

# R&S® SMW200A VECTOR SIGNAL GENERATOR

The fine art of signal generation



Product Brochure  
Version 08.00

**ROHDE & SCHWARZ**

Make ideas real



# AT A GLANCE

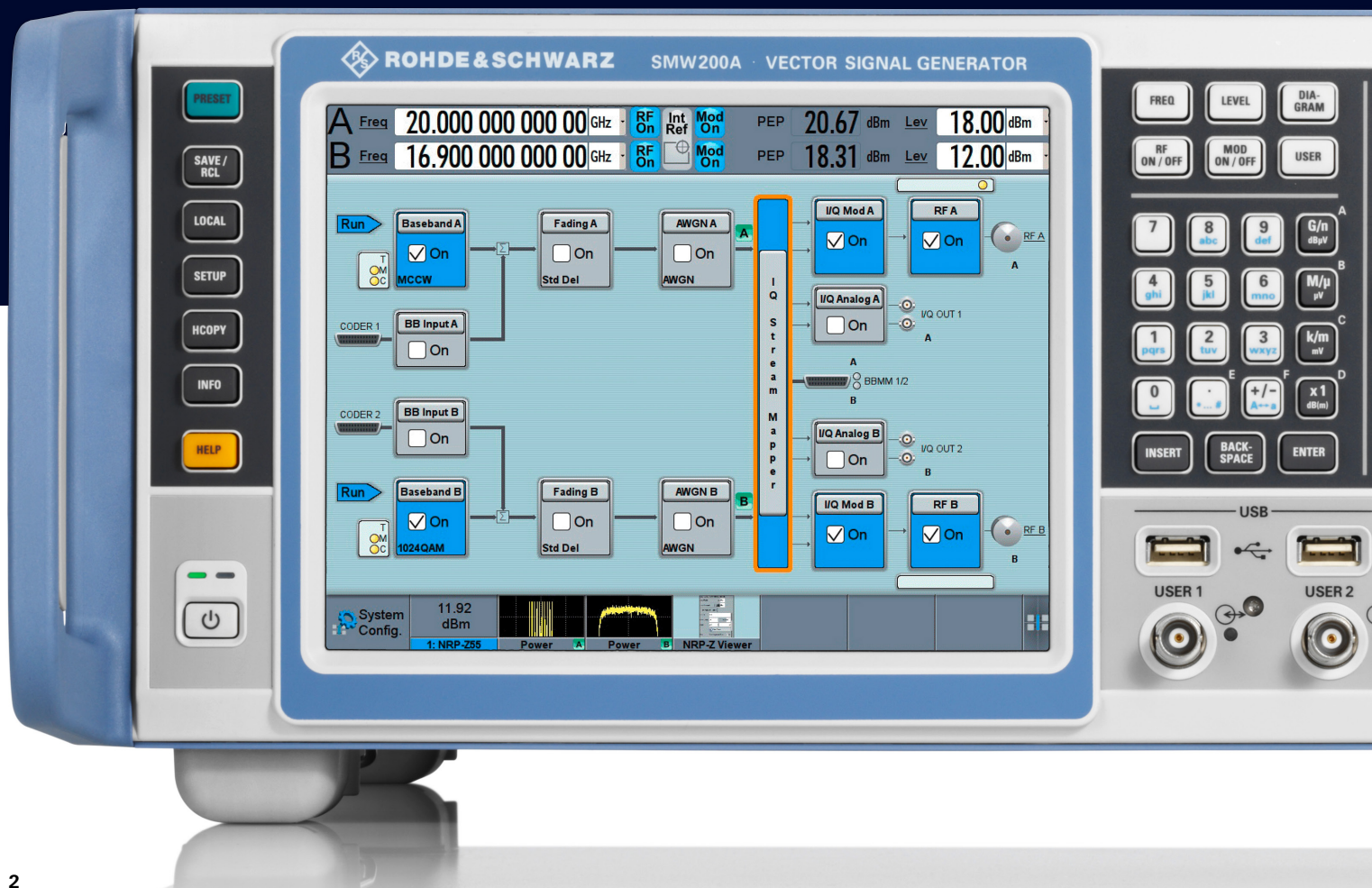
The R&S®SMW200A is the vector signal generator for the most demanding applications. As a result of its flexibility, performance and intuitive operation, it is a perfect tool for generating complex, digitally modulated signals of high quality.

The R&S®SMW200A is the ideal generator for digitally modulated signals required for the development of new wideband communications systems, the verification of 4G and 5G base stations or in the aerospace and defense sector.

The I/Q modulation bandwidth of up to 2 GHz with internal baseband satisfies fourth and fifth generation standards (e.g. 5G, LTE-Advanced and IEEE 802.11ac/ad), and the R&S®SMW200A is designed to meet future requirements. Its modular scalable architecture allows users to optimize the generator to their applications and to upgrade it as required.

A second RF path can be added, as well as a maximum of two baseband and four fading simulator modules – without compromising signal quality. As a result, the R&S®SMW200A can create signal scenarios that previously required multiple instruments or could not be implemented at all. From MIMO up to 8x8 and LTE-Advanced carrier aggregation including fading to multistandard radio – never before has an instrument offered such high class signal generation capability.

If more than two RF paths are required, additional R&S®SGMA signal generator modules can be connected. The intuitive, touchscreen based operating concept provides the user with an overview of measurements, no matter how complex, and quickly delivers the desired results.



# KEY FACTS

- ▶ Frequency range from 100 kHz to 3/6/7.5/12.75/20/31.8/40/44/56/67 GHz
- ▶ Extended frequency range from 110 GHz to 170 GHz with R&S®FE170ST frontend
- ▶ Optional second RF path with 100 kHz up to 3/6/7.5/12.75/20/31.8/44 GHz
- ▶ Up to 2 GHz I/Q modulation bandwidth (in RF) with internal baseband
- ▶ Options for all important digital communications standards
- ▶ Optional integrated fading simulator with up to 800 MHz bandwidth
- ▶ Support of all key MIMO modes including 3x3, 4x4, 8x4, 4x8, 8x8 and 4x2x2
- ▶ Intuitive operation via touchscreen with block diagram as key element

# BENEFITS

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# FOR ALL YOUR NEEDS

Advanced RF measuring equipment must, above all, be flexible. Performance and functionality requirements vary depending on test setup and application. The R&S®SMW200A is unrivaled in mastering this challenge and sets new standards for signal generators. In development and verification, for any type of DUT (components, modules, complete base stations) – the R&S®SMW200A always generates the appropriate test signals.

## Versatile configuration

Thanks to its modular design, the R&S®SMW200A can be equipped with the exact options required for a specific application. Any configuration is possible, from a classic single-path vector signal generator to a multichannel MIMO receiver tester.

The generator can be equipped with a maximum of two internal baseband modules and four fading simulator modules. It is also possible to install a second RF path. This concept yields two full-featured vector signal generators in a single unit, so that even complex signal scenarios (e.g. wanted signal + interferer, dual cell, TX/RX diversity) can be created easily.

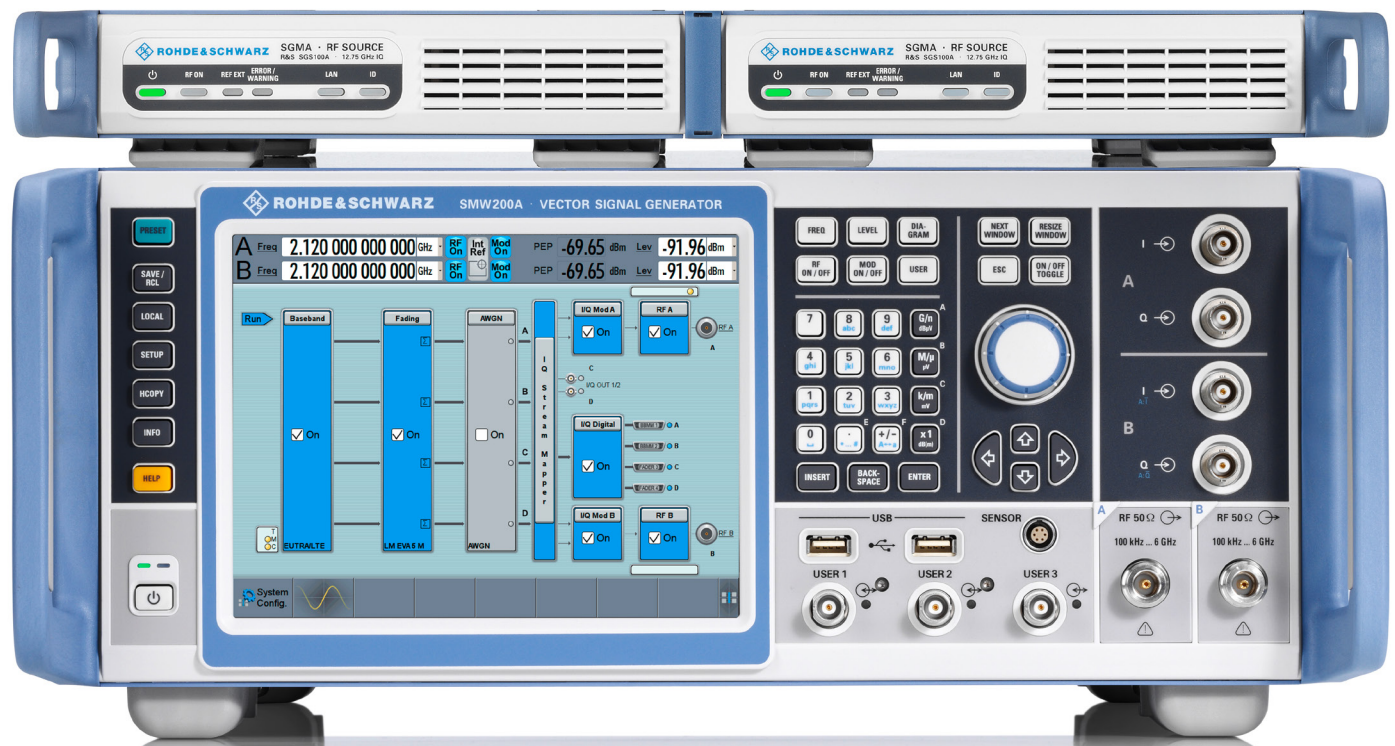
## Ideal for MIMO, MSR or LTE-Advanced applications

And that is by far not all. The capabilities of the R&S®SMW200A surpass those of two conventional generators combined. When the instrument is fully equipped, the baseband section provides up to eight independent signal sources and up to 64 logical faders. This makes the R&S®SMW200A ideal for MIMO and other complex applications encountered in LTE-Advanced (carrier aggregation), HSPA (dual carrier) and multistandard radio, etc.

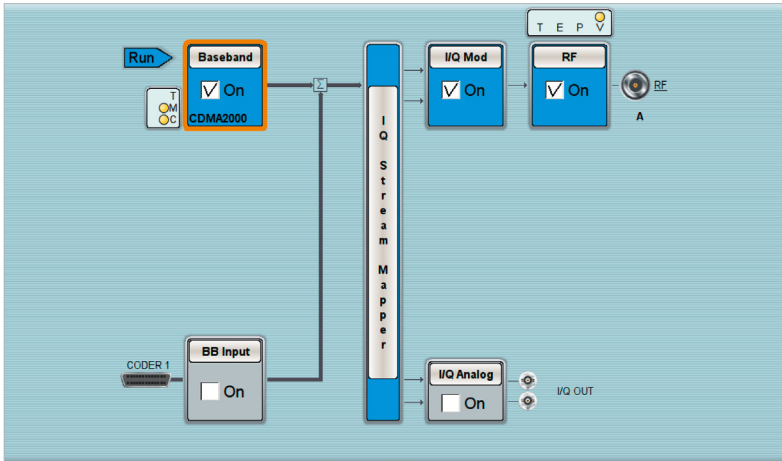
## Modular architecture for optimal adaptation to the application at hand

Almost all options of the R&S®SMW200A can be retrofitted, most of them simply via key code. Starting from the basic configuration as a classic single-path vector signal generator, the R&S®SMW200A can be customized as required for any application. Users only have to purchase what they currently need and are free to decide on upgrades according to their future requirements.

