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Before The
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment to Parts 73 and 90	)	
of the Commission's Rules	)	RM-9719
To Authorize the Transmission	)	
of Emergency Signals on	)	
Channel 200	)	

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To: The Commission

REPLY COMMENTS OF FEDERAL SIGNAL CORPORATION

M. Scott Johnson
Francis E. Fletcher, Jr.
Gardner, Carton & Douglas
1301 K Street, N.W.
Suite 900, East Tower
Washington D.C. 20005
(202) 408-7221

Dated: November 8, 1999

Its Attorneys

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TABLE OF CONTENTS

SUMMARY ii

I. ERDS Will Serve Unmet Public Safety Needs 2

II. Use of Channel 200 Is Essential to the Deployment of ERDS 5

III. Federal Signal's Tests Have Shown That ERDS Operations on Channel 200 Are Compatible With TV Channel 6 and Adjacent Channel FM Reception 8

- A. Interference to TV Channel 6 9
- B. Interference to Adjacent Channel FM 12
- C. Testing of Additional Receivers 14
- D. Alleged Adverse Effects on Transition to Digital 14
- E. Interference to ERDS 15

IV. Conclusion 16

SUMMARY

The Petition requests the Commission to amend Parts 73 and 90 of Title 47 of the Code of Federal Regulations to allocate Channel 200 (87.9 MHz) nationwide for the use and operation of an Emergency Radio Data System ("ERDS") by existing and future public safety licensees. In response to the September 14, 1999 public notice, a number of comments were filed.

A few comments pointed to the Emergency Alert System ("EAS") and Travelers Interaction Service ("TIS") as adequate to communicate emergency messages. ERDS, however, is designed to meet needs which cannot be addressed by either EAS or TIS. EAS communicates emergency information to a widely dispersed audience, while TIS is a fixed location service and requires the motorist to "tune in" to the TIS channel. ERDS, in contrast, is designed to provide information to a local area (measured in feet), only to those who are immediately affected by an emergency situation, and requires no affirmative action by the public.

Concerns expressed in comments as to ERDS self-interference, annoyance, and unauthorized usage are already addressed in the ERDS design. ERDS incorporates emergency-vehicle-to-emergency-vehicle coordination, thereby addressing the multi-signal and self-interference concerns. Annoyance or "road rage" from messages would not occur as ERDS is designed to prevent continuous message. And, existing complex digital ERDS codes should prevent the unlikely intrusion by pirates, pranksters or terrorists.

Comments which assert use of public safety frequencies or other spectrum for ERDS ignore the need for the ubiquitous deployment of ERDS receiving equipment. Federal Signal, in conjunction with the Ford Motor Company and AC Delco, developed an ERDS receiver that would be routinely incorporated in radios by the manufacturer without noticeable added cost. ERDS, in effect, "piggy backs" on the commercial application of the standard Radio Broadcast Data System. Use of Channel 200 is not reserved for exclusive use of noncommercial

educational stations. And the one noncommercial FM station currently on the Channel can be relocated.

Likewise, concern that Mexico, and possibly Canada, might object to use of Channel 200 by ERDS is unsupported and there is every reason to believe that each country's public safety agencies will be supportive, mirroring U.S. public safety group support for ERDS.

The ERDS system is designed to coexist with, and be compatible with, TV Channel 6 and adjacent channel FM operations. The commenters' interference claims are overstated, as interference from passing ERDS transmitters operating in mobile mode would be "physically rare if not impossible." Precisely controlled (directional) antenna patterns and tailored reduced power levels can be used at fixed sites to further limit concern. The attached Technical Report of the consulting engineering firm of Lohnes and Culver responds to specific questions raised by commenters as to Federal Signal's testing of the ERDS system, showing that the tests results as reported are proper. Federal Signal's actual measurements as to potential ERDS interference to TV Channel 6 and FM co-channel operations should be considered more reliable than the commenters' theoretical and speculative conclusions.

The Commission should issue a notice of proposed rulemaking in response to Federal Signal's Petition. It has been shown that ERDS will serve important public safety needs that are not met by existing emergency warning and alert systems. Federal Signal has made a *prima facie* showing of the public interest benefits of ERDS sufficient to warrant issuance of a formal notice of proposed rulemaking.

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REPLY COMMENTS OF FEDERAL SIGNAL CORPORATION

Federal Signal Corporation ("*Federal Signal*"), by its attorneys, hereby responds to comments filed in opposition to its above-captioned Petition for Rulemaking ("*Petition*"). In support of this reply, the following is respectfully shown:

The Petition, filed on August 2, 1999, requests the Commission to amend Parts 73 and 90 of Title 47 of the Code of Federal Regulations to allocate Channel 200 (87.9 MHz) nationwide for the use and operation of an Emergency Radio Data System ("*ERDS*") by existing and future public safety licensees. On September 14, 1999, the Commission issued a Public Notice (Report No. 2361) announcing that interested persons could file statements opposing or supporting the Petition within 30 days, or by October 14, 1999. A number of comments were filed in response to the Public Notice.[1] On October 28, 1999, the Commission extended the time for filing of reply comments until November 8, 1999. *Order* (DA 99-2351, rel. Oct. 28, 1999).

[1] Comments were filed by, among others, the National Association of Broadcasters ("*NAB*"), the Society of Broadcast Engineers ("*SBE*"), Grupo Televisa, S.A.("*Grupo Televisa*"), and National Public Radio ("*NPR*").

1. ERDS Will Serve Unmet Public Safety Needs

A few comments question the need for ERDS, arguing that existing public safety systems, and in particular the Emergency Alert System ("EAS") and the Travelers Information Service ("TIS"), are adequate for ensuring public safety. *NAB*, pp. 2-3; *NPR*, p. 7. However, Federal Signal's Petition makes clear that ERDS is designed especially to meet important public safety needs that are not, and indeed cannot be, addressed by either the EAS or TIS.

