

ENGINEERING EXHIBIT

Application for Digital Television Station Construction Permit

prepared for

WGBH Educational Foundation

WGBH-TV Boston, MA

Facility ID 72099

Ch. 5 34 kW 363 m

WGBH Educational Foundation (“*WEF*”) is the licensee of digital television station WGBH-TV, Channel 5, Facility ID 72099, Boston MA. WGBH-TV is licensed (file# 0000080062) to operate with 6.7 kW effective radiated power (“ERP”) at 363 meters antenna height above average terrain (“HAAT”). *WEF* proposes herein to increase the ERP to 34 kW and is requesting a waiver of §73.622(f).

Reassignment of WGBH-TV from UHF Channel 19 to low-band VHF Channel 5 was specified in the *Incentive Auction Closing and Channel Reassignment Public Notice* (“*CCRPN*”, DA 17-317, released April 13, 2017). WGBH-TV was assigned to make the transition to Channel 5 at phase 4 and commenced operation on Channel 5 on the phase 4 completion date of August 2, 2019. The licensed WGBH-TV operation at 6.7 kW ERP and 363 m HAAT represents the maximum facility achievable for WGBH-TV under §73.622 for a low band VHF digital television station in Zone I. Since transitioning to Channel 5 on the phase 4 completion date, WGBH-TV received numerous phone calls, emails, and social media contacts regarding reception problems.

Problems with digital low-band VHF reception experienced by other stations have been widely publicized since the digital transition in 2009. It has been established that indoor reception is difficult for digital low band VHF stations such as WGBH-TV due to the longer wavelength signal’s inability to readily pass through buildings (the windows are smaller than the wavelength size), the ineffectiveness of many indoor antennas (many of which were designed to emphasize

the shorter wavelengths for UHF reception), and high levels of manmade and environmental noise.¹

Due to the reception issues, Special Temporary Authority (“STA”, file# 0000121660) was granted to authorize WGBH-TV to operate its main antenna at 34 kW ERP. WGBH-TV executed the power increase on October 23, 2020, and now seeks a Construction Permit to match the 34 kW authorized by STA.

WEF was a winning bidder in the incentive auction, which resulted in WGBH-TV’s reassignment from UHF Channel 19 to low band VHF Channel 5. In the incentive auction proceeding, the FCC acknowledged that reception of low band VHF channels “is often difficult due to increased signal interference caused by the higher levels of ambient noise from electronic devices operating on or near the low VHF frequency range.”² The FCC stated that “we adopt the proposal to afford favorable consideration to post-incentive auction requests for waivers of the VHF power and height limits for winning UHF-to-VHF bidders that may be necessary to resolve coverage problems on their new channels. ... Thus, we will consider such waiver requests on a case-by-case basis after the winning bidder has completed construction of its VHF facilities and determined that its viewers are experiencing reception problems. We will afford such requests favorable consideration and grant them where possible.”³

The proposal would allow WGBH-TV to operate with its licensed antenna at 34 kW ERP to aid reception. The proposed 34 kW ERP is the same as that authorized for several other low

¹The FCC stated that “our initial assessment that the low VHF channels are less suitable for DTV service because of high levels of atmospheric and man-made noise” (¶50); and “We noted that TV operations on the lower VHF channels 2-6 are subject to a number of technical penalties, including higher ambient noise levels due to leaky power lines, vehicle ignition systems, and other impulse noise sources and interference to and from FM radio service.” (¶82) *Advanced Television Systems and Their Impact upon the Existing Television Broadcast Service*, Sixth Report and Order, MM Docket 87-268, FCC 97-115, released April 21, 1997.

²“*Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*”, GN Docket 12-268, Report and Order, released June 2, 2014 (R&O), para 369.

³R&O, para 371.

band VHF stations⁴ which have been granted waiver of the §73.622 VHF power and height limits and are now licensed at 34 kW ERP.

WGBH-TV will continue to employ the existing transmitting antenna utilized by the licensed WGBH-TV facility. The antenna is top-mounted on a tower structure which corresponds to FCC Antenna Structure Registration number 1004233. No change to the overall structure height will result.

