

C O D I C O <sup>®</sup>

# Wireless & Waves

**ACTIVE COMPONENTS** | PASSIVE COMPONENTS | CONNECTORS

# Wi-Fi ICs




## Wi-Fi ICs von QUALCOMM

Je nachdem wie die Protokollschichten und die Anwendung auf einer Zielhardware integriert werden sollen, bestehen verschiedene Anforderungen an Wi-Fi ICs. Bei den sogenannten Radio ICs sind lediglich nur die unteren Schichten PHY und MAC (Layer 1+2) integriert. Diese Bausteine benötigen für die Verarbeitung der höheren Schichten (zB TCP/IP) sowie der eigentlichen Anwendung einen Mikrokontroller bzw. Prozessor (beides auch als Host bezeichnet).

Für die Anbindung an die Hosts werden diese Bausteine mit verschiedenen Schnittstellen angeboten, zB USB, PCIe, SDIO, SPI oder UART. Ein weiterer Wi-Fi IC Typ wird als SoC (System on Chip) bezeichnet, da neben dem Stack auch die Anwendungen vollständig auf einem einzigen Baustein integriert werden können und somit kein exter-

ner Host benötigt wird. Für High-End-Anwendungen bietet QUALCOMM außerdem Netzwerkprozessoren mit Multi-CPU-Kernen an, die mit mehr als 1GHz getaktet werden können. Bei diesem Ansatz werden die Netzwerk- und Anwendungsprogramme auf die verschiedenen Kerne separat aufgeteilt. Radio-Bausteine können über PCIe, USB oder SDIO angebunden werden.

So vielfältig die Wi-Fi Anwendungen sind, so vielfältig sind die verschiedenen Bausteintypen von QUALCOMM. Egal, welche Anforderung Sie im Hinblick auf die Wi-Fi Standards 802.11a/b/g/n/ac/ad/ax und Antennenkonfigurationen (Single oder Dual-Band, Multi User MIMO, Rx/Tx Diversity) haben, QUALCOMM bietet die richtige Lösung.

CODICO ist stolz, mit dem renommierten Wi-Fi IC Hersteller QUALCOMM zusammenzuarbeiten.

Durch die Kooperation mit zahlreichen hoch spezialisierten Design Partnern sowie durch die enge Zusammenarbeit unserer FAEs und dem Engineering Team von QUALCOMM ist es uns möglich, auch anspruchsvolle Wi-Fi Designs technisch auf höchstem Niveau zu unterstützen. Bitte kontaktieren Sie uns gerne für ein Beratungsgespräch!

## Wi-Fi ICs from QUALCOMM



*Depending on how the layers of a protocol stack need to be integrated on the target hardware, QUALCOMM offers different IC solutions. Radio ICs cover only the lower layers PHY and MAC (layer 1+2) of the protocol stack. These ICs require an additional MCU or processor that handles higher layers e.g. TCP/IP and the application. For connecting to a host the customer can choose between different interfaces e.g. USB, PCIe, SDIO, SPI or UART. Another Wi-Fi IC type named SoC (System on Chip) also integrates an application processor and therefore eliminates the need of an external MCU or processor as the complete application code and stack are running on a single chip.*

*For high-end applications, QUALCOMM also offers Network Processors with multiple CPU-Cores that support clock rates higher than 1GHz. This multi core approach allows the separation of network and application processing on different cores. Radio ICs can be connected via PCIe, USB or SDIO.*

*As diverse as the applications for Wi-Fi are, so versatile are the IC types from QUALCOMM. Whatever your requirements for the various Wi-Fi standards 802.11a/b/g/n/ac/ad/ax and antenna configurations (Single- or Dual-Band, Multi-User MIMO, Rx/Tx diversity) may be, QUALCOMM offers the right solution.*

*CODICO is proud of the cooperation with the renowned Wi-Fi IC vendor QUALCOMM. Our cooperation with several highly specialized design partners, as well as the collaboration between our FAEs and QUALCOMM's engineering team enables us to provide high-level technical support even for sophisticated Wi-Fi designs. Please contact us for consulting!*

# EMBEDDED Wi-Fi



## Embedded Wi-Fi Portfolio

PART NO.	CENTIPEDE	CARAMBOLA2	LIMA	RAMBUTAN	JALAPENO	HABANERO	MANGO
CPU	MIPS 24K @ 400MHz	MIPS 24K @ 400MHz	MIPS 24 Kc @ 650MHz	MIPS 74 Kc @ 720MHz	Quad Cortex-A7 @ 700MHz	Quad Cortex-A7 @ 716,8MHz	Quad Cortex-A53 @ 1.2GHz or 1.8GHz
Flash	16MB	16MB	32MB	128MB	128MB	32MB NOR & parallel NAND (external)	32MB NOR & parallel NAND (external)
RAM	64MB DDR2 @ 200MHz	64MB DDR2 @ 200MHz	64MB DDR2 @ 300MHz	128MB DDR2 @ 300MHz	256MB DDR3 @ 667MHz	512MB DDR3 @ 672MHz	512MB DDR3 @ 933MHz
Wi-Fi Standards	802.11 b/g/n	802.11 b/g/n	802.11 b/g/n	802.11 b/g/n/a	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac Wave2	802.11 b/g/n/a/ac/ax
MIMO	1x1	1x1	2x2	2x2	Multi User 2x2 DBDC	Multi User 2x2 DBDC	Multi User 2x2 DBDC
Frequency	2.4GHz	2.4GHz	2.4GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz
Interfaces	1x Ethernet, USB, SPI, I2S, SPDIF, SLIC, 24x GPIO	USB, 2x Ethernet, I2S, SPI, SLIC, SPDIF, 23x GPIO	USB, SPI, PCIe, 2x Ethernet, I2C, UART, GPIO	2x USB, 1x 100 Base-T, SGMII, I2S, SPI, I2C, PCIe, GPIO	USB 2.0, USB 3.0, I2S, TDM, UART, GPIO, JTAG and 2x 1000 Base-T	2x UART, SPI, 2x I2C, I2S/TDM, SDIO3.0/eMMC, 4x PWM, 46x GPIOs, JTAG	2x UART, 3x SPI, 2x I2C, 4x PWM, SDIO3.0, 64x GPIOs, JTAG
Dimension	22x60mm	28x38mm	25x35mm	32x47mm	32x47mm	45x49mm	38.3x61.7mm

## Embedded Wi-Fi Module

Embedded Wi-Fi Module bieten den Vorteil, dass neben dem Wi-Fi Modem auch ein Applikationsprozessor, Schnittstellen und Speicher auf dem Modul integriert sind. Hierdurch wird in der Regel bereits ein sehr großer Teil der Systemanforderungen abgedeckt, so dass die Entwicklungszeit und -kosten stark minimiert werden.

