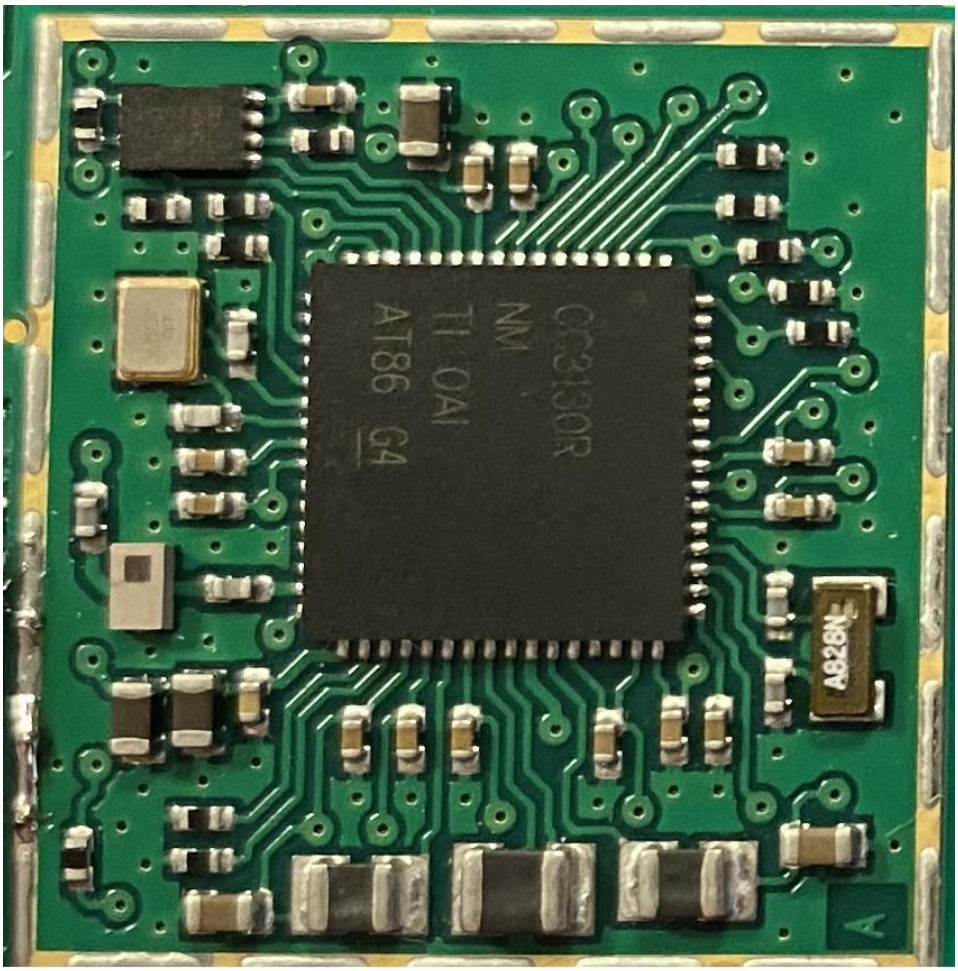
Grundfos RA2G4WIFI Module



Ver. 00REG
User guide

1 Introduction

The WIFI module is a complete integrated WLAN 802.11b/g/n radio transceiver solution based on a wireless network processor. The module supports CCK and OFDM rates in the 2.4GHz band and can operate in station, access-point, or in Wi-Fi Direct mode.
BLE and WIFI radio coexistence is supported with the RA2G4MSR and CIM280 modules.
Firmware can initially be programmed from the host micro using the UART interface. For updating the firmware, the SPI interface can also be used or if this is not available, over the air is also possible (that might require external flash depending on the size of the software).

2 Circuit Description

The Grundfos WIFI module is based on a dedicated WIFI network processor. The module subsystem includes an 802.11b/g/n radio transceiver, integrated IPv6 and IPv4 TCP/IP protocol handling, and baseband with built in power management. The module is supplied through pin 8 and operates on a nominal supply voltage of 3.3V.

