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

In the Matter of	)	
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Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters	)	WT Docket No. 10-4
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COMMENTS OF MOTOROLA SOLUTIONS, INC.

Motorola Solutions, Inc. ("MSI") hereby submits these comments in response to the Federal Communications Commission's ("FCC" or "Commission") Notice of Proposed Rulemaking proposing to create a license-by-rule framework and to adopt other rules governing the operations of wireless signal boosters.[1] In these comments, MSI addresses various aspects of the Commission's proposed rules as they apply to signal boosters that are used to enhance private land mobile systems, including public safety systems, operating on frequencies available under Part 90 of the Commission's rules.

I. INTRODUCTION

MSI supports the Commission's proposals seeking to bring increased consistency and coordination to Part 90 signal booster deployment, which will help boosters fulfill their important role without causing harmful interference. Although MSI does not currently manufacture signal boosters, it does deploy them as elements of system solution designs when appropriate, and thus has an interest in promoting their responsible and effective use. Because of the myriad of users and services interwoven throughout the Part 90 frequency bands, MSI

[1] *See* Amendment of Parts 1, 2, 22, 24, 27, 90, and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, *Notice of Proposed Rulemaking*, WT Docket No. 10-4, 26 FCC Rcd 5490 (2011) ("*Notice*").

believes that all Part 90 signal boosters should only be deployed under the control of the licensees for the frequencies in the areas in which the boosters will operate. Moreover, fixed Part 90 private land mobile radio ("PLMR") boosters that are greater than 20 feet above ground should be site licensed similar to other fixed Part 90 stations.

As a general principle, the technical rules the Commission applies to signal boosters should be crafted to provide sufficient flexibility to allow successful operations, but should not create any greater interference potential than the underlying device being boosted. As the Commission recognizes, Class B signal boosters in particular pose a significant risk of harmful interference to spectrally adjacent licensees. As such, the Commission should place appropriate restrictions on the use of Class B signal boosters in Part 90 frequencies. MSI continues to believe that there is no need for the authorization of new Class B boosters. With contemporary booster technology, the cost difference between deploying Class A and Class B boosters is diminishing, and Class A boosters are providing a superior solution that decreases the risk of interference posed by the use of Class B boosters. If the Commission does choose to continue to authorize additional Class B boosters, however, it should significantly limit their areas of operation and revise other rules as necessary to ensure that they adhere to appropriate technical limits and do not cause harmful interference.

II. THE COMMISSION SHOULD PROCEED WITH ITS PROPOSALS TO CLARIFY AND BRING STRUCTURE TO THE PART 90 BOOSTER RULES.

The Commission's *Notice* proposes to amend the Part 90 signal booster rules to bring additional clarity to their appropriate use and to provide guidance regarding their deployment. The Commission also seeks comment on additional modifications to the technical rules governing booster deployment. MSI believes boosters have an important role to play in wireless communications system design, however because of the potential for harmful interference caused

by uncoordinated installation of signal boosters—particularly Class B boosters—deployment of signal boosters should be carefully managed. To this end, MSI offers the following suggestions with respect to revising the Commission's rules for Part 90 signal boosters.

A. All Part 90 Signal Boosters Should be Licensee-Controlled.

The Part 90 spectrum bands are subject to unique deployment and coordination challenges that necessitate all signal boosters deployed in these services be directly controlled by the relevant licensee. Most Part 90 frequency bands are dominated by shared frequency use subject to a frequency coordination process that is generally effective at preventing and resolving instances of harmful interference before communications are disrupted. Commercial 800 MHz specialized mobile radio (SMR) services are still interwoven with Part 90 PLMR services in many areas, and the potential for interference between these two different types of services, both covered by Part 90 of the Commission's rules, raises a separate set of concerns. In each of these cases, control of the boosters by the licensee will help promote interference-free operations in the bands.

For Part 90 PLMR boosters, MSI recommends that the Commission require site-licensing for signal boosters greater than 20 feet above ground under a discrete station class in order to enhance the frequency coordination process. Boosters operated at lower heights could be licensed by rule similar to the Commission's current rules for control stations. Fixed boosters operated in conjunction with a geographic license would only need to be site-licensed to the extent they are installed near the geographic borders of the service area and require coordination with adjacent geographic licensees.

As the Commission recognizes in the *Notice*, there are particular interference concerns related to booster use in the 800 MHz band, due to the interaction between commercial SMR

operations and interleaved public safety land mobile systems.[2] Site licensing of public safety Part 90 PLMR boosters, as discussed above, should provide a mechanism for quick resolution of any interference caused to commercial SMR operations. However, commercial SMR boosters should also only be deployed under the direct control of the commercial licensee. Because of the diversity of systems operating in this band, including public safety operations, consumers should not be able to deploy boosters on these channels under a license-by-rule framework, as the Commission proposes for consumer boosters.

