Descriptive Information

Subsection	**Description**		
2. 983 (a)	Applicant	:	LG Electronics Inc. 459-9, Kasan-dong, Keumchun-ku, Seoul 153-023, Korea
	Manufacturer	:	LG Electronics Inc. 459-9, Kasan-dong, Keumchun-ku, Seoul 153-023, Korea
2. 983 (b)	FCC ID	:	**BEJDB520**
2. 983 (c)	Quantity	:	Quantity production is planned.
2. 983 (d)	Technical Description		
2. 983 (d) (1)	Emission Type		
2. 983 (d) (2)	Frequency Range:		

- In AMPS mode

Rx : 869.04 ~ 893.97 MHz
Tx : 824.04 ~ 848.97 MHz

- In PCS mode

Rx : 1931.250 ~ 1988.750 MHz
Tx : 1851.250 ~ 1908.750 MHz

2. 983 (d) (3) Range of Operating Power

In PCS mode:

- Range of Open Loop Output Power :

Open loop average output power of Mobile Station is estimated from the average input power. The estimation value is as below:

Average Output Power(dBm) = - Mean Input Power (dBm)

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+ **NOM_PWR(dB)**
+ **INIT_PWR(dB)**

- Range of Closed Loop Power Control :

Range of closed loop power control should be at least within -50dBm ~ **+23dBm**.

Range of maximum power output should be in the range of **+23dBm** ~ **+26dBm**

Maximum power is recommended from manufacturer of Mobile Station and this means the output power which expresses the maximum permissible ERP per every grade of Mobile Station using antenna gain.

Range of Operating Power (in AMPS mode):

+4.0 dBm to +27.0dBm with the capability of reducing the maximum power in five steps of 4dB each on command from a Land station.

Each power level is maintained within **+2/-4dB** of its normal level over

The temperature range of -30 to **+60** degrees **cetigrade** and **+17/-**17% change of the Battery voltage.

2. 983 (d) (4) Maximum Power Rating :

- **In AMPS mode :0.482 W (=26.827dBm**
- **In PCS mode : 0.378 W(=25.778dBm)**

2. 983 (d) (5) DC Voltage and Current into the final radio frequency amplifying device :

Supply Voltage : 3.4~5.0VDC(max 1500mA)

2. 983 (d) (6) Function of Active Devices:

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Ref. No	Function	Part No
1. Baseband Circuit		
U651	MCP Memory (32M Flash/4M SRAM)	28F3204C3
U600	Mobile station modem IC (MSM3100)	MSM3100
	Ringer Enable	
U770	LDO	SC1453ISK-2.8
U787	LDO	TK71627AS
U781	LDO	MIC5219BM5-3.0
•••••••••	Inverter	TC7SH04FU
U771	Reset IC	MAX6809-REUR-T
Q662	AUX_PCM_DIN Enable	2SC4617
Q791, Q792	Sensing Switch	DTC114EE
U6	Hall Sensor	A3210ELH
U	Switching Tr	
Q780	LED Switching Tr	2SC4617
2. Tx RF & IF		
U551	•••• • •• •••• ••••••••••• •••••• ••••	•••••••
U501	•••• • •• •••••••• ••• •••• •••••••• •••••	•••••••
3. PLL Synthesizer		
U490	Reference clock (19.68MHz)	••••••• ••••••••••• ••
U403	**Phase lock loop IC**	**LMX2336**
U401	**VCO for dual band RF frequency**	VC-3R0A23-0967/1750
4. RF Power Amplifier		
U302	RF Power Amp. Module (AMPS)	••••••••
U351	RF Power Amp. Module (PCS)	•••••••
Q460,Q470	Switching FET.(AMPS)	SI305DL
Q461, Q471	Switching FET.(PCS)	SI305DL
Q330	Switching Tr	UMC4N
Q352	Switching Tr	DTC114EE

2. 983 (d) (7) Circuit Diagram & Block Diagram
* Refer to additional file *

2. 983 (d) (8) Operating Instruction Book
* Refer to additional file *

2. 983 (d) (10) Description of Frequency Stabilization Circuits :

Frequency stabilization is achieved with the Temperature Compensated Crystal Oscillator (TCXO). Temperature Stabilization of the crystal is accomplished by Capacitor and Thermistor Network. The oscillator's frequency is maintained within • 2ppm specified.

Frequency trimming is provided by a variable Capacitor and a Varactor Diode controlled by an D/A Converter which is inside of IFR3000 and RFT3100.
A schematic diagram of the TCXO is attached
The operating frequencies of the transmitter are determined by the Voltage Controlled Oscillator (VCO).
The Phase of the Signal (with divided frequency derived from the VCO) is phase locked to the 10KHz signal derived from the High Stability Oscillator (known as the Reference Oscillator).
A schematic diagram of the VCO is attached.

2. 983 (d) (11) Description of Circuits for Suppression of spurious radiation, for Limiting modulation, and for Limiting power :

Means for Suppression of Spurious Radiation :
Spurious and Harmonic Suppression is obtained by proper shielding techniques, and the use of filters such as duplex filter and UHF filter.

Means of Limiting Modulation :
This transmitter is equipped with a device which automatically prevents Modulation in excess of 100%. This device, and instantaneous deviation control circuit, precedes the modulator of the transmitter. It is instantaneous in action for controlling the modulation wave introduced into the transmitter's frequency modulator. The modulation limiter is incorporated in the RFT3100.

Means for Limiting Power :
Power limiting is obtained via the Automatic Power Control (APC) Circuit.

