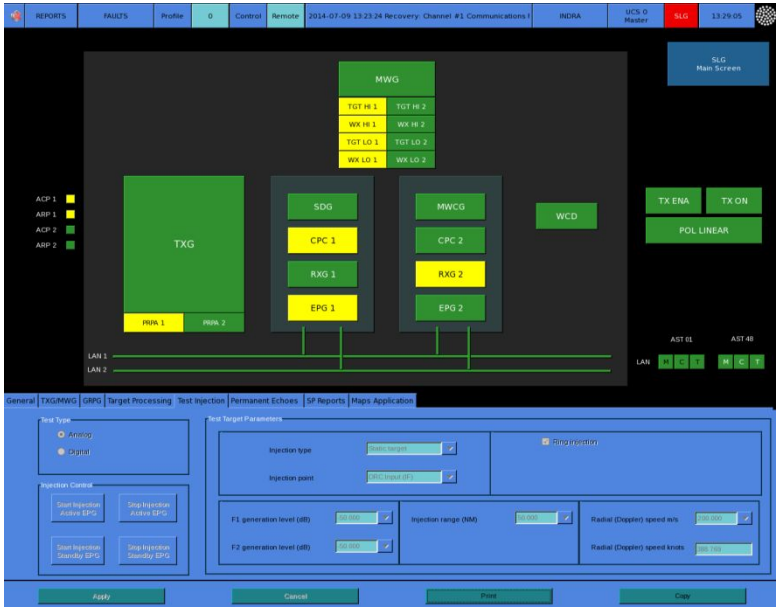
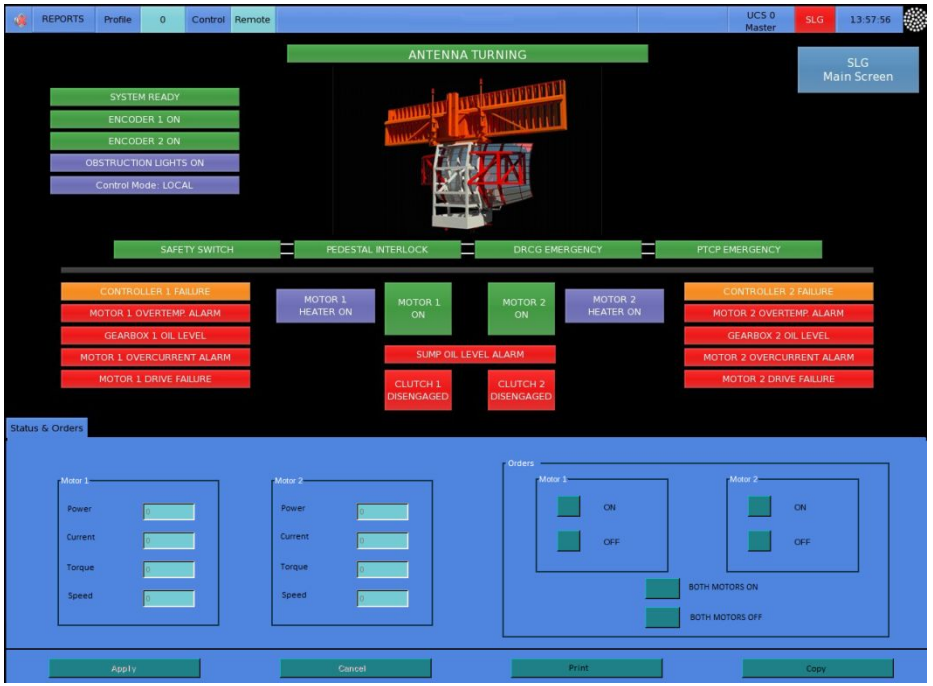
DESCRIPTION OF ELEMENTS
PSR CMS Main Screen

- CMS PSR Features:
  - System Control.
  - Complete System Monitoring.
  - Check Alarm reports and events.
  - Injects Test targets.



DESCRIPTION OF ELEMENTS
Pedestal CMS Main Screen

- Pedestal CMS Features:
  - System Control.
  - Complete System Monitoring.
  - Check Alarm reports and events.



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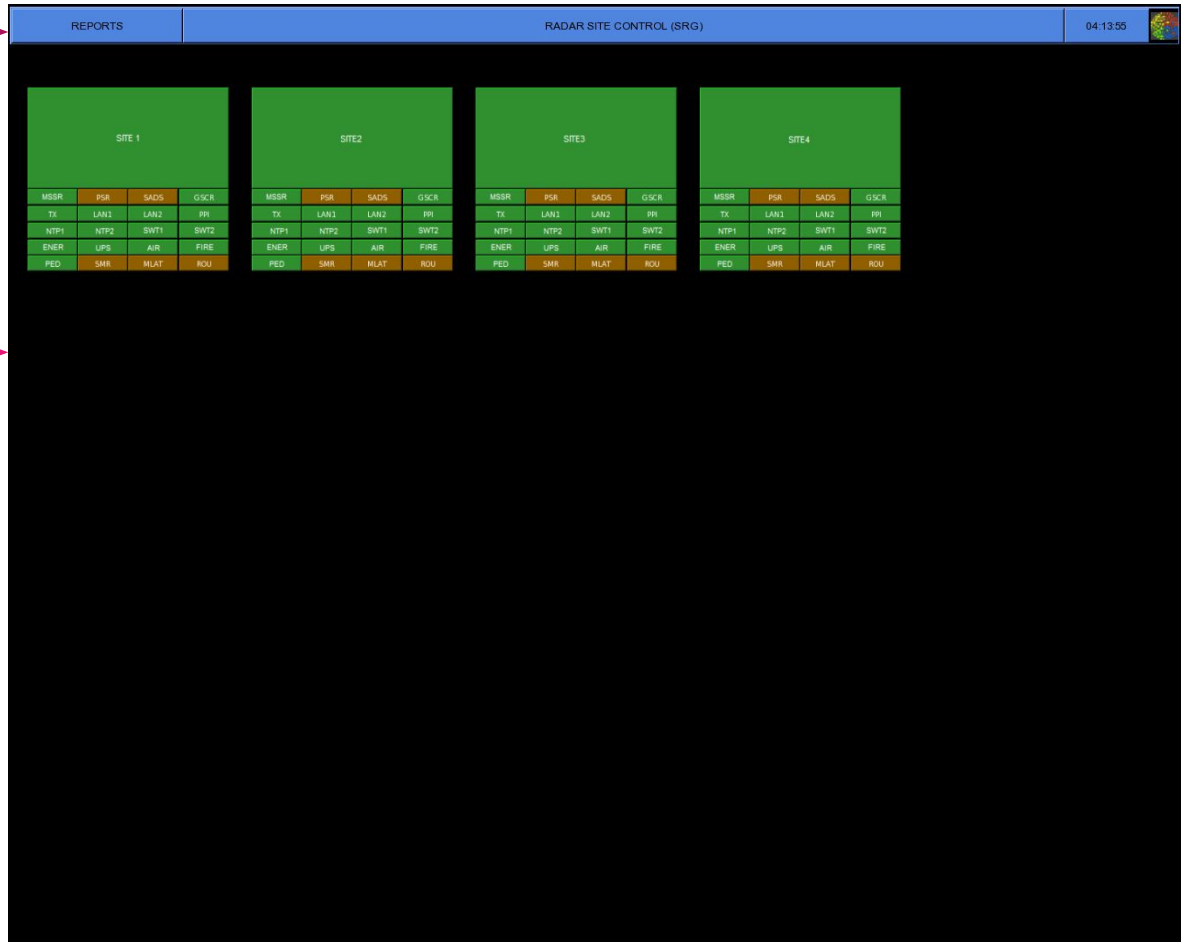
OPERATION AND MONITORING
SRG Main Screen

