



Quanta Microsystems

HM501

Receiver Module Datasheet

Version 1.0

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Chapter 1

Introduction

The HM501 is the first generation of WHDI™ receiver module based on AMIMON's AMN2210 baseband receiver chip. The HM501 WHDI™ wireless receiver module, together with the AMN11100 WHDI™ wireless transmitter module, presents the ultimate solution for converting any High Definition (HD) system into a wireless one. This add-on module enables wireless A/V applications that can easily fit into the living room and eliminate traditional A/V wiring. The ultimate HD video and audio quality and robustness are unmatched by any other wireless technology and present a true alternative to cable. The WHDI system transmits *uncompressed* video and audio streams wirelessly and thus simplifies and eliminates system issues experienced with any other known wireless-based solutions, such as lip-sync, large buffers and other burdens like retransmissions or error propagation.

1.1 Features

- **Uncompressed and uncompromised HD video quality, using AMIMON's baseband chipsets:**
 - AMN2210: WHDI™ Baseband Receiver
- **WHDI – Wireless High Definition Interface:**
 - Digital video: 30-bit RGB or YCrCb
 - Digital audio: I2S and SPDIF
 - Two-wire serial bus slave interface
 - Two interrupt lines
- **Supports any uncompressed video resolutions, including:**
 - HD: 720p, 1080i, 1080p, 576i, 576p, 480p, 480i
 - PC: VGA (640x480), SVGA (800x600), XGA (1024x768)
 - Panel: 854x800, 1280x768, 1366x768
- **Audio:**
 - Up to 3Mbps audio stream:
 - I²S: Two PCM channels (sampled up to 48 KHz x 24 bit)
 - SPDIF: Including AC-3, DTS
- **Strong 256-bit AES encryption**
- **User-defined two-way channel with minimum 10 Kbps for data and control**
- **Less than 1mSec latency between source and sink**

- **Small mechanical footprint:**
 - With PCB integrated antennas.
 - Optional external antennas.
- **RF characteristics:**
 - MIMO technology, using 5GHz unlicensed band, 18MHz bandwidth.
 - Coexists with 802.11a/n and 5.8GHz cordless devices.
 - Support for Automatic Transmission Power Control (ATPC).
 - No line of sight needed between transmitter and receiver. It has a range of over 30 meters, suitable for almost any room.
 - 14mW typical transmission power.
 - Maximum 45mW transmission power.
- **Power requirements:**
 - 3.3V ($\pm 5\%$), ~5.6W
- **Certification & Compliance:**
 - This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
 - Any changes or modifications not expressly approved by Amimon for compliance could void the user's authority to operate the equipment.
 - This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/TV technician for help.
- **Caution:** The module should be positioned so that personnel in the area for prolonged periods may safely remain at least 20 cm (8 in) in an uncontrolled environment from the module. Observe FCC OET Bulletin 56 "Hazards of radio frequency and electromagnetic field" and Bulletin 65 "Human exposure to radio frequency electromagnetic fields."

Chapter 2

Overview

The HM501 WHDI Video Display Unit (VDU) is designed to be at the receiver end of the WHDI downstream. The HM501 receives wireless downstream transmission, demodulates it and regenerates the video, audio and control content transmitted by the HM500 WHDI transmitter. The receiver works at the 5GHz unlicensed band. Figure 1 displays a block diagram of the HM501. It has an MIMO design of five wireless input channels, and one slow rate output wireless channel, which generates an upstream channel for data content transmissions. The outputs from the VDU are digital uncompressed video, digital audio and control, all via the WHDI connector. The MiniMAC uC is responsible for the control and the management.