2. 983 (d) (12) Not Applicable

Features of LG-DB520

1. Wave Type

- **AMPS** : F3E/F9X
- **PCS** : G7W

2. Frequency Scope

Transmit Frequency (MHz)		Receive Frequency (MHz)	
AMPS	PCS	AMPS	PCS
824.04 ~ 848.97	1850~1910	869.04-893.97	1930-1990

3. Rated Output Power : **AMPS = 0.482W**
PCS = 0.378W

4. Output Conversion Method : This is possible by correcting the key board channel.

5. Voltage and Current Value of Termination Part Amplifiir (Catalogue included)

MODE	Part Name	Voltage	Current	Power
AMPS	RM912	3.4V	550mA	0.60W
PCS	RI231 IOU	3.4V	400mA	0.32W

6. Functions of Major Semi-Conductors

Classification	Function
MSM3100-FBGA	Terminal operation control and digital signal processing
FLASH MEMORY & SRAM (28F3204C3)	Flash Memory (32Mbits) Π Storing of terminal operation program SRAM (4Mbits) Π Temporary storing of the data created while busy
IFR3000	Converts IF signal to baseband signal
RFT3100	Converts baseband signal to RF signal

7. **Frequency Stability**

- AMPS : . ±2.5PPM
- PCS : . ±0.1PPM

CDMA Mobile Subscriber Unit
LG-DB210

SERVICE MANUAL

DUAL BAND, DUAL MODE
[PCS/AMPS]
CDMA MOBILE PHONE

Table of Contents

General Introduction

The LG-DB520 phone has been designed to operate on the latest digital mobile communication technology, Code Division Multiple Access (CDMA). This CDMA digital technology has greatly enhanced voice clarity and can provide a variety of advanced features. Currently, CDMA mobile communication technology has been commercially used in Cellular and Personal Communication Service (PCS). The difference between them is the operating frequency spectrum. Cellular uses 800Mhz and PCS uses 1.9Ghz. The LG-DB520 can operate on PCS frequency. Also, LG-DB520 works on Advanced Mobile Phone Service (AMPS). We call it dual-band dual-mode phone. If one of the PCS and AMPS base stations is located nearby, Call fail rate of dual-mode phone is less than single-mode phone.

The CDMA technology adopts DSSS (Direct Sequence Spread Spectrum). This feature of DSSS enables the phone to keep communication from being crossed and to use one frequency channel by multiple users in the same specific area, resulting that it increases the capacity 10 times more compared with that in the analog mode currently used. Soft/Softer Handoff, Hard Handoff, and Dynamic RF power Control technologies are combined into this phone to reduce the call being interrupted in a middle of talking over the phone.

Cellular and PCS CDMA network consists of MSO (Mobile Switching Office), BSC (Base Station Controller), BTS (Base station Transmission System), and MS (Mobile Station). The following table lists some major CDMA Standards.

CDMA Standard	Designator	Description
Basic air interface	TIA/EIA/IS-95-A ANSI J-STD-008	Protocol between MS and BTS for Cellular & AMPS Protocol between MS and BTS for PCS
Network	TIA/EIA/IS-634 TIA/EIA/IS-651 TIA/EIA/IS-41-C TIA/EIA/IS-124	MAS-BS PCSC-RS Intersystem operations Nom-signaling data comm.
Service	TIA/EIA/IS-96-B TIA/EIA/IS-99 TIA/EIA/IS-637 TIA/EIA/IS-657	Speech CODEC Assign data and fax Short message service Packet data
Performance	TIA/EIA/IS-97 TIA/EIA/IS-98 ANSI J-STD-018 ANSI J-STD-019 TIA/EIA/IS-125	Cellular base station Cellular mobile station PCS personal station PCS base station Speech CODEC

* TSB –74: Protocol between an IS-95A system and ANSI J-STD-008

CHAPTER 1. System Introduction

1. System Introduction

1.1 CDMA Abstract

The CDMA mobile communication system has a channel hand-off function that is used for collecting the information on the locations and movements of mobile telephones from the cell site by automatically controlling several cell site through the setup of data transmission routes, and then enabling one switching system to carry out the automatic remote adjustment. This is to maintain continuously the call state through the automatic location confirmation and automatic radio channel conversion when the busy subscriber moves from the service area of one cell site to that of another by using automatic location confirmation and automatic radio channel conversion functions. The call state can be maintained continuously by the information exchange between switching systems when the busy subscriber moves from one cellular system area to the other cellular system area.

In the cellular system, the cell site is a small-sized low output type and utilizes a frequency allocation system that considers mutual interference, in an effort to enable the re-use of corresponding frequency from a cell site separated more than a certain distance. The analog cellular systems are classified further into an AMPS system, E-AMPS System, NMT system, ETACS system, and JTACS system depending on technologies used.

Unlike the time division multiple access (TDMA) or frequency division multiple access (FDMA) used in the band limited environment, the Code Division Multiple Access (CDMA) system which is one of digital cellular systems is a multi-access technology under the interference limited environment. It can process more number of subscribers compared to other systems (TDMA system has the processing capacity three times greater than the existing FDMA system whereas CDMA system, about 12~15 times of that of the existing system).

CDMA system can be explained as follows; TDMA or CDMA can be used to enable each person to talk alternately or provide a separate room for each person when two persons desire to talk with each other at the same time, whereas FDMA can be used to enable one person to talk in soprano, whereas the other in bass (one of the two talkers can carry out synchronization for hearing in case there is a bandpass filter function in the area of the hearer). Another available method is to make two persons to sing in different languages at the same time, space, and frequency when wishing to let the audience hear the singing without being confused. This is the characteristic of CDMA.

On the other hand, when employing the CDMA technology, each signal has a different pseudo-random binary sequence used to spread the spectrum of carrier. A great number of CDMA signals share the same frequency spectrum. In the perspective of frequency area or time area, several CDMA signals are overlapped. Among these types of signals, only desired signal energy is selected and received through the use of pre-determined binary sequence; desired signals can be separated, and then received with the correlator used for recovering the spectrum into its original state. At this time, the spectrums of other signals that have different codes are not recovered into its original state, and appears as the self-interference of the system.

2. Features and Advantages of CDMA Mobile Phone (For AMPS as well)

2.1 Various Types of Diversities

When employing the narrow band modulation (30kHz band) that is the same as the analog FM modulation system used in the existing cellular system, the multi-paths of radio waves create a serious fading. However, in the CDMA broadband modulation (1.25MHz band), three types of diversities (time, frequency, and space) are used to reduce serious fading problems generated from radio channels in order to obtain high-quality calls.
Time diversity can be obtained through the use of code interleaving and error correction code whereas frequency diversity can be obtained by spreading signal energy to wider frequency band. The fading related to normal frequency can affect the normal 200~300kHz among signal bands and accordingly, serious effect can be avoided. Moreover, space diversity (also called path diversity) can be realized with the following three types of methods.
First, it can be obtained by the duplication of cell site receive antenna. Second, it can be obtained through the use of multi-signal processing device that receives a transmit signal having each different transmission delay time and then, combines them. Third, it can be obtained through the multiple cell site connection (Soft Handoff) that connects the mobile station with more than two cell sites at the same time.

