



FUNK IN MEINER APPLIKATION – WELCHE TECHNOLOGIE PASST ZU MEINEM PRODUKT?

David Hofer, Business Development Wireless Connectivity
11.09.2026

EXTERNAL

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT



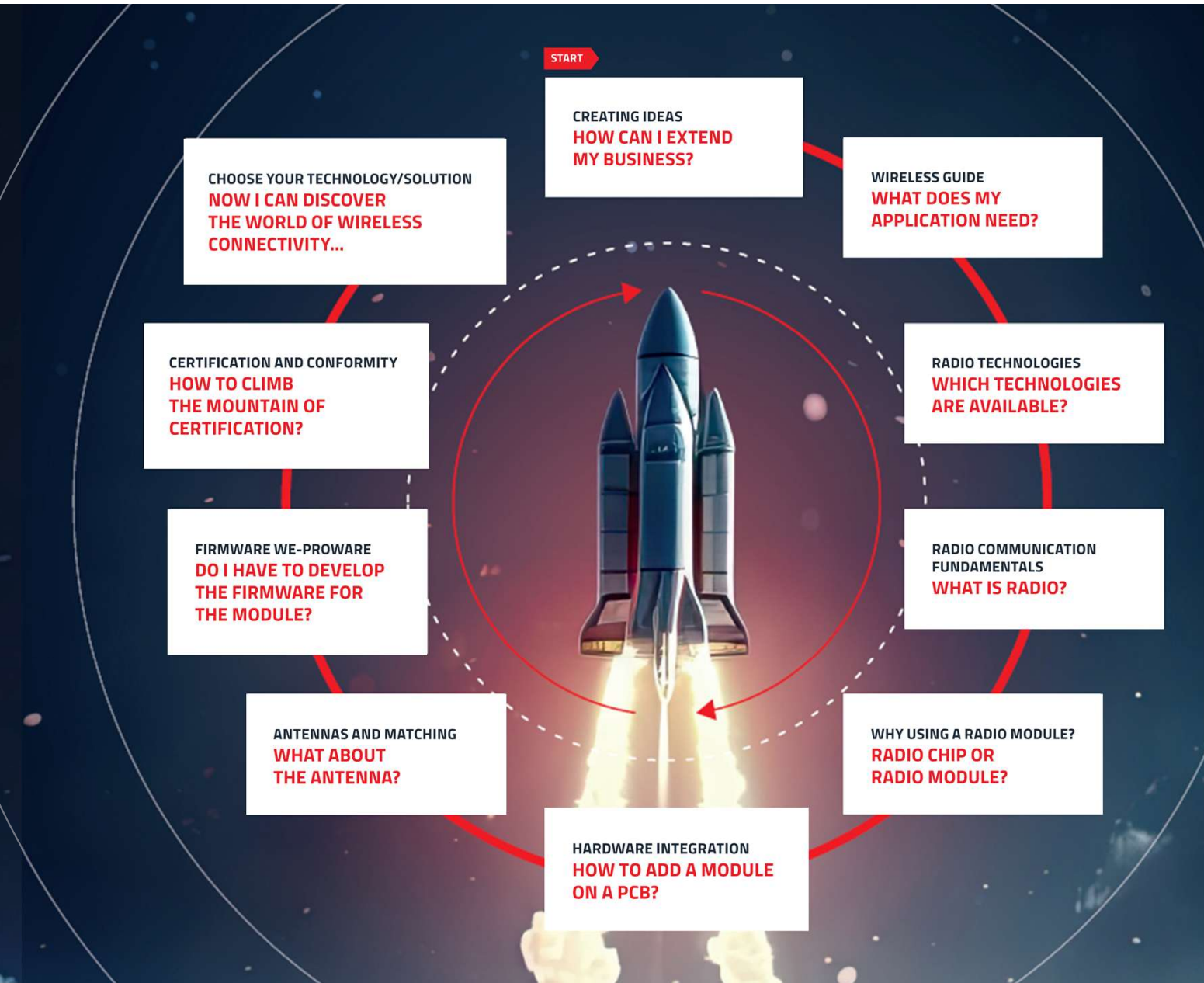
KURZE VORSTELLUNG

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

HOW TO GET STARTED WITH WIRELESS CONNECTIVITY



HOW TO GET STARTED WITH WIRELESS CONNECTIVITY



START

CREATING IDEAS
HOW CAN I EXTEND
MY BUSINESS?

ION

WI
W
AP

CREATING IDEAS





TURN
UPSIDE DOWN



TURN
UPSIDE DOWN

REPLACING LC DISPLAYS

DIGITAL DEVICES



SMART HELMET



WEIGHTING SYSTEM



INTELLIGENT COFFEE MACHINE



LIFESTOCK MONITORING

CONTAINER TRACKING

AUTOMATED GUIDED VEHICLE

BATTERY MONITORING



SMART METERING



START

CREATING IDEAS
HOW CAN I EXTEND
MY BUSINESS?

ION

WI
W
AP

WIRELESS GUIDE
**WHAT DOES MY
APPLICATION NEED?**

WICHTIGE FRAGEN

Wireless Guide

1. Region



In which region will the application run or should be used in the future?

- ☐ Europe
- ☐ North America
- ☐ South America
- ☐ Asia
- ☐ worldwide
- ☐ other: _____

2. Range



What range do you need to cover in your application?

- ☐ 0 - 15 m
- ☐ 15 - 50 m
- ☐ 50 - 100 m
- ☐ 100 - 500 m
- ☐ 500 m - 2 km
- ☐ 2 km - 10 km
- ☐ >10 km

3. Environment



In which environment will your application be used?

- ☐ Indoor
- ☐ Outdoor
- ☐ Industrial
- ☐ Home Automation
- ☐ other: _____

WICHTIGE FRAGEN

Wireless Guide

4. Data

001101
010100
101101

How much data has to be transmitted? Which data rate is required?

- ☐ Very low data rate (up to 1 kbps)
- ☐ Middle data rate (up to 100 kbps)
- ☐ High data rate (>100 kbps)
- ☐ Very high data rate (>500 kbps)

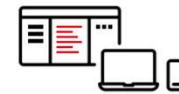
5. Energy



What about power consumption? How much energy is available? How long should a battery last?

- ☐ Long term battery powered
- ☐ Battery powered
- ☐ Main powered
- ☐ other: _____

6. Interface



Communication to...?

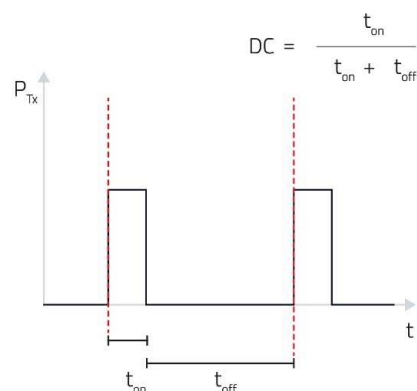
- ☐ Smart Device (Mobile, Tablet)
- ☐ PC, Server, etc.
- ☐ Device of own development
- ☐ Special communication interface (Wirepas, wM-Bus, CAN-Bus, ...)
- ☐ Mesh (Wirepas, Bluetooth® Mesh, Closed Mesh)
- ☐ other: _____

WIRELESS GUIDE
**WHAT DOES MY
APPLICATION NEED?**

RADIO TECHNOLOGIES
WHICH TECHNOLOGIES
ARE AVAILABLE?

	LIZENZFREIE ISM-BÄNDER (INDUSTRIAL SCIENTIFIC MEDICAL)							LIZENZIERTE MOBILFUNK-BÄNDER					
Frequenz [MHz]	169	433	868	915	1500	2400	5000	700	900	1800	2100	2600	3500
Wellenlänge [cm]	178	69	35	33	20	13	6	43	33	17	14	12	9
Funkprotokoll	 		       	      	   	       IEEE 802.15.4 		 	   				
Reichweite	mittel	mittel	hoch	hoch	hoch	niedrig	niedrig	hoch	hoch				
Datenrate	niedrig	niedrig	mittel	mittel	niedrig	hoch	hoch	hoch	niedrig				
Würth Elektronik Antennen		 	 	 	 	 		 	 				

DUTY CYCLE



Frequency [MHz]	TX Power [dBm]	TX Power [mW]	Duty cycle	max. occupied BW* [kHz]	Notes
169.400 - 169.475	+ 27	500	$\leq 1 \%$	50	For metering devices: 10 % DC
169.400 - 169.4875	+ 10	10	$\leq 0.1 \%$	whole band	
169.4875 - 169.5875	+ 10	10	$\leq 0,001 \%$	whole band	0,1 % DC during 0:00 and 6:00 local time
169.5875 - 169.8125	+ 10	10	$\leq 0,1 \%$	whole band	
433.050 - 434.790	+ 10	10	10 %	whole band	
433.050 - 434.790	0	1	no limits	whole band	-13 dBm / 10kHz PSD when bw > 250 kHz, audio/video applications are excluded
434.040 - 434.790	+ 10	10	no limits	25	audio/video applications are excluded
863.0 - 865.0	+ 14	25	$\leq 0.1 \%$ or PSA**	whole band	OBW restrictions except audio & video limited to 300 kHz
865.0 - 868.0	+ 14	25	$\leq 1 \%$ or PSA**	whole band	
868.0 - 868.6	+ 14	25	$\leq 1 \%$ or PSA**	whole band	
868.7 - 869.2	+ 14	25	$\leq 0.1 \%$ or PSA**	whole band	
869.4 - 869.65	+ 27	500	$\leq 10 \%$ or PSA**	whole band	
869.7 - 870.0	+ 7	5		whole band	audio / video applications are excluded
869.7 - 870.0	+ 14	25	$\leq 1 \%$ or PSA**	whole band	analogue audio / video are excluded
2400.0 - 2483.5	+ 10	10	no limits	whole band	non specific short range devices
2400.0 - 2483.5	+ 14	25	no limits	whole band	radio determination devices (radar, RFID,...)
2446.0 - 2454.0		500 / 4000		whole band	RFID only

* BW = Band width

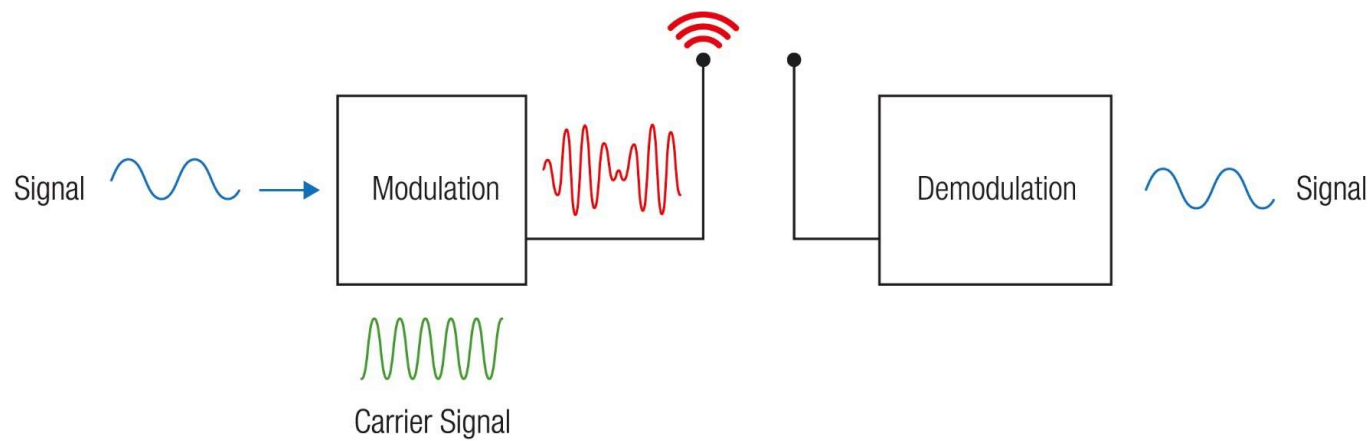
** PSA = Polite Spectrum Access, allows up to 100s sending per 1 hour observation time, so a duty cycle of up to 2.77%

RADIO TECHNOLOGIES
WHICH TECHNOLOGIES
ARE AVAILABLE?

RADIO COMMUNICATION FUNDAMENTALS

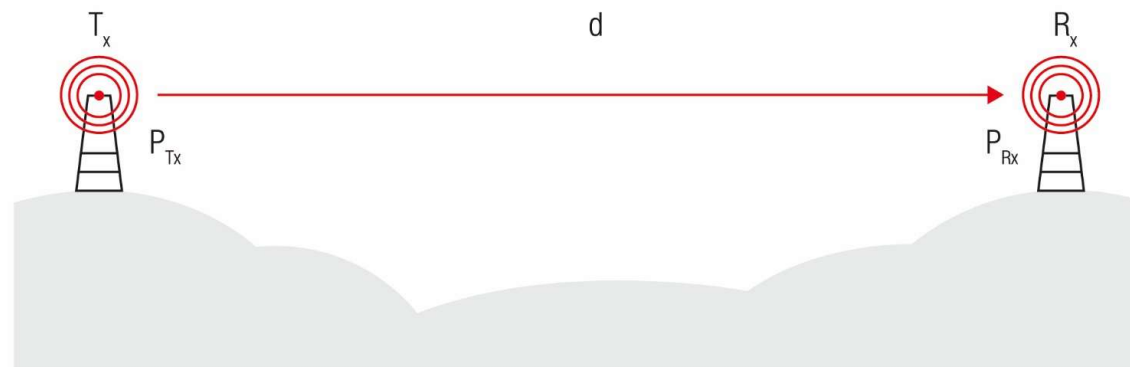
WHAT IS RADIO?

