

Option[®] services for embedded modules

Enabling your device with WWAN connectivity



About Option

Option, the wireless technology company, is committed to bringing mobile broadband solutions to market that can help you acquire new customers, retain your existing ones and enable reductions in supply chain and customer support costs.

A pioneer in wireless data communications since 1986, Option is headquartered in Leuven, Belgium. Our Research & Development is carried out in Leuven. Our specialist software development team is located in Augsburg, Germany, while our ISO 9001 production engineering and logistics facility is based in Cork, Ireland. We also have sales offices in Europe, US, Asia, Japan and Australia.

For more information visit www.option.com.

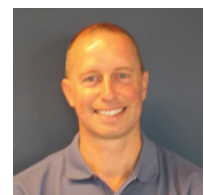


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2. Introduction

Option® offers a complete portfolio of services from design, manufacturing and integration up to certification of embedded modules and devices. These services facilitate wireless 3G integration in a wide range of mobile broadband enabled devices such as the traditional laptops and netbooks, but also e-readers, MID's, portable navigation devices and cameras.

This document intends to give an overview of the different services Option can offer to its customers that want to bring mobile broadband enabled devices to the market.

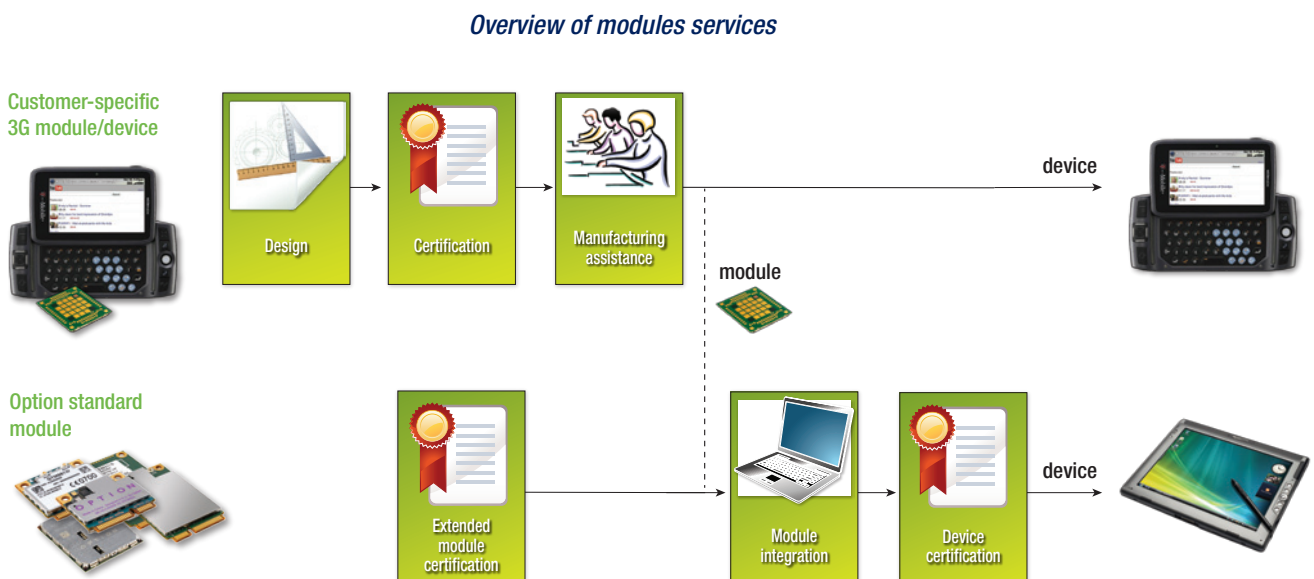
Some of the services described here after are standard and offered free of charge when purchasing a sufficient amount of modules from Option. Other services can be offered against a certain fee.

For more detailed information about our embedded 3G services, please contact services@option.com.

For more sales information, please contact sales@option.com.

3. Overview of Option® modules services

Whether you are looking for a partner to design a custom made 3G device or wish to integrate an existing Option module into your device, we can leverage the knowledge of our technical experts and good understanding of customers' needs to provide just the right solutions.



