User's Manual

The most important thing we build is trust.

VETA Transmitter – Compact

(VT-C)

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100-M0089X1
06/03/09

REVISION HISTORY

Version	Date	Author	Comments
X1	06-16-08	Nathan Moore & Ruzanna Manvelyan	Initial release.

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1.0 Acronyms

This section lists and describes the various acronyms used in this document.

Name	Meaning
16QAM	16-state Quadrature Amplitude Modulation
A/V	Audio/Video
AES	Advanced Encryption System
ABS	Basic Encryption System (8 bit)
COFDM	Coded Orthogonal Frequency Division Multiplexing
CVBS	Composite Video
D/C	Down-Converter
FEC	Forward Error Correction
GUI	Graphical User Interface
I/O	Input/ Output
KBaud	Kilobaud per second
Kbps	Kilobits per second
Mbps	Megabits per second
MER	Modulation Error Rate
MPEG	Moving Picture Experts Group
NTSC	National Television System Committee
PAL	Phase Alternation Line
QPSK	Quadrature Phase Shift Keying
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RX	Receiver
S/N	Signal-to-Noise Ratio
THD	Total Harmonic Distortion
TX	Transmitter
VDC	Volts (Direct Current)
VDL	VETA Digital Link
VR	VETA Receiver
VT	VETA Transmitter
VDR	VETA Digital Repeater
CSM	Compact Surveillance Modem
UDP	User Datagram Protocol
VNA	VETA Network Adapter

2.0 Introduction

GMS' Very Efficient Transmission Apparatus (VETA) product line enables the user to build wireless digital microwave video systems. The product line provides several key features that enable high-quality and low-latency wireless Audio/Video (A/V) transmission for the most demanding short or long distance point–to–point or point to multipoint transmission applications. VETA transmitters are suitable for applications where size, weight, latency, security and power consumption are critical.

VETA uses a digital modulation system known as **Coded Orthogonal Frequency Division (COFDM)** that provides a robust link immune to multipath interference and provides crisp, clear pictures in the most difficult of terrains. The VETA product line employs the standard DVB-T 2K carriers COFDM technology. Additionally, an optional 1.25MHz and 2.5MHz RF bandwidth with 400 carriers may be user selected that allow a larger quantity of simultaneous A/V links to operate in the same frequency band. The 2.5MHz and 1.25MHz bandwidth technology demonstrates better propagation for longer range links.

One of the biggest problems encountered in the transition from analog to digital A/V systems has been the **inherent digital coding/decoding delays** that in some digital systems are 400ms or more. The VETA Transmitters & Receivers employ internal MPEG-2 or MPEG-4 (User Selectable) Encoders and Decoders with specially designed 'low-delay' coding technology, which provides an end to end latency of down to **44ms *without*** the introduction of any further MPEG encoding artifacts. This is crucial for certain applications, where personnel are reacting to real-time events.

The VT-C is a VETA Transmitter that has been designed to be as compact and lightweight as possible with 6.25 cubic inches of volume and only 0.28 pounds of weight, making the VT-C perfect for small Unmanned Aerial Vehicle (UAV) applications. A companion compact high efficiency Power Amplifier is also available to boost the 100-200 mW output power of the VT-C up to 10W! Its small size and low DC power consumption (<6W) make it an ideal candidate for hand-held or covert applications that must be operated from a battery.

The VT-C accepts a composite or S-Video input, analog stereo audio inputs and a RS232 user data input. The video is compressed according to MPEG2 or MPEG4 specifications. The audio is sampled and compressed. The audio, video and data packet streams are multiplexed with basic service data to indicate the service name. Security of transmission is ensured by the use of Standard ABS encryption or, for greater security, by implementing of optional AES 128 or 256 bit scrambling algorithms. The transport stream is sent for FEC pre-processing and COFDM modulation. The modulated signal is amplified and output through a SMA-F connector.

This manual provides information on how to operate the VT-C (VETA Compact Transmitter) as well as pertinent technical information related to the overall system.

2.1 Key System Features

- COFDM Modulation : 2K or 400 [1] (optional) Carriers
- Bandwidths: 6 MHz, 7 MHz or 8 MHz
  (1.25 & 2.5 MHz optional)
- Output Frequency: 0.34 to 7.2 GHz (In-Bands)
- Output Power: Programmable up to 100mW / 200mW
  (Up to 10W with external PA)
- Built-in MPEG-2/4 Encoder
- Low End to End System Latency [3] (~44mS)
- Rugged Compact Design: 2.8" x 3.1" x 1.1" (7.1cm x 7.9cm x 2.8cm)
- Weights only 0.28 pounds
- Local Control Interface
- Companion VETA Receiver with Diversity Reception
- Secure – ABS and AES[3]

[1] 400 carriers is optional with the 1.25 or 2.5MHz RF bandwidths
[2] With DVB-T standard BWs. ~120mS system latency in 1.25 & 2.5 MHz Bandwidths depending on modulation parameters
[3] AES 128 or 256 bit encryption is optional

2.2 Warranty

GMS offers a 12 month standard product warranty. During this period, should the customer encounter a fault with the equipment we recommend the following course of action:

- Check the support section of the website for information on that product and any software/firmware upgrades.
- If fault persists call our support line and report the fault. If you are informed to return the product, please obtain an RMA number from the GMS support department or website and ship the equipment with the RMA number displayed and a description of the fault. Please email the support section the airway bill/consignment number for tracking purposes.

Depending on the nature of the fault **GMS** endeavor to repair the equipment and return it to the customer within 14 days of the item arriving at our workshops. Obviously it is impossible to cater for all types of faults and to manage 100% replacement part availability, and delays are sometimes inevitable.
Please contact **GMS** for details of packages that can be tailored to meet your individual needs, whether they are service availability, technical training, local geographic support or dedicated spares holdings.

2.3 Safe Operating Procedures

• Ensure that the power supply arrangements are adequate to meet the requirements of VETA product.
• Operate within the environmental limits specified for the product.
• Only authorized, trained personnel should open the product. There are no functions that required the User to gain access to the interior of the product.

3.0 General System Information

3.1 Getting Started

The VT is pre-configured by GMS prior to shipment, thus is ready to work "right out of the box".

NOTE: Additional cables and antennas may be delivered by GMS based on customer application. Contact GMS for further information

3.2 Initial Checkout

Prior to installing a VT unit into the desired target environment, an initial checkout should be performed to ensure proper operation of the unit. The initial checkout consists of configuring a basic VDL (VETA Digital LINK) wireless link.

