ON January 21, 1937 one of our engineers at the Frequency Measuring Laboratory at Riverhead, N.Y., was making his usual routine "Cruise of the ether" in the neighborhood of 40 megacycles when to his surprise he heard a carrier modulated with a voice having a distinct English accent. A hurried check of the frequency showed the carrier to have a frequency of 41.5 megacycles per second, (722 meters) the assigned frequency of the voice channel of the Alexandra Palace television transmitter. A few minutes later the transmitter's identity was confirmed as the announcer said: "This is the television transmitter at Alexandra Palace, London." Imagine the operator's surprise!

This was the start of a series of observations and measurements on the English and German television transmissions. Fig. 1 shows the ultra-high frequency receiver used. The lower panel of the further rack is the receiver proper, while just above it is a low capacity antenna switch used to connect the receiver to either the incoming transposed (Uncontinued on page 574)

Fig. 1—Receiver used to pick up European television signals at Riverhead, Long Island.

Fig. 2—Block diagram of the U.H.F. receiver, showing types of tubes used.

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transmission line from the antenna, or to a calibrated high-frequency signal generator in the same tank in the oscilloscope. The main panel of the tank is a rack voltmeter useful in comparing peak signal values and metering signal-to-noise ratios.

The upper panels of the two tanks contain the necessary power supplies and regulators. In order to have the receiver components properly biased and the signal generator hold its frequency settings, it was found desirable to regulate the power supply as long as the dc plate supply from the oscillator.

Special Detectors in Superheterodyne

Fig. 2 shows a block diagram of the receiver. The 300-cps first detector, which may be tuned from 20 to 200 megacycles, is fed the signal and also the output of the 300-cps high-frequency or first oscillator, and produces the first intermediate frequency of 25 megacycles, which is fed to the blank panel from the first intermediate frequency amplifier.

The second detector receives the 25 megacycle signal and also the output of the second oscillator, which is set at 75 megacycles. This detector produces the second intermediate frequency of 75 megacycles, which is amplified by the second intermediate frequency amplifier. The amplifier has a flat band width of 100 kilocycles.

The third detector is fed the 2.1 megacycle signal and provision is also made to supply it with a 2.1 megacycle voltage from the third oscillator. This third oscillator is used for cw reception and as an aid in tuning the desired signal to the center of the 2.1 megacycle intermediate frequency amplifier. The third detector drives a single-stage audio amplifier, the output of which terminates in a pair of loudspeakers at the lower right-hand corner of the receiver. Provision is also made to use the audios output directly.

The receiver input may be switched to either the aerial or a signal generator. A vacuum-tube voltmeter is used to hold this potential to its correct setting.

To receive the ultra-short wave signals a horizontal rhombic antenna was constructed. This antenna was 134 feet long, 68 feet wide, 45 feet high, and had an effective height of about 8 meters. The direction of London from New York is approximately N 50° E.

From January 1 to April 4, the voice channel from London was heard 45 times, whilst the video (image) was heard 15 times. Though the signals were rather weak, at times both the audio (voice) and video (picture) channels became quite strong. The maximum field strength observed was about 70 microvolts per meter on both channels. As the rhombic antenna used had an effective height of about 8 meters, the signal strength at the terminals of the receiver was about 500 microvolts.

Signal Strong Enough to Produce Image

Unfortunately, during the period of maximum signal strength, there was no television receiver available on which to observe the video signal optically. When such a receiver was procured the period of strong signals had passed and there was not sufficient signal voltage to permit proper picture synchronization. However, judging from the fact that at times the received video signal reached a value of well over 600 microvolts, it would be reasonable to assume that a usable picture could have been obtained.

The audio (voice) signal frequency was of sufficient strength to give excellent loud-speaker reproduction. Its fading was prone to be slow and rather fast, but rarely was it of a selective (distortion producing) nature. In fact, when passed through a high fidelity amplifier and loud-speaker system, it produced exceptionally fine results. The transmitter's audio system, from microphone to antenna, is reputed to have a flat audio response curve from 40 to 10,000 cycles. Subsequently it was found in the American broadcast band, due to the close spacing of transmitters and telephone line limitations. Only when there was interference noted that came from the fifth harmonic of a code transmitter at 83 megacycles, located on a ship off the coast of Scotland. The audible response from the video channel consisted of a sharp 50 cycle buzz. This made it difficult to determine whether or not selective fading was present. The fading on this channel was quite slow and usually not deep.

German and French Voice Signals Heard

It should be remarked that the German and French television transmitters were heard on several occasions, but in general these signals were not as strong as the English transmission and were heard less consistently. There was also reason to believe that the Italian television voice channel was not received, although positive identification was not established.

Probably the reader now wonders if this is the start of regular transoceanic television broadcasting. In the opinion of the author this phase of television is still in the future. The trans-oceanic reception of 40 to 45 megacycles may be explained as due to exceptionally high ionization of the F-layer of the Kennelly-Heaviside layer. This is true in phase with the great increase of geomagnetic activity or the maximum of the eleven-year sun spot cycle is approached. With this in mind, it is reasonable to assume that for at least the next few years there will be sporadic reception of ultra-high frequencies over great distances. This phenomenon should reach its peak the winter of 1955-56.

How to Listen for BBC Television Signals

Anyone possessing a receiver that is fairly sensitive in the range of 40 to 45 megacycles could probably hear these English emissions occasionally during the coming winter. A properly designed antenna is almost essential, as the usual broadcast antenna is usually quite poor on these ultra-high frequencies. One of the simplest to construct is the common half-wave dipole. It should be 40 to 45 feet above ground (higher or lower will give inferior results), face England and have a length of 111 feet. The two wire transmission line should be as short as possible.

It should be remembered that winter is the time of year most favorable for long distance reception of these signals. Probably from the middle of December to the end of February is the time during which the strongest signals will be heard. At present the London television equipment is in operation daily except Sunday from 10:00 to 11:00 a.m. and 4:00 to 5:00 p.m. Eastern Standard Time. So far we have heard only the morning program.

More on TELEVISION in next issue—
Data for building a receiver and other practical information.

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