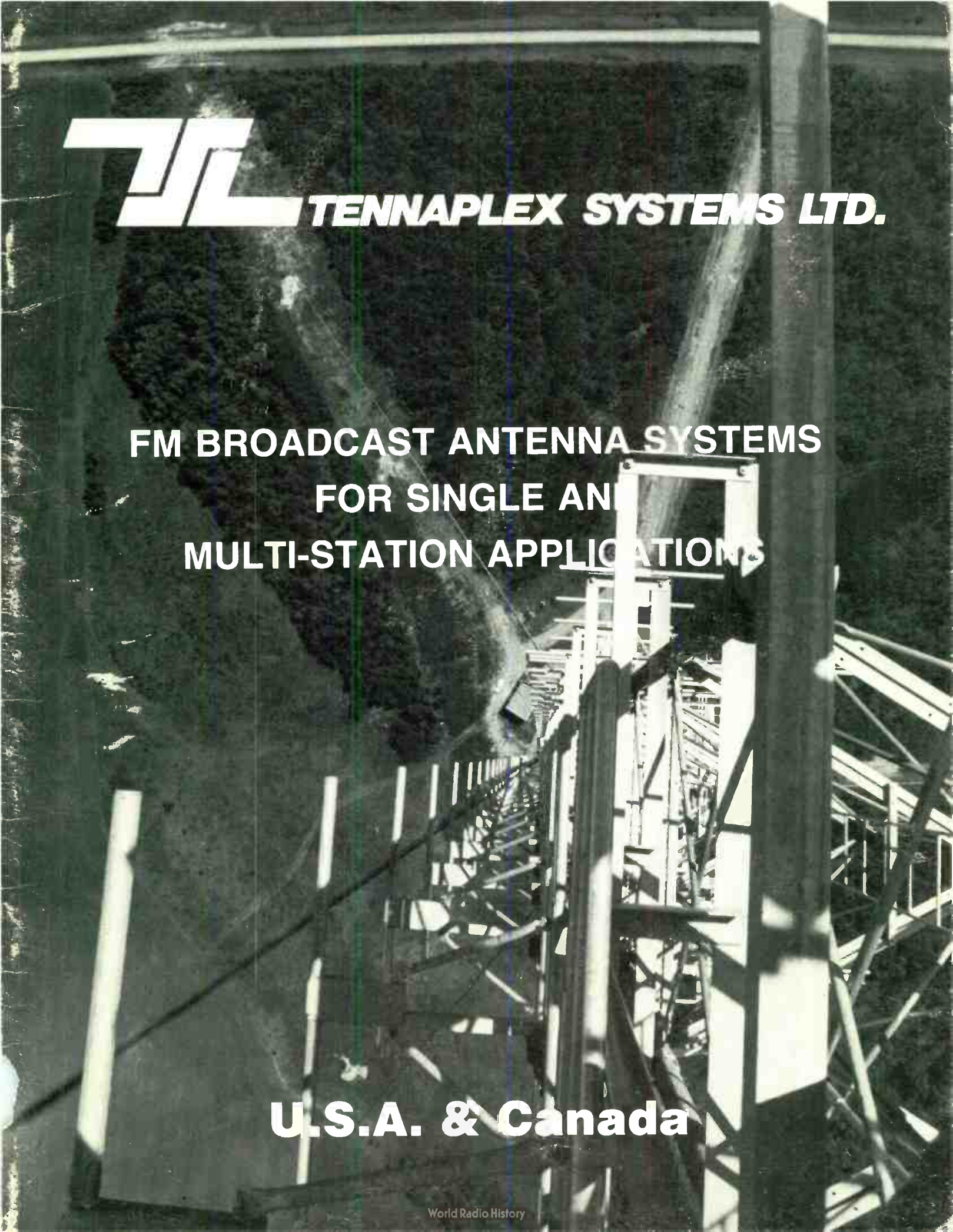


FM BROADCAST ANTENNA SYSTEMS FOR SINGLE AND MULTI-STATION APPLICATIONS

452 Five Farms Lane
Timonium, Maryland 21093
(301)-561-1999

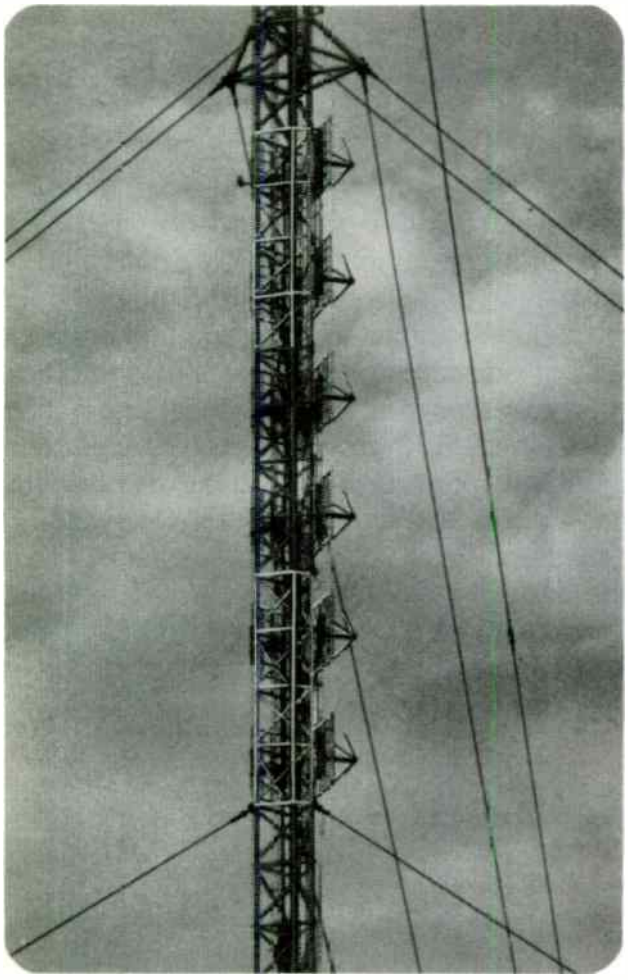
21 Concourse Gate
Nepean, Ontario K2E 7S4
(613)-226-5870

WHY TENNAPLEX?

The broadcast antenna you choose is a key element in your station's success. Without the right antenna, you will not reach the largest possible audience with a good, clear signal. Tennaplex, with its broadband FM panel antenna and its in-depth systems knowledge, helps you to achieve that goal.