FUNKSYSTEM



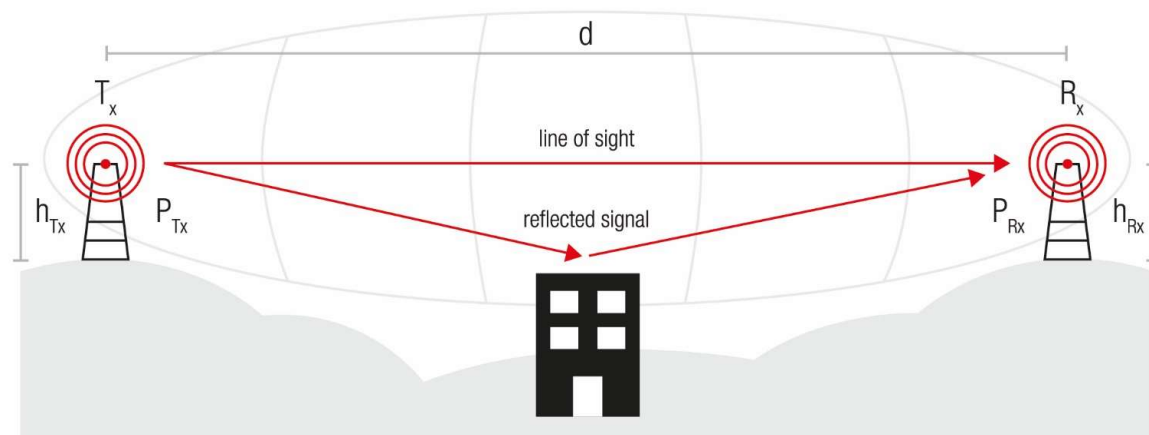
REICHWEITEN ABSCHÄTZUNG

Model 1: Friis Transmission for Free Space



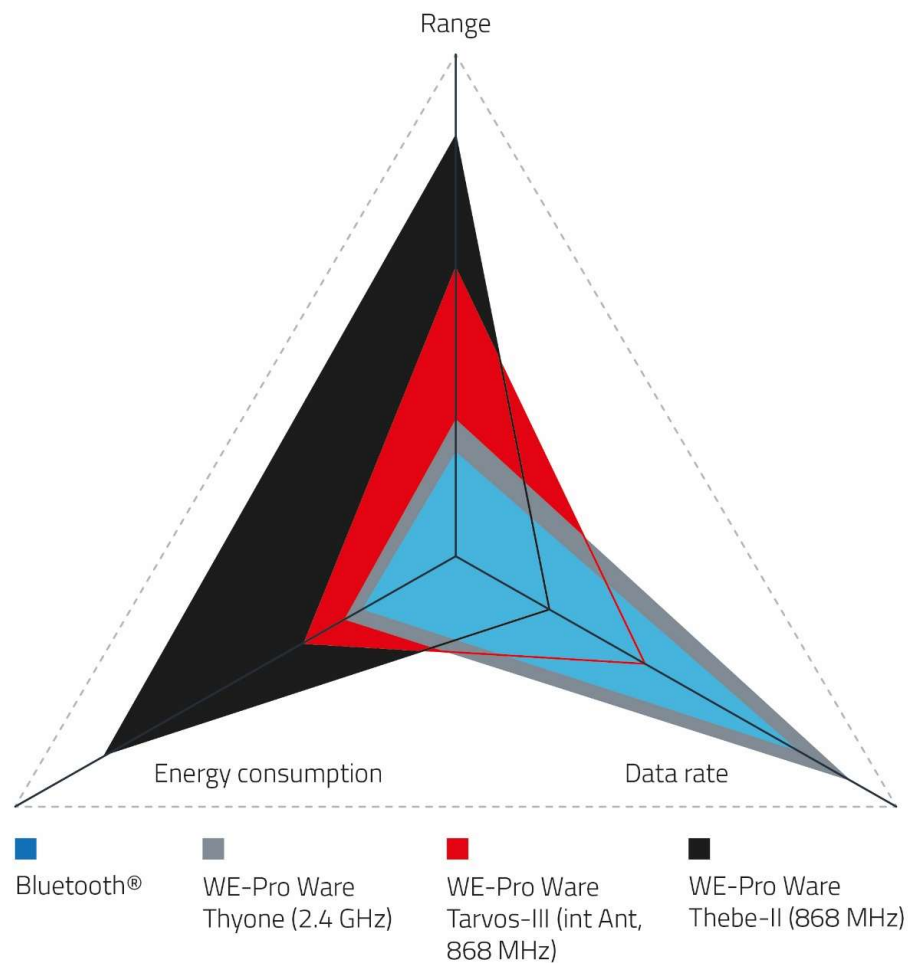
RANGE ESTIMATION

Model 2: Two-ray Ground Reflection

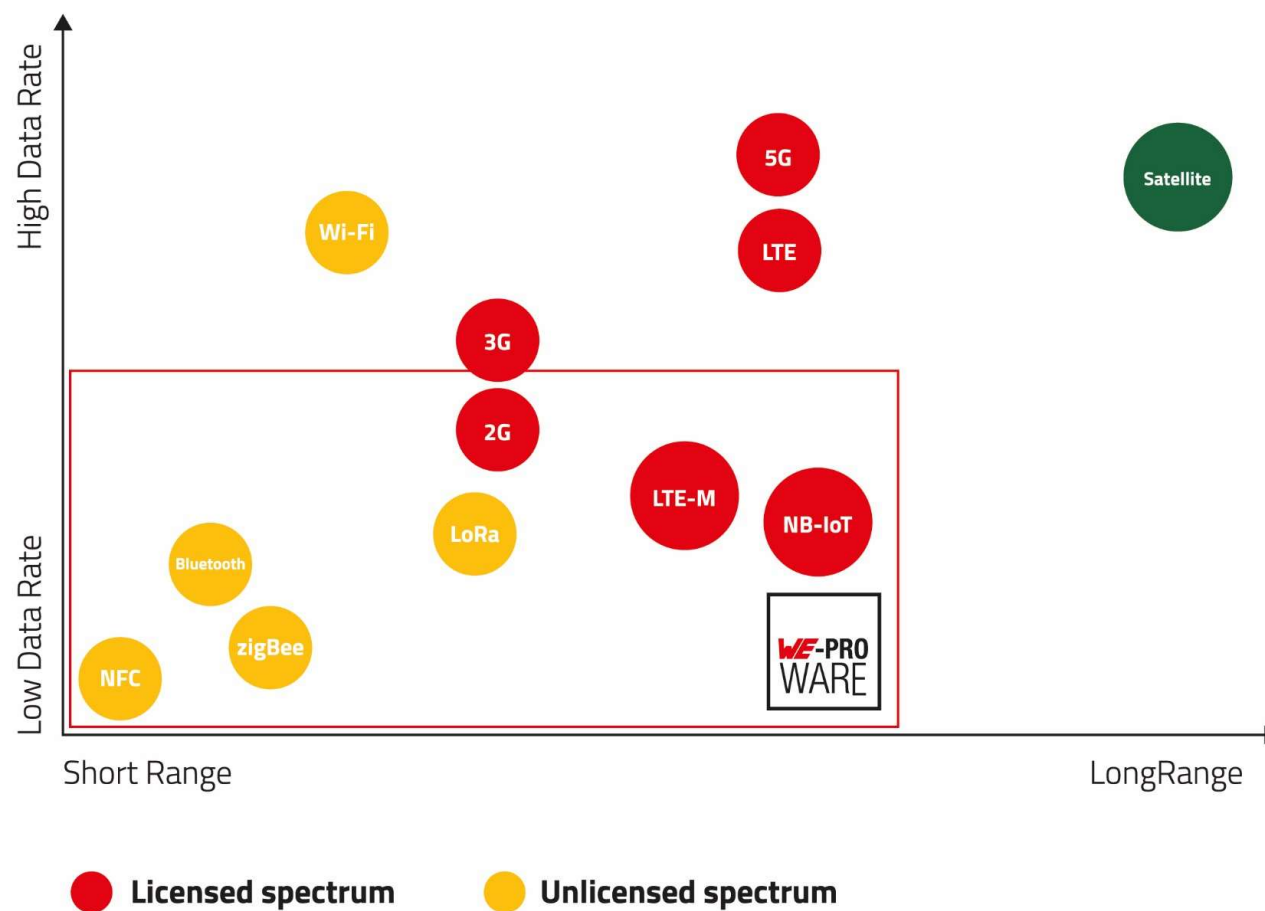


REICHWEITE – DATENRATE – ENERGIEVERBRAUCH

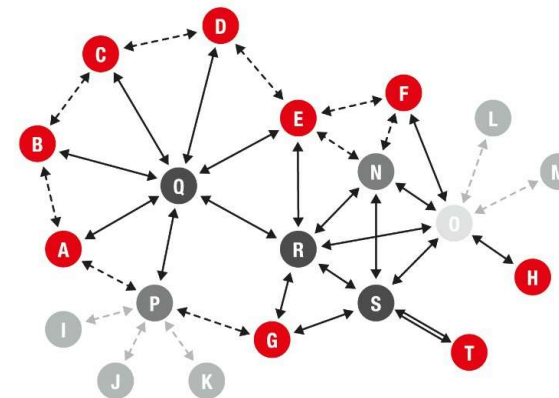
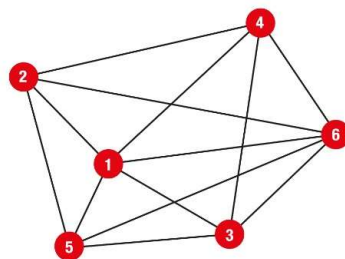
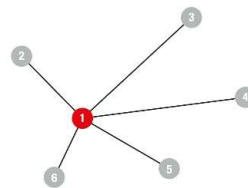
Immer ein Kompromiss



OVERVIEW OF DIFFERENT PROTOCOLS AND STANDARDS



NETZWERK TOPOLOGIEN



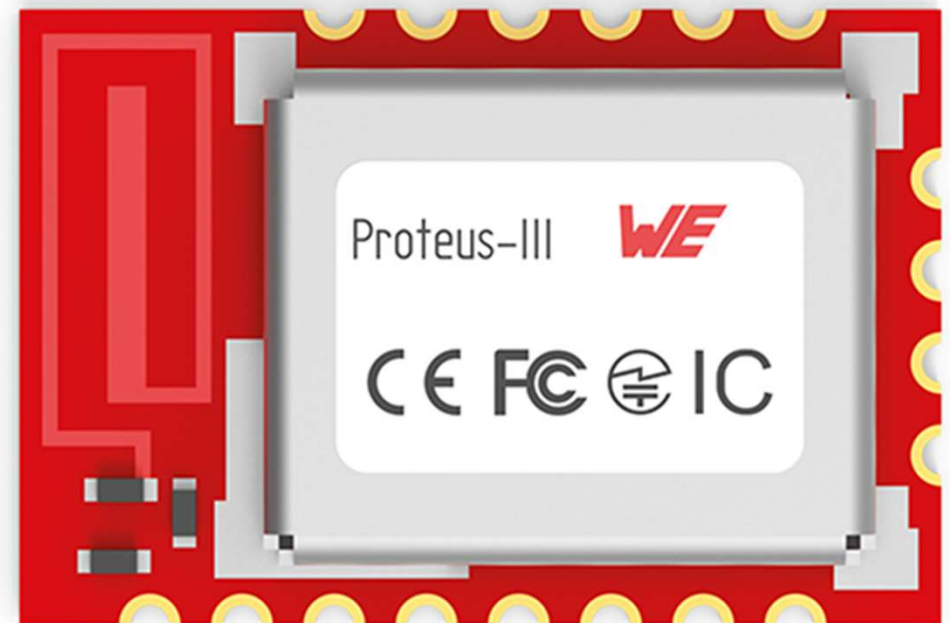
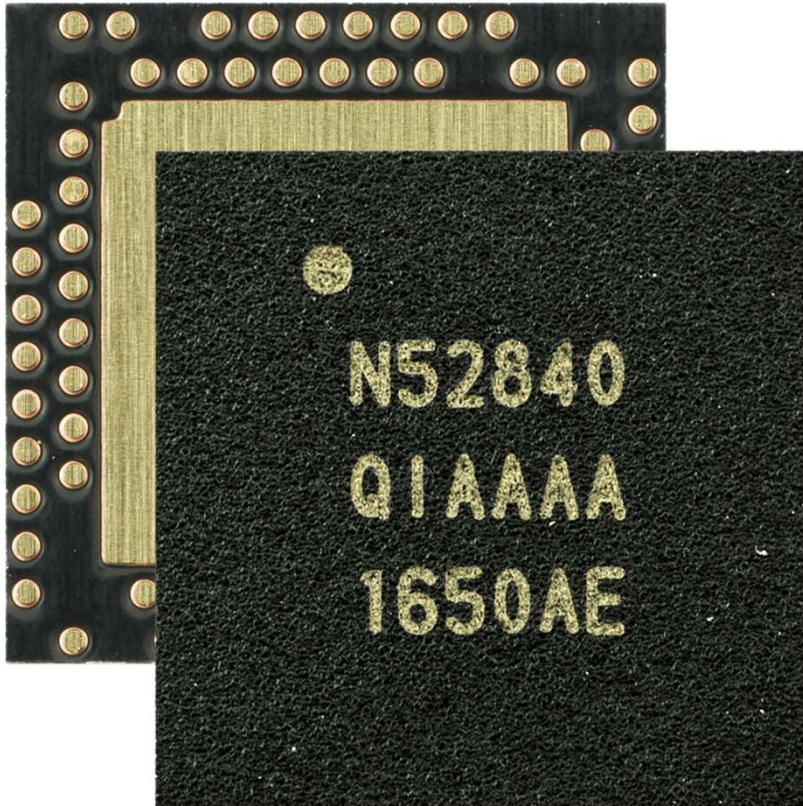
RADIO COMMUNICATION FUNDAMENTALS

WHAT IS RADIO?

WHY USING A RADIO MODULE?
RADIO CHIP OR
RADIO MODULE?

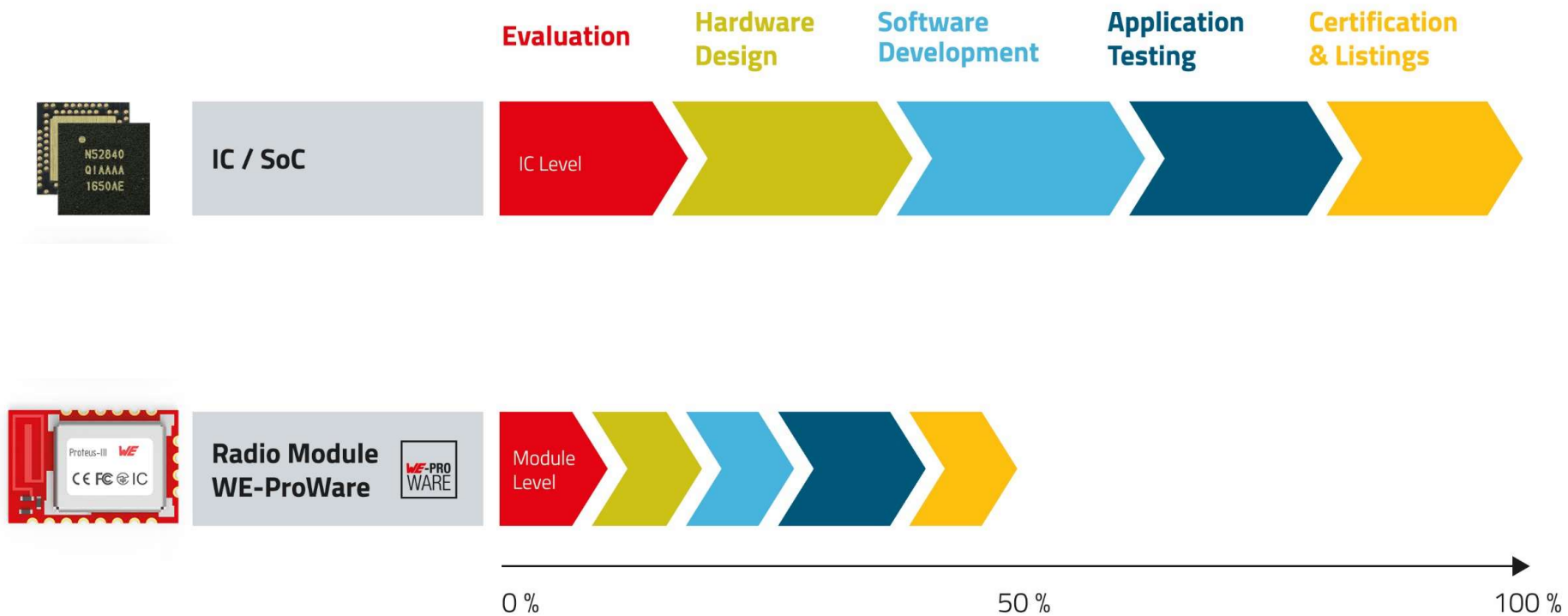
FUNK-CHIP VS. FUNK-MODUL

2 Möglichkeiten

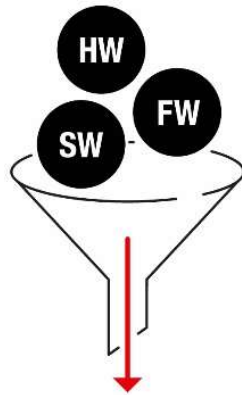


HARDWARE

Funkmodul oder Funkchip



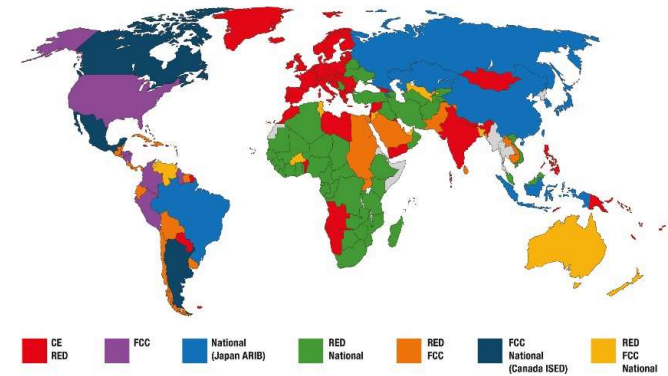
WAS IST EIGENTLICH EIN FUNKMODUL?



