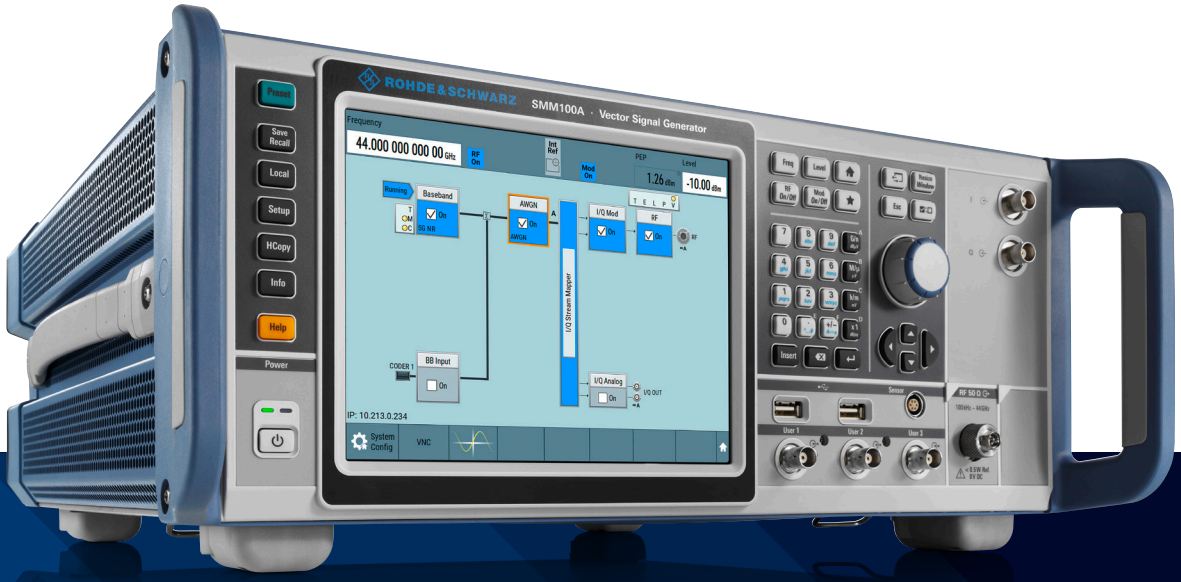
R&S®SMM100A
VECTOR SIGNAL GENERATOR

Redefining midrange



Product Brochure
Version 09.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

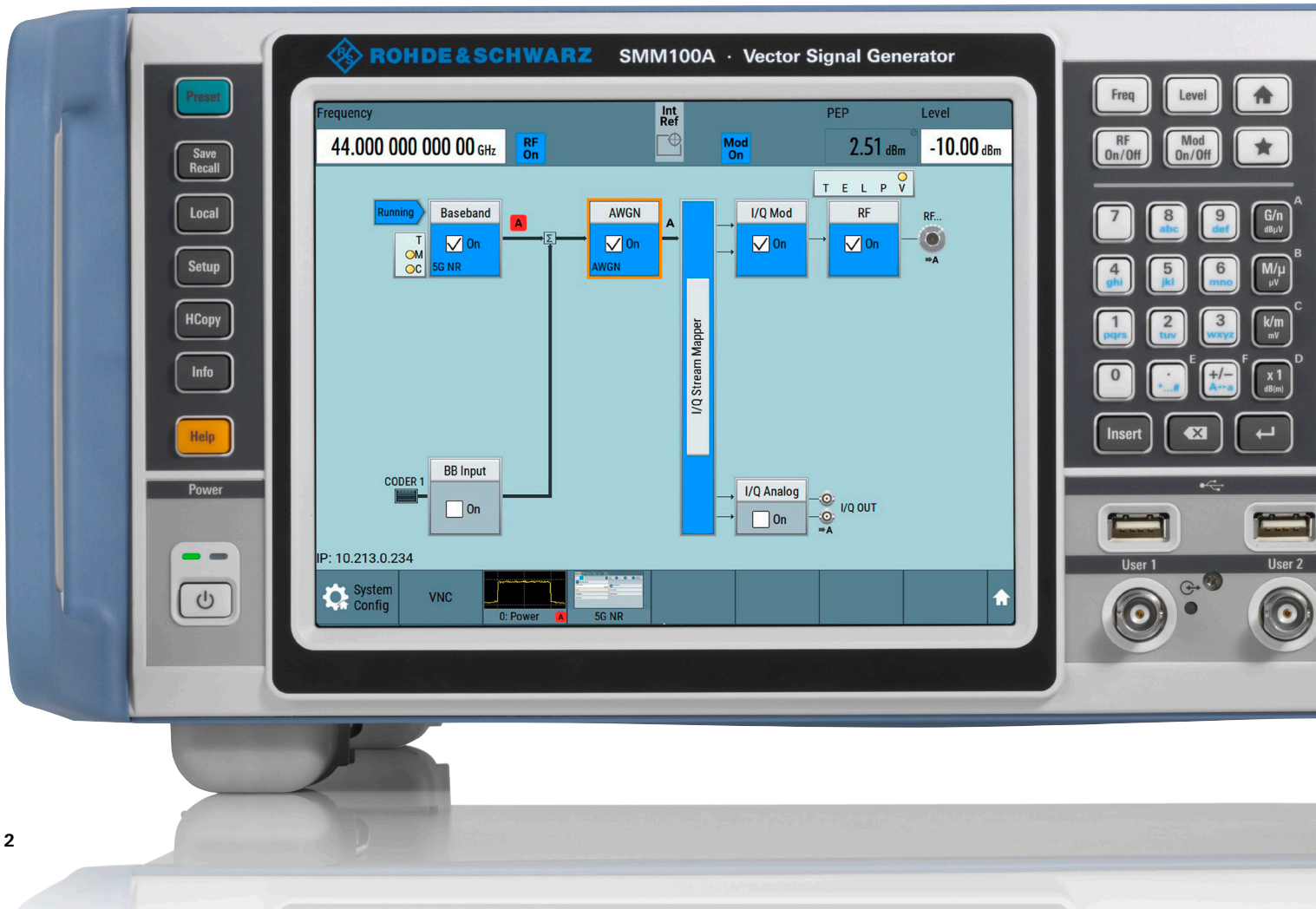
State-of-the-art vector signal generators in the midrange are faced with strict requirements. The R&S®SMM100A provides users with a flexible option concept in combination with outstanding signal quality into the mmWave range as well as an excellent price/performance ratio. Discover the R&S®SMM100A, the only vector signal generator with mmWave testing capabilities in its class.

The R&S®SMM100A vector signal generator provides remarkably good RF characteristics across the entire frequency range from 100 kHz to 44 GHz. The instrument covers the bands below 6 GHz used by existing wireless standards as well as the newly defined bands for 5G NR FR1 and Wi-Fi 6E up to 7.125 GHz and the 5G NR FR2 bands up to 44 GHz.

The internal baseband generator in the R&S®SMM100A supports a maximum RF modulation bandwidth of 1 GHz. Digitally modulated broadband signals can thus be generated as required by the prevalent wireless standards. The R&S®SMM100A is well prepared for future bandwidth requirements.

Depending on the relevant test requirements, the R&S®SMM100A can be configured in particular for applications in production as well as for development work. It can be used as an economically attractive solution for playback of predefined waveforms with the arbitrary waveform generator (ARB). With the optional baseband generator, real-time capabilities are also available when required. Settings for complex signals are handled directly on the instrument – no external software is needed for signal generation.

Furthermore, the option concept of the R&S®SMM100A vector signal generator is very flexible. For example, digital baseband standards or upgrades of the RF modulation bandwidth can be easily activated at any time by entering a keycode, allowing the instrument to adapt to meet future requirements.



KEY FACTS

- Frequency range from 100 kHz to 44 GHz
- High output power up to +18 dBm
- Internal RF modulation bandwidth up to 1 GHz
- Excellent modulation frequency response, error vector magnitude (EVM) and adjacent channel power ratio (ACPR)
- 5G NR signal generation for FR1 and FR2
- Ready for future WLAN requirements for RF frequency and modulation bandwidth
- Convenient operation via touchscreen and block diagram

BENEFITS

Discover excellent signal performance
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APPLICATIONS

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Ready for the next Wi-Fi® generations
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High rate pulse (HRP) ultrawideband (UWB)
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DISCOVER EXCELLENT SIGNAL PERFORMANCE

Verification of the performance of a device under test (DUT) requires the use of a signal generator with better signal quality than the DUT itself. Such performance is defined on one hand based on the SSB phase noise, the error vector magnitude (EVM) and the adjacent channel power ratio (ACPR). However, the amplitude and phase frequency response across the entire signal bandwidth is also an important criterion. The R&S®SMM100A excels in all of these areas.

Excellent SSB phase noise and EVM performance

For the R&S®SMM100A vector signal generator, SSB phase noise of < –129 dBc is specified at an RF frequency of 1 GHz with a 20 kHz offset. The typical value of –134 dBc is even 5 dB lower. Thanks to its excellent RF performance, the R&S®SMM100A can be used not only as a local oscillator (LO) source; it also exhibits outstanding modulation characteristics at higher frequencies. For example, the R&S®SMM100A delivers impressive EVM performance of < –42 dB (0.8%) at an RF frequency of 28 GHz for a 100 MHz 5G NR signal in line with 3GPP test model (TM) 3.1.

