APPENDIX A
GENERAL SERVICE CHANNEL
PLANNING AND MANAGEMENT PROCESS

A.1 Historical Background of the General Service Channels

In May 1970, the Federal Communications Commission (FCC) released the *First Report and Order in the Matter of an Inquiry Relative to the Future Use of the Frequency Band 806-960 MHz; and Amendment of Parts 2, 18, 21, 73, 74, 89, 91, and 93 or the Rules Relative to Operations in the Land Mobile Service Between 806 and 960 MHz (First General Service R&O)* that allocated 115 MHz of spectrum in the 806–947 MHz band for use by the land mobile radio services. A portion of the spectrum, 40 MHz, was allocated for the development of private and shared systems to be used by eligibles in the industrial, land transportation, and public safety radio services. The remaining 75 MHz of spectrum was allocated for the development of high-capacity common carrier mobile communications systems, which were to be operated by wireline common carriers.

The release of the *First General Service R&O* coincided with the release of the *Notice of Inquiry in the Matter of an Inquiry Relative to the Future Use of the Frequency Band 806-960 MHz; and Amendment of Parts 2, 18, 21, 73, 74, 89, 91, and 93 or the Rules Relative to Operations in the Land Mobile Service Between 806 and 960 MHz (General Service NOI).* Within the *General Service NOI*, the FCC requested that any interested parties develop detailed technical and marketing studies with a focus on future use of the newly allocated spectrum. The studies were intended to demonstrate how this 115 MHz of spectrum, through the use of spectrally efficient technologies, could be used to meet the future needs of land mobile radio services. Most of these studies were submitted by July 1972, and many of them raised a number of issues concerning new technologies and revised policy procedures. Because of the success of these studies, the FCC held a 2-day seminar in May 1973, in which it provided a forum for oral presentations concerning the use of the reallocated spectrum.

Using the information and suggestions proposed through the *General Service NOI* process, the FCC released the *Second Report and Order in the Matter of an Inquiry Relative to the Future Use of the Frequency Band 806-960 MHz; and Amendment of Parts 2, 18, 21, 73, 74, 89, 91, and 93 or the Rules Relative to Operations in the Land Mobile Service Between 806 and 960 MHz (Second General Service R&O)*. The *Second General Service R&O* was released in May 1974. It proposed technical standards and policies to govern the use of the reallocated spectrum. Within the *Second General Service R&O,* the FCC proposed a new philosophy on allocating spectrum to the public. The FCC expressed its desire to develop an assignment plan that would allow enough flexibility "to cope with the new and unforeseen technological and economic forces."

A.2 *Report and Order* Approach for Spectrum Allocation

Before releasing the *Second General Service R&O* in 1974, the FCC used a "service perspective philosophy" to allocate blocks of spectrum to about 20 radio service categories

nationwide. The FCC stated within the *Second General Service R&O* that this method of allocation "has led to parochialism among the users and inequitable situations where spectrum shortage and abundance exist side by side in the same cities." Therefore, the FCC proposed a new "system perspective philosophy" for spectrum allocation. The proposal was to allocate spectrum by system type, not by service type, and to allow the market to ultimately determine how much spectrum is used by the various types of users. With this new allocation philosophy, the challenge then became defining the systems to be accommodated, determining the spectrum requirements of these systems, and arranging separate allocations in an orderly plan. To fulfill these goals, it was necessary to define not only the technical characteristics of the systems, but also the compatibility among the different systems. Within the *Second General Service R&O,* the FCC specified that the following five systems were under consideration for spectrum allocation:

- *Conventional and Trunked Communications Systems:* Of the 115 MHz of spectrum under consideration, 30 MHz of spectrum was allocated for use by conventional and trunked systems. This allocation was a reduction from the original allocation of 40 MHz that was proposed in the *First General Service R&O* in 1970. The FCC stated that it envisioned that the "allocation for conventional and trunked systems [would] be available for both private and commercial (third party) operation and used for either mobile telephone or fleet dispatch service." A portion of this 30 MHz of spectrum, which was located in the 806-821/851-866 MHz bands, became known as the "general service channels" used by the public safety services.

