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UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL ENVIRONMENTAL SATELLITE, DATA,  
AND INFORMATION SERVICE  
Washington, D.C. 20233

Office of Radio Frequency Management  
Room 3332, Federal Office Bldg. #4  
Washington, D.C. 20233

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July 15, 1993

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Office of the Secretary,  
Federal Communications Commission  
Washington, D.C. 20554

Ref: ET Docket No. 93-59  
RM-8092

To the Commission:

Attached please find Reply Comments of the National Oceanic and Atmospheric Administration (NOAA) in the captioned matter.

Sincerely,

Richard Barth  
Director

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
)  
Amendment of Section 2.106 )  
of the Commission's Rules ) ET Docket No. 93-59  
to allocate Spectrum for ) RM-8092  
Wind Profiler Radar Systems )

## REPLY COMMENTS

of the

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA), United States Department of Commerce, provides the following Reply Comments in response to the Commission's Notice of Proposed Rulemaking (NPRM) and Notice of Inquiry (NOI) in the captioned matter.

### **The NPRM: Profilers at 449 Mhz**

Concern about an allocation for wind profilers at 449 Mhz appears to originate from four amateur radio clubs, from the Amateur Radio Relay League (ARRL, the League) and from broadcast and mobile radio interests occupying the adjacent band. We will first address amateur radio.

**Amateur Radio Concerns** The four clubs<sup>1</sup> (the clubs) submitted essentially identical comments which assert that local frequency coordinators should participate in the coordination of profiler installations. NOAA supports the Commission's original proposal--that the League should serve as the single interface between profiler operators and the amateur community. To work through a multiplicity of local coordinators would invite confusion, particularly in areas where more than one entity claims the title of frequency coordinator. Establishment of the League as a single interface will put those repeater operators who have not registered their facilities on notice to do so, eliminating any need for multiple contact points.

Citing the inability of 449 MHz profilers (with 2 MHz bandwidth) to equal the low-altitude resolution of a 915 MHz profiler (with a 12.5 MHz bandwidth), the clubs assert that a 449 MHz allocation may be unnecessary. The record makes clear that both frequencies are needed because their capabilities differ.

The clubs (and ARRL<sup>2</sup>) assert that wind profilers are not radiolocation systems, yet reference to the International Radio Regulations<sup>3</sup> readily disproves

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<sup>1</sup> Comments of the Oregon Packet Experimenters Network, the Oregon Region Relay Council, the TEchnology Radio Amateur Club and the Portland Amateur Radio Club.

<sup>2</sup> Comments of the American Radio Relay League at 5.

<sup>3</sup> These definitions are incorporated verbatim into the FCC Rules, 47 CFR 2.1, Terms and definitions.

this assertion. These Regulations define "radiolocation" as "Radiodetermination used for purposes other than those of radionavigation", and "radiodetermination" as "The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves." The wind profiler, which determines the velocity of turbulent eddies in the atmosphere, falls squarely within the definition of radiolocation.

The League<sup>4</sup> urges the Commission to consider comments relative to the technical characteristics of wind profilers. The NTIA's technical standards for profilers were made part of the record during the Comment period<sup>5</sup>, and are thus subject to public discussion in Reply Comments. These standards reflect the demonstrated performance of NOAA's existing 404 MHz Wind Profiler Demonstration Network. NOAA believes that any changes incorporated during the design of 449 MHz profilers will not increase the profiler's interference

NOAA notes the League's proposal<sup>6</sup> that a minimum advance notification of 180 days be provided, in lieu of the 120 days given in the NPRM. This is unnecessary, since NOAA intends to notify the League as soon as a general area has been selected for a profiler. This will trigger discussions necessary to permit selection of a specific site which will minimize interference.

### **Broadcasting Concerns**

We note with some amusement the renaissance of the Phantom Profiler of Brookhaven, Long Island.<sup>7</sup> We first heard of this mythical device in April, and investigation disclosed that (a) NOAA had let no contract for a 449 MHz profiler, at Brookhaven or elsewhere; (b) NOAA had no budget for such a contract; and (c) no one could be found in NOAA who knew anything about a profiler at that location. Brookhaven is, however, a site at which the National Weather Service (NWS) is installing a "NEXRAD" weather radar to operate in the 2700-3000 MHz band. It is likely that this installation caused the rumors, but if certain commenters wish to believe they scared a profiler away, NOAA will not object.

