

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 15 kW Nondirectional

Gray Television Licensee, LLC (“Gray”) is the licensee of digital Low Power Television station WQWQ-LD, Channel 18, Facility ID 19595, Paducah, KY. WQWQ-LD is licensed to operate at 2.5 kW effective radiated power (“ERP”) with a directional antenna (file# 0000201472). *Gray* herein seeks a minor modification Construction Permit to relocate WQWQ-LD and to utilize a nondirectional antenna at increased power and antenna height.

The proposed facility will employ a new side-mounted antenna on the tower structure associated with FCC Antenna Structure Registration number 1003017, located 45.7 km (28.4 miles) from the licensed site. No change to the overall structure height is proposed. The antenna supporting structure is owned by *Gray* and is utilized by *Gray’s* full-service television station KFVS-TV (Facility ID 592, Cape Girardeau MO).

The proposed antenna is a Dielectric model TLP-12A/VP-R having elliptical polarization. The proposed ERP is 15 kW horizontally polarized and 4.5 kW vertically polarized using a “full service” out of channel emission mask.

Figure 1 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. Since the proposed 51 dBμ contour encompasses that of the licensed facility, no service loss area will be created. Considerable service improvement will result as the population within the 51 dBμ contour increases to 337,122 persons (2010 census), which is a 92-fold increase beyond the 3,657 persons within the licensed WQWQ-LD facility’s 51 dBμ contour.

Interference study per OET Bulletin 69¹ shows that the proposal complies with the FCC's interference protection requirements toward all digital television, television translator, LPTV, and Class A stations. FCC processing of this proposal is requested using a 0.5 km cell size and 0.2 km terrain profile increment. 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 10 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 $0.2 \mu\text{W}/\text{cm}^2$, which is 0.1 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.

¹FCC 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, 0.5 km cell size, and 0.2 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.

Engineering Exhibit
Gray Television Licensee, LLC (WQWQ-LD)
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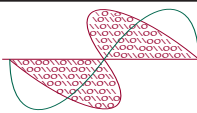


List of Attachments

Figure 1	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.	November 17, 2022	
207 Old Dominion Road	Yorktown, VA 23692	703-650-9600

