



**WESU / Wesleyan University
Spectrum Study – Amendment to
Directional Antenna Pattern
January 5, 2008**

Purpose

WESU filed an application (20070906AAD) to improve their broadcast facility from 1500 watts ERP (omni-directional) to 6000 watts ERP (directional) at the same height 10m HAAT (44m AGL).

The FCC has asked that WESU submit an amendment to this application with a revised exhibit for TV6 protection; the original analysis used the new facility's 54dBu contour numbers vs. the existing facility's 48dBu contour (the 6dB adjustment to the 48dBu interfering contour as pursuant to 73.525 (e)(1)(iii)) was deemed inappropriate; the FCC asked that the 54dBu contour be used for both facilities.

Upon later internal analysis, it was determined that the directional antenna pattern would need minor revisions to meet the conditions of 47 CFR 73.510(a). This Study reflects those revisions

Summary

The new analysis, using 54dBu interfering contours for WESU's existing and proposed/new facilities AND a new pattern, still demonstrates that the new facility will result in a net reduction of population receiving interference to surrounding TV6 facilities.

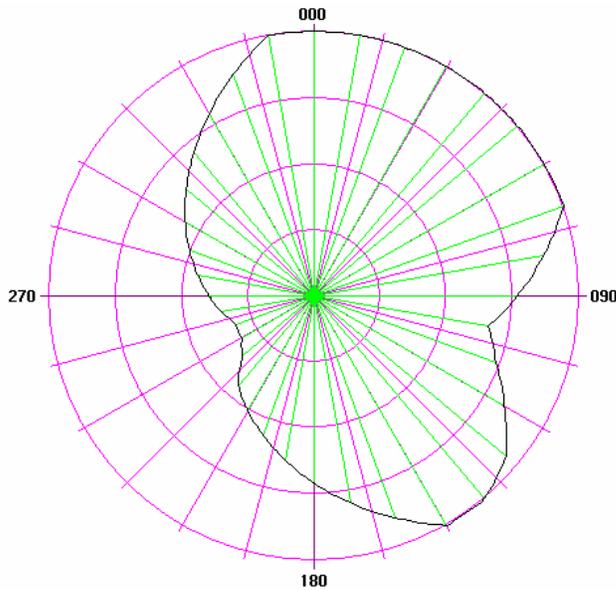
The following pages constitute a consolidated engineering exhibit:

- DA Pattern Information
- TV 6 protection
- FM Contour Separation
- RF Worksheets

DA Pattern Information & Facility Engineering Specifications

Channel	201 (88.1MHz)	Class	A
ERP	6.0 kW H&V	HAAT	10.01m
RC-AGL	44m	RC-AMSL	96m
Latitude	41-33-16 N	Longitude	72-39-30 W
Location	On a short tower on top of the Science Library		
Antenna	Directional	Rotation	n/a (zero)

Degree	Field	Degree	Field	Degree	Field	Degree	Field
0	1.000	100	0.667	200	0.562	300	0.562
10	1.000	110	0.729	210	0.501	310	0.630
20	1.000	120	0.829	220	0.446	320	0.707
30	1.000	130	0.944	230	0.354	330	0.794
40	1.000	140	1.000	240	0.316	340	0.891
50	1.000	150	1.000	250	0.316	350	1.000
60	1.000	160	1.000	260	0.354		
70	1.000	170	0.794	270	0.398		
80	0.876	180	0.707	280	0.446		
90	0.764	190	0.630	290	0.501		



Contour	Type ¹	Area	Population ²
60dBu	F(50,50)	730.9 sqkm ³	329,198
54dBu	F(50,10)	1597.5 sqkm	698,619
40dBu	F(50,10)	10898.4 sqkm	2,564,115
100dBu	F(50,10)	9.5 sqkm	11,160

(existing WESU 60dBu contour = 478.3 sqkm & 176,108 persons)

¹ F(50,50) are service contours, F(50,10) are interfering contours.

² All population figures are from the 2000 U.S. Census.

³ sqkm = Square Kilometers

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Exhibit 19 for Section VII / 15.e
TV Channel 6 Protection

<u>Pop. Overlap</u> ⁴	
79,714	WESU 54dBu & WEDT-DT 47dBu (existing)
61,972	WESU 54dBu & WEDY-DT 47dBu (new)
-17,742	Difference (WEDY-DT)
0	WESU 54dBu & WLNE-TV 47dbu (existing)
2,846	WESU 54dBu & WLNE-TV 47dbu (new)
+2,846	Difference (WLNE-TV)
-20,588	NET DIFFERENCE

Further analysis is provided on the following pages:

WEDY-DT New Haven, CT / Channel 6 digital

As determined by 47 CFR 73.525, there is also a need to protect TV Channel 6 WEDY-DT, owned by Connecticut Public Broadcasting. This presents an interesting issue: WESU already has prohibited overlap⁵ (48dBu F(50,10) interfering contour) with WEDY-DT (47dBu F(50,50) contour). Since WEDY-DT is a new digital TV channel (WEDY's migration from analog channel 65) it went on the air well after WESU; FCC rules do not require new DTV channels to protect NCE-FM signals. Consequently, WESU can maintain or reduce its interference overlap with WEDY-DT, but it cannot increase it. If the WESU overlap with WEDY-DT changes, any new WESU interference area to WEDY-DT must be offset by eliminating a certain amount of existing interference to WEDY-DT.

However, the null required to protect WMNR also reduces WESU's interfering contours in relation to WEDY-DT. As such, even though an expanded WESU will still have prohibited overlap, it will be *less* prohibited overlap.

The engineering charts of 73.599 dictate that the 48dBu interfering contour of WESU be matched to the 47dBu service contour of WEDY-DT. An extra +6dB is used for WESU's interfering contour (for 54dBu total) as allowed under 73.525 (e)(1)(iii); the entire proposed WESU interfering contours are outside of the 68dBu Grade A Service Contour of WEDY-DT, WLNE-TV and WRGB-TV. Currently the 54dBu interfering overlap covers 79,714 population, the proposed facility's overlap covers 68,548 population, a reduction of 11,166 persons.

