ENGINEERING EXHIBIT

Application for Minor Modification of Digital Low Power Television Station Construction Permit

prepared for

Gray Television Licensee, LLC
WQWQ-LD Paducah, KY
Facility ID 19595
Ch. 18 2.5 kW Directional

Gray Television Licensee, LLC ("Gray") is the licensee of digital Low Power Television station WQWQ-LD, Channel 18, Paducah KY, Facility ID 19595. WQWQ-LD, presently silent, is licensed to operate (file# 0000150501) with 3.7 kW effective radiated power ("ERP"), directional. A Construction Permit ("CP" file# 0000159945) authorizes WQWQ-LD to relocate to a different site. *Gray* herein seeks a modification of the CP to specify an alternate location, increased antenna height, and decreased ERP with a different directional antenna pattern.

The proposed facility will employ a new side-mounted antenna on the existing tower structure associated with FCC Antenna Structure Registration number 1310885, located 46.3 km (28.8 miles) from the WQWQ-LD licensed site and 1.1 km (0.7 miles) from the current CP site. No change to the overall structure height is proposed.

The proposed antenna is a Kathrein model K723147 (single panel) having horizontal polarization. The proposed ERP is 2.5 kW using a "simple" out of channel emission mask. A plot of the directional antenna's azimuthal pattern is supplied in Figure 1. Figure 2 depicts the coverage contour of the proposed facility as well as that of the licensed facility, demonstrating compliance with §73.3572 for a minor change.

Interference study per OET Bulletin 69[1] shows that the proposal complies with the FCC's interference protection requirements toward all digital television, television translator, LPTV, and

[1]FCC 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, 1 km cell size, and 1 km terrain increment.

Class A stations. The results, summarized in Table 1, show that any new interference does not exceed the FCC's interference limits (0.5 percent to full power and Class A stations, and 2.0 percent to secondary stations) to any facility.

Human Exposure to Radiofrequency Electromagnetic Field (Environmental)

The proposed facility 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 20 percent antenna relative field in downward elevations (pattern data shows 20 percent or less relative field at angles 30 to 90 degrees below the antenna), the calculated power density attributable to the proposed facility at locations near the transmitter site at a height of two meters above ground level is 32.1 $\mu W/cm^2$, which is 9.7 percent of the general population / uncontrolled maximum permissible exposure limit. No other emitters are known that would be considered a significant contributor in the vicinity of the site.

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.

