SDC9 - mmWave 3D-printed Antenna Design

Detailed description and rules

Introduction

This competition will require students to design and manufacture a linearly-polarized mmwave antenna using additive manufacturing/3D-printing techniques, with maximum gain in the 26.5-30.5GHz range. The designs will be judged based on the matching and gain performance of the antennas.

Design specifications and rules

Participants must design a linearly-polarized passive antenna with maximum gain in the 26.5-30.5 GHz range. The antenna must be manufactured as a single body using only 3D printing/additive manufacturing techniques, and include a 2.92mm coaxial female/jack connector to perform measurements. There is no material set restriction (metal, plastic or ceramic materials are all acceptable). Metal coating of the antenna is allowed. The antenna maximum dimensions and weight will be constrained by the antenna test chamber and positioner system (Maximum DUT size: 40mm x 200mm x 110mm, Maximum DUT weight 3kg). The maximum aperture size must be 83mm.

Participants may fulfill the 2.92mm coaxial connector requirement by means of a passive commercial waveguide-to-coaxial adapter., The 3D-printed antenna, including the coaxial adapter provided by the participant, must incorporate all necessary features to mount it into the Millibox antenna test system. A standard CAD file for the Millibox mount will be provided. Participants are encouraged to contact the organizers to receive this and other relevant data.

Evaluation process

Each participating design will be assembled into the Millibox anechoic chamber. The boresight gain of the antenna, and return losses will be measured in the 26.5-30.5GHz range. These measurements will be summarized in a total score, as described in the next section.

Scoring

Gain and return losses will be measured between 26.5 and 30.5GHz in 1GHz intervals and rounded to the nearest 0.1dB. Gain values at the 5 frequencies will be added together, forming the gain score. The measured return loss values will be taken as positive values and only the minimum value will be retained. This minimum return loss value will be divided by a factor of 5, and added to the gain score to define the total score. The design with the highest total score will win the competition.

An example of scoring for a representative antenna is included below:

Example measured values:	Score:
26.5GHz: Gain=11.5dB, S11=-18dB	
27.5GHz: Gain=11.8dB, S11=-17dB	Gain Score=61.1 (11.5+11.8+12.2+12.6+13)
28.5GHz: Gain=12.2dB, S11=-16dB	Total score= 64.3 (61.1+16/5)
29.5GHz: Gain=12.6dB, S11=-18dB	
30.5GHz: Gain=13dB, S11=-18dB	

Name and number of supporting MTT-S Technical Committee

MTT TC-16 Microwave and Millimeter-Wave Packaging, Interconnect and Integration Committee

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