1 Description of Equipment Under Test (EUT)

The EUT is a CDMA single-mode Hand Held Phone (HHP), designed to meet or exceed the TIA/EIA IS-95B Standard. The EUT is capable of operating

The technical description included in this section covers the receive (RX) and the transmit (TX) sections and the logic hardware and Baseband section of the HHP. The technical descriptions are intended to describe supporting hardware circuits only and are not intended to address firmware or protocol issue except where applicable.

1.1. Description of Circuits and Devices

1.2. RF Receive Path Description

The receive RF section is designed to receive CDMA signals in the 869 – 894 MHz frequency band. The input RF section consist of a Rx/Tx SAW duplexer (U0101), an antenna input switch (J0102), a fixed attenuator (U0102), and the Low Noise Amplifier (LNA), U0103. The antenna switch functions as an external test input/output port to test the HHP. The Rx section of the duplexer provides bandpass filtering of unwanted out-of-band signals prior to being applied to the LNA input. The RF input attenuator is switched into the receive path providing –10 dB attenuation at approximately –95 dBm. This provides overdrive protection and reduces IMD within the RF front end. The LNA is the first gain block in the receive chain and essentially establishes the receiver RF section input noise figure. The RF SAW filter (FL0101), provides image rejection filtering for the RF front-end. The image is located at a frequency which is twice the first IF frequency above the Local Oscillator (LO) frequency. The RF attenuator following the LNA switches –10 dB into the circuit when the input signal is at approximately –85 dBm. This provides at reduction in the signal level to the first mixer that functions to reduce overload, IMD and spurious responses. The first mixer (U0106) is an active-mixer that provides positive conversion gain and frequency translation by down-converting the incoming RF spectrum to the first intermediate frequency (IF). The Local Oscillator (LO) drive level has been set to provide optimum IMD performance. The differential output is coupled into an IF SAW filter that provides receive selectivity for the IF chain. The differential

Controlled Crystal Oscillator (TCXO), U0702, provides the input reference frequency to the synthesizer. The synthesizer output provide the local oscillator input for the receive chain (for down-conversion) via buffer (Q0502).

1.4. TX Synthesizer Section Description

The Synthesizer is shared by both transmit and the receive chains. The synthesizer output also provides the local oscillator (for up-conversion) to the transmit chain via buffer (Q0503).

1.5. Transmitter (TX) Section Description

The transmitter section receives it input from the BBA chip (U0801). The signal is received by the variable voltage amplifier (VGA), U0402. The function of the VGA is to ultimately establish the RF output level at the RF antenna input terminals. The VGA receives an input control voltage from the BBA, which sets the VGA's gain/attenuation response according to the received signal strength. The VGA differential output is routed to the input of a SAW filter (FL0401), that establishes transmit IF selectivity. The filter output is up-converted to the final transmit frequency by mixer (U0301) which is 45 MHz's below the incoming CDMA received signal. Further filtering is provided by RF SAW filter (FL0301) before the signal is applied to a second VGA (U0302). The two VGA's in the transmit chain collectively work to provide the combined dynamic range required to for the maximum/minimum output power ratio. The power amplifier (PA), U0303, further provides signal amplification in the transmit chain. The PA can be rendered inactive by switch (Q0301). The PA is a linear power amplifier. The output is routed through the directional coupler (U0304) where a sample is data and detected by diodes (UD0301) and amplified by op amp (U0306). A circulator (U0305), is provided to buffer or isolated the PA output from reflective energy from the antenna circuit. The PA output is finally routed to the Tx section of duplexer (U0101) which functions to band limited the transmit signal prior to entering the antenna input terminals. The duplexer further functions to isolated the CDMA receive band from the CDMA transmit band by approximately 53 dB. The transmitter signal arrives at the duplexer input terminal where antenna test jack (J0102), provides the functionality of a test port for testing and monitoring the HHP performance. The transmit signal finally arrives at the

The BBA chip (U0701) and the CDMA+100 (U0801) chips together comprise the baseband analog and DSP sections for the HHP. In the BBA chip, all data conversions, such as the analog to digital (ADC) and the digital to analog (DAC), are provided. In the CDMA+100 chip all digital signal processing (DSP) functionality is provided. Both chips are Philips proprietary chip designs. They also function as the baseband Modem providing the modulation and demodulation for the CDMA receive and transmit signals.

