SIM900L User Manual

Note: This device complies with part 15 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.

If this equipment is installed in a host, We can find the ID label when opening the host. For label requirement when transmitter module is installed in a host, the host shall have an additional permanent label referring to the enclosed module:"Contains Transmitter Module FCC ID: UDV-2011091410099" or "Contains FCC ID: UDV-2011091410099".

This equipment has a GSM antenna, and the GSM antenna peak gain is 3 dBi and modulation type is GMSK.

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The antenna of the product, under normal use condition is at least 23.21 cm away from the body of the user,the user must keeping at least 23.21cm distance to the antenna.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

1. SIM900L Description

1.1 Summarize

Designed for global market, SIM900L is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900L features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 24*24*3mm, SIM900L can meet almost all the space requirements in user applications, such as M2M, smart phone, PDA and other mobile devices.

SIM900L has 68 SMT pads, and provides all hardware interfaces between the module and customers' boards.

- Serial port and debug port can help user easily develop user's applications.
- Audio channel which includes a microphone input and a receiver output.
- Programmable general purpose input and output.
- The keypad and SPI display interfaces will give users the flexibility to develop customized applications.

SIM900L is designed with power saving technique so that the current consumption is as low as 1.0mA in sleep mode.

SIM900L integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

1.2 SIM900L Key Features

Table 1: SIM900L key features

Feature	Implementation
Power supply	3.4V ~ 4.5V
Power saving	Typical power consumption in sleep mode is 1.0mA (BS-PA-MFRMS=9)
Frequency bands	- SIM900L Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900. SIM900L can search the 4 frequency bands automatically. The frequency bands also can be set by AT command "AT+CBAND". For details, please refer to *document [1]*. - Compliant to GSM Phase 2/2+
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 10（default） - GPRS multi-slot class 8 (option)
Temperature range	- Normal operation: -20°C ~ +60°C - Restricted operation: -40°C ~ -20°C and +60 °C ~ +85°C[*] - Storage temperature -45°C ~ +90°C
Data GPRS	- GPRS data downlink transfer: max. 85.6 kbps - GPRS data uplink transfer: max. 42.8 kbps - Coding scheme: CS-1, CS-2, CS-3 and CS-4 - Integrate the TCP/IP protocol. - Support Packet Broadcast Control Channel (PBCCH)
CSD	Support CSD transmission
USSD	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
External antenna	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 - Noise Suppression
Serial port and debug port	**Serial port:** - Full modem interface with status and control lines, unbalanced, asynchronous. 1200bps to 115200bps.

	● Can be used for AT commands or data stream. ● Support RTS/CTS hardware handshake and software ON/OFF flow control. ● Multiplex ability according to GSM 07.10 Multiplexer Protocol. ● Autobauding supports baud rate from 1200 bps to 57600bps. **Debug port:** ● Null modem interface GPS/DBG_TXD and GPS/DBG_RXD. ● Can be used for debugging and upgrading firmware.
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM application toolkit	GSM 11.14 Release 99
Real time clock	Support RTC
Physical characteristics	Size: 24*24*3mm Weight: 3.4g
Firmware upgrade	Firmware upgradeable by debug port.

[*]SIM900L does work at this temperature, but some radio frequency characteristics may deviate from the GSM specification.

Table 2: Coding schemes and maximum net data rates over air interface

Coding scheme	1 timeslot	2 timeslot	4 timeslot
CS-1	9.05kbps	18.1kbps	36.2kbps
CS-2	13.4kbps	26.8kbps	53.6kbps
CS-3	15.6kbps	31.2kbps	62.4kbps
CS-4	21.4kbps	42.8kbps	85.6kbps

