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# APPLICATION for a MODIFIED STANDARD ANTENNA PATTERN

WEEI-AM

850 kHz

50 kW DA-2

Fac ID 1912

Boston, MA

Entercom Boston License, LLC

April 2010

This Engineering Report is part of an application by Entercom Boston License, LLC to modify the present augmentation of the nighttime directional antenna pattern of AM station WEEI, Boston, MA. This Form 301 application is being concurrently filed with FCC Form 302 as specified in section §73.152(a) of the Commission's Rules. A partial proof of performance, as well as a full proof of performance on the radials to be augmented is included with the Form 302 filing.

No changes to the licensed daytime operation of WEEI are proposed, however the directional antenna parameters of the daytime antenna have been modified to use the same tower numbering as the nighttime pattern.

It should be noted that the antenna parameters for WEEI in the CDBS list all three towers as having an electrical height of 207°, a parameter that appears to have originated prior to the standard pattern conversion of the early 1980's, and has appeared in the CDBS ever since. The COMMENT field in the CDBS contains the following: "ELEC HGT IS AVG DUE TO EFFECT OF MUTUAL IMPEDANCE ON CURRENT DISTROBUTION".[1]
According to the WEEI station license, BR-760, the actual electrical heights of the towers are 640 feet (199.1°), 600 feet (186.7°) and 560 feet (174.2°). The current Antenna Structure Registrations for these towers agree with the overall heights listed in BR-760, which causes the CDBS specified electrical height to exceed the ASR specified overall height above ground for all three towers. All allocation studies contained in this report are based on the CDBS antenna height of 207°, therefore the data in the associated FCC Form 301 consists of overall heights above ground which correspond to the values in the associated ASRs while the height above base insulator values agree with the 207° electrical height contained in the CDBS.

Completion of the above referenced partial proof of performance (following the installation of a new communications tower on the same property as the WEEI antenna) revealed that the Inverse Distance Field of the nighttime directional antenna along the 240°, 260° and 280° radials could not be brought below their presently licensed augmented standard pattern limits.

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[1]See attached page from 1961 Supplemental Proof of Performance by D.A. Peterson and pages from the 1947 Engineering Statement *Application for Modification of Construction Permit BP-4912 to change to unequal-height towers*

ENGINEERING STATEMENT OF D. A. PETERSON OF THE FIRM OF A. EARL CULLUM, JR., CONSULTING ENGINEERS, IN CONNECTION WITH A SUPPLEMENTAL PROOF OF PERFORMANCE MADE FOR THE OPERATION OF RADIO STATION WHDH ON 850 KILOCYCLES WITH 50 KILOWATTS OF POWER DIRECTIONAL DAYTIME AND NIGHTTIME, DA-2, FILE NO. BR-760

* * * * *

I, D. A. Peterson, am an engineer associated with the firm of A. Earl Cullum, Jr., Consulting Engineers, with offices located in Dallas, Texas. I graduated from Southern Methodist University in 1934 with a Bachelor of Science Degree in Electrical Engineering. I have been employed in an engineering capacity by broadcast stations since 1933. I have been a partner in the firm of A. Earl Cullum, Jr., since 1940, and my qualifications have been accepted by the Federal Communications Commission. This statement has been prepared on behalf of WHDH, INC., Licensee of Radio Station WHDH, Boston, Massachusetts.

Radio Station WHDH is licensed for operation on 850 kilocycles with 50 kilowatts of power and different directional antennas daytime and nighttime, File No. BR-760. The previous proof of performance was made during May, 1953. Since then the antenna system has been maintained by keeping the loop current ratios and phase relations adjusted to the specified license values. Plans were made during the summer of 1960 to carry out a supplemental proof of performance during the 1960-1961 winter months.

Prior to making the proof of performance measurements, the following work was carried out:

1. The sampling loops were inspected and found to be satisfactory.
2. The sampling lines were checked and found to be satisfactory.
3. The phase monitor was checked and found to be satisfactory.
4. The antenna ammeters and common-point ammeter were checked by an authorized meter repair and calibration service company.
5. The sampling loop meters were checked by an authorized meter repair and calibration company.
6. The common-point impedance was checked with a radio-frequency bridge and found to be according to the station license.

TEST PATTERN MEASUREMENTS

The WHDH antenna system consists of three towers spaced 120 electrical degrees on a line bearing 80 degrees true east. The west tower extends 640 feet above ground, the center tower extends 600 feet above ground, and the east tower extends 560 feet above ground. For directional operation all three towers appear to have approximately the same electrical height due to the coupling effects between the towers when operating directionally, as demonstrated by current distribution measurements contained in the original proof of performance, File No. BL-3570.

For essentially non-directional operation the two end towers were grounded at the base. The impedance at the base of the center tower was measured with a radio-frequency bridge and the center tower was fed with 12.3 amperes into 165 ohms measured base resistance for 25 kilowatts of power. No attempt was made to adjust either end tower for minimum reradiation in the horizontal plane, other than to ground the tower base. Due to the fact that the end towers are substantially different in physical height, it is to be expected that the test pattern radiation would not necessarily be the same off the ends of the array; therefore, in order to analyze properly the inverse-distance fields and determine ground conductivity, it was decided to measure the test pattern along fourteen radials rather than only six radials as originally planned. Measurements were also made over an arc to the west.

# ENGINEERING STATEMENT

RADIO STATION WHDH (AM)
BOSTON, MASSACHUSETTS
850 KC, 50 KW, DA-1

BY THE FIRM OF

A. EARL CULLUM, JR.
CONSULTING RADIO ENGINEERS
DALLAS, TEXAS

IN SUPPORT OF

APPLICATION FOR MODIFICATION OF
CONSTRUCTION PERMIT BP-4912
TO CHANGE TO UNEQUAL-HEIGHT TOWERS

JUNE, 1947

ENGINEERING STATEMENT OF THE FIRM OF A. EARL CULLUM, JR., CONSULTING RADIO ENGINEERS, IN CONNECTION WITH THE APPLICATION OF THE MATHESON RADIO COMPANY, INC., LICENSEE OF WHDH, BOSTON, MASSACHUSETTS, FOR MODIFICATION OF CONSTRUCTION PERMIT BP-4912 TO SPECIFY CHANGES IN ANTENNA HEIGHTS AND IN GROUND SYSTEM.

* * * * * *

I, D. A. PETERSON, AM A RADIO ENGINEER ASSOCIATED WITH THE FIRM OF A. EARL CULLUM, JR., CONSULTING RADIO ENGINEERS, WITH OFFICES LOCATED IN DALLAS, TEXAS. I GRADUATED FROM THE ENGINEERING SCHOOL OF SOUTHERN METHODIST UNIVERSITY IN 1934 WITH A BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING. MY EXPERIENCE INCLUDES ALMOST CONTINUOUS EMPLOYMENT BY BROADCAST STATIONS SINCE 1933. SINCE 1940, I HAVE BEEN ASSOCIATED WITH THE FIRM OF A. EARL CULLUM, JR.

THIS FIRM HAS BEEN EMPLOYED BY THE MATHESON RADIO COMPANY, INC., LICENSEE OF STATION WHDH, BOSTON, MASSACHUSETTS, TO PREPARE THE ENGINEERING PORTION OF AN APPLICATION FOR MODIFICATION OF CONSTRUCTION PERMIT BP-4912 TO SPECIFY CHANGES IN ANTENNA HEIGHTS AND IN GROUND SYSTEM. THE PURPOSE OF SUCH CHANGES IS TO PROVIDE IN ACTUAL OPERATION AN ANTENNA ARRAY WHICH WILL MORE NEARLY APPROACH THE THEORETICAL PERFORMANCE PREDICTED FOR EQUAL HEIGHT TOWERS THAN WOULD BE OBTAINED IF EQUAL HEIGHT TOWERS WERE USED.

CURRENT DISTRIBUTION MEASUREMENTS HAVE BEEN MADE ON SEVERAL DIRECTIONAL ARRAYS HAVING CHARACTERISTICS SIMILAR TO THE WHDH ARRAY, AND DATA DESCRIBING THE MEASUREMENTS ARE ON FILE WITH THE FEDERAL COMMUNICATIONS COMMISSION IN KWKH FILE BL-1040, KRLD FILE BL-1701, AND KPAS FILE BL-1752. COPIES OF THESE CURRENT DISTRIBUTION

MEASUREMENTS ARE ATTACHED. SUCH MEASUREMENTS DEMONSTRATE TWO IMPORTANT FACTS FOR UNIFORM CROSS-SECTION, GUYED, VERTICAL, STEEL RADIATORS AS FOLLOWS:

A. FOR NONDIRECTIONAL OPERATION, THE VELOCITY OF PROPAGATION ALONG THE TOWER IS APPROXIMATELY 90 PER CENT OF THE SPEED OF LIGHT, AND

B. FOR DIRECTIONAL OPERATION, THE VELOCITY OF PROPAGATION VARIES AS A RESULT OF THE LOADING CAUSED BY THE MUTUAL IMPEDANCE EFFECTS BETWEEN THE TOWERS.

