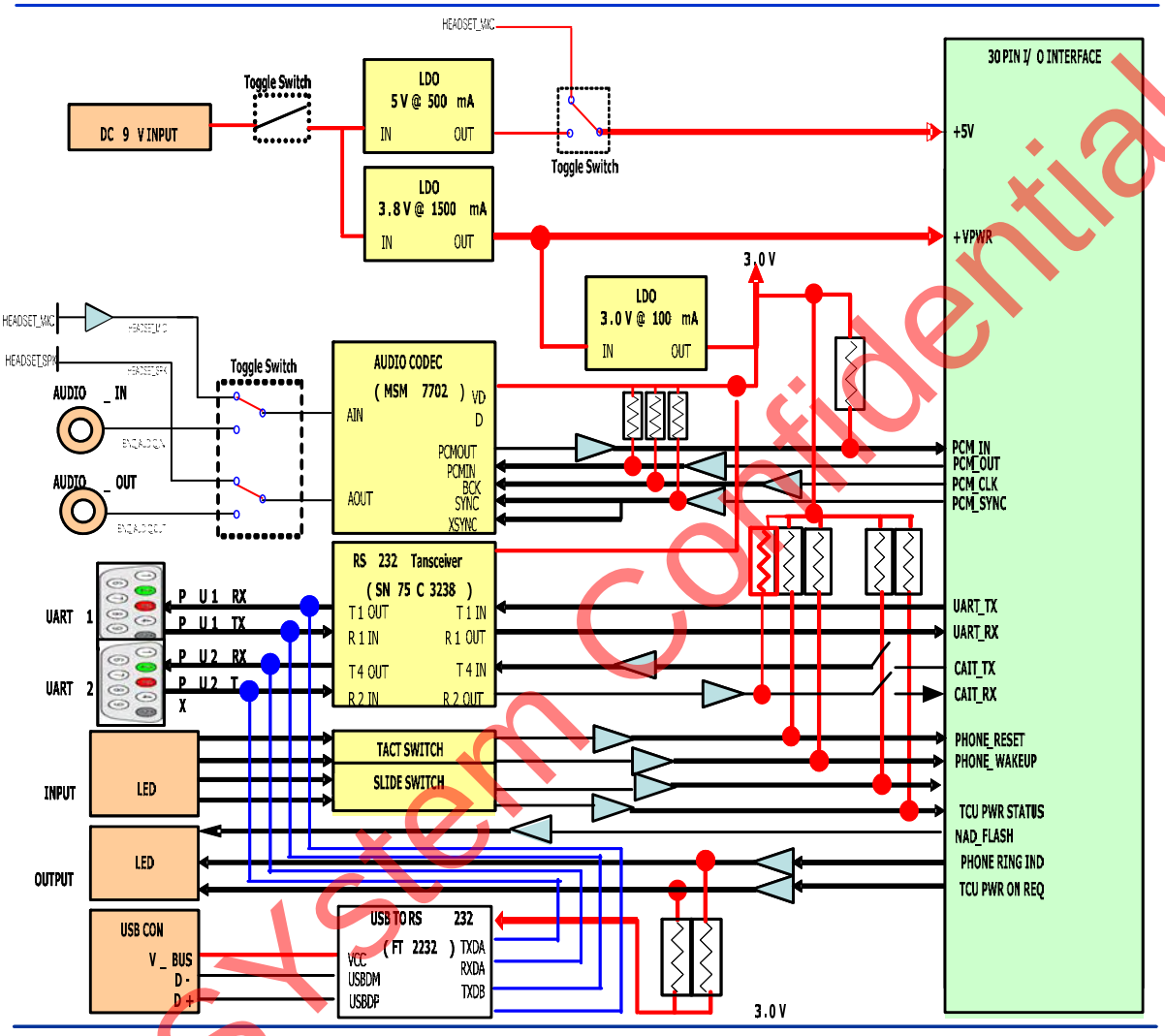
M SEVEN SYSTEM

28235591 NAD
LT Box User Manual
(Version 1.0)

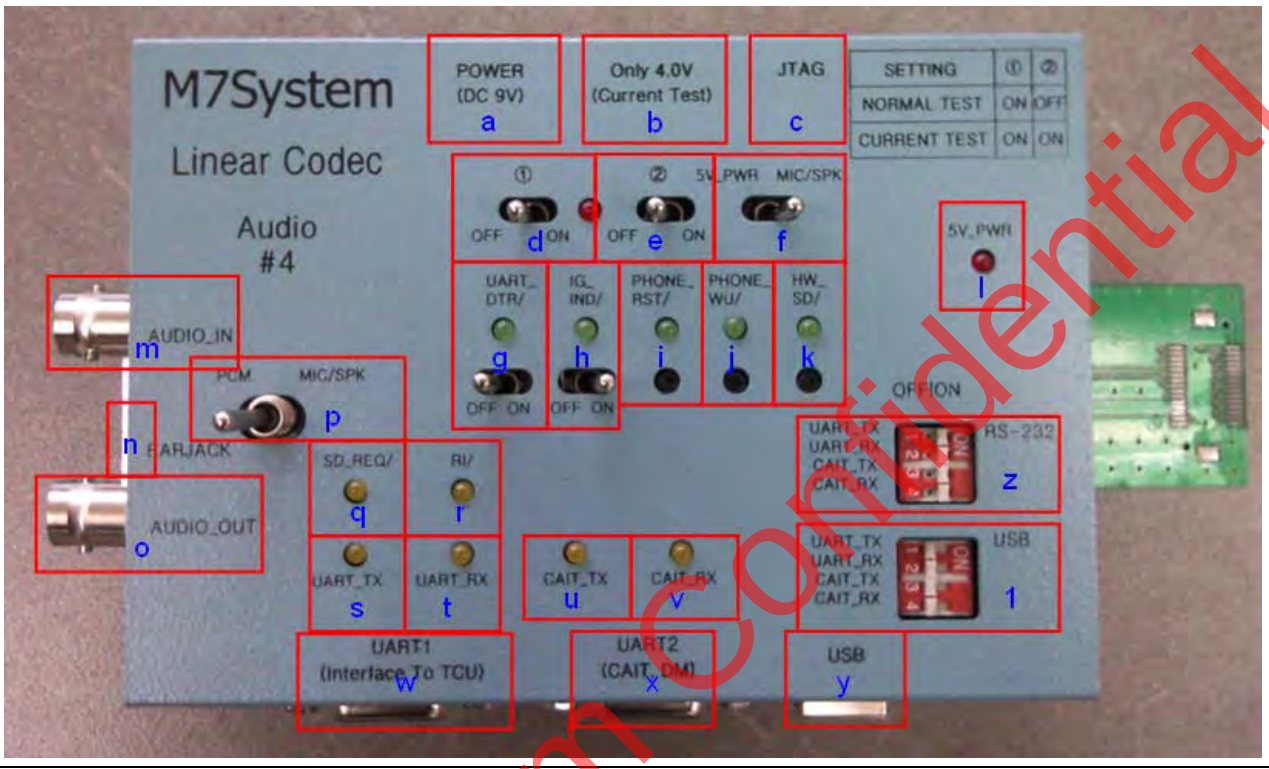
December 4, 2009

M SEVEN SYSTEM

1. LT Box Block Diagram



2. LT Box Picture



<TOP VIEW>

<BOTTOM VIEW>

M SEVEN SYSTEM

3. LT Box Interface

ⓐ **Main Power DC Jack:**

- DC 9V input. Plug in AC/DC Adaptor or Power Supply instruments (8V – 12V). Indicator turns red.

ⓑ **Sub Power DC Jack:**

- DC 4V input. Only for current drain measurement.

ⓒ **JTAG Interface :**

- ARM7 JTAG Interface. Connect Trace32 JTAG. Not used.

ⓓ **Main Power On/off Switch:**

- Power up NAD and Power On main power switch to turn-on LT.

ⓔ **Sub Power On/Off Switch:**

- Sub power switch is only for current drain measurement, otherwise turn off sub power switch.

ⓕ **5V_PWR, MIC/SPK Select Switch:**

- To use 5V power, move “5V_PWR - MIC/SPK” switch to 5V_PWR. Then 5V_PWR indicator turns red. 5V power is for 28235591 NAD only.
- For 28235591 NAD to be used in 28235591 LT BOX, move “5V_PWR - MIC/SPK” switch to MIC/SPK. And confirm that 5V_PWR indicator is off. If 5V power is on, 28235591 NAD can’t work normally or damaged.
- To use analog audio of 28235591 NAD, move “5V_PWR - MIC/SPK” and “PCM - MIC/SPK” switch to MIC/SPK.

ⓖ **UART_DTR/ Switch:**

- Data input, Default High, Active Low. Toggle switch from high to low, it provides TCU processor active. Indicator turns green.

ⓗ **IG_IND/ Switch:**

- Data input, Default High, Active Low. Toggle switch from high to low, it provides ignition on. Indicator turns green.

ⓘ **PHONE_RST/ Switch:**

- Data input, Default High, Active Low. Press tact switch, It provides NAD reset. Indicator turns green.

ⓙ **PHONE_WU/ Switch:**

- While using the JTAG, press tact switch and NAD wake-up. Or press tact switch to turn-on NAD. Indicator turns green.

M SEVEN SYSTEM

ⓚ **HW_SD/ Switch:**

- Data input, Default High, Active Low. Press tack switch, It provides NAD shut down. Indicator turns green.

ⓛ **5V_PWR Indicator:**

- Move “5V_PWR - MIC/SPK” switch to 5V_PWR. Then 5V_PWR indicator turns red.

ⓜ **AUDIO_IN Jack: MIC**

- Audio input. Analog audio input from codec in LT.

ⓝ **Ear Jack 2.5mm:**

- 2.5mm headset used. Analog audio input/output from codec in LT.

ⓞ **AUDIO_OUT Jack: Speaker**

- Audio Output. Analog audio output from codec in LT.

ⓟ **PCM, MIC/SPK Select Switch:**

- To use analog audio and PCM interface of 28235591 NAD.

ⓠ **SD_REQ/ Indicator:**

- Data output, Default High, Active Low. NAD requests hardware shutdown to TCU. Indicator turns yellow.

ⓡ **RI/ Indicator:**

- Data output, Default High, Active Low. Incoming call by NAD. Indicator turns yellow.

ⓢ **UART_TX Indicator:**

- Data output, Default Low, Active High. NAD sends signal to TCU. Indicator turns yellow.

ⓣ **UART_RX Indicator:**

- Data output, Default Low, Active High. NAD is received control signal from TCU. Indicator turns yellow.

ⓤ **CAIT_TX Indicator:**

- Data output, NA. NAD sends data to TCU. Indicator turns yellow.

ⓥ **CAIT_RX Indicator:**

- Data output, Default Low, Active High. NAD is received data from TCU. Indicator turns yellow.

ⓦ **UART1 (Interface to TCU):**

- NAD UART 1 port for TCU Interface. You can connect programs that use AT Commands.

ⓧ **UART2 (CAIT, QXDM):**

- NAD UART 2 port for CAIT, QXDM. You can connect programs.(CAIT,QXDM)

M SEVEN SYSTEM

ⓨ USB Socket:

- USB port, USB to RS232 convertor in LT. When you want to use USB cable, plug in USB port, download USB Driver (VCP Driver: Virtual COM Port Driver “CDM2.00.00.zip”) at www.ftdichip.com and install.

ⓩ RS-232 On/Off switch:

- If you want to use serial cable for connecting UART1 and UART2, RS-232 switch On and USB switch Off.

① USB On/Off switch:

- If you want to use USB cable for connecting UART1 and UART2, RS-232 switch Off and USB switch On.

② 30 Pin I/O Interface:

- 30 pin connector (bottom side) for NAD interface.

4. LT Box Functions.

1) NAD Booting

① Plug in DC 9V power supply or AC/DC Adaptor(9V) in the DC power jack **(ⓐ)**.
② Toggle main power switch from Off to On **(ⓓ)**.
③ Press the PHONE_WU/ switch (ⓙ).
④ NAD booting.

Notice:

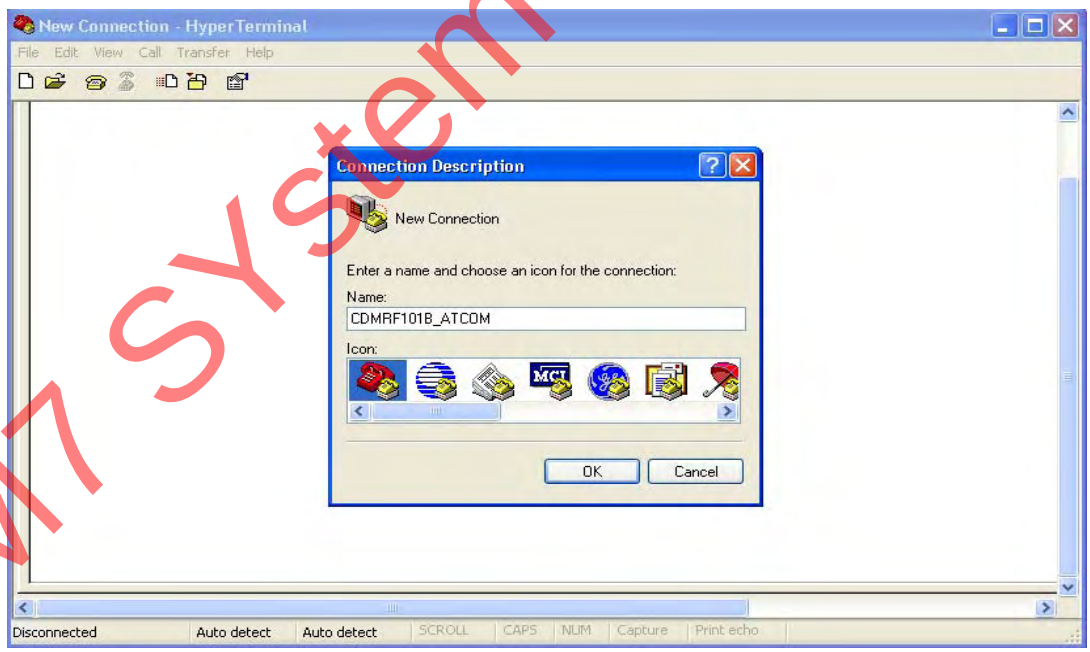
1. Don't plug in DC9V power supply at the Sub Power DC Jack **(ⓑ)**.
2. Sub Power On/Off switch is usually Off **(ⓔ)**.

