

# [I. use a voltage-mode lna with voltage mode](https://assignbuster.com/i-use-a-voltage-mode-lna-with-voltage-mode/)

I. INTRODUCTION  T   HE development of low-cost RF front-ends that meet the requirements of both existingand emerging wirelessstan- dards (e. g., GSM, UMTS, LTE, LTE-A, etc.

) is challenging due to the wide distribution of frequency bands 1. The presence of strong out-of-band interferers and theabsence of tunable RF band-select? lters pose strong linearity requirements on the receiver front-end. Typical commercial front-ends use a bank of dedicated ? lters to separate the variousfrequency bands.

Such implementations are expensive, as to the bill-of-materials scales linearlywith the number of bands addressed. Hence more ? ex- iblereceivers with less or no dedicated ? ltering have been de- veloped, that can be used to cover differentfrequency bands atthe same time and are reviewed in2–4.  Traditional radio receivers exploit an impedancematching low-noise ampli? er (LNA) with voltage gain followed by a voltagedriven mixer. Alternatively, a low-noise transconduc- tance ampli? er (LNTA) can be used followed by a currentcommutating mixer (see Fig.

1). Often, this LNTAalso re- alizes impedance matching, although not always. This latterarchitecture has gained popularity during the last decade, as it can bothachieve very good linearity and low noise, especially when a passive mixeris used. Historically, the fact that   noiseof a MOSFET biased at             is zero has been an importantreason to choose for a passive mixer, where early designs use a voltage-modeLNA with voltage mode passive mixer 5. A narrowband LNTA followed by a current-driven mixer was proposed in 6 and favorable  noise and linearity results were reported comparedto active mixer solutions with anarrowband LC-based LNA 6. Later inductor-less wideband designs stress thebene? ts of RF – conversion to improve bandwidth 7 and interference robustnessin a multi-band or wideband software radio front-end context 8–10. To grasp the potential linearity bene? tsintuitively, it may be instructive to realize that the output voltage swing ofa voltage ampli? er is hard limited to VDD, while there is no hard absolutelimit on the output current of a – converter (see Fig.

1) if low ohmicallyloaded. Hence, handling strong interferers in the current domain can  be bene? cial. Conceptually, the  idea  is to avoid voltage swing and voltage gain at RF. Instead, only- conversion is done at RF, and – conversion is moved to baseband(see Fig. 1), where it can be combined with low-pass ? ltering to eliminateblockers 7, 10, 11. Moreover, the low virtual ground node impedance getsupconverted from node D to B in Fig. 1, reducing the output voltage swing ofthe LNTA, which is bene? cial toreduce -swing related LNTA nonlinearity 8, 11.

The – conversion based receiverconcept can also be com- bined with the impedance matching noise cancellationconcept 4, 12. In 13, input matching is provided by a passive switchedresistor mixer path known as the main path as shown in Fig. 2. The noise of thematching resistor    is cancelled at the output of thereceiver by the frequency-translated noise cancellation (FTNC) technique 7, 13. Comparedto the noise cancellation technique described in 12, the cancellingdoes not occur at RF but at baseband after down-conversion. The upper signalpath, known as the auxiliary path (label “ aux”), achieves noise cancellation byconverting the receiver’s input voltage to an RF current, using atransconductor Gm with high ohmic input. This current is down-converted by a currentdriven passive mixer as shown in Fig.

2, – converted and subtracted