

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)
)
Subpart L of Part 90 of FCC Rules:)
Updated Method to Determine Potential)
Interference Between Land Mobile Stations) RM _____
And Digital Television Stations Operating)
In the 470-512 MHz Band (“T-Band”))

To: The Commission

PETITION FOR RULEMAKING

The Land Mobile Communications Council (“LMCC”) requests the Federal Communications Commission (“FCC” or “Commission”) to modify its Subpart L, Part 90 rules as proposed herein to reflect a much-changed spectrum environment since 1970 when the FCC first authorized land mobile sharing of television channels 14-20 in a limited number of major markets in the county.¹ The time is right to update these rules. While land mobile activity in the 470-512 MHz (“T-Band”) had been suspended for almost a decade, the Consolidated Appropriations Act, 2021 repealed Section 6103 of the Middle Class Tax Relief and Job Creation Act of 2012 (“Spectrum Act”),² which had required the Commission to reallocate and auction T-Band frequencies used by public safety entities.³ The lifting of the so-called “T-Band Mandate” prompted the Wireless Telecommunications Bureau and the Public Safety and Homeland Security Bureau jointly to modify their 2012 suspension on the acceptance and

¹ *Amendment of Parts 2, 89, 91, and 93*, First Report and Order, Docket No. 18261, 23 FCC 2d 325 (1970).

² Consolidated Appropriations Act, 2021, Publ. L. No. 116-260, Division FF, Title IX, Section 902 (2020). Section 902(b)(1) of the Consolidated Appropriations Act, 2021 repealed Section 6103 of the Spectrum Act.

³ Pub. L. No. 112-96, 126 Stat. 156, section 6103 (2012).

processing of most applications for T-Band spectrum⁴ and resume processing renewal applications and applications from incumbent licensees.⁵

The T-Band spectrum landscape has been altered fundamentally in the almost ten years that the Suspension PN was in effect. While the rules governing protection of television stations by land mobile systems remain based on those stations transmitting in an analog National Television System Committee (“NTSC”) format, in fact, they have converted to digital transmission (“DTV”) using the Advanced Television Systems Committee (“ATSC”) DTV format (also called ATSC-1). The rules should be modified to reflect appropriate protection criteria for full service ATSC-1 digital stations as well as Class A stations that have been introduced since the adoption of land mobile sharing rules in 1970. Updated rules will maximize the interference-free use of this important band by both television stations and land mobile systems, consistent with the more advanced technologies that have been implemented by these licensees.

I. INTRODUCTION

The LMCC is a non-profit association of organizations representing virtually all users of land mobile radio systems, providers of land mobile services, and manufacturers of land mobile radio equipment. The LMCC acts with the consensus and on behalf of the vast majority of public safety, business, industrial, transportation, and private commercial radio users, as well as a diverse group of land mobile service providers and equipment manufacturers. Membership includes the following organizations:

⁴ *Wireless Telecommunications Bureau and Public Safety and Homeland Security Bureau Suspend the Acceptance and Processing of Certain Part 22 and 90 Applications for 470-512 MHz (T-Band) Spectrum*, Public Notice, 27 FCC Rcd 4218 (WTB/PSHSB 2012) (“Suspension PN”).

⁵ *Wireless Telecommunications Bureau and Public Safety and Homeland Security Bureau Modify Suspension of Acceptance and Processing of Certain Part 22 and Part 90 Applications for 470-512 MHz (T-Band) Spectrum*, Public Notice, 36 FCC Rcd 788 (WTB/PSHSB 2021).

- American Association of State Highway and Transportation Officials (“AASHTO”)
- American Automobile Association (“AAA”)
- American Petroleum Institute (“API”)
- Association of American Railroads (“AAR”)
- Association of Public-Safety Communications Officials-International, Inc. (“APCO”)
- Aviation Spectrum Resources, Inc. (“ASRI”)
- Enterprise Wireless Alliance (“EWA”)
- Forest Industries Telecommunications (“FIT”)
- Forestry-Conservation Communications Association (“FCCA”)
- Government Wireless Technology & Communications Association (“GWTCA”)
- International Association of Fire Chiefs (“IAFC”)
- International Municipal Signal Association (“IMSA”)
- MRFAC, Inc. (“MRFAC”)
- Telecommunications Industry Association (“TIA”)
- The Monitoring Association (“TMA”)
- Utilities Technology Council (“UTC”)
- Wireless Infrastructure Association (“WIA”)

T-Band is an important wireless resource for many users represented by these organizations in some of the most spectrum-congested markets in the nation. The LMCC appreciates the Commission’s recognition of the critical nature of this band and its support for repeal of the T-Band Mandate. Having successfully recovered land mobile access to this spectrum, updated technical rules will allow land mobile licensees to deploy T-Band channels throughout the markets specified in Rule Section 90.303 while still protecting digital television stations from harmful interference.

II. PART 90, SUBPART L RULES ADOPTED IN 1970 DO NOT REFLECT THE CURRENT T-BAND SPECTRUM ENVIRONMENT.

The attached White Paper entitled An Updated Method to Determine Potential Interference Between Land Mobile Stations and Digital Television Stations Operating in the Band 470-512 MHz (T-Band) (“White Paper”) describes the conversion from analog to digital format by television stations since the original T-Band rules were adopted and sets out a detailed explanation of how the rules protecting those stations should be modified, consistent with that change. It is based on the fact that DTV stations are more immune to interference than analog televisions stations, making the current protection rules overly restrictive. Part 73 of the Rules recognizes the differences in interference immunity of DTV stations and provides updated criteria for interference between television stations. The attached white paper relies on the basic guidelines in Part 73 and adapts them to a set of standards for land mobile protection of DTV stations.

The White Paper addresses the defined noise-limited service contour (“NLSC”) of both full service and Class A television stations and recommends conservative, “safe harbor” distance separations that will allow interference-free sharing by television and land mobile stations. It provides a series of tables that specify the distance separations required to protect the following classes of television stations, based on defined parameters of the proposed land mobile station:

- 1) Protection of co-channel, full facility DTV stations;
- 2) Protection of adjacent channel, full facility DTV stations;
- 3) Protection of co-channel Class A DTV stations;
- 4) Protection of adjacent channel Class A DTV stations; and
- 5) Protection of IF Beat and Intermodulation (IM) channels.

These tables have been incorporated in the proposed Subpart L rules attached as Appendix A. Other updates have been included in the proposed rules as well, for example the deletion of references in Rule Section 90.311(a)(1) to user types such as telephone maintenance and taxicab that were eliminated as defined licensee categories in 1997.⁶ The proposed rules also delete all references to T-Band spectrum in Cleveland, Ohio and Detroit, Michigan. Footnotes 2 and 3 to the table in current Rule Section 90.303(b) note that the assigned channels will not be available until further order from the FCC. It has become evident over the intervening 50 years that these T-Band channels will not be usable in those markets because of Canadian considerations.

III. CONCLUSION

T-Band spectrum has been a mainstay for many hundreds of Public Safety and Industrial/Business land mobile licensees for five decades and will continue to support large numbers of systems now that the T-Band Mandate has been repealed. Its utility can be maximized by updating the rules governing television protection to recognize that the television industry has converted from an analog to digital format that warrants a different technical analysis to ensure continued interference-free operation. The other changes in the Appendix A proposed rules are common sense edits that delete provisions that are no longer relevant for purposes of regulating land mobile use of this spectrum.

⁶ *Private Land Mobile Services*, Report and Order, PR Docket No. 92-235, 12 FCC Rcd 14307 (1997).

The LMCC urges the FCC to adopt a Notice of Proposed Rulemaking consistent with the rule changes proposed herein at the earliest opportunity.

Respectfully submitted,

**LAND MOBILE COMMUNICATIONS
COUNCIL**

A handwritten signature in black ink, appearing to read "David B. Smith". The signature is written in a cursive style with a large, looping initial "D".

David Smith
President
2121 Cooperative Way, Suite 225
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June 24, 2021

ATTACHMENT 1

**An Updated Method to Determine
Potential Interference Between
Land Mobile Stations and
Digital Television Stations
Operating in the Band
470 – 512 MHz (T-Band)**

By
Ralph A. Haller
Forestry Conservation Communications Association
Land Mobile Communications Council
June 7, 2021

An Updated Method to Determine Potential Interference Between Land Mobile Stations and Digital Television Stations Operating in the Band 470 – 512 MHz (T-Band)

Background

The Federal Communications Commission (“FCC”) permitted land mobile sharing of television channels 14 – 20 (470 – 512 MHz) in Docket 18261, adopted May 20, 1970. Although the original proposal suggested land mobile operations in the top 25 markets in the country, sharing has been permitted only in the top 11 markets. The basis of the sharing was that land mobile base stations could be located within 80 km (50 miles) of the center city coordinates of the designated cities at full permitted facility levels while protecting television stations also operating at full permitted facility levels. Mobile stations could then operate with 48 km (30 mi) of the base stations and also provide adequate protection.

