

## Modulating a "Brick" Microwave Source for Beacon Service

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For some time I have been using a Frequency West PLO "brick" type source as a 3456 MHz beacon transmitter. In hearing and presenting several talks on beacons, the topic of keying such a source has often been of concern. PLO sources obviously should not be keyed by interrupting the power supply voltage, a steady supply being necessary for frequency lock and thermal stability purposes. This article describes the two alternatives I have tried.

In order to get a beacon on the air quickly, I initially utilized frequency shift keying (FSK) instead of the on/off keying (CW) emission typical of most VHF/UHF beacons. FSK simplifies things by not requiring any sort of gadgetry on the RF output side of the brick, allowing the antenna to be directly connected to the brick's output so that the entire RF setup could be located up in the air and supplied with DC power through a two conductor shielded cable. In my case FSK was imparted using an admittedly dirty (but easy and quick) approach - varying the power supply voltage to the PLO slightly. A power supply voltage variation on the order of a tenth volt gave me a frequency shift of less than one kilohertz without upsetting the overall frequency stability. The circuit for varying the voltage consists of an optical isolator which switches a resistance in and out of the power supply regulator feedback circuit. The resulting FSK is a bit "rubbery" sounding because the transition from mark to space and back is not quite instantaneous. This could make identifying the beacon difficult during weak conditions and in narrow bandwidths.

Another approach was desired to provide CW keying. PIN diode switching following the frequency source has been used by other beacon builders to impart CW modulation, usually followed by additional amplification. The brick I use is fairly high powered (+16 dbm), so I needed a device that could switch this power level without too much loss to avoid the need for amplification. At a recent hamfest I obtained a complete "microwave modulator" instrument for 8-12 GHz. The

instrument seem to works well enough as-is on 3456 MHz. The key component inside the instrument cabinet was a Hewlett Packard 33001D PIN modulator device. I removed the HP device from the modulator cabinet and mounted it directly on the output of the PLO brick. Although the original instrument contained circuitry to drive the PIN modulator, it was a case of industrial strength overkill. I designed a simple interface (see figure), which accepts a positive going 12 volt signal from the beacon keyer and removes the negative cutoff bias from the PIN modulator during key down intervals. This technique yields about 35 db of modulation depth, not as much as we are typically used to, but enough to call it CW modulation. After modulator losses, the resulting beacon power output is about +13 dbm key down and -22 dbm key up. The key up (backwave) signal will be receivable if the key down signal is at least 35 db above the noise. Receiver AGC will tend to remove the perceived modulation if the backwave is received well above the noise. If you receive the -22 dbm level at any appreciable distance, you know your receiver must be working well or the band is really up!

