

VANTEON[®]

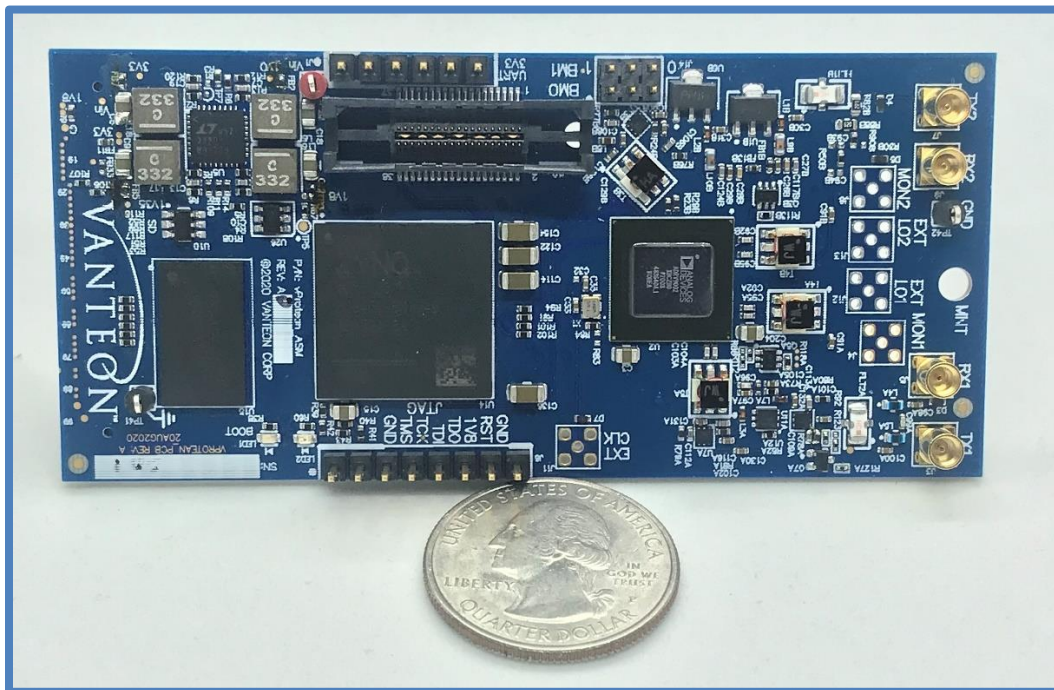
WIRELESS SOLUTIONS



User Manual

Version 1.0

vProtean™ Software Defined Radio



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1 Introduction

The Vanteon vProtean™ is a 2x2 MIMO software defined radio (SDR) that targets signal intelligence and multi-band processing applications. It is based on the Analog Devices ADRV9002 highly integrated wideband RF transceiver and the Xilinx Zynq-7020 All Programmable System-on-Chip (SoC). The vProtean SDR has a custom RF front end that is highly flexible, allowing its frequency range to be configured from 30 to 6000 MHz, and its instantaneous bandwidth from 12 kHz to 40 MHz.

2 Proper Care and Handling

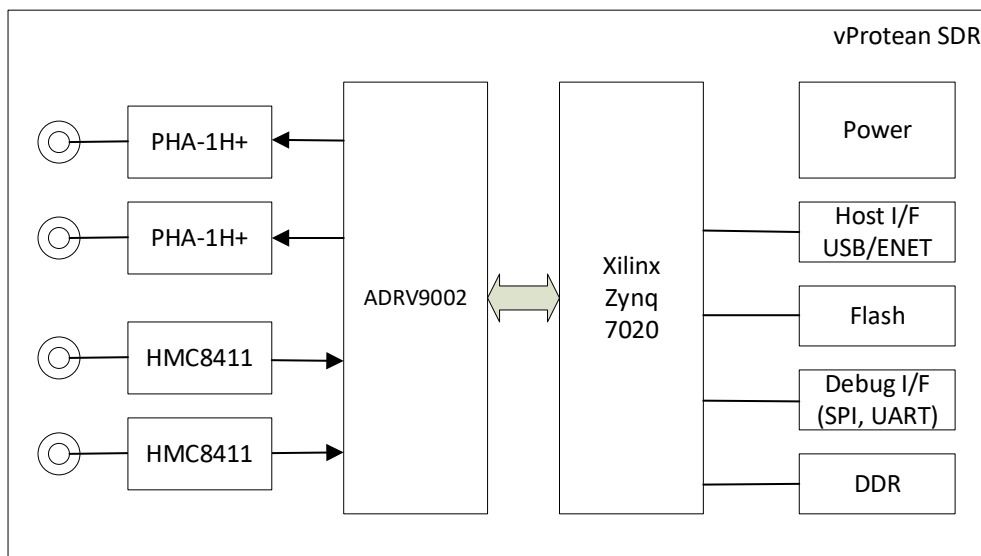
All Vanteon products are thoroughly tested before shipment. The vProtean SDR is guaranteed to be functional at the time it is received by the customer. Improper use or handling of the vProtean SDR can easily cause the device to become non-functional. Listed below are some examples of actions which can prevent damage to the unit:

