

TRW-24G

WENSHING® V1.04

Wireless High Frequency Transceiver Module (RF GFSK)



勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-54151736
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

➤ Key Features :

- ▶ Frequency Range: 2.4~2.527GHz
- ▶ Modulate Mode: GFSK
- ▶ Work Voltage: 3V
- ▶ Channel: 128
- ▶ Output Power: 0dBm
- ▶ Data Rate: 1Mbps; 250Kbps
- ▶ Operating Temperature: -40~+85 Centigrade
- ▶ The longest range : 280m (250Kbps); 150m (1Mbps)
- ▶ No dead spaces in reception.
- ▶ Built in antenna.
- ▶ Competitive price.
- ▶ Apply for various type of products: Wireless Joysticks, Wireless Speaker, Wireless Earphone , Wireless Cell phone , Wireless Intercom , Wireless Mouse, Wireless Keyboard and Data Communication.

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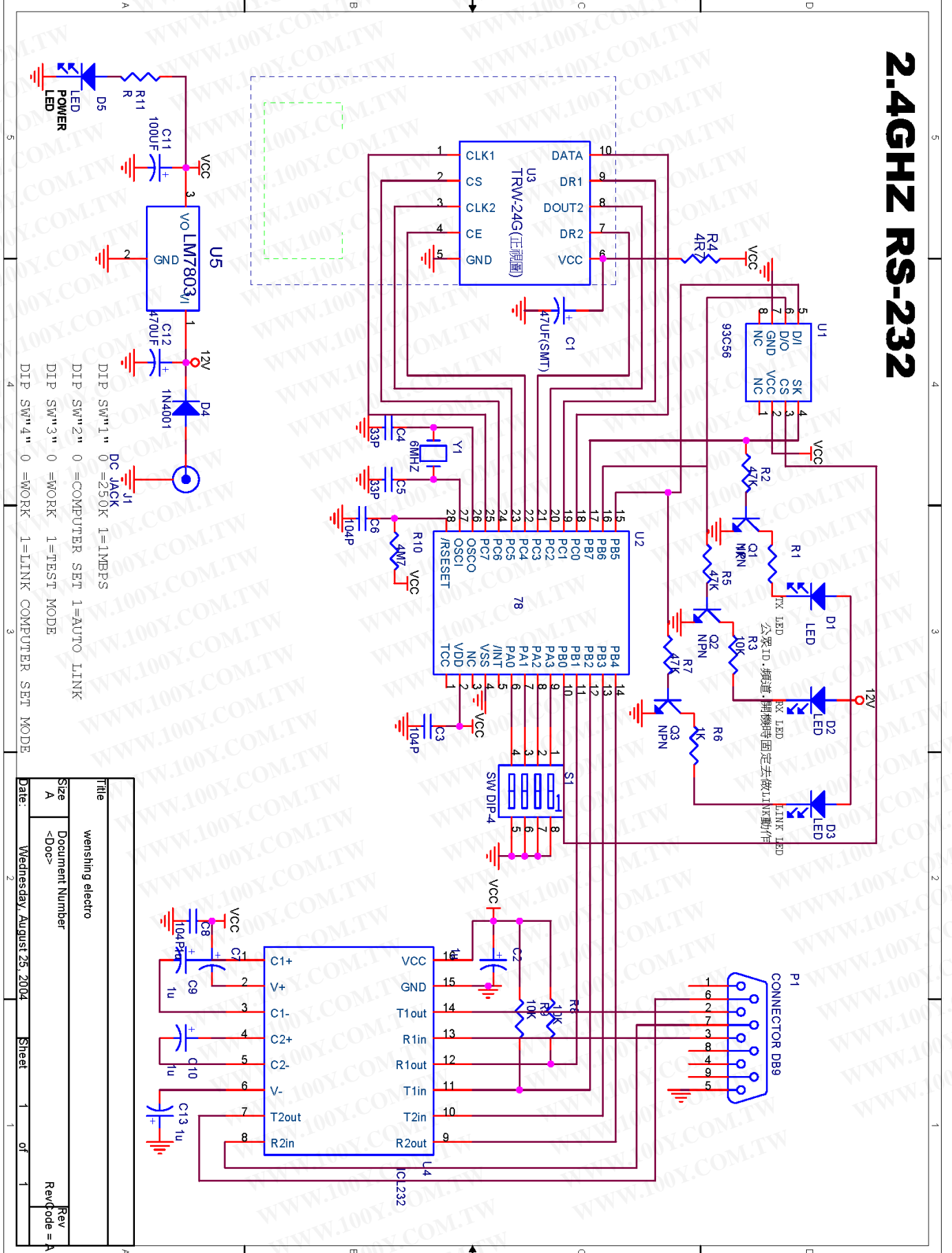
➤ **Specification :**

Conditions: VDD=+3V,VSS=0V,T_A=-40 centigrade to +85 centigrade

Symbol	Parameter(condition)	Min	Typ	Max	Unit
VDD	Supply voltage	1.9	3.0	3.6	V
TEMP	Operating temperature	-40	+27	+85	Centigrade
f _{op}	Operating frequency	2400		2527	MHz
R _{GFSK}	Data rate direct mode	250		1000	Kbps
F _{CHANNEL}	Channel spacing		1		MHz
I _{VDD}	Supply current one channel 250Kbps		18		mA
I _{VDD}	Supply current one channel 1000Kbps		19		mA
I _{VDD}	Supply current two channels 250Kbps		23		mA
I _{VDD}	Supply current two channels 1000Kbps		25		mA
RX _{SENS}	Sensitivity at 0.1%BER(@250Kbps)		-90		dBm
RX _{SENS}	Sensitivity at 0.1%BER(@1000Kbps)		-80		dBm

➤ Demo Circuit Diagram :

2.4GHZ RS-232



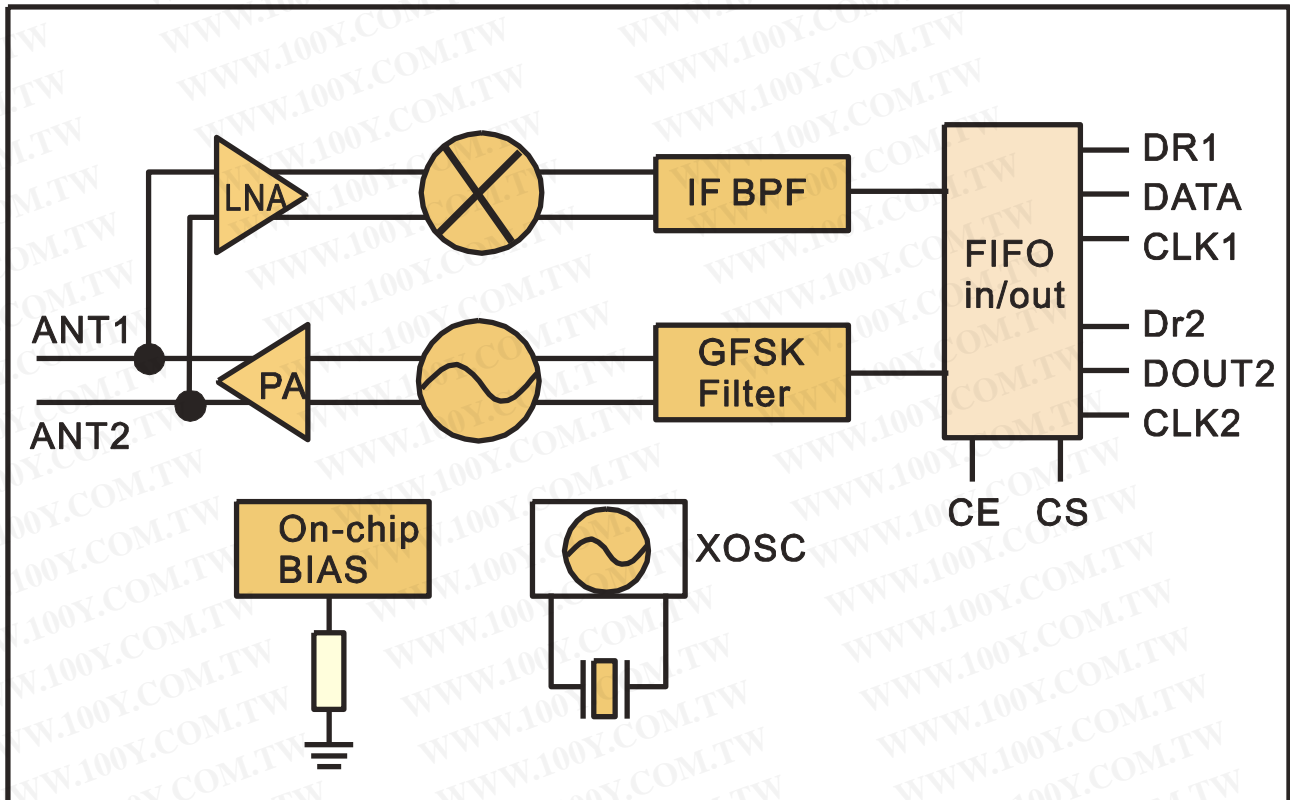
- DIP SW"1" 0 =250K 1=1MEPS
- DIP SW"2" 0 =COMPUTER SET 1=AUTO LINK
- DIP SW"3" 0 =WORK 1=TEST MODE
- DIP SW"4" 0 =WORK 1=LINK COMPUTER SET MODE

