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#4-302 Development of a wireless transmitter for in-core monitoring of reactor irradiation experiments

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A wireless in-core radio transmitter which is currently under development will be able to amplify a signal measured inside a reactor core and transmit the signal to a receiver located outside the core without using instrumentation cables. The transmitter uses vacuum tubes as active components as these are judged –unlike transistors based on semi-conductors –to be able to withstand in-core radiation field. The transmitter is self-powered by means of a thermo-electric generator (TEG) utilizing nuclear heating present in the core.

Within the preparation phase a selection of electronic components envisaged to be used in the transmitter is irradiated in steps in a gamma field of 20 kGy/h reaching an accumulated irradiation dose of 720 kGy. The irradiation took place in the spent fuel pool of the High Flux Reactor (HFR). The electronic parameters of the components were measured before and after every irradiation step. The tested components included three types of miniature low anode voltage vacuum tubes, variety of capacitors and resistors of different nominals, structure and composition, and a commercial bismuth telluride TEG unit.

In a separate dedicated irradiation experiment electronic characteristics of vacuum tubes and capacitors were measured on-line during irradiation. These types of experiments were focused on operation of the components in strong gamma field rather on the effect of permanent radiation damage.

In all irradiation experiments the pre-selected electronic components behaved reasonably well and did not show any significant degradation of properties.

Details on the irradiation conditions and results of the measurements are presented.

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