

eMBMS application tests with the R&S®CMW 500 and R&S®CMWcards

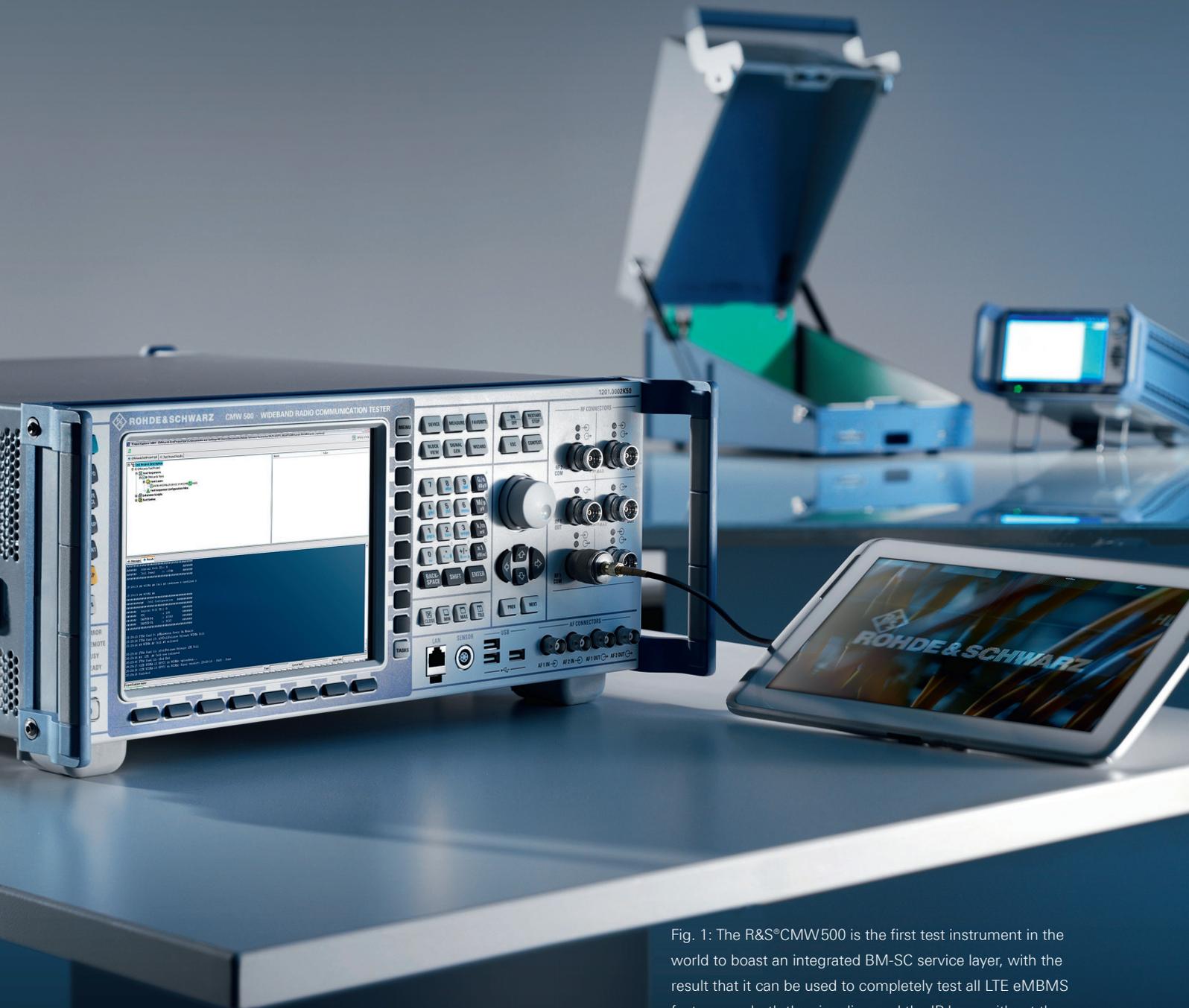


Fig. 1: The R&S®CMW500 is the first test instrument in the world to boast an integrated BM-SC service layer, with the result that it can be used to completely test all LTE eMBMS features on both the signaling and the IP layer without the need for additional test instruments.

New technical approaches are needed to address the heavy load placed on mobile networks by video on demand, video streaming and file sharing services. One solution specifically designed to broadcast video services to a large number of subscribers in LTE networks is the evolved multimedia broadcast multicast service (eMBMS).

Mobile network operators must also continually optimize their networks' air interface in order to handle the increasing data volumes resulting from services such as video broadcasting and file sharing in a spectrum-efficient and cost-effective manner and still provide good quality of service. One way to get the data glut under control is to supplement WLAN traffic offload [1] with the new eMBMS service for LTE networks (see box) standardized by 3GPP in Release 9 of the LTE specifications.

