

# MV8890-V Solution

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Android 6.0 Installation Guide

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## List of Acronyms

Acronyms	Descriptions
AC link	Audio controller Link
AC97	Audio codec '97
ADB	Android Debug Bridge
ADC	Analog-to-Digital Converter
ALSA	Advanced Linux Sound Architecture
APM	Advanced Power Management
ASL	Apache Software License
BCD	Binary-coded decimal
BSP	Board Support Package
CF	Compact Flash
DAC	Digital-to-Analog Converter
DMA	Direct Memory Access
DNW	Samsung Image Download Tool
DVFS	Dynamic Voltage and Frequency Scaling
EBI	External Bus Interface
EGL	Embedded Graphics Library
EINT	External Interrupt
EXIF	Exchangeable Image File Format
FIFO	First In, First Out
FIMC	Fully Interactive Mobile Camera
FIMD	Fully Interactive Mobile Display
FIMG	Fully Interactive Mobile Graphic
FRC	Frame Rate Control
GPIO	General purpose input/output
GPL	General Public License
GPL V2	General Public License Version2
HDMI	High-Definition Multimedia Interface
HS-MMC	High Speed Multimedia Card
I2C	Inter-Integrated Circuit
IIS, I2C	Inter-IC-Sound
IOCTL	Input Output Control
IP	Intellectual Property
IrCA	Infrared Data Association
MFC	Multi Format Codec
MIPI	Mobile Industry Processor Interface
MMC	Multi Media card
MSB	Most-Significant Bit
MTD	Memory Technology Device
NTSC	National Television System Committee
OpenGL	Open Graphic Library
OpenGL ES	Open Graphic Library for Embedded System
OS	Operating System
PAL	Phase Alternation Line
PCLK	Peri Clock
PWM	Pules Width Modulation
SMDK	Samsung Mobile Development Kit
SPDIF	Sony Philips Digital Interconnect Format

SPI	Serial Peripheral Interface
STN	Super-Twisted Nematic display
TFTP	Trivial File Transfer Protocol
UART	Universal Asynchronous Receiver and Transmitter
U-boot	Universal Boot Loader
UMS	USB Mass-Storage
USB OTG	USB(Universal Serial Bus) On-The-Go
V4L	Video for Linux
VFS	Virtual file System
WDT	Watchdog timer
YAFFS	Yet Another Flash File System

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# 1 INTRODUCTION

This document is intended for providing detailed instructions on building and downloading the Android 6.0 for MV8890-V Board.

Since the BSP supports UFS as the booting device, this document covers building, installing, and flashing images to those flash memory devices.

Chapter 2 describes how to set up the development environment on the host PC.

Chapter 3 describes how to configure and build the bootloader, kernel, and Android 6.0 platform.

Chapter 4 describes how to download and flash the images into the MV8890-V board.

Chapter 5 describes measurement of power consumption.

The following files are required for this installation guide. We recommend the whole compile process could be done in Linux environment.

- Cross tool chain:
  - pebuilts/gcc/linux-x86/aarch64/aarch64-linux-android4.9
- Source codes are in code directory
- Images:
  - U-boot : U-boot.bin
  - Kernel : Image, exynos8890-avl8890.dtb
  - Rootfs : ramdisk.img
  - Android : system.img

## NOTE:

This document has been created assuming that the reader is familiar with Embedded Linux Development.

# 2 SETTING UP ENVIROMENT

## 2.1 Development Environment

We recommend Ubuntu 14.04 for development system.

Please follow th guide in below website to build the development environment:

<http://source.android.com/source/initializing.html>

To set up your Linux development environment, make sure you have the following:

Required Packages:

1. Git1.7.9 or newer and the GNU Privacy Guard.
  2. JAVA 7, openJDK
  3. Android SDK : <http://developer.android.com/sdk/index.html>
  4. flex, bison, gperf, libSDL-dev, libesd0-dev, libwxgtk2.6-dev(optional), build-essential, zip, curl
- ```
# sudo apt-get install xinetd build-essential nfs-kernel-server apache2 samba git-core gnupg fles bison gperf libdl-dev libesd0-dev libwxgtk2.6-dev build-essential zip curl libncurses5-dev zlib1g-dev cscope uboot-mkimage
```

