



E21-400G37S

User Manual

ISM band 433/470MHz patch type PA/LNA amplifier module



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Chapter I Overview

1.1 Introduction

E21-400G37S is a pure hardware RF medium power amplifier (PA) launched by Chengdu Yibaite Company. The maximum output power is 37dBm, covering the frequency range of 410~493MHz. The module has a built-in LNA low noise amplifier, which greatly improves the communication distance between wireless networks.

The imported high-quality PA chip+our unique design scheme can greatly improve the working efficiency of PA, lower the working temperature, and enable continuous data transmission under the ambient temperature of -40~+85 degrees. Built in LNA low noise amplifier, filter, limiting device, low noise figure, improve the receiving sensitivity of the receiving channel, and expand the communication distance.



Ultra low power consumption design, standby current is only 3uA, control mode is simple, only two I/O ports are required for receiving and transmitting control switching, SOP chip design mode, ultra small size, very easy to embed, the entire scheme is designed according to industrial grade, and the back is large area of bare copper, customers can simply and reasonably add appropriate heat dissipation treatment according to requirements. Ultra high stability, suitable for a variety of application scenarios, has been widely used in various industries, with stable performance, long transmission distance, strong penetration and diffraction ability, etc.

1.2 Features and functions

- Under ideal conditions, the communication distance can reach 20km;
- The maximum transmission power is 37dBm;
- 410~493MHz frequency band;
- High efficiency PA power amplifier, with PA efficiency above 40%;
- LNA low noise amplifier, sensitivity increased by 14-17dB;
- Built in amplitude limiting device to limit the input power amplitude of the receiving channel;
- Ultra low power consumption design, standby current is only 3uA;
- Support 3.3~5.5V internal control power supply and 7.5V PA power supply;
- Industrial standard design, supporting long-term use at -40~+85 °C;
- The installation of stamp hole patch is conducive to integration and mass production.

Chapter II Specifications

2.1 Limit parameter

Main parameter	Performance		Note
	Min	Max	
Supply voltage (V)	3.3	5.5	Permanently burned modules over 6V
PA drive voltage (V)	7.4	7.6	Default 7.5V power supply can output full power
Blocking power (dBm)	-	10dbm	High burning probability of high-power module in close use
Operating temperature (°C)	-40	+85	Industrial grade

