

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

In the Matter of)	
)	
Emission Mask Requirements for Digital)	PS Docket No. 13-209
Technologies on 800 MHz NPSPAC)	
Channels; Analog FM Capability on Mutual)	RM-11663
Aid and Interoperability Channels)	
)	

COMMENTS OF HARRIS CORPORATION

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Table of Contents

I. SUMMARY.....	2
II. THE COMMISSION SHOULD CODIFY CURRENT RESPONSIBLE PRACTICE OF COMPLYING WITH THE H MASK FOR DIGITAL SYSTEMS.	4
A. Requiring the H Mask for Digital Technologies is Consistent With TETRA Order’s Interference Protection Policy.	4
B. Requiring the H Mask Will Comport With Responsible Industry Practice.	5
C. Imposing Mitigation of Interference Caused By Non-H Mask Compliant Digital Technologies Upon Regional Planning Commissions is Impractical.	6
D. Claims of Increased Spectral Efficiency Are Flawed and Do Not Justify the Interference Resulting From Non-H Mask Compliant Digital Technologies.	7
E. Audio Low Pass Filters Are Not Applicable to Digital Modulations.	9
III. CLARIFYING PART 90.203 TERMS “CAPABLE OF BEING PROGRAMMED TO OPERATE” AND “CAPABLE OF OPERATING” ON DESIGNATED MUTUAL AID/INTEROPERABILITY CHANNELS IN THE 800 MHz, VHF, AND UHF BANDS WILL DRIVE INCREASED INTEROPERABILITY.	10
IV. THE PROPOSED RULES WILL NOT IMPACT INVESTMENT.	13
V. CONCLUSION	14

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Harris Corporation (Harris) respectfully submits these comments in response to the Federal Communications Commission’s (Commission) Notice of Proposed Rulemaking (NPRM), proposing to require that: 1) digital technologies comply with Emission Mask H when operated in the 800 MHz National Public Safety Planning Advisory Committee (NPSPAC) band (806-809/851-854 MHz); and 2) equipment have analog FM capability when operating on the 800 MHz mutual aid channels designated in §90.617(a)(1) of the rules and on the nationwide public safety interoperability calling channels in the 150-174 MHz VHF and 450-470 MHz UHF bands. Harris lauds the Commission’s proposals, and urges it to swiftly adopt these proposed rules in order to protect first responders from interference and further the Commission’s goal of enhancing first responder communication interoperability.

I. SUMMARY

The Commission has consistently focused its rules impacting public safety spectrum on two vital objectives: 1) protect first responder communications from interference; and 2) facilitate increased interoperability among public safety communicators in mutual aid situations. The Commission's proposals to ensure compliance with the H Mask to digital technologies operating in the 800 MHz NPSPAC band and to require subscriber equipment operating on the 800 MHz, VHF, and UHF public safety mutual aid and interoperability calling channels have analog FM capability will meet these objectives and align Commission rules with responsible industry practice.

The Commission's proposals will also follow recent precedent. In a 2012 decision in which the Commission allowed Terrestrial Trunked Radio (TETRA) operation in spectrum in the U.S. for the first time, the Commission restricted TETRA operation on NPSPAC frequencies in order to attain these two essential goals. In the present case, the degree of interference emanating from non-H Mask compliant digital technology is almost identical to that which can result from TETRA operation in NPSPAC spectrum. Moreover, as is the case with TETRA, a related technology one vendor seeks to implement in the 800 MHz NPSPAC channels does not have mutual aid. By applying the same standards of interference protection and furtherance of interoperability through technology neutral requirements in the 800 MHz NPSPAC band, and by mandating a common modulation technology for operation on the designated interoperability calling channels in the 150-174 MHz and 450-470 MHz bands, the Commission can further realize its interference and interoperability objectives.

The few objections to the Commission's proposals are unmerited and do not warrant deviation from policies that protect first responder communications. First, proposals to allow non-H Mask compliant technologies in the 800 NPSPAC channels, only to place a burden on Regional Planning Commissions (RPCs), creates an unneeded effort at the local level to protect from interference-causing technology through spectrum-consuming channel planning. Second, claims that spectral efficiency will otherwise be furthered by allowing non-H Mask compliant technologies into this spectrum ignores the channel spacing that would be required and omits key spectral efficiency factors that make the argument implausible. Additionally, as the Commission has indicated, audio low pass filters are not applicable to digital modulations; this fact refutes claims that use of such filters by non-H Mask compliant digital technologies makes these technologies suitable for use in this band.

