

Miniature WiFi + BLE Dual-Core Microcontroller

**Feature Rich, Low Power and Optimized RF providing
Best Network Connectivity for Harsh Environments**

Built around the RTL8721 SoC from Realtek, the CMP4010 offers single-stream 802.11n + BLE v5.0. This dual-core device features a KM4 MCU, designed by ARM and Realtek specifically for battery-powered WiFi devices, and a M0 core to manage BLE and power modes. The combination of 16 Mbit FLASH and 4.5 Mbit SRAM, combined with execute-in-place (XIP) functionality, allow room for user application code such that an external mcu is not required for most applications. Designed for low-power requirements, SoC shutdown modes and mcu deep-sleep modes minimize current consumption to achieve maximum battery life.



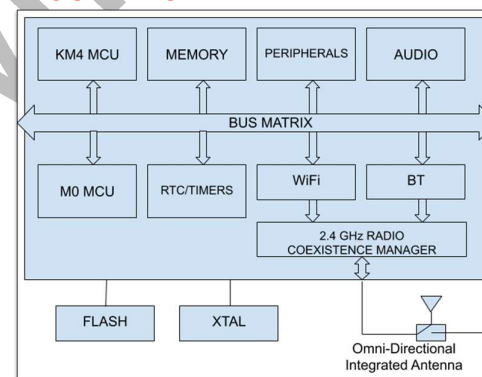
KEY FEATURES

- Multi-Protocol Wireless Connectivity
 - WiFi: Single Stream 802.11 b/g/n
 - Max Tx Power: 18 dBm
 - WiFi Direct and Soft AP support
 - 20MHz/40MHz channels up to MCS7
 - 802.11 Power Management
 - Wake-On-RF Mode
 - BLE v5.0
 - Max Tx Power: 5.7 dBm
 - 2 Mbit PHY
 - Bluetooth Mesh
 - Integrated Co-Existence Manager
- ARM Cortex-KM4 for User Application
 - Clock speed up to 200 MHz
 - Cortex-M4F Instruction Compatible
 - USB/UART/SPI/I2C Serial Interfaces
 - 35 GPIO for Design Flexibility
 - Integrated RTC
 - I2S and Audio Codec
 - Cap Touch and Keyscan
- Integrated Shared Memory Resources
 - 16 Mb flash
 - 4 Mb PSRAM; 512 kb SRAM
- Low-Power Modes
 - 7 uA Deep Sleep (WiFi Off)
 - 30 uA Sleep (WiFi Power Save)
 - Wake from Deep Sleep Input
- Advanced Security Features
 - AES-128/256 HW Crypto Engine and PRNG
 - TrustZone-M Support
 - Secure Boot
 - Flash Decryption On-The-Fly
 - Secure OTA FW Updates

SPECIFICATIONS

- Dimensions: 16.7 x 26.3 x TBD mm
- Antenna: Integrated PCB Trace or u.FI
- Operating Voltage: 3.3V (+/- 0.3V)
- Operating Temperature: -40° C to +85°C
- Certifications: FCC/IC Pending

BLOCK DIAGRAM



SOFTWARE DEVELOPMENT TOOLS

- RTOS Support: FreeRTOS, Arm Mbed
- Toolchain Support: IAR, GCC
- AWS/Google Cloud/Azure Certified Platform
- Alexa/Smart Assistant and Homekit Support

REFERENCE CODE AVAILABLE

- Wi-Fi Provisioning via BLE
- USB UVC Camera Interface
- OTA FW Updates

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TRANSCIVER IC

The CMP4010, utilizing the Realtek RLT8721 SoC, is a WiFi+Bluetooth combo device with dual-integrated MCU cores. This module supports WiFi- and Bluetooth communications while hosting the end-user application. The architecture is optimized for low-power consumption. Customers can select from several supported RTOS implementations and also interface to a variety of peripherals or external MCUs.

INTEGRATED FLASH

The CMP4010 incorporates 16 Mbit an additional SPI flash for storing program code and Over-The-Air code updates. The flash is managed by the core SoC SPI Flash Controller (SPIC) and is accessible by both MCU cores in the CMP4010.