The EAS provides important public safety benefits, but it is nonetheless readily distinguishable in scope and purpose from ERDS. EAS is a broad area product useful in communicating emergency information to a dispersed audience. ERDS, in contrast, is designed to provide a local area (measured in feet), low power transmission of information only to those who are immediately affected by an emergency situation. Even when employed at a municipal, rather than on a national or statewide basis, an EAS transmission covers a relatively large area, measured in square miles, served by the local broadcast station or stations carrying the announcement. As a wide area product, an EAS announcement has limited flexibility and may have little immediacy for much of its audience. In addition, EAS is limited by the fixed transmission facilities of the radio or television broadcast station carrying the EAS signal, whereas a primary application envisioned for ERDS would be mobile. A fire truck cannot use EAS to alert oncoming motorists as it approaches a dangerous intersection.

The Travelers Information Service also is a fixed service. It is useful for advising travelers of relatively long-term, repetitive or continuous applications (*e.g.*, backups at tunnels or construction sites, availability of parking at airports, tourist information, etc.), but not for developing emergencies. Moreover, to receive TIS information, the motorist must take affirmative action to tune the car radio to the TIS frequency assuming, that is, that the motorist has actually taken note of roadside signs advising of the TIS broadcast. ERDS, on the other

hand, automatically tunes to the emergency signal. TIS is a beneficial service, but is clearly no substitute for the automatic, localized, time-sensitive warning system that ERDS would provide motorists in a variety of fast developing situations.

SBE and others express concern that ERDS will be overused and become a source of annoyance to motorists and other radio listeners. SBE envisions simultaneous and uncontrolled ERDS operations by multiple police and public safety agencies, as well as pirates and terrorists, constantly intruding upon and alarming motorists by "taking over" their radios at will and interrupting broadcast service on a non-stop basis. Nothing could be further from the concept and design for ERDS. ERDS was developed in part precisely because the public has become desensitized to overly frequent "emergency" messages, signals and announcements in situations where many if not most members of the public receiving such messages are *not* immediately affected by the subject of the warning. Quite naturally, the public increasingly tends to ignore such warnings. ERDS was conceived and designed specifically to alert only members of the public *in the immediate vicinity of, and actually subject to, potential harm.* Rather than being considered intrusive, Federal Signal believes such messages would be well received and greatly appreciated by the motoring public.

Certainly, the use and operation of ERDS will have to be subject to appropriate restrictions, controls and coordination among public safety agencies. Such coordination issues can be addressed during the course of the rulemaking proceeding. Certain problems anticipated by the commenters have already been addressed in the ERDS design. For example, ERDS incorporates emergency-vehicle-to-emergency-vehicle coordination, thereby addressing the multi-signal and "self-interference" concerns expressed by SBE in the event of multiple vehicles converging on an emergency scene. Similarly, the imagined scenario of the motorist stuck in

traffic being driven to "road rage" from being forced to listen over and over again to the same ERDS message would not occur. As stated in the Petition:

> The message is transmitted for both text and aural display, in a continuous loop, although the ERDS only plays the message through once at a predetermined volume, before returning the receiver to its preexisting state. Petition, p. 6.[2]

Several comments focus on alleged problems with the supposedly "intrusive" features of ERDS that automatically activate or retune the receiver and pause compact disc and tape players during an ERDS message. Federal Signal believes that these concerns are greatly overblown and can, in any event, be readily addressed. For example, activation of ERDS in parked vehicles and related problems imagined by some, such as drained car batteries and triggering of alarm systems, are easily addressed by linking the ERDS to the car's ignition system. For those motorists simply not wanting to be interrupted by an ERDS signal in any event, deactivation of the ERDS would be an available option. Moreover, these and other operating procedures and technical considerations raised by commenters can be fully addressed during the rulemaking process.

As the Commission is well aware, unlicensed or "pirate" radio station operations occur from time to time in the FM band. The potential for unauthorized operations is a risk throughout the radio frequency spectrum and in any radio service. There is no reason to expect that pirate operators, pranksters or terrorists would be any more inclined to unlawfully use ERDS than they would any public safety or broadcast service. In any event, ERDS has been designed to employ digitally encoded safeguards against unauthorized use, thus satisfying the concern expressed by Grupo Televisa and others with regard to ERDS security. *Grupo Televisa*, p. 14.

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[2] This is confirmed in the attached Technical Report at p. 6. The ERDS system will have built into it a message coordination protocol to prohibit multiple transmitters sending multiple messages in the same area. Technical Report, p. 6. Of course, a motorist wishing to rehear the message could simply tune the car radio to Channel 200.

II. Use of Channel 200 Is Essential to the Deployment of ERDS

Several comments assert that Federal Signal has failed to show why Channel 200, as opposed to available public safety frequencies or other frequency spectrum, should be used for ERDS. These comments fail to recognize an essential element to the effectiveness of the ERDS system -- the ubiquitous deployment of ERDS receiving equipment. As indicated in the Petition, Federal Signal has worked for several years in conjunction with the Ford Motor Company and AC Delco to develop an ERDS receiver that would be routinely incorporated in radios by the manufacturer. Federal Signal is convinced that past efforts to develop RF-based warning systems, such as radar systems, have failed to gain wide acceptance in the marketplace because they require the installation and maintenance of RF receivers in addition to the conventional RF receivers of commercial bandwidths generally found in the vehicle or the home.

As explained in materials included under Attachment B to the Petition, ERDS will overcome this impediment. ERDS will be commonly available as a result of "piggy backing" on the commercial application of the Radio Broadcast Data System standard in homes and automotive radio products.[3] RDS allows broadcasters to encode digital information as a subcarrier of an FM channel so that an RDS-equipped receiver can then decode this digital message and pass on information to the user. Delco Electronics introduced its first RDS radio in 1994. There are already more than 500,000 RDS equipped receivers in the United States, representing only one manufacturer's distribution of both residential and automotive sales. Several other manufacturers have announced their plans to introduce RDS models in the near future. In many European countries, RDS is standard in all radio products.