If you are considering the possibility of participating in a multi-station master-antenna system (perhaps because of the new classification criteria set forth in FCC Docket 80-90), then Tennaplex, whose experience is unmatched in such systems, is the company for you.

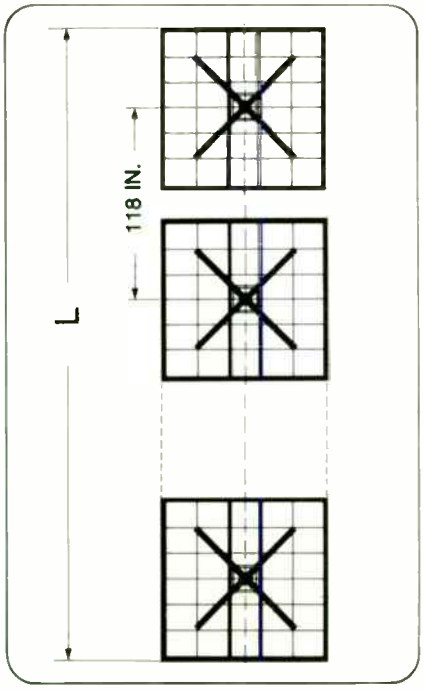
THE TENNAPLEX ANTENNA



Circularly polarized antenna systems for triangular or round masts, consisting of panel combinations for various radiation patterns.

FM Panel Antenna: 87.5–108 MHz

Impedance	50 Ω
Input	EIA flange or any other type of connector
Connect. cables	Flexwell-cable or double shielded, solid insulated coaxial cable
Connectors	Standard type connectors or EIA flanges are used throughout the system, allowing easy assembly and maintenance
Measuring link	In order to facilitate measurements, a measuring link can be provided between main splitter and feeder cable
Frequency range	87.5 - 108 MHz
VSWR	< 1.2 throughout the frequency range 87.5–108 MHz. No tuning necessary. Lower figures for individual channels on request
Power rating	Up to 300 KW T.P.O.
Polarization	Circular
Horizontal radiation pattern	Omnidirectional or custom pattern according to requirement
Vertical radiation pattern	Null fill and beam tilt on request
Factory test	On request
Antenna splitting	The antenna can be divided into 2 halves, each half accepting full power. Both halves are connected by a 2-way splitter or patch panel
Splitters	Coaxial system
Pressurization	System can be provided in pressure tight version. Air stop at panel input. Pressure appr. 4.5 psi.
Painting	If required, antenna is painted in aviation warning colors
Mount. hardware	Hot-dip galvanized steel
Max. wind velocity	140 mph. Safety factor: 2



Number of bays	Panels per bay	Peak Gain[1] dB	Peak Gain[1] times	RMS Gain[1] dB	RMS Gain[1] times	Weight[2] lbs.	Antenna height L ft	Windload (V = 100 mph.) lbs.	Windload (50psf) lbs.
1	2	0	1			310	6.0	530	671
	3	−2	0.63	−3.1	0.49	440		683	864
2	2	3	2.0			575		1057	1338
	3	1	1.26	0.2	1.05	950	15.8	1365	1728
4	2	6	3.98			1280	35.5	2103	2662
	3	4	2.51	3.4	2.19	1760		2730	3455
6	2	8	6.3			1760	55.2	3150	3987
	3	6	3.98	5.27	3.37	2710		4085	5170
8	2	9	7.94			2425	74.9	4207	5324
	3	7	5.01	6.58	4.55	3500		5450	6898
10	2	10	10.00			3000	94.6	5264	6662
	3	8	6.25	7.59	5.74	4450		6815	8625
12	2	10.8	12.00			3705	114.2	6310	7986
	3	8.8	7.5	8.41	6.93	5260		8180	10353

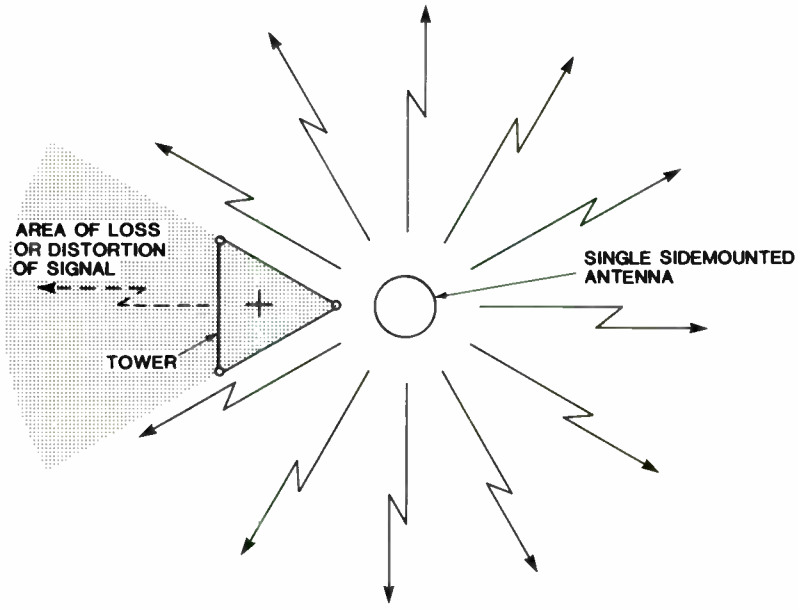
[1]) referred to the half wave dipole, attenuation of the connecting cables not taken into consideration.
[2]) without mounting hardware

THE TENNAPLEX ANTENNA

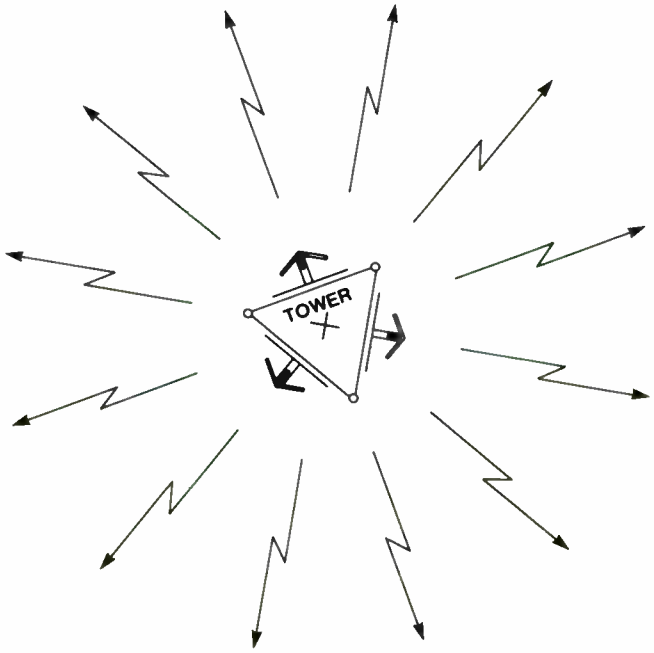
ADVANTAGE: THE TENNAPLEX FM ANTENNA PRODUCES A SIGNAL THAT IS UNAFFECTED BY ITS MOUNTING STRUCTURE