R&S®SMW200A vector signal generator with two R&S®SGMA signal generator modules on top.

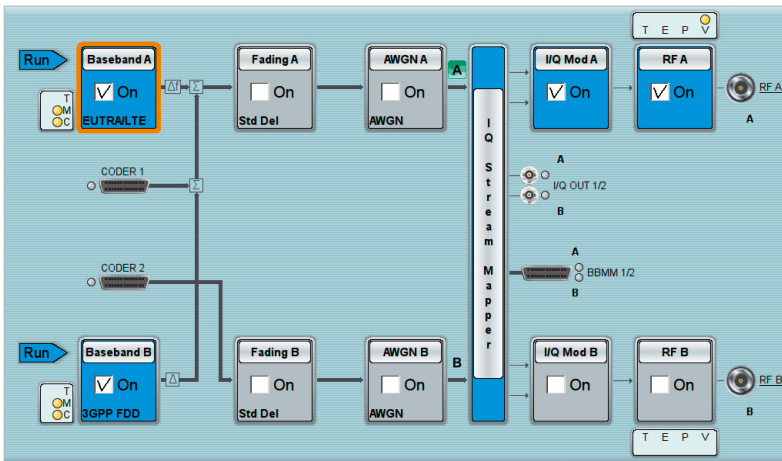


## Basic R&S®SMW200A architecture



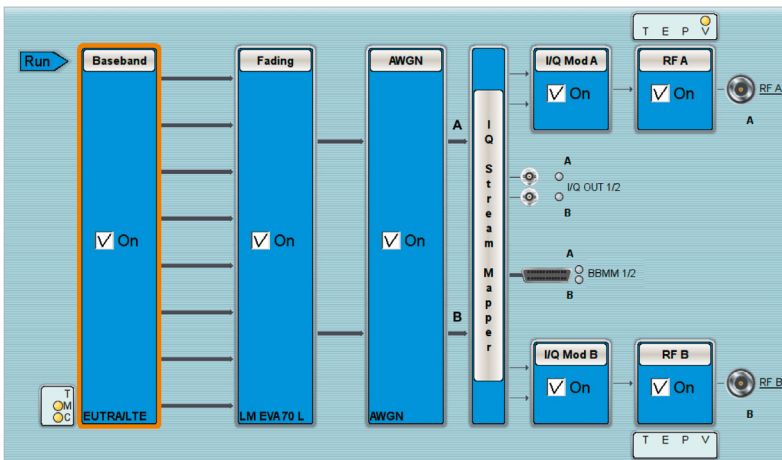
Configuration example 1:

A single-path R&S®SMW200A with internal baseband can be used for measurements on components or for fundamental receiver testing.



Configuration example 2:

A two-path R&S®SMW200A is ideal for receiver and performance tests on base stations. One generator can generate the wanted signal plus interferer (in this example, a wanted LTE signal and a 3GPP FDD interferer).



Configuration example 3:

A fully equipped R&S®SMW200A with MIMO option covers all key MIMO scenarios, such as 8x2 shown in the screenshot. In this case, the baseband section provides eight signal sources and 32 “logical” faders, i.e. MIMO channels.

# SIMPLIFY YOUR SETUP

## Wideband baseband and vector signal generator in one box

A vector signal generator needs a powerful baseband section to meet the requirements of advanced communications systems. The R&S®SMW200A sets standards in this field too. It can be equipped with a baseband section that provides up to 2 GHz internal RF modulation bandwidth. This option makes the R&S®SMW200A the first vector signal generator to offer a fully calibrated wideband solution up to 67 GHz in a single device.

One or two baseband generators can be installed in a single instrument, which makes it possible to generate two independent wideband signals up to 44 GHz with any type of modulation using just one instrument.

Each of the two available baseband modules contains a real-time coder and an arbitrary waveform generator with max. 2 Gsample memory depth. The bandwidth of up to 2 GHz covers modern digital standards, such as 5G NR, LTE and WLAN IEEE802.11be, as well as wideband multicarrier or multistandard radio signals.

## Easy generation of complex signals

The baseband signals can be digitally added, provided with a frequency offset of max.  $\pm 1$  GHz and varied in power and phase relative to each other. This makes it incredibly simple to generate multicarrier scenarios and combinations of different digital standards with the R&S®SMW200A.

A single two-path R&S®SMW200A is all that is needed to create the wanted signal plus interferer scenarios often required in receiver testing. Depending on the scenario's overall bandwidth and the desired level difference between wanted signal and interferer, the signals can in many cases be output by using only one RF path. The second RF path is available for other tasks, e.g. generation of an additional CW interferer.

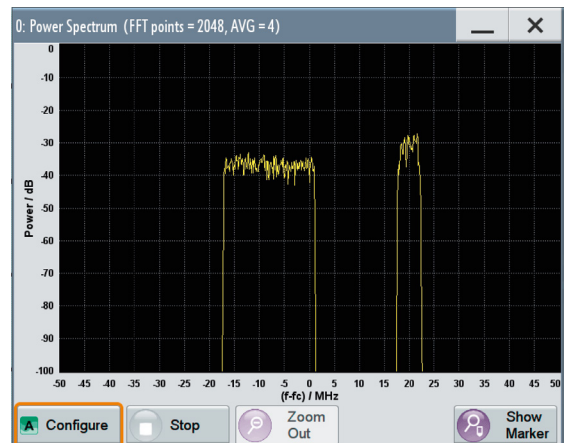
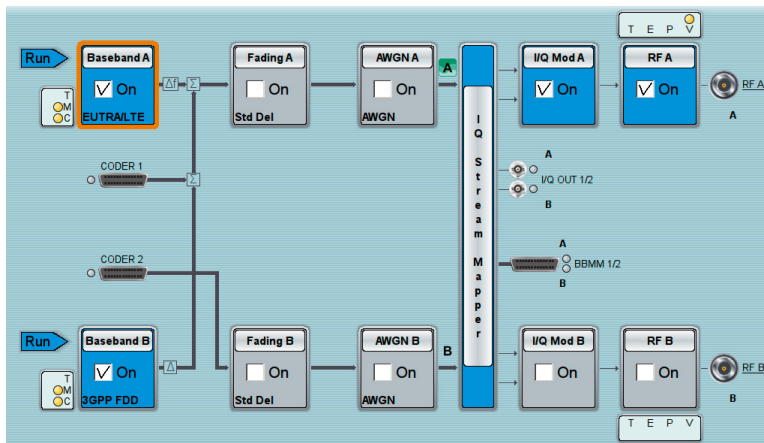
## Advanced multichannel signal generation

The R&S®SMW200A generator's advanced baseband architecture enables it to simulate even complex scenarios. Up to eight internal baseband sources make it easy to generate multiple signals required, for example, for LTE carrier aggregation, multicell/multi-user simulation, interference testing or multistandard radio (MSR) tests. Optional fading and noise simulation for each of the eight individual channels is also possible.

Flexible routing capabilities and internal real-time addition of the baseband signals allow a parallelized testing approach. All signals are generated with their own periodicity. This allows the simultaneous generation of multiple carriers with nontruncated data sequences and enables a DUT to perform demodulation tests for each of the signals at the same time. As a result, the overall test time is reduced and only a minimum of hardware investment is needed.

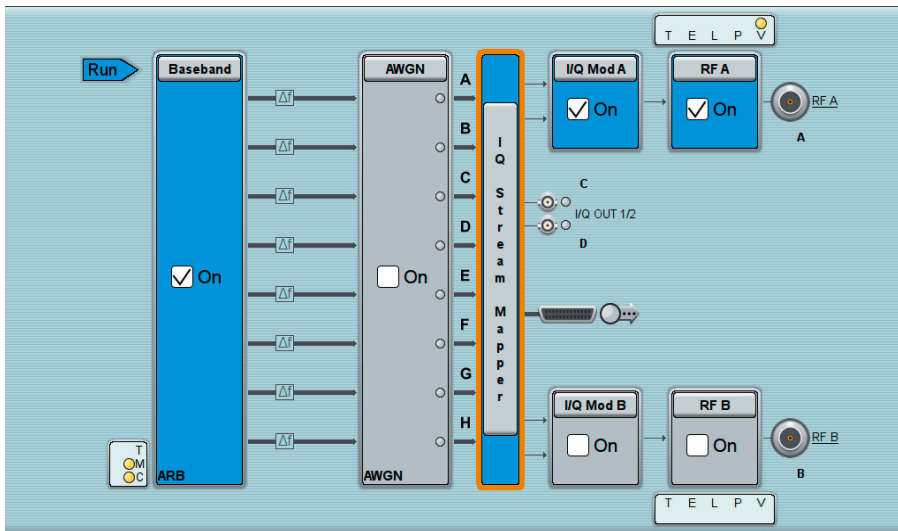
## Two-path R&S®SMW200A

In a two-path R&S®SMW200A, baseband signals can be digitally added and provided with baseband frequency offset. This makes it possible to easily generate multicarrier scenarios or wanted signal plus interferer scenarios.

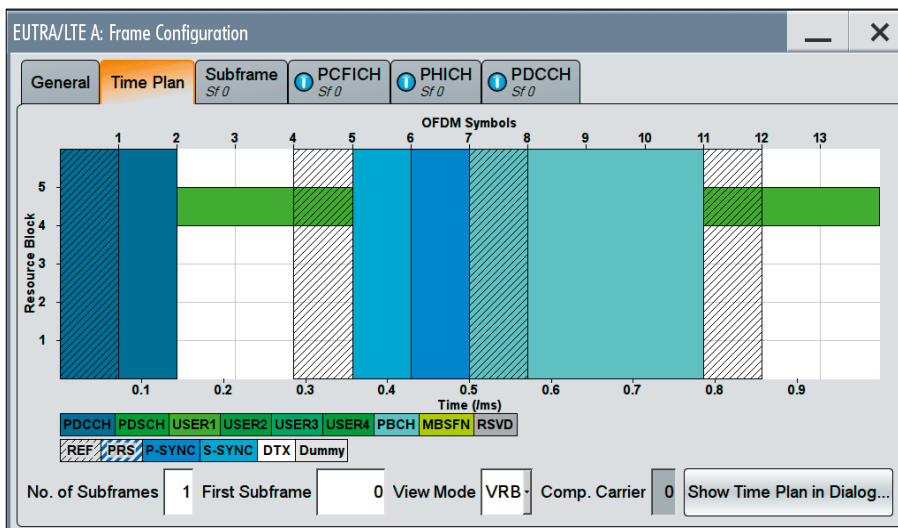


## Ready for future technologies: 5G and IEEE 802.11ad

The R&S®SMW200A is the ideal tool for every engineer who develops components, devices or infrastructure for the next generation of mobile communications. 5G New Radio signals are directly created on the instrument, helping users to efficiently master their design challenges. Typical test scenarios such as co-existence tests with LTE or wideband 5G signal generation in the microwave range are covered by a single instrument. WLAN IEEE802.11ad signals with a symbol rate of 1.76 Gsample/s in single carrier mode are supported as well. Due to its intelligent internal modulation frequency response compensation, the R&S®SMW200A also excels in I/Q flatness and modulation quality for all wideband signals.



The R&S®SMW200A is the ideal generator for multi-standard radio and interference tests. In this example, it is generating eight different frequency-spaced signals that are added up in real time for receiver testing.



Time plan display in the LTE option of the R&S®SMW200A.

