# Current Status of Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES)

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The Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) was designed to be aboard the Japanese Experiment Module (JEM) on the International Space Station (ISS) as a collaboration project of Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). Mission Objectives are: i) Space demonstration of super-conductive mixer and 4-K mechanical cooler for the submillimeter limb-emission sounding in the frequency bands of 624.32- 627.32 GHz and 649.12- 650.32 GHz, and ii) global observations of atmospheric minor constituents in the stratosphere (O3, HCl, ClO, HO2, HOCl, BrO, O3 isotopes, HNO3, CH3CN, etc), contributing to the atmospheric sciences.

The main part of the SMILES payload consists of the Submillimeter Antenna (ANT), Submillimeter Receiver (SRX), Intermediate Frequency Amplification Section (IFA), and Radio Spectrometer (AOS). The SMILES is equipped with a heterodyne superconductor-insulator-superconductor (SIS) receiver to be operated in the 625/650 GHz band as a limb-emission sounding radiometer. The SMILES has a mechanically scanning elliptical offset-Cassegrain antenna with diameters of 40 cm x 20 cm to achieve an altitude resolution of about 3 km at the tangential height ranging from upper troposphere (10 km) to lower mesosphere (60 km) from the orbit of the ISS. The envelope of the SMILES payload mainframe structure has a dimension of 1.85 m x 1 m x 0.8 m. The total mass of the payload is less than 500 kg. The electrical power consumption of the payload is less than 900 W for normal operation.

One of the most unique characteristics of the SMILES observation is its high sensitivity in detecting atmospheric limb emission of the submillimeter wave range (640GHz). The ISS has a circular orbit with an inclination angle of 51.6 degrees and with an orbital period of 93 minutes. In order to measure high-latitude regions, the antenna beam is tilted 45 degrees left from the direction of orbital motion, enabling SMILES to observe latitudes from 38S to 65N. With its high sensitivity the SMILES observation will provide superior global data on several radical species crucial to the ozone chemistry (O3, HCl, ClO, HOCl, BrO, HO2 etc.).

We have done several functional tests. Noise and gain performances of SRX are found good within the specification. Calculated and phase-retrieved far-field beam patterns at 637.32 GHz indicate close match with each other. Gas cell measurements for several species at several conditions also show good performance. All these results confirm expected performance for each of the elements. SMILES will be scheduled for the launch using H-II Transfer Vehicle (HTV) in 2009 summer.