DTEV-DUAL

Multi-band (Cellular + PCS + GPS) with diversity

Circuit Description

1. Overview

The following of this section provides an introductory overview of DTEV-Dual transceiver supporting a variety of diversity-capable handset designs using the radioOne Zero-IF architecture, directly converting signals between RF and baseband (and vice versa).

The module has two antennas at the RF front end.

■ The primary antenna collects CDMA base station forward link signals and radiates the phone's reverse link signal.

■ The secondary antenna collects CDMA base station forward link signals or GPS satellite downlink signals.

The function block diagram for the DTEV-Dual implementation is shown in figure 1-1

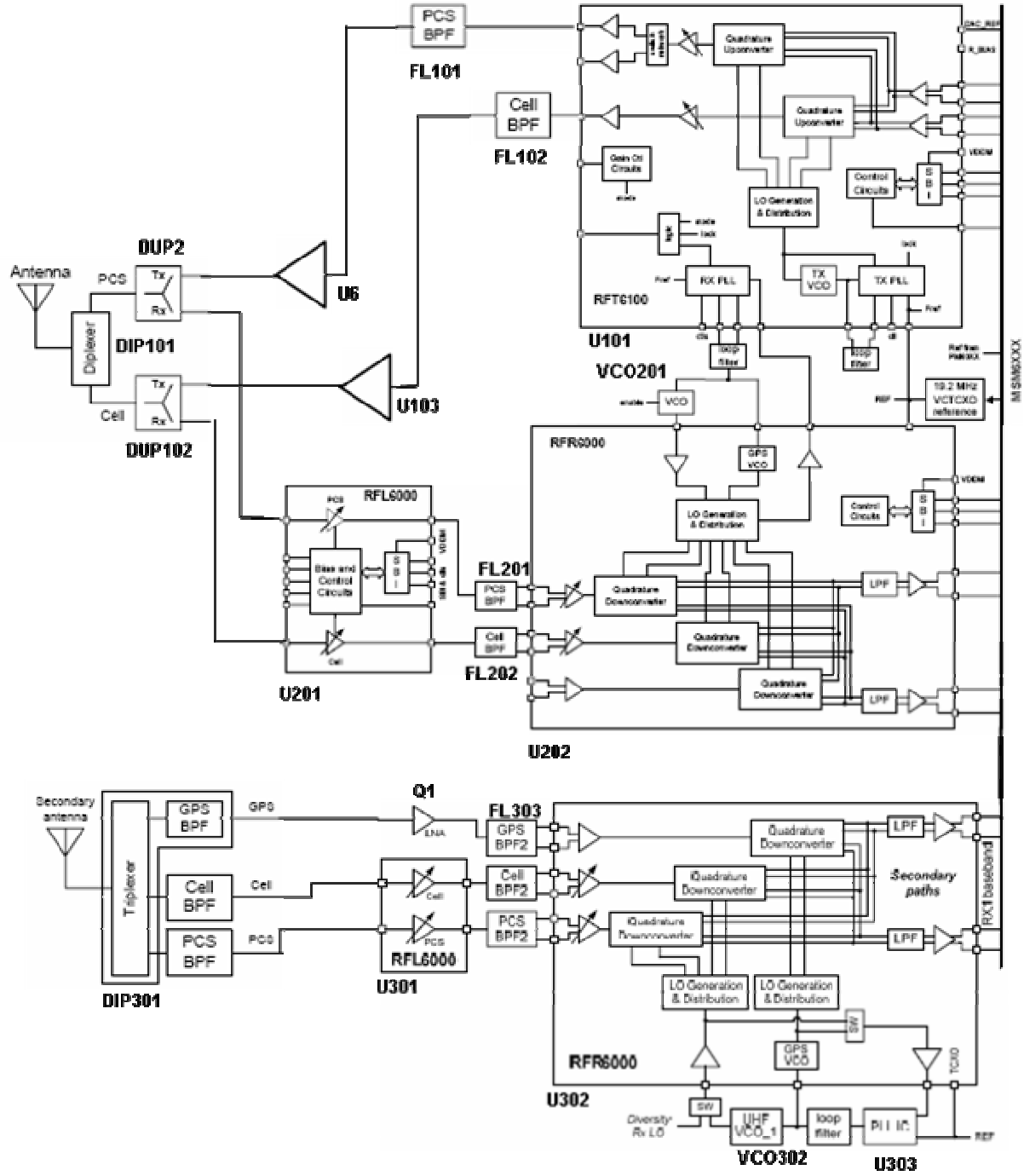

Figure 1-2 DTEV-Dual Transceiver Functional Block Diagram

2. Primary Antenna

The primary antenna of DTEV-Dual is used for CDMA Tx/Rx functions. As the figure1-2, the antenna interface with a diplexer that separates the Cell and PCS bands. Each band has a duplexer to separates Rx and Tx signals.

2.1 Transmitter

For Tx paths, the transmit baseband signals are generated by digital-to-analog converter (DAC) circuits within the MSM. The analog I and Q differential baseband are amplified to levels sufficient for driving the quadrature upconverters, U101 RFT6100. The fully integrated Tx PLL and VCO circuits generate the different LO, one dedicated to Cellular bands and the others to PCS bands, used in the quadrature upconverter that translates baseband signals directly to RF at the correct frequency, with the proper phase relationship, and with adequate drive level. The separates upconverters output plus RF paths supports different frequency bands. The transmit AGC control is implemented on U101 by using an MSM-adjusted pulse density modulated (PDM) signal that is RC-lowpass filtered (R126 and C122) at the RFT input to generate the necessary analog control signal.

