

EXHIBIT C
GENERAL INFORMATION



Retlif Testing Laboratories

Test Report No. R-3318N
FCC ID: H25VTX250

GENERAL INFORMATION REQUIREMENTS

Section 2.983(a)

Name of Applicant: **DTC Communications, Inc.**
Address of Applicant: **75 Northeastern Blvd.
Nashua, NH 03062**
Name of Manufacturer: **DTC Communications, Inc.**
Address of Manufacturer: **75 Northeastern Blvd.
Nashua, NH 03062**

Section 2.983(b)

Equipment Identification: **FCC ID: H25VTX250**

Section 2.983(c)

Quantity: **Production quantities are planned**

Section 2.983(d)

- (1) Type of Emission: **16MOF8W**
- (2) Frequency Range: **2450 to 2500 MHz**
- (3) Power Output: **0.25 Watts**
- (4) Maximum Power Rating: **0.25 Watts**
- (5) DC Voltages and Currents in all elements of the final RF Stage: **All stages including the final rf amplifying device are powered by DC regulated supplies from a standalone battery source. See Exhibit D**



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Test Report No. R-3318N
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GENERAL INFORMATION REQUIREMENTS (continued)

Section 2.983(d) (continued)

- (6) Function of Solid State Devices: **See Exhibit D**

- (7) Circuit Diagrams: **See Exhibit E**

- (8) Instruction Manual: **See Exhibit F**

- (9) Tune Up Procedure: **See Exhibit G**

- (10) Description of all circuitry and devices provided for determining and stabilizing frequency:

This equipment is crystal controlled. A complete description of the frequency stabilizing circuitry is included in Exhibit D.

- (11) Circuits For Suppression of Spurious Emissions, Limiting Modulation and Limiting Power:

A combination of SAW, Ceramic and L-C filters is used for the suppression of spurious radiation. An audio peak modulation clipper and low pass filter pursuant to 90.211 (a) is included for each fm subcarrier. A complete description of these filter elements is made in Exhibit D.



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GENERAL INFORMATION REQUIREMENTS (continued)

Section 2.983(d) (continued)

(12) Digital Modulation: **Not Applicable - The device uses analog modulation**

Section 2.983(e)

Spurious emissions at antenna terminals, field strength of spurious radiation and occupied bandwidth testing were performed at RETLIF TESTING LABORATORIES whose complete facility data package is on file with the FCC. All other testing was performed by DTC Communications, Inc.

See **Exhibit H** For Test Data and Measurement Procedures.

Section 2.983(f)

Equipment Label: **See Exhibit B**

Section 2.983(g)

Equipment Photographs: **See Exhibit B**



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EXHIBIT D
TECHNICAL DESCRIPTION



Retlif Testing Laboratories

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Technical Description

OVERVIEW

The DTC Communications, Inc. VTX-250 microwave transmitter is a low power audio and video S-Band transmitter designed for use in Non-Broadcast operations under Part 90 and Broadcast operations under Part 74. Applications include Law Enforcement, Public Safety, Industrial Video and Sports and News Broadcasting.

The video transmission method is wideband FM, with FM audio subcarriers.

The transmitter operates from a DC voltage between 11 and 32 VDC, consuming 500 mA of current and produces a single output power of 250 mW. The video input to the device is via a BNC connector or the Universal multipin connector. Two wideband audio subcarrier channels are included. Both high level (on BNC connectors) and low level balanced audio inputs (on the Universal connector) are made available to the user. Three to seven switch selectable channels are available to the user.

A LTC text box window and a timecode generator optional input is provided via a BNC connector and the Universal connector. All input signals plus DC power may be brought in via the Universal connector.

The transmitter has three marked, panel mounted switches for Channel, DC Power On/Off and Timecode On/Off.

The transmitter is enclosed in a chromated and painted aluminum housing. It is supplied without battery plates for Part 90 applications or with a variety of standard removable battery plates compatible with ENG cameras for broadcast work under Part 74. Total size without battery plates is 6.6" X 4.1" X 1.25". The size increases to 6.6" X 4.1" X 2.3" with Anton Bauer battery Plates. Total weight is 21 oz.

The antenna connector is a female TNC.

General RF Description

The VTX-250 microwave transmitter is designed by DTC Communications, Inc. to transmit standard television video and audio signals, compliant to NTSC, PAL and SECAM. The transmission method is wideband FM with imbedded low frequency FM audio subcarriers in the 6.0 to 8.5 MHz range. The emission designator is 16M0F8W. The VTX-250 generates a highly stable (RF) carrier on a single frequency and is capable of producing high quality transmissions from 1700 MHz to 2700 MHz.

Part 74 operation is from 1900 – 2500 MHz.

Part 90 operation is from 2450 – 2500 MHz.

The frequency generation and stabilization method is the Phase Locked Loop (PLL) method with a crystal controlled reference for each channel. Channel selection is done

by installing crystals at the DTC Factory. Under no circumstances can the VTX-250 be made to operate outside the limits imposed by 47 CFR Part 74.602 or 90.213.