Rohde&Schwarz offers a UE test solution based on the proven R&S®CMW500 wideband radio communication tester (Fig. 1), a solution that includes all of the LTE network elements needed for comprehensive testing of the protocol layer (control plane) and eMBMS data services (IP user plane) (Fig. 2). Chipset and UE manufacturers as well as mobile communications providers can now quickly and efficiently test eMBMS devices in the lab – including eMBMS middleware and video apps.

An overview: evolved multimedia broadcast multicast service (eMBMS)

eMBMS allows mobile communications providers to broadcast the same content, such as sporting events, TV programs or films, to many users simultaneously – in the same or in different cells. This was achieved by adding new transport and logical channels to the LTE protocol stack (PMCH in the physical layer; MCH, MTCH and MCCH in layer 2), which reduces the load on conventional shared channels. At the higher protocol layers, the IP unicast protocol is replaced by the IP multicast protocol.

The LTE network architecture was also enhanced to include a broadcast multicast server (BM-SC), an MBMS gateway and a multicell coordination entity (MCE) for the cell parameters used on the logical and physical layers. To synchronously transmit the contents to all subscribers in one or more cells, MBSFN areas must be defined in which the affected cells are combined.

Many mobile communications providers are already working on implementing eMBMS in their networks. Initial field trials have been successfully completed and commercial eMBMS-based video offerings will be started in many countries this year.

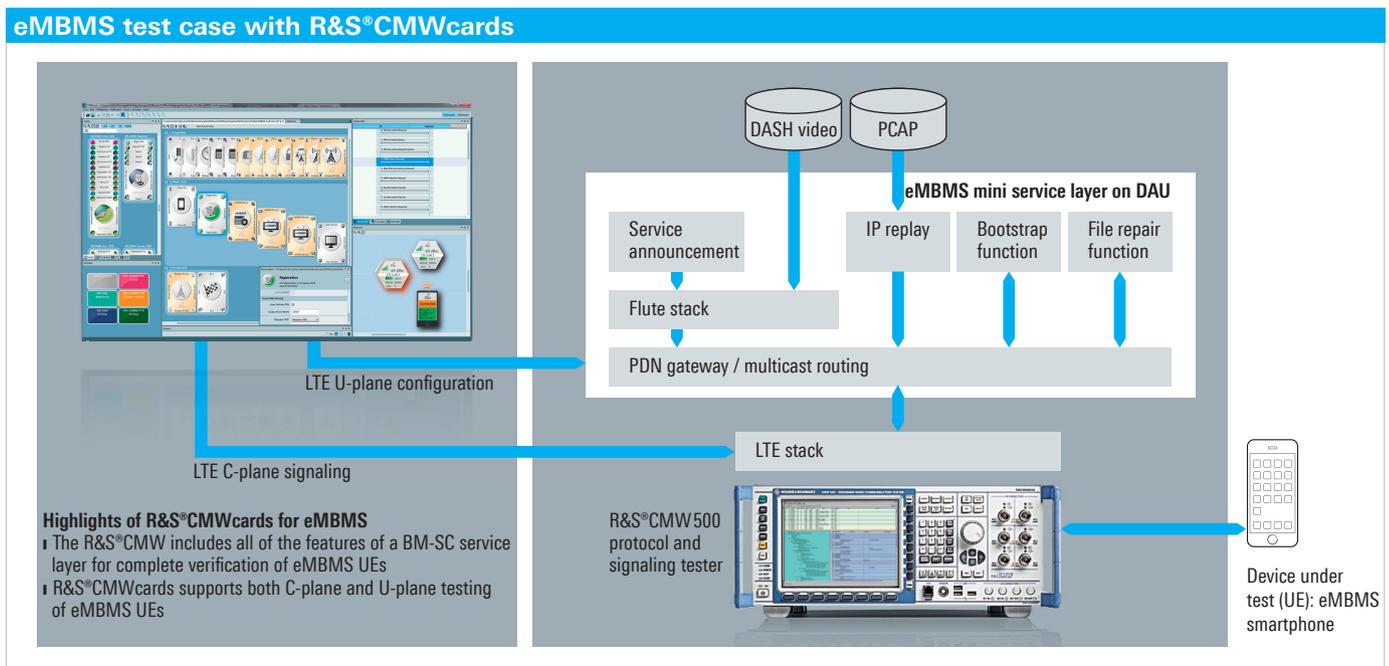


Fig. 2: The R&S®CMW500 with the R&S®CMWcards option – all you need for comprehensive eMBMS application tests.