Zudem werden die meisten Embedded Wi-Fi Module mit CE/RED, FCC und IC Zertifizierungen angeboten, wodurch ebenfalls Kosten gespart werden.

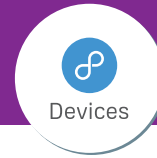
## Embedded Wi-Fi Modules

*The advantage of Embedded Wi-Fi modules is that not only a Wi-Fi modem but an application processor, interfaces and memory are integrated in a single module. As a consequence, a large part of the system requirements is usually already covered by this approach, so that the development time and costs are highly minimized.*

*In addition, most modules are offered with CE/RED, FCC and IC certifications, which saves extra costs at the end-product certification.*



# COMBO RADIO Wi-Fi



## Combo Radio Wi-Fi Portfolio

VENDOR	8DEVICES	8DEVICES	8DEVICES	8DEVICES	8DEVICES
Part Number	BLUE-BEAN-C	BLUE-BEAN-A	RED-BEAN-C	RED-BEAN-A	BLACK-BEAN
Wi-Fi Chip	QCA9377-7	QCA9377-7	QCA9377-3	QCA9377-3	QCA9377-5
Wi-Fi Standards	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac
Bluetooth Standards	V4.2 + HS + BLE	V4.2 + HS + BLE	V4.2 + HS + BLE	V4.2 + HS + BLE	V4.2 + HS + BLE
MIMO	MU 1x1	MU 1x1	MU 1x1	MU 1x1	MU 1x1
Frequency	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz
Antenna Data Rate	433Mbps	433Mbps	433Mbps	433Mbps	433Mbps
Interface Wi-Fi	USB 2.0	USB 2.0	SDIO 3.0	SDIO 3.0	PCIe 2.0
Interface Bluetooth	USB1.1	USB1.1	UART	UART	USB 1.1
Antenna Options	Murata HSC Connector	Integrated Antenna	Murata HSC Connector	Integrated Antenna	Murata HSC Connector
Dimension (mm)	17x12	24x12	17x12	24x12	16,5x30

VENDOR	WISTRON	WISTRON	COMPEX	COMPEX
Part Number	DHXA-222	DHUA-W8S	WSD377	WLT674
Wi-Fi Chip	AR9462	QCA9378-7	QCA9377-3	QCA6174A-5
Wi-Fi Standards	802.11 b/g/n/a	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac	802.11 b/g/n/a/ac
Bluetooth Standards	V4.0	V4.1 + HS + BLE	V4.2 + HS + BLE	V4.2 + HS + BLE
MIMO	2x2	2x2	MU 1x1	2x2
Frequency	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz
Antenna Data Rate	300Mbps	866Mbps	433Mbps	866Mbps
Interface Wi-Fi	PCIe 1.2	USB 3.0	SDIO 3.0	PCIe 1.1
Interface Bluetooth	PCIe 1.2	USB 1.1	UART, PCM	USB 1.1
Antenna Options	2x U.FL	2x U.FL	Edge Connector	2x IPEX MHF4
Dimension (mm)	26.65x29.85	27x25	12x12	30x26.8

### Combo Radio Wi-Fi Module

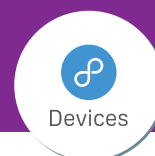
Combo bedeutet das Zusammenspiel aus Wi-Fi und Bluetooth, also die Realisierung (Kombination) von zwei Funkstandards auf einem Modul. Wie bei allen Radio-Modulen gibt es auch hier unterschiedlichste Ausführungen bezüglich Schnittstellen, Formfaktoren und unterstützten Standards. CODICO bietet Combo-Radio-Module mit PCIe, USB und SDIO Schnittstellen in sehr kleinen Formfaktoren für die Standards 802.11 a/b/g/n/ac und Bluetooth + BLE an.

### Combo Radio Wi-Fi Modules

The abbreviation »Combo« is derived from the word »Combination«. With respect to radio-modules, it indicates the integration of two radios (Wi-Fi and Bluetooth) in a single module. As for many radio-modules, there is a wide range of types in the market with different interfaces, form factors, and supported standards. CODICO offers combo-radio-modules with PCIe, USB and SDIO interfaces in a very small form factor for the standards 802.11a/b/g/n/ac in combination with Bluetooth + BLE.



# PCIe RADIO Wi-Fi



## PCIe Radio Wi-Fi Portfolio

<b>VENDOR</b>	COMPEX	COMPEX	COMPEX	COMPEX	COMPEX
Part Number	WLE650V5-18A	WLE1216V5-20-1	WLE1000V5-20	WLE1216V2-20	WLE900VX-I 7C
Chipset	QCA-9888	QCA-9994	QCA-9982	QCA-9984	QCA9890
Standard	802.11 n/a/ac	802.11 n/a/ac	802.11 n/a/ac	802.11 b/g/n	802.11 b/g/n/a/ac
Band	5GHz	5GHz	5GHz	2.4GHz	2.4GHz & 5GHz
MIMO	MU 2x2	MU 4x4	MU 3x3	MU 4x4	3x3
Interface	PCIe 1.2	PCIe 2.0	PCIe. 2.0	PCIe 2.0	PCIe 1.1
Antenna Connector	2x U.FL	4x U.FL	3x U.FL	4x U.FL	3x U.FL
Temperature Range	-40°C to 70°C	-40°C to 85°C	-20°C to 70°C	-20°C to 70°C	-40°C to 85°C

