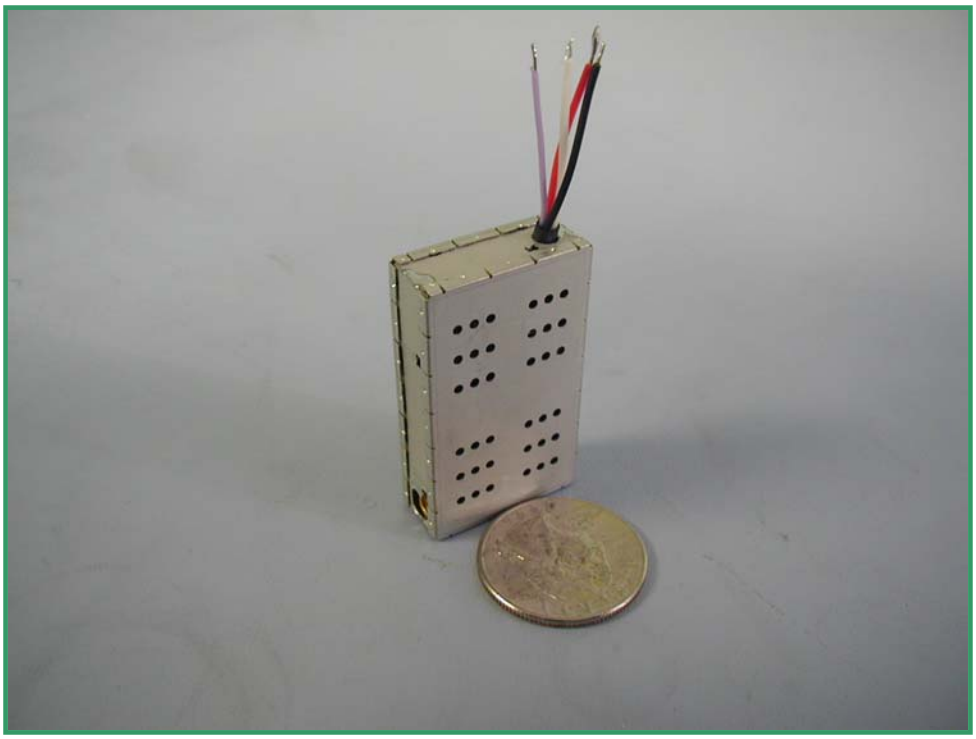
Datawave Technologies, LLC.

2.4GHz 300mW Part 90
Wideband FM Audio/Video Transmit Module

PN 1500-2467-33



User's Manual
FCC Issue Version 1.02

Copyright Information

Revision Listing

Revision Number	Description
1.00	Initial Release

Agency Approval

Agency	Identification
US- FCC	Q4N1500

FCC Notice

Warning: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) The device may not cause harmful interference and (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Label

FCC ID: Q4N1500

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.
(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

Information to the User

Any changes or modifications not expressly approved by DataWave Technologies, LLC could void the user's authority to operate the equipment. It is recommended that the user contact DataWave for installation and integration guidelines for their product.
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Labeling

Warning: All original equipment manufacturers (OEM) integrating this device within their products must comply with FCC labeling requirements. A clearly visible label must be displayed on the outside of the OEM enclosure specifying that the device contains the FCC identifier listed on the FCC label shown below.

RF Exposure

Warning: All original equipment manufacturers (OEM) integrating this device within their products must maintain a minimum distance of 20cm between the installed antenna and the user or general population. For applications requiring handheld or body worn operations OEMS must submit their product to the FCC for Specific Absorption Rate (SAR) testing.

Overview

This manual contains information regarding the hardware and operational aspects of the DataWave 1500 series transmit modules. This information includes theory of operation and integration guidelines to aid the OEM during installation.

The 1500-2467-33 is designed to operate in the 2450MHz- 2483.5MHz license free ISM frequency band. The module can be ordered in a 2 channel configuration and when used with the 1701-2450-33 can cover short to intermediate ranges of up to 1000ft L.O.S. The 1500-2467-33 is ideal for short range communication links requiring full resolution video and single channel audio capabilities.

Specifications

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Operating Voltage	4.85	5	5.15	**Volts**	Regulated
Curent Consumption	485	510	535	**mA**	Pout=300mW
Max RF Output Power	285	300	315	**mW**	Carrier Power
RF Bandwidth	7.75	8	8.25	**MHz**	
First Harmonic Rej.	-57	-60	-65	**dBc**	Reference to Carrier Power
Frequency Range	2450		2483	**MHz**	
Channel 1		2458		**MHz**	
Channel 2		2474		**MHz**	
RF Power Output	1		300	**mW**	
Operating Temp.	-40		85	**°C**	
Modulation Type	Frequency Modulation				
Dimensions					
Antenna Interface	MMCX **see approved antenna listing				
Weight	3 oz				
VSWR Antenna Port	2:1 @ 50Ω				

Table 1 Product Specifications

Theory of Operation

This module transmits NTSC/PAL video and 1Vp-p audio signals using a standard wideband frequency modulation method.

