ENGINEERING REPORT

Modification of a Licensed Facility for DTV Application

KCHF – Santa Fe, NM
License Number – 0000004531
(Facility ID Number: 60793)

August 2021

MUNN–REESE
Broadcast Engineering Consultants
Coldwater, MI 49036

Discussion of Engineering Report

This firm was retained to prepare the required engineering report in support of this Modification of a Licensed Facility for DTV application for KCHF(TV) Santa Fe, MN. Currently KCHF(TV), is authorized to operate on Channel 10 with an ERP of 30.0 kW at 3085.5 meters AMSL utilizing a omni-directional antenna. Proposed operation is requested on Channel 10 from a different site with an ERP of 20.0 kW at 3261.4 meters AMSL, and utilizing a different antenna make and model.

Additional engineering exhibits are attached to this application:

- ***"KCHF Proposed Interference Study".*** This exhibit demonstrates that the proposed facility will not cause Prohibited Interference to stations affected by this proposal. The proposed facility will receive interference and applicant agrees to accept this interference. The details of the study parameters are included in this exhibit and show a Study Cell Size of 2.0 km and a Profile Point Spacing of 1.0 km.

- ***"TV Station KCHF-CH 10 – Santa Fe, NM".*** Evaluation of the proposed facility for compliance with the appropriate guidelines limiting human exposure to radio frequency electromagnetic fields. This evaluation was provided by the firm of Hammett & Edison, Inc., Consulting Engineers.

- ***"KCHF Proposed Equivalent Coverage Map".*** Map showing actual area and population of proposed KCHF to not exceed that of KASA-TV and community coverage of Santa Fe, NM. The comparison of KCHF and KASA-TV is in support proposed ERP. The justification for the power level is found in §73.622(f)(5)—

  (5) Licensees and permittees assigned a DTV channel in the initial DTV Table of Allotments may request an increase in either ERP in some azimuthal direction or antenna HAAT, or both, that exceed the initial technical facilities specified for the allotment in Appendix B of the *Memorandum Opinion and Order* (referenced in paragraph (c) of this section), up to the maximum permissible limits on DTV power and antenna height set forth in paragraph (f)(6), (f)(7), or (f)(8) of this section, as appropriate, or up to that needed to provide the same geographic coverage area as the largest station within their market, whichever would allow the largest service area. Such requests must be accompanied by a technical showing that the increase complies with the technical criteria in §73.623(c), and thereby will not result in new interference exceeding the *de minimis* standard set forth in that section, or statements agreeing to the change from any co-channel or adjacent channel stations that might be affected by potential new interference, in accordance with §73.623(f). In the case where a DTV station has been granted authority to construct pursuant to §73.623(c), and its authorized coverage area extends in any azimuthal direction beyond the DTV coverage area determined for the DTV allotment reference facilities, then the authorized DTV facilities are to be used in addition to the assumed facilities of the initial DTV allotment to determine protection from new DTV allotments pursuant to §73.623(d) and from subsequent DTV applications filed pursuant to §73.623(c). The provisions of this paragraph regarding increases in the ERP or antenna height of DTV stations on channels in the initial DTV Table of Allotments shall also apply in cases where the licensee or permittee seeks to change the station's channel as well as alter its ERP and antenna HAAT. Licensees and permittees are advised that where a channel change is requested, it may, in fact, be necessary in specific

cases for the station to operate with reduced power, a lower antenna, or a directional antenna to avoid causing new interference to another station.

Proposed KCHF Interference Study

tvstudy v2.2.5 (4uoc83)
Database: 127.0.0.1, Study: KCHF without Repack Record, Model: Longley-Rice
Start: 2021.07.22 11:28:39

