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BEFORE THE
Federal Communications Commission
WASHINGTON, D.C.

In the Matter of)
)
Implementation of Section 17 of the)
Cable Television Consumer Protection) ET Docket No. 93-7
and Competition Act of 1992)
)
Compatibility between Cable Systems)
and Consumer Electronics Equipment)

PETITION FOR RECONSIDERATION OF GENERAL INSTRUMENT CORPORATION

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June 15, 1994

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SUMMARY

The Commission's rule prohibiting cable operators from altering the infrared codes used to operate the remote control capabilities of their set-top devices (hereinafter "the infrared alteration ban"), while well-intentioned, is a heavy-handed solution in search of a problem. The putative anticompetitive behavior cited by CFA/HRRC and the Commission as justification for the ban amounts to little more than an imagined risk for which no record support exists. Nor will such anticompetitive behavior arise in the future due to:

- the substantial expense and technical difficulty in carrying out such a strategy;
- the modest return operators can expect from the lease/sale of remote control units under the Commission's actual-cost equipment standard;
- the fact that most remote controls owned by cable subscribers are universal remotes which are preprogrammed to operate compatibly with most cable set-top converters; and
- the mounting competitive threat presented to cable by alternative multichannel video distributors.

In addition, the infrared alteration ban is both overinclusive and underinclusive -- overinclusive in that it punishes all operators prospectively, regardless of individual operator practices, and underinclusive in that it unjustifiably singles out cable operators as eternal guardians of subscriber-owned remotes without any explanation as to why TV/VCR manufacturers are not also covered.

Equally important, in the process of trying to anticipate and prevent operator behavior that will not eventuate, the

infrared alteration ban will create serious technical difficulties and increased costs for operators and set-top suppliers which, in turn, will generate substantial anti-competitive and anti-innovation effects. The ban will stifle competition in the supply of set-top converters to cable systems by encouraging operators to favor their existing set-top suppliers to the detriment of potential new entrants. Moreover, by freezing operators' IR codes at their current levels, the ban will create significant disincentives for set-top suppliers to develop, and cable operators to implement, advanced IR code schemes and new remote control technologies which might otherwise increase efficiencies and subscriber options. The imposition of such a technological moratorium on emerging IR and related technologies is fundamentally at odds with overriding congressional, Commission, and executive branch policy objectives.

Accordingly, GIC respectfully urges the Commission to delete the infrared alteration ban from its rules.

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PETITION FOR RECONSIDERATION OF GENERAL INSTRUMENT CORPORATION

General Instrument Corporation ("GIC") hereby seeks reconsideration of one aspect of the First Report and Order adopted in the above-referenced proceeding.¹ For the reasons stated below, the Commission should delete its rule prohibiting a cable operator from altering the IR codes used to operate the remote control capabilities of the set-top devices employed by the operator (hereinafter "the infrared alteration ban" or "the ban").²

I. THE INFRARED ALTERATION BAN FINDS NO SUPPORT IN THE RECORD, MARKETPLACE REALITIES, OR THE 1992 CABLE ACT

The Commission's infrared alteration ban finds no support whatsoever in the record. Indeed, the Commission bases its

¹ Equipment Compatibility Order, ET Docket 93-7, FCC 94-80, released May 4, 1994 ("Compatibility Order").

² See 47 C.F.R. § 76.630(c).

adoption of this rule solely on three-paragraphs of speculation made by the Consumer Federation of America/The Home Recording Rights Coalition ("CFA/HRRC") in their joint reply comments.³ CFA/HRRC presented no evidence of operator behavior to justify its draconian proposal. Rather, they simply asserted that such a rule was necessary because, absent such a prohibition,

cable systems could easily frustrate th[e] competitive remote control market ... [because] new cable infrared codes could disable a remote control that was cable-compatible upon purchase.⁴

In short, CFA/HRRC's proposal was grounded in little more than an unsubstantiated belief that unless the Commission addressed this purported "incompatibility risk," cable subscribers "would be reluctant to purchase remote controls from independent retailers," and "would continue to be dependent on their local cable monopoly for their remote control supply."⁵

However, CFA/HRRC's analysis and the Commission's rule fail to appreciate the fact that the operator behavior postulated as justification for the infrared alteration ban is strictly illusory; cable operators have no incentive to have their replacement set-top converters engineered for the sole purpose of disabling subscriber-owned remotes. This is especially true

³ CFA/HRRC did not file comments on the Commission's NPRM. As such, cable operators and other interested parties were not afforded an opportunity to formally respond to the proposed infrared alteration ban in the reply round. Nor was there any suggestion in the Commission's NPRM proposals that such a ban was even contemplated.

