IK41UD Operation Description

1 Overview

IK41UD is a USB Connect 4G based on Qualcomm MDM9207+WTR2965 platform, the interface supports USB 2.0 high speed standard, which can be connected directly to the computer's USB port or other USB port, easy to use for technology purchaser and people who need high speed wireless access anywhere.

1.1 The main IC include

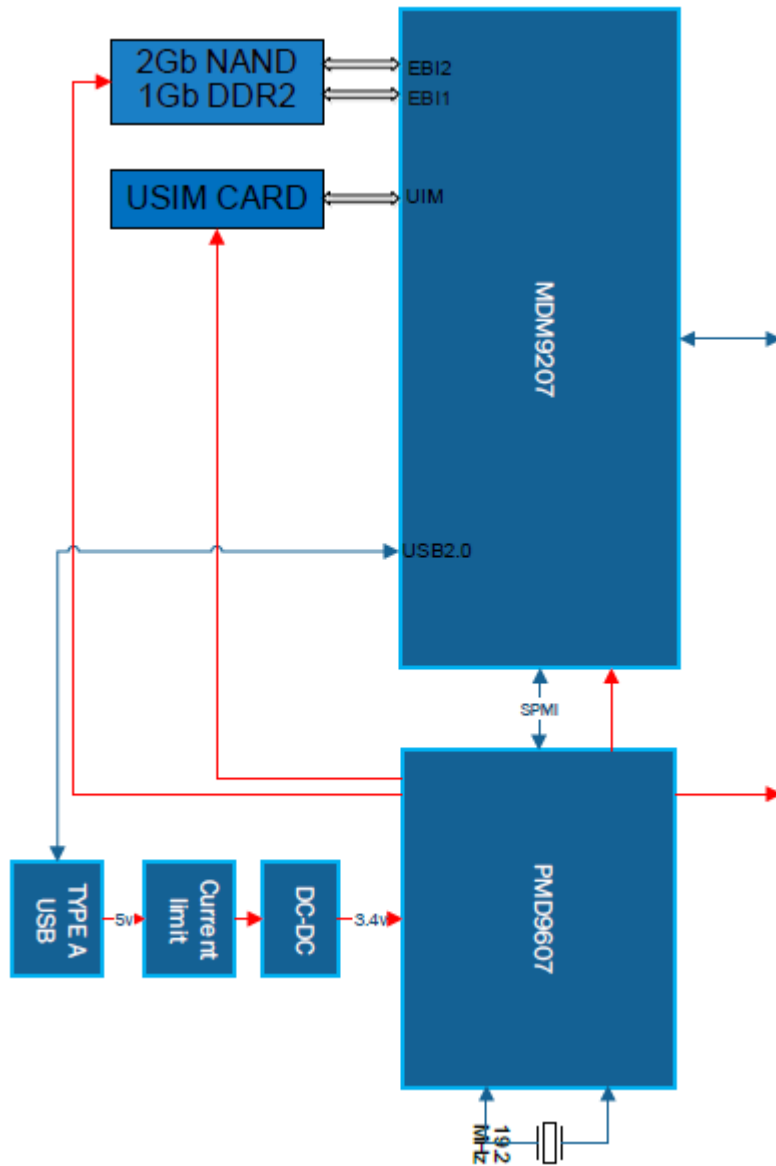| Band (IK41UD)	GSM/EDGE/GPRS：850/900/1800/1900MHz UMTS/HSPA/HSPA+:Band 2/4/5 FDD-LTE: Band 2/3/4/5/7/12/28
Baseband	MDM9207 from Qualcomm
PMIC	PMD9607 from Qualcomm
Memory	2Gb NAND flash + 1Gb LPDDR2 from NANYA
Transceiver	WTR2965 from Qualcomm

