THE DETROIT NEWS

Frequency Modulation Station

W 45 D

4570 Penobscot Building

Detroit . . . . Michigan

BROADCASTING'S BETTER MOUSETRAP

Being an A-B-C of a new radio marvel called "frequency modulation," written in the language of the layman so that he who runs may not only read but—what is even more important—understand.

BY WAY OF INTRODUCTION • •

More than a year ago, when **FM** was only a broadcaster's dream of better radio, the original edition of "Broadcasting's Better Mousetrap" was issued. Because of a widespread demand for information about this new radio development, "Broadcasting's Better Mousetrap" went through edition after edition. It was distributed to every corner of the country, and requests even came from other lands.

Today the swift advance of frequency modulation—which has blossomed into a commercial maturity already serving thousands of **FM** listeners—makes the original edition of "Broadcasting's Better Mousetrap" hopelessly out-of-date.

And yet there are still innumerable people who want to know what **FM** is, what it can do, why it's better. For that reason **FM** BROADCASTERS, Inc., a national trade organization representing the new **FM** stations, has prepared this revised edition of "Broadcasting's Better Mousetrap" to tell the story of **FM** as it stands today. How long this booklet will remain up-to-date is hard to say.

FM, you see, has a remarkable habit of progressing just a little bit faster than anything the broadcasting industry has ever known . . .

• • FM • •

BEGINNING AT THE BEGINNING • •

There's an old adage that's been drifting around for quite a while about what happens when a man builds a better mousetrap.

But this isn't a booklet on mousetraps.

It does deal, however, with something definitely **better**—better in the world of radio. And you'll have to admit, if you'll stop a moment and think, that broadcasting has become a rather important factor in our lives these days.

This **better** thing is a new and startling discovery called "frequency modulation" — which happens to be only a technical phrase to describe a superior method of sending radio programs into your home.

Imagine — if we may borrow your imagination for a moment — that an orchestra is playing. Each note comes across the miles as sharply, as distinctly separate as if you were sitting in the very studio with the orchestra. The upper ranges of the violins are clear. Each shade of tonal color, replete with a full scale of chromatics, reaches your ear in crisp realism.

A musician taps the triangle; its **"ting"** is a precise and cool crystal of sound with a lingering afterglow of uncanny clarity. Between selections the station is so quiet that you can't even believe your set is turned on. Voices and music ring against this background with a new warmth and richness. A trickle of water, the faintest subtlety of a piano, a sheet of paper crumpled

in the announcer's hands—such reproduction by this new system of "frequency modulation" is exact, natural.

But don't let that complex-sounding name terrify you. Radio people and the world at large invariably refer to it as **"FM".** The purpose of this booklet is to do a bit of simple explaining about **FM**—so hear us out.

When we're through—well, maybe you'll understand a lot better why the radio world today is beating a path to frequency modulation's door . . .

HOW LONG HAS THIS BEEN GOING ON?

Most of the bigwigs of broadcasting once told him it couldn't be done.

They pooh-poohed his notions of frequency modulation, yet Major Edwin H. Armstrong just plowed right ahead in his quiet, determined fashion.

And today the radio industry — once skeptical — is forced to admit frankly that **FM** is one of the biggest broadcasting advances since the advent of the vacuum tube.

A more concrete manifestation of its opinions is the fact that many high-power **FM** stations are now on the air commercially, and that a long line of applications for licenses constantly awaits the attention of the Federal Communications Commission. More applications keep fluttering into Washington every week.

There's good, clear handwriting on the wall, and it gets clearer all the time.

But more of that later. Our intention now is to tell you how frequency modulation was born and why it is better. And to do that, we must start with Major Armstrong who is an ace inventor in the radio and electronic field.[1]

It was 25 years ago, during the infancy days of radio, when the Major set out to discover a panacea to eliminate that crackly bugaboo of reception—static. He tried a lot of things and, even more important, he discovered a lot of things.

One of them was a great deal more than just a cure for static. It possessed other advantages which appealed to the Major's farsighted flair for radical ideas in radio.

A flock of experimentation went under the bridge before he felt ready to display his discovery and its possibilities in front of the world. And the world was a bit dubious until it had listened . . .

Listened, you see, to a new and better way to transmit radio programs from studio to home so that they arrive at your living room loudspeaker brighter, fresher, clearer than ever before.

