

## High performance MM-Wave Measurements up to 200 GHz in the Compensated Compact Range

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The measurement of the characteristic antenna data by means of conventional far-field ranges in frequencies up to 200 GHz requires measurement distances of some kilometers. The high atmospheric attenuation and the low available transmit power limit the dynamic range of the measurements considerably.

Advanced measurement techniques like the Compact Antenna Test Range avoid these disadvantages and allow measurements with considerably higher accuracy under controlled environmental conditions.

The DASA Compensated Compact Range (CCR) is a high precision test facility with a quiet zone of 5.5 x 5.0 x 6.0 m. The system consists of two doubly curved reflectors, which generate a coherent electromagnetic field ( quiet zone ) from a spherical wave. The reflector design prevents inherent cross-polarization and creates a very high constant amplitude and phase distribution in the quiet zone.

The precision reflectors have an extremely high surface accuracy of 25  $\mu\text{m}$ , which allow their use even in the mm-wave range. For the frequency band of about 200 GHz, the relative roughness is in the order of  $\lambda/60$ . This results in considerably lower degradation for the DASA CCR compared to the typical degradation on far-field ranges ( $\lambda/16$ ).

For mm-wave application the test facility is equipped with broadband transmit and receive moduls, which covers the frequency range from 75 to 220 GHz. The basic transmit frequency is generated in a tunable Gunn oscillator. The Gunn oscillator is phaselocked to an externally supplied 10 MHz reference signal. This optimized concept allows measurements with a dynamic range of 50 dB at 200 GHz. For a cost efficient solution the complete equipment for the transmit and receive moduls consists of commercial components.

The specific features and applications of this type of test facility and the mm-wave equipment will be explained and presented in detail. Furthermore, qualification results will be presented in the frequency range of 89, 157, 183 and 204 GHz.

To verify the excellent properties in the mm-wave region, the antenna measurement results of the flight model MAS (Microwave Atmospheric Sounder) and of the breadboard model MHS (Microwave Humidity Sounder) will be shown.