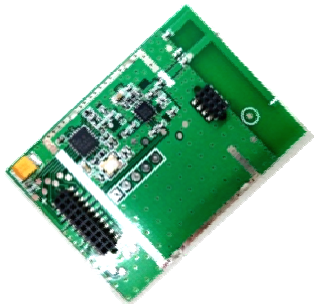
ELSP01 RF Module User Manual

Product Name:ELS-Module-01
Model No.: ELSP01



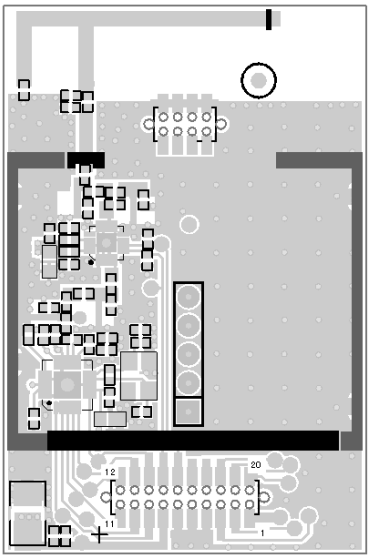
ELSP01 is a 2.4GHz SMD wireless module with function for receiving and transmitting. It has a small size, and high rate up to 2Mbps. The high-performance onboard antenna is included in Module, which is accurate at impedance matching. This module has been mass produced smoothly, and can be used for various applications scenarios. The nRF24LO1 chip in ELSP01 is Norway-imported from Nordic. Equipped with 20dBm power amplification chip of RFX2401 chip imported from America, it's max transmitted power is up to 7dBm (conform to FCCID and CE certification) and the receiving sensitivity can be increased by 10dB. Also, it's small size is convenient for embedded development.

Electrical parameters

No.	Parameters name	Parameter	Note
1	RF chip	Nrf24l01P	Nordic
2	AV and LNA Chip	RFX2401	Rfaxis
3	Operating frequency	2404~2478 MHz	
4	Production technology	lead-free, SMT	
5	Interface	2x10x2.54mm	SMT
6	Power supply	1.9~3.6V DC	Note: Module will be damaged permanently, if the voltage is over 3.6V
7	Communication level	0.7VCC~5V	VCC indicates supply voltage
8	Measured distance	100m+	Normal Mode(Sunny day, circumstance without interference)
9	Transmitted power	≤10dBm	Conducted Emission Test
10	Rate	250K~2Mbps	3 level adjustable(modulated via firmware)
11	Turn-off current	1.0uA	nRF24L01P set to power down, CE low level
12	Emission current	35mA	
13	Receive current	20mA	
14	Communication interface	SPI	Max rate up to 10Mbps
15	Emission Length	Single Data Packet 1~32 Bytes	3 level FIFO
16	Receive Length	Single Data Packet 1~32 Bytes	3level FIFO
17	RSSI supported	Nonsupport	Support simple packet loss only
18	Antenna	3.0dBi PCB PIFA Antenna	
19	Operating Temperature	-10℃～+40℃	
20	Operating Humidity	35％～95％RH	
21	Storage temperature	-40℃～+125℃	

22	Receive sensitivity	-95dBm	1000kbps 0.1% BER
23			More details please refer to chip manual.

Interface specifications:



PCB Specification：
32x48.5x1.0mm

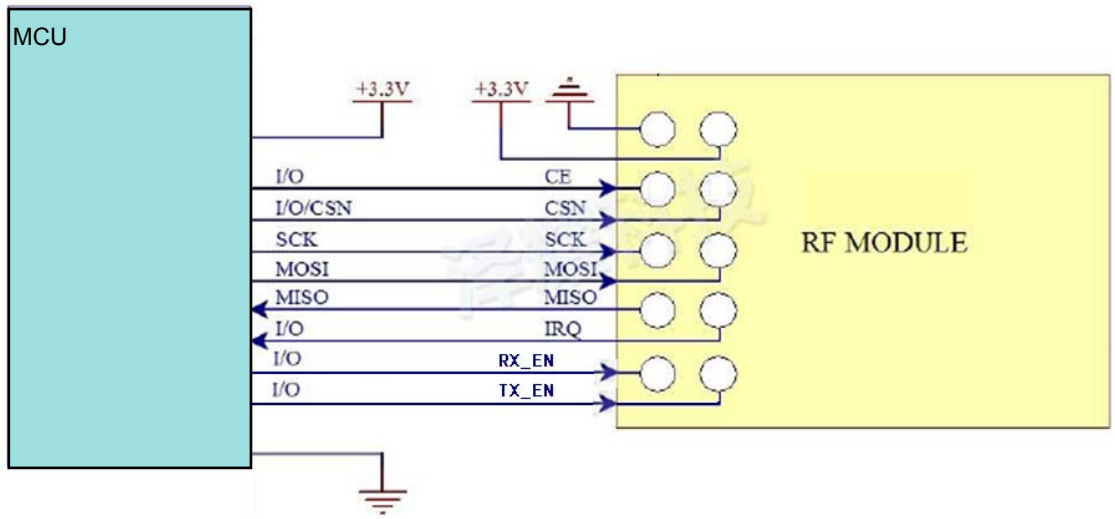
Pin	Name	Pin Direction	Use
1	RF_SCK	Input	Module SPI Bus Clock
2	RF_CSN	Input	Module CS PIN
3	RF_CE	Input	Module control PIN
4	V_NRF		Power supply should be between 1.9-3.6V
5	GND		Ground, connect to Power ground referenced
6	GND		Ground, connect to Power ground referenced
7	GND		Ground, connect to Power ground referenced
8	N/A		Not Connected
9	N/A		Not Connected
10	N/A		Not Connected
11	N/A		Not Connected
12	N/A		Not Connected
13	N/A		Not Connected
14	N/A		Not Connected
15	N/A		Not Connected
16	RX_EN		LNA enable feet, high level effective LNA
17	TX_EN		PA enable feet, high level effective

			PA
18	RF_IRQ	Output	Module interrupt signal output, low level effective
19	RF_MISO	Output	Module SPI data output PIN
20	RF_MOSI	Input	Module SPI data input PIN
*Please refer to Nordic authority《Nrf24l01P Datasheet》for PIN definition of module, software driver and communication protocol.			

Notice

No	Category	Notice
1	Static	High frequency analog device Avoid touching components on module if possible, since the high frequency analog device features electrostatic susceptibility
2	Soldering	Electric soldering iron must be well connected to ground when soldering
3	Power supply	Power supply quality influence on module performance, please insure the power supply will not appear big ripple to avoid dither in power supply.
4	Ground	Module ground apply single point grounding. It's recommended to use ohm inductance or 10mH inductance and set it apart from reference ground of other circuit in other part.
5	Antenna	Mounting structure of module antenna influence module performance. Please insure little noise interference around antenna. Note: Antenna must not mount in metallic shell, otherwise the transmission distance be weakened greatly.
6	Interference	If there are different frequency modules inside one product, the frequency should be well programmed to reduce the influence of harmonic interference and intermediation interference
7	Oscillator	If there is oscillator close to the PCB in which module mount, please increase the distance between oscillator and PCB if possible.

Typical Circuit



ELSP01 RF MODULE AND MCU Connection Schematic

Note:

1. IRQ is a Interrupt Pin, which can be used to activate SCM to achieve quick response.IRQ could be unconnected to obtain interruption status by SPI(It' not recommended because of the low efficiency. And it will influence Power Consumption.)
2. CE can be connect to high voltage level for a long term， in this way write register must be set to POWER DOWN mode first.
3. Truth-value table for relationship between TX_EN and RX_EN as shown:

	Maximum	Minimum
H	4.5V	1.2V
L	0.3V	

无线电通信模块

TX_EN	RX_EN	MODE
H	L	TX
L	H	RX
H	H	TX
L	L	SHUT-DOWN

Driver Statement

1. IC nRF24L01P+RFX2401 is adopted in this module, it's driving means is same as nRF24L01P, user can operate ELSP01 in accordance with manual for chip nRF24L01P.
2. Connect LNA EN to MCU, LNA=1(Opened), LNA=0(Closed)
3. If user want to achieve auto-answer, LNA should be in high level during transmit process, to ensure interface circuit be in working state.

