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RECEIVED

MAR 15 1994

G.A. REITMEIER

DATE: March 14, 1994

TO: C. Basile, Philips  
B. Beyers, Thomson  
R. Keeler, AT&T  
D. Leonard, AT&T  
J. Lim, MIT  
B. Rast, GI  
G. Reitmeier, Sarnoff  
C. Todd, Dolby

FROM: W. Luplow, Zenith

SUBJECT: NAB Presentation

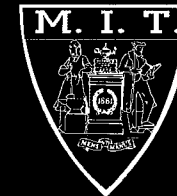
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Attached are unproofed, draft copies of the transmission subsystem presentation for next Sunday.

For your information, I will be staying at the Las Vegas Hilton, arriving late Saturday night and leaving early Tuesday morning.

WCL/e

**GI** General  
Instrument



***Digital HDTV  
Transmission Subsystem***

***Grand Alliance***

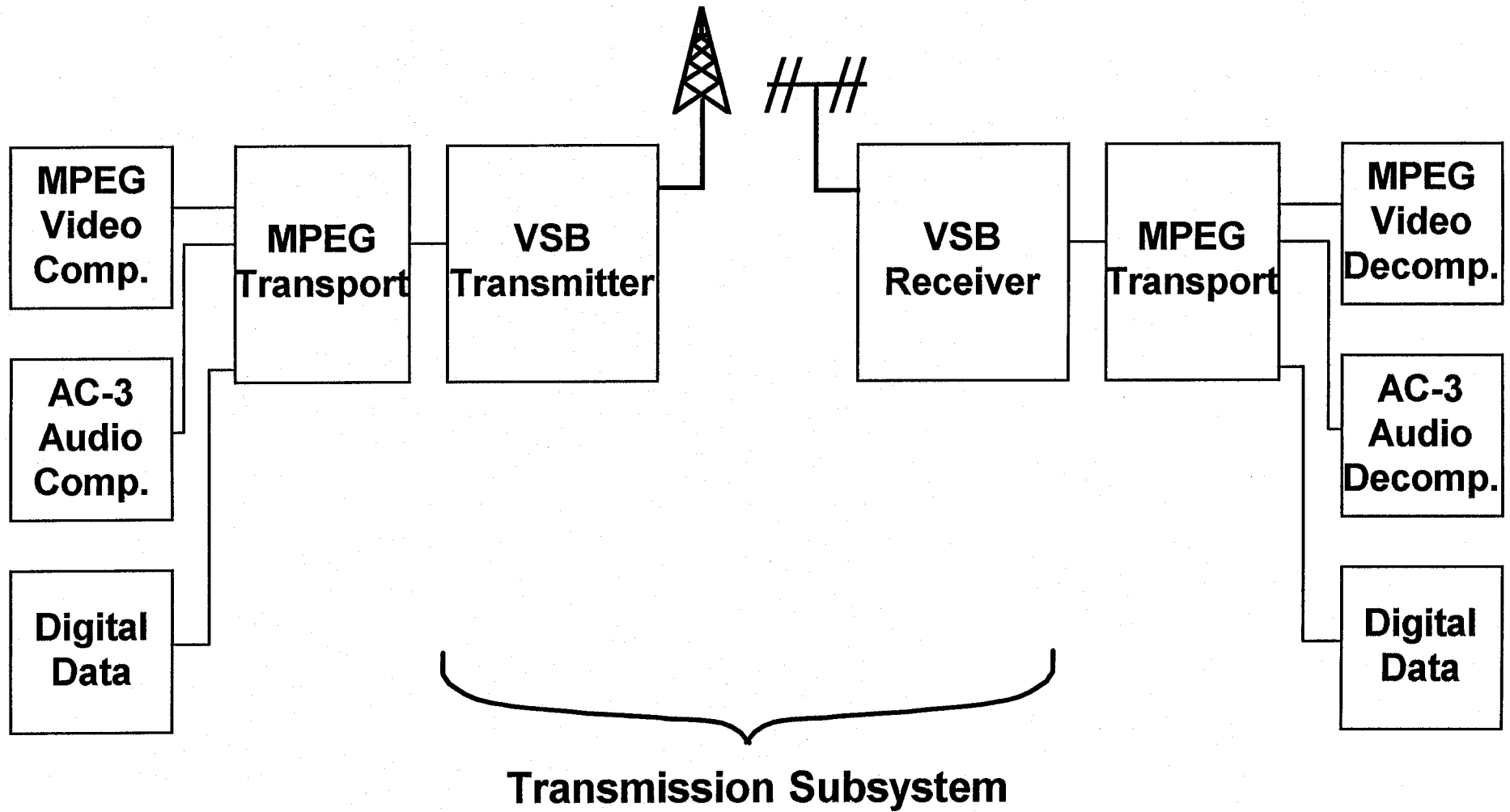


**Sarnoff**

**ACATS**



# Grand Alliance HDTV Terrestrial Broadcast System

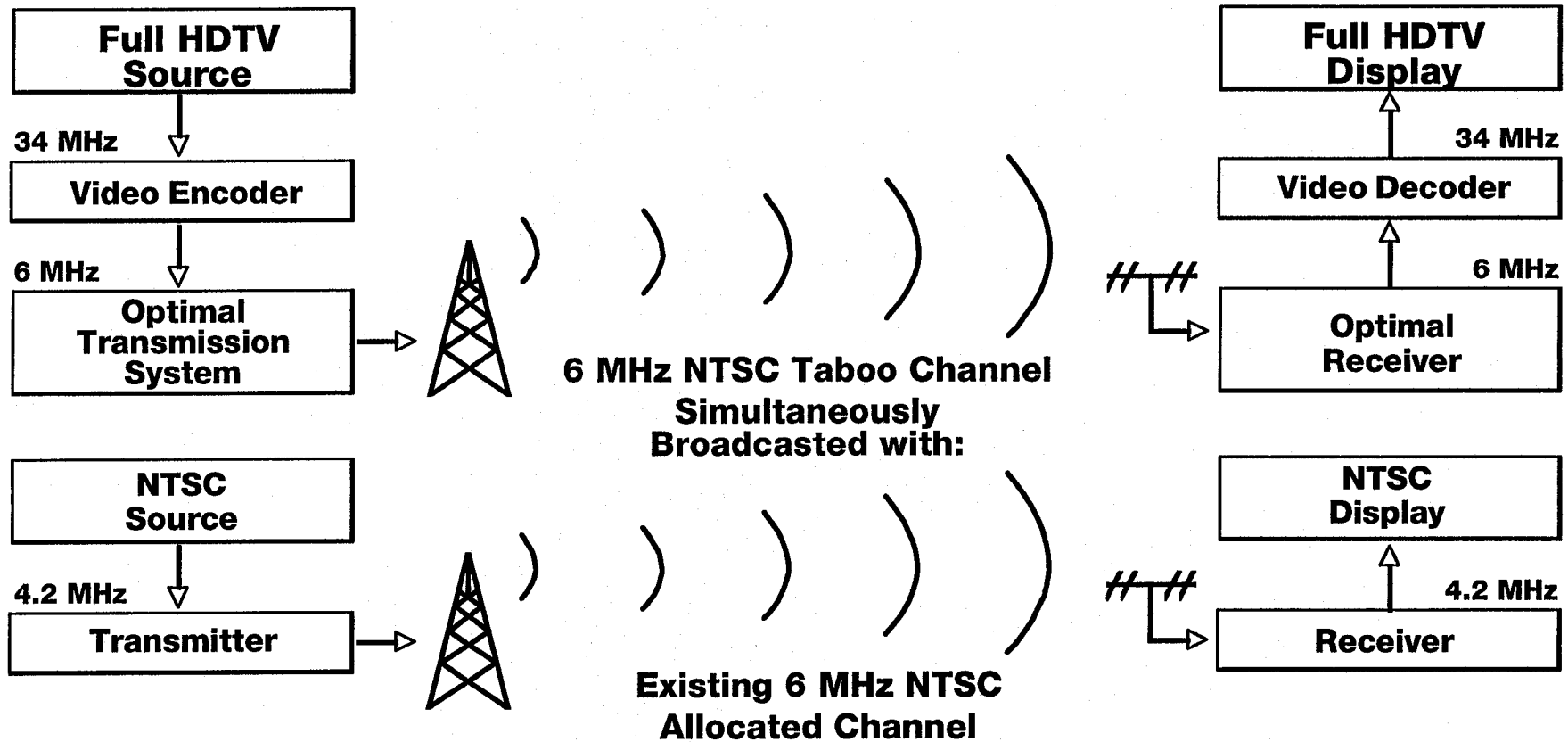