Unlike the more commonplace (in the United States) "bent-ring" or other such single-sidemounted antennas, our antenna is electrically isolated from the tower (or other structure) on which it is mounted. That means that your signal, as transmitted by our antenna, is completely unaffected by the tower whereas, in the case of "sidemounts," the signal can be partially blocked and the coverage pattern distorted by the tower, which in turn translates into reduced audience coverage and impaired reception. In attempting to offset this problem, the makers of sidemounts try, prior to or at the time of installation, to "design around" the potential effects of tower blockage and electrical interaction, but such an approach amounts, at best, to a highly inexact science. Furthermore, as the configuration of any given tower is continually being altered by structural modifications and by the periodic installation, re-positioning, and removal of other antennas, cables, ice shields, etc., so likewise are its electrical blockage and re-radiation characteristics affected. Thus, a sidemount antenna/tower combination whose coverage pattern is optimized at the time of installation may, over the years, provide lessened or poorer reception to its targeted audience. On the other hand, the signal radiated by the Tennaplex antenna will be entirely impervious to such changes.

THE TENNAPLEX ANTENNA



Single Sidemount Antennas: Signal is blocked, reduced, impaired, or distorted in passing through the tower (or other mounting structure). Even a coverage pattern that is optimized at time of installation will, over the years, be affected by changes to the tower structure or the addition or removal of other antennas, cables, etc.

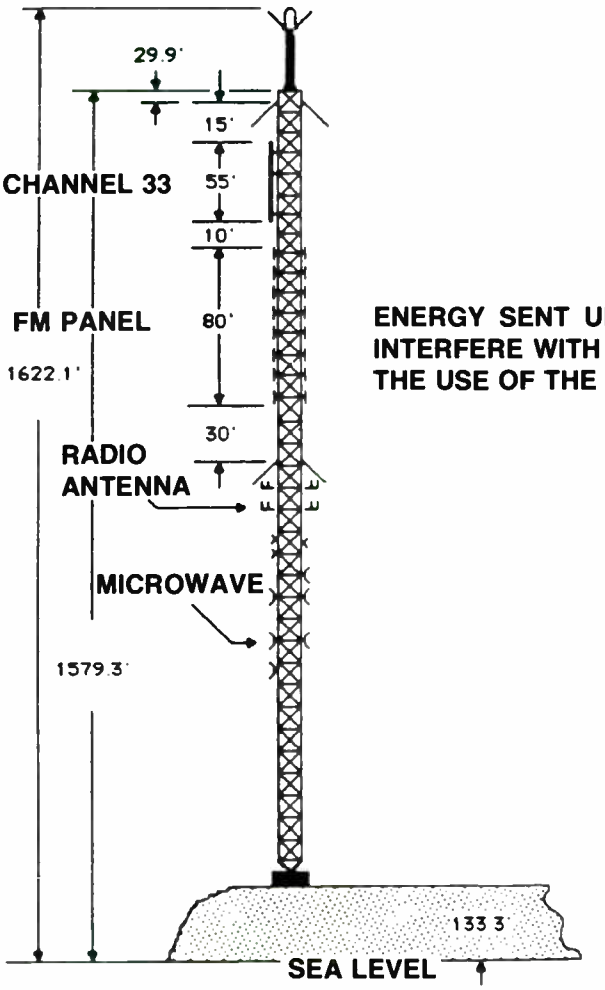


The Tennaplex antenna is completely isolated electrically from the tower and its coverage pattern is unaffected by changes in the tower's structure or by the addition or removal of other antennas, cables, etc.

THE TENNAPLEX ANTENNA

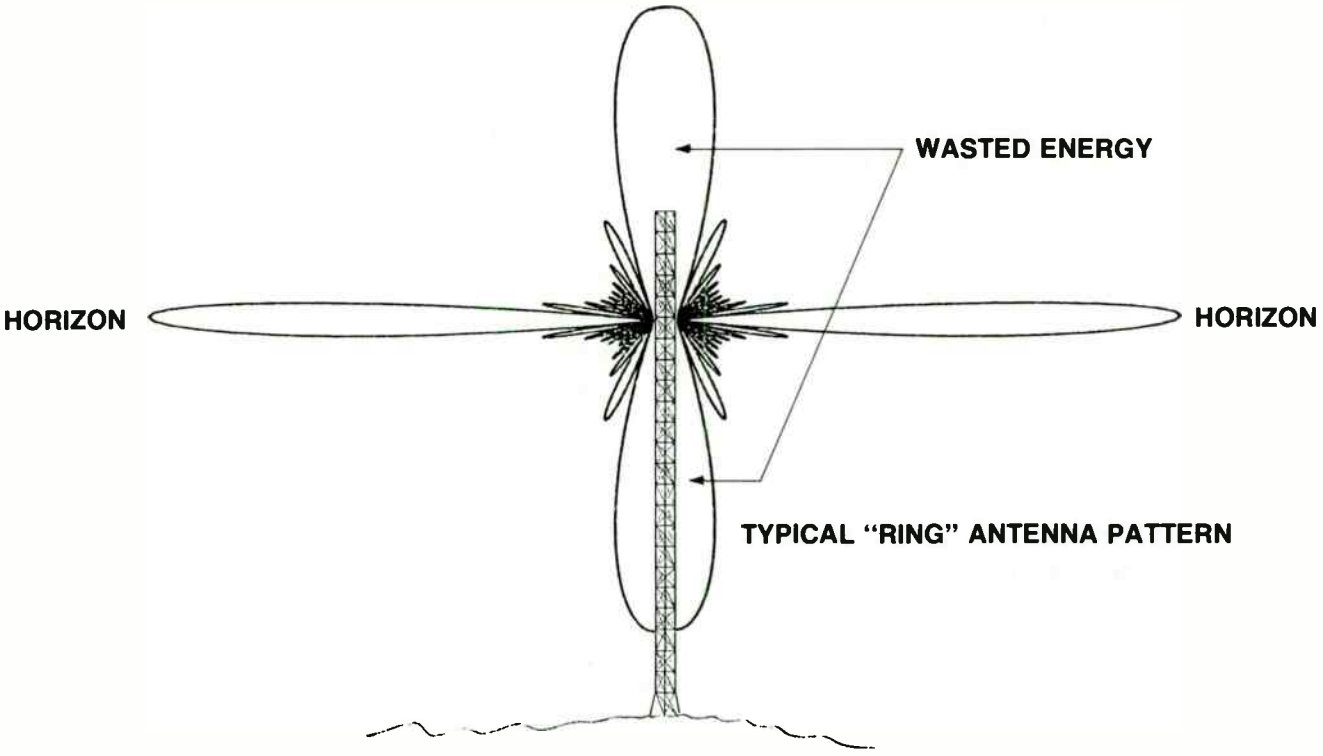
ADVANTAGE: THE TENNAPLEX FM ANTENNA DOES NOT WASTE ENERGY SENDING IT UP AND DOWN THE TOWER

