

**Before the
Federal Communications Commission
WASHINGTON, D.C. 20554**

In the Matter of

Interference Immunity Performance
Specifications for Radio Receivers

ET Docket No. 03-65

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Summary

While improved receiver performance would impact the efficient utilization of the spectrum, the Commission should not rely on receiver standards to the exclusion of other system performance factors. Rather, the FCC must continue to address interference mitigation from an overall system perspective, including characteristics of the systems receiving and causing interference. Further, the FCC should not view the introduction of receiver performance specifications as an opportunity to provide “underlay” users with access to licensed spectrum. Such an approach would create a more uncertain interference environment at the expense of users of licensed services and therefore undermine the impact of improved receiver performance.

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COMMENTS OF MOTOROLA, INC.

Motorola, Inc. (“Motorola”) submits these comments on the Notice of Inquiry (“*NOI*”) in the above captioned proceeding.¹ Motorola congratulates the Commission on initiating this proceeding as part of its continuing efforts to reduce the impact of interference and to ensure the efficient use of spectrum. While we agree with the Commission that receiver performance impacts the efficient utilization of the spectrum, Motorola would like to emphasize two key points. First, the Commission should not rely on receiver standards to the exclusion of other system performance factors. Rather, the Commission must continue to address interference mitigation from an overall system perspective, including characteristics of the systems receiving and causing interference. The introduction of industry developed receiver standards is just one of a number of potential measures to reduce the incidence of interference between multiple systems.

Second, the Commission should not view the introduction of receiver performance specifications as an opportunity to provide “underlay” users with access to licensed spectrum. Such an approach would create a more uncertain interference environment at the expense of

¹ Interference Immunity Performance Specifications for Radio Receivers, ET Docket No. 03-65, Notice of Inquiry, FCC 03-54 (rel. Mar. 24, 2002) (“*NOI*”).

users of licensed services and therefore undermine the impact of improved receiver performance. Instead, the Commission's objective should be to maximize the compatibility among services and users to minimize the potential for interference.

I. The Commission Should Consider Receiver Standards As One Of Several Measures That Can Be Used To Minimize Interference.

The *NOI* expresses the Commission's view that the "incorporation of receiver performance specifications could serve to promote more efficient utilization of the spectrum and create opportunities for new and additional use of radio communications by the American public."² Receiver performance represents only one factor in the interference equation. The susceptibility of a system to interference depends on the overall system design, not just the performance of the receivers. Moreover, as there are numerous different types of interference mechanisms, mitigation techniques need to be matched to the specific problem that is predicted or being experienced in a particular setting. For example, a requirement for appropriate spectral masking of transmitters is just as important as receiver selectivity in controlling out of band interference and increasing spectrum efficiency.³ Accordingly, the Commission should not elevate its reliance on receiver performance standards above all other system performance factors. Rather, it should address interference mitigation from an overall system perspective.

To achieve efficient and predictable use of spectrum, the Commission should seek to maximize the compatibility of services and users. This will require active spectrum management

² *NOI* at ¶ 1.

³ Comments of Motorola, Inc., ET Docket No. 02-135, Jan. 27, 2003, at 15 ("Motorola SPTF Comments"). Increasing channel selectivity of receivers will have only a limited impact on out-of-band interference, whereas spectral masks at the transmission source can minimize this type of interference much more effectively. *See id.* Spectral masks therefore generally provide the more efficient and appropriate solution to out-of-band interference.

by the Commission, rather than reliance upon any single technical parameter, such as receiver performance standards. Furthermore, effective spectrum management will require appropriate limitations on technical flexibility. As Motorola has previously stated: “Unlimited flexibility would allow extreme variations in technical parameters and could result in systems with radically different power and operating characteristics operating in the same or adjacent channels. Such a scenario would create the significant potential for harmful interference, uncertainty in the radio operating environment and inefficient use of spectrum.”⁴ Therefore, as the Spectrum Policy Task Force Report (“Task Force Report”) recognized, while flexibility in spectrum use should be permitted, such flexibility must be limited by appropriate technical parameters.⁵ For example, the Commission must continue to incorporate adequate frequency separation between base and mobile transmit bands and also designate the uplink and downlink bands for paired channel mobile operations.⁶ Intermixing paired and “reverse paired” operations in the same channels invites increased interference. Practical receiver standards are not a solution to this interference.

