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| **Technical report**  for Linear technology RF detector  LTC5530 and ADL5513 |

Abstract

This document is a short technical report of the measurements done on the detector @704MHz

**Document change record**

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| Issue | Date | Modified Section/Sheet | Comment |
| 1 | 07/11/2016 |  | creation |
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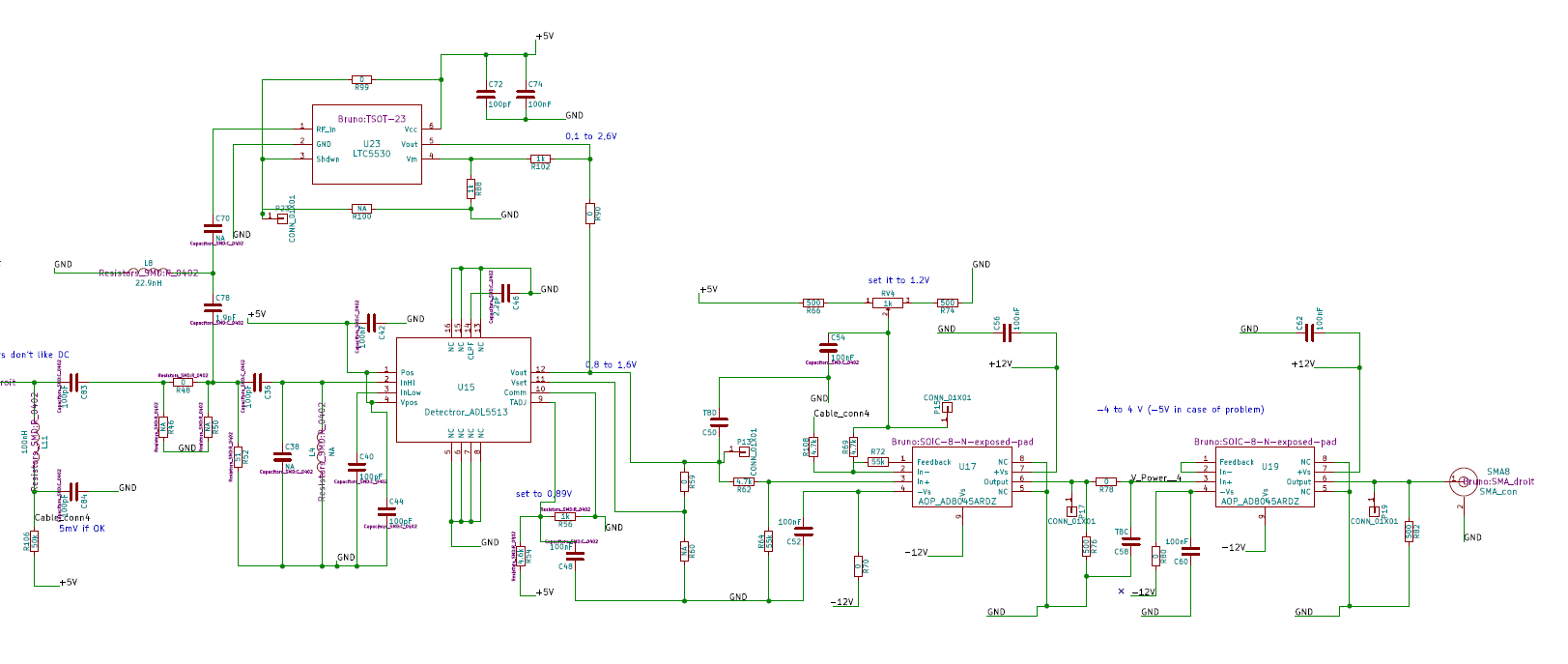
# Presentation/specification

Two channels have been mounted up to the buffer.

One with the ADL5513

The other one with the LTC 5530

The target is to compare the performances of both then cascade the ADC to choose the correct one for the final board assemble.



