

performance generally include selectivity, sensitivity, dynamic range, automatic RF gain control, shielding, modulation method, and signal processing. Receiver selectivity is the ability to isolate and acquire the desired signal from all of the undesired signals that may be present on other channels. Selectivity is a central factor in the control of adjacent channel interference. Sensitivity is the measure of a receiver's ability to receive signals of low strength. More sensitivity means a receiver can pick up lower level signals. Dynamic range is the range of the highest and lowest received signal strength levels over which the receiver can satisfactorily operate. The upper side of a receiver's dynamic range determines how strong a received signal can be before failure due to overloading occurs. Automatic RF gain control allows a receiver to adjust the level of a received signal as it appears at the unit's signal processing and demodulation sections. It can also be used to improve a unit's dynamic range and provide protection against overload. Shielding can consist of metal boxes, foil or other materials that isolate sections of a receiver from undesired RF energy.

13. Signal processing provides increased ability to isolate a desired signal from other RF energy, including another (undesired) transmitted signal. The degree to which interference immunity can be achieved through signal processing depends on the modulation method used for the transmitted signal. For example, the CDMA digital modulation system allows multiple signals to be transmitted and received simultaneously on the same frequency in the same area without intra-system interference. The analog FM modulation system provides for a "capture effect" from processing gain that allows a receiver to demodulate only the strongest signal present. Finally, in digital systems, trade-offs can be made between signal strength and data rates. In order to receive signals with higher data rates, it is generally necessary to have higher levels of signal-to-interference ratio (S/I ratio). Thus, in the presence of interfering signals the data rate could be adjusted to provide satisfactory reception. The interference immunity provided by signal processing and modulation systems is due to radio system design and signal architecture, rather than specific receiver attributes such as filtering. However, because proper use of these system factors can provide improvements in interference immunity, we are including them in the subjects to be investigated in this

proceeding for inclusion in our spectrum policies.

14. We request comment and information on the factors or combination of factors and their interaction that we need to consider in developing receiver interference immunity performance guidelines and standards, as well as the costs and benefits of such guidelines and standards. We specifically request comment on the factors affecting interference immunity we have identified above and their relative importance. We also invite parties to identify additional factors that we should consider in establishing and applying receiver immunity standards. We also seek comment and information in response to the following questions:

- Are there any special hardware designs, software methodologies, or new technologies available that would significantly enhance receiver immunity performance?
- How are these performance factors related to frequency and operating power, and influenced by the nature of the RF environment?
- To what extent, and in what way, are some factors affecting interference immunity relatively more important than others across receivers used with different services or across devices that receive signals transmitted using different modulation methods?
- Are there factors that must be considered as a group and not independently due to their cross-interactions or relationships with other factors?
- Are some factors less important in providing interference immunity in certain modulation systems or receiver designs?
- How should any such differences be treated in specifying receiver immunity guidelines or standards?
- Can receiver interference immunity parameters be ranked in accordance with their level of importance to performance? What procedures or criteria should be used to determine how to trade off the level of receiver performance with the practical issues of cost and implementation?
- Should system characteristics such as signal processing gain and modulation methods that facilitate immunity from interference in receivers be considered germane to the process of establishing receiver performance guidelines or standards?
- Do new and emerging advanced radio systems, including those employing digital modulation, offer potential for significantly improving receiver immunity to interfering signals? What

are the inherent performance limitations of these technologies?

15. The interference environment in which a receiver operates can be highly variable and its characteristics may often be strongly service related. That environment must first be identified and characterized to allow, at least in principle, the development of emission criteria that provide for quantitative comparisons of receiver performance. We request comment on the following questions concerning the interference environment in which receivers operate:

- What are the characteristics of the RF environment in which existing receivers or groups of receivers operate?
- If studies were to be carried out, what would be an efficient way to capture any relevant data or pertinent events given the dynamic changing nature of the environment over time?
- Should different receiver specifications or approaches be taken based on the environment in which the receiver is expected to operate (for example, high-powered or lower-powered frequency bands).

16. Another approach to describing the interference environment would be to develop a generic environment in which all receivers would be expected to perform adequately. Once the environment was identified, criteria directly related to receiver performance in that environment could be established. One way to measure performance would be to look at the signal to noise levels (S/N) of analog systems and the bit error rate (BER) of digital systems. These metrics are quantifiable, but specific levels or ranges would have to be developed. Another approach to receiver performance quantification would be to use generally agreeable criteria that have come about over years of development and interaction with equipment and the marketplace. For example, the 55 dB attenuation standard for adjacent channel protection by cable compatible consumer electronics equipment in Section 15.118(c)(1) was set based on manufacturers' experience with such equipment and their knowledge of the tolerance of equipment suppliers for that level of performance. We request responses to the following questions relating to the establishment of a generic receiver environment and possibilities for measuring receiver performance there under:

- If a generic environment were employed, how many conditions would have to be considered to cover the variability of the natural environments, (*i.e.*, narrow band,