

# **Land Mobile Radio Protection Study**

**Gray Television Licensee, LLC**

**LPTV Station WTME-LD**

**Channel 14, Bruce, MS**

**FCC File Number 0000212911**

**Concerning Potential Out-of-Band-Emissions and  
Receiver Desensitization for Land Mobile Operations in  
the lower adjacent band to TV channel 14**

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## **INTRODUCTION and BACKGROUND**

This study has been prepared for Gray Television Licensee, LLC, the licensee of low-power digital television station WTME-LD ("WTME"), Bruce, MS. WTME holds a construction permit, FCC File Number 0000212911, to modify its licensed facility pursuant to the parameters defined in the permit. Construction has been completed and the licensee is filing to license the constructed facility.

In the construction permit authorization that was granted the following condition must be met: *"During equipment tests, authorized by Section 73.1610 of the Commissions Rules, the permittee shall take adequate measures to identify and substantially eliminate objectionable interference which may be caused to existing land mobile radio facilities in the 460 to 470 MHz band. Documentation that objectionable interference will not be caused to existing land mobile radio facilities shall be submitted along with the request for Program Test Authority..."*

To meet the condition placed in the construction permit, MSW was retained to study the potential impact that the modified WTME facility may have on active and authorized Land Mobile ("LM") operations below channel 14.

MSW performed its study based on the parameters shown in the construction permit to determine if the combined as-built post-transmitter filter added to a the transmitter response would protect LM facilities from Out-of-Band Emissions ("OOBE") and receiver desensitization, referred to as Adjacent Channel Rejection Ratio ("ACRR") in this report, from WTME operating on TV channel 14.

The study focused on a circular area with a radius of 156 km with the center point being close to the transmitter site coordinates as stated in the construction permit. The area studied is shown in Appendix 1 of this report and also shows the location of LM stations in the area.

## **EXECUTIVE SUMMARY**

MSW studied the predicted OOBE interference from the modified WTME facility into authorized LM stations operating below TV channel 14. The potential impact that WTME might have on LM receiver ACRR was also studied.

Based on the results of this study the following conclusions were reached.

1. Utilization of two 8-Pole cascaded post-transmitter filters was found to be effective in significantly reducing OOBE and protecting currently authorized LM stations.
2. There were no cases of OOBE interference into Land Mobile operations reported in this study with the use of a cascaded filter.

3. There were no cases of LM receiver ACRR margin being below 0 dB for any of the Land Mobile stations studied.

Considering the foregoing, WTME meets the requirement of the construction permit by demonstrating with this study that objectionable interference is not predicted to be caused into Land Mobile operations. The remainder of this report gives the parameters and methodology used in conducting the study along with an analysis of the results.

### **SCOPE OF STUDY AND METHODOLOGY**

The scope of this study consists of two parts with each part analyzing the impact of potential channel 14 OOB interference from WTME into a LM receiver and LM receiver adjacent channel rejection with WTME operating on an adjacent channel to LM base or mobile stations.

The first part of this study consisted of an overall area study based on a hypothetical LM station, both fixed and mobile, operating on a frequency close to the channel 14 band edge with default operating parameters (i.e. antenna height, bandwidth, etc.). This serves as an indicator of the effectiveness of post-transmitter filtering and antenna radiation characteristics in protecting LM operations close to the band edge and shows the approximate extent of interference and ACRR in terms of distance from the TV transmitter site. The parameters used for WTME are found in Table 1 and the generic parameters used for both fixed and mobile LM operations are found in Table 2 of this report.

This area based interference study was performed using the Longley-Rice Irregular Terrain Model ("ITM") to predict interference caused by OOB from WTME into both fixed and mobile LM operations using the generic parameters. The study focused on a circular area with a radius of 156 km from a center point with coordinates being near the WTME transmitter site.

The circular area was divided into cells with a size of approximately 1 km per side. The assumed LM receiver location was considered to be at the geographic center of the cell. A path profile was created between the television transmitter site and the cell center followed by the ITM analysis. The OOB loss of the post-transmitter filter, at the LM station frequency, was added to the coupling factor, calculated from the bandwidth of the LM station and the 500 kHz measurement bandwidth used for digital television stations, to the received field strength. LM antenna gain and line loss were then added to the received field strength to obtain the final value used for interference prediction. The reference value used for interference prediction is 17 dBu<sup>1</sup>. Television field strength exceeding this value is considered to be causing interference into LM stations.

ACRR calculations were performed by using the free space loss from the television transmit antenna to the cell center point. The received power level in the direction of the cell included calculated losses due to terrain, calculated antenna azimuth and elevation discrimination and coupling losses based on the bandwidth of the LM station and the 3 dB half-power bandwidth of the television station (approximately 5.38 MHz). LM antenna gain and assumed transmission line loss for fixed base stations was also considered. The reference value used for ACRR is

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<sup>1</sup> See §73.687 (e)(4)(ii) of the Rules

around 80 dB which is a typical receiver off-frequency rejection characteristic<sup>2</sup> near the television station's band edge. ACRR typically increases as the LM frequency moves further away from the band edge and was considered in this study.

The second part of the study consisted of analyzing interference and receiver ACRR into currently authorized fixed and mobile LM facilities. A list of potentially impacted LM facilities was created from the FCC's Universal Licensing System ("ULS") database by searching for all active and licensed LM facilities within a culling distance of 156 km from the WTME transmitter site. The entire area studied is shown in Appendix 1 of this report.

Interference and ACRR calculations were performed similar to the cell analysis described for the first part of the study except the authorized LM facilities (e.g. frequency, antenna height, etc.) were utilized. Other study parameters utilized in the study, including ITM parameters, are shown in Table 3.

Tables 4 and 5 are example calculations for both the interference and receiver ACRR for one of the fixed base stations studied. The purpose of these examples is to show in more detail how the study calculations were performed.

