Technical Operations Manual

The most important thing we build is trust.

VETA Miniature Transmitter (VMT)

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REVISION HISTORY

Version	Date	Author	Comments
X1	07-24-09	Nathan Moore	Initial release.
X2	05-26-2010	DRF	Updated references to the control GUI.

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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
64QAM	64-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
RF	Radio Frequency
RX	Receiver
S/N	Signal-to-Noise Ratio
THD	Total Harmonic Distortion
TX	Transmitter
UDP	User Datagram Protocol
VDC	Volts (Direct Current)
VDL	VETA Digital Link
VETA	Very Efficient Transmission Apparatus
VMT	VETA Miniature Transmitter
VNA	VETA Network Adapter
VR	VETA Receiver
VT	VETA Transmitter

2.0 Introduction

GMS' Very Efficient Transmission Apparatus (VETA) product line enables the user to build wireless digital microwave video systems. The VETA 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.

The VETA Links use a digital modulation system known as Coded Orthogonal Frequency Division Multiplexing (COFDM) that provides a robust link immune to multipath interference to provide 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, MPEG-4 only selectable for 2.5MHz and 1.25MHz Bandwidths) Encoders and Decoders with specially designed coding technology, which provides an end to end video link *without* the introduction of any further MPEG encoding artifacts. This is crucial for certain applications, where personnel are reacting to real-time events.

The VMT is a VETA Miniature Transmitter that has been designed to be as small and power efficient as possible. It is an ideal fit for concealment and body worn applications and small-unmanned vehicles. The VMT accepts a composite or S-Video Input, Analog Stereo Audio Inputs (with MIC Bias) and a RS232 User Data Input. There is also an option to accept SDI Video. The Video is compressed according to MPEG-2 or MPEG-4 (Optional) 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. The stream can be scrambled with a simple fixed key scrambling system (ABS standard) to give basic protection in sensitive applications. Additional security is accomplished with the optional AES scrambling system. 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 VMT (VETA Transmitter) as well as pertinent technical information related to the overall system.

2.1 Key System Features

- COFDM Modulation : 2K or 400 [1] Carriers
- Bandwidths: 6 MHz, 7 MHz or 8 MHz
  (1.25 & 2.5 MHz optional)
- Output Frequency: 0.9 to 8.5 GHz (In-Bands)
- Output Power: 100mW
  (Optional VEPA PA boosts PWR to 2W)
- Built-in MPEG-2/MPEG-4 [2] Encoder
- Low End to End System Latency [3] (down to ~44mS)
- Rugged Compact Design: 2.7" x 1.6" x 0.5" (6.9cm x 4.0cm x 1.3cm)
- Secure – ABS and AES 128/256[4]

[1] 400 carriers is optional with the 1.25 or 2.5MHz RF bandwidth upgrades
[2] MPEG-4 is optional and included with the 1.25MHz upgrade. MPEG4 optionally used in 1.25MHz and 2.5MHz modes.
[3] With DVB-T standard BWs. ~120mS system latency in 1.25 & 2.5 MHz Bandwidths depending on modulation parameters
[4] 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:

- If fault persists, call our support line and report the fault. If fault persists and 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 require the User to access the product's interior.

3.0 General System Information

3.1 Getting Started

The Standard VMT kit includes the following items:

- VMT Unit
- VMT Breakout Cable (GMS p/n 780-C0449*)
  (Power, Composite Video, Audio ( ), RS232 Control)

NOTE: Based on customer applications GMS can deliver a receiving system, additional cables and antennas. Contact GMS for further information

The VMT is pre-configured by GMS prior to shipment (based on customer requirements), thus is ready to work "right out of the box".

3.2 Initial Checkout

Prior to installing a VMT into the desired target environment, an initial checkout should be performed to ensure proper operation of the unit. The initial checkout described below consists of configuring a basic VETA Digital Link (VDL). In the case outlined, we will assume a VETA Receiver (VR) is used to receive the VMT. Note, that any DVB-T compliant receiver can be employed instead if the VMT is set-up in standard DVB-T Mode (RF BW 6, 7, or 8 MHz) and not in ultra-low delay mode.

