CDMA PORTABLE CELLULAR PHONE

MX510

SERVICE MANUAL

Dual-band CDMA w/GPS
[PCS/Cellular CDMA/GPS]
CDMA Mobile Phone

CONTENTS

CHAPTER 1. System Introduction

1. Specification

1.1 General Specification

1.1.1 Transmit/Receive Frequency Interval

1) CELLULAR : 70MHz

2) PCS : 140 MHz

1.1.2 Number of Channels (Channel Bandwidth)

1) CELLULAR : 20 Channels

2) PCS : 48 Channels

1.1.3 Operating Voltage : DC 3.2~4.1V

1.1.4 Battery Power Consumption : DC 3.7V

	SLEEP	IDLE	MAX POWER
CELLULAR	1.5 mA	110 ~ 120mA	600 mA (24 dBm)
PCS	1.5 mA	120 ~ 130 mA	600 mA (24 dBm)

1.1.5 Operating Temperature : -30°C ~ +60°C

1.1.6 Frequency Stability

1) CDMA : ±0.5PPM

2) PCS : ±0.1PPM

1.1.7 Antenna : Fixed Type, 50 Ω

1.1.8 Size and Weight

1) Size : 91(H) * 49(W) * 26.4(D) mm

2) Weight : 110 g (Approximately with standard battery)

1.1.9 Channel Spacing

1) CELLULAR : 1.25MHz

2) PCS : 1.25 MHz

1.1.10 Battery Type, Capacity and Operating Time.

Unit = Hours : Minutes

	Standard (1000mAh)	
Standby Time	CELLULAR	About 110 Hours (SCI=1, Rx Power –75dBm)
	PCS	About 110 Hours (SCI=1, Rx Power –75dBm)
Talk time	CELLULAR	160 Minutes (Rx Power –92dBm)
	PCS	160 Minutes (Rx Power –92dBm)

1.2 Receive Specification

1.2.1 Frequency Range

1) CELLULAR : 869 MHz ~ 894 MHz
2) PCS : 1930 MHz ~ 1990 MHz
3) GPS : 1575.42 MHz

1.2.2 Local Oscillating Frequency Range :

1) CELLULAR : 1738.08 MHz ~ 1787.94 MHz
2) PCS : 1715.56 MHz ~ 1768.89 MHz
3) GPS : 3150.84 MHz

1.2.3 Sensitivity

1) CELLULAR : -104 dBm (C/N 12dB or more)
2) PCS : -104 dBm (C/N 12dB or more)
3) GPS : -148.5 dBm (w/o SA), -152 dBm (w/SA)

1.2.4 Selectivity

1) CELLULAR : 3dB C/N Degration (With Fch ± 1.25 KHz : -30dBm)
2) PCS : 3dB C/N Degration (With Fch ± 1.25 KHz : -30dBm)

1.2.5 Interference Rejection

1) Single Tone : -30dBm at 900 kHz (CELLULAR), -30dBm at 1.25MHz(PCS)
2) Two Tone : -43dBm at 900 kHz & 1700kHz(CELLULAR), -43dBm at 1.25 MHz & 2.05 MHz

1.2.6 Spurious Wave Suppression : Maximum of -80dB

1.2.7 CDMA Input Signal Range

- Dynamic area of more than -104~ -25 dB: 79dB at the 1.23MHz band.
- Transmit Band : below –60dBm
- Receive Band : below –80dBm

1.3 Transmit Specification

1.3.1 Frequency Range

1) CELLULAR : 824MHz ~ 849MHz

2) PCS : 1850 MHz ~ 1910 MHz

1.3.2 Output Power

1) CELLULAR : 0.224 W

2) PCS: 0.224 W

1.3.3 CDMA TX Frequency Deviation :

1) CELLULAR: +300Hz or less

2) PCS: ± 150Hz

1.3.4 CDMA TX Conducted Spurious Emissions

1) CELLULAR : 900kHz : - 42 dBc/30kHz below
1.98MHz : - 54 dBc/30kHz below

2) PCS : -42 dBc / 30KHz below

1.3.5 CDMA Minimum TX Power Control

1) CELLULAR : - 50dBm below

2) PCS: -50dBm below

1.4 MS (Mobile Station) Transmitter Frequency

1.4.1 CELLULAR mode

Ch #	Center Freq. (MHz)	Ch #	Center Freq. (MHz)
1011	824.640	404	837.120
29	825.870	445	838.350
70	827.100	486	839.580
111	828.330	527	840.810
152	829.560	568	842.040
193	830.790	609	843.270
234	832.020	650	844.500
275	833.250	697	845.910
316	834.480	738	847.140
363	835.890	779	848.370

1.4.2 PCS mode

Ch #	Center Freq (MHz)	Ch #	Center Freq (MHz)	Ch #	Center Freq (MHz)
25	1851.25	425	1871.25	825	1891.25
50	1852.50	450	1872.50	850	1892.50
75	1853.75	475	1873.75	875	1893.75
100	1855.00	500	1875.00	900	1895.00
125	1856.25	525	1876.25	925	1896.25
150	1857.50	550	1877.50	950	1897.50
175	1858.75	575	1878.75	975	1898.75
200	1860.00	600	1880.00	1000	1900.00
225	1861.25	625	1881.25	1025	1901.25
250	1862.50	650	1882.50	1050	1902.50
275	1863.75	675	1883.75	1075	1903.75
300	1865.00	700	1885.00	1100	1905.00
325	1866.25	725	1886.25	1125	1906.25
350	1867.50	750	1887.50	1150	1907.50
375	1868.75	775	1888.75	1175	1908.75