1. Never allow metal objects to touch the circuit board while powered.
2. Always properly terminate the transmit port with an antenna or 50Ω load.
3. Always handle the board with proper anti-static methods.
4. Never allow the board to directly or indirectly come into contact with any voltage spikes.
5. Never allow any water, or condensing moisture, to come into contact with the boards.
6. Never apply more than 0 dBm of power into any RF input.
7. Always use at least 30dB attenuation if operating in a loopback configuration

The vProtean SDR is sold for evaluation purposes and test equipment. If you choose to use your vProtean and Carrier to transmit using an antenna, it is your responsibility to make sure that you are in compliance with all laws for the country, frequency, and power levels in which the device is used. Additionally, some countries regulate reception in certain frequency bands. Again, it is the responsibility of the user to maintain compliance with all local laws and regulations.

3 Technical Overview

3.1 Block Diagram



3.2 High Level Specifications

Frequency Band 1	30 to 6000 MHz
Instantaneous Bandwidth	12 kHz to 40 MHz
Number of transmitters	2
Number of receivers	2
Output Transmit Power	Variable up to 19 dBm
Dimensions	9.0 cm x 4.2 cm
Host interface	UART, USB, Ethernet, I2C and SD Card
Antenna connections	MMCX RF connectors
Power control	Wide range of output power from –20 dBm to +19 dBm
Flash	512 Mb
DDR SDRAM	4 Gb
Input Voltage	2.0 VDC to 3.6 VDC
Front End Module Voltage	3.3 VDC to 4.5 VDC

4 Hardware Interfaces

4.1 Connectors

The vProtean SDR has a number of connectors that allow it to be interfaced to a host carrier board, and connectors for antennas. That table below lists all of the connectors and their associated functions. This is followed by board diagrams showing the location of each connector.

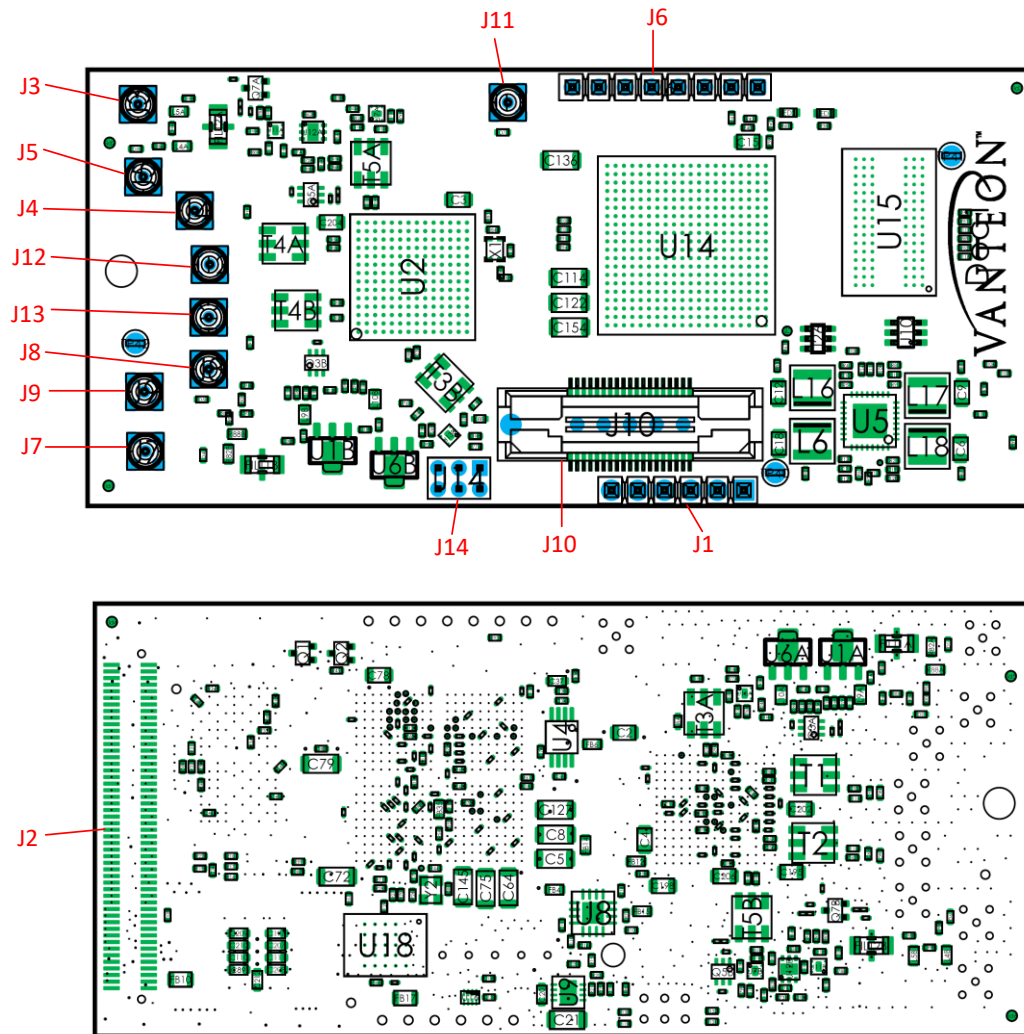
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Connector	Type	Function
J1	1x6 6 pin header	UART
J2	2x50 100 pin header	JTAG, UART, Boot Mode, Power, Reset, USB, Ethernet, SD Card, I2C, GPIO
J3	Antenna	Transmit 1
J4	Antenna	Monitor 1
J5	Antenna	Receive 1
J6	1x8 8 pin header	JTAG
J7	Antenna	Transmit 2
J8	Antenna	Monitor 2
J9	Antenna	Receive 2
J10	MICTOR	Debug
J11	Antenna	External Clock
J12	Antenna	External LO1
J13	Antenna	External LO2



