SkyRadar
Modular Radar Training System
CW, Pulse, Doppler, Security, Target Positioning System, Scopes

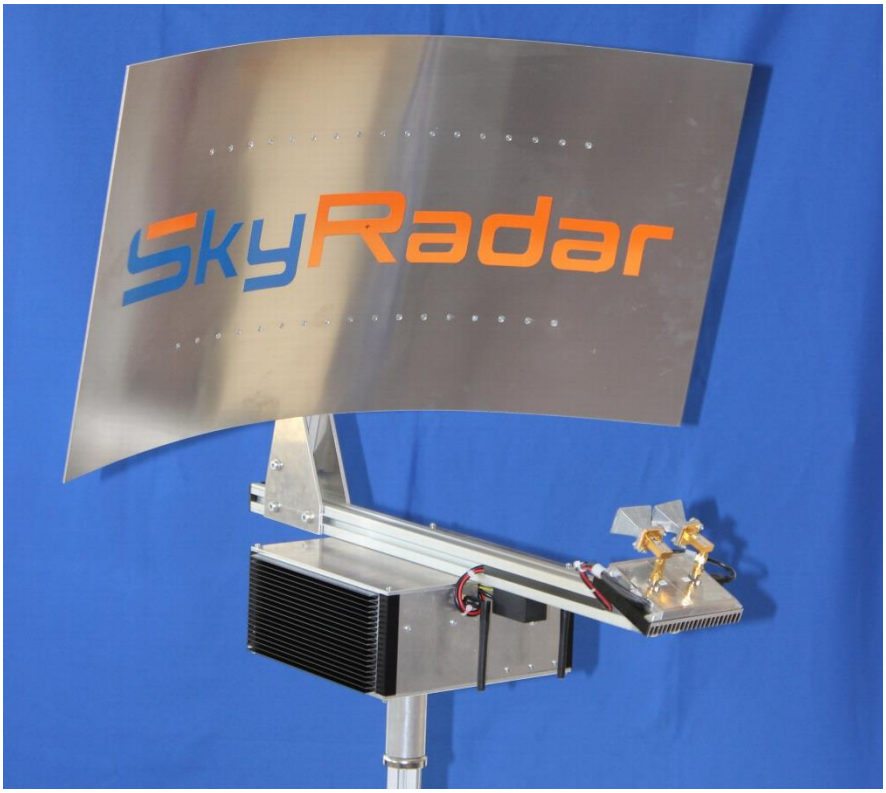

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Table of Contents

1 Introduction

The SkyRadar Modular Radar Training System is a **real functioning radar** system suitable for training purposes – it is **not a simulator**. It is operating safely in training laboratory environments, but also outdoors. This primary surveillance radar system is based on transversal electromagnetic waves operating at a carrier Signal of 24 Ghz.

The system is the result of joint development with experts from the fields of radar development, ATC and military training as well as university research and eduction. Pictures might vary from the final material, as we will deliver the newest material in full technical compliance to this offer.

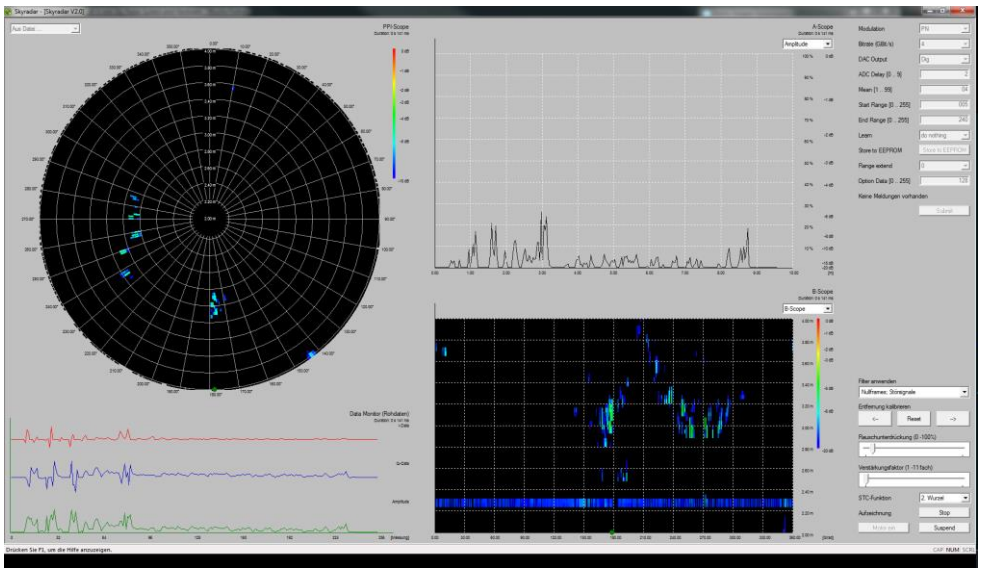

Figure 2: Overview Scope

This specific document describes the constant wave (CW) family including many extensions. For additional information on the Frequency Modulated Constant Wave Radar modules (FMCW) including Synthetic Aperture Radar (SAR) and on Secondary Surveillance and ADS-B Radars please consult the specific catalogs.

The offer consists of the following main groups:

- A modular set for CW, Doppler and Pulse Radar applications
    - The SkyRadar Scopes Software
    - The autonomous base unit including transceiver, DSP and horn antennae (Section 2)
    - A rotatory tripod extension to allow for 360° surveillance and PPI display (extension to the base unit 4)
    - A parabolic reflector, allowing for targeted supervision and experiments (extension to the base unit
    - The SkyRadar Cloud Server
- A security module for defense and homeland security training. As an extension to the primary radar training suite, a special military and homeland security module (extension to the base unit, for details see Chapter 8)

Figure 3: SkyRadar base unit

- A range of target subsystems including a target positioning system, as well as a remote controlled quadcopter drone and a vessel (Chapter 9).

All equipment will be installed by SkyRadar representatives

- All the required SkyRadar devices are movable;
- The SkyRadar Training System can be operated indoors and outdoors;
- All descriptive technical documents for both software and hardware are provided along with original copies of all licenses in English Language;

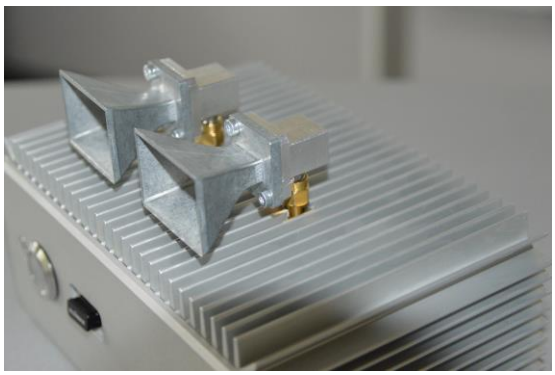

Figure 5: SkyRadar Base Unit with Horn Antennae.

