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E61-TTL-1W Datasheet v1.0

1. Introduction E61-TTL-1W

1.1 Feature E61-TTL-1W

E61-TTL-1W is a high-speed wireless transceiver module, operates at 425~450.5MHz (Default: 433MHz), embedded with high-performance MCU and high-speed RF chip, transparent transmission is available.

The package length is unlimited when module works in Continuous transmission mode, which perfectly realizes continuous transmission for baud rate of 57600/38400/19200/9600 and so on. Air data rate, FEC, password etc. are configurable for user when module works in fixed-length transmission. Transmit data to other modules with configured air data rate in the most efficient way, which realizes low-latency and high-response. The high-speed feature of module is suitable for polling sampling, handshake response communication, and supporting Modbus protocol.

1.2 Basic usage E61-TTL-1W

No.	Usage	Description
1	Continuous transmission (010: Continuous Mode)	In this mode the data transmitting length is unlimited: Perfectly realize continuous transmission for baud rate of 57600/38400/19200/9600/4800/2400/1200.
2	Fixed-length transmission (000: Constant Length)	Air data rate, FEC and Encryption is configurable by users; To transmit data to the receiver in present air data rate in a most effective way to realize low delay and high respond.
3	Encryption	Module has 65536 ciphers (text) reserved for user to define, only when the cipher is matched can the module receive data.
4	High-speed transmission	High air data rate and low delay in 433MHz. Suitable for polling sampling and hand-shake communication and Modbus is available.
5	Broadcast	Set the address as 0xFFFF: All data transmission of modules in the same channel can be monitored. Data transmitted can be received by modules in the same channel to realize broadcasting and monitoring.
6	FEC	Forward Error Correction, high coding efficiency & good correction performance. In the case of sudden interference, it can correct the interfered data packets automatically, so that the reliability & transmission range are improved correspondingly. Without FEC, those date packets can only be dropped.
7	Sleep	When the module works in sleep mode (Mode 3), transmitting & receiving is not available. The typical current is only a few uA.
8	Applicable environment	433MHz is for free which can be used directly by users; compared with 2.4GHz, 433MHz is good in penetrability and diffraction, but air data rate is less than 2.4GHz.
See more details in related manual.		

1.3 Electrical parameter E61-TTL-1W

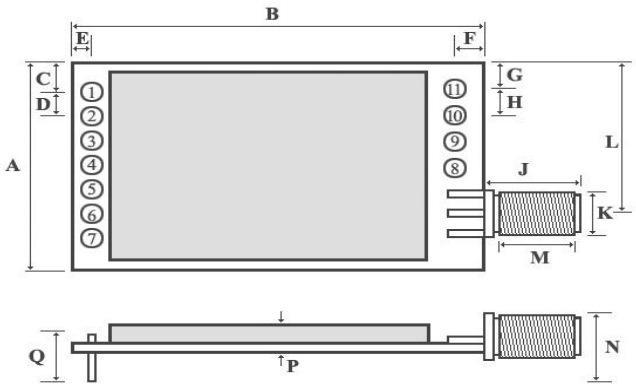
No.	Parameter item	Parameter details	Description
1	Size	24* 43mm	Without SMA
2	Weight	8.3g	With SMA
3	Frequency Band	433MHz	Frequency range：425~450.5MHz, Channel: 256 433±5MHz (recommended)
4	PCB	4-layer	Impedance-matching, lead-free
5	Connector	1 * 7 * 2.54mm	Plug-in
6	Supply voltage	2.8 ~ 5.5V DC	5V (recommended) Voltage higher than 5.5V is forbidden.
7	Communication level	Maximum 5.2V	To lower power consumption, a difference less than 0.3V from supply voltage is recommended.
8	Operation Range	2500m	Continuous transmission：Clear and open area, 30dBm, antenna gain: 5dBi，height: 2m，baud rate: 9600
		6000m	Fixed-length transmission：The same area, 30dBm, antenna gain: 5dBi ,height: 2m ,air date rate: 1.2kbps
9	Transmitting power	30dBm	4 optional level（30, 27, 24, 21dBm）
10	Air data rate	Automatic	Continuous transmission： Match with UART baud rate automatically.
		1.2kbps	Fixed-length transmission：8 optional level （1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 50, 70kbps）
11	Standby current	2.0uA	M1=1, M0=1（Mode 3）
12	Transmitting current	480mA@30dBm	≥1A
13	Receiving current	19mA	Mode 0 (M1=0, M0=0)
14	Communication interface	UART	8N1, 8E1, 8O1, Eight kinds of UART baud rate, from 1200 to 115200 bps（Default: 9600）
15	Driving mode	UART	Can be configured to push-pull/high pull,open-drain
16	Transmitting length	Unlimited	Continuous transmission：UART baud rate：≤57600
		256 bytes buffer	Fixed-length transmission：77 bytes per package
17	Receiving length	Unlimited	Continuous transmission
		256 bytes buffer	Fixed-length transmission
18	Address	65536	0xFF FF is for broadcasting
19	WOR	Not available	-
20	Encryption	Available	65536 self-defined ciphers to prevent data disclosure
21	Sensitivity	-126dBm@1.2kps	Sensitivity has nothing to with baud rate or timing
22	Antenna type	SMA-K	External thread hole, 50Ω impedance
23	Operating temperature	-40 ~ +85℃	Industrial grade
24	Operation Humidity	10% ~ 90%	No condensation
25	Storage temperature	-40 ~ +125℃	Industrial grade

