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## ENGINEERING REPORT

### AMENDMENT to APPLICATION to CHANGE TRANSMITTER SITE and CITY OF LICENSE BP-20070119AGM

WRHC (AM)  
Doral, Florida  
1550 kHz, 8 kW Day, 1 kW Night DA-2  
Facility ID 73945

WRHC Broadcasting Corp.

April 2015

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## Purpose of Application

This Engineering Report is part of an amended application by WRHC Broadcasting Corp. ("WRHC") to consolidate the daytime and nighttime operation of WRHC-AM on the same property as the presently licensed transmitter site of WWFE-AM, and change the City of License of WRHC to Doral, Florida, as first local service. The licensed daytime site of WRHC was destroyed in hurricane Andrew in 1992. As this site was located in the waters of the Atlantic Ocean south of Key Biscayne, current environmental considerations make reconstruction of this site impossible. Approximately two years later, WRHC was informed that the lease for the licensed nighttime transmitter site would not be renewed. WRHC has been operating under STA from the site of co-owned WWFE-AM since that time. In 2003, WRHC was granted a construction permit, file No. BMJP-20000201AHY, which authorized operation from the WWFE site on 1560 kHz. The authorized facilities were constructed, but due to various technical and international political issues, WRHC was unable to license the constructed facilities. In 2007, WRHC filed an application, file No. BP-20070119AGM, requesting authorization to construct a new four tower array for WRHC adjacent to the WWFE array, on the same property. Difficulties in obtaining the proper environmental permits have prevented grant of the current construction permit application.

By this instant application, WRHC proposes to amend BP-20070119AGM to specify DA-2 operation from the WWFE antenna site, using three towers of the WWFE array, and three existing, unused towers constructed under the authority of BMJP-20000201AHY. Grant of the instant application would require no new tower construction.

## Allocation Considerations

All allocation studies contained in this report are based on the April 20, 2015 edition of the FCC AM database for all countries except Cuba. The International Telecommunications Union April 4, 2015 Master Frequency File (MIFR) notified data was used for Cuba<sup>1</sup>. Region II ground conductivities were used in all cases. The proposed daytime 5 mV/m contour will cover 97% of

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<sup>1</sup>In the case of the frequencies relevant to this application, the CDBS and MIFR appear to be in agreement.  
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the land area of Doral, and 100% of the population. The proposed 5 mV/m Nighttime contour<sup>2</sup> will cover 100% of Doral.

## Daytime

The proposed operation of WRHC will not result in prohibited contour overlap with any known facility, with the exception of co-channel station WAMA, Tampa. Existing overlap with WAMA from the licensed operation of WRHC is reduced by this proposal, as demonstrated by the daytime allocation study maps included in this application. The co-channel 0.025 mV/m interfering contour does not overlap the 0.5 mV/m contour of any co-channel Cuban station over Cuban land areas, as demonstrated by Exhibits 17-1, 17-1A and 17-2, and does not overlap the land area of any other country with a facility operating on 1550 kHz. Protection of 1<sup>st</sup>-adjacent channel station ZNS-1, Nassau is demonstrated by Exhibits 17-3 and 17-3A. These exhibits show no overlap of the 1.65 mV/m groundwave contours of ZNS-1 and WRHC over the island of Bimini, and no overlap of the respective 1.2 mV/m groundwave contours over any other Bahamian land areas, thus demonstrating the required 1:1 protection of first adjacent channel stations.<sup>3</sup>

## Nighttime

The proposed operation of WRHC will not enter the 25% RSS calculation of any domestic facility, with the exception of WNZF, Bunnell, FL, or the 50% RSS of any foreign facility, with the exception of CMHO, Nuevitas, Cuba, as demonstrated by the site to site RSS calculations contained in this report. The RSS contribution to both of these facilities is reduced from that of the licensed WRHC operation. Protection of the Class A co-channel facility at Gun Bluff, in the Cayman Islands is demonstrated by map exhibit 18-1 that shows that all of the Cayman Islands are within the 7 mV/m groundwave contour of the Gun Bluff facility, and that this contour is not overlapped by the 100  $\mu$ V/m skywave contour or the 350  $\mu$ V/m groundwave contour of the

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<sup>2</sup>The calculated nighttime interference-free contour level is 4.9 mV/m, based solely on the contribution of XERUV (Jalapa). Therefore nighttime coverage showings contained in this report illustrate the 5 mV/m contour, per §73.24(i)

<sup>3</sup>Per discussion with staff in the Commission's International Branch, we are aware that the Bahamas are not signatories to the Region II agreement, but will often accept proposals which meet the protection requirements of the agreement.

proposed WRHC operation, thus showing that skywave interference from WRHC will not exceed the 20:1 protection ratio over any land area in the Caymen Islands<sup>4</sup>.

There are no Class A facilities in the United States or Canada which are entitled to critical hours protection. Exhibit 18-2 demonstrates that the 25  $\mu\text{V/m}$  10% skywave contour from the proposed operation of WRHC will not overlap the 0.5 mV/m protected groundwave contour of Mexican Class A station XERUV<sup>5</sup>, except over the waters of the Gulf of Mexico. As demonstrated by map exhibit 18-3, all Canadian land area within the proposed WRHC 25  $\mu\text{V/m}$  10% skywave contour is also within the 1 mV/m groundwave contour of Class A station CBE. Thus, the 20:1 maximum interfering contour from WRHC is the 50  $\mu\text{V/m}$  10% skywave. Exhibit 18-4 demonstrates that the 28  $\mu\text{V/m}$  10% skywave contour of WRHC does not reach the border, therefore fully protecting CBE<sup>6</sup>.

As demonstrated by Exhibit 18-4, the proposed 125  $\mu\text{V/m}$  50% skywave contour of WRHC will not overlap the protected 2.5 mV/m groundwave contours of Cuban stations CMOR and CMHO.

#### Facilities Proposed

WRHC Broadcasting Corp. proposes operation on 1550 kHz with a power of 8 kW daytime and 1 kW nighttime, using towers already in place at the licensed transmitter site of WWFE-AM. The table below shows the correspondence of the WWFE tower numbering scheme shown on the antenna plat diagram included in this application with the WRHC tower numbers used in this application.

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<sup>4</sup>A field strength of 350  $\mu\text{V/m}$  from WRHC provides the required 20:1 protection of the Gun Bluff 7 mV/m contour. As the proposed nighttime operation of WRHC will not produce a 350  $\mu\text{V/m}$  50% skywave contour, the map exhibit instead demonstrates no overlap of the larger 100  $\mu\text{V/m}$  50% skywave contour or of the 350  $\mu\text{V/m}$  groundwave contours of WRHC with the 7 mV/m groundwave contour of ZNS-1.

<sup>5</sup>The CDBS contains two accepted records for XERUV, one at Jalapa, with a 180.1° antenna, the other at Acajete, with a 97.9° antenna. The Jalapa facility does not generate a 500  $\mu\text{V/m}$  50% skywave signal. As the Acajete facility was notified after the date of the *AM Agreement between the United States and Mexico (1986)*, the agreement provides that it is protected to the skywave contour equal to the usable field strength, which is the 50% RSS value, 14.27 mV/m. As the accepted facility at Acajete does not produce a 14.27 mV/m 50% skywave signal, both of the notified XERUV facilities are protected along their respective 500  $\mu\text{V/m}$  groundwave contours at night.

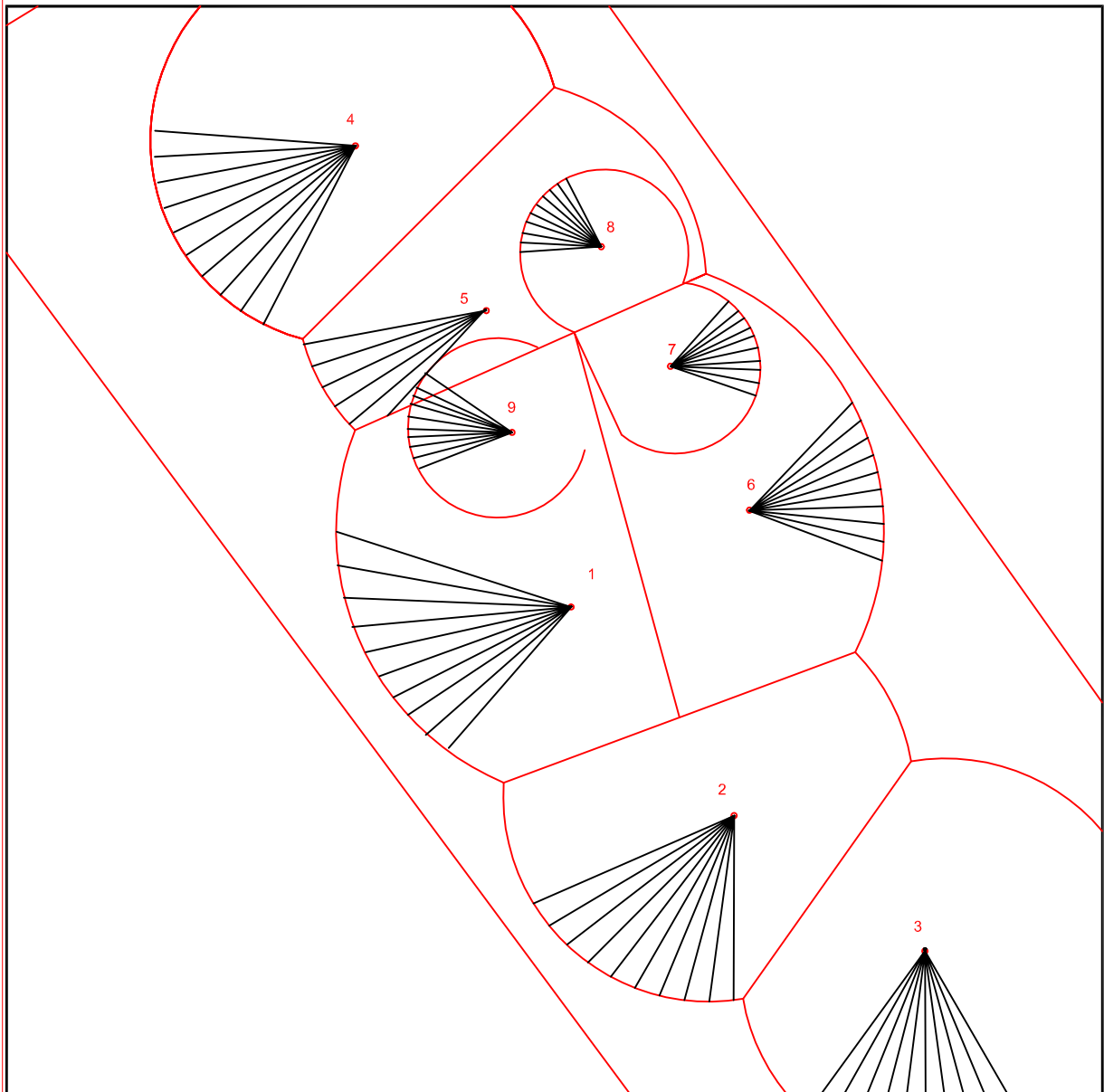
<sup>6</sup> CBE is a former Class I-B station, and is therefore not entitled to critical hours protection.

Site twr #	1	2	3	4	5	6	7	8	9
WRHC Day #	3				1				2
WRHC Night #	3				1	6	5	4	2
ASR #	1215815	1215824	1215820	1215821	1215822	1215823	1215856	1215857	1215860

Antenna tower access will be restricted by fences with locked gates that will be at least 2 meters from the tower bases as required by OET-65. The antenna towers will be posted with warning signs, and all station personnel and contractors will be required to follow appropriate safety procedures before any work is commenced on the antenna towers, including reduction in power or discontinuance of operation. The area within the proposed 1 V/m blanketing contours is unpopulated.

The WRHC studio is located at 330 S.W. 27<sup>th</sup> Avenue, Suite 202, in Miami.

The studio location is 12.2 km (7.6 miles) from the reference coordinates for Doral obtained from the Commission's web site, thus satisfying the requirements of §73.1125(3).

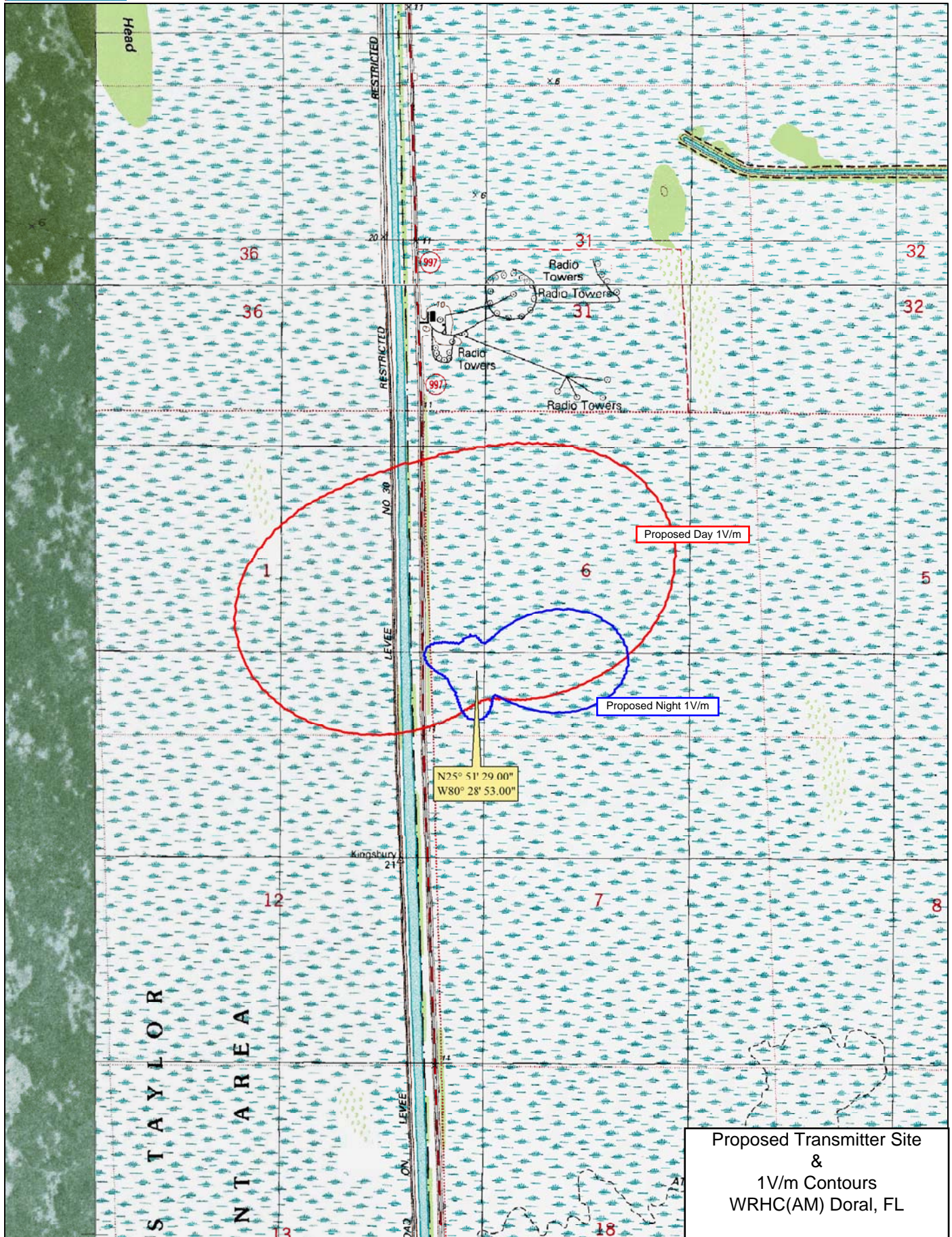


GROUND SYSTEM consists of 120 #10 bare copper wire radials for each tower buried 10-20 cm for each tower except where shorted at property boundaries and at the intersection of adjacent tower ground systems. An additional 120 short radials 15 meters in length are included at the base of each tower. These are all attached to a ring at the base of each tower as well as the ground straps 5 cm width. Radial wires around towers 1-6 are a maximum of 367' in length. Radial wires around towers 7-9 are a maximum of 160' in length.