4. 3G Design, certification & manufacturing Services

With over 20 years experience as a global leader in wireless technology, Option® can offer you the right expertise, equipment and tools to assist you with the design, certification & manufacturing of your own custom 3G module or device. Although the remainder of this chapter talks about modules only, the same service tasks can be performed to create any 3G-enabling or 3G-enabled device whether it is a USB stick, a PCI Express module or even the full system board of a smartphone.

4.1. 3G Design

- As a first step in the 3G device design process, we can assist you in defining detailed **specifications**, based on our market knowledge and capability to translate your customer's expectations into technical specifications.
- To validate your **business case**, a transparent costing proposal containing a detailed COGS estimation (Cost of Goods Sold) and overview of the projected NRE cost (Non Recurring Engineering) is typically the next step.
- After validation of the business case, we can continue with a detailed **design proposal and project plan** with timelines and milestones, including software configuration of firmware & drivers.
- After schematics and layout phase, a more detailed **BOM cost** (Bill of Material) can be calculated, in coordination with your manufacturer who will need to buy the components for mass-production and therefore needs to approve Option's choice of components.
- The required components will be ordered after which the first prototypes can be created for **EVT** (Engineering Verification Tests). Based on the test results, improvements can be implemented, leading to a second batch of prototype that are tested in the **DVT** phase (Design Verification Tests). This leads to a third batch for the final **PVT** phase (Production Verification Tests). This batch is typically used for the various certification tests that are needed.

Typical module design timeline



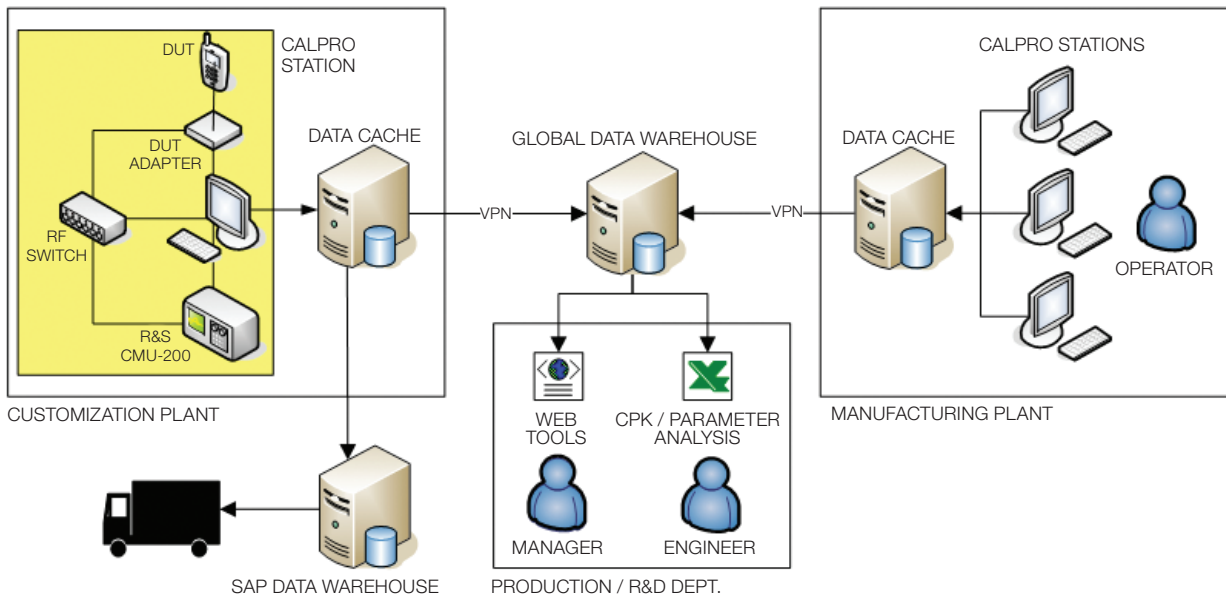
4.2. 3G Certification

- In order to be approved for introduction into the market, 3G devices need to pass 3 sequences of tests
 - > Regulatory approvals are needed for the countries where the device will be used. CE approval (for Europe) and FCC approval (for US) are done by default, but other countries can be covered on request.
 - > Telecom industry approvals are typically required. For Europe this is regulated by GCF (Global Certification Forum), for the US by PTCRB (PCS Type Certification Review Board). Other specific certifications can be requested if other regions need to be addressed.
 - > Operator-specific tests may be required before an operator will allow the device to be sold for operation on their network. Some of these operators (like DoCoMo and AT&T) require specific features in the firmware. Option can implement these features on request, therefore it is important to specify in advance which operators are targeted.

