

# Looking in on

*TV dx reception across the Atlantic is possible with the right equipment. Here's how to convert an old receiver to pick up those European stations*

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# LONDON



**D**URING my 18 years as a licensed radio amateur I have had many exciting dx contacts. I can honestly say that none of these gave me quite as much of a thrill as when I first saw an identifiable transmission direct from London on the screen of my own TV set. The realization that I was watching an event which was taking place almost 4,000 miles away, across the Atlantic Ocean, was truly a breathtaking experience.

Almost as remarkable was the ease with which I got this dx TV reception. My relatively simple equipment included a slightly modified ancient 10-inch television receiver, a pre-world War II FM tuner and a couple of indoor antennas. With this gear I picked up many telecasts from Britain during December, 1957, and January, 1958. With a little luck, patience and ingenuity, the average electronic experimenter should be able to duplicate or better my results this coming winter. The photographs are typical of the kind of reception I got. All broadcasts came from London.

TV dxing is not recommended as an

avocation for beginners. However, if you know your way around a TV chassis, are acquainted with high-frequency receiving techniques and have successfully constructed a few pieces of electronic gear, you are qualified to try your hand at tuning in on London. The material which follows will give you some idea of the problems which may be encountered while searching for signals from "across the pond."

This kind of long-distance reception may appear somewhat fantastic to those acquainted with the 50-150 mile range of the average US TV station. Nevertheless, during the past two winters, there were a number of days when TV transmissions arriving in the midwest from Europe were exceptionally strong. There is every indication that European TV signals of equal excellent intensity will again be encountered next winter.

## How and when

We are all accustomed to the worldwide transmission of radio signals on the high-frequency bands extending to approximately 30 mc. Long-range reception on these frequencies is possible because the signal from the transmitter shoots off into space and is reflected to earth by the ionosphere. Depending upon the angle at which the radio wave hits the reflecting ionospheric layer and on the height of this layer, the signal returns to earth a few miles from the transmitter or thousands of miles away. At one time, it was believed that signals above about 30 mc always penetrated the ionosphere and never were reflected. However, in recent years the spectrum above 30 mc has become loaded with amateur and commercial stations and

we have discovered that there are occasions when even signals above 50 mc are reflected by the ionosphere and come back to earth a great distance from the transmitter.

The period of long-range transmission on these frequencies occurs only during years of maximum sunspot activity. Since there were more sunspots in 1957 than at any other time in recorded history, world-wide propagation of signals on frequencies near 50 mc became commonplace. The number of sunspots will decrease during 1958, probably to a level approaching that of 1956. But there were a number of days in 1956 when 50-mc signals were heard around the world, so there is every reason to believe that with proper equipment 45-mc television signals from London will again be receivable in the United States later this year.

European TV comes in best during the fall and early winter months. So, if you wish to attempt to pick up these signals, your equipment should be ready to go not later than the middle of October.

The most important piece of gear for use in hunting TV dx signals is an FM radio receiver which covers 40 to 50 mc. With one of these sets you can monitor this part of the spectrum to check on what stations are coming through, and you can listen in on the sound portions of any video programs which you succeed in viewing. I am lucky enough to own an old Meissner tuner that covers the 40-50-mc band formerly occupied by FM broadcast stations. This unit has picked up TV sound signals from London and Manchester, England; Caen, France and Berlin, East Germany. The raspy notes of the London and Berlin video carriers have also been successfully picked up.

A number of FM receivers that tune from 30 to 50 mc are presently being marketed. Among these are Monitor-radio's model PR-31 Police Alarm, the Hallcrafters Civic Patrol type S-94 and the Gonset model 3155 vhf communications receiver. Although the French and English sound transmissions are amplitude-modulated, they can be received on FM equipment by tuning slightly off to one side of the signal.

**TABLE I—EUROPEAN TV STATIONS MOST LIKELY TO BE RECEIVED IN US\***

Location	Video Freq (mc)	Video Power (kw)	Audio Freq (mc)	Audio Power (kw)
Belfast, Northern Ireland	45.00	12	41.50*	3
London, England	45.00	200	41.50*	50
Caen, France	52.40	80	41.25*	20

A list of all foreign FM and TV stations may be obtained from Superintendent of Documents, Government Printing Office, Washington 25, D. C. Ask for *Broadcasting Stations of the World, Part IV* and enclose 75¢ in coins.  
\*Sound is AM.