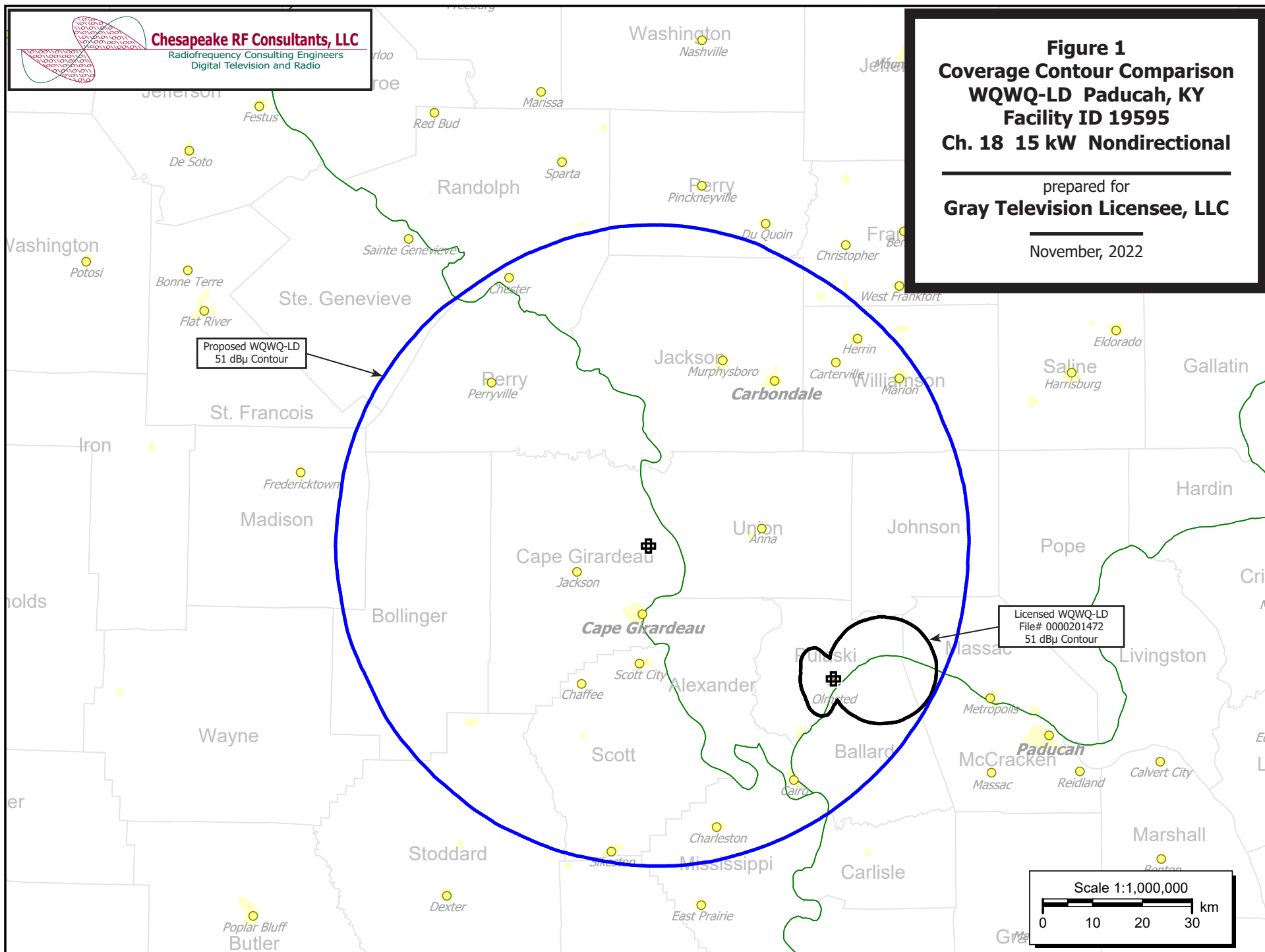


Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio

Figure 1
Coverage Contour Comparison
WQWQ-LD Paducah, KY
Facility ID 19595
Ch. 18 15 kW Nondirectional

prepared for
Gray Television Licensee, LLC

November, 2022



Proposed WQWQ-LD
51 dBu Contour

Licensed WQWQ-LD
File# 0000201472
51 dBu Contour

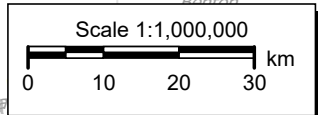


Table 1 WQWQ-LD TVStudy Analysis of Proposal (page 1 of 5)



tvstudy v2.2.5 (4uoc83)
Database: localhost, Study: WQWQ-LD 1003017_prop, Model: Longley-Rice
Start: 2022.11.17 09:02:02

Study created: 2022.11.17 09:02:01

Study build station data: LMS TV 2022-11-17

Proposal: WQWQ-LP D18 LD APP PADUCAH, KY
File number: WQWQ-LD 1003017_prop
Facility ID: 19595
Station data: User record
Record ID: 4762
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	122.0 km
No	WKMU	D17	DT	LIC	MURRAY, KY	BLANK0000087481	118.6
No	WKOI	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	197.1
No	KDTL-LD	D17	LD	CP	ST LOUIS, MO	BLANK0000199682	140.8
No	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	400.9
No	KFSM-TV	D18	DT	LIC	FORT SMITH, AR	BLCDT20060530AIM	451.4
No	KTVV-LD	D18	LD	LIC	HOT SPRINGS, AR	BLANK0000062885	397.0
Yes	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	222.3
No	DKTWN-LD	D18	LD	APP	LITTLE ROCK, AR	BLDTL20070521AAM	348.5
No	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	317.5
Yes	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000150703	246.2
No	WAOE	D18	LD	LIC	OSWEGO, IL	BLANK0000125101	357.8
No	W18CJ	N18-	TX	LIC	QUINCY, IL	BLTTL20011120AAN	323.9
Yes	WZDS-LD	D18	LD	LIC	EVANSVILLE, IN	BLANK0000176762	179.9
Yes	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	273.0
Yes	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLTDT20040803AAG	274.5
No	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000161021	338.7
No	K18KK-D	D18	LD	LIC	COLUMBIA, MO	BLANK0000151812	306.1
Yes	KDKZ-LD	D18	LD	LIC	FARMINGTON, MO	BLANK0000029554	101.8
No	KCPT	D18	DT	LIC	KANSAS CITY, MO	BLANK0000153755	471.6
No	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000157764	476.8
No	W18EW-D	D18	LD	LIC	JACKSON, TN	BLANK0000203028	215.6
No	DWJFB-LP	D18z	LD	APP	LEBANON, TN	BLANK0000005264	273.3
No	W19EW-D	D19	LD	CP	EVANSVILLE, IN	BNPDTL20090825BAA	176.9
Yes	WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	53.2
No	KPTN-LD	D19	LD	LIC	ST. LOUIS, MO	BLANK0000124668	146.2