<b>VENDOR</b>	COMPEX	WISTRON	WISTRON	8DEVICES	8DEVICES
Part Number	WLE600VX-I 7C	DAXA-O1 (3x3)	DNXA-116	Pineapple-5-MPCIE-EX5V	Pineapple-6-MPCIE-EX5V
Chipset	QCA9892	QCA9880	AR9382	QCN9074	QCN9074
Standard	802.11 b/g/n/a/ac	802.11 n/a/ac	802.11 b/g/n/a	802.11 a/b/n/ac/ax	802.11 a/b/n/ac/ax
Band	2.4GHz & 5GHz	5GHz	2.4GHz & 5GHz	5GHz	6GHz
MIMO	2x2	3x3	2x2	MU 4x4	MU 4x4
Interface	PCIe 1.1	PCIe 1.2	PCIe 1.2	PCIe 3.0, mini-PCIe	PCIe 3.0, mini-PCIe
Antenna Connector	2x U.FL	3x U.FL	2x U.FL	4x U.FL	4x U.FL
Temperature Range	-40°C to 85°C	-10°C to 60°C	0°C to 50°C	0°C to +65°C	0°C to +65°C

## PCIe Radio Wi-Fi Module

Allgemein werden Wi-Fi Module in vielen Ausführungsformen angeboten, um allen Anforderungen am Markt gerecht zu werden. Eines der wichtigsten Kriterien bei der Auswahl ist die Schnittstelle, die sich häufig nach Typ des verwendeten Hauptprozessors, der geforderten Datenraten, dem Formfaktor und der erlaubten Verlustleistung richtet. Bei Mehrantennensystemen hat sich bei dem Breitbandstandard 802.11ac/ax allerdings PCIe durchgesetzt, um die hohen Datenantennenrate von bis zu 4.804Gbps (MCS11, 160MHz Channel) zu übertragen. Generell werden PCI-Express-Mini-Karten in einer Baugröße von 30x50,95mm (Full Size) oder in einer kleineren Bauform 30x26,80mm (Half Size) mit einer 52-Pin-Steckverbindung angeboten. Auch wenn bei vielen Anwendern die »Half

Size« Bauform bevorzugt wird, lässt sich auf Grund der Komplexität heutiger Wi-Fi Standards eine Designumsetzung nicht mehr auf derart kleinen Karten realisieren. Daher werden die meisten Module als Full-Size-Karten angeboten. CODICO bietet ein breites Produktportfolio an PCIe Wi-Fi Radio Modulen für die Standards 802.11a/b/g/n/ac/ax an. Alle Module unterstützen hierbei mehrere Send- und Empfangsantennen (MIMO: Multiple Input Multiple Output) zur Steigerung der Datenraten oder zur Nutzung von Rx- und Tx-Diversity.

## PCIe Radio Wi-Fi Modules




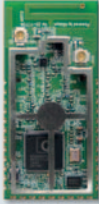



Wi-Fi radio modules are offered in a large number of different versions. Among others, the most important selection criteria are the interfaces, which often depend on the type of the host processor, the required

data speeds, the form factor, and the power dissipation. In multi-antenna systems, PCIe is the preferred interface solution for the 802.11ac/ax broadband standard to meet the high data antenna rate of up to 4.804Gbps (MCS11, 160MHz Channel). In general, PCIe express mini cards are offered in 30x50.95mm (full size) or a smaller 30x26.80mm (half size) design with a 52-pin connector. Despite the fact that many users prefer the »half size« design, the increasing complexity of today's Wi-Fi standards no longer allows a design implementation on such small cards. Therefore, the newest modules available in the market are full-size cards. CODICO offers a wide range of PCIe Wi-Fi Radio Modules for 802.11a/b/g/n/ac/ax standards. All modules support several transmit and receive antennas (MIMO: Multiple Input Multiple Output) to increase data rates or to use Rx and Tx diversity.

# IoT Wi-Fi



## IoT Wi-Fi Portfolio

					
PART NUMBER	DNSA-141	DNSA-144	DNSA-MP1	DNSA-M20	DNSA-M24
Chipset	QCA4002	QCA4004	QCA4010	QCA4020	QCA4024
CPU	XTENSA	XTENSA	XTENSA	Cortex-M4F + Cortex-M0 + XTENSA	ARM Cortex-M4F + Cortex-M0
Standards	802.11 b/g/n	802.11 b/g/n/a	802.11 b/g/n	802.11b/g/n/a + BLE + 802.15.4	BLE + 802.15.4
MIMO	1x1	1x1	1x1	1x1	1x1
Interfaces	SPI (for host MCU)	SPI (for host MCU)	SPI, UART, I2C, ADC, PWM, GPIO	I2C, UART, SPI,SDIO, I2S, GPIOs 8 channels ADC (12 bit, 1MSPs), 8 PWM	I2C, UART, SPI,SDIO, I2S, GPIOs 8 channels ADC (12 bit, 1MSPs), 8 PWM
Frequency	2,4 GHz	2,4GHz & 5GHz	2,4GHz	2,4GHz & 5GHz	2,4GHz
Dimension	20x20mm	42x20mm	30x16mm	28,57x33,50mm	19,4x25,0mm
Temperatur Range	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Antenna Options	Integrated Antenna or 1x U.FL	Integrated Antenna or 2x U.FL	Integrated Antenna or 1x U.FL	Integrated Antenna	Integrated Antenna
Comment	Integrated TCP/IP stack, requires external host MCU to drive stack, API provided by Qualcomm as open C-code	Integrated TCP/IP stack, requires external host MCU to drive stack, API provided by Qualcomm as open C-code	Integrated application processor with 130MHz and 800KB memory, no external MCU required, application and stack running on module	Integrated application processor Cortex-M4F (128MHz, 300KB RAM + XIP), Cortex-M0 @ 64MHz for BLE and 15.4 stack, XTENSA for Wi-Fi stack	Integrated application processor Cortex-M4F (128MHz, 300KB RAM + XIP), Cortex-M0 @ 64 MHz for BLE and 15.4 stack

### IoT Wi-Fi Module

Auf der Client-Seite werden bei IoT (Internet of Things) Anwendungen immer kleinere Wi-Fi-Modullösungen gesucht, die bereits vollständig vor-zertifiziert und kalibriert sind. Low Power ist ebenfalls ein dominierendes Thema, da die Module nicht selten über eine Batterie versorgt werden müssen. CODICO bietet IoT Wi-Fi Module, die allesamt auf Chipsätzen von QUALCOMM und deren Referenzdesigns basieren und so die genannten Anforderungen erfüllen.