Top Area

Middle Area



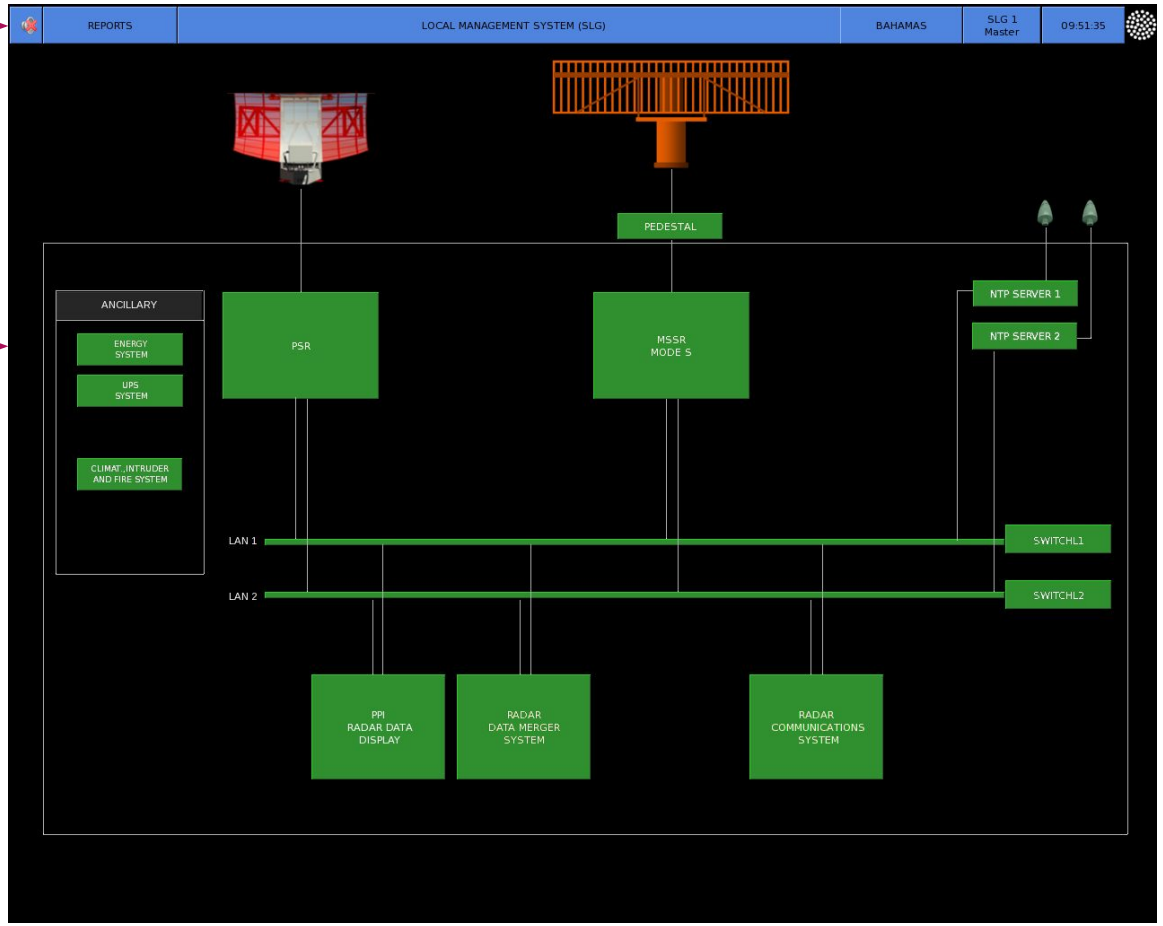
SRG Main Screen

- The main screen of the SRG shows two different areas:
  - Buttons area on top:
    - Button to access to alarm reports and events.
    - Site Name.
    - UTC time.
    - Indra logo: An information window with all the installed versions.
  - Middle Area, Graphical Diagrams:
    - Allows access to every Radar Site (up to 20 Radar Sites).

OPERATION AND MONITORING
SLG Main Screen

Top Area

Middle Area



OPERATION AND MONITORING
SLG Main Screen

- The main screen of the SLG level shows two different areas:
  - Buttons area on top:
    - **Button to access to alarm reports and events.**
    - **Site Name.**
    - **Flags SLG X YY.**
      X: SLG ID Number (0, 1, 2…)
      YY: Master / Slave
    - **UTC time.**
    - **Indra logo: An information window with all the installed versions.**
  - Middle Area, Graphical Diagrams:
    - **Allows access to every subsystem, for instance the Primary Surveillance Radar.**

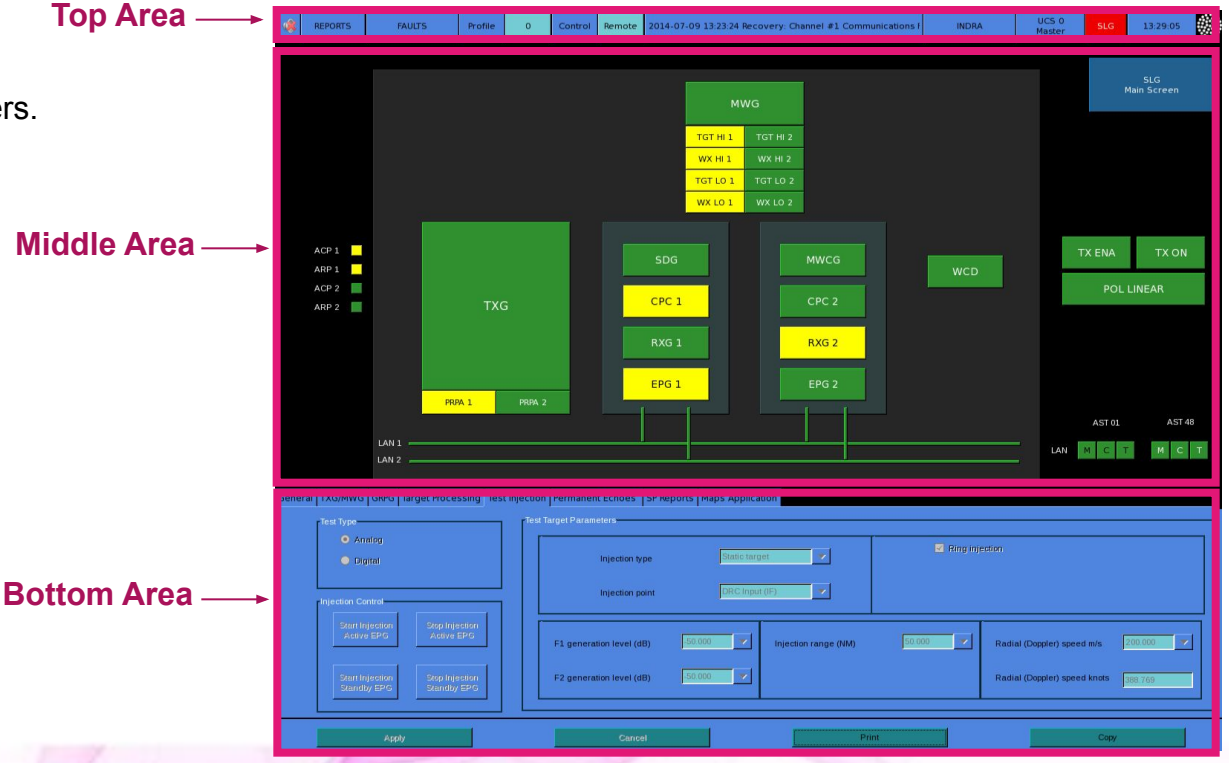
OPERATION AND MONITORING
Colour Code

- Colours used to represent the status of system units.