With regard to the Commission's proposal to require mutual aid capability in subscriber equipment that operates in the 800 MHz, VHF, and UHF public safety channels, this policy will simply enhance interoperability for first responders and codify user practices already in place by almost every vendor selling equipment that operates in these channels. It is important that this requirement be applied only to subscriber units, in harmonization with the existing 700 MHz narrowband interoperability requirements and the proposed UHF and VHF requirements.

Lastly, as the Commission's proposals formalize under rules the very industry practices that have provided increased interference protection and interoperability, they will not limit investment or hamper innovation. For these reasons, Harris urges the Commission to adopt the rules as proposed in the NPRM and as discussed hereinafter.

II. THE COMMISSION SHOULD CODIFY CURRENT RESPONSIBLE PRACTICE OF COMPLYING WITH THE H MASK FOR DIGITAL SYSTEMS.

A. Requiring the H Mask for Digital Technologies is Consistent With TETRA Order's Interference Protection Policy.

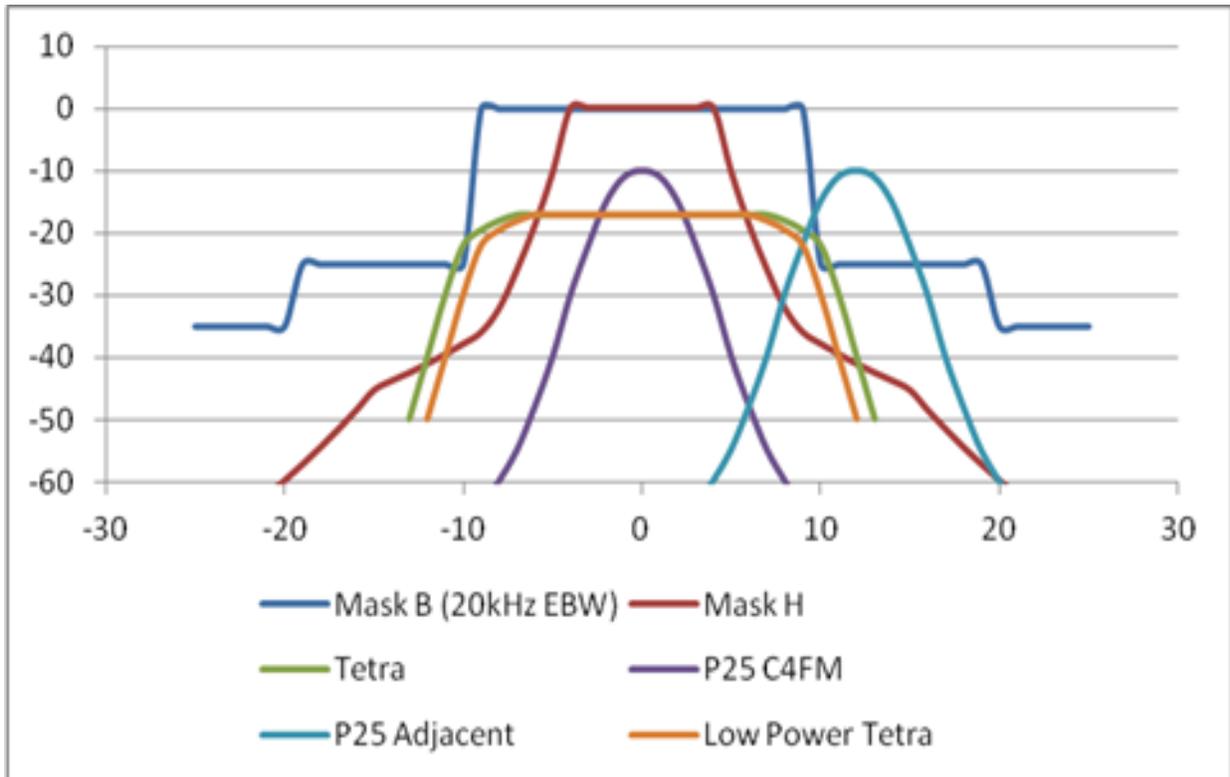
In this proceeding, the Commission seeks to determine whether manufacturers of digital equipment, on a technology-neutral basis, should continue to be able to take advantage of an emission mask rule intended to apply to analog FM systems.¹ In answering this question, the Commission's recent decision to restrict TETRA operation in public safety spectrum must be followed. While the Commission recently allowed TETRA operation in the UHF band and the non-NPSPAC portion of the 800 MHz band, the Commission prohibited TETRA operation in the 800 MHz NPSPAC band or the narrowband portion of the 700 MHz band. The Commission's justification for this prudent decision was simple: use of this specific technology in these frequencies could cause harmful interference and would hamper interoperability.²

Turning to the threshold question of whether the H Mask should be used by all digital equipment in 800 MHz NPSPAC frequencies, the question must be answered in the affirmative to continue the Commission's effort as established in the TETRA Report and Order to protect first responders from adjacent channel interference. As the diagram below reflects, the degree of adjacent channel interference from digital transmissions operating pursuant to the B Mask (the

¹ See *id.* at ¶11.

