SCANTER 1002 Radar System

User's Manual

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1 Introduction

1.1 Purpose

The SCANTER 1002 Radar System is optimized to ensure a high level of situational awareness on land platforms in all weather conditions.

The purpose of this manual is to provide a functional description of the radar system and the transceiver hardware interface.

The manual also provides a guide to the Radar Service Tool software application used to control and monitor the system.

1.2 Warnings and safety instructions

The following outlines basic warnings and safety instructions when working on the radar system. Further warnings and safety instructions can be found in doc. no. 970637-HT: “Warnings and Safety Instructions for Terma Radar Antenna Systems”.

WARNING

WARNINGS, CAUTIONS AND SAFETY INSTRUCTIONS

SAFETY FIRST

CAUTION

AUTHORIZED PERSONNEL ONLY

WARNING **MAINTENANCE OF THE RADAR SYSTEM** CAUTION

Only maintenance for authorized personnel.

This radar produces low power non-ionising electromagnetic radiation. Radiation is normally not dangerous for the human body, however precautions should be taken, and a safety distance of 1 meter when operating should be kept.

Always disconnect power before maintaining the radar. The rotating antenna may cause injury.

Part of the equipment may have hot surfaces. Precautions should be made.

High voltage may be present at several points of the equipment. Observe and follow all electrical safety precautions. These voltages may cause injury or even death.

When maintaining The radar, radar and instruments must be connected to the same electrical protective ground.

Always use ESD (Electrostatic Sensitive Device) precautionary procedures when handling ESD marked modules. The equipment contains components sensitive to damage by electrostatic discharge. Wrist strap connected to earth bonding point must always be used when handling unshielded electronics. Modules must be stored in static shielding packaging (EIA-541). Module repair must be done on a ESD workstation, by qualified personnel.

Equipment weighs about 35 kilograms and to avoid injury, use proper lifting technique, 2 person lifting or lifting aids.

In no event, Terma A/S shall be held liable for any direct, indirect, punitive, incidental or consequential damages what-so-ever arising out of or connected with the use or misuse of its products.

1.2.1 Microwave radiation safety margins

Additional safety margins in respect of microwave radiation can be obtained by increasing distances to the radiating antennas.

As a rule of thumb, the power density is inversely proportional to the square of the distance from the radiating source. Thus, increasing the distance with a factor of 10 will reduce the power density with a factor of 100.

However, this is only true in the far fields distance.

- According to the ICNIRP guideline, the limit for the incident power density level for the general public is 10 W/m^2 in the frequency band from 1-300 GHz and over any 6 minute period. The SCANTER 1002 radar operates within this frequency range. The corresponding level for occupational exposure is 50 W/m^2.

Furthermore, sector transmission is normally implemented, stopping transmission for the parts of the antenna rotation not covering the ground surface. Also, power sectors can be defined in which the transmitted power is reduced.

For additional safety, the SCANTER 1002 transmitter is closed down when antenna rotation is stopped.

Further information is available in doc. no. 721099-RK.

1.2.2 Physical safety

Be careful and use extreme caution when removing and lifting heavy objects as this can cause physical injuries.

For rotating machinery in normal operation, the hazard zone is inside the cover of the radar and is not accessible for any operator.

1.3 References

721002-DP	SCANTER 1002 GSR Radar - Product Specification
357641-HO	SCANTER Radar Service Tool - Operator's Manual
357641-HI	SCANTER Radar Service Tool - Installation Manual
721089-RA	SCANTER 1000 Series Transceiver Core Software Open Source Licenses
721089-SC	SCANTER 1000 Series Transceiver Core SW GPL Source Code
721099-RK	SCANTER 1000 Series Antenna Power Density Analysis
970637-HT	Warnings and Safety Instructions for Terma Radar Antenna Systems

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2 SCANTER 1002 Radar System

The SCANTER 1002 Ground Surveillance Radar (GSR) is designed to perform ground surveillance of high-sensitivity areas and critical infrastructure.

The SCANTER 1002 radar is a Ku-band, 2D, fully coherent pulse compression radar, based on Solid State transmitter technology with digital software-defined functionality.

Both the radar transmitter and receiver, the signal processing electronics, the embedded tracker and the antenna are enclosed inside a radome, giving an extremely compact and portable system.

SCANTER 1002 meets the requirements for professional GSR, where detection of slow and fast-moving targets in adverse weather conditions is required.

Terma's proven pulse compression technology, Frequency Diversity (FD) combined with the unique discrimination between stationary and slowly moving targets gives a truly high-end surveillance radar system.

SCANTER 1002 uses Solid State Power Amplifier (SSPA) transmitter technology, which ensures long service life and high availability.

A receiver with low noise and superior dynamic range provides high resolution and detailed radar images, in all weather conditions, with no need for operator intervention. Combined with the advanced moving target filtering software, the system is able to discriminate a walking or crawling man from the background clutter, even in rain.

An embedded tracker (ET2) using Interacting Multiple Model technology and Multi Hypothesis Tracking is integrated in the radar unit to detect and track agile and small targets in severe weather conditions. The tracker is also used to detect large vessels. Information to track surface targets is obtained from a combination of normal radar and Doppler-processed signals.

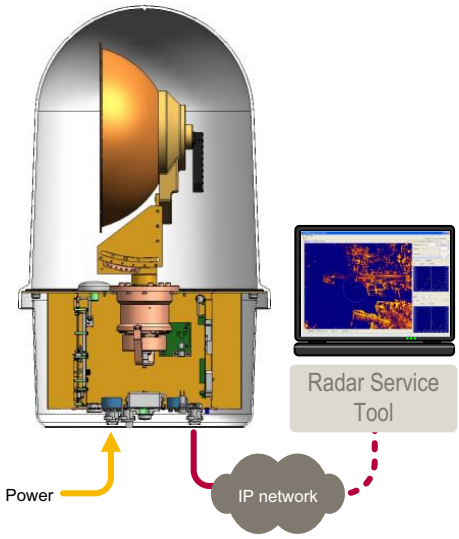

Fig. 2.1 Simplified system components schematics

Communication interface to the transceiver is established via a standard IP network (LAN or WAN), which provides network radar video, plots, tracks, control, etc.

Service information is obtained via the IP network.

The SCANTER Service Display (Radar Service Tool) provides an easy interface for controlling the radar and gives detailed status and diagnostics information from the Built-in Test Equipment (BITE). It also provides access to powerful radar imaging and tracking information.

2.1 System components

The SCANTER 1002 Radar System is mounted in an enclosure consisting of a radome and a sun cover (see Fig. 2.2 (p. 12)). The system consists of the following main assemblies and modules:

- Antenna system including antenna radiating the RF power (and subsequently receiving the radar echoes), and antenna motor including azimuth encoder, rotary joint and waveguide filter
- Transceiver including power supply module (PSU Module), transceiver module (TR Module), processing and control module (PC Module), Motor Controller Module, bottom plate with internal/external interfaces, and top plate holding antenna system and GPS antenna

The antenna is a parabolic reflector with a horizontally polarized pencil beam.

It has a beam width of <4 degrees in azimuth, and the gain of the beam is >= 32 dBi.

Fig. 2.2 SCANTER 1002 Radar System

2.2 SCANTER 1002 product features

The SCANTER 1002 technology and product features are listed in the tables below.

- Software-defined functionality
- Frequency diversity
- Full coherency and pulse compression
- Transmitter power level control in sectors
- Environment adaptation
- Control / profiles / BITE

Featuring
GSR Ground Surveillance, full coherency and frequency diversity
Frequency
Programmable frequencies between 17.1–17.3 GHz
4 sub-bands
Transmitter
8 W SSPA
Receiver
Digital sampling on IF in 12 bits at 200 MHz
Range cell size: 6 m (3 m at instrumented range ≤ 6 km)
External Interfaces
IP network radar signals
Control and monitoring via IP network / serial connection ports
Design
Encapsulated, integrated unit architecture
Maintenance
Remote access to radar video, control and monitoring
BITE for fault management and diagnosis
Antenna
Parabolic reflector
Standards
CE, IEC, UL-60950

Fig. 2.3 SCANTER 1002 product features

2.2.1 Embedded tracker (ET2)

SCANTER 1002 is equipped with an embedded tracker (ET2), which automatically identifies moving objects in the radar image. The tracker assigns to each object a unique identity; determines the position, speed and course of the object; follows the track of the object by predicting its position from scan to scan, and makes this information available in the radar image.

The embedded tracker detects and tracks any moving object. It gives the operator an overview of moving objects, which the normal radar video alone cannot provide. The tracker combines the information from the different Doppler filter channels with the scan-to-scan movements in the normal video to achieve separation of small moving targets from ground clutter.

2.2.2 Physical appearance of SCANTER 1002

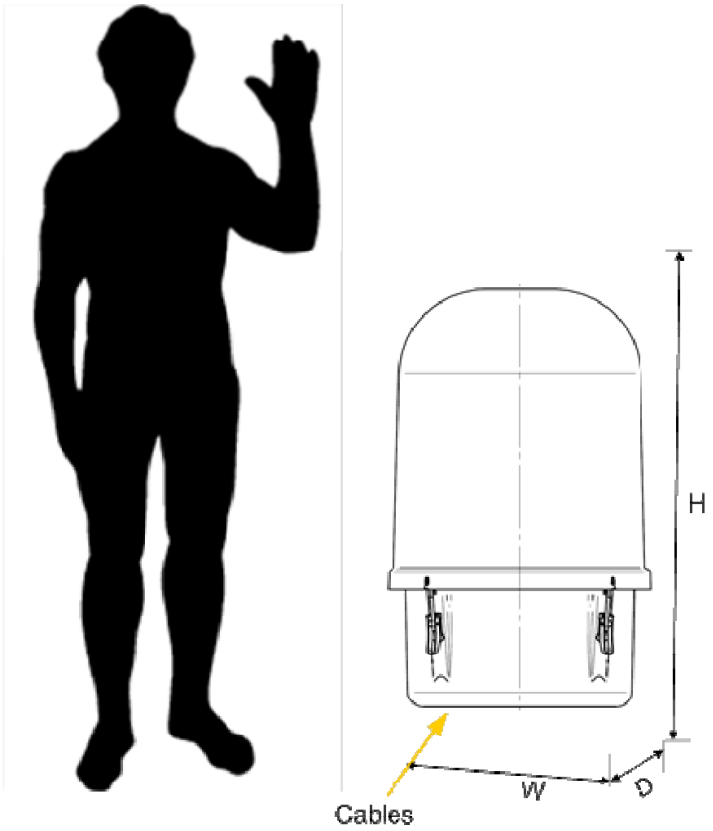

Fig. 2.4 Transceiver dimensions (model)

Weight:	35 kg installed
	~ 50 kg packed for transportation
H x W x D	850 x 500 x 500 mm installed
	~ 1090 x 800 x 600 mm packed for transportation

3 Functional Description

The SCANTER 1002 Radar System is an integrated unit containing both the radar transceiver, power supply, embedded computer and antenna with motor and encoder. The system is enclosed in a radome and a sun cover, which provide environmental protection and passive cooling.

