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Before the

Federal Communications Commission

Washington, D. C. 20554

In the Matter of:	)	
An Inquiry into the Commission's Policies and Rules Regarding AM Radio Service Directional Antenna Performance Verification	))))	**MM Docket No. 93-177**

COMMENTS of R. Morgan Burrow, Jr., P. E.

1. R. Morgan Burrow, Jr., a consulting engineer whose qualifications are known to the Federal Communications Commission herby submits his comments relevant to the topics discussed in the Notice of Proposed Rulemaking. The comments submitted herein are strictly those of the writer and do not express the views of any employer, engineer, station licensee, or any other concerned organization or individual. Any agreement with other parties is strictly a coincidence.

2. This Notice of Inquiry is appropriate in light of the Commission's "effort" to clean up the standard AM broadcast service. It is this commenter's opinion that this proceeding should have preceded Docket 87-267 - but one can always count on a Government agency to get priorities reversed. The most restrictive allocation requirements adopted in Docket 87-267 will mean nothing if reliable and standardized means of verifying performance of standard AM broadcast antenna systems is not in place.

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List A B C D E

Therefore, this commenter does not favor wholesale "gutting" of the AM directional antenna performance rules. The present mess on the AM band is a memorial to "letting wolves run the hen house" over the past 13 years. It is more than a coincidence that well funded, large broadcast organizations seem to get their way in regulatory proceedings (reference Docket 87-267 and others). Commenters who called for enforcement of existing rules instead of changing allocation requirements in Docket 87-267 prior to its adoption were ignored in toto. Perhaps even in this "Democratic" administration, the attitude downtown still is "We have our minds made up, don't confuse us with the facts---if you don't have a lot of money we won't listen to you".

Requirements concerning minimum measured RMS for directional antenna systems should **not** be relaxed since this is tantamount to the "warehousing" of coverage area by a licensee or permittee. Since the FCC records and coverage computations for domestic directional facilities are presently derived from standard or augmented patterns, a measured pattern not in compliance with present rules essentially represents "warehousing" of coverage area by a licensee unless a proponent studying allocation conditions conducts field intensity measurements to support improvement to another existing station or new facility. This commenter believes that a minimum of eight measured bearings be used to establish the measured RMS of a standard AM facility.

3. Predicted Outcome of Proof Deregulation and Need for Congressional Intervention:

This commenter believes that wholesale deregulation of the AM directional antenna proof rules will turn the standard AM broadcast service into a "waste land" where the late FCC Chairman Newton Minow would turn over in his grave twice (once for TV and again for AM). This commenter supports requiring eight-radial proofs for any "simple" directional antennas authorized on the 1605-1705 kHz band.

This commenter believes that Congress needs to micromange the FCC's budget more stringently and allocate funds for enforcement that cannot be shifted by or within the agency for other purposes. The funding should be sufficient to allow full inspection of every AM, FM, TV, and cable facility at least once every license period or at most ten year intervals. The funding should be sufficient to permit the Commission's Field Operations Bureau to hire and train qualified engineering personnel, provide them suitable measurement equipment, travel funding and other means to discharge their duties efficiently, complete the inspections within the ten year time frame, and maintain a similar inspection cycle thereafter.

4. **Advances in Modeling Techniques:** This commenter believes that new advances in antenna modeling when properly used are beneficial to stable design and performance. The numerical modeling techniques (especially the Numerical Electromagnetics Code [NEC]) and others classified under the category of "Matrix Methods" or "Method of Moments" can aid in the design of broadcast antennas to ultimately determine component requirements for an AM station's AM phasing/coupling equipment. This commenter uses NEC and some of its derivatives in estimating antenna drive points for the design of AM antenna phasing and coupling equipment.

One "hazard" of the matrix method computer programs is that the user supplies the array geometry and control parameters as to how the data will be processed. Programs employing the older hemispherical integration and trigonometric methods to compute antenna patterns such as the Commission's RADIAT program fix internal processing parameters and these cannot be changed by the user.

RADIAT and similar programs do not require large amounts of computer time. The matrix method programs such as NEC that perform matrix fill and inversion can consume considerable

computer time and resources, especially if certain processing options are chosen. Even as crude as RADIAT is, it is at least standardized and reasonably satisfactory for computing antenna patterns, especially for the regular series tower. This commenter does take exception with validity of some optional computations in RADIAT, especially the near field and stability routines. Antenna impedances computed using the matrix method programs are generally more representative in the real world and useful for equipment design. Impedances computed using RADIAT in the Signal 5 option rarely represent real world conditions.

One hazard of using most of the matrix programs is that these require voltage and phase input for each antenna instead of a field and phase as used by the RADIAT program. Note the example in the Appendix of a NEC computation for the two tower directional array at KYW in Philadelphia, PA and compare the computed antenna currents to the currents filed in their Application for License.

A transformation of input parameters from the usual field/phase to voltage/phase is therefore involved which is probably not standardized. One scheme developed by James Logan, et al at the NOSC San Diego, California center computes MININEC/NEC parameters from the actual pattern (Reference NOSC Technical Document 866, February 1986).

The matrix programs do not compute "standard" and "augmented" patterns, and the results of these programs will be at variance from RADIAT patterns, especially for various top-loading and sectionalization schemes represented by RADIAT's GETFTH (for F of Theta) routine. The matrix programs do not compute stability (now known as RSS/RMS ratio). Pattern designs with RSS/RMS ratios greater than 1.6 and certainly greater than 2.0 should be discouraged. The stability routines in RADIAT are in the opinion of this commenter non-representative of real world conditions. Some recent work by K. Lahm may be more representative if

measurements support it.

The concepts of "standard pattern" and "augmentation" as known in the present regulations are used as a standardized means to compute unattenuated fields for allocation work. The FCC's RADIAT program computes theoretical, standard, and augmented patterns, and works in conjunction with the AM Engineering data base parameters. Available information indicates the Commission has been using this program for approximately 18 years to assist in AM application processing. A wholesale change of computation procedures would most likely be disruptive and perhaps expensive. Replacement or development of suitable computer software is bound to be time consuming and expensive; disruption both in application preparation as well as processing at the Commission is inevitable.

6. **Reradiating Structures:** The presence and effect of reradiating structures is a site specific situation and attempting to incorporate these structures in a directional antenna model may lead to a lot of confusion, especially if incorporated in a 301 type application. Absolute performance of an antenna system should of course be left to actual measurement. Taken properly, measurements will show where the effect of structures that are not a part of the array itself when included in the localized RF environment. This commenter agrees that reradiation matters are an appropriate purpose for pattern augmentation and the only change to the present method of handling this situation is to permit augmentation beyond measured values on non-monitor point bearings.

   This commenter notes that the reradiation routines in the FCC's RADIAT program apparently do not work when compared to the more recent routines such as the matrix programs.

   This commenter assumes that most of those who will read these comments (especially Government employees) spend most if not all

of the 40 hours per week in the office behind a desk. There is simply a limit to what can be done in the office behind a desk when the situation really requires evaluation in the field.

7. **Misadjusted Directional Arrays:** The Commission's Notice of Inquiry claims that some commenters place the blame for interference on "misadjusted" directional antenna arrays. This may or may not be the actual case. There is at least one documented case of "pattern inversion" applied to a nighttime directional array with unequal height towers in the FCC files. The inverted pattern apparently was licensed by the FCC.