2) Audio test.

Connect MIC at AUDIO_IN Port and SPK AUDIO_OUT Port. You can test Audio.

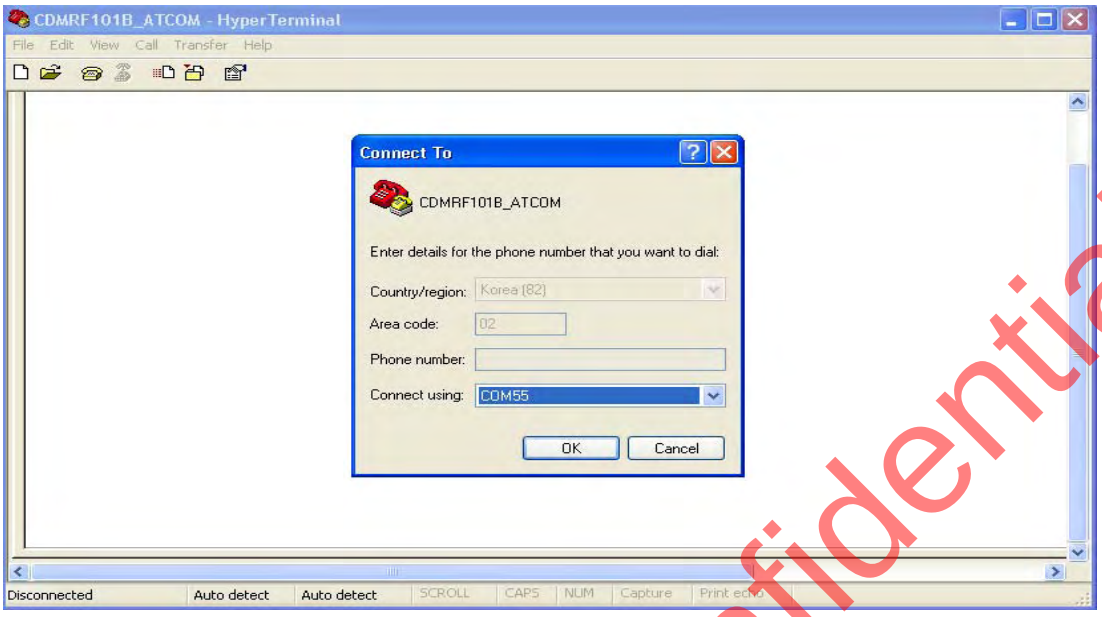
3) Using Tools.

① Hyper Terminal

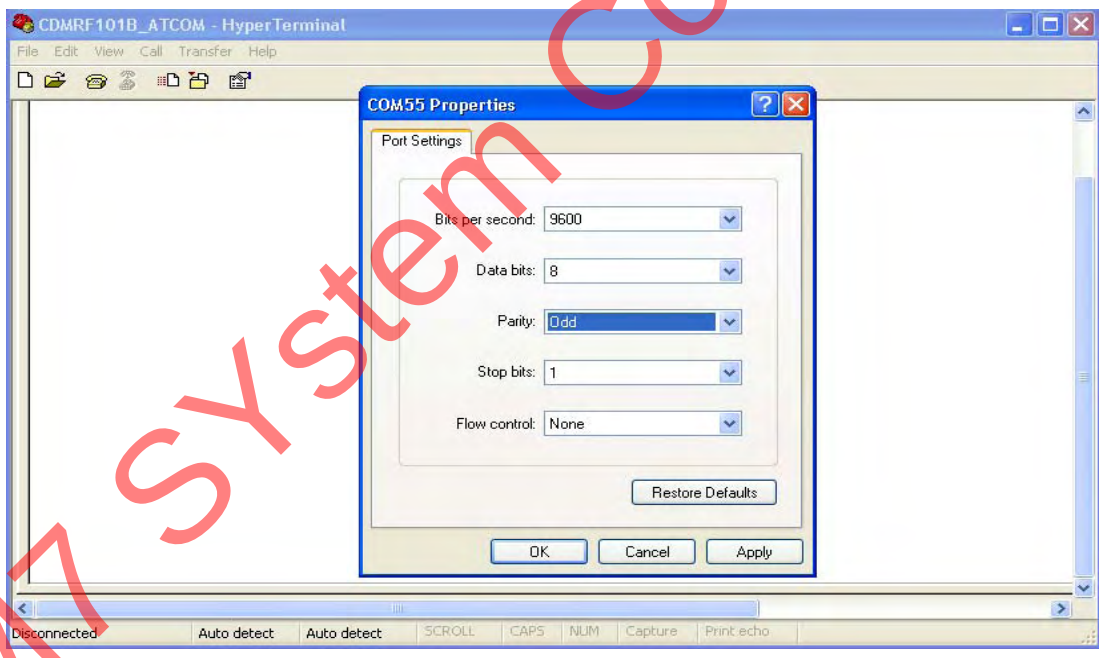


A. Click Hyper Terminal Program

B. Insert the New Connection Name, Click OK Button

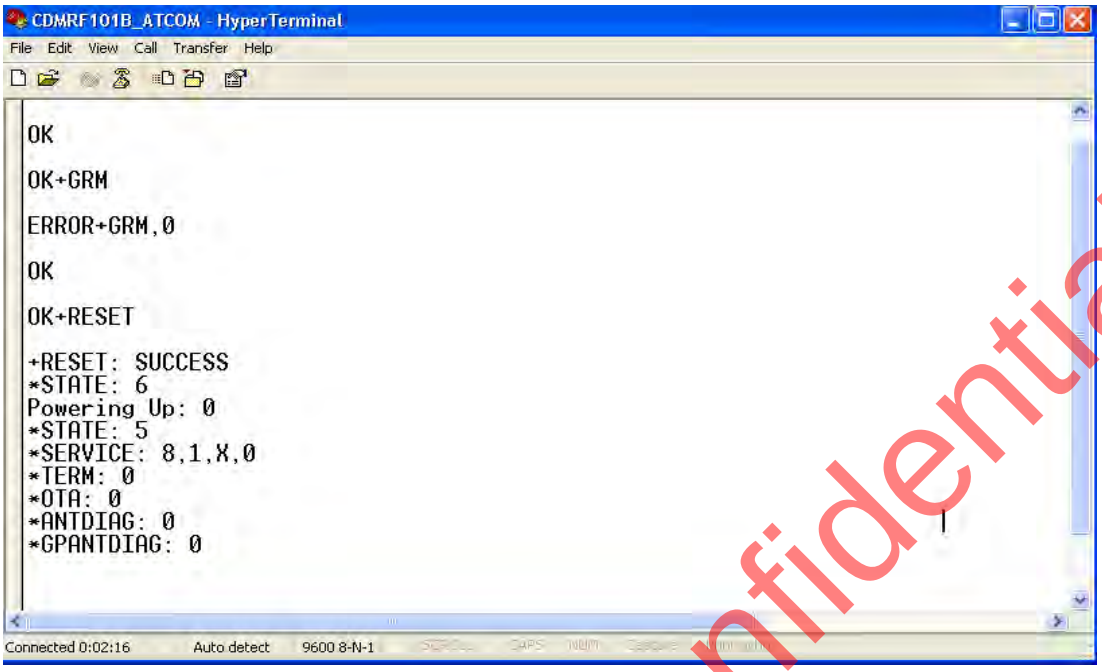


C. Set up the Com port.



D. Set up Bits per second(9600), Data bits(8), Pantry(Odd), Stop bits(1), Flow control (None).

E. Click Apply and OK Button.

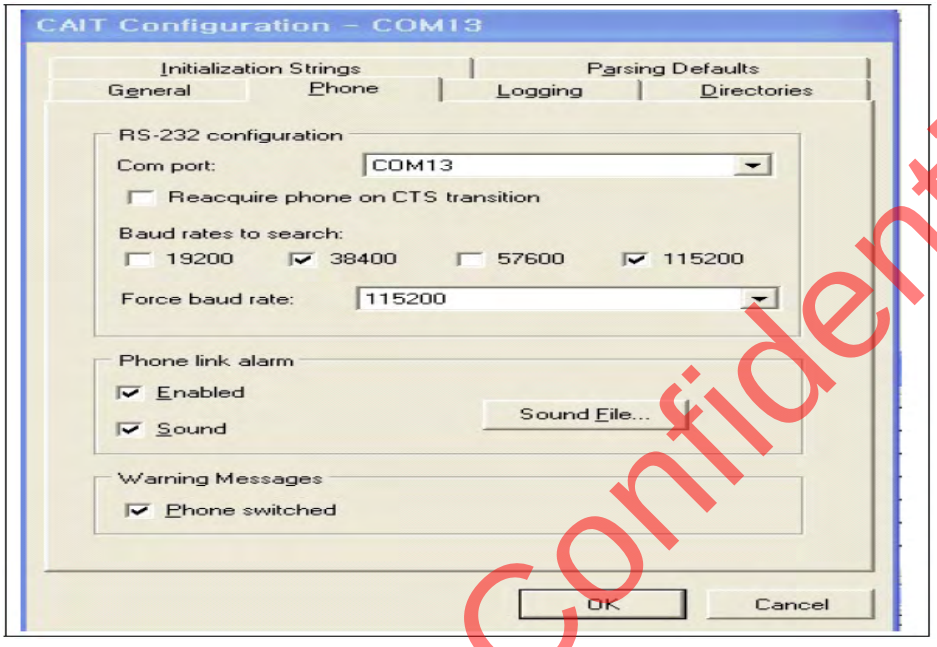


F. You can use AT command.

② CAIT

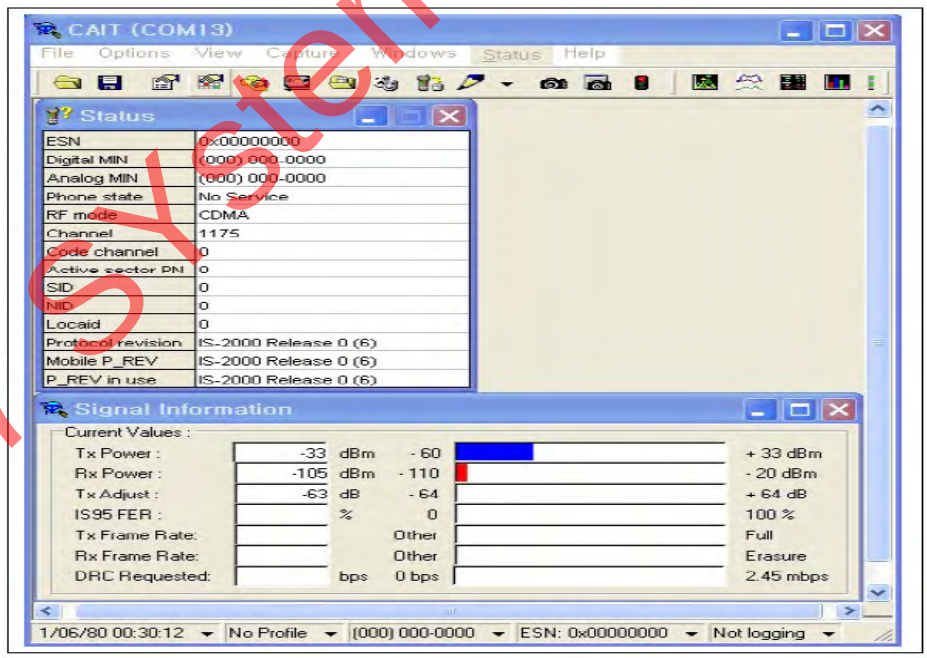
A. Click CAIT Program.

B. In the Option, Click the Configure CAIT.



C. Click the Phone and Set up the Com port, Baud rates.

D. Click OK Button



E. You can use CAIT.

③ UTPST

- Refer to the “28235591_M7PST_User_Manual.pdf”

M Seven System Product Support Tool

Nov. 17, 2009

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M Seven System Ltd.
275-7, Trust Tower Bldg.
YangJae 2-Dong, Seocho-Gu, Seoul, Korea.

M Seven System Incorporated
275-7,Trust Tower Bldg .
YangJae 2-Dong, Seocho Gu, Seoul, Korea.

Product Support Tool

28235591

Nov. 17, 2009

Table of Contents

1. Introduction

1.1 Purpose

M7PST provides a diagnostic client for the DMSS (Dual Mode Subscriber Station) software and is used to aid in mass production of such handsets. It provides a rapid prototyping platform for new diagnostic clients and diagnostic protocol packets. M7PST provides a graphical user interface (GUI) that provides easy setup of handsets and manipulation of production logs.

1.2 Scope and intended audience

This user guide is intended for users who need to know how to install, use, and understand the information provided by M7PST.

This manual can be applied to the following model:

Model	Carrier	Version Prefix
28235591	Delphi	VW6C

The following is an overview of what is covered in this guide.

- Installation
- M7PST screen shots
- Operation of each screen
- Relevant references and information

M7PST also provides some advanced features designed for development.

- Communication parameters

1.3 Conventions

1.4 Revision history

The revision history for this document is shown in Table 1-4.

Document Number	Date	Description
00.00.01	Nov.10.2009	The initial release

[Table 1.4] Revision history

1.5 References

Reference documents are listed in Table 1-2.

Ref.	Document	
1	Recommended Minimum Performance Standards for Dual-Mode Wideband Spread Spectrum Cellular Mobile Stations	TIA/EIA/IS-98-A

[Table 1.5] Reference documents

1.6 Technical assistance

For assistance or clarification on information in this guide, email your question to mailto:kevin.park@m7system.com

1.7 Acronyms

The following acronyms are used throughout this guide.

