ACT Receiver

High-Pass Filter and Poor Hybrid

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Overview

- ACT upstream receiver is shown to be trivial
- Questions and concerns about the complexity of these receivers are addressed in a number of prior contributions
- This contribution is to address the remaining concerns that are raised recently

Background

The following is a partial list of contributions on simplicity of upstream ACT receiver:

- https://ieee802.org/3/dm/public/0125/sedarat_3dm_202501.pdf
- https://ieee802.org/3/dm/public/0125/jonsson_3dm_01b_01_20_25.pdf
- https://ieee802.org/3/dm/public/1124/razavi_fung_jonsson_3dm_01a_11_07_20204.pdf
- https://ieee802.org/3/dm/public/0924/sedarat_3dm_202409.pdf
- https://ieee802.org/3/dm/public/0924/jonsson_razavi_3dm_01_09_15_24.pdf
- https://ieee802.org/3/dm/public/0924/jonsson_3dm_01_09_15_24.pdf
- https://ieee802.org/3/dm/public/0724/sedarat_3dm_202407.pdf
- https://ieee802.org/3/dm/public/0524/sedarat_3dm_02_202405.pdf

Upstream Receiver Complexity

- ACT upstream receiver is shown to be trivial:
  - No need for echo cancellation
  - Simple equalization
  - No baseline-wander effect
  - Not sensitive to MDI return loss and double-reflections
  - Small dynamic range
  - Narrow-band exposure to EMI sources with very low frequency

- Outstanding concerns:
  - It is claimed that there may be a need for an extra high-pass filter in the receive path. What is the impact of this HPF on receiver performance?
  - Hybrid cancellation may be weaker at lower frequencies

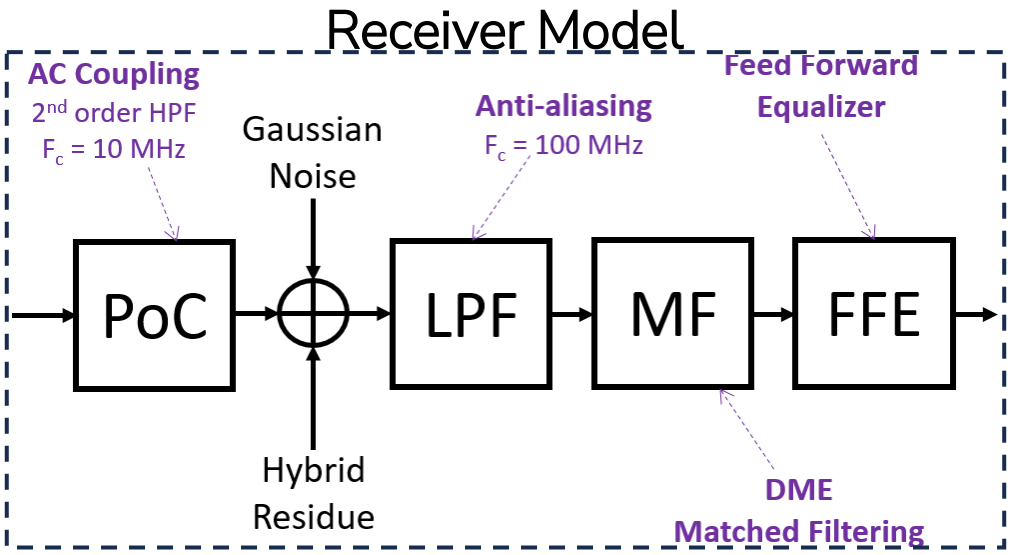
Baseline Analysis[1]

Signal components:

- Weakest signal with insertion loss at limit line (conservative)
- Maximum echo meeting limit line across the entire frequency (unrealistically conservative)
- Double echo from MDI with reflection stronger than the limit with no loss in channel (unrealistically conservative)
- 20 dB hybrid cancellation (conservative)

➔ Receiver Requirements:

- SNR: 19 dB
- Bandwidth: 117 MHz
- Equalization: 3-tap (optional)



1- https://ieee802.org/3/dm/public/0524/sedarat_3dm_02_202405.pdf

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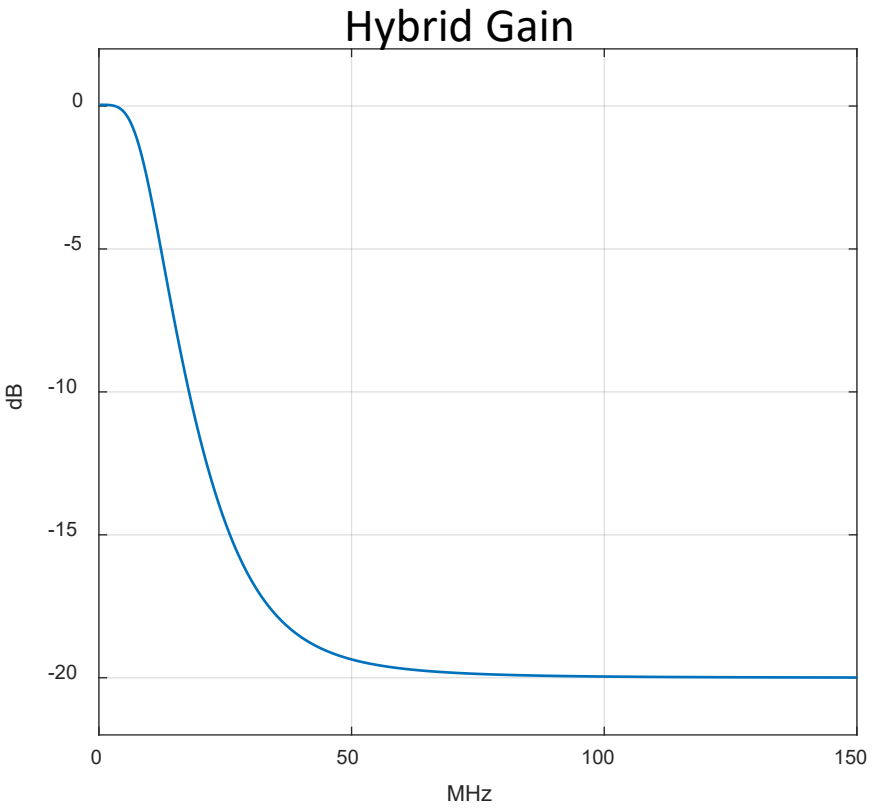
HPF and Hybrid

- Additional HPF in the Rx path:
  - Fc=30 MHz
  - 1st order
- Weaker hybrid cancellation at lower frequencies
  - 20 dB cancellation at higher frequencies
  - Weaker cancellation at lower frequencies



