

**Engineering Assumptions Used for Coverage Analysis
FOR
WYOMING RADIO COMMUNICATIONS SYSTEMS
EXHIBIT 2**

General:

- Cable Type: is assumed to be ½" Heliac[®] per customer input
- Cable Loss assumed to be: 50 MHz Range 0.42/100 ft.
 150 MHz Range 0.815/100 ft.
 450 MHz Range 1.45/100 ft.
- The January 14, 2003 FCC data sets analyzed include temporary base stations and repeaters.
- The datum of the latitude and longitude was either indicated as NAD 87 or not at all, therefore, NAD 87 was assumed for all sites. The latitude and longitude values were all provided in degrees, minutes, and seconds. All values are converted to decimal format using the following equation:
 decimal format = degrees + (minutes/60) + (seconds/3600)
- The output power and ERP are in units of watts and the height is in feet.
- The maps represent the coverage of every tower layered on top on each other.
- When the ERP was provided in all data sets for base/repeater data, the ERP was used in the calculations. When provided, many of the ERP values listed for the mobile units was unrealistic or incorrect. In this situation, attempts were made to correct the data. If unachievable or impractical to validate, the ERP for mobiles are either matched to the base/repeater power or assumed a specific value based on the type of group. The specifics are shown below.

- When a base/repeater ERP is zero or missing, but an output power value is present in the data, the calculated ERP is shown as:

$$\text{Base/repeater ERP (in dBw)} = [10 \times \log_{10}(\text{output power}) - (\text{cavity, coupler and connector losses}) - (\text{coax loss}) + (\text{antenna gain})]$$

Where:

- Cavity and connector losses are assumed to be 2.5 dB
 - Coax loss = [(antenna height + 25' of coax from tower to equipment)/100'] X [cable loss/100']
 - Base/repeater antenna gain is estimated to be 8 dB with reference to a ½ wave dipole in an omni directional orientation.
- When mobile ERP is present, it is used directly in the coverage calculations. When only mobile output power is present in the data sets, the output power is converted to dBw and the ERP is calculated as:

$$\text{Mobile ERP (in dBw)} = 10 \times \log_{10}(\text{output power}) - [(\text{cavity and connector losses}) - (\text{coax loss}) + (\text{antenna gain})], \text{ where the values in brackets is } 0 \text{ dB.}$$

- 0 dB with reference to a ½ wave dipole used to represent the gains and losses associated with the mobile environment beyond the output power of the mobile transmitter. This accounts for the antenna gain, connector losses, cable losses, the effects of light bars, and the effect of high-speed travel on bending of the antenna, when applicable, etc. Light bars or similar devices will be present on vehicles in each grouping, therefore worst case scenario is assumed.
- When mobile ERP and output power were not present then various values were assumed based on the group type. See specifics below.

Group 1: Specific State Agencies (WYDOT Maintenance, HP, SALECS, Wyoming State Forestry Division)

- 100 watts is assumed to be the mobile output power for WYDOT maintenance, HP, and SALECS. 50 watts is the mobile output power provided specifically by the customer for State Forestry Division.
- Customer specifically stated that license KXQ684 should be eliminated from analysis.

Group 2: State Mutual Aid

- 100 watts is assumed to be the mobile output power for State Mutual Aid.

Group 3: Fire

- When no mobile output power is present in the data, 100 watts is assumed to be the mobile output power for VHF systems and 25 watts is assumed to be the output power for UHF systems based on the median value displayed in the data for each band.

Group 4: Law Enforcement

- When no mobile output power is present in the data, 100 watts is assumed to be the mobile output power, except 100 watts is assumed to be the mobile output power when the base/repeater output power is greater than 100 watts.

Group 5: Local Government

- When no mobile output power is present in the data, the mobile output power is assumed to match the base/repeater output power based on the variability of agencies and output powers, except 100 watts is assumed to be the mobile output power when the base/repeater output power is greater than 100 watts.

Group 6: Medical and Special Emergency

- When no mobile output power is present in the data, 100 watts is assumed to be the mobile output power except 100 watts is assumed to be the mobile output power when the base/repeater output power is greater than 100 watts. When more than one mobile output power is present for a site, then the largest output power is used in the calculations.

Group 7: Road and Bridge

- When no mobile output power is present in the data, 100 watts is assumed to be the output power for VHF systems and 25 watts is assumed to be the output power for UHF systems based on the median value displayed in the data for each band.

Group 8: BLM and DOI

- BLM mobile output power is assumed to be 100 watts per customer input.
- BLM receiver sensitivity is assumed to be 0.25 μ V per customer input.
- DOI mobile output power is assumed to match the base/repeater output power except 100 watts is assumed to be the mobile output power when the base/repeater output power is greater than 100 watts.
- DOI receiver sensitivity is assumed to be 0.25 μ V even though BLM indicated that it could be 0.3 μ V so both outputs could be displayed on the same map per contract.
- Per BLM's representative concurrence, all DOI sites are eliminated where yagi antennas are indicated in the data sets.