6. Circuit Description

6-1 Logic Section

6-1-1 Power Supply

With the battery installed on the phone and by pressing the PWR key, the VBATT and ON_SW signals will be connected. This will turn on Q102 (2SC4081BR) and will drive DC-DC converter (U123) to output 5.0V. This in turn will be supplied to pin 6 of regulators (U121 and U122), thus releasing them from the shut-down state to output regulated 3.3V.

The VBATT applied to ON_SW will turn on Q103 (DTC144EE) resulting in the signal ON_SW_SENSE to change state from HIGH to LOW. This will allow MSM to send out PS_HOLD (logical HIGH) to turn on Q102 even after the PWR key is released.

The voltage (+3.3V) from U121 is used in the digital parts of MSM and BBA. The voltage (+3.3AV) from U122 is used in the analog part of BBA. The voltage from U124 (output of 5V) is used for the audio circuitry.

6-1-2 Logic Part

The Logic part consists of internal CPU of MSM, RAM, ROM and EEPROM. The MSM receives TCXO and CHIPX8 clock signals from the BBA and controls the phone during the CDMA and the FM mode. The major components are as follows:

- CPU : INTEL 80186 core
- FROM : U126 (MBM29LV800T) - 8MBIT FLASH ROM
- SRAM : U127 (KM68V2000I) - 2MBIT STATIC RAM
- EEPROM : U113 (AT24C128) - 128KBIT SERIAL EEPROM

CPU

INTEL 80186 CMOS type 16-bit microprocessor is used for the main processing. The CPU controls all the circuitry. For the CPU clock, 27MHz resonator is used.

FLASH ROM

One 8 MBIT FROM 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

One 2 MBIT SRAM is used to store the internal flag information, call processing data, and timer data.

EEPROM

One 128 KBIT EEPROM is used to store ESN, NAM, power level, volume level, and telephone number.

KEYPAD

For key recognition, key matrix is setup using SCAN0-6 of STORE signals and KEY0-3 of input 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 MSM. It also consists a DC-DC converter to supply -3.5V for fine view angle and LCD reflector to improve the display efficiency.

6-1-3 Baseband Part

MOBILE SYSTEM MODEM (MSM)

The MSM equipped with the INTEL 80186 CPU core is an important component of the CDMA cellular phone. The MSM comes in a 176 pins TQFP package. The interface block diagram is shown on page 6-3.

MICROPROCESSOR INTERFACE

The interface circuitry consists of reset circuit, address bus (A0-A19), data bus (AD0-AD15), and memory controls (ALE, DT_R, HWR/, LWR/, RAM_CS/, ROM_CS).

INPUT CLOCK

- CPU clock: 27 MHz
- TXCO/4 (pin 34): 4.92 MHz. This clock signal from the BBA is the reference clock for the MSM except in CDMA mode.
- CHIPX8 : 9.8304 MHz. The reference clock used during the CDMA mode.

BBA INTERFACE

CDMA, FM Data Interface

- TXIQDATA0-7 (pins 24-32) : TX data bus used during both CDMA and FM mode.
- C_RX_IDATA0-3 (pins 16-20) and C_RX_QDATA0-3 (pins 12-15) : RX data bus used during CDMA mode.
- FM_RX_IDATA (pin 7) and FM_RX_QDATA (pin 8) : RX data bus used during FM mode.

Clock

- TX_CLK (pin 22), TX_CLK/(pin 23) : Analog to Digital Converter (ADC) reference clock used in TX mode.
- CHIPX8 : ADC reference clock used in CDMA RX mode.
- FMCLK : Reference clock in FM RX mode.

ADC Interface

ADC_CLK (pin 3), ADC_ENABLE (pin 1) and ADC_DATA (pin 2) are required to control the internal ADC in the BBA.

Data Port Interface

Includes the UART. Also, supports Diagnostic Monitor (DM) and HP equipment interface.

CODEC Interface

The MSM outputs 2.048 MHz PCM_CLK (pin 19) and 8 KHz CODEC_SYNC (pins 16,20) to the CODEC (U117). The voice PCM data from the MSM (U101) PCM_DIN (pin135) is compressed into 8KHz by QCELP algorithm in the CDMA mode. In FM mode, the data is processed by D_FM.

RF Interface

TX : TX_AGC_ADJ (pin 35) port is used to control the TX power level and PA_ON (pin 44) signal is used to control the power amplifier.

RX : AGC_REF (pin 36) port is used to control the RX gain and TRK_LO_ADJ (pin 45) is used to compensate the TCXO clock.

General Purpose I/O Register Pins

Input/output ports to control external devices.

Power Down Control

When the IDLE/ signal turns LOW, only the TX sections will be disabled. If both the IDLE/ and SLEEP/ changes to LOW, all the pins except for the TXCO is disabled.

