A Novel Approach for Testing Antennas with Internal Sources: Phaseless Near-Field Measurements

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Integrated antennas are increasingly becoming common components within modern wireless devices. This is advantageous from both a design and fabrication standpoint. In general, these devices provide an internal source for the antenna and do not contain a port to inject an external source. Clearly from antenna testing standpoint, verifying performance and conducting measurements presents a very challenging problem. In conventional near-field measurements, a referenced signal is required because both amplitude and phase must be measured for the 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 original device specifically allows a way to do so, this is usually not possible. Thus, for measurements of an antenna with an internal source, one cannot use the measurement configuration in the conventional way.

Initially one could consider the possibility of a measurement setup that 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. This means that the measured amplitude and phase value is the relative value in relation to the integrated device's source. In actuality, this is still valid for near-field measurement because relative field values are required to calculate the far-field. In practice, however, the lack of synchronization between the network analyzer's source and the device's internal source creates stability issues (drift) with the measured phase. As it will be shown, the undesirably inaccurate measured phase will prevent one to apply the near-field to far-field transformation.

Instead, a novel near-field phaseless measurement technique which allows accurate characterizations of this class of antennas with internal sources is discussed as a viable strategy to solve this problem. In this phaseless approach, 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. The UCLA mm-wave bi-polar planar near field measurement system will be used to demonstrate the utility of these techniques discussed in this paper for effective and accurate measurements of antennas with internal sources.