Furthermore, as both the Task Force Report and the *NOI* acknowledge, there is a need to provide greater certainty regarding the interference and operating environment.⁷ The Task Force Report recommended the concept of an “interference temperature” metric as a long-term objective, though it recognized that numerous hurdles must be overcome before this metric could

⁴ See *id.* at 4-6.

⁵ See Spectrum Policy Task Force Report, ET Docket No. 02-135, at 16 (2002) (“Task Force Report”) (“[C]lear technical rules remain necessary in all spectrum bands in order to facilitate co-existence of multiple spectrum uses in common and adjacent bands.”); see also *id.* at 64 (policy recommendation 1) (recommending that flexible use should be permitted “within technical parameters”).

⁶ See, e.g., Comments of Motorola, Inc., WT Docket No. 02-353, Feb. 7, 2003, at 5.

⁷ See *NOI* at ¶ 9; Task Force Report at 26-27.

serve as a useful spectrum management tool.⁸ The Task Force Report also recommended that the Commission should undertake a systematic study of the radio frequency (“RF”) noise floor for different frequency bands and geographic regions.⁹

Motorola supports the adoption of a more quantitative approach to defining the interference environment, though it has noted that this is a highly complex problem that requires considerable further study before it can be applied in the real world.¹⁰ The concept of “interference temperature” is new in name only, however. For many years, manufacturers and system designers have recognized that the spectrum environment is a significant factor affecting the incidence of interference and thus have routinely considered this factor along with customer coverage and reliability requirements when designing systems. It is well understood that changes in the spectrum environment in which a particular licensee operates may affect the probability of interference. Depending on the type of interference, the licensee’s operational requirements and the nature of the change in environment, increased receiver interference immunity can be one element that helps mitigate interference. However, simply specifying a target level of receiver interference immunity without considering the other variables is not a solution to either interference mitigation or spectrum efficiency.

II. The Commission Should Not Impose Receiver Standards On Industry In Order To Allow Underlay Users To Increase The Potential For Interference.

The *NOI* states that improved receiver performance specifications could achieve “more efficient and predictable use of the spectrum” and create opportunities for new uses of

⁸ See Task Force Report at 26, 33, 64 (policy recommendation 9).

⁹ See *id.* at 33, 64 (policy recommendation 10).

¹⁰ See Motorola SPTF Comments at 13-14 & Appendix A.

spectrum.¹¹ These are laudable objectives that receive almost universal support, at least at a general level. However, Motorola believes that the impact of receiver standards alone in meeting these objectives is somewhat overstated. Moreover, the process of developing receiver performance specifications should not be used as an opportunity to impose overly burdensome standards on the industry in order to increase access by unproven “underlay” users that are seeking to operate in licensed bands.

Allowing such underlay access would introduce myriad new sources of interference into the operating environments of existing licensees, which is antithetical to the objective of interference avoidance. Because unlicensed underlay users may operate without consultation with incumbents the operating environment for licensees would become significantly less predictable than it is today, increasing the potential for unanticipated incidences of interference. The end result would be to limit innovation and to deter licensees and the manufacturers who serve them from making the investments necessary to develop and deploy new technologies. Furthermore, in such a scenario, the additional cost of deploying receivers with improved performance specifications would be placed on existing licensees, not on the unlicensed users who would be given additional rights to spectrum access. For all of these reasons, the Commission’s objective should be to promote efficient use of spectrum consistent with users’ operational requirements, thereby attracting the investment necessary to develop and deploy useful and reliable systems. This requires continued spectrum management to ensure that incompatible systems are not placed in the same spectrum in the interest of some elusive efficiency or flexibility goals. Motorola thus believes that the Commission should require any

¹¹ *NOI* at ¶ 1.

additional future use of licensed spectrum to be established through secondary market arrangements, not a “commons” underlay approach.¹²

III. Voluntary, Industry-Developed Standards Should Be The Primary Means Of Achieving Receiver Performance Specifications.

The *NOI* states that the Commission’s preference is “to rely primarily on market incentives and voluntary industry programs that provide for flexibility in establishing and managing guidelines for receiver immunity, rather than formal mandatory standards incorporated into our rules.” Motorola continues to support this approach¹³ and notes that it is also consistent with the recommendation of the Spectrum Policy Task Force.¹⁴

The Commission should focus on defining and providing increased certainty regarding the overall environment in which receivers must operate. Coupled with the knowledge of customer’s operational requirements, such increased certainty would help to provide manufacturers with the most relevant information needed to develop appropriate standards and products that meet customers’ needs.