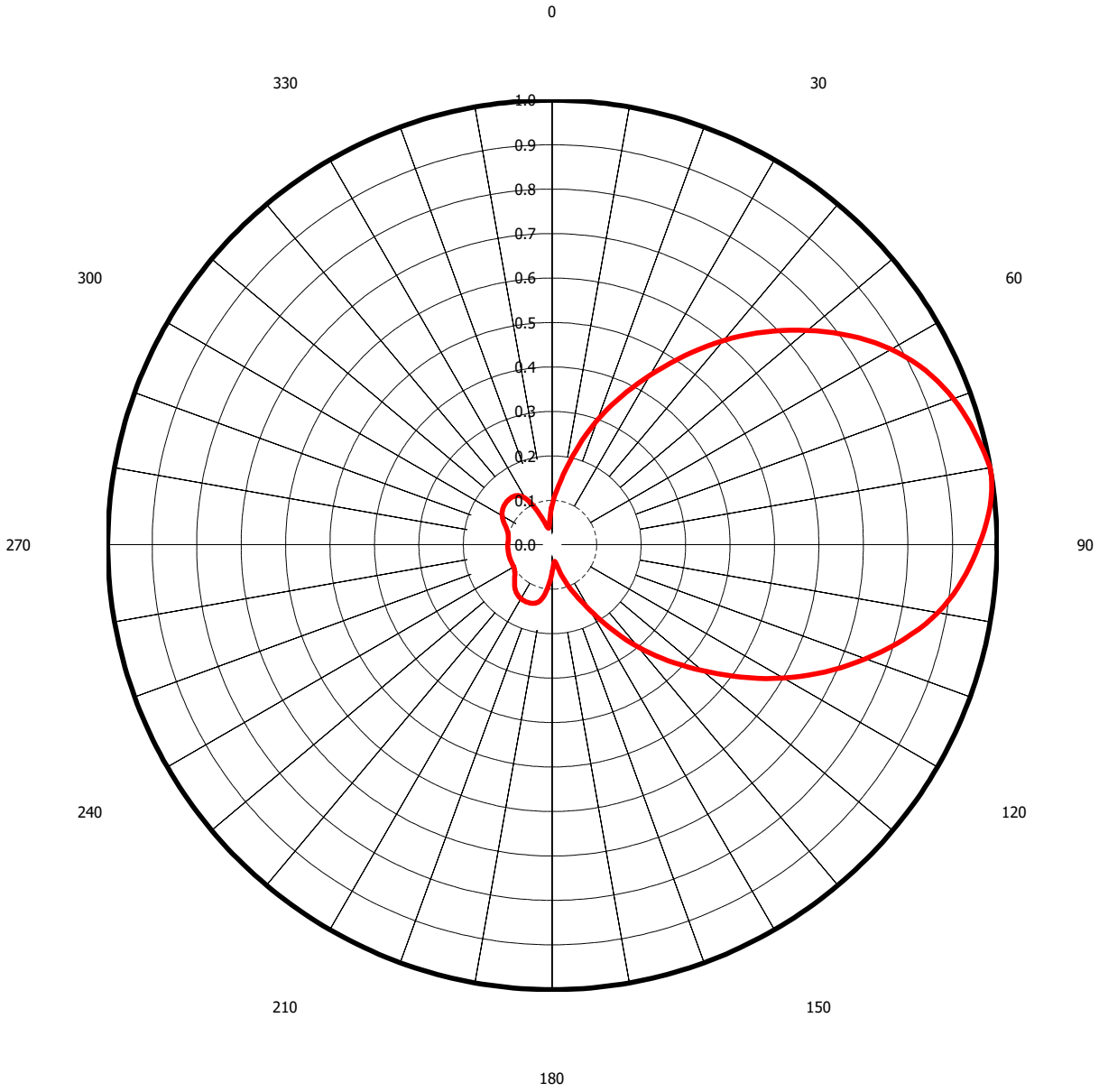
Comparisons of various results of this computer program (run on a Mac processor) to the FCCs implementation of TVStudy show excellent correlation.

List of Attachments

Figure 1	Antenna Azimuthal Pattern
Figure 2	Coverage Contour Comparison
Table 1	TVStudy Analysis of Proposal
Form 2100	Saved Version of Engineering Sections of FCC Form at Time of Upload

Chesapeake RF Consultants, LLC
Joseph M. Davis, P.E. September 7, 2022
207 Old Dominion Road Yorktown, VA 23692 703-650-9600

Azimuth Pattern - Relative Field
(True North)



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

Figure 1
Antenna Azimuthal Pattern
WQWQ-LD Paducah, KY
Facility ID 19595
Ch. 18 2.5 kW Directional

