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**A description of the Truck Coder II analog modulation for occupied bandwidth and spectral mask measurements for FCC type certification.**

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**Title: IDU Video Modulation Description**

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### Revision History

Date	Author	Description of changes	Revision
2/28/2007	L Greenbank	Initial release	--

### Table of Contents

- 1. Introduction and Scope .....3
- 2. Definitions .....3
- 3. References.....3
- 4. Block Diagram and Description.....4
  - 4.1. IDU Analog Modulation Block Diagram .....4
    - 4.1.1. Video input level .....4
    - 4.1.2. Video Low Pass filter .....4
    - 4.1.3. Video pre-emphasis:.....5
    - 4.1.4. Video injection: .....5
    - 4.1.5. Video Test Pattern:.....5
    - 4.1.6. Audio Subcarriers:.....7
  - 4.2. Block Diagram – Layout view .....8

## 1. Introduction and Scope

This document is a description of the Truck Coder II analog modulation as applicable to occupied bandwidth and spectral mask measurements for FCC type certification.

Two modes of analog operation are 17 MHz Frequency Plan, and 12 MHz Frequency Plan. The FM deviation and audio subcarrier frequencies are modified from the standard to meet 12 MHz occupied bandwidth and spectral mask requirements. The occupied bandwidth for 17 MHz operations is 15 MHz. the occupied bandwidth for 12 MHz operation is 12 MHz.

## 2. Definitions

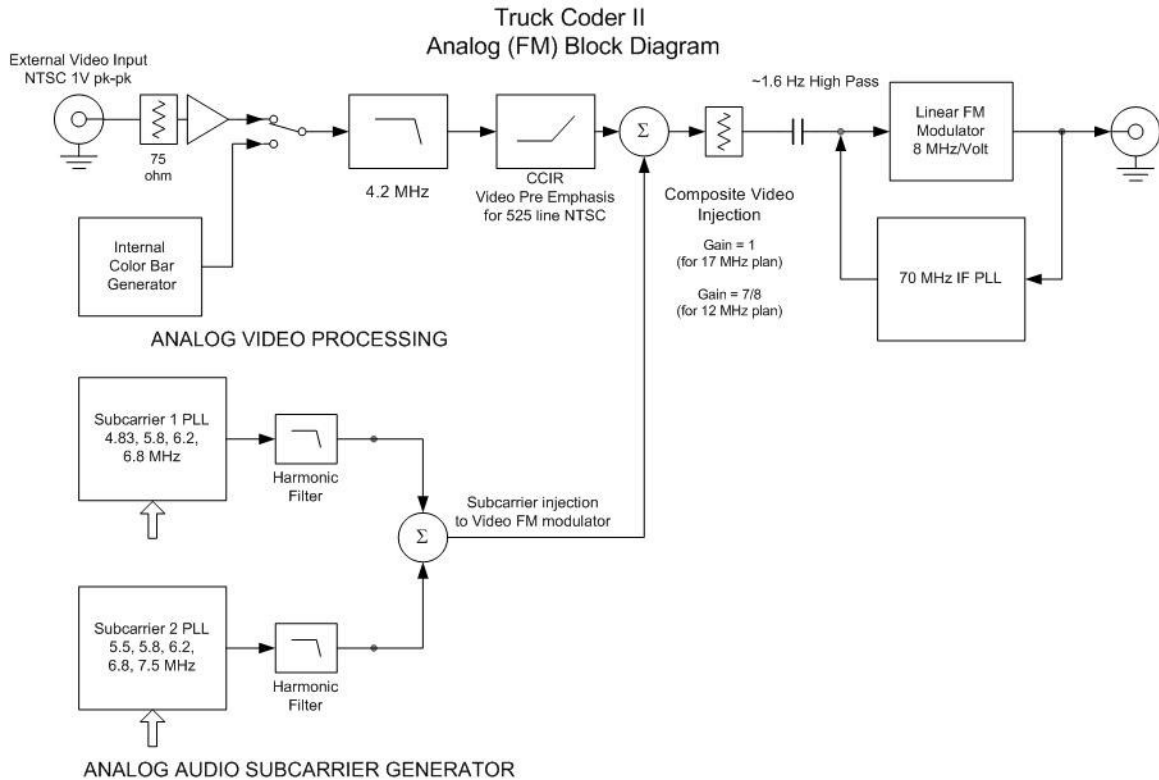
Term	Definition
BMS	Broadcast Microwave Services
EIA	Electronic Industries Association
FCC	Federal Communications Commission
FM	Frequency Modulation
IDU	Indoor Unit
NEMKO	
NTSC	Bandwidth
ODU	Outdoor Unit
OFDM	Orthogonal Frequency Division Multiplex
TCB	Type Certification Board
TCII	Truck Coder II

## 3. References

- [1] EIA/TIA 250-C, Feb 1990
- [2] CCIR Video Emphasis, 525 line NTSC, System M

## 4. Block Diagram and Description

### 4.1. IDU Analog Modulation Block Diagram



#### 4.1.1. Video input level

Standard broadcast equipment is set up for 1 V pk-pk Video, with 75 ohm source and load terminations. For occupied bandwidth and spectral mask measurements, the internal color bar generator is used. This internal generator level is calibrated to be equivalent to standard video input.

#### 4.1.2. Video Low Pass filter

Multipole low pass filter passes 4.2 MHz and rolls off at about 3 dB at 4.5 MHz. This filter configuration is used for NTSC format only, not PAL. Frequency flatness and pre-emphasis are specified by the EIA 250-C standard for short haul systems.

