NEW PROCEDURES FOR THE DESIGN OF IMPLANTABLE PASSIVE TELEMETRY SYSTEMS

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For both control of medical implants like pacemakers or drug-infusion-systems and surveillance of patients, a continuous data-flow of biomedical and physiological signals and functional parameters is required from the implanted devices. Wireless telemetry systems for the information transfer do not involve the risk of an infection and render the patient to be free moveable.

Simple inductive telemetry systems are best suited for this application, using the electromagnetic coupling of two transmission-coils for the signal transmission. However common inductive telemetry systems supply their power-consumption from the implanted battery, shortening the life-time of the implant essentially.

Avoiding both life-time reduction and problems resulting from an inductive energy-transmission into the implant, a passive telemetry system has been developed showing good transmission-characteristics including practically no power-consumption from the implanted battery. Its application in medical implants enables a long-time-surveillance without affecting the implants life-time.

The function of the passive telemetry system is based on impedance-changes of an implanted secondary LC-circuit which is stimulated inductively by an extracorporal oscillator. This stimulating signal has the function of a carrier for the information-transmission altered by the signal to be transmitted.

Depending on the special realization of the system the signal is available in the external circuit as either an amplitude- or frequency-modulated carrier-signal. Using a Fet as a secondary load resistance, altered proportional to the signal by its gate voltage, the necessary modulation power, supplied by the implanted battery, is neglectable.

In order to achieve a high efficiency, amplitude-modulated systems should show high signal changes of the resistive part of the input-impedance \( Z_1 \), given by (fig. 1)

\[
Z_1 = j \omega L_1 + \frac{(\omega M)^2}{Z_2 + j \omega L_2}
\]

Frequency-modulated systems are realized if the oscillator-frequency is determined by the impedance \( Z_1 \) of the transmitter:

\[
Z_1 = \frac{1}{j \omega C_1} + \left( \frac{L_1}{M} \right)^2 R_2
\]

offers the optimal transmission-factor \((L_1/M)^2\). Secondary impedance-changes will be transmitted to the primary circuit with high efficiency, the desired signal can be monitored extracorporally without a remarkable power-consumption for the implanted battery.

Reference:
