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THE "WGAS EFFECT" AND THE FUTURE OF AM RADIO

In the history of broadcasting a number of "Effects" have dramatically impacted on broadcasting. For example, the "Capture Effect" and the "Multipath Effect" of FM, and earlier "Radio Luxemburg Effect" helped shape broadcasting history.

More recently, "Clicks and Pops", "Platform Motion", and "Rain Noise" have influenced the path of AM Stereo. Remember when the Magnavox system was selected by the FCC as the standard in 1980 and the "Click and Pop" effect was discovered. By 1982 it became clear that this "Click and Pop" problem made it essential that the FCC revisit its decision.

There is now a new phenomenon which we propose to name the "WGAS Effect" because it was first described in the "Open Mike" section of the September 7, 1987 issue of "Broadcasting" by Mr. Glenn Mace, President of WGAS, South Gastonia, North Carolina.

It is essential that all AM broadcasters carefully read this short letter because the very future of AM radio may depend upon the industries knowledge of its contents.

It should be stressed that WGAS does not, and cannot, endorse our stereo system as they have never used it. But, nevertheless, we are most appreciative that Mr. Mace has taken the time and effort to make his observations public on this important matter.

More will follow re the "WGAS Effect" and how it impacts on <u>all</u> stations, large and small, which must serve listeners in their 25 mv/meter contour and beyond.

Vol. 113 No. 10

Broadcasting Sep 7

Keeping the (Kahn) faith

Odds are against its becoming de facto AM stereo standard, but system's users are believers

AM broadcasters using Kahn Communications' single-sideband AM stereo system are not easily swayed.

A month ago, the National Telecommunications and Information Administration released a report saying the proliferation of multisystem AM radio receivers, the only kind capable of picking up Kahn stereo signals, was unlikely. The NTIA stopped just short of saying that Motorola's incompatible C-Quam system was the nation's de facto AM stereo standard. Yet Kahn stations reached by BROADCASTING seem to be sticking by Kahn.

The faithful say the Kahn system delivers a better stereo signal without degrading mono signals. Despite the NTIA report, they believe that multisystem radios will eventually make their way in large numbers to the marketplace. And, finally, they feel consumer interest in AM stereo generated by the production of millions of radios capable of receiving only the C-Quam stereo signal is not high enough to warrant a switch to C-Quam.

Among AM broadcasters committed to AM stereo, the Kahn proponents are a small minority. While some 500 stations are now broadcasting with C-Quam, fewer than 100 are on the air with Kahn. Still, the stubbornness of the Kahn stations denies Motorola a clear cut victory in the standards battle that is now in its sixth year. Motorola would like nothing better than to persuade the Kahn stations to switch to C-Quam.

Motorola's Chris Payne concedes nothing to those who say C-Quam is inferior to Kahn. Indeed, he said, many of those who do have never tried C-Quam at their stations.

But, Payne said, stations that are sticking with Kahn are overlooking the non-technical reasons to switch to C-Quam, primarily the fact that there are around 10 million radios, mostly in cars, that can receive only C-Quam stereo signals. The penetration of these receivers may not yet be great enough "to force or compel" stations to switch to C-Quam, he said. But as the number or radios grows, he said, it will become a liability for a station to say it is on the air in stereo and not be able to light the stereo light on C-Quam-only radios.

Dragging out the standards battle disserves the AM radio, he said. "There is a winner," he said. "It's time to get on with the business of improving a AM radio and bringing the industry to life again."

Because no manufacturers make Kahn-only receivers, the future of the Kahn system depends on the proliferation of multisystem sets that are capable of receiving both Kahn and C-Quam signals. The NTIA report, released on Aug. 12, found that although the cost of producing an integrated circuit capable of picking up both AM stereo systems was not significantly higher than the cost of single-system circuits, and although sound quality of multisystem and single-system receivers was nearly equal, "there do appear to be significant obstacles to achieving a successful multisystem AM stereo solution," primarily the unwillingness of manufacturers to produce multisystem sets.

At a press conference held for the report's release, NTIA head Alfred Sikes said: "I don't think there's any doubt that C-Quam is a de facto standard. There might still be some doubt as to whether it is *the* de facto standard. The fact that all radios can receive the C-Quam signal makes it at the very least *a* de facto standard." On the basis of its findings, NTIA recommended that the FCC protect the pilot tone of the C-Quam system from possible interference.

But belief in the quality of the Kahn system seems to be strong enough for some broadcasters to continue transmitting in stereo with it. "We believe that [Kahn] is the superior system technically. All of our engineers unanimously agree on that," said Gary Edens, president of Edens Broadcasting, Phoenix. All four of Edens's AM stations—KKLQ San Diego; WRBQ St. Petersburg, Fla.; KOY Phoenix, Ariz., and WRVA Richmond, Va.—broadcast in stereo with Kahn equipment. The Kahn equipment at KKLQ were installed in mid-July. "We simply believe that in terms of producing a good stereo quality sound that the Kahn system is superior to the alternatives," Edens said.

It is the position of Bonneville International Corp., Salt Lake City (owner of four stations broadcasting with Kahn stereo: KSL Salt Lake City; KAAM Dallas; KMBZ Kansas City, Mo., and KIRO Seattle), that Kahn is "clearly" the superior system, according to Bill Loveless, vice president of engineering. Bonneville engineers, Loveless said, found a number of deficiencies in Motorola's C-Quam. "It does not allow the depth of modulation that the Kahn system allows," Loveless said. "You can only go to 85% negative modulation on Motorola. It cannot be used on skywave at night for the wide area coverage. It's just very difficult to listen to. If there's the slightest amount of co-channel interference, like there is on most smaller stations, then it's just intolerable."

Noble Broadcast Group of San Diego, which also recently installed stereo equipment at one of its stations, WSSH Lowell, Mass., had no qualms about buying the Kahn system after having success with it at its Tijuana, Mexico, station, XTRA. The Mexican station, one of the first to broadcast in Kahn AM stereo, had "no problems producing an effective stereo signal a great distance from the station," said Dennis R. Ciapura, Noble's vice president of technical operations. "We found that the Kahn system imposed no limitations whatsoever on either the mono, most importantly, or the stereo reception distance of the station." Ciapura also said that Noble had experienced few maintenance or construction problems with its Tijuana equipment. "The Kahn was very well built," he said.

Ciapura also found that the Kahn signal on monophonic receivers was superior due to the "power-side," an option on Kahn equipment that boosts the side-band signals to improve the sound on mono radios and is designed to be an advantage for stations that program more talk than music. "The Kahn system, with the power-side option, allows us... to improve performance of the station in the directional antenna and shift the center tuning of the channel away from some of the interference," Ciapura said. Because most AM broadcasters will be more interested in their mono performance than stereo in the near future, Ciapura said the power-side "may be an avenue for Kahn stereo to increase its penetration much more rapidly." Then, he thought, others might find, as Noble has found, that buying Kahn stereo is "a no-risk situation."

Bonneville's Loveless was also impressed by the power-side option. "Even if [AM stereo broadcasting] dies," he said, "then regular mono radios could use it, and it would be a great improvement... We find it very effective."

There was a sense among Kahn stereo broadcasters that C-Quam would not reach the status of de facto standard unless consumer interest in AM stereo grows. While they granted, as the NTIA report said, that only 2%-3% of all AM stereo receivers are capable of picking up the Kahn system, they pointed out that so small a percentage of total radios on the market have AM stereo of any kind that it is too early to call one system a standard. "I don't think there's enough interest in AM stereo yet to justify a switch," Edens said. "You go to a stereo store, and they don't even know what AM stereo is. It's not an issue, and it's not something that is in high demand by listeners. I don't think it will be until AM stereo [sections] are commonplace in all radios."

Ciapura agreed: "I believe the NTIA report found that 98% of the stereo receivers were C-Quam. But that's 98% of what percentage of the universe of receivers? I think the percentage of stereo of any kind is negligable at this point." According to Motorola numbers at the time of the first NTIA report, its AM stereo receivers accounted for only about 2% of the 500 million receivers in the U.S. today. Ciapura said that if the share of

AM stereo radios were to increase to 25% and "if we saw a clear majority of one type of stereo system...then I would consider switching."

Said Al Resnick, director of radio engineering for Capital Cities/ABC: "When you can put [both] systems on the air, run them for a while and take them off the air and get very little listener reaction or none at all, it indicates one of two things: The public isn't aware that there's a stereo transmission or that there are no receivers out there." Capcities/ABC owns three AM stations using Kahn equipment—WABC New York, KABC Los Angeles and WMAL Washington—and two using C-Quam and one using Harris's system. Harris has dropped out of the AM stereo battle and no longer promotes its system.

Resnick would not comment on which system was superior, but he said the matter of whether there are enough AM stereo receivers in use to make a difference to the typical AM broadcaster was "a very good question." He could recall only one time when an ABC station—WLS Chicago (the station with Harris equipment)—temporarily discontinued broadcasting in stereo and received phone calls from listeners. "This was two years ago when the AM stereo issue had a lot more novelty than it does right now," said Resnick. "Whether a person would take the time to telephone the station or whether they would simply tune to another station is a real good question. If they were mind-bent on listening to something on stereo, the choices are not extremely limited any more. It's hard to go through the FM dial without lighting the stereo light," Resnick said.

