

Samples show the quality spread in Communist transmitters and receivers.

ADVERSARY AGENT RADIOS

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Any intelligence service has a lively interest in the tradecraft devices of its competitors. When an agent radio can be subjected to professional examination, it reveals something of the sponsoring service's technical and operational capacity. More than two dozen such radios from the Communist Bloc have been surfaced in the West in the past fifteen years. Some of these have been physically available to us for precise technical evaluation. On others we have had only photographs and non-technical descriptions furnished by other services, but even these give us an idea of the sophistication of the communications system and the kind of operations it serves. The samples range from crude, handmade, manually keyed transmitters to top-quality production-line automatic high-speed equipment.

Criteria for Comparison

Essentially three considerations, beyond the very basic one of signal strength (and consequent circuit reliability), are paramount in the design of an agent radio—on-the-air security, portability, and simplicity of operation. Security is primarily a matter of controlling radiations that might be detected by counterintelligence, minimizing both their spatial spread, as by highly directional antennas, and their duration and predictability in time, as by the use of high-speed bursts and irregular transmission patterns. The requirement for portability or miniaturization reflects the nature of the operation in question. A fifty-pound radio may be suitable for agent use, but not if he has to smuggle it through a customs control point first; its illegitimate presence away from home implies paramilitary or cross-border-supplied operations. A two-pound set of low power, on the other hand, that can be hidden in a book or under an agent's clothing, strongly suggests intracity or border-hopping communications.

Simplicity of operation, the third consideration, is the inverse of requirements for operator skill and therefore training. The more sophisticated the equipment, in general, the less skilled the operator

has to be; and the simpler the electronic design, the less simple the operation and the more training required.

The great strides made in commercial electronics in the past fifteen years are reflected unevenly in the equipment of the Communist Bloc services, which as a whole gives not much evidence of any dramatic technical leap forward. Soviet agent radios show a relatively high level of sophistication and personnel competence consistent over the years; their systems, along with the East German, are comparable with our own. The Chinese equipment remains essentially World War II in type and technique, although it has taken advantage of the availability of transistors now. There is in fact a real technical cleavage between the Eastern and Western Communist services corresponding to the discrepancy between the respective national technologies.

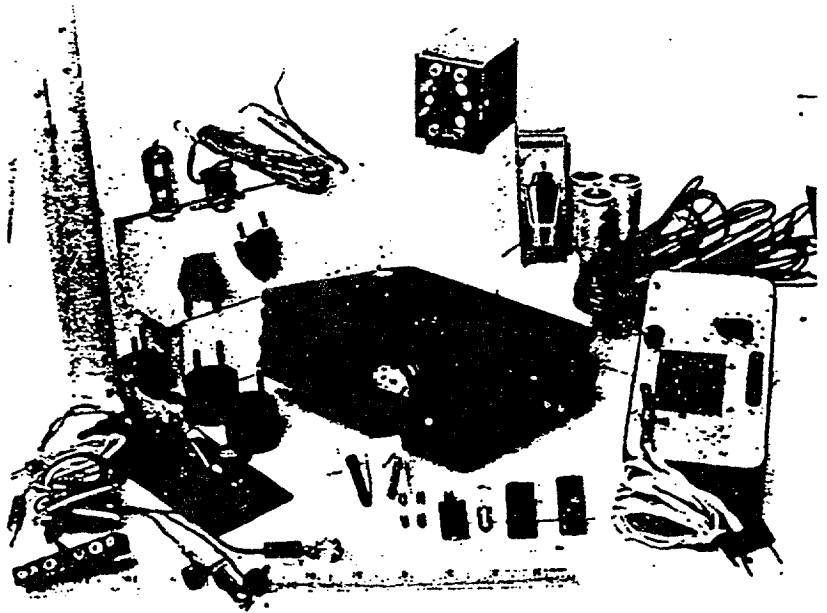
Bulgarian and Polish Sets

Even among the European Communist countries there is a clear demarcation between Soviet and East German sets with their production-line quality and advanced engineering on the one hand and Bulgarian and to a degree Polish agent radios on the other. These latter show an almost elementary approach to design and a handmade quality in their fabrication.

