



ASSOCIATION OF PUBLIC-SAFETY COMMUNICATORS
INTERNATIONAL

2040 S. Ridgewood Ave., South Daytona,

(904) 322-2500 • Fax (904) 322-2501 • (800) 949-APCO

Hi Dave
APCO Reports -
for the Archives.

Take care
Barbara

Volume 10 •• 1994 •• Number 9

Project 25

Steering Committee Submits Ex Parte Presentations on Spectrum Refarming

The APCO Project 25 Steering Committee has sent to the Federal Communications Commission comments regarding the Commission's spectrum refarming proposal for private land mobile radio frequencies below 512 MHz (PR Docket No. 92-235). Included are a "Statement of Requirements" submitted to the Project 25 Interface Committee in August.

Steering Committee Co-Chairman Craig M. Jorgensen, in submitting the "Ex Parte Presentations" to Chief Ralph Haller of the FCC Private Radio Bureau, said, "Our goals, as stated in the ... "Statement of Requirements," have been to provide for interoperability, spectrum efficiency, multi-source equipment and full utilization of user-friendly, state-of-the-art technology. Project 25 is governed by a Steering Committee with representatives from each of the sponsoring organizations ..."

"The Project 25 Steering Committee has spent hundreds (if not thousands) of hours over the last several years in developing standards," Jorgensen wrote. "The Telecommu-

nications Industry Association (TIA) has provided valuable assistance throughout this process, particularly through its working committees which have reviewed all technical proposals and made specific recommendations to the Steering Committee."

"Over 25 manufacturers have participated in various aspects of this process. TIA recently published a Technical Bulletin containing Project 25 recommended standards for the Common Air Interface (CAI), and at the recent APCO Conference in Pittsburgh, four manufacturers announced that they have secured licensing agreements to produce Project 25-compliant equipment. Indeed, on

Project 25 was formed by APCO, the National Association of State Telecommunications Directors (NASTD) and agencies of the federal government for the purpose of developing user-driven standards for digital public safety land mobile radio equipment.

the Conference exhibit floor, two manufacturers (Motorola and Stanilite) demonstrated the interoperability between their actual Project 25-compliant radios."

"The Project 25 CAI standard is based on the use of 12.5 kHz channels and a data rate of 9.6 kbps. The second step (which is predicated on a first step of 12.5 kHz, as outlined

in the attached Statement of Requirements) is to develop interoperable standards for 6.25 kHz of equivalent channels. Critical to the entire Project 25 process is a smooth forward and backward migration path to assure continued interoperability. We strongly believe that this can be best accomplished through a first-step transition to 12.5 kHz, which incidentally is in lock-step with the position our peers in the federal government have taken as articulated in a September 12, 1994, memorandum from William D. Gamble, deputy associate administrator of the Office of Spectrum Management to the IRAC secretary." (That memorandum is on Page 6).

"We hope that you will take these concerns into consideration in your upcoming adoption of final spectrum refarming rules for frequencies below 512 MHz."

STATEMENT OF REQUIREMENTS

A. Introduction

The objectives of this effort to establish a standards profile for the operations and functionality of new digital public safety radio systems are as follows.

1. Obtain maximum radio spectrum efficiency.
2. Ensure competition in system life-cycle procurements.
3. Allow effective, efficient and reliable intra-agency and inter-agency communications.
4. Provide "user-friendly" equipment, "user-friendly" being defined as the least amount of mental and physical interaction by the operator.

B. General Requirements List

In order to meet the stated objectives, it is felt that a general list of requirements is needed that defines the necessary system characteristics. This general list of requirements serves as a guideline for the more-comprehensive list of detailed requirements which follows. To support this, the following statements are set forth as provided by public safety users with some modification.

1. The system shall offer channel utilization that immediately improves spectrum efficiency by at least two times¹ over current analog systems, with a goal of an increase in improvement to at least four times as technology continues to develop.

¹ Public safety frequencies 821-824/866-869 MHz presently use enhanced 25 kHz channel equipment together with a 12.5 kHz / 25 kHz regional coordination plan tied to minimum spacings between base stations. In this instance, the improvement in spectrum efficiency with 12.5 kHz digital channels will be approximately 1.3 times.

2. Subscriber units shall communicate in either a conventional or trunked environment using clear (unencrypted digital), digitally encrypted voice or data modes regardless of the manufacturer of the equipment.

3. The system shall provide up to four levels of encryption with compatible modes of operation and shall provide the same functions associated with clear (unencrypted digital) operation. Subscriber units shall be capable of zero, one or two types of encryption, as required.

Type 1 is for classified national government communication.

Type 2 is for unclassified national security-related communications.

Type 3 is for unclassified sensitive government communications (e.g., public safety).

Type 4 is for other purposes (e.g., exportable).