FAQ:

★ Communication distance is close which did not achieve specified value.		
1	Obstacle	With physical characteristics of poor penetrability for 2.5GHz frequency , communication distance loss will be increased when these is line communication failed.
2	interference source	Interference from temperature, humidity and co-frequency will increase packet loss rate.
3	Metal	Place antenna inside metal shell or there is metal nearby the antenna will cause signal attenuation.
4	RX_EN PIN	RX_EN PIN in emitting devices didn't keep high level will reduce the reception sensitivity for responding signal.
5	Parameter values	功率寄存器设置错误、空中速率设置过高（空中速率越高，距离越近）。 POWER Parameters setting error, the speed set too high.
6	Low voltage	When voltage is under 3.3V, the lower voltage, the less transmission power.
★ Heat of module, module will be damaged easily.		
1	Supply voltage	Check power supply and ensure it's between 2.0V~3.6V. Module will be damaged permanently, if the voltage is over 3.6V
2	Stability	Please check power supply stability, and the power noise.
3	ESD	Please insure ESD protect circuit have been applied in mounting process, especially LNA is a easy damaged part.
4	5V lEVEL	Communication line must be in series with 1k-1.5k resistance if use 5V electrical level.

Appendix:
Channel List

This module will be used on different devices, and the corresponding Channel list will are difference, Mainly, it has two modes:

Mode 1:

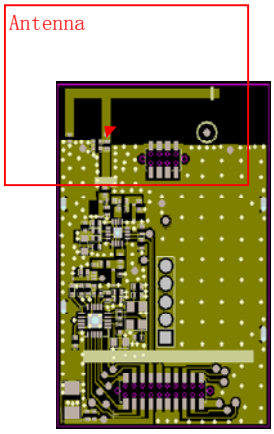
Channel	Trigger pipe frequency/MHz	Date pipe frequency/MHz
1	2456	2448
2	2458	2450
3	2460	2452
4	2462	2454
5	2469	2461
6	2471	2463
7	2473	2465
8	2475	2467
9	2478	
10	2449	
11	2444	
12	2439	
13	2434	
14	2429	
15	2424	
16	2419	
17	2414	
18	2410	
19	2407	
20	2404	

Mode 2：

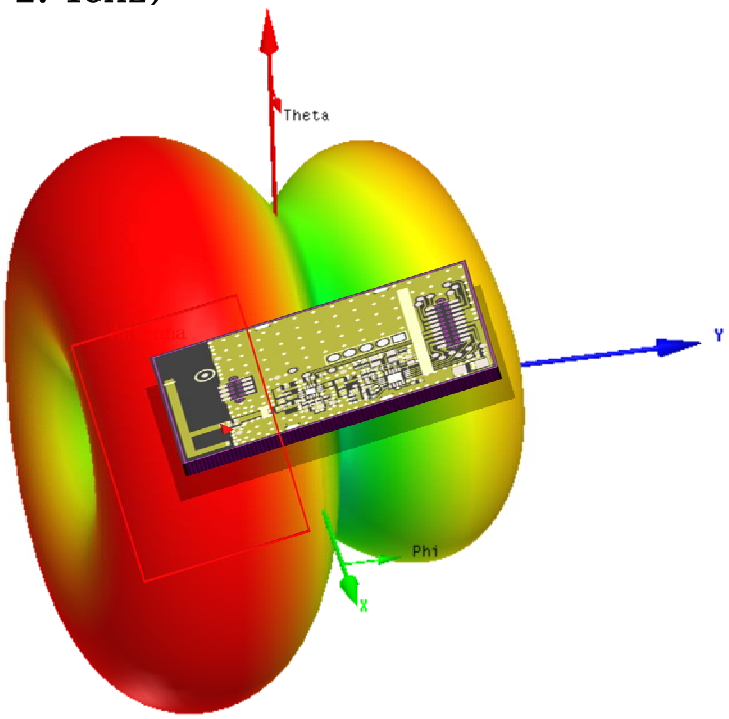
Channel	Frequency/MHz
ZI	2464
CH1	2468
CH2	2470
CH3	2472
CH4	2474
CH5	2409
CH6	2411
CH7	2413
CH8	2415
CH9	2417
CH10	2419
CH11	2421
CH12	2423
CH13	2425
CH14	2427
CH15	2429
CH16	2431
CH17	2433
CH18	2435
CH19	2437
CH20	2439
CH21	2441
CH22	2443
CH23	2445
CH24	2447
CH25	2449
CH26	2451
CH27	2453
CH28	2455
CH29	2457
CH30	2459
CH31	2461
CH32	2463

