# Description of Operation

This equipment under test (EUT) is a transmitter of quad-band (850/900/1800/1900) GSM/GPRS/EDGE and tri-band WCDMA(BC2/BC4/BC5)mobile phone.

The majority of the phone circuitry consists of a four device chipset: the RF3228 HBT IC GSM Power Amplifier and transmit/receive switch; the MSM7225A Baseband Processor ； The RTR6285A device supports quadband UMTS (bands 1 through 6 and bands 8 through 9), quad-band GSM/EDGE, GPS, and UMTS diversity handset operation with direct conversions between RF and baseband using zero-IF (ZIF) radio architecture; The AR6005 is a single chip 802.11 b/g/n device based on cutting edge technology; The WCN2243 device incorporates a Bluetooth baseband processor and a 2.4 GHz Bluetooth transceiver with FM transmitter/receiver in a single chip. The remainder of the major radio components are three wcdma PA IC ， three Duplexers and one PMIC(PM8029); There is also a MCP IC. The system is powered by a rechargeable lithium-ion battery with a nominal voltage of 3.8 volts. This handset uses a USB charger, so its charge voltage is 5V, and the charge current is about 700mA.

RF modem function
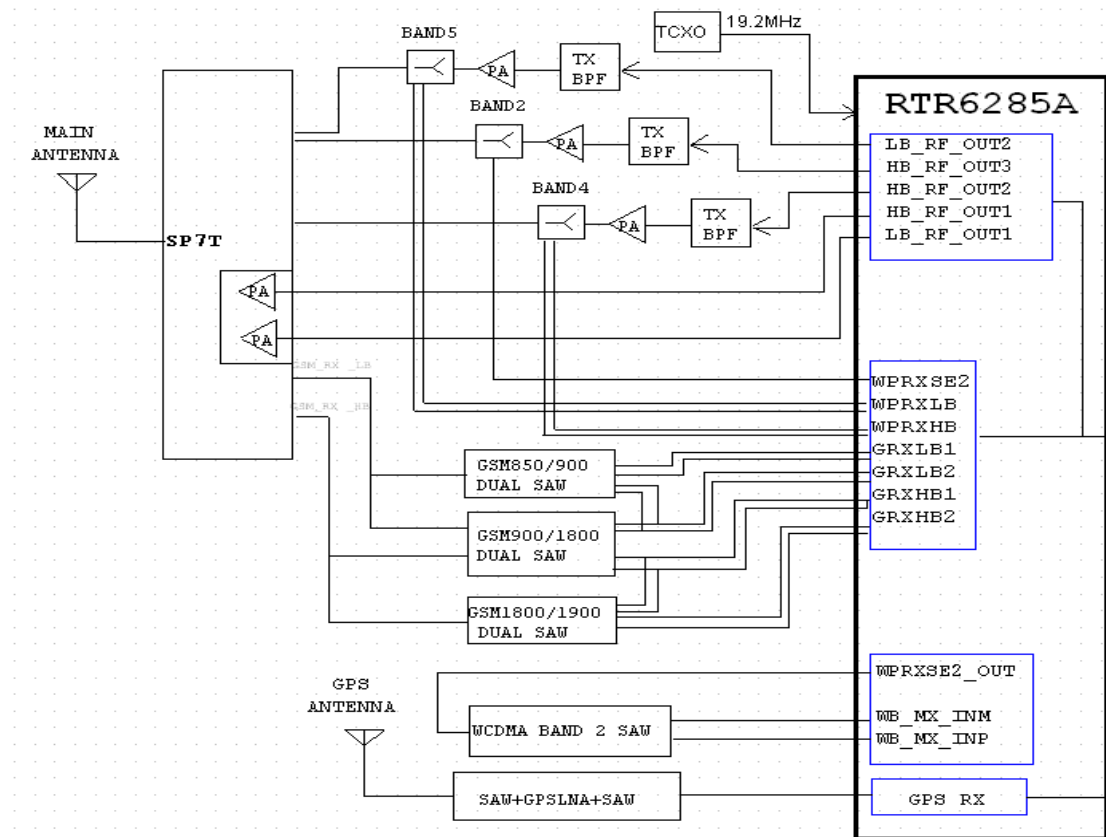
WCDMA path

This EUT is designed to support three bands: W850，AWS and W1900. The RF switch routes the antenna signals to one of the three UMTS Rx/Tx paths, each beginning with its own band-specific duplexer that separates that band's receive and transmit paths. Here takes W850 for example to illustrate downlink and uplink circuit. After separated by the duplexer, W850 downlink signal converts to differential signal simultaneously. The differential signal also need to be matched to achieve the best receiving quality and then route to the transceiver IC RTR6285A to complete the receiving process.

Uplink signal output from RTR6285A, after filtered it goes into the RF PA chip. The signal amplified by PA connects to the duplexer, and then to the antenna switch. The signal also choose the corresponding path through the main chip controlling signals, and thus sent out by the antenna finally to complete the sending process.

