Land Mobile Radio Protection Study

Gray Television Licensee, LLC
LPTV Station K14NR-D
Channel 14, Tyler, TX
FCC File Number 0000210969

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

October 11, 2023

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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 K14NR-D ("K14NR"), Tyler, TX. K14NR has been granted a construction permit, FCC File Number 0000210969, to modify its licensed facility pursuant to the parameters defined in the permit.

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 K14NR 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 K14NR operating on TV channel 14.

The study focused on a circular area with a radius of 143 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.

EXECUTIVE SUMMARY

MSW studied the predicted OOBE interference from the modified K14NR facility into authorized LM stations operating below TV channel 14. The potential impact that K14NR 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, K14NR 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 OOBE interference from K14NR into a LM receiver and LM receiver adjacent channel rejection with K14NR 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 K14NR 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 OOBE from K14NR into both fixed and mobile LM operations using the generic parameters. The study focused on a circular area with a radius of 143 km from a center point with coordinates being near the K14NR 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 OOBE 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[1]. 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

[1] See §73.687 (e)(4)(ii) of the Rules

around 80 dB which is a typical receiver off-frequency rejection characteristic[2] 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 143 km from the K14NR 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 K14NR. 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 OOBE interference or receiver ACRR calculations for both study parts.

For OOBE 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 OOBE rejection of the transmission system (See Figure 2).

Most LM operations use vertical antenna polarization. With K14NR 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 K14NR in the H plane and then applying the cross polarization factor based on the polarization of the LM facility respectively.

[2] Value obtained by researching ACRR values from various receiver manufacturers

STUDY PARAMETERS

The parameters used for K14NR 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 K14NR

Parameter	Value
Analyzed TV Station	K14NR-D
TV Channel	14 (470-476 MHz)
Latitude (NAD83)	36-29-37.3
Longitude (NAD83)	94-51-06.9
Height of Antenna Center of radiation (AMSL)	157.8 m
ERP (15 kW-H)	15.0 kW
Antenna Type†	Directional
Polarization	Horizontal
Elevation Pattern†	Real
Electrical Tilt	0.5 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 K14NR channel 14 OOBE field intensities inside a circular area with a 143 km radius for the area cell study. These parameters were also used for determining the signal strength of K14NR OOBE 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 143 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 13 km for K14NR.

Table 3 – Parameter settings utilized in Land Mobile Study

Parameter		Value
Study Radius		143.00 km
Study Centerpoint Latitude (NAD 83)		32-29-37.0 N
Study Centerpoint Longitude (NAD 83)		94-51-07.0 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		64,026
Area analyzed		64,243.32 sq km
Area predicted to receive field strength => 17 dBu	Fixed Base	1.00 sq km
Area predicted to experience ACRR < 0dB	Fixed Base	2.01 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 Mhz	Call Sign	Svc Code	Svc Cls	DTV->LM Dist km	DTV->LM Az deg	Ant Pol	HAAT m	HAGL m	Gain dB	BW khz
464.9625	WQSV351	IG	FB2	16.8	108.4		12.0	16.0		11.2

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

Parameter	Value
Land Mobile Station Frequency *	469.9625 MHz
Longley-Rice Calculated Received Field Strength [F50,10]TV Station	94.0 dBuV/m
Transmitter + Filter loss at frequency	75.5 dB
Transmitting and receiving antenna discrimination, combined†	0.2 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	-6.2 dBuV/m
Interference criteria utilized (typical LM Receiver Sensitivity)	12.7 dBuV/m
Margin to interference	18.9 dB
Analysis result**	Pass

