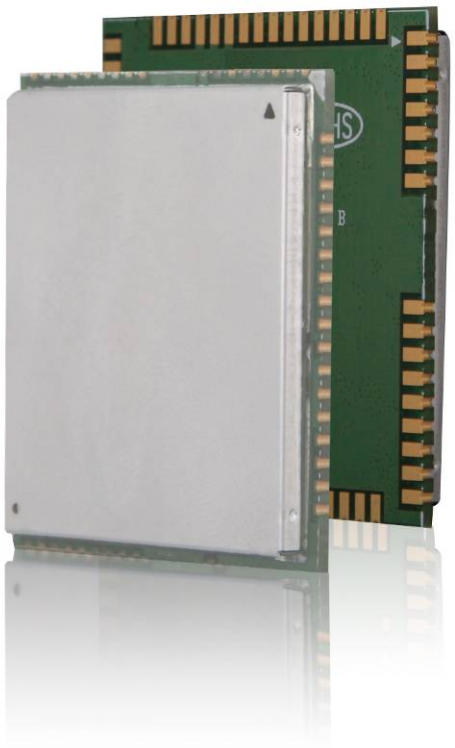
M10

Quectel Cellular Engine



M10 User Guide

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1 .EVB kit introduction

1.1 EVB top and bottom view

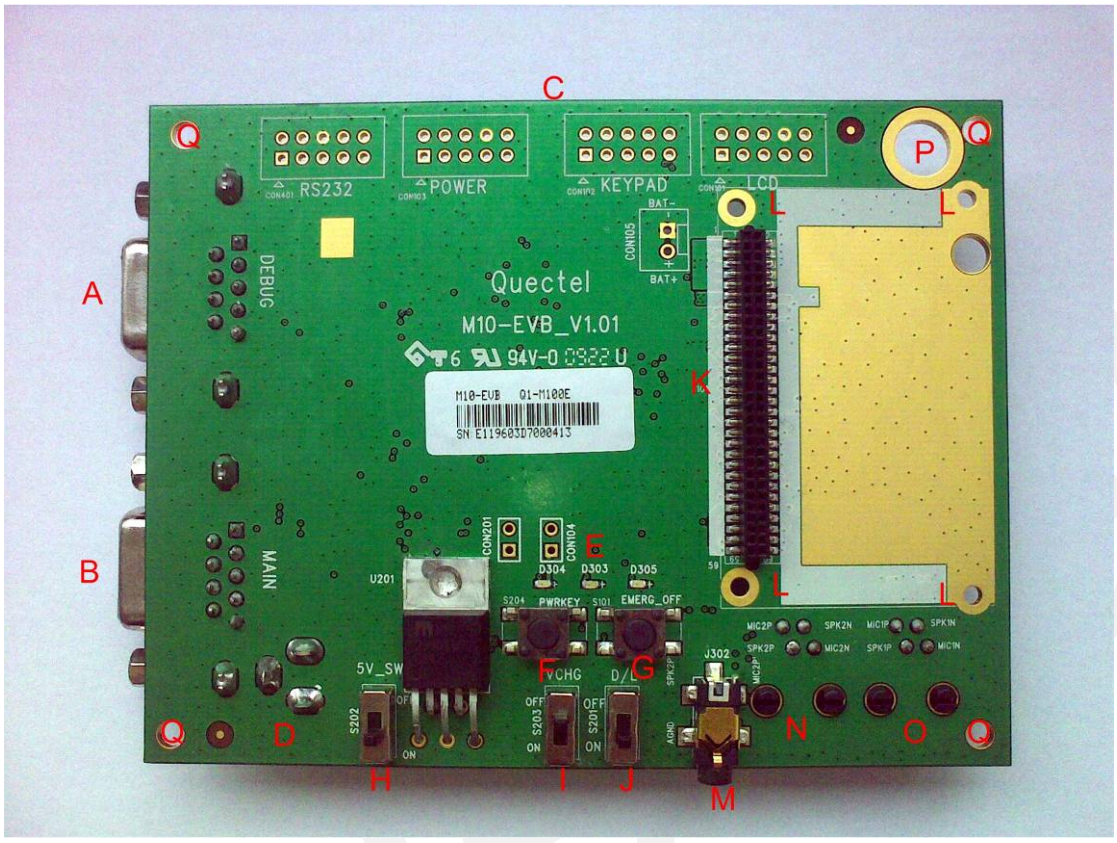


Figure 1: EVB top view

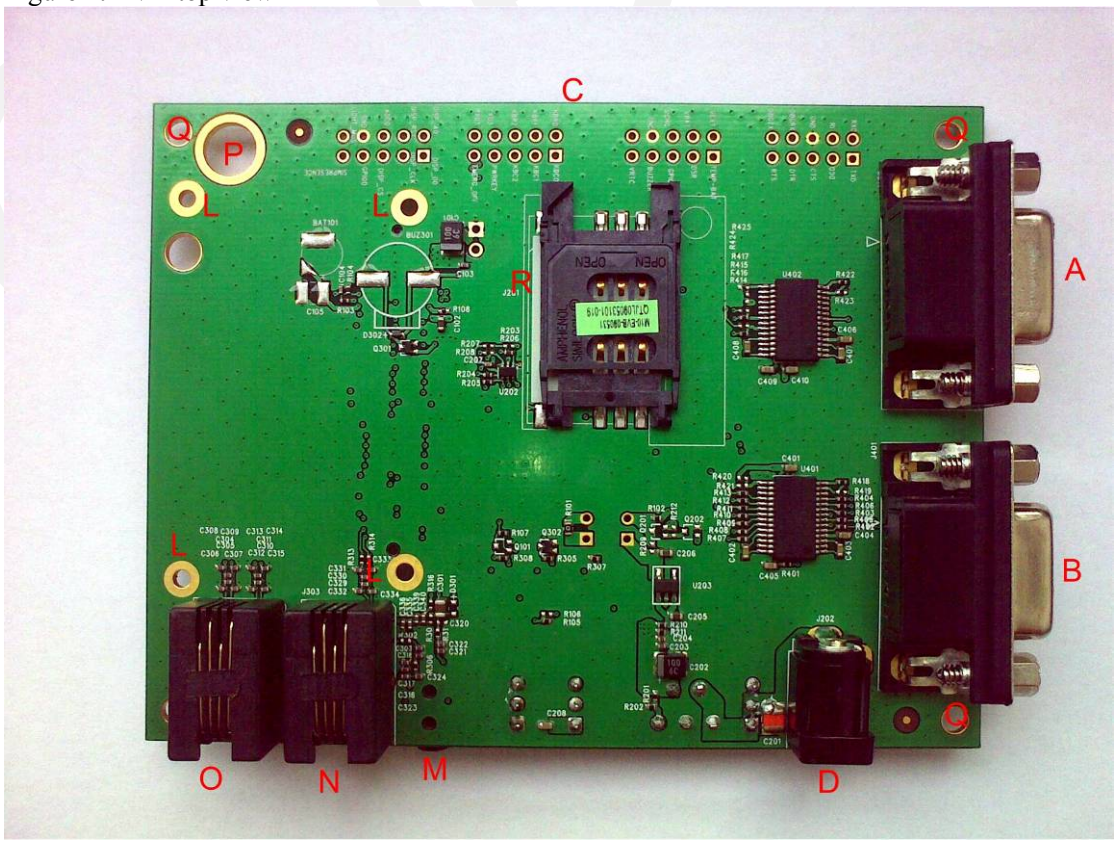


Figure 2: EVB bottom view

A: Debug port
B: Main UART port
C: Test points
D: Adapter interface
E: Module operating status indication LEDs
F: PWRKEY button
G: EMERG_OFF button
H: VBAT switch