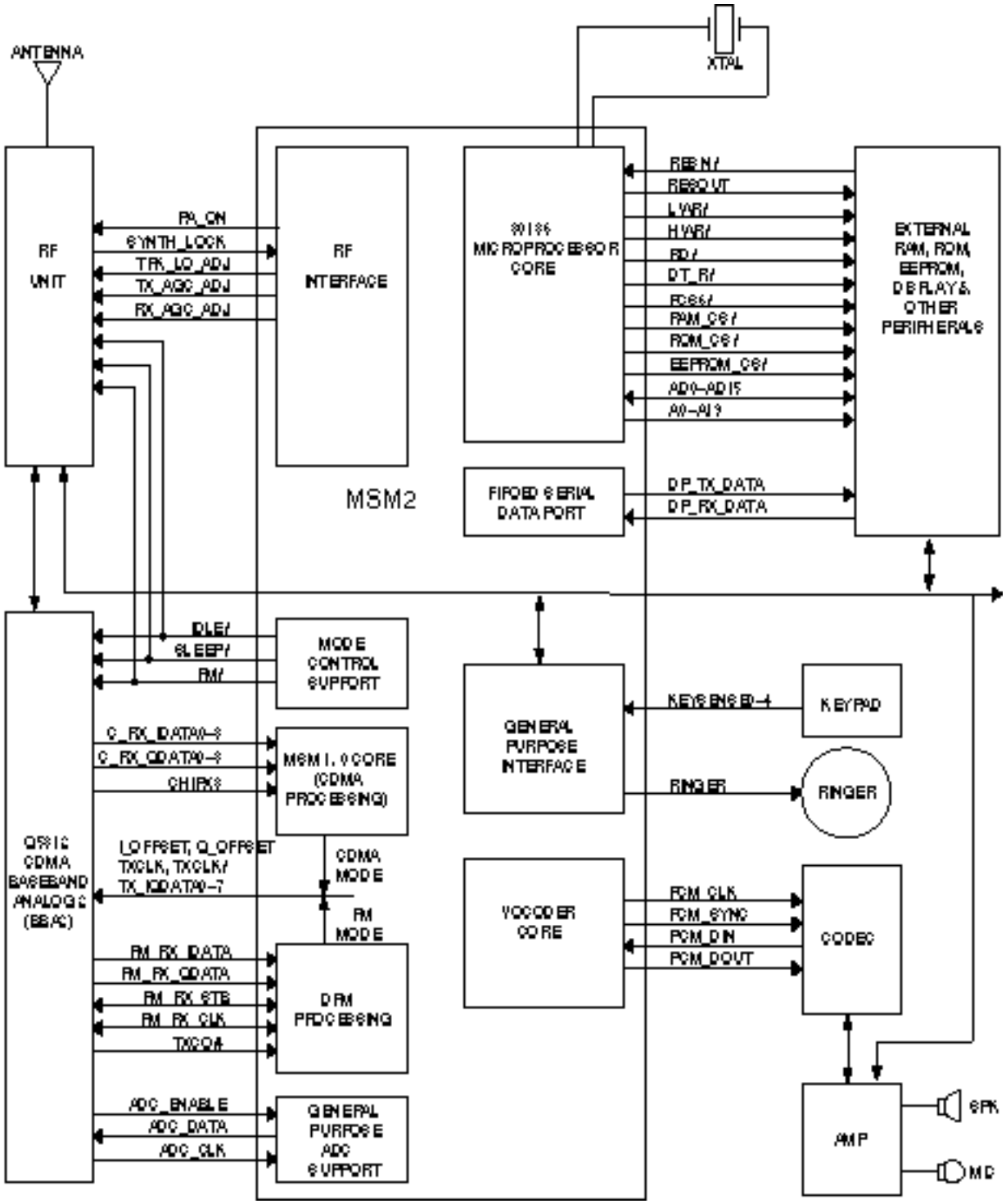


Figure 6-1 Baseband Block Diagram

6-1-4 Audio Part

TX AUDIO PATH

The voice signal output from microphone is filtered and amplified by the internal OP-AMP and is converted to PCM data by the CODEC (U117). This signal is then applied to the MSM (U101)'s internal vocoder.

RX AUDIO PATH

The PCM data out from the MSM is converted to audio signal by ADC of CODEC (U117), is then amplified by the speaker amplifier (U111) to be sent to the speaker unit.

FM TX PATH

Pre-Emphasis Circuit

The circuit features +6dB/oct to reduce signal loss and noise in Tx path.

Compressor

The compressor features 2:1 level to reduce signal loss and noise in Tx path. The zero crossing level of the compressor is ±2.9 kHz/dev, attack time is 3 mS, and release time is 13.5 mS.

Limiter

The limiter performs to cut ±0.53 Vp-p or higher audio signal level so that the FM frequency deviation is not over ±12kHz/dev. The function is used to avoid confusion over phone line. LPF is used to reduce a specific high frequency of limited signal.

RX AUDIO PATH

De-Emphasis Circuit

This circuit is 1st LPF featuring -6dB/oct to reduce signal loss and noise in Rx path.

Expander

The expander features 1:2 level to reduce signal loss and noise in Rx path. The zero crossing level of the expander is ±2.9 kHz/dev, attack time is 3 mS, and release time is 13.5 mS.

Volume Adjust

Volume can be adjusted up to 4 steps for the user to obtain a proper loudness of received signal.

6-1-5 TX WBD, ST, And SAT

These signals are generated from MSM. The modulation level of TX WBD and ST is ±8kHz/dev, and SAT is ±2kHz/dev.

6-1-6 Buzzer Driving Circuitry

Buzzer generates alert tone. When the buzzer receives the timer signal from the MSM, it generates alert tone. The buzzer level is adjusted by the alert signal's period generated from the MSM timer.

