Impact of the target supporting mast in an indoor RCS measurement facility: computation and measurement

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Abstract— **Indoor RCS measurement facilities are usually dedicated to the characterization of only one azimuth cut and one elevation cut of the full spherical RCS target pattern.**

In order to perform more complete characterizations, a spherical experimental layout has been developed at CEA for indoor Near-Field monostatic RCS assessment.

This experimental layout is composed of a 4 meters radius motorized rotating arch (horizontal axis) holding the measurement antennas while the target is located on a mast (polystyrene or Plexiglas) mounted on a rotating positioning system (vertical axis).

The combination of the two rotation capabilities allows full 3D Near-Field monostatic RCS characterization.

The main measurement errors are due to the near field illumination, and the influence of the mast on the measured RCS. The first one has been addressed in a previous paper [4]. This paper investigates the influence of the material of the mast supporting the target under test. RCS measurements results of a canonical target are compared to the simulation of its RCS taking account both the near-field illumination and the presence of the supporting mast.

I. Introduction

Indoor Radar Cross Section (RCS) measurement facilities are usually dedicated to the characterization of only one azimuth cut and one elevation cut of the full spherical RCS target pattern. In order to perform more complete characterizations, a spherical experimental layout was developed in 2006 at CEA for indoor Near-Field monostatic RCS assessment [1]. This experimental layout is based on a motorized rotating arch (horizontal axis) holding the measurement antennas. To cope with the accuracy requirements of the mechanical positioning systems, advanced alignment techniques have been implemented, including a laser tracker to assess the map of residual alignment errors [2].

This experimental layout allows among others to analyze (3D radar imaging) the localization of the scatterers of the target under test. A specific 3D radar imaging method has been developed and applied from the fast 3D spherical Near-Field scans [3].

II. The Near-Field 3D RCS facility

The experimental layout is dedicated to the RCS characterization of small targets (typically < 1 ft). It is composed of a 4 meters radius motorized rotating arch (horizontal axis) holding the measurement antennas while the target is located on a mast mounted on a rotating positioning system (vertical axis). The combination of the two rotation capabilities allows full 3D Near-Field monostatic RCS characterization.

Two bipolarization monostatic RF transmitting and receiving antennas are driven by a fast network analyzer:

• an optimized phased array antenna for frequencies from 800 MHz to 1.8 GHz. This phased array antenna has been optimized to reduce spurious signals coming to and from the arch metallic structure.

• a wideband standard gain horn for frequencies from 2 GHz to 12 GHz (see figure 1).

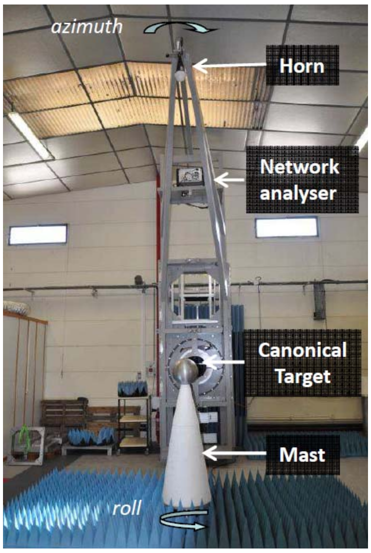

Fig. 1. Near-Field 3D RCS measurement facility

Since the target under test is located vertically on a mast (Polystyrene or Plexiglas) below the measurement antenna, the target rotation with respect