White Paper :

Sea Tel

09 & 10 Series Maritime VSAT Antenna Systems

Marine antenna systems featuring 3 axes of stabilization and 1 axis of polarization—designed for the most demanding conditions.

Sea Tel
COBHAM

This white paper covers significant differences and similarities between 09 and 10 antenna systems from Sea Tel. The 09 and 10 series antennas are also referenced as XX09 and XX10 respectively in this paper.

Sea Tel 09 & 10 Series VSAT

Marine antenna systems featuring 3 axes of stabilization and 1 axis of polarization—designed for the most demanding conditions.

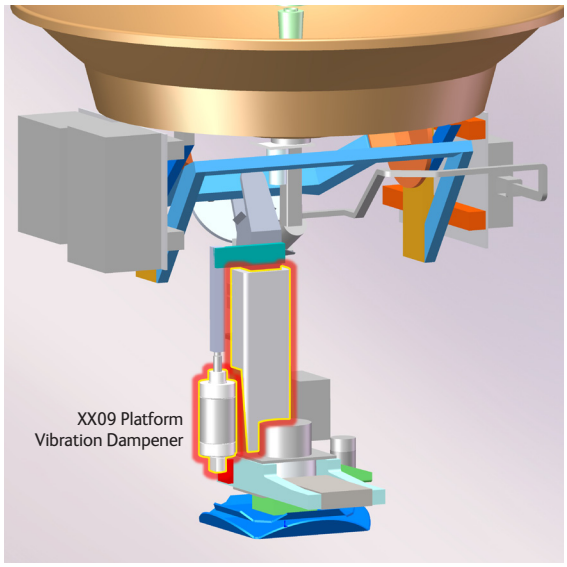
Sea Tel is committed to supplying the broadest range of marine stabilized antennas to its customers. The product range includes smaller antennas for leisure vessels, medium sized systems for rugged operations, specialized antennas for military and larger models for global C Band customers. Sea Tel has professional grade, aesthetically pleasing antennas for practically any maritime deployment. After all, we have been the leader for 33 years. Through innovation in product design and dedication to our dealer network, Sea Tel continues to raise the performance bar year after year. While other antenna manufacturers will sell you one model, Sea Tel offers the opportunity to select the best antenna platform for your application. While competitors data will intoxicate the customers, it leaves a terrible hangover with the end-users. We at Sea Tel take pride in the accuracy of the information we provide because we think you deserve it. Along with innovative products, we have global support teams that directly work with you to ensure your utmost satisfaction.

New antenna models, same Sea Tel high performance

Every ship is unique in the route it takes and its operational characteristics. Sea Tel's 09 and 10 antenna platforms are designed to take into consideration the vessel operation, weather, ocean conditions, and duration of the vessel in inclement weather, and the length of the ship. 09 and 10 series antennas come in three sizes: 1m, 1.2m and 1.5m.

XX09 Platform

- *Designed to meet the most demanding maritime specifications.*
- *Designed for ships that experience excessive vibration.*
- *Can be used in any operation and anywhere.*
- *Latest software and electronics offer the lowest cost of ownership.*


XX09 Platform
Vibration Dampener

The 09 Series Ku band VSAT antenna systems have been designed and tested to meet the most demanding ship's operation in some of the most difficult sea state conditions with the lowest cost of ownership. The 09 VSAT antennas has proven over time that no maritime stabilized Ku band VSAT antenna system comes close to the performance and reliability imparted by this 3-axis stabilized system.

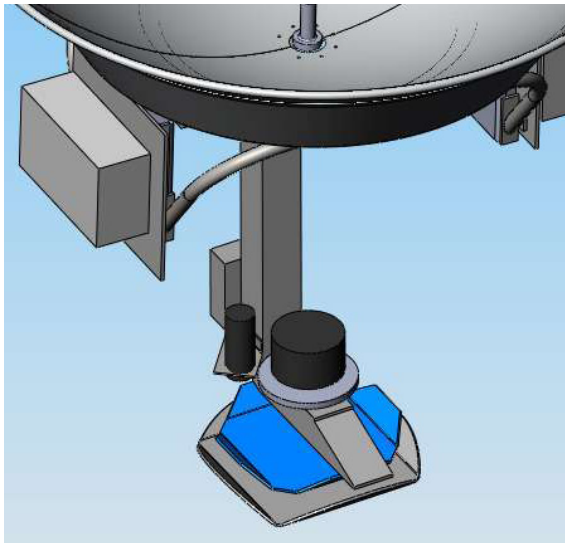
The XX09 Ku antenna is our VSAT marine stabilized antenna systems incorporating the latest technology in optimal reflector performance and vertical isolation characteristics. The platform is designed to withstand the most demanding sea conditions along with the most versatile mounting configurations for BUC and transceiver options. A standard RF "TUNED" radome ensures the best RF performing radome in the maritime market. Reliability in design has been the driving force behind this new model with an emphasis on customer satisfaction.