#### 4.1.3. Video pre-emphasis:

CCIR video pre-emphasis is used. This attenuates low frequency components of the video, and amplifies slightly the high frequency components.

CCIR Video Pre-Emphasis

Frequency (MHz)	Pre-Emphasis (dB)
10	-10
400	-3
761	0 (ref)
3000	+3

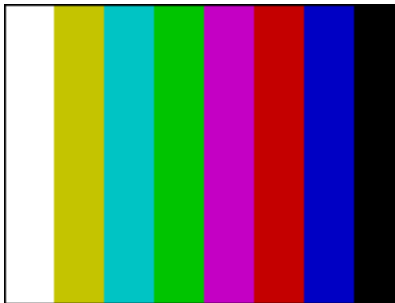
#### 4.1.4. Video injection:

The video is injected into a linear FM modulator with frequency response from a few Hertz to above 5 MHz. Linearity and frequency flatness meets EIA 250-C short haul requirements. FM deviation is 8MHz/Volt for 17 MHz channel plan, and 7 MHz/volt for the 12 MHz channel plan. FM deviation is intentionally attenuated for the 12 MHz plan to meet occupied bandwidth and spectral mask requirements.

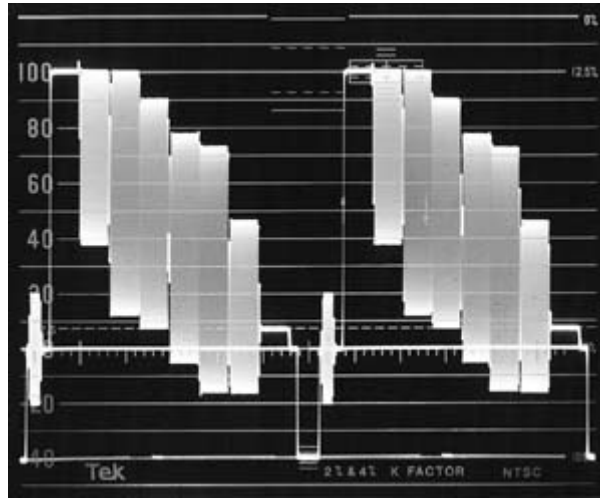
#### 4.1.5. Video Test Pattern:

Six SMTE color bars at 75% luminance, plus a 100% white bar and a 0% black bar, plus white text overlaid upon the color bars. The text is blinking "BMS Truck Coder II" at approximately one second period.

Full Field 100/75/0 Color Bars:



Full Field 100/75/0 Color Bars



	<b>Standard 100/75/0 Color Bar</b>
Bar Type	Full Field style, 8 vertical bars, plus Blinking white text "BMS"
Bar order	White, Yellow, Cyan, Green, Magenta, Red, Blue, Black
Bar Saturation	0%, 100%, 100%, 100%, 100%, 100%, 100%, 0%
Bar Luminance	100%, 75%, 75%, 75%, 75%, 75%, 75%, 0%
Output Levels	1.00Vpp into 75 Ohm

Standard NTSC Video modulation

	<b>NTSC/RS170</b>	<b>PAL</b>
Vertical Frequency	59.94Hz	50Hz
Horizontal Frequency	15.73426Khz	15.650Khz
Chroma Frequency	3.579545Mhz	4.43Mhz
Scan Lines	525 Total	625 Total
Output Levels	1.00Vpp into 75 Ohm	

Note:

1. 140 IRE = 1 V pk-pk,
2. 100 IRE is the maximum luminance level = 100% luminance = white.
3. 7.5 IRE is the minimum luminance level = 0% luminance = black.
4. 100% saturation is the maximum chrominance level of the 3.58 MHz color subcarrier. Phase of the subcarrier ref to the color burst determines the hue.
5. 1 Volt pk-pk sine wave at 761 KHz = 8 MHz pk-pk FM.
6. Emphasis network is referenced to 0 dB at 761 KHz.

#### 4.1.6. Audio Subcarriers:

Two audio subcarriers are injected, each at 10% of the video level, or approximately 100 mVrms. Audio injection is calibrated at the IF output of the IDU by measuring the fundamental component of the FM spectrum.

Audio input modulation does not affect the overall spectrum of the Truck Coder for two reasons. (1) The deviation is small (< 75 KHz peak) and (2) the injection level is 20 dB below the Video modulation.

Standard Audio Subcarrier Frequencies for **17 MHz** channel plan:

Audio Channel	Subcarrier Frequency (MHz)
SC1	4.83, 5.8, 6.2, 6.8
SC2	5.8 , 6.2, 6.8, 7.5

Note: The highest subcarrier frequency pair (6.8 and 7.5 MHz) were chosen for occupied bandwidth and spectral mask measurements for 17 MHz channel plan.

Standard Audio Subcarrier Frequencies for **12 MHz** channel plan:

Audio Channel	Subcarrier Frequency (MHz)
SC1	4.83
SC2	5.5

Note: Only the lowest frequency pair are allowed in order to meet occupied bandwidth requirements for 12 MHz channel spacing. A new standard frequency of 5.5 MHz is proposed for Audio 2, to allow analog (FM) operation within the 12 MHz channel plan to be compliant with FCC occupied bandwidth and spectral mask requirements.

## 4.2. Block Diagram – Layout view

