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

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

REPLY COMMENTS OF POWERTRUNK, INC.

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Summary

In their opening Comments, several parties have focused on compliance with Mask H as exclusively determining whether interference will occur or not. That is, they equate compliance with an absence of any possibility of interference.

However, the Commission has authorized numerous types of equipment for operation on NPSPAC channels which has been compliant only with Mask B. Despite this, there has been no evidence submitted that Mask B-certificated equipment has led to complaints of interference.

Compounding the problem is that the Commission proposes to change its existing Rules -- Rules which manufacturers have relied upon in developing new and improved technological solutions -- without any demonstration that there is a problem that needs to be fixed.

Furthermore the proposal to require all digital equipment to be Mask H-compliant impinges upon the long- established and very successful Commission reliance on the expertise of the NPSPAC Regional Planning Committees in coordinating spectrum within their respective territories.

Imposition of a freeze on the certification and licensing of digital equipment that is not compliant with Mask H, is an extreme and unnecessary measure unsupported by the record in this proceeding, or in the pleadings which preceded issuance of the instant Notice of Proposed Rulemaking.

The proposed rules on interoperability would disserve the needs and interests of users for flexible solutions in meeting interoperability requirements. For example, it would prevent users from communicating via their main channel at the same time as they seek to communicate on an interoperability channel.

As New Jersey Transit has pointed out, requiring multi-mode equipment would saddle users with a more expensive technology that does not meet their interoperability needs.

Accordingly, the Commission should lift the current freeze on certifications of digital equipment for use in the NPSPAC band, and maintain the existing rules allowing analog and digital equipment to be certificated under Mask H and Mask B, as applicable. If despite this, the Commission remains inclined to amend the current rules, the Commission should adopt the TIA standard and only authorize equipment that complies with that standard.

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PowerTrunk submits these Reply Comments in response to submissions by other parties in this proceeding.[1]

The NPRM proposes that digital technologies comply with emission mask H for operation in the 800 MHz NPSPAC band, and that analog FM capability be required for interoperability on the 800 MHz mutual aid channels. The record demonstrates that several commenters misunderstand existing Commission rules, mischaracterize the potential for interference on the 800 MHz NPSPAC frequencies under the existing rules, and/or fail to appreciate the detrimental effect to the public interest if the rules as proposed are adopted.

A. Background

Given the record thus far, PowerTrunk believes it may be useful to provide background information on the technology that was the subject matter of the Harris Corporation ("Harris") Petition,[2] which Petition led to the NPRM.

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[1] In the Matter of Emission Mask Requirements for Digital Technologies on 800 MHz NPSPAC Channels; Analog FM Capability on Mutual Aid and Interoperability Channels, PS Docket No. 13-209, RM-11663, Notice of Proposed Rulemaking, FCC 13-117 (rel. Aug. 27, 2013) (the "NPRM").

[2] In the Matter of Preventing Interference in Public Safety Frequencies By Requiring H Mask and Mutual Aid for Digital Technologies, PS Docket 11-69, Petition for Rulemaking (April 30, 2011) ("Harris Petition").

PowerTrunk is a U.S. corporation founded in 2009 under principles of respect for the laws and regulations of the United States. In reliance on those laws and regulations, PowerTrunk's parent company, Teltronic, S.A.U., a major global land mobile radio vendor, invested significant capital in developing TETRA-Interoperable D-LMR technology (TI D-LMR) which was initially named "Reduced Power TETRA", "TETRA 0.2" or "Low Power TETRA.[3] TI D-LMR was designed, implemented and presented for certification to FCC-approved laboratory authorities in 2009 and 2010 for the twin purpose of complying with Part 90 of the Commission's Rules and, at the same time, retaining full compliance with the TETRA + Critical Communications Association's ("TCCA") TETRA Interoperability Profile ("TIP") established procedures. Both goals were accomplished as indeed TI D-LMR, is a TIP-compliant and Part-90-compliant technology. Following type acceptance of the TI D-LMR technology, New Jersey Transit ("NJT"), the largest statewide transit agency in the U.S., awarded Alcatel-Lucent USA, Inc. with PowerTrunk TI D-LMR technology, the first TETRA contract in the United States.

Such accomplishment, in connection with the TCCA's efforts to have the fully standard version of TETRA accepted in the United States, has given American end-users an opportunity to enjoy the benefits of a technology that has won an overwhelmingly dominant position in the rest of the world, but that has not been available in North America for over a decade. On its way to this achievement, PowerTrunk overcame the same issues which Harris is now presenting in regards to the 800 MHz NPSPAC spectrum. Harris argued in 2012 that TI D-LMR's type acceptance certificates were invalid on the grounds that the then-existing rules did not allow certification of TETRA technology; that PowerTrunk's technology was TETRA because the

[3] "Low Power TETRA" is the pejorative characterization used routinely by Harris in its filings with the Commission.

technology's name included the word "TETRA"; and that digital equipment cannot implement audio low-pass filters and thus could not be certificated under Mask B.

However, PowerTrunk provided evidence that the exact issue regarding Mask B was understood and previously resolved by the Commission's staff. In a July 28, 2010 e-mail, in response to PowerTrunk's parent company's July 14, 2010 letter request, the Commission confirmed PowerTrunk's digital equipment could be certificated using Mask B: "We have confirmed with the Wireless Bureau. Yes, you can apply the Mask B to this device with an audio low-pass filter."[4] The issuance of the certificate for PowerTrunk's TI D-LMR equipment is evidence of PowerTrunk's responsibility and good faith in seeking to fully comply with the Commission's rules.[5]

B. Emission Masks

1. Emissions Mask B and Emission Mask H Were Designed for Analog and Digital Systems.

The Commission proposed emission masks in 1995 as a mechanism to limit power as a function of frequency, and thereby minimize adjacent channel interference; that is, at the time that emission masks were proposed for 800 MHz, both analog and digital equipment were contemplated.[6] In analog voice transmissions, the human voice is the modulating frequency: As the amplitude of the voice signal varies, the carrier instantaneous frequency increases or

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[4] Emphasis added. PowerTrunk's parent company's July 14, 2010 correspondence and the entire E-mail thread between Teltronic S.A.U. and Joe Dichoso, FCC's Equipment Authorization Branch Chief, is attached as Exhibit A.

[5] Harris was fully involved in the Rulemaking requested by the TCCA in August 2009. Harris did not raise its argument regarding Mask B and "digital" technologies' alleged inability of implementing audio low-pass filters until March 2012 following NJT's award to PowerTrunk its RFP 11-018 through Alcatel-Lucent USA, Inc.

[6] In the Matter of Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services and Modify the Policies Governing Them and Examination of Exclusivity and Frequency Assignment Policies of the Private Land Mobile Radio Services, PR Docket No. 92-235, Report and Order and Further Notice of Proposed Rulemaking, FCC 95-255 (rel. June 23, 1995) at paras. 81-90.

decreases. As the NPRM identifies, the width of an analog FM waveform (voice) "is a direct function of the modulating frequency, i.e. the higher the modulating frequency, the wider the spectral waveform, and the greater the potential for adjacent channel interference."[7] Because of this, two masks were proposed to deal with minimizing potential adjacent channel interference in 800 MHz NPSPAC frequencies, one for equipment with a low pass filter, one for equipment without a low pass filter. For systems with an audio low pass filter, Mask B was applicable (i.e. the same mask which is applicable to 25 KHz-wide channels). As noted by the Commission in the NPRM, "The audio low-pass filter in a land mobile FM transmitter limits the modulating frequency typically to 3 kilohertz, thus ensuring that the output waveform conforms to the relevant emission mask."[8] The low pass filter limits the modulating frequency and hence limits the width of the emission to prevent adjacent channel interference.