AMSS	5200- and 6200-based subscriber software
CAIT	CDMA air interface tester
CDMA	Code division multiple access
DLL	Dynamic link library
DMSS	Dual-mode subscriber station
ELF	Executable and linking format
ESN	Electronic serial number

FER	Frame error rate
FFA	Form-fit accurate
F-FCH	Forward fundamental channel
F-SCCH	Forward supplemental code channel
F-SCH	Forward supplemental channel
FTM	Factory test mode
GPS	Global positioning system
GSM	Global system for mobile communications
GUI	Graphical user interface
HTML	Hypertext markup language
MDM	Mobile diagnostic monitor
MSM	Mobile station modem
NV	Nonvolatile memory
PDE	Position determination entity
PN	Pseudorandom noise
QXDM	QUALCOMM extensible diagnostic monitor
R-DCCH	Reverse dedicated control channel
R-FCH	Reverse fundamental channel
RLP	Radio link protocol/processor
R-SCH	Reverse supplemental channel
SIA	Sensor interface application
SILK	Structure Iteration Language toolkit
SURF	Subscriber unit reference platform

2. Installation

2.1 Required hardware and software

The following table describes the minimum hardware requirements needed for normal M7PST operation.

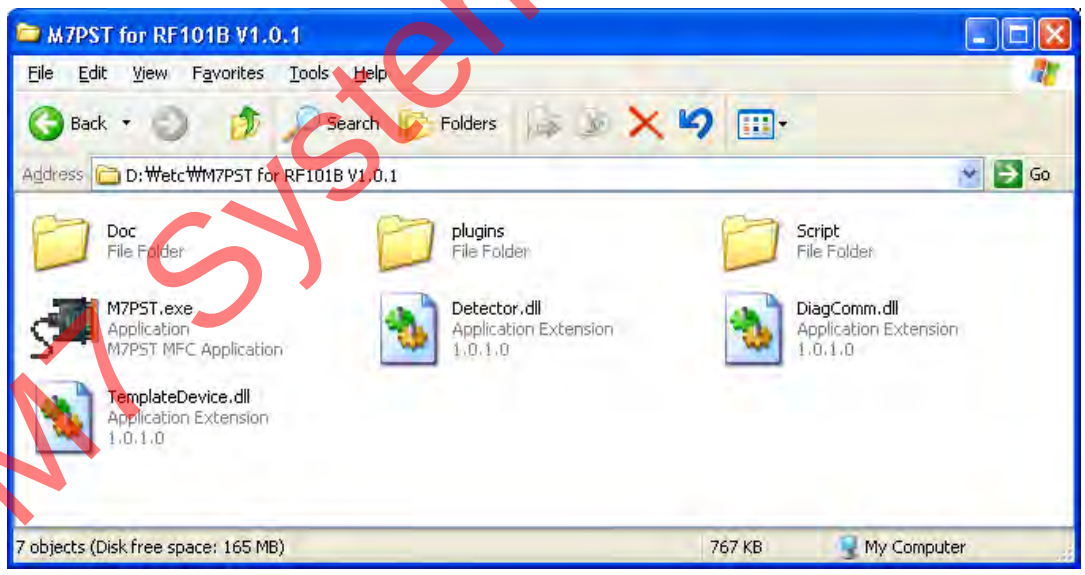
Item	Description
CPU	Intel Pentium or compatible
OS	Microsoft Windows 98, Windows NT, Windows 2000, or Windows XP
RAM	256 MB or higher
Video	1024 × 768, 16 colors

[Table 2.1] Hardware& software SPEC

Installation is done through the three steps:

(1) Check USB driver. M7PST runs on both USB/serial connections. Accompanying USB driver should be installed first before using M7PST if USB connection is to be used.

(2) Uncompress **M7PST for RF101B V1.0.1.zip** to a location wanted to be installed.



2.2 Running M7PST

Click M7PST.exe located in installation directory.

3. Overview

3.1 Overview and Toolbar Icons

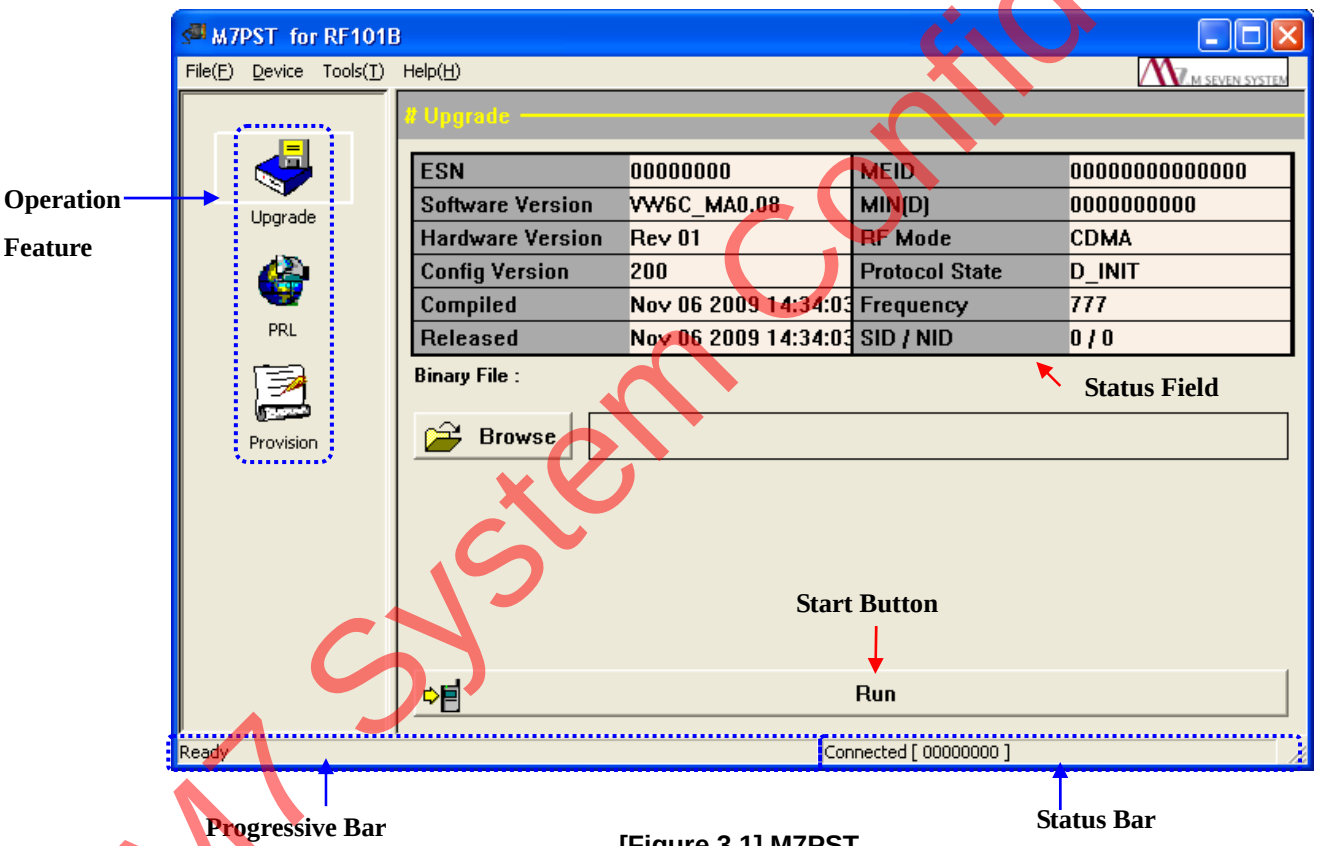
3.1.1 Overview

The following picture illustrates the M7PST User Interface. By pressing each icon of operation feature, users can choose what to do with M7PST.

(1) Upgrade: Upgrade lets users flash SW image to the handset.

(2) PRL: PRL lets users download the proper PRL file into the handset.

(3) Provision: Provision lets users edit handset settings.



[Figure 3.1] M7PST

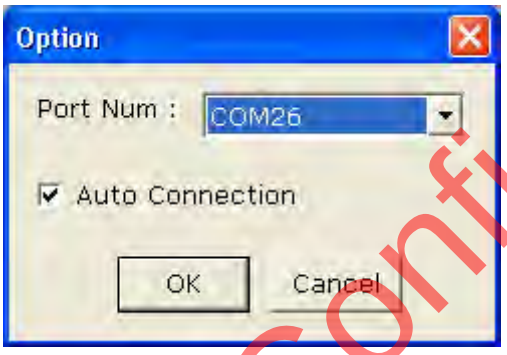
3.1.2 Using the M7PST

Upon running, M7PST tries to find the device model automatically. Connection is also setup automatically. Each device has an associated device image that can be used to visually inspect that the selected device matches the physical device.

3.1.3 Connecting to a M7PST Device

Connection between the host PC and the target handset is made by plugging the handset into the USB/serial cable into the PC. M7PST tries to make a connection to the handset when "Auto Connection" option is enabled. When a connection is made, M7PST also tries to recognize the device model. The connect states will typically be 'Not Connected', 'Connected : No Device', or 'Connected : Device Name'.

3.1.4 Selecting a M7PST Device Connection Port



[Figure 3.2] Port (TOOLS->Opton)

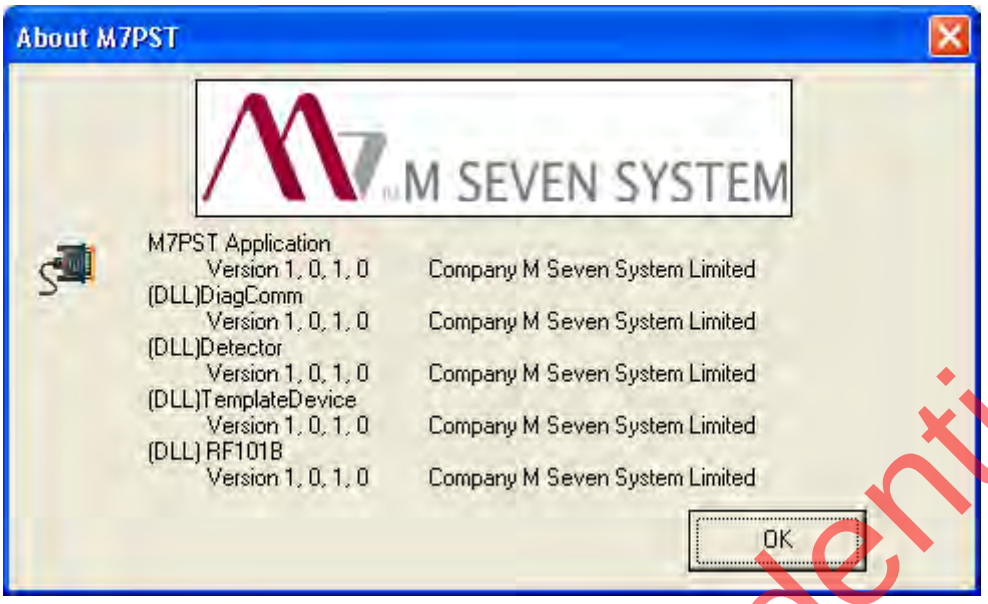
As in 3.2, connection and device detection is done by automatically when "Auto Connection" is enabled. Un-checking on "Auto Connection" is done through TOOLS->Option. When "Auto Connection" is disabled (un-checked), M7PST does not try to make a connection. Connection is made manually by Device->Connect.

3.1.5 Selecting a M7PST Device Feature

There will typically be three feature common to all devices: Upgrade (used for software upgrade), PRL (used for PRL upgrade), and Provision (used for phone setting programming). Click on the desired feature to display the package workspace.

3.1.6 About M7PST Dialog

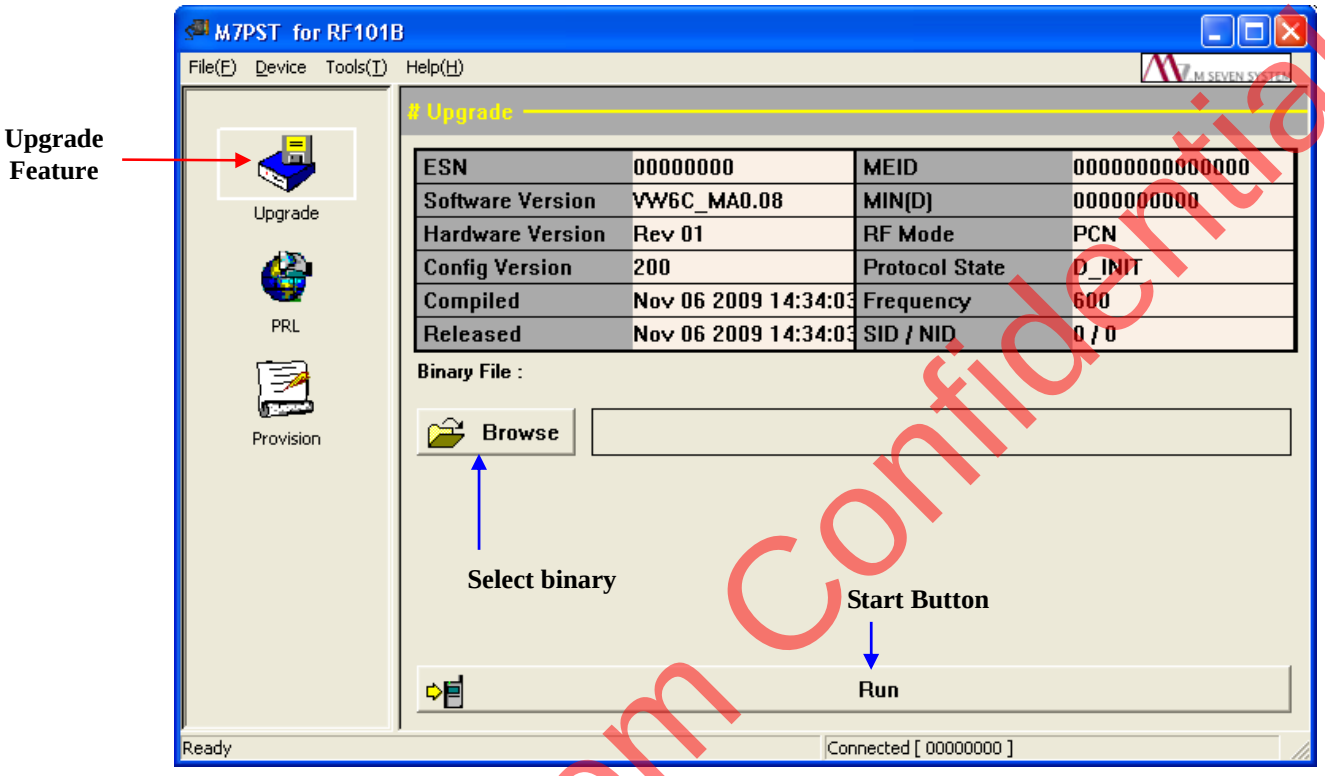
When the About icon on the toolbar is selected, the following dialog is displayed. This display can also be viewed by choosing Help -> About M7PST from the M7PST menu. This dialog displays the M7PST version, Device DLL version.



