SIM800 User Manual

1. SIM800 Description

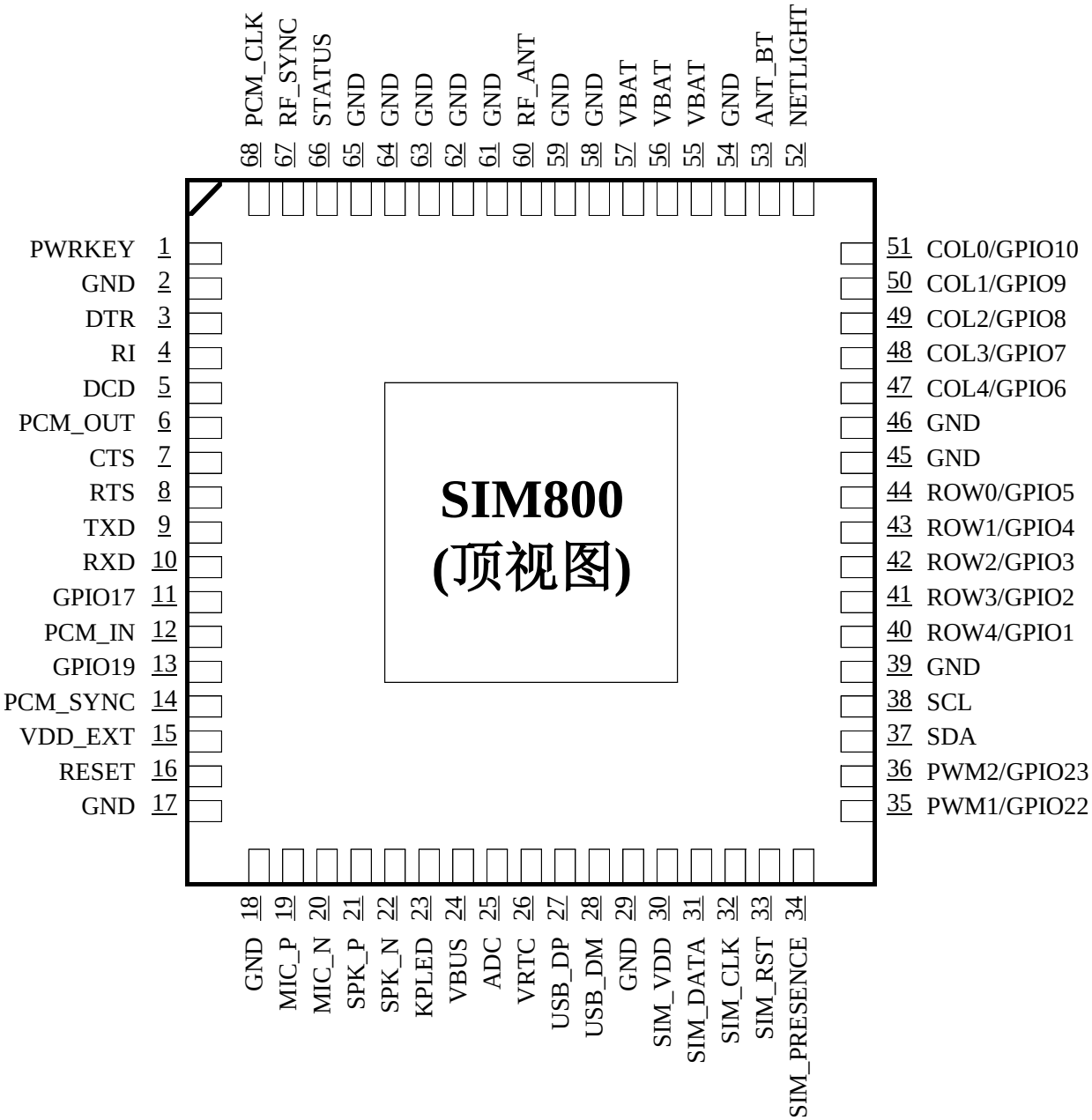
1.1. Summarize

SIM800 designed by SIMCom is a quad band module which supports GSM/GPRS. The baseband circuit is based on MTK and RF circuit is based on RFMD. It works at quad bands------GSM850, EGSM900, DCS1800, and PCS1900. CPU clock is based on 26MHz crystal. The main IC includes MT6260D and RF7196.