The *NOI* also proposes that it may be appropriate, in limited circumstances, for the Commission to adopt receiver performance guidelines or standards. The Commission must ensure that it does not harm the marketplace by establishing standards that are so specific that manufacturers cannot meet other customer requirements or prevent innovative solutions to problems. To the extent that the Commission adopts standards, they should be based on voluntary industry standards and be at a sufficiently high level to allow innovation, thus allowing

¹² See Motorola SPTF Comments at 23 & n.72.

¹³ See Motorola SPTF Comments at 15.

¹⁴ See Task Force Report at 31 (“The Task Force generally prefers the use of voluntary receiver performance requirements, over mandatory standards.”); see also *id.* at 65 (policy recommendation 16).

manufacturers flexibility in how they design equipment to meet minimum performance requirements.¹⁵ Motorola recommends that receiver performance standards also be based on industry definitions, *e.g.*, the ANSI/TIA/EIA 102 and 603 standards for receivers operating in the public safety and private land mobile radio service frequency bands.¹⁶ Such standards have been developed with input from multiple manufacturers in the relevant field under a defined and accepted standards development process, with relevant documentation of the resulting standard that all manufacturers can access.

Any receiver standards should be accompanied by industry-agreed upon measurement procedures that are well defined, credible and practical to test against. If mandatory receiver standards are deemed to be necessary, Motorola recommends that the Commission implement these standards through its equipment authorization process. Minimizing the added regulatory burden in both delay and testing costs to ensure compliance is a key issue for manufacturers that the Commission should consider. Finally, we reiterate that if the Commission were to adopt receiver standards, they should be used as only one of several tools for achieving interference mitigation and neither receiver standards nor other technical solutions can replace active spectrum management.

¹⁵ See Motorola SPTF Comments at 15.

¹⁶ Similarly, globally recognized specifications for commercial mobile systems have been developed in 3GPP and 3GPP2. See, *e.g.*, 3GPP TS 25.101, 3GPP TS 25.104, 3GPP2 C.S0010-B, 3GPP2 C.S0032-1. In addition, Motorola supports the use of the Class A specification for new public safety and private wireless radios in the 800 MHz band. See, *e.g.*, Comments of Motorola, Inc., WT Docket No. 02-55, May 6, 2002, at 21; Reply Comments of Motorola, Inc., WT Docket No. 02-55, Aug. 7, 2002, at 20-21; Comments of Motorola, Inc., WT Docket No. 02-55, Feb. 10, 2003, at 18.

IV. Application Of Receiver Performance Guidelines And Standards To Specific Radio Services.

Motorola has previously stated its belief that receiver performance specifications common to all receivers would be inappropriate.¹⁷ The *NOI* asks for comment on issues relating to receiver performance specifications in a number of service groupings.¹⁸ Although the Commission has attempted to break services down to broad categories, Motorola believes that it is not possible to make blanket recommendations regarding receiver performance requirements for these groupings because of the diverse range of systems and services in each category. In general, however, the Commission should focus on creating a compatible operating environment by (1) developing technical rules for each service that help ensure the systems with similar technical characteristics are grouped together,¹⁹ and (2) defining the operating environment as clearly as possible for licensees and equipment manufacturers.²⁰ With these overall goals in mind, Motorola offers the following comments on specific categories identified in the *NOI*.

A. Public Safety Services

Motorola supports the adoption of performance standards for public safety receivers as long as those standards adequately consider public safety users' operational requirements. For example, in the Commission's ongoing 800 MHz interference proceeding, Motorola has stated its support for adoption of the Class A specification for new public safety radios.²¹ Adoption of

¹⁷ See Motorola SPTF Comments at 14-15.

¹⁸ See *NOI* at ¶¶ 23-24.

¹⁹ See Motorola SPTF Comments at 6-7, 11.

²⁰ See *id.* at 8, 13.

²¹ See *supra* note 16.

this specification would require state-of-the-art intermodulation rejection performance in new radios and thus help ensure a high level of reliability for public safety systems.

