

Infocommunication

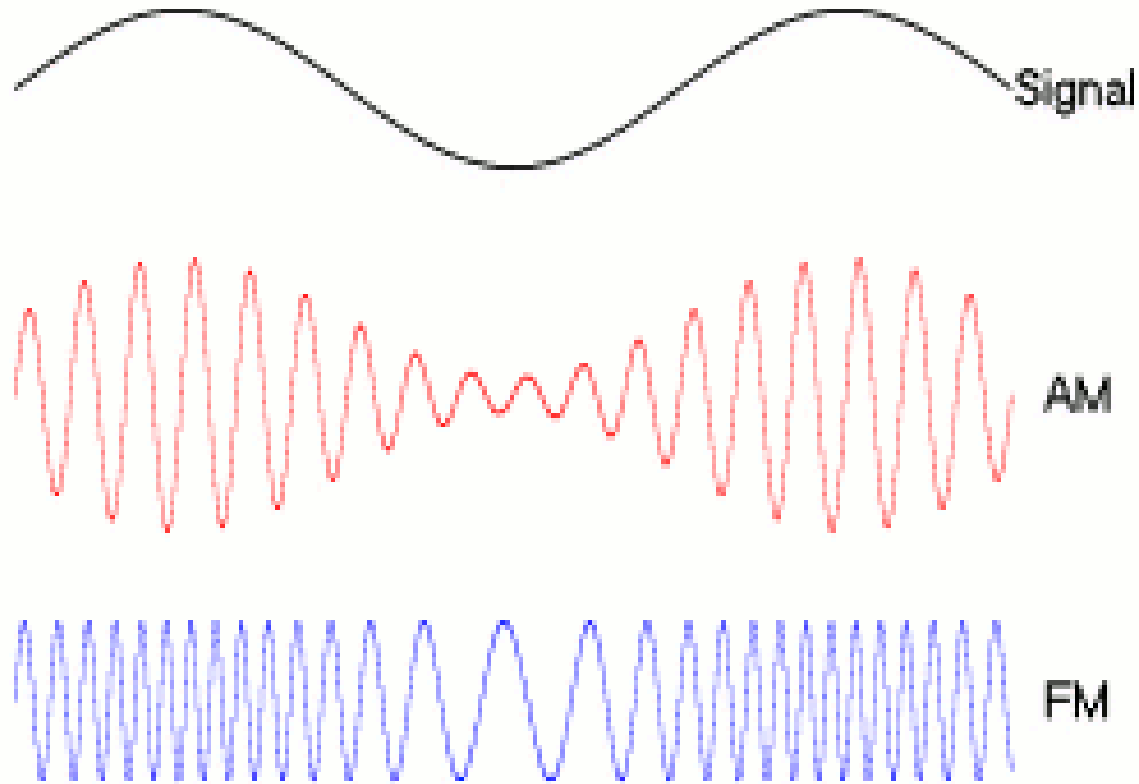
Analog modulation

- Bálint TÓTH, BME TMIT -

Overview

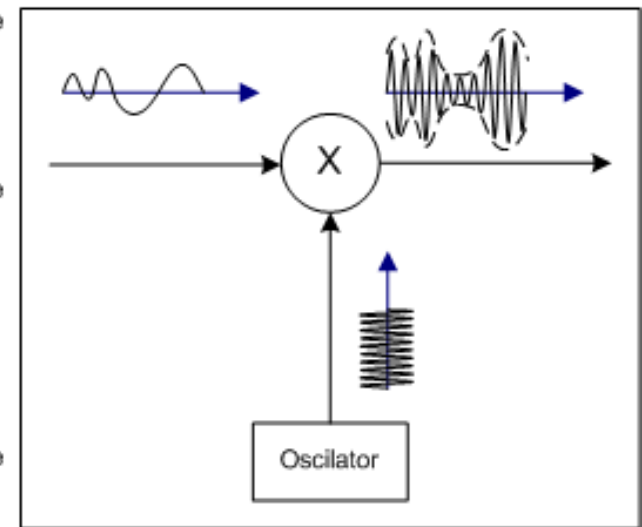
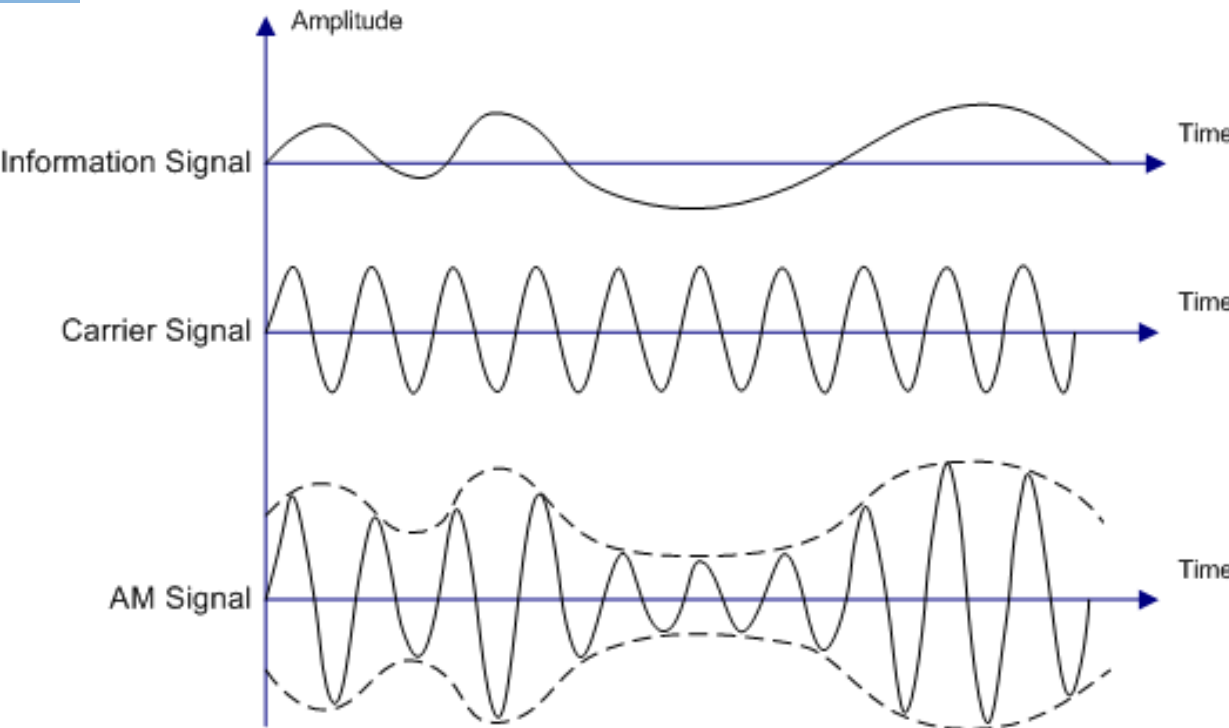
- **PPT is for demonstration, not for learning!**
- Goal of modulation, definitions
- General architecture of analog modulation systems
- Amplitude modulation
 - Modulation, demodulation, figures (spectrum, vector, time)
 - Sinusoid modulating signal
- Angle modulation
 - Frequency modulation (FM) and phase modulation (PM)
 - Modulation, demodulation, figures (spectrum, vector, time)

