1. Section 2.983 (d)(3). Range of operating power levels and description of means for variation of operating power

1. Range of operating power levels

The operating power levels is divided into 14 steps in CDMA mode

1-1. Cellular mode : -50dBm ~ 22.8dBm ± 0.2dB

Level 0 : 22.8dBm ±0.2dB	Level 7 : -15.6dBm ±0.2dB
Level 1 : 18.0dBm ±0.2dB	Level 8 : -21.2dBm ±0.2dB
Level 2 : 12.4dBm ±0.2dB	Level 9 : -26.8dBm ±0.2dB
Level 3 : 6.8dBm ±0.2dB	Level 10 : -32.4dBm ±0.2dB
Level 4 : 1.2dBm ±0.2dB	Level 11 : -38.0dBm ±0.2dB
Level 5 : -4.4dBm ±0.2dB	Level 12 : -43.6dBm ±0.2dB
Level 6 : -10.0dBm ±0.2dB	Level 13 : -49.2dBm ±0.2dB

2. Means for variation of operating power

The RF interface of CBP4.0 communicates with the RF analog circuitry. This RF interface performs gain controls of Power amplifier(PA) and AGC(automatic gain control) amplifier using digital control signals.

The circuit functions of the MAX2538 PCS/Cellular mixer and MAX2308 CDMA IF I/Q demodulator include the Rx AGC amplifier with 90dB dynamic range, quadrature IF mixer, down-conversion from IF to analog baseband, low-pass filters, and analog-to-digital converters(ADC) for converting to digital baseband.

The RF power output level is detected by RF Power Detector Maxim2205 then this information is sent to the CBP4.0. The software controlled power management in CBP4.0 controls the Tx-AGC adjust signal.

2. Section 2.983 (d)(5) : The DC voltages supplied to and DC currents into the final RF amplifying device.

The final RF amplifier circuitry is consisted of RF amplifier CX77105 and DC voltage control transistor. The Cellular Amplifier Module DC voltage and current supplied into the power amp module (PAM) is typical 3.4V and 350mA. In this hand-held device, power amp is directly activated using the battery cell

3. Section 2.983 (d)(6) : Function of each electron tube, semiconductor or

other active device

The function of main component is as follows.

1. RF part

RF part consists of power part, synthesizing part, transmission and reception part.

1-1. Frequency synthesizing Part

Frequency synthesizing part consists of two synthesizer circuit which is first local synthesizer, Dual Tx IF synthesizer and Rx IF synthesizer. Case of Cellular Part, The first local synthesizer generates the primary local system oscillation frequency, operating over 2113.6 ~ 2173.6MHz MHz frequency range. Tx IF and Rx IF synthesizer generate the second local oscillation frequency, 457.2 MHz and 367.2 MHz respectively.

1-2. Receiving Part

- Cellular Duplexer(SF504) : The duplexer filters the RF signal transmitted through ANT (frequency range:824.04~848.97MHz) and sends the signals to LNA(frequency range:869~894MHz)

- MAX2538(U506) : The MAX2538 is a high performance CDMA dual-band&GPS /tri-mode integrated LNA/mixer. The operating voltage is 2.7V and is compatible with 1.8V logic for control lines. The MAX2538 integrates the dual-band LNA/down-converters with 30dB of gain control and TX LO buffers.
- MAX2308(U501): The MAX2308 is a IF receiver designed for dual-band, dual-mode CDMA phone systems. It demodulates the IF signal to get the I/Q signal. The operating voltage is 3.0V. We can change the VGC pin voltage to change the gain of IF signal.

1-3. Transmission Part

- MAX2361 (U505) : This part includes an IF mixer for up-converting analog base band to IF to RF, single sideband up conversion from IF to RF. It need a outside tank VCO to synthesize the local system oscillation frequency.
- Cellular Power AMP module (U502 cx77105) : This part is designed to work in the cellular phone's 824 MHz ~ 849 MHz frequency range in the CDMA. It can amplify the Max2361's RF output signal. It's has two gain states, high gain and low gain.

Logic Part:

Logic part consists of power supply part, digital and audio part, LCD module part.

2-1. Power supply Part

Power is supplied by battery, operating over 3.3V to 4.2V range, or external source.

We use MAX1502 as our power management unit. It has 8 LDOs which could power all RF and base band circuits.