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

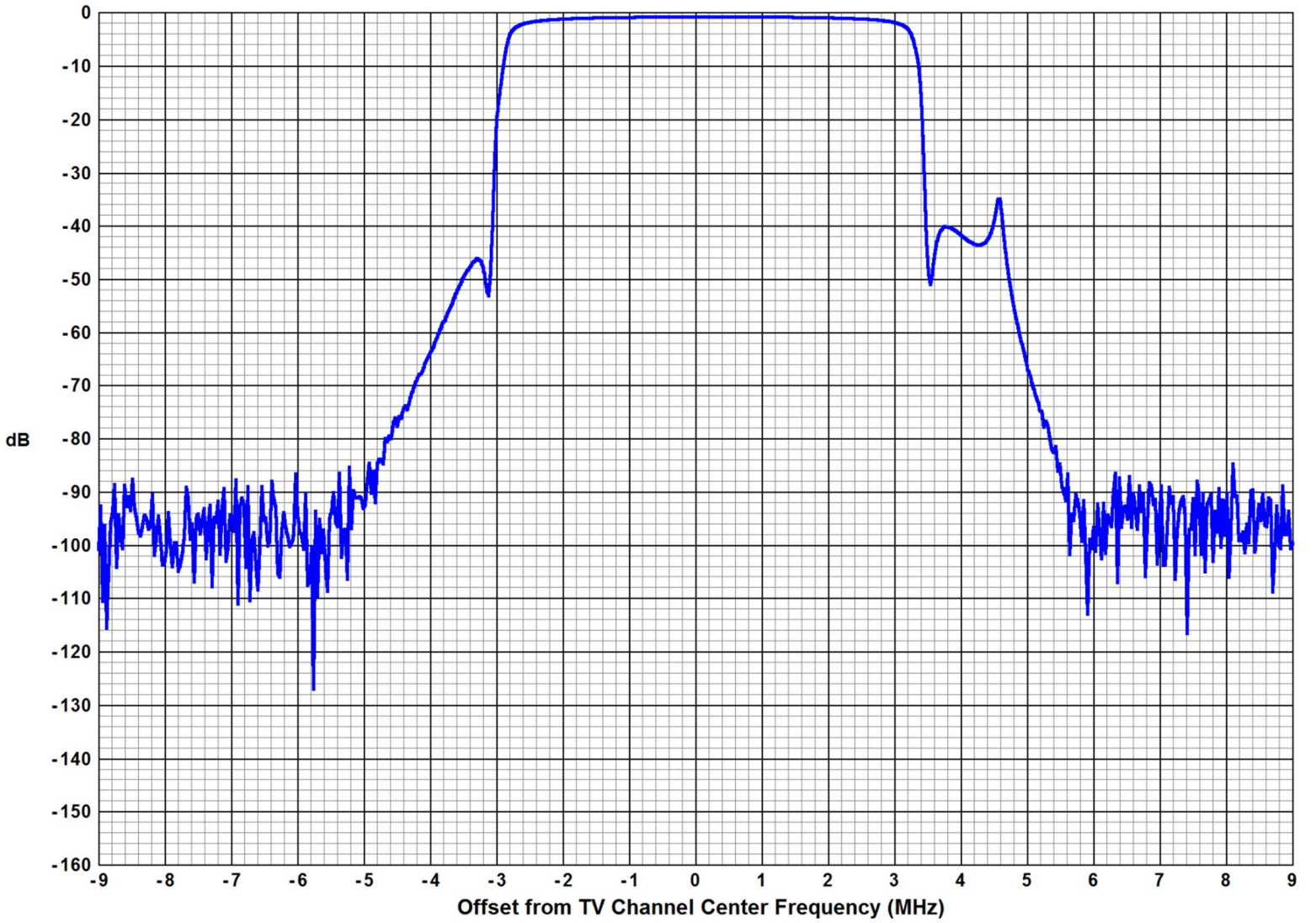
Parameter	Value
Guard Band between DTV and LM Station	0.3413 MHz
Transmit ERP (15 kW H)	71.8 dbm
Free Space Path Loss for dipole antenna at frequency and distance	106.2 dB
Terrain Loss	0.0 dB
Transmitting and receiving antenna discrimination†	0.2 dB
DTV coupling into LM (Bandwidth: DTV=5.38 MHz, LM=11.2 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)	85.8 dB
Effective received DTV station interference power	-155.2 dBm
LM receiver sensitivity	-120.0 dBm
ACRR (receiver desensitization margin)	35.2 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 K14NR operating on channel 14. The filter response was provided by the filter manufacturer.