4010 and 5010 Ku-Band Antennas

The XX10 is the best in its class communications products from Sea Tel. The simple architecture is designed for maritime applications and is available in 1m and 1.2m antennas. It can be used in the roughest sea conditions. In fact, while sea conditions are important in selecting any antenna model, it is the operation of the vessel, specifically the vibrations that the antenna experiences, that causes the biggest mechanical deterioration in the antenna.

XX10 Platform

- *Outperforms competitive specifications and testing.*
- *Operates in practically any ocean condition.*
- *Best value communication antenna from Sea Tel.*
- *Lighter in weight than the 09 series antenna systems.*



The XX10 platform antenna is offered with several customizable options. The Co Pol option, for instance, allows the customers global Ku coverage on co pol and cross pol services.

The XX10 platform antenna is also offered with extremely low loss waveguide in the transmit signal path option to operate with co pol services. The 5010 is optimized to increase customer ROI. When used in a 1m network, customers can have almost 40% more bandwidth and sail further out on the fringes of the foot print.

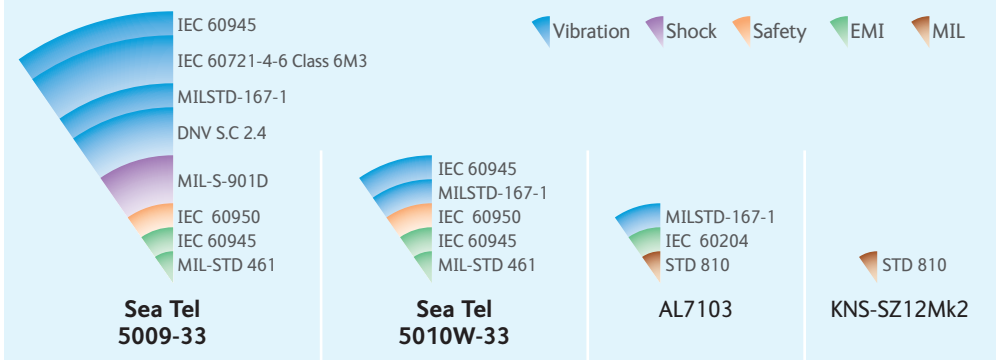
By upgrading the network to 1.2m, service providers can increase profit even further by adding about 40% more customers for the same space segment cost.

When is vertical isolation needed?

Vertical isolation is extremely helpful when antenna is expected to operate under excessive ship vibration. These vibrations are amplified by the time they are experienced by the antenna.

Vertical isolation is also useful if the ship is expected to experience heave in conjunction with excessive vibration. Smaller vessels, having less ability to absorb the energy stored in the ocean waves that are dynamically adjusting to the ocean conditions, often experience this in certain operations.