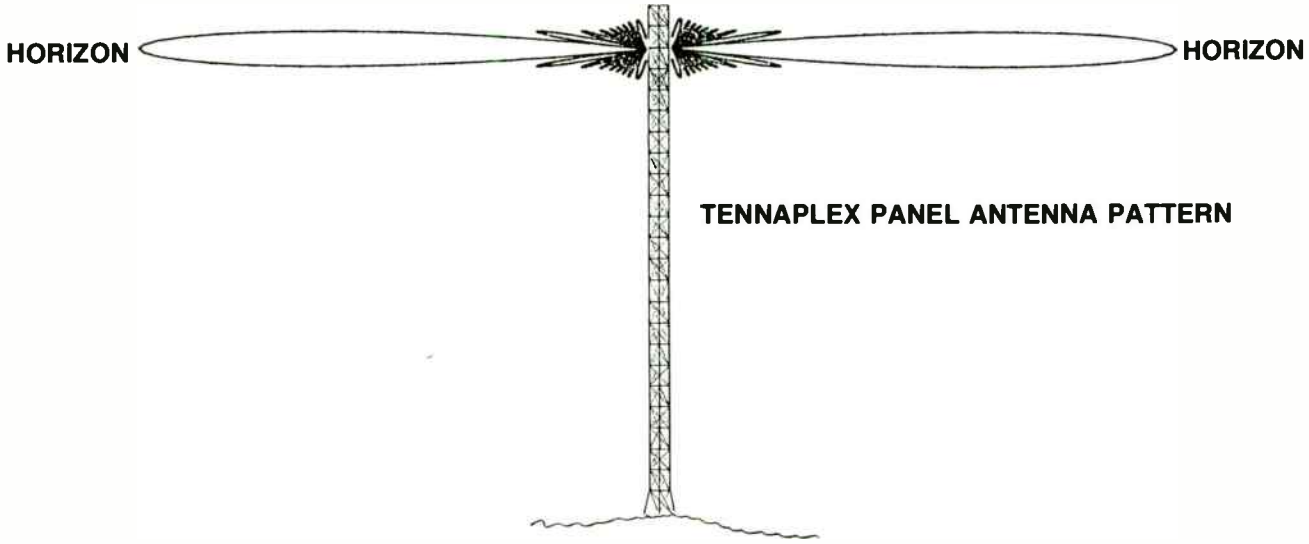
Another significant advantage of our antenna is that it does not waste energy by radiating significant amounts of it up and down the tower (i.e., toward the sky and straight down). Not only do such losses detract from audience coverage, but the misdirected portion of the signal can cause interference with other services that are also using the tower. In evaluating and selecting a broadcast antenna, one should insist upon obtaining information on its vertical radiation characteristics all the way from +90° (the sky) to −90° (the base of the tower).



ENERGY SENT UP AND DOWN THE TOWER CAN INTERFERE WITH THE OTHER SERVICES SHARING THE USE OF THE TOWER

THE TENNAPLEX ANTENNA





With the Tennaplex FM Antenna, the signal is directed toward the intended audience without significant portions of it being radiated toward the sky and the ground.

