8094M Operation Description

1. Overview:

8094M works with GSM quad band (GSM850/GSM900/DCS1800/PCS1900) ， UMTS quad

band (UMTS1/2/4/5/8), LTE band2/3/4/5/7/8/12/13/17/28/66 . And CPU runs at 4x2.0GHz, with 32GB e-MMC Flash Memory and 2GB DDR3.

It can support HSDPA downlink and HSUPA uplink data rates, as well as Class 12 GPRS (in both uplink and downlink mode) and Class 12 EDGE.
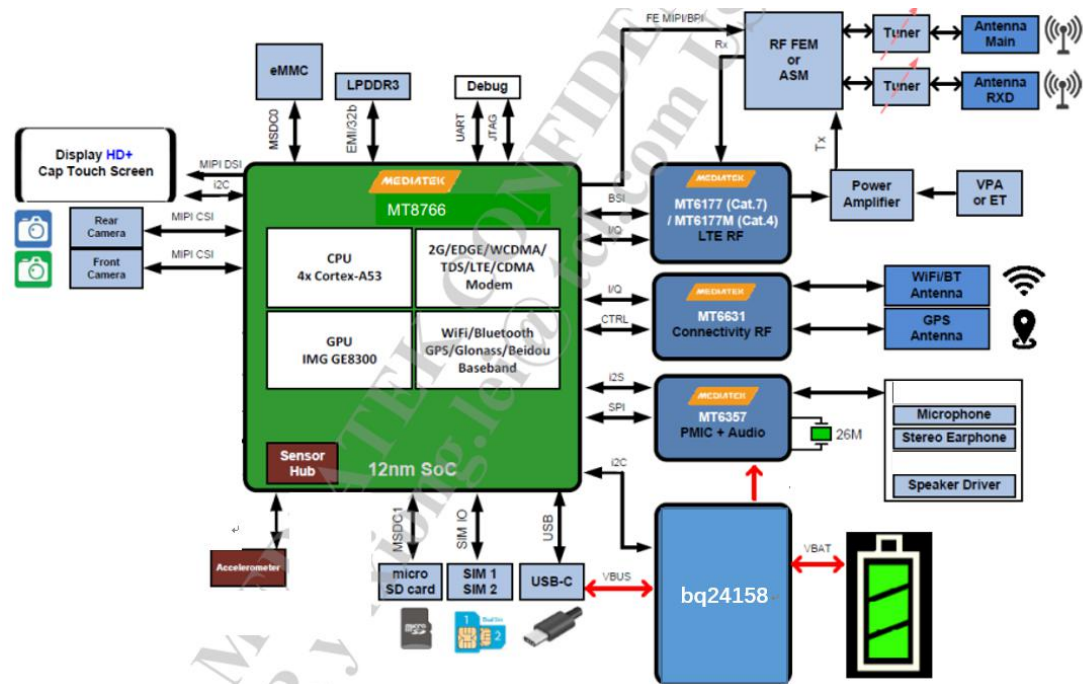
The main IC include

- **Base band + PMIC**
  - MT8766V/WB + MT6357MRV from MTK
- **Memory (e.MMC+LPDDR3 SDRAM)**
  - KMQX60013A-B419----SAMSUNG
- **RF Transceiver**
  - MT6177MV/BCA-H from MTK for GSM&WCDMA&LTE
- **RF TRANSMIT MODULE**
  - S2916-51 from SMARTER MICRO
- **RF PA MODULE**
  - S5643-51 from SMARTER MICRO
- **BT/WIFI/FM   MODULE**
  - MT6631N from MTK
- **DRX SAW**
  - B2+B66: SAWFD1G96AC2F0A from MURATA
  - B3: SFHG42CA002 from WISOL
  - B5: SFH881AA002 from WISOL
  - B7: SFHG56BA002 from WISOL
  - B8: SFH942AA002 from WISOL
  - B12/17: SFH737AA002 from WISOL
  - B13: SAFFB751MAA0F0AR15 from MURATA
  - B28: SFH780AA402 from WISOL
- **Duplexer**
  - B1: B39212B8651P810 from RF360
  - B2: B39202B1244P810 from RF360
  - B3: B39182B1227P810 from RF360
  - B4: B39222B8695L210 from RF360
  - B5: SFX836CYA02 from WISOL
  - B7: SD18-2535R8UUB1 from KYOCERA
  - B8: SFX897EYT02 from WISOL
  - B12/17: SAYEY707MBA0F0A from MURATA
  - B13: SD18-0782R8UUD1 from KYOCERA
  - B28A: B39771B8538P810 from RF360
  - B28B: B39791B8539P810 from RF360