Radio module



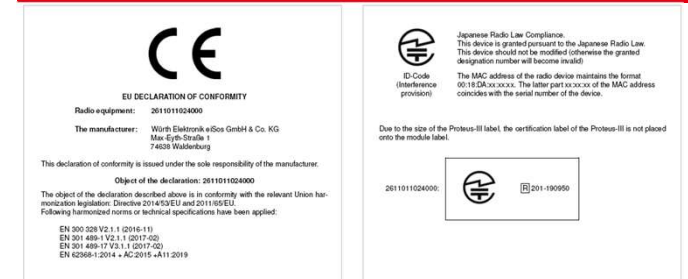
Certification



HW
Hardware

FW
Firmware

SW
Software



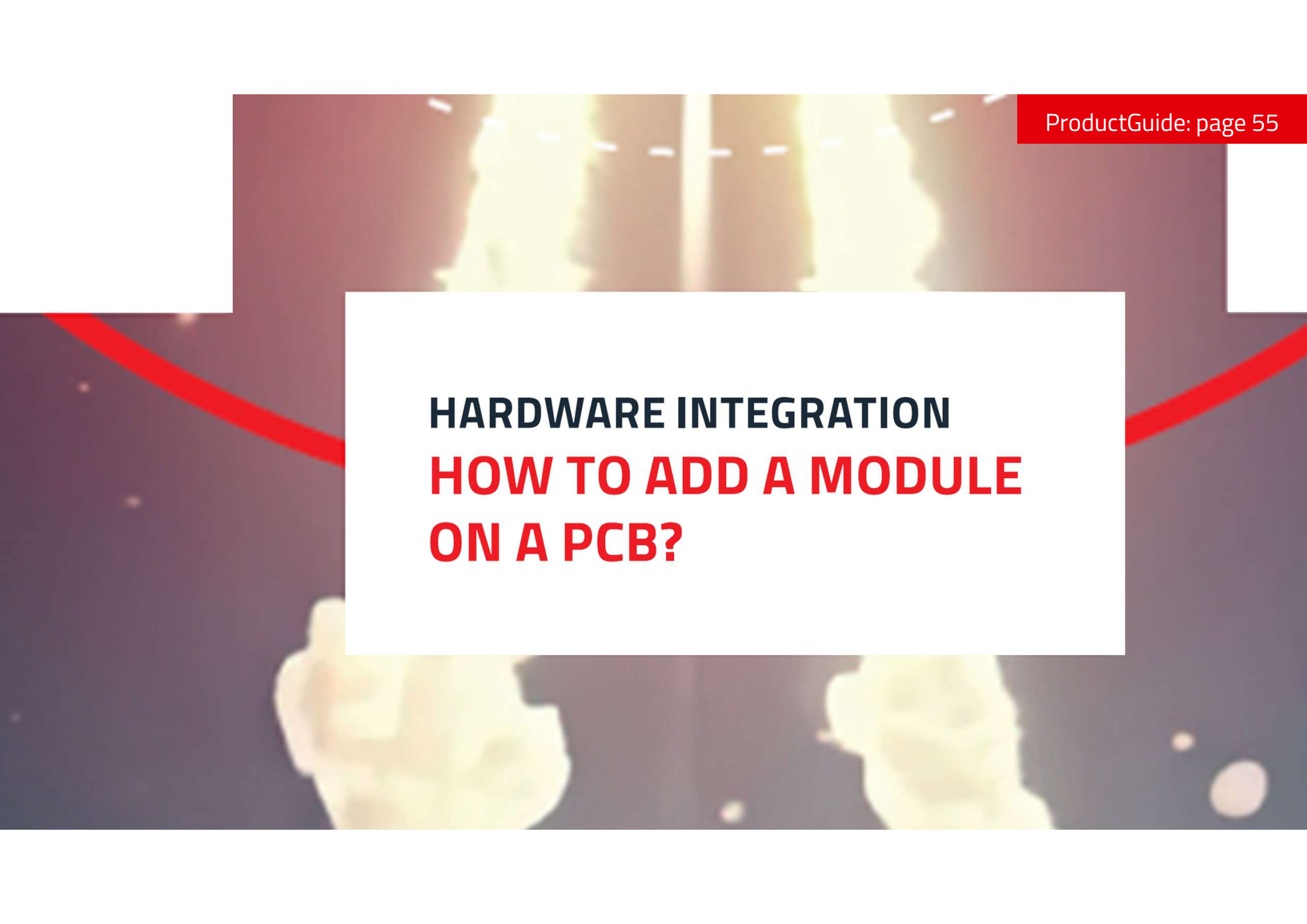
KOSTENVERGLEICH– CHIP VS. MODULE

	What is necessary to consider?	
	Würth Elektronik "Off-the-Shelf" radio module	Customer "Build-Your-Own-Device"
1. FIXED COSTS		
Module Buy-Price The buying price of the radio module should compare apples by apples. A Würth Elektronik Module always comes with in a package of Hardware (radio module), Firmware (µC & RF stack) and the needed Software for evaluation. One price includes all features. "Building-Your-Own-Device" needs to consider ADDITIONALLY the following investments.	€€	€
Hardware Development The hardware costs are more than just the Bill of Materials for like Microcontroller, IC, Oscillator, Antenna, PCB, LNA, and more. It needs to be taken into account the development itself, the necessary rework during the prototype-to-series phases, the antenna design and possible revisions while the device is already in the market. Using an "Off-the-shelf" solution makes all this mainly unnecessary, as Würth Elektronik is taking care of that for you.		€
Firmware Development The Firmware running on a radio modules is an accumulation of the one-time software development costs, the recurring costs for software maintenance and required updates and don't forget the necessary documentation. This can simply sum up in a 6-digit Euro investment and following needs to be broken down to each single radio module. Würth Elektronik eiSos modules require a minimum of configuration like communication between module and host microcontroller into the end application from the system designer. A budget of a few days is realistic.		€€
Required Measurement Equipment The final step while taking the radio module into operation is the necessity of measuring all electrical parameters. Therefore it requires to have measurement tools like a Signal Generator, Spectrum & Signal Analyzer and Oscilloscope available, which represent another 6-digit investment, unless those have already been purchased before.		€€

COST COMPARISON – CHIP VS. MODULE

	What is necessary to consider?	
	Würth Elektronik "Off-the-Shelf" radio module	Customer "Build-Your-Own-Device"
2. VARIABLE & FIXED COSTS Certifications, Conformity, Declaration A product that is to be launched globally must meet the certification or conformity criteria of each country it is to be marketed in. It can be compared with the typical iceberg model, where the measurements, the official certificate or the official stamp only represents the tip. For a "Build-Your-Own-Device" solution it requires a comprehensive knowledge of all those regulations in each country and following a huge time investment, also for the documentation. Würth Elektronik radio modules come along with the Declaration of Conformity following the Radio Equipment Directive for Europe and on top with a variety of different certifications complying to regulations in the United States, Canada, Japan and some even with the Chinese law. To be on the safe side with the end device, Würth Elektronik recommends a simple and very low cost delta measurement in the final device, as all the documentation will be provided to the customers test lab. Using a USB radio stick from Würth Elektronik makes it even easier – Plug & Play, ready to operate at lowest possible costs.	€	€€
3. OPPORTUNITY COSTS Avoid Delayed Market Entry and loose Money Last but not least, deciding for a "Build Your Own Device" solution will set you back several month in most of the cases. Simply, it is missing sales in the market. Instead, using an "Off-the-shelf" radio module solution from Würth Elektronik and starting to sell the end device earlier will accelerate the market release of the end device. It is like gaining time and early profit.		€

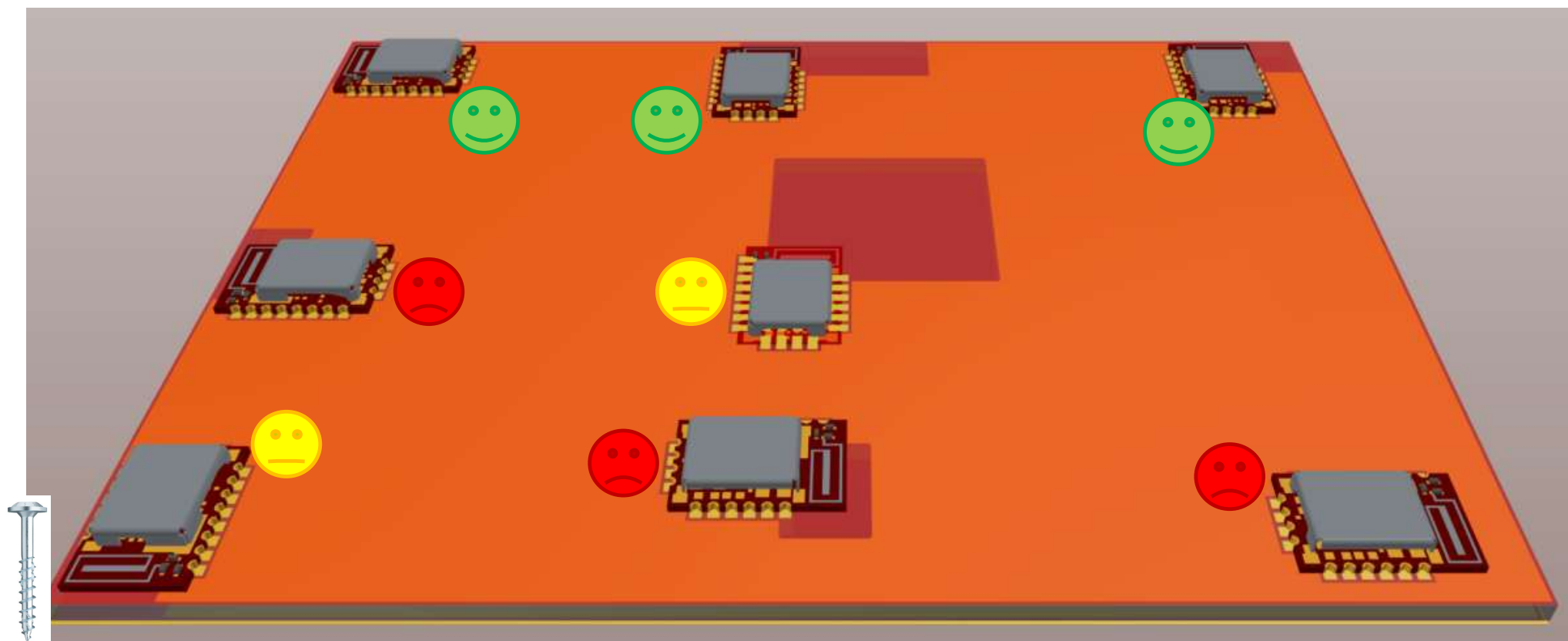
WHY USING A RADIO MODULE?
RADIO CHIP OR
RADIO MODULE?

A microscopic view of a printed circuit board (PCB) showing intricate circuit patterns and components. A prominent red diagonal line runs across the image, adding a graphic element. The text is overlaid on a white rectangular background.

HARDWARE INTEGRATION

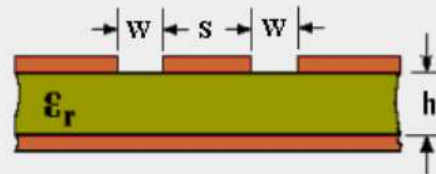
HOW TO ADD A MODULE ON A PCB?

MODULPLATZIERUNG



ANTENNA CONNECTION

15.2 Dimensioning of the micro strip antenna line



INPUT DATA

Relative Dielectric Constant (ϵ_r):

Track Width (S): mm

Gap Width (W): mm

Dielectric Thickness (h): mm

RESULTS

Effective Dielectric Constant (ϵ_{eff}):

Characteristic Impedance (Z_0): Ohms

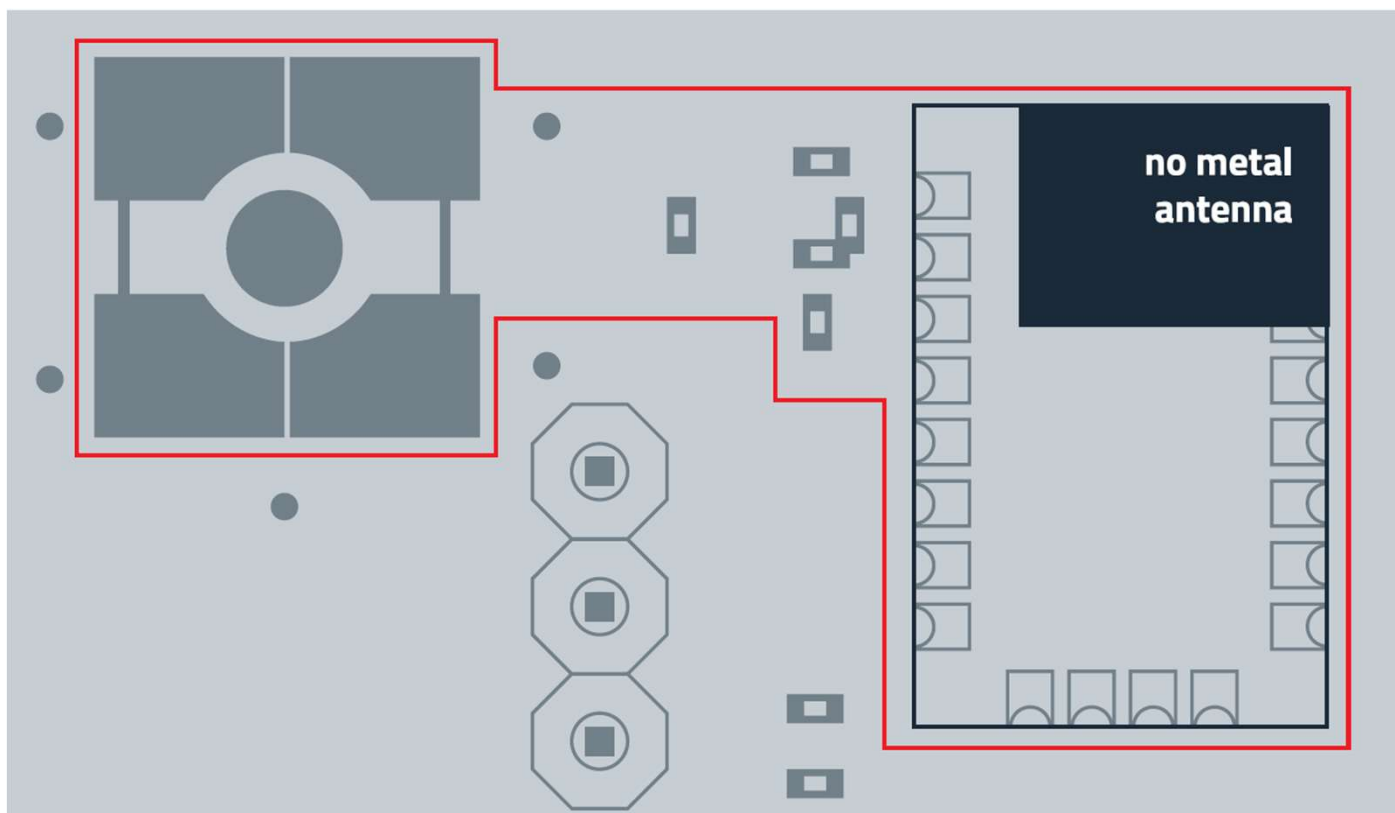
Figure 11.2. Characteristic impedance as approximated by Hammerstad for $\epsilon_r = 1.0$ (air), 3.10

(quartz) and 9.5 (alumina)

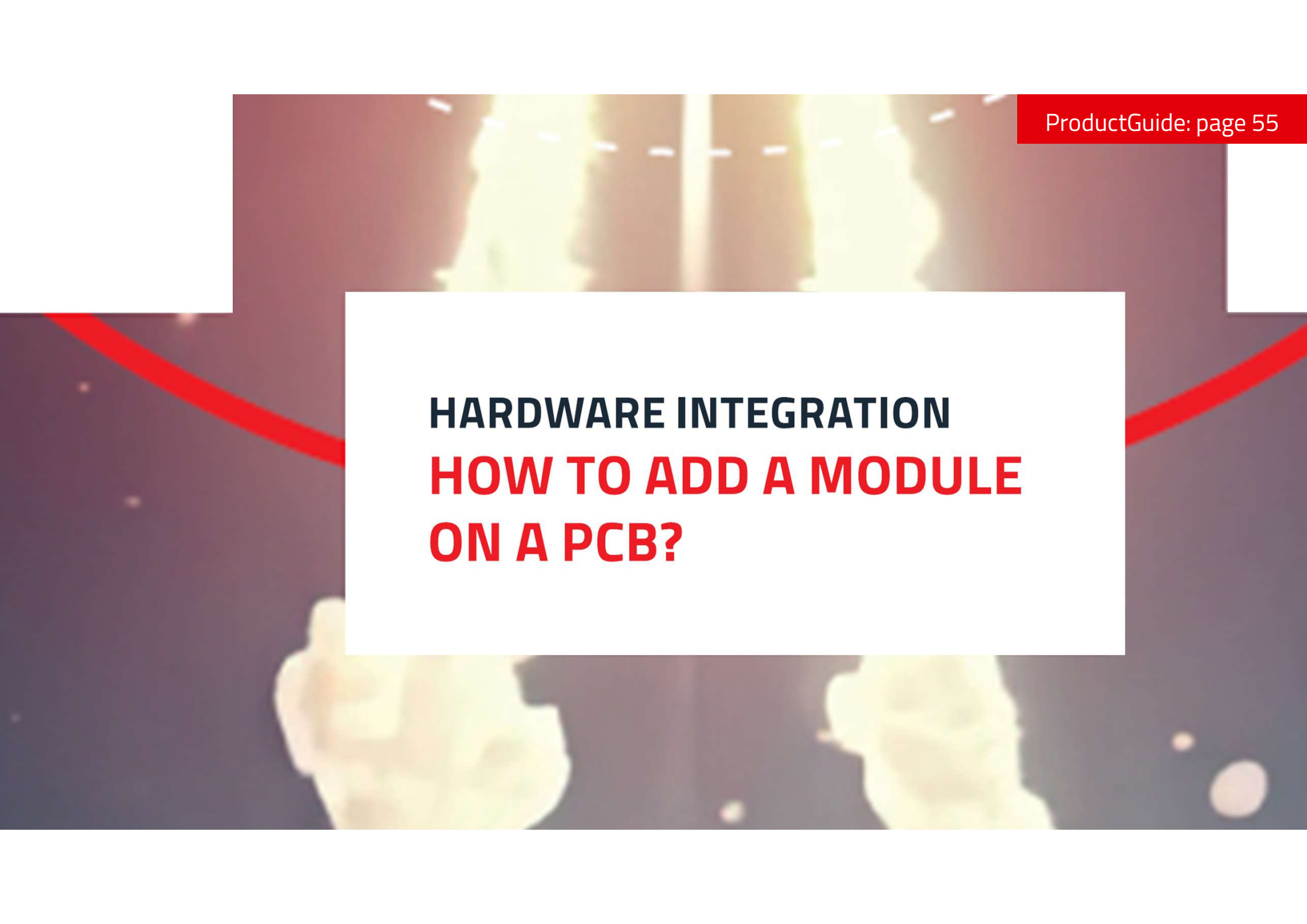
Keep the feeding line as short as possible.