For systems that do not use a low pass filter, and which are therefore capable of transmitting higher baseband frequencies, a more restrictive Mask H was used to account for fluctuations that may cause an increase in the width of the emission, thereby increasing the chance of adjacent channel interference. Because equipment that did not use an audio low-pass filter could indeed trespass the boundaries of Mask B in field operational conditions (as treble sounds are not cut off from the baseband signal captured by the microphone), the more stringent Mask H is required. Compliance with Mask H prevents any modulating frequency in operational conditions from creating an output waveform that exceeds the authorized occupied bandwidth as the peak frequency deviation will not exceed certain thresholds. Otherwise, the two main spectral components at each side of the carrier frequency could indeed be located farther

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[7] NPRM at ¶10.

[8] *Ibid (emphasis added).*

than, respectively, the lower and upper frequencies which define the boundaries of a given NPSPAC channel. Thus, Mask H defines a mandatory attenuation pattern that must be complied with by any FM spectral component that may cause the equipment's radiating on the adjacent channels over the TIA interference-free threshold.

On the other hand, nothing in the rules limits the use of Mask B to analog technologies or Mask H to digital technologies. In fact the NPRM acknowledges that with digital systems such as TETRA (TI D-LMR in this case), "… the width of the emission waveform remains constant and independent of the voice baseband modulating frequency."[9] In other words, the TI D-LMR waveform exhibits the same characteristics that are achieved via an audio low pass filter with analog equipment, i.e. maintaining a constant width waveform independent of the modulating frequency. Hence, the purpose of the audio low-pass filter (to ensure that the output waveform conforms to Mask B) is equally satisfied by TI D-LMR's output waveform which "remains constant" and "conforms to the relevant emission mask."[10] This justifies the use of Mask B for equipment, like PowerTrunk's TI D-LMR, whose output waveform remains constant regardless of how high the voice baseband modulating frequency might be. This digital equipment includes circuitry that is functionally an audio low-pass filter, otherwise through application of Carson's Rule,[11] the equipment's radiated spectrum would exceed the boundaries of the emission mask and/or the authorized occupied bandwidth.

Notwithstanding this technical justification, the TI D-LMR equipment was found literally compliant by the Commission's staff as referred to above. Throughout the correspondence

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[9] *Id. (*emphasis added).

[10] *Ibid.*

[11] The Carson's Rule establishes that BW = 2(D + Fm) where BW is the occupied bandwidth, D is the peak frequency deviation, and Fm is the cutoff frequency of the audio low-pass filter.

between PowerTrunk's parent company and the FCC Equipment Authorization Branch Chief, TI D-LMR's compliance with Rule 2.1047[12] of the Commission's rules was scrutinized and finally approved on the basis that the equipment features an analog audio low-pass filter which is implemented in its ST Microelectronics STw5093 integrated circuit. In other words, TI D-LMR features a functional audio low-pass filter as per the Commission's definition and, in turn, it has an analog audio low-pass filter for the purpose of cutting off the baseband modulating frequency. For these reasons the TI D-LMR equipment is eligible for Mask B certification in the NPSPAC band and also in other portions of the spectrum that require Mask B compliance.[13] Hence, the FCC previous decision to certify TI D-LMR in July 2010 using Mask B is proper.

In view of the above discussion of emission masks, it is baseless for commenters to suggest that emission Mask B was only intended for analog technologies, and Emission Mask H was only intended for digital technologies. [14] Both masks were intended for analog and digital technologies, and arguments to the contrary are without factual support.[15]

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[12] Rule 2.1047(a) refers to the audio low-pass filter.

[13] In its July 27, 2010 e-mail, Joe Dichoso referred to 20 KHz of bandwidth as the valid reference ("Please provide an occupied bandwidth plot showing compliance with the 20 KHz bandwidth requirement in the table of 90.209").

[14] See Comments of Harris Corporation, PS Docket 13-209, RM-11663, p.4 (Nov. 14, 2013) ("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."); Comments of APCO, PS Docket 13-209, RM-11663, p.2 (Nov. 14, 2013)(referencing "Mask B for analog systems and Mask H for digital systems."); Comments of Motorola Solutions, Inc., PS Docket 13-209, RM-11663, p. 3 (Nov. 14, 2013)("As the Commission correctly points out in the Notice, Emission Mask B comes from an earlier era and was based on assumptions regarding voice operations over analog FM transmitters."); Comments of the Telecommunications Industry Association, PS Docket 13-209, RM-11663, p.4 (Nov. 14, 2013)(The record supports the FCC's tentative conclusion that "manufacturers of digital equipment shouldn't continue to be able to take advantage of an emission mask rule intended to apply only to analog FM systems.")

[15] Harris, has gone so far to proclaim that "the Commission has indicated, audio low pass filters are not applicable to digital modulations." Harris Comments at p. 3. However, the NPRM does not say this. Rather, the NPRM states that "the presence -- or absence -- of an audio low-pass filter in such digital equipment appears to meaningless in terms of the width of the output waveform" (NPRM at para. 10); and the Commission recognizes

PowerTrunk's TI D-LMR equipment implements an analog audio-low pass filter and, in addition, a functional audio low-pass filter that conforms its radiated spectrum to not exceed the boundaries of the applicable emission mask, which is Mask B. Being literally and functionally compliant with the Commission's rules, its certification should be beyond question as confirmed by the Commission's staff in July 2010.

Equipment without an audio low-pass filter could exceed the boundaries of Mask B and/or the authorized occupied bandwidth. For example, a 15 kHz audio frequency (i.e. the typical cutoff frequency used in commercial FM broadcasting transmitters) requires 36 kHz of bandwidth (as per the aforementioned Carson's Rule) for a peak frequency deviation of 3 kHz or, for example, 44 kHz of bandwidth for a peak frequency deviation of 7 kHz. For this reason, Mask H is imposed on such equipment as otherwise the FM main spectral components might be located as far as 15 kHz from the carrier frequency and in turn their amplitude would not be limited. However, as explained above, TI D-LMR could never exceed the boundaries of Mask B nor the authorized occupied bandwidth of 20 kHz.

Thus, there is no factual basis for amending the current rules to require all digital equipment to comply with Mask H in NPSPAC. If, despite this, the Commission should nevertheless remain inclined to amend its rules, it should consider requiring <u>all</u> digital and analog equipment to comply with the established TIA interference-free threshold.

Several commenters mischaracterize the Commission's practice of certifying digital equipment with Mask B. Harris states that the proposed rule changes "will codify practice that has been followed with fail until recently."[16] Motorola states that "Although not explicitly

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that in digital systems such as TETRA, "the width of the emission waveform remains constant and independent of the voice baseband modulating frequency." *Id.*

[16] Harris Comments at p. 6.

required by the Commission's rules, under Section 90.201, it became the standard practice that B Mask applied to analog devices and the more stringent Mask H applied to data devices that did no employ a low-pass filter."[17] In fact, the Commission's practice of certifying digital equipment using Mask B refutes Harris' position. The attached Exhibit B identifies examples of land mobile transmitters, analog, digital and hybrid, certified for the 800 MHz band, including NPSPAC spectrum, under Mask B. This Exhibit demonstrates that the Commission has authorized numerous types of equipment for operation on NPSPAC channels which has been compliant only with Mask B, and highlights that there has been no evidence submitted that Mask B-certificated equipment has led to complaints of interference. Lacking such evidence, the Commission's freeze on certifications for such equipment is unjustified in view of the unsupported "interference" claims of Harris. Compounding the problem is that the Commission proposes to change its existing Rules -- Rules which manufacturers have relied upon in developing new and improved technological solutions -- without any demonstration that there is a problem that needs to be fixed.