The key benefit to the RDS piggyback approach is to make the public safety benefit of ERDS transparent and, in effect, "free" to the consumer. Tests have confirmed that radios

[3] The Radio Broadcast Data System was derived from the European Broadcasting Union's Radio Data System ("RDS").

equipped with RDS capabilities can be modified and used for ERDS with relatively minor modifications and at modest cost. Based on Federal Signal's experience in developing ERDS, it is clear that introduction of a separate out-of-band tuner, such as would be necessary if ERDS were to operate on public safety frequencies, would not be economically feasible. Use of out-of-band frequencies for ERDS would fail to gain acceptance in the marketplace just as past RF-based safety systems have failed because they required the consumer to purchase and maintain a separate RF receiver. Federal Signal has confirmed in its discussions with Ford, AC Delco and other manufacturers of automobiles and automotive products, that the additional engineering, space use and other costs of adding a separate out-of-band tuner on car radios would be prohibitive. Use of Channel 200 is therefore essential to the successful deployment of an ERDS system.[4]

NPR contends that allocation of Channel 200 to ERDS would constitute a "nationwide dereservation of spectrum dedicated to noncommercial educational use." *NPR*, p. 3. In support of its argument, NPR contends that the Commission specifically set aside Channel 200 in 1978 for noncommercial educational licensees, and therefore, that the Petition must be denied. *NPR*, pg. 2 (citing *Changes in the Rules Relating to Noncommercial Educational FM Broadcast Stations*, 69 FCC 2d 240, ¶¶ 3-4, 26 (1978) ("*Second Report and Order*").

Contrary to NPR's assertion, though, the Commission has not reserved Channel 200 for the exclusive use of noncommercial educational stations. Instead, the use of Channel 200 was expanded to include noncommercial educational stations in 1978 only under certain limited circumstances. Specifically, the Commission stated that: "this frequency is not part of the band

[4] In its Petition, Federal Signal mentioned a prototype ERDS receiver "equipped with a second front end tuner." SBE seizes upon this to argue that if ERDS receivers will be equipped with a second front end tuner, there is no reason the second tuner could not use a public safety frequency rather than Channel 200. *SBE*, p. 9. The production model of the ERDS receiver will *not* employ a second front end tuner. Tests have confirmed that a second tuner is not needed, and that a single tuner can switch quickly

which has been set aside for educational FM use. Actually it is part of the frequency band of 82-88 MHz which has been assigned to television Channel 6." *Second Report and Order*, ¶ 51. Under the 1978 revisions, Channel 200 was to be used for FM broadcast only if no other commercial channels were available, and only then, with limited operating power and antenna height. The Commission emphasized the "fact that except for this special dispensation, [Channel 200] is not intended to be an FM frequency at all." *Id.* ¶ 62. Thus, it can not be said that "Channel 200 has been reserved for noncommercial educational use." *NPR*, pg. 2. Rather, the use of Channel 200 for noncommercial FM has been permitted only under limited conditions.

Further, as was noted in the Petition, only one noncommercial FM station is currently operating on Channel 200, Station KSFH(FM), Mountain View, California. Thus, Channel 200 is widely available throughout the nation for ERDS use even if KSFH(FM) remains on 87.9 MHz. Under the proposed rules in the *Streamlining of Radio Technical Rules*, KSFH(FM) could move to (a) any available interference-free channel; (b) a NCE FM channel that would cause only second- and/or third- channel contour overlap; or (c) receive consent from those NCE FM stations with co- or first-adjacent channel interference. *1998 Biennial Regulatory Review-Streamlining of Radio Technical Rules in Parts 73 and 74 of the Commission's Rules*, MM Dkt. 98-93 (FCC 98-117), ¶ 62 (1998). Accordingly, if the lone FM broadcast station in the country operating on Channel 200 could be relocated to another frequency. NPR's "dereservation" argument must therefore be rejected.

Grupo Televisa expresses concern that Mexico, and possibly Canada, might object to use of Channel 200 by ERDS. Federal Signal recognized in the Petition that the use of Channel 200 by ERDS implicates international treaties with Mexico and Canada and urged the Commission in its Petition to coordinate international issues necessary to permit ERDS use of Channel 200.

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between frequencies with no noticeable artifacts as necessary to meet the requirements for a high performance ERDS system.

Given the low power, restricted nature of ERDS transmissions, interference to Mexican and Canadian broadcast stations will be no more problematic than Federal Signal's tests have demonstrated domestically. Certainly, the expansive Mexican and Canadian border restrictions that apply under Section 73.501(a) of the Rules to much higher powered Class D FM operations on 87.9 MHz need not apply to ERDS. Finally, it is a reasonable expectation that Mexican and Canadian public safety agencies will be as supportive of ERDS as public safety groups here in the United States; and, in fact, Federal Signal has received favorable inquiries from Canadian public safety agencies interested in the availability of the ERDS system.

III. Federal Signal's Tests Have Shown That ERDS Operations on Channel 200 Are Compatible With TV Channel 6 and Adjacent Channel FM Reception

Federal Signal has designed the ERDS system so that it can coexist with, and be compatible with, TV Channel 6 and adjacent channel FM operations. Comments in opposition fail to take into consideration that ERDS would be operated at very low-power levels with a variable range capability specifically designed to prevent interference to TV Channel 6 and to adjacent FM channels. Federal Signal's field tests have shown that ERDS operations on Channel 200 will not significantly affect reception of either TV Channel 6 or adjacent channel FM broadcasts. The highly generalized and unsupported assertions of several commenters that ERDS will, *ipso facto*, interfere with reception of TV Channel 6 and adjacent FM channels should be rejected.