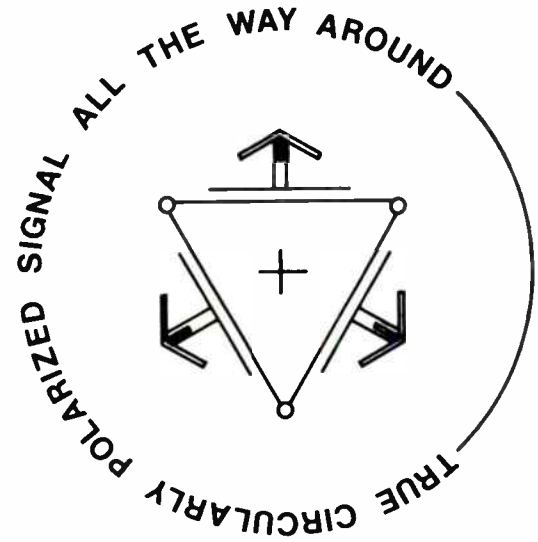
THE TENNAPLEX ANTENNA

ADVANTAGE: THE TENNAPLEX FM ANTENNA PRODUCES TRUE CIRCULAR POLARIZATION

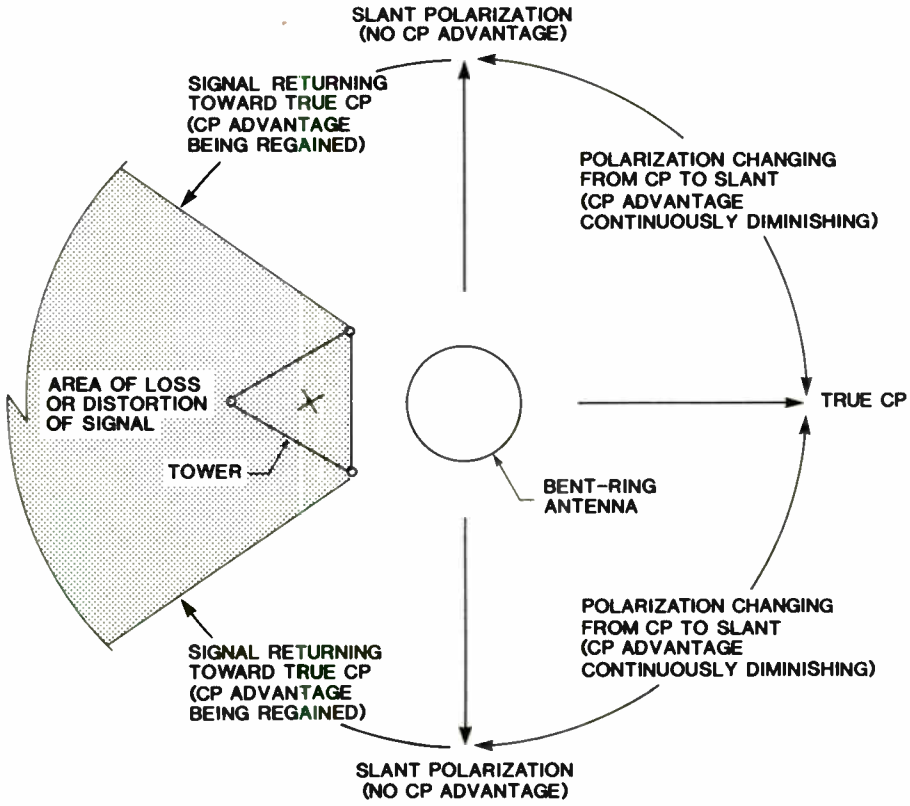
The signal produced by the Tennaplex FM broadcast antenna is circularly polarized. A great advantage of circular polarization is that the radiated energy is distributed in such a way as to maximize the chances of the signal's being received even where it has to undergo a tortuous, non-line-of-sight path from the transmitting antenna to the receiver. Circular polarization (CP) is thus a very valuable feature in concrete city "canyons" where the signal very likely has to "bounce off" (i.e., be reflected by) one or more structures before it gets to the radio receiver. "Sidemounted" antenna installations inherently have a problem when it comes to CP. Even where a nominal CP signal is generated by the antenna, its circular polarization properties are lost or greatly distorted in passing through the tower. Thus, the potential audience located on the tower side of the "sidemount" is reduced even in those cases where the tower as an obstructing element has (for the sake of argument) been successfully "designed around" at the time of installation.

The Tennaplex FM antenna radiates a true circularly polarized signal in all directions from the tower on which it is mounted and without any electrical interaction between the tower and the antenna. "Bent-ring" antennas, on the other hand, are not only subject to electrical interaction with the tower but also have the inherent problem of ever changing polarization characteristics with respect to azimuth or direction from the tower. In front of such antennas, true CP exists. As one moves to the sides, the polarization continuously changes so that, by the time one reaches the 90-degree point to the right or left of the antenna, it has become slant polarization, which means that the favorable coverage effects of circular polarization, as described above, are completely lost. (As one continues toward the back of the antenna, CP would be gradually regained but for the fact that the tower gets in the way.)

THE TENNAPLEX ANTENNA



The advantage of circular polarization (CP) is that the radiated energy is distributed in such a way as to maximize the chances of the signal's being received even where it has to undergo a tortuous, non-line-of-sight path in getting to the receiver. CP thus pays off, for example, in concrete city "canyons."



With "bent-ring" antennas, true undistorted, unimpaired CP exists in only one direction. 90° away, the signal is slant-polarized and the advantage of CP is completely lost.

THE TENNAPLEX ANTENNA

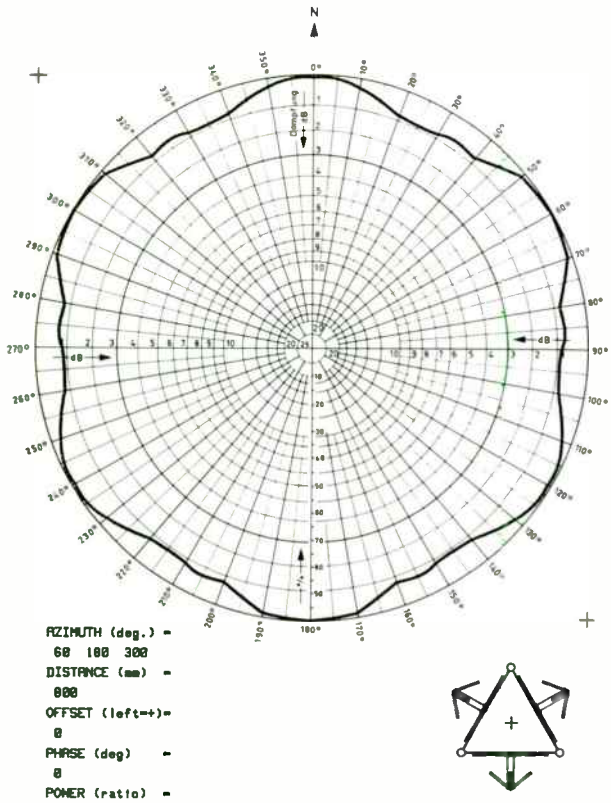
ADVANTAGE: THE TENNAPLEX FM ANTENNA DOES NOT REQUIRE DE-ICERS

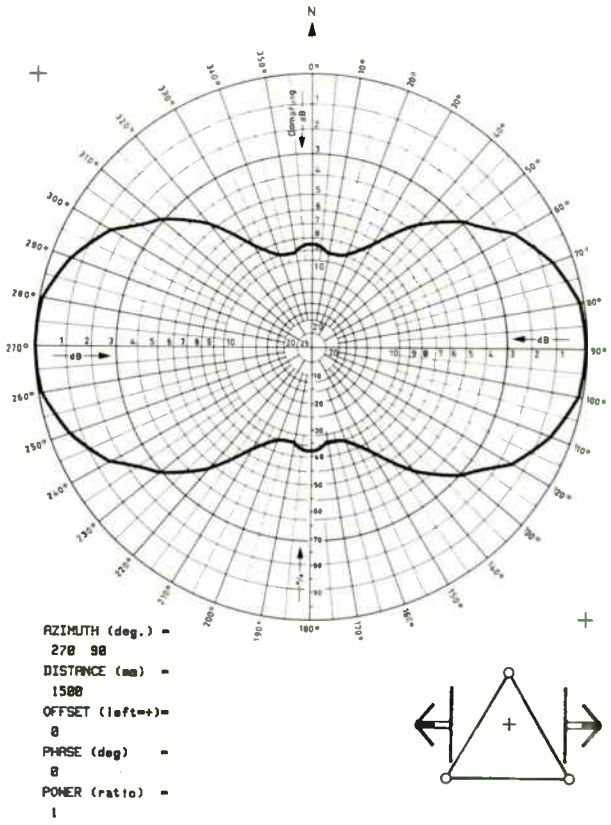
Another great advantage of our FM antenna lies in the fact that it never needs de-icers. Owing to a technique called automatic VSWR compensation, the performance of the antenna is unaffected even under the heaviest icing conditions. Thus, power bills are reduced and the addition of cumbersome equipment is avoided, while reliability is enhanced. Under icing conditions, competing antennas that lack de-icing provisions can exhibit severely impaired performance and may even fail.