AFTER STUDYING THE CURRENT DISTRIBUTION MEASUREMENTS ATTACHED, IT WAS DECIDED THAT THE WHDH THREE-ELEMENT ARRAY COULD BE MADE TO PERFORM MORE NEARLY IN ACCORDANCE WITH THEORETICAL PREDICTIONS OF VERTICAL RADIATION CHARACTERISTICS, BY MAKING THE TOWER HEIGHTS SLIGHTLY UNEQUAL; ACCORDINGLY, IT IS PROPOSED TO LENGTHEN THE WEST TOWER 6.7 PER CENT AND TO SHORTEN THE EAST TOWER 6.7 PER CENT. THE CENTER TOWER IS TO REMAIN UNCHANGED. IT IS EXPECTED THAT SUCH CHANGES WILL CAUSE THE ELECTRICAL HEIGHT OF ALL THREE TOWERS TO BE APPROXIMATELY 207 DEGREES WHEN OPERATING DIRECTIONAL.

IT IS PROPOSED TO INCREASE THE GROUND SYSTEM TO 180 RADIALS ABOUT EACH TOWER AND TO ELEVATE THE FIRST 30 FEET OF THE GROUND SYSTEM 7.5 FEET ABOVE THE GROUND. IT IS MY BELIEF THAT SUCH A GROUND SYSTEM IS DESIRABLE IN PROVIDING FOR STABLE OPERATION.

## LIST OF ATTACHED FIGURES

IN CARRYING OUT THE STUDIES, THE FOLLOWING FIGURES WERE PREPARED BY ME OR UNDER MY DIRECTION:

1. SPECIFICATIONS OF ANTENNA SYSTEM FOR WHDH.
2. DIRECTIONAL ANTENNA FORMULAE.
3. DIRECTIONAL ANTENNA CALCULATIONS.

4. ANTENNA AND GROUND SYSTEM SPECIFICATIONS.

5. DIRECTIONAL ANTENNA HORIZONTAL RADIATION PATTERN AND TABULATION OF DATA FOR 50-KW OPERATION ON THE 850-KC CHANNEL.

6. DIRECTIONAL ANTENNA VERTICAL RADIATION PATTERNS AND TABULATIONS OF DATA FOR 50-KW OPERATION ON THE 850-KC CHANNEL.

7A. GRAPH SHOWING THE CURRENT DISTRIBUTION IN THE CENTER TOWER OF THE KWKH 3-ELEMENT ARRAY FOR DAYTIME OPERATION WITH THE TWO END TOWERS GROUNDED.

7B. GRAPH SHOWING THE CURRENT DISTRIBUTION IN ALL THREE TOWERS OF THE KWKH 3-ELEMENT ARRAY WHEN OPERATING DIRECTIONAL. THE SOUTH TOWER IS ON THE MAXIMUM SIDE OF THE ARRAY AND HAS INCREASED LOADING DUE TO MUTUAL IMPEDANCE EFFECTS. THE NORTH TOWER IS ON THE MINIMUM SIDE OF THE ARRAY AND HAS DECREASED LOADING DUE TO MUTUAL IMPEDANCE EFFECTS. THE CENTER TOWER IS VIRTUALLY UNCHANGED FROM NONDIRECTIONAL OPERATION, SINCE THERE IS NO APPRECIABLE CHANGE IN THE LOADING EFFECT. CALCULATIONS OF LOOP IMPEDANCES VERIFY THE LOADING EFFECTS ON EACH OF THE TOWERS.

8A. GRAPH SHOWING THE CURRENT DISTRIBUTION FOR BOTH TOWERS OF THE KRLD 2-ELEMENT ARRAY FOR DAYTIME OPERATION WITH THE SOUTHWEST TOWER GROUNDED. OPERATION IS ESSENTIALLY NONDIRECTIONAL.

8B. GRAPH SHOWING THE CURRENT DISTRIBUTION FOR BOTH TOWERS OF THE KRLD 2-ELEMENT ARRAY WHEN OPERATING DIRECTIONAL. THE SOUTHWEST TOWER WHICH IS ON THE MAXIMUM SIDE OF THE ARRAY HAS INCREASED LOADING AND THE NORTHEAST TOWER WHICH IS ON THE MINIMUM SIDE OF THE ARRAY HAS DECREASED LOADING OVER THAT INDICATED FOR NONDIRECTIONAL OPERATION. CALCULATIONS OF LOOP IMPEDANCES VERIFY THE LOADING EFFECTS.

9. GRAPH SHOWING THE CURRENT DISTRIBUTION FOR THE KPAS 3-ELEMENT ARRAY. THE SOUTHWEST TOWER WHICH IS ON THE MAXIMUM SIDE OF THE ARRAY HAS INCREASED LOADING AND THE NORTHEAST TOWER WHICH IS ON THE MINIMUM SIDE OF THE ARRAY HAS DECREASED LOADING OVER THAT INDICATED FOR THE CENTER TOWER. BASE IMPEDANCE CALCULATIONS AND MEASUREMENTS VERIFY THE LOADING EFFECTS.

10A. GRAPH SHOWING THE APPROXIMATE CURRENT DISTRIBUTION TO BE EXPECTED IF EQUAL HEIGHT TOWERS ARE TO BE USED FOR THE WHDH 3-ELEMENT DIRECTIONAL ARRAY. LOOP IMPEDANCE CALCULATIONS INDICATE THAT THE WEST TOWER WILL HAVE DECREASED LOADING, THAT THE EAST TOWER WILL HAVE INCREASED LOADING, AND THAT THE CENTER TOWER WILL HAVE NO APPRECIABLE CHANGE IN LOADING FOR DIRECTIONAL OPERATION.

10B. GRAPH SHOWING THE APPROXIMATE CURRENT DISTRIBUTION TO BE EXPECTED IF UNEQUAL-HEIGHT TOWERS AS SHOWN ARE TO BE USED FOR THE WHDH 3-ELEMENT DIRECTIONAL ARRAY.

## CONCLUSIONS

AS THE RESULT OF THE STUDIES WHICH HAVE BEEN MADE, IT IS MY BELIEF THAT THE FOLLOWING CONCLUSIONS ARE TRUE AND CORRECT:

A. THE WHDH 3-ELEMENT ARRAY WITH EQUAL-HEIGHT TOWERS CAN BE ADJUSTED TO COMPLY WITH THE MAXIMUM EXPECTED OPERATING VALUES SHOWN ON FIGURE 5A ATTACHED

B. THE WHDH 3-ELEMENT ARRAY WITH UNEQUAL-HEIGHT TOWERS CAN BE ADJUSTED TO COMPLY WITH THE MAXIMUM EXPECTED OPERATING VALUES SHOWN ON FIGURE 5A ATTACHED

C. THE USE OF UNEQUAL-HEIGHT TOWERS AS SPECIFIED ABOVE WILL PROVIDE VERTICAL RADIATION PATTERNS MORE NEARLY IN ACCORD WITH VALUES SHOWN ON FIGURES 6A TO 6H ATTACHED, AS PREDICTED FOR EQUAL-HEIGHT TOWERS, THAN WOULD BE OBTAINED IF EQUAL-HEIGHT TOWERS WERE ACTUALLY USED

D. THE PROPOSED CHANGES IN TOWER HEIGHTS WILL NOT CHANGE THE INDIVIDUAL LIMITATION TO ANY STATION EXISTING OR PROPOSED FROM THE INDIVIDUAL LIMITATIONS BASED ON WHDH PATTERN 460516 IN FILE BP-4912

E. THE PROPOSED CHANGES IN TOWER HEIGHTS WILL NOT CHANGE THE COVERAGE CONTOURS BASED ON WHDH PATTERN 460516 IN FILE BP-4912.

A. EARL CULLUM, JR.

CONSULTING RADIO ENGINEERS

BY D. A. Peterson
D. A. PETERSON

JUNE 21, 1947

STATE OF TEXAS )
) SS:
COUNTY OF DALLAS )

D. A. PETERSON, BEING DULY SWORN, UPON HIS OATH DEPOSES AND SAYS THAT THE FACTS STATED IN THE FOREGOING, TOGETHER WITH ALL FIGURES ATTACHED THERETO, ARE TRUE OF HIS OWN KNOWLEDGE, EXCEPT AS TO SUCH STATEMENTS AS THEREIN STATED TO BE BASED ON INFORMATION AND BELIEF, AND AS TO SUCH STATEMENTS HE BELIEVES THEM TO BE TRUE.

D. A. Peterson

D. A. PETERSON

SWORN TO AND SUBSCRIBED BEFORE ME THIS 21ST DAY OF JUNE, 1947.

Notary Public in and for
Dallas County, Texas

MY COMMISSION EXPIRES JUNE 1, 1949

We propose to further augment the nighttime directional antenna pattern of WEEI as summarized in the table below.