	COLOURS	MEANING
	GREEN	RUNNING CORRECTLY
	YELLOW	STANDBY
	PURPLE	MAINTENANCE
	BLUE	TEST
	ORANGE	DEGRADED OPERATION
	RED	FAULT, ERROR
	CYAN	NON ACTIVE ELEMENT (without BIT)
	BROWN	DISABLED ELEMENT
	WHITE	LINK LOST, NON COHERENT

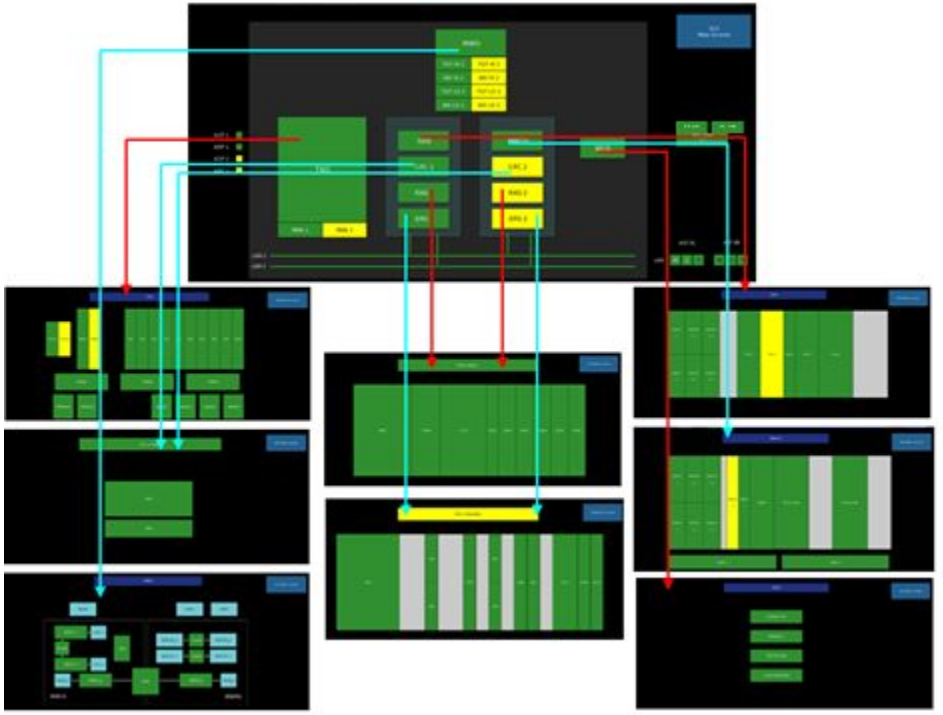
OPERATION AND MONITORING
PSR CMS Main Screen

- CMS PSR main screen shows three different areas:
  - Top Area: Shows different information and allows to generate reports.
  - Middle Area, Graphical Diagrams: View of the Radar main blocks. It is possible to work on them by using mouse buttons.
  - Bottom Area:
    - Control of Channel Parameters.
    - Function Display and Management.



OPERATION AND MONITORING
PSR CMS Main Screen

- In the Graphical Region (middle area on the screen), two different levels are allowed:
  - Level 1: Full System (top image).
  - Level 2: Subsystems, shows the system at LRU level (bottom images).
- Browsing between different levels is done graphically.



PSR CMS Monitoring

- Middle Area: The Encoder Status and the Radar Data Output Status are monitored too:

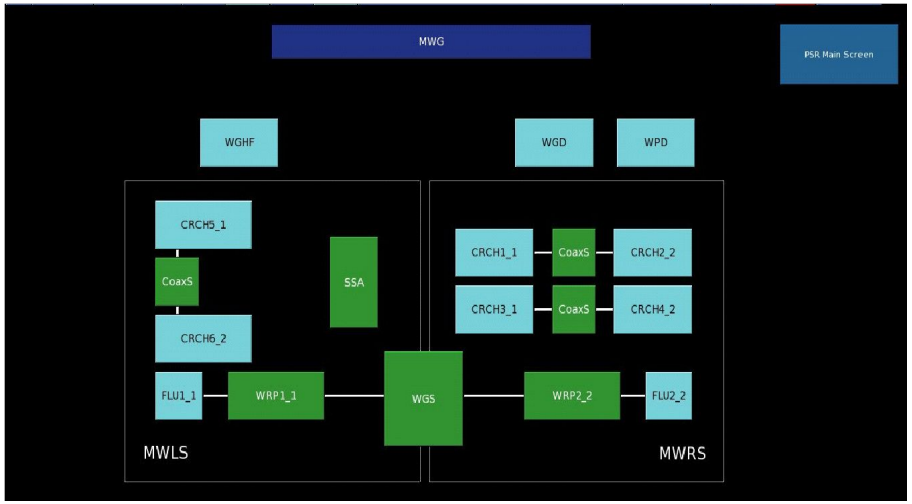
  - Radar Data Output Status: Represents which radar data output is enabled. The selection is made on the General tab and Processing Parameters tab. Data in white bold means that the output is enabled whereas data in black means that the output is disabled.

  - Encoder Status: Represents which Encoder is selected. This selection is made in the General tab. The selected one will appear in green colour and the standby one in yellow color. These elements also changes to red colour when an error is detected in the encoder signals.

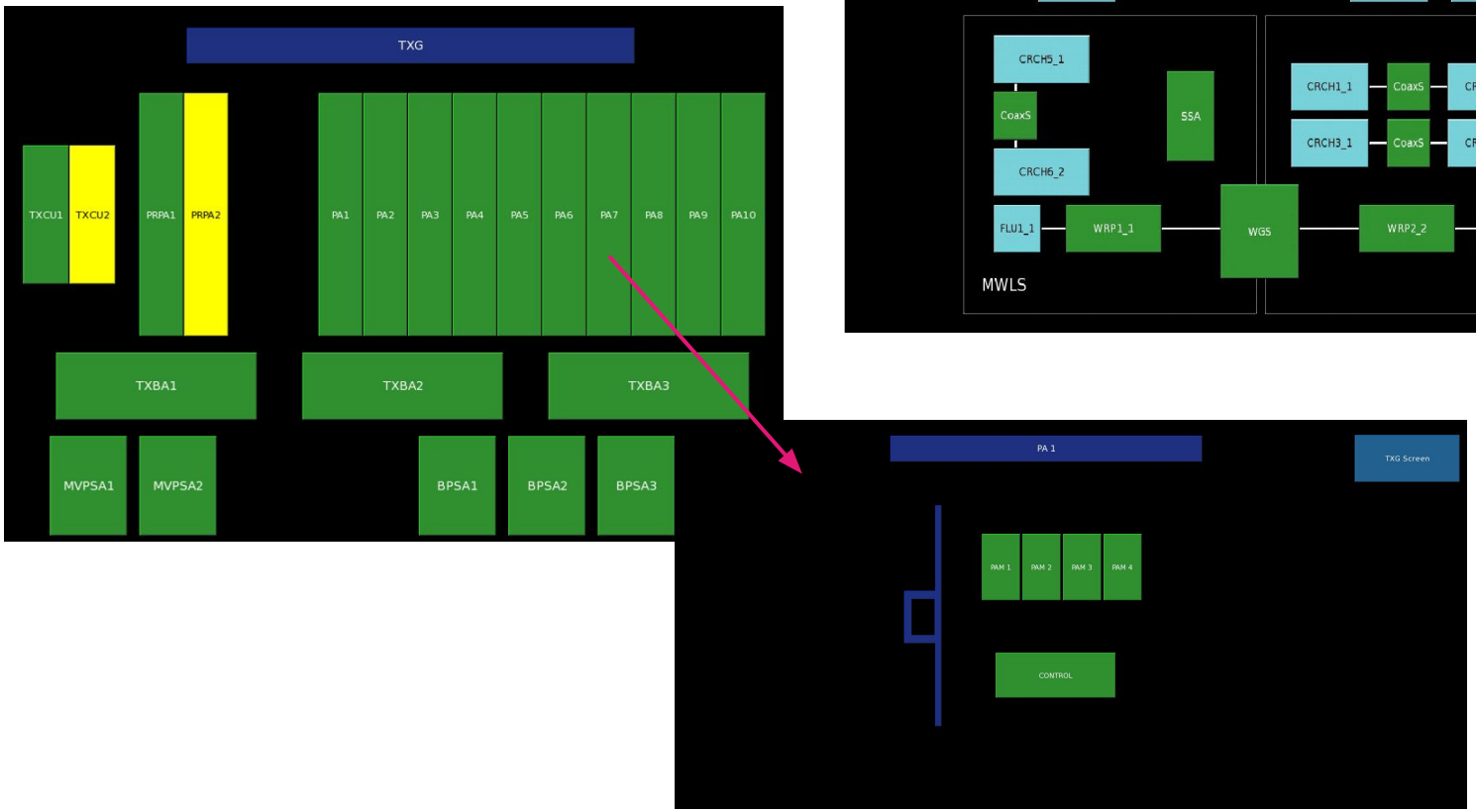
OPERATION AND MONITORING
PSR CMS Monitoring