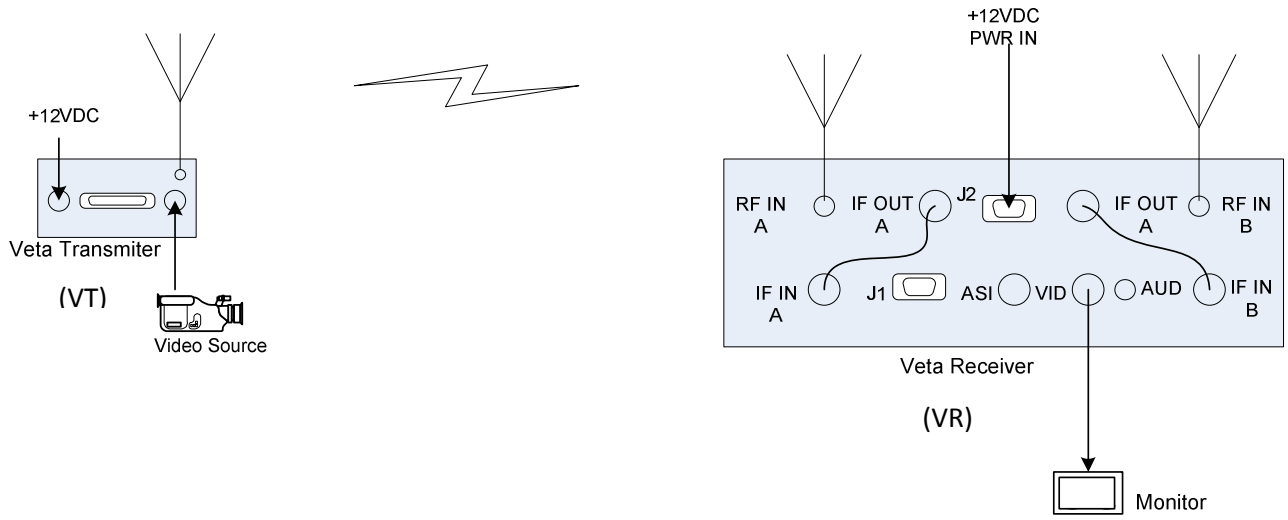

Figure 3.1 Basic VDL Setup

- Install Omni-directional antennas (or ones best suited for the application) onto the RF IN A and RF IN B ports on the Veta Receiver (or equivalent DVB-T receiver) and one on the SMA RF connector on the Veta transmitter.
- Attach the VT (VETA transmitter) power cable and apply **+12VDC** to the red pigtail and GND to the black pigtail. Ensure power supply can supply at least 1.5A at +12VDC.
- Attach a composite video source to the BNC video input cable that is located on the VT breakout cable. If the TX receives the source signal Red Alarm LED will turn off.
- Note which VT Configuration LED 1 through 8 is lit (above the **CONFIG button**); this number must match the receiver configuration, assuming all configurations have matching parameters. See section 5.3 for details.
- Press the **RF button** on the VT so that only one of the **Signal Strength LED-s** of VR (above MODE button) is green. This sets the VT to its lowest RF power setting.
- Attach a video cable from BNC VID output port on the VR (Veta Receiver) to the composite input of the video monitor.

- Apply +12Vdc to the VR, pins 1, 2, +12V and 3, 4 ground to the J2 dB connector (if using provided cable use the red (+12V) and black (GND) pigtails. *Power supply must be able to source 2 AMP at 12VDC.*
- Turn on the video source and video monitor equipment.
- Turn on the VR with the **PWR switch** on the front panel (up is ON).
- Ensure the selected green LED1 through 8 (above the **CONF button**) matches the same configuration LED as the transmitter. If not use the **CONF button** to select the correct configuration, select the same number as the transmitter, assuming that both TX and RX have the default configuration settings.
- Once the VR has powered-up, ensure that the **Config LED** is light solid green. If not, press the **RF button** on the front keypad (this action provides power to the internal down converters) so that corresponding **Config LED** is solid green.
- Press the **MODE button to** turn on the diagnostic OSD (on screen display).
- After approximately 5 seconds, the link should be established and video provided by the source should be displayed on the monitor. On the Receiver side the green **RF LED** should light as well as the **Signal Strength** indicators.
- If the red Alarm LED lights it may be an indication that the receiver is unable to lock to a signal. Check the following:
    - Ensure the receiver and transmitter lit configuration green LED (1 through 8) located above the **CONFIG button** is the same.
    - Ensure the PWR switch for the VR is **ON** and that the **RF button** has been pressed after apply +12VDC.
    - Ensure the transmitter **RF LED** is green, if not press **RF button**.
    - If the TX and RX are physically too close to each other, the RX may overload causing distorted Video. You may reduce the power of the TX (Use RF button) or move the TX & RX further apart.

The initial checkout described above is simply to check the basic video operation of the VT unit. For further details on the connectors, monitoring and controlling the VT read thoroughly through this manual starting with section 5, hardware overview and then section 6, software control and monitoring.

4.0 Hardware Overview

The VT consists of a push button panel with LED indicators along with interface connectors. The push button panel and the LED status indicators are explained in the following section. The interface connectors are explained in section 5.2.

4.1 VT Standard LED and Push Button Panel

The LED status indicators and standard push button panel are explained in this section.

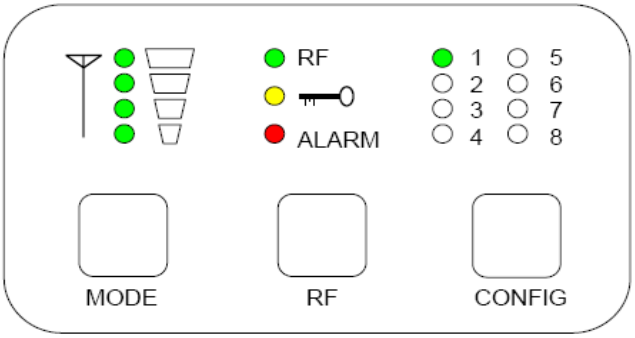

Figure 4.1 VT Control Panel

4.1.1 MODE Button

Pressing the *MODE* button toggles encryption ON/OFF. The *Lock LED* (Key) lights up yellow when Encryption turned ON. In order for the Link to work properly the Encryption type and the encryption key in the TX and RX should match (see software section 5.3).

4.1.2 RF Button

The RF button turns the RF output ON and OFF and also controls the RF level transmitted. Pressing the RF button toggles through the following states:

- RF ON – Full Power (LVL 4)
- RF ON – Medium High (LVL 3)
- RF ON – Medium Low (LVL 2)
- RF ON – Low (LVL 1)
- RF OFF

Note that the levels (LVL) are user defined and set through *Output Pads* in the Control GUI. Refer to section 5.3 on how to set the *Output Pads*, using GMS PC control software.

4.1.3 Range Mode LED-s

The *Range Mode* LED-s *LVL 1* through *LVL 4* (next to the Antenna icon above the *MODE* button) indicate the output power level. The top LED corresponds to *LVL 4,* which is full power. If no LEDS are lit, then the RF output is OFF. (See section 4.1.2 under RF button describing levels).

4.1.4 CONFIG Button

The CONFIG button when pressed selects the next configuration from memory. The 8 configurations in memory define all potential variables including center frequency and modulation BW. The parameters stored in Configurations are listed In Table 6.

☞ *Note that the configuration selection (1 through 8) must match the receiver configuration selection for the link to work properly, assuming that parameters in both TX and RX set accordingly.*

4.1.5 Green Config LED-s 1 to 8

The LED-s, located above the CONFIG button, indicate which one of the eight stored configurations is currently selected. Refer to Table 6 for default parameters.

4.1.6 RF LED

The *RF* LED, located above the *RF* button, indicates that the RF output is active when **ON**.

4.1.7 LOCK LED

The *LOCK* LED (located above the RF button next to the key icon) indicates that Encryption is active when **ON**, see software PC control section on how to enter encryption key. Encryption can be enabled through the GMS PC control software or by pressing *MODE* button.

4.1.8 ALARM LED

The *ALARM* LED (located above the *RF* button) when **ON** indicates a fault condition (faulty equipment) or an alarm. It usually means that the transmitter encoder is not locked to the incoming video (there is no video source attached to the transmitter).

4.2 VT Interface Connectors

The VT interface connectors consist of RF SMA, two LEMO connectors and a Hirose 16 pin connector. They are described in this section.

4.2.1 RF Out

The RF output consists of a female SMA connector.

Table 1: RF Connector

Connector Name	Connector Type	Comments
J3	SMA (F)	Antenna connects here

Figure 4.2 VT Interface Connectors

4.2.2 Power, 4 Pin Lemo Connector

A four (4) pin Lemo connector is provided for power connections. Nominal voltage is +12VDC. Voltage input range is 9 to 16VDC. Reverse polarity protection is provided *but* ***no protection for over voltage.***

☞ *Note: Lemo connectors are keyed. The small red dot on top of the mating connector helps in alignment when inserting the connector. To release (to pull connector out) pull back on the sleeve and at the same time pull connector out.*

Table 2: Lemo Connector (4pins)

Connector Name	Connector Type	PIN	Function
J1	Lemo 4-PIN (F)	1	+12 VDC nominal
J1	Lemo 4-PIN (F)	2	+12VDC nominal
J1	Lemo 4-PIN (F)	3	GND
J1	Lemo 4-PIN (F)	4	GND

4.2.3 Audio and Composite Video, 5 Pin Lemo Connector

A five (5) pin Lemo connector is provided for audio and composite video. The details for the connections are shown below in Table 3. Audio is single ended.
Input audio levels, from microphone to line level, and sample rates (32 KHz, 16 KHz, etc.) are set and adjusted through the PC control software (see section 5.3.2. for details).

