Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Digital Broadcast Copy Protection	)	MB Docket No. 02-230
	)	
	)	

COMMENTS OF ELECTRONIC FRONTIER FOUNDATION

Electronic Frontier Foundation
454 Shotwell Street
San Francisco, CA 94110
(415) 436-9333

Fred von Lohmann
Senior Intellectual Property Attorney

Cory Doctorow
Outreach Coordinator

Seth David Schoen
Staff Technologist

December 6, 2002

CONTENTS

Page

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Digital Broadcast Copy Protection	)	MB Docket No. 02-230
	)	
	)	

COMMENTS OF ELECTRONIC FRONTIER FOUNDATION

December 6, 2002

The Electronic Frontier Foundation (EFF) is pleased to submit the following comments in response to the Commission's August 8, 2002 Notice of Proposed Rulemaking (NPRM), FCC No. 02-231, in the above-captioned proceeding.

I. About EFF

The EFF is a member-supported nonprofit organization devoted to protecting civil liberties and free expression in technology, law, policy and standards. With over 7,000 dues-paying members and over 30,000 mailing-list subscribers, EFF leads the global and national effort to ensure that fundamental liberties are respected in the digital environment.

EFF has been involved with the broadcast flag issue since November 2001. We participated in all the meetings of the Broadcast Protection Discussion Group (BPDG) and submitted a minority opinion to the *Final Report of the Co-Chairs of the Broadcast Protection Discussion Group to the Copy Protection Technical Working Group* ("*BPDG Final Report*"). In addition, we established the *Consensus at Lawyerpoint* weblog[1], the first publicly available source of information about the BPDG proceedings and the broadcast flag issue.

[1] Available at http://bpdg.blogs.eff.org/.

II. Introduction

Advocates of a broadcast flag mandate—primarily motion picture studios and the technology firms who stand to gain an advantage as a result of the mandate—present the flag as a technical solution to a perceived problem of "Internet piracy" the redistribution of free, over-the-air television programming on the Internet without authorization.

In their view, unauthorized Internet redistribution will explode as a consequence of the DTV transition, and fear of this hypothetical explosion is purportedly chilling motion picture companies from licensing works for broadcast on DTV. They contend that their reluctance and the resulting shortage of "high-quality content" available through terrestrial DTV broadcast is retarding the transition to DTV, and so are calling upon government to back a broadcast flag mandate to set their minds at ease. Once they are comfortable with the "safety" of DTV, so goes the argument, they may make more "high-quality content" available, and thereby spur consumer adoption of DTV.

These contentions and the conclusions that flow from them are all highly suspect. First, whether or not "Internet piracy" is a problem today, the terrestrial broadcast of DTV has nothing to do with that "problem." Second, even in the absence of a broadcast flag mandate, there is plenty of high-quality content (even high-quality films from the vaults of the major motion picture studios) on free, over-the-air DTV channels. Today, fully half of the most popular prime-time television programs are being broadcast via DTV.[2] And more programming is on the way.

Furthermore, even if DTV posed a new and serious threat of unauthorized Internet redistribution, the broadcast flag would do nothing to eliminate it. Infringers will go on using the same tools to send files to the same people, unimpeded by the broadcast flag.

In short, a broadcast flag mandate is an ineffective solution to a non-existent problem. At the same time, any broadcast flag mandate will impose *genuine and substantial* costs on consumers and innovators. It would raise the cost of DTV devices while reducing the value that they represent to consumers. It would stifle innovation in DTV and general-purpose technologies. It would abridge the First Amendment freedoms of software authors. All of this, in the end, will impede, rather than encourage, the transition to DTV.

---

[2] Half of the top 20 U.S. prime-time television shows (via http://jam.canoe.ca/TelevisionRatings/us.html#rates, reporting share as of December 1, 2002) are on the air today via terrestrial DTV broadcasts.

Summary

- DTV has nothing to do with "Internet piracy;"
- and even if it did, a broadcast flag mandate would be completely ineffective at addressing the problem;
- while posing a substantial threat to consumers, innovation and the DTV transition itself.

III. A Broadcast Flag Mandate Responds to a Nonexistent Problem

Advocates of a broadcast flag mandate justify their position with a simple story that usually goes something like this: the problem of rampant unauthorized Internet redistribution has made copyright holders reluctant to release content for terrestrial DTV broadcast, which has resulted in a paucity of compelling content that would otherwise drive consumer adoption of DTV.

In other words, the broadcast flag mandate is meant to respond to two problems: (1) unauthorized Internet redistribution of DTV content and (2) the shortage of compelling DTV content that results from the fear of it.

A. Digital Television Has Nothing To Do With "Internet Piracy"

Unauthorized Internet redistribution is a problem[3] that simply has no nexus with DTV today, and is not likely to have any appreciable nexus with it in the foreseeable future. Accordingly, any broadcast flag mandate will have no impact on the problem, so long as alternate channels for infringers (*e.g.*, analog broadcasts, cable television, DVDs, and camcorders) exist.

The vast majority of infringing content shared on the Internet today is captured from analog NTSC broadcasts or cable transmissions, extracted from DVDs, or recorded by camcorders. Any broadcast flag mandate, of course, will have no impact on these other sources, and thus no impact on the stock of unauthorized content.

So the proper question becomes: do "unprotected" terrestrial DTV broadcasts represent any *unique or additional* risk of unauthorized Internet redistribution *over and above the status quo*? The answer is no.

---

[3] This assumes that unauthorized Internet redistribution is a "problem" at all. While the practice certainly qualifies as a "problem" from a copyright law perspective, some have suggested that it may actually constitute a new business opportunity for the copyright industries. See, *e.g.*, KPMG, *The Digital Challenge: Are You Prepared* (released September 25, 2002) (available at http://www.kpmg.com/news/index.asp?cid=659).

1. High-definition DTV programming cannot practically be redistributed through consumer-grade broadband channels.

Some advocates of a broadcast flag mandate contend that the improved quality of DTV broadcasts (referring to perfect, high-resolution, digital copies and "instant" or "immediate" retransmission) will prove an irresistible draw for infringers intent on Internet redistribution. This contention, however, cannot survive scrutiny. The vast majority of the video content being distributed without authorization over the Internet today is at a quality well below that of standard-definition ("SD") NTSC broadcasts, much less the HD quality made possible by DTV. The reason is that high-quality video files are simply too large to redistribute over the Internet using consumer-grade Internet connections. The capabilities of consumer broadband, moreover, are not likely to change this reality in the foreseeable future.

