

Six-Month Status Report of the Project 39 Technical Committee
Presented at the APCO Western Regional Conference
Phoenix, Arizona
March 19, 2002

The Project 39 Technical Committee is pleased to have an opportunity to provide this report on the status of our inquiries into public safety interference in the 800 MHz band.

The Technical Committee is composed of the following APCO participants:

Kevin Kearns, King County, Washington (Chairperson)

Joe Kuran, Washington County, Oregon

Dave Hubbard, Manatee County, Florida

Gary David Gray, Orange County, California

Joe Yurman, City of New York, New York

Bill Cade, Jasper County, Missouri

Jim Warakois, City of Boston, Massachusetts

Jim Kowalik, State of New Hampshire

In addition, an Industry Technical Liaison group has been participating in the work of the Committee and the conference call meetings. This group is composed of:

Dave Maples, Nextel

Phil Hardt, AT&T Wireless

Ron Reiger, AT&T Wireless

Rick Kemper, CTIA

Bernie Olson, Motorola

John Oblak, EF Johnson

Ron Bender, M/A-Com

The Committee held initial organizing discussions at the APCO Conference in Salt Lake City on August 6, 2001 and began conducting regularly scheduled conference call

meetings on September 7, 2001. To date eleven conference call meetings have been conducted and an average of nine people participate in each call.

The primary focus of the Technical Committee to date has been:

- Reviewing the documents and information collected to date on public safety interference in the 800 MHz band.
- Reviewing the individual interference reports filed on the APCO web site.
- Reviewing new information and test data being developed by Project 39 participants and the Industry Technical Liaisons.
- Defining a framework for a new on-line data collection tool that will allow a broader and more informative assessment of 800 MHz interference problems on a national basis.
- Updating previous documentation as a result of improved understandings of the interference problem.

In the Committee's Interim Report issued in December 2001, two documents were attached that helped describe the breadth of the issue as we know it today:

- The first was a document that provided individual interference reports collected up to that time from a web page established by APCO in 2000, when interference concerns were first gaining visibility.
- The second was a listing of interference issues provided by Nextel that they were working on with public safety entities.

As was noted in the Interim Report, some of the interference reports in the APCO data set were also reflected in the Nextel data set, and both contained reports not seen in the other. We also provided a case study from Washington County (Oregon) on the interference challenges and troubleshooting they have done.

In the two month period since the Interim Report, the APCO web site has received additional reports of interference problems from Consumers Energy Company (Michigan), Maricopa County (Arizona), Manatee County (Florida), the Massachusetts

State Police, the New York City Transit Authority, the New Jersey State Police, and the City of Warren (Michigan). Copies of these reports are attached for the record in Attachment 1.

As outlined in our Interim Report, the Technical Committee has reviewed this data to help establish an overall understanding of the underlying interference issues public safety agencies are facing. In total, we now have reports of interference by one or more system operators in 27 States. While a small number of the reported incidences of interference have been corrected on a site-by-site basis, there is an emerging pattern that these corrections are often short-lived and problems soon crop up in other locations.

The Technical Committee had planned to begin a broader data collection effort with improved web-based data collection tools in early 2002. Unfortunately, the lack of a committed funding mechanism for the Project 39 effort has placed that effort on hold. At this time, it is unclear if a funding mechanism will be identified to allow the technical and staff support the Technical Committee needs to expand and formalize our data collection, analysis and reporting effort.

Early in the investigation of interference issues in the 800 MHz band two documents were produced, the Best Practices Guide and the Interference Technical Appendix. As a result of the ongoing work by the Technical Committee and the reports of interference we've been receiving from affected parties, Bernie Olson with Motorola has updated the Interference Technical Appendix (current version number is 1.41 dated February 2002) to include improved documentation and explanations of interference mechanisms. Information has been added to better explain the differences between interference-limited and noise-limited system design approaches, and to demonstrate the affects of site isolation on the severity of the problem. Observations are also included from the experiences of the Winter Olympic Games in Salt Lake City where careful frequency coordination help avoid interference from occurring. The Technical Committee has

reviewed the revised Interference Technical Appendix and accepted it into our record as a formal Project 39 document. A copy is attached as Attachment 2 and copies can also be directly downloaded at:

http://www.motorola.com/cgiss/docs/Interference_Technical_Appendix.pdf

The Technical Committee has also accepted into its record several other documents that help document and define interference factors.

