65-VE240-P1
802.11b/g/n MiniPCI Adapter for 2.4 GHz AP Applications
Product Specification and Modular Installation

65-VE240-P1 MiniPCI Adapter (MA423Gd)
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Product Description

QUALCOMM's 65-VE240-P1 MiniPCI Adapter design is based on QUALCOMM's advanced multi-radio WFB4030 Baseband/MAC IC and WFR4031 RF IC, the worlds first commercially available IEEE 802.11b/g/n wireless LAN solution that sends and receives data at up to 315 Mbps. Using QUALCOMM's advanced chipset with patented True MIMO™ smart antenna technology, QUALCOMM WFB/WFR4xxx-based products provide unprecedented levels of 802.11b/g/n range and throughput, previously unachievable speed and spectral-efficiency, full Wi-Fi product interoperability for IEEE 802.11b/g/n, and IEEE 802.11b/g/n global regulatory compliance.

Chipset

- WFB4030 and WFB4130 Single Chip integrated Baseband and MAC
- AGN4031 Single Chip 2.4/5 GHz 2Tx/3Rx transceiver

Key Features and Benefits

The fourth generation, QUALCOMM's IEEE 802.11n True MIMO™ chipset, provides the implementer of access points, home gateways, WLAN clients, consumer electronics and multimedia entertainment, embedded wireless laptop/desktop/peripheral products with the following key features:

- IEEE 802.11n, IEEE 802.11b, IEEE 802.11g Network Standards
- MIMO link rates up to 315 Mbps
- 2.4 GHz Frequency Band Operation
- Receive Combining and Transmit Diversity
- Dynamically adjusts between 20 and 40 MHz operation on a frame by frame basis
- Interoperability with IEEE 802.11b/g/n , Airgo True MIMO generation 1-3 products, and pre-standard 802.11n Draft 1.0 products
- IEEE 802.11d support
- IEEE 802.11b Long / Short Preamble support on a frame-by-frame basis
- Transmit rate based power control

Additional Hardware Features

- Enhanced interference avoidance
- Programmable defer / detect thresholds
- Closed loop Tx power control

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- Automatic power-on and temperature-based calibration
- Worldwide regulatory EEPROM
- RoHS compliant to directive 2002/95/EC (PCB, components, solder)

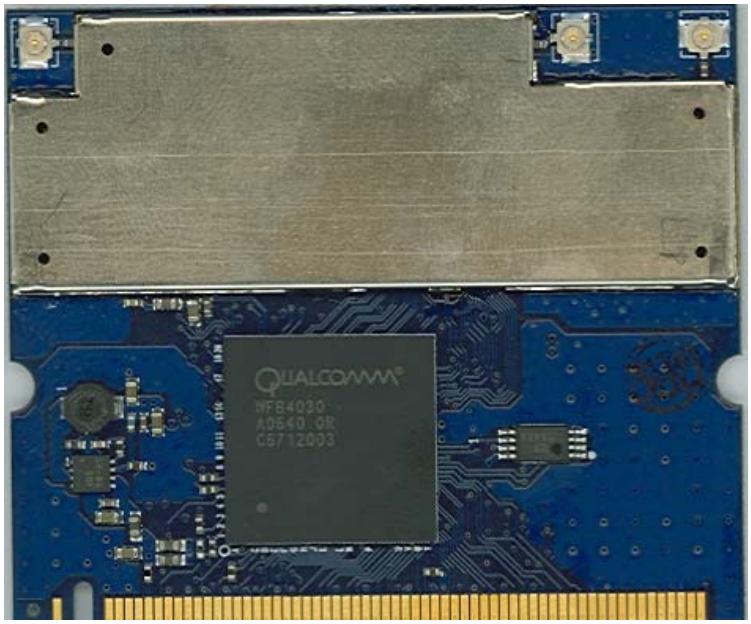

Figure 2 65-VE240-P1 Block Architecture

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Data Rates Supported

- IEEE 802.11b: 1 - 11 Mbps
- IEEE 802.11g: 1 - 54 Mbps
- IEEE 802. 11n: 6.5 – 144 Mbps (20 MHz channel)
  13.5 – 300 Mbps (40 MHz channel)
- Proprietary: 24 – 126 Mbps (20 MHz channel)
  12 – 315 Mbps (40 MHz channel)

Modulation Types Supported

- OFDM: BPSK, QPSK, 16QAM, 64QAM
- DSSS: DBPSK, DQPSK, CCK

Security Features

- Hardware Support for 64-bit (24-bit IV + 40-bit Key) and 128-bit (24-bit IV + 104-bit Key) WEP encryption
- TKIP encryption
- CCMP (AES) encryption
- Hardware Support for Wi-Fi Protected Access WPA/WPA2 Personal/Enterprise authentication
- 802.1x supplicant

Quality of Service (QoS) and Value-Added MAC Features

- WMM
- WMM-SA
- IEEE 802.11e QoS

Antenna Connections

- Three U.FL connectors (also known as IPAX or Hirose connectors).