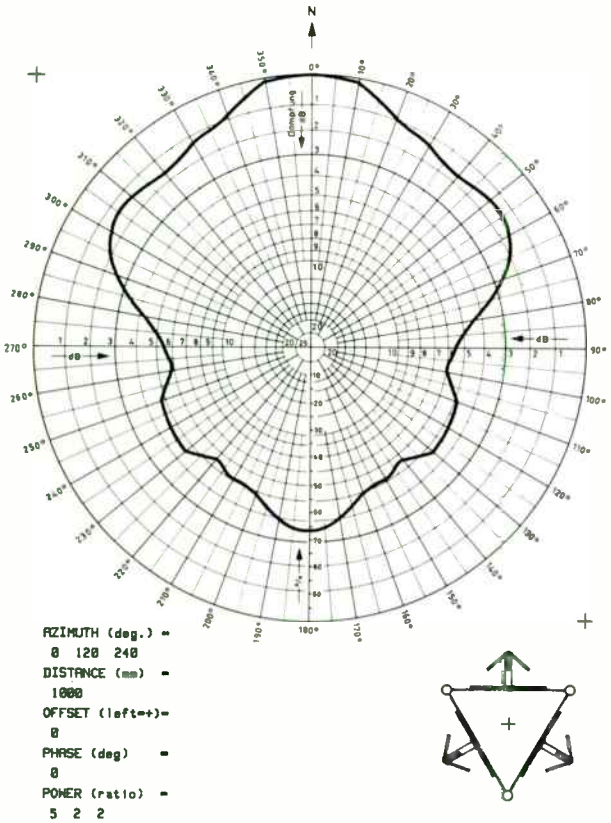
ADVANTAGE: THE TENNAPLEX FM ANTENNA CAN BE CONFIGURED SO AS TO BE EITHER OMNIDIRECTIONAL OR DIRECTIONAL

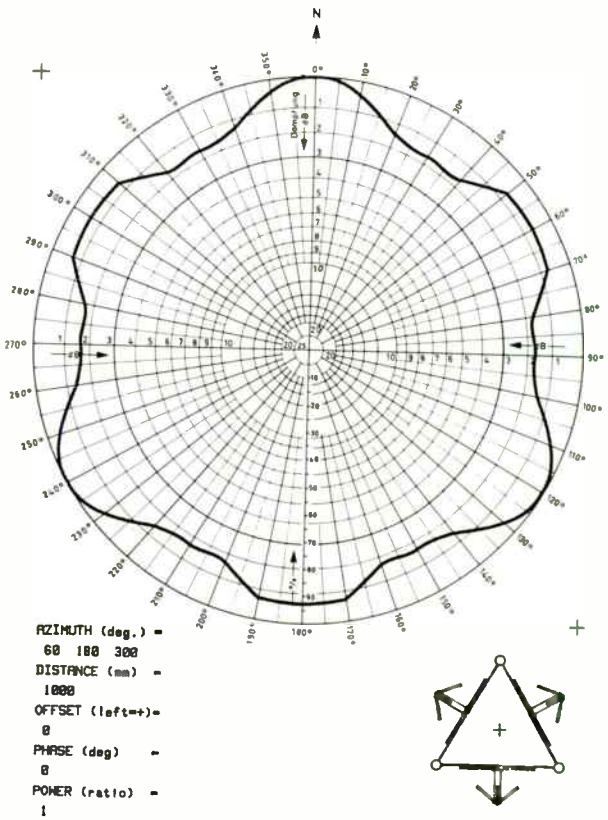
A numberless variety of antenna patterns can be produced with our antenna by altering the orientation and relative spacing of its individual panels and by adjusting electrical phasing, power split, beam tilt, and null fill. We work with you (and your consultant, if and as indicated) in customizing the patterns so that they best fill your specific needs. In that connection, we utilize our own computer program, which, it should be noted, is based on real, measured data, to evolve antenna patterns wherein the signal is not only directed toward the populated area to be served, but interference and multipath effects are minimized. The computer-generated patterns are used as a design tool in the actual manufacture of the antenna and close conformance between them and the measured patterns for the finished product is verified at the factory.

THE TENNAPLEX ANTENNA









A Few Examples of the Many, Many Coverage Patterns—both Omnidirectional and Directional—that can be produced by different configurations of the Tennaplex Antenna

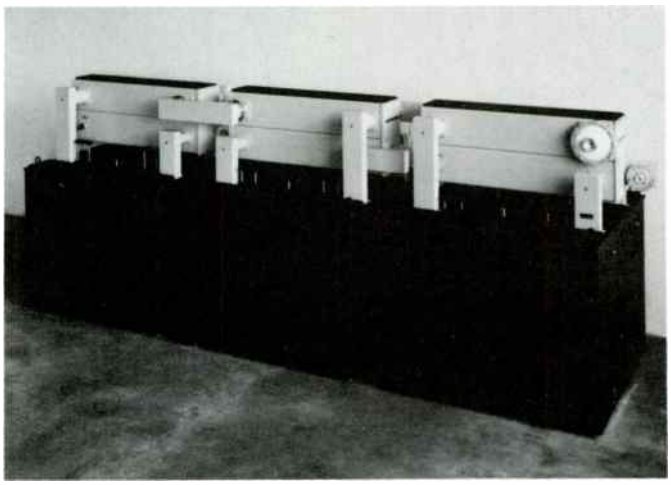
MULTI-STATION MASTER-ANTENNA SYSTEMS

DOCKET 80-90 AND TENNAPLEX

Because of the strictures imposed by FCC Docket 80-90, many existing Class C FM stations face the possibility of being downgraded unless, among other things, the height above average terrain (HAAT) at their transmitting antennas' center of radiation can be increased to at least 300 meters (984 feet). (Class A and B stations are also affected by Docket 80-90.) Often the costs attendant to a single station's maintaining its classification are prohibitive. For that reason, in many instances stations in a given market are collaborating toward the goal of a single, shared multi-station master FM antenna. If your station falls into that category, the Tennaplex FM antenna is ideal for you. In the first place, it covers the entire FM band. By utilizing it together with our combiner, we can provide you a system capable of simultaneously generating high-quality, circularly polarized omnidirectional or directional signals for up to ten stations. We are highly experienced in such multi-station master-antenna systems, having engineered and installed many of them. (No other supplier in the US matches our record in that regard.)