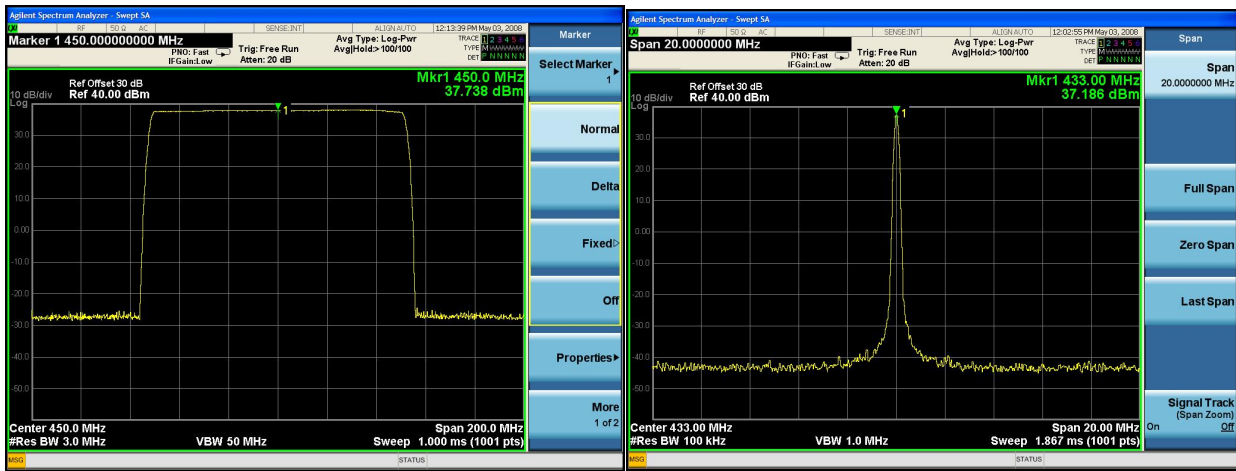
2.2 Working parameters

Main parameter		Performance			Note
		Min	Type	Max	
Supply voltage (V)		3.3	5	5.5	≥ 4.7V guaranteed output power
PA control voltage (V)		7.4	7.5	7.6	7.5V is recommended to ensure the best performance
Operating temperature (°C)		-40	25	+85	Industrial grade design
Operating frequency band (MHz)		410	-	493	ISM band
Power waste	Emission current (mA)	1400	1500	1600	Instantaneous power 37dBm (power supply voltage 5V, PA voltage 7.5V test)
	Receiving current (mA)	6.5	8	-	-100dBm input current 8mA
	Sleep current (μA)		3.0		T/RX_EN = 0
Maximum transmit power (dBm)		36	37	38	The front stage input power is greater than 17dBm, which can ensure full power output
Receive gain (dBm)		14	15	17	-100dBm input

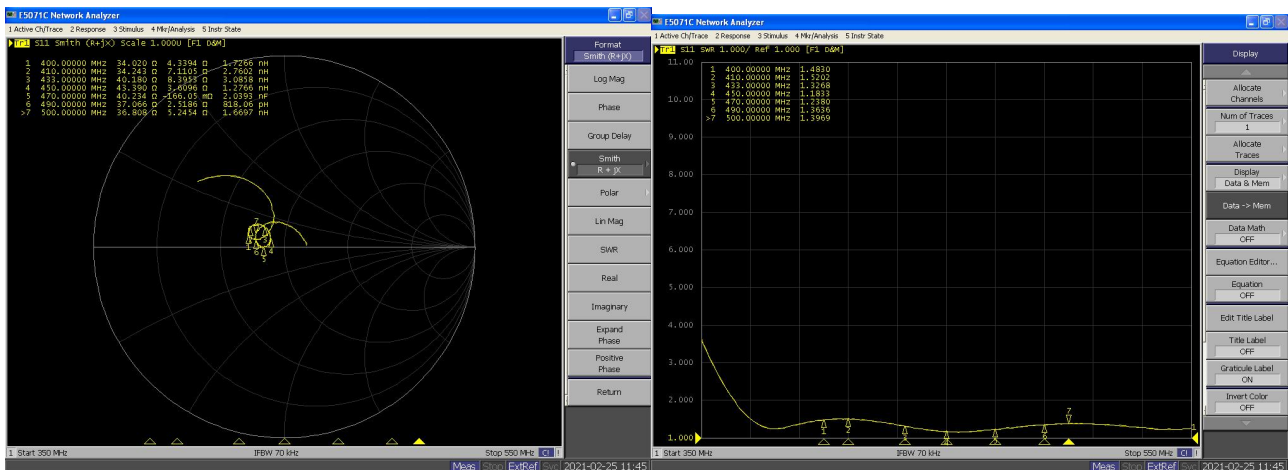
2.3 Parametric curve

Main parameter	Description	Note
Reference distance	20Km	Clear and open environment, antenna gain 5dBi, antenna height 2m, air speed 2.4kbps
Packaging method	SMD	/
Interface mode	1.5mm	Stamp hole
Overall dimensions	45*30mm	/
RF input/output interface	Stamp/IPX	Equivalent impedance about 50 Ω