For protection purposes, analog (National Television System Committee, “NTSC”) television stations were considered to be operating at 1,000,000 watts ERP at all affected locations.¹ The maximum antenna height was taken as 2,000 feet Above Average Terrain (“AAT”). Land mobile stations were considered to have a maximum ERP of 1,000 watts with an antenna height of 500 feet (152.4 meters) AAT. Based on these maximum operating values, the Commission developed a set of five tables that show required distance separations to assure that the interference contours associated with mobile stations provide 50 dB co-channel protection to a television station’s Grade B contour (64 dB μ V/m, F(50,50), R-6602 propagation curves – 47 CFR Section 73.699). In the New York area, the protection was reduced to 40 dB. Adjacent channel protection was taken to be 0 dB protection of the Grade B contour in all areas. The land mobile interference contours were based on use of the F(50,10) R-6602 propagation curves.²

The result of the Commission’s interference study has resulted in Tables A – E of Section 90.309(b) of the *FCC Rules and Regulations*.³ The tables provide that land

¹ Although television stations in the UHF band were permitted to operate with up to 5,000,000 watts ERP, the Commission determined that the vast majority of stations in channels 14 – 20 operated at far less than maximum power and settled on protection at 1,000,000 watts ERP at 2,000 feet AAT.

² The R-6602 curves are also used for determination of land mobile to land mobile interference. However, the ERP is reduced by 9 dB before determining distance to contours with the curves to account for the lower antenna heights of land mobile receiving antennas. The original curves assumed an antenna height of 30 feet above ground. Mobile antennas are typically six feet or less above ground. In the case of land mobile to television interference, the curves are not reduced by 9 dB.

³ 47 C.F.R. § 90.309.

mobile stations can operate at 260 km (162 miles) from co-channel television stations, at full power and antenna height and provide 50 dB protection, or at 209 km (130 miles) with 40 dB protection. The tables then allow for land mobile operation at reduced ERP and antenna height to permit co-channel 50 dB protection at distances as close as 193 km (120 miles) for 50 dB protection and 145 km (90 miles) for 40 dB protection. (Tables A and B.) Tables C and D provide similar distances for mobile stations based on mobile ERP. Finally, Table E provides that land mobile base stations at 108 km (67 miles) or more from a first-adjacent television station will provide 0 dB protection to the Grade B contour. Reductions in land mobile power and antenna height can permit operation on adjacent channels at distances as close as 96 km (60) miles.

On October 22, 1991, the Commission released a *Public Notice* entitled, “*Private Land Mobile Operations in the 470 – 512 MHz Band*,” (PN Release number 20291). This *Public Notice* provided additional guidance on television station protection. Specifically, the PN provided an opportunity for a proposed land mobile applicant to show actual protection of a television station’s Grade B contour for both co-channel and adjacent channel situations based on the 50 dB, 40 dB, and 0 dB protection ratios described above. The PN allowed the applicant to propose co-channel stations at less than 193 km for 50 dB protection, less than 145 km for 40 dB protection, and 96 km for 0 dB protection. Although these applications required a waiver of the rules, the applications would presumptively be granted, as the required protection was being provided to television stations. The affected television station had to be served with a copy of the application and waiver request.

While the above procedures have been followed since their adoption, a major change has occurred that calls for their reexamination. Television stations have converted to digital transmission using the Advanced Television Systems Committee (“ATSC”) digital television (DTV) format (also called ATSC-1). Necessary protection of ATSC-1 digital stations is significantly different from protection of NTSC analog stations, but the FCC has not changed the protection rules. Changing the rules is a reasonable and necessary next step for continued land mobile sharing of the T-Band.

The Proposal

Since the adoption of the original protection requirements, the FCC has introduced other classes of television stations in addition to full service stations. These include Class A, low power television, TV translator, and TV booster stations. For protection purposes, only full service and Class A stations require protection, as all other classes operate as secondary services in those areas.⁴ Thus, only protection of full service and Class A digital television stations will be considered.

⁴ See, 47 C.F.R. § 74.703(e) and 47 C.F.R. § 74.709.

Digital television stations have a defined “noise-limited service contour” (NLSC) that must be protected. For full service stations at UHF, that is nominally the 41 dB μ V/m contour and is the 51 dB μ V/m contour for Class A stations.⁵ These contours are predicted using the F(50,90) UHF curve.⁶ The maximum ERP that can be requested by DTV stations is 1,000,000 watts at a Height Above Average Terrain (HAAT) of 365 meters or less for a full service station.⁷ Higher HAATs can be authorized with a corresponding decrease in ERP. The maximum ERP for a Class A DTV station is 15 kilowatts (11.7 dBk) without any HAAT limit.⁸

To determine the appropriate interference protection level, Section 73.623(c)(2) provides guidance. The table in this section requires a new digital television station to protect an incumbent full service digital television station’s 41 dB μ V/m F(50,90) contour by 15 dB (26 dB μ V/m F(50,10)) for co-channel protection and either -26 dB or -28 dB on the first-adjacent channels. These protection ratios are likely conservative for protection from land mobile stations, because land mobile stations are typically scattered within a 50 mile radius from each city, with each station having a different signal level at the television protected contour, but typically the potential for interference will be less than if all land mobile stations were at the minimum separation distance. Also, land mobile operations are intermittent and not all land mobile stations are likely to be transmitting at a given time. Finally, the planning factors for DTV assume that television receiving antennas have a 14 dB front-to-back ratio, giving further rejection to the land mobile stations. The same table requires only 2 dB co-channel protection for a new analog television station and -48 dB to -49 dB protection for adjacent channel protection. These analog television protection values may be more representative of the effect of a single land mobile station on a digital television station and further illustrate that using the DTV-DTV protection ratios is likely to be conservative.

The proper protection of the television stations from the totality of land mobile operations in an area probably lies between the DTV-to-DTV and analog-to-DTV ratios listed above. However, a conservative estimate for land mobile-to-DTV protection would be to allow for a receiving antenna front-to-back ratio of 6 dB, rather than the planning factor value of 14 dB. Doing this would then require an equivalent co-channel protection ratio of 9 dB at the station’s NLSC. This is equivalent to an F(50,10) field strength of 32 dB μ V/m. (41 dB μ V/m – 15 dB + 6 dB = 32 dB μ V/m). The corresponding adjacent-channel protection ratios would be -32 and -34 dB, which are equivalent to F(50,10) field strengths of 73 and 75 dB μ V/m. (41 dB μ V/m + 26 dB + 6 dB = 73 dB μ V/m and 41 dB μ V/m + 28 dB + 6 dB = 75 dB μ V/m). For convenience, we choose the lesser

⁵ See, 47 C.F.R. § 73.622(e)(1) and 47 C.F.R. § 73.6010(c)(3).

⁶ 47 C.F.R. § 73.625(b) provides a way to calculate the F(50,90) distance using the F(50,50) and F(50,10) curves. However, the FCC provides F(50,90) curves at <https://www.fcc.gov/media/radio/fm-and-tv-propagation-curves-graphs>.

⁷ See, 47 C.F.R. § 73.622(f)(8).

⁸ See, 47 C.F.R. § 73.6007 and 47 C.F.R. § 74.735(b)(2).

ratio of -32 dB to apply conservatively to both adjacent channels. Land mobile protection levels would be 10 dB higher for protection of Class A digital television stations.

Using the F(50,90) curve for UHF television, the distance to the 41 dB μ V/m (50,90) contour for a full service, full power and 365 meter HAAT station is 103 km. The distance to the 32 dB μ V/m F(50,10) full power/antenna height land mobile station is 79 km. Thus, a land mobile station separated from a co-channel maximum facility television station by 182 km (103 km + 79 km) should provide the required protection. For the adjacent channel situation, the distance to the land mobile 73 dB μ V/m F(50,10) contour is 10.5 km, which we round to 11 km. So, a full facility land mobile station, a separation of 114 km (103 km + 11 km) from an adjacent channel full facility television station should provide the required protection.