Schematic of channel 4

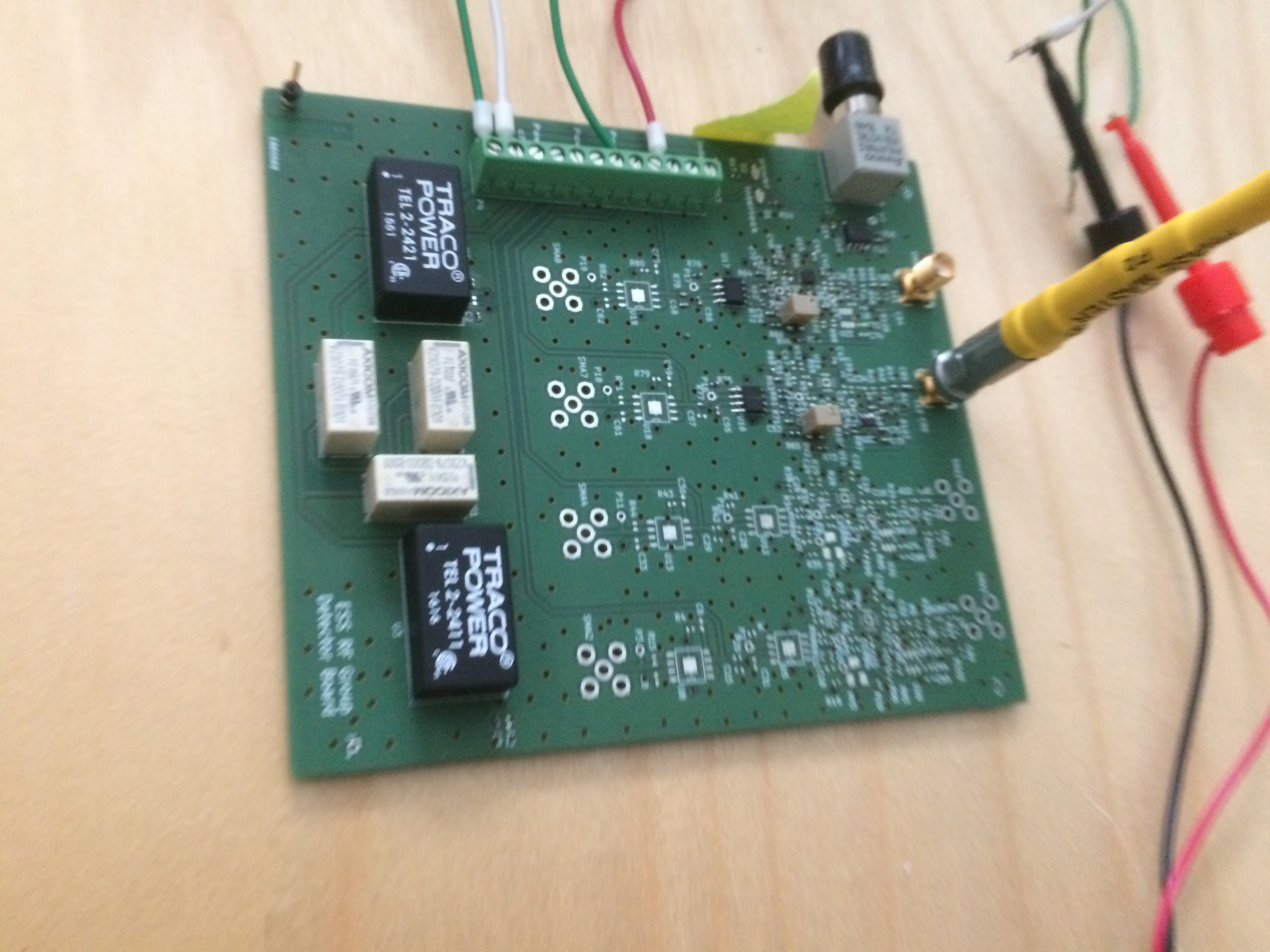
Modifications done:

R69 and R62 = 8,25 kΩ

R78 = 1 kΩ

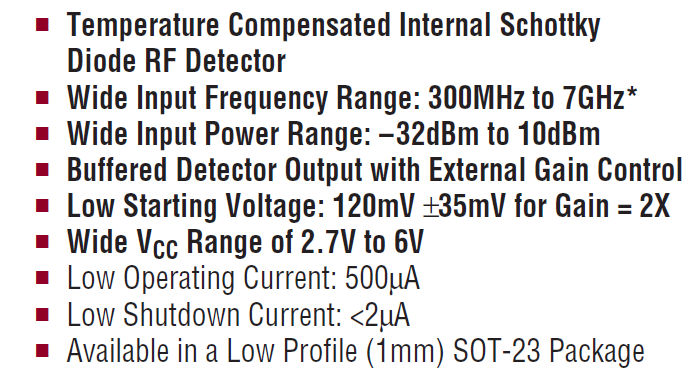
C58 = 100 pF

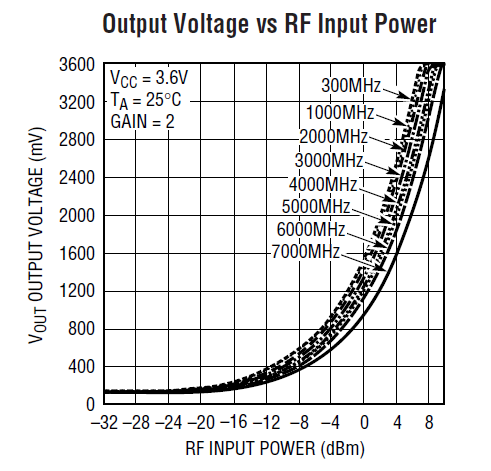
Common pin8 of the +/-5V regulator to gound.



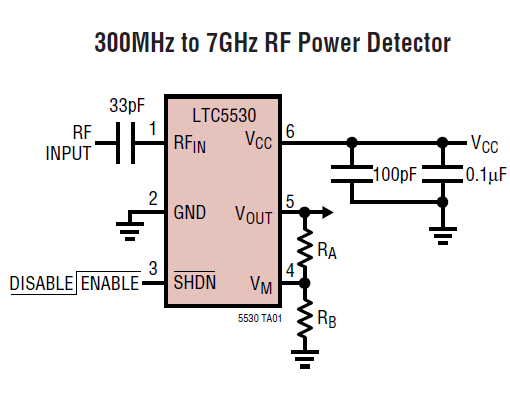
## LTC5530



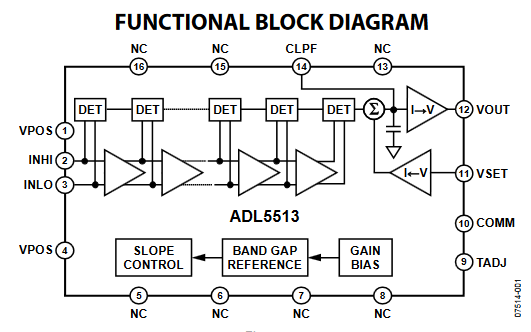


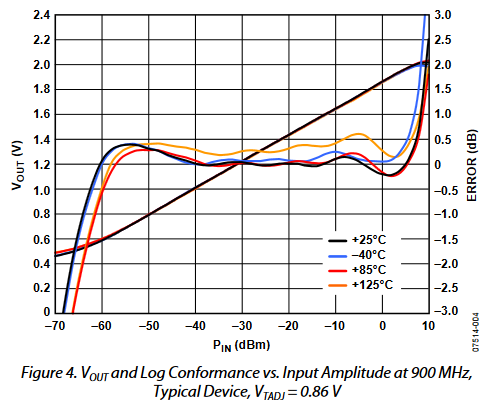


The measurements are done under these conditions with Ra and Rb equal to 1kΩ



## ADL5513





# S11 measurement

Measurements to be done (can’t be done now VNA not available) . And matching to do. Measurements have been done with the matching planned according with the application note.

# consumption

Ic = 112 mA under 18.3V

This correspond to the supply of the complete board (2 channels mounted)

# Vout vs Pin

The signal generator provides the input power to the detector the level is checked with the power meter. At the output noise and voltage is measured with a oscilloscope.

