

VHF and UHF CW Beacons

By Michael Sapp, WA3TTS



144.300MHz Beacon

A Yaesu FT-290R to a 20W 2M FM Radio Shack amplifier which is operated at approximately 7W output. A Cooling fan is required for the duty service of beacon operation. The 2M amplifier was modified to transmit-only operation by providing a low voltage +DC level to the detector diode of the carrier-operated antenna relay circuit. The FT-290R is keyed with an XT4-B Beacon Keyer in the small black box on the left.

432.322MHz Beacon

A Microwave Modules MMT432/28 transverter which is operated at 4W output. A Signetics 531P 28.322 crystal oscillator IC and low pass filter are located in the small Bud box on top of the MMT432/28 transverter. The 28.322MHz oscillator is powered from a +5V regulator mounted on top of the Bud box.

The 28.322MHz RF energy is keyed with a Daico SPDT RF PIN switch to generate the CW message from the XT-4-B Beacon Keyer. The output of the RF PIN switch is directed to the IF transmit input port of the MMT432/28 to generate the 4 Watt 432.322MHz signal.

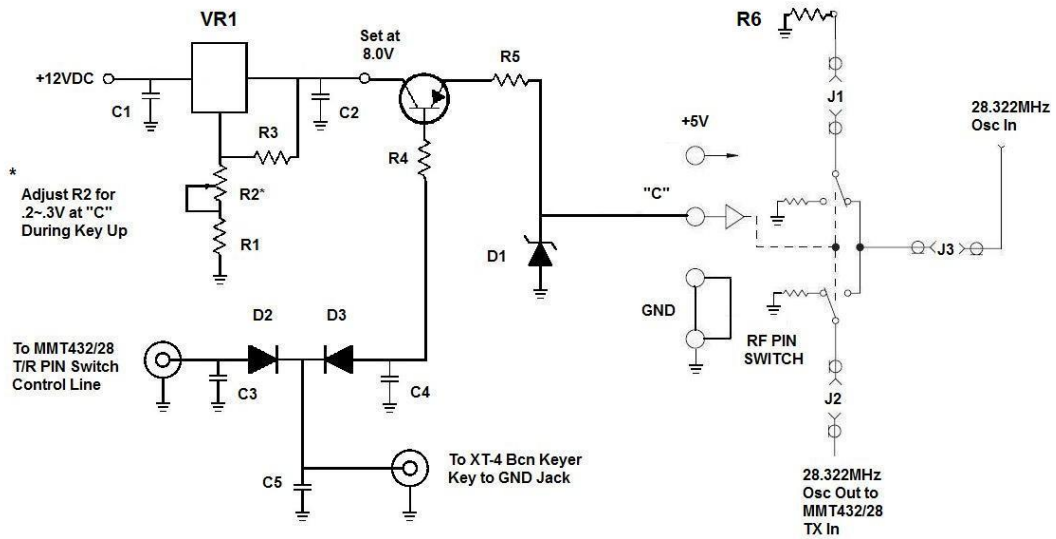
The T/R PIN switch in the MMT432/28 is keyed in tandem with the 28.322MHz oscillator via the XT4-B Beacon Keyer.

Blocking diodes on the small perf-board visible on top of the MMT432/28 transverter isolate the +5V Daico PIN switch control voltage from the +12V control voltage on the MMT432/28 PIN switch line. The XT4-B beacon keyer grounds both control lines simultaneously for CW beacon operation.

The regulator circuit on the right side top of the MMT432/28 provides an optimized voltage setting for the TTL level operation of the Daico PIN switch---5 volts "high" and ".2 to .3 volts "low." The 10W MMT432/28 transverter runs cool at 4W output using it's internal PIN switching feature.

Proper thermal management is an essential aspect of successful, long-term, beacon transmitter operation. In general, it is advisable to operate conventional amateur equipment at 33 to 40 percent of the rated intermittent service power level. Additional cooling fans or other measures may be required to prevent thermal-related equipment failures.