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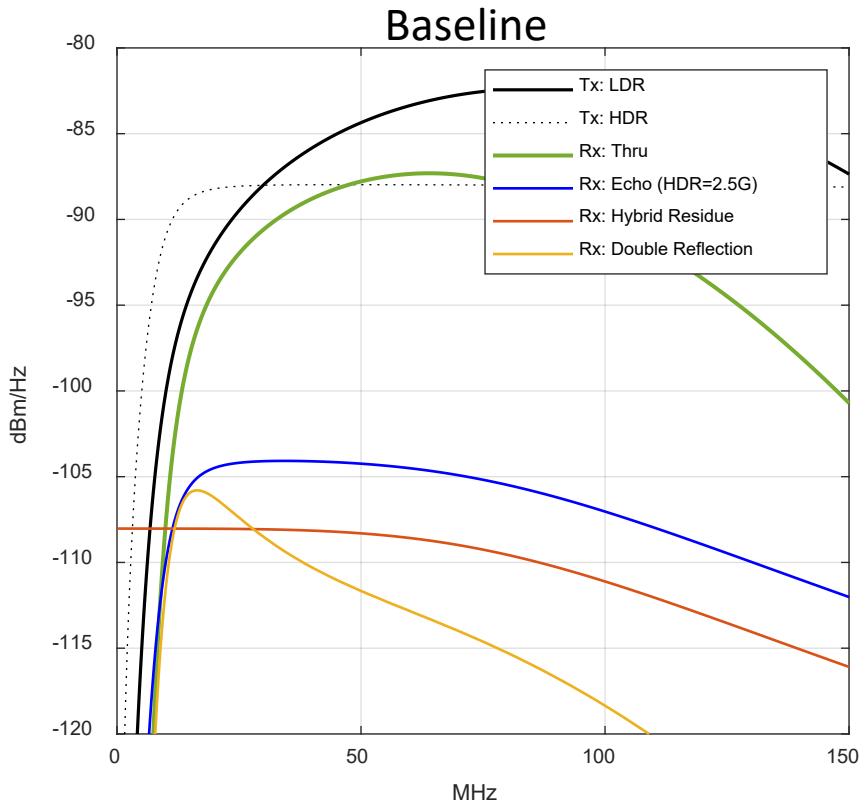
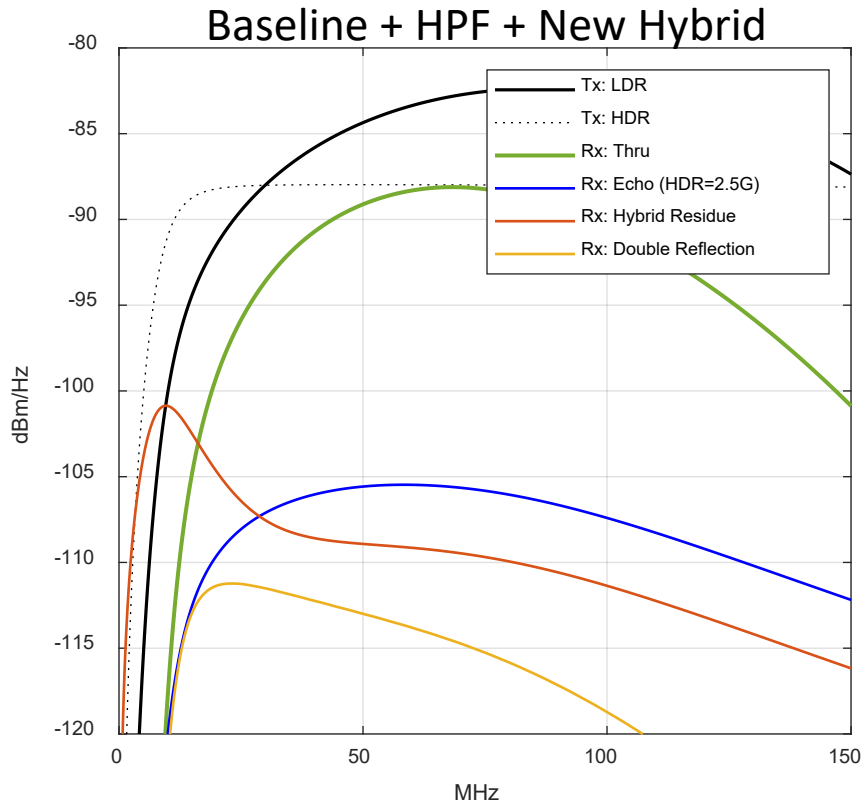
Receiver Requirements

- No echo canceller
- Trivial equalization
- Bandwidth: 117 MHz
- SNR: 20 dB (1 dB higher than baseline)





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Summary

- Investigated the following:
  - Additional HPF in the receiver path with Fc = 30 MHz
  - Hybrid with poor cancellation at lower frequencies

- ACT receiver remains very simple
  - No echo canceller
  - Trivial equalization
  - Low bandwidth
  - Low SNR requirement of 20 dB


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Thank You