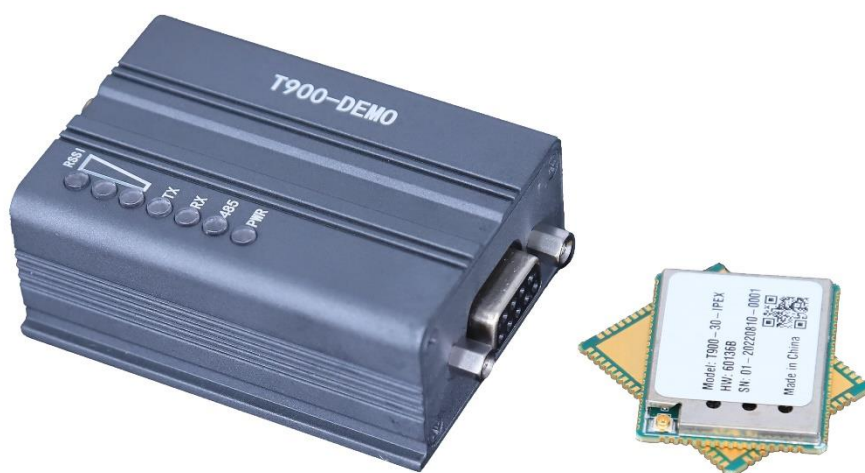


T900-30-IPEX User Manual

900MHz Frequency Hopping Module
Version: 20230422V2.0



Important User Information

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About This Manual

It is assumed that users of the products described herein have either system integration or design experience, as well as an understanding of the fundamentals of radio communications.

Throughout this manual you will encounter not only illustrations (that further elaborate on the accompanying text), but also several symbols which you should be attentive to:



Caution or Warning

Usually advises against some action which could result in undesired or detrimental consequences.



Point to Remember

Highlights a key feature, point, or step which is noteworthy. Keeping these in mind will simplify or enhance device usage.



Tip

An idea or suggestion to improve efficiency or enhance usefulness.

Regulatory Requirements

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 23cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna being used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.



WARNING

This device can only be used with antennas designed for use with 900 MHz products. Please contact Zhejiang Tianze Communication Technology Co.,Ltd. if you need more information or would like to order an antenna.



WARNING

MAXIMUM EIRP

FCC Regulations allow up to 36dBm Effective Isotropic Radiated Power (EIRP). Therefore, the sum of the transmitted power (in dBm), the cabling loss and the antenna gain cannot exceed 36dBm.



WARNING

EQUIPMENT LABELING

This device has been modularly approved. The manufacturer, product name, and FCC and Industry Canada identifiers of this product must appear on the outside label of the end-user equipment.

SAMPLE LABEL REQUIREMENT:

For T900

FCCID: 2A9DBT900

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.

Version History

Date	Versions	Comments
20220915	V1.1	Initial Version
20221125	V1.2	Added version history Added maximum user rate for each mode
20221205	V1.3	Modified dimensions of the T900 module
20221214	V1.4	Modified description of the S159 command Modified Appendix A: Baseboard Reference Design
20221228	V1.5	Some English names revised
20230329	V1.6	Modified the pin description
20230422	V2.0	Modify the current rule 3.4.3 section of work, 3.3V@2A is recommended for reference design Added 6.2.22. Add the S220 register Modified the content and table in Section 9.6

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1 Overview

The T900 module uses point-to-point, point-to-multipoint and mesh with center network communication technologies to provide users with high-performance, secure and effective wireless serial communication.

The T900 module can be used in low-cost OEM integrated designs, properly configured and installed to enable high-rate, long-range wireless communication.

The T900 module is a frequency hopping system in the 902-928 MHz ISM band, using FHSS (Frequency Hopping Spread Spectrum) technology, providing serial-based wireless asynchronous data transmission between most devices using serial communication.

The small size and superior performance of the T900 module makes it ideal for many applications. Some typical uses are listed below:

- | | | |
|-------------------------|-----------------------|------------------|
| power monitoring system | remote monitoring | robotics |
| remote telemetry | fleet management | signal display |
| traffic control | GPS | railroad signals |
| industrial control | measuring instruments | |

2 Performance Features

Key performance features of the T900 module include:

- Use the 902-928 MHz frequency band
- Output power up to 1W (30dBm) (greater than 30dBm can be customized)
- Transparent transmission, low latency, rates up to 276kbps
- Auto Repeater Mode
- Communicate with virtually all serial-based devices
- Wide temperature range
- 16-bit CRC, optional retransmission and forward error correction
- Independent diagnostic port -- real-time remote diagnosis and online network control
- Easy to install and configure -- The T900 uses a subset of the standard AT-style commands, similar to using traditional telephone line equipment
- CMOS 3.3V logic level compatible

2.1 Technical parameters

Basic parameters and indicators:

- Supported frequencies:** 902-928MHz
- Spread spectrum mode:** FHSS
- Frequency band selection:** Configurable frequency space
- Error detection:** 16 bit CRC, ARQ, ReedSolomon
- Data encryption:** 256-bit physical layer encryption
- Scope of Communication:** Up to 100km
- Output power:** 100mW to 1W (20-30dBm) (greater than 1W can be customized)
- Wireless Link Rate:** Up to 276.4kbps
- Serial port baud rate :** Up to 921.6kbps supported
- Sensitivity:**

Link Rate	10 ⁻⁷ BER	Maximum User Rate*
276.4 KBPS	-106 dBm	136kbps
230.4 KBPS	-107 dBm	116kbps
172.8 KBPS	-108 dBm	82kbps
115.2 KBPS	-109 dBm	48kbps
57.6 KBPS	-110 dBm	14kbps

Note: The maximum user rate is halved when there is a repeater.

Environment:

Operating temperature: -40°C to 85°C
Humidity: 5%-95% non-condensing

Appearance:

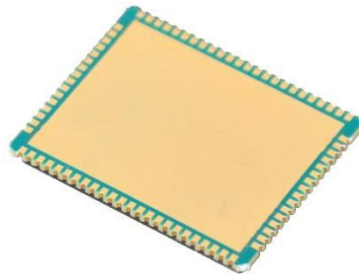
Dimensions: 26.5 mm * 33 mm * 3.5 mm
Weight: Approx. 5.2g
Connector: Antenna: IPEX
Data: 80Pin/Pad SMT

3 Hardware Description

The T900 module is a low-cost OEM module. The module provides the raw signal required for integration and minimizes area and power consumption for the integration of the module. T900-DEMO provides a convenient evaluation platform for testing and designing modules.



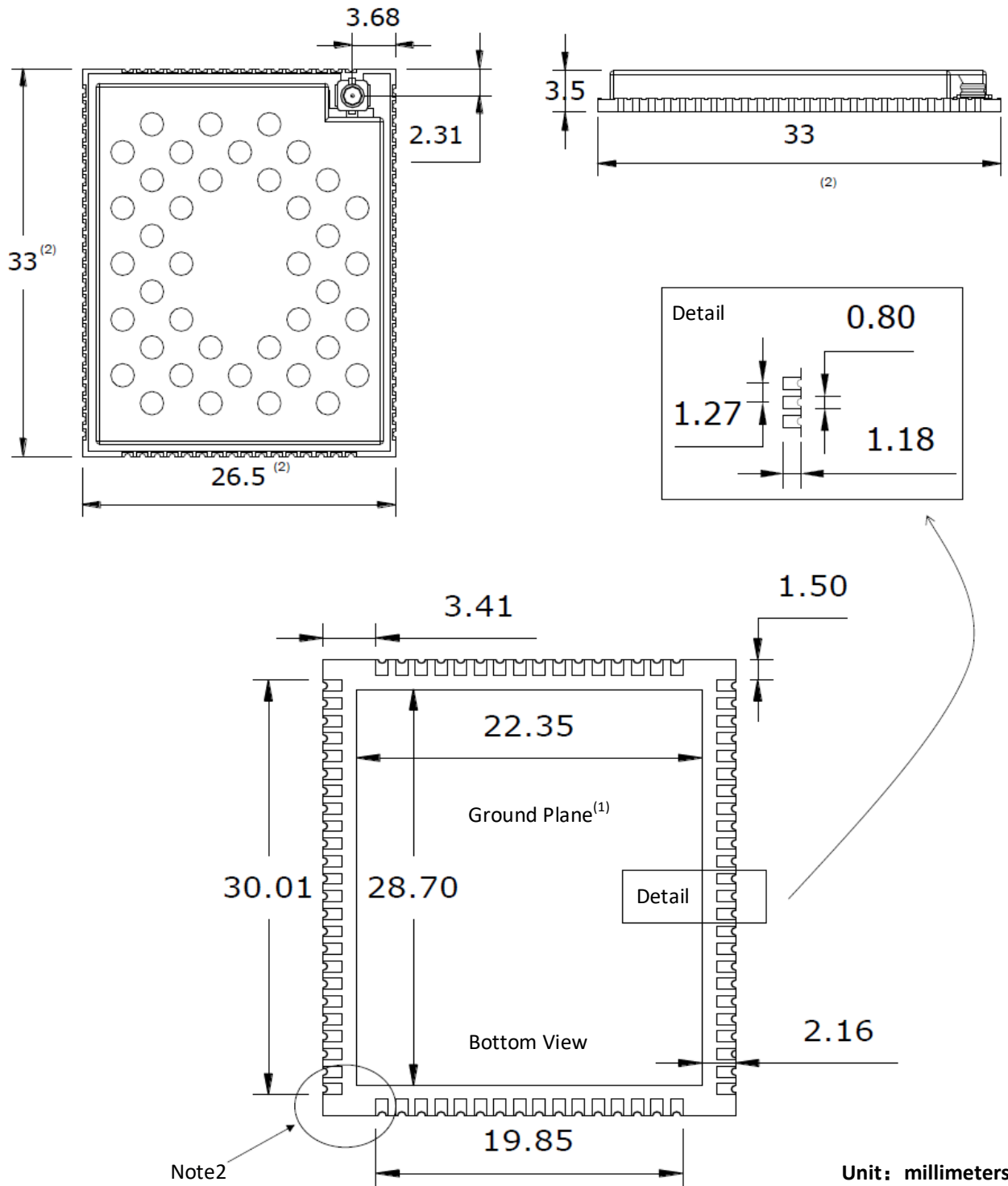
Top view



Bottom View

3.1 Mechanical Drawings

The dimensions of the T900 module are as follows:

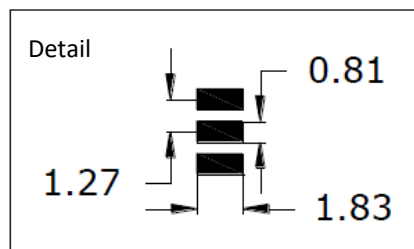
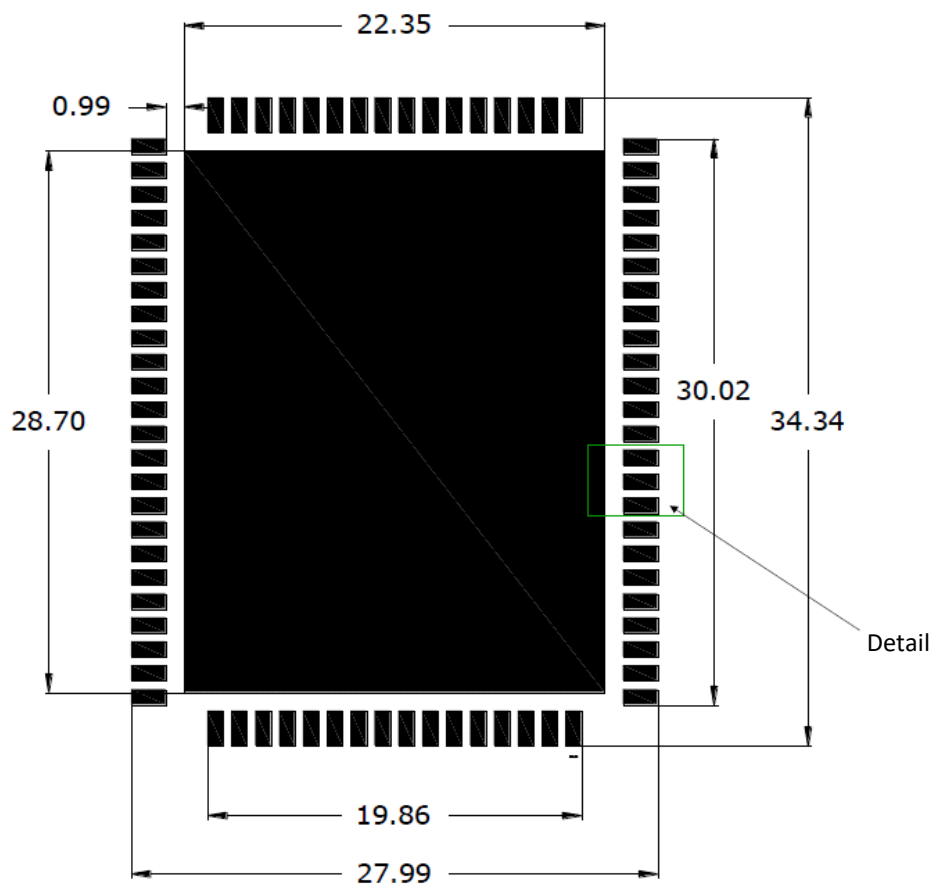


T900 OEM Mechanical

Note 1: Grounding pads must be grounded for heat dissipation.

