On the Bandwidth Characterization of Logarithmically-Periodic Multiport-Antennas Using the Total Active Reflection Coefficient (TARC)

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Mobile communication systems need to support growing data rates for high-speed- and multimedia-intensive applications. In addition, it is desirable to simultaneously cover a wide frequency range with one sole antenna front-end in order to reduce the element count of RF components in the mobile device. Antenna systems that apply to this so-called multiradio- or multi-standard conformity need to provide acceptable bandwidth conditions regarding the impedance level as well as the radiation properties. Therefore the accurate characterization of wide-band multiport antennas is one important issue for modern communication systems. Bandwidth definitions are often taken subject to certain antenna parameters like input impedance behaviour and radiation pattern conditions.

This paper deals with a novel approach to determine the bandwidth in terms of the total active reflection coefficient (TARC) which is a real number between zero and one and can be used to directly relate the incident power of a multiport antenna to its respective radiated power. Instead of using just the reflection coefficient of the scattering matrix, the TARC value allows to draw conclusions regarding the radiated power of an N-port antenna. Additionally the TARC can be used to determine the corresponding TARC-bandwidth as well as the radiation efficiency of the multiport antenna.

Here, the TARC will be used to describe the properties of a logarithmically periodic four-arm antenna that has been developed to support dual-linear polarized operation in a multi-standard RF frontend for wireless mobile communications. The results of the TARC will be compared to the antenna input impedances that are currently used to determine its operational bandwidth. Hence, a corresponding TARC value will be derived as a design criterion for log.-per. antennas.

Furthermore, the antenna provides four operational modes yielding orthogonal, dual-linear or orthogonal circular polarization as a consequence from different excitation vectors. Therefore the TARC value is calculated in any of the operational modes and compared to the operational bandwidth as derived from the input impedance process at one antenna port. Additionally, the excellent cross-polarization suppression between the dual-linear polarized operational modes will be proven by means of TARC definition.