

# Conducted multi-standard in-device coexistence testing

## Automotive Infotainment Testing



### Challenges

One key feature of the connected car is its ability to connect to the outside world to provide passengers with information and entertainment. The car's head unit uses cellular and non-cellular technologies such as radio, satellite and broadcast RF links. Some of the RF standards that are supported in modern automotive infotainment devices are 3G, 4G, Bluetooth®, WLAN, DVB-T/DVB-T2, ATSC 3.0, DAB, DRM, SiriusXM Radio, AM/FM, GPS and GLONASS.

Hardware supporting completely different standards may be designed on the same chip or on multiple chips assembled side by side in order to fit into the car dashboard. From an RF point of view, some of the radio standards operate in very similar frequencies and need to be tested for coexistence issues. And the devices that passengers bring inside the car can cause complex interference scenarios.

### Your task

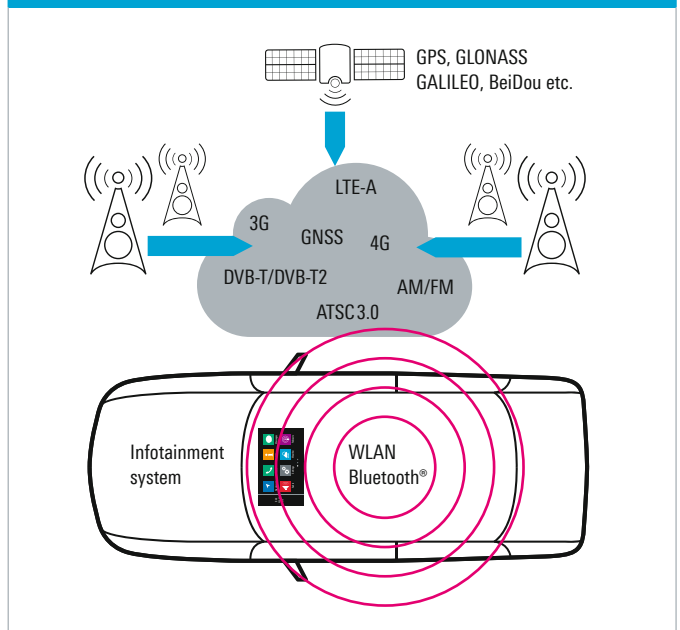
The RF standards have significant proximity and in some cases even overlap in spectrum. The most critical frequency overlaps are between Bluetooth® and WLAN, LTE or 3G with Bluetooth® or WLAN, and LTE or 3G with Digital TV (DTV). For LTE and 3G-WCDMA, only a few selected bands are simultaneously used in a given area. The implemented bands depend on region, country and government regulations. Infotainment devices, however, support an increasing number of bands.

Adjacent channel interference is another potential problem that needs to be considered. For bands located close to each other in the frequency spectrum, a wanted signal is degraded due to poor power control and/or inadequate transmit or receive filtering. Clearly, all supported standards need to function in all supported modes in real-world operation.

### Rohde & Schwarz solution

A simulated real-world scenario is required in the lab to perform conducted coexistence characterization. The proposed solution emulates such a scenario. It includes the R&S®CMW500 wideband radio communication tester,

### Real-world RF environment



the R&S®BTC broadcast test center and the R&S®SMBV100A vector signal generator. The R&S®CMW500 acts as a base station and simulates end-to-end links for 4G, 3G, WLAN, Bluetooth®, etc. The R&S®BTC generates real-world audio and video signals such as AM, FM, DAB/DAB+, DVB-T/ DVB-T2, ATSC, DRM and SiriusXM Radio. The R&S®BTC or R&S®SMBV100A provide SDARS satellite standards (SiriusXM) while the R&S®SMBV100A simulates GNSS signals such as GPS, GLONASS, BeiDou and Galileo.