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Conditions: VDD = +3V, VSS = 0V, T_A = - 40°C to + 85°C

Symbol	Parameter (condition)	Notes	Min.	Typ.	Max.	Units
Operating conditions						
VDD	Supply voltage		1.9	3.0	3.6	V
TEMP	Operating Temperature		-40	+27	+85	°C
Digital input pin						
V _{IH}	HIGH level input voltage		VDD- 0.3		VDD	V
V _{IL}	LOW level input voltage		V _{SS}		0.3	V
Digital output pin						
V _{OHI}	HIGH level output voltage (I _{OHI} =-0.5mA)		VDD- 0.3		VDD	V
V _{OIL}	LOW level output voltage (I _{OIL} =0.5mA)		V _{SS}		0.3	V
General RF conditions						
f _{OP}	Operating frequency	1)	2400		2524	MHz
Δf	Frequency deviation			±156		kHz
R _{GFSK}	Data rate ShockBurst™		>0		1000	kbps
F _{CHANNEL}	Channel spacing			1		MHz
Transmitter operation						
P _{RF}	Maximum Output Power	4)		0	+4	dBm
P _{RFC}	RF Power Control Range		16	20		dB
P _{RFRC}	RF Power Control Range Resolution				±3	dB
P _{BW}	20dB Bandwidth for Modulated Carrier				1000	kHz
P _{RF2}	2 nd Adjacent Channel Transmit Power 2MHz				-20	dBm
P _{RF3}	3 rd Adjacent Channel Transmit Power 3MHz				-40	dBm
I _{VDD}	Supply current @ 0dBm output power	5)		13		mA
I _{VDD}	Supply current @ -20dBm output power	5)		8.8		mA
I _{VDD}	Average Supply current @ -5dBm output power, ShockBurst™	6)		0.8		mA
I _{VDD}	Average Supply current in stand-by mode	7)		12		μA
I _{VDD}	Average Supply current in power down			1		μA
Receiver operation						
I _{VDD}	Supply current one channel 250kbps			18		mA
I _{VDD}	Supply current one channel 1000kbps			19		mA
I _{VDD}	Supply current two channels 250kbps			23		mA
I _{VDD}	Supply current two channels 1000kbps			25		mA
RX _{SENS}	Sensitivity at 0.1%BER (@250kbps)			-90		dBm
RX _{SENS}	Sensitivity at 0.1%BER (@1000kbps)			-80		dBm
C/I _{CO}	C/I Co-channel			6		dB
C/I _{1ST}	1 st Adjacent Channel Selectivity C/I 1MHz			-1		dB
C/I _{2ND}	2 nd Adjacent Channel Selectivity C/I 2MHz			-16		dB
C/I _{3RD}	3 rd Adjacent Channel Selectivity C/I 3MHz			-26		dB
RX _B	Blocking Data Channel 2			-41		dB

➤ **Circuit Description:**



➤ **ShockBurst™**

The ShockBurst™ technology uses on-chip FIFO to clock in data at a low data rate and transmit at a very high rate thus enabling extremely power reduction.

When operation the TRW-24G in ShockBurst™, you gain access to the high data rates(1 Mbps) offered by the 2.4GHz band without the need of a costly, high-speed micro controller (MCU) for data processing.

By putting all high speed signal processing related to RF protocol on-chip, the TRW-24G offers the following benefits:

- Highly reduced current consumption.
- Lower system cost (facilitates use of less expensive micro controller).
- Greatly reduced risk of 'on-air' collisions due to short transmission time.

The TRW-24G can be programmed using a simple 3-wire interface where the data rate is decided by the speed of the micro controller.

By allowing the digital part of the application to run at low speed while maximizing the data rate on the RF link, the nRF ShockBurst™ mode reduces the average current consumption in applications considerably.

➤ **ShockBurst™ principle:**

When the TRW-24G is configured in ShockBurst™, TX or RX operation is conducted in the following way (10 kbps for the example only).

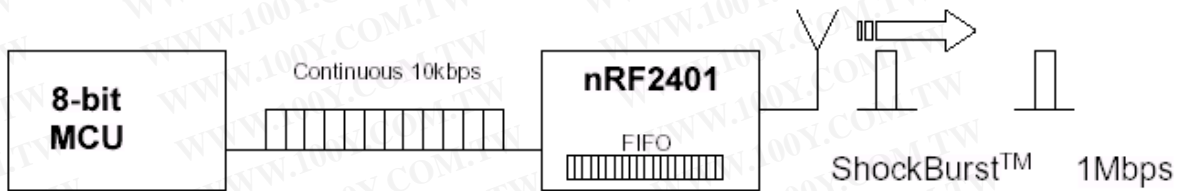


Figure 4 Clocking in data with MCU and sending with ShockBurst™ technology

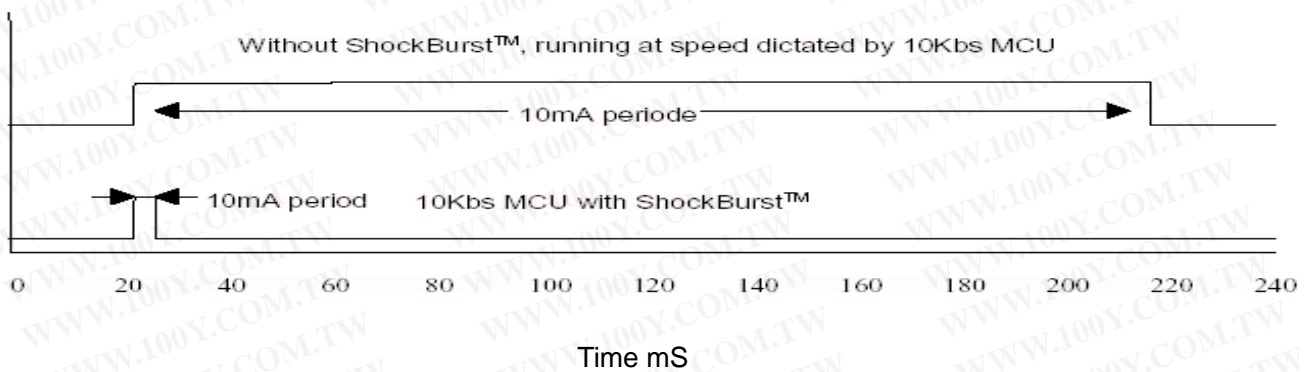


Figure1 Current consumption with & without ShockBurst™ technology

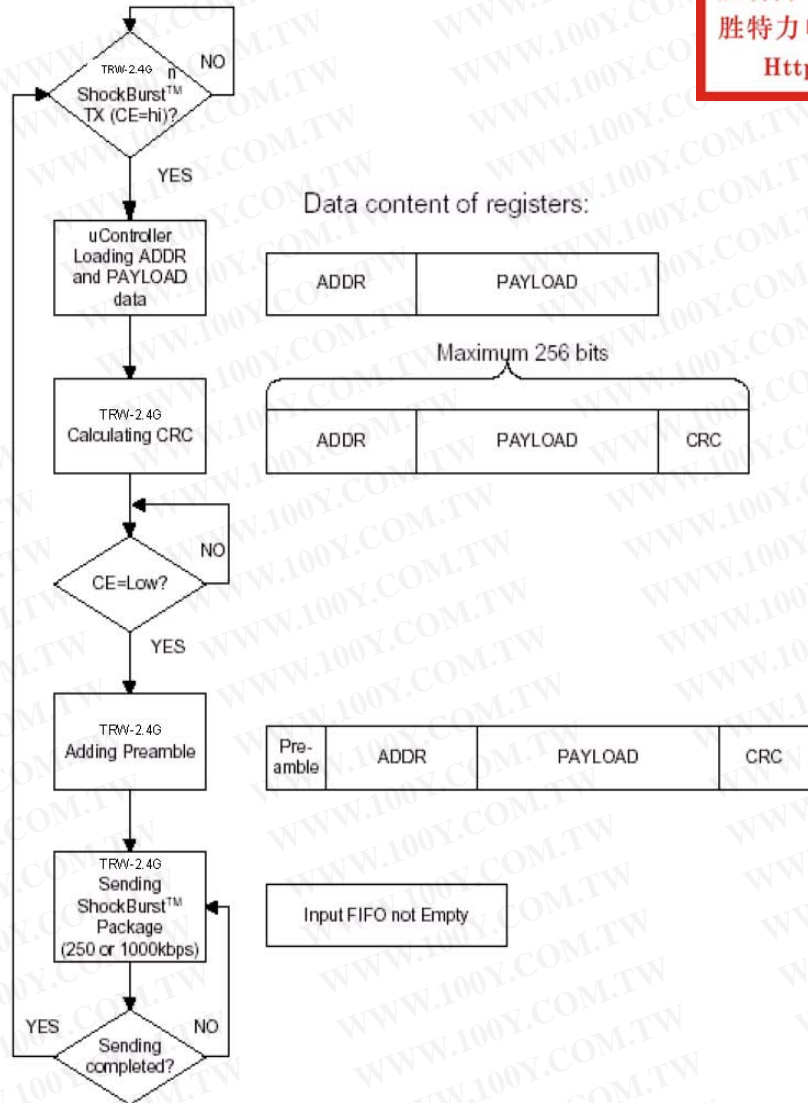


Figure 2 Flow Chart shockBurst™ Transmit of TRW-24G

➤ TRW-24G ShockBurst™ Transmit:

MCU interface pins:CE,CLK1,DATA

1. When the application MCU has data to send,set CE high. This activates TRW-24G on-board data processing.
2. The address of the receiving node(RX address) and payload data is clocked into the TRW-24G. The application protocol or MCU sets the speed <1Mbps(ex:10kbps)>.
3. MCU sets CE low, this activates a TRW-24G ShockBurst™ transmission.
4. TRW-24G ShockBurst™:
 - RF front end is powered up.