Recordings of high-definition broadcasts are huge. ATSC provides up to 19.4 megabits/sec of data capacity, and 1080i broadcasts use nearly all of this capacity. This means that HDTV video data enters the home at over ten times the speed of a "T1" line.[4] A two-hour movie at this rate occupies nearly 140 gigabits (about 17.5 gigabytes). Under assumptions that grant infringers hypothetical ideal conditions, an infringer who dedicated her entire broadband Internet connection to sharing movies (to the exclusion of all other applications) would require at least 40 hours to download a single two-hour movie in HD format.[5] This 40-hour figure is a *best case* scenario, presuming that the downloader finds a source able to offer sustained downloading rates equal to the full capacity of her broadband connection, turns over the entire use of her broadband connection to the transferring of one file, and does not experience a failure of her Internet connection, interruption from the source, or a software malfunction over 40 hours of continuous use.

The broadband capacity of the typical American consumer, moreover, is unlikely to increase in the near-term to overcome the barrier of HD file sizes. First, broadband deployment to the American home has been slow, with fewer than 11% of American households subscribing to

---

[4] A T1 line is a very high speed Internet connection, with a data rate of 1.544 megabits/sec. T1 connections today are normally used for business Internet access, and service providers generally do not attempt to offer them to consumers. (T1 service in a major urban market such as San Francisco typically costs $500-$1,000 per month, making it an unrealistic option for consumer Internet access.) While a few markets offer consumer broadband services with theoretical peak download rates near T1 speeds, upload rates (which are relevant to the ability to share a file with another Internet user) are wildly asymmetrical, running at a fraction of the download speed.

[5] If a user sustained a 1 megabit/sec download rate for 40 hours with extremely low overhead, she could download a single copy of such a movie.

broadband service.[6] More importantly, however, the infrastructure realities of the "last mile" suggest that even if penetration increases, bandwidth is unlikely to grow substantially.[7] In fact, recent trends suggest that consumers may see *less* bandwidth before they see more, as major ISPs are considering "metered" pricing plans to control their bandwidth costs.[8] In other words, the average American household will be lucky to get a broadband connection equivalent to today's DSL and cable modems, and is not likely to see higher-bandwidth connections in the near term.

2. Copyright infringers have, and will continue to have, ample adequate alternative sources for video content.

Recordings of high-definition broadcasts are an unattractive target for Internet infringers, who have proven unable to take advantage of what is already available to them today. High-quality recordings of standard-definition programming, which make for file sizes far smaller than recordings of high-definition programming, are readily available to prospective infringers. Unencrypted standard-definition digital recordings can be obtained readily from NTSC broadcast, from analog cable service, or from DVD discs.[9] Despite the ease with which digital SD recordings can be obtained, they are not generally shared on the Internet at even their native 480i quality.[10] Instead, infringers reduce the quality to well below

---

[6] *Understanding Broadband Demand,* Office of Technology Policy, U.S. Department of Commerce, September 23, 2002, at 5 (available at http://www.ta.doc.gov/reports/TechPolicy/Broadband_020921.pdf).

[7] James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms,* 17 Yale J. on Reg. 39, 42 (2000).

[8] Charles H. Ferguson, *The U.S. Broadband Problem*, Brookings Institute Policy Brief #105, (July 2002)

[9] NTSC transmissions via terrestrial broadcast or cable service can be recorded readily with a TV tuner card in an ordinary PC; such cards are now sold starting at around $40. The recording thus obtained suffers a single one-time generational quality loss in recording; modern low-noise analog to digital conversion technology means that this loss of quality is imperceptible to a typical viewer. Moreover, "ripping" (transcoding for redistribution, archiving or format-shifting) a DVD requires minimal technical knowledge. Transcoding software and dedicated transcoding devices are readily available from various domestic and foreign suppliers. Even if a small fraction of the public chooses to use these technologies, their efforts result in downloadable versions of commercially released DVDs that can be redistributed without any special technical knowledge.

[10] We do not believe that the quality of infringing copies of works shared on the Internet has been studied in detail with a carefully controlled methodology. We observe that public claims about the nature and impact of Internet copyright infringement are lacking in empirical evidence and rigorous technical analysis, and we welcome continued scientific inquiry in this area. Many relevant questions appear to be purely quantitative. It is clear that rigorous research is possible on the actual uses and capabilities of file-sharing networks to transfer extremely large files; see, *e.g.*, Subhabrata Sen and Jia Wang, "Analyzing Peer-to-Peer Traffic Across Large Networks," Internet Measurement

that of 480i, using both "downrezzing" (reducing the resolution of the video source to produce a smaller, lower-quality picture) and "lossy" compression (where the video and audio quality are substantially degraded in the service of reducing the files to a more transmissible size) to sacrifice picture quality in order to reduce download times. This practice demonstrates that infringers have not generally found it practical to share widely even 480i or 480p content conveniently available to them—let alone the 720p or 1080i content brought to them by DTV broadcasts. So long as the content being broadcast on DTV remains widely available in these lower-resolution formats, DTV represents no incremental increase in the Internet redistribution threat.

B. High-Quality Content is Abundant on DTV Today

The second "problem" that the broadcast flag mandate is intended to address—the shortage of compelling DTV content occasioned by fears regarding "Internet piracy"—also turns out to be chimerical. If the DTV transition is behind schedule, it is not because of a lack of high-quality content. A large and growing body of works from the major studios, networks and their affiliates is available to from terrestrial DTV broadcasts today. [11] Already, fully half of the 20 most popular primetime programs are broadcast over terrestrial DTV.[12] In addition, new producers, such as HDNet, are working to fill any vacuum left unaddressed by the incumbent content producers. All of this is occurring in the absence of a broadcast flag mandate.

In fact, not only are the major networks making an increasing quantity of their content available on DTV broadcasts[13], but some newcomers actively oppose a broadcast flag mandate. For example, Mark

---

Workshop 2002 (November 6, 2002) (available at http://www.icir.org/vern/imw-2002/program.html) (characterizing statistically various features of peer-to-peer file-sharing traffic on actual networks based on statistics from major ISPs' routers). Additional evidence of this sort may be useful to the Commission and to a broader discussion of the nature of Internet file sharing.

