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KOPB-DT Channel 10
Portland, Oregon
Request for Waiver of §73.622(f)(7)**

KOPB-DT is a non-commercial/educational television station which is owned and operated by Oregon Public Broadcasting ("OPB"). Licensed to Portland, Oregon, KOPB-DT is the flagship station of the OPB public broadcasting network in Oregon and southwest Washington, which consists of five full-power television stations and numerous TV translator facilities. OPB relies predominately on viewer donations to fund its operations, with some additional funding coming from the State of Oregon and national grant programs. By far the largest population served by any of the OPB stations is that served by KOPB-DT.

KOPB-DT was initially authorized for pre-transition operation on UHF Channel 27, but was approved in Appendix B of the DTV Seventh Report and Order for post-transition operation on high-VHF Channel 10 (the station's analog channel) with an ERP of 32 kW at an HAAT of 509 meters. Subsequently the station received a construction permit to operate with 32.4 kW ERP at an HAAT of 524 meters, that being the height of the analog Channel 10 antenna (see BPEDT-20080215ABK). That facility is constructed and operating, with a license application pending as BLEDT-20090619AAF.

The instant application requests operation with a power increase to an ERP of 77 kW at an HAAT of 524 meters. This ERP value is greater than that which would be permitted by routine application of the table in §73.622(f)(7) of the Commission's Rules, and also results in a noise limited contour area which is larger than that of the largest station within the market.

Since commencing DTV operation on Channel 10, KOPB-DT has – like numerous other VHF digital stations across the country – experienced reception problems which either did not exist or were not

apparent during pre-transition digital operations on the original UHF channel. The licensee has received a number of complaints from viewers, former viewers, and would-be viewers about lack of reception and degraded reception. Its engineering staff has verified reception problems in the field, and, as shown below, the problems can be traced to interference of a type that should be remediable with the proposed power increase. These reception problems are particularly problematic for a public broadcasting station which relies heavily upon viewer donations for its operating budget. In light of the compelling need to improve reception of KOPB-DT, Oregon Public Broadcasting respectfully requests waiver of §73.622(f)(7) of the Commission's Rules to permit operation with an ERP of 77 kW.

Consideration of Man-Made and Sky Noise

The paper "Planning Factors for Fixed and Portable DTTV Reception" authored by Oded Bendov, Yiyang Wu, Charles W. Rhodes, and John F.X. Browne and presented at the IEEE 2003 Broadcast Technical Symposium¹ showed that median residential man-made and sky noise -- *not accounted for in the Commission's DTV planning factors* -- contributes as much as an additional 6.5 to 8.5 dB at Channel 10. When those additional noise levels are added to the Commission's defined field strengths for DTV reception, it is clear that additional power is necessary to replicate the station's analog service area.

Channel	FCC Field Strength F(50,90)	Plus noise power (dB over KToB) Man-made with sky noise Rooftop Antenna	Plus noise power (dB over KToB) Man-made with sky noise Set-top Antenna
10	36 dBu	+6.5 dB = 42.5 dBu	+8.5 dB = 44.5 dBu

Interference from FM Stations

In the article "Testing for DTV Interference" published in TV Technology on June 22, 2009 (available online at www.tvtechnology.com/article/82716), Charles W. Rhodes described the mechanisms by which high-power FM signals can produce second harmonic and A+B mix products in DTV receivers which fall within high-band VHF channels. The A+B mix products are particularly problematic because they manifest 6 dB stronger than either of the second harmonics.

¹ "Planning Factors for Fixed and Portable DTTV Reception" by Oded Bendov, Yiyang Wu, Charles W. Rhodes, and John F.X. Browne, IEEE Transactions on Broadcasting, Vol. 50, No. 3, September 2004.

In the Portland market where KOPB-DT is located, for example, there are fifteen high-power FM stations which produce either second harmonic or A+B mix products in the receiver which fall within the 192-198 MHz spectrum of Channel 10. Those stations, many of which operate with a full 100 kW ERP, are:

Callsign	Frequency	Community of License	ERP
KBOO	90.7 MHz	Portland	26.5 kW
KOPB-FM	91.5 MHz	Portland	73 kW
KGON	92.3 MHz	Portland	100 kW
KPDQ-FM	93.9 MHz	Portland	52 kW
KXTG	95.5 MHz	Portland	100 kW
KYCH-FM	97.1 MHz	Portland	100 kW
KUPL-FM	98.7 MHz	Portland	37 kW
KWJJ-FM	99.5 MHz	Portland	52 kW
KKRZ	100.3 MHz	Portland	100 kW
KUFO-FM	101.1 MHz	Portland	100 kW
KINK	101.9 MHz	Portland	100 kW
KKCW	103.3 MHz	Beaverton	100 kW
KRSK	105.1 MHz	Molalla	22.5 kW
KFBW	105.9 MHz	Vancouver	22.5 kW
KLTH	106.7 MHz	Lake Oswego	100 kW

Of these stations, there are two which produce second harmonics within the Channel 10 spectrum, namely KYCH-FM 97.1 MHz (second harmonic 194.2 MHz) and KUPL-FM 98.7 MHz (second harmonic 197.4 MHz). More significantly, among all fifteen FM stations in this list there are 30 separate frequency combinations which have potential to produce A+B mix products in the receiver within the Channel 10 spectrum.