ABSOLUTE MAXIMUM RATINGS

Description	Min	Max	Unit
Storage temperature range	-40	125	°C
Power supply voltage (VDD)	3.0	3.6	V
I/O supply voltage	0.99	3.6	V

* VDD = Terminal Supply Domain

RECOMMENDED OPERATING CONDITIONS

Description	Min	Typ	Max	Unit
Operating temperature range	-40	-	85	°C
Power supply voltage (VDD)	3.0	-	3.6	V

POWER CONSUMPTION

(@25°C unless otherwise specified)

Operation Mode	Scenario	Min	Typical	Max	Unit
Deep Sleep	RTC Timer; 1 kB RAM retention	7	7.5	8	uA
Sleep	KM4 Power Gate; KM0 Clock Gate All RAM retained; WiFi retained	30	40	50	uA
Active	HT20 MCS0~7 Normal Mode KM4 Active Mode Rx Idle	-	52	-	mA
	HT20 MCS0~7 ULP Mode KM4 Active Mode Rx Idle	-	35	-	
	HT20 MCS0~7 ULP Mode KM4 Active Mode UDP Rx @ 8 Mbps	-	39	-	
WoWLAN Beacon	Rx Beacon Normal Mode KM4 Sleep Mode	-	28	-	mA
	Rx Beacon ULP Mode KM4 Sleep Mode	-	23	-	
WoWLAN DTIM=1	KM4 Sleep Mode; SRAM Retained WiFi Retained	700	750	800	uA

Transmit Mode	Min	Typical	Max	Unit
MCS7/HT20 – 18 dBm Tx	-	248	-	mA
MCS7/HT40 – 18 dBm Tx	-	247	-	mA
OFDM 54 Mbps – 19 dBm Tx	-	262	-	mA
CCK 11 Mbps – 18 dBm	-	257	-	mA

Bluetooth Operation Mode	Typical	Units
Continuous RX	TBD	mA
Continuous TX (4 dBm)	TBD	mA
Continuous TX (12.5 dBm)	TBD	mA
1.28 sec Page Scan	TBD	mA
1.28 sec LE ADV	TBD	mA
1.28 sec Sniff - Master	TBD	mA
1.28 sec Sniff - Slave	TBD	mA

Wi-Fi 2.4 GHz Band RF Receiver Specifications

(@25°C unless otherwise specified)

Parameter	Description	Min	Typ	Max	Unit
Frequency Range	Center Channel Frequency	2412	-	2484	MHz
RX Sensitivity	1 Mbps CCK	-99.1	-98.6	-97.5	dBm
	2 Mbps CCK	-97	-95.9	-95.5	
	5.5 Mbps CCK	-94.5	-94.2	-93.5	
	11 Mbps CCK	-91.5	-91.1	-90.6	
RX Sensitivity	BPSK rate 1/2, 6 Mbps OFDM	-96	-95.4	-94.3	dBm
	BPSK rate 3/4, 9 Mbps OFDM	-94.5	-94.3	-93.9	
	QPSK rate 1/2, 12 Mbps OFDM	-93	-92.9	-92.5	
	QPSK rate 3/4, 18 Mbps OFDM	-91	-90.4	-90	
	16QAM rate 1/2, 24 Mbps OFDM	-87	-86.8	-86.4	
	16QAM rate 3/4, 36 Mbps OFDM	-84	-83.8	-83.4	
	64QAM rate 1/2, 48 Mbps OFDM	-79.5	-79.2	-78.9	
64QAM rate 3/4, 54 Mbps OFDM	-78.1	-77.8	-77		
RX Sensitivity BW = 20 MHz Mixed Mode 800 ns Guard Interval Non-STBC	MCS 0, BPSK rate 1/2	-95.5	-95.1	-94.1	dBm
	MCS 1, QPSK rate 1/2	-92.2	-92	-91.7	
	MCS 2, QPSK rate 3/4	-90	-89.4	-89	
	MCS 3, 16QAM rate 1/2	-86.5	-85.8	-84	
	MCS 4, 16QAM rate 3/4	-83.2	-82.9	-82.5	
	MCS 5, 64QAM rate 2/3	-78.5	-78.4	-78	
	MCS 6, 64QAM rate 3/4	-77	-76.7	-76.4	
RX Sensitivity BW = 40 MHz Mixed Mode 800 ns Guard Interval Non-STBC	MCS 0, BPSK rate 1/2	-93	-92.5	-92.2	dBm
	MCS 1, QPSK rate 1/2	-89.5	-88.7	-87	
	MCS 2, QPSK rate 3/4	-87	-86.5	-86.4	
	MCS 3, 16QAM rate 1/2	-83.5	-83.3	-83	
	MCS 4, 16QAM rate 3/4	-80	-79.9	-79	
	MCS 5, 64QAM rate 2/3	-75.5	-75.4	-75	
	MCS 6, 64QAM rate 3/4	-74.5	-74	-73.9	
Maximum Receive Level	6 Mbps OFDM	-	0	-	dBm
	54 Mbps OFDM	-	0	-	
	MCS 0	-	0	-	
	MCS 7	-	0	-	
Receive Adjacent Channel Rejection	1 Mbps CCK	42	43	44	dBm
	11 Mbps CCK	39	41	42	
	BPSK rate 1/2, 6 Mbps OFDM	39	40	41	
	64QAM rate 3/4, 54 Mbps OFDM	20	22	24	
	HT20, MCS 0, BPSK rate 1/2	39	39	40	
	HT20, MCS 7, 64QAM rate 5/6	19	20	21	
	HT40, MCS 0, BPSK rate 1/2	27	29	32	
HT40, MCS 7, 64QAM rate 5/6	9	10	11		