The module consists of 4 blocks for the transmission of audio/video at 2.4GHz:

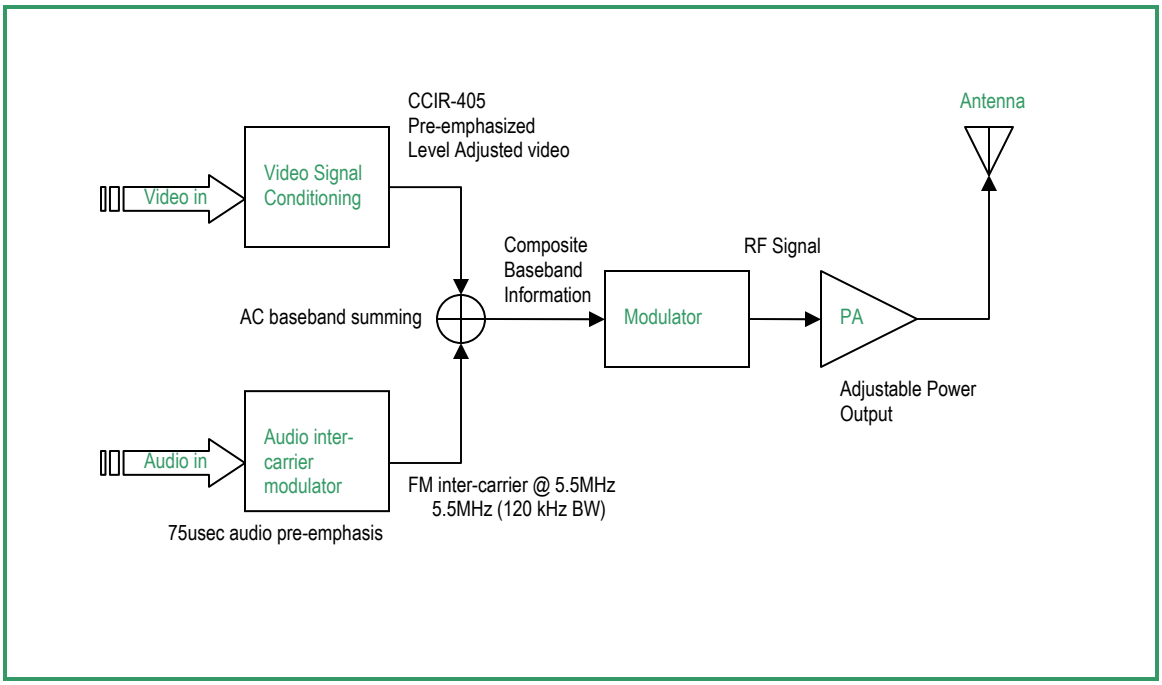


Figure 1 Transmitter Block Diagram

Block Diagram Description

The *Video Signal Conditioning* portion of the transmitter is used to add video pre-emphasis and divide down the incoming video level to provide an adjustable deviation constant for a desired bandwidth. The *Audio Inter-Carrier Modulator* block takes a 1Vp-p audio signal and adds pre-emphasis before it is applied to a 5.5MHz voltage controlled oscillator (VCO). The result of the circuit is a 5.5MHz inter-carrier signal with a deviation of ±60KHz. The two conditioned signals are then AC summed together and applied to the modulation input of the *Modulator* block. The *Modulator* block consists of an RF VCO, synthesizer and reference crystal. The synthesizer is programmed by a microcontroller which controls which carrier frequency is selected by the user. The output of the *Modulator* is a frequency modulated carrier that consists of the video information and the audio inter-carrier sidebands, which are 5.5MHz away from the carrier. The FM signal is then sent to the *PA* block which consists of a pre-amplifier and a power amplifier whose power output can be adjusted from 1mW to 300mW. The output of the *PA* block is fed to a frequency trap to reduce the 1st and 2nd harmonics of the carrier and then routed to the antenna port.

Operation

Power Requirements

The transmit module requires a 5V nominal regulated voltage source that can continuously provide 1.5W of power. Below is a typical power consumption table for certain RF output power levels.