   There are many more people working on broadcast systems now than there were fifteen years ago with various degrees of experience and education. The widespread availability of personal computers and computer programs aid computational aspects of this work. The computer programs are no better than the data being fed to them, and this goes back to the people using them. I personally heard Dr. Richard Adler of the Naval Postgraduate School comment in the course of a lecture when using the NEC (Numerical Electromagnetics Code) program "be sure your results are consistent and make sense". Therefore, interpretation of computerized results cannot be neglected.

   The trade papers advertise personal computer software on a regular basis. Personal computers with considerable computional power and speed are now relatively inexpensive. Some engineers in the industry write their own software for commercial purposes or aid with specialized allocation/equipment design work for their own clients.

   This commenter believes the serious problem of "apparently" misadjusted directional arrays is actually the result of 13 years of excessive deregulation and the Commission's failure to budget funds for adequate field inspections and enforcement of its own rules. The oversight committees in Congress have apparently been

"sold a bill of goods" while the Commission's running this Notice of Inquiry essentially is an admission of trouble since the AM broadcast band turned into a waste land as a result of excessive deregulation. Had the Congressional oversight committees done their job properly, they may have found a regular pattern of the FCC's shortcomings to adequately budget money to field inspect all stations at regular intervals and enforce its own rules. This commenter understands the FCC inspector general has evidence of several situations of gross negligence concerning AM broadcast situations; follow up action is stalled for unknown reasons (maybe political or big money).

The Commission's failure to enforce the rules is actually an incentive for stations to divert technical resources from maintenance of their facilities toward other "more visible" areas such as remotes and/or studios. Therefore, licensees who may have otherwise maintained their AM antenna arrays when partial proofs were required have allowed them to slip into disrepair and subsequent improper operation. Many licensees "claim" that if the transmitter stays on the air, the antenna is working properly. This in most cases obviously is not the case.

Unfortunately, station ownership has drifted from bona fide radio broadcast and technical people to investors simply interested in the bottom line. The investors typically do not give a damn about the station's transmission facilities except perhaps the more visible studios. Typically, these investors are the same high rollers that throw a lot of money to the large broadcast organizations to lobby for less enforcement, general disasters such as Docket 87-267, and more deregulation.

Bona fide radio people take pride both in the studio and transmission facilities. Fortunately, the Commission's fine schedule coupled with regular inspections can be a step in the right direction since it has the potential to make a substantial dent in the bottom line should licensee(s) fail to keep

transmission facilities in proper condition. Again, this commenter suggests that Congress directly line item allocate money for the singular purpose to put and keep its inspectors in the field and perhaps allow money from fines and license fees to pay for a reliable consistent enforcement program.

8. Instrumentation

(a): Field Intensity Meter: This commenter believes that the AM licensee with a directional antenna must own or have ready access to a calibrated field intensity meter. The calibration period for this instrument should not exceed three years. Facilities that calibrate these instruments should be able to demonstrate traceability of its procedures to the National Institute of Standards and Technology.

(b): Antenna Monitor: Each AM station with a directional antenna should have an approved antenna monitor installed near the location of the antenna phasing equipment to facilitate adjustment. To minimize correction errors, new broadcast systems should incorporate equal length phase stabilized sample lines or equivalent method affording equal or better accuracy.

This commenter supports a three year calibration cycle for antenna monitors. The antenna monitor should be recalibrated if critical circuits are damaged by lightning or other surges. The calibration should be performed at the factory or by a service using test equipment of suitable accuracy.

The matter of extension meters or digital displays for studio monitoring or interface to remote control devices is best left for those designers and manufacturers who will certify proper operation of such an equipment package as part of antenna monitor type approval. Arbitrary limitations on cable lengths for extension meters such as Section 73.1550(2) should be eliminated. A regulation stating that extension meters shall be installed strictly in accordance with the equipment manufacturer's

instructions should be used to replace Section 73.1550(2).

(c) Measurement Intervals - General: This commenter supports the general principles in Section 73.186 of the Commission's Rules. The measurement intervals suggested by this section represent a hardship since ready, repeatable, long term access to open areas is rare. There is much more "awareness" of ordinary people and reluctance of many of those who perform proofs to trespass on private property to make these measurements. This commenter supports a generalized requirement for measurement intervals compatable with taking data at "public access" locations such as where the measurement crosses a public road, parking lots, cemeteries, and other "common areas". The desire to obtain sufficient data points for plotting on the graphs must be coupled with the problem of ready access to suitable measurement locations.

Near field correction routines exist (reference Dr. J. K. Raines) for correction of measurement data for array proximity effects.

(d) Regular M.P. Measurements and Partial Proofs: The FCC rules should be amended to require monthly readings at field monitoring points for all AM directional stations. The purpose of this is simply to require a licensee to devote some regular technical attention and time to the transmitter site and the equipment.

This commenter believes that a requirement for a partial proof every five years on a directional pattern should be instituted.

(e) Logging of Parameters to Trap Trouble Conditions: The FCC rules should be amended to require operators at facilities with no automatic logging or alarm to keep a log of transmitter and antenna parameters - the readings to be made at minimum intervals of the middle and end of the duty shift. Additional entries would be required for out of tolerance conditions.

(f) Sampling Systems: This commenter notes the overall

reliability of toroidal sampling transformers for monitoring antenna parameters. Arrays incorporating tall towers over one quarter wave high or sectionalized towers are a case in point where a base to loop current transformation occurs and must be considered when toroid transformer monitoring is employed. There are undoubtedly cases where less than optimum adjustment of an array has occurred where toroidal transformers have been used on tall towers in lieu of sample loops during adjustment and tuning. One way around this array-specific situation may be current distribution measurements and ancillary computations to establish the base to loop transformation when using transformers to tune an array.

Overall, the transformers may be more reliable for monitoring since they are typically mounted with the coupling equipment in a weatherproof enclosure. Typically, no tower climbing is required and access for testing is simplified. Occasionally, lightning or high intensity discharges will damage a sampling transformer. Damaged transformers are simply replaced.

Sampling loops are mounted on the tower and are exposed to the weather. Unless the sampling loops are maintained, the integrity of them can be compromised by natural causes. Typically, contamination of the line connector by rain water, subsequent corrosion, and destruction of the connector is one problem; lightning is another. Acid rain corrosion is another problem.

Regardless of the method (loop or transformer), the net effect of a defective sampling element is an erroneous reading on the antenna monitor; the "error" can either be slight or serious. Inadvertent adjustment of the array to compensate for this "error" without first verifying the integrity of the sampling elements can in fact result in a misadjusted array and interference. Typically, this situation occurs in stations where management treats a qualified engineer or consultant as an "unnecessary expense" and the pattern is "cranked" to make it

read "right".

(g) Detuning: The Commission should require detuning for unused towers in directional arrays where the unused towers are in excess of one quarter wavelength. Most well-designed facilities incorporate this to minimize distortion by the unused towers acting as parasitic elements. The Commission's staff should look for this when processing Form 302 applications involving electrically tall towers.