### IoT Wi-Fi Modules

*On the client side of IoT (Internet of Things) applications the demand for smaller and fully pre-certified and calibrated Wi-Fi modules is growing rapidly. Low power design also has a dominant role, as the modules often need to be powered by a battery. CODICO offers IoT Wi-Fi modules based on chipsets and reference designs from QUALCOMM to meet these hard requirements.*



# CELLULAR



## Cellular Portfolio

5G SUB-6 GHz			
5G Sub-6GHz + mmWave		MV31-W • M.2 Modem Card • 30x42x2.5mm • LTE Cat.20/Cat13 & 3G • Fallback	RM530F-GL • M.2 Form Factor • Sub-6 + mmWave DC • LTE Cat 20
			RM530N-GL • M.2 Form Factor • Sub-6 + mmWave DC • LTE Cat 19
			RM510Q-GL • M.2 Form Factor • 5G NR Sub-6 + mmWave • LTE Cat 20
5G Sub-6 GHz	RG520F Series • 5G Sub-6 GHz 3CA • LTE Cat 20		RM520F-GL • M.2 Form Factor
	RG520N Series • 5G Sub-6 GHz 2CA • LTE Cat 19	RG500L-EU • SoC (System on a Chip) • 5G NR Sub-6 GHz • LTE Cat 19	RM520N-GL • M.2 Form Factor
	RG50xQ Series • 5G NR Sub-6 GHz • LTE Cat 16/20		RM50xQ Series • M.2 Form Factor

LPWA & NB-IOT			
LPWA	BG96 • Cat M1/NB1/ EGPRS/GNSS	BG77 • Cat M1/NB2/ GNSS	BG600L-M3 • Cat M1/NB2/EGPRS/GNSS EXS82-W • Global Cat.M1/Cat.NB1/NB2/2G • GNSS, ThreadX Embedded Processing EXS62-W • Global Cat.M1/Cat.NB1/NB2 • GNSS, ThreadX Embedded Processing
	BG95 Series • Cat M1/NB2/ EGPRS/GNSS	BG770A-GL • Cat M1/NB2/ GNSS	TX82 • Global Cat.M1/Cat.NB1/NB2/2G • Small formfactor • GNSS, ThreadX Embedded Processing TX62 • Global Cat.M1/Cat.NB1 NB2 • Small formfactor • GNSS, ThreadX Embedded Processing
NB-IoT	BC92 • Cat NB2/GSM	BC660K-GL • Cat NB2 (NB-IoT)	
		BC66-NA • Cat NB2 (NB-IoT)	
	BC66 • Cat NB1	BC65 • Cat NB2 (NB-IoT)	

LTE & LTE-A			
Cat 16/18	EG18 Series • 5CA, 4 x 4 MIMO	PLPS9-W • LTE Cat.16 • 3G & 2G Fallback • Audio-VoLTE/CSFB	EM160R-GL • M.2 Form Factor
Cat 12	EG12 Series • 3CA, 4 x 4 MIMO		EM12 Series • M.2 Form Factor
	EG512R-EA • 3CA, 4 x 4 MIMO		
Cat 6	EG06 Series • LTE with CA	EP06 Series • Mini PCIe Form Factor	EM06 Series • M.2 Form Factor
Cat 4	EC25 Series • Compatible with EC2x Series/EG2x-G/ UC200T Series	EG95 Series • Compatible with BG96/BG95 Series/ BC95-G/ UG9x/M95	EM05 Series • M.2 Form Factor
	EC200T Series • Compatible with EC2x Series/EG2x-G/ UC200T Series	PLS83-W • LTE Cat.4, 3G/2G Fallback • eSIM • GNSS, Audio-VoLTE/CSFB	
Cat 1	EC21 Series • Compatible with EC2x Series/EG2x-G/ UC200T Series	EG91 Series • Compatible with BG96/BG95 Series/ BC95-G/UG9x/M95	PLS63-W • LTE Cat.4, 3G/2G Fallback • eSIM • GNSS, Audio-VoLTE/CSFB
	EC200S Series • Compatible with EC2x Series/EG2x-G/ UC200T Series	EG912Y Series • Compatible with EG9x Series/ BG95 Series	

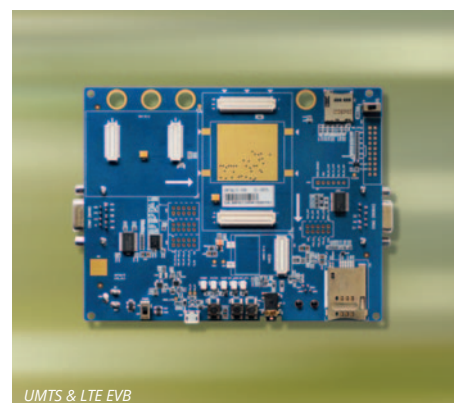
TERMINALS		
DGL61-W: IoT Retrofitting Made Easy with the Cinterion® 4G USB Device Gateway		• LTE Cat.1 with 3G & 2G fallback • Integrated antenna • USB 2.0 interface • Data Only
EGX81: Out of the Box Global MTC Connectivity		• LTE Cat.M and NB-IoT with 2G fallback • RS232 or RS485 • Data Only

### Build a Smarter World

Cellular Communications eignet sich für praktisch jede Internet of Things (IoT)-Anwendung, von 5G bis zu hocheffizienten LPWA-Konnektivität wie LTE Cat.M und NB-IoT. IoT-Module können in einer Vielzahl von Anwendungen eingesetzt werden, darunter Smart City, Automotive, Landwirtschaft, Smart Metering, Wireless POS, Sicherheit und Smart Industry. CODICO arbeitet mit zwei der führenden Anbieter zusammen: QUECTEL und THALES.

### Build a Smarter World

Cellular communications for virtually any Internet of Things (IoT) application, from high-speed data 5G to highly efficient LPWA connectivity such as LTE Cat.M and NB-IoT. IoT Modules can be applied in a wide range of applications including smart city, automotive, agriculture, smart metering, wireless POS, security and Smart Industry. Find new business opportunities! CODICO is working with two of the leading supplier: QUECTEL and THALES.



