UNIVERSITY of HAWAI'I®
MĀNOA

Instrumentation Development Laboratory

XRM – Detector Electronics tests, Pulse response investigation

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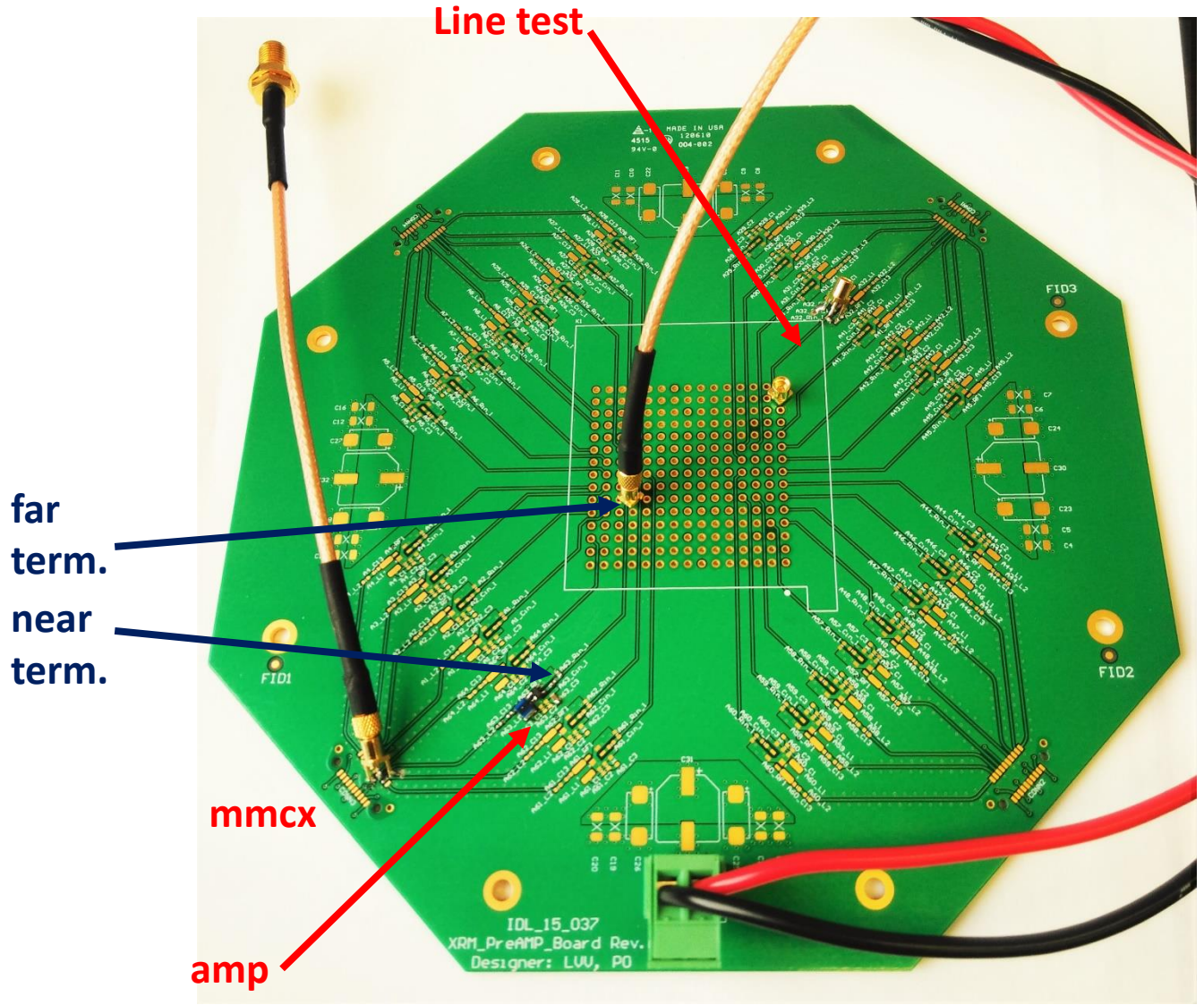
Pre-Amp Pulse response

Test setup

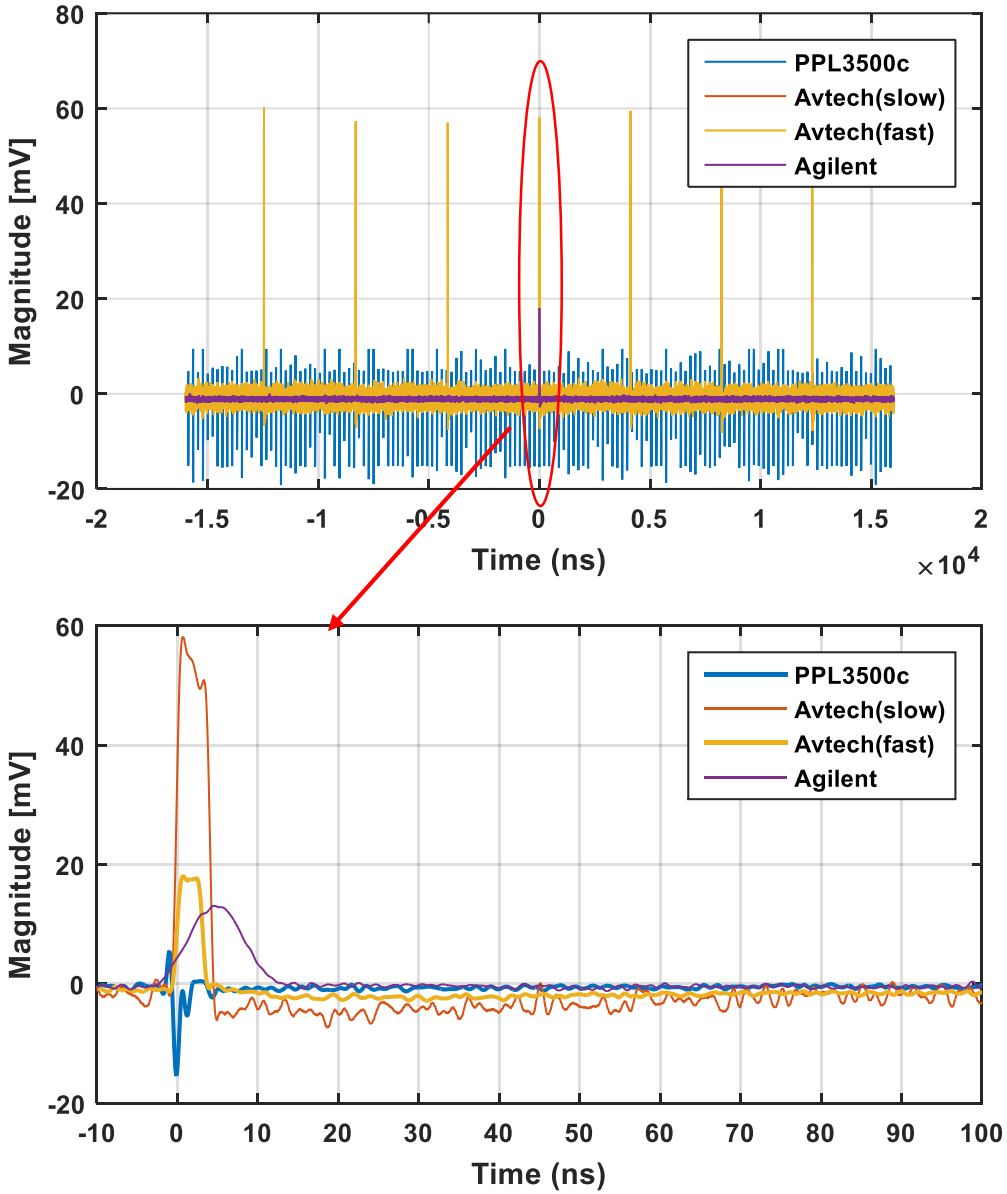
Equipment:

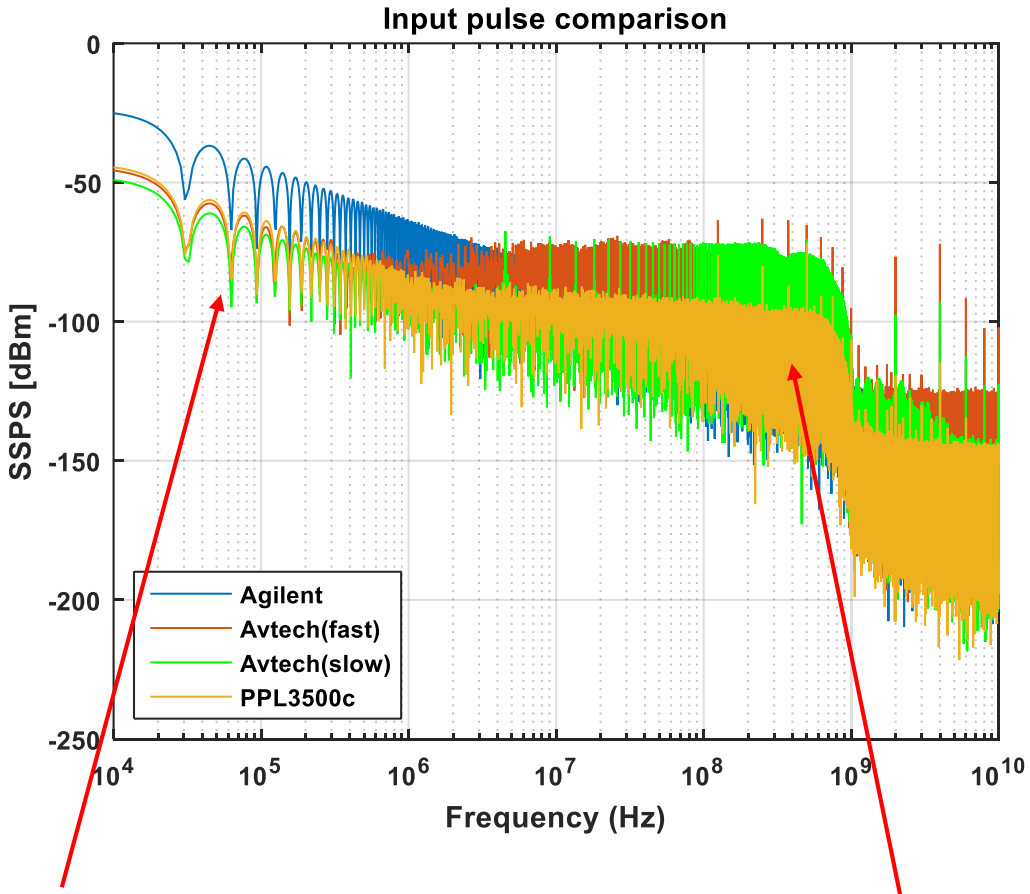
- Voltage probe: Fluke 179
- Pulse generators:
  - Avtech AVP-25-C-P-CM1-OS (4944)
  - Picosecond Pulse Labs m.3500c
  - Agilent 33250A
- Power supply: Quakko HY3005DP-3
- VNA: Agilent PNA-L N5230C
- Scope: Agilent MSO8104A



Pre-Amp Pulse response

Input pulse(s)