The transceiver utilizes frequency modulation (chirping or frequency sweeping) and pulse compression to increase the range resolution as well as the S/N (signal-to-noise) ratio. This allows for transmission of long frequency-modulated chirps with low peak power, and the ability of high range resolution and probability of detection.

The system uses Digital Frequency Synthesis to generate chirps within the four frequency bands, which can be selected by the application. The signal is generated in the PC module, which contains the SCANTER 1002 transceiver processing section. The receiver will automatically tune to the transmitted frequency bands and pass the received signal to the PC Module which will sample the signal, demodulate it, perform pulse compression and post-processing. This will generate radar video used for plot extraction and tracking.

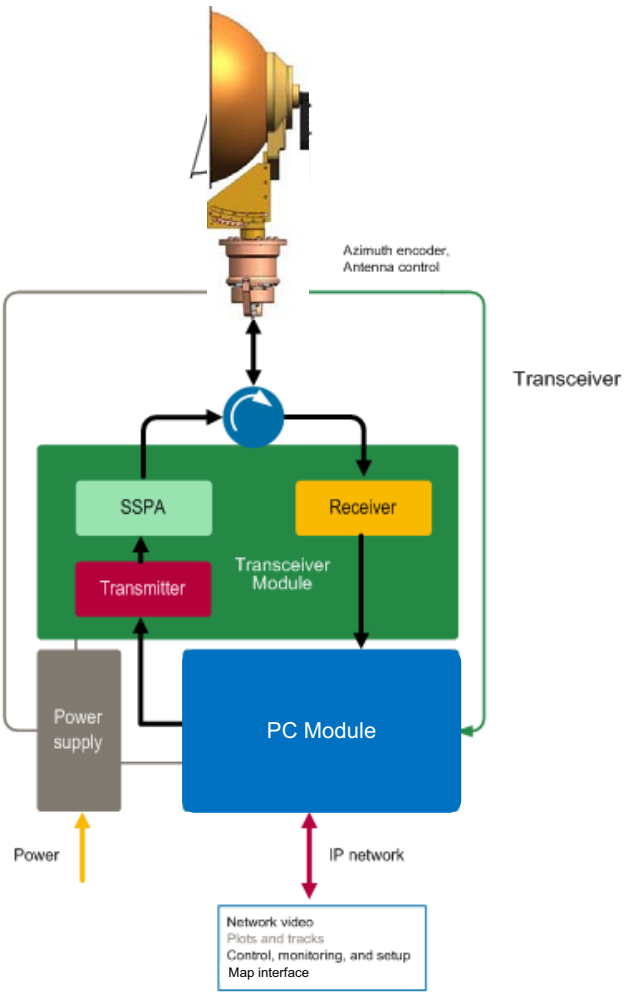

Fig. 3.1 Transceiver block diagram

3.1 Software-defined functionality

Multiple types of SCANTER radars utilize identical core software, which enables a high level of testability, ensures deployment flexibility and makes it easy to add new functionality.

A variety of radar signal processing techniques are available. Multiple functions, such as automatic adaptation to weather scenarios, etc. are performed simultaneously. This, in combination with the use of multiple, identical and powerful common-platform processing modules, leads to the concept “software-defined functionality”.

The entire processing structure is defined by software and functions relevant for the individual application and can be invoked as appropriate. It is also possible to switch between different modes of operation by modifying both the synthesized transmit waveforms and receive signal processing tasks, even on the fly. All settings can be specified in a profile, making configuration easy.

In summary, the radar transceiver is configured to the application scenario, and adaptation to the environment is highly automated.

3.2 SSPA - Solid State Power Amplifier

The SSPA - Solid State Power Amplifier - for SCANTER 1002 is part of the TR Module in the transceiver. It is designed using state-of-the-art MMIC (Monolithic Microwave Integrated Circuit) GaAs high-power amplifiers (HPA). The SSPA amplifies the signal to be transmitted and produces 8 watt of Ku-band microwave power.

The power sector mode feature allows the SSPA output power to be adjustable in azimuth sectors or turned off. This is achieved by sector wise attenuating the input signal into the SSOA from the transmitter.

3.3 Frequency diversity

One of the most difficult challenges for a GSR system is to separate a small target from background clutter. In SCANTER 1002 this is achieved by a combination of transmission diversity and intelligent signal processing.

The effect of the Terma SCANTER frequency diversity is to reduce fluctuation of the echo from desirable targets, thereby enhancing targets relative to clutter. In combination with coherent pulse compression and interference filtering, the radar images become clear and well-suited for tracking.

A prerequisite for the frequency diversity is the ability of the transmitter to change frequency instantaneously from chirp to chirp. The transmitter and receiver support four sub-bands and can freely jump between these frequencies according to predefined profiles.

The advantage of using frequency diversity is that the noise and clutter will be different in the frequency bands, while the echo from the target remains constant. This means that the clutter can be cancelled by integrating echoes from different time intervals and different frequencies.

Full benefit from the frequency diversity is obtainable only if dynamic characteristics are adapted to actual weather and complex clutter situations.

The sensitivity is therefore matched to the actual clutter levels, providing optimum detection at all ranges and in all directions.

Furthermore, receivers and the processing chain have sufficient dynamic range and all components provide sufficient resolution to handle the variety of signals coming from small and large targets at all ranges. This contributes substantially to the quality of the of the radar images. In addition, high resolution improves discrimination of clutter from wanted targets, thereby allowing the processing to separate targets from clutter.

3.4 Full coherency

SCANTER 1002 is fully coherent utilizing amplitude and phase information during transmission and reception. A common, phase stable reference oscillator is used for transmission and reception. Coherency enables pulse compression and allows the receiver to compare the phases of the received echoes from chirp to chirp and thereby detect if targets are moving or not, utilizing the Doppler shift.

In order to detect moving targets, SCANTER 1002 also includes Doppler processing. This improves detection of targets moving radial (moving in range) and with a radial speed different from clutter.

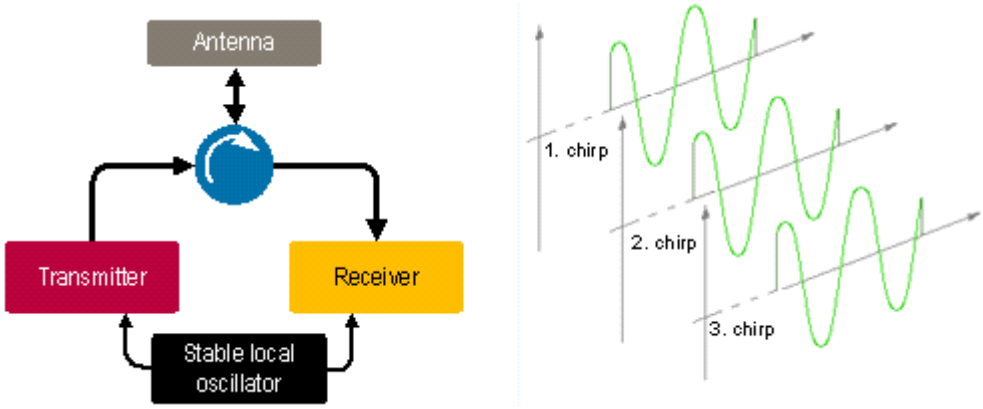

Fig. 3.2 Coherency principle

3.5 Pulse compression

A compact solid-state radar with low power consumption, SCANTER 1002 has a limited peak power. In order to illuminate a target with sufficient energy for detection, it has to transmit long pulses. Unless some clever processing is used, this would lead to a significant loss of range resolution. The SCANTER 1002 transceiver utilizes frequency modulation (chirping or frequency sweeping) and pulse compression to increase the range resolution as well as the signal-to-noise ratio.

When closely separated targets reflect these chirps, the frequency content of the echoes from different targets at a given time will be different, as illustrated in Fig. 3.3 (p. 18).

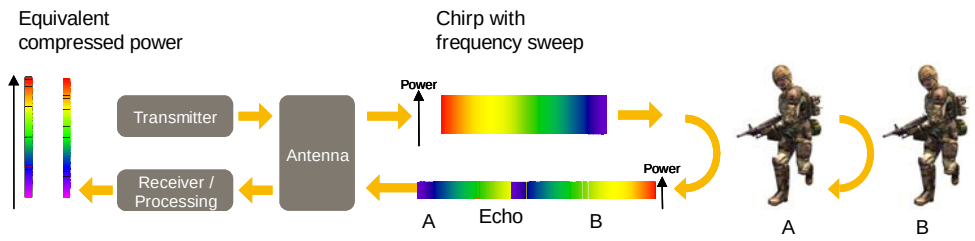

Fig. 3.3 Pulse compression principle

3.6 Power sector transmission

In order to avoid interference from strong echoes from large stationary targets like buildings, mountains or ship superstructure and to reduce the risk of interfering with other Ku-band systems, a power sector mode is available. This feature allows definition of up to 16 individual user defined sectors where the transmitted power can be controlled. Each sector is defined as either:

- Prohibit sector
- Transmit sector
- Reduced power sector

The sectors are aligned relative to north.

Prohibit sectors take precedence over transmit sectors.

For the transmit sectors the power may be attenuated by up to 16 dB in each sector, thus providing a mode with low RF emission.

3.7 Environment adaptation

A false alarm is an erroneous radar target detection caused by clutter, noise or other interfering signals exceeding the detection threshold. In general, it is an indication of the presence of a radar target when there is no valid target.