The VCO operates at the carrier frequency (no IF) and modulation is performed outside of the loop filter bandwidth. The modulated audio FM subcarriers are linearly summed with the main carrier baseband video before modulation. Video pre-emphasis is 75uS to EIA-250 for NTSC. Audio pre-emphasis, limiting and low pass filtering are employed.

The maximum output power of the VTX-250 is 250 mW which is the maximum power permitted under 47 CFR Part 74.636 and is less than the 5W maximum, permitted under 47 CFR Part 90.205(l).

The VTX-250 is powered from an external DC source with a voltage between 11 and 32 VDC. All circuits are powered from internal regulators. Operating current varies slightly with input voltage, varying between 400 and 600 mA DC over the voltage range.

The class AB final power amplifier operates from a regulated 5 VDC and draws 280mA for a total efficiency factor of 17.8% for that stage.

Semiconductor and active circuit device functions

VTX-250 EXCITER (EN-1000 PWB)

Refer to drawing number 1086327.

Board DC Power Conditioning

Pre-regulated 11.5 VDC system power is introduced to this board and immediately regulated on-board by a 10 V linear regulator U7, a LM2940-10 that services all video, the main VCO and the power amplifier circuits. A regulated 5VDC is produced by U5, an LM78L05. This supply voltage is used in conjunction with the audio subcarrier generator.

Frequency Control

Q2, the VCO transistor (AT41411) is a Colpitts oscillator operating at the carrier frequency. The RF output is taken from the untuned collector port and is fed to the amplifier chain. The frequency of the oscillator is determined by a series resonant L/C tuned circuit in the base which is externally tuned by D3, a varactor diode (V20-2023).

The output of the oscillator is buffered through U8, the first amplifier(MSA-3111), a 12 dB power amplifier device. This signal is sent on to the remaining stages U10 (MSA-1105) and U11(MSA-1105). The signal from U8 is also sent to the prescaler divider IC, U9 (SP5070). The prescaler divides the VCO frequency by 256. Also resident on U9 is the phase detector and charge pump. The resulting error current from the charge pump is converted to a voltage and filtered through loop filter components, Q3 (MMBT3904), C61, R62, C50 and C72, thus producing a tuning voltage for the VCO.

The prescaler reference frequency is set by a low frequency crystal. In this way, the frequency is controlled in a very stable manner, by changing reference crystals at the factory. These crystal frequencies are equal to the carrier frequency divided by 256.

Individual channels are selected via the channel switch and three mosfet transistors Q1-Q3 which enable each crystal in-turn. Carrier frequency tolerance with this system is $< \pm 0.001\%$ and the performance over temperature and voltage is $< \pm 0.005\%$.

Modulation

Modulation signals, both audio and video enter the board via P3, the ribbon cable interconnect.

The 75 Ohm terminated video input level of 1Vp-p is pre-emphasized by a network made up of C71, C35, C19, R27, R28, R29, R30 and L3. The video signal is then combined with the audio subcarriers by U3 (LM7121), the summing amplifier.

Also entering the summing amplifier are the two audio subcarrier signals. "Left" audio enters the board via P3. This 600 Ohm terminated "Left" 1Vp-p audio is pre-emphasized (75 μ S) by U1 (LM358) in conjunction with R6, R7, R8, R9 and C4. The "right" subcarrier circuitry is not produced on the Exciter board. Instead it is produced on an identical circuit located on the VTX-250 Power Supply/Power Amp board and enters the Exciter board via P3.

Audio low pass filtering is accomplished via R2, C2 and R3. Subcarrier harmonic low pass filtering is accomplished by C17, C18, and L2.

500 mVp-p at 1000 Hz will produce 50% audio subcarrier modulation.

Audio Subcarrier Generator

The "left" channel subcarrier VCO is Q1 (MMBT3904), a parallel resonant tank Colpitts oscillator. A varactor diode D1 (MVAM115) is used to tune the VCO. This signal is directly locked to the correct subcarrier frequency with a ceramic bandpass device, FL1 associated with a CMOS PLL circuit made of U2 (74HC86). The loop filter consists of R11, R13, and C5 and C75. The tuning voltage is modulated by the pre-emphasized audio signal via U1b (LM358), the modulation summing amplifier. An identical (on another subcarrier frequency) circuit is housed on the VTX-250 mainboard for the "Right" audio channel. Q5 (MMBT-3904) acts as a reference diode for the summing amplifier.

The frequency response of each audio channel is 100 Hz to 15 KHz ± 3 dB. The injection level of the subcarriers is 24 to 28dB below the video carrier. R24 sets the audio subcarrier injection level.

Common Subcarrier frequencies are: 6.0, 6.5, 6.8, 7.0, 7.5 and 8.25 MHz

Video Modulation Compensation

The composite modulation levels from channel to channel are carefully equalized by the modulation compensation circuit. The modulating signal after the summing amplifier is sent to three deviation potentiometers, RV1, RV2 and RV3. Each trimpot is connected to an individual analog switch that is invoked in harmony with the crystal select process. The outputs of the three analog switches U101a, c and d (4066) are combined; thus each channels modulation sensitivity is individually compensated.

