

Deutsche Telekom IoT
connect. digitize. get ahead.

IoT Technology

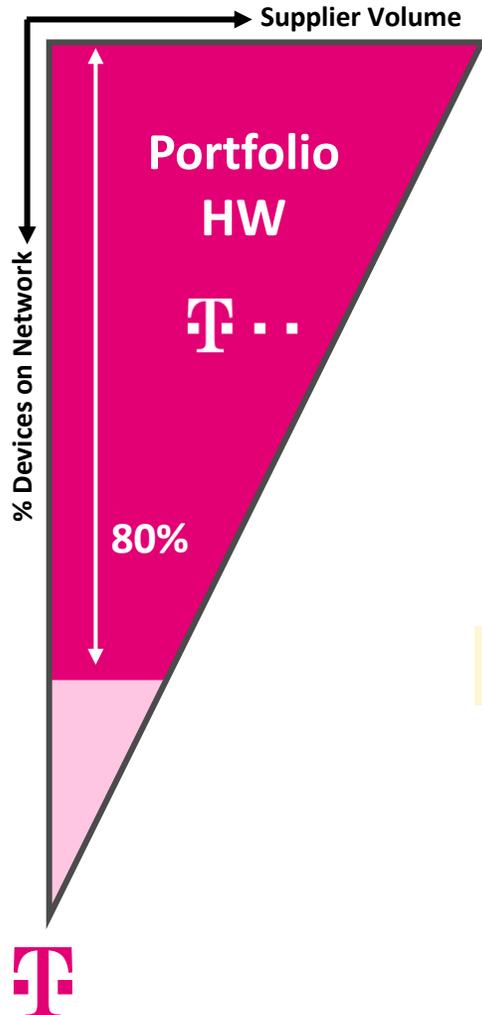
DT Certification Process for Chipsets & Modules

(Public and Private 3GPP Networks, Satellite)



Why operator certifications are necessary in the IoT business

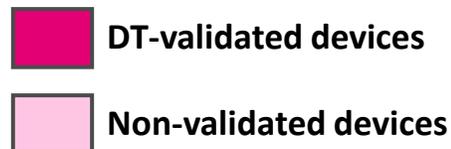
Devices on CONSUMER NETWORK



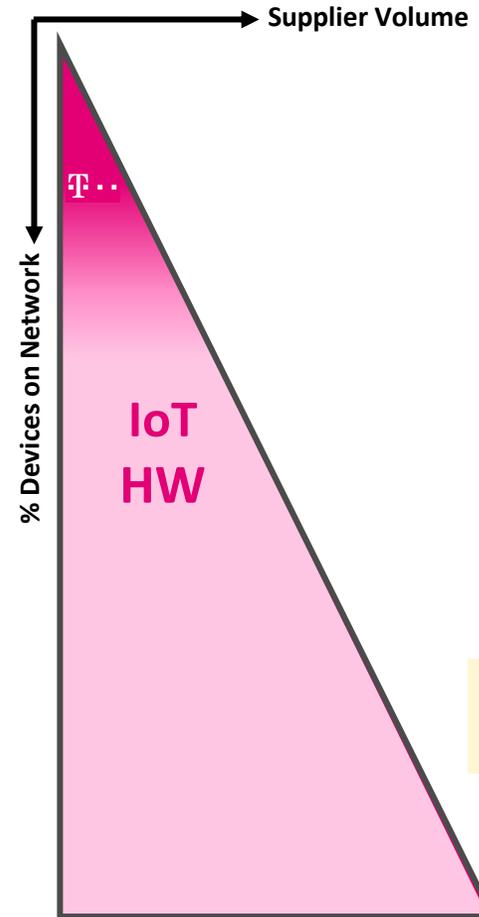
Most devices on **Consumer Network** are in the portfolio and validated by Deutsche Telekom (DT):

- DT has direct relationships with dominant vendors
- Compliance to DT technical requirements
- Standardized, mature services
- Dominant OS platforms used