Figure 4: SkyRadar base unit

2 SkyRadar FreesScopes

Part #: SkyRadar PSR-Scopes-Ver.5.0

Description

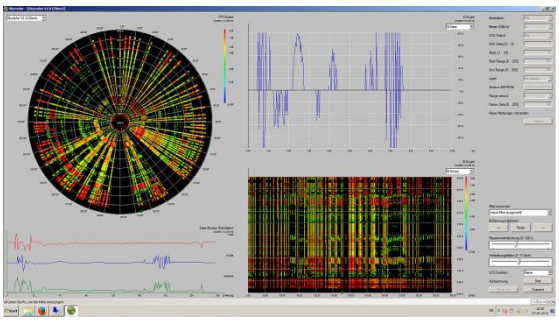

Figure 6: SkyRadar FreeScopes

The SkyRadar FreeScopes provide a comfortable computing environment to read, manipulate and store data. It is an integrated part of all SkyRadar modules presented in this catalog. It can be operated in TCP/IP connection with the SkyRadar PSR Unit (Wireless LAN or Ethernet). The number of concurrent users using SkyRadar Scopes is not limited To assure fast operations, we suggest in classroom contexts to add a SkyRadar Cloud server (see Section 6). The SkyRadar FreeScopes operate within a Web-Browser and do not require any local installation. The radar system can be monitored and accessed by many students concurrently. Doing so, each students can work with different filter or scope-settings (A-scope, B-scope, PPI), as the software read and interpretes Q- and I- raw data. The software FreeScopes is freely accessible

Parts

In the context of a SkyRadar PSR delivery, the Scopes consist of:

- One (1) license for SkyRadar Scopes software utilization
- One (1) Operating manual in English language freely downloadable.

2.1 SkyRadar Scopes and SkyRadar FreeScopes Software Features

The SkyRadar Scopes and FreeScopes software is based on recent HTML5 technology (HTML5, JavaScript, JSON-LD, Scalable Vector Graphics, Canvas). This enables students to work concurrently on the system, even when working on different scopes or with different filter settings. The system allows for online access to the radar training system (when enabled by the academy or university). When more than 5 students access the system concurrently, we advise to use the SkyRadar Cloud Server. Depending on the configuration, this server will provide the required elasticity to scale up with additional users.

- Wireless communication between Server and Radar element.
- Scopes
    - A-Scope.
    - B-Scope.
    - Plan-Position-Indicator (PPI). The PPI is particularly useful when the system is applied together with the turntable unit.
- Possibility to run experiments from e.g., verification of the radar equation up to complex radar experiments and analysis.
- Analysis of the Pulse Train Frequency, which is directly measured at the gate generator.
- Close-Range detection.
- Possible signal processing experiments (list non exhaustive)
    - Measurement of I and Q signals.
    - Learning Doppler basics.
    - Exploring Doppler Sensors.
    - Ranging of moving and stationary objects.
    - Detection of direction angle of moving objects.

Figure 7 shows the scope overview screen of the SkyRadar Suite. The A-Scope is used for measuring distances to radar targets in a defined direction. It consists of a radar display unit with Cartesian representation, in which the horizontal axis shows the distance between the radar and the target object. The system includes a Plan-Position-Indicator as seen in Figure 8. The Plan-Position-Indicator is a polar coordinate display of the area surrounding the radar platform. The A-scope (Figure 9) of the SkyRadar trainer is entirely digital and interactive, allowing for a broad range of filtering and signal manipulation. The B-Scope is a Cartesian, 2-D “top down” representation of space. The horizontal axis (abscissa) represents the measurement of the azimuth (bearing), and the vertical axis (ordinate) represents the measurement of the range. Signals appear as bright spots. Also the B-scope (Figure 10) is entirely digital and interactive, equipped with a

multitude of features for analysis, measurement and signal manipulation. Transmitted and echo signals can be directly represented in the time domain as represented in the raw data monitor (Figure 11).

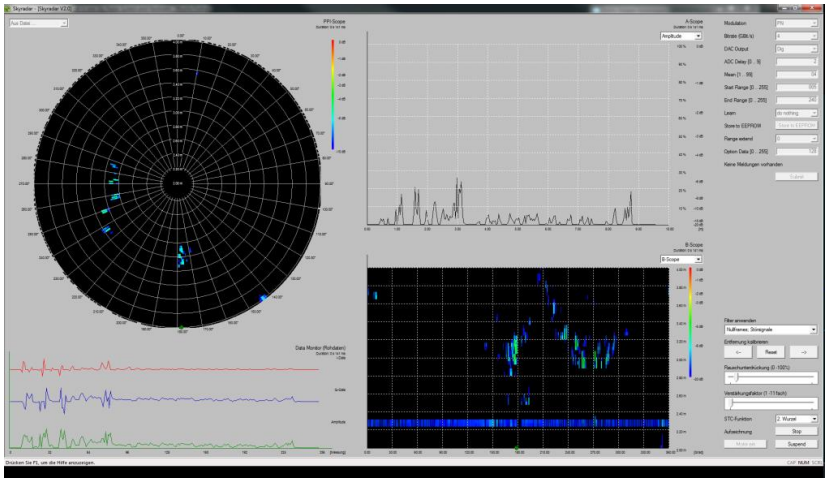

Figure 7: SkyRadar's Overview Scope, showing clockwise (a) a Position-Plan-Indicator PPI (b) an A-Scope, (c) a B-Scope, and (d) a raw data monitor (time scale in milliseconds).

