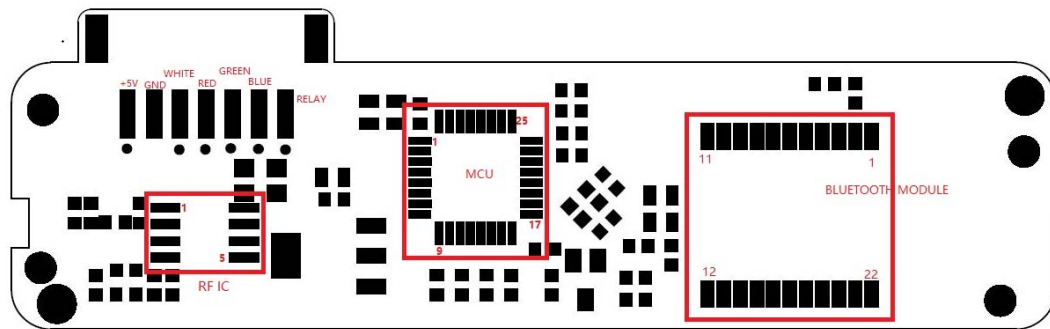# User Manual

1.0 Introduction

This manual is only applicable to PCBA COMMUNICATION MODULE.

2.0 General

The main components of the Bluetooth receiver include Bluetooth module, RF chips (CMT2210LH), MCU, antenna and antenna circuits.

Bluetooth receiver is mainly composed of RF receiving IC, microprocessor and bluetooth module.
The microprocessor is the main body of bluetooth receiver, which is used to process and control signals. RF receiving IC can realize the ook demodulation of the wall control signal and output the control signal after analysis and processing by the microprocessor.The application of bluetooth module realizes the convenient network connection between devices within a short distance.People can control the devices by moving them within a certain distance. The bluetooth module sends and receives signals in this way.

The following is a detailed description of these components

2.1 Bluetooth module Description

GWLE1010A from GooWi is a single-mode Bluetooth low energy module. It's for low power sensors and accessories, such as health device, active 3D glasses. GWLE1010A offers all Bluetooth low energy features: radio, stack, profiles. GWLE1010A also provides flexible hardware interface to connect sensors, simple user interfaces and even driver display device directly. GooWi setups the software development platform in the lab, provides the full software and customization service to our valuable customers.

Device Features：
- A small and cost effective Bluetooth® Low Energy System
- Bluetooth® specification v4.1
- Single module compliant – Supports mater or slave mode
- Integrated Bluetooth low energy stack: GAP,GATT,ATT,L2CAP,SMP
- RSSI monitoring for proximity applications
- Programmable general purpose
- 10-bti ADC
- 12 digital PIOs
- 3 analogue AIOs
- UART
- I2C interface
- Wakeup-interrupt
- Watchdog timer
- Software programmable
- Ultra Low current consumption

Specifications:

Operating Frequency Band	2.4GHz ~ 2.4835GHz unlicensed ISM band
Bluetooth Specification	V4.1
RF Output Power	3.0 dBm (MAX)
Operating Voltage	1.8V-3.6V
Host Interface	UART
Dimension	15.5mm (L) x 12 (W) mm x 2.4 (H) mm

NOTES:Specifications are subject to change without prior notice

Top view

Absolute Maximum Ratings

Rating	Min	Max	Unit
Storage temperature	-40	85	°C
Battery (VDD_BAT) operation$_{(a)}$	1.8	4.4	V
I/O supply voltage （VDD_IO）	-0.4	4.4	V
Other terminal voltages	VSS - 0.4	VDD + 0.4	V

Recommended Operation Conditions

Operating Condition	Min	Typ	Max	Unit
Operating temperature range	-30	-	85	°C
Battery (VDD_BAT) operation	1.8	-	3.6	V
I/O supply voltage (VDD_IO)	1.2	-	3.6	V

