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QST Issue: Feb 1997
Title: Get on 448 THz for Less Than $100
Author: Emil Pocock, W3EP

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The World Above 50 MHz

—Emil Pocock, W3EP*

Get on 448 THz for Less Than $100!

So—you've always wanted to get on a *really* high band but didn't have the know-how? Here is just the project for you: a 1-mW 448-THz station assembled with readily available parts for less than $100. Oh, and just what is 448 THz (actually 447,761,190 MHz)? It is the frequency of the common red laser used in pointers—the pointers that are the basis for this ingenious project devised by David McDaniel, AB5UE.

Genesis of the Laser Transceiver

David and his brother Richard, KC5OEG, began experimenting with noncoherent light communication during the 1960s. The pair modulated the batteries of flashlights with an audio amplifier and detected the resulting beam with an ordinary solar cell hooked up to another audio amplifier. This simple setup worked over distances of 100 yards or so, but they had to put up with weak signals and QRM generated from the headlights of passing cars! (Dave remembered that automotive alternators modulated headlight beams enough to put a slight tone on the received light signals.)

All sorts of white-light sources created unwanted noise, but the real limitation was the difficulty in focusing the flashlight beam over a long distance. The advent of inexpensive, low-power diode-driven lasers seemed to offer a new possibility. In addition, laser light is a form of coherent electromagnetic radiation on a single frequency—thus eligible for inclusion as an amateur band, even though it is well out of the radio range. You could even use a simple laser station to add a few extra contacts and multipliers to a VHF or UHF contest.

The Laser Station

The complete laser station, capable of full amplitude-modulation (AM) duplex operation with a station of similar design, is easy to assemble. No parts are critical. See Figure 1 for the parts list and layout.

The transmitter is built around a laser pointer. You may have to remove the battery and solder in power supply leads. Any audio amplifier capable of 200 mW output coupled through an audio transformer with an 8-Ω primary should provide more than enough power to modulate the 1-mW laser. Attach a suitable microphone.

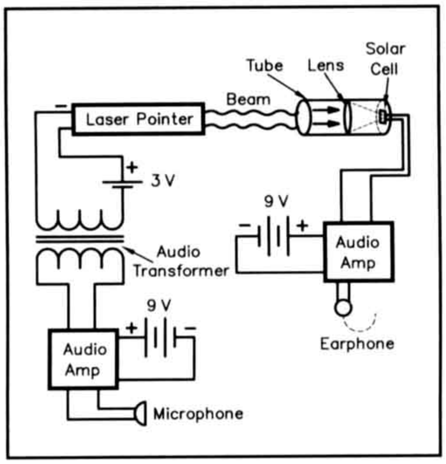

Figure 1—Schematic of the AB5UE 1-mW laser transmitter and receiver. None of the following parts are critical, and can be purchased at Radio Shack:

Item	*Radio Shack part number*
Laser pointer	63-1041
Solar cell	276-124
Audio amplifiers	277-1008
Audio transformer	273-1380

The receiver consists of a solar cell mounted at the focal point of a small lens. Most any 2 or 3-inch lens will do, such as one removed from a magnifying glass. The diameter is not important, just as long as you can focus at infinity. Mount the lens halfway down a cardboard or PVC tube in order to keep stray light from striking the solar cell. The receive-side audio amplifier is also not critical. Use an earphone or speaker.

The difficult part of assembling the station is the mechanical construction, because aiming the laser pointer and the receiver tube can be quite critical. This requires some ingenuity. David devised a small wooden platform to hold the laser pointer on top of a tripod. The tilt of the platform can be adjusted using screws. The position of the receiver tube is less critical, but it can also be mounted on the tripod.

Results

Adjust the gain on the transmitter audio amplifier until the laser visibly flickers when you speak into the microphone—*but do not look directly at the laser.* You can initially test the receiver with a relatively

David McDaniel, AB5UE, makes a contact with his 448-THz red-laser station. The transmitter is on the top of the tripod and the receiver is mounted in the cardboard tube below.

close one-way transmission. A true QSO requires two complete stations, of course, and the job will be much easier if you maintain liaison using hand-held transceivers. Try a hundred or so yards of separation at first, until you develop the technique of proper aiming.

The greater the distance, the more difficult it is to aim the laser exactly toward the distant receiver tube. This has to be done on each end to make a full-duplex QSO. At three miles or so, the laser spot was 10 feet in diameter and barely visible. It took AB5UE and KC5OEG about three hours to get the beams lined up correctly for their longest QSO—3.5 miles (5.6 km)—completed on August 3. David burned out a laser after several hours of continuous use! Attempts to extend the distance to six miles were not successful, as of late November.