[Figure 3.3] About Dialog

4. Upgrade Feature

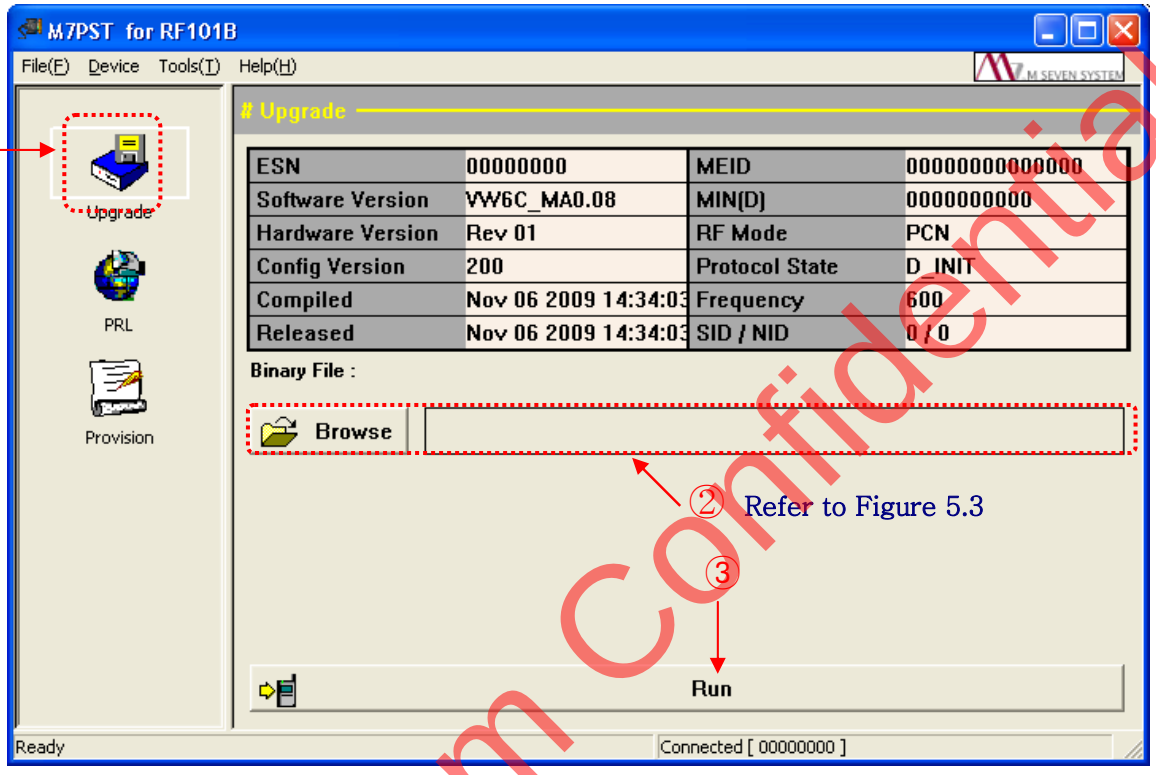
Upgrade feature is used for downloading new software to the phone. Users can manually select the appropriate files by clicking on the 'Browse' button.



[Figure 4.1] Upgrade Feature

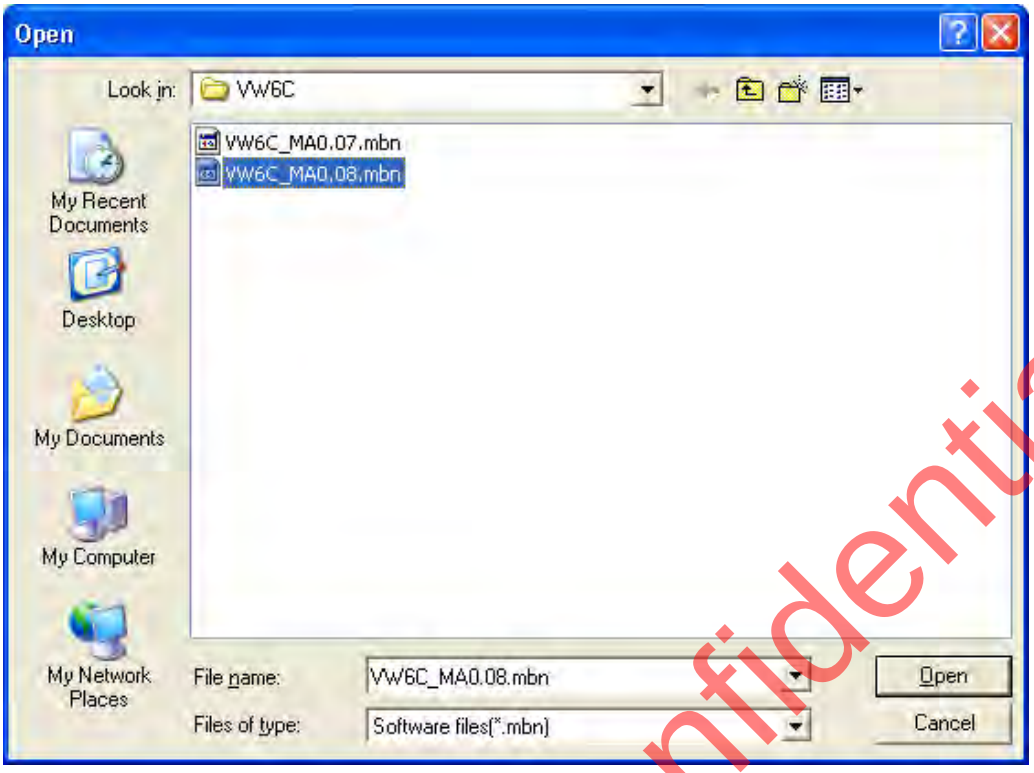
4.1 Upgrade: Step-by-Step Procedure

Pressing 'Upgrade' will show the following screen.



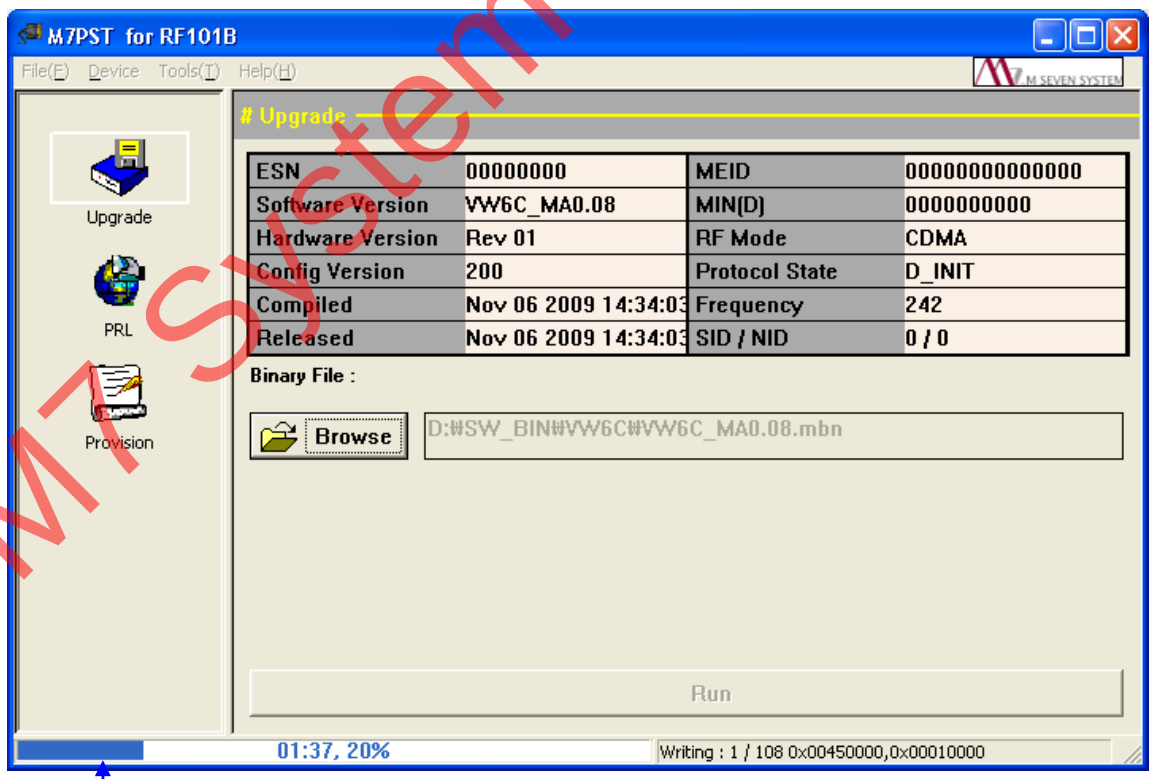
[Figure 4.2] Upgrade procedure

You have to choose HSW(Handset Software) file to upgrade handset by pressing 'Browse' button



[Figure 4.3] Select Flash file

Upgrade starts by pressing 'Run'. The progress bar shows the upgrade status by percentage.