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J14	2x3 6 pin header	Boot Mode



4.1.1 J1 Connector

The J1 connector is a 6 pin header which provides a serial console interface.

Pin	Description
1	GND
2	Unused
3	VCC_SYS
4	FTDI_TXD_3P3V
5	FTDI_RXD_3P3V
6	Unused

4.1.2 J2 Connector

The J2 connector is a 100 pin header which may be used as an interface to a host carrier board, such as the Vanteon Carrier board. The connector provides signals for several peripheral interfaces including JTAG, UART, USB, Ethernet, SD Card, I2C and GPIO.

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Pin	Description	Pin	Description
1	VCC_1P8V	2	VCC_SYS
3	VCC_1P8V	4	VCC_SYS
5	VCC_1P8V	6	VCC_SYS
7	VCC_1P8V	8	VCC_SYS
9	GND	10	GND
11	GND	12	GND
13	UART0_TXD_1P8V	14	VCC_3P3V
15	PS_BOOT_MODE0	16	VCC_3P3V
17	PS_BOOT_MODE1	18	GND
19	PS_GPIO0	20	GND
21	PS_GPIO1	22	VCC_1P0V
23	SDCARD_CD	24	GND
25	UART0_RXD_1P8V	26	USB_DATA2
27	USB_CTL_CLKOUT	28	USB_DATA6
29	USB_CTL_DIR	30	USB_DATA3
31	USB_CTL_NXP	32	USB_DATA7
33	USB_CTL_STP	34	USB_DATA5
35	USB_CTL_RESET_n	36	USB_DATA4
37	PS_SRSTn	38	USB_DATA1
39	GND	40	USB_DATA0
41	ETH0_TX_CLK	42	GND
43	ETH0_TX_DO	44	ETH0_RESET_n
45	ETH0_TX_D1	46	ETH0_RX_CLK
47	ETH0_TX_D2	48	ETH0_RX_CTRL
49	ETH0_TX_D3	50	ETH0_RX_D1
51	ETH0_TX_CTRL	52	ETH0_MDIO
53	GND	54	ETH0_RX_D3
55	J1_GPIO0	56	ETH0_RX_D0
57	J1_GPIO1	58	ETH0_RX_D2
59	J1_GPIO2	60	ETH0_MDC
61	J1_GPIO3	62	GND
63	J1_GPIO4	64	SD_CARD_D2
65	J1_GPIO5	66	SD_CARD_CMD
67	J1_GPIO6	68	SD_CARD_D1
69	J1_GPIO7	70	SD_CARD_D3
71	GND	72	SD_CARD_D0
73	JTAG_TDO	74	SD_CARD_CLK
75	JTAG_TDI	76	GND
77	JTAG_TCK	78	I2C1_SCL
79	JTAG_TMS	80	I2C1_SDA
81	GND	82	GND
83	SPAIR_PAIRS0_P	84	SPAIR_PAIRS3_P
85	SPAIR_PAIRS0_N	86	SPAIR_PAIRS3_N
87	GND	88	GND



89	SPAIR_PAIRS1_P	90	SPAIR_PAIRS2_P
91	SPAIR_PAIRS1_N	92	SPAIR_PAIRS2_N
93	GND	94	GND
95	GND	96	GND
97	GND	98	GND
99	GND	100	GND

4.1.3 J6 Connector

The J6 connector is a 8 pin header which provides a JTAG interface.

