

## **ENGINEERING EXHIBIT**

### **Application for Digital Companion Channel For Low Power Television Station**

prepared for

#### **Gray Television Licensee, LLC**

WQWQ-LP Paducah, KY

Facility ID 19595

Ch. 18 3.7 kW Directional

*Gray Television Licensee, LLC* (“Gray”) is the licensee of analog Low Power Television station WQWQ-LP, Channel 9, Paducah KY, Facility ID 19595 (BLTVL-20010220AAH). *Gray* herein seeks a Construction Permit to authorize a Digital Companion Channel (“DCC”) for WQWQ-LP to operate on Channel 18 as digital at the licensed analog Channel 9 site location.

The WQWQ-LP tower structure is associated with FCC Antenna Structure Registration number 1215850. The proposed WQWQ-LP DCC facility will utilize a directional antenna to be side-mounted on the tower. No change to the overall structure height will result.

The proposed effective radiated power is 3.7 kW using a “full service” out of channel emission mask. The proposed antenna is a Kathrein model K723147x2 having horizontal polarization. A plot of the directional antenna’s azimuthal pattern is supplied in Figure 1.

Figure 2 depicts the relevant coverage contours of the licensed analog WQWQ-LP facility (68 dB $\mu$ ) and that of the proposed DCC facility (51 dB $\mu$ ). The use of the same site and corresponding service area overlap demonstrate 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 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 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 less than 20 percent 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  $1.4 \mu\text{W}/\text{cm}^2$ , which is 0.4 percent of the general population / uncontrolled maximum permissible 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.