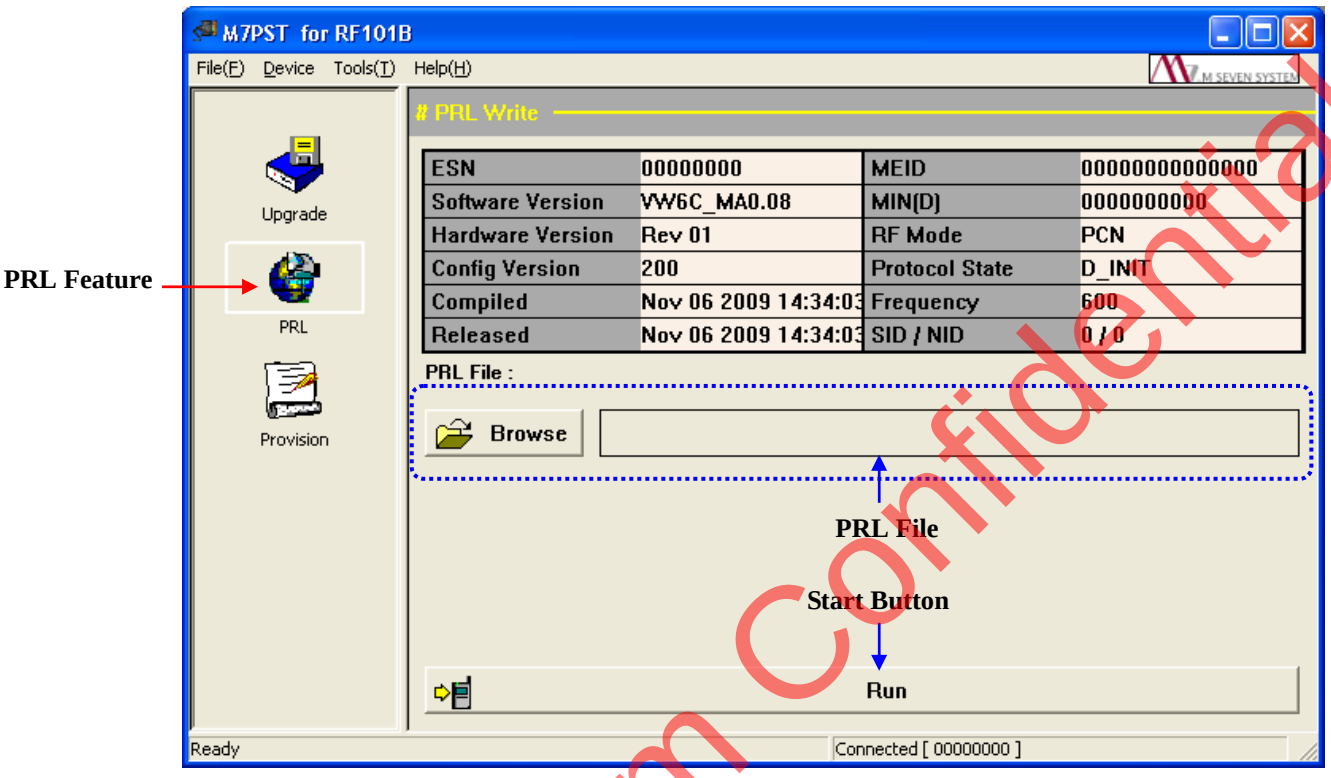


Progressive Bar

[Figure 4.4] Upgrade Start

5. PRL Feature

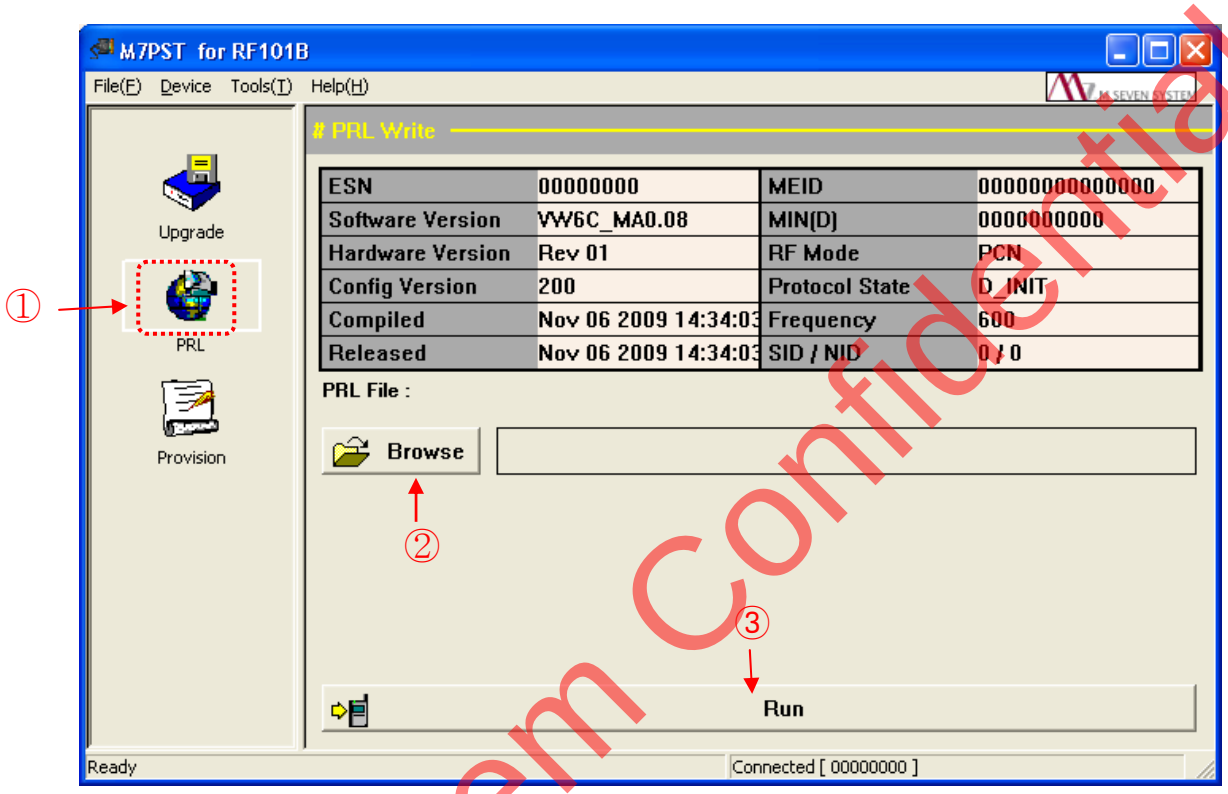
PRL allows the user to download a proper PRL file into the handset.



[Figure 5.1] PRL display

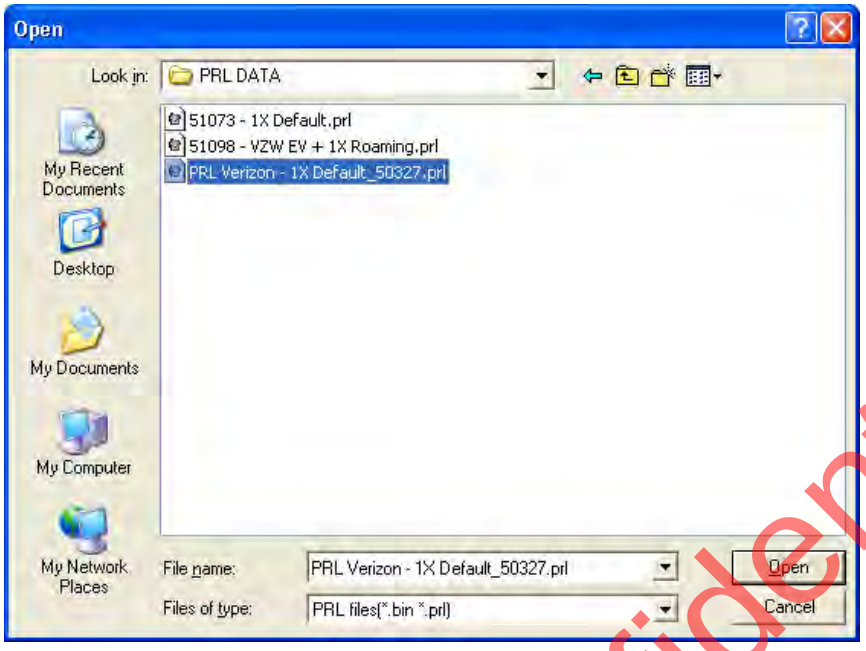
5.1 PRL: Step-by-Step Procedure

Pressing 'PRL' will show the following screen.



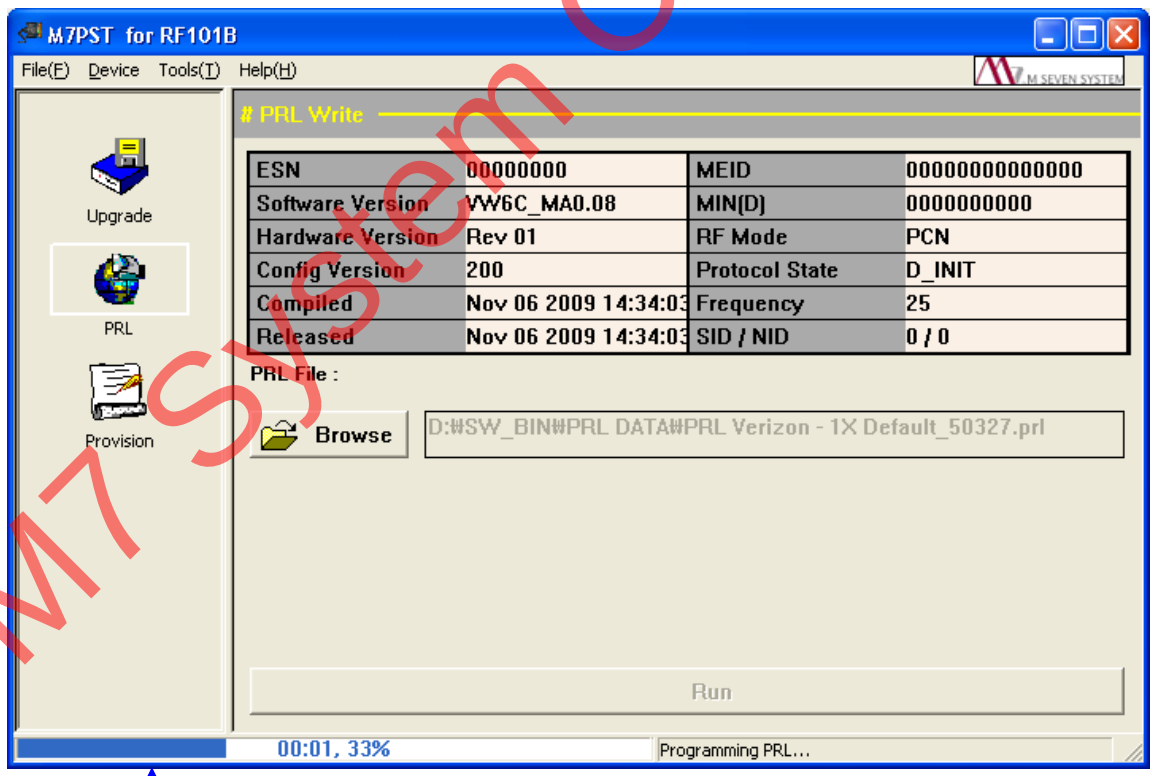
[Figure 5.2] PRL procedure

Users are required to select a proper PRL file by pressing 'Browse' button.



[Figure 5.3] Select PRL file

Programming PRL starts by pressing 'Browse' button.



Progressive Bar

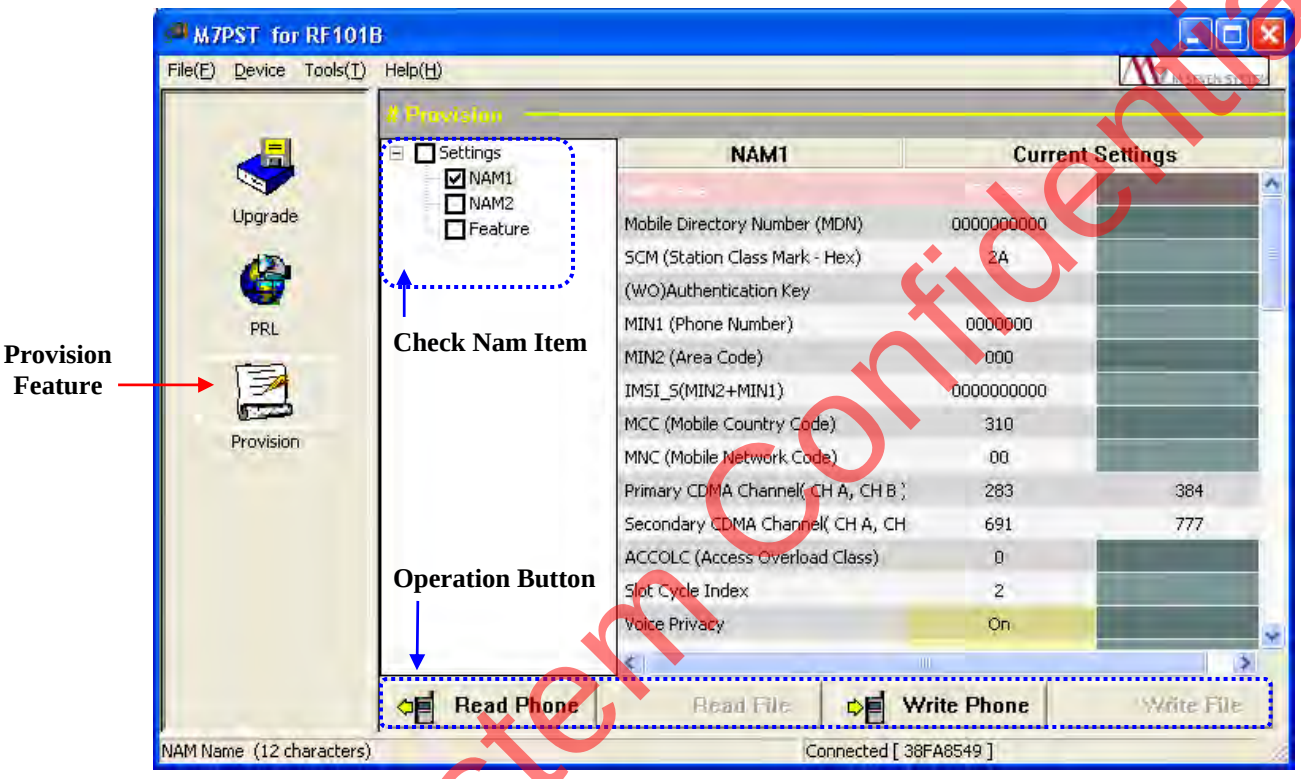
[Figure 5.4] PRL Start

6. Provision Feature

Provision' feature is used to set up the items. (NAM1, NAM2, Feature)

6.1 Items

6.1.1 NAM1, NAM2, Feature



[Figure 6.1] NAM1 View

To set up 'NAM1' items, users need to check 'NAM1' check box after pressing 'Provision' button. Actual setup to the handset is performed after pressing 'Write Phone'.

The four operation buttons are as follows:

Read File : Reads the corresponding information from .a file.

Write File: Write the checked items and their values to a file.

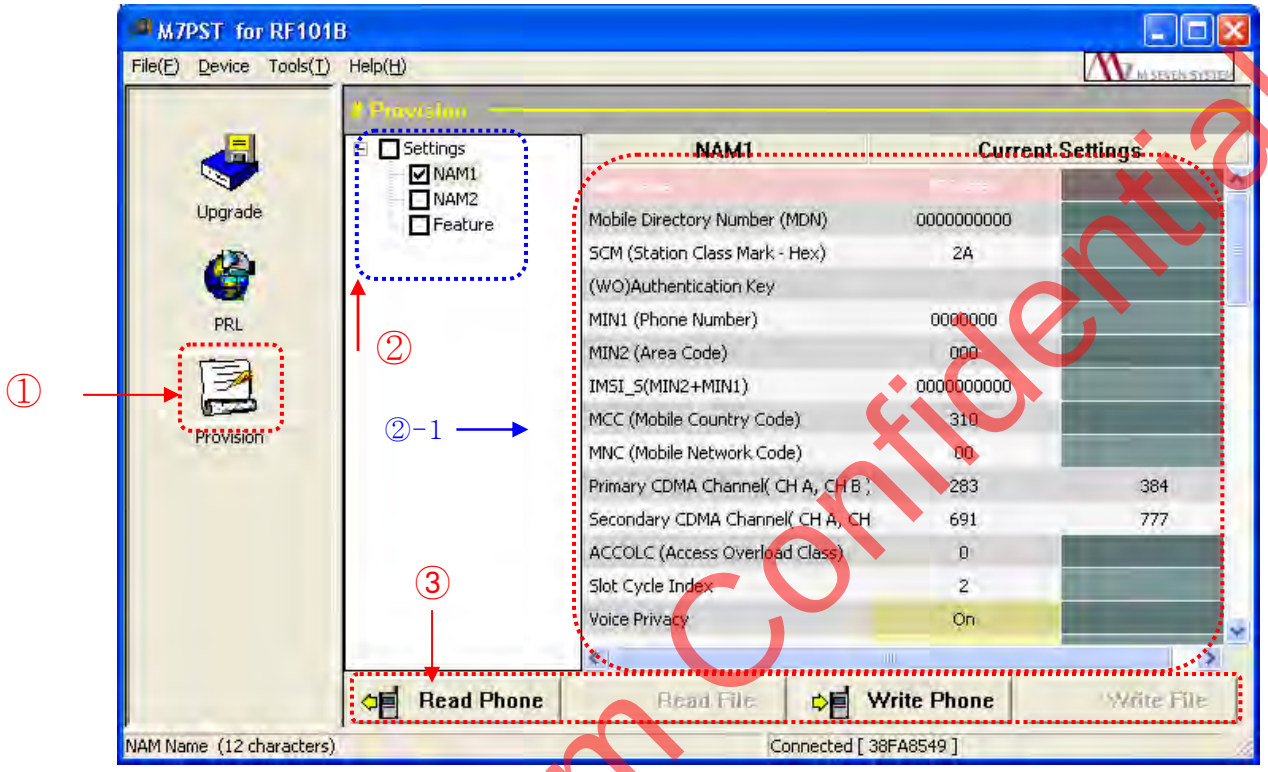
Read Phone: Reads the corresponding information from .the handset.

