

**PowerTrunk**

# **PowerTrunk**

## **TETRA-interoperable D-LMR in the United States**

**Region 8 meeting - August 28, 2012  
Paramus, New Jersey**

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*Vice President Product Marketing*

**PowerTrunk**

**Agenda**



- Who is PowerTrunk? & Why TETRA?
- TETRA Availability in the US
- TETRA/TI D-LMR and FCC Type Certification
- TI D-LMR in the NPSPAC Band
- PowerTrunk opposition to Harris RM petition

**PowerTrunk** **What this discussion IS NOT about**



- ⊠ The issues raised about adjacent channel interference with D-LMR and Public Safety channel have no similarity with the Nextel issues that resulted in Rebanding
- ⊠ The Nextel issues were a result of in-band IM products and a Near-Far problem, causing Nextel mobiles to overwhelm Public Safety base stations.
- ⊠ The focus for this presentation is on our D-LMR product and the occupied bandwidth incursion into the adjacent channels at 12.5 kHz separation, which can be resolved with proper frequency planning by the frequency coordinators and RF Engineering best practices. Please note, there are no such issues with 25 kHz channel separation.

**PowerTrunk** **About PowerTrunk, Inc**

Focus	Experience	Technology	Flexibility
			

- ⊠ HQ is New York City, subsidiary of **Teltronic S.A.U.**, one of the five major global TETRA vendors.
- ⊠ Reliable Ethernet/IP-based multi-technology TETRA/P25 and LTE/WiMax platforms.
- ⊠ Technological independence from third parties; we develop and own 100 % of the technology.
- ⊠ Skilled in Customized Solutions

**PowerTrunk**
**What is TETRA?**








- Published by ETSI , the main contributors being Motorola & Nokia, TETRA is a proven open standard used worldwide in Public Safety.
- Used in 125 countries: over 2 million users, 1 million+ in Public Safety .
- Large Eco-System with multiple vendors equates to a more competitive marketplace
- Outside of North America, TETRA is THE dominant technology used by Public Safety agencies; Police, Fire, Ems, etc., Transit agencies and Utilities at local, regional and national levels.
- Inherently secure voice and data
- 4-slot TDMA architecture over 25 KHz channels; narrowband compliant 6.25 KHz
- Standards body driven by TCCA (TETRA + Critical Communications Association).
- Designed for use in 300 MHz – 1 GHz. Commercially available at global level in 380-400, 410-430, 450-470 and 806-870 MHz plus some special bands. Imminent support to extend down to 130 MHz

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**TETRA Advantages**








- Excellent cellular-like speech quality.
- Full-duplex and half-duplex voice calls.
- Private, group, broadcast and emergency calls.
- Status and short data messages (text, GPS, ...).
- IP packet data (4.8, 9.6 and 19.2 Kbps).
- Circuit data (7.2, 14.4 and 28.8 Kbps).
- Fast call setup (< 0.5 sec)
- Direct mode (Mobile to Mobile) operation (DMO).
- Peripheral equipment interface (PEI).
- Up to 2 X Data Capacity over other Digital LMR technologies

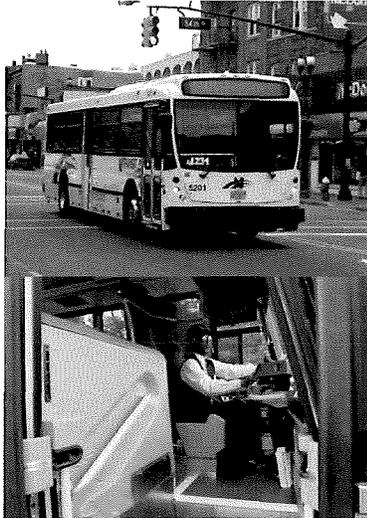
<b>PowerTrunk</b>	<b>Major PowerTrunk Projects</b>
<p><b>Spain</b></p> <ul style="list-style-type: none"> <li>* Barcelona Metro &amp; Buses (TMB)</li> <li>* Madrid Metro &amp; Light Rail</li> <li>* Basque Country Gov. (Itelazpi)</li> <li>* Canary Islands Gov.</li> <li>* Balearic Islands Gov.</li> </ul> <p><b>United States</b></p> <ul style="list-style-type: none"> <li>* <u>New Jersey Transit Bus Radio System</u></li> <li>* <u>New York City Transit (Pilot)</u></li> </ul> <p><b>Brazil</b></p> <ul style="list-style-type: none"> <li>* Supervia, Rio de Janeiro Railway</li> <li>* Rio de Janeiro Military Police</li> </ul> <p><b>Peru</b></p> <ul style="list-style-type: none"> <li>* Lima Light Rail</li> </ul> <p><b>Canada</b></p> <ul style="list-style-type: none"> <li>* <u>BC Hydro Lower Mainland Network</u></li> </ul> <p><b>Great Britain</b></p> <ul style="list-style-type: none"> <li>* Nottingham Tramlink</li> </ul>	<p><b>France &amp; Switzerland</b></p> <ul style="list-style-type: none"> <li>* Buses for 15 Cities</li> </ul> <p><b>Mexico</b></p> <ul style="list-style-type: none"> <li>* Mexico City Metro</li> <li>* Mexico City "Buenavista" Light Rail</li> </ul> <p><b>Malaysia</b></p> <ul style="list-style-type: none"> <li>* Nationwide Public Safety Network</li> </ul> <p><b>Colombia</b></p> <ul style="list-style-type: none"> <li>* Bogota Buses (Transmilenio)</li> <li>* North Atlantic Railway (FENOCO)</li> </ul> <p><b>Russia</b></p> <ul style="list-style-type: none"> <li>* Moscow - St. Petersburg Railway</li> </ul> <p><b>South Korea</b></p> <ul style="list-style-type: none"> <li>* Seoul Metro</li> <li>* Incheon Police Department (Seoul)</li> </ul> <p><b>Argentina</b></p> <ul style="list-style-type: none"> <li>* Ministry of Security of Neuquen</li> <li>* Ministry of Security of Entre Rios</li> </ul> <p><b>Germany:</b></p> <ul style="list-style-type: none"> <li>* Nuremberg Metro</li> </ul>