The situation for a Class A station is more difficult because no limit on the height above average terrain is specified. Assuming that a Class A station could not exceed the maximum height for a full facility DTV station, then calculations could be done at 365 meters HAAT, but this is very conservative based on the typical Class A facility. A more reasonable, yet conservative, HAAT would be 250 meters. This height would cover 19 of the 24 Class A stations that require protection, using the FCC's list of required station protections.⁹ At this height, the distance to the 51 dB μ V/m F(50,90) contour at maximum power would be 53 km. The distance to the land mobile 42 dB μ V/m F(50,10) contour is 53 km. This suggests a separation of 106 km would protect a majority the co-channel Class A DTV station from a full facility land mobile station. Using a value of 6.0 km for the distance to the land mobile 84 dB μ V/m F(50,10) contour, a separation of 59 km from an adjacent channel Class A DTV station would be adequate. Due to the short distance for the land mobile 84 dB μ V/m F(50,10) contour, that value can be used for all lesser combinations of land mobile ERP and HAAT.

The above distances can be considered as "Safe Harbor" distances. Certainly, land mobile facilities of lesser parameters could be closer to the television stations and television stations operating at less than maximum facilities would require less protection.

These distances are also important when considering where DTV stations can be located with respect to the land mobile city reference points. Section 73.623(e) requires that DTV stations be at least 250 km from the reference points for co-channel stations and 176 km for adjacent channel stations.¹⁰ For co-channel situations involving DTV stations, from above, the Safe Harbor separation was determined to be 182 km. A properly fully distanced television station would then be 68 km (250 km – 182 km)

⁹ A listing of the Class A stations requiring protection is shown in Attachment One. Most of the stations with HAATs above 250 meters are in California and presumably on mountains.

¹⁰ 47 C.F.R. § 73.623(e).

farther from the reference point than required for interference protection. Thus, a land mobile base station operating within 68 km of the city reference coordinates and at full permitted facilities will fully protect a fully distanced co-channel television station. Between 68 km and 80 km from the city coordinates, the base station may need to reduce power or antenna height to protect the co-channel television station, depending on the actual distance to the television station.

A similar situation exists for adjacent channel DTV television stations, as 176 km separation is required from the city reference points and the adjacent channel DTV television station. The Safe Harbor distance, from above, is 114 km, or 11 km beyond the DTV station's maximum 41 dBµV/m F(50,90) contour. A land mobile base station operating at 80 km from the city reference point could then be as close as 96 km (176 km – 80 km) to the DTV station. This would be 17 km closer than the Safe Harbor distance, but any location at or less than 63 km (80 km – 17 km) from the city reference points would be considered to provide the required protection. Operation between 63 and 80 km from the city reference points would require detailed analysis, with a possible corresponding decrease in ERP and/or HAAT. For the vast majority of situations, the land mobile base station need not consider DTV television stations meeting the Safe Harbor distance. DTV stations not meeting that separation distance would require more detailed study.

The above analysis can be condensed into a series of tables: 1) protection of co-channel, full facility, DTV stations, 2) protection of adjacent channel, full facility, DTV stations, 3) protection of co-channel, Class A, DTV stations, and 4) protection of adjacent channel, Class A, DTV stations. To produce the charts, television stations were assumed to be operating at the maximum facility levels specified above and land mobile stations were operating a reduced ERP and HAAT levels, as specified in the tables. Separation distances in the tables are in kilometers.

Table One
Separation Distances (km) for Co-Channel Full Facility DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	161	168	174	178	182
800	157	164	170	174	178
600	153	160	166	170	173
400	148	155	161	165	168
200	141	149	155	159	162
100	134	143	149	153	156

Table Two
Separation Distances (km) for Adjacent Channel Full Facility DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	109	110	111	112	113
800	108	109	110	112	113
600	107	108	110	111	112
400	106	108	109	110	111
200	106	107	108	109	110
100	106	106	107	108	109

Table Three
Separation Distances (km) for Co-Channel Class A DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	84	93	99	103	106
800	82	91	97	101	104
600	80	89	95	99	102
400	77	86	92	96	99
200	73	82	87	91	94
100	69	77	82	86	89

Table Four
Separation Distance for Adjacent Channel Class A DTV Station

59 km in all cases.

Table One can be displayed as a graph which makes it easier to interpolate between antenna heights and ERPs. See Figure 1.

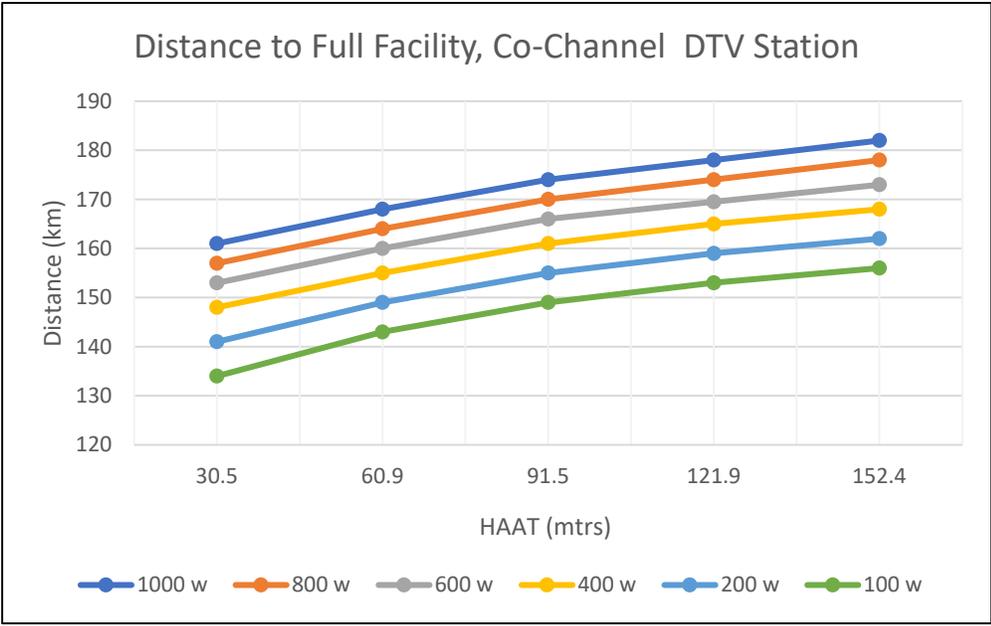


Figure 1. Separation distances required for co-channel protection of DTV stations by land-mobile base stations.

Table Two can easily be interpolated without a graph.

Table Three can also be displayed as a graph for ease of interpolation. See Figure 2.

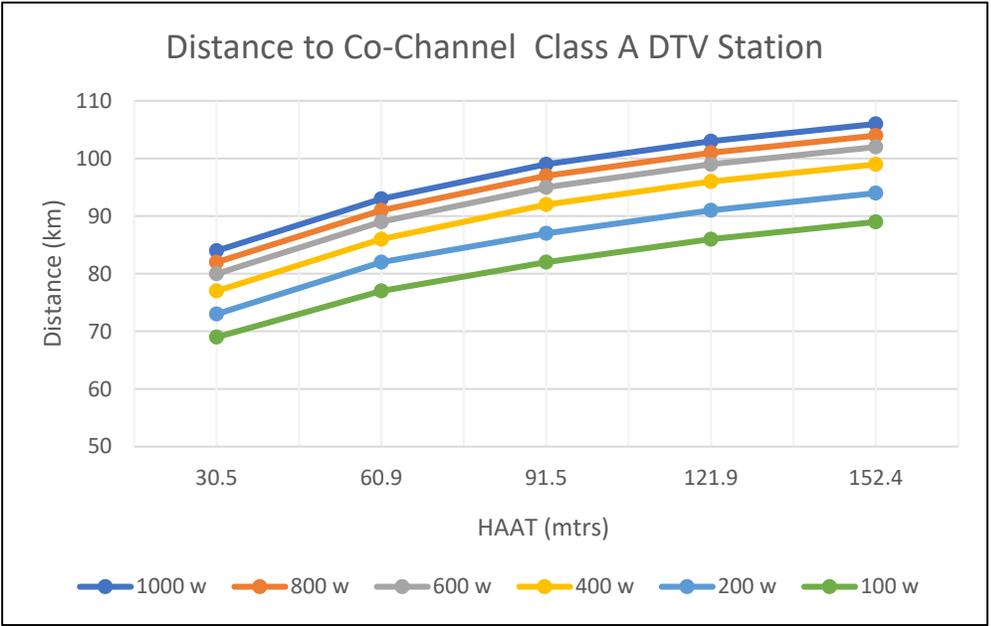


Figure 2. Separation distances required for co-channel protection of Class A DTV stations by land-mobile base stations.