The Society of Broadcast Engineers (SBE) finds "curious" NTIA's statement that interference to a highly sensitive Search and Rescue (SARSAT) satellite passing through the main beam of a profiler would be more significant

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<sup>6</sup> ARRL at 15.

<sup>7</sup> See comments of Jarad Broadcasting Co., Inc. (Jarad), page 2, and the Society of Broadcasting Engineers (SBE) at 16.

than interference to a considerably less sensitive Remote Pickup Unit (RPU) which is protected by the significant sidelobe attenuation of the profiler antenna and by terrain obstructions on the ground. In addition, the International Telecommunications Union (ITU) has placed considerably tighter restrictions on interference to safety-of-life services than on more pedestrian activities.

NOAA disagrees with the 50 km separation suggested by the SBE. The worst-case required separation between a wind profiler and RPU operating at 450 MHz is line-of-sight and may be properly calculated as follows. The power spectral density of the WPR antenna input at 449 MHz will be about 40 dBm/Khz maximum (in the high mode). Because of the small sidelobe levels at low elevation angles, this will be suppressed by 25 Db. At 450 MHz, the spectral density is reduced an additional 39 dB and at 451 MHz, an additional 50 dB. Thus, to a 450 MHz receiver, the profiler would appear as a  $40-25-39 = -24$  dBm/kHz ( $4 \mu\text{W}/\text{kHz}$ ) isotropic emitter. At 451 MHz, the profiler would appear as a  $-35$  dBm/kHz ( $0.3 \mu\text{W}/\text{kHz}$ ) isotropic emitter.

In free space:

$$p_i B_i / p_n B_r = p_i B_i G_r (L/4\pi R)^2 / p_n B_r$$

where  $p_i$  = spectral density of WPR emissions seen by the receiver (mW/kHz)

$p_n$  = receiver noise spectral density (mW/kHz)

$$p_t = 0.004 \text{ mW/kHz or } 0.0003 \text{ mW/kHz}$$

$G_r$  = receiver antenna gain

$B_r$  = receiver bandwidth

$L$  = wavelength (0.67 meters at 450 MHz)

For a receiver with a 20 kHz bandwidth and -120 dBm noise level,  $p_n = 5 \cdot 10^{-14} \text{ mW/kHz}$ . If the receiver antenna is a simple dipole with a 2dB gain, then  $G_r = 10^{0.2} = 1.6$ . The profiler signal disappears into the receiver noise when the right hand side of the equation is less than unity, or when R exceeds 19 km at 450 MHz and 5 km at 451 MHz. Terrain features, including the curvature of the earth, further reduce these maximal separations.

The reasonableness of these results was demonstrated during brief tests run by ARRL, and by NOAA's Boulder laboratories, in which a portable FM receiver operating co-channel with the profiler could no longer hear it when separated from it by less than five miles. The difference between this distance and the much larger one given by SBE stems from a number of errors in SBE's calculations. They fail to compensate for the difference between the profiler's

inappropriate if their 624 km result were even approximately correct. Further, the peak power radiated by a "Type A" profiler is about 16 kW rather than 40 kW.

SBE rather consistently misunderstands the NTIA report. They assert<sup>8</sup> that the nominal 2 MHz bandwidth of the profiler conflicts with the 3 dB bandwidth of 400 kHz. Yet, radar bandwidths are conventionally measured at the 20 dB points, not at 3 dB. They claim<sup>9</sup> that the profiler spectrum typifies that produced by a 7-pole filter with a 3 dB bandwidth of 8 MHz, yet the report states that this characterizes the behavior of the antenna, not the transmitter or the system as a whole. They state<sup>10</sup> that the profiler's ERP equals that of a TV station, but appear not to realize that the profiler's power is restricted to a narrow beam aimed upward while broadcast antennas are often omnidirectional in the horizontal plane and positioned so as to maximize coverage.

Considering the misunderstanding of profilers evidenced by their comments in this proceeding, it is easy to see why the SBE would like to see profilers barred from all Standard Metropolitan Statistical Areas (SMSA) and from a fifty kilometer radius around any fixed RPU. (Emmis<sup>11</sup> proposes a 55 km radius.)

