Wisair's UWB MB-OFDM Development Kit DV9100

User's Guide

Rev1.21

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U.S. Operation:

This device complies with FCC Code of Federal Regulations (CFR) 47, Part 15 Subpart F: Ultra-Wideband Operation. 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.

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About Wisair

Wisair (www.wisair.com) develops and markets MBOA based standard, high performance wireless communication chipset solutions, founded on UWB technology. The company is an active Promoter Member of the Multi-Band OFDM Alliance Special Interest Group (MBOA-SIG), an active participant in the IEEE standardization process and a member of the Wireless USB Promoter Group and Wimedia Alliance.

Wisair, a privately held company, located in Israel is part of the RAD Group. Wisair's international offices, in USA, Japan, Korea and Taiwan, support business development, marketing and customer activities.

For further information contact Wisair local offices and representatives at
http://www.wisair.com/contact.html

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Overview

The DV9100 is one of the Wisair Development modules (DVModule) in Wisair Development Kit (DVK). Wisair DVK is targeted to support the development of reference designs based on Wisair chipset. In addition the development kit enables application evaluation, demonstration and supports regulation and standardization efforts.

The DVK is modular and includes a main module supporting the chipset and main interfaces and additional add on modules to enable additional MAC features and data interfaces development.

The DV9100 is a small form-factor board and a complete UWB Multi-Band OFDM transceiver with several data and host interfaces. It is based on the Wisair 501 SiGe-based RF Transceiver and the 530 CMOS-based Baseband chips. The DV9100 also includes a patented Wisair UWB antenna, based on a PCB-based design, along with the WisMan™ configuration and control host utility.

The UWB MB-OFDM DVModule consists of the following main components, all developed by Wisair:

- UWB Omni Antenna
- RF transceiver Wisair 501 chip
- Baseband Wisair 530 chip
- Internal MAC FPGA chip
- External Data and Control Interfaces

The UWB MB-OFDM DVModule provides the following:

- Based on Wisair MBOA-compliant UWB Baseband and RF transceiver chips.
- Small form-factor: 6 x 2.4" (153 x 64mm).
- High performance, robust wireless UWB link (Bit Error Rate better than 10-9).

- Supports high quality and QoS for Wireless Data and Wireless Video applications.
- Provides MBOA MAC-PHY standard interface.
- Offers multiple data interfaces and protocols: Ethernet/IP and optional MPEG, Transport Stream and High Speed parallel data.
- USB Host interface for external applications.
- Supports multiple operation and communication profiles for the different applications.
- WisMan™ Windows-based software utility based on the Wisair API for managing and configuring Wisair development kit modules.

2

Getting Started

This chapter provides you with the basic information you need to use the UWB MB-OFDM DVModule for the first time.

Package Contents

Wisair's DVModule type DV9100 package contains the following items:

Table 2-1: Package Contents

#	Description	Qty	Remarks
1	DV9100 module assembly	2	Assembled with transparent plastics on each side of module
1.1	DV9100 Serial # XXXXXXX	--	Master mode
1.2	DV9100 Serial # YYYYYYY	--	Slave mode
2	UWB Antenna	2	3-5 GHz type with SMA RF attachment
3	Universal AC to DC power supply	2	100-240VAC to 3.3VDC. (AC power cable not included)
4	USB Cable	2	USB type A to mini USB type B (used for WisMan™ host utility)
5	CD-ROM	1	Electronic format
5.1	This DV9100 User Manual	--	PDF copy
5.2	WisMan™ User Guide	--	PDF copy (entry level)
5.3	WisMan™ Host Application Utility (including USB drivers)	--	Entry level
6	DV9100 Manual Configuration	1	One page quick guide

Introducing the DV9100

Wisair's type DV9100 DVModule has various external connectors, switches, and LEDs, which are listed below:

- Power supply inlet
- SMA female for UWB antenna
- Ethernet RJ-45 connector
- For service, debug, or configuration:
  - Mini USB type B female host connector
  - DIP switches for manual configuration
  - Reset button
- LEDs:
  - Power
  - Signal Strength Indication (RSSI)
  - Line
  - Active
  - Link (UWB)

Performing the Initial DVModule Setup

After opening the UWB MB-OFDM DVModule package, you must perform the following initial setup in order to begin using the module.

