

This note explains reasons for performance problems created by products marketed for earth station antenna anti-icing known as “Surface Heating” systems or “Heat Pad” heating systems. It shows why they should not be used on Ku- or Ka-Band antennas.

SURFACE HEATING / PAD HEATING

With surface heating / pad heating type systems, a surface heater is attached to the mounting structure at the base of the antenna rear to project heat through a insulation on the back of the reflector, which is attached using adhesive material, as shown in **Figure 1**. **Figure 2** below shows a thermal image of the rear of the same antenna while a surface heating / heat pad system is activated. The colors of different spots (e.g. Sp1, Sp2, Sp3, etc.) show their different temperatures. The vertical color spectrum / legend on the right of the image shows the range of temperatures in the image 20 to 60.1 °F. **Table 1** shows temperature measurements for 6 spots on the antenna rear. For example, Spot 6 (Sp6) is 44.4°F, while spot 2 is 69.3 °F, a difference of nearly 25 °F, just a few feet away. The image shows that the bottom of center area of the antenna rear is warm, next to the surface heater insulation, while around 25% of the surface is around 20 °F colder.

Figure 1: Antenna Rear – Surface / Pad Heated Anti-icing



**Table 1
Surface Heating / Pad Heating:
Antenna Rear
Measurements**

Sp1	45.8 °F
Sp2	69.3 °F
Sp3	48.9 °F
Sp4	66.2 °F
Sp5	49.3 °F
Sp6	44.4 °F

Figure 2: Antenna Rear Surface Heating / Pad Heating

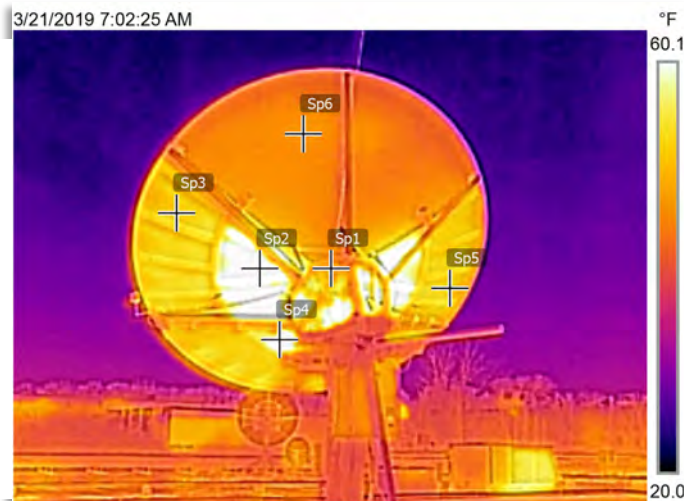


Figure 3 is a thermal image of the Front of the same 3.7m dish taken around the same time with surface/pad heating on. The photo below it shows the antenna front view. **Figure 3** and spot measurements given in **Table 2** show that the front reflector surface temperatures range from 89.6 °F to 43.7°F, a Delta of over 45 °F.

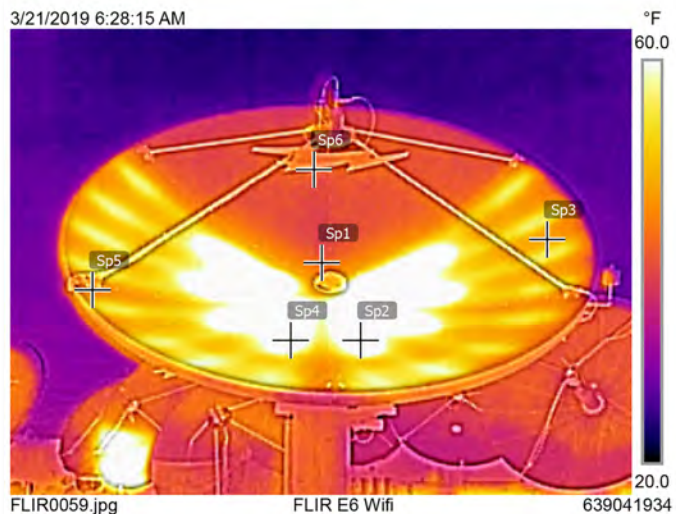
WIDE VARIATION, E.G. 100%+ IN REFLECTOR SURFACE TEMPERATURES CAUSES DISTORTION

The difference between the coldest and warmest two spots is over 100%! This huge variation in surface temperature shows why surface heating / pad heating should not be used on Ku-Band, let alone Ka-Band antennas for anti-icing. The large temperature differences distort reflectors, can cause losses and signal attenuation. De-focusing and off-axis antenna transmissions could even result in interference on the satellite, outages, and penalties. Ku- and Ka-band have tight tolerances.