I: VCHG switch (charge function)
J: Download switch
K: Connector for M10-TE-A board
L: Screw holes for fixing the M10-TE-A
M: Headset socket
N: Handset socket of audio channel 2
O: Handset socket of audio channel 1
P: Antenna connector fixing hole
Q: Screw holes for EVB placement
R: SIM card socket

1.2 EVB accessory

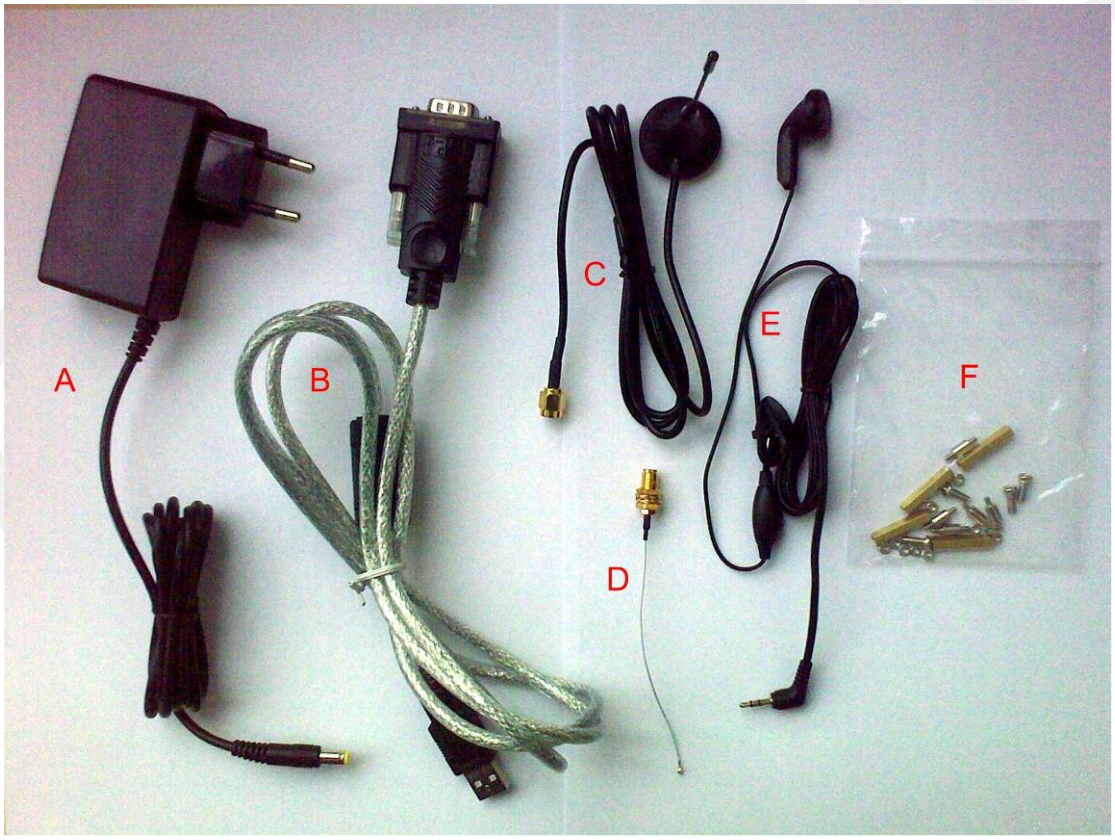


Figure 3: Accessory introduction

A: 5V DC switching adapter
B: USB to UART converter cable
C: Antenna
D: RF cable
E: Headset