Out1: Power supply for base band processor CBP5.0 core circuit. (3.0V@250mA)

Out2: Power supply for CBP5.0 external equipment. (1.8V@150mA)

Out3: NC

Out4: Power supply for TCXO and VCO. (3.0V@80mA)

Out5: Power supply for CBP5.0 analog parts. (3.0V@80mA)

Out6: Power supply for RF receive path. (3.0V@150mA)

Out7: Power supply for external level change. (3.0V@80mA)

Out8: Power supply for RF transmit path. (3.0V@150mA).

2-1.Digital and audio parts, LCD module

BB Processor: CBP4.0 is responsible for CDMA mobile station's base band and digital signal processing. For this chip to work normally Y201 (32.768K) and Y502 (19.2M) are required as basic clocks..

Audio codec: The voice codec has two types of audio paths. The main MIC and SPK for the phone and the auxiliary MIC and SPK for the earpiece.

Polyphonic ringer: YMU762 is used to produce 40 tones of polyphonic rings.

LCD Module: The LCD module needs tow types of power supply V-battery (3.3~4.2V) and VDD_DIG (3.0V). All data was transmitted through 8 bit parallel bus.

4. Section 2.983 (d)(9). Tune-up procedure over the power range.

Cellular Telephone Adjustment and Test Procedure

1. Overview

With ordinary use in clean, dry environments, no periodical alignment should be

necessary for.

We must calibrate these PCBA that our production line manufactures so that can make these PCBA in the best state. After calibration is finished, the mobile phone can initialize again, then begin to test all kinds of performance in call mode.

2. Test equipment

Board Calibration and Test Station Equipment List		
1	PC	Industrial computer，Need USB and standard serial port
2	Ethernet-Card(network-adaptor)	
3	Level shifter	
4	18pin bottom bus cable	For T1100C power supply
5	Fixture	For T1100C
6	Agilent 8960 Or CMU200(B83,K85)	Agilent 8960 OR CMU200 Universal tester must have (US Cellular) CDMA options Agilent priority with E1962B Firmware revision B.06.XX or later , CMU200 SW V3.61 or later
7	Power supply	Keithly 2306 series or Agilent 6631* series
8	Shield Box	
9	RF Cable	One is from 8960 to shield box (1.5m), and one is shield box to module cable (0.4m)
10	GPIB card	NI or Agilent PCI card
11	GPIB Cables	
12	Test UIM	Cellular
13	Test SW(AMTS)	
14	SQL 2k (server,personal edition)	

3.Function.

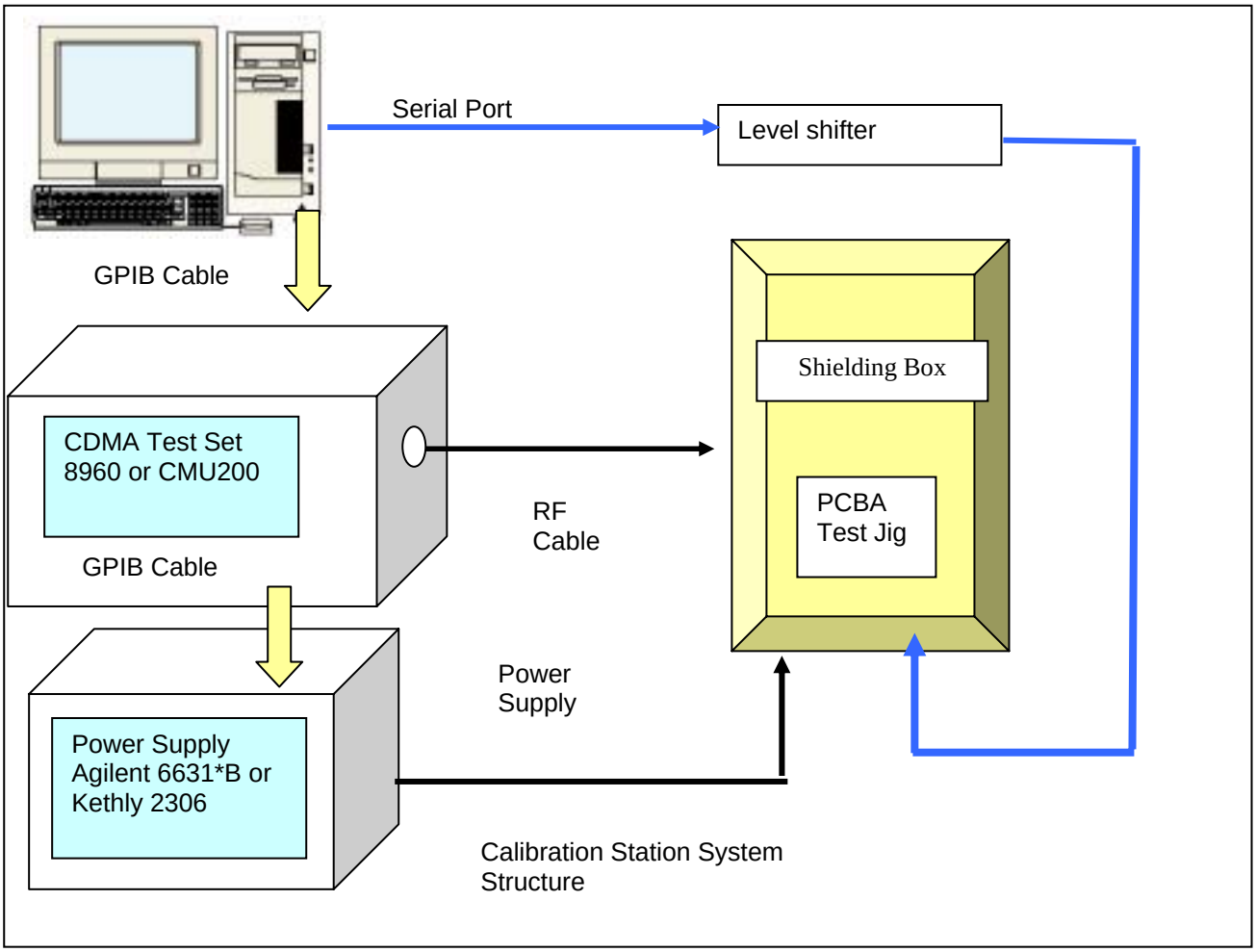
Check if Barcode data have been written into mobile or not

