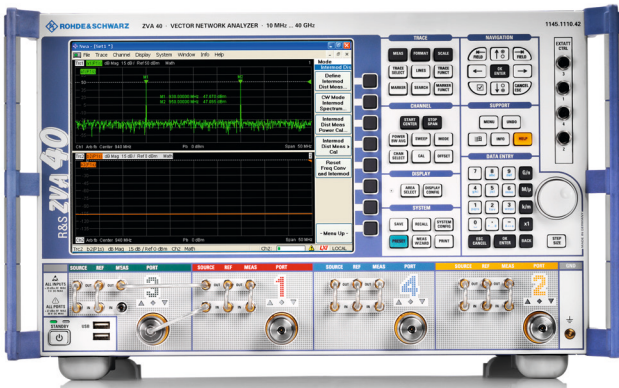


Fast and accurate passive intermodulation (PIM) measurements

Unique automatic level controlled (ALC) based test setup using the R&S®ZVA vector network analyzer and R&S®BBA150 broadband amplifiers provides highly accurate and reproducible results in minimum test time.



Your task

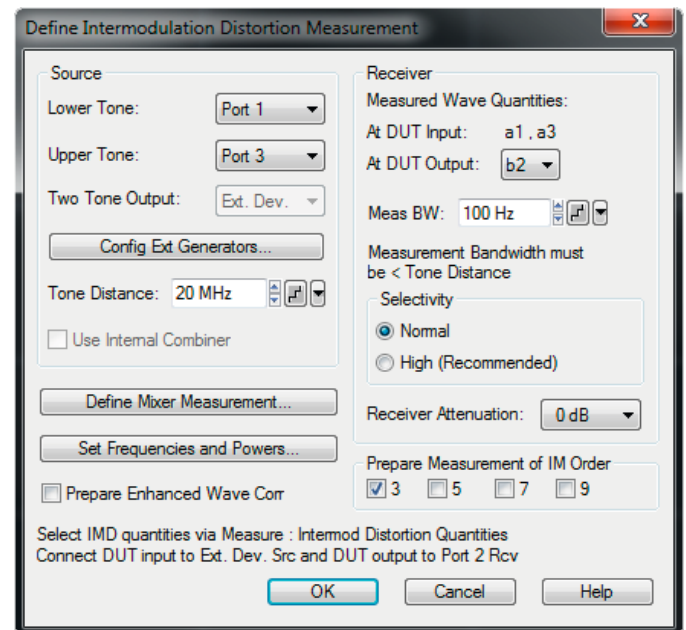
At very high power levels, passive intermodulation (PIM) may occur in devices such as cables, connectors and (duplex) filters. For example, in modern wireless communications systems, PIM is a major concern in base station transceivers, where the frequency of PIM signals can coincide with the receiver path frequency of the duplex filter, degrading the sensitivity of the receiver. PIM testing of duplex filters during production is therefore essential. PIM measurements require two tones to be applied to the device under test (DUT), ideally swept in frequency and power. Conventional multi-instrument test setups based on signal generators and spectrum analyzers provide limited functionality and require programming effort

to control and align the instruments. Solutions based on a single-source network analyzer also require an external signal generator and offer very limited measurement configurations.

Another challenge is the need to provide stable signals at high power levels. The thermal settling effects of the power amplifiers cause output power variations, which must be overcome in order to ensure that calibrated and stable power is applied to the DUT. To avoid damage to the test equipment and the DUT, the amplifiers must be switched off and on again when (dis)connecting the DUT. However, after switching on the amplifiers, a certain amount of time must elapse to regain a settled operating state. Knowing that it is hard to predict how much time is needed to achieve stable operation, and taking into account that speed is crucial in a production environment, it is not desirable to wait until the power amplifiers have reached steady state condition.

T & M solution

Using the R&S®ZVA four-port vector network analyzer with its two internal sources makes it possible to generate two frequency offset tones that can be swept quickly with a single instrument. The R&S®ZVA-K4 frequency conversion software option contains an intermodulation measurement



R&S®ZVA intermodulation measurement configuration menu.

menu to efficiently configure the test setup for frequency- or power-swept measurements.

The two tones are applied to the R&S®BBA150 broadband amplifiers to generate the required high power levels. Offering frequencies up to 6 GHz and output power from 15 W to 200 W, these amplifiers are ideal for making PIM measurements.

The basis for providing stable and accurate test signals to the DUT is the automatic level control (ALC) function of the R&S®ZVA. ALC accurately and independently controls the source output powers of the two tones at ports 1 and 3 using the power levels measured at the reference receivers of the associated ports. This results in extremely quick adjustment of the output power at the reference plane (the DUT) within the short ALC settling time. ALC makes it possible to overcome the issues of thermal and power settling times as well as amplifier output power variation. Measurements can be started directly after connecting

the DUT, and test time is reduced from minutes to typically less than a second per sweep. Production throughput can be significantly increased. In most cases, the default values of the ALC function are sufficient, providing a minimum range of 0.1 dB settling tolerance. If needed, the ALC parameters can be set individually to support specific test requirements.