F: Bolts and nuts for fixing module and EVB

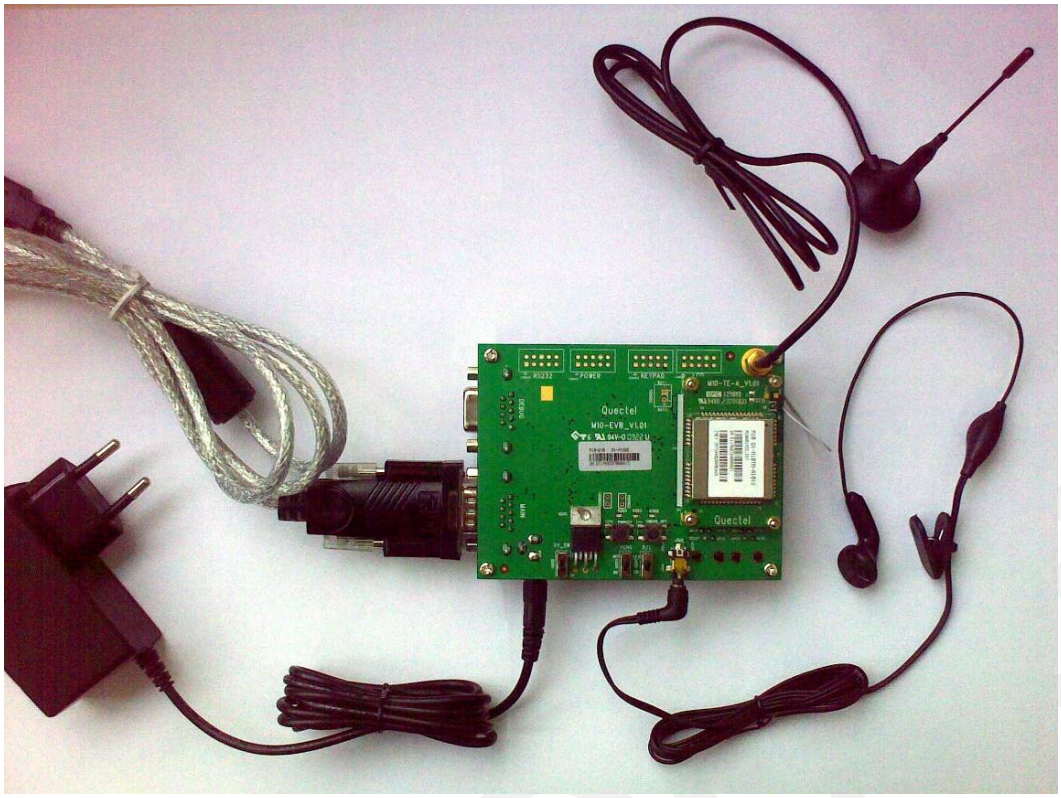
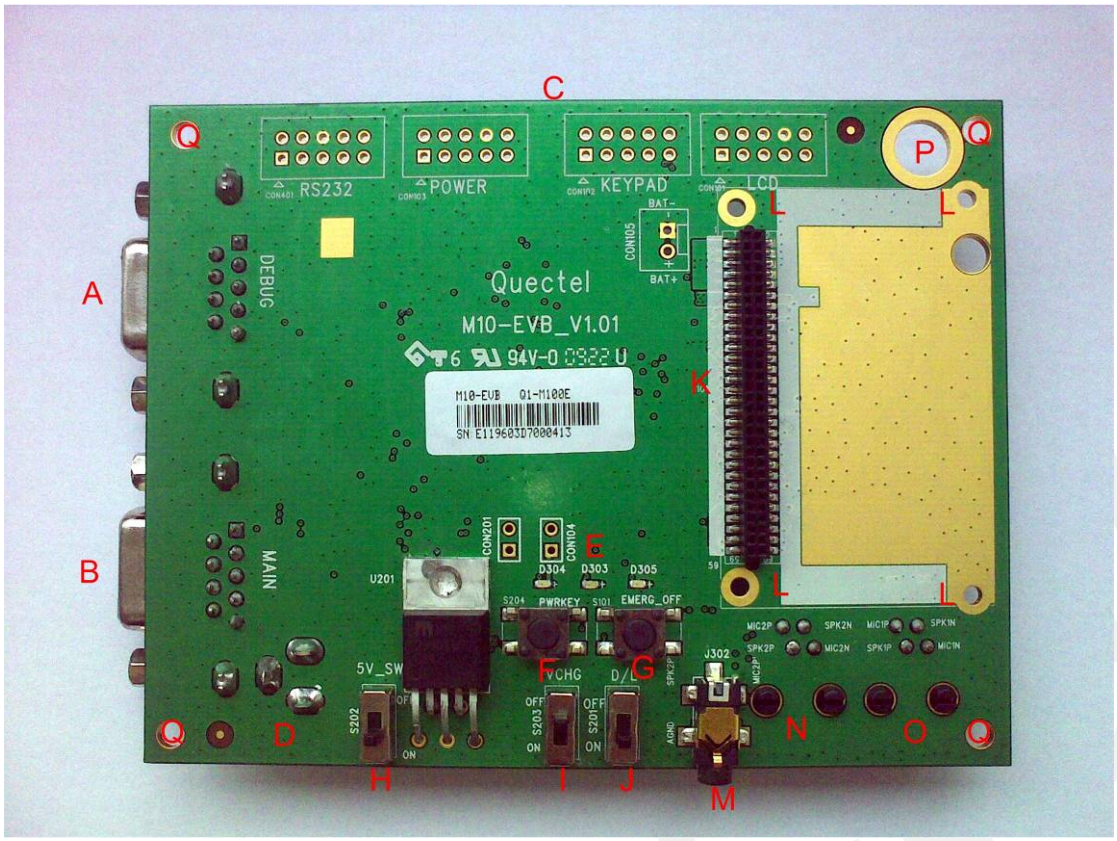


Figure 4: EVB and accessories

2.Operational description

2.1 Tune up procedure

Firstly，please equip the module and accessories as the figure 4.



Then ,switching the **H** switch to **ON** state, **J** switch to **ON** state； Press the **F** button **PWRKEY** for about 2 second, then the LED glint，and the module is tuningup successfully；(the location of All Switches and buttons please see the Figure 1)

