



# Thermal Report

Site Name: NW Medical Center

Customer	Location	Ambient Air Tem. Per ASHRAE	Max Fluid Flow
ATT	Fresno, CA Lat: 36.780 Long: -119.719	107° F	131° F

March 5, 2024 – Rev 2

## **Summary:**

The thermal performance of the shrouded monopole is analyzed for NW Medical Center. The purpose of this report is to show the thermal analysis results and show how each equipment functions in the proposed condition. This report details the outcomes observed during the stress test phase, wherein natural convection suffices for the equipment to operate optimally. All assessments were conducted under simulated ambient temperature and solar settings compliant with GR-487 standards. These specifications mandate the equipment to maintain operational temperatures aligned with its qualifications specified in GR-3108.

In this performance simulation, the target conditions entail the equipment maintaining a maximum temperature of 131°F while subjected to solar exposure of approximately 753 w/m<sup>2</sup>. Throughout the outlined environmental parameters, the equipment consistently stays within its rated temperature range, conforming to both GR-3108 and the maximum temperature allowances set by GR-487 and 456000 standards. Section 6.0 presents the outcomes derived from the simulation involving forced air, highlighting the comparative results between the two simulations for evaluation purposes.

### Approach:

A computational model employing steady-state three-dimensional Finite Element Analysis (FEA) for fluid dynamics and conjugate heat transfer was utilized to examine the structure and related components. This analysis was conducted in accordance with the following design parameters.

The design's environmental specifications were established based on the guidelines outlined in GR-487. To adhere to local maximum ambient temperature data sourced from ASHRAE, the ambient air temperature was configured at 107°F. As stipulated in section 3.3.3.1 of GR-487, the testing parameters for surface temperature assessments of cabinets/enclosures situated in a class IV environment necessitated the application of a solar irradiance of 753 W/m<sup>2</sup> to solar-exposed areas.

The equipment was modeled as solid aluminum with an internal heat source. The equipment optimal operating range is -40°F to +131°F. The equipment and its heat generation can be found in Table 1. Other accessories not modeled (cables, TMA and Diplexers)

*Table 1-Equipment Heat Load*

Equipment	Quantity	Heat Generation (W)
CCI Antennas DMP65R-BU4EAK	3	500
AIR 6419	3	320
AIR 6449	3	350
TPA-65R-BU4DA-K	3	500
Radio 4478 B12A	3	560
Radio 4478 B14	3	650

**Pass/Fail Criterion:**

The OEM's ambient air limit, often set at 131°F, can be unclear when applied to the air temperature surrounding the radio. To address this ambiguity, a different approach is taken by converting the ambient air limit into a radio baseplate temperature limit, allowing for a reasonable safety margin application.

The process involves isolating the Computational Fluid Dynamics (CFD) model of each heat-generating component within a 131°F ambient environment. Following this, the average temperature encompassing the volume of each component is logged as its upper limit. This upper limit functions as a benchmark for assessing against the baseplate temperature recorded when these elements are incorporated into the complete assembly. This comparative analysis plays a crucial role in establishing a suitable safety margin.

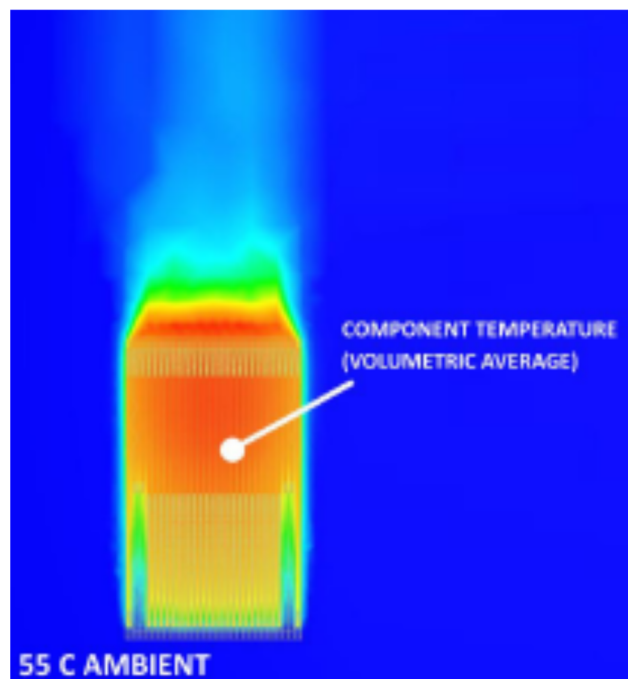


Figure 1-Typical Isolated 131°F Ambient Analysis (Picture for Reference Only)

### Model Details:

Using 3D models of the design, a simplified CFD (Computational Fluid Dynamics) model was built using ANSYS and Autodesk CFD software.