2.2 Power Control

The CDMA system utilizes the forward (from a base station to mobile stations) and backward (from the mobile station to the base station) power control in order to increase the call processing capacity and obtain high-quality calls. In case the originating signals of mobile stations are received by the cell site in the minimum call quality level (signal to interference) through the use of transmit power control on all the mobile stations, the system capacity can be maximized.If the signal power of mobile station is received too strong, the performance of that mobile station is improved. However, because of this, the interference on other mobile stations using the same channel is increased and accordingly, the call quality of other subscribers is reduced unless the maximum accommodation capacity is reduced.
In the CDMA system, forward power control, backward open loop power control, and closed loop power control methods are used. The forward power control is carried out in the cell site to reduce the transmit power on mobile stations less affected by the multi-path fading and shadow phenomenon and the interference of other cell sites when the mobile station is not engaged in the call or is relatively nearer to the corresponding cell site. This is also used to provide additional power to mobile stations having high call error rates, located in bad reception areas or far away from the cell site.
The backward open loop power control is carried out in a corresponding mobile station; the mobile station measures power received from the cell site and then, reversely increases/decreases transmit power in order to compensate channel changes caused by the forward link path loss and terrain characteristics in relation to the mobile station in the cell site. By doing so, all the mobile transmit

signals received by the base station have same strength.

Moreover, the backward closed loop power control used by the mobile station is performed to control power using the commands issued out by the cell site. The cell site receives the signal of each corresponding mobile station and compares this with the pre-set threshold value and then, issues out power increase/decrease commands to the corresponding mobile station every 1.25msec (800 times per second). By doing so, the gain tolerance and the different radio propagation loss on the forward/backward link are complemented.

2.3 Voice Encoder and Variable Data Speed

The bi-directional voice service having variable data speed provides voice communication which employs voice encoder algorithm having power variable data rate between the base station and the mobile station. On the other hand, the transmit voice encoder performs voice sampling and then, creates encoded voice packets to be sent out to the receive voice encoder, whereas the receive voice encoder demodulates the received voice packets into voice samples.

One of the two voice encoders described in the above is selected for use depending on inputted automatic conditions and message/data; both of them utilize four-stage frames of 9600, 4800, 2400, and 1200 bits per second for cellular and 14400,7200,3600,1800 bits per second for PCS, so PCS provide relatively better voice quality (almost twice better than the existing celluar system). In addition, this type of variable voice encoder utilizes adaptive threshold values on selecting required data rate. It is adjusted in accordance with the size of background noise and the data rate is increased to high rate only when the voice of caller is inputted.

Therefore, background noise is suppressed and high-quality voice transmission is possible under the environment experiencing serious noise. In addition, in case the caller does not talk, data transmission rate is reduced so that the transmission is carried out in low energy. This will reduce the interference on other CDMA signals and as a result, improve system performance (capacity increased by about two times).

2.4 Protecting Call Confidentiality

Voice privercy is provided in the CDMA system by means of the private long code mask used for PN spreading. Voice privacy can ve applied on the traffic channels only. All calls are initiated using the public long code mask for PN spreading. The mobile station user may request voice privacy during call setup using the origination message or page response message, and during traffic channel operation using the long code transition request order.

The Transition to private long code mask will not be performed if authentication is not performed. To initiate a transition to the private or public long code mask, either the base station or the mobile station sends a long code transition request order on the traffic channel.

2.5 Soft Handoff

A handoff in which the mobile station commences communications with a new base station without interrupting communications with the old base station. Soft handoff can only be used between CDMA channels having identical freqeuncy assignments.

2.6 Frequency Re-Use and Sector Segmentation

Unlike the existing analog cellular system, the CDMA system can reuse the same frequency at the adjacent cell. there is no need to prepare a separate frequency plan. Total interference generated on mobile station signals received from the cell site is the sum of interference generated from other mobile stations in the same cell site and interference generated from the mobile station of adjacent cell site. That is, each mobile station signal generates interference in relation to the signals of all the other mobile stations.

Total interference from all the adjacent cell sites is the ratio of interference from all the cell sites versus total interference from other mobile stations in the same cell site (about 65%). In the case of directional cell site, one cell normally uses a 120• sector antenna in order to divide the sector into three. In this case, each antenna is used only for 1/3 of mobile stations in the cell site and accordingly, interference is reduced by 1/3 on the average and the capacity that can be supported by the entire system is increased by three times.

2.7 Soft Capacity

The subscriber capacity of the CDMA system is flexible depending on the relation between the number of users and service classes. For example, the system operator can increase the number of channels available for use during the busy hour despite the drop in call quality. This type of function requires 40% of normal call channels in the standby mode during the handoff, in an effort to avoid call disconnection resulting from the lack of channels.

In addition, in the CDMA system, services and service charges are classified further into different classes so that more transmit power can be allocated to high class service users for easier call set-up; they can also be given higher priority of using hand-off function than the general users.

3. Structure and Functions of dual-band CDMA Mobile Phone

The hardware structure of CDMA mobile phone is made up of radio frequency (RF) part and logic part. The RF part is composed of Receiver part (Rx), Transmitter part (Tx) and Local part (LO). For the purpose of operating on dual-band, It is necessary dual Tx path, dual Rx path, dual PLL and switching system for band selection. The mobile phone antenna is connected with the frequency seperater which divide antenna input/output signals between cellular frequency band (824~894 Mhz) and PCS frequency band (1850~1990Mhz). Each separated path is linked with the cellular duplexer and PCS duplexer. Duplexer carrys out seperating Rx band and Tx band. The Rx signals from the antenna are converted into intermediate frequency(IF) band by the frequency synthesizer and frequency down converter. And then, pass SAW filter which is a band pass filter for removing out image frequency. The IF output signals that have been filtered is converted into digital signals via Analog-to-Digital Converter (ADC). In front of the ADC, switching system is required to choose which band path should be open. The digital signals send to 5 correlators in each CDMA de-modulator. Of these, one is called a searcher whereas the remaining 4 are called data receivers (fingers). Digitalized IF signals include a great number of call signals that have been sent out by the adjacent cells. These signals are detected with pseudo-noise sequence (PN Sequence). Signal to interference ratio (C/I) on signals that match the desired PN sequence are increased through this type of correlation detection process, but other signals obtain processing gain by not increasing the ratio. The carrier wave of pilot channel from the cell site most adjacently located is demodulated in order to obtain the sequence of encoded data symbols. During the operation with one cell site, the searcher searches out multi-paths in accordance with terrain and building reflections. On three data receivers, the most powerful 3 paths are allocated for the parallel tracing and receiving. Fading resistance can be improved a great deal by obtaining the diversity combined output for de-modulation. Moreover, the searcher can be used to determine the most powerful path from the cell sites even during the soft handoff between the two cell sites. Moreover, 3 data receivers are allocated in order to carry out the de-modulation of these paths. Output data that has been demodulated changes the data string in the combined data row as in the case of original signals(deinterleaving), and then, are demodulated by the forward error correction decoder which uses the Viterbi algorithm.