Manufacturing-Ready Software

- Manufacturing Test Support Utilities
- Windows Vista 32 and 64 bit (upon MS general release),Windows XP (SP1/SP2) and Windows 2000 (SP4) drivers

Interfaces

- PCI/MiniPCI version 2.2 compliant with bus-master and slave-mode support

Physical

- MiniPCI interface with Type 3A form factor (2.00” long)

Operating Voltage

- 3.3V +/- 10%

Recommended Operating Temperature Range

- 0 to +70 Cº ambient

Recommended Operating Humidity Range

- 15% - 95%, non-condensing

Recommended Storage Temperature Range

- -25 to +85 Cº ambient

Recommended Storage Humidity Range

- Maximum 95%, non-condensing

Peak Power Consumption

All power consumption figures for 3.3 V power supply. Power Consumption definitions are as follows:

- Peak Transmit (Tx). Power consumption during packet transmission (this is a "maximum" number).
- Peak Receive (Rx). Power consumption during packet reception (this is a "maximum" number).
- Idle and Connected: Power consumption when a station is associated with an access point and power save mode is set to maximum (i.e. the station is sleeping between beacons, this is an average number).
- Idle and not Connected: Power consumption when a station has not associated with an access point and power save mode is set to maximum (i.e. sleeping between scans, this is an average number).

Mode	2.4 GHz (Watts)
Peak Tx	2.95
Peak Rx	2.80

Table 1 2.4 GHz Power Consumption

Typical Receiver Sensitivity

The following tables depict target Rx Sensitivity in dBm as defined in IEEE 802.11 specification(s).

NOTE: Tx Power and Rx Sensitivity alone are not sufficient to assess MIMO performance in a multipath environment. The MIMO radio architecture and core DSP algorithms play a far greater role in determining how well a MIMO radio performs -- a well architected MIMO radio with similar Rx sensitivity as a poorly designed MIMO radio provides much better performance. Real world benchmark testing is required to assess the performance of various MIMO radios.

2.4 GHz IEEE 802.11b (8% PER)	
Data Rate Mbps	Rx Sensitivity dBm
1	-101.0
2	-98.0
5.5	-97.0
11	-93.0

Table 2 802.11b Rx Sensitivity

Reference P57, IEEE Std 802.11b-1999: FER shall be less than 8x10^(-2) at a PSDU length of 1024 octets.

2.4 GHz IEEE 802.11g (10% PER)	
Data Rate Mbps	Rx Sensitivity dBm
6	-95.5
9	-94.0
12	-92.5
18	-90.0
24	-88.0
36	-85.5
48	-82.5
54	-80.0

Table 3 802.11g Rx Sensitivity

Reference, P29, IEEE Std 802.11g-2003: PER shall be less than 10% at a PSDU length of 1000 byte

IEEE 802.11n (10% PER) - 20MHz Channel			
MCS Index	20 MHz 800ns GI Data Rates Mbps	20 MHz 400ns GI Data Rates Mbps	Rx Sensitivity dBm
MCS 0	6.5	7.2	-95.5
MCS 1	13.0	14.4	-92.5
MCS 2	19.5	21.7	-90.5
MCS 3	26.0	28.9	-88
MCS 4	39.0	43.3	-85.5
MCS 5	52.0	57.8	-83
MCS 6	58.5	65.0	-80
MCS 7	65.0	72.2	-78
MCS 8	13.0	14.4	-93
MCS 9	26.0	28.9	-90
MCS 10	39.0	43.3	-88
MCS 11	52.0	57.8	-85
MCS 12	78.0	86.7	-83
MCS 13	104.0	115.6	-80
MCS 14	117.0	130.0	-77.5
MCS 15	130.0	144.4	-75.5

Table 4 802.11n 20 MHz Rx Sensitivity

IEEE 802.11n (10% PER) - 40MHz Channel			
MCS Index	40 MHz 800ns GI Data Rates Mbps	40 MHz 400ns GI Data Rates Mbps	Rx Sensitivity dBm
MCS 0	13.5	15.0	-93.5
MCS 1	27.0	30.0	-90.5
MCS 2	40.5	45.0	-88.5
MCS 3	54.0	60.0	-86
MCS 4	81.0	90.0	-83.5
MCS 5	108.0	120.0	-81
MCS 6	121.5	135.0	-78
MCS 7	135.0	150.0	-76
MCS 8	27.0	30.0	-91
MCS 9	54.0	60.0	-88
MCS 10	81.0	90.0	-86
MCS 11	108.0	120.0	-83
MCS 12	162.0	180.0	-81
MCS 13	216.0	240.0	-78
MCS 14	243.0	270.0	-75.5
MCS 15	270.0	300.0	-73.5

Table 5 802.11n 40 MHz Rx Sensitivity

Operating Frequencies/Bands

Actual channels/frequencies supported for a given country are governed by regulatory requirements and regulated by EEPROM contents and software.