AIO

Input Voltage Levels	Min	Typ	Max	Unit
Input voltage	0	-	1.3	V

Pin Definition
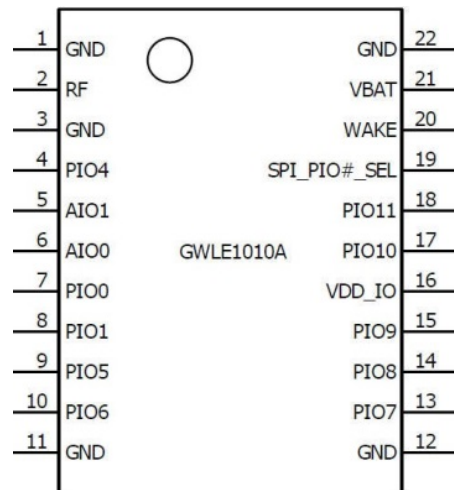
Pin No	Name	Type	Function	Remark
1	GND	GND	Ground	
2	RF	RF	Bluetooth transmitter/receiver	
3	GND	GND	Ground	
4	PIO4	Bi-directional	Programmable Input/Output Line	
			SPI serial flash chip select	
5	AIO1	Bi-directional	Analogue programmable input/output line	
6	AIO0	Bi-directional	Analogue programmable input/output line	
7	PIO0	Bi-directional	Programmable Input/Output Line 0	
			UART Data Output (TX)	
8	PIO1	Bi-directional	Programmable Input/Output Line 1	
			UART Data Input (RX)	
9	PIO5	Bi-directional	Programmable Input/Output Line 5	

|			Serial Peripheral Interface Clock	
10	PIO6	Bi-directional	Programmable Input/Output Line 6	
			Chip Select For Synchronous Serial Interface	
11	GND	GND	Ground	
12	GND	GND	Ground	
13	PIO7	Bi-directional	Programmable Input/Output Line 7	
			Serial Peripheral Interface Data Input	
14	PIO8	Bi-directional	Programmable Input/Output Line 8	
			Serial Peripheral Interface Data Output	
15	PIO9	Bi-directional	Programmable Input/Output Line 9	
16	VDD_IO	Power	Positive supply for all digital I/O port	
17	PIO10	Bi-directional	Programmable Input/Output Line 10	
18	PIO11	Bi-directional	Programmable Input/Output Line 11	
19	SPI_PIO#_SEL	Input	Selects spi debug (Input with strong internal Pull-down)	
20	WAKE	Input	Input to wake csr1000 QFN from hibernate (input has no internal pull-up or pull-down, Use external pull-down)	
21	VBAT	Power	Battery input	
22	GND	GND	Ground	

2.2 The RF receiving IC

The CMT2210LH typical application schematic:
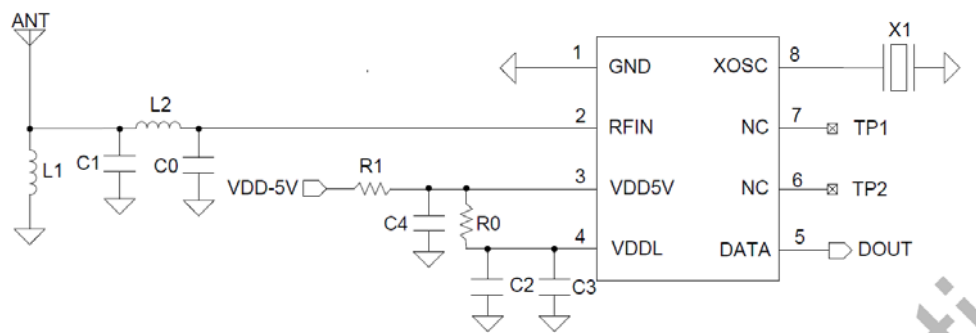
RF receiving IC demodulates the information received from the outside world and supplies it to the MCU for judgment execution.The CMT2210LH is an all-in-one receiver with a digital-analog hybrid

design. The product's 26MHz crystal provides the PLL's reference frequency and digital clock, supports OOK demodulation output with data rate of 1.0-5.0Ksps, and supports time-configurable periodic reset to avoid crashes caused by various external causes. The CMT2210LH supports two voltage range operating scenarios, which can be used in 5V system applications or as a 3V system application.

The chip uses LNA + MIXER + IFFILTER + limiter and PLL's low-IF architecture to achieve wireless reception at frequencies below 1G. The analog front end is responsible for downmixing the RF signal to the intermediate frequency, and converting the real-time RSSI into an 8-bit digital signal through the SAR-ADC, and sending it to the internal OOK demodulation and related processing. At the same time, the internal circuit mixes the intermediate frequency signal to zero frequency (baseband) and performs a series of filtering and judging processing. At the same time, the AGC dynamic control analog front end is performed, and finally the original signal is demodulated and output to the off-chip through the data pin.
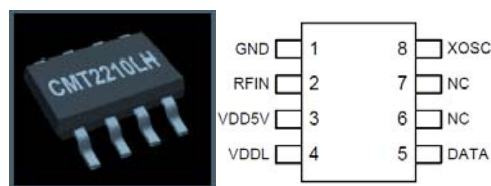
Pin Definition

PIN NO.	NAME	I/O	Description
1	GND	I	GND
2	RFIN	I	RF signal is input to chip LNA
3	VDD5V	I	The power input
4	VDDL	O	The power output
5	DATA	O	Receiving output
6	NC	--	Connectionless, suspended
7	NC	--	Connectionless, suspended
8	XIN	I	Crystal oscillator input, or external reference clock input

Electrical characteristics

VDD = 3.3 V, TOP = 25 ° C, FRF = 433.92 MHz, sensitivity is by receiving a PN9 sequence and matching to 50 Ω impedance, the BER measurement under the standard of 0.1%.Unless otherwise stated, all results were tested on the evaluation board cmt2210lh-em.