**Engineering Exhibit**  
**Gray Television Licensee, LLC** (WQWQ-LP)  
(page 3 of 3)



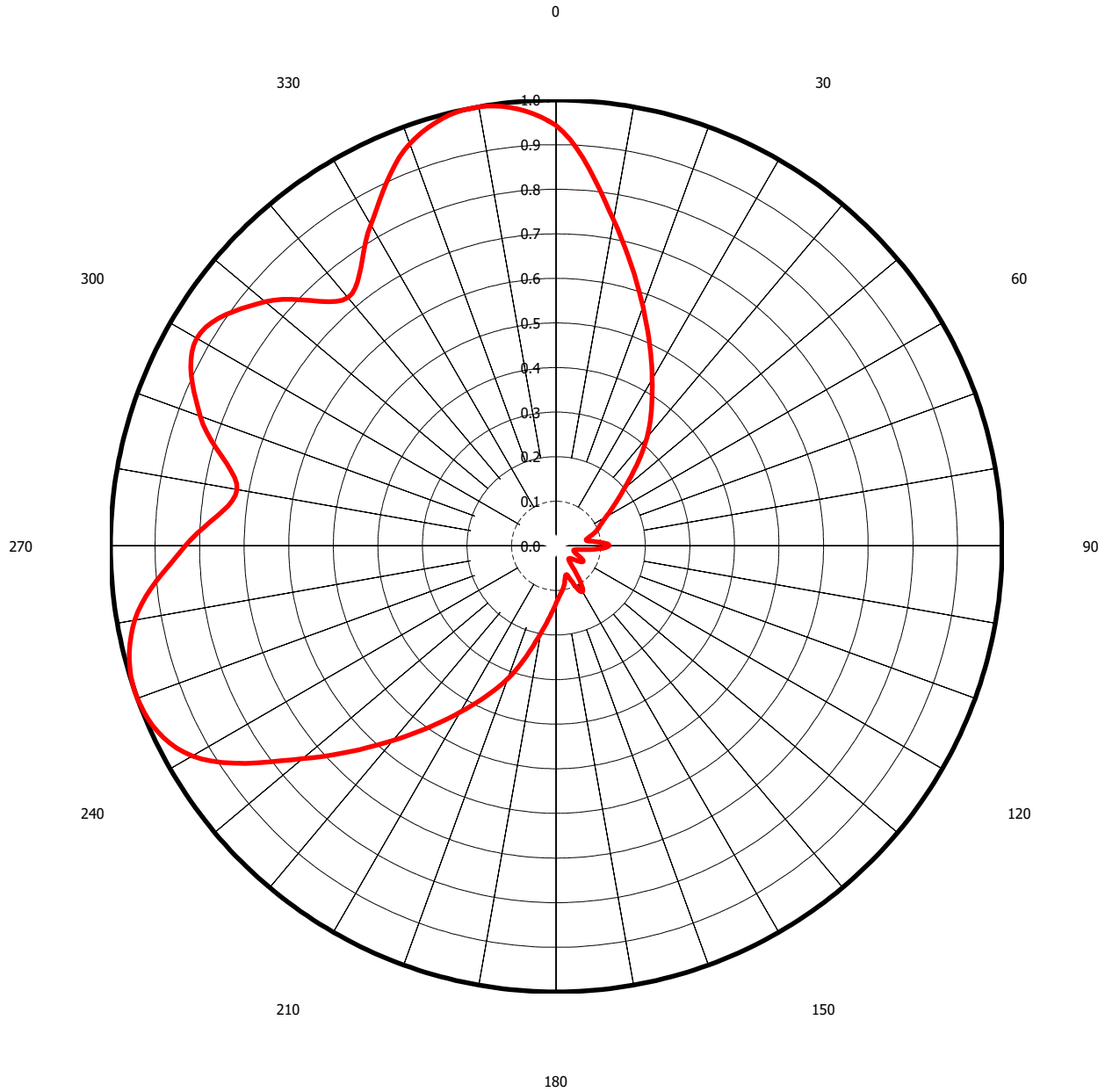
List of Attachments

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.	April 8, 2021	
207 Old Dominion Road	Yorktown, VA 23692	703-650-9600

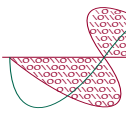
**Azimuth Pattern - Relative Field  
(True North)**



