



ENGINEERING EXHIBIT

Incentive Auction Channel Reassignment

Application for Digital Television Station Construction Permit

prepared for

University Of North Carolina

WUNC-TV Chapel Hill, NC
Facility ID 69080
Ch. 20 960 kW 461 m

University Of North Carolina (“UNC”) is the licensee of digital television station WUNC-TV, Channel 25, Facility ID 69080, Chapel Hill, NC. *UNC* herein proposes construction of the WUNC-TV post-auction facility on Channel 20. Reassignment of WUNC-TV from Channel 25 to Channel 20 was specified in the *Incentive Auction Closing and Channel Reassignment Public Notice* (“CCRPN”, DA 17-317, released April 13, 2017).

The proposed Channel 20 operation will employ a new antenna system to be top-mounted on the WUNC-TV tower in lieu of the existing Channel 25 antenna. The tower structure corresponds to FCC Antenna Structure Registration number 1014574, having an overall structure height above ground of 394.4 meters. The antenna replacement will result in a reduction in the structure’s overall height by 2.4 meters to 392.0 meters above ground level. Following construction, the FAA will be notified of the reduction in height and the FCC ASR will be modified accordingly.

The proposed antenna is an elliptically polarized directional Dielectric model TFU-19ETT/VP-R 4C170 (35 percent vertical polarization). *UNC* proposes to operate WUNC-TV with an effective radiated power (“ERP”) of 960 kW at 461 meters antenna height above average terrain (“HAAT”). The maximum horizontally polarized ERP is 960 kW and the maximum vertically polarized ERP is 336 kW. The vertically polarized component will not exceed the horizontally polarized component at any azimuth. The directional antenna’s azimuthal patterns

are depicted in Figures 1 and 1A for horizontal and vertical polarization, respectively. The antenna's elevation pattern is depicted in Figure 2.

A map is supplied as Figure 3 which depicts the standard predicted coverage contours. This map includes the location of Chapel Hill, WUNC-TV's principal community. As demonstrated thereon, the proposed facility complies with §73.625(a)(1) as the entire principal community will be encompassed by the 48 dB μ contour.

The proposed noise limited service contour ("NLSC") extends beyond that of the *CCRPN* parameters of 892 kW ERP and 464 meters HAAT.¹ The proposal complies with §73.3700(b)(ii) as described in the following.

The *CCRPN* facility specifies the directional antenna pattern corresponding to WUNC-TV's licensed Channel 25 facility. The antenna manufacturer cannot provide the exact pattern on the new channel due to the change in frequency and corresponding mechanical limitations of antenna construction. The directional pattern proposed herein replicates the reassignment pattern as closely as possible. The proposal results in a slightly larger coverage contour in some directions in an attempt to achieve the *CCRPN* coverage contour. Therefore, WUNC-TV qualifies under §73.3700(b)(ii)(A) for a contour extension due to the loss of coverage area resulting from the new channel assignment.

Interference study per FCC OET Bulletin 69² shows that the proposal complies with the 0.5 percent limit of new interference caused to pertinent nearby post-auction full service and Class A television stations and reassessments as required by §73.616. The interference study

¹The antenna radiation center height above ground and above mean sea level is increased by 1.5 meters. The proposed WUNC-TV antenna HAAT is recalculated to be 460.7 meters, based on FCC 30 meter terrain data developed by OET.

²FCC Office of Engineering and Technology Bulletin number 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, February 6, 2004 ("OET-69"). This analysis employed the FCC's current "TVStudy" software with the default application processing template settings, 2 km cell size, and 1 km terrain increment. Comparisons of various results of this computer program (run on a Mac processor) to the FCCs implementation of TVStudy show excellent correlation.

output report is provided as Table 1. This satisfies §73.3700(b)(ii)(C) for the proposed NLSC extension.