433MHz-based diffraction performance test filter with high receiving sensitivity, for example, in master-slave mode communication systems, 433MHz products can actually be used.In this way, the master-slave topology has the advantages of simple network structure, easy layout, and short power-on time. This is actually the prototype of the early smart home. 433MHz, 470MHz is now widely used in the smart meter reading industry.

Recommended Operation Conditions

Parameter	PIN	Conditions	MIN	Tym	MAX	UNIT
Battery (VDD_BAT) operation	V_{DD}	VDD5V and VDDL open circuit, temperature range in - 40 ℃ to + 85 ℃		3.0	5.5	V
		VDD5V and VDDL short circuit, temperature range in - 40 ℃ to + 85 ℃		2.0	3.6	V
Operating temperature range	T_{OP}			-40	85	℃
Supply voltage slope				1		mV/us

2.3 PCB antenna designs

PCB antenna is widely used in short distance remote control and communication. This part outlines Printed Circuit Board (PCB) antennas used by CSR.
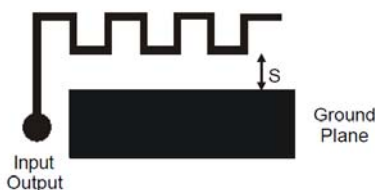

Meander Line Antenna

The length of the meander line antenna is difficult to predict. It is usually a bit longer than a quarter wave but dependent on its exact geometry and proximity to the ground plane.

Note:
In Figure 3 the ground plane is shown in black. S is the distance from the ground plane. See Figure 5 for approximate dimensions.

This type of antenna is always a PCB version. The antenna is printed on the top layer and a ground plane is placed near the antenna on the top layer. There must be no ground plane underneath the radiating section of the antenna.

The real part of the impedance of this antenna is about 15-25W, depending on geometry and proximity to the ground plane. The impedance matching is done by adjusting the length of the antenna until the input impedance is at the unity conductance circle (when normalised to 50W), in the top half of the Smith chart (Point A). A shunt capacitor is then connected between the antenna input and ground to match to 50W (Point B). Experimental measurement is used to determine the correct design.
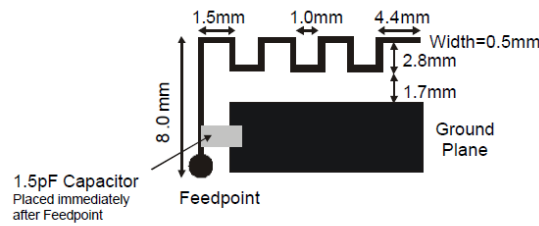
Real Designs

CSR recommends keeping metal objects as far away from the antenna as possible. Keeping metallic objects out of the near field is usually adequate.

Dielectric materials (like plastic or FR-4) detune an antenna by lowering its resonant frequency. The effect is not as serious as placing an antenna next to metal objects and can be corrected by reducing the length of the antenna. Therefore it is important for the antenna to be tuned when it is in the product. This is done during the development of the product.

2.4 MCU

The STM32F051x family incorporates the high-performance ARM Cortex™-M0 32-bit RISC core operating at a 48 MHz frequency, high-speed embedded memories (Flash memory up to 64 Kbytes and SRAM up to 8 Kbytes), and an extensive range of enhanced peripherals and I/Os. All de offer standard communication interfaces (up to two I2Cs, two SPIs, one I2S, one HDMI CEC, and up to two USARTs), one 12-bit ADC, one 12-bit DAC, up to five general-purpose 16-bit timers, a 32-bit timer and an advanced-control PWM timer.vices

The STM32F051x family operates in the -40 to +85 °C and -40 to +105 °C temperature ranges, from a 2.0 to 3.6 V power supply. A comprehensive set of power-saving modes allows the design of low-power applications.

The STM32F051x family includes devices in four different packages ranging from 32 pins to 64 pins. Depending on the device chosen, different sets of peripherals are included. The description below provides an overview of the complete range of peripherals proposed in this family.