The Bulgarian set shown in Figure 1 not only illustrates this simplicity of design but is surprising in the crudeness of its construction. Examining it closely, one finds that many of the hardware components (jacks, nuts, condenser plates) were cut and smoothed by hand. The dial scale is hand drawn, and the spacing between indices was apparently estimated by eye and marked with either a shaky hand or a recalcitrant dip pen. The radio circuit is equally elementary: a super-regenerative receiver—a type that was the latest improvement half a century ago—and a single-stage oscillator-transmitter. Yet there is an innovation in the transmitter; it uses two tubes in parallel to obtain its ten watts output without the complexity and hardware needed for the conventional separate amplifier stage. Manually keyed, its power and frequency range give it limited flexibility over distances of 200 to 500 miles.

That this agent radio is crude and elementary does not necessarily imply inferior performance, however. A regenerative receiver, using the old vario-coupler and a combination detector-amplifier tube, is quite sensitive and selective; it only requires a sure and experienced

FIGURE 1
Bulgarian (1957)

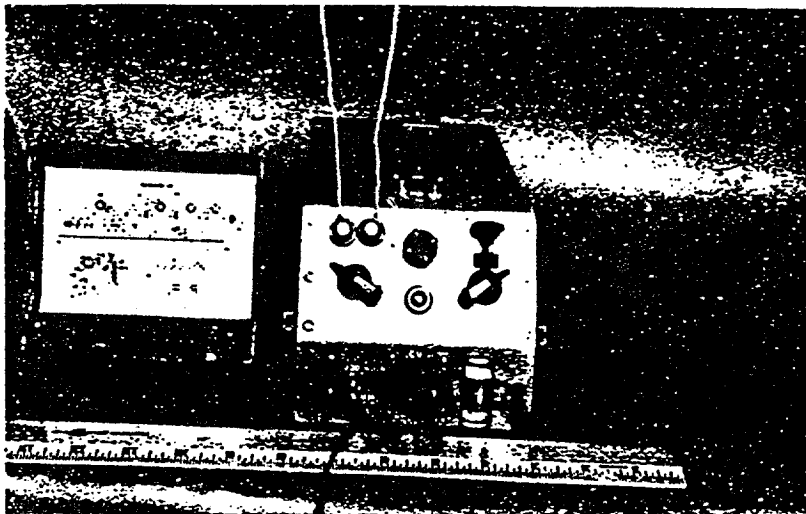


A manual CW (Morse) transmitter and receiver. The transmitter has a unique oscillator with two tubes in parallel which delivers a nominal 10 watts output to the antenna. The receiver is a conventional super-regenerative type. The transmitter operates in the range of 5 to 7 mcs., the receiver between 4.5 and 9.8 mcs. A simple AC power supply with dry disc selenium rectifier is furnished.

hand for proper tuning. The crudeness itself, well below normal hand-fabrication standards for technicians, may even mean that the operator constructed and calibrated the set himself as part of his pre-mission training. If so, we can only envy the principal agent fortunate enough to have an operator of such ability.

The Polish set shown in Figure 2 belongs to the same unsophisticated family. The quality of its hand fabrication is better, more like that of a technician or of laboratory production. Emphasis on practicality is evident in its unitized construction, leaving as external accessories only key, headphones, and dry cells. Of quite low power, 3 watts, but somewhat greater frequency range, it has operational characteristics comparable to those of the Bulgarian set.

FIGURE 2
Polish (1951)