Table Four has no interpolation.

Although the above charts provide Safe Harbor distances, often the actual DTV facility will be operating with lesser facilities than what is being protected by the above charts. This gives rise to the possibility of using contour studies of actual facilities in lieu of meeting the Safe Harbor tables. Again, the contour values that are required for protection are shown below. These must be produced using the FCC propagation curves that have not been modified by 9 dB for land mobile studies. If the contour study software that is available will only produce land mobile contours, then the ERP of both the DTV station and the land mobile base station must be increased by 9 dB. Land mobile stations licensed on the basis of contours to *a less than full facility*, full service, DTV television station should be secondary to allow the television station in increase to full facilities at a later date. Class A stations would be protected at their currently licensed facilities and land mobile stations licensed by contour studies would be primary.

	Protected Contour	Land Mobile Contour
DTV Co Channel	41 dB μ V/m (50,90)	32 dB μ V/m F(50,10)
DTV Adjacent Channel	41 dB μ V/m (50,90)	73 dB μ V/m F(50,10)
Class A Co Channel	51 dB μ V/m (50,90)	42 dB μ V/m F(50,10)
Class A Adjacent Channel	51 dB μ V/m (50,90)	84 dB μ V/m F(50,10)

Mobile and control station protection requirements present another challenge. The R-6602 curves do not extend below HAATs of 30.5 meters (100 feet). One approach would be to use the values in Tables One and Two at 30.5 meters. That may be appropriate for control stations, in some cases with higher antennas, but often not for mobile stations. Another approach is to use Longley-Rice predictions for 50,10,50 parameters (time, location, confidence) and the continental temperate zone.¹¹ Using predictions from ComStudy[®], a mobile station with ERP of 200 watts and an antenna HAAT of 2 meters would produce a 32 dB μ V/m F(50,10,50) at 21.7 km. But, if the front-to-back ratio of the television antenna is assumed to be 6 dB, the effective distance would be reduced to 13.6 km. The 42 dB μ V/m F(50,10,50) contour would be at 13.5 km, or 8.2 km if the 10 dB ratio is applied. This assumes a television receive antenna height of 10 meters (30 feet) which is consistent with the R-6602 curves. Distances to the 73 and 83 dB μ V/m F(50,10,50) contours are trivial, as they are less than two kilometers.

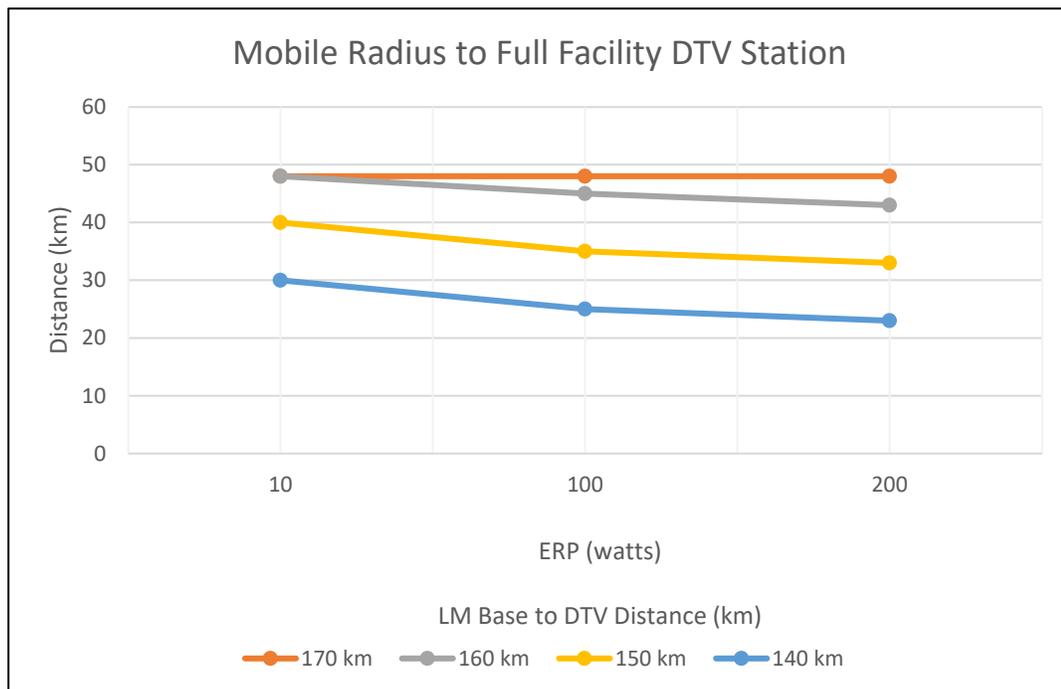
¹¹ See, FCC OET Bulletin 69, Longley-Rice Methodology for Evaluating TV Coverage and Interference, February 5, 2004, III. Part 2: Evaluation of Interference, first paragraph (page 7).

So, a mobile station operating at 200 watts would need to be no closer than 116.6 km to a full facility DTV station (103 km protected contour + 13.6 km distance to interference contour). To determine a permitted radius of operation, the 116.6 km required distance would be subtracted from the distance between the land mobile base station and the DTV station. Assume the distance between stations to be 182 km, then the mobile radius would be rounded to 65 km (182 km – 116.6 km). The value currently in the rules is 48 km and it is proposed that this would be retained. From this, a table can be constructed showing reduced radii based on land mobile to DTV station separation and mobile station power. (Mobile 32 dB μ V/m radius corrected by 10 dB: 100 watts = 12.2 km, 10 watts = 6.6 km.)

Table Five
Mobile Station Radii Around a Base Station to Protect Full Facility DTV Stations

ERP (w)	10	100	200
Dist (km)			
182	48	48	48
170	48	48	48
160	48	45	43
150	40	35	33
140	30	25	23

Converting Table Five to a graph gives: (Note any distance greater than 170 km allows a 48 km mobile service area.)

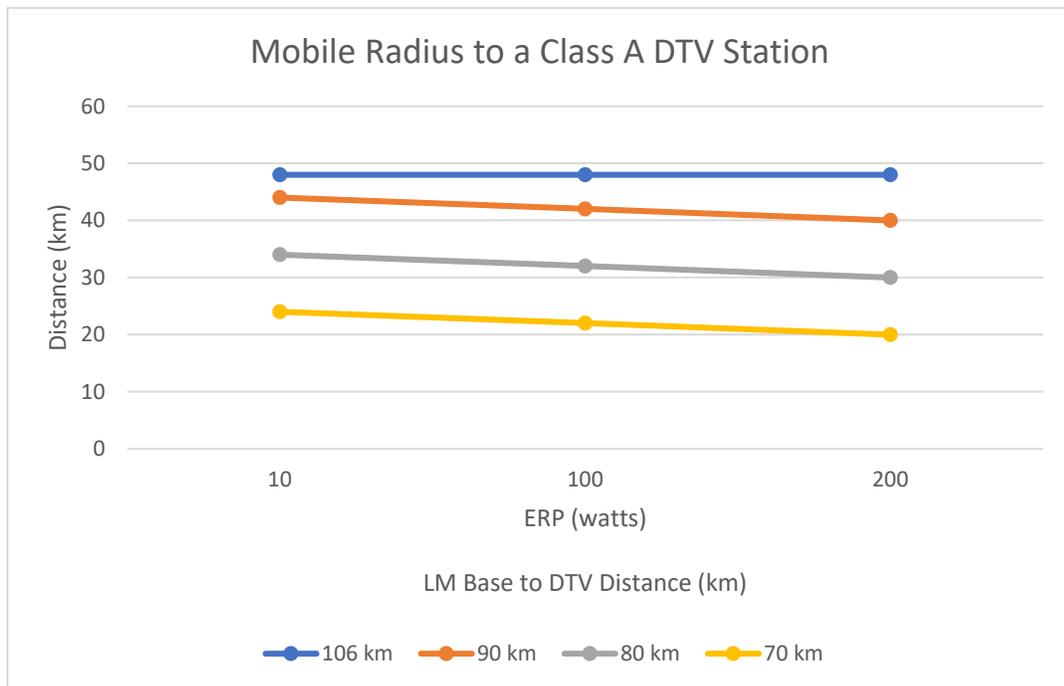


For Class A DTV stations, the distance to the 51 dB μ V/m F(50,90) was determined to be 42 km. Again, using Longley-Rice as described above, the distance to the land mobile 43 dB μ V/m F(50,10,50) contour at 200 watts ERP is 13.5 km. Applying the 10 dB television receiver factor, the distance reduces to 8.0 km. The rounded required separation distance between the land mobile station and the Class A DTV station is 50 km (42 km + 8 km). (Mobile 42 dB μ V/m radius corrected by 10 dB: 100 watts = 6.3 km, 10 watts = 3.9 km.)

