



RF and mmWave Circuit Design

WIRELESS SYSTEMS – SYSTEM DESIGN

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coursera

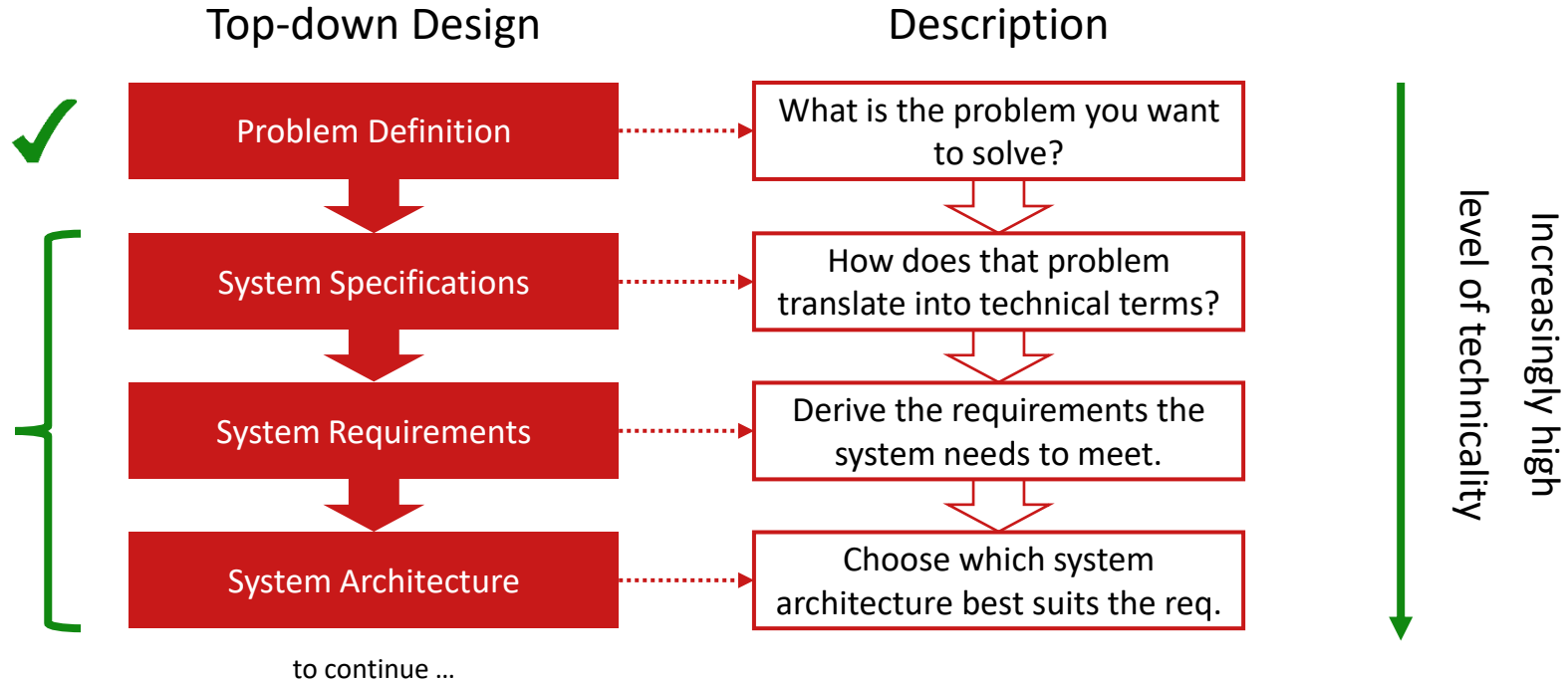
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Wireless Systems

Review

- History and Challenges
- Introduced concepts:
 - Path loss (PL)
 - Transmitter output power (P_{OUT})
 - Receiver sensitivity (P_{IN})
 - Selectivity
 - Distortion (P1dB and IP3)

