The Voice of America at Greenville, North Carolina

. . . This 4.8 Mw Transmitting Complex is the Largest in the World

At the center of the VOA's Greenville 4,800,000 watt broadcasting complex is "Site C," the receiving station whose courtyard is seen above. Incoming programs from Washington, D.C., pass through the Site C control console to transmitting Sites A and B. Incoming overseas teletype and voice feeds are sent to Washington.

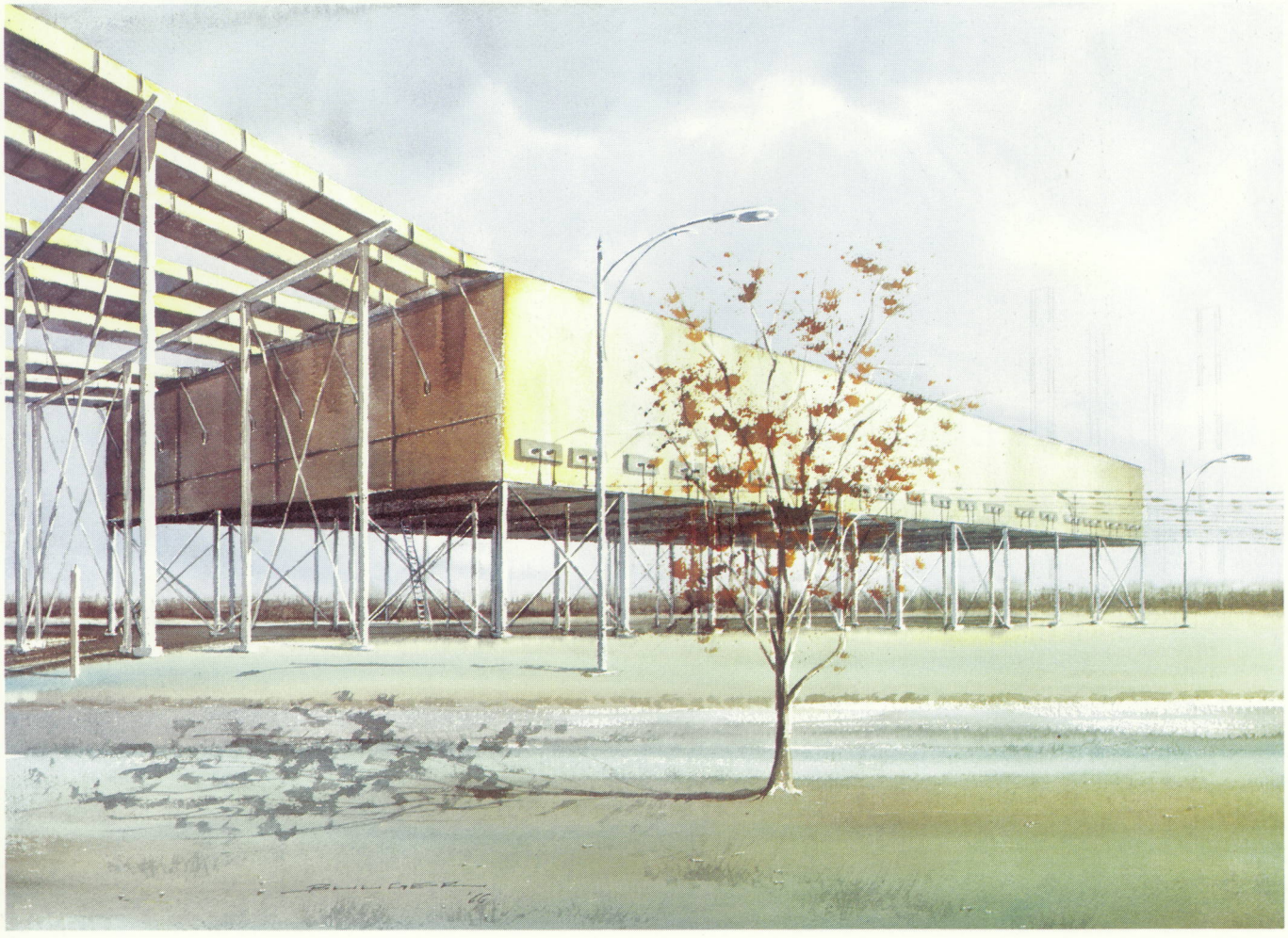
Remotely operated rf switchgear, one of two identical units, channels nearly 3 megawatts of power to an antenna field which covers two miles and more in length . . . and contains huge curtain antennas rising nearly 300 feet, and rhombics over a quarter of a mile long. Both rhombics and curtains, used interchangeably, are beamed at such distant cities as: Moscow, Prague, Cairo, Lagos, Rio de Janeiro, Santiago and Tegucigalpa.