Write Phone: Writes the corresponding information to the handset. Remember this can be done only after 'Read' is performed. This is to prevent users from writing default values to the handset when users don't want it.

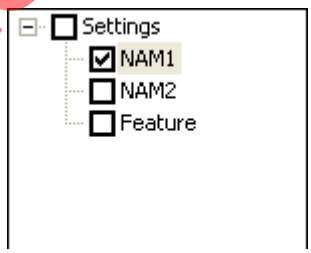
The set up operation for other items is the same as the NAM1 item.

6.2 Provision: Step-by-Step Procedure

After pressing 'Provision', users are required to check whichever items to set up. For example, to set up NAM1 items, users need to check 'NAM1' after pressing 'Provision' button. Actual setup to the handset is performed after pressing 'Write Phone'. 'Write Phone' is always available only after 'Read Phone' is performed.



[Figure 6.2] Provision procedure



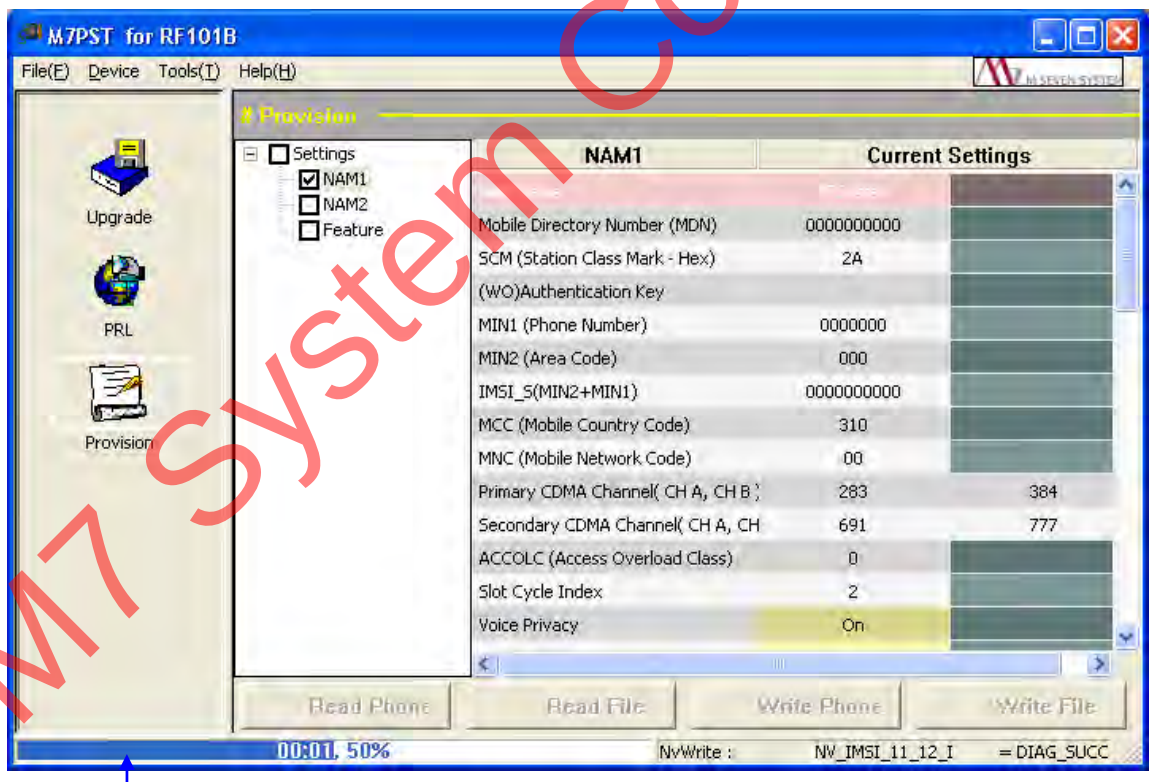
[Figure 6.3] Setting Items procedure

Users can edit each item as follows.

NAM1	Current Settings	
NAM Name	M7System	
Mobile Directory Number (MDN)	0000000000	
SCM (Station Class Mark - Hex)	2A	
(WO)Authentication Key		
MIN1 (Phone Number)	0000000	
MIN2 (Area Code)	000	
IMSI_S(MIN2+MIN1)	0000000000	
MCC (Mobile Country Code)	310	
MNC (Mobile Network Code)	00	
Primary CDMA Channel(CH A, CH B)	283	384
Secondary CDMA Channel(CH A, CH	691	777

Figure 6.4] Item Field

Actual setup to handset will be performed by pressing 'Write Phone'. After pressing 'Write Phone', the progress bar shows the writing status.



[Figure 6.5] Provision Start

M SEVEN SYSTEM

28235591

TCU Phone Module

Component Technical Specification Manual

Ver. 0.1

Oct. 30. 2009

Table of Contents

1. INTRODUCTION / OVERVIEW
1.1 QSC6055 Chipset

The QSC60x5 family of devices represents the next generation of chipset architecture and enhancements for the QCT value and multimedia tiers of products. The QSC60x5 family includes the QSC6055 and QSC6065 devices (supporting CDMA2000 1x voice and data, and Simultaneous-GPS (S-GPS)), the QSC6075 device (adding CDMA2000 EV-DO rel. 0 support) and the QSC6085 device (adding CDMA2000 EV-DO rev. A support). These airlink and multimedia capabilities are supported by integrating Mobile Station Modem™ (MSM™) baseband, radioOne® RF, and power management functionality into a single 12 mm x 12 mm chip scale package (CSP). Together these functions perform all the signal processing and power management tasks within a subscriber unit. This enables reduced handset complexity, cost, time-to-market, and board-space requirements while providing many features and functionalities.

The global expansion of 3G CDMA 1x networks has extended the availability of high-speed, wireless data access. With increased accessibility comes increased demand for wireless devices that function as cameras, camcorders, personal video players, MP3 audio players, gaming consoles, and phones. To efficiently support next-generation data speeds and functionality, wireless devices must integrate applications processors with high-performance modems. The QSC60x5 devices extend the level of integration to include radio frequency and power management functions.

3G products based upon the QSC60x5 devices may include:

■ Voice and data phones

■ Music player-enabled devices and applications

■ Camera phones

■ Multimedia phones, including gaming, streaming video, videoconferencing, and more

■ Position location devices

■ Other applications and devices

QSC60x5 benefits are applied to each of these product-types, including:

■ Higher integration to reduce PCB surface area, power consumption, time-to-market, and BOM costs while adding capabilities and processing power

❒ Baseband functions, including multiple hardware cores

❒ radioOne RF and analog functions (Rx and Tx, both eliminating their intermediate frequency (IF) components)

❒ Power management functions

■ Integrated hardware cores eliminate multimedia co-processors, providing superior image quality and resolution for mobile devices while extending application times:

❒ Longer run-time for mobile devices over other industry solutions that use companion processors

■ Location-based services and applications, including points of interest, personal navigation, and friend finder

■ Single platform that provides dedicated support for all market leading CODECs and other multimedia formats to support carrier deployments around the world

■ DC power reduction using innovative techniques, such as the QUALCOMM IntelliCeiver™ technology and PA bypassing

1.1.1 QSC6055 Features

■ Modem microprocessor – a low-power, high-performance RISC microprocessor core running at 192 MHz and featuring the ARM926EJ-S™ CPU and Jazelle™ accelerator circuit from ARM® Limited.

■ Modem digital signal processor (mDSP) – the low-power, high-performance QDSP4u8™ targeting 85 MHz.

■ Application digital signal processor (aDSP) – the low-power, high-performance QDSP4u8™ targeting 115 MHz.

■ 96 MHz bus clock for 16-bit DDR SDRAM and 16/32-bit PSRAM

■ Dual-memory buses separating the high-speed memory subsystem (EBI1) from low-speed peripherals (EBI2), such as LCD panels

■ 1.8 V memory interface support on EBI1

■ 1.8 V or 2.6 V memory interface support on EBI2

■ Memory types supported:

❒ 16-bit NOR flash (burst mode), including multiplexed address/data types

❒ 8-bit and 16-bit NAND flash and 16-bit OneNAND

❒ 16-bit DDR SDRAM

❒ 16-bit and 32-bit PSRAM requiring multiplexed address/data types

■ Bootup is supported from the following devices:

❒ Burst NOR on EBI1

❒ Any supported NAND memory type on EBI2

■ CDMA2000 1X revisions A and B

■ Enhanced GPS position location

❒ Integrated gpsOne functionality, featuring enhancements by SnapTrack®, Inc., to enable a wide variety of location-based services and applications, including points of interest, personal navigation, and friend finder

❒ Simultaneous-GPS (processes GPS on its Rx path while CDMA signals continue to be processed on a separate Rx path)

❒ 1024x searcher, DFT accelerator, off-chip RAM for measured data storage

■ Two universal asynchronous receiver transmitter (UART) serial ports

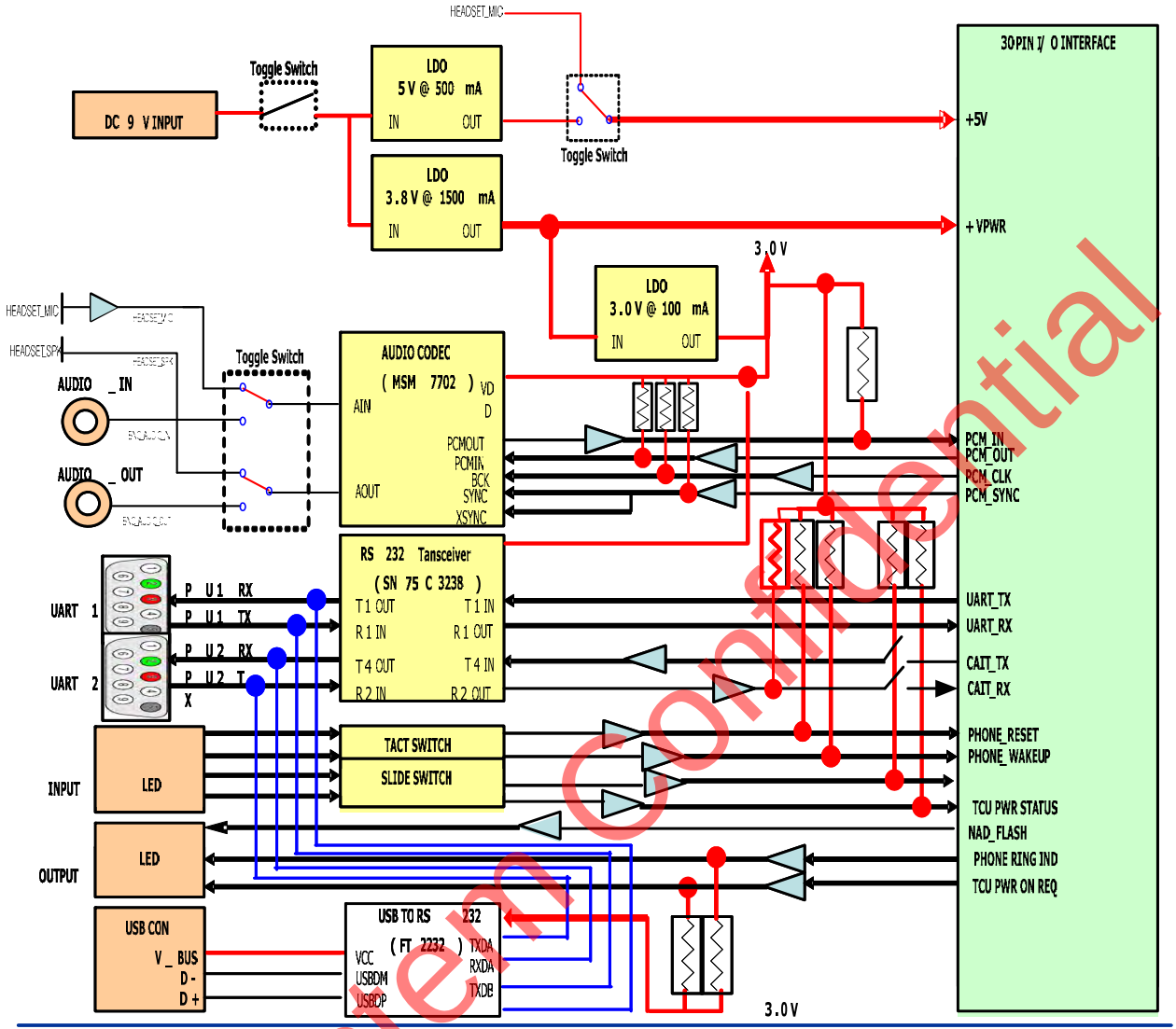
1.2 Mobile Standards

Service Provisioning- OTASP	ANSI TIA EIA-683
Parameter Administration - OTAPA	ANSI TTA ETA-683
Caller ID	IS-2000
Call Hold & Call Waiting	IS-2000
Three-Way Calling	IS-41
E911 Location Determination	TIA EIA IS-801
CDMA 1xRTT Packet Data (153 Kbps forward and reverse)	TIA EIA IS-2000
Mobile IP	TIA EIA IS-835-A
Enhanced Variable Rate Codec-B (EVRC-B)	3GPP2 C.S0014 B
Enhanced Variable Rate Codec (EVRC)	TIA EIA IS-127
EVRC TTY TDD Extension	TTA ETA IS-127-3
SMS (MT,MO)	IS-637