1.7. LCD readout Description

The LCD is 87 x 65 pixels. The Display will illustrated the status of the phone, including battery status, channel number (in test mode), signal strength, menu's roaming or home. Etc.

1.8. CPU Section Description

The CPU is used to provide timing and commands to the RF section and the hardware section. The CPU firmware is stored in FLASH non-volatile memory. The firmware can be upgraded from the bottom connector over a standard RS-232 interface. A volatile SRAM memory is used to store temporary data.

1.9. Serial Buss Interface Description

The interface connector (J1203), is located on the bottom of the HHP where commands, data and external power may be applied to the HHP. The data interface is RS-232.

1.10. Function of Active Devices

The active devices used in the HHP are listed in Table 1.

Table 1 Active HHP Parts

Philips P/N	QTY	Ref. Designator	Part Number
M2740	1	U0307	IC, M20B
M2742	1	U0302	IC, 1037B
M2746	1	U0502	VCO VC
M2760	4	D0501-4	DIODE, CAPACITIVE

M2782	1	D0301	DIODE_SCHOTTKY, HSMS-2825
M2784	5	U0601- 5	REG_V_6, IC, TK11233BMCL
M2785	1	U0201	IC, RF2617
M2787	2	Q0101- 2	TRANSISTOR, NPN, DTC115EEA
M2821	1	Q1002	PNP, 2SB624
M2823	2	D1201-2	DIODE, MMBD4148
M2834	1	U0802	IC, S-75V08ANC5
M2836	3	Q1101- 3	TRANSISTOR, NPN, 2SD596
M2847	1	U0901	IC, LRS1348, BGA, 72pin
M2849	1	Q1001	MOSFET Dual, PCHAN, SI6965DQ
M2850	1	U1002	IC, NC7SZ175P6, SC70-6
M2851	1	U1003	IC, NC7SZ66P5, SC70-5
M2853	1	Q0504	TRANSISTOR, PNP, DTA115EEA
M2859	1	U1001	IC, NC7WZ14P6, SC70-6
M2892	2	D1001- 2	DIODE, BAS16W
M2895	1	Q0901	MOSFET, PCHAN, BSH206, SOT363
M2896	1	U0308	IC, ADG704BRM, RM-10
M2902	1	U0701	IC, CXA3303GA, LFLGA, 76 pin
M2903	1	Q0301	MOSFET, Dual NCHAN, PCHAN, SI1553DL
M2909	2	Q1201-2	TRANSISTOR, NPN, BC817
M3023	3	Q0501-3	TRANSISTOR, PN, E68119
M3025	1	U0303	IC, F3105
M3026	1	U0801	IC, DMA+100 BGA
MRNU0202	1	U0202	IC, MV722 VSP8 OPAMP

1.11. Frequency Stabilization

closed response of the PLL holds the output frequency to the stability of the reference TXCO's frequency stability.

1.12. Suppression of Spurious Radiation

The suppression of spurious radiation is provided through the use of selectively filtering. The transmit paths (IF and RF) incorporates highly selective SAW filters which have excellent out-of-band rejection characteristics. And finally, the selective SAW duplexer adds band shaping and rejection for the CDMA transmit frequency band. The transmitting RF frequency is synthesized with a PLL. The PLL incorporates a 3th order loop filter whose design is twofold.

(1) One to provide a loop response to track the TCXO frequency with small frequency error while providing a good phase margin for overall stability:
(2) Secondly, to provide a closed loop response that suppresses the reference sidebands and other spurious products.

The synthesizer closed loop performance will attenuate spurious that might otherwise enter via the Local Oscillator (LO) into the transmit chain.

1.13. RF output Output Limiting

The final output power at the antenna terminal is limited by the calibration of the firmware within the HHP. The maximum/minimum output power level for the HHP has been calibrated over the range from a minimum of approximately –50 dBm to a maximum of +24 dBm. The calibration tables are resident in the HHP internal FLASH (non-volatile) memory. The output power is sampled with a directional coupler and detected with diodes. The output is sent to the BBA and passed to the CPU for processing. The CPU generates the TX AGC control signals which establishes the over gain of the transmit chain. The CPU controls the output power level from the OFF (switched) state to the maximum power state.