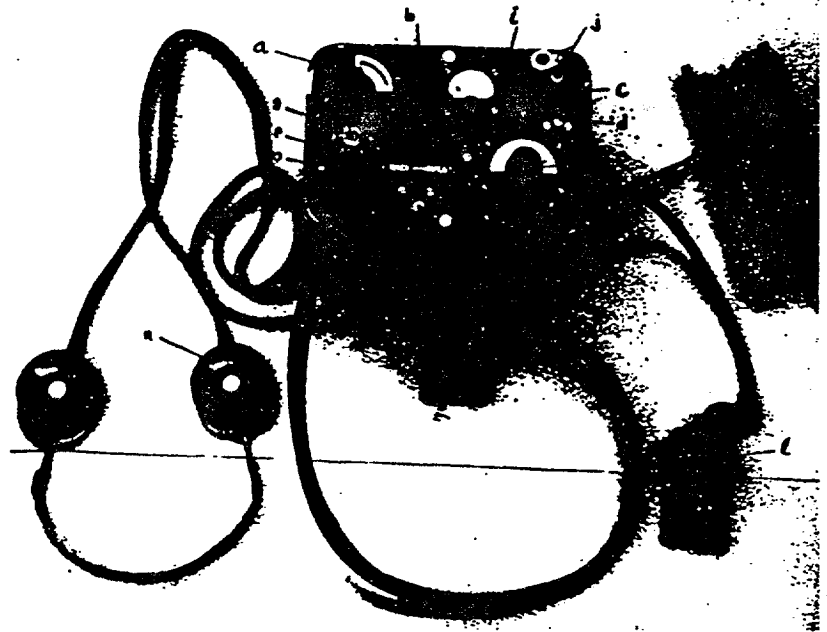
A single-package manual CW communications system. The transmitter is crystal-controlled, using one tube. Power is supplied by dry cell batteries. Transmitter output power is 2.5 watts, the frequency range 3.5 to 8 mcs. Receiver frequency range is 2-12 mcs. Overall dimensions are $10\frac{1}{2} \times 5 \times 4\frac{3}{8}$ inches, weight 8 lbs., 4 oz.

Soviet and East German

Compare these with the Soviet radio of the same vintage shown in Figure 3. Although the receiver is of similarly simple design, the transmitter is conventional and the combined unit is considerably more polished in its construction. It could possibly have been hand fabricated, but the quality is that of a factory production line. Particularly interesting is its hardware, such as toggle switches and tuning dial, which appear to be standard stock items. Its output power and frequency coverage approximate those of the Polish set, but it is much smaller, showing greater capability in miniature design.

But better samples of sophisticated Soviet agent communications equipment are found in some of the larger sets that have fallen into our hands over the years. The one in Figure 4, although of the same general period, is significantly better than the other three in a number

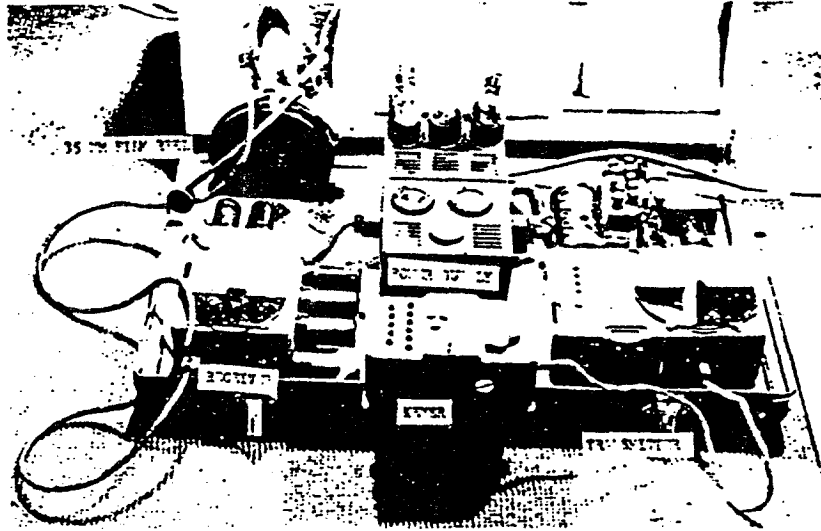
FIGURE 3
Soviet (1951)



A small agent CW transmitter-receiver designed for portable operation. It has the conventional master oscillator and power amplifier in the transmitter and a simple regenerative detector in the receiver. It is probably intended to operate from a battery. The output power is 1.5-2.0 watts, and the frequency range 2.2-7.4 mcs.

of respects. With an output power of 30 watts and a frequency coverage from 3 to 16 mcs, it has wider range and operational flexibility. Instead of keying it by hand, the operator can punch a 35-mm film strip before his contact time and transmit it at 150 words per minute, greatly enhancing his on-the-air security. Automatic transmission also eliminates the personal peculiarities of the operator's "fist," another factor in operational security. Although mounted in a single carrying case, the set has receiver, transmitter, power supply, and keyer in separate units, which can be sneaked in piece by piece if necessary and also are conveniently replaced

FIGURE 4
Soviet (1956)