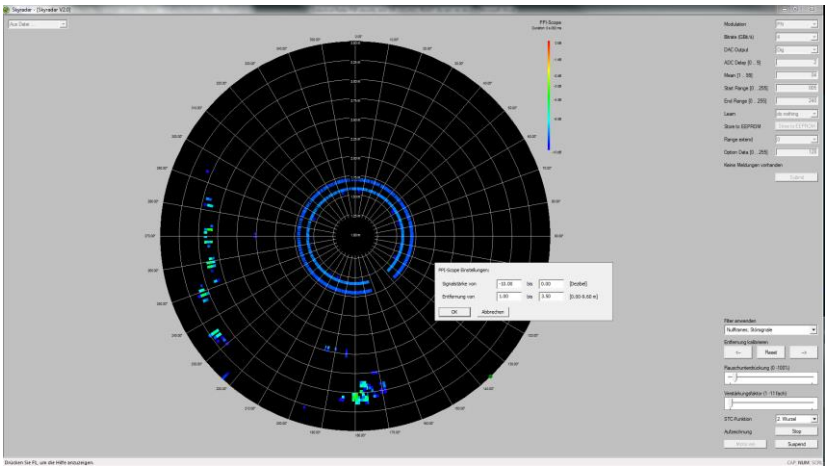

Figure 8: Plan-Position-Indicator (PPI-Scope) with configuration windonw

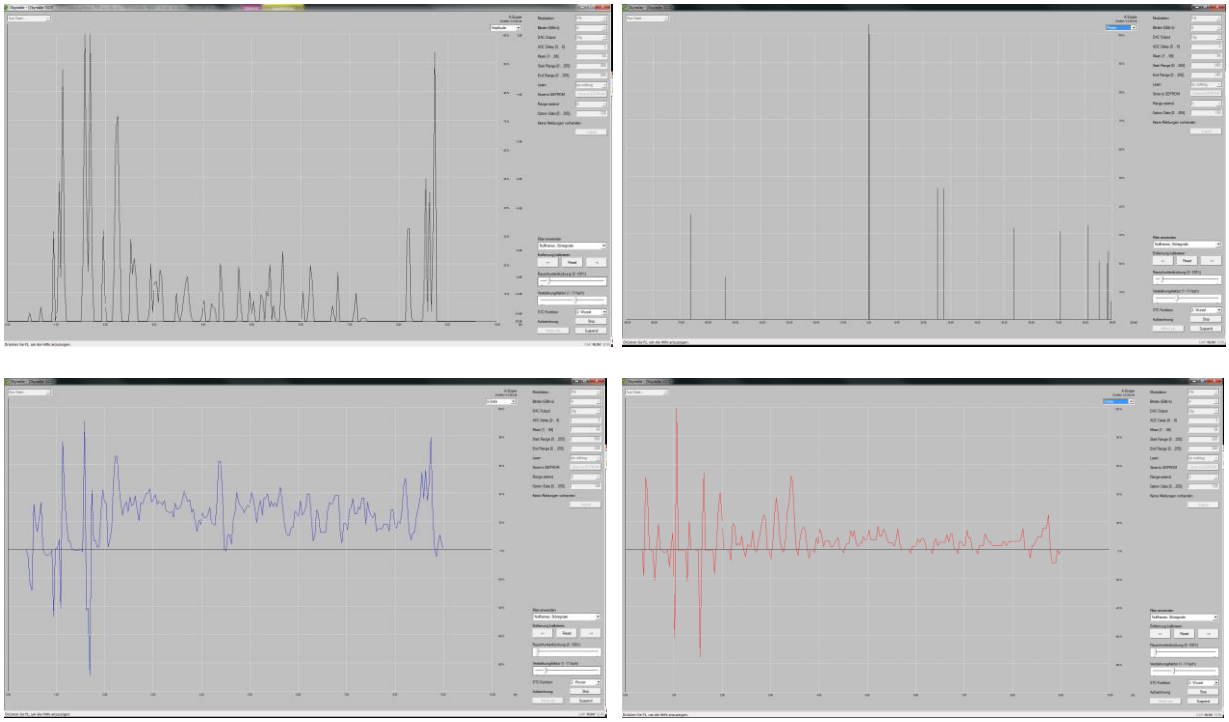

Figure 9: A-Scope (clockwise from tope left: Amplitude, Phase, I-Data, Q-Data)

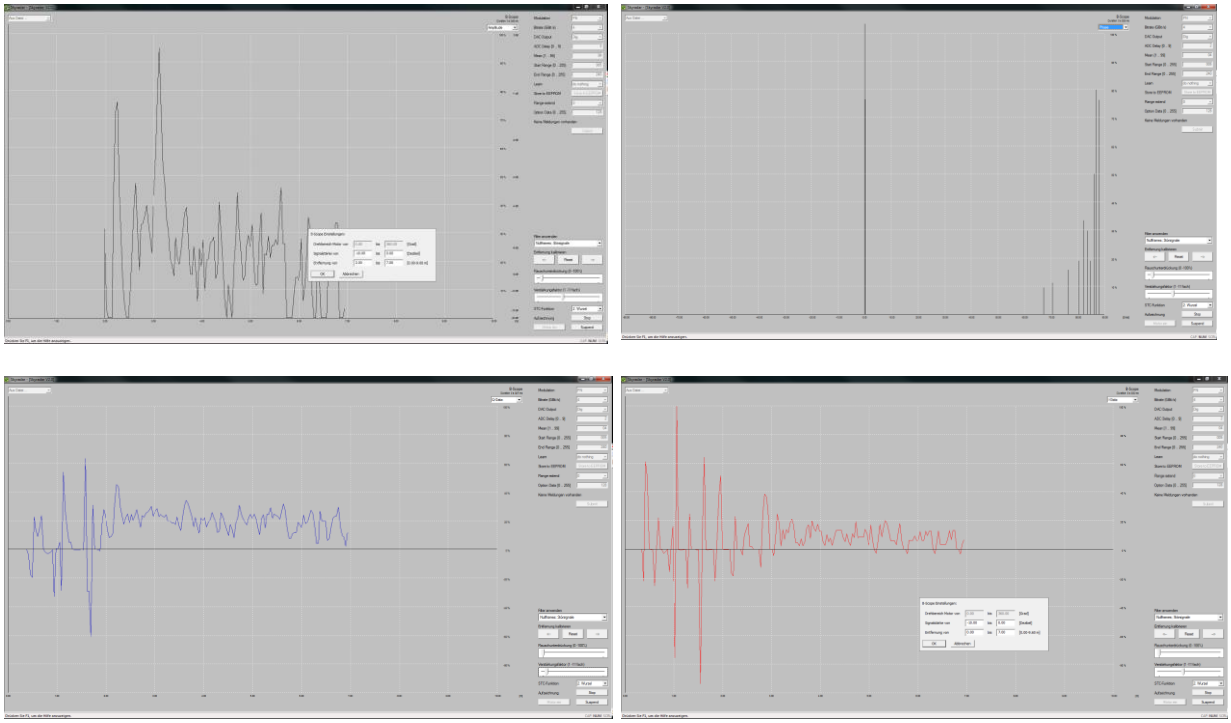

Figure 10: B-Scope (clockwise from tope left: Amplitude, Phase, I-Data, Q-Data)