NIGHT PATTERN

| Radial | 25 kW NON-DA IDF (mV/m/km) | DA/NDA Ratio | DA-N IDF (mV/m/km) | Licensed Augmented IDF (mV/m/km) | Proposed Augmented IDF (MV/m/km) |
|---|---|---|---|---|---|
| 191.7° | 2010 | 0.412 | 828.1 | 1060 | |
| 291.2° | 1770 | 0.152 | 269 | 289.5 | |
| 240° | 1610 | 0.171 | 275.3 | 103 | 325 |
| 260° | 1750 | 0.162 | 283.5 | 128.8 | 292 |
| 280° | 1610 | 0.156 | 251.2 | 104.6 | 290 |

Justification for the requested augmentation is demonstrated in the Proof of Performance for WEEI contained in the concurrently filed FCC Form 302 application for direct measurement of power.

Additionally, several existing augmentations are eliminated by this proposal. All eliminated augmentations are either duplicates (two augmentations of the same radial) or augmentations of radials not measured in any proof of performance. All eliminated augmentations are of radials included within the spans of other augmented radials.

The following site to site RSS study contains calculations for all stations within the span of the proposed augmentations to which the proposed operation of WEEI will exceed the 10% RSS threshold. Also included in this report are maps demonstrating nighttime skywave protection of Class A stations KOA, Denver and WHAS, Louisville.

Site to Site RSS Study
WEEI-AM
Boston, MA

Point: ENOLA  Frequency: 850 kHz

| Station Call | | Distance (km) | Bearing (degs.) | Theta (degs.) | Radiation (mV/m) | SW Mult. (uV/m) | IF Level (mV/m) | RSS (mV/m) |
|---|---|---|---|---|---|---|---|---|
| WKGE | | 163.9 | 84.7 | 55.2 | 205.0 | 329.872 | 13.5275 | 13.5275 |
| CJBC | * | 433.8 | 146.1 | 17.4 | 2280.3 | 127.169 | 5.7996 | 14.7183 |
| **WEEI-P** | | **524.0** | **247.1** | **14.2** | **181.8** | **99.438** | **3.6157** | |
| WTAR | | 361.1 | 356.3 | 32.7 | 103.6 | 170.329 | 3.5285 | |
| KOA | | 2363.1 | 78.9 | .0 | 2560.4 | 6.879 | 3.5229 | |

Point: ENOLA  Frequency: 850 kHz

| Station Call | | Distance (km) | Bearing (degs.) | Theta (degs.) | Radiation (mV/m) | SW Mult. (uV/m) | IF Level (mV/m) | RSS (mV/m) |
|---|---|---|---|---|---|---|---|---|
| WKGE | | 164.9 | 84.7 | 55.0 | 203.1 | 328.831 | 13.3569 | 13.3569 |
| CJBC | * | 434.1 | 146.0 | 17.4 | 2281.1 | 127.051 | 5.7964 | 14.5604 |
| **WEEI-P** | | **523.1** | **247.1** | **14.2** | **182.0** | **99.679** | **3.6285** | |
| WTAR | | 361.2 | 356.5 | 32.7 | 103.7 | 170.242 | 3.5308 | |
| KOA | | 2364.0 | 78.9 | .0 | 2560.4 | 6.873 | 3.5195 | |

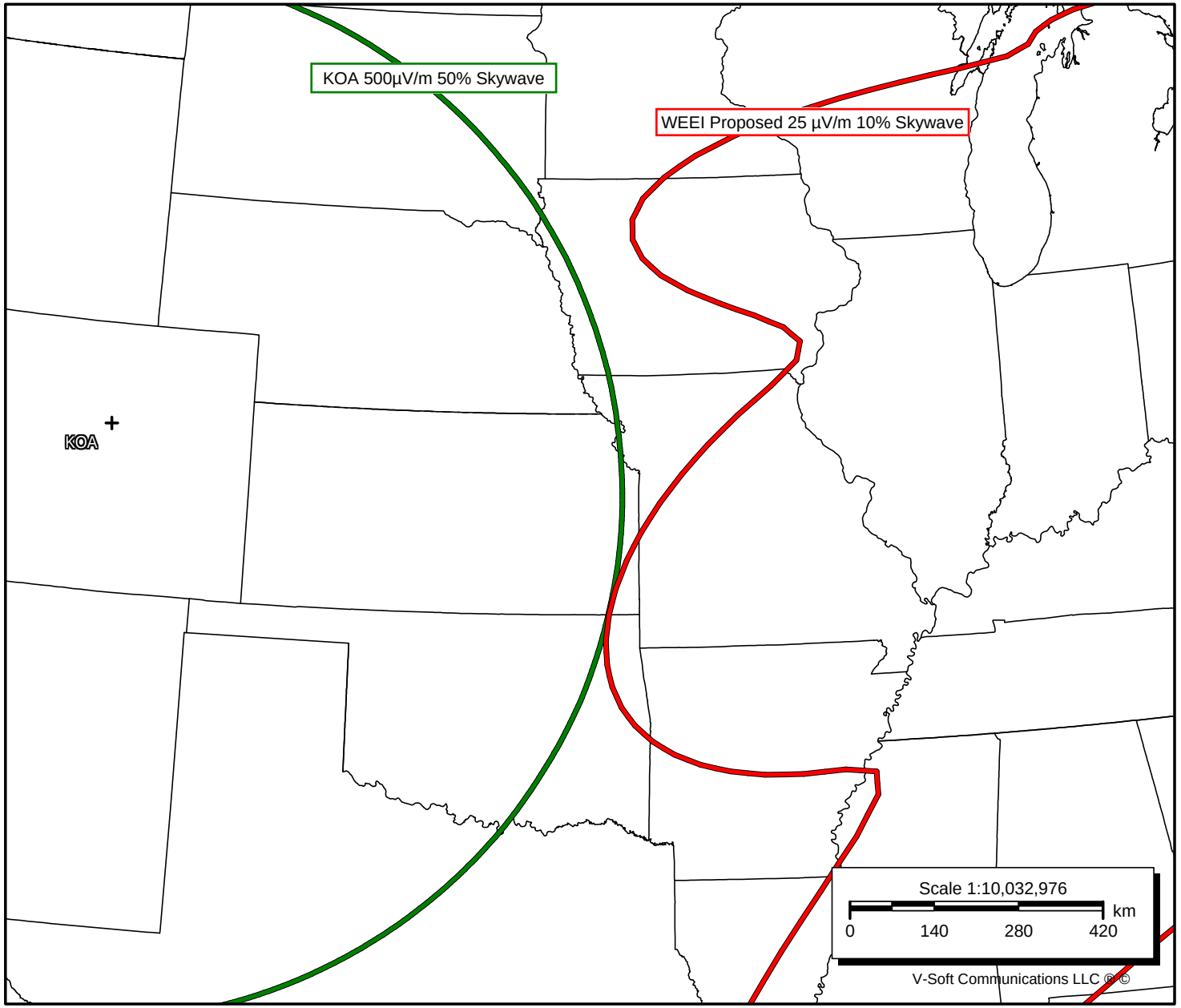
Point: WTAR  Frequency: 850 kHz

| Station Call | | Distance (km) | Bearing (degs.) | Theta (degs.) | Radiation (mV/m) | SW Mult. (uV/m) | IF Level (mV/m) | RSS (mV/m) |
|---|---|---|---|---|---|---|---|---|
| WKIX | | 235.9 | 53.0 | 30.8 | 171.9 | 263.339 | 9.0512 | 9.0512 |
| WKNR | | 642.1 | 135.8 | 19.0 | 343.5 | 78.700 | 5.4063 | 10.5428 |
| WKGE | | 396.1 | 150.5 | 30.2 | 156.7 | 153.003 | 4.7953 | 11.5821 |
| KOA | | 2455.2 | 87.4 | .0 | 2560.4 | 7.049 | 3.6099 | 12.1317 |
| YVLC | | 3114.6 | 345.1 | .0 | 2188.2 | 8.106 | 3.5475 | 12.6397 |
| WHAS | * | 780.3 | 97.2 | 8.7 | 2727.6 | 60.768 | 3.3150 | 13.0672 |
| CJBC | * | 771.2 | 158.9 | 8.8 | 2770.3 | 57.138 | 3.1659 | |
| **WEEI-P** | | **742.6** | **220.4** | **9.3** | **250.8** | **61.736** | **3.0966** | |

* - indicates an adjacent channel station.

