

SeaKu

Ku Band Solid State Radar Systems for
VTS and Coastal Surveillance

PIONEERING RADAR TECHNOLOGY

Tokyo Keiki introduces a new standard of Ku Band (13.65 to 13.95 GHz) solid-state radar (SSR) systems that greatly enhance target separation and target detection performance in radar systems utilised in VTS and coastal surveillance systems.

The exceptional performance and features of Tokyo Keiki's Ku Band radar systems greatly expand the limitations of conventional X Band radar systems.

Distinguish the targets precisely

Missions enhanced with Tokyo Keiki Ku Band solid state radar systems :

- VTS (Vessel Traffic Service)
- Coastal Surveillance
- Oil & Gas Offshore Infrastructure
- Critical Infrastructure and Asset Protection
- Ocean Resource Development Infrastructure
- Port Management
- Border and Homeland Security
- Search and Rescue



Benefits

Antenna

- High gain Ku Band antenna
- Antenna length efficiencies
- Maintenance-free (lubrication not required)

Transceiver

- Tokyo Keiki-designed solid-state power amplifiers
- High Power and Robust Ku Band transceivers
- Single and dual system (for redundancy)
- Maintenance-free (no magnetron)

Signal Processing

- Combination of pulse-Doppler and clutter removal processing to suppress sea clutter, rain clutter and other interference
- STC, FTC adjustments

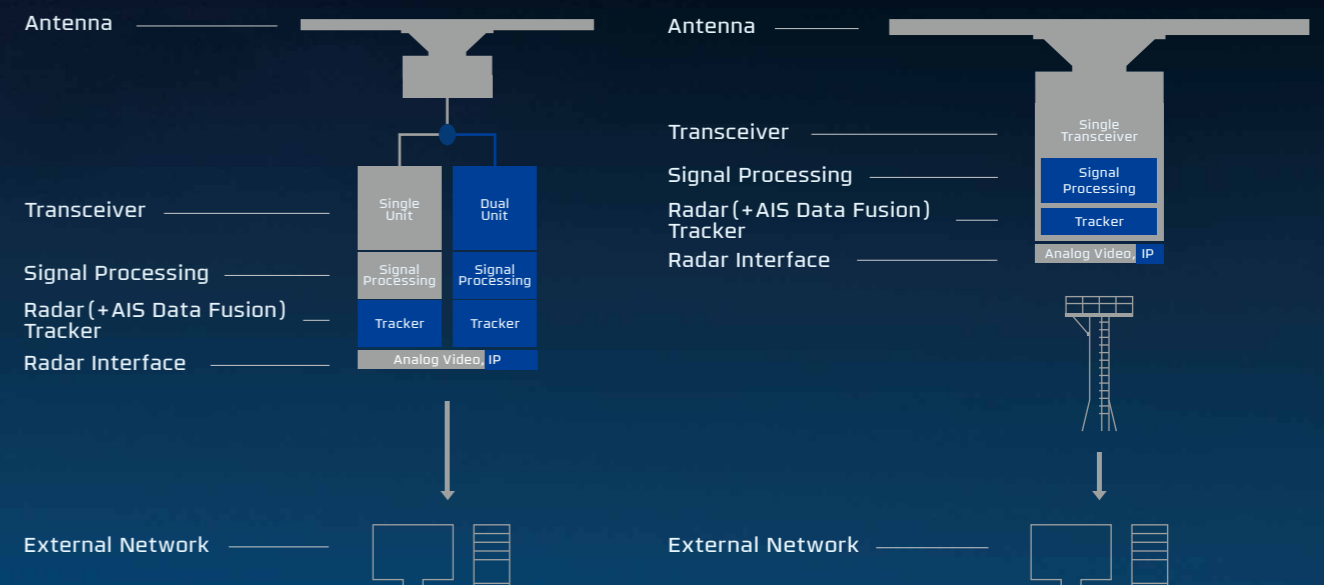
Interface

- Analog video, IP (Asterisk, Optional)