## 2.2 Tool Chain

```
# cd /home/YOURNAME/  
# vim .bashrc
```

attach these lines to the ending ----->

```
export ARCH=arm64
```

```
export CROSS_COMPILE=./prebuilts/gcc/linux-x86/aarch64-linux-android-4.9/bin/aarch64-  
linux-android-
```

<----- attach these lines to the ending

```
# source .bashrc
```



## 2.3 Fastboot and ADB Driver

```
# mv android-sdk_r20-linux.tar /home/YOURMAME/bin/  
# cd /home/YOURMAME/bin/  
# tar -xf android-sdk_r20-linux.tar android-sdk_r20-linux  
# cd android-sk_r20-linux/
```

Read the SDK Readme.txt to download platform-tools according to the method of this document. After you have tools and platform-tools folders:

```
# cd /home/YOURMAME/  
# vim .bashrc
```

attach these lines to the ending----->

```
export PATH=${PATH}:/home/YOURMAME/bin/android-sdk_r20-linux/tools
```

```
export PATH=${PATH}:/home/YOURMAME/bin/android-sdk_r20-linux/platform-tools
```

<-----attach these lines to the ending

```
# source .bashrc
```

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# 3 Build Image

## 3.1 Build Uboot

U-BOOT is the boot loader of Android BSP for MV8890-V board.

### 3.1.1 Main features of U-BOOT

Support fusing bootloader, kernel (Image&dtb), RAMDISK, system image into UFS on board.

Support loading kernel image and RAMDISK image from UFS

### 3.1.2 Compile Procedure:

Start the u-boot compile.

1. Enter the directory uboot
2. Execute the command below for u-boot compile

For MV8890 board

```
$. /build.sh avl8890
```

After this command is executed, there are files generated in the directory UBOOT\_DIR/output.

avl8890-spl.bin : the bl2 binary, the image used for setting DRAM and load uboot.

u-boot.bin : the uboot image used for MV8890-V board

set.bin : merge all image into set.bin

### 3.1.3 Images:

The boot images include bl1/bl2/el3/uboot/tzsw. You need all 5 images to booting the board.

bl1 : bl1 (Samsung released)  
bl2 : avl8890-spl.bin (compile to generate)  
uboot : u-boot.bin (compile to generate)  
el3 : el3 (Samsung released)  
TZSW : tzsw (Samsung released)

In order to facilitate the operation, merge all above image into a set.bin

## 3.2 Build Kernel

1. Change to kernel directory
2. Run commands listed below, choose any one of them, different configurations have different attributes.

The Image will be generated in KERNEL\_DIR/arch/arm64/boot/.

The dtb will be generated in KERNEL\_DIR/arch/arm64/boot/dts/.

```
$ ./build_kernel.sh eng
```

3. You can make menuconfig to select different components.

## 3.3 Build Android

1. Change to Android directory
2. Run command listed below, after that, ramdisk-uboot.img, system.img will be generated

```
$ ./build.sh avl8890 cmcc platform eng
```

**NOTE:** Please compile kernel before android.

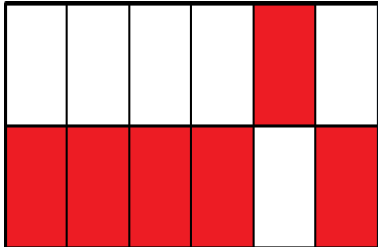
RAMDISK (ramdisk.img) : the root file system

System (system.img) : the files in the directory /output

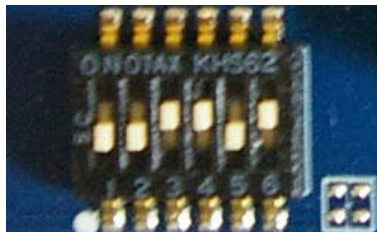
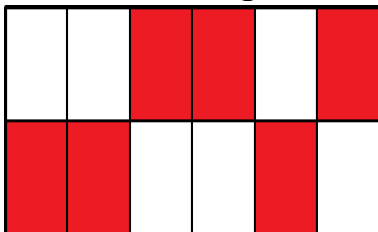
# 4 Flashing Image