Skywave Protection of
Co-Channel Class A Station
KOA, Denver

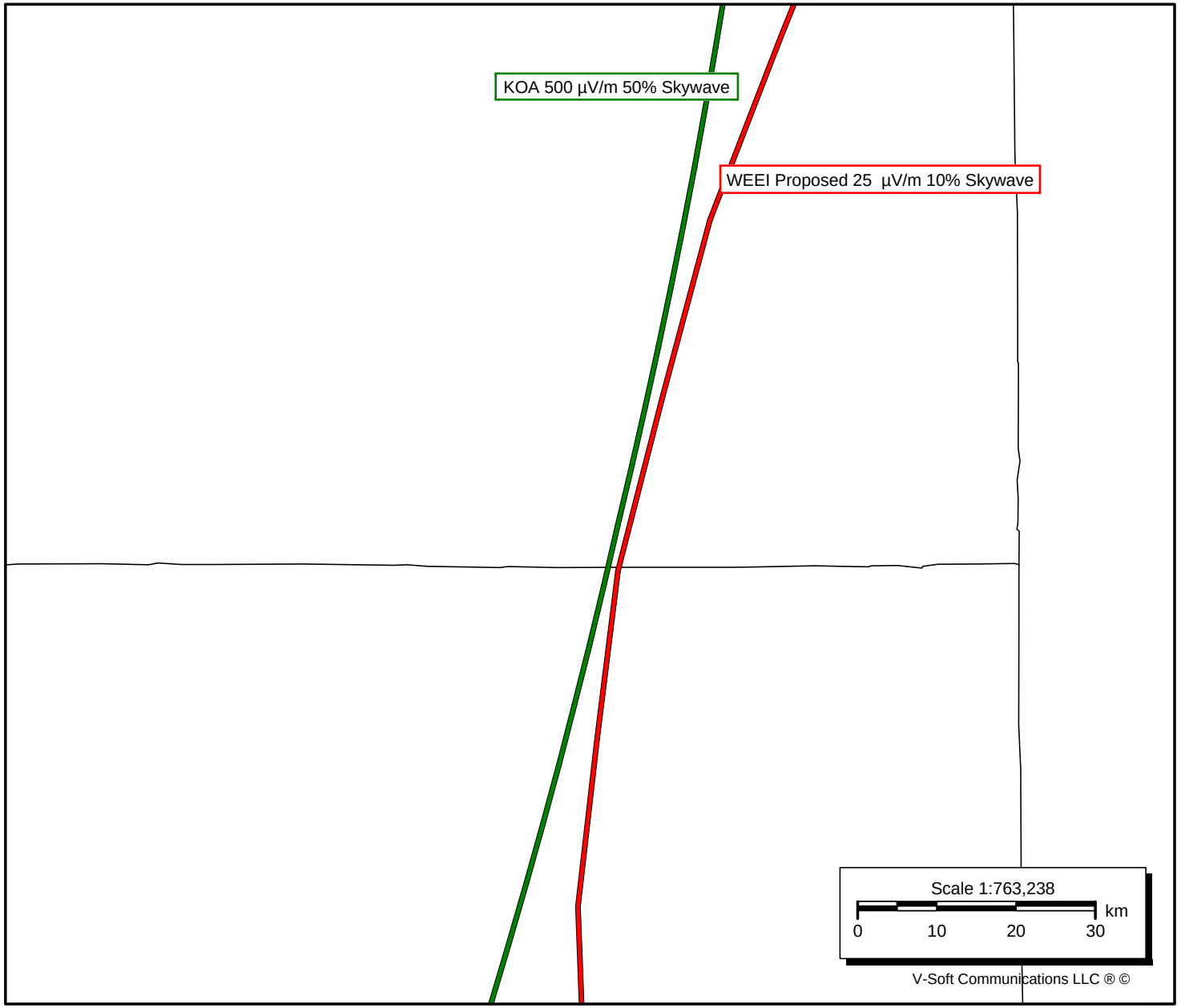
WEEI-AM
Boston, MA



Skywave Protection of
Co-Channel Class A
Station KOA, Denver

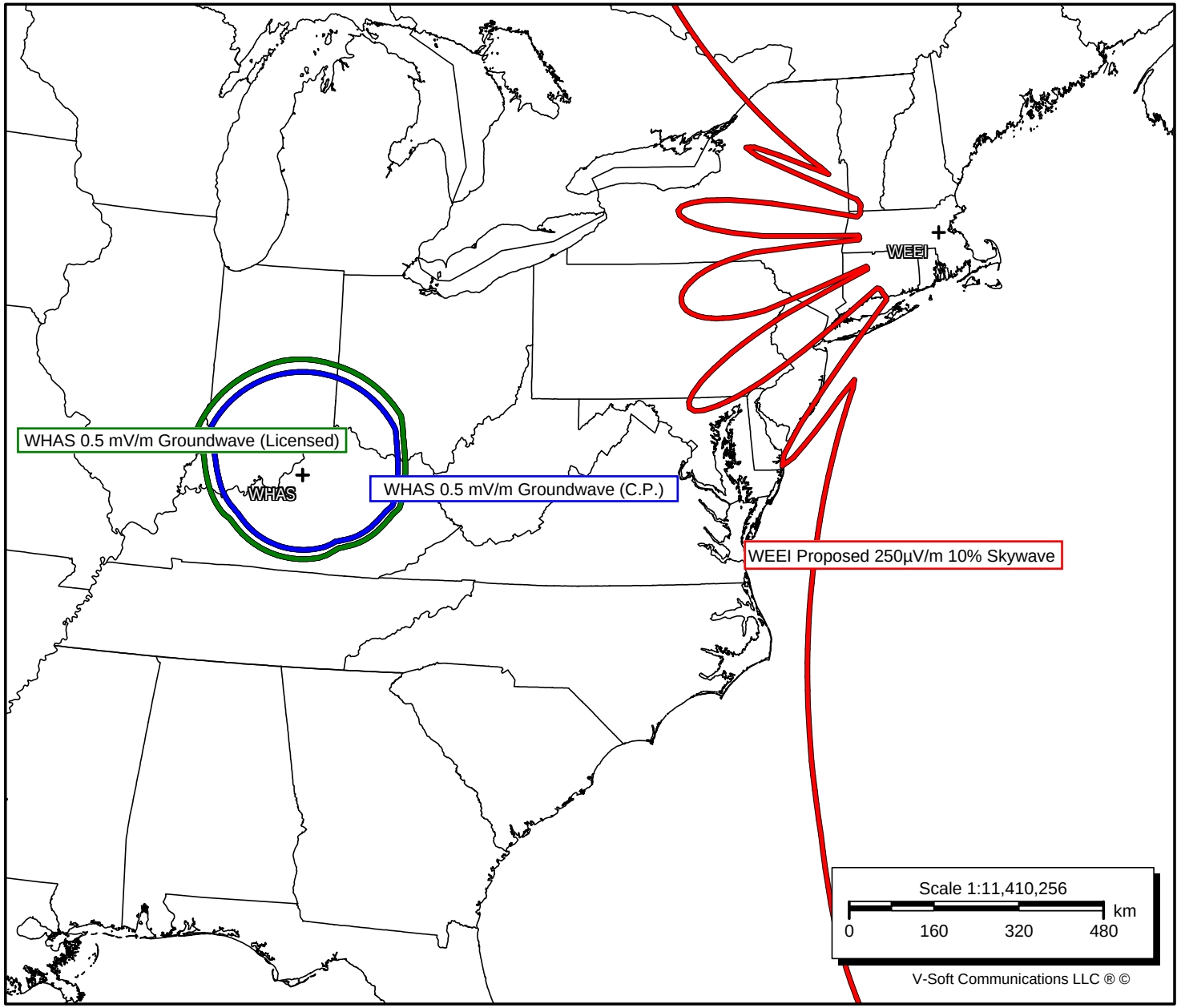
(Expanded View)