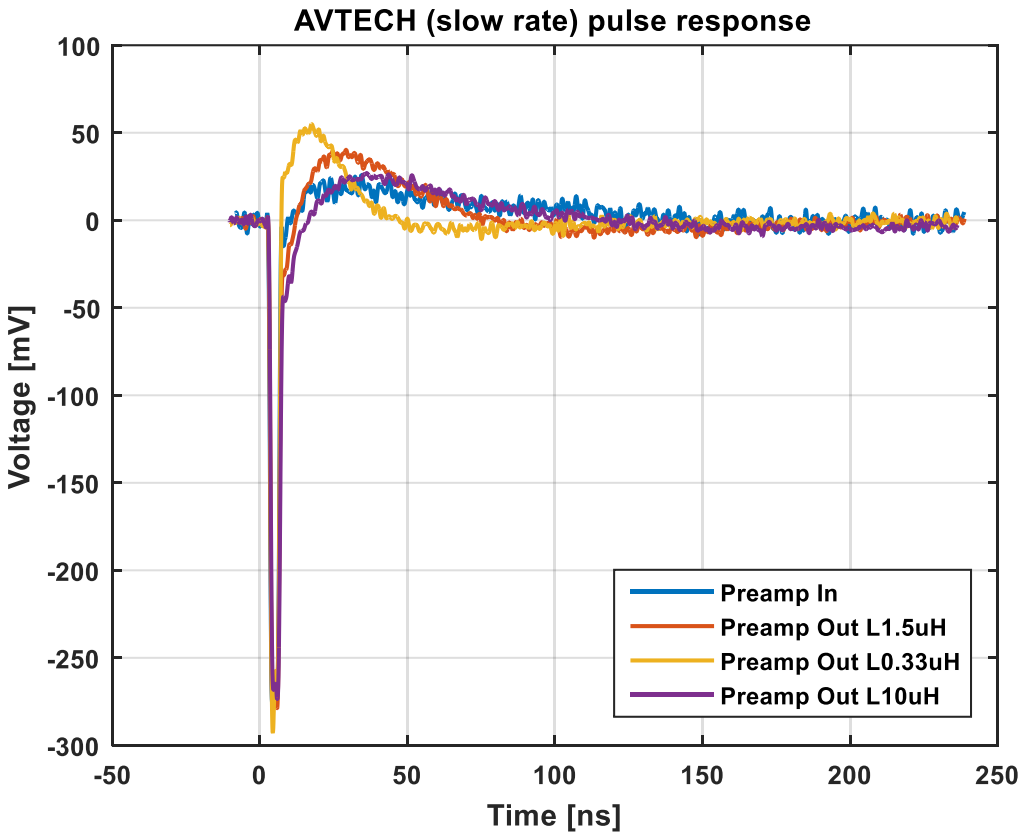


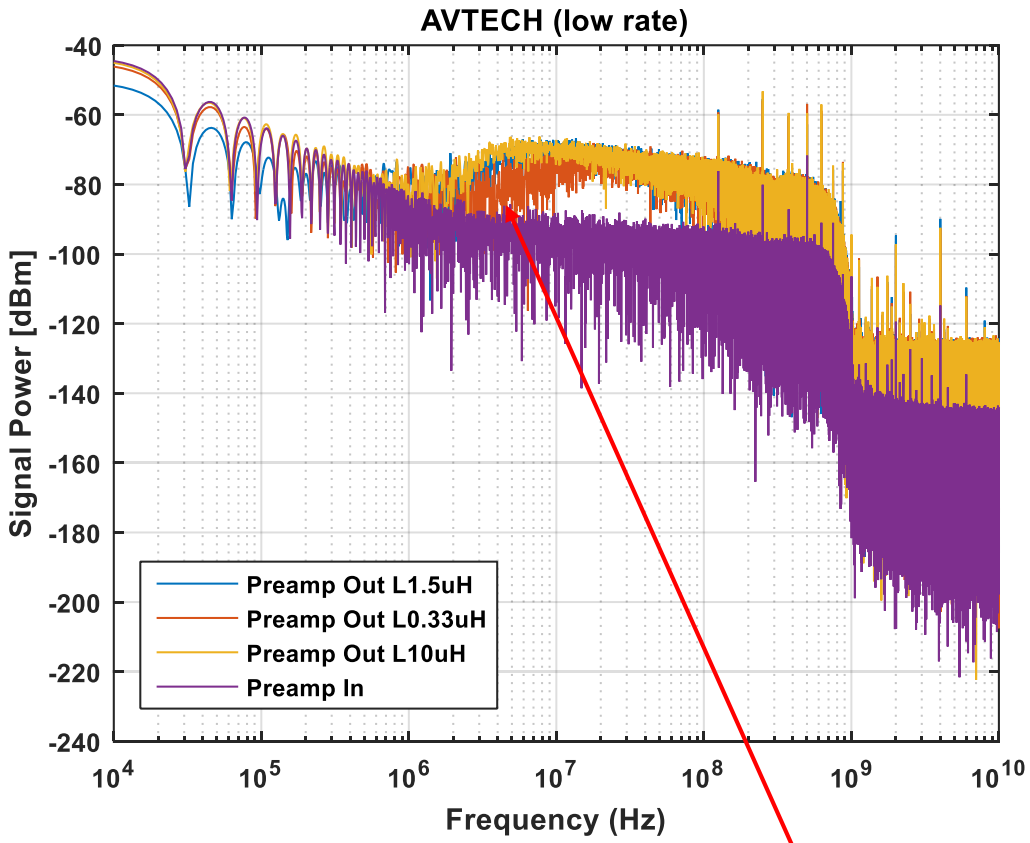


- Slow rate and slow pulse(Agilent) –> some energy other than noise present at low-frequency
- Fast rate and fast pulse (PPL3500c) –> most energy at high frequency