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# Outline of Presentation

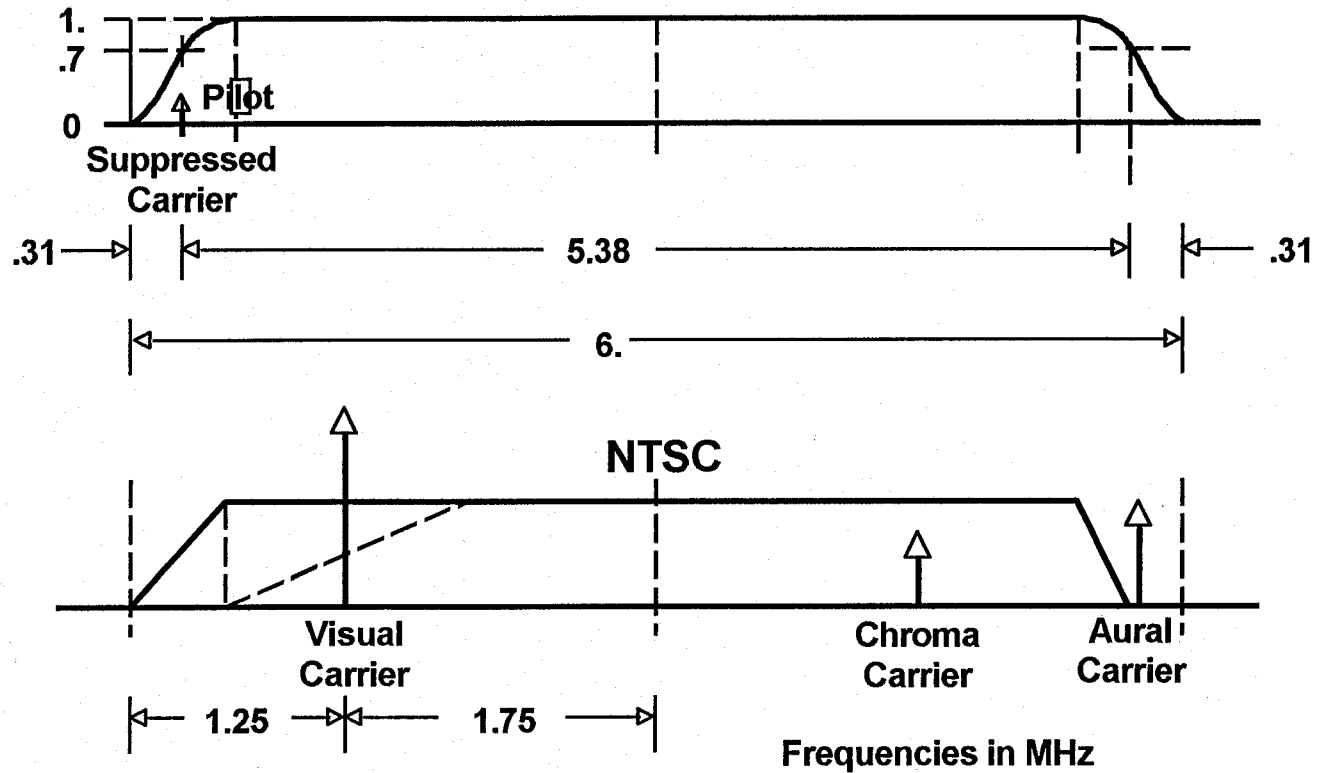
- **Transmission background**
- **Subsystem description**
  - **Transmitter**
  - **Receiver**
- **Parameters**
- **Performance - laboratory test results**
- **Ongoing efforts**

# Simulcast Principle



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# VSB AND NTSC CHANNEL OCCUPANCY