- *Cellular Land Mobile Communications Systems:* The *First General Service R&O* originally allocated 75 MHz of spectrum for wireline common carriers to develop cellular land mobile and air/ground systems. This allocation was determined in 1970 when the FCC admitted that little was known about cellular technology and the potential market for such systems. Most comments received in response to this allocation agreed that 75 MHz was an excessive amount of spectrum to allocate to cellular systems. Therefore, the FCC reduced the size of the allocation for cellular systems to 40 MHz in the *Second General Service R&O*. The FCC stated that "the full 40 MHz of spectrum would not be assigned to a single operator all at once. Rather, in each area the system operator will be given the minimum amount of spectrum required for that area initially. Additional spectrum will be made available upon a showing of need." An additional 20 MHz of spectrum was placed in reserve bands for possible future use by the cellular systems community.

- *Air/Ground Communications Systems:* The FCC decided not to allocate any spectrum for use by air/ground communications systems. The spectrum that was earmarked for these systems was placed in reserve bands for future use by other systems. These reserve bands could, however, be used by the air/ground communications systems if needed.[1]

[1] Currently, Commercial Aviation Air-Ground systems may operate on 10 channel blocks in the 849-851 MHz and 894-896 MHz bands.

- *Industrial, Scientific, and Medical (ISM) Devices:* Comments from manufacturers of microwave ovens disagreed with the FCC's proposal to reduce the ISM spectrum provision from 50 MHz to 26 MHz. These entities argued that at least 38 MHz is required to make an oven that is not only competitively priced but also capable of properly cooking all types of foods. The FCC accommodated the commercial industry and agreed to establish a 12 MHz guard band immediately above the spectrum provisioned for ISM. This 12 MHz of spectrum, coupled with the allocated 26 MHz of spectrum, provided the industry with the necessary spectrum to produce microwave ovens. However, the FCC stated the guard band would be available for only five years, after which time this spectrum would be reallocated for other uses. The FCC believed five years was ample time for the microwave manufacturing community to reduce ISM emission limits.

- *Land Mobile Reserve Allocations:* Numerous comments suggested establishing frequency reserve bands to accommodate new land mobile services or unexpected growth in existing systems. An additional 45 MHz of spectrum, consisting of eight reserve bands, was allocated for this purpose. The *Second General Service R&O* stated that the reserve bands were positioned to allow the "greatest flexibility in expanding the proposed services and for accommodating new services."

Within the *Second General Service R&O*, a special reference was made to areas located along international borders. To protect both Canadian and Mexican television channels in the 806–890 MHz region, land mobile operations close to the borders of these countries would have to be regulated by technical standards different from systems located away from the borders. These special regulations were provided to system manufacturers applying for licenses within the newly allocated spectrum.

A.3 Assignment Plan for General Service Channels

As previously mentioned the spectrum reserved for public safety use, the "general service channels," is situated within the spectrum allocation for conventional and trunked communications systems. Of the spectrum reserved for conventional and trunked communications systems, 70 channels were allocated for public safety communications. These 70 channels are located in the 806–821/851–866 MHz band.

The 1974 *Second General Service R&O* proposed regulatory control schemes for the general service channels (806–821/851–866 MHz spectrum) that were radically different from the FCC's past dealings with land mobile radio services. Before 1974, these services were separated into two groups: common carrier services and private services. The latter included such entities as the Safety and Special Radio Services. With the *Second General Service R&O* of 1974, the FCC adopted new policies to govern the private service entities, separate from those governing the common carrier entities. In reference to the common carrier-type regulatory policy, the *Second General Service R&O* states "that such manner of administrative control is neither appropriate nor desirable for the variegated systems of communication we plan to authorize in the 806–821 MHz and the 851–866 MHz bands."