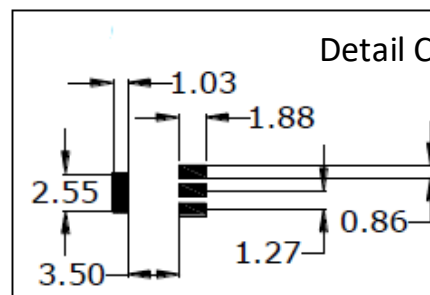
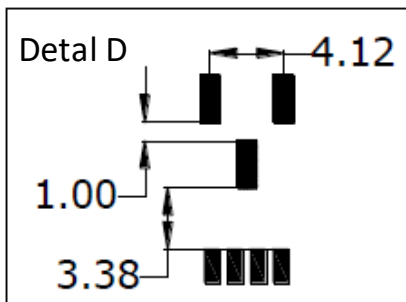
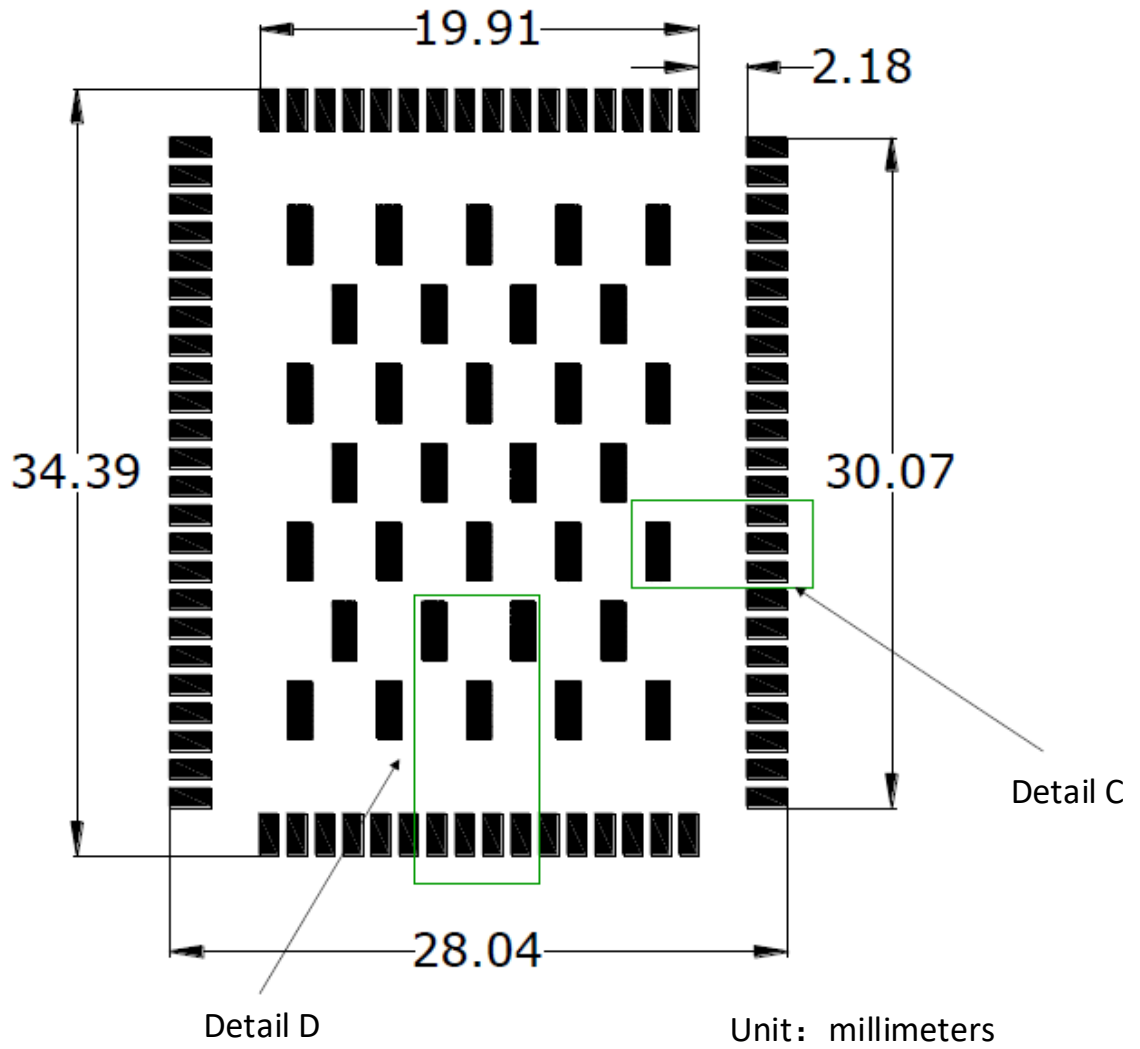
Note 2: Due to the manufacturing process, there may be excess PCB material on the corners. A tolerance of $\pm 0.25mm$ for the excess part should be considered.

3.1.1 Recommended Solder Mask (Pad Landing)

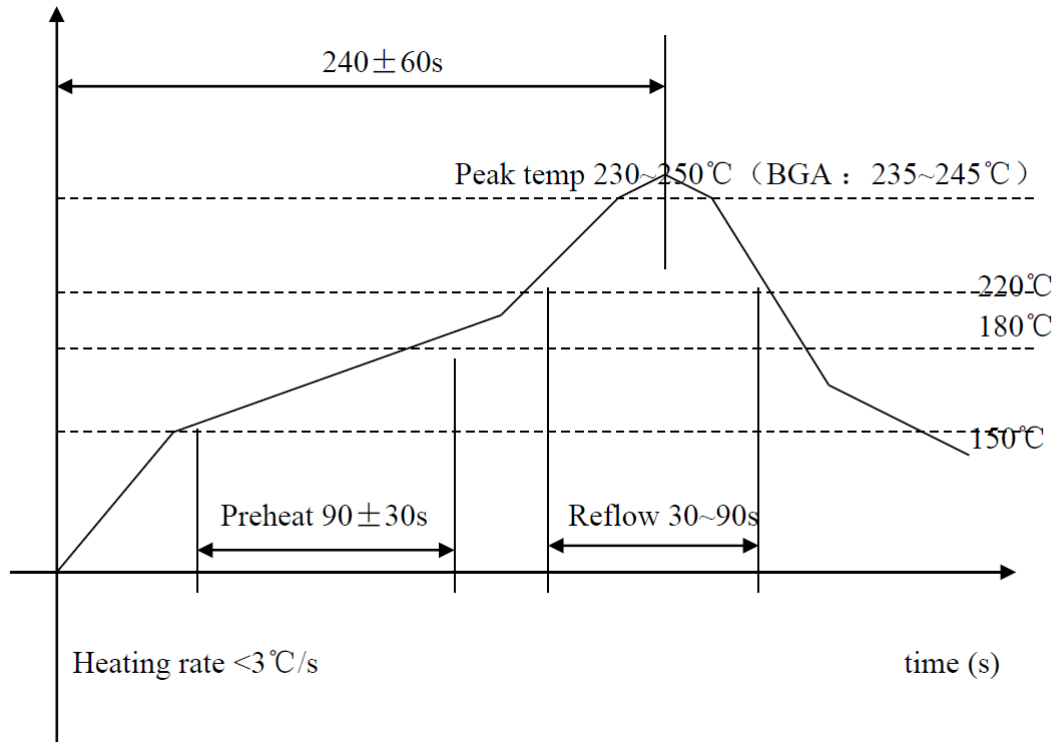


Units: millimeters

3.1.2 Recommended Solder Paste



3.1.3 SMT Temperature Profile



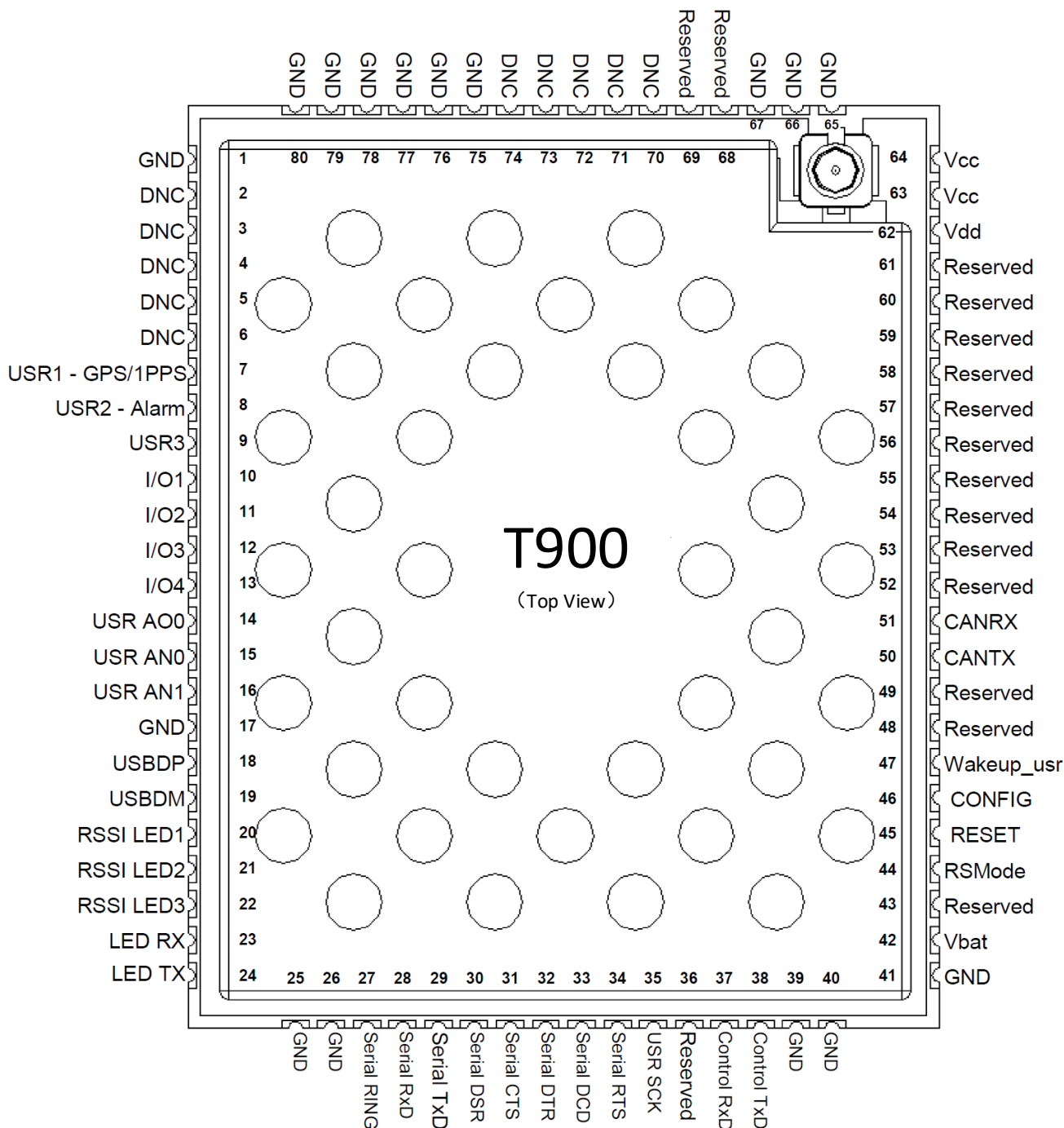
Set Point Control items	Units (slope in degrees/second, time in seconds, temperature in degrees Celsius)
Upward slope	Less than 3s
Soak time (150°C~180°C)	60~100s
Reflow time (>220°C)	30~90s
Maximum temperature	230~250°C

3.1.2 SMT Baking Instructions (MSL)

The T900 module must be baked prior to installation and the following baking instructions should be followed for best results:

- a) At 125°C+/-5°C for at least 8 to 12 hours.
- b) Unused modules should be stored at a relative humidity ≤10%.