Pre-Amp Pulse response

AVTECH pulse with different bias inductors

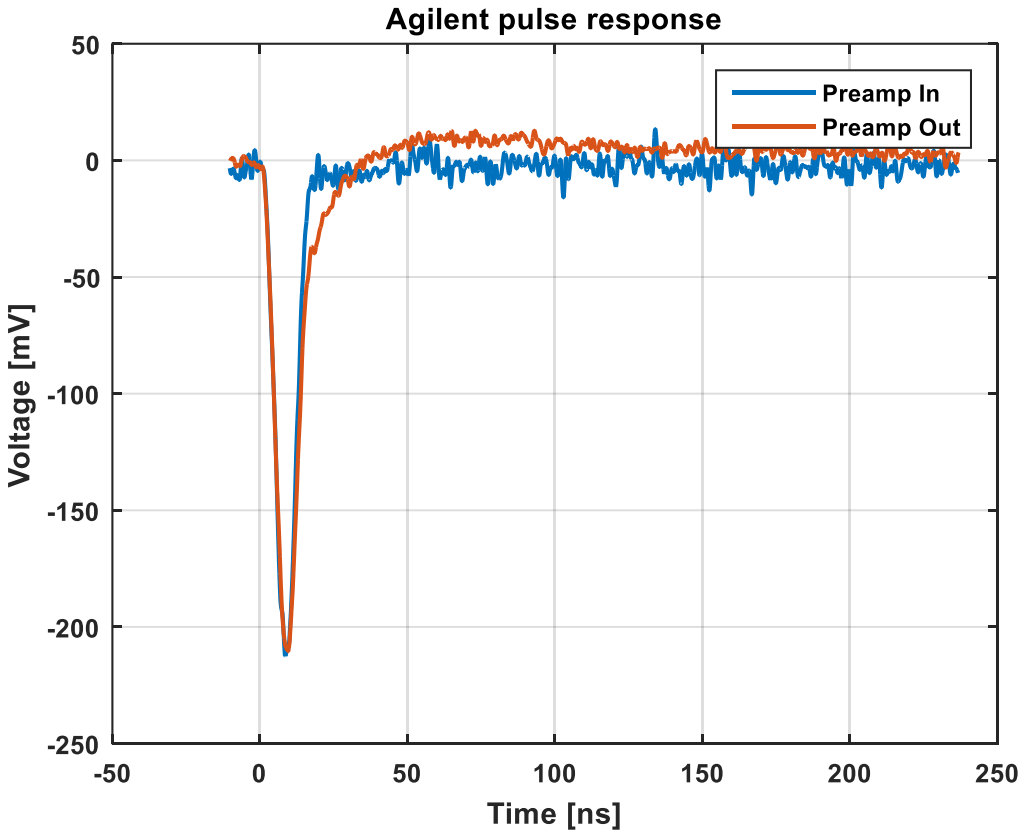


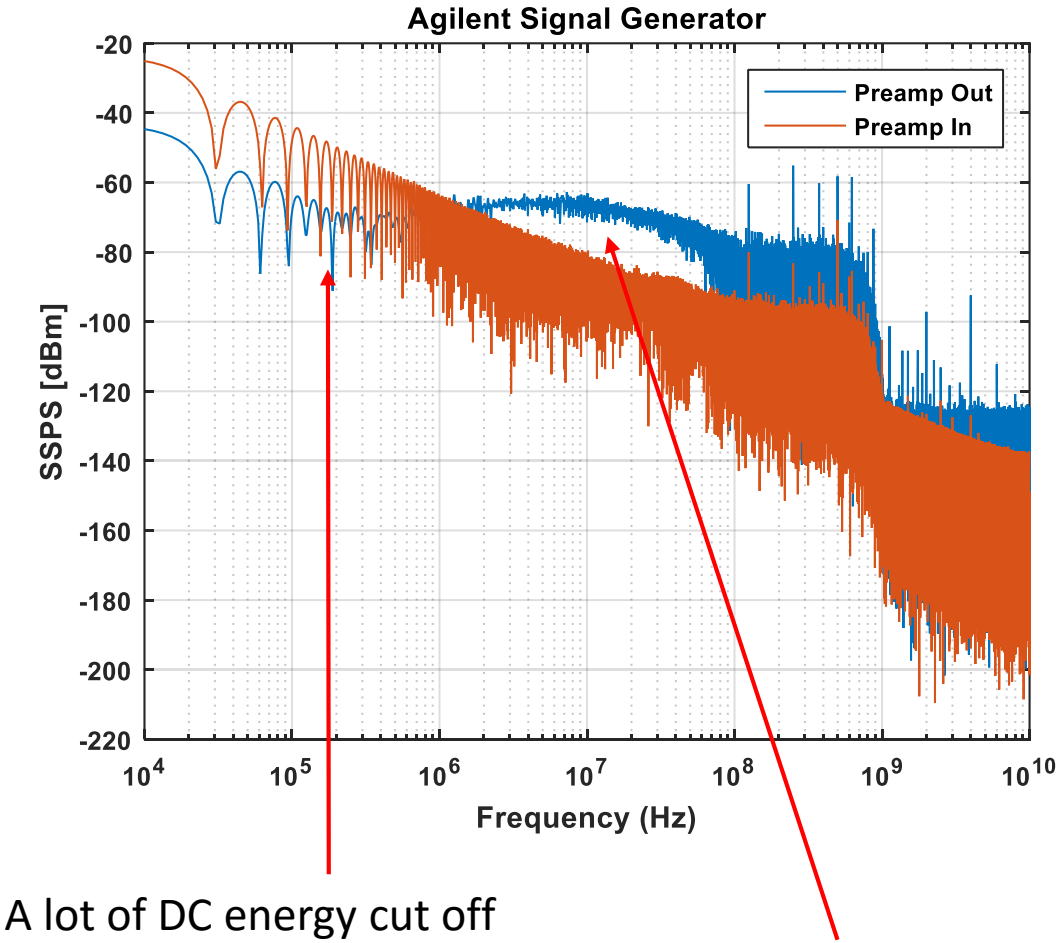


- Different inductor changes mid-frequency response
- A pronounced tail (L1.5) creates some mid-freq. components while a faster tail doesn't (L0.33).
- All measurements form now on are with 10uH inductor

Pre-Amp Pulse response

Agilent Pulse Generator (slow pulse)