---

[1]Major Edwin H. Armstrong, professor of electrical engineering at Columbia University, ranks as one of the most important inventors in the history of radio. Frequency modulation is his fourth major discovery, the roster including the regenerative "feed back" circuit which brought radio out of the crystal set era; the superheterodyne circuit, which is the basis of practically all modern receivers; and the super-regenerative circuit, widely in use for ultra-high frequency receivers.

IT'S LIKE DARWIN WOULD HAVE HAD IT

FM is a logical step in the evolution of radio.

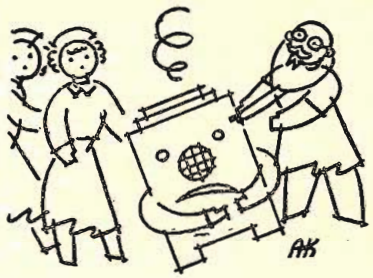
It has as its aims, better, clearer reception, freedom from an increasing barrage of man-made noise, a faithfulness of tone quality never before achieved, and a capability to serve every corner of the nation with more stations, more intense coverage.

The situation, you see, is like this.

That very useful bit of furniture which now sits in your home and lets you eavesdrop on everything from symphonic concerts to baseball games is known as an "amplitude modulation" receiver by the men who wield the slide-rules of radio. It's a product of evolution.

Almost all forms of radiotelephony in use today—aircraft, police calls, short wave broadcasts and the amateur operator who lives down the block — they all depend on what we call the "amplitude method of modulation."

It's been going on like this for more than 20 years—ever since that mysterious gadget known as the vacuum tube was introduced. People started building broadcast transmitters and receivers to operate that way, and the habit just continued on and on until radio became a great national industry which today has some very acute growing pains.



There isn't, for example, much more room in this big, broad land of ours for additional stations under the present scheme of things —

in spite of the fact that countless communities are eager for and entitled to local radio service. The "amplitude" system is inadequate. Stations jostle each other mercilessly, with the result that elbow room in the ether is scarcer than feathers on a flying fish.

FM can smooth all that out . . .

Problem No. 2 that looms for ordinary broadcasters is the fact that in spite of all the midnight oil burned by brilliant engineers, the fidelity of tone, the quality of reproduction, is just about as good as it can ever be under existing circumstances. And it still leaves lots to be achieved.

FM has a sound answer to that, too . . .

Furthermore, in many localities listeners grit their teeth at intermittent noises which butcher reception. Oil burners, elevator motors, dial telephones, X-rays, electric razors, neon signs and a thousand other devices all contribute their buzzes, clicks and roars to the program you're trying to hear. Also, if you live in the country, not too near a powerful station, you know what bedlam a static-ridden night can be.

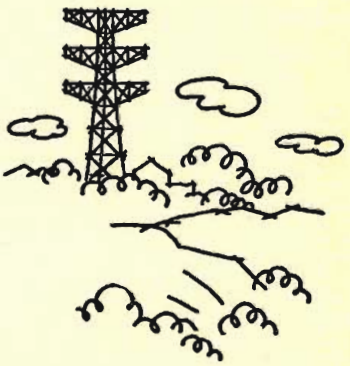
With **FM** those things don't happen. Reception at all times is silvery-smooth as a mountain lake.

So the problems that beset our ordinary system of radio really have no right to be called problems at all.

Not when there's a sure, practical solution that is now being adopted on a widespread scale.

THE MAJOR'S MARVELOUS MOUSETRAP

In Alpine, New Jersey, on the rocky brow of the Palisades rises a gaunt steel tower with a trio of grotesque cross-arms. Nestling at its base lies a laboratory building that has been the scene of Major Armstrong's ultimate refinements in his new discovery — home of the experimental station W2XMN and the cradle of frequency modulation.



As long ago as the fall of 1939, regular programs were radiated daily from the Alpine station while the world of radio watched and occasionally wondered. The Armstrong transmissions were made down in the airy regions of the ultra-short waves which, only a few years back, were considered as mysterious and untenantable as the Arctic Ocean.

Very few persons heard those pioneer programs from W2XMN. Even if their receivers did dip down to the remote frequency of 43,000 kilocycles, the result was only a rasping hash of sound — for **FM** requires a special type of receiver as well as transmitter.