## 4.1 OM Switch setting

### 4.1.1 SD Booting Mode



### 4.1.2 UFS Booting Mode



## 4.2 Requirements & Tools

### 4.2.1 Fastboot Tool

For Linux in android-sdk\_r20-linux/platform-tools:

fastboot and adb

For Windows, they are fastboot.exe and adb.exe

## 4.3 Board Booting Sequence

In the MV8890-V board, by default, the system will boot from internal UFS, except below two conditions:

1. UFS is empty
2. or the context in UFS is invalid

## 4.4 How to use sdcard to firm in UFS:

Insert the sdcard in linux PC, the PC can recognize the sd card, such as in /dev/sdc.

1. The sd\_fusing\_8890.sh/bl1/av18890-spl.bin/u-boot.bin/tzsw in the same directory.

```
$ sudo ./sd_fusing_8890.sh /dev/sdc
```



## 4.6 How to firm in UFS by fastboot:

=====uboot=====

You can flash fwbl1/bl2/bootloader/el3/tzsw separately or just one set.bin.

```
$ fastboot flash fwbl1 bl1
$ fastboot flash bl2 avl8890-spl.bin
$ fastboot flash el3_mon el3
$ fastboot flash bootloader u-boot.bin
$ fastboot flash tzsw tzsw
```

```
$ fastboot flash set set.bin
```

Flash ldf/partition.

```
$ fastboot flash partition_table partition
$ fastboot flash ldfw ldfw
```

=====kernel=====

```
$ fastboot flash dtb exynos8890-avl8890.dtb
$ fastboot flash krenel Image
```

=====android=====

```
$ fastboot flash ramdisk ramdisk.img
$ fastboot flash system system.img
```

=====other=====

```
$ fastboot -w
```

After transfer finished, reset the board

```
$ fastboot reboot
```

# 5 Measurement of Power Consumption

## 5.1 Detail Description

### 5.1.1 Describe the power data format

| PMIC   |                |            | March Governor<br>Home Screen<br>06/29/2016 |         |         |
|--------|----------------|------------|---------------------------------------------|---------|---------|
|        |                |            | Voltage                                     | Current | Power   |
| Output | BUCK1          | VDD_MIF    | 0.53V                                       | 95.05mA | 48.31mW |
| Output | BUCK2          | VDD_MNGS   | 0.60V                                       | 44.74mA | 26.99mW |
| Output | BUCK3          | VDD_APOLLO | 0.59V                                       | 48.76mA | 29.26mW |
| Output | BUCK4          | VDD_INT    | 0.54V                                       | 69.97mA | 37.44mW |
| Output | BUCK5          | VDD_DISP   | 0.53V                                       | 18.43mA | 9.81mW  |
| Output | BUCK6          | VDD_G3D    | -0.07V                                      | 4.84mA  | -0.03mW |
| Output | BUCK7          | VDD_MEM    | 1.03V                                       | 72.16mA | 74.33mW |
| Input  | AP total power |            | 226.11mW                                    |         |         |

Table 5-1 the power data format

## 5.2 Power Data

**Caution :** Because of steady power data, the below data is measured by virtual touch position, drag and selection.

### 5.2.1 Home Screen Measurement Result

| PMIC   |                |            | Home Screen<br>2016-06-29 |         |         |
|--------|----------------|------------|---------------------------|---------|---------|
|        |                |            | Voltage                   | Current | Power   |
| Output | BUCK1          | VDD_MIF    | 0.53V                     | 95.05mA | 48.31mW |
| Output | BUCK2          | VDD_MNGS   | 0.60V                     | 44.74mA | 26.99mW |
| Output | BUCK3          | VDD_APOLLO | 0.59V                     | 48.76mA | 29.26mW |
| Output | BUCK4          | VDD_INT    | 0.54V                     | 69.97mA | 37.44mW |
| Output | BUCK5          | VDD_DISP   | 0.53V                     | 18.43mA | 9.81mW  |
| Output | BUCK6          | VDD_G3D    | -0.07V                    | 4.84mA  | -0.03mW |
| Output | BUCK7          | VDD_MEM    | 1.03V                     | 72.16mA | 74.33mW |
| Input  | AP total power |            | 226.11mW                  |         |         |