[11] "With the fall TV season gearing up, the National Association of Broadcasters (NAB) today announced that High-Definition Television programming is at a record high, with 2,000 hours of prime-time shows, sporting events and movies scheduled to be broadcast in HDTV in the 2002-2003 television season. 'Broadcasters have taken the lead in the Digital Television revolution by giving viewers thousands of hours of premium programming in HDTV format," said Eddie Fritts, President and CEO of NAB." National Assn. of Broadcasters, "Amount of Over-the-Air HDTV Programming Reaches an All-Time High: Broadcasters Are Delivering 2,000 Hours of High-definition Programming This Season; 50% More Since Last Year," October 2, 2002 (available at http://www.nab.org/Newsroom/Pressrel/releases/HDTV100202.pdf). This release includes a current list of prime-time terrestrial broadcasts in HDTV from major networks.

[12] See note 2, *supra.*

[13] See http://www.gatewayaudiovideo.com/dtvschedule.htm for a browsable schedule of current DTV programming, including many Hollywood films.

Cuban, President of HDNet, the only national all-HD television network, opposes such a mandate, considering it unnecessary and even counterproductive to DTV adoption.[14] HDNet is aggressively licensing its HD content for terrestrial broadcast in the absence of a broadcast flag mandate.

In light of the above, it does not appear that compelling content is being held back from terrestrial DTV broadcast. What's more, even if it were, a broadcast flag mandate is no answer to the problem: no rights-holders have made any commitments to make additional content available, even were a broadcast flag mandate to be enacted.

Summary

- DTV files are too large to be practically shared over the Internet;
- Internet infringers have a ready supply of equally attractive programming from other sources;
- Internet infringers cannot widely share even standard-definition video;
- High-quality DTV programming is available today, with availability increasing steadily;
- A broadcast flag mandate will not guarantee that additional programming will be made available.

IV. If There Were a Problem, the Broadcast Flag Wouldn't Solve It

Even assuming (as advocates of a broadcast flag mandate do) that unprotected terrestrial DTV broadcasts are vulnerable to widespread unauthorized Internet distribution, a broadcast flag mandate would be hopelessly ineffective at addressing the problem.

The broadcast flag, by its nature, is an absurdly weak form of security technology.[15] Accordingly, any effort to mandate that DTV receivers respond to the broadcast flag will be undermined by at least three simple methods available to any infringers interested in Internet redistribution: (1) noncompliant receivers, both hardware and software, can always be easily obtained or built because the relevant technology standards are publicly documented and widely understood; (2) noncompliant legacy devices will continue to receive and output DTV

---

[14] See, *e.g.*, "Cuban Bids Broadcasters Ignore Hollywood on Rights Management," *Warren's Washington Internet Daily*, April 9, 2002 (reporting on Cuban speech opposing copy control mandates, delivered at NAB conference).

[15] In fact, it has been our experience that some engineers burst into spontaneous laughter upon first learning of the broadcast flag mandate proposal. "You must be joking," is another common response from technical audiences.

signals without responding to the broadcast flag; and (3) analog outputs on compliant devices will be subject to "redigitizing" (sometimes referred to as the "analog hole").

A. The Broadcast Flag Is a Weak Security Measure

In order to evaluate the efficacy of the broadcast flag as a measure to reduce unauthorized Internet redistribution, it is helpful to understand the nature of the threat. As experts have noted, all it takes is one "leak" in a content security system to facilitate global unauthorized Internet redistribution.[16] All it takes is a single person to capture content in unprotected digital form—once posted to file-sharing networks, the content will quickly propagate. As a result, even the most secure copyright management systems are at risk. (Comparatively speaking, the large size of HD recordings relative to the capacity of consumer broadband connections is a far more effective deterrent to file-sharing than the broadcast flag.)

As a matter of technology, the broadcast flag (also known as the rc_descriptor) is a remarkably weak security measure. Indeed, some technologists are reluctant to call it a security measure at all. The broadcast flag is merely a label that *advises* receiving equipment without *controlling* its operation. The broadcast flag by itself has no power to control or affect the operation of any device, or to prevent non-compliant devices from continuing to operate and to process marked signals. Security experts agree that a flag or label-based approach is technically weak in the presence of "untrusted systems;" it can only be effective when all systems co-operate to give it effect. A broadcast flag mandate, however, cannot rid the world of untrusted systems. Even were the FCC to impose a mandate tomorrow, *every existing receiver* would constitute an untrusted system, as it would continue to receive and output DTV broadcasts while ignoring the broadcast flag.

Determined infringers' access to DTV programming would be unimpeded by a broadcast flag mandate. DTV programming would continue to be broadcast unencrypted to anyone who desired to receive it, using freely published standards that can be, and were meant to be, implemented by any technologist.[17] Existing equipment, and any newly

---

[16] In the words of a recent Microsoft research paper analyzing the problem of unauthorized Internet redistribution, "If there are subverted hosts, then content will leak into the darknet [uncontrolled distribution channels]. If the darknet is efficient, then content will be rapidly propagated to all interested peers." See Peter Biddle, Paul England, Marcus Peinado, and Bryan Willman, "The Darknet and the Future of Content Distribution," presented at the 2002 ACM Workshop on Digital Rights Management, November 18, 2002 (available at http://crypto.stanford.edu/DRM2002/darknet5.doc).

[17] The 8/VSB modulation used for digital terrestrial broadcast is specified, for example, in Advanced Television Systems Committee standard A/53B, *ATSC Standard: Digital*

manufactured equipment using today's designs, would continue to be able to receive DTV broadcasts. Outputs from these devices would continue to be indifferent to the presence or absence of the broadcast flag.[18] Many devices capable of ATSC demodulation have already been sold and many more would be sold before any regulation could be effective. Finally, even compliant receivers would represent a vulnerability, as their analog outputs (in the absence of additional technology mandates addressing analog outputs) could easily be redigitized using inexpensive commodity PC peripherals. These analog-to-digital ("A/D") conversion devices, mature technology that is readily available in the market today, would be unaffected by a broadcast flag mandate and would constitute a "leak" that could be used to facilitate unfettered Internet redistribution.

Television Standard, Revision B (August 7, 2001), Annex D, "RF/Transmission System Characteristics." (SMPTE and NAB published earlier versions of this document, and the Commission, on adopting an earlier version as the U.S. digital television transmission standard, made that version available for public inspection. See In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service (MM Docket No. 87-268), *Fourth Report and Order*, December 24, 1996, Appendix A, *codified at* 47 C.F.R. §73.682(d). The current authoritative version is available directly from ATSC via the World Wide Web at http://www.atsc.org/standards/a_53b_with_amendment_1.pdf.) The same standard notes the goal of providing sufficient technical information for any party to create an interoperable implementation:

> The normative clauses of the Standard do not specify the design of a receiver. Instead, they specify the transmitted bit stream and RF signal *with a thoroughness sufficient to permit the design of a receiver*.