Excellent ACPR/ACLR performance

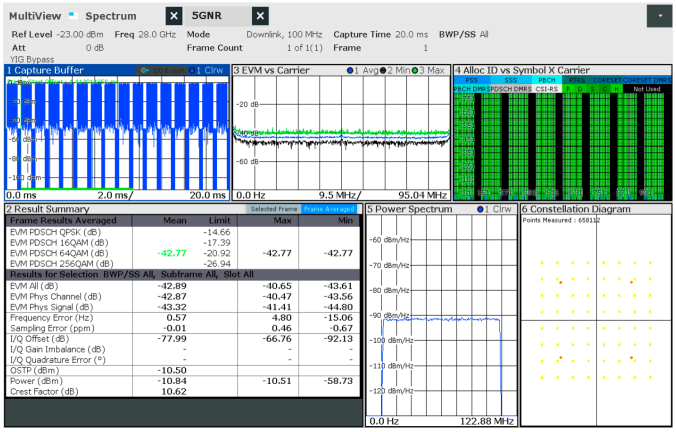
During development of the R&S®SMM100A, special attention was paid to minimizing unwanted distortion in order to achieve the best possible adjacent channel power ratio (ACPR). A 10 MHz LTE test signal in line with 3GPP TM 1.1 achieves ACLR performance in the adjacent channel of –69 dBc.

Extremely flat frequency response

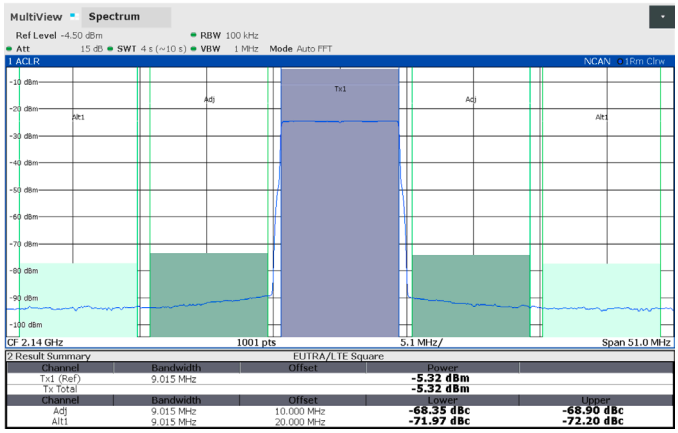
Especially with single-carrier signals, the frequency response of the signal within the modulation bandwidth also has a major influence on the achievable EVM performance. It is thus essential to minimize this parameter in magnitude and phase across the entire RF frequency range of the generator.

Intelligent compensation is provided for internal influences of the R&S®SMM100A on the frequency response. The R&S®SMM100A thus attains a measured magnitude frequency response of < 0.4 dB over the entire RF modulation bandwidth of 1 GHz.

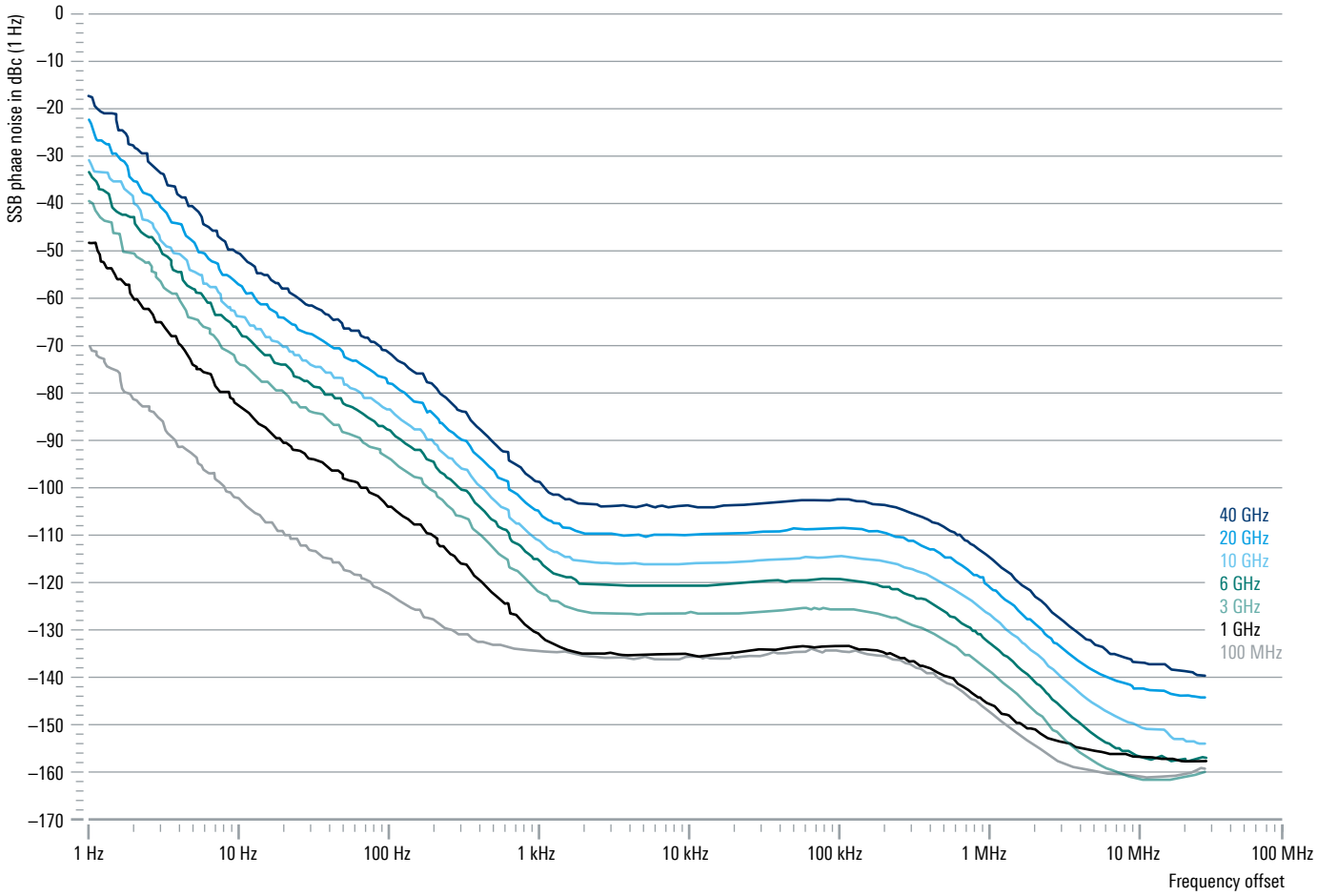
Measured EVM for a 100 MHz 5G NR signal, 3GPP TM 3.1, 28 GHz carrier frequency



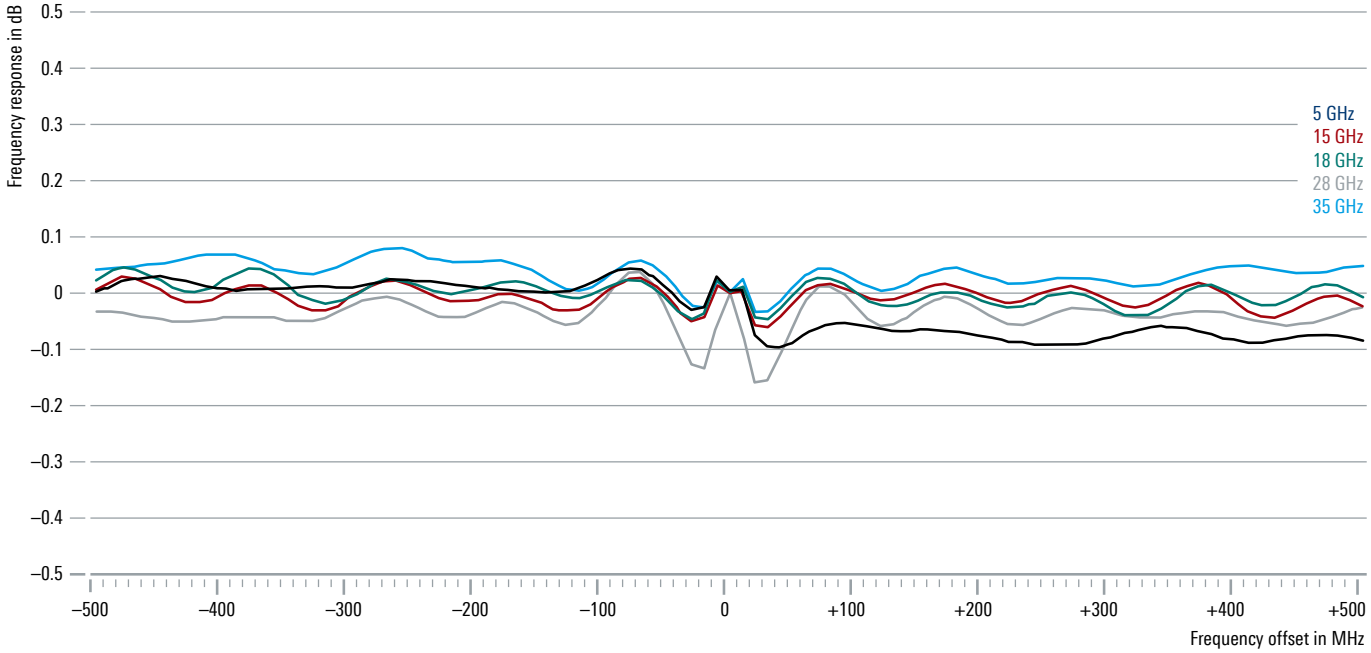
Measured ACLR for a 10 MHz LTE signal, 3GPP TM 1.1