Important Note: If the DVModule is being used for the first time, the DVModule is set to internal MAC mode (DIP switch #1 on both DVModules is in **IMC ("On" position)**). Test the UWB link by using an application that uses the external Ethernet connectors. After this procedure is performed successfully, **External MAC** users should set DIP switch #1 on both DVModules to **EMC ("Off" position)**.

To perform initial setup on the DVModule

1. Verify that the antenna is connected to the semi rigid cable included in the package.
2. Connect the other side of the semi rigid cable to the antenna connector on the DVModule.

3. Verify that the SMA cable-connector is firmly tightened over the connections.

Caution: **Do NOT close the connector too tight. Seven to ten inch-pounds torque using a connector wrench is recommended. The center pin on the SMA connector is fragile and may break.**

Caution: **Do not use any other antenna other than the one provided in the kit. The use of another antenna element other than the one provided in the kit is a violation of FCC rules governing the transmission of UWB signals.**

4. Verify that the configuration of one of the DVModules is Master and the other DVModule is Slave (refer to *Configuring the DVModule Manually* in Chapter 3, *Operating the DVModule*).

Note: Cables and accessories are packed inside the carton section of the box.

5. Connect the external DC power supply cable to the power inlet of each of the DVModules.
6. Place the DVModules two meters apart with their antennas facing each other.
7. Plug the AC power cable into the external power supply to apply power to the DVModules.

Note: The unit supports an international power supply (100-240V, 47 to 63Hz).

8. Verify that the power LED on the DVModule is ON.
9. Verify that the RSSI LEDs are ON (at least one RSSI LED should light on both DVModules in order to start transmission).

Note: If at least one RSSI LED is not lit as expected, reset each of the DVModules using the reset button.

10. Connect a regular PC to an Ethernet wall outlet (LAN side) to surf the Internet. If this connection is working correctly, use this setup for the following steps.
11. Connect a regular Ethernet cable between one DVModule and an Ethernet wall outlet (LAN side).
12. Verify that the Line LED is ON.

Note: The Active LED may blink if the module detects any activity on the network side.

13. Connect a crossed Ethernet cable between the other DVModule and a PC Ethernet port (that previously was configured to work with the LAN network).
14. Verify that the Line LED is ON.
15. Use the PC to surf the Internet over the wireless UWB connection.
16. Verify that the Active LED blinks on both DVModules.

Note: If a link is not established as expected, reset each of the DVModules using the reset button.

Connecting to the WisMan™ Wisair Host Application (Optional)

Working with the DVModule does not require any software application support. To configure a pre-selected basic mode of operation, you can use the on-board pre-configured DIP switches.

For additional modes of operation, an optional WisMan host application is required. For more information about the WisMan host application, refer to the *WisMan User Guide*.

Note: The minimum requirement for the host PC is Windows XP® or Windows 2000® operating system with a USB1.1 interface PC required to run the WisMan host application.

To install the WisMan host application

1. Install the USB drivers (refer to the *WisMan User Guide*).
2. Connect the DVModule to the PC USB interface (if you are using multiple modules, they should be attached to another PC USB port or a USB hub).
3. Install the Wisman application (refer to the *WisMan User Guide*).

3

Operating the DVModule

This chapter discusses how to manually set the DV9100 configuration using DIP switch (S1) for proper operation.

Important Note: The instructions in this chapter apply only to Ethernet users of the DVModule using Wisair's internal MAC. If you are using an External MAC, the Wisair MAC-PHY interface DIP switch#1 **must** be set to EMC ("Off" position) for External MAC. The DIP switch #1 setting defines internal MAC /external MAC.

Setting Up a UWB Link

The following is a simple procedure for setting up a UWB link between two DVModule's and testing that it is functioning correctly

Note: Refer to Chapter 2, *Getting Started* the first time you use the DVModule to surf the Internet using a wireless link based on the UWB link.

To set up a UWB link between two DVModules

1. Connect an antenna to each of the DVModules.
2. Connect a power cable to each of the DVModules.
3. Place the DVModules two meters apart with the antennas facing each other.
4. Power on the DVModules.
5. Verify that both Power LEDs are ON.
6. Verify that on both modules, at least one RSSI LED is ON.
7. Connect Ethernet cables to the DVModules and attach them to the application PCs.
8. Verify that the Line LED is ON
9. Verify that the Active LED blinks (on both DVModules).

