

# NextGen 8 GHz Pulse Radar - Data Sheet

## Overview

SkyRadar's 8 GHz Pulse radar emits in the X-band, the band used by ATC Area Control Radars, but also by the military and the marine. The transmitter can emit very short pulses through the antenna and monitor the reflected pulses. The pulses are reflected of fixed and moving objects.

The signals are digitally processed using a Digital Signal Processor (DSP), data is visualized through the analysis and visualization software SkyRadar FreeScopes. With a range resolution better than 10 cm and a pulse width of 0.5 nsec it is the most accurate training pulse radar in the market. The number of concurrent users practicing independently is not limited.

## General Features

- Active radar, designed for perfectly safe indoors and outside operation (transmitter output power significantly lower as such of a mobile phone).
- The following operating modes can be technically enabled in the hardware
  - Pulse Mode
  - Doppler Mode
- Antenna hardwired on the transceiver card
  - Default operation 8 GHz
  - Parabolic reflector can be added to focus the antenna beam
- Powerful and fast radar image processor.
- All measurements are performed in real time. No sub-sampling or substitution techniques.

## Basic Configuration

The system comes in its basic configuration with NextGen 8 GHz FreeScopes Basic I, providing features like

- Tx Power Control
- FFT
- Threshold limiter
- STC
- Contrast

The users are enabled to do manipulations independently on their computers. Free floating panels of the FreeScopes Control Center allow each student to set up his own signal conversion chain, analyzing raw data, data after FFT, STC etc.

## Possible Exercises

The following subjects can be trained with the system, depending on the included FreeScopes Packages:

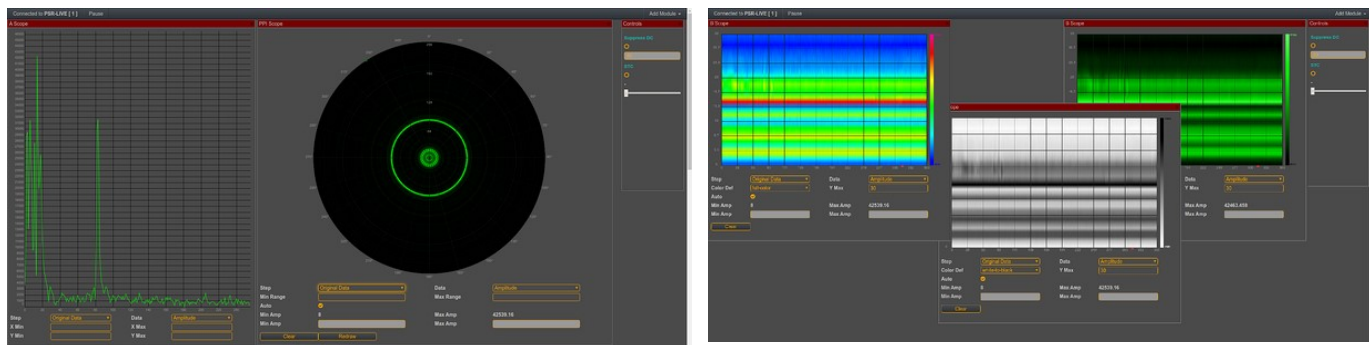
- Experiments on Pulse and Emission Power
- Experiments on A-Scope, B-Scope and Plan-Position-Indicator (PPI)
- Calibrating a radar using amplification, filters and settings
- Experiments in a fixed position as well as through panning and rotation (rotary tripod required)
- Doppler Effect
- Fast Fourier Signal Transformation (FFT) and its effects.
- Clutter processing e.g., through Sensitive Time Control (STC), Threshold limitation or C-FAR
- 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.
- Moving Target Indication for clutter elimination
- Machine Learning (Artificial Intelligence) for image interpretation
- And much more.

## System Extensions

The system can be supplied in a package with several extensions of FreeScopes or it can be extended progressively:

- NextGen 8 GHz FreeScopes Basic II with Moving Target Indication (MTI), C-FAR. RCS
- NextGen FreeScopes ATC including radar plots, radar tracks and enhanced MTI
- NextGen Artificial Intelligence I including AI Solutions for image and pattern recognition (in preparation, expected summer 2020)
- NextGen Pulse Manipulation allowing for changes of pulse width, pulse compression (simulated within the FreeScopes software on the real signals, in preparation, expected summer 2020).
- Next Gen 8 GHz Beam Controller allowing to practice beam forming (in preparation)
- Programming Interface from FreeScopes to MATLAB, PYTHON and other numerical computing environments.