**TABLE II—COMPARISON OF WORLD'S TELEVISION SYSTEMS**

	British	US	Int'l Radio Consultative Committee	Russian	French
Number of lines per picture	405	525	625	625	819
Video bandwidth (in mc)	3	4	5	6	10.4
Channel width (in mc)	5	6	7	8	14
Line frequency (horizontal) (in cycles per second)	10,125	15,750	15,625	15,625	20,475
Field frequency (vertical) (in cycles per second)	50	60	50	50	50
Picture frequency (cycles)	25	30	25	25	25
Sense of video modulation	Pos	Neg	Neg	Neg	Pos
Sound modulation	AM	FM	FM	FM	AM



The French sound comes through quite regularly on 41.25 mc, but the accompanying video at 52.4 mc is so high in the spectrum that there is little chance of receiving it except on extremely rare occasions this coming winter. The European video carriers most likely to be picked up in the US are those from London and Belfast. Since London has an effective radiated power of 200,000 watts, and Belfast 12,000 watts, it is easy to see why the London transmissions are the most consistent, and usually the strongest. Consequently, if you decide to try your hand at TV dxing, I suggest that you center your efforts in the direction of Britain. Table I lists the vital statistics of the dx stations you are most likely to encounter.

By studying Table II, you will note a number of differences between the British 405-line system and our own 525-line standard. The first important dissimilarity is in the spacing between the sound and video carriers. This disparity means that, if you want to hear the audio, along with the picture, you must have a separate sound receiver.

#### Modifying the sweep circuits

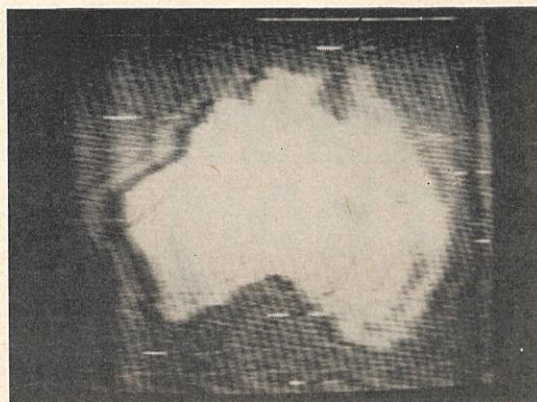
The horizontal frequencies of the two systems differ markedly. I doubt if any factory-built American TV set is equipped with a horizontal control that can shift the oscillator from the normal frequency of 15,750 cycles to the British frequency of 10,125. This means that you'll have to dig into your TV set a bit and make a few modifications. Two popular horizontal oscillator circuits are shown in Fig. 1. If your set uses a multivibrator (Fig. 1-a), you can add capacitance across the ringing coil to lower the frequency. In my receiver, I had to add a .01- $\mu$ f capacitor at this point. As this change caused the oscillator to operate somewhat erratically, I also added a 470- $\mu$ f mica capacitor in parallel with the coupling capacitor between the multivibrator triodes.

An oscilloscope and a calibrated audio oscillator will help you set the horizontal oscillator to the required frequency. Tune the audio oscillator to 10,125 cycles. Connect its output to the scope's horizontal input. Then, connect the vertical amplifier of the scope between point A and ground. When the multivibrator is running at 10,125 cycles, the pattern on the scope will appear as a slightly warped circle. By trying different capacitances across the ringing coil and adjusting the slug in this coil, you should finally arrive at a point where the receiver's horizontal oscillator is working at the British standard.

If your set has a blocking oscillator circuit (Fig. 1-b), a mica capacitor may be wired in parallel with the grid coupling capacitor to lower the horizontal frequency. A value somewhere between 200 and 500  $\mu$ f will probably do the job.