⁴ CFA/HRRC Reply Comments at 9.

⁵ Id.

under the current regulatory regime. Given the Commission's actual cost standard for recovery of regulated equipment costs, the return the operator can expect to receive from the rental/sale of its remotes provides no incentive to engage in the behavior CFA/HRRC envisions. This fact is borne out by the Commission's findings in its "Cable Regulation Impact Survey:"

The lion's share of the change in charges observed between April and September [1993] were in charges for remotes and additional outlets; rates for remotes declined nearly 90%, from \$2.08 to \$.23 per month⁶

Moreover, aside from the impact of the actual-cost equipment standard, operators will not undertake such anticompetitive behavior for the simple fact that it is too expensive to execute and too likely to alienate cable subscribers. In order to effectuate the strategy CFA/HRRC and the Commission postulate, an operator would have to:

- (1) select a replacement set-top converter based not on the inherent attributes of the set-top itself but on the set-top supplier's ability to implement different IR codes from the ones used by the operator's current set-tops in order to frustrate subscriber-owned remotes;
- (2) incur substantial expenses for the purchase of these new replacement set-top converters for all of its subscribers;
- (3) pay for truck rolls to every subscriber home to install the replacement converter (or risk annoying subscribers still further by requiring them to pick up the converter at the operator location); and

⁶ FCC Cable Regulation Impact Survey: Changes in Cable Television Rates Between April 5, 1993 - September 1, 1993 Report and Summary, Cable Services Bureau, Released February 22, 1994, at 5.

- (4) hope that this complicated and expensive strategy would drive subscribers to lease or purchase operator remote controls, rather than (i) lease or purchase a new third-party remote; and/or (ii) file a complaint against the operator with the Commission or local franchising authority; or (iii) discontinue cable service.

The likelihood of CFA/HRRC's "incompatibility risk" actually materializing is reduced still further by the fact that most remote controls owned by cable subscribers are universal remotes which are preprogrammed to operate compatibly with most cable set-top converters.⁷ Set-top manufacturers, such as GIC, generally provide developers of universal remotes documentation on the various IR codes and carrier frequencies they use in order to ensure compatibility with their set-tops. Thus, even if an operator replaced its current set-top converters with new converters that use different IR codes, the majority of subscriber-owned remotes would be compatible with the new set-tops.

In addition, CFA/HRRC's proposal and the Commission's ban completely ignore the substantial disincentive cable operators have to engage in such behavior given the mounting competitive threat they face from alternative multichannel video programming distributors. DBS is expected to initiate service on June 23,

⁷ See Consumer Electronics and Cable System Compatibility, Report to the Congress, October 1993, at 27 ("Universal remotes can be programmed or 'taught' to operate any set-top device and thus can be used to operate other consumer devices, such as a TV receiver or VCR") ("Compatibility Report").

1994⁸ and LMDS operators will not be far behind. Local telcos have filed nearly 30 video dialtone applications with the Commission; the Commission has already granted five, with the assurance of expedited consideration of the pending applications as well as quick resolution of the pending petitions for reconsideration. In addition, SMATV, MMDS, and HSD continue to garner increased subscribership as the emergence of improved wireless technologies and digital compression have facilitated competitive pricing and increased offerings. Lastly, the statutory prohibition on LEC-provision of video programming within their service areas is under active review. Congress is considering legislation to repeal this ownership restriction,⁹ and several LECs have already challenged (one, successfully) the constitutionality of the restriction.¹⁰ The expanding level of competition from these various sources coupled with the regulatory constraints currently placed on cable systems render the anticompetitive behavior contemplated by the ban a non-option for cable operators.

⁸ Chris McConnell, "New DBS Deadline: June 23," Broadcasting & Cable, June 6, 1994, at 57.

⁹ See H.R. 3636, 103rd Cong., 1st Sess., 139 Cong Rec. E-3114 (1993) and S. 1822, 103rd Cong., 2nd Sess., 140 Cong. Rec. 771-788 (1994).

¹⁰ See, e.g., Chesapeake and Potomac Tel. Co. v. U.S., 830 F. Supp. 909 (E.D. Va. 1993), Amended Final Order, Civ. No. 92-1751-1 (Oct. 7, 1993), appeal docketed, Nos. 93-2340 and 93-2341 (4th Cir. Oct. 15, 1993) (holding section 533(b) of the Communications Act unconstitutional as applied to Bell Atlantic within its service areas).