The amount of NLSC extension does not exceed one percent in any direction. Figure 4 supplies a coverage contour comparison of the proposed WUNC-TV facility to the reassignment facility's contour and a one percent extension distance of the reassignment facility's contour. Here, the contour level is adjusted with the dipole factor to match FCC application processing. Table 1's results also demonstrate that the proposed contour is within the baseline contour plus one percent. Therefore the proposed contour extension complies with §73.3700(b)(ii)(B).

The proposed WUNC-TV facility's terrain-limited population provides a 100.8 percent match of the CCRPN baseline facility, as detailed in the following table. The OET Bulletin 69 report summary in Table 1 also concludes that the proposed service area population is more than 95 percent of the baseline population.

Terrain Limited Population - Match of Reassignment		
Population Summary (2010 Census) OET Bulletin 69: TVStudy	Reassignment Parameters	Proposed
Within Noise Limited Contour	4,005,414	4,035,619
Not affected by terrain losses	4,005,414	4,035,619
Match of Reassignment	---	100.75%

The proposed 960 kW ERP exceeds the maximum permitted by §73.622(f)(8)(i) for the proposed antenna HAAT of 461 meters. Section 73.622(f)(5) permits the maximum ERP to be exceeded in order to provide the same geographic coverage area as the largest station within the same market. As demonstrated in Figure 5, the total area within the proposed WUNC-TV NLSC is 33,499 square kilometers, which does not exceed that of WTVD(DT) (51,709 sq. km Ch. 11, Durham NC, BMLCDT-20120814AAG). Thus, the 960 kW ERP specified herein is in compliance with §73.622(f)(5) of the FCC's Rules.

The nearest FCC monitoring station is 421 km distant at Laurel, MD. This exceeds by a large margin the threshold minimum distance specified in §73.1030(c)(3) that would suggest consideration of the monitoring station. The site is not located within the areas requiring coordination with "quiet" zones specified in §73.1030(a) and (b). The site location is beyond the

border areas requiring international coordination. There are no authorized AM stations within 3 kilometers of the site.

Human Exposure to Radiofrequency Electromagnetic Field (Environmental)

The proposed operation was evaluated for human exposure to RF energy using the procedures outlined in the FCC's OET Bulletin Number 65. Based on OET-65 equation (10), and considering 10 percent antenna relative field in downward elevations (pattern data shows less than 10 percent relative field at angles 15 to 90 degrees below the antenna), the calculated signal density near the tower at two meters above ground level attributable to the proposed facility is $3.0 \mu\text{W/cm}^2$, which is 0.9 percent of the general population/uncontrolled maximum permitted exposure limit. This is well below the five percent threshold limit described in §1.1307(b) regarding sites with multiple emitters, categorically excluding the applicant from responsibility for taking any corrective action in the areas where the proposal's contribution is less than five percent.

The general public will not be exposed to RF levels attributable to the proposal in excess of the FCC's guidelines. RF exposure warning signs will continue to be posted. With respect to worker safety, the applicant will coordinate exposure procedures with all pertinent stations and will reduce power or cease operation as necessary to protect persons having access to the site, tower, or antenna from RF electromagnetic field exposure in excess of FCC guidelines. This exhibit is limited to the evaluation of exposure to RF electromagnetic field. No increase in structure height is proposed.

List of Attachments

- Figure 1, 1A Antenna Azimuthal Pattern
- Figure 2 Antenna Elevation Pattern
- Figure 3 Proposed Coverage Contours
- Figure 4 Proposed Contour Expansion
- Figure 5 Maximum ERP per §73.622(f)
- Table 1 OET Bulletin 69 Interference Study
- Form 2100 Saved Version of Engineering Sections from FCC Form at Time of Upload