The FCC explained that private land mobile communications systems have always been regulated in a specialized manner. However, the 1974 regulatory plan was intended to "cover a wider range of alternatives for establishing or obtaining communication services." The plan also stated "in accomplishing this objective, we have abandoned, to a large degree, the service categories employed in the past, and we have also combined private, shared, and common user systems under a single assignment and regulatory plan which we believe to be more efficient than that used in the past." The purpose of the new regulatory plan was to allow flexibility in system design by establishing a large variety of options for communications systems. These varied options allowed entities to choose a system configuration that best met the requirements of a particular user.

According to this 1974 regulatory plan, a police agency could establish its own radio facility and manage the facility in a way that best suited the needs of that department. A police department, for example, could share its facility with other classes of users on a cooperative basis or could form a nonprofit corporation to serve as licensee and manage the system for the police department. This scheme would allow the police department to reduce operating expenses and spread costs over several different agencies. The plan also makes provisions for licensing an individual to provide commercial service to a single customer, such as a large metropolitan police department. The FCC could also license a common user system to provide service to a number of small police agencies, which may be operating in adjacent jurisdictions, under an arrangement that would provide the necessary means of communication at a low cost to the users. Under the 1974 regulatory plan, any of the above options could be applied.

In addition, the plan also allowed considerable freedom in specifying the system configuration. For instance, eligible users could specify a trunked or conventional system. Once a system was chosen, the system users then had an option to switch from one type of system to another, and then back again, if any system was unsatisfactory. In summary, the new regulatory plan provided almost limitless freedom in specifying a new communications system using the newly allocated 30 MHz of spectrum.

Within the 1974 *Second General Service R&O,* the FCC explained that the large amount of spectrum that became available in the early 1970s made it possible to allow considerable freedom in specifying system configurations. The FCC stated "with the spectrum we are making available for immediate use and with what we are holding in reserve, we are assured . . . that we will be able to accommodate the needs and requirements of land mobile operations, in a most effective and efficient manner… for many years to come."

In proposing such a nonrestrictive regulatory scheme, the FCC relied on the competitive forces in the commercial industry to produce spectrally efficient and reliable equipment that would operate over the 30 MHz of spectrum. Because this 30 MHz of spectrum is located in a band much higher than existing public safety bands, the commercial industry needed to develop new system designs, equipment, and marketing practices. The success of the 1974 regulatory plan depended on the ability and the desire of the commercial industry to apply for available spectrum, develop new equipment using the spectrum, and then market this equipment to the user community. Within this process, it is assumed that the commercial industry worked in conjunction with eligible users to define user requirements. Without this dialogue between the

commercial industry and the user community, the commercial industry could develop systems using the new spectrum that did not fully meet the requirements of the eligible users. Furthermore, if the commercial industry did not foresee a profitable market before it developed new systems operating at the assigned frequencies, these systems might not have been created.

Despite its possible shortcomings, the 1974 regulatory plan was intended to provide system design flexibility, which would enable the user community to tailor a communications system to its specific needs. In the *Second General Service R&O*, the FCC stated that its objectives were "to provide a maximum number of ways under which a maximum number of qualified persons may . . . with the least administrative delay and under minimum procedural restraints, provide themselves with the means of radio communication they may require to enable them to conduct their affairs in an efficient and effective manner."

A.4 Regulations Governing Licensing and Use of Allocated Spectrum

Despite the level of freedom provided within the *Second General Service R&O*, a few regulations and technical standards were recommended. The main body of the *Second General Service R&O* proposed the regulations regarding the 900 MHz portion of the newly allocated spectrum. The regulations regarding the 30 MHz of spectrum located in the 800 MHz band were referenced within a subpart of the document's appendix. These regulations addressed issues such as eligibility, technical system specifications, application and processing procedures, and assignment of frequencies.