Study created: 2021.07.22 11:28:39

Study build station data: LMS TV 2021-07-20

```
    Proposal: KCHF D10 DT APP SANTA FE, NM
 File number: Proposed
 Facility ID: 60793
Station data: User record
   Record ID: 98
     Country: U.S.
        Zone: II
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Build options:
Protect pre-transition records not on baseline channel

Search options:
All post-transition APP, CP, and baseline records excluded

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
Yes	KBIM-TV	D10	DT	LIC	ROSWELL, NM	BLANK0000067866	340.7 km
Yes	KFDA-TV	D10	DT	LIC	AMARILLO, TX	BLCDT20111114BLB	418.1

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

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    Channel: D10
   Latitude:  35 12 53.51 N (NAD83)
  Longitude: 106 27  3.94 W
Height AMSL: 3261.4 m
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Proposed KCHF Interference Study

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       HAAT: 1252.0 m
   Peak ERP: 22.0 kW
    Antenna: Omnidirectional
Elev Pattrn: Generic
  Elec Tilt: 2.00
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36.0 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	22.0 kW	1207.1 m	135.4 km
45.0	22.0	1240.4	136.1
90.0	22.0	1107.1	133.2
135.0	22.0	903.7	128.3
180.0	22.0	998.8	130.6
225.0	22.0	1506.5	140.6
270.0	22.0	1577.5	141.5
315.0	22.0	1475.3	140.2

ERP exceeds maximum
ERP: 22.0 kW ERP maximum: 8.78 kW

Distance to Canadian border: 1532.2 km

Distance to Mexican border: 381.4 km

Conditions at FCC monitoring station: Douglas AZ
Bearing: 216.7 degrees Distance: 508.7 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 10.6 degrees Distance: 555.1 km

Study cell size: 2.00 km
Profile point spacing: 1.00 km

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

Proposed KCHF Interference Study

Interference to BLANK0000067866 LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KBIM-TV	D10	DT	LIC	ROSWELL, NM	BLANK0000067866	
Undesireds:	KCHF	D10	DT	APP	SANTA FE, NM	Proposed	340.7 km
	KWES-TV	D9	DT	LIC	ODESSA, TX	BLCDT20121210ACW	148.0
	KFDA-TV	D10	DT	LIC	AMARILLO, TX	BLCDT20111114BLB	308.0

Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX	
45805.5	205,701	45279.2	205,647	43307.8	205,381	42770.6	205,365	1.24	0.01

Undesired	Total IX	Unique IX, before		Unique IX, after	
KCHF D10 DT APP	741.5	54		537.3	16
KWES-TV D9 DT LIC	1061.6	58	1061.6	58	1061.6	58
KFDA-TV D10 DT LIC	909.8	208	909.8	208	705.5	170

Interference to BLCDT20111114BLB LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KFDA-TV	D10	DT	LIC	AMARILLO, TX	BLCDT20111114BLB	
Undesireds:	KCHF	D10	DT	APP	SANTA FE, NM	Proposed	418.1 km
	KBIM-TV	D10	DT	LIC	ROSWELL, NM	BLANK0000067866	308.0

Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX	
46099.7	385,064	44658.4	383,977	44355.3	383,749	44351.3	383,749	0.01	0.00

Undesired	Total IX	Unique IX, before		Unique IX, after	
KCHF D10 DT APP	8.1	0		4.0	0
KBIM-TV D10 DT LIC	303.1	228	303.1	228	299.0	228

Proposed KCHF Interference Study

Interference to proposal scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KCHF	D10	DT	APP	SANTA FE, NM	Proposed	
Undesireds:	KBIM-TV	D10	DT	LIC	ROSWELL, NM	BLANK0000067866	340.7 km
	KFDA-TV	D10	DT	LIC	AMARILLO, TX	BLCDT20111114BLB	418.1

Service area		Terrain-limited		IX-free		Percent IX	
58025.7	1,157,844	53944.0	1,132,343	53788.5	1,132,214	0.29	0.01

Undesired	Total IX		Unique IX		Prcnt Unique IX	
KBIM-TV D10 DT LIC	147.5	129	131.5	109	0.24	0.01
KFDA-TV D10 DT LIC	24.0	20	8.0	0	0.01	0.00

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of TV Station KCHF, Channel 10, Santa Fe, New Mexico, to evaluate proposed modifications to its licensed facility, for compliance with appropriate guidelines limiting human exposure to radio frequency ("RF") electromagnetic fields.

Prevailing Exposure Standard

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers IEEE C95.1-2019, "IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz," includes similar exposure limits. A summary of the FCC's exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation," dated August 1997. Figure 2 describes the calculation methodologies, reflecting the facts that a directional antenna's radiation pattern is not fully formed at locations very close by (the "near-field" effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the "inverse square law"). This methodology is an industry standard for evaluating RF exposure conditions and has been demonstrated through numerous field tests to be a conservative prediction of exposure levels.