3.2 Pin Descriptions



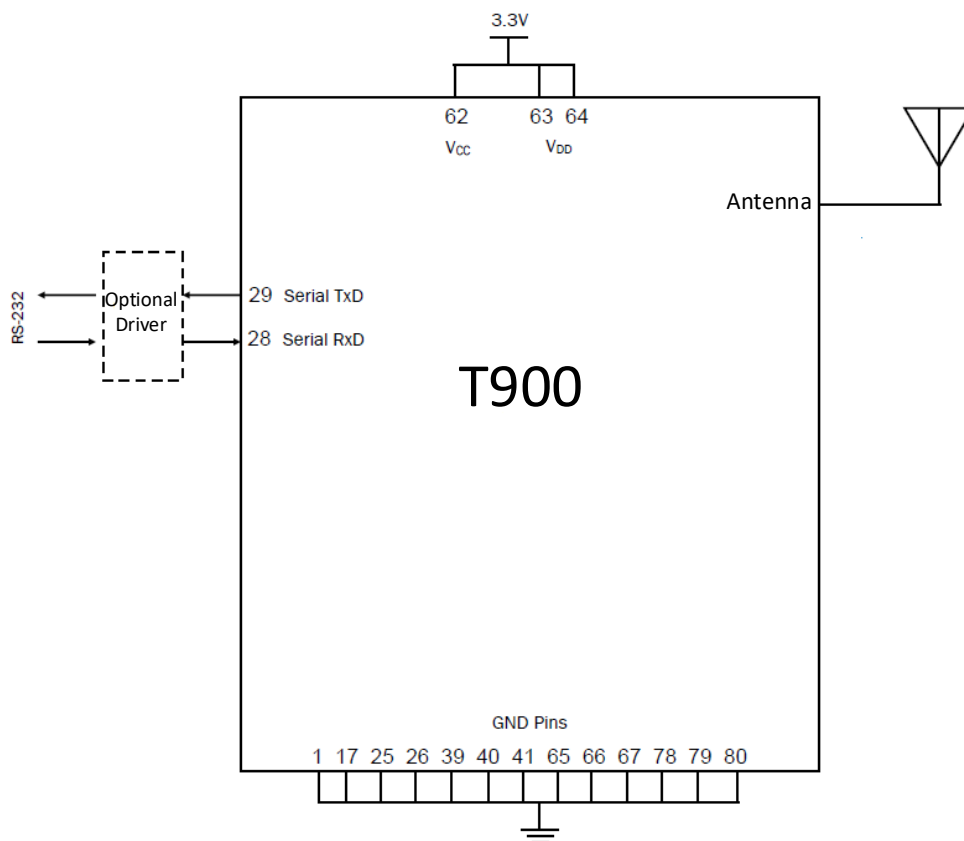
T900 80-pin OEM Connection Info

Above is the top view of the T900 module. The following table shows the function and descriptions of each pin.

Pin Name	No.	Description	Direction
GND	1,17,25-26,75 33-41,65 6-67-80	Reference point.	
DNC	2,3,4,5,6,70-74	Factory reserved pins.	
Reserved	7-9 dec - 19, 35, 36,61,68,69,42,43,44,47 to 59	*Not supported by the current version, reserved*	
GPIO1	10	Repeater number input bit1, CMOS 3.3V.	IO
GPIO2	11	Repeater number input bit2, CMOS 3.3V.	IO
GPIO3	12	Repeater number input bit3, CMOS 3.3V.	IO
GPIO4	13	Repeater number input bit4, CMOS 3.3V.	IO
RS485_RE	14	In 485 mode, data input enabled, active-low.	O
RS485_H/F	15	In 485 mode, half-duplex and full-duplex optional, 0-- full-duplex, 1-- half-duplex.	O
RSSI LED1	20	Receive signal RSSI1, active-high, current limit 5mA.	O
RSSI LED2	21	Receive signal RSSI2, active-high, current limit 5mA.	O
RSSI LED3	22	Receive signal RSSI3, active-high, current limit 5mA.	O
LED RX	23	Receive data indication, active-high, current limit 5mA.	O
LED TX	24	Receive data indication, active-high, current limit 5mA.	O
Serial RING	27	RS485 output enabled, active-high.	O
Serial RxD	28	Data Serial port data reception, CMOS 3.3V.	I
Serial TxD	29	Data Serial port data transmission, CMOS 3.3V.	O
Serial DSR	30	Data serial port DSR, not supported by the current version.	O
Serial CTS	31	Data serial port CTS, not supported by the current version. In 485 mode, data output enabled, active-high.	O
Serial DTR	32	Data serial port DTR, not supported by the current version.	I
Serial DCD	33	Data serial port DCD, not supported by the current version.	O
Serial RTS	34	Data serial port RTS, not supported by the current version.	I
Control RxD	37	Control serial port data reception, CMOS 3.3V.	I
Control TxD	38	Control serial port data transmission, CMOS 3.3V.	O
nRESET	45	Reset pin, active-low.	I
nCONFIG	46	Forced AT command configuration mode pin, active-low. If valid, the default format of the data serial port is 9600/8N1.The pin should be pulled up to Vdd or suspended (internally pulled up to Vdd).	I
Reserved	60	*reserved*	
Vdd	62	Power supply pin for the digital part of the module (3.3V).	I
Vcc	63,64	Power supply pin for the RF part of the module (3.3V).	I

Note: All serial communication signals are logical level CMOS 3.3V and cannot be directly connected to RS232 level (+-12V).

3.3 Minimum Connection Requirements



3.4 Electrical Characteristics

3.4.1 Absolute Maximum Rated Voltage

Permanent damage to the equipment may occur at higher than absolute maximum ratings. These are maximum ratings only and do not imply that the equipment can operate properly under these conditions. Prolonged operation under maximum ratings may affect the reliability of the equipment.

Parameter	Description	Minimum	Maximum
Vcc/Vdd	External main voltage	0V	3.8 V
Vin	Any pin input voltage	-0.3 V	Vdd + 0.3

Absolute maximum voltage

3.4.2 Operating Voltage

The parameters given in the table below are the measured values of T900 at room temperature.

Parameter	Description	Minimum	Typical	Maximum
Vcc	External RF power supply voltage	3.3 V	3.3 V	3.6 V
Vdd	External digital supply voltage	3.0 V	3.3 V	3.6 V

Voltage characteristics in normal operation

3.4.3 Current Characteristics

The parameters given in the table below are the measured values of T900 at room temperature. Test conditions Vcc=3.3V, Vdd=3.3V, ambient temperature 25°C.

Parameter	Description	Maximum
IVcc(TX)	100% of the RF current sent at 1W power	1270 mA
IVcc(TX)	100% of the RF current sent at 500mW power	900 mA
IVcc(TX)	100% of the RF current sent at 100mW power	490 mA
IVcc(RX)	100% of the received RF current	70 mA
IVdd(TX)	100% of the digital current sent	130 mA
IVdd(RX)	100% of the digital current received	130 mA
IVcc + IVdd	Maximum module operating current	1400mA (With antenna) 2000mA(Without antenna)

Note 1: It is recommended that customers increase a certain margin of current in hardware design. 3.3@2A is recommended for reference design, design.

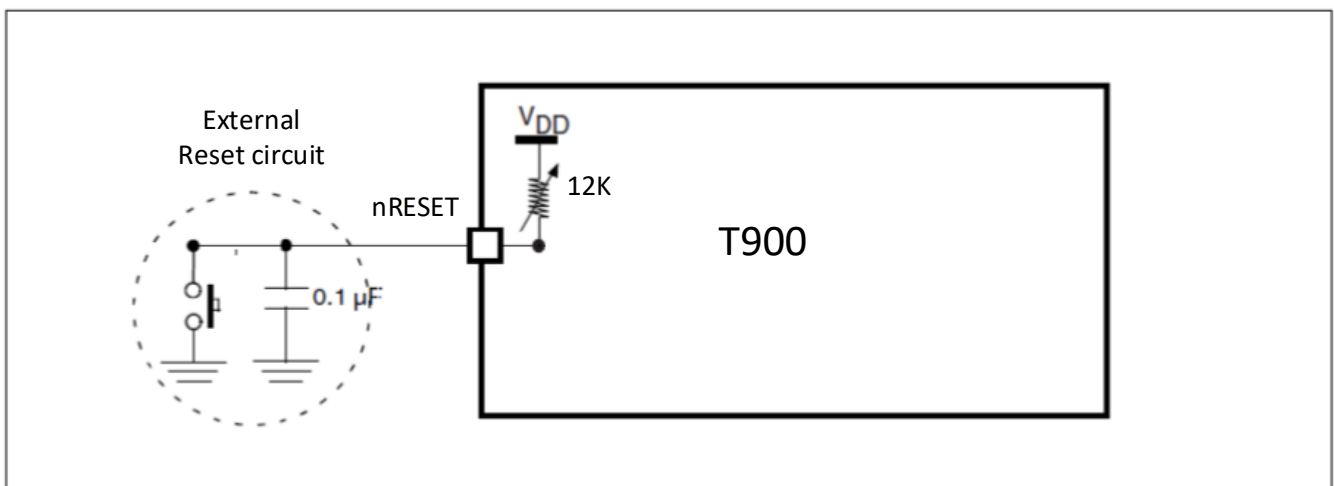
Current characteristics in normal operation

3.5 I/O Port Features

1) Universal I/O features

All pins of the T900 meet the CMOS3.3V electrical standard.