1.5 MS (Mobile Station) Receiver Frequency

1.5.1 CELLULAR mode

Ch. #	Center Freq. (MHz)	Ch. #	Center Freq. (MHz)
1011	869.640	404	882.120
29	870.870	445	883.350
70	872.100	486	884.580
111	873.330	527	885.810
152	874.560	568	887.040
193	875.790	609	888.270
234	877.020	650	889.500
275	878.250	697	890.910
316	879.480	738	892.140
363	880.890	779	893.370

1.5.2 PCS mode

Ch #	Center Freq (MHz)	Ch #	Center Freq (MHz)	Ch #	Center Freq (MHz)
25	1931.25	425	1951.25	825	1971.25
50	1932.50	450	1952.50	850	1972.50
75	1933.75	475	1953.75	875	1973.75
100	1935.00	500	1955.00	900	1975.00
125	1936.25	525	1956.25	925	1976.25
150	1937.50	550	1957.50	950	1977.50
175	1938.75	575	1958.75	975	1978.75
200	1940.00	600	1960.00	1000	1980.00
225	1941.25	625	1961.25	1025	1981.25
250	1942.50	650	1962.50	1050	1982.50
275	1943.75	675	1963.75	1075	1983.75
300	1945.00	700	1965.00	1100	1985.00
325	1946.25	725	1966.25	1125	1986.25
350	1947.50	750	1967.50	1150	1987.50
375	1948.75	775	1968.75	1175	1988.75

1.5.3 GPS mode

- Center Freq. : 1575.42MHz

1.6 AC Adapter : See Appendix

1.7 Cigarret Lighter Adapter : See Appendix

1.8 Portable Hands-Free Kit : See Appendix

2. Installation

2.1 Installing a Battery Pack

1) The Battery pack is keyed so it can only fit one way. Align the groove in the battery pack with the rail on the back of the phone until the battery pack rests flush with the back of the phone.
2) Slide the battery pack forward until you hear a “click”, which locks the battery in place.

2.2 For Adapter Use

1) Plug the adapter into a wall outlet. The adapter can be operated from a 110V source. When AC power is connected to the adapter.
2) Insert the adapter jack into the phone with the installed battery pack.
Red light indicates battery is being charged.. Green light indicates battry is fully charged.

2.3 For Mobile Mount

2.3.1 Installation Position

In order to reduce echo sound when using the Hands-Free Kit, make sure that the speaker and microphone are not facing each other and keep microphone a generous distance from the speaker.

2.3.2 Cradle Installation

Choose an appropriate flat surface where the unit will not interface with driver’s movement or passenger’s comfort. The driver/user should be able to access the phone with ease. Using the four self-tapping screws provided, mount the supplied braket on the selected area. Then with the four machine screws provided, mount the counterpart on the reverse side of the reverse side of the cradle. Secure the two brackets firmly together by using the two bracket joint screws provide. The distance between the cradle and the interface box must not exceed the length of the main cable.

2.3.3 Interface Box

Choose an appropriate flat surface (somewhere under the dash on the passenger side is preferred) and mount the IB bracket with the four self-tapping screws provided. Clip the IB into the IB bracket.

2.3.4. Microphone Installation

Install the microphone either by clipping I onto the sunvisor (driver’s side) or by attaching it to door post (driver’s side), using a velcno adhesive tape (not included).

2.3.5 Cable Connections

2.3.5.1 Power and Ignition Cables

Connect the red wire to the car battery positive terminal and the black wire to the car ground. Connect the green wire to the car ignition sensor terminal. (In order to operate HFK please make sure to connect green wire to ignition sensor terminal.) Connect the kit's power cable connector to the interface box power receptacle.

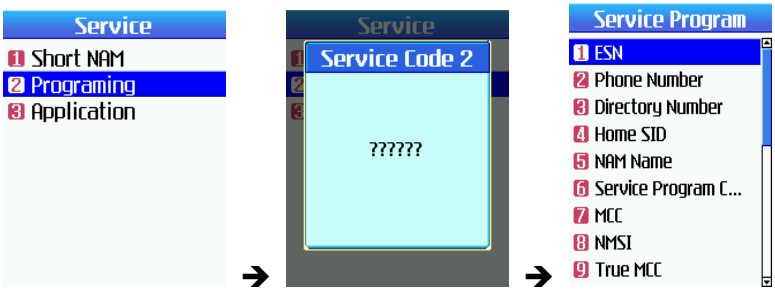
2.3.5.2 Antenna Cable Connection

Connect the antenna coupler cable connector from the cradle to the external antenna connector. (Antenna is not included.)

