

CRMA Technology vs. Traditional TDMA Services

Reducing Delays, Costs, and Contention – The Benefits of mini-VSAT Broadband’s CRMA Technology vs. Traditional TDMA Services

The mini-VSAT BroadbandSM network takes a revolutionary approach to maritime satellite communications to maximize data and voice throughput while preventing interference to adjacent satellites. The network is based on ViaSat’s ArcLight[®] Code Reuse Multiple Access (CRMA) spread spectrum technology, which significantly reduces contention issues, transmission delays, and shared transmission bandwidth compared to traditional Time Division Multiple Access (TDMA) technology relied upon by other VSAT networks.

FCC APPROVED!

In November 2009, the Federal Communications Commission (FCC) granted a permanent “Earth Station on Vessel” or ESV license for KVH’s mini-VSAT BroadbandSM satellite communications service. This new license officially approves the spread spectrum mini-VSAT Broadband service and 24-inch diameter TracPhone[®] V7 antenna as meeting the FCC’s new regulations for mobile broadband services operating in U.S. territory.

Traditional TDMA Networks	mini-VSAT Broadband CRMA Network
<ul style="list-style-type: none"> Require large antennas of 1 meter or more in diameter to narrow their beam widths and avoid interference into neighboring satellites Divide bandwidth and transmissions into time slots and impose transmission delays Limit transmissions to one antenna at a time via very limited bandwidth range 	<ul style="list-style-type: none"> Spreads the signal over a wider bandwidth, thereby reducing interference issues Supports multiple simultaneous users via burst transmissions Enables the use of antenna as small as 12" Reduces costs by using the same transponder frequencies for inbound and outbound signals (feature of ArcLight)

Benefits of ArcLight & CRMA Technology

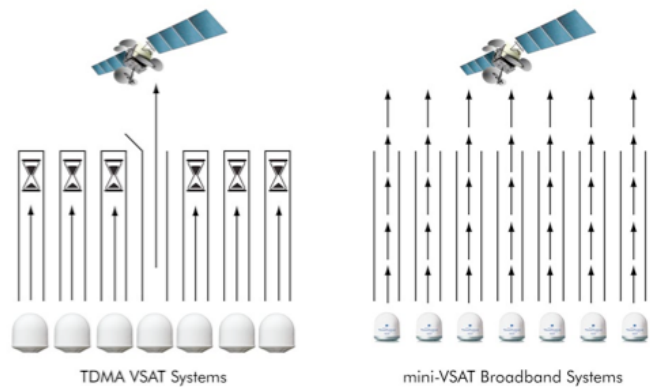
What it includes...	What it offers you...
Adaptive Multi-Rate Forward Link Waveform	Maximum throughput based on antenna type, location, and condition
Spread Spectrum Return Link Waveform	Support for small aperture, compact antennas that reduce adjacent satellite interference, adhere to regulatory requirements, and dramatically reduce hardware and installation costs
No Need for Time Frequency Coordination	Burst transmissions for minimal delays and contention compared to delay-prone, heavily contended single time slot transmissions
Frequency Reuse	Reduces airtime costs as inbound and outbound signals use the same transponder
True Broadband Experience	Data rates similar to cable home & office plans
Proven Technology	8+ years in operation for business jets, vessels, trains, and the U.S. Government

A Technical Assessment of TDMA vs. CRMA and the Operation of Maritime VSAT Communications