MMT432/28 Keying Control Detail & Parts List



Parts List

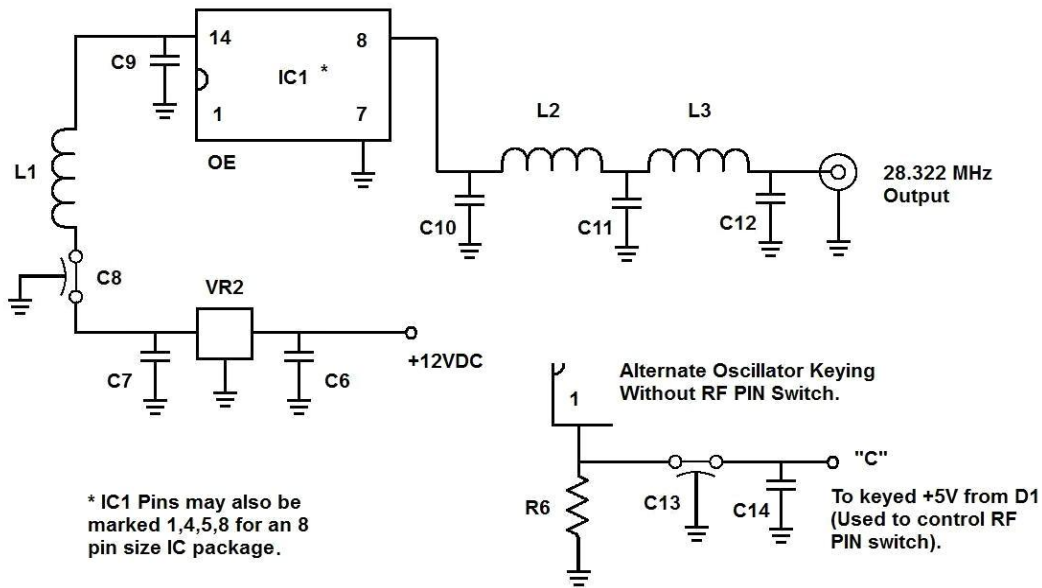
C1,C3,C4,C5	0.1uf 50V polyester film.	R1	680 ohm 1/2W.
C2	1uf 35V tantalum.	R2	1K ohm 15T 3/4W Cermet potentiometer
D1	5.1V 1/2W Zener diode.		
D2, D3	1N4001.	R3	220 Ohm 1/2W.
Q1	2N3906.	R4	4.7K Ohm 1/2W.
R5	390 ohms 1/2W.	R6	50 Ohm SMA termination.
VR1	LM317.		

RF PIN Daico 0622 or Mini-Circuits ZSDR-230, SPDT and TTL control type RF PIN Switch.

Data Sheet & Reference

pdf1.alldatasheet.com/datasheet-pdf/view/140517/DAICO/CDS0622.html
www.fairchildsemi.com/datasheets/LM/LM317.pdf

28.322 MHz IF Oscillator Detail & Parts List



Parts List

C6, C9	0.1uf 50V polyester film.	C8, C13	0.001uf ceramic feedthrough
C7	1uf 10V tantalum.	C11	330pf 50V silver mica.
C10, C12	220pf 50V silver mica.	L1	100uH 1/2W molded inductor.
C14	100uf 35V electrolytic.		
R6	1K ohm 1/4W.		

L2, L3 .290uh 6T #24 enamel wire, close wound on .25" drill bit shaft, with 1/2" leads. Scrape enamel from 1/2" of the wire leads nearest to coil on the drill bit shaft. Bend leads at right angle to coil and cut leads. Remove coil from drill bit shaft. Lightly pull or compress the coil's 1/2 inch long leads until the 6 coil turns are slightly separated and .230" long. Check and adjust coil value on antenna analyzer at 28.3 MHz in Inductance measuring mode. Trim coil leads as required after soldering into circuit. Check and readjust coil length.

VR2 LM7805 5 volt regulator.

IC1 Epson SG-531PT 28.322MHz oscillator IC.

