EINFÜHRUNG FUNK EUROFINS

02.06.2026

Kevin Elert
Business Development Wireless Connectivity & Sensors

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

HOW TO GET STARTED WITH WIRELESS CONNECTIVITY

START

CREATING IDEAS
HOW CAN I EXTEND MY BUSINESS?

WIRELESS GUIDE
WHAT DOES MY APPLICATION NEED?

RADIO TECHNOLOGIES
WHICH TECHNOLOGIES ARE AVAILABLE?

RADIO COMMUNICATION FUNDAMENTALS
WHAT IS RADIO?

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

HARDWARE INTEGRATION
HOW TO ADD A MODULE ON A PCB?

ANTENNAS AND MATCHING
WHAT ABOUT THE ANTENNA?

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

CERTIFICATION AND CONFORMITY
HOW TO CLIMB THE MOUNTAIN OF CERTIFICATION?

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

AGENDA

- Grundlagen Funkübertragung
- Frequenzbänder
- Netzwerktopologien
- Funkprotokolle
- Zertifizierung
- Design-In HW/SW
- Produktportfolio

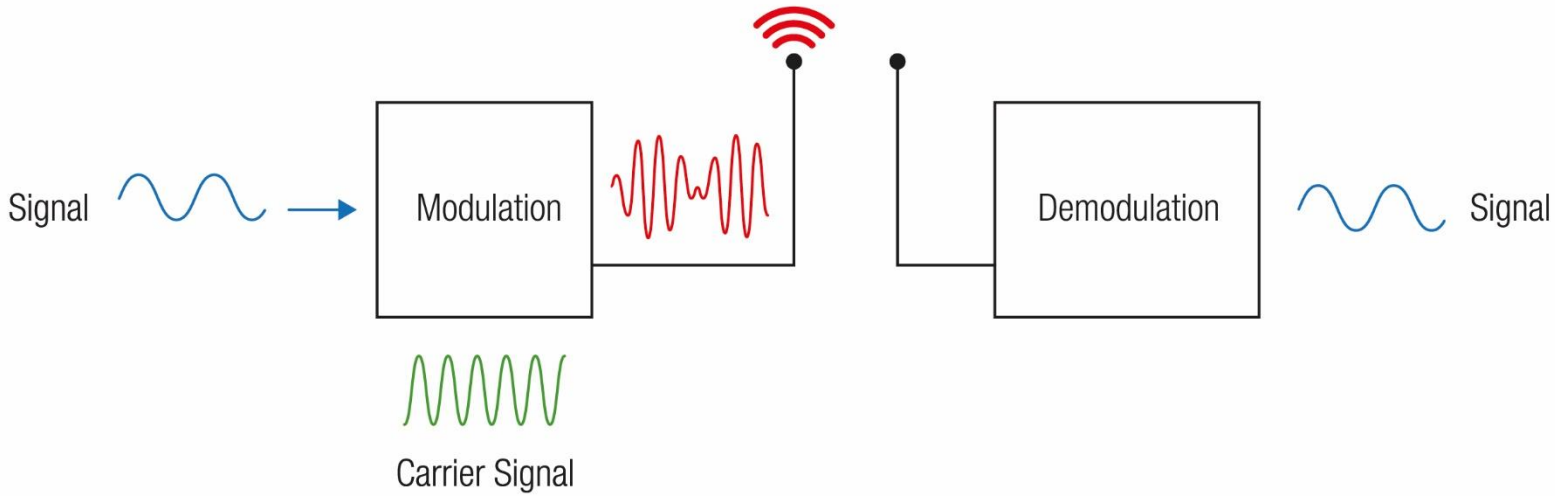
BACKGROUNDINFORMATION

Wireless Connectivity & Sensors Product Guide

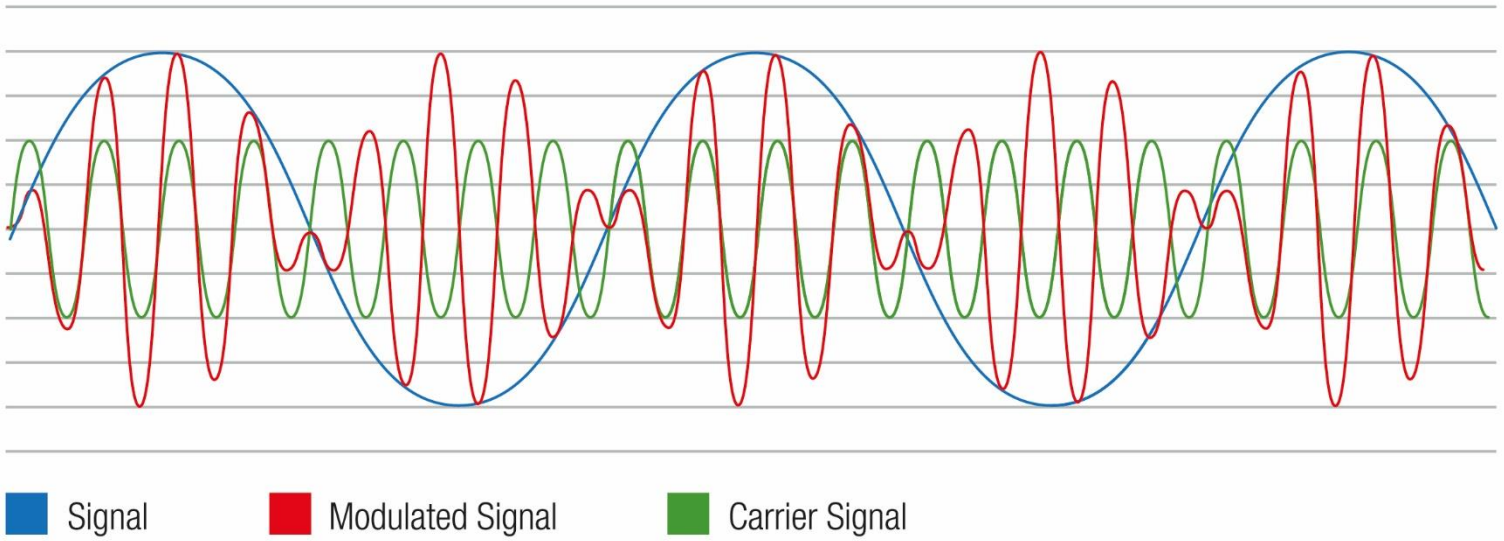
www.we-online.com/wcs-product-guide

GRUNDLAGEN FUNKÜBERTRAGUNG

FUNKSYSTEM

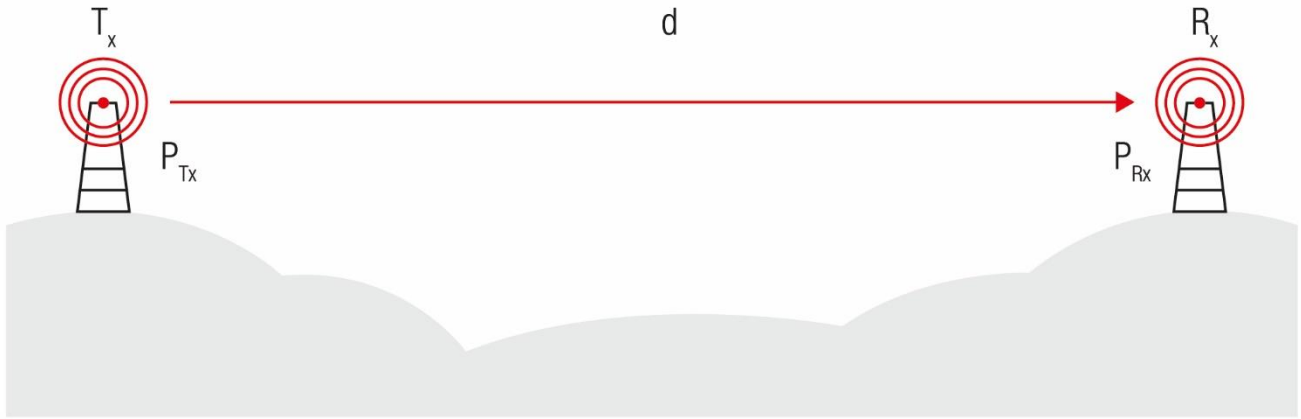


MODULATION



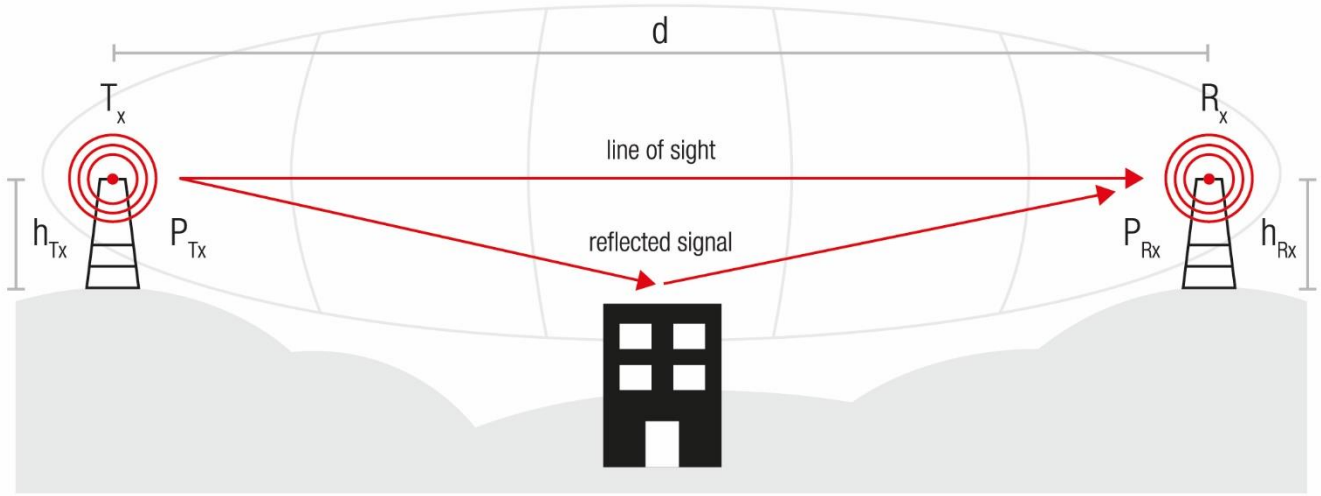
REICHWEITENERMITTLUNG

Model 1: Friis Transmission for Free Space

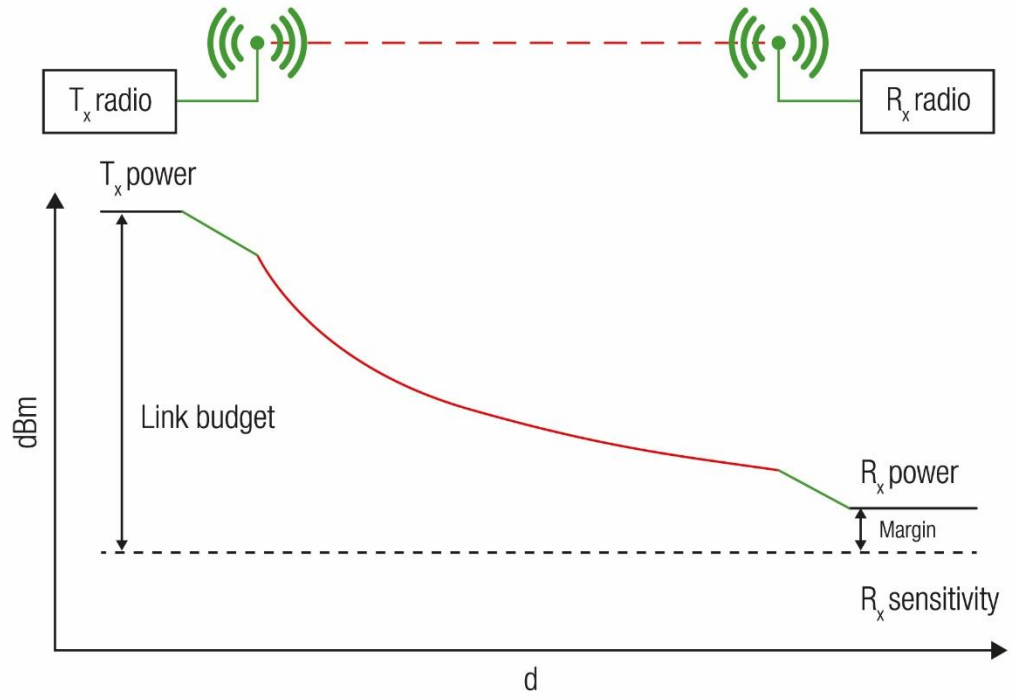


REICHWEITENERMITTLUNG

Model 2: Two-ray Ground Reflection



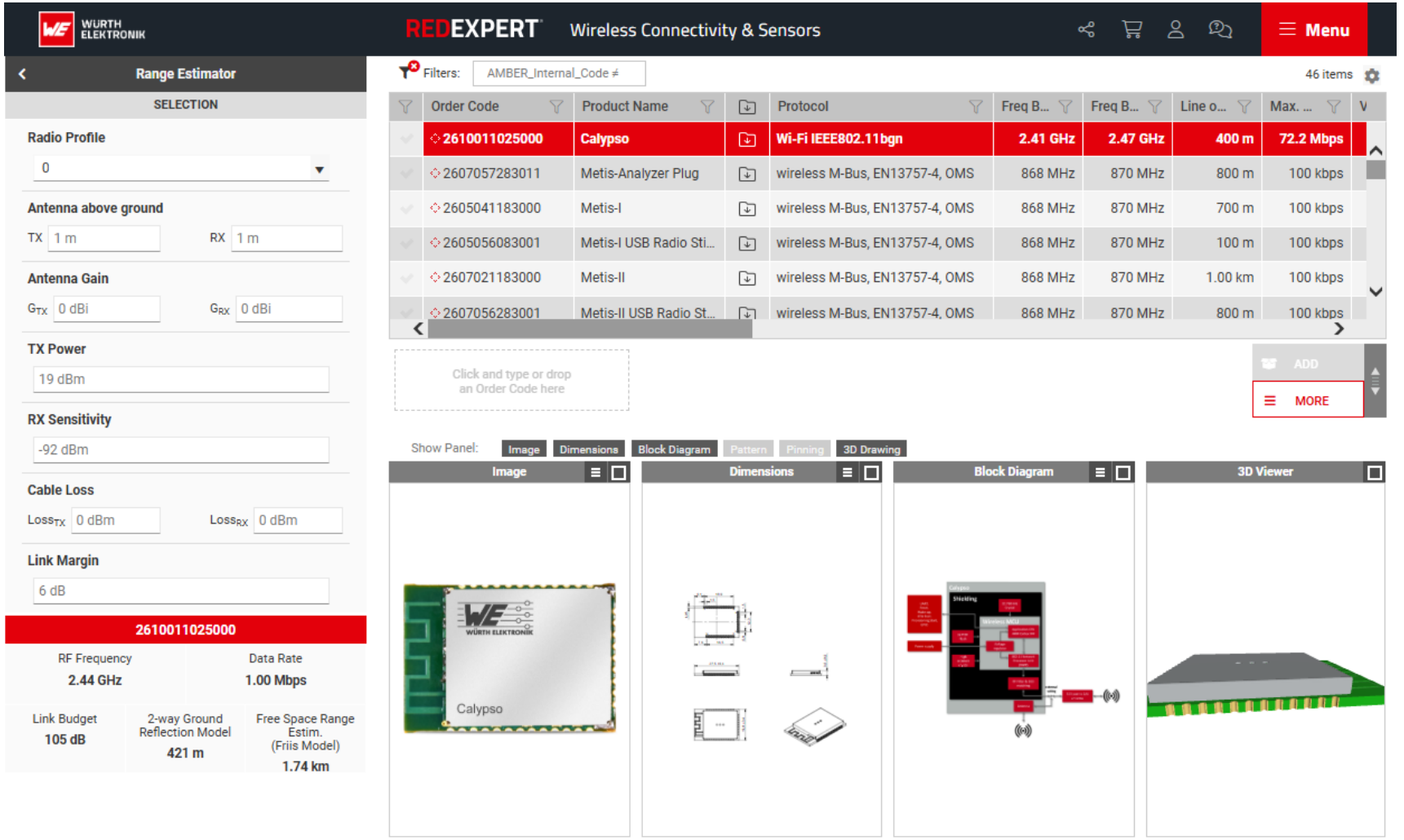
LINK BUDGET



Power [dBm]	Power [watt]
- 120 dBm	1 fW
- 110 dBm	0.01 pW
- 100 dBm	0.1 pW
- 90 dBm	1 pW
- 80 dBm	10 pW
- 70 dBm	100 pW
- 60 dBm	1 nW
- 50 dBm	10 nW
- 40 dBm	100 nW
- 30 dBm	1 µW
- 20 dBm	10 µW
- 10 dBm	100 µW
- 1 dBm	794 µW
0 dBm	1 mW
1 dBm	1.26 mW
10 dBm	10 mW
20 dBm	100 mW
30 dBm	1 W
40 dBm	10 W

