

In July of 2007, the FCC ordered a new 700 MHz band plan for public safety that established revised channel frequencies. Before this change, the 700 MHz public safety frequencies had been separated into 3 MHz blocks. The new FCC-ordered 700 MHz band plan combined frequencies into contiguous channel blocks.

When the FCC established the original 700 MHz band plan for public safety, a database tool, the Computer Assisted Pre-Coordination Resource and Database System, also known as CAPRAD, performed an initial nationwide assignment of channels. The role of the Regional Planning Committees was very limited in the initial CAPRAD channel assignments.

A new CAPRAD sortation of 700 MHz “General”<sup>1</sup> channels is about to be performed. Each Regional Planning Committee (RPC) Chairperson has been sent a listing of geographical areas within their RPC. Based upon the individual geographical areas within each RPC, the Chairs may assign certain channel sortation criterion as depicted in an example below in Figure 1.

County Name	Channel Block Size	Combiner Separation	Capacity Option
District of Columbia, DC	25 kHz	250 kHz ±	Minimum allotment
Allegany County, MD	12.5 kHz	0 kHz	Population model
Anne Arundel County, MD	25 kHz	25 kHz	Population model
Baltimore County, MD	12.5 kHz	50 kHz	Population model
Baltimore City, MD	25 kHz	75 kHz	Population model
Calvert County, MD	12.5 kHz	100 kHz	Population model
Caroline County, MD	25 kHz	125 kHz	Population model
Carroll County, MD	25 kHz	150 kHz	Population model
Cecil County, MD	25 kHz	175 kHz	Population model
Charles County, MD	25 kHz	200 kHz	Population model
Dorchester County, MD	25 kHz	225 kHz	Population model
Frederick County, MD	25 kHz	250 kHz	Population model

FIGURE 1 – EXAMPLE OF SORTATION CRITERION

**It is very important to note that there is a short turn-around period for this sortation data.**

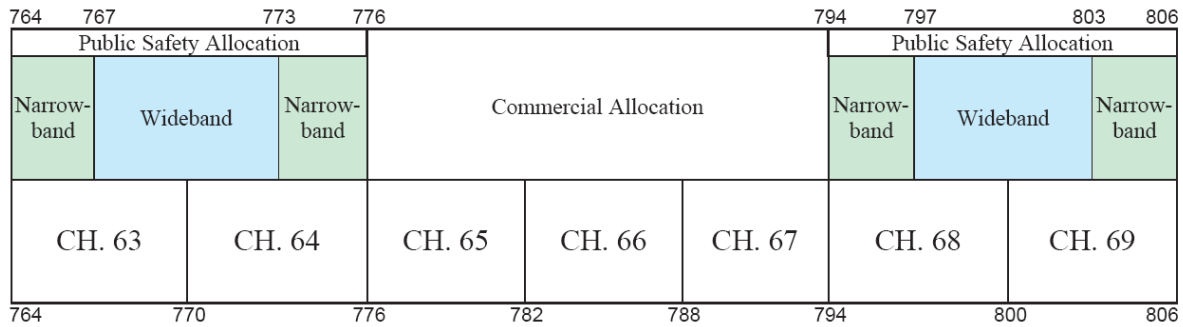
RPC Chairpersons must specify the sortation criterion for each geographical area and return the data to the CAPRAD managers by January 31, 2008. If the sortation criterion is not modified by the deadline, the new 700 MHz channel sortation for the geographical areas will be based upon the original default values used for the first sort; channel block sizes of 25 KHz with contiguous assignments separated by at least 250 KHz. The population model will also be used.

If you wish that the 700 MHz sortation criterion be changed from the default values, please return this email as quickly as possible and before January 29, 2008 to the RPC Chairperson specifying the desired “Channel Block Size”, “Combiner Separation”, and “Capacity Option” for your geographical area. If you require additional information to assist in the understanding of the CAPRAD sortation criterion, please see the following pages.