Configuring DVModule Manually

The DVModule internal MAC emulator supports the following features:

- Point-to-point configuration.
- Ethernet MAC interface (using the RMII interface).
- Support 100 Mbps full duplex.
- Configuration of both RMII MAC and PHY is done using the on-board manual dipswitch configuration or the optional Wisair Host Application using the USB1.1 interface.
- The following configurations are supported: MAC/PHY interface or Internal MAC, Super frame length, [Tx:Rx] duty cycle ratio, Master/Slave, ACK policy.
- Status registers from the MAC can be read through the USB1.1 interface using the optional WisMan, Wisair's Host Application.

The DVModule modes of operation can be set manually by the on-board DIP switch (two positions, six micro-switches) on the component side of the DVModule.

Note: To configure the DVModule using the WisMan host application, refer to the *WisMan User Guide*.

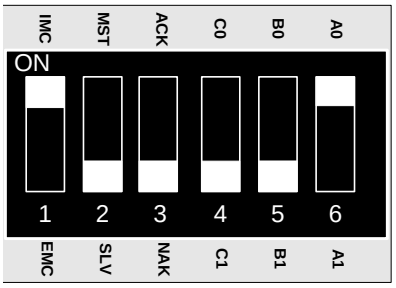


Figure 3-1: DVModule Manual DIP Switch Configuration (Example: Slave Mode)

The modes of operation available by the DIP switch are described below:

Table 3-1: DIP Switch Configurations

DIP switch Number	DIP switch State	Selected Configuration
1	On	Internal MAC (IMC)
	Off	External MAC (EMC)
2	On	Master (MST)
	Off	Slave (SLV)
3	On	Immediate Ack Mode (ACK)
	Off	No Ack Mode (NAK)
4	C	Refer to Table 3-2 for "CBA" state combinations.
5	B	
6	A	

The following table lists of the DIP switch state combinations to use for either the Master or Slave DVModules:

Table 3-2: State Combinations (CBA)

C	B	A	Selected Configuration	From Master	From Slave
On	On	On	100/0%, 5mSec	100%	0%
Off	On	On	92/8%, 5mSec	92%	8%
On	Off	On	80/20%, 5mSec	80%	20%
Off	Off	On	50/50%, 5mSec	50%	50%
On	On	Off	80/20%, 2mSec	80%	20%
Off	On	Off	50/50%, 2mSec	50%	50%
Off	Off	Off	EMUL mode (see page 3-6)		

External MAC Interface / Internal MAC

DIP switch 1 is used to choose between an external MAC (using MBOA type of PHY-MAC interface) and the internal MAC (Wisair proprietary). The internal MAC is either the Ethernet MAC or the internal packet generator. The default configuration is the Ethernet MAC.

Master / Slave

DIP switch 2 is used to indicate if the DVModule works in master or slave mode. For a point-to-point application, designate one DVModule as the master and the other as the slave. The slave DVModule synchronizes itself to the Master DVModule, and channel time usage will be divided between both modules, based on the TDD duty cycle configuration of DIP switch 1.

No-ACK / Imm-ACK

DIP switch 3 is used to identify whether the MAC uses Immediate ACK to acknowledge for received frames. For a point-to-point application, set both DVModules to the same ACK mode. The default configuration is No-Ack.

Duty Cycle and Super-frame Duration Configuration

DIP switches 4, 5, and 6 are used together to define the duty cycle and the super-frame duration for a point-to-point application (see its combination named as CBA).