Battery capacity calibration

RF calibration, include TX, RX, Power etc

RF test, need UIM card to make a Call

4. System Structure.



5. Test Mode

Test commands can be used after switching to test mode when adjusting and diagnosing the telephone. Test mode uses a separate command structure. Built-in antenna shall not be connected in test mode and shall be connected only to the test instrument. If other telephone begins operation within the radius of several meters where telephone is tested in the test mode, it will cause a bit noise or other failure.

Also, a telephone is affected by interference from local stations at places where strong field signal exists causing undesirable effects when measuring reception sensitivity or diagnosing in test mode.

6.Calibratioln Items

The main calibration items are listing below:

(1).CDMA RxAGC Baseline

(2).CDMA RxAGC Frequency channel Adjustment.

(3).CDMA RxAGC Temperature Adjustment

(4).CDMA TxAGC Baseline

(5).CDMA TxAGC Frequency Channel Adjustment.

⑹CDMA TxAGC Temperature Adjustment

⑺.CDMA TxAGC Battery Voltage Adjustment

⑻.CDMA TxAGC Max Power Limit Frequency Adjustment

⑼.CDMA TxAGC Max Power Limit Battery Voltage Adjustment

⑽.CDMA TxAGC Max Power Limit Temperature Adjustment

⑾.CDMA TxAGC Closed Loop RF power measurement.

⑿.CDMA TxAGC Closed Loop Frequency Channel Adjustment.

⒀.CDMA TxAGC Closed Loop Temperature Adjustment

⒁.CDMA TxAGC Closed Loop Max Power Limit Battery Voltage Adjustment.

7.Detail Description of Calibration Procedure.

⑴. CDMA RxAGC Baseline

The basic mechanism for calibration is to provide a signal of known power at the antenna, allow the RxAGC to settle, and make note of the resultant RxAGC PDM value. In this way, the "settled" value of the PDM for a given Rx power is known.

The recommended hysteresis and calibration data point settings for this board ,with two gain states, high gain and low gain.

We choice a baseline channel to do this calibration.

⑵.CDMA RxAGC Frequency channel Adjustment.

The cell band frequency covers from 869~894MHz.Under different channel, the components on the board will have different electrical characteristic. So the RxAGC PDM value will be different although receive the same power. That's why we have to do frequency channel adjustment.

We control the equipment to measure the different value between channels and then store them into the hand phone NVRAM.

⑶.CDMA RxAGC Temperature Adjustment

Write default values to the phone NVRAM.

⑷.CDMA TxAGC Baseline

We do this step in an baseline channel.