## With ADL5513

|  |  |  |
| --- | --- | --- |
| pin | Vout | slope |
| 4 | 3.95 |  |
| 3 | 3.95 |  |
| 2 | 3.93 | 50 |
| 1 | 3.82 | 9.090909 |
| 0 | 3.7 | 8.333333 |
| -1 | 3.55 | 6.666667 |
| -4 | 3.13 | 7.142857 |
| -5 | 3 | 7.692308 |
| -10 | 2.31 | 7.246377 |
| -15 | 1.6 | 7.042254 |
| -20 | 0.94 | 7.575758 |
| -25 | 0.32 | 8.064516 |
| -30 | -0.48 | 6.25 |
| -35 | -1.18 | 7.142857 |
| -40 | -1.85 | 7.462687 |
| -45 | -2.49 | 7.8125 |
| -50 | -3.12 | 7.936508 |
| -55 | -3.63 | 9.803922 |
| -57 | -3.79 | 12.5 |
| -59 | -3.91 | 16.66667 |
| -60 | -3.92 | 100 |
| -61 | -3.92 |  |

Vout vs Pin

We recommend using the detector from 0 dBm to -55 dBm, where the slope is stable. The dynamic recommended is 55dB. For example for the forward power, this will give us the an ability to measure the power from 2MW to 6,31W (Adding a 33dB attenuator assuming a 60dB coupler).

## With LTCC5530

|  |  |  |
| --- | --- | --- |
| pin | Vout | slope |
| 10 | 3.03 |  |
| 9 | 3.03 |  |
| 8 | 3.02 | 100 |
| 7 | 2.51 | 1.960784 |
| 6 | 2.02 | 2.040816 |
| 5 | 1.58 | 2.272727 |
| 4 | 1.2 | 2.631579 |
| 3 | 0.88 | 3.125 |
| 2 | 0.57 | 3.225806 |
| 1 | 0.31 | 3.846154 |
| 0 | 0.06 | 4 |
| -1 | -0.15 | 4.761905 |
| -2 | -0.33 | 5.555556 |
| -3 | -0.51 | 5.555556 |
| -4 | -0.68 | 5.882353 |
| -9 | -1.19 | 9.803922 |
| -14 | -1.47 | 17.85714 |
| -19 | -1.6 | 38.46154 |
| -24 | -1.65 | 100 |
| -29 | -1.67 | 250 |
| -34 | -1.68 | 500 |
| -39 | -1.68 |  |

Vout vs Pin

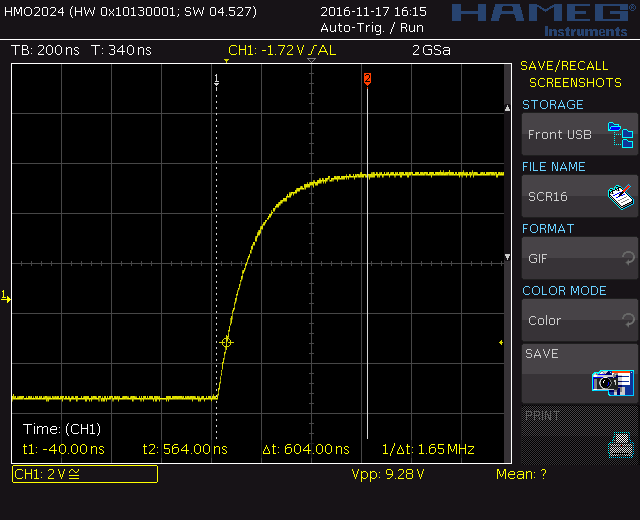
We recommend using the detector from 7 dBm to -4 dBm, where the slope is stable. The dynamic recommended is 11dB. For example for the forward power, this will give us an ability to measure the power from 2MW to 160 kW (Adding a 26dB attenuator assuming a 60dB coupler).