Land suppressor adjusts the sensitivity to the stationary surroundings. Scan integration of SCD - Sea Clutter Discrimination - increases the suppression of clutter and detection of slow-moving targets.

CFAR – Constant False Alarm Rate – and other adaptation techniques provide automatic adjustments such as false alarm rate. CFAR provides a flat noise floor - also based on proprietary algorithms.

3.8 Controlling and using the radar

3.8.1 Remote control

The radar can be controlled and monitored remotely in the following ways:

- In the Radar Service Tool application, a software package connects to the transceiver via an IP network connection. From the software package all parameters, settings, BITE measurements and errors can be accessed.
- Via an open IP network protocol, all parameters, settings, BITE measurements and errors can be accessed.

3.8.2 Profiles

Profiles are predefined parameter sets used to set optimal transceiver performance according to varying weather conditions or specific operational demands. Thus, the 16 available profiles allow the operator to adjust the radar system transmission mode and/or receiver processing in a fast and reliable way.

The profiles eliminate the risk of maladjustment of the radar and reduce the operator need to acquire detailed knowledge about radar characteristics and meaning as such.

At any time, the operator may set a specific radar parameter, e.g. pulse width, to override the definition of the profile.

The profiles are selectable via the Service Display (Radar Service Tool) or per remote IP network.

3.8.3 Built-in Test Equipment (BITE)

Continuous status monitoring of a significant number of parameters/signals on each module is performed in real time by the housekeeping system. The status of the parameters/signals is internally assessed to initiate appropriate actions automatically to maintain operation to the extent possible if an error is detected.

The BITE reporting, see Fig. 3.4 (p. 19), clearly describes the actual event or error and relates it to a specific module, i.e. no need for translation of code numbers. The details of these reports will allow identification to the level of the Line Replaceable Unit (LRU) at fault.

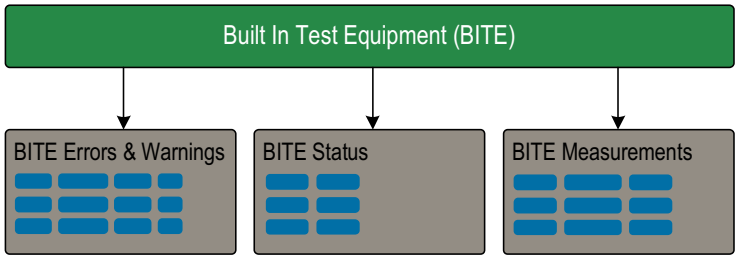

Fig. 3.4 Built-In Test Equipment (BITE)

At power up, the following diagnostic tests are performed:

- Module presence test
- Data link test
- Memory test of all RAM circuits.

The BITE monitors the system during standby and operation and reports the following:

BITE errors/warnings:	Signal activity and processes
	Internal supply voltages
	Internal voltages and temperatures
	Status from motor.
BITE status:	Displays transceiver components status
BITE measurements:	Temperatures
	Internal power supplies.

If parameters exceed specifications, warnings or error messages are automatically issued to the various human user interfaces available.

3.8.3.1 BITE - errors/warnings

Errors and warnings are used to report the presence of abnormal conditions detected by the transceiver software and include the following information:

Title:	The title of a BITE error/warning is a short text indicating the abnormal condition and/or the transceiver component to which it applies, e.g. "High temperature".
Description:	The description of a BITE error/warning is a text that can be used to provide the system operator with an understanding of the context of the abnormal condition, e.g. "FPGA High Temperature Fatal Error" indicates that the core temperature of the FPGA on the processing board in slot 1 has exceeded the allowed maximum rating.
Severity:	The severity of a BITE error/warning is used to indicate the impact of the abnormal condition on transceiver operation. There are three categories of severity and in addition warnings: **Fatal error, critical error and error.** A "fatal error" shuts down the system and a "critical error" stops transmission.
Priority:	The priority of a BITE error is used to indicate the relative importance of an error compared to other errors of the same severity.

3.8.3.2 BITE status

These messages indicate the state of transceiver components or entities of importance to the operational state of the transceiver, e.g. TX Status "On" / "Off".

3.8.3.3 BITE measurements

BITE measurements are used to periodically report a numerical measurement in the transceiver and includes the following information: Title, description and value.

Measured parameters include temperatures, voltages, etc. For each measured parameter, configuration of lower limit, upper limit, maximum update interval and precision is defined.

3.8.3.4 BITE logging

Logging of BITE errors and warnings, BITE status and BITE measurements is performed and data is stored in an allocated area of the hard disc on the embedded computer. See Fig. 3.5 (p. 22).

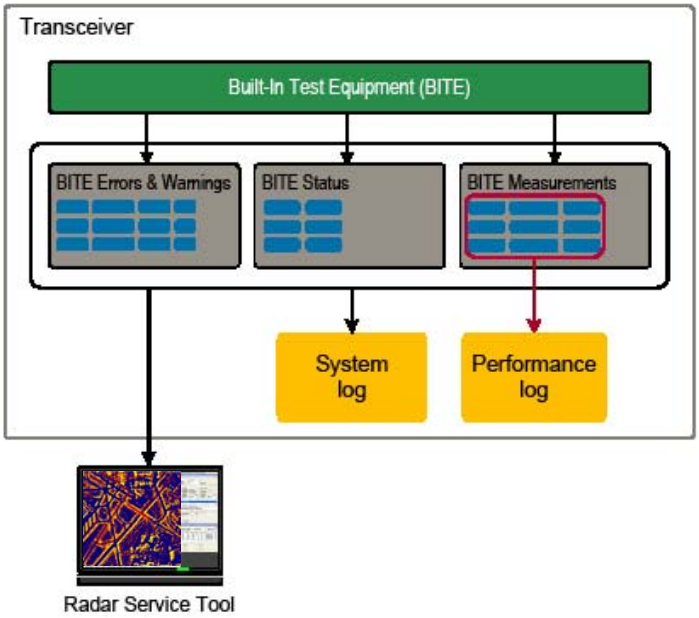

Fig. 3.5 System and performance logs

4 Hardware interface

Bottom plate	Conn.	Function
	X1	Mains, power in
	X2	Aux
	X3	LAN
	GND	Ground (protective earth)

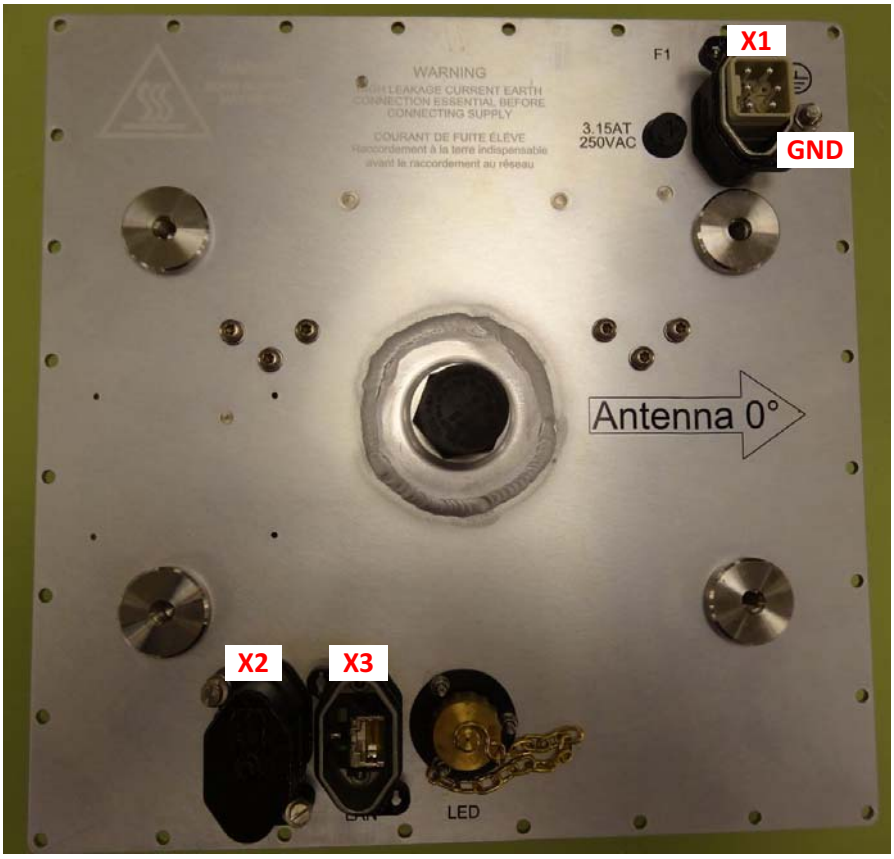

Fig. 4.1 Bottom plate, connections

4.1 X1, Mains

Mains is supplied through the bottom plate and is the supply input for all modules in the transceiver.

Description	Data or Settings
Mains input	90-264 VAC
Frequency	47 - 63 Hz
Current	1A
Fuse	3.15AT
Connector	Harting: Bulkhead type 09 40 703 0301 with 5 poles connector insert type 09 12 005 3001

Terminal	Function	Terminal	Function
1	Phase 1	4	Neutral
2	NC	5	NC
3	NC	PE	Earth

4.2 X2, Aux

The AUX interface is used for debugging by Terma personnel. It includes an IP reset feature that may be applicable for end users. For details on IP reset, refer to section 6.1 (p. 43).

Terminal	Function	Terminal	Function
1	GND	5	Reserved
2	RS-232-Adm PC_TX	6	IP Reset
3	RS-232-Adm PC_RX	7	DFU
4	Reserved	8	NC

4.3 X3, LAN

The LAN interface is used for control of the radar and for track output.

Description	Data or Settings
Interface standard	Ethernet standard IEEE 802.3 10/100 BASE-T
Connector	Harting: Bulkhead type 09 40 703 0301 with RJ45 insert type 09 45 200 1560

Terminal	Function	Terminal	Function
1	BI_DA+	6	BI_DB-
2	BI_DA-	7	BI_DD+
3	BI_DB+	8	BI_DD-
4	BI_DC+	SHELL	Shield
5	BI_DC-		

4.4 GND

The ground stud is for connection to Protective Earth.