The 50-cycle British vertical frequency is close enough to the American standard of 60 cycles to let the vertical

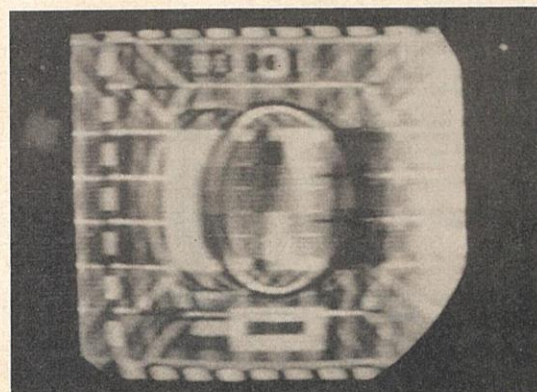
Map of Australia.  
Received at 0930  
hours, Jan. 14, 1958.



Violinist. Received at  
1055 hours Dec. 29,  
1957.



BBC test pattern.  
Note the multiple  
ghosts.



Woman discussing  
coughs and colds. Re-  
ceived at 0945 hours,  
Jan. 14, 1958.





## TELEVISION

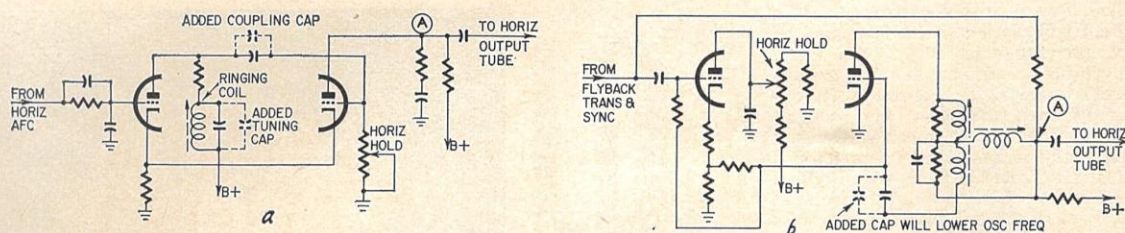


Fig. 1—Adding capacitors is the simple step that changes sweep frequencies to match European standards: a—horizontal multivibrator; b—blocking oscillator.

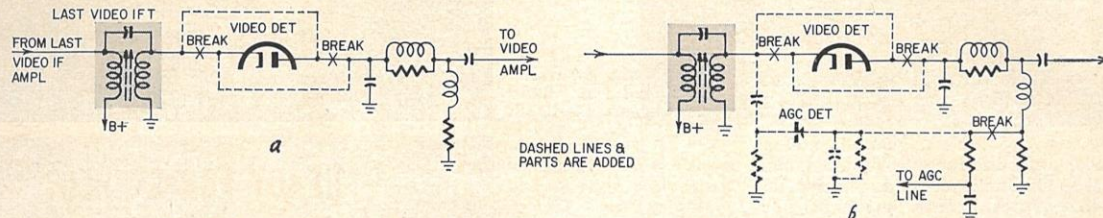


Fig. 2—Switching to positive video modulation: a—set without age; b—set with age.

hold control on your receiver take care of either system.

The American *sense* of video modulation is negative. This means that in this country, as the strength of the carrier increases, the picture gets blacker on the face of the picture tube. English TV stations use positive video modulation and the picture gets whiter as the strength of the video carrier increases. Because of its opposite polarity, the white part of a British picture will appear black on an American receiver. This results in a negative image when a BBC signal is fed to one of our unmodified domestic receivers.

Luckily, there is a very simple way out of this rather strange situation. All you have to do is to reverse the cathode and plate connections of the video de-

tor as shown in Fig. 2-a. Fig. 2-b shows the hookup to use if your receiver derives age voltage from the video detector. Typical constants for the age network can be found by studying similar circuits used in sets made around 1951 and 1952. However, if your set has dc coupling between the detector and first video amplifier, it cannot be used without making extensive changes. This change is needed only to tune in British and French stations. Other European countries use the familiar *negative* video modulation.