- **RF connector**
  - 32080113   from   ECT
  - 32080700 from   JTCONN
- **G-Sensor**
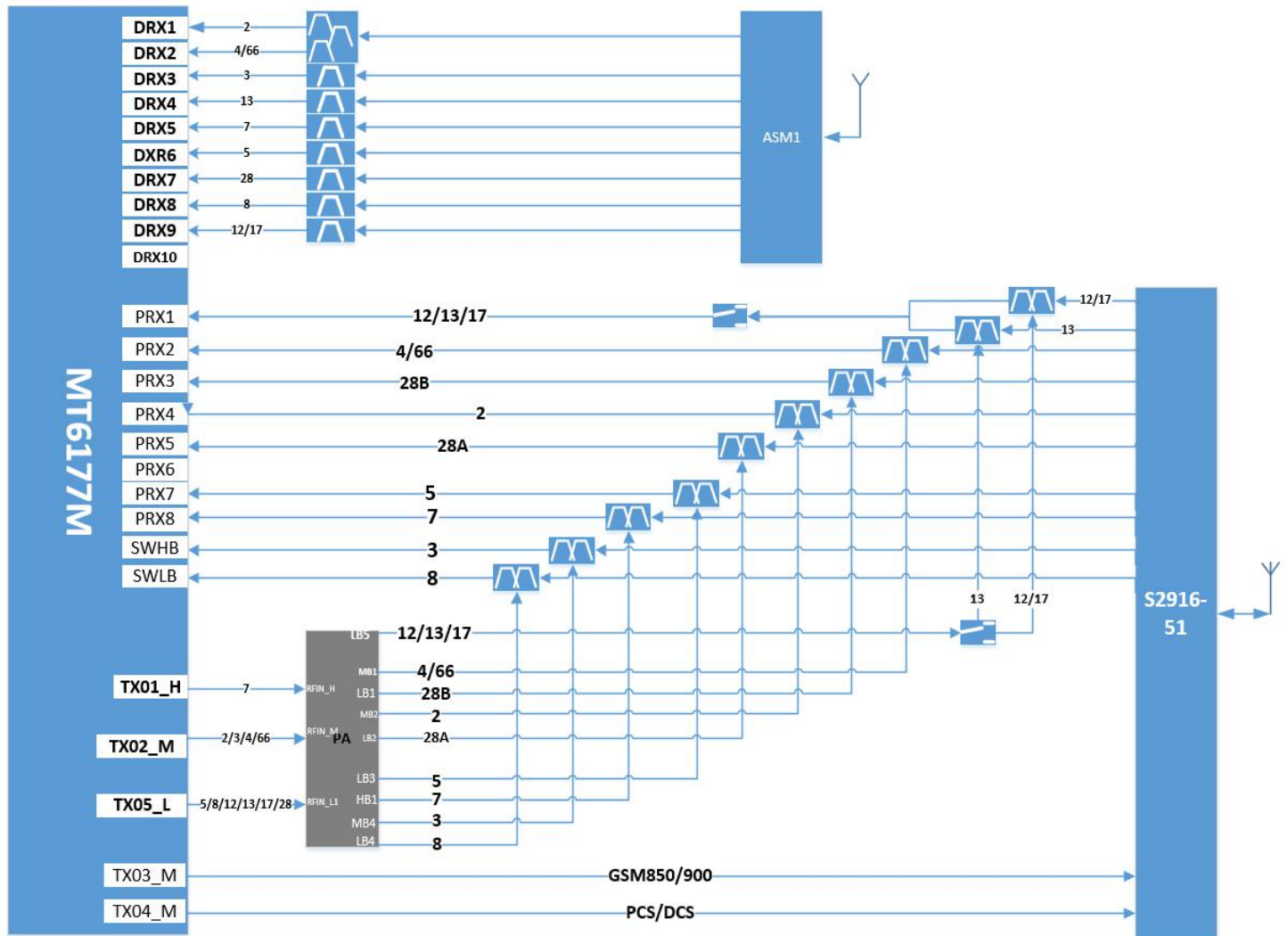 - STK8BA58, from SENSORTEK

2. System diagram Overview:

2.1. Overview:

2.2. RF:

RF (Radio Frequency) section is in charge of the signal transmit and receiving, signal modulation and demodulation.

Product technical parameters:

GENERAL:

GSM

Items	GSM850	GSM900	DCS	PCS
Frequency allocation	TX(Uplink) :824M-849MHZ RX(Downlink) :869M-894MHZ	TX(Uplink) :880M-915MHZ RX(Downlink) :925M-960MHZ	TX(Uplink): 1710M-1785MHZ RX(Downlink): 1805M-1880MHZ	TX(Uplink): 1850M-1910MHZ RX(Downlink): 1930M-1990MHZ
Channel band width	200KHz	200KHz	200KHz	200KHz
Channel	128-251	975-1023 , 0-124	512-885	512-810
Modulation	GMSK,BT=0.3, 8PSK (for EGPRS)	GMSK,BT=0.3, 8PSK (for EGPRS)	GMSK,BT=0.3, 8PSK (for EGPRS)	GMSK,BT=0.3, 8PSK (for EGPRS)
GPRS Class	12	12	12	12
EDGE Class	12	12	12	12
TX/RX channel space	45MHz	45MHz	95MHz	80MHz
(Fn)Freq. calculating formula	Fn=824.2+(N-128) *0.2 N: Channel No. Unit: MHz	Fn=880.2+(N-975) *0.2 N: Channel No. Unit: MHz	Fn=1710.2+(N-512)*0.2 N: Channel No. Unit: MHz	Fn=1850.2+(N-512)*0.2 N: Channel No. Unit: MHz

WCDMA

Items	BAND1	BAND2	BAND4	BAND5	BAND8
Frequency allocation	TX(Uplink) :1920-1980MHZ RX(Downlink) :2110 - 2170MHZ	TX(Uplink) :1850-1910MHZ RX(Downlink) :1930 - 1990MHZ	TX(Uplink) :1710-1755MHZ RX(Downlink) :2110 - 2155MHZ	TX(Uplink) :824-849MHZ RX(Downlink) :869-894MHZ	TX(Uplink) :880-915MHZ RX(Downlink) :925-960MHZ
Channel band width	5MHz	5MHz	5MHZ	5MHz	5MHz
Channel	9612-9888	9262-9538	8562-8763	4132-4233	2712-2863
Modulation	UL:BPSK/QPSK /16QAM	UL:BPSK/QPSK /16QAM	UL:BPSK/QPSK /16QAM	UL:BPSK/QPSK /16QAM	UL:BPSK/QPSK /16QAM
	DL: QPSK /16QAM/64QAM	DL: QPSK /16QAM/64QAM	DL: QPSK /16QAM/64QAM	DL: QPSK /16QAM/64QAM	DL: QPSK /16QAM/64QAM
HSUPA Category	7	7	7	7	7
HSDPA Category	10	10	10	10	10
HSPA+ Category	14	14	14	14	14
DC-HSPA+ Category	24	24	24	24	24
TX/RX channel space	190MHz	80MHz	400MHZ	45MHz	45MHz
(Fn)Freq. calculating formula	Fn = 1922.4 + (N-9612) *0.2 N: Channel No. Unit: MHz	Fn = 1852.4 + (N-9262) *0.2 N: Channel No. Unit: MHz	Fn = 1712.4 + (N-8562) *0.2 N: Channel No. Unit: MHz	Fn = 826.4 + (N-4132) *0.2 N:Channel No. Unit: MHz	Fn =882.4 + (N-2712) *0.2 N: Channel No. Unit: MHz