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 25 44.70 N (NAD83)
Longitude: 89 30 14.20 W
Height AMSL: 618.2 m
HAAT: 0.0 m
Peak ERP: 15.0 kW
Antenna: Omnidirectional
Elev Pattn: Generic
Elec Tilt: 1.00

49.1 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	15.0 kW	502.4 m	67.1 km
45.0	15.0	490.0	66.7
90.0	15.0	495.5	66.9

Table 1 WQWQ-LD TV Study Analysis of Proposal
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135.0	15.0	506.9	67.2
180.0	15.0	493.1	66.8
225.0	15.0	455.8	65.6
270.0	15.0	451.9	65.5
315.0	15.0	462.9	65.9

Database HAAT does not agree with computed HAAT
Database HAAT: 0 m Computed HAAT: 482 m

Distance to Canadian border: 738.7 km

Distance to Mexican border: 1386.0 km

Conditions at FCC monitoring station: Powder Springs GA
Bearing: 131.1 degrees Distance: 586.0 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 287.2 degrees Distance: 1392.7 km

No land mobile station failures found

Proposal is not within the Offshore Radio Service protected area

Study cell size: 0.50 km
Profile point spacing: 0.20 km

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

Interference to BLANK0000064048 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KVTJ-DT	D18	DT	LIC	JONESBORO, AR	BLANK0000064048	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1003017_prop	222.3 km
	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	375.0
	KMYA-DT	D18	DT	LIC	CAMDEN, AR	BLANK0000181238	327.5
	KFSM-TV	D18	DT	LIC	FORT SMITH, AR	BLCDT20060530AIM	329.0
Service area		Terrain-limited		IX-free, before		IX-free, after	Percent New IX
26718.7		1,465,255		26678.7		1,463,835	0.03 0.00
				Total IX	Unique IX, before	Unique IX, after	
Undesired	WQWQ-LP D18 LD APP	8.1		179	7.6	36	
	WZDX D18 DT LIC	8.5		309	8.0	166	
	KMYA-DT D18 DT LIC	5.2		16	5.0	16	
	KFSM-TV D18 DT LIC	1.2		19	1.0	19	

Interference to BLANK0000150703 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000150703	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1003017_prop	246.2 km
	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	163.9
	WMEU-CD	D18	DC	LIC	CHICAGO, IL	BLANK0000086889	324.3
	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	231.4
	WGEM-TV	D19	DT	CP	QUINCY, IL	BLANK0000157750	116.4
Service area		Terrain-limited		IX-free, before		IX-free, after	Percent New IX
20052.4		537,424		19904.4		536,024	0.02 0.00
				Total IX	Unique IX, before	Unique IX, after	
Undesired	WQWQ-LP D18 LD APP	4.7		4	3.7	4	
	WBXC-CD D18 DC LIC	5.2		0	3.5	0	
	WAWV-TV D18 DT LIC	29.8		333	27.5	333	
	WGEM-TV D19 DT CP	47.6		180	47.6	180	

Table 1 WQWQ-LD TVStudy Analysis of Proposal
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Interference to BLANK0000176762 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WZDS-LD	D18	LD	LIC	EVANSVILLE, IN	BLANK0000176762	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1003017_prop	179.9 km
	WKOI	D17	DT	LIC	OWENSBORO, KY	BLANK0000087401	19.3
	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	151.1
	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLEDT20040803AAG	134.0
	W19FD-D	D19	LD	CP	Terre Haute, IN	BLANK0000190758	151.1
Service area		Terrain-limited		IX-free, before		IX-free, after	Percent New IX
7300.8		446,523		7287.4		446,458	0.00
				7070.1		438,126	0.00
				7070.1		438,126	0.00
Undesired		Total IX		Unique IX, before		Unique IX, after	
WQWQ-LP D18 LD APP		0.2		0		0.0	0
WKOI D17 DT LIC		38.7		5,135		33.4	5,116
WAWV-TV D18 DT LIC		174.2		3,190		162.2	3,136
WKYU-TV D18 DT LIC		20.5		77		7.0	10