Mobile station user information send out from the mobile station to the cell site pass through the digital voice encoder via a mike. Then, they are encoded and forward errors are corrected through the use of convolution encoder. Then, the order of code rows is changed in accordance with a certain regulation in order to remove any errors in the interleaver. Symbols made through the above process are spread after being loaded onto PN carrier waves. At this time, PN sequence is selected by each address designated in each call.

Signals that have been code spread as above are digital modulated (QPSK) and then, power controlled at the automatic gain control amplifier (AGC Amp). Then, they are converted into RF band by the frequency synthesizer synchronizing these signals to proper output frequencies.

Transmit signals obtained pass through the duplexer filter and then, are sent out to the cell site via the antenna.

4. Specification

4.1 General Specification

4.1.1 Transmit/Receive Frequency Interval :

1) AMPS : 45MHz
2) PCS : 80 MHz

4.1.2 Number of Channels (Channel Bandwidth)

1) AMPS : 832 Channels
2) PCS : 48 Channels

4.1.3 Operating Voltage : DC 3.6V

4.1.4 Battery Power Consumption : DC 3.6V

	SLEEP	IDLE	MAX POWER
AMPS	(under development)	90mA	900 mA
PCS	1 mA	100 mA	800 mA

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

4.1.6 Frequency Stability

I)AMPS : . 2.5PPM
2) PCS : . 0.1PPM

4.1.7 Antenna : Retractable Type (Herical+Whip), 60 Ω

4.1.8 Size and Weight

1) Size (Inch) : 3.31 (H) 5 1.81 (W) 5 0.98 (D)
2) Weight : Under 3.5 Oz (w/Standard Battery)

4.1.9 Channel Spacing

1) AMPS : 30KHz
2) PCS: 1.25 MHz

4.1.10 Battery Type, Capacity and Operating Time.

Unit = Hours : Minutes

	Extended (1400mAh)	
Standby Time	AMPS	20:00(sleep mode development)
	PCS	200:00
Talk time	AMPS	1:10
	PCS	2:30

4.2 Receive Specification

4.2.1 Frequency Range

1) AMPS : 869.04 MHz ~ 893.97 MHz
2) PCS : 1930 MHz ~ 1990MHz

4.2.2 Local Oscillating Frequency Range :

1) AMPS : 966.88MHz • 12.5MHz
2) PCS : 1719.62MHz ~ 1779.62MHz

4.2.3 Intermediate Frequency :

1) AMPS: 85.38 MHz
2) PCS: 210.38 MHz

4.2.4 Sensitivity

1) AMPS : -116dBm (12dB SINAD)
2) PCS : -104dBm (C/N 12dB or more)

4.2.5 Selectivity

1) AMPS : 16dB at Fch • 80kHz, 60 dB at Fch • 60kHz
2) PCS : 3dB C/N Degration (With Fch • 1.25 kHz : -30dBm)

4.2.6 Spurious Wave Suppression : Maximum of -80dB

4.2.7 CDMA Input Signal Range

- Dynamic area of more than -104~ -25 dB: 79dB at the 1.23MHz band.

4.2.8 AMPS De-Emphasis : -6dB/OCT within 0.3~3kHz

4.2.9 AMPS Expander

- Expansion Rate : 1:2
- Attack Time : within 3mS
- Recovery Time : within 13.5mS
- Reference Input : Output level to a 1000Hz tone from a carrier within +2.9kHz peak frequency deviation.

4.2.10 AMPS Sensitivity : 12dB SINAD/-116dBm

4.2.11 AMPS Intermodulation Spurious Response Attenuation : Above 65dB

4.2.12 AMPS RSSI Range : Above 60dB

4.2.13 AMPS Protection Against Spurious Response Interference : Above 60dB

4.2.14 AMPS In Band Conducted Spurious Emissions

- Transmit Band : below -60dBm
- Receive Band : below -80dBm

4.2.15 AMPS Out of Band Conducted Spurious Emissions : Below -47dBm

4.2.16 AMPS Radiated Spurious Emissions

Frequency Range	Maximum allowable EIRP
25 ~ 70 kHz	- 45 dBm
70 ~ 130 kHz	- 41 dBm
130 ~ 174 kHz	- 41 ~ - 32 dBm
174 ~ 260 kHz	- 32 dBm
260 ~ 470 kHz	- 32 ~ - 26 dBm
470 ~ 1.0 GHz	- 21 dBm

4.3 Transmit Specification

4.3.1 Frequency Range

1) AMPS : 824.04MHz ~ 848.97MHz
2) PCS : 1850 MHz ~ 1910 MHz

4.3.2 Local Oscillating Frequency Range :

1) AMPS : 966.88 MHz • 12.5 MHz
2) PCS : 1719.62MHz ~ 1779.62MHz

4.3.3 Intermediate Frequency : 130.38 MHz

4.3.4 Output Power

1) **AMPS: 0.482W**
2) **PCS: 0.378w**

4.3.5 Interference Rejection

1) Single Tone : -30dBm at 1.25MHz
2) Two Tone : 43dBm at 1.25 MHz & 2.05 MHz

4.3.6 AMPS Carrier ON/OFF Conditions

"ON" condition : within ±3dB of specification output (in 2msec)

4.3.7 AMPS Compressor

1) Compression Rate : 2:1
2) Attack Time : 3msec
3) Recovery Time : 13.5msec
4) Reference Input : Input level for producing a nominal ±2.9kHz peak requency deviation of transmitted carrier.