GSM path

According to the EUT circuit, GSM transmit and receive circuits is separate, and this EUT has two GSM receive signal paths: Low band (GSM900/900), High band(DCS1800 / PCS1900); and has 2 transmit paths: Low band GSM(GSM850/900) and High band GSM(GSM1800/1900).

Downlink signal collected from the antenna will transmit to the RF switch, then filtered and converted to differential signal by the saw after impedance matching network, after that it goes into the transceiver IC,where the RF signal is demodulated to baseband signal, and then connect to MSM7225A by I/Q signal bus complete the receiving process.

Uplink is opposite. GSM transmit signal output from main chip MSM7225A, then after impedance matching and attenuation circuit, input into Quad-band RF PA，which is also the antenna switcher, then amplified RF signal will be transmitted to the antenna under the control of baseband IC MSM7225A。

GPRS Feature descriptions

Packet-switched data:
 class B;
  Multislot class 12 data services;
  CS schemes – CS1, CS2, CS3, and CS4;
  GEA1, GEA2, and GEA3 ciphering;
  Maximum of four Rx timeslots per frame;

BT /FM function

This EUT uses the WCN2243 chip provided by Qualcomm, which also support FM function. The antenna receives the 2.4G high frequency signals, the signals go through the antenna switch, and then pass the match network enter the chip WCN2243. In the chip, via the switch signals reach to the receiving channel, After processed in amplifier, down converter, LPF and ADC then send to the processor for Digital Signal Process .WCN2243 chip's baseband communicates with baseband processor via the URAT interface (data) and the PCM interface (voice), to complete the whole receiving process. The opposite is the same, transmitting path: MSM7225A sends signal to WCN2243 chip's baseband via URAT interface (data) or PCM interface (voice), then after analog-to-digital conversion, low pass filter, frequency conversion and power amplifier etc, again through the inner switch to the transmission path, and after going through outside switcher the signals are sent out by the antenna to complete the whole sending process. Further more WCN2243 support FM function under the control of MSM7225A by I2C bus。
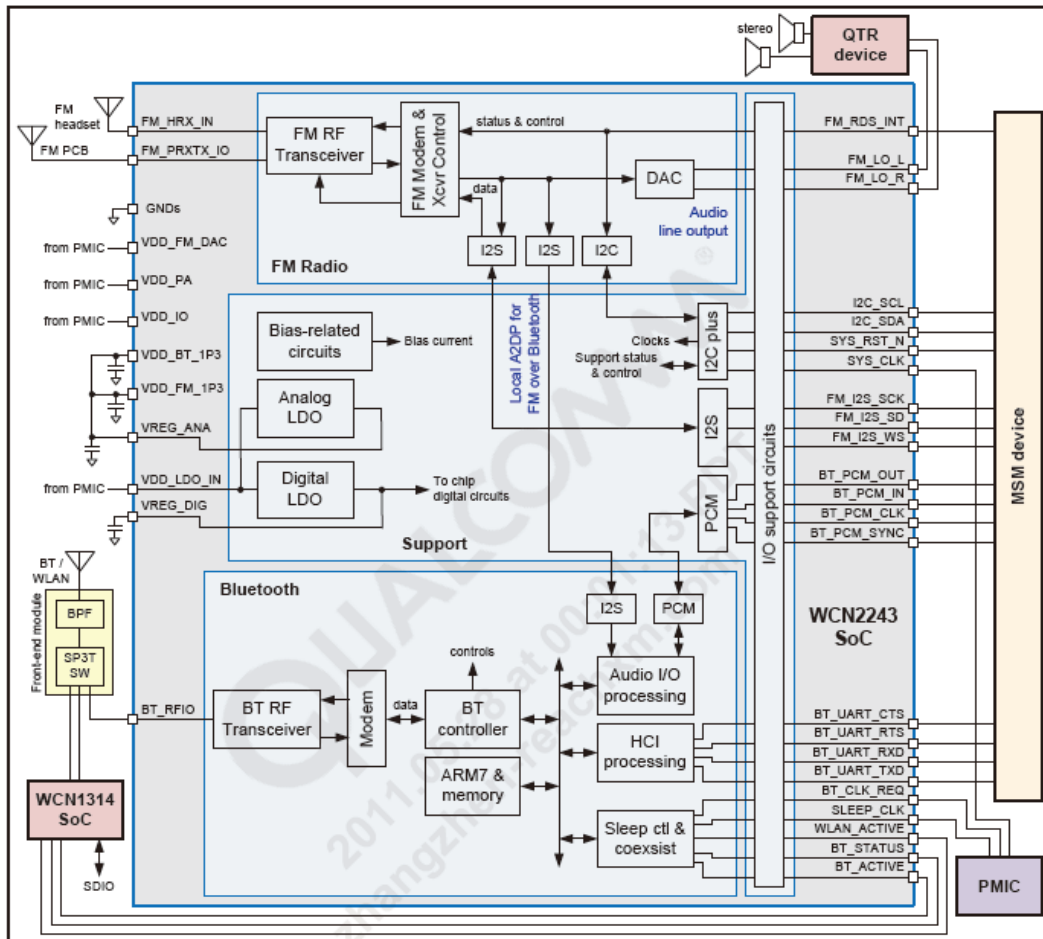
WIFI function