47 CFR 73.525 (b) states:

(b) Existing NCE-FM Stations. (1) A NCE-FM station license authorized to operate on channels 201-220 as of December 31,

⁴ All population numbers are from the 2000 US Census.

⁵ The WESU 48dBu F(50,10) interfering contour overlaps the WEDY-DT 47dBu F(50,50) protected contour. This creates a technical condition that increases the chances a TV viewer will receive interference from WESU within the overlap area.

1984, or a permittee, granted a construction permit for a NCE-FM station as of December 31, 1984, are not subject to this section unless they propose either:

- (i) To make changes in operating facilities or location which will increase predicted interference as calculated under paragraph (e) of this section to TV Channel 6 reception in any direction; or,
- (ii) To increase its ratio of vertically polarized to horizontally polarized transmissions.

Since this new facility would *reduce* predicted interference, point (i) would not apply. Point (ii) does not apply because WESU already operates with a circularly-polarized antenna, and this proposed facility does not include any change to horizontal or vertical polarization,. As such, WESU should be able to improve its facility as we have described.

WLNE-TV Providence, RI / Channel 6 analog

The proposed 6kW directional broadcast facility must also protect WLNE-TV in Providence, RI. It will have Undesired-to-Desired⁶ overlap, covering 2,846 population. However, 47 CFR 73.525 (c) states:

- (c) New NCE-FM stations⁷. Except as provided for by paragraph (d) of this section⁸, applicants for NCE-FM stations proposing to operate on Channels 201-220 must submit a showing indicating that the predicted interference area resulting from the proposed facility contains no more than 3,000 persons.

Our population counter tool demonstrates that the area of contour overlap, at its greatest, will affect only 2846 persons, so the proposed facility is allowed.

WRGB-TV Schenectady, NY / Channel 6 analog

The existing and proposed WESU facility has no prohibited contour overlap with WRGB-TV, as demonstrated on the contour maps on subsequent pages.

⁶ Undesired refers to the series of F50,10 contours from WESU, starting at 48dBu. Desired refers to the matching series of F50,50 contours from WLNE, starting at 47dBu.

⁷ 73.525 (b) refers Existing NCE-FM stations to this section for interference protection rules.

⁸ Paragraph (d) refers to NCE-FM stations co-located with the TV Channel 6 in question, which does not apply here.

Contour and Signal Propagation Plots

Contour Maps : Legend / Key

Other facilities' contours with the same color represent the matching protected or interfering contour for that facility. Contours of the same color should, in theory, not cross.

WESU CONTOUR

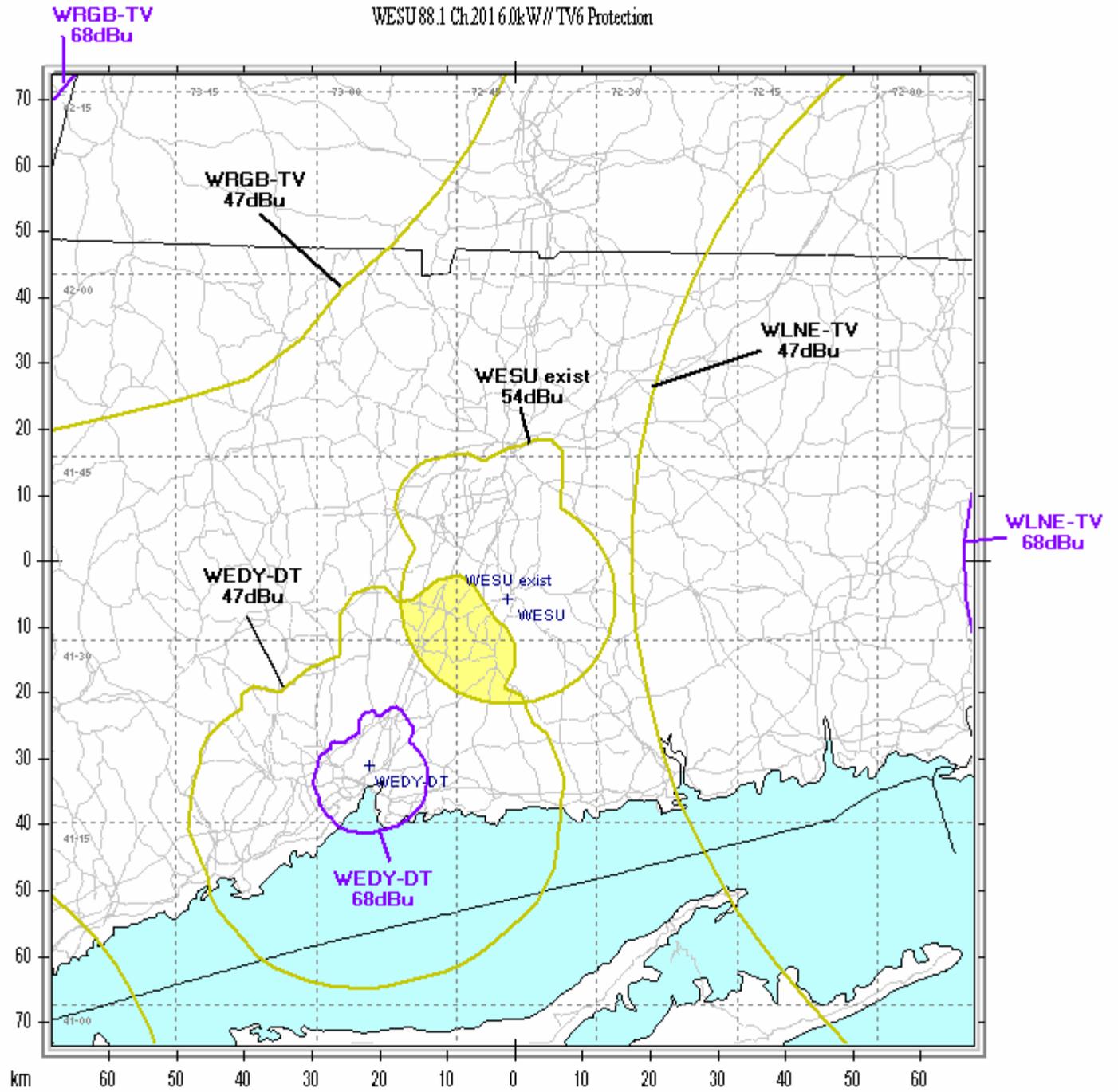
Yellow = 54 dBu interfering (TV 6)

