

Before the  
**Federal Communications Commission**  
Washington DC 20554

In the Matter of )  
 ) ET Docket 01-278  
Review of Part 15 and Other Parts ) RM-9375  
of the Commission's Rules ) RM-10051

**COMMENTS OF POLHEMUS INCORPORATED**

February 12, 2002

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Pursuant to Section 1.415 of the Commission's Rules, Polhemus Incorporated submits these Comments in the above-captioned rulemaking.<sup>1</sup> Polhemus, a Rockwell Collins company, manufactures real-time 3D motion tracking, scanning, and capture solutions for biomedical and biomechanical research, military simulation and training, scientific visualization, CAD and reverse engineering, animated computer games, and the entertainment industry.

**Polhemus strongly supports the Commission's proposal to exempt very low-powered devices from Part 15 regulation.**<sup>2</sup> Polhemus manufactures a device whose extremely low emissions provide a compelling case for adoption of the proposal.

**A. POLHEMUS PRODUCTS EMIT NEGLIGIBLE RF ENERGY.**

Polhemus manufactures a device used for measuring the position and orientation of an object in three-dimensional space, typically over a volume of a few cubic meters. It is available in various configurations. Applications include measuring the orientation of a military pilot's helmet to stabilize optically-projected imagery on the helmet visor; measuring the position and orientation of points on an actor's body to map the actor's movements to an animated cartoon

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<sup>1</sup> *Review of Part 15 and other Part of the Commission's Rules*, ET Docket 01-278, Notice of Proposed Rulemaking and Order, FCC 01-290 (released Oct. 15, 2001) (Notice).

<sup>2</sup> Notice at para. 34.

character; and measuring the position and orientation of a surgeon's instrument so as to overlay a symbolic representation of its movements on medical imagery such as an MRI image.

A typical configuration of the device has three components: a magnetic source consisting of three orthogonally-wound coils in the size range 1-50 cm; a sensor consisting of a smaller set of three coils; and an electronics unit that excites the source and analyzes the currents induced in the sensor. The device transmits magnetic fields (only) at specific frequencies in the 8-40 kHz range.

By definition, RF energy consists of mutually orthogonal B (magnetic) and E (electric) fields.<sup>3</sup> The Polhemus device emits a B wave, but deliberately suppresses the E wave to undetectable levels. This is necessary for successful product operation, because any significant E wave would impair the precision of measured output from the device. The E wave suppression also has the effect of eliminating traveling waves, or RF.<sup>4</sup>

At the actual device output power of 3.5 watts, RF from the antenna is less than  $2 \times 10^{-16}$  watts, or 0.2 femtowatts ( 0.0000002 nanowatts).<sup>5</sup> As an illustration of this low power level,

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<sup>3</sup> See 47 C.F.R. Sec. 2.1 (defining radio waves as "electromagnetic.")

<sup>4</sup> Two techniques are used to suppress the E wave in both the near and far fields. First, the H-field coil is driven resonantly, with the tuning capacitance split between two capacitors on either side of the tuning inductance. This arrangement puts the voltage across the two capacitors 180 degrees out of phase, and so tends to cancel the E wave at all times. Second, the antenna is 4 to 6 orders of magnitude smaller than the wavelength. This favors near-field operation, and yields extremely inefficient antenna performance for any traveling wave. Antenna efficiency falls off with the 4th power of size. For the physical dimensions used, the best possible antenna efficiency is on the order of  $10^{-16}$ . This results in negligible RF output for any feasible power into the antenna.

<sup>5</sup> This value derives from a known transmitter output and a well-established calculation of antenna efficiency. As explained below, direct measurements seriously overestimate the emitted RF.

assume the Polhemus device is a point radiator. Place a receiver across the room, 3 meters away. Place a conventional 3.5 watt transmitter *on the moon*, 390,000 km away. The receiver is illuminated with less power from the Polhemus device 3 meters away than from the transmitter on the moon.

Measurements show emissions from the Polhemus device are *fully four orders of magnitude below the Part 15 limit* -- and even this low number is almost certainly a large overestimate.<sup>6</sup> The potential for interference into any other device is essentially zero.

The device easily qualifies for certification. Polhemus seeks to avoid certification because novel customer demands require frequent changes to the product line, often amounting to custom equipment designs. Certification would greatly increase the cost and delay of these product modifications, with no offsetting benefit to the public.

**B. THE COMMISSION SHOULD EXEMPT FROM PART 15 REGULATION DEVICES THAT ARE 40 dB OR MORE BELOW APPLICABLE 15 LIMITS.**

The Commission should adopt its proposal to exempt devices operating below 490 kHz from certification if the maximum field strength emitted is more than 40 dB below the applicable Part 15 limits.<sup>7</sup> Polhemus agrees the interference potential of such devices is extremely low (if it exists at all). We also agree that requiring certification for these devices is an unnecessary burden on manufacturers.

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<sup>6</sup> The signal from the Polhemus device is so weak as to be undetectable beyond the extreme near field; and extrapolation from the near field overestimates the emitted power. Emissions in the near field fall off with the third power of distance, compared with the second power of distance (inverse square law) in the far field. Near-field measurement thus yields an overestimate because it fails to account for the much faster drop-off close to the emitting device.

<sup>7</sup> Notice at para. 34.

The Polhemus device described above is a paradigmatic example of why the low-power exemption is needed. A requirement for certification of this device adds cost and delay, inconveniencing manufacturer and customer alike, and yet offers no concomitant benefits whatsoever to the public.

The facts justify eliminating all regulation of such devices. Although the alternative of a verification requirement would be less burdensome than certification, there is simply no basis in the public interest for requiring it.

### **CONCLUSION**

The Commission should adopt its proposal to exempt very low-power devices from Part 15 regulation.

Respectfully submitted,

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## SERVICE LIST

I certify that I have caused copies of the foregoing "Comments of Polhemus Inc." to be transmitted by email and by hand delivery to the following persons:

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