1.4 E61 series E61-TTL-1W

Model	Frequency (Hz)	Power (dBm)	Distance (km)	Size (mm)	Package	ANT
E61-TTL-50	433M	17	1.0	21*36	Plug-in	SMA-K
E61-TTL-1W	433M	30	2.5	24*43	Plug-in	SMA-K

2. Functional description E61-TTL-1W

2.1 Pin definition E61-TTL-1W

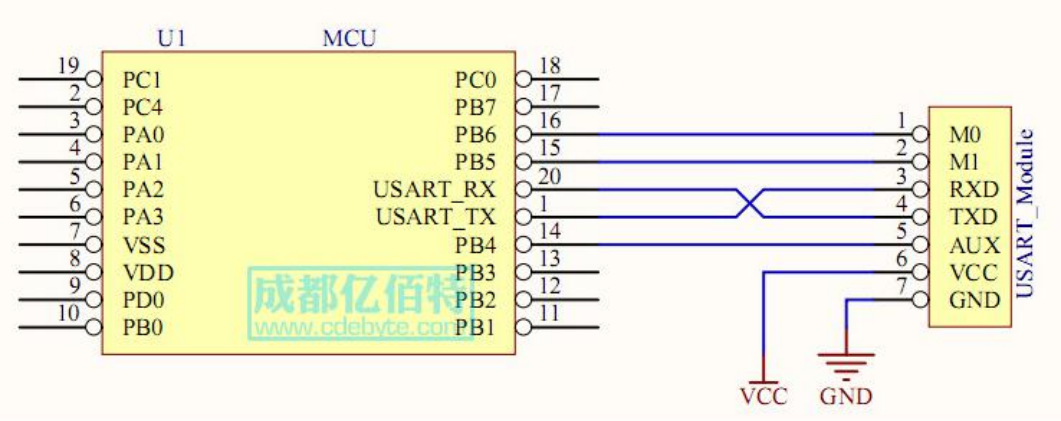


Units: mm

	MIN	MAX
A	24.0	24.1
B	43.0	43.1
C	4.36	4.40
D	2.54	2.54
E	1.48	1.52
F	3.00	3.10
G	4.18	4.22
H	2.54	2.54
J	9.60	9.60
K	6.20	6.20
L	19.0	19.1
M	11.0	11.1
N	12.8	12.9
P	4.20	4.30
Q	11.2	11.3

Pin No.	Pin item	Pin direction	Pin application
1	M0	Input (weak pull-up)	Work with M1 & decide the four operating modes. Floating is not allowed, can be ground.
2	M1	Input (weak pull-up)	Work with M0 & decide the four operating modes. Floating is not allowed, can be ground.
3	RXD	Input	TTL UART inputs, connects to external (MCU, PC) TXD output pin. Can be configured as open-drain or pull-up input.
4	TXD	Output	TTL UART outputs, connects to external RXD (MCU, PC) input pin. Can be configured as open-drain or push-pull output
5	AUX	Output	To indicate module ' s working status & wakes up the external MCU. During the procedure of self-check initialization, the pin outputs low level. Can be configured as open-drain output or push-pull output (floating is allowed).
6	VCC		Power supply 2.8V~5.5V DC
7	GND		Ground
8	Fixing hole		Fixing hole
9	Fixing hole		Fixing hole
10	Fixing hole		Fixing hole
★★★ E61-TTL-1W can be compatible with other E61 series. ★★★			