Figure 3: Antenna Front Surface Heating / Pad Heated Anti-Icing

**Table 2
Surface Heating / Pad Heating
Anti-icing
Front of Antenna
Measurements**

Sp1	43.7 °F
Sp2	89.6 °F
Sp3	47.7 °F
Sp4	86.1 °F
Sp5	45.4 °F
Sp6	43.7 °F

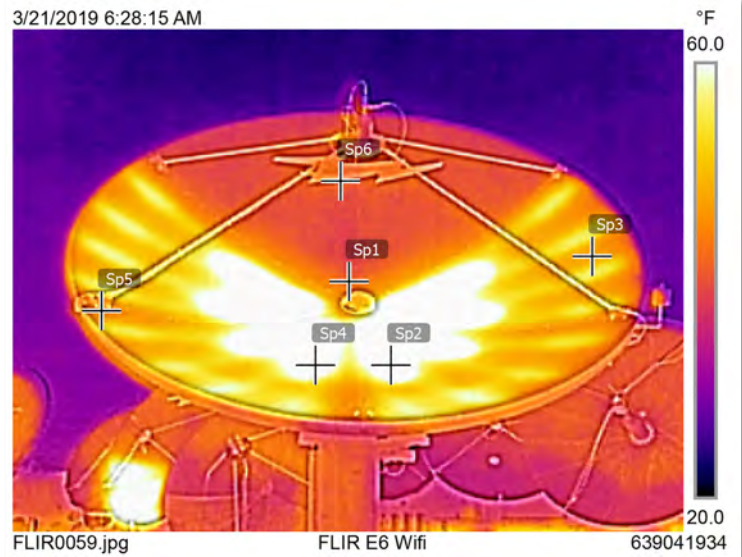


— Continued on Back Page

SURFACE / PAD HEATING: COMPLETELY UNCONTROLLED THERMAL FOOTPRINT

- The purple area in the dish in Figure 3, around 25% of the surface, is ~ 42 °F. That is 100% colder than the warm area in the bottom center (Sp2 and Sp4), which is nearly 90 degrees, and closer to the heat pad/surface heater.
- Figure 3 is a perfect illustration of how surface/pad heating system have a **completely uncontrolled thermal footprint**. This causes reflector distortion and gain losses that operators complain about. It also shows why you should only use a de-icing system that **uniformly heats the entire reflector surface**.
- **Walton Hot-Air Plenum De-Icing systems (See Figure 4)** uniformly heat reflector surfaces to around a 5 °F Delta. These tolerances have proven widely acceptable in the industry, including 100s of Walton De-Ice Ka-Band large dish sites for operators around the globe. Thermostat-like temperature controls and sensors automate heating with Walton systems to maximize efficiency.

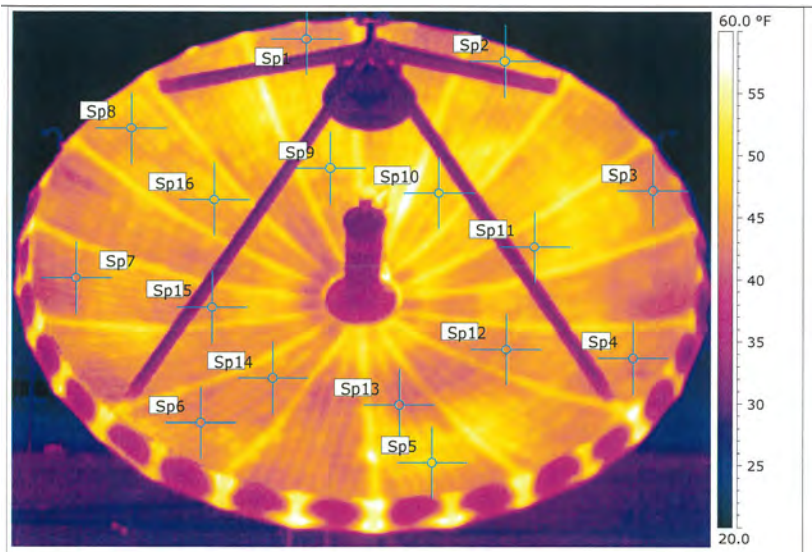
**Figure 3: Antenna Front
Surface Heating / Pad Heated Anti-Icing**



ANOTHER PROBLEM: STRUCTURAL INTEGRITY VS. ADHESIVE WEAR AND TEAR

- Surface heating / pad heating systems are commonly attached by an adhesive applied rear of an antenna. The perimeter is taped with aluminum HVAC tape. Unfortunately, this does not work very long, given that outdoor moisture and temperature conditions can be harsh.
- In contrast, Walton Hot-Air systems mechanically fasten a Plenum to the back structure of the reflector. The Plenum is a breakdown-free hot air enclosure with no mechanical parts that has been field-proven to last for decades around the globe.

**Figure 4: Walton Hot-Air De-Icing
Creates Uniform Surface Temperatures**



ENERGY EFFICIENCY AND POWER REQUIREMENTS

- Because surface heating / pad heating systems heat the exterior rear antenna mount structure and insulation, they waste a lot of energy, and increase power requirements, while failing to deliver the required performance for professional Ku- and Ka-Band systems.
- Compare the same spots in the Front and Rear thermal images, **Figures 2 and 3**, for example, Sp2 and Sp4 in center of the dish. They are around 19-20 degrees hotter in the front of the dish. This difference represents heat and energy lost out of the back reflector surface heating insulation / pad insulation.