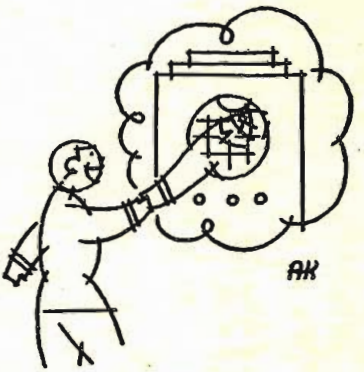
And yet the few scattered explorers who either built or secured special receivers evinced an almost fanatical brand of enthusiasm. They discovered a number of things.

First of all, the programs are clearer than the proverbial bell. Each sound, each note of music comes over the air with the identical clarity it would have if produced right in the same room with you. The announcer

whispers, and you start at his nearness. A match strikes; you can hear its crackle, then the intake of breath as a cigarette is lit. Water is poured from one glass to another with a clear, liquid slosh.

Try these things in front of the microphone at an ordinary amplitude modulated station and you'll find your listeners tuning away from an ear-splitting array of misshapen sounds.

But **FM** is so lifelike you can practically reach out and shake hands with the announcer.



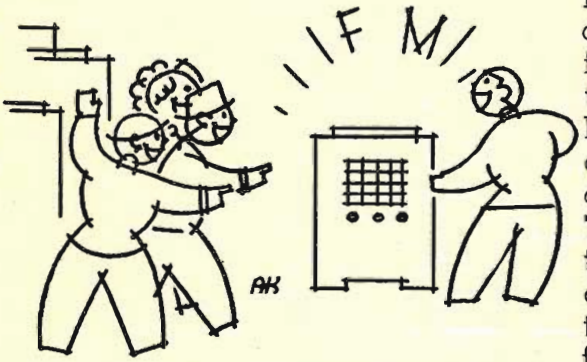
The pioneers discovered other things, too. Seems it's been an accepted axiom for many years that ultra-short waves have a limited range extending only in a straight line to the horizon — whence they leap off into the chilly limbo of outer space. And **FM,** because of its inherent principles, operates in the ultra-short wave regions of the ether.

But the axiom seems to have gone astray. **FM** stations in operation today frequently have ranges in excess of 100 miles, greater than the daytime range of ordinary broadcast stations.

Another thing listeners learned, when they switched back to ordinary stations after listening to programs transmitted by **FM** was . . . well, frankly, they lacked the naturalness which **FM** can offer.

And since lots of these people were in the broadcasting business themselves, this fact soon set them to thinking.

There is today a transition period. As Mr. and Mrs. James J. Public buy new radio receivers, more and more of them are equipped for **FM** reception. The number in use shows a sharply accelerating rise. This is all rather logical, because, after all, they get more for their money with **FM.** Mr. and Mrs. James J. Public are noted for being shrewd shoppers. At the present tempo it will hardly be long before millions of **FM** receivers are providing better, noise-free entertainment and education.



Rome, according to reports, was not constructed overnight.

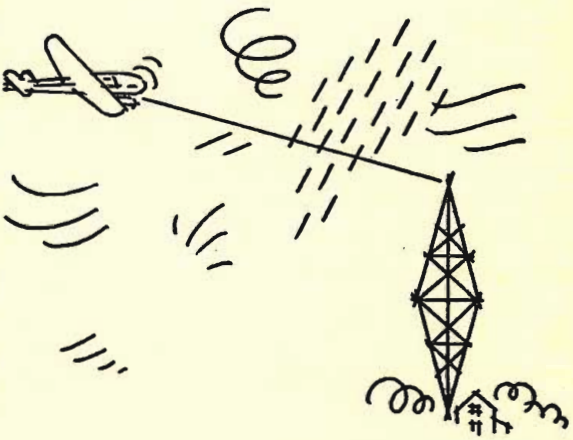
Combination receivers for both **FM** and ordinary broadcasting are a prominent item on the market today. Listeners may tune, at the flick of a switch, to either band — but as better and better service is offered over **FM** stations with their obvious advantages, more and more persons will devote their listening hours to **FM.**

And so eventually we shall see the old type of stations relegated to the role of auxiliary broadcasters, serving great rural areas, perhaps in time to be replaced entirely.

FM — you might care to know — is not exclusively an entertainment medium. Its application to other fields of radio communications is manifold. Today there are hundreds of police radio stations across the

continent, performing an exemplary job in the maintenance of law and order. Yet on cold fall and winter nights they often echo far beyond the areas in which they have work to do. Undoubtedly you've listened to them at times on your receiver at home.