As discussed in the Petition, a primary use envisioned for ERDS transmitters would be on rescue vehicles and similar mobile applications. Based on the ERDS field tests, Federal Signal's consulting engineers have concluded that interference to fixed FM and TV receivers from passing ERDS transmitters operating in mobile mode would be "physically rare if not impossible." Petition, Exhibit E, p. 8. The commenters generally seem to acknowledge that low-power, mobile use of ERDS by police and emergency vehicles is likely to present little, if

any, unacceptable interference problems for household Channel 6 or FM reception. The objections focus primarily on interference from potential fixed uses of ERDS, such as on bridges and overpasses. *See, NAB*, pp. 4-5. The extent to which fixed ERDS applications would be appropriate can be considered during the course of the rulemaking. However, there is no intrinsic reason why ERDS use need be restricted to mobile transmitters. Fixed sites offer the opportunity for precisely controlled (directional) antenna patterns and tailored power levels to avoid interference. For example, using a controlled antenna pattern and appropriate power limitations, an ERDS fixed site could be located in the interior of a major highway cloverleaf or interchange (for example, during periodic icing or other especially dangerous emergencies, which though rare, will occur) without affecting television or mobile or fixed FM reception outside the bounds of the interchange area.

The attached Technical Report of Lohnes and Culver addresses specific questions raised by commenters concerning Federal Signal's field testing of the ERDS system for interference, and particularly the comments filed by SBE, NAB and Grupo Televisa discussed immediately below, which take issue with certain aspects of the engineering statement supporting Federal Signal's request for rulemaking (Petition, Exhibit E).

A. *Interference to TV Channel 6*

SBE claims that the Petition's Exhibit E, Figure 2 (Threshold of Interference from ERDS to Television Channel 6 Audio & Video) "covers a totally inappropriate range of input levels from +19 dBmV to a truly absurd +84 dBmV." *SBE*, p. 5. As stated in the attached Technical Report at page 1, the horizontal scale on Figure 2 was inadvertently mislabeled. It should be "dBmV" rather than "dBm" as shown. Accordingly, the input levels covered in Figure 2 are entirely appropriate. However, SBE further argues that assuming the horizontal scale of Figure 2 is actually dBmV rather than dBm, the claimed D/U ratios are inconsistent with the D/U ratios

shown in Figure 1 of FCC Rule §73.599, resulting in Federal Signal's claimed D/U ratio for no interference to Channel 6 being, in SBE's view, "13.5 dB more lenient than the Section 73.599 FCC Figure 1 could be deduced to show." *SBE*, pp. 5-6. Using §73.599, SBE estimates that at the Grade B (47 dBu) contour of a Channel 6 TV station, a D/U ratio of +3.5 dB is required to avoid interference, with the ratio relaxing to approximately –8 dB for a very strong Channel 6 field strength of 90 dBu (*i.e.*, 16 dB above the 74 dBu City Grade contour for Channel 6 stations). *SBE*, p. 6.

As shown in the attached Technical Report, SBE's analysis is unconvincing. First, SBE's conclusion that a D/U ratio of +3.5 dB is required to avoid interference is premised on a tenuous extrapolation process. Section 73.599 FCC Figure 1 covers tests of TV receivers for interference from FM Channels 201 through 213 only, and does not include Channel 200. SBE's "Channel 200 (Extrapolated)" curve, which it superimposes on Section 73.599, Figure 1 (*See, SBE*, Figure 2), is essentially a guess based on the relative positions of the other curves on the graph. Second, SBE's conclusion misreads its own extrapolated graph. Each vertical division on SBE's Figure 2 is 0.5 dB, so that SBE's reported ration of 3.5 dB is actually at 1.75 dB. In any event, some difference between the measured D/U ratio values reported by Federal Signal and an extrapolation from Section 73.599 FCC Figure 1 is entirely unremarkable and to be expected. The data reported in FCC Rules Section 73.599, collected by different methods for different systems (not ERDS) and different receivers under test, is within approximately 10 dB of the ERDS data as noted by SBE. This is not unusual and is entirely appropriate as a general indicator of potential interference. Certainly, Federal Signal's actual measurements as to potential ERDS interference to TV Channel 6 should be considered more reliable than would be derived from the suppositious conclusions reached by SBE. Technical Report, p. 2.

SBE incorrectly states that Federal Signal assumes that Channel 6 TV stations transmit with aural-visual power ratios near the maximum allowed (i.e., –7 dB or 20% aural power). In reality, according to SBE, most TV stations transmit with aural-visual power ratios of only –10 dB (10% aural power), and many TV transmitters are not even capable of operating at more than 10% aural power. SBE characterizes Federal Signal's presumption of Channel 6 aural ERPs 3 dB higher than commonly used as a "fatal flaw." *SBE*, p. 6. SBE appears to have misread Federal Signal's Engineering Statement. Federal Signal's television receiver tests were not conducted at "20% aural power," as suggested by SBE, but rather using a "20% audio carrier voltage ratio." (Petition, Exhibit E, p. 8). A 20% voltage ratio is equivalent to a 4% power ratio which, in turn, equates to 14 dB. A 4% power ratio is easily achievable by all televisions transmitters and is lower than a typically expected ratio of 10% power. SBE's assertion that Federal Signal's analysis contains a "fatal flaw" is clearly without merit. In fact, Federal Signal's test of interference to TV Channel 6 presents a worst-case, very conservative approach that would suggest a greater potential for interference than is likely to occur in the real world. Thus, Federal Signal's consulting engineers conclude that ERDS will cause less actual potential interference to TV Channel 6 than indicated by its field tests. Technical Report, pp. 2-3.