4. Multiple radio subsystems must be interconnectable into larger systems. Further, subscriber unit units must be able to roam between different radio subsystems. Up to 64,000 different radio subsystems shall be uniquely identifiable. Further, each radio subsystem shall provide for up to 2,000 uniquely identifiable functional talk-groups or vertical partitions for distinct and separate organizations, and at least 48,000 individually identifiable subscriber units. Through hierarchical numbering, individual subscriber units and talk-groups from any radio subsystem are uniquely identifiable in any radio subsystem in concert with their home subsystem identification (similar to hierarchical telephone numbers and area codes).

5. The system shall be designed around a suite of operational standards so that field systems manufactured by different vendors can operate together and offer unit-to-unit communications based on predefined activation procedures.

6. Data transmission between a public or private-switched telephone network access point, standard SNA, X.25 or TCP/IP networks and mobile (or portable) Data Terminal Equipment (DTE), over the RF link, are required. Data transmission shall operate at a speed of at least 9600 bps (including overhead) with minimal error retransmissions. All host applications on SNA, X.25 or TCP/IP networks shall have the ability to identify, and transparently communicate with any subscriber unit linked DTE device.

7. All subsystems which comprise a radio system must be under control of a single network management scheme, regardless of manufacturer. The scope of the single network management scheme includes the five basic elements of network management:

- a. Configuration management.

- b. Fault management.
- c. Security management.
- d. Performance management.
- e. Accounting management.

Implicit in the ability to manage these elements is the transfer of relevant managed object attributes which can be used for example to generate: Managed information reports, alarms, reconfigurations, etc.

8. Management of system components and software levels shall be able to be performed from a single point.

9. Overall system management shall be able to delegate vertical partitioning management to the organization responsible for the operation of the partition.

10. Voice quality for both clear and encrypted communication shall be equal to or superior to current clear-voice analog systems and the measure of quality shall include both male and female voices.

11. System range performance for both clear and encrypted communication shall be equal to or superior to current clear voice analog systems and shall include simulcast without the need for additional site development.

12. The system shall meet all the mandatory requirements and shall offer as options the same desirable features as APCO Project 16A. In all instances where APCO Project 25 State of Requirements conflicts with those of APCO Project 16A, the APCO Project 25 Requirements shall supercede.

13. Equipment size shall be comparable to existing analog systems. Portable subscriber units shall be offered for covert and uniformed users (covert portable being smaller) with batteries that shall power these portables for at least eight hours (5,5,90 duty cycle) with minimal size and weight.

14. Interconnection to public switched telephone network shall be equal to or superior to current analog systems.

15. Each manufacturer's system shall provide for backward compatibility with that manufacturer's existing analog systems to facilitate a graceful and gradual migration from the old analog to the new digital. As a minimum, this shall include mobile and portable subscriber units. In addition, subscriber units shall include the ability to select and operate on available analog mutual aid channels for communications with the fixed network equipment as well as direct unit-to-unit.

16. The system shall be able to co-exist with older analog systems, share the same segments of allocated RF spectrum and provide little interference to existing adjacent-channel analog systems as well as work properly.

17. The system shall be technically flexible to allow for single and multiple site systems, voting and simulcast designs, with variable numbers of stations per site. The system shall allow for single station sites without loss of control, voice or text capability. The maximum number of stations at a site shall not be limited for future growth.

18. The system shall allow for continued enhancement of standardized functions and features so that the system can grow with user needs. Further, a standard method shall be specified for segmenting non-standard (or potentially future-standard), value-added features between manufacturers to safeguard from unintentional interaction between subscriber units of different manufacturers subsystems.

19. The system shall minimally be equally adaptive to all public safety mobile radio frequency bands and blocks of spectrum, without precluding its adapting to other land mobile bands.

20. The mobile and portable equipment shall meet the applicable sections of MIL-STD-810D "Environmental Test Methods and Engineering Guide" as follow.

506.2 Rain, Procedure 1 (blowing rain)

509.2 Salt Fog, Procedure 1 (aggravated screening)

510.2 Sand and Dust, Procedure 1 (~~blowing sand,~~
blowing dust)

514.3 Vibration, ~~Category 4~~ Procedure 1, Category 1
(3 ~~AXES~~ axes)

516.3 Shock, Procedure 1 (functional)

21. Throughput delay shall be as follows:

a. Less than 250 msec in direct radio-to-radio communications.

b. Less than 350 msec in radio-to-radio communications through a single conventional repeater.

c. Less than 500 msec in radio-to-radio communications within an RF subsystem.

22. The system shall be designed to be resistant to interference from co-channel, adjacent-channel and intermodulation effects similar to Continuous Tone-Controlled Squelch Systems (CTCSS) used today.

23. The system shall allow direct mobile-to-mobile communication at any time without degrading normal system performance. Direct communication while in range of the fixed equipment shall do no more than temporarily capture receivers from possible outbound messages. Direct communication shall be possible at any time while out of range of the fixed equip-

ment with no degradation in system performance or capacity.

