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ROSETTA LANDER

REPORT ON EQM & FM DEVELOPMENTS

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CONSERT LANDER ANTENNA

INTRODUCTION

In CONSERT (=COMet Nucleus Sounding Experiment by Radiowave Transmission) narrow pulses of radio waves are transmitted through a cometary nucleus. The phase and amplitude of the radio signal are measured after the signal has passed through the comet and are compared to the theoretical value for propagation in vacuum. The changes in phase and amplitude reflect the electrical properties and spatial structures of the cometary materials.

Stated differently the experiment measures the attenuation and the time delay of a short pulse of radio signal propagating through the comet.

The experiment is operating in the VHF band at 90 MHz. It consists of a transmitter/receiver on the Orbiter and of a transmitter/receiver on the Lander. On each spacecraft the experiment uses a single transmit/receive antenna. In principle a narrow pulse (100 ns wide or 10 MHz signal bandwidth) is transmitted from the Orbiter. The pulse propagates through space, enters the comet nucleus, propagates through the nucleus, and emerges from the nucleus. At the position of the Lander the signal is received, and its amplitude and phase (attenuation and time delay) are detected. As the Orbiter moves in its orbit and as the comet spins, the relative position of the Orbiter and Lander is changing with time. Thus, measurements of a function of time corresponds to measurements along varying radio waves paths through the comet.

On the lander there are severe restrictions on mass and on the location of the antenna. In order to ensure a good coupling of the energy radiated by the antenna into the comet it is desirable to place the antenna as close to the comet surface as possible, and possible at a height less than 1/10 of a wavelength. In order not to interfere with possible later movements of the lander the antenna could not be placed on the feet or legs of the lander. Instead two monopoles were placed about 1/10 of a wavelength over the surface on the lander base plate. A monopole has a broad antenna diagram, and a relative large real component of the impedance making it a broad band antenna. Two monopoles oriented 90 degrees to each other and feed 90 degrees out of phase form a circular antenna. These monopoles form the lander antenna.

The linear scale of the monopoles is a quarter of a wavelength, or 0.8 m. During launch the monopoles are folded back along the base plate and fixed in place by the collapsed lander legs. As the legs deploy, spring forces acting at the foot of the monopoles deploy the antenna.

1. DEVELOPMENT PLAN

All parts for the EQM have been delivered, except the monopoles, which were not requested as part of the EQM.

The CONCERT Lander antenna consists of the following main components:

- 2 monopoles;
- 2 monopole feet (to mount the monopoles to the base plate);
- 2 cables connecting the monopoles to the tuning box;
- 1 tuning box, where the signals from the monopoles are combined;
- 1 cable, connecting the tuning box output to the E-box input.

The mechanical construction of the antenna is documented in the following drawings:

RO-LCN-350001-BC
RO-LCN-DW-350001-BC
RO-LCN-DW-350002-BC
RO-LCN-DW-350003-BC
RO-LCN-DW-350004-BC
RO-LCN-DW-350005-BC
RO-LCN-DW-350006-BC
RO-LCN-DW-350007-BC
RO-LCN-DW-350008-BC
RO-LCN-DW-350009-BC
RO-LCN-DW-350010-BC
RO-LCN-DW-350011-BC
RO-LCN-DW-350012-BC
RO-LCN-DW-350013-BC
RO-LCN-DW-350014-BC
RO-LCN-DW-350015-BC
RO-LCN-DW-350016-BC
RO-LCN-DW-350017-BC
RO-LCN-DW-350018-BC

These drawings are contained in the files,

consert_interface.dxf
consert_tuning_box.dxf
con_land_kompl_1.dxf
con_land_kompl_2.dxf
con_land_kompl_3.dxf
con_land_kompl_4.dxf
con_land_kompl_5.dxf

The antenna electrical function diagram is documented in the drawing,

RO-OCN-DW-3701

The drawing is in the file,

octet-bemm-1

The declared mechanical component list, the declared component list, the declared material list, and the declared process list are in documents,

RO-LCN-MPAE-LI-005M
RO-OCN-LAN-LI-3001
RO-OCN-LAN-LI-3002
RO-OCN-LAN-LI-3003

These lists are in the files,

DMC-lcn-list_1.doc
msword-bemm-1
msword-bemm-2
msword-bemm-3

All files can be accessed in the ftp-site,

[osf1.mpae.gwdg.de/pub/mpae/consert/outgoing](ftp://osf1.mpae.gwdg.de/pub/mpae/consert/outgoing)

The only outstanding problem to be resolved is the design and construction of the interface between the monopoles and the Lander legs. This interface is now under development.

2. QUALIFICATION

The vibration tests (sine-, random-, and slow sine), the Strength Load test, the Thermal Vacuum test, and the Thermal Balance test, will be done with the antenna system mounted on the Lander, together with the testing of the Landing Gear. The antenna system is fixed by the Landing gear. Both side legs in the stowed position hold the monopoles in their folded position. Thus, testing the antenna together with the Landing gear is essential. No separate tests of the antenna system are planned.

3. DOCUMENTATION

The antenna has two functional modes,

- folded, with the monopoles placed parallel to the side of the base plate, and kept in place by the collapsed Lander legs;
- deployed, when the Lander legs are extended the monopoles deploy automatically.

4. CURRENT FM DEVELOPMENT AND TEST PLAN

The STM and EQM are build to FM standard. Thus, pending the qualification tests the FM build standard is known. Only the interface between monopoles and legs is still under development.