Several comments misinterpret Federal Signal's position with respect to interference potential between ERDS and TV Channel 6 after the conversion from analog to digital television. Federal Signal did not suggest that no television stations would operate on Channel 6 after the conversion, but that potential interference will be even of less concern once TV Channel 6 operations, if any, remaining after the conversion are digital. As shown in the attached Technical Report, it can be expected that the interference susceptibility of DTV from an analog ERDS signal will be much less than from analog television. The interference rejection

improvement with DTV is likely to be substantial, in the range of 20 to 30 dB or more. Technical Report, pp. 6-7.

B. *Interference to Adjacent Channel FM*

Using the F(50,10) curves and based on an antenna "effective height of zero meters", SBE purports to plot the 71 dBu contour of a 1-watt ERP ERDS signal at 1.98 kilometers, and argues that an "interference zone of two kilometers is totally unacceptable." *SBE*, p. 7. SBE's claim of an interference zone that would remotely approach such magnitude is unsupportable. As shown in the attached Technical Report, the FCC F(50,10) curves cannot be used to accurately estimate signal strength from a height of *zero meters* as attempted by SBE. The FCC curves do not go below 30 meters, and the minimum distance on the F(50,10) curve is 15 kilometers. SBE's beyond-the-pale extrapolation to "zero" antenna height and a distance of 2 kilometers is so radical as to be considered impossible, far less an accurate methodology for plotting coverage.

Use of an extrapolation methodology in these circumstances is extremely hazardous and will almost certainly yield results less accurate than actual measurements, such as conducted by Federal Signal. However, to be remotely credible, an extrapolation must at least assume a finite antenna height. Based on an antenna height of 1 meter, Federal Signal's consulting engineers plot the 1-watt, 71 dBu, F(50,10) radius is about 0.06 kilometers. Technical Report, p. 4. Moreover, the validity of this radius is confirmed by Federal Signal's field tests, which, at 1 watt ERP, delivered a usable ERDS message at far below the nominal FM service contour value of 60 dBu. The field tests showed that, even at a range of 0.25 miles, the ERDS signal did not reach the 60 dBu level. See, Petition, Exhibit E. p. 4, and accompanying chart. It is clear, therefore, that a 1-watt ERDS 71 dBu contour is of relatively nominal size, and would approach nowhere near the almost 2 kilometers claimed by SBE.

message. Thus, there will be no detectable loss of audio with the tuner designed for use with ERDS. Technical Report, p. 6.

C. Testing of Additional Receivers

NAB contends that Federal Signal should have tested more than the two FM receivers and three TV receivers discussed in the Petition. NAB asserts that tests need to be conducted on receivers, such as clock radios, that are generally poor performers when it comes to rejecting interference from stations operating on second or third adjacent channels. *NAB*, pp. 4-5. While testing of additional receivers would yield additional data, Federal Signal believes that the tests it has conducted so far of representative receivers are adequate to proceed with a notice of proposed rulemaking. Clock radios are not likely to be found in close proximity to traffic involved in an ERDS alert situation. To the extent a clock radio or personal radio, such as a Walkman, happened to be in the immediate proximity of an emergency situation, any interference suffered could well be of benefit to the listener by providing some warning of the emergency.

D. Alleged Adverse Effects on Transition to Digital

NAB contends that the basic IBOC system relies on placing the digital signal on the "sidebands" of the main channel, increasing the possibility of interference from new services in the FM band, making the digital signal "closer" to the immediately adjacent channel, so that one of the sidebands of the 88.1 signal could be affected by the ERDS signal operating on 87.9, and vice versa. *NAB*, p. 6. As stated in the attached Engineering Statement, the ERDS signal at 1 watt will be at least 10 dB below the IBOC side lobe power for the lowest power Class A stations. ERDS will transmit an analog signal in a narrow band relative to the wider bandwidth IBOC. Adjacent channel interference has been one of the tested and claimed strong points of the

IBOC system. As a consequence, Federal Signal's consulting engineers conclude that the "probability of affecting both sidebands is fast approaching zero." Technical Report, p. 7.

E. Interference to ERDS

SBE and others argue that Federal Signal has not demonstrated that ERDS would not receive interference. Federal Signal has not suggested that there would be no interference to ERDS from TV Channel 6 and FM Channel 201 signals. As stated in the Engineering Statement accompanying the Petition, "[o]peration on frequencies immediately adjacent to television channel 6 and FM channels is understood to present the potential for interference with ERDS in some locations." Petition, Exhibit E, p. 5. ERDS will co-exist with co-channel and adjacent channel users and any resulting interference to ERDS will have to be accommodated. But, Federal Signal's field tests have shown that an interfering first adjacent FM signal must be at least 100 times stronger than the ERDS signal for any noticeable interference and at least 10,000 times stronger to disrupt the ERDS signal. Petition, Exhibit E, p. 6.[5] Thus, Federal Signal believes that while ERDS operations could be adversely affected by interference in a few areas, such interference will have little impact on the operation of the ERDS as a whole. The ERDS system will function even though its effective range may be limited in a few cases. Technical Report, p. 3.

The conclusion that ERDS will work effectively notwithstanding potential interference from adjacent channel FM and TV Channel 6 is reinforced by the expectation that ERDS will primarily operate with alert transmitters and receivers in very close proximity. In this regard, several parties have misinterpreted Federal Signal's testing of ERDS field intensity up to a

[5] Moreover, with the Commission's permission, in July 1998 Federal Signal demonstrated ERDS at the Californial Highway Patrol test track, which is within the city-grade service contour of a Channel 6 station. No harmful effects were detected.

distance of one mile as indicating that it is intended that ERDS would operate over such a radius. For example, one commenter asserts that Federal Signal's field tests show that 1-watt power is "inadequate for purposes of achieving the one-mile signaling radius that Federal Signal contemplates," and that it is therefore "inevitable" that an ERDS power increase eventually would be sought. Grupo Televisa, pp. 7-8. Such is not the case. Testing to a range of one mile was done only to provide an indication of maximum range possible while limited to 1 watt ERP. At a typical ERDS range of 1/10th of a mile, the ERDS signal will be much (more than 10 dB) stronger, so that potential interference into the ERDS system will diminish dramatically. As the alert transmitter and receiver close the distance, the ERDS signal grows geometrically in strength so that even a very close interference source will not prevent the alert message from getting through. In addition, future transition to digital messaging will make the ERDS system even more interference proof and effective. Technical Report, p. 3.