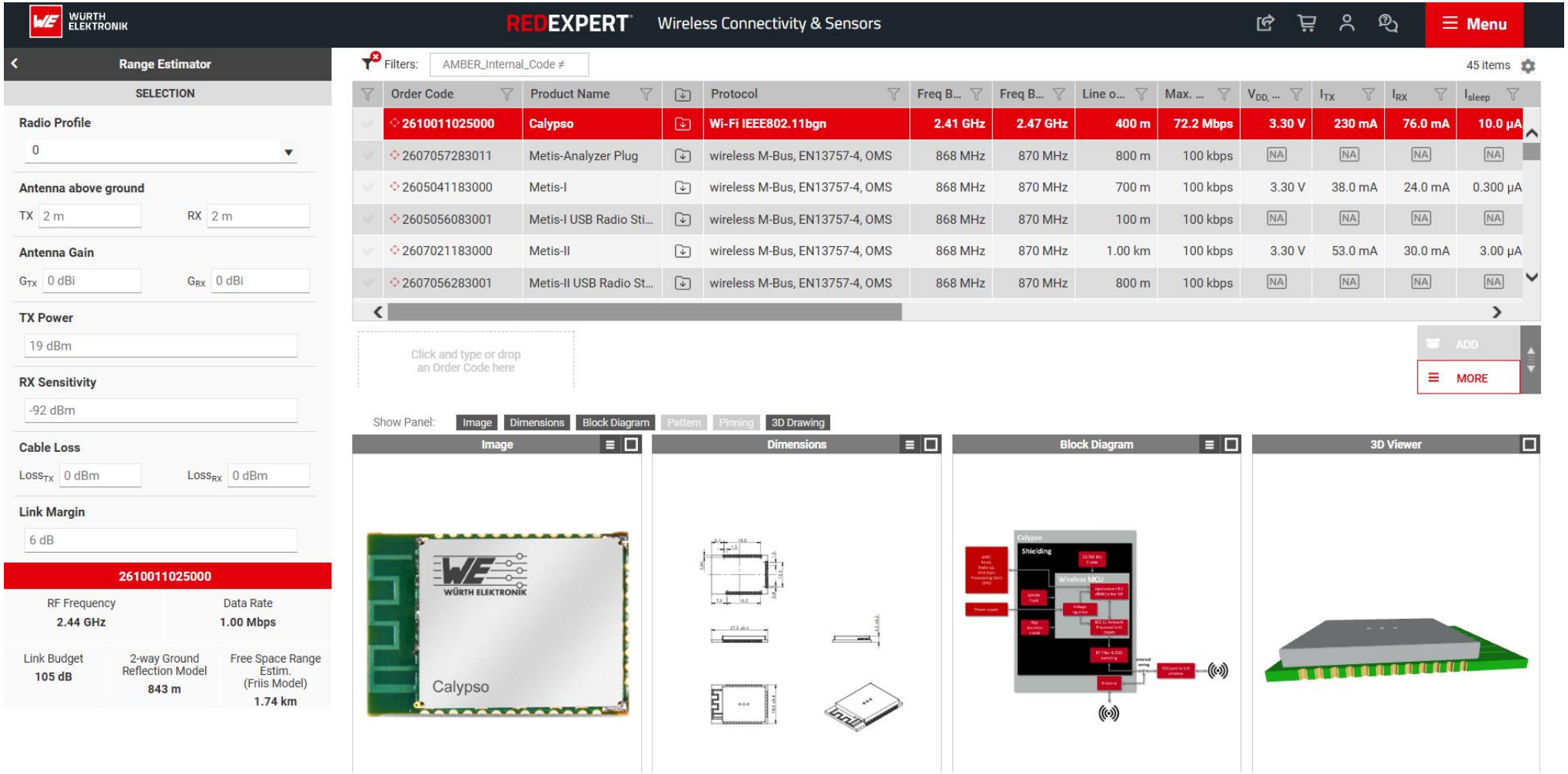
RED EXPERT RANGE ESTIMATOR

Red Expert Range Estimator



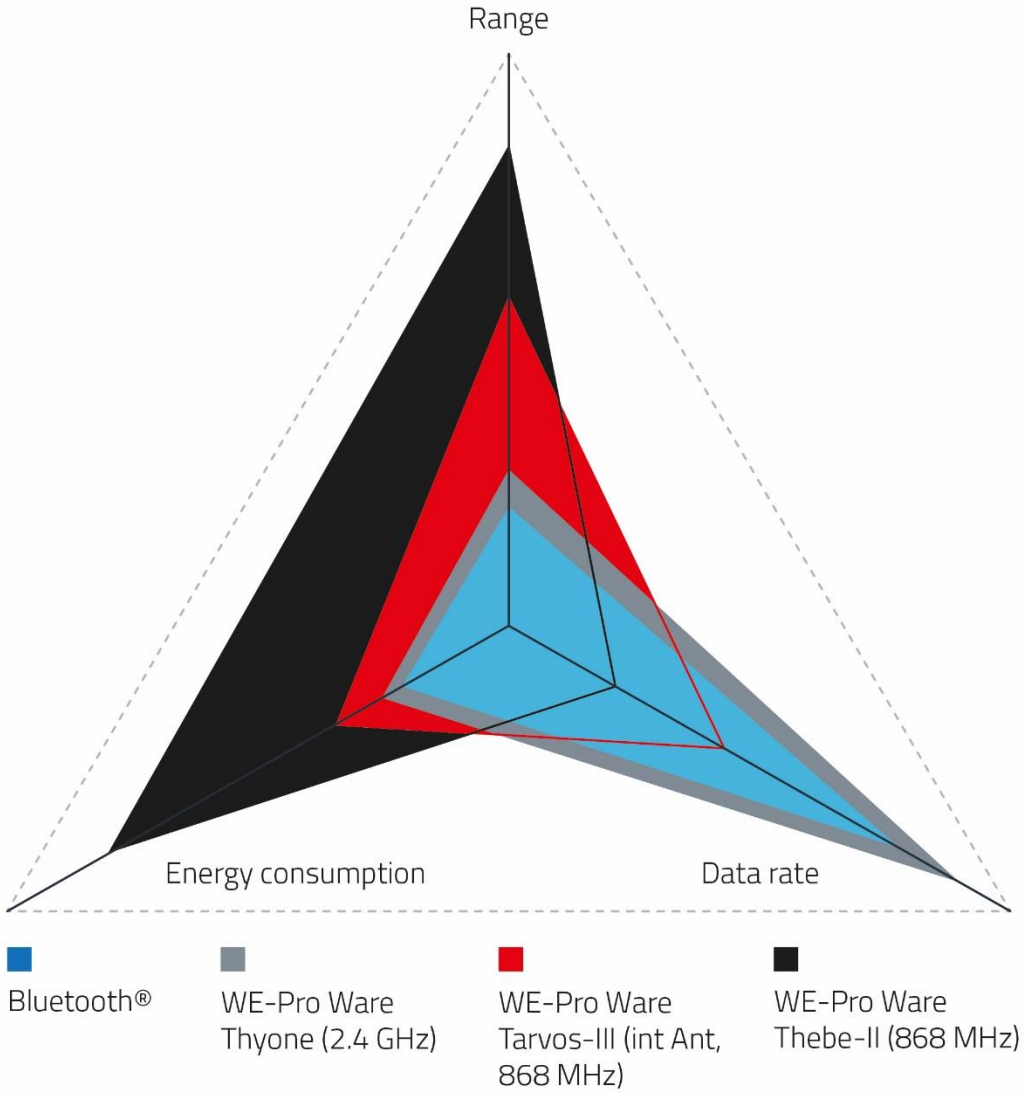
RED EXPERT RANGE ESTIMATOR

Red Expert Range Estimator



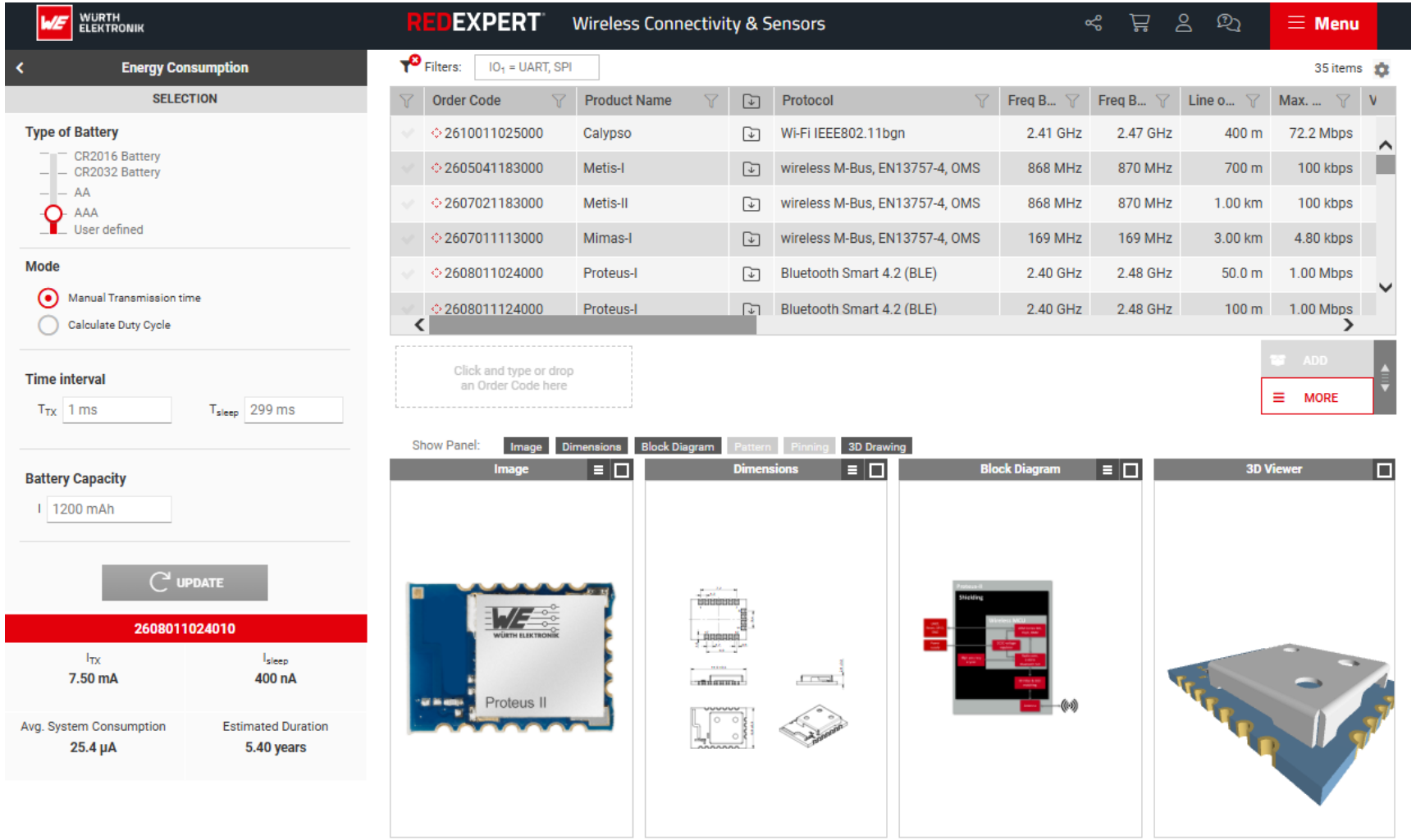
RANGE – DATA RATE – ENERGY CONSUMPTION

A compromise



RED EXPERT ENERGY CONSUMPTION

Red Expert Energy Consumption



FREQUENZBÄNDER

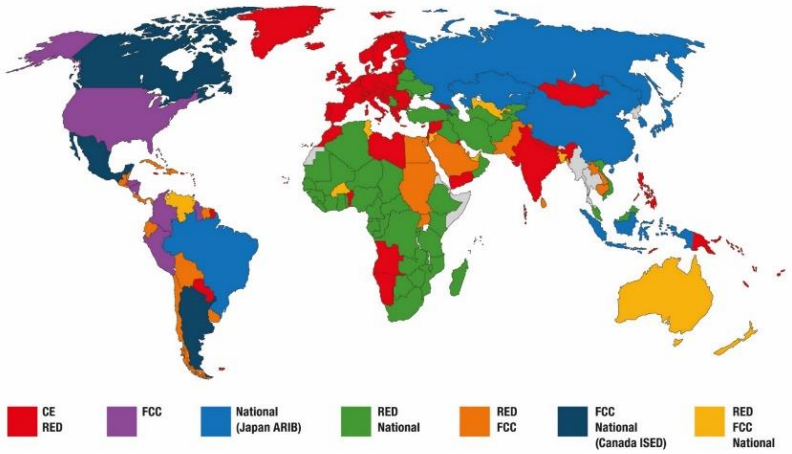
EINFÜHRUNG IN DIE FUNKENTWICKLUNG

1. Wo wollen Sie ihr Produkt einsetzen?

1. Region

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

- [ ] Europe
- [ ] North America
- [ ] South America
- [ ] Asia
- [ ] worldwide
- [ ] other: _____



	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

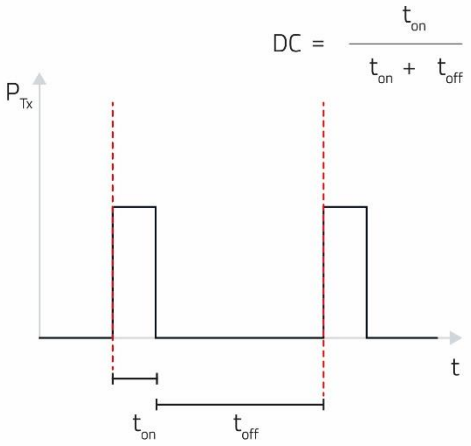
UNLIZENSIERTE ISM/SRD BÄNDER:

- USA/Canada:
  - 260 – 470 MHz (FCC Part 15.231; 15.205)
  - 902 – 928 MHz (FCC Part 15.247; 15.249)
  - 2,4 – 2,4835 GHz (FCC Part 15.247; 15.249)

- Europe:
  - 433,050 – 434,790 MHz (ETSI EN 300 220)
  - 863,0 – 870,0 MHz (ETSI EN 300 220)
  - 2,4 – 2,4835 GHz (ETSI EN 300 440 or ETSI EN 300 328)