LTE

Items	BAND2	BAND3	BAND5	BAND7	BAND8
Frequency allocation	TX(Uplink) :1850-1910MHZ RX(Downlink) :1930-1990MHZ	TX(Uplink) :1710-1785MHZ RX(Downlink) :1805-1880MHZ	TX(Uplink) :824-849MHZ RX(Downlink) :869-894MHZ	TX(Uplink) :2500-2570MHZ RX(Downlink) :2620-2690MHZ	TX(Uplink) :880-915MHZ RX(Downlink) :925-960MHZ
Channel band width	1.4,3,5, 10,15,20MHz	1.4,3,5, 10,15,20MHz	1.4,3,5, 10 MHz	5,10,15,20MHz	1.4,3,5,10 MHz
Channel UPLINK	18600 -19199	19207-19943	20407-20643	20775-21425	21457-21793
Modulation UL	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM
Modulation DL	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM/64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM
Category	4	4	4	4	4
TX/RX channel space	80MHz	95MHz	45 MHZ	120MHZ	45MHz

Items	BAND4	BAND28	BAND12	BAND13	BAND17
Frequency allocation	TX(Uplink) :1710-1755MHZ RX(Downlink) :2110-2155MHZ	TX(Uplink) :703-748MHZ RX(Downlink) :758-803MHZ	TX(Uplink) :699-716MHZ RX(Downlink) 729-746MHZ	TX(Uplink) :777-787MHZ RX(Downlink) :746-756MHZ	TX(Uplink) :704-716MHZ RX(Downlink) : 734-746MHZ
Channel band width	1.4,3,5, 10,15,20MHz	3,5, 10,15,20MHz	1.4,3,5, 10MHz	5, 10MHz	5, 10MHz
Channel UPLINK	19950 -20399	27360-27659	23010 – 23179	23180– 23279	23730-23849

Modulation UL	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM	QPSK/16QAM
Modulation DL	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM
Category	4	4	4	4	4
TX/RX channel space	400 MHz	55MHz	30MHZ	31MHZ	30MHZ

Items	BAND66
Frequency allocation	TX(Uplink) :1710-1780MHZ RX(Downlink) :2110-2180MHZ
Channel band width	1.4,3,5, 10,15,20MHz
Channel UPLINK	131972 -132671
Modulation UL	QPSK/16QAM
Modulation DL	QPSK/16QAM /64QAM
Category	4
TX/RX channel space	400MHz

BT Specs:

Items		Values
Frequency Range		2400 MHz – 2483.5 MHz
RF Power Output		≤10.5dBm
Modulation		GFSK/8-DPSK/ π /4-DQPSK
Number or channels	BR EDR	79
	LE	40
Channel spacing	BR EDR	1MHz
	LE	2MHz
Version		v2.1+EDR，v3.0+HS，v4.2/LE，v5.0（LE-2M No support）

WiFi   Specs:

Frequency range	2.4G： 2.412 GHz – 2.462 GHz for b/g/n(HT20) 2.422GHz – 2.452GHz for n(HT40) 5G： 5.15 GHz -- 5.35GHz(UNII 1，2A) 5.725 GHz -- 5.85 GHz (UNII 3)
IEEE	802.11b,802.11g, 802.11n HT20 HT40,802.11ac
RF power 802.11b	12 dBm +1.0/-1.0 dBm
RF power 802.11g	12 dBm +1.0/-1.0 dBm
RF power 802.11n	2.4G：12 dBm +1.0/-1.0 dBm；5G：6.5 dBm +1.0/-1.0 dBm
RF power 802.11ac	6.5 dBm +1.0/-1.0 dBm
Modulation	DSSS/OFDM/16QAM/64QAM
Number of channels	11 for US
Channel spacing	5MHz

Support	hotspot	Peer-to-Peer	DFS detection
	Support	No support	No support

Hotspot Frequency range	2.4G: 2.412GHz – 2.462GHz(HT20)
	        2.422GHz – 2.452GHz(HT40)
	5G：
	    5.15 GHz -- 5.35GHz(UNII 1，2A)
	    5.725 GHz -- 5.85 GHz (UNII 3)

RECOMMENDABLE OPERATION CONDITION:

Normal Supply Voltage (V d.c.)	3.85V

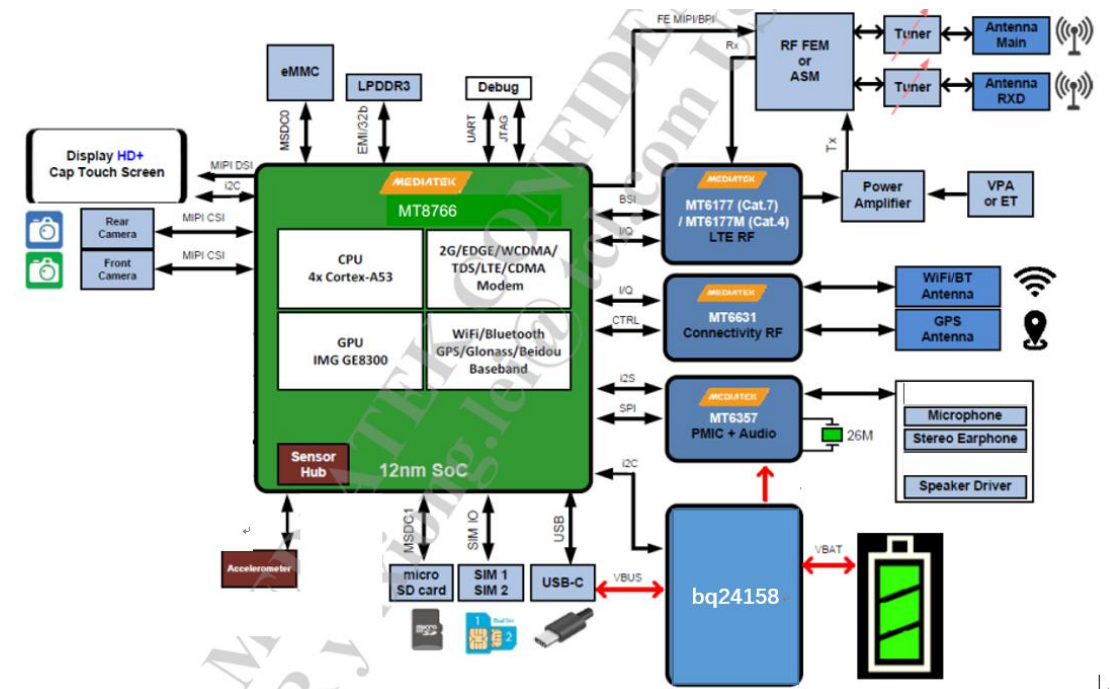|	
Maximum Extreme Supply Voltage (V d.c.)	4.35V
Minimum Extreme Supply Voltage (V d.c.)	3.5V
Minimum Extreme Temperature**	-10 degree
SIM/USIM Voltage	1.8 / 3v