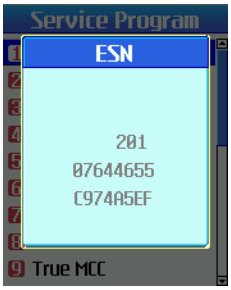
CHAPTER 2. NAM Input Method
(Inputting of telephone numbers included)

1. NAM Program Method and Telephone Number Inputting Method

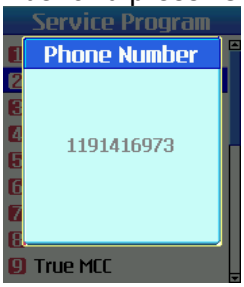
* NAM Programming Method : Enter Menu -> Press # -> Press 0-> password:000000 -> Press 2 ->Password:953047



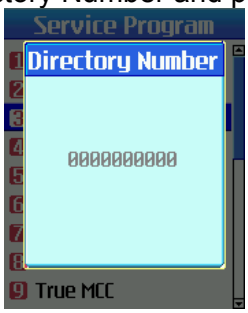
1) .ESN :Check ESN. and press “OK” key.(Read Only)



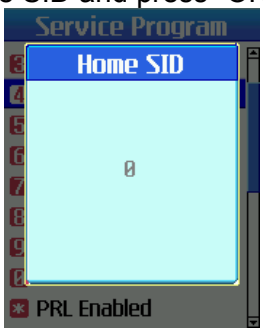
2) Insert the phone number and press “OK” key



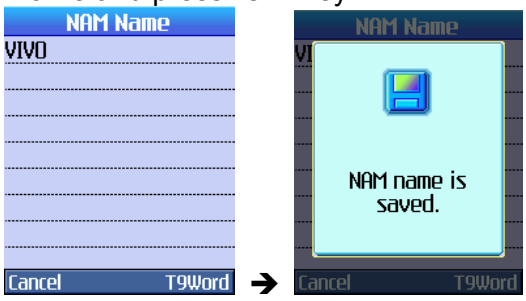
3) Insert the Directory Number and press “OK” key.



4) Insert the Home SID and press “OK” key.

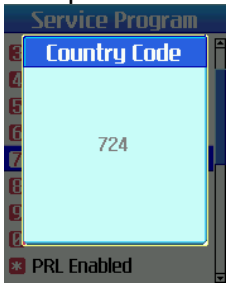


5) Insert the NAM Name and press “OK” key.



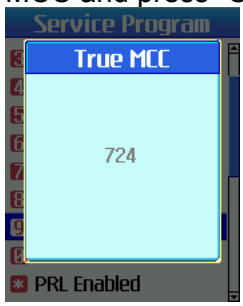
6) Insert the SPC 1 and SPC 2 and press “OK” key.

7) Insert the MCC and press “OK” key.



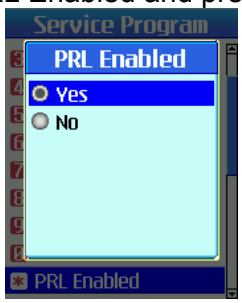
8) Insert the NMSI and press “OK” key.

9) Insert the True MCC and press “OK ”key.

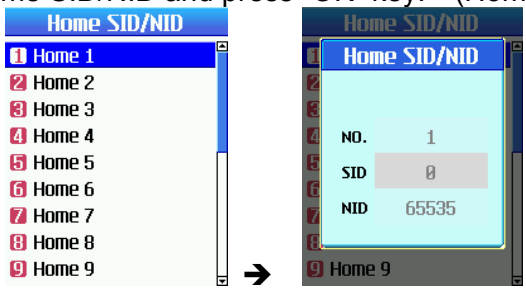


10) Insert the True IMSI NMSI and press “OK ”key.

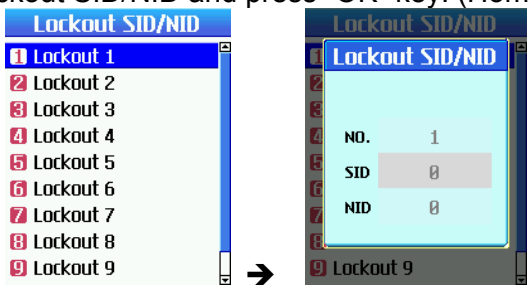
11) Check the PRL Enabled and press “OK ”key.



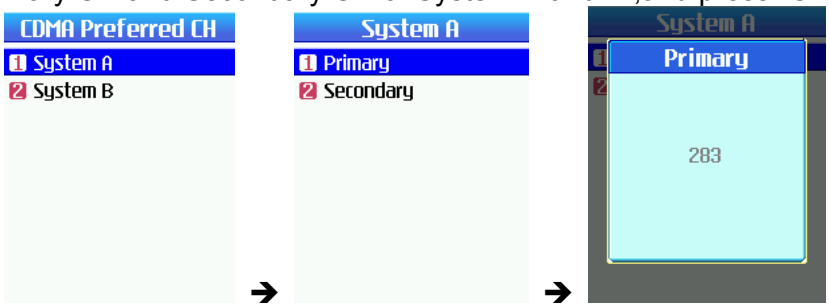
12) Check the Home SID/NID and press “OK ”key. (Home SID/MID from 1 till 20.)



