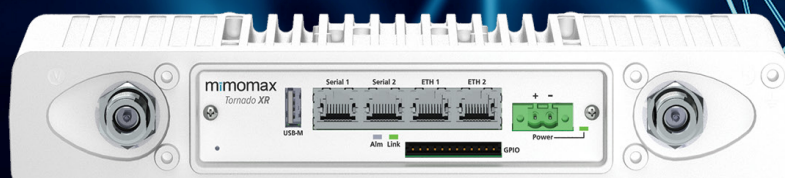
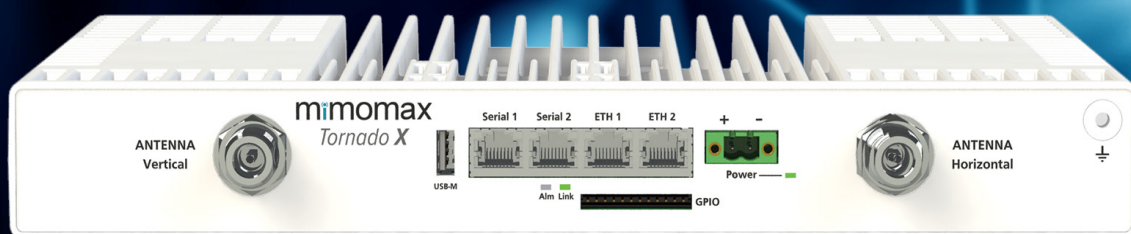
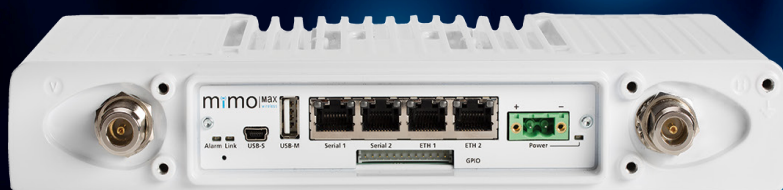


UBIIK  mimomax

# Tornado Family





# TORNADO FAMILY

## Tornado

Our award-winning Ubiik Mimomax Tornado radio is pushing the boundaries of what can be achieved in narrowband channels. Utilizing MIMO technology, full duplex communications and high order modulation, the Tornado radio can achieve aggregate data rates of up to 1280kbps in a 50kHz channel and latency as low as 3ms with our Optimized Protection Variant and sub 10ms in a standard point-to-point configuration.

**Tornado OPV** – an optimized protection variant of the Tornado radio, designed to provide stable, ultra-low latency links for utility teleprotection circuits. The ultra-low latency requirements of teleprotection can be supported by enabling our Optimized Protection Variant software on either Tornado or Tornado X.



## Tornado X & Tornado XR

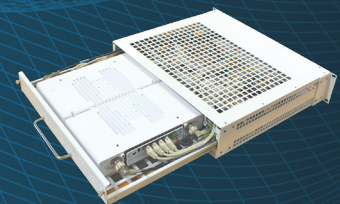
Tornado X is a high transmit power addition to our full duplex, MIMO product range. Offering a transmit power which remains stable across all modulations, Tornado X is fully compatible with the Tornado radio allowing for a mix of radios in the network to suit terrain or meet network requirements.

Tornado XR is a full duplex, high Tx power remote radio for use in Multipoint networks only. Tornado XR is an ideal remote radio for networks where traffic is uplink predominant. It can also be integrated at weak remote sites to boost uplink performance.



## Tornado 1+1

Tornado 1+1 provides automated support for both a warm and hot standby system with the Ubiik Mimomax Tornado 1+1. If one radio fails, a second standby radio is automatically switched in to take over, with no loss of data. An ideal product for mission critical links with the highest availability requirements.