# **HDTV Digital Transmission Subsystem Goals**

- **Maximize coverage area - population and geography**
- **Minimal additional interference into existing NTSC service area**
- **Maximize usable data delivery rate**
- **System and signal robustness**
  - **Multipath, phase noise, pull-in range, acquisition impulse noise**
- **Alternate delivery media considerations**

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# Digital Transmission Subsystem Selection Process

- **Comparison of former proponent transmission approaches**
  - **G-A plan when formed**
  - **Assures best overall approach**
    - **Terrestrial**
    - **Alternative delivery Media**
  - **Extensive hardware tests in January & February**
    - **ATTC and Cablelabs facilities**
    - **ACATS and G-A personnel**
    - **VSB and QAM technologies**

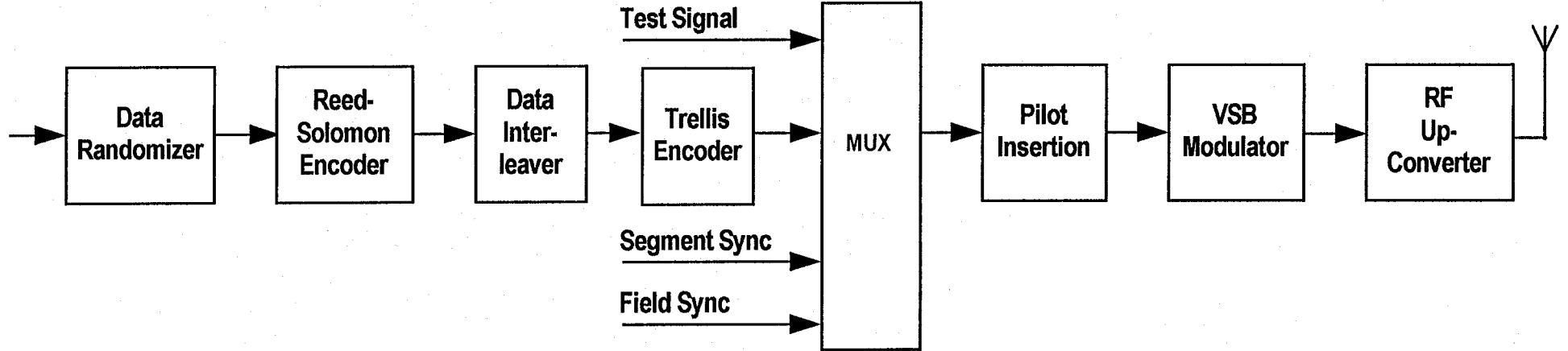
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# Digital Transmission Subsystem Selection Process (continued)

- **Results**
  - Both systems showed substantial improvements over previously tested transmission systems
  - VSB had slightly better overall performance
  - G-A selected VSB based on data
- **FCC's advisory committee endorsed/selected VSB for its ATV transmission system**