- Middle Area: It is where system and subsystems (up to LRU) status are monitored.
- Allows reverse browsing.

Microwave Group

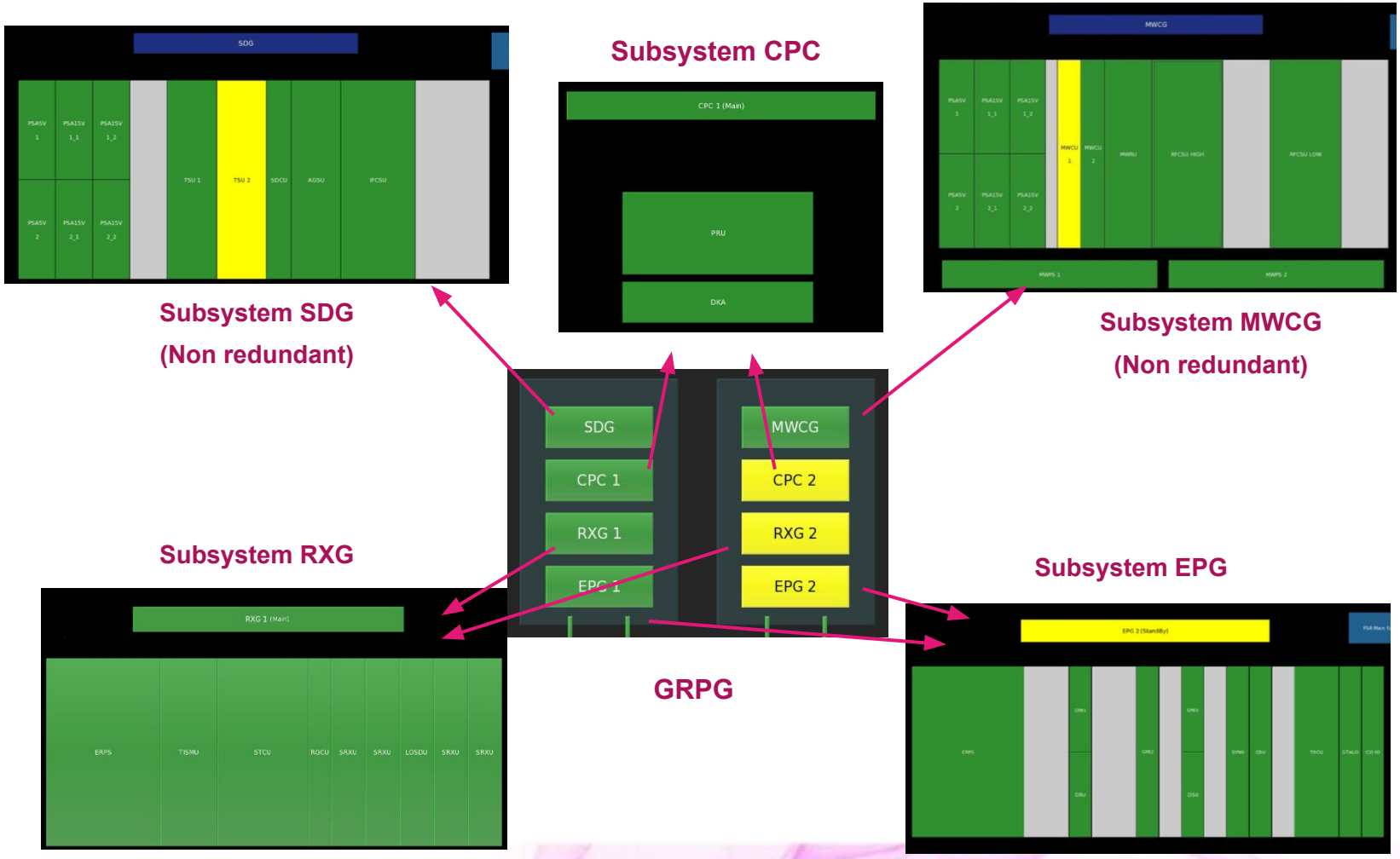


Transmitter Group



OPERATION AND MONITORING
PSR CMS Monitoring

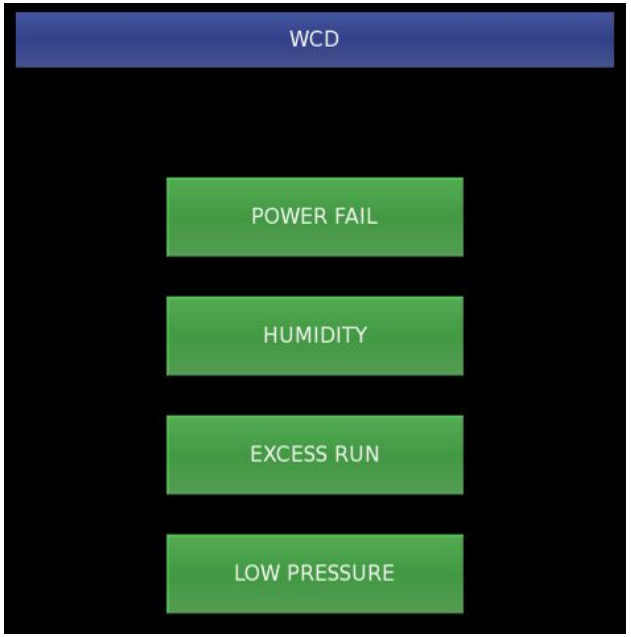
- In GRPG Group will appear a different monitoring screen depending on the selected subsystem.



PSR CMS Monitoring

- Monitoring of WCD: All four possible alarms are indicated in the CMS.