Fig. 4.2 Bottom plate, ground stud

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5 Radar Service Tool

The radar system can be managed through the Radar Service Tool (RST), which is a software application used for controlling the radar system, such as parameters and BITE information, and for monitoring radar video, plots and tracks.

The RST runs on a laptop or on a PC connected to the radar LAN.

The RST provides the user with a consistent look and feel across the various features implemented. It supports different perspectives, where each perspective corresponds to a particular arrangement and subset of RST windows (views). The user may define, store and recall individual perspectives.

For detailed descriptions of the Radar Service Tool functions, see doc. no. 357641-HO: “SCANTER Radar Service Tool - Operator’s Manual”.

5.1 Installation

5.1.1 System requirements

The system requirements for the computer running the RST are found in doc. no. 357641-HI: “SCANTER Radar Service Tool”.

5.1.2 Installing and starting the Radar Service Tool

To install the RST, use the 7-Zip application to extract the zip file from the CD (357641-NF) to the computer. The startup file rst.exe is located in the directory: "RST-357641-NF-<revision>-<Win/Linux>-<32/64bit>\rst".

Start the Radar Service Tool by double-clicking the "rst.exe" file. The user may create a shortcut to this file and place it on the desktop.

5.2 RST features

5.2.1 Authentication

The available access administration is:

- Access to the computer is protected by a normal Windows login.

5.2.2 Access levels

To operate or to change parameters in the radar it is necessary to connect to the radar using one of the three access levels available:

- Operational access level.
- Service access level.
- Debug access level.

Operational access level allows the user to change the most commonly used parameters and to operate the radar.

The service access level allows to change all parameters, while the debug access level is intended for technicians having intensive and detailed knowledge about the radar system.

5.2.3 User documentation

The RST “DocLib” view contains a list of documents stored on the transceiver, such as technical manuals.

5.2.4 Parameters and BITE access

Access to all necessary parameters is available through the RST.

The RST provides status on radar functions and performance as well as detailed status on all modules in the system. All BITE information available about the modules is shown together with any status or error message issued by the module.

5.2.5 Tools

In addition to live radar video, the RST provides the user with operator’s tools, such as A-Scope, EBL, VRM, continuous zoom, histograms, primary-, secondary- and AIS tracks, plots, maps, etc.

These operator’s tools allow the user to perform a detailed analysis of the system performance. Display of track data is possible by clicking on the individual target, in combination with a right-click menu.

5.2.6 Situation display

The situation display presents live video, A-Scope, EBL, VRM, continuous zoom, histograms, primary-, secondary- and tracks, plots, maps, etc.

These operator tools are available to allow the user to perform more detailed analysis of the system performance. Display of track data is possible by mouse click on the individual target, in combination with a pop-up menu (right mouse click).

The situation display is one of five default perspectives, all described in the following.

5.3 RST screen layout

The Radar Service Tool screen layout is shown in Fig. 5.1 (p. 29) with definitions of the different operation areas.

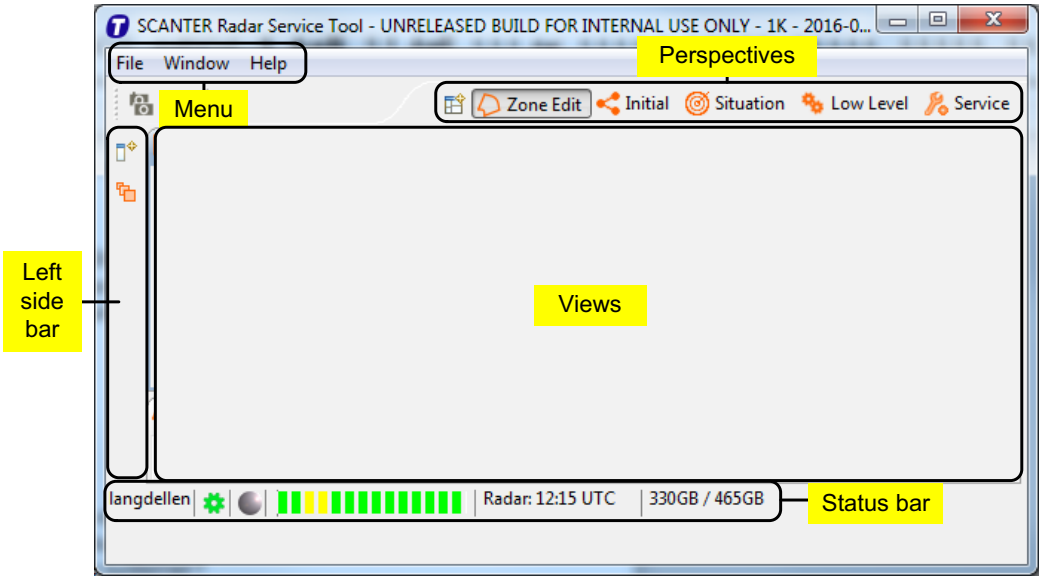

Fig. 5.1 RST, screen layout

In the “Views” area of the screen, it is possible to open interactive views for display and handling of graphical information e.g. radar video, measurement tools, radar control, parameters, BITE information, etc.

Presentation of these views can be selected and deselected individually.

The five default perspectives are described in section 5.5 (p. 32).

The Radar Service Tool menu bar consists of “File”, “Window” and “Help”.

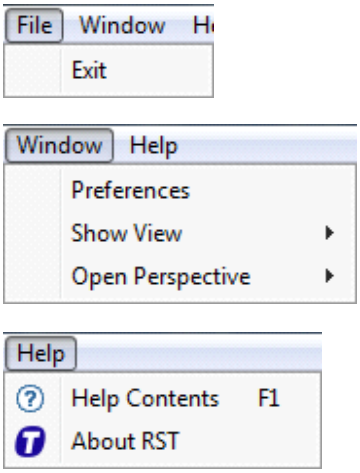

Fig. 5.2 Radar Service Tool - menus and submenus

The ”File” menu is used to exit the RST, while the “Help” menu displays the RST software version and provides information on a number of topics as well as a search function. The help topics can also be displayed by pressing the F1 key anywhere in the RST user interface.

In the “Window” menu, the submenu “Preferences” is used to set default colors, units, snapshots storage directory, radar video setting such as decay, sweep, trails history, video gain, etc.

“Show View” and “Open Perspective” are used to activate a view or a perspective.

The left side bar, shown in Fig. 5.1 (p. 29), is used to open fast views. A fast view remains on the monitor as long as it is in focus. It will disappear from the monitor if the operator clicks any place outside the fast view.

It is possible to reset predefined perspectives to the default layout.To do so, open the perspective, right-click on the perspective button and choose "Reset".

5.3.1 RST keyboard and mouse actions

5.3.2 General

General	
Maximize/Restore view	Double left-click on view tab
Move view to another docking	Left-drag view tab

5.3.3 Adjust text size

Adjust text size	
Parameters view	Ctrl - scroll wheel
Profile Editor view	
Profile Names view	
Errors/Warnings view	
Status/Measurements view	

5.3.4 Situation perspective control

PPI view	
Re-center	Ctrl - right-click
Zoom	Scroll wheel
Zoom in	Ctrl - right-drag - up - right
Zoom out	Ctrl - right-drag - down - left
Reset zoom and re-center to own unit position	Ctrl - right-drag - up - left

A-Scope view	
Zoom	Scroll wheel
Pan/Adjust VRM circle	Left-drag

VRM-Scope view	
Zoom	Scroll wheel
Pan/Adjust EBL angle	Left-drag

Area Masking view	
Press buttons “Delete Mask” or “Create Mask” to start creating a polygon	
Add polygon vertices	Left-click
Finish creating polygon	Right-click
Delete last vertex while creating a polygon	Ctrl - left-click
Abort current polygon creation	Esc

5.3.5 RST menu navigation and search

Use the four buttons at the top to the right of the view to collapse the navigation tree (All parameters) or to expand the tree. See Fig. 5.3 (p. 31). The view can be minimized into a sidebar or maximized.

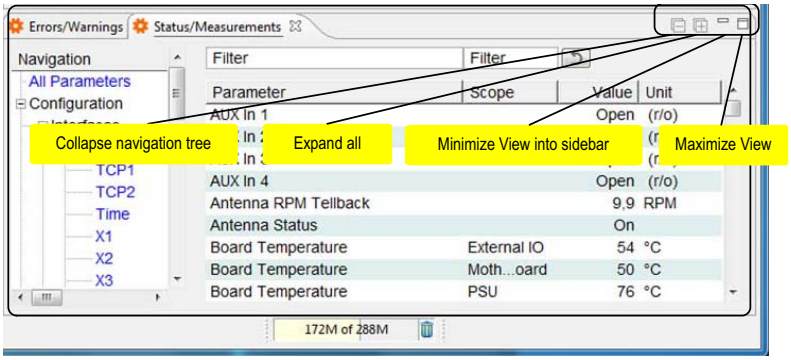

Fig. 5.3 RST, View control buttons

To search for a parameter, enter the parameter name in the “Parameter filter” or in the “Scope filter” field. See Fig. 5.4 (p. 32). The shown search is sector 11. To change a parameter value, simply click and enter the new value in the relevant field. The “All parameters” in the navigation tree must be selected to enable the search in the entire navigation tree.

In case a parameter cannot be found, pay attention to the log-on access level.

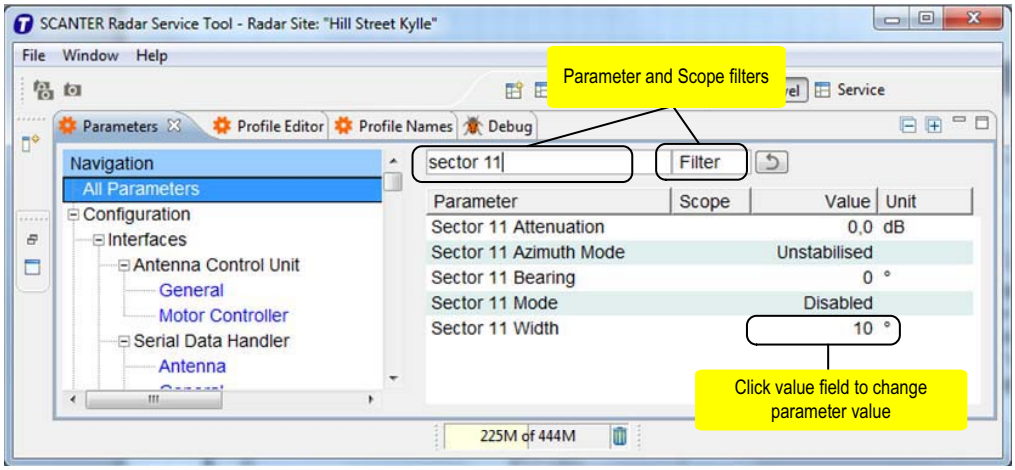

Fig. 5.4 RST, search filters

5.4 Preferences

In the Preferences menu it is possible individually to change color and fonts. The user can select what unit format to use, specify general settings of the RST, the PPI (radar video, background, trails etc). The following sections describe the usage of the RST Preferences.