RF Output Power (mW)	Power Consumption at 5V (Watts)
300	1.3
250	1.2
200	.96
150	.76
100	.57
50	.39
25	.31
10	.2

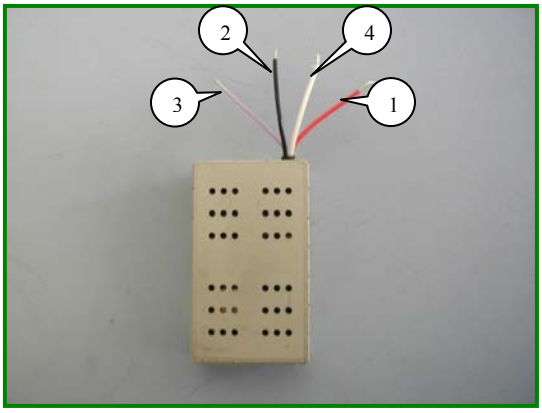
Table 2 Power Consumption

Module Connections

The transmit module wire harness requires four connections which are listed in Table 3.

Wire #	Function	Wire color	Description
1	Power	Red	5V supply
2	Ground	Black	5V return
3	Audio	Purple	1Vp-p audio across 600Ω
4	Video	White	NTSC 1Vp-p across 75Ω

Table 3 Wire connections



In order for the module to output any signals, wire 1 must be connected to a regulated 5V power supply and wire 2 must be connected to ground. Applying power to the module without applying a video or audio source will generate a CW signal at the carrier frequency that is modulated by a 5.5MHz inter-carrier. Using this configuration produces a carrier signal and a set of 5.5MHz sidebands similar to the one pictured below.

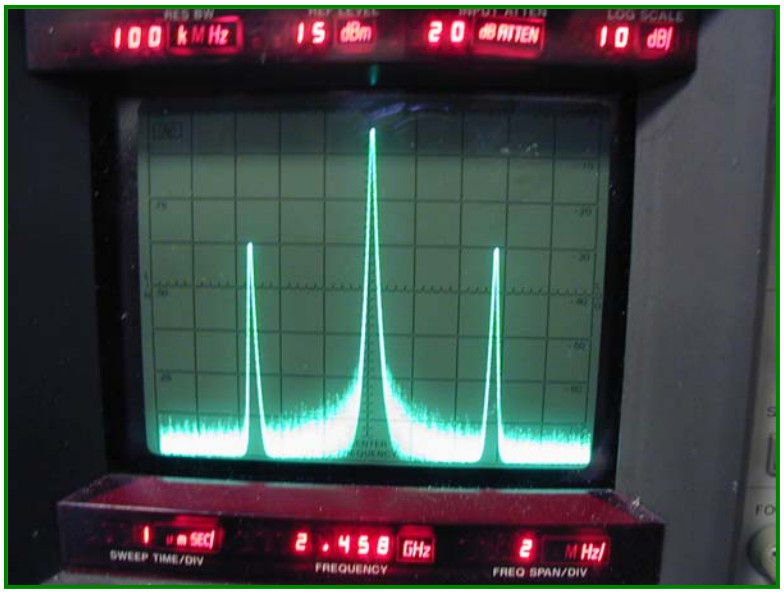


Figure 2 Example RF carrier without audio and video information

When a video and audio signal is applied (wire 4 and 3 respectively) the carrier is then modulated and the spectrum should look like the picture below.

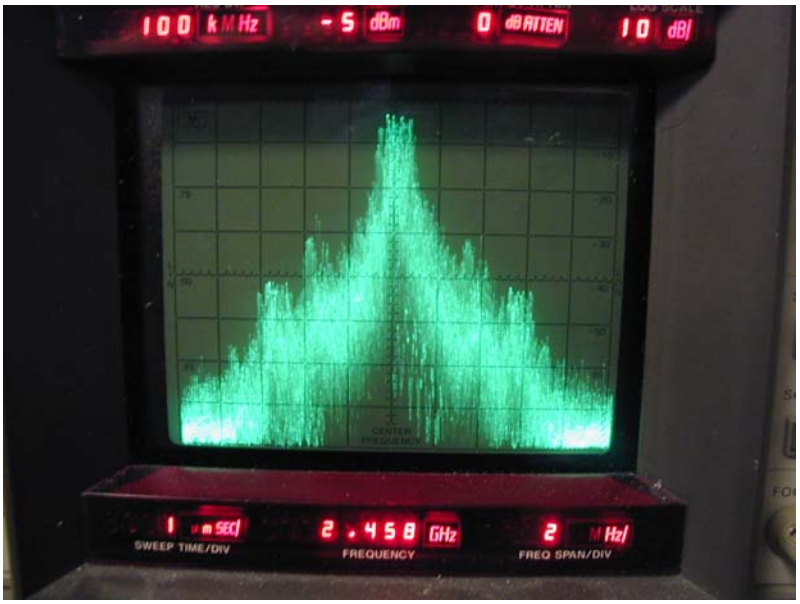


Figure 3. Carrier with video and audio information

Channel Selection

Upon installation the user can select one of two channels; 2458MHz or 2474MHz. This is done by changing the dip switch setting found on the transmitter PCB.