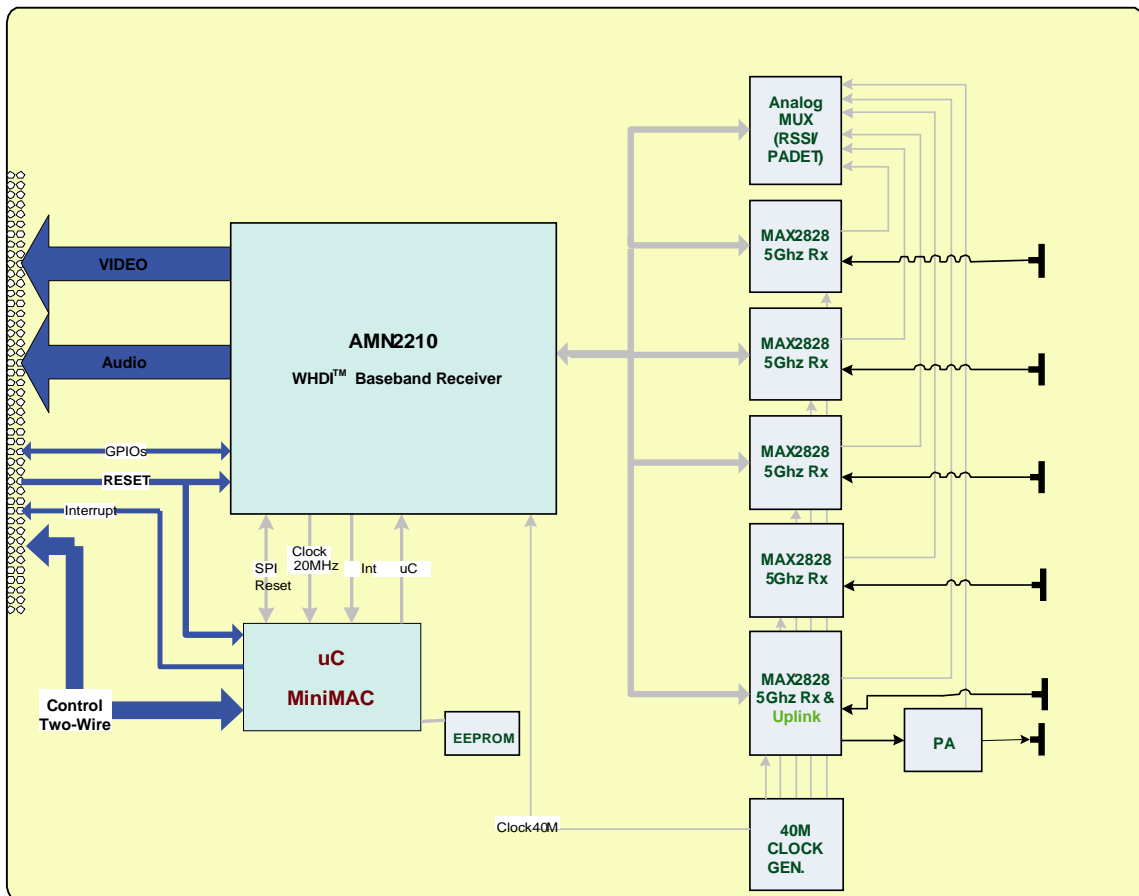


Figure 1: HM501 Block Diagram

The main building blocks of the HM501 are as follows:

- **AMN2210 WHDI Baseband Transmitter**, as briefly described on page 4
- **STM32F103RBT6 Mini-MAC μ Controller**, as briefly described on page 4
- **MAX2828 5GHz (802.11a) Transceiver**, as briefly described on page 5
- **Power Amplifier (PA)**, as briefly described on page 5
- **Board Connector (WHDI™ Connector)**, as described on page 5
- **EEPROM**, as described on page 5
- **40MHz Clock Gen**, as described on page 5

2.1 AMN2210 WHDI Baseband Receiver

The AMN2210 WHDI™ baseband receiver chip is the *heart* of the HM501 WHDI Receiver module. The AMN2210 interfaces the A/V source through the WHDI connector, and is controlled on board by the MiniMAC μ C.

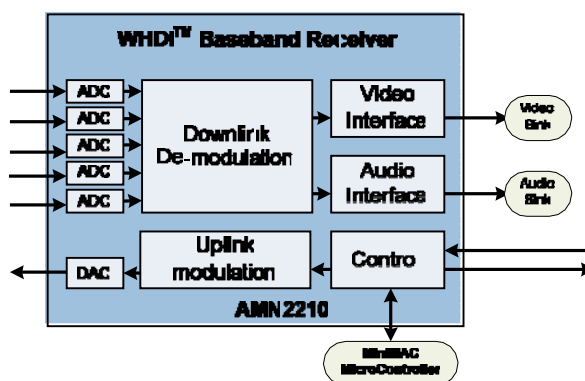


Figure 2: WHDI Baseband Receiver Chipset

The AMN2210 is based on MIMO technology receiving up to five input channels. Five analog-to-digital converters and one digital-to-analog converter are embedded within the chip.

The AMN2210 internal PLL accepts an input clock frequency of 40MHz. The input frequency is multiplied and then used as an internal system clock.

2.2 STM32F103RBT6 Mini-MAC μ Controller

The STM32F103RBT6 microcontroller is based on a 32-bit ARM7TDMI-S CPU, with embedded 128kB high-speed memory. It is used as an external microcontroller for implementing the MAC layer of the WHDI link.

The STM32F103RBT6 internal PLL accepts an input clock frequency of 40MHz.