- RF package is completed (preamble added, CRC calculated).
- Data is transmitted at high speed (250kbps or 1 Mbps configured by user).
- TRW-24G return to stand-by when finished.

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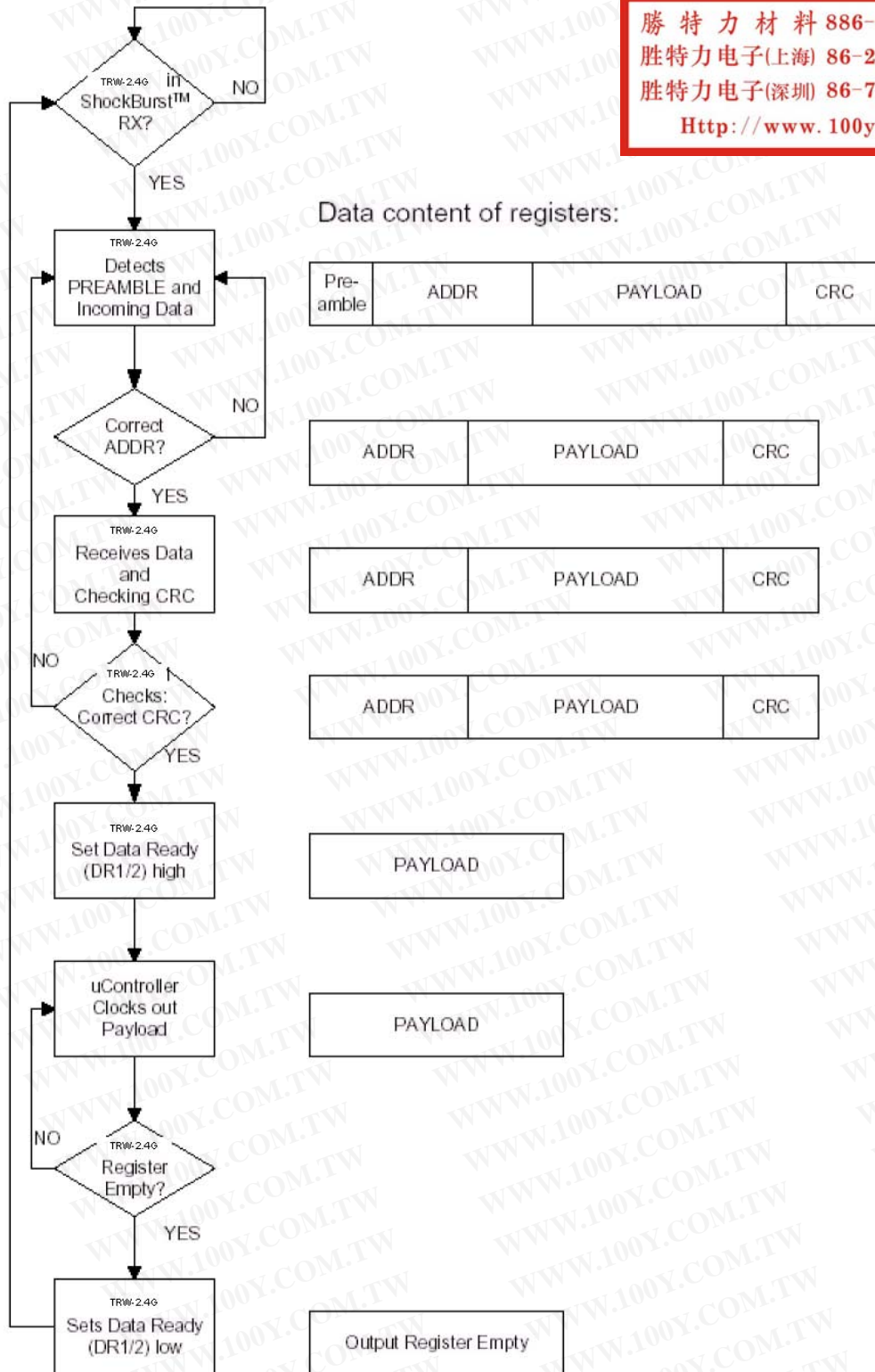


Figure 3 Flow Chart ShockBurst™ Receive of TRW-24G

➤ **TRW-24G ShockBurst™ Receive:**

MCU interface pins: CE, DR1, CLK1 and DATA (one RX channel receive)

1. Correct address and size of payload of incoming RF packages are set when TRW-24G is configured to ShockBurst™ RX.
2. To activate RX , set CE high.
3. After 200us settling, TRW-24G is monitoring the air for incoming communication.
4. When a valid package has been received (correct address and CRC found), TRW-24G removes the preamble, address and CRC bits.
5. TRW-24G then notifies (interrupts) the MCU by setting the DR1 pin high.
6. MCU may (or may not) set the CE low to disable the RF front end (low current mode).
7. The MCU will clock out just the payload data at a suitable rate (ex,10 kbps).
8. When all payload data is retrieved TRW-24G sets DR1 low again, and is ready for new incoming data package if CE is kept high during data download. If the CE was set low, a new start up sequence can begin, see Figure 12.

➤ **Duoceiver™ Simultaneous Two Channel Receive Mode:**

In both ShockBurst™ modes the TRW-24G can facilitate simultaneous reception of two parallel independent frequency channels at the maximum data rate.

This means:

- TRW-24G can receive data from two 1Mbps transmitters (ex: TRW-24G or TRW-24G) 8MHz (8 frequency channels) apart through one antenna interface.
- The output from the two data channels is fed to two separate MCU interfaces.
- Data channel 1:CLK1,DATA,and DR1
- Data channel 2:CLK2,DOUT2,and DR2
- DR1 and DR2 are available only in ShockBurst™.

The TRW-24G DuoCeiver™ technology provides 2 separate dedicated data channels for RX and replaces the need for two, stand alone receiver systems.

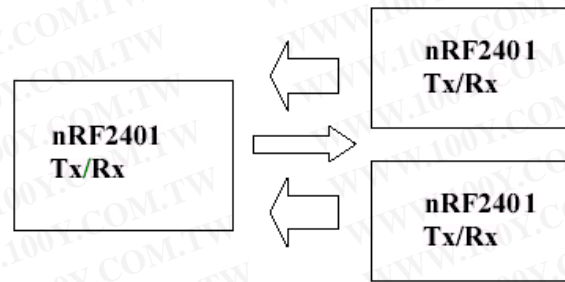


Figure 4 Simultaneous 2 channel receive on TRW-24G

There is one absolute requirement for using the second data channel. For the TRW-24G to be able to receive at the second data channel the frequency channel must be 8MHz higher than the frequency of data channel 1. The TRW-24G must be programmed to receive at the frequency of data channel 1. No time multiplexing is used in TRW-24G to fulfil this function. In direct mode the MCU must be able to handle two simultaneously incoming data packets if it is not multiplexing between the two data channels. In ShockBurst™ it is possible for the MCU to clock out one data channel at a time while data on the other data channel waits for MCU availability, without any lost data packets, and by doing so reduce the needed performance of the MCU.

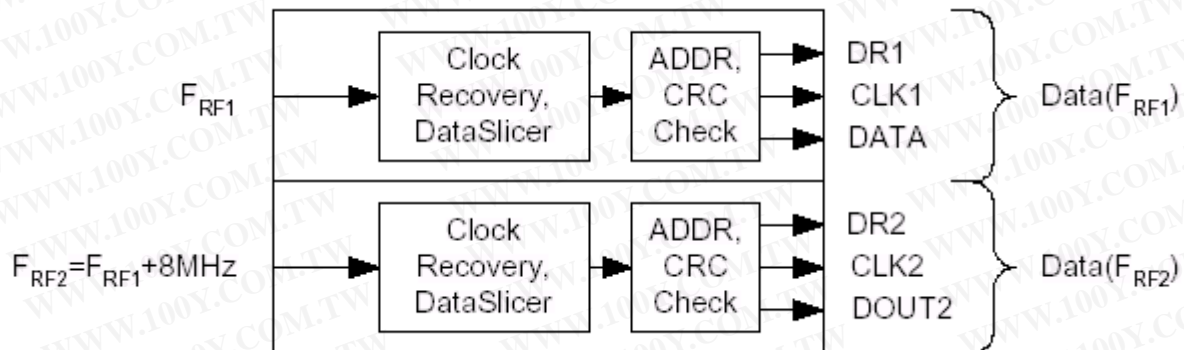


Figure 5 DuoCeiver™ with two simultaneously independent receive channels

➤ **Device Configuration:**

All configuration of the TRW-24G is done via 3-wire interface to a single configuration register. The configuration word can be up to 15 bytes long for ShockBurst™.

➤ **Configuration or ShockBurst™ operation:**

The configuration word in ShockBurst™ enables the TRW-24G to handle the RF protocol. Once the protocol is completed and loaded into TRW-24G only one byte, bit [7:0], needs to be updated during actual operation.