→ **LOW RISK TO NETWORK**



Devices on IOT NETWORK

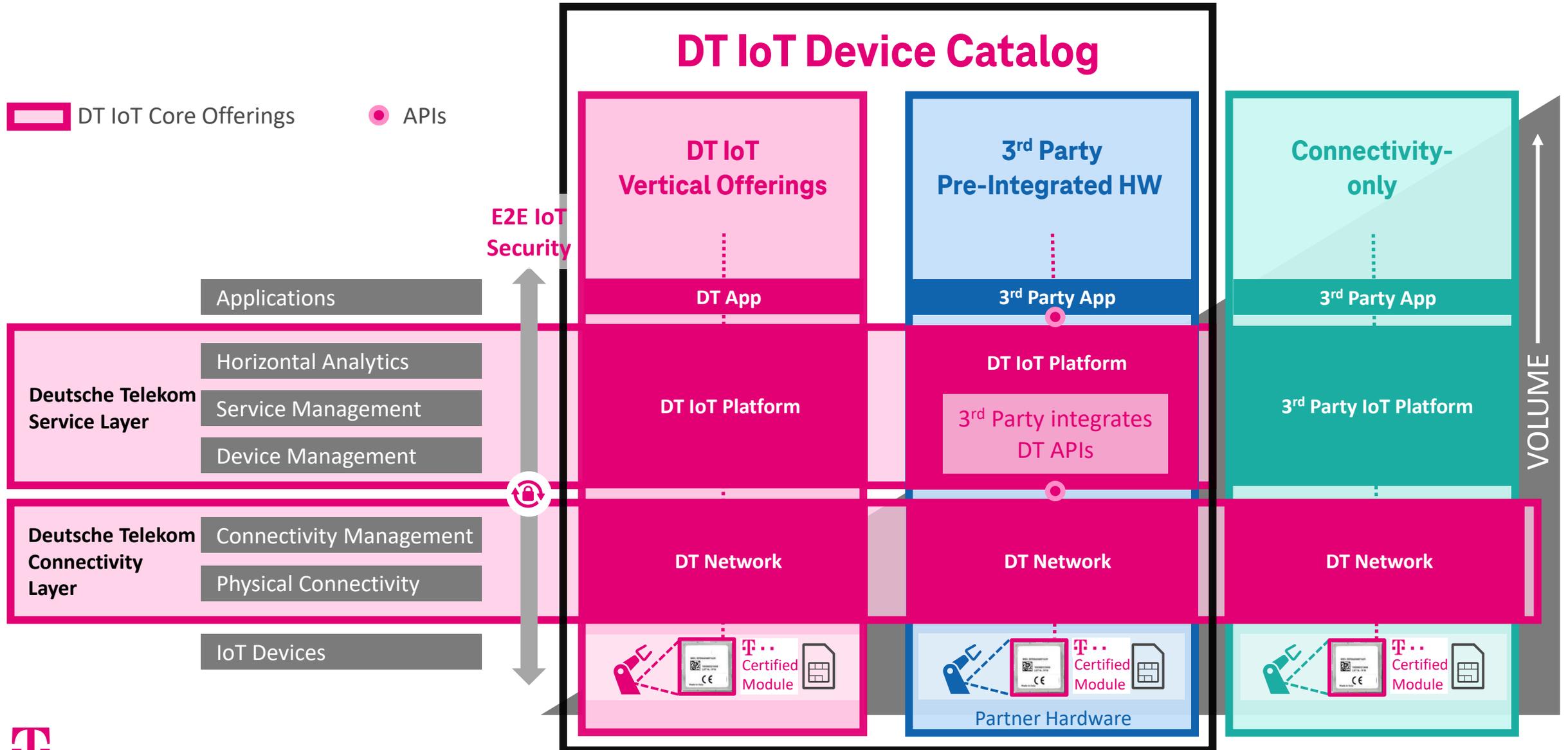


Few devices on **IoT Network** are in DT's portfolio and tested E2E:

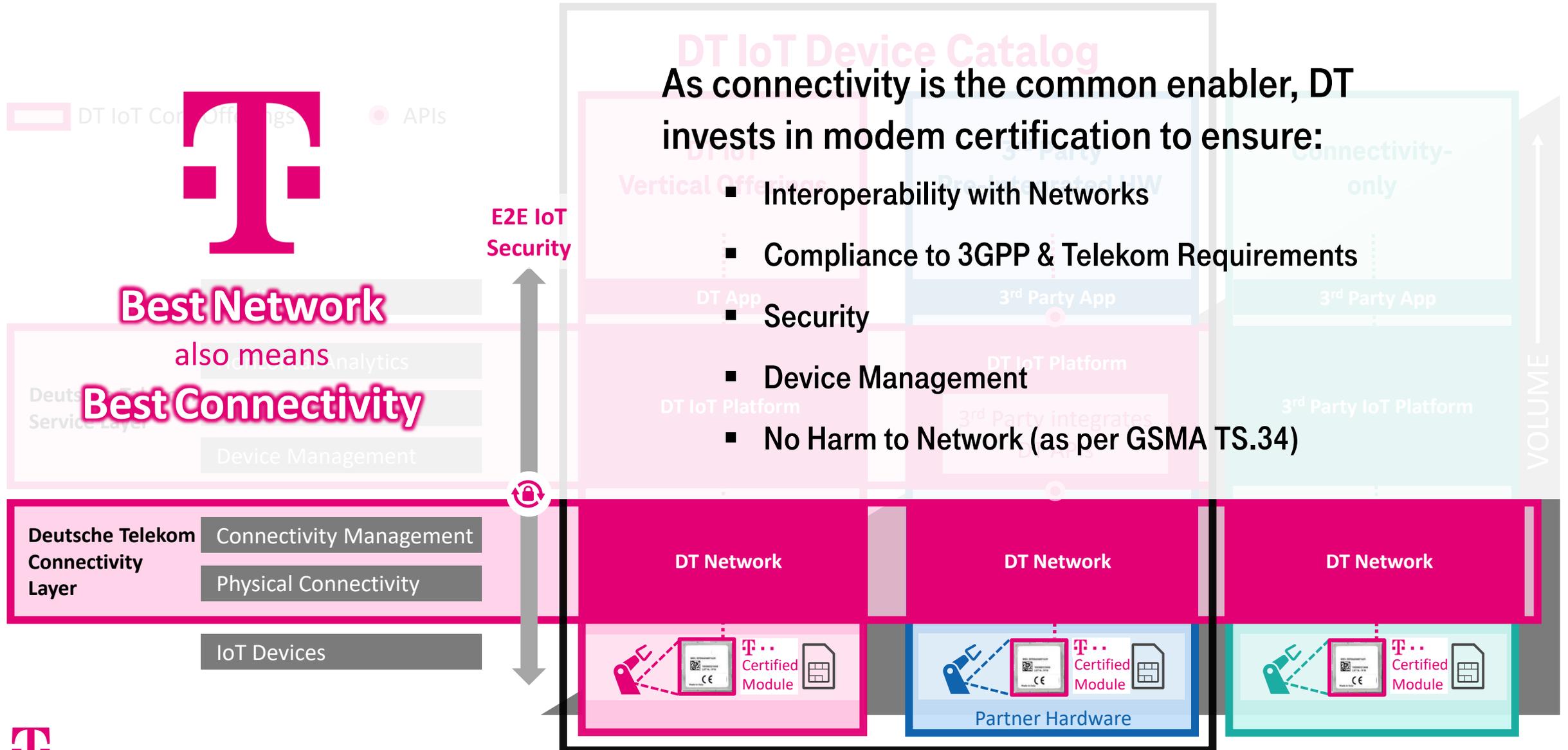
- Thousands of suppliers
- Little visibility / stake on 3rd party design
- High risk that interoperability is not assured
- Innovative, disruptive services
- No standardized APIs to protect network from unwanted behavior