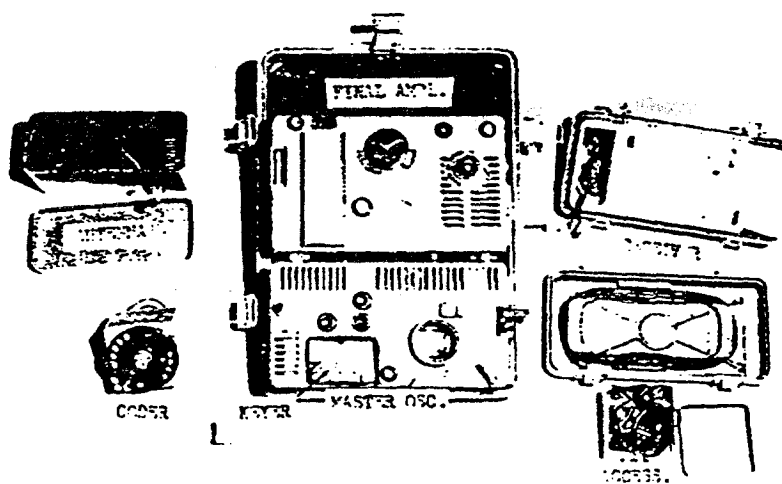
A medium-speed CW agent communications system with 25-35 watts output. Tubes are packed separately from the equipment and plugged into the set externally, making for very compact packing. The receiver has conventional superheterodyne circuitry with a regenerative RF stage for reception of Morse signals and a frequency range from 3.6 to 14.4 mcs in two bands. The transmitter, with a frequency range of 3.6 to 16.2 mcs in four bands, can be operated by keyboard or automatically with a punched 35 mm film strip up to 150 words per minute. The case is about 4 by 13 by 18 inches.

when defective. The conventional superheterodyne receiver is easy to operate.

The later Soviet set shown in Figure 5 reflects the application of advanced technology to agent radios. It unquestionably represents a superior system of covert long-distance communications. It has a magnetic tape keyer for automatic transmission at a rate of either 450 or 750 words per minute. With an output power of 80 watts and a frequency spread of 4 to 18 mcs, it is eminently suitable for intercontinental traffic. Such a radio set reveals an extensive commitment of effort to clandestine operations and a high order of professionalism.

The agent radios produced by East Germany approximate those of the USSR in imaginative design and competent workmanship. A

FIGURE 5
Soviet (1962)



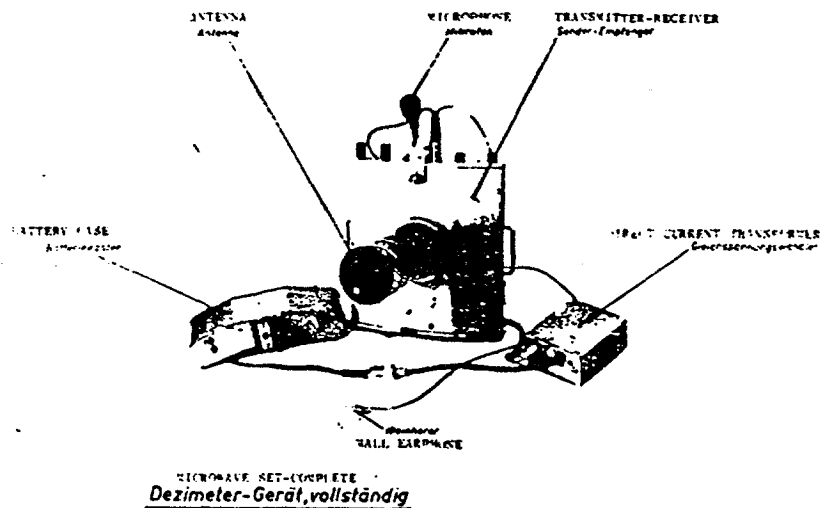
A long-range agent communications system consisting of an 80-watt transmitter, a magnetic tape keyer, a coder, and an AM-CW transistorized superheterodyne receiver. Frequency-shift keying is used at either 450 or 750 words per minute. Transmitter frequency range is 4.5 to 18 mcs, receiver 4.0 to 20 mcs. The transmitter case is about 4 by 9½ by 13 inches, the total weight of the set 33 pounds.

three-tube automatic transmitter, for example, features a coder with a dial for selecting the desired Morse characters. Although its magnetic tape keyer operates at the relatively low speed (for automatic transmission) of 60 to 70 words per minute, the set is small, light, concealable in a briefcase, and quite suitable for ranges of 100 to 300 miles. Another East German set, shown in Figure 6, is for short distances, operating at microwave frequencies in either clear voice or Morse. Its range with directional antenna is estimated at 5 to 8 miles, quite adequate for intracity use or communicating across the Wall. The complete package is a distinct innovation.