Microphone power is provided on the audio connectors at approximately 2V (suitable for "Electret" microphones).

The composite video input is a 75 ohm impedance, PAL or NTSC selectable using the PC control software (see section 5.3.2.).

☞*Note: Lemo connectors are keyed. The small red dot on top of the mating connector helps in alignment when inserting the connector. To release (to pull connector out) pull back on the sleeve and at the same time pull connector out*

Table 3: Lemo Connector (5pin)

Connector Name	Connector Type	PIN	Function
J2	Lemo 5-PIN (F)	1	Audio right channel
J2	Lemo 5-PIN (F)	2	Audio left channel
J2	Lemo 5-PIN (F)	3	GND for Audio
J2	Lemo 5-PIN (F)	4	Composite video
J2	Lemo 5-PIN (F)	5	GND for composite video

4.2.4 Control, Data and S-Video, 16 pin Hirose Connector

A 16 pin Hirose connector provides for the Control TX and RX lines (used by the GMS PC control software to change and monitor all transmitter parameters.), the Data TX and RX lines (used to send RS232 data through the link), a common ground for the Control and Data lines, S-Video connections (Y & C) and its ground connection. This connector also contains connections for the "Chaining" interface which is a proprietary Transport Stream (TS) interface used for special functions like forming a Repeater using a VR and VT together.

These connections are detailed in Table 4 below.

Table 4: Hirose Connector

Connector Name	Connector Type	PIN	Function
J4	Hirose 16-pin (F)	1	NC
J4	Hirose 16-pin (F)	2	GND for CTRL and DATA
J4	Hirose 16-pin (F)	3	CTRL - TX
J4	Hirose 16-pin (F)	4	CTRL - RX
J4	Hirose 16-pin (F)	5	DATA - TX
J4	Hirose 16-pin (F)	6	DATA - RX
J4	Hirose 16-pin (F)	7	GPIO
J4	Hirose 16-pin (F)	8	Chaining CLK In
J4	Hirose 16-pin (F)	9	GND
J4	Hirose 16-pin (F)	10	Chaining Data In
J4	Hirose 16-pin (F)	11	Chaining CLK Out
J4	Hirose 16-pin (F)	12	GND
J4	Hirose 16-pin (F)	13	Chaining Data Out
J4	Hirose 16-pin (F)	14	GND – for S-Video
J4	Hirose 16-pin (F)	15	Y Luminance component S(Video)
J4	Hirose 16-pin (F)	16	C Chroma component S (Video)

5.0 Software Overview

Configuration, control and monitoring of the VETA units are done by using GMS' optional (sold separately) MS Windows-based VETA Link Configurator software program. This Graphical User Interface (GUI) program provides the end user with a straightforward way to interface with the VETA TX unit. During normal operation, once a VETA link is established, the VETA Link Configurator GUI does not need to be active and can be disconnected from the VETA unit.

5.1 System Requirements

The VETA Configurator program has been developed and tested on Windows 2000, Windows XP and Windows NT. Although the VETA Link Configurator program may work properly on other operating systems, only the Windows 2000, Windows XP and Windows NT environments have been used at GMS and no support or assistance can be provided concerning other operating systems.

5.2 Software Installation

The following instructions outline the installation process for the VETA Configurator program:

1. Insert provided CD-ROM into computer.
2. Click on 'setup.exe' file. This will launch the GMS_VETA Setup program and several initial setup files will begin to be copied onto the computer.
3. After the initial setup files are copied over, the GMS_VETA Setup program will prompt the user to close any applications that are running. Once all other programs are exited, click on the 'OK' button.

4. The GMS_VETA Setup program will prompt the user to click on the 'computer icon' button to begin installation. If desired, the user can change the destination directory from the default. Click on the 'computer icon' button.
5. The GMS_VETA Setup program will then prompt the user to 'Choose Program Group'. If desired, the user can change the program group from the default. Click on the 'Continue' button.
6. After quickly installing the VETA Configurator program, the GMS_VETA Setup program will put up a window indicating that setup was completed successfully. Click 'OK'.

5.3 VETA Configurator Functions

The VETA Configurator program provides the user access to many different configurations, control and monitoring options. When the VETA Configurator program is launched, the screen shown in **Figure 5.1** is displayed. The user should first select the serial port their computer is connected to via the Serial Port Selector and Status region. If the selected serial port is valid, the gray-colored status box will show 'Ready'. The Device Selector region allows the end user to choose to interface to VETA TX unit. To configure VETA, select the 'VETA' box in the Device Selector region. Once it is selected, the screen shown in **Figure 5.2** is displayed. The VETA Configurator program contains function buttons and all the configurable settings available on a VETA. The following sections explain, in detail, the various options.

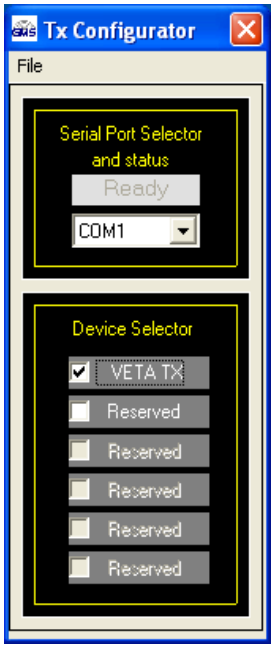

Figure 5.1 VETA Configurator

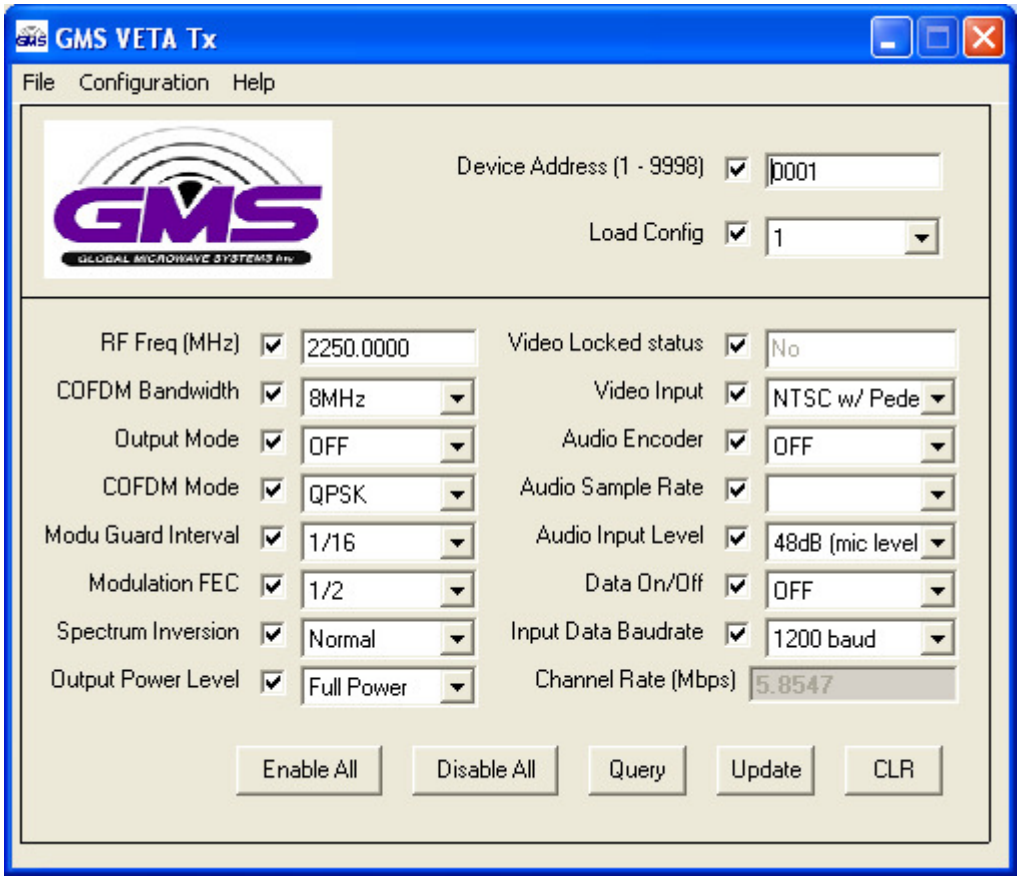

Figure 5.2 VETA Configurator Main Screen

5.3.1 Function Buttons

- "**Enable All**" **Button**: Clicking on this button enables all the check boxes on the screen. This operation is done to prepare all the fields to be written to (or read from). Alternatively, the end user can individually select a given field by using the mouse and clicking its corresponding check box.