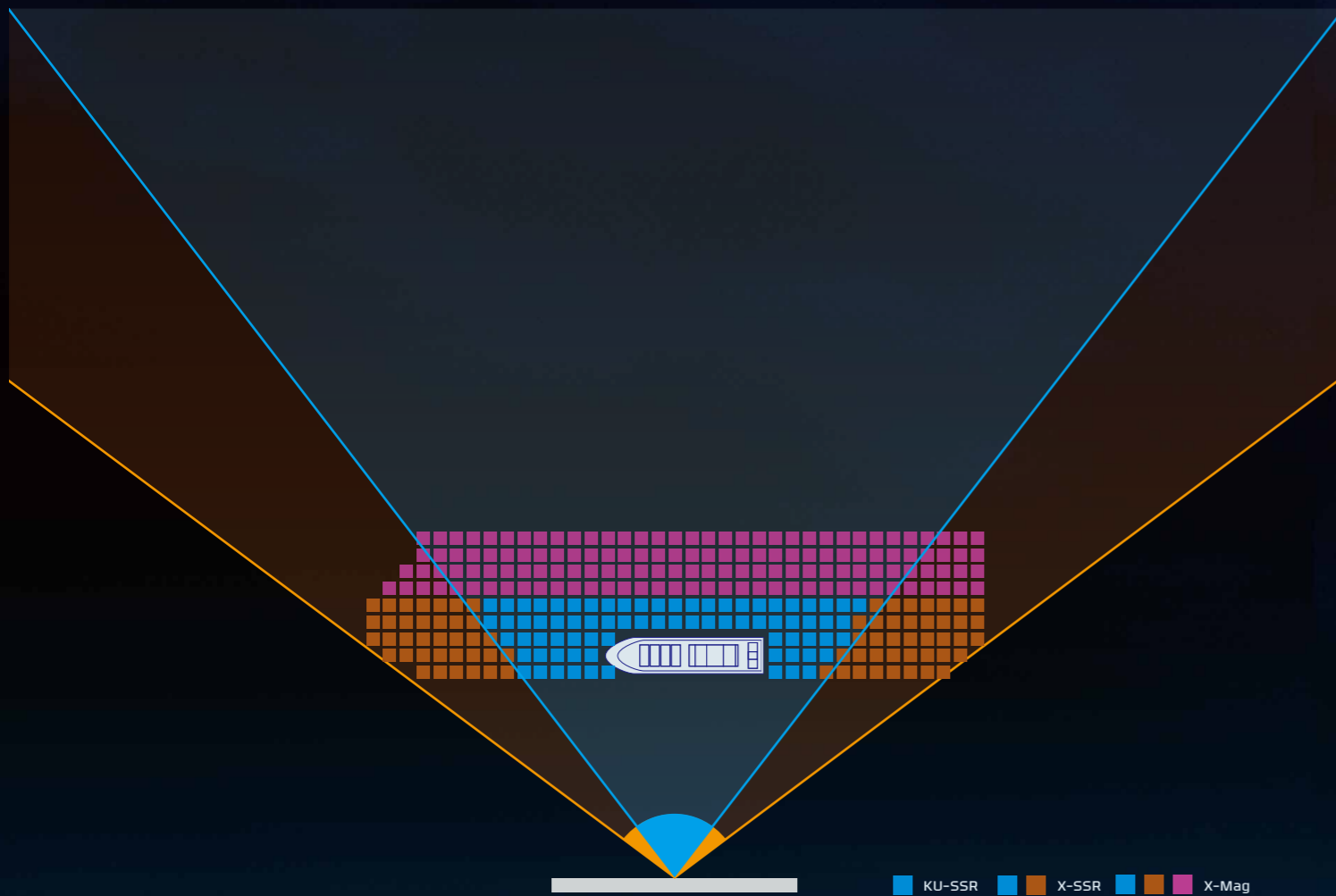
System configurations

■ Fundamental Equipment ■ Optional



The Possibilities of Ultra High Definition

Typical Radar Raw Video Comparison at Medium Range

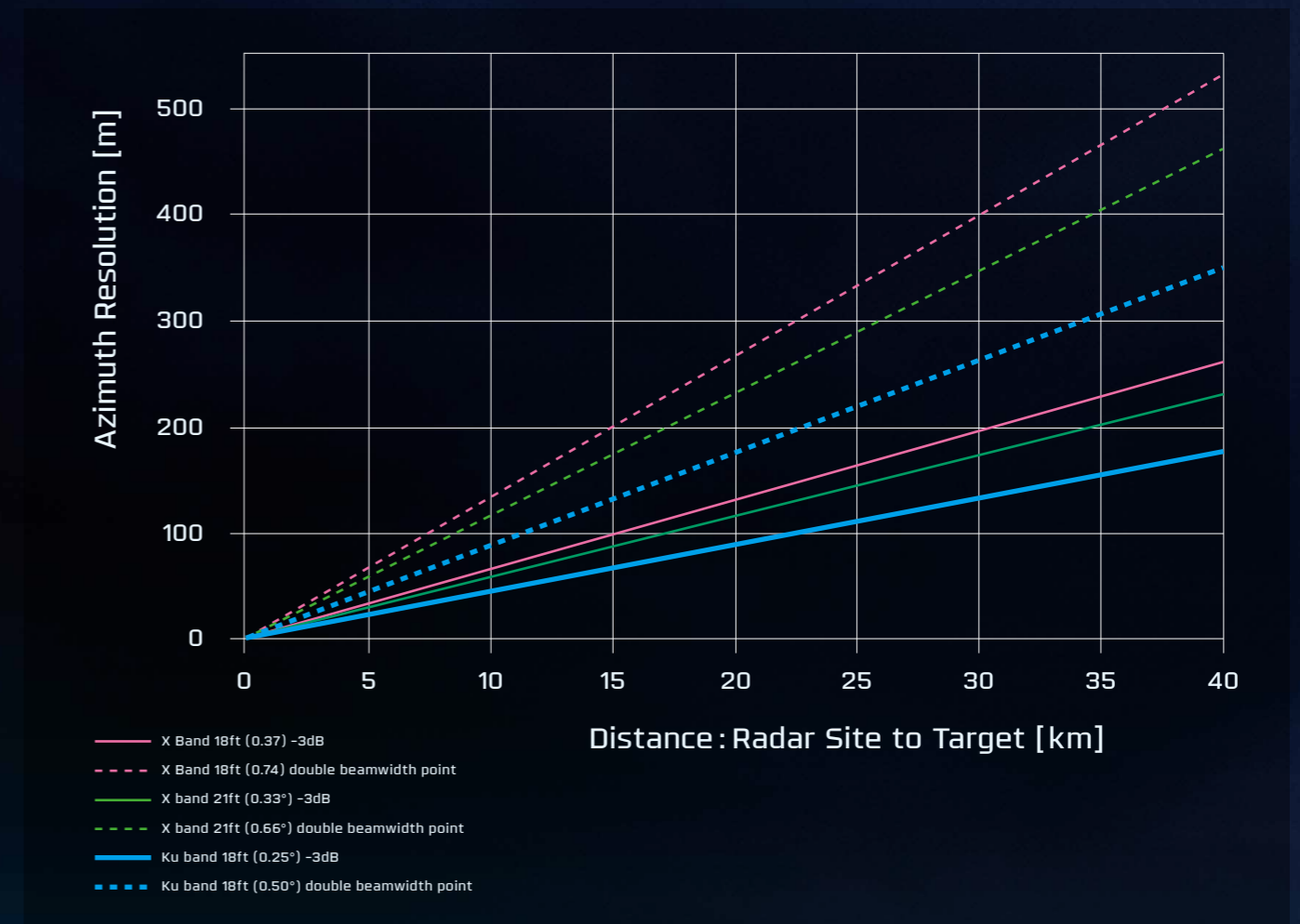


Tokyo Keiki Ku Band SSR systems' superior detection capabilities and higher separation performance are designed to satisfy the critical requirements of advanced monitoring and surveillance missions.

The capabilities and performance of the high target angular separation and high gain Ku Band antennas are superior to conventional X Band radars. The differences in detection and separation are remarkable at greater distances.

Tokyo Keiki SSR systems improve the target range separation compared to magnetron-based radar systems with optimised sharper pulse waveforms and sophisticated signal processing technology.

Theoretical comparison of Ku Band and X Band radar



The angular separation performance table of Ku Band radar with an 18ft antenna and X Band radar with an 18ft and 21ft antenna is shown in this graph. It describes angular separation performance by distance from the radar site to the target. The lower the number, the better the angular separation, which means more precise target discrimination and recognition.

Generally, the angular separation of raw radar video is described as its typical performance between the value of the horizontal beam pattern (-3dB point) and the double value of beamwidth(one-way).