Finally, the infrared alteration ban finds no support in the 1992 Cable Act. In particular, Section 17(c)(2)(E) -- which CFA/HRRC cite¹¹ and upon which the Commission implicitly relies¹² as authority for the ban -- is decidedly inapposite. Section 17(c)(2)(E) was adopted to curtail a specific practice engaged in by certain cable operators who disabled the remote control capability of their set-top converters if subscribers did not lease/purchase their remotes from the operator. In so doing, these operators prevented the use of all commercially available remotes, thereby forcing the subscriber either to obtain a remote from the operator or to pay the operator a monthly fee to re-activate the remote control capability of the set-top so the subscriber could use a commercially available remote.

It is important to note that this practice, unlike the behavior targeted by the Commission's infrared alteration ban, occurred in an unregulated environment in which the return on remote control rental/sale was highly profitable, the disabling function was easy and inexpensive to implement (usually requiring

¹¹ CFA/HRRC Reply Comments at 9.

¹² Compatibility Order at ¶ 63 ("Our requirement that cable operators otherwise take no action to prevent the use of subscriber-owned remote controls also includes CFA/HRRC's suggestion that we prohibit cable operators from changing the IR codes used to operate the remote control capabilities of the set-top devices they employ").

no more than the flip of a switch at the cable headend),¹³ and the competitive threat to cable was not what it is today.

To end this pre-regulation practice, Congress adopted Section 17(c)(2)(E) which requires operators to ensure that their set-tops operate compatibly with "commercially available remote control units." Thus, for example, Section 17(c)(2)(E) prohibits operators from turning off the remote control capability of operator-provider set-tops, since the effect of this practice would be to "disable[] the converter box supplied by the cable operator from operating compatibly with commercially available remote control units." Importantly, Section 17(c)(2)(E) does not require that cable operators guarantee that their set-tops operate compatibly with every subscriber-owned remote as the Commission's order suggests.¹⁴ Seen in this light, the infrared alteration ban relies on an unjustifiable broadening of the plain language and underlying intent of Section 17(c)(2)(E), neither of which supports such a cable-financed insurance program for individual subscriber-owned remote control units.

II. THE INFRARED ALTERATION BAN IS BOTH OVERINCLUSIVE AND UNDERINCLUSIVE

Even if one could point to anecdotal evidence of such anticompetitive operator behavior, such isolated incidents would

¹³ See Compatibility Report at 27 ("In cases where a subscriber no longer desires to rent a remote control unit from the cable system, the operator generally turns off the remote feature of the set-top by sending an electronic signal to the set-top unit").

¹⁴ See Compatibility Order at ¶ 63.

not justify the Commission's technological proscription. This is especially true given the fact that the Commission's rate rules already proscribe the behavior which the infrared alteration ban seeks to prevent. In the Third Order on Reconsideration, the Commission held that "adding previously unneeded equipment and charging for that equipment in order to provide customers with the same services they received previously" would constitute a potential evasion of the rate rules.¹⁵ Dealing with the issue as a potential evasion of the rate rules is preferable as a policy matter, since this approach focuses on the specific practices of individual cable operators and, if appropriate, penalizes those operators accordingly, rather than crafting an overinclusive technological ban which prospectively penalizes all operators for behavior in which they have no incentive to engage.

At the same time, the infrared alteration ban is underinclusive in that it unjustifiably singles out cable operators as eternal guardians of subscriber-owned remotes. The Commission provides no explanation as to why its ban does not apply to consumer electronics products. Indeed, the Commission doesn't even address this issue. Yet, the "incompatibility risk" that gave rise to the ban -- i.e., the potential disabling of subscriber-owned remotes -- certainly extends to the consumer electronics realm, as well. For example, if a consumer who owns a remote control that operates compatibly with his TV, VCR, and

¹⁵ Third Rate Reconsideration Order, 74 R.R.2d (P&F) 1274, ¶ 135 (1994).

set-top converter replaces his TV/VCR with a new TV/VCR that uses different IR codes, it is possible that the subscriber's old remote will be incompatible with the new TV/VCR. Alternatively, the consumer may replace his operator-provided set-top converter with a commercially available converter which may render inoperable the previously compatible subscriber-owned remote.