## Family Compatibility

Each radio of the Tornado family can be integrated with other members of the family to provide the customized coverage and throughput required in different parts of your communications network. The Tornado family is also inter-operable with Ubiik Mimomax's Tier II Pyxis radio. To find out more about Pyxis, visit our website- <https://ubiikmimomax.com>

## Key Benefits of the Tornado Family

- Utilizes MIMO technology to double capacity in narrowband channels- 1280kbps in a 50kHz channel
- Full duplex communications – a requirement for better management of IP traffic
- High order modulation 256QAM offering greater throughput
- Engineered for ultra-low latency – sub 10ms in a standard point-to-point link and as low as 3ms with our Optimized Protection Variant
- Operates in licensed frequency bands between 136-174MHz, 400-470MHz, 757-788MHz, 806-960MHz
- Adaptive Modulation (QPSK up to 256QAM) to ensure all links remain independent
- Built-in duplexers and band-pass filters to minimize interference

## APPLICATIONS



# Tornado Family Specs

Spec subject to frequencies. Check with the Ubiik Mimomax team for more details.

		700MHz	900MHz
Gross Aggregate Data Rates	75kHz	-	480/960/1440/1920kbps <i>Full-duplex (Tornado)</i>
	50kHz	320/640/960/1280kbps <i>Full-duplex</i>	320/640/960/1280kbps <i>Full-duplex</i>
	25kHz	160/320/480/640kbps <i>Full-duplex</i>	160/320/480/640kbps <i>Full-duplex (Tornado)</i> 148/297/446/594kbps <i>Full-duplex (Part 24 - Tornado X and XR)</i>
	12.5kHz	80/160/240/320kbps <i>Full-duplex</i>	80/160/240/320kbps <i>Full-duplex (Tornado)</i> 71/143/214/286kbps <i>Full-duplex (Part 24 - Tornado X and XR)</i>
Configuration		2 x 2 Full Duplex MIMO	
Supply Voltage		10.5v DC to 60V DC	
Maximum Power Consumption		Tornado: 26W ( <i>peak</i> ) - 20W ( <i>typical</i> ) Tornado X and XR: 100W ( <i>peak</i> ) - 67.5W ( <i>100% duty cycle</i> ) - 22.5W ( <i>25% duty cycle</i> )	
Standby Power Consumption		<6W typical (Tornado), <7.75W typical (Tornado X and XR)	
Ambient Temperature Range		-30°C (-40°C) to +60°C (+70°C)	
Mounting		1U 19" Rack Mount   Pole Mount   Wall Mount   DIN Rail Mount (Tornado and Tornado XR), 1U 19" Rack Mount (Tornado X)	
Dimensions (L x W x H)		180 x 270 x 44mm (Tornado and Tornado XR), 330 x 480 x 45mm (Tornado X)	
Weight		2 kg (Tornado and Tornado XR), 6 kg (Tornado X) <i>radio unit only, excl. mounts</i>	
RECEIVER			
Modulation		QPSK/16/64/256QAM	
Number of MIMO receivers		2	
Symbol Rate	75kHz	-	2x60k symbols/sec (Tornado)
	50kHz	2x40k symbols/sec	2x40k symbols/sec
	25kHz	2x20k symbols/sec	2x20k symbols/sec (Tornado), 2x18.576k symbols/sec (Part 24 - Tornado X and XR)
	12.5kHz	2x10k symbols/sec	2x10k symbols/sec(Tornado), 2x 8.929k symbols/sec (Part 24 - Tornado X and XR)
Modulation Sensitivity for 10 <sup>-4</sup> BER	75kHz	-	<-107.5/-101/-95/-89dBm
	50kHz	<-110.5/-104/-98/-92dBm	<-109.5/-103/-97/-91dBm
	25kHz	<-113.5/-107/-101/-94.5dBm	<-112.5/-106/-100/-93.5dBm
	12.5kHz	<-116.5/-110/-104/-97dBm	<-115.5/-109/-103/-96dBm
Modulation Sensitivity for 10 <sup>-6</sup> BER	75kHz	-	<-106.5/-100/-94/-87.5dBm
	50kHz	<-109.5/-103/-97/-90.5dBm	<-108.5/-102/-96/-89.5dBm
	25kHz	<-112.5/-106/-100/-93dBm	<-111.5/-105/-99/-92dBm
	12.5kHz	<-115.5/-109/-103/-95.5dBm	<-114.5/-108/-102/-94.5dBm
Frequency Range		757-788 MHz	806-869 MHz   852-933 MHz   896-960 MHz
Frequency Step Size		5 kHz & 6.25 kHz selectable	
Frequency Accuracy and Stability		better than +/- 1ppm	
Nominal Channel Bandwidth		12.5 kHz, 25 kHz, 50kHz	12.5 kHz, 25 kHz, 50kHz, 75kHz (Tornado); 12.5 kHz, 25 kHz, 50kHz (Tornado X and XR)
TRANSMITTER			
RF Power Output		Avg. after duplexer: 2 x 24dBm (Tornado) Avg. after duplexer: 2 x 34dBm (Tornado X and XR)	
RF Power Control Range		>20 dB	
Other Details		Modulation, Number of MIMO receivers, Symbol Rates, Frequency Range, Frequency Step Size, Frequency Accuracy and Stability are similar with Receiver	
DUPLEXER (INTERNAL)			
Type		Bandpass	
Tx / Rx Split		30 MHz	9 MHz minimum
Frequency Range		757-788 MHz	806 to 960 MHz
Duplexer Sub Bands		757-758 to 787-788 MHz	806-869 MHz   852-933 MHz   896-960 MHz
Stop Band Attenuation		>75 dB	>60 dB @ >9 MHz from centre
Pass Band Bandwidth		3 MHz (-0.5dB)	1 MHz (-0.5dB)
INTERFACE (DIGITAL & ANALOG)			
ETHERNET		Dual 10BaseT/100BaseT   Connector: 2 x RJ45	
ASYNCHRONOUS SERIAL		Dual RS232   Connector: 2 x RJ45	
USB		High speed USB 2.0   Connector: Type A and mini B (Tornado), Type A (Tornado X)	
ALARM		1 set of volt-free change over contacts	
GPIO Analogue/Digital		4 x s/w configurable I/O ports	