9. **International Matters:** The results of Docket 87-267 and this proceeding mean absolutely nothing if the FCC neglects its responsibility to monitor international activities and swiftly object to IFRB filings that contravene the Region II guidelines. Annex 2, Chapter 4, Paragraphs 4.4.1 and 4.4.2 of the Region 2 treaty (Rio) clearly state a power limit of 100 kW for new stations.

The record is replete with defective Cuban and Mexican records in particular which the FCC's International Branch requires U.S. stations to protect. The FCC's International Branch claims that the records must be protected since they appear in the Master Register. Many of the foreign records are totally unworkable from an allocation stand point. It is hard to believe the FCC is supporting in a "de facto" way with U.S. taxpayer money Fidel Castro and other vagabond countries that permit facilities with power levels that contravene the international treaties. It is amazing that these apparently defective international records are getting into the IFRB Master Register without FCC knowledge or review. The reasons for failure of the FCC's International Branch to promptly review, object to these records, and failure to warn countries that such defective records will not receive protection from U.S. facilities, is unknown. This situation undermines the objectives of Docket 87-267 completely and the double standard makes Docket 87-267 a complete joke.

The Commission should commission a study on ambient noise levels and degradation of the standard AM broadcast band using actual short-term and long-term measurement results. The result of such a study should then be used to reevaluate domestic allocation standards. This commenter believes the NTIA or other reliable agency with a qualified staff should perform the study.

Applicants should not have to protect vagabond facilities in 301 filings that clearly violate the international treaties on reasonable showing. There are documented cases of the FCC's International Branch requiring applicants to protect Cuban 200 and 500 kilowatt unlimited time facilities that create havoc to domestic allocations. The International Branch also does not permit Cuban records to contribute to the RSS night limit of Cuban stations. The Mexican allocations are also a mess, with multiple allocations at different locations bearing the same call sign; many of which are well within protected contours of domestic licensed facilities.

The international situation has created much confusion over what foreign stations require protection or can be included in the RSS night limit to existing facilities. One suggestion that may alleviate some of this confusion is a simple change to the FCC AM Engineering Data Base. This data base should contain at a minimum a field for foreign records such as a "P" for protect and "N" for not protect. Ideally, another field should be allocated for nighttime purposes such as a "U" for use in a nighttime RSS, and "N" for no use in a nighttime RSS. This addition would save FCC resources and processing time since this would minimize the confusion. This confusion has gotten to the point where calls to the FCC staff are necessary to get straight answers. Such calls to the staff at typically five minutes a call could be reduced by incorporating this suggestion.

More stringent domestic allocation requirements simply means that more domestic U.S. facilities suffer increased interference to

their service areas from the vagabond facilities and have more of their service areas ruined, especially at night. For example, a Class II-C or III facility can count on having its nighttime service ruined when faced with a 500 kW vagabond facility operating within several hundred miles of its site. The record is replete even with interference to Class I facilities from certain vagabond stations. Some of the affected stations are currently operating under special temporary authority; however, even the special temporary authority does not alleviate the entire domestic interference problem.

The table in the Appendix shows a list of foreign stations in the FCC AM Engineering Data Base that have operating or proposed power levels in excess of 100 kilowatts.

SUMMARY:

a. The Cost of the Proof is a Legitimate Cost of Doing Business: This commenter does not favor wholesale deregulation of directional AM proof of performance requirements. The cost of the proof has always been a cost of doing business with a directional antenna on the AM band. Those who don't want to demonstrate their facilities are working properly simply have no business being Commission licensees. The concept of "if it sounds bad, the listener will tune away" simply doesn't cut it.Some adjustment of the regulations to accommodate access problems to measurement points may be justified.

b. Effects of 13 Years of Deregulation: The Commission has a sorry track record over the past 13 years and especially the past four years when it has attempted to "equitably" regulate interests involving both "big money interests" and small businesses, entities, or individuals. The Commission has bowed to big money interests in the past with the reallocation of the 220-222 MHz. amateur bands, wasted taxpayer dollars to fight opposition by the amateur operators to former 47CFR97.67(f) (new

47CFR97.313(b) changing the 1 kW D. C. power input on A3E emission in the HF amateur bands (Baxter v. FCC), and allowing the cable industry to run amok and hit the American public with uncontrolled rate increases and then claim funding problems when it comes time for enforcement. Perhaps in some small way these situations will again enhance general voter dissatisfaction at the ballot box in 1996, which may in turn encourage "government by the people for the people" and end "government for the rich by the rich".

Furthermore, Section 73.93(h)(2) which was formerly a part of the Commission's rules and conveniently deleted around 1981, should be reinserted into the Rules under Section 73.1870 pertaining to Chief Operators and apply to all stations. This rule would read "The station licensee shall vest such authority in, and afford such facilities to the chief operator as may be necessary to insure that the chief operator's primary responsibility for the proper technical operation of the station may be discharged efficiently. This shall include but not be limited to the prompt procurement of tubes and other supplies necessary to maintain the transmitting and monitoring equipment, repair or calibration services, tower relamping and rigging services, and outside technical consultation." The case of F.C.C. v. J. B. Broadcasting of Baltimore, Inc. (1974) [FCC Docket 74-371] is ample support of this requirement.

c. "While the Cat's Away the Mice Play" - The FCC must enforce its rules vigorously: It is probable that the actions of a few may be responsible for the majority of apparent or real interference caused by operation of standard broadcast stations with disregard to its construction permit conditions. Unfortunately, effective enforcement is probably the only way to encourage all licensees to obey the rules and perhaps in a great way reduce some of the interference. Responsible licensees may generally find compliance with the rules beneficial and profitable; irresponsible licensees are in effect stealing from

honest operators to serve their own needs at others' expense or demise.

Respectfully submitted:

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19 August 1993

Appendix: NEC run on KYW

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  NUMERICAL ELECTROMAGNETICS CODE (NEC-3)

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    - - - - COMMENTS - - - -

METHOD OF MOMENTS STUDY ON KYW



    - - - STRUCTURE SPECIFICATION - - -

      COORDINATES MUST BE INPUT IN
      METERS OR BE SCALED TO METERS
      BEFORE STRUCTURE INPUT IS ENDED
```

WIRE NO.	X1	Y1	Z1	X2	Y2	Z2	RADIUS	NO. OF SEG.	FIRST SEG.	LAST SEG.	TAG NO.
1	0.00000	0.00000	5.00000	0.00000	0.00000	470.00000	3.00000	30	1	30	1
2	258.82999	331.28799	5.00000	258.82999	331.28799	470.00000	3.00000	30	31	60	2
3	0.00000	0.00000	0.00000	0.00000	0.00000	5.00000	0.10000	3	61	63	3
4	258.82999	331.28799	0.00000	258.82999	331.28799	5.00000	0.10000	3	64	66	4

```
 STRUCTURE SCALED BY FACTOR   0.30480

 GROUND PLANE SPECIFIED.

 WHERE WIRE ENDS TOUCH GROUND, CURRENT WILL BE INTERPOLATED TO IMAGE IN GROUND PLANE.