4.3.7 AMPS Preamphasis : 6dB/OCT within 0.3 ~ 3 kHz

4.3.8 AMPS Maximum Frequency Deviation

1) F3 of G3 : • 12kHz (• 40%)
2) Supervisory Audio Tone : • 2kHz (• 40%)
3) Signaling Tone : • 8kHz (• 40%)
4) Wideband Data : • 8kHz (• 40 %)

4.3.9 AMPS Post Deviation Limiter Filter

1) 3.0kHz ~ 5.9kHz : above 40log(F/3000) dB
2) 5.9kHz ~ 6.1 kHz : above 35dB
3) 6.1kHz ~ 15kHz : above 40log(F/3000) dB
4) Over 15kHz : above 28dB

4.3.10 AMPS Spectrum Noise Suppression

1) For all Modulation

fo+20kHz ~ fo+45kHz : above 26dB

2) For Modulation by Voice and SAT

fo+45kHz : above 63+10log(Py) dB

3) For Modulation by WBD (without SAT) and ST (with SAT)

fo+45kHz ~ fo+60kHz : above 45dB

fo+60kHz ~ fo+90kHz : above 65dB

fo+90kHz ~ 2fo : above 63+10log(Py) dB,

where fo=carrier frequency, Py=mean output power in watts.

4.3.11 AMPS Harmonic and Conducted Spurious Emissions : above 43+10log(Py) dB

4.3.12 CDMA TX Frequency Deviation :

1) AMPS: ±300Hz or less
2) PCS: ± 150Hz

4.3.13 CDMA TX Conducted Spurious Emissions

1) PCS : -42 dBc / 30KHz below

4.3.14 CDMA Minimum TX Power Control

1) PCS : -50dBm below

4.4 MS (Mobile Station) Transmitter Frequency

4.4.1 AMPS 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

4.4.2 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

4.5 MS (Mobile Station) Receiver Frequency

4.5.1 AMPS 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

4.5.2 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

4.6 Desktop Charger : See Appendix

4.7 Travel Charger : See Appendix

4.8 Cigar Lighter Charger : See Appendix

4.9 Hands-Free Kit : See Appendix

5. Installation

5.1 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 th phone until e 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.

5.2 For Desktop Charger Use

1) Plug the charger into a wall outlet. The charger can be operated from either a 110V or a 220V source.
(When AC power is connected to the desktop charger, both the green and red LED' s blink once.)
2) Insert the phone with the installed battery pack into the battery pack slot. (Red light indicates battery is being charged. Green light indicates battry is fully charged.)

(5.3 For Mobile Mount

5.3.1 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.

5.3.2 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 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.

5.3.3 Interface Box

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

5.3.4. Microphone Installation

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

5.3.5 Cable Connections

5.3.5.1 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 Hands-Free Kit, please make sure to connect green wire to ignition sensor terminal.). Connect the kit' s power cable connector to the interface box power receptacle.

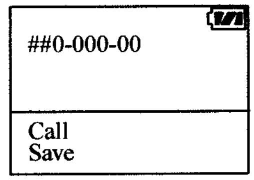
5.3.5.2 Antenna Cable Connection

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

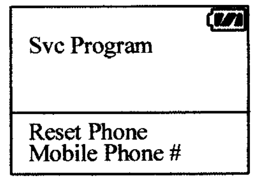
CHAPTER 2. NAM Input Method (Inputting of telephone numbers included)

1) NAM Programming Method

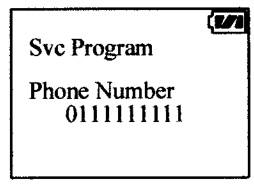
1. Press "##" + Service Programming Code



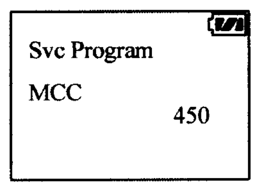
2. Select ' Save' Menu.



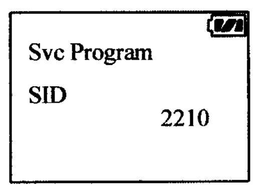
3. Select ' Mobile Phone #' Menu.
   Input Phone Number and press ' ok' .



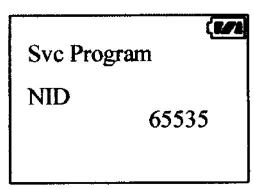
4. Select ' MCC' Menu.
   Input the MCC and press ' ok'



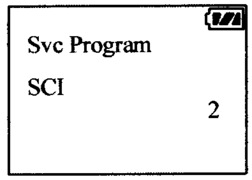
5. Select ' SID' Menu.
   Input SID and press ' ok'



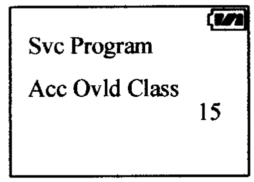
6. Select ' NID' Menu.
   Input NID and press ' ok'



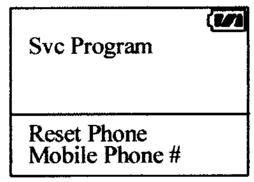
7. Select ' Slot Cycle Index' Menu.
   Input SCI and press ' ok'