Table 4-2 Home Screen Measurement Result

### 5.2.2 LPA (no MP3 Play) Measurement Result

| PMIC   |                |            | LPA (No MP3 Play) |         |         |
|--------|----------------|------------|-------------------|---------|---------|
|        |                |            | 2016-06-29        |         |         |
|        |                |            | Voltage           | Current | Power   |
| Output | BUCK1          | VDD_MIF    | 0.51V             | 27.06mA | 13.88mW |
| Output | BUCK2          | VDD_MNGS   | 0.6V              | 21.69mA | 13.05mW |
| Output | BUCK3          | VDD_APOLLO | 0.54V             | 16.51mA | 9.64mW  |
| Output | BUCK4          | VDD_INT    | 0.54V             | 55.86mA | 29.9mW  |
| Output | BUCK5          | VDD_DISP   | 0.53V             | 5.67mA  | 3.01mW  |
| Output | BUCK6          | VDD_G3D    | -0.07V            | 4.47mA  | -0.32mW |
| Output | BUCK7          | VDD_MEM    | 1.03V             | 13.76mA | 14.17mW |
| Input  | AP total power |            | 83.33mW           |         |         |

Table 4-3 LPA(no MP3 Play) Measurement Result

### 5.2.3 LPA (MP3 Play) Measurement Result

| PMIC   |                |            | LPA (MP3 Play) |         |         |
|--------|----------------|------------|----------------|---------|---------|
|        |                |            | 2016-06-29     |         |         |
|        |                |            | Voltage        | Current | Power   |
| Output | BUCK1          | VDD_MIF    | 0.51V          | 42.2mA  | 21.63mW |
| Output | BUCK2          | VDD_MNGS   | 0.6V           | 22.76mA | 13.78mW |
| Output | BUCK3          | VDD_APOLLO | 0.54V          | 19.93mA | 11.68mW |
| Output | BUCK4          | VDD_INT    | 0.55V          | 70.07mA | 38.79mW |
| Output | BUCK5          | VDD_DISP   | 0.53V          | 4.55mA  | 2.42mW  |
| Output | BUCK6          | VDD_G3D    | -0.07V         | 3.13mA  | -0.22mW |
| Output | BUCK7          | VDD_MEM    | 1.03V          | 22.01mA | 22.67mW |
| Input  | AP total power |            | 110.74mW       |         |         |

Table 4-4 LPA(MP3 Play) Measurement Result



### 5.2.4 Video Play Measurement Result (720p resolution)

| PMIC   |                |            | 720P – H.264 |          |         |
|--------|----------------|------------|--------------|----------|---------|
|        |                |            | 2016-06-29   |          |         |
|        |                |            | Voltage      | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.52V        | 100.32mA | 52.52mW |
| Output | BUCK2          | VDD_MNGS   | 0.61V        | 51.7mA   | 33.63mW |
| Output | BUCK3          | VDD_APOLLO | 0.64V        | 95.21mA  | 62.47mW |
| Output | BUCK4          | VDD_INT    | 0.56V        | 136.81mA | 77.11mW |
| Output | BUCK5          | VDD_DISP   | 0.54V        | 26.4mA   | 14.16mW |
| Output | BUCK6          | VDD_G3D    | -0.06V       | 5.93mA   | -0.28mW |
| Output | BUCK7          | VDD_MEM    | 1.03V        | 69.07mA  | 71.48mW |
| Input  | AP total power |            | 311.08mW     |          |         |

Table 4-5 Video Play Measurement Result (720p resolution)