Figure 1
Post-Transmitter Filter Response

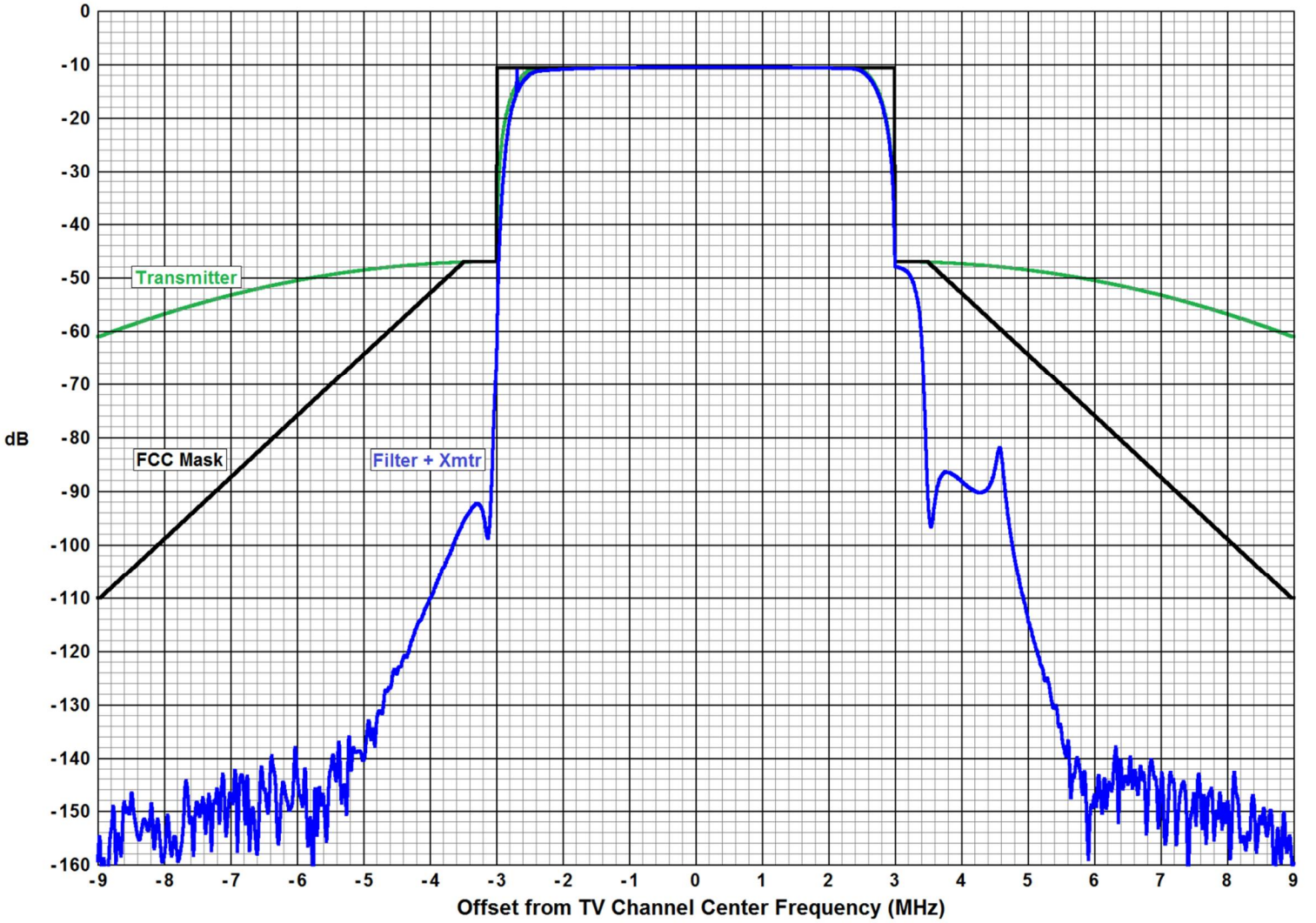


As shown above, this cascaded filter adds significant attenuation to OOBE, particularly near the band edge (-3.0 MHz). Combined with the transmitter pre-filter response, very effective filtering of OOBE is provided.