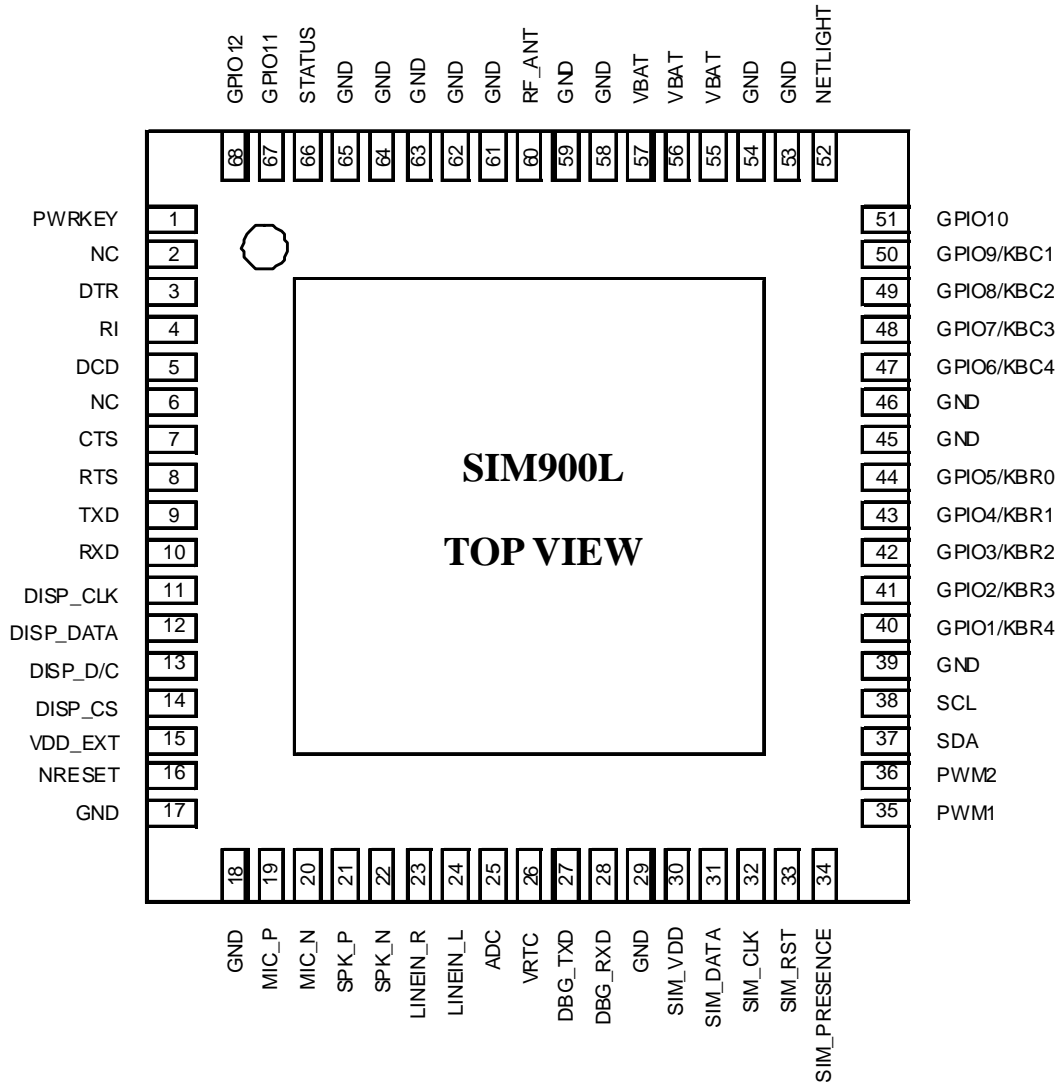# 2. Package Information

2.1 Pin out Diagram

Figure 1: SIM900L pin out diagram (Top view)

2.2 Pin Description

Table 3: Pin description

Pin name	Pin number	I/O	Description	Comment
Power supply				
VBAT	55,56,57	I	Power supply	
VRTC	26	I/O	Power supply for RTC	It is recommended to

				connect with a battery or a capacitor (e.g. 4.7uF).
VDD_EXT	15	O	2.8V output power supply	If it is unused, keep open.
GND	17,18,29,39, 45,46,53,54, 58,59,61,62, 63,64,65		Ground	
Power on/down				
PWRKEY	1	I	PWRKEY should be pulled low at least 1 second and then released to power on/down the module.	Pulled up internally.
Audio interfaces				
MIC_P	19	I	Differential audio input	If these pins are unused, keep open.
MIC_N	20			
SPK_P	21	O	Differential audio output	
SPK_N	22			
LINEIN_R	23	I	Line-in input	
LINEIN_L	24			
Status				
STATUS	66	O	Power on status	If these pins are unused, keep open.
NETLIGHT	52	O	Network status	
LCD interface				
DISP _CLK	11	O	Display interface	If these pins are unused, keep open.
DISP_DATA	12	I/O		
DISP _D/C	13	O		
DISP _CS	14	O		
I^{2}C interface				
SDA	37	O	I^{2}C serial bus data	If these pins are unused, keep open.
SCL	38	I/O	I^{2}C serial bus clock	
Keypad interface / GPIOs				
GPIO5/KBR0	44	I/O	GPIO5/keypad row 0	If these pins are unused, keep open.
GPIO4/KBR1	43		GPIO4/keypad row 1	
GPIO3/KBR2	42		GPIO3/keypad row 2	
GPIO2/KBR3	41		GPIO2/keypad row 3	
GPIO1/KBR4	40		GPIO1/keypad row 4	
GPIO9/KBC1	50		GPIO9/keypad column 1	
GPIO8/KBC2	49		GPIO8/keypad column 2	
GPIO7/KBC3	48		GPIO7/keypad column 3	
GPIO6/KBC4	47		GPIO6/keypad column 4	
GPIO10	51		GPIO10	