HARDWARE DESIGN

Trace Design



„DAS IST DOCH NUR DER EMPFÄNGER“



HARDWARE INTEGRATION

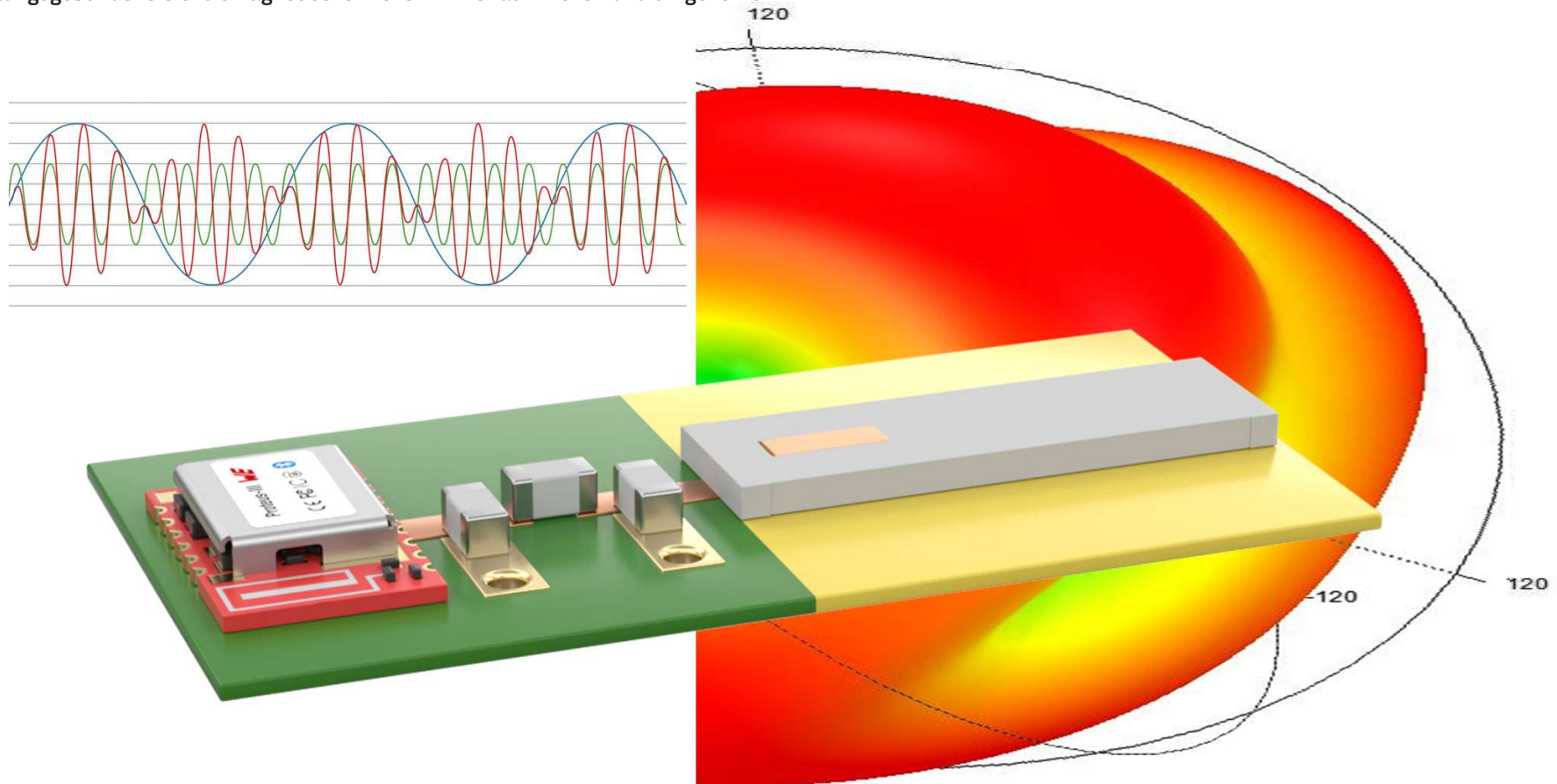
HOW TO ADD A MODULE ON A PCB?

ANTENNAS AND MATCHING
WHAT ABOUT
THE ANTENNA?

DAS WICHTIGSTE BAUTEIL FÜR DIE FUNKPERFORMANCE:

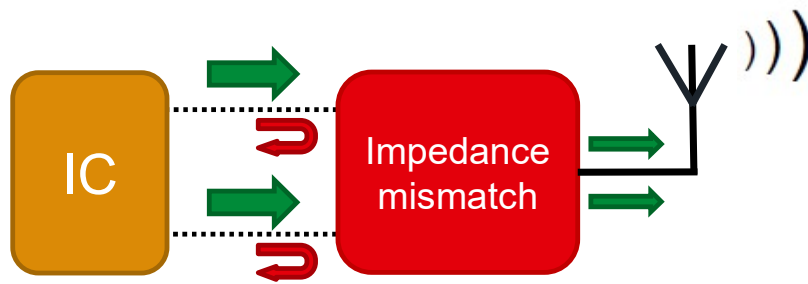
Die Antenne...

... wandelt Leitungsgebundene elektromagnetische Wellen in Freiraumwellen und umgekehrt.

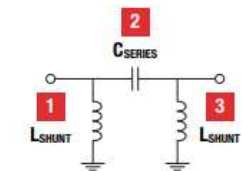
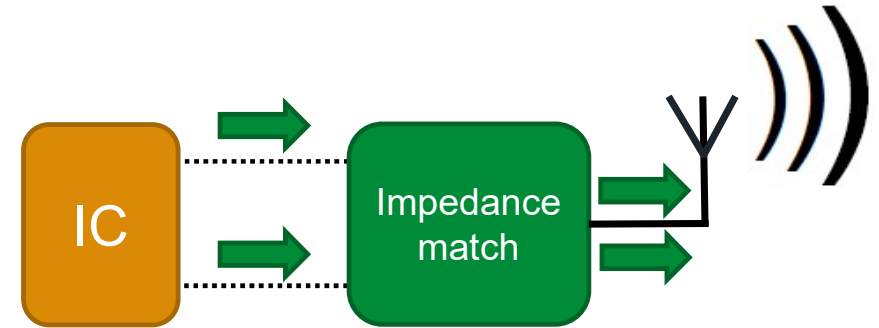
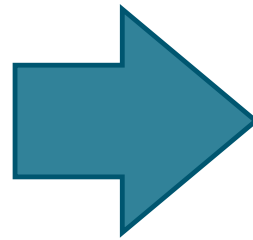


ANTENNA MATCHING

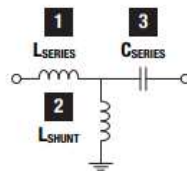
Warum?



Impedance
Matching circuit



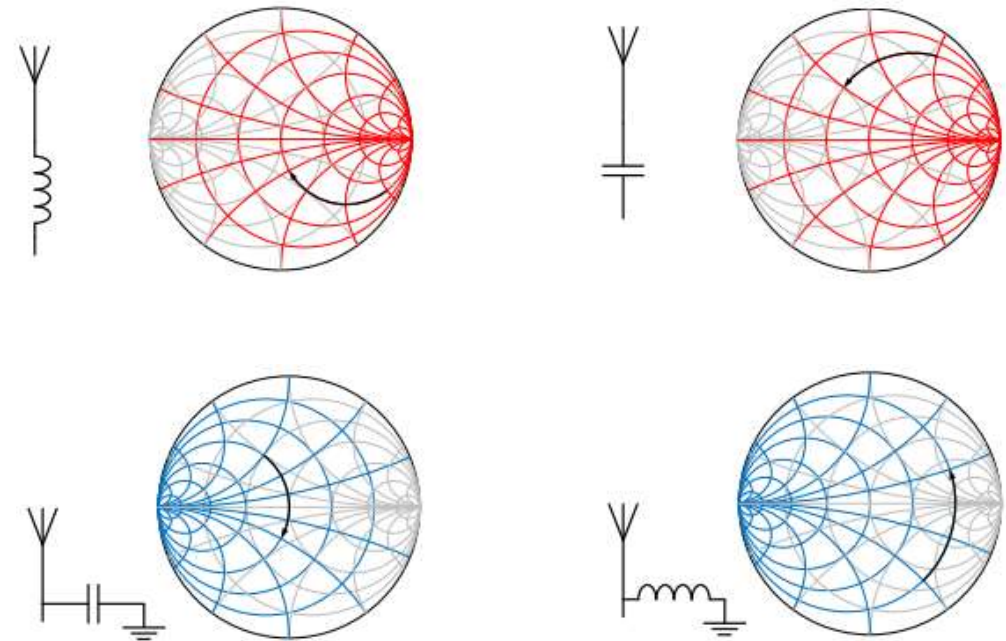
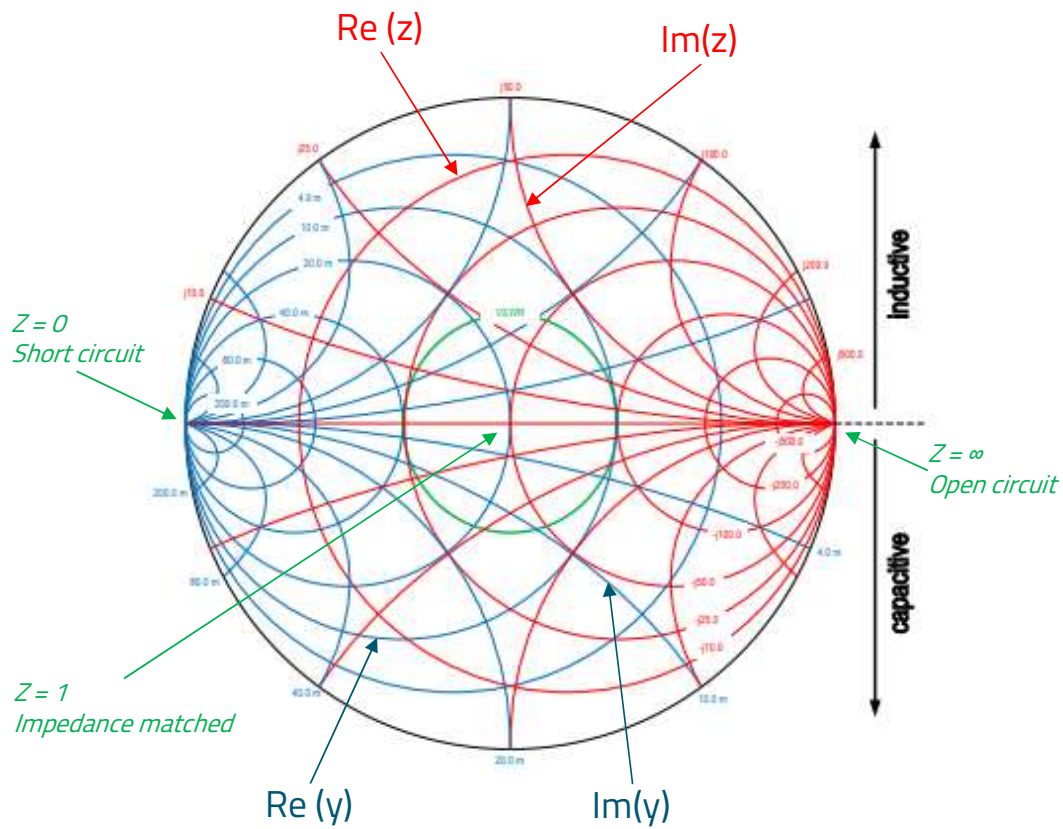
Pi matching for Point A



T matching for Point B

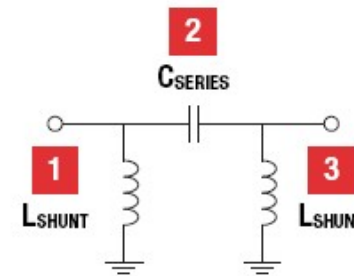
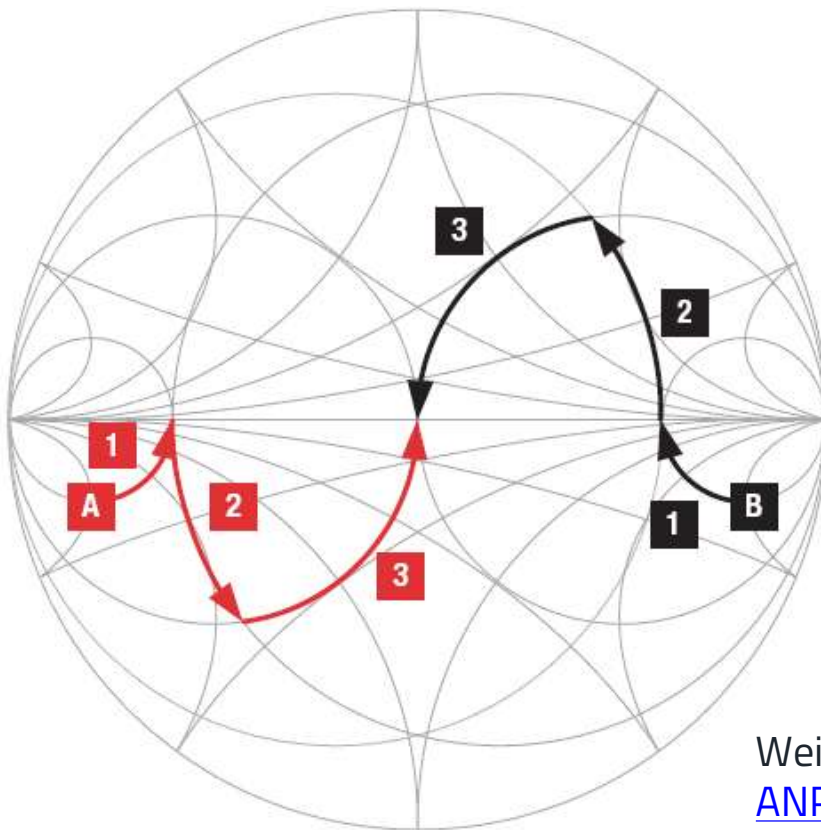
ANTENNA MATCHING

Wie?

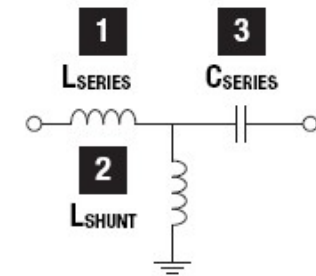


ANTENNA MATCHING

Wie?