IV. Conclusion

The Commission should issue a notice of proposed rulemaking in response to Federal Signal's Petition. It has been shown that ERDS will serve important public safety needs that are not met by existing emergency warning and alert systems. Contrary to the apparent view of some commenters, it is not necessary, nor would it be consistent with Commission procedure, that each and every issue raised in initial comments (for example, procedures governing ERDS use, licensing, and other such matters) be definitively resolved before the Commission can issue a notice of proposed rulemaking. Indeed, the purpose of initiating a rulemaking is to develop a record and to fully vet and explore such issues. The Commission has, in fact, gone well beyond the notice stage in rulemakings where it has allocated frequency spectrum to new services even before addressing licensing and service rules.[6] Federal Signal has made a *prima facie* showing

[6] *See, e.g., Intelligent Transportation Services, Report and Order in ET Docket No. 98-95* (FCC 99-305, rel. Oct. 22, 1999).

of the public interest benefits of ERDS sufficient to warrant issuance of a formal notice of proposed rulemaking.

Respectfully submitted,

FEDERAL SIGNAL CORPORATION

By: M. Scott Johnson

By: Francis E. Fletcher, Jr.

Gardner, Carton & Douglas
1301 K Street, N.W.
Suite 900, East Tower
Washington D.C. 20005
(202) 408-7221

Its Attorneys

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EXHIBIT E
TECHNICAL REPORT RE:
REPLY TO INFORMAL OBJECTIONS
TO PETITION FOR RULE MAKING ON THE
FEDERAL SIGNAL - ERDS SYSTEM

INDEX

INTRODUCTION	PAGE 1
MEASURED SYSTEM PERFORMANCE AND FM INTERFERENCE RATIOS	PAGE 1
TELEVISION AURAL SIGNAL RATIO	PAGE 2
ERDS AND FM INTERFERENCE POTENTIALS	PAGE 3
ERDS SYSTEM SERVICE ESTIMATES	PAGE 5
ERDS IMPACT ON DTV AND IBOC DIGITAL RADIO	PAGE 6
CONCLUSION	PAGE 7

Prepared by
Lohnes and Culver Washington, D.C.
November, 1999

EXHIBIT E
TECHNICAL REPORT RE:
REPLY TO INFORMAL OBJECTIONS
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FEDERAL SIGNAL - ERDS SYSTEM

INTRODUCTION

This statement is prepared on behalf of Federal Signal, a manufacturer and worldwide supplier of safety, signaling and communications equipment, fire rescue products, tools, parking control and other equipment. Federal Signal has developed an Emergency Radio Data System (ERDS) to be made available to emergency personnel to alert the public of imminent hazards. A petition for Rule Making has been filed with the FCC requesting authorization to operate the system on FM Channel 200. This engineering statement contains responses to several questions raised in the informal objections and a further technical description and analysis of the ERDS system.

MEASURED SYSTEM PERFORMANCE AND FM INTERFERENCE RATIOS

In the Federal Signal request for Rule Making, data was presented in the Engineering Statement relative to the laboratory measured ERDS system performance and interference potential. Figures 1A and 1B presented FM to ERDS received and caused interference thresholds relative to desired receiver input power (d/u ratio in dB). The receiver input was measured, reported and graphed on Figures 1A and 1B as dBm (decibels relative to one milliwatt). Similar measurements illustrating interference to television reception on Channel 6 were conducted. Those tests were measured and reported in dBmV (decibels relative to one millivolt). However the receiver input scale was not labeled dBmV, but instead was kept as dBm. The data is correctly plotted for the scale that should be re-labeled dBmV.

The values reported and indicated in Figures 1A, 1B and 2 were the actual values measured for the ERDS system under test and a selection of receivers. This data provided Federal Signal with a proof of concept estimation of the threshold of caused and received interference for the system as designed and anticipated to be used. Since ERDS will be

used primarily to alert motorists about imminent hazards, automobile receivers were chosen as the test FM receivers. A small but representative sample of home television receivers were chosen for testing.

In the comments filed by the Society of Broadcast Engineers (SBE), a copy of the graph from FCC Rules Section 73.599, the FM educational channels to television Channel 6 interference ratio, is presented. On the graph the interference ratio has been extrapolated outside of the FCC reported range of Channels 201 to 213, to include a curve labeled "channel 200 (extrapolated)". In general such extrapolation should be done with care because of the likelihood for increasing error with increasing reach of the extrapolation. In this case the error should be modest. However, the SBE technical presentation incorrectly interprets the d/u scale on the left side of the graph to indicate 1.0 dB per division. In reality it indicates 0.5 dB per division and the 3.5 dB reported d/u ratio is really 1.75 dB.

Considering the unique low power ERDS signal being tested, the expected range of results, along with subjective evaluation of interference thresholds for a small sample size, a variation in results relative to other testing is expected. The data reported in FCC Rules Section 73.599, collected by different methods for different systems (not ERDS) and different receivers under test, is within approximately 10 dB of the ERDS data as noted by SBE. This is not unusual and is entirely appropriate for a proof of concept test and as a general indicator of potential interference. The precise value of interference signals and ratios may be determined with greater precision in the future if field testing shows a potential for interference and the need for such precision.

TELEVISION AURAL SIGNAL RATIO

The SBE objection continues by making the assumption that the television channel 6 test signal has an aural power ratio, "of -7 dB (i.e. 20% aural power)". SBE then objects that this high aural power ratio, nearly at the FCC permitted maximum, is not necessarily

a universal level or even a possible level depending on the transmitter in use. The statement regarding 20% aural power being high and not possible in some cases is correct, but the assumption that Federal Signal conducted testing at that level is not correct.