Frequency modulation is now being widely adopted for police and emergency work, permitting dozens of stations to operate on the identical channel, each doing its local task without any form of inter-station interference. The country's armed forces have also found in **FM** a thorough answer to their many communication problems.



And in flying, too, **FM** is beginning to perform a valuable task. Airlines are testing its advantages to guide huge transport planes on their routes despite ear-splitting summer static or the almost equally troublesome "snow-static" that occurs in winter months. **FM** assures continuous, reliable plane-to-ground contacts.

Television, in the standards set up for this new and promising industry of visual radio, will uniformly employ **FM** for the sound transmission that accompanies the pictures.

PROBLEMS OF PROGRESS— WITH ANTIDOTE • •

Probably the outstanding virtue of **FM,** aside from its realistic reception, is the prompt solution that it offers for one of the Federal Communications Commission's greatest headaches.

It is merely 20 years since the first broadcasting stations were licensed, and yet in that two-decade flight of progress we have reached a point where almost 900 different stations, many of them members of great national chains, are in daily operation. Within the limits of the 550 to 1600 kilocycle band — once thought a spacious and more-than-ample territory — there is now barely room to cram in a handful more stations without unleashing an intolerable bedlam of interference and protest.

If you live in a small town situated away from the metropolitan centers, you undoubtedly know what happens when evening comes.

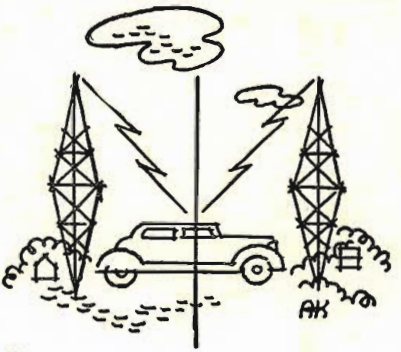
Distant stations begin to creep in on your dial. You get cross-talk, heterodynes and echoes. Some stations come in thunderously, then drift away to crumbling undertones. Other broadcasters are forced by regulations to leave the air at the time of local sunset because darkness means they will interfere with rival stations on the same channel, perhaps a 1000 miles or more away.

Special directional antennas, power increases and juggling of channels — made necessary by the circum-

stances — have all provided but temporary relief. And there are thousands of enterprising communities earnestly in need of, and entitled to, local broadcasting service, yet unable to enjoy it because of the existing situation. Something obviously had to be done if radio was to continue its free and healthy growth as an instrument of democracy. **FM** was, and is, the answer.

Why not? **FM** has a lucky, useful faculty whereby the stronger[1] of two signals invariably predominates. You hear one or the other—not both.

So sharp is the distinction between two **FM** stations that you can drive from one town to another with an **FM** receiver in your car and, at one definite location, you will magically stop hearing a station, only to have it replaced by another on the same channel — without even retuning the receiver.



You see what this means?

In May, 1940 the Federal Communications Commission set aside a group of special channels for **FM** —40 of them, in fact—that open up a territory with room for thousands of new broadcasting stations. Every small town may now have its own broadcaster, offering programs of superb fidelity and local interest, unbothered by man-made or nature-made interference.

[1]When we say "stronger" signal, we mean the ratio of 2 to 1. If one station, at a given location, comes in twice as loud as another station operating on the same channel—you'll hear only the first one without a trace of interference from the second. A 2 to 1 ratio is not so great as it may sound. In standard broadcasting today, one station must possess a signal 20 to 50 times stronger than its competitor before it gains the upper hand on the dial.

PUTTING THINGS SIMPLY AS POSSIBLE

It would be the most logical thing in the world for you, at this particular point, to frown and demand somewhat bluntly:

"Well . . . just what is this **FM** stuff? What makes it so wonderful? How does it work?"

That's a big order.

FM is rather complex. But, oddly enough, neither so complex nor potentially expensive as the accepted system of amplitude modulation in use on the ordinary broadcast band.

When you bought your present receiver, you didn't demand an explanation of its inner workings and principles from the man behind the counter, did you? All you wanted were results.

And so, unless you've studied a good bit of physics, the chances are slim that you're likely to grasp the intricacies of **FM** any better than you have of the ordinary system.

Let's stick pretty close to what it does — not how.

The major point is — it gives better results and it's not expensive.