If the Commission is primarily concerned about disenfranchising subscribers who use old remotes, why aren't TV/VCR manufacturers (who are equally responsible under Section 17 for assuring compatibility) covered by the Commission's ban? Similarly, why should a subscriber who uses an operator-provided set-top be entitled to greater protection than a subscriber who purchases/leases its set-top from Radio Shack? In the end, the Commission's rule amounts to little more than a selective penalty on cable operators for imaginary behavior which they have neither the incentive nor the ability to undertake.

III. THE COMMISSION SERIOUSLY UNDERESTIMATES THE TECHNICAL DIFFICULTIES, COSTS, AND BURDENS WHICH THE INFRARED ALTERATION BAN WILL IMPOSE ON CABLE OPERATORS AND SET-TOP MANUFACTURERS

The Commission's perfunctory observation that its ban "will [not] be a significant burden for cable operators, as they can simply choose replacement equipment that operates with the same IR codes as their existing equipment"¹⁶ seriously underestimates the technical difficulties, costs, and burdens imposed on cable operators and set-top manufacturers.

¹⁶ Compatibility Order at ¶ 63 (footnote omitted).

The Commission's observation is based on the incorrect assumption that new equipment manufacturers will be able to employ the same IR codes for remote controls as are used with subscribers' existing set-top equipment. The reality is that manufacturers, such as GIC, are not able to simply take all existing IR codes and employ them in their equipment because some companies have copyrighted their libraries of device codes. In order for other vendors to use such proprietary codes, rights must be granted, typically by way of licensing. Because such licensing has not been widespread to date, negotiations between set-top suppliers over licensing terms and conditions would be required. This, of course, assumes that the owners of the proprietary codes are willing to license the codes in the first place. For these reasons, although operators may specify to the set-top manufacturer the codes they wish to employ in replacement equipment, the ability of a manufacturer to deliver equipment which includes such codes is far from certain.

In addition, the Commission's ban fails to take into account the nature of IR technology, including the different coding and modulation methods, the conflicts in IR codes now in use, and the expected increase in such codes as new functions are added to TVs and set-top converters. The Commission also incorrectly assumes that the IR codes embedded in older set-top terminals continue to be used in newer set-top terminals. In fact, GIC and other manufacturers periodically make improvements to their IR signalling techniques such that old IR codes are not all employed

in updated models. Such improvements include but are not limited to the use of new or different frequencies or modulation schemes.

The Technical Appendix which GIC submits herewith shows that there are a variety of technologies used by IR remote controls (e.g., pulse position modulation, carrier modulation with several different choices of carrier frequencies), as well as different pulse widths and different assignments of codes to specific functions. The technology has changed over time, and will continue to change. Similarly, the assignment of codes has changed over time, and will continue to do so, particularly as more codes must be assigned to support additional functions.

For example, as the Technical Appendix explains, whereas the Jerrold 5507 set-top converter and its associated remote control use an IR carrier frequency of 26.67 kHz and pulse widths of 1.6 milliseconds, other models use different carrier frequencies and different pulse widths. And it would be difficult or impossible to redesign this product to support remote controls that were intended for use with some of the older Starcom set-tops, which used non-carrier pulse position modulation and pulse widths of 8, 12, and 24 milliseconds.

Similarly, while most GIC set-top converters support a set of 32 different IR remote control codes, older units support fewer codes while emerging products have the capability to support up to 256 different codes. As shown in the Technical Appendix, these IR codes can conflict with one another, even though the products are offered by a single manufacturer. In

short, given the wide range of technologies available for IR remote controls, it is by no means clear that cable operators, notwithstanding the "quantity" of set-tops ordered, could simply "specify the specific codes to be used in new equipment,"¹⁷ or that such a specification would be sufficient to allow continued use of older remote controls. The differences in IR technology from one product to another -- as well as the existence of non-licensed proprietary IR schemes -- may make it impossible to support both old and new IR technologies in a single IR receiver in a set-top converter.¹⁸

Nor would the incorporation of a "universal," agile receiver into set-top equipment -- an expensive and technically difficult proposition -- facilitate compliance with the infrared alteration ban. In addition to detecting and receiving a wide range of pulse widths, such a receiver would need to determine whether the IR transmission is pulse position modulation or carrier modulation, as well as the particular carrier frequency being used. GIC is not aware that any such IR receiver exists. But even if one were designed, proprietary infrared codes and conflicting IR codes from different manufacturers would likely render such a device unusable.

¹⁷ Compatibility Order at n. 40.

¹⁸ GIC is not aware of any comprehensive catalog of IR technologies and codes available to cable operators, nor are there, as far as we know, public standards for IR remote control technology.