6-1-7 Key Tone Generator

Ringer signal (pin 49) out from MSM (U101) is passed through 2 serial LPF consisting of R141, C145, R145, and C142, amplified at the speaker amp (U111), and comes out to speaker. In hands-free mode, the key tone is applied to RX audio line through the LPF and C153, R142.

6-2 Receiver Section

LOW NOISE AMPLIFIER (LNA)

The low noise amplifier featuring 1.5dB and 16 dB gain amplifies a weak signal received from the base station to obtain the optimum signal level.

DOWN CONVERTER (MIXER)

First local signal is applied to this down converter. The down converter transfers the signal amplified at the LNA into 85.38 MHz IF signal. 85 MHz IF signal is made by subtracting 881 ±12.5 MHz RF signal from 966 ±12.5MHz first local signal.

RX IF AUTOMATIC GAIN CONTROLLER (AGC) AMP

85.38 MHz IF signal is applied to IF AGC amp, the IF AGC output level is applied to BBA (Baseband Analog ASIC). The IF AGC amp (U302) keep the signal at a constant level by controlling the gain. Dynamic range is 90 dB, up gain +45dB, and down gain -45dB.

RF BAND PASS FILTER (BPF)

The RF BPF (F302) accepts only a specific frequency (881 ±12.5MHz) from the signal received from the mobile station. The band width is 25 MHz.

IF SAW BAND PASS FILTER FOR AMPS

IF SAW BPF (F304) is used for AMPS system having 30 kHz channel spacing and ±15 kHz band width. The filter also eliminates the image product generated at the mixer.

IF SAW BAND PASS FILTER FOR CDMA

IF SAW BPF (F303) is used for CDMA system having 1.23 MHz wide band and ±630 kHz band width. The filter also eliminates the image product generated at the mixer.

BUFFER

Buffer (Q342) amplifies signal to be applied to the local input of the down converter (U301) when a phase is locked between VCO (U341) and PLL IC (U342).

VOLTAGE CONTROLLED OSCILLATOR

The VCO (U341) generates the signal having 966 MHz center frequency and ±12.5 MHz deviation with the voltage control. PLL IC (U342) controls this signal.

PHASE LOCKED LOOP (PLL)

Input reference frequency is generated at VC_TCXO (U343) and the divided signal is generated at VCO (U341). PLL compares the two signals and generates the desired signal with a pre-programmed counter which controls voltage.

VOLTAGE CONTROLLED TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

It provides 19.68 MHz reference frequency to the mobile main set. A correct frequency tuning is made by the voltage control.

THERMISTOR

The thermistor (U371) detects temperature. It is used to compensate active component characteristics due to the temperature difference.

DUPLEXER

Duplexer (F301) controls to transmit through the antenna only the signals within acceptable Tx frequency range (836 ±12.5 MHz) and to receive through the antenna only the signals within acceptable Rx frequency range (881 ±12.5 MHz). It also matches LNA (U301) input in receiving part and PA output in transmitter part with the antenna.

POWER SUPPLY REGULATOR

The power supply regulator (U381, U382) generates a regulated power (3.6VR).

ANTENNA

Antenna (ANT1) allows signals to send to receive from the base station.

6-3 Transmitter Section

BASEBAND ANALOG ASIC (BBA)

BBA (U401) consists of ADC, DAC, LPF (FM/CDMA), divider, VCO, logic control circuit, PLL, and mixer.

BBA performs a specific function between RF part and logic part, with MSM. The IF signal out from Rx IF AGC amp is secondly converted through the down-converter. The signal passes through the CDMA or FM filter, converts to digital signal through ADC, then is sent to MSM. The digital signal out from MSM converts to analog signal through DAC. The analog signal converts to the IF signal through each filter and the up-converter.

POWER AMP MODULE

Power Amp module (U467) amplifies signal (28 dB Gain) to be sent out to the base station through the antenna .

UP CONVERTER (MIXER)

The up-converter (U461) receives the first local signal to generate 836 ±12.5 MHz from the signal controlled by TX IF AGC amp (U460). 836 ±12.5 MHz signal comes out from the mixer output by subtracting 130 MHz IF signal from 966 ±12.5 MHz first local signal. The driver amp and this up-converter are packaged into one in U461.

IF AUTOMATIC GAIN CONTROLLER AMP

The signal out to the base station should be a constant level. The TX IF AGC amp (U460) controls power to keep the signal at a constant level. Dynamic range is 85 dB, up gain +40dB, and down gain -45dB.

RF BAND PASS FILTER (BPF)

The RF BPF (F451) accepts only a specific frequency (836 ±12.5MHz) to send it out to the base station. The band width is 25 MHz.

POWER SUPPLY SWITCHING

Power supply switching (Q483) turns on TX_POWER when the phone is in traffic mode and supplies power to the circuits.

ISOLATOR

Isolator (U468) is used to reduce a reflected signal to protect the power amp module from being damaged.

POWER SUPPLY REGULATOR

The power supply regulator (U482, U483) supply a regulated power to each part of transmitter. U483 supplies 4.7V to TX mixer (U461) and OP amp (U463). U482 supplies 3.6 V to TX IF AGC amp (U460).

