



R&S®ZN-ZCG COMB GENERATOR

Wideband and traceable phase calibration



Precise phase calibration with the R&S®ZNA

High-end vector network analyzers enable phase phase testing even in combination with frequency conversion. This feature is crucial for a wide range of applications – from on-wafer amplifier design to advanced A&D and satellite applications. Calibration mixers are inadequate due to limited bandwidth and wideband reciprocity issues.

The R&S®ZN-ZCG comb generator, clocked by the R&S®ZNA vector network analyzer, generates a time-domain pulse sequence that produces a phase-characterized harmonic comb. This enables wideband receiver calibration

Ideal for

Aerospace and defense

Multichannel receiver

Amplifier design testing

Converter design

without calibration mixers. A single calibration step added to the system error correction supports accurate high-order harmonic and RF-IF mixer conversion phase measurements. The magnitude and phase of each spectrum line are factory-characterized, and this characterization is referenced to the National Institute of Standards and Technology (NIST).

Specifications in brief

Frequency range	R&S®ZN-ZCG44	10 MHz to 44 GHz
	R&S®ZN-ZCG67	10 MHz to 67 GHz
RF output connector	R&S®ZN-ZCG44	2.92 mm, female
	R&S®ZN-ZCG67	1.85 mm, female
Clock input connector	adapter for 1.85 mm included (R&S®ZN-ZCG67)	2.92 mm, female
Input frequency range	clock signal	640 MHz, 1 GHz, 2 GHz
Minimum output power per picket	$\Delta f = 10$ MHz (Δf defined as: tone spacing/comb frequency grid)	
	10 MHz to 26.5 GHz	> -79 dBm (typ.)
	26.5 GHz to 44 GHz	> -85 dBm (typ.)
	44 GHz to 67 GHz (R&S®ZN-ZCG67 only)	> -94 dBm (typ.)
Tone spacing	characterized	Δf from kHz range to 1 MHz or 100 MHz
	functional	$\Delta f \geq 100$ MHz to 2 GHz
Phase response uncertainty	10 MHz to 26.5 GHz	$\pm 2^\circ$
	26.5 GHz to 44 GHz	$\pm 2.5^\circ$
	44 GHz to 67 GHz	$\pm 3.5^\circ$

Features

- ▶ Integrated in R&S®SMARTerCal: only a single connection required for port group calibration
- ▶ System error correction automatically calibrates the phase of all receivers
- ▶ R&S®ZNA with R&S®ZNA-B12 option for control and synchronization
- ▶ Any R&S®ZNA port can supply the 2 GHz clock signal
- ▶ Powered via power over Ethernet (PoE)
- ▶ Generates equally spaced, very narrow pulses (< 20 ps), resulting in a comb spectrum beyond 67 GHz
- ▶ Magnitude and phase of each harmonic is factory-characterized and NIST-traceable
- ▶ Tone spacing adjustable (from kHz range to 100 MHz; optionally up to 2 GHz)

Your benefit

- Seamless integration into vector network analyzer (VNA) calibration workflows
- Easy setup and system integration
- Optimization for signal-to-noise ratio and measurement frequency grid



For options, prices and more information, visit www.rohde-schwarz.com

Seamless system integration

Thanks to the automatic calibration via R&S®SMARTerCal, the RF output of the R&S®ZN-ZCG only needs to be connected to one port of an R&S®ZNA port group. Together with the VNA's system error correction, all involved receivers are automatically phase-calibrated.