4.3. 3G Manufacturing

- While Option® can perform the manufacturing of the EVT, DVT and PVT builds, at the moment of market introduction production needs to be transferred to your manufacturer of choice. This manufacturer needs to take over the procurement of the components required to build the 3G device and setup a production line for the manufacturing. Option has experience with every step of this process and can assist if desired.
- Option has developed a state-of-the-art production monitoring, customization, calibration and testing software suite called CALPRO. CALPRO is used to streamline the entire production process which allows the device to be manufactured, calibrated and tested in high volume with high yield. If not available yet in your factory of choice, Option can additionally lease specialised radio testing equipment to be used in combination with the CALPRO suite.
- Since yield is the most important factor for controlling the cost of the finished goods, Option can share its experience to bring the yield to the highest achievable level by analyzing test failures (running CALPRO in manual mode) and making small improvements to the design and/or production process where needed.

Typical CALPRO-based setup of production process



5. Integration Services (for modules only)

When a module has passed all required certifications, it is ready to be integrated into the mobile broadband enabled device that you wish to bring to market. Both from a hardware as well as from a software perspective, certain services are offered by Option®.

5.1. Hardware integration

5.1.1. Pre-integration services

Before a module can be integrated into the device, the device itself needs to be prepared to accept the module.

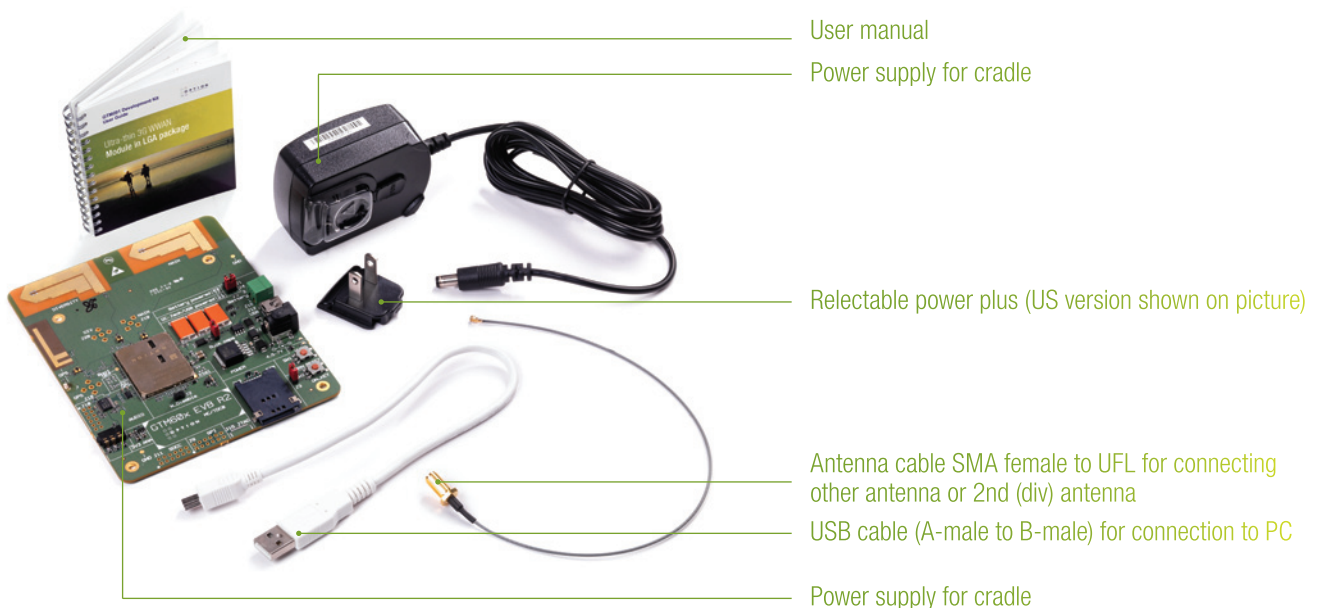
- First step is a full review of the device itself to select the optimal module
 - > Regions where you want to sell your device
 - > Operator(s) you target in these regions
 - > Type of device you want to bring to the market and key design considerations (super-thin or ultra-low-power, Android and/or Windows® 7, ...)