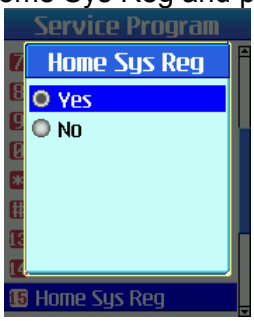
13) Check the Lockout SID/NID and press “OK ”key. (Home SID/MID from 1 till 10.)



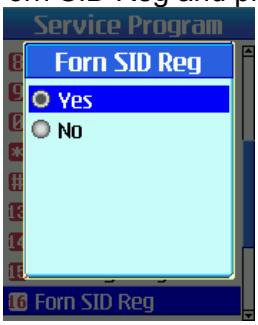
14) Insert the Primary CH and Secondary CH of System A and B ,and press “OK ”key.



15) Check the Home Sys Reg and press “OK ”key.

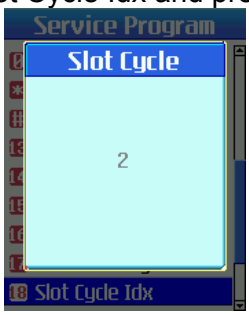


16) Check the Forn SID Reg and press “OK ”key.



17) Check the Forn NID Reg and press “OK ”key.

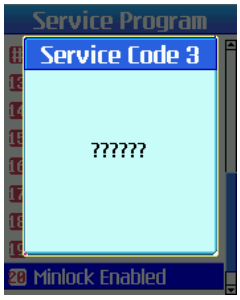
18) Insert the Slot Cycle Idx and press “OK ”key.



19) Confirm the Acc Ovld Class and press “OK ”key.

20) Check the Minlock Enabled and press “OK ”key.

Service Code 3 password ; Last 2 byte of ESN Hex change Decimal. Password input 6 number After Decimal.



21) Insert the AAN Password (Only 16 number) and press “OK” key.

22) Press “End” key or “Clr” key then the phone will restart.