Sea Tel Specifications Profile

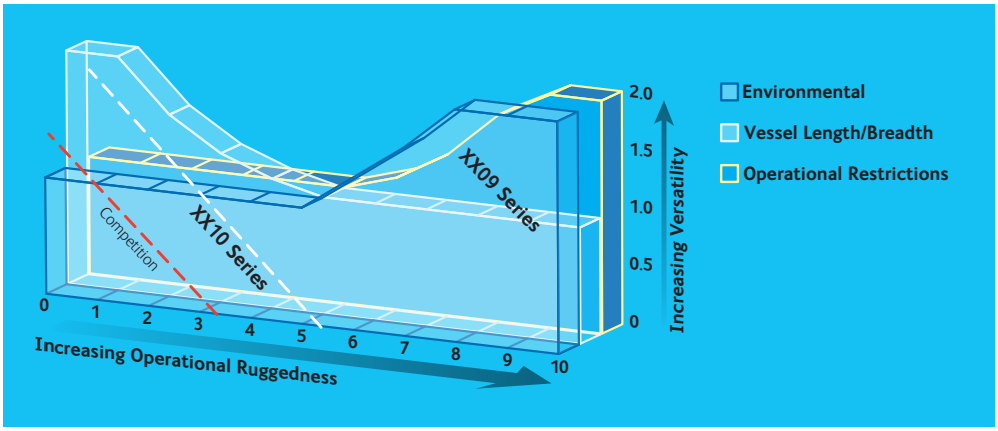


Why different models of antennas?

The biggest performance and visible difference between the two antenna platforms is the vertical isolation on the 09 model. The implication is that 09 can withstand more vertical motion than the 10 series. When the vertical isolation is absent as in 10 series antennas the momentum gets transferred to the reflector, feed and cross-level assembly of the XX10 model and other such competitive antennas that do not have vertical isolation.

Antenna Installation Guide

Relative Importance	Characteristic	XX10 Installation	XX09 Installation
25%	Operation	Liner / Scheduled itinerary	Station Keeping / Towing
20%	Mast Ratio	h/D < 75	76 < h/D < 300
16%	Height Above WL	H < 5 meters	5 < H < 20 meters
14%	Sea States	< Force 7	> Force 7
10%	Mast Type	Straight or Girder	Truss, Raked
10%	Location	Near Amidships	Aft, Forward Mounting
5%	Length/Breadth	L/B > 10	L/B < 9



Due to its visually violent nature, sea state may seem to have the biggest impact on the degradation of the antenna to the human eye. However, judging sea state without taking into account the size of the vessel often leads to wrong conclusions about the antenna selection. For most vessels, it is the combination of vessel operation and sea state that determine the antenna's mechanical performance. To a trained naval architect, sea state is often not the determinant factor in selecting the antenna; rather it is a careful consideration of all factors in the ship's operation. Very often, it is not even the most important variable in selecting the antenna model. Other variables listed above contribute significantly in selecting the antenna model. A smaller, wider vessel such as workboat on a short haul schedule should be installed with the 09 series antenna. On the other hand, a large commercial vessel that, for instance, is greater than 100m in length and 20 meters wide isolates the antenna's vertical motion well enough that 10 series antenna will do just fine. Vessels of different sizes respond to the sea conditions and vibrations differently.

Vibrations on the ship

Induced vibrations – from hull girder reactions, engine vibrations, harmonics of ship motion or other sources – are often superimposed. When recordings are made of vibrations onboard a ship, we often see the waveform as a random waveform with some fuzzy peaks. When

analyzed using a Fast Fourier Transform, the various frequencies in the waveform can be associated with specific amplitudes. We can look at this frequency domain plots in many ways. Since the XX10 series has no isolation spring, the 'k', the indicator for spring stiffness, of the system in vertical motion is effectively the spring rate of the resilient mount of the rod end. All other things being equal, the natural frequency of the a 5010 system with the same mass as the 5009 would be about 6 times the natural frequency of the 5009. This implies the structure the XX10 series should be mounted on should have a higher natural frequency than what is allowable on the XX09 systems.

Choosing the right product

The 09 and 10 Series antennas are available in many different sizes and versions depending on the network and application. A quick reference guide of various options and antennas gains are shown here.