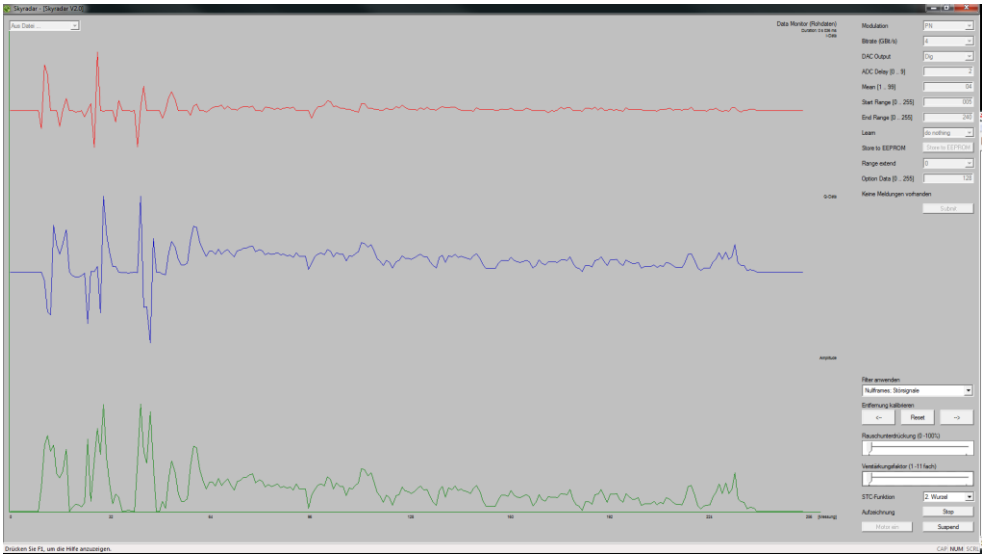

Figure 11: Raw Data Representation over Time (milli seconds)

3 SkyRadar SkyRadar Base Unit (CW, Pulse and Doppler)

Part #: SkyRadar PSR-Base-Ver.5.0

Description

Figure 12: SkyRadar Base Unit.

The base unit of the SkyRadar Modular Radar Training System provides a fully operational close range radar. Technically it is based on a pulsed noise radar. It is operatable in CW, Doppler and Pulse mode. The SkyRadar *base unit* allows for experiments ranging from basic working principles like validating the radar equation to most complex radar scenarios. The system operates with the SkyRadar Scopes Software which provides many scopes (A-Scopes, B-Scopes, PPI), control interfaces and filters). The unit allows highest flexibility in the learning process, while providing high-resolution at close distance with an electro-magnetic emission of a small fraction of that of a mobile phone (see Table 3). For details on SkyRadar Scopes see Chapter 2. The system comes with two horn antennae that can be plugged on the system. Other antennae types are in preparation.

Parts

The PSR Module consists of:

- one (1) mounted pair of horn antennas
- one (1) base unit, including
  - one (1) digital signal processing unit (DSP)
  - one (1) transceiver
  - one (1) motor control unit (only activated when rotary unit is added)
- One (1) cable set.

Prerequisites

- Computer with latest HTML5 enabled browser. Current versions of Chrome, Firefox, MS Internet explorer, Opera and Safari are able to read HTML5.
- SkyRadar FreeScopes (comes free with the SkyRadar Base Unit, see Chapter 2).

Extensions

- SkyRadar Rotary Tripod (Chapter 4)
- SkyRadar Parabolic Reflector (Chapter 5)
- SkyRadar Cloud Server (Chapter 6)
- SkyRadar Target Tracking (Chapter 7)
- SkyRadar Security (Chapter 8)
- SkyRadar Target Subsystems (Chapter 9)
- SkyRadar Secondary Surveillance Radar (see catalog)

At the heart of the system, the server card controls a constant wave radar. The transmitter can emit very short pulses through the antenna and monitor the reflected pulses. The pulses are reflected of fixed objects (buildings, trees...) and moving objects (cars, people...) which pass the antenna beam. The SkyRadar *Modular Radar Training System's Base Unit* provides the opportunity to study Doppler effects.

The signals are digitally processed using a Digital Signal Processor (DSP), data is depicted through the analysis and visualization software SkyRadar Scopes.

Figure 14: SkyRadar Base Unit.

3.1 SkyRadar *Base Unit* Hardware Features

- Active radar, designed for perfectly save indoors and outside operation (transmitter output power significantly lower as such of a mobile phone, see Table 3)
- The following operating modes can be technically enabled in the hardware
    - Constant Wave (CW)
    - Doppler
    - Pulse
- Antenna
    - Standard: Double Horn Antenna
    - Default operation 24 GHz
    - Antennae can be exchanged in plug-and play concept; see Figure 17.
- Powerful and fast radar image processor.
- All measurements are performed in real time. No sub-sampling or substitution techniques.
- Optimized for detection of real targets in a 3-dimensional space within laboratories or outside (see Chapter 9, including moveable targets (9.1), remote controlled remote controlled aircrafts. No limiting target table or rail system required.
- Large variety of radar applications:
- Clutter processing e.g., through Sensitive Time Control (STC),
- Radar Cross Section (RCS) analysis allowing for an understanding of the varying detectability of objects based on material, absolute and relative size, reflection angle, distance and strength of the signal.
- Allows analyzing performance and false alarm tolerances through adjustment of the sensitivity.
- Adjustable decision threshold allowing for experiments on background noise.
- And more…