2. Compliance with Emission Masks Does Not Prevent Adjacent Channel Interference In The NPSPAC Band.

The Commission has long recognized that the RPCs play a vital role that provides "optimal flexibility to meet state and local needs, encourage innovative use of the spectrum, and accommodate new and unanticipated developments in technology and equipment."[18] However, most of the commenters seek to prevent the RPCs from performing this vital role by changing the existing rules to prevent the introduction of new technologies in favor of the incumbent

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[17] Motorola Comments at pp. 3-4.

[18] The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010, First Report and Order and Third Notice of Proposed Rulemaking, WT docket No. 96-86, 14 FCC Rcd 152 (1998).

technology. For example, TIA identifies its "concern over the prospect that alternative technologies be permitted to interfere with incumbent uses, as well as coordination and interoperability issues related to incumbent uses."[19] Likewise, APCO stresses that "[t]he NPSPAC band has been available to public safety users for more than two decades and has extensive incumbent use."[20]

TIA states that its Engineering Committee TR-8 formulated standards for Project 25, and weighs in that it supports amending the rules to require digital technology to meet the more stringent Mask H emission requirements due to the "obvious and inevitable interference" of equipment certified with Mask B in public safety frequencies. However, TIA fails to mention that the same Engineering Committee TR-8 developed the TSB-88.1 standard titled "Wireless Communications Systems Performance In Noise And Interference-Limited Situations Part 1: Recommended Methods For Technology Independent Performance Modeling." TSB-88.1 sets the standard for the adjacent channel power ratio ("ACPR") in order to avoid potential interference, namely TIA-102.CAAB and TIA-603. For a 12.5 kHz offset in 800 MHz, the former requires ACPR > 67 dB with 6 kHz of bandwidth, and the latter requires ACPR > 50 dB with 8.5 kHz of bandwidth.

TIA's support for the application of Mask H to digital equipment is inconsistent with its own standard. For example, 4-slot OpenSky, which was certified using Mask H, features ACPR = 42 dB under TIA-102.CAAB,[21] and its ACPR = 35.2 dB under TIA-603. Functionally, this means that 4-slot OpenSky radiates 316 times more RF power on the adjacent channels than the

[19] TIA Comments at p. 4.

[20] APCO Comments at 2

[21] Harris mistakenly claims in its Comments that its ACPR equals 46 dB.

interference-free threshold under TIA-102.CAAB and 30 times more under TIA-603. No sensible engineer, let alone an FCC-approved lab, would question that 4-slot OpenSky presents a substantial threat that it will "interfere" with the adjacent channels in the NPSPAC spectrum. However, no such engineer can dispute that it is the frequency coordination of the RPCs -- not compliance with Mask H -- which allows digital systems such as 4-slot OpenSky to operate without causing adjacent channel interference. [22]

It has been PowerTrunk's experience that the RPCs are up to the task of accommodating new and unanticipated developments in technology and equipment, including equipment certified using Mask B for NPSPAC frequencies such as TI D-LMR.[23] PowerTrunk agrees with NJT that the RPCs have the necessary tools to coordinate frequencies in the NPSPAC band and that any extra burden will be imposed, not on the RPCs, but on the applicant who may have to adhere to stricter spacing requirements, lower power, directional antenna patterns, etc. according to the specific characteristics of each type of terrain.

In other words, the proposal to require all digital equipment to be Mask H-compliant impinges upon the long-established and very successful Commission reliance on the expertise of the NPSPAC Regional Planning Committees in coordinating spectrum within their respective territories.

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[22] To fully appreciate that Commission Rules allow "interference" in the NPSPAC band, the Commission's rules for the 700 MHz band are instructive. TIA's ACPR standards are imposed by the Commission on the narrowband portion of the 700 MHz which is 6.25 kHz-spaced native but that allows aggregating two or four 6.25 kHz-wide frequencies to form 12.5 kHz or 25 kHz channels. Harris has also 2-slot OpenSky which is compliant with TIA standards on 12.5 kHz-wide frequencies. The 2-slot OpenSky complies with the TIA standards on aggregated 12.5 kHz channels. The question is why Harris uses 2-slot OpenSky in 700 MHz and 4-slot OpenSky in 800 MHz NPSPAC. The answer is that "interference" is allowed on NPSPAC frequencies but not in the narrowband 700 MHz spectrum. The fact that TIA comments do not address the standard it has developed to avoid adjacent channel interference, is puzzling.

[23] PowerTrunk was invited to present its TI D-LMR technology to RPCs #28 and #8, respectively, on July 11, 2012 and August 28, 2012 as Harris raised complaints before both in the context of its protest against NJT's award.

C. Harris' Evaluation of Spectral Efficiency Does Not Take Into Account Real World Considerations

In its comments, Harris presents a mathematical analysis in support of its argument that its OpenSky technology is more spectrally efficient than PowerTrunk's TI D-LMR technology. [24] The analysis appears to show that TI D-LMR consumes three 12.5 kHz channels (thus using 37.5 kHz of bandwidth) and that 4-slot OpenSky consumes less spectrum because its bandwidth is less than TI D-LMR's on a given NPSPAC frequency. However, Harris' analysis fails to take into account the exclusion zone associated with a given deployment of the technology. An exclusion zone is defined as the geographical area where a given system's radiation on the adjacent channels exceeds the TIA interference-free threshold (i.e. "interference" exists unless a technology's exclusion zone's size is zero). When the exclusion zone is considered, both technologies equally consume three 12.5 kHz channels. Therefore, within the exclusion zone, TI D-LMR and 4-slot OpenSky consume the same amount of spectrum as the channels cannot be fractioned in units smaller than 12.5 kHz. The consequence is that, inside 4-slot OpenSky's exclusion zone, TI D-LMR's vs. 4-slot OpenSky's spectral efficiency ratio is indeed 36 Kbit/s divided by 19.2 Kbits/s = 1.875.

Any discussion of spectral efficiency, in this context, is meaningless unless the ratio between the sizes of TI D-LMR's and 4-slot OpenSky's exclusion zones is considered. And that ratio is dependent upon real life deployment considerations such as the type of terrain (flat, hilly, forested, desert, …), type of antennas (omni, directional, …), height of the towers, RF power, etc. For example, 4-slot OpenSky's exclusion zone might be smaller than TI D-LMR's in flat areas but it could be the same in valleys or flat terrain framed by mountains. In turn, a TI D-

[24] Harris Comments at pages 8-9.

LMR system's exclusion zone could be smaller than a 4-slot OpenSky's if the former used directional antennas and the latter used omni-directional antennas. Exhibit C illustrates the effects of the exclusion zones. These considerations counsel against the Commission amending its rules to encroach on the RPCs' responsibility and ability to approve or reject specific network designs on a case-by-case basis taking into account the spectral efficiency for a given deployment.

D. The Proposed Rule Would Preclude Use of a Wide Variety of Currently-Approved Equipment for the NPSPAC Band.

As demonstrated above, if the Commission truly intends to eliminate any risk of interference in the NPSPAC spectrum, both TI D-LMR and 4-slot OpenSky (among other technologies as outlined below) should be prohibited in the NPSPAC spectrum as neither complies with the applicable TIA interference-free threshold. In addition, since their respective exclusion zones are not necessarily dissimilar but rather their size is very much dependent on each type of terrain and specific network design, it is impractical to establish an absolute rule that does not take the size of exclusion zones into account. However, the size of exclusion zones can only be accounted for once the proposed deployment of the equipment is fully considered. Therefore, the consideration of exclusion zones is best left to the RPCs who have the necessary information to determine how spectral efficient a given equipment is when actual deployment is considered.