Figure 1 supplies a map that demonstrates compliance with §73.625(a)(1) regarding coverage of the entire principal community. The proposed facility's predicted population exceeds 95 percent of the baseline facility's population as described in the *CCRPN*.

The proposed facility expands the WGBH-TV service contour beyond that established by the *CCRPN*. Interference study per FCC OET Bulletin 69⁵ shows that the proposal complies with the 0.5 percent limit of new interference caused to pertinent nearby full service and Class A television stations as required by §73.616. The interference study output report is provided as Table 1, showing that no interference to any other relevant station is predicted.

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 30 percent antenna relative field in downward elevations at downward elevations (pattern data shows less than 30 percent relative field at angles 20 to 90 degrees below the antenna), the calculated signal density near the tower at two meters above ground level attributable to the

⁴See WPVI-TV (34 kW ERP, Ch. 6, file# BLCDDT-20111019ACJ, Facility ID 8616, Philadelphia PA), WDPN-TV (34 kW ERP, Ch. 2, file# 0000074950, Facility ID 1283, Wilmington, DE), and WACP (34 kW ERP, Ch. 4, file# 0000093491, Facility ID 189358, Atlantic City, NJ). Additionally, WRGB is licensed at 30.2 kW ERP (Ch. 6, file# BMLCDDT-20110816AAF, Facility ID 73942, Schenectady NY)

⁵FCC 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 1.0 km terrain increment. Comparisons of various results of this computer program (run on a Mac processor) to the FCC's implementation of TVStudy show excellent correlation.

proposed facility is $1.6 \mu\text{W}/\text{cm}^2$, which is 0.8 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.

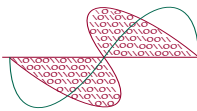
The general public will not be exposed to RF levels attributable to the proposal in excess of the FCC's guidelines. RF exposure warning signs will continue to be posted. With respect to worker safety, the applicant will coordinate exposure procedures with all pertinent stations and will reduce power 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.

List of Attachments

Figure 1	Proposed Coverage Contours
Table 1	TVStudy Analysis of Proposal
Form 2100	Saved Version of Engineering Sections from FCC Form at Time of Upload

Chesapeake RF Consultants, LLC

Joseph M. Davis, P.E.	November 25, 2020	
207 Old Dominion Road	Yorktown, VA 23692	703-650-9600

