Receiver Standards vs. Protection Limits

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There are two regulatory approaches to influencing receiver performance.

In one, the regulator/spectrum manager specifies the *interference environment* that the victim system is expected to operate in so that the system engineer can then specify the characteristics of a receiver that can operate successfully in that environment.

In the other, the manager specifies minimum *receiver characteristics*, e.g. sensitivity and front-end performance. While the advantages and disadvantages of each approach are be well understood in the engineering community, more work is required to deepen understanding and reach consensus in the policy community.

The following table compares and contrasts the two approaches to prompt debate about their respective merits.

	Receiver standards	**Protection Limits**
	Orientation: Performance Ratios, e.g. desired/undesired , C/I, SNR in dB Deterministic	Orientation: Environment Absolute values, e.g. field strength density in dB(µV/m)/MHz Probabilistic
	Example: Cable TV receivers Part 15.118 (e-CFR) - detailed requirements and measurement methods for adjacent channel interference, image channel interference, direct pickup interference, tuner overload and cable input conducted emissions	Example: Profile of ceiling on resulting average field strength density at percentage of locations from other operators, in-band and out-of-band, and peak resulting total field strength density in adjacent channels
The Case for Receiver Standards	Pro: Certainty; compliance easily verifiable, e.g. with bench test of receiver	Con: Compliance validation requires modeling and/or measurement, with assumptions about propagation models and/or sample statistics
	Pro: Deterministic test of receivers makes it easy to determine harm if receivers suffer interference (given a harmful interference caveat on transmitter rights)	Con: Probabilistic resulting field strength metric makes it hard to apportion blame if multiple transmitters combine to exceed reception protection limit
	Pro: Allows detailed individualization of rules to particular circumstances of a given band	Con: Short list of parameters may omit a key parameter that is vital to the effective management of a particular case
		Con: Doesn't capture nuances of harmful interference mechanisms, e.g. different impact of different modulations
		Con: Protection limits attached to a transmitter license are useless when receivers are not controlled by licensee (e.g. TV, GPS)

The Case for Protection Limits	Con: Long list of parameter values	Pro: Short list of parameter values
	Con: Parameters technology- and service-specific; depend on receiver architecture	Pro: Parameters technology- and service-neutral (though parameters choice encodes assumptions)
	Con: Ratchet* requires predicting details of technology evolution, since trade-offs between performance parameters are tied to receiver architecture	Pro: Ratchet* is technology-independent since it specifies operating environment, not receiver performance
	Con: Regulator determines implementation details, constraining ability of manufacturers to innovate and operators to make commercial trade-offs	Pro: Flexibility; implementation details, including using cheap and poor receivers but living with service degradation, left to receiver operators
	Con: Incoherence; no overall framework for rulemaking, have to start from scratch every time	Pro: Uniformity of approach in all cases makes rulemaking easier and more predictable
	Con: May block innovation since detailed receiver performance specs may preclude the deployment of a new service with different receiver architecture	
	Con: Uncertainty for adjacent operators – given a C/I criterion, a neighboring transmitter operating unchanged (constant I) may unexpectedly cause harm if the victim system merely reduces its power (reduced C)	
	Con: Regulator's authority to specify receiver standards may be contested	

* Ratchet: A multi-step, multi-year transition between current receiver performance and improved future ones, e.g. progressively more stringent requirements on either performance or operating environment defined at year zero, ten, and twenty.

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