OTHER STATION'S CONTOUR

Yellow = 47 dBu city grade

Purple = 68 dBu Grade A Service Contour

WESU 88.1 Ch 2016.0k W//TV6 Protection

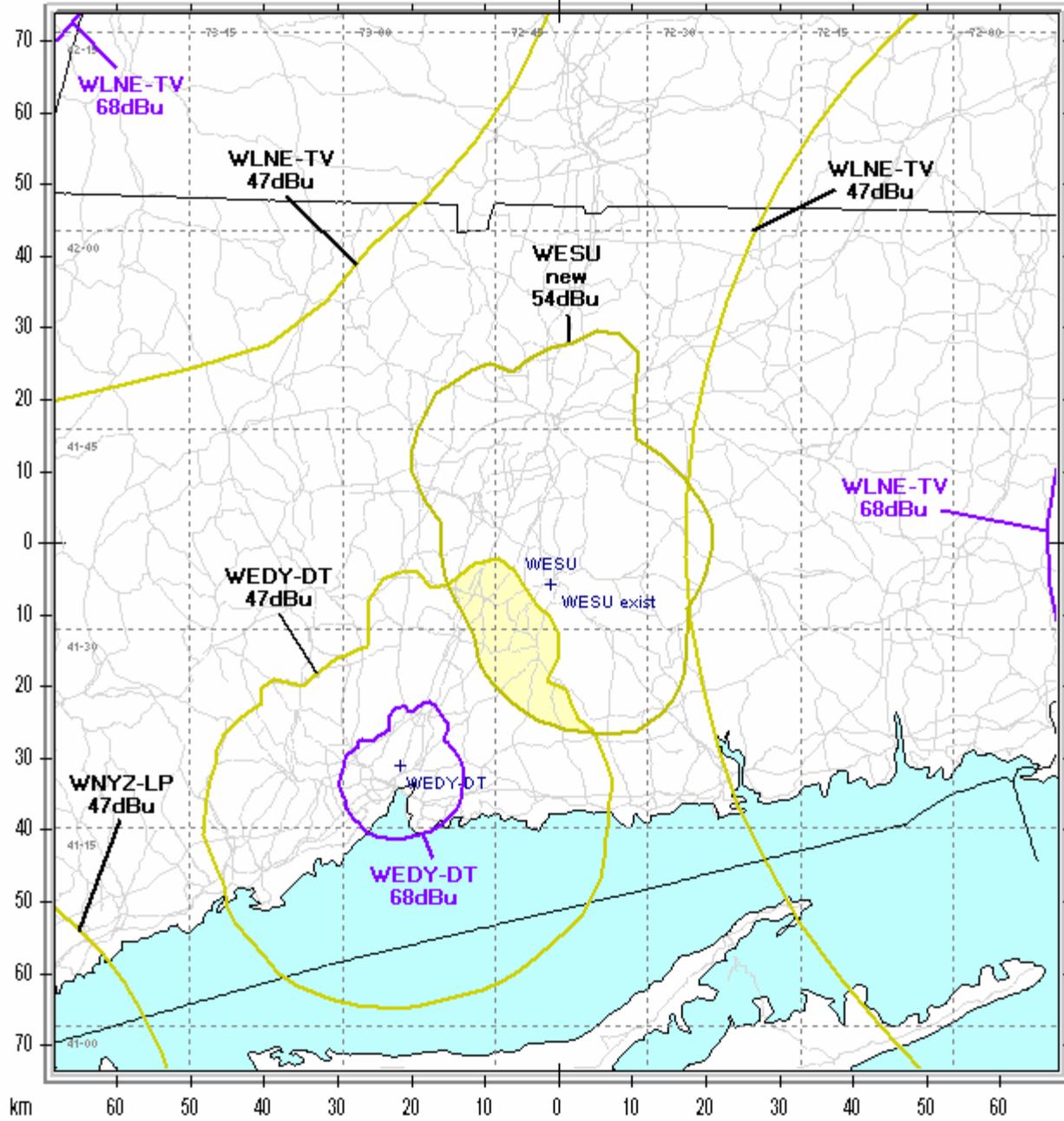


WESU Yellow=54dBu F(50.10)/ Others Yellow=47dBu F(50.50) Purple=68dBu Grade A

State Borders Highways Lat/Lon Grid

Map Scale: 1:931818 1 cm = 9.32 km V/H Size: 147.40 x 136.40 km

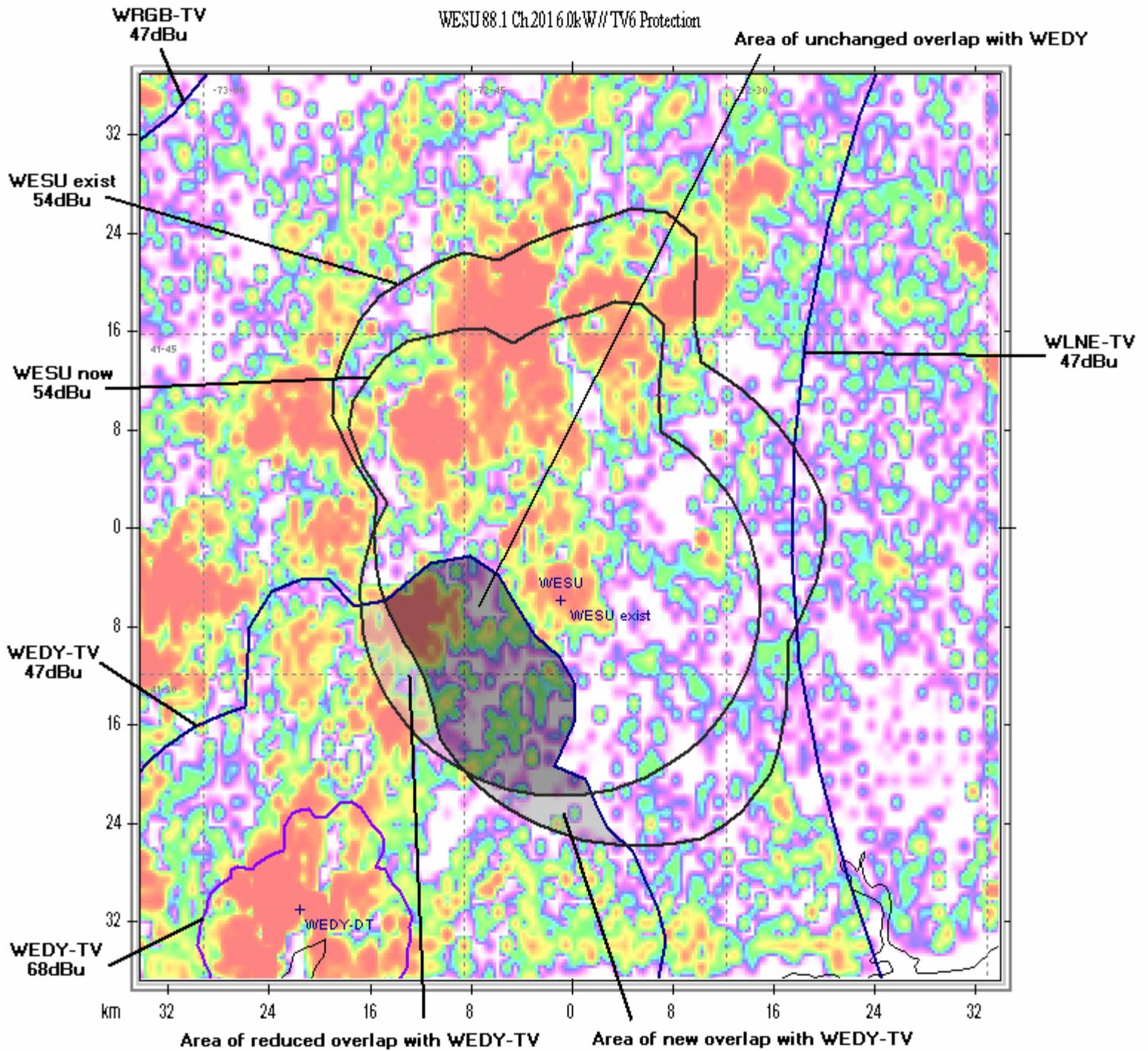
WESU 88.1 Ch 2016.0k W//TV6 Protection



WESU Yellow=54dBu F(50,10) / Others Yellow=47dBu F(50,50) Purple=68dBu Grade A

State Borders Highways Lat/Lon Grid

Map Scale: 1:931818 1 cm = 9.32 km V/H Size: 147.40 x 136.40 km



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Exhibit 16 for Section VII / 15.a
Contour Overlap / Protection

Facility Summary

The proposed WESU facility is at the same frequency, location and height above average terrain (HAAT) as the existing WESU facility. Frequency is 88.1 MHz (Channel 201), location is 41-33-16 N / 72-39-30 W, HAAT is 12m.

This application's purpose is to increase effective radiated power from 1500 watts to 6000 watts and to change the antenna pattern from non-directional to directional. Circular polarization will be retained.

Relevant Surrounding Broadcast Facilities

See contour maps at the end of this exhibit for a visual reference for contour separations. The proposed WESU facility has to protect the following facilities:

Co-channel (88.1 MHz)

- WMNR Monroe, CT (existing license, construction permit & auxiliary facility) **