CHAPTER 3. Circuit Description

1. RF Transmit/Receive Part

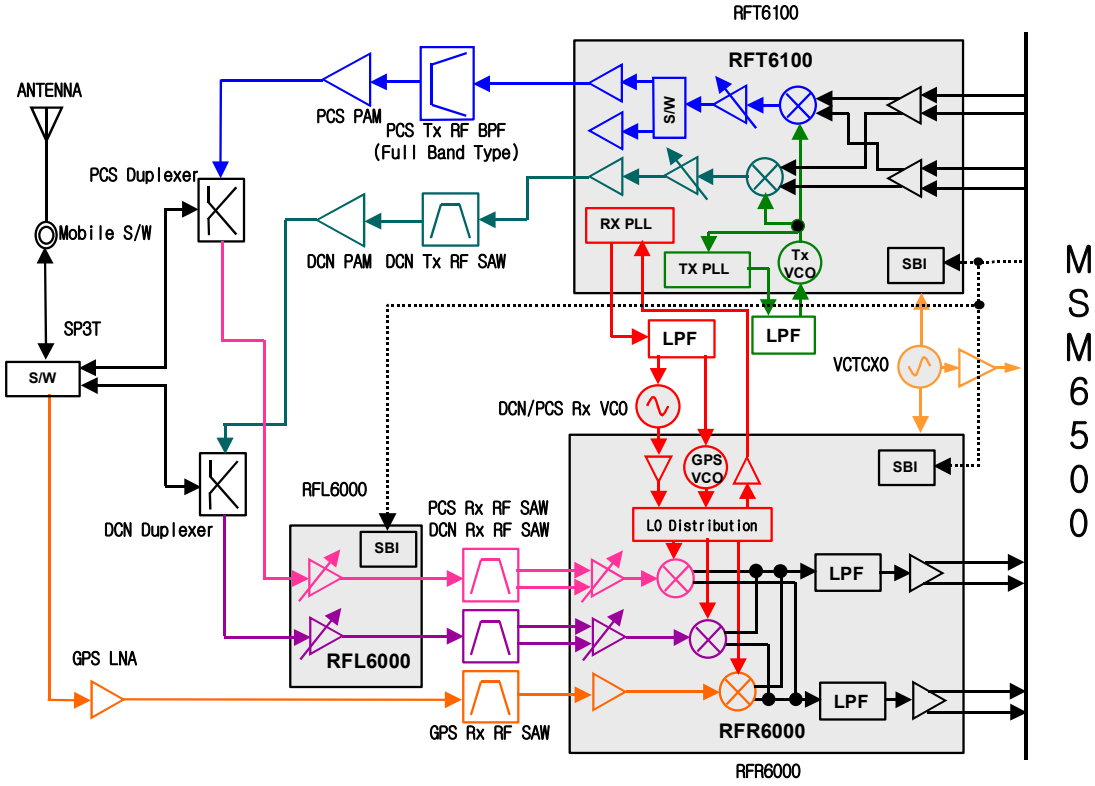
1.1 Overview

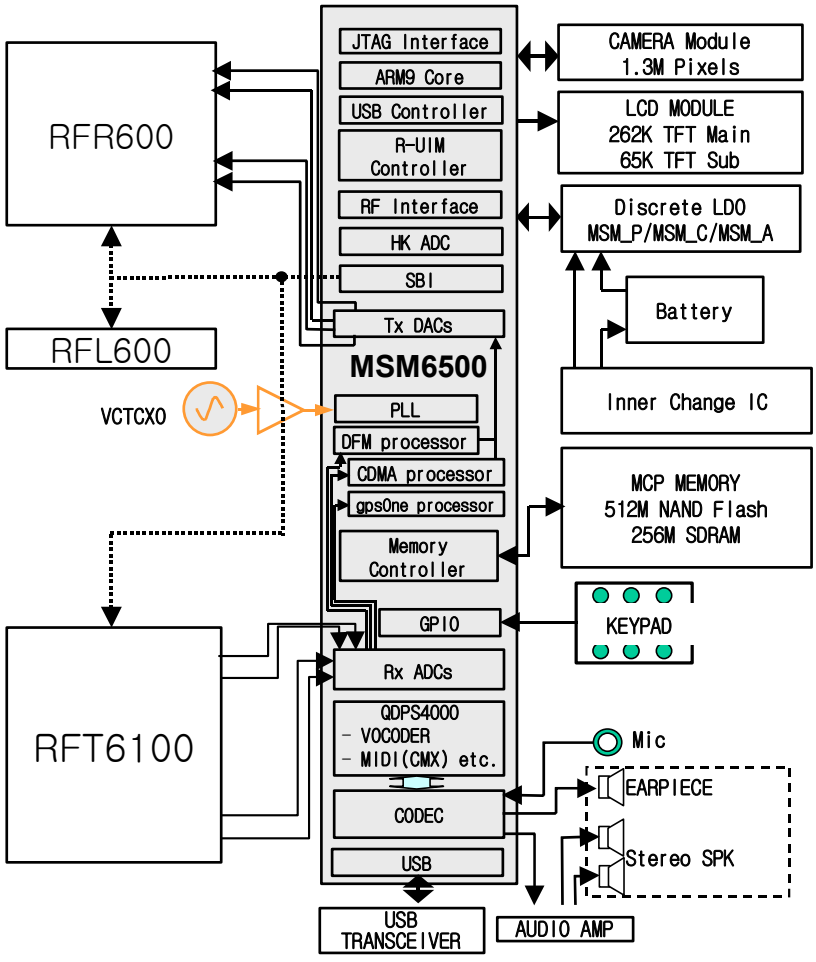
The Tx and Rx part employs the Direct-Conversion system. The Tx and Rx frequencies are respectively 824.04~848.97 and 869.04~893.97 for cellular and 1850~1910 and 1930~1990 for PCS. The block diagram is shown in [Figure 1-1]. RF signals received through the antenna are seperated by the SP3T switch.

RF Signal fed into the low noise amplifier (LNA) through the duplexer. Then, they are fed into RFR6000. In RFR6000, the IF signal is changed into baseband signal directly. Then, this signal is changed into digital signal by the analog to digital converter (ADC, A/D Converter), and the digital circuit part of the MSM(Mobile Station Modem) 6500 processes the data from ADC. The digital processing part is a demodulator.

In the case of transmission, RFT6100 receives OQPSK-modulated anlaog signal from the MSM6500. The RFT6100 connects directly with MSM6500 using an analog baseband interface. In RFT6100, the baseband quadrature signals are upconverted to the Cellular or PCS frequency bands and amplified to provide signal drive capability to the power amp.

After that, the RF signal is amplified by the Power Amp in order to have enough power for radiation. Finally, the RF signal is sent out to the cell site via the antenna after going through the duplexer.


RFT6100
RFT6100
ANTENNA
PCS PAM
PCS Tx RF BPF
(Full Band Type)
PCS Duplexer
Mobile S/W
DCN PAM
DCN Tx RF SAW
SP3T
S/W
RX PLL
TX PLL
Tx VCO
SBI
LPF
LPF
VCTCXO
DCN/PCS Rx VCO
GPS VCO
LO Distribution
RFL6000
PCS Rx RF SAW
DCN Rx RF SAW
DCN Duplexer
SBI
LPF
GPS LNA
RFL6000
LPF
GPS Rx RF SAW
RFR6000
RFR6000
MSM6500


RFR600
RFL600
VCTCXO
RFT6100
JTAG Interface
ARM9 Core
USB Controller
R-UIM Controller
RF Interface
HK ADC
SBI
Tx DACs
MSM6500
PLL
DFM processor
CDMA processor
gpsOne processor
Memory Controller
GPIO
Rx ADCs
QDPS4000
- VOCODER
- MIDI(CMX) etc.
CODEC
USB
USB TRANSCEIVER
AUDIO AMP
CAMERA Module
1.3M Pixels
LCD MODULE
262K TFT Main
65K TFT Sub
Discrete LDO
MSM_P/MSM_C/MSM_A
Battery
Inner Change IC
MCP MEMORY
512M NAND Flash
256M SDRAM
KEYPAD
Mic
EARPIECE
Stereo SPK

[Figure 1-1] Block Diagram Of MX510

1.2 Description of Receive Part Circuit

1.2.1 SP3T RF switch (U101)

The main function of SP3T switch is to prohibit the other band signals from flowing into the one band circuit and vice versa. RF designer can use common tri-band antenna regardless of frequency band (800, 1575 and 1900 MHz). The specification of MX510 SP3T switch is described below:

	Cellular	GPS	PCS
Frequency Range	824 – 894 MHz	1575.42 MHz	1850 – 1990 MHz
Insertion Loss to Common	0.5 dB Max (at +25 deg)	0.75 dB Max. (at +25 deg)	0.5 dB Max (at +25 deg)
Isolation	25 dB Min.		
Return Loss	20 dB Min.		
Power Capacity	35 dBm Max.		
Temperature Range	-40 to +85 deg		

1.2.2 Duplexers (DP100, DP101)

The duplexer consists of the Rx bandpass filter (BPF) and the Tx BPF which has the function of separating Tx and Rx signals in the full duplex system for using the common antenna. The Tx part BPF is used to suppress noises and spurious out of the Tx frequency band. The Rx BPF is used to receive only Rx signal coming from the antenna, which is usually called preselector. It's main function is to limit the bandwidth of spectrum reaching the LNA and mixer, attenuate receiver spurious response and suppress local oscillator energy. As a result frequency sensitivity and selectivity of mobile phone increase. The specification of MX510 duplexer described below ;

- PCS duplexer

	Tx	Rx	Tx to Rx (min)
Pass Band	1850~1910 MHz	1930~1990 MHz	
Insertion Loss	3.0 dB max	3.0 dB max	
Return Loss	8.0 dB min	8.0dB min	
Attenuation	40 dB min (1930~1990MHz)	50dB min (1850~1910MHz)	50 dB (1850~1910MHz) 40 dB (1930~1990MHz)

- Cellular duplexer

	Tx	Rx	Tx to Rx (min)
Pass Band	824~849MHz	869~894 MHz	
Insertion Loss	2.5 dB max	3.5 dB max	
VSWR	2.4 max	2.2 max	
Attenuation	40 dB min (869~894MHz)	50 dB min (824~849MHz)	55 dB (824~849MHz) 43 dB (869~894MHz)

1.2.3 LNAs (U104)

The RFL6000 has cellular and PCS LNAs, respectively. The characteristics of Low Noise Amplifier (LNA) are low noise figure, high gain, high intercept point and high reverse isolation. The frequency selectivity characteristic of mobile phone is mostly determined by LNA.

The specification of MX510 LNAs are described below:

Parameter	**Low gain**		**Middle gain**		**High gain**		**Units**
	Cellular	**PCS**	**Cellular**	**PCS**	**Cellular**	**PCS**	
Gain	-19	-20	-2	-9	15.5	16	dB
Noise Figure	19	20	2	9	1.4	1.6	dB
Input IP3	25	25	20	20	6	8	dBm

1.2.4 Down-converter Mixers(RFR600 : U108)

The RFR6000 device performs signal down-conversion for Cellular, PCS and GPS tri-band applications. It contains all the circuitry (with the exception of external filters) needed to support conversion of received RF signals to baseband signals. The three downconverting Mixers (Cellular, PCS and GPS), and an LO Buffer Amplifier to buffer the RF VCO to the RF Transmit Upconverter. The GPS LNA & mixers offer the most advanced and integrated CDMA Rx solution designed to meet cascaded Noise Figure (NF) and Third-order Intercept Point (IIP3) requirements of IS-98C and J-STD-018 specifications for Sensitivity, Two-Tone Intermodulation, and Single-tone Desense.

Operation modes and band selection are specially controlled from the Mobile Station Modem MSM6500.

The specification of MX510 Mixers are described below:

Parameter	**Low gain**		**High gain**		**Units**
	Cellular	**PCS**	**Cellular**	**PCS**	
Noise Figure	27	27	11	11	dB

Input IP3	4	3	4	3	dBm
Input IP2	50	50	75	70	dBm

1.2.5 GPS LAN(Q100)

The characteristics of Low Noise Amplifier (LNA) are low noise figure, high gain, high intercept point and high reverse isolation. The frequency selectivity characteristic of mobile phone is mostly determined by LNA.

The specification of MX510 GPS LNA is described below

Parameter	GPS Band	Units
Gain	17.7	dB
Noise Figure	0.6	dB
1dB compression point	14.4	dBm
IIP3	6.5	dBm

1.2.6 Rx RF SAW FILTER(F100, F101, F104)

The main function of Rx RF SAW filter is to attenuate mobile phone spurious frequency, attenuate noise amplified by the LNA and suppress second harmonic originating in the LNA.

1.3 Description of Transmit Part Circuit

1.3.1 RFT6100 (U109)

The RFT6100 baseband-to-RF Transmit Processor performs all Tx signal-processing functions required between digital baseband and the Power Amplifier Modulator (PAM). The baseband quadrature signals are upconverted to the Cellular or PCS frequency bands and amplified to provide signal drive capability to the PAM. The RFT6100 includes an mixers for up-converting analog baseband to RF, a programmable PLL for generating Tx and Rx LO frequency, cellular and PCS driver amplifiers and Tx power control through an 85 dB VGA. As added benefit, the single sideband upconversion eliminates the need for a band pass filter normally required between the upconverter and driver amplifier.