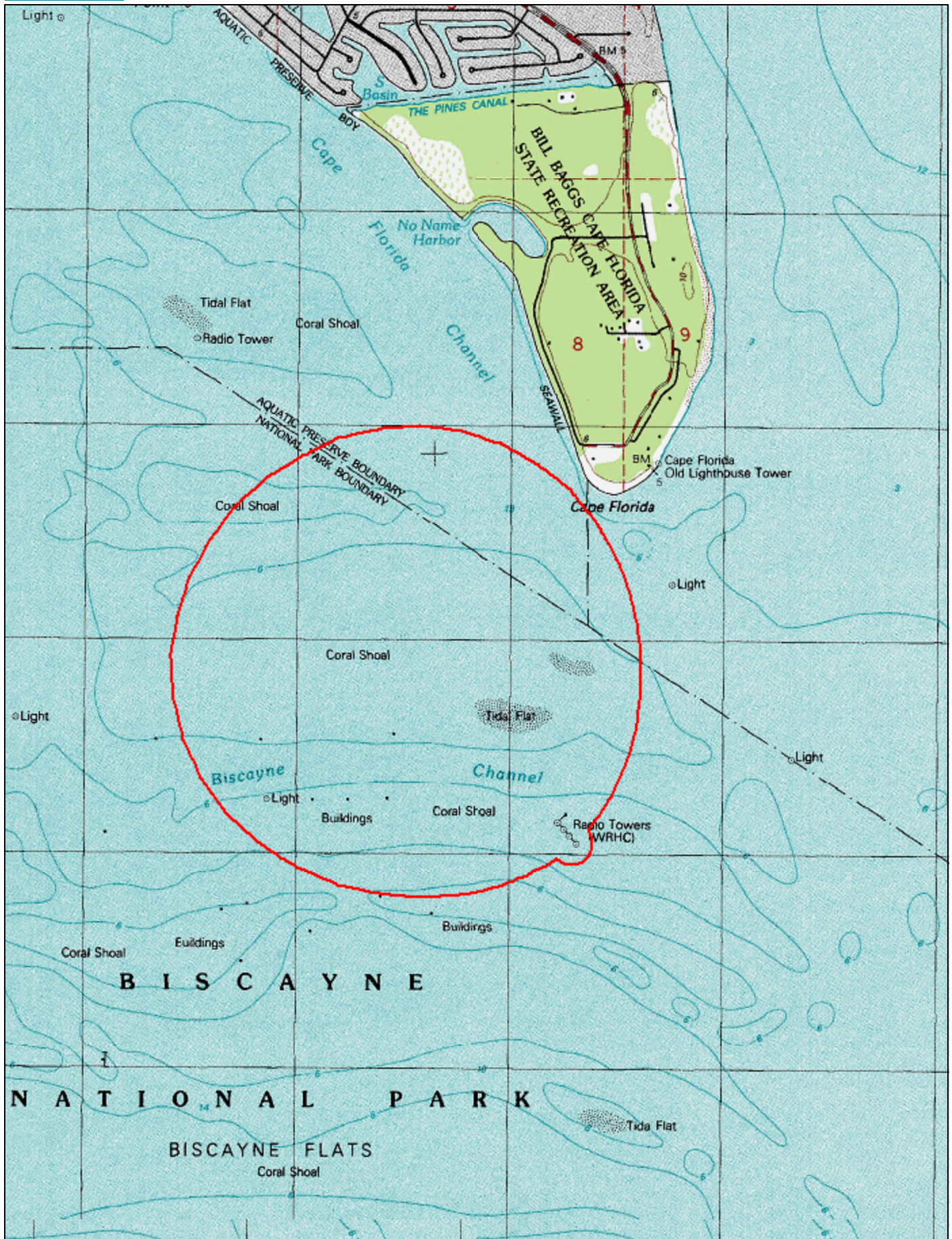
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CONSULTING ENGINEERS