- Japan:
  - 315 MHz (Ultra low power applications)
  - 426-430, 449, 469 MHz (ARIB STD-T67)
  - 2,4 – 2,4835 GHz (ARIB STD-T66)
  - 2,471 – 2,497 GHz (ARIB RCR STD-33)

DUTY CYCLE



Frequency [MHz]	TX Power [dBm]	TX Power [mW]	Duty cycle	max. occupied BW* [kHz]	Notes
169.400 - 169.475	+ 27	500	≤ 1 %	50	For metering devices: 10 % DC
169.400 - 169.4875	+ 10	10	≤ 0.1 %	whole band	
169.4875 - 169.5875	+ 10	10	≤ 0,001 %	whole band	0,1 % DC during 0:00 and 6:00 local time
169.5875 - 169.8125	+ 10	10	≤ 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	≤ 0.1 % or PSA**	whole band	OBW restictions except audio & video limited to 300 kHz
865.0 - 868.0	+ 14	25	≤ 1 % or PSA**	whole band	
868.0 - 868.6	+ 14	25	≤ 1 % or PSA**	whole band	
868.7 - 869.2	+ 14	25	≤ 0.1 % or PSA**	whole band	
869.4 - 869.65	+ 27	500	≤ 10 % or PSA**	whole band	
869.7 - 870.0	+ 7	5		whole band	audio / video applications are excluded
869.7 - 870.0	+ 14	25	≤ 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%

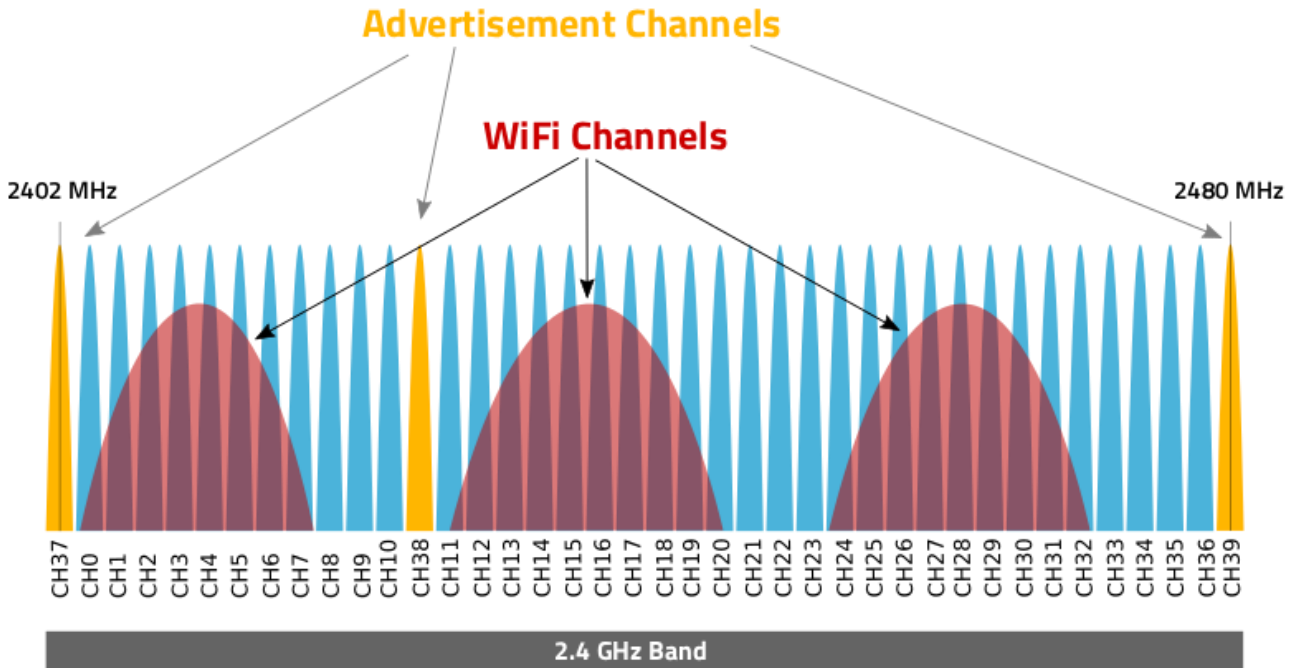
GRUNDKONZEPT BLE: ADVERTISING & SCANNING PROZESS

