# Operational Description

Functional Description

Hawaii Refresh cellular phone operates in GSM, DCS, and CEL & PCS bands. It provides GPRS class 10, EDGE class 10 and Bluetooth class 2 data support. It consists of RFMD Prime chipsets, Neptune LTE2, Atlas Ultra-Lite, Bluetooth module, internal system memory of 512Mbit flash, 128Mbit PSRAM and removable memory storage in the form of microSD memory card up to 2GB. It also embedded a 2MP CMOS camera, FM radio and MegaSIM capabilities.

Hardware Interface
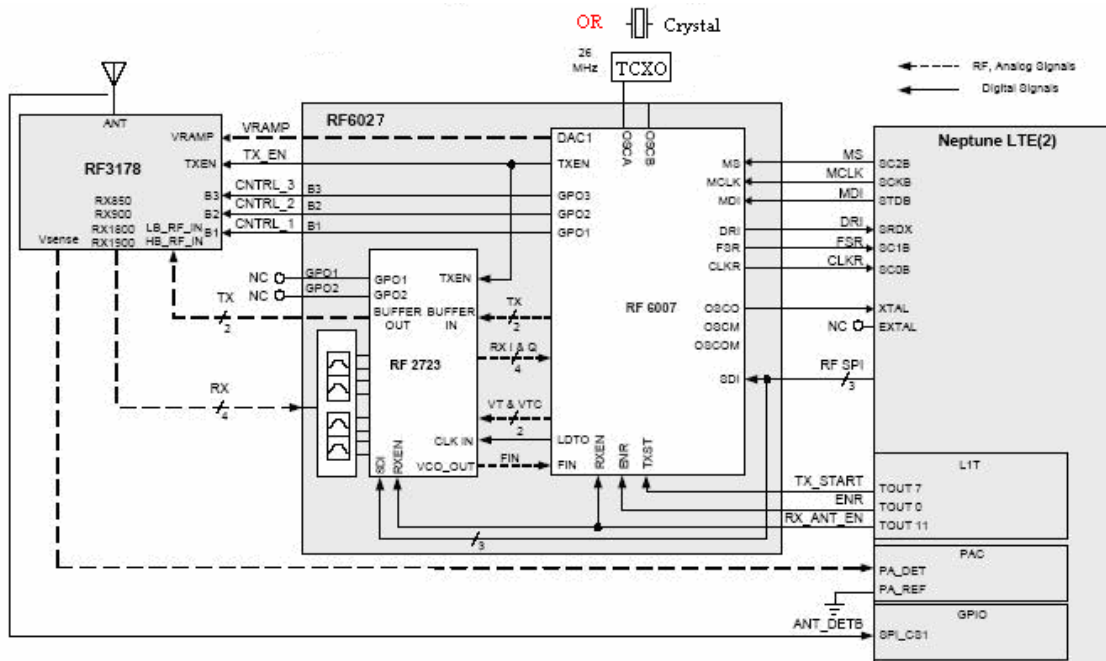
The signaling diagram shows a general view of the interfaces involved between the chips on the RF portion of the radio. RF6027 and RF3178 formed the RFMD Prime chipset.

Antenna Switch
An internal antenna switch is employed in this design. The antenna switch routes the appropriate band transmit or receive signal between the antenna and respective IC. It is controlled by 3 control lines, B1, B2 and B3, coming from the RF6027.

RF3178

The RF3178 module is a 50Ω input/output, quad-band, dual-mode, GMSK/8PSK(EDGE) PA module intended for 2.75G radio applications. The module consists of a dual line-up power amplifier, harmonic filter, and antenna switch. The antenna switch connects the antenna to any one of four receiver ports or either low band or high band power amplifier output. The module contains two RF dies using HBT technology, a silicon die for the power control and antenna switch controller, and harmonic filters. The module incorporates an indirect closed loop method for power control. Output power is controlled by varying the collector voltage. The module does not have a coupler or a power detector.

RF6027

The RF6027 is a combination Fractional-N synthesizer and signal processing IC, which also includes RF front end with the VLIF/DC receive IC, constitutes a quad-band GSM/EDGE transceiver solution. In GSM mode, it offers a fully digital GMSK modulator for extremely low current consumption. The signal processing section provides a digital receive filter path. The IF inputs are digitized, filtered and down converted to base-band I and Q signals. The flexible base-band interface can be configured for either analog or digital operation. Chip functionality is controlled through a three-wire SDI bus.