### Frequency conversion

The European stations you want to see operate on channels not covered by American TV receivers and frequency conversion must be used ahead of your

set. The circuit shown in Fig. 3 is that of an old converter which I happened to have on hand. It was readily adapted to the 40-50-mc range by changing the coils. Since it lacked adequate sensitivity, I added a 6AG5 preselector (see Fig. 4).

Channel 5 (76-82 mc) is vacant in the Detroit area and was chosen as the output frequency of the converter. When tuned to the 45-mc English video frequency, the converter oscillator can be operated either on 33 or 123 mc to produce an output frequency in the middle of channel 5. Because of the vestigial-sideband nature of the London transmissions, the received signal most nearly fits the video response curve of an American receiver if the oscillator frequency is 123 mc. However, results seem to be just about as good when working with an oscillator frequency of 33 mc and, since this frequency is easily measured with the gear available to the average experimenter, the oscillator coil shown is designed for 33 mc.

### What kind of antenna

Although it is true that the better the antenna the better the results, I had surprisingly good luck with rather simple aerials. I used a two-element beam in the attic for video reception. It was fastened between the rafters about 18 feet above ground. The antenna proper was a folded dipole cut from 300-ohm ribbon line. Behind it was a length of No. 18 wire which acted as a parasitic reflector. Dimensions are shown in Fig. 5. My sound antenna was a 300-ohm folded dipole without a reflector. Undoubtedly, performance would have been better if the antennas had been made of aluminum tubing and mounted high in the air, clear of surrounding objects. However, it was late fall when I started my experiments, and I like to do my sky-wire work when the weather is warm. It is worth noting that, even though the 45-mc transmissions are vertically

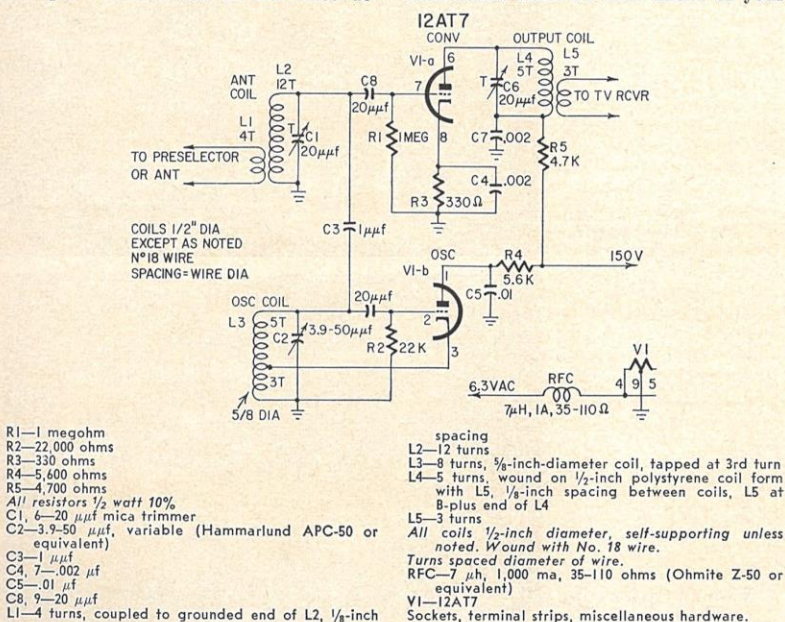
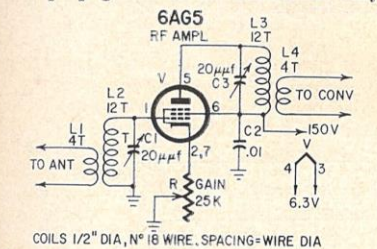


Fig. 3—Simple converter puts BBC on channel 5. Oscillator grid capacitor is C9.



polarized, the receiving antenna can be mounted in a horizontal plane because the original polarization of the signal is lost as it passes through the ionosphere.

