

## **ENGINEERING EXHIBIT**

### **Digital Low Power Television Station Application for Minor Modification of Licensed Facility** prepared for

**Gray Television Licensee, LLC**  
WQWQ-LD Paducah, KY  
Facility ID 19595  
Ch. 18 3.7 kW Directional

*Gray Television Licensee, LLC* (“Gray”) is the licensee of digital Low Power Television station WQWQ-LD, Channel 18, Facility ID 19595, Paducah KY. *Gray* herein seeks a minor modification Construction Permit to relocate WQWQ-LD.

As proposed herein, WQWQ-LD will be sited at a location 46.8 km (29.1 miles) distant from the licensed WQWQ-LD site. The proposed WQWQ-LD facility will employ a directional antenna system to be side-mounted on a structure having an overall height above ground of 12.2 meters. The structure does not require an FCC Antenna Structure Registration number since its overall height is less than 61 meters above ground and the structure passes the FCC’s “TOWAIR” slope test program.

The proposed WQWQ-LD facility will operate with a directional antenna at 3.7 kW effective radiated power using a “full service” 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. The service area overlap demonstrates compliance with §73.3572 for a minor change.

Interference study per OET Bulletin 69<sup>1</sup> shows that the proposal complies with the FCC’s interference protection requirements toward all digital television, television translator, LPTV, and

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<sup>1</sup>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 1.0 km terrain increment. Comparisons of various results of this computer program (run on a Mac processor) to the FCC’s implementation of

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**

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 20 percent antenna relative field in downward elevations (pattern data shows less than 20 percent relative field at angles 30 to 90 degrees below the antenna), the calculated signal density near the antenna at two meters above ground level attributable to the proposed facility is  $65.3 \mu\text{W}/\text{cm}^2$ , which is 19.7 percent of the general population/uncontrolled maximum permitted exposure limit. No other television or radio broadcast facilities are authorized within sufficient distance to be a significant contributor to RF exposure at this location.

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 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, structure, or antenna from RF electromagnetic field exposure in excess of FCC guidelines. Environmental matters covered by this exhibit are limited to the evaluation of exposure to RF electromagnetic field.

