E34-2G4H20D

nRF24L01+ 2.4GHz TTL

Auto Frequency Hopping Module

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Contents

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1. Introduction

1.1 Feature

E34-2G4H20D is a 100mW wireless transceiver module, which operates at 2.4-2.518GHz. The outstanding advantages of this module is concentrated power densities, long transmission range, automatic frequency hopping &strong anti-interference, TTL level.

Automatic frequency hopping technology is in order to ensure the communication of the secret and anti-interference, compared with fixed frequency communication, frequency hopping communication is more covert and difficult to be intercepted. Frequency hopping communication also has a good anti-interference ability, even if there are some frequency interference, still can communicate on the undisturbed frequency point.

The module has the function of data encryption & compression. The data of the module transmitted over the air features randomness. And with the rigorous encryption & decryption, data interception becomes pointless. The function of data compression can decrease the transmission time & probability of being interfered, while improving the reliability & transmission efficiency.

No.	Feature	Description
1	Frequency hopping	When the module is in frequency hopping mode, operates automatic frequency hopping function, compared with fixed frequency communication, frequency hopping communication is more obscure and difficult to be intercepted. Frequency hopping communication also has a good anti-interference ability, even if there are some frequency interference, still can communicate on the undisturbed frequency point
2	Fixed transmission	Module can communicate with other modules which work in different channels and address, easy for networking and repeater. Module A transmits AA BB CC to module B (address: 0x00 01, channel: 0x80), HEX format is 00 01 80 AA BB CC (00 01 refers to the address of module B, 80 refers to the channel of module B), then module B receives AA BB CC (only module B).
3	High-speed communication	With high air data rate, it features fast communication speed, low delay and big data packet. This is suitable for those applications requiring low delay and big data packet.
4	Application	2.4G is free frequency band, so users can use it directly without application. Because of high frequency and short wavelength, so it's only suitable for the open area or the effect decreases in the complicated environment.

1.2 Electrical parameter

No.	Item	Parameter details	Description
1	Size	21 * 36mm	Excluding SMA connector
2	Weight	6.7g	Including SMA connector
3	Frequency band	2400 ~ 2518MHz	Default: 2400MHz, Channel:12
4	Process	Lead-free, SMT	-
5	Connector	1 * 7 * 2.54mm	Drop-in
6	Supply voltage	2.3~ 5.5V DC	Note: the voltage higher than 5.5V is forbidden;
7	Communication level	Maximum 5.2V	Recommended difference between supply voltage is less than 0.3V to lower power consumption
8	Operation Range	2000m	Test condition：clear and open area&20dBm，antenna gain: 5dBi ，height:> 2m ，air data rate: 250Kbps
9	Transmitting power	Maximum 20dBm	Four optional level: 20, 14, 8, 2dBm
10	Air data rate	Default 250Kbps	Three optional level: 250, 1000, 2000Kbps
11	Standby current	75uA	M1 =1 ，M0= 1(Mode 3)
12	Transmitting current	110mA@20dBm	≥250mA (recommended)
13	Receiving current	21.5mA	（mode 0 or mode 1）
14	Driving mode	UART	Can be configured to push-pull/high pull, open-drain
15	Communication interface	UART	8N1, 8E1, 8O1， Eight kinds of UART baud rate, from 1200 to 115200 bps
16	Transmitting length	256 bytes	27 bytes per package
17	Receiving length	256 bytes	27 bytes per package
18	Address	4096	Easy for networking, Point to point transmission (no broadcasting)
19	Wake-on-air	Not supported	-
20	RSSI	N/A	-
21	Antenna type	SMA-K	External thread hole, 50Ω characteristic impedance
22	Operating temperature	-40 ~ +85℃	-
23	Operating humidity	10% ~ 90%	Relative humidity, no condensation
24	Storage temperature	-40 ~ +125℃	-
25	Receiving sensitivity	-102dBm@250kbps	Sensitivity has nothing to do with serial baud rate or timing

1.3 E34 series

Model	Interface	Frequency (Hz)	Power (dBm)	Operation range (km)	Air data rate (bps)	Packing
E34-2G4H20D	UART	2.4G	20	2.0	250k~2M	Plug-in
E34-DTU (2G4H20)	232/485	2.4G	20	2.0	250k~2M	Screwing/ DB9
E34-2G4H20D is compatible with other E34 series						

1.4 FAQ

No.	Question	Description
1	Air data rate	Low air rate is recommended, the higher the air rate ,the shorter the range and higher data loss.
2	Antenna selection	Antenna and module frequency must match with each other, the higher the antenna gain higher the better, the lowe SWR the better. Sucker antenna is recommended.
3	Messy codes	One reason is serail port baud rate does not match, another one may be due to inadequate power supply.
4	High delay	Turn off the FEC on both sides, increase air data rate.