Figure 15: SkyRadar Base Unit with Horn Antennae

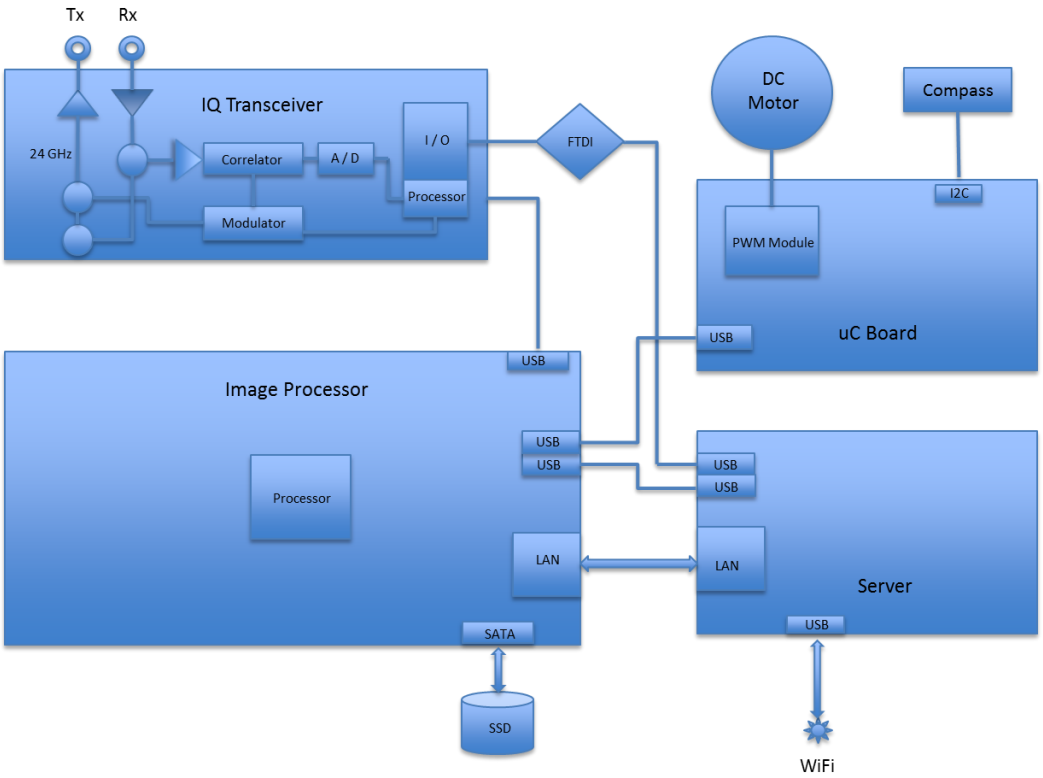

Figure 16: Connection Diagram SkyRadar PSR.

Figure 17: Userexchanges an antenna plug and play in seconds

Figure 18: Motherboard with image processor

Range extension, factor	**1**	**1**	**1**	**1**
Carrier frequency	4 Ghz	3 Ghz	2 Ghz	1 GHz
Resolution	3,75 cm	5, cm	7,5 cm	15 cm
at a distance of	10 m	13 m	19 m	40 m
range extension factor up to	8	8	8	8
Tracking rate	8 ms	8 ms	8 ms	8 ms

Table 1: Horn antenna without reflector

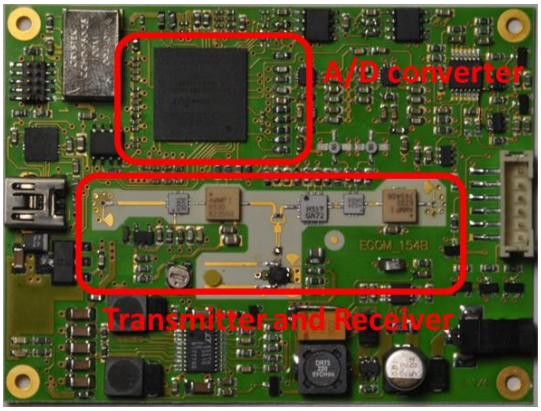

Figure 19: Transceiver Unit

Supply Voltage	**24V**
Supply Current	300 mA
Operating Temperature	-20 … + 60 °C

Table 2: General operative characteristics of the Transceiver

Carrier Frequency	24 Ghz	24,125 GHz	24,250 Ghz
Transmitter Output Power:	-6dBm	-2 dBm	+2 dBm
Transmitter Output Power:	0,25 mW		1,58 mW*
Spectral Width	20 GHz	…	28 GHz
Spectral Density	-30 dBm	-30 dBm	-30 dBm
Frequency Drift vs Temperature	-0,3 Mhz / °C	-0,3 Mhz / °C	-0,3 Mhz / °C
Spurious emission	-30 dBm	-30 dBm	-30 dBm

Table 3: Operative characteristics of the Transmitter (subsection of the Transceiver)

Antenna Gain Horn Antenna without Parabolic Reflector	17 dBi
Sensitivty	- 91 dBm
Overall Sensitivity	-106 dBc

Table 4: Operative characteristics of the Receiver (subsection of the Transceiver)

Figure 20: Horn antenna unit

4 SkyRadar Rotary Tripod

Part #: SkyRadar PSR-Rotary-Ver.5.0

Figure 21: Rotary Tripod with motor slip ring for electrical transmission

Description

To allow for 360° (endless) PPI rotation, swivel modes or target tracking, SkyRadar provides a rotary tripod, equipped with a slip ring for electrical transmission and powered by a DC Motor. The unit also includes a compass.

Parts

- Tripod with implemented DC-Motor and slip ring
- Power Supply Unit with DC cable
- AC-Supply cable
- Compass
- License to use the motor control unit which is embedded in the base unit (3.1)

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes

Extensions

- whole Family of SkyRadar Modular Radar Training System

4.1 Hardware specification

Design	I²C
Data update frequency:	75 Hz
Buffer	45 samples
Complete refresh of the buffer every	640 milliseconds
Rawdata from the magnetometometer and accelerometer available every	13,3 milliseconds
Measured movements	x, y, z orthogonal positions as well as pitch and roll movements
Number of sensors	3
Resolution	0,1° (= 3600 Measurement points per revolution)

Table 5: Operative characteristics of the Compass

5 SkyRadar Parabolic Reflector

Part #: SkyRadar PSR-Parabol-Ver.5.0

Description

A stainless steel parabolic reflector calibrated and optimized. The reflector is placed on a variable mounting with adjustable slope angle. It allows for experimental verification

Figure 22: Parabolic Reflector with Mounting

Parts

- Calibrated reflector
- Adjustable mounting

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes
- SkyRadar Rotary Tripod

Extensions

- whole Family of SkyRadar Modular Radar Training System

6 SkyRadar Cloud Server

Part #: SkyRadar PSR-Cloud-Ver.5.0

Description

The SkyRadar Cloud Server is part of the SkyRadar Modular Radar Training System. It operates as relay server, meaning it routes data messages between one or several radar devices and the clients who access the radars through the SkyRadar Scopes or FreeScopes Software.

Figure 23: SkyRadar Cloud Server

The sever allows to connect the radar systems to university networks, to learning management systems (e.g., Moodle or Blackboard) and it lowers the traffic load on the radar systems.

Depending on the hardware configuration of the server and the bandwidth of the university's or academy's network, the number of concurrent users can be increased in an unlimited way.

Parts

- One (1) Hardware server (configuration depending on customer requirement) with LINUX operating system
- One (1) SkyRadar Cloud Server software

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes

Extensions

- whole Family of SkyRadar Modular Radar Training System

7 SkyRadar Target Tracker

Part #: SkyRadar PSR-MTI-Ver.5.0

Description

SkyRadar Target Tracker is a fully automated target tracking device. Applying the Moving Target Indication Procedure, it discriminates targets against clutter. Indicated targets are automatically tracked. For this, the radar antenna works in pivoting mode..