WRHC 1550 KHZ  
DORAL, FL

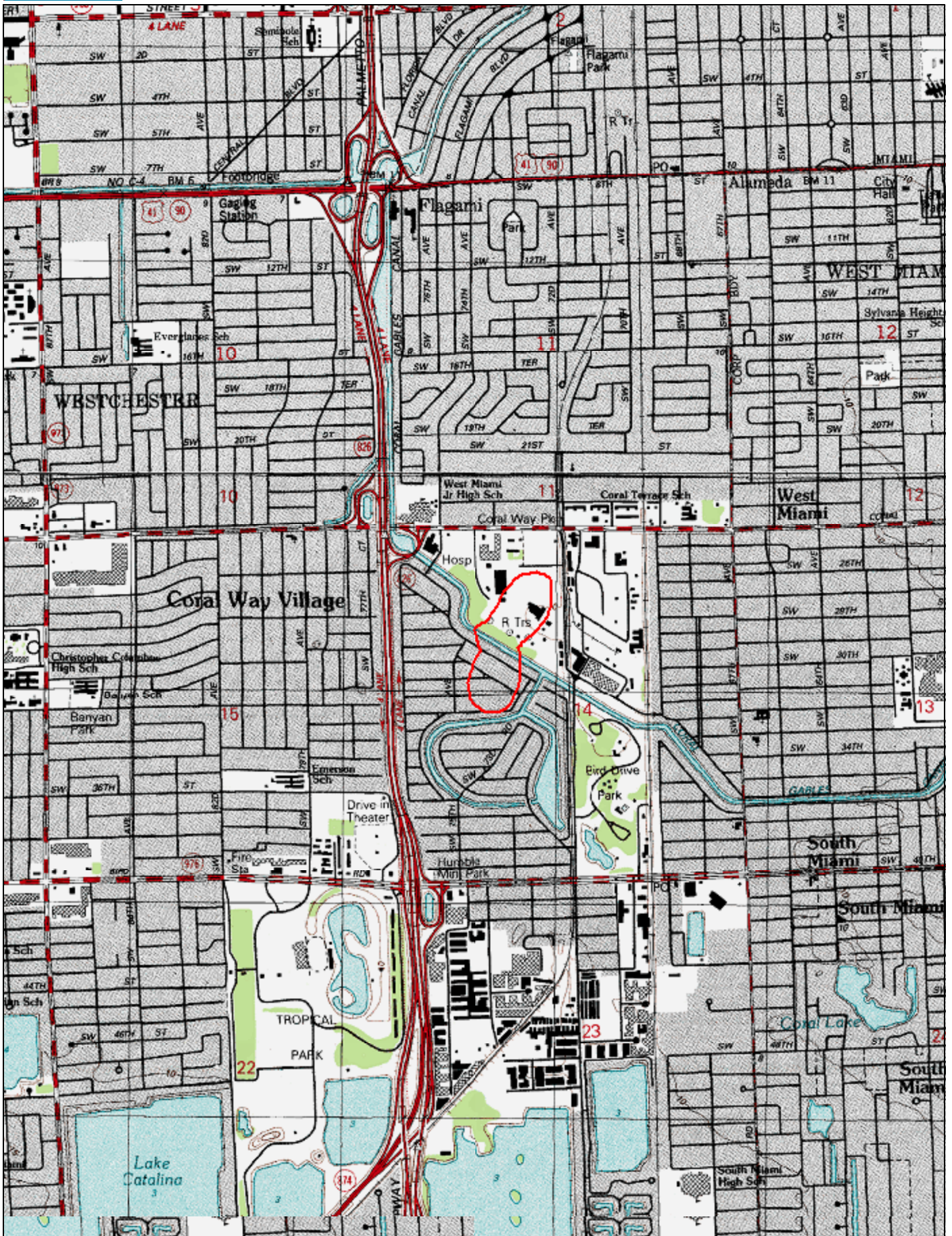














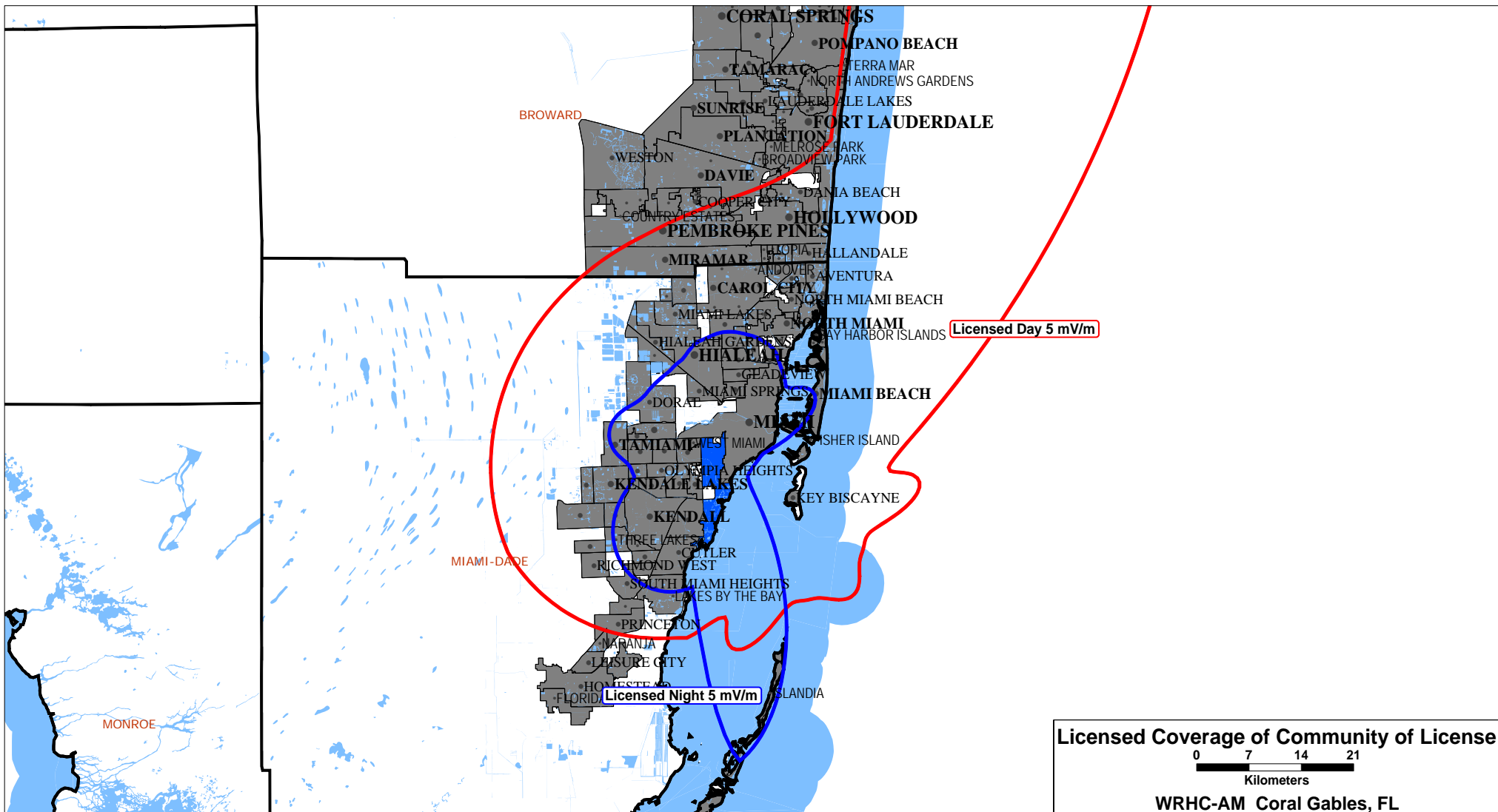


Proposed Transmitter Site

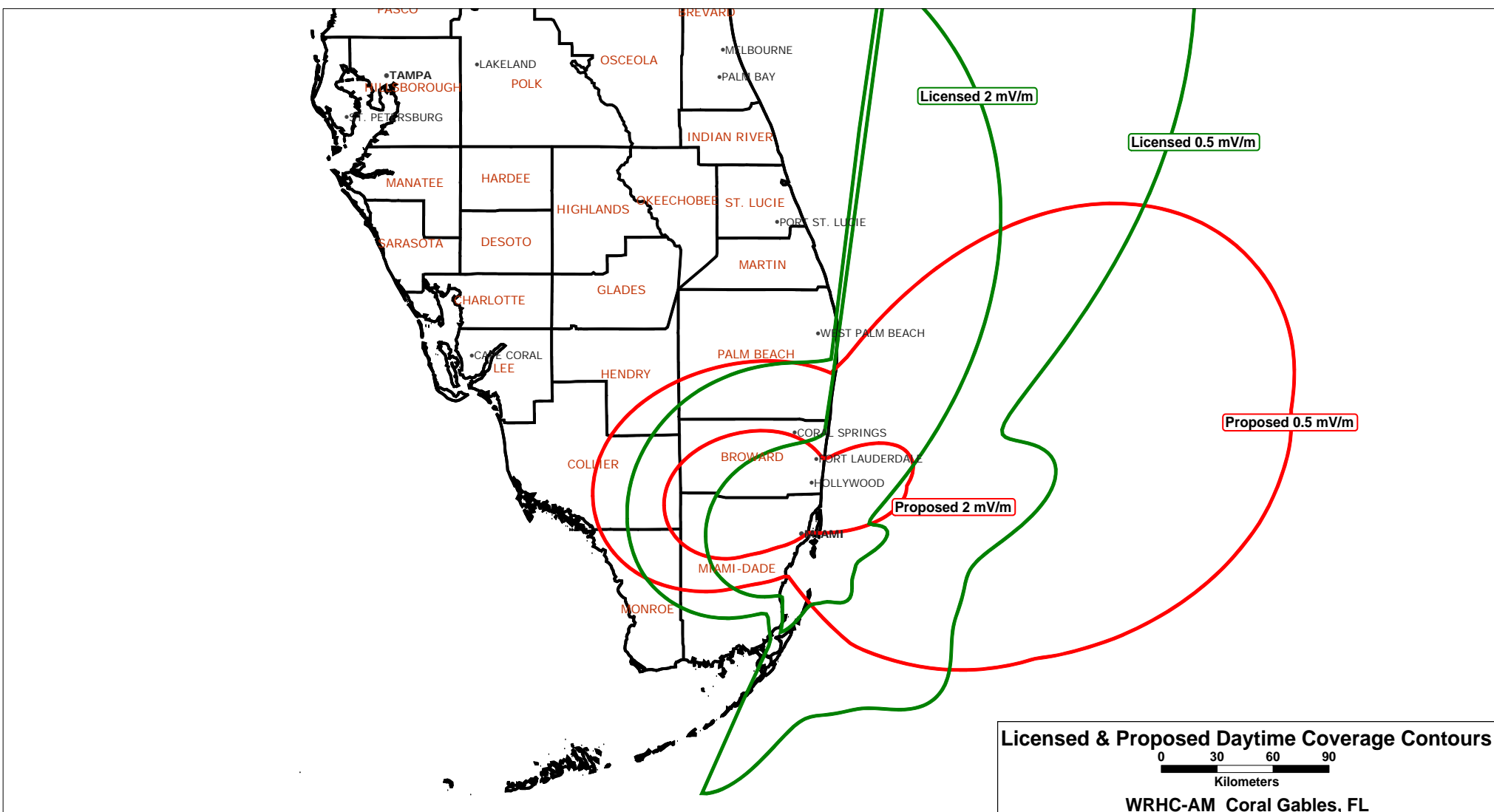
WRHC-AM Doran, FL

Hatfield & Dawson Consulting Engineers









WRHC

Freq: 1550 kHz

Class: B

Latitude: 25-51-29 N

Longitude: 080-28-53 W

Power: 8 kW

RMS: 940.81 mV/m @ 1km

# Towers: 3

# AUs: 0

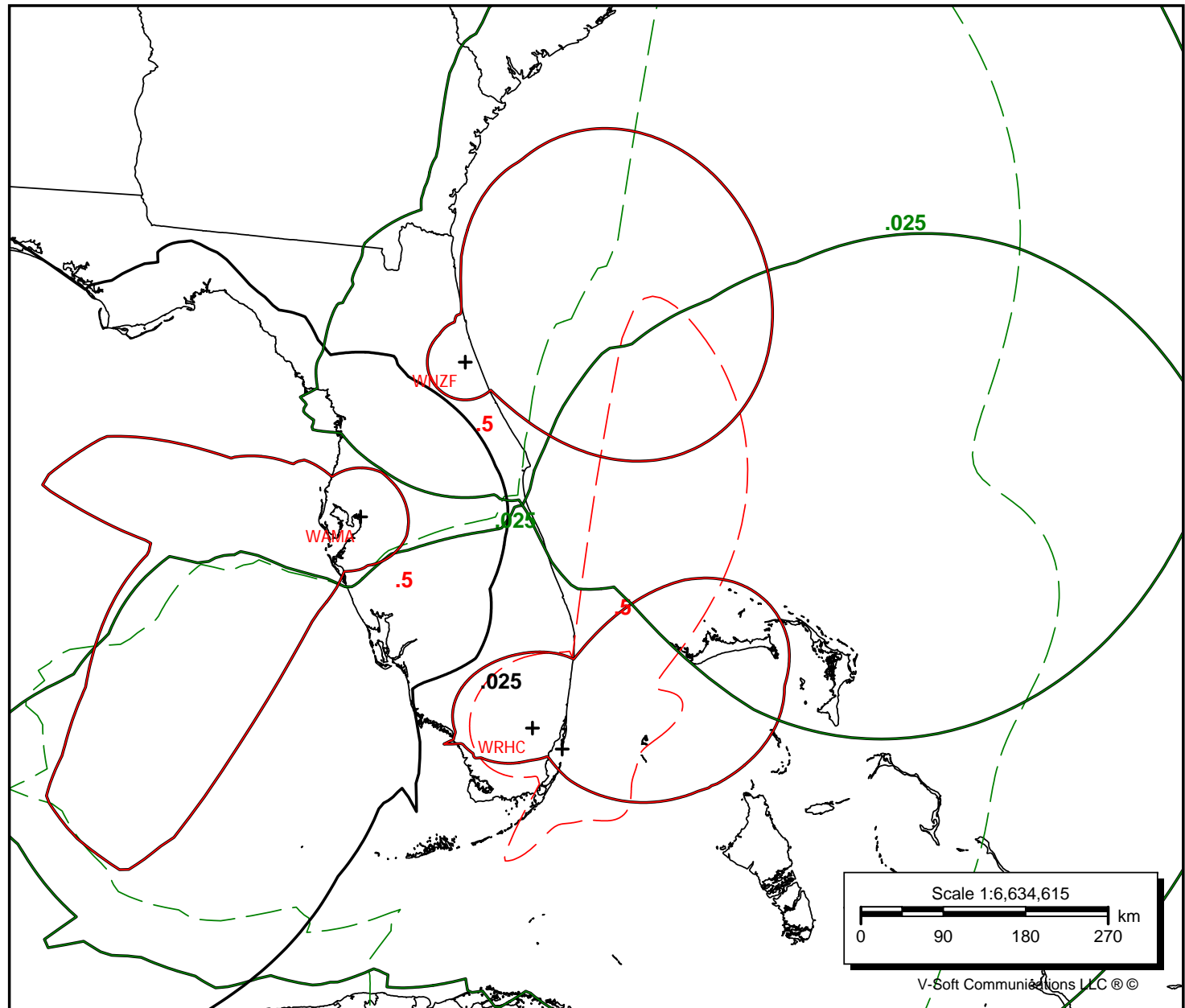
Daytime Co-Channel

Allocation Study

Domestic Stations

Dashed lines are

Licensed WRHC operation

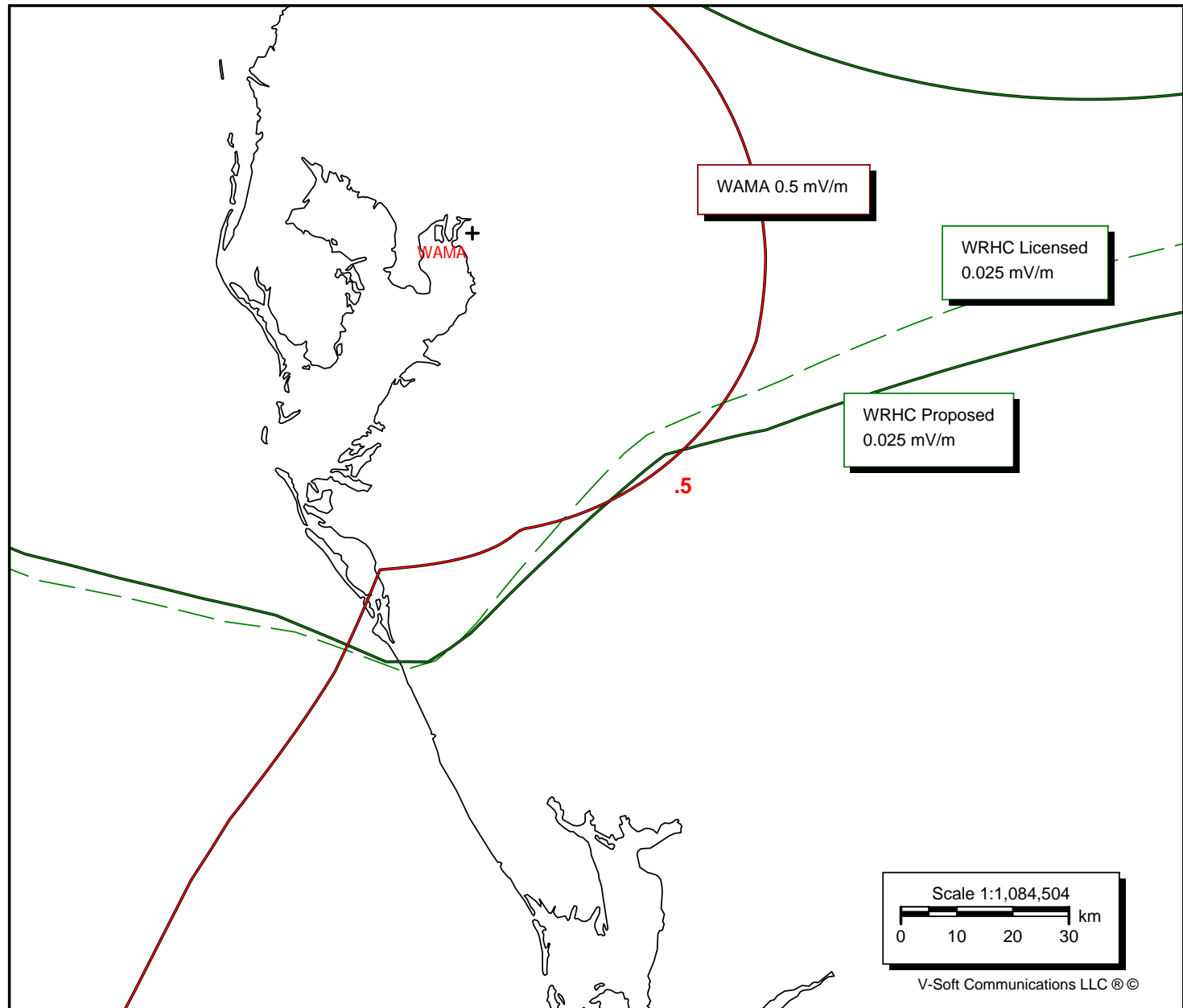


WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 8 kW  
RMS: 940.81 mV/m @1km  
# Towers: 3  
# Augs: 0