For authorized mobile and temporary fixed LM operations a study was conducted similar to the general cell area study discussed above. A circular area was defined using the radius of operation for the mobile LM facility as authorized. If no radius was defined then a default radius of 48 km was used. The center point used was the coordinates of the mobile LM operation as authorized. The circular area was divided into 1 km/side cells and calculations were made at the geographic center of each cell. A pass/fail determination was made for each cell for both interference and receiver ACRR as calculated from the received signal of WTME. After analyzing all cells within the circular area the number of failures was compared to the total number of cells analyzed. If the total number of failures was at or under 2% of the total area then the amount of interference or receiver ACRR below 0 dB was considered de minimis and the facility was considered to have passed.

Land Use/Land Clutter losses were not considered in this study for either OOB interference or receiver ACRR calculations for both study parts.

For OOB interference calculations the transmitter 500 kHz bandwidth lower adjacent channel sideband pre-filter response was added to the cascaded post-transmitter filter to obtain the total OOB rejection of the transmission system (See Figure 2).

Most LM operations use vertical antenna polarization. With WTME proposing to use horizontal polarization the total received power at an LM station would be dependent on the polarization of the LM received antenna. For an LM station using linear polarization a conservative value of 6 dB was used in this study when considering antenna cross polarization discrimination. Received power was calculated based on the total power radiated from WTME in the H plane and then applying the cross polarization factor based on the polarization of the LM facility respectively.

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<sup>2</sup> Value obtained by researching ACRR values from various receiver manufacturers

## **STUDY PARAMETERS**

The parameters used for WTME operating on channel 14 and LM operations below channel 14 are shown in Tables 1 and 2, respectively. Table 2 shows the general LM analysis parameters for the area cell study. For the individual studies to each LM facility the authorized parameters were used as shown in the LM station's authorization.

**Table 1 - Parameters for WTME**

| Parameter   | Value                |
|---|----------------------|
| Analyzed TV Station   | WTME-LD              |
| TV Channel  | 14 (470-476 MHz)     |
| Latitude (NAD83)  | 35-10-29.0           |
| Longitude (NAD83)   | 89-50-43.0           |
| Height of Antenna Center of radiation (AMSL)                    | 375.6m               |
| ERP (15 kW-H)   | 15.0 kW              |
| Antenna Type  | Non-Directional      |
| Polarization  | Horizontal           |
| Elevation Pattern†  | Real                 |
| Electrical Tilt   | 1.05 degrees         |
| Antenna Mechanical Tilt Amount                                  | N/A                  |
| Antenna Mechanical Tilt Orientation                             | N/A                  |
| Antenna Pattern Relative Field per Azimuth and Depression Angle | Calculated           |
| Post-transmitter Filter Type                                    | Dual Cascaded 8-Pole |

**Table 2 - Parameters for Land Mobile Stations**

| Parameter  | Value                   |
|--|-------------------------|
| Antenna Type   | Omni-directional        |
| Frequency (MHz)* (Lower Adjacent TV channel 14 band) | 469.75                  |
| Bandwidth*   | 30 kHz                  |
| Height of Antenna Center of radiation (AGL)*         | 10.0m FB, 3.0m MO       |
| Polarization*  | Vertical                |
| Receive Antenna Gain*                                | 11.0 dBd FB, 0.0 dBd MO |
| Antenna Pattern Relative Field per Azimuth Bearing   | 1.0                     |
| Antenna Pattern Relative Field per Depression Angle  | 1.0                     |
| Receive Line Loss for Fixed Base stations only       | 2.0 dB                  |
| Receiver Threshold                                   | -120.0 dBm              |
| Receiver ACRR (Fixed value used for cell study)      | 86.7 dB**               |

† Antenna parameters based on data furnished by the manufacturer

\* Value assumed for cell analysis. The authorized parameter was used for individual LM station studies

\*\* Calculated based on LM frequency separation from the television station band edge frequency

Table 3 below shows the parameters used for the Irregular Terrain Model in deriving the WTME channel 14 OOB field intensities inside a circular area with a 156 km radius for the area cell study. These parameters were also used for determining the signal strength of WTME OOB into each LM station found inside the circular area (see Appendix 1).

Since the FCC Rules do not specify a defined distance to be studied for LM operations operating below channel 14 a study radius of 156 km was utilized for this study. This distance is based on the 130 km distance specified in § 74.709 (b) of the Rules from a defined center point for LM operations to the protected LM contour. This distance is added to the distance from the LPTV transmitter to the edge of its 76 dBu, F50,10 contour, which is approximately 26 km for WTME.

**Table 3 – Parameter settings utilized in Land Mobile Study**

| Parameter  |            | Value                   |
|--|------------|-------------------------|
| Study Radius   |            | 156.00 km               |
| Study Centerpoint Latitude (NAD 83)                                  |            | 35-10-29.0 N            |
| Study Centerpoint Longitude (NAD 83)                                 |            | 89-50-43.0 W            |
| Cross Polarization Discrimination Factor                             |            | 6.0 dB                  |
| Target Study cell size   |            | 1.0 km/side             |
| Study Path Distance Increment  |            | 0.1 km                  |
| Terrain Database   |            | 1 arc second            |
| Location Variability   |            | 50 %                    |
| Time Variability   |            | 10 %                    |
| Confidence   |            | 50 %                    |
| Ground Permittivity  |            | 15.0                    |
| Ground Conductivity  |            | 0.005 S/m               |
| Surface Refractivity   |            | 301.0 N-units PPM       |
| Longley-Rice Mode ‡  |            | 1 or 3                  |
| Climate Code   |            | 5 Continental Temperate |
| Utilize Land Use/Land Clutter in analysis                            |            | False                   |
| Interference criteria utilized [See §73.687 (e)(4)(ii) of the Rules] |            | 17.0 dBuV/m             |
| Number of cells analyzed   |            | 76,376                  |
| Area analyzed  |            | 76,451.4 sq km          |
| Area predicted to receive field strength => 17 dBu                   | Fixed Base | 0.00 sq km              |
| Area predicted to experience ACRR < 0dB                              | Fixed Base | 0.00 sq km              |
| Area predicted to receive field strength => 17 dBu                   | Mobile     | 0.00 sq km              |
| Area predicted to experience ACRR < 0dB                              | Mobile     | 0.00 sq km              |

‡ 1 - Individual mode used for LM station analysis, 3 – Broadcast mode used for cell analysis