ABSOLUTE MAXIMUM RATING of RF PA:

PA parameter	Specification		
	Min.	Typ.	Max.
Power supply voltage	3.0	3.8v	4.6v
Power supply current	-	-	2.5A

Antenna Description:

Air Interface	Antenna Description	Band/MHz	Type	Simultaneous Transmission	Voice Over Digital Transport (data)
GSM	NO MIMO	850/900/1800/1900	VOICE	YES BT OR WIFI	NA
		GPRS	DATA		
		EGPRS	DATA		
WCDMA	MIMO:1T2R	UMTS	VOICE		
		RMC	DATA		
		HSDPA	DATA		
		HSUPA	DATA		
		DC-HSDPA	DATA		
LTE		LTE BAND	DATA		
WIFI	NO MIMO	2.4G	DATA	YES, GSM, GPRS, EGPRS, RMC, HSDPA, HSUPA DC-HSDPA, HSPA+, LTE	
		5G	DATA		
Bluetooth		2450	DATA		

2.2. BB:

BB (Base-Band) section is the control & management center of the mobile where OS (Operate System) running and provides the MMI for the mobile.

Main Features:

The basic MT8766 system solution consists of RF transceiver: MT6177M, Power management: MT6357, Wireless connectivity, including WLAN, Bluetooth, GPS, and FM radio: MT6631N.

The MT8766 device (see Figure 1-1), with integrated Bluetooth, FM, WLAN and GPS modules, is a highly integrated baseband platform incorporating both modem and application processing subsystems to enable LTE/LTE-A and C2K smart device applications. The chip integrates ARM® Cortex-A53 operating up to 2.0GHz and powerful multi-standard video codec. In addition, an extensive set of interfaces and connectivity peripherals are included to interface to cameras, touch-screen displays and MMC/SD cards.

The application processor, an Quad-core ARM® Cortex-A53 MPCore™ equipped with NEON engine offers processing power necessary to support the latest OpenOS along with its demanding applications such as web browsing, email, GPS navigation and games. All are viewed on a high resolution touch screen display with graphics enhanced by the 2D and 3D graphics acceleration.

The multi-standard video accelerator and an advanced audio subsystem are also integrated to provide advanced multimedia applications and services such as streaming audio and video, a multitude of decoders and encoders.

Imagination MIPS32® InterAptive, DSP, and 2G and 3G coprocessors combined provide a powerful modem subsystem capable of supporting LTE Cat 7, Category 24 HSDPA downlink and Category 7 HSUPA uplink data rates, Category 14 TD-HSDPA downlink and Category 6 TD-HSUPA uplink, as well as Class 12 GPRS, EDGE.

MT8766 also embodies wireless communication device, including WLAN, Bluetooth and GPS. With four advanced radio technologies integrated into one single chip, MT8766 provides the best and most convenient connectivity solution in the industry.

The enhanced overall quality is achieved for simultaneous voice, data and audio/video transmission on mobile phones and Media Tablets. The small footprint with low-power consumption greatly reduces the PCB layout resource.

1.1 Highlighted Features Integrated in MT8766

- Quad-core high performance ARM® Cortex-A53 MPCore™ operating up to 2.0GHz
- LPDDR3 up to 4GB (single channel with 32-bit data bus width)
- LPDDR4X up to 4GB (dual channels with 16-bit data bus width)
- Memory clock up to LPDDR3-1866 or LPDDR4X-3200
- LTE Cat 7 (300Mps)
- Embedded connectivity system including WLAN/BT/FM/GPS
- Resolution up to WXGA (1,280*800)
- OpenGL ES 3.0 3D graphic accelerator
- ISP supports 21MP@30fps.
- SW dual cam 13+8MP@30fps/16+8 MP @24fps
- HEVC 1080p @ 30fps decoder
- H.264 1080p @ 30fps encoder
- Speech codec (FR, HR, EFR, AMR FR, AMR HR, Wide-Band AMR, and EVS_WB)

1.2   Platform Features

- **General**
  - Tablet, two MCU subsystems architecture
  - Supports eMMC boot
  - Supports LPDDR3
  - Supports LPDDR4X

- **AP MCU subsystem**
  - Quad-core ARM® 2.0GHz Cortex-A53 MPCore™
  - NEON multimedia processing engine with SIMDv2/VFPv4 ISA support
  - 32KB L1 I-cache and 32KB L1 D-cache
  - 512KB L2 cache
  - DVFS technology with adaptive operating voltage from 0.65V to 1.023V

- **MD MCU subsystem**
  - Imagination MIPS32® InterAptive processor with max. 864MHz operation frequency
  - High-performance multi-core and multi-thread processor architecture (two cores and two threads)
  - 32KB L1 I-cache and 32KB L1 D-cache per core
  - 384KB SPRAM (Scratchpad memory, Two-Core's ISPRAM and DSPRAM)
  - 256KB L2 Cache (share L2 cache for two cores)
  - High-performance AXI bus Interfaces
  - General DMA engine and dedicated DMA channels for peripheral data transfer
  - Power management for clock gating control

- **MD external interfaces**
  - Dual SIM/USIM interface
  - Interface pins with RF and radio-related peripherals (antenna tuner, PA, etc.)