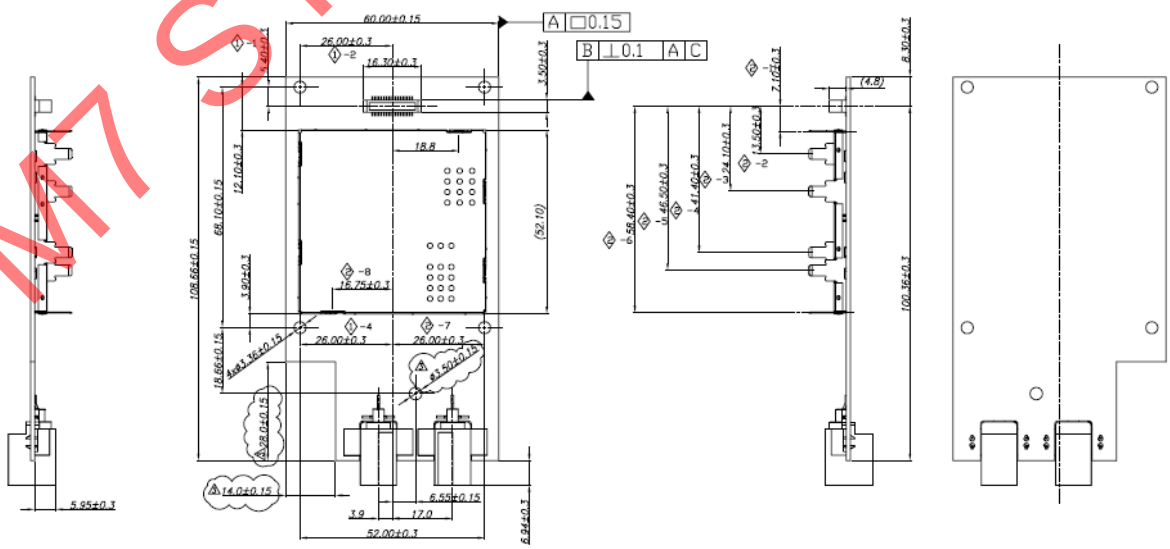
1.3 Acronym Definitions

Define all acronyms that will be used in the document

1.4 Development Tools for the Phone Module
1.4.1 LT Box



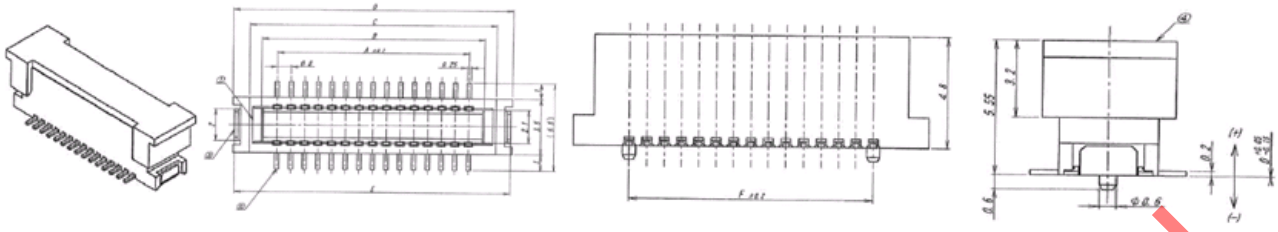
2 MECHANICAL DESCRIPTIONS
2.1 Phone Module Mechanical Outline



2.2 Phone Module I/O Connector

Iriso Part Number: 9827B-40BGFC (connector only) 9827B-40Y912 (tape and reel)

2.2.1 I/O Connector Drawing and Supplier Part Number

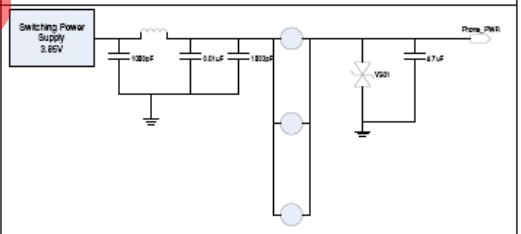
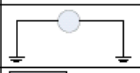
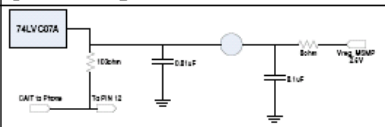
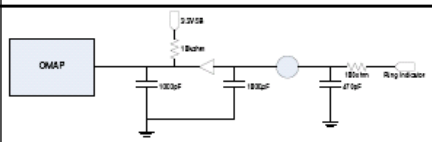
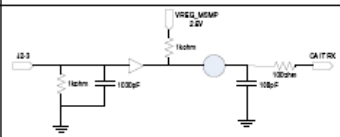


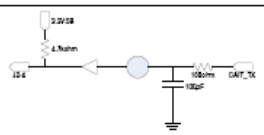
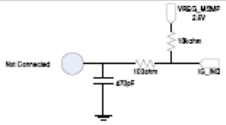
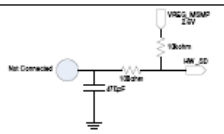
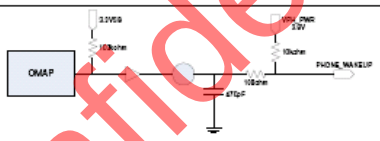
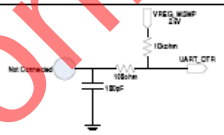
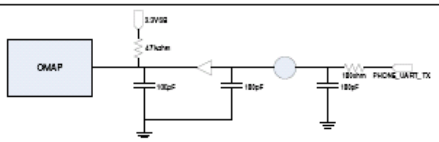
CKT	PARTS No.	A	B	C	D	E	F	G	H	M
30	9827B-30Y944	9.6	12.85	16.7	17.5		24	11.5	21.5	
40	-40	13.6	16.85	20.7	21.5	28.4	32	14.2	25.0	
50	-50	17.6	20.85	24.7	25.5					
60	-60	21.6	24.85	28.7	29.5	40.4	44	20.2	37.0	8.0
70	-70	25.6	28.85	32.7	33.5					
80	9827B-80Y944	29.6	32.85	36.7	37.5	52.4	56	26.2	49.0	

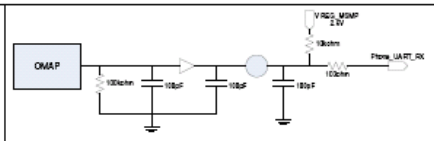
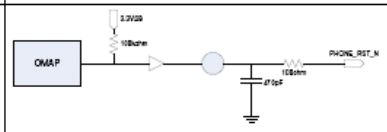
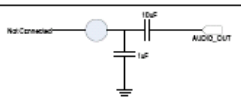
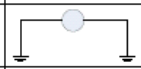
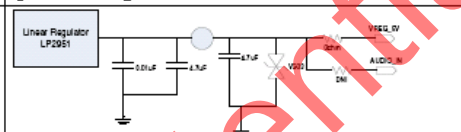
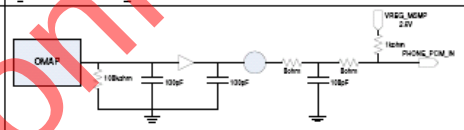
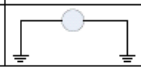
This connector is placed on the phone module

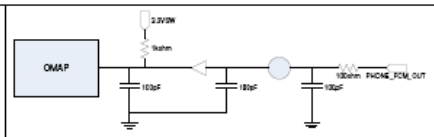
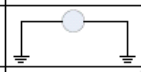
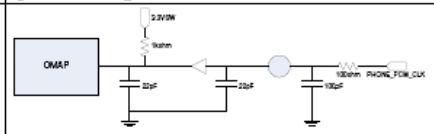
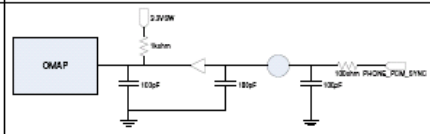
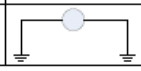
2.2.2 I/O Connector Electrical Characteristics

2.2.2.1 I/O Connector Pin Assignment, I/O Interface, and Circuit Diagrams

Phone Pin #	DCM Pin #	Name	Description	I/O	Signal Voltage Level	TCU Z	Phone Z	Imax	TCU----------O----------Phone
1	J4-30	GND	Ground	O	Typ: 0V	NA	NA	1.0 A	
2	J4-28	NC	NA	NC	NA	NA	NA	NA	
3 4 5	J4-26 J4-24 J4-22	PHONE_PWR	3.8volts +/- 5% supply voltage to phone module	I	Min: 3.8V*(1 - 0.05) Max: 3.8V*(1 + 0.05)	NA	NA	1A	
6	J4-20	NC	Not Connected	NA	NA	NA	NA	NA	
7	J4-18	GND	Ground	O	Typ: 0V	NA	NA	1A	
8	J4-16	V_REF	Reference Logic Voltage level generated by the Phone	O	Vref: VREG_MSMP*(1-0.03) to VREG_MSMP*(1+ 0.03) *VREG_MSMP=2.6V+/- 3%		NA	10mA	
9	J4-14	RI	Ring Indicator Generated by the Phone	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/- 3%	1MΩ		2mA	
10	J4-12	CAIT_RX	CAIT Receive Data Input to the Phone	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/- 3%	125Ω to GND 1kΩ to VREF		3mA	

11	J4-10	CAIT_TX	CAIT Transmit Data Output from the Phone	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	1MΩ		6mA	
12	J4-8	IG_IND	Ignition Indicator	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	Infinite		2mA	
13	J4-6	HW_SD	Hardware Shutdown	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	Infinite		2mA	
14	J4-4	SD_REQ	Hardware Shutdown Request	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	Infinite		2mA	
15	J4-2	PHONE_WU	Reuest to wake_up the phone from TCU	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	125Ω		3mA	
16	J4-1	UART_DTR	UART Data terminal ready to Phone from TCU	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	Infinite		2mA	
17	J4-3	UART_TX	UART Transimt from the Phone to TCU	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	1MΩ		4mA	

18	J4-5	UART_RX	UART Recevie to the Phone from TCU	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	125Ω		3mA	
19	J4-7	PHONE_RST	Phone reset from TCU to Phone	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	125Ω		3mA	
20	J4-9	SPK_OUT_PHONE	Speaker low level audio Output to TCU from Phone	O	Common mode DC voltage (Typ 1.0V) @Avss Vdd : 2.0V ~ 2.1V Max. 1.65Vpp* with 600ohm load condition	Infinite	600ohm	TBD	
21	J4-11	GND	Ground	O	Typ: 0V	NA	NA	1.0A	
22	J4-13	5VSW or MIC_IN_PHONE	5 volt supply to be passed to Active GPS antenna or Microphone low level Audio input to Phone from TCU	I	5VSW (Typ): 5V +/- 3% or MIC_IN_PHONE (Max.): 171mVpp	NA	NA or 10kΩ	33mA or TBD	 *Retain logic level to previous circuitry (MIC in circuitry)
23	J4-15	GND	Ground	O	Typ: 0V	NA	NA	1.0A	
24	J4-17	PCM_IN	PCM Audio Input to the Phone from TCU	I	VHigh: 0.65*VREG_MSMP to VREG_MSMP+0.3V VLow: -0.3V to 0.35 *VREG_MSMP *VREG_MSMP=2.6V+/-3%	10kΩ		2mA	
25	J4-19	GND	Ground	O	Typ: 0V	NA	NA	1.0 A	

26	J4-21	PCM_OUT	PCM Audio Output from the Phone to the TCU	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	10MΩ		2mA	
27	J4-23	GND	Ground	O	Typ: 0V	NA	NA	1.0 A	
28	J4-25	PCM_CLK	PCM Audio Clock Generated by the Phone	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	1MΩ		2mA	
29	J4-27	PCM_SYNC	PCM Audio Sync Generated by the Phone	O	VHigh: VREG_MSMP-0.45V to VREG_MSMP VLow: 0V to 0.45V *VREG_MSMP=2.6V+/-3%	1MΩ		2mA	
30	J4-29	GND	Ground	O	Typ: 0V	NA	NA	1.0 A	

3. OPERATING TEMPERATURE AND STORAGE

3.1 Temperature

3.1.1 Storage Temperature

The phone module shall be capable of being stored at -40C ~ 85C without any damage.

3.1.2 Operating Temperature

The phone module shall operate within specification from -30C – 85C

4 ELECTRICAL INTERFACE

Phone / TCU System Mechanization

4.1 Design Guidelines

4.1.1 Component Derating

4.1.1.1 Ceramic Capacitors / Parallel Plate Capacitors

Ceramic capacitors or parallel plate capacitors on power lines shall be two devices in series to protect against capacitor shorts.

4.1.1.2 Electrolytic Capacitors

Electrolytic capacitors shall be rated at 2x the maximum voltage for a given circuit.

4.1.1.3 Tantalum Capacitors

Tantalum capacitors shall be rated at 3x the maximum voltage for a given circuit on a power supply. They shall be rated at 2X for applications on signal lines.

Tantalum capacitors shall not be placed on circuits with currents that exceed a current of 1A or the current shall be limited to 1A.

4.1.2 Communication Pins and Unused Pins

Serial communications signals shall be terminated per manufacturers specifications.

Unused IC pins should be terminated according to manufacturer's recommendations.

4.2 Supply Voltage

A power supply or supplies with the following characteristics shall power the NAD:

Power Supply	Unit	Value			Notes
		MIN	TYP	MAX	
V_{DD}	V	3.61	3.8	3.99	Single supply for NAD
I_{DD}	A			1.125	
$V_{DD\ Ripple\ MAX}$	mV			100	

Note: Phone Module should not be damaged by the instantaneous loss of the supply voltage

4.3 Current Draw

4.3.1 TX Current Drain

<Voice Call>
-. USCellular(Ch.384) Current: 245 mA
-. USPCS(Ch.675) Current : 230 mA
<Data Call>
-. USCellular(Ch.384) Current: 350 mA
-. USPCS(Ch.675) Current: 360 mA

4.3.2 Standby Current Drain.

Band	Celluar (ch 384)		PCS (ch 600)	
Slot Mode	SLOT1	SLOT2	SLOT1	SLOT2
Current [mA]	3.78 mA	2.63 mA	3.76 mA	2.59 mA

4.3.3 Off current drain.

-Under 100uA

4.4 Output Power

The phone output power is measured at the end of phone module antenna connector using the RF power meter. The power level of the phone module is controlled by the base station and the range of the power level is varied from Min output power to Max output power that is defined in the table below.