The configuration blocks dedicated to ShockBurst™ is as follows:

- Payload section width: Specifies the number of payload bits in a RF package. This enables the TRW-24G to distinguish between payload data and the CRC bytes in a received package.
- Address width: Sets the number of bits used for address in the RF package, This enables the TRW-24G to distinguish between address and payload data.
- Address (RX Channel 1 and 2): Destination address for received data.
- CRC: Enables TRW-24G on-chip CRC generation and de-coding.

NOTE:

These configuration blocks, with the exception of the CRC, are dedicated for the packages that a TRW-24G is to receive.

In TX mode, the MCU must generate an address and a payload section that fits the configuration of the TRW-24G that is to receive the data.

When using the TRW-24G on-chip CRC feature ensure that CRC is enabled and uses the same length for both the TX and RX devices.

PRE-AMBLE	ADDRESS	PAYLOAD	CRC
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Figure 10 Data packet set-up

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➤ **Configuration word overview:**

	Bit position	Number of bits	Name	Function
ShockBurst™ configuration	143:120	24	TEST	Reserved for testing
	119:112	8	DATA2_W	Length of data payload section RX channel 2
	111:104	8	DATA1_W	Length of data payload section RX channel 1
	103:64	40	ADDR2	Up to 5 byte address for RX channel 2
	63:24	40	ADDR1	Up to 5 byte address for RX channel 1
	23:18	6	ADDR_W	Number of address bits (both RX channels).
	17	1	CRC_L	8 or 16 bit CRC
	16	1	CRC_EN	Enable on-chip CRC generation/checking.
General device configuration	15	1	RX2_EN	Enable two channel receive mode
	14	1	CM	Communication mode (Direct or ShockBurst™)
	13	1	RFDR_SB	RF data rate (1Mbps requires 16MHz crystal)
	12:10	3	XO_F	Crystal frequency
	9:8	2	RF_PWR	RF output power
	7:1	7	RF_CH#	Frequency channel
	0	1	RXEN	RX or TX operation

Table 1 Table of configuration words

The configuration word is shifted in MSB first on positive CLK1 edges, New configuration is enabled on the falling edge of CS.

NOTE:

On the falling edge of CS, the TRW-24G updates the number of bits actually shifted in during the last configuration.

Ex:

If the TRW-24G is to be configured for 2 channel RX in ShockBurst™, a total of 120 bits must be shifted in during the first configuration after VDD is applied.

Once the wanted protocol, modus and RF channel are set, only one bit (RXEN) is shifted in to switch between RX and TX.

➤ Configuration Word Detailed Description:

The following describes the function of the 144 bits (bit 143=MSB) that is used to configure the TRW-24G

General Device Configuration: bit [15:0]

ShockBurst™ Configuration: bit [119:0]

Test Configuration: bit [143:120]

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MSB	TEST							
D143	D142	D141	D140	D139	D138	D137	D136	
Reserved for testing								
1	0	0	0	1	1	1	0	Default

MSB	TEST															
D135	D134	D133	D132	D131	D130	D129	D128	D127	D126	D125	D124	D123	D122	D121	D120	
Reserved for testing															Close PLL in TX	
0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	Default

DATA2 W								
D119	D118	D117	D116	D115	D114	D113	D112	
Data width channel#2 in # of bits excluding addr/crc								
0	0	1	0	0	0	0	0	Default

DATA1 W								
D111	D110	D109	D108	D107	D106	D105	D104	
Data width channel#1 in # of bits excluding addr/crc								
0	0	1	0	0	0	0	0	Default

ADDR2												
D103	D102	D101	....	D71	D70	D69	D68	D67	D66	D65	D64	
Channel#2 Address RX (up to 40bit)												
0	0	0	...	1	1	1	0	0	1	1	1	Default

ADDR1												
D63	D62	D61	....	D31	D30	D29	D28	D27	D26	D25	D24	
Channel#1 Address RX (up to 40bit)												
0	0	0	...	1	1	1	0	0	1	1	1	Default

ADDR_W						
D23	D22	D21	D20	D19	D18	
Address width in # of bits (both channels)						
0	0	1	0	0	0	Default

CRC		
D17	D16	
CRC Mode 1 - 16bit, 0 - 8bit		CRC 1 - enable; 0 - disable
0	1	Default

RF-Programming														LSB		
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	
Two Ch.		BUF	OD	XO Frequency			RF Power			Channel selection					RXEN	
0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	Default

Table 2 Configuration data word

The MSB bit should be loaded first into the configuration register.
 Default configuration word:
 h8E08.1C20.2000.0000.00E7.0000.0000.E721.0F04.

➤ **ShockBurst™ configuration:**

The section B[119:16] contains the segments of the configuration register dedicated to ShockBurst™ operational protocol. After VDD is turned on ShockBurst™ configuration is done once and remains set whilst VDD is present, During operation only the first byte for frequency channel and RX/TX switching need to be changed.

PLL_CTRL

PLL_CTRL		
D121	D120	PLL
0	0	Open TX/Closed RX
0	1	Open TX/Open RX
1	0	Closed TX/Closed RX
1	1	Closed TX/Open RX

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Table 10 PLL setting.

Bit 121-120:
 PLL_CTRL: Controls the setting of the PLL for test purposes. With closed PLL in TX no deviation will be present.

DATAx_W

DATA2 W							
119	118	117	116	115	114	113	112

DATA1 W							
111	110	109	108	107	106	105	104

Table 4 Number of bits in payload.

Bit 119-112:
 DATA2_W: Length of RF package payload section for receive-channel 2.
 Bit 111-104:
 DATA1_W: Length of RF package payload section for receive-channel 1.

NOTE:

The total number of bits in a ShockBurst™ RF package may not exceed 256!
 Maximum length of payload section is hence given by:

$$DATAx_W(bits)=256-ADDR_W-CRC$$

Where:

ADDR_W: length of RX address set in configuration word B [23:18]

CRC: check sum, 8 or 16 bits set in configuration word B [17]

PRE: preamble, 4 or 8 bits are automatically included

Shorter address and CRC leaves more room for payload data in each package.

ADDRx

ADDR2											
103	102	101	....	71	70	69	68	67	66	65	64

ADDR1											
63	62	61	....	31	30	29	28	27	26	25	24

Table 5 Address of receiver #2 and receiver #1

Bit 103-64:

ADDR2: Receiver address channel 2, up to 40 bit.

Bit 63-24:

ADDR1: Receiver address channel 1, up to 40 bit.

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NOTE:

Bits in ADDR_x exceeding the address width set in ADDR_W are redundant and can be set to logic 0.

ADDR_W & CRC

ADDR_W						CRC_L	CRC_EN
23	22	21	20	19	18	17	16

Table 6 Number of bits reserved for RX address + CRC setting

Bit 23-18:

ADDR_W: Number of bits reserved for RX address in ShockBurst™ packages.

NOTE:

Maximum number of address bits is 40 (5 bytes). Values over 40 in ADDR_W are not valid.

Bit 17:

CRC_L: CRC length to be calculated by TRW-24G in ShockBurst™.

Logic 0: 8 bit CRC

Logic 1: 16 bit CRC

Bit 16:

CRC_EN: Enables on-chip CRC generation (TX) and verification (RX).

Logic 0: On-chip CRC generation/checking disabled

Logic 1: On-chip CRC generation/checking enabled

NOTE:

An 8 bit CRC will increase the number of payload bits possible in each ShockBurst™ data packet, but will also reduce the system integrity.

➤ **General device configuration:**

This section of the configuration word handles RF and device related parameters.

Modes:

RX2 EN	CM	RFDR SB	XO F			RF PWR	
15	14	13	12	11	10	9	8

Table 7 RF operational settings

Bit 15:

RX2_EN:

Logic 0: One channel receive

Logic 1: Two channels receive

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NOTE:

In two channels receive, the TRW-24G receives on two, separate frequency channels simultaneously. The frequency of receive channel 1 is set in the configuration word B[7-1], receive channel 2 is always 8 channels (8 MHz) above receive channel 1.

Bit 14:

Communication Mode:

Logic 1: nRF2401 operates in ShockBurst™ mode

Bit 13:

RF Data Rate:

Logic 0: 250 kbps

Logic 1: 1 Mbps

NOTE:

Utilizing 250 kbps instead of 1 Mbps will improve the receiver sensitivity by 10 dB. 1 Mbps requires 16MHz crystal.

Bit 12-10:

D12	D11	D10
0	1	1

Table 8

Bit 9-8:

RF_PWR: Sets TRW-24G RF output power in transmit mode:

RF OUTPUT POWER		
D9	D8	P [dBm]
0	0	-20
0	1	-10
1	0	-5
1	1	0

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Table 9 RF output power setting

➤ **RF channel & direction:**

RF CH#							RXEN
7	6	5	4	3	2	1	0

Table 10 Frequency channel + RX/TX setting

Bit 7-1:

RF_CH#: Sets the frequency channel the nRF2401 operates on.

The channel frequency in **transmit** is given by:

$$\text{Channel}_{RF} = 2400 \text{ MHz} + \text{RF_CH\#} \cdot 1.0 \text{ MHz}$$

RF_CH # : between 2400MHz and 2527MHz may be set.

