

“Names for the Class of Instrumentation and for the Users’ Forum itself”

Moderated by Kate Remley, notes by Dominique Schreurs

The purpose of this discussion is to try to agree on a name that covers the class of instrumentation that enables the non-linear/large-signal characterisation of microwave components. In other words, this class of instrumentation encompasses measurement systems such as the LSNA, MTA, (sampling) scope, ...

Based on the preliminary discussion during the previous Users’ Forum and on reactions received in connection to an e-mail based information gathering and poll, Kate gave an overview of the proposals received and their respective advantages and drawbacks:

- **Large-Signal Network Analyzer**
 - + no longer a strong link between LSNA and a manufacturer
 - + this is quite good
 - not exclusively used for large-signal measurements: mixers and modulators also
 - no unique definition of ‘large’

- **Vector(ial) Component Analyzer**
 - + descriptive of system
 - vectorial simply does not work here
 - Vector Component Analyzer is OK, but it is awkward

- **ANA: Absolute Network Analyzer**
 - + describes measurements of absolute quantities rather than ratios
 - implies that the network analyzer itself is absolute, not that the quantities it measures are absolute

- **Large signal Vector Analyzer**
 - + descriptive of setup
 - the instrument does not analyze vectors

- **Nonlinear Vector Network Analyzer**
 - + descriptive of system
 - + has historically been used
 - you are not measuring vectors

During the discussion, two more names were proposed:

- Absolutely Calibrated Network Analyzer
- Nonlinear Network Analyzer

While Kate was presenting this overview, several considerations were made. The major discussion ‘bottlenecks’ are:

- ‘large-signal’ versus ‘non-linear’: Jan Verspecht clarified that ‘large-signal’ has to be understood as ‘large’ relative to the operating range of the device,

and this in contrast to ‘small-signal’ or ‘linear’ operation. Several people are in favour of ‘non-linear’ though, as there exist circuits that operate non-linearly when excited by a small signal, like frequency multipliers and mixers.

- ‘vector’ versus ‘vectorial’: the primary aim here is to denote that one measures ‘complex’ variables as opposed to ‘scalar’ variables. ‘Vector’ in the English language sense however involves a ‘movement’, and as long as our measurement instrumentation is pinned down on the lab floor, we are not measuring ‘moving’ variables. ‘Vectorial’ is the adjective of ‘vector’, although ‘vector’ itself is more commonly used as adjective as well. This topic has been addressed in large detail on the MTT-11 forum on non-linear measurements. Therefore, we refer to the archive of this forum to check out the opinions by native-English speaking and non-linear/large-signal specialists from all over the world.

Other considerations and clarifications are:

- ANA: this is in fact the old term for VNA, but ‘A’ stood for ‘automatic’ and not ‘absolute’
- LSNA: this was the instrument name while it was in development at Agilent Technologies. Now, this instrument is being produced and sold by Maury and it has a typical Maury product number that is no longer related to ‘LSNA’. Therefore, Marc Vanden Bossche thinks that ‘LSNA’ can stand for the technology, and not just for one particular instrument.

Due to the two ‘eternal’ bottlenecks mentioned above, only consensus could be reached about the two final letters, being ‘N’ and ‘A’, or ‘Network Analyser’. As it is the purpose to describe a class of instrumentation, some important remarks were though:

- with ‘network’ characterisation, one assumes that the voltages and currents at the device ports can be measured. An MTA has however only two channels, whereas the major number of non-linear/large-signal microwave components has two-ports, thus requiring four channels. Although, when one would consider the extensions that research groups have realised in terms of adding external circuitry such as switches, the capabilities of those set-ups are equivalent to the LSNA.
- Jose Carlos Pedro indicated that a scope is not a ‘network analyser’ either, as it is only a ‘receiver’, because it misses a stimulus and also calibration. In other words, only the set-up as a whole, i.e., including RF sources etc., can be understood as a ‘network analyser’.

Even when considering these latter remarks, people still felt comfortably with ‘NA’. The discussion continued for a little longer on the preceding letter(s). One suggestion was ‘harmonic NA’, but this was immediately counter-reacted as this term does not cover modulation. Other suggestions were the names we added above, being Absolutely Calibrated Network Analyzer and Nonlinear Network Analyzer. Jan Verspecht and Chris Silva proposed ‘THE’ NA. The reasoning is that at the time that the (linear) VNA was

conceived, there was no non-linear alternative yet, and that is why there is no clearer indication of the 'linearity' limitation in the VNA name.

At the end, we organised an informal poll. All attendees could vote once for one of the seven possibilities listed above. The results were as follows:

- LSNA: 8
- VCA: 0
- ANA: 2
- ACNA: 1
- NVNA: 5
- NNA: 11

Finally, it was agreed that the discussion concerning a more optimal name for this forum will happen as soon as the name issue for the class of instrumentation is resolved.