Table Six
Mobile Station Radii Around a Base Station to Protect Class A DTV Stations

ERP (w)	10	100	200
Dist (km)			
106	48	48	48
90	44	42	40
80	34	32	30
70	24	22	20

Converting Table Six to a graph gives: (Note any distance greater than 106 km allows a 48 km mobile service area.)



It is recommended that control stations be treated as mobile stations for ERP levels of 100 watts or less and 6.1 meters above ground or less. Generally, control stations are little more than mobile stations operating on a fixed power supply. Larger control stations should be treated in a similar manner to base stations.

Adjacent channel protection from mobiles is a somewhat trivial case. As stated above, the distances to the 73 and 83 dB μ V/m F(50,10,50) contours are less than 2 km. So any distance greater than 105 km from a full service DTV station (103 km + 2 km) or 55 km from a Class A DTV station (53 km + 2 km) would provide the required adjacent channel protection.

Distributed Transmission Systems (DTS)

The FCC has recently modified its rules to allow expanded use of DTS technology for “next generation” or “ATSC 3.0” technology. In this type of system, multiple transmitters would be placed in the station’s service area to provide coverage rather than a single transmitter. The new rules allow the DTS 41 dB μ V/m F(50,50) contours to be contained within the station’s original 41 dB μ V/m F(50,50) contour. But, paragraph two of the *Report and Order* specifically states that a station employing DTS technology will not be entitled to interference protection beyond its authorized service area (see also, paragraph 17). Therefore, protection of the currently licensed 41 dB μ V/m F(50,90) contour is all that a DTS licensee can expect.¹² A similar approach was adopted for Class A DTV stations. Thus, this proposal need not further consider DTS technology.

Conclusion

Using the general protection guidelines provided in Parts 73 and 74 of the *FCC Rules and Regulations*, protection requirements can be developed for land mobile stations operating in the T-Band. Utilizing the protection criteria described above, Safe Harbor distances can be determined that will protect full facility DTV televisions, both co-channel and adjacent channel, and typical Class A DTV stations, again co-channel and adjacent channel. Land mobile facilities less than the maximum permitted will allow shorter spacings, as outlined in the above tables and graphs. But, failure to meet the Safe Harbor distances may not mean that the land mobile base station or mobile service area cannot be licensed. Often the DTV facilities are less than that being protected. In that case, contours for the actual DTV facilities and land mobile base station facilities should be used to develop the required protection contours. If the contours do not overlap, then the land mobile base stations should be able to be licensed on a secondary basis with the proper showing to the Federal Communications

¹² In the Matter of Rules Governing the Use of Distributed Transmission System Technologies, MB Docket 20-74, and Authorizing Permissive Use of the “Next Generation” Broadcast Television Standard, GN Docket 16-142, Report and Order, adopted January 13, 2021.

Commission, without a waiver request. Mobile radii of operation can then be computed and licensed.

The Federal Communications Commission should update the protection rules in Subpart L of Part 90 to reflect protection of DTV, rather than analog, television stations.

ATTACHMENT ONE

CLASS A DTV STATIONS SHOWING HAAT VALUES FOR EACH

CALL	HAAT - MTRS
WNYS	-91
KSBB	44
WOBC	77
WCBZ	93
WYSH	93
WYSJ	93
WCRP	100
WFWC	117
WJMB	119
WXSP	120
WFNY	160
K21DO	176
WOHL	183
WBGH	203
WFDC	222
WKTD	222
WBYD	227
KLDF	232
K17GD	236
WAZT	312
KTLD	373
KBBV	386
KUVS	562
K17JI	619

ATTACHMENT 2

Subpart L – Authorization in the Band 470-512 MHz (UHF-TV Sharing)

§90.301 Scope.

This subpart governs the authorization and use of frequencies by land mobile stations in the band 470-512 MHz on a geographically shared basis with Digital Television Broadcast Stations, both full service and Class A. Under this sharing plan, different frequencies are allocated depending on the geographic urban area, as full detailed in the following rule sections. Protection of TV booster, TV translator, and Low Power television stations is not required.

§90.303 Availability of frequencies.

- (a) Frequencies in the 470-512 MHz band are available for assignment as described below. Coordinates are referenced to North American Datum 1983 (NAD83).
- (b) The following table lists frequency bands that are available for assignment in specific urban areas. The available frequencies are listed in §90.311 of this part.

Urbanized area	Geographic center		Bands (MHz)	TV channels
	North latitude	West longitude		
Boston, MA	42°21'24.4"	71°03'23.2"	470-476, 482-488	14, 16
Chicago, IL ¹	41°52'28.1"	87°38'22.2"	470-476, 476-482	14, 15
Dallas/Fort Worth, TX	32°47'09.5"	96°47'38.0"	482-488	16
Houston, TX	29°45'26.8"	95°21'37.8"	488-494	17
Los Angeles, CA ²	34°03'15.0"	118°14'31.3"	470-476, 482-488, 506-512	14, 16, 20
Miami, FL	25°46'38.4"	80°11'31.2"	470-476	14
New York, NY/NE NJ ³	40°45'06.4"	73°59'37.5"	470-476, 476-482, 482-488	14, 15, 16
Philadelphia, PA	39°56'58.4"	75°09'19.6"	500-506, 506-512	19, 20
Pittsburgh, PA	40°26'19.2"	79°59'59.2"	470-476, 494-500	14, 18
San Francisco/Oakland, CA	37°46'38.7"	122°24'43.9"	482-488, 488-494	16, 17
Washington, DC/MD/VA	38°53'51.4"	77°00'31.9"	488-494, 494-500	17, 18

¹In the Chicago, IL, urbanized area, channel 15 frequencies may be used for paging operations in addition to low power base/mobile usages, where applicable protection requirements for ultrahigh frequency television stations are met.

²Channel 16 is available in Los Angeles, CA, for use by eligibles in the Public Safety Radio Pool.

³The band 482-488 MHz (TV Channel 16) is available for use by eligibles in the Public Safety Radio Pool in the following areas: New York City; Nassau, Suffolk, and Westchester counties in New York State; and Bergen County, New Jersey.

§90.305 Location of stations.

- (a) The transmitter site(s) for base station(s), including mobile relay stations, shall be located not more than 80 km. (50 mi.) from the geographic center of the urbanized area listed in §90.303.
- (b) Mobile units shall be operated within 48 km. (30 mi.) of their associated base station or stations. Such units may not be operated aboard aircraft in flight except as provided for in §90.315(i).
- (c) Control stations must be located within the area of operation of the mobile units.
- (d) Base and control stations shall be located a minimum of 1.6 km. (1 mi.) from local television stations operating on UHF TV channels separated by 2, 3, 4, 7, 8, 14 and 15 TV channels from the television channel in which the base station will operate.

§90.307 Protection Criteria.

- (a) The tables and figures listed in §90.309 shall be used to determine the effective radiated power (ERP) and antenna height of the proposed land mobile base (repeater) station.
- (b) Base/repeater stations operating on the frequencies available for land mobile use in any urbanized area and having an antenna height (AAT) less than 152 meters (500 feet) shall afford protection to co-channel and adjacent channel television stations in accordance with the tables and charts set out in §90.309.
- (c) For base stations having antenna heights between 152 and 914 meters (500-3000 feet) above average terrain, the effective radiated power must be reduced below 1 kilowatt in accordance with the values shown in the power reduction graph in Table Eight in §90.309.
- (d) Mobile units and control stations operating on the frequencies available for land mobile use in any given urbanized area shall afford protection to co-channel and adjacent channel television stations in accordance with the values set forth in §90.309.
- (e) The television stations to be protected (co-channel, adjacent channel, IM, and IF) in any given urbanized area, in accordance with the provisions of paragraphs (a), (b), (c), and (d) of this section, are identified in the Commission's publication "TV stations to be considered in the preparation of Applications for Land Mobile Facilities in the Band 470-512 MHz." The publication is available at the offices of the Federal Communications Commission in Washington, DC or upon the request of interested persons.

§90.309 Tables, charts, and figures.