# SOM & SBC

## System on Modules (SOM)

PART NUMBER	D660 SOM	D820 SOM	D845 SOM	S626 SOM	S820 SOM	
Snapdragon	Snapdragon 660, 14nm	Snapdragon 820, 14nm	Snapdragon 845, 10nm	Snapdragon 626, 14nm	Snapdragon 820, 14nm	
Part Number	SDA-660-0-692NSP-TR-01-0-AA	APQ-8096-1-994CMNSP-MT-04-0-AB	SDA-845-A-914BMSP-TR-02-0-AA	APQ-8053-A-792NSP-TR-01-1-AC	APQ-8096-1-994CMNSP-MT-04-0-AB	
PLATFORM	CPU	8x Kryo 260 4x 2.2GHz cores 4x 1.9GHz low power cores	4x Kryo 2x 2.15GHz cores 2x 1.592GHz low power cores	8x Kryo 385 4x 2.649GHz cores, each 256 KB L2 cache 4x 1.766GHz, each 128KB L2 cache	8x Cortex-A53 @ 2.2GHz One quad with 1MB L2 cache One quad with 512KB L2 cache	4x Kryo • 2x 2.15GHz cores • 2x 1.592GHz low power cores
	GPU	Adreno 512	Adreno 530 with 64bit addressing	Adreno 630 with 4K 60fps or 2x 2k 90fps	Adreno 506	Adreno 530 with 64bit addressing
	DSP	Hexagon 680	Hexagon 680 DSP	Hexagon Vector Extensions (HVX) processor	mDSP Hexagon DSP V56 850 MHz 768 kB L2 caches, aDSP Hexagon v56 850 MHz	Hexagon 680 DSP with dual-Hexagon vector processor(HVX-512)@825MHz
	OS	Android 9	Android 8	Android 8, Linux 4.9, Linux 1.0 (Yocto), Ubuntu 16.04	Android 7, Linux 3.18, Linux 1.3 (Yocto)	Android 7
	Memory & Storage	3GB LPDDR4x + 32GB eMMC or (4GB+64GB)	4GB LPDDR4 + 64GB eMMC/UFs	4GB LPDDR4x + 64GB UFS or (6GB + 64GB)	2GB LPDDR3 + 16GB eMMC	4GB LPDDR4 + 64GB eMMC
	Display	2x MIPI-DSI 4-lane, up to 2560x1600@60 fps	2x MIPI-DSI 4-lane, up to 3840x2400@60fps 1x HDMI out v2.0, up to 4096x2160@ 60fps	2x MIPI-DSI 4-lane, up to 3840x2400@60fps	2x MIPI-DSI 4-lane, FHD (1920x1200)@60fps	2x MIPI-DSI 4-lane, up to 3840x2400@60fps 1x HDMI out v2.0, up to 4096x2160@60fps
MULTIMEDIA	Camera	Spectra 160 Camera ISP Dual 14bit ISPs 3x MIPI-CSI4-lane up to 25MP single cameras up to 16MP dual cameras	Dual 14bit Spectra ISP, 3x MIPI-CSI 4-lane, Dual ISP, up to 28MP	Spectra 280 ISP, 3x 4-lane MIPI_CSI + 1x 2-lane MIPI_CSI, Dual 14bit ISP + one Lite ISP, up to 32MP	Dual ISP, 3x 4-lane MIPI_CS, 2.1Gbps per lane Supports CMOS and CCDsensors up to 24MP sensors	Dual 14bit Spectra ISP, 3x MIPI-CSI 4-lane, Dual ISP, up to 28MP
	Decode	4K@30fps 8bit VP9, H.264, VP8, MPEG4 and 10bit H.265	1080p@240fps, 4K@60fps, 8x 1080p@30fps (H.264, VP8, H.265 8/10bit, VP9)	4K@60fps decode for H.264 High Profile, H.265 Main Profile and VP9 Profile 2	4K@30fps,1080p@60fps (H.264, H.265, VP8, VP9)	1080p@240fps, 4K@60fps, 8x 1080p@30fps (H.264, VP8, H.265 8/10bit, VP9)
	Encode	4K@30fps H.265, H.264, VP8, MPEG4	1080p@120fps, 4K@30fps, 4x 1080p@30fps (H.264, VP8, H.265)	4K@60fps, H.264 High Profile, H.265 Main 10 Profile, 4K@30fps encode for VP8	4K@30fps,1080p@60fps (H.264, H.265, VP8)	1080p@120fps, 4K@30fps, 4x 1080p@30fps (H.264, VP8, H.265)
CONNECTIVITY	WiFi	802.11a/b/g/n/ac, MU-MIMO 2x2 (WCN3990)	802.11a/b/g/a/n/ac, MIMO 2x2 (QCA6174A)	802.11a/b/g/a/n/ac MU-MIMO 2x2 (WCN3990)	802.11a/b/g/n/ac, MIMO 1x1 (WCN3680B)	802.11 ac/a/b/g/n, MIMO 2x2 (QCA6174A)
	Bluetooth	Bluetooth 5.0 (WCN3990)	Bluetooth 4.2 (QCA6174A)	Bluetooth 5.0 (WCN3990)	Bluetooth 4.2 (WCN3680B)	Bluetooth 4.2 (QCA6174A)
	Interfaces	1x USB3.1, 1x USB2.0, 1x SDIO3.0, 2x UIM, 1x JTAG, 1x Vibrator Driver, 3x Flash LED Driver, 3x LED Driver, 7x BLSP, GPIO	1x USB2.0, 1x USB3.0, 1x PCIe2.1,4x I2C, 4x UART, 2x SPI, 1x I2S, 4(+)*x GPIOs, 1x SDIO 3.0, 1x TF card	2x USB3.1, 1x PCIe2.1, 1x PCIe3.0,1x SDIO 3.0, 1x TF card, QUP for UART/I2C/SPI x 5, 8x GPIOs, 4x MI2S	1x USB3.0, 15 xGPIOs, 1x Slimbus, 1x SDIO, 2x I2S, BLSP for SPI, UART, 7x I2C	1x USB2.0, 1x USB3.0, 1x PCIe2.1, 4x I2C, 4x UART, 2x SPI, 1x I2S, 4(+)*x GPIOs, 1x SDIO 3.0, 1x TF card
MODULE SPEC	Dimension (mm)	LGA: 40x35x2.89	BTB: 36x51x10.5	BTB: 60x37x7.1	BTB: 37x52x10.5	BTB: 40x55x10.5
	Power Supply	+4.2V/3A Input	+3.8V/3A Input	+3.8V/3A Input	+3.8V/3A Input	+3.8V/3A Input
	Operating Temp.	-20 to +65°C	-20 to +70°C	-20 to +70°C	-20 to +70°C	-20 to +55°C
	Relative Humidity	5 to 95%, non-condensing	5 to 95% non-condensing	5 to 95% non-condensing	5 to 95% non-condensing	5 to 95% non-condensing
	Certification	RED, FCC	RED, FCC,IC	RED, FCC, Telec, Jate, VCCI	RED, FCC	RED*, FCC, IC