1967: 25th Anniversary of the "Voice"

The Voice of America embodies the determined expression of a faith in the value of open information readily available to anyone. Behind the massive system of communications needed to realize this goal, stand the developments of twenty-five years. In 1942, when the total power of the country's shortwave communications facilities was just under 450 kW, the VOA "assembled" its first network from these commercial units. Within the next year or so—from now—the domestic power, alone, of the VOA's transmitters will be nearly 9000 kW. Overseas there is presently a total of nearly 8000 kW power with an additional back-up of 1200 kW. This global communications system is based on a domestic transmitter network, (East Coast, West Coast and East Central) and a series of ten overseas relay stations. These relay stations—which ring the globe from England, Greece, Germany, Africa, Ceylon, Philippines, Okinawa and Vietnam—accept the domestic signal, which originates in the proper language in Washington, D.C., and re-broadcast it to specific population areas. By use of the relay stations auroral interference is bypassed and high quality signals are achieved locally.

Ironically, the usefulness of this high—even super power—system has been augmented by the broad availability of a device at the other end of the power spectrum—the transistor radio. Bringing "instant sound" to nearly everyone, this ubiquitous receiver has added new significance to the range and impact of the "Voice."

Monitoring stations are used by the VOA to determine the technical quality of broadcast reception. As many as a million reports have been made in a single year; more than 90% of the programs are judged to be well received. Audience size has been "monitored," too. A transistor radio contest was conducted for the VOA English language broadcasts—and "a total of more than 85,000 cards and letters were received from listeners in one hundred and sixty-seven countries and territories from every corner