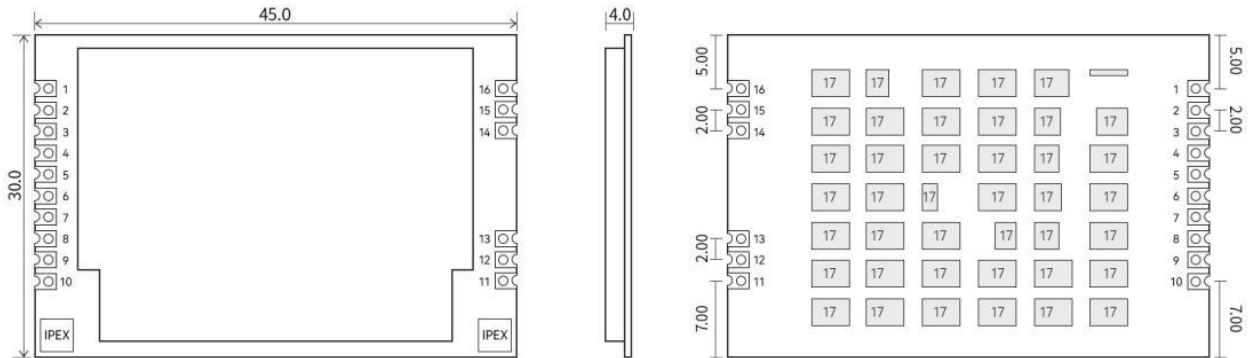
2.3.1 Power



2.3.2 Smith and SWR



Chapter 3 Mechanical Dimensions and Pin Definitions



pad : 1.95
0.80 1.50

Unit : mm
pad quantity : 17
Tolerance value : X.X±0.1mm
X.XX±0.05mm

PIN	Name	Direction	Usage
1	GND		Ground wire, connected to reference ground
2	+7.5V		PA drive power VCC1
3	+7.5V		PA drive power VCC1
4	GND		Ground wire, connected to reference ground
5	+5V		Control power supply VCC2
6	GND		Ground wire, connected to reference ground
7	TXEN	Input	Enable the transmission mode, effective at high level (support 3.3V/5V level)
8	RXEN	Input	Receive mode enable, active at high level (support 3.3V/5V level)
9	GND		Ground wire, connected to reference ground
10	PIN	Input/Output	Transmission mode: RF signal input/reception mode: RF signal output
11	POUT	Output/Input	Transmission mode: RF signal output/reception mode: RF signal input
12	GND		Ground wire, connected to reference ground
13	GND		Ground wire, connected to reference ground
14	GND		Ground wire, connected to reference ground
15	GND		Ground wire, connected to reference ground
16	GND		Ground wire, connected to reference ground
17	GND		Bottom heat dissipation pad, connecting module GND

Note:

1. TXEN and RXEN cannot be opened at the same time at any time, which may cause direct damage to PA module.
2. The bottom bonding pad is connected to the internal GND, which needs to be coated with silicone grease for heat dissipation or welded to the base plate to enhance heat dissipation.

Chapter 4 Basic Operation

4.1 Hardware design

- It is recommended to use DC regulated power supply to supply power to the module. The ripple coefficient of the power supply should be as small as possible. The module should be reliably grounded. It is recommended to use power supply above 20W;
- Please pay attention to the correct connection of the positive and negative poles of the power supply. If the connection is reversed, the module may be permanently damaged;
- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, and the voltage cannot fluctuate significantly and frequently;
- When designing power supply circuit for modules, it is often recommended to reserve more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module shall be as far away from power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference as possible;
- High frequency digital wiring, high frequency analog wiring and power wiring must avoid the lower part of the module. If it is really necessary to pass under the module, suppose that the module is welded on the Top Layer, and the top layer of the module contact part is paved with copper (all are paved with copper and well grounded), and must be close to the digital part of the module and routed on the Bottom Layer;
- If the module is welded or placed in the top layer, it is also wrong to randomly route in the bottom layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- If there are components with large electromagnetic interference around the module, it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to keep away from the module properly. If circumstances permit, appropriate isolation and shielding can be done;
- Assuming that there are wiring (high-frequency digital, high-frequency analog, power wiring) with large electromagnetic interference around the module will also greatly affect the performance of the module, it is recommended to keep away from the module appropriately according to the intensity of the interference, and appropriate isolation and shielding can be done if circumstances permit;
- The antenna installation structure has a great impact on the module performance. It is necessary to ensure that the antenna is exposed, preferably vertically upwards. When the module is installed inside the enclosure, high-quality antenna extension cable can be used to extend the antenna outside the enclosure;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.
- Pay attention to the good grounding, large area of grounding, small power ripple, increase the filter capacitor and try to be close to the VCC and GND pins of the module;