Measured SSB phase noise performance, CW mode



Measured I/Q modulation frequency response with internal baseband generator



DISCOVER BASEBAND CAPABILITIES

Internal real-time signal generation

The internal baseband of the R&S®SMM100A offers impressive real-time capabilities. Users can configure and generate standard-compliant signals for all major digital communications standards right on the instrument, including 5G NR, LTE, WLAN and many others. No external signal generation software is needed. The well-arranged configuration menus simplify operation of the instrument and help to speed up measurement tasks.

Arbitrary waveform generator

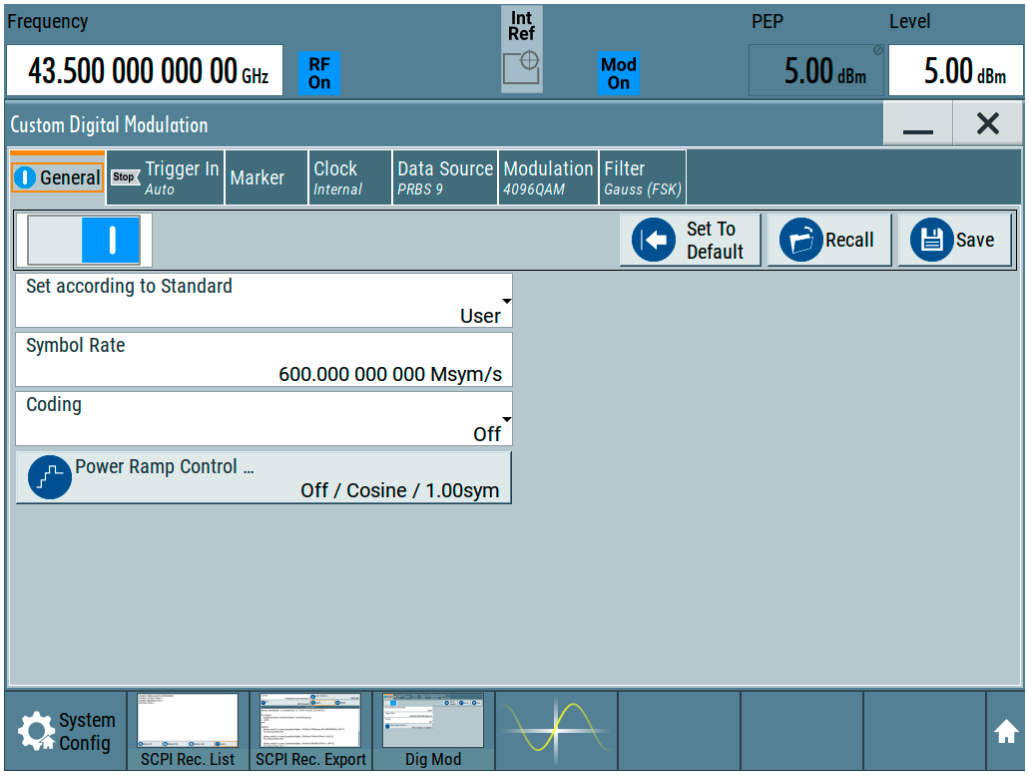
The arbitrary waveform generator is especially suitable for applications in production. Waveforms generated with the R&S®WinIQSIM2 simulation software can be loaded and played back. User-specific waveforms are also supported. The R&S®SMM100A is impressive with its large memory depth of up to 2 Gsample and maximum sampling rate of 1.2 Gsample/s.

Multi-segment mode is another ARB function that considerably speeds up test sequences by allowing fast switching between individual baseband signals.

Custom digital modulation

The R&S®SMM100A also makes it easy to generate custom digitally modulated signals with predefined modulation types and a symbol rate of up to 600 Msymbol/s. Besides standard pseudo noise (PN) data, user-specific data lists can also be loaded and a variety of configurable filters can be applied. Preconfigured settings are also available for various digital standards such as GSM and Bluetooth®.

Custom digital modulation



DISCOVER SCALABILITY

Frequency options

The R&S®SMM100A is available with various frequency options up to a maximum frequency of 44 GHz. This allows users to precisely configure the R&S®SMM100A to meet their actual test requirements. For example, signals can be generated in the 5G NR frequency ranges FR1 and FR2 up to 44 GHz. With the 7.5 GHz option, however, the relevant frequency range for Wi-Fi 6E can also be precisely covered.

Keycode extendable bandwidth and ARB memory

In the basic configuration, the R&S®SMM100A supports a maximum RF modulation bandwidth of 120 MHz. Depending on the requirements, this can be extended up to 1 GHz by installing a license key. With similar flexibility, the ARB memory depth can be extended from 64 Msample up to a maximum of 2 Gsample.

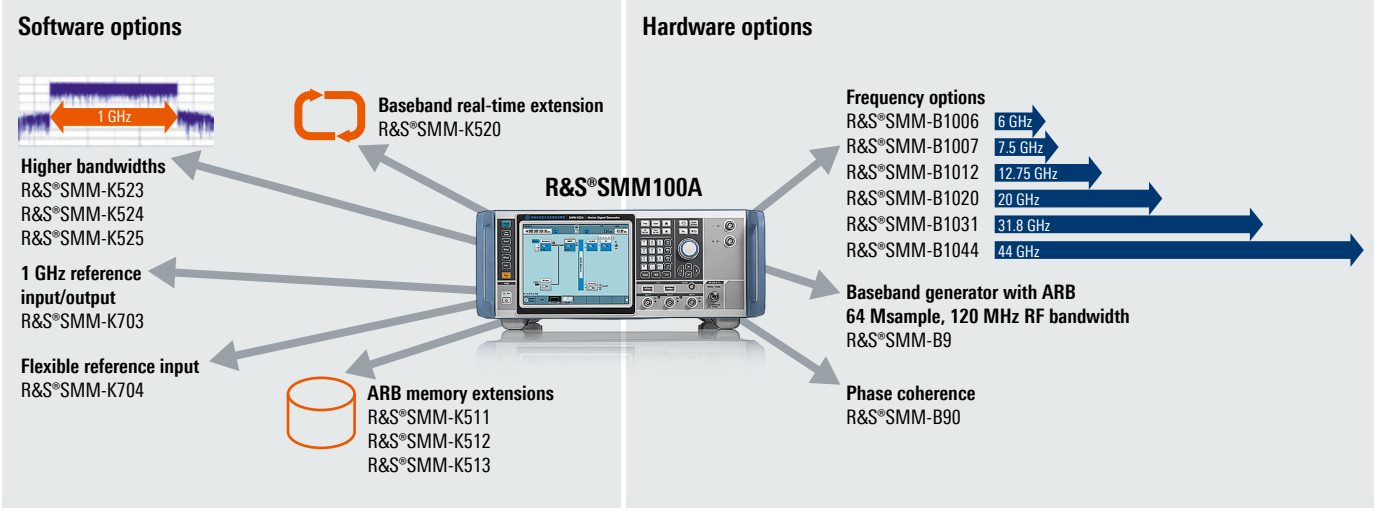
Timed licenses and waveform packs

In addition to permanent software licenses, time-limited licenses are available for three, six or twelve months in order to support smaller projects in a cost-efficient manner. In cases where only a few test signals are needed from various standards, the waveform packages available in different sizes are the right choice. Once registered, the waves can be used as often as necessary with no time limitation.

Floating licenses

In production environments, many test procedures might run in parallel but not always at the same time. Measurement options that are tied to specific instruments go unused to some extent. The license server provides a solution to this problem. All available licenses are stored in a central location on a server. The different instruments simply access the license pool when necessary. This helps reduce the number of necessary licenses while simultaneously cutting costs.

