

THE NEW FM BANDS

By ALAN JAY

OLD

FM	42
TELE	50
AM	56
TELE	60
TELE	66
GOV'T	72
TELE	78
TELE	84
GOV'T	90
AERO	92
GOV'T	94
TELE	96
TELE	102
GOV'T	108
AMAT	112
MISC.	116
GOV'T	120

ON December first, FM stations start testing on the new high-frequency bands. From January first, operation will be in the "upstairs" portion of the spectrum. The new frequency allocations are: Educational; 88-92 Mc., Commercial Broadcasting; 92-106 Mc. (see chart). At that time, FCC published a report of the proposed allocations from 25,000 to 30,000,000 kilocycles. This report fixed the frequencies at the place they now occupy. Panel 2 and 5 of the Radio Technical Planning Board recommended that FM broadcasting be retained in its present place in the spectrum, i.e., in the 40 to 50 Mc. region. Those who opposed the recommendation believed that FM should be moved to a higher place in the spectrum to avoid skywave interference.

Before a decision could be reached as to FM's place in the radio spectrum, careful consideration had to be given to the propagation problems created by skywave interference of the "burst," "sporadic E" and "F2 layer" types.

The ionosphere's E layer reflects or refracts broadcast frequencies so that long distance reception is possible. The F layer (120 to 180 miles above sea level) reflects or refracts short waves that pass through the E layer (60 miles above sea level), thus making possible short-wave reception from distances of four and five thousand miles or greater (See Fig. 1). These layers vary in density and in height with changes in seasons, and time of day, and are subject to "magnetic storms." These layers respond in the same manner for higher frequencies with the added inconvenience of sudden and unpredictable changes. The height and the positions vary almost constantly, with the result that a radio wave passing through the E layer might at one moment be refracted back to earth at a given angle and then, because of the change taking place, be sent back at a different angle. Since it is this angle of reflection that governs the point at which the wave strikes the earth, the sporadic or sudden and intermittent effects have disastrous results on the FM signals.

A sporadic E layer transmission on 44.3 Mc. was received in the vicinity of Atlanta, Georgia, from a station in Paxton, Massachusetts, during 12 percent of the time in July, 1944, with sufficient intensity to cause interference at 50 microvolts/meter. Interference of this type was experienced for shorter periods at intervals throughout the entire year. Interference 12 percent of the time during even one month would not result in good FM service.

Sporadic E and F layer transmissions are rare indeed in the 100 Mc. region. Present experience supports the view that F layer transmissions would be negligible in the vicinity of 80 Mc. and that sporadic E would be approximately 1/100 as troublesome at 80 Mc. as at 40 Mc. The virtual disappearance of skywave interference above 80 Mc. solves the chief propagation difficulty for FM and eliminates the prin-

cipal obstacle in the way of permanent establishment of a new basic system of radio broadcast service.

The suggestion was made that zoning of stations within the limits of skip distance would be a means of avoiding skywave interference. Such a plan would be uneconomical since it would require a great many more frequencies. Moreover, a zoning plan would not be practicable because of the difficulty of predicting the areas of interference. A slight increase in tropospheric wave interference may be expected between 40 and 80 Mc. This effect may be negated by a somewhat greater geographical separation between co-channel stations. Thus the problem can be solved effectively by proper station allocation. Multipath distortion is not generally regarded as a difficulty which would seriously impair FM service either in its present band or in the suggested higher frequencies.

"Shadows" would be more pronounced at 100 Mc. than at 50 Mc. Reduced field intensities due to shadows in certain areas, should they occur, is not believed to be sufficiently serious to impair FM service.

Skywave transmissions would be negligible in the vicinity of 80 Mc. and would be practically non-existent beyond 100 Mc.

The channel width is of greater importance to this service than any other factor, including its position in the spectrum. At the present time, the Commission's rules prescribe a channel 200 Kc. wide. A reduction in channel width to 100 Kc. would cause a 6 db. loss in the ability of the FM receiver to discriminate against electrical noises and co-channel interference would be increased.

As a compensation for the lower quality of FM service resulting from halving the channel width, it is contended that the number of available channels could be doubled. However, this benefit does not follow, since the geographical separation of co-channel stations would have to be greater, particularly in the congested metropolitan areas where the need for channels is greatest. Additional objections to a 100 Kc. channel are based on the stringent requirements that such a change would impose upon the receiver design, particularly with respect to oscillator drift or receiver stability. Finally, in the event that multiplexing of facsimile with FM broadcasting should prove feasible, such multiplexing would be extremely difficult if not impossible if the channel width were reduced to 100 Kc.

Since it is possible that the FM band may ultimately extend from 78 to 108 Mc., it is probable that FM receiver manufacturers will build sets to encompass the entire range, minimizing obsolescence of receivers. Existing FM stations will not be required to move to new assignments in this band until new receivers are available and in the hands of the public.

480 to 920 Mc. has been made available for experimental television. 460 to 470 Mc. has been allocated to a new "Citizens' Radiocommunication Band." This service

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NEW

EXP. POLICE	42
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TELE	54
TELE	60
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TELE	72
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TELE	82
TELE	88
EDUC. FM	92
COMM FM	106
FACSIMILE	108
GOV'T	118
AIRPORT CONTROL	122
AERO MOBILE	122

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NEW FM BANDS

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allocation results in increased cost in receivers and changes in transmitters. . . . combining to result in reduced sales. . . . From a technical standpoint . . . the new wave band will improve service to the actual purchaser and may . . . prove to be a desirable procedure."