The channel frequency in **data channel 1** is given by:

$$\text{Channel}_{RF} = 2400 \text{ MHz} + \text{RF_CH\#} \cdot 1.0 \text{ MHz (Receive at PIN\#8)}$$

RF_CH # : between 2400MHz and 2524MHz may be set.

NOTE:

The channels above 83 can only be utilized in certain territories (ex: Japan)

The channel frequency in **data channel 2** is given by:

$$\text{Channel}_{RF} = 2400 \text{ MHz} + \text{RF_CH\#} \cdot 1.0 \text{ MHz} + 8\text{MHz (Receive at PIN\#4)}$$

RF_CH # : between 2408MHz and 2524MHz may be set.

Bit 0:

Set active mode:

Logic 0: transmit mode

Logic 1: receive mode

The data packet for both ShockBurst™ mode and direct mode communication is divided into 4 sections. These are:

1. PREAMBLE	<ul style="list-style-type: none"> · The preamble field is required in ShockBurst.
2. ADDRESS	<ul style="list-style-type: none"> · The address field is required in ShockBurst. mode. · 8 to 40 bits length. · Address automatically removed from received packet in ShockBurst.mode
3. PAYLOAD	<ul style="list-style-type: none"> · The data to be transmitted · In Shock-Burst mode payload size is 256 bits minus the Following :(Address: 8 to 40 bits. + CRC 8 or 16 bits).
4. CRC	<ul style="list-style-type: none"> · 8 or 16 bits length · The CRC is stripped from the received output data.

Data Package Description:

PRE-AMBLE	ADDRESS	PAYLOAD	CRC
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Figure 7 Data Package Diagram

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➤ 配置TRW-24G數據時從高位開始:

範例：在 ShockBurth 的發射模式，以一個通道在 2410MHz 下以 1Mbps Rate 傳送。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	1	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	0

範例：在 ShockBurth 的接收模式，以一個通道在 2410MHz 下以 1Mbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	1	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

勝特力材料 886-3-5753170
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 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

範例: 在 ShockBurth 的發射模式, 以一個通道在 2410MHz 下以 250Kbps Rate 發射。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	1	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	0

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範例：在 ShockBurth 的接收模式，以一個通道在 2410MHz 下以 250Kbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	1	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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範例：在 ShockBurth 的接收模式，以二個通道在 2410MHz 下以 1Mbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
1	1	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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範例：在 Shock Burth 的接收模式，以二個通道在 2410MHz 下以 250Kbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
1	1	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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➤ 配置TRW-24G數據時從高位開始:

範例：在直接發射模式，以一個通道在 2410MHz 頻道下以 1Mbps Rate 發射。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	0	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	0

範例：在直接接收模式，以一個通道在 2410MHz 頻道下以 1Mbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	0	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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範例：在直接發射模式，以一個通道在2410MHz頻道下以250Kbps Rate發射。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	0	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	0

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範例：在直接接收模式，以一個通道在 2410MHz 頻道下以 250Kbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	0	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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範例：在直接接收模式，以二個通道在 2410MHz 頻道下以 250Kbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
1	0	0	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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範例：在直接接收模式，以二個通道在 2410MHz 頻道下以 1Mbps Rate 接收。

Bit143	Bit142	Bit141	Bit140	Bit139	Bit138	Bit137	Bit136
1	0	0	0	1	1	1	0
Bit135	Bit134	Bit133	Bit132	Bit131	Bit130	Bit129	Bit128
0	0	0	0	1	0	0	0
Bit127	Bit126	Bit125	Bit124	Bit123	Bit122	Bit121	Bit120
0	0	0	1	1	1	0	0
Bit119	Bit118	Bit117	Bit116	Bit115	Bit114	Bit113	Bit112
1	1	0	0	1	0	0	0
Bit111	Bit110	Bit109	Bit108	Bit107	Bit106	Bit105	Bit104
1	1	0	0	1	0	0	0
Bit103	Bit102	Bit101	Bit100	Bit99	Bit98	Bit97	Bit96
1	1	0	0	0	0	0	0
Bit95	Bit94	Bit93	Bit92	Bit91	Bit90	Bit89	Bit88
1	0	1	0	1	0	1	0
Bit87	Bit86	Bit85	Bit84	Bit83	Bit82	Bit81	Bit80
0	1	0	1	0	1	0	1
Bit79	Bit78	Bit77	Bit76	Bit75	Bit74	Bit73	Bit72
1	0	1	0	1	0	1	0
Bit71	Bit70	Bit69	Bit68	Bit67	Bit66	Bit65	Bit64
0	1	0	1	0	1	0	1
Bit63	Bit62	Bit61	Bit60	Bit59	Bit58	Bit57	Bit56
1	0	1	0	1	0	1	0
Bit55	Bit54	Bit53	Bit52	Bit51	Bit50	Bit49	Bit48
0	1	0	1	0	1	0	1
Bit47	Bit46	Bit45	Bit44	Bit43	Bit42	Bit41	Bit40
1	0	1	0	1	0	1	0
Bit39	Bit38	Bit37	Bit36	Bit35	Bit34	Bit33	Bit32
0	1	0	1	0	1	0	1
Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
1	0	1	0	1	0	1	0
Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
1	0	1	0	0	0	1	1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
1	0	1	0	1	1	1	1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	1	0	1	0	1

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➤ **Important Timing Data:**

The following timing applies for operation TRW-24G.

TRW-24G Timing Information:

nRF2401 timing	Max.	Min.	Name
PWR_DWN → ST_BY mode	3ms		Tpd2sby
PWR_DWN → Active mode (RX/TX)	3ms		Tpd2a
ST_BY → TX ShockBurst™	195µs		Tsby2txSB
ST_BY → TX Direct Mode	202µs		Tsby2txDM
ST_BY → RX mode	202µs		Tsby2rx
Minimum delay from CS to data.		5µs	Tcs2data
Minimum delay from CE to data.		5µs	Tce2data
Minimum delay from DRI/2 to clk.		50ns	Tdr2clk
Maximum delay from clk to data.	50ns		Tclk2data
Delay between edges		50ns	Td
Setup time		500ns	Ts
Hold time		500ns	Th
Delay to finish internal GFSK data		1/data rate	Tfd
Minimum input clock high		500ns	Thmin
Set-up of data in Direct Mode	50ns		Tsdm
Minimum clock high in Direct Mode		300ns	Thdm
Minimum clock low in Direct Mode		230ns	Tldm

Table 11 Switching times for TRW-24G

When the TRW-24G is in power down it must always settle in stand-by(Tpd2sby) before it can enter configuration or one of the active modes.

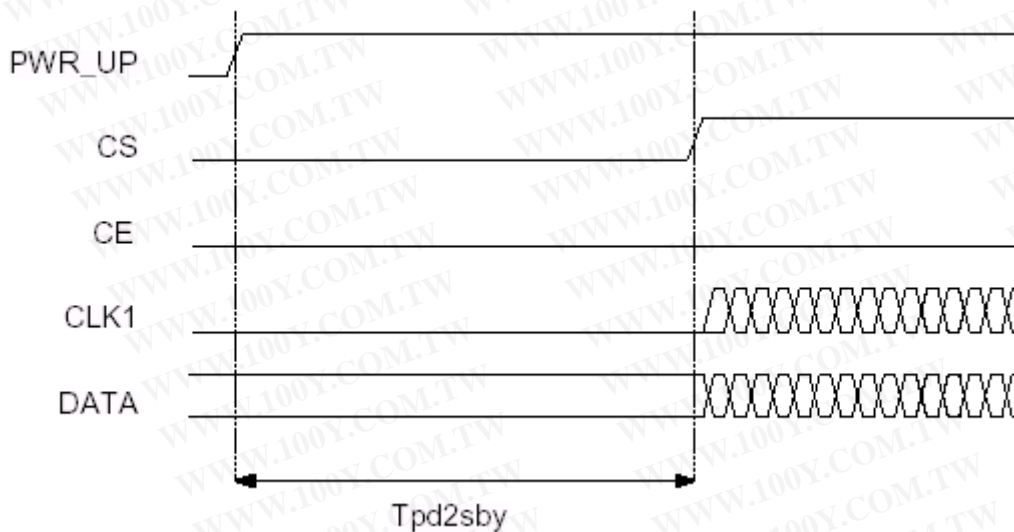


Figure 8 Timing diagram for TRW-24G (or VDD off) to stand by mode

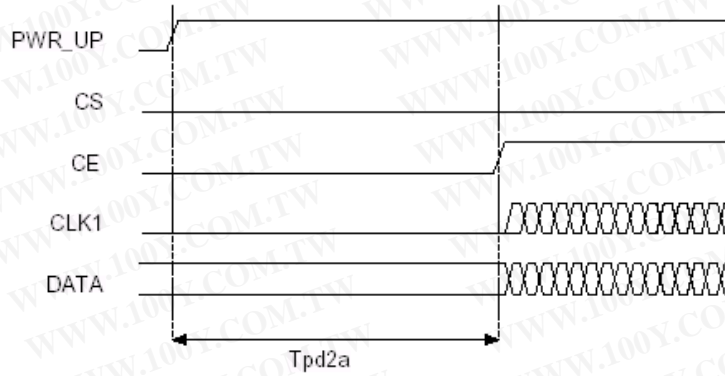


Figure 9 VDD off to active mode

Note that the configuration word will be lost when VDD is turned off and that the device then must be configured before going to one of the active modes. If the device is configured one can go directly from power down to the wanted active mode.