2. M10 features

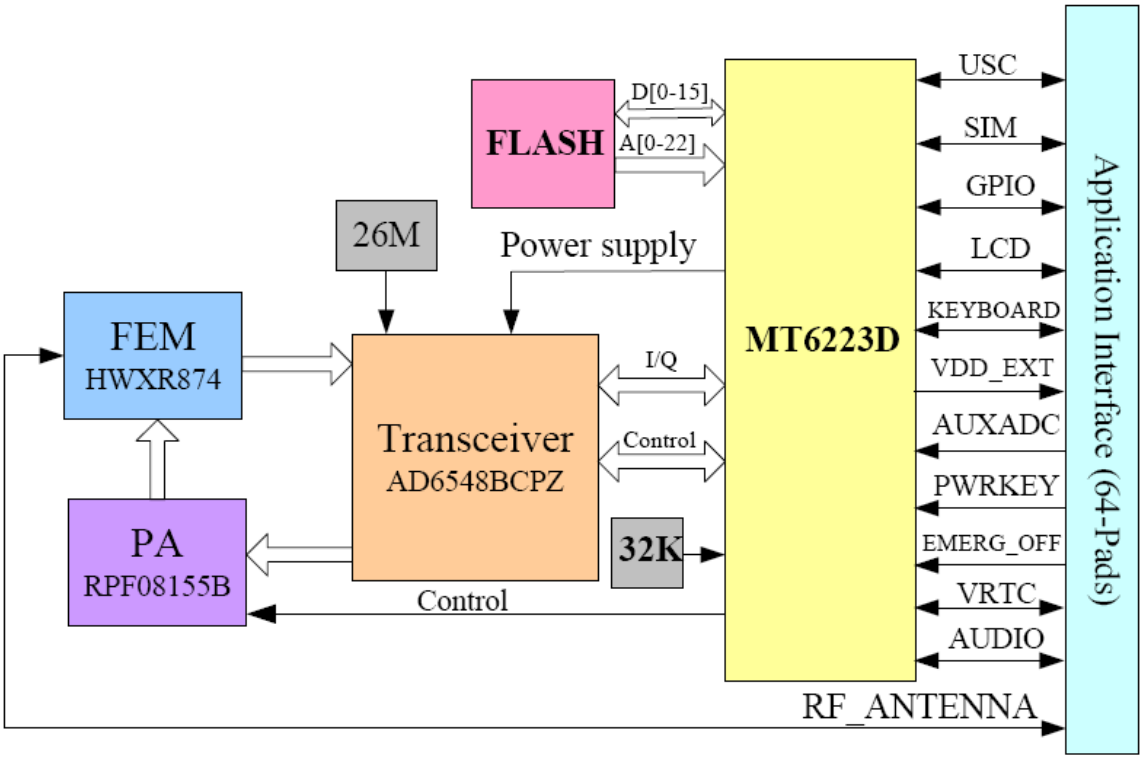
2.2.1 General specification

M10 is a Quad-band GSM/GPRS module delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. M10 can be used for WLL applications/M2M application and much more.
Quad- band GSM/GPRS module with a size of 29x29x3.6mm

- Customized MMI and keypad/LCD support
- An embedded Powerful TCP/IP protocol stack
- Supply voltage range 3.4 ... 4.5 V
- Normal Operation Temperature: -35°C ~80°C
- GPRS multi-slot Class 12
- GSM R99

2.2.2 Hardware Specification

The hardware block diagram for M10 is shown as below:



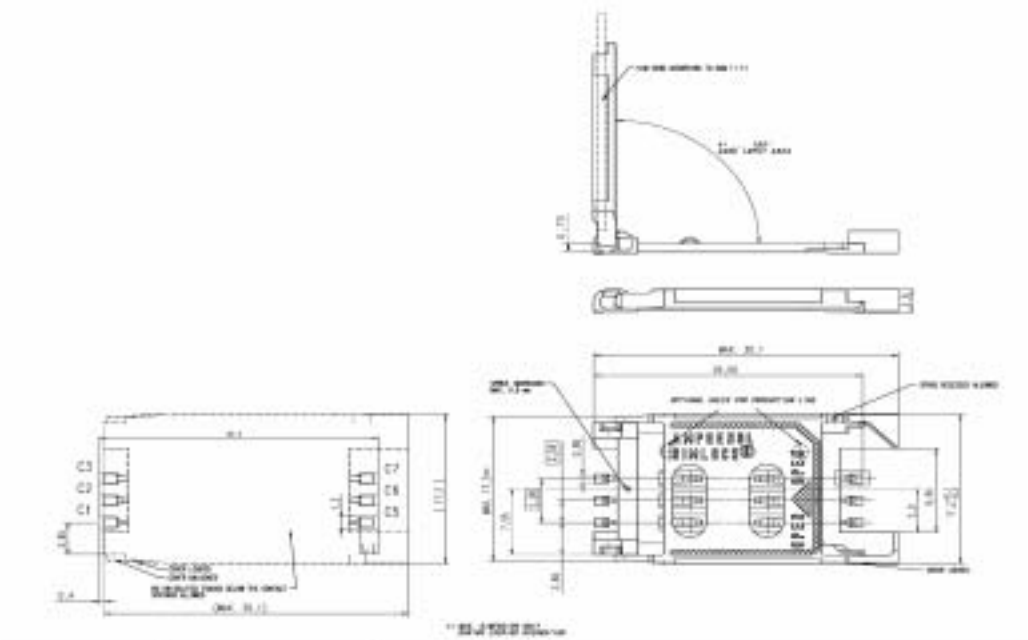
The PCB for M10 is 6 layers.

Frequency	Max	Min
GSM850	33dBm ±2dB	5dBm±5dB
EGSM900	33dBm ±2dB	5dBm±5dB
DCS1800	30dBm ±2dB	0dBm±5dB
PCS1900	30dBm ±2dB	0dBm±5dB

Frequency	Receive sensitivity
GSM850	< -107dBm
EGSM900	< -107dBm
DCS1800	< -107dBm
PCS1900	< -107dBm

Frequency	Receive	Transmitting	channel
GSM850	869 ~ 894MHz	824 ~ 849MHz	128 ~ 251
EGSM900	925 ~ 960MHz	880 ~ 915MHz	0~124, 975~1023
DCS1800	1805 ~ 1880MHz	1710 ~ 1785MHz	512 ~ 885
PCS1900	1930 ~ 1990MHz	1850 ~ 1910MHz	512 ~ 810

The mechanical architecture of SIM card holder and the definition of SIM card are shown below:



Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode, one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset.
C3	SIM_CLK	SIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	Not connect.
C7	SIM_DATA	SIM Card data I/O.

2.2.3 Software Specification

Feature	Implementation
Power supply	Single supply voltage 3.4V – 4.5V
Power saving	Typical power consumption in SLEEP mode to 1.1 mA@ DRX=5 0.7 mA@ DRX=9
Frequency bands	Quad-band: GSM850, EGSM 900, DCS1800, PCS1900. The module can search these frequency bands automatically. The frequency bands also can be set by AT command. Compliant to GSM Phase 2/2+
GSM class	Small MS
Transmitting power	Class 4 (2W) at GSM 850 and EGSM 900 Class 1 (1W) at DCS 1800 and PCS 1900
GPRS connectivity	GPRS multi-slot class 12 （default） GPRS multi-slot class 10 (option) GPRS multi-slot class 8 (option) GPRS mobile station class B