1.2. Feature

- Quad-Band 850/900/1800/1900MHz
- GPRS multi-slot class 12
- GPRS mobile station class B
- Bluetooth output power class 1
- Bluetooth v3.0 with data rates 3.0Mbps
- Compliant to GSM phase 2/2+
  - Class 4 (2 W @ 850/900 MHz)
  - Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24*24*3 mm
- Weight: 3.14 g
- Control via AT commands (3GPP TS 27.007, 27.005 and SIMCom enhanced AT Commands)
- Supply voltage range 3.6~4.2 V
- Low power consumption
- Operation temperature:-30~80℃
- 68 SMT pads include
  - Interface to external SIM 3V/1.8V
  - Analog audio interface
  - RTC backup
  - Serial interface
  - USB interface
  - Keypad interface
  - LCD interface
  - Antenna pad
  - PCM
  - GPIO
  - ADC

1.3. Pin


SIM800
(顶视图)
1 PWRKEY
2 GND
3 DTR
4 RI
5 DCD
6 PCM_OUT
7 CTS
8 RTS
9 TXD
10 RXD
11 GPIO17
12 PCM_IN
13 GPIO19
14 PCM_SYNC
15 VDD_EXT
16 RESET
17 GND
18 GND
19 MIC_P
20 MIC_N
21 SPK_P
22 SPK_N
23 KPLED
24 VBUS
25 ADC
26 VRTC
27 USB_DP
28 USB_DM
29 GND
30 SIM_VDD
31 SIM_DATA
32 SIM_CLK
33 SIM_RST
34 SIM_PRESENCE
35 PWM1/GPIO22
36 PWM2/GPIO23
37 SDA
38 SCL
39 GND
40 ROW4/GPIO1
41 ROW3/GPIO2
42 ROW2/GPIO3
43 ROW1/GPIO4
44 ROW0/GPIO5
45 GND
46 GND
47 COL4/GPIO6
48 COL3/GPIO7
49 COL2/GPIO8
50 COL1/GPIO9
51 COL0/GPIO10
52 NETLIGHT
53 ANT_BT
54 GND
55 VBAT
56 VBAT
57 VBAT
58 GND
59 GND
60 RF_ANT
61 GND
62 GND
63 GND
64 GND
65 GND
66 STATUS
67 RF_SYNC
68 PCM_CLK