- First, a November 2001 document prepared by the Private Radio Section of the Telecommunications Industry Association (TIA) and presented to the FCC in response to WT Docket No. 99-168 – Service Rules for the 746-764 and 776-794 MHz Bands. While this document was directed at specific issues being considered in the 700 MHz band, the conclusions reach in it were mainly guided by the interference experiences in the 800 MHz band and is an important documentation of the physical phenomenon creating interference problems. This document is attached as Attachment 3.
- The Committee has also accepted into its record a document prepared by Bernie Olson with Motorola titled Receiver Performance Tradeoffs. This document outlines the operational and technical constraints that are faced in the design of a portable radio and helps build the understanding of how challenging it is to build an effective public safety portable radio that can operate in a high RF environment. This document is attached as Attachment 4.
- Finally, we have accepted a report from Gary David Gray from Orange County (California), documenting their experiences in finding that even radios that follow the recommendations in the Best Practices Guide are unable to operate properly in the presence of high-power commercial sites. A copy of this document is attached as Attachment 5.

In our Interim Report we advised that up to that point in time, the Technical Committee had not been made aware of any fundamental interference mechanisms other than

those described in the Best Practices Guide and the Technical Appendix. This continues to be the case. The three primary mechanisms (receiver intermodulation [IM], side-band noise, and receiver overload) continue to be identified root causes when detailed field and/or bench testing is conducted. Receiver IM appears to be the most common issue, although, when it is eliminated, side-band noise or receiver overload phenomenon may be detected as well. The evidence to date also makes it clear that this is an issue faced in multiple manufacturers' equipment, and is not isolated to a single manufacturer or product line.

The Technical Committee has also built a significant understanding of the considerable impacts that site isolation has in the interference equation, particularly when coupled with an understanding of the design differences between public safety systems (typically noise-limited designs) and commercial carrier systems (typically interference-limited designs) and the operational and technical constraints faced in the design of public safety portable radios. It seems very clear that continued proliferation of low-HAAT/high-power sites is only making public safety's problems worse.

Conclusions

The Technical Committee was given the following goal for the first six months of operation:

The committee's six-month goal is to have all current public safety 800 MHz interference issues catalogued, including how the problem manifests, who the contact parties are for the affected public safety agencies, what is providing the interference, how long it has been occurring and what, if anything, has been or is being done to resolve it.

It is our belief that to the extent our limited resources have allowed, we have fulfilled this goal. We would have liked to develop a more robust data collection and analysis process, and have staff available to do further follow-up with reporting affected parties, but without a Project funding source, this has not been possible. However, the body of technical information that presently exists in our record, and being reported here,

provides a competent understanding of the root-cause mechanisms of interference in the 800 MHz public safety bands. The Committee strongly believes that the reported incidences of interference in the APCO record do not represent the sum total of interference nationally. Based on the record and the root-cause mechanisms identified to date, it is our firm belief that interference exists anywhere low-HAAT/high-power (or extreme downtilt) sites in the 800 MHz band are operating within the operational footprint of 800 MHz radio systems designed under noise-limited principles. We also believe this to not be a phenomenon isolated to Nextel sites in the footprint of public safety systems. Multiple public safety systems operating in the same geographic area could present the same challenge if their design philosophies differed, as could other commercial carriers. Further, based on our record and anecdotal information it seems clear these problems would exist in other bands under similar design philosophy differences.

The Committee was also given the following 12-month goal:

Within 12 months, the committee's goal is to have all potential short-term interference solutions identified, tested and applied, where applicable.

The record and experiences documented to date put us in a position where the 12-month goal has been largely accomplished as well. While the previously described resource constraints have prevented us from achieving true national documentation of all incidences of interference events, and we have had only limited opportunity through the voluntary efforts of Project 39 participants to test and verify some of the technical details and findings, the evidence at hand does present a consistent and compelling picture. It is our belief that the various site-by-site solutions documented in our record (changing frequencies, lowering power levels, changing antenna patterns, changing transmitter combining strategies, etc.) do offer meaningful short term relief to specific interference problems, and should be applied any time interference is identified. It does seem clear however that these measures are not adequate to address the overall problem and clearly do not address the goal of preventing interference in the first place. This seems to be a goal that can only be met by addressing issues such as which

technologies are allowed in particular bands (or adjacent bands), what types of design topologies are allowed in particular bands, determination of appropriate receiver specifications for equipment, and how effective frequency coordination can be applied prospectively before interfering sites even get on the air. This indeed seems to be where our future efforts should be most directly targeted.