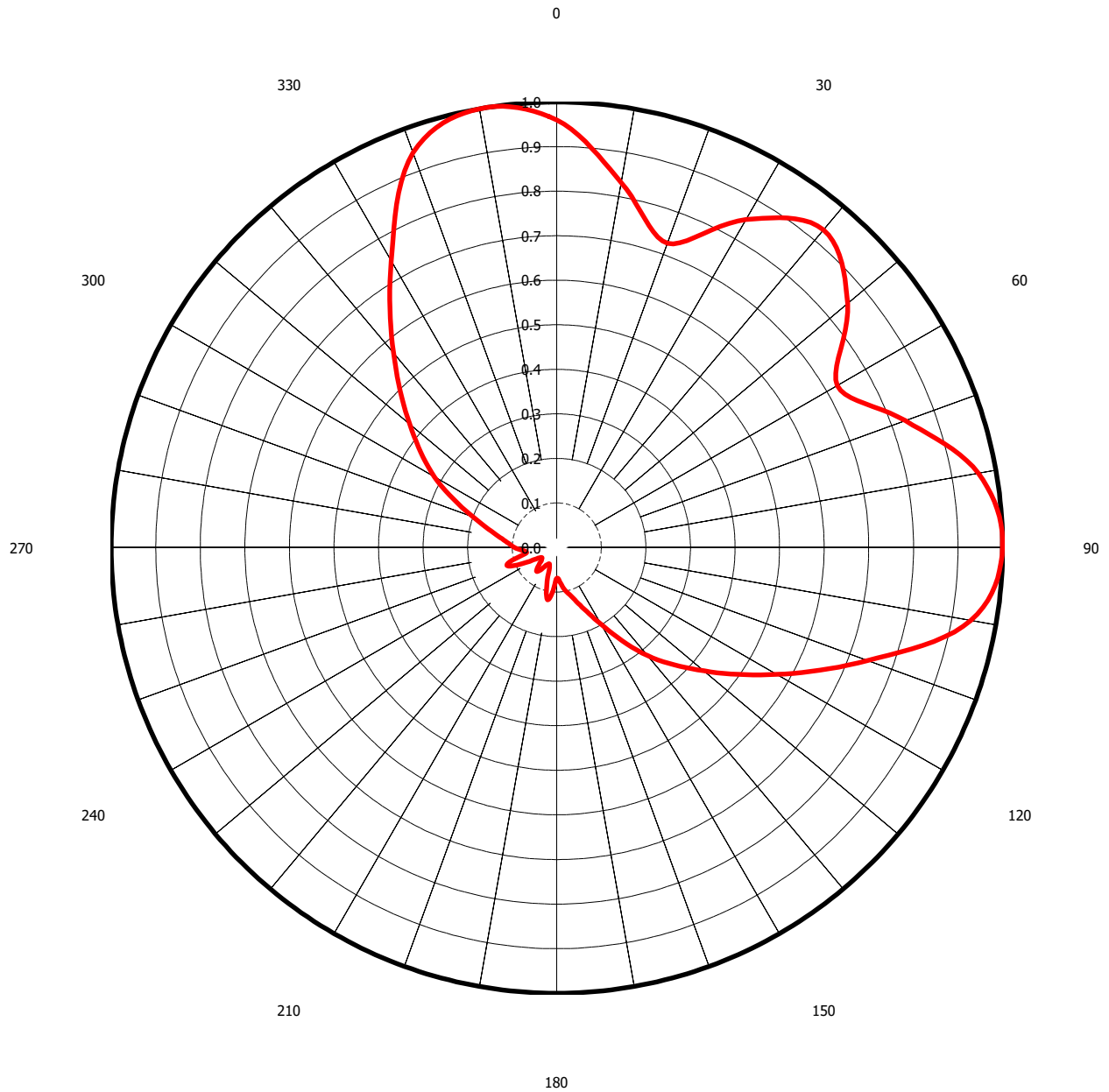
#### List of Attachments

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

### **Chesapeake RF Consultants, LLC**

Joseph M. Davis, P.E.	September 21, 2021	
207 Old Dominion Road	Yorktown, VA 23692	703-650-9600

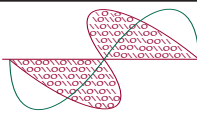
**Azimuth Pattern - Relative Field  
(True North)**



**Figure 1**  
**Antenna Azimuthal Pattern**  
**WQWQ-LD Paducah, KY**  
**Facility ID 19595**  
**Ch. 18 3.7 kW Directional**