 TOTAL SEGMENTS USED=   66     NO. SEG. IN A SYMMETRIC CELL=   66     SYMMETRY FLAG=  0


       - MULTIPLE WIRE JUNCTIONS -
JUNCTION    SEGMENTS  (- FOR END 1, + FOR END 2)
 NONE
```

- - - - SEGMENTATION DATA - - - -

COORDINATES IN METERS

I+ AND I- INDICATE THE SEGMENTS BEFORE AND AFTER I

SEG.	COORDINATES OF SEG. CENTER			SEG.	ORIENTATION ANGLES		WIRE	CONNECTION DATA			TAG
NO.	X	Y	Z	LENGTH	ALPHA	BETA	RADIUS	I-	I	I+	NO.
1	0.00000	0.00000	3.88620	4.72440	90.00000	0.00000	0.91440	63	1	2	1
2	0.00000	0.00000	8.61060	4.72440	90.00000	0.00000	0.91440	1	2	3	1
3	0.00000	0.00000	13.33500	4.72440	90.00000	0.00000	0.91440	2	3	4	1
4	0.00000	0.00000	18.05940	4.72440	90.00000	0.00000	0.91440	3	4	5	1
5	0.00000	0.00000	22.78380	4.72440	90.00000	0.00000	0.91440	4	5	6	1
6	0.00000	0.00000	27.50820	4.72440	90.00000	0.00000	0.91440	5	6	7	1
7	0.00000	0.00000	32.23260	4.72440	90.00000	0.00000	0.91440	6	7	8	1
8	0.00000	0.00000	36.95700	4.72440	90.00000	0.00000	0.91440	7	8	9	1
9	0.00000	0.00000	41.68140	4.72440	90.00000	0.00000	0.91440	8	9	10	1
10	0.00000	0.00000	46.40580	4.72440	90.00000	0.00000	0.91440	9	10	11	1
11	0.00000	0.00000	51.13020	4.72440	90.00000	0.00000	0.91440	10	11	12	1
12	0.00000	0.00000	55.85460	4.72440	90.00000	0.00000	0.91440	11	12	13	1
13	0.00000	0.00000	60.57900	4.72440	90.00000	0.00000	0.91440	12	13	14	1
14	0.00000	0.00000	65.30341	4.72440	90.00000	0.00000	0.91440	13	14	15	1
15	0.00000	0.00000	70.02780	4.72440	90.00000	0.00000	0.91440	14	15	16	1
16	0.00000	0.00000	74.75220	4.72440	90.00000	0.00000	0.91440	15	16	17	1
17	0.00000	0.00000	79.47660	4.72440	90.00000	0.00000	0.91440	16	17	18	1
18	0.00000	0.00000	84.20100	4.72440	90.00000	0.00000	0.91440	17	18	19	1
19	0.00000	0.00000	88.92540	4.72440	90.00000	0.00000	0.91440	18	19	20	1
20	0.00000	0.00000	93.64980	4.72440	90.00000	0.00000	0.91440	19	20	21	1
21	0.00000	0.00000	98.37421	4.72440	90.00000	0.00000	0.91440	20	21	22	1
22	0.00000	0.00000	103.09860	4.72440	90.00000	0.00000	0.91440	21	22	23	1
23	0.00000	0.00000	107.82301	4.72440	90.00000	0.00000	0.91440	22	23	24	1
24	0.00000	0.00000	112.54740	4.72440	90.00000	0.00000	0.91440	23	24	25	1
25	0.00000	0.00000	117.27180	4.72440	90.00000	0.00000	0.91440	24	25	26	1
26	0.00000	0.00000	121.99620	4.72440	90.00000	0.00000	0.91440	25	26	27	1
27	0.00000	0.00000	126.72060	4.72440	90.00000	0.00000	0.91440	26	27	28	1
28	0.00000	0.00000	131.44501	4.72441	90.00000	0.00000	0.91440	27	28	29	1
29	0.00000	0.00000	136.16940	4.72440	90.00000	0.00000	0.91440	28	29	30	1
30	0.00000	0.00000	140.89380	4.72440	90.00000	0.00000	0.91440	29	30	0	1
31	78.89138	100.97659	3.88620	4.72440	90.00000	0.00000	0.91440	66	31	32	2
32	78.89138	100.97659	8.61060	4.72440	90.00000	0.00000	0.91440	31	32	33	2
33	78.89138	100.97659	13.33500	4.72440	90.00000	0.00000	0.91440	32	33	34	2
34	78.89138	100.97659	18.05940	4.72440	90.00000	0.00000	0.91440	33	34	35	2
35	78.89138	100.97659	22.78380	4.72440	90.00000	0.00000	0.91440	34	35	36	2
36	78.89138	100.97659	27.50820	4.72440	90.00000	0.00000	0.91440	35	36	37	2
37	78.89138	100.97659	32.23260	4.72440	90.00000	0.00000	0.91440	36	37	38	2
38	78.89138	100.97659	36.95700	4.72440	90.00000	0.00000	0.91440	37	38	39	2
39	78.89138	100.97659	41.68140	4.72440	90.00000	0.00000	0.91440	38	39	40	2
40	78.89138	100.97659	46.40580	4.72440	90.00000	0.00000	0.91440	39	40	41	2
41	78.89138	100.97659	51.13020	4.72440	90.00000	0.00000	0.91440	40	41	42	2
42	78.89138	100.97659	55.85460	4.72440	90.00000	0.00000	0.91440	41	42	43	2
43	78.89138	100.97659	60.57900	4.72440	90.00000	0.00000	0.91440	42	43	44	2
44	78.89138	100.97659	65.30341	4.72440	90.00000	0.00000	0.91440	43	44	45	2
45	78.89138	100.97659	70.02780	4.72440	90.00000	0.00000	0.91440	44	45	46	2
46	78.89138	100.97659	74.75220	4.72440	90.00000	0.00000	0.91440	45	46	47	2
47	78.89138	100.97659	79.47660	4.72440	90.00000	0.00000	0.91440	46	47	48	2
48	78.89138	100.97659	84.20100	4.72440	90.00000	0.00000	0.91440	47	48	49	2
49	78.89138	100.97659	88.92540	4.72440	90.00000	0.00000	0.91440	48	49	50	2
50	78.89138	100.97659	93.64980	4.72440	90.00000	0.00000	0.91440	49	50	51	2
51	78.89138	100.97659	98.37421	4.72440	90.00000	0.00000	0.91440	50	51	52	2
52	78.89138	100.97659	103.09860	4.72440	90.00000	0.00000	0.91440	51	52	53	2

54	78.89138	100.97659	112.54740	4.72440	90.00000	0.00000	0.91440	53	54	55	2
55	78.89138	100.97659	117.27180	4.72440	90.00000	0.00000	0.91440	54	55	56	2
56	78.89138	100.97659	121.99620	4.72440	90.00000	0.00000	0.91440	55	56	57	2
57	78.89138	100.97659	126.72060	4.72440	90.00000	0.00000	0.91440	56	57	58	2
58	78.89138	100.97659	131.44501	4.72441	90.00000	0.00000	0.91440	57	58	59	2
59	78.89138	100.97659	136.16940	4.72440	90.00000	0.00000	0.91440	58	59	60	2
60	78.89138	100.97659	140.89380	4.72440	90.00000	0.00000	0.91440	59	60	0	2