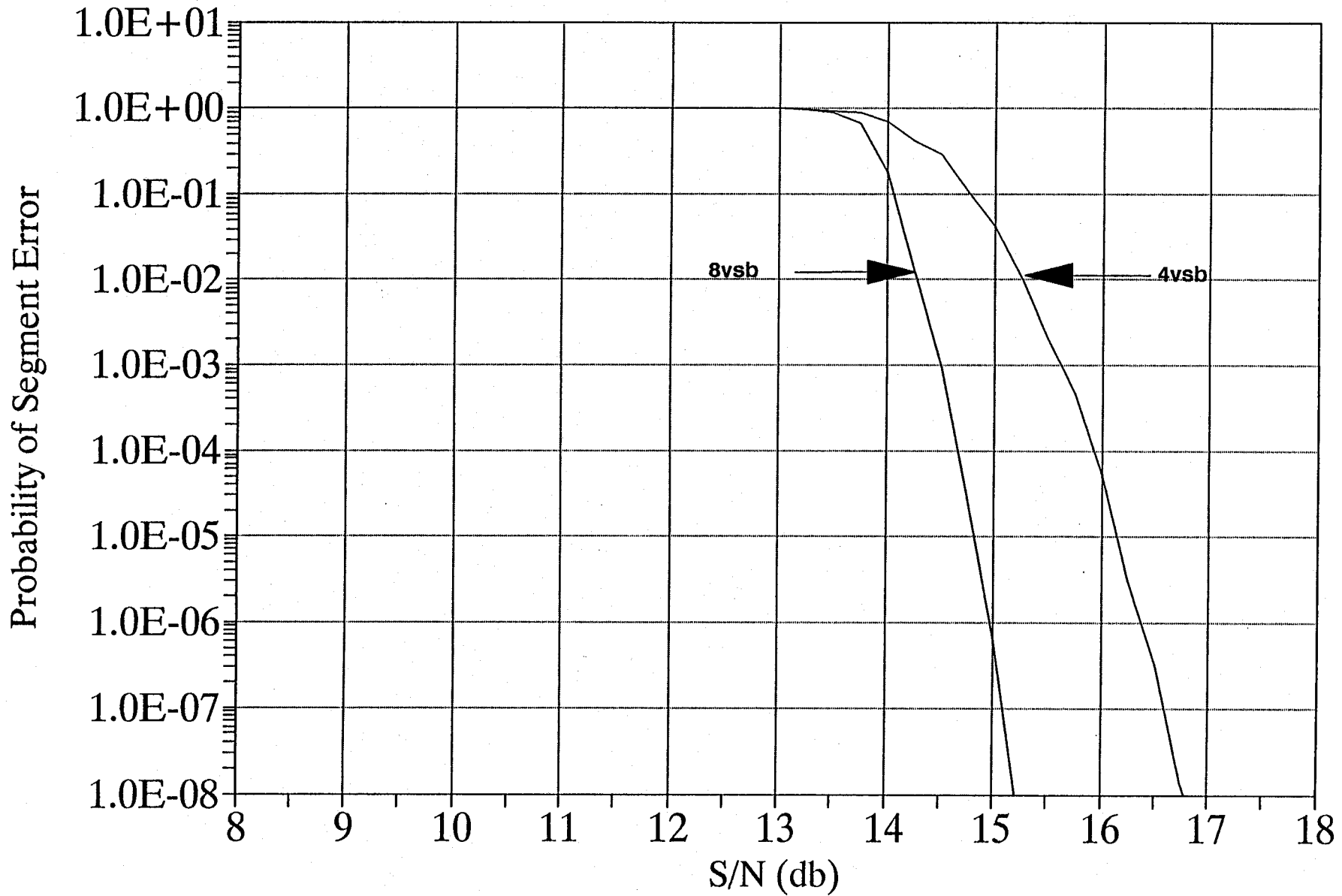
# VSB Transmitter



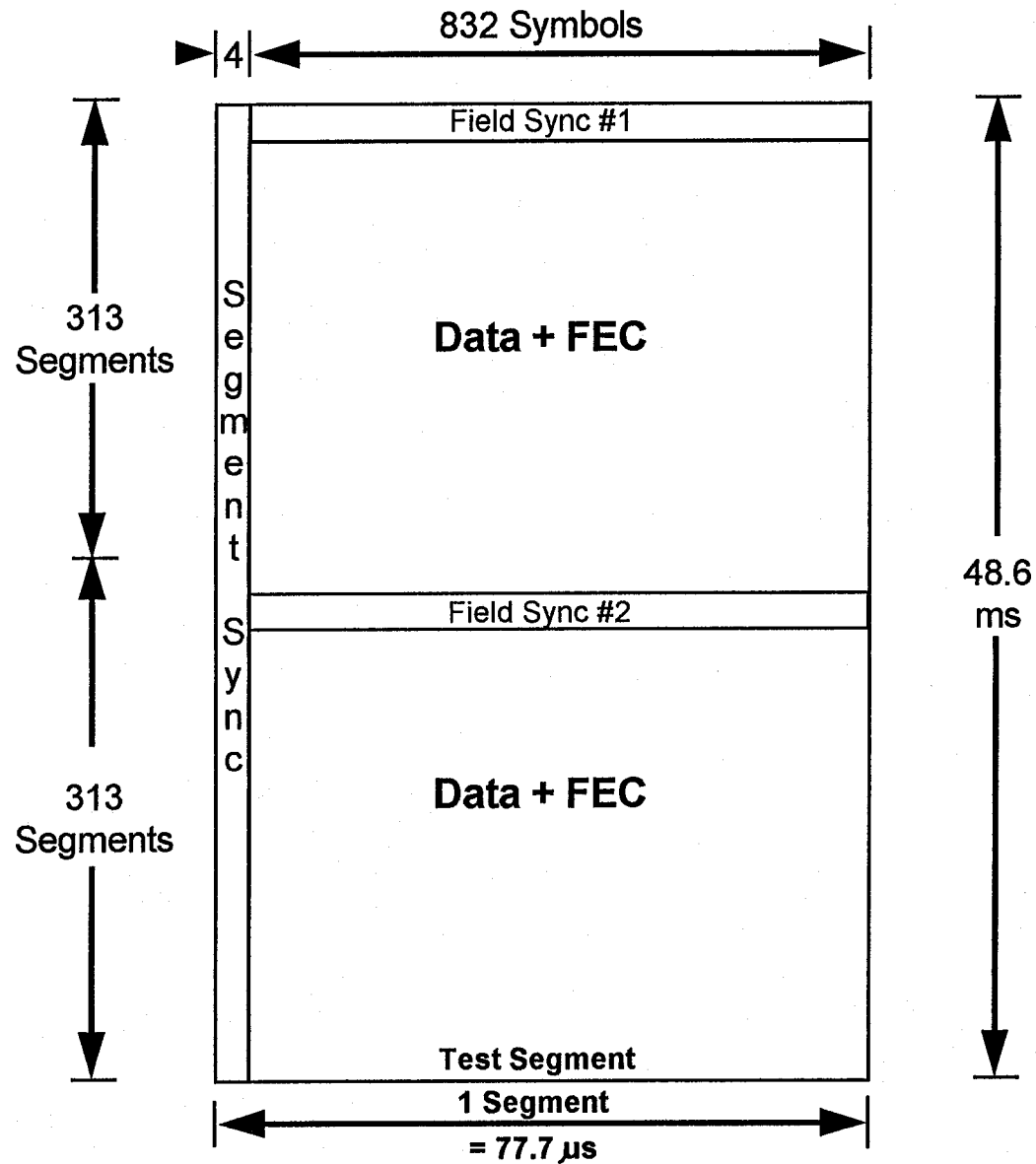
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# Segment Error Probability

8vsb w/4state trellis; RS=(208,188)