The CC3130R consists of a dedicated MCU that handles the WIFI communication driver and internet protocol TCP/IP stack.

Two crystals are used in this design, a 40MHz crystal[X2] for the WLAN circuit, and a 32.768kHz crystal[X3] for the RTC circuit.

Controlling the WIFI module from an external host can be done through the SPI or UART interface. The interrupt (INTRPT PIN 15) signal can be used to initiate a SPI data transfer by interrupting the external host.

For storage a 16Mb serial Flash memory [U6] is accessible and can be programmed through the UART or SPI interface.

The CC3130R features a single-ended 50Ω RF port. The RF signal is filtered through a 2.4GHz bandpass filter [FLT1] and can be accessed on pin 2.

3 Specifications

Supply				
-	Min	Nominal	Max	Unit
Supply voltage	-0.5	2.1 –**3.3** - 3.6	3.8	V
Current consumption TX[1]	223	247,5	272	mA
Current consumption RX	-	53	-	mA
Current consumption idle	-	690	-	µA
Peak calibration current	-	450	-	mA
Temperature				
	Min	Nominal	Max	Unit
Operating temperature	-40	-	+85	°C
Storage temperature	-55	-	+125	°C
Radio performance[2]				
	Min	Nominal	Max	Unit
Transmission power [1Mbps DSSS]	-	16.05	-	dBm
Transmission power [54Mbps OFDM]	-	14.15	-	dBm
Receiver sensitivity [1Mbps DSSS]	-	-93	-	dBm
Receiver sensitivity [54Mbps OFDM]	-	-71	-	dBm

Table 2: Specifications

1) Conditions: supply voltage: 3.6V, max power, range from 1Mbps DSSS to 54Mbps OFDM.
2) Conditions: supply voltage : 3.3V, max power, temperature ambient: 25°C.
3) Conditions: supply voltage : 3.3V | The complete calibration can take up to 17mJ of energy from the battery over a time of 24ms.