The AR6005 is a single chip 802.11 b/g/n device based on cutting edge technology, optimized for low power embedded applications. The typical data path consists of the host interface, mailbox DMA, AHB, memory controller, MAC, BB, and radio. The CPU drives the control path via register and memory accesses. External interfaces include SDIO or GSPI, reference clock, and front-end components as well as optional connections such as UART, SPI/I2C, GPIO, JTAG, 32 kHz source.

AR6005 Features:

All-CMOS IEEE 802.11 b/g/n single-chip client;

Support HT20;

Two RF input and two RF output;
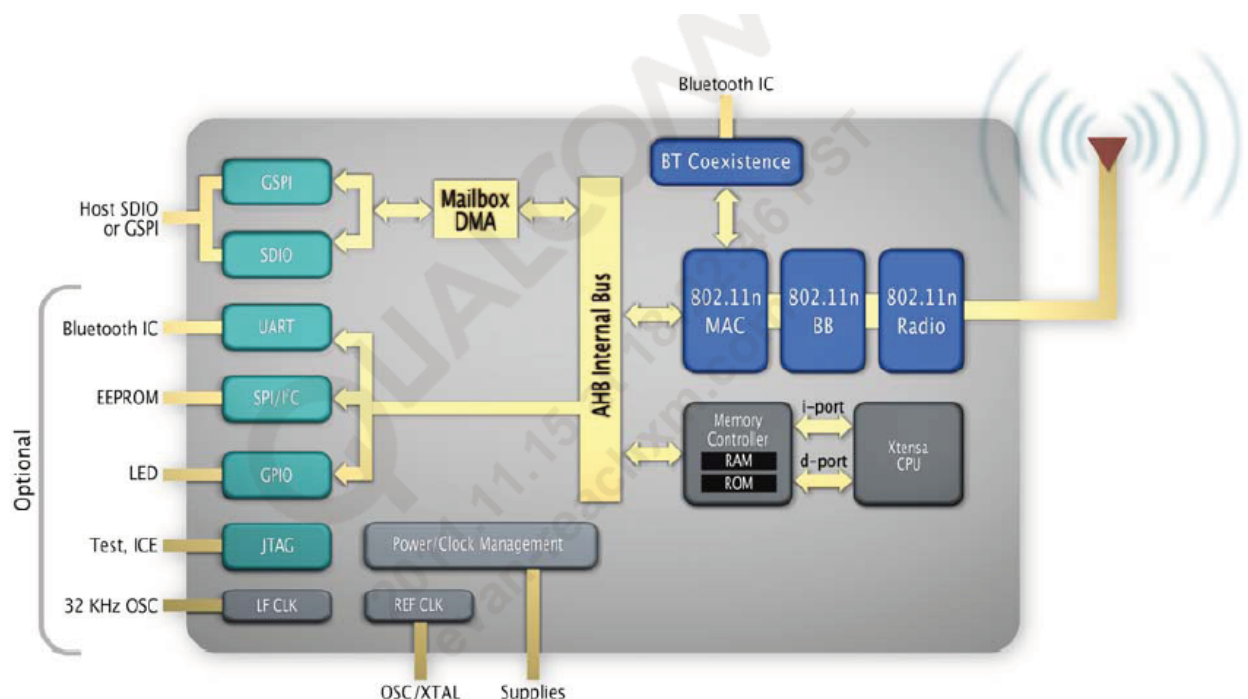
Baseband function

This EUT baseband IC use Qualcomm MSM7225A . The MSM7225A device is fabricated using the advanced 45 nm CMOS process, and is available in the $11 \times 11 \times 1.05$ mm, 0.4 mm pitch, 576-pin nanoscale package (576 NSP). Its general feature as below:

1) support WCDMA Rel '99 plus HSDPA and HSUPA

2) High-performance ARM CORTEX A5™ application processor at up to 800 MHz/1 GHz;

3) High-performance ARM926EJ-S™ modem processor at up to 400 MHz; QDSP4000™ at 122.88 MHz

4) Support for Bluetooth® 3.0 over UARTDM via an external Bluetooth System-on-Chip (SoC)

5) Mobile Industry Processor Interface (MIPI) that optimizes the interconnection cost between

the MSM device and the LCD panel/camera devices

And this baseband IC completes the phone design and includes the displays, camera, T-FLASH card read/write, keypads, vibration motor, LEDs, speaker, microphone, CTP and headset. The more details related operations, please refer to the user manual.