## STUDY METHODOLOGY AND EXAMPLE

Tables 4 and 5 show the methodology that was used for calculating interference and receiver ACRR into the LM Base Station shown below.

|          |         |      |      |         |         |     |       |       |      |      |
|----------|---------|------|------|---------|---------|-----|-------|-------|------|------|
| Freq     | Call    | Svc  | Svc  | DTV->LM | DTV->LM | Ant | HAAT  | HAGL  | Gain | BW   |
| Mhz      | Sign    | Code | Cls  | Dist km | Az deg  | Pol | m     | m     | dB   | khz  |
| 464.5250 | WQDV716 | IG   | FB6* | 4.3     | 137.9   |     | 144.0 | 137.0 |      | 11.2 |

**Table 4 - Methodology for Predicting Interference into a Land Mobile receiver from a DTV Station**

| Parameter  | Value        |
|--|--------------|
| Land Mobile Station Frequency *                                    | 469.5250 MHz |
| Longley-Rice Calculated Received Field Strength [F50,10]TV Station | 105.9 dBuV/m |
| Transmitter + Filter loss at frequency                             | 76.6 dB      |
| Transmitting and receiving antenna discrimination, combined†       | 0.5 dB       |
| DTV coupling into LM (Bandwidth: DTV=500 kHz, LM=11.2 kHz)         | 16.5 dB      |
| Cross-polarization discrimination                                  | 6.0 dB       |
| LM antenna gain  | 0.0 dB       |
| LM line loss   | 2.0 dB       |
| Calculated field strength  | 4.3 dBuV/m   |
| Interference Threshold (Corrected for 17 dBuV/m @ 30 kHz BW)       | 12.7 dBuV/m  |
| Margin to interference   | 8.4 dB       |
| Analysis result**  | Pass         |

**Table 5 - Methodology for Predicting ACRR into a Land Mobile receiver from a DTV Station**

| Parameter   | Value      |
|---|------------|
| Guard Band between DTV and LM Station                             | 0.7788 MHz |
| Transmit ERP (15 kW H)  | 71.8 dbm   |
| Free Space Path Loss for dipole antenna at frequency and distance | 94.4 dB    |
| Terrain Loss  | 0.0 dB     |
| Transmitting and receiving antenna discrimination†                | 0.5 dB     |
| DTV coupling into LM (Bandwidth: DTV=5.38 MHz, LM=11.2 kHz)       | 26.8 dB    |
| Cross-polarization discrimination                                 | 6.0 dB     |
| LM antenna gain   | 0.0 dB     |
| LM line loss  | 2.0 dB     |
| LM receiver out-of-band rejection (Based on Guard Band)           | 87.4 dB    |
| Effective received DTV station interference power                 | -145.3 dBm |
| LM receiver sensitivity   | -120.0 dBm |
| ACRR (receiver desensitization margin)                            | 25.3 dB    |
| Analysis result (Passes if ACRR is not negative)                  | Pass       |

\* Assumed repeater input frequency

† Only transmit antenna azimuth and elevation discrimination factors are considered

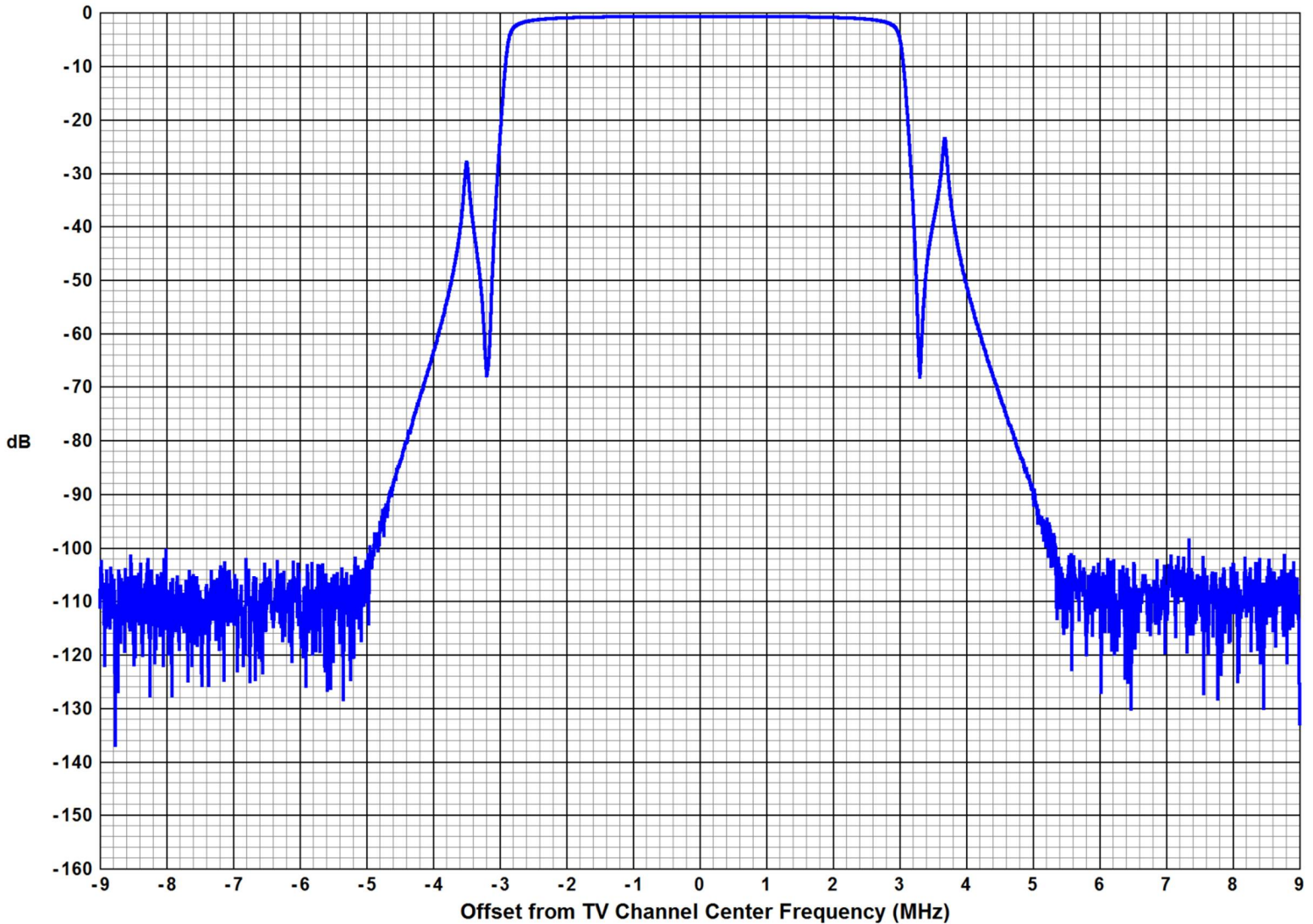
\*\* If analysis fails additional Post-transmitter filtering would be required.