The basic mechanism of the calibration is to transmit a signal at the antenna port with a certain PDM setting, the power of which is measured by a CDMA tester. The PDM setting and resultant power are the recorded.

⑸.CDMA TxAGC Frequency Channel Adjustment.

Similar to the step ⑵.The transmitter's electrical characteristic will be various across frequency band. It means the same DAC value from CBP4.0 will make transmitter output different RF power over different channel. So we must measure the differences between other channels and the baseline channel. And

fill these values to the NVRAM. The handset will make the adjustment while transmitting special power.

⑹.CDMA TxAGC Temperature Adjustment

The transmitter's electrical characteristic will be different among different temperature. We must make adjustment to the handset. Write default values which measured beforehand to the phone NVRAM.

⑺.CDMA TxAGC Battery Voltage Adjustment

The transmitter's output power will differ between battery voltages. We must make this adjustment. Write default values which measured beforehand to the phone NVRAM.

⑻.CDMA TxAGC Max Power Limit Frequency Adjustment

The CDMA phones must have a precise maximum output power control. We must measure the compensation value that contains the frequency correction.

⑼.CDMA TxAGC Max Power Limit Battery Voltage Adjustment

The compensation value of different battery voltage under max power transmitting.

⑽.CDMA TxAGC Max Power Limit Temperature Adjustment

The compensation value of different frequency under max power transmitting

⑾.CDMA TxAGC Closed Loop RF power measurement.

Read the ADC value which was detected by the CBP4.0 AUX ADC part. The power detector detects the power, convert it to voltage. Then the CBP4.0 make the A/D convert.

⑿.CDMA TxAGC Closed Loop Frequency Channel Adjustment.

Measure the compensation values of power detector output voltage under different frequency.

⒀.CDMA TxAGC Closed Loop Temperature Adjustment

Measure the compensation values of power detector output voltage under different temperature.

⒁.CDMA TxAGC Closed Loop Max Power Limit Battery Voltage Adjustment.

Measure the compensation values of power detector output voltage under different battery voltage.

5. Section 2.983 (d)(10). Description of frequency determining and stabilizing circuitry

Frequency synthesizing part is composed of the first local RX IF synthesizer, the Tx IF VCO and the RF LO.

- UHF LO VCO output frequency range is 2105.2 ~ 2155.2MHz. It is controlled by the transmitter.
- Cellular Mode Rx IF synthesizer : 367.2 MHz

Rx IF PLL loop is consisted of PLL synthesizer in the PLL module, VCO installed in IFR IC, loop filter and VC-TCXO(Crystal oscillator 19.2 MHz). It oscillates twice the intermediate receiving frequency of 367.2 MHz and then generates 183.6 MHz, Rx IF frequency.

- Cellular mode Tx IF Synthesizer : 457.2MHz

  The configuration of PLL loop is composed of PLL Synthesizer, VCO which is composed of R L C component, loop filter and VC-TCXO(standard clock). It oscillates twice of the transmission intermediate frequency of 457.2 MHz and then generates Tx IF frequency of 228.6 MHz through the PLL loop.

The frequency of 19.2 MHz generated from the VC-TCXO is the standard clock of those each the frequency synthesizer part. PLL frequency stability is determined by the stability of oscillator sage of VC-TCXO. This prevents maximum frequency variation from exceeding ±2.0PPM.

6. Section 2.983 (d)(11). Description of circuit employed for suppression of spurious radiation

In the CDMA transmit signal path, the frequency spectrum at the output of the CDMA DACs contains unwanted frequency components due to the DAC output transition edges and transients. The transmit clock frequency and harmonics are found in the spectrum.

- Each CDMA DAC is followed by an anti-aliasing low-pass filter with a bandwidth of 630 KHz that reduces unwanted frequency components installed in RFT.

The Tx RF output of the Tx Mixer and the drive amp is filtered again by the SAW band pass filter. The nominal specification of the filter is as follows.

< Cellular Mode >

- Pass band : 824 MHz ~ 849 MHz
- Attenuation : DC ~ 800MHz : 31 dB min.
  869 ~ 1049MHz : 38 dB min.
  1049 ~ 2000MHz : 30 dB min.