System Design Methodology



Specifications and Requirements

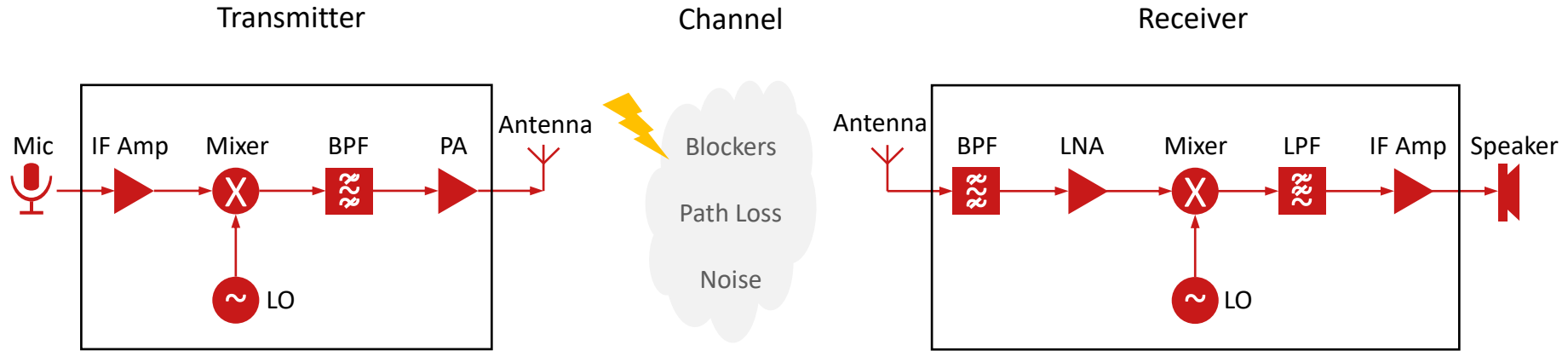
Wireless Tin Can Telephone (my design)



System Specification	→	System Requirements	→	System Architecture
Audio Wireless	→	Analog processing	→	Amplitude modulation
Low Power	→	$P_{DC} < 1 \text{ W}$	→	Direct conversion
Simple Design	→	$f_c = 1 \text{ MHz}$	→	Half-duplex
Noisy Environment	→	$\text{SNR}_{\text{OUT}} \geq 70 \text{ dB}$	→	Differential Circuit