1.2 RECOMMENDABLE OPERATION CONDITION

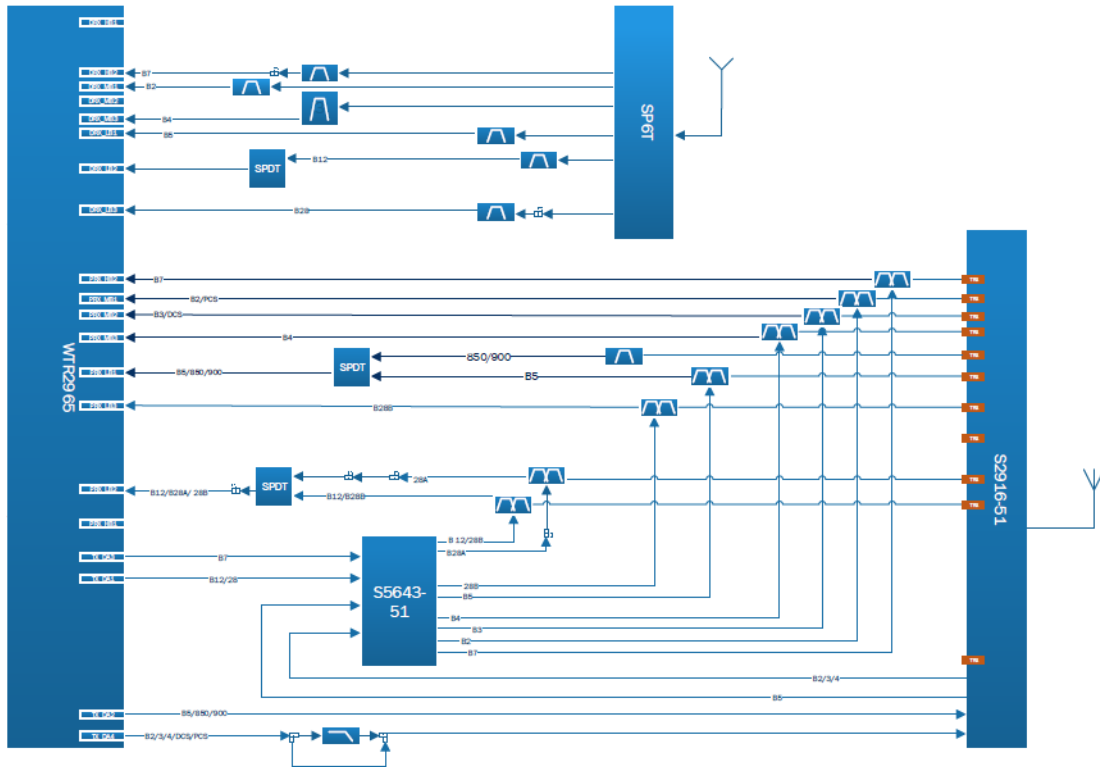| Normal Supply Voltage (V d.c.)	5V
Operating Temperature	-10 to 55°C
Operation Humidity	10% to 90%
Storage Temperature	-10 to 70°C
Storage Humidity	5% to 95%
USIM Voltage	1.8/3V

2 System diagram Overview

2.1 Overview

The principle diagram of the IK41UD as shown in the figure below:

BB BLOCK:

RF BLOCK:

Mainly includes the following several parts:

(1) Baseband
(2) PMIC
(3) RF transceiver
(4) RF PA & Switch
(5) USB Interface

2.2 RF

RF (Radio Frequency) section is in charge of the signal transmit and receiving, signal modulation and demodulation. Freeport IK41UD supports FDD-LTE Cat 4, which can reach a maximum downlink 150Mbps High Speed.

Mode	Uplink	Downlink	BLER
GSM	824MHz~849MHz	869MHz~894MHz	<-108dBm
	880MHz~915MHz	880MHz~915MHz	<-108dBm
	1710MHz~1785MHz	1805MHz~1880MHz	<-108dBm
	1850MHz~1910MHz	1930MHz~1990MHz	<-108dBm
WCDMA	1850MHz~1910MHz	1930MHz~1990MHz	<-108dBm
	1710MHz~1755MHz	2110MHz~2155MHz	<-108dBm
	824MHz~849MHz	869MHz~894MHz	<-108dBm
FDD -LTE	1850MHz~1910MHz	1930MHz~1990MHz	<-96dBm
	1710MHz~1785MHz	1805MHz~1880MHz	<-96dBm