The Commission should also consider the public benefit interests of ensuring interoperability for public safety users by requiring new public safety radios to meet industry developed interoperability standards. Specifically, the Commission should consider extending the requirement for radios in the 700 MHz Public Safety spectrum to incorporate the capability to operate in compliance with the P25 Phase I (ANSI 102) standard to the VHF, UHF and 800 MHz Public Safety bands.

B. Mobile Services

Because the mobile service grouping covers such a diverse range of systems, it would not be possible to develop blanket performance specifications. Motorola notes however, that commercial mobile radio services are generally highly competitive and there is already considerable market pressure for industry-developed standards that ensure high system reliability.

C. Digital Television

The *NOI* requests comments on approaches to fast-track the development and implementation of voluntary receiver performance standards for broadcast digital television (“DTV”). Motorola supports Commission action in expediting this activity, as it will foster the transition to DTV and the availability of digital services to the general public and, more importantly, open critical spectrum for Public Safety applications. Spectrum allocated more than five years ago to support Public Safety is still unavailable in many of the largest U.S. cities because of the continued presence of analog TV operations in the 700 MHz band. Continued

analog broadcasting in the 700 MHz band by 5% of the nation's television stations are delaying the availability of spectrum to public safety entities that serve and protect over 50% of the U.S. population.

The Commission should take any available action in expediting the DTV transition by finding ways to encourage development of equipment for the consumer market. One of the issues cited for the delay of DTV is that relatively few set-top devices incorporate digital-to-analog conversion technology, which enables consumers to view digital broadcast signals on their existing analog TV sets. Motorola currently markets a range of digital cable set-top devices that can provide analog down-conversion functionality for DTV programming.²² The cable industry and their suppliers have already developed and deployed, and are increasingly promoting (both for lease and for retail purchase), customer set-top equipment that will facilitate the DTV transition. This is an important consideration in expediting the transition and clearing the 700 MHz spectrum for public safety use because approximately 70% of the TV households nationwide receive their programming by cable rather than over-the-air. In many of the markets where analog TV stations are preventing public safety use, this percentage is even higher.

²² For example, the DCT5100 and DCT5200 digital set-top equipment can downconvert both high-definition ("HDTV," *e.g.*, 1080i or 720p) and standard definition ("SDTV," *e.g.*, 480i and 480p) digital signals (including broadcast signals) for display on analog TV sets. Cable MSOs have recently begun to deploy these units in their systems. To date, Motorola has shipped approximately 140,000 DCT5100/DCT5200 units to cable MSOs, and estimates that approximately 100,000 are currently in use in customers' homes. Motorola also is promoting the DCT5100/DCT5200 family of equipment to retailers, urging them to purchase these units and resell them directly to consumers. In addition, Motorola's DCT2000 family of digital set-top devices can downconvert the 480i digital format to analog. Over 25 million DCT2000 series units are currently deployed in the United States.

V. Treatment Of Legacy Receivers.

The Commission should consider whether and how any receiver specifications would apply to existing receivers. As the *NOI* recognizes, the appropriate approach will vary based on the circumstances.²³ The potential benefits of uniform receiver performance must be weighed against the impact to licensees and users in any transition. Accordingly, sufficient time must be provided to allow a transition taking into consideration the normal receiver turnover rate. The appropriate timing of and requirements for a transition will vary depending on the nature of the services and the perceived benefit of the transition. The transition requirements could vary by geography as well as time, with areas where the benefits are high, such as resolving interference, being transitioned quickly while other areas progress on an extended time frame.

VI. Conclusion.

Motorola again congratulates the Commission on its efforts to promote efficient spectrum use consistent with operational needs and a predictable spectrum environment upon which to base system designs. However, the Commission cannot rely on receiver standards to the exclusion of other system performance factors because interference mitigation involves an overall system perspective, not just receivers. Industry developed receiver standards are just one of a number of potential measures to help reduce the probability of interference. In addition, the Commission should not use the introduction of receiver performance specifications as an opportunity to provide underlay users with access to licensed spectrum. Such an approach would create new sources of interference and a more uncertain interference environment at the expense

²³ See *NOI* at ¶ 39.

of users of licensed services. Instead, the Commission's objective should be to maximize the compatibility among services and users to minimize the potential for interference.

Respectfully submitted,

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