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

prepared for  
**Gray Television Licensee, LLC**

April, 2021

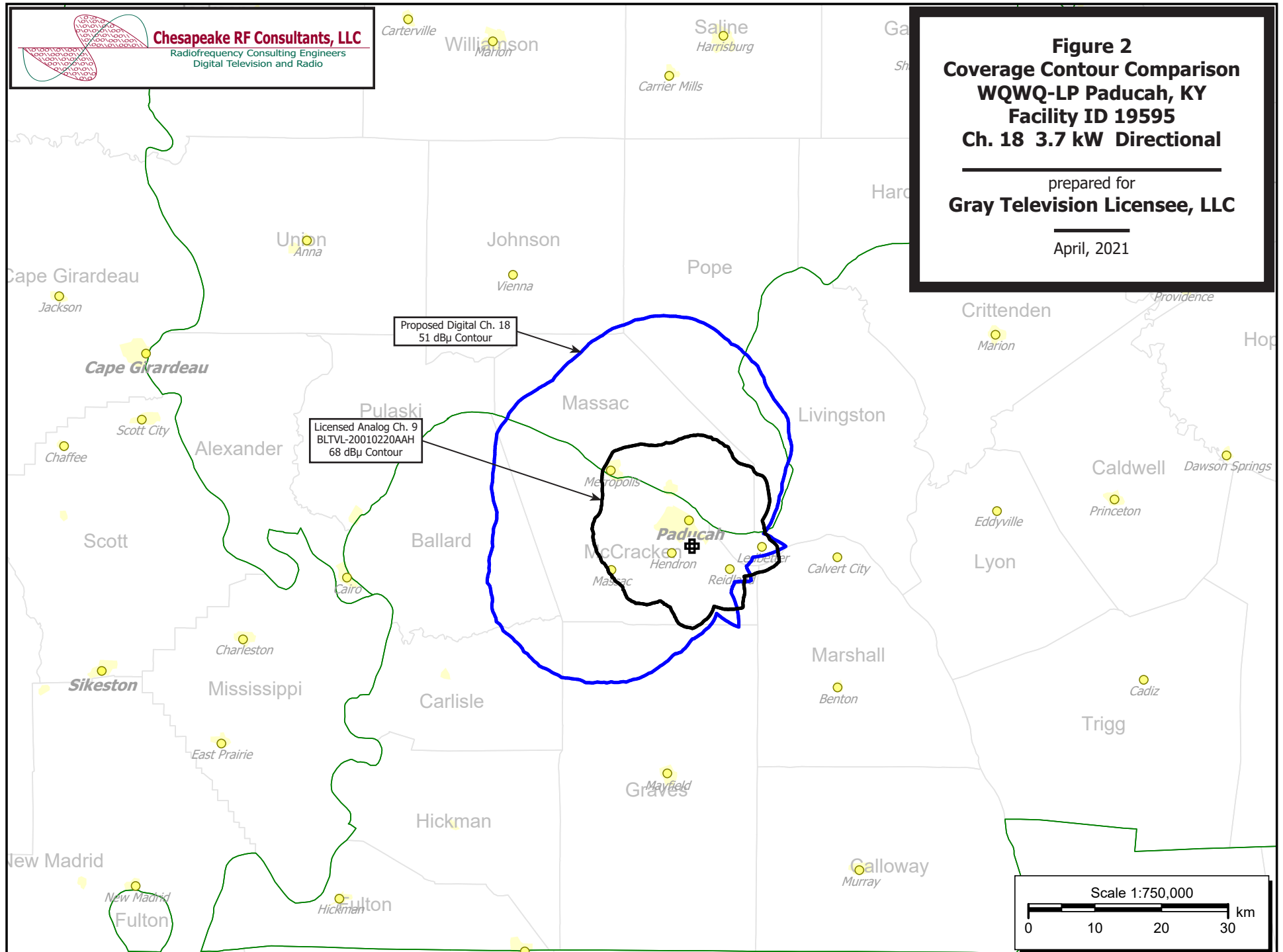


**Chesapeake RF Consultants, LLC**  
Radiofrequency Consulting Engineers  
Digital Television and Radio

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

prepared for  
**Gray Television Licensee, LLC**

April, 2021



# **Table 1 WQWQ-LP TVStudy Analysis of Proposal** (page 1 of 3)



tvstudy v2.2.5 (4uoc83)  
Database: localhost, Study: WQWQ-LD prop DCC, Model: Longley-Rice  
Start: 2021.03.26 09:41:58

Study created: 2021.03.26 09:41:58

Study build station data: LMS TV 2021-03-23

Proposal: WQWQ-LP D18 LD APP PADUCAH, KY  
File number: WQWQ-LD prop DCC  
Facility ID: 19595  
Station data: User record  
Record ID: 3579  
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	PARAGOUL, AR	BNPDTL20101019AAN	184.4 km
Yes	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	39.9
No	WKOI	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	143.0
No	WRTN-LD	D17	LD	CP	ALEXANDRIA, TN	BLANK0000054584	182.4
No	W17EI-D	D17	LD	CP	JACKSON, TN	BLANK0000071918	150.0
No	W18ET-D	D18	LD	LIC	BIRMINGHAM, AL	BLANK0000136285	429.0
No	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	317.0
No	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	235.7
No	KTWN-LD	D18	LD	LIC	LITTLE ROCK, AR	BLDTL20070521AAM	380.2
No	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	341.8
No	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000117568	310.8
No	WSEC	D18	DT	CP	JACKSONVILLE, IL	BLANK0000129544	310.8
No	WAOE	D18	LD	LIC	PEORIA, IL	BLANK0000125101	408.7
No	WZDS-LD	D18	LD	CP	EVANSVILLE, IN	BLANK0000074344	133.8
No	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	265.6
No	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLDTL20040803AAG	191.6
No	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000087049	284.0
No	K18KK-D	D18	LD	CP	COLUMBIA, MO	BLANK0000090527	396.9
No	KDKZ-LD	D18	LD	LIC	FARMINGTON, MO	BLANK0000029554	192.6
No	W17DV-D	D18	LD	CP	STARKVILLE, MS	BLANK0000071826	400.4
No	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000115955	428.9
No	W18DS-D	D18	LD	LIC	CHATTANOOGA, TN	BLDTL20120320ABS	362.1
No	W18EW-D	D18	LD	CP	JACKSON, TN	BLANK0000071916	150.0
No	WPXK-TV	D18	DT	LIC	JELICO, TN	BLANK0000081463	431.6
No	DWJFB-LP	D18z	LD	APP	LEBANON, TN	BLANK0000005264	182.4
No	W19EW-D	D19	LD	CP	EVANSVILLE, IN	BNPDTL20090825BAA	133.8
No	WCZU-LD	D19	LD	LIC	BOWLING GREEN, KY	BLANK0000124983	201.5
No	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	37.8
No	K19JU-D	D19	LD	CP	POPLAR BLUFF, MO	BDCCDTL20120308ABT	121.7
No	WLLC-LP	D19	LD	CP	NASHVILLE, TN	BLANK0000052774	189.5

Non-directional AM stations within 0.8 km:  
WPAD 1560 L ND2 D PADUCAH, KY BL20170216ADQ  
WPAD 1560 L ND2 N PADUCAH, KY BL20170216ADQ