Chesapeake RF Consultants, LLC

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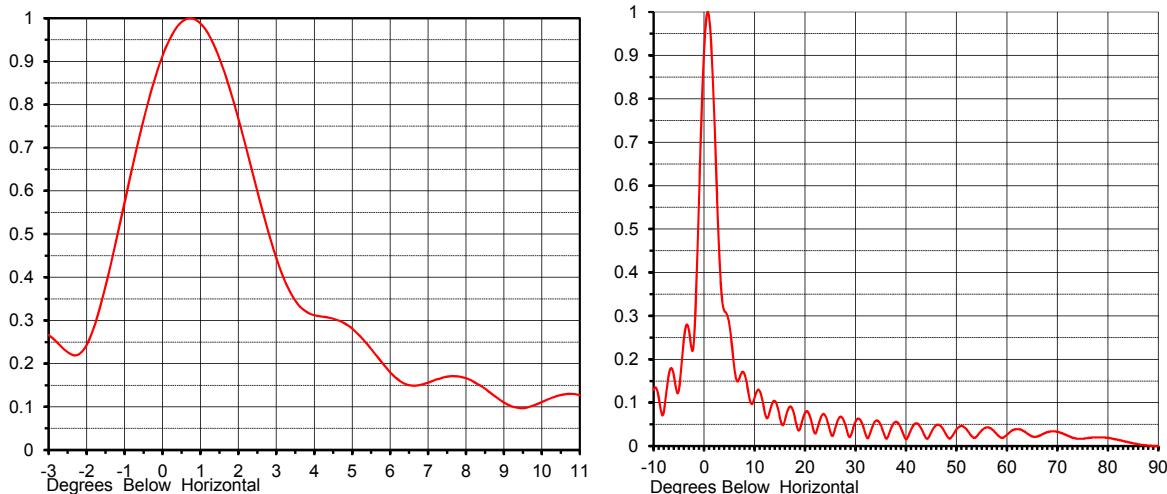
ELEVATION PATTERN

Proposal No. C-70217-1
 Date 3-Mar-17
 Call Letters WUNC 20
 Frequency 509 MHz
 Antenna Type TFU-19ETT/VP-R 4C170

