VCom® Inc.

www.vcom.com

Advanced Broadband Products

DESCRIPTION

3.5 GHz
BROADBAND WIRELESS
INTERNET NETWORK

BWIN™ BASED ON DOCSIS™

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306 955 7075

4210 Commerce Circle
Victoria BC
Canada V8Z 6N6
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1 EXECUTIVE SUMMARY

VCom Inc. is pleased to present you with this summary description of a typical Broadband Wireless Internet Network based on proven Data over Cable Service Interface Specifications (DOCSIS™) technology. Our Broadband Wireless Internet Network, ***BWIN™ BASED ON DOCSIS™*** proposal marries DOCSIS Cable Modem Termination Systems (CMTS) with VCom radio frequency (RF) technology. Commercial deployments have demonstrated that the ***BWIN™ BASED ON DOCSIS™*** approach achieves high performance and reliability in a cost-effective fashion.

VCom designs and supplies leading edge broadband access transmission equipment, primarily for broadband fixed wireless networks and data over cable. Service providers use VCom's products to deliver high-speed data, Internet, video on demand (VOD) and other bandwidth intensive services to residential and business subscribers. VCom's products are designed to allow service providers to rapidly and cost-effectively bridge the last mile, by overcoming the bottleneck resulting from insufficient bandwidth existing in legacy last mile infrastructures. The Company's customer base includes original equipment manufacturers (OEM), system integrators and leading multiple system operators (MSO) and other service providers. Please find details at http://www.vcom.com/.

The key feature of VCom's ***BWIN™ BASED ON DOCSIS™*** solution is that high volumes of standard DOCSIS™ modems are being produced by a large number of manufacturers; the economies of scale created by this situation results in inexpensive, feature rich subscriber equipment. The basic most cost-effective network is designed with only a limited amount of redundancy. Options are available that provide full 1 to 1 redundancy for all CMTS and base station RF equipment.

2 SYSTEM OVERVIEW

The architecture of the VCom ***BWIN™ BASED ON DOCSIS™*** system utilizes standard DOCSIS™ cable equipment as the network elements. Complementing this standard DOCSIS™ setup is VCom RF hardware designed to translate specific sub-bands of the DOCSIS™ cable frequency plan into the frequency allocations of each specific customer.

Key characteristics of the system are as follows:

- 27 Mbps time division multiplexed downstream using 64QAM in a 6 MHz channel, or 36 Mbps in an 8 MHz channel
- 256 Kbps to 10 Mbps time division multiple access burst upstream using QPSK or 16QAM in 200 kHz to 3.2 MHz bandwidths
- near line of sight performance
- systems already operating at 600 MHz, 700 MHz, 1.9 GHz, 2.1 GHz, 2.3 GHz, 2.5 GHz, 3.5 GHz and 5.7 GHz around the world
- audible installation alignment beeper available on some models to facilitate customer self-install and avoid a truck roll
- economies of scale by reusing existing DOCSIS™ products which are now being deployed in high volume worldwide

2.1 DOCSIS Overview

DOCSIS™ is an open industry standard developed and coordinated through the efforts of cable MSOs and technology manufacturers such as Cisco, Motorola, Arris etc. and VCom under the non-profit institution, CableLabs®. DOCSIS™ technology is mature and in operation in many countries around the world as the standard for Internet access on hybrid fibre coax cable systems. A fundamental advantage of using DOCSIS™ is the wide variety of manufacturers producing cable modems and the volumes currently being deployed which translate into very cost effective subscriber equipment. Over 15 million DOCSIS™ cable modems are currently deployed worldwide with over 200,000 upstream DOCSIS™ ports. DOCSIS™ cable modem pricing is now less than US$55 in quantity.

The technology behind DOCSIS™ also lends itself very well to use as a fixed broadband wireless access mechanism. A well-developed physical layer, sophisticated media access control, and a complete network reference model provide for a commercial grade wireless system.