## **DTV POST-TRANSMITTER FILTER**

The plot below in Figure 1 shows the response of two cascaded 8-Pole filters for WTME operating on channel 14. The filter response was provided by the filter manufacturer.

**Figure 1**  
**Post-Transmitter Filter Response**



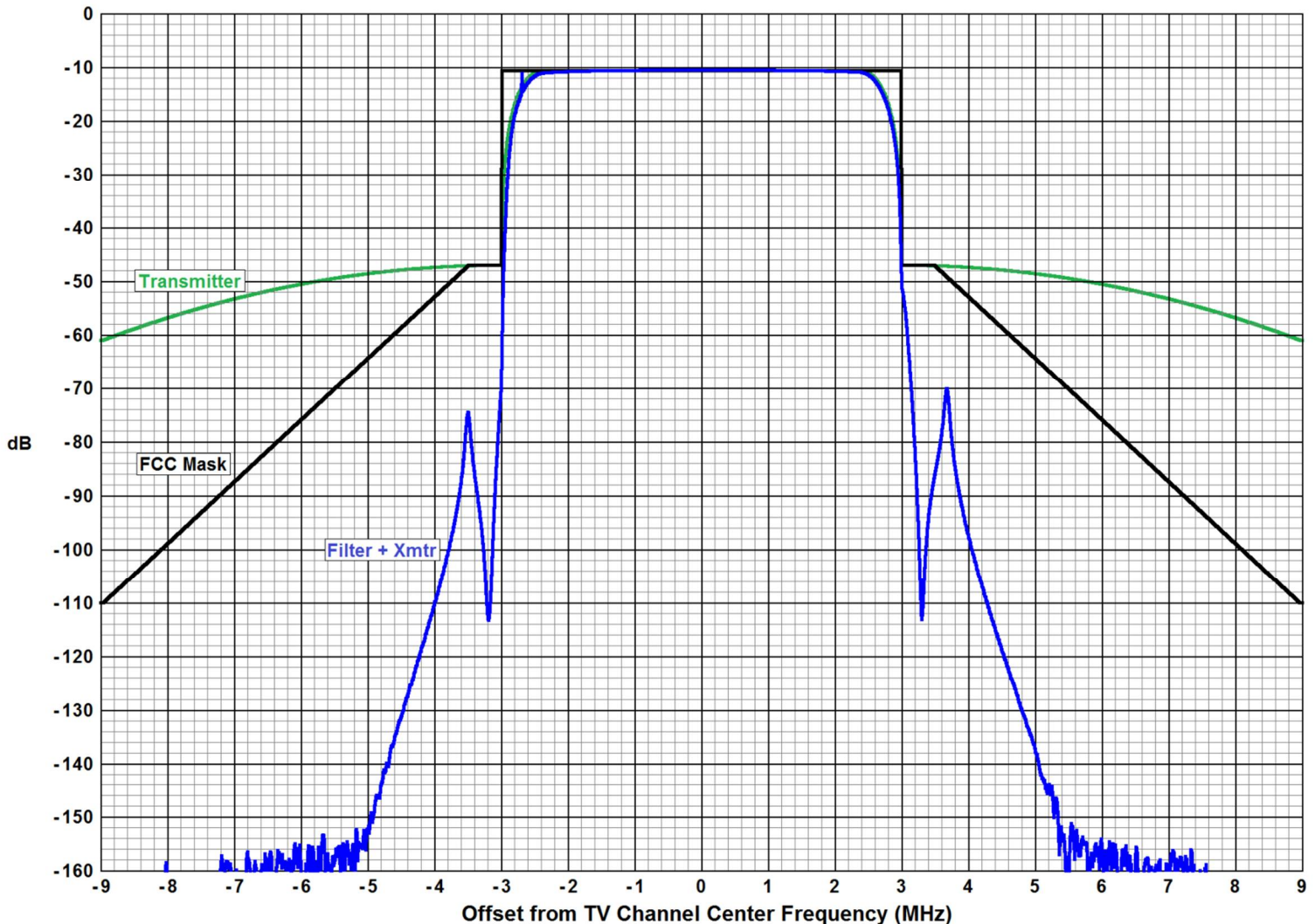
As shown above, this cascaded filter adds significant attenuation to OOB, particularly near the band edge (-3.0 MHz). Combined with the transmitter pre-filter response, very effective filtering of OOB is provided.



## **TOTAL DTV TRANSMITTER PLUS POST-TRANSMITTER FILTER RESPONSE**

Shown below in Figure 2 is a conservative transmitter pre-filter response (green plot). Total response of both the two cascaded 8-Pole post-transmitter filters plus the transmitter response is also shown (blue plot). The full-service FCC mask response is shown for reference (black plot) to demonstrate the overall effectiveness of the filtering.

**Figure 2**  
**Response of Transmitter plus Two Cascaded 8-Pole Post-Transmitter Filters**



As shown above, the cascaded filter adds significant attenuation to OOB beginning at -3 Mhz which is the lower end of TV channel 14. Combined with a typical transmitter pre-filter response, very effective filtering of OOB is provided and surpasses that of the full-service FCC mask.

The response of the post-transmitter filter was obtained from the filter manufacturer.