We look forward to further meetings and discussions with the Project 39 Steering Committee to review our work efforts to date and to establish direction for the Technical Committee going forward.

Attachment 1 – APCO Interference Reports Since the December Interim Report

December 6, 2001

Location City:..... Livonia, Michigan

County:..... Wayne

State:..... MI

Agency Name:..... Consumers Energy Company

Type of service:..... Utility

Service coverage area:..... licensed 40 dBu contour

Population estimate:..... ~.5 Million

Is interference Annoying:..... Yes

Type of PS System:..... EDACS Trunked

Band:..... 806-824

Identified interference:..... Nextel transmitter on property causing wide band noise onto desired users

Interference been reported to:..... Commercial Provider

Has interference been resolved:.....

If, how:

Nextel installed a cavity-type combiner to eliminate the wideband noise.

Descriptive Narrative This problem is (and has been) a major problem for Consumers Energy for the past few years at several sites. It has been exacerbated by Nextel's build-out. We are not a public safety entity; we are, in fact, a B/ILT eligible. We are also members of APCO.

Technical Contact Name:..... Mark A. Gutowski

Technical Contact Title:..... Senior Engineer

Agency:..... Utility

Email:..... magutowski@cmsenergy.com

December 31, 2001

Location City:..... Phoenix

County:..... Maricopa County

State:..... Arizona

Agency Name:..... Maricopa County Wireless Systems

Type of service:..... Police, Flood Control, Courts, Transportation, Animal Control

Service coverage area:..... Maricopa County

Population estimate:.....

Is interference Annoying:..... Yes

Type of PS System:..... Trunked Analog/Digital

Band:..... 806-824

Identified interference:..... Cellular Towers Alltel and Nextel

Interference been reported to:..... Commercial Provider

Has interference been resolved:..... No

If, how:

Descriptive Narrative

Noise floor raised in immediate area of cell towers, over-riding control channel signals.

Technical Contact Name:..... Jeffrey L. Harris

Technical Contact Title:..... Network Analyst

Agency:..... Maricopa County

Email:..... jeffharris@mail.maricopa.gov

January 31, 2002

Location City:..... Warren
County:..... Macomb
State:..... Michigan
Agency Name:..... Warren Police Department
Type of service:..... Police,Fire,EMS,DPW
Service coverage area:..... City of Warren
Population estimate:..... 650,000
Is interference Annoying:..... Yes
Type of PS System:..... trunked
Band:..... 806-821
Identified interference:..... Nextel BDA
Interference been reported to:..... FCC
Has interference been resolved:.....

If, how:

FCC field engineer unplugged offending unit.

Descriptive Narrative

Nextel installed BDA in new construction approx 1/4 mile from main trunking site. BDA radiated a "walking carrier" on and around the control channel of this six channel analog Smartnet system.

Technical Contact Name:..... Keith M. Bradshaw
Technical Contact Title:..... Service Manager
Agency:..... Macomb County Technical Services
Email:..... macrad@libcoop.net

February 15, 2002

Location City:..... BRADENTON
County:..... MANATEE
State:..... FLORIDA
Agency Name:..... COUNTY OF MANATEE
Type of service:..... PUBLIC SAFETY EDACS SYSTEM (Approximately 45 Agencies Countywide)
Service coverage area:..... COUNTY
Population estimate:..... 300,000
Is interference Annoying:..... Yes
Type of PS System:..... Trunked, analog, digital, voice, encrypted voice, MDT, AVL
Band:..... 806-821
Identified interference:..... Wireless Provider , Nextel, Alltel
Interference been reported to:..... APCO
Has interference been resolved:..... No

If, how:

Past history Nextel has been extremely helpful relocating channels (approximately 15 to date)that are spaced closer than 50KHz to operating channels. Nextel has also resolved some site issues where combining was a problem. Alltel has also resolved at least one case of a noise floor issue.

Descriptive Narrative

2/15/02 Nextel has been advised of problem and has indicated that they have turned one channel off that is interfering with an operating control channel. At this time there are also channels that are closer than 50 KHz to our operating channels that are continuing to cause interference. This interference causes noise to mobiles, portables, and control points that are in close proximity to the wireless providers site.