Overview of important software and hardware options



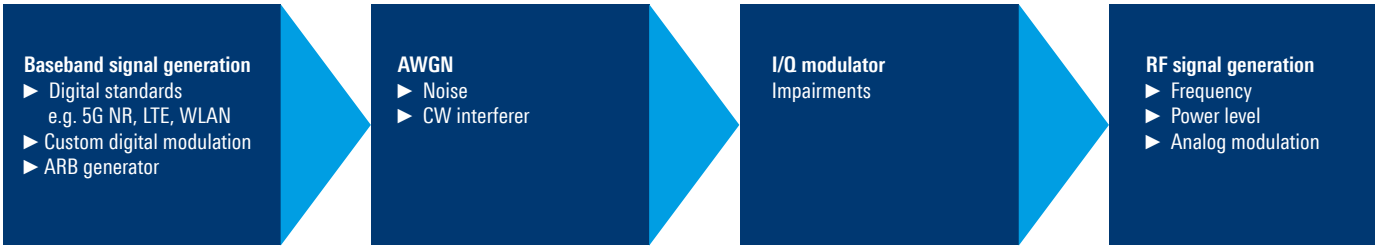
DISCOVER USABILITY

Structured and intuitive user interface

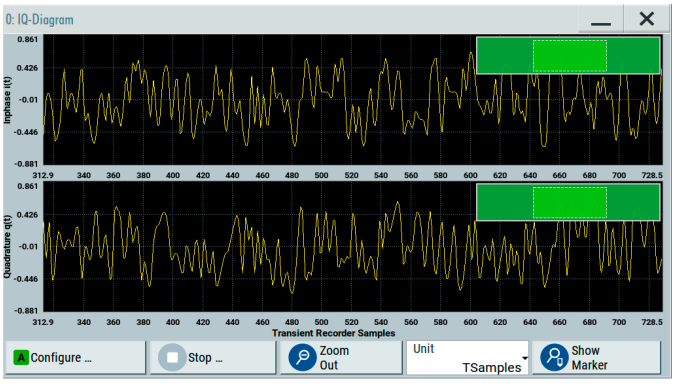
Instrument setups can be configured via a 8.4" touchscreen. The logically structured user interface is presented in the form of a block diagram. The configuration blocks begin with the baseband generator and are followed by the additive white Gaussian noise (AWGN) block, the I/Q modulator and the RF block for signal output. The block diagram represents the signal flow while simultaneously helping the user to intuitively work through the configuration menus.

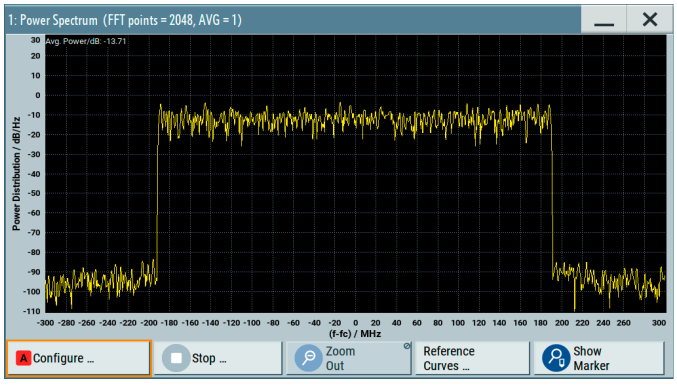
The built-in graphical analysis function allows verification of the configured baseband signal at different points within the overall signal flow path. Signals can be displayed in real time either in the time domain or as a spectrum. Additional analysis functions are available for the baseband signal.

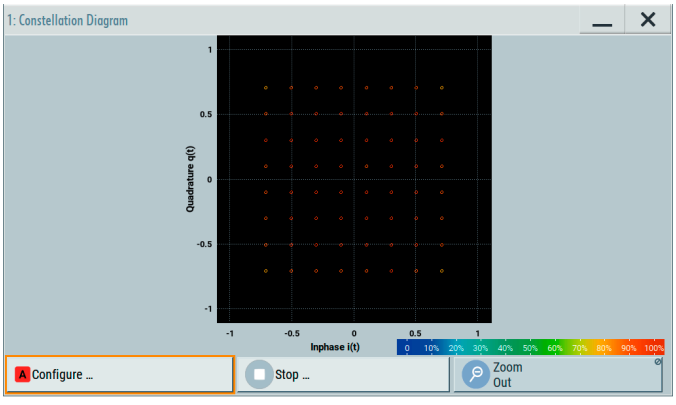
Division of the user interface into configuration blocks

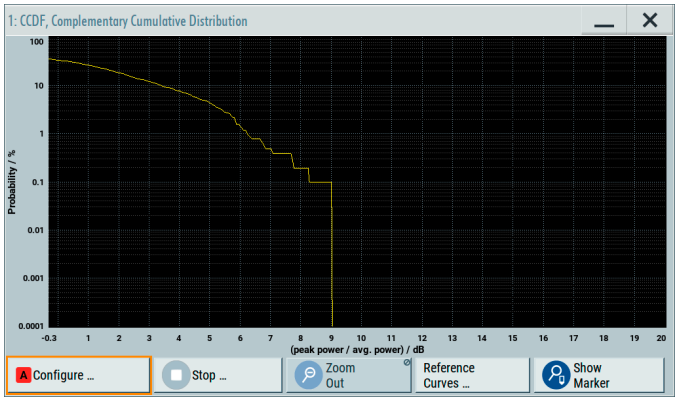


Graphical signal monitoring in real time







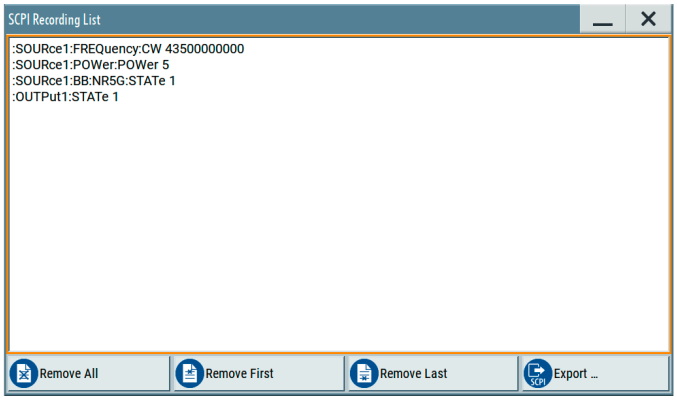


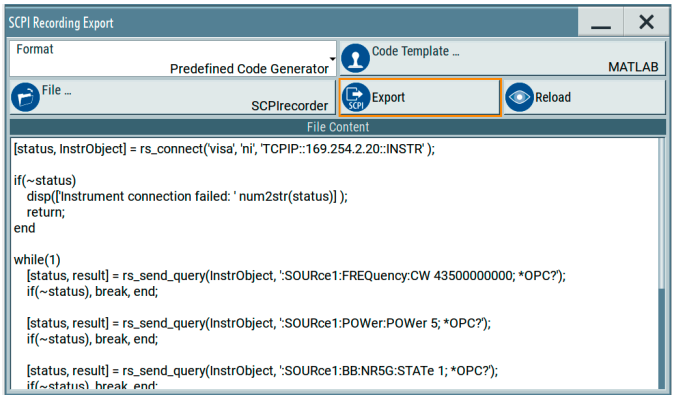
Automation made easy with context-sensitive help system and SCPI recording

Context-sensitive online help offers comprehensive information. It describes each parameter and setup menu in detail, states the setting range and shows the associated remote control commands. Moreover, users can search for specific parameters in the user manual installed on the instrument.

The R&S®SMM100A helps users quickly and correctly create remote control programs. The instrument's built-in SCPI macro recorder with code generator can automatically record all manual settings and create an executable MATLAB® or Python script. They can be reused with other Rohde&Schwarz vector signal generators due to code compatibility. The R&S®SMM100A therefore helps minimize the time required for test automation, saving development resources.

The built-in SCPI macro recorder and code generator support fast, easy generation of SCPI sequences

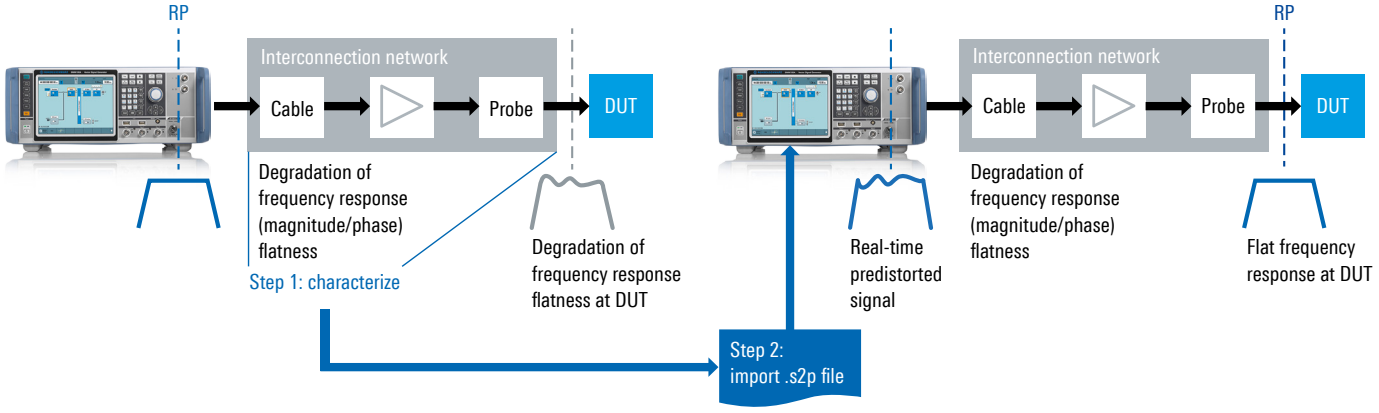




R&S®SMM-K544 frequency response correction

Various RF components such as cables, adapters, amplifiers and antennas are used to connect the signal generator to the DUT. Of course, all of these components influence the RF signal provided by the R&S®SMM100A. The R&S®SMM-K544 frequency response correction option can be used to automatically compensate for this effect. The frequency response for the components that are used is saved in .s2p files, which can be individually selected as required. The reference plane of the test signal is thus shifted from the RF connector of the R&S®SMM100A to the DUT input.