Data Sheet & Reference

pdf.datasheetcatalog.com/datasheet/epson/SG-531P.pdf
www.fairchildsemi.com/datasheets/LM/LM7805.pdf

Beacon Antennas



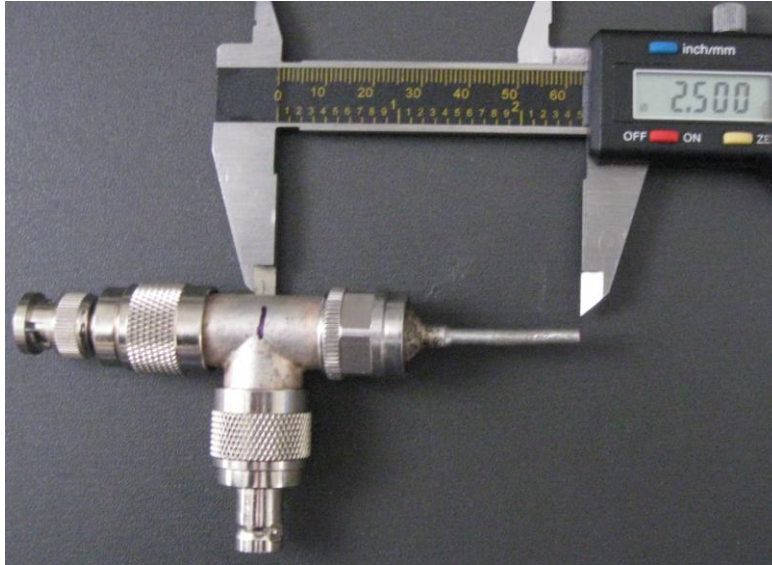
A pair of 144 MHz PAR Loop antennas and a 4-stack of Ben Lowe's "432 MHz Lowe's Loops"¹ are used on 432 MHz. These antennas are mounted on two heavy-duty 10 foot long Radio Shack masts, guyed at the 15 foot mast level and are roof-mounted. A 50 MHz PAR Loop is also present. A Diamond MX2000 Triplexer allows a single run of CNT-400 feed line from the antennas to the beacon transmitters.

A second Diamond MX2000 Triplexer allows the output from multiple beacons to be combined on the other end of the CNT-400 feed line. The series configuration of two triplexers on the coaxial line also provides substantial additional harmonic filtering at 100 MHz and 288 MHz (up to 60dB). However, at 432MHz, the triplexers act as high-pass filters and can freely pass 864 MHz energy. For this reason, a simple 1/4 wave open coaxial stub is used at 864 MHz

¹ July 2006 QST, p28.

on the output of the MMT432/28 transverter to provide an additional 40 dB of 2nd harmonic filtering. It was observed that the output power of the MMT432/28 MHz transverter rose slightly at 432 MHz with the addition of the 864MHz stub filter.

864 MHz 1/4 Wave Stub Filter Detail



This 864 MHz harmonic filter consists of a Type N 50 ohm female T adapter and a short length of RG-141 rigid cable with a male N connector. BNC adapters complete the RF connection to the transverter and the RF watt meter used for output monitoring to the antenna.