Technical Contact Name:..... Dave Hubbard
Technical Contact Title:..... Radio Division Manager
Agency:..... Manatee County Government
Email:..... dave.hubbard@co.manatee.fl.us

March 13, 2002

Location City:..... New York City

County:..... Queens

State:..... New York

Agency Name:..... New York City Transit Authority

Type of service:..... Surface Transportation, Operations, Transit Police, Emergency Response

Service coverage area:..... City of New York, NY (Bronx, Manhattan, Queens, Kings, Richmond Counties)

Population estimate:..... 10+ million

Is interference Annoying:..... Yes

Type of PS System:..... Motorola Smartnet Simulcast Trunked Analog Voice Radio System

Band:..... 806-821

Identified interference:..... Newly Implemented Nextel Transmitter Site

Interference been reported to:..... Commercial Provider

Has interference been resolved:..... No

If, how:

Descriptive Narrative

Portable radio coverage has been virtually eliminated in an area about 2 city blocks in a radius from a new low HAAT Nextel radio site implemented in the Main St/Roosevelt Avenue intersection. This location is a major transportation hub for both buses and trains with large numbers of people. When this Nextel site is taken off the air, sector by sector, NYCT portable radio coverage is fully restored. When the Nextel site is reactivated, sector by sector, no portable radio coverage on the NYCT 800 MHz system is possible. The noise floor in the area is -30dBm with the Nextel site active. Without the low HAAT Nextel site, the noise floor is in the area of -127dBm. Nextel has tried use of an autotune combiner without success. System interference has been present since activation of the Nextel site 6-8 months ago (Sept 2001). Trouble was only reported Feb 2002. NYCT's concern is building as Nextel is planning another low HAAT site in this same area to increase its capacity for calls.

Technical Contact Name:..... Joseph Yurman

Technical Contact Title:..... Principal Engineer

Agency:..... NYC Transit

Email:..... joyurma@nyct.com

March 13, 2002

Location City:..... Brooklawn

County:..... Gloucester

State:..... New Jersey

Agency Name:..... New Jersey State Police

Type of service:..... POLICE

Service coverage area:..... State

Population estimate:.....

Is interference Annoying:..... Yes

Type of PS System:..... Trunked Simulcast Smartnet Motorola

Band:..... 806-821

Identified interference:..... Nextel Cellular site

Interference been reported to:..... Commercial Provider

Has interference been resolved:..... No

If, how:

Descriptive Narrative

Approximately 1/4 mile around this nextel site. The noise floor is about -85dbm of signal that over powers our public safety signal in that area. This makes our mobiles in that area loose the control channel that makes the radio unusable.

Technical Contact Name:..... Mark L. Getsinger
Technical Contact Title:..... Telecommunications Analyst II
Agency:..... New Jersey State Police
Email:..... p052getsingerm@gw.njsp.org

-----Original Message-----

From: Gary Gutowski [mailto:mspradio@yahoo.com]

Sent: Wednesday, February 20, 2002 8:28 AM

To: 800int@apco911.org

Subject: Interference on Massachusetts 800 system

My name is Gary Gutowski, and I am supervisor of communications maintenance for the Massachusetts State Police.. The MSP has an 806-821 trunked radio Smart Zone System implemented from Boston and Cape Cod out through the route 91 corridor in Western Massachusetts and parts of the Berkshires.. I have attached an xl spreadsheet with information regarding harmful interference which appears to be originating from NEXTEL transmitter sites in certain areas of our patrols..

Gary Gutowski, Communications Supervisor
Massachusetts State Police
470 Worcester Road
Framingham, MA 01702
508-820-2345
["mspradio@yahoo.com"](mailto:mspradio@yahoo.com)



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INTERFERENCE DAT/

Attachment 2 – Interference Technical Appendix (Version 1.41, February 2002)



"P39-011005-06-02 -
Interference Technic

or

http://www.motorola.com/cgiss/docs/Interference_Technical_Appendix.pdf

Attachment 3 – Letter from TIA to FCC re 700 MHz Band Interference



"P39-011116-03-01 -
TIA Letter to FCC re

Attachment 4 – Receiver Performance Tradeoffs



"P39-020315-02-01 -
Receiver Performanc

Attachment 5 – Subscriber Unit Intermodulation Rejection Specification



"P39-020315-03-01 -
Subscriber Unit Inter