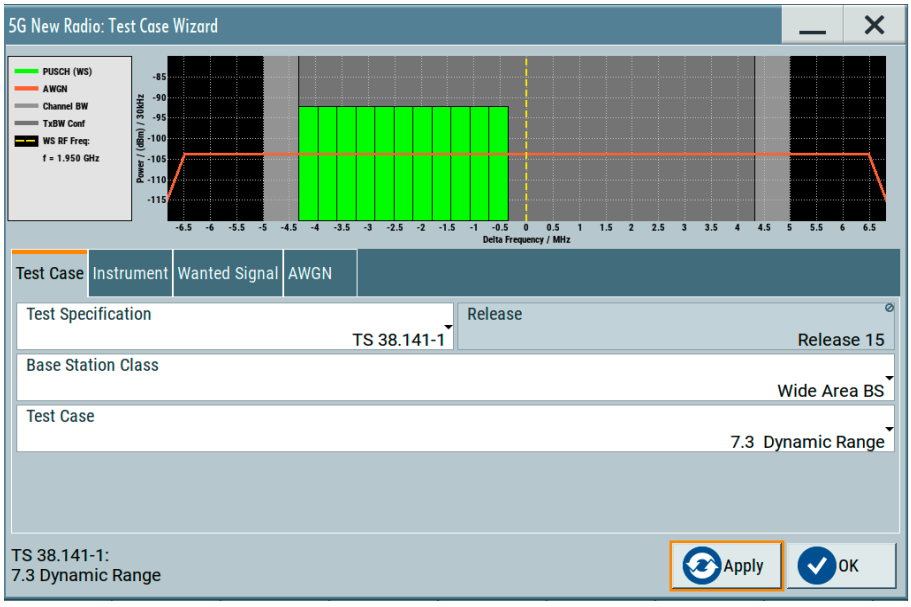
Principle of user-defined frequency response correction with R&S®SMM-K544 option



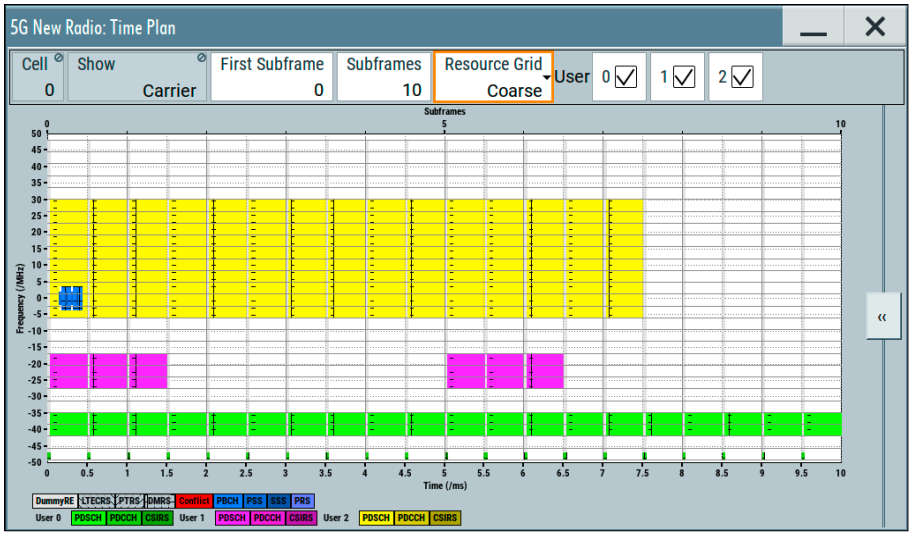
MOBILE COMMUNICATIONS STANDARDS

Using a wide range of available signal generation options, the R&S®SMM100A can produce test signals in compliance with the most important wireless communications standards. The instrument is especially well suited for generation of standard-compliant 5G NR signals. When equipped with the R&S®SMM-B1044 frequency option, the instrument covers frequency ranges FR1 up to 7.125 GHz and FR2 up to 44 GHz. Together with the R&S®SMM-K525 bandwidth extension to 1 GHz, the instrument can handle the increased requirements for signal bandwidth in 5G applications (especially in frequency range FR2 and with carrier aggregation). With its outstanding signal quality, the R&S®SMM100A is the perfect signal generator for 5G NR base station conformance testing in all frequency ranges – conducted and OTA.

Users benefit from the predefined test models and fixed reference channels (FRC). A test case wizard simplifies configuration of the instrument for 3GPP-compliant 5G NR and LTE BTS conformance tests. Once the user has selected the desired conformance test case, the wizard automatically handles configuration of all signal parameters and other R&S®SMM100A settings.



The 5G NR test case wizard allows the R&S®SMM100A to be conveniently and cleverly configured for BTS tests in line with 3GPP TS 38.141



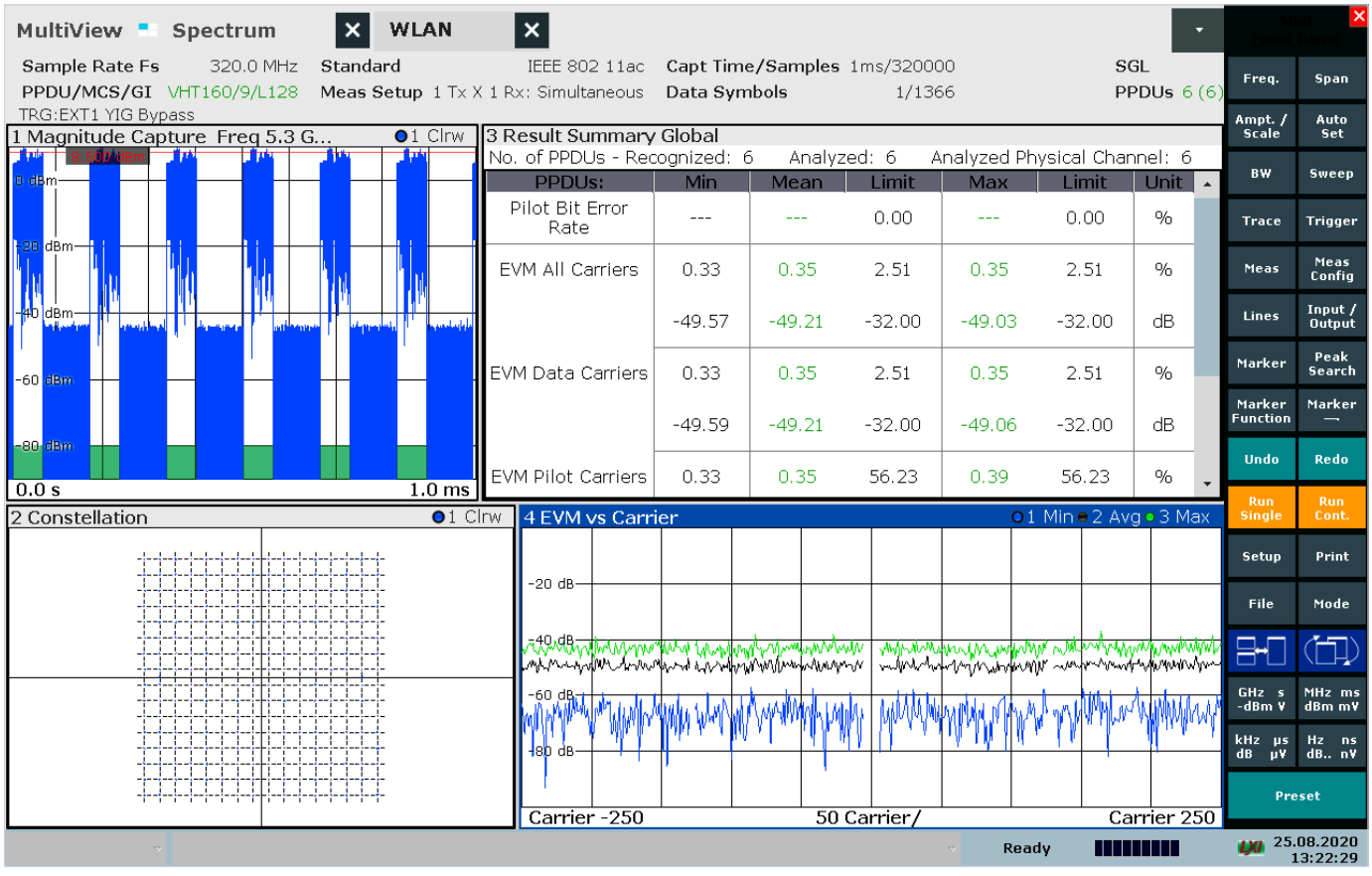
Time plan display in the 5G NR option of the R&S®SMM100A

READY FOR THE NEXT Wi-Fi® GENERATIONS

Below 6 GHz, the current WLAN standards IEEE 802.11ac and IEEE 802.11ax use a maximum signal bandwidth of 160 MHz. However, WLAN is also following the trend toward higher frequencies and larger bandwidths. For Wi-Fi 6E, the frequency range between 5.8 GHz and 7.125 GHz will be used. For future WLAN standards such as IEEE 802.11be, a signal bandwidth of 320 MHz has already been specified.