61	0.00000	0.00000	0.25400	0.50800	90.00000	0.00000	0.03048	61	61	62	3
62	0.00000	0.00000	0.76200	0.50800	90.00000	0.00000	0.03048	61	62	63	3
63	0.00000	0.00000	1.27000	0.50800	90.00000	0.00000	0.03048	62	63	1	3
64	78.89138	100.97659	0.25400	0.50800	90.00000	0.00000	0.03048	64	64	65	4
65	78.89138	100.97659	0.76200	0.50800	90.00000	0.00000	0.03048	64	65	66	4
66	78.89138	100.97659	1.27000	0.50800	90.00000	0.00000	0.03048	65	66	31	4

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***** DATA CARD NO.  1   GN   1    0    0    0  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
***** DATA CARD NO.  2   EK   0    0    0    0  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
***** DATA CARD NO.  3   FR   0    0    0    0  1.06000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
***** DATA CARD NO.  4   EX   0    3    2    1  1.00720E+04  7.95000E+02  5.00000E+01  0.00000E+00  0.00000E+00  0.00000E+00
***** DATA CARD NO.  5   EX   0    4    2    1  7.55600E+03  1.78800E+03  5.00000E+01  0.00000E+00  0.00000E+00  0.00000E+00
***** DATA CARD NO.  6   RP   0    1   72    1  9.00000E+01  0.00000E+00  0.00000E+00  5.00000E+00  1.60934E+03  0.00000E+00
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- - - - - - FREQUENCY - - - - - -

FREQUENCY= 1.0600E+00 MHZ
WAVELENGTH= 2.8283E+02 METERS

- - - STRUCTURE IMPEDANCE LOADING - - -

THIS STRUCTURE IS NOT LOADED

- - - ANTENNA ENVIRONMENT - - -

PERFECT GROUND

APPROXIMATE INTEGRATION EMPLOYED FOR SEGMENTS MORE THAN 282.830 METERS APART

THE EXTENDED THIN WIRE KERNEL WILL BE USED

- - - MATRIX TIMING - - -

FILL= 57.150 SEC., FACTOR= 3.660 SEC.

- - - ANTENNA INPUT PARAMETERS - - -

TAG NO.	SEG. NO.	VOLTAGE (VOLTS) REAL	VOLTAGE (VOLTS) IMAG.	CURRENT (AMPS) REAL	CURRENT (AMPS) IMAG.	IMPEDANCE (OHMS) REAL	IMPEDANCE (OHMS) IMAG.	ADMITTANCE (MHOS) REAL	ADMITTANCE (MHOS) IMAG.	POWER (WATTS)
3	62	1.00720E+04	7.95000E+02	5.[illegible]E+00	6.73047E+00	8.08024E+02	-7.97254E+02	6.27096E-04	6.18738E-04	3.20061E+04
4	65	7.55600E+03	1.78800E+03	3.[illegible]72E+00	4.60938E+00	1.03620E+03	-8.14256E+02	5.96640E-04	4.68844E-04	1.79857E+04

- - - CURRENTS AND LOCATION - - -

LENGTHS NORMALIZED BY WAVELENGTH (OR 2.*PI/CABS(K))

SEG. NO.	TAG NO.	COORD. OF SEG. CENTER X	Y	Z	SEG. LENGTH	- - - CURRENT (AMPS) - - - REAL	IMAG.	MAG.	PHASE
1	1	0.0000	0.0000	0.0137	0.01670	5.9927E+00	3.6072E+00	6.9946E+00	31.045
2	1	0.0000	0.0000	0.0304	0.01670	6.1005E+00	8.2658E-01	6.1563E+00	7.716
3	1	0.0000	0.0000	0.0471	0.01670	6.1526E+00	-1.3010E+00	6.2886E+00	-11.939
4	1	0.0000	0.0000	0.0639	0.01670	6.1680E+00	-3.2150E+00	6.9556E+00	-27.530
5	1	0.0000	0.0000	0.0806	0.01670	6.1512E+00	-4.9694E+00	7.9077E+00	-38.934
6	1	0.0000	0.0000	0.0973	0.01670	6.1041E+00	-6.5876E+00	8.9809E+00	-47.182
7	1	0.0000	0.0000	0.1140	0.01670	6.0282E+00	-8.0768E+00	1.0078E+01	-53.264
8	1	0.0000	0.0000	0.1307	0.01670	5.9249E+00	-9.4371E+00	1.1143E+01	-57.878
9	1	0.0000	0.0000	0.1474	0.01670	5.7952E+00	-1.0664E+01	1.2137E+01	-61.479
10	1	0.0000	0.0000	0.1641	0.01670	5.6411E+00	-1.1755E+01	1.3038E+01	-64.364
11	1	0.0000	0.0000	0.1808	0.01670	5.4633E+00	-1.2701E+01	1.3826E+01	-66.725
12	1	0.0000	0.0000	0.1975	0.01670	5.2638E+00	-1.3499E+01	1.4489E+01	-68.697
13	1	0.0000	0.0000	0.2142	0.01670	5.0442E+00	-1.4144E+01	1.5016E+01	-70.372
14	1	0.0000	0.0000	0.2309	0.01670	4.8062E+00	-1.4630E+01	1.5399E+01	-71.814
15	1	0.0000	0.0000	0.2476	0.01670	4.5527E+00	-1.4957E+01	1.5635E+01	-73.071
16	1	0.0000	0.0000	0.2643	0.01670	4.2842E+00	-1.5120E+01	1.5715E+01	-74.180
17	1	0.0000	0.0000	0.2810	0.01670	4.0045E+00	-1.5123E+01	1.5644E+01	-75.168
18	1	0.0000	0.0000	0.2977	0.01670	3.7143E+00	-1.4960E+01	1.5414E+01	-76.056
19	1	0.0000	0.0000	0.3144	0.01670	3.4172E+00	-1.4639E+01	1.5033E+01	-76.861
20	1	0.0000	0.0000	0.3311	0.01670	3.1143E+00	-1.4159E+01	1.4498E+01	-77.596
21	1	0.0000	0.0000	0.3478	0.01670	2.8085E+00	-1.3527E+01	1.3816E+01	-78.271
22	1	0.0000	0.0000	0.3645	0.01670	2.5022E+00	-1.2748E+01	1.2992E+01	-78.895
23	1	0.0000	0.0000	0.3812	0.01670	2.1969E+00	-1.1826E+01	1.2029E+01	-79.476
24	1	0.0000	0.0000	0.3979	0.01670	1.8956E+00	-1.0773E+01	1.0938E+01	-80.020
25	1	0.0000	0.0000	0.4146	0.01670	1.5991E+00	-9.5894E+00	9.7218E+00	-80.532
26	1	0.0000	0.0000	0.4313	0.01670	1.3100E+00	-8.2869E+00	8.3898E+00	-81.017
27	1	0.0000	0.0000	0.4480	0.01670	1.0289E+00	-6.8671E+00	6.9437E+00	-81.479
28	1	0.0000	0.0000	0.4647	0.01670	7.5620E-01	-5.3281E+00	5.3815E+00	-81.922
29	1	0.0000	0.0000	0.4815	0.01670	4.9126E-01	-3.6586E+00	3.6914E+00	-82.352
30	1	0.0000	0.0000	0.4982	0.01670	2.1563E-01	-1.6984E+00	1.7120E+00	-82.764
31	2	0.2789	0.3570	0.0137	0.01670	4.1632E+00	2.2734E+00	4.7435E+00	28.638
32	2	0.2789	0.3570	0.0304	0.01670	4.5729E+00	1.9611E-01	4.5771E+00	2.456
33	2	0.2789	0.3570	0.0471	0.01670	4.8645E+00	-1.3901E+00	5.0592E+00	-15.948