Mr. Rhodes happens to live near Portland, and as described in the article has performed tests of ten NTIA-approved downconverters at his home 14 miles from the FM towers. Those tests

confirmed that the total received power of the FM signals was -26 dBm, *some 10 dB stronger* than any DTV signal at that location.

As noted in Mr. Rhodes' article, interference from FM stations to high-band VHF can be eliminated by utilizing either an FM trap or a 75 ohm high pass filter (which attenuates FM and low-band VHF signals, but passes high-band VHF and UHF signals) at the input to affected DTV receivers. Indeed, OPB engineers have first-hand field experience with the use of these techniques. In numerous cases, the application of either an FM trap or high pass filter has resulted in a marked improvement in reception of KOPB-DT on affected receivers. The additional filtering has often made the difference between truly robust reception and marginal or no reception of KOPB-DT.

This first-hand experience demonstrates that not only is the FM interference mechanism described above a theoretical possibility, but it is also a real-world fact affecting reception of KOPB-DT. Nevertheless the use of filtering techniques, while a solution in individual cases, is not a universal solution owing to the impracticality of providing every affected receiver with an appropriate filter. Many viewers experiencing reception problems will not know where to turn for help, and many will simply assume that nothing can be done.

Conclusion

While the 3.75 dB power increase requested herein cannot be expected to resolve all reception problems experienced by viewers of KOPB-DT, this increase will help by raising the KOPB-DT received signal strength higher relative to the noise floor to which the FM products (and man-made and sky noise not accounted for in the FCC DTV planning factors) contribute. Furthermore, as is demonstrated in the interference study included in this application, operation of KOPB-DT at the power level requested herein will not result in prohibited interference to any other station. It is therefore submitted that operation of KOPB-DT at 77 kW ERP would be in the public interest, and waiver of §73.622(f)(7) of the Commission's Rules is warranted and respectfully requested.

Second Harmonic and A+B Mix Products for High-Power Portland FM Stations

("High power" defined as 20 kW ERP and higher)

	KBOO	KOPB-FM	KGON	KPDQ-FM	KXTG	KYCH-FM	KUPL-FM	KWJJ-FM	KKRZ	KUFO-FM	KINK	KKCW	KRSK	KFBW	KLTH	KXJM
MHz	90.7	91.5	92.3	93.9	95.5	97.1	98.7	99.5	100.3	101.1	101.9	103.3	105.1	105.9	106.7	107.5
90.7	181.4															
91.5	182.2	183.0														
92.3	183.0	183.8	184.6													
93.9	184.6	185.4	186.2	187.8												
95.5	186.2	187.0	187.8	189.4	191.0											
97.1	187.8	188.6	189.4	191.0	192.6	194.2										
98.7	189.4	190.2	191.0	192.6	194.2	195.8	197.4									
99.5	190.2	191.0	191.8	193.4	195.0	196.6	198.2	199.0								
100.3	191.0	191.8	192.6	194.2	195.8	197.4	199.0	199.8	200.6							
101.1	191.8	192.6	193.4	195.0	196.6	198.2	199.8	200.6	201.4	202.2						
101.9	192.6	193.4	194.2	195.8	197.4	199.0	200.6	201.4	202.2	203.0	203.8					
103.3	194.0	194.8	195.6	197.2	198.8	200.4	202.0	202.8	203.6	204.4	205.2	206.6				
105.1	195.8	196.6	197.4	199.0	200.6	202.2	203.8	204.6	205.4	206.2	207.0	208.4	210.2			
105.9	196.6	197.4	198.2	199.8	201.4	203.0	204.6	205.4	206.2	207.0	207.8	209.2	211.0	211.8		
106.7	197.4	198.2	199.0	200.6	202.2	203.8	205.4	206.2	207.0	207.8	208.6	210.0	211.8	212.6	213.4	
107.5	198.2	199.0	199.8	201.4	203.0	204.6	206.2	207.0	207.8	208.6	209.4	210.8	212.6	213.4	214.2	215.0

Red highlight indicates products which fall within the 192-198 MHz spectrum of TV Channel 10