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<sup>8</sup> SBE at 4B

<sup>9</sup> SBE at 4E

<sup>10</sup> SBE at 4F

<sup>11</sup> Comments of the Emmis FM Broadcasting Corp., page 3

However, these things are neither necessary nor appropriate. Profilers can be situated to take advantage of terrain shielding and so to protect RPUs in the same manner as they protect amateur repeaters. NOAA said in its Comments that it saw no reason to bar all amateur repeaters from a fixed radius around profilers; we similarly see no reason why RPUs need a fixed clearance. Further, the size of some SMSAs would leave large areas from which no profiler data would be available. For these reasons, NOAA expects to deploy profilers where they are needed, consistent with providing other services with the protection to which they are entitled.

Cohen, Dippell & Everist (CD&E) mention<sup>12</sup> protection of "fly-by-wire" aircraft, hang-glider riders, hot air balloonists and the like. These matters are not pertinent to the selection of a frequency since they would be equally applicable (or inapplicable) to any frequency in the range of interest. Moreover, detailed calculations, which commenters have apparently not performed, show that the power flux of the Type A profiler does not, at any point in space, exceed ANSI standards for public exposure. Further, CD&E significantly overstates the dimensions of the profiler beam. For the five degree beamwidth given in the NTIA report, the 3 dB beam radius at 16 km height would be 700 meters and not 5 km as given by CD&E.<sup>13</sup> Such analysis as they do provide contains significant errors. The table of "Land Mobile to Wind Profiler" separation vs. frequency

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<sup>12</sup>Comments of CD&E, page 4

<sup>13</sup>CD&E, page 5

offset<sup>14</sup> is taken from NTIA data for the "type B" profiler, which is unlikely to be licensed in this band and would not meet NTIA standards. Like the SBE, CD&E confuses the profiler antenna's frequency response with that of the profiler system<sup>15</sup>. CD&E might also be less concerned with the potential for profiler interference if they had based their conclusions on a more accurate understanding of the NTIA report.

### **Land Mobile Concerns**

The protection of land mobile systems above 450 MHz is similar to that of land-based RPUs. It involves the same methods, often the same types of equipment, and the same mathematics to perform interference analysis. The computational errors to which this analysis is vulnerable are also similar. Specifically, Motorola lists<sup>16</sup> the mixed profiler characteristics it uses to calculate separation distance. These include the +72 dBm peak transmit power from the high mode (it's 69 dBm in the low mode) and 45 dB spectrum rolloff from the low mode (it's 55 dB in the high mode.) In both modes, the off-axis gain at the horizon is -25 dBi, not -25 dB. Simple calculations based on Table 3-2 of the NTIA Report, which Motorola did not include and may not have made, reveal that the peak power spectral densities are about  $1.3 \cdot 10^{-2}$  W/Hz in the high mode and  $4.2 \cdot 10^{-4}$  W/Hz in

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<sup>14</sup>**CD&E**, page 3

<sup>15</sup>**CD&E**, page 2

<sup>16</sup>**Comments** of Motorola Inc., page 4

the low mode. Given these factors, the power emitted by a WPR in the horizontal plane at 451 MHz into an 18 kHz bandwidth is about 2  $\mu$ W in the high mode and 0.8  $\mu$ W in the low mode. These values are far removed from the "over 100 watts ERP" claimed by Motorola. Subsequent conclusions and recommendations based on the 100 watt value are incorrect.

### **The NOI: Profilers at 915 MHz**

Many comments opposing the allocation of non-Government profilers at 915 MHz come from manufacturers and operators of nonlicensed devices. The Commission's Rules on these devices are clear: those who wish to avoid the expense and difficulty of licensing may elect to operate under Part 15 of the Commission's Rules. In return, they receive no protection, and must protect duly authorized operations. A number of commenters apparently find this difficult to understand, or to accept, and write to complain about the possibility that they may receive interference from profilers. Symbol Technologies (Symbol) makes clear<sup>17</sup> that they do not understand the Rules under which they operate. They complain that adoption of Radian's proposal "...would put the public on notice that any technology operating on a secondary basis cannot be depended upon for long-term service, and that investing in such a technology carries unpredictable and largely unmanageable risks." The non-licensed devices they manufacture are not secondary; they are in fact less than secondary and operate on a non-interference

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<sup>17</sup>Comments of Symbol Technologies, Inc. at 8

basis (NIB). The public should be put on notice in precisely the terms Symbol uses, and in some cases they are, since the Commission's Rules require that certain Part 15 Devices be labeled to indicate their NIB status.