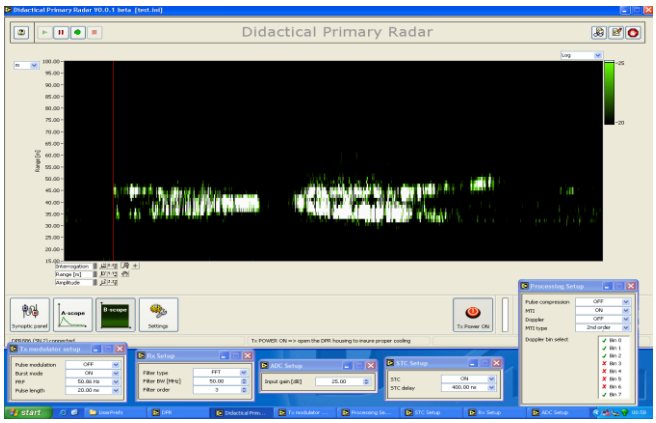

Figure 24: The radar immediately tracks the target movement.

Parts

The Target Tracker consists of:

- One (1) license for Target Tracking activation

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes
- SkyRadar Rotary Tripod

Extensions

- whole Family of SkyRadar Modular Radar Training System

7.1 SkyRadar Target Tracking Software

The Module has the following features:

- Multi-functional Moving Target Detector (MTD) function (using Doppler radar)
- Multi-functional Moving Target Indicator (MTI) function
- Fully automatic tracking of indicated target through the antenna, operating in pivoting mode
- Target Plot creation and display, see Figure 24

The software provides various features to configure afterglow and target indication. Target indication can be done automatically or through manual indication.

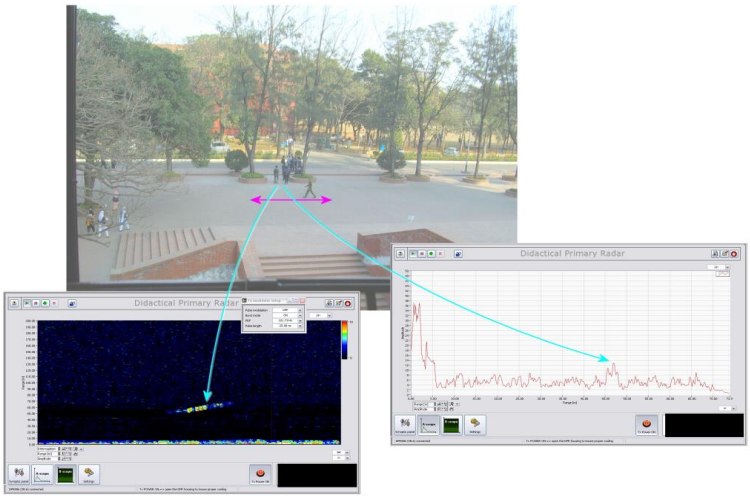

Figure 25: Moving target indication (MTI) of a moving group of people vizualized in a B-Scope (left) and an A-Scope (right)

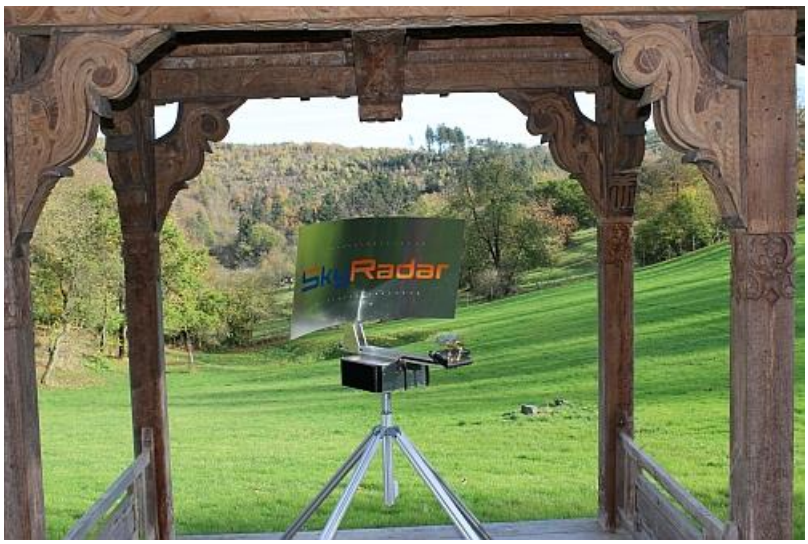

Figure 26: Radar in tracking mode

8 SkyRadar Security Module

Part #: SkyRadar PSR-Security-Ver.5.0

The Security module builds on the PSR Module and is made for homeland security and military oriented radar training. It allows training on Electronic Counter Measures as well as Electronic Counter Counter Measures.

Parts

The Security Module consists of:

- One (1) Computer-controlled hardware jammer for Electronic Counter Measure (ECM)
- Electronic Counter Counter Measure Functionalities (ECCM)
- One (1) Antenna
- One (1) Laptop with SkyRadar Security Software installed
- One (1) software license

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes

Extensions

- whole Family of SkyRadar Modular Radar Training System

The Security Module comprises of a hardware based target generator, which is able to create ghost targets. The system is connected to a Laptop. Supported by a configurator software, it serves as hardware jammer to create disturbances. The Security Module further includes Electronics Counter Counter Measure functionalities (ECCM). Various exercises can be conducted on the system to react on the multiple possible attack strategies through jammers and ghost targets.

8.1 Features

The Jammer is an 8 patch Doppler module with an asymmetrical beam for short distance applications. It is connected to a PC, where the SkyRadar Security Software generates disturbances and ghost targets. With its IF bandwidth from DC to 50MHz it opens many new applications. Many applications are possible thanks to the unique SkyRadar oscillator design. This allows using this module even in ranging applications

- 24 GHz K-band miniature transceiver
- 180MHz sweep FM input
- Dual 4 patch antenna
- Single balanced mixer with 50MHz bandwidth
- Beam aperture 80°/34°
- 15dBm EIRP output power
- 25x25mm2 surface, 6mm thickness