. These reasons counsel against a rule change as the only possible change would be to amend Section 90.210 of the Commission's rules to impose TIA's interference protection standards as the Commission has done for other 12.5 KHz-spaced portions of the spectrum such as, for example, the 700 MHz band. Should Section 90.210 be amended this way, the following technologies would be excluded from NPSPAC use: TI D-LMR (20K0), 4-slot OpenSky (12K1),

Analog FM 20 kHz (14K0), Analog FM 25 kHz (16K0) and Securenet (20K0) as none complies with ACPR>50 dB under TIA-603 for a 12.5 kHz offset and 8.5 kHz of bandwidth. Among them, however, TI D-LMR stands out for being the most efficient in terms of data throughput (as well as speech quality) versus actually occupied bandwidth. In other words, Mask H is not effective to prevent interference and may result in excluding equipment that is more spectrally efficient for a given deployment.

E. Industry Practice and De Facto Standards Do Not Trump the Commission's Rules.

New digital technologies, like TETRA and PowerTrunk's TI D-LMR, offer spectral efficiency at a fraction of the cost of the equipment currently used in the U.S. Commenters seem to suggest that "industry practice" has resulted in the development of *de facto* unwritten rules that require a change in the Commission's existing rules to prevent the introduction of these new technologies.[25] PowerTrunk submits that it should be other way around, i.e. industry must comply with the Commission's Rules. Manufacturers and marketers of new technologies can only comply with the laws and regulations in force, and investors in new technology need assurance that their efforts will not be forestalled by "industry practice." This is particularly true here, where the "industry practice" is limited to the United States. TETRA technology is the most widely used equipment for public safety in the world -- outside of the United States. Although Harris asserts that implementation of the proposed rules will not limit investment or slow innovation, Harris ignores that the implementation of the proposed rules will maintain the inflated costs paid by U.S. public safety officials in not having access to spectrally efficient technology currently in use throughout the rest of the world.

[25] E.g., Harris Comments at page 13; Motorola at page 1.

F. The Proposed Rules On Interoperability Do Not Reflect Real World Considerations.

PowerTrunk concurs with the Commenters regarding the importance of interoperability. In fact, PowerTrunk has demonstrated its commitment to the applicable interoperability rules through its certification of its multi-mode equipment four months before the NPRM was issued. . Notwithstanding its certification, PowerTrunk supports NJT's view that certain end-users may not require multi-mode subscriber units in practice because they implement interoperability through alternative means. In addition, Section 90.203(i) only requires mutual aid interoperability for equipment marketed for public safety operation. Thus, amending the rules to require FM analog does not reflect real world considerations. In its Comments, NJT explained how it complies with national interoperability and local interoperability simultaneously using more than one radio. Multi-mode radios are not capable of providing simultaneous operations in more than one mode, and thus multi-mode units cannot satisfy the interoperability requirements of users like NJT. Adopting the proposed rules will invariably force manufacturers to add functionality that is neither necessary nor cost- effective for public safety users.

In summary, the proposed rules on interoperability would disserve the needs and interests of users for flexible solutions in meeting interoperability requirements.

G. The Freeze is Inequitable and Contrary to the Public Interest.

In view of the number of types of equipment affected (Exhibit B illustrates just a sample), the freeze represents a fundamental change in the Commission's policy and favors analog equipment in the NPSPAC band over digital equipment. If analog equipment certified under Mask B and exceeding the emission limits of Mask H, is permitted to operate on the NPSPAC band, then digital equipment certified under Mask B should be given the same consideration and

allowed to operate on the NPSPAC band as well. Attached as Exhibit D are two charts for the Kenwood TK980 analog equipment having emission designators 14K0F3E nor 20K0F1D, respectively. On each chart, Mask H has been superimposed. Although the equipment has been certificated for use on the NPSPAC band using Mask B, it is clear that the equipment does not meet the limits of Mask H. Equity demands that if analog equipment certificated under Mask B is available for use in the NPSPAC band, then digital equipment certificated under Mask B should likewise be available for use in the NPSPAC band. In the alternative, all equipment certificated under Mask B, whether analog or digital, should be subject to the freeze regarding the NPSPAC band.

In this case, the imposition of a freeze on the certification and licensing of digital equipment that is not compliant with Mask H, is an extreme and unnecessary measure unsupported by the record in this proceeding, or in the pleadings which preceded issuance of the instant Notice of Proposed Rulemaking.

H. CONCLUSION

For the reasons discussed above, the Commission should lift the current freeze on certifications of digital equipment for use in the NPSPAC band, maintain the existing rules allowing analog and digital equipment to be certificated under Mask H and Mask B, as applicable, and not impose an FM modulation requirement to its interoperability rules. In the

alternative, if the Commission is inclined to amend the current rules to prevent any chance of interference in the NPSPAC band, the Commission should adopt the TIA standard and only authorize equipment that complies with that standard.

Respectfully submitted,

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November 29, 2013

Declaration

I, Jose Martin, hereby declare as follows:

I am Chief Executive Officer, PowerTrunk, Inc. Among my prior positions, I was a senior engineer, head of trunked radio systems, and director of research and development for a land mobile radio equipment manufacturer for a period of eight years. I hold a Master's Degree in Telecommunications Engineering. I am qualified to address the technical subjects covered in the Reply Comments being filed on behalf of PowerTrunk in PS Docket No. 13-209.

I have read and am familiar with the Reply Comments including, in particular, the technical points made therein. These Reply Comments are true and correct to the best of my knowledge and belief.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 29th day of November, 2013.

Jose Martin

JOSE M. MARTIN CURRICULUM VITAE

- Master's Degree in Telecommunications Engineering (Madrid Technical University, 1987) with honors for contributions to airborne real-time software (ARINC-429-based platforms) in the European Space Agency (ESA) programme PRODAT.
- Expert in MODULA-2, Pascal and C programming languages, and system specifications in LOTOS (Language Of Temporal Ordering Specifications).
- In 1987 joined ENSA (nowadays part of INDRA).
    - Fellow of the NATO programme MIDS (Multifunctional Information Distribution System) in Bloomfield, NJ (1988). He carried out technical works in connection with electronic counter-counter measures (ECCM) radio technologies.
    - Engineered HF radio platforms to implement ECCM techniques in 1989-90.
    - As Head of the Trunked Radio Systems Department (1991-93, he acted as the principal engineer and team leader to develop ENSA's trunked mobile radio technology under the MPT-1327 industry standard.
    - As CTO of ENSA (1994-95) he led the development of early digital implementations of land mobile radio equipment under the TETRA standard and participated in the ETSI technical subcommittee in charge of its development.
- Appointed technical director of TELETRUNK (a Spanish SMR operator). Led the commissioning, testing and final acceptance of various MPT-1327 trunked radio systems with GEC-Marconi technology.
- In 1999 joined Teltronic S.A.U. as CMO.
    - Member of the Board of the Spanish Association of Electronic Industries, ASIMELEC (2002-04).
    - Vice Chairman of the TETRA Rail Forum (TETRA + Critical Communications Association, TCCA) in 2010-2012.
    - Led the technical definitions and negotiations with the Kazakhstan Railways and Bombardier Transportation that led to the first implementation of ETCS high-speed rail signaling over TETRA.
- Appointed COO of PowerTrunk in 2009 and CEO in 2013.

EXHIBIT A

From: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov]
Sent: Wednesday, July 28, 2010 12:39 PM
To: Jose Roman
Cc: Tim Maguire; Laura Martinez; Alfredo Calderon; Joe Dichoso
Subject: RE: INQUIRY NUMBER 955470

Hello Jose,
We have confirmed with the Wireless Bureau. Yes, you can apply the Mask B to this device with an audio low pass filter.
Regards,
Joe

From: Jose Roman [mailto:j-roman@teltronic.es]
Sent: Wednesday, July 28, 2010 10:32 AM
To: Joe Dichoso
Cc: Tim Maguire; 'Laura Martinez'; 'Alfredo Calderon'
Subject: RE: INQUIRY NUMBER 955470

Dear Joe,

I enclose the required plots.