1710MHz~1755MHz	2110MHz~2155MHz	<-96dBm
824MHz~849MHz	869MHz~894MHz	<-95dBm
2500MHz~2570MHz	2620MHz~2690MHz	<-95dBm
699MHz~716MHz	729MHz~746MHz	<-95dBm
703MHz~748MHz	758MHz~803MHz	<-95dBm

GSM modulation

Items		GSM850	GSM900	DCS	PCS
Frequency allocation/MHz		TX :824-849 RX :869-894	TX :880-915 RX :925-960	TX: 1710-1785 RX:1805-1880	TX：1850-1910 RX： 1930-1990
Channel band width/KHz		200	200	200	200
Channel		128-251	975-1023, 0-124	512-885	512-810
Modulation	UL	GMSK, 8PSK	GMSK, 8PSK	GMSK, 8PSK	GMSK, 8PSK
	DL	GMSK, 8PSK	GMSK, 8PSK	GMSK, 8PSK	GMSK, 8PSK
TX/RX channel space /MHz		45	45	95	80
(Fn)Freq. calculating formula		$Fn=824.2+(N-128)\times0.2$ N: Channel No. Unit: MHz	$Fn=880.2+(N-975)\times0.2$ N: Channel No. Unit: MHz	$Fn=1710.2+(N-512)\times0.2$ N: Channel No. Unit: MHz	$Fn=1850.2+(N-512)\times0.2$ N: Channel No. Unit: MHz
Multi-slot class		33	33	33	33

WCDMA modulation

Items		B Ⅱ	BⅣ	B Ⅴ
Channel bandwidth/MHz		5	5	5
Modulation	UL	BPSK/QPSK	BPSK/QPSK	BPSK/QPSK

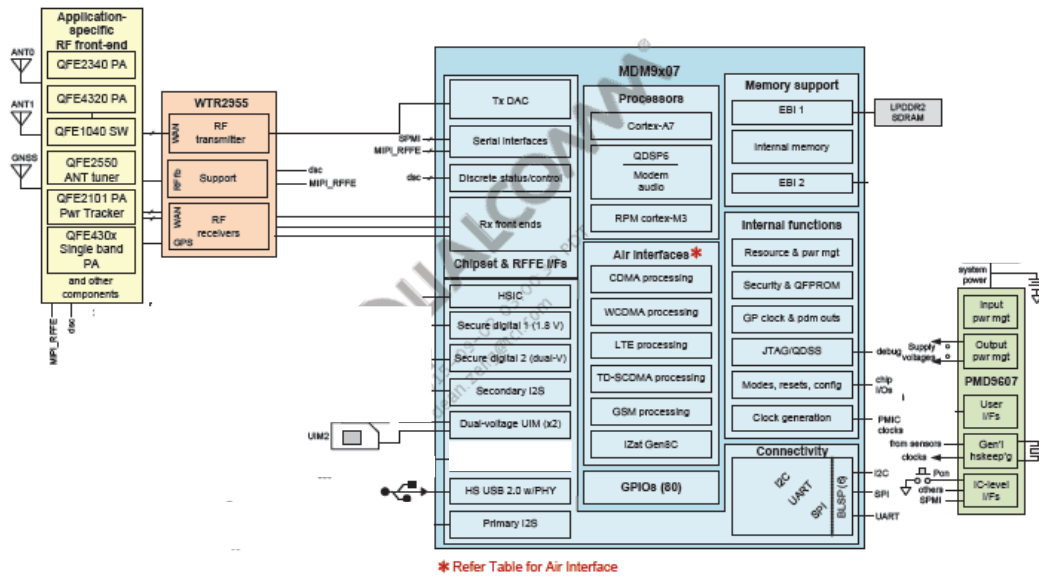|		DL	QPSK/16Q AM/64QAM	QPSK/16QAM /64QAM	QPSK/16QA M/64QAM
Channel			9612-9888	937-1288	2712-2863
Category			HSDPA:10 HSUPA:6 HSPA+:18 DC-HSDPA :24	HSDPA:10 HSUPA:6 HSPA+:18 DC-HSDPA: 24	HSDPA:10 HSUPA:6 HSPA+:18 DC-HSDPA: 24