Loveless expresses the frustration at Bonneville: "We definitely need radios out there to receive stereo. If it [were judged on] truly an engineering basis, which it should be but isn't, Kahn would win, clearly."

AND NOW FOR A LETTER THAT NEEDS TO BE READ BY EVERY AM BROADCASTER IN THE USA

Little problem

EDITOR: AM stereo is killing the small stations.

For many years our monaural AM daytime station has served this community with a presunrise authority of 500 watts. This power has always been adequate and still is on mono AM receivers. But on AM stereo receivers, the distant skywave signals render our local signal useless. I discovered this last year when we purchased a GM car with [a Motorola C-Quam] AM stereo radio. Even in very strong signal areas (25 millivolts per meter) the distant skywave co-channel signals intermittently turn on and off the AM stereo circuits in the radio, causing unbearable interference.

It's my understanding that the "beating together" of the skywave co-channel signals with the local signal produces a resultant third signal that turns on the stereo circuit. The radio will have a perfectly good mono signal and the stereo will come on and seem to lock in on a distant signal that proceeds to move slowly from one speaker to the other. There is a constant jumping from signal to signal.

To determine whether this was only on our station, I drove to within three miles of a station operating on local channel **1450** with 1 kw. The same result. Later I drove to a nearby city with a station on local channel **1340** operating with 1 kw: ditto. I have heard the same situation on any number of local and regional stations as I travel at night.

I have never seen a report on this, so I called the FCC. The gentleman I talked to had not heard of this problem but promised to check with the Motorola people. He called back and reported that the Motorola people were aware of the situation and were working on it.

I'm sure that AM stereo has much to offer ailing AM. But surely there has to be a way to do it without killing the small community stations.—*Glenn Mace, president, WGAS(AM) South Gastonia, N.C.*

Broadcasting Sep 7 1987

WGAS operates on 1420 kHz a regional channel. Mr. Mace also reports on 1340 and 1450 kHz, local channel operation.

NOTE, HOWEVER, EVEN CLEAR CHANNEL STATIONS HAVE TO WORRY ABOUT THEIR 25 MV/METER CONTOURS.

AMPLITUDE MODULATION THEORY AND MEASUREMENTS - NEW AND OLD PARADOXES

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INTRODUCTION

Most electrical engineers find modulation theory both challenging and satisfying. The mathematics that services this branch of communications engineering covers a wide span, from elementary trigonometry to the finer points of Fourier analysis and Bessel functions theory.

Furthermore, aspects of sideband analysis that are now taught as being "obvious", (a most dangerous word, especially in patent law) were hardly obvious in the early days of radio engineering when even the inventors researching the field often "hedged their bets" by describing their inventions two ways; one in the time domain and the second in the frequency domain, in terms of the "new" sideband theory.

Indeed, it is reported by M. G. Scroggie in his informative book "Essays in Electronics" 1963, Illiffee Books, London, that in the 1930's the question as to the reality of sidebands was so heatedly resisted by a number of prestigious engineers, (including Sir Ambrose Fleming, the inventor of the vacuum tube diode) that the government of Great Britain appointed a committee to investigate. This committee came to the correct finding, sidebands were real!

The present paper was written in an attempt to serve two purposes:

(1) To dispel certain apparent misconceptions concerning modulation theory that have found their way into our profession, many starting at the very inception of communication engineering and others introduced as recently as 1986. Some of these apparent misconceptions may impact on efforts to update AM radio. In view of all the problems now facing AM radio, it would be suicidal for the AM industry to make major changes in its technical plant based upon fallacious or misleading technical concepts.

(2) Review methods of measuring "splatter", a most serious form of adjacent channel interference. (Splatter is a transient form of interference caused by sideband components falling into an adjacent channel.) While this review is extremely brief, it does discuss a basic limitation to such measurements that severely impacts on the validity of some of the measurement methods now being considered.

Basic Trigonometric Equation Defining an AM Signal

For single tone modulation;

$$e = Ec\left[1+m*\cos(wat)\right]*\cos(wct)$$

$$= \underbrace{Ec*\cos(wct)}_{\text{carrier}} + \underbrace{m/2\ Ec*\cos(wct+wat)}_{\text{upper sideband}}$$

$$+ \underbrace{m/2\ Ec*\cos(wct-wat)}_{\text{lower sideband}}$$

where;

Ec = the carrier voltage
m = the modulation factor (1=100%)
wa = 2*pi*fa, fa is the audio tone frequency
wc = 2*pi*fc, fc is the carrier frequency

Thus, we see that for a single tone wave 100% (m=1.0) modulated AM wave, with a peak envelope voltage of 2 volts (4 watts PEP if across a 1 ohm resistor) there are three components a carrier, center frequency component of 1 volt, a lower sideband component of .5 volts and a mirror symmetrical upper sideband component of .5 volts.

NEW AND OLD MODULATION PARADOXES

Basic Modulation Paradox

The first point that confounded early researchers, and caused some to believe a sideband was merely a "mathematical fiction", is the difficulty of accepting the concept that a combination of three constant amplitude, constant frequency waves produces a single wave having a variable amplitude envelope. By use of the phasor diagram of FIG. 1(c) and armed with 20/20 hindsight, the original doubts of the reality of the mathematical defining equations are quickly dispelled. However, as mentioned above, all of this was not so readily accepted in the early days of radio. The equivalent paradox for FM, is how can a large number of components (actually infinite) all having, for fixed amount of deviation, constant amplitudes and constant frequencies combine to produce a single wave that varies in frequency.

The second point (not really a paradox but a bit of confusion that arose, I understand, in some schools) is that one can "see" sidebands when viewing a modulated wave in the time domain; i.e., a normal time sweep oscilloscope display.

This concept springs from an incorrect interpretation of a time domain representation of an AM wave (FIG. 1(b)) where some engineers believed the top of the figure represents the upper sideband and the bottom the lower sideband. However, it is impossible to see sidebands with this display, which is not frequency sensitive. To "see" sidebands you need a frequency domain display such as provided by a spectrum analyzer.

[Of course, if the modulated wave is fully defined in the time domain by a descriptive equation, or by a sufficient number of sample points spaced in time, one can determine the magnitude and phase of the sidebands and the carrier by performing a Fourier analysis.] A corollary of this erroneous concept, that a diode detector will demodulate one sideband if it is connected one way and the other sideband if the diode's connections are reversed, also has no factual basis. The diode merely responds to the envelope of the amplitude modulated wave which is defined by the summation of the carrier and both sidebands.

Overmodulation, Is It Really a Major Source of Interference?

NAB published, in September of 1986, a lengthy document as part of its AM improvement program, ("Modulation, Overmodulation, and Occupied Bandwidth: Recommendations for the AM Broadcast Industry" by Harrison J. Klein.) The document provides an extensive discussion of amplitude modulation theory with emphasis on the subject of "Splatter".

The main purpose of that document was to provide practicing broadcast engineers information that would better allow them to reassess their operating methods so as to reduce interference to other stations.

It is clear, that if AM radio is to fully compete with FM, receiver manufacturers must dramatically improve the fidelity characteristics of their products.* However, as is made clear in the NAB publication, wideband receivers are more prone to respond to adjacent channel interference. Therefore, the trade that AM broadcasters must be willing to accept is clean spectrum for wideband receivers. Anyone who believes in the long term future of AM broadcasting; therefore, must not ignore sources of adjacent channel interference, which include excessive preemphasis, high degrees of clipping to provide loudness, incidental phase modulation, poorly maintained transmitters that have high degrees of distortion and, not to raise a delicate issue, certain types of AM Stereo operation, where the L-R components can negate limits placed on the L and R input signals.

*For a thorough analysis see U.S. Department of Commerce publication dated Feb. 1987, "AM Stereo and the Future of AM Radio", Alfred C. Sikes, Assistant Secretary of Commerce.

The question spotlighted by the NAB publication is whether "overmodulation" is a significant factor in causing interference.

Unfortunately, the NAB publication reached certain conclusions by applying the results of an analysis of a wave generated by a very special class of amplitude modulator; i.e., a multiplicative type, for example, a balanced modulator. This line of reasoning lead to statements incorporated in this lengthy document that seriously downplayed the danger of overmodulation.

For example, the first conclusion in the "Executive Summary" of this NAB document, subtitled "Recommendations for the AM Broadcast Industry" is:

> "1. The primary cause of splatter interference is not the disappearance of the carrier during overmodulation, but instead is the presence of excessive high-frequency content in the audio signal that modulates the transmitter."

Furthermore, later in the document in the "Conclusions and Recommendations" it is stated:

> "1. The primary cause of splatter is excessive high frequency content in modulating audio. This is the single most important conclusion to be drawn from this report. If the modulation contains excessive high frequencies, these will cause splatter. Traditional "overmodulation", meaning the pinchoff of the carrier, is undesirable, but is much less significant than the audio itself. Carrier disappearance, commonly believed to be the significant cause of splatter, has little to do with it."