Neptune LTE2

The Neptune LTE2C90 base-band IC is a digital base-band processor for the 2.75G GSM application. The design is derived from HiP7 Neptune LTE with changes to process, memory configuration, and several module enhancements. It is a dual-core processor that contains a Synthesizable Onyx DSP core (56600), an ARM7TDMI-S microcontroller, and custom peripherals. Neptune LTE2C90 is configured for EDGE applications. Neptune LTE2C90 is available in a 280-pin MAPBGA package in either a production or development configuration.

The Neptune LTE2 C90 IC is derived from the Neptune LTE IC with the following key changes:
• CMOS90 (90nm) process technology
• On-chip memory:
– MCU RAM size is 512 KBytes.
– MCU ROM size is 128 KBytes.
– DSP X, Y, and P RAM and ROM sizes (same as LTE)
– 127 K x 24 bits PROM
– 63.75 K x 24 bits PRAM
– 40 K x 16 bits XROM
– 20 K x 16 bits XRAM
– 40 K x 16 bits YROM
– 20 K x 16 bits YRAM
• LEM enhancement for A5/3

• GEM enhancement for GEA-3
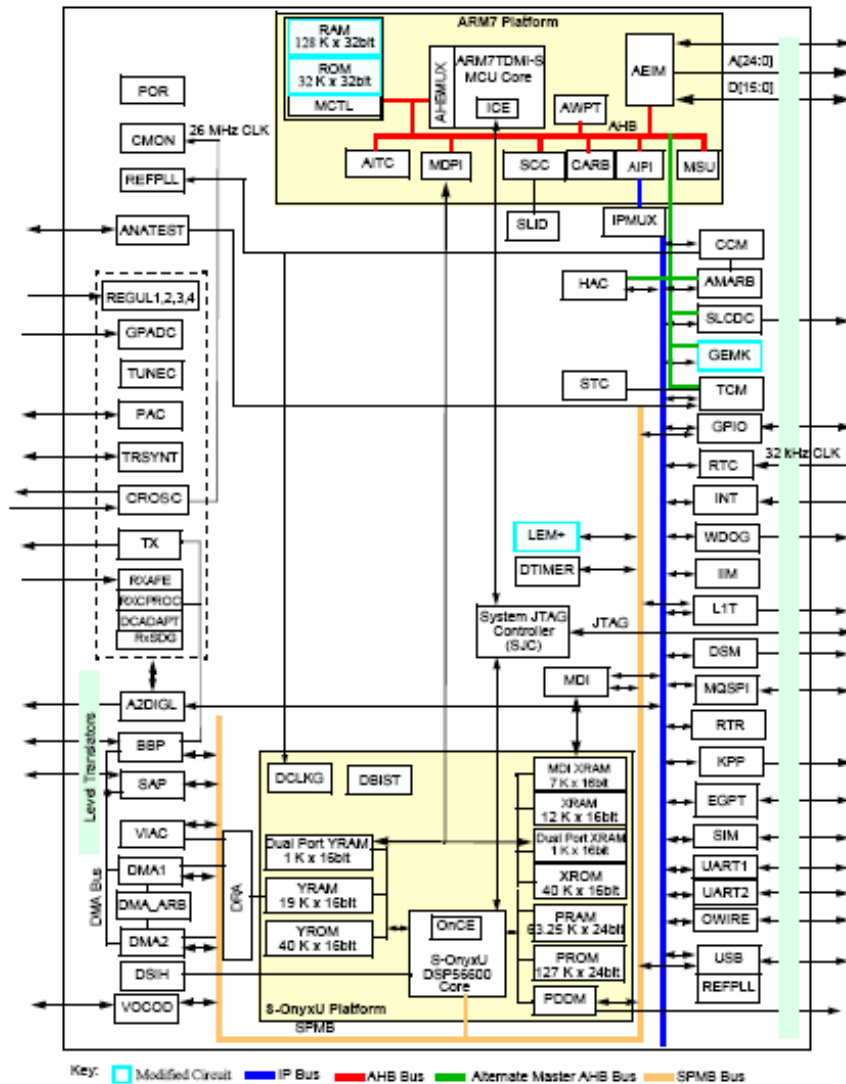
Atlas Ultra-Lite
Atlas Ultra-Lite (referred to herein as AUL) is a power management and user interface product providing general power, audio, and lighting management functions. AUL is targeted for the GSM/GPRS/EDGE space for non-applications processor lineups, but it is protocol independent and may fit other applications due to its modular functionality.