<b>PowerTrunk</b>	<b>Some other TETRA Public Safety references</b>
	<p><b>Belgium</b></p> <ul style="list-style-type: none"> <li>* ASTRID National Public Safety Network (Cassidian)</li> </ul> <p><b>Great Britain</b></p> <ul style="list-style-type: none"> <li>* UK Police Nationwide Network (Motorola, Sepura)</li> <li>* London Underground (Motorola) (integrated by Alcatel-Lucent)</li> </ul> <p><b>Germany</b></p> <ul style="list-style-type: none"> <li>* BOSNet Nationwide Public Safety Network (Cassidian, Motorola, Sepura)</li> </ul> <p><b>Italy</b></p> <ul style="list-style-type: none"> <li>* Italian Police Nationwide Network (Selex, Cassidian, Motorola, Sepura)</li> </ul> <p><b>The Netherlands</b></p> <ul style="list-style-type: none"> <li>* C2000 Public Safety Nationwide Network (Motorola, Sepura, PowerTrunk/Teltronic)</li> </ul>

Leading TETRA vendors in the world (by volume): Motorola Solutions  
Cassidian, PowerTrunk/Teltronic, Selex, Sepura

**PowerTrunk**

**NJ & NYC Transit Pilots**



- ▣ Two-site network in 800MHz.
- ▣ Mobile and portable subscribers with GPS.
- ▣ Integration with third-party CAD system (NJ Transit).
- ▣ Integration with legacy VHF systems
- ▣ Integration with PABX/PSTN.
- ▣ Text messaging to / from cell phones.
- ▣ FCC type accepted PowerTrunk TI D-LMR equipment used

**PowerTrunk**

**TETRA availability  
in the US**

**PowerTrunk** **TETRA availability in the US**



- The ETSI Standard TETRA RF signal does not meet two FCC 47 CFR 90 requirements:
  - Mask B<sub>e</sub> equipment with audio low pass filter (As defined by FCC 47 CFR § 2.1049 § 90.210.)
  - Occupied bandwidth < 20 KHz. As defined by FCC 47 CFR § 2.1049 & 90.209.
- No TETRA equipment was previously able to receive type acceptance from the FCC

**PowerTrunk** **Achieving FCC Part 90 Compliance**



PowerTrunk made a minor change in one of the parameters of the RRC (Root Raised Cosine Filter) of the TETRA modulation. This change made our equipment compliant with FCC Part 90 rules.

Roll-off factor (α) RRC Modulation Filter	Occupied Bandwidth (KHz) (as defined FCC 47 CFR § 2.1049) with Square Windowed version RRC filter <sup>1</sup>	Occupied Bandwidth (KHz) (as defined FCC 47 CFR § 2.1049) with Hamming Windowed version RRC filter
0.05	18.703	19.969
0.1	19.055	20.250
0.15	19.406	20.602
<b>0.2</b>	<b>19.758</b>	20.953
0.25	20.250	21.445
0.3	20.742	21.867
<b>0.35 (default value)</b>	<b>21.305</b>	22.359
0.4	21.938	22.922
0.45	22.570	23.484
0.5	23.273	24.680

D-LMR  
  
ETSI TETRA

**PowerTrunk** Fully Interoperable

TETRA 0.35      TETRA 0.2

TMO      TMO

0.35 or 0.2

TETRA network

DMO

TI D-LMR equipment passes 100 % of the TETRA Interoperability Profile (TIP) tests as defined by the TETRA + Critical Communications Association (TCCA)

Find TIPs at [www.tandcca.com](http://www.tandcca.com)

**PowerTrunk**

# TETRA/TI D-LMR and FCC Type Certification



## FCC Certification of PowerTrunk



FCC grants Type Certification for TETRA-interoperable D-LMR in UHF and 800 bands.