prepared for
Gray Television Licensee, LLC

September, 2022

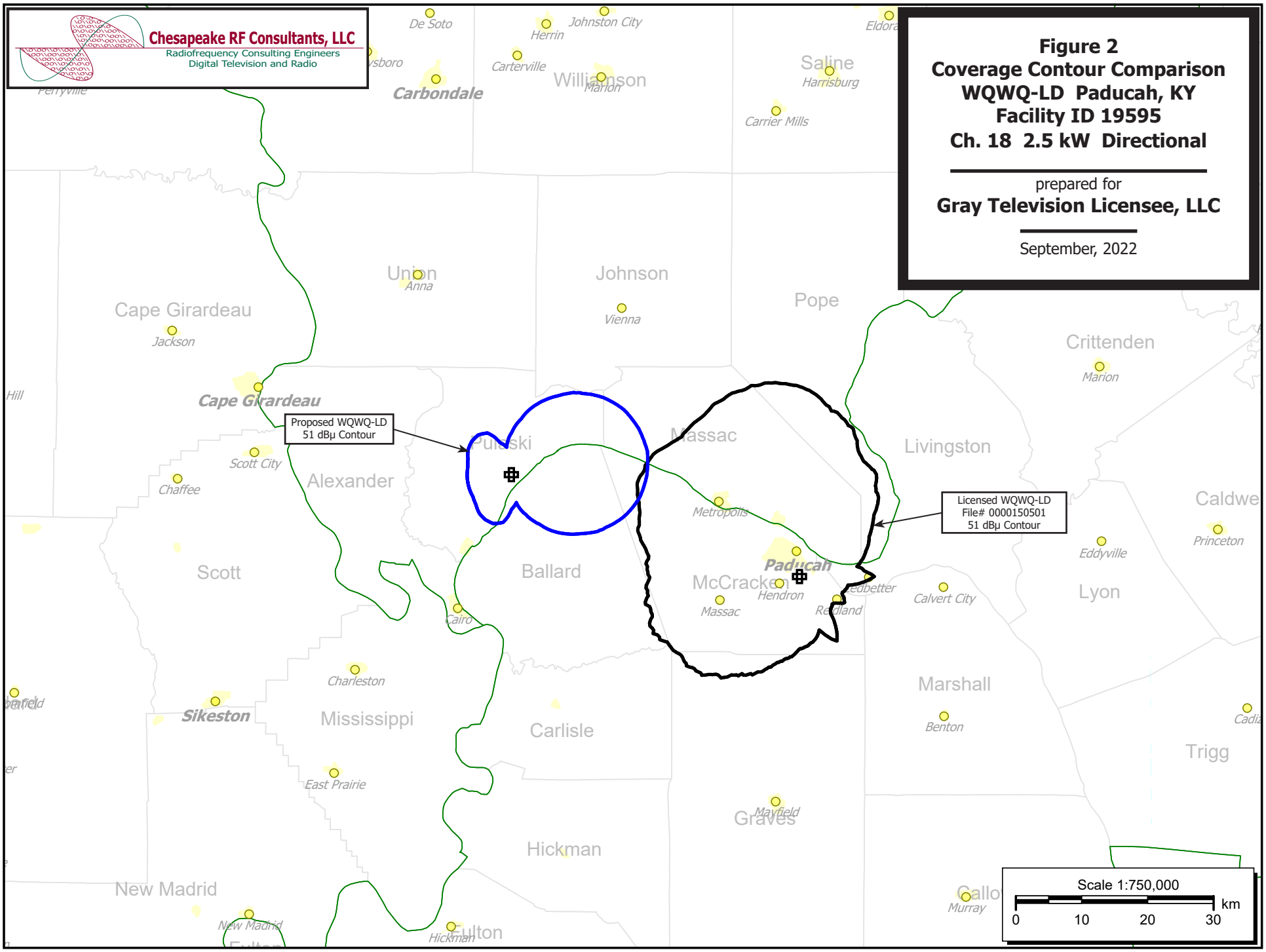

Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio
Figure 2
Coverage Contour Comparison
WQWQ-LD Paducah, KY
Facility ID 19595
Ch. 18 2.5 kW Directional
prepared for
Gray Television Licensee, LLC
September, 2022
Proposed WQWQ-LD
51 dBµ Contour
Licensed WQWQ-LD
File# 0000150501
51 dBµ Contour
Cape Girardeau
Carbondale
Paducah
Sikeston
Union
Johnson
Pope
Crittenden
Alexander
Pulaski
Massac
Livingston
Scott
Ballard
McCracken
Lyon
Marshall
Carlisle
Mississippi
Hickman
Graves
New Madrid
Trigg
Caldwell
Scale 1:750,000
km
0
10
20
30