WEEI-AM
Boston, MA

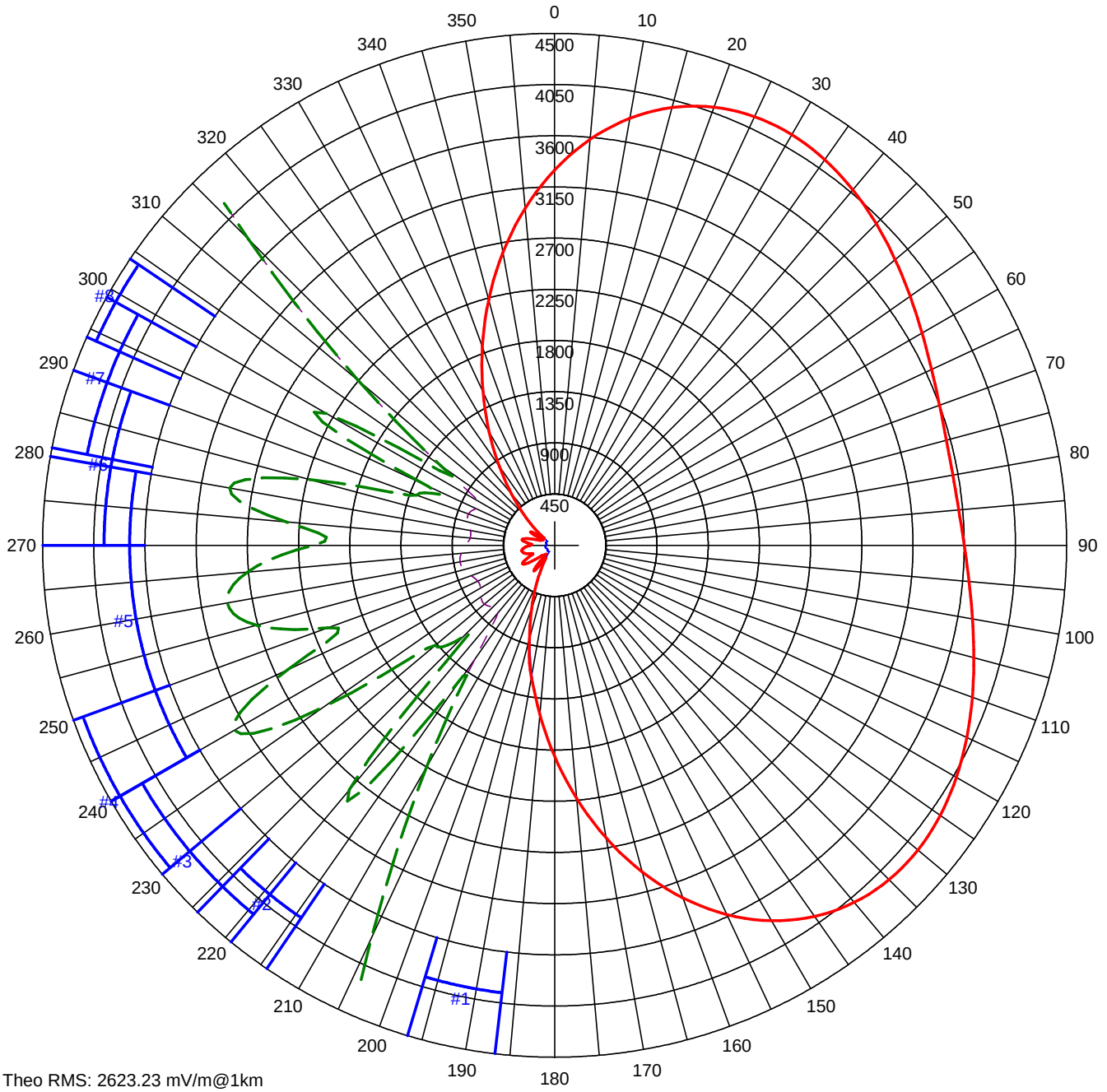


Skywave Protection of
Adj-Channel Class A
Station WHAS Louisville

WEEI-AM
Boston, MA



# AM Directional Pattern




Theo RMS: 2623.23 mV/m@1km
Std RMS: 2755.392 mV/m@1km
Aug RMS: 2757.714 mV/m@1km
Q: 70.711 mV/m@1km

Modified Standard Horizontal Plane Pattern

Aug Pattern (mV/m@1km)
Std Pattern (mV/m@1km)
Aug Pattern X10
Std Pattern X10

| # | Field Ratio | Phase (deg) | Spacing (deg) | Orient (deg) | Height (deg) | Ref Swtch |
|---|---|---|---|---|---|---|
| 1 | 1.000 | 75.0 | 0.0 | 0.0 | 207.0 | 0 |
| 2 | 1.970 | 0.0 | 120.0 | 80.0 | 207.0 | 0 |
| 3 | 1.000 | -75.0 | 240.0 | 80.0 | 207.0 | 0 |

| # | Azimuth (deg) | Radiation (mV/m@1km) | Span (deg) |
|---|---|---|---|
| 1 | 191.70 | 1078.26 | 10.0 |
| 2 | 219.20 | 289.68 | 10.0 |
| 3 | 229.60 | 136.79 | 20.8 |
| 4 | 240.00 | 325.00 | 20.0 |
| 5 | 260.00 | 292.00 | 40.0 |
| 6 | 280.00 | 290.00 | 20.0 |
| 7 | 290.00 | 128.75 | 18.0 |
| 8 | 299.00 | 241.40 | 10.0 |

Call: WEEI
Freq: 850 kHz
BOSTON, MA, US
Hours: N
Lat: 42-16-41 N
Lng: 071-16-02 W
Power: 50.0 kW
Theo RMS: 2623.23 mV/m@1km
@ 50.0 kW
# of Augmentations: 8

# Tabulation of Proposed Nighttime Augmented Directional Antenna Pattern

Call: WEEI
Freq: 850 kHz
BOSTON, MA, US
Hours: N
Lat: 42-16-41 N
Lng: 071-16-02 W
Power: 50.0 kW
Theo RMS: 2623.23 mV/m @ 1km @ 50.0 kW
# of Augmentations: 8

| # | Field Ratio | Phase (deg) | Spacing (deg) | Orient (deg) | Height (deg) | Ref Swtch | TL Swtch | A (deg) | B (deg) | C (deg) | D (deg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 75.0 | 0.0 | 0.0 | 207.0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1.970 | 0.0 | 120.0 | 80.0 | 207.0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 1.000 | -75.0 | 240.0 | 80.0 | 207.0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |

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## Augmented Horizontal Plane Pattern

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 3298.70 | 120.0 | 4078.00 | 240.0 | 325.00 |
| 5.0 | 3581.18 | 125.0 | 4137.97 | 245.0 | 258.80 |
| 10.0 | 3810.87 | 130.0 | 4167.48 | 250.0 | 212.49 |
| 15.0 | 3983.14 | 135.0 | 4156.78 | 255.0 | 271.10 |
| 20.0 | 4097.40 | 140.0 | 4097.40 | 260.0 | 292.00 |
| 25.0 | 4156.78 | 145.0 | 3983.14 | 265.0 | 271.10 |
| 30.0 | 4167.48 | 150.0 | 3810.87 | 270.0 | 212.49 |
| 35.0 | 4137.97 | 155.0 | 3581.18 | 275.0 | 237.10 |
| 40.0 | 4078.00 | 160.0 | 3298.70 | 280.0 | 290.00 |
| 45.0 | 3997.74 | 165.0 | 2971.98 | 285.0 | 222.78 |
| 50.0 | 3907.07 | 170.0 | 2612.94 | 290.0 | 128.75 |
| 55.0 | 3814.97 | 175.0 | 2235.89 | 295.0 | 122.48 |
| 60.0 | 3729.20 | 180.0 | 1856.29 | 300.0 | 231.56 |
| 65.0 | 3656.09 | 185.0 | 1489.38 | 305.0 | 122.15 |
| 70.0 | 3600.49 | 190.0 | 1173.94 | 310.0 | 224.62 |
| 75.0 | 3565.80 | 195.0 | 857.82 | 315.0 | 380.55 |
| 80.0 | 3554.01 | 200.0 | 588.25 | 320.0 | 588.25 |
| 85.0 | 3565.80 | 205.0 | 380.55 | 325.0 | 845.86 |
| 90.0 | 3600.49 | 210.0 | 224.62 | 330.0 | 1148.86 |
| 95.0 | 3656.09 | 215.0 | 140.37 | 335.0 | 1489.38 |
| 100.0 | 3729.20 | 220.0 | 280.70 | 340.0 | 1856.29 |
| 105.0 | 3814.97 | 225.0 | 114.18 | 345.0 | 2235.89 |
| 110.0 | 3907.07 | 230.0 | 136.71 | 350.0 | 2612.94 |
| 115.0 | 3997.74 | 235.0 | 248.95 | 355.0 | 2971.98 |

Augmented Pattern

Calculated at 5.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 3222.90 | 120.0 | 3990.76 | 240.0 | 318.27 |
| 5.0 | 3498.45 | 125.0 | 4047.73 | 245.0 | 253.33 |
| 10.0 | 3722.84 | 130.0 | 4075.00 | 250.0 | 207.66 |
| 15.0 | 3891.55 | 135.0 | 4063.14 | 255.0 | 264.91 |
| 20.0 | 4003.98 | 140.0 | 4003.98 | 260.0 | 285.33 |
| 25.0 | 4063.14 | 145.0 | 3891.55 | 265.0 | 264.91 |
| 30.0 | 4075.00 | 150.0 | 3722.84 | 270.0 | 207.66 |
| 35.0 | 4047.73 | 155.0 | 3498.45 | 275.0 | 232.07 |
| 40.0 | 3990.76 | 160.0 | 3222.90 | 280.0 | 284.01 |
| 45.0 | 3913.94 | 165.0 | 2904.48 | 285.0 | 218.22 |
| 50.0 | 3826.83 | 170.0 | 2554.72 | 290.0 | 125.97 |
| 55.0 | 3738.17 | 175.0 | 2187.50 | 295.0 | 119.70 |
| 60.0 | 3655.48 | 180.0 | 1817.76 | 300.0 | 227.01 |
| 65.0 | 3584.94 | 185.0 | 1460.27 | 305.0 | 122.70 |
| 70.0 | 3531.25 | 190.0 | 1152.77 | 310.0 | 224.31 |
| 75.0 | 3497.74 | 195.0 | 844.27 | 315.0 | 377.54 |
| 80.0 | 3486.35 | 200.0 | 580.91 | 320.0 | 580.91 |
| 85.0 | 3497.74 | 205.0 | 377.54 | 325.0 | 832.62 |
| 90.0 | 3531.25 | 210.0 | 224.31 | 330.0 | 1128.30 |
| 95.0 | 3584.94 | 215.0 | 140.14 | 335.0 | 1460.27 |
| 100.0 | 3655.48 | 220.0 | 275.06 | 340.0 | 1817.76 |
| 105.0 | 3738.17 | 225.0 | 111.55 | 345.0 | 2187.50 |
| 110.0 | 3826.83 | 230.0 | 133.76 | 350.0 | 2554.72 |
| 115.0 | 3913.94 | 235.0 | 243.83 | 355.0 | 2904.48 |