Supported 2.4 GHz Channels	Frequencies		Channels	Frequencies
Channel	Frequency		Channel	Frequency
1	2412		8	2447
2	2417		9	2452
3	2422		10	2457
4	2427		11	2462
5	2432		12	2467
6	2437		13	2472
7	2442		14	2484

Table 6 Operating Frequencies/Bands

Maximum Transmit Output Power

In typical end user product operation, actual transmit power will be limited based on local regulatory requirements and EEPROM configuration.

NOTE: Tx Power and Rx Sensitivity alone are not sufficient to assess MIMO performance in a multipath environment. The MIMO radio architecture and core DSP algorithms play a far greater role in determining how well a MIMO radio performs -- a well architected MIMO radio with similar Rx sensitivity as a poorly designed MIMO radio provides much better performance. Real world benchmark testing is required to assess the performance of various MIMO radios.

Tx Power		
IEEE Mode	Per Chain (dBm)	Total Tx Power (dBm)
11b	21	24
11g	21	24
11n	21	24

Table 7 Tx Power

Physical Dimensions
Weight: 12 grams (including shield)

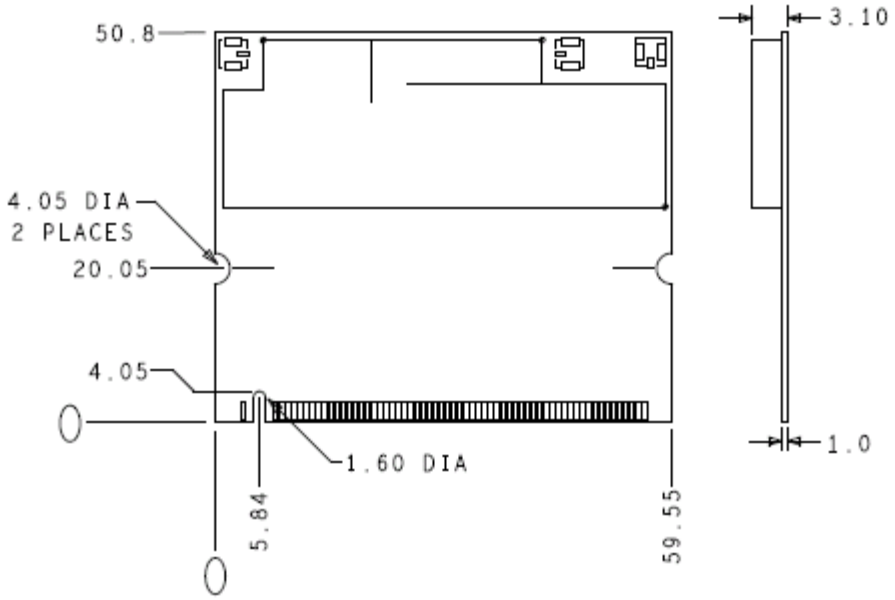

Figure 3 PCB and Shield Mechanical Drawing (dimensions in millimeters)

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Modular Installation

The 65-VE240-P1 is designed specifically for Broadband Gateways and other similar Access Point applications. The 65-VE240-P1 uses a miniPCI connector for insertion into an attaching system. However, the 65-VE240-P1 does not conform to the miniPCI PCB size or power restrictions.

Below is a "typical" 65-VE240-P1 module installation:

- Align the miniPCI connector on the 65-VE240-P1 with the miniPCI receptacle on the attaching system, taking care to fit the notch in the bottom left of the radio module with the tab on the miniPCI receptacle on the attaching system (see Figure 4).
- Firmly press the radio card towards the attaching system until the clips engage.
- **Disseminating end-user documentation for the installation/removal of the 65-VE240-P1 is expressly prohibited by regulatory statues.**