### Support of all important digital standards

The R&S®SMW200A uses software options to generate signals for all important digital standards, particularly 5G NR, LTE/LTE-Advanced (up to Release 15), 3GPP FDD/HSPA/HSPA+, GSM/EDGE/EDGE Evolution and WLAN IEEE 802.11a/b/g/n/j/p/ac/ax/ad/be. The entire physical layer is simulated, as well as channel coding for the majority of standards. As a result, the R&S®SMW200A is perfect for standard-compliant receiver measurements, e.g. tests on base stations in line with 3GPP TS38.141 (for 5G NR) or 3GPP TS36.141 (for LTE/LTE-Advanced).

In contrast to many other solutions on the market, the signals for the digital standards can be configured and generated directly on the R&S®SMW200A. Because the software options integrate seamlessly into the instrument's firmware, there is no need for additional PC software. This simplifies operation and also saves valuable testing time, since no time-consuming waveform transfer from the external PC software to the signal generator's output memory has to be performed.

As a result of its outstanding performance, the R&S®SMW200A responds virtually without delay to new settings, even when they require comprehensive signal calculations. Therefore, test scenarios can easily and quickly be adapted to new requirements. Parameters can be varied with immediate effect for optimization or troubleshooting, without causing unproductive interruptions or waiting time.

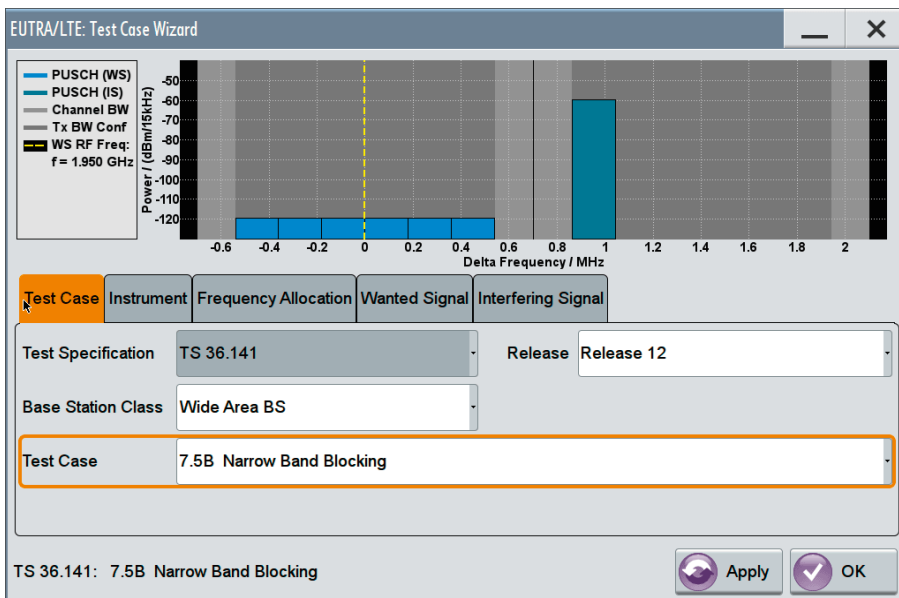
Users benefit from numerous help functions. Predefined settings can be used to configure standard-compliant signals (e.g. test models defined in the standard) at the

press of a button. Visual aids such as the time plan in the LTE option provide a graphical overview of the signal structure. They help users keep track of even complex signal scenarios and quickly set the desired parameters. The test case wizards for complex digital standards such as 5G NR, LTE and 3GPP FDD (UMTS) are powerful tools that simplify the user's task. It only takes a few steps to configure the R&S®SMW200A for base station tests in line with 3GPP TS38.141, 3GPP TS36.141 or 3GPP TS25.141.

### Generating signals for radar module and receiver tests

Together with the R&S®Pulse Sequencer software the R&S®SMW200A generates simple pulses, pulse trains as well as complex multi-emitter and multichannel radar scenarios. For each individual pulse, the pulse timing and the intrapulse modulation such as AM/FM, wideband chirp, Barker or polyphase can flexibly be configured. Control elements such as nested loops, overlays and subsequences allow dynamic sequencing applications. Deterministic or random interpulse modulation profiles enable the user to configure time-varying pulse train characteristics with minimum effort.

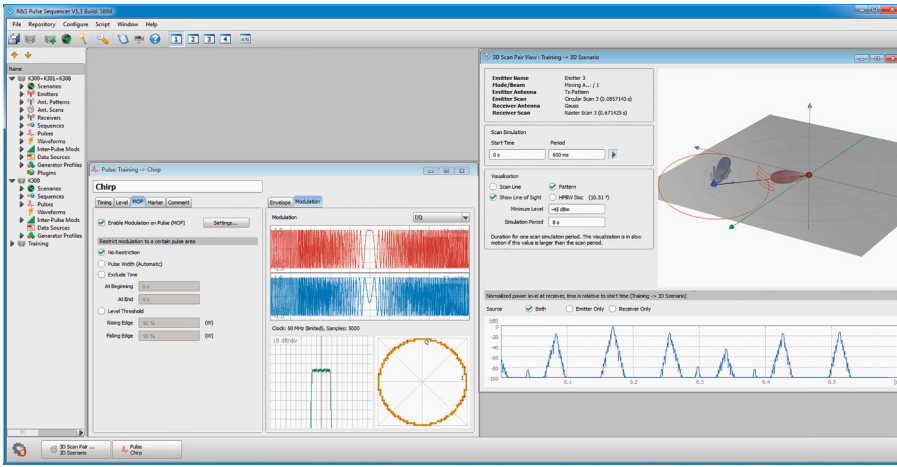
Antenna diagrams and antenna scans can be added to the defined pulse sequences to simulate realistic radar emitters. For scenario simulation, multiple emitters and a receiver can be placed on a 2D map, including attitude and height information. Using an additionally configured receiver antenna diagram and antenna scan, the R&S®SMW200A creates real-world signals as they occur at the RF output of a receiver antenna. This allows inexpensive conducted receiver tests in the lab instead of costly over-the-air field tests. The emulated receiver can even be configured to carry multiple antennas, each with individual



The LTE test case wizard allows the R&S®SMW200A to be conveniently and cleverly configured for BTS tests in line with 3GPP TS36.141. In this example, wanted signal and interferer for a narrowband blocking test are set.



R&S®Pulse Sequencer software for creating radar signals and scenarios with the R&S®SMW200A.



antenna pattern, position and pointing direction. This turns the R&S®SMW200A into a powerful platform for testing radar modules as well as multichannel receivers in direction finding applications.

Furthermore, the R&S®SMW200A together with the R&S®Pulse Sequencer software can create radar signals as specified by FCC, ETSI or the TELEC T403 standard for dynamic frequency selection (DFS) tests. This makes the R&S®SMW200A the ideal solution for testing WLAN devices for correct behavior in the presence of a radar signal in the same frequency band.

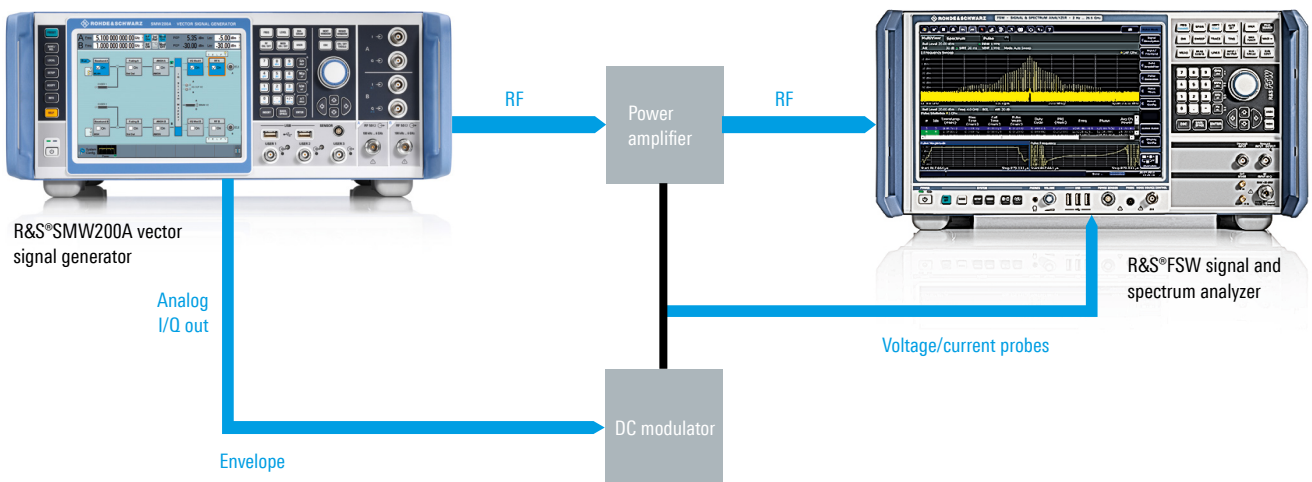
### Efficient testing of amplifiers with envelope tracking

The objective of envelope tracking (ET) is to reduce power consumption and the amplifier's overall energy consumption. Instead of receiving a constant supply voltage, the amplifier is fed a voltage from a DC modulator. This

voltage tracks the envelope of the RF signal. Extremely precise synchronization is crucial since even deviations in the nanosecond range would cause significant modulation errors (EVM).

The R&S®SMW200A offers options that allow users to very easily generate the right envelope signal for an RF signal in real time and output it at the analog I/Q output. Since both signals come from the same instrument, users do not need to worry about synchronization. The delay between the RF signal and the envelope signal relative to each other can be set in real time with a 1 ps resolution in order to compensate for different delays in the test setup. The digital predistortion option enables AM/AM and AM/φM predistortion of the signals in real time. This flexibility and its outstanding signal performance make the R&S®SMW200A the perfect signal source for precise and efficient ET measurements.

### Test setup for envelope tracking with the R&S®SMW200A and the R&S®FSW



# BRING REALITY TO YOUR LAB

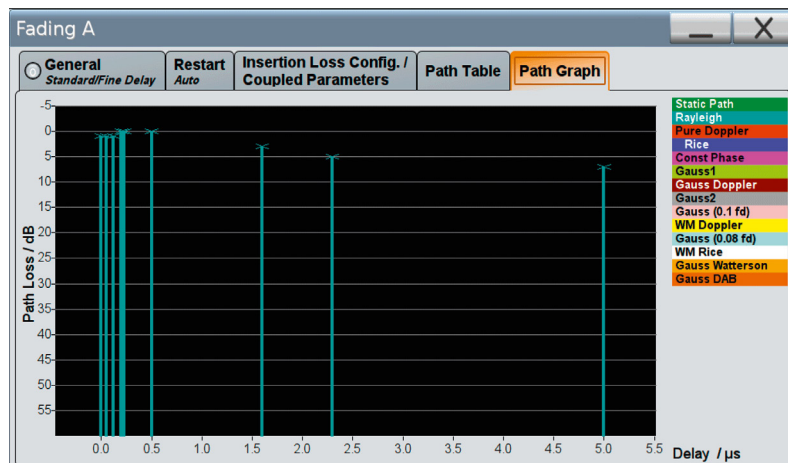
## Advanced, state-of-the-art channel emulation

The internal fading simulator option is another element that distinguishes the R&S®SMW200A from other RF vector signal generators. Using latest FPGA technology the hardware was designed for exceptional compactness so that up to four of the powerful fading modules can be installed. These modules can simultaneously emulate as many as 64 fading channels. The maximum fading bandwidth is 800 MHz. As a result, the R&S®SMW200A can realistically map even MIMO scenarios such as 3x3 MIMO for WLAN IEEE 802.11.