34	2	0.2789	0.3570	0.0639	0.01670	5.1042E+00	-2.8140E+00	5.8285E+00	-28.868
35	2	0.2789	0.3570	0.0806	0.01670	5.3016E+00	-4.1161E+00	6.7119E+00	-37.825
36	2	0.2789	0.3570	0.0973	0.01670	5.4608E+00	-5.3140E+00	7.6197E+00	-44.219
37	2	0.2789	0.3570	0.1140	0.01670	5.5836E+00	-6.4133E+00	8.5033E+00	-48.957
38	2	0.2789	0.3570	0.1307	0.01670	5.6711E+00	-7.4144E+00	9.3346E+00	-52.588
39	2	0.2789	0.3570	0.1474	0.01670	5.7233E+00	-8.3140E+00	1.0094E+01	-55.457
40	2	0.2789	0.3570	0.1641	0.01670	5.7412E+00	-9.1102E+00	1.0768E+01	-57.781
41	2	0.2789	0.3570	0.1808	0.01670	5.7242E+00	-9.7974E+00	1.1347E+01	-59.704
42	2	0.2789	0.3570	0.1975	0.01670	5.6733E+00	-1.0373E+01	1.1823E+01	-61.323
43	2	0.2789	0.3570	0.2142	0.01670	5.5890E+00	-1.0833E+01	1.2189E+01	-62.709
44	2	0.2789	0.3570	0.2309	0.01670	5.4716E+00	-1.1174E+01	1.2441E+01	-63.909
45	2	0.2789	0.3570	0.2476	0.01670	5.3232E+00	-1.1396E+01	1.2578E+01	-64.962
46	2	0.2789	0.3570	0.2643	0.01670	5.1433E+00	-1.1495E+01	1.2593E+01	-65.895
47	2	0.2789	0.3570	0.2810	0.01670	4.9352E+00	-1.1475E+01	1.2491E+01	-66.728
48	2	0.2789	0.3570	0.2977	0.01670	4.6986E+00	-1.1332E+01	1.2267E+01	-67.479
49	2	0.2789	0.3570	0.3144	0.01670	4.4369E+00	-1.1071E+01	1.1927E+01	-68.161
50	2	0.2789	0.3570	0.3311	0.01670	4.1508E+00	-1.0693E+01	1.1470E+01	-68.785
51	2	0.2789	0.3570	0.3478	0.01670	3.8431E+00	-1.0202E+01	1.0902E+01	-69.358
52	2	0.2789	0.3570	0.3645	0.01670	3.5162E+00	-9.6026E+00	1.0226E+01	-69.889
53	2	0.2789	0.3570	0.3812	0.01670	3.1714E+00	-8.8978E+00	9.4461E+00	-70.383
54	2	0.2789	0.3570	0.3979	0.01670	2.8123E+00	-8.0961E+00	8.5706E+00	-70.844

56	2	0.2789	0.3570	0.4313	0.01670	2.0569E+00	-6.2156E+00	6.5471E+00	-71.689
57	2	0.2789	0.3570	0.4480	0.01670	1.6641E+00	-5.1459E+00	5.4083E+00	-72.079
58	2	0.2789	0.3570	0.4647	0.01670	1.2613E+00	-3.9892E+00	4.1839E+00	-72.454
59	2	0.2789	0.3570	0.4815	0.01670	8.4639E-01	-2.7369E+00	2.8647E+00	-72.816
60	2	0.2789	0.3570	0.4982	0.01670	3.8421E-01	-1.2695E+00	1.3263E+00	-73.161
61	3	0.0000	0.0000	0.0009	0.00180	5.8281E+00	6.6836E+00	8.8678E+00	48.911
62	3	0.0000	0.0000	0.0027	0.00180	5.8242E+00	6.7305E+00	8.9006E+00	49.129
63	3	0.0000	0.0000	0.0045	0.00180	5.8555E+00	6.2891E+00	8.5930E+00	47.045
64	4	0.2789	0.3570	0.0009	0.00180	3.6777E+00	4.5742E+00	5.8693E+00	51.200
65	4	0.2789	0.3570	0.0027	0.00180	3.6699E+00	4.6094E+00	5.8919E+00	51.474
66	4	0.2789	0.3570	0.0045	0.00180	3.7461E+00	4.2813E+00	5.6888E+00	48.814

- - - POWER BUDGET - - -

INPUT POWER = 4.9992E+04 WATTS
RADIATED POWER= 4.9992E+04 WATTS
STRUCTURE LOSS= 0.0000E+00 WATTS
NETWORK LOSS = 0.0000E+00 WATTS
EFFICIENCY = 100.00 PERCENT

- - - RADIATION PATTERNS - - -

RANGE= 1.609344E+03 METERS

EXP(-JKR)/R= 6.21371E-04 AT PHASE 111.55 DEGREES

LOWER MEDIUM - EXP(-JKR)/R= 6.21371E-04 AT PHASE 111.55 DEGREES

- - ANGLES - -		- POWER GAINS -			- - - POLARIZATION - - -			- - - E(THETA) - - -		- - - E(PHI) - - -	
THETA DEGREES	PHI DEGREES	MAJOR DB	MINOR DB	TOTAL DB	AXIAL RATIO	TILT DEG.	SENSE	MAGNITUDE VOLTS/M	PHASE DEGREES	MAGNITUDE VOLTS/M	PHASE DEGREES
90.00	0.00	1.53	-999.99	1.53	0.00000	0.00	LINEAR	1.28345E+00	181.17	0.00000E+00	111.55
90.00	5.00	0.33	-999.99	0.33	0.00000	0.00	LINEAR	1.11747E+00	184.86	0.00000E+00	111.55
90.00	10.00	-1.02	-999.99	-1.02	0.00000	0.00	LINEAR	9.56815E-01	187.73	0.00000E+00	111.55
90.00	15.00	-2.50	-999.99	-2.50	0.00000	0.00	LINEAR	8.06280E-01	189.59	0.00000E+00	111.55
90.00	20.00	-4.11	-999.99	-4.11	0.00000	0.00	LINEAR	6.70069E-01	190.23	0.00000E+00	111.55
90.00	25.00	-5.80	-999.99	-5.80	0.00000	0.00	LINEAR	5.51722E-01	189.42	0.00000E+00	111.55
90.00	30.00	-7.49	-999.99	-7.49	0.00000	0.00	LINEAR	4.54022E-01	187.01	0.00000E+00	111.55
90.00	35.00	-9.07	-999.99	-9.07	0.00000	0.00	LINEAR	3.78717E-01	183.09	0.00000E+00	111.55
90.00	40.00	-10.37	-999.99	-10.37	0.00000	0.00	LINEAR	3.25995E-01	178.30	0.00000E+00	111.55
90.00	45.00	-11.26	-999.99	-11.26	0.00000	0.00	LINEAR	2.94100E-01	173.89	0.00000E+00	111.55
90.00	50.00	-11.69	-999.99	-11.69	0.00000	0.00	LINEAR	2.80034E-01	171.37	0.00000E+00	111.55
90.00	55.00	-11.64	-999.99	-11.64	0.00000	0.00	LINEAR	2.81558E-01	171.66	0.00000E+00	111.55
90.00	60.00	-11.12	-999.99	-11.12	0.00000	0.00	LINEAR	2.98952E-01	174.67	0.00000E+00	111.55
90.00	65.00	-10.14	-999.99	-10.14	0.00000	0.00	LINEAR	3.34789E-01	179.27	0.00000E+00	111.55
90.00	70.00	-8.77	-999.99	-8.77	0.00000	0.00	LINEAR	3.91948E-01	183.98	0.00000E+00	111.55
90.00	75.00	-7.16	-999.99	-7.16	0.00000	0.00	LINEAR	4.71805E-01	187.62	0.00000E+00	111.55
90.00	80.00	-5.46	-999.99	-5.46	0.00000	0.00	LINEAR	5.73813E-01	189.71	0.00000E+00	111.55
90.00	85.00	-3.78	-999.99	-3.78	0.00000	0.00	LINEAR	6.95982E-01	190.21	0.00000E+00	111.55
90.00	90.00	-2.20	-999.99	-2.20	0.00000	0.00	LINEAR	8.35363E-01	189.31	0.00000E+00	111.55