RMS Directivity at Main Lobe
 RMS Directivity at Horizontal

17.50 (12.43 dB)
14.60 (11.64 dB)
 Calculated

Beam Tilt 0.75 deg
 Drawing Number 19E175075



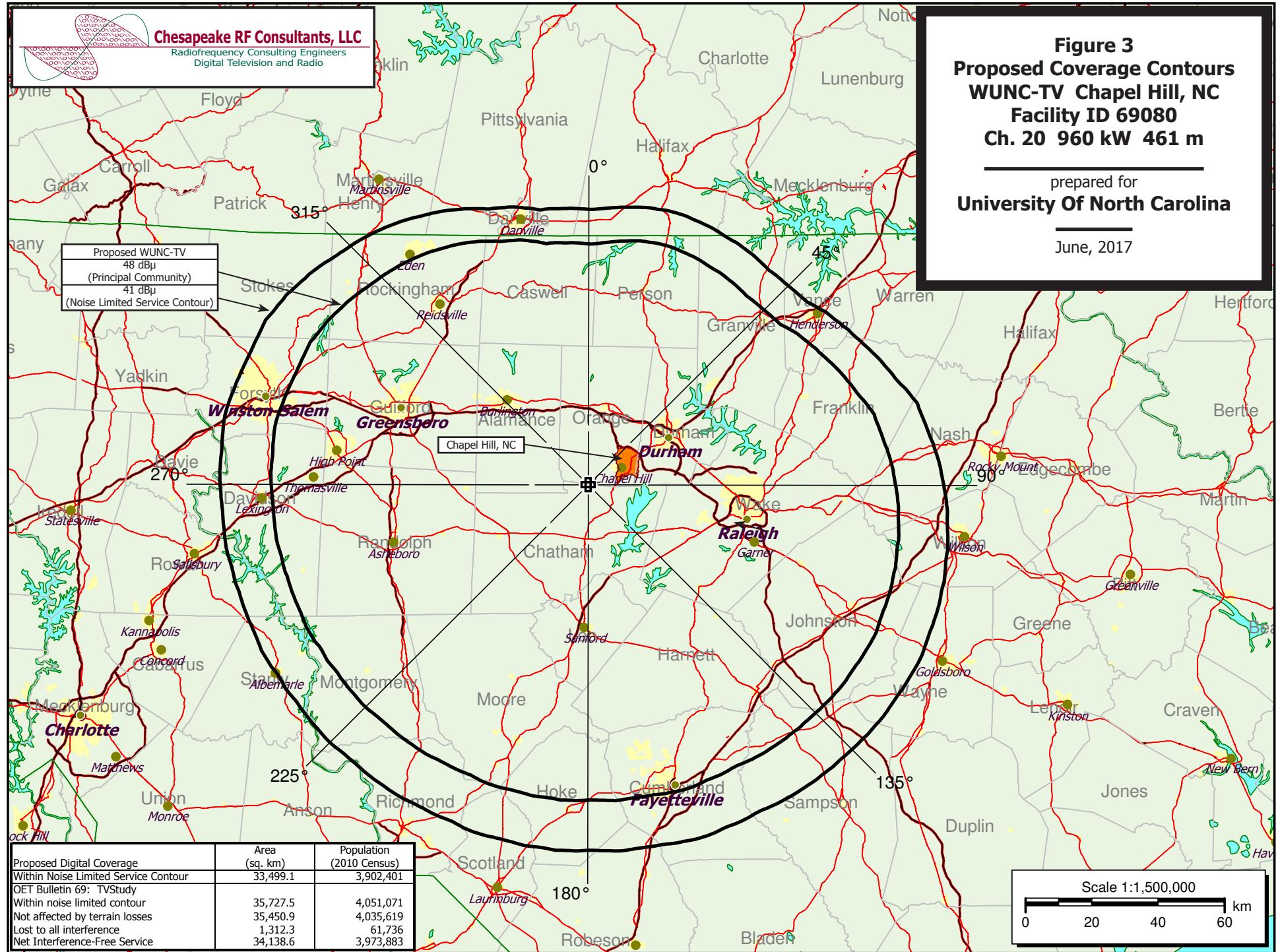
Angle	Field								
-10.0	0.129	10.0	0.111	30.0	0.056	50.0	0.038	70.0	0.033
-9.0	0.113	11.0	0.127	31.0	0.059	51.0	0.046	71.0	0.029
-8.0	0.078	12.0	0.079	32.0	0.027	52.0	0.039	72.0	0.024
-7.0	0.164	13.0	0.078	33.0	0.033	53.0	0.023	73.0	0.019
-6.0	0.163	14.0	0.104	34.0	0.058	54.0	0.022	74.0	0.017
-5.0	0.129	15.0	0.067	35.0	0.048	55.0	0.036	75.0	0.017
-4.0	0.246	16.0	0.059	36.0	0.018	56.0	0.043	76.0	0.018
-3.0	0.266	17.0	0.091	37.0	0.039	57.0	0.039	77.0	0.020
-2.0	0.243	18.0	0.065	38.0	0.056	58.0	0.027	78.0	0.020
-1.0	0.573	19.0	0.039	39.0	0.042	59.0	0.019	79.0	0.020
0.0	0.913	20.0	0.077	40.0	0.016	60.0	0.026	80.0	0.019
1.0	0.988	21.0	0.068	41.0	0.038	61.0	0.036	81.0	0.017
2.0	0.767	22.0	0.029	42.0	0.052	62.0	0.039	82.0	0.014
3.0	0.445	23.0	0.062	43.0	0.041	63.0	0.037	83.0	0.012
4.0	0.312	24.0	0.070	44.0	0.018	64.0	0.029	84.0	0.009
5.0	0.281	25.0	0.033	45.0	0.031	65.0	0.022	85.0	0.006
6.0	0.180	26.0	0.042	46.0	0.048	66.0	0.022	86.0	0.004
7.0	0.156	27.0	0.067	47.0	0.045	67.0	0.027	87.0	0.002
8.0	0.166	28.0	0.048	48.0	0.026	68.0	0.032	88.0	0.001
9.0	0.110	29.0	0.022	49.0	0.020	69.0	0.034	89.0	0.000
						90.0	0.000		