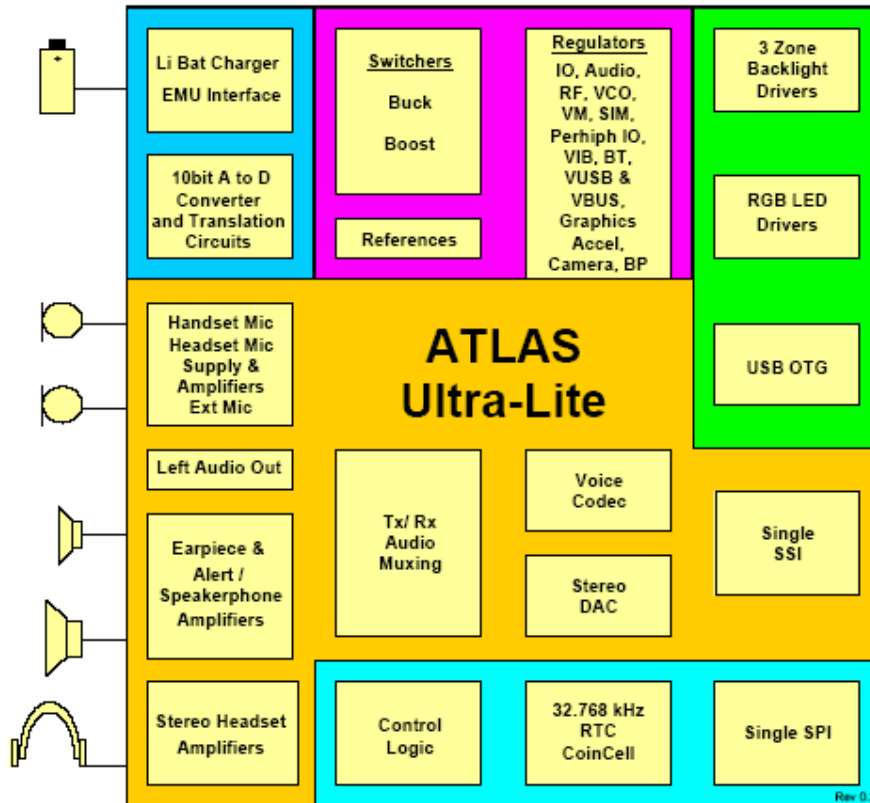
A high level feature list of AUL includes:
- Battery charger with anticipated Enhanced Mini-USB (EMU) charger capability.
- 10bit ADC for battery monitoring and other readout functions.
- Buck switcher for supply of the processor core, system memory, or other loading.
- Boost switcher for backlight, fun lights, and USB On-The-Go (OTG) supply.
- LDO regulators with integrated pass devices.
- Transmit amplifiers for handset and headset microphones.
- Receive amplifiers for handset, alert/speaker phone, headset and external power amps.
- 13bit voice CODEC with both narrow and wide band sampling.
- 16bit stereo DAC supporting multiple sample rates.
- Single SSI audio bus with network mode for connection to multiple devices.
- Power control logic with processor interface and event detection.
- Real time clock and crystal oscillator circuitry.
- Single SPI control bus.
- Three zones of backlight drivers and 3 banks of tri-color driver support with PWM, ramping, and fun lights control.
- EMU compatible charger path and USB transceiver with CEA936 car kit support.

