airFiber® 5X HD

DATASHEET

5 GHz Carrier Radio with LTU™ Technology

Up to 1+ Gbps Real Throughput, 100+ km Range

Full-Band Certification including DFS

Ubiquiti's LTU Custom Silicon

Ten years ago, Ubiquiti sparked a global Wireless ISP revolution with the introduction of NanoStation® — a cost-disruptive 802.11 Wi-Fi long range outdoor plug and play radio. The NanoStation broke down technical and financial barriers for WISP's around the world, enabling nearly any operator to deploy scalable networks and grow profitable business models.

As bandwidth demands and scalability challenges increased through the years, Ubiquiti responded with performance-enhancing innovations such as the airMAX® TDMA protocol, PRISM® active RF filtering, and GPS synchronization — all working to extract every ounce of potential from consumer 802.11 Wi-Fi chipsets.

However, we always knew that one day growing subscriber bandwidth demands combined with an increasingly crowded unlicensed RF spectrum would expose the fundamental limitations of 802.11 Wi-Fi silicon and ultimately threaten the survival of our industry.

Years ago, a core group of engineers at Ubiquiti set out to make sure this day would never come. We began an ambitious plan that would span millions of man hours of development and tens of millions of dollars of investment. The result was a new technology and ASIC chipset created from the ground floor up specifically for the Wireless ISP industry — a technology we believe positions our Industry to succeed in the new challenging landscape of the future. Welcome to what we call the Long Term Ubiquiti vision, or simply LTU™.

Overview

Ubiquiti continues to disrupt the wireless broadband market with revolutionary LTU technology that breaks through the limitations of 802.11 Wi-Fi technology. Designed for use in the 5 GHz frequency band, the new airFiber® AF-5XHD is Ubiquiti's first LTU radio, offering greater channel bandwidths of up to 100 MHz, and more advanced RF components.

Pair the AF-5XHD with a compatible Ubiquiti® airFiber X antenna or RocketDish™ antenna for a complete 5 GHz Point-to-Point (PtP) solution.

An IP67 upgrade kit is included to provide enhanced protection from dust and water.

Engineered for Performance

Designed specifically for the Wireless ISP industry from the ground floor up, the AF-5XHD's custom LTU silicon and radio architecture provide breakthrough performance. Its core communications processing engine surpasses the limitations inherent to generic Wi-Fi chips to provide low latency, long-range capability, DFS flexibility, higher constellations, and better power output, along with improved receive sensitivity.

The AF-5XHD features industry-leading 21.2 bps/Hz spectral efficiency*, line-rate data packet processing for up to 1.34 Gbps of real data throughput*, and innovative xtreme Range Technology (xRT™).

* *Assuming 4096QAM (requires firmware version 1.1.2 or above).*

Key Features

The AF-5XHD offers the following advanced features:

- **Auto Output Power** Enabled by default, the Auto Output Power option causes the AF-5XHD to set the output power (EIRP) to the appropriate level.
- **Programmable Transmit Power** The radio's transmit power level can be programmed up to +29 dBm.
- **Programmable DL/UL Ratio** The AF-5XHD can split downlink and uplink traffic and support asymmetric traffic as needed. DL/UL ratios include 25%, 33%, 50%, 67%, and 75%. The DL/UL Ratio is an essential part of GPS sync functionality; it must be the same in all APs that you wish to synchronize.
- **Configurable GPS Synchronization** The AF-5XHD offers configurable support for 2, 2.5, 4, and 5 ms frames. Timing is compatible with all other synchronous systems, and 5 ms frame length is compatible with airMAX networks.
- **Split TX and RX Frequency**[1] The radio can operate on different frequencies for TX and RX, allowing great flexibility for interference avoidance.
- **Split TX and RX Channel Bandwidth**[2] Support for different channel bandwidths for TX and RX allows users to scale required data capacity more efficiently.
- **Adaptive Modulation up to 4096QAM**[1] Adaptive modulation rates of up to 4096QAM are supported.
- **Dual Redundant Gigabit Ethernet Ports with PoE** The AF-5XHD has two Gigabit Ethernet ports that can be used for redundant PoE power.
- **Bluetooth Wireless Configuration** Use the built-in Bluetooth interface for wireless configuration.
- **AlignLock™ Antenna Aiming Guard** This alerts the user when the radio or antenna aiming is changed due to tampering, impact, or storm damage.
- **Redundant Images for Fail-Safe Configuration** Creation of backup firmware images ensures fail-safe configuration and enhances reliability.
- **Persistent Spectrum Analysis with Dedicated RX** Perform real-time spectral analysis for the full band on live links without interrupting the link operation.
- **Wide Voltage Range, Enhanced Surge Protection** The AF-5XHD has an operating voltage range of 19-50VDC[3] and provides enhanced surge protection.