  - Type: VFBGA
  - 11.4mm*11mm
  - Height: Max. 0.9mm
  - Ball count: 558 balls
  - Ball pitch: 0.4mm

- **Security**
  - ARM® TrustZone® Security

- **External memory interface**
  - LPDDR3 up to 4GB (single channel with 32-bit data bus width)
  - LPDDR4X up to 4GB (dual channels with 16-bit data bus width)
  - Memory clock up to LPDDR3-1866 or LPDDR4X-3200
  - Self-refresh/partial self-refresh mode
  - Low-power operation
  - Programmable slew rate for memory controller's IO pads
  - Dual rank memory device
  - Advanced bandwidth arbitration control

- **Peripherals**
  - USB2.0 OTG mode
  - eMMC5.1
  - 2 UART for debugging and applications
  - 6 SPI masters for external devices
  - 7 I2C to control peripheral devices, e.g. CMOS image sensor, LCM or FM receiver module
  - Max. 3 PWM channels (depending on system configuration/IO usage)
  - I2S for connection with optional external hi-end audio codec
  - GPIOs
  - 2 sets of memory card controllers supporting SD/SDHC/MS/MSPRO/MMC and SDIO2.0/3.0 protocols

- **Operating conditions**
  - Core voltage: 0.7V/0.8V
  - I/O voltage: 1.8V/2.8V/3.3V

  - Memory: 1.1V/0.6V
  - LCM interface: 1.8V
  - Clock source: 26MHz, 32.768kHz

- **Package**

1.3   Modem Features

- **LTE**
  - FDD/TDD Up to 300Mbps downlink, 150Mbps uplink
  - Downlink carrier aggregation (CA) ability; 1.4 to 20MHz RF bandwidth per component carrier (CC) and up to 2 CCs
  - Uplink intra-band carrier aggregation (CA) ability; 1.4 to 20MHz RF bandwidth per component carrier (CC) and up to 2 CCs
  - Uplink 64QAM
  - 4*2 downlink SU-MIMO per component carrier
  - Downlink MU-MIMO per component carrier
  - Supports feICIC
  - Supports MBMS
  - Uplink CoMP ability
  - Advanced Interference Cancellation
  - Transmit Antenna Selection

- **3G UMTS FDD supported features**
  - 3G modem supports most main features in 3GPP Release 7 and Release 8
  - CPC (DTX in CELL_DCH, UL DRX DL DRX), HS-SCCH-less, HS-DSCH
  - Dual cell operation
  - MAC-ehs
  - 2 DRX (receiver diversity) schemes in URA_PCH and CELL_PCH
  - Uplink Cat. 7 (16QAM), throughput up to 11.5Mbps
  - Downlink Cat. 24 (64QAM, dual-cell HSDPA), throughput up to 42.2Mbps
  - Fast dormancy
  - ETWS
  - Network selection enhancements
  - Transmit Antenna Selection

- **TD-SCDMA**
  - CDMA/HSDPA/HSUPA baseband
  - TD-SCDMA Bands 34, 39 & 40 and quad band GSM/EDGE
  - Circuit-switched voice and data; packet-switched data
  - 384/384Kbps class in UL/DL for TD-SCDMA
  - TD-HSDPA: 2.8Mbps DL (Cat.14)
  - TD-HSUPA: 2.2Mbps UL (Cat.6)
  - F8/F9 integrity protection
  - Transmit Antenna Selection

- **Radio interface and baseband front-end**
  - High dynamic range delta-sigma ADC converts the downlink analog I and Q signals to digital baseband.
  - 10-bit D/A converter for Automatic Power Control (APC)
  - Programmable radio Rx filter with adaptive gain control
  - Dedicated Rx filter for FB acquisition
  - Baseband Parallel Interface (BPI) with programmable driving strength
  - Supports multi-band

- **GSM modem and voice CODEC**
  - Dial tone generation
  - Noise reduction
  - Echo suppression
  - Advanced side-tone oscillation reduction
  - Digital side-tone generator with programmable gain
  - 2 programmable acoustic compensation filters
  - GSM quad vocoders for adaptive multi-rate (AMR), enhanced full rate (EFR), full rate (FR) and half rate (HR)
  - GSM channel coding, equalization and A5/1, A5/2, A5/3, and A5/4 ciphering
  - GPRS GEA1, GEA2, GEA3, and GEA4 ciphering
  - Programmable GSM/GPRS/EDGE modem

- Packet switched data with CS1/CS2/CS3/CS4 coding schemes
- GSM circuit switch data
- GPRS/EDGE Class 12
- Supports SAIC (Single Antenna Interference Cancellation) technology
- VAMOS (Voice services over adaptive multi-user channels on one slot) technology in R9 spec
- Transmit Antenna Selection

- **CDMA2000 modem interfaces**
  - Supports CDMA2000 1xRTT (releases 0) and CDMA2000 HRPD/1xEV-DO Revision 0 and A
  - Supports maximum 1x data rates of 153.6kbps for forward and reverse links and DO data rates of 3.1Mbps for forward link and 1.8Mbps for reverse link
  - Hybrid operation between 1x and HRPD
  - Supports simultaneous hybrid dual receiver (SHDR)
  - Supports 1x/DO diversity
  - Supports SRLTE
  - Transmit antenna selection

1.4 Connectivity Features

MT8766 includes four wireless connectivity functions:

- WLAN
- Bluetooth
- GPS
- FM Receiver

The RF parts of those four blocks are placed on chip MT6631. With four advanced radio technologies integrated on one chip, M6763/MT6631 is the best and most convenient connectivity solution in the industry, implementing advanced and sophisticated Radio Coexistence algorithms and hardware mechanisms. It supports single antenna sharing among 2.4GHz Bluetooth, 2.4GHz/5GHz WLAN and 1.575GHz for GPS. The enhanced overall quality is achieved for simultaneous voice, data and audio/video transmission on mobile phones and Media Tablets. The small footprint with low-power consumption greatly reduces PCB layout resource.