Preferences		
Color	General	Help
Perspectives	Plug-ins	RST Own Unit Override
Unit		

Fig. 5.5 RST, preferences

5.5 Perspectives

When launching the RST program for the first time, there are four default perspectives, each of these containing a certain number of views. The presentation of these views can be selected and deselected individually.

The “Initial” perspective is used when a connection to the transceiver and its services is established. See Fig. 5.6 (p. 32).

Initial	
Connection Manager	Connection Status
Recordings	

Fig. 5.6 “Initial” perspective, default

The “Low Level” perspective provides parameter and profile views for configuring profile content and editing profile names.

The “Errors/Warnings” and “Status/Measurements” views are used to monitor the health of the transceiver.See Fig. 5.7 (p. 33).

Low Level		
Parameters	Profile Editor	Profile Names
Debug	Errors/Warnings	Status/Measurements
Recent Errors/Warnings		

Fig. 5.7 “Low Level” perspective, default

The “Service” perspective is used for transceiver backup/restore and software update. Further, it provides access to the documents/user guides stored in the transceiver. See Fig. 5.8 (p. 33).

Service		
Backup/Restore	Software Update	DocLib
Console		

Fig. 5.8 “Service” perspective, default

The “Situation” perspective is used by the operator to start the radar and transmission, to select profile and to monitor the radar video. Measurement tools are included in this perspective. See Fig. 5.9 (p. 33).

Situation		
PPI	Parameters	Debug
Video Setup	Area Masking	Radar Control
VRM-Scope	Histogram	A-Scope
Zones	Markers	Vectors

Fig. 5.9 “Situation” perspective, default

The “Zone Edit” perspective provides views for creating and editing zones and zone parameters. See Fig. 5.10 (p. 33).

Zone Edit		
Zones	Legacy NAAZ Zones	Legacy NTZ Zones
Parameters		

Fig. 5.10 “Zone Edit” perspective - default

Any default perspective can be customized by adding or removing views freely selected by the user.

Alternatively, new personal perspectives can be created, which can be stored in the perspectives area.

Views are placed inside the “Views” area, or “minimized” and placed in the sidebar areas (right and left side) of the RST window.

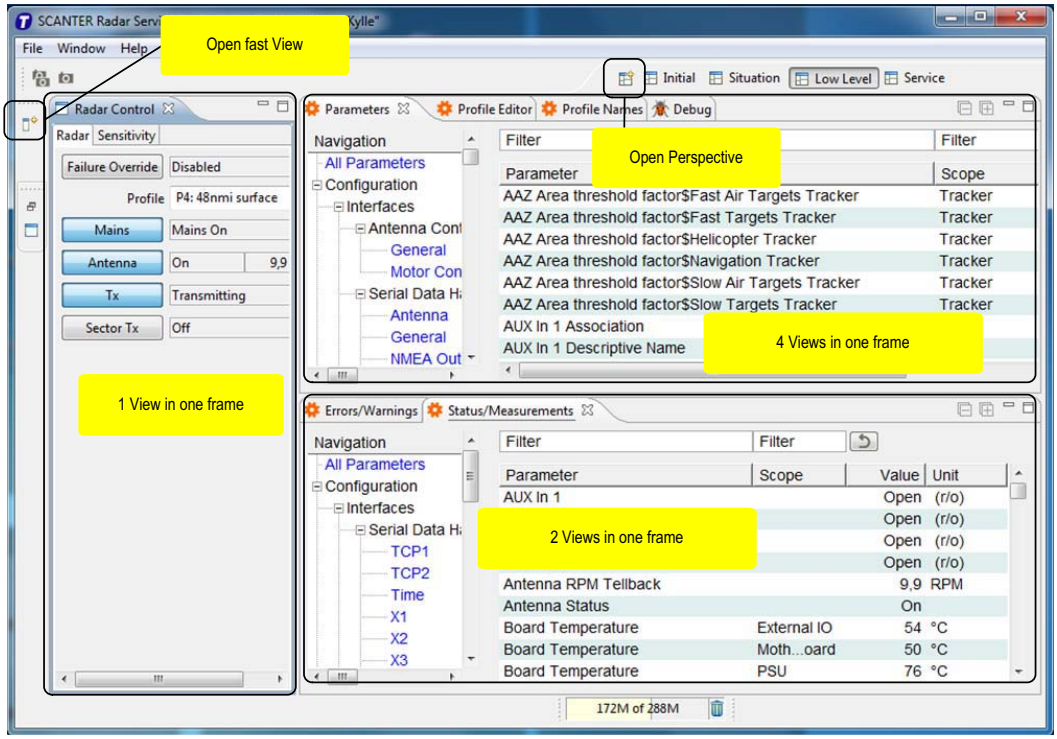

Fig. 5.11 RST, Views

A view can be placed in its own frame, or several views can be placed in the same frame/window. See Fig. 5.11 (p. 34).

To move a view within the view area, select the view tab with the left mouse button while holding down the button. Move the view to another location or inside a frame already containing one or more views.

5.6 Radar Control

When the Mains switch on the transceiver is turned to the Off position, the transceiver is in the “Off” state where it cannot function or be reached from remote.

The transceiver can enter any of the states shown in the below table:

		Radar Control view in the Radar Service Tool	
Transceiver states	External mains switch	Antenna	Transmission
Off	Off	-	-
Standby	On	Off	Off
Fully functioning	On	On	On

The “Standby” state is entered when the external mains switch is switched on and the transceiver has performed a booting procedure that may last for 3-5 minutes. The transceiver is checking the presence and condition of all hardware modules. In this state, the LAN ports on the External I/O module are up and running. An RST client can then connect to the transceiver through the LAN network.

"Radar Control" view - Radar tab (Fig. 5.12 (p. 35)) is used for switching on/off the antenna motor, the transmitter, and sector transmission.

Note that “Mains” cannot be switched off using the RST, but must be switched off directly on the external switch.

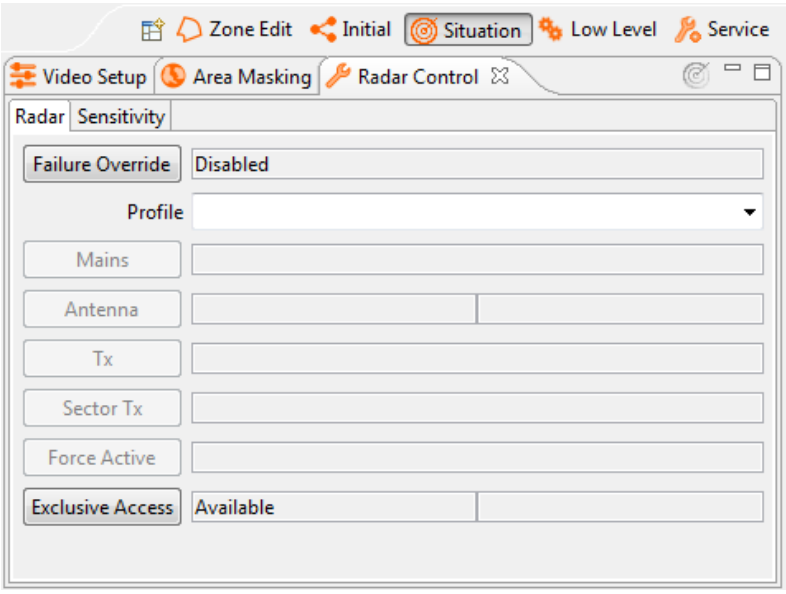

Fig. 5.12 Radar Control view - Radar

To change transceiver configuration, the "Profile" drop down menu, see Fig. 5.12 (p. 35), gives the possibility to select one of sixteen predefined profiles.

With "Antenna" it is possible to switch on and off the antenna motor. To the right is shown the actual antenna rotation speed in RPM.

With "Tx" it is possible to switch on and off the transmitter. To the right is shown the status of the transmitter (transmitting, stand by, etc.).

"Sector Tx" switches on and off the sector transmission and will affect all sectors enabled.

“Force Active” is for use in redundant systems only, i.e. in SCANTER 1002 this button is dimmed.

“Exclusive Access” is used for requesting ‘master control mode’ of the radar. This mode allows the user to gain exclusive access to the radar, i.e. lock the configuration parameters for sole use. Master control mode is defined in the parameter ‘Master Control Mode’ and can have the values ‘Disabled’, Optional’ or ‘Mandatory’. If the parameter is set to ‘Optional’ or ‘Disabled’, the user must request master control mode before being able to change configuration parameters. If set to ‘Disabled’, exclusive access cannot be requested and the button will be dimmed. Exclusive access can be released by pressing the button.

The “Radar Control” view - Sensitivity tab (Fig. 5.13 (p. 36)) is used for auto adjusment tracker sensitivity for surface and air channels.

Note: Manual adjustment is not supported for SCANTER 1002.