## **ANALYSIS RESULTS**

This study was performed in response to a condition placed in the permit, FCC File Number 0000212911, to modify the transmission facility for WTME-LD, channel 14, Bruce, MS. Specifically, WTME must not cause objectionable interference into Land Mobile operations operating in the 460-470 MHz band below channel 14.

The map in Appendix 1 shows the WTME 51 dBuV/m protected contour along with all LM facilities located within a radius of 156 km from the transmitter site and operating in the band from 460 to 470 MHz which is below TV channel 14.

The area study that was conducted using the parameters found in Tables 1 and 2 of this report showed none of the 76,376 cells studied to receive interference or an ACCR margin below 0 dB. There were 10,500 authorized LM facilities studied, consisting of both fixed base and mobile.

There were 3,695 individual fixed base LM facilities studied. Appendix 2 is a list, stacked in ascending order, of 30 of the fixed base stations with the lowest interference margin, with the lowest margin being 8.4 dB. The list in Appendix 3 is similar to Appendix 2 but for receiver ACRR, with the lowest value being 17.4 dB.

There were 6,805 mobile LM facilities studied. Appendix 4 is a list of 30, stacked in ascending order, of the mobile stations with the lowest interference margin, with the lowest margin being 16.9 dB. The list in Appendix 5 is similar to Appendix 4 but for receiver ACRR, with the lowest value being 27.5 dB.

Due to the large number of LM facilities studied a full list was not included with this report. The full list is available and can be provided upon request.

Regarding LM receiver ACRR, adjacent channel rejection characteristics may vary based on the frequency separation of the desired LM channel from the band edge of the higher power station. Rejection could increase from 80 to 90 dB or more depending on the frequency separation. Rejection also depends on the front end architecture of the LM radio as designed by the manufacturer. ACRR calculation is not dependent on the type of post-transmitter filter used since it is not an OOB issue but rather that of a sensitive LM radio being in close proximity to a higher power facility, like that of a television station. There were no cases of receiver ACRR margin being below 0 dB predicted in the area cell study and no cases were predicted into authorized LM operations.

Table 7 below shows a high level summary of the results for current authorized LM stations studied within a 156 km radius of the granted WTME transmitter site.

**Table 7 – Statistics from the Analysis of Current Licensed LM facilities**

| Item                                    | Value        | Comment  |
|---|--------------|----------|
| LM Authorizations Found                 | 1,118        | -        |
| Individual LM Facilities Studied        | 10,500       | -        |
| Closest LM Frequency to Band Edge       | 469.9750 MHz | 14 Found |
| Closest Fixed Base Land Mobile Location | 0.5 km       | 87 Found |
|   |              |          |
| Fixed Base Stations:                    |              |          |
| Lowest Predicted IX Margin              | 8.4 dB       | WQDV716  |
| Number Predicted to Receive IX          | 0            | -        |
| Lowest Predicted ACRR                   | 17.4 dB      | WPUP420  |
| Stations Affected by ACRR < 0 dB        | 0            | -        |
|   |              |          |
| Mobile LM Operations:                   |              |          |
| Lowest Predicted IX Margin              | 16.9 dB      | WQZS493  |
| Number Predicted to Receive IX          | 0            | -        |
| Lowest Predicted ACRR                   | 27.5 dB      | WPQA386  |
| Stations Affected by ACRR < 0 dB        | 0            | -        |

## **CONCLUSION**

MSW studied the predicted OOB interference into authorized LM stations operating within a radius of 156 km from a center point near the WTME transmitter site coordinates with WTME operating on channel 14 as defined in its construction permit. The potential impact that WTME might have on LM receiver ACRR was also studied.

Based on the results of the study the following conclusions were reached.

1. Utilization of two 8-Pole cascaded post-transmitter filters was found to be effective in significantly reducing OOB and protecting currently authorized LM stations.
2. There were no cases of OOB interference into Land Mobile operations reported in this study with the use of a cascaded filter.
3. There were no cases of LM receiver ACRR margin being below 0 dB for any of the Land Mobile stations studied.

Considering the above, WTME meets the requirement of the construction permit by demonstrating with this study that objectionable interference will not be caused into Land Mobile operations.

This study conducted by MSW is based on the ITM prediction model. Actual field conditions including, but not limited to, propagation conditions, errors and omissions in the FCC database, active and passive intermodulation products and LM receiver characteristics may affect the actual results in the field and are considered outside the control of MSW.

This study was performed using defined locations extracted from the FCC ULS database (e.g. geographical coordinates and well defined boundaries, such as counties and radius and center point) as granted for both fixed base and mobile LM operations. The FCC database base contains hundreds of authorizations for itinerant users that are authorized over the entire country, states and other wide areas. It is impractical to attempt to analyze those operations without knowing the specific location of a LM receiver if and when they are deployed in the area studied.

MSW stands ready to answer any questions regarding this report and to assist WTME in responding to any issues that may be reported by LM operators.

## **CERTIFICATION**

The undersigned author of this report, Joseph L. Snelson, Jr., is a Certified Professional Broadcast Engineer (CPBE) as recognized by the Society of Broadcast Engineers and possesses over 50 years of experience in Broadcast Engineering including Television signal analysis, propagation, coverage and interference prediction. He is a contract employee of Meintel, Sgrignoli and Wallace, LLC, Broadcast Television & Radio Engineers, and was assigned to study the impact that the granted facility for WTME-LD would have on authorized Land Mobile facilities operating on the lower adjacent band to channel 14 (460 - 470 MHz).

He has prepared numerous studies of this type pertaining to the protection of Land Mobile Radio Service stations from adjacent channel television station transmissions that have been submitted to and accepted by the FCC.

The undersigned hereby certifies that all statements made in this report are true and correct to the best of his own knowledge except, where noted, when data or information has been supplied by others, which he believes to be correct.