### 5.2.5 Video Play Measurement Result (1080p resolution)

| PMIC   |                |            | 1080P – H.264 |          |         |
|--------|----------------|------------|---------------|----------|---------|
|        |                |            | 2016-06-29    |          |         |
|        |                |            | Voltage       | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.51V         | 106.11mA | 54.03mW |
| Output | BUCK2          | VDD_MNGS   | 0.6V          | 50.97mA  | 30.79mW |
| Output | BUCK3          | VDD_APOLLO | 0.62V         | 90.76mA  | 56.42mW |
| Output | BUCK4          | VDD_INT    | 0.53V         | 115.19mA | 61.62mW |
| Output | BUCK5          | VDD_DISP   | 0.53V         | 26.87mA  | 14.27mW |
| Output | BUCK6          | VDD_G3D    | -0.06V        | 6.17mA   | 0.13mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V         | 92.59mA  | 95.31mW |
| Input  | AP total power |            | 312.57mW      |          |         |

Table 4-6 Video Play Measurement Result (1080p resolution)

### 5.2.6 3D Game (Temple Run) Measurement Result

| PMIC   |                |            | Game (Temple Run) |          |          |
|--------|----------------|------------|-------------------|----------|----------|
|        |                |            | 2016-06-29        |          |          |
|        |                |            | Voltage           | Current  | Power    |
| Output | BUCK1          | VDD_MIF    | 0.53V             | 146.75mA | 77.55mW  |
| Output | BUCK2          | VDD_MNGS   | 0.6V              | 123.72mA | 74.85mW  |
| Output | BUCK3          | VDD_APOLLO | 0.66V             | 141.63mA | 94.28mW  |
| Output | BUCK4          | VDD_INT    | 0.53V             | 82.55mA  | 44.13mW  |
| Output | BUCK5          | VDD_DISP   | 0.53V             | 27.18mA  | 14.45mW  |
| Output | BUCK6          | VDD_G3D    | 0.48V             | 135.66mA | 65.82mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V             | 114mA    | 117.33mW |
| Input  | AP total power |            | 488.41mW          |          |          |

Table 4-7 3D Game Measurement Result

### 5.2.7 Music List Measurement Result

| PMIC   |                |            | Music List |          |         |
|--------|----------------|------------|------------|----------|---------|
|        |                |            | 2016-06-29 |          |         |
|        |                |            | Voltage    | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.53V      | 123.57mA | 66.54mW |
| Output | BUCK2          | VDD_MNGS   | 0.64V      | 121.84mA | 84.42mW |
| Output | BUCK3          | VDD_APOLLO | 0.66V      | 75.96mA  | 52.62mW |
| Output | BUCK4          | VDD_INT    | 0.57V      | 94.55mA  | 54.1mW  |
| Output | BUCK5          | VDD_DISP   | 0.54V      | 21.09mA  | 11.32mW |
| Output | BUCK6          | VDD_G3D    | -0.01V     | 12.34mA  | 3.56mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V      | 85.27mA  | 88.19mW |
| Input  | AP total power |            | 360.75mW   |          |         |

Table 4-8 Music List Measurement Result

### 5.2.8 Menu Scroll Measurement Result

| PMIC   |                |            | Menu Scroll |          |         |
|--------|----------------|------------|-------------|----------|---------|
|        |                |            | 2016-06-29  |          |         |
|        |                |            | Voltage     | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.52V       | 112.37mA | 59.78mW |
| Output | BUCK2          | VDD_MNGS   | 0.63V       | 74.36mA  | 50.2mW  |
| Output | BUCK3          | VDD_APOLLO | 0.64V       | 73.39mA  | 49.58mW |
| Output | BUCK4          | VDD_INT    | 0.57V       | 91.07mA  | 51.87mW |
| Output | BUCK5          | VDD_DISP   | 0.54V       | 19.31mA  | 10.36mW |
| Output | BUCK6          | VDD_G3D    | 0.07V       | 23.32mA  | 8.95mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V       | 76.82mA  | 79.46mW |
| Input  | AP total power |            | 310.2mW     |          |         |