Table 1 WQWQ-LD TVStudy Analysis of Proposal


```
tvstudy v2.2.5 (4uoc83)
Database: localhost,  Study: WQWQ-LD 1310885 2.5kW,  Model: Longley-Rice
Start: 2022.09.07 12:01:22

Study created: 2022.09.07 12:01:21

Study build station data: LMS TV 2022-09-07

    Proposal: WQWQ-LD D18 LD APP PADUCAH, KY
 File number: WQWQ-LD 1310885 2.5kW
 Facility ID: 19595
Station data: User record
   Record ID: 4645
     Country: U.S.

Build options:
Protect pre-transition records not on baseline channel

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	K17LV-D	D17	LD	LIC	PARAGOULD, AR	BLANK0000179143	137.6 km
Yes	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	73.5
No	WKOH	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	171.6
No	KDTL-LD	D17	LD	CP	ST LOUIS, MO	BLANK0000191169	183.3
No	WRTN-LD	D17	LD	LIC	ALEXANDRIA, TN	BLANK0000191369	228.2
No	W17EI-D	D17	LD	CP	JACKSON, TN	BLANK0000179410	173.6
No	W17EI-D	D17	LD	LIC	JACKSON, TN	BLANK0000164056	170.9
No	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	356.3
No	KFSM-TV	D18	DT	LIC	FORT SMITH, AR	BLCDT20060530AIM	477.4
No	KTVV-LD	D18	LD	LIC	HOT SPRINGS, AR	BLANK0000062885	405.6
No	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	218.0
No	DKTWN-LD	D18	LD	APP	LITTLE ROCK, AR	BLDTL20070521AAM	355.5
No	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	333.1
No	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000150703	281.1
No	WAOE	D18	LD	LIC	OSWEGO, IL	BLANK0000125101	386.8
No	W18CJ	N18-	TX	LIC	QUINCY, IL	BLTTL20011120AAN	365.7
No	WZDS-LD	D18	LD	LIC	EVANSVILLE, IN	BLANK0000176762	156.6
No	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	272.1
No	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLEDT20040803AAG	235.3
No	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000161021	314.7
No	K18KK-D	D18	LD	LIC	COLUMBIA, MO	BLANK0000151812	351.6
No	KDKZ-LD	D18	LD	LIC	FARMINGTON, MO	BLANK0000029554	146.8
No	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000157764	457.0
No	W18DS-D	D18	LD	LIC	CHATTANOOGA, TN	BLDTL20120320ABS	407.3
No	W18EW-D	D18	LD	CP	JACKSON, TN	BLANK0000179485	173.4
No	W18EW-D	D18	LD	LIC	JACKSON, TN	BLANK0000159471	171.1
No	WPXK-TV	D18	DT	LIC	JELLICO, TN	BLANK0000081463	477.6
No	DWJFB-LP	D18z	LD	APP	LEBANON, TN	BLANK0000005264	228.2
No	W19EW-D	D19	LD	CP	EVANSVILLE, IN	BNPDTL20090825BAA	156.0
No	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	9.3

```
No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

    Channel: D18
       Mask: Simple
   Latitude:  37 11 16.00 N (NAD83)
  Longitude:  89  5  8.90 W
Height AMSL: 117.7 m
       HAAT: 0.0 m
   Peak ERP: 2.50 kW
    Antenna: KAT-1x K723147 (ID 1008960) 80.0 deg
Elev Pattrn: Generic