Advertising (Peripheral Side)

- Überträgt Pakete auf 3 primären Advertising Ch. (37 Datenkanäle, insgesamt 40)
- Konfigurierbares Intervall: 20 ms bis 10,24 Sekunden
- Pakettypen:
  - **Connectable** (ermöglicht Verbindungsaufbau)
  - **Non-connectable** (nur Übertragung, z. B. Beacons)
  - **Scannable** (ermöglicht Scan-Antwort)

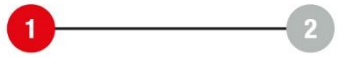
Scanning (Central Side)

- Lauscht auf den primären Advertising Kanälen
- Wichtige Parameter:
  - Scanfenster: Wie lange soll zugehört werden?
  - Scanintervall: Wie oft soll gescannt werden?
- **Schnelleres Advertising = schnellere Entdeckung = schnellere Verbindung**

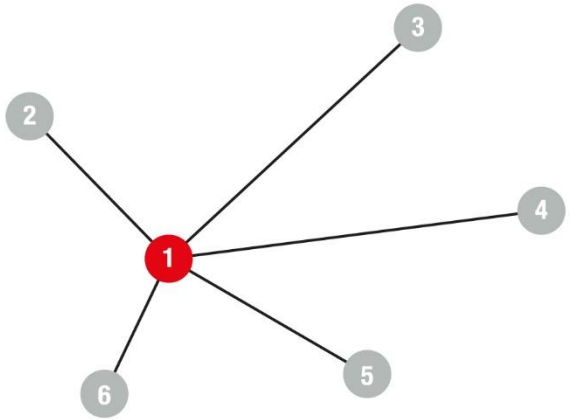


NETZWERKTOPOLOGIEN

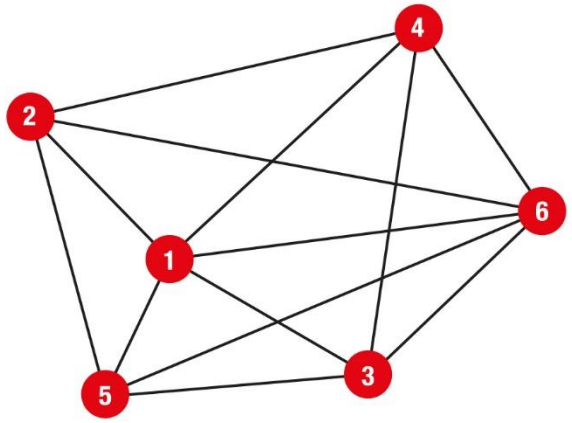
NETZWERKTOPOLOGIEN



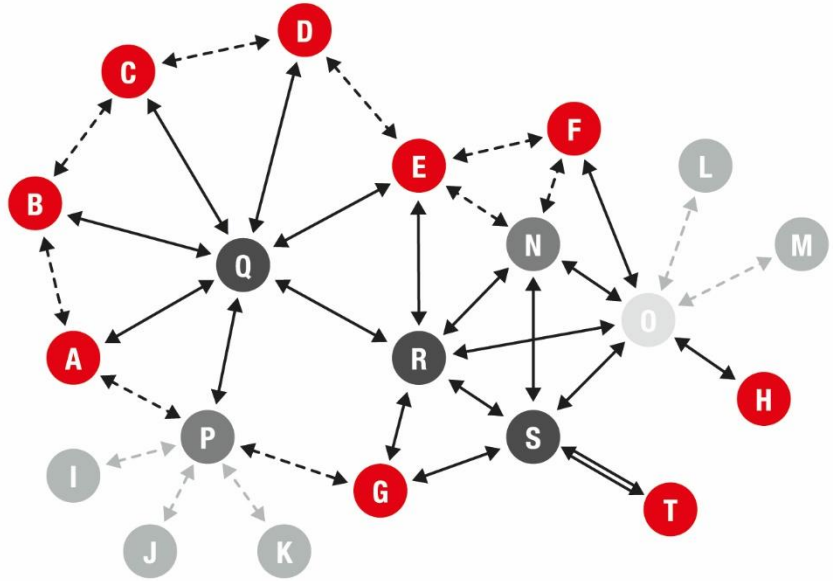
Point-to-Point



Star



Peer to Peer



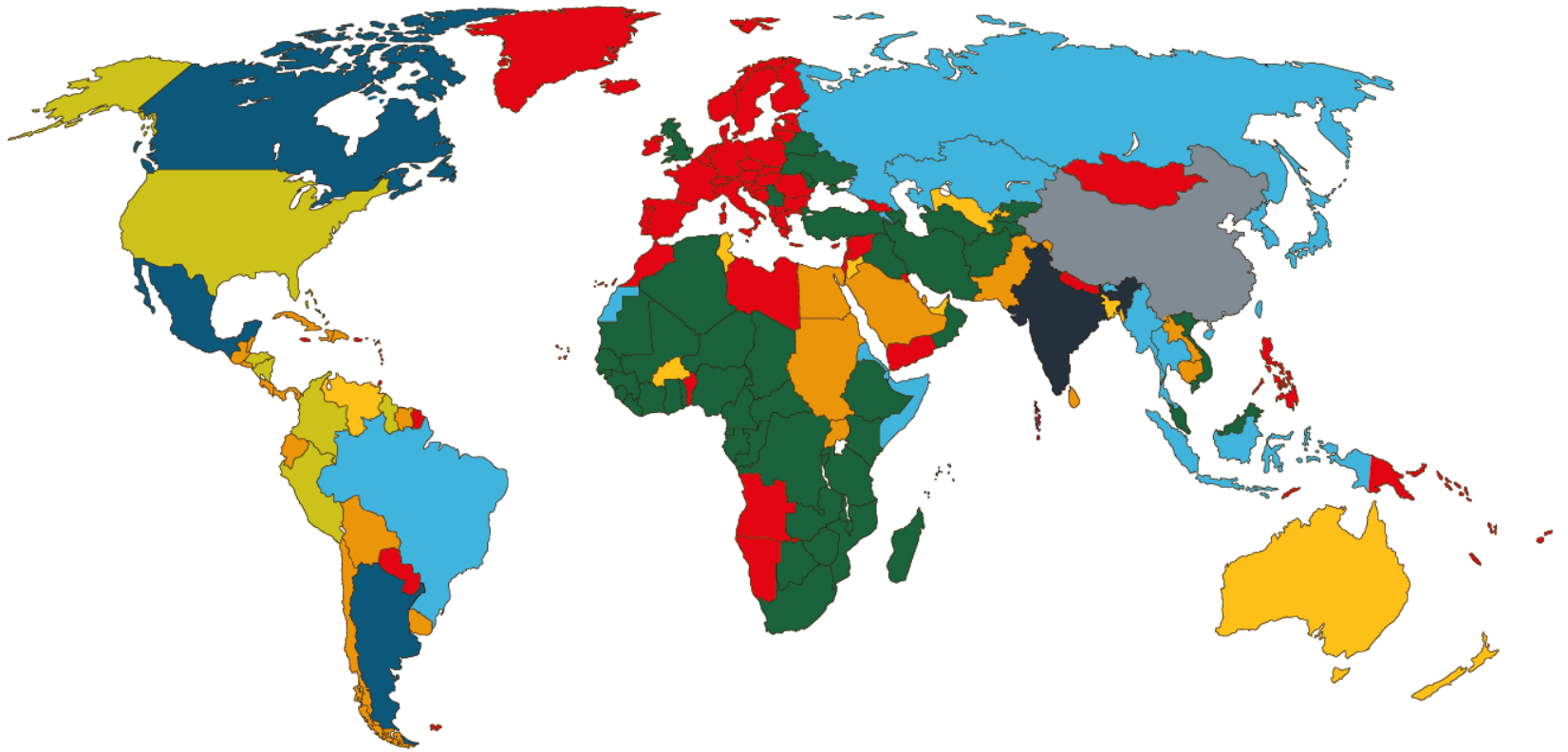
(Flooding) Mesh

FUNKPROTOKOLLE

	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	Wireless M-Bus		Wireless M-Bus, LoRa, sigfox, zigbee, Z-Wave, enocean, mioty	Wireless M-Bus, LoRa, sigfox, zigbee, Z-Wave, enocean		Bluetooth, WiFi, zigbee, matter, THREAD, Wirepas, IEEE 802.15.4, ANT+	WiFi	LTE, 5G			NB-IoT, LTE-M, GSM, UMTS		
Reichweite	mittel	mittel	hoch	hoch	hoch	niedrig	niedrig	hoch			hoch		
Datenrate	niedrig	niedrig	mittel	mittel	niedrig	hoch	hoch	hoch			niedrig		
Würth Elektronik Antennen														

ZERTIFIZIERUNGEN

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-CLTI	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-III	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	Calypso	2400	WIRL-WIFS	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	Calypso 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	Telesto-I	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	no	no	modified	modified	possible	on request
2607021191010	Telesto-II	915	WIRL-PRO9	915 MHz proprietary module with RF pad	no	yes	yes	no	no	modified	modified	possible	on request
2609011091000	Telesto-III	915	WIRL-PRO9	915 MHz proprietary module with integrated antenna	no	yes	yes	modified	modified	modified	modified	possible	on request
2609011191000	Telesto-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 fullfils national requirements, testing, certification and/or self declarations are done. Module fullfills 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 countrys.
- **Receiver only modules** are exempted from radio conformity approach in some countrys.