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**APPENDIX 2**  
**Land Mobile Fixed Base Stations with the Lowest Interference Margins**  
**Listing of the Lowest 30 out of 3,695 Fixed Base LM Facilities**

| Freq<br>Mhz | Call<br>Sign | Svc<br>Code | Svc<br>Cls | DTV->LM<br>Distkm | DTV->LM<br>Azdeg | Ant<br>Pol | HAAT<br>m | HAGL<br>m | Gain<br>dBd | BW<br>khz | IX Mgn<br>dB | ACRR Mgn<br>dB |
|-------------|--------------|-------------|------------|-------------------|------------------|------------|-----------|-----------|-------------|-----------|--------------|----------------|
| 464.5250    | WQDV716      | IG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     |             | 11.2      | 8.4          | 25.3           |
| 464.9375    | WPPF818      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 10.0         | 20.2           |
| 464.5250    | WPRB668      | IG          | FB2*       | 8.5               | 191.8            |            | 60.0      | 51.0      | 1.5         | 11.0      | 12.5         | 29.5           |
| 464.4500    | WPJM850      | IG          | FB6*       | 8.1               | 211.8            |            | 134.0     | 124.0     | 4.8         | 11.2      | 13.1         | 25.7           |
| 464.4500    | WPJM850      | IG          | FB6*       | 8.1               | 211.8            |            | 134.0     | 124.0     | 4.8         | 7.6       | 13.1         | 27.3           |
| 464.4250    | WQDV717      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 14.6         | 23.8           |
| 464.4250    | WQDV717      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 7.6       | 14.6         | 25.5           |
| 464.9625    | WPPF818      | YG          | FB8*       | 18.8              | 261.7            |            | 159.0     | 138.0     | 4.9         | 11.0      | 16.2         | 31.3           |
| 464.4500    | WQER903      | YG          | FB8*       | 8.1               | 211.8            |            | 131.0     | 124.0     |             | 11.2      | 17.9         | 30.5           |
| 464.4500    | WQER903      | YG          | FB8*       | 8.1               | 211.8            |            | 131.0     | 124.0     |             | 7.6       | 17.9         | 32.1           |
| 464.9750    | WQZS493      | IG          | FB2*       | 20.5              | 202.8            |            | 24.9      | 10.0      | 1.2         | 11.2      | 18.0         | 35.5           |
| 464.9750    | WQZS493      | IG          | FB2*       | 20.5              | 202.8            |            | 24.9      | 10.0      | 1.2         | 7.6       | 18.0         | 37.2           |
| 464.5875    | WPTN567      | YG          | FB6*       | 8.0               | 210.2            | V          | 31.0      | 127.0     | 3.0         | 11.2      | 18.4         | 26.9           |
| 464.4625    | WRFZ377      | IG          | FB2*       | 11.9              | 305.5            | V          | 16.4      | 23.0      |             | 7.6       | 19.2         | 35.5           |
| 464.5750    | WRQI568      | YG          | FB6*       | 5.9               | 42.0             |            | 15.9      | 14.0      |             | 7.6       | 19.2         | 30.8           |
| 464.5875    | WPTP544      | YG          | FB6*       | 8.9               | 102.2            | V          | 72.0      | 128.0     | 3.0         | 11.2      | 19.4         | 27.9           |
| 464.5875    | WPTP544      | YG          | FB6*       | 8.9               | 102.2            | V          | 72.0      | 128.0     | 3.0         | 8.3       | 19.4         | 29.2           |
| 464.6500    | WPHR408      | IG          | FB4*       | 5.0               | 134.1            |            | 143.0     | 140.0     | 2.6         | 11.2      | 20.7         | 23.3           |
| 464.6500    | WPHR408      | IG          | FB4*       | 5.0               | 134.1            |            | 143.0     | 140.0     | 2.6         | 7.6       | 20.7         | 25.0           |
| 464.6000    | KQD728       | YG          | FB6*       | 8.1               | 211.8            |            | 132.0     | 124.0     | 1.8         | 11.2      | 21.1         | 28.3           |
| 464.6000    | KQD728       | YG          | FB6*       | 8.1               | 211.8            |            | 132.0     | 124.0     | 1.8         | 7.6       | 21.1         | 29.9           |
| 464.2500    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 21.2         | 17.4           |
| 464.5875    | WPTP795      | YG          | FB6*       | 11.1              | 265.9            | V          | 164.0     | 152.0     | 3.0         | 11.2      | 21.4         | 29.9           |
| 464.9375    | WPPF819      | YG          | FB8*       | 18.8              | 261.7            |            | 159.0     | 138.0     | 4.9         | 11.0      | 21.4         | 31.5           |
| 464.4750    | WQZE486      | IG          | FB2*       | 22.5              | 168.0            |            | 29.5      | 10.0      | 1.2         | 11.2      | 21.6         | 38.1           |
| 464.4750    | WNKD398      | IG          | FB2*       | 30.9              | 264.6            |            |           | 21.0      | 3.9         | 11.2      | 21.7         | 38.2           |
| 464.9250    | WQWT999      | IG          | FB2*       | 8.2               | 182.7            |            | 157.7     | 148.8     |             | 4.0       | 21.7         | 33.5           |
| 464.9375    | WPPF818      | YG          | FB8*       | 19.1              | 96.1             |            | 72.0      | 54.0      | 3.9         | 11.0      | 22.4         | 32.5           |
| 464.4375    | WRFZ377      | IG          | FB2*       | 11.9              | 305.5            | V          | 16.4      | 23.0      |             | 7.6       | 23.1         | 35.6           |
| 464.4625    | WQWR551      | IG          | FB2*       | 18.5              | 197.1            |            | 10.5      | 9.1       |             | 11.2      | 23.1         | 37.6           |

Note: Asterisk after Service Class indicates frequency is the output. Input frequency used for study