- WKIV Westerly, RI (existing license & construction permit) **
- WCHC Worcester, MA
- WXBA Brentwood, NY
- WCWP Brookville, NY

First-adjacent (88.3 MHz)

- WVCR Loudonville, NY
- WLIU Southampton, NY **
- WBKW Beekman, NY
- WBGO Newark, NY
- WGAO Franklin, MA
- WIQH Concord, MA
- WQRI Bristol, RI
- WEVS Nashua, NH

Second-adjacent (88.5 MHz)

- WFCR Amherst, MA
- WVOF Fairfield, CT

(Continued on next page)

Third-adjacent (88.7 MHz)

- WFNP Rosendale, NY
- WRHV Poughkeepsie, NY
- WNHU West Haven, CT
- WPKM Montauk, NY

I.F. Protection (98.7 and 98.9 MHz)

- WNLC 98.7 East Lyme, CT

Those stations marked with a ** have the most relevance to this application. See Exhibit 19 for TV Channel 6 protection information.

Contour Separation Standards

As defined in 47 CFR 73.509 (a), the following standards are used in this application:

(a) An application for a new or modified NCE-FM station other than a Class D (secondary) station will not be accepted if the proposed operation would involve overlap of signal strength contours with any other station licensed by the Commission and operating in the reserved band (Channels 200-220, inclusive) as set forth below:

Frequency separation	Contour of proposed station	Contour of other station
Co-channel	0.1mV/m (40 dBu)	1 mV/m (60 dBu)
200 kHz (1 st adjacent)	0.5 mV/m (54 dBu)	1 mV/m (60 dBu)
400 kHz/600 kHz (2 nd & 3 rd adjacent)	100 mV/m (100 dBu)	1 mV/m (60 dBu)