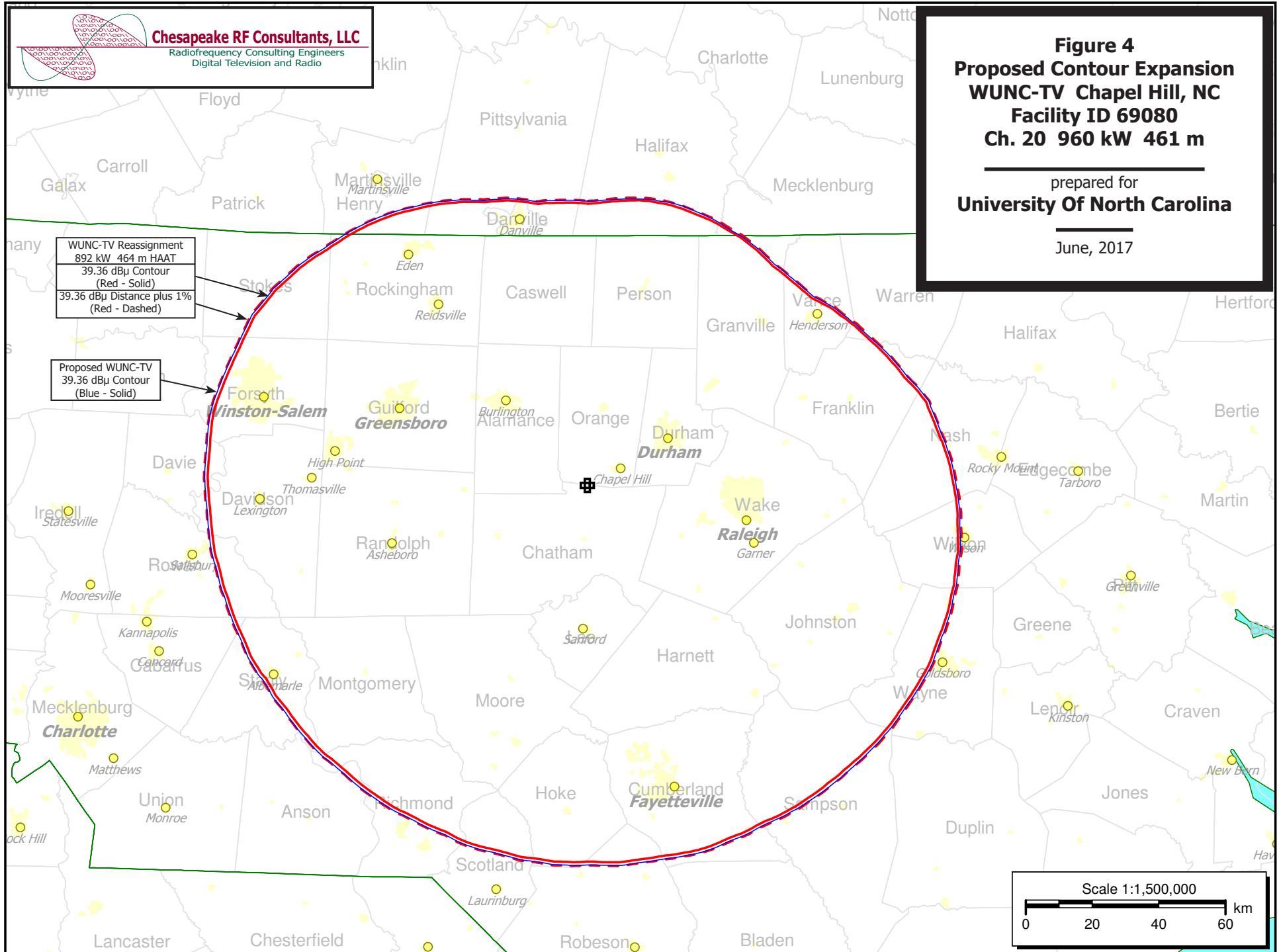
Figure 2
Antenna Elevation Pattern
WUNC-TV Chapel Hill, NC
Facility ID 69080
Ch. 20 960 kW 461 m