2.3 MAX2828 5GHz (802.11a) Transceiver

The VDU has five MAX2828 chips embedded in it. The MAX2828 is a single-chip, RF transceiver IC designed specifically for single-band 4.9GHz to 5.875GHz, OFDM, 802.11 WLAN applications. It includes all the circuitry necessary to implement the RF transceiver function, providing a fully integrated receive path, transmit path, VCO, frequency synthesizer and baseband/control interface. Only the PA, RF switches, RF bandpass filters (BPF), RF BALUNs and a small number of passive components are required to form the complete RF front-end solution. AMIMON's WHDI™ technology uses the low cost and high availability of the 802.11a/n RF to allow low-cost RF for the video modem. Future generations of the WHDI modem will use an AMIMON-designed, cost-efficient, single-chip, integrated RFIC for multiple transmits on the transmitter side and a single-chip integrated RFIC for multiple receivers on the receiver side.

2.4 Power Amplifier (PA)

In order to extend the operating range for the HM501 upstream, the RF transmitter uses a power amplifier. The power amplifier has an output power detector for TPC purposes. Amimon has implemented Anadigics AWL6951 PA on the HM501.

2.5 Board Connector (WHDI™ Connector)

For information regarding the connector specification and pin-outs see following section.

2.6 EEPROM

The EEPROM is currently a system option, enabling mating and authentication in a multipoint design environment.

2.7 40MHz Clock Gen

An on-board 40MHz TCXO is connected to the MAX2828 chipsets and the AMN2210 baseband. The clock is then divided by two by the AMN2210 and supplied to the STM32F103RBT6 uC.

Chapter 3

WHDI Connector Pin-Outs

3.1 Signals

Table 1: WHDI Connector Signals

# of Pins	Pin Name	Description/Functionality	Group	Direction Tx	Remarks
30	D[29:0]	30-bit RGB (10:10:10) or YCrCb (10:10:10)	Video	Out	
1	DCLK	Video data clock	Video	Out	Up to 78.125 MHz
1	DE	Data enable	Video	Out	
1	H_SYNC	Horizontal sync	Video	Out	
1	V_SYNC	Vertical sync	Video	Out	
1	SPDIF	SPDIF audio interface	Audio	Out	
1	SCLK	I2S continuous serial clock	Audio	Out	Up to 3.072Mbps
1	WS	I2S Word Select (Left/right clock) which defines also the sampling rate	Audio	Out	
1	SDA	Two-wire Serial Bus Data (Slave Mode)	Control	I/O	Control I/F for WHDI
1	SCL	Two-wire Serial Bus Clock (Slave Mode)	Control	In	Control I/F for WHDI
1	INT	Interrupt from WHDI module	Control	Out	
1	RESET	Reset / Power-down line	Control	In	
6	3.3V	VCC	Power	Power	300 mA maximum rating per pin
46	GND	Ground	Power	Power	
1	I2S_D0				
1	U_GPIO0				
1	MCLK	² I ² S master clock coherent to WS according to specified ratio	Audio	Out	Rate is adjustable on Rx side
1	N.C.				

3.2 Pin List

Table 2: Rx WHDI Connector Pin List

Pin Number	Signal	Pin Number	Signal	Pin Number	Signal	Pin Number	Signal
1	RESET	31	D23	61	GND	91	SCLK
2	INT	32	D28	62	GND	92	D1
3	GND	33	GND	63	D7	93	GND
4	GND	34	GND	64	D11	94	GND
5	SCL	35	D21	65	GND	95	WS
6	SDA	36	D26	66	GND	96	D2
7	U_GPIO	37	GND	67	DCLK	97	GND
8	TBD2	38	GND	68	D9	98	GND
9	TBD3	39	D19	69	GND	99	I2S_D0
10	TBD6	40	D25	70	GND	100	D0
11	3.3V	41	GND	71	V_SYNC		
12	GND	42	GND	72	D8		
13	3.3V	43	D15	73	GND		
14	GND	44	D22	74	GND		
15	3.3V	45	GND	75	DE		
16	GND	46	GND	76	D6		
17	3.3V	47	D17	77	GND		
18	GND	48	D20	78	GND		
19	3.3V	49	GND	79	H_SYNC		
20	GND	50	GND	80	D5		
21	3.3V	51	D14	81	GND		
22	GND	52	D18	82	GND		
23	N.C	53	GND	83	SPDIF		
24	D29	54	GND	84	D4		
25	GND	55	D12	85	GND		
26	GND	56	D16	86	GND		
27	D24	57	GND	87	MCLK		
28	D27	58	GND	88	D3		
29	GND	59	D10	89	GND		
30	GND	60	D13	90	GND		

U.S. Regulatory Wireless Notice

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna,

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: T5U-HM501"

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Canadian Regulatory Wireless Notice

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions:

- 1) this device may not cause interference and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device

Caution:

The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.