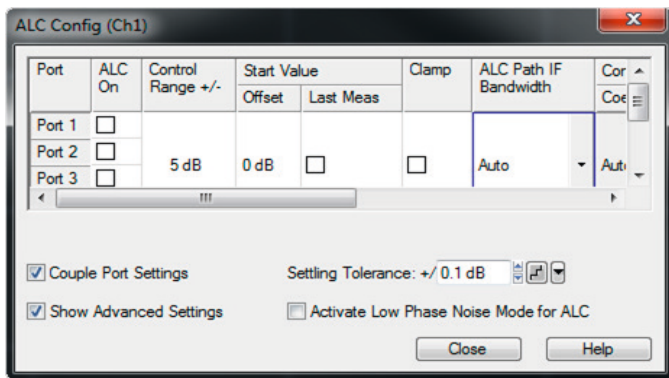
During initial power calibration, the powers generated by the internal sources are correlated with the power levels measured at the associated reference receivers and with the desired power delivered at the reference plane. For PIM measurements on duplex filters for base station transceivers, for example, this unique solution can be configured to provide the required power level of up to +47 dBm to the DUT. Using the test parameters and components described in this application card, an unrivaled wide dynamic range of up to -168 dBc at 43.5 dBm (1 Hz IF) at about 2 GHz is available. This can be enhanced by a further 10 dB by using direct receiver access.

Summary

PIM testing performance essentially depends on the (thermal) settling time of the power amplifiers, which in turn impacts level accuracy, stability and test time. The four-port R&S®ZVA with its two internal sources and automatic level control (ALC), together with the R&S®BBA150 broadband amplifiers, provides a unique solution for extremely fast, highly accurate and reproducible PIM measurements.

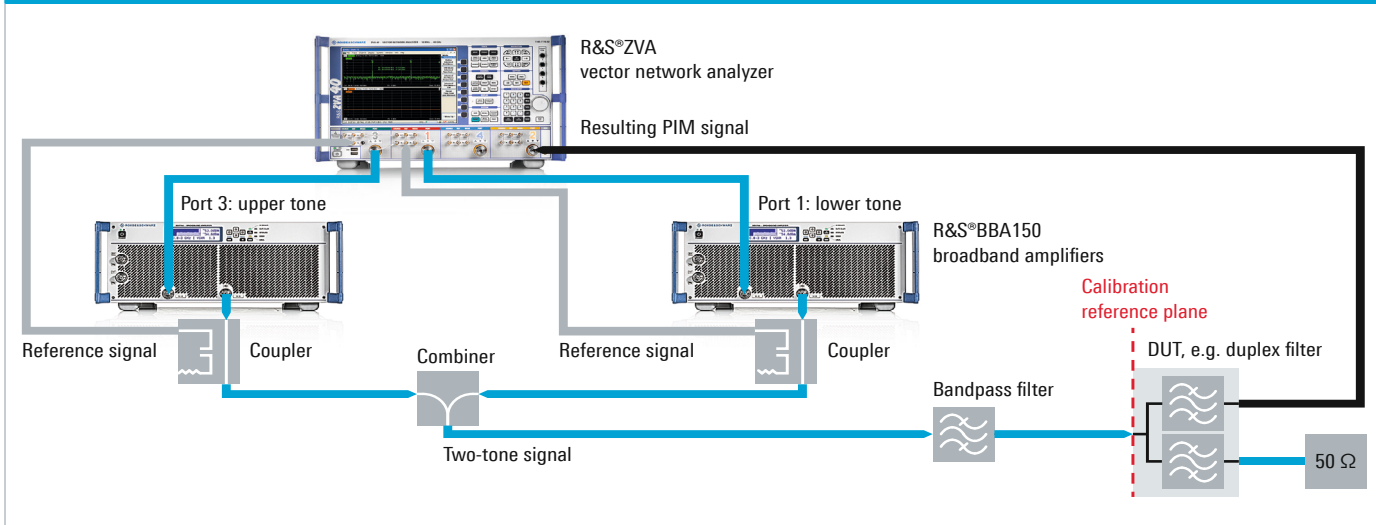
See also

www.rohde-schwarz.com/product/ZVA
www.rohde-schwarz.com/product/BBA150



R&S®ZVA automatic level control (ALC) configuration menu.

Test setup with the R&S®ZVA and two R&S®BBA150 amplifiers for reduced test time and enhanced accuracy



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 3606.9227.92 | Version 01.00 | September 2013 (as)
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