- "**Disable All**" **Button**: Clicking on this button disables all the check boxes on the screen. This operation is done to inhibit all the fields to be written to (or read from). Alternatively, the end user can individually deselect a given field by using the mouse and clicking its corresponding check box.

- "**Query**" **Button**: Clicking on this button performs a read operation on all the fields that have their check box enabled. Once clicked, all the selected fields will be read back reflecting their current configuration.

- "**Update**" **Button**: Clicking on this button performs a write operation on all the fields that have their check box enabled. Once clicked, all the selected fields will be written to with the value denoted in their respective field.

- **"CLR" Button**: Clicking on this button clears out all fields on the screen, regardless of whether the fields' check boxes are selected or not. This button proves useful when the end user wants to verify that a write operation has been correctly performed. An example scenario would be to 1) enable all fields, 2) change desired fields, 3) perform 'Update' (write) operation, 4) perform a 'CLR' operation and 5) perform a 'Query' operation. As a result of the 'Query' operation, the fields on the screen should all update to those values that were written during the 'Update' operation.

5.3.2 Field Definitions

There are several different fields that can be configured by the VETA Configurator. The fields located in the main screen (see **Figure 5.2**) and their associated values are defined in below. Also noted in the table is whether the field is readable or readable and writeable.

☞*Note:* Changes can be made to the configuration using drop down and data entry fields. Changes only are applied when Update button is clicked. Current values can be read using Query button. Parameters that are status information appear grayed. Every time the Update button is clicked, all the current parameters will be saved in the selected configuration.

Load Config

VETA TX features eight user selectable and programmable configurations. By default, all 8 configurations are set to the values which are listed in Table 6. The settings in each CONFIG can be changed by user. The configuration that is currently active is indicated in Load Config pull- down menu (upper right corner of GUI). To activate a different configuration select the desired configuration in the Load Config menu and then click Update button in the lower right corner of the GUI.

Table 5: VETA Field Definitions

Field	R/W	Description
Device Address (1 – 9998)	R/W	Allows the user to assign a unique address to the VETA. Value can range from *1 to 9998*.
Load Config	R/W	Allows the user to select one of eight stored configurations. Value can range from 1 to 8.
RF Freq (MHz)	R/W	RF output frequency. Desired frequency is entered in MHz.
COFDM Bandwidth	R/W	Determines the BW of transmit signal. Desired bandwidth is selected from the following values: *6, 7, 8, 2.5 or 1.25 MHz.* 2.5 and 1.25MHz BW are optional and may not be selectable.
Output Mode	R/W	Output Mode controls power to the Power Amplifier / RF portion of the Transmitter and allows the following values*: Off or On*. [**NOTE**: If '*OFF*' is selected, the transmitter can still be configured]
COFDM Mode	R/W	**COFDM** modulation type. Desired **COFDM** modulation type is selected from the following values: *QPSK or 16QAM*.
Modulation Guard	R/W	Desired modulation guard interval size is selected, values are COFDM Mode dependable: *1/32, 1/16,*

Field	R/W	Description
Interval		*1/8 or ¼*. For Narrow Band Modes: *1/16, 1/8*
Modulation FEC	R/W	Desired modulation FEC rate is selected, values are COFDM Mode dependable: *½, 2/3, ¾, 5/6, 7/8* For Narrow Band Modes: *1/3, 2/3*
Spectrum Inversion	R/W	Desired inversion is selected, Normal or Inverted
Output Power Level	R/W	Output power level. Desired output level of VETA is selected: *Low, Medium Low, Medium High or Full Power*
Video Locked Status	R	Indicates that the VETA has line-locked onto the analog video input signal.
Video Input	R/W	Desired video input format is selected from the following values: *Off, PAL, NTSC with Pedestal, NTSC, S-Video NTSC or S-Video PAL.*
Audio Encoder	R/W	Desired mode of operation of the audio encoder is selected from the following values: *Off, Stereo or Mono.*
Audio Sample Rate	R/W	Desired sampling rate of the Audio signal is selected from the following values: 32KHz/12bit, 32KHz/8bit, 16KHz/8bit and 8KHz/8bit
Audio Input Level	R/W	This control is used to define the audio gain to be applied to the audio input signal. 0dB is used for line level audio and various options up to 48dB of gain can be applied for microphone inputs.
Data On/Off	R/W	With this ON / OFF control the user can select whether the transmitter passes serial RS232 data across the RF link to the receiver. Desired mode of operation of the external data port is selected from the following values: *Off or On.*
Input Data Baud Rate	R/W	Desired Baud Rate of external data port is selected from the following values: *1200 baud, 2400 baud, 4800 baud, 9600 baud, 19200 baud or 38400 baud.* *Note: COM Port should be set with 1 Stop bit, Flow control-none.*
Channel Rate	R	Displays channel rate depending on Modulation parameters.

☞Warning: If a configuration group is changed, it may not match the receiver configuration group and the digital link may no longer work. Keep in mind the receiver and transmitter configuration groups settings must match.

☞ Note: Changing a configuration turns off the RF output to prevent accidental transmission and potential interference. The RF output must manually be re enabled by pushing RF Button once the user is confident that the correct configuration has been selected. Modifying the default configurations is done from the PC control application.

5.3.3 Pull-Down Menu Definitions

There are several different pull-down menus that are included in the VETA Configurator program. Each of these pull-down menus contains further user-configurable options or commands. The following sections describe these menus in detail.

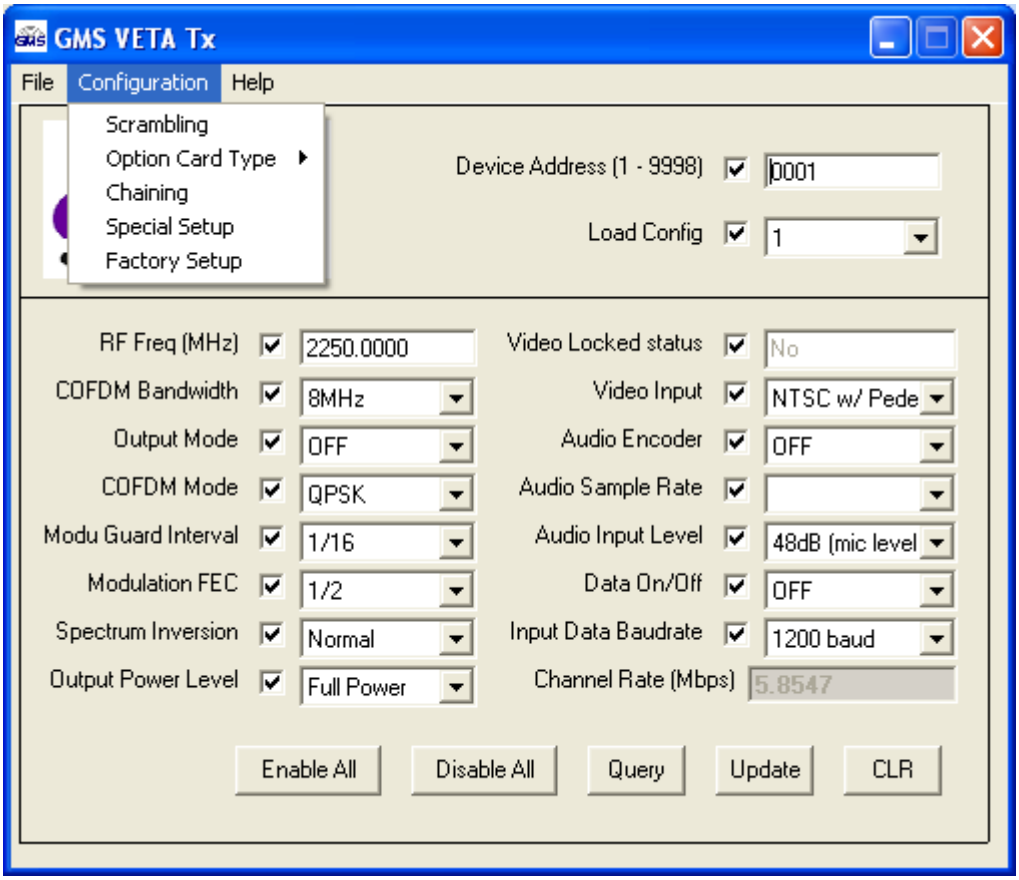

Figure 5.3 Configuration Menu

5.3.3.1 File

This pull-down menu is used solely to exit the VETA Configurator program. Alternatively, the 'X' box in the upper right hand corner of the window can be used to exit the program.