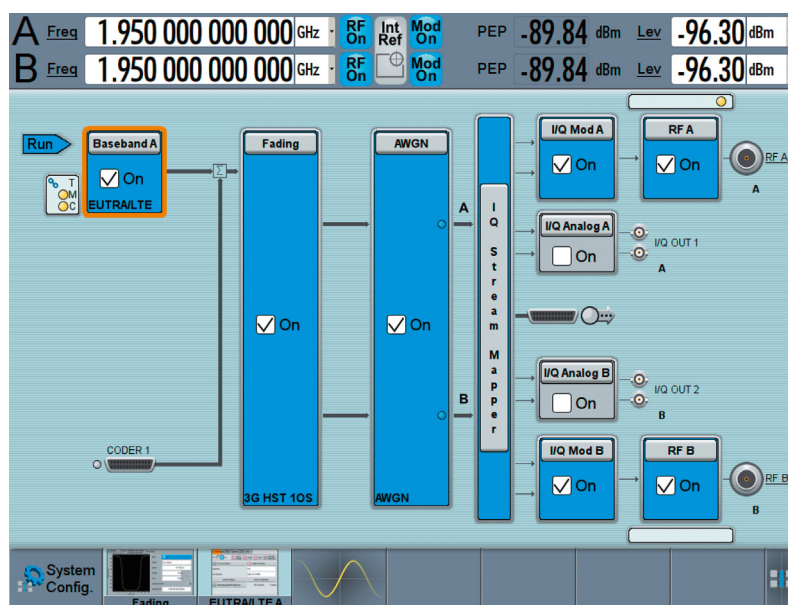
Inside buildings, there are more reflections than in open terrain. The time difference between different echoes normally is in the range of only a few nanoseconds. Its time resolution of 2 ps and its ability to simulate up to 20 paths

per fading channel enable the R&S®SMW200A to realistically simulate indoor fading scenarios. All in all, the R&S®SMW200A offers a fading performance that has so far only been achieved by significantly more expensive special instruments (e.g. RF faders).

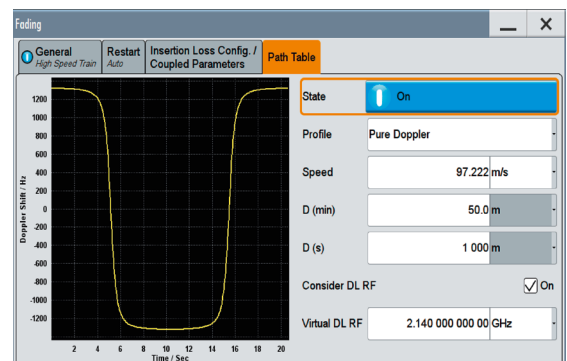
The user can select the fading scenarios required for all major standards directly from the predefined settings. In addition to classic multipath scenarios with Raleigh, Rice or pure Doppler fading, the R&S®SMW200A can also simulate the dynamic scenarios specified in recent standards, such as birth-death, moving propagation and high-speed train. Profiles for car-to-car communications are supported as well. All parameters can also be set manually, which makes it easy to implement user-specific fading configurations.



The fading settings of the R&S®SMW200A can be visualized to support the user. The screenshot shows the fading path configuration of an LTE ETU300 scenario.



The R&S®SMW200A is perfect for LTE base station performance tests in line with 3GPP TS 36.141. In this example, the block diagram (screenshot on the left) and fading settings (screenshot below) for testing with high-speed train fading are shown.



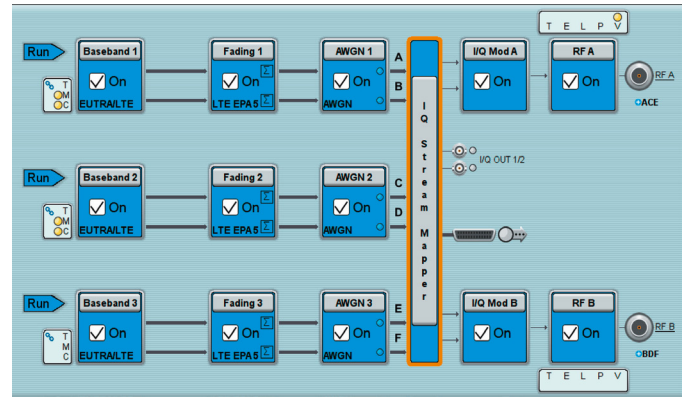
## Prestigious discipline: MIMO

All modern wireless communications standards utilize MIMO technology to increase the effective data throughput. A test generator must be able to simulate MIMO scenarios exactly as they are present at the receive antennas of a receiver – even with complex MIMO receivers. This is where the multipath and fading capabilities of the R&S®SMW200A come into their own. The built-in baseband modules allow the simultaneous generation of up to eight signals. For MIMO scenarios, the signals from all transmit antennas – with antenna-specific coding – can be directly generated in a single instrument.

In addition, the R&S®SMW200A is able to simulate the entire MIMO channel. Up to 64 logical faders cover all key MIMO scenarios such as 3x3, 4x4, 8x4, 4x8 and 8x8. The user can also set the correlations between the propagation paths. Multistandard setups, such as simultaneous 2x2 MIMO for LTE and 3GPP FDD HSPA, are possible as well. Furthermore, carrier aggregation scenarios with four LTE component carriers (each with 2x2 MIMO) can be simulated with a single instrument. No matter how complicated the application – the R&S®SMW200A handles unique stimulus generation and channel simulation in parallel.

The R&S®SMW200A can be equipped with one or two internal RF paths. If necessary, more RF paths can be added: Two additional I/Q-modulated R&S®SGT100A signal generator modules turn the R&S®SMW200A into an extremely compact 4x4 MIMO complete solution. Adding another four R&S®SGT100A modules enhances the solution to cover even 8x8 or 2x4x4 MIMO scenarios. The additional hardware is operated and remotely controlled directly from the R&S®SMW200A.

The R&S®SMW200A easily handles even complex MIMO setups. The global system configuration dialog can be used to reconfigure the signal generator according to the



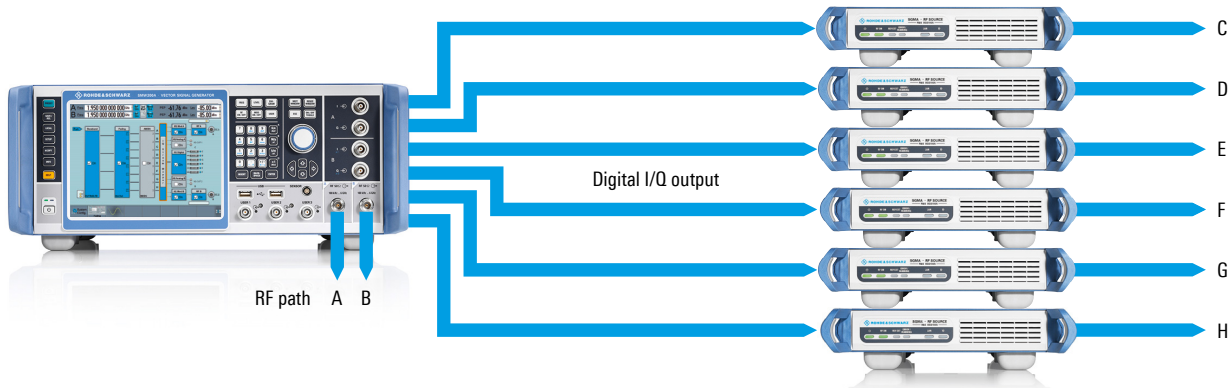
Block diagram of the R&S®SMW200A configured for the generation of a LTE Release 11 feCIC test scenario. One R&S®SMW200A simultaneously generates the LTE serving cell as well as the two aggressor cells, each with 2x2 MIMO, with correlated fading channels.

required signal scenario. The block diagram on the GUI changes with the application so that the user can see at a glance which signal scenario is being generated. Every system configuration is accompanied by typical application examples. Users who “think beyond the standard” will also easily find an optimal scenario for their needs.

In the case of MIMO-capable standards such as 5G NR, LTE or WLAN, the transmit signals depend on each other. Therefore, the R&S®SMW200A features a shared menu (coupled sources mode) with which multi-antenna signals can be configured quickly and conveniently.

As an alternative, the signals can be set individually in the R&S®SMW200A (separate sources mode). This mode allows the simultaneous generation of signals for different standards, which makes the R&S®SMW200A ideal for testing multistandard base stations. Combinations (e.g. LTE, WCDMA and GSM) are possible as well as the use of user-defined ARB signals.

## 4x8 MIMO setup



4x8 MIMO setup, consisting of a two-path R&S®SMW200A and six R&S®SGT100A signal generator modules operated from the R&S®SMW200A. The modules provide RF paths 3 to 8. The R&S®SMW200A fully performs baseband signal generation and fading.

# MAKE YOUR DEVICE EVEN BETTER

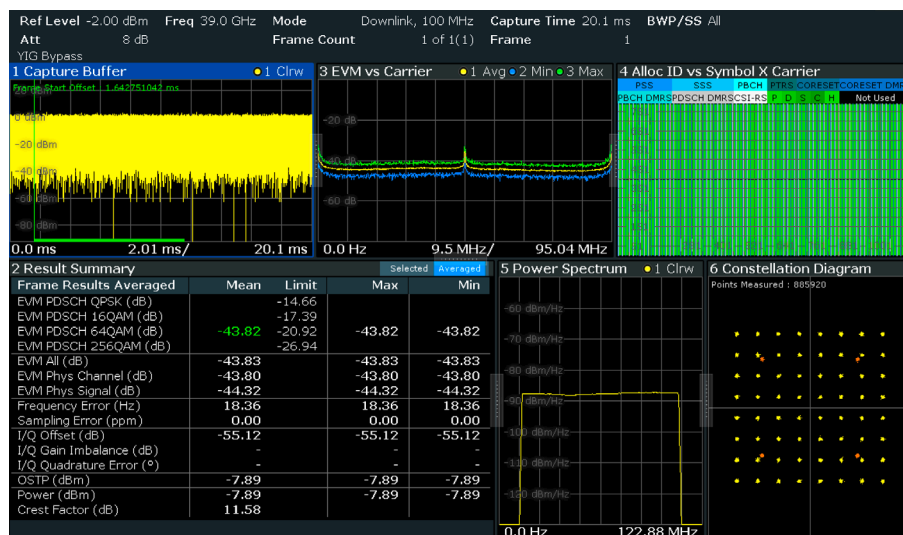
## Excellent signal quality

Testing high performance DUTs requires a signal generator solution that features significantly better RF characteristics than the DUT itself. Otherwise, the measurement results might be falsified by the signal generator. The R&S®SMW200A fully meets this requirement, enabling the DUT's entire potential to be utilized.

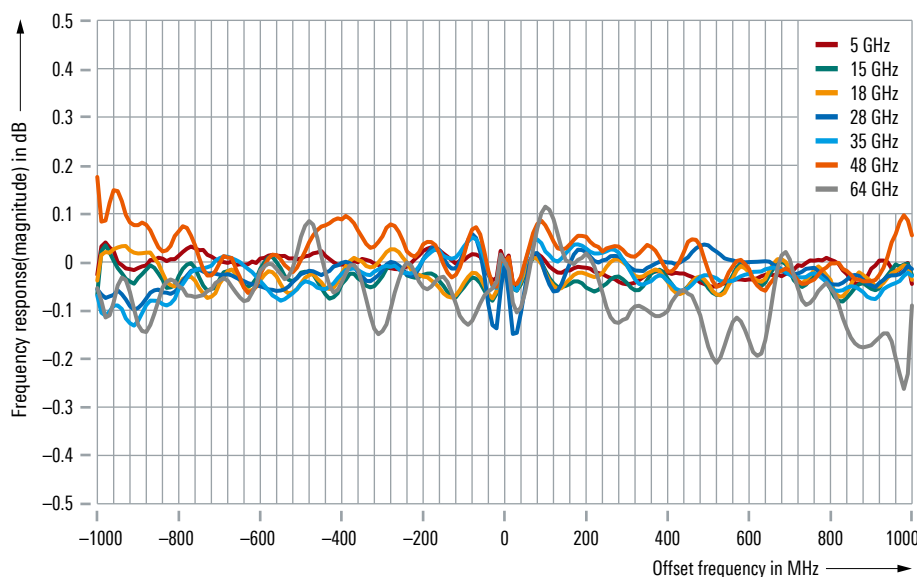
## Exceptional modulation characteristics

The R&S®SMW200A features a wideband I/Q modulator with up to 2 GHz RF bandwidth. With this bandwidth, it covers practically all applications in its frequency range, including wireless and satellite communications, radar, research and education. The internal baseband makes it possible to generate signals with a maximum width of 2 GHz.