[1] *Requires firmware version 1.1.2 or above*
[2] *Available with a future firmware upgrade*
[3] *Depends on length of Ethernet cable*

Software

The airFiber AF-5XHD uses Ubiquiti's airOS® LTU software, which offers you a variety of advanced features.

Powerful New Features

Version 1.1.2 offers many new features to help make your network faster, easier to operate, and more resistant to interference:

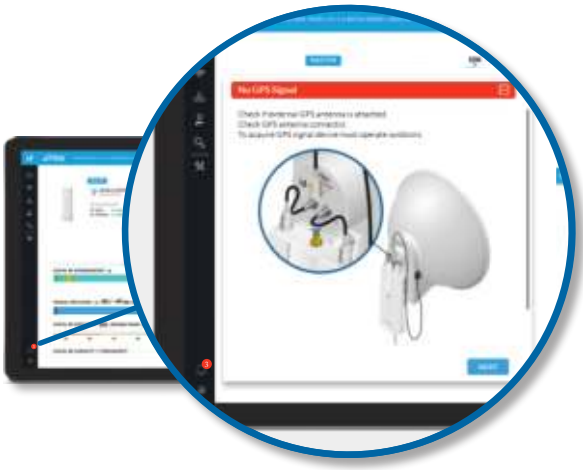
- **Frequency Split** Use this to configure separate TX and RX frequencies. This feature is very helpful in environments where certain channels may be experiencing interference on one end of the link, but are clear on the other end. The ability to configure different channels for each end of the link provides an ideal solution to this problem.
- **4096QAM (12x) Support** The AF-5XHD has been the only product that allows WISPs to push links beyond 256QAM while delivering unmatched spectral efficiency. With the introduction of 4096QAM, WISPs will now be able to further increase link speeds simply by upgrading the software.
- **Link Frequency Selector** Found on the Wireless screen, this feature displays a graph of the link's RF environment that includes a Best Frequency hint to help you select the clearest frequency.

- **Seamless Frequency Changes** The link is no longer dropped when frequency-related settings (Frequency, Split Frequency, Alternative Frequencies, Auto Frequency) are changed.
- **Centralized Link Management** This feature simplifies and speeds up link management. You now only have to manage the master device; changes made to it are automatically propagated to the remote device.
- **Smart Assistant (Alerts)** The new Smart Assistant monitors and alerts you of errors and warnings, such as a missing GPS signal, Ethernet negotiation failures, or a lower than expected signal strength. The Smart Assistant also provides detailed troubleshooting instructions for fixing each problem that it identifies.
- **Auto Frequency on DFS Event (Beta)** When this option is enabled, the link automatically switches to the clearest operating frequency when a DFS event occurs.
- **Other Improvements**
  - Traffic prioritization based on DSCP/TOS bit values
  - Enhanced auto rate recovery
  - Better 4ms/5ms stability in high interference conditions
  - Wider channel stability improvements

airOS LTU

Wireless Screen

Smart Assistant Alerts



Spectral Analysis with airView

airView® allows you to identify noise signatures and plan your networks to minimize noise interference. airView performs the following functions:

- Constantly monitors environmental noise
- Collects energy data points in real-time spectral views
- Helps optimize channel selection, network design, and wireless performance

airView runs in the background without disabling the wireless link, so there is no disruption to the network.