1Vp-p of baseband video input will produce 4MHz peak deviation through the entire transmitter circuit.

RF Amplification

The buffered VCO signal is further amplified to the +10 dBm level by two more MMIC amplifiers, U10 (MSA-1105) and U11 (MSA-1105). TX Level pot RV3 adjusts the exciter output power. Low pass filtering and matching components are included.

Video Switch Protection Circuit

The VTX-250 has a feature that automatically disables the RF output when the video signal is removed. That is, when a valid video signal is not present, the RF output is greatly reduced by disabling U11, the exciter output amplifier. A video detect circuit, U6 (LM-393) connected to the video input, trips high in the absence of video turning off Q4 (MMBT-3906), the power switch for U11.

CRYSTAL SELECTOR BOARD

The crystal selector PWB is a small crystal deck which includes three mosfets Q1-3 (2n7002) for channel selection. This is a daughterboard to the Exciter.

POWER SUPPLY/POWER AMP BOARD

Refer to drawing number 1086323.

This PWB contains the bulk of the main power conditioning circuitry, the right audio subcarrier generator, both of the audio subcarrier low level microphone amplifiers the timecode generator module and the 250 mW power amplifier.

Main Power Conditioning

Reverse polarity protection is provided by D7 (MBRS-140) and D13 (MBRS-140) Schottky diodes. Fuse protection is provided by F1, a 2A board mounted device. Overvoltage protection is provided by D8, a 36V shunt power zener.

The VTX-250 power supply circuitry allows an extended range of DC input voltages to be handled, essentially from 11 to 32 VDC. From 13 to 32 VDC, Q4 (IRF-9521), the power mosfet pass device and associated regulator devices, reference, D10 (LM336-2.5), Q5 (3904) and Q6 (3906) comprise a high current 12.5VDC linear regulator. This voltage is used to power all other regulators and circuits.

The second mode of Q4 is that of a saturated switch between 11 VDC and 13 VDC. The dropout condition is allowed under these circumstances and efficiency is high with very low voltage drop.

The third mode of Q4 is that of a dropout battery protection switch. Voltage sensing and switching circuitry comprised of the reference D15 (LM-336-2.5) and comparator U16 (LM393) and switches Q16 (3904) and Q14 (3904) provide a battery saving feature that "cuts out" the power when the battery drops below 10 VDC in the nominal 12-15 VDC case and below 18VDC in the 24-32 VDC case.

The 12.5V regulator is further conditioned by a series of linear and switching regulators resident on both cards.

A step-down switching regulator U2 (LM2594), provides 5VDC for the 250mW power amplifier. U4 (MAX853) is a switching negative bias generator which in concert with U5a and U5B (TLC27M2) Op-Amps produce the negative bias required for the 250mW power amplifier U6 (PM2104).

U3 is an 8VDC linear regulator (78L08) for U12 (LM7121) and U14 (LM7121) the video loop through amplifiers servicing the timecode window module U17 (ICS2008).

Timecode Window Module

This OEM module U17, produces an analog signal that produces a text window for external timecode data generators often found on broadcast cameras and equipment. This signal is summed with the raw video input before video processing on the exciter board. An analog switch pair, U15 A and B (4066) provide a means to jump around the timecode module while Q12 (MIC94031), a switch mosfet, disables timecode module power on the command of the external user switch. This is a daughterboard to the Power Supply / Power Amplifier PWB.

Power Amplifier

The power amplifier MMIC is a device (PM2104) that amplifies the exciter output to the 250mW level. It has 50 Ohm input and output ports. C19, C20 and L4 provide additional antenna low pass harmonic filtering.

The amplifier's output is connected to an on-board MMCX connector which allows a coaxial interconnect to the external TNC antenna connector.

Microphone Preamplifiers

Both high level and low level audio input signals are handled. A 1 Vp-p 600 ohm input for each subcarrier generator is brought from the chassis BNC connector directly into audio mixers, U7a (Left) and U7b (Right) (LF353). Balanced low level (-40 dBV) inputs are provided by U11a and U11b (Left) (LF353) and U10a and U10b (Right) (LF353) amplifier stages, which also feed the audio mixer stages.

Right Channel Subcarrier Generator

An identical subcarrier circuit to the one on the Exciter board is included on this board made of Q9 (3904), D12 (MVA115), U8 (LM358) and U9 (74HC86). Right channel audio deviation is set with RV1.

LED and Channel Switch Logic

Q1-3 (3904) and Q11(3904) and D14 (1N914) are LED driver circuits. U1 (4011) provides switch channel demultiplexing for the exciter card crystal bank.

Power Supply/Power Amp Board Interfaces

The P1-J1 interface brings the channel select, timecode and power switch signals onto the Power Supply/Power Amp PWB. The channel, timecode and power LED outputs also come through this connector.

The P2-J2 interface brings all of the input signals and DC power from the BNC connectors and the universal connector onto the Power Supply/Power Amp PWB.

The P3-J3 interface is the interconnect between the Exciter card and the Power Supply/Power Amp PWB.