Waveguide Compressor-Dehydrator

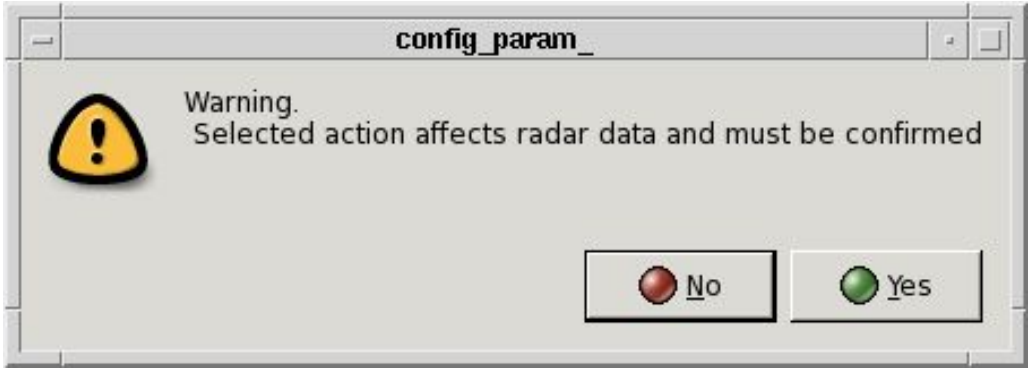


OPERATION AND MONITORING
PSR CMS Operation

- Reports Button: Allows to generate failure and event reports.
- Faults Button: Opens a window that shows only the active alarms.
- Profile: Shows user profile (0, 1, 2, 3, 4).
- Control Type: Local or Remote.
- Messages Area: Any Failure message, Warning or Error referring to operator actions.
- Site Name.
- Flags UCS X YY:
  - X: CMS PSR ID Number (0, 1, 2…).
  - YY: Master / Slave.
- SLG Icon: SLG status. Except subsystem in view:
  - Green: All subsystems (except PSR) are working correctly.
  - Orange: One or more subsystem (except PSR) are working with some degradation.
  - Red: One or more subsystem (except PSR) are in failure.
- Time Zone: UTC Time.
- INDRA Logo: Shows SLG software versions.

PSR CMS Operation

- On the Bottom Area of CMS, there are some tabs that allow the user to manage the PSR system.
  - Processing parameters modification.
  - Configuration maps application.
  - Test targets injection.
  - Operation parameters reports.
- Each parameter whose modification affects the Radar needs user confirmation.



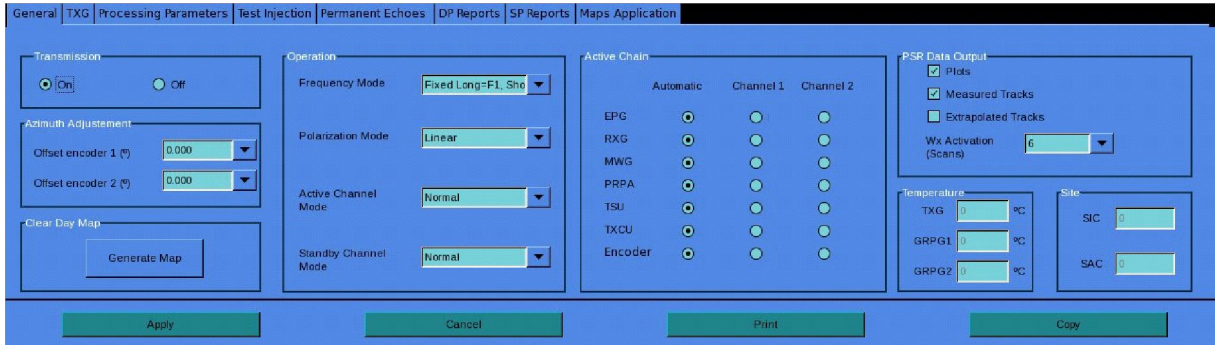
PSR CMS Operation

- Available tabs:
  - General: General system controls.
  - TXG: Transmitter Group controls.
  - Processing Parameters: Editable parameters list for the processing algorithms.
  - Test Injection: Allows digital/analogic test targets injection.
  - Permanent Echoes: Up to 10 permanent echoes .
  - SP Reports: Shows the value of different parameters to check specifications.
  - DP Reports: Shows the value of different parameters for the defined Permanent Echoes.
  - Maps Application: To change applied configuration maps.

- To apply parameters changes, press Apply Button is required to send the control message in almost all cases.

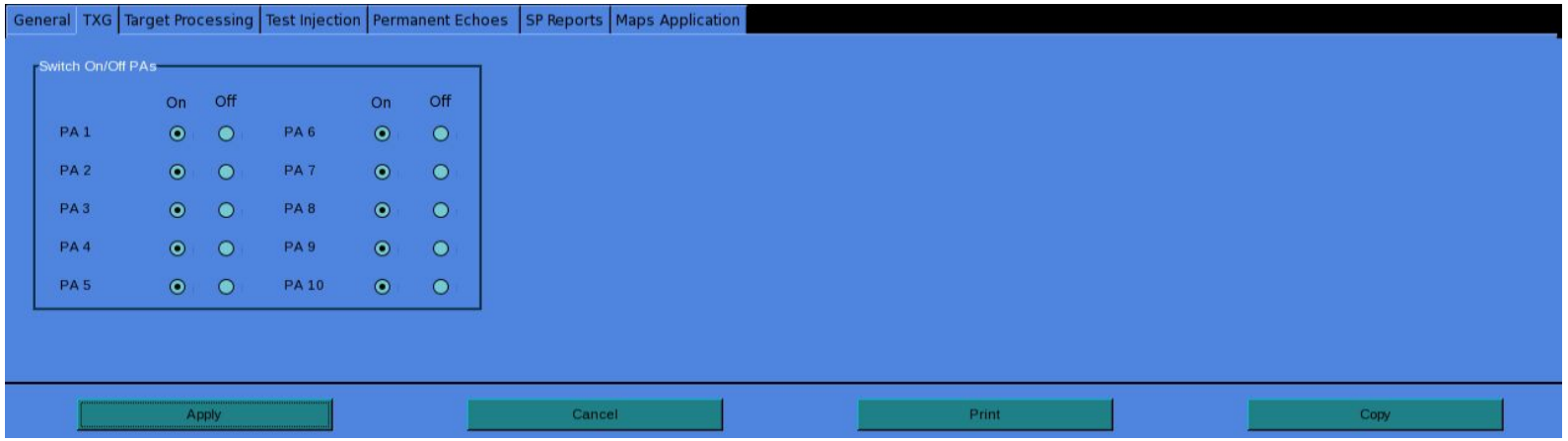
OPERATION AND MONITORING
PSR CMS Operation

- Main Tab: General settings.
  - TX On/ TX Off Transmission.
  - Azimuth adjustment: Offset for North adjustment.
  - Clear Day Map generation.
  - Operation:
    - Frequency Mode: Fixed or alternating frequencies.
    - Polarization Mode: Linear, Circular or Automatic.
    - Active/Standby Channel Mode: Normal operation or test.
  - Active chain selection: Allows to select automatic or manual channel selection.
  - PSR Data Output: Allows to select the output data characteristics (plots, measured and extrapolated tracks) and the updating of weather data.
  - Temperature.
  - SIC and SAC presentation.