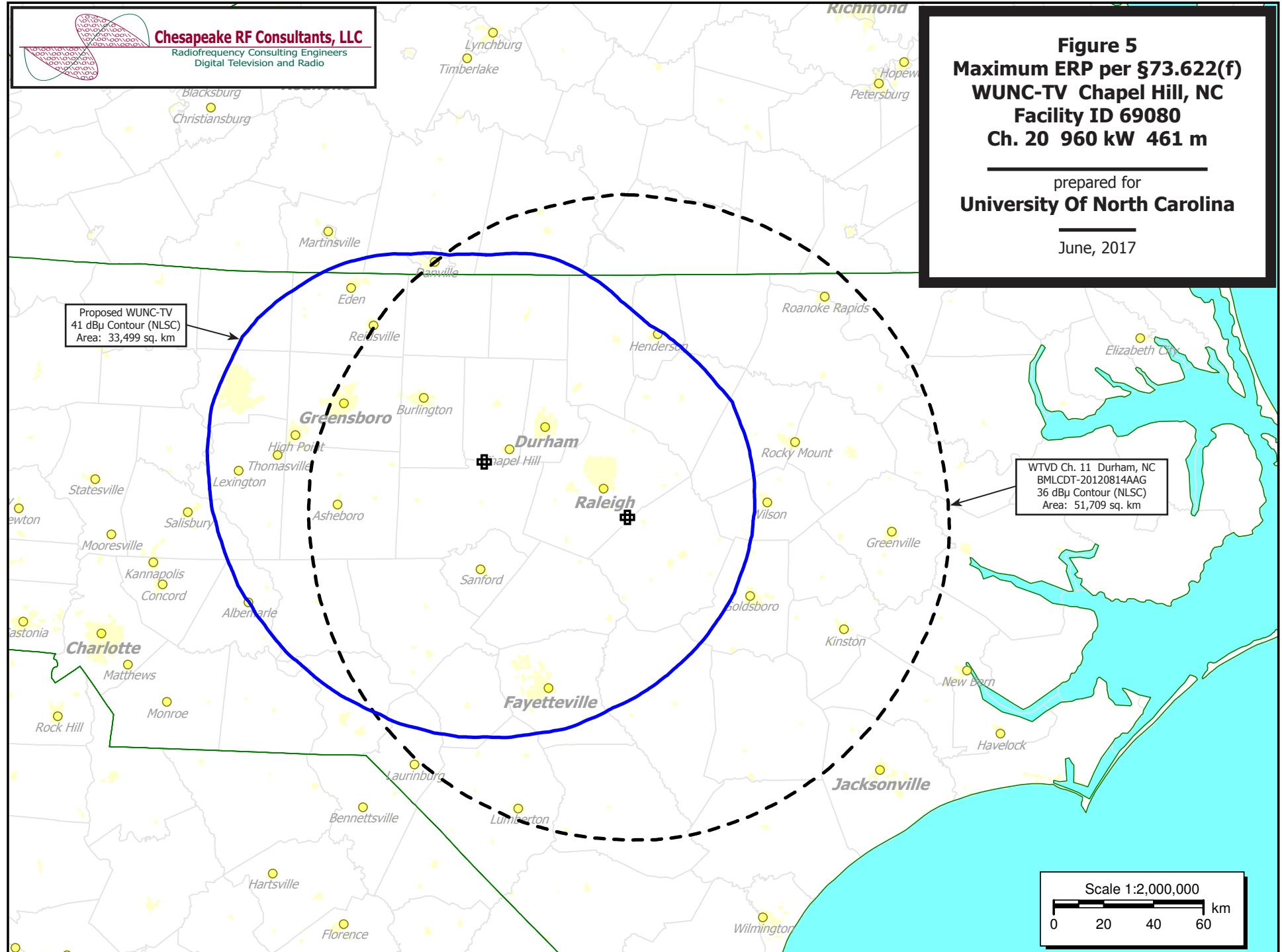
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June, 2017