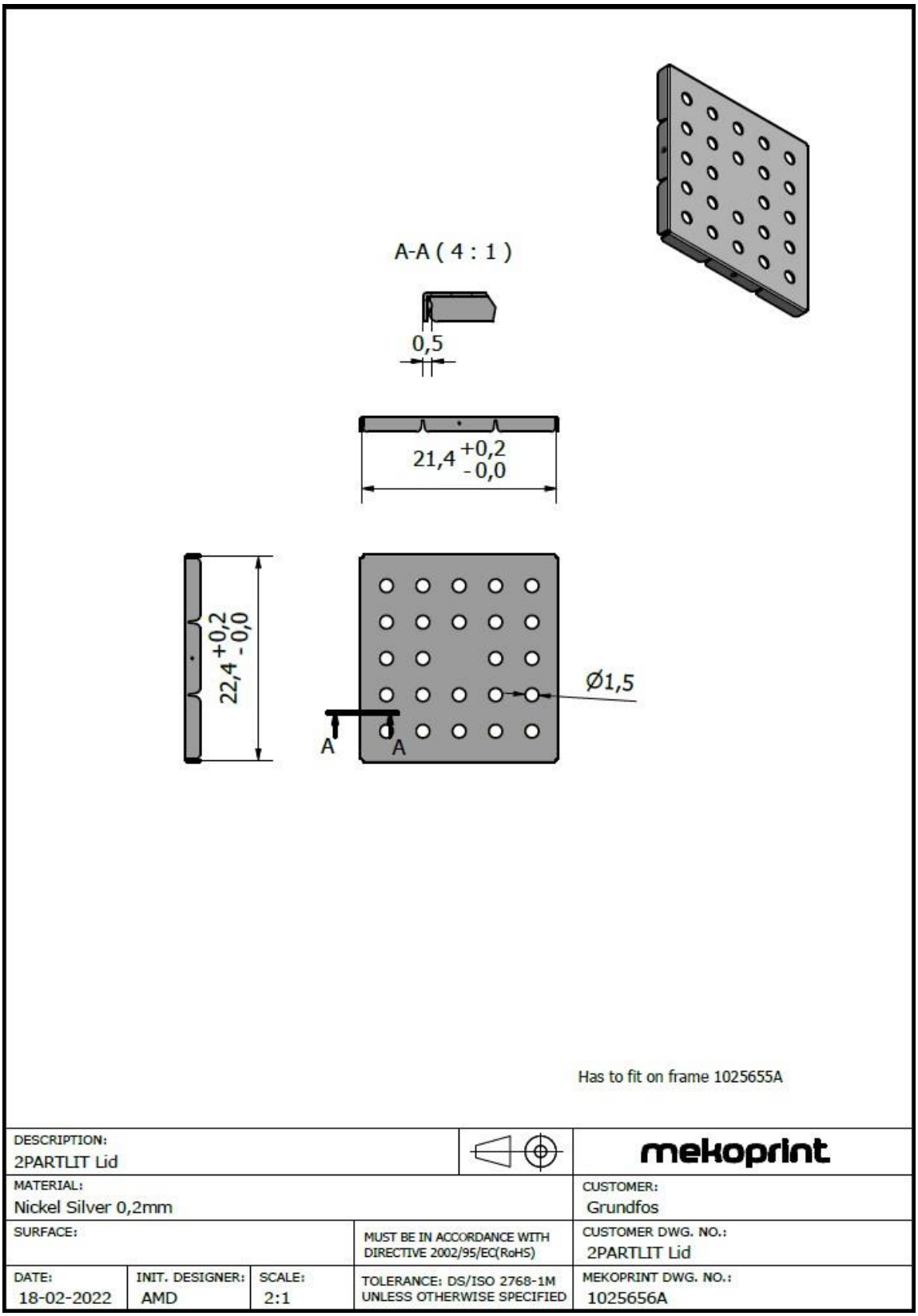
4 Features

A complete list of the network processor (NWP) features can be seen in Table 3.

Feature	Description
Wi-Fi standards	802.11b/g/n station 802.11b/g AP supporting up to four stations Wi-Fi Direct client and group owner
Wi-Fi channels	2.4 GHz ISM
Channel Bandwidth	20 MHz
Wi-Fi security	WEP, WPA/WPA2 PSK, WPA2 enterprise (802.1x), WPA3 personal and enterprise
Wi-Fi provisioning	SmartConfig technology, Wi-Fi protected setup (WPS2), AP mode with internal HTTP web server
IP protocols	IPv4/IPv6
IP addressing	Static IP, LLA, DHCPv4, DHCPv6 with DAD
Cross layer	ARP, ICMPv4, IGMP, ICMPv6, MLD, NDP
Transport	UDP, TCP SSLv3.0/TLSv1.0/TLSv1.1/TLSv1.2 RAW
Network applications and utilities	Ping HTTP/HTTPS web server mDNS DNS-SD DHCP server
Host interface	UART/SPI
Security	Device identity Trusted root-certificate catalog TI root-of-trust public key
Power management	Enhanced power policy management uses 802.11 power save and deep-sleep power modes
Other	Transceiver Programmable RX filters with event-trigger mechanism Rx Metrics for tracking the surrounding RF environment

Table 3: Network processor feature list

5 RF Shield



DESCRIPTION: 2PARTLIT Lid				mekoprint
MATERIAL: Nickel Silver 0,2mm				CUSTOMER: Grundfos
SURFACE:			MUST BE IN ACCORDANCE WITH DIRECTIVE 2002/95/EC(RoHS)	CUSTOMER DWG. NO.: 2PARTLIT Lid
DATE: 18-02-2022	INIT. DESIGNER: AMD	SCALE: 2:1	TOLERANCE: DS/ISO 2768-1M UNLESS OTHERWISE SPECIFIED	MEKOPRINT DWG. NO.: 1025656A

6 Host labelling requirements

Grundfos Holding A/S WIFI radio module, which is labelled “FCC ID: OG3-RA2G4WIFI” and “IC: 10447A-RA2G4WIFI” must observe the guide below for any host product

1. The host product must have a window or opening allowing the module label to be visible, or
2. Must have a label with the text
    - ”Contains FCC ID: OG3-RA2G4WIFI”, and
    - ”Contains IC: 10447A-RA2G4WIFI”,

The lines may not be divided, or

3. If the host has an electronic display, the text
    - ”Contains FCC ID: OG3- RA2G4WIFI”, and
    - ”Contains IC: 10447A- RA2G4WIFI”

must be accessible with no more than 3 key presses.