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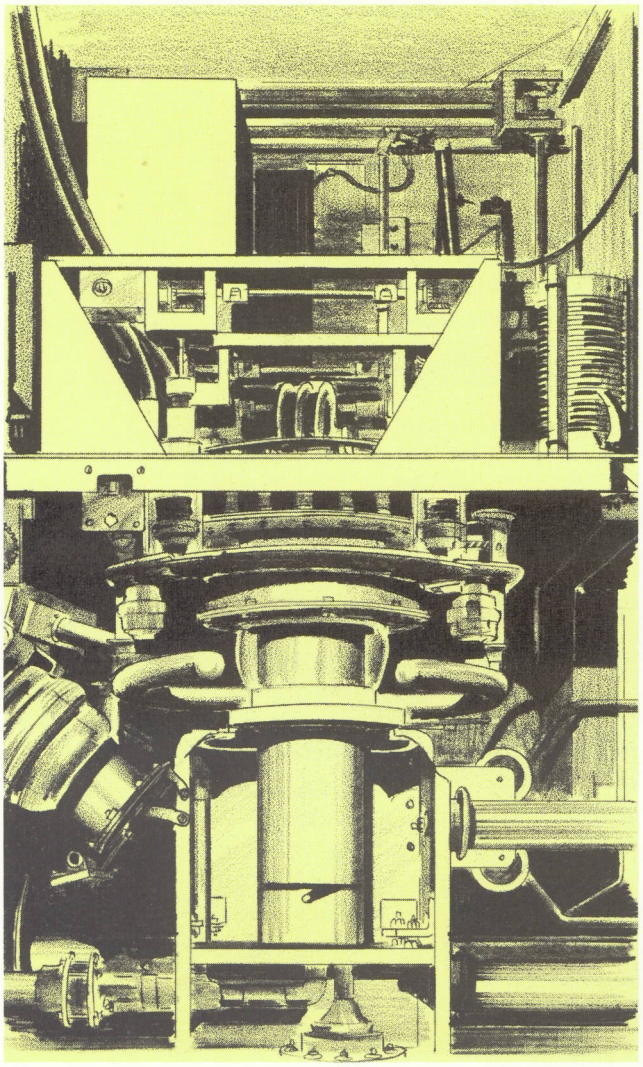
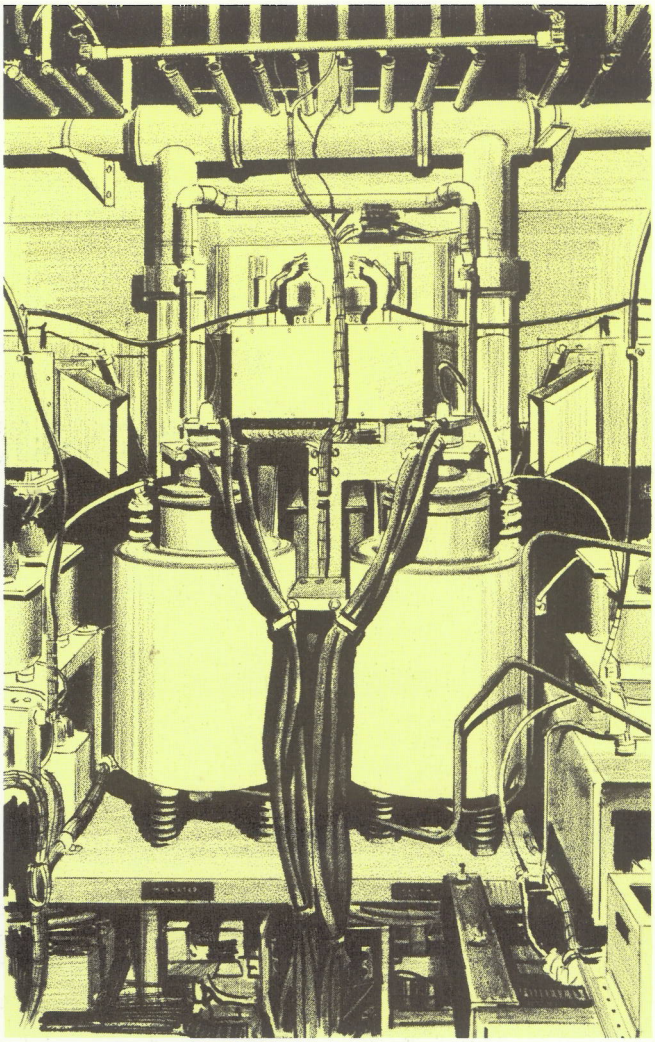
Site C, as it is known in Greenville, houses the headquarters staff, the offices of James Alley, Manager, and Deputy Manager William Slater, and the principal receiving equipment for the entire complex. Dual diversity receivers accept overseas teletype and voice reports (these receivers are designed to offset the effects of ionospheric fading). A 7 kmc microwave link brings programming in from Washington. Through the doors above is seen the master control panel through which programs are channeled, via local microwave, to the transmitting Sites A and B, each some fifteen miles distant. Microwave program channels carry the incoming material; return communication channels to Washington are maintained. In addition to program origination, Washington supplies frequency and facility assignments for the 270 hours of daily programming over Greenville's 18 high power transmitters. Facility and frequency assignment charts are prepared at Site C for use by the transmitting sites and are distributed well in advance for review to assure smooth operation. . . . Central to each transmitting site is the Control Room—shown opposite—which accepts the Site C programming, monitors transmitter operation and establishes the proper rf flow to the scheduled antennas. Surrounding this large central room are the several transmitter consoles. . . . The Control Room Operator establishes the correct operating frequency on the fre-