LTE modulation

Items			FDD2	FDD3	FDD4
Channel band width/MHz			1.4,3,5,10,15,20	1.4,3,5,10, 15,20	1.4,3,5,10, 15,20
Modulation		UL	16QAM/QPSK	16QAM/QPSK	16QAM/QPSK
		DL	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM
Items			FDD5	FDD7	B12
Channel band width/MHz			1.4,3,5,10,	5,10,15,20	1.4,3,5,10,
Modulation		UL	16QAM/QPSK	16QAM/QPSK	16QAM/QPSK
		DL	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM	QPSK/16QAM /64QAM
Items			FDD28		
Channel band width/MHz			3,5,10,15,20		
Modulation		UL	16QAM/QPSK		
		DL	QPSK/16QAM /64QAM		
Catego ry	Downlink		4		
	Uplink		4		

2.3 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.

❋ Refer Table for Air Interface

Features integrated into the MDM9x07 device

➢ 28 nm LP SoC process for lower active power dissipation, and faster peak CPU performance
➢ Cortex-A7, up to 1.2 GHz
➢ Single-channel, Non-PoP High speed memory – LPDDR2 SDRAM, up to 300 MHz clock rate
➢ Latest airlink technologies
➢ Support for QTI's RF front-end devices – QFE2340, QFE430x PAs, QFE4320 PA with integrated antenna switch, QFE1040 antenna switches, QFE2550 antenna tuners, and QFE2101 average power tracker
➢ SGMII with MDIO control
➢ Bus interfaces for chipset and RFFE support
➢ MIPI RFFE interface for RF front-end components
➢ System power management interface (SPMI) for PMIC communications, including interrupts

Feature MDM9x07 capability

Processors	
Applications	ARM Cortex A7 up to 1.2 GHz with 256 kB L2 cache ARM Cortex A7 – primary boot processor
Modem system	QDSP6 processor at up to 691 MHz (Turbo) Low-power audio post-processing supported in the modem system 768 kB L2 caches
RPM system	Cortex M3 up to 100 MHz The only master of the modem power manager (MPM) MPM coordinates shutdown/wakeup, clock rates, and VDDs Boot flow is RPM/applications processor-based
Memory support	

External memory
    EBI1
    EBI2
    SDC
	
	32-bit LPDDR2 SDRAM at up to 300 MHz
	Multiplexed address/data bus; 8-bit NAND flash
	uSD cards

internal memory	144 kB boot ROM 16 kB IMEM
RF support	
RF operating bands	Defined by WTR2955 device (80-NP237-x)

Air interfaces
    GSM
    CDMA
    WCDMA
    TD-SCDMA
    LTE
	See Section 1.3.2 for details.
	Yes – all variants except MDM9307
	Yes – MDM9607/MDM9628 only
	Yes – MDM9207-0/MDM9607/MDM9207-1/MDM9628
	Yes – all variants except MDM9307
	Yes – all variants except MDM8207

QTI RF front-end support	
QFE1040	RxD antenna switch
QFE2550	Antenna tuner
QFE2340	HB PA
QFE430x	single band PA
QFE2101	Average power tracker
QFE4320	LB/MB PA with integrated antenna switch

Connectivity	
BLSP ports	Six, 4 bits each; multiplexed serial interface functions
UART	Yes – up to 4 MHz
I2C	Yes – sensors, etc.
SPI (master only)	Yes – sensors, etc.; up to 50 MHz
UIM	voltage (1.8/2.95 V)
USB	One USB2.0 with built-in USB PHY
Secure digital interfaces	Two ports SDC1 – Muxed with other functionalities, 4-bit 1.8 V for WLAN interface SDC2 – Dedicated, 4-bit, dual-voltage SD 3.0 at up to 50 MHz DDR (1.8/2.95 V)
HSIC	Inter-chip communication
Audio interfaces	Primary and secondary I2S/PCM
Configurable GPIOs	
Number of GPIO ports	80 – GPIO_0 to GPIO_79
Input configurations	Pull-up, pull-down, keeper, or no pull
Output configurations	Programmable drive current
Top-level mode multiplexer	Provides a convenient way to program groups of GPIOs
Internal functions	
Security	Secure boot, secure file system, secure execution environment