2. UART functional description

2.1 Broadcast transmission

	Format	Values
Fixed transmission format (hexadecimal) for example: FF FF 04 AA BB CC FF FF are broadcast address; 04 is the channel of target module; AA BB CC are the data to be sent.		
Transmitter A	HEX	Address: 00 01; Channel: 02
Receiver B	HEX	Address: 00 03; Channel: 04
Receiver C	HEX	Address: 00 05; Channel: 04
Receiver D	HEX	Address: 00 07; Channel: 06
Module A must be in fixed transmission mode.		
Module A sends	HEX	FF FF 04 AA BB CC
Module B receives	HEX	AA BB CC
Module C receives	HEX	AA BB CC
Module D receives	HEX	Null
The receivers under target channel will receive data.. Only 1 data packet length is supported for fixed transmission (refer to electrical parameters); If the data exceeds 1 data packet length, it will be sub-packed automatically.		

2.2 Broadcast address

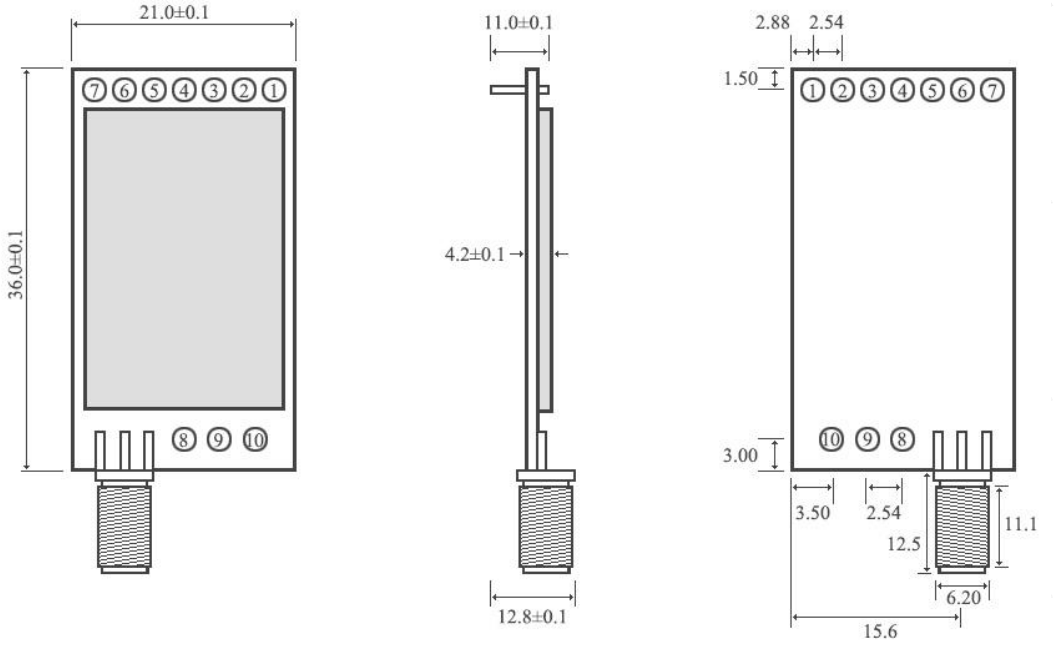
1. For example, set module A address as 0xFF FF and channel as 0x04.
2. When module A is transmitter (transparent mode), all modules with channel 0x04 will receive the data.

2.3 Monitor address

1. For example, set module A address as 0xFF FF and channel as 0x04.
2. When module A is receiver (transparent mode), it with data sent by all modules with channel 0x04.

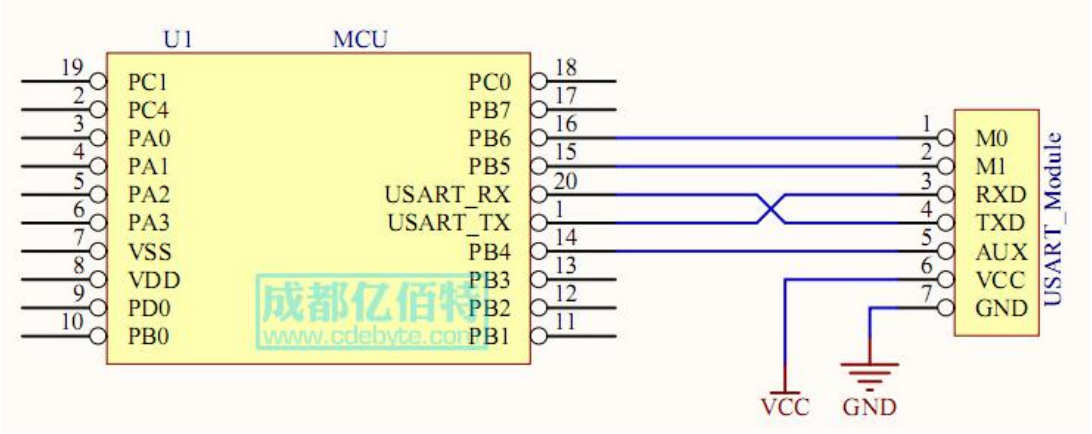
3. Functional description

3.1 Pin definition



Pin	Pin	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 2.3V-5.5V DC
7	GND	-	Ground
8	Fixing hole	-	Fixing hole
9	Fixing hole	-	Fixing hole
10	Fixing hole	-	Fixing hole

3.2 Connect to MCU



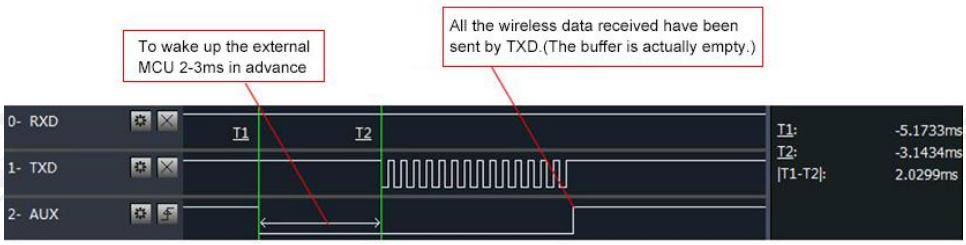
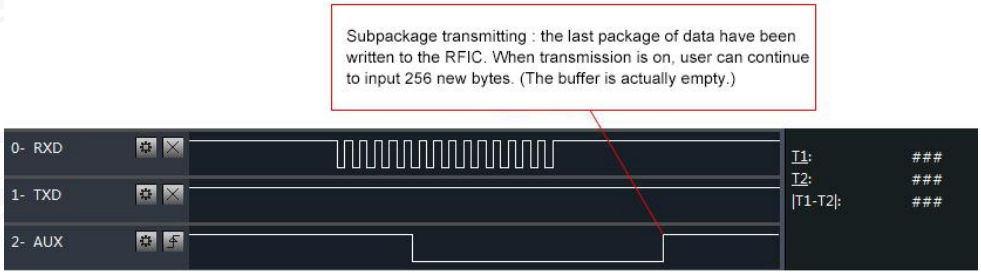
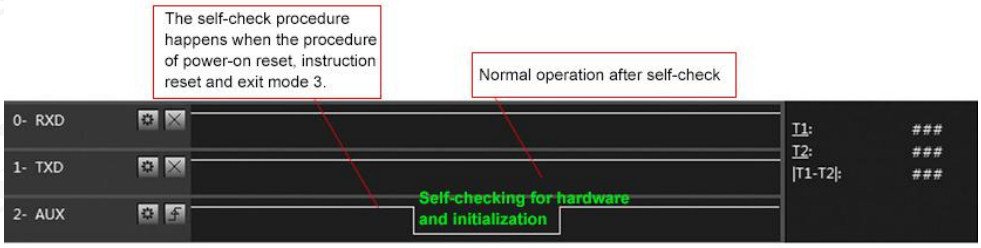
No.	Description（STM8L MCU）
1	The UART module is TTL level.
2	For some MCU works at 5VDC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

3.3 Reset

No.	Description
1	When the module is powered, AUX outputs low level immediately, conducts hardware self-check and sets the operating mode on the basis of the user parameters. During the process, the AUX keeps low level. After the process completed, the AUX outputs high level and starts to work as per the operating mode combined by M1 and M0. Therefore, the user needs to wait the AUX rising edge as the starting point of module′ s normal work.