Channel and Facility Information	Section	Question	Response
Proposed Community of License	Facility ID	69080	
	State	North Carolina	
	City	CHAPEL HILL	
	DTV Channel	20	
Facility Type	Facility Type	Noncommercial Educational	
	Station Type	Main	
Zone	Zone	2	

Antenna Location Data	Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes	
	ASR Number	1014574	
Coordinates (NAD83)	Latitude	35° 51' 59.0" N+	
	Longitude	079° 10' 00.5" W-	
	Structure Type	TOWER-A free standing or guyed struct	
	Overall Structure Height	394.4 meters	
	Support Structure Height	360.6 meters	
	Ground Elevation (AMSL)	226.2 meters	
Antenna Data	Height of Radiation Center Above Ground Level	384.3 meters	
	Height of Radiation Center Above Average Terrain	460.7 meters	
	Height of Radiation Center Above Mean Sea Level	610.5 meters	
	Effective Radiated Power	960 kW	

Antenna Technical Data	Section	Question	Response
	Antenna Type	Antenna Type	Directional Custom
		Do you have an Antenna ID?	No
		Antenna ID	
	Antenna Manufacturer and Model	Manufacturer:	DIE
		Model	TFU-19ETT/VP-R 4C170
		Rotation	0 degrees
		Electrical Beam Tilt	0.75
		Mechanical Beam Tilt	Not Applicable
		toward azimuth	
		Polarization	Elliptical
	DTV and DTS: Elevation Pattern	Does the proposed antenna propose elevation radiation patterns that vary with azimuth for reasons other than the use of mechanical beam tilt?	No
		Uploaded file for elevation antenna (or radiation) pattern data	

Directional Antenna Relative Field Values (Pre-rotated Pattern)

Degree	V _A (Authorized Value)						
0	0.21	90	0.73	180	0.91	270	1.00
10	0.23	100	0.85	190	0.90	280	0.99
20	0.25	110	0.94	200	0.90	290	0.94
30	0.23	120	0.99	210	0.90	300	0.85
40	0.21	130	1.00	220	0.91	310	0.73
50	0.22	140	1.00	230	0.92	320	0.59
60	0.30	150	0.96	240	0.94	330	0.44
70	0.44	160	0.94	250	0.96	340	0.30
80	0.59	170	0.92	260	0.99	350	0.22

Additional Azimuths

Degree	V _A
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Construction Permit Certifications	Section	Question	Response
	Post-Incentive Auction Expedited Processing	<p>It will operate on the DTV channel for this station as established in the post-incentive auction channel reassignment public notice.</p> <p>It will operate post-incentive auction facilities that do not expand the noise-limited service contour in any direction beyond that established by the post-incentive auction channel reassignment public notice.</p> <p>It will operate post-incentive auction facilities that match or reduce by no more than five percent with respect to predicted population from those defined in the post-incentive auction channel reassignment public notice.</p> <p>The antenna structure to be used by this facility has been registered by the Commission and will not require re-registration to support the proposed antenna, OR the FAA has previously determined that the proposed structure will not adversely affect safety in air navigation and this structure qualifies for later registration under the Commission's phased registration plan, OR the proposed installation on this structure does not require notification to the FAA pursuant to 47 C.F.R. Section 17.7.</p>	Yes No Yes Yes
	Environmental Effect	Would a Commission grant of Authorization for this location be an action which may have a significant environmental effect? (See Section 1.1306 of 47 C.F.R.)	No
	Broadcast Facility	The proposed facility complies with the applicable engineering standards and assignment requirements of 47 C.F.R. Sections 73.616, 73.622(i), 73.623(e), 73.625, 73.1030, and 73.1125.	Yes