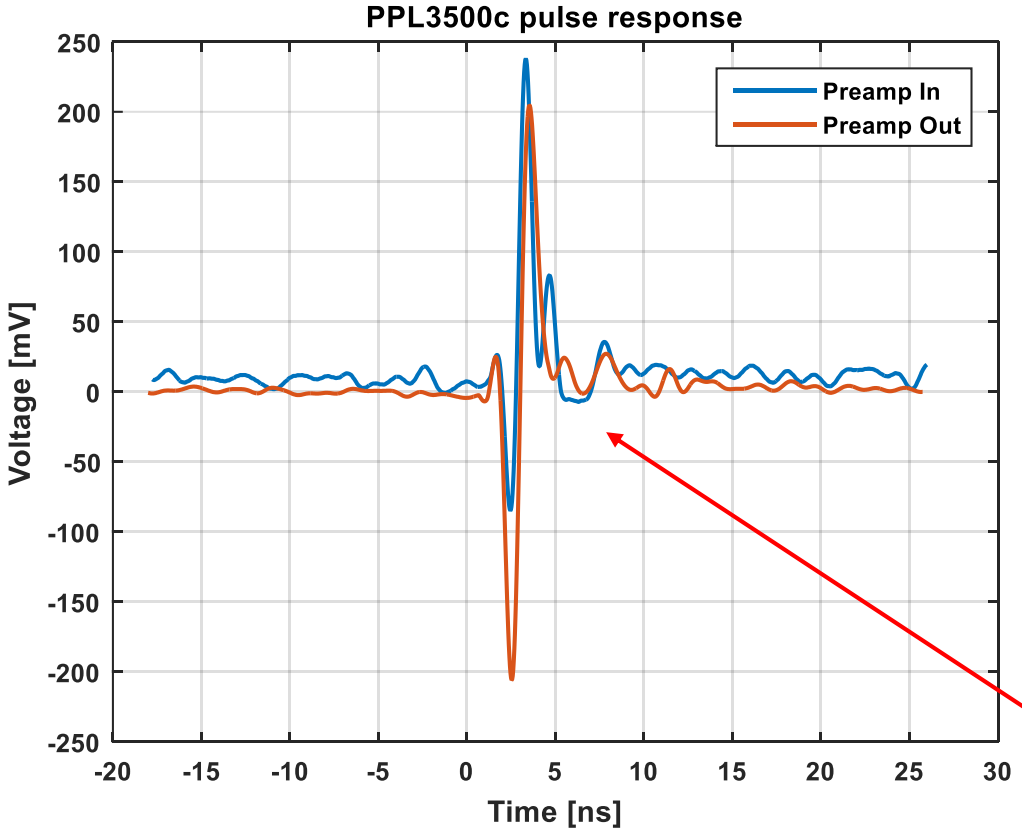


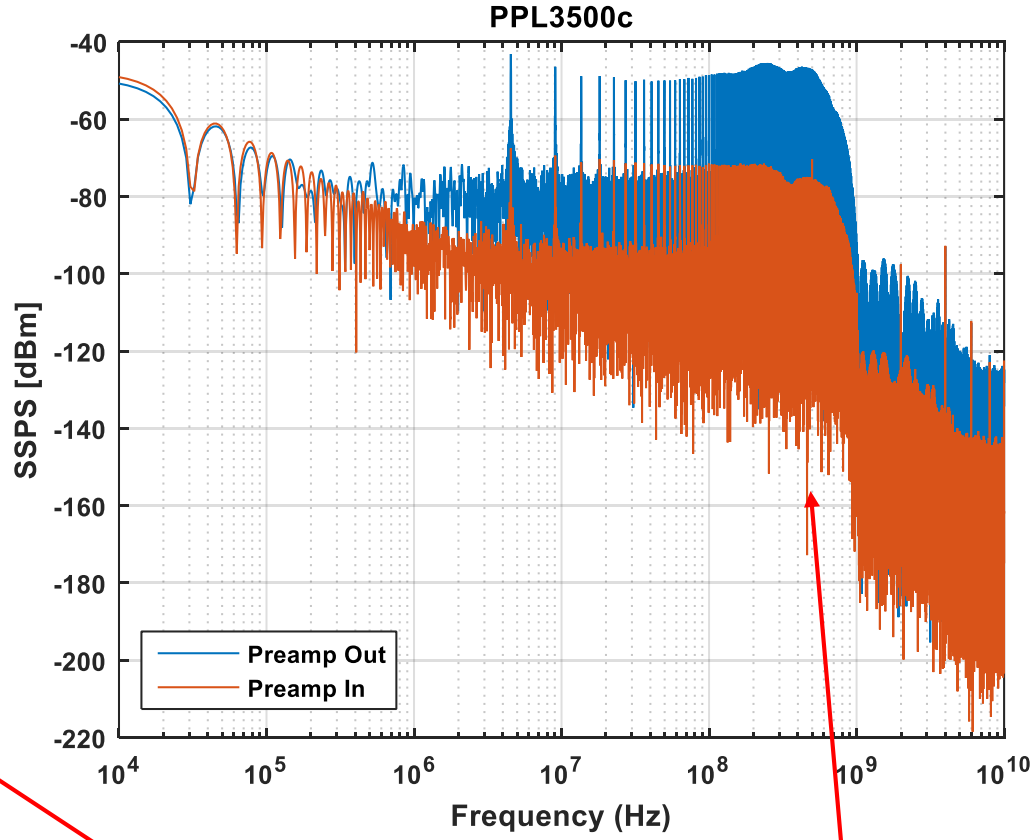


- A lot of DC energy cut off
- Pulse altered…tail produces low-mid frequency components (even more pronounced than before)

Pre-Amp Pulse response

PPL3500c (fast pulses)