There are many possibilities for improvement to and variation in this basic design. Try your own innovations. Laser pointers with 3 mW output are also available. It may be worth experimenting with the sensitivity to red light of various kinds of solar cells. Placing the solar cell behind a small telescope might increase the sensitivity of the receiver, although the mechanical and aiming problems will increase significantly. However you manage to get on 448 THz, please send me your results. By the way, the listed US distance record for the red-light band is 92 km.

For more information on this interesting project, contact David McDaniel,

This Month

February 8-9	Good EME conditions

*Send reports to Emil Pocock, Box 100, Lebanon, CT 06249. Leave voice messages at 860-642-4347, or fax 860-594-0259 or e-mail **w3ep@arrl.org**.

AB5UE, 412 Cedar Pl, Boerne, TX 78006; tel 210-981-4601.

ON THE BANDS

The Leonids take top billing for the November activity news, thanks to some advance warning that something special might be brewing. Those that got up early in the morning of November 17 were well rewarded with some meteor bursts of unusually long duration. Sporadic E continues to produce no end of surprises. Six meters was open on at least 10 days during this normally slow month, including double-hop and DX opportunities on some days. As is the usual practice, dates and times are UTC.

Leonids on the Upsurge

The November 17 Leonids meteor shower normally yields about 20 visual meteors per hour during optimal times. This makes it considerably less spectacular than the August Perseids (more than 60 per hour) or the December Geminids (about 50 per hour), but the Leonids have two things going for it. First, Leonids are the fastest of any shower meteors, so they tend to burn up higher in the atmosphere. This might provide opportunities for meteor-scatter contacts that are longer than usual. Second, the Leonids have a periodic cycle, and can produce incredible meteor storms every 33 years, such as the most-recent big one in 1966.

Although 1996 is a bit early to expect a full storm, the Leonids did create a bit of a stir, especially for stations in the Western US. More than a dozen reports had the same refrain: there were many useful burns that lasted from 30 to as long as 120 seconds on 144 MHz. At times, 50-MHz paths opened for as long as 10 minutes at a time—nearly like sporadic E. It was difficult to judge a peak time from so few reports, but contacts were made throughout the period from 0800 to 1900 on November 17.

Here is a sampling of some of the 2-meter contacts, with the length of the longest burn in seconds:

N7EIJ (CN85)	N6ENU (DM05)	20 s
K6ZX (CN82)	AA7A and N7WS	45 s
N7STU (DM07)	KD7TS (CN87)	15 s
N7STU (DM07)	K7ND (CN87)	60 s
VE3GBA/7 (CN88)	N7STU (DM07)	90 s
CO2OJ (EL83)	K5YY (EM26)	30 s

Several western operators, including John Price, N7MWV (CN87), noted that they completed two or three contacts on a single long burn. Activity was not confined to the West. Mark Ammann, KMØA (EM48), completed a schedule with VE9AA (FN65) using high-speed CW. Mark heard Mike for several complete 15-second sequences before the contact was completed just after 0800. The distance was nearly 2100 km and gave VE9AA Missouri as a new state.

If these experiences are evidence that Leonids activity is picking up, then this shower may well produce some spectacular conditions in the coming years. The Leonids storm, if one appears this time around, is not expected until 1999. We may get several years of extraordinary openings out of the Leonids before the year 2000.

Sporadic E

Six-meter operators from nearly every part of the country reported E-skip contacts on November 1-2, 4, 5-6, 14, 15, 16, 17, 21-22, 24, and 28-29. The opening on the evening of the 1st was highlighted by TG9SO, who made a string of contacts into Mexico City (where he was 40 over S9), and as far north as Texas. WA5JCI worked the Guatemalan, as well as hearing beacons in Arizona between 2345 and 0025. Larry Lambert, NØLL (EM09), copied XE1KK/b (Mexico City) about this time.

Conditions were quite good on November 5-6, although reports are scarce. WA5IYX (EL09) found 6 meters open to Tennessee by 2300, when the MUF quickly rose past 88 MHz, as evident from FM broadcast stations from Georgia. Jay Rupar, KØETC (EM27), worked two stations in New Orleans at about the same time and then found TI5LNE (EK70) around 2325. N5JHV (DM62) made some double-hop contacts as far east as EM90 around 0015 and also worked TI5LNE at 0030.

WAØKBZ (EM48) worked several East Coast stations on his way home from work on the evening of the 15th. Six meters popped open for WA5JCI (EM21) after 0020 on the 16th, when he began hearing 4s and 8s. Frank Ayers, WB2DUS (FN22), worked KØETC and heard other midwestern stations about the same time. Frank found the band open again the next day around 1330 and worked N9PEZ and K8KD. San Hutson, K5YY (EM36), reported stations all along the East Coast, from Florida to New England, after 1340. K5YY, WØMTK and others remarked that the openings on the morning of the 17th sounded like they were meteor-enhanced, perhaps a secondary effect of the Leonids shower.

