

Small Animal Transmitter (SAT) Theory Of Operation

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Applicable Transmitter Models

SAT-TX-SS
SAT-TX-FLEX

Overview

The Small Animal Transmitter (SAT) is intended for telemetry applications in Electrophysiology and Neuroscience research. The SAT has four independent frequency modulated RF outputs in the 900MHz ISM band with a range of up to 50 meters.

Theory of Operation

The transmitter is based upon four identical Colpitts oscillators that feed a common Class A amplifier. Each oscillator uses a SAW resonator (X1 – X4) to control the frequency of that particular output. The oscillators are coupled to the amplifier using a resistor/capacitor matching network that also helps to reduce coupling between channels. The output of the amplifier is matched to a rigid or flexible ¼-wave wire antenna using a PI filter to reduce harmonic emissions.

AC stimulus impulses at millivolt levels are applied from the animal to the CH1 – CH4 inputs on the SAT connector. This stimulus is filtered and amplified using low voltage rail-to-rail op amps (U3 – U6). The output of each op amp drives a varactor diode (D1 – D3) that provides a load on the collector of each Colpitts oscillator. This variation in load that results from the AC stimulus impulses results in frequency modulation of the SAT outputs.

The SAT derives its power from a tiny Lithium Polymer battery that is permanently attached to terminals on the SAT circuit board. A linear regulator (U1) reduces the +4Vdc battery voltage to a +3.3Vdc to provide consistent transmitter output power and current consumption. Nominal transmitter RF output power is 100uW per channel with a total current draw of 22 – 24ma.

List of Active Devices

The circuit contains 10 active devices:

(4) NE85619 RF Transistors (Q1 – Q4) that provide gain so that each of the SAW stabilized Colpitts circuits will oscillate.

(1) NE85619 RF Transistor (Q5) that provides amplification of the RF signals from each of the Colpitts oscillators.

(1) TC10553.3VCT713 Low Dropout Linear Regulator (U1) that regulates the battery voltage to +3.3Vdc to provide consistent transmitter output power and current consumption.

(4) LMV821M7 Rail-To-Rail Op Amps (U3 – U6) that provide amplification of the stimulus inputs from the animal and drive the varactor diodes to frequency modulate the RF outputs.