The Federal Signal engineering statement clearly said, "The television receiver video carrier to audio carrier power ratio for this test was 14 dB (20% audio carrier voltage ratio)." The ratio was stated as a voltage ratio because the test results were presented in voltage level. The 14 dB voltage ratio is 20% voltage ratio and 4% power ratio. A 4% power ratio is easily achievable by all television transmitters and is lower than a typically expected ratio of 10% aural power. Testing of the ERDS system interference to television Channel 6 reception with 4% aural power represents a worst case, very conservative, test. It over estimates the potential interference to typical television aural signals (10% ratio) by 4 dB and tends to show protection even to stations with deficient aural power .

ERDS AND FM INTERFERENCE POTENTIALS

Several objections were made relative to potential interference to ERDS. The ERDS system is not designed to be interference free. By its very nature, designed to be used in any area where vehicles may operated, the probability for eventual operation near a television Channel 6 or FM Channel 201 station is small but not zero. As an ERDS transmitter and receiver both enter a high TV-6 or FM 201 signal area, interference will increase and effective range will be reduced. But, as the receiver continues to approach the alert area and the ERDS transmitter at that location, the ERDS signal will increase geometrically and eventually overcome even strong TV-6 or FM 201 interference. The effective range may be reduced to 1/4 mile or 1/10 mile, but the message will still get through. Federal Signal accepts the limitation imposed by the few high interfering signal areas.

Interference to TV-6 and FM 201 operations is likewise a small potential. SBE

claims a potential interference area, the predicted distance to the ERDS 71 dBu F(50,10) contour, to extend nearly 2 kilometers. To arrive at this SBE assumes, "an effective height of zero meters and use of the F(50,10) curves." These are inappropriate assumptions.

The ERDS system will operate with very low transmit and receive antenna heights. The SBE assumptions, however, force the minimum transmitter height to 30 meters and the receive antenna height to 9 meters. Some approximation of the expected signal can be achieved by calculating the approximate signal reduction due to the reduced antenna heights and applying this to the FCC estimated signal estimation curves at 30 meters antenna height. This is a dangerous extrapolation, far beyond the FCC curves, but to illustrate the magnitude of the change the following is presented. Since a reduction from either 30 meters or 9 meters to "zero" height would yield an indeterminate solution, a height of 1 meter is assumed as the "zero" height at the transmitter. The signal reduction can be estimated for antenna height changes by the formula ($20*\text{Log } H_1/H_2$). However, for a height change of this magnitude and close to the ground, caution must be exercised, the effects of local objects very close to ground level must be considered. The height change ratio of 1/30 yields a 29.5 dB signal reduction. By antenna reciprocity theory we can apply this correction to either the transmitted power or the desired signal value and re-estimate the contour distance, using the FCC computer signal prediction program, still using the 30 meter minimum available FCC antenna height. The result is 0.06 kilometers to the 71 dBu contour. Even assuming a 20 dB reduction, the contour distance is 0.2 kilometers, about 1/10 that predicted by SBE.

This gross approximation of interference is not meant to present the final or precise potential interference contour value or distance, but instead to show the relative magnitude of the potential interfering contour, it is very small. Actual signal level measurements were made from the ERDS test transmitter system. Federal Signal confirms that the signal measurements were made with a calibrated receiver and antenna positioned as an actual receiver might be located and illuminated from a test transmitter vehicle positioned at the distances reported. The value reported represents the median value of several test

measurements made over a small area at the reported distance. The test values were reported in the engineering attached to the Federal Signal request for Rule Making and are reproduced below for convince.

DIST. MI.	FIELD INTENSITY	RECEPTION EXPERIENCE
0.25	56 dBu	"Good readability"
0.50	46 dBu	"Readable, some noise"
0.75	39 dBu	"Noisy, but readable"
1.0	32 dBu	"Very noisy"

The estimation of 0.06 kilometers to the 71 dBu signal distance is not at all out of line for a gross extrapolation as calculated above and in relation to the measure data tabulated above. The measured data was provided to establish approximate operating distances, at relatively large distances of 0.25 to 0.5 kilometers, but not interference at short distances such as 0.1 kilometers or less. Additional measurements at closer distances will serve that purpose if necessary.

ERDS SYSTEM SERVICE ESTIMATES

As discussed briefly above, the ERDS system is not expected to operate in an interference free environment. Present users on television Channel 6 and FM Channel 201 will present interference potential. Likewise ERDS may interfere with those other users. However, because of the low power and low antenna height there will be a very large proximity effect for both service and interference as the ERDS transmitter is approached. This factor works strongly in the favor of ERDS to ensure high probability of close range operation and a very low probability of interference at moderately longer range.

Objections are noted that the ERDS service signal levels cited above were not measured at 30 feet (10 meters) above ground level and reports only a single value at set distances. For the ERDS system under consideration, the way it operates and for the proof

of concept purpose of the measurements, the methodology and reporting are appropriate. Reception is not intended for receivers with a 30 foot antenna height. Measuring the signal intensity and reporting the audio quality at fixed distance single locations is sufficient for the need to gauge ERDS service distance.

An objection was made based on the assumption that two separate RF receivers would be used in the system and that the antenna signal would be split and therefore each receiver input would be reduced. However, contrary assumptions such as the use of an active antenna and preamplifyer, were not made. In reality, the current test receivers for the ERDS system use time multiplexing to switch away from the FM channel of interest to Channel 200 to briefly monitor for the ERDS signal. With new receivers in which ERDS will be included, this switch can be made in an interval short enough that the brief audio mute on the system is not detectable by the listener. Only when the ERDS signal is detected and identified as a legitimate alert signal, would the audio mute be extended and replaced by a short beep tone, immediately followed by the alert message.

