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Circulator Tracking at 80.5 MHz

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A high power amplifier at 80.5 MHz was developed for a linear accelerator system. This amplifier has to hold 100% reflection at all phases and therefore a circulator has to be integrated to protect the transistor of the amplifier pallet from overvoltage breakdown.

At this low frequency isolation and reflections are changing with RF power and temperature. To hold the necessary input return loss of the circulator, voltage controlled tuning coils give the ability to adjust the magnetic field and tune the circulator in such way that is keeps minimum reflection.

Software defined tracking algorithm was developed to control the circulator. Input parameters of the tracking algorithm are forward and reflected RF power applied to the input port of the circulator and heat sink temperature. Output of the control module is an analog voltage that keeps circulator return loss at input port at minimum and therefore isolation at maximum.

Three circulators are part of one 2 kW Solid-State Power Amplifier unit and are controlled simultaneously. Software controlled circulator tracking works for any reflection phase, CW or modulated signal and requires no ramp up or inhibition time to reach full power.

Circulator characterization, tracking algorithm and implementation results will be presented.

Summary

Software regulation of a 80.5 MHz circulator in a high power solid-state power amplifier for a linear accelerator system.

Primary author: Mr KLANJSEK, Janez (HBH Microwave GmbH)

Co-authors: Mr SCHÜTT, Fabian (HBH Microwave GmbH); Mr BEYER, Martin (HBH Microwave GmbH); Mr EHRET, Matthias (HBH Microwave Gmbh); Mr WEBER, Thomas (Elamakato GmbH); Mr TEWES, Wilhelm (HBH Microwave)

Presenter: Mr KLANJSEK, Janez (HBH Microwave GmbH)

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