3.4 AUX description

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 via wireless way, or whether all wireless data has been 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 been 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 data, 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 when power-on resetting or exiting 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 met, AUX outputs high level.
2	When AUX outputs low level, it means the module is busy & cannot conduct operating mode checking. Within 1ms since AUX outputs high level, the mode switch will be completed.
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 effected 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.

4. Operating mode

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

Mode (0-3)	M1	M0	Mode introduction	Remark
Mode 0 Fixed frequency mode	0	0	UART and wireless channel are open, transparent transmission is on.	The receiver must work in mode 0 or mode 2
Mode 1 Frequency hopping mode	0	1	The difference between fixed frequency mode and frequency hopping mode is: the frequency will change in send &receive process according to certain algorithm rules, the scope is not limited to the basic frequency of user setting, the module has a specific spread sequence.	The receiver must work in mode 1
Mode 2 Reservation mode	1	0	Reservation mode	Same with mode 0
Mode 3 Sleep	1	1	Parameter setting	-

4.1 Mode switch

No.	Remarks
1	The user can decide the operating mode by the combination of M1 and M0. The two GPIO of MCU can be used to switch mode. 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 are yet to finish wireless transmitting, it will start to work in new mode after the UART transmitting finished. After the module receives the wireless data & transmits the data through serial port, it will start to work in new mode after the transmitting finished. Therefore, the mode-switch is only valid when AUX outputs 1, otherwise it will delay.
2	For example, in mode 0 or mode 1, 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 completed. It is recommended to check AUX pinout status and wait 2ms after AUX outputs high level before switching the mode.
3	If the module switches from other modes to stand-by mode, it will work in stand-by mode only after all the remained data process completed. The feature can be used to save power consumption. For example, when the transmitter works in mode 0, after the external MCU transmits data ″12345″, it can switch to sleep mode immediately without waiting 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 reduces 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 enables the user to omit the procedure of AUX inquiry and switch mode swiftly. For example, when switching from transmitting mode to receiving mode, the user MCU can go dormancy before mode-switch, using external interrupt function to get AUX change so that the mode-switch can be realized.
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 the work load and power consumption of the whole system has been reduced and the efficiency of whole system is largely improved.

4.2 Fixed Frequency Mode (Mode 0)

	When M1 = 0 & M0 = 0, module works in mode 0
Transmitting	The module can receive the user data via serial port, and transmit wireless data package of 29 bytes. When the data inputted by user is up to 29 byte, the module will start wireless transmission. During which the user can input data continuously for transmission. When the required transmission bytes are less than 29 bytes, the module will wait 3-byte time and treat it as data termination unless continuous data inputted by user. Then the module will transmit all the data through wireless channel. When the module receives the first data packet from user, the AUX outputs low level. After all the data are transmitted into RF chip and transmission is started , AUX outputs high level. At this time, it means that the last wireless data package transmission is started, which enables the user to input another 256 bytes continuously. The data package transmitted from the module working in mode 0 can only be received by the module working in mode 0 or 2.
Receiving	The wireless receiving function of the module is on, the data packet transmitted from the module working in mode 0 & mode 2 can be received. After the data packet is received, the AUX outputs low level, 5ms later the module starts to transmit wireless data through serial port TXD pin. After all the wireless data have been transmitted via serial port, the AUX outputs high level.

4.3 Frequency hopping mode (Mode 1)

	When M1 = 0 & M0 = 1, module works in mode 1.
Transmitting	The condition of data packet transmission & AUX function is the same as mode 0. The only difference is that the module will according to certain algorithm rules, the frequency will change in send &receive process, the scope is not limited to the basic frequency of user setting, the module has a specific spread sequence. Therefore, the data package transmitted from mode 1 can be received by mode 1
Receiving	The same as that in mode 0.