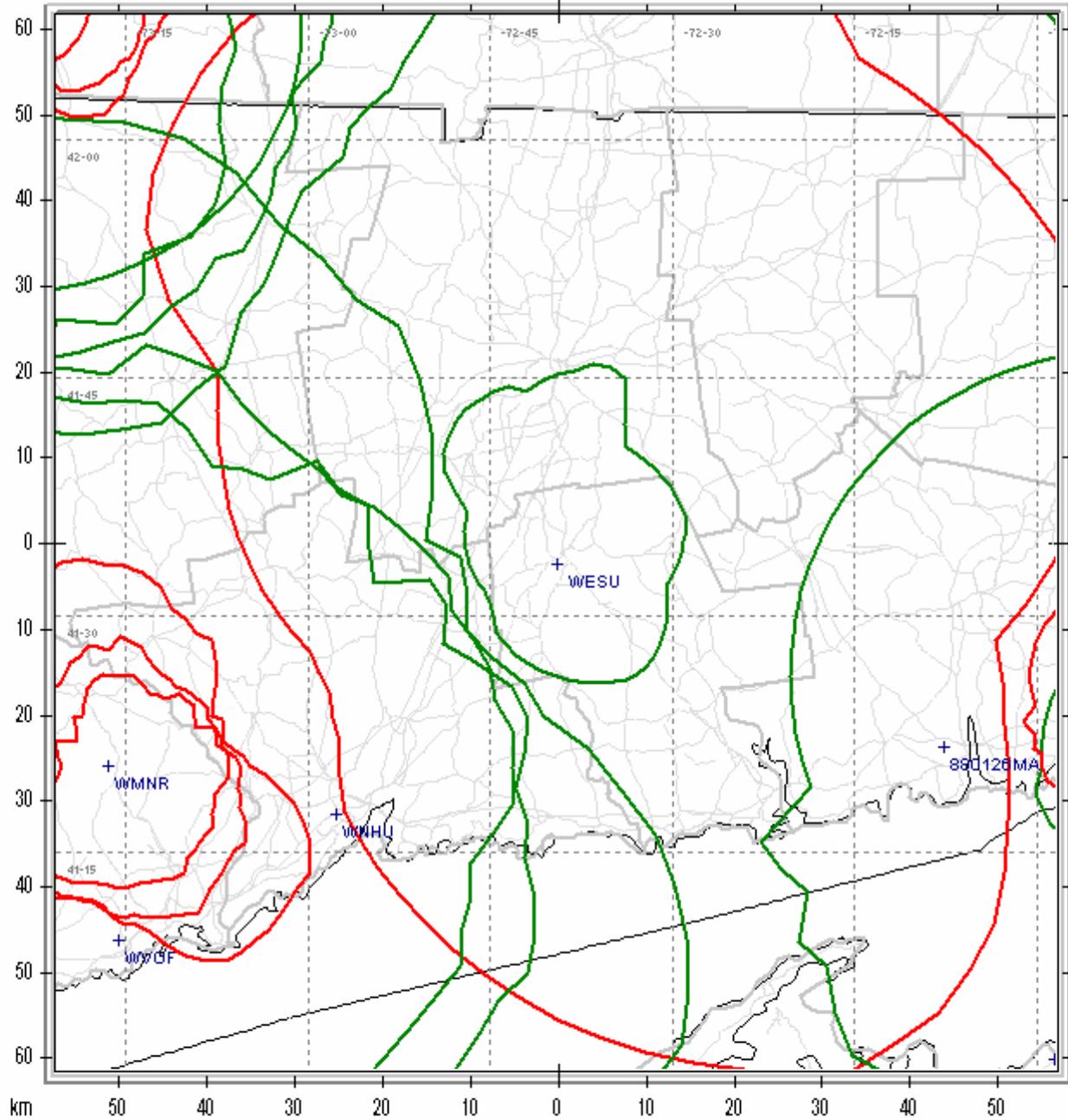
In the supplied contour maps, the colors are as follows:

WESU	Red	40 dBu F(50,10) interfering
WESU	Orange	54 dBu F(50,10) interfering
WESU	Blue	100 dBu F(50,10) interfering
WESU	Green	60 dBu F(50,50) protected/service
All co-channels	Red	60 dBu F(50,50) protected/service
All co-channels	Green	40 dBu F(50,10) interfering
All 1 st adjacents	Orange	60 dBu F(50,50) protected/service
All 1 st adjacents	Green	54 dBu F(50,10) interfering
All 2 nd adjacents	Blue	60 dBu F(50,50) protected/service
All 2 nd adjacents	Green	100 dBu F(50,10) interfering
All 3 rd adjacents	Blue	60 dBu F(50,50) protected/service
All 3 rd adjacents	Green	100 dBu F(50,10) interfering
I.F. Protection	Maroon	

The maps can be read as “WESU contours cannot cross others of the same color”.

In conclusion: this exhibit demonstrates that the proposed WESU facility meets the requirements of 47 CFR Section 73.509 and the proposed facilities create no prohibited contour overlap.