Temperature range	Normal operation: -35°C ~ +80°C Restricted operation: -45°C ~ -35°C and +80°C ~ +85°C ① Storage temperature: -45°C ~ +90°C
DATA *GPRS:* *CSD:*	GPRS data downlink transfer: max. 85.6 kbps GPRS data uplink transfer: max. 85.6 kbps Coding scheme: CS-1, CS-2, CS-3 and CS-4 Supports the protocols PAP (Password Authentication Protocol) usually used for PPP connections. Integrates the TCP/IP protocol. Support Packet Switched Broadcast Control Channel (PBCCH) CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent Unstructured Supplementary Services Data (USSD) support
SMS	MT, MO, CB, Text and PDU mode SMS storage: SIM card
FAX	Group 3 Class 1
SIM interface	Support SIM card: 1.8V, 3V
Antenna interface	Connected via 50 Ohm antenna pad
Audio features	Speech codec modes: Half Rate (ETS 06.20) Full Rate (ETS 06.10) Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) Adaptive multi rate (AMR) Echo Cancellation Echo Suppression Noise Reduction
Serial port and Debug port	Serial Port: Seven lines on Serial Port Interface Serial Port can be used for CSD FAX, GPRS service and send AT command of controlling module. Serial Port can use multiplexing function. Autobauding supports baud rate from 4800 bps to 115200bps. Debug Port: Two lines on Serial Port Interface /TXD and /RXD Debug Port only used for debugging
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM Application Toolkit	Support SAT class 3, GSM 11.14 Release 99
Real time clock	Implemented
Alarm function	Programmable via AT command
Physical characteristics	Size: 29±0.15 x 29±0.15 x 3.6±0.3mm Weight: 8g
Firmware upgrade	Firmware upgrade over serial port

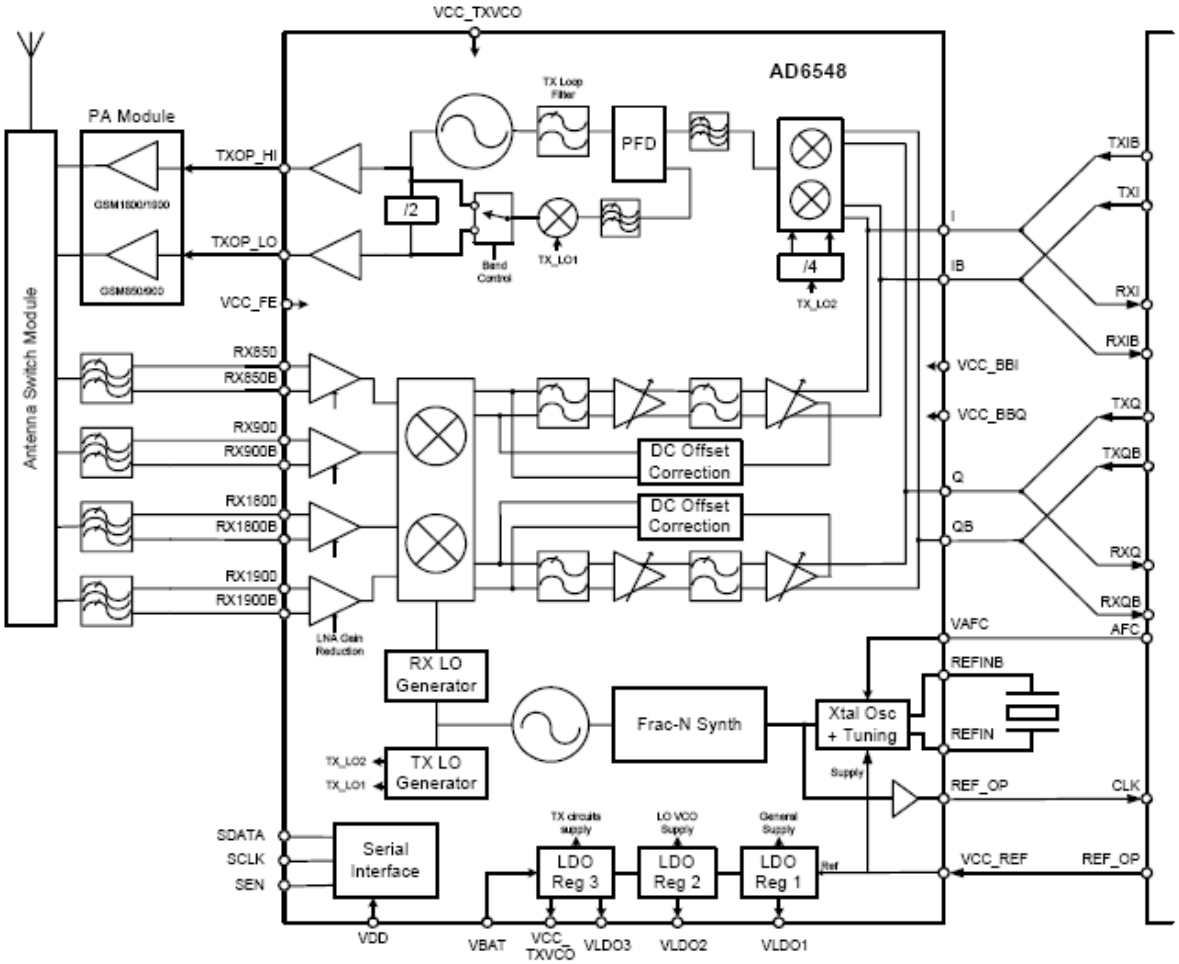
2.2.4 Solution of M10

The hardware solution is MT6223D+AD6548+PF08155B+HWR874-2+SST34HF3284; The software solution is MTK Release 0836.

2.2.5 Radio frequency units

The RF units for M10 include AD6548 (transceiver), PF08155(PA), HWX874-2(FEM).