These features make the STM32F051x microcontroller family suitable for a wide range of applications such as application control and user interfaces, handheld equipment, A/V receivers and digital TV, PC peripherals, gaming and GPS platforms, industrial applications, PLCs, inverters, printers, scanners, alarm systems, video intercoms, and HVACs.
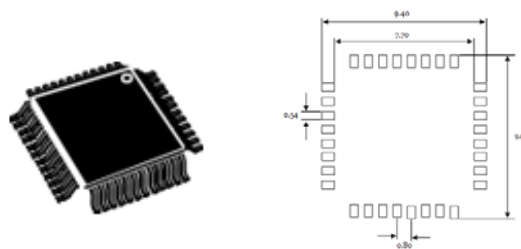
2.4.1 Memories

The device has the following features:

Up to 8 Kbytes of embedded SRAM accessed (read/write) at CPU clock speed with 0 wait states and featuring embedded parity checking with exception generation for fail- critical applications.

The non-volatile memory is divided into two arrays:

- – 16 to 64 Kbytes of embedded Flash memory for programs and data
- – Option bytes

The option bytes are used to write-protect the memory (with 4 KB granularity) and/or readout-protect the whole memory with the following options:

- – Level 0: no readout protection
- – Level 1: memory readout protection, the Flash memory cannot be read from or written to if either debug features are connected or boot in RAM is selected
- – Level 2: chip readout protection, debug features (Cortex-M0 serial wire) and boot in RAM selection disabled

2.4.2 Electrical characteristics

Parameter conditions

Unless otherwise specified, all voltages are referenced to VSS.

Minimum and maximum values

Unless otherwise specified, the minimum and maximum values are guaranteed in the worst conditions of ambient temperature, supply voltage and frequencies by tests in production on 100% of the devices with an ambient temperature at TA = 25 °C and TA = TAmax (given by the selected temperature range).

Data based on characterization results, design simulation and/or technology characteristics are indicated in the table footnotes and are not tested in production. Based on characterization, the minimum and maximum values refer to sample tests and represent the mean value plus or minus three times the standard deviation (mean±3).

Typical values

Unless otherwise specified, typical data are based on TA = 25 °C, VDD = VDDA = 3.3 V. They are given only as design guidelines and are not tested.

Typical ADC accuracy values are determined by characterization of a batch of samples from a standard diffusion lot over the full temperature range, where 95% of the devices have an error less than or equal to the value indicated (mean±2).
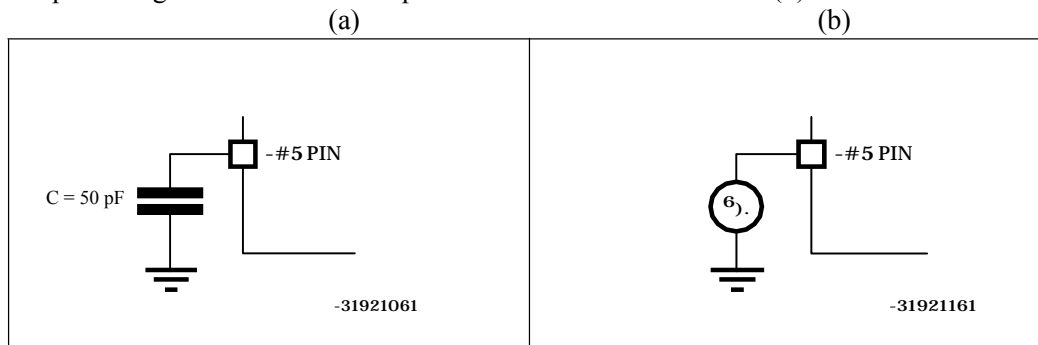
Typical curves

Unless otherwise specified, all typical curves are given only as design guidelines and are not tested.

Loading capacitor

The loading conditions used for pin parameter measurement are shown in (a).

Pin input voltage

The input voltage measurement on a pin of the device is described in (b).

| (a)	(b)
C = 50 pF -#5 PIN -31921061	6). -#5 PIN -31921161

2.4.3 Communication interfaces

- Up to two I^{2}C interfaces; one supporting Fast Mode Plus (1 Mbit/s) with 20 mA current sink, SMBus/PMBus, and wakeup from STOP
- Up to two USARTs supporting master synchronous SPI and modem control; one with ISO7816 interface, LIN, IrDA capability, auto baud rate detection and wakeup feature
- Up to two SPIs (18 Mbit/s) with 4 to 16 programmable bit frame, 1 with I2S interface multiplexed
- HDMI CEC interface, wakeup on header reception

2.5 The operational use conditions

2.5.1 Install

bluetooth
receiver

plug in
receiver

power supply
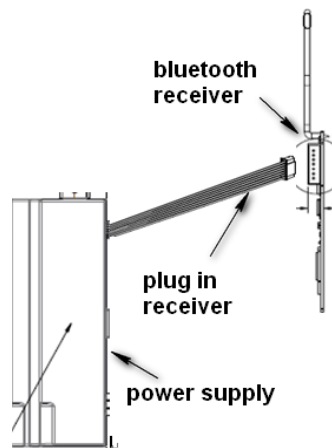
2.5.2Function

The main technique index as listed in the table below.