Notwithstanding, if you'd like an analogy . . . put on your wading boots because here's the theory of **FM** boiled down to its essentials.

Radio waves, in general, have two basic characteristics.

The first of these is "frequency" — the number of times they vibrate per second, usually measured in kilocycles (thousands of cycles) or megacycles (millions of cycles).

Frequency, in radio, is like a street address. It tells you where to find a station on your dial.

The second characteristic is "amplitude" — the strength or intensity of the signal.

Now when we put modulation (voices and music) upon a radio wave as in radiotelephony — a fancy name for broadcasting — we have to vary something in accordance with variations of the voices and music.

The ordinary method of "amplitude modulation" varies the intensity of the signal. It gets stronger when the music is stronger, fades when the music is weaker. (This is where static comes in because, like most reception-marring noises, static is produced by variations in electrical amplitude.)

FM takes another approach. An **FM** signal remains constant in its strength (intensity or amplitude) but alters its number of vibrations (frequency) slightly as it shuttles back and forth within the confines of a given channel, 200 kilocycles wide. The result is noise-free from the usual sources of interference and capable of sending over the air programs of extreme fidelity.

A frequency modulated station requires a channel or radio roadway about 20 times wider than the ordinary 10 kilocycle broadcast band channel for best results. Paradoxically enough, this doesn't waste space on the air but makes more economical use of it. The strongest station always predominates, and you can therefore place transmitters much nearer together, geographically, than is possible with the old system.

And probably no other discovery in the history of the world — with the exception of the printed word — has the power to reach so many people at once and mold their thoughts as has our 20th Century marvel of radio broadcasting.

Frequency modulation is in stride with today. It is a logical, inevitable development commensurate with better living and that impetus of daily life which we refer to vaguely as progress.

You'll hear more and more about it in the months to come.

• • FM • •

TO SUM IT ALL UP • •

While you read this booklet, there are dozens of established and veteran broadcasters licensed to operate commercial **FM** stations. Many are already on the air, offering special **FM** program schedules. Others are rushing completion of transmitting equipment.

We can't quote the exact number because it grows so rapidly that this booklet would be out of date in a few months. But in the middle of 1941, for example, almost 125 groups had sought permission to erect **FM** stations. That's a goodly total for less than a year's time.

The significant thing is that these people—and many manufacturers who supply the necessary equipment—are willing to put their faith and money and engineering skill into a new development — not because they are visionary, but because they recognize frequency modulation as an irresistible tide in a world of radio that is already noteworthy for its breathless growth and susceptibility to progress.

Today more than a dozen concerns are actively engaged in the manufacture of **FM** receivers that the public may purchase. All of the largest radio engineering firms in America have assigned experts to a fuller study of the new development. In short, it's far past the stage of being a pipe dream.

We have today better, more comfortable homes, precision-built automobiles, luxurious airliners that span oceans, sleek high-speed trains which shrink miles — these are all the gifts of an era whose keynote is to find a better way of doing any and everything.

Not only does it mean better service to the listening public, but better business as well — for each station represents an investment that can stimulate trade and civic spirit in its own community. Of the 40 new channels, 35 are set aside for regular commercial **FM** stations operating on a par with ordinary broadcasters. The other five have been designated for non-commercial, educational stations operated by city schools, universities and colleges. All may be heard on the standard **FM** receiver.

Probably one of the first thoughts you have is whether these innumerable local stations will result in a lower caliber of programs.

FM in no-wise spells the doom of the network. Instead it opens a path for more broadcasting chains, lessening the accusation of monopoly.

It is technically unfortunate that telephone wires now used in linking ordinary network stations are today incapable of carrying such high fidelity programs as **FM** can transmit without flaw. But the problem has been attacked in the laboratory with mounting success, and radio relay between towns — one station picking up and rebroadcasting a neighboring one—is an accomplished and highly successful fact.

ACCORDING TO THE CRYSTAL BALL • •

Nobody in his right mind thinks American radio is going to drop everything and come a-running to **FM** between now and next Tuesday morning. Changes just don't take place like that, even in this highly changeable decade of ours.

This booklet has been prepared
and distributed by

FM BROADCASTERS, Inc.
52 Vanderbilt Avenue New York City

as a non-profit endeavor solely in the
interests of frequency modulation broadcasting.

BROADCASTING'S BETTER MOUSETRAP