1) AD6548



2) PF08155

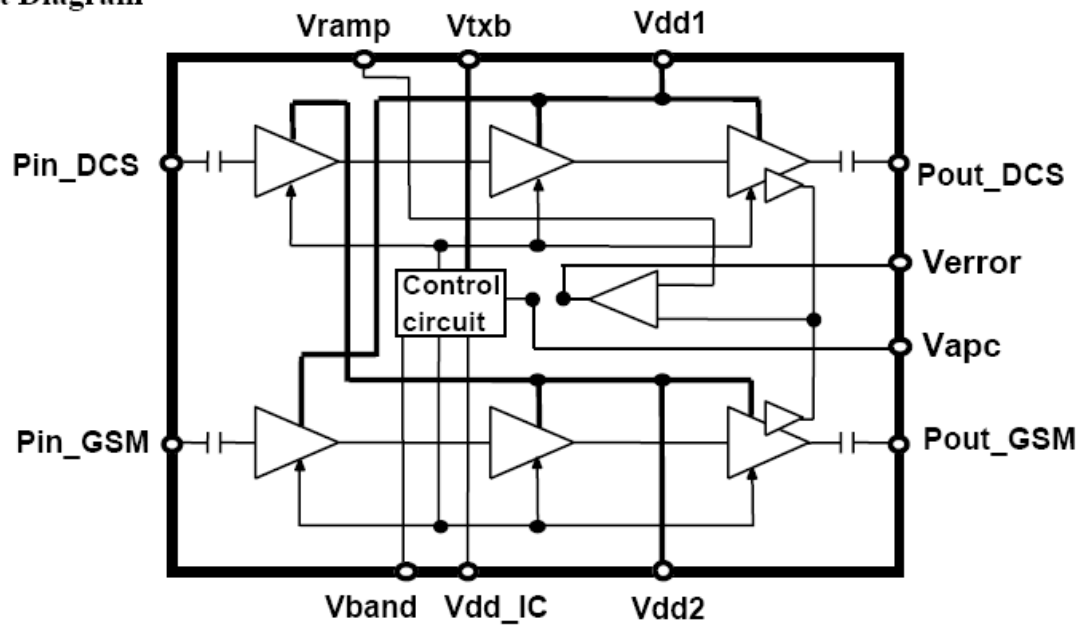
Application

- Quad band amplifier for
  US/E-GSM (824 to 849MHz, 880 to 915 MHz),
  DCS1800/1900 (1710 to 1785 MHz, 1850 to 1910 MHz).
- For 3.5 V nominal operation

Features

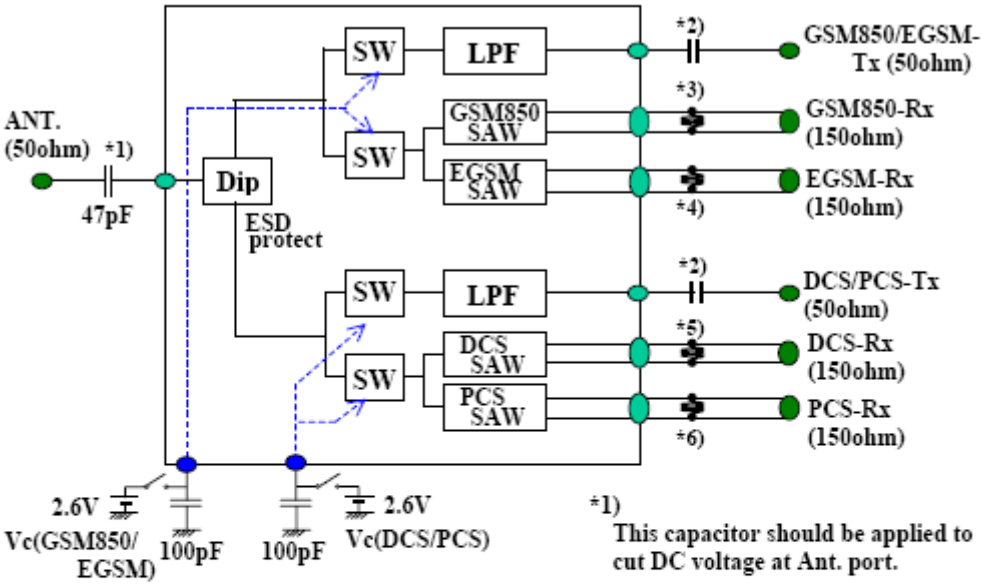
- Built-in closed loop APC circuit with power detector performs stable power control accuracy under varied supply voltage and temperature.
- Easy power control design
- The smallest size : 6.0 × 6.0 × 1.2mm typ. (1.3 mm t Max.) as APC integrated PA module.
- High Gain 3-stage amplifier: 3 dBm typical Input power.
- Superb forward isolation level: -45dBm Typical at 6dBm input power.
- Lead free soldering process available
- GPRS Class 12 compatible

Circuit Diagram



3) HWX874

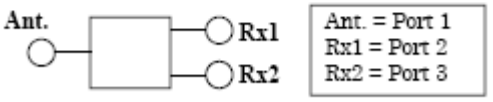
Block Diagram, Test circuits



*1)
This capacitor should be applied to cut DC voltage at Ant. port.

*2)
The Tx ports provide a DC path to ground.
If DC voltage appeared at application circuit, DC cut C will be needed.

*3),4),5),6)
Matching inductors for Rx ports are simulated on Network Analyzer.
L value : GSM850: 82nH
EGSM: 56nH
DCS: 22nH
PCS: 27nH



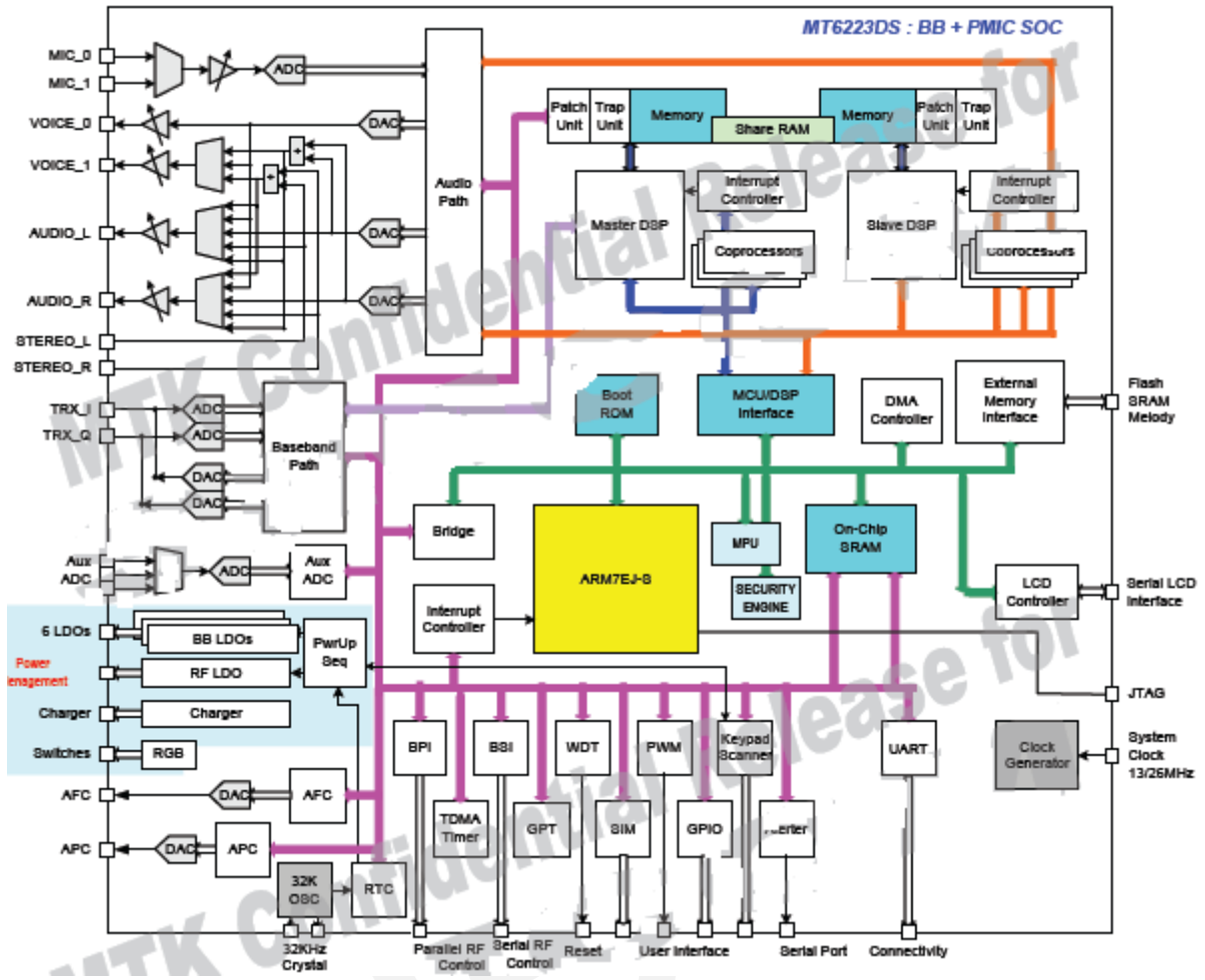
$$\text{Output Amplitude Balance} = 20\log\left|\frac{S31}{S21}\right|$$