### APPENDIX 3

#### Land Mobile Fixed Base Stations with the Lowest Receiver ACRR Margins

##### Listing of the Lowest 30 out of 3,695 Fixed Base LM Facilities

| Freq<br>Mhz | Call<br>Sign | Svc<br>Code | Svc<br>Cls | DTV->LM<br>Distkm | DTV->LM<br>Azdeg | Ant<br>Pol | HAAT<br>m | HAGL<br>m | Gain<br>dBd | BW<br>khz | IX Mgn<br>dB | ACRR Mgn<br>dB |
|-------------|--------------|-------------|------------|-------------------|------------------|------------|-----------|-----------|-------------|-----------|--------------|----------------|
| 464.2500    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 21.2         | 17.4           |
| 464.1500    | WQDW968      | IG          | FB6*       | 4.3               | 137.9            | V          | 127.0     | 122.0     | 9.0         | 11.2      | 26.3         | 17.5           |
| 463.9500    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 35.7         | 18.3           |
| 463.8750    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 38.9         | 18.6           |
| 463.8250    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 41.1         | 18.7           |
| 463.7250    | WQDW968      | IG          | FB6*       | 4.3               | 137.9            | V          | 127.0     | 122.0     | 9.0         | 11.2      | 45.0         | 18.8           |
| 462.8000    | WQTH318      | IK          | FB6C*      | 4.3               | 137.9            | V          | 186.0     | 180.0     | 6.0         | 20.0      | 88.9         | 19.5           |
| 462.1000    | WQDW968      | IG          | FB6*       | 4.3               | 137.9            | V          | 127.0     | 122.0     | 9.0         | 11.2      | 80.2         | 19.7           |
| 462.2250    | WQDW968      | IG          | FB6*       | 4.3               | 137.9            | V          | 127.0     | 122.0     | 9.0         | 11.2      | 82.6         | 19.7           |
| 463.3500    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 60.3         | 19.9           |
| 461.4750    | WPUP420      | YG          | FB6*       | 4.3               | 137.9            | V          | 117.0     | 110.0     | 9.0         | 11.2      | 81.5         | 20.0           |
| 464.9375    | WPPF818      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 10.0         | 20.2           |
| 464.7125    | WPPF818      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 25.2         | 21.1           |
| 464.8500    | WPUH809      | YG          | FB6*       | 4.3               | 137.9            | V          | 137.9     | 132.8     | 3.0         | 11.2      | 35.3         | 21.3           |
| 464.8500    | WPUH809      | YG          | FB6*       | 4.3               | 137.9            | V          | 137.9     | 132.8     | 3.0         | 7.6       | 35.3         | 23.0           |
| 463.9875    | WPPF818      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 38.8         | 23.0           |
| 464.6500    | WPHR408      | IG          | FB4*       | 5.0               | 134.1            |            | 143.0     | 140.0     | 2.6         | 11.2      | 20.7         | 23.3           |
| 461.9625    | WQLS688      | IG          | FB         | 23.5              | 329.4            |            | 80.0      | 57.9      | 19.5        | 11.2      | 93.8         | 23.3           |
| 464.4250    | WQDV717      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 14.6         | 23.8           |
| 464.3250    | WQDV717      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 23.3         | 24.1           |
| 464.2500    | WPHR408      | IG          | FB4*       | 5.0               | 134.1            |            | 143.0     | 140.0     | 2.6         | 11.2      | 28.0         | 24.3           |
| 463.5625    | WPPF819      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 56.5         | 24.3           |
| 464.1750    | WPTF974      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 32.0         | 24.5           |
| 464.0750    | WPTF974      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 36.9         | 24.7           |
| 463.6750    | WPUH809      | YG          | FB6*       | 4.3               | 137.9            | V          | 137.9     | 132.8     | 3.0         | 11.2      | 53.1         | 24.7           |
| 463.3875    | WPPF819      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 64.3         | 24.7           |
| 464.7500    | WPJM850      | IG          | FB6*       | 8.1               | 211.8            |            | 134.0     | 124.0     | 4.8         | 11.2      | 35.0         | 24.8           |
| 462.2000    | WPPF819      | YG          | FB8*       | 4.3               | 137.6            |            | 191.0     | 186.0     | 3.3         | 11.0      | 89.3         | 24.8           |
| 464.7500    | WPTW810      | YG          | FB6*       | 4.3               | 137.9            |            | 127.3     | 121.9     | 0.0         | 11.2      | 35.0         | 24.9           |
| 464.0250    | WPTF974      | YG          | FB6*       | 4.3               | 137.9            |            | 144.0     | 137.0     | 1.7         | 11.2      | 39.2         | 24.9           |

Note: Asterisk after Service Class indicates frequency is the output. Input frequency used for study

# **APPENDIX 4** **Mobile Operations with the Lowest Interference Margins** **Listing of the Lowest 30 out of 6,805 Mobile LM Facilities**

| Freq<br>Mhz | Call<br>Sign | Svc<br>Code | Svc<br>Cls | DTV->LM<br>Distkm | DTV->LM<br>Azdeg | Ant<br>Pol | HAAT<br>m | HAGL<br>m | Gain<br>dBd | BW<br>khz | IX Mgn<br>dB | ACRR Mgn<br>dB |
|-------------|--------------|-------------|------------|-------------------|------------------|------------|-----------|-----------|-------------|-----------|--------------|----------------|
| 469.9750    | WQZS493      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 16.9         | 34.4           |
| 469.9750    | WQZS493      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 16.9         | 36.1           |
| 469.4625    | WRFZ377      | IG          | MO         | 5.6               | 306.5            |            |           |           | 0.0         | 7.6       | 17.3         | 33.6           |
| 469.4750    | WNKD398      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 4.0 11.2  | 17.6         | 34.2           |
| 469.5250    | WQDV716      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 18.4         | 35.4           |
| 469.5250    | WPRB668      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.0      | 18.5         | 35.6           |
| 469.9625    | WPPF818      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 11.0      | 19.1         | 34.3           |
| 469.4750    | WRQL465      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 19.4         | 37.7           |
| 469.4625    | WQWR551      | IG          | MO         | 6.1               | 203.7            |            |           |           | 0.0         | 11.2      | 20.4         | 35.0           |
| 469.4750    | WQZE486      | IG          | MO         | 6.8               | 166.4            |            |           |           | 0.0         | 11.2      | 20.4         | 37.0           |
| 469.5750    | WRQI568      | YG          | MO6        | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 21.1         | 32.8           |
| 469.4375    | WRFZ377      | IG          | MO         | 5.6               | 306.5            |            |           |           | 0.0         | 7.6       | 21.1         | 33.7           |
| 469.4625    | WQFT677      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 21.1         | 35.7           |
| 469.9500    | WRQV273      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 21.5         | 35.9           |
| 469.5625    | KB80447      | IG          | MO         | 11.6              | 235.4            |            |           |           | 0.0         | 11.2      | 21.9         | 33.3           |
| 469.4625    | WQFT677      | IG          | MO         | 16.3              | 351.4            |            |           |           | 0.0         | 11.2      | 22.3         | 36.9           |
| 469.4500    | WQER903      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 23.0         | 35.6           |
| 469.4500    | WQER903      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 23.0         | 37.3           |
| 469.9500    | WQDV717      | YG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 23.3         | 36.0           |
| 469.9500    | WQDV717      | YG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 23.3         | 37.7           |
| 469.4500    | WPJM850      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 23.4         | 36.0           |
| 469.4500    | WPJM850      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 23.4         | 37.7           |
| 469.5750    | WQBL678      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.0      | 23.6         | 33.6           |
| 469.5750    | WQBL678      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 23.6         | 35.2           |
| 469.9188    | WRFK380      | IG          | MO         | 5.6               | 306.5            |            |           |           | 0.0         | 4.0       | 23.7         | 34.1           |
| 469.9375    | WPPF818      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 11.0      | 23.8         | 34.0           |
| 469.4375    | WPEY593      | YG          | MO         | 8.4               | 309.2            |            |           |           | 0.0         | 11.2      | 24.1         | 34.9           |
| 469.4375    | WPEY593      | YG          | MO         | 8.4               | 309.2            |            |           |           | 0.0         | 7.6       | 24.1         | 36.6           |
| 469.3750    | WQXY339      | IG          | MO         | 5.3               | 6.3              |            |           |           | 0.0         | 11.0      | 24.2         | 28.8           |
| 469.9375    | WPPF819      | YG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.0      | 24.3         | 34.5           |