State-of-the-art D/A converters and an excellent RF chain ensure exceptional modulation characteristics. All in all, a modulation frequency response of < 0.4 dB (meas.) over 2 GHz bandwidth can be achieved. The R&S®SMW200A generates 5G NR signals (100 MHz channel bandwidth, 64QAM PDSCH, 39 GHz carrier frequency) with an EVM of -43 dB (meas.). Other signal types such as WCDMA, LTE, wideband QAM-modulated carriers or chirped pulses as well as multicarrier CW scenarios can also be output with highest quality.

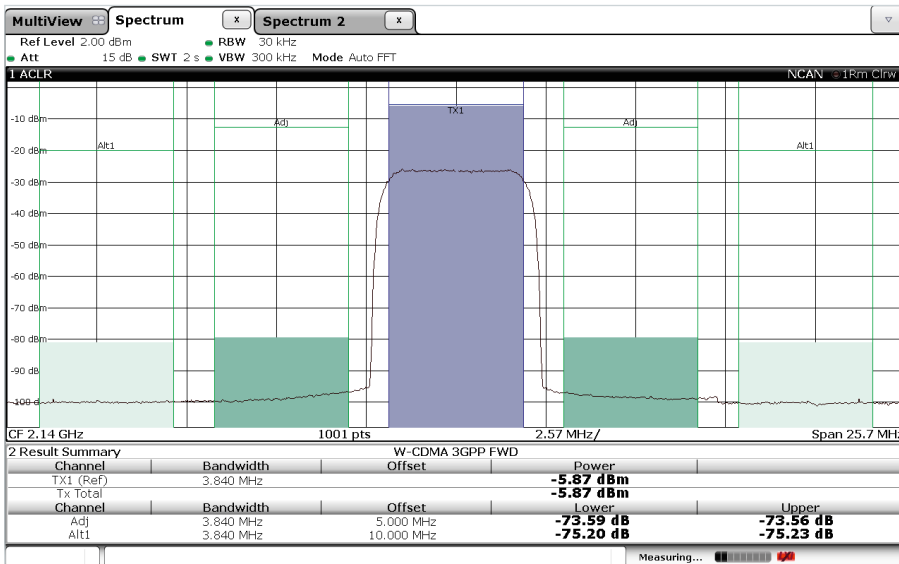


Measured EVM of a 5G NR signal (100 MHz channel bandwidth, 64QAM PDSCH, 39 GHz carrier frequency).

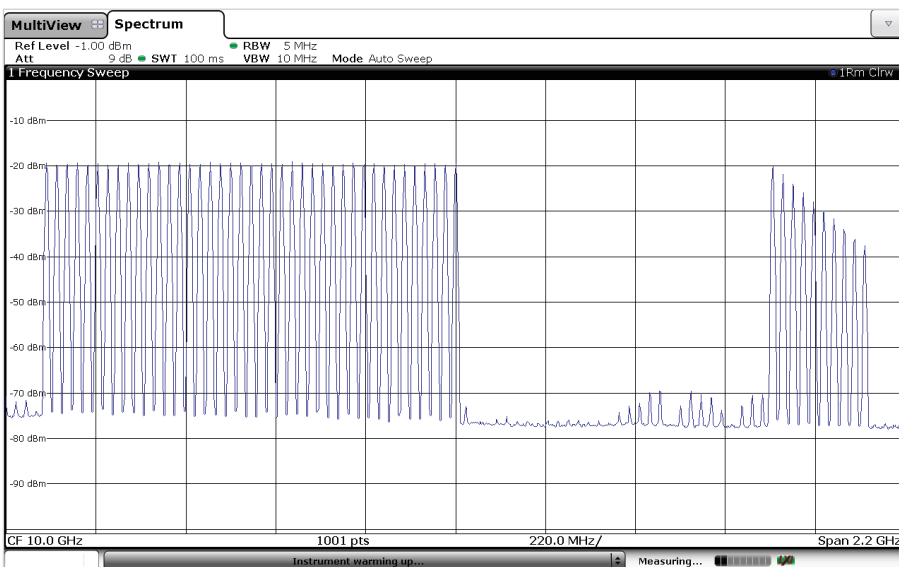


Measured I/Q modulation frequency response with internal wideband baseband.

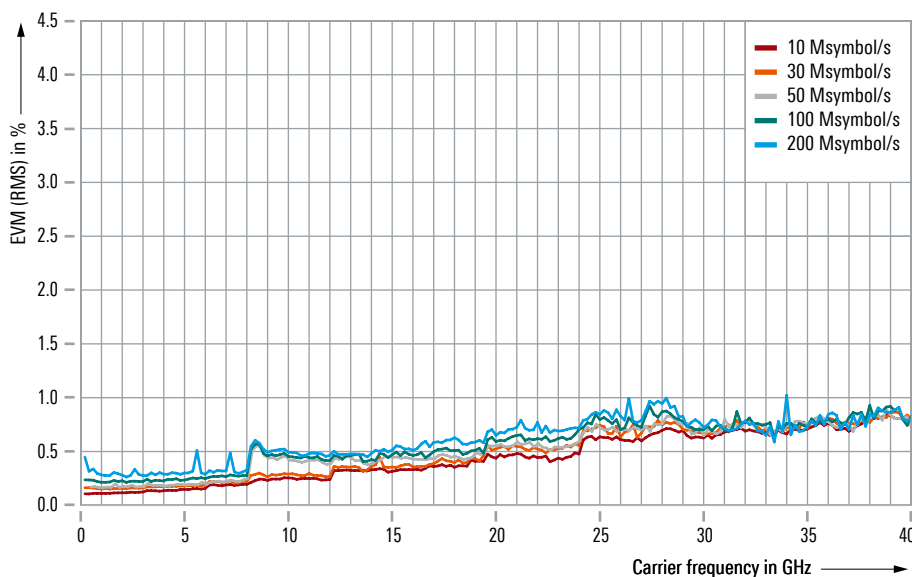
Measured ACPR for 3GPP test model 1, 64 DPCH.

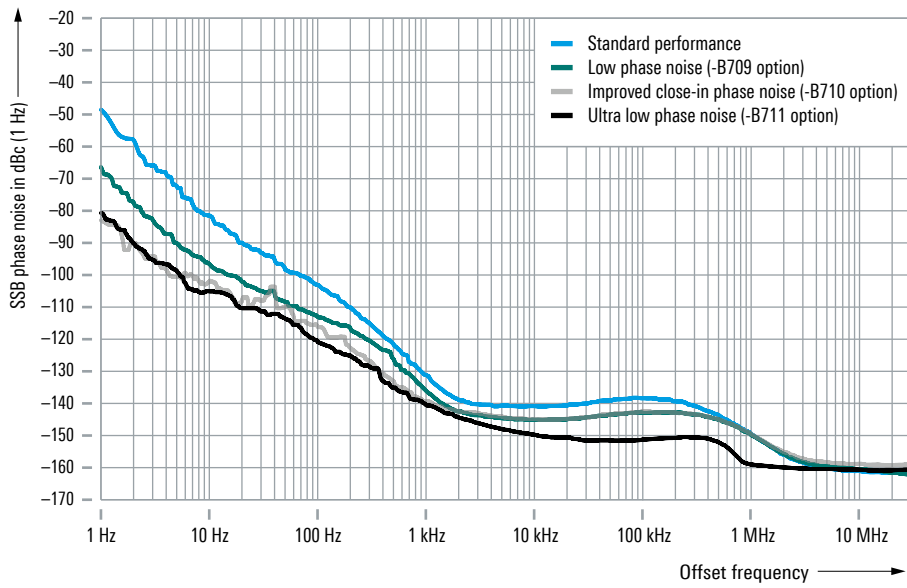


The R&S®SMW200A generates top-quality wideband signals, including signals that are asymmetrical to the center frequency. In this example, at 10 GHz a 2 GHz wide multicarrier CW scenario with 41 equal-power carriers is generated on the left and 10 carriers with graduated power on the right.

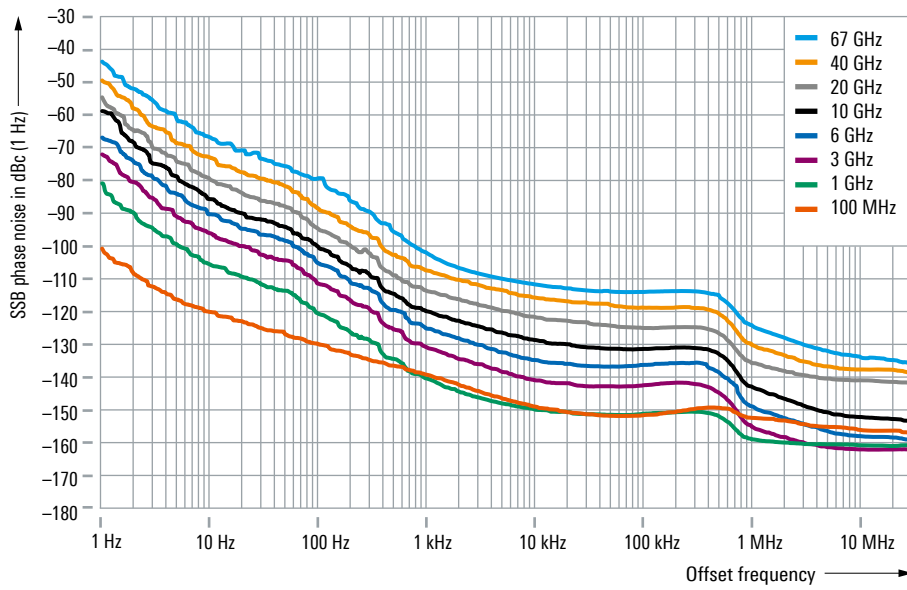


Measured EVM versus carrier frequency for 16QAM.

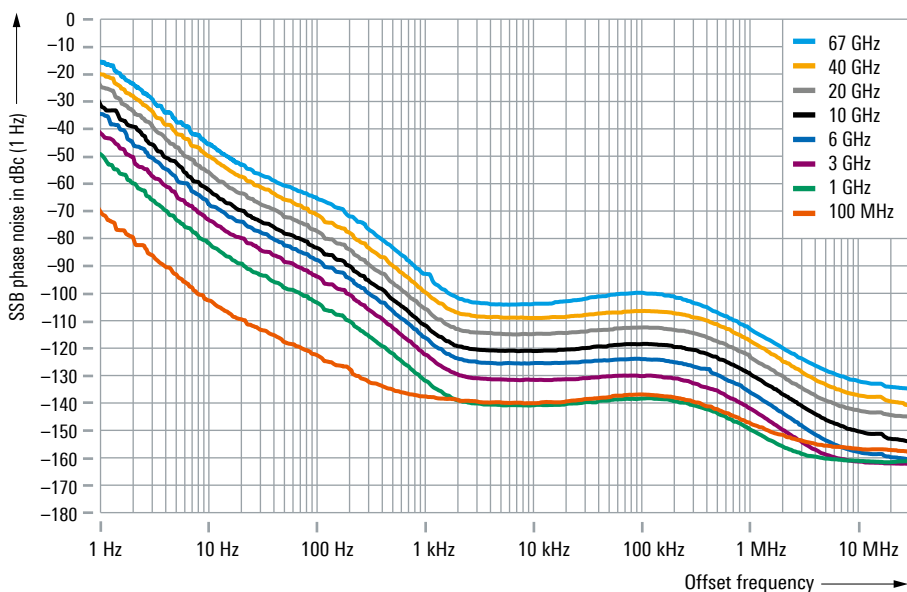




Measured SSB phase noise performance at  $f = 1$  GHz, CW mode, standard performance versus the R&S®SMW-B709, R&S®SMW-B710 and R&S®SMW-B711 options.