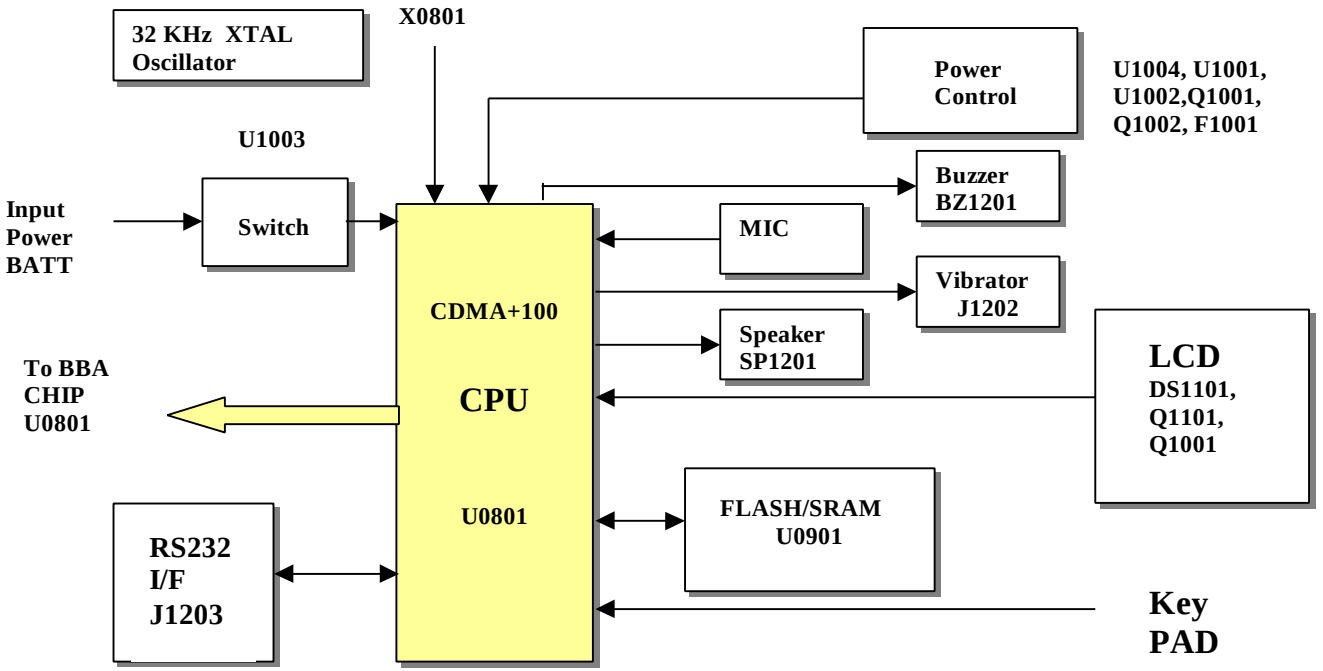
1.14. Description of Modulation

has been filtered to limit the transmission bandwidth. This signal is combined at the base station transmitter with all other users in that cell. The QPSK modulated signal is received by the mobile handset where the coding is removed, and de-spread back to the original 9600 bps (in this example). The ratio of the 1.2288 MHz CDMA transmission bandwidth to the 9600 Hz data bandwidth is 128 or 21 dB. The AMPS analog system requires the desired incoming RF signal to be 18 dB above the interferer or residual noise to have an acceptable call quality. Using the same example for CDMA (because of the 21dB coding gain), the mobile handset can tolerate an interferer up to 18 dB stronger than the desired incoming RF signal (assumes signal strength is 3 dB lower after coding gain).