# rise and fall time

RF rise and fall time measured with pulsed generator and observed on scope (synchronised with the generator) with probe out of the DUT:

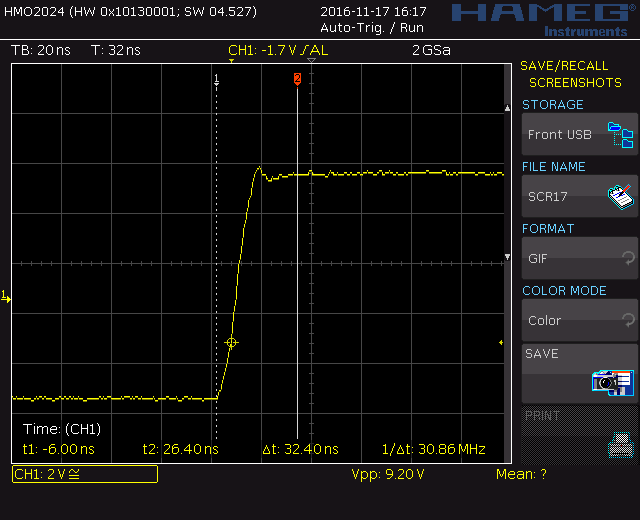
## With ADL5513

After the filter



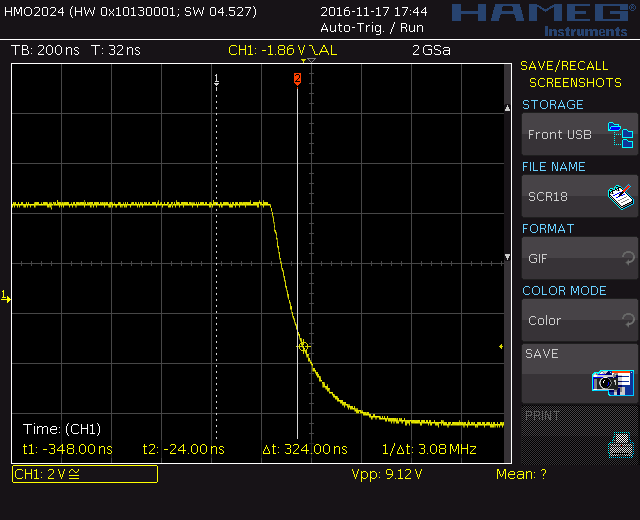
Rise time measured for 0dBm input is 604ns.

Before the filter the rise time is

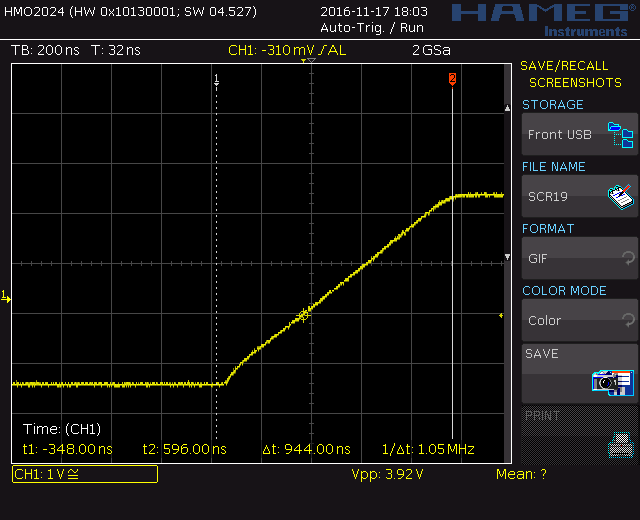


32 ns

Fall time after the filter



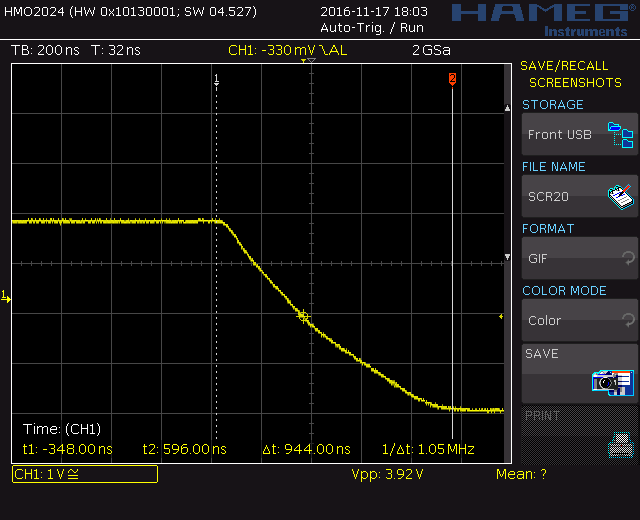
## With LTC5530



Rise time measured for 0dBm input is 1µs.