Measured SSB phase noise performance, with R&S®SMW-B711/-B721 options, CW mode.



Measured SSB phase noise performance, standard instrument, CW mode.

### Very good RF characteristics

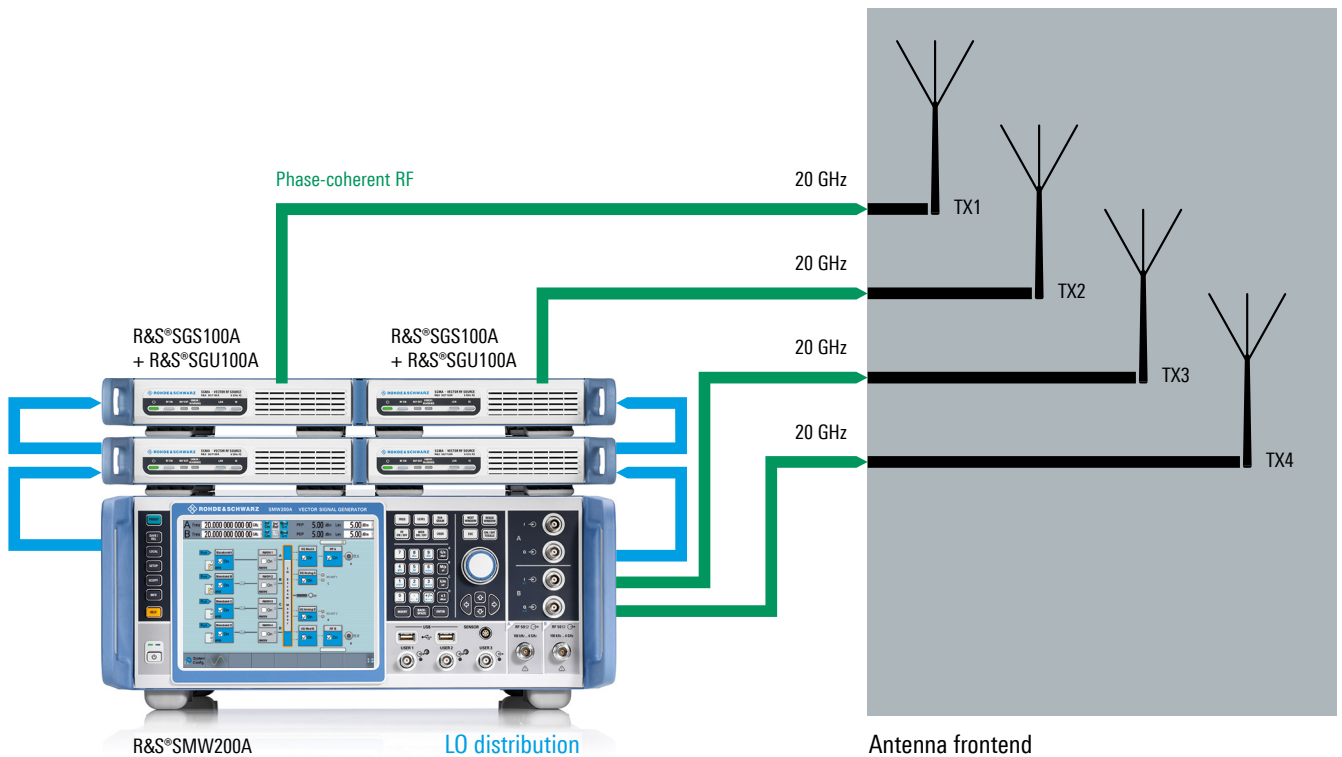
The RF characteristics of the R&S®SMW200A are simply impressive. The absolute level accuracy is better than 0.5 dB ( $f \leq 3$  GHz) across the entire specified level range from -120 dBm to +18 dBm, without additional options being required. Frequency and level setting times of 600  $\mu$ s (typ.) via IEC/IEEE bus make the R&S®SMW200A the fastest high-end vector signal generator on the market and help save valuable time. Thanks to its excellent pulse modulator with on/off ratio > 80 dB and rise/fall time < 10 ns, the R&S®SMW200A is ideal for generating pulsed signals for radar applications.

The high-end synthesizer, which is included in the standard version of the R&S®SMW200A, already delivers exceptional SSB phase noise and nonharmonic values. The user can choose between several low phase noise options to improve performance even more. The R&S®SMW-B711/-B721 ultra low phase noise options provide best possible performance for all carrier offsets. The R&S®SMW200A is perfect for measurements that place high requirements on spectral purity.

### Phase-coherent signals up to 44 GHz

Beamforming applications, such as for measurements on active antenna systems, require high quality, phase-coherent test signals. More than just a common reference signal is usually needed to make sure that the relative phases remain stable over a long time period. The LO coupling offered by the R&S®SMW200A enables extremely precise and stable long-term phase synchronization of both generator paths. Up to 44 GHz, the generator can provide two phase-coherent RF paths in a single instrument, without additional cabling. If more phase-coherent carriers are needed, the internal LO signal of the R&S®SMW200A can be connected to another R&S®SMW200A or an R&S®SGS100A or R&S®SGU100A signal generator module.

### Setup for antenna testing



Setup with a two-path R&S®SMW200A, two R&S®SGS100A and two R&S®SGU100A to generate four phase-coherent CW or modulated signals, for example for antenna testing up to 20 GHz. The setup can be scaled to 40 GHz and duplicated if more RF paths are required.

# SPEED UP YOUR DEVELOPMENT

Increasing cost pressure results in ever shorter development cycles. At the same time, testing requirements are becoming more stringent. The R&S®SMW200A accomplishes complex measurement tasks quickly and efficiently. Numerous innovations in intuitive user guidance make work extremely easy.

## Ergonomic design for maximum operating convenience

A high resolution touchscreen and an easy-to-use graphical user interface make for ergonomic operation. A block diagram provides a clear overview at all times. The user sees at a glance the signal flow and the status of all inputs and outputs. The drag&drop functionality makes signal flow reconfiguration simpler than ever. For MIMO and other complex applications, the block diagram is adapted to the prevailing signal scenario.

All menu feature tabs for fast access to signal parameters. A context-sensitive online help system provides information about every parameter, such as setting range, detailed circuit description and SCPI command. Various functions facilitate everyday work, e.g. each parameter can be individually reset to its specific preset status.

The built-in graphics function of the R&S®SMW200A allows the generated signals to be displayed in real time in up to eight simultaneous windows. The user can select the type of display (I and Q versus time, frequency spectrum, vector diagram, etc.) and the point in the signal flow where the measurement will be performed.

The baseband measurement function allows real-time measurement of the level of a signal or signal component at defined points in the signal flow. This feature is especially useful when the level of specific components of a complex signal is to be determined or varied during a measurement, as for example in closed-loop scenarios.

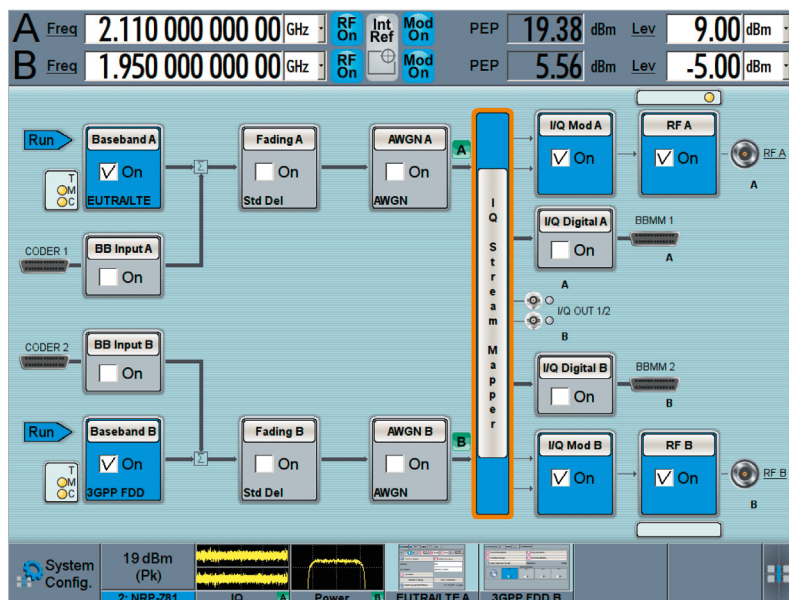
## Automation made easy

The R&S®SMW200A can be controlled via all common remote interfaces. The user benefits from a number of help functions when programming an automatic test sequence control. The SCPI commands for every setting parameter can be displayed directly and all modifications of the instrument's preset status can be highlighted graphically. This makes it easy to identify all parameters that are important for remote control.

The R&S®SMW200A also has a built-in SCPI macro recorder with code generator, which records all manual operating steps to generate a file with a remote command sequence. Code templates are provided for directly generating executable code for MATLAB® or CVI. User-specific templates can also be used. As a result, the R&S®SMW200A contributes to minimizing the time required for test automation, saving development resources.

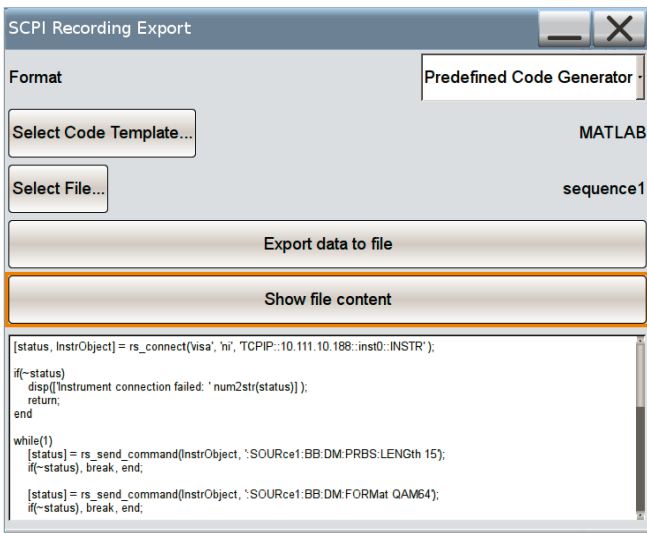
## A fast instrument for speedy work

The Linux based operating system of the R&S®SMW200A helps ensure short boot times. The high computer performance speeds up work even when settings require comprehensive signal calculation.