Bluetooth Module

Hawaii Refresh incorporates the TI Bluetooth solution into the overall hardware design, instead of BCM2035 has been used in many phones design. This design is based upon a Texas Instruments (TI) BRF6150 single-chip 0.13-µm CMOS Bluetooth solution. This solution will utilize an embedded ARM7 base-band microprocessor and an on-chip Digital Radio Processor (DRP) functioning as the integrated 2.4GHz transceiver. The IC will also comply with Bluetooth core specification v1.2 and will function as a power class 2 (+4dBm) Bluetooth device.

Hawaii Refresh will be using a dedicated Bluetooth crystal which will provide 16MHz clock signal to the Bluetooth module when the module is enabled.
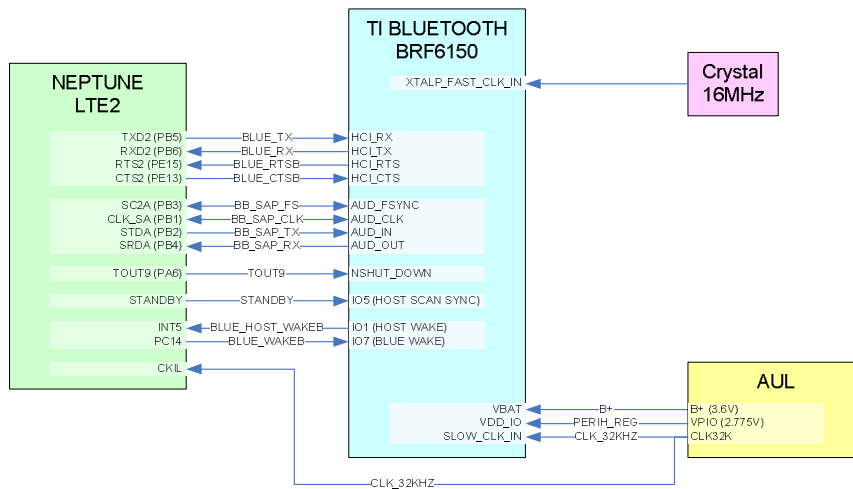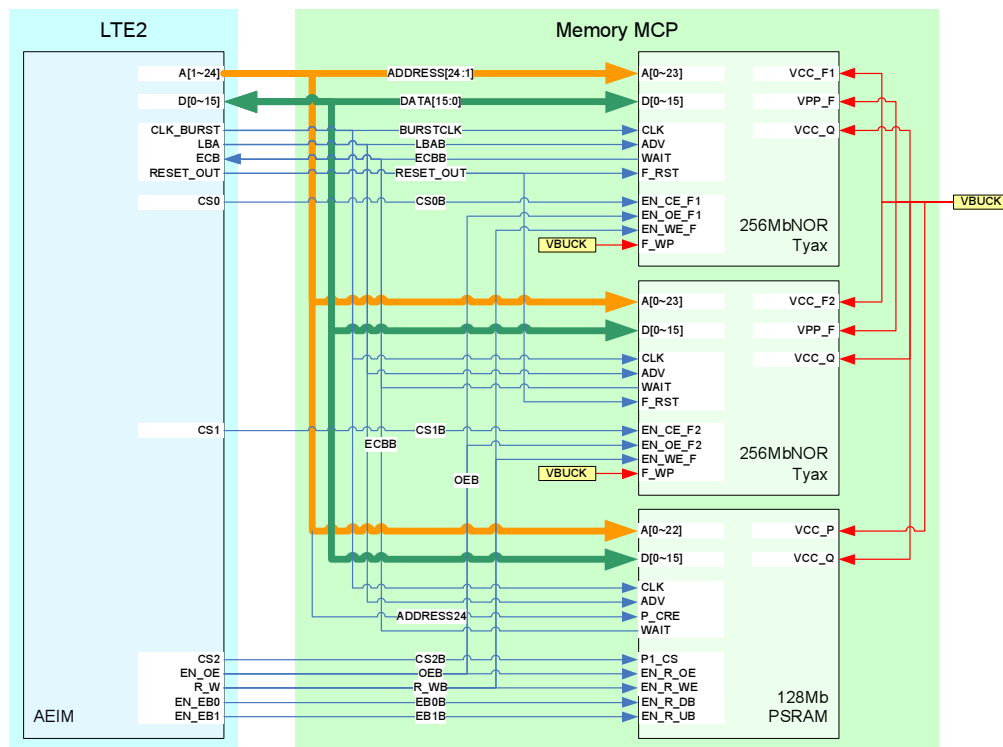

FM Radio Module

Hawaii Refresh incorporates the SiLabs Si4703 single chip FM radio tuner IC. This 4x4 mm chip requires only single 2.7~5.5V power supplier, and 32KHz external clock. The internal frequency synthesizer delivers superior RF performance, allow to receive FM radio in the range of 76~108MHz.
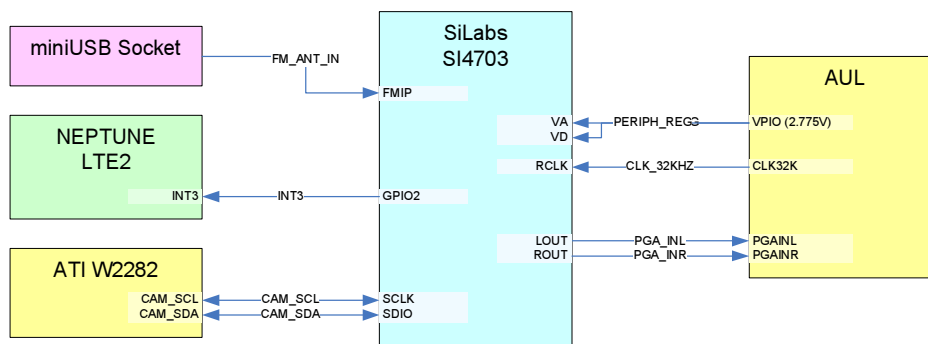
Memory - Flash/PSRAM