4.4 Reservation mode (Mode 2)

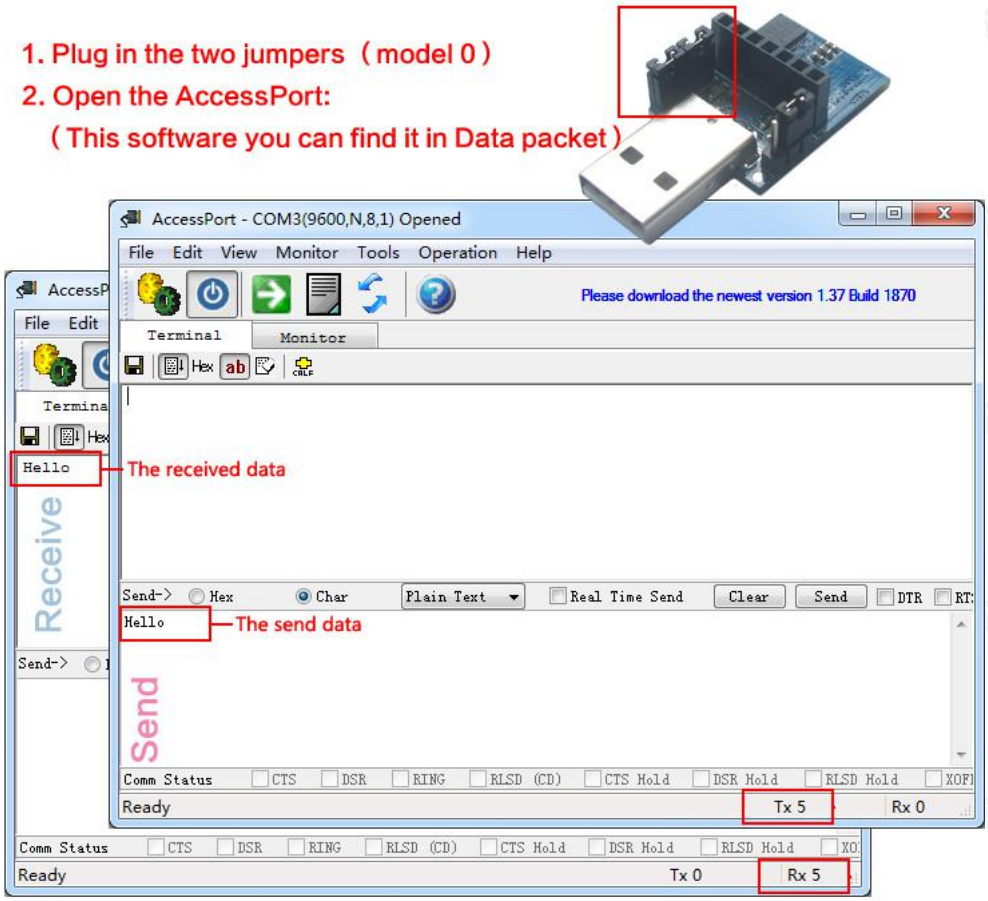
	When M1 = 1 & M0 = 0, module works in mode 2.
Transmitting	The same as that in mode 0.
Receiving	The same as that in mode 0.

4.5 Sleep mode (Mode 3)

	When M1=1, M0=1,module works in mode 3
Transmitting	Cannot send data
Receiving	Cannot receive data
Parameter setting	This mode can be used for parameter setting. It uses serial port 9600 & 8N1 to set module working parameters through specific instruction format.
Notes	When the mode changes from stand-by mode to others, the module will reset its parameters, during which the AUX keeps low level and then outputs high level after reset completed. It is recommended to check the AUX rising edge for user.

4.6 Quick communication test

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 (it supports 2.3V ~ 5.5V).
3	Operate AccessPort software and select the correct serial port code.



5. Instruction format

In sleep mode（mode 3：M1=1, M0=1）, 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 be sent 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 be sent in succession.
3	C2+working parameters	C2 + 5 bytes working parameters are sent in hexadecimal format. 6 bytes in total and must be sent in succession. (Do 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 they must be sent in succession.
5	C4+ C4 +C4	Three C4 are sent in hexadecimal format. The module will reset one time and they must be sent in succession.

5.1 Default parameter

	Default parameter values：C0 00 00 18 00 40						
Model	Frequency	Address	Channel	Air data rate	Baud rate	Parity	Transmitting power
E34-2G4H20D	2.4GHz	0xF000	0x00	250kbps	9600	8N1	100mW

5.2 Parameter setting instruction

The difference between C0 command and C2 command is that C0 command will write parameters into the internal flash memory and can be saved when power down, while C2 command cannot be saved when power down, because C2 command is temporarily mend instruction.