Daytime Co-Channel  
Allocation Study

WRHC vs WAMA  
Overlap Reduction



WRHC

Freq: 1550 kHz

Class: B

Latitude: 25-51-29 N

Longitude: 080-28-53 W

Power: 8 kW

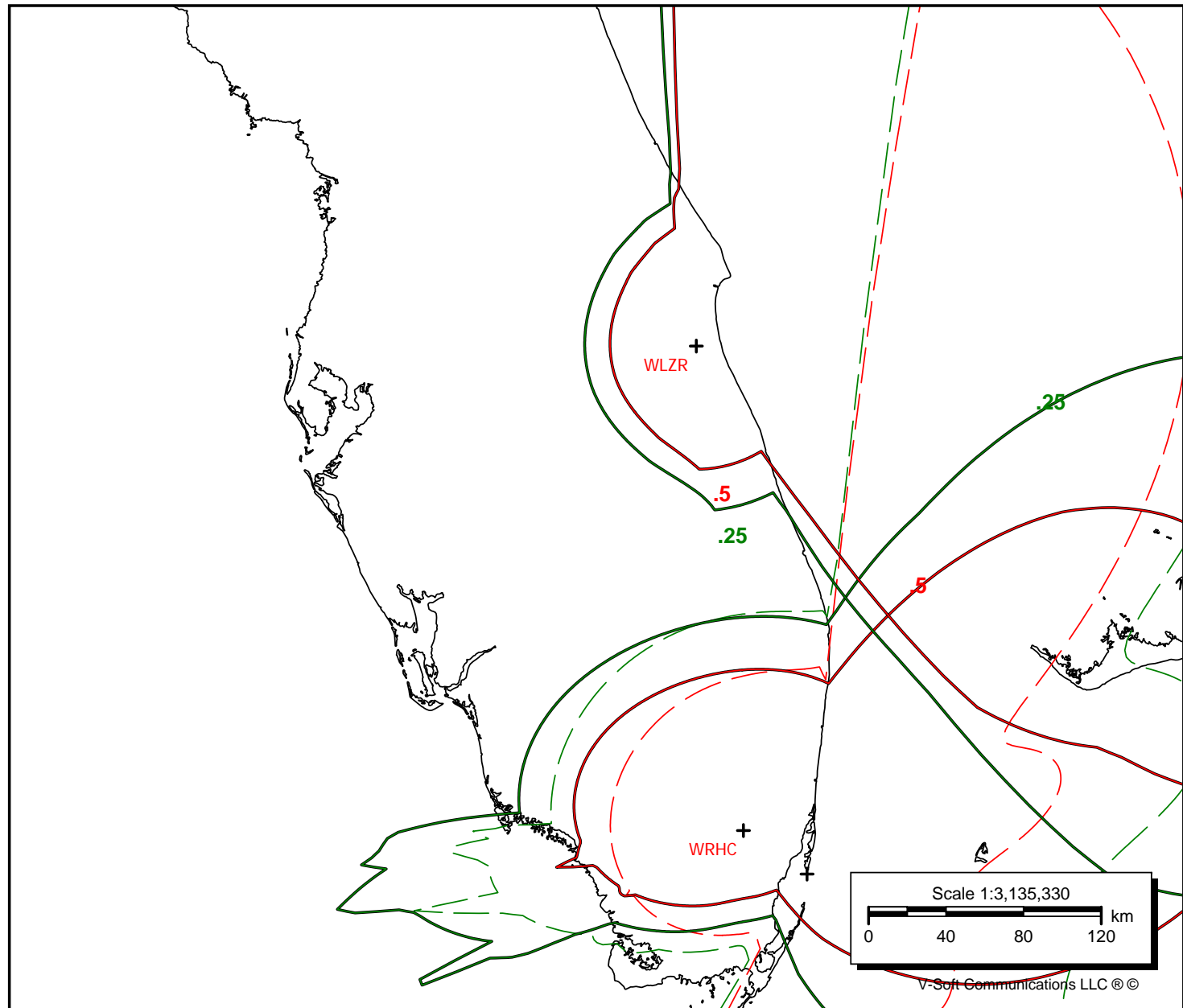
RMS: 940.81 mV/m @1km

# Towers: 3

# Aucs: 0

Daytime 1st adj-Channel  
Allocation Study

Dashed lines are  
Licensed WRHC operation



WRHC

Freq: 1550 kHz

Class: B

Latitude: 25-51-29 N

Longitude: 080-28-53 W

Power: 8 kW

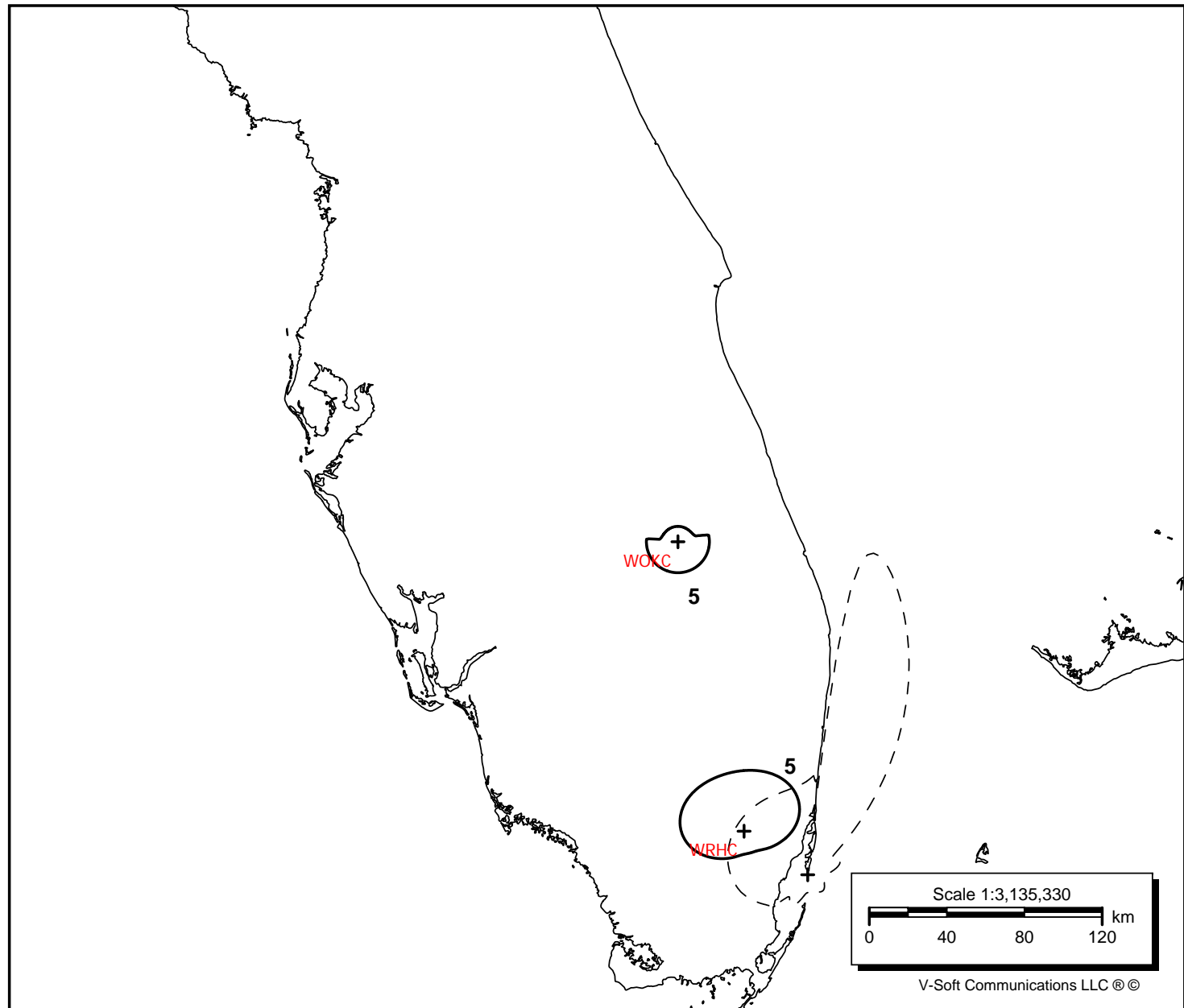
RMS: 940.81 mV/m @1km

# Towers: 3

# Aucs: 0

Daytime 2nd adj-Channel  
Allocation Study

Dashed lines are  
Licensed WRHC operation





WRHC

Freq: 1550 kHz

Class: B

Latitude: 25-51-29 N

Longitude: 080-28-53 W

Power: 8 kW

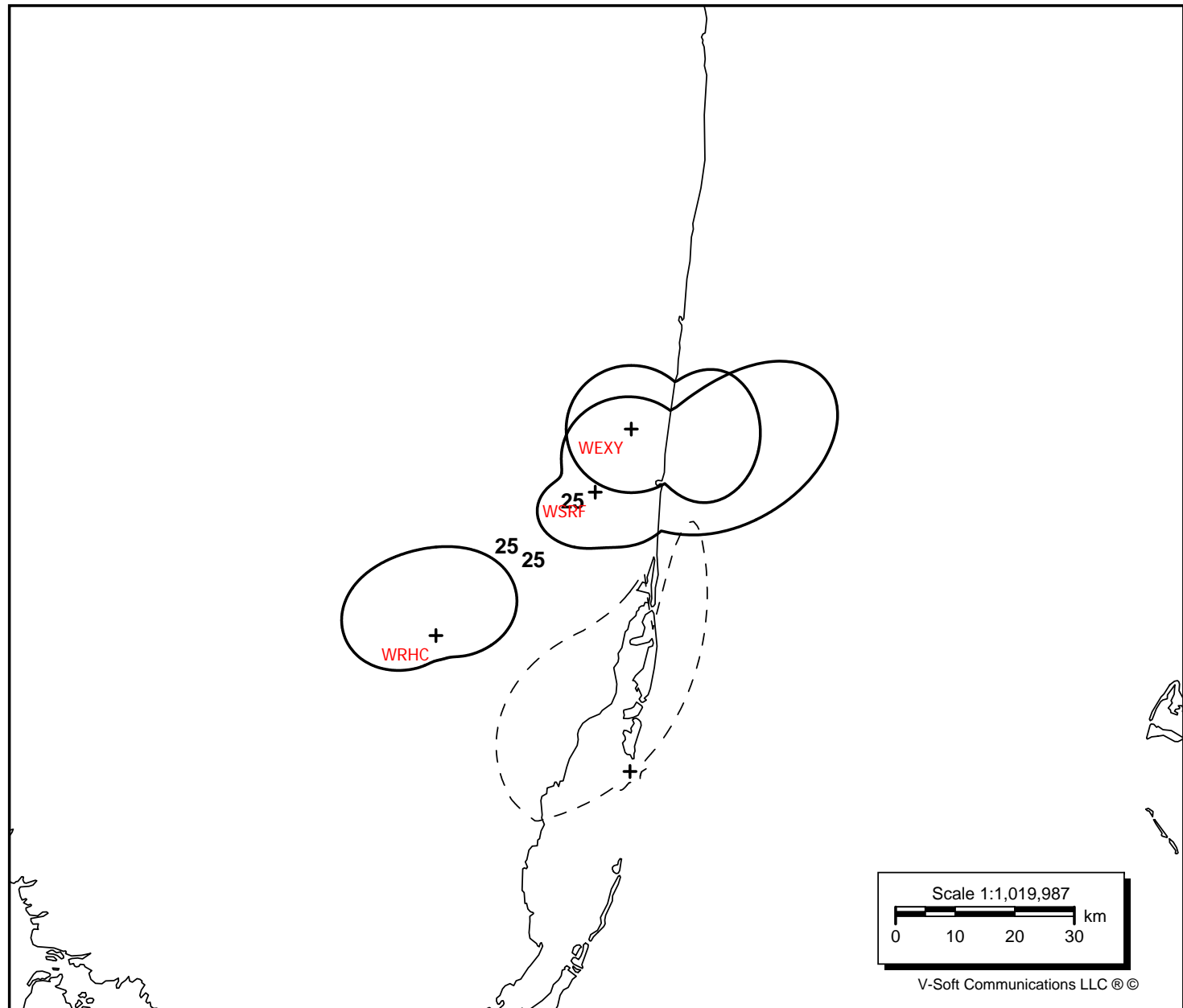
RMS: 940.81 mV/m @ 1km

# Towers: 3

# Aucs: 0

Daytime 3rd adj-Channel  
Allocation Study

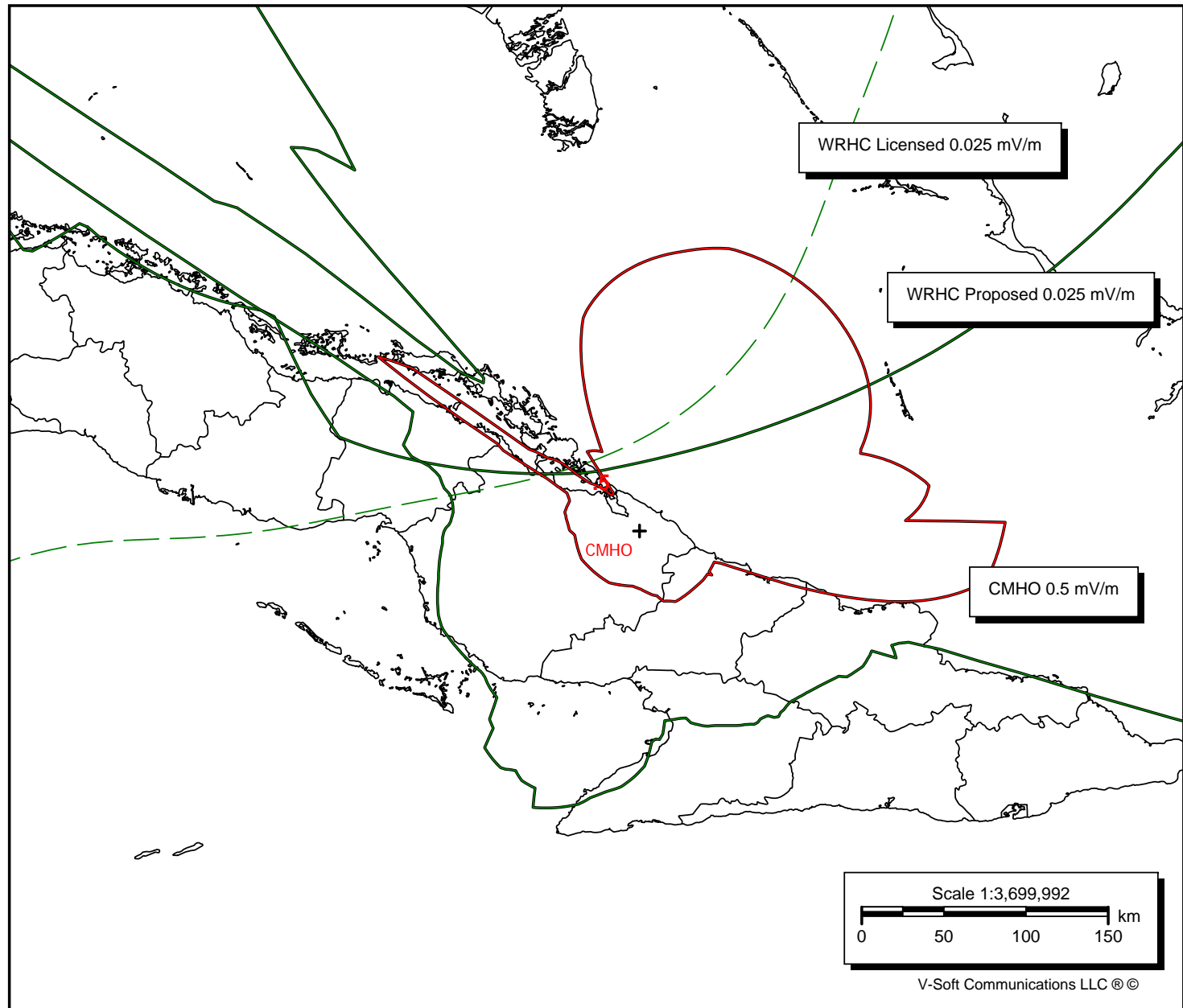
Dashed lines are  
Licensed WRHC operation



WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 8 kW  
RMS: 940.81 mV/m @1km  
# Towers: 3  
# AUs: 0

Daytime Co-Channel  
Allocation Study  
Exhibit 17-1  
WRHC vs. CMHO

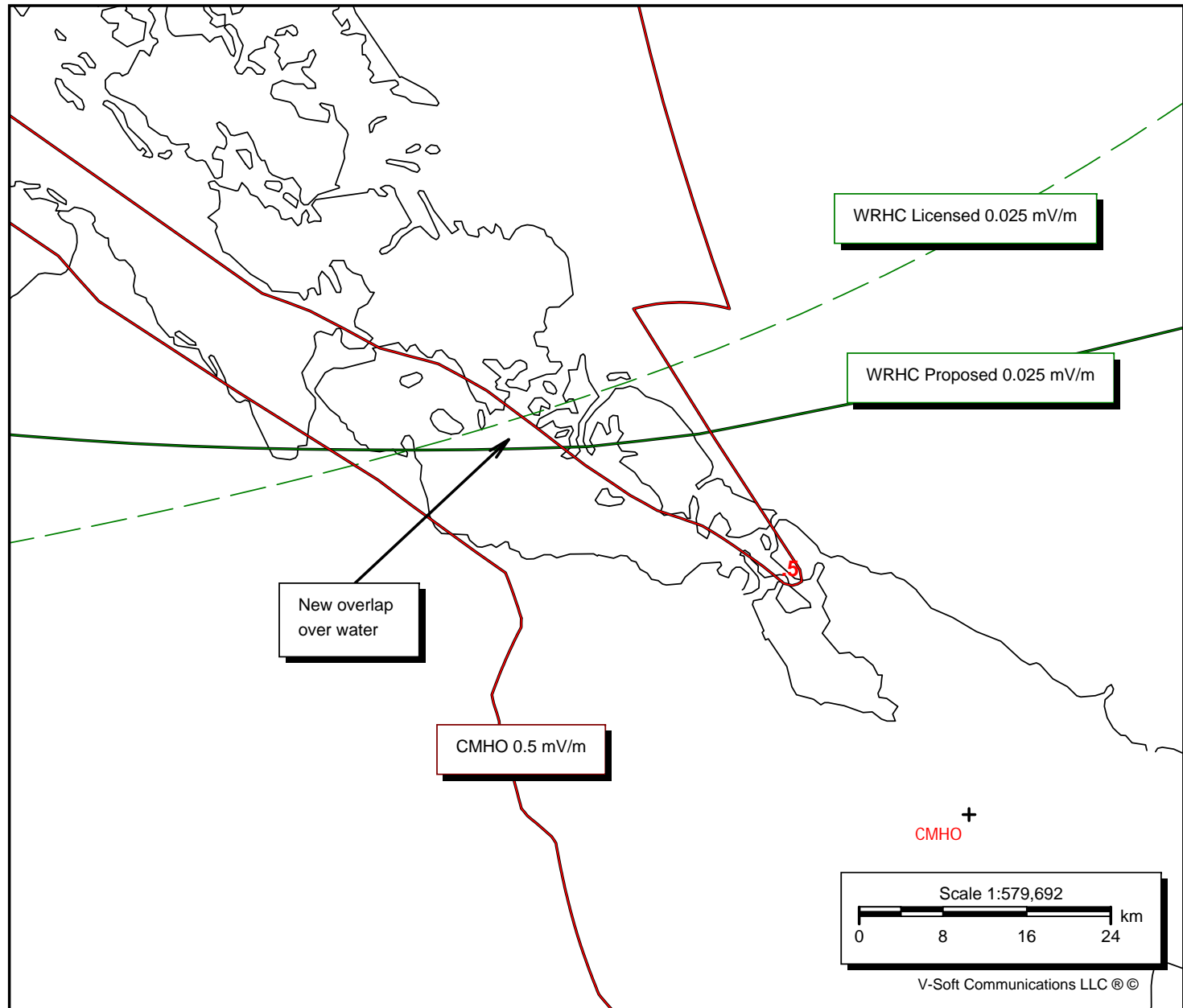


WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 8 kW  
RMS: 940.81 mV/m @1km  
# Towers: 3  
# Augs: 0