A quick overview of features is given below, but a more thorough discussion on the specific technical requirements for wireless can be provided as your project matures. CableLabs® website, http://www.cablemodem.com/ also contains the current DOCSIS™ specifications.

2.1.1 Physical Layer Characteristics

Key parameters of the physical layer include:

Downstream:

- 30 Mbps in a 6 MHz RF channel (standard DOCSIS™)
- 64QAM modulation
- Reed-Solomon forward error correction (~10% overhead)
- time division multiplexing
- continuous transmission

Upstream:

- variable channel bandwidths from 200 KHz to 3.2 MHz
- QPSK or 16QAM modulation
- Reed-Solomon forward error correction (~10% overhead)
- burst mode transmission
- adaptive power control over 50 dB range

2.1.2 Media Access Control (MAC)

The DOCSIS™ MAC utilizes a request/grant mechanism under central management of the CMTS. This time division multiple access (TDMA) reservation-based protocol requires each CPE to request a time to transmit data. The CMTS examines all of the incoming requests and grants a time to transmit based on a multitude of parameters including CPE data rate limitations and service priorities. A DOCSIS™ 1.1 compliant system with full QoS features is also available.

2.1.3 Security

Baseline Privacy Plus (BPI+), included as part of the DOCSIS™ protocol, provides advanced security and privacy features for both the service provider and the customer. All over-the-air communications operate with 56-bit DES encryption (or 40 bit where regulations require). Additionally, encrypted key management between the CMTS and modems requires subscriber authorization and registration to ensure reliable and secure billing for multiple server classes which prevents unauthorized access to the system. Various cable modems support end to end 3DES encryption.

2.2 RF Systems

2.2.1 Point to Multipoint Configuration

Figure 1 shows the overall system diagram for point to multipoint communication. A generic diagram of a single sector system is shown but standard configurations allow for one, three, four and six sector base stations. Detailed network capacity and RF planning is necessary to determine the optimum solution for a specific customer requirement.

Since the amount of spectrum available in the 3.5 GHz band is highly dependent on the country of operation, a standard band plan is not appropriate. VCom can support the following generic channel plans as per CEPT ERC 14-03 and 12-08:

3400-3700 MHz 24 MHz subbands, 50 or 100 MHz T-R spacing

Custom spacing and subbands for specific customer and country frequency allocations can be developed as required.

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FIGURE 1 - POINT TO MULTIPOINT SYSTEM OVERVIEW

Transceiver Reverse Path Output

TR3500 → QPSK: +22 dBm; 16QAM: +20 dBm (at RF port)

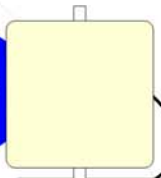
TRI3500 → QPSK: +40 dBm EIRP; 16QAM: +38 dBm EIRP (Integrated Antenna)

Reach farther and capture more subscribers

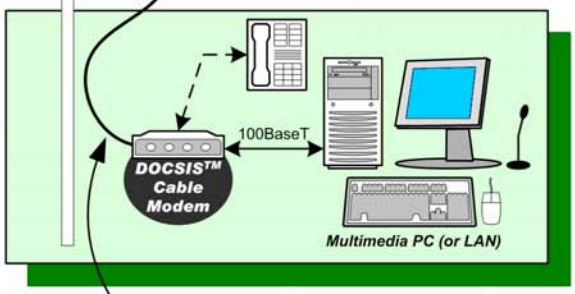
Compact, Very Easy to Install

Unique audible alignment beeper on some models to facilitate self-install

VCom TRI3500 Transceiver (TR3500 not shown)



Subscriber Home / Office



DOCSIS™ cable modem frequencies

Downstream
3400 to 3700 MHz
(12 or 24 MHz subbands)
(27 / 36 Mbps)