The Asian Bloc

Turning to the Far East, the Communist services in China, Korea, and Indochina, we find the radios much less impressive and a little

FIGURE 6
East German (1964)

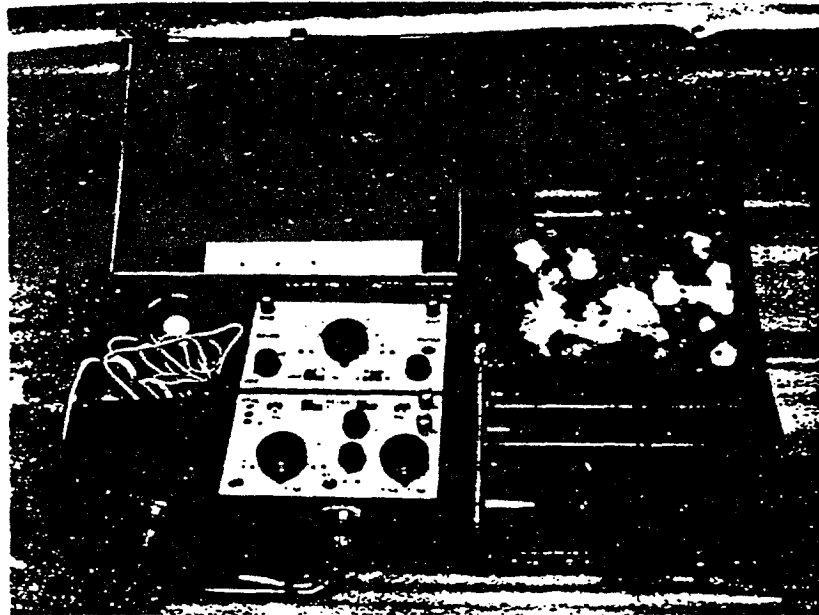


A 1.5-kilomegacycle voice or Morse transmitter-receiver system. Two collapsible helical beam antennas, one with 9 turns giving a 46-degree beam width and one with 5 turns and a 61-degree beam, offer a gain of approximately 10 to 12 decibels. Output power is 140 milliwatts. The entire unit, with the antenna collapsed can be worn hidden under the operator's coat or jacket.

less disparate than in Europe. All use older techniques; Soviet know-how with high-speed automatic systems is apparently not shared with the Asian services. About the most advanced and best of the Asian agent radios seen to date is the Chinese set shown in Figure 7. Being entirely transistorized, it is of low power but has a good spread of frequencies; in terms of manual Morse communications it is quite a respectable package. The circuits are of conventional design. The flashlight batteries make an easily replenished power source. The whole set is particularly light and small. Although it shows little novelty or imagination, it does reflect competence in drawing upon commercially available products and techniques to fabricate a device for clandestine use.

The sets produced by the North Koreans and North Vietnamese are of poorer quality. Figure 8 shows a North Korean agent trans-

FIGURE 7
Chinese (1963)