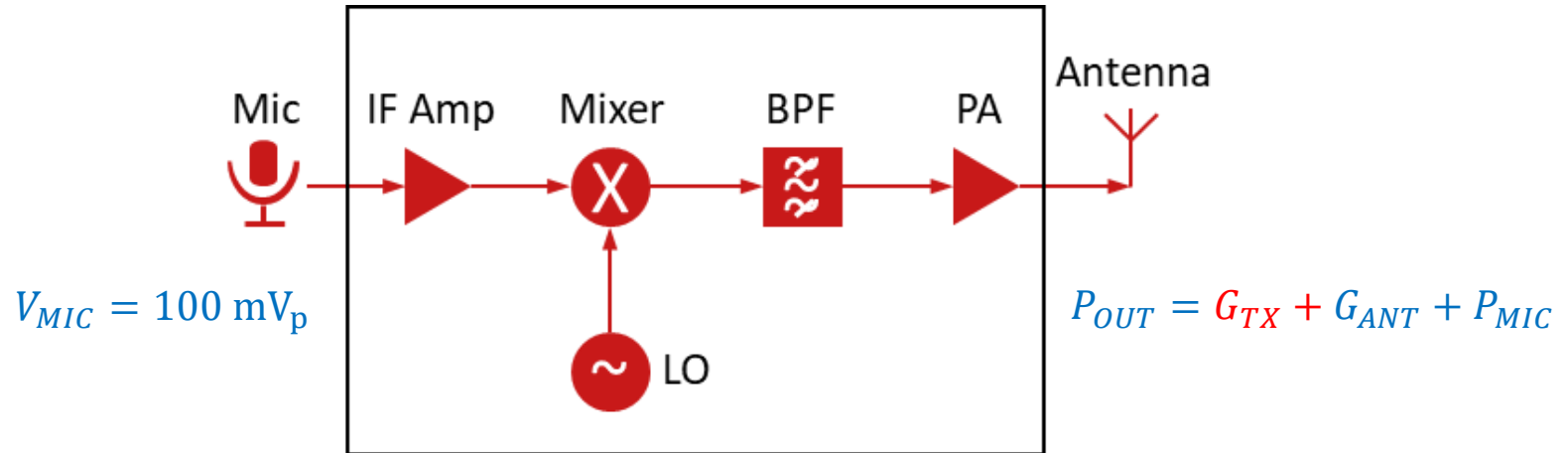
System Architecture

Wireless Tin Can Telephone



System Architecture

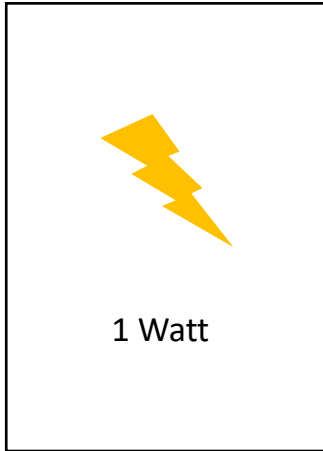
Transmitter



System Architecture

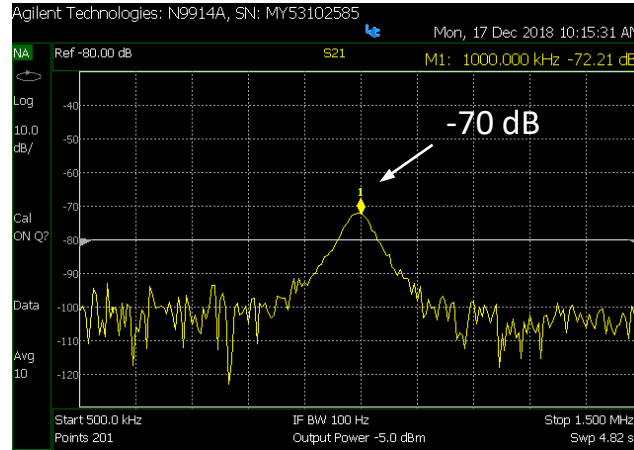
Channel

Blockers



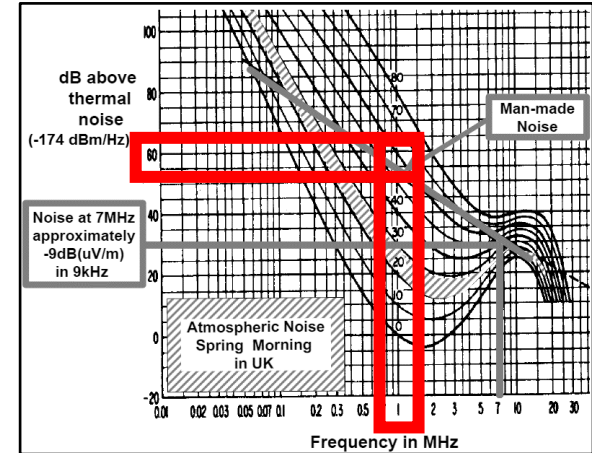
From AM stations

Path Loss



Two loop antennas 10 meters apart
Data will be available at Couseura

Man-made noise



https://en.wikipedia.org/wiki/Atmospheric_noise

System Architecture

Receiver Load – Speaker

1 - Sound Pressure Level

- This is how loud the sound will be at a specific distance.
- 0 dB is the lower limit of audibility, and 60 dB is the SPL at 1 m from a TV set at home level.