2) nRESET pin reference circuit



nRESET pin reference circuit

4 T900 Enclosed

The T900-DEMO provides standard data ports, power supply ports, and antennas for a single T900. The P900 Enclosed is ideal for base stations or applications where complicated integration of the OEM module is not required, but a modem with a small footprint is still required. The T900-DEMO can also be used to quickly evaluate the features and performance of the T900. The development board is the internal circuit board of the complete machine with one T900 module embedded, and all interfaces are the same as those of the complete machine except the antenna interface

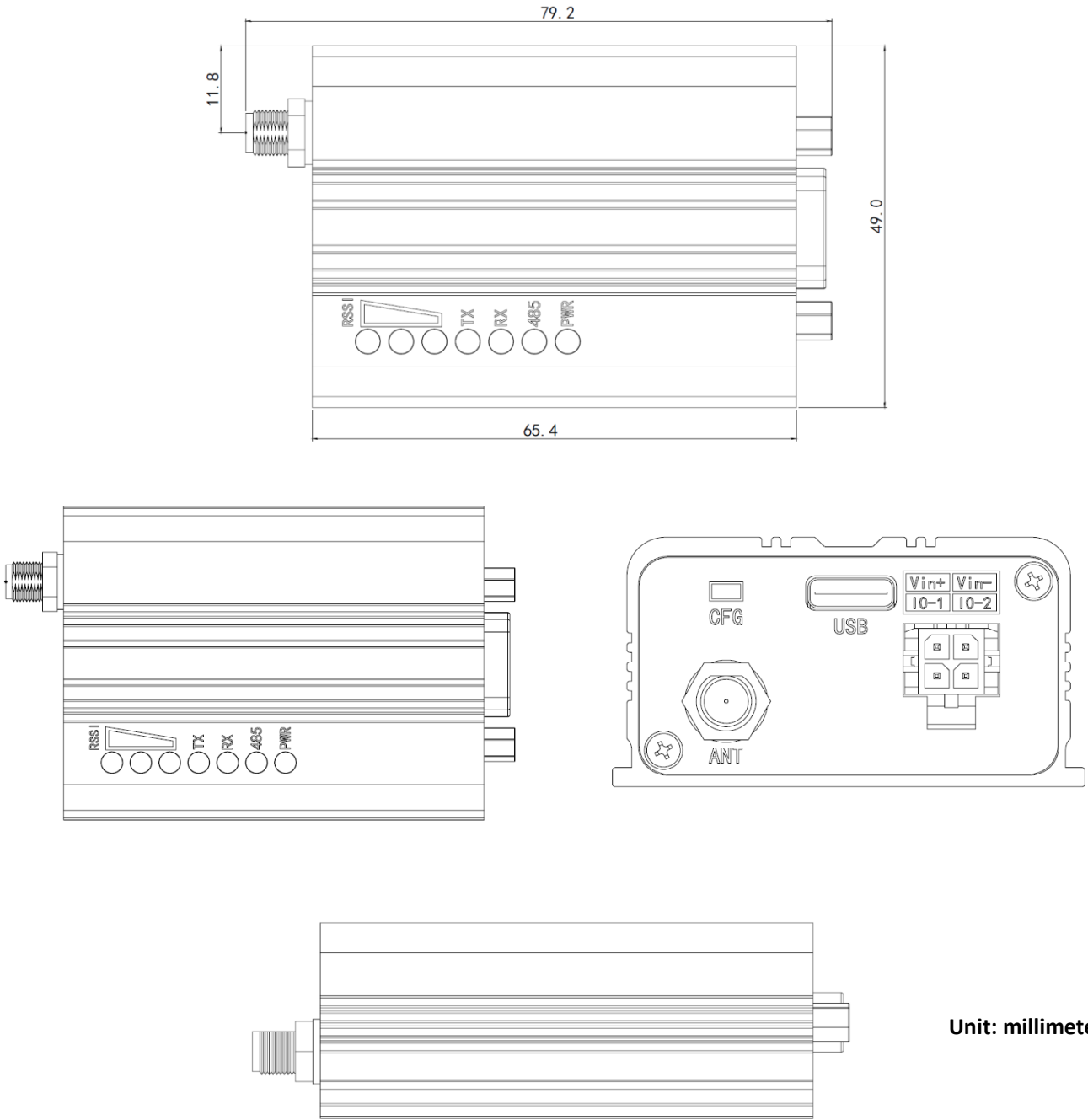
The T900-DEMO provides the following interfaces:

- Input power 12V DC
- Power indicator
- RS232/RS485 data port
- RSSI signal strength indicator
- Transmit/Receive indicators
- Setting button
- The antenna
- USB control serial port
- Reserved I/O ports



T900-Demo

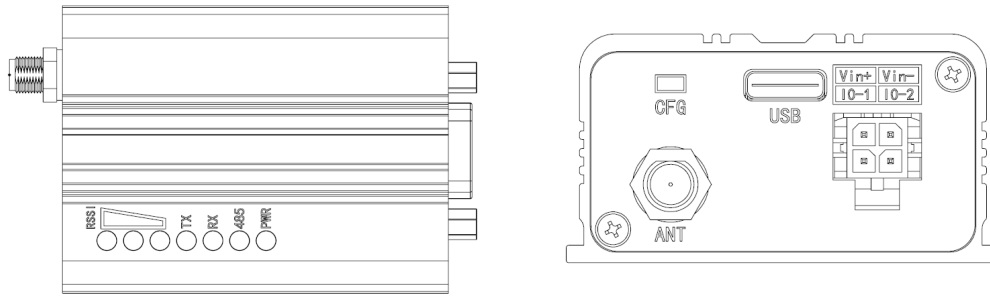
4.1 T900-Demo Drawings



Unit: millimeters

T900-DEMO Views

4.2 Device Connectors and LED Indicators



Connectors and indicators (top and rear view)

Power supply (blue)

If this indicator is on, the T900-DEMO is powered on (12VDC).

RS485 (red)

If this indicator is on, the data port of T900-DEMO is configured as RS485.

Emission light (red)

When the TX light is on, it indicates that the module is transmitting data in the air.

Receiver light (red)

When the RX light is on, it indicates that the module is synchronized and receives valid data packets.

Received Signal Strength Indication (RSSI) (three green lights)

Starting with the leftmost RSSI light, the number of lit RSSI indicators increases as the strength of the received signal increases. RSSI can check the S123 and S124 registers at the same time.

Module Type	Model	Indicator Status		
		RX	TX	RSSI 123
all	AT command configuration mode	OFF	OFF	OFF
master	Working	Blinking when receiving data	ON	Proportional to the strength of the received signal
slave	Non-synchronization	OFF	OFF	Cycle light every 860ms
slave	Synchronization	ON	Blinking when transmitting data	Proportional to the strength of the received signal
repeater	Non-synchronization	Alternately flashing with the TX light	Alternately flashing with the RX light	Cycle light every 860ms
repeater	Synchronization	Blinking when receiving data. Otherwise steady on	Blinking when transmitting data. Otherwise steady on	Proportional to the strength of the received signal

LED light status indication

Setting button

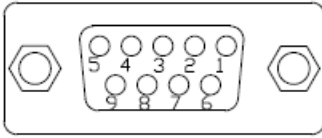
Press and hold this button before powering up. The module will enter the forced AT command configuration mode. The default data serial port is 9600/8N1.

USB

Type-C USB port. The USB port is converted to a serial port and connected to the control serial port.

Data serial port

Connects to the data serial port of T900-DEMO for data transmission or AT command control. The current version only supports simple RS232, and only uses RXD and TXD. Other control lines are not supported for the time being. The direction of sending and receiving is based on the T900 module.



pin	RS232	RS485 (Full duplex)	RS485 (Half duplex)
1	DCD		
2	TXD	TX-	Data-
3	RXD	RX+	
4	DTR		
5	GND	GND	GND
6	DSR		
7	RTS	RX-	
8	CTS	TX+	Data+
9			

DB9 Interface Definition

Vin+/Vin-

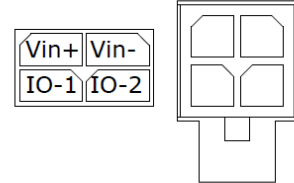
Used to power the module. Input voltage ranges from 9 to 30VDC.

IO-1/IO-2

It is not supported by the current version but it can customized.

ANT

RF-SMA female antenna connector



5 Data Serial Port

The data serial port can be used for AT command configuration mode and data mode, corresponding to the use of pins Serial RxD and Serial TxD. AT command configuration mode can be entered in two ways, one is forced entry into AT command configuration mode on power-up, and the other is entry in data mode.

5.1 Data Mode

When the nCONFIG pin is high or suspended during power-up or reset, data mode is then on.

In data mode, the data serial port is used for transparent data transmission without any data processing. The data serial port input buffer is 4096 bytes. When the buffer overflows, it will cause data loss.

5.2 Force into the AT Command Configuration Mode on Power-up

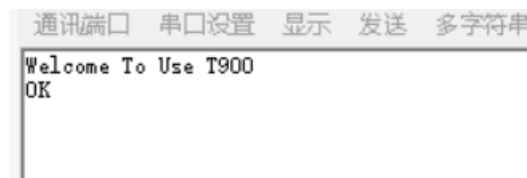
If the nCONFIG pin is low during power-up or reset, the AT command configuration mode is entered.

When you enter the AT command configuration mode in this way, the baud rate of the data serial port is forcibly set to 9600bps 8N1.

5.3 Enter the AT Command Configuration Mode in Data Mode

In data mode, you can enter the AT command configuration mode by idling for 1s, then sending "+++", and then idling for another 1s. When you enter the AT command configuration mode, the data serial port displays "Welcome To Use T900 OK".

When you enter the AT command configuration mode in this way, the data serial port baud rate is the serial port baud rate in data mode.



In AT command configuration mode, you can enter the AT command to read and write the internal register, read the required data, or configure the required mode.

When you switch from data mode to AT command mode, the rate and format of the serial port are not changed. The configuration in data mode is retained.

After entering the AT command mode, you can configure it using AT commands. For details about the AT command, see Section 7.

6 AT Command/Register Description

6.1 AT Command

AT Command (both upper and lower case accepted)	Description
ATI1	Query the hardware version
ATI2	Query the firmware version
ATI3	Query the software version
ATI4	Query the SN Number
AT&V	Display the current parameter table
AT&W	Save the current parameter table
ATA	Exit the AT command configuration mode and enter the data mode
ATSxxx?	Query the value of register Sxxx
ATSxxx=yyy	Write the value of register Sxxx as yyy
ATSxxx /?	Display the help file of register Sxxx
AT&Fn	Load the factory default configuration 4: Factory default settings for mesh with center master 5: Factory default settings for mesh with center slave 7: Factory default settings for point-to-multipoint master 8: Factory default settings for point-to-multipoint slave 9: Factory default settings for point-to-multipoint repeater 10: Factory default settings for point-to-point master 11: Factory default settings for point-to-point slave 12: Factory default settings for point-to-point repeater

Note: All register changes must be saved using the AT&W command to take effect.

6.2 List of Registers

All registers of the T900 are shown in the table below.

Register Number	Description
S101	Operating Mode
S102	Serial Baud Rate
S103	Wireless Link Rate
S104	Network Address (ID)
S105	Unit Address(Local address)
S108	Output Power (dBm)
S110	Serial Data Format
S113	Packet Retransmissions
S114	Repeater Index
S118	Sync Address
S123	RSSI From Master RSSI (dBm) (Indicator of master signal size)
S124	RSSI From Slave RSSI (dBm) (Indicator of slave signal size)
S133	Network Type
S140	Destination Address
S141	Repeater Y/N
S142	Serial Channel Mode
S143	Repeater Index Use GPIO
S159	Encryption Enable
S160	Encryption Key
S244	Channel Access Mode
S221	Unit Address Max for TDMA

S220	TDMA TX TIME SLOT
------	-------------------

6.2.1 S101 Operating Mode

The operating mode defines the role of each device on the network. Each T900 module can be configured in any mode and take on any role in the network.

Master: There is only one master in each network. In point-to-point and point-to-multipoint networks, it is used to synchronize the entire network.

Repeater: It is used in a network to extend transmission distance, increase network coverage, and connect to a master or repeater.

Slave: The slave is directly connected to the master or repeater.

Values
0 - Master
1 - Repeater
2 - Slave

6.2.2 S102 Serial Baud Rate

S102 is used to configure the data serial port baud rate. When the serial port rate is changed, please note that the serial port baud rate of the device connected to the T900 should be modified.

Values (bps)
0-230400 6-14400
1-115200 7-9600 (Default)
2-57600 8-7200
3-38400 9-4800
4-28800 15-460800
5-19200 16-921600

6.2.3 S103 Wireless Link Rate

S103 determines the communication rate of the entire network. Every device on the network must be configured to the same rate. The higher the rate, the higher the network throughput, but the worse the sensitivity. The sensitivity difference between adjacent modes is about 1dB.

Values (bps)
0-172800 (default)
1-230400
2-276480
3-57600
4-115200

6.2.4 S104 Network Address (ID)

All devices on a network must have the same network address. Devices with different network addresses do not communicate with each other. When multiple networks are operating simultaneously in the same area, the network address of each network must be guaranteed to be unique.

Values (0~4294967295)
Default 1234567890

6.2.5 S105 Unit Address

On the same network, unit addresses are used for identification, and each device should have a unique unit address.

For a point-to-point network, the default value is 0. The device automatically assigns the unit address. Users do not need to set this parameter. Users can also manually assign non-0 unit addresses. If automatic allocation is used on the same network, the local addresses of all devices are set to 0. If manual assignment is used, you can set the local address S105, sync address S118, and destination address S140 for each device to ensure that the network topology is correct.