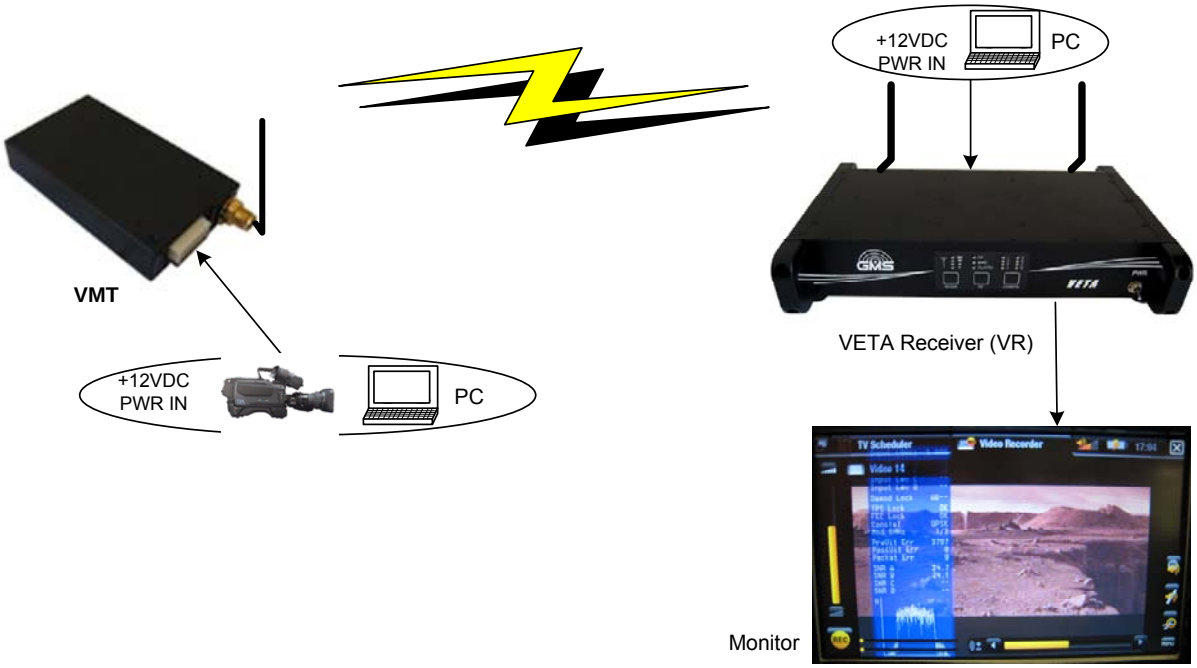

Figure 3.1 Basic VDL Setup

The following setup can be done, either wirelessly with antennas, or through hard line connection with 50Ω cable. In either case, make sure there is enough attenuation from the Tx to the Rx to avoid overdriving the receiver. In most DVB-T receivers, their optimal input power ranges from -30 to -70 dBm. The VR shown has internal BDCC installed locally within unit, which is our standard VR configuration.

3.2.1 Initial Checkout of VMT

- 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 VMT transmitter. *Note: As a rule, transmitters should not be powered on without a load attached to the RF output connector.*
- Attach the VMT standard breakout cable (or customer equivalent), 780-C0449* to the Tx. Apply +12VDC to the red pigtail and GND to the black pigtail. Ensure power supply can supply at least 0.4A at +12VDC (Note: The VMT can operate over 5.9-18VDC range).
- Attach a composite video source to the BNC video input cable that is located on the VMT breakout cable. Make sure that the source video is powered on and outputting the video in the desired format (PAL or NTSC) and input port (Composite #1 or #2 or SDI).
- Connect the RS232 Control of the VMT to the corresponding serial port of the PC. Open the GMS configurator software (see *VETA Miniature Transmitter Software Manual*, 100-M0130, for control software details).
- If the TX receives the source video signal, the *Video Locked Status* indicator will show: *"YES."* If the *Video Locked Status* shows *"NO,"* check the connection of the Video source, verify that the video source is indeed active, and click the "*Query*" button. Verify that the Video source matches the *"Video Input"* selection. If the source is NTSC, then the VMT *"Video Input"* should show *"NTSC."*
- Next, note which VMT Configuration is active, 1 through 16 under the *Load Config* pull down window. This number must match the receiver configuration, which assumes all configurations have matching parameters. Also verify that the *Output Mode* shows *"ON,"* otherwise the RF section of the VMT will be shutdown and no RF transmission will be possible.
- This completes the initial setup of the VMT for Video transmission and RF testing.