→ **HIGH RISK TO NETWORK**

DT's IoT offerings are highly differentiated



DT Certification helps to secure IoT connectivity...



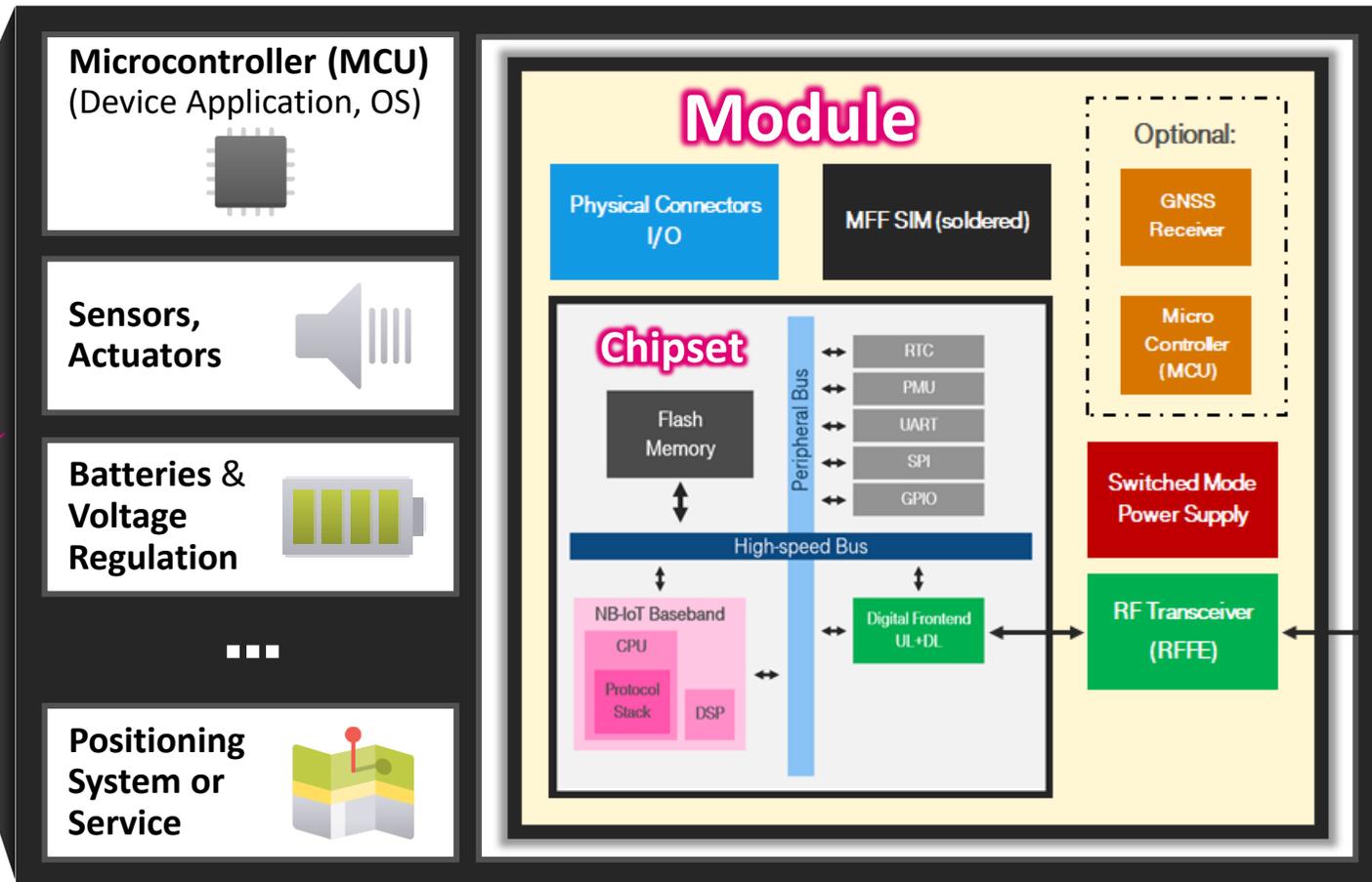
DT certifies modules so that your connectivity works flawlessly

Example IoT application:
Connected shopping cart



IoT devices are often called “sensors” out of simplicity... because they are usually monitoring specific assets.