5.3.3.2 Configuration

This pull-down menu contains several different configuration options (see **Figure 5.3**). These are outlined below:

- *Scrambling*: This selection pulls up a window that allows the user to apply a scrambling scheme to the transport stream prior to modulation. The choices for this option are: OFF, ABS, AES128 or AES256. When any scrambling option is selected the user is prompted to enter an encryption key. The difference between scrambling modes is the length of the key (8, 32 and 64 characters respectively). In order for the Receiver to be able to unscramble encrypted signal it has to be in the descrambling mode and have

the same key as the incoming signal. The key also can be entered from a text file. Scrambling key is limited to Hex-Decimal characters.

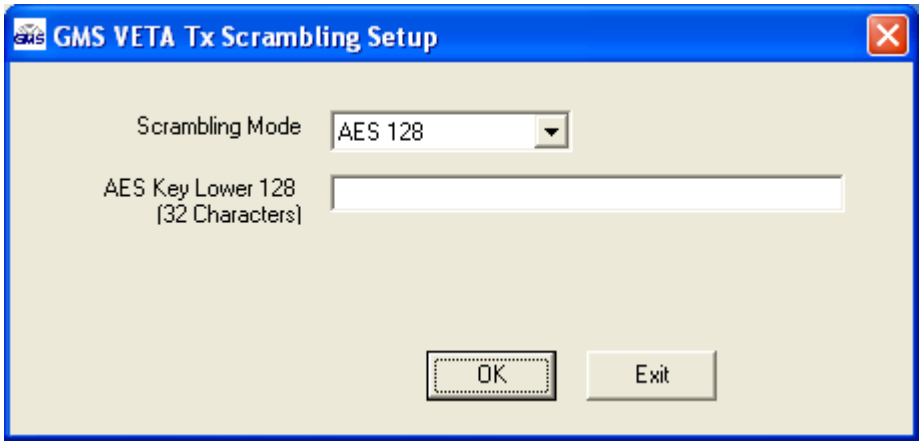

Figure 5.4 Scrambling window

- *Option Card Type*: **RESERVED / TBD**
- *Chaining*: This selection pulls up a window that allows the user to chain multiple digital streams together and send them over a single RF channel. The choices for this option are: On, Off or Relay. When the *Chaining* is "On" it is necessary to assign a chain number to the unit from drop-down list.
- *Special Setup*: This selection has the following sections.

    - Output pads: values determine the Power level of output RF signal for back off power levels. The default settings are such that for a 200milliWatt unit the subsequent levels correspond to 100milliWatt, 50milliWatt and full back off level. User can change these values by changing the values of the proper PAD-s. The following is the default values of the Output power levels in dBm for 200 and 100milliWatt units:

Full	(4 green LED-s)	23dBm	20dBm
Medium High	(3 green LED-s)	20dBm	17dBm
Medium Low	(2 green LED-s)	17dBm	14dBm
Low	(1 green LED-s)	~-5dBm	~-5dBm

    - *Horizontal resolution* can be selected from 704, 528, 480 and 352 pixels. Changing the horizontal resolution to lower values will make the coded picture softer. Care should be taken to match the horizontal resolution to the resolution of the camera connected to the transmitter; this will give best image results. The rest of the selections are related to Video Encoding Format.

    - *Sleep Mode* (i.e., Yes/No): VETA transmitters can be placed in a low current consumption standby mode by pressing and holding the RF button for one second. The LED-s will go out indicating that the unit is in standby mode.

Pressing and holding the RF button for one second brings the unit back out of Sleep mode.

- *Sleep in no Video Lock:* If *YES* is selected, then the TX will go in to *Sleep* mode if no Input Video is present.

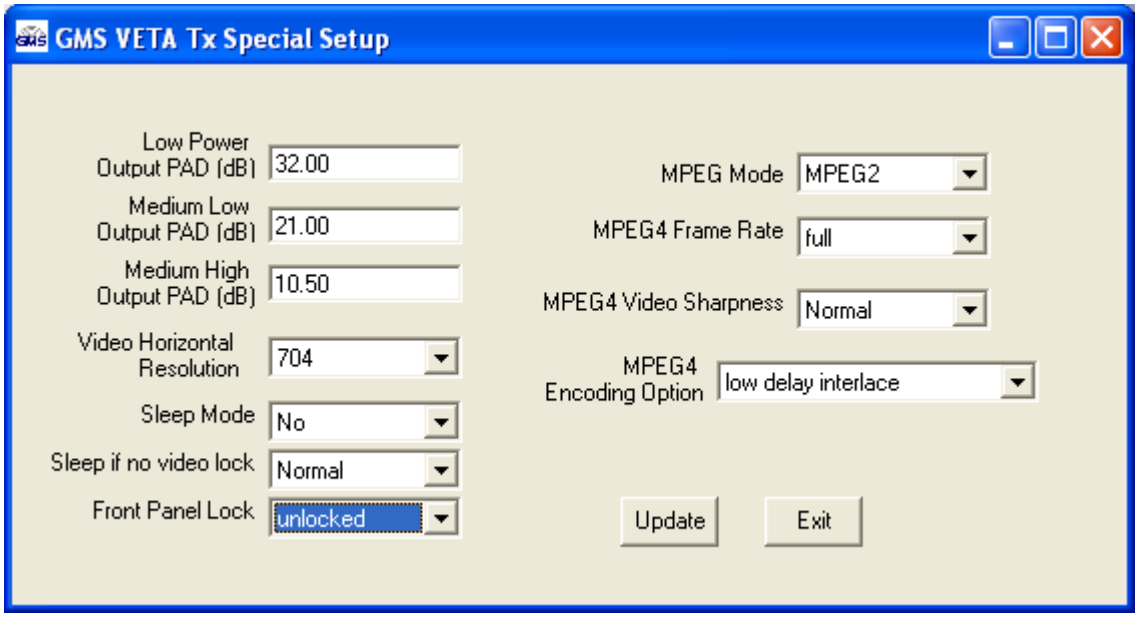

Figure 5.5 Special Set up

- *Front Panel Lock* (locked or unlock) when On the Front Panel buttons are inoperable.

- *MPEG Mode*: the default encoding mode is MPEG2. MPEG4 is only available for VETA TX if the Ultra Narrow Band upgrade has been purchased. It is recommended that MPEG4 be employed when the unit is operating at low bitrates (2.5MHz bandwidth FEC1/3 or 1.25MHz bandwidth FEC1/3).

- *MPEG4 Frame Rate* option is only available on VETA products installed with the Ultra Narrow Band Upgrade. This option allows the user to select lower frame rate encoding (1/2 frame rate, ¼, 1/8 etc) It is recommended that MPEG4 reduced frame rates be employed when the unit is operating at low bitrates (1.25MHz bandwidth FEC1/3).

- *MPEG4 Video Sharpness:* Sharpness is related to the clarity of detail and edge definition of an image. Encoding of video information may remove some higher-frequency content in the original video information. The decoded information may appear smoothed and/or somewhat fuzzy when displayed. To improve video image quality additional algorithms might be implemented by setting this parameter to Sharp.

- *MPEG4 Encoding Mode* is only available on VETA TX with the Ultra Narrow Band Upgrade. The default is low delay interlace. Other modes are available but advice should be sought before selection.