Augmented Pattern

Calculated at 10.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 3003.69 | 120.0 | 3736.99 | 240.0 | 298.85 |
| 5.0 | 3259.25 | 125.0 | 3785.60 | 245.0 | 237.68 |
| 10.0 | 3468.25 | 130.0 | 3806.71 | 250.0 | 194.15 |
| 15.0 | 3626.55 | 135.0 | 3791.79 | 255.0 | 247.51 |
| 20.0 | 3733.52 | 140.0 | 3733.52 | 260.0 | 266.56 |
| 25.0 | 3791.79 | 145.0 | 3626.55 | 265.0 | 247.51 |
| 30.0 | 3806.71 | 150.0 | 3468.25 | 270.0 | 194.15 |
| 35.0 | 3785.60 | 155.0 | 3259.25 | 275.0 | 217.74 |
| 40.0 | 3736.99 | 160.0 | 3003.69 | 280.0 | 266.74 |
| 45.0 | 3669.81 | 165.0 | 2709.14 | 285.0 | 204.97 |
| 50.0 | 3592.75 | 170.0 | 2386.08 | 290.0 | 117.82 |
| 55.0 | 3513.79 | 175.0 | 2047.07 | 295.0 | 111.77 |
| 60.0 | 3439.84 | 180.0 | 1705.67 | 300.0 | 214.06 |
| 65.0 | 3376.55 | 185.0 | 1375.26 | 305.0 | 124.27 |
| 70.0 | 3328.30 | 190.0 | 1090.66 | 310.0 | 222.95 |
| 75.0 | 3298.14 | 195.0 | 804.17 | 315.0 | 368.11 |
| 80.0 | 3287.88 | 200.0 | 558.80 | 320.0 | 558.80 |
| 85.0 | 3298.14 | 205.0 | 368.11 | 325.0 | 793.41 |
| 90.0 | 3328.30 | 210.0 | 222.95 | 330.0 | 1067.90 |
| 95.0 | 3376.55 | 215.0 | 139.57 | 335.0 | 1375.26 |
| 100.0 | 3439.84 | 220.0 | 258.95 | 340.0 | 1705.67 |
| 105.0 | 3513.79 | 225.0 | 104.09 | 345.0 | 2047.07 |
| 110.0 | 3592.75 | 230.0 | 125.15 | 350.0 | 2386.08 |
| 115.0 | 3669.81 | 235.0 | 228.97 | 355.0 | 2709.14 |

Augmented Pattern

Calculated at 15.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 2664.22 | 120.0 | 3339.62 | 240.0 | 268.82 |
| 5.0 | 2888.98 | 125.0 | 3376.25 | 245.0 | 213.86 |
| 10.0 | 3074.08 | 130.0 | 3388.77 | 250.0 | 174.26 |
| 15.0 | 3215.93 | 135.0 | 3370.01 | 255.0 | 221.73 |
| 20.0 | 3313.87 | 140.0 | 3313.87 | 260.0 | 238.70 |
| 25.0 | 3370.01 | 145.0 | 3215.93 | 265.0 | 221.73 |
| 30.0 | 3388.77 | 150.0 | 3074.08 | 270.0 | 174.26 |
| 35.0 | 3376.25 | 155.0 | 2888.98 | 275.0 | 195.98 |
| 40.0 | 3339.62 | 160.0 | 2664.22 | 280.0 | 240.03 |
| 45.0 | 3286.43 | 165.0 | 2406.26 | 285.0 | 184.24 |
| 50.0 | 3224.09 | 170.0 | 2124.01 | 290.0 | 105.01 |
| 55.0 | 3159.42 | 175.0 | 1828.10 | 295.0 | 100.06 |
| 60.0 | 3098.38 | 180.0 | 1530.00 | 300.0 | 194.75 |
| 65.0 | 3045.87 | 185.0 | 1241.06 | 305.0 | 126.38 |
| 70.0 | 3005.68 | 190.0 | 991.71 | 310.0 | 219.23 |
| 75.0 | 2980.51 | 195.0 | 739.18 | 315.0 | 351.15 |
| 80.0 | 2971.95 | 200.0 | 521.78 | 320.0 | 521.78 |
| 85.0 | 2980.51 | 205.0 | 351.15 | 325.0 | 729.75 |
| 90.0 | 3005.68 | 210.0 | 219.23 | 330.0 | 971.51 |
| 95.0 | 3045.87 | 215.0 | 138.66 | 335.0 | 1241.06 |
| 100.0 | 3098.38 | 220.0 | 234.65 | 340.0 | 1530.00 |
| 105.0 | 3159.42 | 225.0 | 93.14 | 345.0 | 1828.10 |
| 110.0 | 3224.09 | 230.0 | 111.64 | 350.0 | 2124.01 |
| 115.0 | 3286.43 | 235.0 | 205.79 | 355.0 | 2406.26 |

Augmented Pattern

Calculated at 20.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 2238.80 | 120.0 | 2833.70 | 240.0 | 231.19 |
| 5.0 | 2425.30 | 125.0 | 2857.13 | 245.0 | 184.29 |
| 10.0 | 2580.35 | 130.0 | 2860.66 | 250.0 | 150.28 |
| 15.0 | 2701.00 | 135.0 | 2838.72 | 255.0 | 190.73 |
| 20.0 | 2786.62 | 140.0 | 2786.62 | 260.0 | 205.19 |
| 25.0 | 2838.72 | 145.0 | 2701.00 | 265.0 | 190.73 |
| 30.0 | 2860.66 | 150.0 | 2580.35 | 270.0 | 150.28 |
| 35.0 | 2857.13 | 155.0 | 2425.30 | 275.0 | 168.98 |
| 40.0 | 2833.70 | 160.0 | 2238.80 | 280.0 | 206.48 |
| 45.0 | 2796.32 | 165.0 | 2025.97 | 285.0 | 158.00 |
| 50.0 | 2750.83 | 170.0 | 1793.85 | 290.0 | 89.09 |
| 55.0 | 2702.68 | 175.0 | 1550.82 | 295.0 | 86.97 |
| 60.0 | 2656.66 | 180.0 | 1305.89 | 300.0 | 171.96 |
| 65.0 | 2616.75 | 185.0 | 1067.99 | 305.0 | 127.62 |
| 70.0 | 2586.04 | 190.0 | 862.36 | 310.0 | 211.04 |
| 75.0 | 2566.74 | 195.0 | 652.15 | 315.0 | 325.15 |
| 80.0 | 2560.16 | 200.0 | 469.93 | 320.0 | 469.93 |
| 85.0 | 2566.74 | 205.0 | 325.15 | 325.0 | 644.25 |
| 90.0 | 2586.04 | 210.0 | 211.04 | 330.0 | 845.22 |
| 95.0 | 2616.75 | 215.0 | 136.72 | 335.0 | 1067.99 |
| 100.0 | 2656.66 | 220.0 | 205.47 | 340.0 | 1305.89 |
| 105.0 | 2702.68 | 225.0 | 81.10 | 345.0 | 1550.82 |
| 110.0 | 2750.83 | 230.0 | 94.86 | 350.0 | 1793.85 |
| 115.0 | 2796.32 | 235.0 | 176.54 | 355.0 | 2025.97 |

Augmented Pattern

Calculated at 25.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 1767.57 | 120.0 | 2262.28 | 240.0 | 189.73 |
| 5.0 | 1912.27 | 125.0 | 2273.68 | 245.0 | 151.60 |
| 10.0 | 2033.94 | 130.0 | 2269.79 | 250.0 | 124.02 |
| 15.0 | 2130.35 | 135.0 | 2246.64 | 255.0 | 157.18 |
| 20.0 | 2200.93 | 140.0 | 2200.93 | 260.0 | 169.03 |
| 25.0 | 2246.64 | 145.0 | 2130.35 | 265.0 | 157.18 |
| 30.0 | 2269.79 | 150.0 | 2033.94 | 270.0 | 124.02 |
| 35.0 | 2273.68 | 155.0 | 1912.27 | 275.0 | 139.05 |
| 40.0 | 2262.28 | 160.0 | 1767.57 | 280.0 | 169.42 |
| 45.0 | 2239.86 | 165.0 | 1603.61 | 285.0 | 129.12 |
| 50.0 | 2210.70 | 170.0 | 1425.50 | 290.0 | 72.80 |
| 55.0 | 2178.78 | 175.0 | 1239.33 | 295.0 | 75.48 |
| 60.0 | 2147.68 | 180.0 | 1051.62 | 300.0 | 148.59 |
| 65.0 | 2120.36 | 185.0 | 868.86 | 305.0 | 125.50 |
| 70.0 | 2099.17 | 190.0 | 710.94 | 310.0 | 195.88 |
| 75.0 | 2085.79 | 195.0 | 547.08 | 315.0 | 288.65 |
| 80.0 | 2081.22 | 200.0 | 403.90 | 320.0 | 403.90 |
| 85.0 | 2085.79 | 205.0 | 288.65 | 325.0 | 540.73 |
| 90.0 | 2099.17 | 210.0 | 195.88 | 330.0 | 696.92 |
| 95.0 | 2120.36 | 215.0 | 131.80 | 335.0 | 868.86 |
| 100.0 | 2147.68 | 220.0 | 174.95 | 340.0 | 1051.62 |
| 105.0 | 2178.78 | 225.0 | 70.94 | 345.0 | 1239.33 |
| 110.0 | 2210.70 | 230.0 | 77.56 | 350.0 | 1425.50 |
| 115.0 | 2239.86 | 235.0 | 144.42 | 355.0 | 1603.61 |