8. Select ' Acc Ovld Class' Menu.
   This is read only item.



9. Select ' Reset Phone' Menu to reboot.



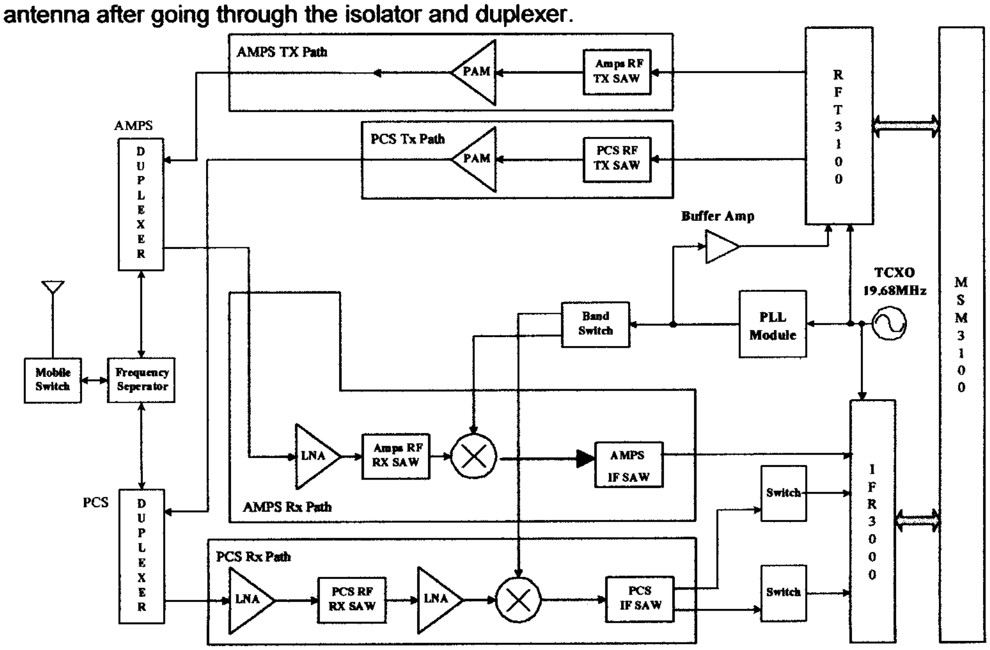
CHAPTER 3. Circuit Description

1. RF Transmit/Receive Part

1.1 Overview

The Tx and Rx part employs the Super-Heterodyne system. The Tx and Rx frequencies are [illegible] ·848.97 and 869.04~893.97 for cellular and 1850~ [illegible] or PCS. The block diagram is shown in [Figure 1-1]. RF signals received through the antenna are seperated by the frequency separater and fed into the low noise amplifier (LNA) through the duplexer. Then, they are combined with the signals of local oscillator (VCO) at the down conversion mixer in order to create intermediate frequency (IF). IF signal created is sent out to each bandpass filter (BPF) through the AMPS or PCS path and then, fed into IFR3000. In IFR3000, the IF signal is changed into baseband signal. 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)3100 processes the data from ADC. The digital processing part is a demodulator.

In the case of transmission, RFT3100 receives QPSK-modulated anlog signal from the MSM3100. The RFT3100 connects directly with MSM3100 using an analog baseband interface. In RFT3100, 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 isolator and duplexer.



[Figure 1-1] Block Diagram of RF Transmit/Receive Part

1.2 Description of Rx Part Circuit

1.2.1 Frequency Separator

The main function of frequency separator is to prohibit cellular band signal from flowing into the PCS circuit and vice versa. RF designer can use common antenna regardless of frequency band (800 and 1.9Ghz). The specification of LG-DB210 frequency separator is described below:

	AMPS	PCS
Frequency Range	824 – 894 Mhz	1850-1990 Mhz
Insertion Loss to Common	0.4dB Max (at +25 deg) 0.5dB Max (at -35 to +85 deg)	0.55 dB Max. (at +25 deg) 0.65 dB Max. (at -35 to +85 deg)
Attenuation	20 dB Min	18 dB Min
Return Loss	12 dB Min	
Power Capacity	3W Max	
Temperature Range	-35 to +85 deg	

1.2.2 Duplexer

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 LG-DB520 duplexer described below ;

- PCS duplexer :

	Tx	Rx	Tx to Rx (min)
Pass Band	1850~1910 MHz	1930~1990 MHz	
Insertion Loss	3.6dB max	4.4dB max	
Return Loss	10.0dB min	10.0dB min	
Attenuation	37dB min (1930~1990MHz)	55dB min(1850~1910MHz)	56dB (1850~1910MHz) 39dB (1930~1990MHz)

- AMPS duplexer

	Tx	Rx	Tx to Rx (min)
Pass Band	824~849MHz	869~894 MHz	
Insertion Loss	3.0dB max	4.0dB max	
VSWR	1.7 max min	1.8 max	
Attenuation	43dB min(869~894MHz)	50dB min(824~849MHz)	52dB (1850~1910MHz) 44dB (1930~1990MHz)

1.2.3 LNA

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. LG-DB210 has one LNA for cellular Rx part and two LNA for PCS Rx part, because LNA gain of PCS is not enough to compare with cellular. The specification of LG-DB20 LNA described below:

Parameter	Min		Typ		Max		Units
	AMPS	PCS	AMPS	PCS	AMPS	PCS	
Gain	19.5	12.5	20	16			dB
Noise Figure			1.6	1.6	2.0	2.0	dB
Input IP3			22.0	22.5			dBm

1.2.3 Rx RF SAW FILTER

The main function of Rx RF SAW filter is to attenuate mobile phone spurious frequency, attenuate direct IF frequency pick up, attenuate noise at the image frequency originating in or amplified by the LNA and suppress second harmonic originating in the LNA. The Rx RF SAW filter usually called image filter.

1.2.4 Mixer

Mixer perform frequency translation by multiplying two signals. Downconversion mixer employed in the Rx path has two distinctly different inputs. One is RF and the other is Local Osillator (LO) port. The RF port senses the signal to be downconverted and the LO port senses the periodic waveform generated by the local osillator. LG-DB520 downconversion mixers used in cellular mode and PCS mode is same and the specificaion described below ;

	Conditions		Typ/Norm		Units
	AMPS	PCS	AMPS	PCS	
Conversion Gain			10.0	9.5	dB
Noise Figure			8.0	6.0	dB
IIP3			9.0	9.0	dBm
Return Loss	Mixer RF input	Mixer RF input	10	10	dB
	Mixer LO input	Mixer LO input	10	10	dB
Isolation	RF to IF; after IF match	RF to IF; after IF match	33	33	dBm
	LO to IF: after IF match	LO to IF: after IF match	40	40	dBm
IF Zout	Mixer "On"	Mixer "On"	500	500	ohm
	Mixer "Off"	Mixer "Off"	<50	<50	ohm
Supply Current			4.5	6.0	mA

1.2.4 Rx IF SAW FILTER

The IF SAW filter protects its following stages from close-in Inter Modulation (IM) signals, provides adjacent channel selectivity, and attenuates the second image.

1.2.4 IFR3000

1.2.4.1 CDMA Rx SIGNAL

The circuit functions of the IFR3000 include Rx Automatic Gain Controller (AGC) with 90 dB dynamic range, quadrature IF mixers, down-conversion mixer from IF to baseband, low pass filters and Analog to Digital Convertors (ADC) for converting to digital baseband. The IFR3000 includes clock generators that drive the digital processor and a VCO which generates the LO frequency for baseband down-conversion.