- PowerTrunk's TI D-LMR's filter change made TETRA-interoperable equipment compliant with FCC Part 90 rules.
- PowerTrunk's repeater and subscriber radio equipment have obtained FCC type acceptance in 409-430, 450-470 and 806-870 MHz. Certification in 764-806 MHz in progress.
- Other vendors have also obtained FCC Type Certification for their TETRA equipment, including Sepura and DAMM.
- PowerTrunk's TETRA-interoperable D-LMR (TI D-LMR) is marketed under the brand name PowerTrunk-T



TI D-LMR  
in  
NPSPAC  
Spectrum

**PowerTrunk** **NPSPAC – FCC Requirements**

FCC 90.209

- Frequency band : 806-809 / 851-854 MHz
- Authorized Bandwidth: 20 KHz
- Channel spacing: 12.5 KHz

Emission masks: FCC 90.210

- Mask B (with audio low-pass filter)
- Mask H (without audio low-pass filter)

Interoperability requirements (FCC 90.203 (i))

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25 <sup>2</sup>		
25-50	20	20
72-76	20	20
150-174	17.5	1.320/1.25/8
216-220 <sup>3</sup>	6.25	20/11.25/8
220-222	5	4
406-512 <sup>2</sup>	16.25	1.220/1.25/6
806-809/851-854	12.5	20
809-824/854-869	25	20

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 <sup>1</sup>	A or B	A or C
25-30	B	C
72-76	B	C
150-174 <sup>2</sup>	B, D, or E	C, D, or E
190 Paging-only	B	C
230-222	F	F
421-512 <sup>2</sup>	B, D, or E	C, D, or E
450 Paging-only	B	G
806-809/851-854	B	H
809-824/854-869 <sup>3</sup>	B	G
896-901/935-940	I	J

(i) Equipment certificated after February 16, 1988 and marketed for public safety operation in the 806-809/851-854 MHz bands must have the capability to be programmed for operation on the mutual aid channels as designated in §90.617(a)(1) of the rules.

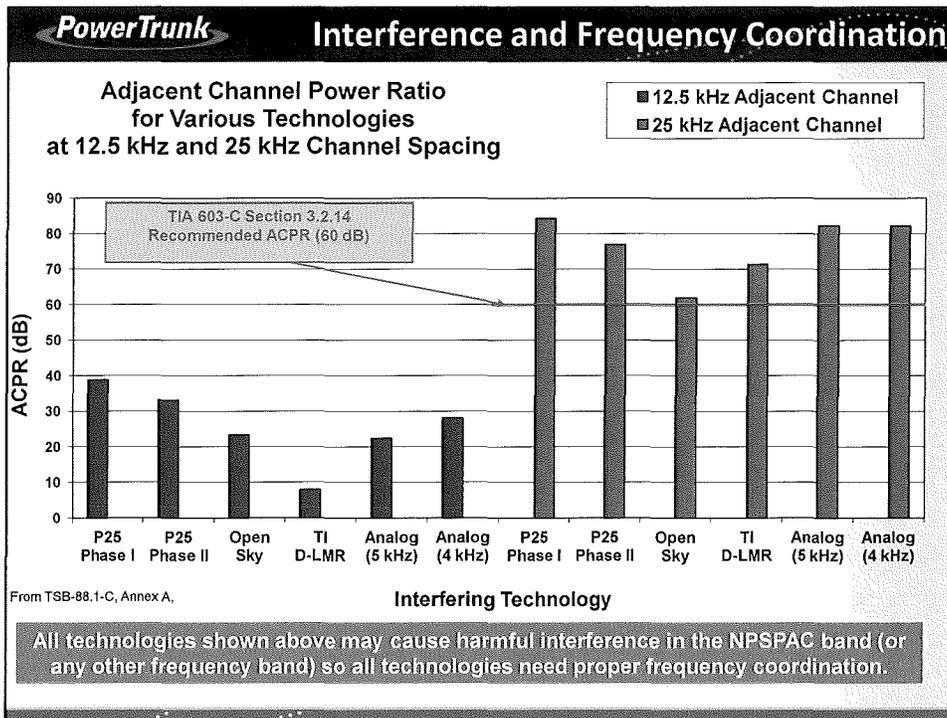
**PowerTrunk** **Interference and Frequency Coordination**