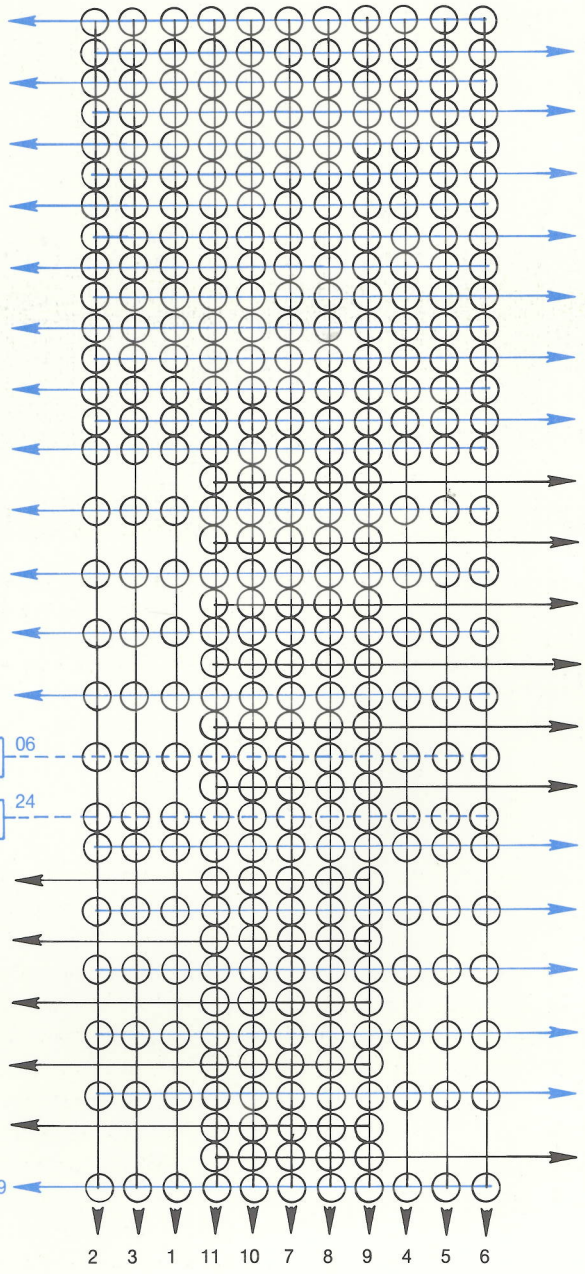
quency synthesizer, actuates the rf switch gear to select the right antenna, and measures the frequency to the cycle, using a digital counter. He then sets up an audio clipper and modulation monitor to set the modulation level at the transmitter—all in time for the Sign-On signal from Site C. This procedure takes place thirty-five times daily at each transmitting site—three or more times on each transmitter. On each of the three operating shifts there are 4 men, one of whom is in the control room at all times. Two men pre-tune transmitters in anticipation of program requirements. The supervisor, who can handle all duties, assists as needed. Signals normally run straight through without external patches. The master level control is set at Washington and is referred to by Site C. Sites A and B refer to C. Normal operation employs 9 db of clipping and this is set in the Control Room. A transmitter is set up to clip speech at 6 db, then the average level is raised by 3 db. Clipping is done so as to improve intelligibility (by high frequency pre-emphasis, and by low- or mid-frequency vowel clipping). Overmodulation is avoided by this clipping. A continuous monitoring of the programming is maintained by the Control Room Operator. Aural monitoring is primary with reference to VU meters then clipper output if noise or distortion is encountered. (To monitor some of the many tongues must take a practiced ear.)





Above, left, an ML-5682 peak power tube, one of four in the PA of a Continental Electronics 420A 500,000 watt carrier transmitter. The power amplifier is driven by modulated amplifiers using four ML-5681's. Six 420A transmitters supply 3 of the 4.8 Mw power at Greenville. . . . Above, right, ML-7482 vapor cooled triodes in the modulator position of a General Electric 4 BT 250A1 250,000 watt carrier power transmitter, again, one of six at Greenville. ML-7482's are also the 2nd IPA and PA. . . . The complex switch network, diagrammed on the opposite page, clearly indicates the magnitude of this extraordinary broadcasting operation. The 11 inputs and 39 outputs of the system are arranged so that 58 combinations may be made. All switches are pneumatically operated from a dry air system. Interlocking controls prevent dual energizing of a single antenna. "Preset" controls prevent presetting an antenna to more than one transmitter. During switching, interlocks remove transmitter plate voltage prior to the actual opening of the rf switch. Voltage is automatically restored after the new antenna load has been established. After a proper preset the selected antenna position can be established from each transmitter individually, or antennas may be "group switched" from the control panel.