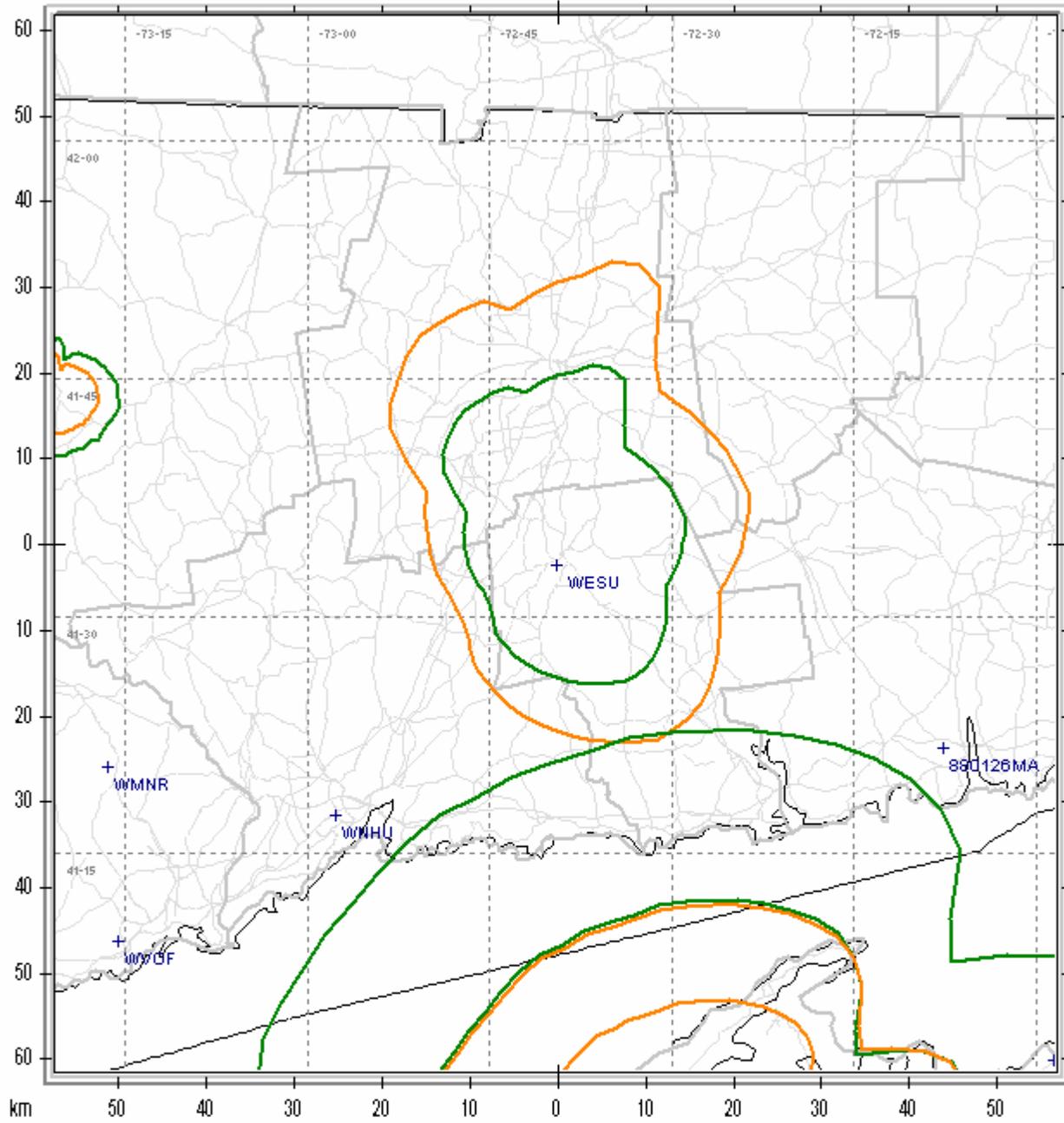
WESU 88.1 Ch.201 6kW ERP // Co-Channel Protection



WESU Contours: F(50,50) Green=60dBu / F(50,10) Orange=54dBu, Red=40dBu, Blue=100dBu

County Borders State Borders Highways Lat/Lon Grid

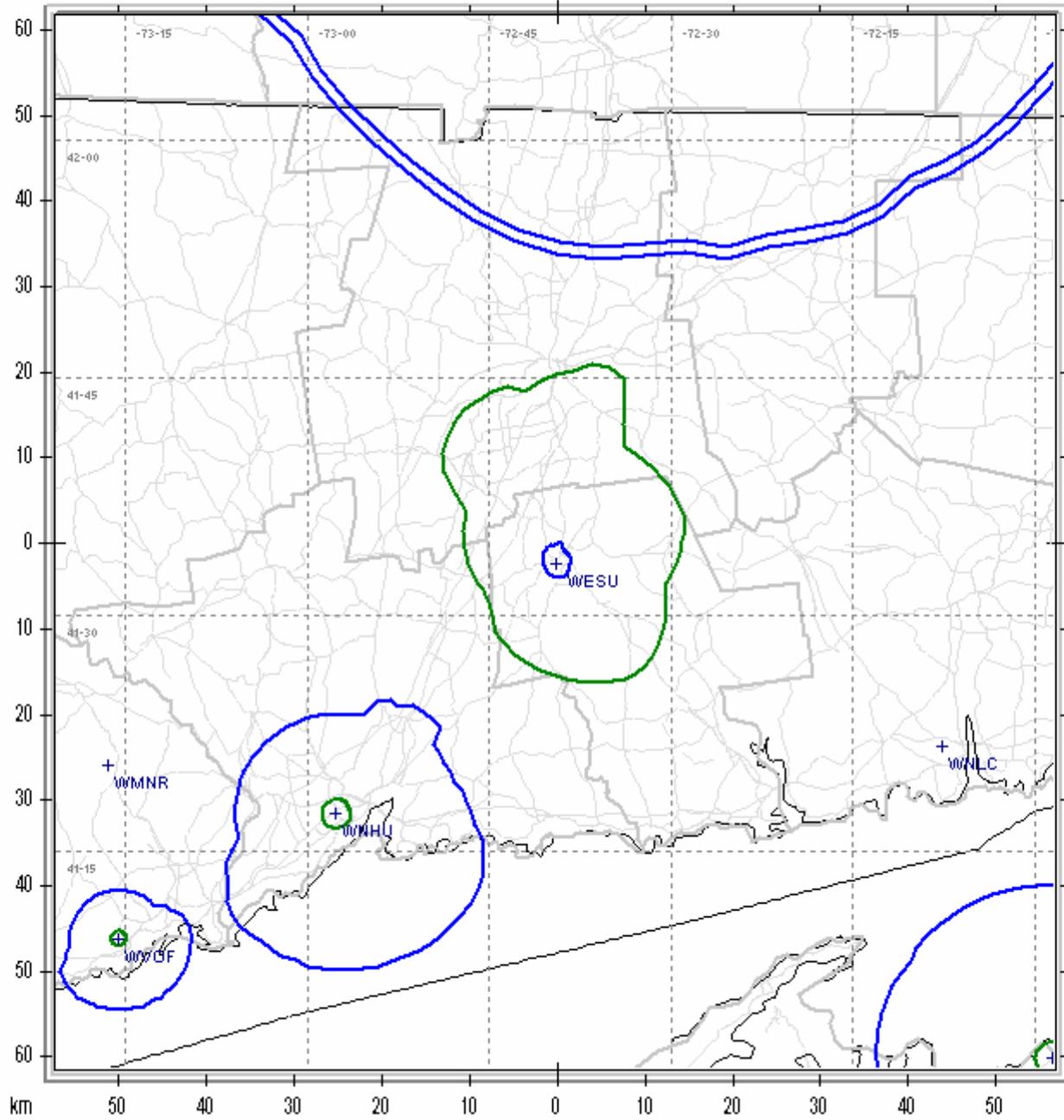
WESU 88.1 Ch 201 6kW ERP // 1st-Adjacent Protection