- (a) *Directions for using the tables and charts.* Using the method specified in §1.958 of this chapter, determine the distances between the proposed land mobile base/repeater station and the protected co-channel television stations and between the proposed land mobile base/repeater station and the protected adjacent channel television stations. If the exact mileage does not appear in table or chart, values may be interpolated. The lowest base/repeater parameters determined on the television station by television station study shall be the maximum parameters permitted for the land mobile base/repeater station.
- (b) For the tables, start in the column that is equal to or higher than the HAAT of the proposed base/repeater station. Move down that column to find a distance that is greater than or

equal to the distance determined in paragraph (a) of this section for each television station. The allowable ERP for the land mobile base/repeater station can be found by moving left in the table to the Pwr(w) column. The table can be interpolated between rows and columns to find more refined ERP levels. Charts are also provided to make interpolation easier for some tables.

Table One
Separation Distances (km) for Co-Channel Full Facility DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	161	168	174	178	182
800	157	164	170	174	178
600	153	160	166	170	173
400	148	155	161	165	168
200	141	149	155	159	162
100	134	143	149	153	156

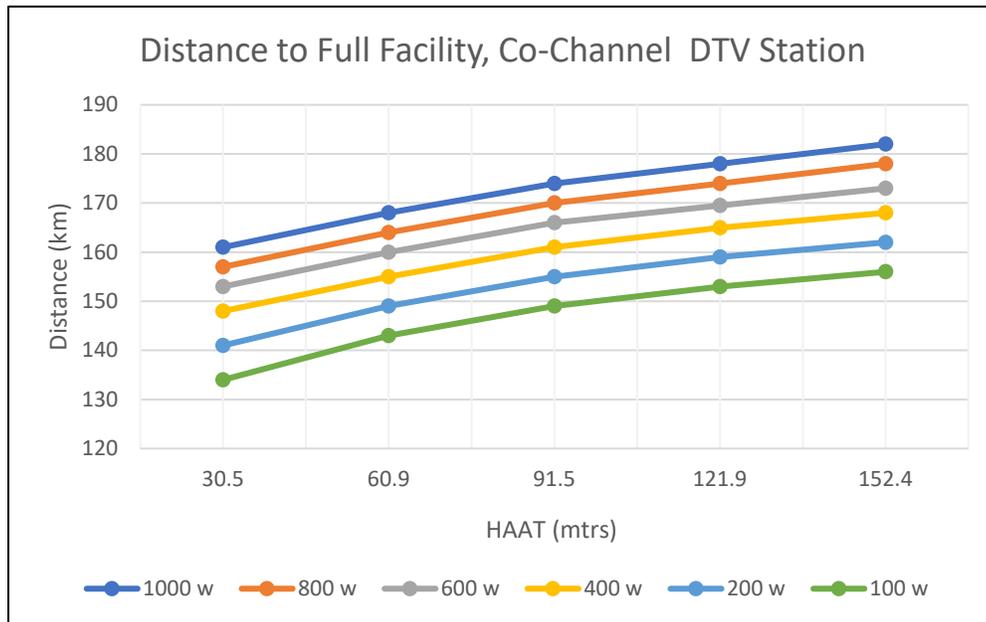


Figure 1. Separation distances required for co-channel protection of DTV stations by land-mobile base stations. (Graph of Table One.)

Table Two
Separation Distances (km) for Adjacent Channel Full Facility DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	109	110	111	112	113
800	108	109	110	112	113
600	107	108	110	111	112
400	106	108	109	110	111
200	106	107	108	109	110
100	106	106	107	108	109

Table Three
Separation Distances (km) for Co-Channel Class A DTV Stations

Pwr (w)	HAAT				
	30.5 m 100 ft	60.9 m 200 ft	91.5 m 300 ft	121.9 m 400 ft	152.4 m 500 ft
1000	84	93	99	103	106
800	82	91	97	101	104
600	80	89	95	99	102
400	77	86	92	96	99
200	73	82	87	91	94
100	69	77	82	86	89

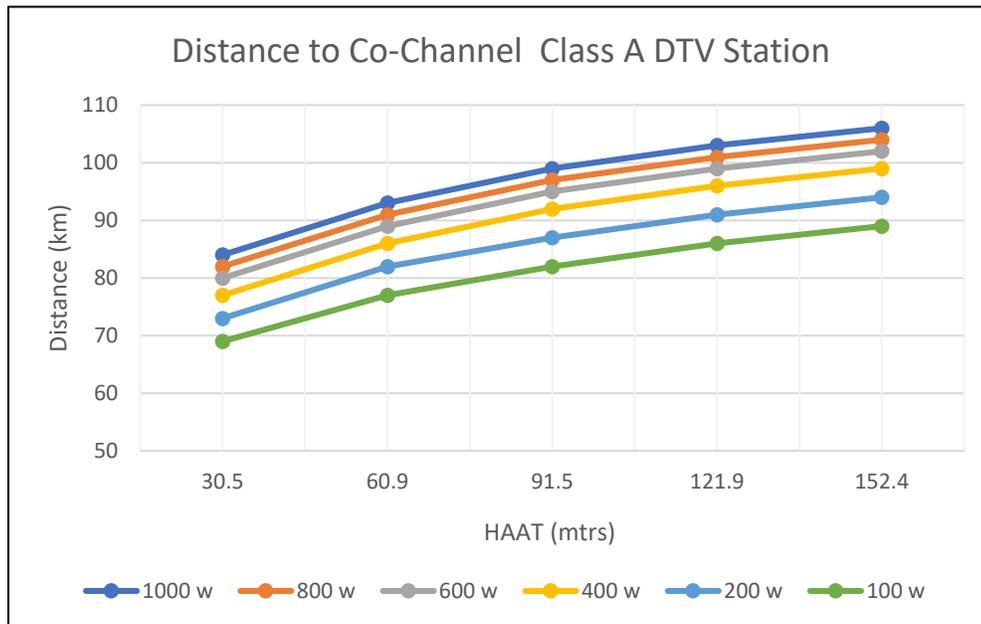


Figure 2. Separation distances required for co-channel protection of Class A DTV stations by land-mobile base stations. (Graph of Table Three.)

Table Four
Separation Distance for Adjacent Channel Class A DTV Station

59 km in all cases.

- (c) Although the above tables and charts provide Safe Harbor distances, the DTV station may be operating at less than the fully permitted parameters. In that case a contour overlap study may be provided to show the compliance with the required contour overlap protections shown in Table Five. Studies must be done with the UHF R-6602 curves found in §73.699 of the Rules or using the equivalent charts provided by the Commission’s Office of Science and Technology. Using this method to protect full facility DTV stations will result in the land mobile base/mobile station being licensed as secondary status, allowing the DTV station to increase its facilities at a future time. Class A stations will be protected at their current parameters and the land mobile base/mobile station will be licensed as primary.

Table Five
Contour Protection Values to Protect DTV Stations

	Protected Contour	Land Mobile Contour
DTV Co Channel	41 dBµV/m (50,90)	32 dBµV/m F(50,10)
DTV Adjacent Channel	41 dBµV/m (50,90)	73 dBµV/m F(50,10)
Class A Co Channel	51 dBµV/m (50,90)	42 dBµV/m F(50,10)
Class A Adjacent Channel	51 dBµV/m (50,90)	84 dBµV/m F(50,10)

- (d) Mobile stations may be licensed with a service radius based on the separation distance between the land mobile base/repeater station and the closest protected DTV station. Tables Six and Seven provide allowed mobile radii and these distances are shown graphically in Figures Three and Four. The Tables and Charts are for co-channel protection. The maximum mobile service radius is 48 km. For adjacent channel protection, any distance greater than or equal to 105 km between the land mobile base/repeater station and the full service DTV station allows the maximum of 48 km mobile radius. The maximum mobile service radius is 48 km. For Class A stations, any distance greater than or equal to 55 km between the land mobile base/repeater station and the Class A DTV station will allow a 48 km mobile radius.