Greenville Relay Station Antenna Switching System Plant A



Freq. Range MC'S	Bearing	Type	No.
9 & 11	45°	C	07
11 & 15	45°	C	08
15 & 17	45°	C	09
17 & 21	45°	C	10
17 & 21	32°	C	05
15 & 17	32°	C	04
11 & 15	32°	C	03
9 & 11	32°	C	02
14 to 28	45°	R	11
14 to 28	55°	R	13
6 to 12	67°	R	14
4 to 8	32°	R	01
4 to 8	45°	R	06
4 to 30	305°	LP	37
4 to 30	305°	LP	36
13 to 26	205°	R	35
9 to 18	295°	R	34
6 to 12	285°	R	38

No.	Type	Bearing	Freq. Range MC'S
12	C	55°	15 & 17
16	C	67°	17 & 21
15	C	67°	15 & 17
17	C	91°	15 & 17
18	R	94°	11 to 22
26	R	94°	14 to 28
25	R	94°	8 to 16
30	R	67°	14 to 28
29	R	67°	11 to 22
28	R	67°	11 to 22
32	R	45°	14 to 28
31	R	45°	6 to 12
27	R	67°	6 to 12
21	C	164°	15 & 17
20	C	164°	9 & 11
23	R	205°	9 to 18
22	R	174°	11 to 22
19	R	146°	9 to 18
33	R	146°	11 to 22

● = Switch

Target Areas

32° – Moscow
45° – Prague
55° – Cairo
67° – Tangier
91° – Accra, Lagos
94° – Accra, Lagos
146° – Rio de Janeiro
164° – Buenos Aires
174° – Santiago
205° – Tegucigalpa
285° – Dixon, Delano, Honolulu
305° – Bethany

ANTENNA TYPE

C = Curtain Antenna
LP = Log Periodic Antenna
R = Rhombic Antenna

Power Ratings
= High Power
= Medium Power
= 250 KW Maximum

XMTR.	POWER OUTPUT
1, 2, 3	500 KW
4, 5, 6	250 KW
7, 8, 9	50 KW
10, 11 (SSB)	10 KW (PEP)

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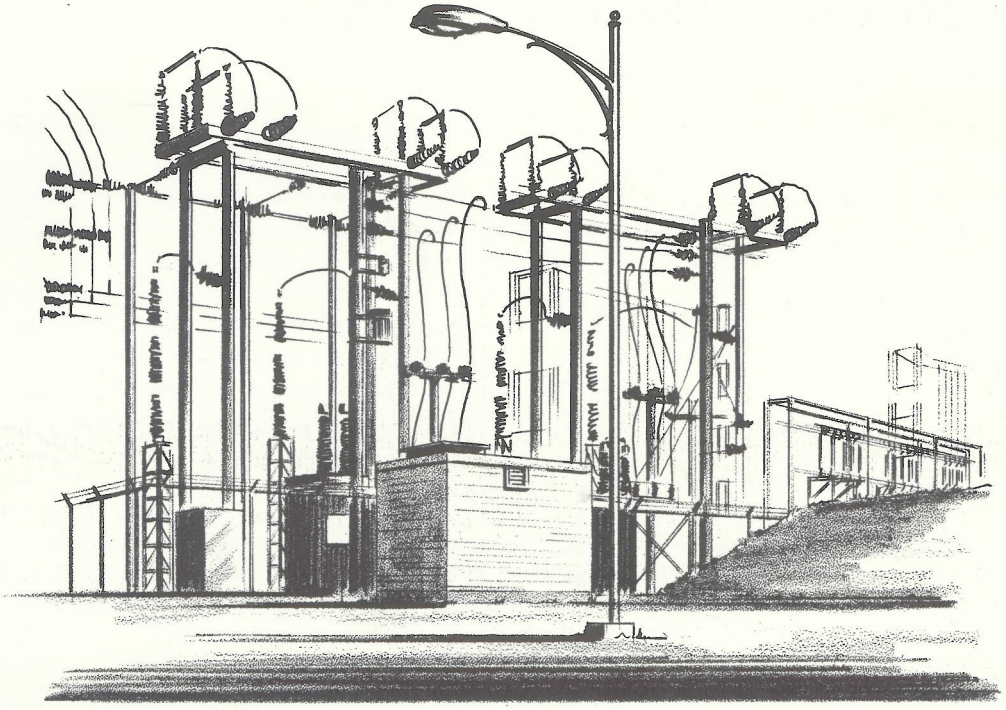

