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Microwave reflectometry diagnostic for density profile and fluctuation measurements on Helically Symmetric eXperiment

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A dual band frequency-modulated continuous wave (FMCW) reflectometry is developed to measure the density profile and its associated fluctuation on Helically Symmetric eXperiment (HSX). This reflectometry equips a switch to select the frequency source between two voltage controlled oscillators (VCOs) to the transmitter, realizing an extended operational frequency range from Ku to K bands (14.5 - 25 GHz). The polarization of the system can be tuned between O- and X-modes by rotating the horn aiming to accommodate with the magnetic field and the density coverage on HSX. More specifically, the reflectometer is in X-mode operation at 0.5 T of the magnetic field and in O-mode when the magnetic field is above 1.0 T, corresponding to a cutoff density range of about $0.2 \sim 2 \times 10^{18}$ m^{-3} in X-mode at 0.5 T and $2.6 \sim 7.8 \times 10^{18}$ m^{-3} in O-mode regime.

This reflectometry was originally installed in 2007[1], recently an upgrade of the system is ongoing for the bi-static antenna structure and the Ka-band extension. Here we introduce the current reflectometry system and the plan for the upgrade. To validate the system performance on HSX, the experimental measurements of the density profile and an estimation of the density fluctuation level under different magnetic configurations and plasma parameters are presented.

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[1] K. Likin, et al, poster, 16th International Stellarator / Heliotron Workshop, Oct. 15-19, 2007, Toki, Japan

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