

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

<b>In the Matter of</b>	)	
	)	
<b>Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems</b>	)	<b>ET Docket 98-153</b>

**TO: The Commission**

**COMMENTS OF KOHLER CO.**

Kohler Co. hereby submits its comments in response to the Commission's Notice of Proposed Rule Making ("NPRM") in the above-captioned matter. For the reasons set forth below, Kohler supports the Commission's proposal, which Kohler believes will facilitate the commercial development and use of an exciting new technology.

**Background**

Kohler, headquartered in Kohler, Wisconsin, is a worldwide leader in plumbing and power systems. The company is, perhaps, best known for its innovative and market-leading products for the home kitchen and bath.

Realizing the benefits that ultra-wideband (UWB) technology could generate, Kohler has been an early proponent of applications of the technology. Specifically,

Kohler has developed a device (the ventilating toilet kit or VTK) that will eliminate bathroom odors by using UWB technology to sense the presence of a user and automatically activate an air filtration system. This device, which operates from inside a toilet tank by looking “through” the wall of the toilet tank without the need for an IR transmissive aperture, is intended for use in residential bathrooms and is designed to be easily installed by consumers. Because of its use of UWB technology, the Kohler device does not require the relatively complex adjustment and positioning, and/or expensive product redesigns, that might be necessary with an infrared sensor.

Kohler’s engineering studies demonstrate that operation of the VTK, which operates with a center frequency of approximately 5.8 GHZ, will not interfere with other users. Nevertheless, because the FCC’s rules do not now permit the routine manufacture and marketing of UWB products, this product is not yet on the market. Instead, Kohler’s waiver application has been awaiting FCC approval for over a year and half.

Kohler’s experience in developing its ventilating toilet kit – and its inability to bring the product to market because of the barriers posed by the Commission’s current rules – uniquely position the company to comment upon the Commission’s proposals.

## **DISCUSSION**

As noted above, Kohler supports the Commission’s efforts to permit UWB devices under Part 15 of its rules. However, as discussed further below, there are two respects in which Kohler believes that the Commission’s proposal should be modified.

Should the Commission's proposed rules be adopted without these changes, Kohler believes that they will encourage manufacturers to use wider bandwidths in their design of UWB equipment. Wider bandwidths, in turn, will increase the number of frequencies in which potential interference may be generated and, hence, the number of possible victim receivers. To minimize this problem, Kohler believes that the Commission should adopt final rules which do not disadvantage UWB devices, such as Kohler's VTK, that use comparatively narrower bandwidths.<sup>1</sup>

**I. THE COMMISSION SHOULD AMEND ITS PROPOSAL BY ADOPTING THE DARPA DEFINITION OF UWB DEVICES.**

For purposes of defining UWB devices, the Commission has proposed adopting the definition established the OSD/DARPA UWB radar review panel "with some modifications." NPRM at ¶ 21. One of the modifications suggested by the Commission is to base the definition of an UWB device on the -10 dB bandwidth rather than the -20 dB bandwidth. Id. The Commission proposed this modification because it believes that "in many cases it will not be possible to measure the -20 dB bandwidth." Id.

As we understand it, the Commission does not in theory disagree with the OSD/DARPA UWB definition – only with the difficulty in conducting measurements so close to the noise floor. Kohler does not disagree with the Commission in either respect.

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<sup>1</sup> The VTK has a bandwidth of approximately 1.5 GHz.

<sup>2</sup> Ironically, even though the FCC has based its action (or rather its inaction) concerning the VTK on its classification as a UWB device, adoption of the definition proposed by the Commission would prevent the Kohler device from qualifying as an ultra-wideband device.

What is needed, we believe, is to apply the DARPA definition at a point and in a way that is measurable – but in a way that preserves the definition.

Unfortunately, the change that the Commission has suggested not only alters the point at which the measurement will be conducted but also significantly alters the DARPA definition. Using the alteration proposed by the Commission, the Kohler device, and other devices that unquestionably should be defined as UWB devices, will fall outside the UWB definition. Thus, such devices, which the NPRM seeks to sanction, would presumably still require waivers of the Commission’s rules in order to operate.

We agree that there will be difficulties reliably measuring these low-power devices at the –20 dB points, but we submit that a better approach is to move to –10 dB measurement points as proposed by the Commission, but to change the requirement to be 20% of the center frequency, rather than 25% as proposed by the Commission.

$$H(f) = \text{sinc}^2[\tau(f - f_c)]$$

We obtain the 20% fractional bandwidth requirement because for an ideal pulse of length  $\tau$ , the emitted power spectrum has the shape: where  $f_c$  is the center frequency of the emission. The sinc function falls off to the –20 dB points when the argument reaches  $\pm 0.908$ , and to the –10 dB points when the argument reaches  $\pm 0.738$ . To maintain equivalence with the DARPA definition, therefore, the required fractional bandwidth

should be reduced in the ratio 0.738/0.908: *i.e.*, from 25% to 20%, to account for the change in measurement points.

In this way an ideal pulse of a length that meets the DARPA definition (25% fractional bandwidth at the –20 dB points) will also be defined as a UWB device by the proposed Rules.

**II. THE COMMISSION SHOULD ELIMINATE OR SUBSTANTIALLY MODIFY ITS PROPOSAL FOR A VARIABLE ABSOLUTE PEAK LIMIT.**

The Commission has proposed that the absolute peak limit for the emission over its entire bandwidth “be variable based on the amount the –10 dB bandwidth of the UWB emission exceeds 50 MHz.” NPRM at ¶ 43. Kohler believes that this proposal, while well intended, would have the undesirable result of encouraging use of broader bandwidth.

The Kohler VTK was designed to generate as narrow a bandwidth as possible, consistent with its functional requirements. This was done for the purpose of reducing the number of bands into which the signal might theoretically intrude, and, accordingly, the number of possible victim receivers. The effect of the Commission’s proposal, on the other hand, will be to encourage manufacturers to use as broad a bandwidth as possible in order to increase the peak limit. This will result in the potential intrusion of such devices into a much broader range of frequencies, including restricted government bands. Kohler

submits that this would be an undesirable result.<sup>3</sup> Accordingly, Kohler believes that the Commission should eliminate the variable limit entirely.

### **CONCLUSION**

The Commission has taken a substantial step forward by proposing rules that would permit the development and deployment of ultra-wideband technology. Kohler supports those efforts.

However, Kohler urges the Commission to modify its proposals in two respects. First, the Commission should preserve the integrity of the DARPA definition by modifying it to 20% of the center frequency at the -10 dB points. Second, the Commission should eliminate its proposal for a variable absolute peak limit.

Respectfully submitted,

**KOHLER CO.  
444 Highland Drive  
Kohler, WI 53044  
(920) 457-4441**

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<sup>3</sup> It is also worth noting that such a variable limit was not contained in any of the three waivers previously granted by the Commission and referenced in the NPRM: Time Domain Corporation; U.S. Radar, Inc. and Zircon Corporation.