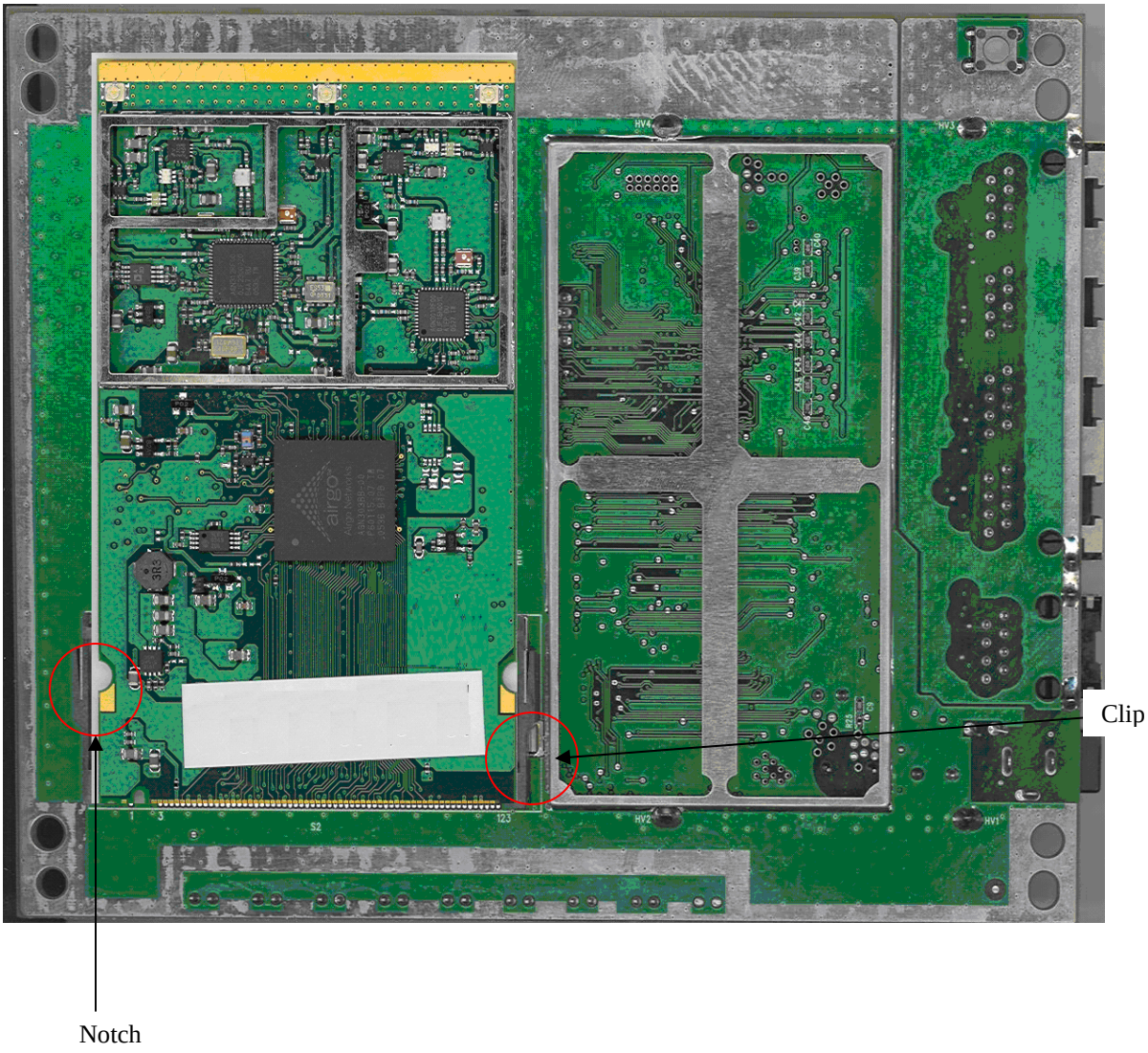

Figure 4 Radio Module Alignment

65-VE240-P1 Antenna Specifications

The 65-VE240-P1 provides support for three antennas per radio module. These antennas are connected by way of Hirose connectors. It must be noted that there are no special requirements for the types of antennas used with MIMO technology. The specifications for the antennas that have been used with the 65-VE239-P1 are as follows:

- Frequency Range: 2.4 to 2.5 GHz
- Impedance: 50 Ohms nominal
- VSWR: 2.0
- Normal Gain: 2 dBi @ 2.45 GHz
- Radiation: Omni-directional
- Polarization: Vertical

Product Labeling

The 65-VE240-P1 radio transmitter module is authorized only for use in a device where the antenna may be installed such that 20 cm can be maintained between the antenna and the users. End-user products containing 65-VE240-P1 modules **MUST** have affixed to their labels the following phrase:

This product contains FCC ID: J9C-65VE240P1 module

Product Usage

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

1. The antenna must be installed such that 20 cm is maintained between the antenna and users.
2. The transmitter module may not be co-located with any other transmitter or antenna.
3. Use only authorized antenna(s) as described in the FCC filing under FCCID: J9C-65VE240P1

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

The OEM/ODM integrator is responsible for testing their product for any additional compliance mandates required when this module is installed within an end-user product.

i IMPORTANT NOTE: In the event that these conditions cannot be met, then the FCC authorization is no longer considered valid and the FCC ID number cannot be used on the final product and thus the OEM/ODM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

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Product Documentation
Following RF exposure information shall be supplied in end-users manual for products containing the 65-VE240-P1:

IMPORTANT NOTE:
To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

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.