1.4. Picture

Figure 1: Top and Bottom view of SIM800

1.5. Dimension

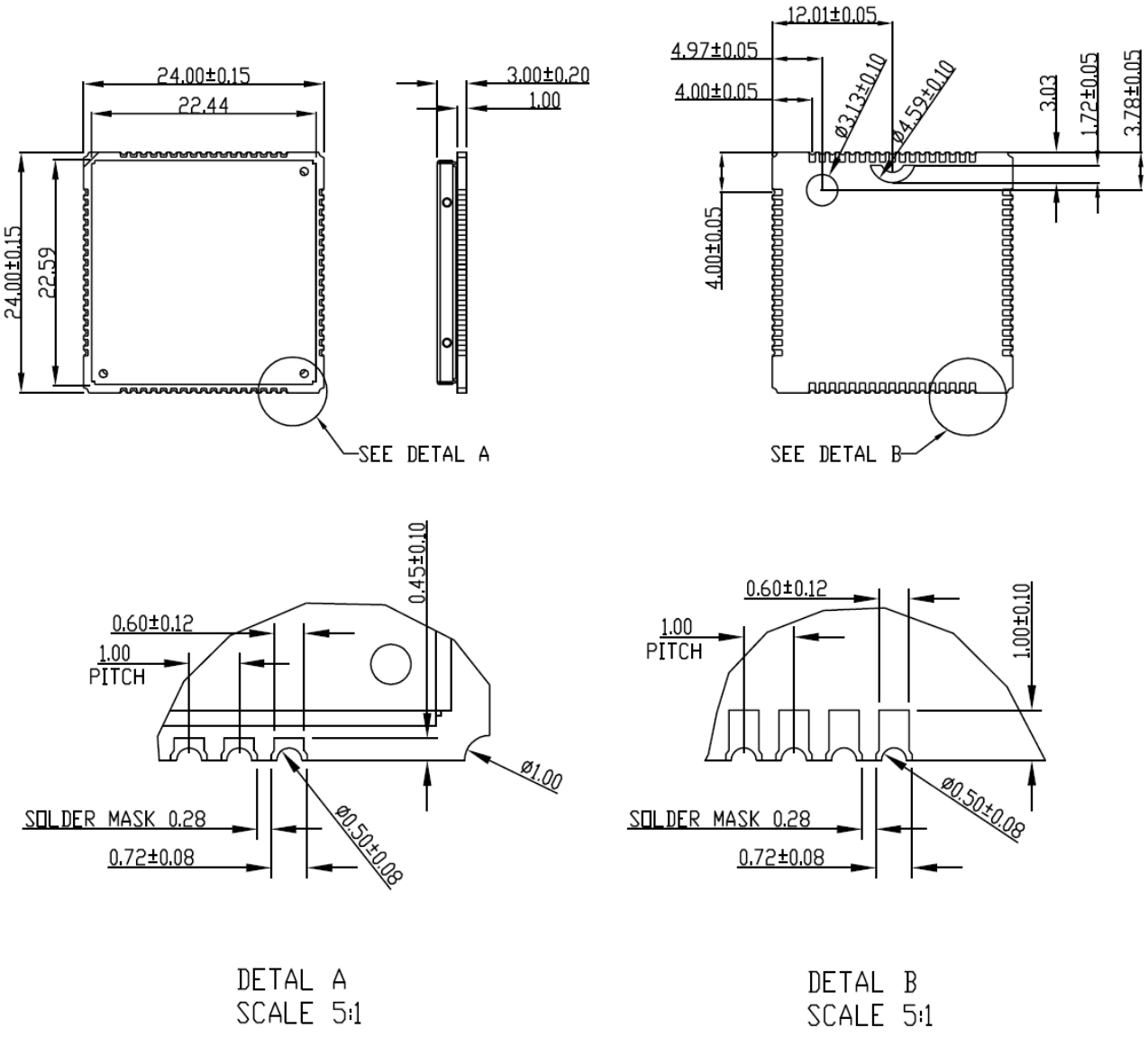


Figure 2: Dimention

2. Detail Block Diagram

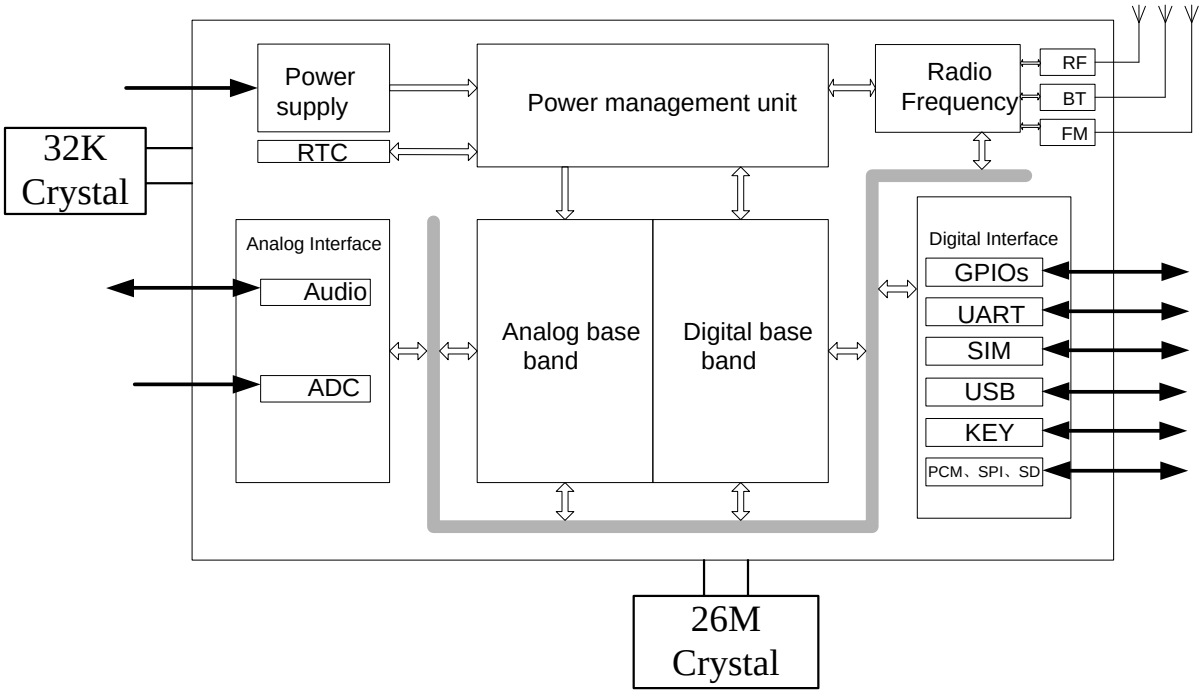


Figure 3: Block diagram of SIM800

3. Electrical and Reliability Characteristics

3.1. Absolute Maximum Ratings

The absolute maximum ratings stated in following table are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to SIM800.