Id., Annex E, "Receiver Characteristics," at p. 68 (emphasis added). The technical details of ATSC broadcast are also described by other standards documents, discussed in textbooks, and taught in schools to electrical engineers. The ATSC standards were deliberately intended to facilitate many independent implementations. The Commission considered it essential that, like the NTSC standards, the details of the ATSC standards, with which broadcasters are required to comply, should be available to all. Of course, there is no suggestion by advocates of a mandate that this technical information would be withdrawn from circulation or that technologists of the future would somehow remain ignorant of the means of receiving ATSC broadcasts.

[18] As the Commission predicted in 1996,

> [when ATSC was altered or extended, t]he resultant conditions would be reminiscent of the introduction of color or stereo sound to the NTSC system. Earlier equipment continued to work unimpaired even as newer equipment provided additional or improved features.

In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service (MM Docket No. 87-268), *Fourth Report and Order*, December 24, 1996, at para. 41. Earlier equipment would, in this sense, likewise "work unimpaired" if newer equipment instead provided *fewer* or *more limited* features. As a technical matter, the introduction of the rc_descriptor into the PSIP standard has indeed had no effect on devices that do not assign a meaning to this descriptor.

B. It Will Always be Easy to Build or Acquire Noncompliant Receivers

Since the ATSC specifications are published openly, no reasonably sophisticated engineer is lacking the necessary technical details to implement this operation from scratch. The digital-signal processing operations necessary to convert a spectrum sample into an MPEG-2 stream are simply a series of mathematical calculations, which can be specified precisely, and can be implemented on any general-purpose computer or calculating system. Indeed, every PC with adequate processor power is susceptible to being programmed to perform this calculation.[19]

ATSC demodulation can be performed entirely in software on a general-purpose computer supplied with a suitable raw spectrum sample. A practical software ATSC demodulator is currently under development by the GNU Radio project, a project of the Free Software Foundation.[20] This project underscores the technical straightforwardness of implementing VSB demodulators, since two engineers with no corporate support and *no prior television engineering experience* produced a working prototype in under a year.[21]

Since the broadcast flag is only a flag and does not affect the modulation, quality, or format of the signal at all, these "noncompliant" systems will not necessarily respond to the broadcast flag. The means of demodulating ATSC to MPEG-2 is widely known and widely available—to consumers, to off-shore manufacturers, and, most importantly, to would-be infringers. Implementing a broadcast flag mandate in this context would create an effectively impossible enforcement challenge.

C. Legacy Devices Will Ignore the Broadcast Flag

ATSC tuner cards designed to be inserted into general-purpose PCs were independently developed in a relatively short time by several manufacturers, and are being sold freely today. ATSC demodulator chips, already readily available in the market, can be used to fabricate DTV tuner

---

[19] The speed (but not the basic feasibility) of software demodulation depends on the characteristics of the computer hardware on which the demodulation is performed.

[20] See "GNU Radio—The GNU Software Defined Radio," http://www.gnu.org/software/gnuradio/gnuradio.html. See also Eric Blossom, "GNU Radio: A Free Software Defined Radio," presentation to the Copy Protection Technical Working Group, February 27, 2002 (available at http://www.cptwg.org/Assets/Presentations/gnuradio-27-feb-2002-cptwg.ppt). The current GNU Radio source code, in C++, is available by anonymous CVS from :pserver:anoncvs@subversions.gnu.org:/cvsroot/gnuradio.

[21] Eric Blossom, personal communication, December 6, 2002 (noting that GNU Radio implementers had no television experience).

devices. All of these devices do not and *will not* check for and respond to the broadcast flag, which means that each instance of such a product represents a "leak" whence DTV programming can make its way onto the Internet.

D. The Analog Hole Renders the Broadcast Flag Irrelevant

Broadcast flag proponents, in the course of other legislative advocacy, have admitted that the broadcast flag measure cannot be effective by itself because of the so-called "analog hole." MPAA explained in a submission to Congress that measures relying on encryption might be of limited effectiveness since

> [d]igital devices can capture and digitize unprotected analog signals (including formerly protected digital signals that are stripped of their protection as they pass through analog outputs) with complete disregard for current analog copy protection mechanisms, thus enabling a major source of unauthorized duplication and/or redistribution.[22]

In addition, at a recent roundtable hosted by the Associated Press, Warner Brothers Chief Technical Officer Chris Cookson admitted that any broadcast flag mandate that failed to address analog outputs would be entirely ineffective at reducing Internet redistribution of content.

Analog-to-digital ("A/D") conversion, sometimes referred to by entertainment industries as "the analog hole" or "re-digitization," is a routine and straightforward process. If you connect a DVD player's analog outputs to a computer's video capture card, the computer will create a digital recording from the DVD's output, performing an A/D conversion. A/D conversion capabilities for audio and video are readily available to consumers at relatively low cost.[23] The costs of video capture capabilities, moreover, are falling rapidly.

Where DTV is concerned, performing A/D conversion can yield a near-perfect digital copy, subject to an imperceptible loss of quality, especially if the high-quality "component" video outputs offered by many HD-capable sets and tuners are used. Virtually every DTV device sold to date includes an unprotected, high-quality analog output, as all but the most recent generation of DTV displays rely on analog inputs. No publicly

---

[22] Motion Picture Association of America, *Content Protection Status Report*, April 25, 2002. Submitted to the United States Senate Committee on the Judiciary (available at http://judiciary.senate.gov/special/content_protection.pdf).

[23] These products range in price from $40 to over $1,000, and have been available for several years.

distributed broadcast flag mandate proposal to date has offered any solution to this gaping vulnerability.[24]

Some supporters of the broadcast flag mandate have advocated additional federal technology regulation in order to "plug the analog hole."[25] Such proposals are beyond the scope of this rule-making, potentially reach a dizzying array of commonly-used technologies, and are extraordinarily controversial. Moreover, efforts to impose mandates on analog outputs raise the specter of making all legacy HD sets and displays obsolete (as such devices typically have only analog inputs), potentially leaving millions of American consumers stranded with display devices that can no longer fully interoperate with new DTV receivers and products.