We did not mount any filter on it.

Fall time is the same and confirms the measurement done on the LTC5530 in standalone.



# Noise

## For ALD5513

The noise is measured with the scope, measuring the max-min output voltage on a large BW: 44 mV P- P for 0dBm input (corresponding to 0,3dB) for ALD5513.

Between 0 and -55dBm the noise is around 0,4dB.

|  |  |
| --- | --- |
| Pin (dBm) | Noise in dB |
| 2 | 2.2 |
| 1 | 0.4 |
| 0 | 0.366667 |
| -1 | 0.293333 |
| -4 | 0.314286 |
| -5 | 0.338462 |
| -10 | 0.318841 |
| -15 | 0.309859 |
| -20 | 0.333333 |
| -25 | 0.354839 |
| -30 | 0.275 |
| -35 | 0.314286 |
| -40 | 0.328358 |
| -45 | 0.34375 |
| -50 | 0.349206 |
| -55 | 0.431373 |
| -57 | 0.55 |
| -59 | 0.733333 |
| -60 | 4.4 |

Noise vs Pin

This curve confirms the range where it is nice to use the detector.

## For LTC5530

We measure 35 mV corresponding to 0,1dB at 5dBm.

However this measurement need to be confirmed cascading the ADC and after calibration.

|  |  |
| --- | --- |
| Pin (dBm) | Noise in dB |
| 8 | 3.8 |
| 7 | 0.07451 |
| 6 | 0.077551 |
| 5 | 0.086364 |
| 4 | 0.1 |
| 3 | 0.11875 |
| 2 | 0.122581 |
| 1 | 0.146154 |
| 0 | 0.152 |
| -1 | 0.180952 |
| -2 | 0.211111 |
| -3 | 0.211111 |
| -4 | 0.223529 |
| -9 | 0.372549 |
| -14 | 0.678571 |
| -19 | 1.461538 |
| -24 | 3.8 |
| -29 | 9.5 |
| -34 | 19 |

Noise vs Pin

This curve confirms the range where it is nice to use the detector.