But there are many more ingredients in an IoT device than just the “sensing” parts: antennas, a microcontroller running application software, batteries, and a communication module, among others...



Inside your device’s module is a chipset. This processes your data so it can be sent over DT networks properly. IoT devices on our networks must use DT-certified modules.

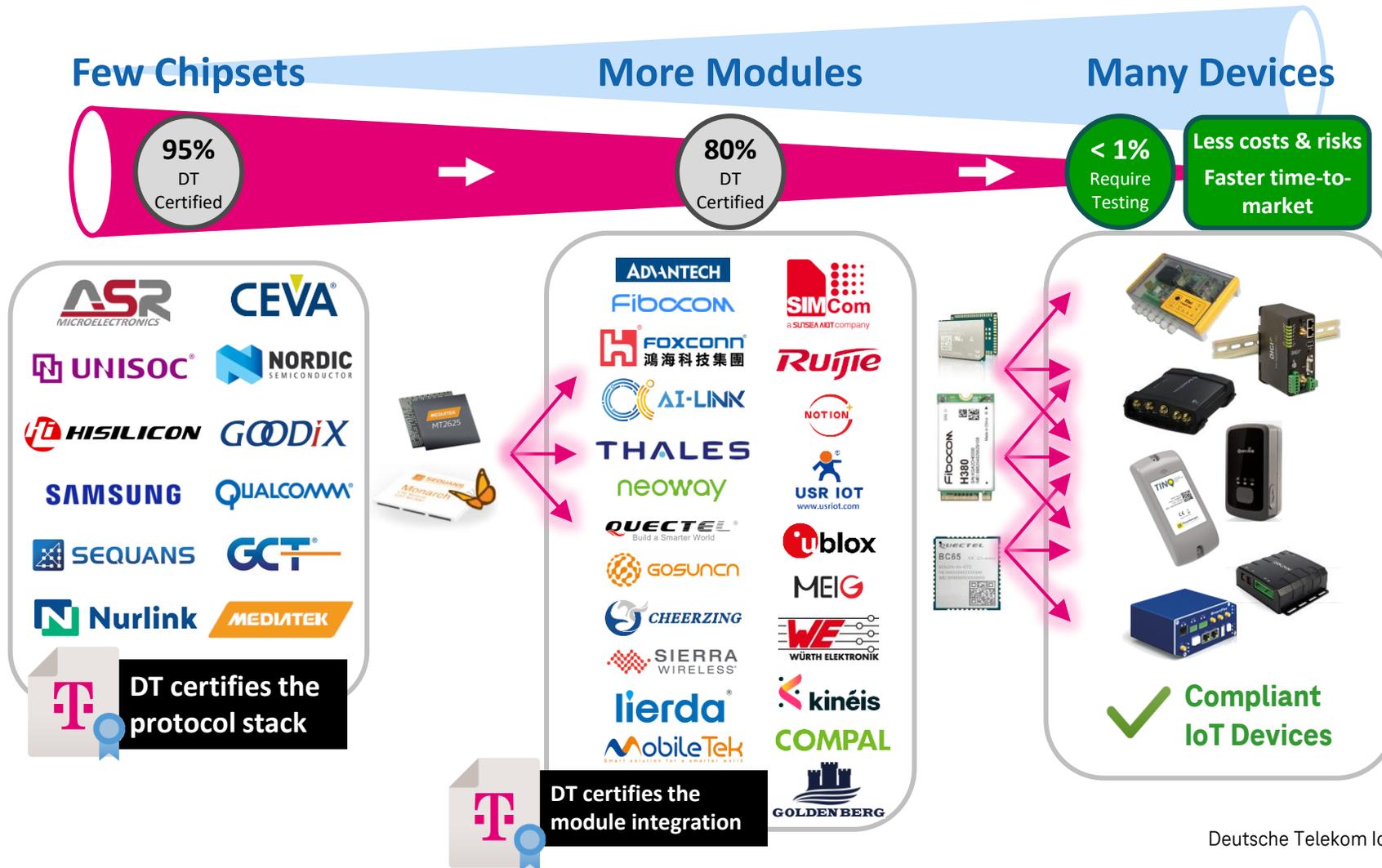
Learn more about IoT:

<https://dt.iotsolutionoptimizer.com/Learn/TechnologyCards>



DT Certification benefits the entire IoT value chain

We test most suppliers' IoT chipsets & modules to **reduce your deployment costs** and give you the **widest options** possible! DT networks have become a **European benchmark** for the IoT industry.



Benefit of



- 98** Mobile IoT modules certified:
- 45 multimode (LTE-M + NB-IoT)
 - 47 singlemode (NB-IoT only)
 - 6 singlemode (LTE-M only)



- 117** 2G/3G/4G modules certified
- 13** 5G modules certified
- 2** Satellite IoT modules certified



Certification secure lifecycle quality assurance

We cover all the angles – from the protocol stack, to OEM differentiations, firmware updating, and performance testing.