24. A dispatcher shall have the ability to interrupt any call enabled by the system that an individual may be engaged in.

25. The mobile and portable equipment shall be able to scan both conventional channels (at least § 8) and trunked talk-groups (at least eight) in both clear and encrypted voice. The scan to be completed in the minimum time. The scan shall be selectable priority which means that the transmitter channel or talk-group selected by the user is the priority channel or talk-group.

26. The system shall have over-the-air-rekeying (OTAR) of encryption keys.

27. The system shall allow mobiles and portables to roam over a wide coverage area with automatic connection as the unit enters a new site coverage area within any radio subsystem. The system must provide for registration and authorization control over subscriber units roaming between radio subsystems. Manual and automatic roaming capabilities shall be provided between radio subsystems.

28. The system shall allocate channels at sites based upon subscriber units present which need to receive a given message.

29. A manufacturer of an APCO 25 software product should define the extent of the operating environment over which the product is known to work.

C. Detailed Requirements List

In order to meet the above stated general requirements list, it is felt that a detailed list of requirements is needed that defines the necessary system characteristics and services. The general rule for these detailed requirements is that they stem from one or more of the general requirements. To support this, the following requirements are recommended.

1. System Requirements.

a. The system shall support existing 25 kHz and 12.5 kHz channelization where already established. Within 25 kHz channelization and where permitted, the system shall support operation on 2-for-1 12.5 kHz channelization. All protocols and procedures shall be adaptable to further channel splits as technology permits.

b. Systems or subsystems shall be configured in single site, multiple site non-simulcast, or multiple site simulcast. Multiple RF subsystems shall be combinable into larger wide-area systems. Wide-area systems shall be composed of individual RF subsystems which are independently capable of single site, multiple site or multiple site simulcast. Any

individual site need only deploy as many stations as necessary except in RF simulcast subsystems.

c. Systems shall support authorized roamers from compatible digital systems for interagency assistance.

d. All calls shall be digital except compatible analog voice calls.

e. The site (or simulcast RF subsystem) location of all subscriber units, including authorized roamers, shall be maintained by the system.

f. Calls shall not require resources at sites that do not contain addressed subscriber units (except simulcast RF subsystems).

g. RF subsystems shall contain all the control intelligence to support call processing and track unit location and roamers within the RF subsystem. All RF subsystems shall support standard signalling and communications interfaces to be flexibly linked into wider-area networks via private or public networks.

h. RF subsystems from any manufacturer (as described in C.1.g.) must be interconnectable into a wide-area system.

i. Signalling format(s) must be compatible with standard transmission facilities in accordance with the North American transmission standards as defined by Bellcore TR-TSY-000333 for Switched and Special Access Services.

2. RF Subsystem Interfaces

a. An RF subsystem shall support either analog or ISDN standard fixed-network PSTN interfaces for telephone interconnect.

b. An RF subsystem shall support a fixed-network host computer interface or an X.25, SNA or TCP/IP network interface.

c. An RF subsystem shall support standard network management interfaces to other RF subsystems of any manufacturer.

d. An RF subsystem shall support standard service signalling and bearer channel interface for interconnection with other RF subsystems by a public or private wide-area network. The standard service set between RF subsystems shall be composed of the following.

(1) group calls setup

(2) private calls setup

- (3) voice encryption control
- (4) RF subsystem registration (roaming)
- (5) analog bearer channel
- (6) digital bearer channel
- (7) access control and security

3. Common Air Interface Requirements

a. One channel bit-rate, modulation and link layer shall be utilized for all voice and data capabilities, excepted only for manufacturer-specific subsystems to provide backward compatibility to existing manufacturer-specific systems.

b. For single channel operation, control, voice or data, features must be integrated into a common channel.

c. A standard service set for all manufacturers composed of the following.

- (1) group calls
- (2) private calls
- (3) interconnect calls
- (4) voice encryption control
- (5) data messages
- (6) site registration
- (7) RF subsystem registration (roaming)
- (8) dynamic subscriber unit talk-group regrouping
- (9) emergency alarm
- (10) User ID

4. Mobile/Portable Subscriber Unit Requirements.

- a. Support all digital communications within this system.
- b. Support analog communications within this system when involved in a call from an analog unit.
- c. Support analog communications on a conventional channel.
- d. Support a data port to an attached MDT (mobile data terminal), portable computer or other peripheral device.

D. Standards Suite Proposed

In order to meet the state objectives and requirements, it is felt that a comprehensive suite of standards is necessary that defines the interface characteristics and permits the interconnection of all system components. The necessary standards components are as follows.