GPIO11	67		GPIO11	
GPIO12	68		GPIO12	
Serial port				
RXD	10	I	Receive data	This pin should be pulled up to VDD_EXT externally.
TXD	9	O	Transmit data	If these pins are unused, keep open.
RTS	8	I	Request to send	
CTS	7	O	Clear to send	
DCD	5	O	Data carrier detect	
RI	4	O	Ring indicator	
DTR	3	I	Data terminal ready	
Debug interface				
DBG_TXD	27	O	For debugging and upgrading firmware	If these pins are unused, keep open.
DBG_RXD	28	I		
SIM interface				
SIM_VDD	30	O	Voltage supply for SIM card. Support 1.8V or 3V SIM card	All signals of SIM interface should be protected against ESD with a TVS diode array.
SIM_DATA	31	I/O	SIM data input/output	
SIM_CLK	32	O	SIM clock	
SIM_RST	33	O	SIM reset	
SIM_PRESENCE	34	I	SIM card detection	If it is unused, keep open.
ADC				
ADC	25	I	Input voltage range: 0V ~ 2.8V	If it is unused, keep open.
External reset				
NRESET	16	I	Reset input(Active low)	Recommend connecting a 100nF capacitor.
Pulse width modulation(PWM)				
PWM1	35	O	PWM	If these pins are unused, keep open.
PWM2	36	O	PWM	
RF interface				
RF_ANT	60	I/O	Radio antenna connection	Impendence must be controlled to 50Ω.
Not connect				
NC	2,6	-		These pins should be kept open.