Few Chipsets

More Modules

Many Devices

Platform Testing

- 3GPP Layer 3
- Supplier Features
- Performance
- TS.34 RPM 

 DT certifies the protocol stack



Delta Testing

- OEM Features
- FOTA
- Performance
- Regression Test

 DT certifies the module integration

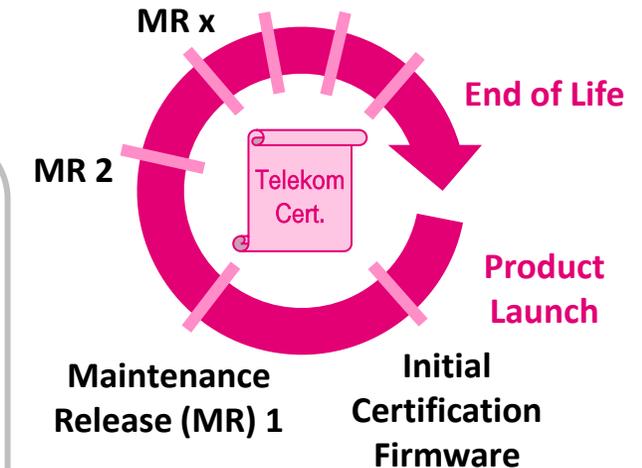


Network Interoperability Secured

for your peace of mind

Benefit of  . . .

DT Certification follows chipset/module lifecycles



Technical Certifications are updated to reflect:

- Corrected defects
- New features
- New markets
- Hardware updates



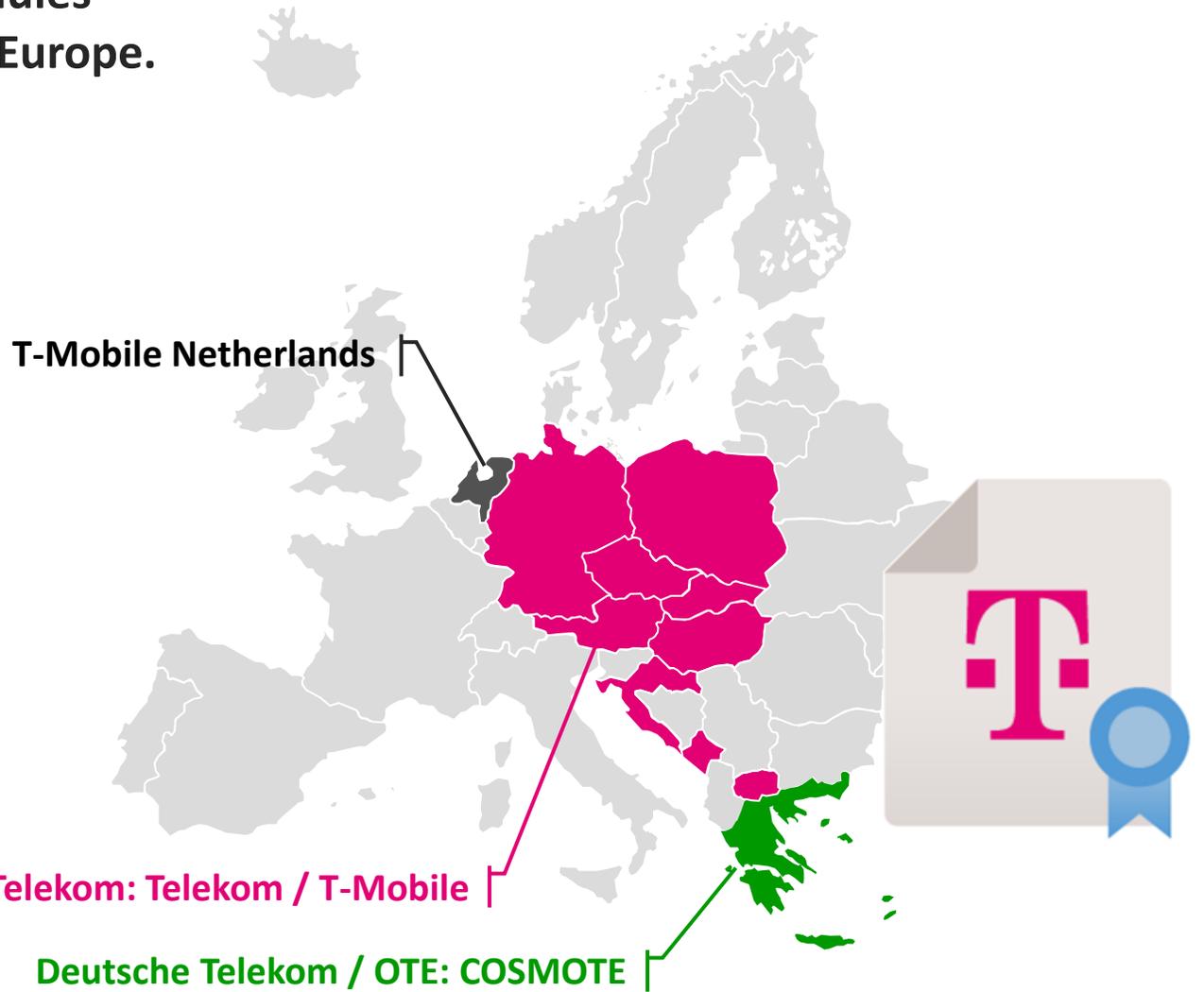
Which markets are covered by the DT Certification?

The DT Certification process for chipsets and modules covers multiple technologies and markets across Europe.