Working voltage	5VDC
Rated power	<140mW（26mA）
Standby power	<125mW（24.3mA）
Operating ambient temperature	0-35°C
Storage ambient temperature	-30-80°C
Operating Relative Humidity	0-95%RH
Storage Relative Humidity	0-95%RH

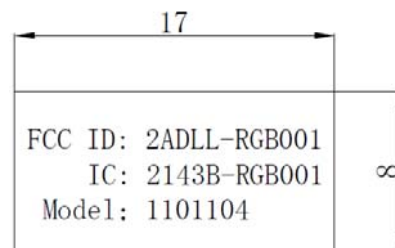Bluetooth LE frequency Range: 2.402GHz-2.48GHz

As a Bluetooth receiving board, it is powered by 5VDC. Rated power is less than 140mw.

2.5.3Physical drawing
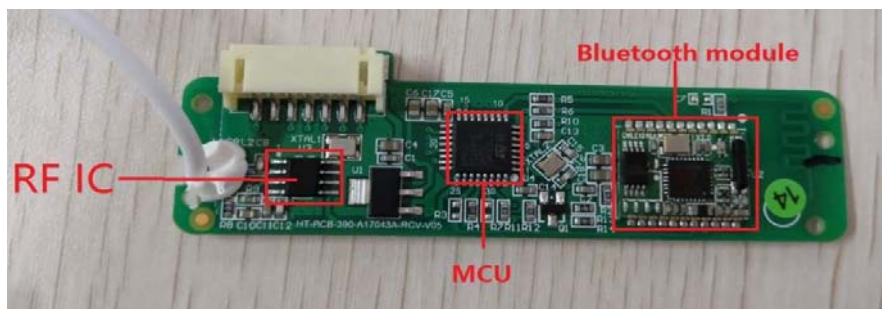
2.6 Label information

Physical or e-label stating "Contains FCC ID" with finished product.

2.7 FCC/ISEDC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules and licence-exempt RSS standards. 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.

Toute modification ou modification non expressément approuvée par la partie responsable de la conformité pourrait annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

Cet appareil est conforme à la section 15 des règles de la FCC et aux normes RSS exemptes de licence. L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne peut pas causer d'interférences nuisibles, et (2) cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent causer un fonctionnement indésirable.
ce dispositif est conforme aux règles de la partie 15 de la rss et exempts de licence.

RF Exposure Statement:

This equipment complies with FCC/ISEDC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Énoncé d'exposition RF:

Cet équipement est conforme aux limites d'exposition aux rayonnements FCC/ISEDC établies pour un environnement non contrôlé. Cet équipement doit être installé et exploité avec une distance minimale de 20cm entre le radiateur et votre corps.

FCC/ISEDC Label Instructions:

Physical or e-label stating "Contains FCC ID: 2ADLL-RGB001" or "Contains IC: 2143B-RGB001" with finished product. Any similar wording that expresses the same meaning may be used.

L'étiquette physique ou électronique indiquant Contient le FCC ID: 2ADLL-RGB001 ou Contient IC: 2143B-RGB001 avec le produit fini. Toute formulation similaire exprimant le même sens peut être utilisée.

Regulatory Module Integration Instructions:

This device complies with part 15.247 of the FCC Rules and RSS-247 of RSS standards.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The Bluetooth antenna is integral PCB antenna and maximum gain is 0dBi.

This Bluetooth module has been granted modular approval for bath fan application.OEM integrators for host products may use the module in their final products without additional FCC certification if they meet the following conditions. Otherwise, additional FCC/ISEDC approvals must be obtained.

The host product with the module installed must be evaluated for simultaneous transmission requirements.

The user's manual for the host product must clearly indicate the operation requirements and conditions that must be observed to ensure compliance with current FCC/ISEDC RF exposure guidelines.

To comply with FCC/ISEDC regulations limiting both maximum RF output power and human exposure to RF radiation, use this module only with the included onboard antenna.

The final host/module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a part 15 digital device.