Pi matching for Point A



T matching for Point B

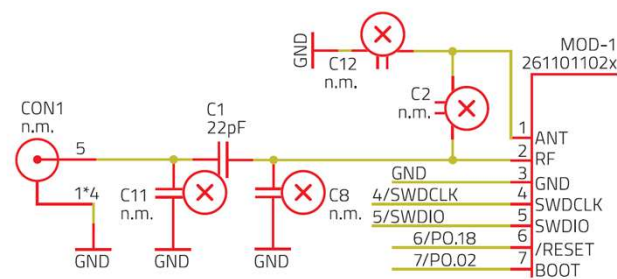
Weitere Information:

[ANP057WE-MCA Multilayer-Chipantenne Platzierung und Anpassung](#)

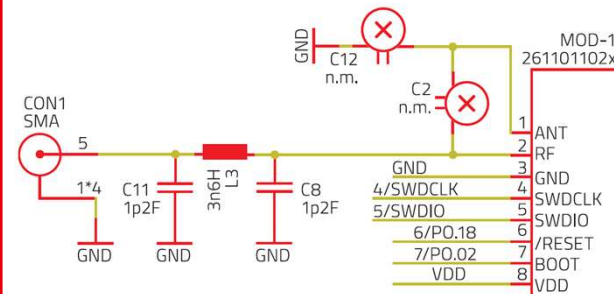
SMART ANTENNA SELECTION

ANTENNA MATCHING

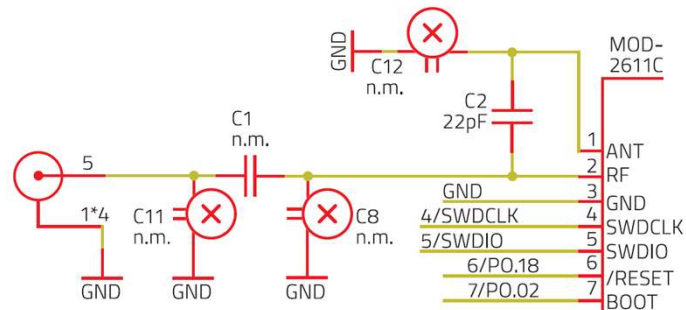
Coaxial connector w/o filter or matching



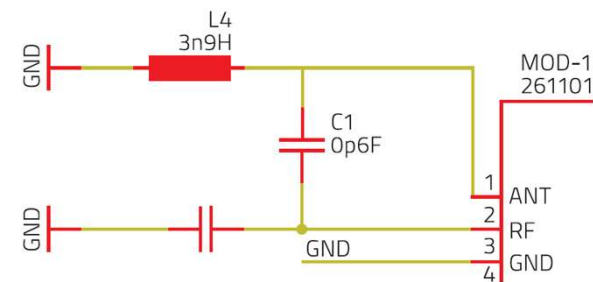
Pi-Filter: i.e. lowpass with cut-off frequency 2.5 GHz and ripple of 0.1 dB, (Chebyshev) adapted to 50 Ohm network



Internal antenna w/o filter or matching



Rematching: i.e. 15-j102 back to 50 Ω

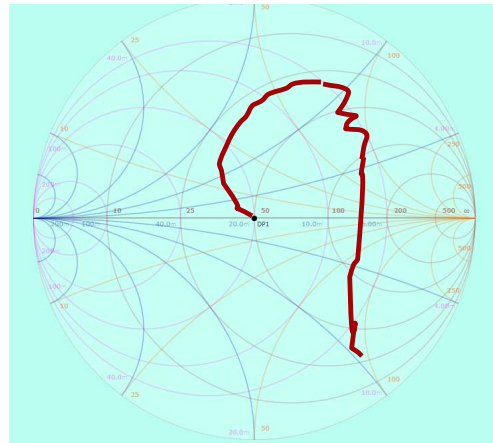


SMART ANTENNA CONNECTION

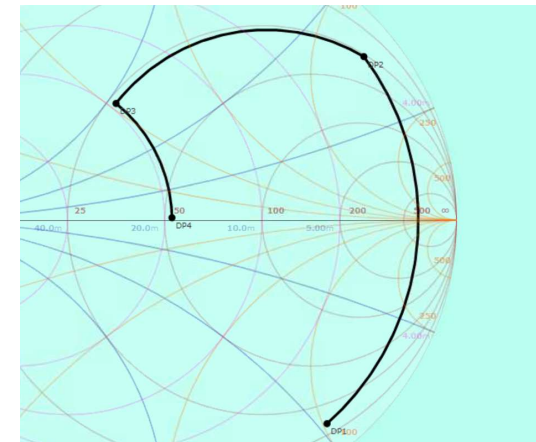
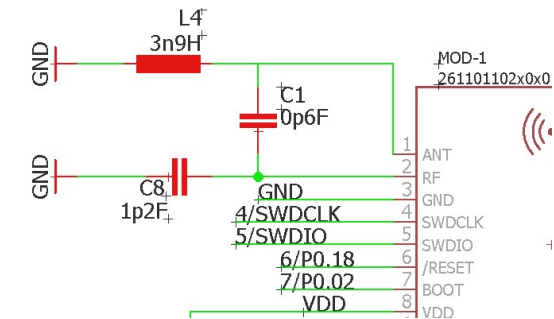
Was ist eigentlich mit Feintuning oder Rematching gemeint?



Antenne wird durch die Integration in die Anwendung verstimmt.



Rematching, z.B. von 15-j102 zurück auf 50 Ohm



DESIGN AND SOLUTIONS

ANTENNA MATCHING SERVICE



Antenna matching:
www.we-online.com/antennamatching

Service Process

Our process enables transparent integration into your project plan. If you have any questions about the process or general questions about antenna matching, our service is also available to you.

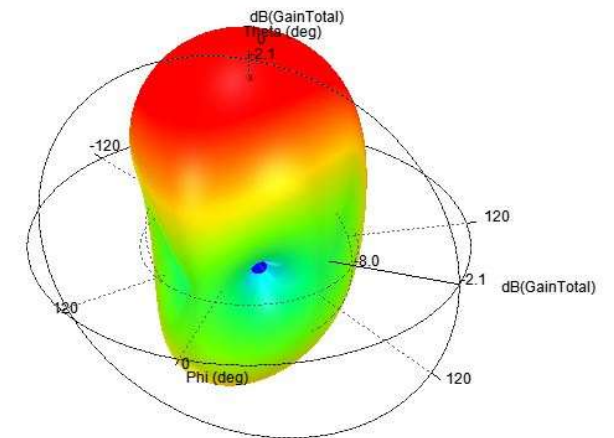
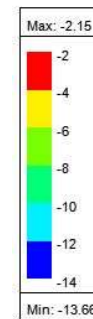
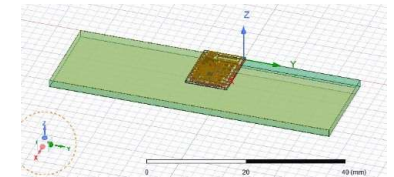
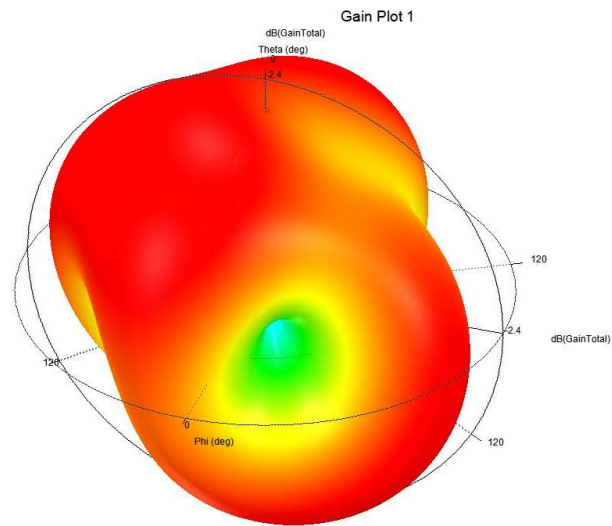
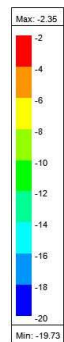
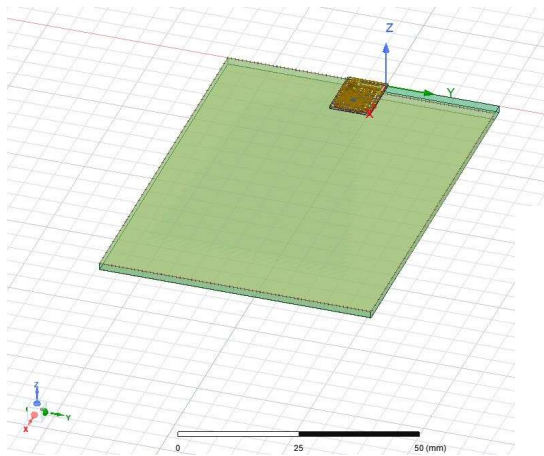
- Get in touch with us via the online contact form on our website we-online.com/antennamatching
- We review your information and get back to you.
- Please have the following data ready for analysis:
 - **Antenna:** Order code, required operating frequency range, required transmission range
 - **Radio Module:** Order code
 - **PCB:** BOM, circuit diagram, layout, layer structure, layer material
 - **Application:** casing information, immediate environment, environment
- We analyze your data and advise you.
- After successful analysis, the following materials will be required for antenna matching:
 - Complete application with housing and battery/accumulator
 - Two fully assembled PCBs on which the antenna is placed
- We match your antenna and send you a report.
- Your material will be returned.

SERVICES

- ✓ Advice on antenna selection
- ✓ Advice on antenna placement
- ✓ Advice on selection of the matching circuit for the antenna with RF-inductors and -capacitors
- ✓ Measurement of antenna S11 parameters: return loss (RL), voltage standing wave ratio (VSWR) and RL efficiency
- ✓ Antenna simulation models

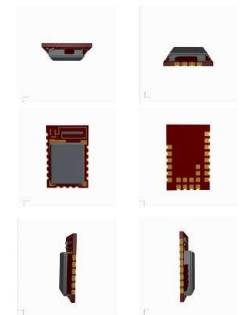
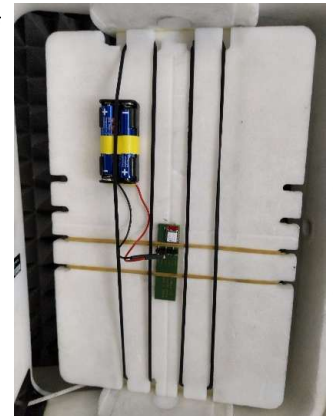
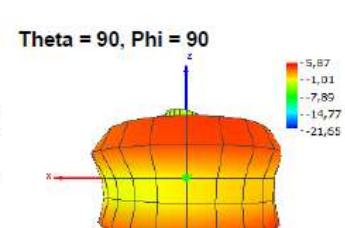
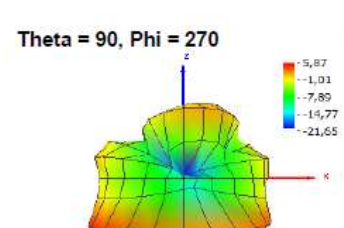
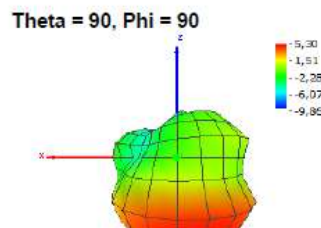
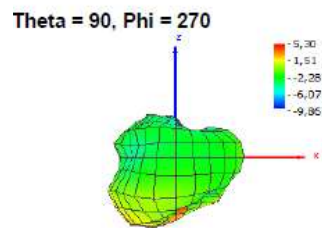
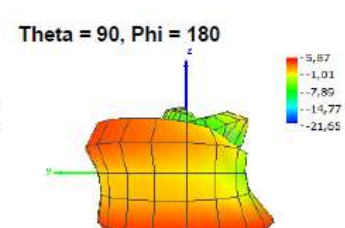
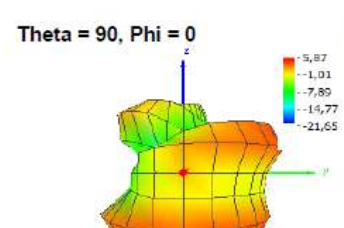
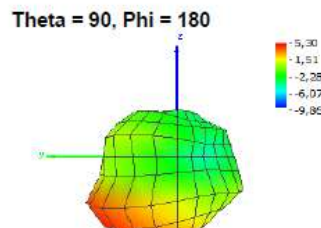
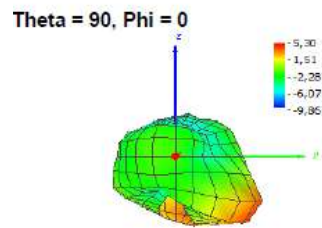
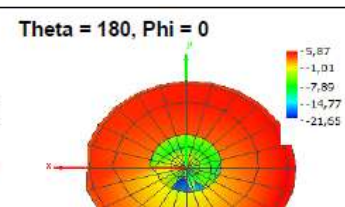
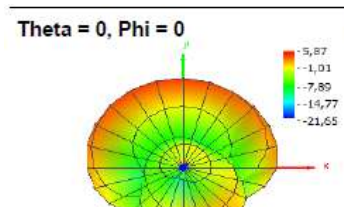
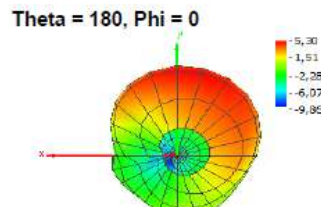
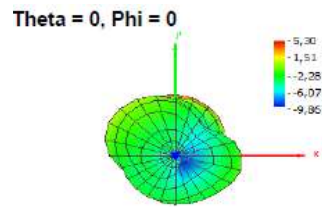
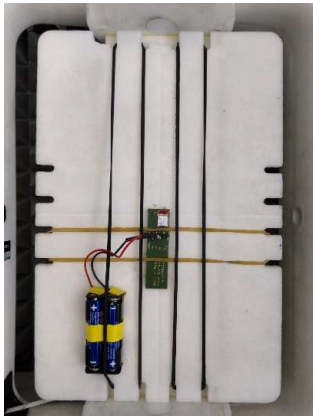
BEEINFLUSSUNG DER ANTENNENCHARAKTERISTIK DURCH DIE UMGEBUNG

Massefläche



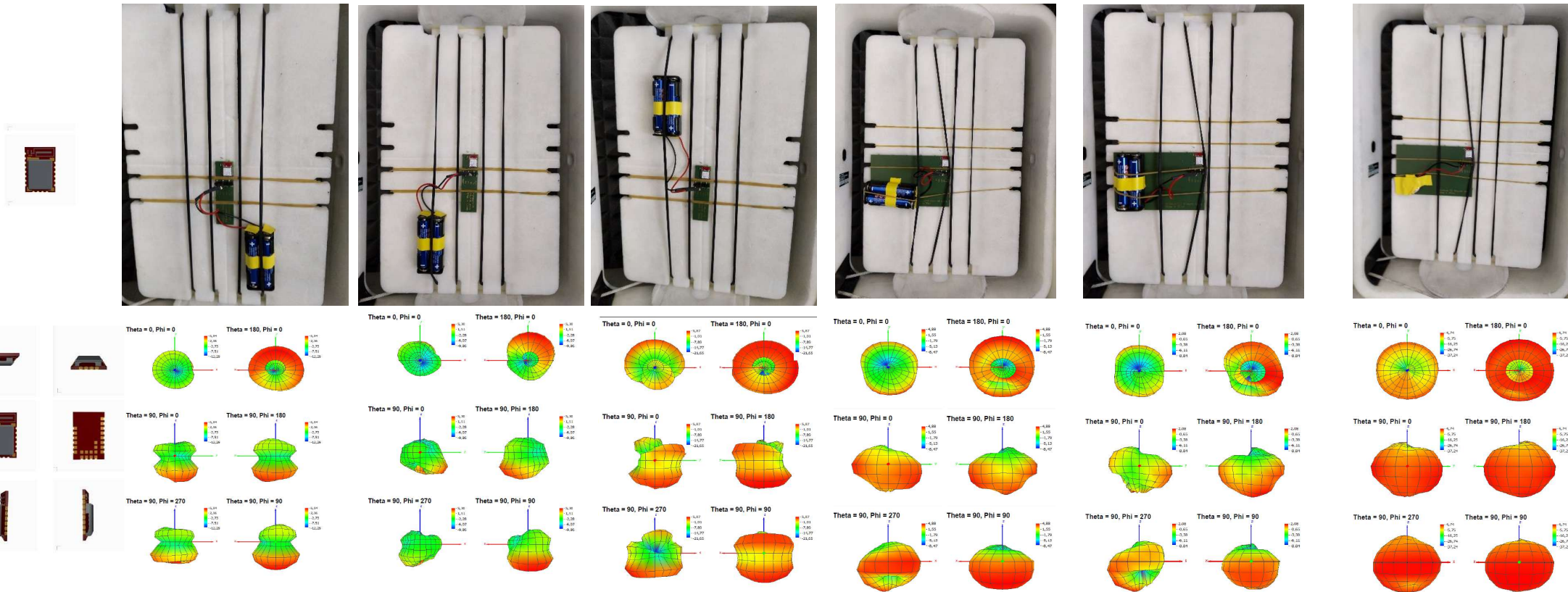
BEEINFLUSSUNG DER ANTENNENCHARAKTERISTIK DURCH DIE UMGEBUNG

Batterie



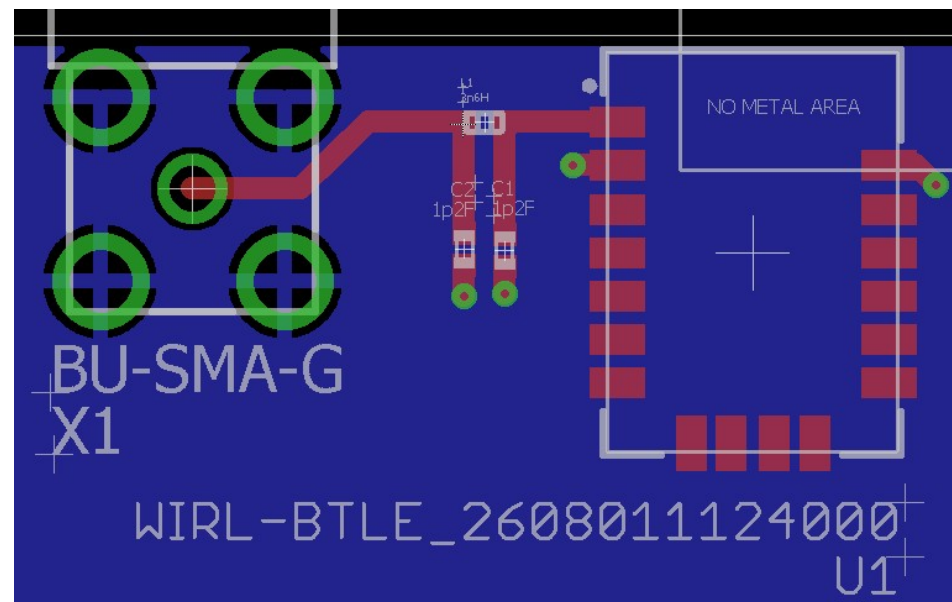
DESIGN-IN:

Umgebungseinflüsse am Beispiel der Platzierung der Batterie



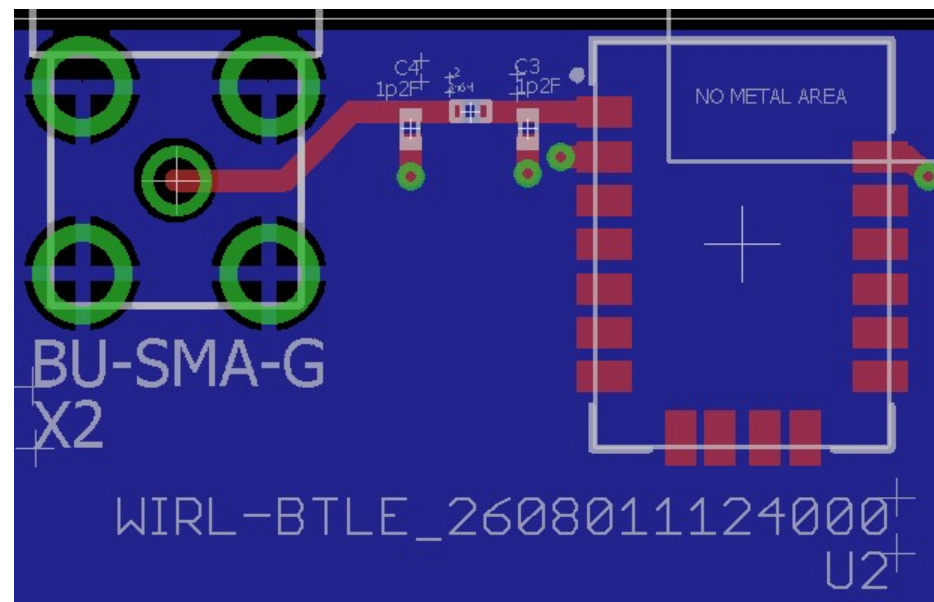
LAYOUT TIPS

- Filter- und Abblockkondensatoren direkt in die Zuleitung platzieren
- leerlaufende Stichleitungen vermeiden
- Anpassungselemente für die Antenne möglichst nah an der Antenne oder dem Steckverbinder platzieren
- Abblockkondensatoren möglichst nah am Module.