Table 4-9 Menu Scroll Measurement Result

### 5.2.9 Thumbnail Scroll on Gallery View Measurement Result

| PMIC   |                |            | Thumbnail Scroll |          |         |
|--------|----------------|------------|------------------|----------|---------|
|        |                |            | 2016-06-29       |          |         |
|        |                |            | Voltage          | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.52V            | 108.68mA | 57.31mW |
| Output | BUCK2          | VDD_MNGS   | 0.62V            | 84.98mA  | 55.79mW |
| Output | BUCK3          | VDD_APOLLO | 0.63V            | 70.62mA  | 46.83mW |
| Output | BUCK4          | VDD_INT    | 0.56V            | 89.56mA  | 50.65mW |
| Output | BUCK5          | VDD_DISP   | 0.54V            | 19.16mA  | 10.27mW |
| Output | BUCK6          | VDD_G3D    | 0.07V            | 23.79mA  | 9.07mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V            | 80.7mA   | 83.47mW |
| Input  | AP total power |            | 313.4mW          |          |         |

Table 4-10 Thumbnail Scroll on Gallery Measurement Result

### 5.2.10 Full Screen Scroll on Gallery Measurement Result

| PMIC   |                |            | Full Screen Scroll |          |         |
|--------|----------------|------------|--------------------|----------|---------|
|        |                |            | 2016-06-29         |          |         |
|        |                |            | Voltage            | Current  | Power   |
| Output | BUCK1          | VDD_MIF    | 0.52V              | 102.61mA | 54.17mW |
| Output | BUCK2          | VDD_MNGS   | 0.62V              | 67.88mA  | 44.9mW  |
| Output | BUCK3          | VDD_APOLLO | 0.63V              | 58.3mA   | 38.24mW |
| Output | BUCK4          | VDD_INT    | 0.56V              | 86.74mA  | 49.11mW |
| Output | BUCK5          | VDD_DISP   | 0.54V              | 19.34mA  | 10.37mW |
| Output | BUCK6          | VDD_G3D    | -0.02V             | 10.4mA   | 2.4mW   |
| Output | BUCK7          | VDD_MEM    | 1.03V              | 71.32mA  | 73.77mW |
| Input  | AP total power |            | 272.96mW           |          |         |

Table 4-11 Full Screen Scroll on Gallery Measurement Result

### 5.2.11 Calculator Measurement Result

| PMIC   |                |            | Calculator |          |          |
|--------|----------------|------------|------------|----------|----------|
|        |                |            | 2016-06-29 |          |          |
|        |                |            | Voltage    | Current  | Power    |
| Output | BUCK1          | VDD_MIF    | 0.53V      | 136.94mA | 72.98mW  |
| Output | BUCK2          | VDD_MNGS   | 0.63V      | 135.58mA | 90.68mW  |
| Output | BUCK3          | VDD_APOLLO | 0.67V      | 128.36mA | 88.62mW  |
| Output | BUCK4          | VDD_INT    | 0.57V      | 99.83mA  | 56.9mW   |
| Output | BUCK5          | VDD_DISP   | 0.54V      | 20.01mA  | 10.74mW  |
| Output | BUCK6          | VDD_G3D    | 0.46V      | 79.39mA  | 37.98mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V      | 114.37mA | 118.19mW |
| Input  | AP total power |            | 476.09mW   |          |          |

Table 4-11 Calculator Measurement Result

### 5.2.12 SMS Measurement Result

| PMIC   |                |            | SMS        |          |          |
|--------|----------------|------------|------------|----------|----------|
|        |                |            | 2016-06-29 |          |          |
|        |                |            | Voltage    | Current  | Power    |
| Output | BUCK1          | VDD_MIF    | 0.54V      | 16069mA  | 88.48mW  |
| Output | BUCK2          | VDD_MNGS   | 0.64V      | 191.93mA | 129.38mW |
| Output | BUCK3          | VDD_APOLLO | 0.71V      | 113.32mA | 86.27mW  |
| Output | BUCK4          | VDD_INT    | 0.57V      | 98.68mA  | 56.67mW  |
| Output | BUCK5          | VDD_DISP   | 0.55V      | 43.75mA  | 24.22mW  |
| Output | BUCK6          | VDD_G3D    | 0.19V      | 49.58mA  | 21.94mW  |
| Output | BUCK7          | VDD_MEM    | 1.03V      | 131.4mA  | 135.75mW |
| Input  | AP total power |            | 542.72mW   |          |          |

Table 4-11 SMS Measurement Result

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