Summary

- If there *were* a problem with DTV infringement on the Internet, a broadcast flag mandate would not address it;
- Building noncompliant receivers is easy, making any broadcast flag mandate effectively unenforceable;
- Legacy devices will continue to receive and output DTV broadcasts without regard for the broadcast flag;
- The "analog hole" permits the re-digitization of any DTV signal notwithstanding the broadcast flag, without a perceptible loss of quality.

---

[24] "[A]n analog output" is always a permitted output of a compliant device under the BPDG proposal, with respect to any digital terrestrial broadcast television content. *BPDG Final Report*, Tab C-1, "Requirements for the Protection of Unencrypted Digital Terrestrial Broadcast Content Against Unauthorized Redistribution" (dated June 3, 2002), X.3(a)(1), X.4(a)(1).

[25] **"Goal Two:** To 'plug' the 'analog hole.'

[…] This means the digital signal is immediately transformed into an analog signal in order for the consumer to watch it. If the analog signal is then converted back to digital, it cannot be protected by any known protection device. This is called 'the analog hole.' One way to 'plug the hole' could be through a 'watermark detector.' The 'watermark' is an ingenious design, which commands the signal converter in the TV set to respond to the instructions on the movie. […]

To reach this goal, Congressional assistance will be necessary." Jack Valenti, "If You Cannot Protect What You Own, You Don't Own Anything!", presented to the Senate Committee on Commerce, Science, and Transportation, February 28, 2002 (emphasis in original) (available at http://www.mpaa.org/jack/2002/2002_02_28b.htm).

V. The Broadcast Flag Harms Consumer Interests and Slows the DTV Transition

Because it would be an ineffective solution to a nonexistent problem, the benefits that would flow from a broadcast flag mandate are few. At the same time, the costs are high. A broadcast flag mandate would necessarily threaten fair use and legitimate consumer expectations, as well as interoperability, innovation, and constitutionally protected speech, thereby impeding, rather than assisting, the DTV transition.

A. A Threat to Fair Use and Legitimate Consumer Expectations

No use-control scheme can avoid placing some burden on legitimate activities. A broadcast flag mandate is no exception. Collateral damage to legitimate, noninfringing activities is inevitable because content protection technologies cannot reliably determine whether a use is infringing or non-infringing, and cannot predict future uses that might be deemed fair.

U.S. copyright law has always recognized that the rights of copyright holders are not absolute and are subject to various limitations where the public interest would otherwise be adversely impacted. Since 1841, courts have recognized that the public has the right to make "fair use" of copyrighted works, even where the copyright holder objects to the use in question. Fair use is an integral part of the copyright law. Indeed, the Supreme Court has held that the doctrine of fair use is required in order to promote the exchange and free flow of ideas and information that underpins the right of free speech, and that leads to creative innovation.[26]

But by its nature, *fair use requires a fact-specific and case-by-case analysis* and is not reducible to a set of technical rules. A DTV receiver can't examine the intent of its user, or the market impact of the user's actions, each of which might be highly significant to determining whether the actions would be deemed fair. Congress has left the decision about whether a particular use is fair to courts, to decide after weighing various factors and the underlying purposes of the copyright law.[27] By contrast, a

---

[26] See, e.g., *Rosemont Enterprises, Inc., v. Random House, Inc.*, 366 F. 2d 303, 307 (2nd Cir. 1966); *Harper and Row v. Nation Enterprises*, 471 U.S. 539, 558, 582, and 589 (1985). See also Neil Weinstock Netanel, "Locating Copyright Within the First Amendment Skein," 54 Stanford Law Rev. 1 (2001) (examining historical relationship between copyright and free expression, noting that courts have considered fair use and related doctrines necessary and sufficient to protect the public's first amendment rights, and arguing that these doctrines may now be insufficient to this purpose) (available at http://www.utexas.edu/law/faculty/nnetanel/Netanel.pdf).

[27] See 17 USC §107; *Cambell v. Acuff-Rose Music, Inc.,* 510 U.S. 569 (1994) (applying fact-specific analysis under §107 to finding of fair use in commercial context).

broadcast flag mandate would condition the ability to exercise some use on whether that capability is permitted within the limits of the mandate's regulation of input, output, and robustness requirements. Accordingly, such a mandate necessarily sacrifices noninfringing uses by failing to accommodate the fact-based analysis intended by Congress.

Collateral damage is also inevitable because the broadcast flag mandate cannot hope to accurately predict future noninfringing uses. If, for example, the federal government had in 1972 imposed a mandate on devices capable of recording analog television, and had judiciously followed the borders of fair use precedents of the day, such a mandate would almost certainly have prohibited the range of functionality represented by the first consumer VCR, introduced by Sony four years later.

It is one of the great strengths of the fair use doctrine that it is capable of evolution. This advantage arises from the fact that copyright law allows technology vendors to innovate first, and test the innovation in court later. It is one of the great weaknesses of technology regulations like the broadcast flag mandate that they require innovators to ask for permission before they may innovate, often from incumbent industrial giants with a vested interest in stopping disruptive innovation.

Broadcast flag proponents minimize the costs of a technology mandate and emphasize that certain non-infringing uses will remain possible. By exaggerating the scope of these "permitted" uses, some proponents have even suggested that legitimate consumer expectations would not affected *at all* by a broadcast flag mandate. The basis for this peculiar claim seems to be that simulacra of certain existing devices (especially the analog VCR) can be implemented by means of these technologies. On this view, so long as the remote control has the same buttons, consumers have lost nothing. Of course, this fails to recognize that consumers are losing future features (including both buttons on a future remote that have not been invented yet, as well as existing buttons that have yet to be tested in court[28]).

But a broadcast flag mandate will deprive consumers of more than merely future innovations. A broadcast flag mandate would force existing

---

[28] The question of whether automatic commercial skipping features fall within the scope of consumers' fair use rights is currently being tested in a court case involving ReplayTV. *See* Paramount Pictures Corp. v. ReplayTV, Inc. No. CV-01-09358 FMC. Similarly, court cases may soon address the question of whether consumers have the right to edit movies they have legitimately purchased in order to remove profanity and nudity. *See* Chris Marlowe, *Final cut: DGA Battles Third-Party Editors,* The Hollywood Reporter, Oct. 30, 2002 (available at http://www.hollywoodreporter.com/hollywoodreporter/search/article_display.jsp?vnu_content_id=1751554).

products off the shelves without replacing them with anything comparable. It would eliminate legitimate features and functionality that consumers are enjoying today.