Pin	Description
1	GND
2	JTAG_TMS
3	JTAG_TCK
4	JTAG_TDI
5	JTAG_TDO
6	VCC_1P8V
7	PS_SRSTn
8	GND

4.1.4 J14 Connector

The J14 connector is a 6 pin header that defines the boot mode for vProtean.

Pin	Description
1	VCC_3P3V
2	VCC_3P3V
3	PS_BOOT_MODE0
4	PS_BOOT_MODE1
5	GND
6	GND

The boot mode settings are defined by pins 3 and 4.

Mode	PS_BOOT_MODE0	PS_BOOT_MODE1
JTAG	0	0
QSPI	0	1
SD Card	1	1

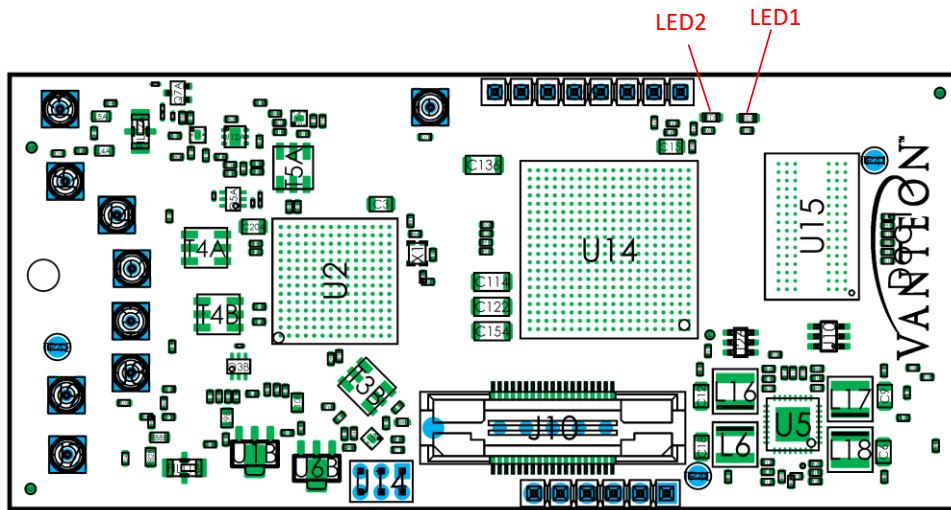
The boot mode jumpers are provided on the vProtean SDR and the Carrier board. The vProtean SDR boot mode jumpers should only be used when the vProtean SDR is used without the Vanteon Carrier board. Otherwise, the Carrier board vProtean jumpers should be used.

4.2 LEDs

The vProtean software defined radio has two (2) LEDs, whose function is described in the table below. This is followed by a board diagram showing the location of each LED.

LED1	Blue	On when Zynq 7020 programmable logic has been programmed
LED2	Green	Software control





5 User Console

If the vProtean SDR was purchased as part of an evaluation kit, it is preloaded with a menu-based application that allows a user to perform transmit and receive functions. This section explains how to use the vProtean SDR evaluation application.

5.1 UART

The simplest method to access the preloaded test application on the vProtean SDR is to mount it to a the Vanteon Carrier board. The Carrier board provides a serial console interface via the Type-C USB connector. Connect the vProtean Carrier Board to a PC using the appropriate USB cable. Use a terminal emulator program on the PC to open a terminal session using the virtual COM port associated with the vProtean Carrier Board. The serial port parameters are: 115200 baud, 8 bits, no parity, 1 stop bit, no handshaking.