NOTE:

CE and CS may not be high at the same time. Setting one or the other decides whether configuration or active mode is entered.

➤ **Configuration mode timing:**

When one or more of the bits in the configuration word needs to be changed the following timing apply.

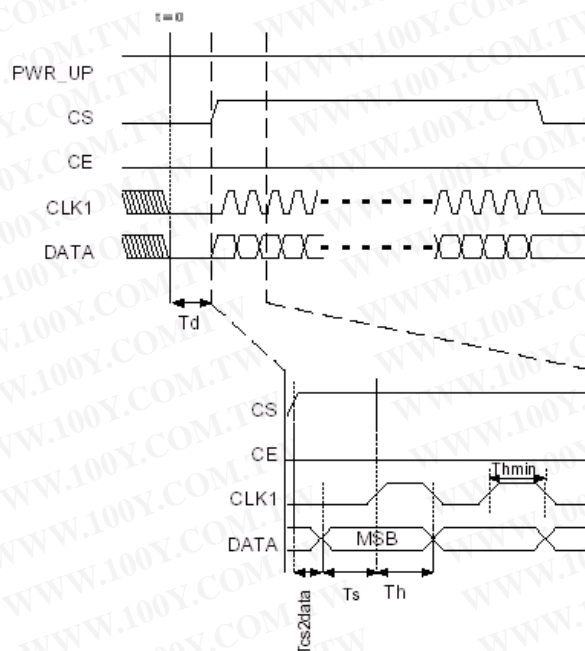


Figure 10 Timing diagram for configuration of TRW-24G

If configuration mode is entered from power down, CS can be set high after T_{pd2sby} as shown in Figure 8

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➤ **ShockBurst™ Mode timing:**

ShockBurst™ TX:

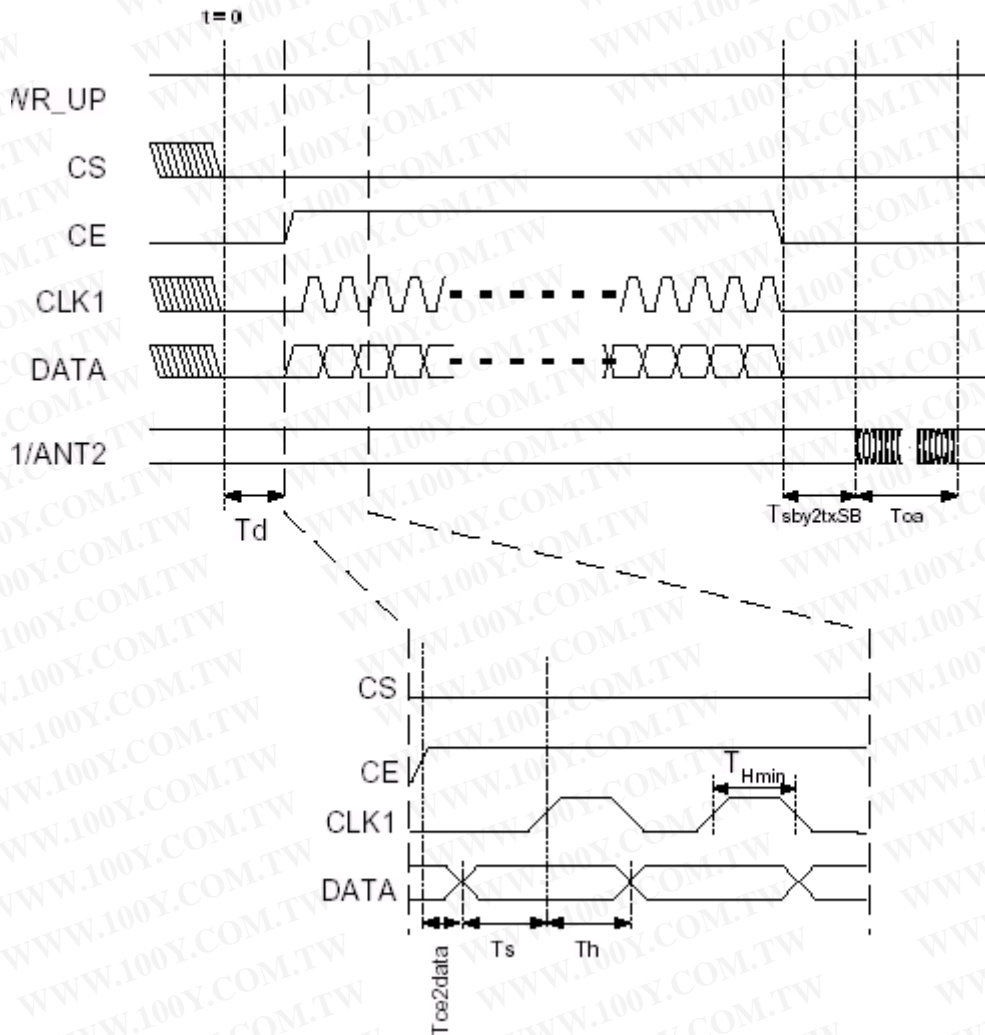


Figure 11 Timing of ShockBurst™ in TX

The package length and the data rate give the delay T_{oa} (time on air), as shown in the equation.

$$T_{OA} = 1/\text{datarate} \cdot (\#\text{databits} + 1)$$

➤ **ShockBurst™ RX:**

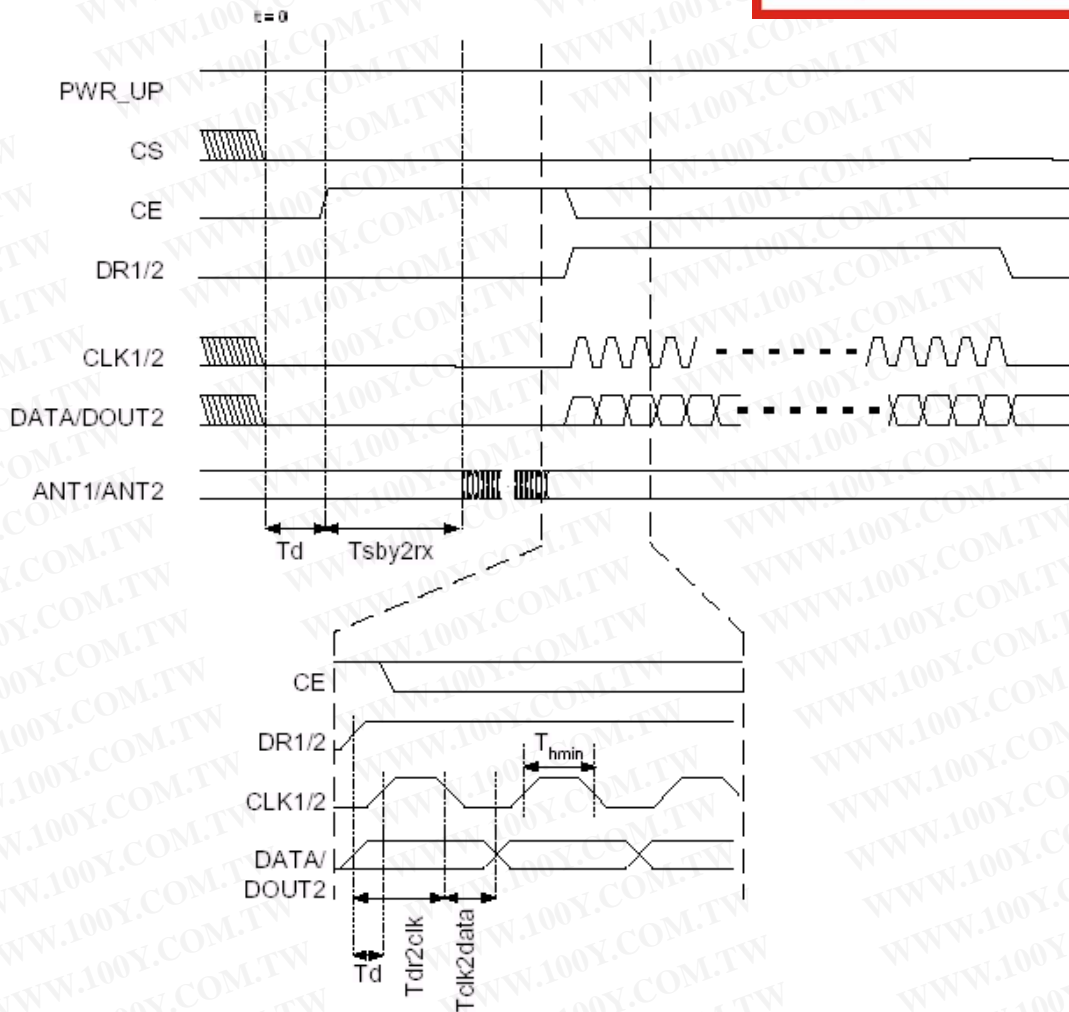


Figure ¹² Timing of ShockBurst™ in RX

The CE may be kept high during downloading of data, but the cost is higher current consumption (18mA) and the benefit is no start-up time(200μs) after the DR1 goes low.