Example 1: 80/20 Configuration

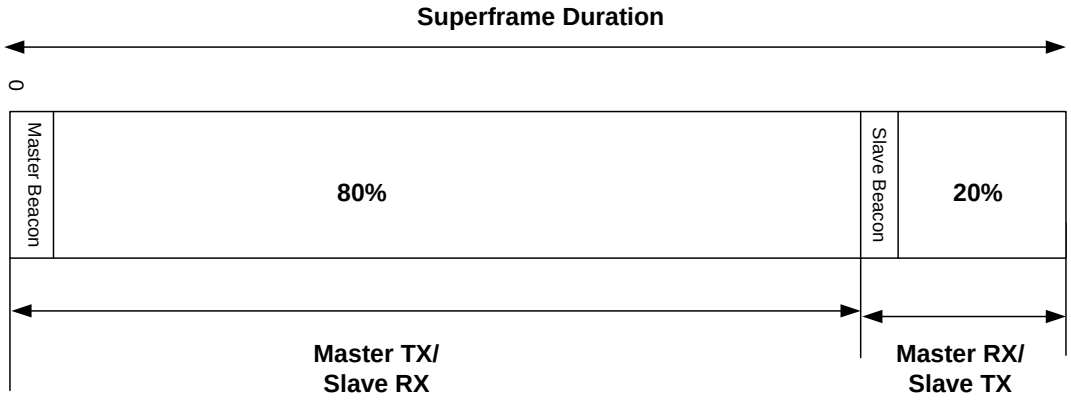


Figure 3-2: 80%/20% MAC Configuration Example

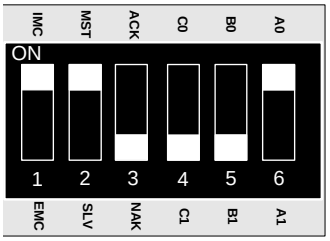
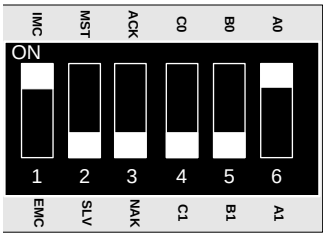
Note: The master is defined as the source of the high throughput for asymmetric transfer. For example:

If you chose Tx:80/Rx:20 and 5mSec (CBA=On, On, On):

- The DVModule configured as the master is set to 80%.
- The DVModule configured as the slave is set to 20%.

Example 2: 50/50 Configuration, 5mSec Superframe

*Table 3-3: Example: **Internal** MAC, 50% Tx/50% Rx, 5mSec – Default Configuration*

DIP Switch#	Description	DV9100 Master Wisair S/N:		DV9100 Slave Wisair S/N:	
1	External MAC / Internal MAC	On (IMC)		On (IMC)	
2	Master/Slave	**On (MST)**		**Off (SLV)**	
3	ACK/NAK	Off (NAK)		Off (NAK)	
4	CX	Off (C1)	5 millisecond 50% - 50%	Off (C1)	5 millisecond 50% - 50%
5	BX	Off (B1)		Off (B1)	
6	AX	On (A0)		On (A0)	
					
		Figure 3-3: Example 50/50 DV9100 Master Configuration		*Figure 3-4: Example 50/50 DV9100 Slave Configuration*	

This result in superframe duration of 5mSec and a duty cycle of 50%/50%.

EMUL Mode (Test Mode for Compliance Testing)

In general the DVModule's transmission is controlled by the internal MAC function. Unless set otherwise, the unit will not transmit on power up or reset. For troubleshooting or compliance testing purposes, a TX test mode is incorporated into the module (TX Emulator mode or EMUL).

Configure DVModule Manually

Set the DIP switches as described in the following table.

Table 3-4: DIP Switches

DIP Switch #	Description	DV9100
1	Internal MAC/ External MAC	On (IMC)
2	Master/Slave	On (MST)
3	ACK/NAK	On (ACK)
4	CX	Off (C1)
5	BX	Off (B1)
6	AX	Off (A1)

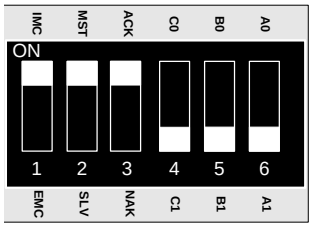


Figure 3-5: DVModule Emulation Mode Configuration

Note: The DIP switch configuration is sampled at module reset. Therefore, after you change the DIP switches, reset the module by pressing the Reset button.

Generated Signal

The EMUL transmit only mode is used only for test purposes and intended to be used for FCC tests. The data sent in the test mode is a pseudo-random data sequence of 64Bytes. The DV9100 under normal operating condition works with a receiver. If there is no receiver located, the transmitter stops transmitting in less than 10 seconds.

Important Note: EMUL test mode is the worst case conditions (in terms of energy transmitted). When EMUL test mode is selected it overrides the TDD duty cycle selection configured by the module's dipswitches.

The following are the spectrum analyzer settings and view for this signal.