I, I/, Q and Q/ signals proceed from the MSM6500 to RFT6100 are analog signal. In CDMA mode, These signals are modulated by Offset Quadrature Phase Shift King (OQPSK). I and Q are 90 deg. out of phase, and I and I/ are 180 deg. The mixers in RFT6100 converts baseband signals into RF signals. After passing through the upconverters, RF signal is inputted into the Power AMP.

- RFT6100 Cellular and PCS CDMA RF Specifications

Parame	**Condition**	**Min.**	**Typ.**	**Max.**	**Units**

Rated Output Power	Average CDMA Cellular Average CDMA PCS		8 10		dBm dBm
Min Output Power	Average CDMA Cellular Average CDMA PCS		-80 -78		dBm dBm
Rx band noise power	CDMA Cellular CDMA PCS		-133 -132		dBm/Hz
ACPR	Cellular: Fc±885kHz PCS: Fc±1.25MHz		-56 -56		dBc/ 30kHz

1.3.2 Power Amplifier(U105, U106)

The power amplifier that can be used in the PCS and CDMA mode has linear amplification capability and high efficiency. For higher efficiency, it is made up of one MMIC (Monolithic Microwave Integrated Circuit) for which RF input terminal and internal interface circuit are integrated onto one IC after going through the AlGaAs/GaAs HBT (heterojunction bipolar transistor) process. The module of power amplifier is made up of an output end interface circuit including this MMIC. The maximum power that can be inputted through the input terminal is +17dBm and conversion gain is about 28dB. RF transmit signals that have been amplified through the power amplifier are sent to the duplexer.

1.4 Description of Frequency Synthesizer Circuit

1.4.1 Voltage Control Temperature Compensation Crystal Oscillator (VCTCXO, X100)

The temperature variation of mobile phone can be compensated by VCTCXO. The reference frequency of a mobile phone is 19.2 MHz. The receiver frequency tuning signals called TRK_LO_ADJ from MSM as 0.5 V~2.5 V DC via R and C filter in order to generate the reference frequency of 19.2 MHz and input it into the frequency synthesizer. Frequency stability depending on temperature is ±2.0 ppm.

1.4.2 Voltage Controlled Oscillator (VCO, U107)

The external VCO signal is processed by the LO generation and distribution circuits in RFR6000 to create the PCS and Cellular quadrature downconverter's LO signals. Likewise, the internal VCO signal of RFR6000 is processed to create the GPS quadrature downconverter's LO signal. In all cases, the LO signals applied at the mixer ports are at the frequency different than the VCO frequency. This assures that the VCO frequency is different than the RF frequency, an important consideration for Zero-IF processing. The VCO frequency used are 1715.56~1768.89 MHz for PCS and 1738.08~1787.94 MHz for cellular and they are produced in single voltage controlled oscillator of U109.

2. Digital/Voice Processing Part

2.1 Overview

The digital/voice processing part processes the user's commands and processes all the digital and voice signal processing in order to operate in the phone. The digital/voice processing part is made up of a keypad/LCD, receptacle part, voice processing part, mobile station modem part, memory part, and power supply part.

2.2 Configuration

2.2.1 Keypad/LCD and Receptacle Part

This is used to transmit keypad signals to MSM6500. It is made up of a keypad backlight part that illuminates the keypad, LCD part that displays the operation status onto the screen, and a receptacle that receives and sends out voice and data with external sources.

2.2.2 Voice Processing Part

The voice processing part is made up of an audio codec used to convert MIC signals into digital voice signals and digital voice signals into analog voice signals, amplifying part for amplifying the voice signals and sending them to the ear piece, amplifying part that amplifies ringer signals coming out from MSM6500, and amplifying part that amplifies signals coming out from MIC and transferring them to the audio processor.

2.2.3 MSM (Mobile Station Modem) 6500 Part

MSM is the core elements of CDMA terminal and carries out the functions of CPU, encoder, interleaver, deinterleaver, Viterbi decoder, Mod/Demod, and vocoder.

2.2.4 Memory Part

The memory part is made up of a flash memory, SRAM for storing data. Our memory is consist of 512 NAND flahs memory and 256 SRAM.

2.2.5 Power Supply Part

The power supply part is made up of circuits for generating various types of power, used for the digital/voice processing part.

2.3 Circuit Description

2.3.1 Keypad/LCD and Receptacle Part

Once the keypad is pressed, the key signals are sent out to MSM6500 for processing. In addition, when the key is pressed, the keypad/LCD lights up through the use of 16 LEDs. The terminal status and operation are displayed on the screen for the user with the characters and icons on the LCD.