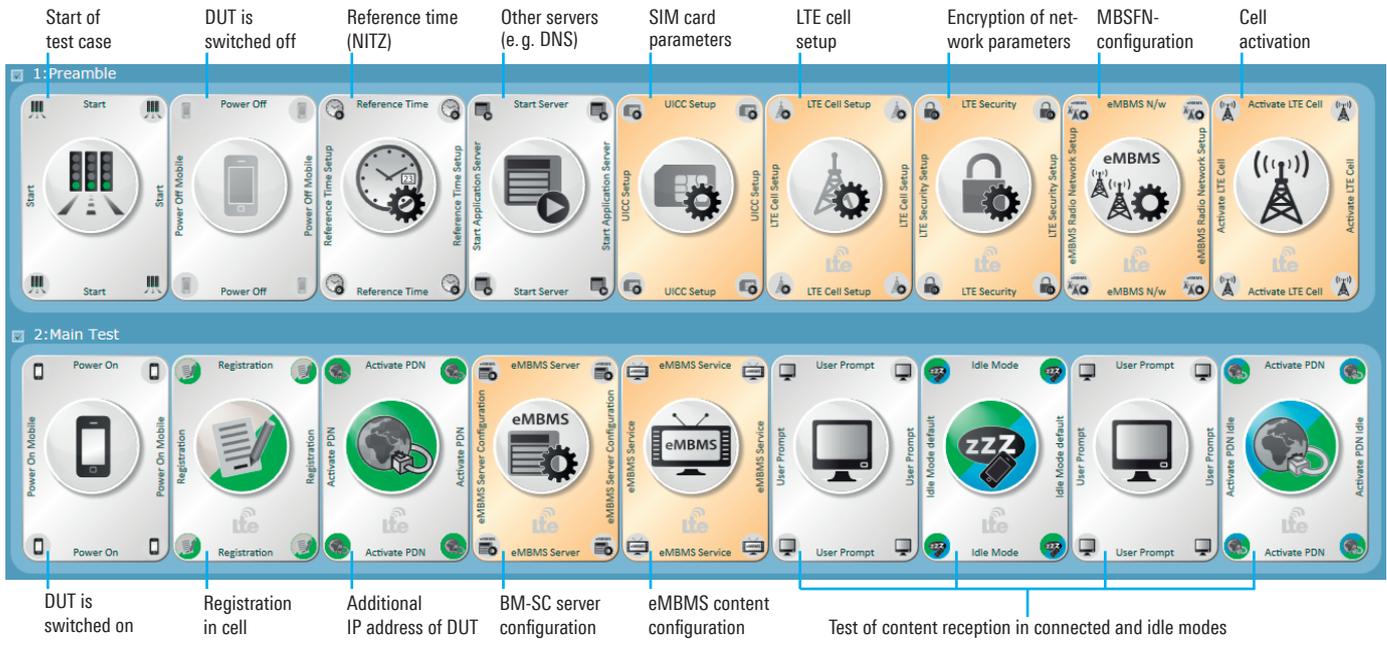


Fig. 3: R&S®CMWcards test case for eMBMS with one LTE cell.

The screenshot displays the R&S CMWcards software interface with several key components:

- Protocol Measurement Charts:** Shows LTE Throughput (Downlink/Uplink) and LTE BLER (Downlink/Uplink) metrics. The Downlink PHY throughput is 1946.27, and the Uplink PHY throughput is 5.51.
- Message Tree:** Shows a list of messages including EpsL3Message, RRCConnectionReconfiguration, PDCP SRB Control PDU, and AMD PDU Header.
- Parent Children:** Shows details for message ID 10683, including EpsL3Message, RRCConnectionReconfiguration, PDCP SRB Control PDU, and AMD PDU Header.
- Bitstream:** Shows the bitstream details for message ID 10683, including EPS Quality of Service (V), Access Point Name (LV), and PDN Address.

eMBMS protocol and application tests with R&S®CMWcards

The R&S®CMWcards graphical test case development tool for the R&S®CMW500 combines the LTE, WCDMA, GSM and WLAN tests into a single application. Now it can also be used for eMBMS protocol stack and application tests. The R&S®CMW500 is the only test platform in the world to offer a specifically designed eMBMS mini service layer on the data application unit (DAU, an integrated server in the R&S®CMW500), which provides all required eMBMS services.

Based on a playing cards metaphor, R&S®CMWcards abstracts the logical flow of a test case, from configuration of the LTE cells, definition of the reference time and configuration of the eMBMS services within the BM-SC to the signaling flow for UE cell registration and subsequent data transmission.

Fig. 3 shows an R&S®CMWcards test case with one LTE cell. After registering on the network, the mobile device receives one or more video streams in this cell, first in connected mode and then in idle mode. The user can configure up to two MBSFN area IDs, each with up to two LTE cells. This extends the test coverage to accommodate a wide variety of eMBMS use cases, including reception during cell reselections, handover and carrier aggregation as well as fading scenarios with many different fading profiles. The MBMS interest indication and MBMS counting procedures that were added by the 3GPP LTE RRC TS 36.331 specification are offered as separate cards and can be included in any eMBMS test case.