5.2 Main Menu

The vProtean software defined radio has a hierarchical menu structure that allows you to configure the radio and to transmit and receive test waveforms. The main menu consists of the following status and commands:

Item	Name	Function
-	TX RX Sample Rate	Display of the pre-configured sample rate
-	FPGA Temperature	Display of the FPGA temperature
-	ADRV Temperature	Display of the RF IC temperature
-	RX1 RSSI	Display of RX1 RSSI
-	RX2 RSSI	Display of RX2 RSSI
1	TX1 RX1 Settings	Configure TX1 and RX1
2	TX2 RX2 Settings	Configure TX2 and RX2
3	Capture RX	Initiate RX capture according to RX capture settings
4	RX Capture Waveform Settings	Configure the RX capture parameters



5.2.1 TX1/RX1 and TX2/RX2 Settings Menu

There are two submenus for configuring the TX1/RX1 and TX2/RX2 pairs. This section covers both submenus, and refers to TX1 and TX2 as a generic TX_, and RX1 and RX2 as a generic RX_.

Item	Name	Function
1	TX_/RX_ Frequency	Set the TX_/RX_ frequency (30 MHz to 6000 MHz)
2	Toggle TX_	Toggles transmit for TX_ on/off
3	TX_ Waveform Select	Go to TX_ waveform select menu
4	Digital Attenuation (dB)	Attenuation that is applied digitally to the transmit waveform (0 to 100 dB)
5	TX_ Front End Atten (dB)	Sets the attenuation in the ADRV9002 (0 to 41.5 dB), value can only be changed when TX is enabled
6	TX_ BOOST	Adds an additional 3 dB to the transmit
7	Toggle RX_	Toggles received for TX_ on/off
-	RX_ RSSI	Report signal receive strength for RX_

Note that the vProtean SDR may require external cooling, should both transmit channels be used continuously. The FPGA and ADRV temperatures displayed on the main menu should be monitored by the user, and external cooling should be applied as needed.

5.2.1 TX1 and TX2 Waveform Select Menu

The TX Waveform Select Menu configures the waveform that is transmitted when the TX is toggled on.

Item	Name	Function
-	Current Waveform	Display the current selected waveform
1	Zeros	Fills transmit buffer with zero waveform
2	USB Tone, Offset=FS/32	Upper side band waveform, FS=sample rate
3	Dual Tone, Offset=FS/32+FS/8	Dual tone waveform, FS=sample rate
4	File	Go to file select menu to load waveform file from SD card

5.2.2 TX1 and TX2 File Select Menu

The File Menu allows the user to select a user defined value that specifies the transmit waveform. The format of the filename must have a “.iq” extension to show up in the file list. The filename must be 9 characters or less.

The file must be preloaded to the SD card by the user prior to using this menu.

The maximum number of samples that can be provided in a transmit waveform file is 2,097,150.

The format of a transmit waveform is a .CSV file where the first column is the I value and the second column is the Q value.



The vProtean SDR and Carrier board should be powered down whenever mounting or removing the SD card.

5.2.1 RX Waveform Capture Settings Menu

The RX Waveform Capture Settings Menu allows the user to set the number of samples captured and the file to which the samples are saved. It also allows the user to configure which RX channel will be captured.

Item	Name	Function
1	Filename	The name of the file to save the RX samples to. The filename can be up to 9 characters. The filename extension can be up to 2 characters. It is recommended that the filename extension be ".iq"
2	Samples	The number of samples to capture. The maximum number of samples that can be captured is 2,097,150.
3	RX Channel [1,2]	Configure which RX channel the capture should be performed on.

6 Customer Support

If you experience difficulty after reading the manual and/or using the product, please feel free to contact info@vanteon.com for additional assistance.

Vanteon offers contract engineering services and can assist you in implementing this product into your system.

7 Terms and Conditions of Sale

All sales of product are subject to the terms and conditions described in "Vanteon Corporation – Terms and Conditions of Product Sales". Unless explicitly agreed to in writing, Vanteon rejects all modifications to these standard terms and conditions.

8 One Year Warranty

Vanteon Corporation provides a One-Year Limited Warranty for all products sold. Should this product, in Vanteon Corporation's opinion, fail to be in good working order during the warranty period, Vanteon Corporation will, at its option, repair or replace this product at no charge, provided that the product has not been subject to abuse, misuse, accident or unauthorized modification or repair.

Products returned to Vanteon must be pre-authorized by Vanteon and sent prepaid, insured and packaged for safe shipment. Vanteon will return this product by prepaid ground shipment service.

Should the product prove to be irreparable, Vanteon reserves the right to substitute an equivalent product if available.

See "Vanteon Corporation – Terms and Conditions of Product Sales" for additional information regarding this warranty.

The above warranty is the only warranty authorized by Vanteon for this product. Under no circumstances will Vanteon be liable in any way for any damages, including any lost profits, business revenue, special, indirect, incidental, exemplary, punitive or consequential damages arising out of the use of, or inability to use such product.



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