Switching system is located in front of the IFR3000 CDMA_IF+ and CDMA_IF- terminal and is for band selection between cellular and PCS. The Rx AGC either amplifies or attenuates the received CDMA IF signal to provide a constant-amplitude signal to the I/Q downconvertor. The IF output of the Rx AGC amplifier separate into I-channel and Q-channel baseband components and down-converted by mixer with quadrature LO. LO signals are generated by a Voltage Controlled Osillator (VCO) and frequency stabilized by external varator-tuned resonant tank circuit. The I/Q down converter outputs the CDMA signals at baseband frequency. Low-pass filtering enables the receiver to select the desired baseband signals from the effects of unwanted nosie or adjacent-channel interference. I/Q base band components are converted to digital signals by two identical 4-bit ADCs. The CDMA chariceristic of IFR3000 described below;

- CDMA Receive Performance Parameters

	Min.	Typ.	Max.	Units
Min Input Signal	-102			dBm
Max Input Signal			-12	dBm
Gain Slope	10		70	dB/V
IF Center Frequency		85.38	250	MHz
Spurious Content			-25	dBc
Isolation FM to CDMA	30			dB

1.2.4.2 FM Rx SIGNAL

The FM Rx signal path is designed to accept a differential IF signal with frequency modulation extending • 15kHz from the center frequency to form a 30 kHz wide IF channel. The IF signals are divided further into I and Q signals through the CDMA signaling process, and then converted into baseband signals and fed into ADC via each LPF. FM LPF has a bandwidth that is considerably lower than CDMA LPF. Since FM baseband signal has a very low bandwidth, ADC uses the low power 8-bit continuous approximation ADC. The serial 8-bit digital signal conversion of analog signal is carried out as follows; the FM clock signals of MSM3100 are inputted into the FM_Rx_CLK terminals of IFR3000 in order to synchronize ADC. The FM strobe signal, another MSM3100 signal, is inputted into the RXFM_STROBE terminal and then, the sampling of I/Q signals is started. Signals that have been digitalized as above are inputted into MSM3100. The CDMA chariceristic of IFR3000 described below:

	Min.	Typ.	Max.	Units
Min Input Signal	-98.3			dBm
Max Input Signal			-8.3	dBm
Gain Slope	10		70	dB/V
IF Center Frequency		85.38		MHz
Spurious Content			-42	dBc

1.3 Description of Transmit Part Circuit

1.3.1 RFT3100

The RFT3100 baseband-to-RF Transmit Processor performs all Tx signal-processing functions required between digital baseband and the Power Amplifier Modulater (PAM). The baseband quadratures signals are upconverted to the Cellular or PCS freqeuncy bands and amplified to provide signal drive capability to the PAM. The RFT3100 includes an IF mixer for upconverting analog baseband to IF, a programmable PLL for generating Tx IF frequency, one RF mixer for single sideband upconversion from IF to RF, two cellular and two PCS driver amplifiers and Tx power control through an 85 dB VGA. As added benefit, the single sideband upconversion eliminates the need for a bandpass filter normally required between the upconverter and driver amplifier.

I, I/, Q and Q/ signals proceed from the MSM3100 to RFT3100 are analog signal. In CDMA mode, These signals are modulated by Quadrature Phase Shift King (QPSK), But in AMPS mode These are baseband signal (audio signal, supuervisory audio tone and signaling tone) directly converted from DAC. I and Q are 90 deg. out of phase, and I and I/ are 180 deg. Tx IF signal can be obtained by mixing analog signal with 130.38 1^{st} local osillator frequency which is generated by Tx VCO. The Tx IF signal is amplified by AGC controlled by MSM3100. The second mixer on RFT3100 converts IF signals into RF signals. After passing through the upconverter , RF signal is inputted into the Power AMP.

- RFT3100 PCS CDMA RF Specifications

	Condition	Min.	Typ.	Max.	Units
Rated Output Power	Average CDMA PCS	9.3			dBm
Min Output Power	Average CDMA PCS			-80	dBm
RF Leakage at RF LO Input			-30		dBm
LO Leakage at RF Output				-10	dBm
ACPR	PCS : Fc±1.25MHz	52			dBc/ 30kHz

- RFT3100 FM RF Specifications

	Condition	Min.	Typ.	Max.	Units
Min Output Power				-25	dBm
Rated Output Power		10			dBm
RF Leakage at RF LO Input			-50		dBm

1.3.6 Power Amplifier

The power amplifier that can be used in the PCS and FM mode has linear amplification capability, whereas in the FM mode, it has a 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. 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)

The temperature variation of mobile phone can be compensated by TCXO. The reference frequency of a mobile phone is -30~+80 °C. The receives frequency tuning signals called TRK_LO_ADJ from MSM as 0.5V~2.5V DC via R and C filter in order to generate the reference frequency of 19.68 and input it into the frequency synthesizer of UHF band. Frequency stability depending on temperature is • 2.0 ppm.

1.4.2 Dual band PLL Module

The UHF band frequency synthesizer is composed of an indirect frequency synthesizer, Phase Locked Loop (PLL), VCO with the center frequency of 967 for cellular mode and 1750 for PCS mode, Loop Filter and a directional coupler. PLL IC's phase detector compares the reference clock frequency (19.68, TCXO clock) divided down to 10kHz by the reference divider with a signal from the VCO divided by the PLL main divider. Thus generating local oscillation signals with zero phase difference. These local oscillation signals are used both for Tx and Rx. The local oscillation signals are separated for Tx and Rx by the directional coupler. There are Rx and Tx IF synthesizers, respectively. The Tx IF synthesizer is composed of the RFT3100, Tx Tank circuit, and the loop filter. The Tx phase detector within the RFT3100 receives the oscillation signals from the tank circuit generating 130.38 Tx IF. The Rx IF synthesizer is composed of the PLL(Dual Mode PLL),the IFR3000,the Rx Tank circuit,and the loop filter. The signal generated from the tank circuit is sent through the IFR3000 to the dual mode PLL' s phase detector. The PLL IC generates control voltage to the loop filter such that 210.38 Rx IF is synthesized.

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 MSM3100. 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 MSM3100, and amplifying part that amplifies signals coming out from MIC and transferring them to the audio processor.