AM, FM: Sinusoid carrier and modulating signal



www.wikipedia.org

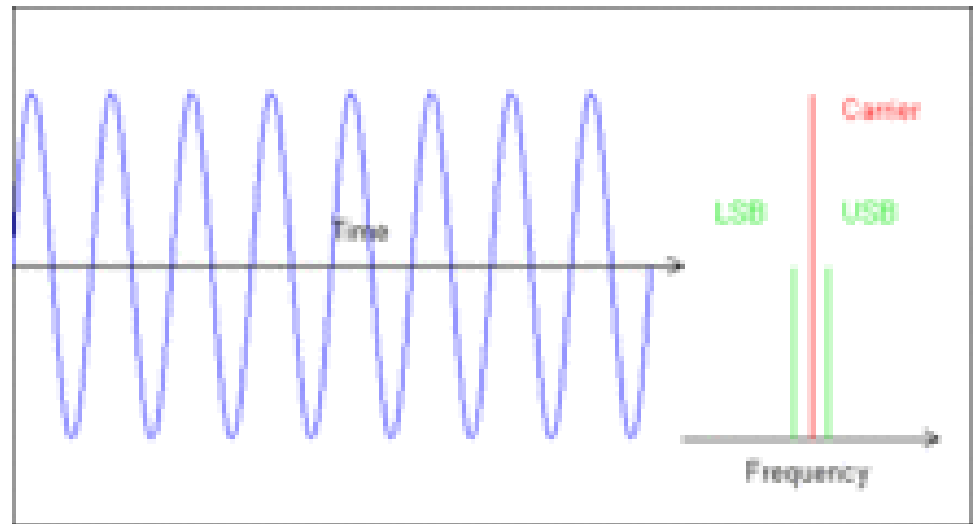
Generating AM signal with sine wave carrier



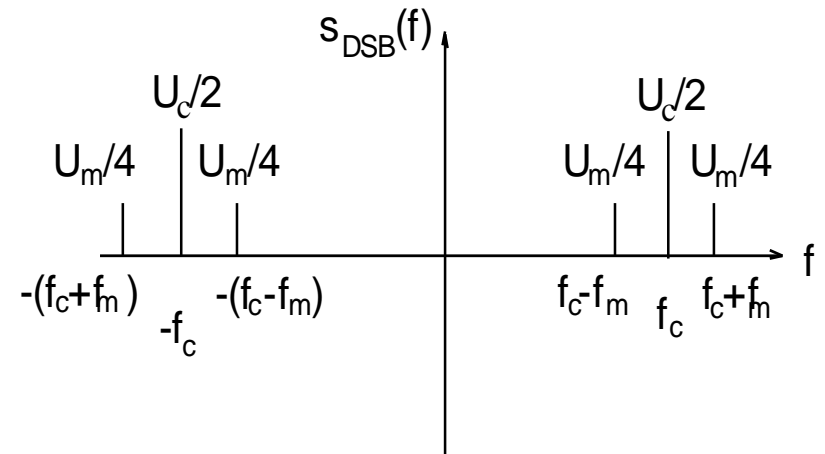
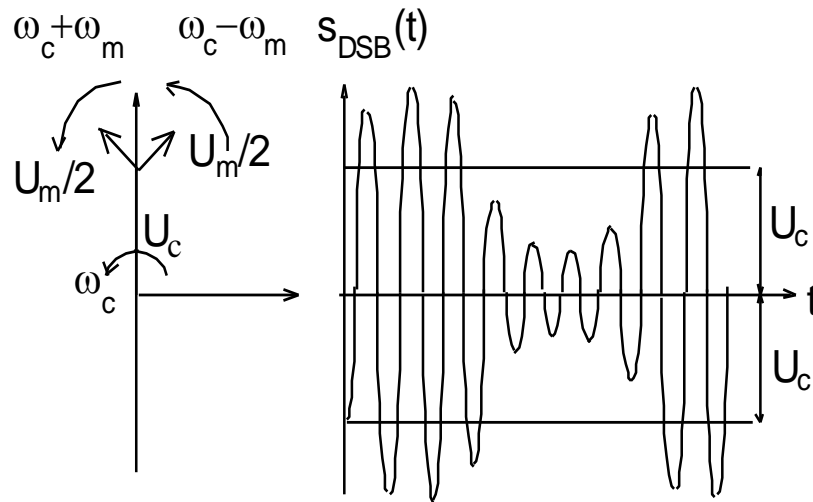
zarrata.com