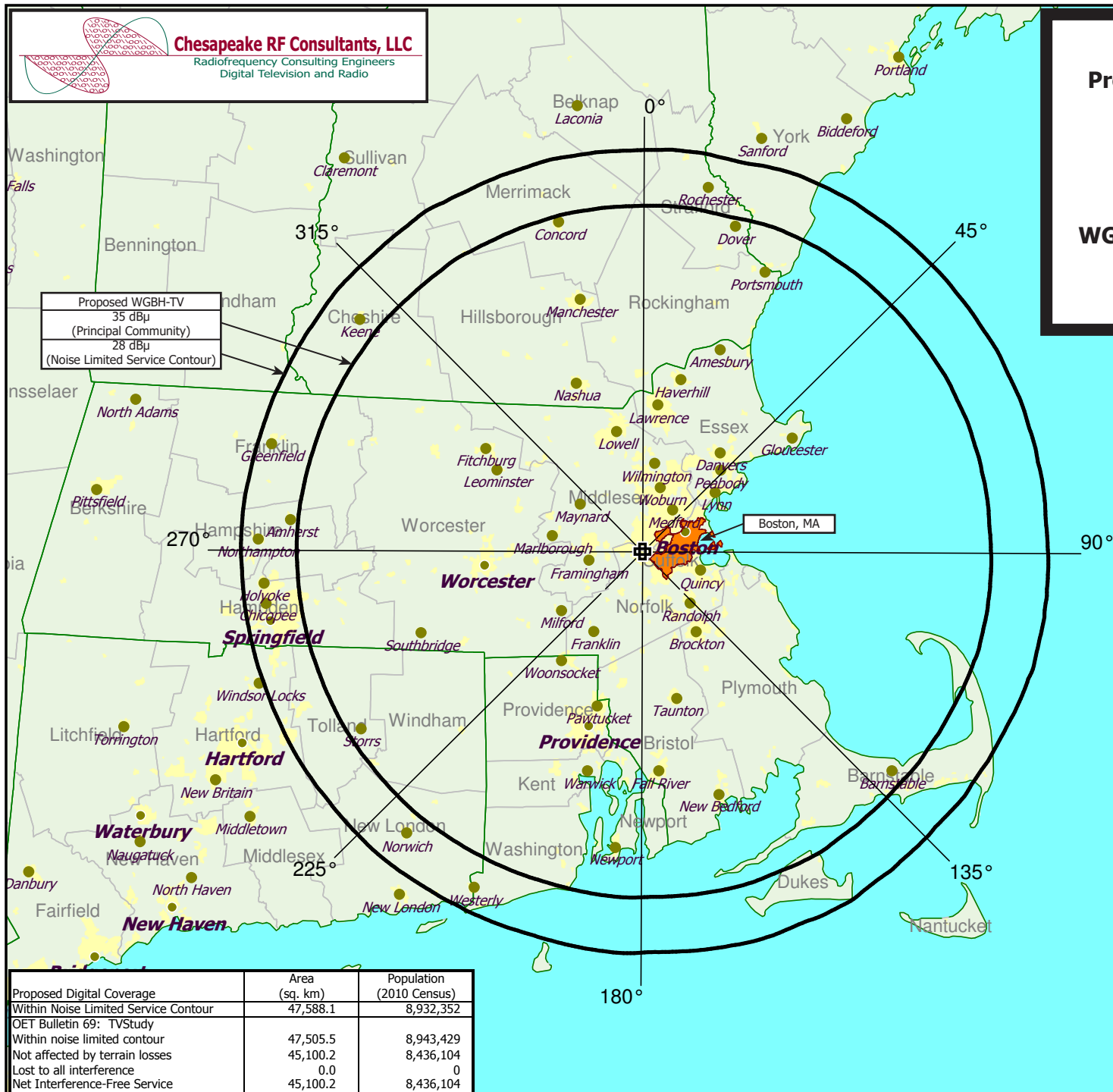


Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio

Figure 1
Proposed Coverage Contours
WGBH-TV Boston, MA
Facility ID 72099
Ch. 5 34 kW 363 m

prepared for
WGBH Educational Foundation

November, 2020



Proposed WGBH-TV
35 dBu
(Principal Community)
28 dBu
(Noise Limited Service Contour)

Proposed Digital Coverage	Area (sq. km)	Population (2010 Census)
Within Noise Limited Service Contour	47,588.1	8,932,352
OET Bulletin 69: TVStudy Within noise limited contour	47,505.5	8,943,429
Not affected by terrain losses	45,100.2	8,436,104
Lost to all interference	0.0	0
Net Interference-Free Service	45,100.2	8,436,104

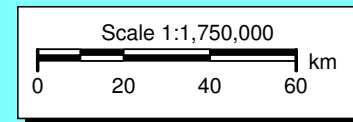


Table 1 WGBH-TV TVStudy Analysis of Proposal

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tvstudy v2.2.5 (4uoc83)
Database: localhost, Study: WGBH-TV_34kW, Model: Longley-Rice
Start: 2020.11.25 10:31:56

Study created: 2020.11.25 10:31:56

Study build station data: LMS TV 2020-11-23

Proposal: WGBH-TV D5 DT APP BOSTON, MA
File number: WGBH-TV 34kW
Facility ID: 72099
Station data: User record
Record ID: 2846
Country: U.S.
Zone: I

Search options:
Baseline record excluded if station has CP

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
No	WRGB	D6	DT	LIC	SCHENECTADY, NY	BMLCDT20110816AAF	231.7 km
No	WRGB	D6	DT	APP	SCHENECTADY, NY	BLANK0000035659	231.7