Eligibility. The *Second General Service R&O* defined the following persons or entities as eligible users of the 800 MHz spectrum:

- Any person or entity deemed eligible for licensing by the FCC
- Any person or entity proposing to provide dispatch service to any person or entity deemed eligible for licensing on a not-for-profit, cost-shared basis
- Any person or entity, except wireline telephone common carriers, proposing to provide dispatch service to any person or entity deemed eligible
- Any person or entity, except wireline telephone common carriers, proposing to provide radiotelephone service to the public over trunked systems of communication.

Within the *Second General Service R&O*, an individual or entity was deemed as an eligible user under Parts 89, 91, or 93 of Chapter I of Title 47 of the Code of Federal Regulations (CFR).

Limitations on Power and Antenna Height. The FCC specified power and antenna height

For suburban-conventional systems, the *Second General Service R&O* stated that the maximum effective radiated power and antenna height for base stations operating in the 851–866 MHz (transmit bands) shall be no greater than 500 watts (27 dBW) and 500 feet above average terrain (AAT), respectively. For trunked and urban-conventional systems, the *Second General Service R&O* stated that the maximum effective radiated power and antenna height for base stations operating in the 851–866 MHz band shall be no greater than 1 kW (30 dBW) and 1,000 feet AAT, respectively. If a different antenna height or power level was used in the system design, the *Second General Service R&O* specified an equivalent set of requirements, which are provided in Table A-1.

Table A-1
Antenna Heights and Associated Maximum Power Requirements

Antenna Height (AAT) (feet)	Power (watts)
4,501–5,000	65
4,001–4, 500	70
3,501–4,000	75
3,001–3,500	100
2,501–3,000	140
2,001–2,500	200
1,501–2,000	350
1,001–1,500	600
Up to 1,000	1,000

Restrictions on Operational Fixed Stations. With the exception of control stations, the *Second General Service R&O* did not authorize the use of operational fixed facilities in the 806–821 MHz and 851–866 MHz bands. The *Second General Service R&O* also required control stations to use directional antennae with a signal strength of no more than 6 dB. Before any control station operating in the 800 MHz band could be approved, the FCC required a statement certifying that the control station was in compliance with the above regulations.

Restriction on Licensing Manufacturers and Equipment Suppliers. The *Second General Service R&O* stated that "no person engaged in the manufacture or sale of radio equipment to be used in systems authorized by this subpart, or who has any direct or indirect interest in any such manufacturing or sales enterprise, may be licensed to operate more than one common user trunked system of communications used to provide commercial service to eligibles or to the public in any one market, and no more than five such systems in the United States."

Application and Processing Procedures. The FCC required that all applications for conventional or trunked radio facilities be submitted on FCC Form 400. If an applicant was proposing to provide a dispatch service to an eligible entity on a not-for-profit, cost-shared basis, the applicant was required to furnish the following information in addition to FCC Form 400:

- A copy of the plan or agreement under which the service would be offered, including verification that the service was being provided at cost

- A statement of the purposes for which the system was to be used and the planned mode of operation

- The names and addresses of each person who participated in the sharing arrangement

- A statement showing that each participant was eligible to use the system for the purposes for which it was to be employed.

Those applicants proposing to provide dispatch service to eligible entities on a commercial basis were required to supply the following information in addition to FCC Form 400:

- A statement of the purposes for which the system was to be used and the planned mode of operation

- A statement certifying that no person eligible to use the proposed facility for the purposes for which it was to be authorized would be offered or provided service over or through the licensee's system

- A copy of the basic agreement under which the dispatch service was offered.

Those applicants proposing to provide radiotelephone service to the public on a commercial basis were required to provide the following information in addition to FCC Form 400:

- A statement of the purposes for which the system was to be used and the planned mode of operation

- A copy of the basic agreement under which the radiotelephone service was offered.