Daytime Co-Channel  
Allocation Study

WRHC vs. CMHO



WRHC

Freq: 1550 kHz

Class: B

Latitude: 25-51-29 N

Longitude: 080-28-53 W

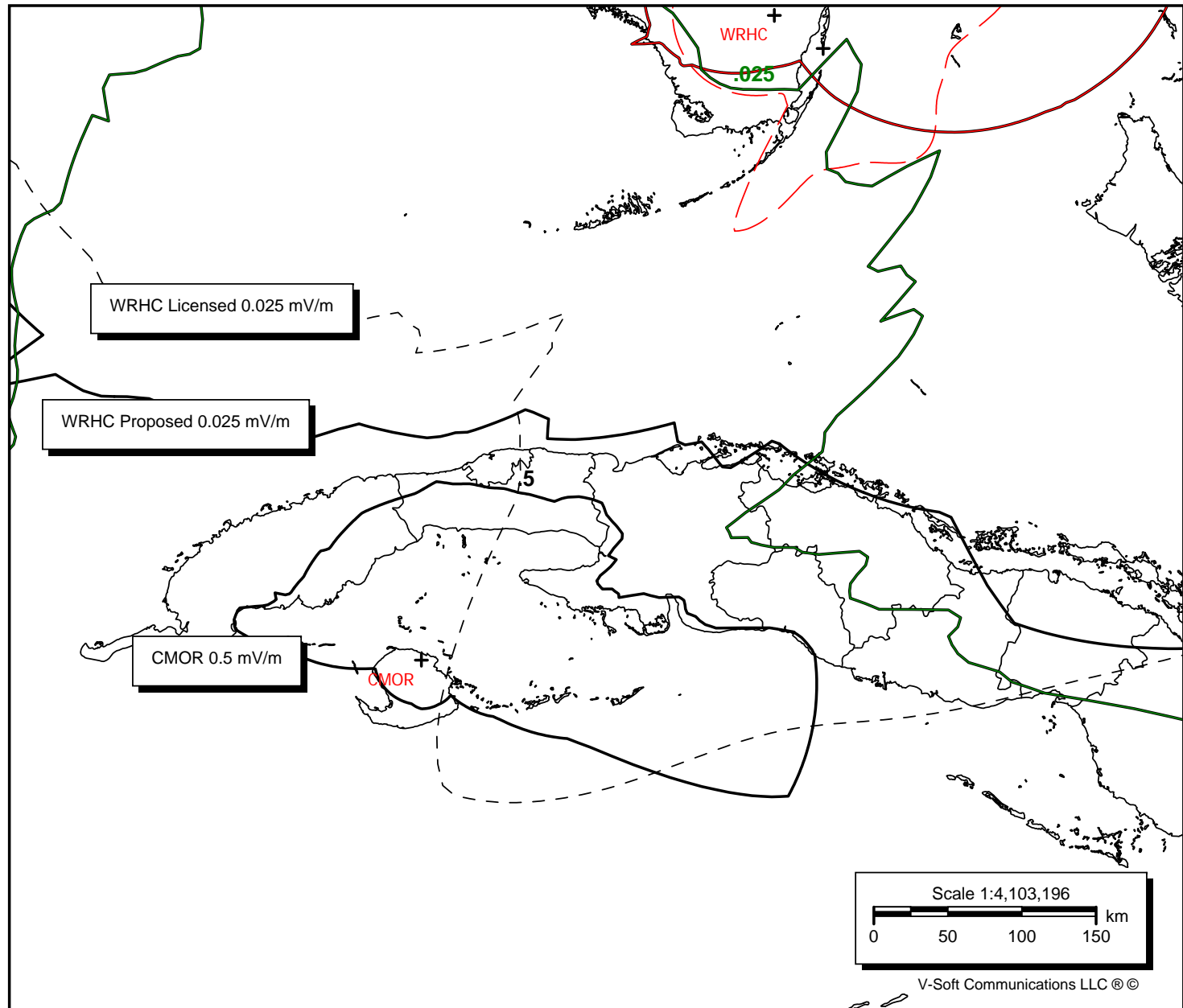
Power: 8 kW

RMS: 940.81 mV/m @ 1km

# Towers: 3

# AUs: 0

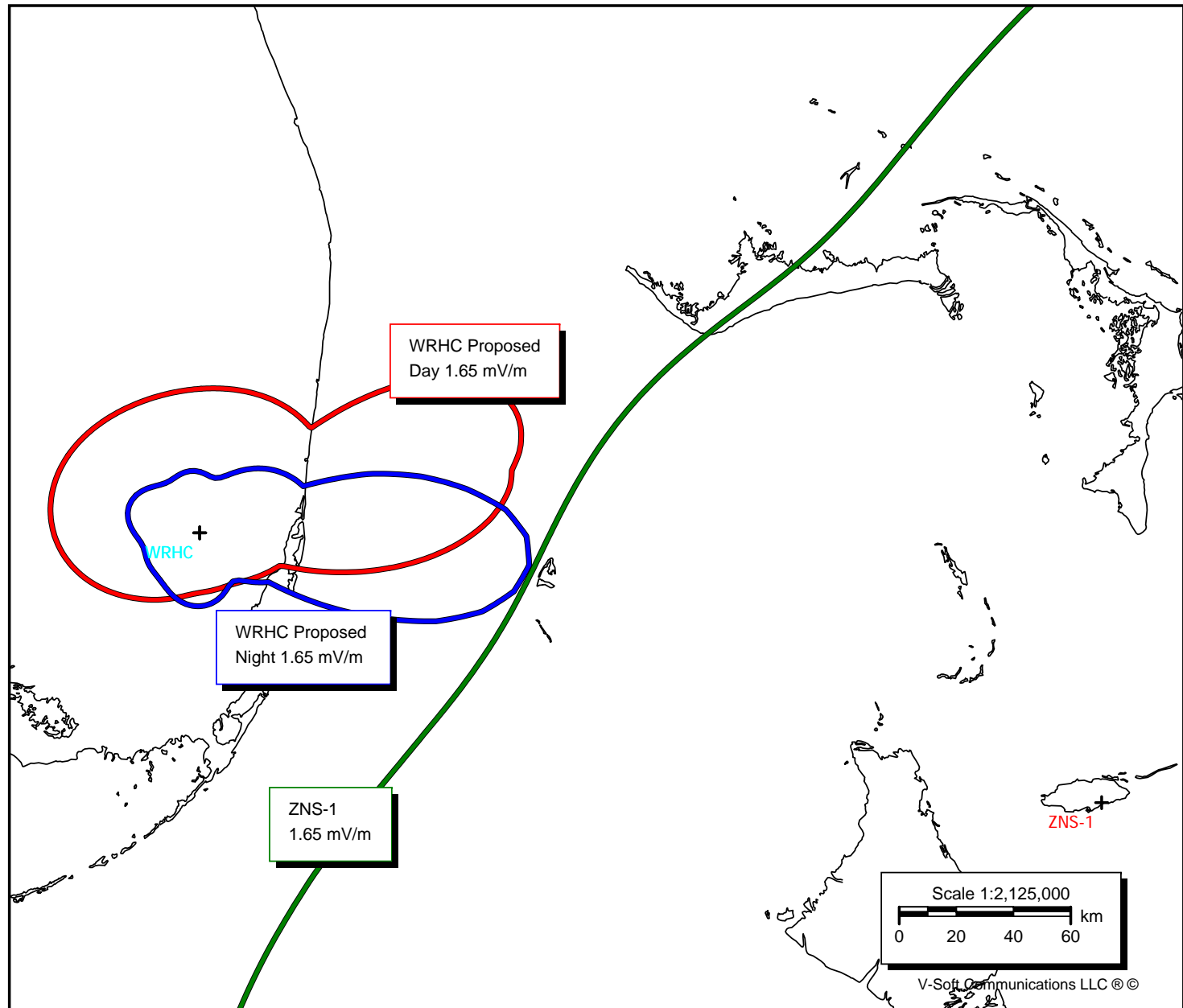
Daytime Co-Channel  
Allocation Study  
Exhibit 17-2  
WRHC vs. CMOR



## WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 8 kW  
RMS: 940.81 mV/m @ 1km  
# Towers: 3  
# Aucs: 0

1st adj-Channel  
Groundwave  
Allocation Study  
Exhibit 17-3  
WRHC vs. ZNS-1

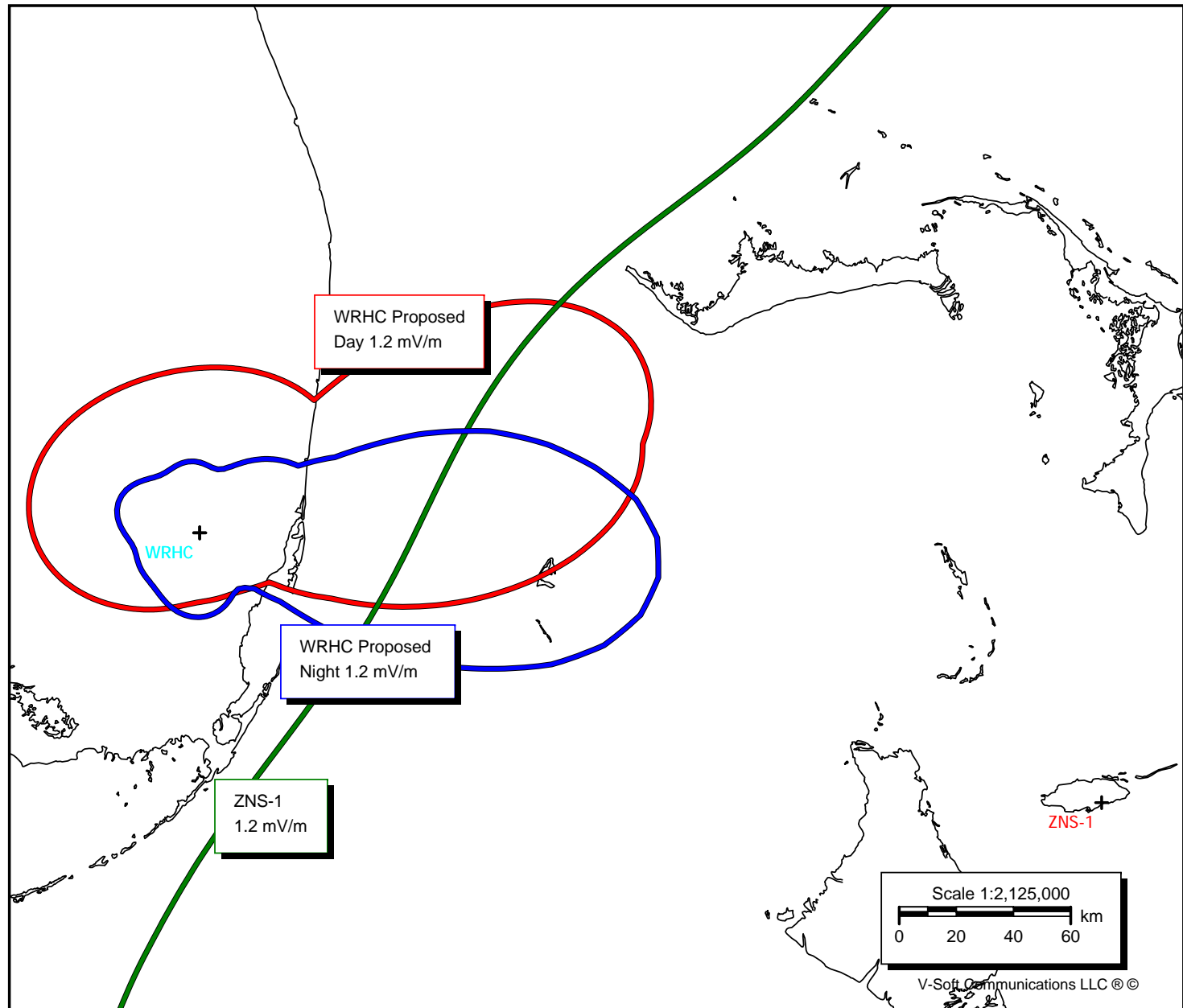




## WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 8 kW  
RMS: 940.81 mV/m @1km  
# Towers: 3  
# Aucs: 0

1st adj-Channel  
Groundwave  
Allocation Study  
Exhibit 17-3A  
WRHC vs. ZNS-1



# Site to Site RSS Calculations WRHC-AM Doral, FL

Protected Station: WNZF, 1550 kHz - BUNNELL, FL, US Standard: FCC Rules (1992 Skywave Propagation Model) [ 10% ]

Current:

Call	Freq (kHz)	Limit (mV/m)	(%)
<b>*WRHC</b>	<b>1550</b>	<b>3.787</b>	<b>100.0</b>
XERUV/A	1550	3.703	97.8
-----	50%	-----	-----
CBE/A	1550	2.301	43.4
WSDK	1550	1.906	33.0
HJZI-A	1550	1.606	26.4
-----	25%	-----	-----
WLTJ	1550	1.566	24.9
HITS-C	1550	1.559	24.0
HRNN 37-A	1550	1.483	22.2
WITK	1550	1.443	21.1
WFME	1560	1.329	19.0
HJCB-A	1550	1.040	14.6
XE/A	1550	1.039	14.5
HJGY-A	1550	0.952	13.1
XE/A	1550	0.944	12.9
ZNS-1-A	1540	0.940	12.7
XEDV/A	1550	0.899	12.1
XETAM/A	1550	0.780	10.4
XE0032/A	1550	0.764	10.1

Proposed:

Call	Freq (kHz)	Limit (mV/m)	(%)
XERUV/A	1550	3.703	100.0
<b>*WRHC-PRO</b>	<b>1550</b>	<b>3.397</b>	<b>91.8</b>
-----	50%	-----	-----
CBE/A	1550	2.301	45.8
WSDK	1550	1.906	34.5
HJZI-A	1550	1.606	27.5
WLTJ	1550	1.566	25.8
-----	25%	-----	-----
HITS-C	1550	1.559	24.9
HRNN 37-A	1550	1.483	23.0
WITK	1550	1.443	21.8
WFME	1560	1.329	19.6
HJCB-A	1550	1.040	15.1
XE/A	1550	1.039	14.9
HJGY-A	1550	0.952	13.5
XE/A	1550	0.944	13.2
ZNS-1-A	1540	0.940	13.1
XEDV/A	1550	0.899	12.4
XETAM/A	1550	0.780	10.7
XE0032/A	1550	0.764	10.4

Protected Station: WKFE, 1550 kHz - YAUCO, PR, US  
Standard: FCC Rules (1992 Skywave Propagation Model) [ 10% ]

Current:

Call	Freq (kHz)	Limit (mV/m)	(%)
HITS-C	1550	9.004	100.0
-----	50%	-----	-----
HJZI-A	1550	4.201	46.7
HJCB-A	1550	3.020	30.4
ZNS-1-A	1540	2.618	25.2
-----	25%	-----	-----
HJGY-A	1550	2.394	22.4
XERUV/A	1550	1.786	16.3
HJQD-A	1550	1.685	15.2
WSDK	1550	1.608	14.3
HJLT-A	1550	1.499	13.2
CP 115-A	1550	1.278	11.2
CBE/A	1550	1.240	10.8

Proposed:

Call	Freq (kHz)	Limit (mV/m)	(%)
HITS-C	1550	9.004	100.0
-----	50%	-----	-----
HJZI-A	1550	4.201	46.7
HJCB-A	1550	3.020	30.4
ZNS-1-A	1540	2.618	25.2
-----	25%	-----	-----
HJGY-A	1550	2.394	22.4
<b>*WRHC-PRO</b>	<b>1550</b>	<b>2.332</b>	<b>21.2</b>
XERUV/A	1550	1.786	15.9
HJQD-A	1550	1.685	14.8
WSDK	1550	1.608	14.0
HJLT-A	1550	1.499	12.9
CP 115-A	1550	1.278	10.9
CBE/A	1550	1.240	10.5

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Protected Station: CMHO-D, 1550 kHz - NUEVITAS, , CU  
Standard: Region 2 [ 50% ]

Current:

Call	Freq (kHz)	Limit (mV/m)	(%)
HITS-C	1550	2.225	100.0
<b>*WRHC</b>	<b>1550</b>	<b>1.780</b>	<b>80.0</b>
-----	50%	-----	
HJCB-A	1550	1.071	37.6
HRNN 37-A	1550	0.893	29.3
HJGY-A	1550	0.801	25.2
-----	25%	-----	
XERUV/A	1550	0.745	22.8
HJZI-A	1550	0.677	20.2
WNZF	1550	0.645	18.9
WKFE	1550	0.596	17.1
WSDK	1550	0.425	12.0

Proposed:

Call	Freq (kHz)	Limit (mV/m)	(%)
HITS-C	1550	2.225	100.0
<b>*WRHC-PRO</b>	<b>1550</b>	<b>1.601</b>	<b>71.9</b>
-----	50%	-----	
HJCB-A	1550	1.071	39.1
HRNN 37-A	1550	0.893	30.3
HJGY-A	1550	0.801	26.0
-----	25%	-----	
XERUV/A	1550	0.745	23.5
HJZI-A	1550	0.677	20.7
WNZF	1550	0.645	19.4
WKFE	1550	0.596	17.6
WSDK	1550	0.425	12.3

Protected Station: CMOR-D, 1550 kHz - NUEVA GERONA, , CU  
Standard: Region 2 [ 50% ]

Current:

Call	Freq (kHz)	Limit (mV/m)	(%)
<b>*WRHC</b>	<b>1550</b>	<b>2.663</b>	<b>100.0</b>
XERUV/A	1550	2.060	77.4
HRNN 37-A	1550	1.780	52.9
-----	50%	-----	
HITS-C	1550	0.975	25.6
-----	25%	-----	
HJCB-A	1550	0.646	16.4
HJGY-A	1550	0.532	13.4
HJZI-A	1550	0.487	12.1
XE/A	1550	0.465	11.5
XE/A	1550	0.456	11.2

Proposed:

Call	Freq (kHz)	Limit (mV/m)	(%)
XERUV/A	1550	2.060	100.0
HRNN 37-A	1550	1.780	86.4
<b>*WRHC-PRO</b>	<b>1550</b>	<b>1.391</b>	<b>51.1</b>
-----	50%	-----	
HITS-C	1550	0.975	31.9
-----	25%	-----	
HJCB-A	1550	0.646	20.1
HJGY-A	1550	0.532	16.3
HJZI-A	1550	0.487	14.7
XE/A	1550	0.465	13.9
XE/A	1550	0.456	13.5
WNZF	1550	0.351	10.3

Protected Station: HITS-C, 1550 kHz - TAMAYO, , DR  
Standard: NARBA [ 10% ]

Current:

Call	Freq (kHz)	Limit (mV/m)	(%)
WKFE	1550	4.015	100.0
HJCB-A	1550	3.977	99.1
HJZI-A	1550	3.119	55.2
-----	50%	-----	
HJGY-A	1550	2.813	43.6
-----	25%	-----	
HJQD-A	1550	1.211	17.2
<b>*WRHC</b>	<b>1550</b>	<b>1.007</b>	<b>14.1</b>
WSDK	1550	0.955	13.2
HJLT-A	1550	0.940	12.9
XERUV/A	1550	0.940	12.8
HRNN 37-A	1550	0.843	11.4

Proposed:

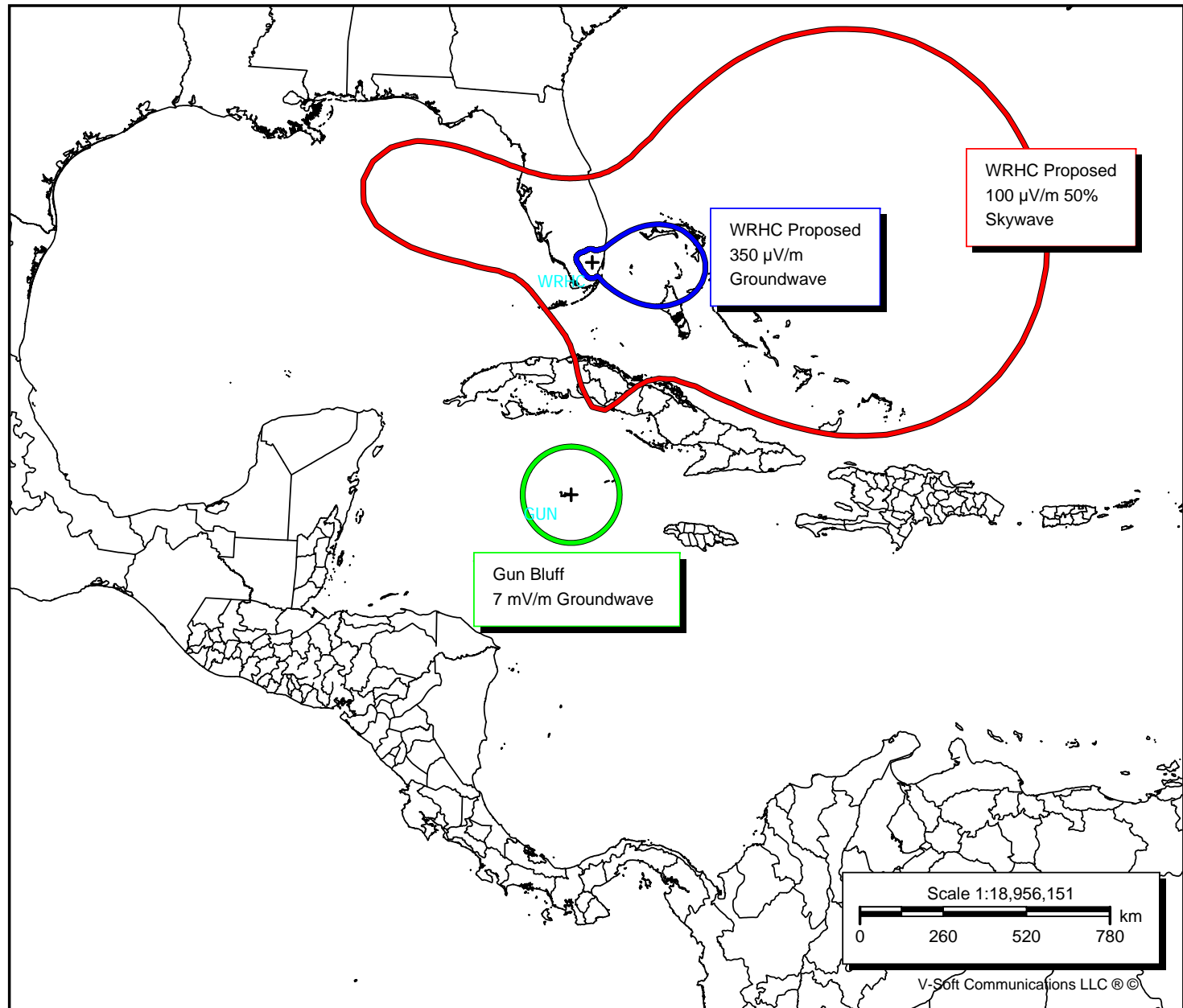
Call	Freq (kHz)	Limit (mV/m)	(%)
WKFE	1550	4.015	100.0
HJCB-A	1550	3.977	99.1
HJZI-A	1550	3.119	55.2
-----	50%	-----	
HJGY-A	1550	2.813	43.6
<b>*WRHC-PRO</b>	<b>1550</b>	<b>2.207</b>	<b>31.3</b>
-----	25%	-----	
HJQD-A	1550	1.211	16.4
WSDK	1550	0.955	12.8
HJLT-A	1550	0.940	12.5
XERUV/A	1550	0.940	12.4
HRNN 37-A	1550	0.843	11.0

GUN

Freq: 1550 kHz  
Class: A  
Latitude: 19-19-00 N  
Longitude: 081-06-00 W  
Power: 20 kW  
RMS: 309.47 mV/m @ 1km  
# Towers: 1  
# AUs: 0

Nighttime Protection  
of co-channel  
facility at Gun Bluff, CJ

Exhibit 18-1



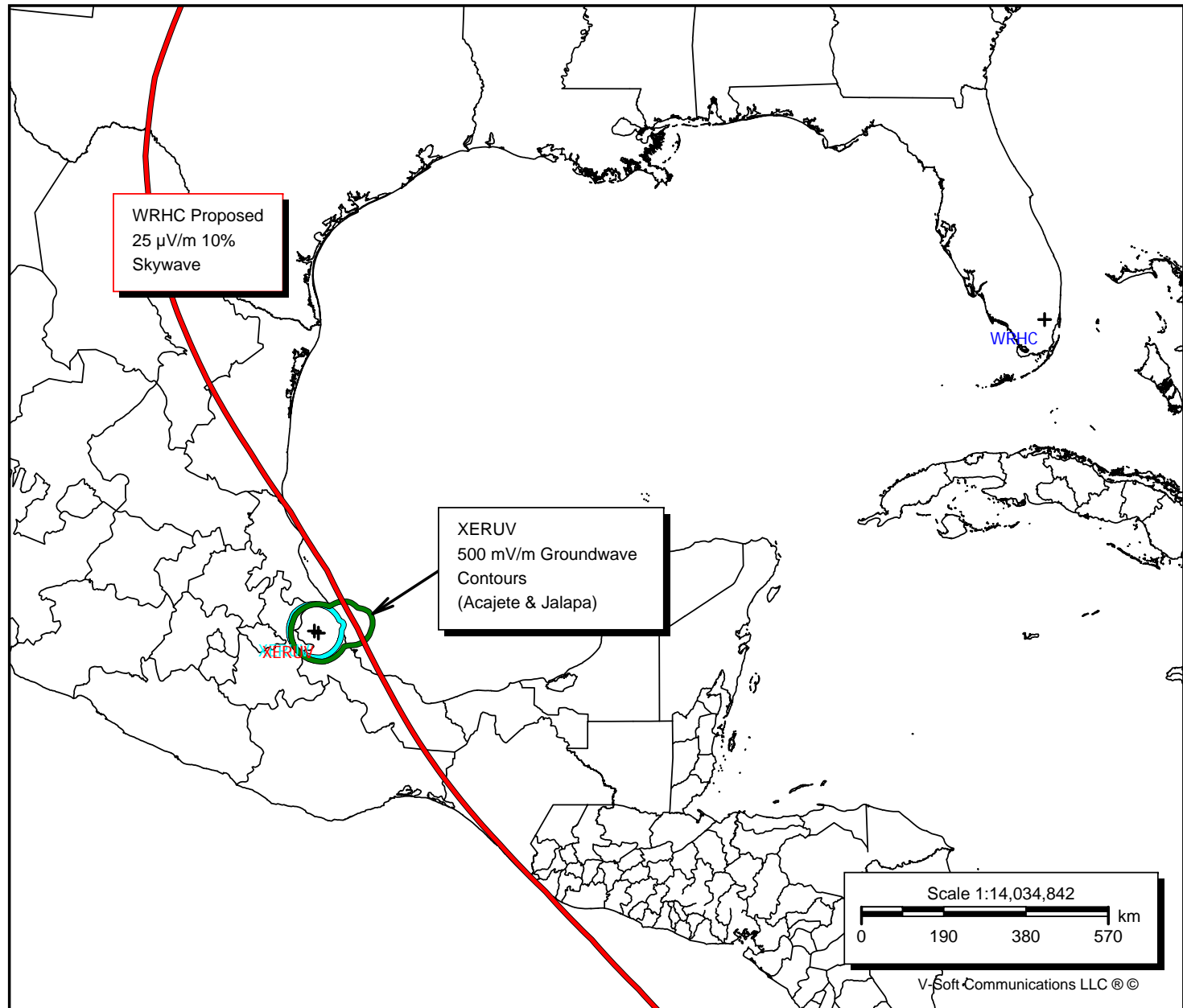


# XERUV

Freq: 1550 kHz  
Class: A  
Latitude: 19-35-07 N  
Longitude: 096-59-57 W  
Power: 10 kW  
RMS: 310.883 mV/m @1km  
# Towers: 1  
# AUs: 0

Nighttime Protection  
of co-channel  
Class A facility  
XERUV  
(Acajete & Jalapa)

Exhibit 18-2

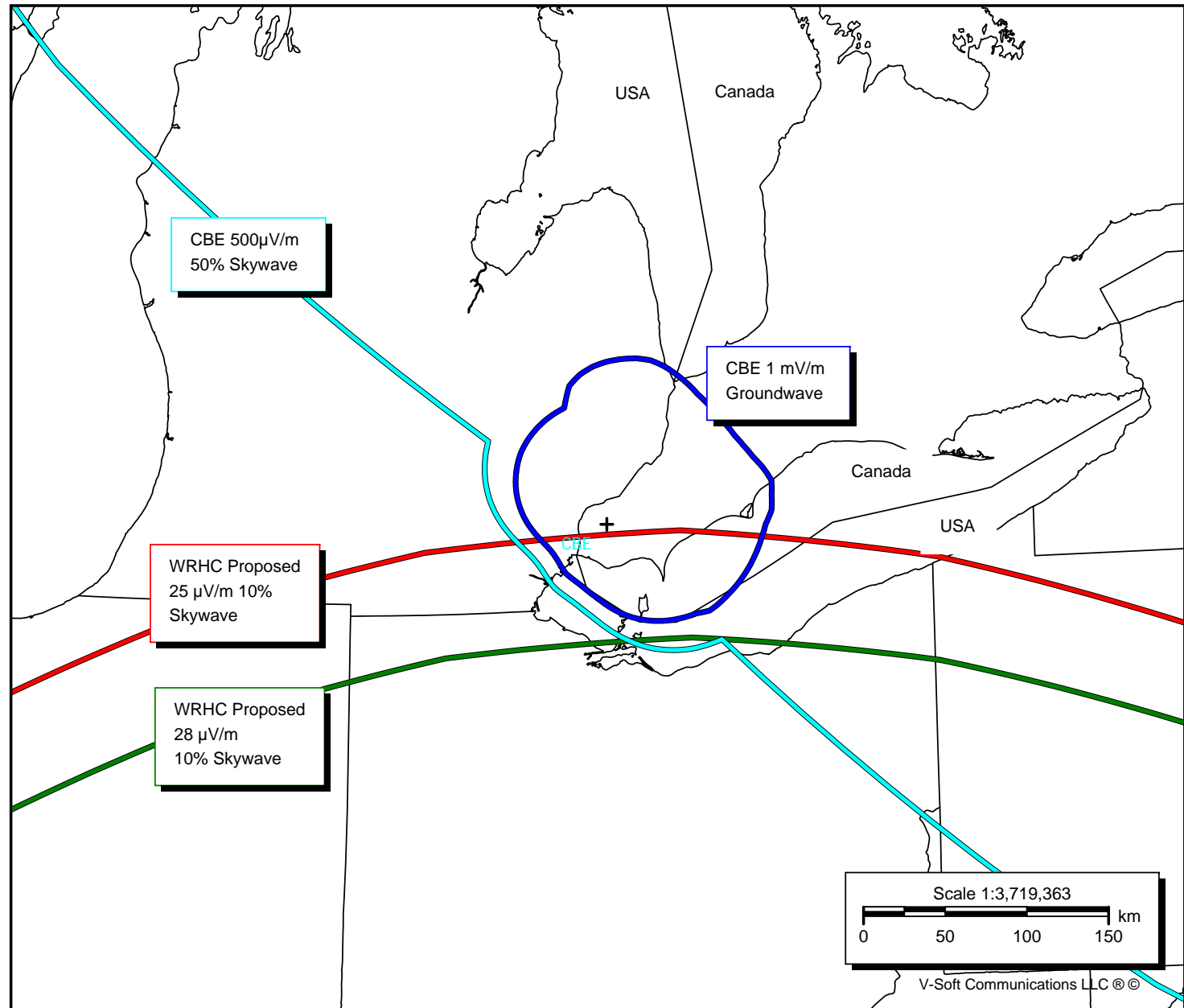


WRHC

Freq: 1550 kHz  
Class: B  
Latitude: 25-51-29 N  
Longitude: 080-28-53 W  
Power: 1 kW  
RMS: 352.399 mV/m @1km  
# Towers: 6  
# Augs: 0

Nighttime Protection  
of co-channel  
Class A facility  
CBE

Exhibit 18-3



CMHO

Freq: 1550 kHz

Class: C

Latitude: 21-33-00 N

Longitude: 077-16-00 W

Power: 0.25 kW

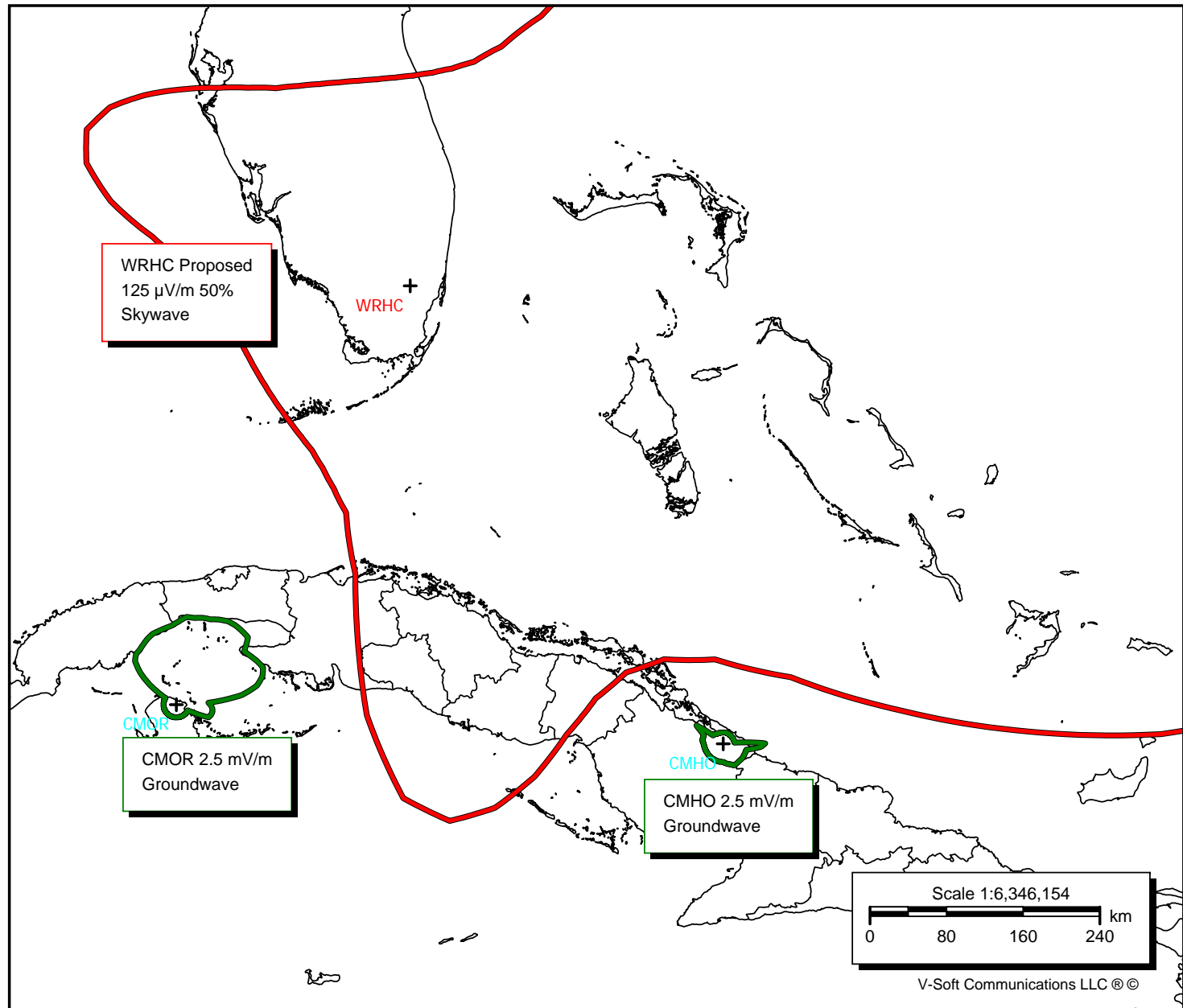
RMS: 309.4 mV/m @1km

# Towers: 1

# Aucs: 0

Skywave protection of  
co-channel Cuban stations  
CMHO & CMOR

Exhibit 18-4



Tabulation of Daytime Directional Antenna Pattern  
WRHC (AM) Doral, FL

Call: WRHC  
 Freq: 1550 kHz  
 DORAL, FL, US  
 Hours: D  
 Lat: 25-51-29 N  
 Lng: 080-28-53 W  
 Power: 8.0 kW  
 Theo RMS: 941.59 mV/m @ 1km @ 8.0 kW