Interference to BLANK0000087258 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1003017_prop	273.0 km
	WBXC-CD	D18	DC	LIC	CHAMPAIGN/URBANA, IL	BLANK0000112220	121.0
	WMEU-CD	D18	DC	LIC	CHICAGO, IL	BLANK0000086889	293.8
	WSEC	D18	DT	LIC	JACKSONVILLE, IL	BLANK0000150703	231.4
	WFWA	D18	DT	LIC	FORT WAYNE, IN	BLANK0000063130	278.7
	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLEDT20040803AAG	256.2
	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000161021	166.5
	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000157764	247.0
Service area		Terrain-limited		IX-free, before		IX-free, after	Percent New IX
23982.1		703,851		23840.9		700,987	0.00
				23231.0		685,233	0.00
				23231.0		685,233	0.00
Undesired		Total IX		Unique IX, before		Unique IX, after	
WQWQ-LP D18 LD APP		1.3		2		0.0	0
WBXC-CD D18 DC LIC		499.9		5,925		499.2	5,918
WSEC D18 DT LIC		2.5		2		0.5	0
WFWA D18 DT LIC		12.1		488		4.0	140
WKYU-TV D18 DT LIC		9.2		301		2.3	7
WMYO-CD D18 DC LIC		55.3		5,256		23.7	2,759
WSTR-TV D18 DT LIC		78.1		6,827		41.3	4,300

Interference to BLEDT20040803AAG LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	WKYU-TV	D18	DT	LIC	BOWLING GREEN, KY	BLEDT20040803AAG	
Undesireds:	WQWQ-LP	D18	LD	APP	PADUCAH, KY	WQWQ-LD 1003017_prop	274.5 km
	WKSO-TV	D17	DT	LIC	SOMERSET, KY	BLANK0000087465	143.2
	WZDX	D18	DT	LIC	HUNTSVILLE, AL	BLANK0000108705	258.8
	WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	256.2
	WMYO-CD	D18	DC	LIC	LOUISVILLE, KY	BLANK0000161021	154.5
	WSTR-TV	D18	DT	LIC	CINCINNATI, OH	BLANK0000157764	290.4
	WPXK-TV	D18	DT	LIC	JELICO, TN	BLANK0000081463	252.0
Service area		Terrain-limited		IX-free, before		IX-free, after	Percent New IX
14788.4		411,541		14588.2		408,276	0.00
				14453.1		404,139	0.00
				14453.1		404,139	0.00
Undesired		Total IX		Unique IX, before		Unique IX, after	
WQWQ-LP D18 LD APP		1.2		327		0.0	0
WKSO-TV D17 DT LIC		0.5		13		0.0	0
WZDX D18 DT LIC		21.0		612		16.6	277
WAWV-TV D18 DT LIC		43.4		1,594		24.5	1,010
WMYO-CD D18 DC LIC		72.4		2,153		41.6	1,649
WSTR-TV D18 DT LIC		44.3		836		16.5	317

Table 1 WQWQ-LD TVStudy Analysis of Proposal
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WPXK-TV D18 DT LIC										0.5	0	0.2	0	0.2	0

Interference to BLANK0000029554 LIC scenario 1															
		Call	Chan	Svc	Status	City, State		File Number		Distance					
Desired:		KDKZ-LD	D18	LD	LIC	FARMINGTON, MO		BLANK0000029554							
Undesireds:	WQWQ-LP	D18	LD	APP		PADUCAH, KY		WQWQ-LD 1003017_prop		101.8 km					
	KVTJ-DT	D18	DT	LIC		JONESBORO, AR		BLANK0000064048		244.0					
	WSEC	D18	DT	LIC		JACKSONVILLE, IL		BLANK0000150703		205.5					
Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX							
8750.4 206,730		8138.7 200,028		8106.3 198,833		7655.5 194,924		5.56 1.97							
Undesired		Total IX		Unique IX, before		Unique IX, after									
WQWQ-LP	D18 LD APP	469.1		5,096		450.8 3,909									
KVTJ-DT	D18 DT LIC	21.6		261 20.6 261		10.7 7									
WSEC	D18 DT LIC	11.8		934 10.8 934		3.2 1									