It is the present author's opinion that these statements tend to be misleading as it is impossible to operate a conventional AM transmitter so as to suffer "carrier disappearance" without causing severe interference.

It should be emphasized that the basic weakness in the analysis is quite subtle and the above quoted conclusions appear to be logical conclusions derived from an examination of a very special case.

Paradox That Almost Destroyed FM

This situation proves, once again, that modulation is a most arcane subject that can confound even the best trained engineers. Indeed, the prestigious engineer and mathematician, John R. Carson of Bell Laboratories, in 1922 published an analysis of narrow band FM that so biased the industry against FM that it delayed the acceptance of Major Edwin H. Armstrong's monumental development of wideband FM as announced in 1936. The early Carson paper concluded; "This type of modulation inherently distorts without any compensating advantages whatever."

It is noteworthy that another giant in radio engineering, F. E. Terman, stated in the 1937 edition of the classic, "Radio Engineering":

> "Frequency modulation is not particularly satisfactory as a means of transmitting intelligence. The frequency band is at least as great as that employed with amplitude modulation and is in general somewhat greater. Also the reception of frequency-modulated signals is not so simple a matter as the reception of amplitude-modulated waves."

This illustrates the danger of making broad generalizations (all FM signals are useless) based on special case examples, (analysis of narrowband FM).

Two Types of Overmodulation

Let us now follow the logic of the NAB publication. The balanced modulator theoretically produces a distortion free double-sideband suppressed carrier wave. If one wishes to produce a wave that, for modulation of less than -100%, i.e., no overmodulation, is equal to a conventional amplitude modulation, it is only necessary to add a carrier component, having an amplitude equal to or greater than the sum of the two sidebands when the sidebands are at their maximum negative going instant. The carrier component must be directly in line with the sum of the two sidebands if a pure amplitude modulated wave is to result.

If such a generator is caused to overmodulate, (by either upping the audio fed to the balanced modulator or conversely reducing the carrier level) the output does not cut off or flatten off as would be true of conventional AM transmitters, FIG. 2(a), but "folds over", FIG. 2(b).

This "fold over" overmodulation does not, as the NAB paper correctly points out, cause the sudden generation of higher order spectrum components. It does cause however, severe distortion in an envelope demodulator but not in a product demodulator. Actually, the "fold over" envelope distortion is over twice as high (23.9%) as is normal overmodulation clipping distortion (10.8%) at +141% modulation.

Thus, the NAB publication reasons overmodulation, per se, is not a source of excessive splatter. It is also true that the cusps (the sharp points where the envelope just goes in and out of the fold over region) are discontinuities but they also do not create splatter.

Another Paradox

Thus, we face yet another paradox. Years of operating experience have proven to broadcast engineers that overmodulation does indeed cause severe out-of-band radition, but we now see that a simple balanced modulator IC can produce a modulated wave capable of enormous amounts of overmodulation while maintaining excellent spectral characteristics.

The answer to the puzzle is that the overmodulated multiplicative wave is a lot more complex than one might conclude by viewing it on either a spectrum analyzer or an oscilloscope. The wave has another modulation component that is being ignored. The phase of the overall wave reverses at the very instant that the envelope folds over. This phase modulation makes the wave a very special case.

Actually the phase modulation of this wave produces a wideband spectrum as does the envelope modulation component. Indeed, the spectrum lines of both components of the overmodulated wave only approach zero amplitude as the sideband order approaches infinity! Thus, both the PM component and the AM components

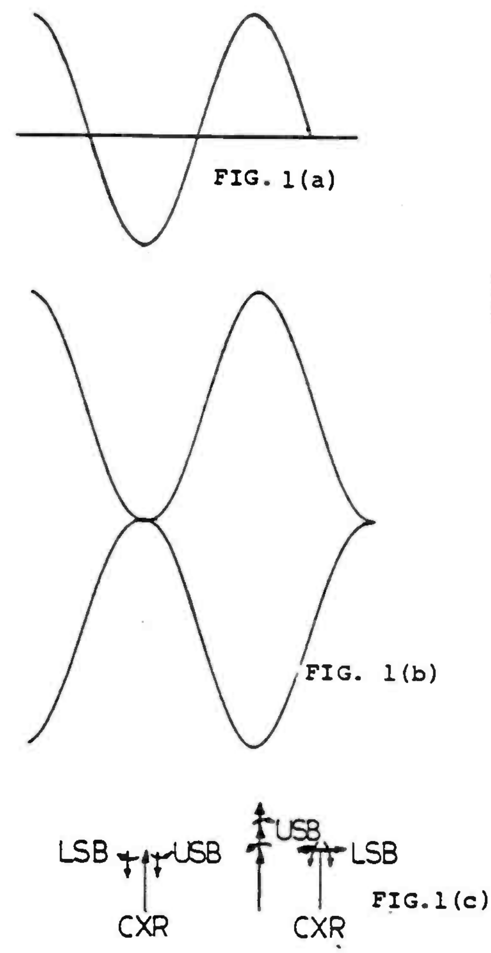


FIG. 1 SINGLE TONE 100% MODULATED AM WAVE

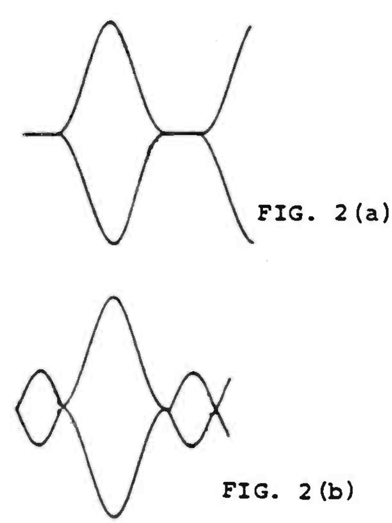


FIG. 2 TWO TYPES OF OVERMODULATION

are wideband waves whenever the overmodulation condition is reached; i.e., when "fold over"occurs.

This situation becomes clear if one compares FIG. 3 and FIG. 4.

In FIG. 3 we see a wave that would be produced by a conventional modulator if it was fed an AF wave with a folded over region and the wave just went through -100% modulation at the cusps. The spectrum is exceedingly poor....actually a good deal wider than a normal "flat bottomed" overmodulated wave.

On the other hand, if we use a balanced modulator type modulator, we will produce the identical envelope wave shape as shown in FIG. 3 but with the rf phase reversed in the fold over region (FIG.4). This phase reversal is sufficient to develop a wideband component that, when envelope modulated by the folded over envelope wave, produces a theoretically perfect double sideband spectrum.

Thus, we see that the wideband PM wave component is essential if this wave is not to splatter when overmodulated. In other words, the deduction that AM splatter is not caused by overmodulation is false, and the wave that was used to deduce this erroneous conclusion was actually not a pure AM wave but was a hybrid modulated wave with its PM component having the exact wideband characteristic necessary to cause a cancellation of the splatter components that would have been produced by the overmodulated envelope modulation.

Actually, without the PM component the "folded over" AM wave (FIG. 3) has a spectrum that violates FCC rules even when the audio frequency is restricted to voice frequency components below 3 kHz. In other words, as most broadcasters would expect, heavy overmodulation can cause excessive interference, even when transmitting low fidelity talk programs.

Actually, one can (and should) make a strong statement concerning overmodulation. Overmodulation, of a conventional AM transmitter, is a most serious source of splatter. Indeed, under normal conditions, overmodulation may well be the main cause of adjacent channel splatter.

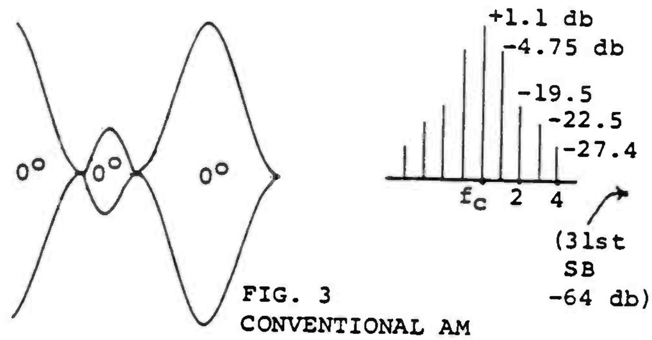


FIG. 3
CONVENTIONAL AM

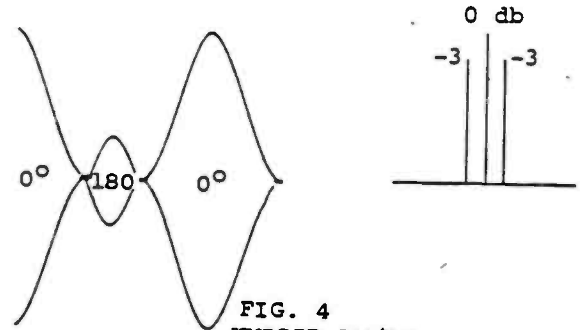


FIG. 4
HYBRID AM/PM

MEASURING SPLATTER

With the advent of AM Stereo there have been a number of proposals to replace the single tone test procedure for proving compliance with occupied bandwidth rules. The author believes that any group recommending the replacement of a standard test procedure must expect to be treated with some degree of suspicion and bears the burden of proving, beyond any question, that the proposed new method is better than the existing test procedure and that it provides at least as much information about the equipment being tested.