Table Six
Mobile Station Radii Around a Base Station to Protect Full Facility DTV Stations

ERP (w)	10	100	200
Dist (km)			
182	48	48	48
170	48	48	48
160	48	45	43
150	40	35	33
140	30	25	23

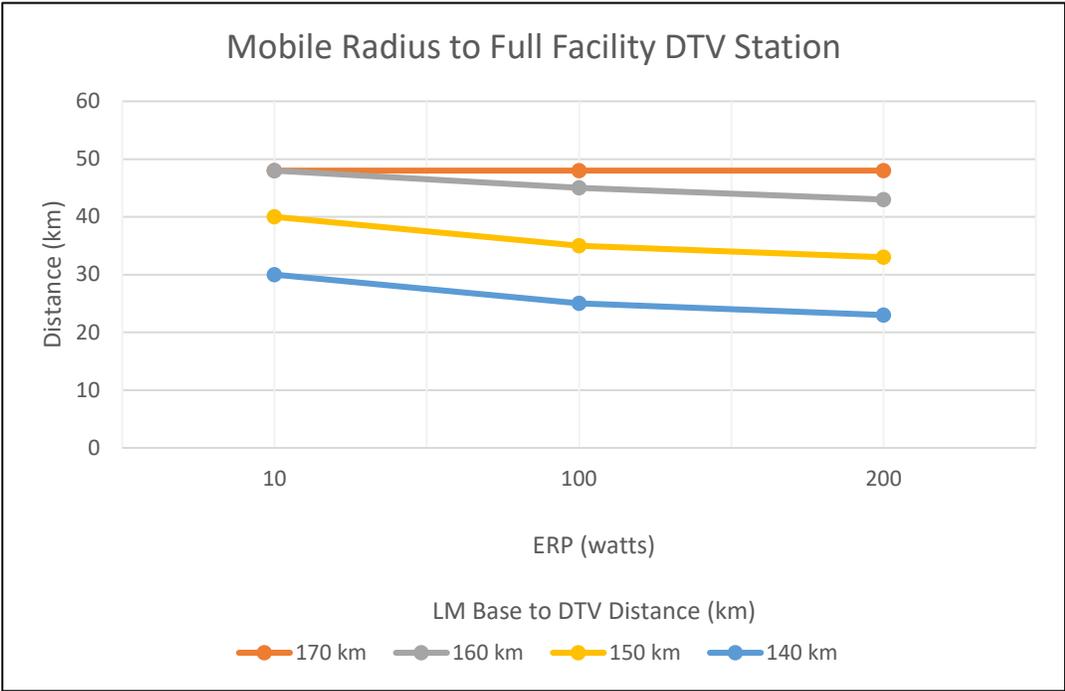


Figure 3. Allowable mobile radii based on separation from the land mobile base/repeater to the closest full facility DTV station. (Graph of Table Six.)

Table Seven
Mobile Station Radii Around a Base Station to Protect Class A DTV Stations

ERP (w)	10	100	200
Dist (km)			
106	48	48	48
90	44	42	40
80	34	32	30
70	24	22	20

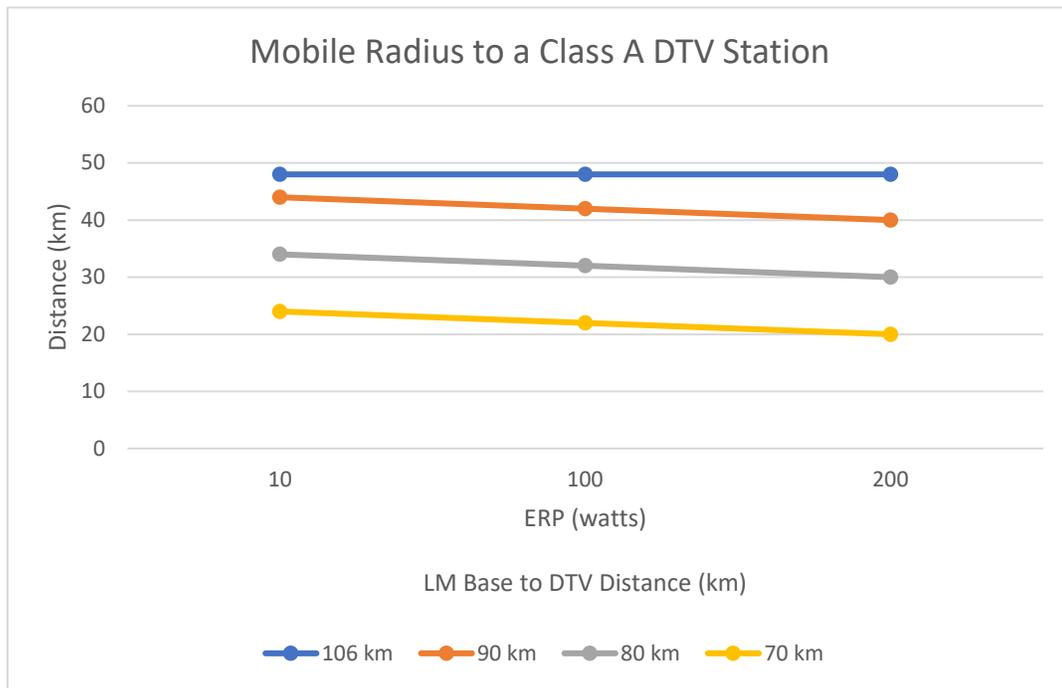


Figure 4. Allowable mobile radii based on separation from the land mobile base/repeater to the closest Class A DTV station. (Graph of Table Seven.)

- (e) Control stations having an antenna height not greater than 6.1 meters above ground can be treated as a mobile station using the above charts. The maximum permitted ERP for a control station is 200 watts. For control stations having an antenna height greater than 6.1 meters above ground, the charts for land mobile base/repeater parameters must be used. Control stations having antenna heights above 6.1 meters must be individually licensed.
- (f) Land mobile base/repeater stations having a HAAT heights between 152 and 914 meters (500-3000 feet) shall reduce ERP according to the following table. ERP values may be interpolated between listed values in Table Eight and/or Figure 5. If the distance to the protected television station would require a power reduction under the 152 meter HAAT column of any of the Tables and Figures in §90.309, then the dB deduction in Table Eight would be applied to the power determined in §90.309, but in no case less than one watt. For example, if the distance between the protected television station and the land mobile base/repeater was determined to be 173 km, then Table A would allow a maximum of 600 watts ERP. Assume the actual land mobile to be 500 meters, a reduction of 10.0 dB would need to be applied to the 600 watts ERP, or 60 watts ERP would be the maximum allowed.

Table Eight
Power Reduction Due to High HAAT

HAAT (m)	ERP	dB
100	1000	0.0
152	1000	0.0
200	710	-1.5
300	320	-4.9
400	165	-7.8
500	100	-10.0
600	65	-11.9
700	45	-13.5
800	33	-14.8
900	25	-16.0
1000	21	-16.8
2000	8	-21.0
3000	5	-23.0
4000	4	-24.0
5000+	3	-25.2

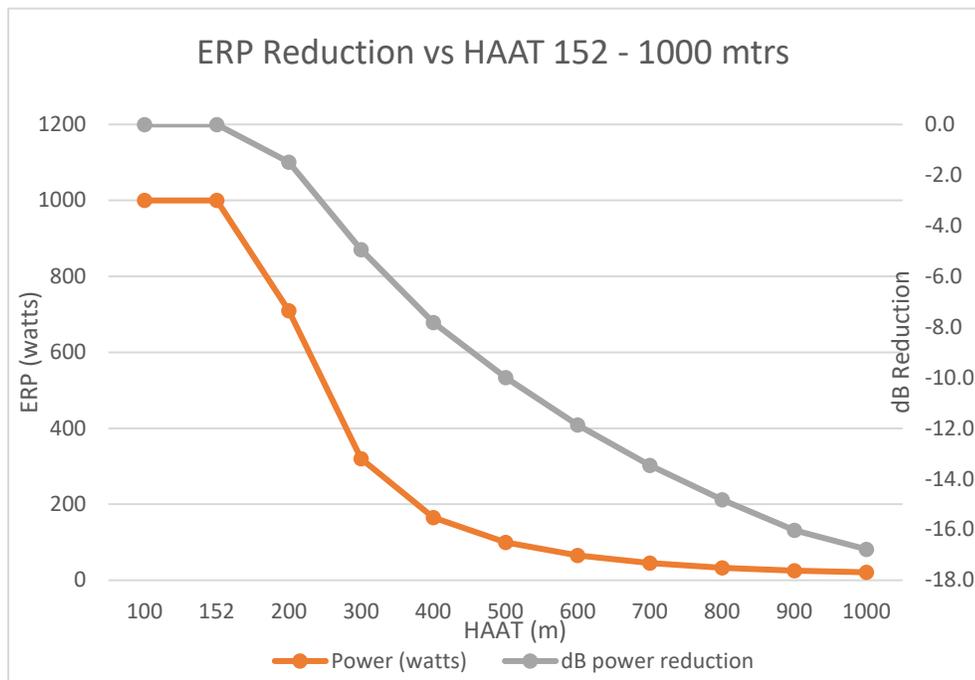


Figure 5. Required ERP reductions between 152 and 1,000 meters HAAT for an allowed ERP of 1,000 watts as determined in §90.309..

§90.311 Frequencies.