90.00	95.00	-0.74	-999.99	-0.74	0.00000	0.00	LINEAR	9.88279E-01	187.23	0.00000E+00	111.55
90.00	100.00	0.58	-999.99	0.58	0.00000	0.00	LINEAR	1.15040E+00	184.19	0.00000E+00	111.55
90.00	105.00	1.76	-999.99	1.76	0.00000	0.00	LINEAR	1.31682E+00	180.34	0.00000E+00	111.55
90.00	110.00	2.78	-999.99	2.78	0.00000	0.00	LINEAR	1.48210E+00	175.84	0.00000E+00	111.55
90.00	115.00	3.67	-999.99	3.67	0.00000	0.00	LINEAR	1.64052E+00	170.81	0.00000E+00	111.55
90.00	120.00	4.40	-999.99	4.40	0.00000	0.00	LINEAR	1.78624E+00	165.34	0.00000E+00	111.55
90.00	125.00	5.00	-999.99	5.00	0.00000	0.00	LINEAR	1.91364E+00	159.52	0.00000E+00	111.55
90.00	130.00	5.46	-999.99	5.46	0.00000	0.00	LINEAR	2.01764E+00	153.44	0.00000E+00	111.55
90.00	135.00	5.79	-999.99	5.79	0.00000	0.00	LINEAR	2.09400E+00	147.18	0.00000E+00	111.55
90.00	140.00	5.97	-999.99	5.97	0.00000	0.00	LINEAR	2.13965E+00	140.80	0.00000E+00	111.55
90.00	145.00	6.03	-999.99	6.03	0.00000	0.00	LINEAR	2.15288E+00	134.39	0.00000E+00	111.55
90.00	150.00	5.95	-999.99	5.95	0.00000	0.00	LINEAR	2.13343E+00	128.01	0.00000E+00	111.55
90.00	155.00	5.74	-999.99	5.74	0.00000	0.00	LINEAR	2.08259E+00	121.73	0.00000E+00	111.55
90.00	160.00	5.40	-999.99	5.40	0.00000	0.00	LINEAR	2.00300E+00	115.62	0.00000E+00	111.55
90.00	165.00	4.93	-999.99	4.93	0.00000	0.00	LINEAR	1.89853E+00	109.75	0.00000E+00	111.55
90.00	170.00	4.34	-999.99	4.34	0.00000	0.00	LINEAR	1.77395E+00	104.19	0.00000E+00	111.55
90.00	175.00	3.63	-999.99	3.63	0.00000	0.00	LINEAR	1.63468E+00	99.02	0.00000E+00	111.55
90.00	180.00	2.81	-999.99	2.81	0.00000	0.00	LINEAR	1.48638E+00	94.31	0.00000E+00	111.55
90.00	185.00	1.87	-999.99	1.87	0.00000	0.00	LINEAR	1.33470E+00	90.14	0.00000E+00	111.55
90.00	190.00	0.84	-999.99	0.84	0.00000	0.00	LINEAR	1.18502E+00	86.59	0.00000E+00	111.55
90.00	195.00	-0.28	-999.99	-0.28	0.00000	0.00	LINEAR	1.04221E+00	83.73	0.00000E+00	111.55
90.00	200.00	-1.45	-999.99	-1.45	0.00000	0.00	LINEAR	9.10504E-01	81.63	0.00000E+00	111.55
90.00	205.00	-2.64	-999.99	-2.64	0.00000	0.00	LINEAR	7.93421E-01	80.33	0.00000E+00	111.55
90.00	210.00	-3.81	-999.99	-3.81	0.00000	0.00	LINEAR	6.93697E-01	79.81	0.00000E+00	111.55
90.00	215.00	-4.88	-999.99	-4.88	0.00000	0.00	LINEAR	6.13255E-01	79.98	0.00000E+00	111.55
90.00	220.00	-5.78	-999.99	-5.78	0.00000	0.00	LINEAR	5.53210E-01	80.59	0.00000E+00	111.55
90.00	225.00	-6.42	-999.99	-6.42	0.00000	0.00	LINEAR	5.13961E-01	81.29	0.00000E+00	111.55
90.00	230.00	-6.73	-999.99	-6.73	0.00000	0.00	LINEAR	4.95442E-01	81.73	0.00000E+00	111.55
90.00	235.00	-6.70	-999.99	-6.70	0.00000	0.00	LINEAR	4.97496E-01	81.68	0.00000E+00	111.55
90.00	240.00	-6.31	-999.99	-6.31	0.00000	0.00	LINEAR	5.20145E-01	81.16	0.00000E+00	111.55
90.00	245.00	-5.62	-999.99	-5.62	0.00000	0.00	LINEAR	5.63558E-01	80.44	0.00000E+00	111.55
90.00	250.00	-4.68	-999.99	-4.68	0.00000	0.00	LINEAR	6.27734E-01	79.90	0.00000E+00	111.55
90.00	255.00	-3.58	-999.99	-3.58	0.00000	0.00	LINEAR	7.12146E-01	79.86	0.00000E+00	111.55

90.00	265.00	-1.21	-999.99	-1.21	0.00000	0.00	LINEAR	7.53774E-01	81.78	0.00000E+00	111.55
90.00	270.00	-0.05	-999.99	-0.05	0.00000	0.00	LINEAR	1.07001E+00	84.24	0.00000E+00	111.55
90.00	275.00	1.05	-999.99	1.05	0.00000	0.00	LINEAR	1.21455E+00	87.24	0.00000E+00	111.55
90.00	280.00	2.07	-999.99	2.07	0.00000	0.00	LINEAR	1.36504E+00	90.93	0.00000E+00	111.55
90.00	285.00	2.98	-999.99	2.98	0.00000	0.00	LINEAR	1.51648E+00	95.21	0.00000E+00	111.55
90.00	290.00	3.79	-999.99	3.79	0.00000	0.00	LINEAR	1.66343E+00	100.02	0.00000E+00	111.55
90.00	295.00	4.47	-999.99	4.47	0.00000	0.00	LINEAR	1.80022E+00	105.27	0.00000E+00	111.55
90.00	300.00	5.04	-999.99	5.04	0.00000	0.00	LINEAR	1.92119E+00	110.90	0.00000E+00	111.55
90.00	305.00	5.48	-999.99	5.48	0.00000	0.00	LINEAR	2.02105E+00	116.82	0.00000E+00	111.55
90.00	310.00	5.79	-999.99	5.79	0.00000	0.00	LINEAR	2.09516E+00	122.97	0.00000E+00	111.55
90.00	315.00	5.97	-999.99	5.97	0.00000	0.00	LINEAR	2.13990E+00	129.28	0.00000E+00	111.55
90.00	320.00	6.03	-999.99	6.03	0.00000	0.00	LINEAR	2.15286E+00	135.67	0.00000E+00	111.55
90.00	325.00	5.95	-999.99	5.95	0.00000	0.00	LINEAR	2.13309E+00	142.08	0.00000E+00	111.55
90.00	330.00	5.73	-999.99	5.73	0.00000	0.00	LINEAR	2.08111E+00	148.44	0.00000E+00	111.55
90.00	335.00	5.38	-999.99	5.38	0.00000	0.00	LINEAR	1.99893E+00	154.67	0.00000E+00	111.55
90.00	340.00	4.89	-999.99	4.89	0.00000	0.00	LINEAR	1.88988E+00	160.71	0.00000E+00	111.55
90.00	345.00	4.27	-999.99	4.27	0.00000	0.00	LINEAR	1.75839E+00	166.46	0.00000E+00	111.55
90.00	350.00	3.50	-999.99	3.50	0.00000	0.00	LINEAR	1.60967E+00	171.85	0.00000E+00	111.55
90.00	355.00	2.59	-999.99	2.59	0.00000	0.00	LINEAR	1.44941E+00	176.79	0.00000E+00	111.55

***** DATA CARD NO. 7 EN 0 0 0 0 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00

RUN TIME = 78.520

INPUT DATA
TO NEC-3