Examples of activities that are possible today but could be banned under a broadcast flag mandate similar to the one proposed in the *BPDG Final Report* include:

- Recording DTV broadcasts to standard universally-playable removable media formats, such as recordable DVD or VCD.
- Sending a short excerpt of a DTV broadcast to a relative via e-mail.
- Recording or transferring a DTV broadcast to a laptop computer's hard drive, in order to watch it later (for example, on an airplane).
- Transferring a recording of a broadcast over any TCP/IP network, such as a home Ethernet or wireless Ethernet ("WiFi") network, in order to move a recording between playback devices.
- Incorporating an excerpt of a broadcast program into an academic report, a documentary or work of scholarship, or into a home movie.

This is *not* a question of whether these activities could be enabled in the future: they, and other lawful and useful capabilities, are available and practical for DTV viewers *right now* with current technology, using commercially available products. Consumers are already benefiting today from the ability to make these and other uses of DTV, but the requisite technology would be forbidden to them under a broadcast flag mandate.

Generally speaking, consumers anticipate that they should be able to do with DTV what they have done with analog television.[29] But the real promise of DTV is much greater. It can, and should, supply the flexibility to allow the development of new and previously unanticipated uses. That flexibility—and not solely picture quality—promises to provides consumers with unique value from making the DTV transition.

B. A Threat to Interoperability

The collateral damage that would result from a broadcast flag mandate extends beyond frustrating consumers' legitimate expectations.

---

[29] Before making the substantial investment involved in the DTV transition, consumers have a right to expect that they will have *at least* the same capabilities with DTV that they have with traditional analog television. For example, most PVR owners today will likely resist DTV until equally functional PVR devices are available for DTV content.

By banning the use of "unapproved" outputs and recording methods and by requiring "robustness" (*i.e.*, tamper-resistance) in all compliant devices, a broadcast flag mandate could create a welter of confusing, mutually incompatible systems that will raise the cost of DTV devices while reducing their value.

There is presently substantial uncertainty about compatibility and interoperability on the part of consumers who are considering buying HD-capable equipment. Prospective DTV adopters all across America are asking questions like these:

> If I buy a TV right now that doesn't have a DVI input and this becomes the standard, is the TV useless for HD? Is it possible to make an adapter that will convert the DVI signal to component? Furthermore, if DVI is the standard, will all of the receivers that are used as switchers need to incorporate this as well?[30]

Consumers are reluctant to purchase equipment because they don't know whether the equipment will continue to function in the future—and whether it will continue to interoperate with other equipment they might want to purchase later on. They want to know whether a suitable adapter will be available to guarantee interoperability. This consumer reluctance will be exacerbated by a broadcast flag mandate, as it will take vendors at least 18-24 months to design and bring compliant devices to market. In the meantime, consumer uncertainty may take a substantial toll on the DTV transition.

The consumer question above emphasizes the indirect costs that would be imposed on consumers by a broadcast flag mandate. As a technical matter, there is no reason why an adapter to convert a signal between any arbitrary pair of interfaces might not exist. Where there is demand for such an adapter, there are many vendors ready to manufacture it. Unfortunately, the prospect of a broadcast flag mandate reduces the chance of this reasonable consumer expectation being met in the marketplace. Many useful adapters capable of preserving compatibility would be out of bounds. Further, a mandate risks indirectly making various products obsolete because of the narrowed pool of other products with which they are permitted to interoperate. The additional restrictions that would be imposed on recording create further risks that devices bought today could be substantially less useful in the future.

One consumer electronics magazine gives us an example of this sort of risk: "Unfortunately," it says, "D-Theater tapes won't play on non-

---

[30] Richard Straus, letter to the editor, *Home Theater*, December 2002, p. 18.

D-Theater-certified D-VHS players."[31] Ordinary D-VHS tapes will play on all D-VHS players; consumers are currently permitted to make, and able to make, ordinary D-VHS recordings of terrestrial broadcast, and therefore to be sure of achieving the greatest possible compatibility. The *BPDG Final Report* contemplates eliminating consumers' present ability to record flagged programming onto ordinary D-VHS tapes, requiring instead that consumer recordings be less-compatible encrypted D-Theater tapes.[32]

Consumers ought to be assured that, regardless of which players they possess, interoperable recorders will continue to be available. They ought to be assured that, regardless of the display devices they possess, interoperable video sources will continue to be available. They ought to be assured that, in general, adapters to convert one interface to another will continue to be available. Not only can these assurances not be given while a mandate looms, but these assurances may well be *false* under a mandate.

C. A Threat to Innovation

Encouraging innovation in digital television technology has been part of U.S. DTV policy since its inception. In adopting the ATSC standard, the Commission specifically noted its desire "to encourage further innovation by those who have devised the ATSC DTV Standard as well as new entrants."[33] A broadcast flag mandate, however, would retard, rather than encourage, DTV innovation.

The value of any new technology is in large part derived from unanticipated, innovative uses, uses that spring up as the widest possible variety of technologists and end-users tinker, modify, and experiment to discover remarkable ways of extracting new value unimagined even by the technology's inventors. The explosive growth of technologies such as the Internet, the cellular phone and the automobile is characterized by a Cambrian explosion of innovation in each case. From the drive-in theater

---

[31] Mike Wood, "D-VHS: Be kind. Rewind," *Home Theater*, December 2002, p. 151.

[32] *BPDG Final Report*, Tab C-2 (dated June 3, 2002), at 7 (proposing obligation for D-VHS recordings to include copy controls). No such restriction exists today, and D-VHS equipment is currently able to make maximally compatible recordings of ATSC broadcasts. See, *e.g.*, "[A]ll D-VHS decks [as of 2001] also allow you to record (via MPEG-2 encoding) high definition broadcasts off the air[.]" "D-VHS—A First Look At a New Format," *The Digital Bits*, January 31, 2001 (available at http://www.thedigitalbits.com/articles/dvhs/).

[33] In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service (MM Docket No. 87-268), Fourth Report and Order, December 24, 1996, at para. 48, quoting Fifth Further Notice of Proposed Rulemaking, at 6251.

to telephone dating to Internet-based auctions, innovation has been a principal driver of consumer adoption of a new technology.

Innovation flourishes in the absence of stricture. Hot-rodders and overclockers both rely on open hardware to tweak their equipment for maximum performance, and even an average driver would balk at the notion of purchasing an automobile whose hood was welded shut. A broadcast flag mandate, particularly if it includes tamper-resistance requirements, *effectively welds shut the hood of every DTV device*. It insists that only authorized parties may peek at the works of any given DTV device, and requires that interoperability be subject to the prior consent of vendors who may have reason to discriminate against new market entrants. In this regime, which BPDG co-chair Andy Setos of Fox Studios described as an "orderly marketplace," competition is replaced by gentlemen's agreements between self-interested parties who seek (in the case of the entertainment companies) to control private use of DTV programming and (in the case of the technology companies whose protection technologies are chosen) to shut out their competitors.