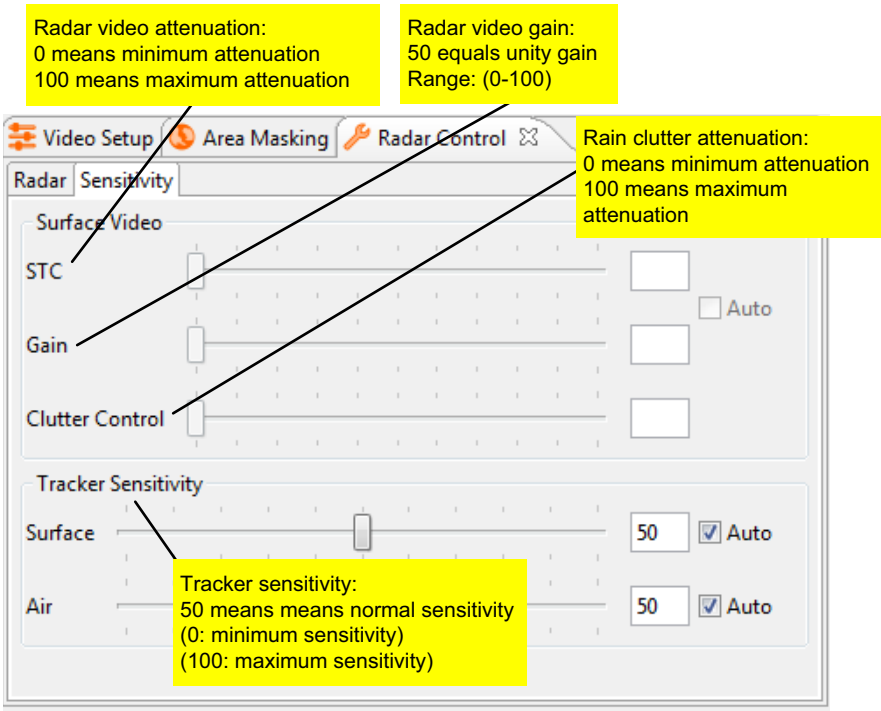

Fig. 5.13 “Radar Control” - Sensitivity

5.6.1 Starting transceiver

Step 1	Turn on power to the transceiver using the external power switch.
Step 2	Establish a connection between the transceiver and the RST by means of the RST “Connection Manager” view.
Step 3	In the RST “Radar Control” view, select “Antenna”, “Tx” and an appropriate profile. Enable sector transmission if created and needed.

5.6.2 Stopping transceiver

Step 1	Switch off “Tx” and “Antenna” in the RST “Radar Control” view.
Step 2	Turn off power to the transceiver using the external power switch.

5.6.3 Creating sectors

In the “Parameters” view - Sectors, it is possible to set up sixteen independent sectors, selected as transmission sectors, prohibited sectors or reduced power transmitting sectors. All available as stabilized or non-stabilized sectors.

A stabilized sector is always kept relative to north. Not stabilized sectors will follow the moving platform when it is turning, i.e. they are not kept relative to north.

When setting up a sector it is necessary to know or to calculate the bearing of the sector, i.e. the middle. In the same way it is necessary to know or to calculate the width (extent) of the sector (in degrees). See Fig. 5.14 (p. 37).

A prohibit sector is a non-transmission sector.

Selecting reduced power sector, it is possible to transmit with reduced power. Power attenuation is selectable in the interval 0..15.5 dB.

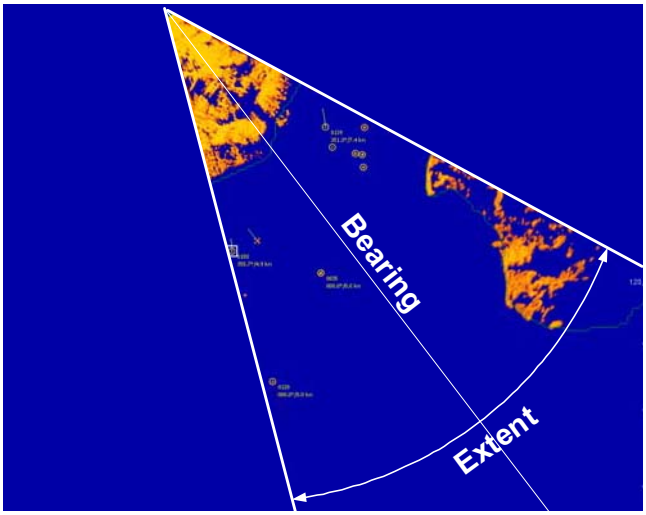

Fig. 5.14 Sector Bearing and Width

Sector bearing:	0..359 degrees
Sector width:	10.. 350 degrees
Sector mode:	Disabled, prohibited, reduced power sector, transmitting sector
Azimuth mode	Stabilized or unstabilized
Sector attenuation	0..15.5 dB

5.6.4 Creating ET2 tracking zones

Tracking zones facilitate optimized control of tracking in specific areas.

The following types of tracking zones can be set up for a naval system (note the conditions applying to AAZs):

- Automatic Acquisition Zone (AAZ): Automatic Acquisition Zones are areas where tracking will be initiated automatically. AAZs must cover the entire demanded tracking area.

  Note: When the RST is used to control a transceiver, it must be connected using *Parameter Control Protocol v. 2.2 or newer*, and the transceiver must support creating and editing AAZs from this protocol.

- Non-Tracking Zone (NTZ): zone in which the tracker will not perform tracking on plots. No tracks are initiated in the zone and thus no tracks are maintained.

- Non-Automatic Acquisition Zone (NAAZ): zone in which the tracker will not initiate tracks based on the plots within. Confirmed tracks moving into a NAAZ will be maintained.

NTZ and NAAZ can be created and drawn in the PPI view using the "Zone Edit" view.

Zones can be defined for air or surface channel, or for both air and surface channels.

5.6.5 Backup/restore

The backup and restore functions in the RST provide backup and restore facilities for the SCANTER 1002 radar system.

The transceiver contains the application SW, factory default data, transceiver configuration data and site default data.

Furthermore, some space is allocated for log files (i.e. performance and measurement data) and temporary files. See Fig. 5.15 (p. 39).

The data set currently being used by the transceiver is stored in the “Transceiver configuration” memory area.

The “Site Default” data area is used to store a copy of the “Transceiver Configuration”. It is recommended to copy the “Transceiver Configuration” to the “Site Default” area after Setting-To-Work (STW) and later on after major changes of the settings.

Furthermore, it is recommended to back up the “Transceiver Configuration” and logs, area masking and maps on the Radar Service Tool computer. When activating the backup from the RST, the FTP server will create and store a temporary backup file which is then transmitted to the RST computer.

The “Temporary files” directory has a limited size, hence it is possible to delete some of these files by means of the RST.

The “Factory Default” data area contains basic settings for the transceiver, created and used at transceiver production. These data are not intended to be used on site.

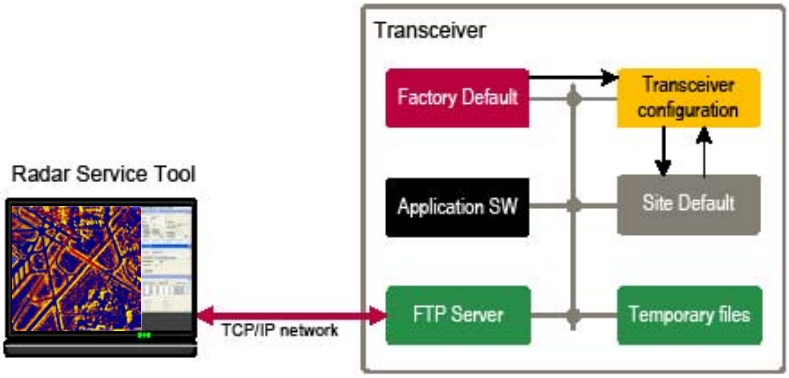

Fig. 5.15 Transceiver - SW and configuration data

5.6.5.1 Creating/restoring backup of configuration data

Note: Antenna rotation must be stopped before initiating the backup.

To create a backup of the “Transceiver configuration” and log files, use the RST “Backup/Restore” view. See Fig. 5.17 (p. 40).

The RST saves the backup file in the directory selected by the user:

For each zipped backup file, the date is used as the file name (i.e. BackupDate.tar). The backup file contains all parameters for the transceiver and the radar system, logs, area masking and maps.

The restore function copies the transceiver backup file from the RST computer to the "Transceiver configuration" area. Once the backup file has been uploaded, the transceiver *will restart* to activate and use the restored backup file.

The restore function is available in two variants: Partial Restore or Full Restore.

A “Full Restore” is used in situations where a complete replacement of the configuration of the transceiver is desired. This includes site specific settings such as IP address, encoder alignment and calibration data. This is the type of restore to be used when exchanging the LRU containing the transceiver hard drive or if a complete re-initialization of the transceiver to a previously backed up state is required.

A “Partial Restore”, on the other hand, replaces only configuration data not tied to the specific transceiver on which it was created. This type of restore operation is useful if the same basic configuration is to be reused across several transceivers. A backup is then created on a master transceiver and partially restored on the remaining transceivers.

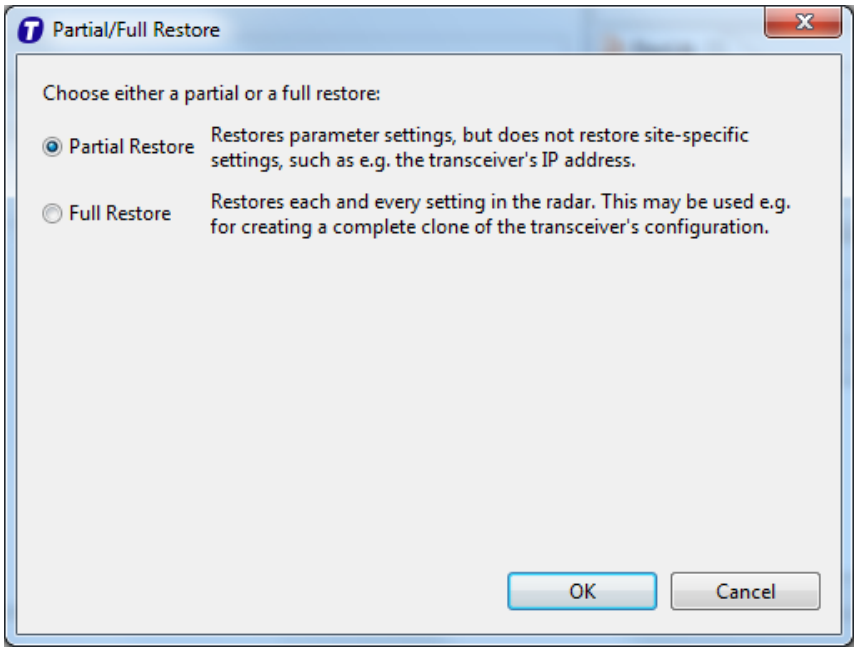

Fig. 5.16 Partial/Full Restore

“Delete Temp” removes temporary files stored in the transceiver (FTP Server).