6-4 Rapid Desk-Top Charger

Rapid Charger, DTC58 is composed of power supply part and control part.

6-4-1 Power Supply Part (Flyback type SMPS circuit)

AC INPUT

AC input protection circuit and rectifier circuit

AC power through the AC plug is rectifiered to DC power of high voltage through the BD1 and C2. MOV1 is used by protection circuit from AC power surge. F1 is fuse to prevent over current. C1 and LF1 is EMI noise protection filter of switching power.

Switching controller and transformer

IC1 supplies constant voltage and constant current to secondary circuit through the transformer. D1, D2 absorbs the reverse voltage when transformer winding turns off.

SECONDARY POWER

Output constant voltage circuit : HIC, IC7, VR1

The HIC detects output voltage and compares it with reference voltage in HIC. The error is FED to primary circuit by IC7A. The feeback error is converted to current by IC7B and D3. The current controlls IC1.

Secondary rectifier circuit : D4, D5, C8, C11

The secondary AC output of transformor is rectified to DC voltage.

Secondary filter circuit : L1, L2, C9, C12

It minimizes the high frequency ripple noise, which is caused by primary oscilation.

Secondary DC/DC converter circuit : Q2, D8, L3, C19

It changes the DC output voltage to 8.4V through step-down chopper method.

Reverse current protection circuit : D6, D7

When power is off, it protects the reverse flow of current from battery pack.

6-4-2 Control Part

MICOM CONTROLLER : HIC

HIC is include u-COM to controlled whole charging system and include following internal circuit :
-General Input/Output port
-A/D converter
-Reset delay circuit (Power on delay)
-Timer

It is carried following functions :
-Battery Recognition
-Charging termination condition detection
-Output short detection and output protection
-Temperature detection

BATTERY RECOGNITION CIRCUIT : HIC

Battery identity detection determined to voltage detection battery internal between C/F and GND.

CURRENT DETECTION CIRCUIT : R5, R6, R11, R12, HIC

Battery charging current is changed voltage through R5, R6, R11, R12. This voltage inputed u-COM to 16 times amplifiered through HIC.

VOLTAGE DETECTION CIRCUIT : HIC

u-COM A / D through HIC pin 12, 13 detected voltage.

BATTERY TEMPERATURE DETECTION CIRCUIT : HIC, TH1

Battery temperature detection determined temperature by ues of thermistor registor variation of THI by HIC.

CURRENT LIMIT CIRCUIT : HIC

When soft-change, current detection circuit limited current flow to battery, reference voltage more than detected current, detected current and HIC internal reference voltage.

6-5 Hands-Free Kit

6-5-1 Charging Circuit

A constant voltage is used for the hands-free kit. This circuit converts DC 12V input current to 8.4V DC to charge the battery. When the battery is fully charged, the charge current drops and the circuit operates as a constant voltage.

6-5-2 u-Processor

Micro processor controls charging power and charging current to protect the phone. It also allows to communicate with a HHP, and to convert from hands-free mode to private mode, and vice verse. It adjusts speaker volume at 8 steps and attenuates echo and noise occurred during conversation.

6-5-3 Speaker circuit

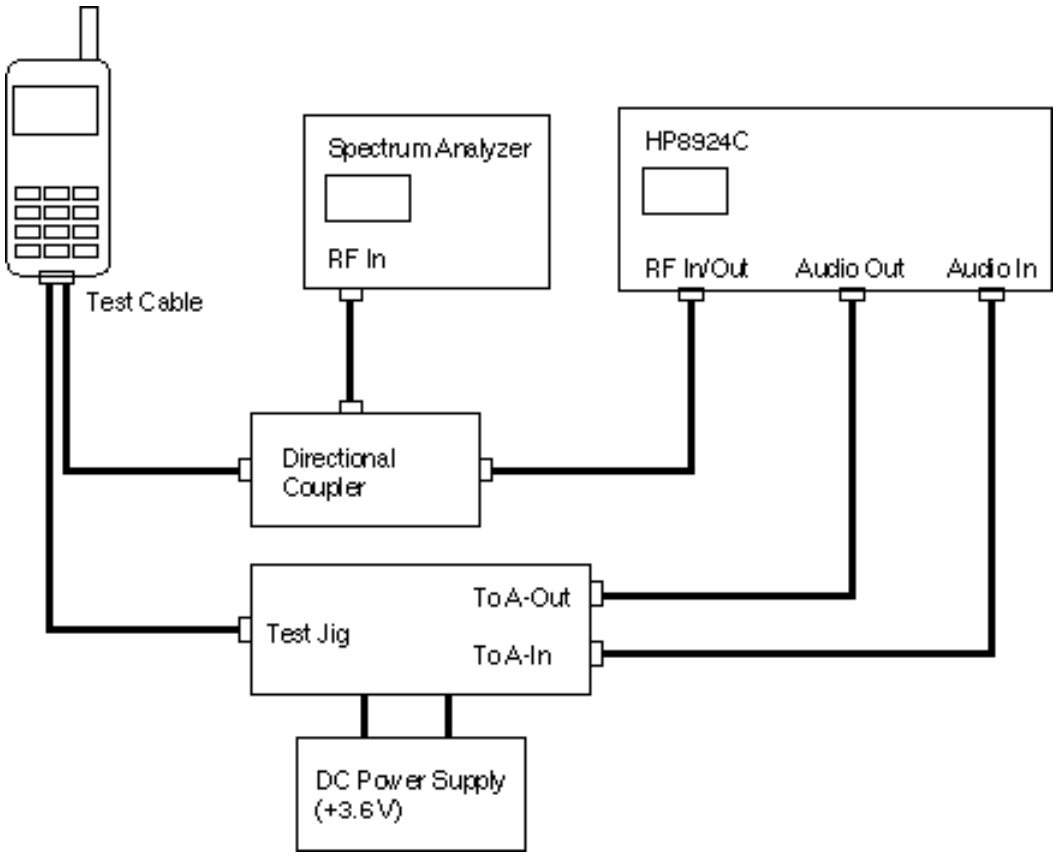
This circuit eliminates HHP noise, and controls the sound quality and speaker volume using analog C-mos IC which checks the speaker signal up to 8 steps. 5W audio amplifier amplifies the speaker signal.