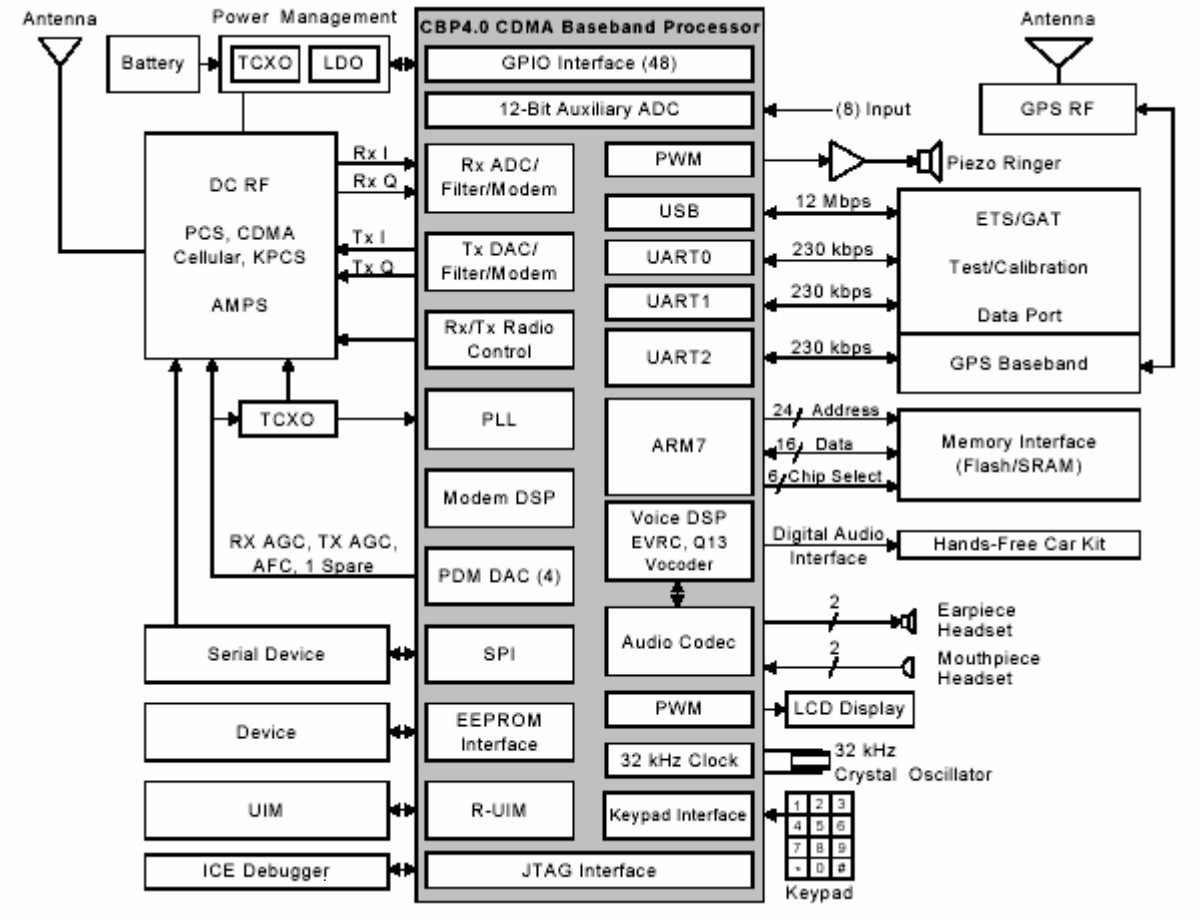
  3700 MHz ~ 3820 MHz : 25 dB min.

7. Section 2.983 (d)(12). Description of modulation system used

The Tri-Mode(PCS/CDMA/AMPS&GPS) phone model: uses digital signal processing. To design the digital signal processing, VIA CDMA Base Band Process(CBP)4.0 integrates functions of a CDMA processing, a digital FM(DFM) processing, Vocoder, Codec, RF interface, and ARM microprocessor. CDMA subsystem in the CBP4.0 performs CDMA signal processing about CDMA modulation/demodulation, viterbi coding/decoding, interleaving/deinterleaving, and etc.