**NPSPAC – Interference & Frequency Coordination (I)**

- FCC 90.209 -> NPSPAC 806-809 / 851-854MHz
  - Authorized Bandwidth: 20 KHz
  - Channel spacing: 12.5 KHz

Overlapping areas

Proper frequency coordination is required



### PowerTrunk Interference and Frequency Coordination

<u>FCC REQUIREMENTS</u>		<u>PowerTrunk D-LMR Equipment</u>
Frequency band : 806-809 / 851-854MHz →		<b><u>Certified to operate on NPSPAC spectrum.</u></b>
Authorized Bandwidth: 20KHz (90.209) →		Meets the authorized bandwidth < 20 KHz
Channel spacing: 12.5KHz (90.209) →		Needs proper frequency coordination the same way other technologies do for operation on NPSPAC frequencies.
Emission masks : Mask B (90.210) →		Uses audio low-pass filters in its modulation block
Interoperability requirements (90.203 (i)) →		PowerTrunk subscriber terminal equipment <b>will</b> operate on analog mutual aid channels.

PowerTrunk D-LMR equipment can be used in NPSPAC frequency bands

PowerTrunk has notified the Commission of its intention in the near future to conduct equipment certification in full compliance with all applicable interoperability rules.



# PowerTrunk's opposition to Harris RM petition



Harris Claims/Arguments	Outcome
The Waiver Order and the Order on Clarification do not authorize any form of TETRA in public safety frequencies	<u>Defeated by the Commission</u> by issuing a license in favor of NJ TRANSIT that included public safety frequencies
Mask B is not applicable to digital technologies	<u>Previously resolved by the FCC</u> in 2010 by confirmation in writing from the Equipment Authorization Branch Chief after consultations with the Wireless Bureau
Equipment certificated under Mask B will cause harmful interference in public safety spectrum	(1) OpenSky offers worse ACPR than PowerTrunk's D-LMR in 25 KHz channels (62 dB vs. 71 dB); (2) <u>Harris failed to present any reason to justify why the RPCs cannot conduct frequency coordination with PowerTrunk's FCC-certified D-LMR equipment in NPSPAC spectrum.</u>
PowerTrunk's equipment's modulation scheme is not compatible with analog FM for operation on mutual aid channels	<u>Contradicted</u> by the fact that state-of-the-art technology allows IQ modulation (used by PowerTrunk) to generate analog FM signals (example: CML digital integrated circuits).
A rulemaking is requested to change the Part 90 rules to ban equipment previously certified under Mask B in public safety spectrum, including an immediate freeze of all certificates previously issued (*)	<u>Pending to be resolved</u> by the Commission. However, <u>no single expression of support has been filed by any party.</u> Motorola Solutions, PowerTrunk, Alcatel-Lucent and NJ TRANSIT have opposed the rulemaking requested by Harris

(\*) Harris's RM petition came to confirm that its previous claims were unfounded

In its January 15, 2010 Ex Parte Notice, in response to the TETRA Association's *Request for a Waiver of Sections 90.209, 90.210 and 2.1043*, Harris argued that a waiver of Part 90 rules was unnecessary because "TETRA technology could be modified to comply with Part 90 rules" (i.e. Harris suggested exactly what PowerTrunk did). It appears that Harris has changed gears too many times.

**PowerTrunk** **What is "low power TETRA"?**



- The term is not relevant and has no meaning.
- PowerTrunk never coined such a definition.
- In spite of the numerous clarifications filed by PowerTrunk at the FCC docket 11-69 to explain that its equipment could not be defined as "low power", Harris, Motorola Solutions and some other parties have been consistently referring to PowerTrunk's equipment as "low power".
- PowerTrunk's FCC-certified base station repeater offers 75 Watts of RF power (the power of the transmitter has nothing to do with the method used by PowerTrunk to comply with the applicable emission masks).

**PowerTrunk** **Key Take Away Points**



- Proven open standard used worldwide in Public Safety
- Standards body driven by TCCA (truly independent interoperability certification).
- Large Eco-System with multiple vendors equates a more competitive marketplace
- PowerTrunk D-LMR is type accepted and fully compliant with Part 90 Rules, including 800 MHz NPSPAC spectrum.
- With best RF Engineering practices and proper frequency coordination that is being done today, D-LMR can be deployed in Public Safety Channels.
- PowerTrunk is currently in the process to obtain type acceptance in 764-870 MHz including interoperating with P25 and analog FM (mutual aid channels).

**PowerTrunk**

# Thank You

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