We offer the broadcaster a series of combiners, the essential function of which is to feed the energy from each station's transmitter into the master antenna. Our combiners are distinguished by their extremely high reliability (none has ever failed), the "cleanness" of their design (they require a minimum of external plumbing; troublesome blowers are not required because heat is distributed uniformly without "hot spots"), and the stability of their performance over wide ambient temperature ranges. They are field-retunable. In case it becomes necessary to change frequencies at a later date, the retuning of the combiner can be accomplished on site by field personnel. Also, the combiner can be expanded for the later inclusion of additional stations. Our combiners are compact and take a minimum of floor space.

The Tennaplex combiners utilize bandpass, rather than band-reject, technology. Among other advantages, the bandpass approach gives greater bandwidth (that is, it covers a greater number of frequencies), complete frequency agility (that is, there is no restriction as to the frequencies to which it can be set within the FM band), and the ability to be re-tuned, as explained above. It also affords excellent group delay response to eliminate distortion to revenue-producing subcarrier services.



A 3-Module (3-Station) Combiner. (Modules can be added for more stations.)

MULTI-STATION MASTER-ANTENNA SYSTEMS

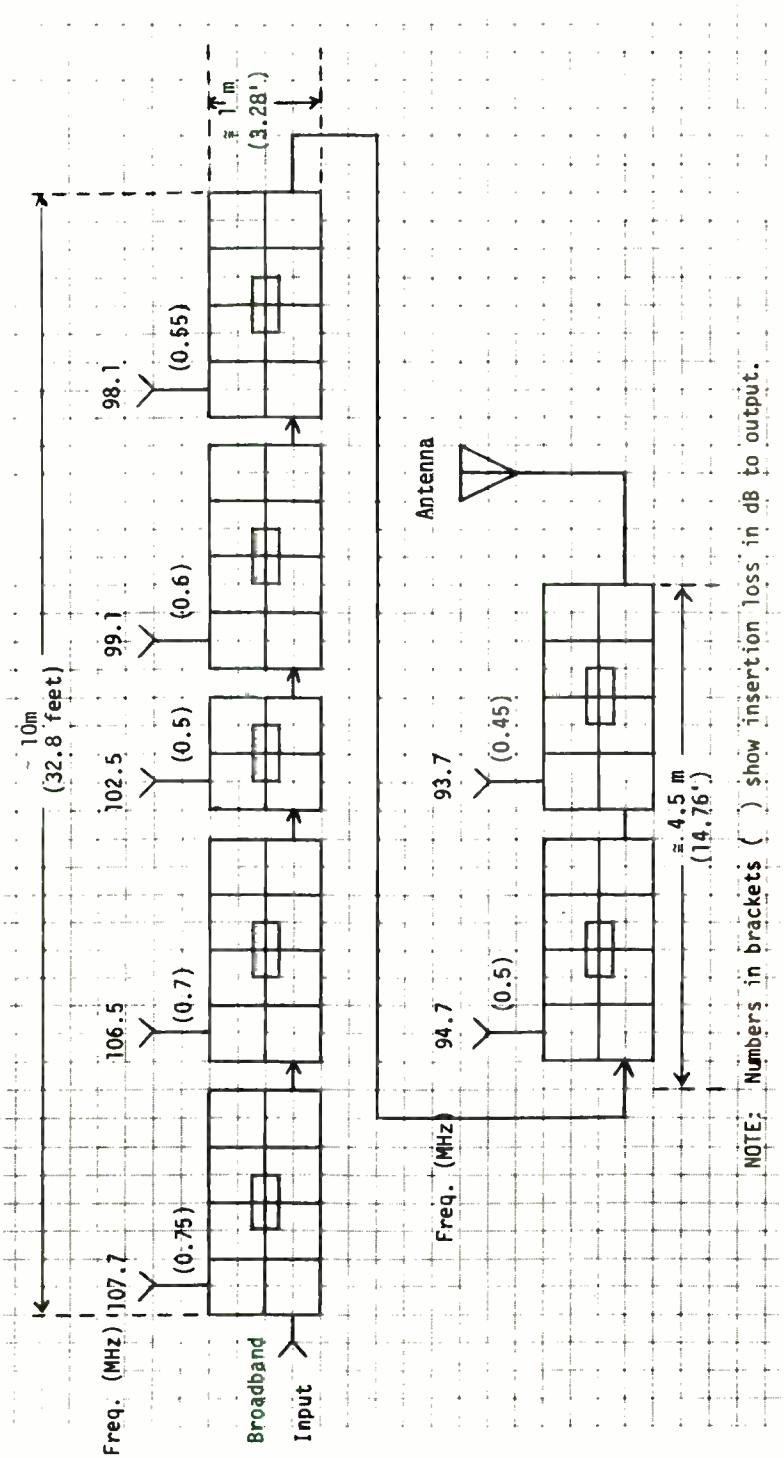


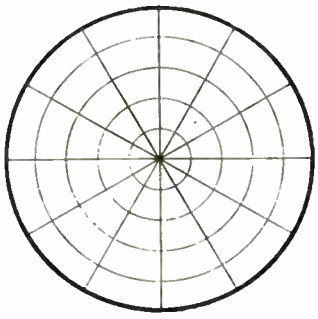
Diagram of a 7-Station System.

IF YOU WANT A PROPOSAL FROM TENNAPLEX

PROPOSING THE TENNAPLEX FM ANTENNA FOR YOUR REQUIREMENTS

Tennaplex will be pleased to provide you with a detailed proposal—including patterns, equipment descriptions, specifications, prices, and delivery—for an antenna system tailored to your requirements. In order for us to prepare the proposal, please provide the following information:

1. Operating Frequency (or Frequencies, in the case of multi-station master antennas): _____MHz.
2. Effective Radiated Power: _____KW.
3. Prime (Transmitter) Power: _____KW.
   (If you have not determined the power needed, we can make recommendations).
4. Estimated Length of Feed Line: _____feet
5. Face-Size of Tower where antenna will be installed: _____feet.
6. Null Fill Desired: _____%.
7. Beam Tilt Desired: _____°.
8. Omnidirectional or Directional? _____.
   a. In cases calling for a directional antenna, please provide details, using the polar graph shown and any other details that you feel might be helpful.



Sketch Horizontal Radiation Pattern

9. Any other considerations we should know about? (EXAMPLES: Short spacing, protected directions, populated areas of prime consideraton, etc.)
10. Do you want a turnkey installation? _____ .
11. Anticipated Date of Commissioning System _____ .