➢ *Factory Setup*: This selection is password protected and reserved for factory use.

5.3.3.3 Help

This pull-down menu contains information about the VETA firmware and the VETA Configurator software. This information is outlined below:

➢ *FW version*: This selection pulls up a window that displays the VETA Software Version, FPGA Version and Serial Number.

➢ *About*: This selection pulls up a window that displays the Version Number of the GMS VETA Configurator program.

Figure 5.6 HELP screen

Default Setting

The VETA Transmitters are shipped with the following default settings in all 8 configurations:

Table 6: Default Settings

Setting	Value
Device Address	0001
RF Frequency	Middle of the Band
COFDM BW	8MHz
Output Mode	OFF
COFDM Mode	QPSK
Modulation GI	1/32
Modulation FEC	1/2
Output Power Level	Full Power
Video Input	NTSC
Audio Encoder	OFF
Audio Sample Rate	32KHz, 12 Bit
Audio Input	Line Level
Data ON/OFF	OFF
Input Data Rate	38400 Baud
Scrambling	OFF
Chaining	OFF
Output Pads	Factory set such that back off PWR levels are 20dBm,17dBm, and full power back off ~-5dBm for 200mW units (17dBm,14dBm and ~-5dBm for 100mWatt units)
Horizontal resolution	704
Sleep Mode	No
Sleep in no Video	Normal
Front Panel Lock	Unlocked
MPEG Mode	MPEG-2
MPEG4 Frame Rate	Full
Sharpness	Normal
Encoding Option	Standard Delay Interlaced

6.0 Control Protocols

The following section describes the control protocol employed on the RS232 link for controlling the VETA transmitters. Normally, this interface is only used when the VT is incorporated into a system that contains an integrated System Controller.

6.1 RS232 Control

The physical interface is RS232. Normal operation involves sending a packet from the control device (normally a PC) to the device being controlled. If the packet satisfies an address integrity check, then the controlled device will action the command and send a reply. For compatibility with modems an ASCII style protocol is used.

Ports are set for 115200 Baud, 8 bits, No parity, 1 stop bit, Flow Control: None.

6.2 Packet Structure Sending (from PC)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
R	20h-7Eh	1 byte command type. **r** read, **w** write or **m** misc
I	20h-7E	1 byte indicator of internal data block
ABC	20h-7Eh	Command –three byte mnemonic
;	3Bh	Separator
PQR	20h-7Eh	Data –Optional, variable length
;	3Bh	Separator
X	20h-7Eh	Sum Check
ETX	03h	End byte

6.3 Packet Structure Reply (from controlled device)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
Z	20h-7Eh	Status Byte
PQR	20h-7E	Data –Optional, variable length
;	20h-7Eh	Separator
X	3Bh	Sum Check
ETX	20h-7Eh	End byte

The Sum check byte is the summation of all bytes in the packet, not including the start and end bytes. Higher order bytes are ignored and the final byte result is modified to prevent ASCII control characters being sent. Bit 7 (highest) is forced high. Status byte will indicate command performed OK, or indicate an error.

ASCII	Meaning
1	All OK
E	General error, Command could not be actioned.

Typically E will be returned if the message is formatted incorrectly (separators in wrong place) or if commands are in upper case, or if commands do not match against the allowed list of commands, or if the checksum is wrong.

Addresses in the range 0001 to 9998 are for general use. Address 0000 is reserved and 9999 is a broadcast address. I.e. any device will reply to this address. Its reply will contain its own specific address.

All data in the transmitter and receiver is stored as one of 5 data types: Double, String, List, Integer or Hex Integer. The data type dictates the contents of the data section of the reply.

- List – 1 byte for sending. Value is hexadecimal coded as ASCII. 2 byte reply. Reply represents index into original choice list. E.g. Reply 02 indicates entry 2 in original list.
- Double - variable length. Reply always contains decimal point and 4 decimal places, can have 1 to 3 digits before decimal.
- Integer - 6byte reply. Integer value with stuffed with preceding zeros. e.g. GOP reply 000012 = GOP length 12
- String - Variable length. Reply is string excluding null terminator
- Hex Integer – 8byte Hex reply

6.4 Transmitter Command List

Type 'o' messages for Modulation commands

Function	R/W	Block	Command	DATA	Type
Set Modulation IF output	r/w	o	out	1 byte 0 OFF 1 COFDM	Int
Set Narrow Band Modulation FEC	r/w	o	fec	1 byte 1 = 2/3 2 = 1/3	Int
Set Narrow Band Modulation Guard Interval	r/w	o	gua	1 byte 1 = 1/16 2 = 1/8	Int
Set Narrow Band COFDM Mode	r/w	o	mod	1 byte 0 = QPSK 1 = 16 QAM	int
Set Modulation Frequency	r/w	o	fre	Set Frequency in MHz, decimal point allowed	double
Spectrum Inversion	r/w	o	spe	1 byte 0 = Normal 1 = Inverted	Int
COFDM Bandwidth	r/w	o	wid	0 = 6 MHz 1 = 7 MHz 2 = 8 MHz 3 = 2.5 MHz 4 = 1.25 MHz	list
Output Attenuation Low Power	r/w	o	llv	Default level is 32 Value 0 to 32 in 0.25dB steps	Int
Output Attenuation Med-Low Power	r/w	o	lml	Value 0 to 32 in 0.25dB steps	Int
Output Attenuation Med-High Power	r/w	o	lev	Value 0 to 32 in 0.25dB steps	Int
Output Power Switch	r/w	o	hls	0 = Low Power 1 = Medium Low Power 2 = Medium High Power 3 = Full Power	int
DVB-T FEC	r/w	o	dfe	0 = ½ 1 = 2/3 2 = ¾ 3 = 5/6 4 = 7/8	
DVB-T Guard Interval	r/w	o	dgu	0 = 1/32 1 = 1/16 2 = 1/8 3 = ¼	
DVB-T mode	r/w	o	dmo	0 = QPSK 1 = 16QAM 2 = 64QAM	

Type 'z' messages for Scrambling commands

Function	R/W	Block	Command	DATA	Type
Scrambling	r/w	z	scr	1 byte 0 = Off 1 = ABS 4 = AES128 6 = AES256	Int
AES Key Lower 128	w	z	kez	Encryption Key for AES lower 128	Hex String (32 Characters)
AES Key Upper 128	w	z	kex	Encryption Key for AES upper 128	Hex String (32 Characters)
ABS key	w	z	key	Encryption key for ABS	Hex String (12 Characters)

Type 'v' or 'e' messages for Video commands

Function	R/W	Block	Command	DATA	Type
Video Input	r/w	v	inp	1 byte 0 = Off 2 = PAL 3 = NTSC 4 = NTSC No Pedestal 5 = PAL S-Video 6 = NTSC S-Video 7 = NTSC S-Video No Ped.	Int
Video Locked	r	v	loc	1 byte 0 = No 1 = Yes	Int
Video Bitrate (Only applicable when chaining In Enabled)	r/w	e	vid	Value in Mbps	double
Video Horizontal Resolution	r/w	e	hor	1 byte 0 = 704 1 = 528 2 = 480 3 = 352	Int
Sleep if no Video lock	r/w	v	sle	0 = normal 1 = sleep if no video	Int
MPEG Mode	r/w	e	enc	0 = MPEG2 1 = MPEG4	int
MPEG4 frame rate	r/w	e	frm	0 = Full 1 = ½ 2 = ¼ 3 = 1/8 4 = 1/24	int

MPEG4 encoding option	r/w	e	cmd	0 = low delay interlaced 1 = standard delay interlaced 2 = low delay progressive 3 = standard delay progressive	
MPEG4 video sharpness	r/w	e	sha	0 = normal 1 = sharp	Int

Type 'a' messages for Audio commands

Function	R/W	Block	Command	DATA	Type
Audio Encoder	r/w	a	enc	1 byte 0 = Off 1 = 32KHz, 12cbit, Stereo 2 = 32KHz, 12cbit, Mono 3 = 32KHz, 8cbit, Stereo 4 = 32KHz, 8cbit, Mono 5 = 16KHz, 8cbit, Stereo 6 = 16KHz, 8cbit, Mono 7 = 8KHz, 8cbit, Stereo	Int
Audio Input Level	r/w	a	lev	1 byte 0 = 0dB (line level) 1 = 12dB (mic level) 2 = 24dB (mic level) 3 = 36dB (mic level) 4 = 48dB (mic level)	Int