Theoretical Gain Values of Various Antennas*

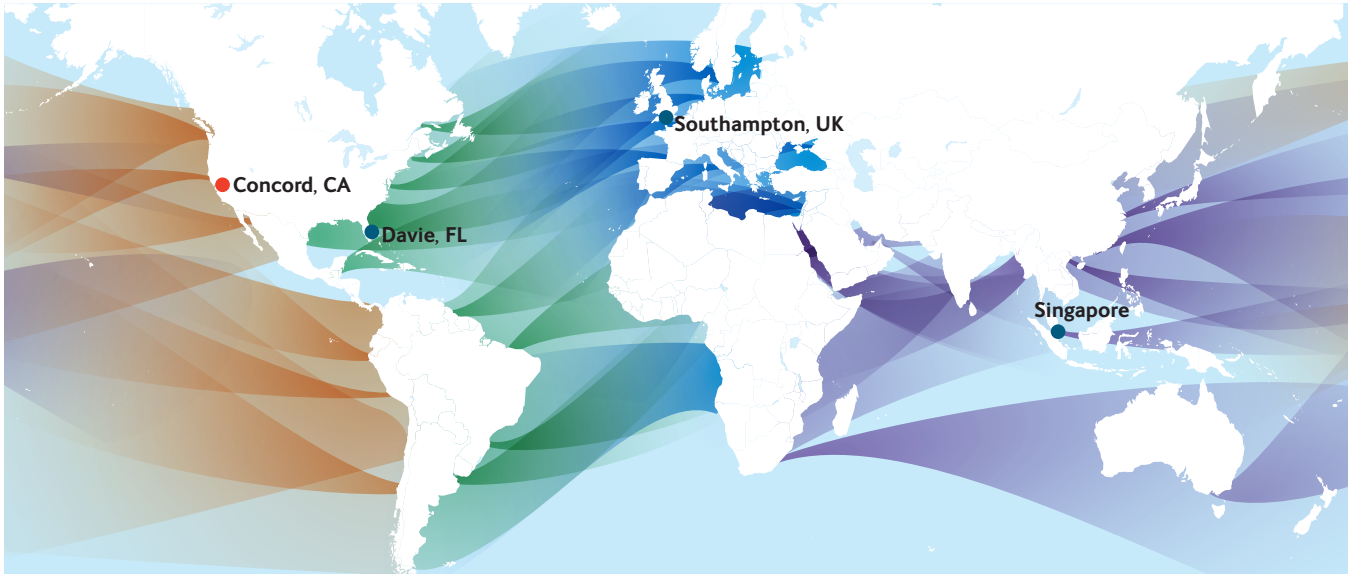
Model	Reflector size (in meters)	G/T	Tx	Rx
USAT 30	0.76	16	39	37.8
4009/4010	1	18.1	41	39.6
5009/5010	1.2	20	43.1	41.8
6009	1.5	21.9	45.1	43.8

*Actual data may vary depending on radome losses, satellite service and weather.

Types of ships/ Ocean Conditions/ Routes	XX10 Series	XX09 Series
Commercial Shipping	G	E
Mega Yachts	G	E
Regional Routes	G	E
Deep Sea/Research Vessels	G	E
Dynamic Positioner		E
Support Vessels		E
Oil Rigs/Perm Struct		E
Military	G	E
Short Haul Routes	G	E
Transition Routes	G	E
Long Haul Routes	G	E
1.5m		E
Global (Cross Pol and Co Pol)	G	E
Satellite Service Independent	G	E

G=Good, E=Excellent

Standard Configurations	4010C-90	4010C-23	4010W-91	4010W-33	4009-90	4009-23	4009-91	4009-33	5010C-90	5010C-23	5010W-91	5010W-33	5009-90	5009-23	5009-91	5009-33	6009-90	6009-23	6009-91	6009-33
Cross Pol Only	X	X			X	X			X	X			X	X			X	X		
Co Pol Equipped (2 LNBs Required)			X	X			X	X			X	X			X	X			X	X
8 Watt Mini Codan	X		X		X		X		X		X		X		X		X		X	
8 Watt Codan (LBUC)		X		X		X		X		X		X		X		X		X		X
16 Watt Codan (LBUC)		X		X		X		X		X		X		X		X		X		X
Coax Cable (BUC to Feed) (TXRF)	X	X								X	X									
Waveguide (BUC to Feed) (TXRF)			X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X
Pedestal Powered LNB	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Quad L/O LNB Capable	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Single Band LNB Capable	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
50 Inch Radome (Standard)	X	X	X	X																
50 Inch Radome (Tuned)					X	X	X	X												
60 Inch Radome (Standard)	X	X	X	X																
60 Inch Radome (Tuned)					X	X	X	X												
66 Inch Radome (Tuned)									X	X	X	X	X	X	X	X				
76 Inch Radome (Tuned)																	X	X	X	X
81 Inch Radome, Aircon (Tuned)																		X	X	X
Uplogix Support	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



The most important thing we build is trust

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