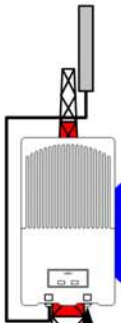
Upstream
3400 to 3700 MHz
(12 or 24 MHz subbands)
(250 kbps to 10 Mbps)

Automatic Transmit RF Mute

Reduces power consumption and virtually eliminates broadband noise emissions

Distances Up to 30 km

Depends on geography and tower height



VCom OBST3500 Base Station Transceiver (1 per sector)

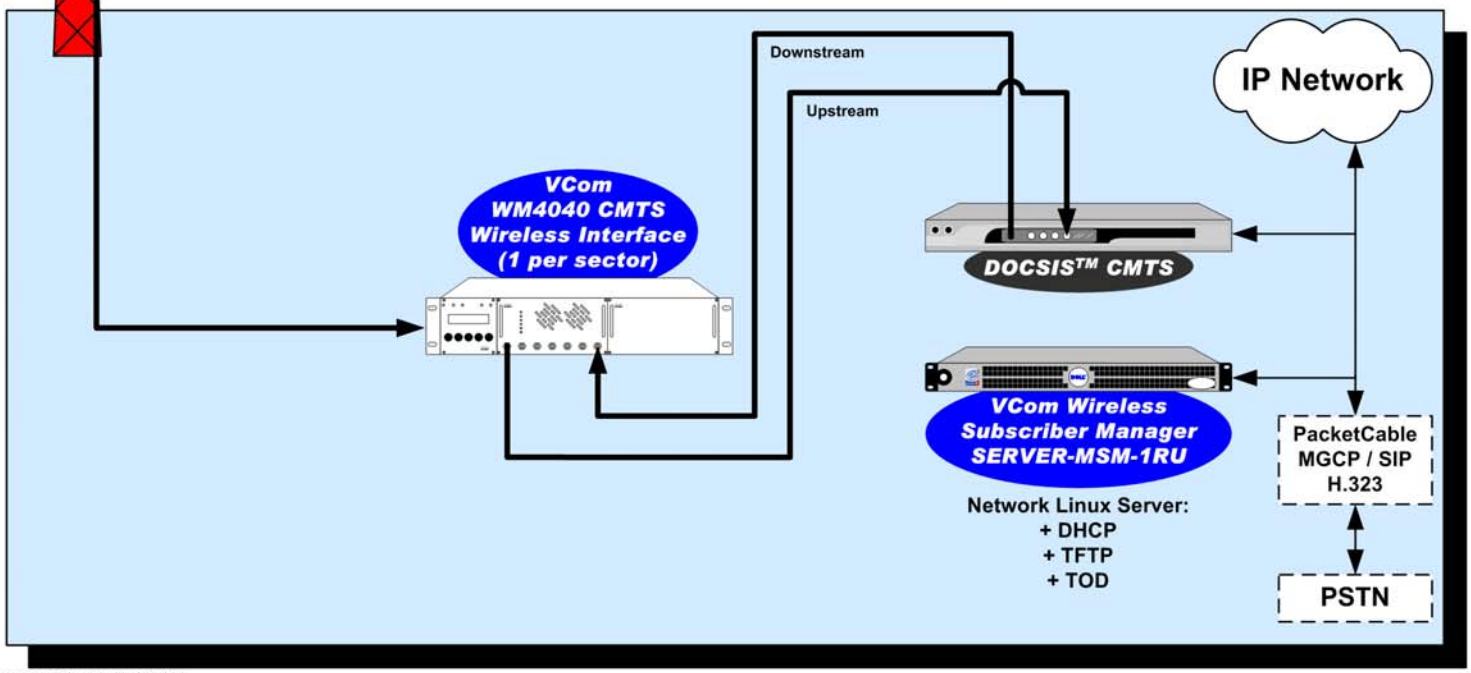
Full DOCSIS™ speeds

No limitation due to wireless link

Base Station

Utilizes Non-Proprietary DOCSIS™ equipment

Low cost, mature industry proven performance and quicker ROI



2.2.1.1 Base Station

Figure 2 shows a detailed diagram of the standard base station configuration; the transport/network connection ties directly into the hub CMTS. ***BWIN™ BASED ON DOCSIS™*** capability at 3.5 GHz requires two additional VCom components to complement the CMTS at the base station (hub) site. These additional components serve to convert the standard DOCSIS™ cable frequency plan to the required 3.5 GHz frequency plan and include the following:

(1) WM4040 CMTS Wireless Interface (Indoor Unit)
(2) OBST3500 Base Station Transceiver (Outdoor Unit)

For maximum integration and simplicity of interface at the base station, a common, universal indoor module for all single-carrier-per-base station transceiver systems from 2.1 GHz to 38 GHz was developed by VCom. This common module, the WM4040 CMTS Wireless Interface, connects to both the CMTS and the OBST3500 Base Station Transceiver. The WM4040 provides for sophisticated management of the OBST3500 frequency plan and power levels and it also provides alarm indications on the performance of the IF upconverter and base station transceiver.

This WM4040 module provides the following interfaces:

Network Element	Interfaces
CMTS	Upstream IF at 17-42 MHz (up to 6 upstream channels per module on 6 separate female 'F' connectors) Downstream IF at 44 MHz (single channel per module on female 'F' connector)
NMS	SNMP over 10BaseT Ethernet (on female RJ45 connector)
ODU (single coaxial cable)	Downstream IF in the 88-858 MHz band Upstream IF at 17-42 MHz Bidirectional signalling for BST management Frequency reference DC supply voltage (all delivered on single coaxial connector)
Other	Front panel display and controls AC (100-240VAC) or DC (-48VDC) power supply connection Upconverted IF Monitor port

An internal splitter is used to separate the single upstream connection from the outdoor transceiver into six separate 17 MHz to 42 MHz upstream IF signals. All connections to the outdoor transceiver, including DC power, are made through a single coaxial cable for ease of installation.

The software module to support the frequency plan will be factory-loaded into the WM4040. This will ensure that the output frequency is properly configured to prevent accidental emissions outside of the regulated band. Additionally, these software changes will ensure that the front panel and management interface display accurately reflects the RF over-the-air frequency plan rather than the IF signal carried between WM4040 up-converter and transceiver. All software upgrades to the WM4040 can be initiated without disruption of service to that sector. Any WM4040 module can control any frequency transceiver when loaded with the appropriate software drivers and security is included in the transceiver to ensure that the WM4040 frequency settings accurately reflect the transceiver frequency plans and duplexers installed. Updated software modules can be loaded at any time via TFTP.

Management of base station transceivers is performed using a bi-directional, half-duplex signalling protocol. Full control of transceiver operating parameters is provided via the standard element methods – front panel buttons and display, or RS232. Full control of transceiver operating parameters using an SNMP interface is optional. Transceiver software upgrades can also be initiated through TFTP.

Output power management will be done under control of the NMS. The WM4040 and transmitter combination will implement two power control modes: closed loop automatic transmit power control and open loop gain control. Closed loop automatic transmit power control (ATPC) will attempt to set the measured output power to the value specified through the management interface. In open loop gain control mode, a specific gain will be set for the WM4040/transmitter combination and output power level will track input power level, but will be hard-limited to never rise above a level that could exceed the spectral mask.

Redundancy within the WM4040 is optional – this redundancy allows a redundant power supply and upconverter card to be included in the chassis. The secondary path connects directly to a secondary CMTS modem.

The OBST3500 Base Station Transceiver is an outdoor transceiver mounted next to the antenna. Various external single antenna configurations depending on the cell size and subscriber density are available; standard options include omnidirectional, 120º, 90º, and 60º. The WM4040 is used to communicate with the OBST3500 to accomplish functions such as setting transmit frequency and power level and polls the OBST3500 for indication of system performance and alarm conditions.