Furthermore, since broadcasters and receiver manufacturers agree that adjacent channel splatter is one of the most serious problems facing AM radio, it is even more important that any new test procedure proposed to measure splatter be thoroughly investigated.

List of Test Methods

Standard Single Tone	Sweep of audio from 50 to 15,000 Hz at 25% to at least 75%, preferably to maximum modulation capability of transmitter.
Multitone	For example, test proposed by NAMSRC 4 Tones; 400 Hz (35%), 2[illegible]Hz (25%), 5500 Hz (15%) a[illegible]500 Hz (10%).
Noise	White noise.
Shaped Noise	White noise passed through filter which supposedly simulates the characteristics of program material.
Normal Programming	Whatever station is transmitting during test period or "typical" programming.
Special Programming	Selected program material that hopefully stresses the equipment being tested.

All of the above test methods, with the exception of the standard single tone test as used by engineers since the beginning of radio engineering, present serious measurement problems. The basic problem with these alternative measurement procedures becomes evident when one considers certain fundamental measurement principles.

Some Measurements Are Inherently Inaccurate

At the outset it is worthwhile to consider the fact that measuring the frequency and amplitude of a sine wave is, and can only be, an approximation.

This concept becomes clear when one recognizes that a sine wave is not physically reliable as it is supposed to have started at minus infinity in time and must continue forever into the future. If you generate a sine wave in the laboratory you are only generating an infinitesimal part of a true sine wave. Therefore, when you turn "on" a tone generator, you generate keying sidebands, just as you do when you turn the oscillator off at night.

Fortunately, for the communications engineering profession, the bandwidth of these pseudo sine waves becomes extremely narrow in just a few seconds, allowing one to use a very narrow filter to determine the frequency of the sine wave. (Using a frequency counter does not change the situation in that you have to give the counter time to determine the frequency - the more precise the measurement, the longer the count.) Such limitations are met in other fields and apply to the accuracy of atomic observations (see "Theoretical Physics" by Georg Joos - Blacke and Son Ltd., Glasgow, 3rd Edition 1958) where Heisenberg's Uncertainty Principle established the fact that certain combined measurements of atomic particles are not only technically difficult but inherently impossible. In the instant case, because splatter is a very short term phenomenon, precise measurements are impossible.

Thus, attempts at determining splatter characteristics by use of narrowband spectrum analyzers are inherently inaccurate. Actually, the shorter the time span of the phenomenon, the less precise will be the frequency measurement.

On the other hand, steady state single tone measurements are quite accurate and repeatable, allowing regulatory agencies to be certain that licensed stations meet FCC rules.

Furthermore, peaky noise or program material can cause observers to see readings which will always tend to be low. Such problems are even more significant when conventional spectrum analyzers are used because:

1) The splatter component may not be present at the instant the analyzer's narrowband filter sweeps through the component's frequency.

2) The rise time of the analyzer's narrowband filter may be too long (too slow) to respond.

3) The phosphor's rise time of conventional display devices may be too slow to provide full response for faster transient components.

4) The viewer's response time may be too long to see short transient phenomenon and lack of concentration may cause the viewer to miss components.

Some of these difficulties can be alleviated by using a special spectrum analyzer with digital storage or by photographing or video recording the display information.

But even if such equipment is available, its use cannot overcome the basic inaccuracy problems due to the physics of measurements. Even "real time" analyzers, which use a multiplicity of stationary narrowband filters, while overcoming sweeping problems are still limited by the response time of the filters.

Single Tone Tests, Tough But Accurate

On the other hand, conventional single tone tests,while denigrated by some engineers (possibly because they have problems in passing such tests) have basic advantages such as, simplicity, low cost, high accuracy and repeatability. This does not mean that special noise tests and even mere listening tests are not useful. Indeed, it is inconceivable that a competent engineer would ever use a new broadcast technique without first carefully listening to the new technique with typical (and even atypical) radios. Listening to adjacent channels, especially if the transmission systems are A/B switched, can be quite revealing.

Especially questionable are shaped noise tests based on "average" spectrum measurements of voice and music. Industry experience with the standard FM preemphasis curve has shown the peak amplitude of short term high frequency components has been seriously underrated. With the advent of digital recording and electronic music it should be clear that the statistics of music are complex and few engineers are foolhardy enough to jump to conclusions based upon such statistics.

The author would like to note that he is not opposed to expanding test procedures as long as the basic single tone test is maintained as part of the overall test plan. Indeed, having done early work on shaped noise testing of new modulation techniques, he recognizes the fact that such techniques can be useful, especially if instead of using standard noise generators, repeatable computer generated pseudo-noise waves are used.

The important point is that there is no valid reason for discontinuing standard single tone testing. The situation is analogous to the continued use of harmonic distortion testing even though intermodulation distortion measurements have been, for decades, thoroughly accepted.

CONCLUSIONS

Overmodulation Causes Splatter

In view of the importance of correcting what the author believes is potentially a serious source of misunderstanding that may cause some stations to ignore the dangers of overmodulation, the author wishes to make the following statement as strongly as possible; i.e., there is no practice that can, under normal conditions, cause more adjacent channel interference than overmodulation of a typical AM transmitter.

When the level of the audio signal, fed to an AM transmitter, is increased past a point where the transmitter's output will not decrease, the problems of sharp negative peak clipping are experienced. Indeed, the effect is always worse than an equal amount of negative clipping in the audio processor feeding the transmitter because, except for the output rf tuning and bandwidth limits of the antenna, there is no filtering.

Furthermore, the worst problems of IPM (Incidental Phase Modulation) are generally experienced when a transmitter is forced to approach the region of 100% negative modulation.

Thus, the main purpose of this paper is to dispel the slightest doubt that "sharp edges" and overmodulation of AM transmitter signals have a tremendous effect on splatter, something most broadcast engineers knew all along. This is one paradox that cannot be allowed to confuse the industry for a long period of time.

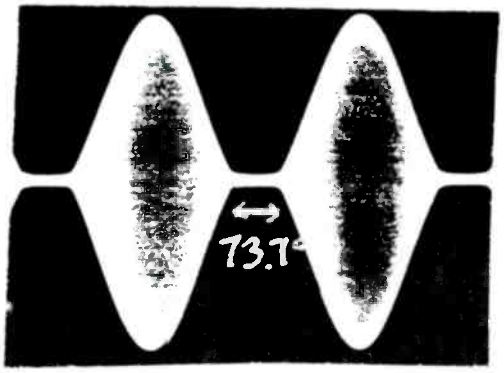
Single Tone Testing Must be Enforced to Protect Spectrum

Regarding new techniques for measuring splatter, such techniques are to be encouraged especially if they can help guard against new and unusual sources splatter and other forms of interference. However, until rigorous proofs are available guaranteeing that such new techniques cover all aspects of present test practice, both the new and old test procedures must be used if the spectrum is to be properly protected. It is abundantly clear that the AM radio industry cannot accommodate even the slightest increase in interference beyond present rules.

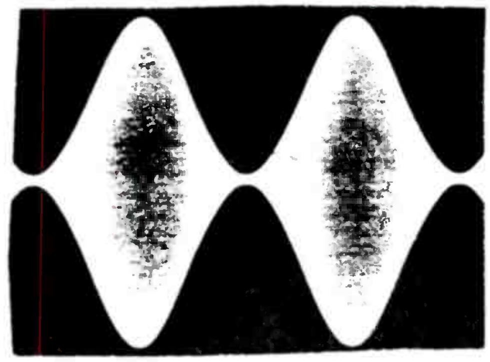
It is certainly not the time to abandon tried and proven test procedures, just because these tests are difficult to pass.

GOOD n LOUD

Model No. GNL-86



Conventional +125%
Clipped Asymmetry



GOOD N LOUD +125%
Modulation

- LOUD, full +125% modulation without a rough, distorted clipping sound that turns listeners off. Patented GOOD n LOUD is <u>free of odd harmonic distortion</u> and the even order terms are significantly reduced.

- LOUD, without a squashed sound - GOOD n LOUD <u>expands</u> the positive peaks of your AM signal rather than squashing negative peaks, therefore, it provides increased <u>effective dynamic range</u> - keeps listeners interested and tuned to your <u>livelier sound</u>.

- LOUD, without causing your signal to splatter. Being a good neighbor really pays off - <u>your signal is easier to tune to</u> - called by some, a fatter signal - actually is a cleaner, leaner, signal that <u>makes tuning easy</u>.

- LOUD, in narrow band (lo-fi) radios, the type, unfortunately, most of your listeners use. Your "clean, lean", <u>powerful signal will pass through narrow radios</u> (also sounds great with the new wide, high-fi multi-system AM stereo radios) without ruining loudness.

Of course, we manufacture a GOOD n LOUD AM Stereo model. It interfaces with the STR-84 Kahn/Hazeltine Stereo Exciters in minutes.

Note that GOOD n LOUD is not a substitute for your multi-band limiter, it compliments these units.