Tennaplex will provide qualified technical personnel to oversee the installation and to insure that it is successfully placed in service. Our equipment and services are fully warranted.

CONSIDERATIONS ON SYSTEM SELECTION

CRITERIA FOR SELECTING AN FM ANTENNA SYSTEM

1. Is the antenna electrically isolated from its supporting structure?

2. How will the antenna's performance (the antenna patterns) be affected by later structoral changes to the tower or by the addition of deletion of other equipment (cables, other antennas, radomes, etc.) on the tower?

3. What portion of the antenna's energy is radiated up and down the tower? To what extent will that energy interfere with other services that are also using the tower? (A full vertical radiation pattern, covering from $+90°$ to $-90°$ is important in evaluating this question.)

4. Does the antenna produce a circularly polarized pattern? Is the polarization pattern constant or does it change with azimuth? To what extent is the polarization pattern affected behind (i.e., on the tower side of) the antenna?

5. Are de-icers required for this installation? To what extent is the performance of the antenna affected by ice? Is it possible for icing to cause the antenna to malfunction or fail?

6. How closely does the antenna's horizontal radiation pattern match the station's specific coverage requirements? In cases where short spacing exists or a neighboring station must be protected, to what extent can protection be realized without undue compromise to the signal being directed toward the intended audience?

7. In cases of multi-station master-antenna systems, is the combiner of the bandpass or band-reject type?

8. In case I have to change frequencies later, can I re-tune my combiner on site?

9. How is the combiner cooled?

FREQUENTLY ASKED QUESTIONS

WHO IS TENNAPLEX?

Tennaplex Systems Ltd. is a broadcast systems house that specializes in broadband FM and TV panel antennas, combiners, and associated products manufactured to our design by Kathrein KG of West Germany. A Canadian corporation headquartered in metropolitan Ottawa, Ontario, Tennaplex engineers, installs, and maintains systems throughout North America.

The president of the company, Marvin B. Crouch, is a well-known registered professional engineer who regularly contributes technical articles to broadcast industry publications and delivers papers at related engineering meetings in both the United States and Canada. On the staff are other engineers, installers, and field-service personnel. The company takes great pride in its good relations with, and tradition of service to, its customers. Tennaplex' motto is "Technical Excellence at Competitive Prices."

Our equipment supplier, Kathrein KG, is a solid "old line" company that was founded over sixty years ago. Kathrein has been building broadcast antennas for more than thirty years.

WHAT CAN YOU TELL US ABOUT YOUR EQUIPMENT?

It is of the highest quality. Failure is truly a rarity. Both the FM antenna and the combiners (and the TV antennas as well) are of proven design and are in widespread service on every continent in the world. Over a hundred Kathrein-built combiners are currently operating in multi-station master-antenna systems. *Not one has ever failed.* That is a record of reliability that no competing manufacturer can match.

WHAT IS THE HISTORY OF YOUR COMPANY?

Since its inception six years ago, Tennaplex has concentrated on the Canadian market, where some three hundred of our antennas are now in everyday service. We stand today as the principal supplier of FM broadcast antennas in Canada, many of which are multiple-station master antennas. We now have several FM and TV antennas in operation or planned for the United States. At this writing, our first master-antenna system within the continental United States has been put into service.

FREQUENTLY ASKED QUESTIONS

HOW COME WE NEVER HEARD OF YOU BEFORE?

Until quite recently, we had no regular promotional program in the United States—we basically "served" the market by responding to inquiries that found their way to us in Ottawa. Now we have an active marketing program here and have established a facility in Maryland. If you hadn't heard from us in the past, you have now, and you will hear more in the future.

HOW CAN YOU ASSURE ME I WOULD BE MAKING THE RIGHT DECISION IN GOING WITH TENNAPLEX?

In the first place, our antennas and combiners are of proven design and have an excellent in-service "track record." You would not be taking any risk with our equipment. Also we are a "hands-on" company that routinely conducts the installation and commissioning of systems incorporating our equipment. (You can hire us to do the complete job on a turnkey basis or, alternatively, to oversee the installation and commissioning of the system.) *Furthermore, we have more experience with multi-station master-antenna systems and with directional antennas than do any of our competitors.* (Shared and directional antennas are much more prevalent in Canada; so we are regularly involved with them.) It should also be noted that our largest single overall customer, the Canadian Broadcasting Corporation (which, in terms of owned stations, is far larger than any of the US networks), maintains and enforces a very high level of performance and acceptance standards (higher, some argue, than those prevailing in the United States).

WHAT HAPPENS IF I HAVE AN OPERATIONAL PROBLEM WITH YOUR EQUIPMENT?

We are keenly aware of the criticality of "down time" and have on our staff highly qualified field-service personnel who can be dispatched to your location on a day's notice or less. We also maintain in inventory a supply of spare parts. It should be noted that Ottawa, a major metropolitan area and the capital of Canada, has regular airline connections to principal cities in the United States; indeed, many US cities are more accessible by air from Ottawa than they are from the locations of some of our competitors' field-service headquarters. Having said all that, we would still emphasize that our equipment is the most reliable you can get and that malfunction or failure are rare (barring, of course, acts of God, accidents, and the like). Be that as it may, we care about all of our systems and will be there if and when you need us.

FREQUENTLY ASKED QUESTIONS

WHAT ARE YOUR WARRANTY PROVISIONS?

Where we perform a turnkey installation or are hired by you to oversee the installation and commissioning of the antenna system, our equipment and its performance as a system are warranted in full for one year from the date of commissioning. Where you conduct your own installation and do not retain our services to oversee the installation and commissioning, the equipment is warranted for one year from the date of delivery to you.

WHO ARE YOUR CUSTOMERS?

As mentioned above, our biggest single customer has been the CBC. We also have many commercial FM and TV customers in Canada, and have gained several TV and FM customers here. Also, our first multi-station master-antenna system in the United States is now operating. Further, we are in the midst of competitions for a number of other master-antenna systems, not to mention single-antenna systems, for both FM and TV.

WHAT ARE YOUR RELATIONSHIPS WITH YOUR CUSTOMERS?

In a word, excellent. If you wish, we shall provide you with a complete list of Tennaplex' customers in the hope that you will contact them for references on our company, its products, and its performance both before and after the sale is made.

ARE YOUR PRICES COMPETITIVE?

Yes.

A FINAL WORD

We hope you will give Tennaplex the opportunity to show you what we can do for you. If you do, we will amply vindicate your judgment.

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TIMONIUM, MARYLAND 21093
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(613)-226-5870