## Notes:

1. Mobile analysis performed within a defined area of operation from mobile LM coordinates
2. 48 km radius used for mobile area of operation if not specified in authorization
3. Mobile Distance/Azimuth is shown to the cell with the lowest margin
4. Average mobile interference margin and/or ACRR over the area are shown

**APPENDIX 5**  
**Mobile Operations with the Lowest Receiver ACRR Margins**  
**Listing of the Lowest 30 out of 6,805 Mobile LM Facilities**

| Freq<br>Mhz | Call<br>Sign | Svc<br>Code | Svc<br>Cls | DTV->LM<br>Distkm | DTV->LM<br>Azdeg | Ant<br>Pol | HAAT<br>m | HAGL<br>m | Gain<br>dBd | BW<br>khz | IX Mgn<br>dB | ACRR Mgn<br>dB |
|-------------|--------------|-------------|------------|-------------------|------------------|------------|-----------|-----------|-------------|-----------|--------------|----------------|
| 469.7125    | WPQA386      | IG          | MO         | 5.5               | 16.8             |            |           |           | 0.0         | 11.2      | 31.6         | 27.5           |
| 469.8125    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 11.2      | 47.9         | 27.5           |
| 469.8375    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 44.8         | 27.6           |
| 469.7000    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 11.2      | 30.5         | 28.0           |
| 469.2375    | WPQA386      | IG          | MO         | 5.5               | 16.8             |            |           |           | 0.0         | 11.2      | 33.0         | 28.7           |
| 469.3750    | WQXY339      | IG          | MO         | 5.3               | 6.3              |            |           |           | 0.0         | 11.0      | 24.2         | 28.8           |
| 469.6375    | WQIF721      | IG          | MO         | 4.9               | 109.5            |            |           |           | 0.0         | 11.2      | 25.0         | 28.8           |
| 469.8250    | WPKH732      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 48.2         | 29.0           |
| 469.2625    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 11.2      | 32.1         | 29.1           |
| 469.2875    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 30.7         | 29.2           |
| 469.8125    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 7.6       | 47.9         | 29.2           |
| 469.8375    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 44.8         | 29.3           |
| 469.1375    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 11.2      | 38.7         | 29.5           |
| 469.6250    | WQWE285      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 24.7         | 29.6           |
| 469.7000    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 7.6       | 30.5         | 29.7           |
| 469.7875    | WQBL334      | IG          | MO         | 6.5               | 273.0            |            |           |           | 0.0         | 11.2      | 48.4         | 29.9           |
| 469.2625    | WQXJ742      | IG          | MO         | 5.8               | 216.9            |            |           |           | 0.0         | 11.2      | 33.1         | 30.1           |
| 469.7625    | WPTA977      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 42.7         | 30.1           |
| 468.8875    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 50.2         | 30.4           |
| 468.7875    | WQXY339      | IG          | MO         | 5.3               | 6.3              |            |           |           | 0.0         | 11.0      | 54.1         | 30.5           |
| 469.0375    | WQXJ742      | IG          | MO         | 5.8               | 216.9            |            |           |           | 0.0         | 11.2      | 44.5         | 30.7           |
| 469.2625    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 7.6       | 32.1         | 30.8           |
| 469.7625    | WPTA977      | YG          | MO8        | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 43.5         | 30.8           |
| 468.6875    | WQXY339      | IG          | MO         | 5.3               | 6.3              |            |           |           | 0.0         | 11.0      | 58.4         | 30.8           |
| 469.2875    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 7.6       | 30.7         | 30.9           |
| 469.8375    | WQXU488      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 48.1         | 30.9           |
| 468.6625    | WQHH930      | IG          | MO         | 0.5               | 308.4            |            |           |           | 0.0         | 11.2      | 59.9         | 31.0           |
| 467.2750    | WQCM989      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 11.2      | 90.5         | 31.0           |
| 469.1375    | WQYD303      | IG          | MO         | 4.7               | 98.0             |            |           |           | 0.0         | 7.6       | 38.7         | 31.2           |
| 467.3875    | WPQA386      | IG          | MO         | 5.5               | 16.8             |            |           |           | 0.0         | 11.2      | 91.7         | 31.2           |

**Notes:**

1. Mobile analysis performed within a defined area of operation from mobile LM coordinates
2. 48 km radius used for mobile area of operation if not specified in authorization
3. Mobile Distance/Azimuth is shown to the cell with the lowest margin
4. Average mobile interference margin and/or ACRR over the area are shown