Types of AM

- AM-DSB
- AM-DSB/SC
- AM-SSB
 - LSB
 - USB
- AM-SSB/SC
- AM-VSB

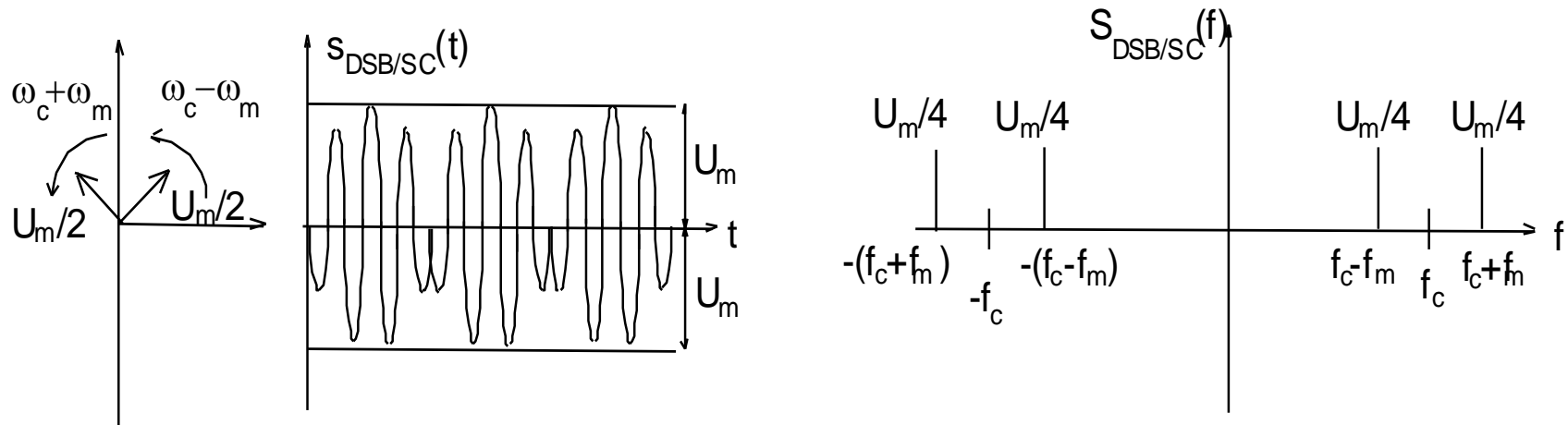


AM-DSB



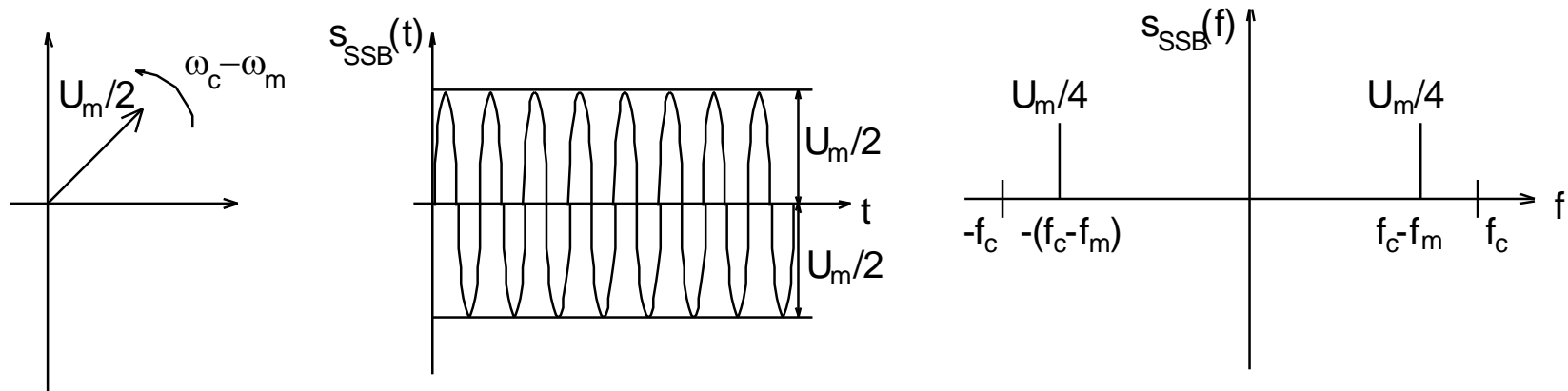
$$\omega_i = 2\pi \cdot f_i$$

AM-DSB/SC



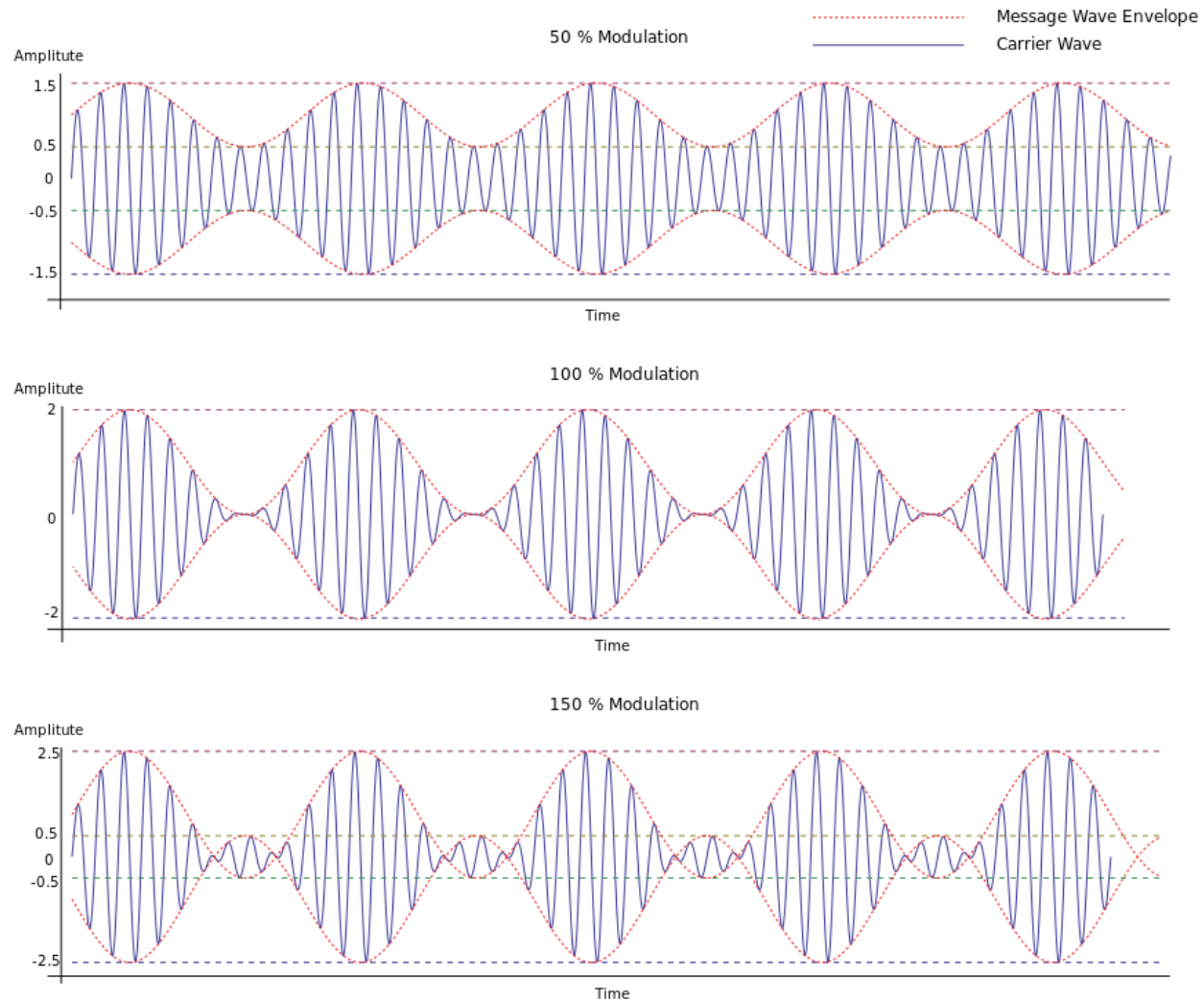
$$\omega_i = 2\pi \cdot f_i$$

AM-SSB/SC



