Signal Generator SMP: automatic user correction of RF level with Power Meter NRVS or NRVD

FIG 1 Signal Generator SMP and Power Meter NRVD – a powerful team guaranteeing high output levels and precision up to 40 GHz Photo 43 071

More and more satisfied customers are becoming familiar with the name SMP, which stands for microwave generators with excellent signal characteristics in the frequency range 10 MHz to 40 GHz [1; 2]. In the SMP signal generator family, Rohde & Schwarz has proven once more its ability to offer outstanding technical features and high quality at an attractive price. Despite utilizing all the potential of modern microwave and microprocessor technologies, there is one thing the four SMP models (TABLE) cannot do of course, ie turn elementary laws of physics upside down. Still, thanks to their built-in intelligence, they do make the innate difficulties of microwave measurements extremely easy to get along with. This is exemplified here by automatic determination of level correction data with the user correction function.

Model	Frequency range	Guaranteed level at f_{max}
SMP02	10 MHz/2 GHz to 20 GHz	+11.5 dBm
SMP22	10 MHz/2 GHz to 20 GHz	+20 dBm
SMP03	10 MHz/2 GHz to 27 GHz	+13 dBm
SMP04	10 MHz/2 GHz to 40 GHz	+10 dBm

TABLE Overview of SMP models

First a closer look at the **measurement task** itself. In most test setups you find you need a somewhat longer RF connecting cable between the generator output and DUT input. Plus, you may have to loop RF switches, power splitters, phase shifters and the like into the signal path. At 20 GHz for example, this quickly adds up to an insertion loss of a few dB. Unfortunately the same setup at a lower frequency, say at about 2 GHz, will produce no more than a few tenths of a dB in insertion loss, which generally means significant frequency response. Things are further aggravated by the effects of SWR which, as a result of the inevitable matching errors, is superimposed on the frequency response. Although you can set SMP output level with high precision and stability, you do not initially know the exact driving level at the DUT input. So you cannot perform those measurements correctly that, in one way or another, are dependent on level, eg transmission measurements on frequency multipliers or RF detectors, but also compression and harmonics measurements on limiters, amplifiers, mixers or YIG bandpass filters. Here you often need to know the driving level to within a few tenths of a dB.

All **SMP models** have two functions that help you get the required accuracy with the aid of an external power meter. First there is **external level control.** This requires Power Meter NRVS for continuous measurement of the nominal level [3]. The other possibility is the **user correction** function. This is based on a table stored in SMP in which you can enter level correction data for up to 160 selectable frequencies. You can do

this manually via the front panel, but it is far more convenient to let SMP do it. The required test setup is shown in FIG 1. Basically, all you need in addition to SMP is Power Meter NRVS or NRVD [4] – of course with a suitable sensor for the operating frequency range in question – and an IEC/IEEE-bus cable so that SMP can automatically control the power meter and read results from it (FIG 2). So, with SMP acting as the bus controller in correction-value measurements, you must make sure that there is no second active controller connected to the IEC/IEEE bus.

Automatic correction-value measurement is performed as follows:

- Set the required level on SMP.
- Select the "Level-Ucor" menu.
- Set "State" to "On" – this activates user correction.
- Select your power meter (NRVD or NRVS).
- Select a table and enter the desired frequencies. (To generate an equi-spaced frequency table, use the fill function of the list editor.)
- Start correction-value measurement by activating the "Measure Connection via Power Meter" menu item.

SMP first determines the IEC/IEEE-bus address of the power meter and the type of sensor connected. Then it measures the correction values and enters them in the table. When the measurement is completed, you can display the results with the Edit/View function of the list editor. As many as ten different correction tables can be generated and recalled in this convenient way.

After correction-value measurement, simply remove the power sensor. If you now connect the DUT instead, it is fed with precisely the RF level set on SMP. If you select frequencies in between the frequency points of the tables, it is no problem, because SMP determines the correction values for these frequencies by interpolation. But if you select a frequency outside the ranges covered by the tables, the RF level will not be corrected – which is stating the obvious.

Compared to the above-mentioned external level control, which can likewise be used for RF level correction, the **automatic user correction** function offers the following **advantages:**

- The power meter and its sensor are only needed for the duration of the correction-value measurement. After that you can use them for something else.
- With external level control, the sensor must be connected via a power splitter or directional coupler. Here these components are superfluous. Please remember – the less components connected, the smaller the loss in useful microwave power.
- The user correction function is a pure control function. So obviously it operates faster than external level control, because there are no control loops that have to settle. This is a big advantage for fast frequency changes on the IEC/IEEE bus.

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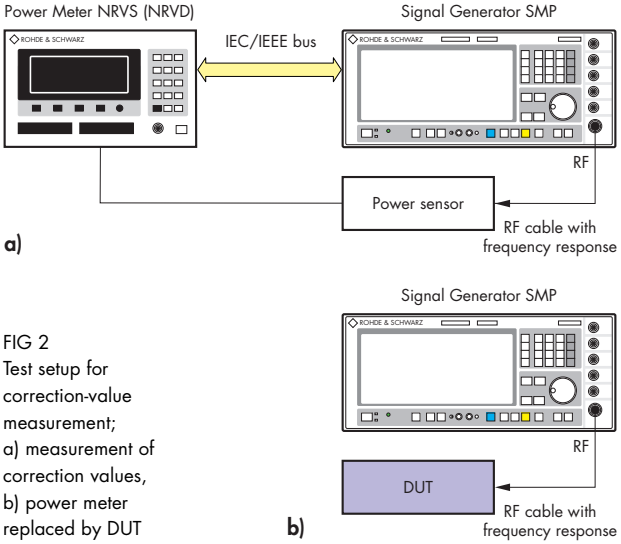

FIG 2
Test setup for correction-value measurement;
a) measurement of correction values,
b) power meter replaced by DUT

REFERENCES

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[3] Kraemer, W.: External precision level control for microwave Signal Generator SMP. News from Rohde & Schwarz (1994) No. 144, p 14

[4] Reichel, T.: NRVD and NRVS, new thermocouple power meters. News from Rohde & Schwarz (1992) No. 137, pp 4–7

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