2.2 Connect to MCU E61-TTL-1W



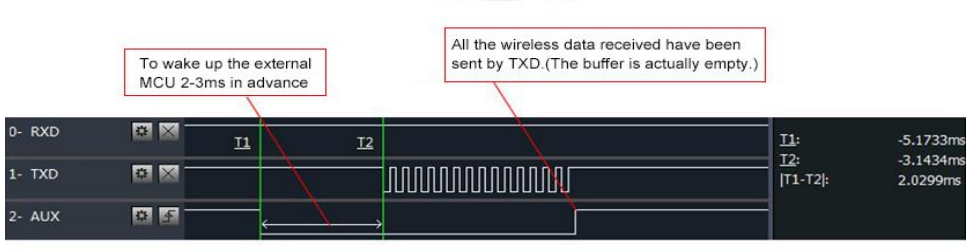
No.	Description (STM8L MCU)
1	The UART module is TTL level.
2	For some MCU works at 5VDC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

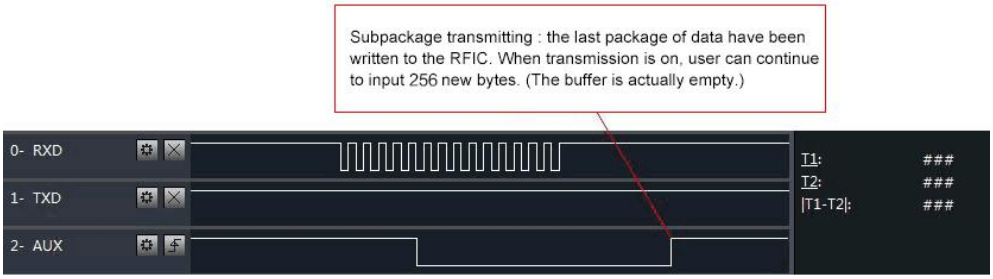
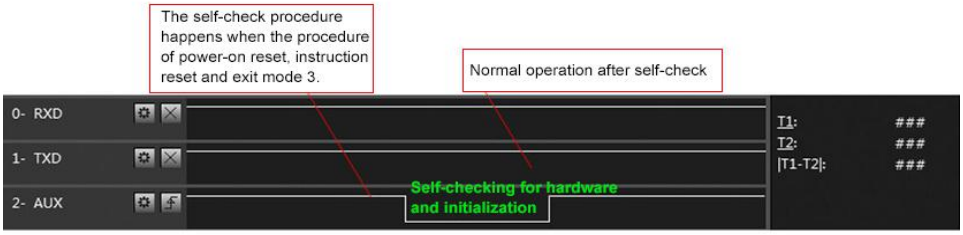
2.3 Reset E61-TTL-1W

No.	Description
1	When the module is powered, AUX outputs low level immediately, conducts hardware self-check and set the operating mode on the basis of the user parameters. During the process, the AUX keeps low level. After the process completes, the AUX outputs high level and starts to work as per the operating mode combined by M1 and A0. Therefore, the user needs to wait the AUX rising edge as the starting point of module’ s normal work.

2.4 AUX description E61-TTL-1W

AUX Pin can be used as indication for wireless send & receive buffer and self-check. It can indicate whether there are data that are yet to send through wireless, or whether all wireless data has sent through UART, or whether the module is still in the process of self-check initialization.

No.	Description
1	【Indication of UART output】can be used to wake up external MCU.  Timing Sequence Diagram of AUX when TXD pin transmits

2	【Indication of wireless transmitting】 Buffer (empty): the internal 256 bytes data in the buffer are written to the RFIC (Auto subpackage). When AUX=1, the user can input data less than 256 bytes continuously without overflow. Buffer (not empty): when AUX=0, the internal 256 bytes data in the buffer have not written to the RFIC completely. If the user starts to transmit data at this circumstance, it may cause overtime when the module is waiting for the user date, or transmitting wireless subpackage. Notes: When AUX = 1, it does not mean that all the UART data of the module have been transmitted already, perhaps the last packet of data is still in transmission.  **Timing Sequence Diagram of AUX when RXD pin receives**
3	【Configuration procedure of module】 Only happened in the process of power-on and exit sleep mode.  **Timing Sequence Diagram of AUX when self-check**

No.	Notes for AUX
1	For function 1 & function 2 mentioned above, the priority should be given to the one with low level output, which means if it meets each of any low level output condition, AUX outputs low level, if none of the low level condition is meet, AUX outputs high level.
2	When AUX outputs low level, it means the module is busy & cannot conduct operating mode checking. After AUX outputs high level 1ms later, it will complete the mode-switch task.
3	After switching to new operating mode, it won’ t be work in the new mode immediately until AUX rising edge 2ms later. If AUX is on the high level, the operating mode switch can be effect immediately.
4	When the user switches to other operating modes from mode 3 (sleep mode) or it’ s still in reset process, the module will reset user parameters, during which AUX outputs low level.