Parameter	Conditions / Notes	Symbol	Min	Typ	Max	Unit
Operating conditions						
Supply voltage		V_{cc}	4,75	5,00	5,25	V
Supply current	VCO Pin open	I_{cc}		35,00	45,00	mA
VCO input voltage		U_{vco}	-0,50		2,00	V
VCO pin resistance	Driving voltage source	R_{vco}		570,00		Ω
Operating temperature	Top		-20,00		60,00	°C
Storage temperature	Tst		-20,00		80,00	°C
Transmitter						
Transmitter frequency	VCO pin left open, Tamb=-20°C .. +60°C	f_{TX}	24050	24125	24250	GHz
Frequency drift vs temperat.	Vcc=5.0V, -20°C .. +60°CNote2	Δf_{TX}		-1,00		MHz/°C
Frequency tuning range		Δ fvco		180,00		MHz
VCO sensitivity		Svco		-80,00		MHz/V
VCO Modulation Bandwidth	Δf=20MHz	B_{VCO}		3,00		MHz
Output power	EIRP	P_{TX}	12,00	15,00	17,00	dBm
Output power deviation	Full VCO tuning range	ΔP_{TX}			+/- 1	dBm
Spurious emission	According to ETSI 300 440	P_{spur}			-30,00	dBm
Turn-on time	Until oscillator stable, ΔfTX < 5MHz	t_{on}		1,00		µs
Receiver						
Mixer Conversion loss	fIF = 1kHz, IF load = 1kΩ	D_{mixer1}		-6,00		dB
	fIF = 20MHz, IF load = 50Ω	D_{mixer2}		-11,00		
Antenna Gain	FTX=24.125GHz	G_{Ant}		8.6		dB
Receiver sensitivity	fIF =500Hz,B=1kHz,RIF =1kΩ,S/N=6dB	P_{RX1}		-96,00		dBm
	fIF =1MHz,B=20MHz,RIF =50Ω,S/N=6dB	P_{RX1}		-84,00		dBm
Overall sensitivity	fIF =500Hz,B=1kHz,RIF =1kΩ,S/N=6dB	D_{system}		-111,00		dBc
IF output						
IF resistance		RIF		50,00		Ω
IF frequency range	-3dB Bandwidth, IF load = 50Ω	f_{IF}	0,00		50,00	MHz
IF noise power	fIF =500Hz, IF load = 50Ω	$P_{IFnoise1}$		-134,00		dBm/Hz
fIF =1MHz, IF load = 50Ω	PIFnoise2			-164,00		dBm/Hz
IF noise voltage	fIF =500Hz, IF load = 1kΩ	$U_{IFnoise1}$		-147,00		dBV/Hz
fIF =500Hz, IF load = 1kΩ	UIFnoise1			45,00		nV/√Hz
IF output offset voltage	Full VCO range, no object in range	U_{IF}	10,00		200,00	mV
Supply rejection	Rejection supply pins to IF output	D_{supply}		26,00		dB
Antenna						
Horizontal -3dB beamwidth	E-Plane	W_{φ}		80		°
Vertical -3dB beamwidth	H-Plane	W_{θ}		34		°
Horiz. sidelobe suppression		D_{φ}		-12		dB
Vertical sidelobe suppression		D_{θ}		-12		dB
Body	5pin single row jumper					
Outline Dimensions	25*25*6					mm^3

Table 6: Features of the SkyRadar EW Jammer

8.1.1 Antenna System Diagram

The antenna system diagram shows module sensitivity in both azimuth and elevation directions. It incorporates therefore the transmitter and receiver antenna characteristics.

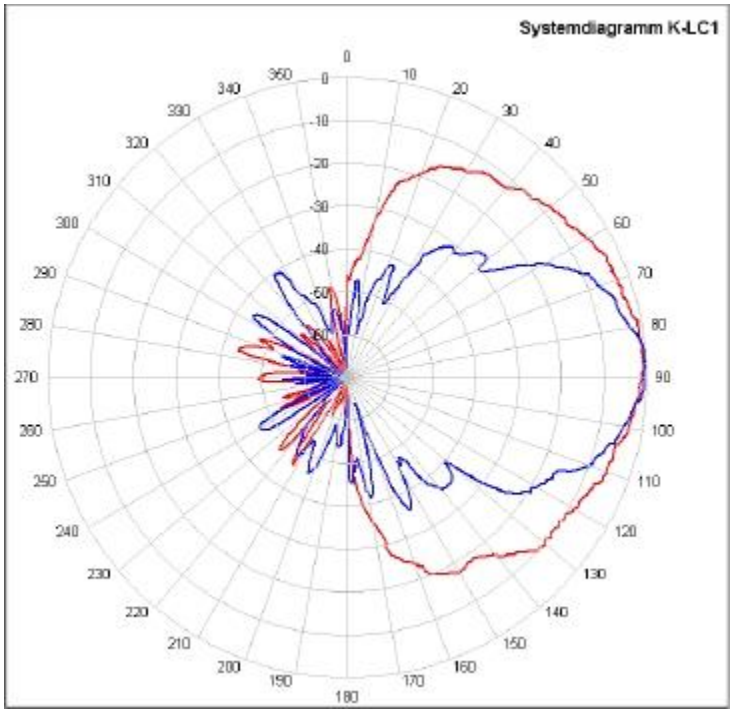

Figure 27: System diagram of SkyRadar EW Jammer

8.1.2 FM Characteristics

VCO Voltage generates an output signal even without an object in range because of the finite isolation between transmitter and receiver path. This effect is called selfmixing and leads to a DC signal that depends on the carrier frequency / the VCO voltage.

8.1.3 Pin Configuration

Pin	Description	Typical Value
1 *)	nc	---
2	VCC	5VDC supply
3	IF output	load 1kOhm
4	GND	ground
5 *)	VCO in	Open = f_0

9 Target Subsystems

To insure the highest possible learning outcome, SkyRadar works with remote controlled moveable targets. The set includes a chain-driven, highly versatile moveable target unit, a remote controlled controlled quadcopter. All of our radar subsystems can make use of these systems. We strongly advise against limiting target tables or rail-based systems which are available from many suppliers in the market, as they do not come close to any realistic setting!

9.1 Moveable Target Positioning System

Part #: SkyRadar PSR-Target-Ver.5.0

For inside and outside experiments the chain-driven remote controlled moveable device for inside applications is able to move freely in the laboratory without any of the limitations of a target table or a rail system.

Figure 28: Remote controlled moveable target with 3 different reflectors.

Parts

The Moveable Target Positioning System consists of:

- One (1) remote controlled track vehicle including batteries
- One (1) remote control including batteries
- One (1) pod with mounting possibility
- Three (3) targets

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes

Extensions

- whole Family of SkyRadar Modular Radar Training System

Features

- The subsystem can position targets precisely through a comfortable remote control device. In contrast to traditional target tables, the target is not spatially limited.
- The sub-system is able to carry various radar targets easily connectable to the target system without the requirement of any tools.
- Different targets representing various radar cross-sections (RCS) are supplied with the Radar Training System, including a corner reflector (retro-reflector) consisting of three mutually perpendicular, intersecting flat surfaces.
- The drive control system is designed to comply with the current requirements of the current European and national guidelines. A chain-drive insures highest maneuverability to support all possible trajectories. It includes:
- A servo-drive system operating with highly versatile chain-drives.
- Built-in BEC system supplying the connected receiver incl. servo with the necessary voltage.
- A control LED on the front of the drive control system informing on the corresponding control state of the drive control system during operation and adjustment.