Interference to BLANK0000116960 LIC scenario 1															
		Call	Chan	Svc	Status	City, State		File Number		Distance					
Desired:		WPSD-TV	D19	DT	LIC	PADUCAH, KY		BLANK0000116960							
Undesireds:	WQWQ-LP	D18	LD	APP		PADUCAH, KY		WQWQ-LD 1003017_prop		53.2 km					
	WHNT-TV	D19	DT	CP		HUNTSVILLE, AL		BLANK0000127591		350.6					
	WGEM-TV	D19	DT	CP		QUINCY, IL		BLANK0000157750		368.4					
	KYTV	D19	DT	LIC		SPRINGFIELD, MO		BLANK0000172336		350.6					
	WTSN-CD	D20	DC	LIC		EVANSVILLE, IN		BLDTL20120328AJA		174.7					
Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX							
40903.7 883,173		40314.4 875,861		40005.5 872,530		39723.9 868,202		0.70 0.50							
Undesired		Total IX		Unique IX, before		Unique IX, after									
WQWQ-LP	D18 LD APP	302.1		4,393		281.6 4,328									
WHNT-TV	D19 DT CP	99.6		1,246 99.6 1,246		99.6 1,246									
WGEM-TV	D19 DT CP	60.1		409 44.8 305		40.6 263									
KYTV	D19 DT LIC	161.4		1,757 146.0 1,653		133.7 1,652									
WTSN-CD	D20 DC LIC	3.1		23 3.1 23		3.1 23									

Interference to BLANK0000116960 LIC scenario 2															
		Call	Chan	Svc	Status	City, State		File Number		Distance					
Desired:		WPSD-TV	D19	DT	LIC	PADUCAH, KY		BLANK0000116960							
Undesireds:	WQWQ-LP	D18	LD	APP		PADUCAH, KY		WQWQ-LD 1003017_prop		53.2 km					
	WHNT-TV	D19	DT	LIC		HUNTSVILLE, AL		BLCDT20111118COZ		350.6					
	WGEM-TV	D19	DT	CP		QUINCY, IL		BLANK0000157750		368.4					
	KYTV	D19	DT	LIC		SPRINGFIELD, MO		BLANK0000172336		350.6					
	WTSN-CD	D20	DC	LIC		EVANSVILLE, IN		BLDTL20120328AJA		174.7					
Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX							
40903.7 883,173		40314.4 875,861		40056.3 872,825		39774.7 868,497		0.70 0.50							
Undesired		Total IX		Unique IX, before		Unique IX, after									
WQWQ-LP	D18 LD APP	302.1		4,393		281.6 4,328									
WHNT-TV	D19 DT LIC	48.8		951 48.8 951		48.8 951									
WGEM-TV	D19 DT CP	60.1		409 44.8 305		40.6 263									
KYTV	D19 DT LIC	161.4		1,757 146.0 1,653		133.7 1,652									
WTSN-CD	D20 DC LIC	3.1		23 3.1 23		3.1 23									

Interference to proposal scenario 1															
2.29% interference received															
		Call	Chan	Svc	Status	City, State		File Number		Distance					
Desired:		WQWQ-LP	D18	LD	APP	PADUCAH, KY		WQWQ-LD 1003017_prop							
Undesireds:	KVTJ-DT	D18	DT	LIC		JONESBORO, AR		BLANK0000064048		222.3 km					
	WSEC	D18	DT	LIC		JACKSONVILLE, IL		BLANK0000150703		246.2					

Table 1 WQWQ-LD TVStudy Analysis of Proposal
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		WAWV-TV	D18	DT	LIC	TERRE HAUTE, IN	BLANK0000087258	273.0
		KDKZ-LD	D18	LD	LIC	FARMINGTON, MO	BLANK0000029554	101.8
		WPSD-TV	D19	DT	LIC	PADUCAH, KY	BLANK0000116960	53.2
Service area		Terrain-limited		IX-free		Percent IX		
13862.7	355,670	13793.2	355,195	13221.6	347,065	4.14	2.29	
Undesired		Total IX		Unique IX		Prcnt Unique IX		
KVTJ-DT	D18 DT LIC	7.8	0	5.1	0	0.04	0.00	
WSEC	D18 DT LIC	2.2	37	0.5	0	0.00	0.00	
WAWV-TV	D18 DT LIC	1.2	37	0.0	0	0.00	0.00	
KDKZ-LD	D18 LD LIC	232.8	3,258	227.7	3,221	1.65	0.91	
WPSD-TV	D19 DT LIC	334.2	4,872	332.7	4,872	2.41	1.37	

**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	1003017
Coordinates (NAD83)	Latitude	37° 25' 44.7" N+
	Longitude	089° 30' 14.2" W-
	Structure Type	GTOWER-Guyed Structure Used for Communication Purposes
	Overall Structure Height	511.1 meters
	Support Structure Height	486.1 meters
	Ground Elevation (AMSL)	246.8 meters
Antenna Data	Height of Radiation Center Above Ground Level	371.4 meters
	Height of Radiation Center Above Mean Sea Level	618.2 meters
	Effective Radiated Power	15 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:	Dielectric
	Model	TLP-12A/VP-R
	Rotation	
	Electrical Beam Tilt	1.0
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Elliptical
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