In the absence of a broadcast flag mandate, all an innovator needs to know to build a novel DTV device is what she can find in publicly-available materials. She need not beg permission of a favored vendor for some exotic copy-control system nor submit to a private license agreement governing the scope of her use of that system. She need not add superfluous tamper-resistance measures that seek to prevent end-users from modifying her invention or lock out service-centers from performing minor repairs.

The broadcast flag proposal turns all this on its head. An innovator in a broadcast flag mandate world needs to build her technology to interact not with a simple MPEG file, but with a proprietary system whose only documentation and tools exist at the sufferance of a private licensor. She is bound not only by the strictures of the art and science, but by any conditions that the licensors with whom she must treat choose to burden her with. She can not rely on free/open source software—which encourages end-user modification—for critical components.

As a result, we can expect that a wide array of innovations will be slowed or never come to pass as a result of a broadcast flag mandate. Innovation in this area might include the entry of new manufacturers and implementers, and the development of new applications of ATSC (and of 8/VSB modulation) as well as new applications for existing implementations. It might also include a variety of ancillary tools and technologies that would serve niche markets too small for major vendors to address. Some innovations that might be imperiled by a broadcast flag mandate include:

- Using DTV content in lawful ways not originally intended, including with new product categories that might not have existed when the content was originally captured, as Macintosh users do when they use Apple's iMovie software to piece together home movies with excerpts from recorded TV broadcasts.
- Using existing software in lawful ways not originally intended, including with new DTV programming that might not have existed when the programs were originally created.
- Manipulating files using free/open source software, and retaining the ability to repair, modify, and improve that software and to share improvements with others.
- Using any communications or recording medium to transfer or archive any data.

D. Excludes Free/Open Source Software from the DTV Marketplace

Free software, sometimes called "open source" software, is a phenomenon of growing importance in the computer world. Free/open source software authors release their work to the world in a form that can be easily modified by other authors, on the condition that those authors release their modifications under the same terms. Free/open source software has resulted in a number of significant, industry-standard technologies. From Apache, the web-server software that powers the majority of the world's web sites, to Linux, the operating system that is viewed as the most credible threat to Microsoft's Windows, Free/open source software powers the Internet and is widely viewed as the most reliable, least expensive and most flexible form of software extant.

Free/open source software developers are today striving to produce products that may offer flexible, low-cost DTV solutions to consumers. A wide variety of video applications—including video recorders, editors, and players—are now available and are subject to active development. Innovative free/open source video software like DScaler[34] is pushing the boundaries of the art. A variety of applications, both generic video-processing software and ATSC-specific tools, is under development and promises to be of use to DTV viewers.

Given the increasing power of general-purpose PCs and the convergence of PCs and home theater, it is becoming clear that a DTV receiver can be implemented entirely in software on general purpose PCs,

---

[34] DScaler is a free/open source video deinterlacer, performing functions elsewhere implemented in costly hardware products. http://deinterlace.sourceforge.net/

using so-called "software defined radio" (SDR) technologies. Given high-frequency digital samples from a chosen region of the RF spectrum, SDR receiver software can perform a demodulation function and recover a representation of the original transmitted signal. As Joseph Mitola III, who coined the term "software radio," explains, software radio techniques can be used to implement both transmitters and receivers, with a variety of benefits:

> As communications technology continues its rapid transition from analog to digital, more functions of contemporary radio systems are implemented in software—leading toward the software radio. A software radio is a radio whose channel modulation waveforms are defined in software. That is, waveforms are generated as sampled digital signals, converted from digital to analog via a wideband DAC and then possibly upconverted from IF to RF. The receiver, similarly, employs a wideband Analog to Digital Converter (ADC) that captures all of the channels of the software radio node. The receiver then extracts, downconverts and demodulates the channel waveform using software on a general purpose processor.[35]

SDR technology is the subject of active research by a broad range of firms, academic projects, governments, and individuals.[36] One example of a Free/open source SDR project aimed at DTV is GNU Radio. It currently includes essentially complete implementations of FM audio demodulation, and ATSC video modulation and demodulation functions.[37]

A broadcast flag mandate, to the extent it embraces a "tamper-resistance" requirement, essentially bans Free/open source software from the DTV marketplace. By its nature, Free/open source is "tamper-friendly," in that the software developers freely publish their source code, intending that others will understand, modify, and improve it.[38]

---

[35] Joseph Mitola III, "What Is A Software Radio" (available at http://ourworld.compuserve.com/homepages/jmitola/whatisas.htm).

[36] The Commission has also begun an examination of the opportunities presented by SDR technology. See generally In the Matter of Authorization and Use of Software Defined Radios, ET Docket No. 00-47.

[37] The Technical Advisory Committee of the Commission's Office of Engineering and Technology (OET TAC) heard a presentation about GNU Radio on December 4, 2002. Presentation slides from this TAC meeting are available at http://www.gnu.org/software/gnuradio/talks/fcc_tacii_open_source_sw_and_hw.pdf. Additional information about GNU Radio is at note 20, *supra*.

[38] "Covered Products shall be manufactured in a manner clearly designed to [effectively] frustrate [User] attempts to modify such Covered Products to defeat the Compliance Requirements." Broadcast Protection Discussion Group *Final Report*, Tab C-1,

Should a "tamper-resistance" requirement bar open source developers from entering the DTV market, a number of important interests would be harmed. First, insofar as open source software offers a very low-cost (typically royalty-free) software-based alternative to consumers, excluding it from the market would harm consumers. Open source software has also frequently been an important force for ensuring a competitive marketplace in software, offering a viable competitor to proprietary software vendors who may otherwise exercise market power. Finally, because open source software encourages developers freely to build upon each other's contributions, innovation can be more rapid. Moreover, insofar as source code has been repeatedly recognized as a form of speech entitled to First Amendment protections, any broadcast flag mandate that attempts to proscribe the publication and distribution of source code relating to DTV reception would tread on the constitutional rights of software programmers.[39]

E. A Threat to the DTV Transition

By undermining competition, limiting interoperability, frustrating innovation, and locking out Free/Open Source software, a broadcast flag mandate is likely to hinder, rather contribute to the DTV transition.