Table 1: Absolute maximum ratings

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	-	-	4.5	V
VBUS	-	-	30	V	VBUS
I_I*	Input current	-	-	8	mA
I_O*	Output current	-	-	8	mA

*These parameters are for digital interface pins, such as keypad, GPIO, I^2C, UART, LCD and DEBUG.

3.2. Digital Interface Characteristics

Table 2: Digital interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit

I_{IH}	High-level input current	2.1	-	3.1	V
I_{IL}	Low-level input current	-0.3	-	0.7	V
V_{OH}	High-level input voltage	2.4	-	-	V
V_{OL}	Low-level input voltage	-	-	0.4	V

* These parameters are for digital interface pins, such as keypad, GPIO, I^2C, UART, LCD, PWMs and DEBUG.

3.3. SIM Card Interface Characteristics

Table 3: SIM card interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-1	-	1	uA
I_{IL}	Low-level input current	-1	-	1	uA
V_{IH}	High-level input voltage	1.4	-	-	V
		2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.27	V
				0.4	V
V_{OH}	High-level output voltage	1.62	-	-	V
		2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.36	V
		-	-	0.4	V

3.4. SIM_VDD Characteristics

Table 4: SIM_VDD characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	2.70	2.80	2.90	V
I_O	Output current	-	-	50	mA

3.5. VRTC Characteristics

Table 5: VRTC characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{RTC-IN}	VRTC input voltage		2.8		V
I_{RTC-IN}	VRTC input current	-	3	-	uA
$V_{RTC-OUT}$	VRTC output voltage	-	2.8	-	V
$I_{RTC-OUT}$	VRTC output current	-		2	mA

3.6. Current Consumption (VBAT = 3.8V)

Table 6: Current consumption

Symbol	Parameter	Conditions			Value	Unit
I_{VRTC}	VRTC current	VBAT disconnects. Backup battery is 3 V			2	uA
I_{VBAT}	VBAT current	Power down mode			50	uA
		Sleep mode	BS-PA-MFRMS=9		1.0	mA
			BS-PA-MFRMS=5		1.2	
			BS-PA-MFRMS=2		1.8	
		Idle mode	GSM 850		19	mA
			EGSM 900			
			DCS 1800			
			PCS 1900			
		Voice call	GSM 850 EGSM 900	PCL=5	250	mA
				PCL=12	110	
				PCL=19	76	
			DCS 1800 PCS 1900	PCL=0	168	
				PCL=7	89	
				PCL=15	76	
		Data mode GPRS(1Rx,1Tx)	GSM 850 EGSM 900	PCL=5	240	mA
				PCL=12	110	
				PCL=19	83	
			DCS 1800 PCS 1900	PCL=0	170	mA
				PCL=7	95	
				PCL=15	80	
		Data mode GPRS(4Rx,1Tx)	GSM 850 EGSM 900	PCL=5	270	mA
				PCL=12	150	
				PCL=19	120	
			DCS 1800 PCS 1900	PCL=0	205	mA
				PCL=7	130	
				PCL=15	115	
		Data mode GPRS(3Rx,2Tx)	GSM 850 EGSM 900	PCL=5	440	mA
				PCL=12	185	
				PCL=19	130	
			DCS 1800 PCS 1900	PCL=0	300	mA
				PCL=7	155	
				PCL=15	122	

$I_{VBAT-peak}$	Peak current	During Tx burst	2	A

3.7. Electro-Static Discharge

SIM800 is an ESD sensitive component, so more attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

Table 7: The ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Pin	Contact discharge	Air discharge
VBAT	±6KV	±12KV
GND	±6KV	±12KV
RXD, TXD	±2KV	±8KV
Antenna port	±5KV	±10KV
SPK_P/SPK_N/MIC_P/MIC_N	±2KV	±5KV
PWRKEY	±2KV	±8KV

4. Radio Characteristics

4.1. Module RF Output Power

The following table shows the module conducted output power, it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 8: SIM800 GSM 900 and GSM 850 conducted RF output power