Reverse CDMA Channel Modulation (HHP to Base Station)
Description:

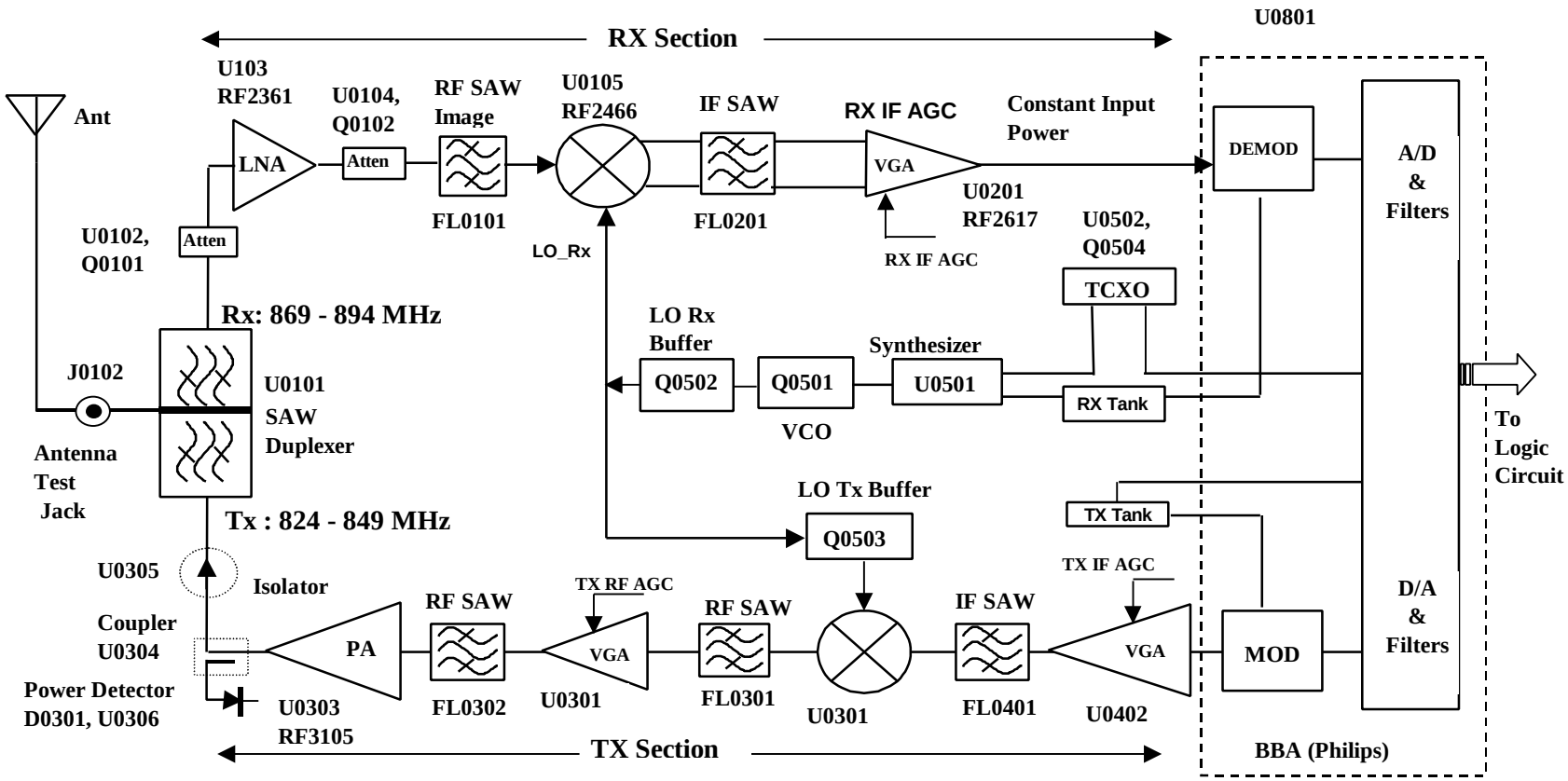
The mobile handset transmits filtered Offset QPSK (OQPSK) to the base station in the reverse channel. The offset is used to avoid the amplitude transients inherent in QPSK. This also allows a simpler design for the output Power Amplifier (PA) in the mobile handset. The capacity is different in the forward and reverse direction due to the difference in Modulation. The forward channel has the phase reference – the pilot signal –as well as orthogonal codes.