Technology	Countries Certified
5G-NR (NSA)	AT, CZ, DE, GR, HR, HU, NL, PL, SK, Campus
4G LTE	AT, CZ, DE, GR, HR, HU, ME, MK, NL, PL, SK
3G UMTS	AT, HR, HU, ME, MK, NL, PL
2G GSM	AT, CZ, DE, GR, HR, HU, ME, MK, NL, PL, SK
LTE-M eMTC	AT, DE, NL, HU (planned)
NB-IoT	AT, CZ, DE, HR, NL, PL, SK

 US: Not covered by DT Certification

-  AT
-  CZ
-  DE
-  GR
-  HU
-  ME
-  MK
-  NL
-  PL
-  SK



Supplier inputs to start DT Certification

DT Certification for Mobile IoT (NB-IoT, LTE-M) and 5G are free of cost.

For 4G/3G/2G and VoLTE, please contact the DT Certification Program for a quote.

Hardware

- 1-2 modules or chipsets with latest firmware
- 1-2 evaluation kits (EVK) to mount and connect the modules/chipsets
- Antenna connectors (if not standard SMA)
- Accessories if required (e.g., special trace cables, audio connectors, switches etc.)
- Power supply if not standard USB (mini/micro/...)

Software / Tools

- USB drivers for Windows OS
- Flashing tool to upgrade firmware if necessary
- Trace tool to analyze at least layer 3 radio messages (RRC, NAS)

Documentation

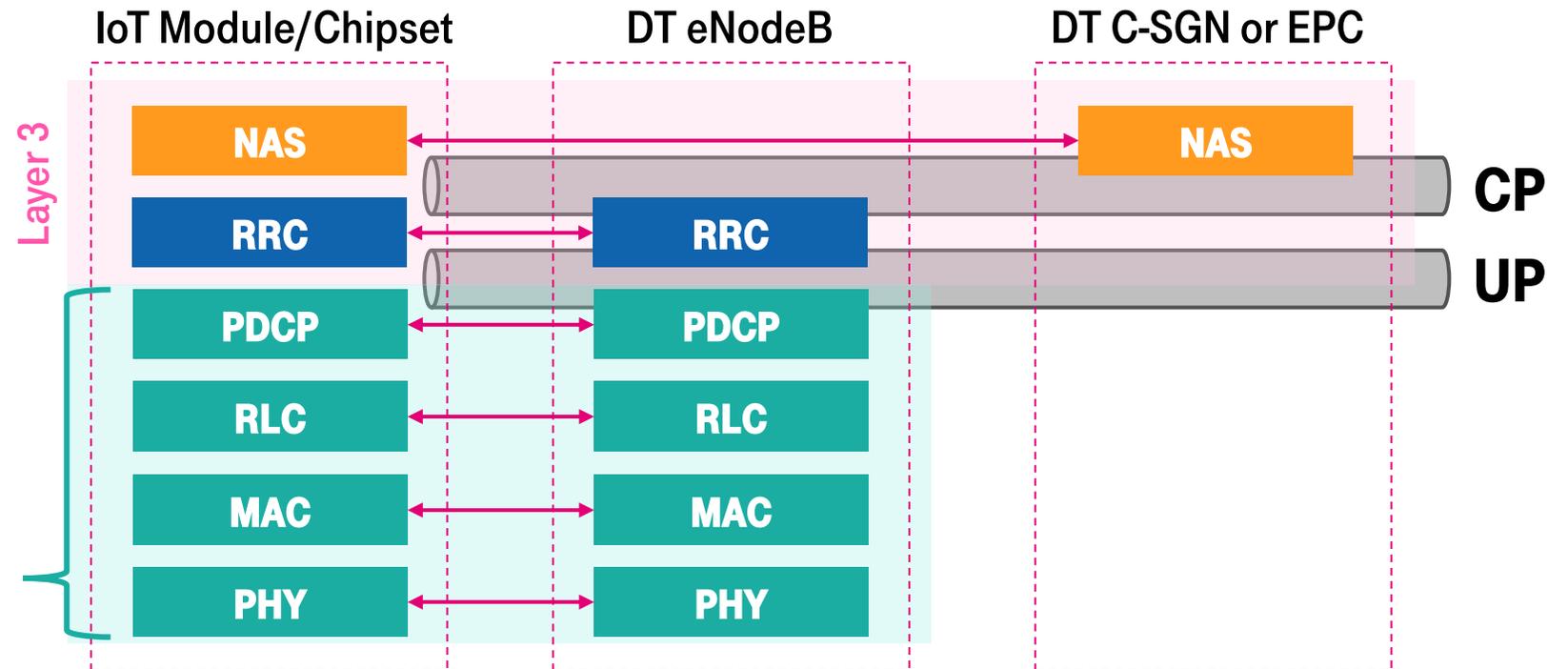
- Chipset/module product description (3GPP release, supported bands, UE categories, etc.)
- Firmware release notes / known issue lists
- AT command reference (3GPP and proprietary)
- Evaluation kit set-up guidelines
- Firmware flashing guidelines
- Logging/tracing guidelines



DT Certification focus area

DT Certification focuses on Layer 3 procedures, as well as overall device performance. Unlike most European operators, DT does not require module suppliers to present GCF certification. Chipset providers submit evidence that they pass GCF test cases for Layers 1-2.

C-SGN: CloT Serving Gateway Node
CloT: Cellular Internet of Things
eNB: Evolved Node B (LTE Base Station)
EPC: Enhanced Packet Core
MAC: Medium Access Control
MME: Mobility Management Entity
NAS: Non-Access Stratum
PDPC: Packet Data Convergence Protocol
PHY: Physical Layer
RRC: Radio Resource Control



Example: 4G stack (NB-IoT without User Plane, UP)



Where and how is DT Certification performed?