Site and Facility Description

KCHF proposes to relocate its main transmitting facilities about 39 miles south to Tower 31 at the Sandia Crest Electronics Site, located approximately 12 miles northeast of Albuquerque, New Mexico, in the Cibola National Forest. Except for the steep drop-off to the west, which itself limits access, the high-power portion of the Sandia Crest Electronics Site is encompassed by a chain-link fence, with access into the area controlled by three locked gates.

KCHF proposes to mount an Alive Model BCE83M-V3-10, three-bay elliptically-polarized* directional antenna on Tower 31, located near the northern end of the high-power portion of the site. The antenna would employ 2° electrical downtilt and would be mounted at an effective height of about 90 feet above ground, oriented toward 210°T. The maximum effective radiated power in any direction would be 28.6 kilowatts, representing 22.0 kW for horizontal polarization and 6.60 kW for vertical polarization. There are presently antennas for use by several other broadcast and wireless telecommunications operators on the subject tower and on other towers at the site.

Measurements were made by Mr. David Kelly, a qualified field technician employed by Hammett & Edison, Inc., on July 14, 15, and 16, 2020, throughout the high-power site, outside the south gate in the public parking lot and lookout area, and on the trail running along the eastern end of the site. The measurement equipment used was a Narda Type NBM-520 Broadband Field Meter with Type EA-5091 Isotropic Broadband Electric Field Probe (Serial No. 01291). The meter and probe were under current calibration by the manufacturer. The Type EA-5091 probe is frequency-shaped to reflect the occupational exposure limits detailed in the FCC standard, allowing the meter to measure correctly the total exposure levels from various emitters at the site. The meter conveniently reads directly in percent of the occupational limit of the standard. The maximum RF exposure level measured at the publicly accessible trail that runs along the eastern fence line of the site was 32% of the applicable public exposure limit.

Study Results

For a person anywhere at ground within the fenced area, the maximum RF exposure level due to the KCHF operation is calculated to be 0.046 mW/cm^2, which is 4.6% of the applicable occupational exposure limit. It should be noted that this result includes several "worst-case" assumptions and therefore is expected to overstate actual power density levels from the operation. Since the maximum calculated RF exposure level is less than 5% of the FCC occupational limit, it is therefore excluded under Section 1.1307(b)(5) of the FCC Rules from having to consider the contributions of other stations at the site in establishing its own compliance with the FCC occupational exposure limits.

The maximum calculated RF exposure levels at the publicly accessible trail along the eastern fence line of the site is 11% of the applicable public exposure limit. Therefore, cumulative levels along that trail, from all the facilities at the site, are expected to be less than 43% of the applicable public exposure limit. RF exposure levels due to the KCHF operation in the publicly accessible Sandia Crest parking lot and lookout area, over 1,500 feet away, are calculated to be well below 5% of the FCC public exposure limit.

* 30% vertical component.

Recommended Mitigation Measures

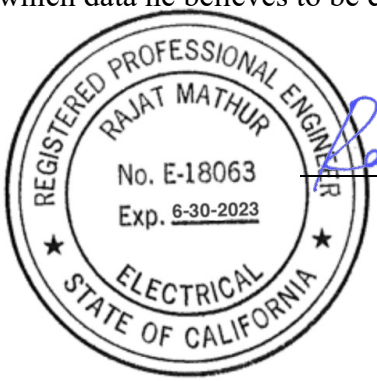
Due to its mounting location and height, the KCHF antenna is not accessible to unauthorized persons, and so no measures are necessary to comply with the FCC public exposure guidelines. To prevent occupational exposures in excess of the FCC guidelines, it is recommended that appropriate RF safety training, to include review of personal monitor use and lockout/tagout procedures, be provided to all authorized personnel who have access to the fenced site and to the tower. No access directly in front of the KCHF antenna itself, such as might occur during certain maintenance activities high on the tower, should be allowed while it is in operation, unless other measures can be demonstrated to ensure that occupational protection requirements are met. It is recommended that explanatory signs† be posted at the locked gates and on the tower at or below the antenna, readily visible from any angle of approach to persons who might need to work there.