² See Amendment of Part 90 of the Commission's Rules to Permit Terrestrial Trunked Radio (TETRA) Technology, WT Docket No. 11-69, ET Docket No. 09-234, *Report and Order*, 27 FCC Rcd 11569 at ¶¶ 4-6 (2012) (TETRA Report and Order).

orange line), such as Low Power TETRA, is almost identical to that of TETRA operations in the same spectrum (the green line). Further, the diagram makes clear that any non-H Mask compliant digital technology will present a significantly increased adjacent channel interference threat over H Mask compliant digital technologies.



Thus, in order to mitigate against interference in the 800 MHz NPSPAC channels in a manner consistent with Commission precedent, the Commission must require that the H Mask be used for digital equipment regardless of the type of technology.

B. Requiring the H Mask Will Comport With Responsible Industry Practice.

The proposal to apply the H Mask will merely make regulations consistent with responsible industry practice. Although NPSPAC channels are spaced 12.5 kHz apart, they can occupy up to 20 kHz of bandwidth. Historically, digital LMR equipment operating in the NPSPAC spectrum

has been designed to comply with the H Mask to minimize interference. To date, for NPSPAC systems, manufacturers have minimized the potential for producing adjacent channel interference by developing NPSPAC systems compliant with the H Mask. Thus, the Commission's common-sense proposal will codify practice that has been followed without fail until recently. In fact, had the proposed introduction of a digital technology by a party that seeks to take advantage of a rule and the emissions mask that was intended to apply only to analog systems not occurred, this proceeding would not be necessary.

C. Imposing Mitigation of Interference Caused By Non-H Mask Compliant Digital Technologies Upon Regional Planning Commissions is Impractical.

The Commission seeks to assess a claim that it should allow non-H Mask compliant digital technologies to operate in the 800 MHz NPSPAC channels, leaving RPCs to manage the resulting interference.³ As the Commission notes, such a scheme would impose an unnecessary, arduous burden on RPCs.⁴

Under a scenario including technologies certified to Mask B, a much larger exclusion area is necessary before utilizing adjacent channels than is needed with equipment certified to Mask H. Having large geographic exclusion zones around digital transmitters not compliant with the H Mask results in considerable loss in actual realized spectrum efficiency. Due to regional planning based on 12.5 kHz center frequencies in the NPSPAC band, in effect a non-H Mask compliant transmitter will require use of $12.5 \text{ kHz} \times 3 = 37.5 \text{ kHz}$ of bandwidth. The benefits of 4 slot TDMA thereby become substantially reduced. When comparing TETRA to P25 Phase 2,

³ See H Mask NPRM at ¶ 12.

⁴ See *id.* (noting that the Commission “believe[s] that implementation of PowerTrunk’s proposal would impose an additional burden on RPCs and would necessarily restrict the ability of the RPCs to make efficient use of the NPSPAC spectrum.”).

one then finds that a Phase 2 system is considerably more spectrum efficient than TETRA, when deployed in a NPSPAC frequency plan.

D. Claims of Increased Spectral Efficiency Are Flawed and Do Not Justify the Interference Resulting From Non-H Mask Compliant Digital Technologies.

The Commission seeks evaluation of claims of improved spectral efficiency by PowerTrunk of its low-power TETRA product over those that operate free from interference and comply with the H Mask in 800 MHz NPSPAC channels.⁵ Harris believes that improved spectral efficiency comes in many forms, and begins with the ability of a technology to avoid generating interference. Without such a capability, it is difficult to deem any technology spectrally efficient. Additionally, as the Commission has made clear, interference threats to first responders operating in the 800 MHz NPSPAC channels are particularly acute, given the nature of the technology used and the important mission of first responder emergency communications.⁶ Thus, it is difficult to envision a scenario where interference-causing technologies should be allowed in the 800 MHz NPSPAC channels.

The interference potential in a typical scenario is illustrated in the table below. The table shows the difference in Adjacent Channel Power (ACP) for different TDMA technologies. ACP is typically defined as the ratio of the average power in the adjacent frequency channel to the average power in the transmitted frequency channel. In this case the adjacent channel is assumed to be a typical P25 receiver.

⁵ See *id.* at ¶ 14.

⁶ See TETRA Report and Order at ¶ 9.