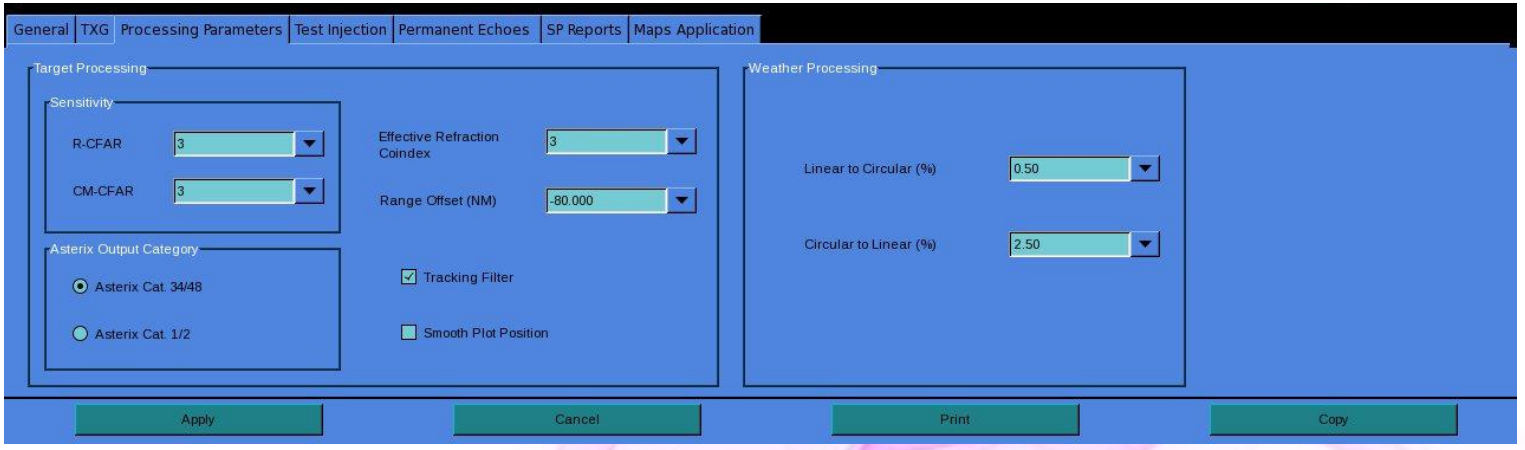
PSR CMS Operation

- TXG Tab: Control of Transmitter Group.
  - Switch On/Off PA's: Each PA can be turned off separately. Used for PA's corrective maintenance (units substitution).



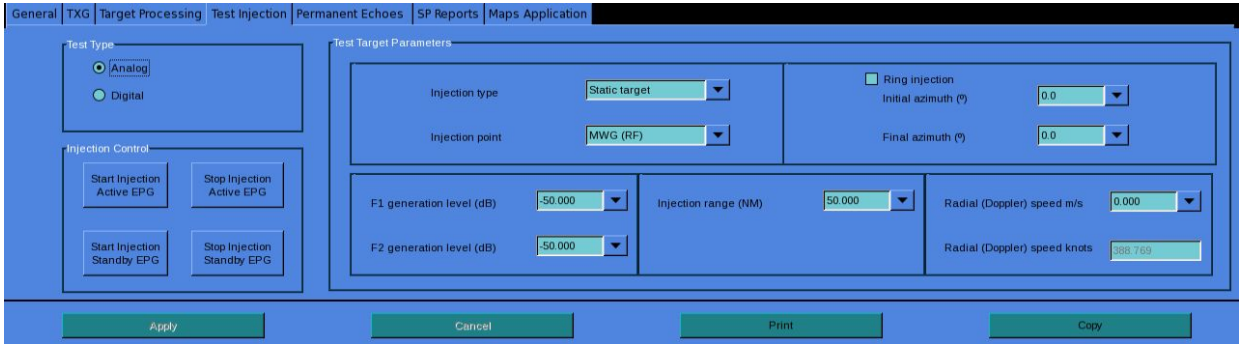
PSR CMS Operation

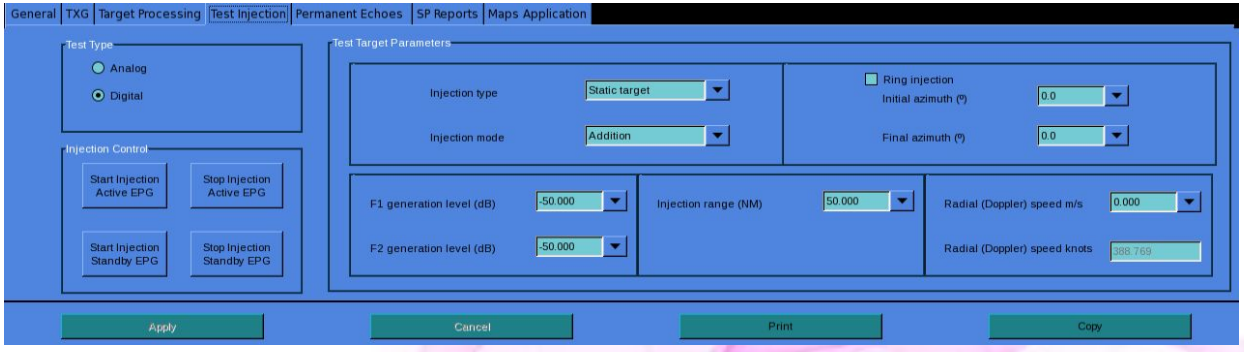
- Processing Parameters Tab: Control of Processing Parameters.
  - Sensitivity:
    - R-CFAR and clutter map processing (CM-CFAR) sensitivity.
    - ASTERIX output category: Selection between 1/2 or 34/48.
    - Effective Refraction Coindex: Used for calculation of the propagation model.
    - Range Offset: Correction of the deviation between the detections and the real position.
    - Tracking Filter activation.
    - Smooth Plot Position: Position of the plot calculated on the tracking process.
    - CP and LP limit: for automatic switching between circular and linear polarization.



PSR CMS Operation

- Test Injection Tab: To inject test targets.
  - Digital Test Targets: Injected from the processor. Their power, position and type are configurable.
  - Analog Test Targets: Injected from RF in the MWG or in IF in IFCSU. Their power, position and type are configurable.
  - Apply / Stop Buttons: Start / Stop test targets injected.



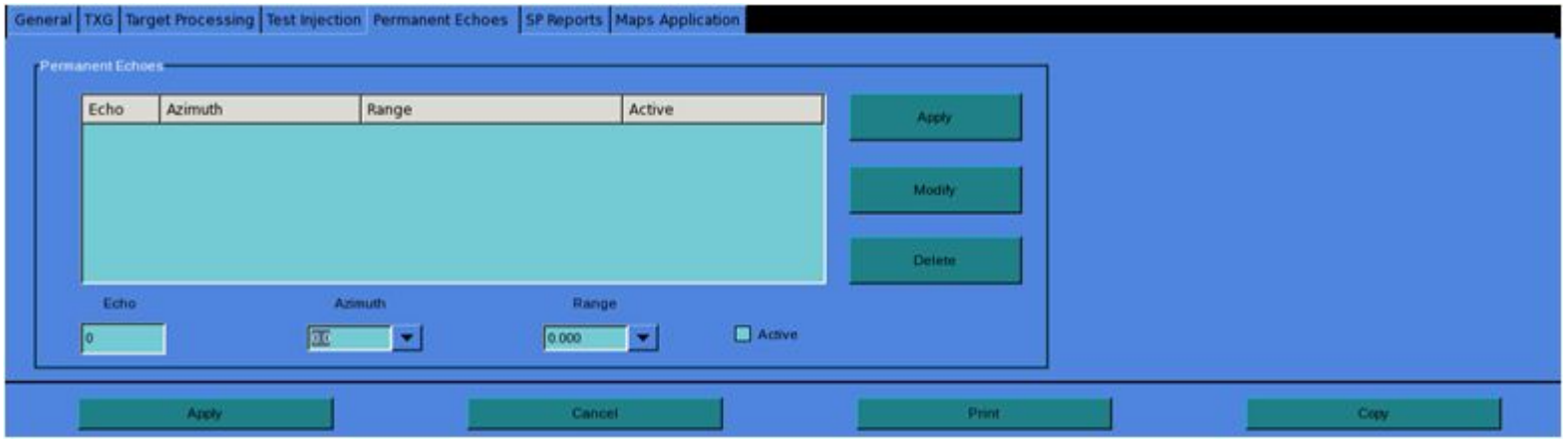


PSR CMS Operation

- Permanent Echoes Tab.