# TORNADO FAMILY CUSTOMER EXPERIENCES

"The MIMO technology provided by Mimomax offered excellent performance and led to an efficient, cost-effective network design."

**Chris Campbell**, Senior Director of Grid Modernization Services at Salt River Project

## Lower Total Cost of Ownership Field Area Network for Salt River Project

**Location:** Arizona, USA

**Products:** Tornado & Pyxis

Encompassing three Arizona counties, including the metropolitan Phoenix area, Mimomax's Tornado-based Field Area Network has been designed to enable centralized monitoring and control of Salt River Project's distributed power and water systems. Connecting Distribution Automation applications, providing AMI backhaul and controlling power flows from numerous advanced solar installations, the multi-tier FAN combines higher functionality, higher capacity Tornado radios at the center of the network with lower cost, lower capacity Pyxis radios at network endpoints. This approach provided SRP with appropriate levels of coverage across their network and a lower total cost of ownership for the Field Area Network.



## Providing Orion with Ultra-low Latency Substation Protection

**Location:** Canterbury, New Zealand

**Products:** Tornado Optimized Protection Variant

Power utility Orion required a dedicated teleprotection network offering ultra-low latency and jitter and extremely high availability. With difficult terrain and Department of Conservation concessions to contend with, the protection ring required ease of installation in addition to interference-free operation. The installed network provides Orion with high availability due to the greater immunity to weather and path obstructions offered in 450MHz and ultra-fast network feedback with a typical latency of sub 5ms. The use of high capacity, MIMO Tornado OPV radios has also offered Orion the ability to use residual capacity to carry IP/SCADA traffic with no impact on the dedicate protection circuit.

"The key benefit of using this [Mimomax] solution is essentially that more data can be passed through a small channel. The use of MIMO technology combined with high order modulation means we will be able to transmit an impressive amount of data inside of a 50kHz channel."

**Kathy Shaft**, Senior Telecommunications Engineer at Great River Energy



### About

**Founded:** 2007

**Headquarters:** Christchurch, New Zealand

**Regional offices:** Phoenix, Arizona and Portland, Oregon

Combining a deep understanding of RF engineering with expertise gained from numerous deployments across the globe, Ubiik Mimomax provides utility customers with cost-effective, wireless communications, from mission critical narrowband to pLTE, to support grid modernization. Advanced communications technology coupled with sophisticated RF network design ensures our customers not only gain visibility right to the edge of the grid but also optimize their investment in spectrum.

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