Could you say me if you need any additional documentation?

I await your answer.

Best regards

Jose Roman

-----Mensaje original-----
De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov]
Enviado el: martes, 27 de julio de 2010 21:51
Para: Jose Roman
CC: Tim Maguire; Laura Martinez; Alfredo Calderon; Joe Dichoso
Asunto: RE: INQUIRY NUMBER 955470

Hello Jose,
Please provide an occupied bandwidth plot showing compliance with the 20 kHz bandwidth requirement in the table of 90.209.
Thanks

-----Original Message-----
From: Jose Roman [mailto:j-roman@teltronic.es]

Sent: Tuesday, July 27, 2010 11:51 AM
To: Joe Dichoso
Cc: Tim Maguire; 'Laura Martinez'; 'Alfredo Calderon'
Subject: RE: INQUIRY NUMBER 955470
Importance: High

Dear Joe,

We would like to know if the information provided yesterday related to the audio low pass filter is enough to justify the application of Mask B to our equipment (HTT-500).

Could you give us an answer today?

I am sorry, but we don't know what else to do for clarifying this misunderstanding. We think we have provided all the required information to solve this formal process and to apply for the FCC Grant.

Best regards.

Jose Roman.

-----Mensaje original-----
De: Jose Roman [mailto:j-roman@teltronic.es]
Enviado el: lunes, 26 de julio de 2010 21:21
Para: 'Joe Dichoso'
CC: 'Tim Maguire'; 'Laura Martinez'; 'Alfredo Calderon'
Asunto: RE: INQUIRY NUMBER 955470

Dear Joe,

Yes, we can measure the frequency response of the audio low pass filter. The attached plot is the real response measured by our engineers.

If you need we could explain to you how we can measure it.

Best regards
Jose Roman

-----Mensaje original-----
De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov] Enviado el: lunes, 26 de julio de 2010 20:29
Para: José Román
CC: Tim Maguire; Laura Martinez
Asunto: RE: INQUIRY NUMBER 955470

So you are able to measure the audio low pass filter by itself within the IC and the data is attached?

-----Original Message-----
From: José Román [mailto:j-roman@teltronic.es]
Sent: Friday, July 23, 2010 11:50 AM
To: Joe Dichoso
Cc: Tim Maguire; 'Laura Martinez'
Subject: RE: INQUIRY NUMBER 955470

Dear Joe,

Let me to explain you.

In our first letter to FCC ("Letter_to_TIMCOFCC_100604ed0500") we explained that the audio low pass filter is wholly contained in the audio processing IC (STMicroelectronics STw5093). As the filter is contained within the IC, from the outside of the HTT-500 cannot get the frequency response of this filter alone. It is that we tried to explain in this letter.

For this reason, we included in this first letter the frequency response of this filter included in the datasheet of the Integrated Circuit (table in page 2 of the letter). This response is supplied directly by the manufacturer of this IC. We thought that this information was sufficient to show that the equipment had a low pass filter and to show the frequency response of this filter.

In your response to TIMCO on 07/19/2010, you require us the plot of this low pass filter. For this reason, we have measured directly the frequency response of this filter, using our knowledge of our equipment. This plot was measured directly over the IC

Therefore the attached plot is the true frequency response of our filter.

I hope that this explanation will be sufficient for your understanding of the low pass filter.

Anyway, I can arrange a conference call with our engineers for solving all your doubts. I think it could be very interesting in order to clarify the problem. We will be available on next Monday at anytime.

If you have any doubt, don't hesitate to contact with me.

Thanks in advance.

Best regards

Jose Roman

-----Mensaje original-----
De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov] Enviado el: viernes, 23 de julio de 2010 15:05
Para: José Román
CC: Tim Maguire; Laura Martinez
Asunto: RE: INQUIRY NUMBER 955470

Hello Jose,

Please clarify. This was the response when the data was first asked for. It says that the audio low pass filter isn't available. We need the test data for the audio low pass filter. It appears that you are resubmitting some other low pass filter data.
Thanks,

Joe

---Reply from Customer on 07/09/2010---

Yes there is a pending petition for conentional TETRA radio but conventional TETRA using a standard industry 0.35 raised cosine filter factor does not meet the requirements and a TETRA using a RC filter with a 0.2 factor does. There are currently other certificated TETRA radios (see Sepura grantee code XX6). As to the technical question of the response of the audio low pass filter, the audio low pass filter is wholly contained in the audio processing IC and as such isn't available externally to measure and plot but tabulated data on the low pass filter is included in the technical brief is a chart (see chart labeled STW5093) from the IC manufacturer's data sheet.

-----Original Message-----
From: José Román [mailto:j-roman@teltronic.es]
Sent: Thu 7/22/2010 11:58 AM
To: Joe Dichoso
Cc: Tim Maguire; Laura Martinez
Subject: RE: INQUIRY NUMBER 955470

Dear Joe,

Yesterday we sent to TIMCO the audio low pass filter response, with a little explanation. Anyway, data of this low pass filter is contain in the letter that I sent you last week and in the test report.

I attach the response that I sent to TIMCO

Plot with measured frequency response for audio low pass filter is attached according to FCC requirement 2.1047(a). See "Frequency Response for Audio Low Pass Filter (STw5093 STMicrolectronic codec).pdf"

This filter is contained in the audio signal processing IC, which is STw5093 STMicroelectronic Codec.

Frequency range from 100Hz to 5KHz is shown in the plot as specified in 2.1047(a)

This issue has already been indicated as a table from manufacturer(STMicroelectronic) in both "Letter_to_TIMCO&FCC_100604ed0500" (page 2) and "226AUT10TestReport_Rev4" Section "Audio Low Pass Filter - VOICE MODULATED COMMUNICATION EQUIPMENT" (page 19).

I hope that this information will be sufficient for you. Please, if you need any additional information, don't hesitate to require me.

I would like to manage this inquiry directly with you, without any intermediary, in order to avoid misunderstanding.

I await your answer.

Best regards.

Jose Roman

De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov] Enviado el: jueves, 22 de julio de 2010 16:43
Para: José Román
CC: Tim Maguire
Asunto: RE: INQUIRY NUMBER 955470

Hello Jose,

It is up to you how you want to handle the inquiry. To clarify, it was proposed to use Mask B instead of Mask C. Mask B is for devices with an audio low pass filter. Section 2.1047 requires appropriate data for devices with and audio low pass filter. However, you said that it cannot be supplied. If this data cannot be supplied, a waiver is needed.

Thanks,
Joe

From: José Román [mailto:j-roman@teltronic.es]
Sent: Thursday, July 22, 2010 3:05 AM
To: Joe Dichoso
Subject: RE: INQUIRY NUMBER 955470
Importance: High

Dear Joe,

We apologize for the inconvenience caused, but I would like that you explain me the present situation.

When Teltronic receive the inquiry we tried to solve through TIMCO, but the inquiry remained without solution. For this reason, Teltronic contacted directly with you, in order to manage the problem directly with FCC.

I am worried because we don't understand the reasons why this problem still isn't solved.

Yesterday, I spoke with TIMCO, and TIMCO had received a notification for FCC that said:

"The data is required per 2.1047. If the data is not submitted, approval of a waiver is needed."

As you say in your previous e-mail, I understand that it is the response of FCC to TELTRONIC letter that I sent to you last week. Could you confirm me it?

In this case, If you will be so kind, I would like that you indicate me the appropriate way to solve this problem. Should we continue to manage through TIMCO? Or Can we manage directly with you?

Thanks in advance.

Best regards.