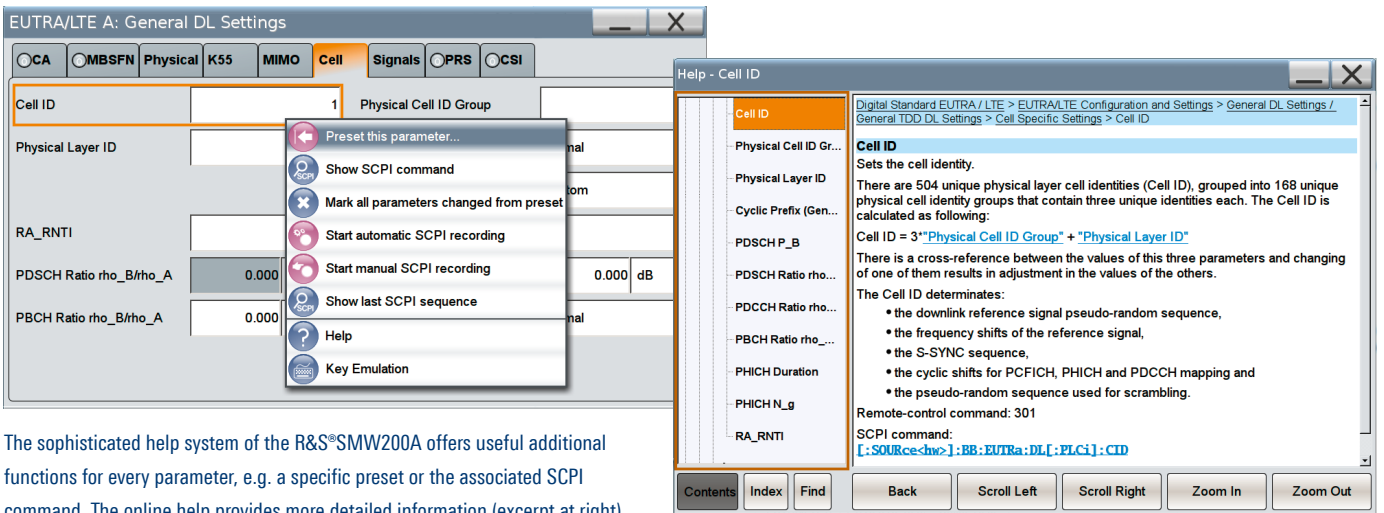
User interface of the R&S®SMW200A. The header shows the frequency, level and important instrument statuses. The footer provides quick access to open menus. The generated signals and the measurement results of any connected R&S®NRP-Zxx power sensor(s) can be displayed as well (second field from left in footer).





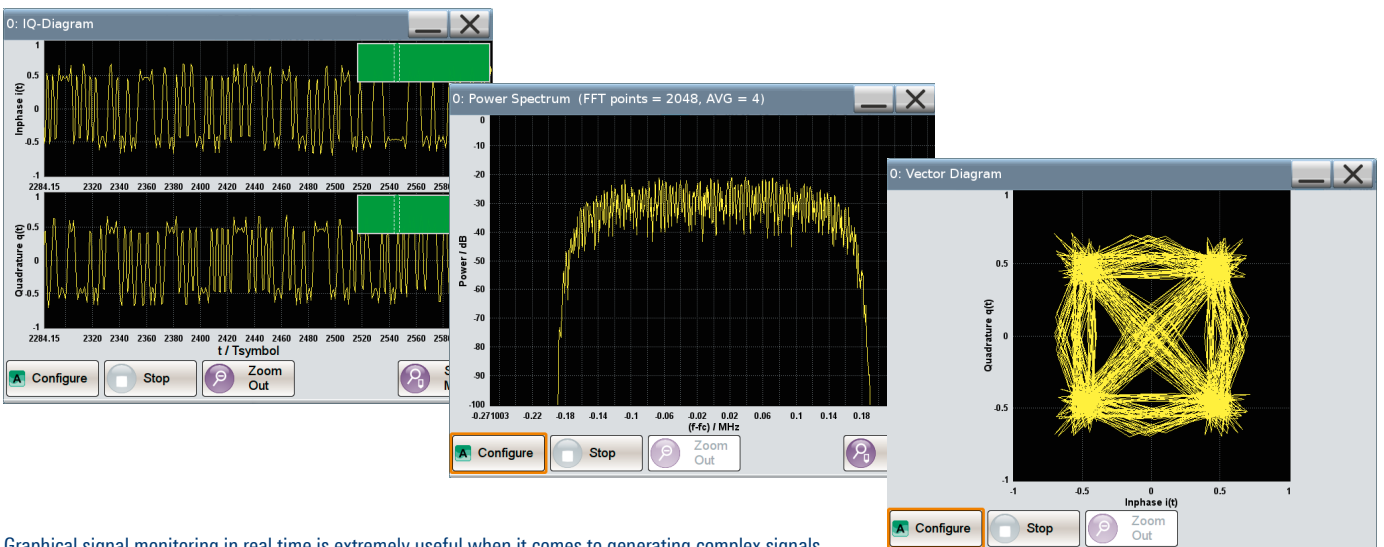
The built-in SCPI macro recorder and code generator supports fast, convenient generation of SCPI program sequences.

### Context-sensitive online help system of the R&S®SMW200A



The sophisticated help system of the R&S®SMW200A offers useful additional functions for every parameter, e.g. a specific preset or the associated SCPI command. The online help provides more detailed information (excerpt at right).

### Graphical signal monitoring in real time



Graphical signal monitoring in real time is extremely useful when it comes to generating complex signals.

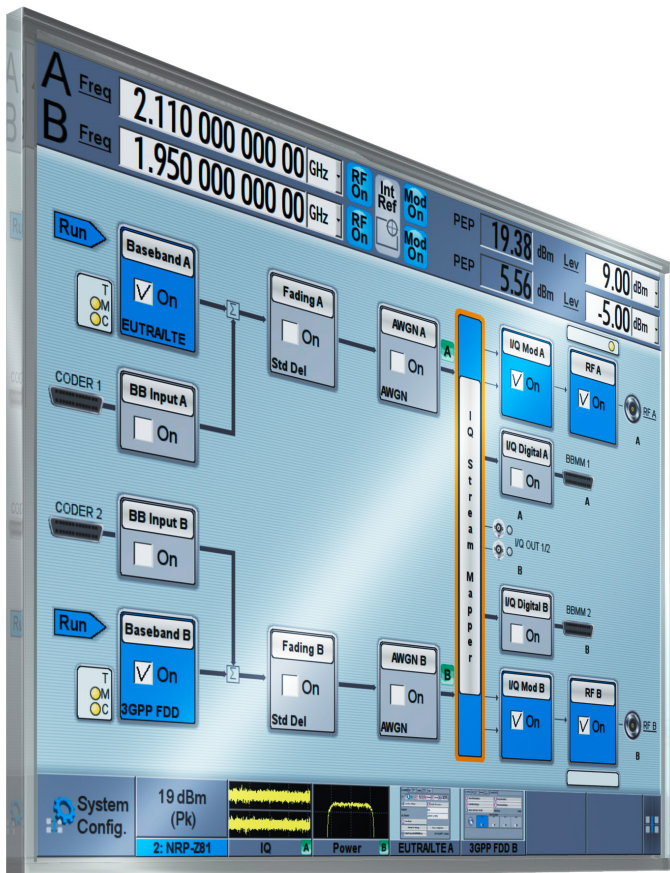
# GROWS WITH YOUR NEEDS

Advanced technology and a modular, upgradeable hardware concept make the R&S®SMW200A a future-ready investment.

R&S®SMW200A hardware options can be retrofitted with minimum effort. The baseband modules come as plug-ins and can easily be inserted into the rear panel without opening or recalibrating the instrument.

Software functions (e.g. digital standards) are simply activated via key codes. The R&S®SMW200A firmware can be updated from a USB flash drive or via LAN. Free updates can be downloaded from [www.rohde-schwarz.com/product/smw200a](http://www.rohde-schwarz.com/product/smw200a).

In this way, the R&S®SMW200A can be precisely customized to suit the applications at hand and can be enhanced whenever new requirements arise. Users only have to purchase what they currently need and are free to decide on upgrades according to future requirements.



The R&S®SMW200A can be upgraded with various hardware and software options. For example, a large variety of digital standards is offered as software options.



The R&S®SMW200A vector signal generator with a power sensor.

The R&S®SMW200A can be used together with many other Rohde & Schwarz instruments

| R&S®SMW200A function/connection | Related option(s) | Rohde & Schwarz partner instrument   | Application example   |
|---------------------------------|-------------------|--|---|
| RF output                       | R&S®SMW-K553      | R&S®FExx frontends, e.g. R&S®FE170ST   | extended frequency range from 110 GHz to 170 GHz                    |
| Digital baseband output         | R&S®SMW-K18/-K19  | e.g. R&S®SGT100A signal generator module or R&S®SMCV100B vector signal generator | provides additional RF paths  |
| Analog I/Q output               | R&S®SMW-K16/-K17  | e.g. R&S®SGS100A signal generator module   | provides additional RF paths  |
| R&S®NRP sensor connector        | —                 | R&S®NRPxxS power sensors, R&S®NRP-Z28/-Z98 level control sensors                 | high precision power measurement, result display on the R&S®SMW200A |

# SPECIFICATIONS IN BRIEF

## Specifications in brief

### Frequency

|   |                               |                      |
|---|-------------------------------|----------------------|
| Frequency range, RF path A  | R&S®SMW-B1003                 | 100 kHz to 3 GHz     |
|   | R&S®SMW-B1006                 | 100 kHz to 6 GHz     |
|   | R&S®SMW-B1007                 | 100 kHz to 7.5 GHz   |
|   | R&S®SMW-B1012                 | 100 kHz to 12.75 GHz |
|   | R&S®SMW-B1020                 | 100 kHz to 20 GHz    |
|   | R&S®SMW-B1031                 | 100 kHz to 31.8 GHz  |
|   | R&S®SMW-B1040/-B1040N         | 100 kHz to 40 GHz    |
|   | R&S®SMW-B1044/-B1044N/-B1044O | 100 kHz to 44 GHz    |
|   | R&S®SMW-B1056/-B1056N/-B1056O | 100 kHz to 56 GHz    |
|   | R&S®SMW-B1067/-B1067N/-B1067O | 100 kHz to 67 GHz    |
| Frequency range, RF path B (optional, see R&S®SMW200A data sheet for possible RF path configurations) | R&S®SMW-B2003                 | 100 kHz to 3 GHz     |
|   | R&S®SMW-B2006                 | 100 kHz to 6 GHz     |
|   | R&S®SMW-B2007                 | 100 kHz to 7.5 GHz   |
|   | R&S®SMW-B2012                 | 100 kHz to 12.75 GHz |
|   | R&S®SMW-B2020                 | 100 kHz to 20 GHz    |
|   | R&S®SMW-B2031                 | 100 kHz to 31.8 GHz  |
|   | R&S®SMW-B2044/-B2044N/-B2044O | 100 kHz to 44 GHz    |

### Level

|                       |  |  |
|-----------------------|--|--|
| Specified level range | 3 MHz ≤ f ≤ 20 GHz   | -120 dBm to +18 dBm (PEP)                      |
|                       | R&S®SMW-B1031/-B1040/-B1040N/-B1044(N/O)/-B2020/-B2031/-B2044(N/O) | -120 dBm to +11/+18 dBm (PEP), depending on RF |
|                       | R&S®SMW-B1056(N/O)/-B1067(N/O)                                     | -120 dBm to +9/+15 dBm (PEP), depending on RF  |

### Spectral purity

|                                |  |                             |
|--------------------------------|--|-----------------------------|
| Harmonics                      | level < 10 dBm, CW   | < -30 dBc                   |
|                                | R&S®SMW-B1020/-B1031/-B1040/-B1040N/-B1044(N/O)/-B2020/-B2031/-B2044(N/O), f > 3.5 GHz                             | < -55 dBc                   |
|                                | R&S®SMW-B1056(N/O)/-B1067(N/O) f > 3.5 GHz, level < 6 dBm  | < -55 dBc                   |
| Nonharmonics                   | CW or vector modulation with full-scale DC input, level > -10 dBm, carrier offset > 10 kHz, 200 MHz < f ≤ 1500 MHz |                             |
|                                | standard   | < -85 dBc                   |
|                                | with R&S®SMW-B711/-B721 option   | < -95 dBc                   |
| SSB phase noise                | CW, carrier offset = 10 kHz, f = 1 GHz   |                             |
|                                | standard   | < -134 dBc                  |
|                                | with R&S®SMW-B709/-B719 option   | < -139 dBc                  |
|                                | with R&S®SMW-B711/-B721 option   | < -144 dBc, -150 dBc (typ.) |
|                                | CW, carrier offset = 10 kHz, f = 10 GHz  |                             |
|                                | standard   | < -114 dBc                  |
| with R&S®SMW-B709/-B719 option | < -119 dBc   |                             |
| with R&S®SMW-B711/-B721 option | < -124 dBc, -130 dBc (typ.)  |                             |