2 - Speaker Sensitivity

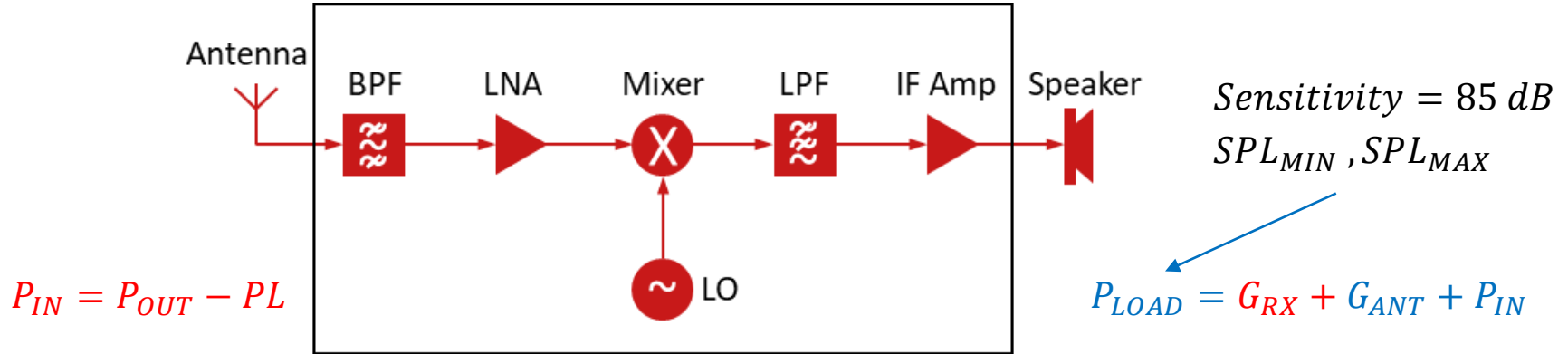
- How much SPL is measured at 1 meter from a speaker with 1 W power driving it.
- It indicates how much the speaker transforms electrical energy into sound.

3 - Example:

- Traditional speakers may have a 85 dB sensitivity. This means that a signal with 2.8 Vrms (1 W at 8 Ω load) on the speaker generates a SPL of 85 dB at 1 meter.

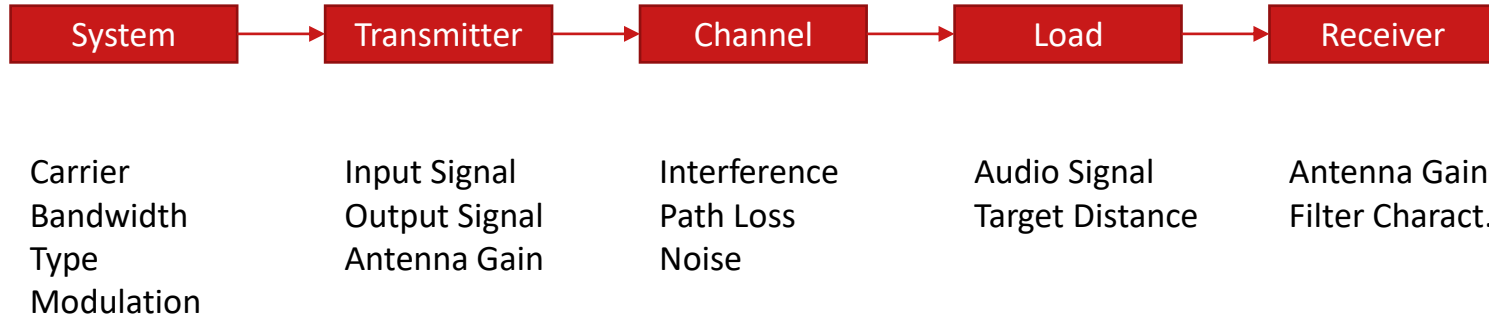
System Architecture

Receiver

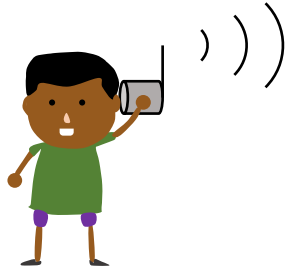


System Architecture

Link Budget – Reference Table



Thanks for watching!



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