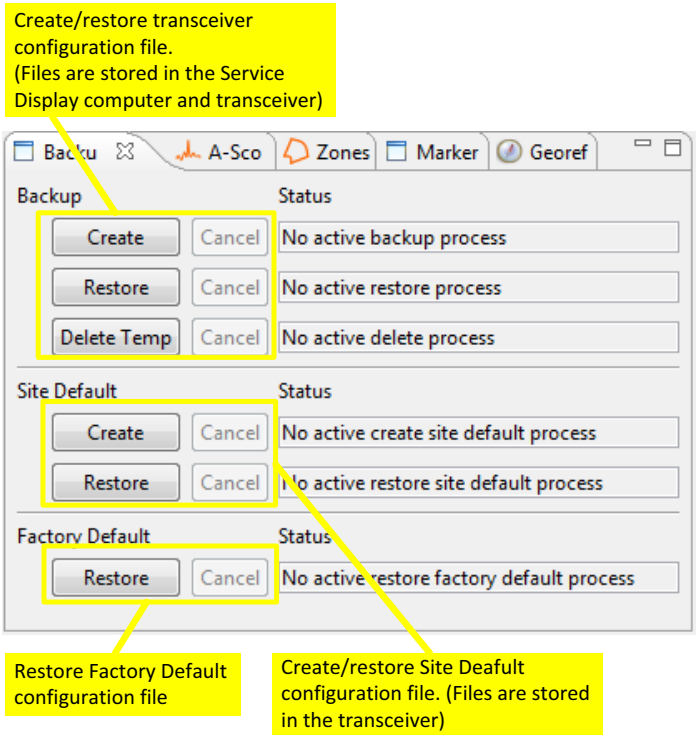

Fig. 5.17 Menu: Window / Show View / Backup/Restore

The “Site Default” create option copies the” Transceiver configuration” to the “Site Default” area. Restore copies the “Site Default” to the “transceiver configuration” area. The transceiver will restart to activate and use the new data.

The “Factory Default” data contains basic parameter values for the transceiver. These are created at transceiver production and should not be used after the radar has been set up.

Restoring the “Factory Default” data will delete the “transceiver configuration” area. The transceiver will then be out of service, unless a backup has been created on the RST that can be restored.

(Intentionally left blank)

6 Software installation

6.1 Resetting IP address on transceiver to default (169.254.1.50)

This procedure should be performed if the connection to the transceiver cannot be established. This may be the case if the transceiver has been replaced, or if the transceiver is temporarily replaced with another transceiver, for instance in connection with service.

Tool requirements:	Screwdriver, flat
Spare parts / consumables:	Reset Switch, X2 (902059-001) - part of toolkit Service PC with Radar Service Tool (RST) Network adapter
Est. time consumption	1/2 hour

1. Disconnect the external power cable on the transceiver.
2. Configure the network adapter on the service PC with an IP address on the 169.254.0.0/24* LAN segment.
3. Connect the network adapter on the service PC directly to the LAN connector (X3) on the transceiver.
4. Connect the Reset Switch, X2 (see Fig. 6.1 (p. 43)) to the Aux connector (X2) on the transceiver and fasten the screws.
5. Toggle the switch on the Reset Switch, X2 to ”IP Reset” mode.

Fig. 6.1 Reset switch, X2 in IP reset mode

6. Connect the external power cable to the transceiver.
7. Wait for the bootloader to finish booting to “IP Reset” mode, as indicated by the LED.
8. Toggle the switch on the Reset Switch, X2 to neutral position (middle).
9. In the RST “Parameters” view > Service and Installation\ Network Configuration, set “IP Address” to the final IP address for the transceiver on the site in question. Also change “Default Gateway” and “Subnet Mask” accordingly.
10. Set “Store Network Configuration” to ‘Store’ for changes to take effect.

*According to the CIDR notation, ‘/24’ means that netmask must be set to 255.255.255.0 (24 bit set, 8 bit not set).

6.2 Replacing transceiver software

This procedure describes how to perform a Device Firmware Update (DFU). The procedure should be performed if the transceiver PC Module has been replaced or following an unsuccessful transceiver software update due to e.g. power failure.

Note: The procedure will erase all existing software on the transceiver.

Tool requirements:	Screwdriver, flat
Spare parts / consumables:	Reset Switch, X2 (902059-001) - part of toolkit Service PC with Radar Service Tool (RST) Network adapter
Est. time consumption	1/2 hour

1. Disconnect the external power cable on the transceiver.
2. Configure the network adapter on the service PC with an IP address on the 169.254.0.0/24* LAN segment.
3. Connect the network adapter on the service PC directly to the LAN connector (X3) on the transceiver.
4. Connect the Reset Switch, X2 (see Fig. 6.2 (p. 44)) to the Aux connector (X2) on the transceiver and fasten the screws.
5. Toggle the switch on the Reset Switch, X2 to “DFU” mode.

Fig. 6.2 Reset switch, X2 in DFU mode

6. Connect the external power cable to the transceiver.
7. Wait for the bootloader to finish booting to “DFU” mode, as indicated by the LED.
8. Toggle the switch on the Reset Switch, X2 to neutral position (middle).
9. Use the Radar Service Tool to upload transceiver core software (902085-NF) to 169.254.1.50.
10. The transceiver will automatically reboot into the newly installed software.

*According to the CIDR notation, ‘/24’ means that netmask must be set to 255.255.255.0 (24 bit set, 8 bit not set).

7 BITE errors and warnings

The following lists BITE errors and warnings that may be detected in the system. Please note that the list is not exhaustive. For a complete list of errors and warnings, please refer to doc. 721086-DI “SCANTER 1000 Series Transceiver Control Protocol Data Definition - Service Access Mode”.

Name	Min	Max	Severity	Description
ADC Calibration Error			Error	
Antenna RPM Too Large Error			Error	Error indicating that 'Antenna RPM' parameter value is larger than 'Maximal Antenna RPM' calculated.
BITE Measurement Log Disk Limit Reached			Error	Indicates that the amount of disk space allocated to the BITE Measurement Log has been used up
BITE Status Log Disk Limit Reached			Error	Indicates that the amount of disk space allocated to the BITE Status Log has been used up
BITE Warning and Error Log Disk Limit Reached			Error	Indicates that the amount of disk space allocated to the BITE Warning and Error Log has been used up
CAN Bus Status#Motor Controller			Error	
Cancelable Call Warning#Motor Controller			Warning	
Chirp Reference Level Low Error#f0			Error	Indicates that the power of the transmitted signal as seen by the receiver is lower than expected.
Chirp Reference Level Low Error#f1			Error	Indicates that the power of the transmitted signal as seen by the receiver is lower than expected.
Chirp Reference Level Low Error#f2			Error	Indicates that the power of the transmitted signal as seen by the receiver is lower than expected.
Chirp Reference Level Low Error#f3			Error	Indicates that the power of the transmitted signal as seen by the receiver is lower than expected.
Clutter Map Input Link			Error	Could not connect to data input source.
Comm Error#Motor Controller			Error	
Command Error#Motor Controller			Error	
Communication Error#Motor Controller			Error	

Name	Min	Max	Severity	Description
Control Error#Motor Controller			Error	
Control Link Down#ClutterMap			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#CoreTracker			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#ET2			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#Motor Controller			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#Network Configurator			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#NTPWatch#ET2			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#NTPWatch#HK			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#PlotCombiner			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#PlotPublisher			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#PlotServer#Air			Error	Indicates that the communication between the main software node and the software node specified is not established
Control Link Down#TrackPublisher			Error	Indicates that the communication between the main software node and the software node specified is not established
Core Tracker Input Link			Error	Could not connect to data input source.
CPU Load Error#HousekeepingPC	106	100000	Error	Indicates that the CPU is heavily overloaded
CPU Load Error#TrackerPC	106	100000	Error	Indicates that the CPU is heavily overloaded
CPU Load Warning#HousekeepingPC	101	105	Warning	Indicates that the CPU is slightly overloaded
CPU Load Warning#TrackerPC	101	105	Warning	Indicates that the CPU is slightly overloaded
Custom antenna pattern Error			Error	
Drive I2T Protection Warning#Motor Controller			Warning	
Drive Over Temperature Error#Motor Controller			Error	

Name	Min	Max	Severity	Description
Drive/Motor Initialization Error#Motor Controller			Error	
Duty Cycle Error			Error	
EEPROM VCO Multiplier Configuration Missing	0	0	Error	Indicates that the VCO multiplier configuration is not stored in the LRU EEPROM of the RxTx LRU. A 2x multiplier configuration is assumed, which will lead to garbled radar video if used with a 4x multiplier unit. The correct setting is available from the operation sheet of the RxTx LRU and may be programmed in the LRU EEPROM from the debug www page
Enable Status Of Drive/Motor Disabled#Motor Controller			Error	
Failure Override Enabled Warning			Warning	
Fault#Motor Controller			Error	
FFT Bandwidth Exceeded Error			Error	
Filter Coefficients Calculation Error			Error	An error occurred during calculation of filter coefficients
FPGA Temperature Error#FPGA0	90.0	500.0	Fatal Error	Indicates that the FPGA core temperature is outside the allowed range and that Mains has been turned off to prevent component damage
FPGA Temperature Warning#FPGA0	85.0	90.0	Warning	Indicates that the FPGA core temperature is outside the recommended range
Hall Sensor Missing/Resolver Error/BiSS Error/Pos Wrap Around Error#Motor Controller			Error	
Invalid HDL PEX Input#Air			Error	The HDL PEX has delivered erroneous data within the last scan to the PlotServer.
I2T Protection Error#Motor Controller			Error	
Long Chirp Length Truncated Warning			Warning	
Low Disk Space Error			Error	
Low Disk Space Warning			Warning	
Maximum Track Latency Exceeded			Warning	The maximum processing latency for track generation through the tracker has been exceeded.
Missing frequency in PSAT Calibration Table Error			Error	PSAT calibration table not complete for this profile, rerun PSAT calibration for this profile
Motor I2T Protection Warn-			Warning	