No

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

Possible

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

Modified

Module is not fullfilling 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 zertifizierten 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 300 328 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

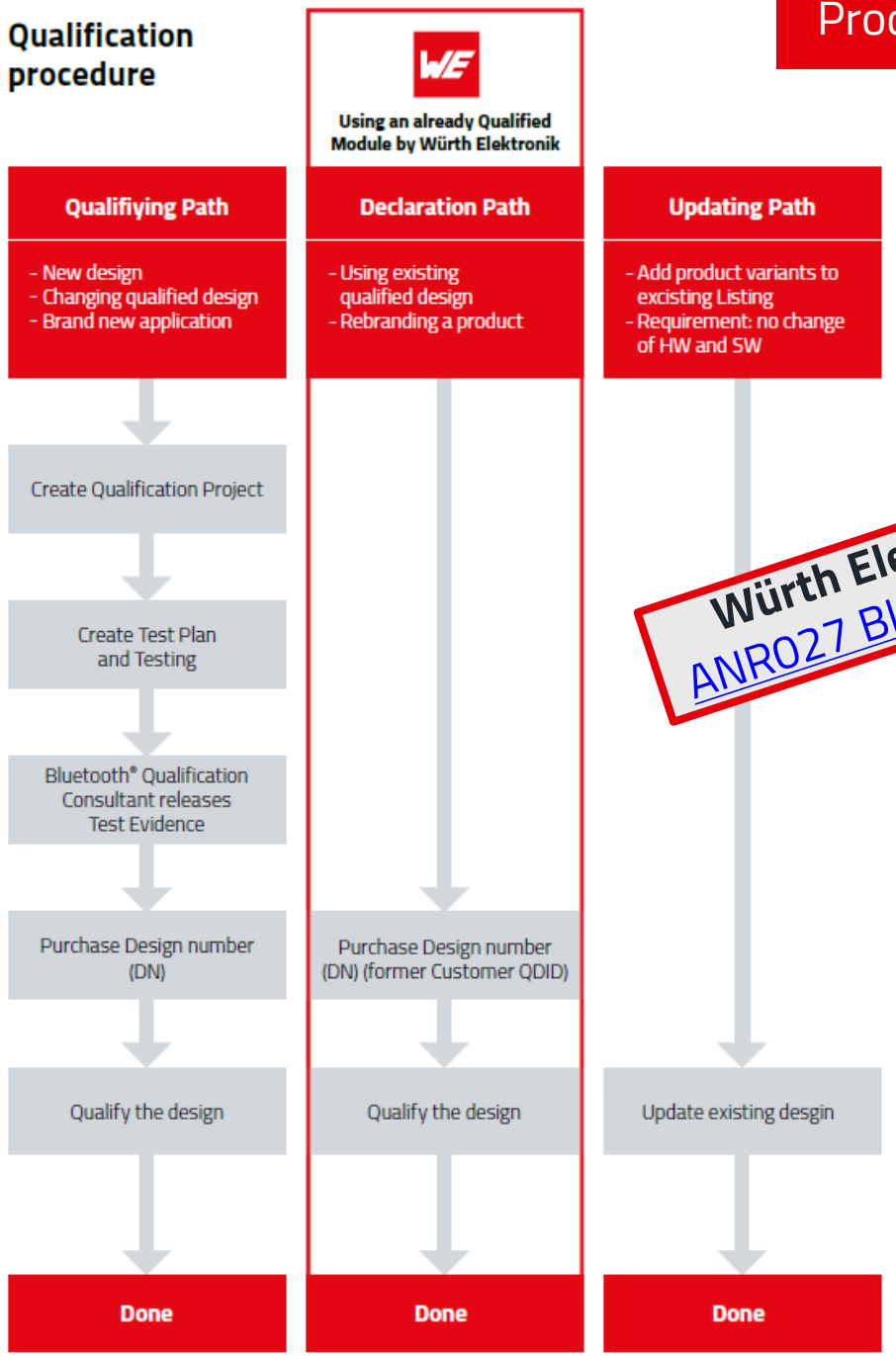
5.4.6	Adaptivity	Nominal	Nominal	-/-	☐	☐	☒	☐	-/-
5.4.7	Occupied channel bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.8	Transmitter unwanted emissions in the out-of-band domain	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
5.4.9	Transmitter unwanted emissions in the spurious domain (cond. + rad.)	Nominal	Nominal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

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

BLUETOOTH®

Declaration Process

- Die Bluetooth®-Qualifizierung besteht aus Qualifizierung (Qualification) und Deklaration (Declaration).
- Der Qualifizierungsprozess ist einer der wichtigsten Aspekte der Bluetooth®-Technologie, da er die Interoperabilität und Konformität mit den Bluetooth®-Spezifikationen sicherstellt.
- Bluetooth® Qualification Consultants (BQCs) stehen zur Verfügung, um die Mitglieder bei diesen Prozessen zu unterstützen.
- Qualifizierung bezeichnet den gesamten Prozess einschließlich der Tests.
- Mitglieder der Bluetooth® SIG müssen den Qualifizierungs- und Deklarationsprozess für ihr Bluetooth®-fähiges Produkt abschließen, um die Konformität nachzuweisen und zu erklären.
- Der Distributor (Vertreiber/Inverkehrbringer) ist dafür verantwortlich sicherzustellen, dass die erforderliche Listung durchgeführt wird.
- Eine reine Deklaration ist möglich, wenn ein bereits qualifiziertes Produkt verwendet wird. In diesem Fall entfällt der Mess- und Testaufwand; es sind lediglich Deklarations- und Informationsarbeiten zu erledigen.
- BT-Deklaration: 12.000 USD pro Endgerät.

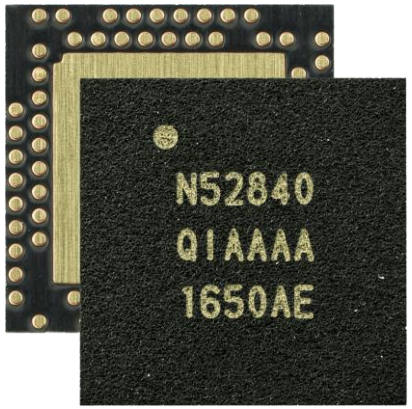


Würth Elektronik AppNote:
ANR027 Bluetooth Listing Guide

DESIGN-IN HW/SW

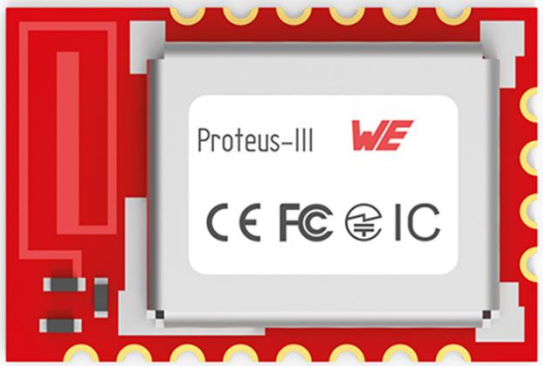
ENTWICKLUNGSANSÄTZE FÜR FUNKANWENDUNGEN

Es gibt 3 Möglichkeiten eine Funkentwicklung zu starten



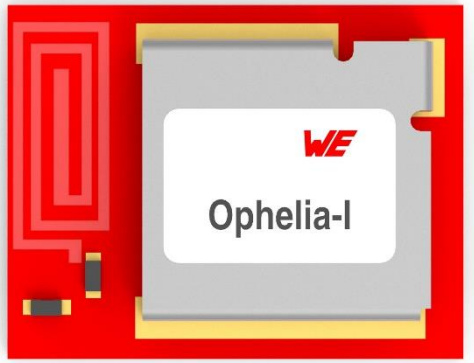
Funkchip

VS.



Funkmodul mit Software

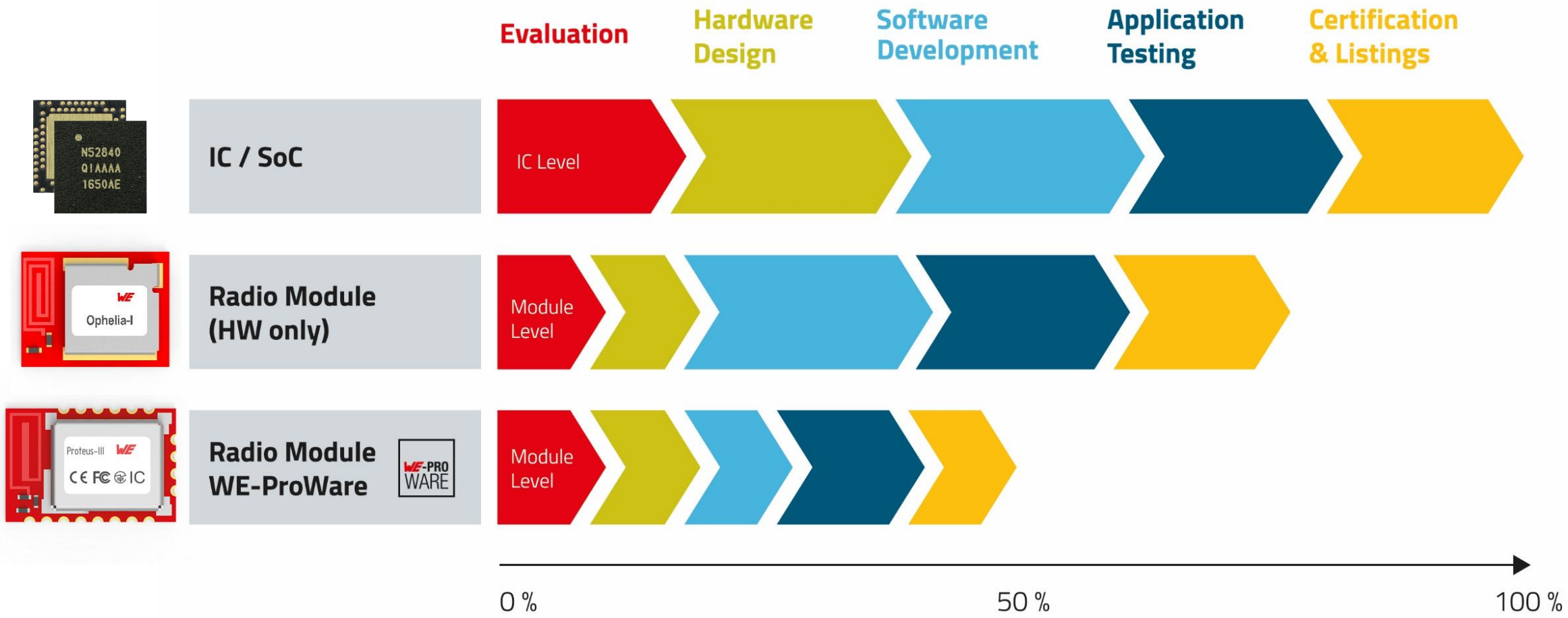
VS.



