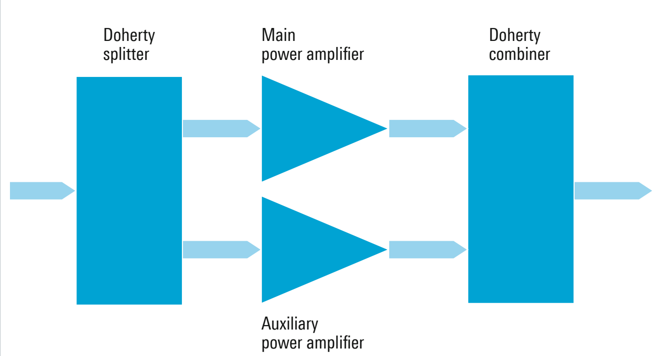
Making effective use of Doherty architecture
Up to 60 % more output power and 20 % efficiency increase for RF power amplifiers

With the evolution of 5G technology, the need for antenna array systems is growing. This increases the demand for efficient power amplifier implementations to support high-density setups. Imagine you could get 60 % more output power, 50 % more bandwith and up to 20 % efficiency gain per amplifier in a MIMO antenna array setup? Would you spend time on rethinking your implementation plans? Let's take a closer look at how this can be achieved.

Typical Doherty design



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RF power amplifiers use various topologies and designs. A Doherty architecture gives you increased output power and efficiency while ensuring high linearity for modulated signals.

The Doherty power amplifier structure is nothing new. Invented by William H. Doherty in 1936, its goal was to design a high-power transmitter with 50 kW for modulated signals.

The target application, such as 5G, and its corresponding standard define the basic parameters (RF frequency range, signal bandwidth, output power and gain) and minimal RF performance such as signal distortion. The main differentiating factor is efficiency. The objective is to minimize the amount of energy one must use to reach the target amplification and output power with a certain linearity. The Doherty design is a very interesting and useful approach to reaching the goal.

Splitting the signal to run via the main power amplifier for the major portion, along with an additional boost from the auxiliary power amplifier for the signal peaks, gives you the freedom to deploy a highly efficient and linear amplifier for the respective path. This combines the benefit of improved efficiency and low distortion by using the most suitable amplifier technology and class.

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The structure yields a number of variables the designer has to decide on amplifier technologies, working points and splitter setup.

Since one decision directly affects other variables, finding the best solution is not an easy task. Common assumptions for the splitter are often taken as a given. However, this limits the capabilities of the Doherty design.

To find the optimal efficiency and maximum saturated power or P1dB compression point for any Doherty variant, extensive measurement campaigns are conducted over:
- targeted frequency bands, e.g. 3.4 GHz to 3.6 GHz for 5G
- splitter setup

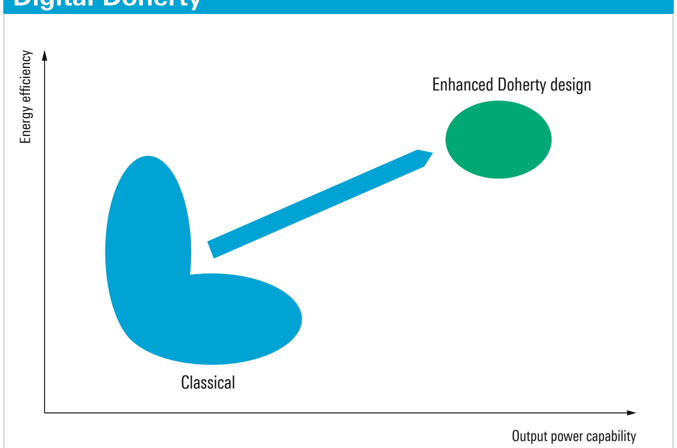
A digital Doherty power amplifier offers the most flexible approach. Instead of using a fixed analog splitter, the two signals come from the digital baseband. The designer has online control of the splitting function and adopts the signal flow on the fly.

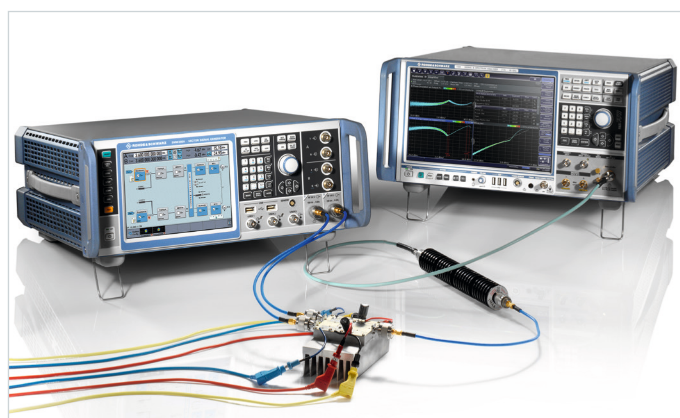
This approach offers without sacrificing linearity:
- 60 % more output power
- 20 % more efficiency
- 50 % more bandwidth

However, you need two complete RF paths to support the digital Doherty structure.

The R&S®SMW200A signal generator offers two internally synchronized channels that generate the two drive signals for the Doherty channels. The instrument features flexible signal generation, including 5G signals, and is a unique solution that provides impressively fast and reliable insights. No matter which Doherty implementation you choose, it enables you to better design a fixed splitter, control an adjustable splitter or model the digital splitter function. The bottom-line benefit is that you get a competitive advantage while improving your device specifications.

Digital Doherty





R&S®FSW and R&S®SMW200A.

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PD 3607.0075.32 | Version 01.00 | April 2019 (as)
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Data without tolerance limits is not binding | Subject to change

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3607.0075.32 01.00 PDP 1 en