Type 'g' messages for Unit Level commands

Function	R/W	Block	Command	DATA	Type
Software Version	r	g	ver	Software Version Number	Hex String
FPGA Version	r	g	fpg	FPGA Version Number	Hex String
Serial Number	r	g	ser	Hex Based Serial Number	Hex String
License Code	w	g	lic	License Number for Software Facilities	Hex String
Narrow Band Service Name	r/w	g	nam	Unit Name String	String
Set Unit Address	r/w	g	add	Unit Address	int
Load Configuration Number	r/w	g	lod	Config Number	Int
Sleep Mode	r/w	g	sle	1 byte 0 = No 1 = Yes	Int
Front Panel Lock	r/w	g	fpl	0 = unlocked 1 = locked	Int
DVB-T Service Name	r/w	g	dna	Unit String Name	String
Heart Beat Enable	r/w	g	blo	0 = Off 1 = On	Int

Type 'd' messages for Data commands

Function	R/W	Block	Command	DATA	Type
Data On/Off	r/w	d	inp	1 byte 0 = Off 1 = On 2 = On (Even Parity) 3 = On (Odd Parity)	int
Input Data Baudrate	r/w	d	bau	1 byte 0 = 1200 baud 1 = 2400 baud 2 = 4800 baud 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 57600 baud (Note not supported in DVB-T modes) 7 = 115200 baud	int

Type 'c' messages for Chaining commands

Function	R/W	Block	Command	DATA	Type
Chaining Input	r/w	c	Inp	1 byte 0 = Off 1 = On 2 = Relay	Int
Chaining Output	r/w	c	out	1 byte 0 = Off 1 = On	Int
Chaining Loop	r/w	c	hio	1 byte 0 = Off 1 = output loop to input for external encryption	Int
Chaining Status – describes if chaining input is active	r	c	sta	1 byte 0 = Not Active 1 = Active 2 = Overflow	Int
Chain Number	r/w	c	cha	0 - 9	Int

7.0 VETA Chaining Feature

The VETA series of products use a Proprietary Transport stream protocol called 'Chaining' to create the VDR (VETA Digital Repeater), the CSM (Compact Surveillance Modem) or a UDP Tx. This is all available by utilizing the chaining feature which comes standard on all VETA Tx, VR and VNA. Contact factory for more information about the Chaining feature and the variety of applications it can be employed with.

7.1 VETA Digital Repeater (VDR)

An In band or cross band repeater can be made very simply with the VETA series Transmitter (VT-2W, VT-C, or VT-L) in conjunction with a VETA Receiver. The user simply has to connect the 'Chaining Out' of the VR into the 'Chaining In' of a VETA Tx.

7.2 Compact Surveillance Modem (CSM)

The VETA Compact Surveillance Modem is much like the VDR with the addition of the VETA NETWORK ADAPTOR (VNA). The VNA allows for IP streaming of video, or with a complement CSM a LAN Bridge (CSB) can be created across the link.

7.3 UDP Transmitter

A UDP transmitter can easily be employed using the Chaining Out of a VNA into the Chaining In of a VETA Tx. UDP can be sent to the VNA via the RJ45 connector which is converted to Chaining within the VNA and delivered to the VETA Tx through the Chaining interface. On the receiver Side, a VR will send its Chaining Out to the Chaining In of a VNA. The VNA can be connected to a router or simply another computer to distribute the UDP data.

8.0 Fault Finding

Table 7: Indicated Faults

Condition	Meaning	Action
No LED-s are On	Unit is in asleep mode	Push and hold for a few seconds RF button
Alarm LED lit permanently	Likely no Video input	Ensure video input corrected and of correct standard
Push Button Panel is not operable	Likely Front Panel is locked	Unlock Front Panel through Control SW (Configuration/Special Set up)

9.0 Specifications

9.1 COFDM RF Output

Output Frequency: 0.34 to 7.2 GHz (In-Bands)
Bandwidth: Selectable 6, 7, 8 MHz (1.25 & 2.5 MHz Optional)
RF Output Power: Programmable up to 0.2W
(Optional PA boosts PWR up to 10 W)
Connector: SMA-F
Frequency Stability: +/-10ppm, -10˚ to +70˚ C
Output Impedance: 50Ω, unconditionally stable, open & short circuit protected

9.2 Modulation

Modulation Type: COFDM 2K: QPSK, 16QAM
FEC: 1/2, 2/3, 3/4, 5/6, 7/8
Guard Intervals: 1/32, 1/16, 1/8, 1/4
Optional Narrow Band (1.25 & 2.5 MHz BW)
Modulation Type: COFDM 400: QPSK, 16QAM
FEC: 1/3, 2/3,
Guard Intervals: 1/16, 1/8

9.3 Video Encoding

Video Input: Composite or S-Video
Standards: NTSC or PAL
Connector: Lemo 5 pin 0B, 75Ω input impedance
Compression Standard: MPEG-2 or MPEG-4 Part 2
Chrominance Profile: 4:2:0
Line Standard: 525 and 625
Horizontal Resolution: 704, 528, 480 or 352 pixels
Vertical Resolution: 576 (625 line) and 480 (525 line)
Veta Systems Latency end to end delay: Down to ˜44ms for DVB-T mode
Video Frequency Response: 10 Hz to 4 MHz +/-1.0 dB

9.4 Audio Encoding

Analog Audio Inputs:
Dual, Line Level or Mic Level, Single Ended, Clip Level 12 dBm
(Mic connection via breakout cable)
Compression Type: MPEG Layer I (Musicam) or NICAM (User Selectable)
NICAM
Bits per Sample: 12 or 8
Sampling Frequency: 32 KHz, 16 KHz or 8 KHz
MPEG Layer I
Compression Standard: ISO/IEC 13818-3
Bit rates: 256 kbit/s/ch
Sampling Frequency: 32 kHz or 48kHz
Audio Frequency Response: 20 Hz to 15 KHz +/- 1.0 dB
Mic Bias: 2V

9.5 RS232 Data Input

Baud Rate: Up to 115 KBaud.

9.6 Security Option

ABS is standard. The VT-C can optionally be provided with Advanced Encryption System (AES) 128/256 for protecting the signal in sensitive applications.

9.7 Physical

Dimensions: 2.5" wide x 2.5" long x 1" high
63.5 mm wide x 63.5 mm long x 25.4 mm high
Weight: 0.28lbs
0.127grams

9.8 Environmental

Operational Temperature: -20 to 70 deg C
Humidity: Up to 95% non-condensing

9.9 DC Power

DC Voltage Range: 7 V -16 V
Reverse Polarity Protection up to 30 V
Power Consumption depending on Output Power 5 to 6 Watts
Connector: Lemo 4 Pin 0B

9.10 Control

Local – Easy to use local control and status panel allows up to 8 user-defined operating modes covering most programmable parameters including center frequency, 4 power settings, Encryption ON/OFF, status of Video in and RF Power Level

Remote (User Interface) – VT-C can be controlled through its RS-232 control port via an optional MS Windows-based control application.