## System on Modules (SOM)...

sind die Lösung, wenn Sie für Ihr Produkt einen langen Lebenszyklus und ein flexibles System benötigen. Die SOM-CPU (1-x Kern), der Speicher und die I/O-Schnittstelle sind flexibel. Die meisten Module arbeiten in einem Temperaturbereich von -40 bis +85°C. Der Unterschied zwischen System on Modules (SOM) und Computer on Modules (COM) besteht darin, dass SOM die neuesten CPUs und Schnittstellen verwendet und daher

komplexere Anwendungen unterstützen kann. COMs haben Peripherieanschlüsse, während in einem SOM die meisten Peripherien, wie beispielsweise Wi-Fi oder Bluetooth, bereits integriert sind.

## System on Modules (SOM)...

are the solution if you need a long product life-cycle and a flexible system. These modules are flexible in the type of CPU (1-x core), memory and I/O interfaces they offer. Most modules operate in a tempe-

ature range from -40 up to +85°C. The difference between System on Modules (SOM) and Computer on Modules (COM) is that SOMs uses the newest CPUs as well as interfaces and can support more complex applications than the COM. The COMs include peripheral connectors while on a SOM the most peripherals, like Wi-Fi or Bluetooth, are integrated.





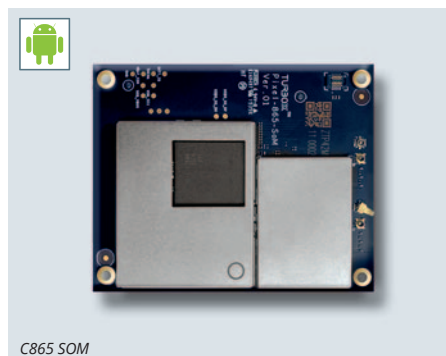
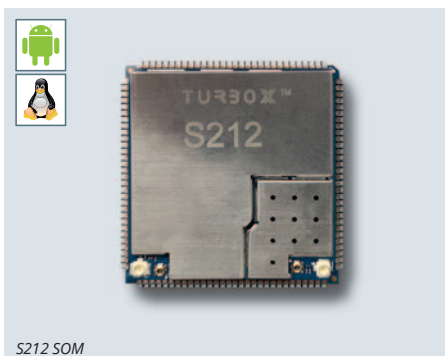
C404/405 SOM	S212 SOM	C865 SOM	C450 SOM	C610 SOM	C410 SOM
QCS404/QCS405	APQ8009, 28nm LP CMOS	SM8250, 7nm	SDA450, 14nm	QCS610, 11nm LPP	QCS410, 11nm LPP
QCS-404-0-NSP722-TR-01-1-AA*	APQ8009-0-504NSP-TR-00-0-VV	SM8250-0-MPSP1099-TR-02-0-AA	SDA-450-A-792NSP-TR-01-0-AA	QCS-610-0-PSP806-MT-01-0-AC	QCS-410-0-PSP806-MT-01-0-AC
4x Cortex-A53@1.4GHz	4x Cortex-A7@1.3GHz	8x Kryo 585 1x Kryo 585 Prime@2.84GHz 3x Kryo 585 Gold@2.42GHz 4x Kryo 585 Silver@1.80GHz	8x Cortex-A53@1.8GHz	2x K4G (Enyo)@2.2GHz 6x K4S (A55)@1.8GHz, 1MB L3 cache	2x K4G (Enyo) @ 2.2GHz 2x K4S (A55) @ 1.8GHz, 1MB L3 cache
Adreno 306 (C405 only)	Adreno 304 GPU	Adreno 650 GPU, 665 VPU, 995 DPU	Adreno 506 GPU	Adreno GPU 608 with 64bit addressing 845MHz	Adreno GPU 608 with 64bit addressing 845MHz
2x Hexagon QDSP6 v66 Low Power Audio Subsystem&Compute DSP	Hexagon 536 DSP	Hexagon DSP with quad HVX	Hexagon 546	Dual Hexagon Vector eXtensions (HVX), 1.1GHz	Dual Hexagon Vector eXtensions (HVX), 1.1GHz
Linux 4.10 (Yocto)	Android 5.1, Linux OS (Yocto), kernel 3.18	Android 10	Android 9	Linux 4.14	Linux 4.14
1GB LPDDR3 + 8GB eMMC	2GB LPDDR3 + 16GB eMMC	6GB LPDDR5(POP) + 128GB UFS	2GB LPDDR3 + 16GB eMMC	2GB LPDDR4x + 16GB eMMC	1GB LPDDR4x + 4GB eMMC
C405 only: 1x MIPI-DSI 4-lane, 720P 1x HDMI, 1080p@30fps	1x MIPI-DSI 4-lane, supports HD(1280x720)@60fps	2x MIPI-DSI 4-lane, 5040*2160@60fps	2x MIPI-DSI 4-lane, FHD(1920x1200)@60fps	1x MIPI-DSI 4-lane, 1080p@60, up to 10 hardware layers, DisplayPort	1x MIPI-DSI 4-lane, 1080p@60, up to 10 hardware layers, DisplayPort
NA	2x MIPI-CSI, 2-lane, 1.5Gbps per lane, supports CMOS and CCD sen- sors up to 8MP	6x MIPI-CSI, 4-lane, 2.5Gbps per lane, supports CMOS and CCD sen- sors up to 64MP sensors	3x MIPI-CSI, 4-lane, 2.1Gbps per lane, supports CMOS and CCD sen- sors up to 24MP sensors	Dual ISP support, three 4-lane CSIs (4/4/4 or 4/4/2/1), D-PHY 2.1Gbps/lane, C-PHY 5.7Gbps/lane	Dual ISP support, three 4-lane CSIs (4/4/4 or 4/4/2/1), D-PHY 2.1Gbps/lane, C-PHY 5.7Gbps/lane
NA	1080p@30fps (HEVC/H.264/MPEG-4/DivX/VP8) WVGA@30fps (H.263)	8K@60fps (H.264/H.265/ VP8/VP9)	1080P@60fps (H.264/H.265/ VP8/VP9)	4K@30 10bit: HEVC	1080p@90 10bit: HEVC
NA	720p@30fps (H.264) WVGA@30fps (H.263/VP8/MPEG-4)	8K@30fps (H.264/H.265/VP8)	1080P@60fps (H.264/H.265/VP8)	4K@30 8bit: HEVC	1080p@90 8bit: HEVC
802.11a/b/g/ac, MIMO 2x2 (WCN3999) or MIMO 1x1 (WCN3980)	802.11a/b/g/n, MIMO 1x1, FM (WCN3660B)	802.11 a/b/g/n/ac/ax (QCA6391)	802.11 ac/a/b/g/n	802.11a/b/g/n/ac, MIMO 1x1 (WCN3980)	802.11a/b/g/n/ac, MIMO 1x1 (WCN3980)
Bluetooth 5.0	Bluetooth 4.x (BR/EDR + BLE)	Bluetooth 5.1 (QCA6391)	BT 4.x (BR/EDR + BLE)	Bluetooth 5.0	Bluetooth 5.0
1x USB3.0, 1x USB2.0, 6x BLSP, 1x TF Card, 1x PCIe, 2x/3x SPDIF, RGMII, GPIOs, SLIMBus, 5x I2S(C404), 6x I2S(C405), 8x DMIC, Soundwire	1x USB2.0, 6x I2C, 6x SPI, 2x UART, 1x TF Card, I2S_2 TX & RX, I2S_1A/B RX only, 2x PMU GPIO, 1x PWM, 10x GPIOs, 1x ADC	1x Sound Wire, 2x RF connector for Wi-Fi/BT, 2x USB3.1, 2x SSC I/F for sensor, 2x PCIe, 1x UART, 1x SDC for SD card, 6x DMICs, 2x Speakers, GPIOs	1x Slimbus, 1x USB3.0, 1x SDIO, 1x I2S, 8x BLSP, GPIOs	2x Slimbus, 1x USB 3.1, 1x USB 2.0, 1x SDIO, 4x I2S, 14x QUPs, 1x RGMII, 120x GPIO	2x Slimbus, 1x USB 3.1, 1x USB 2.0, 1x SDIO, 4x I2S, 14x QUPs, 1x RGMII, 120x GPIO
LGA: 33.8x33.8x2.5	LGA: 40x41x3.0	BTB: 45x56x9	LGA: 35x34x2.3mm	LGA: 38x38	LGA: 38x38
+3.8V/3A Input	+3.8V/3A Input	3.8V ~ 4.2V	3.8V ~ 4.2V	3.8V ~ 4.2V	3.8V ~ 4.2V
-20 to +55°C	-20 to +70°C	-20 to +70°C	-20 to +70°C	-20 to +70°C	-20 to +70°C
5 to 95% non-condensing	5 to 95% non-condensing	5 to 95% non-condensing	5 to 95%, non-condensing	5 to 95%, non-condensing	5 to 95%, non-condensing
RED, FCC	RED, FCC	RED, FCC		RED, FCC, Telec, JATE, VCCI	RED, FCC, Telec, JATE, VCCI