6-5-4 Microphone Circuit

This circuit separates ground to eliminate the noise occurring from the HHP antenna and microphone. u-processor controls this circuit to attenuate echo which may occur in Land side.

6-6 Test Procedure

6-6-1 Configuration of Test



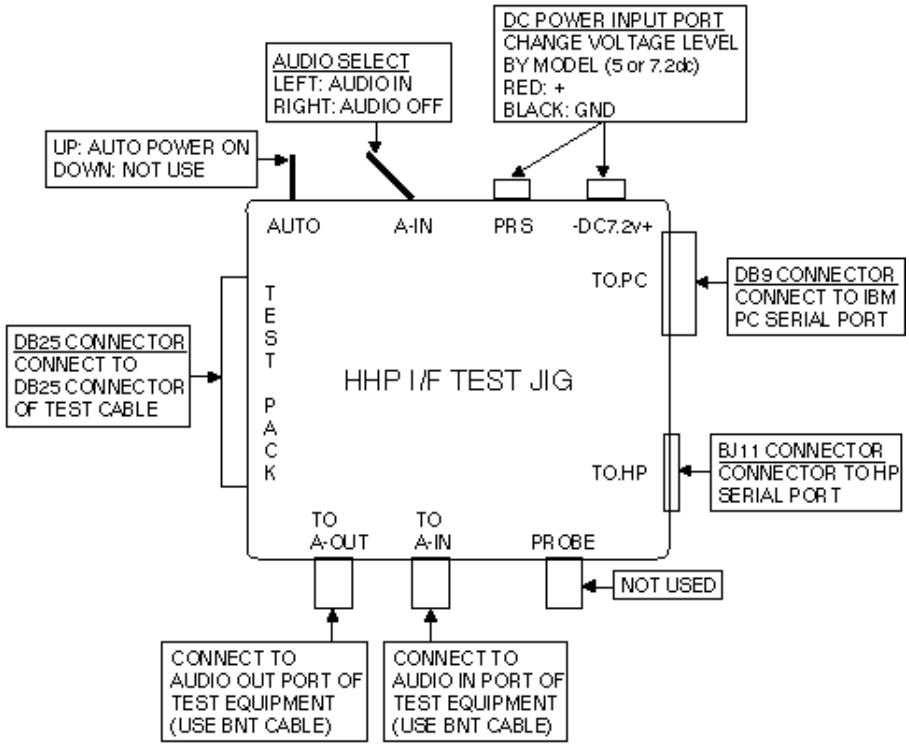
Items needed to purchase from SAMSUNG.

Items	Parts #	Remark
RF Test Cable	GH97-00687A	
Test JIG (RF Interface Pack Ass'y)	GH80-10502A	Including 1. Power Cable (Black, Red) 2. 9-pin RS232 Data Cable
DM Cable	GH39-30515A	

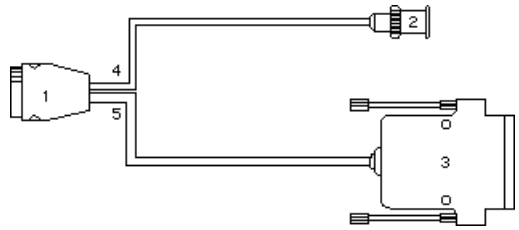
6-6-2 List of Equipment

- DC Power Supply
- Test Jig
- Test Cable
- CDMA Mobile Station Test Set — HP8924C, HP83236A, CMD-80 etc
- Spectrum Analyzer (include CDMA Test Mode) — HP8596E

TEST JIG



TEST CABLE

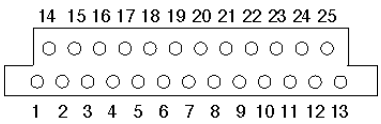


Test Cable Connections

1	Plug Connect to SCH-210
2	BNC Connector (RF)
3	Dsub 25Pin Connector (DATA)
4	RF Cable
5	Data Cable

Dsub 25 Pin Connector Pin Description
(Test Cable 1, Back Side)

Data Description	Dsub CONN. Pin No.
Vcc	4, 5, 6
GND	13, 23, 24, 25
PW ON / OFF	7
TX Audio	10
TX Data	22
RX Audio	12
RX DATA	21
RSSI	8