➤ **Output Power adjustment:**

Power setting bits of configuring word	RF output power	DC current consumption
1	0 dBm ±3dB	13.0 mA
0	-5 dBm ±3dB	10.5 mA
01	-10 dBm ±3dB	9.4 mA
00	-20 dBm ±3dB	8.8 mA

Conditions: VDD= 3.0V, VSS= 0V, TA= 27°C, Load impedance =400Ω


```
DLY_REG EQU 0X1C
KEY_REG EQU 0X1B
TIMER_REG EQU 0X1A
```

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```
;-----
```

```
ORG 0X0
JMP RESET
JMP INT_0
```

```
ORG 0X8
JMP INT_1
```

RF_CONFIG_TABLE:

```
MOV A, R0
ADD 0X2, A

RETL 0X8E ; TEST
RETL 0X08
RETL 0X1C

RETL 0X20 ; DATA2_W
RETL 0X0D0 ; DATA1_W
RETL 0X0BB ; ADDR2
RETL 0X0BB
RETL 0X0BB
RETL 0X0BB
RETL 0X0BB
```

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RETL 0X12 ; ADDR1
RETL 0X34
RETL 0X56
RETL 0X78
RETL 0X9A
RETL 0X0A1 ; ADDR_W/CRC

RETL 0X53 ; RF-PROGRAMMING
RETL 0X02

ADDRESS_TABLE: MOV A, R0

ADD 0X2, A
RETL 0X12 ; ADDR1
RETL 0X34
RETL 0X56
RETL 0X78
RETL 0X9A

RESET:

MOV A, @0X0
IOW 0XF
IOW 0XE
MOV A, @0X0FF
IOW 0XB
MOV A, @0X0F8

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IOW 0XD

MOV A, @0X08 ; P5, 0- LED P5,1-LED P5,2-PW
P5,3-CRYSTALL_SLECT

IOW 0X5

MOV A, @0X47 ; P6, 0- KEY P6,1-KEY P6,2-KEY
P6,3-CE

IOW 0X6 ; P6,4-DATA P6,5-CLK1 P6,6-DR1
P6,7-CS

BC P6, 3 ; CE

BC P6, 7 ; CS

MOV A, @0X0D ;WDT

CONTW

MOV A, @0X80

IOW 0XE ; WATCHDOG ENABLE

MOV A, @0X2F

MOV 0X3F, A

MOV A, @0X10

MOV 0X4, A

CLEAR_REG: CLR0X0

INC 0X4

DJZ 0X3F

JMP CLEAR_REG

MOV A, @0X3

MOV 0X10, A

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S_LED_TEST:

MOV A, @0X0FF

MOV 0X11, A

S_LED_TEST1:

CALL DELAY1MS

CALL DELAY1MS

WDTC

JBS 0X11, 7

JMP S_LED_OFF

BS P5, 0 ; LED

BS P5, 1 ; LED

JMP S_SKIP

S_LED_OFF:

BC P5, 0 ; LED

BC P5, 1 ; LED

S_SKIP:

DJZ 0X11

JMP S_LED_TEST1

DJZ 0X10

JMP S_LED_TEST

; ENI

=====

===== MAIN PROGRAM =====

=====

MAIN_LOOP:

BS P5, 2 ; PW

BC P5, 0 ; R_LED

BC P5, 1 ; T_LED

BC P6, 3 ; CE

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```
CALL    DELAY1MS
MOV     A, P6
AND     A, @0X07
MOV     KEY_REG, A
JBC     P5, 3      ; CRYSTALL SELECT< 0-16M  1-20M>
BS      KEY_REG, 3

MOV     A, KEY_REG
AND     A, @0X03
XOR     A, @0X0
JBC     0X3, 2     ; Z
JMP     T_MODEL

MOV     A, KEY_REG
AND     A, @0X03
XOR     A, @0X1
JBC     0X3, 2     ; Z
JMP     R_MODEL

MOV     A, KEY_REG
AND     A, @0X03
XOR     A, @0X03
JBC     0X3, 2     ; Z
JMP     SLEEP_MODEL

JMP     MAIN_LOOP

;-----
T_MODEL:
```


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```
AND    A, @0X07
MOV    BYTE, A
JBC    P5, 3    ; KEY
BS     BYTE, 3
MOV    A, BYTE
XOR    A, KEY_REG
JBC    0X3, 2    ; Z
JMP    T_LOOP
BC     P5, 1    ; T_LED
JMP    MAIN_LOOP
```

R_MODEL:

```
BC     P5, 0    ; R_LED
BC     P5, 1    ; T_LED
CALL   DATA_PRO
MOV    A, @0X1F    ; TX_OFF RX_ON
MOV    0X22, A
MOV    A, @0X4F    ; 250K 0db
JBC    P6, 2    ; <0-250K 1-1000K>
MOV    A, @0X6F
MOV    0X30, A
MOV    A, @0X15    ; 2410
MOV    0X31, A
CALL   RF_CONFIG

MOV    A, @0X10
MOV    0X13, A
BS     P6, 3    ; CE
```

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```
CLR    TCC
BC     0XF, 0    ;TIMER FLAG
MOV    A, @0X1
IOW    0XF      ;TIMER INTERRUPT ENABLE
R_SP1:
BC     P5, 0    ;R_LED
R_LOOP1:
MOV    A, @0X060
MOV    TIMER_REG, A
BC     FLAG, 0  ; INTERRUPT FLAG
DJZ    0X13
JMP    R_LOOP
JMP    R_MODEL

R_LOOP:
WDTC
JBC    FLAG, 0  ;INTERRUPT FLAG
JMP    R_SP1
MOV    A, P6
AND    A, @0X7
MOV    BYTE, A
JBC    P5, 3    ;KEY
BS     BYTE, 3
MOV    A, BYTE
XOR    A, KEY_REG
JBS    0X3, 2    ;Z
JMP    R_RET
JBS    P6, 6    ;DR1
JMP    R_LOOP
BS     P5, 0    ;R_LED
```

```

MOV    A, @0X10
MOV    0X13, A
CALL   RF_RECEIVE
CALL   DELAY1MS
JMP    R_LOOP1

```

R_RET:

```

BC     P6, 3    ; CE
BC     P5, 0
MOV    A, @0X0
IOW    0XF
JMP    MAIN_LOOP

```

SLEEP_MODEL:

```

CALL   DATA_PRO
BC     P5, 0    ; R_LED
BC     P5, 1    ; T_LED
CALL   DATA_PRO
MOV    A, @0X1E    ; TX_OFF RX_OFF
MOV    0X22, A
MOV    A, @0X4C    ; 250K 0db
JBC    P6, 2    ; <0-250K 1-1000K>
MOV    A, @0X6C
MOV    0X30, A
MOV    A, @0X15    ; 2410
MOV    0X31, A
CALL   RF_CONFIG
BC     P5, 2    ; PW

```

S_LOOP:

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```
CALL    DELAY1MS
WDTC
MOV     A, P6
AND     A, @0X07
MOV     BYTE, A
JBC     P5, 3    ;KEY
BS      BYTE, 3
MOV     A, BYTE
XOR     A, KEY_REG
JBC     0X3, 2    ;Z
JMP     S_LOOP
JMP     MAIN_LOOP
```

=====

DATA_PRO:

```
MOV     A, @0X20
MOV     0X4, A
CLR     R0
MOV     A, @0X12    ;18
MOV     0X10, A
```

DATA_LOOP:

```
CALL    RF_CONFIG_TABLE
MOV     0X0, A
INC     R0
INC     0X4
DJZ     0X10
JMP     DATA_LOOP
RET
```

=====

;===== RF CONFIG SUBROUTINE =====

;-----

RF_CONFIG:

BC P6, 3 ;CE
BS P6,7 ;CS
CALL DELAY200US
MOV A, @0X12 ;18
MOV 0X10, A
MOV A, @0X20
MOV 0X4, A

RF_CONF_BYTE_LP:

MOV A, @0X8
MOV 0X11, A
MOV A, 0X0
MOV BYTE, A

RF_CONF_BIT_LP:

BC P6, 5 ;CLK1
JBS BYTE, 7
BC P6, 4 ;DATA
JBC BYTE, 7
BS P6, 4 ;DATA
RLC BYTE
BS P6, 5 ;CLK1
DJZ 0X11
JMP RF_CONF_BIT_LP
INC 0X4
DJZ 0X10
JMP RF_CONF_BYTE_LP
CALL DELAY5US
BC P6, 5 ;CLK1

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BC P6, 7 ; CS

RET

=====

===== RF SEND SUBROUTINE =====

=====

RF_SEND:

BC P6, 7 ; CS

BS P6, 3 ; CE

CALL DELAY5US

CALL DELAY5US

CLR R0

MOV A, @0X5 ; ADDRESS BIT 5*8=40 BIT

MOV 0X10, A

RF_S_ADD_BYTE:

CALL ADDRESS_TABLE

MOV BYTE, A

MOV A, @0X8

MOV 0X11, A

RF_S_ADD_BIT:

BC P6, 5 ; CLK1

JBS BYTE, 7

BC P6, 4 ; DATA

JBC BYTE, 7

BS P6, 4 ; DATA

RLC BYTE

BS P6, 5 ; CLK1

DJZ 0X11

JMP RF_S_ADD_BIT

INC R0

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```

DJZ    0X10
JMP    RF_S_ADD_BYTE

MOV    A, @0X1A    ; 208 BIT DATA
MOV    0X10, A
RF_S_D_BYTE:
MOV    A, @0X8
MOV    0X11, A
MOV    A, @0X037
MOV    BYTE, A
RF_S_D_BIT:
BC     P6, 5    ; CLK1
JBS    BYTE, 7
BC     P6, 4    ; DATA
JBC    BYTE, 7
BS     P6, 4    ; DATA
RLC    BYTE
BS     P6, 5    ; CLK1
DJZ    0X11
JMP    RF_S_D_BIT
DJZ    0X10
JMP    RF_S_D_BYTE
CALL   DELAY5US
BC     P6, 5    ; CLK1
BC     P6, 3    ; CE
RET