For a point-to-multipoint network, each device must be manually assigned a non-0 device address.

For details, see Section 8.7.

Values (0 to 65535)
Default 0

6.2.6 S108 Output Power (dBm)

S108 is used to set the transmitting power of the local device.

Values (dBm)	
20 - 100mW	26 - 400mW
21 - 125mW	27 - 500mW
22 - 160mW	28 - 630mW
23 - 200mW	29 - 800mW
24-250mW	30-1000mW (default)
25 - 320mW	

6.2.7 S110 Serial Data Format

The data format of the serial port supports only 8N1.

Values
1-8N1 (default)

6.2.8 S113 Packet Retransmissions

This register determines the maximum number of times a packet can be retransmitted. The times of retransmission is used to ensure the robustness of the system in complex environment or weak signal situations. Retransmission can cause additional data transfer, which can reduce system throughput. The maximum number of packet transmissions is the number of data retransmissions plus one.

Values (0~255)
Default 3

6.2.9 S114 Repeater Index

In point-to-point mode, the register takes effect only when the operating mode is repeater and the local address is 0. This register indicates the relative position of the repeater on the network. No additional configuration is required on the master and slaves to add or remove repeater devices on a point-to-point network. When the repeater device is started, it automatically connects to the point-to-point network. When it is shut down, the network is reconnected.

When multiple repeaters are used, ensure that the serial numbers of the repeaters from the master to the slave increase monotonously, which can be discontinuous.

Values (1~254)
Default 1

6.2.10 S118 Sync Address

You can set the sync address of the repeater device and the slave device to specify the device whose address is synchronized from the local address (S105) to the sync address (S118).

On a point-to-point network, when the local address (S105) is set to 0, the sync address is automatically assigned. When the local address (S105) is not 0, the sync address must be set to determine the network topology.

On a point-to-multipoint network, you must manually set the correct sync address for each device.

For details, see Section 8.7.

Values (0 to 65535)
Default 0

6.2.11 S123 RSSI From Master RSSI (dBm)

It indicates the received signal strength of the slave or repeater. The value corresponds to pins RSSI1, RSSI2, and RSSI3.

S123 of the repeater device indicates the signal strength of the superior device, and S124 indicates the signal strength of the subordinate device.

Values (dBm)
-255 to 0 (read only)

6.2.12 S124 RSSI From Slave RSSI (dBm)

Indicates the received signal strength of the master or repeater. The value corresponds to pins RSSI1, RSSI2, and RSSI3.

S123 of the repeater device indicates the signal intensity of the upper-level device, and S124 indicates the signal strength of the subordinate device.

Values (dBm)
-255 to 0 (read only)

6.2.13 S133 Network Type

This register is used to set the network type. On one network, the network type of all devices must be the same.

Point-to-Multipoint: The master broadcasts data to all devices, and all slave devices send data back to the master (There can be 0 or multiple repeaters).

Point-to-Point: Only the master and slave communicate on a point-to-point basis (There can be 0 or multiple repeaters).

Mesh with Center: The master and slaves are connected to each other, but no repeater is supported and no data is forwarded between devices.

Values
0 - Point to Multipoint
1 - Point to Point
2 - Mesh with Center

6.2.14 S140 Destination Address

On the master and repeater devices, you can set the destination address to specify the address of the subordinate device connected to the local device.

On a point-to-point network, when the local address is set to 0, the destination address is automatically assigned. When the local address is not 0, the destination address must be set to specify the network topology.

On a point-to-multipoint network, you must manually set the correct destination address for each device.

For details, see Section 8.7.

Values (0 to 65535)
Default 0

6.2.15 S141 Repeater Y/N

On a point-to-point network where addresses are automatically assigned (local address S105 is 0), this register is invalid, but must be set to 0. In this case, the network automatically identifies the repeater, and the repeater does not need to be set.

When manually assigning addresses, this register is set based on whether a repeater exists in the current network.

Values (0~1) (Only valid for master)
0 - Without repeater (default)
1 - With repeater

6.2.16 S142 Serial Channel Mode

The register is configured with the operating mode of the data serial port. The default value is RS232.

Values
0 - RS232 (default)
1 --RS485 half-duplex
2 --RS485 full-duplex

6.2.17 S143 Repeater Index Use GPIO

To facilitate the repeater to change the serial number, the user can use GPIO[4:1] to configure the repeater serial number.

When S143 is 0, the repeater number is S114. The value ranges from 1 to 254.

When S143 is 1, the repeater number is GPIO[4:1]+1, which ranges from 1 to 16.

If GPIO is used as the repeater number, the repeater number ranges from 1 to 16. Therefore, a maximum of 16 repeaters can be configured.

Values
0 - Use the S114 register (default)
1 - Use GPIO[4:1] to indicate the repeater number

6.2.18 S159 Encryption Enable

The T900 provides 256bit data encryption, which is turned on or off via the S159 register.

Values
0 - Disable encryption (default)
1 - Enable encryption

6.2.19 S160 Encryption Key

When using the encryption function, set a 256bit key for encryption and decryption. Both sending and receiving ends need to be configured with the same key in order to receive the correct data.

Values
256bit secret key

6.2.20 S244 Channel Access Mode

The channel access mode specifies how the slave accesses the network. In RTS/CTS mode, the slave needs to request permission from the master to send data. After the master agrees to allocate resources, the slave sends data. In TDMA mode, the master makes uniform allocation, and the slave sends data according to the allocation. The TDMA mode supports only point-to-multipoint and mesh with center networks.

Both modes have advantages and disadvantages. RTS/CTS mode is more efficient in half-duplex networks, while TDMA mode is more suitable for the situation where master and slave send data independently.

Values
0 - RTS/CTS
1 - TDMA

6.2.21 S221 Unit Address Max for TDMA

This register does not specify the maximum address of the master polling in TDMA mode. In TDMA mode, the master polling address is from the master's local address S105+1 to this maximum address. The local address S105 set on the slave should be within these addresses; otherwise, the network cannot be accessed.

Values (0 to 65535)
Default 6

Example of address assignment in TDMA mode: 1 master + 6 slaves, S221=7, S244=1

	Local Address S105	Sync Address S118	Destination Address S140
Master	1	0	0
Slave 1	2	1	0
Slave 2	3	1	0
Slave 3	4	1	0
Slave 4	5	1	0
Slave 5	6	1	0
Slave 6	7	1	0

In this configuration, the starting address of the slave polled by the master is $1+1=2$ and ranges from 2 to 7. The slaves send packets one by one according to the address.

The polling time for each address is 20ms. Therefore, the total polling time for six addresses is 120ms. In this case, the transmission delay from the slaves to the master ranges from 0 to 120ms. The transmission from the master to the slaves is not affected by polling, and the delay is 0~20ms.

6.2.22 S220 TDMA tx time slot

This register is used to specify the maximum number of TDMA slots allocated in TDMA_AUTO mode. It is used to allocate the required number of time slots adaptively according to the amount of data sent. The default value is 15.

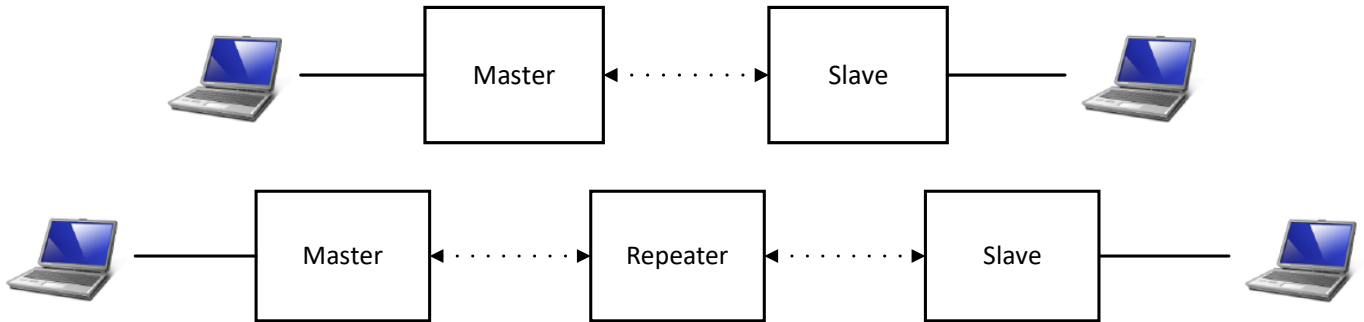
Values (0~65535)
Default 15

For example, if the air port is 276400bps, set 15 to a maximum of 5.1KB/s data can be transmitted continuously. Occupies a total of 15 time slots.

7 Point-to-Point Networks

In a point-to-point network, T900 module can be used to establish a data path between point A and point B. Point A could be the master, point B could be the slave. When point A and point B cannot be directly connected, a repeater node can be added. For point-to-point networks, you need to configure the network type register S133=1.

The point-to-point network can also be used in special scenarios: When multiple slaves or repeaters are deployed, the master selects the required slave for communication by configuring destination address S140.



7.1 Configuration Preparations

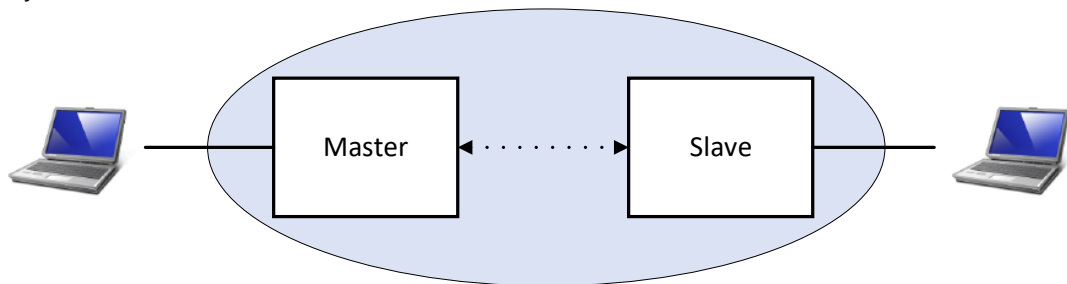
Before configuration, you must use the matched development board or user-designed hardware to provide power and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols. For details about relevant interfaces, see Chapter 3 Hardware Description.

7.2 Operating Mode

The T900 point-to-point network works in three modes: Master, Slave, and Repeater.

