51. **VIDEO FRAME FORMAT & BANDWIDTH REQUIREMENTS**

**NTSC Standard - U.S. GRAMophone RS-170 Signal Format & LC Specs.**

525 Lines (2 Fields/Frame Interlaced)
-40 Lines (20/Field)
485 Active Viewable Lines
60 Fields/sec, 30 Frames/sec

**Horizontal Sync. Freq.** \( f_H \) (One Line)

\[
\begin{align*}
 f_H &= \left(\frac{525 \text{ Lines}}{\text{Frame}}\right) \times \left(50 \text{ Frames/sec}\right) \\
&= \left(262.5 \text{ Lines/Field}\right) \times \left(60 \text{ Fields/sec}\right) \\
&= 15,750 \text{ Lines/sec} \text{ or } 1575 \text{ Sync/sec} \\
T_H &= \frac{1}{f_H} = 63.5 \mu\text{sec (one line)}
\end{align*}
\]

**Vertical Sync. Freq.** \( f_V \) (Field Rate)

\[
\begin{align*}
 f_V &= 60 \text{ Fields/sec} = \left(2 \text{ Fields/frame}\right) \times \left(30 \text{ Frames/sec}\right) \\
&= 60 \text{ Vertical Sync/sec} \\
T_V &= \frac{1}{f_V} = 16.67 \mu\text{sec (one field time)}
\end{align*}
\]

**Figure 8.2: The image as a serial signal**
(a) One complete frame - Composite Image
(b) One complete line

**CCD Camera:** 480 Lines, 25%
8 Bit Grey Level

- # Bytes/Field = 240 x 256
  = 61,440 bytes
- # Bytes/sec = 61,440 bytes
  / 16,670 x 10^{-6} sec/frame
  = 3.7 MB/sec
- **ADC rate** = 5 MB/sec
- **Data Transfer Rate** = 4 MB/sec
- **Memory Write Speed** \( \leq 250 \text{ MW} \)

**Disk Must Be Fast!**
Get Around Problem by
- **Compressing Image** - Run Length Coding, FAX, etc.