R&S®CMWcards comes with a wide variety of LTE eMBMS signaling and application tests, allowing users to immediately put a UE into operation and use it to quickly generate additional test cases.

Visualizing eMBMS measurements in R&S®CMWmars

The R&S®CMWmars graphical message analyzer aids in troubleshooting complex message protocols. Its powerful tools graphically display signaling procedures or signaling message flows between the UE and the R&S®CMW500 wideband radio communication tester, making them easy to follow [2].

For detailed analysis of LTE and WCDMA protocol layers 1 through 3, R&S®CMWmars was enhanced to include six additional graphical tools. These new analysis views and features such as CMWmars scripting are part of the R&S®CMW-KT023 CMWmars advanced extension software option, which combines the previous R&S®CMW-KT016 and R&S®CMW-KT017 protocol test monitor options. Key features include:

- Protocol measurement charts that graphically display the downlink / uplink data rates and block error rate (BLER) measurements for all protocol layers over time (Fig. 4)
- Monitor views that show configuration data and values measured on the PHY, MAC, RLC, PDCP protocol layers for every LTE and WCDMA cell simulated by the R&S®CMW500 wideband radio communication tester (Fig. 5)
- The RRC monitor view that displays layer 3 system information and radio bearer settings

In online mode, the protocol measurement charts and monitor views are updated in realtime during a test sequence, while in offline mode they are updated after the test is completed and a message log file is loaded.

For testing signaling scenarios and IP data streams, the R&S®CMWmars advanced extension graphically displays the eMBMS-specific measured values and data rates of each eMBMS flow /radio bearer separately for every MBSFN area (Fig. 6).



Fig. 4: R&S®CMWmars GUI: Protocol measurement charts graphically display the downlink / uplink data rates and BLER measurements for all protocol layers over time.

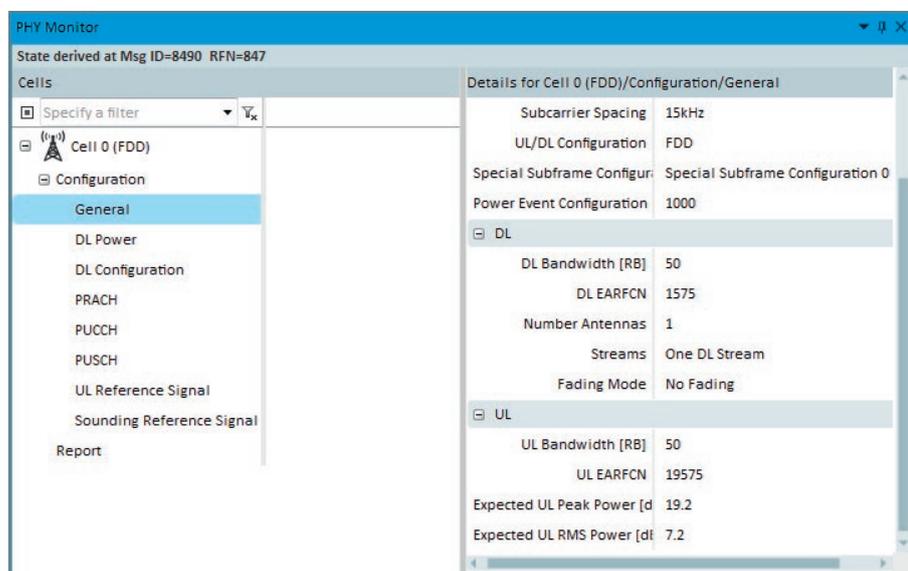


Fig. 5: Monitor views show configuration data and values measured on the PHY, MAC, RLC, PDCP protocol layers for every LTE and WCDMA cell simulated by the R&S®CMW500.



Fig. 6: For testing signaling scenarios and IP data streams, the R&S®CMWmars advanced extension graphically displays the eMBMS-specific measured values and data rates of each eMBMS flow / radio bearer separately for every MBSFN area.

Summary

The R&S®CMW500 wideband radio communication tester is the first test instrument in the world to boast an integrated BM-SC service area layer, with the result that it can be used to completely test all LTE eMBMS features on both the signaling and the IP layer without the need for additional test instruments.

Easy generation of LTE eMBMS test cases in R&S®CMWcards and the new R&S®CMWmars advanced extension graphical analysis tool greatly facilitate verification of eMBMS-ready smartphones, significantly reducing the time required for troubleshooting.

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References

- [1] WLAN traffic offload – bypass for crowded mobile networks. NEWS (2015) No. 212, pp. 10–15.
- [2] Now easier than ever: analysis of complex wireless protocols. NEWS (2014) No. 210, pp.10–13.