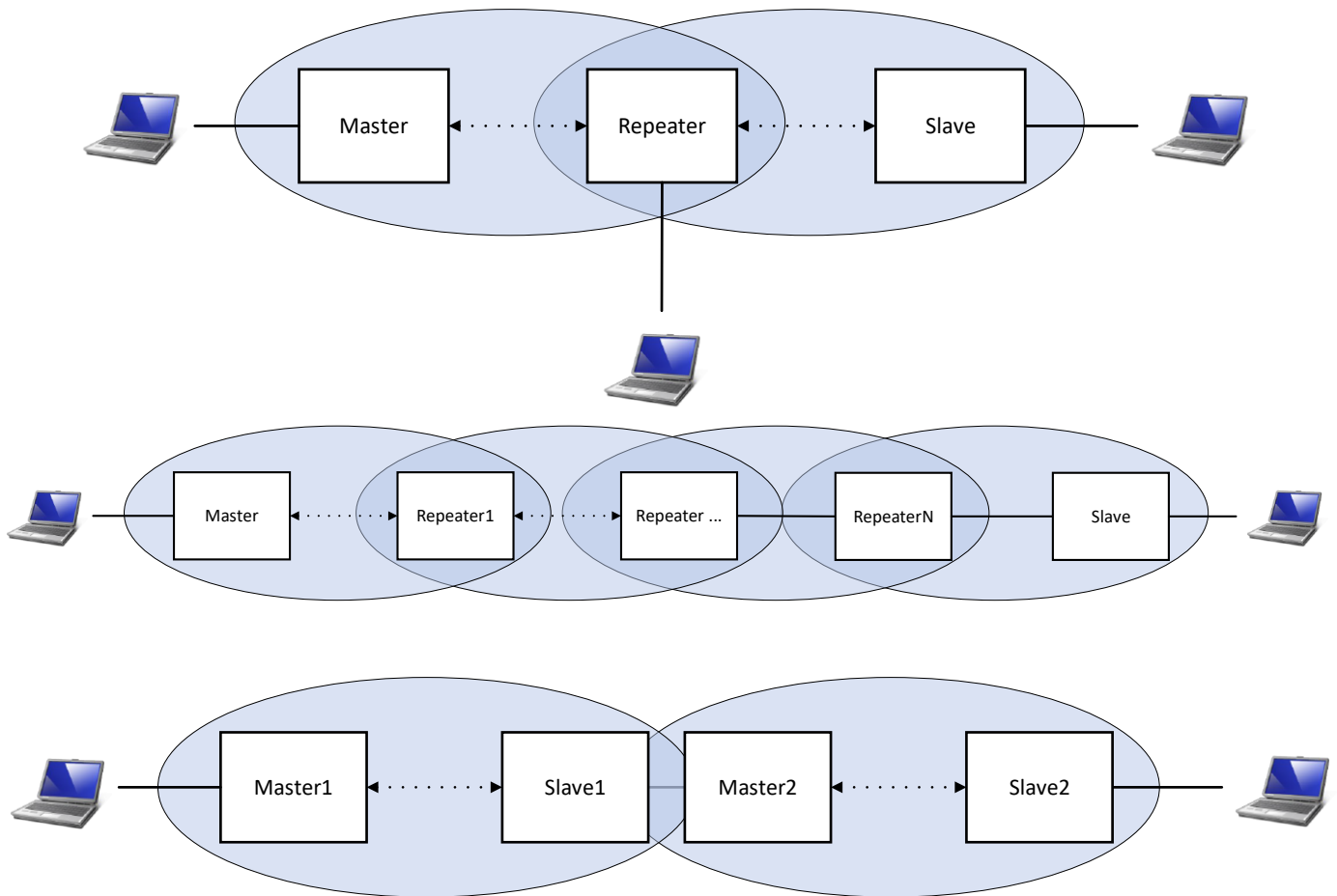
The master provides synchronization signals for the entire network to ensure normal communication between all devices.

The slave is the final node of the network and communicates directly with the master or repeater. When no user data is transmitted on the point-to-point network, the slave device synchronizes data with the master device and does not send any information on the network.



A repeater can extend the coverage area of the master and forward data. The repeater synchronizes with the master or an upper-level repeater and sends synchronization signals to lower-level devices. The repeater device can also be used as a slave to send and receive data through the data serial port. The output data is only the data sent by the upper-level device and does not output the data of the subordinate device. However, the input data from upper-level device will be confused with the data sent by the subordinate device and sent to the superior device together.

Adding repeaters to the network reduces the total throughput of the network by half, but only by half, and does not decrease as the number of repeaters increases. If the repeater is required but the throughput is considered, another solution is to place two devices back-to-back at the repeater site. One is the slave of the upstream network and the other is the master of the downstream network. The serial ports of the two devices are connected by cables, both of which require their own antennas and need careful consideration of antenna placement and device configuration.



When the local address is set to 0 on the point-to-point network of the T900, the addresses are automatically assigned. Users do not need to set the local address, sync address, and destination address.

The T900 point-to-point repeater mode is very flexible and easy to use. Adding a repeater device to a point-to-point network requires no additional configuration for the master and the slave. You only need to set the repeater to the same network ID, wireless link rate, and repeater number. After the device is powered on, the existing network automatically detects whether a repeater is added to the network. The repeater serial number must increase from the master to the slave in order, but can be discontinuous. Pay attention to the repeater location to ensure link stability.

The operating mode configuration register is S101. Run the following command:

```

ATS101=0 -- Master
ATS101=1 -- Repeater
ATS101=2 -- Slave
    
```

7.3 Use Factory Defaults

The factory defaults command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using the factory defaults sets all registers to their default values. Using the default settings has the following benefits:

1. To speed up the configuration process. If there is no special requirements, please use the default configuration.
2. To troubleshoot issues. If communication cannot be established due to the adjustment of the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory defaults provide all the functionality required for point-to-point network. No matter how complex the special requirements are, the configuration can be started from the factory default settings. All operating modes and network types have corresponding factory default settings commands.

```

AT&F10 -- Factory default settings for the point-to-point master
    
```

AT&F11 -- Factory default settings for the point-to-point slave
 AT&F12 -- Factory default settings for the point-to-point repeater

```

    通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
    at&f /?
    Factory Defaults
    &F4 - Mesh With Center Master
    &F5 - Mesh With Center Slave
    &F7 - PMP Master
    &F8 - PMP Slave
    &F9 - PMP Repeater
    &F10 - PP Master
    &F11 - PP Slave
    &F12 - PP Repeater
    OK
    
```

7.4 Master Setting

```

    通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
    at&f10 A
    OK
    at&w B
    OK
    at&v C
    T900
    900MHz Hopping Radio System
    Hardware Version TZ60136B
    Firmware Version 0001-20220623-0A
    Software Version 0001-20220623-0A
    Serial Number 123456

    Network Type           S133=1 D           Operating Mode           S101=0 H
    Wireless Link Rate     S103=0 E           Output Power (dBm)     S108=30
    Network Address (ID)   S104=1234567890 F Unit Address             S105=0 I
    Synchronous Address    S118=0
    Serial Baud Rate       S102=7 G           Destination Address     S140=0
    Repeater Y/N          S141=0
    Encryption Enable      S159=0
    RSSI Form Master (dBm) S123=-255          Repeater Index Use Gpio S143=0
    RSSI Form Slaver (dBm) S124=-255          Repeaters Index         S114=1

    OK
    
```

- A) AT&F10 - Restore the factory default settings for the point-to-point master
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 1, corresponding to point-to-point network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT&S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S101 - The operating mode must be set to 0, corresponding to the master
- I) S105 - Unit address is set to 0, auto-assigning addresses

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

7.5 Slave Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f11 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=1 D      Operating Mode         S101=2 H
Wireless Link Rate     S103=0 E      Output Power (dBm)    S108=30
NetWork Address(ID)    S104=123456789 F  Unit Address           S105=0 I
Synchronous Address    S118=0
Serial Baud Rate       S102=7 G      Destination Address    S140=0
Repeater Y/N           S141=0
Encryption Enable      S159=0
RSSI Form Master (dBm) S123=-255     Repeater Index Use Gpio S143=0
                      Repeater Index      S114=1
                      RSSI Form Slaver (dBm) S124=-255

OK

```

- A) AT&F11 - Restore the factory default settings for the point-to-point slave
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 1, corresponding to point-to-point network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S101 - The operating mode must be set to 2, corresponding to the slave
- I) S105 - Unit address is set to 0, auto-assigning addresses

After the configuration is completed, run the AT&W command to save the current settings. Run the AT command to exit the AT command mode and then the settings take effect.

7.6 Repeater Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f12 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=1 D           Operating Mode           S101=1 H
Wireless Link Rate     S103=0 E           Output Power(dBm)       S108=30
NetWork Address(ID)    S104=1234567890 F  Unit Address             S105=0 I
Synchronous Address    S118=0             Destination Address      S140=0
Serial Baud Rate        S102=7 G           Serial Channel Mode      S142=0
Repeater Y/N           S141=0             Repeater Index Use Gpio S143=0
Encryption Enable      S159=0             Repeaters Index          S114=1 J
RSSI Form Master(dBm)  S123=-255          RSSI Form Slaver(dBm)   S124=-255

OK

```

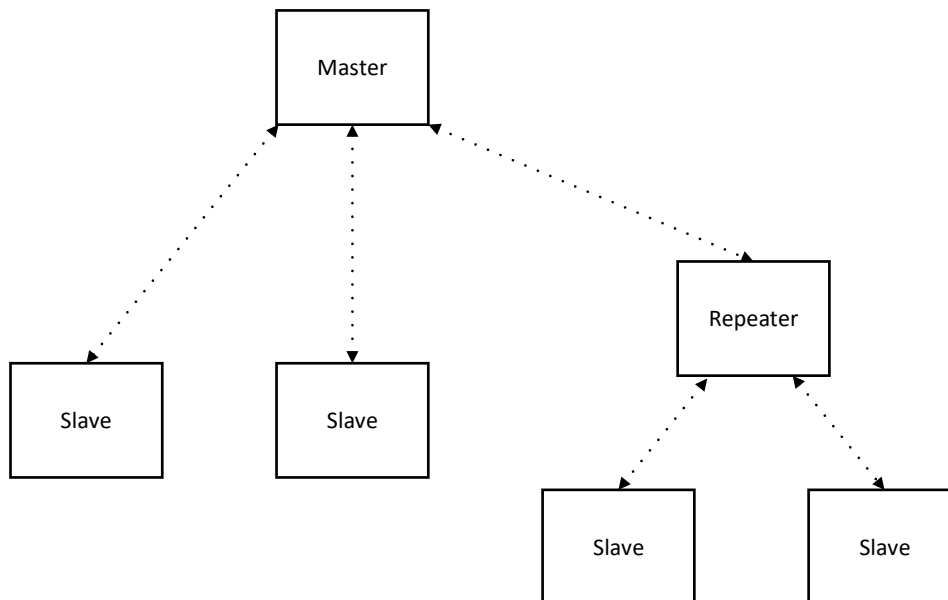
- A) AT&F12 - Restore the factory default settings for the point-to-point repeater
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 1, corresponding to point-to-point network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use ATs104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S101 - The operating mode must be set to 1, corresponding to the repeater
- I) S105 - Unit address is set to 0, auto-assigning addresses
- J) S114 - The repeater index indicates the position of the repeater on the network. The closer the repeater is to the master, the smaller the repeater index is, which can be discontinuous.

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

8 Point-to-Multipoint Networks

In a point-to-multipoint network, the master can directly connect to multiple slaves or connect to multiple slaves through repeaters. The repeater also has the function of the slave and can communicate with the master, but its uplink data will be confused with that of the slave. The network type register S133=0 needs to be configured for point-to-multipoint networks.

The master can use destination address S140 to temporarily select a specific slave or repeater for communication and filter out data transmission requests from other devices.



A point-to-multipoint network topology

8.1 Configuration Preparations

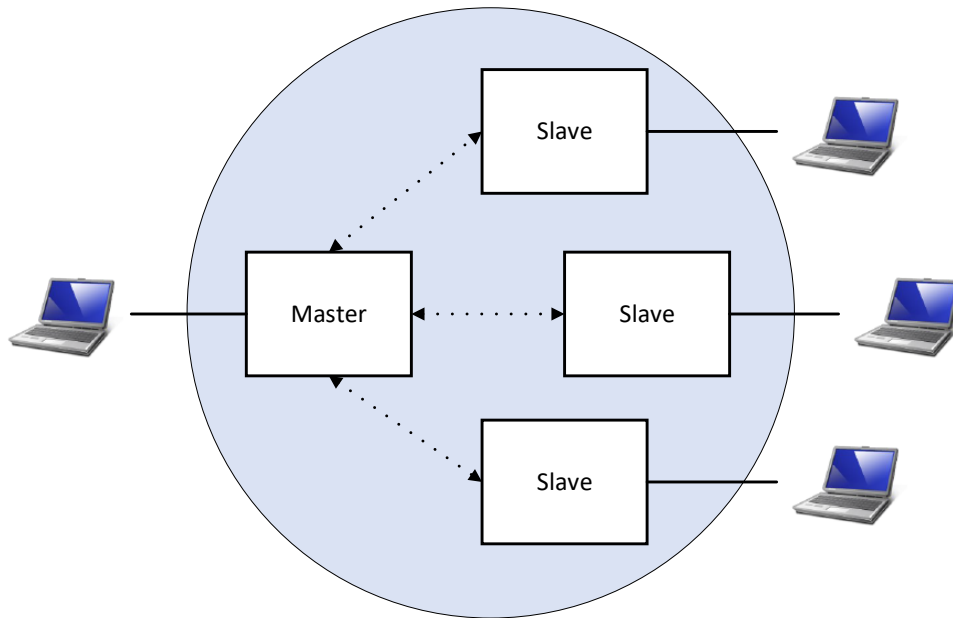
Before configuration, you must use the matched development board or user-designed hardware to provide power and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols. For details about relevant interfaces, see Chapter 3 Hardware Description.

