

RESEARCH ON TESTING AND SIMULATION OF THE EMISSIONS PRODUCED BY THE NARROW BAND SIGNALS

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Abstract: *This research PhD thesis studies one of the cutting edges challenges faced nowadays by the electric and electronic design engineers. The research is developed around the electromagnetic interferences produced by the switched mode power supply sources that operate with the narrowband control signals. These signals are width modulated hence the switch mode power supply can be controlled to provide an improved quality of the electric energy. This efficient power supply technology comes together with electromagnetic interferences issues. For the research study three switched mode power supplies are studied and simulated through Spice simulation software. The simulated regulated power supply are commonly named as Buck, Boost and Buck-Boost converters and they are most used in the automotive electronic circuitry components. The conducted emissions produced by the studied converters have been simulated in Spice. The Spice circuitry follows the Cispur 25 voltage test method layout circuitry and the conducted emissions level have been compared with specified enforced limits and regulations. A corrective solution is proposed including the ESR and ESL equivalent decoupling capacitors circuitry and again the emissions levels results are compared and validated with Cispur 25 regulation limits. Final part of the research study proposes a Feko simulation model of the Cispur 25 radiated emissions test setup used in the automotive component measurements performed in the frequency range of 0.01 MHz – 30 MHz. The study investigates first the ground plane resonance issues with the anechoic chambers metallic floor within 10 MHz – 30 MHz. A multilayer ferrite ground plane is introduced to improve the simulation model, therefore the simulation geometry and results reproducibility are much improved. The paper details afterwards the radiated emission simulation result analysis when the test is set up by two parallel wires excited by a 4.8 kHz pulse signal source. The Feko simulation results are compared and validated with the experimental data.*

Further research could be conducted in order to achieve better correlations with experimental data. The simulation model could be used for further radiation emissions simulation and research for any electrical circuitry that operate with narrow band signals propagated through wire harnesses.

Keywords: Switched mode power supplies, Buck converter, Boost converter, Buck-Boost converter, narrowband signals, pulse width modulated, duty cycle, frequency, Fourier analysis, harmonic analysis, Cispur 25, conducted emissions, conductive wires, decoupling capacitors, EMI suppression, radiated emissions, anechoic chamber, monopole antenna, floor resonance.

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