Theory of Operation/Technical Description

The "RF module G4.5" is based on Semtech Ltd. transceiver SX1277 patented LoRaTM (Long Range) digital modulation technique.

Main RF parameters the radio modem are represented in the table 1.

Table 1

	Parameter	Value
1	Output power on the SMA antenna connector	13 dbm
2	Occupied bandwidth	> 500kHz
3	1/2 wave vertical dipole antenna VTORCH	VTGSMA-83

RF module is used on one RF channel only in the USA ISM band in the frequency range 902-928MHz. The maximum number radio system is 16. Each radio system has number defined by DIP switch in the host controller and it occupied only one of channel represented in the table 2.

Table 2

System number	Channel central frequency [MHz]
1	903.75
2	905.25
3	906.75
4	908.25
5	909.75
6	911.25
7	912.75
8	914.25
9	915.75
10	917.25
11	918.75
12	920.25
13	921.75
14	923.25
15	924.75
16	926.25

The RF module dimensions: 48 x 30 x 20 mm approx.

The RF module is connected by "Host connector" with host controller. There are all signals in the host connector represented in the table 3

Table 3

PIN	Name	Function	Description
J1/1	GND	Power	Ground
J1/2	RF_CSn	Input	SPI Chip select of transceiver SX1277
J1/3	RF_SCK	Input	SPI Clock
J1/4	RF_SI	Input	SPI Master Output Slave Input (MOSI)
J1/5	RF_SO	Output	SPI Master Input Slave Output (MISO)
J1/6	N/A	N/A	N/A
J1/7	N/A	N/A	N/A
J1/8	GND	Power	Ground
J1/9	RF_GPIO3	Output	N/A
J1/10	GND	Power	Ground
J2/1	GND	Power	Ground
J2/2	RF_GPIO0	Output	Receive/Transmit interrupt from transceiver SX1277
J2/3	DIO	N/A	N/A
J2/4	LOCK	N/A	N/A
J2/5	MODE	N/A	N/A
J2/6	VCC	Power	Power supply 3.3VDC
J2/7	RF_GPIO2	N/A	N/A
J2/8	GND	Power	Ground
J2/9	NRESET	Input	Transceiver SX1277 reset, active low
J2/10	GND	Power	Ground

In the beginning the host controller makes the init of the RF transceiver SX1277 by serial SPI channel. On this stage the host controller defines all main RF parameters: frequency channel, modulation, baud rate, output power and etc. After init the RF transceiver goes to sleep mode with very low power consumption (few hundreds nanoampers).

If necessary, the host controller changes "sleep" to receive mode. In this case it sends command "receive" to transceiver SX1277 by SPI channel. If SX1277 receives relevant RF message, then it generates interrupt RF_GPIO0 to host controller and host controller reads binary data message from SX1277 data buffer by SPI channel during few milliseconds.

If necessary, the host controller changes "sleep" to transmit mode. In this case it fills SX1277 data buffer and sends command "transmit" to transceiver SX1277 by SPI channel.

In the frequency range 902-928MHz is used the receiver input RFI_HF and transmitter output RFO_HF.

In receive mode the RF signal received by antenna connected to J3 (SMA connector) is crossed the RF switch U43 to pin U43/3 and matching circuit C18, C17 and L7 to input RFI_HF of transceiver SX1277. The signal (RXTX) from pin U26/20 (low level) controls the RF switch U43. RF_GPIO4 signal (high level) activates the RF switch U43 in receive or transmit modes. In the sleep mode the RF_GPIO4 signal has low level and supports zero current consumption in the RF switch.

In transmit mode the output RF signal RFO_HF is connected to input of low pass filter (LPF:

C10, R2, C28, L8, C30, C31, L9, C32, L10 and C34). The clean RF signal from output of LPF is connected to pin U43/1 of RF switch and from U43/5, C39 and J3 to antenna.

Sincerely,

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