Funkmodul ohne Software

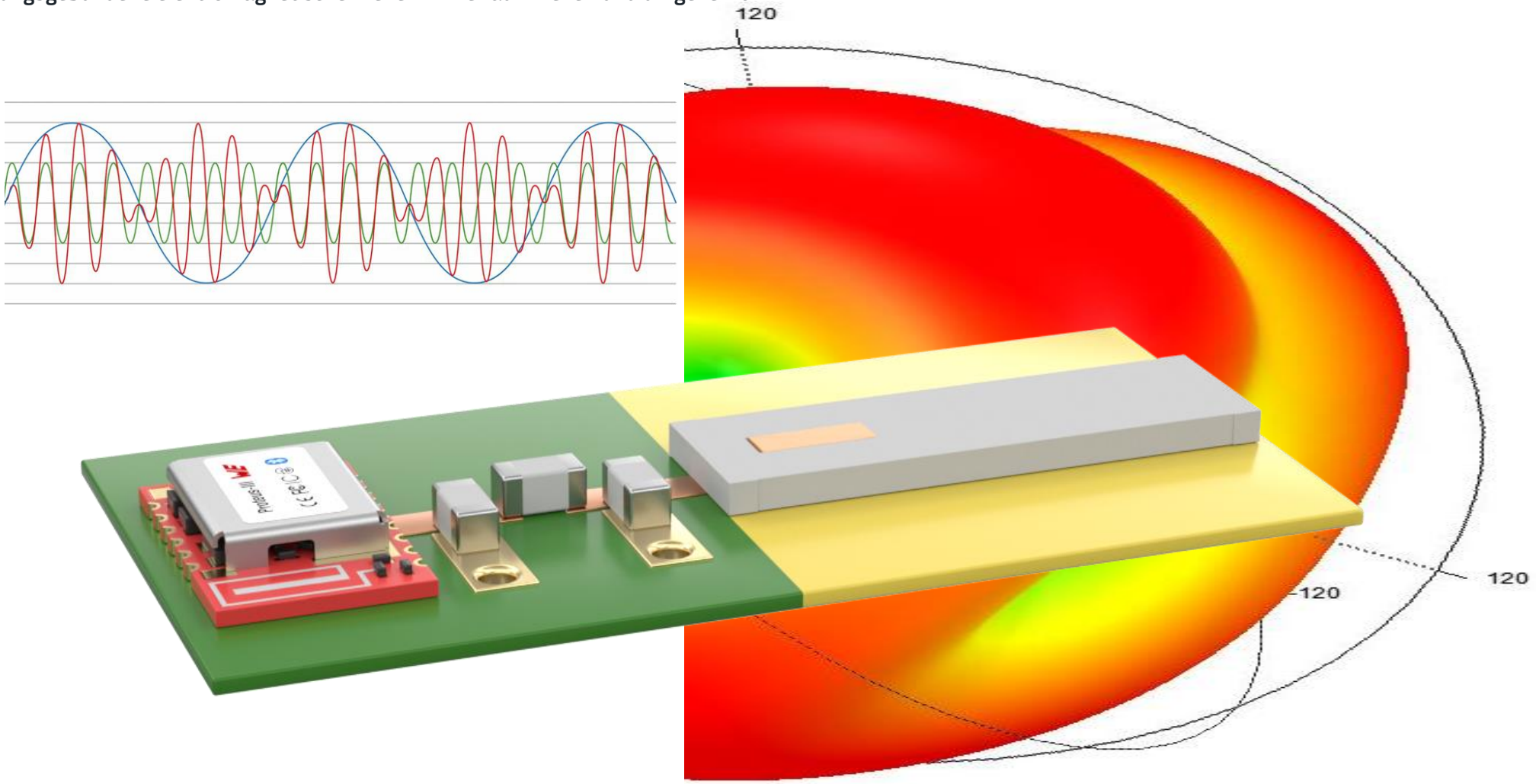
VERGLEICH ENTWICKLUNGSAUFWAND

RF-CHIP vs. Funkmodul-HW vs. Funkmodul



DAS WICHTIGSTE BAUTEIL FÜR DIE FUNKPERFORMANCE:

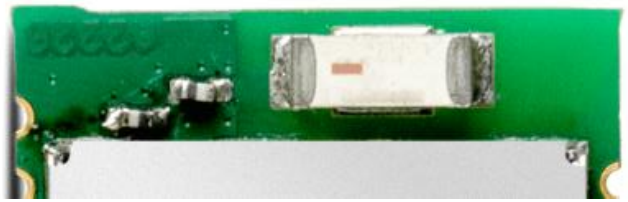
Die Antenne...
... wandelt Leitungsgebundene elektromagnetische Wellen in Freiraumwellen und umgekehrt.