$$\text{Output Phase Balance} = \angle\frac{S31}{S21} - 180^{\circ}$$

Fig.1 Explanation of Balance characteristics

2.2.6 Baseband units

The baseband units for M10 include MT6223D and SST34HF.
1) MT6223D (MT6223D is integrated Digital baseband and analog baseband).



2) SST34HF

Features：

32-Mbit Flash and 8-Mbit PSRAM 2.7V~3.0V Operating voltage

Flash：32-megabit（2M*16）2.7V to 3.0V Read/Write Access Time-70ns Sector Erase Architecture

-Sixty-three 32K WordSectors With Individual Write Lockout

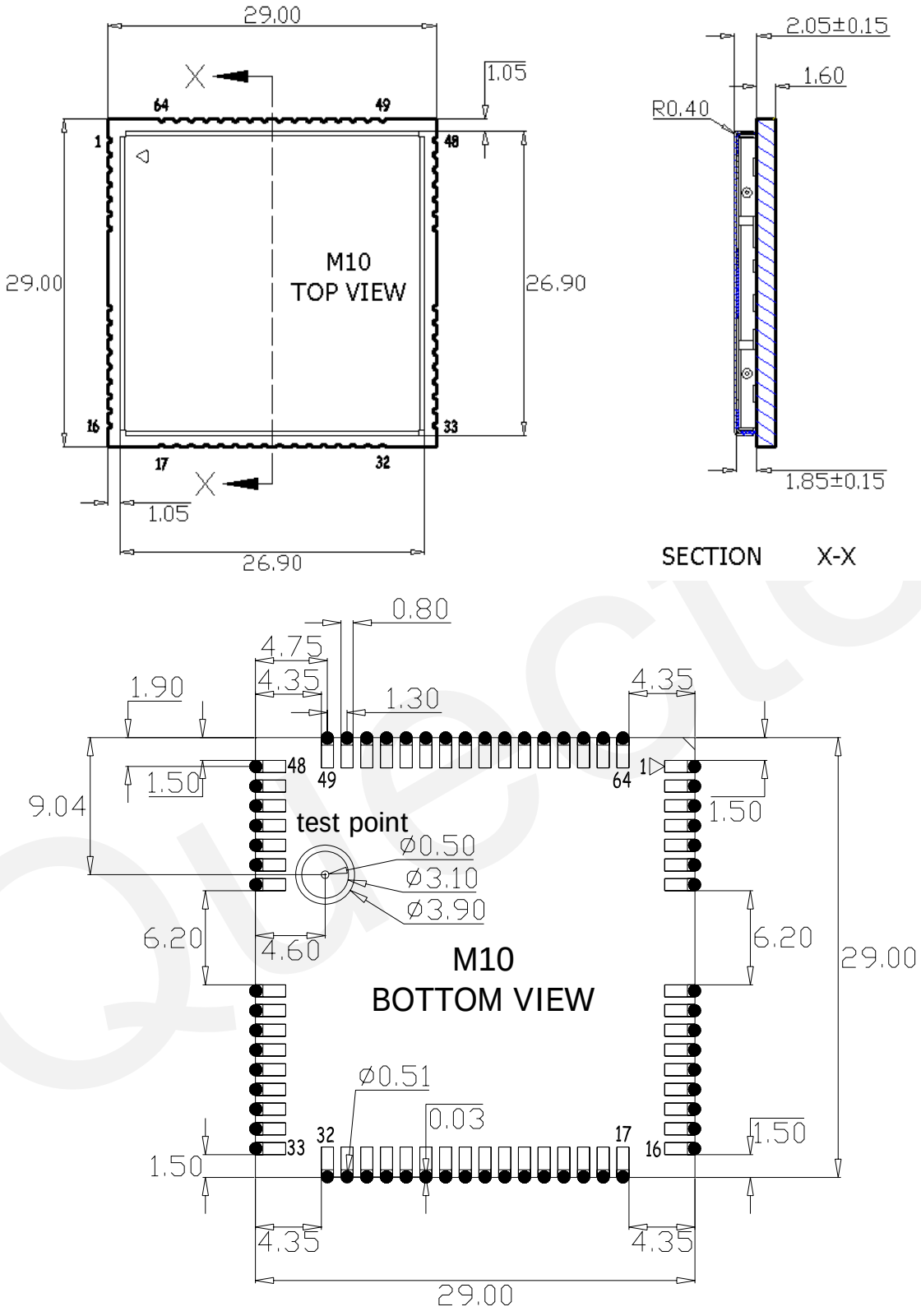
-Eight 4K Word Sectors with Individual Write Lockout Fast Word Program Time-15us Suspend/Resume Feature for Erase and Program

-Supports Reading and Programming from Any Sectors by Suspending Erase of a Different Sector -Supports Reading Any Word by Suspending Programming of Any Other Word

