

# **Abstract**

CMOS RF front-end design for terrestrial and mobile digital television systems

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With the increasing demand for high quality TV service, digital television (DTV) is replacing the conventional analog television. DTV tuner is one of the most critical blocks of the DTV receiver system; it down-converts the desired DTV RF channel to baseband or a low intermediate frequency with enough quality. This research is mainly focused on the analysis and realization of low-cost low-power front-ends for ATSC terrestrial DTV and DVB-H mobile DTV tuner systems. For the design of the ATSC terrestrial tuner, a novel double quadrature tuner architecture, which can not only minimize the tuner power consumption but also achieve the fully integration, has been proposed. A double quadrature down-converter has been designed and fabricated with TSMC 0.35 $\mu\text{m}$  CMOS technology; the measurement results verified the proposed concepts. For the mobile DTV tuner, a zero-IF architecture is used and it can achieve the DVB-H specifications with less than 200mW power consumption. In the implementation of the mobile DVB-H tuner, a novel RF variable gain amplifier (RFVGA) and a low flicker noise current-mode passive mixer have been proposed. The proposed RFVGA achieves high dynamic range and robust input impedance matching performance, which is the main design challenge for the traditional implementations. The current-mode passive mixer achieves high-gain, low noise (especially low flicker noise) and high-linearity (over 10dBm IIP3) with low power supplies; it is believed that this is a promising topology for low voltage high dynamic range mixer applications. The RFVGA has been fabricated in TSMC 0.18 $\mu\text{m}$  CMOS technology and the measurement results agree well with the theoretical ones.