```
CM METHOD OF MOMENTS STUDY ON KYW
CM
CE
GW   1, 30, 0.0, 0.0, 5.00, 0.0, 0.0, 470.0, 3.00
GW   2, 30, 258.830, 331.288, 5.00, 258.830, 331.288, 470.0, 3.00
GW   3,  3, 0.0, 0.0, 0.0, 0.0, 0.0, 5.00, 0.10
GW   4,  3, 258.830, 331.288, 0.0, 258.830, 331.288, 5.00, 0.10
GS 0, 0,0.3048
GE  1
GN  1
EK
FR  0,0,0,0, 1.060
EX  0,3,2,1,10072.,795.,50.
EX  0,4,2,1,7556.,1788.,50.
RP  0,1,72,1,90.,0.,0.,5.,1609.344,0.
EN
```

MAIN TRANSMITTER

Broadcast Application	FEDERAL COMMUNICATIONS COMMISSION	Section II-A
LICENSE APPLICATION ENGINEERING DATA STANDARD BROADCAST	Name of applicant: WESTINGHOUSE BROADCASTING CO., INC.	

Purpose of authorization applied for: *(Check one)*

	Answer Paragraphs
[X] Station license	1 thru 13
[ ] Direct measurement of power	2,6,7,8,9,14

1. Facilities authorized in construction permit

Call letters	File No. of construction permit
KYW	NONE

Frequency	Hours of operation	Power in kilowatts Night	Power in kilowatts Day
1060 kHz	U	50	50

2. Station location

State	City or town
PENNSYLVANIA	PHILADELPHIA

3. Transmitter location

State	County
PENNSYLVANIA	MONTGOMERY
City or Town: WHITEMARSH TOWNSHIP	Street Address *(or other identification)*: 5090 JOSHUA ROAD

4. Main studio location

State	County
PENNSYLVANIA	PHILADELPHIA
City or Town: PHILADELPHIA	Street and number: INDEPENDENCE MALL EAST

5. Remote control point location

State	City or town
SAME AS STUDIO	

Street Address *(or other identification)*

6. Transmitter installed

Make	Type No.	Rated Power
CONTINENTAL ELECTRONICS	317 - C	50 kW

Last radio stage

TYPICAL	Total unmodulated plate current	Plate voltage
Night	4.41A	17,100V
Day	4.4A	17,100V

Operation of last radio frequency amplifier stage: A [ ] B [ ] BC [ ] C [ ] D [ ] ON FILE

Manufacturer's recommended operating efficiency ON FILE for the last radio frequency amplifier stage in percent.

Is inverse feedback utilized? Yes [ ] No [ ]

If "Yes", to what value of feedback power is transmitter adjusted (in db) ON FILE

Efficiency of the last radio frequency amplifier stage as now adjusted

69.82% *(use formula* $\frac{I_a^2 R_a}{E_p I_p}(100)\%$*)*

7. Operating constants: (If directional system, give current at point of resistance measurement.)

RF common point or antenna current without modulation for night power in amperes	RF common point or antenna current without modulation for day power in amperes
32.55	32.55

Actual measured antenna or common point resistance (in ohms) at operating frequency	Actual measured antenna or common point reactance (in ohms) at operating frequency
Night 49.7 Day 49.7	Night 0 Day 0

Currents, and phases for directional operation

Tower	Phase reading in degrees Night	Phase reading in degrees Day	Antenna base current Night Amps	Antenna base current Day Amps	Remote indication of antenna current Night %	Remote indication of antenna current Day %
NE (1)	26.6	26.6	4.1	4.1	89.7	89.7
SW (2)	0	0	6.4	6.4	100.0	100.0

Manufacturer and type of antenna monitor: POTOMAC INSTRUMENTS MODEL AM-19D(210) SERIAL 595

Describe equipment used for remote indication of antenna currents (antenna monitor or other method)

ANTENNA MONITOR

8. Description of antenna system

(If directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary. Height figures should not include obstruction lighting.)

Type radiator	Height in feet of complete radiator above base insulator, or above base if grounded.
UNIFORM CROSS SECTION, GUYED, VERTICAL STEEL RADIATOR	465'
Overall height in feet above ground. 470'	If antenna is either top loaded or sectionalized, describe fully as Exhibit No. NONE

Excitation: Series [X] Shunt [ ]

Geographic coordinates to nearest second.

For directional antenna give coordinates of center of array. For single vertical radiator give tower location.

North latitude	West longitude
40°06'12"	75°14'56"

If not fully described above, give further details and dimensions including any other antennas mounted on tower and associated isolation circuits as Exhibit No. NONE

Details and dimensions of ground system: (Attach sketch as Exhibit No. if necessary for complete description)

120 X 465' EQUALLY SPACED BURIED COPPER RADIALS, PLUS A 48' SQUARE GROUND SCREEN ABOUT THE BASE OF EACH TOWER. RADIALS AND GROUND SCREENS ARE BONDED TO COPPER BUSSES AT POINTS OF INTERSECTION