4.2 Software Edit

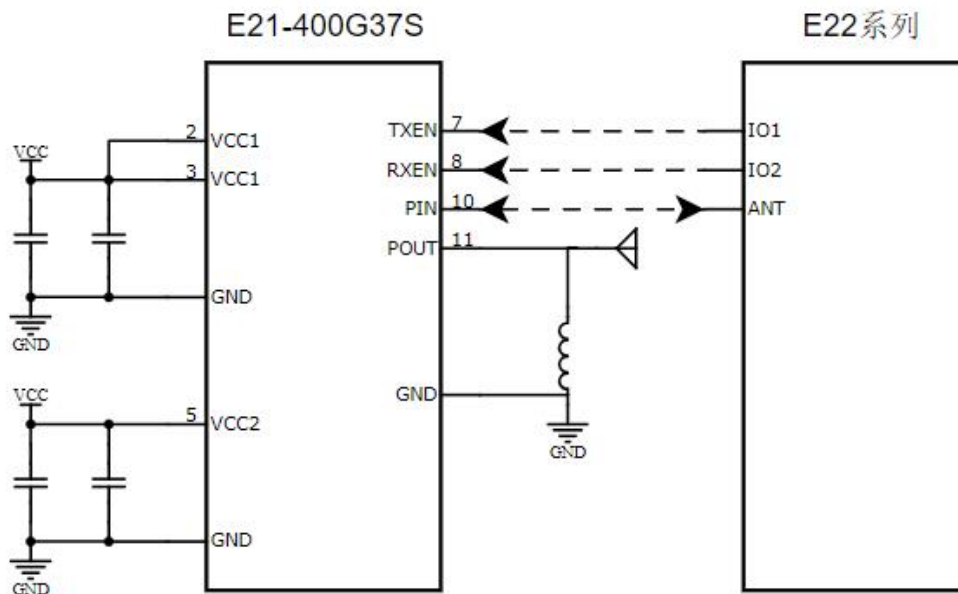
1. Mode description

Note: TX will be sent 2mS in advance_ EN is opened, and start time is reserved;

Pin Name		Mode	Note
TXEN	RXEN		External input high and low level, select mode (support 3.3/5V level)
L	L	Sleep mode	When the module enters the sleep mode, PA and LNA do not work
L	H	Receiving mode	When the module enters the receiving mode, PA does not work and LNA works
H	L	Emission mode	The module enters the transmission mode, PA works, LNA does not work
H	H	Not allow	TXEN and RXEN cannot be high level at the same time, including program initialization, otherwise the module will be permanently damaged

Chapter 5 Basic Application

5.1 Basic circuit



Chapter 6 FAQ

6.1 Transmission distance is not ideal

- When there is a linear communication obstacle, the communication distance will decay accordingly;
- Temperature, humidity and co frequency interference will lead to higher communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- The sea water has a strong ability to absorb radio waves, so the seaside test effect is poor;
- If there are metal objects near the antenna or placed in the metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air rate is set too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply is lower than the recommended value at room temperature, and the lower the voltage, the smaller the power generation;
- The matching degree between the antenna and the module is poor or the quality of the antenna itself is poor.

6.2 Modules are easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, and the voltage cannot fluctuate significantly and frequently;
- Please ensure anti-static operation during installation and use, and electrostatic sensitivity of high-frequency devices;
- Please ensure that the humidity during installation and use is not too high, and some components are humidity sensitive devices;
- If there is no special demand, it is not recommended to use it at too high or too low temperature.