Option has many years of experience in assisting its customers with device reviews. Based on careful analysis, the optimal module is selected.

- After selection, the first connection tests can be started. There is a development kit for each module in Option's portfolio. This kit makes it possible to connect the module to the device by using a standard USB cable. By doing so, the manufacturer can setup a 3G connection for the device without physically inserting the module.

The module development kit contains following parts:

- > Evaluation board with module, power supply and SIM card holder
- > Antenna cable that can be connected to the evaluation board
- > USB cable to connect the evaluation board to the device
- > Detailed manual



6. Software customization Services

Since software is easier to customize than hardware, the list of available software customization services is long.

- Customization of firmware to support desired operation. Typical examples are the support of a specific A-GPS server or the integration of specific features such as CBS (Cell Broadcast System).
- Customization of firmware flashing application. When the firmware is present in the module and you want to allow your end-customer to upgrade the firmware, a flashing application needs to be present on your device. This application can be customized as well to your desired look-and-feel.
- Customization of driver package to support a certain feature or specific operating system(s).
- Customization or extension of the RIL package. Typically not all functions in the RIL have been implemented, because there was no perceived need for these functions.
- Customization or extension of the functions available in the SDK. Also for the SDK it can occur that a function you desire is not present yet and needs to be added.
- Customization of the user interface of *uCAN*[®] Connect, our connection manager software. *uCAN*[®] Connect offers very powerful skinning capabilities, and can even change skins automatically (based on the SIM that was inserted).
- Customization or integration of dashboard applications, such as integration of WiFi, Bluetooth, GPS control, Wifi offloading etc.

This list is just a selection of the possible customizations. A detailed list with customizations is available on request.

7. Extended module and device certification Services

It is practically impossible to certify a module in all countries and with all operators. However, devices that are planned to be launched in a country and/or with an operator for which module approval has not yet been achieved, might face an easier approval process if the module was approved first, depending on that country's regulations or operator's guidelines. After such module approval, device approval usually consists of a delta approval only – an easier and faster process.

7.1. Extended module certification services

- When Option's module is not approved yet in the target country where you want to launch your device, Option can perform the full approval process.
- The same service extends to Mobile Network Operators. Also here some operators have specific test requirements or demand the availability of certain features in the software. Option has worked with all major MNO's and can again offer its valuable experience to fulfill specific requirements.

7.2. Device certification services

Even when all module approvals have been achieved, you will not be able to launch your device without additional certifications. The reason is that module approvals are typically done with modules in development cradles and with standard antennas. Devices have a different module encapsulation which changes the radiation characteristics and uses different, often customized antennas, again impacting the cellular transmission characteristics. Additional measurements on this customized hardware are therefore unavoidable.

The required certifications are multiple:

- > Telecom industry approvals (PTCRB, GCF, JATE etc)
- > Regulatory approvals (FCC, CE, etc)
- > Operator approvals (AT&T, DoCoMo, Verizon, T-Mobile etc)

Option is your perfect partner to take over this certification task partly or entirely, by performing tests on your device before presenting it for certification, saving costly lab access.