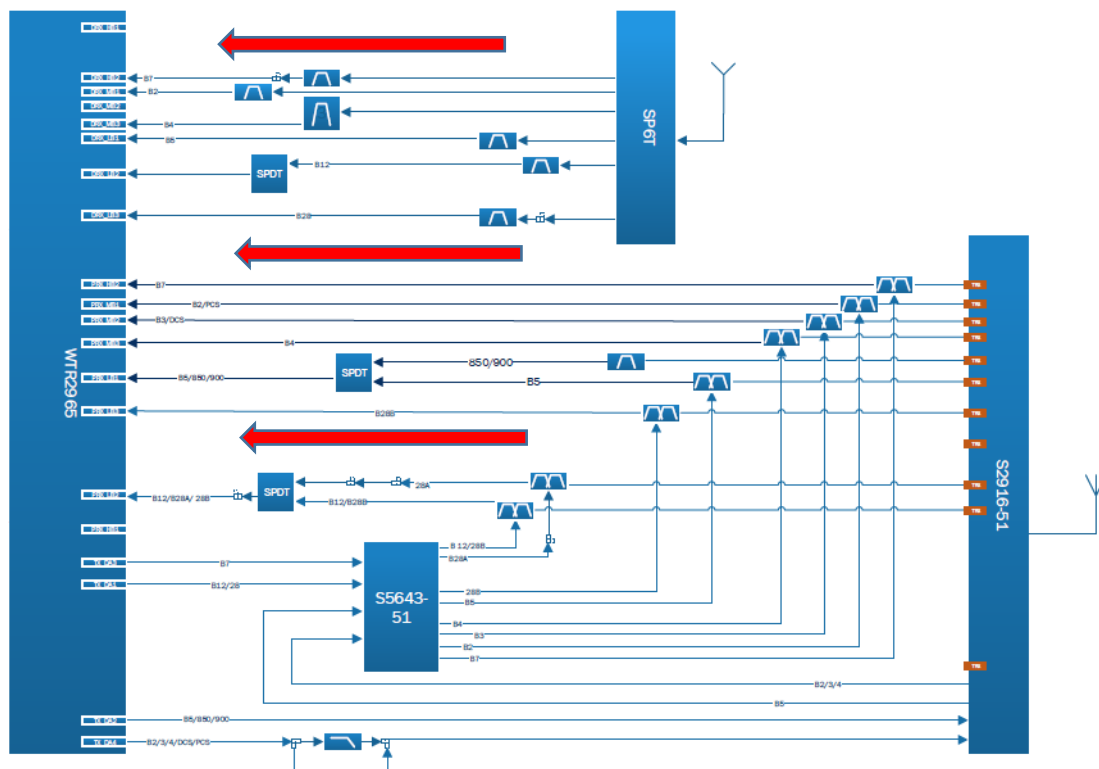| Boot sequence	1) Application system, 2) RPM system, 3) modem system Emergency boot over HS-USB Refer to *MDM9x07/MDM9628 Boot Architecture and Board Support Package Overview* (TBD) for details.
Boot sources	NAND, USB
PLLs and clocks	Multiple clock regimes; watchdog & sleep timers Inputs: 19.2 MHz CXO General-purpose outputs: M/N counter

Resource and power manager	Fundamental to bootup and power management
	Key blocks: RPM core, Cortex M3, security controller, MPM
	Improved efficiency via clock control, split-rail power collapse and voltage scaling; several low-power sleep modes
Debug	JTAG, QDSS
Others	Thermal sensors; modes & resets; peripheral subsystem
Chipset and RF front-end (RFFE) interface features	
RF front-end components	MIPI RFFE interfaces
Power management	2-line SPMI; plus other lines as needed via GPIOs
Fabrication technology and package	
Digital die	28 nm LP CMOS
Small, thermally efficient packages	328 PSP: 6.9 x 7.8 x 0.82 mm; 0.35 mm pitch

3 Signal Flow

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. IQ signals input to CPU, Go through A/D, DSP, and D/A section in CPU, then output to receiver.

RX signal flow chart:

Note: Marked by RED color arrow

3.2 Transmitter principle

TX signal flow chart:

Note: Marked by RED color arrow