

ST2000 SWS Safety Transmitter Theory of Operation

Critical components:

- U1 12 bit DAC
- U2 24.1000 GHz Gunn Oscillator with bias input to adjust frequency
- U3 4,096 bit temperature sensor
- U5 Microcontroller with Flash memory

The ST2001 is tested and configured by a computer-based test station which installs the determined Gunn Oscillator bias vs. frequency data, Gunn Oscillator temperature vs. frequency data and the specific text data (SWS specified) for the messages required by the customer into the memory of U2.

Data transmission

Data bit: U5 sends data to U1 and sets the bias voltage of the Gunn Oscillator. A data bit consists of 20 individual bias levels creating a FM data bit. The resultant FM data bit is a change in the transmitted frequency of 5 MHz over 500 microseconds (2 KHz bit rate). A one bit equals -2.5 MHz to $+2.5$ Mhz change while a zero bit equals a $+2.5$ MHz to -2.5 Mhz change.

Message:

1. CW Marker - 24.1 GHz for 522 milliseconds
2. Header field – 12 bits (all ones)
3. Text field 1 – 10 bits
4. Text field 2 – 10 bits
5. Text data repeated a total of 9 times

Operation:

U5 receives the temperature of the Gunn Oscillator from U3 upon turn-on and sets the transmitted frequency to 24.100 GHz plus or minus 20 MHz by setting the bias voltage (U1) in accordance with the bias vs. frequency data and temperature vs. frequency data stored in memory. The specific message is then transmitted. The transmitter is continuously calibrated during operation by this closed-loop system resulting in a Gunn Oscillator that has an inherent 1 to 1.4 MHz change per degree centigrade remaining within a total of 20 MHz across the minus 30 to plus 50 degree centigrade ST2000 operating temperature range.

Message selection:

The selection of the transmitted is accomplished by changing the grounds on pins three through six of J3 resulting in the ability to select up to 16 pre-loaded SWS messages.