prepared for  
**Gray Television Licensee, LLC**

September, 2021

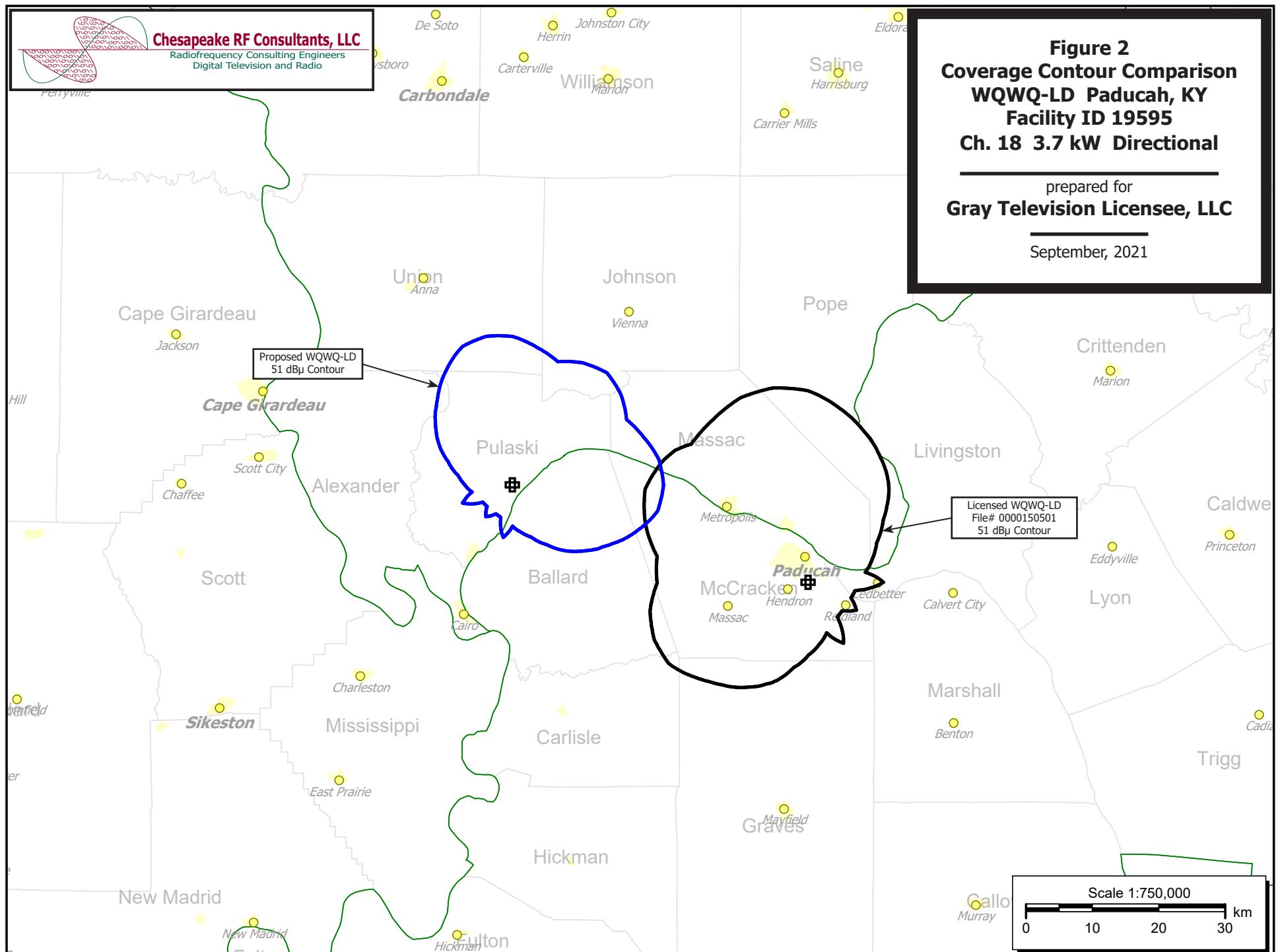


**Chesapeake RF Consultants, LLC**  
Radiofrequency Consulting Engineers  
Digital Television and Radio

**Figure 2**  
**Coverage Contour Comparison**  
**WQWQ-LD Paducah, KY**  
**Facility ID 19595**  
**Ch. 18 3.7 kW Directional**

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September, 2021



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



tvstudy v2.2.5 (4uoc83)  
Database: localhost, Study: WQWQ-LD prop, Model: Longley-Rice  
Start: 2021.09.21 15:26:47

Study created: 2021.09.21 15:26:47

Study build station data: LMS TV 2021-09-21

Proposal: WQWQ-LD D18 LD APP PADUCAH, KY  
File number: WQWQ-LD prop  
Facility ID: 19595  
Station data: User record  
Record ID: 3881  
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	CP	PARAGOULD, AR	BNPDTL20101019AAN	156.0 km
No	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	73.5
No	WKOH	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	172.6
No	WRTN-LD	D17	LD	CP	ALEXANDRIA, TN	BLANK0000054584	228.6
No	W17EI-D	D17	LD	CP	JACKSON, TN	BLANK0000071918	167.0
No	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	356.2
No	KFSM-TV	D18	DT	LIC	FORT SMITH, AR	BLCDT20060530AIM	476.4
No	KTVV-LD	D18	LD	LIC	HOT SPRINGS, AR	BLANK0000062885	404.5
No	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	216.9
No	DKTWN-LD	D18	LD	APP	LITTLE ROCK, AR	BLDTL20070521AAM	354.4
No	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	334.0
No	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000150703	281.7
No	WAOE	D18	LD	LIC	OSWEGO, IL	BLANK0000125101	387.5
No	W18CJ	N18-	TX	LIC	QUINCY, IL	BLTTL20011120AAN	365.9
No	WZDS-LD	D18	LD	CP	EVANSVILLE, IN	BLANK0000074344	157.1
No	WZDS-LD	D18	LD	APP	EVANSVILLE, IN	BLANK0000159665	157.7
No	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	273.2
No	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLDTL20040803AAG	236.1
No	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000087049	315.8
No	K18KK-D	D18	LD	LIC	COLUMBIA, MO	BLANK0000151812	351.3
No	KDKZ-LD	D18	LD	LIC	FARMINGTON, MO	BLANK0000029554	146.5
No	W17DV-D	D18	LD	CP	STARKVILLE, MS	BLANK0000071826	415.8
No	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000157764	458.1
No	W18DS-D	D18	LD	LIC	CHATTANOOGA, TN	BLDTL20120320ABS	407.5
No	W18EW-D	D18	LD	LIC	JACKSON, TN	BLANK0000159471	170.8
No	W18EW-D	D18	LD	APP	JACKSON, TN	BLANK0000159667	185.1
No	DWJFB-LP	D18z	LD	APP	LEBANON, TN	BLANK0000005264	228.6
No	W19EW-D	D19	LD	CP	EVANSVILLE, IN	BNPDTL20090825BAA	157.1
No	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	10.1