C2 is recommended for the occasion that need to change the operating parameters frequently, such as C2 F0 00 18 00 40

No.	Item	Description	Remark
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-off C2: Do not save the parameters when power-off
1	ADDH	7, 6, 5, 4: resend times (only valid under mode 0 & 2) --- 3, 2, 1, 0: high address（default F0H）	Default 15 times (default F). Lost data will be resent. When multiple same addresses exist, conflict may occur, please set as 0. --- Default 0
2	ADDL	Low address of module (default 00H) （the default 00H）	00H-FFH

3	SPED	Rate parameter，including UART baud rate and air data 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） 000：1200bps 001：2400bps 010：4800bps 011：9600bps（default） 100：19200bps 101：38400bps 110：57600bps 111：115200bps ---------- 2, reserved ---------- 1，0 Air data rate（bps） 00：250（default） 01：1M 10：2M 11：2M (eaqual to 10)	UART mode can be different between communication parties ---------- 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. ---------- 0 is recommended ---------- The lower the air data rate, the longer the transmitting distance, better anti-interference performance and longer transmitting time The air data rate must keep the same for both communication parties. 10 and 11 are 2Mbps
4	CHAN	7，6，5，4： reserved ---------- 3，2，1，0：Channel CHAN（default 0） Fixed frequency mode（mode 0） 0-5 Communication frequency：2400M + CHAN * 2M 6-11 Communication frequency：2508M + (CHAN-6）* 2M Frequency hopping mode（mode 1） 0-11 Communication frequency：2412M + CHAN * 2M	0(recommended) ---------- 0H-0BH，Totally 12 channels

5	OPTION	7， Fixed transmission（similar to MODBUS） 0： Transparent transmission mode（default） 1： Fixed transmission mode ---------- 6 IO drive mode (default 1) 1：TXD and AUX push-pull outputs, RXD pull-up inputs 0：TXD、AUX open-collector outputs, RXD open-collector inputs ---------- 5，4，3， 2 reserved ---------- 1, 1,0 transmitted power(approximation） 00： 20dBm（default） 01： 14dBm 10： 8dBm 11： 2dBm	In fixed transmission mode, the first three bytes of each user's data frame can be used as high/low address and channel. The module changes its address and channel when transmit. And it will revert to original setting after complete the process. ---------- 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 resistor. ---------- 0(recommended) ---------- The peak value of the transmitting current is the current of the data transmission, current value becomes pointless when it is not transmitting The external power must make sure the ability of current output more than 250mA and ensure the power supply ripple within 100mV.

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 data rate is 250k		
Corresponding hexadecimal	1				8			

5.3 Reading operating parameters

Instruction format	Description
C1+C1+C1	In sleep mode（M0=1，M1=1）， User gives the module instruction (HEX format): C1 C1 C1, Module returns the present configuration parameters. For example, C0 00 00 18 00 40.

5.4 Reading version number

Instruction format	Description
C3+C3+C3	In sleep mode（M0=1，M1=1）， User gives the module instruction (HEX format): C3 C3 C3, Module returns its present version number, for example C3 34 xx yy. 32 here means the module model (E34 series); xx is the version number and yy refers to the other module features.

5.5 Reset instruction

Instruction format	Description
C4+C4+C4	In sleep mode（M0=1，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.

6. Parameter setting

Step	Operation	Description
1	Install Driver	Please install the USB adapter driver (CP2102).
2	Pull out the jumper	Pull the M0, M1 jumper out, 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 "OpenPort" button. Please choose other serial numbers until open successfully.
5	Interface	Press "Preset" button , the interface will be as below. If failed, please check if the module is in mode 3, or if the driver has been installed.
6	Input parameter	Please adjust the parameter as your request according to the corresponding setting, then click "SetParam" button, write the new parameter to the module.
7	Complete the o peration	Please operate the "Fifth step" if you need to reconfigure, if the configuration is completed, please click "ClosePort" and then take off the module.
8	Commands Configuration	Parameter configuration is also available for MCU (in mode 3).

7. Customization

★Please contact us for customization.

★Ebyte has established profound cooperation with various well-known enterprises.

Revision history

Version	Date	Description	Operator
1.0	2020-8-20	Initial Version	Li
1.1	2021-4-2	Parameter correction	Linson

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