NB-IoT field-to-lab testing with R&S®CMWcards

R&S®CMWcards, an intuitive and user-friendly software application, makes it possible to recreate field testing in a lab environment.

Your task

Narrowband IoT (NB-IoT) is a low power wide area network (LPWAN) radio technology initially standardized by 3GPP in Release 13. It operates in a limited bandwidth of 200 kHz and can be deployed in three operating modes: standalone, guard band and in-band. NB-IoT provides services that span various vertical industries, e.g. logistics tracking, smart home, smart city, etc.

Outstanding indoor coverage even under poor radio conditions, reliable mobility performance and minimum power consumption are just a few of the key performance indicators of NB-IoT modules.

It is essential to thoroughly verify the performance of the NB-IoT module in various mobile operator networks before product launch. Sometimes it is even necessary to conduct benchmarking tests to ensure the market leading position of your product. Field tests play a very important role in this context.

Field tests enable users to test the module in real network environments, providing the necessary level of confidence in the functionality and reliability of the NB-IoT product. Issues seen during field tests are usually hard to reproduce due to the dynamic nature of real-world conditions. This makes it hard to verify fixes.

Rohde & Schwarz solution

R&S®CMWcards is a graphic test script creation tool that runs on the R&S®CMW500 and requires no prior programming knowledge. Just by setting up a hand of cards, you can create various signaling test scripts to simulate a variety of test scenarios and verify your device's protocol behavior. Each card comprises a predefined protocol procedure, yet is flexible enough to allow users to adjust the signaling parameters. The built-in error checking functionality of each card ensures the conformity of the signaling flows.

The field-to-lab (F2L) application works closely with R&S®CMWcards and allows users to reproduce the real network scenario in the lab environment. The majority of the field-related issues can then be investigated in a controllable, repeatable and deterministic way.

R&S®CMWcards with F2L is a powerful tool for verifying field behavior. It extracts the network configurations from the field logs and imports them into R&S®CMWcards to simulate the test scenario with live network configurations, including cell information, RRC and NAS messages.

It can replace specific layer 3 (L3) messages in the test script with the one from the field log in order to easily test how this L3 message content impacts module behavior.

Field RF conditions, e.g. RF power and quality, can also be extracted with optional synchronization with downlink messages and reproduced in the test script. In the future, it will be possible to extend the variable radio conditions to simulate the fading condition.

ROHDE & SCHWARZ

Application workflow

The figure below shows a typical use case of the R&S®CMWcards F2L feature for NB-IoT application.

❶ To debug a field test problem, first a field test log file is needed. This kind of log file can be obtained by a Rohde & Schwarz network scanner or captured via the UE traces.

❷ Feed the field log as input to the F2L application wizard. The wizard automatically analyzes the log file. Based on the analysis output, the user determines the network parameters and the L3 message contents that need to be further investigated.

❸ The F2L wizard generates a network profile that contains the network configurations, layer 3 messages and RF parameters extracted from the field log. The network profile is a set of cards where the parameters of each card are configured like those in the real network.

❹ Create an R&S®CMWcards test script that reflects the test sequence of your field test. For example, as shown in the script below, the NB-IoT DUT registered with user plane cellular IoT (cIoT) EPS optimization resumes the data connection on another NB-IoT cell after a radio link failure.

❺ Select the network profile created in step 3. The network profile will automatically replace the cards in the test script you created in step 4.

After step 5, the R&S®CMWcards test scenario simulates the live network conditions in a lab environment (R&S®CMW500).

The R&S®CMWcards and F2L combination offers a unique and powerful way to recreate and eventually resolve NB-IoT field test problems in the lab. This approach greatly increases debugging efficiency, optimizing your OPEX.

See also
www.rohde-schwarz.com/CMWcards

Outline of NB-IoT field-to-lab test concept
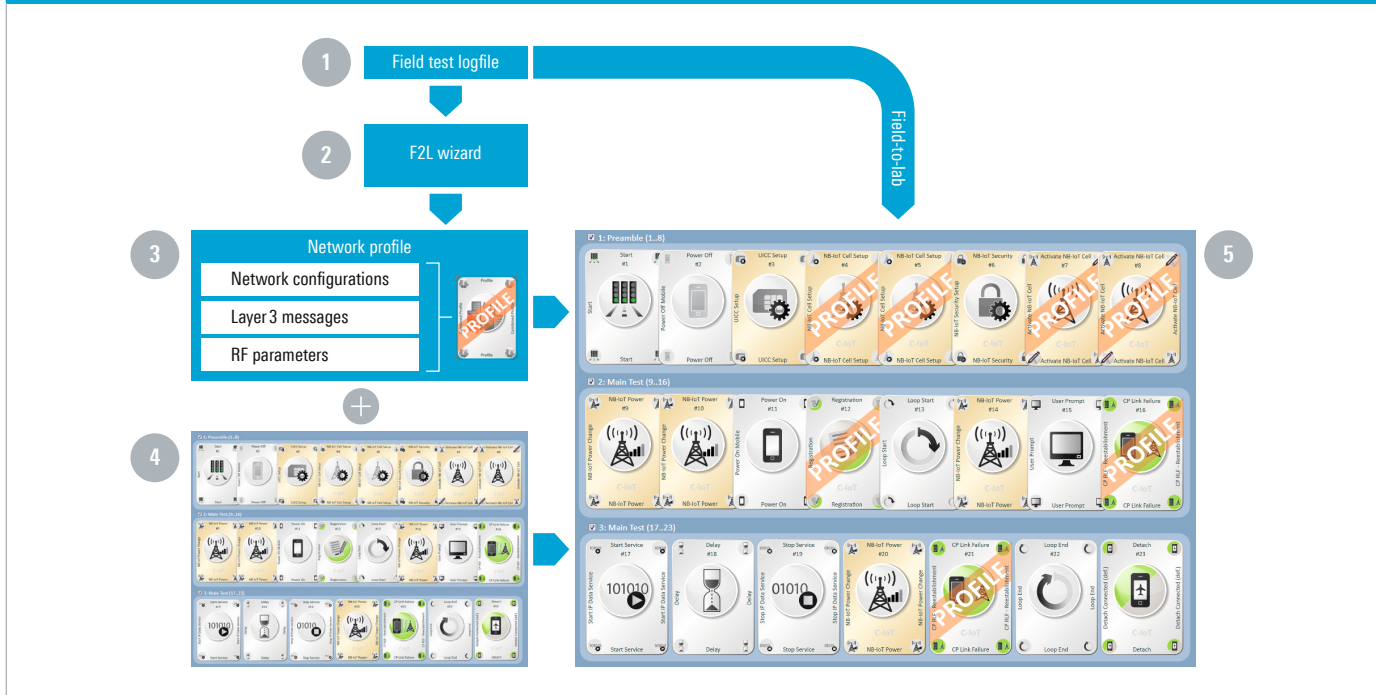
Designation	Type	Order No.
R&S®CMWcards framework	R&S®CMW-KP091	1211.0540.02
R&S®CMWcards	R&S®CMW-KT022	1207.9301.02
R&S®CMWcards advanced extension	R&S®CMW-KT026	1209.1750.02
R&S®CMWcards field-to-lab signaling extension	R&S®CMW-KT030	1211.2850.02
Field-to-lab power/quality extension	R&S®CMW-KT041	1532.5015.02

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