Wi-Fi 2.4 GHz Band RF Transmitter Specifications

(@25°C unless otherwise specified)

Parameter	Description	Min	Typ	Max	Unit
Frequency Range	Center Channel Frequency	2412	-	2484	MHz
Output power with spectral mask and EVM compliance	1 Mbps CCK	-	18	-	dBm
	11 Mbps CCK	-	18	-	
	BPSK rate 1/2, 6 Mbps OFDM	-	17	-	
	64QAM rate 3/4, 54 Mbps OFDM	-	17	-	
	HT20, MCS 0, BPSK rate 1/2	-	16	-	
	HT20, MCS 7, 64QAM rate 5/6	-	16	-	
	HT40, MCS 0, BPSK rate 1/2	-	16	-	
HT40, MCS 7, 64QAM rate 5/6	-	16	-		
TX EVM	BPSK rate 1/2, 6 Mbps OFDM	-	-	-5	dBm
	64QAM rate 3/4, 54 Mbps OFDM	-	-	-25	
	HT20, MCS 0, BPSK rate 1/2	-	-	-5	
	HT20, MCS 7, 64QAM rate 5/6	-	-	-28	
	HT40, MCS 0, BPSK rate 1/2	-	-	-5	
	HT40, MCS 7, 64QAM rate 5/6	-	-	-28	
Output Power Variation	After Power Trim	-1.5	-	1.5	dBm
Carrier Suppression Harmonic Output Power	1 st Harmonic	-	-	-30	dBm
	2 nd Harmonic	-	-23-	-21.9	
	3 rd Harmonic	-	-15	-14	

Bluetooth 2.4 GHz Band RF Tx/Rx Specifications

(@25°C unless otherwise specified)

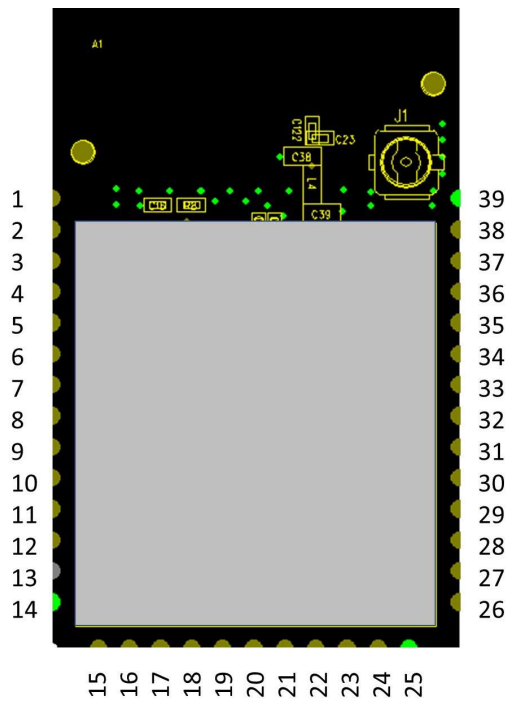
Parameter	Min	Typ	Max	Unit
Frequency Range	2402	-	2480	MHz
Bluetooth Max TX Power	-	TBD	-	dBm
Bluetooth RX Sensitivity	-	TBD	-	dBm

I/O PIN ASSIGNMENTS

Refer to the RLT8721 datasheet for pin functionality details.