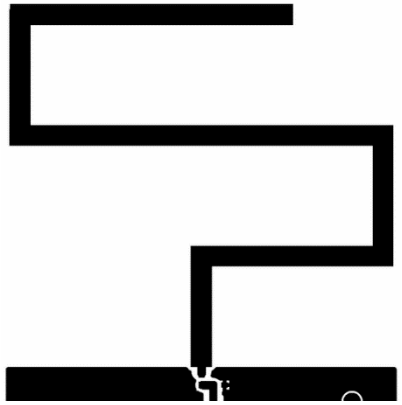
DESIGN-IN: ANTENNEN

- PCB Antenne
- Chip Antenne
- Wire Antenne
- Dipol Antenne

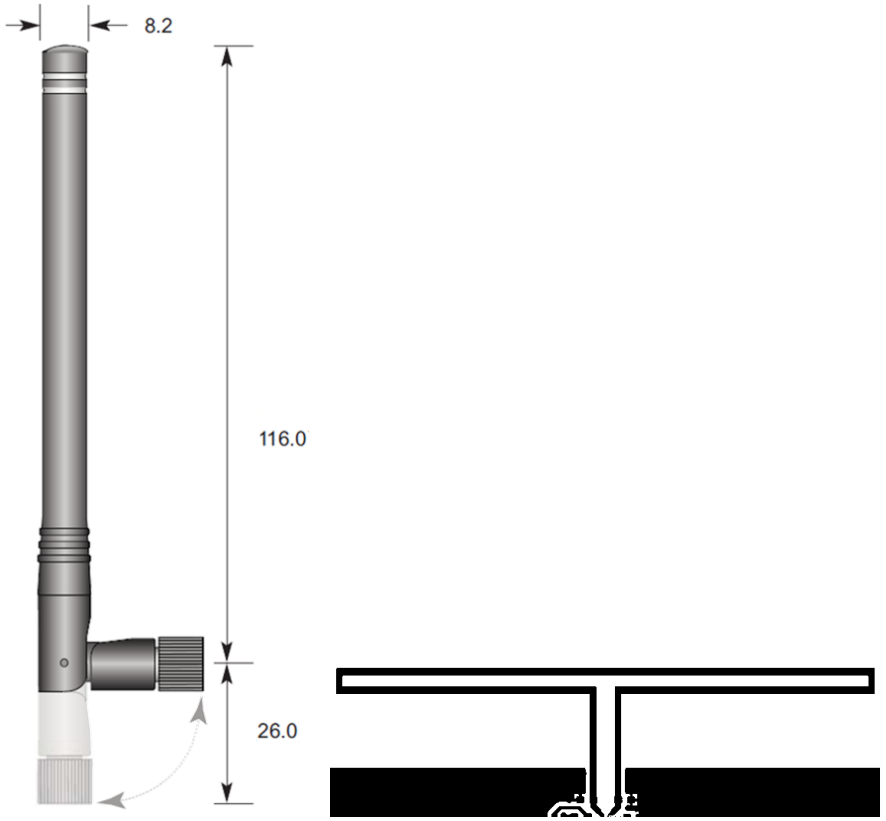
PCB Antenne



Chip Antenne



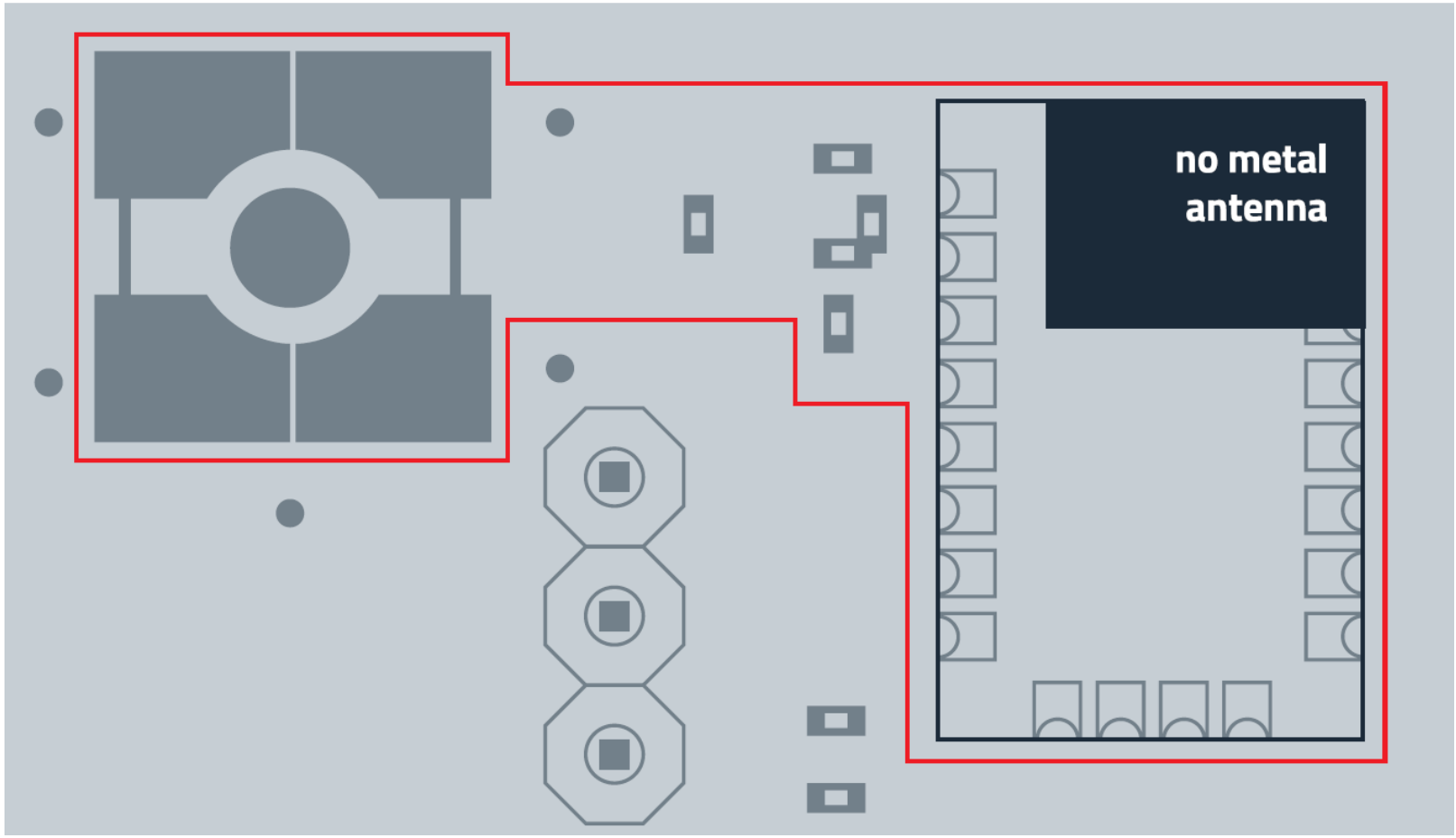
Single Ended Antenne



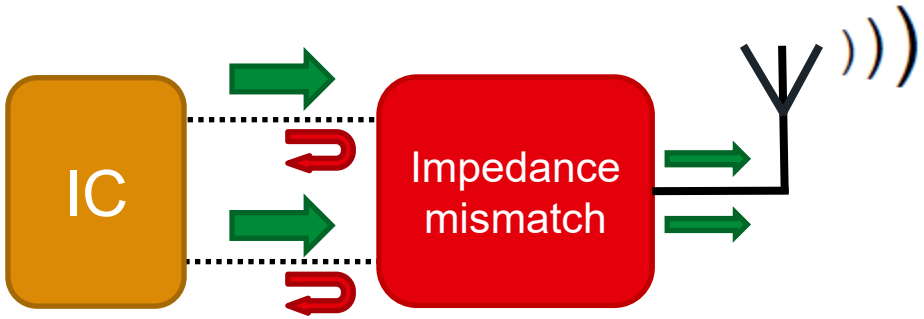
Dipol Antenne

HARDWARE DESIGN

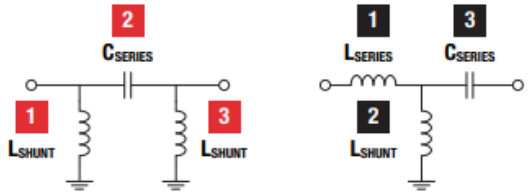
Trace Design



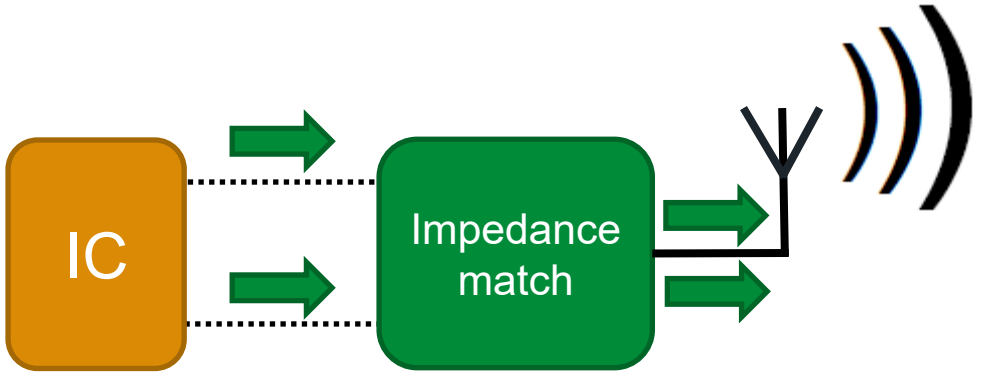
ANTENNENANPASSUNG



Impedance
Matching circuit



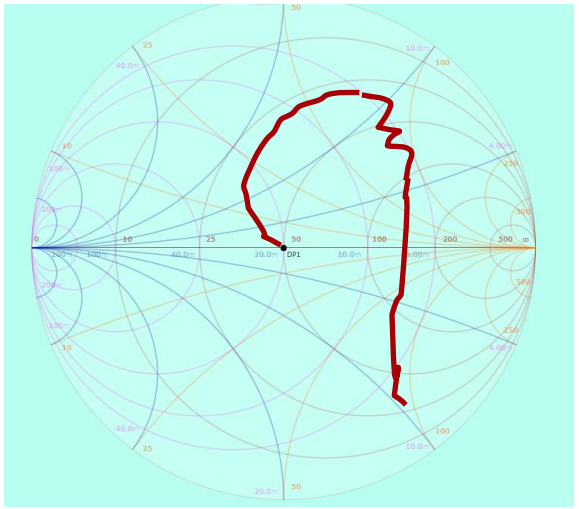
Pi matching for Point A *T matching for Point B*



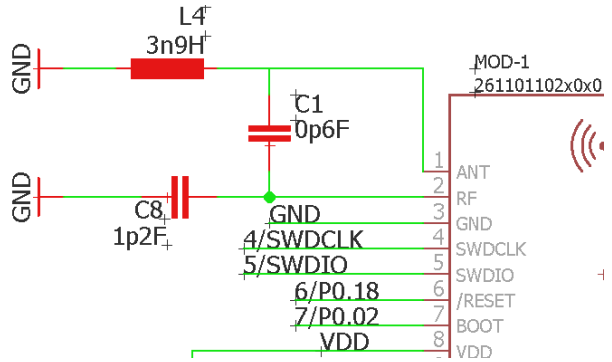
SMART ANTENNA CONNECTION

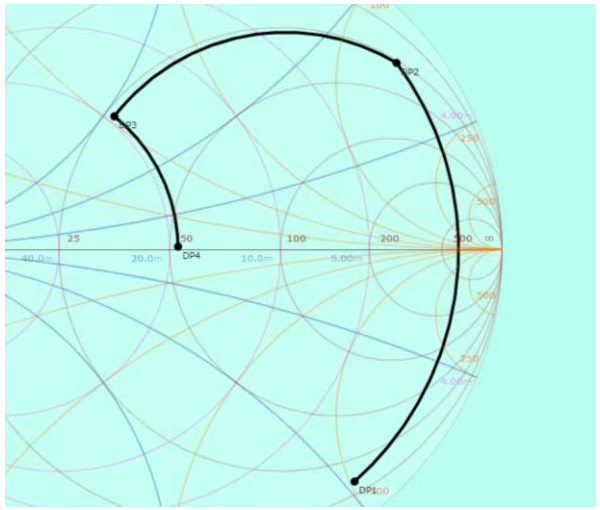
Was ist eigentlich mit Feintuning oder Rematching gemeint?

Antenne wird durch die Integration in die Anwendung verstimmt.



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

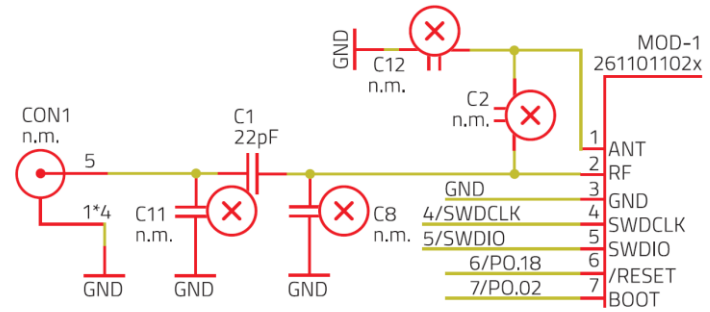




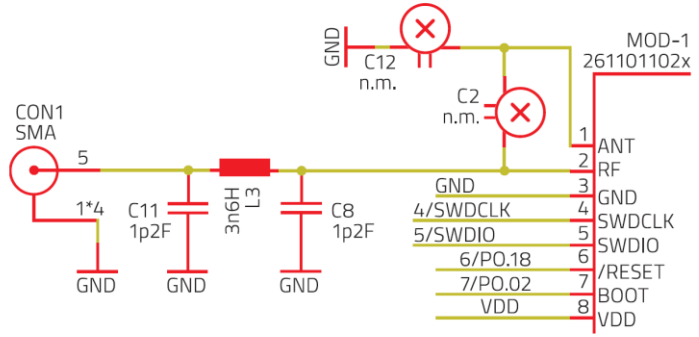
SMART ANTENNA SELECTION

ANTENNA MATCHING

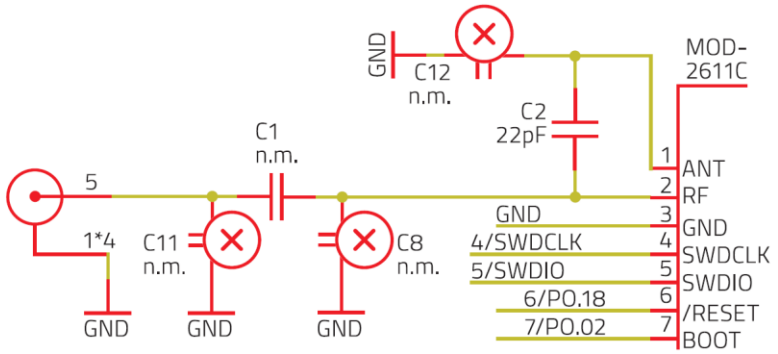
Coaxial connector w/o filter or matching



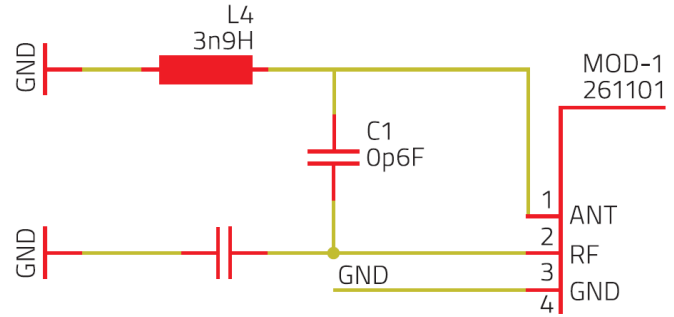
Pi-Filter: i.e. lowpass with cut-off frequency 2.5 GHz and ripple of 0.1 dB, (Chebyshev) adapted to 50 Ohm network