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 OOBE 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 OOBE 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 0000210969, to modify the transmission facility for K14NR-D, channel 14, Tyler, TX. Specifically, K14NR 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 K14NR 51 dBuV/m protected contour along with all LM facilities located within a radius of 143 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 only showed one of the 64,026 cells studied to receive interference and an ACCR margin below 0 dB. One other cell showed an ACRR margin below 0 dB. Both cells were close to the transmitter site and applicable to only hypothetical Fixed Base stations.

There were 7,889 authorized LM facilities studied, consisting of both fixed base and mobile.

There were 3,100 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 18.9 dB. The list in Appendix 3 is similar to Appendix 2 but for receiver ACRR, with the lowest value being 21.9 dB.

There were 4,789 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 14.3 dB. The list in Appendix 5 is similar to Appendix 4 but for receiver ACRR, with the lowest value being 29.3 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 OOBE issue but rather that of a sensitive LM radio being in close proximity to a higher power facility, like that of a television station. As stated earlier in this report, only 2 cases of receiver ACRR margin being below 0 dB were 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 143 km radius of the granted K14NR transmitter site.

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

Item	Value	Comment
LM Authorizations Found	765	-
Individual LM Facilities Studied	7,889	-
Closest LM Frequency to Band Edge	469.9750 MHz	KNCL345
Closest Fixed Base Land Mobile Location	0.1 km	82 Found
Fixed Base Stations:		
Lowest Predicted IX Margin	18.9 dB	WQSV351
Number Predicted to Receive IX	0	-
Lowest Predicted ACRR	21.9 dB	WRCZ942
Stations Affected by ACRR < 0 dB	0	-
Mobile LM Operations:		
Lowest Predicted IX Margin	14.3 dB	WPEE921
Number Predicted to Receive IX	0	-
Lowest Predicted ACRR	29.3 dB	WRUX220
Stations Affected by ACRR < 0 dB	0	-