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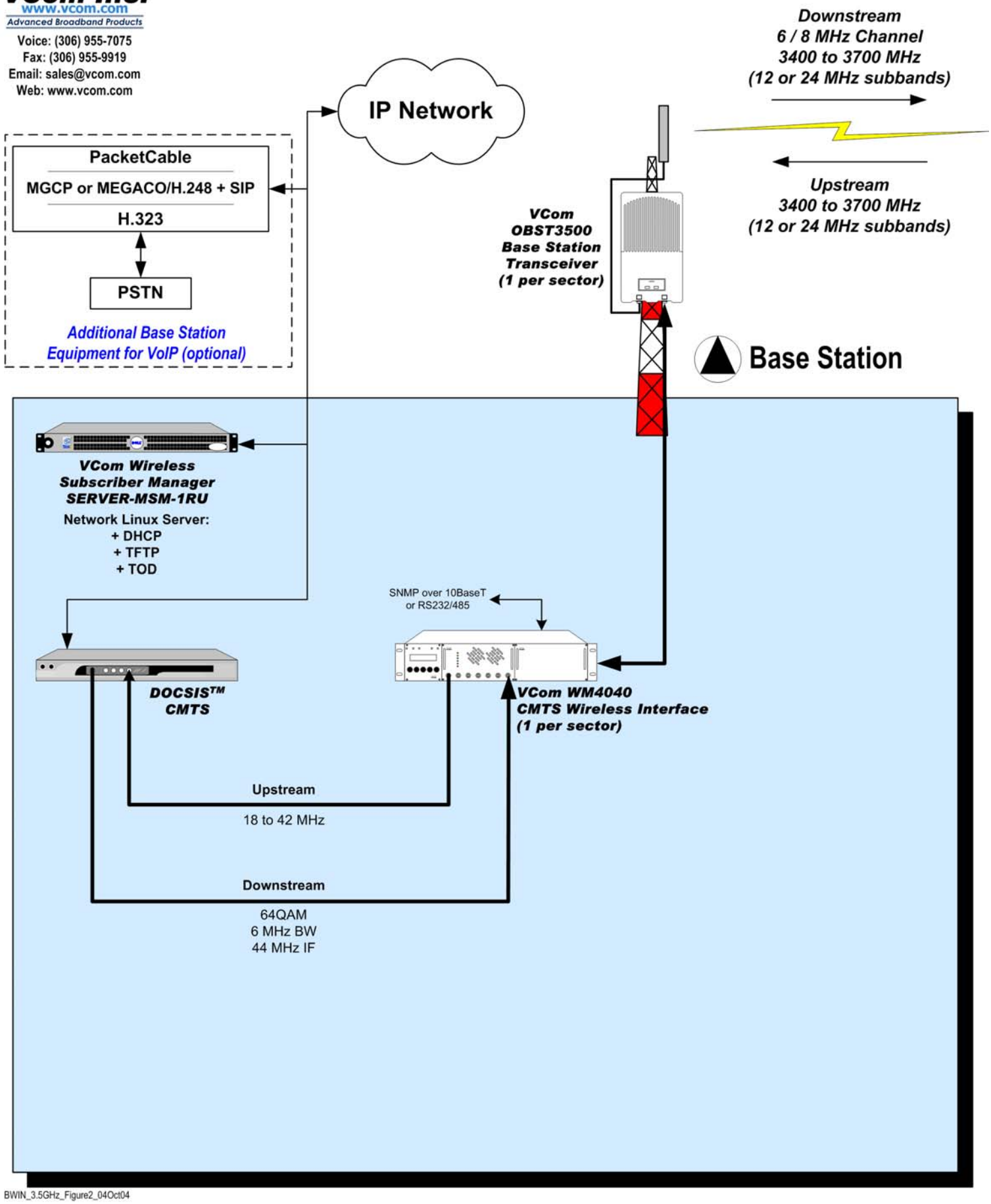
FIGURE 2 - POINT TO MULTIPOINT BASE STATION DETAIL

Single Sector



2.2.1.2 Subscriber

Figure 3 details the configuration for a standard subscriber installation. There are two fundamental elements, each with multiple options depending on performance and feature set: the outdoor RF transceiver (TR3500 or TRI3500) and the indoor DOCSIS™ modem.