3. Operating mode E61-TTL-1W

Contents in below table are the introduction of input status of M1 & M0 and their corresponding mode:

Mode (0-3)	M0	M1	Mode introduction	Notes
Mode 0 Transmitting	0	0	UART and wireless channel are open, transparent transmission is on.	In this mode, module can be configured as Continuous transmission (default) and fixed-length transmission.
Mode 1 Reserve	1	0	Reserve	
Mode 2 Command	0	1	UART is open, wireless channel is disabled, can be used for parameter-setting.	For parameter-setting
Mode 3 Sleep	1	1	Enter sleep mode, UART and module is closed.	

3.1 Mode switch E61-TTL-1W

No.	Notes
1	The user can decide the operating mode by the combination of M1 and M0. The two GPIO of MCU can be used to control the mode-switch. After modifying M1 or M0, it will start to work in new mode 1 ms later if the module is free. If there are any serial data that is yet to finish wireless transmitting, it will start to work in new mode after the UART transmitting finishing. After the module receives the wireless data & transmits the data through serial port, it will start to work in new mode after the transmitting finishing. Therefore, the mode-switch is only workable when AUX outputs 1, otherwise it will delay.
2	For example, in mode 0, if the user inputs massive data consecutively and switches operating mode at the same time, the mode-switch operation is invalid. New mode checking can only be started after all the user’s data process completing. It is recommended that after check AUX pin output status and wait 2ms after AUX outputs high level, then switch the mode.
3	If the module switches from other modes to stand-by mode, it will be work in stand-by mode only after all the remained data process completing. The feature can be used to save power consumption. For example, the transmitter works in mode 0, after the external MCU transmits data “12345”. It can switch to sleep mode immediately but not wait the rising edge of the AUX pin, also the user’s main MCU will go dormancy immediately. Then the module will transmit all the data through wireless transmission & go dormancy 1ms later automatically. Which reduce MCU working time & save power.
4	Likewise, this feature can be used in any mode-switch. The module will start to work in new mode within 1ms after completing present mode task, which enable the user to omit the procedure of AUX inquiry and switch mode swiftly. For example, when switch from transmitting mode to receiving mode, the user MCU can go dormancy in advance of mode-switch, using external interrupt function to get AUX change so that the mode-switch can be done.
5	This operation is very flexible and efficient. It is totally designed on the basis of the user MCU’s convenience, at the same time reduce the whole system work load as much as possible, increase the efficiency of system work and reduce power consumption.

3.2 Normal mode (Mode 0) E61-TTL-1W

		When M1 = 0 & M0 = 0, module works in mode 0
Continuous Mode	Transmitting	The air data rate is matched automatically according to baud rate (≤57600) , the module will start continuous data transmission. When the baud rate 115200, the module can transmit data but can not conduct continuous mode. It is not recommended to set 115200 to achieve continuous transmission. When the module receives the first data packet from user, the AUX outputs low level(means "transmitting occupied"). After the module transmit all the data into RF chip & start transmission, AUX outputs high level.
	Receiving	When internal module receives data from transceiver , AUX outputs low level (means "receiving occupied") and after 5ms of delay, the data is transmitted via TXD pin; when all data transmitted via TXD the AUX outputs high level; the UART baud rate for transceiver and receiver must be the same. When module receives data from transceiver, TXD can output data continuously without any gap of time between bytes. "Continuous mode" is applicable in occasions that have strict time requirements such as Modbus.
Constant Length Mode	Transmitting	Users can set baud rate, air data rate, address, FEC, encryption and so on flexibly with max transmitting length of 77 bytes per packet; The rule is : In present air data rate, to receive data from transceiver to receiver as quick as possible; When data received via RXD surpass 77 bytes, the module can not start wireless transmission(77 bytes for this packet); when surpassing 77 bytes, the data will be transmitted in the next packet; When the data is less than 77 bytes, module will wait a time for 3 bytes, if there is no data inputted by users the module will consider data completed and start transmit all the data. For example, when 1 byte is inputted, the module will wait time for 3 bytes and transmit the byte via a packet; When the module receives the first data packet from user, the AUX outputs low level(means "transmitting occupied"). After the module transmit all the data into RF chip & start transmission, AUX outputs high level; The buffer is 256 bytes, the data inputted to module for one time must not surpass 256 bytes; When AUX turns to high level from low level, the user can input data for next packet.
	Receiving	When internal module receives data from transceiver , AUX outputs low level (means "receiving occupied") and after 5ms of delay, the data is transmitted via TXD pin; when all data transmitted via TXD the AUX outputs high level;