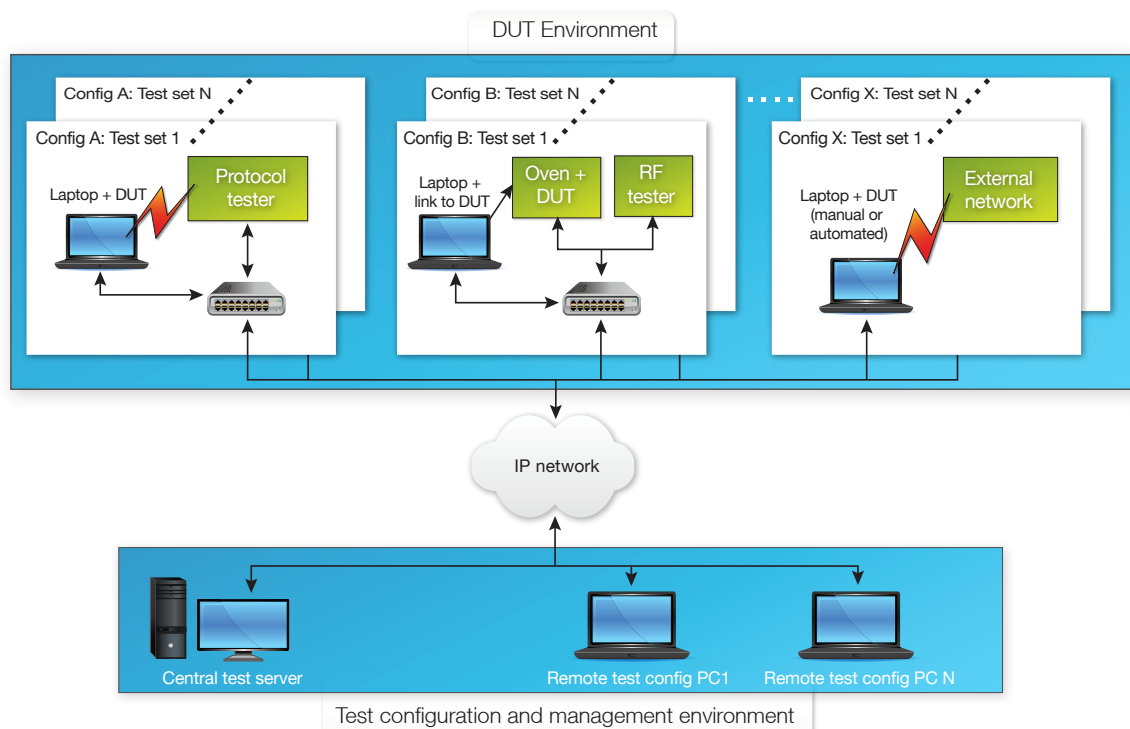
7.3. Device Field Testing services

A good user experience is every device manufacturer's primary concern.

Because of the nature of 3G communication, the situation is different in every area in the world. So no matter how well you prepare your device for communicating over the 3G network, it is best practice to include some live testing in the field as well.

Imagine selling a Personal Navigation Device with embedded 3G module for live traffic updates. Are you sure the connection will not drop when travelling in Europe from Germany into Austria, over the Alps into Italy? Option has sent its engineers all over the world with their backpacks filled with laptops and other connected devices, buying local SIMs, driving local cars and measuring the connectivity performance under various and often extreme conditions. With a specialised program called OATS (Option Automated Test System), the field trial process of hardware and software can be simplified, reproduced, analysed and stored in a central database location over the web with the GPS coordinates of the test location. Interfacing with protocol tester, RF tester and live network can be compared.

Option's automated test system



8. After Sales Support Services

Option®'s involvement does not have to stop after your device has been sold to your customer.

The following after-sales services are offered:

- Warranty on module design and manufacturing issues for the agreed period. This is typically 12 months + 3 months integration time, can be extended up to 3 years.
- Support for on-site quality monitoring and module debugging.
- Development of failure analysis tools and flowcharts.
- Detailed RMA analysis of customer returns.

9. Conclusion

Option® has a large amount of experience delivering services that bring mobile broadband connectivity to your device, whether this involves designing a customized module, a wirelessly enabled system board or integrating an existing Option module.

When the desired development approach is selected, Option can further assist with the integration and certification tasks when you need to bring mobile broadband enabled devices to market.

Whether you are looking for full project management or highly customized individual services, Option is the right choice.

The information presented in this document can serve as a first guideline on the portfolio of available services. For more detailed information about our module services capabilities and the exact commercial terms for these services, please contact services@option.com.

For more sales information, please contact sales@option.com.