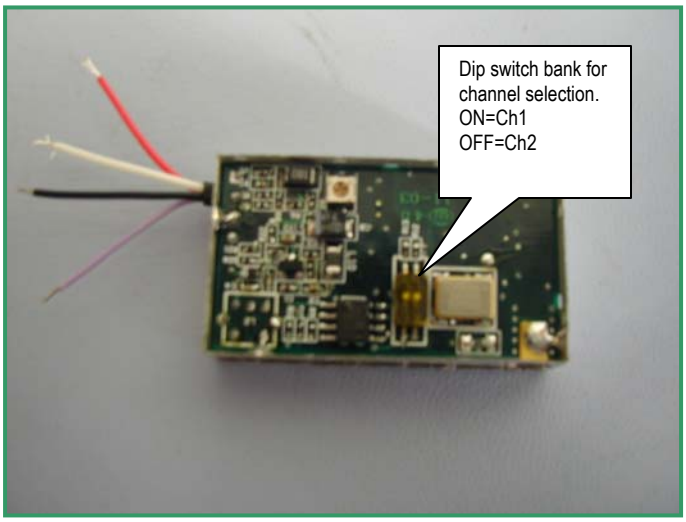
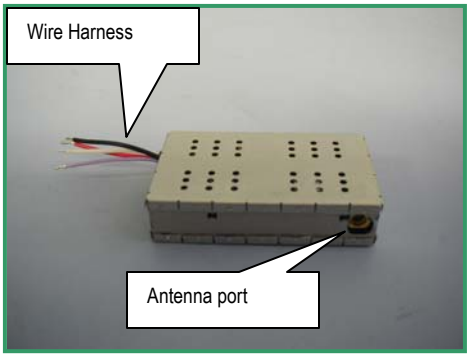


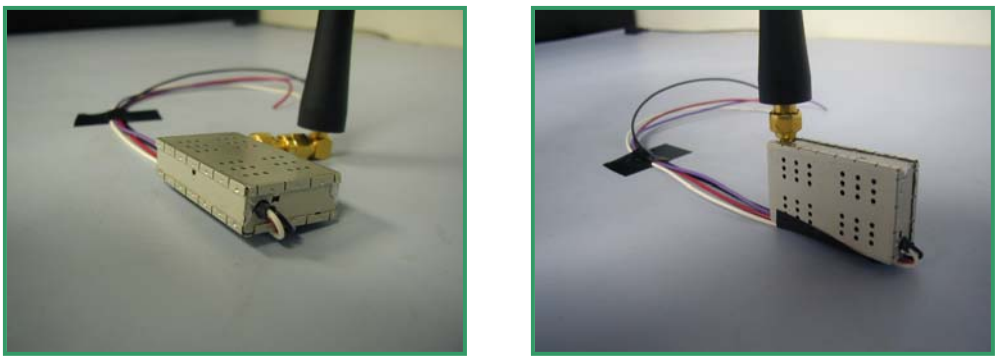
Figure 4 Dip switch location

Installation

Since the module radiates RF energy, care should be taken as to how it is installed in the end product. The PCB must not be removed from the aluminum housing as the housing is a required to minimized spurious radiation levels and its removal may cause spurious emissions to exceed their approved levels. Below is a picture showing the wire harness and antenna port locations.



The wire harness and antenna ports were designed to come out from different ends of the housing in order to help prevent radiated energy from coupling back through the power leads. It should be noted that the supply lines themselves need to provide a method of RFI/EMI isolation in order to protect RF from traveling back on the supply lines. A ferrite bead with an impedance value above 180Ω at 2.45GHz should suffice.



For harness connections that need to run close to the module, it is recommended that the harness be routed next to the side that is farthest away from the antenna. See pictures below for examples.

Figure 5 Example harnessing methods

Failure to carefully route the wire harness as well as failing to implement proper EMI/RFI techniques may result in the interference of video and audio reception. Please contact the manufacturer for installation support as needed.

Factory Tuning Procedure

1. Power on transmitter and set to channel 1 operating frequency.
2. Adjust the output power to 300mW using R23. The current draw at 300mW should be around 500mA +/- 50mA.
3. Verify sub-carrier presence and adjust carrier offset by adjusting L2. The offset should be 5.5MHz.
4. Adjust deviation constant by adjusting R1 and measuring the level of video at C8. The proper deviation constant is reached when the peak to peak amplitude of video is .25V.
5. Sweep frequencies from 10MHz to Carrier noting signals exceeding 46dBuV. Make any repairs if necessary. Record any levels within 6dB of limit.
6. Verify 1st and 2nd Harmonic levels not to exceed -39.2dBc. Make any repairs if necessary. Record any levels within 6dB of limit.
7. Repeat Steps 4 and 5 for channel 2 operation as well.