The multicoupler (above) provides for one rhombic antenna to be used with two 250 kW transmitters operating simultaneously on different frequencies. 2 psi dry air in the multicoupler keep it dust free. Not so easy to keep trouble-free are the rf transmission lines—some nearly a mile long—which are subject to collisions with birds, bug clouds, field fire smoke, any of which may cause line arcs and knock out a transmitter.

of the world."* Based on this response—and other evidence—the weekly VOA audience is estimated at 42,000,000 people.

More than the VOA's own relay stations broadcast its programs. Over 250 radio stations in 15 Latin American countries re-broadcast the Spanish language programs (in whole or in part), on standard wavelengths, to their listeners. (The Agency also tells the American story abroad by means of "packaged" taped programs. Some 15,000 hours a week are placed on more than 2,500 medium-wave local stations throughout the non-Communist world.)

The High Power Greenville Transmitters

High power at high modulation levels is required of the Greenville hf transmitters. The Continental 420A 500 kW transmitters, designed in the early '50's, each use two 250 kilowatt linear high efficiency output amplifiers, each with its own associated modulated amplifier. Outputs from the two 250 kilowatt amplifiers are combined in a network to feed a single 300 ohm balanced transmission line. The two modulator amplifiers are driven by a common rf driver unit and by an audio modulator for grid bias modulation. Two ML-5681 tubes are used in a push-pull Class C grid bias modulated stage, which drives the grid circuit of the 250 kilowatt linear amplifier. This latter amplifier uses 4 ML-5682 tubes in a Doherty circuit with two tubes in push-pull operating as the carrier and two tubes operating as the peak tube. Carrier tubes operate grounded grid; peak tubes grounded cathode. The output of each amplifier feeds into a bridge-type combining network using a balancing resistor to maintain equalization of the load on the two amplifiers, so preventing the transfer of power from the terminals of one amplifier to the other.

The General Electric 4BT 250A1 transmitters employ high level modulation. 5 ML-7482 vapor cooled triodes: two in the final, two as modulators and one driver. The final tubes operate in parallel in a grounded-grid cavity. Since both final and driver stages are modulated, linearity is improved and negative modulation may be obtained without neutralization. Use of the cavity provides circuit

*Burgeni, E. F., Jacobs, G., Martin, E. T., "The Voice of America—A Generation of Growth," *Cathode Press*, Vol. 22, No. 1, 1965, pp. 12.

tuning stability under all conditions.

Because the program requirements of the VOA specify heavy program clipping (audio peak clipping amplifiers are used to increase average speech power without exceeding peak modulation percentages) transmitter modulator requirements are stringent, requiring, in this instance, use of a trapezoidal waveform necessitating modulating powers considerably higher than normal; audio frequency requirements include 100% sinewave modulation from 50 to 10,000 cps and 100% square wave modulation from 100 to 3000 cps with the square wave flat-top "tilt" less than 5%. The tilt requires an extended low frequency response flat to 3 cps.

The VOA has acquired a complex of four transportable transmitters which can be moved to any point in the world by rail, air, sea or road and put on the air within 30 days. At the present time one of these units is in Florida, broadcasting to Cuba. The others, for example, were used in Liberia, filling in until the new base there became operational and are presently in use in the Philippines, broadcasting to Southeast Asia.

The U. S. Information Agency has participated actively in programs related to the field of space communications, both in radio and television, so that when this new dimension of communications becomes a practical reality, USIA will be in a position to make maximum use of it.

Transmitter building—one of two—housing nearly 2500 kW of hf transmitting power. More than a scale-up of smaller units, an electronic "power generator" of this magnitude must be designed to operate at levels where corona voltages may easily be reached. Exacting maintenance is essential under these conditions since any failure can carry with it extensive costly damage. Since efficient performance is mandatory in the megawatt range, monthly tests are made, using both sine and square wave inputs, the first for response, and distortion, carrier shift and noise from 100 to 10,000 cps; the second for modulator response characteristics. Simplified daily tests are also made.

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