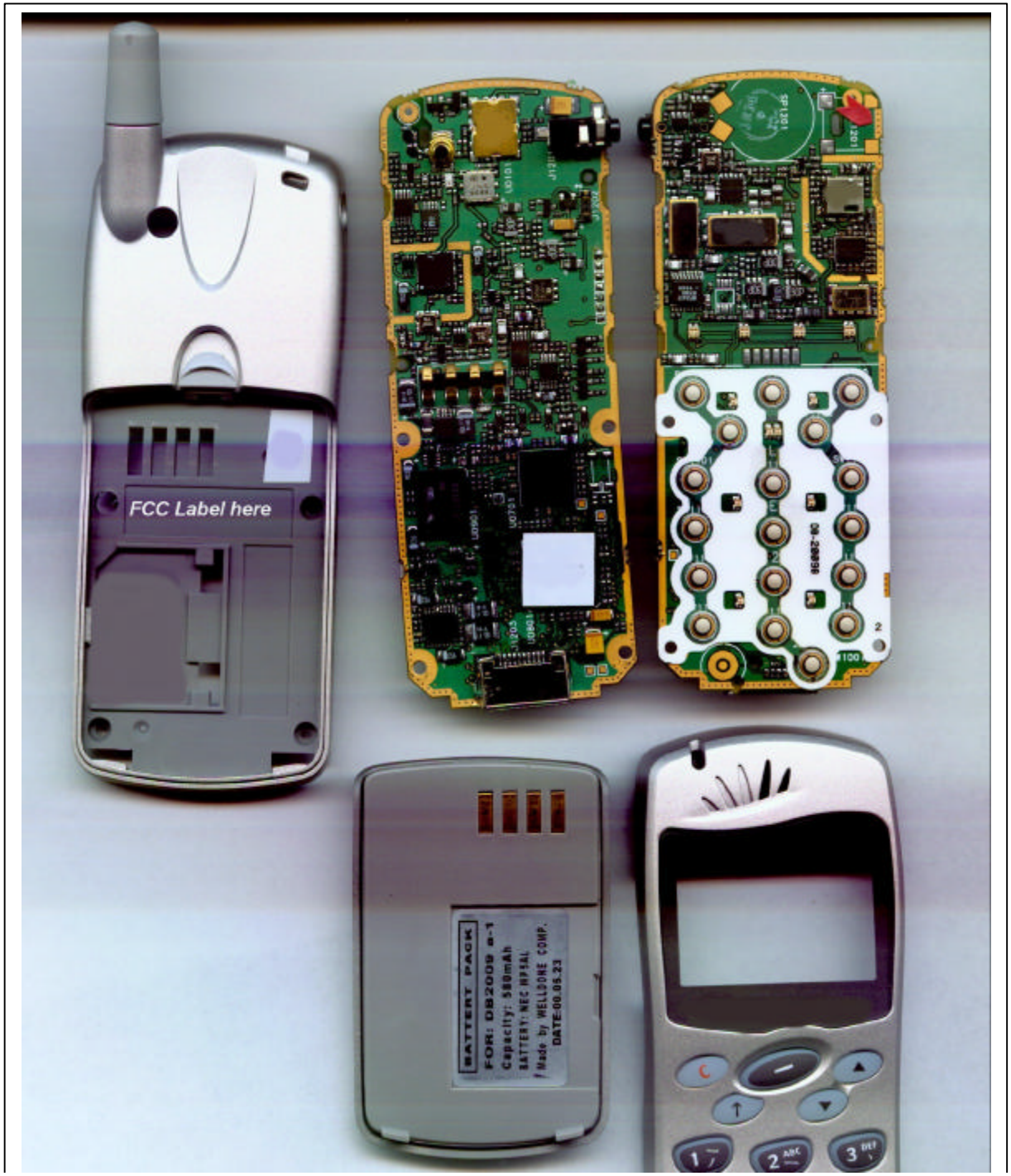
1.15. Overall Circuit Schematic



Logic Hardware Block Diagram

RF Block Diagram




FCC Label here
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FOR: DB2009 e-1
Capacity: 580mAh
BATTERY: NEC NiMH
Made by WELLSOME COMP.
DATE:00.05.23