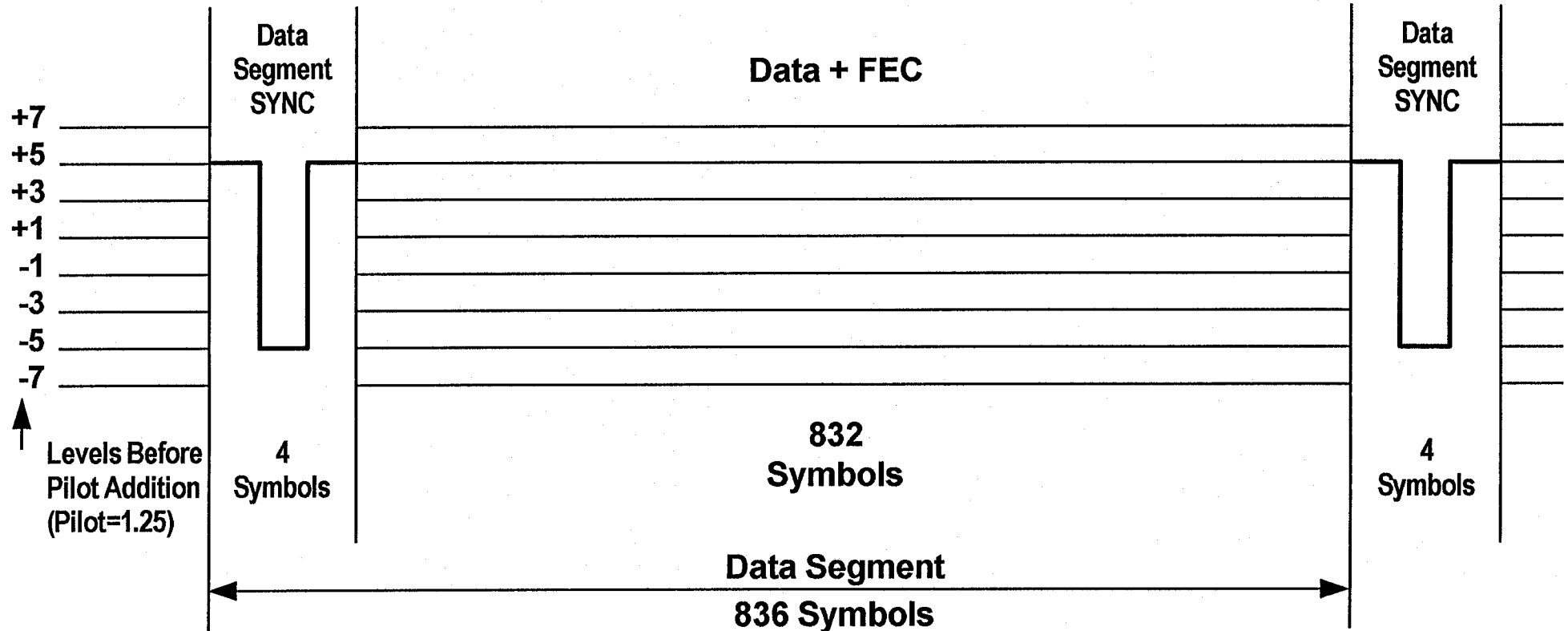


# VSB Data Frame



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# VSB Data Segment (Terrestrial)