Interfaces of the R&S®ZN-ZCG

Device information display

Ready indication, IP address

Trigger output

Triggering peripheral units

Host interface

Controlled by R&S®ZNA with R&S®ZNA-B12 interface

LAN power over Ethernet (PoE) interface

Acts as power supply input and optional control interface after calibration

Clock input

RF input signal from vector network analyzer as clock signal



Optimization and traceability

The comb generator acts as a pulse generator and produces equally spaced pulses at which the resulting harmonic spectrum is phase-characterized. The magnitude and phase of each spectral line are factory-characterized, stored internally and traceable to the NIST. Tone spacing is derived from the measurement by default but user-adjustable. The spacing of the spectral lines ranges from the kHz range for very fine frequency grids up to 100 MHz (optionally up to 2 GHz) to increase the power per tone and improve the per-tone signal-to-noise ratio. The combination of adjustable tone spacing and factory traceability makes the R&S®ZN-ZCG well suited for amplifier harmonic, mixer harmonic and sideband phase testing as well as spectrum evaluation and verification.

Easy setup and system integration

The control and timing synchronization requires the R&S®ZNA-B12 direct control option¹⁾, which can be installed on site at the rear of the R&S®ZNA.

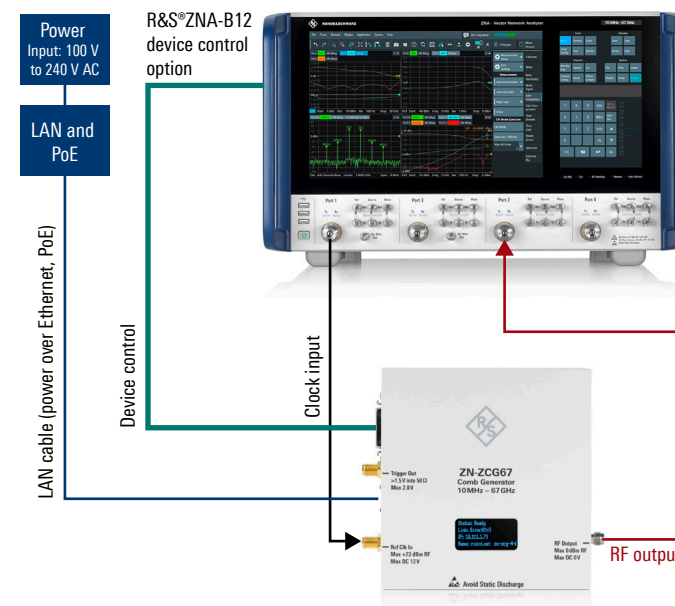
Any of the VNA ports – a port to be calibrated or an unused port – can be used to deliver the 2 GHz RF clock signal.

¹⁾ The interface card is bound to the dedicated instrument and serial number.

The R&S®ZN-ZCG RF output provides the frequency comb spectrum from 10 MHz to 44 GHz/67 GHz and is connected to an R&S®ZNA port for the receiver phase calibration.

The LAN PoE interface serves as the power supply.

Example R&S®ZN-ZCG connection for R&S®ZNA calibration



Main applications

Amplifier design	<ul style="list-style-type: none"> ▶ Accurate receiver phase calibration for challenging amplifier testing applications ▶ Evaluation of the magnitude and phase of the harmonics ▶ Waveform testing using time domain analysis
Converter development	<ul style="list-style-type: none"> ▶ Accurate mixer phase measurements for receivers and frequency-converting T/R modules ▶ Converter testing with stepped local oscillator (LO)
System integration	<ul style="list-style-type: none"> ▶ Remote controlled systems with external software for calibration, e.g. load pull system, on-wafer testing, receiver calibration ▶ Support for embedding and deembedding networks included
Metrology and uncertainty measurements	<ul style="list-style-type: none"> ▶ Tighten uncertainty and traceability to phase

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R&S®ZN-ZCG comb generator

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See also application cards



Validating RF frontends for satellite links
(PD 3610.2700.92)



Enhance frequency translating measurements
(PD 3673.3010.92)

Operating modes

The R&S®ZN-ZCG can be used in different ways:

- ▶ As an additional automatic calibration module during R&S®ZNA system error correction
- ▶ For activating the output spectrum (when not calibrating) for evaluation, optimization and verification purposes
- ▶ For standalone operation as a generic reference for general (remote) receiver calibration