Module Pin Number	Pin Name	Notes
1	PA27	
2	PA30	
3	RREF/PA28	
4	HSDP/PA26	
5	HSDM/PA25	
6	PB1	
7	PB2	
8	PB3	
9	PB4	
10	PB5	
11	PB6	
12	PB7	
13	VCC	
14	GND	
15	F_SPI_DATA0/PB18	
16	PB19	
17	F_SPI_CS_PB20	
18	F_SPI_DATA1/PB21	
19	PB22	
20	PB23	
21	PB26	
22	PB29	
23	PB31	
24	PA0	
25	GND	
26	PA4	
27	PA2	
28	CHIP_ENABLE	
29	UART_LOG_TXD	
30	UART_LOG_RXD	
31	PA19	
32	PA18	
33	PA17	
34	PA16	
35	PA15	
36	PA14	
37	PA12	
38	PA13	
39	GND	

MODULE PINOUT



MODULE DIMENSIONS

16.7 x 26.3 x TBD mm

MODULE LAND FOOTPRINT

TBD

EVALUATION KIT

Part Number: CMP4010-A-EVB



PROCESSING

Recommended Reflow Profile

Parameter Values	
Ramp Up Rate (from T_{soakmax} to T_{peak})	3°/sec max
Minimum Soak Temperature	150°C
Maximum Soak Temperature	200°C
Soak Time	60-120 sec
T_{Liquidus}	217°C
Time above TL	60-150 sec
T_{peak}	250°C
Time within 5° of T_{peak}	20-30 sec
Time from 25° to T_{peak}	8 min max
Ramp Down Rate	6°C/sec max

Pb-Free Solder Paste

Use of “No Clean” soldering paste is strongly recommended, as it does not require cleaning after the soldering process.

Note: *The quality of solder joints on the castellations (“half vias”) where they contact the host board should meet the appropriate IPC Specification. See the Castellated Terminations Section in the latest IPC-A-610 Acceptability of Electronic Assemblies document.*

Cleaning

In general, cleaning the populated module is strongly discouraged. Residuals under the module cannot be easily removed with any cleaning process.

- Cleaning with water can lead to capillary effects where water is absorbed into the gap between the host board and the module. The combination of soldering flux residuals and encapsulated water could lead to short circuits between neighboring pads. Water could also damage any stickers or labels.
- Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the two housings, which is not accessible for post-washing inspection. The solvent could also damage any stickers or labels.
- Ultrasonic cleaning could damage the module permanently.

The best approach is to consider using a “No Clean” solder paste and eliminate the post-soldering cleaning step.

Optical Inspection

After soldering the module to the host board, consider optical inspection to check the following:

- Proper alignment and centering of the module over the pads
- Proper solder joints on all pads
- Excessive solder or contacts to neighboring pads or vias

Repeating Reflow Soldering

Only a single reflow soldering process is encouraged for host boards.

Wave Soldering

If a wave soldering process is required on the host boards due to the presence of leaded components, only a single wave soldering process is encouraged.

Hand Soldering

Hand soldering is possible. When using a soldering iron, follow IPC recommendations (reference document *IPC-7711*).

Rework

The CMP4010 can be unsoldered from the host board. Use of a hot air rework tool should be programmable and the solder joint and module should not exceed the maximum peak reflow temperature of 250°C.

Caution

If temperature ramps exceed the reflow temperature profile, module and component damage may occur due to thermal shock. Avoid overheating.

Warning

Never attempt a rework on the module itself (i.e., replacing individual components); such actions will terminate warranty coverage.

Additional Grounding

Attempts to improve the module or the system grounding by soldering braids, wires or cables onto the module RF shield cover is done at the customer's own risk. The ground pins at the module perimeter should be sufficient for optimum immunity to external RF interference.

AGENCY CERTIFICATIONS (PCB ANTENNA ONLY) **PENDING**

The following certifications are in effect for CMP4010:

- FCC
- IC
- CE RED

FCC Compliance Statement Part 15.19, Section 7.15 of RSS-GEN **PENDING**

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS Standards. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Warning (Part 15.21)

Changes or modifications not expressly approved by CEL could void the user's authority to operate the equipment.

20 cm Separation Distance

To comply with FCC/IC RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM Responsibility to the FCC and IC Rules and Regulations

The CMP4010 has been certified per FCC Part 15 Rules and to Industry Canada license-exempt RSS Standards for integration into products without further testing or certification. To fulfill the FCC and IC Certification requirements, the OEM of the CMP4010 must ensure that the information provided on the CMP4010 label is placed on the outside of the final product. The CMP4010 is labeled with its own FCC ID Number and IC ID Number. If the FCC ID and the IC ID are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. The exterior label can use wording such as the following:

"Contains Transmitter Module FCC ID: W7Z- tbd" or "Contains FCC ID: W7Z- tbd"

"Contains Transmitter Module IC: 8254A- tbd " or "Contains IC: 8254A- tbd"

The OEM of the CMP4010 may only use the approved antenna (PCB trace antenna) that has been certified with this module. The OEM of the CMP4010 must test their final product configuration to comply with Unintentional Radiator Limits before declaring FCC Compliance per Part 15 of the FCC Rules.