Taken together, the foregoing technical problems impose unreasonable and impractical burdens and costs on both cable operators and set-top manufacturers. The result, as described in the following two sections, will be deleterious effects on: (1) competition in the set-top supplier market and (2) the development of innovative IR and related technologies.

IV. THE INFRARED ALTERATION BAN WILL STIFLE COMPETITION IN THE SUPPLY OF SET-TOP CONVERTERS TO CABLE SYSTEMS

In its efforts to protect subscribers from a non-existent problem, the Commission has succeeded in erecting a substantial barrier to entry for set-top manufacturers who seek to supply their products to cable systems. From time to time, cable operators replace set-top converters because of severe security breaches, problems with obsolete equipment, or simply because the operator seeks to expand the services offered to subscribers. These are all legitimate reasons for upgrading such equipment. However, the real-world anticompetitive effect of the Commission's infrared alteration ban will be to encourage operators to favor their existing set-top suppliers to the detriment of potential new entrants.

As described in the previous section, if cable operators are required to support old IR codes, the result will be more expensive set-top converters that include the necessary work-around to support the IR scheme of the devices being replaced as well as the new devices with better signalling characteristics. Thus, in addition to any increased costs incurred due to

licensing fees for the use of proprietary codes, the replacement set-tops might include extra costs for more memory to handle more complex IR code reference tables, as well as more expensive IR receivers.¹⁹

The problems discussed above will be compounded by the fact that most cable operators presently use, within a given system, a number of different set-top converters that incorporate a variety of IR schemes. This multiplicity of set-tops is a result of operator design in most instances, but often may stem from (1) cable systems merging with other cable systems that may have deployed different set-top equipment with different IR codes; or (2) the Commission's compatibility rules under which third-party set-tops, which may utilize different IR codes, will become more widely deployed in cable subscribers' homes. Thus, the mere fact that "in large quantity orders, cable operators will be able to specify the specific codes to be used in new equipment"²⁰ is immaterial, since in many cases the operator may not even know the full range of codes to specify.²¹ In order to comply (if

¹⁹ Of course, such increased set-top costs would ultimately redound to the detriment of subscribers who would experience higher cable equipment rates, as well.

²⁰ Compatibility Order at n. 40.

²¹ The Commission also overlooks the fact that many cable systems, especially small systems, may not be able to make the "large quantity orders" necessary to allow them to dictate the preferred IR code configuration to the set-top supplier. In this case, yet another anticompetitive outcome will ensue since the operator will be forced to select an alternative set-top based not on the inherent attributes of the product but on the supplier's willingness and ability to implement the specified IR codes.

compliance is at all possible) with the infrared alteration ban under these circumstances, system operators would have to choose between maintaining a stock of multiple types of replacement converters or ordering more expensive set-top converters that either include all of the alternative IR schemes used in the particular cable system (provided any proprietary codes could be licensed) or that support a very broad range of IR schemes.

The additional costs, burdens, and technical difficulties which cable operators would face in complying with this ban would inhibit many operators from replacing older equipment with new equipment, thereby solidifying the entrenched position of existing set-top suppliers while substantially reducing the ability of new suppliers to compete for cable operator business. As such, the ban undermines one of the principal objectives of the Commission's compatibility regulations, *i.e.*, to "provide and encourage competition in the market for equipment used by subscribers to receive cable service.... includ[ing] channel converters, remote control units and other customer premises equipment."²²

V. THE INFRARED ALTERATION BAN WILL STIFLE TECHNOLOGICAL INNOVATION, CONTRARY TO OVERRIDING CONGRESSIONAL, COMMISSION, AND EXECUTIVE BRANCH POLICY OBJECTIVES

The infrared alteration ban will stifle the development of advanced IR codes and impede the emergence of related technologies and services. By freezing operators' IR codes at

²² Equipment Compatibility NPRM, 8 FCC Rcd. 8495, ¶ 11 (1993).

their current levels, the ban will create significant disincentives for set-top manufacturers to develop, and cable operators to implement, advanced IR code schemes and new remote control technologies which would increase efficiencies and subscriber options. For example, set-top suppliers contemplating alternative techniques for improving remote control communications (e.g., using radio waves in place of IR codes) may abandon such projects for fear they would not be implemented due to the infrared alteration ban. In addition, the deployment of new, interactive services which will require more sophisticated remote control code schemes may be substantially delayed or entirely thwarted due to the ban.