9.2 Remote Controlled Quadcopter

Part #: SkyRadar PSR-Quad-Ver.5.0

In particular for Air-traffic-control or homeland-security-oriented use, the system includes a remote quadcopter model.

Figure 29: Remote controlled Quadcopter, taking off.

Parts

The Moveable Target Positioning System consists of:

- One (1) remote controlled quadcopter including rechargeable batteries
- One (1) remote control including batteries

Prerequisites

- SkyRadar Base Unit
- SkyRadar FreeScopes

Extensions

- whole Family of SkyRadar Modular Radar Training System

Figure 30: Remote controlled Quadcopter in static position.

10 Teaching Curricula and Documentation

An important part of the SkyRadar modules is the professional documentation and the detailed teaching curriculum. In the frame of train-the-trainer seminar, our specialists train experts on the customer side in effectively using our system and curriculum documents to allow them to meet their overall training requirements.

The SkyRadar teaching material (in English Language) consists of:

- A curriculum for the train-the-trainer seminar
- The transparency hand outs (on CD ROM) from the Train-the-Trainer Seminar. They can be used and adapted unlimited in time within the training purposes of your academy.
- Training Manuals with Defined Learning Objectives and detailed content.
- Test Manuals
    - Students' versions,
    - Teacher versions which include the answers and potential side comments.
    - Product Manuals. Those are the user manuals which explicitly explain how to use a specific SkyRadar training hardware and software.

11 Terms of Delivery

The modules come in a plug-and-play ready to operate way. It is accompanied by an operating manual written in English. SkyRadar experts will lead the initial, local commissioning and provide training. Details are subject to a written contract between SkyRadar and the beneficiary. The Terms and Conditions, described in Chapter 12 apply.

12 Terms and Conditions

SkyRadar provides a system to teach, research and experiment on Radar Technology. By using SkyRadar's software (defined below), the Customer agrees to comply with and to be legally bound by these terms and conditions. These Terms govern the ownership and the use of the SkyRadar system, the SkyRadar proprietary software and content (defined below), third party software (defined below) as well as all Customer software (defined below), and constitute a binding legal agreement between the Customer and SkyRadar.

Definitions

- SkyRadar stands for the SkyRadar Consortium, legally represented in this project by The SkyRadar Consortium, M - Engineering UG, Am Schmachtenberg 11, 58636 Iserlohn, Germany.
- SkyRadar System is the entirety of hardware, software and content provided by SkyRadar.
- SkyRadar Proprietary Software embraces all code that SkyRadar provides with the system at time of installation or through updates, excluding any third party software, services, APIs or content. It explicitly includes the configuration of third party software.
- SkyRadar Content embraces all educational material as well as technical documents and guidelines, provided by SkyRadar.
- Third Party Software and Content embraces all code and content provided with the system at time of installation or through updates, which is of third party origin (e.g. operating system, dlls).
- SkyRadar Software Applications is SkyRadar Proprietary Software or Third Party Software deployed within the SkyRadar System and made accessible via a user interface. In those software applications, all code is non-accessible to the end user, apart from the code delivered to the browsers of the client computers.
- Customer Software embraces all code produced by the Customer that interacts with the externalized standard interfaces, provided by SkyRadar.

Eligibility

The SkyRadar system is intended solely for the use of education, experimentation, research and data acquisition. Any access to or use of the system, software or content in an operational context, may it be air traffic control or military purposes, is prohibited.

Ownership

The Customer purchases the SkyRadar system in the configuration as specified in the corresponding technical offer. The SkyRadar system is protected by copyright, trademark, and other laws of Germany. The Customer acknowledges and agrees that all associated intellectual property to the SkyRadar system and related software or documents is the exclusive property of SkyRadar and its third party providers. The Customer will not remove, alter or obscure any copyright or other proprietary rights notices incorporated in or accompanying the SkyRadar system, SkyRadar Proprietary Software and Content, or Third Party Software and Content.

Usage of SkyRadar Proprietary Software

- According to the Customer's compliance with the terms and conditions of these Terms, SkyRadar grants the Customer a limited, non-exclusive, non-transferable right and license to use the SkyRadar proprietary software and content described above solely in the manner and for the purpose described in these Terms. The Customer purchases the right and license to use the provided software. Therein, neither the time of use nor the number of concurrent users is limited. The latter, however, is limited by the system's technical capacity of handling concurrent users and concurrently instantiated applications.
- The Customer shall not make any modification to the SkyRadar proprietary software without written permission by SkyRadar.
- The Customer may copy any of the provided proprietary software and content for backup purposes only and for the exclusive use of the Customer. Copies produced to be handed out to third parties are explicitly not permitted.
- The Customer must not sell or sublicense the proprietary software and content without written permission of SkyRadar. He may however sell the SkyRadar System in its entirety. He is also entitled to apply the SkyRadar System including its software and content in the context of commercial services or consulting. In particular, he has the right to train third parties (e.g. RAF) and to use the equipment for industrial research projects.
- For the purpose of training, education or advertisement, the Customer may provide students and non-subscribed external users with access to the Software Applications or parts thereof via internal networks or via the Internet.
- The Customer is entitled to use the proprietary software to operate at own risk third party antennae or software, when using the provided standard interfaces.
- The Customer owns all data produced with the software (e.g. radar raw data) and with connected radar equipment.
- The Customer is solely responsible for compliance with any and all laws, rules, regulations, and other obligations that may apply when using the SkyRadar system. SkyRadar explicitly points to the restrictions concerning the emitting of secondary surveillance frequencies (in particular carrier frequency 1030/1090 MHz).
- When using screen-prints, generated with SkyRadar Software Applications, the Customer shall include the following legend in all media: "www.SkyRadar.com"

Terms and Conditions for Third Party Software

SkyRadar respects copyright law and does not claim any ownership rights over Third Party Software. SkyRadar expects its Customers to do the same. For all third party software (e.g. operating system), the terms and conditions account as communicated by the license owner.

Terms and Conditions for Customer Software

The Customer owns all rights for Customer software. The Customer acknowledges and agrees that he is solely responsible for Customer software, in particular for any damage caused to the system by Customer Software.

Indemnification
The Customer agrees that SkyRadar, its subsidiaries, officers and employees, will not be held responsible for any third party claim, demand, or damage, including reasonable attorneys' fees, arising out of the Customer's use of the system.

Salvatory Clause
In case that a specific clause in the contract is invalid the validity of the remaining clauses is not affected. The Customer and the SkyRadar will work together to replace inapplicable paragraphs s as far as possible.

Controlling Law and Jurisdiction
These Terms will be interpreted in accordance with the laws of the Federal Republic of Germany.