8.2 Operating Mode

The T900 point-to-multipoint network works in three modes: master, slave, and repeater.

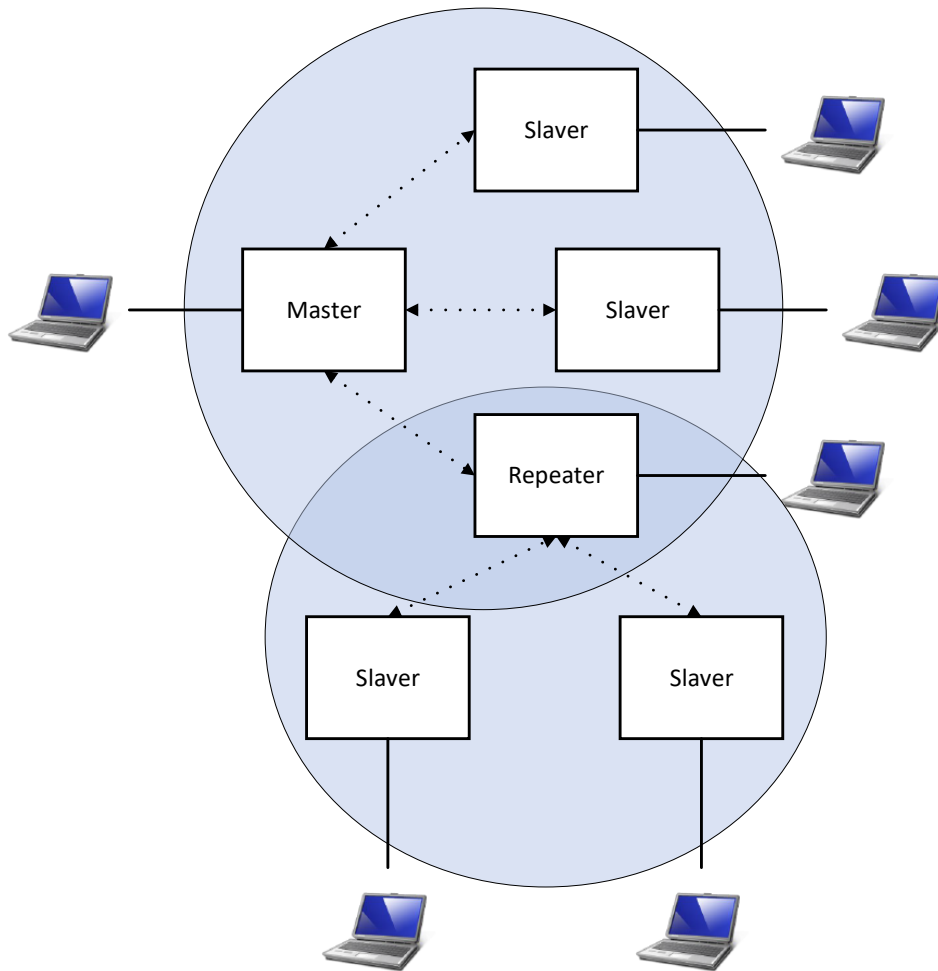
The master provides synchronization signals for the entire network to ensure normal communication between all devices.

The slave is the final node of the network and communicates directly with the master or repeater. When no user data is transmitted on the point-to-multipoint network, the slave device only synchronizes with the master device and does not send any information on the network.



A repeater can extend the coverage area of the master and forward data. The repeater synchronizes with the master or an upper-level repeater and sends synchronization signals to lower-level devices. The repeater device can also be used as a slave to send and receive data through the data serial port. The output data is only the data sent by the upper-level device and does not output the data of the subordinate device. However, the input data from upper-level device will be confused with the data sent by the subordinate device and sent to the superior device together.

Adding repeaters to the network reduces the total throughput of the network by half, but only by half, and does not decrease as the number of repeaters increases. If the repeater is required but the throughput is considered, another solution is to place two devices back-to-back at the repeater site. One is the slave of the upstream network and the other is the master of the downstream network. The serial ports of the two devices are connected by cables, both of which require their own antennas and need careful consideration of antenna placement and device configuration.



Repeaters for point-to-multipoint networks cannot be automatically added as repeater does for point-to-point networks. You need to manually configure registers S105, S118, and S140 to determine the network topology.

The operating mode configuration register is S101. Run the following command:

```
ATS101=0 -- Master
ATS101=1 -- Repeater
ATS101=2 -- Slave
```

8.3 Use Factory Defaults

The factory defaults command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using the factory defaults sets all registers to their default values. Using the default settings has the following benefits:

1. To speed up the configuration process. If there is no special requirements, please use the default configuration.

2. To troubleshoot issues. If communication cannot be established due to the adjustment of the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory defaults provide all the functionality required for point-to-multipoint network. No matter how complex the special requirements are, the configuration can be started from the factory default settings. All operating modes and network types have corresponding factory default settings commands.

```
AT&F7 -- Factory default settings for the point-to-multipoint master
AT&F8 -- Factory default settings for the point-to-multipoint slave
AT&F9 -- Factory default settings for the point-to-multipoint repeater
```

```

    通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
    at&f /?
    Factory Defaults
    &F4 - Mesh With Center Master
    &F5 - Mesh With Center Slave
    &F7 - PMP Master
    &F8 - PMP Slave
    &F9 - PMP Repeater
    &F10 - PP Master
    &F11 - PP Slave
    &F12 - PP Repeater
    OK
    
```

8.4 Master Setting

```

    通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
    at&f7 A
    OK
    at&w B
    OK
    at&v C
    T900
    900MHz Hopping Radio System
    Hardware Version TZ60136B
    Firmware Version 0001-20220623-0A
    Software Version 0001-20220623-0A
    Serial Number 123456

    Network Type           S133=0 D           Operating Mode           S101=0 I
    Wireless Link Rate     S103=0 E           Output Power (dBm)     S108=30
    NetWork Address(ID)   S104=1234567890 G Unit Address             S105=0 J
    Synchronous Address   S118=0 K           Destination Address    S140=0 L
    Serial Baud Rate       S102=7 G           Serial Channel Mode    S142=0
    Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
    Encryption Enable      S159=0
    RSSI Form Master (dBm) S123=-255           Repeaters Index        S114=1
    RSSI Form Slaver (dBm) S124=-255
    OK
    
```

- A) AT&F7 - Restore the factory default settings for the point-to-multipoint master
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT&S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S141 - Whether a repeater exists on the network
- I) S101 - The operating mode must be set to 0, corresponding to the master
- J) S105 - For the unit address, refer to the example in Section 8.7
- K) S118 - For the sync address, refer to the example in Section 8.7
- L) S140 - For the destination address, refer to the example in Section 8.7

After the configuration is completed, run the AT&W command to save the current settings. Run the AT&A command to exit the AT command mode and then the settings take effect.

8.5 Slave Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f8 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=2 I
Wireless Link Rate     S103=0 E           Output Power(dBm)    S108=30
NetWork Address(ID)   S104=1234567890 F Unit Address           S105=0 J
Synchronous Address   S118=0 K           Destination Address  S140=0
Serial Baud Rate      S102=7 G           Serial Channel Mode  S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master(dBm) S123=-255          Repeater Index       S114=1
RSSI Form Slaver(dBm) S124=-255
OK

```

- A) AT&F8 - Restore the factory default settings for the point-to-multipoint slave
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT\$S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S141 - Whether a repeater exists on the network
- I) S101 - The operating mode must be set to 2, corresponding to the slave
- J) S105 - For the unit address, refer to the example in Section 8.7
- K) S118 - For the sync address, refer to the example in Section 8.7
- L) S140 - For the destination address, refer to the example in Section 8.7

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

8.6 Repeater Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f9 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=1 I
Wireless Link Rate     S103=0 E           Output Power (dBm)   S108=30 J
NetWork Address(ID)   S104=1234567890 F  Unit Address          S105=0 J
Synchronous Address   S118=0 K           Destination Address   S140=0
Serial Baud Rate       S102=7 G           Serial Channel Mode   S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master (dBm) S123=-255          Repeater Index        S114=1
RSSI Form Slaver (dBm) S124=-255

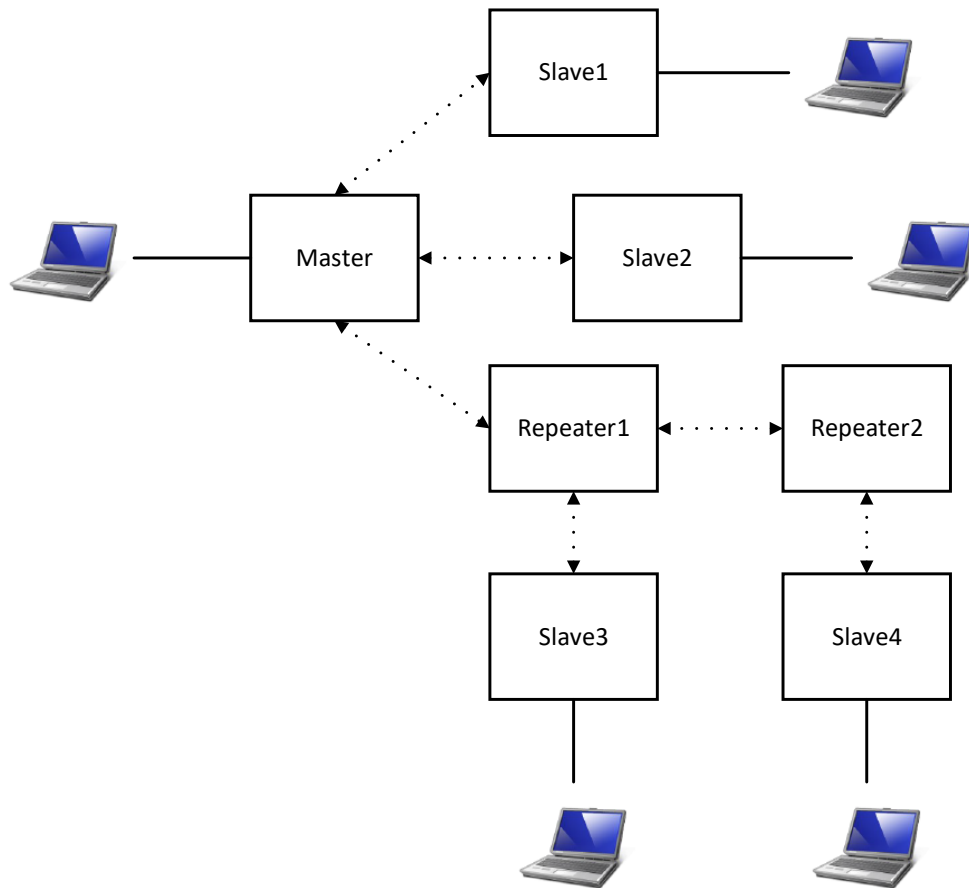
OK

```

- A) AT&F9 - Restore the factory default settings for the point-to-multipoint repeater
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT\$S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S141 - Whether a repeater exists on the network
- I) S101 - The operating mode must be set to 1, corresponding to the repeater
- J) S105 - For the unit address, refer to the example in Section 8.7
- K) S118 - For the sync address, refer to the example in Section 8.7
- L) S140 - For the destination address, refer to the example in Section 8.7

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

8.7 Examples for Configuring Point-to-Multipoint Network Addresses



A point-to-multipoint network has one master, four slaves, and two repeaters. Slave 1, slave 2, and repeater 1 are synchronized to the master, repeater 2 is synchronized to repeater 1, slave 3 is synchronized to repeater 1, and slave 4 is synchronized to repeater 2. S141=1 at the master indicates that there are repeaters on the network. The following table describes the local address and sync address settings of each device.