CONCLUSION

MSW studied the predicted OOBE interference into authorized LM stations operating within a radius of 143 km from a center point near the K14NR transmitter site coordinates with K14NR operating on channel 14 as defined in its construction permit. The potential impact that K14NR 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 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 above, K14NR 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 K14NR 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 K14NR-D 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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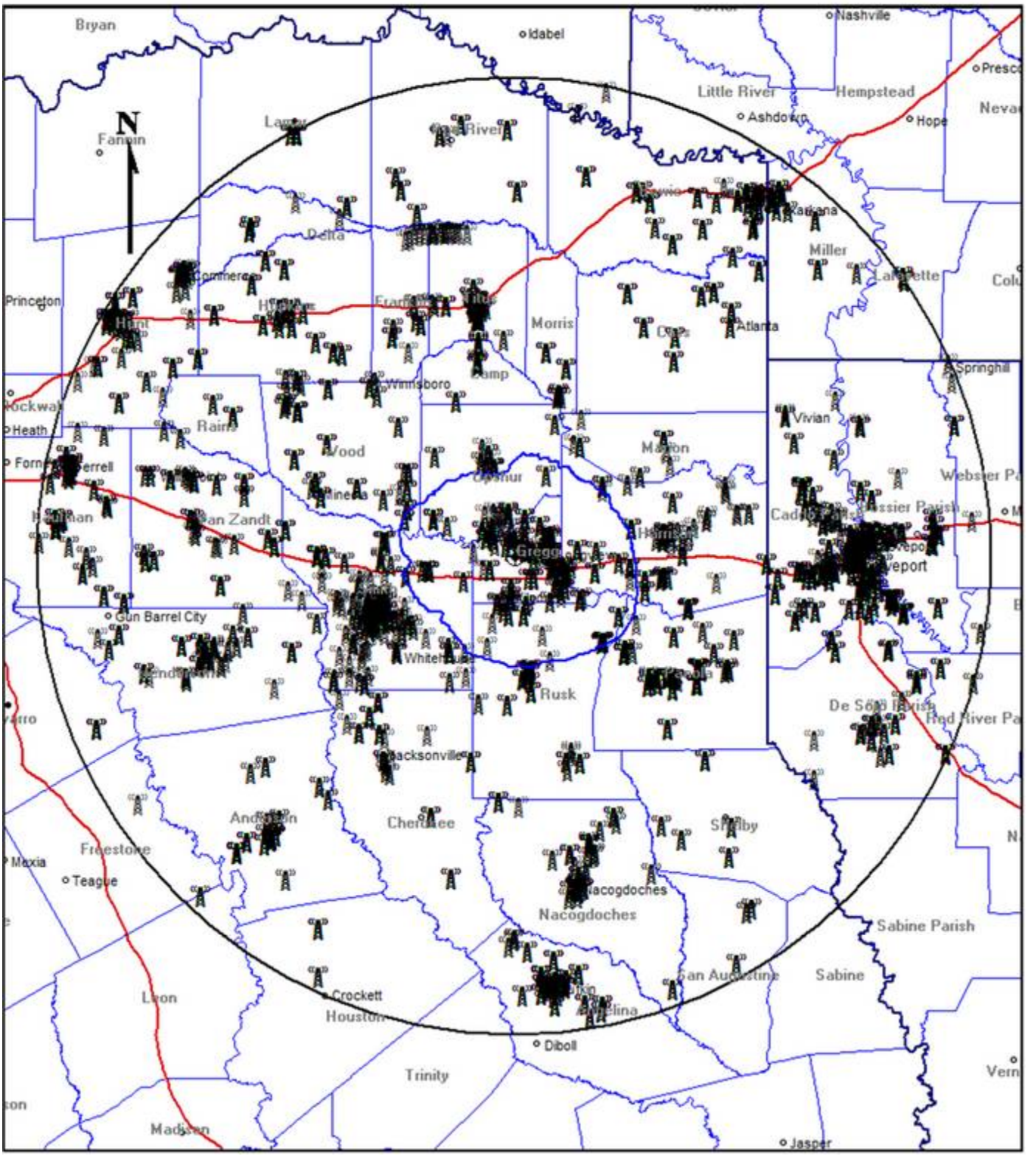
October 11, 2023

APPENDIX 1
K14NR-D, Channel 14, Tyler, TX
Land Mobile Facilities, 460-470 MHz, within 143 km of the K14NR-D Transmitter Site
K14NR-D 51 dBu Protected Contour Shown in Blue



APPENDIX 2
Land Mobile Fixed Base Stations with the Lowest Interference Margins
Listing of the Lowest 30 out of 3,100 Fixed Base LM Facilities