7 Host installation recommendations

It is recommended to have a full GND layer in the application PCB (e.g. mid-layer of your application PCB). To prevent interference with your application circuit, please follow the advices below:
Avoid any copper structure in the area directly underneath the module (top-layer layout of your application PCB). If this is not possible in your design, you must provide coating on top of your PCB to prevent short circuits to the module. All bare metal surfaces including vias have to be covered (e.g. adequate layout of solder resist).
To avoid RF performance degradations, it is recommended to separate signal traces (e.g. bus signals and power lines) from the module. If signal tracks routing under the module is unavoidable the separating can be obtained creating a ground plane between module and signal traces.

8 Power supply requirements

In order to ensure a good radio performance, attention must be paid to the power supply layout and RF shielding.
All GND pins must be connected to GND (be careful not to create loops).
The ground must be realized ideally on both sides of the PCB board with many VIA´s.
The power supply is required to deliver a minimum of 272mA output current for the WIFI module. It is recommended to use a power supply with some headroom that can deliver higher current to avoid threshold limitations and voltage drops.
The recommended supply voltage is 3.3V. If 3.3V is not available, it is possible to operate the WIFI module from 2.1V to 3.8V. The supply voltage and current consumption specifications can be seen in Table 2. The radio performance is very sensitive to the supply voltage level and care must be taken especially if lowering the voltage. If the voltage level drops below 2.1V all sections of the radio shut down except for the hibernate module. To avoid unintentionally shut down of the module and radio performance degradation the minimum voltage specified must also include the supply voltage ripple (CC3130R requires less than ±300 mV ripple) and all other transient dips.

9 Antenna recommendations

The antenna is an essential part of the radio and it is important that the design and mechanical integration is considered early in the development phase. The CC3130R radio used is one of the best in the marked, but it can easily be destroyed by a poor antenna design and integration.
In general, it is recommended to place the antenna as close to the module as possible and to ensure an impedance matching of 50Ω.

For any advice, questions or design-help the development department can always be contacted.

The maximum allowed Effective Isotropic Radiated Power (EIRP) is 20dBm for FHSS equipment in EU (ETSI 300.328 wideband transmission systems). The FCC EIRP rules is less strict with a maximum allowed EIRP of 36dBm.

Depending on the antenna gain it may be necessary to decrease the transmission output power. When calibrating the output power, it is recommended to consider anything that can affect the power as DUT-to-DUT variations, temperature, modulation etc.

For internal verification and modular approval an PCB printed IFA antenna is used with a max. antenna gain of 3dBi.

In some areas it can be allowed to transmit with more power, in such cases the design must be verified with the development department.

9.1 Antenna design example

For PCB antenna design with the WIFI module a 2.4GHz IFA can be used – see Figure 5