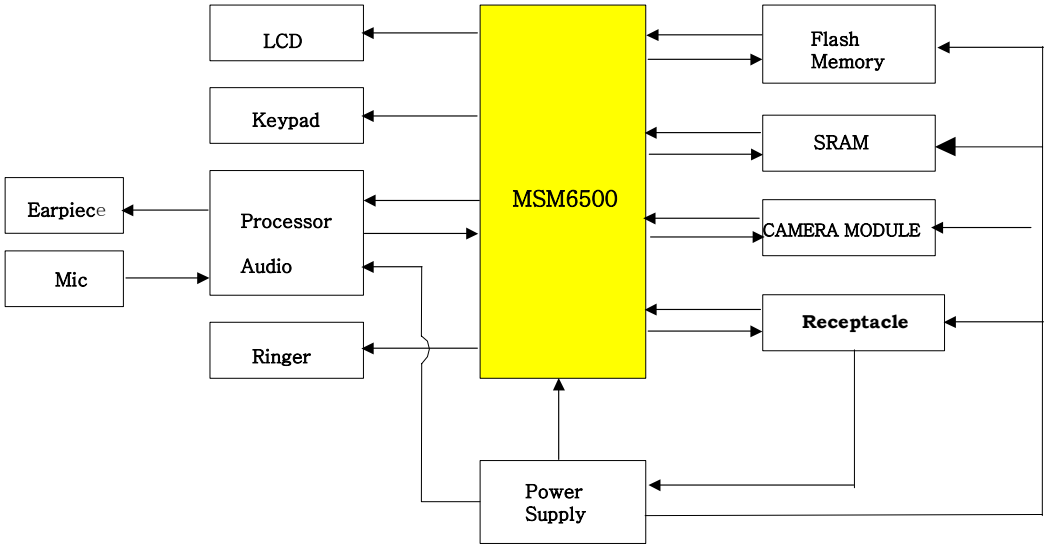
Moreover, it exchanges audio signals and data with external sources through the receptacle, and then receives power from the battery or external batteries.

2.3.2 Audio Processing Part

MIC signals are amplified through OP AMP, inputted into the audio codec(included in MSM6500) and converted into digital signals. Oppositely, digital audio signals are converted into analog signals after going through the audio codec. These signals are amplified at the audio amplifier and transmitted to the ear-piece. The signals from MSM6500 activate the ringer by using signals generated in the timer in MSM6500.

2.3.3 MSM Part

MSM6500 is the core element of CDMA system terminal that includes ARM926EJ-S microprocessor core. It supports both CDMA and Digital FM, operating in both the cellular and PCS spectrums. The subsystems within the MSM6500 include a CDMA processor, a DFM processor, a multi-standard Vocoder, an integrated CODEC with earpiece and microphone amplifiers, general-purpose ADC for subsystem monitoring, an ARM926EJ-S microprocessor, and both Universal Serial Bus(USB) and an RS-232 serial interfaces supporting forward and reverse link data communications of 307.2 Kbps simultaneously. And it also contains complete digital modulation and demodulation systems for CDMA standards, as specified in IS-95-A/B/C. In MSM, coded symbols are interleaved in order to cope with multi-path fading. Each data channel is scrambled by the long code PN sequence of the user in order to ensure the confidentiality of calls. Moreover, binary quadrature codes are used based on walsh functions in order to discern each channel. Data created thus are 4-phase modulated by one pair of Pilot PN code and they are used to create I and Q data. When received, I and Q data are demodulated into symbols by the demodulator, and then de-interleaved in reverse to the case of transmission. Then, the errors of data received from viterbi decoder are detected and corrected. They are voice-decoded at the vocoder in order to output digital voice data.



[Figure 2-2] Block Diagram of Digital/Voice Processing Part

2.3.4 Memory Part

MCP contents 512 Gbits flash memory and 256 Mbits Static RAM. In the Flash Memory part of MCP are programs used for terminal operation. The programs can be changed through down loading after the assembling of terminals. On the SRAM data generated during the terminal operation are stored temporarily.

2.3.5 Power Supply Part

When the battery voltage (+3.7V) is fed and the PWR key of keypad is pressed, the power-up circuitry in Power on & off part is activated by the PWR_ON_SW signal, and then the LDO regulators for MSM are operated and +1.375V_MSMC, +1.8V_MSMP1,+2.6V_MSMP2, and +2.6V_MSMA are generated.

The Rx part regulator (+2.9V_RX) is operated by the control signal of SLEEP/ from MSM6500

The Tx part regulator (+2.85V_TX) is operated by the control signal of IDLE/ from MSM6500.

The Camera part regulators(+1.8V_CAMERA,+2.8V_CAMERA) are operated by the control signal of CAMERA_EN/from MSM6500

2.3.6 Logic Part

The logic part consists of internal CPU of MSM, RAM(MCP). The MSM6500 receives TCXO (=19.2MHz) from U104 and controls the phone in both CDMA and FM modes. The major components are as follows:

- **CPU**

The ARM926EJ-S microprocessor includes a 3 stage pipelined RISC architecture, both 32-bit ARM and 16-bit THUMB instruction sets, a 32-bit address bus, and a 32-bit internal data bus. It has a high performance and low power consumption.

- **MCP**

Flash ROM is used to store the terminal's program. Using the down-loading program, the program can be changed even after the terminal is fully assembled.

SRAM is used to store the internal flag information, call processing data, and timer data.

- **KEYPAD**

For key recognition, key matrix is setup using KYPD[1][3][5][7][9][11][13][15][17][19][21] signal from MSM. 16 LEDs and backlight circuitry are included in the keypad for easy operation in the dark.

- **LCD MODULE**

LCD module contains a controller which will display the information onto the LCD by 16-bit data from the MSM6500. It is also supplied stable 2.8V_LCD from U609 for fine view angle and LCD reflects to improve the display efficiency. 4 LEDs are used to display LCD backlight.

CHAPTER 4. Trouble Shooting