A broadcast flag offers absolutely no benefit to the consumers who are being asked to purchase new DTV equipment, and may well penalize early adopters who have made already made substantial investments in DTV equipment. Instead, a mandate will artificially limit the capabilities that DTV vendors can offer to the American public. In essence, a

---

"Requirements for the Protection of Unencrypted Digital Terrestrial Broadcast Content Against Unauthorized Redistribution" (dated June 3, 2002), X.7(a) (brackets in original). "Without limiting the requirements of Sections X.7 and X.8, portions of a Covered Product that implement in Software the content protection requirements set forth in the Compliance Requirements shall: (1) Comply with Section X.7(c) by a reasonable method […] and, in addition, using techniques of obfuscation clearly designed to effectively disguise and hamper attempts to discover the approaches used." *Id.*, X.9(b). These requirements are intrinsically inconsistent with the requirements of free/open source software. "[A]ccessibility of source code is a necessary condition for free software." Free Software Foundation, "The Free Software Definition," available at http://www.fsf.org/philosophy/free-sw.html. "The source code for a work means the preferred form of the work for making modifications to it." GNU General Public License, version 2, June 1991, available at http://www.fsf.org/licenses/gpl.html. "The program must include source code, and must allow distribution in source code as well as compiled form. […] The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed." Open Source Initiative, "The Open Source Definition," version 1.9, available at http://www.opensource.org/docs/definition.php.

[39] See, *e.g.*, *Universal City Studios v. Corley*, 273 F.3d 429 (2nd Cir. 2001); *Bernstein v. United States Dept. of State*, 974 F.Supp. 1288 (N.D.Cal. 1997).

broadcast mandate would force DTV technology vendors to assume that all of their consumers are "thieves," and treat them accordingly.

History suggests that this is precisely the wrong approach. Incumbent entertainment industries have repeatedly responded to new consumer media technologies with initial suspicion and anxiety, decrying what they perceive as the "thieving" ways of the American public. The initial concerns, however, have invariably given way to new market opportunities for those same industries. In several well-known instances, motion picture studios made confident—and completely erroneous—public predictions that some new technology would damage their business interests.

For example, when color came to NTSC television broadcast, major studios were reluctant to broadcast their movies in color. In time, they recognized that color television was of use to them and began to use it—not because color television was changed, but because time and experience validated it, and competitive pressures encouraged studios to adopt it.[40]

A few decades later, the motion picture industry attacked the newly-introduced VCR, arguing that the American consumer could not be trusted with a device capable of recording video content from over-the-air broadcasts. In the words of MPAA President Jack Valenti before a House subcommittee in 1982:

> But now we are facing a very new and a very troubling assault on our fiscal security, on our very economic life and we are facing it from a thing called the video cassette recorder and its necessary companion called the blank tape. And it is like a great tidal wave just off the shore. This video cassette recorder and the blank tape threaten profoundly the life-sustaining protection, I guess you would call it, on which copyright owners depend, on which film people depend, on which television people depend and it is called copyright.
>
> […]

[40] "The network with the most invested in color, NBC, thus premiered … the first prime time series of recent films as *Saturday Night at the Movies.* Ratings were high and the other two major networks, CBS and ABC, seeing how poorly their shows fared against Saturday Night at the Movies, quickly moved to set up their own "Nights at the Movies." http://www.museum.tv/archives/etv/M/htmlM/moviesontel/moviesontel.htm

> I say to you that the VCR is to the American film producer and the American public as the Boston strangler is to the woman home alone.[41]

Ironically enough, in the course of litigating against Sony over the Betamax VCR, Disney and Universal City Studios suggested that VCR makers be required to implement a "jamming" system that would respond to a signal that would be embedded in television broadcasts.[42] Twenty years of history have made it clear that this early version of a broadcast flag mandate was not necessary. The motion picture industry has since recognized that the VCR was a much bigger business opportunity than threat.[43]

It is clear that some studios are apprehensive about perceived risks arising from terrestrial DTV broadcasting. The existence of such apprehension, however, is not by itself sufficient to justify a federal technology mandate, especially where the mandate in question would be ineffective and would exact such a high cost from other stakeholders.

The DTV transition *cannot* be accelerated through a broadcast flag mandate—quite the opposite is true.

Summary

- A broadcast flag mandate presents real threats to consumer interests and the DTV transition;
- The broadcast flag cannot accommodate fair use and other rights reserved to the public by copyright law;

---

[41] Home Recording of Copyrighted Works, Hearings before the Subcommittee on Courts, Civil Liberties, and the Administration of Justice of the Committee on the Judiciary, 97th Congress, 2nd Session.

[42] "[A]n engineer, one Richard J. Stumpf, […] was supposed to testify to the ease with which Sony, if it wanted, could make a videotape recorder that served all the legally innocent purposes of a Betamax and none of the culpable ones. Stumpf had conceived a system that could render a Betamax incapable of recording a program unless the broadcaster—presumably on the copyright holder's say-so—chose to let it be recorded. The system relied on a simple jamming device that could be installed in a Betamax at a cost, Stumpf was prepared to testify, of less than fifteen dollars a machine." James Lardner, Fast Forward: A Machine and the Commotion it Caused (Concord, N.H.: Pierce Law, 2002) (revised ed.), at 104.

[43] Although Congress did ultimately craft a very limited technology mandate for analog VCRs, requiring VCRs to respond to Macrovision, see 17 U.S.C. 1201(k), the differences between this mandate and the proposed DTV broadcast flag mandate are striking. First, the Macrovision mandate was enacted only after more than 20 years of marketplace competition and at a time when the technology was fully mature. DTV technology, by contrast, is still in its infancy. Second, the Macrovision mandate applies to only a narrowly-defined class of products—analog VCRs. The DTV broadcast flag mandate, in contrast, would apply to a much wider category of products—all devices capable of receiving DTV.

- The broadcast flag will make it harder for consumers to be confident that their DTV devices will interoperate;
- Reduced interoperability and tamper-resistance mandates will shrink the universe of possible DTV innovations;
- A tamper-resistance mandate would impinge upon the First Amendment rights of Free/Open Source software authors;
- By raising the cost and reducing the capabilities of DTV devices, a broadcast flag mandate will endanger the DTV transition.

VI. Conclusion

For the foregoing reasons, EFF requests that the Commission reject any broadcast flag mandate that would require devices or computer programs to respond to the ATSC broadcast flag in any particular way.