<sup>1</sup> See 47 CFR §90.531(b)(6)

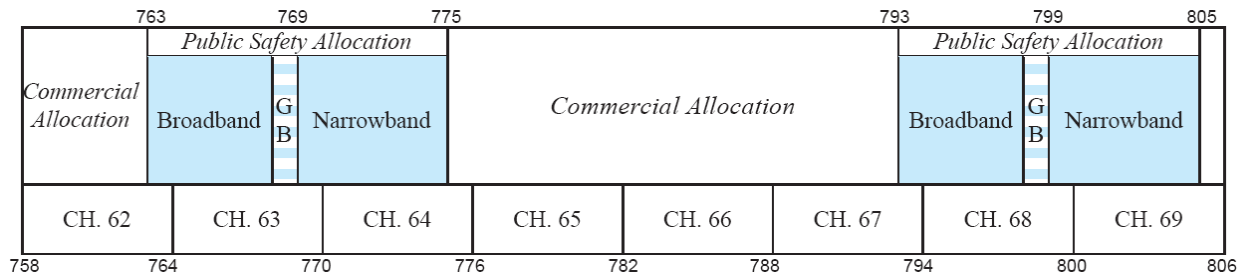
## Background

As indicated on the preceding page, the FCC ordered a new 700 MHz band plan for public safety as part of the Second Report and Order<sup>2</sup>. The old and new band plans are depicted below in Figures 2 and 3.



 Narrowband Channels  
 Wideband Channels – General Use, Reserve, Interoperability

**FIGURE 2 - ORIGINAL 700 MHz BAND PLAN**



**FIGURE 3 - REVISED 700 MHz BAND PLAN**

CAPRAD originally used a number of factors to assign the maximum number of General<sup>3</sup> channels to geographical areas while simultaneously providing co-channel and adjacent channel interference protection. The criterion used in the original CAPRAD sort of 700 MHz was based upon assignments in four (4) consecutive blocks of 6.25 KHz channels with the blocks separated by at least 250 KHz. Based upon these engineering factors as well as the population of the geographical area, generally defined as a county, CAPRAD attempted to assign the maximum number of channels available. This criterion was adopted as a strategy to be “technology neutral”.

From a background perspective, the FCC established the 700 MHz frequency band with an acute sense of spectrum management. As such, the Commission’s vision seems to favor digital multi-user trunked radio systems that promote interoperability and efficient spectrum management. From the perspective of the U.S. Department of Homeland Security (DHS), adoption of the P-25

<sup>2</sup> See FCC 07-132 Released July 31, 2007 and published August 10, 2007

<sup>3</sup> CAPRAD’s General Pool channel assignments do not relate to State channels as defined in 47 CFR §90.531(b)(5)

standard is encouraged to promote the rudimentary interoperability of public safety products produced by different equipment manufacturers.

### **Deciding Sortation Criterion**

In deciding the CAPRAD 700 MHz sortation criterion for the geographical area, the initial factor to be considered relates to fundamental questions.

*Is this a planning exercise for a future system?*

*Does the jurisdiction have a technology defined as part of a Plan or specified by a RFP or actual vendor contract?*

If the latter and the user has a contract with an equipment vendor, the user's consultant and/or vendor should be consulted to assist in the identification of the geographic sortation criterion. Conversely, if the channels may be used in the future for an undefined technology, the factors discussed below may be of value to the user.

Regardless of application or channel block size, it is critical that the geographical area understand the 700 MHz spectrum efficiency requirements of the FCC found in 47 CFR § 90.535. Those requirements are provided on the following pages.

### **Channel Block Size – 12.5 KHz (two 6.25 KHz channel pairs)**

The DHS encourages the use of the P-25 standard. P-25 systems require 12.5 KHz frequencies. In P-25 Phase I, the 12.5 KHz frequency utilizes Frequency Division Multiple Access (FDMA) to achieve one (1) talkpath. In Phase II, the 12.5 KHz frequency will use Time Division Multiple Access (TDMA) and support two (2) talk paths.

Today, all of the major manufacturers of land mobile radio equipment support the P-25 standard. Motorola's current P-25 system is called ASTRO25® while M/A-COM offers its P-25 product under the name of P25<sup>IP</sup>®. Other equipment manufacturers sell mobile and portable radios that support the P-25 standard.

From the perspective of a RPC, 12.5 KHz frequencies (two channels) potentially result in a greater number of assignments without the need to manage "orphaned" channels.