The signals output of U101 are filtered by FL102 for Cell and FL101 for PCS. Those filters pass the transmit channel power while suppressing wideband noise, spurs, harmonics, and other undesired out-of band spectra. And then the power amplifiers U103 for Cell and U6 for PCS boost the channel power with the transmitter performance characteristics such as output power level, ACPR, Rx band noise. Finally, the transmit signal continues to the different duplexer's Tx port; the duplexers DUP2 and DUP102 provides filtering and separates the Tx and Rx signals, and then on to the diplexer DIP101 to separate Cellular and PCS frequency bands.

2.2 Tx LO synthesizer

As in the Figure 1-2, the Tx LO circuits include a reference divider (the R-counter), phase detector, charge pump, feedback divider (the N-counter), Tx VCO, LO generation and distribution are included within the RFT6100 (U101).Only the off chip loop filter allow optimization the stability, transitory response, settling time and phase noise.

The buffered 19.2 MHz TCXO signal provides the synthesizer input (REF), the frequency reference to which the PLL is phase and frequency locked. The reference is divided by the Rcounter to create a fixed frequency input to the phase detector, FR. The other phase detector input (FV) varies as the loop acquires lock, and is generated by dividing the VCO output frequency using the feedback paths N-counter. The closed loop will force FV to equal FR when locked.

The Tx LO distribution circuits apply signals at mixer port of Cell and PCS upconverter are differential with a quadrature phase relationship.

2.3 Receiver

The primary CDMA receive signal paths which are routed from the primary antenna to the diplexer DIP101, and separated to Cellular and PCS bands. Each bands are separated into receive and transmit paths by the duplexers DUP2 and DUP102.

The CDMA receiver signals from each duplexer which are amplified by the LNA RFL6000 (U201). Separate LNAs are provided each bands Cell and PCS. The LNA gain is incrementally and dynamically controlled by the MSM to maximize the receiver's dynamic range. And then, the LNA outputs are routed to the bandpass filters FL202 for Cell and FL201 for PCS that suppresses out-of-band received signals as well as handset transmitter leakage. Those filters are a single-ended to differential transformation for compatibility with the differential downconverter input to RFR6000 U202.

The quadrature downconverter translates the RF signal directly to baseband, producing two analog outputs: in-phase (I) and quadrature (Q). The downconverted baseband outputs are multiplexed and routed to lowpass filters. And then, the **baseband signals Rx0** are buffered and routed to the MSM .

2.4 Rx LO synthesizer

The primary Rx LO PLL supports to the receivers RF-to-baseband downconversions. The Rx PLL has reference divider, phase detector, charge pump, and feedback divider within U101 RFT6100. The loop filter and primary VCO201 are off-chips. The PCS and Cellular LO signal originates within an off-chip VCO that is closed-loop controlled by the RFT6100 PLL via a discrete loop filter and share a common RFR6000 buffer amplifier that supplies a feedback signal to the RFT6100 as the PLL circuits. The VCO's output is buffered within U202_RFR6000, and then distribution circuits create the PCS and Cellular quadrature downconverters' LO signals.

External RX VCO Frequency Range Option

Operation Band	VCO Output Frequency (MHz)		
	Lower	Center	Upper
US Cellular	1738	1763	1788
USPCS	1715	1742	1769

3. Secondary Antenna

The secondary antenna of DTEV-Dual is used for CDMA base station forward link signal and GPS satellite down link signals. As the figure1-2, this antenna interface with a triplexer that separates the Cell, PCS and GPS bands. Each band's Rx signal is filtered before applied to the U302 RFR6000.

3.1 CDMA Receiver

The secondary CDMA receive signal paths include Cell and PCS which are routed from the secondary antenna to the triplexer DIP301. After filtering by FL302 and FL301, those are amplified by LNA U301 RFL6000. The amplifier outputs drive RF ports of the quadrature RF-to-baseband downconverters (a dedicated downconverter for each band). The downconverted baseband outputs are multiplexed and routed to lowpass filters (one I and one Q) whose passband and stopband characteristics are mode dependent. The filter outputs, **baseband signals Rx1** are buffered and routed to the MSM device for further processing.

3.2 GPS Receiver

The GPS receive signal is collected by secondary antenna and passed through triplexer DIP301 to separate GPS band. The signal are amplified by a discrete LNA Q1, and filtered again by FL303. The filter output drives the fixed gain U302 RFR6000 for the quadrature RF-to-baseband downconverter, and baseband circuits include I and Q lowpass filters suitable for GPS processing and buffers that drive the MSM device for further processing.

3.3 Rx LO synthesizer

The secondary Rx LO functions are distributed between U302 RFR6000 and U303 PLL IC, loop filter, second external VCO302 and LO switch SW301. The PLL IC's charge pump output controls two VCOs, one for CDMA and another for GPS.

For GPS operation, GPS VCO within U302 RFR6000 is active that is closed-loop controlled by the U303 PLL IC.

For CDMA modes the LO switch selects between two external VCO modules, VCO201 and VCO302. The primary VCO201 is used within the U302 RFR6000 only during diversity reception. The VCO302 is used if the secondary receiver is tuned to a CDMA channel other than the one being processed by the primary receiver. If only the primary receiver is active, the second external VCO302, GPS VCO and U303 PLL IC are turned off.

4. Resonators Frequency

Resonator	Output Frequency
Sleep Crystal Oscillator	**32.768 KHz**
USB Oscillator	**48 MHz**
TCXO	**19.2 MHz**