B. Signal Booster Technical Rules Should Facilitate Successful Operations Without Creating Any Greater Interference than the Devices Being Boosted.

As a guiding principle for crafting the signal booster rules, the Commission should strive to facilitate deployment of signal boosters in a manner that helps fill gaps in licensees' service areas without creating any greater interference than the devices being boosted. Part 90 signal booster emissions limits, power levels, frequency stability, and other metrics should all be crafted with this principle in mind. In keeping with this principle, narrower filters, programmable filters, or other technological measures may need to be developed and implemented on boosters going forward, but this is necessary to ensure successful operations and to minimize interference both at the time of installation of the booster, and as the local RF environment changes in the future.

Referring to challenges faced by Class A boosters in boosting discrete digital narrowband channels, the Commission seeks comment on the appropriate emissions limits for Part 90 signal boosters.[3] As indicated above, signal booster out-of-band emissions and frequency stability should generally be equivalent to those of the underlying devices. MSI agrees with those

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2 *Notice*, 26 FCC Rcd at 5497-98 ¶ 18.

3 *See Notice*, 26 FCC Rcd at 5521 ¶ 82.

commenters that assert that the passband on Class A signal boosters has to be wider than the assigned bandwidth in order to minimize the potential for distortion/group delay of signals passing through the device. Whatever the appropriate width of the passband may be, however, emissions outside this passband should be subject to the same out-of-band emissions limits as the device being boosted.

For Class B boosters, MSI agrees that the passband should be the minimum practical width necessary to transmit the licensee's authorized frequencies. In this case as well, the out-of-band emissions of the booster should be no greater than for the devices being boosted. The 35 dB attenuation on which the Commission seeks comment may not be sufficient to meet this requirement.[4] For both types of boosters, to the extent that standards need to be developed or other determinations made with respect to the appropriate passband size, channel bandwidth, or emissions rolloff, these determinations should be made in appropriate industry fora and standards development organizations such as TIA.

Regarding the appropriate power levels for Part 90 signal boosters, the 5 watts ERP power limit is sufficient for fixed Class B boosters, which should not require more power for the return link than mobile or portable units on ground located at the same location. However, MSI continues to believe that Class A boosters should be permitted to increase their power.[5] This power increase would be an acceptable solution to filling gaps in coverage as the increased power level would be consistent with current Part 90 mobile transmitter power levels. If Class A boosters are site-licensed, as MSI advocates for above, the boosters could be coordinated or easily identified if interference occurs.

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4 *See id.*, 26 FCC Rcd at 5522 ¶ 85-87.

5 *See* Comments of Motorola, Inc., WT Docket No. 10-4 at 9 (filed Feb. 5, 2010).

The maximum power per channel that should be allowed to pass through a booster is related to the out-of-band emission limit of the device. As more channels pass through a booster simultaneously, increased intermodulation products, spurious signals, and harmonics are radiated. Thus, to ensure that they do not exceed the maximum allowable out-of-band emissions, booster operators require "over limit control" or maximum composite power control.

Finally, like other base station or mobile equipment, booster authorizations should be based upon allowable output power and out-of-band emissions, and installation based upon the maximum possible ERP per channel. All devices should be tested using a single carrier to set the maximum power output per channel and also tested using multiple input signals to set the maximum composite power output so as to ensure that out-of-band emissions from multiple carriers are not exceeded. Out-of-band emissions testing should be conducted on all devices. For Class A boosters, each narrow passband should be tested. For Class B boosters, testing should be conducted for out-of-band emissions compliance for the original signal within the pass band and to filter limits at the edge of the wide passband. Testing and authorization should be based upon industry standards, such as those developed and maintained by TIA.[6]

C. Mobile Class B Boosters in Part 90 PLMR Frequencies Pose a Problematic Risk of Harmful Interference.

MSI agrees with the Commission that the overlapping nature of Part 90 channels means that a number of different licensees could be negatively affected by a malfunctioning Class B booster.[7] A mobile transmitter of this sort could be extremely difficult to identify and address, and interference caused by these devices could be commonplace as PLMR mobile transmitters

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[6] *See, e.g.*, TIA, Land Mobile Radio Antenna Systems, Minimum Standards for RF Signal Boosters, TIA-156-A (2007).

[7] *See Notice*, 26 FCC Rcd at 5520 ¶ 81.

often operate at powers of 30-35 watts ERP, and portable transmitters typically output 2-5 watts ERP. Power levels this high present difficulties in isolating the effect of the booster with a single vehicle or fleet of vehicles.