Conclusion

Based on the information and analysis above, it is the undersigned's professional opinion that the proposed KCHF operation will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment. The highest calculated level in publicly accessible areas is less than the prevailing standards allow for exposures of unlimited duration. Training authorized personnel and posting explanatory signs are recommended to establish compliance with occupational exposure limits.

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration No. E-18063, which expires on June 30, 2023. This work has been carried out under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.



Rajat Mathur, P.E.
707/996-5200

June 29, 2021

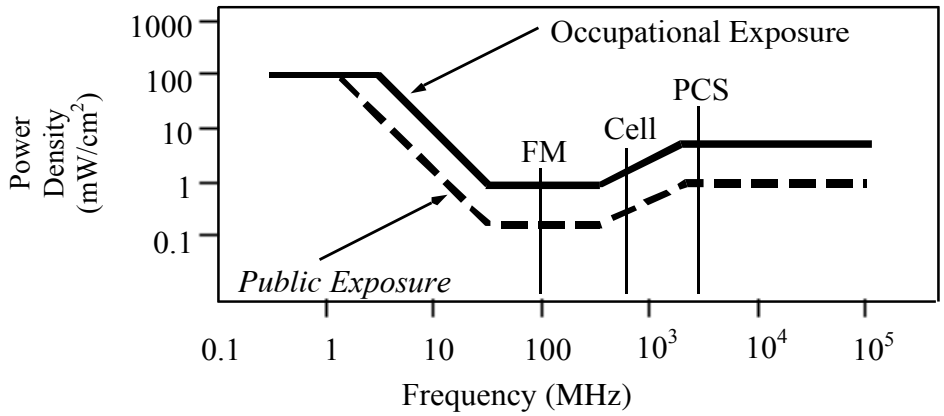
† Signs should include the following information to comply with recent FCC Rules: appropriate signal word and associated color, RF energy advisory symbol, explanation of the RF source, behavior necessary to comply with the exposure limits, and contact information to arrange for close access. The selection of language(s) is not an engineering matter, and guidance from the landlord, local zoning or health authority, or appropriate professionals may be required.

FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

Frequency	Electromagnetic Fields (f is frequency of emission in MHz)					
Applicable Range (MHz)	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm^2)	
0.3 – 1.34	614	*614*	1.63	*1.63*	100	*100*
1.34 – 3.0	614	*823.8/ f*	1.63	*2.19/ f*	100	*180/ f^2*
3.0 – 30	1842/ f	*823.8/ f*	4.89/ f	*2.19/ f*	900/ f^2	*180/ f^2*
30 – 300	61.4	*27.5*	0.163	*0.0729*	1.0	*0.2*
300 – 1,500	$3.54\sqrt{f}$	*$1.59\sqrt{f}$*	$\sqrt{f}/106$	*$\sqrt{f}/238$*	f/300	*f/1500*
1,500 – 100,000	137	*61.4*	0.364	*0.163*	5.0	*1.0*



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has incorporated those formulas in a computer program capable of calculating, at thousands of locations on an arbitrary grid, the total expected power density from any number of individual radio frequency sources. The program allows for the inclusion of uneven terrain in the vicinity, as well as any number of nearby buildings of varying heights, to obtain more accurate projections.

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.
Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D \times h}$, in mW/cm^2,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \times 16 \times \eta \times P_{net}}{\pi \times h^2}$, in mW/cm^2,

where θ_{BW} = half-power beamwidth of antenna, in degrees,
P_{net} = net power input to antenna, in watts,
D = distance from antenna, in meters,
h = aperture height of antenna, in meters, and
η = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.
OET-65 gives this formula for calculating power density in the far field of an individual RF source:

power density $S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2}$, in mW/cm^2,

where ERP = total ERP (all polarizations), in kilowatts,
RFF = three-dimensional relative field factor toward point of calculation, and
D = distance from antenna effective height to point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula is used in a computer program capable of calculating, at thousands of locations on an arbitrary grid, the total expected power density from any number of individual radio frequency sources. The program also allows for the inclusion of uneven terrain in the vicinity, as well as any number of nearby buildings of varying heights, to obtain more accurate projections.

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KCHF-D
Proposed
Latitude: 35-12-53.51 N
Longitude: 106-27-03.94 W
ERP: 22.00 kW
Channel: 10
Frequency: 195.0 MHz
AMSL Height: 3261.43 m
Elevation: 3234.0 m
Horiz. Pattern: Omni
Vert. Pattern: Yes
Elec Tilt: 2.0
Prop Model: None
Service Contour:
Area: 57,983.7 km²
Population: 1,159,472

KASA-TV
0000136792
Latitude: 35-12-49.80 N
Longitude: 106-27-03.30 W
ERP: 369.00 kW
Channel: 27
Frequency: 551.0 MHz
AMSL Height: 3301.6 m
Elevation: 3234.5 m
Horiz. Pattern: Omni
Vert. Pattern: Yes
Elec Tilt: 2.5
Prop Model: None
Service Contour:
Area: 58,356.1 km²
Population: 1,160,522