A signal in three bands over the 3-5GHz frequency band should be present and can be viewed with a spectrum analyzer, such as Agilent™ 8563E, E4407B or a similar model covering this frequency range.

Set the following parameters on the Spectrum Analyzer:

- Center Frequency: 3.960GHz
- Span: 2GHz
- RBW: 1MHz (RBW : Reference Band Width)
- VBW: 1MHz (VBW : Video Band Width)
- Reference level: -20dBm
- Scale: 10dB/div

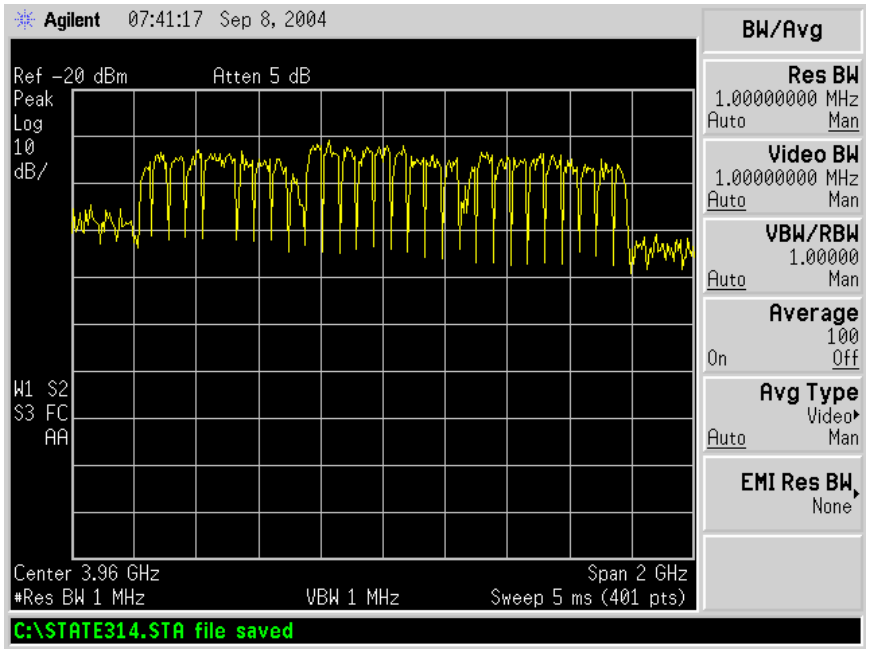


Figure 3-6: TX EMUL test mode Transmit Signal

If the signal is not visible at this stage, push the white RESET button on the module and wait a few seconds.

Note: If no signal is visible, contact Wisair for technical support.

Once this test is complete, return the DIP switches to their previous positions and reset the DVModule.

A

Specifications

The following are the specifications for the DV9100.

DV9100 Module Specification

Table A-1:DV9100 Specification

Parameter	Description / value
Frequency Band	3.168 – 4.752GHz (three MBOA sub bands – Band Group 1) with 528MHz spacing
Modulations	MB-OFDM (QPSK)
Output Power	80µW (-42dBm/MHz max)
Receiver Sensitivity	-80dbm
Data Rate	100 Mbps
Wisair Chipset	501 RF Transceiver 530 Baseband
MBOA Data interface	MAC-PHY interface
Parameters Configuration	• Manually select using a DIP switch • WisMan™ Wisair PC-based host application utility
MBOA PHY specification	Based on Rev0.9
MAC-PHY I/F MBOA Specifications	Based on Rev0.9
External data Interface	Ethernet 100Base-T (Full Duplex), RJ-45
External Control Interface	USB1.1, Mini-USB type B female
Power Supply Input	+3.3VDC +5%/-5% @ 4 Amp

Parameter	Description / value
LED indications	Power, Link (UWB), Line, Active, Signal strength indication RSSI(0-3)
Size	6 x 2.4" (153 x 64mm)
Temperature Range	Operational: 0 to 40 °C Storage: -20 to 70 °C
Humidity	5-95% (non-condensing)
Options:	
- External Power Supply	Desktop power supply Input: 100-240VAC 2A 47-63Hz Output: 3.3VDC @4Amp
- UWB Antenna	UWB external Omni (or directional radiation pattern)
- WisMan™ Host Application Utility	Wisair's Windows-based application utility with a graphical user interface that allows you to manage Wisair UWB-enabled devices in piconets