System	ACP (measured in a 6 kHz bandwidth at a 12.5 kHz offset)
Low Power 4 slot TETRA compliant to B Mask	-22 dBc
OpenSky 4-slot TDMA system compliant to the H mask	-46 dBc

This 24 dB decrease in interference protection, in a very realistic scenario, must be considered unacceptable.

Moreover, PowerTrunk’s claim of superior spectral efficiency of its Low Power TETRA product, compared to Harris’ OpenSky system, is inaccurate. PowerTrunk asserts that their D-LMR equipment has superior data capacity and speech quality, comparing Kbits/s per 25 kHz channel.⁷ As noted by APCO, Harris OpenSky 4 slot systems operating in NPSPAC spectrum occupies a 12.1 kHz bandwidth, compared to Reduced Power TETRA that has an occupancy bandwidth of 20 kHz.⁸ Consistent with these facts, there are three measures of spectrum efficiency that the Commission should weigh in evaluating PowerTrunk’s assertions. First is Data efficiency, which is commonly measured as the ratio of data rate to bandwidth. OpenSky operates at a raw data rate of 19.2 kbps, so its efficiency is $19.2/12.1 = 1.58$ bps/Hz. Low Power

⁷ See PowerTrunk Comments, In the Matter of Preventing Interference in Public Safety Frequencies By Requiring H Mask and Mutual Aid for Digital Technologies, *Petition for Rulemaking*, RM No. 11663 (filed Apr. 30, 2012) (“*Harris Petition*”) at 4.

⁸ <http://www.apcointl.org/spectrum-management/resources/licensing-links/emission-designators.html>

TETRA has an efficiency of $36 \text{ kbps}/20 = 1.8 \text{ bps/Hz}$, very comparable to OpenSky. Next, 4-Slot OpenSky systems deliver 4 voice calls in 12.1 kHz of bandwidth, with a voice call efficiency rating of $4/12.1 = 0.33$, compared to Low Power TETRA which has a voice call efficiency rating of $4/20 = 0.2$, which is nearly 50% less than 4-Slot OpenSky. Finally, OpenSky permits effective licensing of adjacent channels on 12.5 kHz channel centers, consistent with the NPSPAC channel plan, whereas Low Power TETRA requires vacating the adjacent 12.5 kHz channel in the vicinity of one of its transmitters to avoid interference. Hence, PowerTrunk's assertions that Low Power TETRA offers superior spectrum efficiency are simply not correct.

E. Audio Low Pass Filters Are Not Applicable to Digital Modulations.

PowerTrunk has claimed that a digital transmitter equipped with an audio low pass filter implemented in the digital domain qualifies for being certificated under Mask B for NPSPAC, and cites a removal of Rule 90.211 in 1999 as some form of justification. For background, Section 90.211 was formerly known as §88.417 (which was deleted from the Commission's Rules in 1999). The language used in Commission documents as §88.417 was modified throughout the years up to and including the eventual deletion of §90.211 supports the assertion the "audio low-pass filter" proviso in §90.210 regarding mask applicability does not apply, or is not available when equipment employs digital modulation. In other words, the "audio low-pass filter" proviso is only available to equipment modes utilizing analog FM modulation. This interpretation is further supported by the fact there is absolutely no difference in the spectrum profile of voice transmissions and data transmissions when digital modulation is concerned. However, the same is not true for equipment employing analog FM modulation.

The terminology “audio low pass filter,” which is exclusively applicable to analog systems should not be used to certify digital technologies that increase potential for interference in the NPSPAC spectrum.

III. CLARIFYING PART 90.203 TERMS “CAPABLE OF BEING PROGRAMMED TO OPERATE” AND “CAPABLE OF OPERATING” ON DESIGNATED MUTUAL AID/INTEROPERABILITY CHANNELS IN THE 800 MHz, VHF, AND UHF BANDS WILL DRIVE INCREASED INTEROPERABILITY.

Harris agrees with the Commission that it should, given present market entrance attempts, clarify the terms “capable of being programmed to operate” and “capable of operating” when such terms are applied to the designated interoperability/mutual aid channels in the 800 MHz, VHF, and UHF bands as requiring analog FM modulation in subscriber units.⁹ As the Commission notes, the current rules for interoperability channels in effect mandated mutual aid capability, given that analog FM was the predominant modulation used on public safety frequencies.¹⁰ However, the absence of an express requirement of the use of common modulation has allowed some to attempt to introduce subscriber technology incapable of analog FM on such designated mutual aid/interoperability channels.¹¹ The impact of this new development would be severe: as the Commission continues to increase its focus on enhancing public safety communications unit to unit interoperability, manufacturers may be allowed to avoid baseline capabilities that enable interoperability among LMR vendors. The Commission’s proposal is sound; FM modulation is the least common denominator today, in these frequency bands. Achieving interoperability

⁹ See id at ¶ 1.