Item	Specification	Min	Typical	Maximum	Unit
Max Output Power	Power Class II	23	24	26	dBm/1.23MHz
Min Output Power			-53	-50	dBm/1.23MHz

4.5 Audio Interface

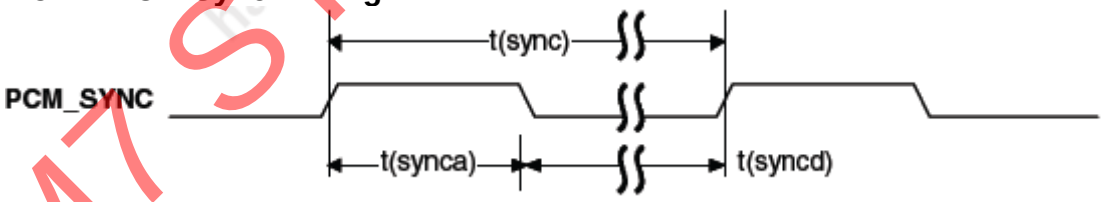
4.5.1 PCM Audio

4.5.1.1 QSC Timing Parameters

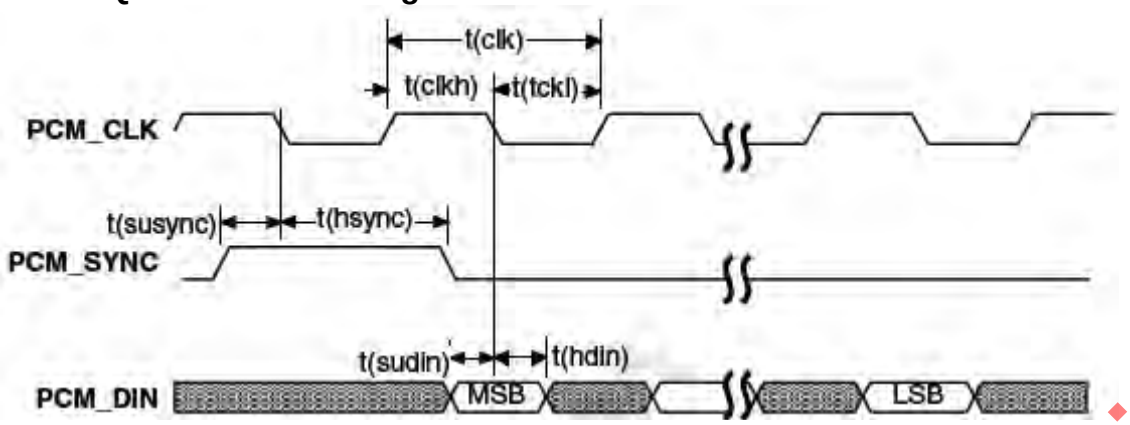
Parameter	Description	Min	Typical	Max	Unit	Note
t(sync)	PCM_SYNC cycle time (PCM_SYNC_DIR=1)	—	125	—	µs	1
	PCM_SYNC cycle time (PCM_SYNC_DIR=0)	—	125	—	µs	
t(synca)	PCM_SYNC asserted time (PCM_SYNC_DIR=1)	400	500	—	ns	1
	PCM_SYNC asserted time (PCM_SYNC_DIR=0)	—	—	—	ns	
t(syncd)	PCM_SYNC de-asserted time (PCM_SYNC_DIR=1)	—	124.5	—	µs	1
	PCM_SYNC de-asserted time (PCM_SYNC_DIR=0)	—	—	—	µs	
t(clk)	PCM_CLK cycle time (PCM_CLK_DIR=1)	400	500	—	ns	1
	PCM_CLK cycle time (PCM_CLK_DIR=0)	—	—	—	ns	

Parameter	Description	Min	Typical	Max	Unit	Note
t(clkh)	PCM_CLK high time (PCM_CLK_DIR=1)	200	250	—	ns	1,2
	PCM_CLK high time (PCM_CLK_DIR=0)	—	—	—	ns	
t(clkl)	PCM_CLK low time (PCM_CLK_DIR=1)	200	250	—	ns	1,2
	PCM_CLK low time (PCM_CLK_DIR=0)	—	—	—	ns	
t(susync)	PCM_SYNC setup time to PCM_CLK falling	—	150	—	ns	
	(PCM_SYNC_DIR=1, PCM_CLK_DIR=1)					
	PCM_SYNC setup time to PCM_CLK falling	—	—	—	ns	
	(PCM_SYNC_DIR=0, PCM_CLK_DIR=0)					
t(hsync)	PCM_SYNC hold time after PCM_CLK falling	—	300	—	ns	
	(PCM_SYNC_DIR=1, PCM_CLK_DIR=1)					
	PCM_SYNC hold time after PCM_CLK falling	—	—	—	ns	
	(PCM_SYNC_DIR=0, PCM_CLK_DIR=0)					
t(sudin)	PCM_DIN setup time to PCM_CLK falling	50	—	—	ns	
t(hdin)	PCM_DIN hold time after PCM_CLK falling	10	—	—	ns	
t(pdout)	Delay from PCM_CLK rising to PCM_DOUT valid	—	—	350	ns	
t(zdout)	Delay from PCM_CLK falling to PCM_DOUT HIGH-Z	—	160	—	ns	

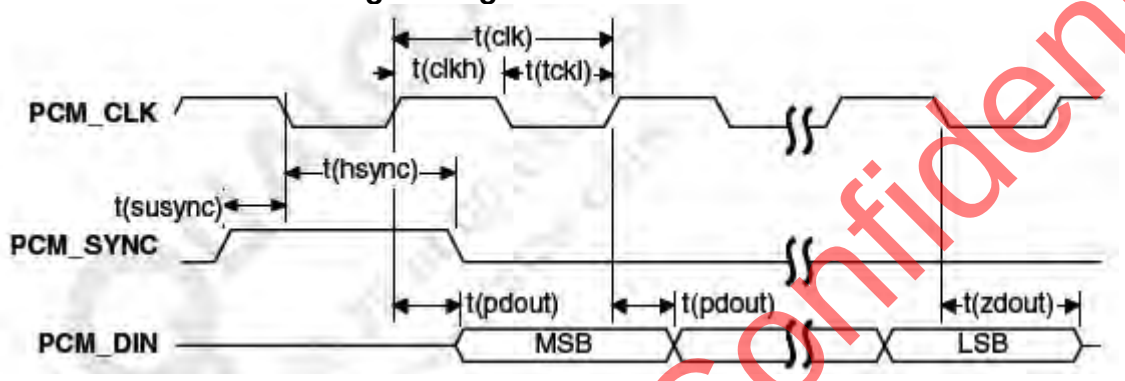
4.5.1.2 PCM Sync Timing



4.5.1.3 QSC Receive Timing



4.5.1.4 MSM Transmitting Timing



4.5.2 UART Data Interface

QSC6055 devices are capable of providing up to two universal asynchronous receiver transmitter (UART) ports. Each UART communicates with serial data ports that conform to the RS-232 interface protocol. With a properly written and user-defined download program, the UART can be used as the handset's serial data port for test and debug, and can support additional interface functions such as an external keypad or ringer. If the handset uses EEPROM or flash memory, then the UART can be used to load and/or upgrade system software.

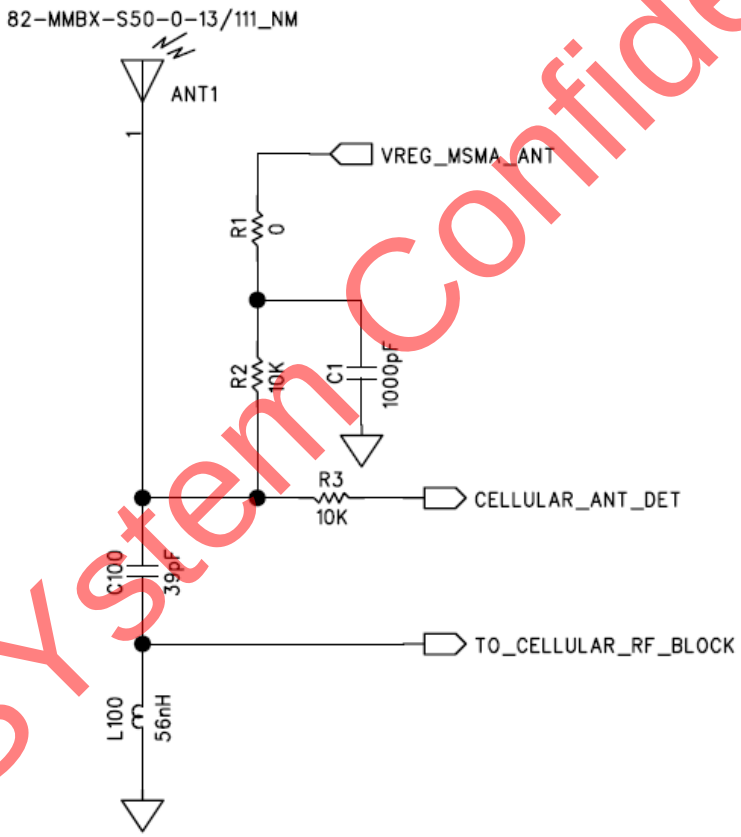
UART1 capability is expanded to include a high-speed (Up to 4 Mbps) mode.

4.5.3 Cellular Antenna Open/Short Sense

The phone module provides the antenna diagnostics function by the antenna detection circuit. The antenna detection circuit can detect three statuses: GOOD, OPEN and SHORTED. The detection circuit senses current drain through antenna and sends analog voltage to QSC. QSC reads analog voltage by its ADC and monitors the antenna status.

DC Volts	2.1V		
Status	ADC Volts	HEX	DEC
Good	0.9V	0x6D	109
Open	1.1V	0x86	134
Shorted	0.6V	0x49	73

<Cellular Antenna diagnostics>



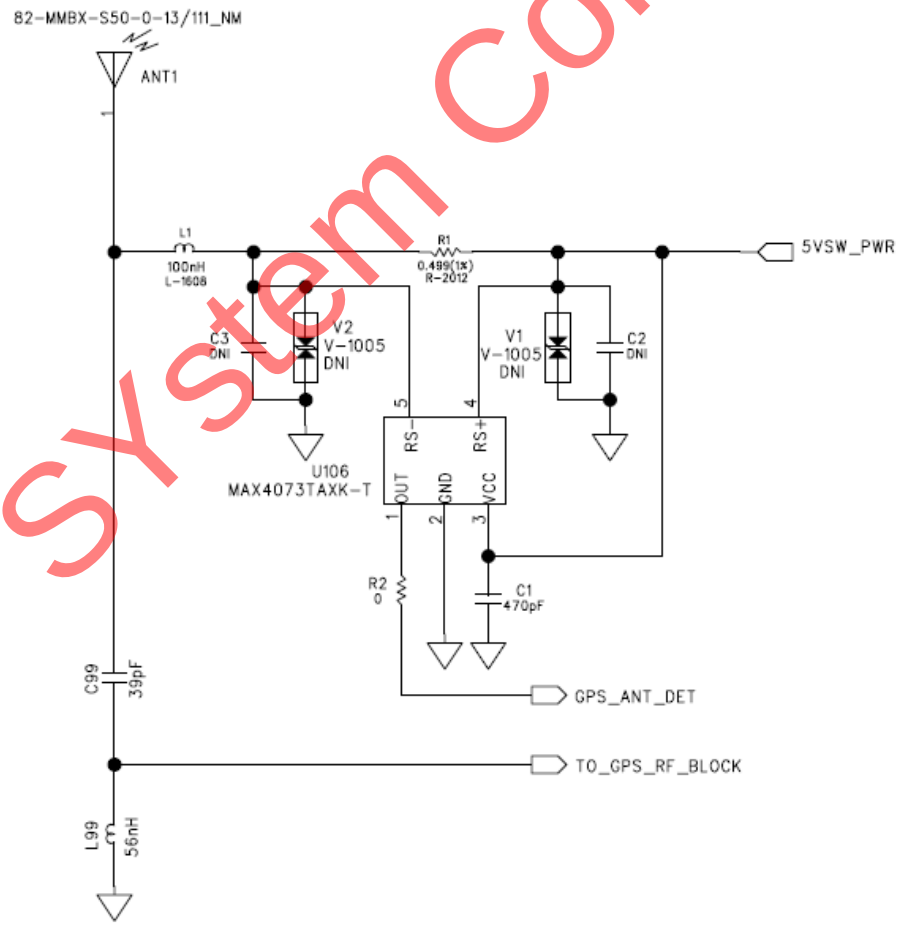
<Cellular Antenna Detection Circuit>

4.5.4 GPS Antenna Open/Short Sense

The phone module provides the antenna diagnostics function by the antenna detection circuit. The antenna detection circuit can detect three statuses: GOOD, OPEN and SHORTED. Less than 10mA is considered open, greater than 40mA is considered shorted. The NAD shall detect antenna fault and report to the host via AT command, only while Vehicle Power = ON.

Current Draw	Condition
< 10mA	Antenna Open
> 40mA	Antenna Short
> 10mA and < 40mA	OK

<GPS Antenna diagnostics>



<GPS Antenna Detection Circuit>

FCC ID: XOECDMRF101B

	Warning: Exposure to Radio Frequency Radiation The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 20 cm during normal operation. The gain of the antenna for Cellular band must not exceed -2 dBi and PCS band must not exceed -3dBi.

FCC Compliance Information

This device complies with Part 15 of FCC Rules.
Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept any interference received.
Including interference that may cause undesired operation.