6-7 Test Command Table

Command No. (OP, AB, RB)	Command SW Name	Description
01(1F, 0, 0)	T_SUSPEND_I	Terminate the normal mode, enter to the test mode.
02(3F, 0, 0)	T_RESTART_I	Terminate the test mode, enter to the normal mode.
03(FD, 0, 0)	T_SAVE_VAL_I	Save value in EEPROM. (Only for Auto test)
04(1D, 0, 1)	T_GET_MODE_I	Get mode. (CDMA or FM) Return value '0' is FM mode, '1' is CDMA mode.
05(1C, 1, 0)	T_SET_MODE I	Set mode to CDMA or FM. (Only for Auto test) '0' is FM mode, '1' is CDMA mode.
06(1E, 0, 0)	T_WRITE_NV_I	Write an EEPROM item. (one of the NV items)
07(81, 0, 0)	T_CARRIERON_I	Turn the carrier on.
08(82, 0, 0)	T_CARRIEROFF_I	Turn the carrier off.
09(83, 4, 0)	T_LOADSYN_I[2)]	Set the synthesizer to the channel specified by ch_ data.
10(84, 1, 0)	T_PWRLEVEL_I[2)]	Set the RF power attenuation to the value specified.
11(85, 0, 0)	T_RXMUTE_I	Mute the receive-audio signal.
12(86, 0, 0)	T_RXUNMUTE_I	Unmute the receive-audio signal.
13(87, 0, 0)	T_TXMUTE_I	Mute the transmit-audio signal.
14(88, 0, 0)	T_TXUNMUTE_I	Unmute the transmit-audio signal.
16(8F, 0, 0)	T_STON_I	Transmit a continuous Signaling Tone (ST).
17(90, 0, 0)	T_STOFF_I	Stop transmit a continuous Signaling Tone.
22(91,96,96)	T_SNDNAM_I[1)]	Display and send NAM information.
23(95, 3, 4)	T_SNDVERSION_I[1)]	Display and return S/W version.
24(9F, 7, 8)	T_SNDESN_I[1)]	Display and return ESN.
25(92, 0, 0)	T_BACKLIGHT_ON_I	Turn on the backlight.
26(93, 0, 0)	T_BACKLIGHT_OFF_I	Turn off the backlight.
27(96, 0, 0)	T_LAMP_ON_I	Turn on the LAMP.
28(97, 0, 0)	T_LAMP_OFF_I	Turn off the LAMP.
29(9A, 5, 0)	T_REBUILD_I	Rebuild EEPROM.
30(9D,16, 0)	T_PLINE_I	Display and return production date.
32(A0, 1, 0)	T_SATON_I[*2)]	Enable the transmission of SAT.
33(A1, 0, 0)	T_SATOFF_I[*]	Disable the transmission of SAT.
34(A2, 0, 0)	T_CDATA_I	Transmit continuous 5-word Reverse CTL CH message.
35(A3, 0, 0)	T_VOLUME_UP_I	Increase value of the last command. (Only for autotest)
36(A4, 0, 0)	T_VOLUME_DOWN_I	Decrease value of the last command. (Only for autotest)
38(A6, 3, 0)	T_VOC_ENC_OFFSET_I	Vocoder ENC offset.
39(A7, 3, 0)	T_VOC_DEC_OFFSET_I	Vocoder DEC offset.

Command No. (OP, AB, RB)	Signal. Name	Description
40(A8, 4, 0)	T_VOC_CDMA_UNITY_GAIN_I	Vocoder ENC offset.
41(A9, 3, 0)	T_VOC_FM_HFRX_UPGAIN_I	Vocoder DEC offset.
42(AA, 1, 0)	T_DTMFON_I[2]	Activate DTMF generator with keycode.
43(AB, 0, 0)	T_DTMFOFF_I	Deactivate DTMF generator.
44(B0, 0, 0)	T_COMPANDORON_I	Enable the compressor and expandor.
45(B1, 0, 0)	T_COMPANDOROF_I	Disable the compressor and expandor.
46(B2, 0, 0)	T_FM_VCLINE_I[*]	Enter Analog voice channel state.
47(B3, 3, 0)	T_FM_AUD_GAIN_I	FM audio gain.
48(B4, 0, 0)	T_VIBRATOR_ON_I	Activate a vibrator.
49(B5, 0, 0)	T_VIBRATOR_OFF_I	Inactivate a vibrator.
50(B6, 0, 4)	T_BATT_TYPE_I	Battery type.
51(B7, 1, 1)	T_BBA_I	BBASIC supplier
52(B9, 2, 2)	T_HW_VERSION_I	HW version
53(BA, 3, 0)	T_CARRIER_I	Target Carrier option.
54(BB, 0, 0)	T_VOC13K_I	Target Service option.
55(BC, 0, 0)	T_EXT_AUDIO_I	External Audio Path On / Off.
57(BC, 0, 0)	T_MIC_ON_I	Mic path on.
58(BD, 0, 0)	T_MIC_OFF_I	Mic path off.
59(BE, 0, 0)	T_ALLPATH_I	Set RX Path, TX path Unmute to Earpiece.
60(BF, 3, 0)	T_FM_TX_GAIN_I[2)3)]	FM TX Audio Gain Control.
61(C0, 3, 0)	T_FM_RX_GAIN_I[2)3)]	FM RX Audio Gain Control.
62(C1, 3, 0)	T_DTMF_VOL_TX_I[2)3)]	FM TX DTMF Gain Control.
63(C2, 3, 0)	T_TX_LIMITER_I[2)3)]	FM TX Limiter Gain Control.
64(C3, 3, 0)	T_FM_SAT_LEVEL_I[2)3)]	FM TX SAT level Control.
65(C4, 3, 0)	T_FM_FREQ_SGAIN_I[2)3)]	FM TX Master Gain Control.
66(C5, 3, 0)	T_FM_ST_GAIN_I[2)3)]	FM TX ST Gain Control.
67(C6, 3, 6)	T_READ_BATT_I[1)]	Reads low batt. Value in Standby, or Talk mode.
68(C8, 0, 3)	T_VBATT1_I[3)]	Set the low battery position in the standby.
69(C9, 0, 3)	T_VBATT2_I[3)]	Set the low battery position in the talking.
70(CA, 3, 0)	T_WRITE_BATT_I[3)3)]	Write low battery Level Value to NVM.
71(D1, 3, 0)	T_CDMA_TXADJ_I[2)]	Change pdm TX AGC in CDMA.
72(D2, 3, 0)	T_FM_TXADJ_I[2)]	Change pdm TX AGC in FM.
73(D3, 1, 0)	T_SET_PA_R_I[2)]	Set PA R1, R0 in CDMA.
74(D4, 3, 0)	T_TXADJ_0DBM_I	Sets tx_agc_adj for fm mode.