No non-directional AM stations found within 0.8 km

Directional AM stations within 3.2 km:
WUNR 1600 L DA1 D BROOKLINE, MA BMML20090211ADN
WUNR 1600 L DA1 N BROOKLINE, MA BMML20090211ADN
WXKS 1200 L DA2 D NEWTON, MA BMML20110217ADC
WXKS 1200 L DA2 N NEWTON, MA BMML20110217ADC
WRCA 1330 L DA2 D WATERTOWN, MA BMML20090202CEX
WRCA 1330 L DA2 N WATERTOWN, MA BMML20090202CEX

Record parameters as studied:

Channel: D5
Latitude: 42 18 10.70 N (NAD83)
Longitude: 71 13 4.90 W
Height AMSL: 406.3 m
HAAT: 362.7 m
Peak ERP: 34.0 kW
Antenna: Omnidirectional
Elev Pattn: Generic
Elec Tilt: 1.00

28.0 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	34.0 kW	358.6 m	122.7 km
45.0	34.0	383.3	124.3
90.0	34.0	376.0	123.7
135.0	34.0	362.5	122.9
180.0	34.0	351.3	122.3
225.0	34.0	354.3	122.5
270.0	34.0	357.7	122.6
315.0	34.0	358.2	122.7

ERP exceeds maximum
ERP: 34.0 kW ERP maximum: 5.61 kW

**Proposal 13.00 dBu contour crosses Canadian border, coordination required
Distance to Canadian border: 302.1 km

Distance to Mexican border: 2960.7 km

Conditions at FCC monitoring station: Belfast ME
Bearing: 35.2 degrees Distance: 294.0 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 276.7 degrees Distance: 2833.9 km

Table 1 WGBH-TV TVStudy Analysis of Proposal
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Study cell size: 2.00 km
Profile point spacing: 1.00 km

Maximum new IX to full-service and Class A: 0.50%
Maximum new IX to LPTV: 2.00%

Interference to proposal scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WGBH-TV	D5	DT	APP	BOSTON, MA	WGBH-TV 34kW	

	Service area		Terrain-limited		IX-free		Percent IX
47505.5	8,943,429	45100.2	8,436,104	45100.2	8,436,104	0.00	0.00

**Channel and
Facility
Information**

Section	Question	Response
Proposed Community of License	Facility ID	72099
	State	Massachusetts
	City	BOSTON
	DTV Channel	5
	Designated Market Area	BOSTON (MANCHESTER)
Facility Type	Facility Type	Noncommercial Educational
	Station Type	Main
Zone	Zone	1

**Antenna Location
Data**

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1004233
Coordinates (NAD83)	Latitude	42° 18' 10.7" N+
	Longitude	071° 13' 04.9" W-
	Structure Type	GTOWER-Guyed Structure Used for Communication Purposes
	Overall Structure Height	366.0 meters
	Support Structure Height	335.6 meters
	Ground Elevation (AMSL)	46.0 meters
Antenna Data	Height of Radiation Center Above Ground Level	360.3 meters
	Height of Radiation Center Above Average Terrain	362.7 meters
	Height of Radiation Center Above Mean Sea Level	406.3 meters
	Effective Radiated Power	34 kW

**Antenna
Technical Data**

Section	Question	Response
Antenna Type	Antenna Type	Non-Directional
	Do you have an Antenna ID?	
	Antenna ID	
Antenna Manufacturer and Model	Manufacturer:	DIE
	Model	TDM-3A5
	Rotation	
	Electrical Beam Tilt	1.0
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Circular
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	

**Construction
Permit
Certifications**

Section	Question	Response
Post-Incentive Auction Expedited Processing	It will operate on the DTV channel for this station as established in the post-incentive auction channel reassignment public notice.	Yes
	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.	No
	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.	Yes
	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.	Yes
Environmental Effect	Would a Commission grant of Authorization for this location be an action which may have a significant environmental effect? (See 47 C.F.R. Section 1.1306)	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