José Román Gimeno (j-roman@teltronic.es)

Certifications & Services Area Manager / Jefe Area de Certificaciones y

Servicios

R&D Dept./ Dpto. I+D

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De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov] Enviado el: miércoles, 21 de julio de 2010 17:26
Para: José Román
Asunto: RE: INQUIRY NUMBER 955470

You need to check with the person/test lab who submitted the inquiry.

From: José Román [mailto:j-roman@teltronic.es]
Sent: Wednesday, July 21, 2010 11:15 AM
To: Joe Dichoso
Subject: RE: INQUIRY NUMBER 955470

Dear Joe,

I have introduced the KDB inquiry number (955470) in the OET KDB, but there isn't any response.

Do I need to use another KDB inquiry number?

I am worried for this issue.

Thanks in advance.

Best regards.

José Román Gimeno (j-roman@teltronic.es)

Certifications & Services Area Manager / Jefe Area de Certificaciones y Servicios

R&D Dept./ Dpto. I+D

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De: Joe Dichoso [mailto:Joe.Dichoso@fcc.gov] Enviado el: lunes, 19 de julio de 2010 19:18
Para: José Román
CC: Rashmi Doshi; Alfredo Calderon; Diane Poole
Asunto: RE: INQUIRY NUMBER 955470

Jose,

We will be sending you a response via the KDB.

Thanks,

Joe

From: José Román [mailto:j-roman@teltronic.es]
Sent: Wednesday, July 14, 2010 2:55 PM
To: Joe Dichoso
Cc: Rashmi Doshi; 'Alfredo Calderon'
Subject: INQUIRY NUMBER 955470

Dear Mr. Dichoso

My name is Jose Roman, and I represent the company Teltronic S.A.U. in Spain and its US subsidiary, PowerTrunk Inc., for certification issues for our products.

I would like to clarify some issues respect to the KDB Inquiry nº 955470.

I attach a letter with our explanation and doubts about this inquiry (Please see the document "Letter to FCC_100714"). Also I include other annexed documents to facilitate your understanding of the letter.

We look forward to your soon response. Don't hesitate to contact with me if you have any doubt.

Sincerely

José Román Gimeno (j-roman@teltronic.es)

Certifications & Services Area Manager / Jefe Area de Certificaciones y Servicios

R&D Dept./ Dpto. I+D

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EXHIBIT B

CRITERIA FOR SEARCHING:
Equipment which were granted by FCC and fullfiled these requirements:

DIGITAL

Digital Modulation:	Allowed numbers in the emission designator (6th character):
With audio low pass filter:	Mask B
Date:	Both Grant and Test Report should be available:
FCC Rule Parts:	FCC Part 90

ANALOG

Emission Designators	16K0F3E, 14K0F3E, 11K0F3E
With audio low pass filter:	Mask B
Date:	Both Grant and Test Report should be available:
FCC Rule Parts:	FCC Part 90

Applicant Name:	Analog / Digital	Commercial Name	FCC Identifier:	Frequency Range:	Emission designator:	Date of Grant	Type	Comments
JVC KENWOOD Corporation	Digital / Analog (NEXEDGE)	NX-920G-K, NX-920-K	K44458300	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	6/18/2013	Mobile	
	Digital / Analog (NEXEDGE)	NXR-900-K	K44417100	851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	11/16/2010	Repeater	
	Digital / Analog (P25)	TK-5910-K	K44421000	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	12/4/2009	Mobile	
HARRIS CORPORATION	Digital / Analog (P25)	XG-25M	OWDTR-0076-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	5/14/2013	Mobile	
	Digital / Analog (P25)	XG-25P	OWDTR-0073-E	809.0 - 824.0 MHz 854.0 - 869.0 MHz	16K0F3E, 14K0F3E	10/26/2012	Portable	
	Digital / Analog (P25)	XG-75	OWDTR-0074-E	809.0 - 824.0 MHz 854.0 - 869.0 MHz	16K0F3E, 14K0F3E	1/12/2012	Portable	
	Digital / Analog (OpenSky / EDACS / P25)	P5300 / P5500	OWDTR-0066-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	9/8/2011	Portable	
	Digital / Analog (P25)	XG-100M	AQZ-XG-100M00	806.0 - 809.0 MHz 809.0 - 824.0 MHz 851.0 - 854.0 MHz 854.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	5/24/2011	Mobile	
	Digital / Analog (OpenSky / EDACS / P25)	M7300 / M5300	OWDTR-0060-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	9/30/2010	Mobile	
	Digital / Analog (P25)	XG-100P	AQZ-XG-100P00	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	2/5/2010	Portable	
	Digital / Analog (OpenSky / EDACS / P25)	P7300	OWDTR-0054-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	7/1/2009	Portable	
	Digital / Analog (OpenSky / EDACS / P25)	M7300 / M5300	OWDTR-0051-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	5/30/2008	Mobile	
	Digital / Analog (OpenSky / EDACS / P25)	P5400	OWDTR-0043-E	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	4/3/2008	Portable	
	Digital / Analog (OpenSky / EDACS / P25)	M7200	BV8M7200	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	10/4/2005	Mobile	
	Digital / Analog (OpenSky / EDACS / P25)	P7200	BV8P7200	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	9/20/2005	Portable	
	Digital (OpenSky)	P801T	BV8P801T	806.0 - 8240 MHz 851.0 - 869.0 MHz	12K5F1D, 13K5F1E	3/29/2004	Portable	

Hytera Communications Corporation Ltd.	Digital / Analog (DMR)	PD702G U5/ PD706G U5/ PD708G U5/ HD705G U5	YAMPD70XGU5H	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 11K0F3E	5/27/2013	Portable	
	Digital / Analog (DMR)	PD782G U5/ PD786G U5/ PD788G U5/ HD785G U5	YAMPD78XGU5H	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 11K0F3E	5/23/2013	Portable	
	Digital / Analog (DMR)	PD702G U5/ PD706G U5/ PD708G U5/ HD705G U5	YAMPD70XGU5	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 11K0F3E	5/23/2012	Portable	
Motorola Solutions, Inc.	Digital / Analog	MotoTRBO XPR™ 755 0/XPR™ 7580	ABZ99FT5014	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 11K0F3E	5/30/2013	Portable	
	Digital / Analog	GTR8000	ABZ89FC5810B	851.0 - 870.0 MHz 854.0 - 870.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	5/22/2013	Base Station	Permissive Change to add "H-Mask" for NPSPAC applications
	Digital / Analog	MTR300	ABZ89FC5819	851.0 - 870.0 MHz	16K0F3E, 11K0F3E	03/09/2010	Base Station	Permissive Change to add "H-Mask" for NPSPAC applications
	Digital / Analog	MTR3000	ABZ89FC5817	851.0 - 870.0 MHz	16K0F3E, 11K0F3E	8/27/2010	Base Station	Permissive Change to add "H-Mask" for NPSPAC applications
	Digital / Analog	XPR 8300 / XPR 8380	ABZ99FT6001	851.0 - 869.0 MHz	16K0F3E, 11K0F3E	4/23/2010	Repeater	
	Digital / Analog	XPR 8300 / XPR 8380	ABZ99FT5029	851.0 - 869.0 MHz	16K0F3E, 11K0F3E	1/8/2010	Repeater	
	Digital / Analog (ASTRO, P25)	APX 7500	AZ492FT7035	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 11K0F3E 20K0F1E	11/17/2009	Mobile	
	Analog	HT 1250	AZ489FT5836	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E	3/7/2007	Portable	
	Analog	AT S2500	AZ489FT5837	806.0 - 824.0 MHz 851.0 - 870.0 MHz	16K0F3E	11/7/2005	Portable	
	Analog (P25)	MTX8250	AZ489FT5836	806.0 - 824.0 MHz 851.0 - 870.0 MHz	16K0F3E	4/26/2007	Portable	
	Digital / Analog (ASTRO, P25)	APX 7500 / APX 05	AZ492FT7048	851.0 -869.0 MHz	20K0F1E, 8K10F1E, 8K10F1D, 11K0F3E, 16K0F3E	12/7/2011	Mobile	
	Digital / Analog (ASTRO, P25)	PDR 3500	AZ492FT5809	851.0 -870.0 MHz	20K0F1E, 8K10F1E, 8K10F1D, 16kK0F3E	3/25/2002	Repeater	
	Digital / Analog (ASTRO, P25)	XLT5000	AZ492FT5823	764.0 - 870.0 MHz	20K0F1E, 8K10F1E, 8K10F1D, 11K0F3E, 16K0F3E	9/5/2003	Mobile	
Kenwood USA Corporation	Digital / Analog (P25)	TK-5410D-K2, TK-5410D-K3	ALH468800	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	10/23/2013	Portable	
	Digital / Analog (P25)	TK-5410 - K2, TK-5410 - K3	ALH420700	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	12/13/2009	Portable	
E. F. Johnson Company	Digital / Analog (P25)	VP900	ATH2425780	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	7/24/2013	Portable	
	Digital / Analog (ASTRO, P25)	VP600	ATH2425770	806.0 - 824.0 MHz 851.0 - 869.0 MHz	16K0F3E, 14K0F3E	2/10/2012	Portable	
	Digital / Analog (P25)	5300	ATH2425371	806.0 - 869.0 MHz	16K0F3E, 14K0F3E, 11K0F3E	3/4/2005	Mobile	
	Digital / Analog (P25)	5100 ES	ATH2425180	806.0125 - 868.9875 MHz	8K10F1E, 16K0F3E, 14K0F3E	5/9/2002	Portable	
Tait Limited	Analog	TP8100	CASTPCK6A	806.0 - 824.0 MHz 809.0 - 824.0 MHz 851.0 - 870.0 MHz 854.0 - 870.0 MHz	16K0F3E, 11K0F3E	06/03/2009	Portable	

