COMPARISON OF THE NEAR-FIELD MEASUREMENTS BETWEEN A COMMERCIAL OPEN-ENDED RECTANGULAR WAVEGUIDE PROBE AND ITS EQUIVALENT PROBE IN SIW TECHNOLOGY

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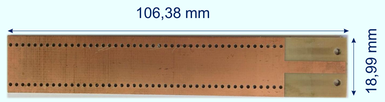
Goal and Methodology

Study, under the same measurement conditions, the behaviour of a commercial rectangular waveguide probe and its equivalent probe in SIW technology. The near-field measurements obtained with both probes will be compared, and it will be shown that SIW probes present higher spatial resolution than their equivalent commercial probes. To evaluate the possible differences between the SIW probe and the commercial probe, the measurements were obtained with different widths of the scan in x and y-directions and distances between the DUT and the receiver antenna.

Open-ended SIW Probe

SIW Characteristics

- X-band operation range
- Diameter holes: 1 mm
- Pitch adjacent posts: 2 mm
- Substrate: RO4003C 60 mils



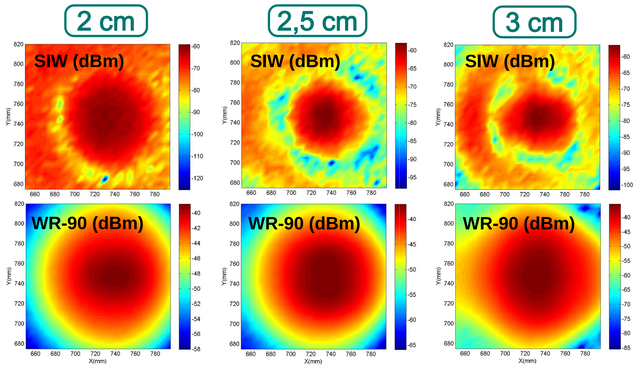
Near-Field Measurements of a Pyramidal Horn

Measurement Setup

- DUT: Narda 640 pyramidal horn
- RX1: open-ended SIW
- RX2: commercial open-ended WR-90
- Measurement method: planar range
- Frequency Range: X band

VARIATION: Distance DUT-RX

- Step width scan 5 x 5 mm, frequency 9 GHz

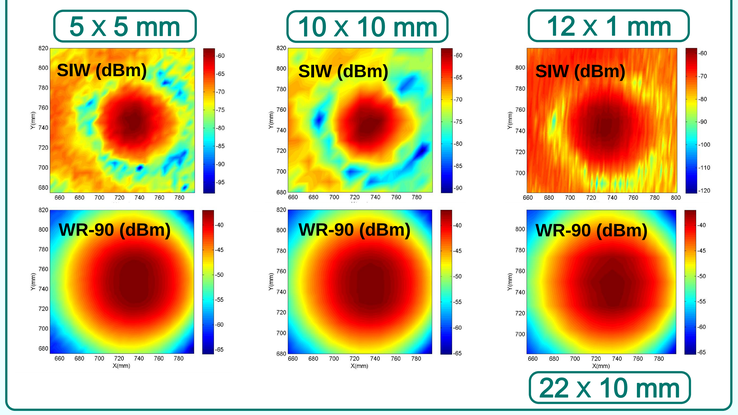


Conclusions

- The open-ended SIW probe detects the pyramidal horn E-field distribution.
- When the DUT-RX distance increases, the power focused in the main lobe begins to extend around de aperture, decreasing the resolution measurements.
- The difference between the power level received by the SIW and the commercial probe changes about 20 dB. Not all the received power is delivered to the measure system, because the SIW aperture impedance is not well matched to the TE10 equivalent characteristic impedance.
- The losses of the SIW also cause that the difference between the received power by each probe is more pronounced at the edges of the pyramidal horn aperture, because the level of the received power is too close to the measure device sensibility.

VARIATION: Step Width Scan

- DUT-RX distance 2,5 cm, frequency 9 GHz



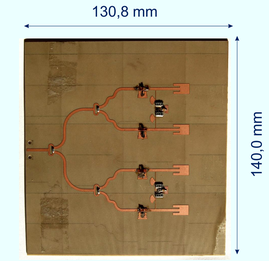
Conclusions

- The near-field measurements are more accurate when the step widths of the scan in x and y directions are very close to the RX antenna aperture dimensions, due to less number of samples in a particular space region.
- The measurements of the SIW probe present higher resolution and, therefore, are more accurate than those of the commercial probe, because the aperture dimensions of the SIW probe are smaller than those of the WR-90 probe, about 55 percent lower length, and 10 percent lower width.
- For the same step width of the scan, the taken samples by the SIW probe are less overlapped than those by the WR-90 probe, so the results obtained with the SIW probe present higher resolution.

Near-Field Measurements of a Microstrip Antenna Array

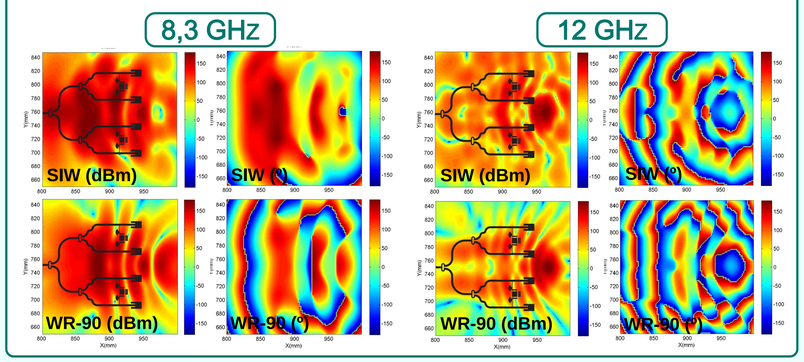
Measurement Setup

- DUT: Microstrip antenna array, $f_{central}$: 8 GHz
- RX1: open-ended SIW
- RX2: commercial open-ended WR-90
- Measurement Method: planar range
- Frequency Range: X band



VARIATION: Frequency

- DUT-RX distance 1,5 cm, step width scan 2 x 2mm



Conclusions

- The results obtained from the open-ended SIW probe present higher resolution than those of the commercial probe. It was found higher field levels in the proximity of the connector, Wilkinson dividers and microstrip patches when the measurements were performed with the SIW probe.
- The higher the frequency, the higher the antenna reflection coefficient is, so the microstrip antenna becomes more reflective and the field is accumulated next to the microstrip patches.
- **SIW supply higher resolution than those of commercial probes, so SIW probes are more suitable to measure circuits that present abrupt variation of E-field in close regions of space.**

Acknowledgment

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