In airView, there are three spectral views, each of which represents different data: waveform, waterfall, and ambient noise level.

airView provides powerful spectrum analyzer functionality, eliminating the need to rent or purchase additional equipment for conducting site surveys.

Helpful new features of airView include Zoom, used for quick zooming in/out of the airView display, and In-Band Scanning, which eliminates noise within the working channel.

Dedicated Spectral Analysis

Zoom View (UNII-1 Selected)

UNMS App

The AF-5XHD supports the Ubiquiti Network Management System. UNMS™ is a comprehensive management controller featuring an easy-to-navigate graphic UI.

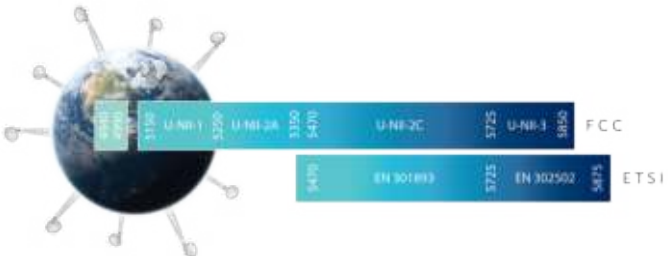
The UNMS app provides instant access to the airOS configuration interface and can be downloaded from the App Store® (iOS) or Google Play™ (Android). UNMS allows you to set up, configure, and manage the AF-5XHD and offers various configuration options once you're connected or logged in.

Management Using UNMS App

5 GHz Backhaul

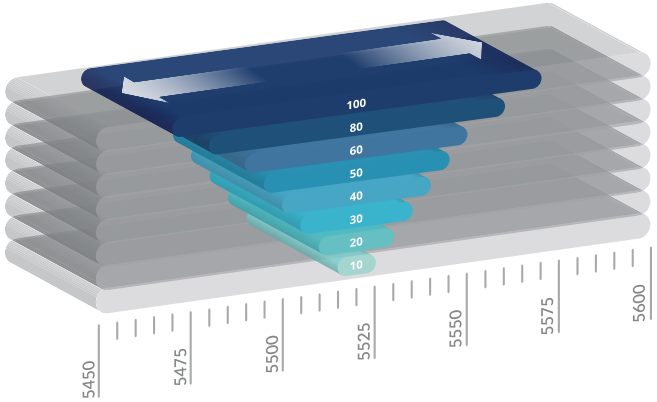
Full-Band Certification with DFS

The AF-5XHD covers the entire, license-free, 5 GHz spectrum and includes DFS approval. Anyone around the world can deploy and operate the AF-5XHD in the 5 GHz range practically anywhere they choose (subject to local country regulations).



Optimal Operation in Unlicensed Bands

Channel width flexibility (10/20/30/40/50/60/80/100 MHz) allows independent TX and RX channel frequency configurations anywhere within the radio band to avoid local interference, and the channel centers are selectable in 1 MHz increments. You also have the ability to program different uplink and downlink duty cycles to support asymmetric traffic requirements.



Ultra-Low Latency with HDD Technology

The AF-5XHD is designed to provide the highest TDD throughput available and is engineered with proprietary Hybrid Division Duplexing* (HDD) technology.

In a backhaul link, two AF-5XHD radios use patent-pending HDD technology to calculate the propagation delay and know when each radio can transmit and receive, so they send packets in precise synchronization. Packet transmission latency is virtually eliminated.

Co-Location

Co-location is vital in many scenarios. For example, a WISP may have limited tower space, so it must co-locate all equipment within that allotted footprint.

GPS Synchronization

Precise GPS frame synchronization frees the AF-5XHD from interference for superior co-location capability. GPS enables the concurrency of TX and RX frames so you can co-locate the AF-5XHD radios and enhance the overall performance of your backhaul links.