Freq Mhz	Call Sign	Svc Code	Svc Cls	DTV->LM Dist km	DTV->LM Az deg	Ant Pol	HAAT m	HAGL m	Gain dBd	BW khz	IX Mgn dB	ACRR Mgn dB
464.9625	WQSV351	IG	FB2*	16.8	108.4		12.0	16.0		11.2	18.9	35.2
464.9625	WQSV351	IG	FB2*	16.8	108.4		12.0	16.0		7.6	18.9	36.9
464.9750	WPEE921	IG	FB2*	10.9	59.6		11.0	9.0	3.0	11.2	20.9	40.8
464.9750	WPEE921	IG	FB2*	10.9	59.6		11.0	9.0	3.0	7.6	20.9	42.5
464.7875	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	22.8	21.9
464.7875	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	22.8	23.5
464.4500	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	26.4	22.9
464.4500	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	26.4	24.5
464.3125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	30.4	23.2
464.3125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	30.4	24.9
464.7625	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	30.5	30.4
464.1625	WRDG363	IG	FB2*	3.3	72.3		41.2	30.5		11.2	34.4	23.6
464.1625	WRDG363	IG	FB2*	3.3	72.3		41.2	30.5		7.6	34.4	25.3
464.4625	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	34.6	31.3
464.9375	WPKM654	YG	FB8*	41.7	251.6	V	123.0	106.7	9.0	11.2	35.9	42.9
464.9750	WPZV544	IG	FB2*	42.2	251.4		60.5	54.8	0.0	11.2	36.7	56.5
464.9750	WPZV544	IG	FB2*	42.2	251.4		60.5	54.8	0.0	7.6	36.7	58.2
464.8375	WRDZ573	IG	FB2*	10.6	320.9		48.0	35.4	3.5	7.6	37.0	34.3
464.8375	WRDZ573	IG	FB2*	10.6	320.9		48.0	35.4	3.5	11.3	37.1	32.6
464.2500	WQEF290	IG	FB2*	7.8	87.5		36.3	35.0	1.8	11.2	37.6	28.8
464.4375	WQOB513	IG	FB2*	11.9	110.0		5.0	12.0		11.2	37.7	34.0
464.4375	WQOB513	IG	FB2*	11.9	110.0		5.0	12.0		7.6	37.7	35.7
464.8000	WQBL284	YG	FB8*	11.5	15.2		368.8	334.7	0.0	11.2	37.9	36.3
464.9125	WPUV474	YG	FB8*	41.1	173.1	V	139.7	154.0	9.0	11.2	38.8	38.2
464.0125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	39.1	24.0
464.0125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	39.1	25.7
464.6500	WQED502	IG	FB2*	23.8	124.2		35.6	36.5	3.0	11.0	39.1	39.5
464.6500	WQED502	IG	FB2*	23.8	124.2		35.6	36.5	3.0	7.6	39.1	41.1
464.6500	WQED502	IG	FB2*	23.8	124.2		35.6	36.5	3.0	11.2	39.2	39.4
464.7000	WQZP707	IG	FB2*	17.0	242.6		49.0	49.0		8.1	39.4	41.6

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
Listing of the Lowest 30 out of 3,100 Fixed Base LM Facilities

Freq Mhz	Call Sign	Svc Code	Svc Cls	DTV->LM Dist km	DTV->LM Az deg	Ant Pol	HAAT m	HAGL m	Gain dBd	BW khz	IX Mgn dB	ACRR Mgn dB
464.7875	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	22.8	21.9
464.4500	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	26.4	22.9
464.3125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	30.4	23.2
464.7875	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	22.8	23.5
464.1625	WRDG363	IG	FB2*	3.3	72.3		41.2	30.5		11.2	34.4	23.6
464.0125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		11.2	39.1	24.0
464.4500	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	26.4	24.5
464.3125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	30.4	24.9
463.6375	WRHW947	IG	FB2*	4.1	347.9	V	47.0	25.0	6.0	11.2	49.9	24.9
464.1625	WRDG363	IG	FB2*	3.3	72.3		41.2	30.5		7.6	34.4	25.3
464.4500	WRCB368	IG	FXO	1.4	5.0		15.9	9.1	6.0	11.2	68.6	25.3
468.2000	WQRJ825	IG	FXO	7.7	306.6		25.0	29.0	12.0	11.0	60.9	25.4
464.0125	WRCZ942	IG	FB2*	3.3	72.3		10.9	30.5		7.6	39.1	25.7
463.6375	WRHW947	IG	FB2*	4.1	347.9	V	47.0	25.0	6.0	7.6	49.9	26.6
468.2000	WQRJ825	IG	FXO	9.6	300.5		57.0	46.0	12.0	11.0	62.8	27.3
462.4750	WQVA678	IG	FB2*	3.4	59.3	V	16.7	11.0	3.0	7.6	72.3	27.3
463.3875	WQBL849	IG	FB2*	11.5	108.6	H	4.8	11.0	3.0	11.2	57.8	27.5
468.2000	WQRJ825	IG	FXOT	0.1	122.8			0.0	12.0	11.0	63.3	27.8
464.2500	WQEF290	IG	FB2*	7.8	87.5		36.3	35.0	1.8	11.2	37.6	28.8
468.2000	WQRJ825	IG	FXO	11.9	306.7		67.0	60.4	12.0	11.0	64.9	29.3
462.0250	WPKW906	IG	FB6*	5.7	103.0		104.0	119.0	4.4	11.0	76.1	29.8
462.3500	WQBL849	IG	FB2*	11.5	108.6	H	4.8	11.0	3.0	11.2	78.8	30.0
464.7625	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	30.5	30.4
464.4625	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	34.6	31.3
464.8375	WRDZ573	IG	FB2*	10.6	320.9		48.0	35.4	3.5	11.3	37.1	32.6
463.9875	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	48.3	32.6
462.8000	WQGB471	IK	FB6C*	15.3	166.2		196.0	167.0	8.0	20.0	77.2	32.7
463.2250	WQEB422	IG	FB2*	11.4	85.7		48.9	40.2	3.2	11.2	67.9	33.5
463.5625	WPUI964	YG	FB8*	11.5	15.2	H	368.8	334.7	0.0	11.2	60.5	33.9
464.4375	WQOB513	IG	FB2*	11.9	110.0		5.0	12.0		11.2	37.7	34.0

