OPERATIONAL DESCRIPTION

The equipment under test (EUT) is the transmitter of QSX400 a Four-band (850/900/1800/1900) GSM/GPRS mobile phone. The transmitter operates in a duplex system according to the GSM standards.

The majority of the phone circuitry consists : the RF7170 Power Amplifier and the AD6548 RF Receiver and the MT6235 Baseband Processor. There is also a combination NAND Flash Memory/PSRAM IC. The system is powered by a rechargeable lithium-ion battery with a nominal voltage of 3.7 volts.

The receiver consists of two distinct parts, the RF receiver front-end and the IF section. The RF receiver front-end amplifies the GSM850 (869-894MHZ), E-GSM900 (925-960 MHz), DCS1800 (1805-1880 MHz), PCS1900(1930-1990MHZ) aerial signal, converts the chosen channel down to a low IF of 0 kHz, and provides in addition more than 35 dB image suppression. Two LNAs are available on-chip and can be configured to allow 4-band functionality. The switched LNA will be used for roaming in different countries. Some selectivity is provided at this stage by an on-chip low-pass filter, and channel selectivity is provided by means of a high performance integrated band-pass filter. The IF section further amplifies the wanted channel performs gain control to tune the output level to the desired value and rejects DC. This DC rejection is realised with an active high pass circuit and operates either continuously or keeps the acquired offset correction during the burst depending on the programming.

The transmitter is fully differential using a direct up conversion architecture. It consists of a single side band power up mixer. Gain is controlled by 4 dB via 3-wire serial bus programming. The fully integrated VCO and the power mixer are designed to achieve LO suppression, quadrature phase error, quadrature amplitude balance and low noise floor specifications. Output balun components are integrated to drive a standard 50 ohms single ended load.

The local oscillator (LO) signals required are provided by an on chip VCO for operation of the receive and transmit sections. The VCO is fully integrated and self calibrating to reduce manufacturing tolerances. It consists of 64 differents frequency ranges that are selected internally depending on frequency programming. The frequencies of the RF VCO are set by an internal fractional N synthesiser PLL circuit, which are programmable via a 3-wire serial bus. Comparison frequency is 26 MHz (24 Hz step programmability) derived from the 26 MHz reference signal which is

generated from the semi integrated reference oscillator. The quadrature phase RF LO signals required for IQ mixers are generated internally.

26 MHz is the reference frequency. It is turned on when the supply voltage VTCXO is applied. After buffering a reference clock of 26 MHz is supplied to the other parts of the system through the pin XBUF.

The circuit can be powered-up into four different modes: RX, TX, SYN or REF mode, depending on supply voltages applied, the logical level at pin CTRL and the 3-wire bus serial programming. In RX (TX) mode, all sections required for receive (transmit) are turned on. The SYN mode is used to power-up the synthesiser and the RF-VCO prior to the RX or TX mode. In the SYN mode, some internal LO buffers are also powered-up such that VCO pulling is minimized when switching on the receiver or the transmitter. The reference oscillator (REF mode) is turned on by applying the supply voltage. Additionally band selection is done using the 3-wire bus serial programming allowing the proper enabling of the LNAs.

The RF part also includes the blue tooth (blue tooth built-in baseband MT6616), WIFI chip MT5921, analog television +FM chip ATV168H.

Device features:

Bluetooth Features

■ Fully compliant with Bluetooth 2.1 + EDR (1Mpbs, 2Mbps, and 3Mbps)
■ On-chip integrated balun
■ Receiver of -93dBm sensitivity
■ Hardware AGC dynamically adjusting receiving performance
■ Fully integrated power amplifier with 7dBm maximum power
■ Low transmitting out-of-band spurious emissions supporting simultaneous operation with GPS, GSM/GPRS worldwide radio systems
■ Fractional-N PLL synthesizer supporting crystal frequencies from 12MHz to 52MHz

WIFI Features

■ Host interface : SDIO / eHPI16 / eHPI8
■ Support Orthogonal Frequency Division Multiplexing (OFDM), Complementary Code Keying (CCK), and Direct Sequence Spread Spectrum(DSSS) to provide a variety of data rates
■ Support ad-hoc and infrastructure modes
■ IEEE 802.11g (OFDM 54Mbps) and IEEE 802.11b (DSSS 11Mbps)
■ Support Bluetooth co-existence

■ Support low power consumption sleep mode via 32 kHz clock
■ IEEE 802.11i (AES, TKIP, 802.1X) for advanced security
■ IEEE 802.11e QoS support for multimedia applications
■ Wakeup by specific packet (pattern search)
■ 64/128-bit Wired Equivalent Privacy (WEP)
■ Shared clock, EEPROM, and full RF front ends integrated for WiFi
■ 40MHz crystal embedded
■ OS support WinCE/Win Mobile (V6.0/V6.1) and Linux

The MT5921 support IEEE 802.11b/g standard and it can provide up to 54Mbps for IEEE 802.11g, 11Mbps for 802.11b to connect your wireless LAN.

Analog TV+FM Features
■ Built-in CMOS RF tuner
■ Supports VHF-I, FM, VHF-III, and UHF bands
■ Worldwide FM stereo support
■ Worldwide PAL, NTSC, and SECAM support
■ Supports all NTSC standards: NTSC-M, NTSC-J, NTSC-4.43
■ Supports all PAL standards: B, B1, D, D1, G, H, I, K, K1, M, N, Nc
■ Supports SECAM B, D, G, K, K1
■ Fully integrated VCOs, PLL loop filter, and crystal oscillator
■ Dual automatic and programmable AGC for RF and IF gain saves power and reduces host processor overhead
■ I2C control interface
■ BT.601/656 8-bit parallel video interface for seamless compatibility with popular baseband processors
■ I2S audio interface
■ Analog audio interface
■ Includes device drivers for all popular processors and operating systems

The ATV18H is a PAL/NTSC/SECAM/FM receiver that implements the RF tuner and digital demodulator on the same die. NMI601 receives an input single-ended RF signal from the antenna through the VHFI/FM, VHF-III, or UHF-band RF input.
The tuner integrates the LNAs, mixers, VCO, PLL/loop filter, LO generation, crystal oscillator, baseband filters and amplifiers, and analog-digital converters. The tuner also includes an innovative closed loop RF gain control.
The demodulator receives a baseband input from the tuner and provides an Automatic Gain Control (AGC) signal to control the tuner gain. The demodulator

implements the full acquisition, synchronization, and demodulation for PAL, NTSC, SECAM, and FM transmission.
The ATV168H communicates with the host via the I2C interface for control, the BT.601/656 video interface and the I2S interface for audio. An analog audio output is also provided as an alternative to the I2S audio interface.

The baseband processor handles all physical layer radio control signals and network interfaces. The 32 KHz clock oscillator operates the baseband IC from a backup battery when the main battery is removed. The baseband processor is a dual-core device that splits the processing between a DSP core and an ARM ™ processor. The DSP handles the physical and layer 1 processing, while the ARM executes the layer 2 and layer 3 protocol and the man-machine interface (MMI). The dual cores communicate through a dedicated block of dual port memory. It also communicates with the Subscriber Identity Module (SIM) through an interface to the mixed signal device. The baseband processor also communicates to the calibration system or external devices through a digital serial link that is available on the system connector. The other main signals on the system connector include the digital audio interface (DAI) and allows for an external battery charging voltage.

The MMI completes the phone design and includes the displays, keypads, vibration motor, speaker, microphone, and headset.