The imposition of such a technological moratorium on emerging IR and related technologies is fundamentally at odds with overriding congressional, Commission, and executive branch policy objectives. Section 7 of the Communications Act of 1934, as amended, provides: "It shall be the policy of the United States to encourage the provision of new technologies and services to the public."²³ In addition, among the primary policy objectives of the 1992 Cable Act is the congressional desire to "ensure that cable operators continue to expand, where economically justified, their capacity and the programs offered over their cable systems."²⁴

²³ 47 U.S.C. § 175.

²⁴ 1992 Cable Act § 2(b)(3).

More specifically, any attempt by the Commission to freeze IR codes to ensure compatibility frustrates the statutory provisions of Section 17 which properly anticipate "improvements and changes in cable systems," and which consequently instruct the Commission to review periodically and, if necessary, modify its compatibility regulations to accommodate these improvements ~~and~~ changes.²⁵ It is also to one of the "major purposes" of Section 17, namely to "ensure that consumers reap the benefits of new and innovative technologies."²⁶

Finally, at a time when the cable industry is poised to contribute significantly to the development of the National Information Infrastructure, the imposition of a moratorium on IR codes and, indirectly, related technologies is particularly ill-conceived in that it will delay the deployment of important elements of the NII initiative.

²⁵ Id. § 17(d).

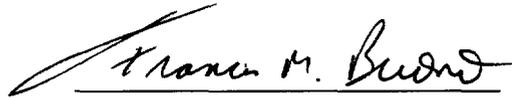
²⁶ 138 Cong. Rec. H8649, H8649 (daily ed. Sept. 17, 1992) (statement of Rep. Schumer).

CONCLUSION

For the reasons set forth above, GIC respectfully urges the Commission to delete 47 C.F.R. § 76.630(c) from its rules.

Respectfully submitted,

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June 15, 1994

TECHNICAL APPENDIX

INFRARED REMOTE CONTROL TECHNOLOGY

There are at least two different types of IR remote control technology in use today, pulse position modulation (PPM) and carrier modulation, as well as variations within these two types due to differing pulse widths and carrier frequencies.

Pulse position modulation employs pulses of IR that are sent at specified intervals. IR carrier modulation employs a carrier frequency to modulate the IR source, supplemented by pulse position modulation of the modulated carrier.

Many of the Jerrold IR carrier-modulation products use a 38 kHz carrier frequency. However, some products (e.g., the Jerrold 5503-VIP, 5507, and 5508 addressable converters) employ a 26.67 kHz carrier frequency. Those two groups of products are not interoperable; a set-top converter that receives 38 kHz IR signals cannot receive 26.67 kHz signals. There is no industry standard for IR carrier frequencies; other manufacturers may use other carrier frequencies.

PULSE WIDTHS

Specific pulse widths employed by Jerrold converters that use PPM include 8, 12, and 24 milliseconds. The digit "zero" is represented by a pulse width of 12 milliseconds; the digit "one" is represented by a pulse width of 8 milliseconds; and a 24 millisecond pulse is a "synch" pulse. However, there is no industry standard for pulse widths, and different manufacturers may use different pulse widths for the PPM codes.

Pulses used with IR carrier modulation systems are shorter than those used with PPM systems. In most Jerrold products that employ IR carrier modulation, a "zero" is represented by a carrier-on pulse of 2.25 milliseconds and a "one" is represented by a carrier-on pulse of 4.5 milliseconds. However, in other products (e.g., the Jerrold 5503-A addressable converter), "zero" is represented by carrier-on and "one" by carrier-off for 1.1 milliseconds or (for the Jerrold 5503-VIP, 5507, and 5508) for 1.6 milliseconds.

IR CODES

The IR codes that control specific functions in the set-top converter are created as sequences of pulses. For example, the code "decimal 07" might be represented as the sequence of "zeros" and "ones" that comprise the binary representation (0111) of the number 7; the IR remote control sends the proper set of pulses that correspond to that sequence of zeros and ones. Most Jerrold products today support a set of 32 IR codes. However, older products supported fewer codes, and newer models support up to 256 different IR codes.

Jerrold IR products are not consistent in the choice of codes for specific functions. For example, the following table lists the IR codes used for the ON/OFF function:

| <u>CODE</u> | <u>PRODUCT</u> |
|-------------|-------------------------------------|
| 19 | Starcom 400, 450 |
| 28 | Starcom V |
| 03 | Starcom 6+, Starcom 7, Impulse 7000 |
| 24 | 5503-A, 5507, 5508 |