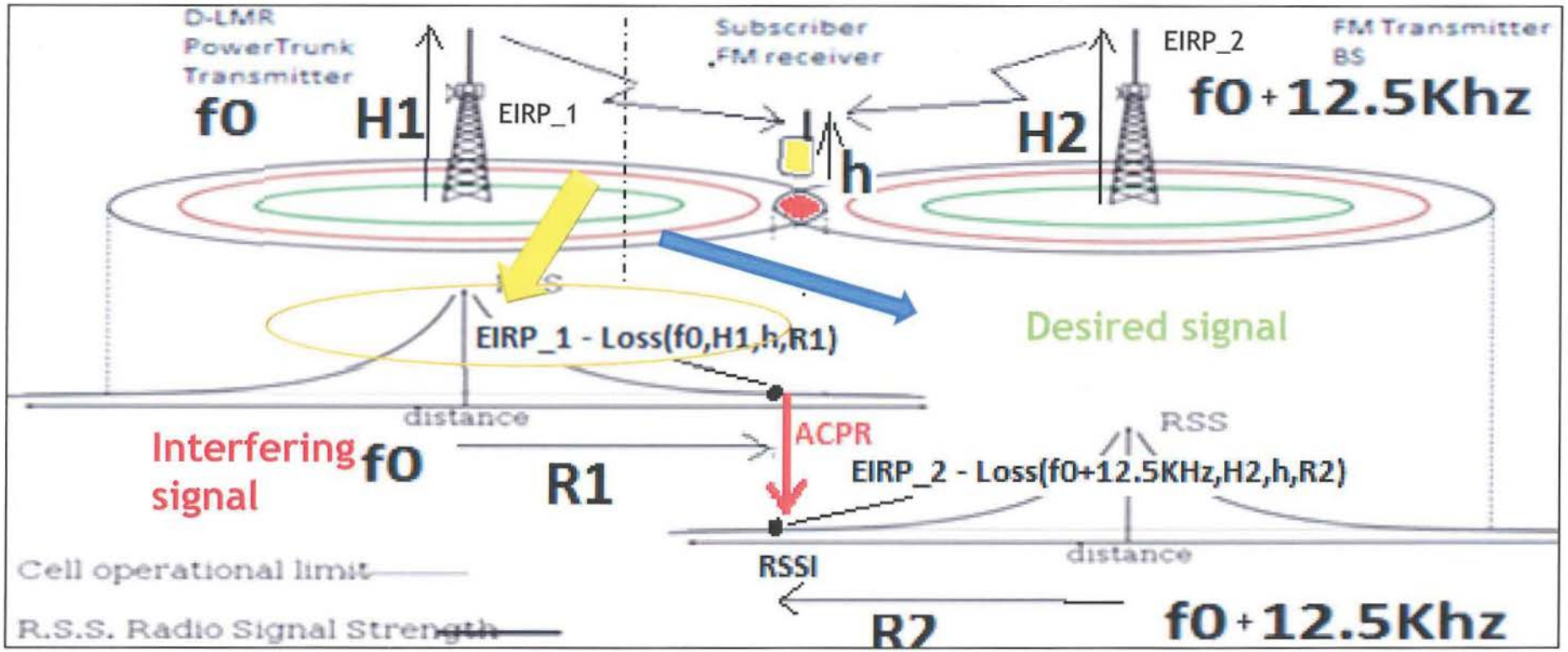
	Digital / Analog (P25)	TM9100	CASTMAK5F	806.0 - 870.0 MHz	16K0F3E, 11K0F3E	4/17/2007	Mobile	
	Analog	TM8200	CASTMAK5D	806.0 - 869.0 MHz	16K0F3E, 11K0F3E	15/03/2007	Mobile	
	Analog	TM8100	CASTMAK5B	806.0 - 869.0 MHz	16K0F3E, 11K0F3E	2/19/2007	Mobile	
	Digital	DRT9955B	XLM1201B	851-869 MHz	17K7D7W	4/8/2011	Amplifier	
Digital Receiver Technology, Inc.	Digital	DRT1201B	XLM9955B1	851-869 MHz	17K7D7W	4/8/2011	Base Station	
T L Parker Ltd	Digital / Analog (ASTRO / P25)	RDX Series (ASTRO XTS3000)	QKGRDX-U3	806-870 MHz	8K10F1E, 16K0F3E, 11K0	2/12/2003	Mobile	
CynTrust Communications	Digital	CDVSL411SAV00	PCKCDVSL411SAV001	806.0 - 824.0 MHz 851.0 - 869.0 MHz	18K9D7W	3/19/2001	Mobile	
Digital Receiver Technology	Digital	DRT9955B	XLM9955B1	851.0 - 869.0 MHz	17K7D7W	4/8/2011	Amplifier	

Analog emission designator with B mask in NPSPAC band
Digital emission designator with B mask
Analog and Digital emissions designators with B mask

EXHIBIT C

NPSPAC - Interference & Frequency Coordination (III)