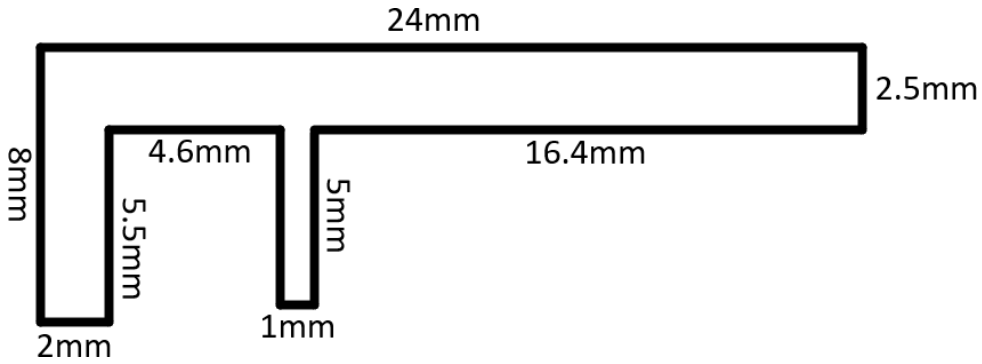


Figure 5: 2.4GHz IFA

10 Detailed description

10.1 WLAN Features

- 802.11b/g/n integrated radio, modem, and MAC supporting WLAN communication as a BSS station, AP, Wi-Fi Direct client, and group owner with CCK and OFDM rates in the 2.4 GHz band (channels 1 through 13).
  Note 802.11n is supported only in Wi-Fi® station and Wi-Fi Direct.
- The automatically calibrated radio with a single-ended 50-Ω interface enables easy connection to the antenna without requiring expertise in radio circuit design.
- Advanced connection manager with multiple user-configurable profiles stored in serial flash allows automatic fast connection to an access point without user or host intervention.
- Supports all common Wi-Fi security modes for personal and enterprise networks with on-chip security accelerators, including: WEP, WPA/WPA2 PSK, WPA2 Enterprise (802.1x), WPA3 Personal and WPA3 Enterprise.
- Smart provisioning options deeply integrated within the device providing a comprehensive end-to-end solution. With elaborate events notification to the host, enabling the application to control the provisioning decision flow. The wide variety of Wi-Fi provisioning methods include:
  - Access Point with HTTP server
  - WPS - Wi-Fi Protected Setup, supporting both push button and pin code options.
  - SmartConfig Technology: TI proprietary, easy to use, one-step, one-time process used to connect a CC3130-enabled device to the home wireless network.
- 802.11 transceiver mode allows transmitting and receiving of proprietary data through a socket The 802.11 transceiver mode provides the option to select the working channel, rate, and transmitted power. The receiver mode works with the filtering options.
- Antenna selection for best connection
- BLE/2.4 GHz radio coexistence mechanism to avoid interference

10.2 Network stack

- Integrated IPv4, IPv6 TCP/IP stack with BSD socket APIs for simple Internet connectivity with any MCU, microprocessor, or ASIC
  Note: Not all APIs are 100% BSD compliant. Not all BSD APIs are supported.
- Support of 16 simultaneous TCP, UDP, RAW, SSL\TLS sockets
- Built-in network protocols:
- Static IP, LLA, DHCPv4, DHCPv6 with DAD and stateless autoconfiguration
  - ARP, ICMPv4, IGMP, ICMPv6, MLD, ND
  - DNS client for easy connection to the local network and the Internet
- Built-in network applications and utilities:
  - HTTP/HTTPS
- Web page content stored on serial flash
- RESTful APIs for setting and configuring application content
- Dynamic user callbacks
  - Service discovery: Multicast DNS service discovery lets a client advertise its service without a centralized server. After connecting to the access point, the CC3130 device provides critical information, such as
- device name, IP, vendor, and port number.
  - DHCP server
  - Ping

10.3 Host UART interface

Simplelink UART Host interface configuration

property	Supported configuration
Baud rate	115200 bps
Data bits	8 bits
Flow control	CTS/RTS
Parity	None
Stop bits	1
Bit order	LSBit first
Host interrupt polarity	Active high
Host interrupt mode	Rising edge or level 1

10.4 BLE/WIFI coexistence

- The CC3130 device is designed to support BLE/2.4 GHz radio coexistence. Because WLAN is inherently more tolerant to time-domain disturbances, the coexistence mechanism gives priority to the Bluetooth low energy entity over the WLAN.

The following coexistence modes can be configured by the user:

- Off mode or intrinsic mode
  - No BLE/WIFI radio coexistence, or no synchronization between WLAN and Bluetooth low energy—in case Bluetooth low energy exists in this mode, collisions can randomly occur.
- Time division multiplexing (TDM, single antenna)
  - WIFI and BLE share the antenna through an RF switch using two GPIOs (one input and one output from the WLAN perspective).
- Time division multiplexing (TDM, dual antenna)
  - WIFI and BLE have separate antennas, No RF switch is required and only a single GPIO (on input from the WLAN perspective).