No directional AM stations found within 3.2 km

Record parameters as studied:

Channel: D18  
Mask: Full Service  
Latitude: 37 2 54.50 N (NAD83)  
Longitude: 88 35 41.40 W  
Height AMSL: 163.4 m  
HAAT: 0.0 m  
Peak ERP: 3.70 kW  
Antenna: KAT-K723147 1X2 (ID 1001019) 300.0 deg  
Elev Pattn: Generic

**Table 1 WQWQ-LP TV Study Analysis of Proposal**  
(page 2 of 3)



49.1 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	3.29 kW	56.3 m	31.1 km
45.0	0.246	61.9	19.1
90.0	0.052	59.1	12.5
135.0	0.008	51.9	7.4
180.0	0.062	50.7	12.0
225.0	1.59	38.1	23.1
270.0	2.56	36.1	24.8
315.0	2.31	63.0	30.5

Database HAAT does not agree with computed HAAT

Database HAAT: 0 m Computed HAAT: 52 m

Distance to Canadian border: 714.7 km

Distance to Mexican border: 1426.7 km

Conditions at FCC monitoring station: Powder Springs GA

Bearing: 134.2 degrees Distance: 498.1 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:

Bearing: 288.4 degrees Distance: 1482.3 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 BLANK0000087481 LIC scenario 1

Desired:	Call	Chan	Svc	Status	City, State	File Number	Distance
	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD prop DCC	39.9 km
	WAAY-TV	D17	DT	LIC	HUNTSVILLE, AL	BLANK0000071637	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	14118.1	344,352	14114.1 344,328	0.03 0.01
Undesired		Total IX		Unique IX, before		Unique IX, after	
WQWQ-LP	D18 LD APP	4.0	24			4.0 24	
WAAY-TV	D17 DT LIC	26.2	217	14.1	170	14.1 170	
WKOH	D17 DT LIC	32.0	544	21.0	497	21.0 497	
WEPH	D17 DT LIC	15.2	236	6.1	189	6.1 189	

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Interference to BLANK0000087481 LIC scenario 2

Desired:	Call	Chan	Svc	Status	City, State	File Number	Distance
	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD prop DCC	39.9 km
	WAAY-TV	D17	DT	CP	HUNTSVILLE, AL	BLANK0000127697	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	14111.1 344,317	0.03 0.01
Undesired		Total IX		Unique IX, before		Unique IX, after	

**Table 1 WQWQ-LP TV Study Analysis of Proposal**  
(page 3 of 3)



WQWQ-LP D18 LD APP	4.0	24			4.0	24
WAAY-TV D17 DT CP	30.2	229	17.1	181	17.1	181
WKOI 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

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Interference to proposal scenario 1  
7.48% interference received

Desired:	Call	Chan	Svc	Status	City, State	File Number	Distance
	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD prop DCC	
Undesireds:	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000117568	310.8 km
	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	37.8
Service area		Terrain-limited		IX-free		Percent IX	
1453.2	80,045	1443.2	79,997	1245.8	74,016	13.68	7.48
Undesired			Total IX		Unique IX	Prct Unique IX	
WPSD-TV D19 DT LIC			197.5	5,981	197.5	5,981	13.68 7.48



**Channel and Facility Information**

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

**Antenna Location Data**

Section	Question	Response
<b>Antenna Structure Registration</b>	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1215850
<b>Coordinates (NAD83)</b>	Latitude	37° 02' 54.5" N+
	Longitude	088° 35' 41.4" W-
	Structure Type	TOWER-A free standing or guyed struct
	Overall Structure Height	103.6 meters
	Support Structure Height	103.6 meters
	Ground Elevation (AMSL)	102.4 meters
<b>Antenna Data</b>	Height of Radiation Center Above Ground Level	61.0 meters
	Height of Radiation Center Above Mean Sea Level	163.4 meters
	Effective Radiated Power	3.7 kW

**Antenna  
Technical Data**

Section	Question	Response
<b>Antenna Type</b>	Antenna Type	Directional Custom
	Do you have an Antenna ID?	Yes
	Antenna ID	1001019
<b>Antenna Manufacturer and Model</b>	Manufacturer:	KAT
	Model	K723147 1X2
	Rotation	300 degrees
	Electrical Beam Tilt	Not Applicable
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Horizontal
<b>Elevation Radiation Pattern</b>	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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