SPECULARITY CONSTRAINTS IN TELECOM REFLECTORS PAYLOADS - EVALUATION AND POSSIBLE USE OF NEW DIFFUSE METALLIZATION PROCESS (AIRBUS DS)

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ABSTRACT

When designing space communication systems, using large size deployable reflectors, RF architects must take care that they usually do not operate in a free-space environment. Diffraction, reflectance distribution, straylight or specularity issues shall be taken into account at early steps of the design to avoid signal fading, or even loss of signal transmission to the earth which would lead to significant mission outage.

Avoiding specular reflection is one of the key driver in these designs. Specular reflection occurs if and only if the energy of the incident beam is fully transmitted to a unique reflected beam, on the contrary of a diffused reflection. This is the case in most of mirrors or very flat metallic surfaces when the defects at the interface are lower than the wavelength. This may be measured using BRDF technique measurements (Bidirectional Reflectance Distribution Function).

Of course, these constraints come in addition of “well know” space environment requirements such as: thermal vacuum cycling, outgassing and ATOX (for LEO orbits), radiation and ESD risks mitigation. Therefore, MLI blankets are most of time used to cover, as an outer protection surface, all the antennas, deployable reflectors and pallets used in Telecom satellite payloads.

Very recently, Airbus DS Spain (formerly CASA), developed a new option to enhance the properties of a usual MLI coverage; this option is a based on an improved patented metallization process, based on a film of VDA polyimide with Stamet coating on top of the layer side. This process has been already used either in Ka band equipments or probes due to its high absorptance and hemispherical emittance properties.

The paper is a joined presentation from Airbus DS Toulouse and Spain and will be split in 2 parts:

- At Airbus DS Toulouse level, it will describe the reason why RF architects are interested in the use of such Stamet black PI materials, and the first results of evaluation performed, especially the tests related to BRDF measurements.
- At Airbus DS Spain level, it will describe the technical details of the qualification performed in order to have a space qualified product for MLI coverage of antennas, pallets and deployable reflectors.

The conclusion will address the way forward in order to enhance usual MLI protections by using Stamet black polyimides, for future Telecom platforms in GEO, but also probes or constellation programs.