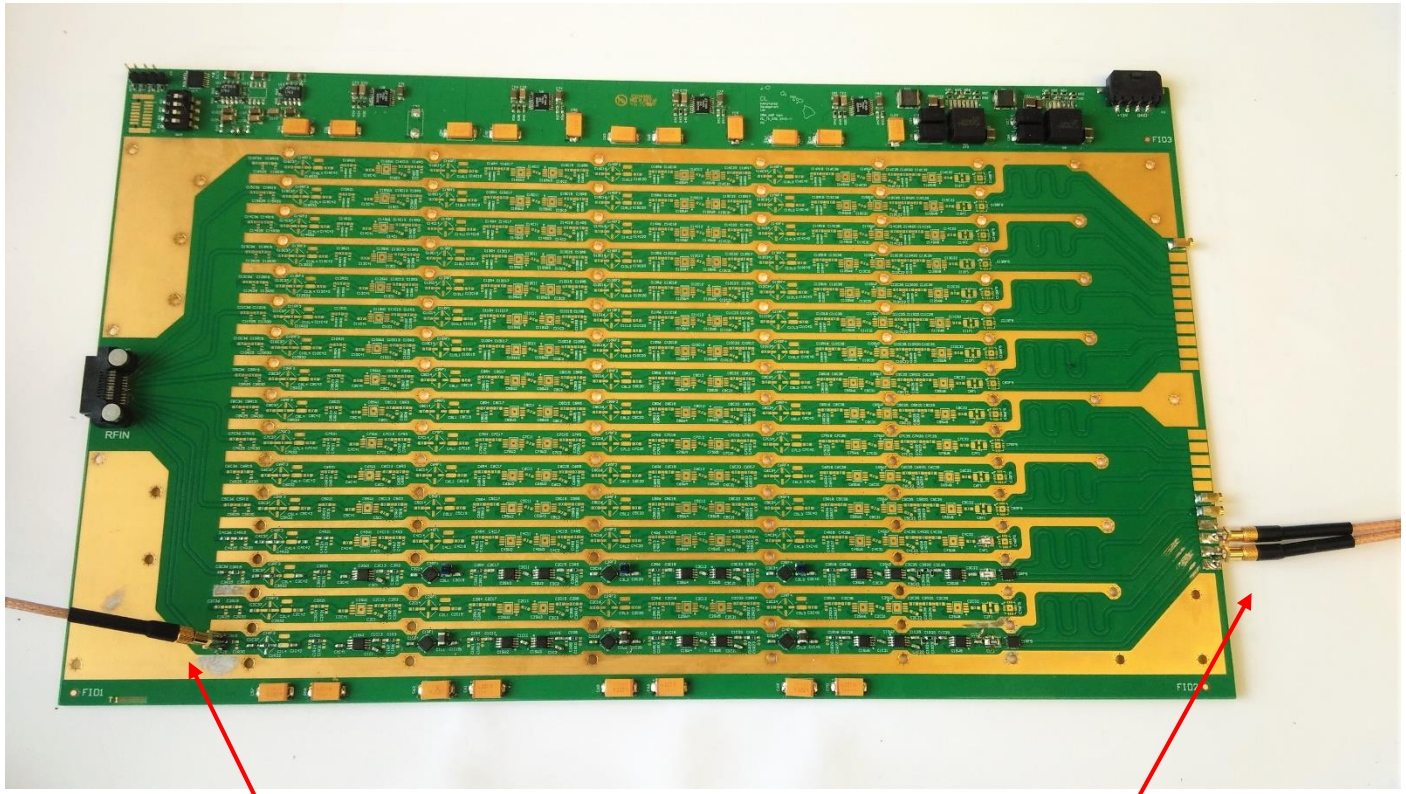




- Pulse is not significantly altered (most of the energy is at high frequency)

Amp Pulse response

Test setup

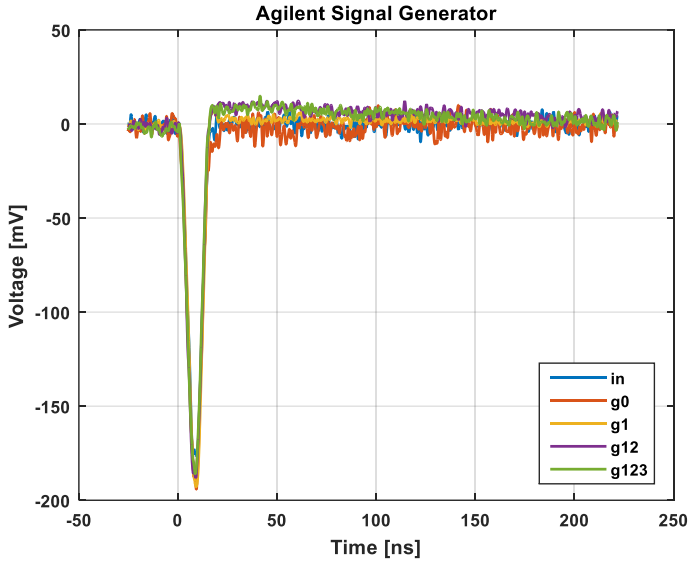


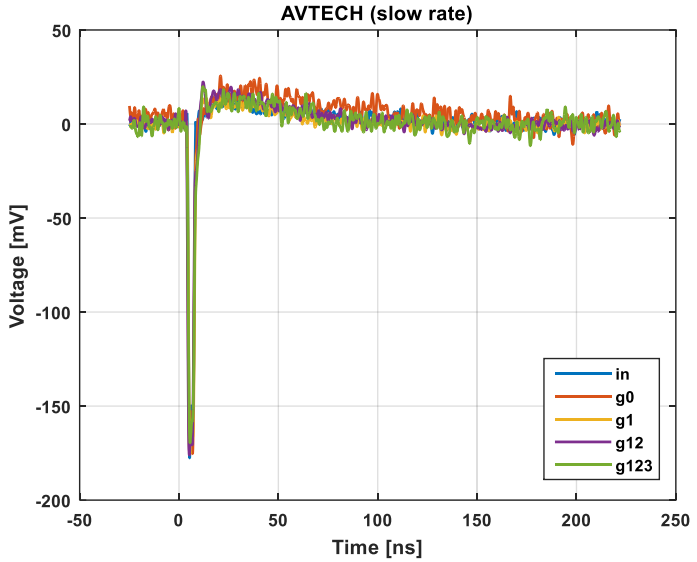
- MMCX on input and output
- All AC coupling capacitors were changed to 100nF and the bias inductors to 10uH