With EVM of better than –50 dB for a signal bandwidth of 320 MHz, the R&S®SMM100A satisfies the relevant requirements for signal quality. In combination with the R&S®SMM-B1007 frequency option up to 7.5 GHz and the R&S®SMM-K524 bandwidth extension to 500 MHz, the R&S®SMM100A is the ideal signal generator for WLAN testing of components, modules and devices.

EVM measurement of a IEEE 802.11ac WLAN signal with 160 MHz signal bandwidth



ENVELOPE TRACKING

An increasing number of power amplifiers support envelope tracking (ET) in order to reduce power consumption and improve efficiency, for example in smartphones and tactical radios. Typical test setups for measuring power amplifiers comprise at least one signal generator and one spectrum analyzer. Envelope tracking requires an additional generator to deliver the envelope signal for the DC modulator.

RF and envelope signal out of one box

Equipped with the R&S®SMM-K540 envelope tracking option, the R&S®SMM100A generates both the RF signal and the corresponding envelope signal. The envelope signal is generated from the baseband signal in real time. This means that any user-specific I/Q signals and any supported wireless communications signals, such as 5G NR or LTE, can be used.

Generating the RF signal and the envelope signal in a single instrument makes it possible to precisely adjust the delay between the two signals.

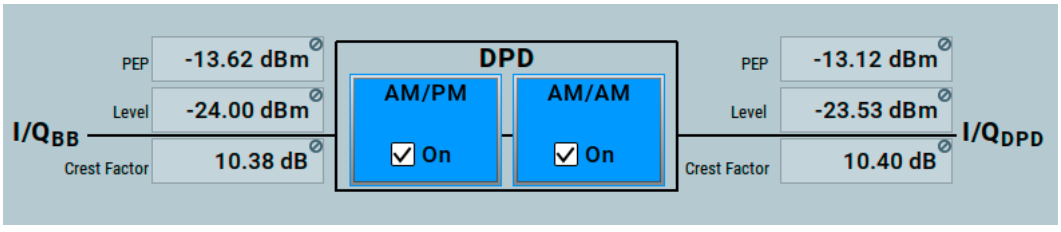
The R&S®SMM100A adjusts the delay in picosecond steps in real time, meeting tight requirements, for example accuracy better than 1 ns for a 20 MHz LTE signal.

The envelope signal is shaped to optimize the power amplifier for efficiency or linearity. The R&S®SMM100A offers various shaping methods, such as look-up table and polynomial, which are applied in real time. For power sweeps, the R&S®SMM100A automatically calculates the amplitude of the envelope signal, eliminating time-consuming manual calculations. It is also possible to adjust additional parameters, such as the gain and impedance of the DC modulator.

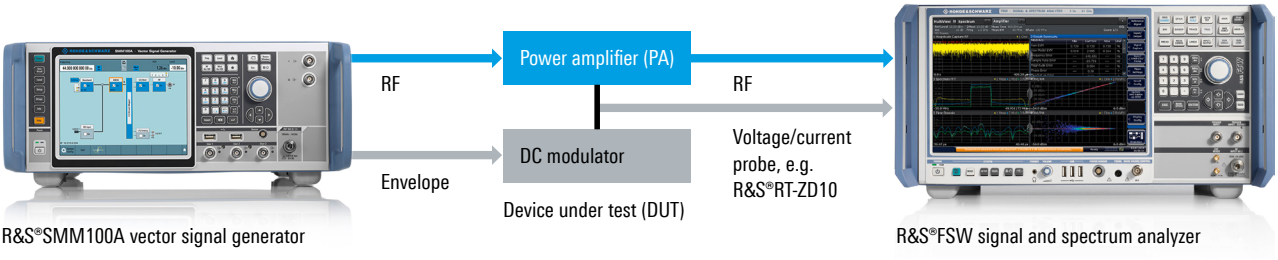
Real-time digital predistortion

With envelope tracking, the amplifier is operated close to or even in saturation, causing distortion at the amplifier output. To compensate for this effect, envelope tracking is often used in combination with digital predistortion (DPD). Equipped with the R&S®SMM-K541 digital predistortion option, the R&S®SMM100A can apply real-time amplitude and phase correction to each complex I/Q sample using the values in the DPD tables. As a result, users can quickly verify the effect of predistortion, even for different power levels, without having to manually calculate the original waveform.

Digital predistortion user interface with the R&S®SMM-K541 option



Compact Rohde&Schwarz setup for power amplifier tests including envelope tracking



R&S®SMM100A vector signal generator

R&S®FSW signal and spectrum analyzer

HIGH RATE PULSE (HRP) ULTRAWIDEBAND (UWB)

Due to the ability to determine distances with extremely high precision, HRP UWB is becoming increasingly important in many applications. In mobile devices, this information is used for hands-free access, mobile payments or asset finding, for example. In automotive applications, keyless entry systems that determine the distance between the key and the vehicle are also well established.

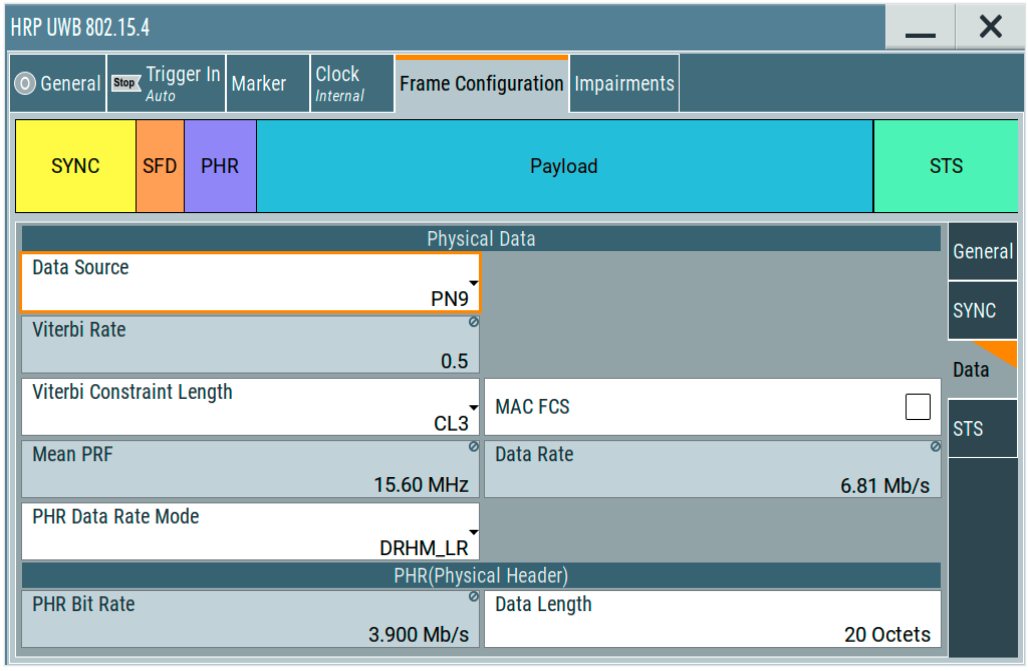
Based on amendment IEEE 802.15.4z to the IEEE 802.15.4a-2015 standard, new coding and preamble options as well as higher symbol rates for existing modulation types have been introduced for HRP UWB PHY in order to increase the accuracy of distance determination and improve the integrity of the measurement.

The R&S®SMM100A is ideally suited for HRP UWB receiver testing. With the R&S®SMM-B1012 frequency option up to 12.75 GHz, the R&S®SMM100A covers the frequency range used by HRP UWB up to 10.6 GHz. Together with the R&S®SMM-K524 baseband extension option to 500 MHz RF bandwidth, signals can be generated on the most important channels with a signal bandwidth of up to 500 MHz.

The R&S®SMM-K149 HRP UWB baseband option supports signal generation for the three specified modes: HRP UWB from IEEE 802.15.4a-2015 as well as the base pulse repetition frequency (BPRF) mode and the high pulse repetition frequency (HPRF) mode for enhanced ranging devices (ERDEF) from IEEE 802.15.4z.

For use in testing receivers, flexible configuration of the HPR UWB frame is supported. Depending on the requirements, the channel number, idle time, synchronization header (SHR), physical header (PHR), physical service data unit (PSDU) and scrambled timestamp sequence (STS) for time of flight measurements can all be individually configured. In addition, impairments due to symbol timing error and frequency offset can be simulated.