KAHN COMMUNICATIONS, INC.
425 Merrick Avenue
Westbury, N. Y. 11590
(516) 222-2221

DESCRIPTION

GOOD n LOUD offers AM broadcasters full modulation capability without sacrificing good quality sound.

For most effective modulation enhancement GOOD n LOUD incorporates a brand new embodiment of the Kahn Symmetra-Peak circuit. The symmetrical signal is passed through the patented Non-Symmetra-Mod enhancement device which introduces precisely controlled amounts of asymmetry. The resulting output is fed directly to the transmitter. Also provided is a "brick wall" clipper that insures exact peak negative going modulation.

The Non-Symmetra-Mod part of the GOOD n LOUD unit enhances the positive peaks without the use of clipping circuitry, thus avoiding harsh disagreeable clipping sounds. Those nasty sounding odd order harmonics disappear.

GOOD n LOUD produces a significantly cleaner sideband structure than conventional means for producing asymmetrical waves. Cleaner sidebands, besides making you a good neighbor, reduce sensitivity to tuning errors, thus allowing listeners more leeway in tuning. However, since this device enhances high levels of modulation it helps alleviate the "squashed" sound of heavily processed signals. The end result is a clean, lively, powerful sound that satisfies those professionals who insist on loudness as well as those who demand good, clean sound. The only cleaner sound available is unprocessed symmetrical modulation.

SPECIFICATIONS (GNL-86-M and GNL-86-ST)

Input Impedance............	600 ohms, balanced or unbalanced, as ordered.
Input Level................	+10 dbm
Output Impedance...........	600 ohms, balanced or unbalanced, as ordered.
Output Level...............	+10 dbm
Control Range..............	All input levels of positive going modulation from 70 to 100% enhanced up to, at least 125% assuming transmitter is capable.
Noise......................	Better than 50 db (typically 55 db).
Distortion.................	With no enhancement less than 1%. Odd order harmonics from the enhancement action, is less than .1%.
Frequency Response.........	50 Hz to 15,000 Hz within +1 db.
Power......................	115 volts less than 40 watts.
Size.......................	3½" x 19" x 13"

AM

NEW Model STR-84 EXCITER

STEREOPHONIC Transmitter Adapter

DESCRIPTION

Kahn Commnications, Inc., STR-84 is a new, FCC Type Accepted AM Stereo Exciter that provides significant improvements in performance over the STR-77, model which was used by leading broadcasters to introduce AM Stereo in the United States, Canada and Mexico.

The new STR-84 Exciter is based upon a recently patented invention which significantly reduces distortion, especially foe heavily separated stereo material. The new Exciter also provides extended stereo separation, from 50 Hz to over 6,000 Hz, typically providing over 35 db over much of this range. This separation is, unlike phase separation systems, available not only in transmitter monitors, but is available in high quality receivers even beyond the normal mono coverage.

The new unit also allows for sum and difference stereo processing and provides transformerless audio circuitry. The sum stereo processing can, if desired, use clipping which can then be maintained through this equipment without tilt.

Finally, the excellent specrum characteristics of the STR-84 Exciter allows broadcasters to fully modulate without fear of causing interference. Thus, in common with the STR-77, there is no sacrafice of mono coverage. Indeed, major all-talk stations have reported mono enhancement. Also, in common with the STR-77 there is no platform motion, noise increase in weak signal locations and the system can be used with any normal transmitter and with even problem directional antennas.

The mechanical design of the STR-84 conforms with Kahn Communications´ commitment to the production of rugged, reliable broadcast equipment.

KAHN COMMUNICATIONS INCORPORATED

KAHN COMMUNICATIONS, INC.
425 MERRICK AVENUE
WESTBURY, N. Y. 11590
(516) 222-2221

Specifications:

(Meets or exceeds FCC Specifications.)

Stereo Separation.............	Typically in excess of 30 db for 50 to over 6,200 Hz. No separation 7,500 Hz.
Envelope Frequency Response....	± 1 db 50 to 15,000 Hz.
Envelope Harmonic Distortion...	Less than .5% total added harmonic distortion. (Typically .04%)
Audio Input Level..............	+10 dbm per channel 600 ohms (balanced or unbalanced connection, specified with order).
Audio Output Level.............	+10 dbm 600 ohms (balanced or unbalanced connection, specified with order).
Frequency Range of Adapter.....	Any single frequency between 540 and 1,600 kHz. (Frequency must be specified with order.)
RF Output......................	2 to 3 watts at 50 ohms.
Hum and Noise..................	Greater than -55 db relative to maximum level. Typically 65 db.
Line Voltage...................	105-125 or 210-250 volts 50/60 Hz (specify with order).
Size...........................	28" of 19" rack space, approximately 14" deep.

KAHN COMMUNICATIONS, INC. reserves the right to make changes in specifications which result in product improvement.

KAHN COMMUNICATIONS INCORPORATED

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425 MERRICK AVENUE
WESTBURY, NEW YORK 11590
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POWER -SIDE™

The Powerful Sideband System

The newly patented **POWER-side** system is a powerful new tool for AM broadcasters that improves reception in antenna nulls, reduces fading problems, provides better reception under adjacent and co-channel interference conditions and also makes radios easier to tune.

POWER-side allows you to increase power in one sideband and benefit from many of the advantages of SSB, the wave of the future, right now. Even if your station is lucky enough to be free of interference, all stations suffer from man-made and natural noise, often in heavily populated areas.

POWER-side, by increasing the loudness and clarity of your signal, will effectively combat such reception problems especially in antenna nulls.

While **POWER-side's** main advantages apply to mono reception, the system also enhances reception with multi-system AM stereo radios.

What is POWER-side?

POWER-side is the combination of Independent Sideband (ISB) transmission with a special audio processor that causes most of the sideband energy to fall on one sideband. The system is carefully designed to fully comply with FCC occupied bandwidth rules. Actually, to enjoy all of the advantages of POWER-side you must transmit a "clean" signal and thus be a "good neighbor" which is good for the future of AM radio.

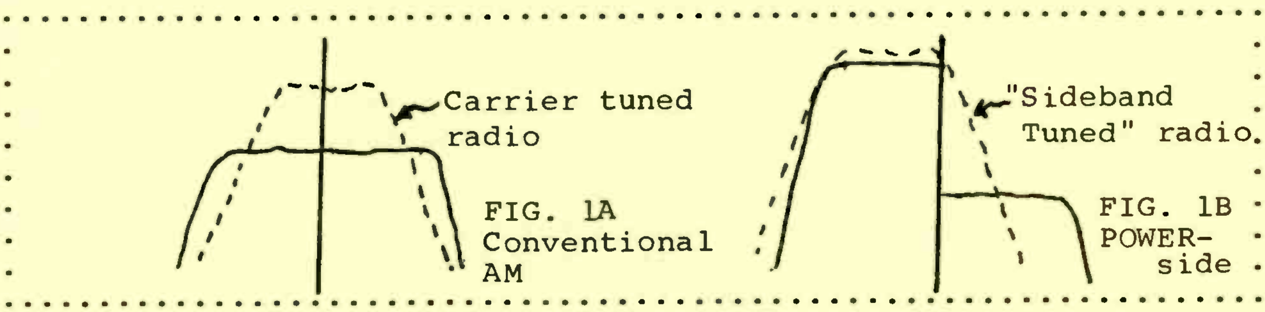

FIG. 1 illustrating enhancement of the lower sideband.

In FIG. 1 we provide an example of the enhancement of the lower sideband. A station suffering from adjacent channel interference from a station above the POWER-side station would generally wish to enhance the lower sideband. FIG. 1B demonstrates that "sideband tuning" produces more signal energy in the receiver´s passband.

Thus, when a listener sideband tunes to the enhanced sideband, the loudness is increased. Even more important than the increase in loudness is the dramatic increase in fidelity, when typical radios are used.

KAHN COMMUNICATIONS INCORPORATED

The reason for this dramatic improvement in fidelity is that a typical receiver is much too narrow, even for reception of voice signals. For example, the standard car radio, introduced in the 1980s, has a 6 db audio response of 2.2 kHz! If the IF bandwidth limits the overall fidelity of the radio, (not the audio amplifier section) and the radio is sideband tuned by 2 kHz, a 4.2 kHz bandwidth becomes available!

Thus, we have generated a wave that can take advantage of the well known concept of Information Theory, the "matched filter" principle. We have actually matched the transmitted wave to the typical narrowband radio in your listeners´ homes.

The main problem - Pre-emphasis

Years ago, sophisticated listeners "sideband tuned" their AM receivers, to combat noise. Thus, although the average receiver had substantially better frequency response in the 1960s than it does today, there was, even then, a substantial advantage in "sideband tuning" in noisy locations. "Sideband tuning" was also effective against adjacent channel interference.

Advent of Pre-emphasis

But with the introduction of poorer (narrow band) fidelity receivers in an attempt to minimize the overcrowding of the AM band, broadcasters were forced to provide compensation (pre-emphasis) so as to at least partially restore system fidelity.

The use of pre-emphasis, of course, increases splatter and the leading car radio manufacturers, instead of recognizing that further narrowing the bandwidth of their radios would force broadcasters to use more pre-emphasis, (thus increasing interference) further narrowed their receivers. The spiral has now reached the point that the use of 2.2 kHz audio receivers is widespread and this has forced the use of, as much as, 18 db of transmitter pre-emphasis.