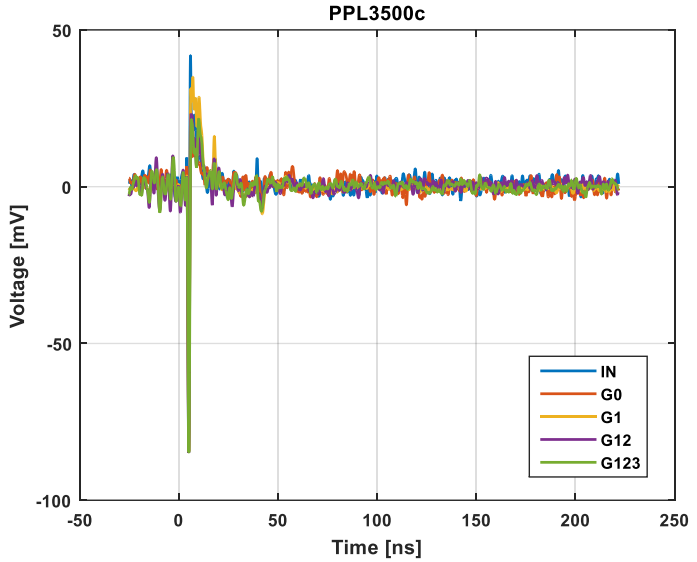
Amp Pulse response

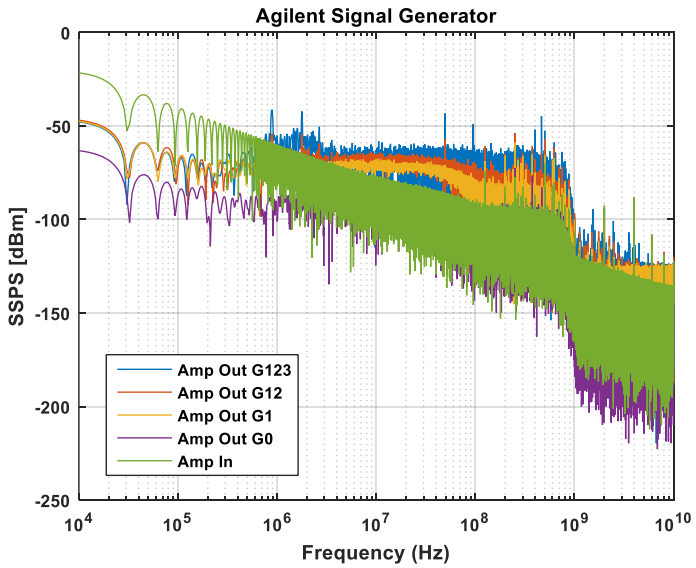
- Similar story as with the Pre-Amp but better at low frequency