HRP UWB signal generation (R&S®SMM-K149 option)



STATE-OF-THE-ART USER INTERFACE

High-resolution touchscreen
With easy-to-use graphical user interface and block diagram

Context-sensitive help system

Signal monitoring with graphical result display
For practically every point in the signal flow

Favorite key
For simplified and fast operation via customizable user menu

Connector
For an R&S®NRP power sensor

RF output connector
1.85 mm male [1)]

User-configurable connectors
E.g. trigger, marker, clock

[1)] Depending on frequency option.

REAR PANEL CONNECTIONS

Removable hard disk drive
or R&S®SMM-B93 solid-state drive option

Flexible reference input/output from 1 MHz to 100 MHz
R&S®SMM-K704 option

1 GHz reference input/output
R&S®SMM-K703 option

LO in/out for phase coherence application
R&S®SMM-B90 option

Remote control via GPIB

Remote control via USB or LAN

Single-ended and differential analog I/Q outputs
R&S®SMM-K17 option

Input for external pulse modulation signal
R&S®SMM-K22 option

SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency range	with R&S®SMM-B1006 option	100 kHz to 6 GHz
	with R&S®SMM-B1007 option	100 kHz to 7.5 GHz
	with R&S®SMM-B1012 option	100 kHz to 12.75 GHz
	with R&S®SMM-B1020 option	100 kHz to 20 GHz
	with R&S®SMM-B1031 option	100 kHz to 31.8 GHz
	with R&S®SMM-B1044/-B1044N/-B1044O options	100 kHz to 44 GHz
Level range	peak envelope power (PEP)	
	100 kHz ≤ f < 1 MHz	–120 dBm to +3 dBm
	1 MHz ≤ f ≤ 3 MHz	–120 dBm to +8 dBm
	with R&S®SMM-B1006/-B1007/-B1012/-B1020 options	
	3 MHz < f ≤ 20 GHz	–120 dBm to +18 dBm
	with R&S®SMM-B1031/-B1044/-B1044N/-B1044N options	
	3 MHz < f ≤ 3 GHz	–120 dBm to +18 dBm
	3 GHz < f ≤ 14 GHz	–120 dBm to +17 dBm
	14 GHz < f ≤ 20 GHz	
	CW, I/Q modulation, signal bandwidth ≤ 160 MHz	–120 dBm to +15 dBm
	I/Q modulation, signal bandwidth > 160 MHz	–120 dBm to +12 dBm
	20 GHz < f ≤ 29 GHz	–120 dBm to +18 dBm
	29 GHz < f ≤ 33 GHz	–120 dBm to +17 dBm
	33 GHz < f ≤ 40 GHz	–120 dBm to +15 dBm
	40 GHz < f ≤ 42 GHz	–120 dBm to +13 dBm
	42 GHz < f ≤ 44 GHz	–120 dBm to +11 dBm
Spectral purity		
SSB phase noise	CW, standard performance, carrier offset = 20 kHz, measurement bandwidth = 1 Hz	
	20 MHz ≤ f ≤ 200 MHz	< –129 dBc, –134 dBc (typ.)
	f = 1 GHz	< –129 dBc, –134 dBc (typ.)
	f = 2 GHz	< –123 dBc, –128 dBc (typ.)
	f = 3 GHz	< –119 dBc, –124 dBc (typ.)
	f = 4 GHz	< –117 dBc, –122 dBc (typ.)
	f = 6 GHz	< –113 dBc, –118 dBc (typ.)
	f = 10 GHz	< –109 dBc, –114 dBc (typ.)
	f = 20 GHz	< –103 dBc, –108 dBc (typ.)
	f = 30 GHz	< –99 dBc, –104 dBc (typ.)
	f = 40 GHz	< –97 dBc, –102 dBc (typ.)
	f = 44 GHz	< –96 dBc, –101 dBc (typ.)
Harmonics	CW, f > 1 MHz	
	with R&S®SMM-B1006/-B1007/-B1012 options, level < 10 dBm	< –30 dBc
	with R&S®SMM-B1020/-B1031/-B1044/-B1044N/-B1044O options	
	f ≤ 3.5 GHz	< –30 dBc
	f > 3.5 GHz	< –55 dBc
Nonharmonics	CW, I/Q modulation (external wideband I/Q, full-scale DC input), level > –10 dBm, > 10 kHz offset from carrier	
	100 kHz ≤ f ≤ 200 MHz	< –80 dBc
	200 MHz < f ≤ 1.5 GHz	< –85 dBc
	1.5 GHz < f ≤ 3 GHz	< –79 dBc
	3 GHz < f ≤ 6 GHz	< –73 dBc
	6 GHz < f ≤ 12 GHz	< –67 dBc
	12 GHz < f ≤ 24 GHz	< –61 dBc
	24 GHz < f ≤ 44 GHz	< –55 dBc

Specifications in brief		
Analog modulation	supported analog modulation modes	
	with R&S®SMM-K720 option	AM, FM, PM
	with R&S®SMM-K22 option	pulse modulation
I/Q modulation		
RF modulation bandwidth	with internal baseband I/Q, I/Q wideband on; with R&S®SMM-B1006/-B1007/-B1012/-B1020/-B1031/-B1044 options	
	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 1.25 GHz	±40 % of carrier frequency
	f > 1.25 GHz	±500 MHz
	with internal baseband I/Q, I/Q wideband on; with R&S®SMM-B1044N option	
	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 1.25 GHz	±40 % of carrier frequency
	1.25 GHz < f ≤ 20 GHz	±500 MHz
	f > 20 GHz	±275 MHz
	with internal baseband I/Q, I/Q wideband on; with R&S®SMM-B1044O option	
	1 MHz ≤ f ≤ 300 MHz	±32 % of carrier frequency
	300 MHz < f ≤ 1.25 GHz	±40 % of carrier frequency
	1.25 GHz < f ≤ 31.75 GHz	±500 MHz
	31.75 GHz < f ≤ 37.05 GHz	±225 MHz
	f > 37.05 GHz	±500 MHz
Modulation frequency response in specified RF modulation bandwidth	with internal baseband, I/Q wideband on	< 1.0 dB, < 0.4 dB (meas.)
I/Q baseband generator		
Signal bandwidth	standard	120 MHz
	with R&S®SMM-K523 option	240 MHz
	with R&S®SMM-K523/-K524 options	500 MHz
	with R&S®SMM-K523/-K524/-K525 options	1000 MHz
ARB memory depth	standard	64 Msample
	with R&S®SMM-K511 option	512 Msample
	with R&S®SMM-K511/-K512 options	1 Gsample
	with R&S®SMM-K511/-K512/-K513 options	2 Gsample
Digital standards		
Supported standards and modulation systems		5G NR, OFDM signal generation, cellular IoT, LTE, 3GPP FDD/HSPA/HSPA+, GSM/EDGE/ EDGE Evolution, CDMA2000®, 1xEV-DO Rev. A/B, WLAN IEEE 802.11a/b/g/n/j/p/ac/ax, HRP UWB, AWGN and more

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
Vector signal generator, including power cable and quick start guide	R&S®SMM100A	1440.8002.02
Options R&S®SMM-Bxxx = hardware option, R&S®SMM-Kxxx = software/keycode option		
Frequency options		
100 kHz to 6 GHz	R&S®SMM-B1006	1440.9009.02
100 kHz to 7.5 GHz	R&S®SMM-B1007	1440.9109.02
100 kHz to 12.75 GHz	R&S®SMM-B1012	1440.9209.02
100 kHz to 20 GHz	R&S®SMM-B1020	1440.9309.02
100 kHz to 31.8 GHz	R&S®SMM-B1031	1440.9409.02
100 kHz to 44 GHz	R&S®SMM-B1044	1440.9509.02
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited from 20 GHz to 44 GHz	R&S®SMM-B1044N	1440.9609.02
100 kHz to 44 GHz, I/Q modulation bandwidth and minimum pulse width limited from 31.75 GHz to 37.05 GHz	R&S®SMM-B1044O	1441.0405.02
RF options		
Phase coherence	R&S®SMM-B90	1440.9709.02
Pulse modulator	R&S®SMM-K22	1441.1330.02
Pulse generator	R&S®SMM-K23	1441.1347.02
Multifunction generator	R&S®SMM-K24	1441.1353.02
100 MHz, 1 GHz ultra low noise reference input/output	R&S®SMM-K703	1441.1301.02
Flexible reference input (1 MHz to 100 MHz)	R&S®SMM-K704	1441.1318.02
AM/FM/PM	R&S®SMM-K720	1441.1324.02
Baseband		
Baseband generator with ARB (64 Msample, 120 MHz RF bandwidth)	R&S®SMM-B9	1440.9809.02
Differential analog I/Q outputs	R&S®SMM-K17	1441.2143.02
ARB memory extension to 512 Msample	R&S®SMM-K511	1441.1260.02
ARB memory extension to 1 Gsample	R&S®SMM-K512	1441.1276.02
ARB memory extension to 2 Gsample	R&S®SMM-K513	1441.2120.02
Baseband real-time extension	R&S®SMM-K520	1441.2114.02
Baseband extension to 240 MHz RF bandwidth	R&S®SMM-K523	1441.2108.02
Baseband extension to 500 MHz RF bandwidth	R&S®SMM-K524	1441.2095.02
Baseband extension to 1 GHz RF bandwidth	R&S®SMM-K525	1441.2089.02
Baseband enhancements		
Additive white Gaussian noise (AWGN)	R&S®SMM-K62	1441.2072.02
Bit error rate tester	R&S®SMM-K80	1441.2066.02
ARB Ethernet upload	R&S®SMM-K507	1441.0934.02
Envelope tracking	R&S®SMM-K540	1441.2050.02
AM/AM, AM/PM predistortion	R&S®SMM-K541	1441.2043.02
User-defined frequency response correction	R&S®SMM-K544	1441.2037.02
Crest factor reduction	R&S®SMM-K548	1441.1130.02
Frontend control	R&S®SMM-K553	1441.1147.02
Notched signals	R&S®SMM-K811	1441.1047.02
Digital standards		
GSM/EDGE	R&S®SMM-K40	1441.2020.02
EDGE evolution	R&S®SMM-K41	1441.2014.02
3GPP FDD	R&S®SMM-K42	1441.2008.02
CDMA2000®	R&S®SMM-K46	1441.1999.02
1xEV-DO Rev. A	R&S®SMM-K47	1441.1982.02