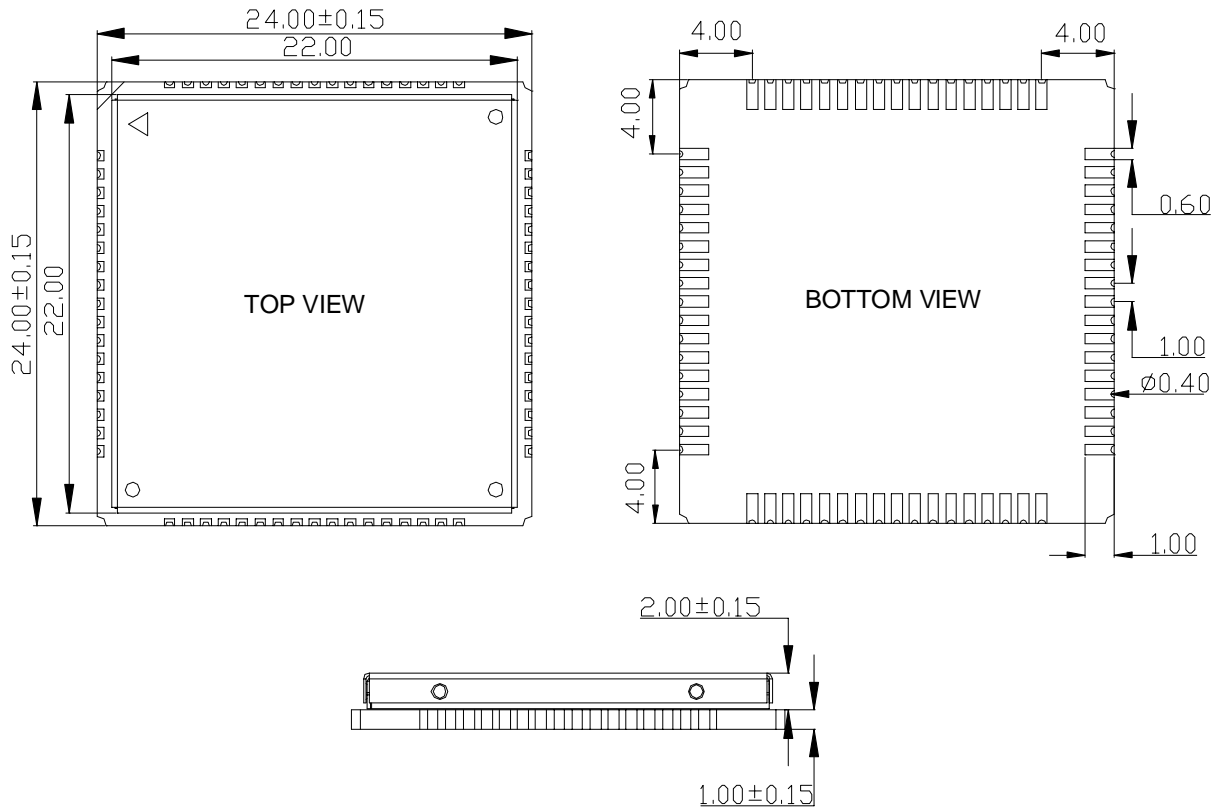## .3 Package Dimensions

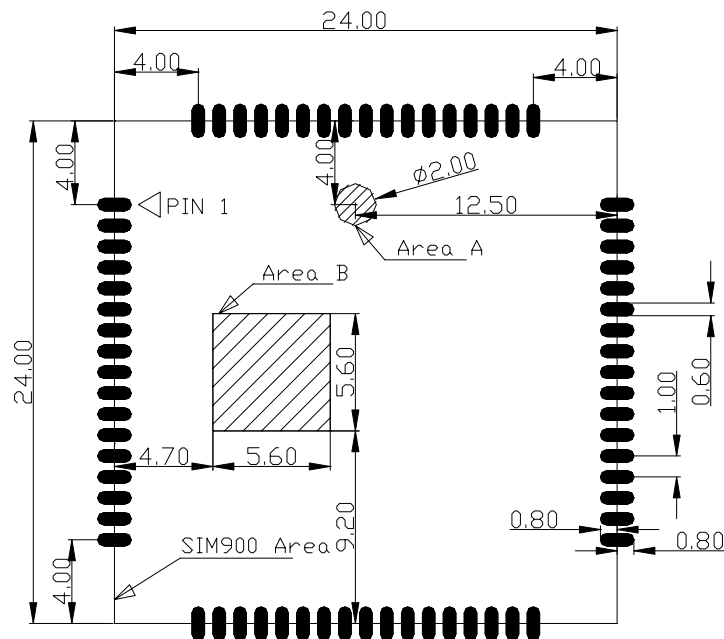**Figure 2: Dimensions of SIM900L（Unit: mm）**

Figure 3: Recommended PCB footprint outline（Unit: mm）

2.4 Pictures

Figure 4: the top view of SIM900L

3. Detail Block Diagram
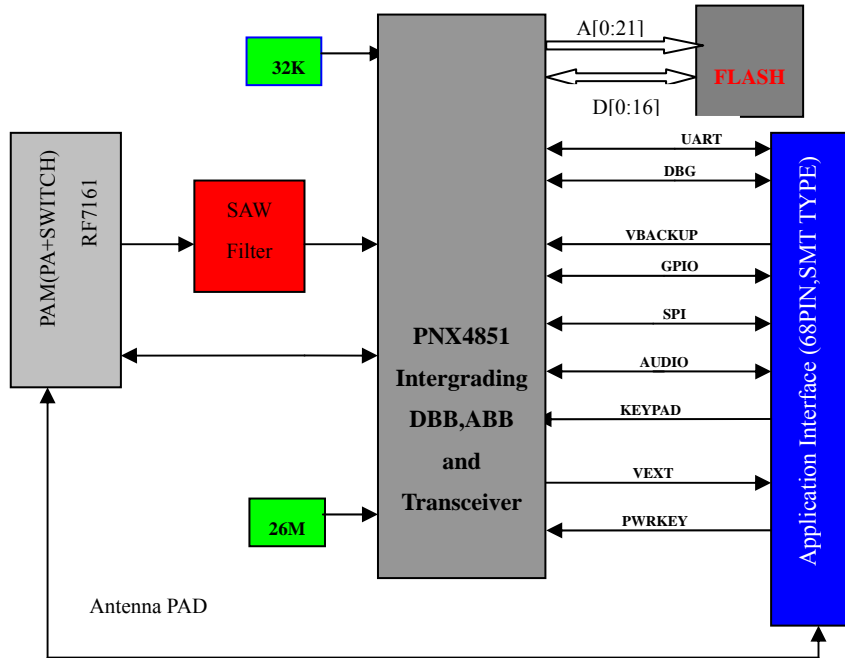
Figure 5: Block diagram of SIM900L

4. Electrical and Reliability Characteristics

4.1 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 SIM900L.