Name	Min	Max	Severity	Description
ing#Motor Controller				
Motor Over Temperature Error#Motor Controller			Error	
Negative Limit Switch Status#Motor Controller			Error	
Network Video Replication Warning			Warning	
No Connection To NTP Daemon#ET2			Error	>Unable to establish connection to the local NTP daemon
No Connection To NTP Daemon#HK			Error	>Unable to establish connection to the local NTP daemon
No Transmission Sectors Defined Warning			Warning	Sector transmission is enabled while no transmission sectors are defined
No valid GPS data			Error	No valid GPS data
Over Voltage Error#Motor Controller			Error	
Over-Current Error#Motor Controller			Error	
Parameter Change Log Disk Limit Reached			Error	Indicates that the amount of disk space allocated to the Parameter Change Log has been used up
Plot Publisher Input Link#Air			Error	Could not connect to surface data input source.
Plot Publisher Input Link#Surface			Error	Could not connect to surface data input source.
PlotCombiner Input Link#Air			Error	Could not connect to data input source #Air.
PlotCombiner Input Link#Surface			Error	Could not connect to data input source #Surface.
PlotCombiner Performance Decreased			Error	Input plot older than latest output plot
PlotServer Overload#Air			Error	The number of received plots from HDL PEX is to big.
Positive Limit Switch Status#Motor Controller			Error	
Profile Unsaved Warning			Warning	Indicates that changes were made to current profile that are not yet saved
PSAT Calibration Data Not Matching SSPA Error			Error	Stored calibration data does not match installed SSPA, rerun PSAT calibration
PSAT Calibration Failed Error			Error	PSAT calibration failed, rerun PSAT calibration for this profile

Name	Min	Max	Severity	Description
PSAT Calibration Running Warning			Warning	Indicates that a PSAT calibrating session is ongoing and that optimal transceiver performance cannot be expected
PSAT Not Calibrated Warning			Warning	Indicates that a PSAT calibration has not been completed with the current frequency planning configuration
Setup Table Status#Motor Controller			Error	
Short-Circuit Protection Status#Motor Controller			Error	
Synthetic Encoder Data Enabled Warning			Warning	Indicates that synthetic encoder data generation is active (i.e. the Synthetic Encoder Data parameter has been set to 'Enable')
Time Not Synchronized#ET2			Warning	Time has not (yet) been synchronized with the time server
Time Not Synchronized#HK			Warning	Time has not (yet) been synchronized with the time server
Track Drop Threshold Auto Overload Error	0.0	100	Error	The track generation overload.
Track Drop Threshold Auto Overload Warning	-10.0	0	Warning	The tracker is approaching track generation overload.
Track Publisher Input Link			Error	Could not connect to data input source.
Transceiver Configuration Restore Error			Error	Indicates that a restore operation has failed
Under Voltage Error#Motor Controller			Error	
Video Server Link Error	0	1	Error	

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8 Technical terms and definitions

Accuracy	The difference between the average of repeated measurements of the same quantity under identical conditions and the known "true" value, i.e. the difference between the average of the measurements of the range to a fixed reference target and the range value calculated from the geographical coordinates of the reference target and radar sensor.
Antenna	The upper rotating part of the antenna system. The antenna is radiating the RF power and receiving the echoes from the targets. Depending on the antenna type the radiating component can be a slotted waveguide or a horn with belonging reflector.
Antenna Polarization	Antenna polarization is determined by the direction of the electrical field. SCANTER 1002 is horizontally polarized.
Azimuth	The angle between a horizontal reference direction (north or heading) and the horizontal projection of the direction of interest, measured clockwise.
Doppler Effect	In radar technology the Doppler Effect is used for speed measurement, among others. The Doppler Effect is the apparent change in frequency or pitch when a moving target is hit by a radar beam. When a target is approaching the radar, the target is "compressing" the beam in front of it resulting in a higher frequency in the echo.
Encoder	Unit which provides information about the azimuth i.e. the direction in which the antenna is pointing. For each rotation the encoder sends a number of azimuth count pulses (ACPs), typically 8192 pulses and one azimuth reference pulse (ARP). The encoder is included in a encoder assembly which normally holds one or two encoders.
Extractor	The extractor analyses the incoming video for plot creating plots. Furthermore, it calculates plot properties such as area, intensity, centre of gravity, etc.
Frequency Diversity	Frequency Diversity (FD) is a sequential transmission on two different frequencies which after processing increases the signal quality by an increase of the signal-to-noise ratio. The target is hit twice and behaves differently depending upon the frequency of the electromagnetic wave hitting it. Furthermore, if slotted waveguide antennas are used, an additional advantage is achieved, namely the time diversity.

Lack	Lack is a number counting unsuccessful consecutive updates of a track.
Noise Figure	Noise Figure is defined as the signal-to-noise ratio at the input divided by the signal-to-noise ratio at the output. Noise Figure is expressed in dB.
Parameter	A parameter is a quantity which influences the radar video, the subsequent signal processing, the plot extraction, or the target tracking. Examples are: transmitted power, video sampling rate, video threshold for plot selection, and expected maximum speed of target.
Plot	A radar plot is a group of connected radar cells in which the measured video signal exceeds a defined threshold value and/or fulfils some other discrimination criterion.
Precision	The standard deviation of repeated measurements of the same quantity under identical conditions i.e. the standard deviation of the measurements of the range to a fixed reference target.
Profile	A profile is a set of common operational parameters for the transceiver and the tracker. Profiles are identified by a name. When a specific Profile, i.e. Profile Name, is chosen by the operator, all transceiver and tracker parameters are set according to the profile content.
Pulse Compression	For a simple rectangular pulse, the pulse duration is equal to the reciprocal value of its bandwidth. Improving the radar sensitivity by increasing pulse duration and thereby the transmitted power, will have a negative impact on the range resolution. Pulse compression, also known as pulse coding, is a signal processing technique designed to maximise the sensitivity and resolution of a radar system. By manipulating the amplitude and phase of a pulse, it is possible to increase the pulse bandwidth, while keeping the pulse duration unchanged, or vice versa. By doing so, the increased average transmitted power improves sensitivity while having a high range resolution. The effectiveness of a particular pulse code is often judged by its time-bandwidth product. The time-bandwidth product for a simple rectangular pulse is equal to one. A compressed pulse might have a time-bandwidth product of ten. This means that each compressed radar pulse contains ten times the energy of the simple un-coded pulse of the same resolution. Equivalently, range resolution is ten times finer than an un-coded pulse of the same duration.

Radar Cell	The disc around the radar out to the maximum range is covered by a polar grid. Each azimuth sector is divided into 4096 range cells of equal range depth. A specific range cell in a specific azimuth sector is called a radar cell.
Radar Cross Section	The Radar Cross Section (abbreviated RCS) is the size and ability of a target to reflect RF energy - this is summarized in a single term, which has the dimension [m^2]. The size of the RCS depends on frequency, antenna polarisation and a lot of characteristics of the target, ex. physical dimensions, aspect angle, coating and material, surface. The RCS can be quite difficult to estimate and is normally determined by measurements and in certain extend experience.
Radial Speed	The true velocity of an air plane is composed of three vectors. The vector, which points directly towards the radar or away from the radar, represents the radial speed of the air plane. Assuming, an air plane is flying around the radar in a circle path, the radial speed will be permanently zero. The produced Doppler frequency is zero and the air plane is not detected.
Resolution	The minimum distance in range or angle between two equally strong radar targets (same radar cross section) which allow the echoes from these targets to be perceived as separate echoes.
Scan	The collection of consecutive sweeps covering one full rotation.
Sea Clutter Discrimination	Sea Clutter Discrimination (abbreviated SCD) performs sliding window scan-to-scan correlation for each range-azimuth cell. This is used to discriminate between clutter and targets.
Sweep	The radar return of one transmitted pulse as a function of range.
Track	The track of a target is a table holding position, speed, course, etc. versus time.
Tracking	Tracking is the process of associating a time series of plots with the physical movement of one physical object (the target) and to derive speed, course etc. from this time series.
Track update	A track is updated when a plot from the most recent scan is associated to a tentative or a confirmed track.
Trail	Historic radar echoes, usually presented in a color different from the actual radar echoes and fading away within a user defined time interval.

Waveguide filter	The waveguide filter functions as waveguide, i.e. a conductor within which RF energy can be efficiently transmitted.

9 Abbreviations and acronyms

Term	Definition
ACP	Azimuth Count Pulse
AIS	Automatic Identification System
ARP	Azimuth Reference Pulse
BITE	Built-In Test Equipment
CFAR	Constant False Alarm Rate
DFU	Device Firmware Update
FD	Frequency Diversity
FPGA	Field Programmable Gate Array
GSR	Ground Surveillance Radar
HPA	High-Power Amplifier
I/O	Input/Output
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
IP	International Protection / Internet Protocol
IT	See ‘TN’
LAN	Local Area Network
LRU	Line Replaceable Unit
MMIC	Monolithic Microwave Integrated Circuit
PA	Power Amplifier
PC	Processing & Control
RCS	Radar Cross Section
RF	Radio Frequency
RPM	Rotations per minute
RS	Recommended Standard
RST	Radar Service Tool
Rx	Receive / Receiver
SCD	Sea Clutter Discrimination

Term	Definition
SNR	Signal-to-Noise Ratio
SSPA	Solid State Power Amplifier
STC	Sensitivity Time Control
TCP/IP	Transmission Control Protocol / Internet Protocol
TN	International standard IEC 60364 distinguishes three families of earthing arrangements, using the two-letter codes TN, TT, and IT. The first letter indicates the connection between earth and the power supply equipment (generator or transformer): T: direct connection of a point with earth (Latin: terra); I: no point is connected with earth (isolation), except perhaps via a high impedance. The second letter indicates the connection between earth and the electrical device being supplied: T: direct connection with earth, independent of any other earth connection in the supply system; N: connection to earth via the supply network.
TT	See ‘TN’
Tx	Transmit / Transmitter
WAN	Wide Area Network

10 Annex A - Acknowledgement

The SCANTER 1000 Series transceiver software package contains open source software components. License information can be found in doc. no. 721089-RA: "SCANTER 1000 Series Transceiver Core Software Open Source Licenses", while the source code for these components are available in doc. no. 721089-SC: "SCANTER 1000 Series Transceiver Core Software GPL Source Code".

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