Hawaii Refresh is having external system memory of 512Mbit flash and 128Mbit PSRAM packaged in a stack part. There are two suppliers for the 512Mb/128Mb Flash/PSRAM stack part, i.e.:

- 2x256Mb/128Mb STM (M36LLR8870D1ZAQ) stack part. This stack memory IC two bank of 256 Mbit (16Mx16bit multi-bank multi-level burst) flash memory and one bank of 128 Mbit (4Mx16bit) pseudo SRAM.
- 2x256Mb/128Mb Intel (PF38F4460) stack part. This stack IC package contains two monolithic Intel Tyax 256Mb flash part and a 128 Mbit PSRAM.

LTE2	Memory MCP

A[1~24] ADDRESS[24:1] A[0~23] VCC_F1
D[0~15] DATA[15:0] D[0~15] VPP_F
CLK_BURST BURSTCLK CLK VCC_Q
LBA LBAB ADV
ECB ECBB WAIT
RESET_OUT RESET_OUT F_RST
CS0 CS0B EN_CE_F1
EN_OE_F1
EN_WE_F
VBUCK F_WP
256MbNOR Tyax

A[0~23] VCC_F2
D[0~15] VPP_F
CLK VCC_Q
ADV
WAIT
F_RST
CS1 CS1B EN_CE_F2
ECBB EN_OE_F2
EN_WE_F
OEB VBUCK F_WP
256MbNOR Tyax

A[0~22] VCC_P
D[0~15] VCC_Q
CLK
ADV
P_CRE
ADDRESS24 WAIT
CS2 CS2B P1_CS
EN_OE OEB EN_R_OE
R_W R_WB EN_R_WE
EN_EB0 EB0B EN_R_DB
EN_EB1 EB1B EN_R_UB
AEIM 128Mb PSRAM

VBUCK

Removable Memory Storage

Hawaii Refresh is supporting removable memory storage in the form of microSD memory card, as well as TransFlash card. The microSD/TransFlash card is NAND flash based memory card with a form factor of 11mm x 15mm x 1mm. When used with SD Adapter, the microSD/TransFlash card is compatible with all existing SD card applications (i.e. PC, digital camera, MP3 player, etc)

SD Adapter

The microSD/TransFlash card communication is based on an 8-pin electrical interface and it supports Secure Digital (SD) protocol (the same communication protocol used by SD cards) as well as SPI protocol. The SPI protocol will be used for communication between LTE2 and microSD/TransFlash card.

Seven different memory capacities are supported, i.e. 16MB, 32MB, 64MB, 128MB, 256MB, 512MB, 1GB and 2GB, with their corresponding Motorola TransFlash component part number shown below:

Capacity	Motorola Part No.
16MB	8287927W01
32MB	8287928W01
64MB	8287929W01
128MB	8287930W01
256MB	8287931W01
512MB	
1GB	
2GB	

MegaSIM

Hawaii Refresh is supporting 3.0V MegaSIM card with MMC type external memory storage. Two extra pins SD0, SDCMD are added, and one pin SDCLK is reused the write protection pin of traditional SIM connector. External memory interface is shared with TransFlash/microSD interface and controlled by ATI W2282.
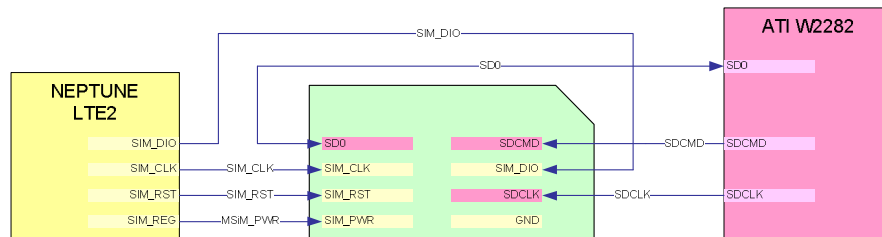
Camera and Display

Hawaii Refresh is supporting 1.9 inch TFT QCIF LCD display, the resolution is 220x176.

Hawaii Refresh is also incorporates a 2MP pixel CMOS camera module. The camera module sensor and processor is Micron ¼ inch single chip camera module SOC2020. The resolution is 1600x1200 pixels, and the pixel size is 2.2x2.2 um. The responsivity is 0.53 V/lux-sec, dynamic range 59.5dB and SNRmax is 37.7dB.

Both LCD and camera module are controlled by ATI GPU W2282.