3.2.1.1 Key RF settings For COFDM Transmission

The RF settings shown in Figure 3.2 show the key COFDM configurations for setting up any COFDM link. The settings underlined in RED must be matched specifically to the VETA Receiver for proper RF lock and demodulation (the other COFDM parameters are auto-detected). In general, when troubleshooting a RF link, the operator should make sure that the following RF parameters are matched at both the Transmitter and Receiver.

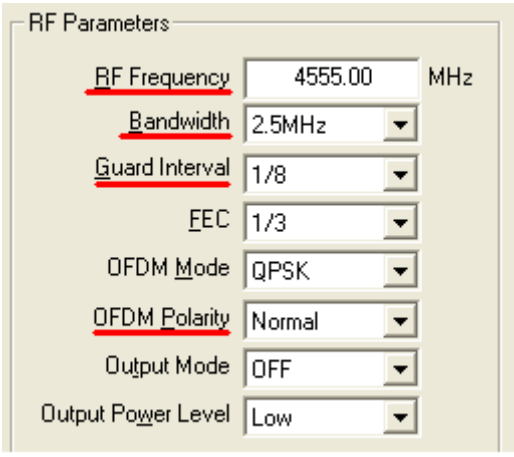

Figure 3.2 VMT RF Essentials

3.2.2 Setup of Corresponding VETA Receiver

- 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 configuration matches that of the transmitter. If not, use the VETA Receiver configurator to select or modify the configuration, see Figure 3.2 for VMT settings to match to the VR.
- 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 on the Front Panel to turn on the diagnostic OSD (on screen display) for the video monitor.
- 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. The OSD should show lock onto the incoming signal with a corresponding power level and SNR on the two receive inputs.
- 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 have matching RF configurations, see Figure 3.2.
  - Ensure the transmitter *Output Mode* is *"ON."*
  - If the TX and RX are physically too close to each other, the RX may overload causing distorted Video. If the RF power sensed by the VR is greater than -20dBm, you may want to reduce the power out of the TX (using RF attenuators) or physically move the TX & RX further apart.
  - Conversely, the power level to the VR may be too low for RF lock and demodulation. If the RF power sensed by the VR is less than -80dBm, you may want to increase the RF power to the VR. Either decrease the RF attenuation between the Tx and Rx or physically move the two closer to one another.

The initial checkout described above is simply to check the basic video operation of the VMT unit. For further details on the connectors, monitoring and controlling the VMT read thoroughly through this manual.

4.0 Hardware Overview

The VMT consists of a rotary switch along with interface connectors.

4.1 VMT Interface Connectors

The VMT interface connectors consist of a RF SMA, and a 21 PIN JST connector. They are described in this section.

4.1.1 RF Out

The RF output consists of a female SMA connector.

Connector Type	Comments
SMA (F)	Antenna connects here

Table 1 RF Connector

Figure 4.1 VMT Interface Connectors

4.1.2 I/O

The VMT 'I/O' connector is a dual row twenty one (21) pin JST, JST part number: SM21B-SHLVS-G-TB(LF). A GMS breakout Cable, #780-C0449 is provided for testing. It is used to provide the interface for external power, audio (with phantom biasing for Tibbetts microphones), analog video and RS232 control. The pin out for the I/O connector is shown in Table 2 below.

PIN	SIGNAL	NOTES
1	SDI VIDEO IN	SD-SDI Video Input. This is an optional upgrade. Must be selected with GMS Control Software.
2	GND	GND
3	CHAIN CLK IN	N/C. Chaining used in Repeater/Multiplexing applications, contact GMS for details
4	CHAIN DATA IN	N/C. Chaining used in Repeater/Multiplexing applications, contact GMS for details
5	AUDIO GND	AUDIO GND
6	COMP INPUT 1	Composite Video Input. Must be selected with GMS Control Software. Also used for S-VIDEO Input.