9.11 Connectors

Lemo 5 pin 0B: Composite Video, Audio
Shielded 16 pin Hirose 3500 series: S-Video, RS 232 Data and RS232 Control Lemo 4 pin 0B: DC Power

Appendix A Power Cable

NOTES:
1. REFERENCE BOM 780-C0349X3, AND OR LATEST MINOR REVISION FOR REFERENCE DESIGNATIONS AND PART DESCRIPTIONS .
2. LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0349X3 USING BEST COMMERCIAL METHOD.
3. LABEL CONNECTOR WITH REFERENCE DESIGNATOR AND DESCRIPTION AS SHOWN USING BEST COMMERCIAL METHOD. LABEL TO BE WITHIN 3.0 OF CONNECTOR.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E0823	X1	INITIAL RELEASE	08/13/07	
E1028	X2	UPDATE TO CORRECT ERRORS	08/07/08	
E1167	X3	ADD A HEATSHRINK	03/10/08	

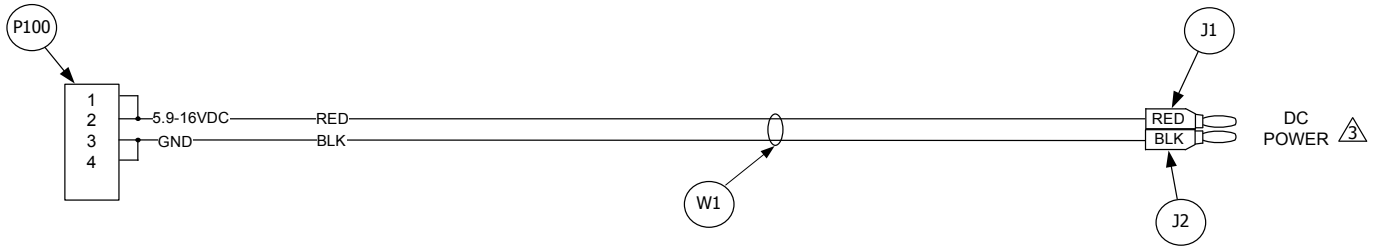

FIGURE 1
CABLE WIRING
DIAGRAM

TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG/TECH Nathan M. DRAWN Ruzanna M. ENG PROD QC	COBHAM GMS Products	DWG TITLE: CABLE, VETA TX, POWER	
		SIZE B	DATE 04/02/09	DWG NO 100-C0349X3 REV X3
		SCALE: NONE		SHEET 1 OF 3

GENERAL NOTES:

1. REFERENCE BOM 780-C0350X1 AND OR LATEST MINOR REVISION FOR REFERENCE DESIGNATIONS AND PART DESCRIPTIONS .

△2 LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0350X1 USING BEST COMMERCIAL METHOD.

△3 LABEL CONNECTOR WITH REFERENCE DESIGNATOR AND DESCRIPTION AS SHOWN USING BEST COMMERCIAL METHOD. LABEL TO BE WITHIN 3.0 OF CONNECTOR.

4 REFERENCE MANUFACTURING INSTRUCTION 100-MI0112 IF NEEDED.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E0823	X1	INITIAL RELEASE	11/27/07	

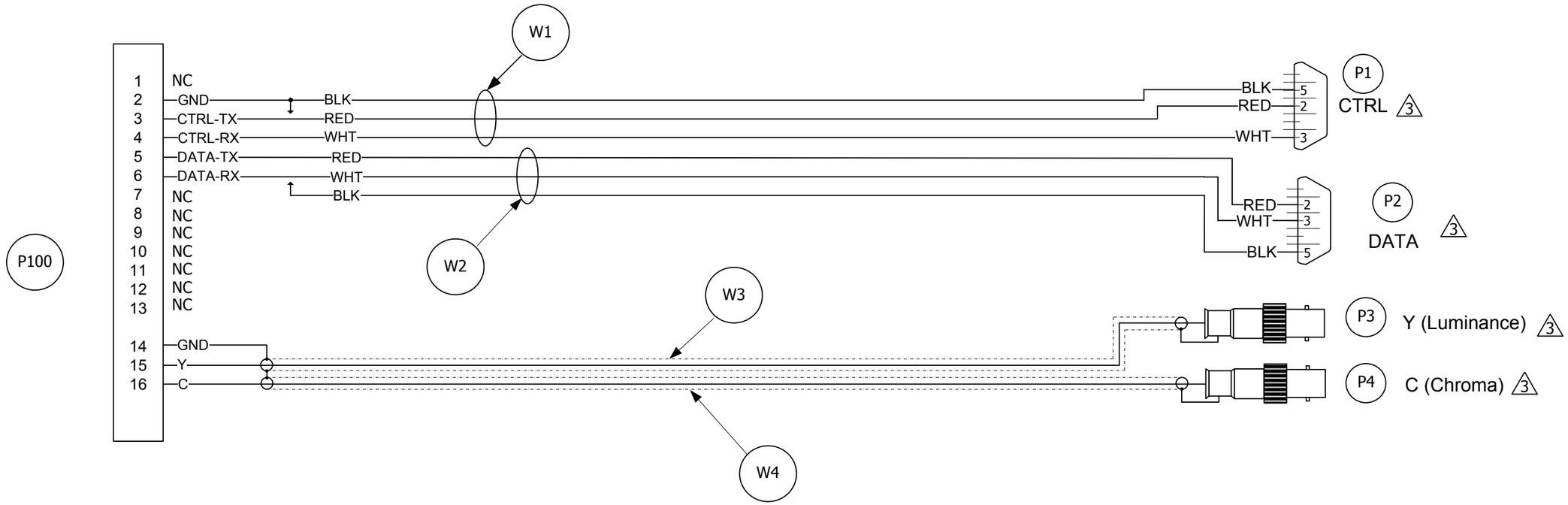

FIGURE 1
CABLE WIRING
DIAGRAM

TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG/TECH Nathan M DRAWN NLM ENG PROD QC	COBHAM GMS Products	DWG TITLE: CABLE, VETA TX,CONTROL/USER DATA/S-VIDEO
		SIZE B	DATE 07/10/08
		SCALE: NONE	DWG NO 100-C0350 REV X1
			SHEET 1 OF 4

Appendix C A/V Cable

NOTES:
1. REFERENCE BOM 780-C0351X4 AND OR LATEST MINOR REVISION FOR PART REFERENCE DESIGNATIONS AND DESCRIPTIONS .
2. LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0351X4 USING BEST COMMERCIAL METHOD.
3. LABEL CONNECTOR WITH REFERENCE DESIGNATOR AND DESCRIPTION AS SHOWN USING BEST COMMERCIAL METHOD. LABEL TO BE WITHIN 3.0 OF CONNECTOR.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E0823	X1	INITIAL RELEASE	08/13/07 NLM	
E0887	X2	CHANGE LEMO CONNECTOR	12/04/07	
E0973	X3	UPDATE LEMO CONNECTOR	05/21/08	
E1167	X4	UPDATE ALL CABLES/CONN	03/31/2009	

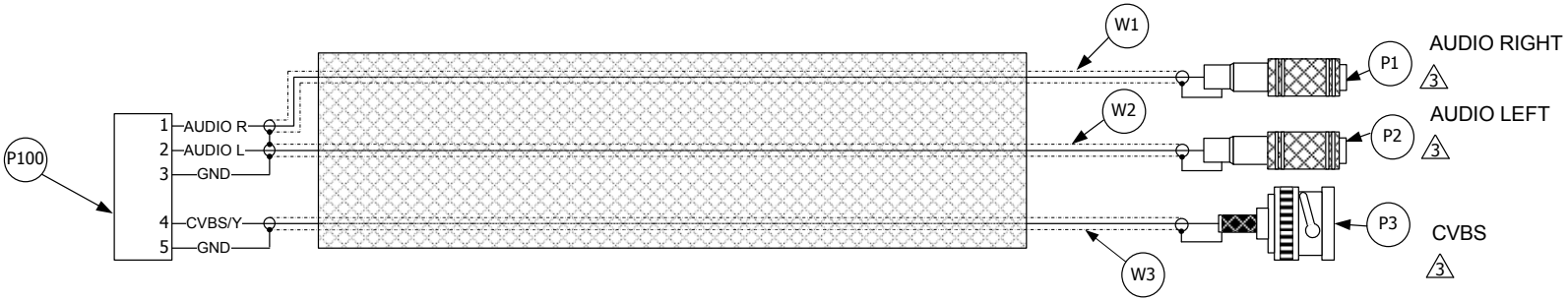

FIGURE 1
CABLE WIRING DIAGRAM

TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG/TECH R. Manvelyan DRAWN RM ENG PROD QC	COBHAM GMS Products SIZE B DATE 08/13/07 SCALE: NONE	DWG TITLE CABLE, VETA TX, AUIDO/VIDEO DWG NO 100-C0351X4 REV X4 SHEET 1 OF 4