#### R&S®CMW500 wideband radio communication tester

- Continuous frequency range up to 6 GHz
- Internal fading simulation
- Multitechnology solution
  - GSM/(E)GPRS
  - WCDMA/HSPA/HSPA+
  - LTE-A (FDD, TDD)
  - CDMA2000® 1xEV-DO Rev A, Rev B
  - TD-SCDMA
  - WLAN, Bluetooth®
- eCall/ERA-GLONASS
- In-device coexistence testing with other technologies

#### R&S®BTC broadcast test center

- Signal generation and DUT audio/video analysis in one instrument
- 2 RF output signal generators with frequency range up to 6 GHz
- Internal fading simulation
- HDMI™ and analog options supporting in-depth video and audio analysis
- Integrated audio player and multimedia generator
- Realtime signal generation for all global analog and digital broadcasting standards

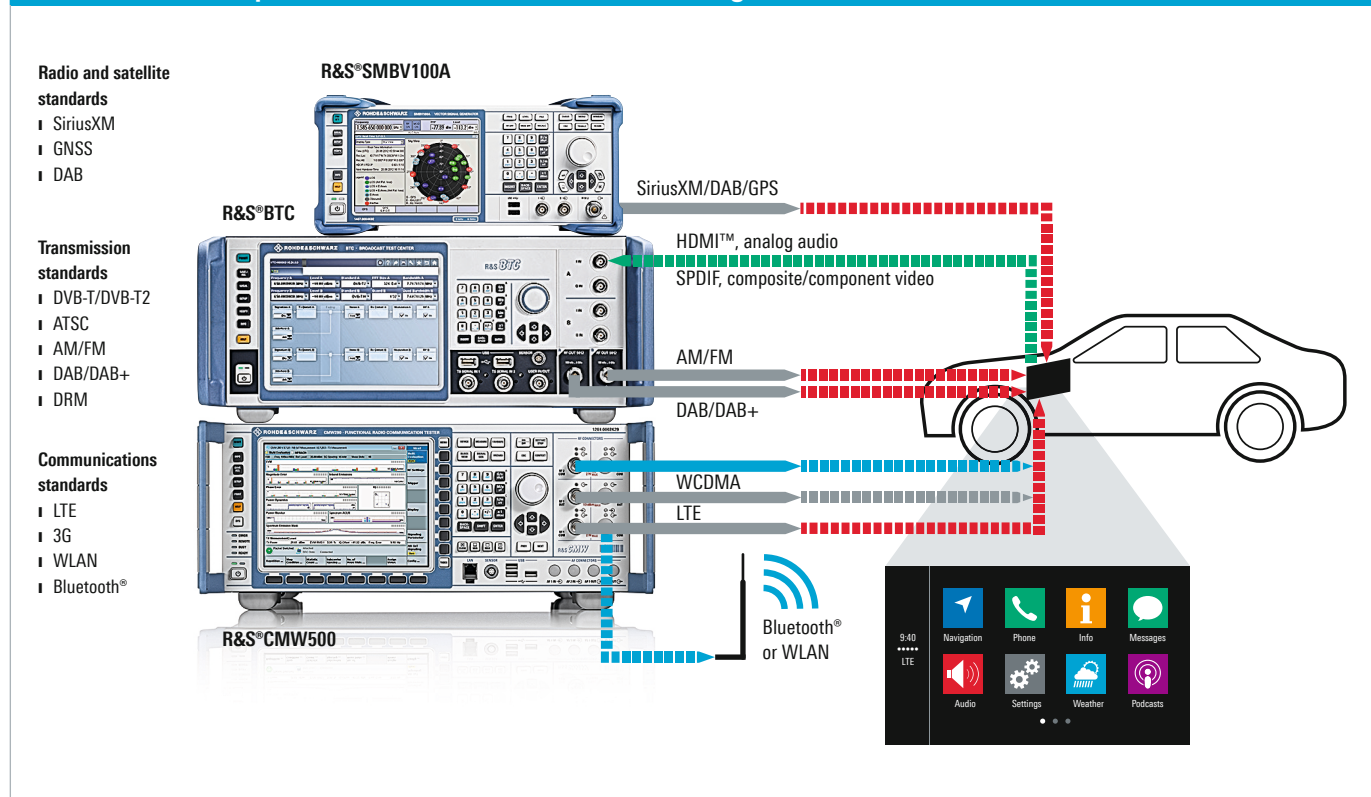
#### R&S®SMBV100A vector signal generator

- Continuous signal generation up to 6 GHz
- GNSS simulator
  - GPS, GLONASS, Galileo, BeiDou and QZSS/SBAS
- Baseband generator with realtime coder and arbitrary waveform generator (optional)
- ARB-only baseband generators (optional)

#### See also

[www.rohde-schwarz.com/appnote/1MA275](http://www.rohde-schwarz.com/appnote/1MA275)

### Measurement setup for conducted RF coexistence testing on infotainment devices



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