In MSI's experience, cross band vehicular repeaters (station class MO3) or in-band vehicular repeaters are often better solutions for mobile signal enhancement. One problematic source of interference in mobile signal booster systems is the potential for the power output of the handheld device to trigger oscillation in the booster or for the combined system to exceed the maximum allowable power output. With a cross-band vehicular repeater system, the link between the portable and the mobile unit is on a separate frequency that typically transmits at lower powers. In such systems the risk of interference is reduced substantially. For this reason, it would make more sense to promote MO3 vehicular repeater operations rather than allowing mobile signal boosters on Part 90 channels.

MSI recognizes that many public safety agencies have acquired and successfully deployed mobile Class B boosters in mission-critical situations without causing harmful interference to any other operators. As such, an immediate prohibition against such uses may be draconian. MSI urges the Commission to consider transition strategies that allow licensees to continue to use existing equipment when interference is not present.

D. Signal Boosters for 700 MHz Public Safety Broadband Systems Should Also be Designed to Limit the Potential for Harmful Interference.

The Commission also seeks comment on whether 700 MHz public safety broadband licensees or their public safety users should be permitted to operate mobile Class B boosters.[8] MSI broadly supports the development and deployment of a robust public safety broadband network in the 700 MHz band, and recognizes that signal boosters may be an important

[8] *See Notice*, 26 FCC Rcd at 5520 ¶ 81.

component to 700 MHz public safety broadband network design in some environments. However, just as with other signal boosters, the Commission should take care in authorizing Class B mobile boosters in this spectrum, and should ensure that the potential for harmful interference to adjacent services is minimized. For example, the Commission may wish to consider authorizing public safety broadband use of mobile Class B boosters at lower powers than the 5 W ERP limit applied to fixed Class B boosters. Consistent with the principles identified above, Class B boosters operating on 700 MHz public safety broadband networks should not be permitted to create out-of-band emissions that are any greater than the devices being boosted.

E. The Commission Should Place Other Appropriate Limits on the Operations and Licensing of Fixed Class B Boosters.

In the *Notice*, the Commission seeks comment on several other proposed modifications to the rules governing Part 90 Class B fixed signal booster operations. As was previously explained, contemporary booster technology is such that Class A boosters are a competitive substitute for Class B boosters in terms of both price and functionality.[9] With the additional clarity and certainty regarding booster operations promised by the current rulemaking, the viability of Class A boosters should only increase. As such, MSI continues to believe that the Commission should not approve additional Class B boosters in the future. However, to the extent that the Commission chooses to continue to allow the deployment of additional Class B boosters, MSI supports several of the proposals discussed in the *Notice* for adjustments to the Class B signal booster rules, consistent with the above-expressed principle of creating no greater interference than the underlying device.

[9] *See* Reply Comments of Motorola, Inc., WT Docket No. 10-4 at 8-9 (filed Mar. 8, 2010).

MSI supports the Commission's clarification that fixed Class B boosters may only be operated in confined spaces by the removal of the reference to "remote areas" from Section 90.219(d).[10] As the Commission indicates, limiting Class B boosters to confined spaces will facilitate coordination of these boosters with other Part 90 licensees. It will also help isolate the devices affected by the boosters. However, further clarification of "confined space" is required. Because, by their nature, fixed Class B boosters transmit multiple channels, these boosters should only be deployed where the licensee has control over access to the space and can prevent potentially incompatible devices or frequencies from being introduced. Existing booster systems that are inconsistent with the newly modified rules should be grandfathered indefinitely unless they cause interference. Identifying, locating, and removing all current systems would be difficult and costly as they are not currently individually licensed or registered.

MSI also supports the Commission's proposal to allow the pairing of fixed Class B boosters with external antennas, provided reasonable power and antenna heights are imposed to minimize interference.[11] As discussed above, booster operations should, wherever possible, be conducted consistent with the power level, emissions, and other technical parameters of the underlying devices being boosted. For an external antenna paired with a fixed Class B booster, the system should be able to operate within a coverage area similar to a mobile device and the antenna height should generally not need to be higher than for a mobile transmitter. As with all fixed booster installations, the Class B booster should be site-licensed, and the external antenna should be configured similarly to a repeater control station, using either a directional antenna or minimal gain/pattern to establish and maintain the RF path.

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10 *See Notice*, 26 FCC Rcd at 5519 ¶ 78.

11 *Id.*, 26 FCC Rcd at 5519-20 ¶ 79.

III. CONCLUSION

MSI reiterates its support for responsible deployment of Part 90 signal boosters in a manner that enables robust wireless system coverage while also minimizing the risk of harmful interference. As explained above, MSI believes the best way to achieve this goal is to ensure that signal boosters are only deployed under the control of the licensee, and that booster systems generally create no greater interference than the underlying devices being boosted. The *Notice* is an important step toward, and MSI looks forward to continuing to work with the Commission in its implementation.

Respectfully submitted,

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