ZMUM820 Circuit Description

1 Receiver

E-GOLDvoice features a fully integrated constant-gain direct conversion receiver, i.e. there is no interstage filter
needed and the baseband level at the analogue IQ-interface follows directly the RF input level. Depending on the
baseband ADC dynamic range, single- or multiple-step gain switching schemes are possible. An integrated, selfaligning,
low-pass filter ensures the receivers to function under blocking and reference interference conditions and
avoids aliasing by baseband sampling. An automatic DC-offset compensation is implemented and can be
switched depending on the gain setting.

1.1 RF Front-End and Demodulator

The E-GOLDvoice RF front-end contains 2 integrated LNAs for the pair of Dual Bands with balanced inputs. The
amplified RF signal is direct converted by a quadrature demodulator to the final output signals at the baseband
frequency. The orthogonal LO signals are internally generated via a divider by four for the GSM850/900 bands and by two for the GSM1800/1900 bands.

1.2 Baseband Stage

The resulting in-phase and quadrature signals are fed into the baseband stage, which comprises low pass filtering,
programmable gain steps, a programmable gain correction and automatic DC offset compensation circuitry. The
fully integrated baseband filter provides sufficient suppression of blocking signals and adjacent channel
interferences to match optimally with the baseband ADCs providing a 72dB dynamic range at full scales from 1
V_{pp} up to 4 V_{pp}. The ADCs anti-aliasing requirements are fulfilled for sampling rates from 6.5MHz on up. The low
pass filter is self-aligning with a residual 3dB roll off frequency tolerance of ±7%.

1.3 Gain Correction

Process tolerances mainly in the receiver RF section may cause a deviation from nominal overall gain values
(receiver gain + front-end insertion losses). To be centered within the ADC dynamic range over process and
temperature a programmable gain correction with a range of +/-6 dB with 1 dB stepping is implemented. This
avoids an exceeding noise contribution of the ADC in a minimum gain case or an ADC overdrive in a maximum
gain case.

Gain Correction Procedure

Receive level measurement and reporting in GSM is needed for adjacent cell monitoring and part of the transmit
power control. The specified level reporting accuracy requires a calibration of the receiver overall gain during the
final assembly of the mobile phone. For PMB7880 it is recommended to perform this separately for RXGAIN0 = 1 (high/medium gain) and RXGAIN0 = 0 (low gain). The calibration information is

saved in a look-up
table and available to correct the receiver overall gain over frequency and temperature burst by burst. All gain
steps RXGS0..RXGS3 have a high accuracy (+/-0.2dB) and, therefore, their consideration in the receiver
calibration routine is not needed.

2 Transmitter

The digital transmitter architecture is based on a fractional-N sigma-delta synthesizer for constant envelope GMSK
modulation. This configuration allows a very low power design with a reduced external component count.
The modulation is transferred between baseband- and RF-part of the PMB7880 via a digital interface signal into
the digital modulator.
The following Gaussian filter shapes the digital data stream for the GMSK modulation. Additionally a pre-distortion
filter compensates the attenuation of the PLL transfer function resulting in a very low distortion at the transmit
output.
The filtered digital data stream is scaled appropriately and added to the channel word. This sum is fed into the
MASH modulator. The output of the MASH modulator is a sequence of integer divider values representing the high
resolution fractional input signal. This sequence controls the MMD (multi modulus divider) at a sample rate of
26MHz. Thus a tightly controlled frequency modulation of the VCO is achieved.
The output signal of the VCO is divided by four for GSM 850/900 or by two for GSM 1800/1900 respectively. Finally
the divided signal is amplified by a single ended output driver with 50Ohm output impedance to allow for a direct
connection to the PA.
The transmitter achieves a very low out-of-band noise, typically-163.5 dBc/Hz @ 20 MHz offset, and a very low
rms phase error of 1.2 degree typically.

3 RF-Synthesizer

The PMB7880 contains a fractional-N sigma-delta synthesizer for the frequency synthesis in the RX and TX
operation mode. The 26MHz reference signal is provided by the internal crystal oscillator. This frequency serves
as comparison frequency of the phase detector and as clock frequency of all digital circuitry.
The N-counter of the synthesizer is carried out as a multi-modulus divider (MMD). The loop filter is fully integrated
and the loop bandwidth is about 100 kHz to allow the transfer of the phase modulation.
The fully integrated quad-band VCO is designed for the four GSM bands (850, 900, 1800, 1900 MHz) and operates
at the double or four times transmit or receive frequency. To cover the wide frequency range the VCO is
automatically aligned by a binary automatic band selection (BABS) before each synthesizer startup.