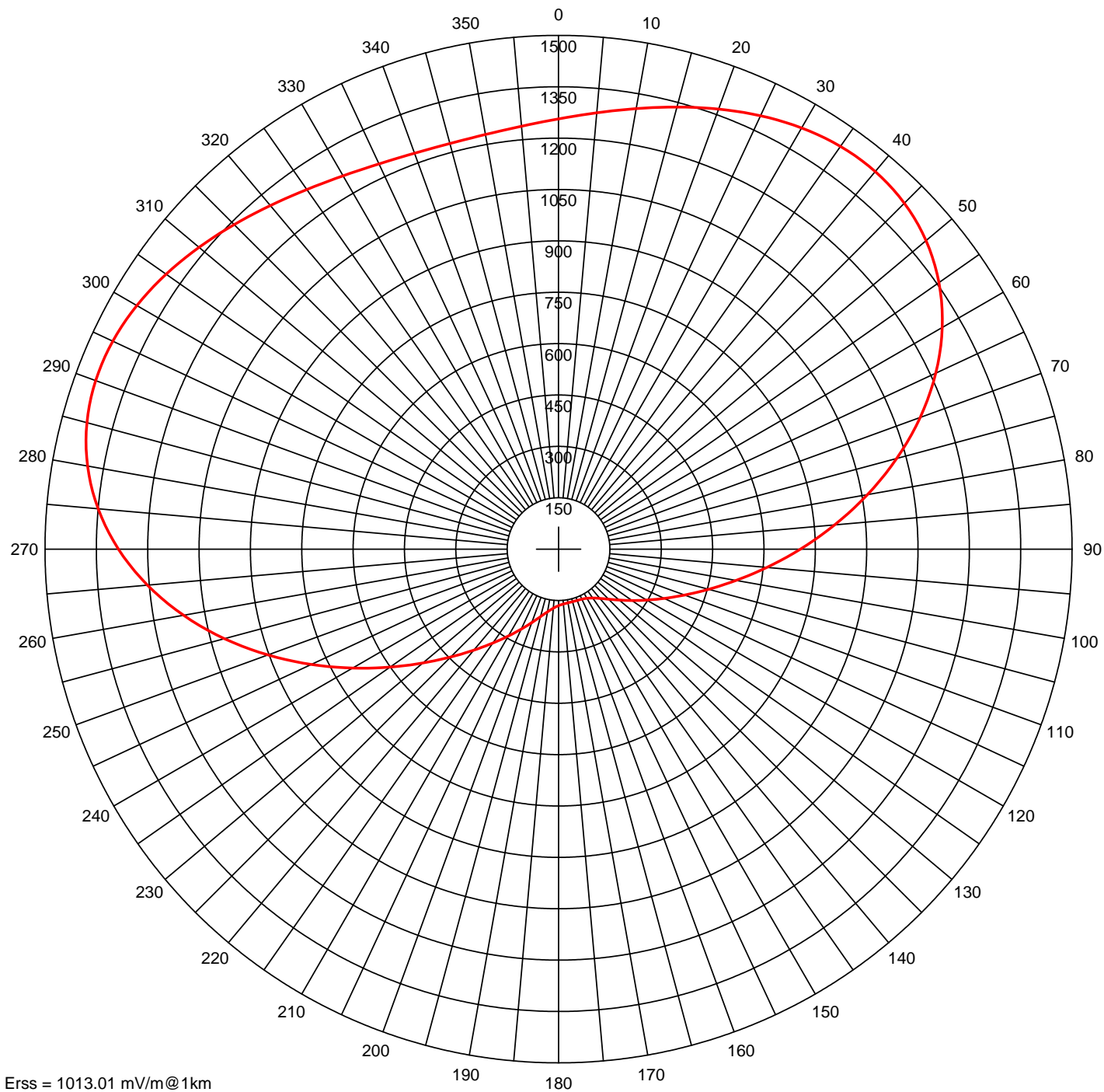
#	Field Ratio	Phase (deg)	Spacing (deg)	Orient (deg)	Height (deg)	Ref Switch	TL Switch	A (deg)	B (deg)	C (deg)	D (deg)
1	0.445	-122.0	0.0	0.0	204.0	0	0	0.0	0.0	0.0	0.0
2	1.000	0.0	78.9	165.3	107.8	0	0	0.0	0.0	0.0	0.0
3	0.455	37.0	227.6	165.3	204.0	0	0	0.0	0.0	0.0	0.0

-----

Standard Horizontal Plane Pattern

Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)
0.0	1256.22	120.0	297.52	240.0	694.55
5.0	1278.81	125.0	261.53	245.0	796.72
10.0	1306.06	130.0	231.43	250.0	903.41
15.0	1336.29	135.0	206.86	255.0	1010.20
20.0	1367.26	140.0	187.85	260.0	1112.37
25.0	1396.23	145.0	174.37	265.0	1205.43
30.0	1420.07	150.0	165.89	270.0	1285.55
35.0	1435.48	155.0	161.32	275.0	1349.89
40.0	1439.24	160.0	159.30	280.0	1396.87
45.0	1428.54	165.0	158.73	285.0	1426.18
50.0	1401.31	170.0	159.17	290.0	1438.77
55.0	1356.46	175.0	160.97	295.0	1436.60
60.0	1294.15	180.0	165.17	300.0	1422.43
65.0	1215.80	185.0	173.10	305.0	1399.43
70.0	1124.10	190.0	185.94	310.0	1370.90
75.0	1022.79	195.0	204.28	315.0	1340.02
80.0	916.31	200.0	228.19	320.0	1309.57
85.0	809.37	205.0	257.62	325.0	1281.86
90.0	706.44	210.0	292.87	330.0	1258.64
95.0	611.29	215.0	334.87	335.0	1241.15
100.0	526.56	220.0	385.16	340.0	1230.20
105.0	453.46	225.0	445.48	345.0	1226.22
110.0	391.83	230.0	517.17	350.0	1229.35
115.0	340.43	235.0	600.54	355.0	1239.48

AM Directional Pattern



Erss = 1013.01 mV/m@1km  
Theo RMS: 941.587 mV/m@1km  
Std RMS: 989.112 mV/m@1km  
Q: 28.284 mV/m@1km

Standard Horizontal Plane Pattern

— Pattern (mV/m @ 1km)  
— Pattern X10

#	Field Ratio	Phase (deg)	Spacing (deg)	Orient (deg)	Height (deg)	Ref Switch	TL Switch	A (deg)	B (deg)	C (deg)	D (deg)
1	0.445	-122.0	0.0	0.0	204.0	0	0	0.0	0.0	0.0	0.0
2	1.000	0.0	78.9	165.3	107.8	0	0	0.0	0.0	0.0	0.0
3	0.455	37.0	227.6	165.3	204.0	0	0	0.0	0.0	0.0	0.0

Call: WRHC  
Freq: 1550 kHz  
DORAL, FL, US  
Hours: D  
Lat: 25-51-29 N  
Lng: 080-28-53 W  
Power: 8.0 kW  
Theo RMS: 941.59 mV/m@1km  
@ 8.0 kW

# Tabulation of Nighttime Directional Antenna Pattern WRHC (AM) Doral, FL

Call: WRHC  
 Freq: 1550 kHz  
 Doral, FL, US  
 Hours: N  
 Lat: 25-51-29 N  
 Lng: 080-28-53 W  
 Power: 1.0 kW  
 Theo RMS: 352.40 mV/m @ 1km @ 1.0 kW

#	Field Ratio	Phase (deg)	Spacing (deg)	Orient (deg)	Height (deg)	Ref Swrch	TL Swrch	A (deg)	B (deg)	C (deg)	D (deg)
1	0.455	21.0	0.0	0.0	204.0	0	0	0.0	0.0	0.0	0.0
2	0.320	-31.5	78.9	165.3	107.8	0	0	0.0	0.0	0.0	0.0
3	1.000	0.0	227.6	165.3	204.0	0	0	0.0	0.0	0.0	0.0
4	0.540	-48.5	107.3	69.9	113.5	0	0	0.0	0.0	0.0	0.0
5	0.325	-75.5	134.4	112.2	107.8	0	0	0.0	0.0	0.0	0.0
6	0.425	-95.5	208.2	129.0	204.0	0	0	0.0	0.0	0.0	0.0

## Standard Horizontal Plane Pattern

Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)
0.0	170.53	120.0	440.03	240.0	156.18
5.0	159.28	125.0	356.92	245.0	155.12
10.0	148.32	130.0	280.21	250.0	155.09
15.0	144.01	135.0	216.13	255.0	159.36
20.0	154.10	140.0	172.47	260.0	170.92
25.0	182.73	145.0	155.87	265.0	190.25
30.0	228.13	150.0	163.59	270.0	214.74
35.0	286.02	155.0	183.90	275.0	240.14
40.0	352.37	160.0	206.81	280.0	262.20
45.0	423.87	165.0	227.15	285.0	277.53
50.0	497.50	170.0	242.74	290.0	283.99
55.0	570.33	175.0	252.76	295.0	280.83
60.0	639.35	180.0	256.99	300.0	268.68
65.0	701.49	185.0	255.51	305.0	249.46
70.0	753.71	190.0	248.68	310.0	226.16
75.0	793.16	195.0	237.16	315.0	202.65
80.0	817.38	200.0	222.05	320.0	183.11
85.0	824.52	205.0	204.97	325.0	170.95
90.0	813.58	210.0	188.04	330.0	167.23
95.0	784.57	215.0	173.58	335.0	170.01
100.0	738.54	220.0	163.47	340.0	175.60
105.0	677.64	225.0	158.22	345.0	180.37
110.0	604.95	230.0	156.65	350.0	181.78
115.0	524.29	235.0	156.58	355.0	178.51

# Standard 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	162.70	120.0	436.67	240.0	148.42
5.0	152.36	125.0	355.51	245.0	147.31
10.0	142.83	130.0	280.63	250.0	147.80
15.0	140.41	135.0	218.04	255.0	153.14
20.0	152.33	140.0	175.09	260.0	166.08
25.0	182.01	145.0	157.90	265.0	186.66
30.0	227.46	150.0	164.04	270.0	212.02
35.0	284.65	155.0	182.74	275.0	237.93
40.0	349.86	160.0	204.37	280.0	260.25
45.0	419.95	165.0	223.78	285.0	275.74
50.0	492.04	170.0	238.71	290.0	282.37
55.0	563.31	175.0	248.28	295.0	279.42
60.0	630.83	180.0	252.23	300.0	267.51
65.0	691.61	185.0	250.62	305.0	248.48
70.0	742.69	190.0	243.80	310.0	225.20
75.0	781.29	195.0	232.41	315.0	201.37
80.0	805.01	200.0	217.48	320.0	181.01
85.0	812.04	205.0	200.58	325.0	167.54
90.0	801.42	210.0	183.71	330.0	162.27
95.0	773.12	215.0	169.08	335.0	163.63
100.0	728.20	220.0	158.49	340.0	168.14
105.0	668.74	225.0	152.52	345.0	172.24
110.0	597.75	230.0	150.12	350.0	173.37
115.0	518.97	235.0	149.30	355.0	170.20

Standard 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	141.32	120.0	426.60	240.0	126.12
5.0	133.81	125.0	351.09	245.0	124.99
10.0	128.63	130.0	281.46	250.0	127.22
15.0	131.67	135.0	223.15	255.0	135.97
20.0	148.47	140.0	182.32	260.0	152.96
25.0	180.56	145.0	163.76	265.0	176.98
30.0	225.71	150.0	165.78	270.0	204.58
35.0	280.65	155.0	179.97	275.0	231.69
40.0	342.41	160.0	197.91	280.0	254.60
45.0	408.36	165.0	214.57	285.0	270.46
50.0	475.98	170.0	227.52	290.0	277.52
55.0	542.71	175.0	235.73	295.0	275.20
60.0	605.89	180.0	238.85	300.0	264.05
65.0	662.74	185.0	236.87	305.0	245.72
70.0	710.53	190.0	230.06	310.0	222.74
75.0	746.68	195.0	219.00	315.0	198.34
80.0	768.95	200.0	204.60	320.0	176.07
85.0	775.67	205.0	188.19	325.0	159.22
90.0	765.93	210.0	171.48	330.0	149.65
95.0	739.71	215.0	156.36	335.0	146.79
100.0	697.98	220.0	144.42	340.0	148.00
105.0	642.67	225.0	136.31	345.0	150.00
110.0	576.59	230.0	131.44	350.0	150.24
115.0	503.23	235.0	128.40	355.0	147.34



# Standard 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	113.26	120.0	409.94	240.0	92.14
5.0	110.73	125.0	343.12	245.0	91.42
10.0	112.72	130.0	281.55	250.0	97.48
15.0	123.61	135.0	229.75	255.0	112.48
20.0	146.08	140.0	192.37	260.0	135.73
25.0	179.97	145.0	172.62	265.0	164.24
30.0	223.40	150.0	169.47	270.0	194.33
35.0	274.19	155.0	177.30	275.0	222.50
40.0	330.27	160.0	189.63	280.0	245.77
45.0	389.64	165.0	201.92	285.0	261.90
50.0	450.25	170.0	211.67	290.0	269.51
55.0	509.92	175.0	217.67	295.0	268.17
60.0	566.35	180.0	219.41	300.0	258.39
65.0	617.12	185.0	216.78	305.0	241.53
70.0	659.81	190.0	209.97	310.0	219.67
75.0	692.15	195.0	199.39	315.0	195.40
80.0	712.17	200.0	185.78	320.0	171.59
85.0	718.38	205.0	170.12	325.0	151.01
90.0	709.98	210.0	153.69	330.0	135.81
95.0	686.94	215.0	137.87	335.0	126.64
100.0	650.12	220.0	123.88	340.0	122.35
105.0	601.22	225.0	112.44	345.0	120.62
110.0	542.74	230.0	103.51	350.0	119.16
115.0	477.78	235.0	96.71	355.0	116.68

Standard 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	91.90	120.0	386.91	240.0	50.82
5.0	95.84	125.0	330.93	245.0	52.33
10.0	105.63	130.0	279.29	250.0	66.79
15.0	123.00	135.0	235.49	255.0	91.02
20.0	148.44	140.0	202.69	260.0	120.70
25.0	181.38	145.0	182.78	265.0	152.50
30.0	220.77	150.0	175.11	270.0	183.64
35.0	265.34	155.0	176.34	275.0	211.67
40.0	313.77	160.0	182.17	280.0	234.45
45.0	364.63	165.0	189.04	285.0	250.36
50.0	416.31	170.0	194.66	290.0	258.40
55.0	467.08	175.0	197.73	295.0	258.29
60.0	515.03	180.0	197.62	300.0	250.47
65.0	558.16	185.0	194.10	305.0	236.02
70.0	594.46	190.0	187.22	310.0	216.57
75.0	622.02	195.0	177.23	315.0	194.09
80.0	639.19	200.0	164.60	320.0	170.70
85.0	644.74	205.0	149.96	325.0	148.52
90.0	637.97	210.0	134.08	330.0	129.36
95.0	618.88	215.0	117.76	335.0	114.43
100.0	588.15	220.0	101.65	340.0	104.01
105.0	547.25	225.0	86.24	345.0	97.43
110.0	498.24	230.0	71.81	350.0	93.56
115.0	443.79	235.0	59.13	355.0	91.63

Standard 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	92.79	120.0	358.06	240.0	10.62
5.0	100.56	125.0	313.92	245.0	25.25
10.0	113.54	130.0	273.06	250.0	52.54
15.0	131.94	135.0	237.96	255.0	82.62
20.0	155.65	140.0	210.56	260.0	113.95
25.0	184.29	145.0	191.87	265.0	145.09
30.0	217.28	150.0	181.42	270.0	174.41
35.0	253.90	155.0	177.39	275.0	200.30
40.0	293.27	160.0	177.28	280.0	221.27
45.0	334.37	165.0	178.71	285.0	236.17
50.0	376.01	170.0	179.92	290.0	244.29
55.0	416.84	175.0	179.76	295.0	245.46
60.0	455.38	180.0	177.56	300.0	240.02
65.0	490.06	185.0	173.02	305.0	228.82
70.0	519.28	190.0	166.05	310.0	213.07
75.0	541.55	195.0	156.76	315.0	194.24
80.0	555.56	200.0	145.37	320.0	173.91
85.0	560.33	205.0	132.20	325.0	153.61
90.0	555.32	210.0	117.59	330.0	134.75
95.0	540.52	215.0	101.83	335.0	118.45
100.0	516.48	220.0	85.10	340.0	105.49
105.0	484.34	225.0	67.36	345.0	96.30
110.0	445.77	230.0	48.40	350.0	91.02
115.0	402.88	235.0	28.14	355.0	89.76