  - Definition of configured Permanent Echoes and possibility of a MTI Reflector.

    - Permanent Echo: Up to 10 active permanent echoes.



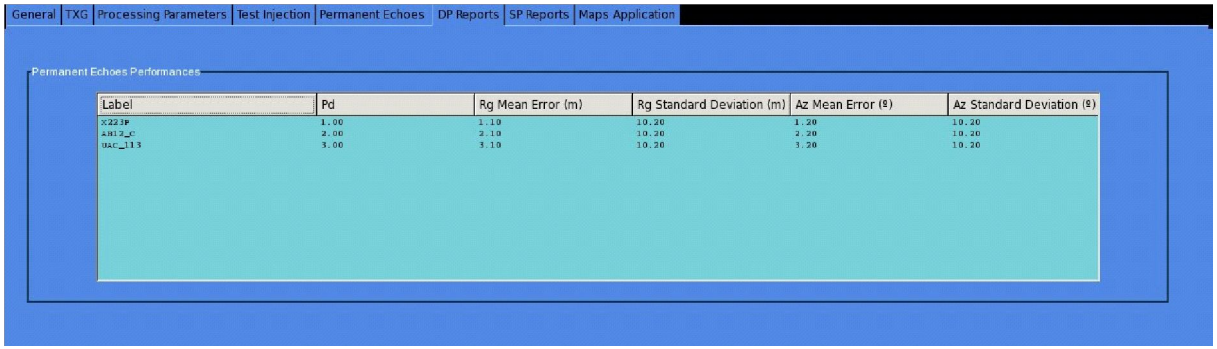
PSR CMS Operation

- SP Reports Tab: Shows information about specifications.
- Two sub-tabs are available: Active Chain and Standby Chain.
  - Noise: Shows Noise level for each processing channel.
  - IF and RF Relative Level: By means the injection of Test Signal Loops, the whole signal path is checked both in IF and RF.
  - TX Mon Relative Level: The transmitted signal is monitored in order to check the transmitted signal level.

  - Stability: Stability level for each of the 4 channels per pulse
    - Monitoring Point: The point where signal is monitored can be selected.
    - Stability is also monitored by means the Test Signal Loop injection.
  - Power: Shows the level of Transmitted Power.
  - VSWR: Shows the level of VSWR at transmitter output.

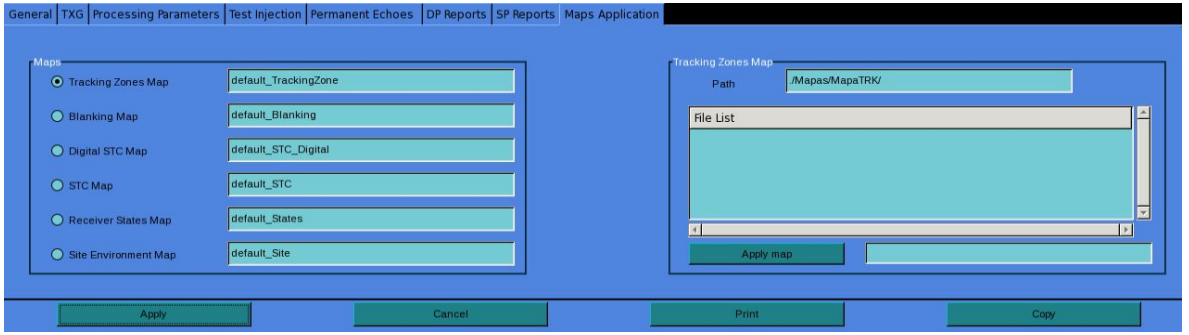
PSR CMS Operation

- DP Reports: Shows information about calculated performances for every.
  - Pd: Detection probability.
  - Rg Mean Error: Mean Error for calculated range in meters.
  - Rg Standard Deviation: Standard Deviation for calculated range in meters.
  - Az Mean Error: Mean Error for calculated azimuth in degrees.
  - AzDeviation: Standard Deviation for calculated azimuth in degrees.

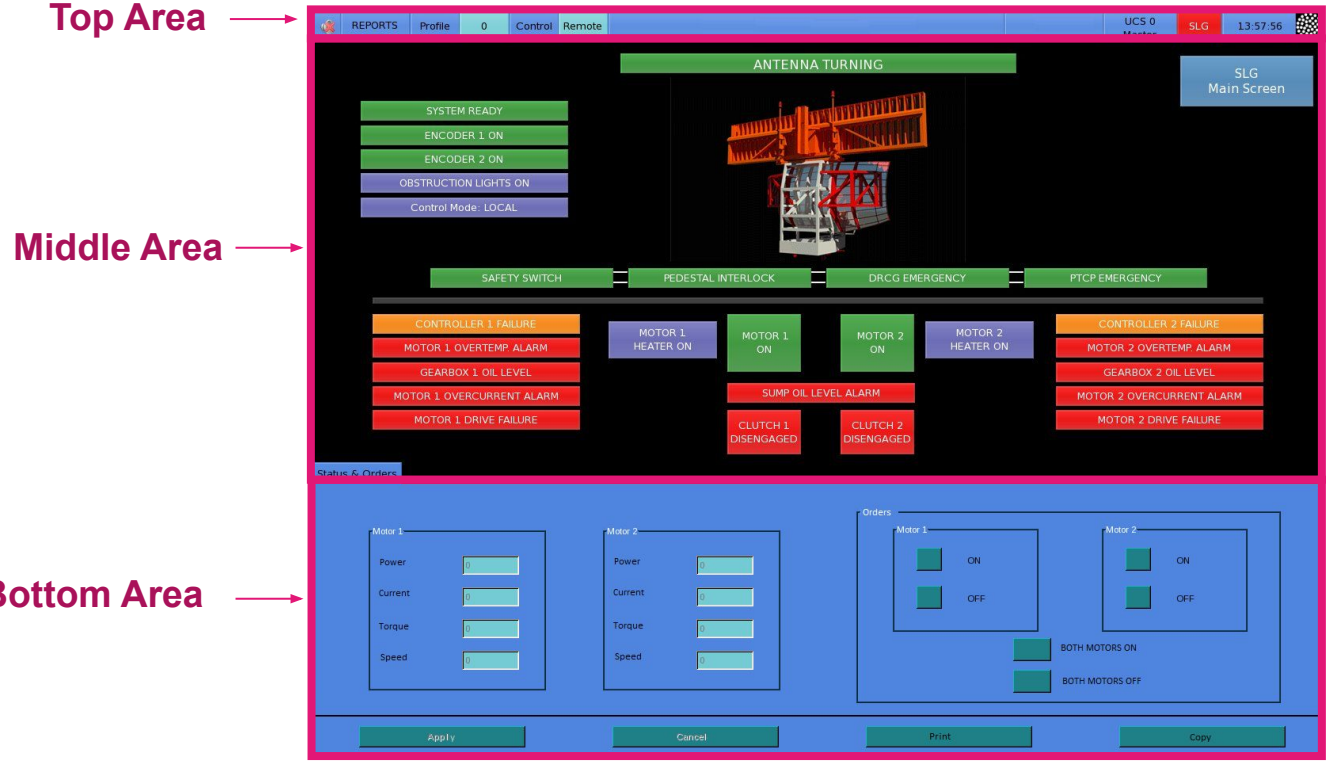


PSR CMS Operation

- Maps Application Tab: Allows to select a new map, to change it for one of the 7 configuration maps.
  - Tracking zones: Includes the default tracking parameters and the specific parameters for some areas.
  - Blanking: Sectored. Switches off transmission in some sectors. Up to 10 sectors.
  - Digital STC: Allows to modify the values in range and azimuth limited sectors. Configures the minimum detection threshold.
  - STC: Sectored. Select the STC curves.
  - Receiver states: Sectored. Selects when low or high beam, and short or long pulse, have to be processed.
  - Site Environment: Allows to define the clutter maps adaptation parameters depending on the geographical area.