```

```

;=====
;===== RF RECEIVE SUBROUTINE =====
;=====

```

RF_RECEIVE:

BC P6, 7 ; CS
BC P6, 3 ; CE
CALL DELAY5US
CALL DELAY5US
MOV A, @0X20
MOV 0X4, A
MOV A, @0X1A ; 208 bit
MOV 0X10, A
CLR BYTE

RF_BYTE_LP:

MOV A, @0X8
MOV 0X11, A

RF_BIT_LP:

RLC BYTE
BS P6, 5 ; CLK1
JBS P6, 4 ; DATA
BC BYTE, 0
JBC P6, 4 ; DATA
BS BYTE, 0
BC P6, 5 ; CLK1
DJZ 0X11
JMP RF_BIT_LP
INC 0X4
DJZ 0X10
JMP RF_BYTE_LP
CALL DELAY5US
CALL DELAY5US
BS P6, 3 ; CE
RET

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```
;=====
;===== DELAY1MS SUBROUTINE =====
;=====
```

```
DELAY1MS:
    MOV    A, @0X0FF
    JMP    DLY_SKIP
```

```
DELAY200US:
    MOV    A, @0X32
    JMP    DLY_SKIP
```

```
DELAY5US:
    MOV    A, @0X1
DLY_SKIP:
    MOV    DLY_REG,A
```

```
DLY_LOOP:
    NOP
    NOP
    NOP
    DJZ    DLY_REG
    JMP    DLY_LOOP
    RET
```

```
;=====
;===== INTERRUPT SUBROUTINE =====
;=====
```

```
INT_0:
INT_1:
```

```

BC      0XF, 0      ;TIMER FLAG
DJZ     TIMER_REG
JMP     INT_RET
BS      FLAG, 0     ;INTERRUPT FLAG
INT_RET:
RETI

```

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➤ Demo Program (use C8051F330 MCU):

```

/* -----
功能：頭檔載入區
----- */
#include <C8051F330.H>
#include "Public_variable.h"
/* -----
功能：IO定義區
----- */
sbit TRW_24G_CLK = P1^1;
sbit TRW_24G_DATA = P1^6;
sbit TRW_24G_CS = P1^2;
sbit TRW_24G_CE = P1^3;
sbit TRW_24G_DR1 = P1^4;
/* -----
功能：向TRW-24G寫入一個BYTE（包含寫入一個配置字跟發送一個BYTE資料
----- */
void Write_TRW_24G_BYTE(x)
{
    char i;
    for(i=0;i<8;i++)
    {
        TRW_24G_CLK = 0;
        if(x&0x80)
            TRW_24G_DATA= 1;
        else
            TRW_24G_DATA= 0;
        x<<=1;
        TRW_24G_CLK = 1;
        TRW_24G_CLK = 1;
        TRW_24G_CLK = 1;
    }
}

```

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```
    }  
}  
/*-----  
功能：從TRW-24G讀出一個BYTE資料  
-----*/
```

```
char Read_TRW_24G_BYTE(void)
```

```
{  
    char i,x;  
    for(i=0;i<8;i++)  
    {  
        TRW_24G_CLK = 0;  
        TRW_24G_CLK = 0;  
        TRW_24G_CLK = 0;  
        TRW_24G_CLK = 1;  
        x<<=1;  
        if(TRW_24G_DATA)  
            x|=0x01;  
        else  
            x|=0x00;  
    }  
    return(x);  
}
```

```
/*-----  
功能：配置TRW-24G  
-----*/
```

```
void Config_TRW_24G(void)
```

```
{  
    unsigned char i;  
    P1MDOUT |= 0x4E;  
    TRW_24G_CE = 0;  
    TRW_24G_CS = 1;  
    for(i=0;i<18;i++)  
        Write_TRW_24G_BYTE(RF_Buffer[i]);  
    TRW_24G_CS = 0;  
    if(RF_Status[0]&&(RF_Status[6]==1))  
    {  
        P1MDOUT &= 0xBD;  
        P1 |= 0x42;  
        TRW_24G_CE = 1;  
    }  
}
```

```
/*-----  
功能：利用TRW-24G發送一個封包  
-----*/
```

```
void Send_TRW_24G(char x)
```

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```

{
    unsigned char i;
    TRW_24G_CS = 0;
    TRW_24G_CE = 1;
    Write_TRW_24G_BYTE(0xF0);
    Write_TRW_24G_BYTE(0xF0);
    for(i=0;i<28;i++)
        Write_TRW_24G_BYTE(x);
    TRW_24G_CE = 0;
}
/* -----
功能：從TRW-24G中讀出一個封包。
----- */

```

```

char Receive_TRW_24G(void)
{
    unsigned char i=0,RF_Data[30];
    TRW_24G_CE = 1;
    P1MDOUT &= 0xBF;
    P1      |= 0x40;
    TRW_24G_CLK = 0;
    if(TRW_24G_DR1)
    {
        for(i=0;i<28;i++)
            RF_Data[i] = Read_TRW_24G_BYTE();
        i = RF_Data[4];
    }
    return(i);
}
/* -----
功能：建立TRW-24G的Table表。
----- */

```

```

const unsigned char code TRW_24G_Table[18] =
{ 0x8E,0x08,0x1C,0xE0,0xE0,0x00,0x00,0x00,0xF0,
  0xF0,0x00,0x00,0x00,0xF0,0xF0,0x43,0x0F,0x00 };
/* -----

```

此程式為Kit_10來配置TRW_24G/TRW_24G的一部分。
 其中引用RF_Status[7]跟RF_Buffer[110]陣列。
 以下說明RF_Status[7]陣列的詳細定義：
 RF_Status[0] = 0 ,模組工作在發射狀態
 = 1 ,模組工作在接收狀態
 RF_Status[1] = 忽略
 RF_Status[2][3] = 以16進制保存其頻率值。
 如果其值= 0x0190,則說明現工作頻率為2400M。
 如果其值= 0x01B0,則說明現工作頻率為2342M。
 RF_Status[4] = 0 ,模組工作在1M的速率。
 = 1 ,模組工作在250K的速率。
 RF_Status[5] = 0 ,設置模組的發射功率為-20dBm
 = 1 ,設置模組的發射功率為-10dBm

```

        = 1 ,設置模組的發射功率為- 0dBm
RF_Status[6] = 0 ,模組工作在direct模式
        = 1 ,模組工作在ShockBurth模式
----- */

```

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```

Void Control_TRW_24G(void)
{
    unsigned char i,Send_Value = 0x00,Receive_Time = 0,Receive_Value=0;
    unsigned int Freq_buffer;

    Freq_buffer = RF_Status[2]<<8;
    Freq_buffer += RF_Status[3];
    if((RF_Status[6]==1)&&(RF_Status[0]==0))
    {
        for(Freq_buffer=0;Freq_buffer<10000;Freq_buffer++)
            for(i=0;i<200;i++);
    }

    else if((Freq_buffer>527)||(Freq_buffer<400))

        show_Freq_Error();

    else
    {
        for(i=0;i<18;i++)
            RF_Buffer[i]=TRW_24G_Table[i];
        if(RF_Status[0])
        {
            RF_Buffer[2] = 0x1F;
            RF_Buffer[17] |= 0x01;
        }

        else
        {
            RF_Buffer[2] = 0x1C;
            RF_Buffer[17] &= 0x00;
        }

        Freq_buffer -= 400;
        Freq_buffer <<=1;
        i=Freq_buffer&0xFE;
        RF_Buffer[17] |= i;
        if(RF_Status[6]==0)
            RF_Buffer[16] |= 0x40;
        if(RF_Status[4]==0)
            RF_Buffer[16] |= 0x20;
        switch(RF_Status[5])
        {

```

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```
case 0:
    RF_Buffer[16] &= 0xFC; break;
case 1:
    RF_Buffer[16] |= 0x01; break;
default:
    RF_Buffer[16] |= 0x03; break;
}
Config_TRW_24N();

if(RF_Status[0]&&(RF_Status[6]==1))
{
    LCD_write_String(0x02,0x11,0xB2,"Direct output RF",0);
    LCD_write_String(0x02,0x11,0xB3," DATA from TP5 8",0);

    while((Key_Value&0x08)==0x00)
        Scan_Key();
}
else
{
    Freq_buffer >>= 1;
    Show_24G_Image(Freq_buffer);

    while((Key_Value&0x08)==0x00)
    {
        Scan_Key();
        if(RF_Status[0])
        {
            RF_Buffer[2] |= 0x1F;
            RF_Buffer[17] |= 0x01;
            Config_TRW_24G();
            for(Freq_buffer=0;Freq_buffer<500;Freq_buffer++);
            i = 0;

            while(i==0)
                i = Receive_TRW_24G();
            ++Receive_Time;
            if(Receive_Value>i)
            {
                Receive_Time = 1;
                Send_Value = 0;
            }
            Receive_Value = i;
            ++Send_Value;
            RF_Buffer[2] &= 0x1C;
        }
    }
}
```