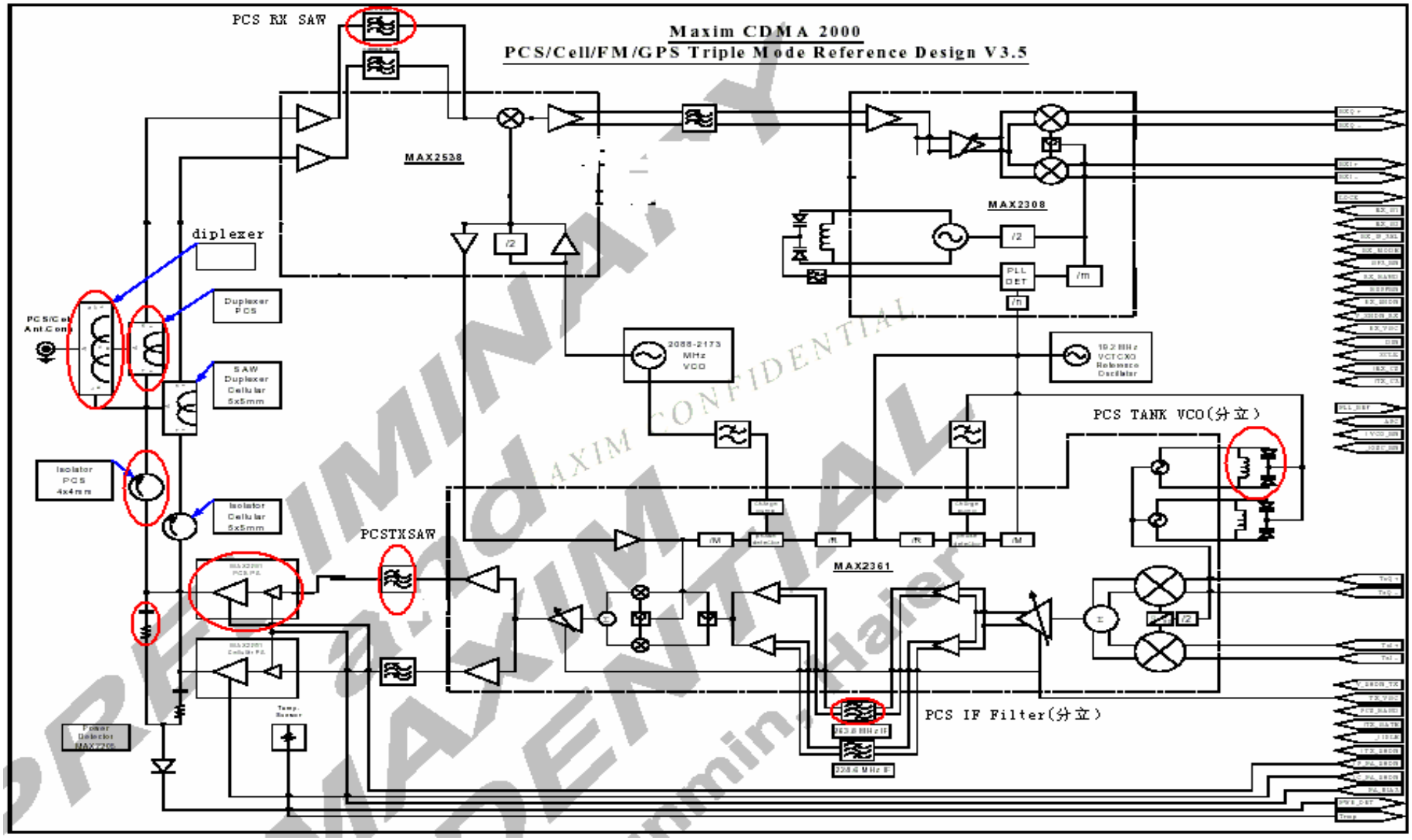
The internal CODEC of CBP4.0 interfaces directly with the microphone and ear piece, converting analog audio signals from the microphone into digital(PCM samples) for the Vocoder. The CODEC also converts digital audio data from the Vocoder into analog audio for the earpiece. The internal Vocoder of CBP4.0 converts digital PCM samples from the CODEC into compressed packets for transmission in CDMA mode.

Figure 3-1. CBP4.0 Functional Block Diagram



The modulator performs the orthogonal modulation, long code PN spreading and quadrature

spreading. The resulting data stream is then band limited with FIR filters and sent to the analog base band processor.



The base band quadrature signals are upconverted to cellular frequency bands and amplified to provide signal drive capability to the PA. The Max2361 includes an IF mixer for upconverting analog base band to IF , a programmable PLL for generating Tx IF frequency, signal sideband upconversion from IF

to RF. Then the CX777105 amplifies the transmitted power. Max2361 operating modes are controlled by the CBP4.0 through 3W-bus and include selective power-down, gain control, and punctured CDMA transmission(gated Tx power), for optimal power savings and talk-time improvement.