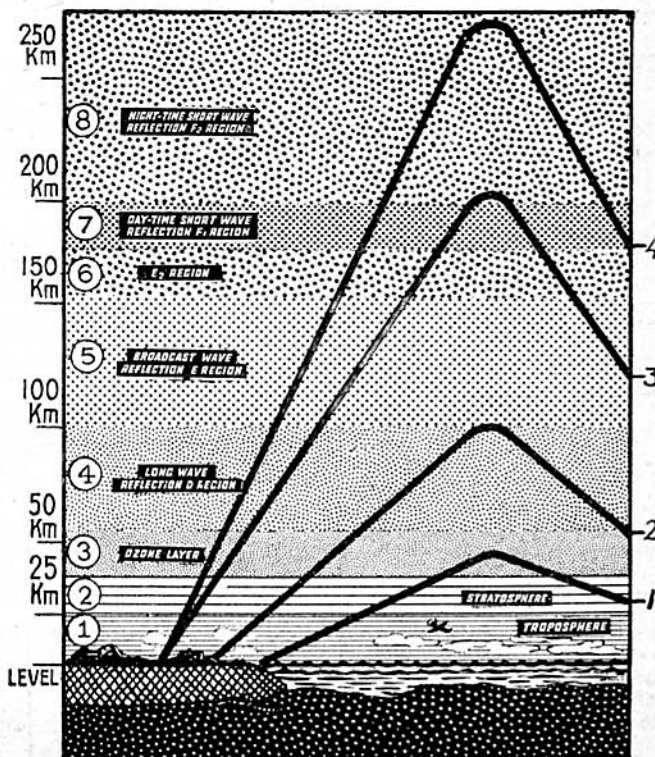
Mr. Ray H. Manson, President of Stromberg - Carlson Company is also of the opinion that the change will delay the advent of full commercialized FM on a standard now comparable with AM. In regard to converters, he states: "the only type which will give completely satisfactory service is one which has a complete R.F. system, up to and including the detector, so that this converter may be

This cross-section of earth and sky depicts the various reflecting layers which turn back different radio waves.

plugged into a phonograph jack of the regular receiver and thereby employ only the audio system."

Mr. Isidore Goldberg, president of Pilot Radio, believes that two bands are necessary at present; otherwise sales will be affected. He states: "Sets now out of date

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would be of some value during emergencies when wire facilities are interrupted as a result of hurricane, flood, earthquake, or other disaster, as has been so ably demonstrated by the invaluable work the hams in the amateur service have performed in the past with large numbers of low-power sets.

In view of the controversy over the new allocations and their effect on the present FM set owner, Radio-Craft contacted the leading manufacturers and FM broadcasting companies, asking the following questions:

1. What is your opinion as to the effect the new allocations might have on the sales of FM?
2. What will happen to the present FM sets?
3. Do you (in the case of the manufacturers) intend to put out a service bulletin informing the radio serviceman how to proceed in the service of your FM sets?
4. Would you recommend converter units for the present FM sets?
5. Would it be better from your standpoint if the user were to return the set to your factory's repair department rather than have a serviceman repair it in his shop?
6. What effect, in your opinion, will this new set-up have on television?
7. What do you plan in post-war FM?

These questions were asked by telephone and by wire.

The replies follow:

Mr. W. J. Halligan, President of The Hallcrafters Company "believes that the new allocations will greatly increase the sales of FM sets. Converters are recommended. The FCC did an excellent job under difficult circumstances."

Mr. E. G. May, Sales Manager of Sentinel Radio Corporation states: "The new

RADIO SCHOOL DIRECTORY

NEW FM BANDS
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should be rebuilt rather than have a converter unit installed as part of the set. The frequency shift will have a favorable effect on television."

Mr. Harvey Anhalt, Chief engineer for WGYN—FM station, says that: "The shift in frequencies will have no effect on sales, and is desirable from a television standpoint."

The National Broadcasting System made no comment, referring to the testimony of Niles Trammel at the FCC hearing.

Mr. Robert Howard, Sales Manager of Admiral Radio believes that: "The shift will increase the sales of FM without discouraging buyers." He believes that "sets now in use will be obsolete and that they should be junked."

Mr. Bernard Shapiro, Service Manager of Emerson Radio and Phonograph Co., is of the firm conviction that "the user should definitely return the set to the factory for conversion."

Dr. Harrison Summers, Manager of Public Service of the American Broadcasting Company, believed that "the sales volume should increase as a result of the frequency change. Sets should be converted."

Mr. John V. L. Hogan, president of WQXQ, FM station of WQXR, New York, states: "The new allocations will have no effect on the sale of FM sets after new sets become available, BUT these sets may not become available as rapidly as FM sets would have if there had been no change in frequency. Converters have not been satisfactory. . . . Would prefer one complete set to do the job." He also states that they dislike any delay . . . "which may result from the change in frequency."

Mr. Parker H. Erickson, Director of sales of the Majestic Radio and Television Corporation says: "There should be no adverse effect on the sales of FM . . . converters will be manufactured and it will be up to the public to decide whether or not to buy, their preference being on cost and convenience differentials between converters and new receivers."

General consensus of opinion was that: the shift will increase sales; market possibilities will in no way be affected; new sets are proposed or are already in production in most plants; and opinion is divided as to what to do with the sets now in use. Since the average set is about 4 years old now, it might be advisable to "turn it in for a later model."

Troublesome "ghosts" are caused by reflections, as shown in the drawing. Most troublesome in big cities, a ghost may be produced in rural areas by reflection from a cliff or steep hill. Since difference of time between direct and reflected signal is the cause of ghosts, double reflections are important. One such is shown in this illustration.