WESU Contours: F(50,50) Green=60dBu / F(50,10) Orange=54dBu, Red=40dBu, Blue=100dBu

- County Borders
- State Borders
- Highways
- Lat/Lon Grid

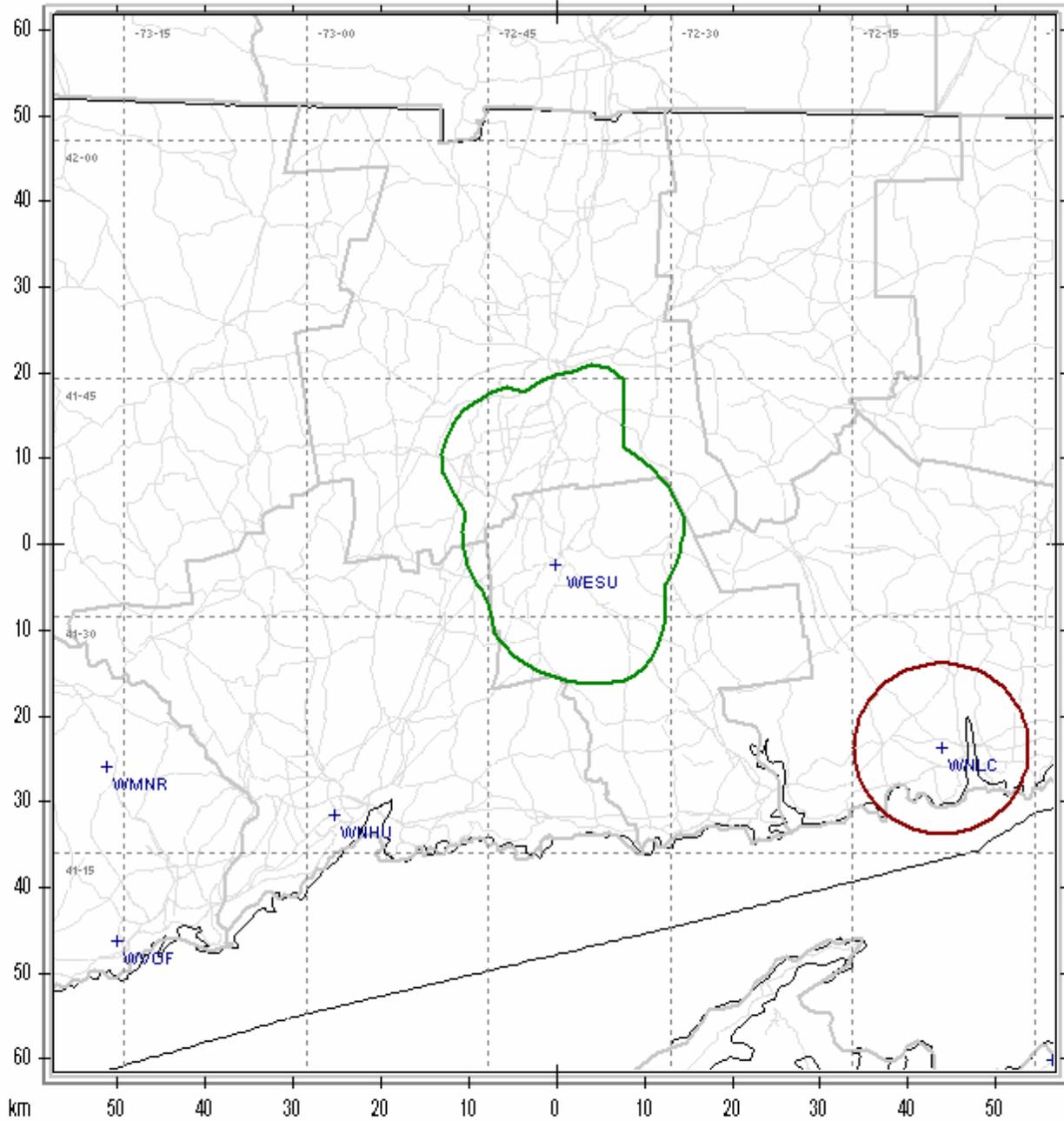
WESU 88.1 Ch.201 6kW ERP // 2nd- & 3rd-Adjacent Protection



WESU Contours: F(50,50) Green=60dBu / F(50,10) Orange=54dBu, Red=40dBu, Blue=100dBu

County Borders State Borders Highways Lat/Lon Grid

WESU 88.1 Ch.201 6kW ERP // IF Separation



WESU Contours: F(50,50) Green=60dBu / F(50,10) Orange=54dBu, Red=40dBu, Blue=100dBu

County Borders State Borders Highways Lat/Lon Grid

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Certification of Ability to Comply with RF Exposure Limits

Our first analysis, employing the RF Worksheet, results in a “worst case” estimate exceeding the occupational/controlled limits on the roof of the building hosting the antenna (Wesleyan University’s Science Library).

WESU proposes to employ a multi-bay, circularly polarized antenna to help limit human exposure to radio frequency energy on the roof of the building upon which the tower is mounted. The antenna will be designed to minimize potential exposure, and a field survey at time of construction and testing will be performed to facilitate the creation of a fully compliant RF exposure management program. The rooftop area is a controlled area secured from unauthorized entry, and the University will ensure that all personnel who have occasion to work there will be suitably informed and equipped to manage their exposure, to the extent that exposure management is required.

Exposure on the ground near the building will be compliant with the general population/uncontrolled exposure standards.