ELSP01 Antenna Specification

- PCB PIFA antenna
- GAIN:3.0dBi

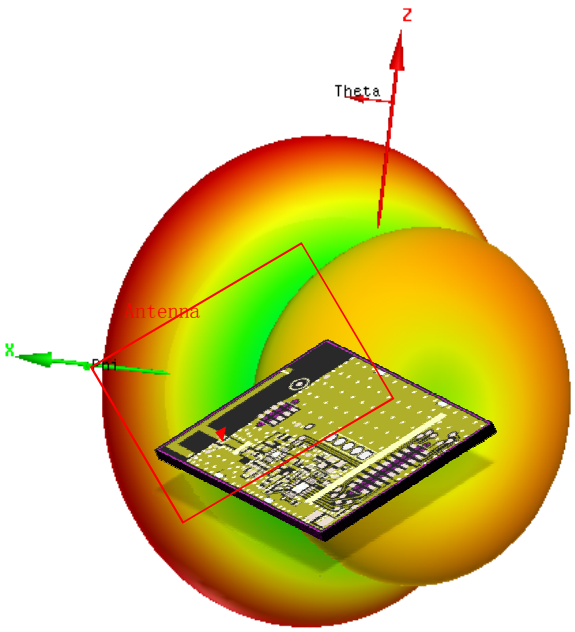


Far field(f=2.4GHz)



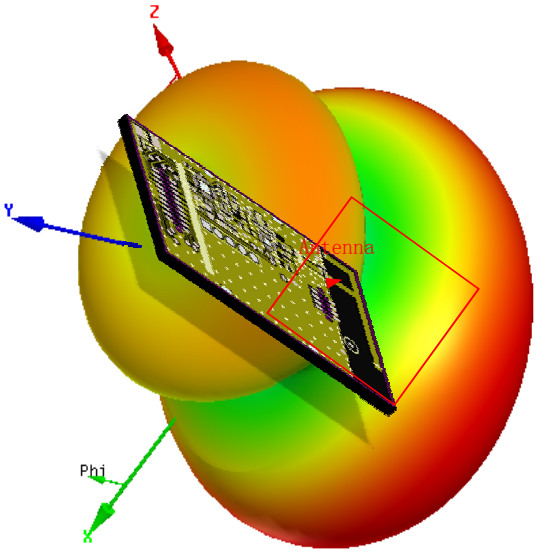
Type	Far field
Approximation	enable(KR>>1)
Monitor	Far field(f=2.4) [1]
Component	Abs
Output	Directivity
Frequency	2.4GHz
Gain.	3.0dBi

Far field(f=2.45GHz)



Type	Far field
Approximation	enable(KR>>1)
Monitor	Far field(f-2.45) [1]
Component	Abs
Output	Directivity
Frequency	2.45GHz
Gain	3.0dBi

Far field(f=2.5GHz)



Type	Far field
Approximation	enable(KR>>1)
Monitor	Far field(f-2.5) [1]
Component	Abs
Output	Directivity
Frequency	2.5GHz
Gain	3.0dBi

FCC Warning:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
o Reorient or relocate the receiving antenna.
o Increase the separation between the equipment and receiver.
o Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
o Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modi?cations to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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