- Supports integrated Wi-

- **Wi-Fi**
  - Dual-band (2.4/5GHz) single stream 802.11 ac/a/b/g/n MAC/BB/RF SoC, 20/40/80MHz bandwidth, MCS0~9 (256-QAM)
  - 802.11 d/e/h/i/j/k/r/v compliant
  - Security: WFA WPA/WPA2 personal, AES-CCMP, WPI-SMS4, GCMP, WPS2.0, WAPI (hardware)
  - QoS: WFA WMM, WMM PS
  - 802.11n optional features: STBC, A-MPDU, Blk-Ack, RIFS, MCS Feedback, 20/40MHz coexistence (PCO), unscheduled PSMP
  - Supports 802.11w protected managed frames
  - Supports 802.11ac STBC TX/RX, 4T1R beamformee, MU-MIMO RX, WoWLAN
  - Supports MediaTek proprietary low power Green AP mode for portable hotspot operation
  - Auto rate control for optimizing the signal range and performance
  - Supports Wi-Fi Direct (WFA P-2-P standard) and Wi-Fi Miracast (Wi-Fi Display)

- **Supports integrated Wi-Fi/Bluetooth/GPS**
  - Single antenna for Bluetooth and WLAN/GPS/Bluetooth
  - Self calibration
  - Single TCXO and TMS for GPS, BT and WLAN
  - Best-in-class current consumption performance
  - Intelligent BT/WLAN coexistence scheme that goes beyond PTA signaling (e.g. transmit window and duration that take into account protocol exchange sequence, frequency, etc.)

  - Integrated PA with 9dBm (class 1) transmit power or 12dBm boost mode via WIFI PA.
  - RX sensitivity: GFSK -95dBm, DQPSK -94.5dBm, 8-DPSK -88dBm, BLE -98dBm
  - Supports BT/Wi-Fi/LTE coexistence
  - Supports 7 BT links and 16 BLE links
  - Supports Packet Loss Concealment (PLC) function for better voice quality
  - Supports Wideband speech
  - Supports mSBC and SBC including mono and stereo
  - Supports secure connection with AES128 and ECC256
  - Support Adaptive Frequency Hopping with built-in channel assessment method

- **GPS**
  - Supports GPS/Glonass/Beidou/Galileo/QZSS tri-band reception concurrently
    - GPS/Galileo only (GPS only)
    - GPS/Galileo - GLONASS (G+G)
    - GPS/Beidou (G+B)
    - GPS/GLONASS/Beidou (G+G+B)
    - GPS/Galileo/GLONASS (G+G+G)
    - GPS/Galileo/GLONASS/Beidou (G+G+G+B)
  - Supports SBAS (Satellite-Based Augmentation Systems): WAAS/MSAS/EGNOS/GAGAN
  - Best-in-class sensitivity performance
    - -165 dBm tracking sensitivity
    - -163 dBm hot start sensitivity
    - -148 dBm cold start sensitivity
    - -151 dBm warm start sensitivity
  - AGPS sensitivity is 8dB design margin over 3GPP
  - Full A-GPS capability (E911/SUPL/EPO/HotStill)
  - Active interference cancellation for up to 12 in-band tones

Display)
  - Supports Wi-Fi HotSpot 2.0
  - Integrated 2.4GHz PA with max. 23dBm CCK output power and 5GHz PA with max. 18.5dBm OFDM 54Mbps output power
  - RX sensitivity at 11n HT20 MCS7 mode and -62dBm 5GHz RX sensitivity at 11ac VHT80 MCS9 mode
  - Supports 32 multicast address filters and TCP/UDP/IP checksum offload
  - Per packet TX power control

- **Bluetooth**
  - Supports Bluetooth 5 dual mode for 4x the range, 2x the speed and 8x the broadcasting message capacity

  - Supports both TCXO and TMS (Thermister Crystal) clock source
  - 5Hz update rate

- **FM**
  - 65-108MHz with 50kHz step
  - RDS/RBDS
  - Digital stereo demodulator
  - Simplified digital audio interface (I2S)
  - Stereo noise reduction
  - Audio sensitivity 2dBµVemf (SINAD=26dB)
  - Audio SINAD 60dB
  - Anti-jamming
  - Integrated short antenna

- **WBT IPD**
  - Integrated matching network, balance band-pass filter, GPS-WBT diplexer
  - Fully integrated in one IPD die
  - Single and dual antenna operation

- **GPS IPD**
  - Integrated high-pass type matching network and 5th-order ellipse low-pass filter
  - Fully integrated in one IPD die
  - Single and dual antenna operation

1.5 Multimedia Features

- **Display**
  - Portrait panel resolution up to WXGA (1,280*800)
  - MIPI DSI interface (4 data lanes)
  - MiraVisionTM for picture quality enhancement
  - Embedded LCD gamma correction
  - True colors
  - 6 overlay layers with per-pixel alpha channel and gamma table
  - Spatial and temporal dithering
  - Color enhancement
  - Adaptive contrast enhancement
  - Image/video/graphic sharpness enhancement
  - Dynamic backlight scaling

- **Graphics**
  - OpenGL ES 3.1/3.0/2.0/1.1 3D graphic accelerator capable of processing 160M tri/sec and 1,600M pixel/sec @ 770MHz
  - OpenCL ES 1.1 full profile

- **Image**
  - Integrated image signal processor supports 21MP@30fps
  - Electronic image stabilization
  - Video stabilization
  - Preference color adjustment
  - Noise reduction
  - Multiple frame noise reduction for image capture
  - Temporal noise reduction for video recording
  - Lens shading correction
  - Auto sensor defect pixel correction
  - Supports AE/AWB/AF
  - Edge enhancement (sharpness)
  - Face detection and visual tracking
  - Video face beautification