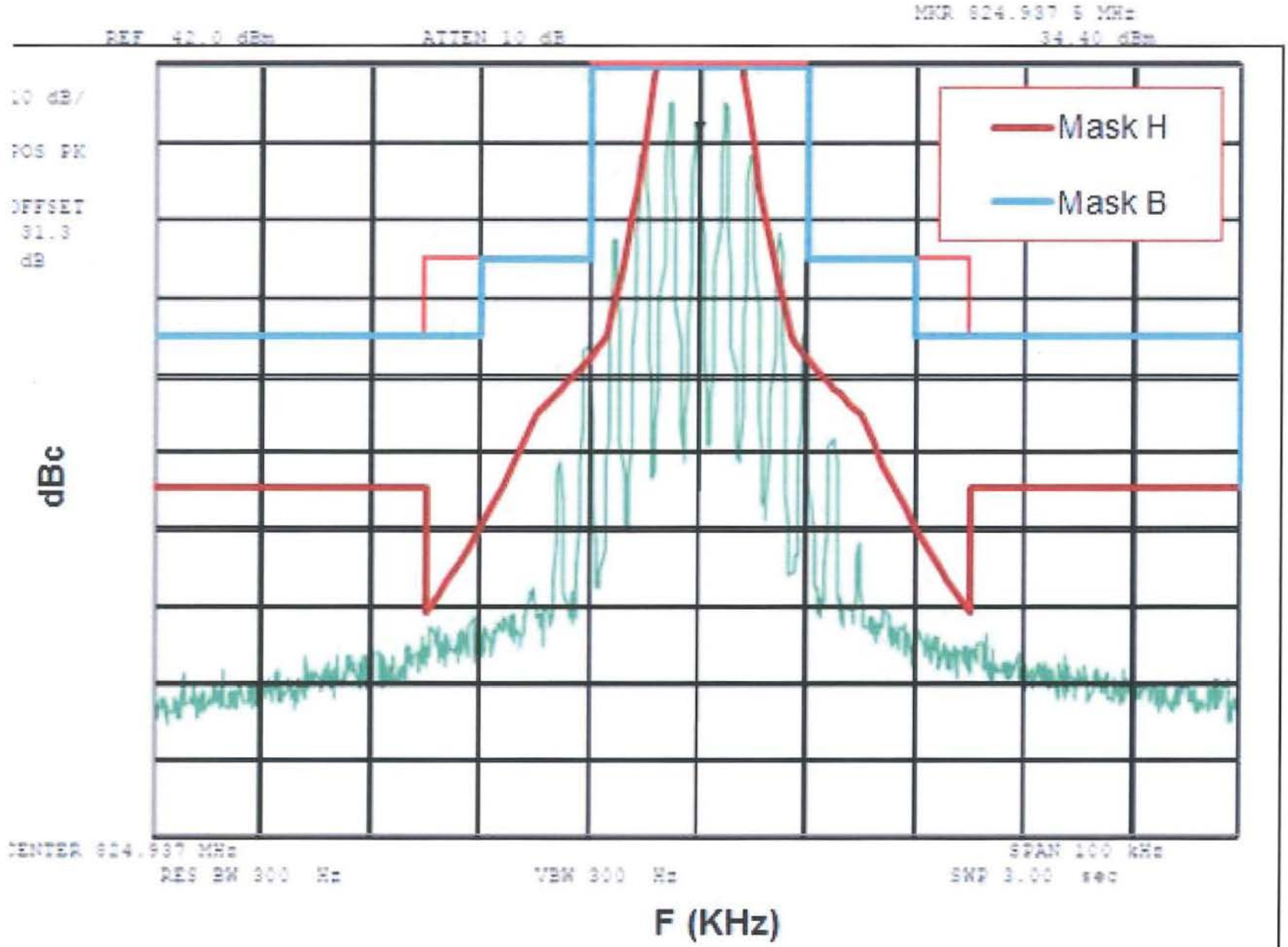
Distance between systems and type of antennas shall be considered:



EIRP: Equivalent Isotropic Radiated Power.
Loss(..): Propagation Losses as a function of frequency, antenna heights and distance.

DISTANCE "R1" CAN BE CALCULATED TO AVOID INTERFERENCE

EXHIBIT D



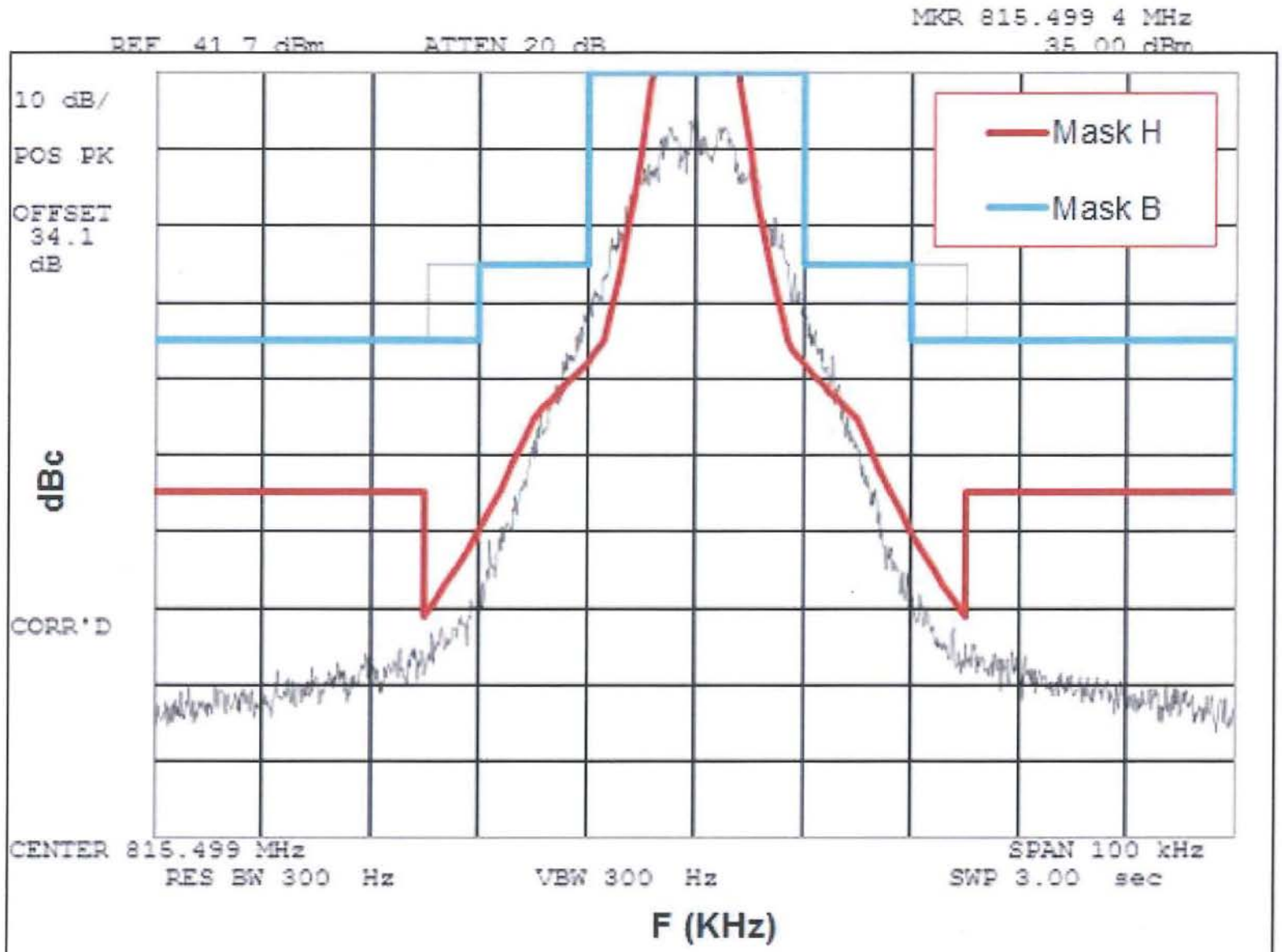
Power / Channel

High / High Channel of Lower Band Sp

Modulation:

Voice: 2500 Hz (14K0F3E)

Mask: B, VHF/UHF 25kHz, w/LPF



POWER: HIGH

MODULATION: GMSK 19200 BITS PER SECO

MASK: B, VHF/UHF 25kHz, w/LPF