Supposition about the future operation of the ERDS system lead to objections based on the assumed reception of multiple alert messages from many sources at an emergency scene, or the repetition of the same alert message over and over for every receiver stuck close to the alert transmitter. The ERDS system will have built into it a message coordination protocol to prohibit multiple transmitters sending multiple messages in the same area. The receiver will identify a unique message and not present multiple repetitions of the same message. A new message from the same transmitter, or another transmitter at the scene, will be presented to the receiver only if it is properly encoded and identified as a new message by the receiver, and then presented only once to the listener.

ERDS IMPACT ON DTV AND IBOC DIGITAL RADIO

As television and FM radio both transition to digital in the future the ERDS system may find itself sharing the spectrum with adjacent channel FM IBOC and the edge of DTV

Channel 6. ERDS may also transition to a digital mode of signaling.

The DTV Channel 6 operation will comprise the full 6 MHZ wide television channel. ERDS will occupy perhaps just over 100 kHz of bandwidth. The potential for ERDS interference to DTV Channel 6 is quite small, something more like adjacent channel NTSC interference than for Co-Channel interference . Reviewing the FCC DTV co-channel and adjacent channel interference ratios, it is expected that ERDS will be 20 to 30 dB or more less intrusive to DTV than to analog NTSC television on Channel 6.

IBOC digital radio in the FM band is proposed with each station using two digital sideband carriers, one on each side of the host analog signal. The system has been designed, and is claimed to be, strongly resistant to adjacent channel interference. The FM IBOC side band signal will be approximately 25 dB below the FM analog host station carrier. For the lowest power 3 kW ERP Class A FM station, the IBOC side band power is still more than 10 dB above the 1 watt ERDS signal. The FM IBOC system is designed to continue to operate with one of its sideband signals lost. A nearby ERDS adjacent channel signal, a first adjacent FM station or a second adjacent IBOC signal all might affect an IBOC FM station. The probability of a narrow band ERDS signal (or any of the above potential interference signals) affecting a relatively wide band IBOC sideband signal is low. The probability of affecting both sidebands is fast approaching zero.

CONCLUSION

ERDS is designed to function over a very small area using a low power low antenna height transmitter, received by low antenna height automobile receivers. Considering the low power and antenna heights the improvement in service grows very rapidly with decreasing distance from transmitter to receiver. Conversely, the potential interfering signal starts at very low power and hence very small distance and the interfering signal diminishes rapidly as the distance from the transmitter is increased. The potential for interference to digital transmissions is dramatically reduced by the inherent immunity to

interference of the digital transmission methods. Fears and objections expressed in the opposition to the ERDS petition for Rule Making are mostly founded on misunderstanding of the ERDS system or under appreciation of the severely limited potential interference from such a low power limited area system. Worries expressed regarding the usurpation of ERDS frequencies for bootleg or terroristic uses are imaginative, but useless. A system designed to identify and control legitimate messages, will easily reject bogus messages.

Respectfully submitted,
LOHNES AND CULVER

Robert D. Culver, P.E.
Md. Reg. No. 19672

November, 1999

CERTIFICATE OF SERVICE

I, Elizabeth A. Fertig, a secretary in the law firm of Gardner, Carton & Douglas, certify that I have this 8th day of November, 1999, caused to be sent by first-class U.S. mail, postage-prepaid, a copy of the foregoing Motion for Extension of Time of Federal Signal Corporation, to the following:

Norman P. Leventhal, Esquire
Barbara K. Gardner, Esquire
Walter P. Jacob, Esquire
Leventhal, Senter & Lerman
2000 K Street, N.W.
Suite 600
Washington, D.C. 20006-1809
(Counsel to Grupo Televisa, S.A.)

Christopher D. Imlay, Esquire
Booth, Freret, Imlay & Tepper
5101 Wisconsin Avenue, N.W., Suite 307
Washington, D.C. 20016
(Counsel to Society of Broadcast Engineers, Inc.)

Gregory A. Lewis, Esquire
National Public Radio, Inc.
635 Massachusetts Avenue, N.W.
Washington, D.C. 20001

Henry L. Baumann, Esquire
Jack N. Goodman, Esquire
Lori J. Holy, Esquire
National Association of Broadcasters
1771 N Street, N.W.
Washington, D.C. 20036

Richard-Michelle Eyre
REC Networks
P.O. Box 2408
Tempe, Arizona 82580-2408

Deborah S. Proctor, General Manager
Radio Station WCPE
P.O. Box 828
Wake Forest, North Carolina 27588-0828

John R. Benjamin
WKJCE Radio
P.O. Box 28
Vowinckel, Pennsylvania 16260

Charles R. Coplien
WKJCE Radio
P.O. Box 19
Vowinckel, Pennsylvania 16260

Christopher Maxwell
Secretary/Treasurer of Virginia
Center for the Public Press
1621 West Broad Street
Richmond, Virginia 23220

Larry Erickson, Chief Engineer
KBJR-TV
230 East Superior Street
Duluth, Minnesota 55802

John C. Quale, Esquire
Skadden, Arps, Slate, Meagher & Flom, LLP
1440 New York Avenue, N.W.
Washington, D.C. 20005
(Counsel to KHQ, Incorporated)

Todd D. Gray, Esquire
Margaret L. Miller, Esquire
Dow Lohnes & Albertson, PLLC
1200 New Hampsuire Avenue, N.W.
Suite 800
Washington, D.C. 20036-6802
(Counsel to Arkansas Educational
Telecommunications Commission
Board of Regents for Benefit of the University of Arizona
Central Michigan University
KVIE, Inc.
Prairie Public Broadcasting, Inc.
Rocky Mountain Public Broadcasting Network, Inc.)

Ms. D'wana R. Terry
Federal Communications Commission
445 12th Street, S.W., Room 4-C321
Washington, D.C. 20554
(VIA HAND DELIVERY)

Elizabeth A. Fertig

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