Such heavy pre-emphasis has made the use of even small amounts of "sideband tuning" impractical, because detuning increases the pre-emphasis harshness. Thus, the use of "sideband tuning", to improve reception in poor signal locations, has practically disappeared.

POWER-side Audio Processing

The special audio processing incorporated in the overall POWER-side system provides the advantages of "sideband tuning" without the harsh sound caused by pre-emphasis. And, because it enhances modulation in one sideband, POWER-side improves both the signal-to-noise and interference ratios. And, most importantly, POWER-side processing will cause all listeners, not just sophisticated listeners, to automatically "sideband tune" their tunable radios, in noisy locations, because they will hear the loudness and intelligibility increase.

Of course, the POWER-side broadcaster must be careful to produce a clean spectrum (avoid overmodulation, clipping, neutralize the transmitter, etc.) or he will make "sideband tuning" difficult and deny his own listeners the full advantages of POWER-side.

Thus, POWER-side users will not only improve their own performance but will cause less interference to their AM neighbors, thus helping AM radio generally.

Conquers Pre-emphasis Tuning Harshness

Let us first discuss the method by which POWER-side audio processing removes the harsh pre-emphasis tuning problem. The POWER-side audio processor incorporates circuitry that de-emphasizes the audio that subsequently feeds the stronger sideband so as to counter the station's normal pre-emphasis. By making the strong sideband relatively flat, the difficulty in offset "sideband tuning" is alleviated bringing back the "good old" days when tuning a radio was much easier.

But if you remove pre-emphasis, what happens to reception when low fidelity digital mono radios are used? It would, of course, degrade reception. That is why POWER-side provides additional processing for the weaker sideband.

Thus, the weaker sideband supports the necessary pre-emphasis effect so that you can maintain good service for listeners to low fidelity digital mono radios.

Which sideband should a station use?

It does not matter which sideband is strengthened if a station's only problems are noise, antenna nulls, selective fading and poor fidelity. However, if your station suffers from adjacent channel interference, raising the level of the sideband away from the interfering station, provides another important advantage. (If co-channel interference is the problem you should, if the interfering signal has already implemented POWER-side, take the opposite sideband.)

Your listeners will automatically "sideband tune" to the strongest sideband and;

1) The loudness of your signal will be enhanced because more sideband energy will pass through narrow band radios, and,

2) Secondly, your listeners, by tuning their receivers away from the interference, place the interference lower on the selectivity curve.

These two effects combine to provide substantial improvement in both signal-to-noise and signal-to-interference ratios when conventional tunable radios are "sideband tuned".

On the other hand, the POWER-side advantages in antenna nulls, building and power-line reradiation problem locations, and areas subject to selective fading are available for all radios, including digital 10 kHz step tuned radios.

Want more information, please call Kahn Communications, Inc., (516) 222-2221.

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• 425 MERRICK AVENUE • WESTBURY, N.Y. 11590 • 516-222-2221

NEW *POWER-side* - The Powerful Sideband System

Advanced AM sideband transmission technology from *Kahn Communications, Inc.* has finally arrived to allow AM broadcasters to *dramatically* improve *reception* of their signals in analog-tuned radios, the type the vast majority of consumers use. Not merely an incremental improvement, the patented *POWER-side* truly represents a *revolutionary* advance, allowing you to increase power in one sideband and benefit from the efficiency of *SSB* while maintaining full compatibility with *all* receivers.

This patented technology is applicable *to all types of programming,* but it is especially useful to stations that program "talk" for extensive periods of their broadcast schedule. POWER-side signals can incorporate stereo effects, but all program material essential to monaural listeners must be transmitted in the enhanced sideband.

POWER-side is a special combination of an unmodified Kahn/Hazeltine Independent Sideband (ISB) AM stereo exciter with the unique POWER-side audio processor which causes most of the sideband energy to fall on one sideband. The system is carefully designed to fall well within FCC occupied bandwidth rules.

If your listeners tune to the center of your POWER-side signal, reception is in no way degraded. However, when they tune to your *POWER-side* they will hear a *dramatic* increase in loudness with a *substantial* improvement in both signal-to-noise and interference ratios when typical tunable radios are used, actually turning the narrow bandwidth of these radios from a disaster into a distinct *advantage.*

POWER-side's advanced patented audio processing provides your listeners with the advantages of *"sideband tuning"* without the harsh sound caused by pre-emphasis. Furthermore, POWER-side processing will cause listeners to *automatically* "sideband tune" their analog-tuned radios because of the *dramatic* increase in loudness and intelligibility.

If your station also has an adjacent channel interference problem, POWER-side allows you to place your programming on the sideband *away* from the interfering station. Listeners "sideband tuning" your signal are gaining not only the *dramatic* increase in fidelity and *reduction* in noise, but are tuning *away* from the adjacent interference (co-channel interference can also be reduced). And, listeners with the new quality digital and analog multi-system AM stereo receivers can enjoy the benefits of "selectable sideband" reception.

Your station can, by remote control, instantly switch to normal high quality Kahn/Hazeltine stereo during periods of the day you do not require coverage enhancement. And, POWER-side is fully compatible with other advanced Kahn AM technology such as the *Flatterer* and *Good N Loud.*

POWER-side from *Kahn Communications, Inc.*

....Further confirmation of the direction in which *advanced* AM technology is heading.

Report on the GROWTH of

POWER—Side

Since we issued the attached brochure, six months ago, there has been a DRAMATIC GROWTH of POWER-side.

Never have we, at Kahn, seen a new product so quickly accepted by AM broadcasters.

POWER-side is now in operation in New York (3 stations in NYC equipped, and a 4th on order), Connecticut, Florida, Texas, Utah, California, Puerto Rico, Maryland, Oklahoma, New Jersey and Massachusetts, all since its first on-the-air operation in May.

And the following advantages have been proven on-the-air:

1) Reduces antenna null distortion in all radios.

2) Reduces selective fading in all radios.

3) Higher fidelity with tunable Walkman and most home receivers.

4) Easier tuning, "fatter dial", and,

5) "Sideband Tuning" allows listeners to tune out adjacent channel interference and tune down co-channel.

NEW *The FLATTERER™* - A New Approach to Antenna Broadbanding

The *Flatterer* from *Kahn Communications, Inc.* broadbands any AM broadcasting antenna, thus *audibly* improving monaural and *all* types of stereo signals.

It is obvious that in order to compete in today's market your station needs to deliver the highest quality sound possible. This is *especially* true now that high quality AM radios, such as the Sony, Sansui, Sanyo, and Kenwood multi-system AM stereo radios are entering the market.

Unfortunately, at most stations the antenna is the weak link limiting the overall fidelity by attenuating the high frequency components of one of the sidebands, thereby distorting and reducing the level of high frequency sounds.

Normally, a station would replace the antenna with a new, wider bandwidth antenna or broadband the existing antenna by use of (power-robbing) high-powered coils and capacitors, *both* methods being expensive and time consuming solutions.

The FLATTERER broadbands antennas by use of a new patented procedure that, after a one night installation, takes only 15 to 20 minutes to adjust. It does not require power-robbing coils and capacitors and allows an *extremely accurate correction* to be achieved. Since many stations experience a change in effective bandwidth of the antenna each season, the FLATTERER can save *substantial* downtime every year.

The FLATTERER can be used for all monaural *and* all stereo stations. Since the FLATTERER uses much of the circuitry normally found in the Kahn STR-84 AM stereo exciter, less than an additional $5,000 covers the necessary extra stereo circuitry. Now you can have wideband, state-of-the-art AM stereo in time for the influx of high technology, multi-system AM stereo radios. While the *Flatterer will work with other AM stereo systems,* it cannot, unfortunately, eliminate all problems inherent in these other systems. Fortunately, users of other systems can now broadband *and* (if they wish) inexpensively upgrade to state-of-the-art Kahn/Hazeltine AM Stereo.

Whether stereo or mono, the time is *now* to *add* listeners by:

* Improving high frequency sound with lower distortion
* Increasing Effective Modulation
* Enhancing separation and quality for stereo operation

THE FLATTERER from *Kahn Communications, Inc.*

....State of the art technology dedicated to AM growth.

NEW *GOOD N LOUD*™ - 125% Modulation that's *clean!*

GOOD N LOUD from *Kahn Communications, Inc.* provides full 125% modulation *without* the rough, distorted, clipping sound that loses listeners. The patented GOOD N LOUD is *free* of odd harmonic distortion and significantly reduces even order terms.

GOOD N LOUD prevents that "squashed" sound by actually *expanding* positive peaks rather than squashing negative ones to provide increased *effective dynamic range.* It keeps listeners interested and tuned to your new, lively sound.

GOOD N LOUD is *loud* without causing your signal to splatter, making it easier to tune in.

GOOD N LOUD works with all transmitters capable of 125% modulation. Note that GOOD N LOUD is not a substitute for your multi-band limiter; it complements these units. Of course, we manufacture a GOOD N LOUD AM stereo model which interfaces with the STR-84 Kahn/Hazeltine AM stereo system exciter in minutes.