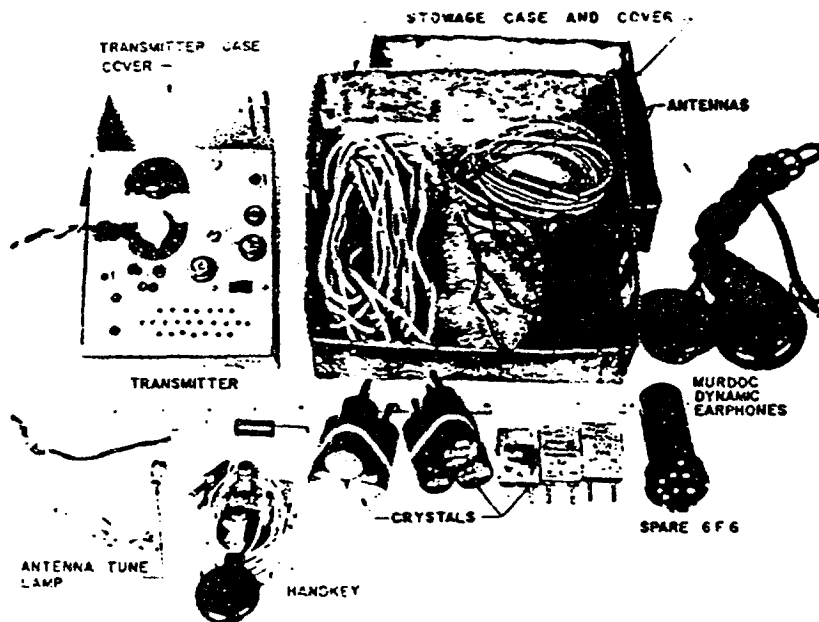


A miniaturized all-transistor system. Twelve flashlight cells in a separate metal carrying case can be used as power supply or as filter for AC operation. May sometimes be equipped with rechargeable nickel-cadmium batteries. The frequency range is 4 to 15 mcs, power output 3 to 5 watts. The main case weighs about $3\frac{1}{2}$ pounds, the power supply $4\frac{1}{4}$.

mitter of 1960 vintage. It is quite simple, obviously handmade and not too well at that, from components of an indiscriminate variety of national origins. Its electrical characteristics, however, are quite sound: 10 watts of power over a frequency range of 4 to 12 mcs make it well suited for use across Korean distances.

The North Vietnamese set shown in Figure 9 is about as elementary and crude as one could have and still maintain communications. To the Western handler sophisticated in the ways of clandestine communications, the need to train an operator to use this set effectively would be rather dismaying. Once this were done, however, the device should perform adequately. In skilled hands, moving from one jungle camp to another, communicating over dis-

FIGURE 8
North Korean (1960)

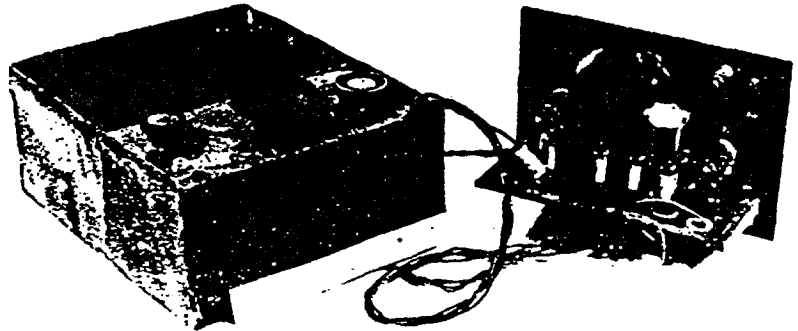


A simple one-tube transmitter with up to 10 watts of output over a frequency range of 4.5 to 11.379 mcs. Components used in the circuit are of various manufacture—American, Russian, Chinese, North Korean. The unit is mounted in a roughly finished galvanized metal box. No power supply is furnished.

tances of 100 to 200 miles, such a makeshift product could prove quite satisfactory.

Which brings us back to the criteria by which foreign sets can be gauged and the operational demands for them inferred. With respect to on-the-air security, which is determined in great measure by advanced transmission techniques like high-speed automatic transmission, we can infer from the Soviet and East German devices that they were designed to meet operating conditions in countries possessing a respectable technical ability and means for intercepting and locating illegal signals. The Asian Bloc countries are evidently not so much concerned with this requirement as their European counter-

FIGURE 9
North Vietnamese (1963)



A simple two-tube transmitter and regenerative receiver believed to be used by the Viet Cong. The system is contained in a crude square container; it apparently operates on dry cell batteries.

parts. The best Asian equipment we have seen is light and small, emphasizing the criterion of portability and concealment, as though these were paramount considerations in their operations. With respect to simplicity of operation, the Soviet and East German radios require less stringent training for their agent operators; it is especially advantageous in third-country operations not to have to recruit nationals who are professional radio operators or technicians and may be watched by counterintelligence for just that reason.