PIN	SIGNAL	NOTES
7	COMP INPUT 2	N/C. Only used for S-VIDEO Input. Must be selected with GMS Control Software.
8	GND	GND
9	AUDIO LEFT	Audio Left, W/ 2V Phantom Bias.
10	AUDIO RIGHT	Audio Right, W/ 2V Phantom Bias.
11	GND	GND
12	CHAIN CLK OUT*	N/C. Chaining used in Repeater/Multiplexing applications, contact GMS for details
13	CHAIN DATA OUT*	N/C. Chaining used in Repeater/Multiplexing applications, contact GMS for details
14	GND	GND
15	RS232_DATA_Rx	N/C. RS232 for User Data, Rx
16	RS232_DATA_Tx	N/C. RS232 for User Data, Tx
17	RS232_CNTRL_Rx	RS232 for PC CONTROL Software
18	RS232_CNTRL_Tx	RS232 for PC CONTROL Software
19	2.8V uC	N/C. 2.8V Output from Unit
20	GND	GND
21	VBATT_IN	Input Power to Unit: 5.9-18VDC

Table 2 JST Connector (21 Pins)

Note: Table 2 references Cable 780-C0449. GMS can build customized cables to customer specifications to access functionality not included in our standard cable. Customers can also choose to build their own cables. Contact GMS with any questions.

4.1.2.1 Phantom Bias for TIBBETTS Microphones

The VMT does not provide a traditional separate bias voltage for surveillance microphones. Instead, we provide a 2V Microphone BIAS directly on the signal lines. This is called phantom biasing of microphones and has been proven to work with TIBBETTS 151/251/351 series microphones by GMS. See TIBBETTS technical application notes for Phantom powered 2-wire connection for specific details, GMS standard breakout cable employs 2-Wire Option C. This wiring is in accordance with section 4.9.2 of RFP: E007216R and Attachment A of RFP: E007216R.

In addition, to note, single ended line level audio can also be used instead of microphones. The user will want to lower the *Audio Gain* to *"0dB"* through the GMS control software when Line level audio is input.

4.2 Local Control

4.2.1 Set-Up Group Select Switch

How to Operate

There is one 16 position external rotary switch mounted into the chassis for the VMT (reference Figure 4.2)

Figure 4.2 VMT with Rotary Switch

The switch is used to control set-up group selection. Set-up group selection can also be controlled through GMS control software configurator GUI (refer to the Software Manual, 100-M0143).

As previously stated, administrators define the set-up groups for specific applications. Each set-up group completely defines all of the transmitter's set-up parameters including center frequency, output RF power level, modulation parameters, video, audio, user data and encryption. Each set-up group can be completely different from any other group. Field personnel will select specific set-up groups via pre-determined guidance from the administrators. Matching the transmitter operation to the receiver operation is as simple as selecting the same set-up groups. For example: If the transmitter is set to preset #4, then the receiver needs to be set to preset #4 for them to operate together.

The Rotary Switch is in Hexadecimal format, representing the 16 configurations. While the switch is in hexadecimal the control software is shown in decimal format, see Table 3. Because the switch is in binary format, the first setting begins at zero.

Rotary Switch Position	Configuration # (Decimal Value)
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
A	11
B	12
C	13

Rotary Switch Position	Configuration # (Decimal Value)
D	14
E	15
F	16

Table 3 Rotary Switch Configurations

5.0 Remote Control of VMT

The VMT can be configured with GMS' RS232 VETA Remote Control Unit (VRCU). Alternatively the VMT can also be configured with GMS' Wireless Remote Control Unit (WRCU) or the USB Wireless Control Module (UWCM) through GMS' Wireless Control Module (WCM).

5.1 VETA Remote Control Unit – VRCU

In addition to being able to select a set-up group by using the rotary switch on the VMT, a RCU, remote control unit, is available. The RCU is a small hand–held remote control unit designed for serial control of the VMT transmitter. It allows the operator to access all features of the transmitter on a two-wire RS-232 connection. For details, see the on-line manual: 100-M0104.