Table 4: Absolute maximum ratings

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	-	-	5.5	V
V_I^*	Input voltage	-0.3	-	3.1	V
I_I^*	Input current	-	-	10	mA
I_O^*	Output current	-	-	10	mA

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

4.2 Recommended Operating Conditions

Table 5: Recommended operating conditions

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	3.2	4.0	4.8	V
T_{OPER}	Operating temperature	-40	+25	+85	℃
T_{STG}	Storage temperature	-45		+90	℃

4.3 Digital Interface Characteristics

Table 6: Digital interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-10	-	10	uA
I_{IL}	Low-level input current	-10	-	10	uA
V_{IH}	High-level input voltage	2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.4	V
V_{OH}	High-level output voltage	2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.1	V

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

4.4 SIM Card Interface Characteristics

Table 7: SIM card interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-10	-	10	uA
I_{IL}	Low-level input current	-10	-	10	uA
V_{IH}	High-level input voltage	1.4	-	-	V
		2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.4	V
				2.4	V
V_{OH}	High-level output voltage	1.7	-	-	V
		2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.1	V
		-	-	0.1	V

4.5 VDD_EXT Characteristics

Table 8: VDD_EXT characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	2.70	2.80	2.95	V
I_O	Output current	-	-	10	mA

4.6 SIM_VDD Characteristics

Table 9: SIM_VDD characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	2.75	2.9	3.00	V
		1.65	1.80	1.95	
I_O	Output current	-	-	10	mA

4.7 VRTC Characteristics

Table 10: VRTC characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{RTC-IN}	VRTC input voltage	2.00	3.00	3.15	V
I_{RTC-IN}	VRTC input current	-	2	-	uA
$V_{RTC-OUT}$	VRTC output voltage	-	3.00	-	V
$I_{RTC-OUT}$	VRTC output current	-	10	-	uA

4.8 Current Consumption (VBAT = 3.8V, GPS engine is powered down)

Table 11: GSM 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			30	uA
		Sleep mode	BS-PA-MFRMS=9		1.0	mA
			BS-PA-MFRMS=5		1.2	
			BS-PA-MFRMS=2		1.5	
		Idle mode	GSM 850		22	mA
			EGSM 900			
			DCS 1800			
			PCS 1900			
		Voice call	GSM 850	PCL=5	250	mA

			EGSM 900	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	
$I_{VBAT\text{-}peak}$	Peak current	During Tx burst			2	A

4.9 Electro-Static Discharge

SIM900L 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 12: The ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Pin	Contact discharge	Air discharge
VBAT	±5KV	±10KV
GND	±4KV	±10KV
RXD, TXD	±3KV	±6KV
Antenna port	±5KV	±10KV
SPKP/ SPKN MICP/ MICN	±2KV	±8KV
PWRKEY	±1KV	±8KV

4.10 Radio Characteristics

4.10.1 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 13: SIM900L GSM 900 and GSM 850 conducted RF output power

GSM 900 and EGSM 850			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
0-2	39	±2	±2.5
3	37	±3	±4
4	35	±3	±4
5	33	±3	±4
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 14: SIM900L DCS 1800 and PCS 1900 conducted RF output power

DCS 1800 and PCS 1900			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
29	36	±2	±2.5
30	34	±3	±4
31	32	±3	±4
0	30	±3	±4
1	28	±3	±4

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
15-28	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 +/-2dB under normal condition and +/-2.5dB under extreme condition.

4.10.2 Module RF Receive Sensitivity

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

Table 15: SIM900L conducted RF receive sensitivity

Frequency	Receive sensitivity（Typical）	Receive sensitivity(Max)
GSM850	-109dBm	-107dBm
EGSM900	-109dBm	-107dBm
DCS1800	-109dBm	-107dBm
PCS1900	-109dBm	-107dBm

4.10.3 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 16: SIM900L 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