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 4,789 Mobile LM Facilities

Freq Mhz	Call Sign	Svc Code	Svc Cls	DTV->LM Dist km	DTV->LM Az deg	Ant Pol	HAAT m	HAGL m	Gain dBd	BW khz	IX Mgn dB	ACRR Mgn dB
469.9750	WPEE921	IG	MO	3.7	58.1			0.0		11.2	14.3	34.3
469.9750	WPEE921	IG	MO	3.7	58.1			0.0		7.6	14.3	36.0
469.9625	WQSV351	IG	MO	0.1	122.8			0.0		11.2	17.5	34.0
469.9625	WQSV351	IG	MO	0.1	122.8			0.0		7.6	17.5	35.7
469.6625	WRUX220	IG	MO	0.1	122.8			0.0		11.2	28.7	29.3
469.6375	WQEB422	IG	MO	0.1	122.8			0.0		11.2	31.9	32.3
469.6375	WQEB422	IG	MO	0.1	122.8			0.0		7.6	31.9	33.9
469.7875	WQEB422	IG	MO	0.1	122.8			0.0		11.2	32.5	31.7
469.7875	WQEB422	IG	MO	0.1	122.8			0.0		7.6	32.5	33.4
469.7000	WQZP707	IG	MO	0.1	122.8			0.0		8.1	34.1	36.5
469.6250	WQBL849	IG	MO	3.7	122.9			0.0		11.2	34.4	34.3
469.4000	WRUX220	IG	MO	0.1	122.8			0.0		11.2	34.5	30.0
469.9750	WPZV544	IG	MO	10.9	236.7			0.0		11.2	34.6	54.5
469.9750	WPZV544	IG	MO	10.9	236.7			0.0		7.6	34.6	56.2
469.7625	WPUI964	YG	MO8	0.1	122.8			0.0		11.2	34.7	34.8
469.6500	WQED502	IG	MO	0.1	122.8			0.0		11.2	34.8	35.3
469.6500	WQED502	IG	MO	0.1	122.8			0.0		11.0	34.8	35.4
469.6500	WQED502	IG	MO	0.1	122.8			0.0		7.6	34.8	37.0
469.7875	WRCZ942	IG	MO	0.1	122.8			0.0		11.2	35.5	34.7
469.7875	WRCZ942	IG	MO	0.1	122.8			0.0		7.6	35.5	36.4
469.8000	WQBL284	YG	MO8	0.1	122.8			0.0		11.2	36.1	34.7
469.8250	WRCK679	IG	MO	10.7	106.4			0.0		11.2	37.4	34.2
469.6750	WQVH246	IG	MO	13.2	112.1			0.0		11.2	38.4	39.0
469.3625	WQEB422	IG	MO	0.1	122.8			0.0		11.2	38.5	32.9
469.3625	WQEB422	IG	MO	0.1	122.8			0.0		7.6	38.5	34.6
469.8875	WQBL849	IG	MO	3.7	122.9			0.0		11.2	38.7	33.4
469.8375	WRDZ573	IG	MO	0.1	122.8			0.0		11.3	38.8	34.5
469.4625	WPUI964	YG	MO8	0.1	122.8			0.0		11.2	38.8	35.7
469.8375	WRDZ573	IG	MO	0.1	122.8			0.0		7.6	38.8	36.2
469.4500	WRCZ942	IG	MO	0.1	122.8			0.0		11.2	39.1	35.7