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: Full Service  
Latitude: 37 10 50.50 N (NAD83)  
Longitude: 89 5 41.30 W  
Height AMSL: 112.2 m  
HAAT: 0.0 m  
Peak ERP: 3.70 kW  
Antenna: KAT-K723147 1X2 (ID 1001019) 40.0 deg  
Elev Pattn: Generic

49.1 dBu contour:  
Azimuth ERP HAAT Distance  
0.0 deg 3.41 kW 1.6 m 24.5 km

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



45.0	2.94	-5.3	23.8
90.0	3.70	8.5	24.9
135.0	0.518	12.4	15.6
180.0	0.018	18.2	6.9
225.0	0.012	11.6	6.3
270.0	0.033	3.2	8.0
315.0	0.927	-1.6	18.4

Database HAAT does not agree with computed HAAT  
Database HAAT: 0 m Computed HAAT: 6 m

Distance to Canadian border: 733.0 km

Distance to Mexican border: 1398.6 km

Conditions at FCC monitoring station: Powder Springs GA  
Bearing: 131.7 degrees Distance: 540.6 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:  
Bearing: 288.1 degrees Distance: 1435.6 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%

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Interference to proposal scenario 1  
48.86% interference received

Desired:	Call	Chan	Svc	Status	City, State	File Number	Distance
	WQWQ-LD	D18	LD	APP	PADUCAH, KY	WQWQ-LD prop	
Undesireds:	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	216.9 km
	WZDS-LD	D18	LD	CP	EVANSVILLE, IN	BLANK0000074344	157.1
	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLEDT20040803AAG	236.1
	W18EW-D	D18	LD	LIC	JACKSON, TN	BLANK0000159471	170.8
	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	10.1

Service area		Terrain-limited		IX-free		Percent IX	
965.0	8,974	932.8	8,829	486.4	4,515	47.86	48.86
Undesired		Total IX		Unique IX		Prcnt Unique IX	
KVTJ-DT	D18 DT LIC	93.9	900	0.0	0	0.00	0.00
WKYU-TV	D18 DT LIC	2.0	16	0.0	0	0.00	0.00
WPSD-TV	D19 DT LIC	446.4	4,314	352.5	3,414	37.79	38.67

**Channel and  
Facility  
Information**

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

**Primary station proposed to be rebroadcast:**

Facility Id	Call Sign	City	State
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**Antenna Location  
Data**

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	No
	ASR Number	
Coordinates (NAD83)	Latitude	37° 10' 50.5" N+
	Longitude	089° 05' 41.3" W-
	Structure Type	MAST-Self-support struct
	Overall Structure Height	12.2 meters
	Support Structure Height	12.2 meters
	Ground Elevation (AMSL)	101.5 meters
Antenna Data	Height of Radiation Center Above Ground Level	10.7 meters
	Height of Radiation Center Above Mean Sea Level	112.2 meters
	Effective Radiated Power	3.7 kW



## Antenna Technical Data

Section	Question	Response
Antenna Type	Antenna Type	Directional Custom
	Do you have an Antenna ID?	Yes
	Antenna ID	1001019
Antenna Manufacturer and Model	Manufacturer:	KAT
	Model	K723147 1X2
	Rotation	40 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:	Full Service

### Directional Antenna Relative Field Values (Pre-rotated Pattern)

Degree	Value	Degree	Value	Degree	Value	Degree	Value
0	.931	90	.431	180	.070	270	.431
10	.852	100	.317	190	.045	280	.570
20	.727	110	.199	200	.048	290	.743
30	.832	120	.129	210	.119	300	.943
40	.960	130	.095	220	.069	310	1.00
50	1.00	140	.069	230	.095	320	.960
60	.943	150	.119	240	.129	330	.832
70	.742	160	.048	250	.199	340	.727
80	.570	170	.045	260	.317	350	.850

### Additional Azimuths

Degree	V <sub>A</sub>
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