Figure 5.1 VETA Remote Control Unit

5.2 Wireless Control Module – WCM

The GMS' Wireless Control Module (WCM) is a tiny transceiver that is designed to be mounted closed to a covert VMT. The WCM communicates with a VMT via RS232. The transceiver interfaces with other WCM over UHF frequencies in the 900MHz ISM band. For details, see the on-line manual 100-M0124

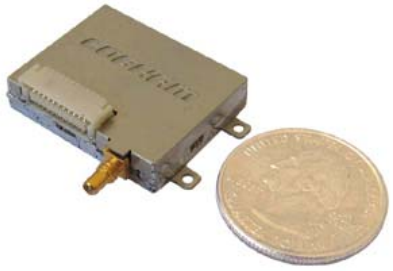

Figure 5.2 Wireless Control Module

The companion WCM is employed within either a Wireless Remote Control Unit (WRCU) or a USB Wireless Control Module (UWCM).

5.2.1 Wireless Remote Control Unit – WRCU

The Wireless Remote Control Unit (WRCU) is a small DC operated device that allows User-level control and status monitoring of a VMT system through its simple user interface and dual 16-character LCD display. It is designed to communicate with the WCM, for details see online manual 100-M0125.

Figure 5.3 Wireless Remote Control Unit

5.2.2 USB Wireless Control Module - UWCM

The USB Wireless Control Module (UWCM) is a small USB device that allows User and Admin-level control and status monitoring of a VMT system through the host computer to which it is attached. For details on the UWCM, see online manual 100-M0126.

Figure 5.4 USB Wireless Control Module

The UWCM allows the user to remotely control a VMT while using the GMS' configurator software. This feature allows the user to access admin level controls, provided they have password access. For details on using the GMS configurator see section 6 below.

6.0 Software Overview

Configuration, control and monitoring of the VMT units are done by using GMS' MS Windows-based VMT Configurator software program 100-SW0070. This Graphical User Interface (GUI) program provides the end user with a straightforward way to interface with the VMT unit. During normal operation, once a link is established, the VMT Configurator GUI does not need to be active and can be disconnected from the VMT unit.

Refer to the Software Manual, 100-M0143, for further information.

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 that comes standard on all VETA Tx, VR and VNA. Contact the 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, VT-L, or VMT) in conjunction with a VETA Receiver (VR). 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 that 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 Specifications

8.1 COFDM RF Output

Output Frequency: 0.9 to 8.5 GHz (In-Bands)
Bandwidth: Selectable 6, 7, 8 MHz (1.25 & 2.5 MHz Optional)
RF Output Power: Programmable up to 50 mW
(Optional VEPA PA boosts PWR up to 2W)
Connector: SMA-F
Frequency Stability: +/-2 ppm,
Output Impedance: 50Ω, unconditionally stable, open & short circuit protected
Harmonics: <-25 dBm

8.2 Modulation

Modulation Type: COFDM 2K: QPSK, 16QAM and 64QAM
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: C-OFDM 400: QPSK, 16QAM
FEC: 1/3, 2/3,
Guard Intervals: 1/16, 1/8
Spurious > 52dBc
COFDM MER > 23dB

8.3 Video Encoding

Video Input: Composite, S-Video
Standards: NTSC or PAL
SDI option available
Compression Standard: MPEG-2 or MPEG-4
Chrominance Profile: 4:2:0 or 4:2:2
Line Standard: 525 and 625
Horizontal Resolution: 704, 528, 480 or 352 pixels
Vertical Resolution: 576 (625 line) and 480 (525 line)
Systems Latency end to end delay: Down to ˜40 ms

8.4 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 or NICAM (User Selectable)
NICAM AUDIO
Bits per Sample: 12 or 8
Sampling Frequency: 32 KHz, 16 KHz or 8 KHz
MPEG AUDIO
Compression Standard: ISO/IEC 13818-3
Bit rates: Up to 448 kbit/s/ch
Sampling Frequency: 32 kHz or 48KHz
Mic Bias: 2V

8.5 RS232 Data Input

Baud Rate: Up to 115 KBaud.