Command No. (OP, AB, RB)	Signal. Name	Description
75(D5, 0, 3)	T_READ_RSSI_I[3]	Read a RSSI.
76(D6, 3, 0)	T_WRITE_RSSI_I[3]	Writes RSSI value.
77(D7, 0, 3)	T_READ_TEMP_I	Read Temp.
78(D8, 0, 3)	T_READ_HDET_I	Read High Detect.
79(D9, 1, 0)	T_BUZZER_ON_I[2]	Buzzer On at DTMF 0 key.
80(DA, 0, 0)	T_BUZZER_OFF_I	Buzzer Off.
81(E3, 0, 0)	T_VOC_PCMLPON_I	Play a PCM LOOP BACK.
82(E4, 0, 0)	T_VOC_PCMLPOFF_I	Play off a PCM LOOP BACK.
84(E6, 3, 0)	T_WR_CD_TXLIMIT_I[2)3)]	
85(E7, 0, 0)	T_SPEAKER_ON_I	Turn on the speaker path.
86(E8, 0, 0)	T_SPEAKER_OFF_I	Turn off the speaker path.
87(E9, 0, 0)	T_FM_LOOP_TEST_I	Play a PCM FM loopback.
88(EA, 0, 0)	T_TRK_ADJ_I[3]	FM TRK_LO_ADJ control.
89(EB, 3, 0)	T_CDTRK_ADJ_I	CDMA TRK _LO_ADJ control.
90(F0, 3, 0)	T_FM_HIGH_CH_PWR_I	Compensated value for high chan PWR.
91(F0, 3, 0)	T_FM_LOW_CH_PWR_I	Compensated value for low chan PWR.
92(F2, 3, 0)	T_FM_TX_PWR_2_I[2)3)]	Setting the volume for Power Level 2.
93(F3, 3, 0)	T_FM_TX_PWR_3_I[2)3)]	Setting the volume for Power Level 3.
94(F4, 3, 0)	T_FM_TX_PWR_4_I[2)3)]	Setting the volume for Power Level 4.
95(F5, 3, 0)	T_FM_TX_PWR_5_I[2)3)]	Setting the volume for Power Level 5.
96(F6, 3, 0)	T_FM_TX_PWR_6_I[2)3)]	Setting the volume for Power Level 6.
97(F7, 3, 0)	T_FM_TX_PWR_7_I[2)3)]	Setting the volume for Power Level 7.
99(F9, 3, 0)	T_FM_MOST_CH_PWR_I	Compensated value for Power Level 2.
100(FF, 3, 0)	T_MAX_I	Compensated value for Most chan PWR.

[1)] The AB (Input Argument Byte Number) values of these commands are used only in the manual test. In automatic test mode, the AB is regarded as 0.

[2)] You can assign the value for these commands. If the AB value is assigned without argument, the test is achieved with the value stored in EEPROM.

[3)] After you get a desired test value by performing these commands, if you want to save the value into EEPROM, use T-SAVE-VAL-I command to store the test value into the corresponding position.

* OP: Operation Command Number
  AB: Input Argument Byte Number
  RB: Return Byte Number
* SAT 32, 33 are not operating in MSM2 CHIP test
* 46 command is required in Rx, and Tx path test at FM mode

6-8 Rapid Travel Charger

Rapid Charger, TC59-US is composed of power supply part and control part.

6-8-1 Power Supply Part (Flyback type SMPS circuit)

AC INPUT

AC input protection circuit and rectifier circuit

AC power through the AC plug is rectifiered to DC power of high voltage through the D1, D2, D3, D4, C1 and C2. MOV1 is used by protection circuit from AC power surge. F1 is fuse to prevent over current. L1 and L2 is EMI noise protection filter of switching power.

