A Phaseless Near-field Measurement Technique for Antennas with an Internal Source

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Modern wireless devices are increasingly becoming completely integrated, where all components from the source to the antenna are included in the overall design. From a design and manufacturing standpoint this is quite advantageous, however, from a testing and measurement standpoint, verifying performance can be complicated, especially when characterizing the antenna. In conventional antenna measurements, an input signal is applied directly to the input of the antenna where its radiation is measured using a measuring probe at a certain far field distance from the antenna. This input signal is usually referenced using a network analyzer or similar transceiver system to determine the amplitude and phase captured by the measuring probe. In conventional near-field measurements, this referenced signal is required because both amplitude and phase must be measured to allow calculation of the far-field radiation pattern from the measured near fields.

For antennas that feature their own internal source, the input signal must have some way to be referenced. Unless the device designer specifically adds a way to do so, this is usually not possible. For existing antenna measurement chambers and ranges, this adds complication to the configuration to measure the antenna, especially for near-field ranges where modification of existing chambers may not be possible. Thus, for measurements of an antenna with an internal source, one cannot use the measurement configuration in the conventional way.

This presentation will introduce a solution using a unique measurement configuration and phaseless measurement techniques. The configuration includes terminating the transmitter on the network analyzer and using it purely as a receiver, measuring both amplitude and phase of the antenna using the reference signal from the network analyzer instead of a reference signal from the antenna's internal source. In this configuration, the measured amplitude and phase value is the relative value in relation to the integrated device's source. In theory, this is still valid for near-field measurement because relative field values are required to calculate the far-field. In reality, however, the lack of synchronicity between the network analyzer's source and the device's internal source causes stability issues (drift) with the measured phase. This renders the measured phase unusable for the near-field to far-field transformation. In contrast, the relative amplitude can be used as long as the internal source power is stable. This allows for the use of phaseless near-field measurement techniques (i.e. phase retrieval) to determine the near-field phase that is required for the near-field to far-field transformation. Representative measured results are shown to demonstrate the utility of this techniques.