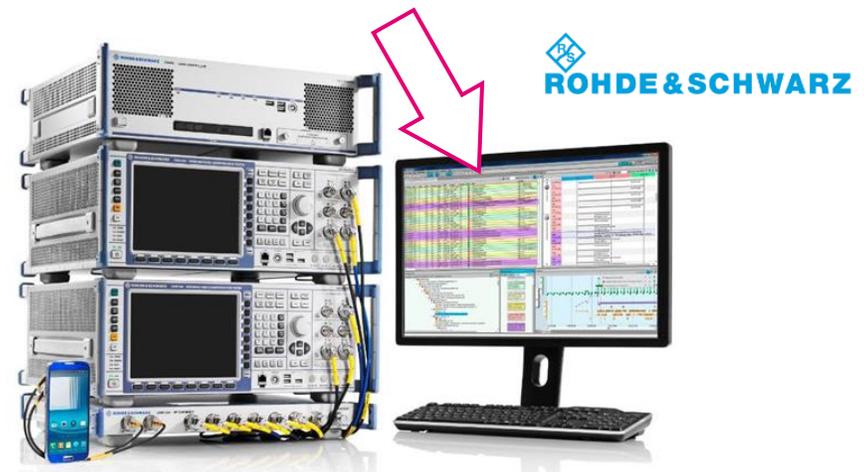
We validate the E2E interoperability of IoT chipsets/modules against multiple DT radio and core network configurations deployed across Europe.

Reference Environment



DT operates instances of its RAN/EPC/5GC networks at its Group Test Facility in **Germany**. Our facility in **Poland** can also patch into this environment.

Simulated Networks



Rohde & Schwarz CMW500 units are also employed to simulate negative scenarios, as well as to emulate complex scenarios involving cell reselection, access barring, etc.

IoT chipset/module DT Certification criteria

[Chipset Supplier] Full Certification

- GCF internal test results delivered with no major issues
- ¹GSMA TS.34 **Radio Policy Manager** implemented
- No showstoppers found on Layer 3 interoperability for DT radio/core networks
- No performance issues in latency, throughput and power consumption

[Chipset Supplier] Limited Certification

- GCF internal test results delivered with no major issues
- ¹No GSMA TS.34 **Radio Policy Manager** implemented:
 - **Volume limit of 10K units per IoT application**
- No showstoppers found on Layer 3 interoperability for DT radio/core networks
- No performance issues in latency, throughput and power consumption

Firmware exhibiting showstoppers on Layer 3 interoperability or serious performance deviations in latency, throughput, or power consumption are not certifiable

¹ RPM is not required for LTE MBB and 5G SA/NSA chipsets and modules

[Module Supplier] Full Certification

- **GCF certification** available
- ¹GSMA TS.34 **Radio Policy Manager** implemented
- No showstoppers found on Layer 3 interoperability for DT radio/core networks
- No performance issues in latency, throughput and power consumption

[Module Supplier] Full Certification

- **GCF certification** available
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- No performance issues in latency, throughput and power consumption



What value does DT deliver in a chipset/module certification?

What does a vendor receive once their chipset or module is DT-certified?

- **DT Certification Letter**
- **DT Certification Report** (issues documented, work-arounds, performance analysis)
- **DT Product Management** (DT Group) is informed about certification, specs, and USPs
- Listing in Deutsche Telekom's online list of [Certified IoT Chipset/Modules](#)

IMPORTANT: DT SIM contracts require customers to only use of DT-certified chipsets/modules

How does a customer benefit by using DT-certified chipsets or modules?

- **Time-to-market** improved for their IoT projects
- Qualification of IoT devices using DT-certified module for **promotion in DT's [Hardware Ecosystem](#)**



Frequently asked questions: Modules & chipsets

DT-certified wireless communication chips enable Best Connectivity

Is use of a DT-certified module on DT networks mandatory?

- **Yes.** DT tariffs require customers to use [DT-certified modules](#). These are proven to work well on our networks¹. We have the largest portfolio of certified, commercially-available IoT modules. There are 300+ to choose from!

Where can I find the latest list of certified modules?

- **Online.** We regularly update our catalog to show you the latest snapshot of certified modules. If you want to learn more about specific details (e.g., firmware version), please download the most recent, [detailed overview](#).

Isn't the GCF-certification of modules good enough?

- **No.** From experience we know that GCF does not prevent most of the critical interoperability issues we find.

Can DT help me with integration questions?

- **Yes.** We know each and every one of our certified modules, in-and-out. Many important workarounds exist for a smoother integration and improved interoperability. We also study their performance, in-depth.

Interested to learn more? Visit our [online pages](#) on certification processes or [contact us](#)!

¹ DT-certification covers: **DT Group** (Austria, Croatia, Czechia, Germany, Greece, Hungary, Montenegro, North Macedonia, Poland, Slovakia) + **T-Mobile Netherlands** + **1NCE**

Frequently asked questions: Modules & chipsets

DT-certified wireless communication chips enable Best Connectivity

Which technologies does DT's chipset/module certification process cover?

- **We focus on standardized 3GPP™ technologies:** Mobile IoT (NB-IoT, LTE-M), 2G, 3G, 4G (including Mobile Broadband), VoLTE, and 5G New Radio. There's a dedicated certification for 5G/4G Campus private networks.