- Zero shutter delay image capture
- Captures full size image when recording video (up to 21M sensors)
- 2 MIPI CSI-2 high-speed camera serial interfaces; both are 4 data lane
- Hardware JPEG encoder: Baseline encoding with 130M pixel/sec; Continuous shot with 220M pixel/sec
- Supports YUV422/YUV420 color format and EXIF/JFIF format

- **Video**
  - HEVC decoder 1080p @ 30fps/40Mbps
  - VP9 decoder 1080p @ 30fps/40Mbps
  - H.264 decoder: Baseline 1080p @ 30fps/40Mbps
  - H.264 decoder: Main/high profile 1080p @30fps/40Mbps
  - Sorenson H.263/H.263 decoder: 1080p @ 30fps/40Mbps
  - MPEG-4 SP/ASP decoder: 1080p @ 30fps/40Mbps
  - DIVX4/DIVX5/DIVX6/DIVX HD/XVID decoder: 1080p @ 30fps/40Mbps
  - MPEG2 decoder 1080p @ 30fps/40Mbps
- MPEG-4 encoder: Simple profile D1 @ 30fps
- H.263 encoder: Simple profile D1 @ 30fps
- H.264 encoder: High profile 1080p @ 30fps

- **Audio**
- Audio content sampling rates supported: 8kHz to 192kHz
- Audio content sample formats supported: 8-bit/16-bit/24-bit, Mono/Stereo
- Interfaces supported: I2S, PCM
- External CODEC I2S interface supports 16-bit/24-bit, Mono/Stereo, 8kHz to 192kHz.
- 4-band IIR compensation filter to enhance loudspeaker responses

  - Proprietary audio post-processing technologies: BesLoudness (MB-DRC), BesSurround, Android built-in post processing
  - Audio encoding: AMR-NB, AMR-WB, AAC, OGG, ADPCM
  - Audio decoding: WAV, MP3, MP2, AAC, AMR-NB, AMR-WB, MIDI, Vorbis, APE, AAC-plus v1, AAC-plus v2, FLAC, WMA, ADPCM

- **Speech**
  - Speech codec (FR, HR, EFR, AMR FR, AMR HR, Wide-Band AMR, and EVS_WB)
  - CTM

- **Speech**
  - Speech codec (FR, HR, EFR, AMR FR, AMR HR, Wide-Band AMR, and EVS_WB)
  - CTM
  - Noise reduction
  - Noise suppression
  - Noise cancellation
  - Dual-MIC noise cancellation
  - Echo cancellation
  - Echo suppression
  - Dual-MIC voice tracking
  - Dual-MIC sound recording w/o wind noise rejection
  - MagiLoudness (enhances the voice clarity based on near end environment noise)
  - MagiClarity (maximizes loudness while controlling the maximum receiver output power; feed-forward receiver protection)
  - Compensation filter and digital gain for both uplink and downlink paths

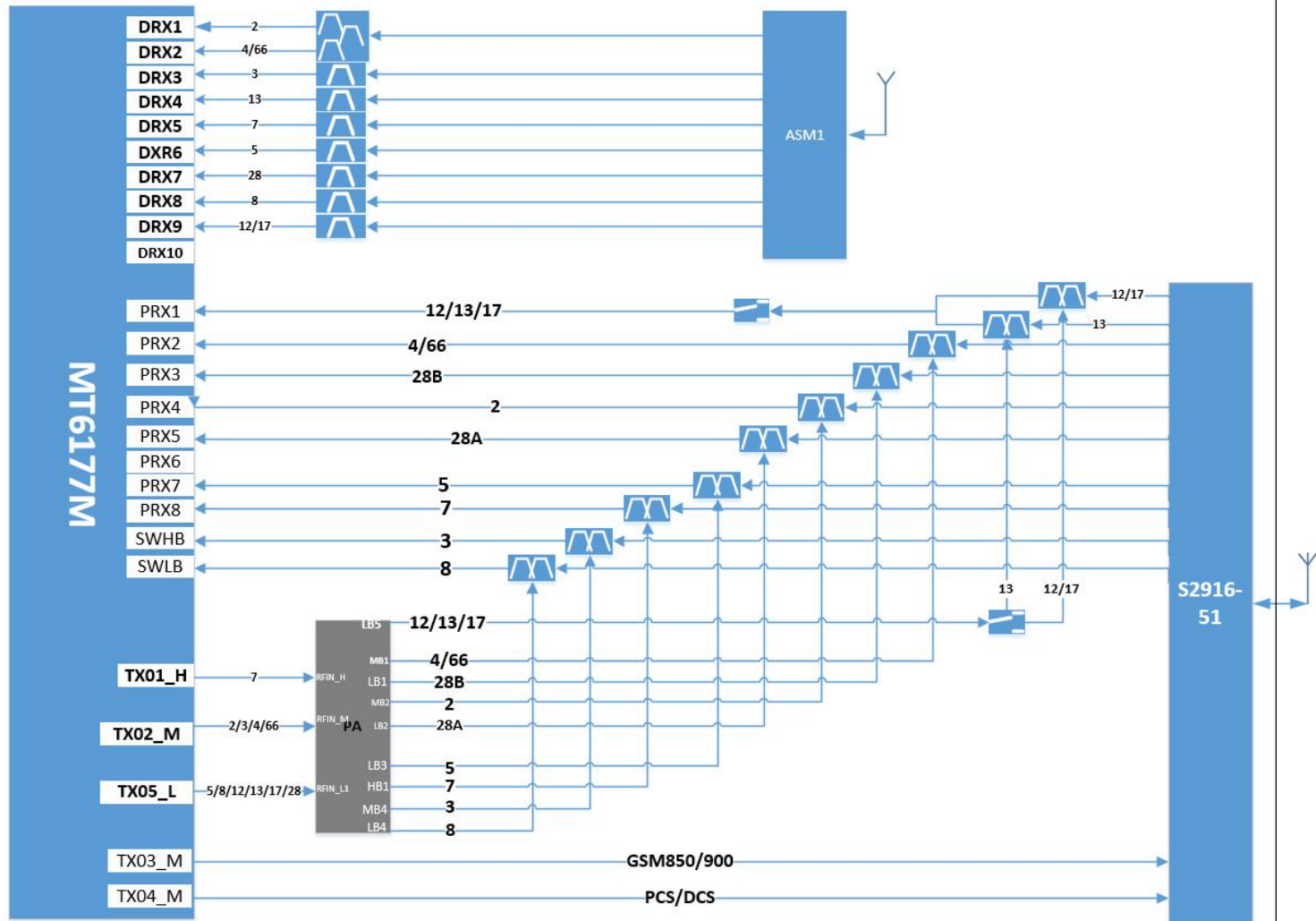## Architecture and baseband processing features