1. Adopt 12.5 kHz bandwidth channels with future migration to 6.25 kHz bandwidth channels as technology allows.

2. Adopt work done under FS-1024 project (Narrowband Digital Land Mobile Radio) as much as possible to ensure vendor competition and interoperability.

3. a. Establish a Common Air Interface all-digital trunking control standard, voice and data standard, and a control standard.

b. Adopt an RF subsystem Interface Standard for the connections between all RF subsystems from international, national or industry standards as appropriate and available. Such standards sources as CCITT shall be consulted, among others.

4. Host Interface Standard

The mobile data terminal (MDT) interface must be able to present an addressable MDT data stream to a host-attached port, physically over either an RS-232 or V.35 electrical interface, using either analog or digital transmission public switched telephone network (PSTN) facilities, or a computer network. When connected to a computer network, each MDT must be individually provided with its own network address, with such network presentation conforming to layers 1 through 3 of the OSI model according to the following specifications.

a. 1984 CCITT Recommendation X.25. The physical layer must be capable of conforming with EIA RS-232-C for data rates under 19.2 kbps and CCITT V.35 for data rates above 19.2 kbps. The link layer must be compliant with High-level Data Link Control (HDLC) Link Access Procedure Balanced (LAPB).

b. IBM System Network Architecture (SNA) using Physical Unit (PU) 2 to PU 4 with Logical Unit (LU) 2 and LU 3. The physical layer is as specified in item D.1., above. The link layer must be compliant with Synchronous Data-Link Control (SDLC).

5. Encryption Standard

a. Adopt FIPS 46 DES (Data Encryption Standard) to ensure vendor competition and interoperability.

Absent Refarming, Federal Government Now Procuring 12.5 kHz Equipment For Both Trunked and Conventional, Analog and Digital Systems

In a September 12 memorandum for the Executive Secretary, IRAC, Deputy Associate Administrator William D. Gamble of the National Telecommunications and Information Administration (NTIA) Office of Spectrum Management reported on channel bandwidths for mobile, non-tactical radios in the 138-420 MHz region:

"In May 1992 NTIA (Ref. Doc. 27719/1-1.9.205/2.4.3/2.10) approved recommendations of the IRAC to reduce the channel widths for land mobile equipment operating in the band 162.0125-175 MHz to 12.5 kHz in accordance with plans developed by IRAC Ad Hoc 205. Moreover, as indicated in the Land Mobile Spectrum Efficiency: Summary Report, sent to Congress by Secretary of Commerce Ronald H. Brown in October 1993, NTIA selected a 12.5 kHz channel bandwidth to replace the existing 25 kHz widths for mobile non-tactical radios in the bands 138-150.8 MHz and 406.1-420 MHz. This would double the number of basic channels available using current technologies."

"The NTIA has implemented channel plans for the 162.0125-175 MHz bands and IRAC Ad Hoc 205 has drafted a plan for the 406-420 MHz. Federal agencies have already begun procurement of 12.5 kHz analog and digital radios for the 162-174 MHz and 406.1-420 MHz bands. In addition, 12.5 kHz digital radios are expected to be adopted by the Association of Public-Safety Communications Officials-International, Inc. (APCO) to ensure baseline interoperability, which would lead to widespread use by state and local law enforcement agencies."

"NTIA and the federal agencies examined several alternatives before settling on a migration to 12.5 kHz radios. Their decisions were influenced by the successful use of 12.5 kHz analog technology, the rapidly changing and developing digital signalling technology, and the potential for economic production of 12.5 kHz digital equipment."

"NTIA also concluded that the selection of 12.5 kHz channel widths should be reviewed if the Federal Communications Commission selected 5 kHz or 6.25 kHz channel widths as a consequence of their 'refarming initiatives.' This review would be to decide if a plan for using 5 kHz or 6.25 kHz channel widths for federal users should be developed."

"In the intervening period, the FCC has not completed its 'refarming initiative' while, as noted above, federal agencies have begun to procure the 12.5 kHz equipment for both trunked and conventional, analog and digital systems. APCO remains committed to the development of 12.5 kHz channel widths. Moreover, only 12.5 kHz equipment is available now, although cost-effective amplifiers for 5 kHz or 6.25 kHz systems in the 162-174 and 406-420 MHz bands should be available in the future, since they are being used in the 220-222 MHz band."

"Thus, NTIA will continue to support 12.5 kHz channels now and in the future. When narrowband or other new equipment (e.g., CDMA or wideband digital equipment) becomes available, we will review existing federal land mobile usage and requirements to decide if other channel spacings should be added to the plan."

Editor: Alan W. Chase • Assistant Editor: Rick Arndt
Production Coordinator: Kathy O'Connell • Assistants: Gwen Segren, Ray Barnes

APCO REPORTS
2040 S. Ridgewood Ave.
South Daytona, FL 32119-8437



FIRST CLASS MAIL

Serving
Public Safety Communications
Since 1935