Six meters was in good shape on November 21-22. Newcomer NA9N (EN71) worked some very loud stations in FN35, 42, 53, 54, 63, 65, and 66 by 2230. Germain Bisson, VE2PEP (FN46), ran a string of stations from Virginia to Indiana and south to Georgia. WB2DUS began hearing midwesterners by 2300, and heard them working into Florida. W3EP/1 (FN31) found NØKM (DM67) at 0200 for an unexpected double-hop contact; listened to W5FF (DM64) for nearly an hour; and heard several single-hop stations in Texas, Arkansas, Missouri and adjacent states. KØGU (DN70) found the band open after 0300 to a wide area from Texas to Missouri and east to south Georgia.

Six meters was open for a good part of Thanksgiving Day (November 28-29 UTC), but reports were sparse. By 1400, stations in the Northeast were working widely throughout the Midwest and South as far as Oklahoma and Texas. WA5IYX reported 90-MHz plus FM broadcast stations booming in from Florida after 0220. NØLL heard XE1KK/b.

VHF/UHF/MICROWAVE NEWS

EME Conditions for 1997

Derwin King, W5LUU, has once again provided an analysis of EME conditions for every weekend of the year. Many thanks for his contribution. Weekends that Derwin rates as *good* or better are included in the "This Month" box each month. A weekend rates *good* if the combination of Earth-Moon distance and cosmic noise degrades propagation by no more than 2.5 dB from optimal conditions.

Using those criteria, 1997 is not an auspicious one for the moonbouncers. Only eight weekends rate *good* or better and none merit *excellent*. A few decibels can make a big difference when working with weak signals, especially for stations already near the margin of EME capability.

NOTES FROM ALL OVER

More October Transequatorial

Mail from Argentina can be slow, so the fine report from Nestor Zucchi, LW5EJU, came too late for my January column. Nestor adds quite a log full of 6-meter stations heard and worked via transequatorial propagation (TEP) in October, including a number of US stations. It is amazing how many DX stations stay on the air, even during the lulls between propagation peaks. All times were between 2300 and 0230. Here are the highlights:

Date	*Stations Worked or Heard*
9	YV4AB/b, TI4JHQ, TI2NA/b
12	YV4AB/b,
22	YV4AB/b, V44K, HIØVHF/b, XE1KK/b
23	WP4ARJ, TI2NA/b, TI5NLE, KP4A, HP3XUG, TI4JHQ, TG9SO, TI7DBS, W7US/b, HIØVHF/b, KP4EIT, KC7A, AA6DD
24	YV4AB/b, XE2UZL
25	V44KAA, V44K/b, V44KAI, HIØVHF/b
26	TI2NA/b, YV4AB/b, TI4JHQ
27	YV4AB/b, J3/WZ8D
28	YV4AB/b

John Walker, WZ8D, in Grenada in late October to install a new 6-meter beacon, caught some of the TEP, as noted in Nestor's log. J3/WZ8D worked five ZP calls, 10 LUs, PY2DSC and PY3PT. By the way, J3EOC/b (FK92) went on the air October 27 on 50.056 MHz with 1.5 W. QST

VHF/UHF Century Club Awards

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmations for contacts with the minimum number of Maidenhead grid-square locators (indicated in italics) for each band listing. The numbers after call signs refer to endorsements. The totals shown are for credits given from October 5 to December 2, 1996. Please send an SASE for the current rules and appli-cat-ions forms. The VUCC application form, field sheets and complete list of VHF awards managers is now located on the World Wide Web at **http://www.arrl.org/awards/msd/**. VUCC lapel pins are available for $5 each.

Compiled By Bill Moore, NC1L, Century Club Supervisor

50 MHz
100

844 N6HKF
845 W5EHM
846 KS4DU
847
VE3KDH 848
KE4KVF
849 VE6NTT
850
WB9DRB
851
KB2RHA
852 N7YAP
853 N2YXW
854 N7YAG
855 KF4CYB
W0KEA 550
KB2TGU 200
KB2RHA 125
WA2HFI/Ø 125
W4DR 700
WB4AYE/6 200
W4UDH 300
KD4IRT 225
N5HHS/5 450
N5HHS 250
N7YAP 125
WB7QBC 300
K8TL 125

144 MHz
100

528 N6HKF
529 VE3FOD
530 K5LLL
531 K7ND
W0JRP 200
W0KEA 200
N5HHS 125

432 MHz
50

262 KF9B
263 N5HHS/5
264 N4KWX
NØLL 100
N5HHS/5 60
N5FAC 80

1296 MHz
25

AA5C 55

10 GHz
5

W6HCC 40

Satellite
100

64 WE1U
65 VS6XMT
66 N5JGK
VS6XMT 150
N5JGK 150

QST