Augmented Pattern

Calculated at 30.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 1290.74 | 120.0 | 1671.29 | 240.0 | 149.14 |
| 5.0 | 1393.98 | 125.0 | 1673.72 | 245.0 | 119.13 |
| 10.0 | 1481.91 | 130.0 | 1665.40 | 250.0 | 97.60 |
| 15.0 | 1553.00 | 135.0 | 1643.78 | 255.0 | 123.93 |
| 20.0 | 1606.78 | 140.0 | 1606.78 | 260.0 | 133.31 |
| 25.0 | 1643.78 | 145.0 | 1553.00 | 265.0 | 123.93 |
| 30.0 | 1665.40 | 150.0 | 1481.91 | 270.0 | 97.60 |
| 35.0 | 1673.72 | 155.0 | 1393.98 | 275.0 | 109.21 |
| 40.0 | 1671.29 | 160.0 | 1290.74 | 280.0 | 133.08 |
| 45.0 | 1660.88 | 165.0 | 1174.72 | 285.0 | 101.50 |
| 50.0 | 1645.29 | 170.0 | 1049.29 | 290.0 | 59.54 |
| 55.0 | 1627.19 | 175.0 | 918.44 | 295.0 | 67.14 |
| 60.0 | 1608.97 | 180.0 | 786.44 | 300.0 | 126.15 |
| 65.0 | 1592.64 | 185.0 | 657.57 | 305.0 | 116.80 |
| 70.0 | 1579.82 | 190.0 | 547.04 | 310.0 | 171.33 |
| 75.0 | 1571.67 | 195.0 | 429.17 | 315.0 | 240.82 |
| 80.0 | 1568.87 | 200.0 | 325.33 | 320.0 | 325.33 |
| 85.0 | 1571.67 | 205.0 | 240.82 | 325.0 | 424.14 |
| 90.0 | 1579.82 | 210.0 | 171.33 | 330.0 | 535.71 |
| 95.0 | 1592.64 | 215.0 | 121.03 | 335.0 | 657.57 |
| 100.0 | 1608.97 | 220.0 | 145.64 | 340.0 | 786.44 |
| 105.0 | 1627.19 | 225.0 | 63.98 | 345.0 | 918.43 |
| 110.0 | 1645.29 | 230.0 | 63.16 | 350.0 | 1049.29 |
| 115.0 | 1660.88 | 235.0 | 113.59 | 355.0 | 1174.72 |

Augmented Pattern

Calculated at 35.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 843.63 | 120.0 | 1104.44 | 240.0 | 114.87 |
| 5.0 | 909.09 | 125.0 | 1101.89 | 245.0 | 91.42 |
| 10.0 | 965.62 | 130.0 | 1092.66 | 250.0 | 74.66 |
| 15.0 | 1012.30 | 135.0 | 1075.34 | 255.0 | 95.05 |
| 20.0 | 1048.80 | 140.0 | 1048.80 | 260.0 | 102.31 |
| 25.0 | 1075.34 | 145.0 | 1012.30 | 265.0 | 95.05 |
| 30.0 | 1092.66 | 150.0 | 965.62 | 270.0 | 74.66 |
| 35.0 | 1101.89 | 155.0 | 909.09 | 275.0 | 83.75 |
| 40.0 | 1104.44 | 160.0 | 843.63 | 280.0 | 102.51 |
| 45.0 | 1101.86 | 165.0 | 770.74 | 285.0 | 79.21 |
| 50.0 | 1095.78 | 170.0 | 692.36 | 290.0 | 50.62 |
| 55.0 | 1087.72 | 175.0 | 610.78 | 295.0 | 59.76 |
| 60.0 | 1079.08 | 180.0 | 528.46 | 300.0 | 104.01 |
| 65.0 | 1071.08 | 185.0 | 447.86 | 305.0 | 98.57 |
| 70.0 | 1064.66 | 190.0 | 380.89 | 310.0 | 135.89 |
| 75.0 | 1060.52 | 195.0 | 304.68 | 315.0 | 182.08 |
| 80.0 | 1059.10 | 200.0 | 237.11 | 320.0 | 237.11 |
| 85.0 | 1060.52 | 205.0 | 182.08 | 325.0 | 300.48 |
| 90.0 | 1064.66 | 210.0 | 135.89 | 330.0 | 371.22 |
| 95.0 | 1071.08 | 215.0 | 101.55 | 335.0 | 447.86 |
| 100.0 | 1079.08 | 220.0 | 118.16 | 340.0 | 528.46 |
| 105.0 | 1087.72 | 225.0 | 57.67 | 345.0 | 610.78 |
| 110.0 | 1095.78 | 230.0 | 53.16 | 350.0 | 692.36 |
| 115.0 | 1101.86 | 235.0 | 88.41 | 355.0 | 770.74 |

Augmented Pattern

Calculated at 40.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 453.21 | 120.0 | 598.72 | 240.0 | 91.56 |
| 5.0 | 486.99 | 125.0 | 595.10 | 245.0 | 72.77 |
| 10.0 | 516.60 | 130.0 | 588.12 | 250.0 | 59.29 |
| 15.0 | 541.59 | 135.0 | 577.16 | 255.0 | 75.28 |
| 20.0 | 561.75 | 140.0 | 561.75 | 260.0 | 80.99 |
| 25.0 | 577.16 | 145.0 | 541.59 | 265.0 | 75.28 |
| 30.0 | 588.12 | 150.0 | 516.60 | 270.0 | 59.29 |
| 35.0 | 595.10 | 155.0 | 486.99 | 275.0 | 66.73 |
| 40.0 | 598.72 | 160.0 | 453.21 | 280.0 | 81.85 |
| 45.0 | 599.68 | 165.0 | 415.94 | 285.0 | 64.12 |
| 50.0 | 598.70 | 170.0 | 376.11 | 290.0 | 42.76 |
| 55.0 | 596.51 | 175.0 | 334.77 | 295.0 | 48.84 |
| 60.0 | 593.75 | 180.0 | 293.06 | 300.0 | 80.87 |
| 65.0 | 590.98 | 185.0 | 252.10 | 305.0 | 69.29 |
| 70.0 | 588.66 | 190.0 | 223.41 | 310.0 | 89.76 |
| 75.0 | 587.14 | 195.0 | 181.00 | 315.0 | 114.55 |
| 80.0 | 586.61 | 200.0 | 143.57 | 320.0 | 143.57 |
| 85.0 | 587.14 | 205.0 | 114.55 | 325.0 | 176.54 |
| 90.0 | 588.66 | 210.0 | 89.76 | 330.0 | 212.96 |
| 95.0 | 590.98 | 215.0 | 71.94 | 335.0 | 252.10 |
| 100.0 | 593.75 | 220.0 | 92.25 | 340.0 | 293.06 |
| 105.0 | 596.51 | 225.0 | 47.24 | 345.0 | 334.77 |
| 110.0 | 598.70 | 230.0 | 44.65 | 350.0 | 376.11 |
| 115.0 | 599.68 | 235.0 | 71.26 | 355.0 | 415.94 |

Augmented Pattern

Calculated at 45.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 136.97 | 120.0 | 181.47 | 240.0 | 80.30 |
| 5.0 | 146.54 | 125.0 | 179.75 | 245.0 | 63.97 |
| 10.0 | 155.06 | 130.0 | 177.10 | 250.0 | 52.22 |
| 15.0 | 162.40 | 135.0 | 173.40 | 255.0 | 66.31 |
| 20.0 | 168.52 | 140.0 | 168.52 | 260.0 | 71.34 |
| 25.0 | 173.40 | 145.0 | 162.40 | 265.0 | 66.31 |
| 30.0 | 177.10 | 150.0 | 155.06 | 270.0 | 52.22 |
| 35.0 | 179.75 | 155.0 | 146.54 | 275.0 | 58.65 |
| 40.0 | 181.47 | 160.0 | 136.97 | 280.0 | 71.72 |
| 45.0 | 182.44 | 165.0 | 126.53 | 285.0 | 55.26 |
| 50.0 | 182.82 | 170.0 | 115.46 | 290.0 | 33.07 |
| 55.0 | 182.81 | 175.0 | 104.03 | 295.0 | 33.71 |
| 60.0 | 182.54 | 180.0 | 92.53 | 300.0 | 60.18 |
| 65.0 | 182.18 | 185.0 | 81.26 | 305.0 | 31.35 |
| 70.0 | 181.84 | 190.0 | 92.19 | 310.0 | 36.79 |
| 75.0 | 181.60 | 195.0 | 69.94 | 315.0 | 43.50 |
| 80.0 | 181.51 | 200.0 | 51.42 | 320.0 | 51.42 |
| 85.0 | 181.60 | 205.0 | 43.50 | 325.0 | 60.47 |
| 90.0 | 181.84 | 210.0 | 36.79 | 330.0 | 70.49 |
| 95.0 | 182.18 | 215.0 | 35.68 | 335.0 | 81.26 |
| 100.0 | 182.54 | 220.0 | 71.74 | 340.0 | 92.53 |
| 105.0 | 182.81 | 225.0 | 31.90 | 345.0 | 104.03 |
| 110.0 | 182.82 | 230.0 | 34.95 | 350.0 | 115.46 |
| 115.0 | 182.44 | 235.0 | 61.66 | 355.0 | 126.53 |