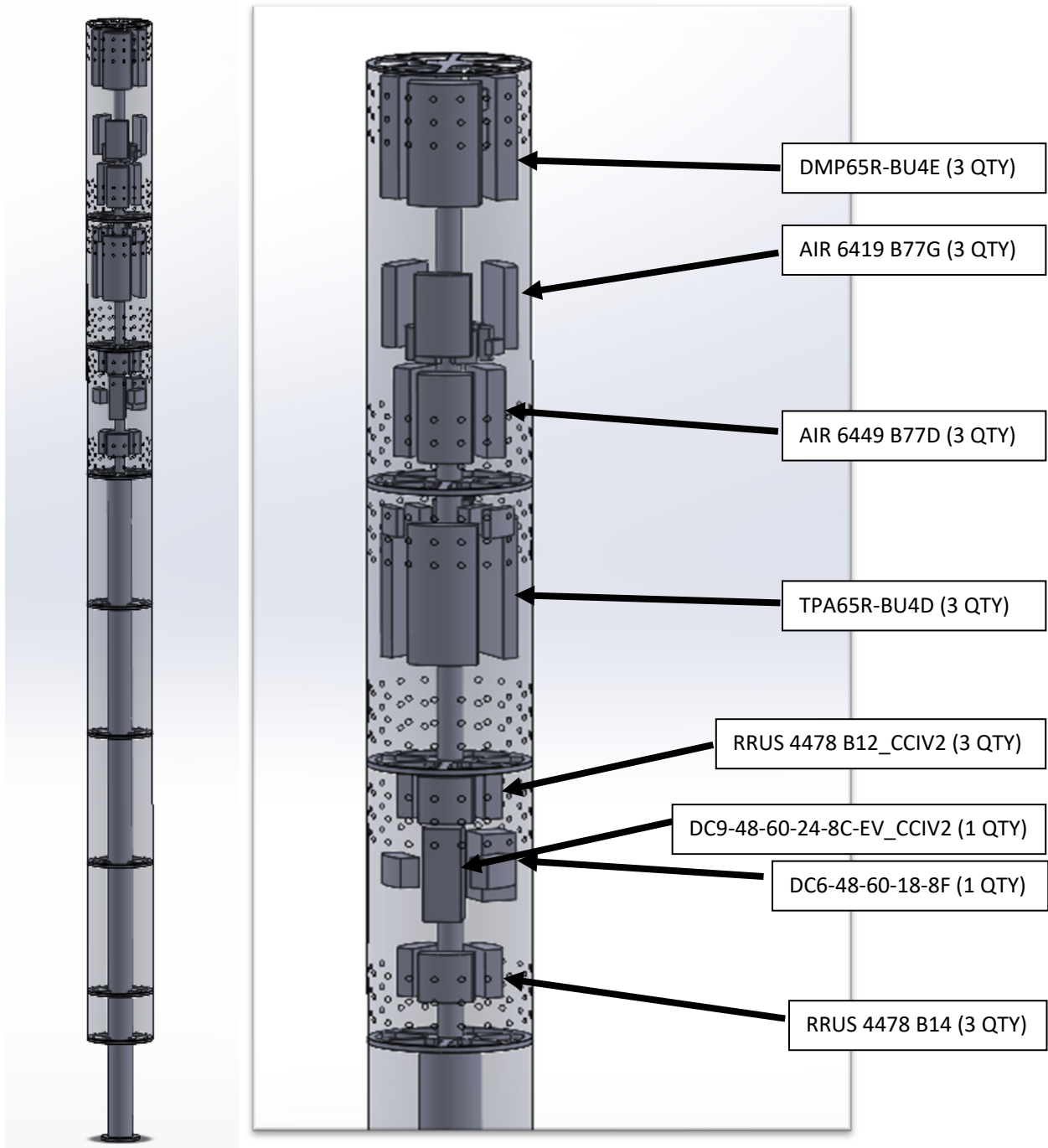


Figure 2-3D Fusion Model: Concealed

### Modifications:

Modifications to the original model are as follows:

- No modifications are required

### Assumptions:

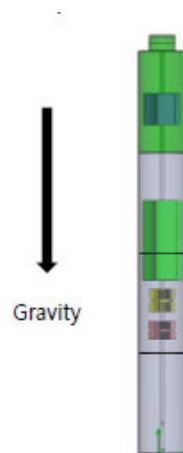
Estimated material/finish coefficients:

- Absorptivity of concealment = 1
  - Assumed to be a perfect opaque body, all incoming radiation is absorbed.
- Emissivity of concealment = 0.9
  - Conservative estimate of emissivity for all applicable solar areas.

Cable resistance is anticipated to be low and was not included in the model.

### Environmental Conditions:

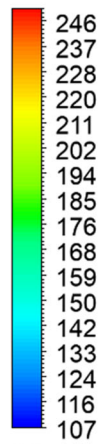
- Air temperature & Initial solid parts temperature = 107 deg F.
- Pressure = 1 atm = 14.7 psi
- Wind Speed = 0 ft/s



