

Type "N" Carrier system.

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TAE

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**MEMORANDUM:**

We have been informed that development work will be undertaken on a proposed type "N" 12-Channel carrier system for operation on a single cable. The following items have been developed in discussions with members of the Operation and Engineering Department:

1. The type "N" carrier system provides 12 channels which for lengths up to about 200 miles approach the quality for "K" facilities and which may prove in economically over two-wire cable circuits for distances as short as 20 miles. Tentatively the field of use may be considered to be in voice cables for distances of 20 to 200 miles.
2. It is expected that one system may be operated on each of two pairs of wires in quadded and low capacity 19 gauge cables. In the high capacity cable, such as, the 455 pair 19 gauge cables, the cross-talk limitation will reduce the number of systems that may be secured. It is probable that 50 to 100 systems may be operated in a 455 pair cable over distances between 20 and 40 miles. It may also be possible to use quads in the outer layers of coaxial cables, however, the crosstalk between the pairs and the coaxials has not yet been definitely been determined. While it would be possible to operate "N" systems in cables designed for "K" operation this would probably not be desirable as the available "K" lines in the two separate cables probably would be required for longer haul systems. It is not possible to operate the "N" system in a single cable where one side of a "K" system is also included in the same sheath.
3. No crosstalk balancing arrangements comparable to that for "K" equipment are required with the "N" systems as companders will be included as an integral part of the terminals.
4. In the present state of development which is still in the paper stage, it is expected that the channels will be spaced about 8 kc apart and that both side bands and the carrier will be transmitted. As stated previously, one pair will be required for each direction of transmission. One direction of transmission will utilize frequencies from about 24 to 112 kc and the other direction from about 120 to 210 kc.
5. Dialing and ringing arrangements will be included as an integral part of the channel terminals, - somewhat comparable to the arrangements proposed for M-1 carrier systems. The cost data does not include terminating sets, but it is anticipated that these may be provided rather cheaply. Again, possibly some arrangement comparable to that for M-1 carrier equipment.

6. Main repeater stations will be placed at about 24 mile intervals and may be arranged to feed power to one auxiliary on each side. The auxiliary repeater stations will be placed at about 8 mile intervals.
7. Repeaters for 40 systems at an auxiliary point will occupy two bays. Terminal equipment with carrier supply and all miscellaneous items, but excluding four-wire terminating sets for five systems will occupy one bay.
8. The costs are estimated to be about as follows:

12-Channel terminals excluding four-wire terminating sets	\$3,000
Auxiliary repeaters, per system per repeater point	\$600
Power Plant for each 24 miles of system	\$200

9. Channels may be set up to zero db equivalent and are individually regulated. As they will not have the reserve gain of our present carrier systems, it will be necessary to use inputs of near switch-board level.

It is expected that these systems will be available for shipment about 1950 or 1951.

JEM:F