Clean Power Output

Using digital pre-distortion compensation and multi-IFFT processing, the innovative RF design delivers ultra-clean power output that improves noise immunity and co-location performance. This reduces the potential impact on the RF noise environment and allows for the use of higher-order modulation, such as 1024QAM.

* *Available with a future firmware upgrade*

Deployment Flexibility

The AF-5XHD can be used with existing airFiber slant-polarized antennas for improved noise immunity and Signal-to-Noise Ratio (SNR). It is compatible with multiple Ubiquiti airFiber X antennas offering gain of 23 to 34 dBi. The compact form factor of the AF-5XHD allows it to fit into the radio mount of airFiber X antennas, so installation requires no special tools.

airFiber X Antenna Model Summary

The airFiber X antennas are purpose-built with 45° slant polarity for seamless integration with the AF-5XHD. Pair the AF-5XHD with one of the following airFiber X antennas:

	AF-5G23-S45	AF-5G30-S45	AF-5G34-S45
Freq.	5 GHz	5 GHz	5 GHz
Gain	23 dBI	30 dBi	34 dBi

RocketDish Model Summary

You can also pair the AF-5XHD with one of the RocketDish antennas shown below using the included Universal Bracket or by using a kit to convert the RocketDish to 45° slant polarity.

	RD-5G30	RD-5G34
Freq.	5 GHz	5 GHz
Gain	30 dBI	34 dBi

Conversion Kit

The 5 GHz RocketDish to airFiber Antenna Conversion Kit (model AF-5G-OMT-S45) converts the RocketDish RD-5G30 or RD-5G34 antenna for use with the AF-5XHD.

airFiber AF-5XHD	
Dimensions	224 x 82 x 48 mm (8.82 x 3.23 x 1.89")
Weight	0.35 kg (12.3 oz)
RF Connectors	(2) RP-SMA Weatherproof (CH0, CH1) (1) SMA Weatherproof (GPS)
GPS Antenna	External, Magnetic Base
Power Supply	24V, 1A Gigabit PoE Adapter (Included)
Power Method	Passive Power over Ethernet Pins 1, 2, 4, 5 (+) and Pins 7, 8, 3, 6 (-)
Max. Power Consumption	6-12W[1]
Supported Voltage Range	+18 to +54VDC[2]
Mounting	airFiber X Mount (Rocket Mount Compatible) GPS Pole Mount (Included)
Operating Temperature	-40 to 55° C (-40 to 131° F)
Weatherproofing	IP67[3]
Certifications	CE, FCC, IC

System	
Processor	airFiber LTU IC
Maximum Throughput	1.34 Gbps[4, 5]
Maximum Range	100 km[4]
Packets per Second	2+ Million[6]
Latency	1.5 ms - 3.5 ms[7]
Encryption	AES-256
OS	airOS LTU
Wireless Modes	PtP Master/Slave

[1] Varies with firmware load and operational mode.

[2] Full range depends on Ethernet cable length.

[3] After installation of IP67 upgrade kit (included).

[4] Throughput and range values may vary depending on the environmental conditions.

[5] Assuming 4096QAM (requires firmware version 1.1.2 or above).

[6] Hardware bridge mode only.

[7] Based on 2 ms frame.

Networking Interface	
Data Port	(1) 10/100/1000 Ethernet Port
Management Port	(1) 10/100/1000 Ethernet Port Bluetooth v4.0

Radio	
Max. Conducted TX Power	29 dBm (Dependent on Regulatory Region)
Frequency Accuracy	< 2 ppm
Channel Bandwidth	10/20/30/40/50/60/80/100 MHz Selectable Programmable Uplink and Downlink Duty Cycles

Operating Frequency (MHz)	
Worldwide	4800 - 6200*
US/CA	
U-NII-1	5150 - 5250
U-NII-2A	5250 - 5350
U-NII-2C	5470 - 5725
U-NII-3	5725 - 5850