GSM850、EGSM900			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
5	33	±2	±2.5
6	31	±3	±4
7	29	±3	±4
8	27	±3	±4
9	25	±3	±4
10	23	±3	±4
11	21	±3	±4
12	19	±3	±4
13	17	±3	±4

14	15	±3	±4
15	13	±3	±4
16	11	±5	±6
17	9	±5	±6
18	7	±5	±6
19-31	5	±5	±6

Table 9: SIM800 DCS 1800 and PCS 1900 conducted RF output power

DCS1800、PCS1900			
PCL	**Nominal output power (dBm)**	**Tolerance (dB) for conditions**	
		Normal	**Extreme**
0	30	±1	±1.5
1	28	±2	±3
2	26	±3	±4
3	24	±3	±4
4	22	±3	±4
5	20	±3	±4
6	18	±3	±4
7	16	±3	±4
8	14	±3	±4
9	12	±4	±5
10	10	±4	±5
11	8	±4	±5
12	6	±4	±5
13	4	±4	±5
14	2	±5	±6
15	0	±5	±6

For the module's output power, the following is should be noted:

At GSM900 and GSM850 band, the module is a class 4 device, so the module's output power should not exceed 33dBm, and at the maximum power level, the output power tolerance should not exceed +/-2dB under normal condition and +/-2.5dB under extreme condition.

At DCS1800 and PCS1900 band, the module is a class 1 device, so the module's output power should not exceed 30dBm, and at the maximum power level, the output power tolerance should not exceed +/-1dB under normal condition and +/-1.5dB under extreme condition.

4.2. Module RF Receive Sensitivity

The following table shows the module's conducted receive sensitivity, it is tested under static condition.

Table 10: SIM800 conducted RF receive sensitivity

Frequency	Receive sensitivity（Typical）	Receive sensitivity(Max)
GSM850	-108dBm	-106dBm
EGSM900	-108dBm	-106dBm
DCS1800	-108dBm	-106dBm
PCS1900	-108dBm	-106dBm

4.3. Module Operating Frequencies

The following table shows the module's operating frequency range; it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 11: SIM800 operating frequencies

Frequency	Receive	Transmit
GSM850	869 ~ 894MHz	824 ~ 849 MHz
EGSM900	925 ~ 960MHz	880 ~ 915MHz
DCS1800	1805 ~ 1880MHz	1710 ~ 1785MHz
PCS1900	1930 ~ 1990MHz	1850 ~ 1910MHz

5. Antenna interface

There are three antenna ports for SIM800, GSM antenna port named RF_ANT, Bluetooth antenna port named BT_ANT, The RF interface of the three antenna ports has an impedance of 50Ω.The maximum gain of the antenna gain should not exceed 3dbi considering the SAR radio.

- The input impendence of the antenna should be 50Ω, and the VSWR should be less than 2.
- It is recommended that the GSM antenna and the BT antenna be placed as far as better.
- The isolations of the three antenna should be bigger than 30db

5.1 GSM Antenna Interface

There is a GSM antenna pad named RF_ANT for SIM800 the connection of the antenna must be decoupled from DC voltage. This is necessary because the antenna connector is DC coupled to ground via an inductor for ESD protection.

The external antenna must be matched properly to achieve best performance, so the matching circuit is necessary, the connection is recommended as following:

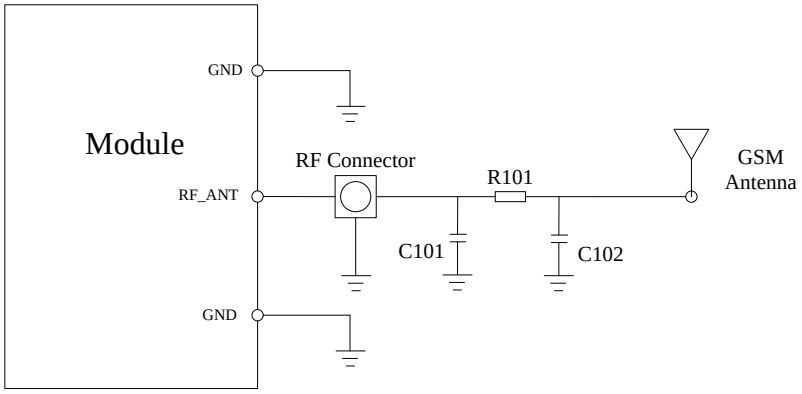


Figure1: GSM antenna matching circuit

R101，C101，C102 are the matching circuit, the value should be defined by the antenna design. normally R101 is 0Ω, C101 和 C102 are not SMD. The RF connector is used for conducted

5.2 Bluetooth antenna interface

The module provides a Bluetooth antenna interface named BT_ANT.