IC Certification — Industry Canada Statement ****PENDING****

The term "IC" before the certification/registration number only signifies that the Industry Canada technical specifications were met.

Certification IC - Déclaration d'Industrie Canada

Le terme "IC" devant le numéro de certification/d'enregistrement signifie seulement que les spécifications techniques Industrie Canada ont été respectées.

Section 14 of RSS-210

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population. Consult Safety Code 6, obtainable from Health Canada's website:

<http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>

L'article 14 du CNR-210

Le programme d'installation de cet équipement radio doit s'assurer que l'antenne est située ou orientée de telle sorte qu'il ne pas émettre de champ RF au-delà des limites de Santé Canada pour la population générale. Consulter le Code de sécurité 6,

disponible sur le site Web de Santé Canada: <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>

ANTENNA

CEL's CMP4010 includes an integrated Printed Circuit Board (PCB) trace antenna. An optional configuration which uses a u.FI connector on the module allows the user to connect an external antenna. The CMP4010 has been certified with the PCB trace antenna only.

The PCB antenna employs a topology that is compact and highly efficient. To maximize range, an adequate ground plane must be provided on the host PCB. Correctly positioned, the ground plane on the host PCB will contribute significantly to the antenna performance (it should not be directly under the module PCB antenna). The position of the module on the host board and overall design of the product enclosure contribute to antenna performance. Poor design affects radiation patterns and can result in reflection, diffraction and/or scattering of the transmitted signal.

For optimum antenna performance, the CMP4010 should be mounted with the PCB trace antenna overhanging the edge of the host board. To further improve performance, a ground plane may be placed on the host board under the module; up to the antenna (a minimum of 1.5" x 1.5" is recommended). The installation of an uninterrupted ground plane on a layer directly beneath the module will also allow you to run traces under this layer. CEL can assist with your PCB layout.

The following are some design guidelines to help ensure antenna performance:

- Never place the ground plane or route copper traces directly underneath the antenna portion of the module
- Never place the antenna close to metallic objects
- In the overall design, ensure that wiring and other components are not placed near the antenna
- Do not place the antenna in a metallic or metalized plastic enclosure
- Keep plastic enclosures 1cm or more away from the antenna in any direction

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

SHIPMENT, HANDLING AND STORAGE

Shipment

The CMP4010 modules are delivered in tape and reel. The reel diameter is TBD and contains 600 modules.

Handling

The CMP4010 modules are designed and packaged to be processed in an automated assembly line.

Warning

The CMP4010 modules contain highly sensitive electronic circuitry. Handling without proper ESD protection may destroy or damage the module permanently.

Warning

The CMP4010 modules are moisture-sensitive devices. Appropriate handling instructions and precautions are summarized in J-STD-033. Read carefully to prevent permanent damage due to moisture intake.

Moisture Sensitivity Level (MSL)

MSL 3, per J-STD-033

Storage

Storage/shelf life in sealed bags is 12 months at <40°C and <90% relative humidity.

QUALITY

CEL Modules offer the highest quality at competitive prices. Our modules are manufactured in compliance with the IPC-A-610 specification, Class II. Our modules go through JESD22 qualification processes which includes high temperature operating life tests, mechanical shock, temperature cycling, humidity and reflow testing. CEL conducts RF and DC factory testing on 100% of all production parts.

CEL builds the quality into our products, giving our customers confidence when integrating our products into their systems.

ORDERABLE PART NUMBERS

Orderable Part Number	Description	Min/Mult
CMP4010-A-R	RLT8721 IC, Wi-Fi + BT combo, PCB antenna	600/600
CMP4010-C-R	RLT8721 IC, Wi-Fi + BT combo, u.FI connector	600/600
CMP4010-A-EVB	Evaluation Board, QCA9377 IC, Wi-Fi (SDIO) + BT (UART) combo	1/1

REFERENCES

Reference Documents	Download
Health Canada Safety Code 6	Link

REVISION HISTORY

Revision	Changes to Current Version	Page(s)
0027-00-07-00-000 (Issue A) July 17, 2020	Initial Preliminary Data Sheet	N/A
0027-00-07-00-000 (Issue B) Sept 25, 2020	Add 'Reference Code Available' section. Add BLE Mesh capability.	1
0027-00-07-00-000 (Issue C) Oct 30, 2020	Update operational temperature range	4

DISCLAIMER

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TECHNICAL ASSISTANCE

For Technical Assistance, please contact us at wirelessmodules@cel.com