FCC Form 340 / Worksheet 7 / RF Worksheet 1 - Applied to WESU Facilities

EFFECTIVE RADIATION CENTER HEIGHT

- 1. Enter proposed "Height of radiation center above ground" OR as listed in line 1 44m
- 2. Is antenna supporting structure located on the roof of a building ? (check one) Yes
- 3. If line 2 is "yes," enter the building height measured at the base of the antenna 30m
If line 2 is "no," enter "0" in line 3 n/a
- 4. Subtract line (3) from line (1) 14m
- 5. Subtract the value 2.0 from line (4) 12m

TOTAL EFFECTIVE RADIATED POWER

(If "beam tilt" is utilized, list maximum values)

- 6. List Effective Radiated Power in the Horizontal Plane. 6 kW
- 7. List Effective Radiated Power in the Vertical Plane 6 kW
- 8. Add Lines (6) and (7) OR list value from Line 2 in Worksheet 1A 12 kW

PERCENTAGE OF FCC RF LIMIT(S) FOR MAXIMUM PERMISSIBLE EXPOSURE

- 9. Multiply Line (8) by 33.41 400.92
- 10. Multiply the value listed in line (5) by itself 144
- 11. Divide Line (9) by Line (10) 2.784
- 12. Multiply Line (11) by (100) 278.4%

DETERMINATION OF COMPLIANCE WITH CONTROLLED/OCCUPATIONAL LIMIT

- 13. Does Line (12) exceed 100% **YES**

IF YOU ANSWERED "YES" IN LINE (13), THE WORKSHEETS MAY NOT BE USED IN THIS CASE. *

IF YOU ANSWERED "NO" IN LINE (13), THEN THE SITE SHOULD COMPLY WITH THE FCC'S CONTROLLED/ OCCUPATIONAL RF EXPOSURE LIMITS FOR GROUND LEVEL EXPOSURE.

*** In this case, you may need to prepare an Environmental Assessment.**

EXPLANATION A: In the downward angles toward the roof, the emissions of WESU’s proposed facility are significantly attenuated below the ERP in the horizontal plane. At depression angles of 45 degrees or more, typical four-bay, full-wave spaced antennas have a minimum attenuation on the major downlobes of 9 to 14 dB. Using 10 dB as an initial estimate, the 313% exposure potential estimated in the worksheet would be downgraded to a 31% level simply from accounting for the antenna vertical pattern. If upon final design and specification of the antenna it is determined that further suppression is necessary, an additional ten to twenty dB of attenuation is attainable with a half-wave spaced antenna. Upon issuance of a construction permit, the station will finalize an antenna design that strikes the necessary balance between cost, structural loading, and RF exposure potential, and develop an RF exposure management program suited to the conditions.

DETERMINATION OF COMPLIANCE WITH THE UNCONTROLLED/GENERAL POPULATION LIMIT

14. Does Line (12) exceed 20% **YES**

IF YOU ANSWERED "NO" IN LINE (14), THEN THE SITE SHOULD COMPLY WITH THE FCC'S UNCONTROLLED/ GENERAL POPULATION RF EXPOSURE LIMITS FOR GROUND LEVEL EXPOSURE. NO FURTHER STUDY REQUIRED.

IF YOU ANSWERED "YES" IN LINE (14), CONTINUE.

Rooftop with restricted access.

If you answered "yes" in Line (14) and "yes" in Line (2) (indicating that the tower is located on the roof of a building), and the general public is not allowed access to the rooftop level, repeat lines 5 through 12, entering the value in Line (1) directly in Line (4).

(If Multiple FM Use Tower, recalculations should be in accordance with instructions on Worksheet #1A.)

- 1. Enter proposed "Height of radiation center above ground" OR as listed in line 1 **44m**
- 2. Is antenna supporting structure located on the roof of a building ? (check one) Yes
- 3. If line 2 is "yes," enter the building height measured at the base of the antenna 30m
If line 2 is "no," enter "0" in line 3 n/a
- 4. Subtract line (3) from line (1) **44m**
- 5. Subtract the value 2.0 from line (4) 42m

TOTAL EFFECTIVE RADIATED POWER

(If "beam tilt" is utilized, list maximum values)

- 6. List Effective Radiated Power in the Horizontal Plane. 6 kW
- 7. List Effective Radiated Power in the Vertical Plane 6 kW
- 8. Add Lines (6) and (7) OR list value from Line 2 in Worksheet 1A 12 kW

PERCENTAGE OF FCC RF LIMIT(S) FOR MAXIMUM PERMISSIBLE EXPOSURE

- 9. Multiply Line (8) by 33.41 400.92
- 10. Multiply the value listed in line (5) by itself 1764
- 11. Divide Line (9) by Line (10) 0.2272
- 12. Multiply Line (11) by (100) 22.72%

Upon recalculation, does Line (12) exceed 20% YES

IF YOU ANSWERED "YES" IN LINE (15), THE WORKSHEETS MAY NOT BE USED IN THIS CASE.

IF YOU ANSWERED "NO" IN LINE (15), THEN THE AREA AT GROUND LEVEL SHOULD COMPLY WITH THE FCC'S UNCONTROLLED/GENERAL POPULATION EXPOSURE LIMIT. NO FURTHER STUDY REQUIRED.

EXPLANATION B: See above **Explanation A** for relevant information. In addition, as defined by OET 65 Supplement A, page 18, Table 6 "Minimum height for single FM antenna compliance with general population/uncontrolled exposure limits."...a four-bay antenna with total ERP of 10kW needs a radiation center height of 33.3m / 13.1m (worst/best case) above ground level (since the rooftop tower has restricted access).

A 4-bay antenna with total ERP of 25kW needs a radiation center height of 51.5m / 19.6m (worst/best case) above ground level.

The total ERP of the proposed WESU facility is 12kW. We interpolate that the worst-case height required is 35.73m and the best-case height required is 13.97m.

The proposed WESU radiation center above ground level (RCAGL) is 44m, which is HIGHER THAN both the worst-case and best-case minimum heights. Therefore, WESU can meet the uncontrolled/general population limit.

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