### Einplatinenrechner (SBC)...

sind komplette Computer auf einer Platine inklusive CPU, Speicher und I/O-Schnittstellen. Sie benötigen keine weiteren Busschnittstellen, denn fast alle Komponenten sind bereits auf den Boards.

### Single-Board Computer (SBC)...

are complete computers built on a single circuit board including CPU, memory and I/O interfaces. They need no bus-interface, all components are on this board.



# BLUETOOTH AUDIO



## Bluetooth® Audio ICs

VENDOR	PART	DESCRIPTION	TYPE	CODECS	PACKAGE TYPES
QUALCOMM	CSR8670	Dual-Mode Bluetooth Multimedia IC with 80MIPS DSP	Flash based, 16mbit	SBC, AAC, aptX, aptX-LL	6.5×6.5 BGA, 4.7×4.8 WL-CSP
QUALCOMM	CSR8675	Dual-Mode Bluetooth Multimedia IC with 120MIPS DSP	Flash based, 16mbit	SBC, AAC, aptX, aptX-LL, aptX-HD	6.5×6.5 BGA, 4.7×4.8 WL-CSP
QUALCOMM	QCC3001	Headset ROM Device, mono output, 1 & 2mic cVc	Entry Level Flash	SBC, AAC	3.9×3.6 WLCSP, 5.5×5.5 VFBGA
QUALCOMM	QCC3002	Headset ROM Device, mono output, 1 & 2mic cVc	Entry Level Flash	SBC, AAC, aptX	3.9×3.6 WLCSP, 5.5×5.5 VFBGA
QUALCOMM	QCC3003	Headset ROM Device, stereo output, 1mic cVc	Entry Level Flash	SBC, AAC	6.0×6.0 QFN
QUALCOMM	QCC3004	Headset ROM Device, stereo output, 2mic cVc	Entry Level Flash	SBC, AAC	5.5×5.5 VFBGA
QUALCOMM	QCC3005	Headset ROM Device, stereo output, 1 & 2mic cVc	Entry Level Flash	SBC, AAC, aptX	5.5×5.5 VFBGA
QUALCOMM	QCC3006	Speaker ROM Device, mono output, 1mic cVc	Entry Level Flash	SBC, AAC	8×8 QFN
QUALCOMM	QCC3007	Speaker ROM Device, stereo output, 1mic cVc	Entry Level Flash	SBC, AAC	8×8 QFN
QUALCOMM	QCC3008	Speaker ROM Device, stereo output, 1mic cVc	Entry Level Flash	SBC, AAC, aptX	8×8 QFN
QUALCOMM	QCC3020	Mono Headset TWS/TWS+, 1mic + 2mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC	5.5×5.5 BGA
QUALCOMM	QCC3021	Stereo Speaker, TWS/TWS+, 1mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC	8×8 QFN
QUALCOMM	QCC3024	Stereo Headset, 1mic + 2mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC	5.5×5.5 BGA
QUALCOMM	QCC3026	Mono Headset, TWS/TWS+, 1 & 2mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC	3.98×4.02 CSP
QUALCOMM	QCC3031	Stereo Speaker, TWS/TWS+, 1mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC, aptX	8×8 QFN
QUALCOMM	QCC3034	Stereo Headset, 1 & 2 mic cVc, Broadcast Audio	Entry Level Flash	SBC, AAC, aptX	5.5×5.5 BGA
QUALCOMM	QCC5120	BT 5.0 (BR, EDR, BLE) & Audio Platform 2× 120MIPS DSP, cVc, ANC	Low Power Flash	SBC, AAC, aptX, aptX-LL, aptX-HD	6.5×6.5 BGA
QUALCOMM	QCC5121	BT 5.0 (BR, EDR, BLE) & Audio Platform 2× 120MIPS DSP, cVc, ANC	Low Power Flash	SBC, AAC, aptX, aptX-LL, aptX-HD	3.98×4.02 CSP
QUALCOMM	QCC5124	BT 5.0 (BR, EDR, BLE) & Audio Platform 2× 120MIPS DSP, cVc, ANC	Low Power Flash	SBC, AAC, aptX, aptX-LL, aptX-HD	5.5×5.5 BGA
QUALCOMM	QCC5125	BT 5.0 (BR, EDR, BLE) & Audio Platform 2× 120MIPS DSP, cVc, ANC	Low Power Flash	SBC, AAC, aptX, aptX-LL, aptX-HD	5.5×5.5 BGA