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Augmented Pattern

Calculated at 50.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 102.21 | 120.0 | 135.29 | 240.0 | 80.04 |
| 5.0 | 108.83 | 125.0 | 133.61 | 245.0 | 63.85 |
| 10.0 | 114.81 | 130.0 | 131.30 | 250.0 | 52.21 |
| 15.0 | 120.08 | 135.0 | 128.31 | 255.0 | 66.12 |
| 20.0 | 124.58 | 140.0 | 124.58 | 260.0 | 71.09 |
| 25.0 | 128.31 | 145.0 | 120.08 | 265.0 | 66.12 |
| 30.0 | 131.30 | 150.0 | 114.81 | 270.0 | 52.21 |
| 35.0 | 133.61 | 155.0 | 108.83 | 275.0 | 58.60 |
| 40.0 | 135.29 | 160.0 | 102.21 | 280.0 | 71.54 |
| 45.0 | 136.46 | 165.0 | 95.08 | 285.0 | 55.30 |
| 50.0 | 137.21 | 170.0 | 87.57 | 290.0 | 33.50 |
| 55.0 | 137.64 | 175.0 | 79.85 | 295.0 | 33.95 |
| 60.0 | 137.84 | 180.0 | 72.09 | 300.0 | 59.78 |
| 65.0 | 137.91 | 185.0 | 64.49 | 305.0 | 30.09 |
| 70.0 | 137.90 | 190.0 | 82.20 | 310.0 | 34.00 |
| 75.0 | 137.87 | 195.0 | 61.31 | 315.0 | 38.72 |
| 80.0 | 137.86 | 200.0 | 44.20 | 320.0 | 44.20 |
| 85.0 | 137.87 | 205.0 | 38.72 | 325.0 | 50.40 |
| 90.0 | 137.90 | 210.0 | 34.00 | 330.0 | 57.21 |
| 95.0 | 137.91 | 215.0 | 34.52 | 335.0 | 64.49 |
| 100.0 | 137.84 | 220.0 | 71.27 | 340.0 | 72.09 |
| 105.0 | 137.64 | 225.0 | 32.17 | 345.0 | 79.85 |
| 110.0 | 137.21 | 230.0 | 35.33 | 350.0 | 87.57 |
| 115.0 | 136.46 | 235.0 | 61.62 | 355.0 | 95.08 |

Augmented Pattern

Calculated at 55.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 258.14 | 120.0 | 342.47 | 240.0 | 92.27 |
| 5.0 | 273.97 | 125.0 | 337.26 | 245.0 | 75.56 |
| 10.0 | 288.46 | 130.0 | 330.67 | 250.0 | 63.78 |
| 15.0 | 301.44 | 135.0 | 322.55 | 255.0 | 76.06 |
| 20.0 | 312.82 | 140.0 | 312.82 | 260.0 | 80.66 |
| 25.0 | 322.55 | 145.0 | 301.44 | 265.0 | 76.06 |
| 30.0 | 330.67 | 150.0 | 288.46 | 270.0 | 63.78 |
| 35.0 | 337.26 | 155.0 | 273.97 | 275.0 | 70.73 |
| 40.0 | 342.47 | 160.0 | 258.14 | 280.0 | 84.26 |
| 45.0 | 346.45 | 165.0 | 241.20 | 285.0 | 72.11 |
| 50.0 | 349.40 | 170.0 | 223.44 | 290.0 | 59.88 |
| 55.0 | 351.49 | 175.0 | 205.19 | 295.0 | 65.78 |
| 60.0 | 352.91 | 180.0 | 186.80 | 300.0 | 89.14 |
| 65.0 | 353.84 | 185.0 | 168.60 | 305.0 | 79.39 |
| 70.0 | 354.39 | 190.0 | 163.11 | 310.0 | 90.88 |
| 75.0 | 354.68 | 195.0 | 138.99 | 315.0 | 103.90 |
| 80.0 | 354.77 | 200.0 | 118.35 | 320.0 | 118.35 |
| 85.0 | 354.68 | 205.0 | 103.90 | 325.0 | 134.09 |
| 90.0 | 354.39 | 210.0 | 90.88 | 330.0 | 150.93 |
| 95.0 | 353.84 | 215.0 | 81.34 | 335.0 | 168.60 |
| 100.0 | 352.91 | 220.0 | 97.97 | 340.0 | 186.80 |
| 105.0 | 351.49 | 225.0 | 64.80 | 345.0 | 205.19 |
| 110.0 | 349.40 | 230.0 | 61.03 | 350.0 | 223.44 |
| 115.0 | 346.45 | 235.0 | 77.53 | 355.0 | 241.20 |

Augmented Pattern

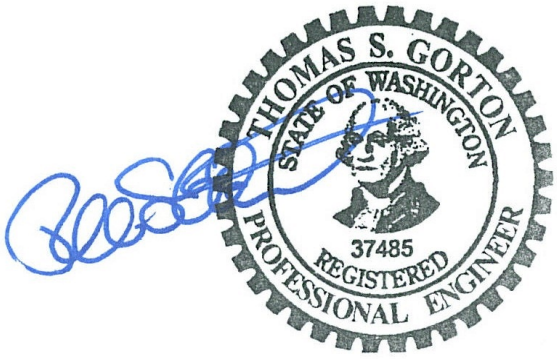
Calculated at 60.0 Degrees Elevation

| Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) | Azimuth (Deg) | Field (mV/m @1km) |
|---|---|---|---|---|---|
| 0.0 | 342.65 | 120.0 | 450.17 | 240.0 | 116.88 |
| 5.0 | 361.67 | 125.0 | 442.54 | 245.0 | 100.82 |
| 10.0 | 379.31 | 130.0 | 433.32 | 250.0 | 89.86 |
| 15.0 | 395.39 | 135.0 | 422.42 | 255.0 | 98.79 |
| 20.0 | 409.77 | 140.0 | 409.77 | 260.0 | 102.39 |
| 25.0 | 422.42 | 145.0 | 395.39 | 265.0 | 98.79 |
| 30.0 | 433.32 | 150.0 | 379.31 | 270.0 | 89.86 |
| 35.0 | 442.54 | 155.0 | 361.67 | 275.0 | 96.94 |
| 40.0 | 450.17 | 160.0 | 342.65 | 280.0 | 110.12 |
| 45.0 | 456.37 | 165.0 | 322.50 | 285.0 | 103.33 |
| 50.0 | 461.27 | 170.0 | 301.51 | 290.0 | 98.63 |
| 55.0 | 465.07 | 175.0 | 280.01 | 295.0 | 107.47 |
| 60.0 | 467.90 | 180.0 | 258.34 | 300.0 | 129.38 |
| 65.0 | 469.93 | 185.0 | 236.85 | 305.0 | 128.38 |
| 70.0 | 471.29 | 190.0 | 225.31 | 310.0 | 142.93 |
| 75.0 | 472.06 | 195.0 | 199.45 | 315.0 | 159.09 |
| 80.0 | 472.31 | 200.0 | 176.77 | 320.0 | 176.77 |
| 85.0 | 472.06 | 205.0 | 159.09 | 325.0 | 195.78 |
| 90.0 | 471.29 | 210.0 | 142.93 | 330.0 | 215.90 |
| 95.0 | 469.93 | 215.0 | 129.70 | 335.0 | 236.85 |
| 100.0 | 467.90 | 220.0 | 136.14 | 340.0 | 258.34 |
| 105.0 | 465.07 | 225.0 | 106.82 | 345.0 | 280.01 |
| 110.0 | 461.27 | 230.0 | 99.39 | 350.0 | 301.51 |
| 115.0 | 456.37 | 235.0 | 107.51 | 355.0 | 322.50 |

Statement of Engineer

This Engineering Report, relative to an Application for a modified standard pattern for WEEI-AM Boston, MA has been prepared by the undersigned. All representations contained herein are true to the best of my knowledge. I am an experienced radio engineer whose qualifications are a matter of record with the Federal Communications Commission. I am an engineer in the firm of Hatfield and Dawson Consulting Engineers and am Registered as a Professional Engineer in the States of Washington and Oregon.

Signed this 26th day of April 2010




Thomas S. Gorton, P.E.