GOOD N LOUD - Another *advanced* AM technology product from *Kahn Communications, Inc.*

STR-84 - *The* State of the Art AM Stereo Exciter

Kahn Communications, Inc. STR-84 represents *superior* AM Stereo engineering providing unsurpassed stereo reception on all multisystem AM stereo receivers as well as full fidelity monaural reception with *no reduction in coverage.*

Recent developments in the industry continue to confirm a multi-system future for AM stereo receivers assuring listeners that they will be able to enjoy the finest in AM stereo reception.

The STR-84 providing *unequaled* performance, is the overwhelming choice of engineers because:

* *No* degradation of your monaural signal with absolutely no loss of coverage.
* Excellent spectrum characteristics allow you to fully modulate without fear of causing interference.
* *Unsurpassed* AM stereo reception on multi-system AM stereo receivers free of "rain noise", and "platform motion". Ensures stereo coverage out to your .5 mv contour.
* Compatible with your new or old AM transmitter and your new or old antenna.
* Ready for and capable of advanced AM receiver technology of the future, including compatibility with *synchronous demodulated* sideband receivers.
* Compatible with new synchronous transmission systems.
* Building block for POWER-side and the FLATTERER.

Why not join the growing number of broadcasters *adding* listeners to their audience! The STR-84 represents the *long term* solution for superior AM stereo performance, without sacrificing your present audience and coverage.

In 1988, *Kahn Communications Inc.* will be proudly celebrating the 30 year anniversary of the *Symmetra-Peak* which stations continue to purchase....Further proof of the *long term* solutions which can only be found at *Kahn Communications, Inc.*

In addition to advanced AM *transmission* technology, we are actively researching advanced AM monaural and stereo *receiver* technology. Our goal is to ultimately make the AM broadcast medium *directly* competitive with FM in terms of both fidelity *and* profitability. *Kahn Communications, Inc.*, as always, welcomes your suggestions.

Join with us in *The New Growth Medium : AM RADIO!*

TECH NOTE #2

"FLATTERER™"

A Method for Broadbanding Antennas

The Flatterer offers AM broadcasters a new method for broadbanding antennas. Unlike conventional methods of broadbanding antennas, there are no high powered coils or capacitors required. Thus, there are no significant size or installation problems, nor do users suffer from the inefficiency of passing all their transmitter's output power through additional components.

The patented Flatterer system allows users to re-optimize their antenna, as weather conditions require, with as little as 15 minutes of down time.

How Does the Flatterer Work?

Please see FIG. 1 which is a simplified block diagram of the Flatterer.

A stereo or mono generator is used to produce a low powered wave at 1.4 MHz*. This mono or stereo wave is at less than a milliwatt level. This wave is then fed to a fairly sophisticated network that comprises six adjustable tuned circuits sections. (If both day and night patterns must be treated, there are twice as many adjustments provided.)

Because the adjustments are non-interacting one can rapidly realign the network whenever weather conditions cause the antenna to shift characteristics.

The interaction between network sections is minimized by providing an AVC that holds levels relatively constant during the adjustment of the network and by isolating the six sections by use of 50 ohm input and output terminations. Also, the six sections are mounted in individual drawn aluminum cans so that electrostatic coupling is minimized. The network uses toroidal coils insuring low magnetic coupling.

The network sections are adjusted so that the wave at the output of the network is a mirror image of the antenna's asymmetrical frequency characteristic being treated. As an example, say for a mono signal modulated by a 10 kHz tone, an antenna radiates a 3 db more upper sideband level than the lower sideband level. The Flatterer network, in this case, would be adjusted to boost the lower sideband by 3 db.

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* If the station operates within 50 kHz of 1.4 MHz a different IF frequency is used to avoid interference.

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425 MERRICK AVENUE
WESTBURY, N. Y. 11590
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The stations´s engineer has the choice of adjusting for symmetry of the common point, or even better, symmetry at the main lobe. Once this asymmetry is provided by the network the problem is how do you convert this milliwatt asymmetrical 1400 kHz wave to a wave having the required carrier frequency and power.

This is accomplished by a system closely resembling the Envelope Elimination and Restoration system (EER) which Kahn engineers pioneered for SSB HF systems.

What is done is the output wave from the Flatterer network is split into its two basic components; its phase modulation component, and its envelope modulation component. This is done by first phase detecting the wave and using the audio from the phase detector, properly equalized and time delayed for compatibility with the associated transmitter, to feed a phase modulator operating at the station´s carrier frequency. The output of the phase modulator is amplified and used to drive the associated transmitter´s RF chain.

Next, the correct envelope modulation is derived by envelope detecting the output of the Flatterer network, audio amplifying it and feeding it to the transmitter´s audio input.

By performing this procedure, the output of the associated transmitter produces a wave that corrects the tilt of the antenna system producing a symmetrical sideband structure for mono and correcting the phase modulation component of the stereo wave (L-R component) as well as providing the correct envelope modulation (the L+R component). Thus, the procedure corrects antennas by use of networks operating at low power rather than requiring networks that must handle the full transmitted power.

Conclusion

As a result of an analysis and actual on-the-air experience, we believe that the Flatterer is a major new tool for AM stations that wish to improve their mono and stereo performance so as to better compete with FM and other modern music delivery systems.

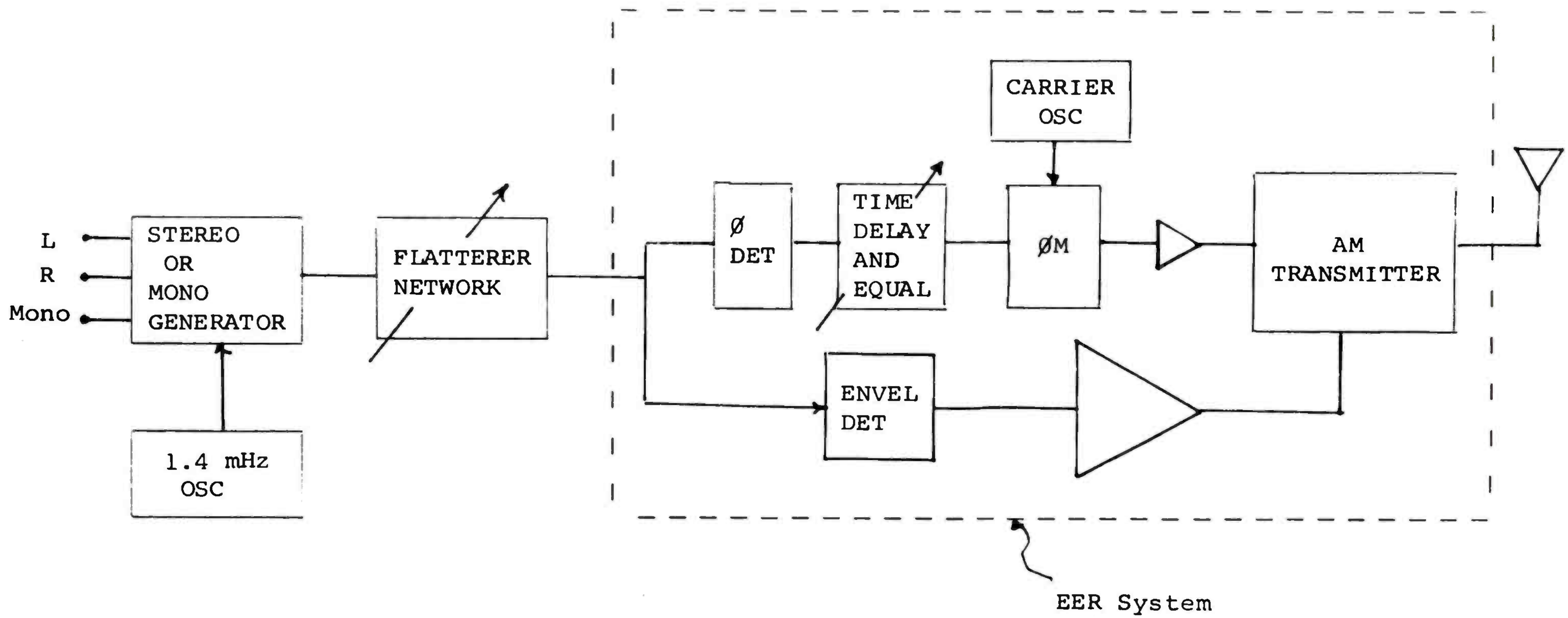
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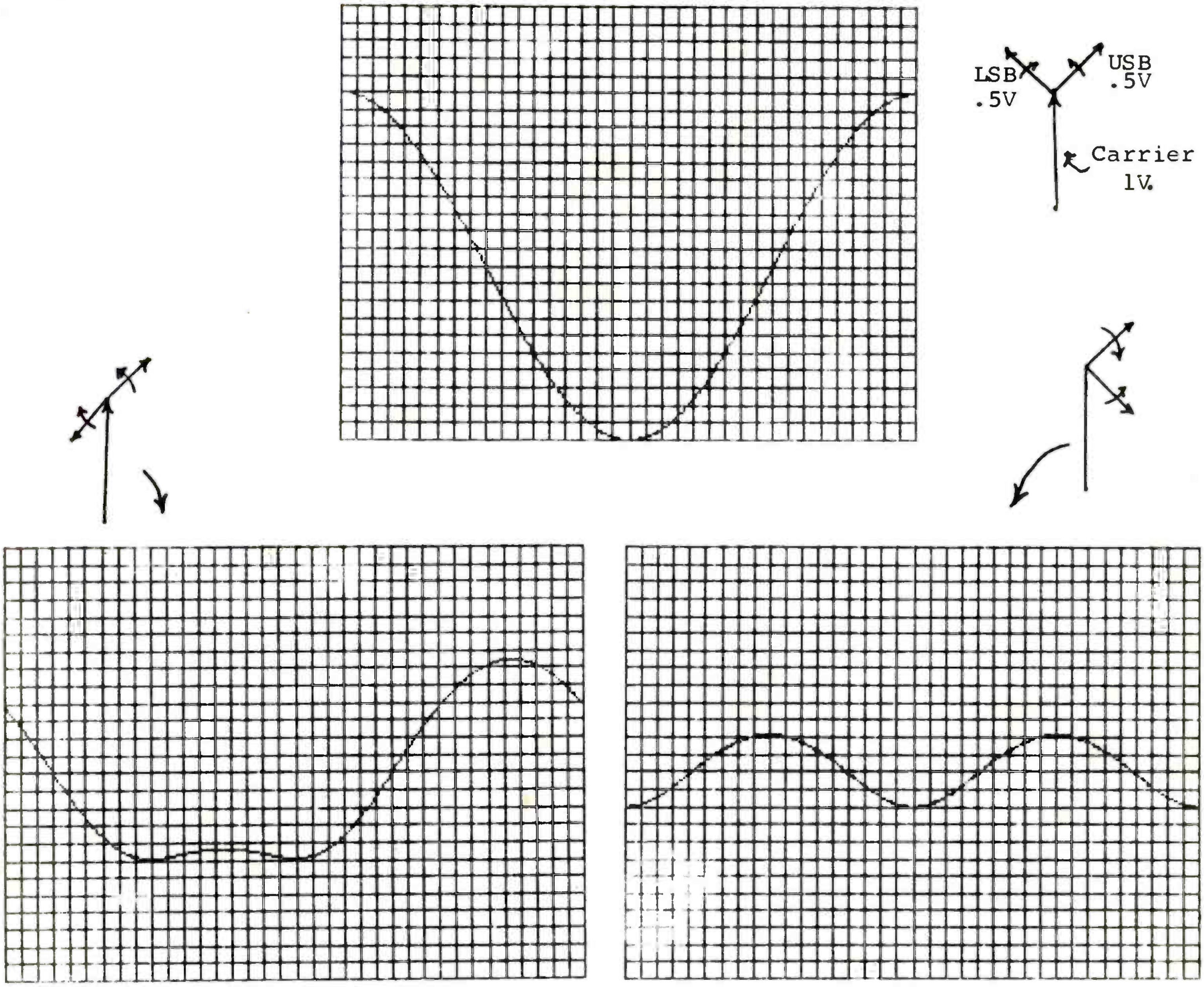
FIG. 1