The *Second General Service R&O* also required all applicants using conventional systems to provide the number of vehicle or portable units used at the time of the assignment approval and the number of these units in service 8 months after the date of the application approval. In addition, it required all applicants using trunked systems to specify the number of mobile units to be placed in operation within the terms of the license.

Once the FCC received all applications, it would first review them for completeness, in the sequence in which they were received. After the review process, an application would either be granted and the frequency assigned, or rejected and returned to the applicant with reasons for its rejection.

A.5 Selection and Assignment of Frequencies

For both conventional and trunked systems, the *Second General Service R&O* specified that channels within the 806–821 MHz and 851–866 MHz bands would be created using a

25 kHz channeling plan, with 45 MHz of spacing between mobile and base-station frequencies. Interference protection would be provided only by mileage separation. Both trunked systems and urban-conventional systems used a separation criterion of 70 miles between co-channel bases. The suburban-conventional system used a separation criterion of 45 miles.

Trunked systems were authorized on the basis of the loading criteria presented in Table A-2. The *Second General Service R&O* further stated that any licensee using a trunked system occupied at 90 percent would be permitted to apply for additional channels. The FCC also required that any licensee of trunked facilities must either begin construction on its new system within 6 months of the frequency assignment or risk losing the grant.

Table A-2
Loading Requirements for Trunked Systems

Service Group	Vehicular Radio Units		
	5-Channel Systems	10-Channel Systems	20-Channel Systems
Police and Fire Group	300	750	1,500
Business Radio Group	500	1,000	2,000
Motor Carrier Group	800	1,600	2,500
Other Services Group	400	800	1,600
Mixed Services Group	500	1,000	2,000
Radiotelephone Group	300	400	800

Conventional systems were authorized on the basis of the loading criteria presented in Table A-3. As was the case for trunked systems, conventional system users would be allowed to apply for additional channels if proof could be provided that the user's system was at least 90 percent occupied.

Table A-3
Loading Requirements for Conventional Systems

Service Group	Channel Loading—Units Per Channel Vehicular/Portable		
	Single Licensee	Two to Five Licensees	More Than Five Licensees
Police and Fire Group	50/100	40/80	30/60
Business Radio Group	90/180	70/140	50/100
Taxicab Radio Group	150	125	100
Motor Carrier Group	150/300	125/250	100/200
Other Services Group	70/140	50/100	40/60
Mixed Services Group	—	70/140	50/100

In conclusion, the *Second General Service R&O* stated that frequency assignments would be based not only on the spectrum availability but also on the applicant's ability to demonstrate a requirement for the additional spectrum.

A.6 Summary of *Report and Order* Regulations and Policies

A review of the basic regulatory philosophy of the *Second General Service R&O* indicates that the process can best be described in terms of "what it was not rather than what it was." The process, which was neither overly restrictive nor cumbersome, allowed applicants considerable freedom in specifying the system development and management criteria of proposed systems. Even the few technical standards set forth as requirements by the *Second General Service R&O* were not overly burdensome. Instead, the FCC decided to provide land mobile users with a section of spectrum in the 800 MHz band and allow the commercial industry to recognize this allocation of spectrum as an opportunity to develop a new market. In developing this market, it was hoped that the commercial industry would enlist the aid of appropriate users. The burden was placed on land mobile service users and the commercial industry community to decide the best use of this spectrum with regard to cost efficiency, spectral efficiency, and system interoperability. Figure A-1 illustrates the "general service channel" regulatory process.

In developing the policies set forth in the *Second General Service R&O*, the FCC attempted to develop a flexible process that would allow public safety agencies an ability to cater system specifications to meet specific needs without interfering with adjacent jurisdictions. In several sections of the document, the FCC suggested that adjacent jurisdictions work together with the commercial industry to develop usable systems for all potential users. Thus, as early as 1974, the need for interoperability was an issue. The issues with interoperability, overcrowding of channels and spectral inefficiency became important topics during the early 1980s.