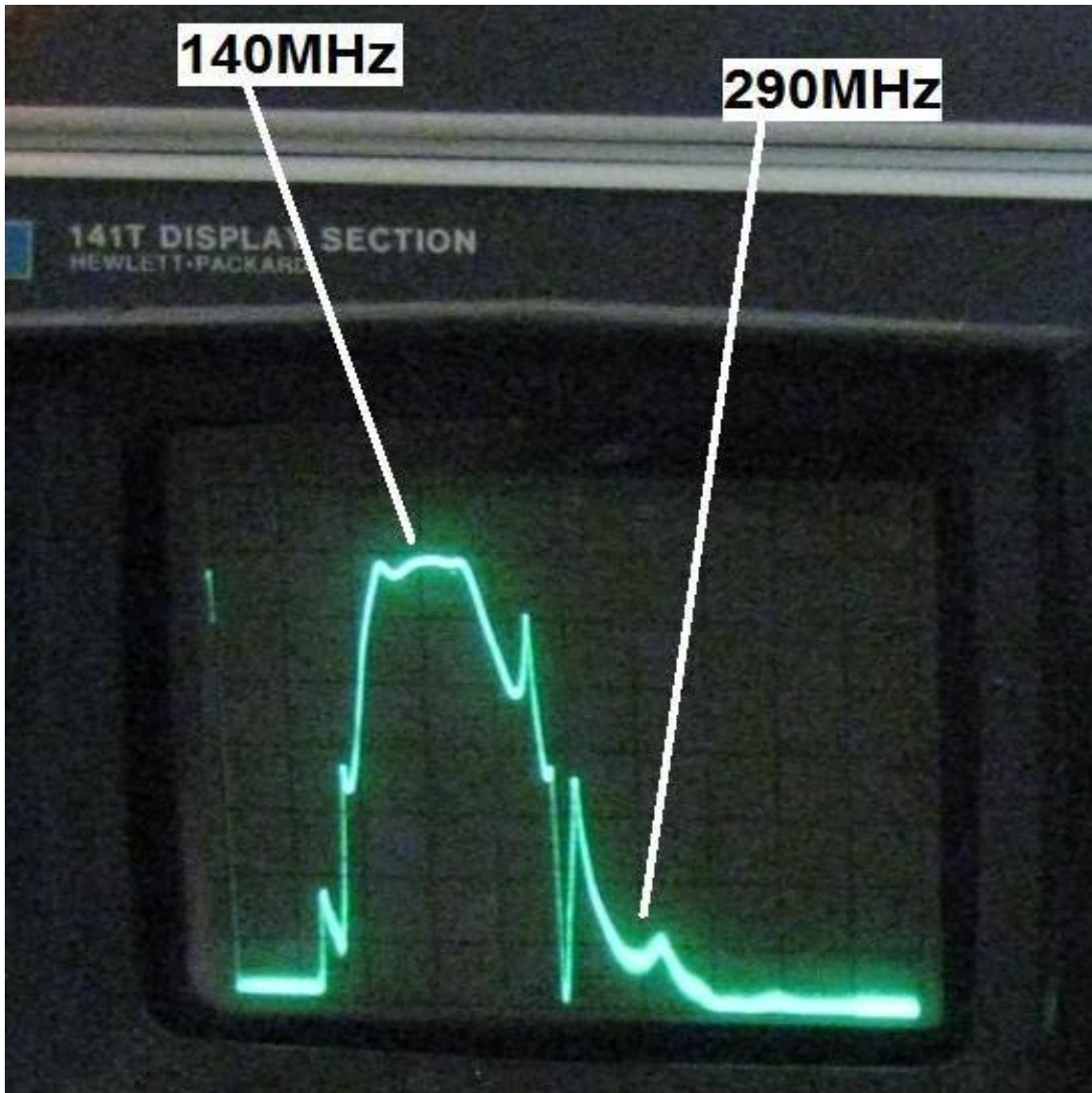
The combined length from the exact center of the T adapter to the open end of the RG-141 cable is 2.500 inches for this coaxial stub tuned to 864MHz. This 2.5 inch length is just slightly longer than the calculated electrical length. (Note: a quarter wave at 432MHz = 6.83 inches. Divide 6.83 inches by 2 and apply the 70 percent velocity factor for RG141 cable = 2.39 inches at 864 MHz).



864 MHz 1/4 Wave Coaxial Notch Filter Performance.
10dB per Division Vertical, 50 MHz per Division Horizontal.



Back-to-Back Diplexer Configuration Showing 60dB Notch at 100MHz.
View Centered on 50MHz, 10MHz per Division Horizontal and 10dB per Division Vertical.



Back-to-Back Diamond MX-2000 Triplexer Performance on the 144MHz Ports.
View Centered on 240MHz and 50MHz per Horizontal Division and 10dB per Vertical Division.