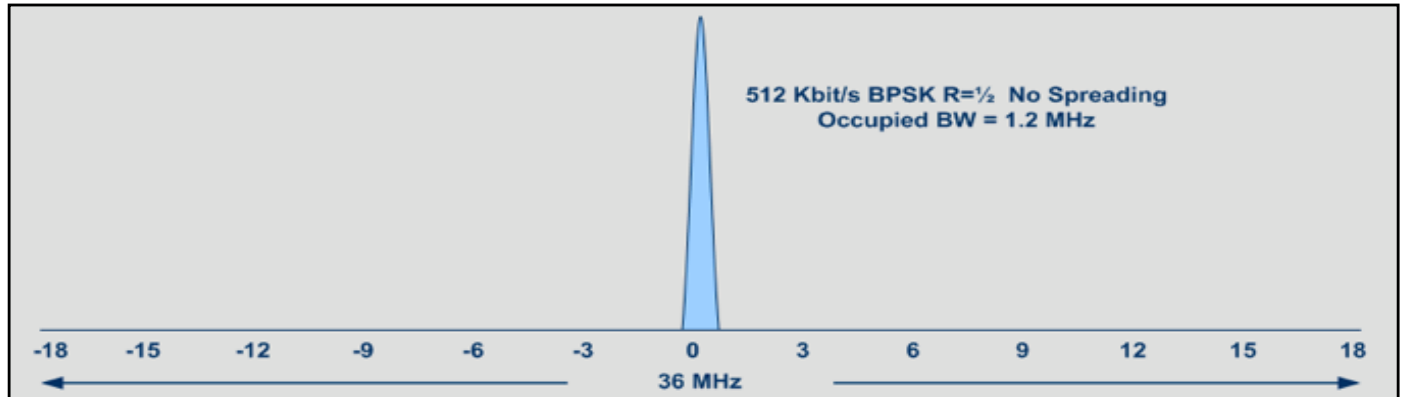
Traditional VSAT solutions use large antennas (>1m) with narrow beam widths that track very accurately and normally do not introduce interference into neighboring satellites. A typical 512 Kbps return link carrier occupies approximately 1.2 MHz of bandwidth. However, only one terminal in a traditional TDMA system can use this frequency at any time.

The mini-VSAT Broadband approach spreads the transmitted signal power over a frequency spectrum typically 20 times as wide, thereby lowering the signal's power spectral density. As a result, it is possible to use smaller antennas with wider beams for two-way VSAT communications, all without interfering with neighboring satellites or suffering interference from other broadcasts.

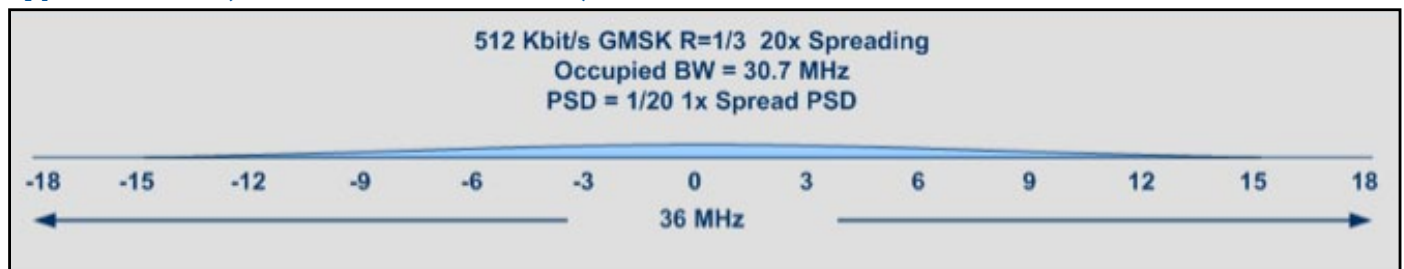
The new mini-VSAT Broadband service is also the first maritime service of its kind to utilize hub cancellors at the ground stations, enabling the service to transmit and receive using the same frequency rather than separate frequencies. The added efficiency reduces the satellite spectrum required by as much as 50% and offers greater bandwidth and lower costs.



Typical TDMA



Typical CRMA (mini-VSAT Broadband)



The Bottom Line: The proven ArLight technology used by the mini-VSAT Broadband network results in less latency and contention compared to equally sized networks, supports the use of smaller terminals, and reduces overall hardware and service costs.