- (a) Except as provided for in §90.315 and except for those frequencies allocated to services in part 22 of this chapter (see §§22.591, 22.621, 22.651, and 22.1007 of this chapter) the

following frequencies in the band 470-512 MHz may be assigned as indicated in the table below. The first and last assignable frequencies are shown. Assignable frequencies occur in increments of 6.25 kHz. The separation between base and mobile transmit frequencies is 3 MHz for two frequency operation. All channels having five decimal places and ending in "5" will be authorized a maximum channel bandwidth of 6.25 kHz. All other channels will be allowed a maximum channel bandwidth of 12.5 kHz. (Stations already authorized a channel bandwidth of 25.0 kHz may continue to use that bandwidth until notified by the Commission of a required reduction in channel bandwidth.)

Channel Assignment	Urbanized Area	General access pool	
		Base and mobile	Mobile
14	Boston, MA Chicago, IL Miami, FL New York/N.E. NJ Pittsburgh, PA	470.30625 to 472.99375	473.30625 to 475.99375
14	Los Angeles, CA	470.05625 to 472.99375	473.05625 to 475.99375
15	Chicago, IL New York/N.E. NJ	476.30625 to 478.99375	479.30625 to 481.99375
16	Boston, MA Dallas/Fort Worth, TX San Francisco/Oakland, CA	482.30625 to 484.99375	485.30625 to 487.99375
16	Los Angeles, CA (Use is restricted to Public Safety Pool eligibles)	482.00625 to 484.99375	485.00625 to 487.99375
17	Houston, TX San Francisco/Oakland, CA Washington, DC/MD/VA	488.30625 to 490.99375	491.30625 to 493.99375
18	Pittsburgh, PA Washington, DC/MD/VA	494.30625 to 496.99375	497.30625 to 499.99375
19	Philadelphia, PA	500.30625 to 502.99375	503.30625 to 505.99375
20	Los Angeles, CA	506.13125 to 508.99375	509.13125 to 511.99375
20	Philadelphia, PA	506.30625 to 508.99375	509.30625 to 511.99375

- a. Channel availability in the General Access Pool in any of the urbanized areas referred to in the table depends on whether that channel is presently assigned to either the Public Safety pool, as defined in §90.20 or the Business/Industrial pool, as defined in §90.35.
- b. If a channel is assigned in a market area, subsequent authorizations in that market will only be granted to users from the same pool, or, if the channel should subsequently become unassigned, it will be treated as available to both pools. If the conditions of §90.187 are met and the distance between a proposed station and an incumbent station exceeds 60 km, the applicant may request licensing in the other pool. An applicant can also request licensing in the other pool with a letter of concurrence from all incumbents on the channel in the market area.

§90.313 Frequency loading criteria.

- (a) To obtain exclusive use of a channel in an area, the following loading standards must be met:
 - a. 50 units for systems eligible in the Public Safety pool.
 - b. 90 units for systems eligible in the Business/Industrial pool.
- (b) If a licensee has exclusive use of a frequency, then the loading standards in paragraph (a) of this section, may be exceeded. If it is a shared channel, the loading standards can be exceeded upon submission of a signed statement by all those sharing the channel agreeing to the increase.
- (c) A unit is defined as a mobile transmitter-receiver. Loading standards will be applied in terms of the number of units actually in use or to be placed in use within 8 months following authorization. Channel capacity may be reached either by the requirements of a single licensee or by several users sharing a channel. Until a channel is licensed to capacity it will be available for assignment to other users in the same area. A frequency pair may be reassigned at distances 64 km. (40 mi) or more from the location of base stations authorized on that pair without reference to loading at the point of original installation.

§90.315 Special provisions governing the use of frequencies in the 476-494 MHz band (TV channels 15, 16, and 17) in the Southern Louisiana-Texas Offshore Zone.

- (a) The frequency bands from 490-491 and 493-494 MHz will be available for assignment to stations governed by this part within Zone A. The boundaries of Zone A are from longitude 87°45' on the east to longitude 94°00' on the west, and from the 3-mile limit along the Gulf of Mexico shoreline on the north to the limit of the Outer Continental Shelf on the south. The frequency bands from 484-485 and 476-488 MHz will be available for assignment to stations governed by this part within Zone B. The boundaries of Zone B are from longitude 87°45' on the east to longitude 95°00' on the west and from the 3-mile limit along the Gulf of Mexico shoreline on the north to the limit of the Outer Continental Shelf on the south. The frequency bands from 478-479 and 481-481 MHz will be available for assignment to stations governed by this part within Zone C. The boundaries of Zone C are from longitude 94°00' on the east, the 3-mile limit on the north and west, a 281 km (175 mile) radius from

the reference point at Linares, N.L., Mexico on the southwest, latitude 26°00' on the south, and the limits of the Outer Continental Shelf on the southeast. These frequencies may also be assigned to fixed stations located on shore designed to provide communications service within the zone.

- (b) Offshore base/repeater/mobile, and offshore and shore fixed stations may be authorized.
- (c) F2, F3, F4, F9, and A2, A3, A4, and A9 emissions may be authorized.
- (d) Offshore stations shall afford cochannel and adjacent channel DTV station protection on channels 14, 15, 16, 17, and 18 as described in the Tables and Figures in §90.309 of this section.
- (e) Shore stations communicating point-to-point with offshore stations will be permitted at least the same ERP as the offshore station, but only in the direction of the offshore station. A directional antenna shall be used and the rearward radiated power from the antenna in a sector $\pm 22\frac{1}{2}^\circ$ from the line joining the shore antenna to the cochannel television station shall not exceed those described in §90.309 of this section.
- (f) Mobile stations shall not operate closer to shore than 6.4 km (4 miles) beyond the three mile limit and shall not operate with an ERP in excess of 100 watts with 9.1 m (30 ft) maximum antenna height.
- (g) Mobile stations installed in aircraft shall operate 11 km (7 miles) beyond the three mile limit and shall not operate with an ERP in excess of 1 watt or at heights in excess of 305 m (1000 feet) AMSL.
- (h) The following frequency bands are available for assignment in all services for use in the Zones defined in paragraph (a) of this section.

PAIRED FREQUENCIES (MHz)

Zone	Transmit (or receive)	Receive (or transmit)
A	490.01875-490.98125	493.01875-493.98125
B	484.01875-484.98125	487.01875-487.98125
C	478.01875-478.98125	481.01875-481.98125

Note: Only the first and last assignable frequencies are shown. Frequencies shall be assigned in pairs with 3 MHz spacing between transmit and receive frequencies. Assignable frequency pairs will occur in increments of 6.25 kHz. The following frequencies will be assigned for a maximum authorized bandwidth of 6 kHz: 478.01875, 478.98125, 484.01875, 484.98125, 490.01875, 490.98125, 481.01875, 481.98125, 487.01875, 487.98125, 493.01875, and 493.98125 MHz.

- (i) Fixed stations operating point-to-point shall be assigned frequencies beginning with 490.025/493.025 MHz (Zone A), 484.025/487.025 MHz (Zone B) and 478.025-481.025 MHz (Zone C) and progressing upwards utilizing available frequencies toward the end of the band. Offshore base/mobile stations shall be assigned frequencies beginning at 490.975/493.975 MHz (Zone A), 484.975/478.975 MHz (Zone B) and 478.975/481.975 MHz (Zone C) and progressing downwards utilizing available frequencies toward the

beginning of the band. All frequency assignments are subject to the conditions specified in §90.173.

§90.317 Fixed ancillary signaling and data transmissions.

- (a) Licensees of systems that have exclusive-use status in their respective geographic areas may engage in fixed ancillary signaling and data transmissions, subject to the following requirements:
 - a. All such ancillary operations must be on a secondary, non-interference basis to the primary mobile operation of any other licensee.
 - b. The output power at the remote site shall not exceed 30 watts.
 - c. Any fixed transmitters will not count toward meeting the mobile loading requirements.
 - d. Automatic means must be provided to deactivate the remote transmitter in the event the carrier remains on for a period in excess of three minutes.
 - e. Operational fixed stations authorized pursuant to the provisions of this paragraph are exempt from the requirements of §§90.425 and 90.429.
 - f. If the system is licensed on 470-512 MHz conventional frequencies, and exclusivity has been achieved through the aggregate loading of more than a single co-channel licensee, then a licensee must obtain the concurrence of other co-channel licensees prior to commencing such ancillary operations.
- (b) Licensees of systems that do not have exclusive-use status in their respective geographic areas may conduct fixed ancillary signaling and data transmissions only in accordance with the provisions of §90.235 of this part.