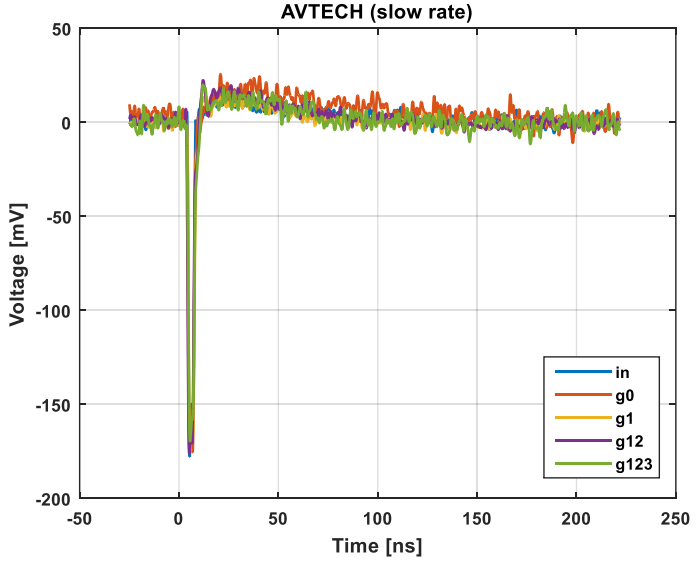
Pulse response

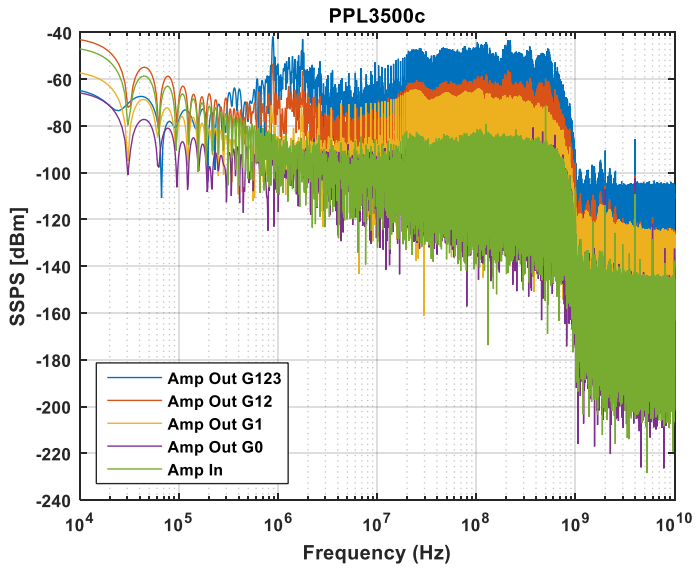








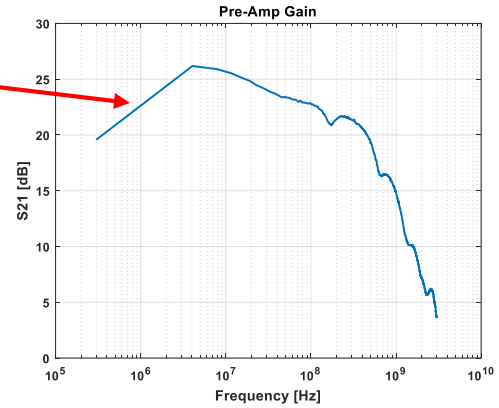


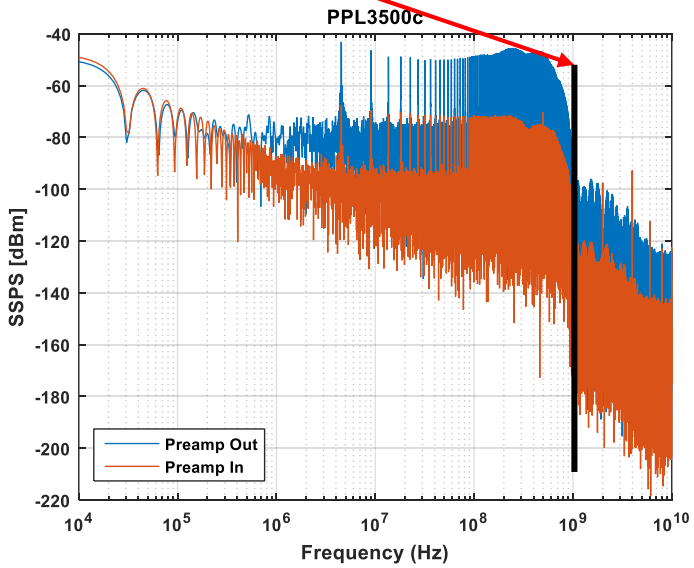


Pre-Amp & Amp Pulse response

Summary

- System not optimized for amplifying low frequency content
  - Slower pulses make for worse response
  - Tails seem to give rise to mid-frequency components
- System seem to respond reasonably well to faster pulses
  - Do to 1GHz bandwidth limitation of the Scope the real pulse might be a bit different -> need faster scope
- All of the tried pulses do not reach the “expected” target waveform

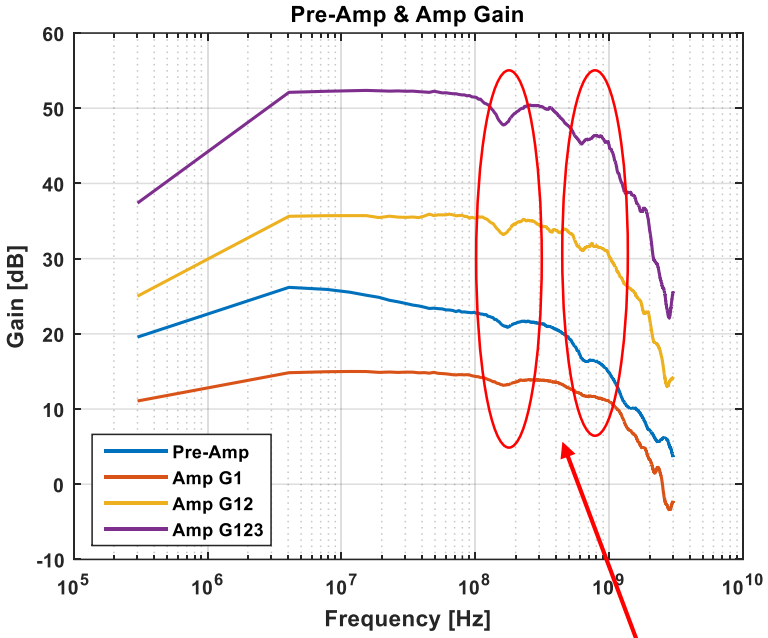


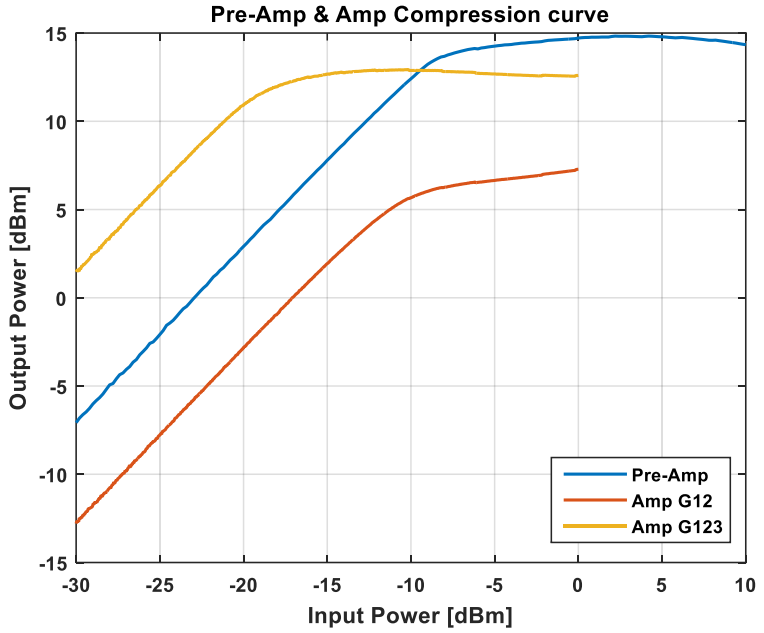


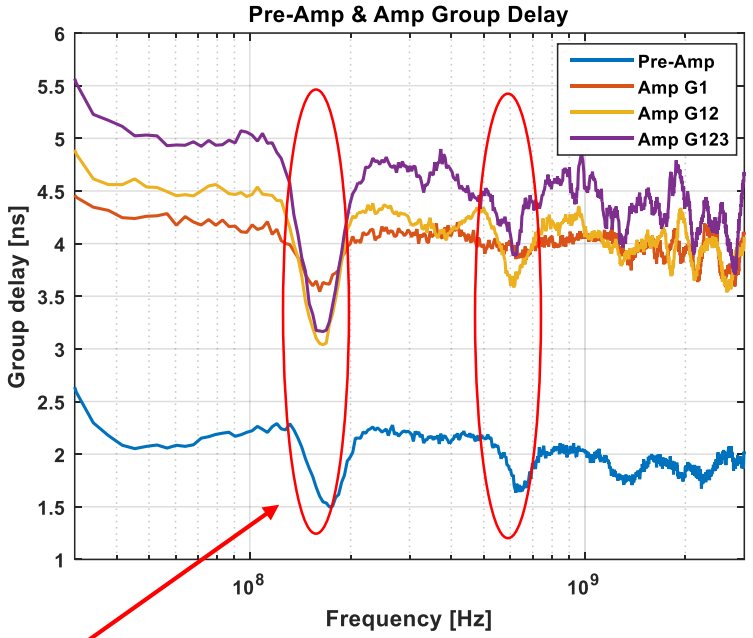
- Next priority should be to get some “expected” waveform data and optimize the electronics for it

Pre-Amp & Amp Frequency response

Summary







- Amp board has flatter gain response
- Compression is consistent with datasheet
- Group delay reasonably flat
  - Pre-amp: 2ns
  - Amp cumulative: 5ns

Potential issue for narrow pulse?

- Artifact of VNA (cold startup)