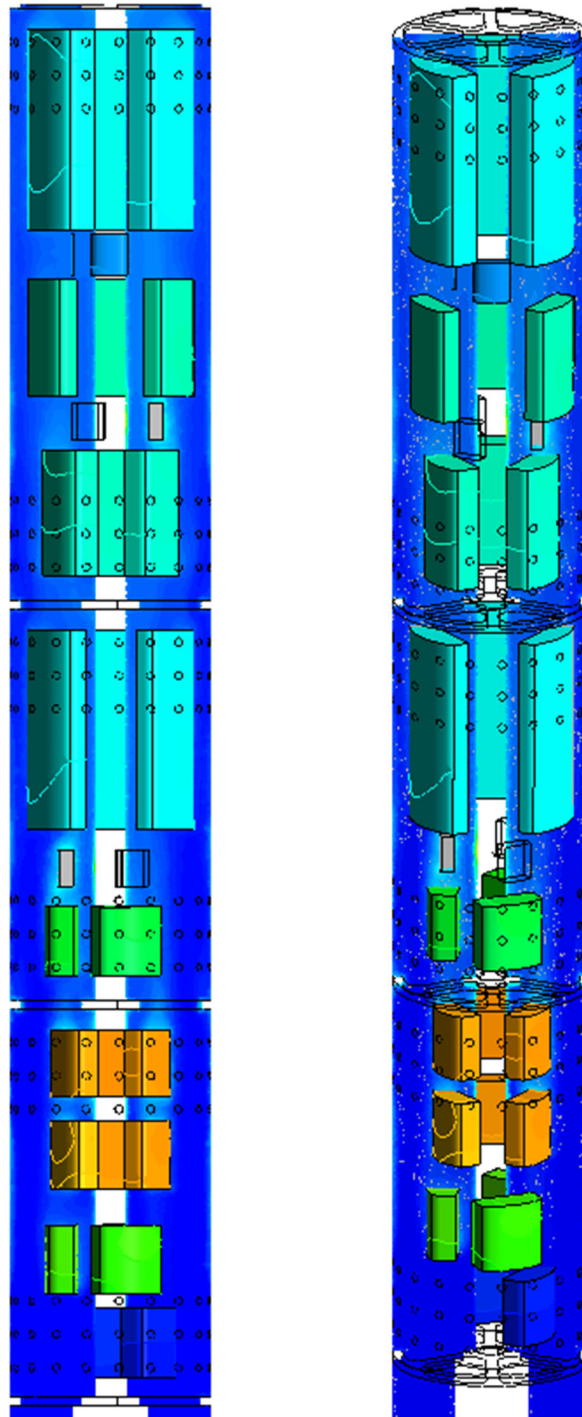
## Simulation Results:

### Temperature Plots:

Temperature  
Contour 1

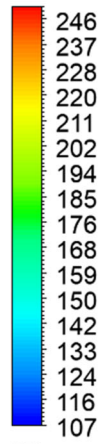


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## Temperature Plots:

Temperature  
Contour 1

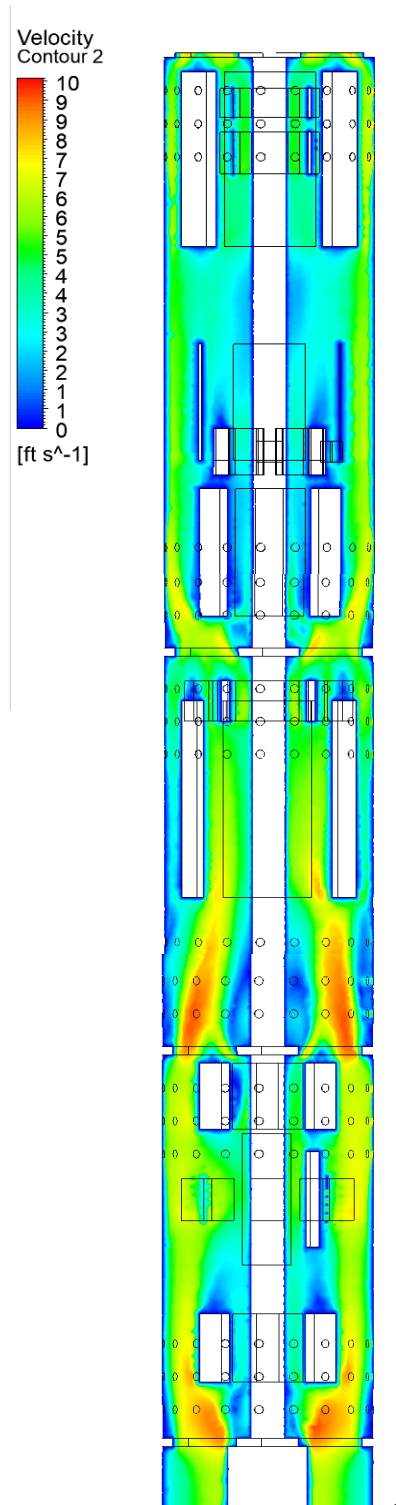


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## Velocity Plots:



**Conclusion:**

Under the proposed design conditions and assumptions, including the specified modifications, all equipment will be operating as if it were in an ambient temperature of 131°F or lower, meeting OEM specifications.

*Table 2-Volumetric Average Baseplate Temperatures*

Equipment	Quantity	Ambient Temperature
CCI Antennas DMP65R-BU4EAK	3	119°F
AIR 6419	3	116°F
AIR 6449	3	115°F
TPA-65R-BU4DA-K	3	109°F
Radio 4478 B12A	3	109°F
Radio 4478 B14	3	102°F