### **Channel Block Size – 25 KHz (four 6.25 KHz channel pairs)**

If the user has not made a technology decision for the future, some would recommend that 25 KHz channel blocks should be maintained for a geographical region as the default value to provide the greatest level of flexibility in the future. Through the assignment of 25 KHz blocks, P-25 systems can still be supported; however, the RPC has to deal with the issue of the remaining two unused channels also known as "orphaned" channels. The "orphaned" channels can be potentially reused in the RPC provided that adjacent channel interference does not result. Depending upon the location of the reassignment, it may be necessary to formally amend the

RPC Plan for 700 MHz and coordinate the plan's channel assignment revisions with the adjoining RPC's before re-filing the Plan with the FCC.

In addition to P-25, a 25 KHz channel block would permit the use of a wideband land mobile radio system that supports the goal of spectrum efficiency mandated by the FCC. An example of such a system is M/A-COM's OpenSky® technology that uses TDMA and permits four simultaneous talkpaths on a 25 KHz operating frequency.

From the perspective of data, a 25 KHz channel block also permits a rudimentary amount of bandwidth for data. To meet the efficiency requirements of the FCC, the channel must provide a minimum of 19.2 kbps. This may be helpful in situations where broadband capability is nonexistent or cost prohibitive.

25 KHz channel blocks are the default setting for Channel Block Size.

### **Combiner Separation**

Through the selection of combiner separation requirements, a user may impact the number of channels assigned to a geographic area by CAPRAD. Again, if a user has a system under contract with a manufacturer, the user should consult with the vendor representative or project consultant for advice.

In a "simulcast" system, most vendors will request 250 KHz of separation as a strategy to minimize the cost of a combiner. In reality, some combiners can support more densely packed channels; however, the signal losses may be somewhat higher as well as the cost of the product. In a large system, multiple combiners may be used and through careful planning, smaller separation requirements may be possible even with the use of "standard" 250 KHz combiners.

Channel spacing of 250 kHz allows the use of a single combiner when all of the channels in a geographic area are licensed and used at the same site. When the channels are used by different licensees, this wide spacing doesn't provide any advantage. Even if all channels are used at the same site, reducing the spacing to 125 kHz may require two combiners, which is common in large systems anyway to provide antenna redundancy.

In a multicast system, the separation between channels may not be as critical. With tighter combiner spacing, the geographical area should receive a greater number of channel blocks.

250 KHz of combiner separation is the default value.

### **Capacity Option**

Geographical areas may also receive channel blocks based upon the "Capacity Option" selected. The population model provides the greatest number of channel blocks while the "Minimum Allotment" method does not.

The default setting is Population Model.

#### **47 CFR § 90.535 Modulation and spectrum usage efficiency requirements**

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the following modulation standards:

(a) All transmitters in the 769-775 MHz and 799-805 MHz frequency bands must use digital modulation. Mobile and portable transmitters may have analog modulation capability only as a secondary mode in addition to its primary digital mode. Mobile and portable transmitters that only operate on the low power channels designated in §§ 90.531(b)(3), 90.531(b)(4), are exempt from this digital modulation requirement.

(b) Transmitters designed to operate in the narrowband segment using digital modulation must be capable of maintaining a minimum data (nonvoice) rate of 4.8 kbps per 6.25 kHz of bandwidth.

(c) Transmitters designed to operate in the wideband segment using digital modulation must be capable of maintaining a minimum data (non-voice) rate of 384 kbps per 150 kHz of bandwidth.

(d) The following provisions apply to licensees operating in the channels designated in §§ 90.531(b)(5) or 90.531(b)(6).

(1) With the exception of licensees designated in paragraph (d)(2) of this section, after December 31, 2014, licensees may only operate in voice mode in these channels at a voice efficiency of at least one voice path per 6.25 kHz of spectrum bandwidth.

(2) Licensees authorized to operate systems in the voice mode on these channels from applications filed on or before December 31, 2014, may continue operating in voice mode on these channels (including modification applications of such licenses granted after December 31, 2014, for expansion or maintenance of such systems) at a voice efficiency of at least one voice path per 12.5 kHz of spectrum bandwidth until December 31, 2016.

(3) The licensees designated in paragraph (d)(2) of this section must, no later than January 31, 2017, file a declaration through the Universal Licensing System that they are operating these channels at a voice efficiency of at least one voice path per 6.25 kHz of spectrum bandwidth.