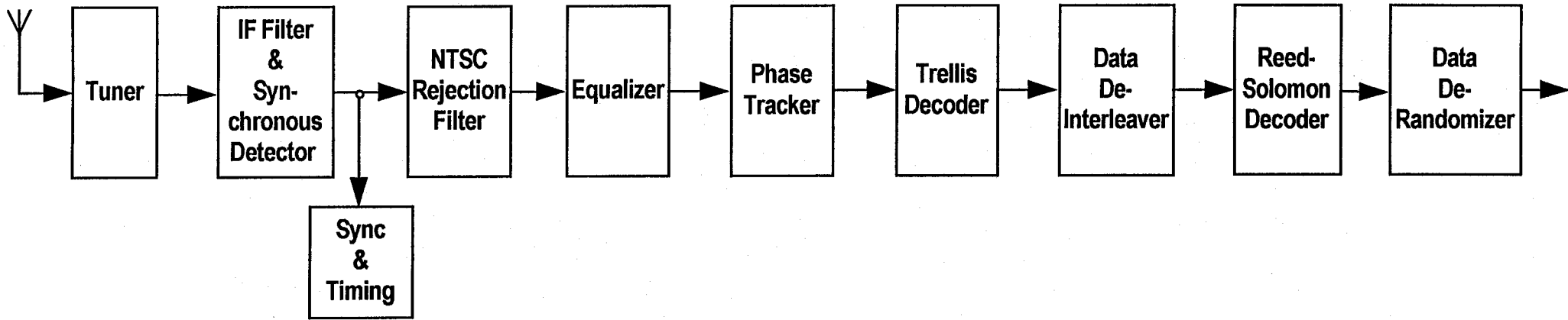


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# Pre-Equalizer Filter

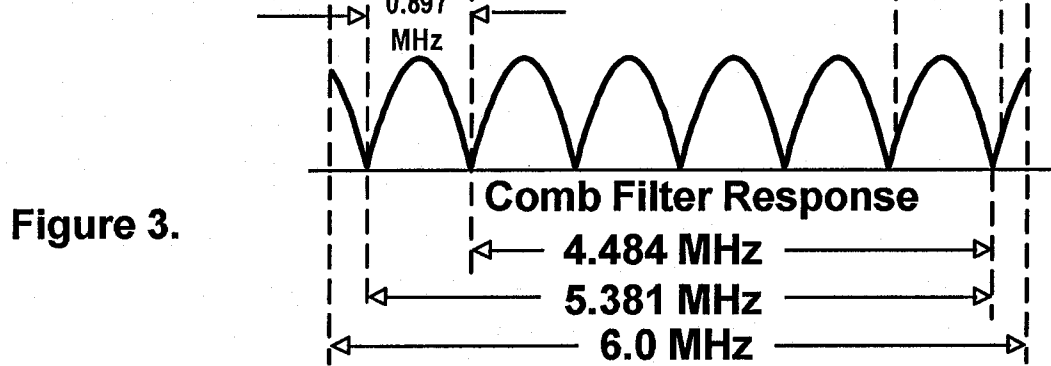
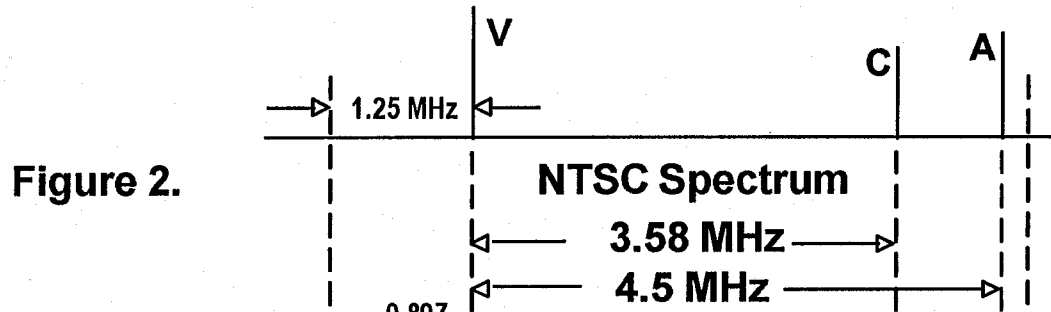
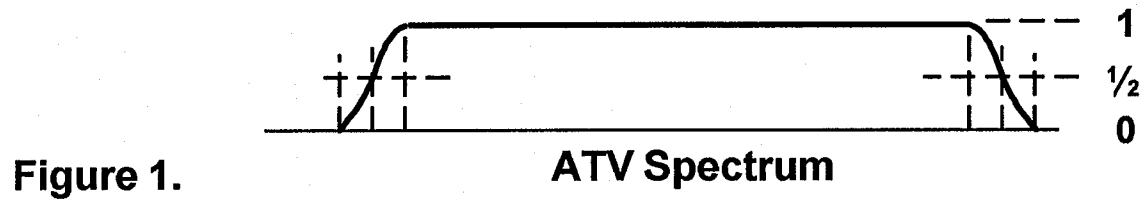
- **Compensates for high power amplifier**
  - In-band ripple
  - Frequency roll-off at band edges
- **Sample from antenna feed**
  - Linearizes the entire system
  - Assures flat spectrum at output of high power amplifier
- **Thus, capability of receiver equalizer can be completely dedicated to correct propagation effects**

# VSB Receiver



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# ATV AND NTSC CO-CHANNEL SPECTRA





# VSB Parameters

Parameter	Terrestrial Mode	High Data Rate Cable
Channel Bandwidth	6 MHz	6 MHz
Excess Bandwidth	11.5%	11.5%
Symbol Rate	10.76 MSPS	10.76 MSPS
Bits per Symbol	3	4
Trellis FEC	2/3 rate	None
Reed-Solomon FEC	T=10 (208, 188)	T=10 (208, 188)
Segment Length	836 symbols	836 symbols
Segment Sync	4 symbols per segment	4 symbols per segment
Frame Sync	1 per 313 segment	1 per 313 segment
Payload Data Rate	19.3 Mb/s	38.6 Mb/s
NTSC Co-Channel Rejection	NTSC Rejection Filter in receiver	N/A
Pilot Power Contribution	0.3 dB	0.3 dB
C/N Threshold	14.9 dB	28.3 dB

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# Transmission Subsystem - Looking Ahead

- Subsystem-only field tests in Charlotte
- Refinements to VSB system - in parallel with Charlotte tests
  - Change segment-sync structure to be consistent with MPEG-2 data packetization
  - Incorporate adaptive equalization algorithm from QAM system to improve performance with dynamic multipath
  - Explore and implement other potential embellishments
- Integrate VSB subsystem with other G-A subsystems - summer

*Will also add some photos from Charlotte site*

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