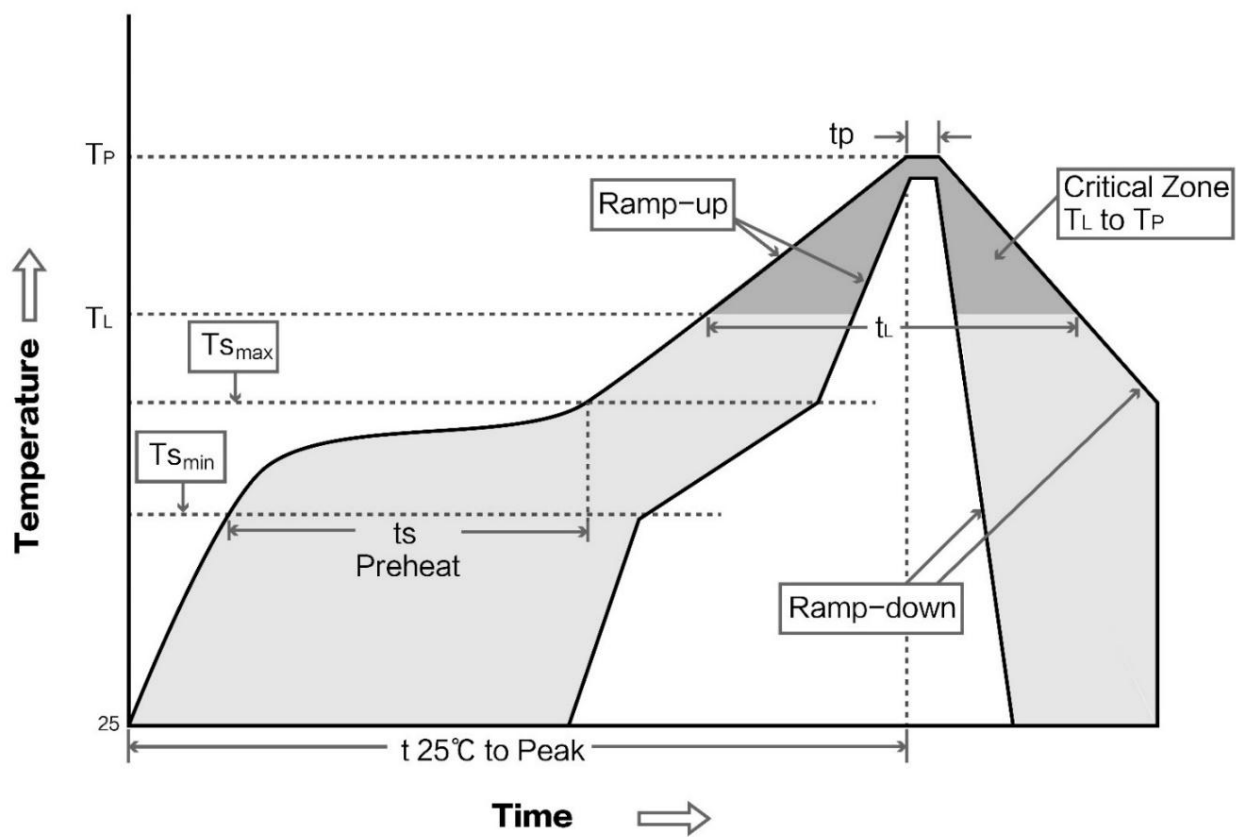
Chapter 7 Welding Operation Guidance

7.1 Reflow soldering temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (T _{smin})	Minimum preheating temperature	100℃	150℃
Preheat temperature max (T _{smax})	Maximum preheating temperature	150℃	200℃
Preheat Time (T _{smin} to T _{smax}) (t _s)	Warm up time	60-120 sec	60-120 sec
Average ramp-up rate(T _{smax} to T _p)	Average rate of rise	3℃/second max	3℃/second max

Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time (tL) Maintained Above (TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate (Tp to Tsmax)	Average falling rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25 ℃ to peak temperature	6 minutes max	8 minutes max

7.2 Reflow welding curve



Chapter 8 Related Models

Model	PA + LNA	Frequency	PA maximum power	LNA gain	Packaging form	Antenna form
		MHz	dBm	dBm		
E21-400G30S	√	400~470	30	15	SMD	Stamp hole
E21-900G30S	√	850~931	30	12	SMD	Stamp hole