Standard 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	112.68	120.0	324.31	240.0	38.05
5.0	119.70	125.0	291.92	245.0	47.83
10.0	130.73	130.0	261.72	250.0	67.11
15.0	145.67	135.0	235.27	255.0	91.00
20.0	164.33	140.0	213.70	260.0	116.79
25.0	186.45	145.0	197.47	265.0	142.67
30.0	211.62	150.0	186.29	270.0	167.14
35.0	239.38	155.0	179.20	275.0	188.84
40.0	269.11	160.0	174.90	280.0	206.63
45.0	300.07	165.0	172.05	285.0	219.64
50.0	331.42	170.0	169.51	290.0	227.32
55.0	362.15	175.0	166.48	295.0	229.56
60.0	391.17	180.0	162.41	300.0	226.60
65.0	417.31	185.0	157.01	305.0	219.04
70.0	439.41	190.0	150.13	310.0	207.77
75.0	456.35	195.0	141.78	315.0	193.85
80.0	467.16	200.0	132.03	320.0	178.43
85.0	471.12	205.0	121.02	325.0	162.66
90.0	467.84	210.0	108.89	330.0	147.59
95.0	457.30	215.0	95.80	335.0	134.17
100.0	439.93	220.0	81.88	340.0	123.15
105.0	416.57	225.0	67.42	345.0	115.13
110.0	388.44	230.0	53.16	350.0	110.53
115.0	357.10	235.0	41.44	355.0	109.65

Standard 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	134.97	120.0	287.08	240.0	73.97
5.0	139.64	125.0	265.41	245.0	80.26
10.0	147.07	130.0	244.92	250.0	91.69
15.0	157.19	135.0	226.50	255.0	106.99
20.0	169.88	140.0	210.73	260.0	124.58
25.0	184.97	145.0	197.81	265.0	142.97
30.0	202.18	150.0	187.61	270.0	160.83
35.0	221.21	155.0	179.67	275.0	177.05
40.0	241.64	160.0	173.38	280.0	190.69
45.0	262.98	165.0	168.11	285.0	201.06
50.0	284.62	170.0	163.27	290.0	207.74
55.0	305.88	175.0	158.42	295.0	210.61
60.0	326.02	180.0	153.23	300.0	209.81
65.0	344.24	185.0	147.49	305.0	205.71
70.0	359.73	190.0	141.11	310.0	198.91
75.0	371.73	195.0	134.06	315.0	190.11
80.0	379.58	200.0	126.37	320.0	180.09
85.0	382.80	205.0	118.13	325.0	169.65
90.0	381.12	210.0	109.46	330.0	159.52
95.0	374.53	215.0	100.55	335.0	150.37
100.0	363.32	220.0	91.73	340.0	142.76
105.0	348.06	225.0	83.52	345.0	137.13
110.0	329.56	230.0	76.87	350.0	133.82
115.0	308.85	235.0	73.16	355.0	133.05

# Standard 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	149.16	120.0	248.19	240.0	101.35
5.0	151.60	125.0	235.55	245.0	105.50
10.0	155.68	130.0	223.28	250.0	112.15
15.0	161.40	135.0	211.80	255.0	120.97
20.0	168.70	140.0	201.38	260.0	131.35
25.0	177.52	145.0	192.13	265.0	142.55
30.0	187.70	150.0	184.01	270.0	153.76
35.0	199.07	155.0	176.88	275.0	164.27
40.0	211.38	160.0	170.51	280.0	173.43
45.0	224.33	165.0	164.68	285.0	180.77
50.0	237.57	170.0	159.18	290.0	185.97
55.0	250.68	175.0	153.84	295.0	188.89
60.0	263.18	180.0	148.53	300.0	189.59
65.0	274.61	185.0	143.18	305.0	188.25
70.0	284.46	190.0	137.76	310.0	185.18
75.0	292.27	195.0	132.27	315.0	180.80
80.0	297.64	200.0	126.76	320.0	175.54
85.0	300.28	205.0	121.28	325.0	169.88
90.0	300.03	210.0	115.95	330.0	164.24
95.0	296.87	215.0	110.91	335.0	159.03
100.0	290.97	220.0	106.40	340.0	154.58
105.0	282.64	225.0	102.74	345.0	151.18
110.0	272.35	230.0	100.35	350.0	149.04
115.0	260.67	235.0	99.74	355.0	148.33

# Standard 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	151.29	120.0	209.66	240.0	118.39
5.0	152.07	125.0	203.99	245.0	120.70
10.0	153.62	130.0	198.12	250.0	124.03
15.0	155.97	135.0	192.21	255.0	128.29
20.0	159.12	140.0	186.36	260.0	133.29
25.0	163.07	145.0	180.65	265.0	138.76
30.0	167.76	150.0	175.11	270.0	144.39
35.0	173.12	155.0	169.74	275.0	149.87
40.0	179.05	160.0	164.54	280.0	154.89
45.0	185.41	165.0	159.50	285.0	159.20
50.0	192.03	170.0	154.62	290.0	162.61
55.0	198.71	175.0	149.89	295.0	165.02
60.0	205.23	180.0	145.32	300.0	166.40
65.0	211.35	185.0	140.94	305.0	166.79
70.0	216.83	190.0	136.78	310.0	166.30
75.0	221.44	195.0	132.87	315.0	165.09
80.0	224.98	200.0	129.25	320.0	163.34
85.0	227.31	205.0	125.96	325.0	161.24
90.0	228.31	210.0	123.05	330.0	158.98
95.0	227.97	215.0	120.60	335.0	156.76
100.0	226.33	220.0	118.67	340.0	154.74
105.0	223.50	225.0	117.37	345.0	153.07
110.0	219.64	230.0	116.81	350.0	151.87
115.0	214.95	235.0	117.12	355.0	151.25

Standard 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	141.31	120.0	173.34	240.0	124.86
5.0	141.03	125.0	172.50	245.0	125.57
10.0	140.94	130.0	171.15	250.0	126.51
15.0	141.06	135.0	169.32	255.0	127.65
20.0	141.44	140.0	167.03	260.0	128.96
25.0	142.09	145.0	164.35	265.0	130.42
30.0	143.02	150.0	161.33	270.0	131.99
35.0	144.24	155.0	158.04	275.0	133.63
40.0	145.74	160.0	154.58	280.0	135.29
45.0	147.49	165.0	151.03	285.0	136.94
50.0	149.49	170.0	147.46	290.0	138.50
55.0	151.68	175.0	143.96	295.0	139.95
60.0	154.03	180.0	140.61	300.0	141.22
65.0	156.49	185.0	137.48	305.0	142.29
70.0	159.00	190.0	134.61	310.0	143.12
75.0	161.51	195.0	132.06	315.0	143.70
80.0	163.96	200.0	129.85	320.0	144.02
85.0	166.26	205.0	128.01	325.0	144.12
90.0	168.36	210.0	126.54	330.0	143.99
95.0	170.20	215.0	125.44	335.0	143.69
100.0	171.70	220.0	124.69	340.0	143.26
105.0	172.80	225.0	124.28	345.0	142.76
110.0	173.47	230.0	124.19	350.0	142.22
115.0	173.66	235.0	124.39	355.0	141.72



Standard Pattern

Calculated at 55.0 Degrees Elevation

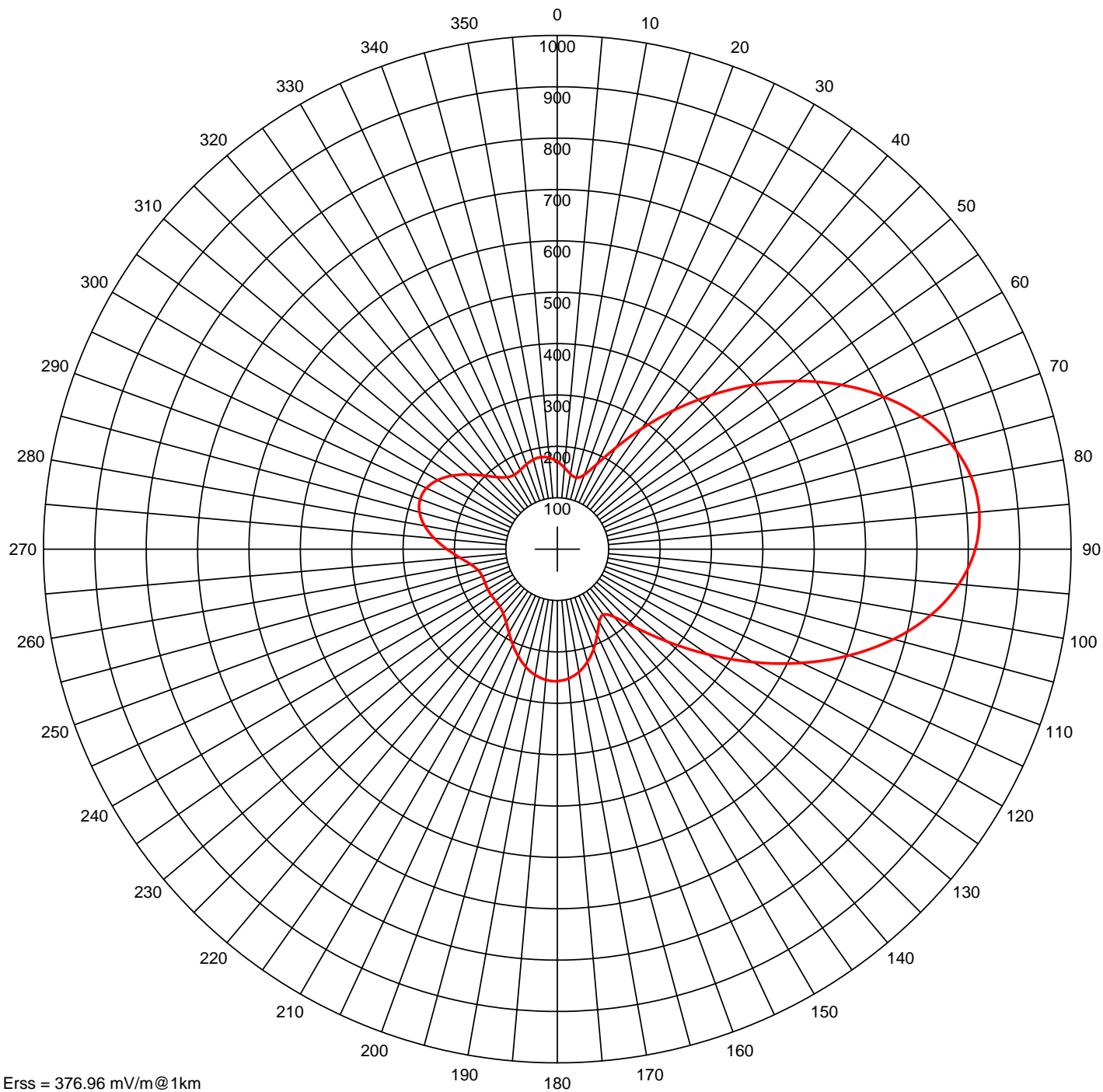
Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)	Azimuth (Deg)	Field (mV/m @1km)
0.0	121.58	120.0	140.53	240.0	121.68
5.0	120.77	125.0	142.56	245.0	121.14
10.0	119.80	130.0	143.99	250.0	120.46
15.0	118.71	135.0	144.78	255.0	119.62
20.0	117.54	140.0	144.94	260.0	118.67
25.0	116.33	145.0	144.52	265.0	117.66
30.0	115.12	150.0	143.58	270.0	116.66
35.0	113.95	155.0	142.20	275.0	115.78
40.0	112.87	160.0	140.49	280.0	115.10
45.0	111.95	165.0	138.54	285.0	114.69
50.0	111.24	170.0	136.47	290.0	114.62
55.0	110.82	175.0	134.35	295.0	114.89
60.0	110.78	180.0	132.30	300.0	115.50
65.0	111.18	185.0	130.37	305.0	116.37
70.0	112.10	190.0	128.63	310.0	117.42
75.0	113.58	195.0	127.11	315.0	118.56
80.0	115.62	200.0	125.84	320.0	119.69
85.0	118.19	205.0	124.83	325.0	120.72
90.0	121.20	210.0	124.05	330.0	121.59
95.0	124.54	215.0	123.47	335.0	122.23
100.0	128.05	220.0	123.04	340.0	122.61
105.0	131.56	225.0	122.71	345.0	122.73
110.0	134.91	230.0	122.42	350.0	122.59
115.0	137.94	235.0	122.09	355.0	122.19

# Standard 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	95.91	120.0	111.78	240.0	110.62
5.0	94.94	125.0	115.06	245.0	109.28
10.0	93.67	130.0	117.79	250.0	107.66
15.0	92.15	135.0	119.93	255.0	105.79
20.0	90.40	140.0	121.48	260.0	103.70
25.0	88.48	145.0	122.48	265.0	101.47
30.0	86.43	150.0	122.96	270.0	99.19
35.0	84.31	155.0	123.00	275.0	96.97
40.0	82.21	160.0	122.67	280.0	94.95
45.0	80.22	165.0	122.06	285.0	93.25
50.0	78.46	170.0	121.26	290.0	91.96
55.0	77.05	175.0	120.33	295.0	91.15
60.0	76.15	180.0	119.36	300.0	90.84
65.0	75.89	185.0	118.41	305.0	90.99
70.0	76.39	190.0	117.51	310.0	91.52
75.0	77.71	195.0	116.70	315.0	92.34
80.0	79.88	200.0	115.99	320.0	93.32
85.0	82.83	205.0	115.37	325.0	94.34
90.0	86.44	210.0	114.83	330.0	95.30
95.0	90.54	215.0	114.33	335.0	96.09
100.0	94.93	220.0	113.83	340.0	96.66
105.0	99.43	225.0	113.26	345.0	96.95
110.0	103.85	230.0	112.57	350.0	96.92
115.0	108.01	235.0	111.71	355.0	96.58

# AM Directional Pattern



Erss = 376.96 mV/m@1km  
 Theo RMS: 352.399 mV/m@1km  
 Std RMS: 370.168 mV/m@1km  
 Q: 10.0 mV/m@1km

Standard Horizontal Plane Pattern

— Pattern (mV/m @ 1km)  
 — Pattern X10

#	Field Ratio	Phase (deg)	Spacing (deg)	Orient (deg)	Height (deg)	Ref Switch	TL Switch	A (deg)	B (deg)	C (deg)	D (deg)
1	0.455	21.0	0.0	0.0	204.0	0	0	0.0	0.0	0.0	0.0
2	0.320	-31.5	78.9	165.3	107.8	0	0	0.0	0.0	0.0	0.0
3	1.000	0.0	227.6	165.3	204.0	0	0	0.0	0.0	0.0	0.0
4	0.540	-48.5	107.3	69.9	113.5	0	0	0.0	0.0	0.0	0.0
5	0.325	-75.5	134.4	112.2	107.8	0	0	0.0	0.0	0.0	0.0
6	0.425	-95.5	208.2	129.0	204.0	0	0	0.0	0.0	0.0	0.0

Call: WRHC  
 Freq: 1550 kHz  
 Doral, FL, US  
 Hours: N  
 Lat: 25-51-29 N  
 Lng: 080-28-53 W  
 Power: 1.0 kW  
 Theo RMS: 352.40 mV/m@1km  
 @ 1.0 kW

## Statement of Engineer

This Engineering Report, relative to an application for a new antenna system and city of license change for WRHC-AM, Doral, FL 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 a staff 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 24<sup>nd</sup> day of April 2015



Thomas S. Gorton, P.E.