LAYOUT TIPS

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LAYOUT TIPS

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- Abblockkondensatoren möglichst nah am Module.
- Masseanbindung für Modul und Kondensatoren so kurz wie möglich und mit mindestens einer Durchkontaktierung auf die Masselage
- ESD Schutz möglichst nah zu der ausgesetzten/berührungsgefährdeten Stelle platzieren

ANTENNAS AND MATCHING
WHAT ABOUT
THE ANTENNA?

FIRMWARE WE-PROWARE
DO I HAVE TO DEVELOP
THE FIRMWARE FOR
THE MODULE?

FIRMWARE OPTIONEN

STANDARD FIRMWARE

- RF Module comes with a standardized firmware
- RF Module is subject to further firmware development
- 100% verified, electrical tested and validated
- update functionality given (UART, FOTA, ...)
- packaged in Tape & Reel, ESD und MSL conform



FIRMWARE FREEZE

A firmware freeze guarantees a static behaviour of the module and no change in the module at all.

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CUSTOM

A fully customized product with your dedicated application implemented on the module. This might require Würth Elektronik to offer design consultancy services and the product is not available ex stock.

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- RF Module will have a unique part number
- 100% electrical testing on customer request
- packaged in Tape & Reel, ESD und MSL conform
- we can upload your Firmware in our production process to the WE Hardware



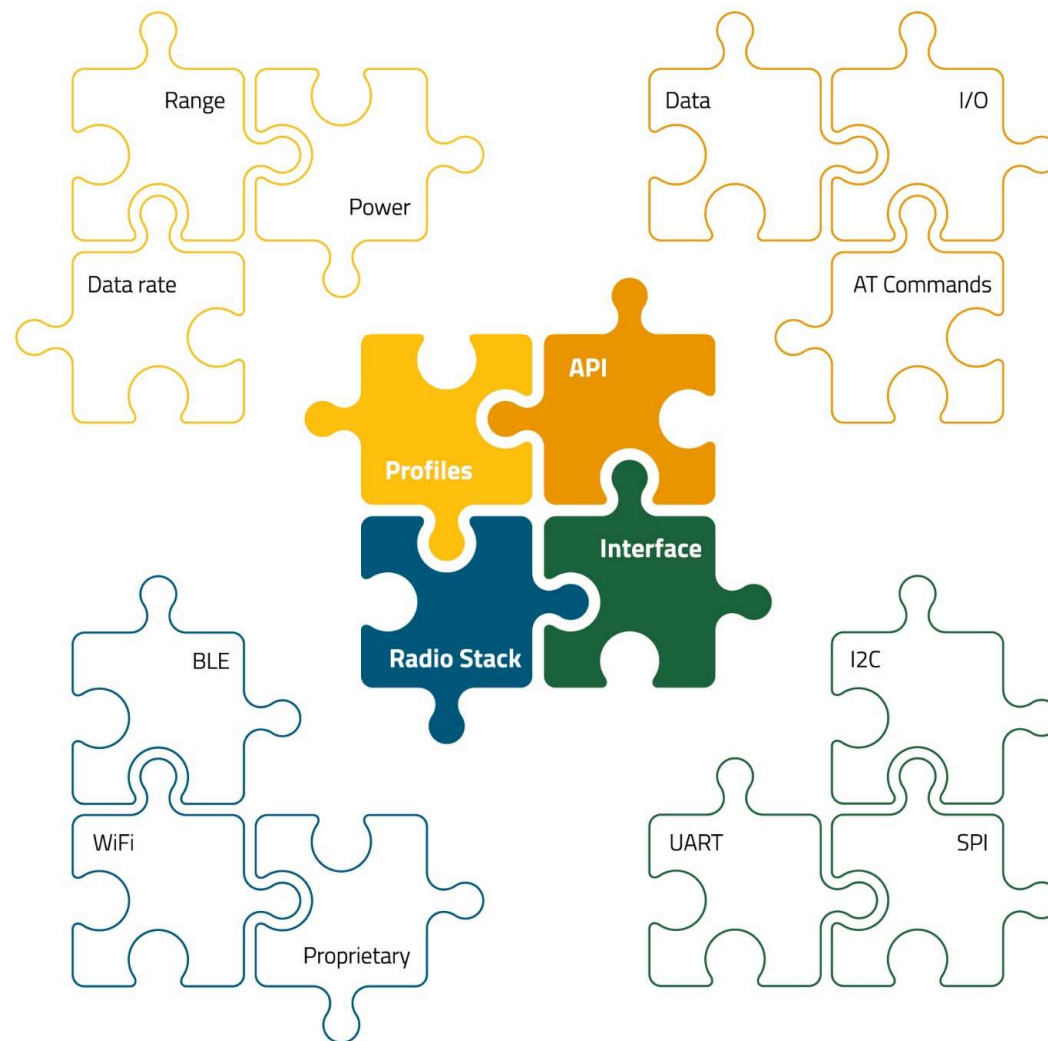
BUILD YOUR OWN FIRMWARE

Get every module without WE Firmware to bring your own solution on it.

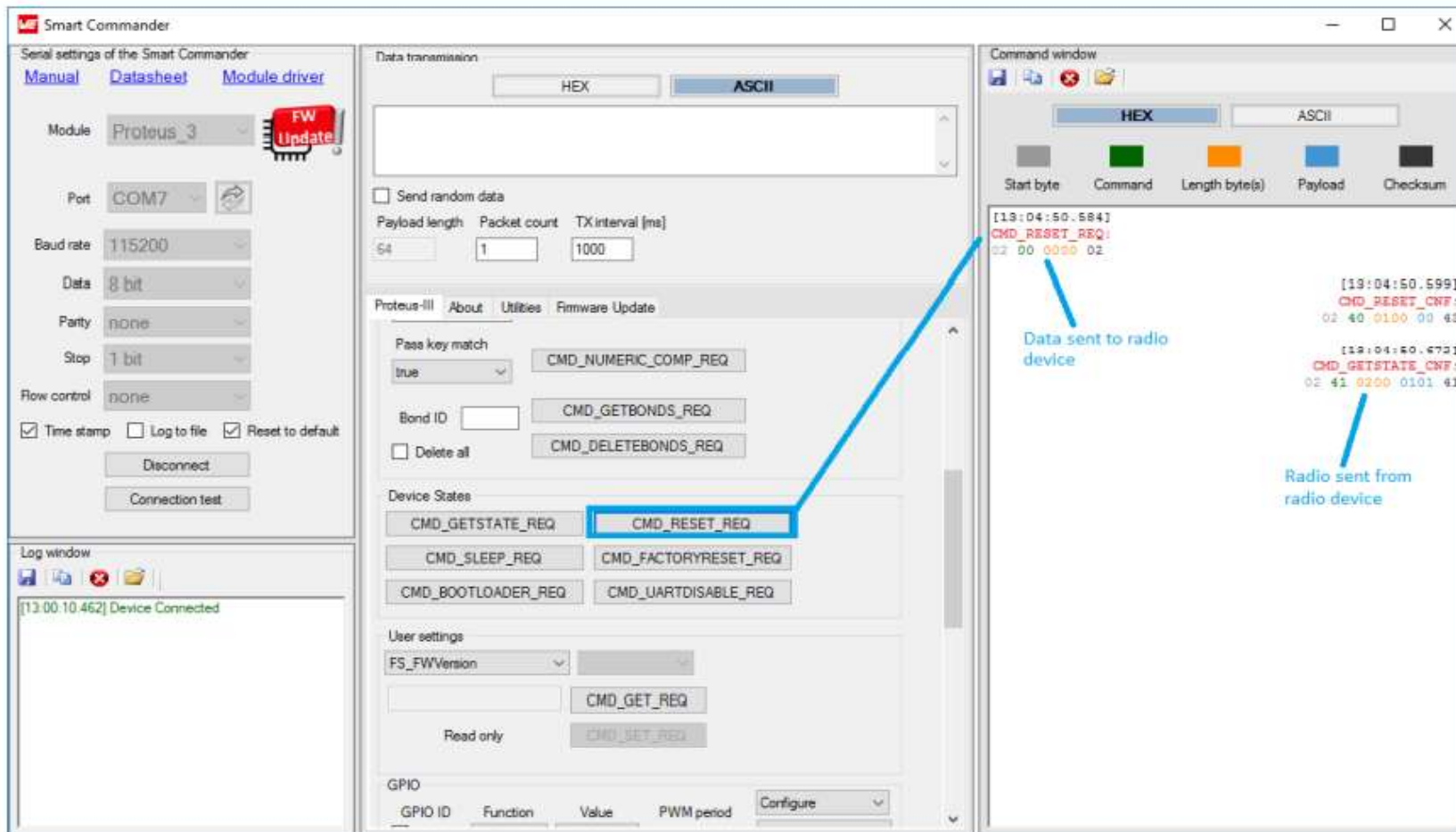
- RF Module comes without any standardized firmware
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SDK



SOFTWARE TOOL: SMART COMMANDER



Smart commander tool

Einfache PC-Software, die die vollständige Steuerung der Funkmodule über eine intuitive GUI ermöglicht

USING THE WE WIRELESS CONNECTIVITY SDK

Welches SDK ist das Richtige für meine Applikation?

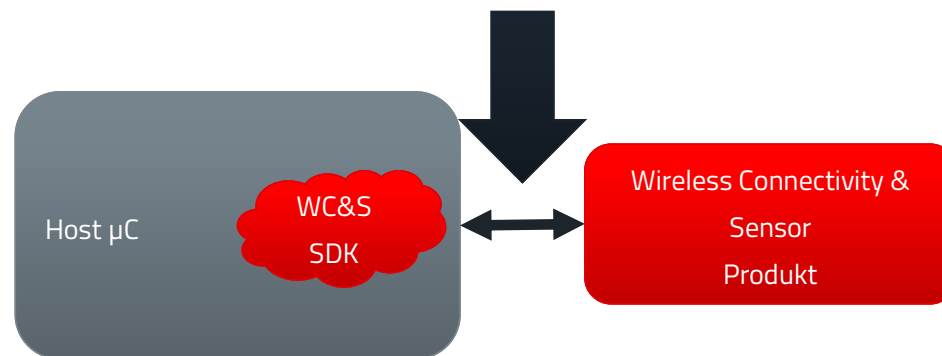
Es sind aktuell 2 SDK's über GitHub verfügbar <https://github.com/WurthElektronik>

- Empfohlen für Neuentwicklungen: [Wireless Connectivity SDK](#)
Enthält alle neuen Produkte und unsere Fokusprodukte (Calypso, Metis, Proteus-e, Proteus-III, Tarvos-III, Telesto-III, Thebe-II, Themisto-I, Thyone-I)
 - Benutzt einen STM32 (ARM Cortex M0/3/4) µC als Host sowie die STM32 Qube IDE für die integrierten Beispielprojekte, Portierung auf andere ARM basierte µC sind somit sehr einfach möglich
 - Einfach zu kombinieren mit unserem [Sensors SDK](#)
- Legacy, Archiviert: [Legacy Wireless Connectivity SDK](#)
 - Enthält unsere älteren Produkte und wird nicht mehr weiterentwickelt
 - Benutzt Raspberry Pi mit Linux als Host und Code::Blocks als IDE für die mitgelieferten Beispiele

USING THE WE WIRELESS CONNECTIVITY SDK

Porting – 1. Plattform / Kommunikationsschnittstelle

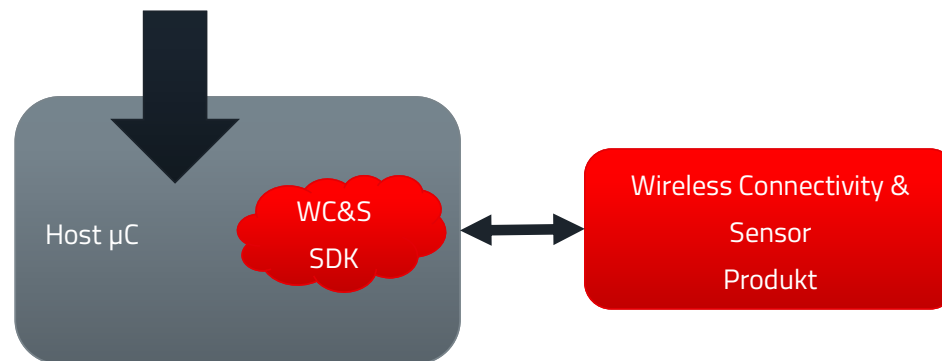
- UART Interface des Hosts über SDK eingebunden
 - Lesen und Schreiben von Bytes und Kommandos ermöglicht
 - Zwischenschicht "Plattform" eingesetzt, mit UART Funktionalitäten des Hosts verbunden
- Protokoll ("Sprache" des Moduls) schon im SDK enthalten
- wird auf einem Höheren Level der Applikation im Host zu Verfügung gestellt



USING THE WE WIRELESS CONNECTIVITY SDK

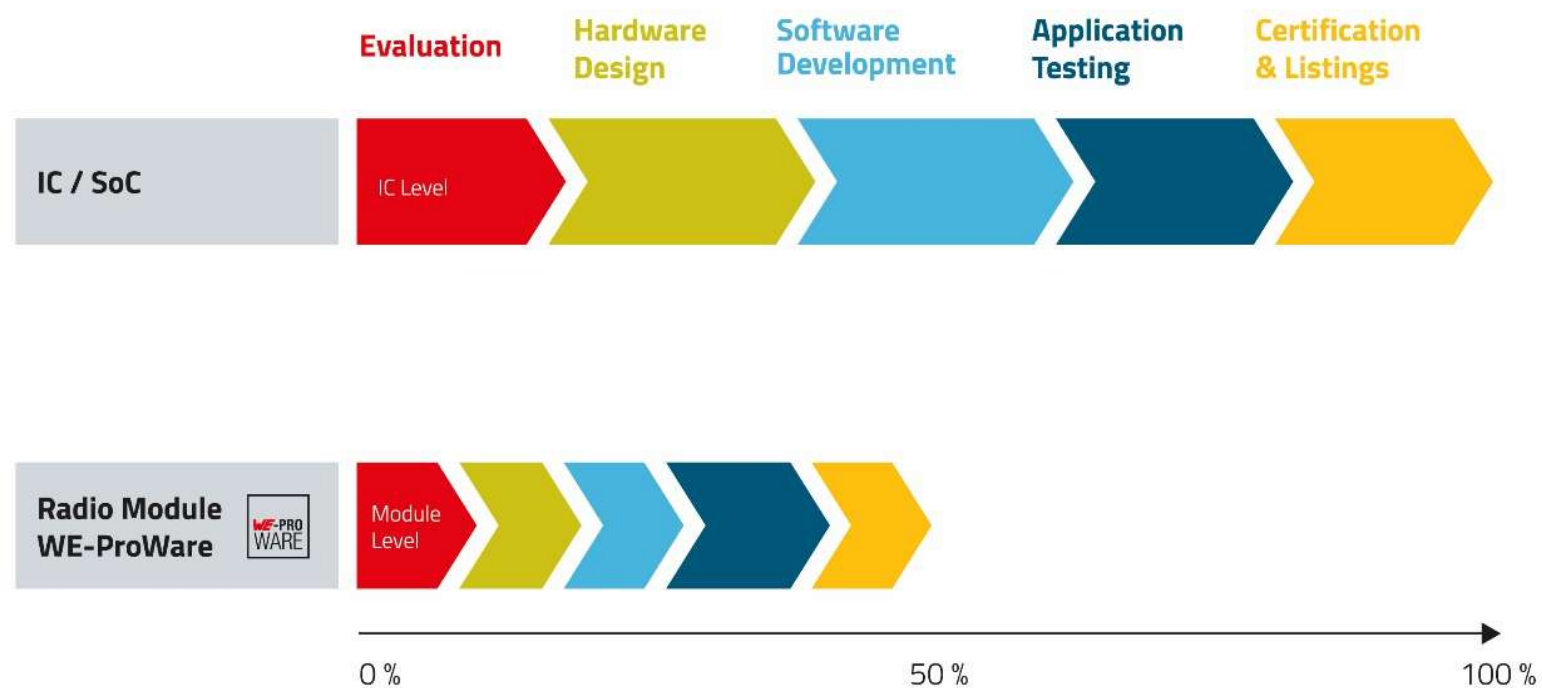
Porting – 2. Applikation

- high-level Funktionen des SDK in der Applikation aufgerufen.
 - "Init" Anteil dient zur
 - Initialisierung der Interfaces & des Modules
 - zur Konfiguration des Moduls
 - Über Applikationsanteil werden zyklische Aufgaben ausgeführt
 - es erfolgen Reaktionen auf Ereignisse (Events)

