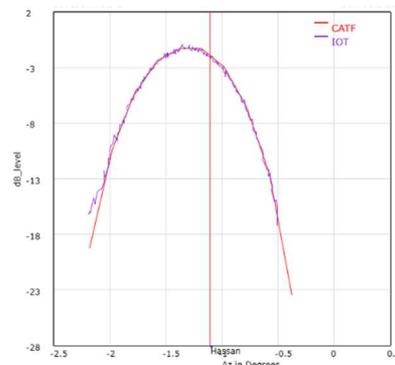


Successful Implementation of

3D Printed Feed cluster and Hybrid CFRP Feed Cluster Assembly in GSAT-19

ISRO has recently successfully launched GSAT-19 communication satellite on 5th June, 2017. This satellite has flown two new breakthrough technologies of Feed realization, namely, 3D Printing and hybrid CFRP technology for the first time on ISRO's satellites. In orbit test of GSAT-19 indicated that the RF performance of the antennas particularly feeds using these technologies have been normal. Thus it paved the way for forthcoming high throughput satellite payload antennas wherein large number (> 40 nos.) of feeds are required.

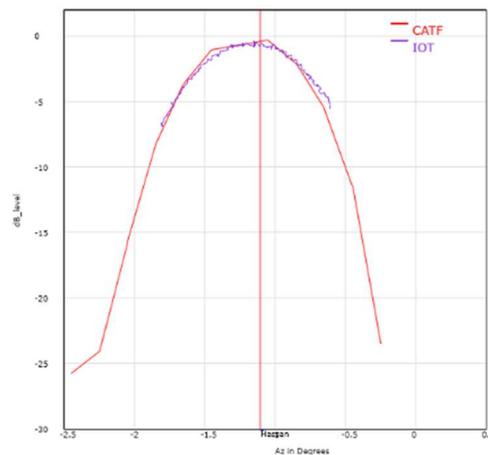
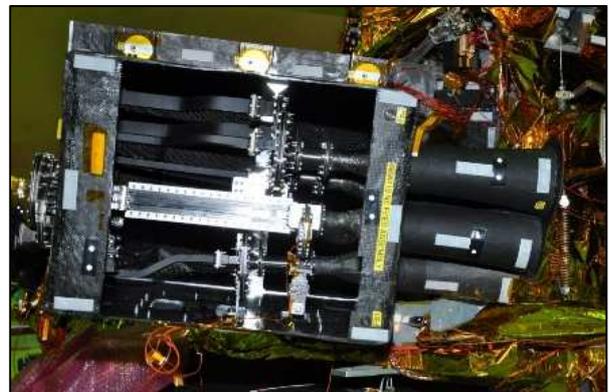
North west feed cluster assembly of GSAT-19 is implemented using Direct Laser Metal Sintering (DMLS) technique which is also known as 3D printing. It is an additive manufacturing technology which is explored to develop not only, load bearing non-functional parts (Brackets etc.) but the scope is extended to develop and print functional parts for microwaves e.g. GSAT-19 feeds. In this a cluster of 4 feed horns was simultaneously printed in single setup avoiding alignment issues and saving time. It also avoided alignment errors, reducing assembly parts, reduced joints, fasteners and lead to decreased RF Leakage. Part is printed in Powder AlSi10Mg layer by layer and laser is used to stitch the layers. Powder AlSi10Mg has mechanical, thermal and other desired properties for space applications akin to Al Alloy 6061T6, which is parent material for Space applications.



3D Printed Ku-band NW Feed cluster and final feed cluster assembly of GSAT-19

and IOT Performance Comparison

North-East feed cluster assembly of GSAT-19 was realized with Al lined CFRP feed horn. This is a novel technology implemented for Feeds in which advantage of mass using composite material and AL lining for RF performance. This horn has been made using CFRP laminate wrapping over aluminium mandrel. Subsequently the inside metallic mandrel was machined up to 0.4 mm thickness. North East (NE) feed bracket was realised with CFRP materials for the reduction in weight to enhance the payload capability. Vacuum infusion technique was used for realizing CFRP bracket. The CFRP bracket along with Al lined feed cluster assembly has successfully undergone all qualification tests, including vibration tests, Thermal vacuum test RF testing etc. The total weight gain with respect to metallic version was ~2.5 Kg. Both the feed clusters have undergone successfully through temperature qualification test of -90°C to $+140^{\circ}\text{C}$.



Ku-band Hybrid CFRP Feed horn and NE Feed cluster of GSAT-19 and IOT performance Comparison