The best time of day to look for foreign TV signals is from around 0800-1300 EST. An all-daylight path is usually required between the transmitter and the receiver. Due to uncertain propagation conditions on the very



COILS 1/2" DIA., NO. 18 WIRE, SPACING=WIRE DIA.  
R—pot, 25,000 ohms  
C1, 3—20 μf, mica trimmer  
C2—0.1 μf  
L1—4 turns, wound over cold end of L2, layer of electrical tape between coils  
L2—12 turns  
L3—12 turns  
L4—4 turns, wound over cold end of L3, layer of electrical tape between coils  
All coils wound on 1/2-inch diameter forms with No. 18 wire. Turns spaced diameter of wire.  
V—6AG5  
Sockets, terminal strips, miscellaneous hardware

Fig. 4—For more gain, use this preselector ahead of the converter shown in Fig. 3.

high frequencies, it is difficult to say on what date long-distance reception will again be possible. I would suggest, though, that you be prepared to listen and watch not later than Oct. 15, 1958. Once you pick up programs in French at 41.25 and English at 41.5 mc on your sound receiver, you can be sure that conditions are optimizing. Keep checking 45 mc for the raspy buzz produced by the London video carrier. As soon as it comes through, you can try for a picture on the TV set.

#### Tuning in for dx

Set the receiver's fine tuning at mid-range on channel 5, or 6 if 5 is occupied in your locality. Tune the converter oscillator back and forth until the familiar out-of-sync zig-zag lines denoting a video carrier appear on the screen. The vertical hold control should stop the picture vertically, but you may have to readjust the horizontal oscillator transformer or ringing coil slug a bit before the horizontal hold control will bring the picture to a standstill horizontally. All the tuned circuits in the converter may now be adjusted to give you the sharpest image. You get the greatest contrast when all signal circuits are tuned to the same frequency. This arrangement, however, will result in a peaked response with low picture definition. Stagger tuning will reduce the gain, but will make for a better picture. TV dx tuning is an art that is a little hard to describe on paper. It is best learned by experiment.

Don't expect the pictures to be as sharp and steady as the ones you get from your local TV station. Since the ionosphere is a very imperfect reflector,

the signals arriving at the receiver will travel several different paths. These paths are usually not of equal length, and numerous ghosts may appear on the screen, just as when you have multipath reflections on local TV signals. This ghost problem is often acute. Once, in a tennis match from overseas, there were at least 30 players batting 15 balls back and forth. The sync pulses, as well as picture elements, are subject to this ghosting effect. Consequently, there are often so many sync pulses of varying phase and amplitude that the receiver's circuits are unable to cope with them. At these times the picture jumps wildly up and down and sideways. Fairly often, however, ionospheric conditions settle down and a single, steady picture appears on the screen. Large objects, human faces and sometimes even program titles are then recognizable.

There are several explanations for the lack of sharpness in the image produced by a foreign TV signal. A certain amount of smearing appears because the if curve of an American receiver is not absolutely compatible with the signal transmitted from overseas. Ghost effects also tend to reduce the apparent sharpness. The selectivity introduced by the converter ahead of the TV re-

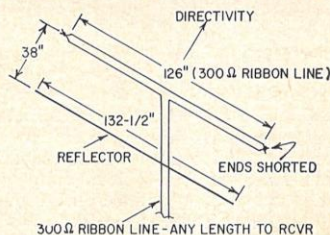


Fig. 5—Sketch of beam antenna for 45-mc TV reception.

ceiver also contributes to loss of definition. Probably most important, however, is the fact that because of varying ionospheric conditions, it is seldom possible to receive all portions of the TV channel with equal strength. Another cause of picture degradation is the TVI produced by the many American mobile services operating between 40 and 50 mc.

When you get pictures on your TV screen direct from London, you'll undoubtedly want to photograph them to have a permanent record of your efforts. I used a 35-mm camera loaded with Plus-X film for the illustrations accompanying this article. Exposure was f 4.5 at 1/25 second. This shutter speed is optimum, as it is roughly equivalent to the scanning time required for one complete frame. [For more details on this type of photography, see "Photographing C-R Tube Images," RADIO-ELECTRONICS, February, 1958.]

Don't be surprised if the photos lack the sharpness and detail of the image you thought you saw on the TV screen. Remember, a camera lacks the human brain's ability to fill in the small details which it knows should be in a picture, even when they aren't.

END