## Bluetooth® Audio

QUALCOMM ist ein international anerkannter, führender Anbieter von Bluetooth®-Audiotechnologie-Produkten. Ursprünglich stammen die QUALCOMM-Bluetooth-Audiolösungen vom Bluetooth-Spezialisten Cambridge Silicon Radio (CSR), der 2015 von QUALCOMM übernommen wurde. Die All-in-One-Silikon- und Software-Lösungen für Headsets und Sprechgarnituren vermitteln dem Benutzer ein eindrucksvolles Erlebnis und bieten ihm durch ihr kleines Format vielfältige Möglichkeiten. Bei unabhängigen Untersuchungen hinsichtlich Audioperformance und Klangqualität liegen ihre Ergebnisse durchwegs im Spitzenfeld. Die einzelnen Technologien, wie zB aptX® und cVc® bieten hilfreiche Unterscheidungsmerkmale zwischen den zahlreichen weltweit begehrtesten Marken der Unterhaltungselektronik.

## Bluetooth® Audio

QUALCOMM is an acknowledged leader in Bluetooth® audio technologies. Its Bluetooth® audio solutions origin from the Bluetooth® specialist Cambridge Silicon Radio (CSR), which QUALCOMM acquired in 2015. The all-in-one silicon and software solutions for headsets and speakers deliver a rich user experience and many possibilities due to a small form factor. It consistently tops independent surveys for best audio performance and clarity. The specific technologies – such as aptX® and cVc® – help QUALCOMM to differentiate among many of the world's most desirable consumer electronics brands.




aptX® HDX® Qualcomm aptX® Adaptive

**aptX®:** aptX audio technology delivers CD-like quality audio over a Bluetooth connection. It's a key product differentiator where a true audiophile experience is paramount.

**aptX®-HD:** aptX-HD provides a wider dynamic range complementing playback of Hi Resolution audio content. 24bit audio resolution can be maintained end to end. aptX-HD delivers a great SNR performance of 129dB, which is wider than any ADC/DAC.

**aptX® Adaptive:** Designed to be backwards compatible with aptX and aptX HD supported devices, aptX Adaptive is the next generation dynamically adjustable audio codec designed to deliver robust, low-latency, low-bit rate, high quality wireless audio.



**cVc®:** The latest generation of cVc® brings advanced audio enhancements and noise suppression to the near and far end, as well as providing packet loss and bit error concealment to deliver the best possible call quality on Bluetooth headsets, handsets, hands-free devices, and automotive.

# GPS & GNSS



## GPS/GNSS Portfolio

STAND-ALONE MODULES				MODULES WITH EMBEDDED ANTENNA									
GPS			L70	18-pin LCC MT3339			L80	12-pin LCC MT3339					
			L70-R	18-pin LCC MT3337			L80-R	12-pin LCC MT3337					
			L70-RL	18-pin LCC MT3337 Built-in LNA									
GNSS	L26C	24-pin LCC Built-in LNA		L76-C	18-pin LCC Built-in LNA			L95	L96 31-pin LCC MT3333		L86	12-pin LCC MT3333	
				L76	18-pin LCC MT3333								
	L26	24-pin LCC MT3333		L76-B	18-pin LCC MT3333								
				L76-L	18-pin LCC MT3333 Built-in LNA								
Size	12.2×16.0×2.4mm			10.1×9.7×2.5mm			14.0×9.60×2.0mm			16.0×16.0×6.45mm (L80) 18.4×18.4×6.45mm (L86)			

### GNSS Modul Familie

QUECTELs GNSS-Produkte sind für Projekte gedacht, bei denen GPS, GLONASS, BeiDou, QZSS oder Galileo zur Standortbestimmung oder zum Tracking benötigt werden. GNSS Funktionalität wird in einem großen Teil des IoT-Netzwerks benötigt.

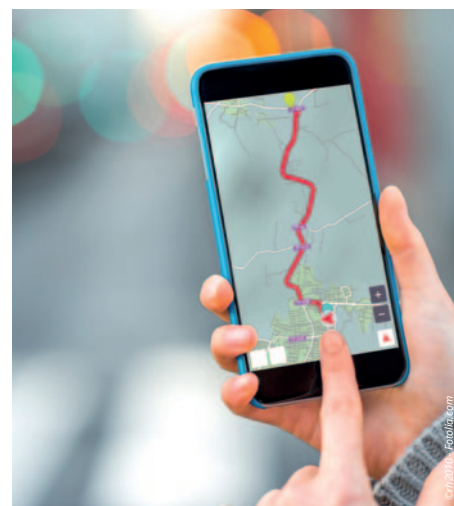
Die Funktionalität lässt Ihr angeschlossenes Gerät wissen, wo es sich befindet und kann diese und weitere Informationen zB über NB-IoT, CAT-M1 oder GSM versenden. Dies ist eine großartige Möglichkeit, den Überblick zu behalten, wo sich das Gerät befindet und welcher Zustand vorliegt.

### GNSS Module Family



QUECTELs GNSS products are intended for your location projects where GPS, GLONASS, BeiDou, QZSS or Galileo is needed for establishing location. Location based services are thought to be a huge part of the IoT network.

This feature allows your connected device to confirm its own location as well as report back the location and some additional informations via NB-IoT, CAT-M1 or GSM.





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