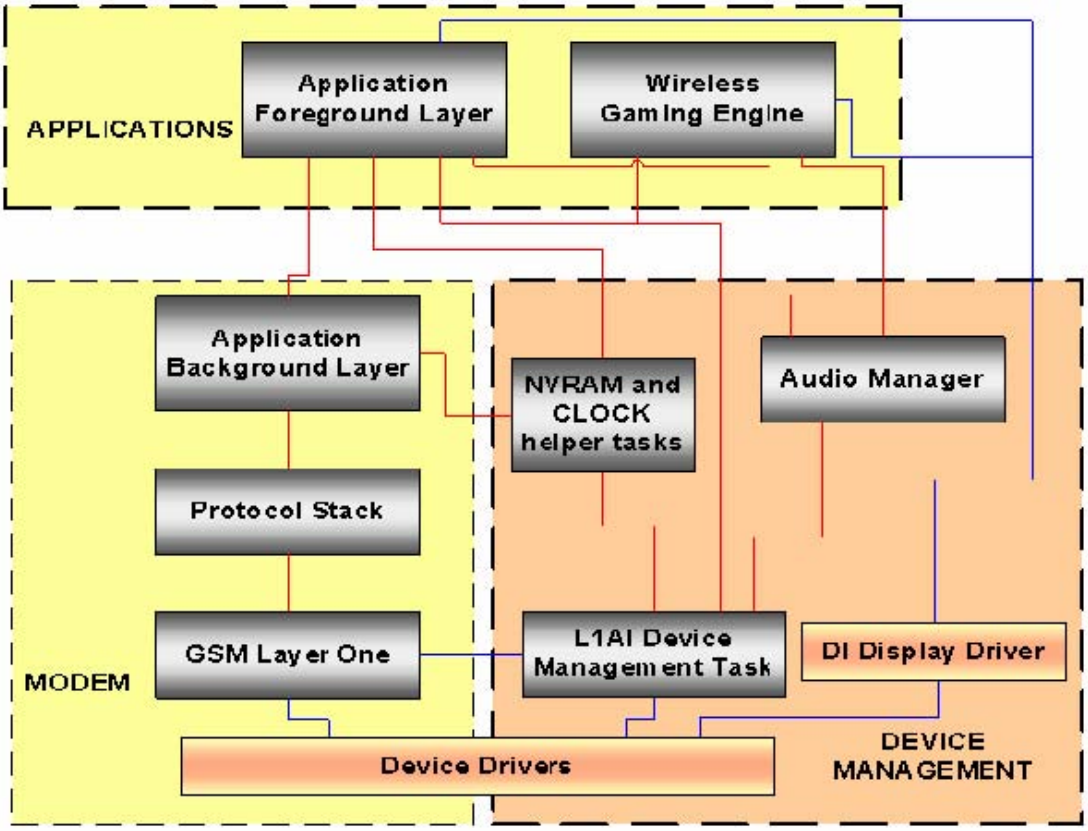
Low-power Operation -12mAActive -13uA Standby

PSRAM：4-megabit（256K*16）/8-megabit(512K*16) 2.7V to 3.3V Vcc 70ns Access Time

2.2.7 Mechanical architecture



2.2.8 Software Architecture


APPLICATIONS
Application Foreground Layer
Wireless Gaming Engine
Application Background Layer
NVRAM and CLOCK helper tasks
Audio Manager
Protocol Stack
GSM Layer One
L1AI Device Management Task
DI Display Driver
MODEM
Device Drivers
DEVICE MANAGEMENT

3 AT command

（please see the AT command document）

4 FCC Labeling Requirement

Please note：When the M10 is integrated into a final product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel，door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text：“Contains FCC ID：**XMR-16182009002** ”M10 FCC label is shown as：

5 FCC RF exposure requirements

The maximum measured power output is
30dBm(1900MHz)
33dBm(850MHz),
the maximum antenna gain is
3.0dBi(1900MHz)
0.8dBi(850MHz),

The maximum permissible exposure is defined in 47 CFR 1.1310 with 1 mW/cm^2.
The transmitter is using indoor antennas that operate at 20 cm or more from nearby persons.

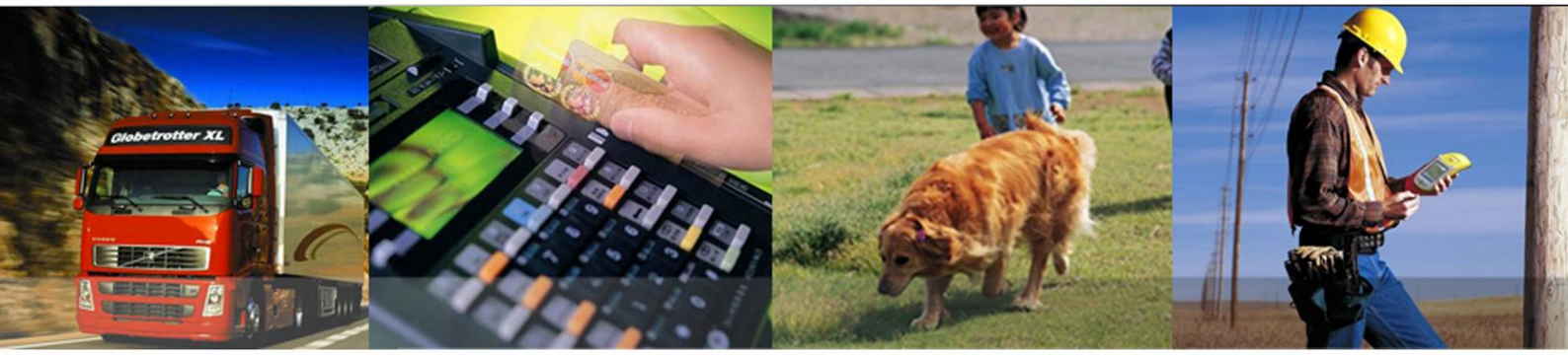
The maximum permitted level is calculated using the general equation:
$S = P'/ 4\pi R^2$

GSM850MHz: G=0.8dBi P′= 33dBm+0.8dBi=33.8dBm=2399mW
GSM1900MHz: G=3.0dBi P′= 30dBm+3.0dBi=33.0dBm=1995mw
R = 20 cm
π = 3.1416

Solving for S, the power density at 20 cm is

GSM850: **0.4773** mW/cm^2.
GSM1900: **0.3969** mW/cm^2.

So The power density limit is 1 mW/cm^2 is kept.



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