3.3 Reserve mode (Mode 1) E61-TTL-1W

	When M1 = 0 & M0 = 1, module works in mode 1.
Notes	N/A, UART and wireless transmission are closed.

3.4 Command mode (Mode 2) E61-TTL-1W

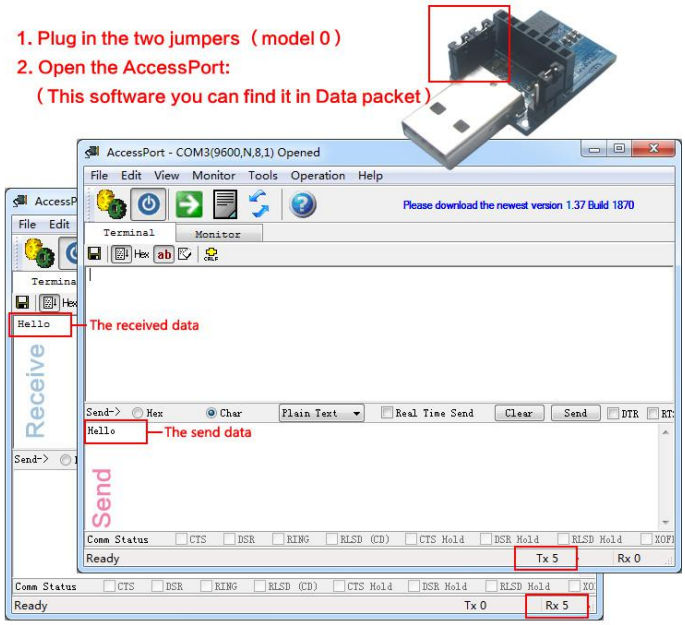
	When M1 = 1 & M0 = 0, module works in mode 2.
Transmitting	N/A
Receiving	N/A
Parameter setting	It uses serial port 9600 & 8N1 to set module working parameters through various instruction format. (please refer to parameter setting for details)

3.5 Sleep mode (Mode 3) E61-TTL-1W

	When M1=1,M0=1,module works in mode 3
Transmitting	N/A
Receiving	N/A
Notes	Wireless receiving is closed and MCU is in sleep mode. The power consumption is only a few uA.

3.6 Quick communication test E61-TTL-1W

Steps	Operation
1	Plug the USB test board (E15-USB-T2) into computer, make sure the driver is installed correctly. Plug mode-select jumper in the USB test board (M1 = 0 , M0 = 0), make the module work in mode 0.
2	Optional power supply, 3.3V or 5V (module supports 2.8V~5.5V).
3	Operate AccessPort software and select the correct serial port code. Observe the transmitting and receiving window.



4. Instruction format E61-TTL-1W

In command mode (mode 2：M1=1, M0=0) , it supports below instructions on list.

Only support 9600 and 8N1 format when setting

No.	Instruction format	Illustration
1	C0 + working parameters	C0 + 5 bytes working parameters are sent in hexadecimal format. 6 bytes in total and must send in succession. (Save the parameters when power-down)
2	C1+C1+C1	Three C1 are sent in hexadecimal format. The module returns the saved parameters and must send in succession.
3	C2 + working parameters	C2 + 5 bytes working parameters are sent in hexadecimal format. 6 bytes in total and must send in succession. (Not save the parameters when power-down)
4	C3+C3+C3	Three C3 are sent in hexadecimal format. The module returns the version information and must send in succession.
5	C4+C4+C4	Three C4 are sent in hexadecimal format. The module will reset one time and must send in succession.