Do you certify chipsets?

- **Chipsets are regularly DT-certified.** For 2G, 3G, 4G, and 5G, most certification activities focus on modules. Mobile IoT chipsets, however, are always certified in advance before we start testing all corresponding modules.

Do some products on your certified module list include global-band support?

- **Yes.** Many **DT-certified modules** support global bands, and can operate in the Americas, Asia, Oceania, the Middle East, and Africa. You can use the "Module Selection Guide" on our catalog to filter for other key features.

Are DT-certified modules also certified for T-Mobile US, or vice versa?

- **No.** T-Mobile US and Deutsche Telekom (Europe) have separate certification processes.

Interested to learn more? Visit our [online pages](#) on certification processes or [contact us](#)!



Frequently asked questions: Modules & chipsets

DT-certified wireless communication chips enable Best Connectivity

I want to use a module that DT hasn't certified yet. What should I do?

- **5G, 5G Campus, Mobile IoT (NB-IoT / LTE-M):** Our program certifies new access technology modules for free. Please contact us to let us know about your needs. There's probably a good chance that we're already working on it!
- **4G (incl. MBB), 3G, 2G:** These technologies are tested and certified upon request, as an affordable paid service. You can find our comprehensive certification service offering online, or under the following links:

4G LTE Mobile Broadband (Cat.6+)

4G Voice over LTE (VoLTE)

4G LTE Cat.1/1bis – Cat.4

What do I do if a specific DT-certified module is not certified yet for DT's private networks?

- **Campus:** We can certify 4G IoT modules for use on DT private networks upon request, as a very affordable paid service. 5G modules get automatically certified for DT private networks at no cost to you.

Interested to learn more? Visit our online pages on certification processes or contact us!



Where can I find DT-certified modules & compatible devices?

The screenshot shows the 'HARDWARE' section of the IoT Hardware Ecosystem website. A 'Hardware Selection Guide' modal is open, providing a checklist of technical specifications. The guide includes a 'Need help?' link and a 'Module Selection Guide' button. The main page lists various IoT modules from manufacturers like Advantech, Al-Link, Astrocast, Cheerzing, Compal, and Fibocom. A specific product, the Fibocom FG621-EA, is highlighted with a 'Volte' logo and a list of features.

Hardware Selection Guide

Choosing the right hardware is critical to ensure proper performance, quality and regulatory compliance during deployment. Please consider these factors:

Technical Specification:

- Thermal sensor
- 5G-NR (New Radio) support
- 4G (LTE) support
- 3G (UMTS) support
- 2G (GSM) support
- 3GPP Rel.14 support
- WiFi Hotspot
- LwM2M support
- DTLS 1.2 support

Volte

- LGA form factor wireless communication module
- LTE-FDD/LTE-TDD/WCDMA support
- The high speed Cat.6 module can reach up to 400Mbps DL and 50Mbps UL
- It can be widely used in CPE and STB gateway industry
- Can cover EMEA/APAC/Australian mobile networks

Visit our IoT Hardware Ecosystem
(hardware.iot.telekom.com)

DT-certified modules:

<https://hardware.iot.telekom.com/Hardware/Modules>

Public network-compatible devices:

Partner devices integrating DT-certified modules

<https://hardware.iot.telekom.com/Hardware/>

Campus network-compatible 5G & 4G devices:

Partner devices integrating DT-certified modules for private networks

<https://hardware.iot.telekom.com/Hardware/Applications?id=36>



Where can I find DT's functional/technical IoT requirements?

LEARN

SOLUTION GUIDELINES

Design more efficient IoT solutions!
In order to help customers and partners bring more resilient products to our networks, we've compiled guidelines to assist during their development. These represent industry-best practice and lessons learned from past deployments.

- Connectivity
- Communication Efficiency
 - Documents
 - IoT Solution Guidelines - No Harm to Network Communication Efficiency EN v2.6**
 - IoT Solution Guidelines - No Harm to Network Kommunikationseffizienz DE v2.6
 - IoT Solution Guidelines 2.6 - No Harm to Network Compliance
 - GSMA IoT Connection Efficiency Guidelines

<https://hardware.iot.telekom.com/Learn/SolutionGuidelines>

Visit our IoT Hardware Ecosystem
(hardware.iot.telekom.com)

5G requirements:

<https://hardware.iot.telekom.com/LoadDocument/4535/iot%20Solution%20Guidelines%20-%205G%20for%20IoT%20Connectivity%20EN%20v1.1.pdf>

VoLTE requirements:

<https://hardware.iot.telekom.com/LoadDocument/2665/iot%20Solution%20Guidelines%20-%20VoLTE%20for%20IoT%20Connectivity%20EN%20v1.2.pdf>

“No Harm to Network” requirements: (English Version)

<https://hardware.iot.telekom.com/LoadDocument/1395/iot%20Solution%20Guidelines%20-%20No%20Harm%20to%20Network%20Communication%20Efficiency%20EN%20v2.6.pdf>

(German Version)

<https://hardware.iot.telekom.com/LoadDocument/2174/iot%20Solution%20Guidelines%20-%20No%20Harm%20to%20Network%20Kommunikationseffizienz%20DE%20v2.6.pdf>



Your feedback is important to us!

Please contact us if you have any questions.

We are glad to help!



Deutsche Telekom IoT
connect. digitize. get ahead.

IoT Technology

THANK YOU