27 / 04 / 2020



## System Features

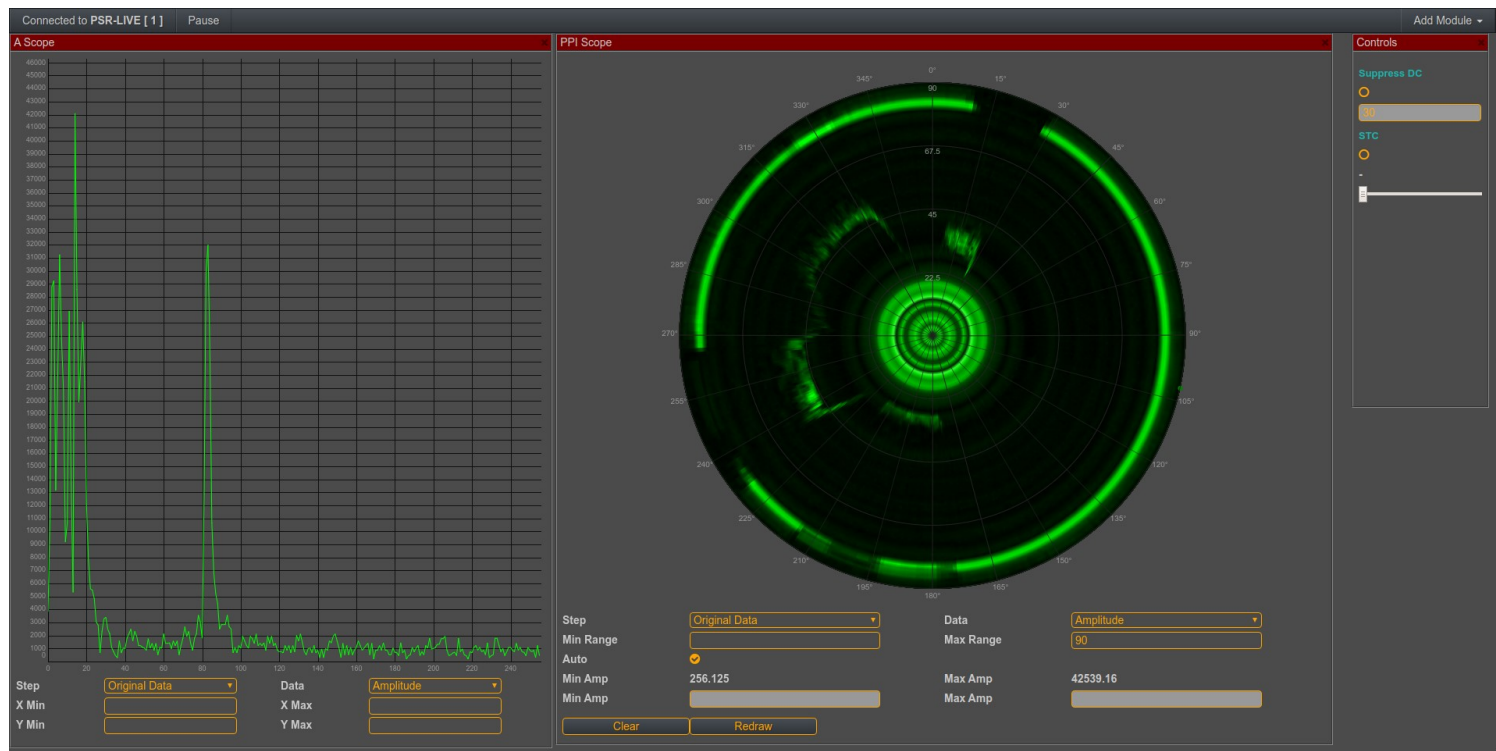
Overview of the key technical features:

- Range Resolution: better than 10 cm
- Range: up to 25 m
- Tx center frequency (ETSI): 7.29 GHz
- Tx bandwidth (ETSI): 1.4 GHz
- Pulse Width: 0.5 nsec
- Peak Pulse output power (ETSI): -0.7 - 6.3 dBm
- Tx output power is variable (low, medium, high)
- Pulse repetition frequency (PRF) is variable
- Max pulse repetition frequency. 40.5 MHz
- Rx sampling rate: 23.3 GS/s
- Rx gain (ETSI): 12.3 - 15 dB
- Rx noise figure (ETSI): 5.4 - 8.8 dB
- Elevation: 68°
- Azimuth: 68°
- Update rate (signal processing) > 100 frames per second (fps)

<b>Power Requirements</b>	12V, 5V
<b>Maximum Range</b>	up to 25 m
<b>Maximum Sampling Rate Rx</b>	23.3 GS/s
<b>Dimensions</b>	140 mm x 143mm x 200 mm;
<b>Net Weight</b>	below 5 kg



27 / 04 / 2020



# Transmitter Features

Supply Current	100 mA
Operating Ambient Temperature	+ 10 ... + 40 °C

Table: General operative characteristics of the Transceiver

Parameter	Min	Typ	Max
Transmitter Center Frequency (ETSI / KCC)		7.29 GHz / 8.748 GHz	
Transmitter Bandwidth (ETSI / KCC)		1.4 GHz / 1.5 GHz	
Energy per Pulse (ETSI)	0.45 pJ	1.47 pJ	2.6 pJ
Peak Pulse Output Power (ETSI)	- 0.7 dBm	4.1 dBm	6.3 dBm
Pulse Repetition Frequency			40.5 MHz
Differential Output Impedance		100 Ohm	

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

## Receiver Features

Parameter	Min	Typ	Max
<b>Radar Frame Length</b>		9.87 m / 65.8 ns	
<b>Sampling Rate</b>		23.328 GS/s	
<b>Receiver Gain (ETSI)</b>	12.3 dB	14.1 dB	15.0 dB
<b>Receiver Noise Figure (ETSI)</b>	5.4 dB	6.8 dB	8.8 dB
<b>Receiver Bandwidth (- 3 dB), <math>F_{\text{low}}</math></b>	6.13 GHz	6.5 GHz	
<b>Receiver Bandwidth (- 3 dB), <math>F_{\text{high}}</math></b>		10.0 GHz	10.76 GHz
<b>Differential Input Impedance</b>		100	Ohm

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



## Delivery and Export Regulations based on European Law

SkyRadar produces products to train the civil use of radar equipment. We actively take that mission to makes this world a better and safer place. We do not provide goods which are in conflict of the dual use regulation (unless with specific written consent of the European Regulation Bodies and if the purpose is a peaceful one). SkyRadar has received a general export permit 40066564 dated 22.08.2011.

SkyRadar emphasizes that the [COUNCIL REGULATION \(EC\) No 428/2009](#) and its amendments are the only authentic legal reference and that the information in this document does not constitute legal advice.

According Paragraph 6A008, goods are subject to the above stated Regulation, when they comply to the following criteria:

Criteria	Explanation why SkyRadar does not comply to these criteria
a. Operating at frequencies from 40 GHz to 230 GHz and having any of the following: ...	The system operates at 24 GHz and operates with max 1.8 mW far below the critical threshold
b. A tunable bandwidth exceeding $\pm 6,25$ % of the 'centre operating frequency'	The bandwidth is below 1% of the centre operating frequency
c. Capable of operating simultaneously on more than two carrier frequencies	The system operates with one carrier frequency
d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode	The base module itself does not include SAR, iSAR or SLAR features.
e. Incorporating electronically scanned array antennae	The system does not work with electronically scanned array antennae. It operates either with 2 horn antennae.

The dual use regulation, in particular paragraph 6A008 does not control "Displays or monitors used for air traffic control (ATC)", as done by SkyRadar [FreeScopes](#).

Section I.1 of paragraph 6A008 addresses "Automatic target tracking" providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage. This paragraph however does not "control conflict alert capability in ATC systems". Only that is done by the SkyRadar FreeScopes software. Target tracking in terms of trajectory projection, as done by military systems is explicitly excluded and not part of the system.

27 / 04 / 2020

Paragraph 6A108 concerns Radar systems and tracking systems, other than those specified in entry 6A008. It covers Radar and laser radar systems designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104. This is not applicable to the SkyRadar training equipment.