FLATTERER™ - A NEW CONCEPT FOR BROADBANDING AM ANTENNAS

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(516) 222-2221

(SBE CONVENTION - BOOTH 227)

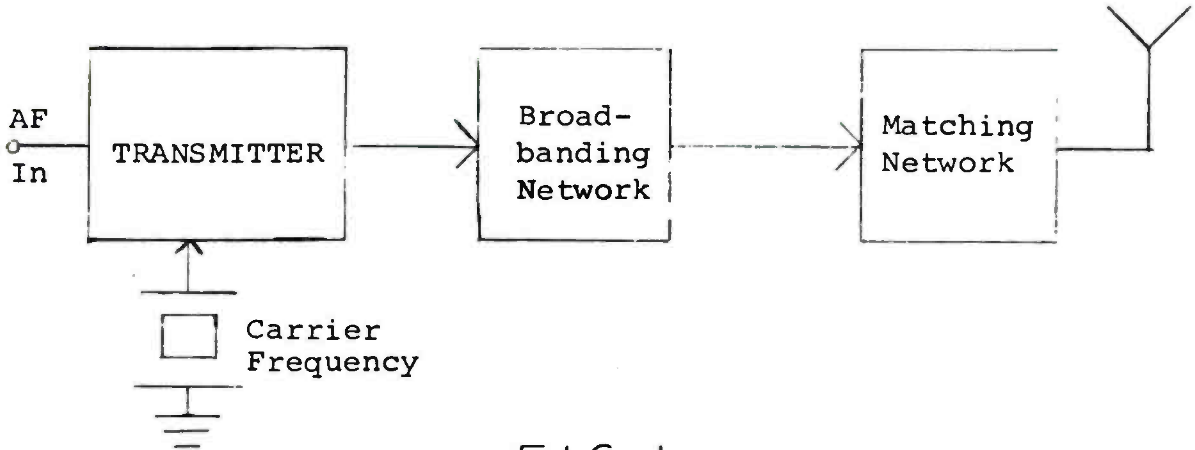
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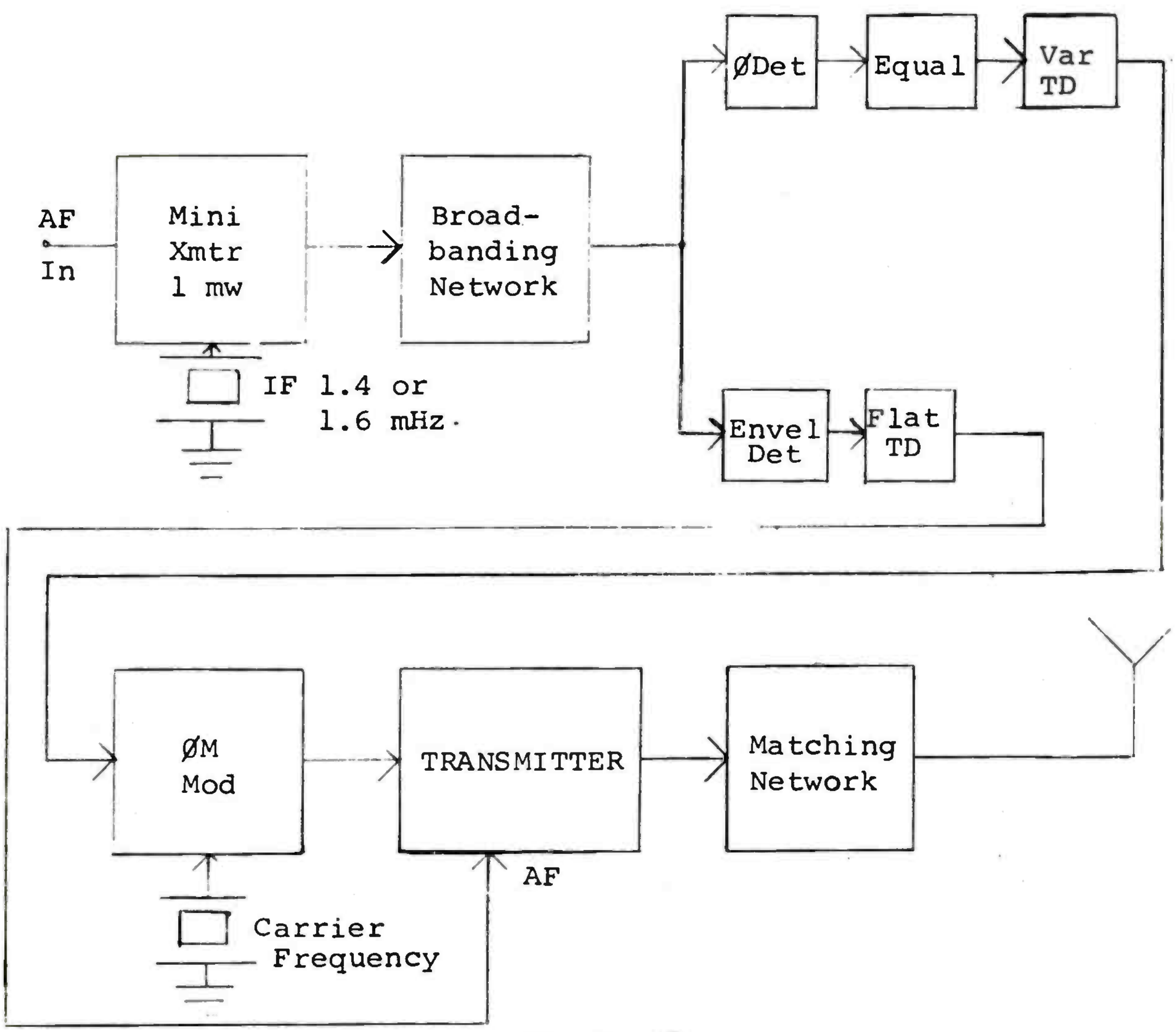
FIG.1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Matching
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Frequency

FIG.2