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
Listing of the Lowest 30 out of 4,789 Mobile LM Facilities

Freq Mhz	Call Sign	Svc Code	Svc Cls	DTV->LM Dist km	DTV->LM Az deg	Ant Pol	HAAT m	HAGL m	Gain dBd	BW khz	IX Mgn dB	ACRR Mgn dB
469.6625	WRUX220	IG	MO	0.1	122.8			0.0		11.2	28.7	29.3
469.4000	WRUX220	IG	MO	0.1	122.8			0.0		11.2	34.5	30.0
469.7875	WQEB422	IG	MO	0.1	122.8			0.0		11.2	32.5	31.7
469.6375	WQEB422	IG	MO	0.1	122.8			0.0		11.2	31.9	32.3
467.4750	WQVA678	IG	MO	0.1	122.8			0.0		7.6	77.6	32.7
469.3625	WQEB422	IG	MO	0.1	122.8			0.0		11.2	38.5	32.9
469.7875	WQEB422	IG	MO	0.1	122.8			0.0		7.6	32.5	33.4
469.8875	WQBL849	IG	MO	3.7	122.9			0.0		11.2	38.7	33.4
469.6375	WQEB422	IG	MO	0.1	122.8			0.0		7.6	31.9	33.9
469.9625	WQSV351	IG	MO	0.1	122.8			0.0		11.2	17.5	34.0
469.1375	WQJS848	IG	MO	0.1	122.8			0.0		11.2	45.5	34.1
468.9375	WQEB422	IG	MO	0.1	122.8			0.0		11.2	50.7	34.1
469.8250	WRCK679	IG	MO	10.7	106.4			0.0		11.2	37.4	34.2
469.9750	WPEE921	IG	MO	3.7	58.1			0.0		11.2	14.3	34.3
469.6250	WQBL849	IG	MO	3.7	122.9			0.0		11.2	34.4	34.3
469.8375	WRDZ573	IG	MO	0.1	122.8			0.0		11.3	38.8	34.5
469.8625	WPQK484	YG	MO8	0.1	122.8			0.0		11.2	40.4	34.5
469.3625	WQEB422	IG	MO	0.1	122.8			0.0		7.6	38.5	34.6
469.7875	WRCZ942	IG	MO	0.1	122.8			0.0		11.2	35.5	34.7
469.8000	WQBL284	YG	MO8	0.1	122.8			0.0		11.2	36.1	34.7
469.7625	WPUI964	YG	MO8	0.1	122.8			0.0		11.2	34.7	34.8
469.6500	WQED502	IG	MO	0.1	122.8			0.0		11.2	34.8	35.3
469.6500	WQED502	IG	MO	0.1	122.8			0.0		11.0	34.8	35.4
469.9625	WQSV351	IG	MO	0.1	122.8			0.0		7.6	17.5	35.7
469.4625	WPUI964	YG	MO8	0.1	122.8			0.0		11.2	38.8	35.7
469.4500	WRCZ942	IG	MO	0.1	122.8			0.0		11.2	39.1	35.7
468.9375	WQEB422	IG	MO	0.1	122.8			0.0		7.6	50.7	35.8
469.9750	WPEE921	IG	MO	3.7	58.1			0.0		7.6	14.3	36.0
469.4375	WQOB513	IG	MO	8.2	119.1			0.0		11.2	39.7	36.0
469.3375	WQWU620	IG	MO	0.1	122.8			0.0		11.2	42.3	36.0

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