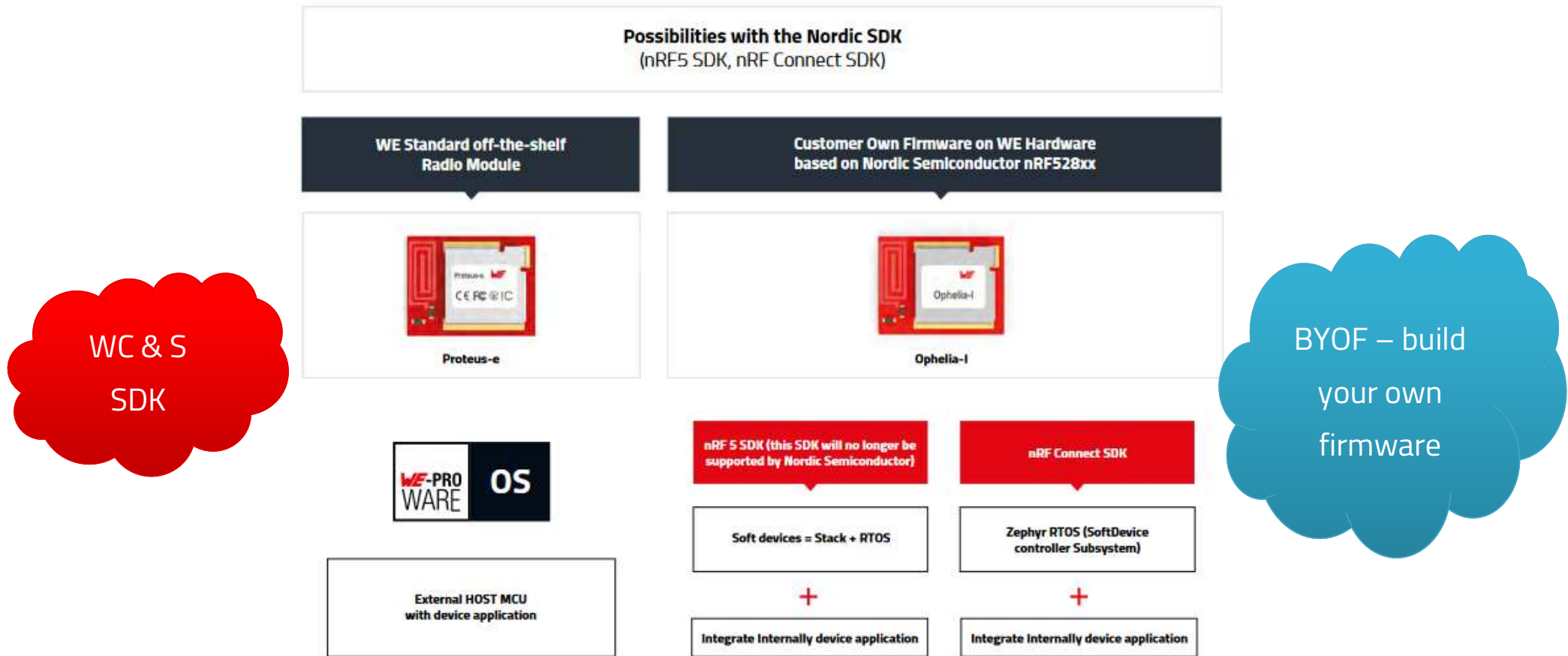


DESIGN-IN

Vergleich Funkchip vs. Funkmodul



NRF CONNECT SDK & WE-PROWARE OS + SDK



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- 100% electrical testing on customer request
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CERTIFICATION OF CUSTOM MODULE

How can the certification of the standard module be re-used for the custom module?

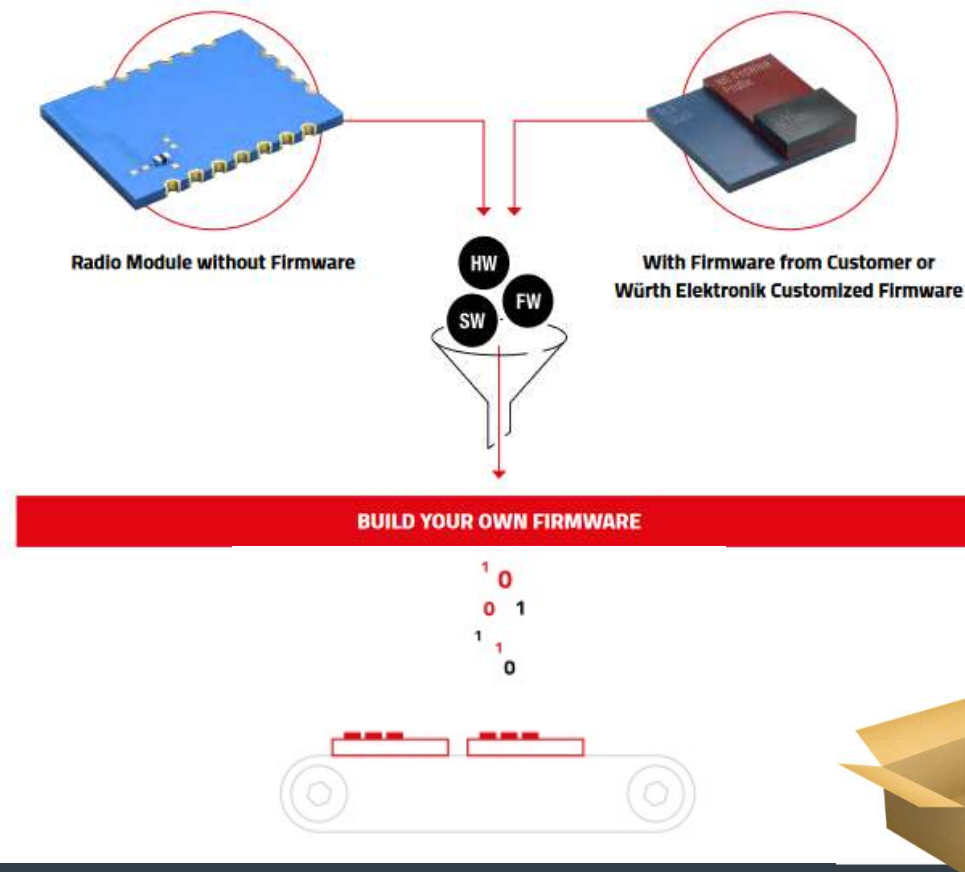
- For **RED (Europe), FCC (USA), IC (Canada), UKCA (Great Britain)** a **declaration of identity** must be done in case the custom module is **radio identical** to the standard module.
- TELEC (Japan) does not provide this opportunity.
- **Radio identical**: Radio of the custom module must respect the maximum TX power and radio profiles (Bluetooth LE 1 Mbit for example) as specified in the ANR031.

Proteus-III, Proteus-III- SPI, Setebos-I, Ophelia-III	• Using Bluetooth® LE radio of the nRF52840 • Using 1 MBit, 2 MBit or LE-Coded phy • Output power register of the radio chip set to maximum 8 dBm • Using Bluetooth® LE stack Nordic Semiconductor S140 Version 7.0.1¹ or nRFConnect SDK [1]
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Würth Elektronik AppNote:
ANR031 Certification of custom modules

INDIVIDUALISIERUNGEN

Anpassungen gefällig?

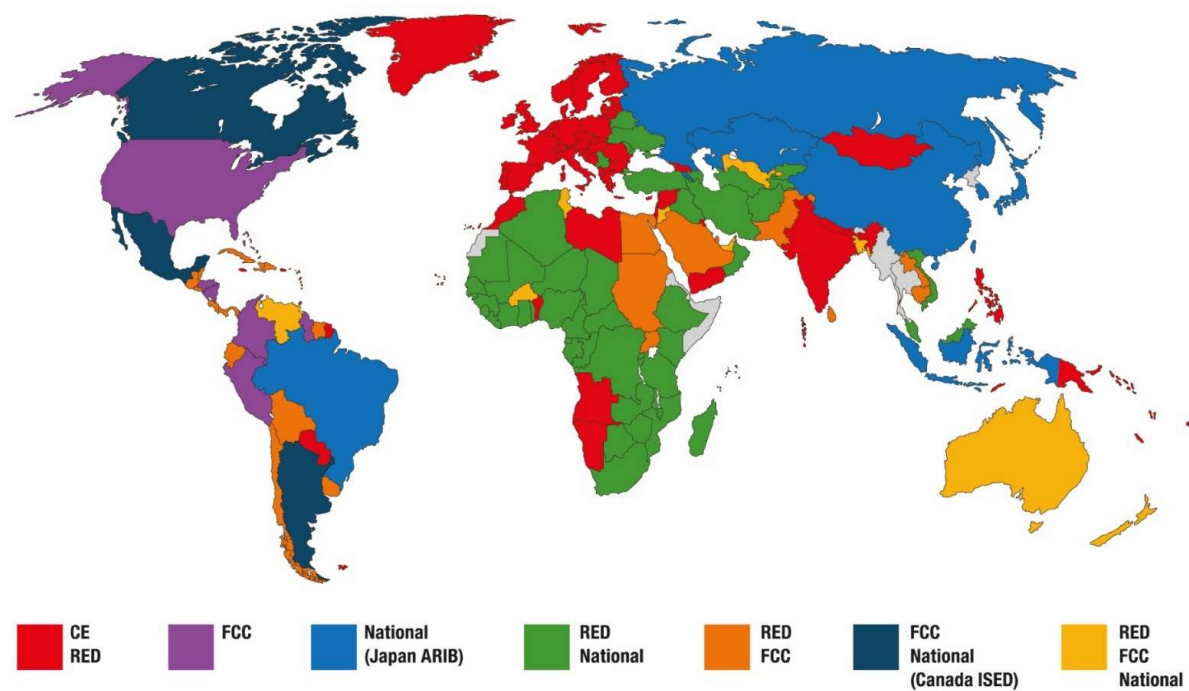


- Jede SoC (System on Chip) HW Plattform kann für die BYOF Option benutzt werden, z.B. dem nRF52840.
Unlock + Mass Erase + eigene Firmware über das SWD Interface (Serial Wire Debug) flashen, fertig.
- Nutzen des jeweiligen Hersteller SDK und der dort unterstützten Entwicklungsumgebung, z.B. dem nRF Connect SDK
- Würth Elektronik eiSos kann im Rahmen eines kundenspezifischen Produktes die Kundenfirmware in der Produktion aufspielen

FIRMWARE WE-PROWARE
DO I HAVE TO DEVELOP
THE FIRMWARE FOR
THE MODULE?

CERTIFICATION AND CONFORMITY
HOW TO CLIMB
THE MOUNTAIN OF
CERTIFICATION?

REGULARIEN WELTWEIT



NATIONAL REQUIREMENTS MATRIX

Order Code (part number)	Product Name	Frequency [MHz]	Match code (Product Series)	Product Information (Article Description)	CE EU	FCC USA	IC Canada	TELEC Japan	SRRC China	WPC India	Australia	Brazil	Other countries
2615011136000	Adrastea-I	800-1800 / 1560-1610	WIRL-CUT1	LTE-M / NB-IoT Cellular module with GNSS	yes	possible	possible	no	possible	on request	on request	possible	on request
2612011022000	Ophelia-I	2400	WIRL-NFW2	2.4 GHz radio module without firmware	yes	yes	yes	yes	yes	yes	yes	possible	on request
2617011025000	Stephano-I	2400	WIRL-COMB	Bluetooth® Low Energy 5.0 & IEEE 802.11 b/g/n 2.4 GHz	yes	yes	yes	yes	possible	possible	possible	possible	on request
2608011024000	Proteus-I	2400	WIRL-BTLE	Bluetooth® LE 4.2 with integrated antenna	yes	yes	yes	yes	yes	possible	possible	possible	on request
2608011124000	Proteus-I	2400	WIRL-BTLE	Bluetooth® LE 4.2 with RF pad	yes	yes	yes	yes	no	possible	possible	possible	on request
2606031021000	Thalassa	2400	WIRL-PRO2	2.4 GHz proprietary module with integrated antenna	yes	yes	yes	no	no	possible	possible	possible	on request
2606031121000	Thalassa	2400	WIRL-PRO2	2.4 GHz proprietary module with RF pad	yes	yes	yes	no	no	possible	possible	possible	on request
2606031321000	Thalassa	2400	WIRL-PRO2	2.4 GHz proprietary module with U.FL connector	yes	yes	yes	no	no	possible	possible	possible	on request
2611011024020	Setebos-I	2400	WIRL-PRO2	2.4 GHz radio module with proprietary and Bluetooth® LE 5.1 radio protocol	yes	yes	yes	possible	possible	yes	possible	possible	on request
2608011024010	Proteus-II	2400	WIRL-BTLE	Bluetooth® LE 5.0 with integrated antenna	yes	yes	yes	yes	possible	yes	possible	possible	on request
2611011024000	Proteus-III	2400	WIRL-BTLE	Bluetooth® LE 5.1 with smart antenna selection	yes	yes	yes	yes	yes	yes	possible	possible	on request
2611011024010	Proteus-III- SPI	2400	WIRL-BTLE	Bluetooth® LE 5.1 with SPI interface	yes	yes	yes	yes	possible	yes	possible	possible	on request
2611011020000	Ophelia-II	2400	WIRL-NFW2	2.4 GHz	yes	yes	yes	yes	yes	yes	yes	possible	on request
2612011024000	Proteus-e	2400	WIRL-BTLE	Bluetooth® LE 5.1 module	yes	yes	yes	yes	possible	yes	possible	possible	on request
2610011025000	Calypto	2400	WIRL-WIF5	2.4 GHz WiFi module	yes	yes	yes	possible	possible	yes	possible	possible	on request
2611011021000	Thyone-I	2400	WIRL-PRO2	2.4 GHz proprietary module; smart antenna selection	yes	yes	yes	yes	possible	yes	possible	possible	on request
2612011021000	Thyone-e	2400	WIRL-PRO2	2.4 GHz proprietary module; smart antenna selection	yes	yes	yes	possible	possible	possible	possible	possible	on request
2611011021010	Thetis-I	2400	WIRL-PRO2	2.4 GHz Wirepas Mesh module	yes	yes	yes	possible	possible	yes	possible	possible	on request
2608011124010	Proteus-II	2400	WIRL-BTLE	Bluetooth® LE 5.0 with RF pad	yes	yes	yes	yes	on request	yes	on request	possible	on request
2603011021000	Triton	2400	WIRL-PRO2	2.4 GHz proprietary module with integrated antenna	yes	yes	yes	possible	possible	yes	possible	possible	on request
2603011121000	Triton	2400	WIRL-PRO2	2.4 GHz proprietary module with RF pad	yes	yes	yes	possible	possible	yes	possible	possible	on request
2611059021001	Thyone-I FeatherWing	2400	WIRL-EVAL	Proprietary 2.4 GHz RF-Module Connection	yes	yes	yes	possible	yes	on request	on request	possible	on request
2610039025001	Calypto FeatherWing	2400	WIRL-EVAL	WiFi-Connection 2.4 GHz	yes	yes	yes	possible	yes	on request	on request	possible	on request
2609041191000	Themisto-I	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	modified	no	no	modified	possible	on request
2607021191000	Tekesto-I	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	no	no	modified	modified	possible	on request
2607021191010	Tekesto-II	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	no	no	modified	modified	possible	on request
2609011091000	Tekesto-III	915	WIRL-PRO9	915 MHz proprietary module with integrated antenna	no	yes	yes	modified	modified	modified	modified	possible	on request
2609011191000	Tekesto-III	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	modified	modified	modified	modified	possible	on request
2609031181000	Thebe-II	869	WIRL-PRO8	868 MHz proprietary module with RF pad	yes	no	no	no	no	no	no	no	on request
2605041183000	Metis-I	868	WIRL-WMB8	868 MHz wM-BUS module	yes	no	no	no	no	no	no	no	on request
2607021183000	Metis-II	868	WIRL-WMB8	868 MHz wM-BUS module	yes	no	no	no	no	no	no	no	on request
2607056283011	Metis-II	868	WIRL-WMB8	868 MHz wM-BUS radio simulation USB-Stick	yes	no	no	no	no	no	no	no	on request
2607057283011	Metis- Analyzer Tool	868	WIRL-WMB8	868 MHz wM-BUS radio Analyzer USB-Stick	yes	no	no	no	no	no	no	no	on request
2605041181000	Tarvos-I	868	WIRL-PRO8	868 MHz proprietary module with RF pad	yes	no	no	no	no	modified	no	no	on request
2607021181000	Tarvos-II	868	WIRL-PRO8	868 MHz proprietary module with RF pad	yes	no	no	no	no	modified	no	no	on request
2609011081000	Tarvos-III	868	WIRL-PRO8	868 MHz proprietary module with integrated antenna	yes	no	no	no	modified	modified	no	no	on request
2609011181000	Tarvos-III	868	WIRL-PRO8	868 MHz proprietary module with RF pad	yes	no	no	no	modified	modified	no	no	on request
2618011181000	Daphnis-I	868	WIRL-LoRa®	868 MHz Long-Range-WAN module with RF pad	yes	modified	modified	on request	on request	on request	on request	no	on request
2605031141000	Thadeus	434	WIRL-PRO4	434 MHz proprietary module with RF pad	yes	no	no	no	no	no	possible	no	on request
2607011111000	Titania	169	WIRL-PRO2	169 MHz proprietary module with RF pad	yes	no	no	no	no	possible	on request	no	on request
2607011113000	Mimas-I	169	WIRL-WMB1	169 MHz wM-BUS module	yes	no	no	no	no	possible	on request	no	on request

