ZS-910PA Telemetry Transmitter
Tune-up Procedure

General Description

The ZS-910PA transmitter transmits ECG and other from a patient to a Nihon Kohden monitor for continuous monitoring.
The ZS-910PA carries continuous serial data. It covers the frequency band from 608 to 614 MHz. Channel spacing of 12.5kHz is available. The output power is nominally 1mW. Modulation technique is CPFSK (Continuous Phase Frequency Shift Keying).

The ZS-910PA requires +0.9VDC to 1.6VDC supply using one alkaline dry-cell batteries.

The ZS-910PA has a frequency synthesizer module. The module generates UHF radio frequency. The frequency synthesizer module is enclosed in a sealed metal box, which is installed in a main board of the transmitter. The main board consists of CPU, Bio-signal Amplifier, A/D Converter, DC Voltage Regulator etc. The frequency synthesizer module is controlled by the CPU.

Technical Description

The following explains mainly about a frequency synthesizer module. The module connects a main board via connector.
Refer to the block diagram and the schematic of a frequency synthesizer module.

1. Power supply

The module needs two kinds of DC powers 1.0V and 2.7V. 1.0V DC power is fed to Power Amplifier stage, and 2.7V DC power is fed to VCO and PLL-IC. Series regulators generate DC powers.

2. VCO (Voltage-controlled UHF oscillator)

Q2 acts as the VCO whose frequency is determined primarily by L2, C11, C13, and trimmer VC1. D1 is the varicap diode. The diode allows the oscillator frequency (UHF) to be tuned by a control voltage. The control voltage is fed to the cathode side of diode D1 via R5. Q1 acts as the buffer amplifier.
The output signal from the oscillator (VCO) is split, the one is fed to the U1, and the other one is fed to the power amplifier.

3. PLL (Phase-locked loop)

U1, called PLL-IC, incorporates two programmable frequency divider and a phase comparator. The comparator is driven by the outputs of the two frequency dividers. The division ratios are set by means of serial data. The serial data is generated by Gate Array.
The output from VCO is fed via C6 to the input one of the frequency dividers at pin8 (FIN). The other input pin1 (OSCIN) connects crystal oscillator X1.
The phase comparator output appears at pin5 (DO) and is fed via loop-filter (LPF) to the cathode side of D1. The loop-filter consists of C20, R11, C19, R9, and C18. The loop-filter determines the dynamic behavior of the controllable loop bandwidth.

4. Power amplifier

The first stage of the power amplifier is a buffer amplifier. The buffer amplifier consists of Q4, R23, R24, R31, C30, C31, and L5. Its main function is to provide isolation between VCO and final power amplifier. This is in order to minimize the effect of transmitter load change on the oscillator frequency.
The final power amplifier consists of Q5, L6, C33, and volume VR5. Output power is adjusted 1mW by VR5.

5. Low-pass filter

The output from Q5 is fed via C34 to a low-pass filter which consists of C38, L7, C39, L8, and C40. The low-pass filter suppresses spurious emissions.

6. Modulation stage

The bit stream data is rolled by low-pass filter, and fed modulation input (pin10) as an analog signal. VR081 (on main board) functions as an analog gain control.
The modulation signal at the junction of VR4 is fed to the modulation input of the crystal oscillator X1. The wiper of VR4 is connected via R14 to the anode side of the varicap diode D2 in the crystal oscillator. VR4 sets the frequency deviation of a low frequency band in the modulation signal.
The modulation signal at the junction of VR3 is fed to the modulation input of the voltage-controlled oscillator. The wiper of VR3 is connected via R10 to the anode side of the varicap diode D1 in the voltage-controlled oscillator. VR3 sets the frequency deviation of a high frequency band in the modulation signal.

This arrangement constitutes 'dual-point modulation'. The modulation applied to the VCO is only effective outside the bandwidth of the frequency control loop while that applied to the crystal oscillator is effective within this bandwidth. VR3 and VR4 function as a 'deviation balance' control and is adjusted to have the overall modulation response flat across its full frequency range.