4.1 Default parameter E61-TTL-1W

	Default parameter values：C0 00 00 18 50 50						
Model	Frequency	Address	Channel	Transmitting mode	Baud rate	Parity	Transmitting power
E61-TTL-1W	433MHz	0x0000	0x50	Continuous transmission	9600	8N1	1W

4.2 Parameter setting instruction E61-TTL-1W

No.	Item	Description	Notes
0	HEAD	Fix 0xC0 or 0xC2, it means this frame data is control command	● Must be 0xC0 or 0xC2 C0: Save the parameters when power-down C2: Not save the parameters when power-down
1	ADDH	High address byte of module (The default 00H)	00H-FFH ● Address is defined by ADDH and ADDL to form a 16 bit. ● Only when the address is the same can both parties to communicate. ● When ADDH=FFH, ADDL=FFH, the module has the broadcasting function: 1. As the transceiver, module can transmit data to all modules in different address. 2. As the receiver, module can

			monitor data packets in different address.
2	ADDL	Low address byte of module （The default 00H）	00H-FFH
3	SPED	Rate parameter，including UART baud rate and air date rate 7，6 UART parity bit 00：8N1（default） 01：8O1 10：8E1 11：8N1（equal to 00） ---------- 5，4，3 TTL UART baud rate（bps） 000：1200 001：2400 010：4800 011：9600（Default） 100：19200 101：38400 110：57600 111：115200 ---------- 2，1，0 Air date rate（bps） 000：1.2k 001：2.4k 010：4.8k 011：9.6k 100：19.2k 101：38.4k 110：50k 111：70k	● UART mode can be different between communication parties ---------- ● In Continuous Mode, the baud rate must be same for both communication parties. The higher the baud rate the shorter the transmission distance. ● In Constant Length Mode, UART baud rate can be different between communication parties. The UART baud rate has nothing to do with wireless transmission parameters & won’t affect the wireless transmit / receive features. ---------- ● In Constant Length Mode, The air date rate must keep the same for both communication parties. the lower the air date rate, the longer the transmitting distance, better anti-interference performance and longer transmitting time. ● In Continuous Mode, the setting is not available. The air data rate will match automatically according to UART baud rate.
4	CHAN	Communication frequency（425M + CHAN * 0.1M）Default 50H（433MHz）	● 00H-FFH，for 425~ 450.5Mhz

5	OPTION	7， FEC Enable 1：turn on FEC 0：turn off FEC（Default）	● After turn off FEC, the actual data transmission rate increases while anti-interference ability decreases. Also the transmission distance is relatively short.
		----------	----------
		6 IO drive mode(the default 1) 1：TXD and AUX push-pull outputs, RXD pull-up inputs 0：TXD, AUX open-collector outputs, RXD open-collector inputs	● This bit is used to the module internal pull-up resistor. It also increases the level’ s adaptability in case of open drain. But in some cases, it may need external pull-up (4~10kΩ) resistor.
		----------	----------
		5，4，3 Transmission mode: (for receiver it is monitoring gap time, for transceiver it is gap time for continuously transmitting preamble code) 000: Constant Length 001: Reserved, like 0 010: Continuous Mode (the default) 011: Reserved, like 0 100: Reserved, like 0 101: Reserved, like 0 110: Reserved, like 0 111: Reserved, like 0	● See more details in related chapters.
		----------	----------
		2, Enable Encryption 1: Turn on 0: Turn off (default)	● Defined by users and the encryption must be the same for both parties. ● The switch must keep the same for both parties.

		---------- 1, 0 transmission power (approximation) 00： 30dBm (Default) 01： 27dBm 10： 24dBm 11： 21dBm	---------- ● The external power must make sure the ability of current output more than 1A and ensure the power supply ripple within 100mV. ● Low power transmission is not recommended due to its low power supply efficiency.

For example: The meaning of No.3 "SPED" byte

The binary bit of the byte	7	6	5	4	3	2	1	0
The specific value(user configures)	0	0	0	1	1	0	0	0
Meaning	UART parity bit 8N1		UART baud rate is 9600			Air date rate is 1.2k		
Corresponding hexadecimal	1				8			

4.3 Reading operating parameters E61-TTL-1W

Instruction format	Description
C1+C1+C1	In command mode (M0=0 , M1=1) , User gives the module instruction (HEX format): C1 C1 C1, Module returns the present configuration parameters. For example, C0 00 00 18 50 50.

4.4 Reading version number E61-TTL-1W

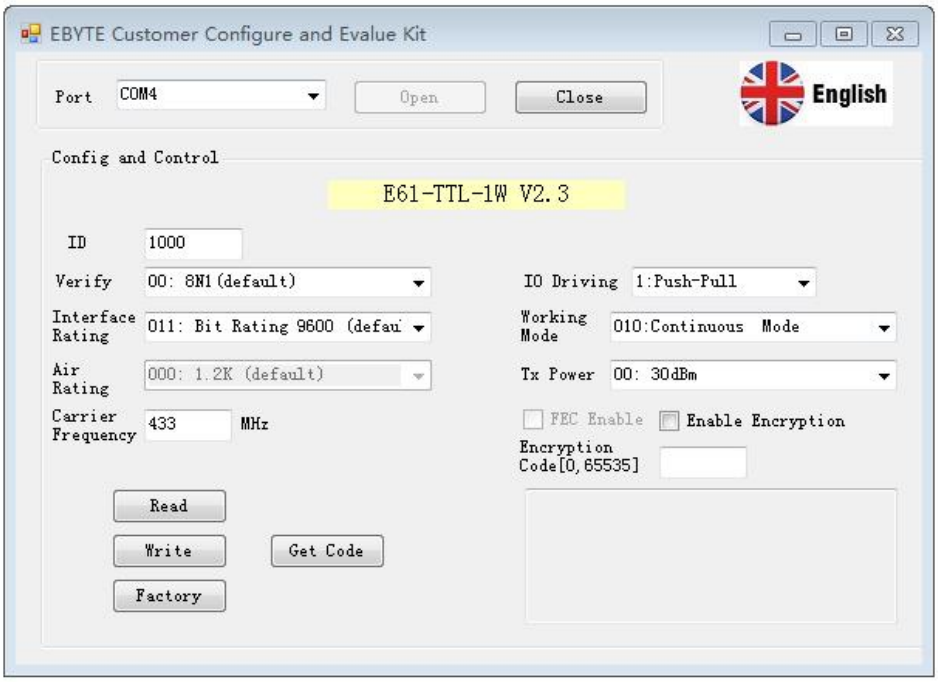
Instruction format	Description
C3+C3+C3	In command mode (M0=0 , M1=1) , User gives the module instruction (HEX format): C3 C3 C3, Module returns its present version number, for example C3 61 xx yy. 61 here means the module model (E61 series); xx is the version number and yy refers to other module features.

4.5 Reset instruction E61-TTL-1W

Instruction format	Description
C4+C4+C4	In command mode (M0=0 , M1=1) , User gives the module instruction (HEX format): C4 C4 C4, the module resets for one time. During the reset process, the module will conduct self-check, AUX outputs low level. After reset completing, the AUX outputs high level, then the module starts to work regularly which the working mode can be switched or be given another instruction.

5. Parameter setting E61-TTL-1W

Step	Operation	Description
1	Install Driver	Please install the USB adapter driver (CP2102).
2	Pull out the jumper	Pull the M1 jumper out as module in mode 2 (M0=0, M1=1). 3.3V or 5V are available for jumper.
3	Connect to module	Connect the module with USB adapter. Connect to the USB interface of PC.
4	Open serial port	Operate the parameter setting software, choose corresponding serial number and press the "Open" button, choose other serial numbers until open successfully.
5	Interface	Press "Read" button as shown below If failed, check if the module is in mode 2, or the driver has been installed or not.
6	Write parameter	Please adjust the parameter as your request according to the corresponding setting, then click "Write" button, write the new parameter to the module
7	Complete the operation	Please operate the "Fifth step" if you need to reconfigure, if the configuration is completed, click "Close" and then take off the module.
8	Instruction setting	Parameters can be set via instructions for MCU, see details in< Instruction Format-Parameter setting instruction>.



6. About us E61-TTL-1W

Chengdu Ebyte Electronic Technology Co., Ltd., a high-tech company focusing on application of Internet of Things, owns a number of independently researched and developed products and obtains unanimous approvals from customers. With a powerful R&D team, perfect after-sales system, our company provides perfect solutions and technical assistance, shortens R&D period, reduces R&D cost and provides a strong platform for brand new ideas about product R&D.

Our products have been widely applied in various fields, such as consumer electronics, industrial control, healthcare, security alarm, field acquisition, smart home, expressway, property management, water and electricity meter reading, power monitoring, etc.

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