We tested and verified the Ku Band radar performance in the actual field using a controlled target, which resulted in Ku Band SSR systems' superiority in angular separation.

Ku Band radar high-target separation capabilities enable better discrimination of vessels and objects in congested areas at longer distances, significantly improving mission performance.

Ku Band and X Band radar video comparison

The Ku Band SSR systems with enhanced ability to detect very small objects will increase target detection and separation to a much higher level. Compared to conventional X Band radar systems, Ku Band with high gain and narrower horizontal beamwidth antennas will achieve much higher detection and separation.



The above radar picture shows Tokyo Keiki's Ku Band radar capturing several targets in the waterway. Looking at the image's centre, you can see three vessels navigating in the northeast direction. Each of the three ships' aspects is discriminated and does not overlap.

If you turn over this page, you can see the conventional X Band radar picture, which had been installed nearby the Ku band radar. You can turn over the page and evaluate the difference, especially the three ships navigating in the northeast direction.



The radar echoes of the three ships navigating northeast overlap in the X Band radar video above. On the other hand, the Ku band radar video on the previous page identifies the echoes of the congested ships.

This comparison explains the Ku Band radar's advantage in performing better angular separation. The detailed theoretical comparison between Ku Band and X Band radar can be found in "Theoretical comparison of Ku Band and X Band radar".

Specifications

1. OVERALL

Type	Pulse compression radar systems (Solid-state radar systems)
Transmitting frequency	13.85 GHz (Option: 13.65 GHz, 13.75 GHz and 13.95 GHz)

2. ANTENNAS

Type	Slotted array		
Antenna Length	18ft	28ft (Aperture lens)	28ft
Polarization	Horizontal (HP) or Circular (CP) or Vertical Polarization (VP)		
Waveform	Fan beam	Fan beam	Quasi-inverse cosecant square
Antenna gain	$\geq 36\text{dBi}$ (CP)	$\geq 41.5\text{dBi}$ (CP)	$\geq 36\text{dBi}$ (CP)
Horizontal Beam-width (-3 dB)	0.28°	0.18	0.18
Horizontal Beam-width (-10 dB)	0.50°	0.34	0.34
Azimuth Sidelobes between $\pm 3^\circ$ and $\pm 10^\circ$	< -30 dB	< -30 dB	< -30 dB
Weight	144kg	505kg	241kg
Dimensions (L x W x H)(in mm)	5,510 x 467 x 550	8,561 x 670 x 816	8,557 x 420 x 500
Option	Lighting protection systems with lighting arrestors as a secondary lighting protection		

3. ROTATION UNITS

Type	Direct drive (rotary torque motor) (Gear-box type is also available upon request)
Rotation speed	6 to 60 rpm (programmable, limitation may apply depending on the antenna types)
Power Supply	3 ϕ AC 400V 50/60Hz
Temperature	Operational: -10°C to 50°C, Storage: -25°C to 70°C
Humidity	40% to 90% RH (relative humidity)

4. TRANSCIVERS

Type	Solid State Power Amplifier-SSPA
Output peak power	200W
Pulse width	0.08 μ S to 64 μ S
Pulse compression ratio	Up to 29dB (794:1)
Clutter suppression and discrimination	STC, CFAR, Combination of pulse Doppler processing
Minimum detection level	$\leq -96\text{dBm}$, before pulse compression
Weight	$\leq 70\text{kg}$ (Single System)
Height x Length x Depth x Width	700 x 600 x 300 mm
Power supply	1 ϕ AC 100 to 240V, 50 or 60Hz
Radio Spectrum	
Unwanted emissions in the out of band domain	TU-R SM.1541-6
Unwanted emissions in the spurious domain	ITU-R SM.329-12
Temperature	Operational: 0°C to 40°C, Storage: -25°C to 70°C
Humidity	40% to 90% RH (relative humidity)

5. INTERFACES

Signal output	Analog video, IP (Asterix, Optional)
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Design and specifications are subject to change without prior notice, and without any obligation on the part of the manufacturer.



CAUTION Before operating this equipment, you should first thoroughly read the operator's manual.

**TOKYO
KEIKI**

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<https://www.tokyokeiki.jp/Portals/0/html/mts/e/>

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March 2023 Cat.No.1480-3-E-1-H