Yes

Module fulfills national requirements, testing, certification and/or self declarations are done. Module fulfills national requirements. If required testing, certification and/or declaration of conformity are done.

Yes also includes products that have not been tested, certified or declared to be conform in case of not required.

Some examples:

- Evaluation boards are excluded from radio conformity approach in many countries.
- Receiver only modules are exempted from radio conformity approach in some countries.

No

Module is not suitable to fulfill national requirements, e.g.: frequency range, transmitter on time, output power, hopping, bandwidth.

Possible

Module is expected to fulfill national requirements, but no testing, no certification and/or no self declaration was done.

Modified

Module is not fulfilling national requirements but is suitable to do with some modifications that can only be implemented in a new or custom product.

On Request

The requirements must be checked depending on the project.

Brazil

Certification in Brazil is valid two years. Therefore we decided to not certify modules. We support customers with exchange to the authority (fillings and confidential docs).

United Kingdom (UKCA)

With the intention of the British government to legislate in spring 2024 the indefinitely recognition of EU requirements, including CE marking for 21 product regulations, amongst others the Radio Equipment Regulations no further conformity prove or marking than CE is needed.
<https://www.gov.uk/guidance/using-the-ukca-marking>

DURCHFÜHRUNG DER ZULASSUNG

mit einem zertifiziertem Funkmodul – WE Testreport

7 Summary of measurement results									
☒	No deviations from the technical specifications were ascertained								
☐	There were deviations from the technical specifications ascertained								
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.								
TC identifier	Description	verdict	date				Remark		
RF-Testing	ETSI EN 300 329 V2.1.1 (2016-11)	See table!	2017-01-11				-/-		
Test specification clause	Test case	temperature conditions	power source voltages	Mode	C	NC	NA	NP	Remark
5.4.2	RF output power	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
		Low	Nominal	GFSK	☒	☐	☐	☐	
		High	Nominal	GFSK	☒	☐	☐	☐	
5.4.2	Duty cycle, Tx-sequence, Tx-gap, medium utilization	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.3	Power spectral density	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.4	Accumulated transmit time, freq. occupation and hopping sequence	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.5	Hopping frequency separation	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.6	Adaptivity	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.7	Occupied channel bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.8	Transmitter unwanted emissions in the out-of-band domain	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.9	Transmitter unwanted emissions in the spurious domain (cond. + rad.)	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.10	Receiver spurious emissions (cond. + rad.)	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.11	Receiver blocking	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

- Testreports der bestandenen Funkprüfung verfügbar
- Reduziert den Testaufwand des Endprodukts deutlich
- Module mit spezieller Test-FW möglich
- Pre-Tests im Labor in Waldenburg möglich

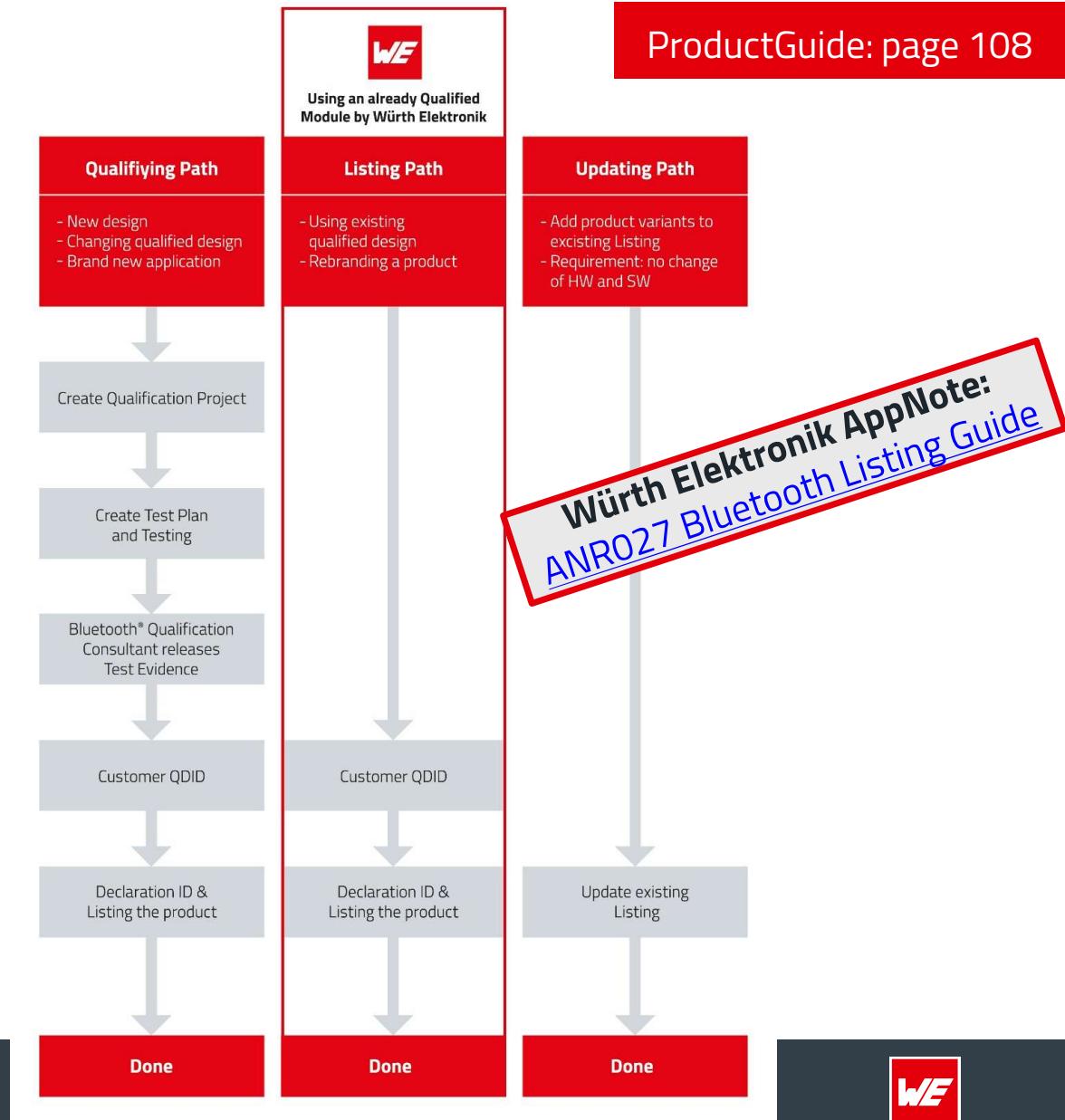
5.4.6	Adaptivity	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.7	Occupied channel bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.8	Transmitter unwanted emissions in the out-of-band domain	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.9	Transmitter unwanted emissions in the spurious domain (cond. + rad.)	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.10	Receiver spurious emissions (cond. + rad.)	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.11	Receiver blocking	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-

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BLUETOOTH®

Listing Prozess

- Besteht aus qualification und declaration
 - qualification Prozess
 - = Funktionalität und Konformität zu Spezifikationen (inkl. Tests und Messungen)
 - Declaration = Keine Tests oder Messungen, Ausschließlich verwaltungsaufwand (nur "paperwork"; und declaration fee)
- Der Inverkehrbringer ist für das Vorhandensein eines Listing verantwortlich
- Möglichkeit eines Updates eines vorhandenen Listing
 - identische Bluetooth HW und SW
 - Identischer Inverkehrbringer
 - → keine zusätzlichen Listing-Kosten entstehen



CERTIFICATION AND CONFORMITY
HOW TO CLIMB
THE MOUNTAIN OF
CERTIFICATION?

CHOOSE YOUR TECHNOLOGY/SOLUTION
NOW I CAN DISCOVER
THE WORLD OF WIRELESS
CONNECTIVITY...

HOW TO GET STARTED WITH WIRELESS CONNECTIVITY

ProductGuide: page 55



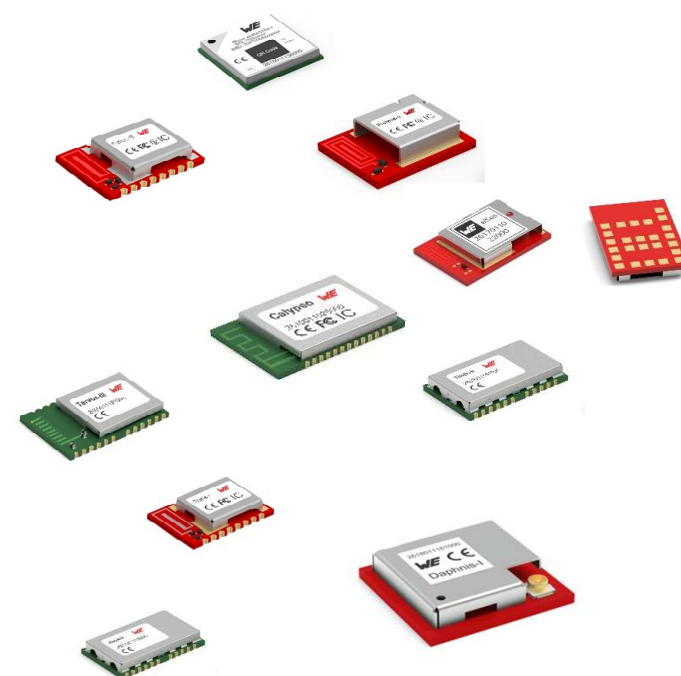
PRODUKTÜBERSICHT



PRODUKTÜBERSICHT

WIRELESS CONNECTIVITY

LTE-M 	Connect Machine Globally	Cellular
Bluetooth®	Connect Machine to Mobile Device	Bluetooth®
WiFi CERTIFIED	Connect Machine to Internet	WiFi
Long-Range	Connect Device to Gateway	Long-Range-WAN
	Connect Machine to Machine	Proprietary
 Bluetooth® WiFi	Connect M2M & Mobile Device	Combined
 Wirepas	Connect all together	Mesh
M-Bus wireless	Connect Smart Meter	Wireless M-Bus
	Open Module/No Firmware	Build Your Own Firmware



PRODUKTÜBERSICHT

SENSORS



Motion Sensors



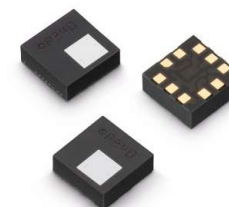
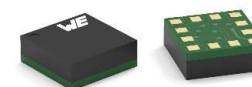
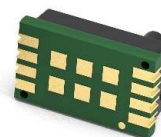
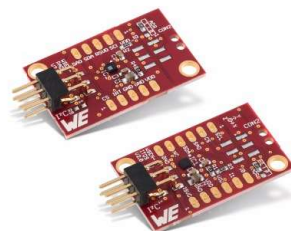
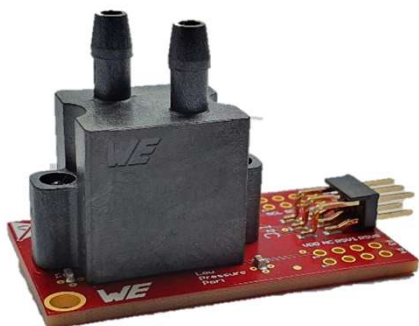
Environmental Sensors



Pressure Sensors



Current Sensors



SOFTWARE & EVALUATION TOOLS

SOFTWARE TOOLS

IoT will become intelligent when hardware and software work harmoniously together!

Würth Elektronik provides a variety of software development kits (SDK) and software tools to test the wireless connection and to speed up the design processes. All tools and software development kits, can be downloaded for free in our online shop as required by their application.

GitHub

Würth Elektronik eiSos GitHub page

In order to ensure ease-of-use for the developers, all our SDK are available on the GitHub platform. Please visit the Würth Elektronik eiSos GitHub page to find the latest version of our SDKs.



github.com/WurthElektronik

Wireless Connectivity Software Development Kit (SDK)

The aim of the Wireless Connectivity SDK is to minimize the effort required on customer side to enable his host MCU to communicate with Würth Elektronik eiSos radio modules. It contains the implementation of all available commands in pure C-code. In order to integrate any Würth Elektronik eiSos wireless module, the user has to simply port the corresponding C-code to his host processor. This significantly reduces the time needed for developing the software interface to the radio module.



we-online.com/WCO-SDK

Smart Commander Tool

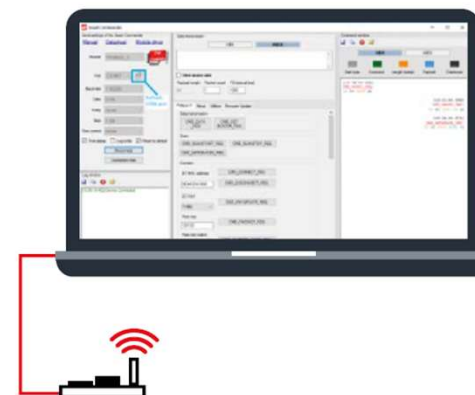
The WE Smart Commander is an easy-to-use PC software that enables complete control of the Würth Elektronik eiSos wireless modules through an intuitive GUI. This tool along with the evaluation boards allow quick prototyping and testing of various features of the radio modules.

- Simple setup
- Intuitive interface
- Color coded packet interpretation
- 100% log traceability

The Smart Commander itself is an executable and does not require installation. It will create folders and files on the hard drive e.g. for log file storing. However, the serial-to-USB FTDI converter chip (i.e. FT232R) on the evaluation platform or USB dongles requires special drivers to be installed for proper operation. To use USB dongles or evaluation boards of Würth Elektronik eiSos wireless connectivity modules, the Virtual COM Port (VCP) drivers have to be installed by following the "Installation Guides" of FTDI found under:



we-online.com/SmartCommander



EVALUATION TOOLS

WIRELESS CONNECTIVITY



Evaluation Kit



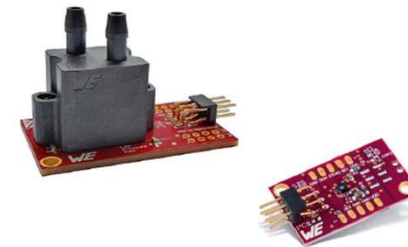
Mini/Family- Evaluation Board



FeatherWings



USB Radio Stick



Evaluation Board



Sensor Shield for Arduino



Sensor Node



FeatherWing

SENSORS

WEITERE INFORMATIONEN HIER:

WWW.WE-ONLINE.DE/KATALOG/WCO

WWW.WE-ONLINE.COM/WCS-PRODUCT-GUIDE

HINTERGRUNDINFORMATIONEN

Wireless Connectivity & Sensors Product Guide



www.we-online.com/wcs-product-guide

VIELEN DANK!

NOCH FRAGEN?



Bei Fragen immer gerne melden!



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