Designation	Type	Order No.
TD-SCDMA	R&S®SMM-K50	1441.1960.02
TD-SCDMA, enhanced BS/MS tests	R&S®SMM-K51	1441.1953.02
IEEE 802.11a/b/g/n/j/p	R&S®SMM-K54	1441.1930.02
LTE Release 8	R&S®SMM-K55	1441.1924.02
Bluetooth® EDR	R&S®SMM-K60	1441.1918.02
Multicarrier CW signal generation	R&S®SMM-K61	1441.1901.02
3GPP FDD HSPA/HSPA+, enhanced BS/MS tests	R&S®SMM-K83	1441.1899.02
LTE Release 9	R&S®SMM-K84	1441.1882.02
LTE Release 10	R&S®SMM-K85	1441.1876.02
IEEE 802.11ac	R&S®SMM-K86	1441.1860.02
1xEV-DO Rev. B	R&S®SMM-K87	1441.1853.02
NFC A/B/F	R&S®SMM-K89	1441.1160.02
LTE Release 11	R&S®SMM-K112	1441.1847.02
LTE Release 12	R&S®SMM-K113	1441.1830.02
OFDM signal generation	R&S®SMM-K114	1441.1824.02
Cellular IoT Release 13	R&S®SMM-K115	1441.1818.02
Bluetooth® 5.x	R&S®SMM-K117	1441.1799.02
LTE Releases 13, 14 and 15	R&S®SMM-K119	1441.1776.02
LoRa®	R&S®SMM-K131	1441.1760.02
IEEE 802.11ax	R&S®SMM-K142	1441.1753.02
Cellular IoT Release 14	R&S®SMM-K143	1441.1747.02
5G NR Release 15	R&S®SMM-K144	1441.1730.02
Cellular IoT Release 15	R&S®SMM-K146	1441.1247.02
IEEE 802.11be	R&S®SMM-K147	1441.1053.02
5G NR Release 16	R&S®SMM-K148	1441.2166.02
HRP UWB	R&S®SMM-K149	1441.1099.02
5G NR sidelink	R&S®SMM-K170	1441.1076.02
5G NR Release 17	R&S®SMM-K171	1441.1018.02
U-plane generation	R&S®SMM-K175	1441.1030.02
Digital standards using R&S®WinIQSIM2 [1]		
GSM/EDGE	R&S®SMM-K240	1441.1724.02
EDGE Evolution	R&S®SMM-K241	1441.1718.02
3GPP FDD	R&S®SMM-K242	1441.1701.02
GPS, 1 satellite	R&S®SMM-K244	1441.1699.02
CDMA2000®	R&S®SMM-K246	1441.1682.02
1xEV-DO Rev. A	R&S®SMM-K247	1441.1676.02
TD-SCDMA	R&S®SMM-K250	1441.1653.02
TD-SCDMA, enhanced BS/MS tests	R&S®SMM-K251	1441.1647.02
DVB-H/DVB-T	R&S®SMM-K252	1441.1630.02
DAB/T-DMB	R&S®SMM-K253	1441.1624.02
IEEE 802.11a/b/g/n/j/p	R&S®SMM-K254	1441.1618.02
LTE, Release 8	R&S®SMM-K255	1441.1601.02
Bluetooth® EDR	R&S®SMM-K260	1441.1599.02
Multicarrier CW signal generation	R&S®SMM-K261	1441.1582.02
Additive white Gaussian noise (AWGN)	R&S®SMM-K262	1441.1576.02
Galileo, 1 satellite	R&S®SMM-K266	1441.1560.02
3GPP FDD HSPA/HSPA+, enhanced BS/MS tests	R&S®SMM-K283	1441.1547.02
LTE Release 9	R&S®SMM-K284	1441.1530.02
LTE Release 10	R&S®SMM-K285	1441.1524.02
IEEE 802.11ac	R&S®SMM-K286	1441.1518.02
1xEV-DO Rev. B	R&S®SMM-K287	1441.1501.02
NFC A/B/F	R&S®SMM-K289	1441.1499.02

[1] R&S®WinIQSIM2 requires an external PC.

Designation	Type	Order No.
GLONASS, 1 satellite	R&S®SMM-K294	1441.1482.02
IRNSS, 1 satellite	R&S®SMM-K297	1441.1199.02
Modernized GPS, 1 satellite	R&S®SMM-K298	1441.1476.02
BeiDou, 1 satellite	R&S®SMM-K407	1441.1460.02
LTE Release 11	R&S®SMM-K412	1441.1453.02
LTE Release 12	R&S®SMM-K413	1441.1447.02
OFDM signal generation	R&S®SMM-K414	1441.1430.02
Cellular IoT Release 13	R&S®SMM-K415	1441.1424.02
DVB-S2/DVB-S2X	R&S®SMM-K416	1441.1418.02
Bluetooth® 5.x	R&S®SMM-K417	1441.1401.02
LTE Releases 13, 14 and 15	R&S®SMM-K419	1441.1382.02
Modernized GLONASS	R&S®SMM-K423	1441.0928.02
LoRa®	R&S®SMM-K431	1441.1182.02
Modernized BeiDou, 1 satellite	R&S®SMM-K432	1441.1176.02
IEEE 802.11ax	R&S®SMM-K442	1441.1376.02
Cellular IoT Release 14	R&S®SMM-K443	1441.1253.02
5G NR Release 15	R&S®SMM-K444	1441.1360.02
Cellular IoT Release 15	R&S®SMM-K446	1441.1230.02
IEEE 802.11be	R&S®SMM-K447	1441.1060.02
5G NR Release 16	R&S®SMM-K448	1441.2172.02
HRP UWB	R&S®SMM-K449	1441.1101.02
DVB-RCS2	R&S®SMM-K469	1441.0905.02
5G NR sidelink	R&S®SMM-K470	1441.1082.02
5G NR Release 17	R&S®SMM-K471	1441.1024.02
DVB-S2/DVB-S2X Annex E	R&S®SMM-K476	1441.0911.02
Options with external R&S®Pulse Sequencer Software or R&S®Pulse Sequencer DFS Software		
Pulse sequencing	R&S®SMM-K300	1441.1153.02
Enhanced pulse sequencing	R&S®SMM-K301	1441.1201.02
DFS signal generation	R&S®SMM-K350	1441.1224.02
Waveform packages for signals from R&S®WinIQSIM2, R&S®Pulse Sequencer Software or R&S®Pulse Sequencer DFS Software		
1 waveform	R&S®SMM-K200	1441.1124.71
5 waveforms	R&S®SMM-K200	1441.1124.72
50 waveforms	R&S®SMM-K200	1441.1124.75
Other options		
Solide-state drive	R&S®SMM-B93	1440.9996.02
Health and utilization monitoring service (HUMS)	R&S®SMM-K980	1441.1118.02
Recommended extras		
19" rack adapter	R&S®ZZA-KN4	1177.3033.00
Cable for HS digital I/Q interface, optical cable with QSFP+ plug	R&S®DIGIQ-HS	3641.2948.03
USB serial adapter for RS-232 remote control	R&S®TS-USB1	6124.2531.00
Adapters for instruments with an R&S®SMM-B1012/-B1020/-B2020/-B1031 frequency option		
Test port adapter, 2.92 mm female		1036.4790.00
Test port adapter, 2.92 mm male		1036.4802.00
Test port adapter, N female		1036.4777.00
Test port adapter, N male		1036.4783.00
Adapters for instruments with an R&S®SMM-B1044/-B1044N frequency option		
Coaxial adapter, 1.85 mm (f) to 1.85 mm (f)		3588.9654.00
Coaxial adapter, 1.85 mm (f) to 2.92 mm (f)		3628.4728.02