# Setup

Signal generator keysight MXG N5182B



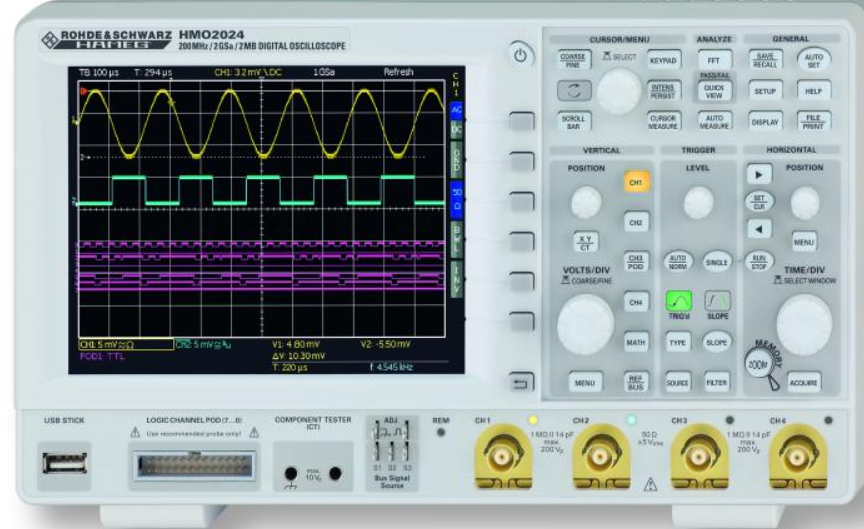
Power meter Agilent N1912A

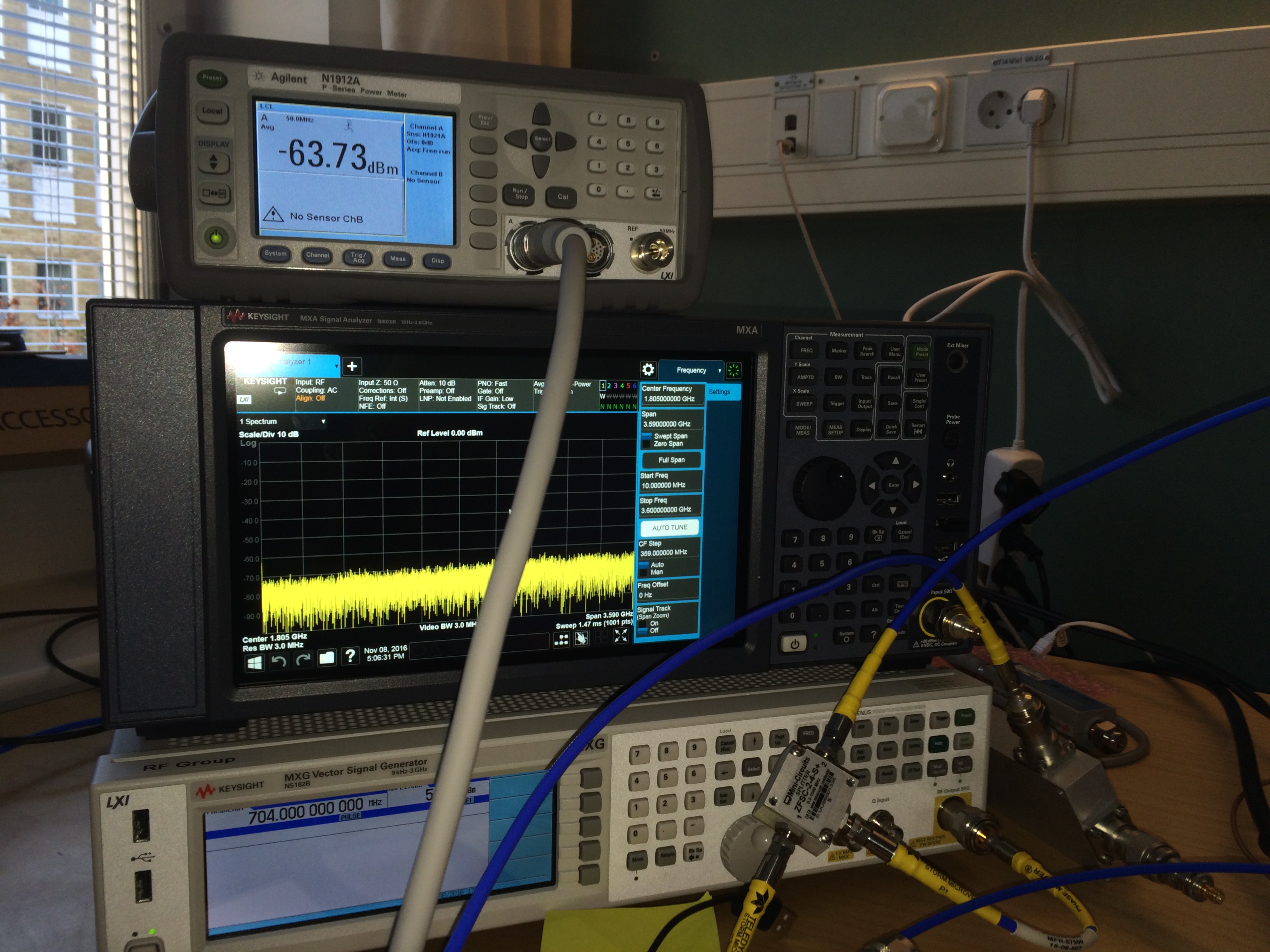


Spectrum analyser Keysight MXA N9020B:



Osciloscope R&S Hameg HMO2024





## For output +/-1V:

For ADL5513: Vout det. = 0,8 to 1,6 V mid: 1,2 (set V set to 1,2V)

We need so R67 = 22 kΩ

For LTC5530: Vout det. = 0,1 to 3,6 V mid: 1,8 (set V set to 1,8 V)

We need so R67 = 100 kΩ

# Conclusion

The board is working fine.

ADL5513 has a better dynamic (55dBc) it is linear but the noise is high.

LTC5530 has a lower dynamic (11dBc) even if it can be used for monitoring on a larger range, the noise is low for high power detected.

The Board needs to be cascaded with the ADC to choose the final good detector component since the accuracy is influenced by both.