Are current LSNA hardware setups adequate to support the needs of behavioral modelling techniques?

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*) *One of the biggest limits of the Large Signal Network Analyzer (LSNA) is the lower frequency (600 MHz) of the measurement bandwidth.*

The lower frequency of the measurement bandwidth of the LSNA is restricted to 600 MHz due to the bandwidth of the phase reference standard. Furthermore, the characteristics of the couplers do not allow to measure below 500 MHz.
The lower frequency of 600 MHz allows to characterise the single tone behaviour of a nonlinear device but puts a serious restriction on the multi-tone characterisation.

A possible solution would be to design 2 different test-sets: one for the low frequencies and one for the high frequencies, in order to cover the whole measurement bandwidth from DC to 50 GHz. This in combination with a second low frequency phase reference standard.

The upper frequency of the measurement bandwidth (50 GHz) is high enough for all nonlinear application of the participants.

*) *How important is load-pull for behavioural modelling?*

Nowadays people often use synthetic load-pull data to model their devices under different load conditions. Or they assume that the device is perfectly matched.
However, for device modelling the load conditions of the device-under-test are often critical. The characteristics of the DUT need to be known under various load conditions. And therefore it is important to be able to perform correct load-pull measurements.
When working with neural networks, there is not only a need for passive load-pull but there is also a special need for flexible boundary conditions or active load-pull.

*) *Multiport measurements and modelling*

The need for 3-port or multiport measurements is growing very fast. Therefore the 2-port LSNA has been extended to 3-ports at the University of Brussels. This measurement instrument is not yet commercially available.
The 3-port LSNA has the same measurement bandwidth limitations as the 2-port LSNA (600 MHz - 50 GHz).
The 3-port LSNA can not only be used to perform mixer measurements but also to perform differential measurements. The need for truly differential measurements is growing and since a 2-port differential system is often treated as a 4-port, the need for multiport measurement instruments rises.
To perform correct differential measurements, one needs to be able to excite both input ports together. Furthermore, one must be able to control the phase of both input signals.
Another way of doing differential measurements is by using multichannel oscilloscopes. But then there is no independent control of the signal generation.
As a result a lot of people are working towards a truly differential source, as could also be seen at the 62nd ARFTG conference.
To model the nonlinear behaviour of differential devices, one should take into account that the principle of linear superposition is no longer valid.

The need for high power differential measurements starts to grow. This is one more challenge for the LSNA.