- ✓ Applications:
  - Quad ARM high performance Cortex-A53@2.0GHz
  - 12nm process for lower active power dissipation
  - Support LPDDR3 up to 4GB, single channel with 32bit data bus width, clock up to 1866MHz, Support LPDDR4X up to 8GB, dual channels with 16bit data bus width, clock up to 3200MHz.

Memory support features

- ✓ Support LPDDR3 up to 4GB, single channel with 32bit data bus width, clock up to 1866MHz, Support LPDDR4X up to 8GB, dual channels with 16bit data bus width, clock up to 3200MHz.
- ✓ External memory: v5.1 eMMC/SD devices

3. Signal Flow

Brief of the mobile signal flow as below:
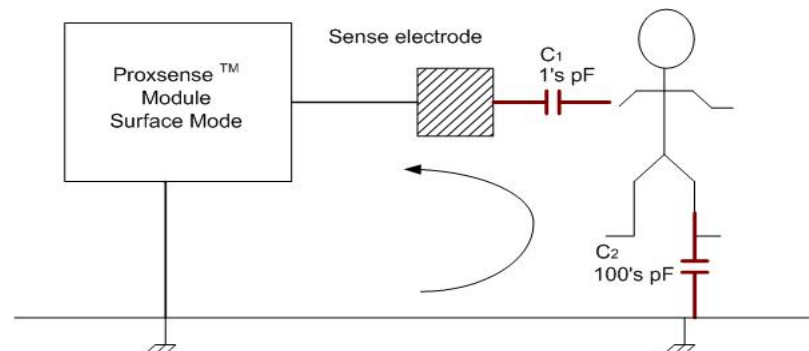
3.1. Receiver principle

The aerial signal mobile received go to RF Connector, and then transmit to transceiver via the selected band in RF switcher & SAW filter. Four IQ signals input to CPU, Go through A/D, DSP, and D/A section in CPU, then output to receiver.

3.2. Transmitter principle

Audio signal input from Microphone, Microphone convert the voice signal to analog signal and input to CPU. Go through A/D, DSP, and D/A section, output to transceiver by IQ signals, These analog input signals are buffered, filtered by low-pass filters, amplified, and then applied to the quadrature upconverter mixers …in transceiver(MT6177M). Then output to PA, go through duplexer, ASM to antenna.
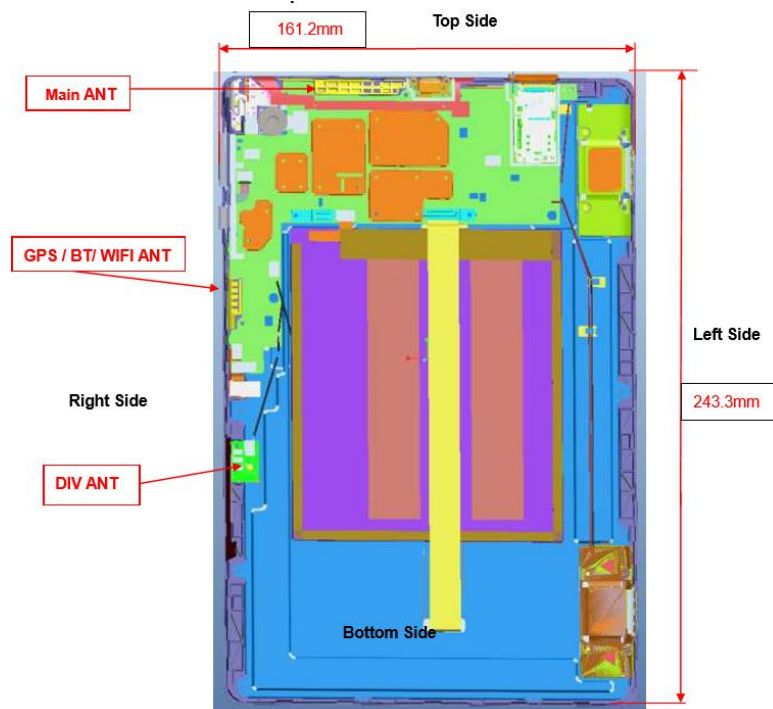
4.1 P-Sensor mechanism and algorithms

Circuitry measures capacitance of sense electrode (attached to the IC sense pin) relative to ground (Cx). Measurement occurs by continual charging of Cx, discharging into internal reference capacitor (Cs), until trip voltage is reached. Quantity of consecutive charges for Cs to reach trip voltage is counted, and referred to as the current sample. User interaction determined from the current sample deviations from the baseline (long term average or LTA). Use PCB pads to sense a touch or proximity event.

4.2 How Proximity Sensor works

Proximity Sensor using for reducing RF conductive power when testing Body SAR with 0mm. When user hand or other parts of body close to the antenna within the sensor trigger distance, RF output power will be reduced, the device working with low power, otherwise the device working with normal power.

Top Side

161.2mm

Main ANT

GPS / BT/ WIFI ANT

Right Side

DIV ANT

Left Side

243.3mm

Bottom Side

Twin SAM V8.0
S/N: 1931
P/N: QD 000 P41 AA
Made in Switzerland

Picture 17-9 Rear 14mm

Picture 17-12 Top 12mm

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