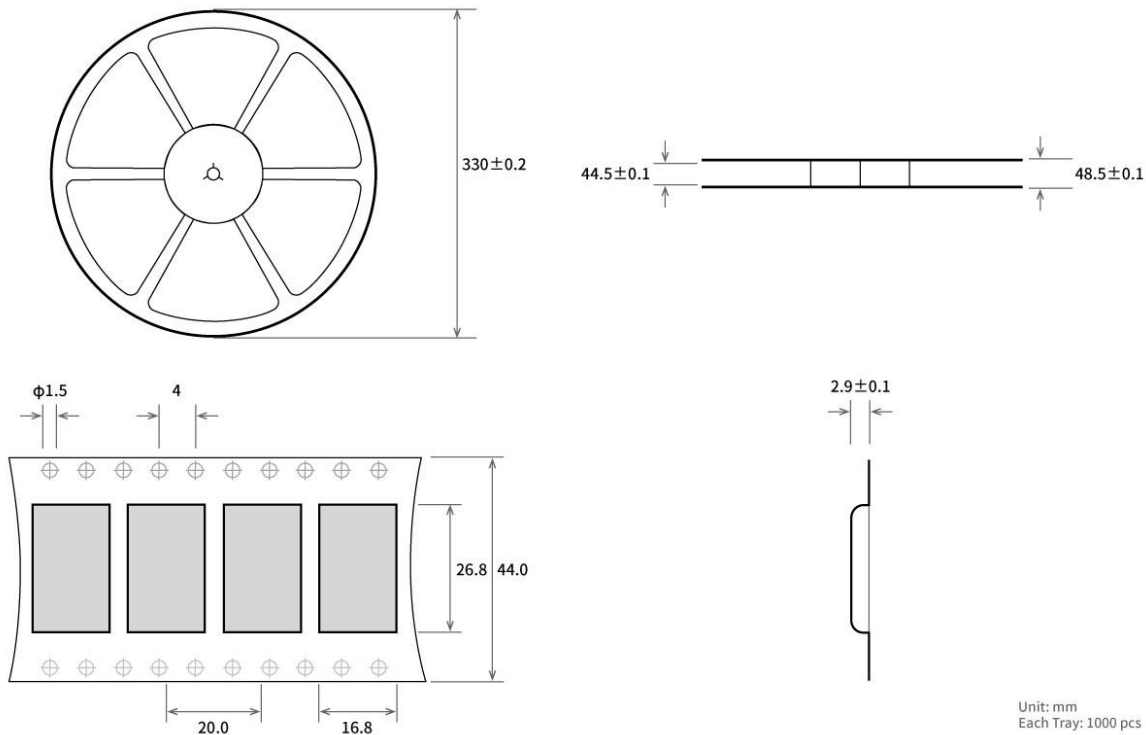
Chapter 9 Antenna Guide

9.1 Antenna recommendation

Antennas play an important role in the communication process, and poor quality antennas often have a great impact on the communication system. Therefore, we recommend some antennas to be used as antennas supporting our wireless modules with excellent performance and reasonable price.

Model	Type	Frequency	Gain	Size	Feeder	Interface	Feature
		MHz	dBi	cm	cm		
TX433-XP-200	Sucker	400~470	4	1.9	200	SMA-J	Ultra short straight, omnidirectional antenna
TX433-JKD-20	Rubber	400~470	4	2.0	/	SMA-J	Bendable rubber rod, omnidirectional antenna
TX868-XPL-100	Sucker	850~900	3.5	2.9	100	SMA-J	Small sucker antenna, cost-effective
TX868-JKD-20	Rubber	850~900	3.0	2.0	/	SMA-J	Bendable rubber rod, omnidirectional antenna
TX915-XPL-100	Sucker	900~931	3.5	2.6	100	SMA-J	Small sucker antenna, cost-effective
TX868-JKS-20	Rubber	900~931	3.0	2.1	/	SMA-J	Bendable rubber rod, omnidirectional antenna

Chapter 10 Batch Packaging Method



Revision History

Version	Revision date	Description	Maintainer
1.0	2021-8-31	First published	LJ
1.1	2022-10-12	Parameter confirmation	Yan



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