The external antenna must be matched properly to achieve best performance, so the matching circuit is necessary, the connection is recommended as following figure:

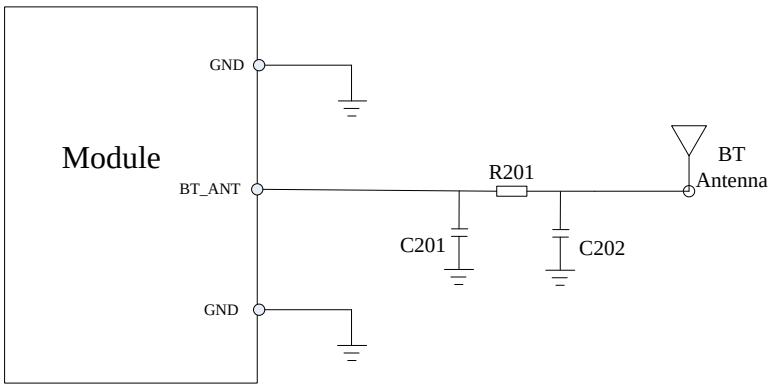


Figure 5: BT antenna matching circuit

R201，C201，C202 are the matching circuit, the value should be defined by the antenna design. R201 is recommended as 1.2NH and C202 is 1.5pF, C201 are not SMD.

There are some suggestions to components placing and lying for GSM and Bluetooth RF traces:

- The RF connector is used for conducted test, so keep it as close as pin RF_ANT;
- Antenna matching circuit should be closed to the antenna;
- Keep the RF traces as 50Ω;
- The RF traces should be kept far away from the high frequency signals and strong disturbing source.

5.3.1 GSM antenna

Model GSM antenna: WT-C&G-28-90
Frequency Range (MHz) 824 ~ 960 1710 ~ 1990
VSWR ≤1.5 (900MHz) ≤2 (1800MHz)
Gain (dBi): 3dBi (850MHz); 2dBi(1900MHz)
Input Impedance (Ω): 50
Polarization Type: Vertical
Connector Type: SMA

Figure 6 GSM antenna

5.3.2 Bluetooth antenna

1. Frequency Range: 2.4 GHz ~2.5GHz &5.15 GHz ~5.825 GHz
2. Impedance: 50 Ohms nominal
3. VSWR: ≦1.92
4. Gain: 2.0dBi
5. Admitted power radiation: 1W
6. Radiation: Omni
7. Polarization: Vertical
8. Connector Type: SMA P/S

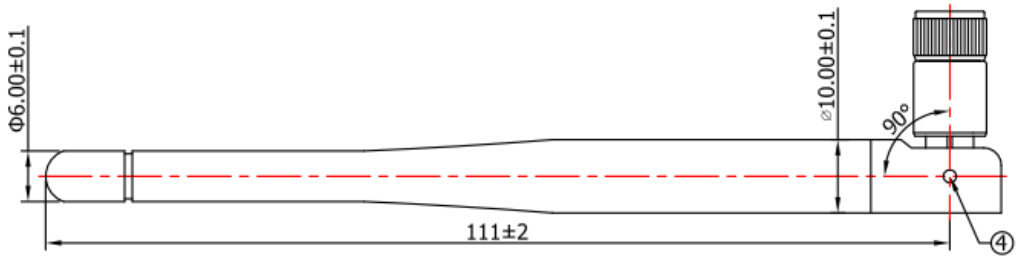


Figure 7 Bluetooth antenna

For mobile and fixed operating configurations the antenna gain, including cable loss, must not exceed 2 dBi at 1900 MHz and 3 dBi at 850 MHz as defined in 2.1091 for satisfying RF exposure compliance. Under no condition may an antenna gain be used that would exceed the 7W erp Part 22 and the 2W eirp Part 24 power limits.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1)This device may not cause harmful interference, and (2) this device must accept any interference received,including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant toPart 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for Compliancecould void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

RF Exposure Compliance

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.The antenna(s) used for this transmitter must be installed to provide a separation distance of at least20 cm from all persons and must not be co-located or operating in conjunction with any other antenna orTransmitter.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is stillresponsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be usedon the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product(including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may bemaintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains

FCC ID:**UDV-201314**. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.