2.2.3 MSM (Mobile Station Modem) 3100 Part

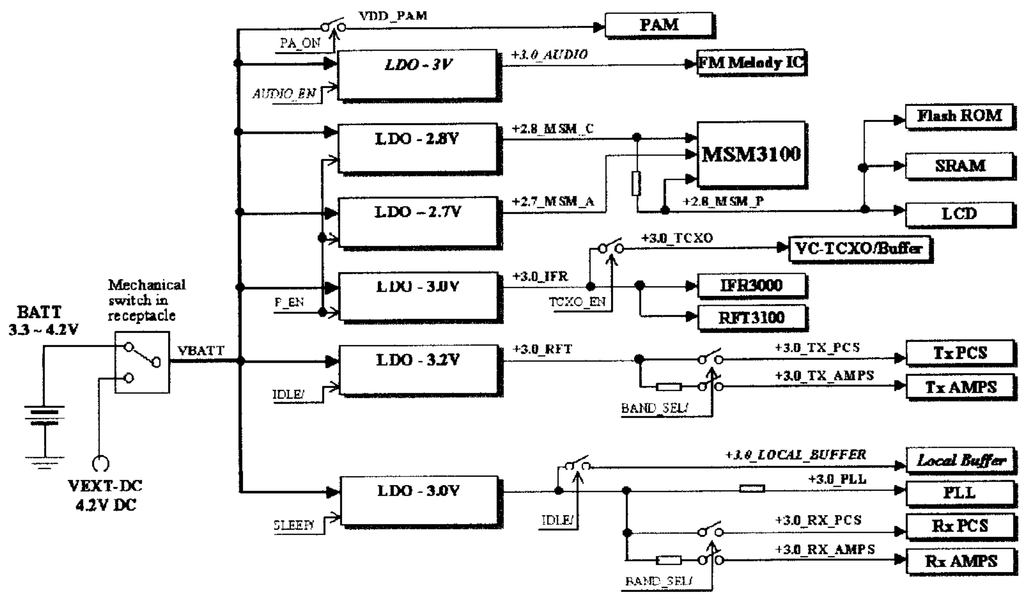
MSM is the core elements of CDMA terminal and carries out the functions of CPU, encoder, interleaver, deinterleaver, Viterbi decoder, Mod/Demod, and vocoder.

2.2.4 Memory Part

The memory part is made up of a MCP (Flash memory + SRAM) for storing data.

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. The block diagram of power supply part is shown in [Figure 2-1].



[Figure 2-1] Block Diagram of Power Supply 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 MSM3100 for processing. In addition, when the key is pressed, the keypad/LCD lights up through the use of 8 LEDs. The terminal status and operation are displayed on the screen for the user with the characters and icons on the LCD (12 characters × 7 lines, 1 line icon).

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

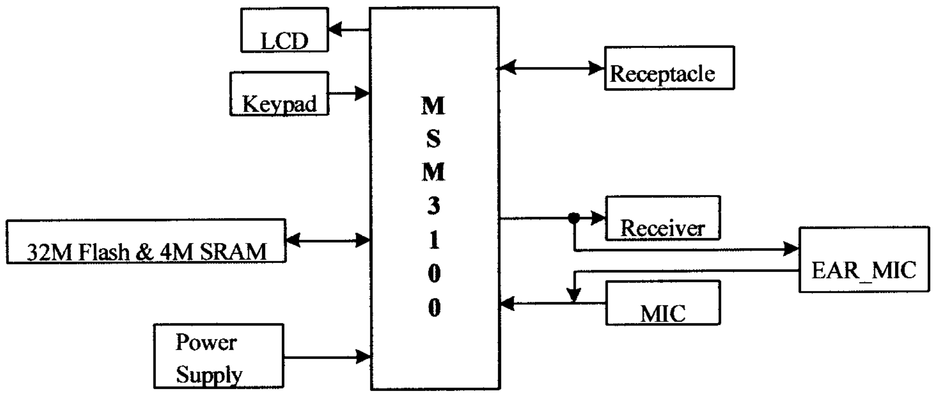
MIC signals are amplified through OP AMP, inputted into the audio codec(included in MSM3100) and converted into digital signals. Oppositely, digital audio signals are converted into analog signals after going through the audio codec. These signals are amplified at the audio amplifier and transmitted to the ear-piece. The signals from MSM3100 activate the ringer by using signals generated in the timer in MSM3100.

2.3.3 MSM Part

MSM3100 is the core element of CDMA system terminal that includes ARM7TDMI microprocessor core. It supports both CDMA and Digital FM, operating in both the cellular and PCS spectrums. The subsystems within the MSM3100 include a CDMA processor, a DFM processor, a multi-standard Vocoder, an integrated CODEC with earpiece and microphone amplifiers, general-purpose ADC for subsytem monitoring, an ARM7TDMI microprocessor, and both Universal Serial Bus(USB) and an RS-232 serial interfaces supporting forward link MDR data communications of 86.4 Kbps. And it also contains complete digital modulation and demodulation systems for both CDMA and AMPS cellular standards, as specified in IS-95-B.

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

Flash Memory/SRAM and are MCP (Multi Chip Package) that content 32 Mbit flash memory and 4 Mbit Static RAM. In the Flash Memory part are programs used for terminal operation. The programs can be changed through down loading after the assembling of terminals. On the SRAM(4Mbits) data generated during the terminal operation are stored temporarily.

2.3.5 Power Supply Part

The block diagram of power supply part is shown in [Figure 2-1]. When the battery voltage (+4.2V) is fed and the PWR key of keypad is pressed, D791 is activated by the PWR_ON_SW signal, and then the control signal P_EN is generated. Based on this P_EN, the regurator U770, U787 and MIC480 are operated and +2V8_MSMC, +2V8_MSMP, +3V0_IFR, +3V0_RFT, +3V0_TCXO and +2V7_MSMA are generated.

The regulator(MIC460) is operated by the control signal IDLE/ from MSM3100. MIC460 generates +3V2_RFTX and voltages used in Tx part. The generated voltages are used for RFT3100 and Tx part.

Q791 (DTC114EE) is turned on by PWR_ON_SW and then, 'L' is outputted on ON_SW_SENSE/. MSM receives this signal, and then recognizes that the POWER key has been pressed. During this time, MSM outputs PS_HOLD as 'H', and then continues to activate D791 in order to maintain power even if the POWER key is separated.

2.3.6 Logic Part

The logic part consists of internal CPU of MSM, RAM, ROM. The MSM3100 receives TCXO (=19.68MHz) from U490 and controls the phone in both CDMA and FM modes. The major components are as follows:

CPU : ARM7TDMI microprocessor core

FLASH MEMORY and SRAM : U651 (28F3204C3)

- FLASH ROM : 32Mbits
- STATIC RAM : 4Mbits

- **CPU**

The ARM7TDMI microprocessor includes a 3 stage pipelined RISC architecture, both 32-git 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.

- **FLASH ROM and SRAM**

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 key sense 0~4 signals and GPIO 5, 32~36 of output ports of MSM. Eight 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 8-bit data from the MSM3100. It is also supplied stable +2V8_MSMP by regulator(U770) for fine view angle and LCD reflects to improve the display efficiency. E/L are used to display LCD backlight.