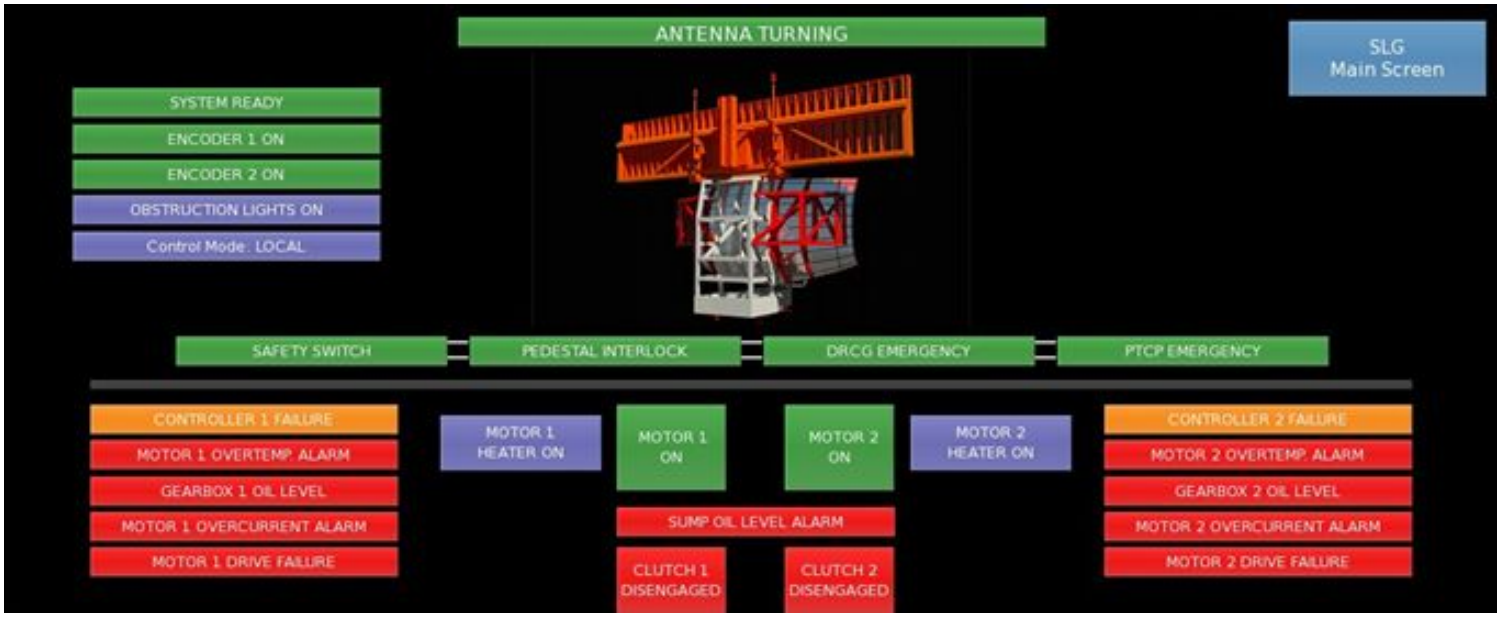
OPERATION AND MONITORING
Pedestal CMS Main Screen



- Pedestal CMS main screen shows three different areas:
  - Top Area: Shows different information and allows to generate reports.
  - Middle Area, Graphical Diagrams: View of all the possible alarms, interlock chain and moving image of the antenna.
  - Bottom Area:
    - Motor Control Star-Up and Stop.
    - Reports Display.

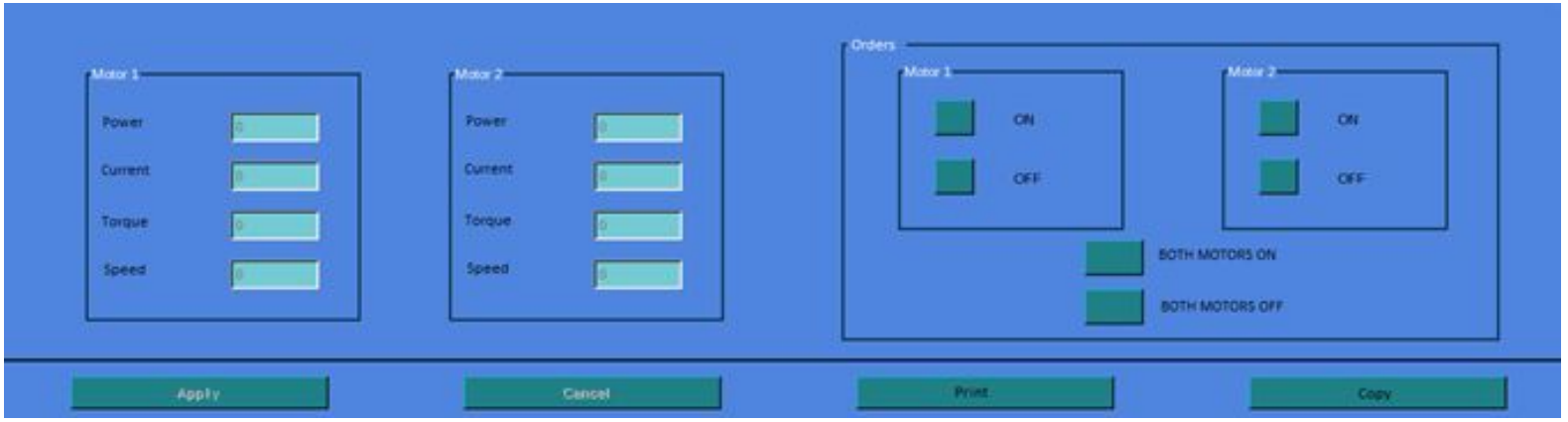
OPERATION AND MONITORING
Pedestal CMS Monitoring

- The Middle Area displays the Antenna and Pedestal system status.
- Optional Elements:
  - Hatch Interlock: Another box will appear in the interlock chain for the hatch interlock if installed.
  - Vibration sensor: Showing measured values and an alarm if the threshold is surpassed.



Pedestal CMS Operation

- The Bottom Area allows the user to manage the Antenna and Pedestal system.
  - Motor 1 and Motor 2 Reports:
    - Power and current consumption.
    - Percentage of nominal torque value used in the motor.
    - Motor contribution to antenna speed.
  - Motor control:
    - Motor 1: On/Off.
    - Motor 2: On/Off.
    - Both motors On.
    - Both Motors Off.



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