Switching controller and transformer

U1 supplies constant voltage and constant current to secondary circuit through the transformer. D5, D6 absorbs the reverse voltage when transformer winding turns off.

SECONDARY POWER

Output constant voltage circuit : U4, D24, R17

The HIC detects output voltage and compares it with reference voltage in HIC. The error is FED to primary circuit by U2B. The feeback error is converted to current by U2A and D7. The current controlls U1.

Secondary rectifier circuit : D21, C21

The secondary AC output of transformor is rectified to DC voltage.

Secondary filter circuit : L20, C22

It minimizes the high frequency ripple noise, which is caused by primary oscilation.

Reverse current protection circuit : D20

When power is off, it protects the reverse flow of current from battery pack.

6-8-2 Control Part

MICOM CONTROLLER : U4

U4 is include u-COM to controlled whole charging system and include following internal circuit :
-General Input / Output port
-A / D converter
-Reset delay circuit (Power on delay)
-Timer

It is carried following functions :
-Battery Recognition
-Charging termination condition detection
-Output short detection and output protection
-Temperature detection

BATTERY RECOGNITION CIRCUIT : U4

Battery identity detection determined to voltage detection battery internal between ID and GND.

CURRENT DETECTION CIRCUIT : R14, R15, R16, U4

Battery charging current is changed voltage through R14, R15, R16. This voltage inputed u-COM to 16 times amplifiered through U4.

VOLTAGE DETECTION CIRCUIT : U4

u-COM A/D through U4 pin 15 detected voltage.

BATTERY TEMPERATURE DETECTION CIRCUIT : U4

Battery temperature detection determined temperature by ues of thermistor resistor variation of battery by U4.

CURRENT LIMIT CIRCUIT : U4

When soft-change, current detection circuit limited current flow to battery, reference voltage more than detected current, detected current and U4 internal reference voltage.

6-9 CLA (Cigarette Lighter Adaptor)

6-9-1 Functional Specification

SUMMARY

This standard describes on the specifications of CLA (Cigarette Lighter Adaptor) for the SCH-210 of SAMSUNG.

SCOPE

CLC includes the following two function.

Adapter function

It supplies power needed to operate Cellular Phone with battery pack.

Charger function

Charger for battery pack.

ELECTRONIC SPECIFICATION

Input voltage : 11~30V DC
(normal voltage 13.7V DC)

Output current

-HHP power and battery power setting : 8.2V DC ± 0.05V/0mA
-Output current : 0A to 660mA
-Current limit of this unit should be kept 660mA ± 40mA
-Output voltage range : 8.2V -0.4/+0.2
-LED green : 180mA ± 30mA

Ripple and noise : 100mVpp

Proper fuse capacity : 250V, 2A

Charge time

Small Capacity	about 2hrs.
Medium Capacity	about 3hrs.
Large Capacity	about 4 1/2hrs.

ENVIRONMENTAL SPECIFICATION

Temperature

-Operating temperature : 0°C ~ 50°C
-Storage temperature : -20°C ~ 105°C

Humidity

-Operating humidity : 5% ~ 90%
-Storage humidity : 5% ~ 95%

CLC FUNCTION

Protection circuit

Protection circuit keeps against electronic stress like over current, and inputting polarity power promptly in case of occurring unexpected situation in CLC unit source power.

Function of confirming mobile phone installation

Function of confirming proper charge process with turning on lamp in CLC which is connected with Cellular Phone.
Green : Full charge
Red : Being charge

Function of confirming battery installation

Function of confirming battery installation in cellular phone, then control the CLC activation.

Function of auto power on

Function of turning on Cellular Phone automatically with inserting CLC interface jack into the phone.

6-9-2 Circuit description of SCH-210 CLC

POWER SUPPLY

This circuit supplies HHP & battery with power received from Cigar Lighter jack of automobile.

POWER CIRCUIT OF CHARGE FOR HHP POWER & BATTERY

This Switching Regulator produces needed power for charging HHP power & battery, supplied U1, D1, D2, C1, C2, L1, R25 from Cigar Lighter jack of automobile.

CONFIRMING CIRCUIT OF EXISTING BATTERY OR NOT

U3A reads separated voltage between resistance battery C/F and R20, controls no. 5 pin of U1 through reference voltage and comparator then decides to produce Vcc or not.

CHARGE CURRENT CONTROL CIRCUIT

U2A, U4, Q1 and side circuit detects R4's flowing current, controls no. 5 pin of U1 then charge current and charge voltage.

LED ACTIVATING CIRCUIT

LED activating circuit compares to voltage difference between R4 source and D4 PROP, controls Q3, Q4 through U2B comparator for Q6 and side circuit, then activates LED.

AUTO POWER ON CIRCUIT

Q9, Q10 and side circuit makes power on the circuit allowed Vcc power to no. 9 HHP pin(power on) by turned on Q9, following up the producing Vcc.

CONNECTION OF CLC, CURL, AND CABLE

Pin no (CLC)	Description	Pin no (HHP)
#1	HP-PWR	9
#2	V-BAT	12/13/16
#3	V/F	N.C
#4	C/F	3
#5	GND	2/4/6