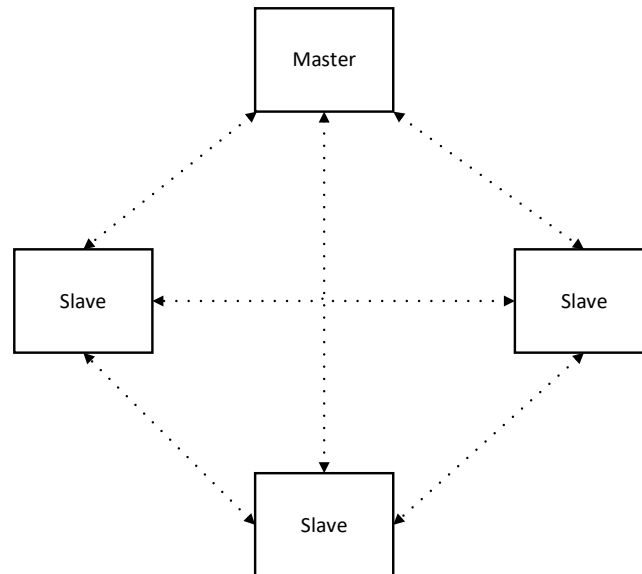
	Local Address S105	Sync Address S118	Destination Address S140
Master	1	0	0
Repeater 1	2	1	0
Repeater 2	3	2	0
Slave 1	4	1	0
Slave 2	5	1	0
Slave 3	6	2	0
Slave 4	7	3	0

On the same point-to-multipoint network, the local address of each device must be unique and non-0. Set the sync address to the local address of its upper-level device. The destination address is usually set to 0, or set to the local address of a certain device if it is appointed to be received.

9 Mesh with Center Networks

A mesh with center network is a special point-to-multipoint network. The center of the network is still the master, and all the slaves can exchange data with each other but do not forward data. A mesh with center network needs to be configured with the network type register S133=2. **This network type does not support repeater.**

The master can use destination address S140 to temporarily select a specific slave to communicate with, filtering out data transmission requests from other devices.



The Mesh with Center Network topology

9.1 Configuration Preparations

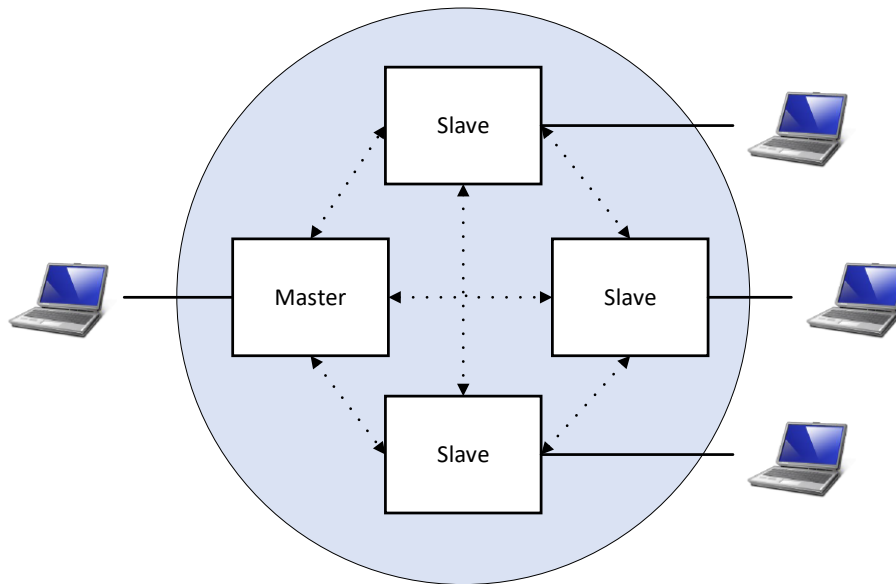
Before configuration, you must use the matched development board or user-designed hardware to provide power and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols. For details about relevant interfaces, see Chapter 3 Hardware Description.

9.2 Operating Mode

The T900 mesh-with-center network supports only two operating modes: master and slave. The repeater is not supported.

The master provides synchronization signals for the entire network to ensure normal communication between all devices.

The slave is the final node of the network and communicates directly with the master or the slave. When no user data is transmitted on the point-to-multipoint network, the slave device synchronizes with the master device and does not send any information on the network.



For a mesh with center network, registers S105, S118 and S140 need to be configured in advance to determine the network topology.

The operating mode configuration register is S101. Run the following command:

```
ATS101=0 -- Master
ATS101=2 -- Slave
```

9.3 Use Factory Defaults

The factory defaults command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using the factory defaults sets all registers to their default values. Using the default settings has the following benefits:

1. To speed up the configuration process. If there is no special requirements, please use the default configuration.

2. To troubleshoot issues. If communication cannot be established due to the adjustment of the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory defaults provide all the functionality required for a mesh-with-center network. No matter how complex the special requirements are, the configuration can be started from the factory default settings. All operating modes and network types have corresponding factory default settings commands.

AT&F4 -- Factory default settings for the Mesh-with-Center master

AT&F5 -- Factory default settings for the Mesh-with-Center slave

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f /?
Factory Defaults
&F4 - Mesh With Center Master
&F5 - Mesh With Center Slave
&F7 - PMP Master
&F8 - PMP Slave
&F9 - PMP Repeater
&F10 - PP Master
&F11 - PP Slave
&F12 - PP Repeater
OK
    
```

9.4 Master Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f7 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=0 I
Wireless Link Rate     S103=0 E           Output Power(dBm)    S108=30
NetWork Address(ID)   S104=1234567890 F  Unit Address          S105=0 J
Synchronous Address   S118=0 K           Destination Address   S140=0 L
Serial Baud Rate       S102=7 G           Serial Channel Mode   S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master(dBm) S123=-255          RSSI Form Slaver(dBm) S124=-255

OK
    
```

- A) AT&F7 - Restore the factory default settings for the mesh-with-center master
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 2, corresponding to mesh with center network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use AT\$S104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S141 - Whether a repeater exists on the network or not, the value must be set to 0
- I) S101 - The operating mode must be set to 0, corresponding to the master
- J) S105 - For the unit address, refer to the example in point-to-multipoint networks
- K) S118 - For the sync address, refer to the example in point-to-multipoint networks
- L) S140 - For the destination address, refer to the example in point-to-multipoint networks

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

9.5 Slave Setting

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at+f8 A
OK
at+w B
OK
at+v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=2 I
Wireless Link Rate     S103=0 E           Output Power(dBm)     S108=30
NetWork Address(ID)    S104=1234567890 F  Unit Address           S105=0 J
Synchronous Address   S118=0 K           Destination Address   S140=0
Serial Baud Rate       S102=7 G           Serial Channel Mode    S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master(dBm) S123=-255          Repeater Index         S114=1
RSSI Form Slaver(dBm) S124=-255

OK

```

- A) AT&F7 - Restore the factory default settings for the mesh-with-center slave
- B) AT&W - Save setting parameters
- C) AT&V - Display the current settings
- D) S133 - The network type must be set to 2, corresponding to mesh with center network
- E) S103 - The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput. The lower the rate, the better the sensitivity
- F) S104 - The network addresses (IDs) of all devices on the network must be set to the same. It is strongly recommended not to use the default settings, 1234567890. To change the network address, use ATS104=xxxxxxx
- G) S102 - The baud rate of the serial port matches that of the connected device
- H) S141 - Whether a repeater exists on the network or not, the value must be set to 0
- I) S101 - The operating mode must be set to 2, corresponding to the slave
- J) S105 - For the unit address, refer to the example in point-to-multipoint networks
- K) S118 - For the sync address, refer to the example in point-to-multipoint networks
- L) S140 - For the destination address, refer to the example in point-to-multipoint networks

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and then the settings take effect.

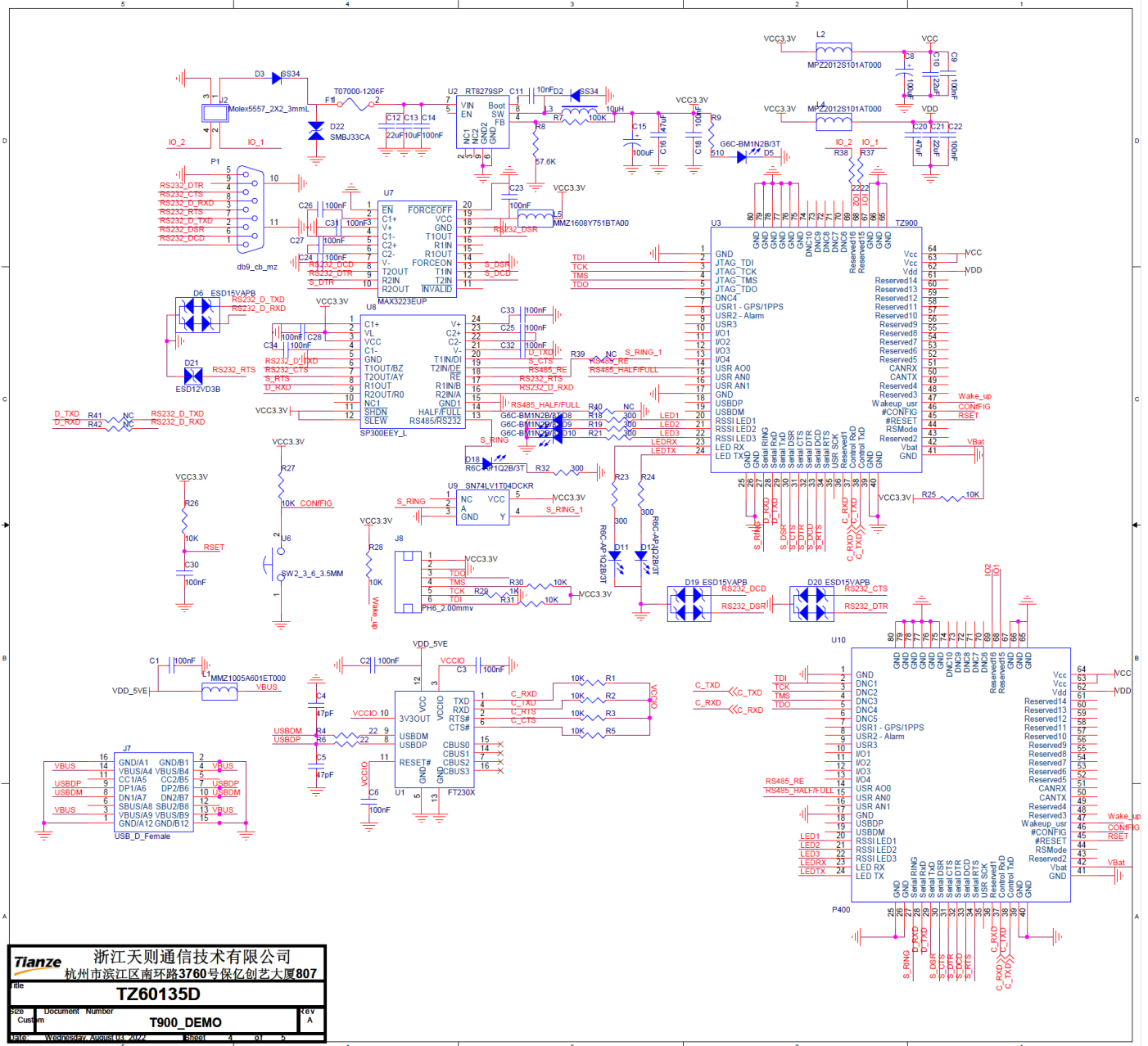
9.6 Packet Length Limit

In the case of a central Mesh network, when the channel access mode is TDMA, each device communicates with each other. When multiple devices send data, data output from serial ports will interleave each other. To ensure the integrity of data packets, the length of data packets must be smaller than the maximum length sent by a single time slot.

When the channel access mode is set to TDMA_AUTO, the length of customer data packets is not restricted.

Wireless Link Rate	Maximum Length of a Single Packet
276.4 kbps	175 bytes
230.4 kbps	140 bytes
172.8 kbps	100 bytes
115.2 kbps	55 bytes
57.6 kbps	15 bytes

10 Appendix A: Base Plate reference design



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File	TZ60135D
Size	Document Number
Custom	T900_DEMO
URL	Version
WED155549V_A000103_2017	1.0