$$\omega_i = 2\pi \cdot f_i$$

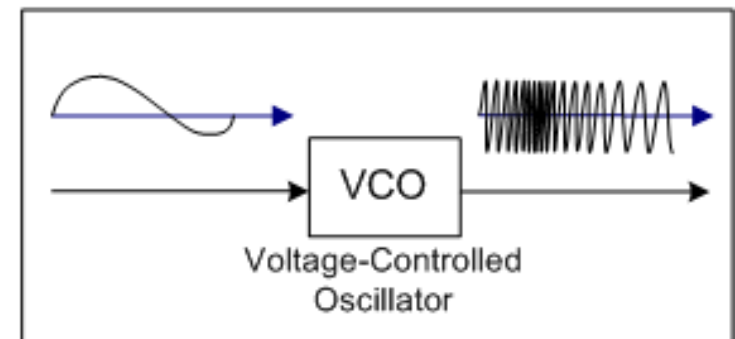
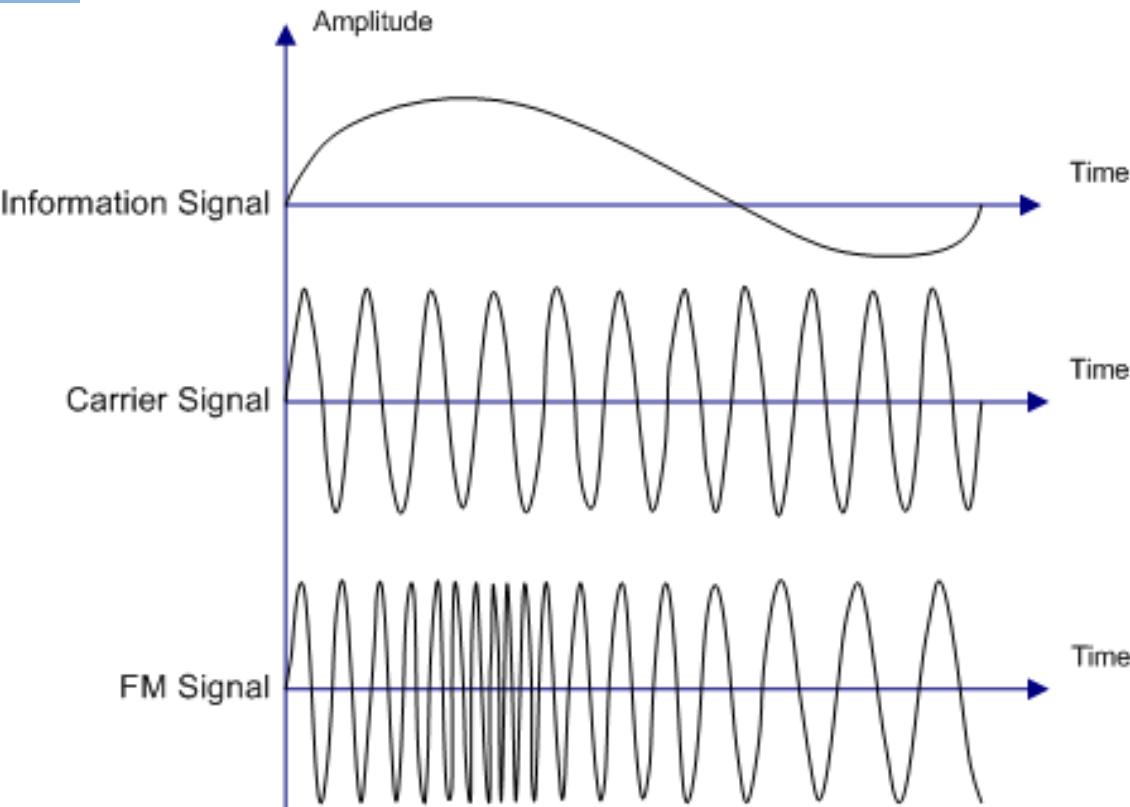
Modulation index (depth)



Angle modulation

- Phase modulation
- Frequency modulation
- Differences to AM
 - Amplitude is constant
 - Spectrum contains infinite sidebands
 - Non-linear process

Generating FM signal with sine wave carrier



Examples

- AM-SSB: radio amateurs
- AM-DSB: radio station, moderate quality
 - 0-4.1 kHz, $B=9$ kHz
- FM: radio stations, high quality
 - 0-15 kHz, $B=240-300$ kHz
- Television broadcast (analog)
 - Picture: AM-VSB
 - Color: QAM and FM
 - Sound: FM