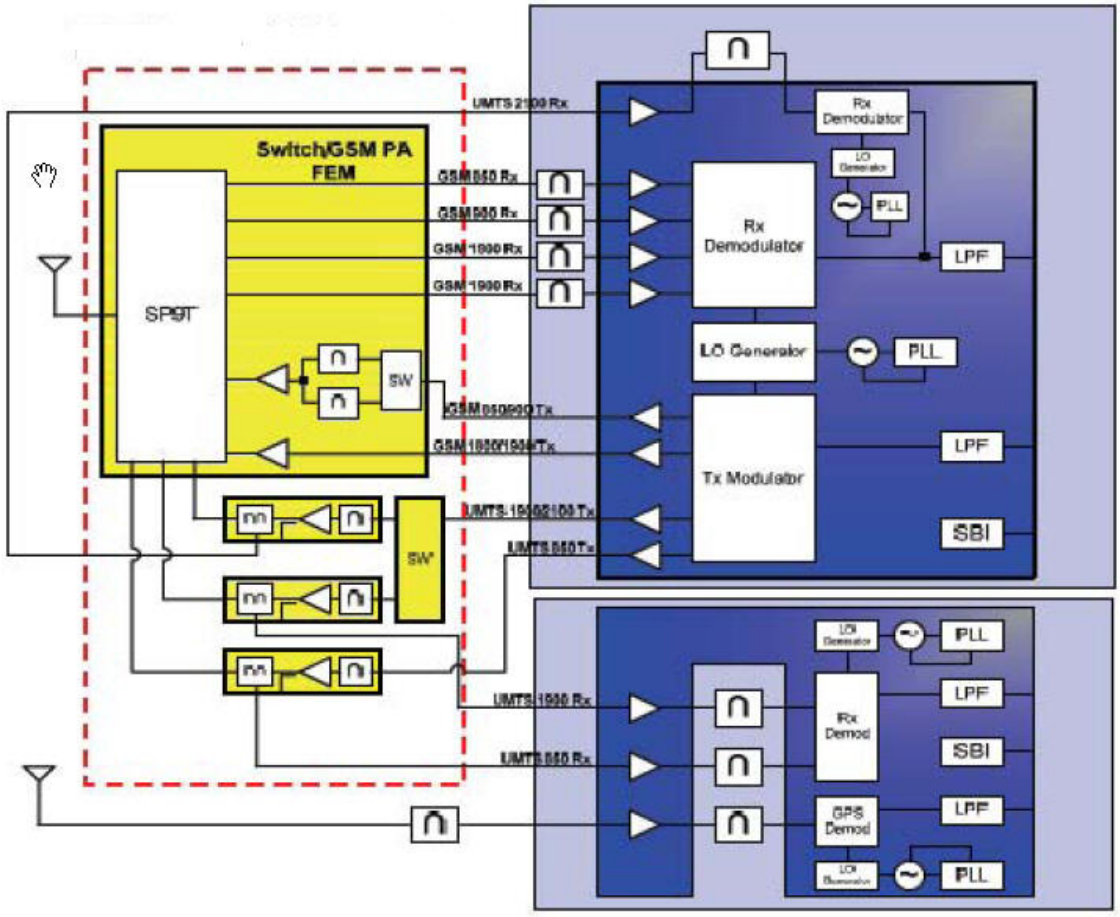
Part 1 GSM/GPRS/EDGE/UMTS/HSDPA

1.1 Phone Block Diagram



1.2 System Overview

The phone supports triple-band UMTS/HSDPA, quad-band GSM/EDGE and GPS handset design variants. All receivers and all transmitters for RF chipset use the radioOne ZIF architecture to eliminate intermediate frequencies; directly converting signals between RF and baseband. The Polar modulation technique is used to generate the required GSM/EDGE signal. A generic, high level functional block diagram of a handset is shown in section 1-1.

There are two antennas, each supported by their own front-end circuits. The primary antenna collects basestation downlink signals and radiates handset uplink signals through a switch module and three duplexers for UMTS high-band and low-band operations. The secondary antenna is used for GPS receiver with switch module and three SAW filters.

The primary UMTS receive signals are amplified by the transceiver /receiver LNA circuits and then passed through inter-stage bandpass filters before being applied to the receiver downconverter stages. One high-band receive path (UMTS 2100) is handled by transceiver IC, while the second high-band receive path (UMTS 1900) and UMTS 850 path are accommodated in the receiver IC. Onchip circuits downconvert the received signal directly from RF to baseband using radioOne ZIF techniques. Generation of the

RX0 downconverter LOs is fully integrated within the transceiver / receiver IC (except the loop filter for receiver). The primary analog baseband signals (RX0) are routed to the MSM device for further processing.

The secondary UMTS receive signal paths eliminate the inter-stage filter. After the secondary UMTS RF signals enter the receiver IC, they remain on-chip; there is no need to access off-chip inter-stage filters. The UMTS RX1 downconverter LO is provided by the same LO signal that being used by the primary receiver (Rx LO0). Rx diversity requires coherent LO

sources (derived from the same VCO output) for both receivers. The receiver IC integrates the necessary circuits for sharing receiver LO0 with the secondary UMTS receiver. A dedicated secondary baseband output (RX1), separate from the primary output (RX0), is routed to the MSM device for further processing.

The GPS signal is filtered, amplified by the receiver pre-LNA, filtered again, and then applied to the downconverter stages. On-chip circuits downconvert the received signal directly from RF to baseband using radioOne ZIF techniques. The RX1 downconverter LO (tuned for GPS) is generated by an on-chip synthesizer; only the loop filter is off-chip. The same receiver baseband output used for secondary UMTS signals, supports GPS signals as well (RX1); the analog baseband signals are routed to the MSM device for further processing.

For the transmit chains, the TX IC directly translates the transceiver baseband signals (from the MSM device) to an RF signal using an internal LO generated by integrated on-chip PLL and VCO. The TX IC output delivers fairly high-level RF signals that are first filtered by Tx SAWs and then amplified by their respective UMTS PAs. The high- and low-band UMTS RF transmit signals emerge from the transceiver where the UMTS high-band signal is switched onto one of two transceiver chains before tracking to three RF band-pass filters, three UMTS power amplifiers (PA with HSDPA capability), three couplers, three duplexers, and onto the antenna switch module.

In the GSM receive path, the received RF signals are applied through their band-pass filters and down-converted directly to baseband in the transceiver IC. These baseband outputs are shared with the UMTS receiver and routed to the MSM IC for further signal processing. The TX GSM/UMTS IC receiver baseband output shares the same interface to the MSM IC input ADC as the transceiver IC baseband output. The GSM/EDGE transmit path employs one stage of up-conversion and, to improve efficiency, is divided into phase and amplitude components to produce an open loop Polar topology:

1. The on-chip quadrature up-converter translates the GMSK-modulated signal or 8-PSK modulated signal, to a constant envelope phase signal at RF.
2. The amplitude-modulated (AM) component is applied to the ramping control pin of Polar

power amplifier from a DAC within the MSM.