Knogo et. al., the "consolidated clients" of Wilkinson, Barker, Knauer and Quinn, (Knogo) go so far as to say<sup>18</sup> that "...it should no longer be the rule that licensed devices are protected and unlicensed products must give way." (Emphasis in the original.) Knogo simply want to have their cake and eat it too. Rather, having chosen the convenience of nonlicensed operation, they must be prepared to live with its limitations.

### **Conclusions and Recommendations**

These matters considered, NOAA concludes that the facts presented in the NTIA study form the basis for successful operation of wind profilers at 449 MHz and at 915 MHz. No interest having been shown in non-Government profiler operation at 449 MHz, NOAA recommends that the Commission add to the allocation tables the footnote proposed in the NPRM covering Government operation only.

Significant interest having been shown in non-Government profiler operation at 915 MHz, NOAA recommends that the Commission proceed with a Notice of Proposed Rulemaking so that additional public comment on this matter may be obtained.

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<sup>18</sup> Comments of the Consolidated Clients, page 4

I, Richard Schlapia, an engineer in NOAA's Office of Radio Frequency Management, certify that on this date I have caused copies of these Reply Comments to be mailed to the persons listed.

*Richard Schlapia*

Richard Schlapia  
July 15, 1993

Joseph A. Godles  
GOLDBERG, GODLES, WIENER & WRIGHT  
(Counsel for ENSCAN Inc.)  
1229 Nineteenth Street, NW  
Washington, DC 20036

Gary M. Epstein  
Raymond B. Grochowski  
LATHAM & WATKINS  
(Counsel for Hughes Aircraft)  
1001 Pennsylvania Ave., NW  
Washington, DC 20004

David E. Hilliard  
Edward A. Yorkgitis, Jr.  
Aliza F. Katz

Stanley M. Gorinson  
John Longstreth  
PRESTON GATES ELLIS &  
ROUVELAS MEEDS

George Y. Wheeler  
KOTEEN & NAFTALIN  
(Counsel for Mark IV IVHS Div.)  
1150 Connecticut Avenue, NW  
Washington, DC 20036

NATIONAL ASSN. OF BROADCASTERS  
Attn: Henry L. Baumann  
Barry D. Umansky  
1771 N Street, NW  
Washington, DC 20036

James E. Dunstan  
Counsel for Radian Corp.  
HALEY, BADER & POTTS  
4350 North Fairfax Drive  
Suite 900  
Arlington, VA 22203-1633

Desmond T. Bailey  
U.S. Environmental Protection Agency  
Ofc. of Air Quality Planning & Stds.  
Research Triangle Park, NC 27711

UTILITIES TELECOMMUNICATIONS COUNCIL  
Attn: Jeffrey L. Sheldon  
Sean A. Stokes  
1140 Connecticut Avenue, NW  
Suite 1140  
Washington, DC 20036

Henry M. Rivera  
Larry S. Solomon  
GINSBURG, FELDMAN & BRESS,  
CHARTERED  
(Counsel for Metricom, Inc.)  
1250 Connecticut Avenue, NW  
Washington, DC 20036  
Attn: Henry M. Rivera

Motorola, Inc.  
Attn: Michael D. Kennedy  
Stuart E. Overby  
1350 Eye Street, NW  
Suite 400  
Washington, DC 20005

COHEN, DIPPELL AND EVERIST  
Attn: Warren M. Powis  
1300 L Street, N.W.  
Suite 1100  
Washington, DC 20005

John E. Fiorini III  
Counsel for Emmis FM Broadcasting  
GARDNER, CARTON &  
DOUGLAS  
1301 K Street NW  
Suite 900, East Tower

John B. Richards  
KELLER & HECKMAN  
1001 G Street, NW  
Washington DC 20001

Oregon Packet Experimenters Network  
c/o Joseph H. Johanesen, KB7DBD  
36625 SE Blackberry Ln  
Sandy, OR 97055

**Peter Tannenwald  
Mitchell Lazarus  
ARENT, FOX, KINTNER,  
PLOTKIN & KAHN  
(Counsel for Symbol Technologies, Inc.)  
1050 Connecticut Avenue, NW  
Washington, DC 20036-5339**

**Portland Amateur Radio Club  
c/o James H. Walters, WB7AAK  
1524 SE Rex Street  
Portland, OR 97202**

**Oregon Region Relay Council  
c/o John D. White, K7RUN  
Box 13274  
Portland, OR 97213**

**TEchnology Radio Amateur Club  
c/o Eugene P. Single  
1080 NW 107 Avenue  
Portland, OR 97229**