** Depends on regulatory region.*

Bluetooth LE Management Radio (MHz)	
Worldwide	2400 - 2483.5

Suggested Max. TX Power	
12x	12 - 15 dBm
10x	19 - 20 dBm
8x	21 - 22 dBm
6x	23 - 24 dBm
4x	29 dBm
2x	29 dBm
1x	29 dBm

Receive Sensitivity (dBm)									
Modulation Rate	Modulation	Sensitivity							
		10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	100 MHz
12x	4096QAM	-56	-53	-51	-49	-47	-44	-42	-39
10x	1024QAM	-66	-63	-61	-59	-57	-55	-53	-51
8x	256QAM	-72	-69	-67	-65	-63	-61	-59	-57
6x	64QAM	-78	-75	-73	-71	-69	-67	-65	-63
4x	16QAM MIMO	-84	-81	-79	-77	-75	-73	-71	-69
2x	QPSK MIMO	-88	-85	-83	-82	-81	-80	-79	-78
1x	½ Rate QPSK xRT	-90	-87	-85	-84	-83	-82	-81	-80

TDD Capacity (Mbps)*									
		Channel Width							
MCS		10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	100 MHz
QPSK SISO	Upload	5.76	12.16	18.24	24.32	29.76	35.20	45.44	54.72
	Download	5.76	12.16	18.24	24.32	29.76	35.20	45.44	54.72
	Aggregate	**11.52**	**24.32**	**36.48**	**48.64**	**59.52**	**70.40**	**90.88**	**109.44**
QPSK MIMO	Upload	11.52	24.32	36.48	48.64	59.52	70.40	90.88	109.44
	Download	11.52	24.32	36.48	48.64	59.52	70.40	90.88	109.44
	Aggregate	**23.04**	**48.64**	**72.96**	**97.28**	**119.04**	**140.80**	**181.76**	**218.88**
16 QAM MIMO	Upload	23.04	48.64	72.96	97.28	119.04	140.80	181.76	218.88
	Download	23.04	48.64	72.96	97.28	119.04	140.80	181.76	218.88
	Aggregate	**46.08**	**97.28**	**145.92**	**194.56**	**238.08**	**281.60**	**363.52**	**437.76**
64 QAM MIMO	Upload	34.56	72.96	109.44	145.92	178.56	211.20	272.64	328.32
	Download	34.56	72.96	109.44	145.92	178.56	211.20	272.64	328.32
	Aggregate	**69.12**	**145.92**	**218.88**	**291.84**	**357.12**	**422.40**	**545.28**	**656.64**
256 QAM MIMO	Upload	46.08	97.28	145.92	194.56	238.08	281.60	363.52	437.76
	Download	46.08	97.28	145.92	194.56	238.08	281.60	363.52	437.76
	Aggregate	**92.16**	**194.56**	**291.84**	**389.12**	**476.16**	**563.20**	**727.04**	**875.52**
1024 QAM MIMO	Upload	57.60	121.60	182.40	243.20	297.60	352.00	454.40	547.20
	Download	57.60	121.60	182.40	243.20	297.60	352.00	454.40	547.20
	Aggregate	**115.20**	**243.20**	**364.80**	**486.40**	**595.20**	**704.00**	**908.80**	**1,094.40**
4096 QAM MIMO	Upload	69.12	145.92	218.88	291.84	357.12	422.40	545.28	656.64
	Download	69.12	145.92	218.88	291.84	357.12	422.40	545.28	656.64
	Aggregate	**138.24**	**291.84**	**437.76**	**583.68**	**714.24**	**844.80**	**1,090.56**	**1,313.28**

* *For 2 ms frame length*

Specifications are subject to change. Ubiquiti products are sold with a limited warranty described at: ui.com/support/warranty
The limited warranty requires the use of arbitration to resolve disputes on an individual basis, and, where applicable, specify arbitration instead of jury trials or class actions.
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