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Title:One-port De-embedding technique for the quasi-optical characterization of integrated components
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Abstract:We describe a one-port de-embedding technique suitable for the quasi-optical characterization of terahertz integrated components at frequencies beyond the operational range of most vector network analyzers. This technique is also suitable when the manufacturing of precision terminations to sufficiently fine tolerances for the application of a TRL de-embedding technique is not possible. The technique is based on vector reflection measurements of a series of easily realizable test pieces. A theoretical analysis is presented for the precision of the technique when implemented using a quasi-optical null-balanced bridge reflectometer. The analysis takes into account quantization effects in the linear and angular encoders associated with the balancing procedure, as well as source power and detector noise equivalent power. The precision in measuring waveguide characteristic impedance and attenuation using this de-embedding technique is further analyzed after taking into account changes in the power coupled due to axial, rotational, and lateral alignment errors between the device under test and the instruments' test port. The analysis is based on the propagation of errors after assuming imperfect coupling of two fundamental Gaussian beams. The required precision in repositioning the samples at the instruments' test-port is discussed. Quasi-optical measurements using the de-embedding process for a WR-8 adjustable precision short at 125 GHz are presented. The de-embedding methodology may be extended to allow the determination of S-parameters of arbitrary two-port junctions. The measurement technique proposed should prove most useful above 325 GHz where there is a lack of measurement standards. © 2001-2012 IEEE.
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Main heading:Instrument errors
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Uncontrolled terms:De-embedding - De-embedding process - De-embedding techniques - Detector noise - Device under test - Imperfect coupling - Lateral alignment - Measurement standards - Measurement techniques - Operational range - Propagation of error - Quantization effects - Quasi-optical - Quasioptical measurements - Reflection measurements - Required precision - Tera Hertz - Vector network analyzers - Waveguide characteristic
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