8.6 Security Option

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

8.7 Physical

Dimensions: 1.6” wide x 2.7” long x 0.5” high
4.0 cm x 6.9 cm x 1.3 cm
Weight: 0.114 lbs
52 grams

8.8 Environmental

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

8.9 DC Power

DC Voltage Range: 5.9 V - 18 V
Reverse Polarity Protection up to 30 V
Power Consumption: Depends on Frequency (Assumes 50mW output)
4.1W - L & S Band
4.4W - C Band
5W X - Band

8.10 Control

Local – Easy to use Rotary Switch allows up to 16 user-defined operating modes covering most programmable parameters.

Remote (User Interface**)** – VT-2W can be controlled through its RS-232 control port via an optional MS Windows-based control application.

Connector - DB-9 (F), RS232 control.

Appendix A: Standard Breakout Cable

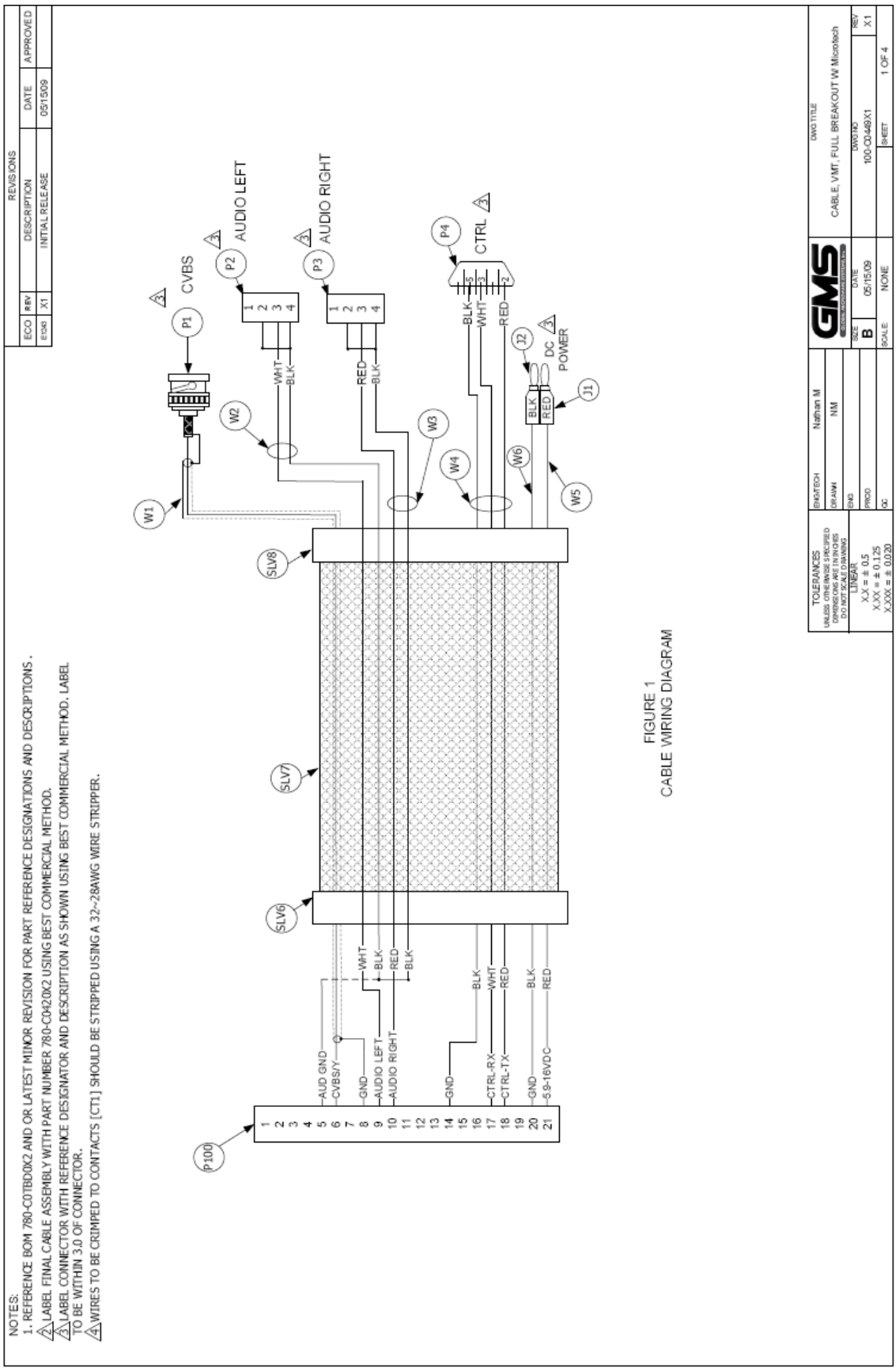

FIGURE 1
CABLE WIRING DIAGRAM

Appendix B: VMT Factory Defaults

Table 4: LS-Band Defaults

PARAMETER	CONFIGURATIONS															
Config #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Device Address	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
COFDM BW	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	2.5MHz	2.5MHz	2.5MHz
RF Frequency	1755	1802	1850	1755	1802	1850	2200	2300	2400	2200	2300	2400	2345	1802	2300	1802
Output Mode	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
DVB-T COFDM Mode	QPSK	QPSK	QPSK	16QAM	16QAM	16QAM	QPSK	QPSK	QPSK	16QAM	16QAM	16QAM	QPSK	QPSK	16QAM	16QAM
DVB-T Modulation GI	1/4	1/4	1/4	1/8	1/8	1/8	1/8	1/8	1/8	1/32	1/32	1/32	1/4	1/4	1/4	1/4
DVB-T Modulation FEC	1/2	1/2	1/2	2/3	2/3	2/3	1/2	1/2	1/2	2/3	2/3	2/3	2/3	1/2	1/2	1/2
NB COFDM Mode	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	16QAM	16QAM
NB Modulation GI	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/16	1/16	1/16
NB Modulation FEC	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	2/3	2/3
Sp Inversion	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Output Power Level	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
Video Input	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC
Audio Encoder	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo
MPEG Audio Sample Rate	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit
Audio Input Gain	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB
Auxiliary Data ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Input Data Rate	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600
Scrambling	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chaining Input	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chaining Output	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chain Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport Stream Control	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT
Output Attenuation: High Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output Attenuation: Low Power	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Horizontal resolution	704	704	704	704	704	704	704	704	704	704	704	704	704	704	704	704
Sleep Mode	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Sleep in no Video	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Front Panel Lock	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked
MPEG Mode *	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG4	MPEG4
MPEG4 Frame Rate **	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	1/2	1/4
Sharpness	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Encoding Option	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog

Table 5: C2-Band Defaults

PARAMETER	CONFIGURATIONS															
Config #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Device Address	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
COFDM BW	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	7MHz	2.5MHz	2.5MHz	2.5MHz
RF Frequency	4400	4700	5000	4400	4700	5000	4400	4700	5000	4400	4700	5000	4400	4700	5000	4400
Output Mode	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
DVB-T COFDM Mode	QPSK	QPSK	QPSK	16QAM	16QAM	16QAM	64QAM	64QAM	64QAM	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
DVB-T Modulation GI	1/4	1/4	1/4	1/8	1/8	1/8	1/8	1/8	1/8	1/32	1/32	1/32	1/16	1/16	1/16	1/16
DVB-T Modulation FEC	1/2	1/2	1/2	2/3	2/3	2/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
NB COFDM Mode	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	16QAM	16QAM
NB Modulation GI	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
NB Modulation FEC	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	2/3	1/3
Sp Inversion	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Output Power Level	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
Video Input	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC	NTSC
Audio Encoder	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo	MPEG, 48kHz, Stereo
MPEG Audio Sample Rate	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit	256kbit
Audio Input Gain	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB	36dB
Auxiliary Data ON/OFF	ON	Even	OFF	Odd	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Input Data Rate	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600	9600
Scrambling	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chaining Input	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chaining Output	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chain Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport Stream Control	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT	Chain IN / Chain OUT
Output Attenuation: High Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Output Attenuation: Low Power	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Horizontal resolution	704	704	704	704	704	704	704	704	704	704	704	704	704	704	704	704
Sleep Mode	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Sleep in no Video	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Front Panel Lock	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked
MPEG Mode *	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG2	MPEG4	MPEG4
MPEG4 Frame Rate **	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	1/2	1/4
Sharpness	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Encoding Option	Standard Delay Prog	Standart Delay Int	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog	Standard Delay Prog