### Analog modulation

|                                   |                      |                   |
|-----------------------------------|----------------------|-------------------|
| Supported analog modulation modes | depending on options | AM, FM, φM, pulse |
|-----------------------------------|----------------------|-------------------|

## Specifications in brief

### I/Q modulation

|                         |  |                           |
|-------------------------|--|---------------------------|
| RF modulation bandwidth | with internal wideband baseband, "I/Q wideband" on |                           |
|                         | 1 MHz ≤ f ≤ 300 MHz                                | ±32% of carrier frequency |
|                         | 300 MHz < f ≤ 2.5 GHz                              | ±40% of carrier frequency |
|                         | f > 2.5 GHz  | ±1 GHz                    |
|                         | with internal standard baseband, "I/Q wideband" on |                           |
|                         | 1 MHz ≤ f ≤ 250 MHz                                | ±32% of carrier frequency |
|                         | f > 250 MHz  | ±80 MHz                   |

|  |   |                            |
|--|---|----------------------------|
| Modulation frequency response in specified RF modulation bandwidth | with internal baseband, "I/Q wideband" on | < 1.0 dB, < 0.4 dB (meas.) |
|--|---|----------------------------|

### Wideband baseband generator

|  |                                     |                        |
|--|-------------------------------------|------------------------|
| R&S®SMW-B9 option, up to two wideband baseband generators can be installed |                                     |                        |
| Signal bandwidth   | standard                            | 500 MHz                |
|  | with R&S®SMW-K525 option            | 1 GHz                  |
|  | with R&S®SMW-K525 and -K527 options | 2 GHz                  |
| ARB memory depth   | standard                            | 256 Msample            |
|  | with R&S®SMW-K515 option            | 2 Gsample              |
| Frequency offset   | standard                            | -250 MHz to +250 MHz   |
|  | with R&S®SMW-K525 option            | -500 MHz to +500 MHz   |
|  | with R&S®SMW-K525 and -K527 options | -1000 MHz to +1000 MHz |

### Standard baseband generator

|  |                                     |                    |
|--|-------------------------------------|--------------------|
| R&S®SMW-B10 option, up to two baseband generators can be installed |                                     |                    |
| Signal bandwidth   | standard                            | 120 MHz            |
|  | with R&S®SMW-K522 option            | 160 MHz            |
| ARB memory depth   | standard                            | 64 Msample         |
|  | with R&S®SMW-K511 option            | 512 Msample        |
|  | with R&S®SMW-K511 and -K512 options | 1 Gsample          |
| Frequency offset   | standard                            | -60 MHz to +60 MHz |
|  | with R&S®SMW-K522 option            | -80 MHz to +80 MHz |

### Digital standards

|  |   |  |
|--|---|--|
| Supported standards and modulation systems | 5G NR Releases 15 to 17,<br>LTE Releases 8 to 15, NB-IoT, eMTC,<br>3GPP FDD/HSPA/HSPA+,<br>GSM/EDGE/EDGE Evolution,<br>WLAN IEEE802.11a/b/g/n/j/p/ac/ax/ad/be,<br>GNSS, AWGN and more |  |
|--|---|--|

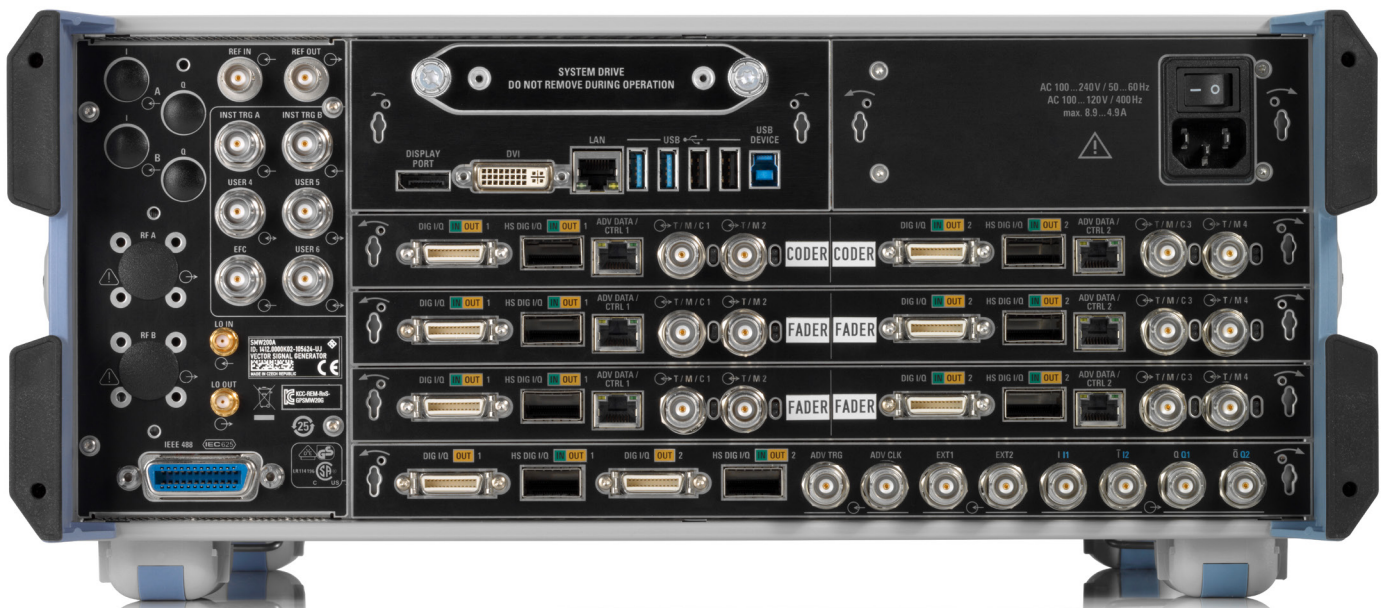
### Fading and MIMO

|                       |   |  |
|-----------------------|---|--|
| Fading simulator      | R&S®SMW-B14/-B15 option, up to four fading modules can be installed |  |
| Fading bandwidth      | depending on options  | max. 800 MHz   |
| Fading channels       | depending on options  | max. 64  |
| MIMO fading scenarios | depending on options  | 2x2, 3x3, 4x4, 8x4, 4x8, 8x8, 2x2x2, 2x4x4, 4x2x2 and more                     |
| Fading modes          | depending on options  | multipath, moving delay, birth-death, high speed train, two-channel interferer |
| Fading profiles       | depending on options  | Rayleigh, Rice, pure Doppler, static path, Gaussian, customized and more       |

## Options for digital communications standards (selection)

| Standard/technology | Options   | Key features  |
|---------------------|---|---|
| 5G NR               | R&S®SMW-K144/-K145/-K148/<br>-K170/-K171/-K175        | <ul style="list-style-type: none"> <li>▶ In line with 3GPP Releases 15, 16 and 17</li> <li>▶ Downlink and uplink signals for FR1 and FR2</li> <li>▶ All numerologies and channel bandwidths</li> <li>▶ Support of multiple bandwidth part (BWP) with mixed numerology</li> <li>▶ Support of uplink closed-loop base station tests in line with 3GPP TS38.141</li> </ul> |
| LTE/LTE-Advanced    | R&S®SMW-K55/-K69/-K81/-K84/<br>-K85/-K112/-K113/-K119 | <ul style="list-style-type: none"> <li>▶ In line with 3GPP LTE Releases 8, 9, 10, 11, 12, 13, 14 ,15</li> <li>▶ FDD and TDD</li> <li>▶ Downlink (OFDMA) and uplink (SC-FDMA)</li> <li>▶ Carrier aggregation</li> <li>▶ Support of uplink closed loop base station tests in line with 3GPP TS36.141</li> <li>▶ LTE test case wizard</li> </ul>                           |
| Cellular IoT        | R&S®SMW-K115/-K143/-K146                              | <ul style="list-style-type: none"> <li>▶ In line with 3GPP Releases 13, 14 ,15</li> <li>▶ NB-IoT and eMTC downlink and uplink signal generation</li> <li>▶ NB-IoT in-band, guard band and standalone modes</li> <li>▶ Real-time processing of HARQ feedback commands for closed loop base station tests</li> </ul>  |
| 3GPP FDD/HSPA/HSPA+ | R&S®SMW-K42/-K83                                      | <ul style="list-style-type: none"> <li>▶ In line with 3GPP FDD Release 11</li> <li>▶ Downlink and uplink</li> <li>▶ HSDPA H-sets</li> <li>▶ Higher order modulation, MIMO, CPC</li> <li>▶ Support of base station tests in line with 3GPP TS25.141</li> <li>▶ 3GPP test case wizard</li> </ul>  |

Rear panel of the R&S®SMW200A.



| Standard/technology                    | Options  | Key features  |
|--|--|---|
| DVB-S2/-S2X, DVB-RCS2                  | R&S®SMW-K116/-K169/-K176                                   | <ul style="list-style-type: none"> <li>▶ Signals for component, payload and ground station testing</li> <li>▶ DVB-S2X beam hopping and superframe signals in line with ETSI EN302307-2 V1.3.1, Annex E (2021)</li> <li>▶ DVB-RCS2 implementation in line with ETSI EN301545-2 V1.3.1 Lower Layer Satellite Specification (2020–07)</li> </ul>   |
| WLAN<br>IEEE802.11a/b/g/n/j/p/ac/ax/be | R&S®SMW-K54/-K86/-K142/-K147                               | <ul style="list-style-type: none"> <li>▶ Support of all mandatory physical layer modes</li> <li>▶ EHT frames with up to 320 MHz transmission bandwidth</li> <li>▶ BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM and 4096QAM modulation</li> <li>▶ MIMO modes with four transmit antennas</li> <li>▶ Frame block sequencer for alternating legacy frames in line with 11a/b/g/j/p, 11n or 11ac</li> </ul>  |
| WLAN<br>IEEE802.11ad                   | R&S®SMW-K141   | <ul style="list-style-type: none"> <li>▶ In line with IEEE802.11ad-2012</li> <li>▶ Support of control, single carrier, OFDM and low-power single carrier modes</li> <li>▶ Modulation and coding schemes 0 to 31</li> <li>▶ Support of aggregated MPDUs</li> </ul>   |
| GNSS                                   | R&S®SMW-K44/-K66/-K94/ /-K97/ -K98/-K106/-K107/-K123/-K132 | <ul style="list-style-type: none"> <li>▶ Support of GPS, GLONASS, Galileo, BeiDou, IRNSS and QZSS/SBAS, including hybrid constellations</li> <li>▶ Real-time simulation of realistic constellations with unlimited simulation time</li> <li>▶ Flexible scenario generation including moving scenarios, dynamic power control and atmospheric modeling</li> <li>▶ Configuration of realistic user environments, including obscuration and multipath, antenna characteristics and vehicle attitude</li> </ul> |

For more information, see [www.rohde-schwarz.com/product/smw200a](http://www.rohde-schwarz.com/product/smw200a) and

- ▶ R&S®SMW200A data sheet (PD 3606.8037.22)
- ▶ R&S®SMW200A configuration guide (PD 3606.8037.92)
- ▶ “Digital Standards for Signal Generators” data sheet (PD 5213.9434.22)
- ▶ “GNSS and Avionics Simulation for Rohde&Schwarz Signal Generators” data sheet (PD 3607.6896.22)

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