

# UESTC3029

## Communication Circuits Design

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# Example

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- An AM broadcast station operates at its maximum allowed total output of 50 kW and at 95 percent modulation. How much of its transmitted power is sidebands?

# Example

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- Calculate the required  $Q$  for a 100-kHz carrier with 80-dB sideband suppression prior to filtering the upper and lower sidebands are separated by 200 Hz
- Solution:

# Example

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Determine the bandwidth required for an FM signal with frequency  $f_i = 3 \text{ kHz}$  and a maximum deviation  $\delta_{\max} = 10 \text{ kHz}$

# Example

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Determine the relative total power of the carrier and side frequencies when  $m_f = 0.25$  for a 10 kW FM transmitter. (Note: for  $m_f = 0.25$ , the carrier is 0.98 times its unmodulated amplitude and J1 is the only significant sideband, with a relative amplitude of 0.12).

# Example

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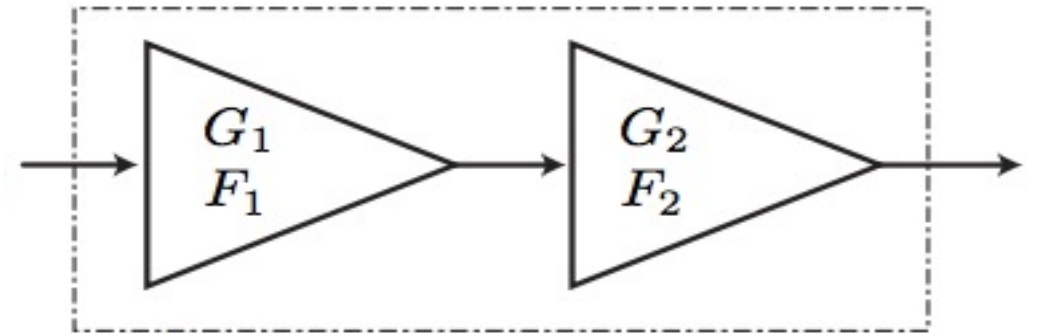
- (a) Determine the permissible range in maximum modulation index for commercial FM that has 30 Hz to 15 kHz modulating frequencies.
- (b) Repeat for a narrowband system that allows a maximum deviation of 1 kHz and 100 Hz to 2 kHz modulating frequencies.

**Note: The maximum deviation in broadcast FM is 75 kHz**

# Example

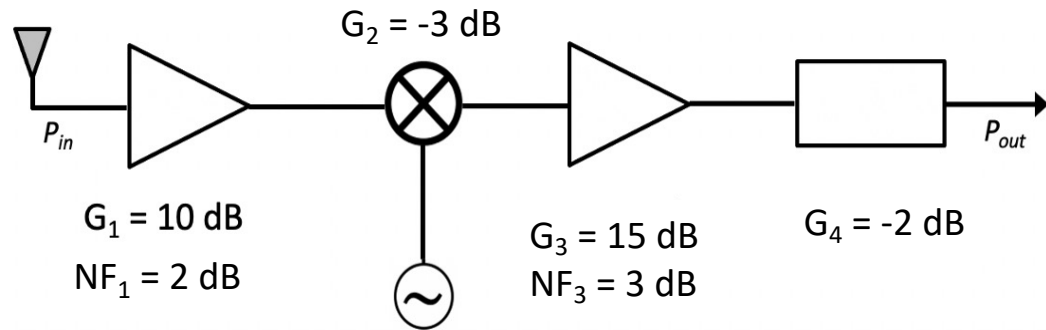
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Find the overall gain, noise factor and  $T_e$  of the system below if  $G_1 = 10$  dB,  $NF_1 = 3$  dB,  $G_2 = 9$  dB,  $NF_2 = 6.5$  dB



# Example

What is the sensitivity of the receiver below if it operates at room temperature and has a bandwidth of 10 MHz and desired SNR of 15 dB?





# Example

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A superheterodyne receiver is tuned to 5 MHz with an IF of 850 kHz and -3 dB bandwidth of 200 kHz. The tuning capacitors are maximum at 300 pF when the RF frequency is 5 MHz. Find

- The numerical  $Q$  of the filter?
- LO frequency
- RF inductance
- LO inductance

# Example

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A superheterodyne receiver has been tuned to a signal at 85 MHz and has its local oscillator operating at 110 MHz. What frequency should an incoming have to cause image reception?

# Example

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For a signal  $v(t) = 20\sin(2\pi(500)t)$ , determine the minimum sampling rate according to Nyquist-Shannon sampling theorem. What happened if the signal is sampled at 400 Hz?

# Example

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Find the resolution of an 8-bit ADC for a reference high voltage of 14 V and low voltage of 2 V.

# Example

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Determine the distance from a  $\lambda/2$  dipole to the boundary of the far-field region if the  $\lambda/2$  dipole is being used in the transmission of a 90.7-MHz FM broadcast band signal.

# Example

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- Two  $\lambda/2$  dipoles are separated by 50 km. They are “aligned” for optimum reception. The transmitter feeds its antenna with 10 W at 144 MHz. Calculate the power received. Hint: gain of half-wave dipole is 2.15 dB
- If the receiving  $\lambda/2$  dipole is aligned such that its gain is cut in half. Calculate the received power and voltage into a  $73\ \Omega$  receiver

# Example

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A  $\lambda/2$  dipole is driven with a 5-W signal at 225 MHz. A receiving dipole 100km away is aligned such that its gain is cut in half. Calculate the received power and voltage into a  $73\text{-}\Omega$  receiver.