The TR3500 (or TRI3500) subscriber transceiver serves to frequency translate and amplify the upstream and downstream signals to the appropriate cable frequencies for use by the indoor DOCSIS™ modem. A highly directional flat panel antenna is integrated with the transceiver and a single low cost 75 ohm cable (i.e.: RG-59 or RG-6) is used to connect between the transceiver IF port and indoor AC/DC power inserter. A short jumper cable is used to connect to the DOCSIS™ modem. Recommended modems depend on the application.

FIGURE 3 - POINT TO MULTIPOINT SUBSCRIBER DETAIL
Subscriber Home/Office

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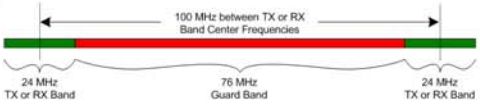
VCom 3.5 GHz Transceiver Options

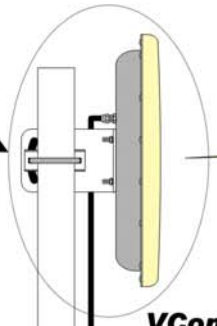
Standalone (use with external antenna)
TR3500 - 12 or 24 MHz Subbands
QPSK: +22 dBm; 16QAM: +20 dBm (at RF port)

Integrated Antenna (flat panel)
TRI3500 - 12 or 24 MHz Subbands
QPSK: +40 dBm EIRP; 16QAM: +38 dBm EIRP

TR3500 / TRI3500 12 MHz Subband Configuration:

TR3500 / TRI3500 24 MHz Subband Configuration:





Downstream
3400 to 3700 MHz
(12 or 24 MHz subbands)

Upstream
3400 to 3700 MHz
(12 or 24 MHz subbands)

VCom TRI3500 Transceiver (TR3500 not shown)

Coaxial Cable Connection to Transceiver

Downstream:
366 to 594 MHz*

Upstream:
18 to 42 MHz*

****Actual frequency range determined by 3.5 GHz license***

Media Terminal Adapter (MTA)

Telephone

***NOTE:** MTA is not necessary if a DOCSIS™ Cable Modem with an Embedded MTA (E-MTA) is used*

Additional Subscriber Equipment for VoIP (optional)

24 VDC Power Supply

Coaxial Cable Connection to Cable Modem

DOCSIS™ Cable Modem

100BaseT Ethernet
10BaseT Ethernet
(USB may also be available)

Multimedia PC (or LAN)

2.3 Element and Network Management

All network and RF elements, with the exception of the subscriber transceivers are fully visible on the network when using a VCom SERVER. VCom's SERVER is a Linux based web-server configured with VCom's Microwave History Manager (MHM) software. The MHM software offers basic logging and display of cable modem statistics.

VCom's optional Microwave Subscriber Manager (MSM) software offers DHCP, TFTP, customer database, individual control of cable modems, and latitude/longitude mapping support functions in addition to the basic functions available in MHM.

3 Ongoing Field Trial

VCom now has 33 different transceiver designs covering frequency bands from 500 MHz to 6 GHz and has sold thousands of CPE units globally. VCom's confidence in these products has lead to a launched a service provisioning (WISP) subsidiary under the name YourLINK (http://www.yourlink.ca/) and currently operates in Saskatoon, SK Canada.

References to customers with operational systems on 4 continents are available on request. VCom would be pleased to demonstrate this system and to put in place any particular tests or equipment configurations to demonstrate the performance and manageability of the system.

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