¹⁰ See id at ¶ 19.

¹¹ See id at ¶ 18.

involves more than simply the ability of a radio to be tuned to a given frequency. Realizing unit to unit operational interoperability between subscribers on designated mutual aid channels requires the utilization of common modulation. Thus, to close the potential loophole that could be capitalized upon by manufacturers and result in decreased realization of unit to unit operational interoperability, the Commission should:

- 1) Mandate that all mobile and portable transmitters certified for operation in the 150-174 MHz, 450-470 MHz and 800 MHz NPSPAC channels be capable of tuning to operate on the designated mutual aid channels; and
- 2) Mandate that mobile and portable transmitter operations on the 800 MHz mutual aid channels designated in §90.617(a)(1) of the rules, and that operations on the nationwide public safety interoperability calling channels in the 150-174 MHz and 450-470 MHz bands be FM modulation.

To harmonize the requirements for subscriber unit operation on designated mutual aid/interoperability channels in the VHF, UHF and 800 MHz NPSPAC and the 700 MHz public safety bands, and to minimize any potential negative financial impact to public safety licensees, Harris suggests the language for §§90.203(i) & (j)(1) proposed in the Notice of Proposed Rulemaking be changed to read as follows:

§ 90.203

(i) Mobile and portable transmitters certificated pursuant to applications for certification received on or after DATE and designed to transmit on public safety frequencies in the 800 MHz NPSPAC band must have the capability to be programmed for analog FM operation on the mutual aid channels as designated in §90.617(a)(1) of the rules.

(j) ***

(1) Applications for certification received on or after DATE, for mobile and portable transmitters designed to transmit on public safety frequencies in the 150–174 MHz band will be granted only if the mobile/portable equipment is capable of operating in the analog FM mode on the nationwide public safety interoperability calling channel in the 150–174 MHz band. (See §90.20(c),(d) of this part.) Applications for certification received on or after DATE, for mobile and portable transmitters designed to transmit on public safety frequencies in the 450–470 MHz band will be granted only if the mobile/portable equipment is capable of operating in the analog FM mode on the nationwide public safety interoperability calling channel in the 450–470 MHz band. (See §90.20(c),(d) of this part.)

The modest revision to Subpart (i) above to the Commission’s proposed rule changes will ensure that the goals of the Commission are met to ensure increased interoperability among subscriber units, harmonize the requirements in the VHF, UHF, 800 MHz NPSPAC and 700 MHz public safety bands for mobile and portable transmitters, and avoid unintended application of the rules to base stations.¹² Inadvertent application of the proposed rules to base stations may unnecessarily increase cost to public safety users of 800 MHz NPSPAC spectrum with no discernible unit to unit operational interoperability benefit. Moreover, existing base stations used by first responders in 800 MHz NPSPAC channels may not have any analog FM capability. Adopting the analog FM mandate as applicable to “equipment” in the 800 MHz NPSPAC band may negate the compliance of many previously certified and utilized 800 MHz NPSPAC base stations. Imposing the analog FM requirement on base stations in the 800 MHz NPSPAC band is not “in the public interest.”

¹² The Commission has issued related rules for digital operation in 700 MHz narrowband public safety spectrum. See 47 CFR § 547. While the Commission has issued other technical rules in this spectrum for other system equipment, such as base stations, it has limited applicability of its rules on operation on interoperability channels to mobile and portable transmitters. See, e.g., Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communications Requirements Through the Year 2010, WT Docket No. 96-86, First Report and Order and Third Notice of Proposed Rulemaking, 14 FCC Rcd 152 (1998).

IV. THE PROPOSED RULES WILL NOT IMPACT INVESTMENT.

Finally, the Commission seeks input on the potential impact of its proposed rules on investment in digital technology.¹³ Virtually all manufacturers currently provide FM modulation capability in subscriber units, regardless of whether the units apply the H Mask to digital operation in the 800 MHz NPSPAC channels and operate on the designated interoperability/mutual aid channels in VHF, UHF and 800 MHz or other channels in those bands. Thus, it is highly unlikely that the codification of a rule following industry practice will limit investment or otherwise slow innovation or market demand for these products. Moreover, any miniscule investment impact that may be claimed by those who plan to ignore the spirit and function of the current rules to employ a common modulation technology in existing subscriber units is far outweighed by the resulting interference protection and enhancement to interoperability.

¹³ See H Mask NPRM at ¶ 15.