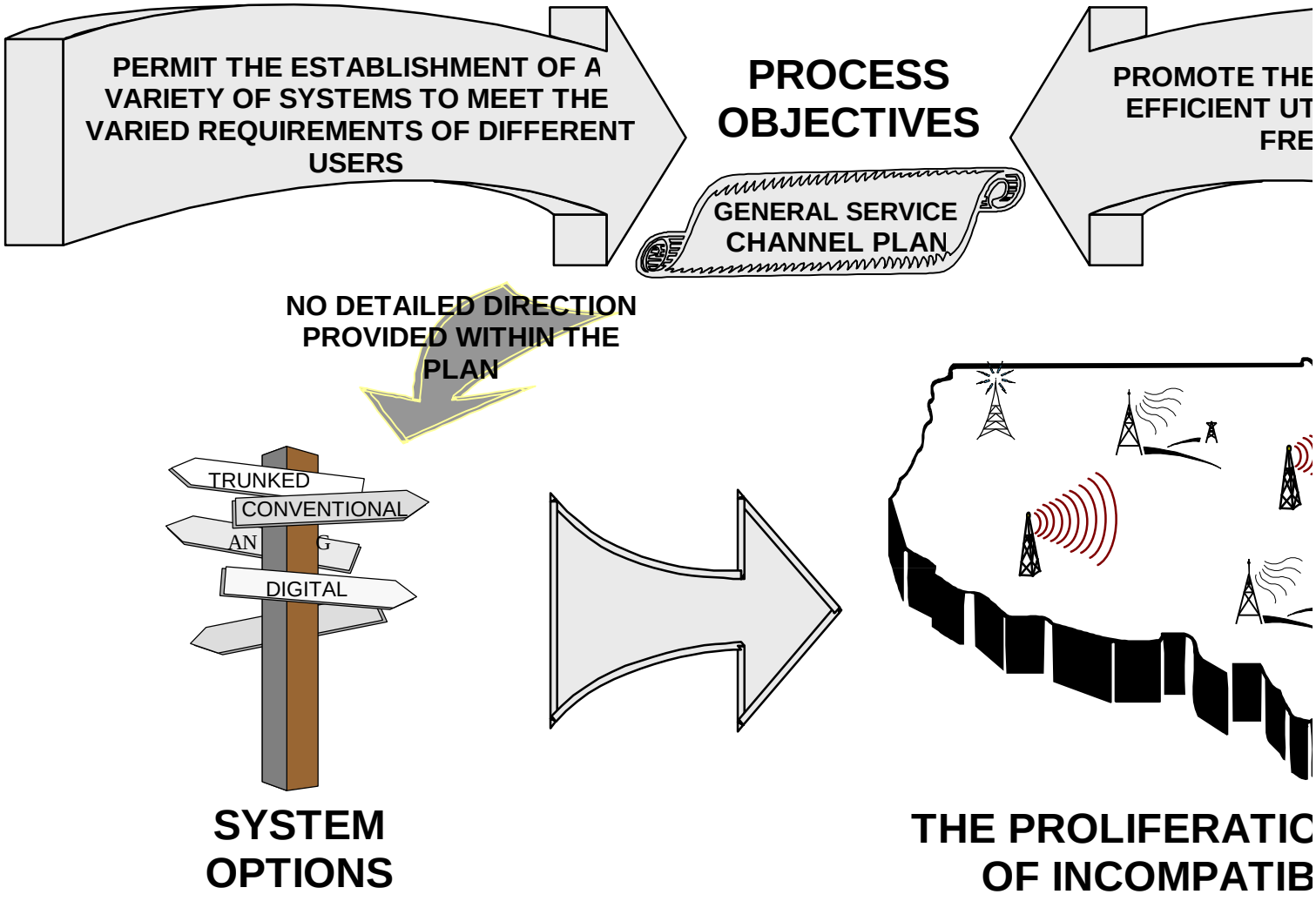

Figure A-1
General Service Channel Planning and Management Process