49.1 dBu contour:
Azimuth      ERP       HAAT   Distance
```

Table 1 WQWQ-LD TVStudy Analysis of Proposal
(page 2 of 2)

0.0 deg	0.020 kW	6.3 m	7.1 km
45.0	1.14	2.4	19.4
90.0	2.30	14.3	22.7
135.0	0.342	12.8	14.2
180.0	0.009	23.1	5.9
225.0	0.036	16.6	8.2
270.0	0.025	6.4	7.5
315.0	0.049	1.0	8.8

Database HAAT does not agree with computed HAAT
Database HAAT: 0 m Computed HAAT: 10 m

Distance to Canadian border: 731.9 km

Distance to Mexican border: 1399.7 km

Conditions at FCC monitoring station: Powder Springs GA
Bearing: 131.8 degrees Distance: 540.5 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 288.1 degrees Distance: 1436.1 km

No land mobile station failures found

Proposal is not within the Offshore Radio Service protected area

Study cell size: 1.00 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 BLANK0000087481 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	
Undesireds:	WQWQ-LD	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1310885 2.5kW	73.5 km
	WAAY-TV	D17	DT	LIC	HUNTSVILLE, AL	BLANK0000163425	282.7
	WKOH	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	167.3
	WEPH	D17	DT	LIC	TUPELO, MS	BLANK0000062855	326.0

Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX	
14218.6	345,604	14173.4	345,255	14115.1	344,341	14097.2	344,231	0.13	0.03

Undesired	Total IX		Unique IX, before		Unique IX, after	
WQWQ-LD D18 LD APP	17.9	110			17.9	110
WAAY-TV D17 DT LIC	30.2	229	17.1	181	17.1	181
WKOH D17 DT LIC	32.0	544	21.0	497	21.0	497
WEPH D17 DT LIC	15.2	236	5.1	188	5.1	188

Interference to proposal scenario 1
42.40% interference received

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WQWQ-LD	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1310885 2.5kW	
Undesireds:	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	218.0 km
	W18EW-D	D18	LD	CP	JACKSON, TN	BLANK0000179485	173.4
	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	9.3

Service area		Terrain-limited		IX-free		Percent IX	
538.0	4,830	518.1	4,731	293.0	2,725	43.45	42.40

Undesired	Total IX		Unique IX		Prcnt Unique IX	
KVTJ-DT D18 DT LIC	47.8	677	0.0	0	0.00	0.00
WPSD-TV D19 DT LIC	225.1	2,006	177.3	1,329	34.23	28.09

Channel and Facility Information

Section	Question	Response
Facility ID	19595	
State	Kentucky	
City	PADUCAH	
LPD Channel	18	

Antenna Location Data

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1310885
Coordinates (NAD83)	Latitude	37° 11' 16.0" N+
	Longitude	089° 05' 08.9" W-
	Structure Type	LTOWER-Lattice Tower
	Overall Structure Height	83.8 meters
	Support Structure Height	76.2 meters
	Ground Elevation (AMSL)	105.5 meters
Antenna Data	Height of Radiation Center Above Ground Level	12.2 meters
	Height of Radiation Center Above Mean Sea Level	117.7 meters
	Effective Radiated Power	2.5 kW

Antenna Technical Data

Section	Question	Response
Antenna Type	Antenna Type	Directional Custom
	Do you have an Antenna ID?	Yes
	Antenna ID	1008960
Antenna Manufacturer and Model	Manufacturer:	KAT
	Model	1x K723147
	Rotation	80 degrees
	Electrical Beam Tilt	Not Applicable
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Horizontal
Elevation Radiation 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	
	Out-of-Channel Emission Mask:	Simple

Directional Antenna Relative Field Values (Pre-rotated Pattern)

Degree	Value	Degree	Value	Degree	Value	Degree	Value
0	1.000	**90**	0.04	**180**	0.10	**270**	0.04
10	0.96	**100**	0.06	**190**	0.10	**280**	0.09
20	0.88	**110**	0.12	**200**	0.10	**290**	0.17
30	0.75	**120**	0.14	**210**	0.11	**300**	0.30
40	0.60	**130**	0.14	**220**	0.13	**310**	0.44
50	0.44	**140**	0.13	**230**	0.14	**320**	0.60
60	0.30	**150**	0.11	**240**	0.14	**330**	0.75
70	0.17	**160**	0.10	**250**	0.12	**340**	0.88
80	0.09	**170**	0.10	**260**	0.06	**350**	0.96

Additional Azimuths

Degree	V_A