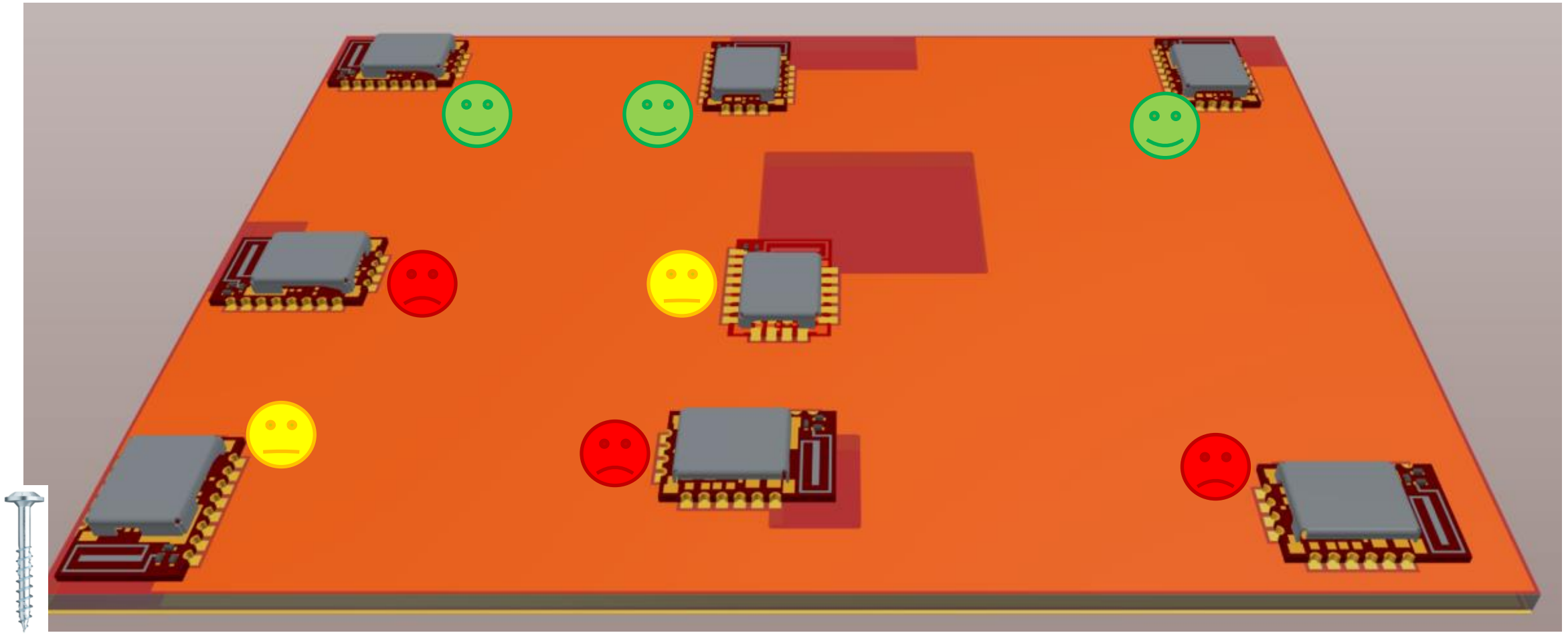
Internel antenna w/o filter or matching



Rematching: i.e. 15-j102 back to 50 Ω

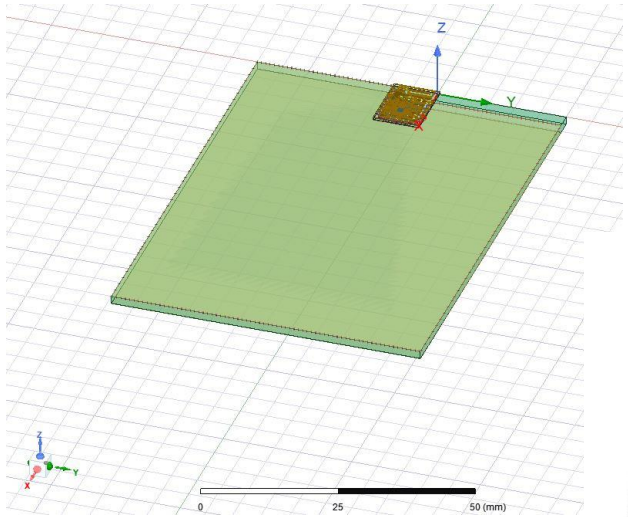


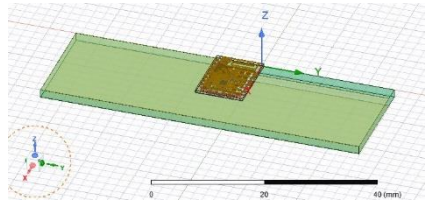
MODULPLATZIERUNG

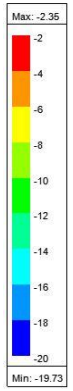


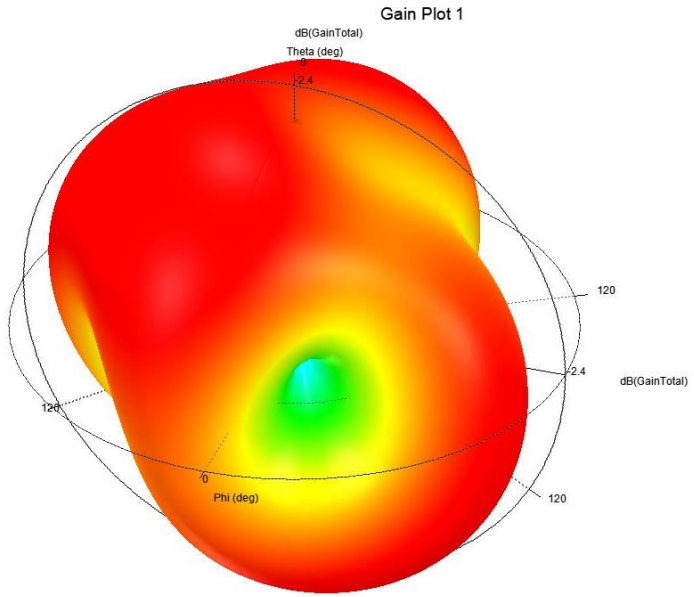
BEEINFLUSSUNG DER ANTENNENCHARAKTERISTIK DURCH DIE UMGEBUNG

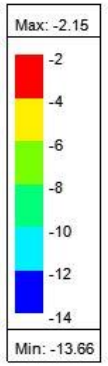
Massefläche

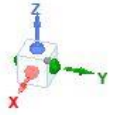


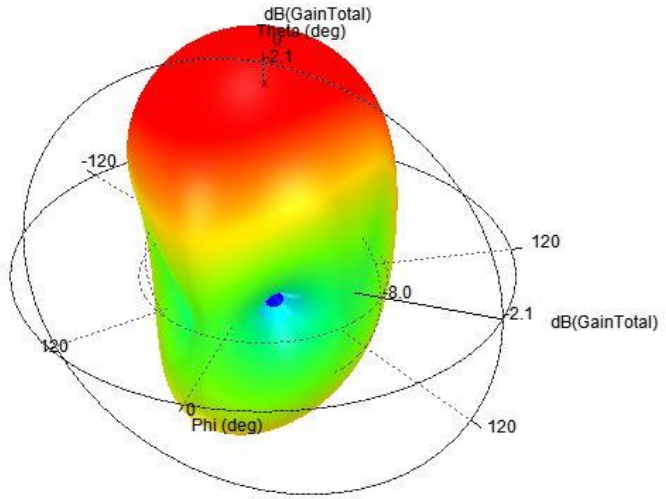












DESIGN-IN: SOFTWARE

Beispiel: Command Mode

Transmitter

Start signal	Command	Length	Payload	CS
0x02	0x00	0x0C	0x48656C6C6F20576F726C6421	0x96
			Hello World!	

Receiver

Start signal	Command	Length	Payload	RSSI	CS
0x02	0x81	0x0D	0x48656C6C6F20576F726C6421	0xD9	0x56
			Hello World!	-39 dBm	

ZERTIFIZIERUNG KUNDENSPEZIFISCHER MODULE

Wie kann die Zertifizierung des Standardmoduls für das kundenspezifische Modul wiederverwendet werden?

- Für RED (Europa), FCC (USA), IC (Kanada) und UKCA (Großbritannien) muss eine **Identitätserklärung** (Declaration of Identity) ausgestellt werden, sofern das kundenspezifische Modul **funktechnisch identisch** (radio identical) mit dem Standardmodul ist.
- TELEC (Japan) bietet diese Möglichkeit leider nicht an.
- **Funktechnisch identisch** bedeutet: Der Funkteil des kundenspezifischen Moduls muss die maximale Sendeleistung (TX Power) und die Funkprofile (zum Beispiel Bluetooth LE 1 Mbit) strikt einhalten, wie sie in der Application Note ANR031 spezifiziert sind

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 7.0.1[1] or nRFConnect SDK [1]

Würth Elektronik AppNote:
ANR031 Certification of custom modules

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

CE National

FIRMWARE FREEZE

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

- RF Module comes with a standardized firmware
- RF Module is NOT subject to further firmware development
- RF Module will have a fixed revision of the firmware e.g. 1.3.1
- RF Module will have a unique part number
- 100% verified, electrical tested and validated
- packaged in Tape & Reel, ESD und MSL conform

INDIVIDUALIZED ADAPTION (USER SETTINGS)

We align our standard firmware to your requirements which simplifies your production process.

- RF Module comes with a standard firmware
- User Settings adaptions defined by customer
- Continuous & further firmware development only on customer request
- Individualized Adaption (User Settings)
- Firmware freeze on customer request
- RF Module will have a unique part number
- 100% verified and electrical tested
- packaged in Tape & Reel, ESD und MSL conform

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.

- RF Module comes with a custom firmware
- 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

Thread | MIOTY | Zigbee | RS485 / CAN | Bluetooth® Mesh | Application on the module | SPI / I²C | Switch status | Sensor measuring | ...

BUILD YOUR OWN FIRMWARE

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

- RF Module comes without any standardized firmware
- 100% electrical testing on customer request
- RF Module will have a standard part number
- packaged in Tape & Reel, ESD und MSL conform

~~CE~~ ~~National~~ ~~FC~~ ~~IC~~ ~~UKCA~~

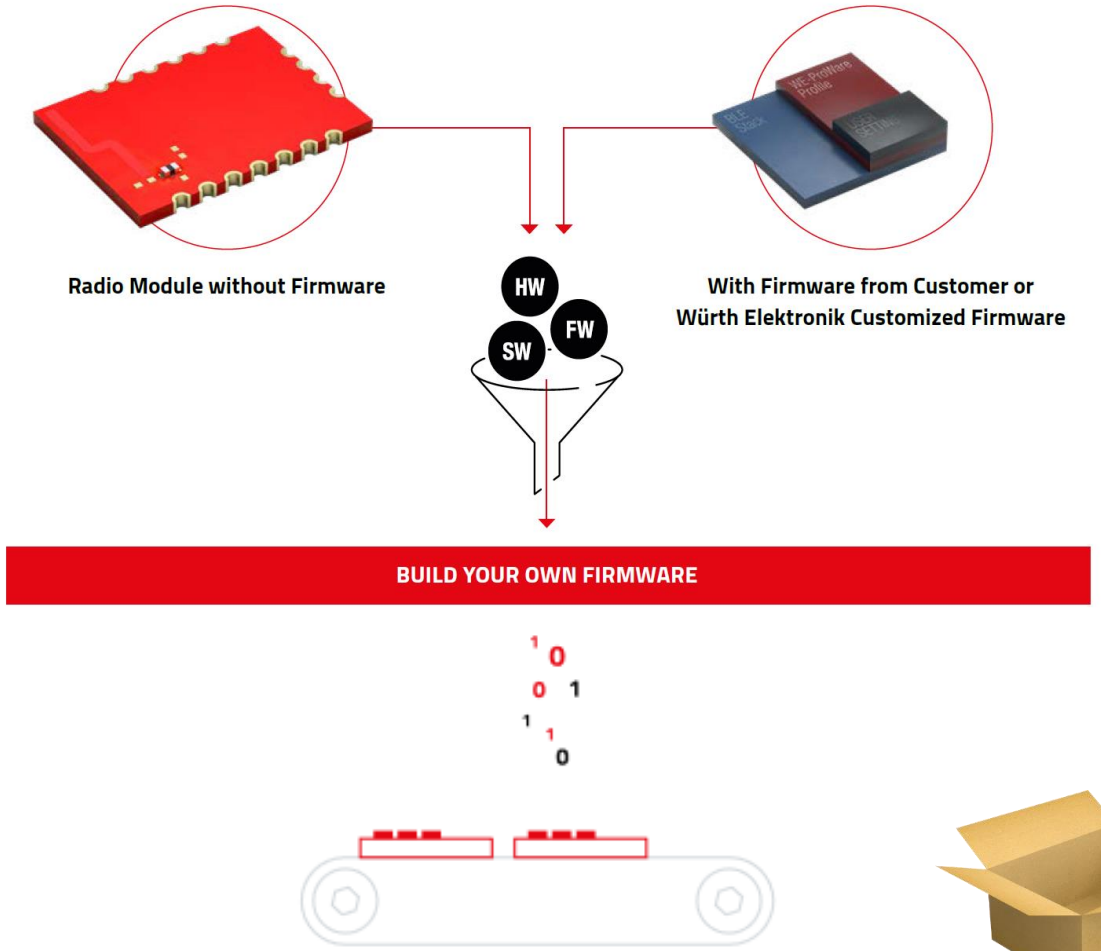
page: 114

Ophelia-I

Hardware-only module based on Nordic nRF52805 radio chipset

FLASHING SERVICE

Kundenspezifische Module



- Die kundeneigene Firmware (FW) kann direkt im Produktionsprozess bei Würth Elektronik eiSos™ geflasht (aufgespielt) werden.
- Es kann eine spezifische Testroutine definiert werden.
- Dafür wird eine kundenspezifische Artikelnummer angelegt.
- Bestellungen können auch von einem EMS-Dienstleister (Electronic Manufacturing Services) etc. platziert werden.

SOFTWARE TOOLS

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

Würth Elektronik provides a variaty 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

PRODUKTÜBERSICHT

WIRELESS CONNECTIVITY

LTE-M NB-IoT	Connect Machine Globally	**Cellular**
Bluetooth	Connect Machine to Mobile Device	**Bluetooth®**
WiFi	Connect Machine to Internet	**WiFi**
LoRa®	Connect Device to Gateway	**LoRaWAN®**
WE PROWARE	Connect Machine to Machine	**Proprietary**
WE PROWARE Bluetooth WiFi	Connect M2M & Mobile Device	**Combined**
WE PROWARE Wirepas	Connect all together	**Mesh**
M-Bus wireless	Connect Smart Meter	**Wireless M-Bus**
	Open Module/No Firmware	**Build Your Own Firmware**

HOW TO GET STARTED WITH WIRELESS CONNECTIVITY

START

CREATING IDEAS
HOW CAN I EXTEND MY BUSINESS?

WIRELESS GUIDE
WHAT DOES MY APPLICATION NEED?

RADIO TECHNOLOGIES
WHICH TECHNOLOGIES ARE AVAILABLE?

RADIO COMMUNICATION FUNDAMENTALS
WHAT IS RADIO?

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

HARDWARE INTEGRATION
HOW TO ADD A MODULE ON A PCB?

ANTENNAS AND MATCHING
WHAT ABOUT THE ANTENNA?

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

CERTIFICATION AND CONFORMITY
HOW TO CLIMB THE MOUNTAIN OF CERTIFICATION?

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

VIELEN DANK!