

*Before the*  
**Federal Communications Commission**  
Washington, DC 20554

In the matter of

Digital Broadcast Content Protection

MB Docket No. 02-230

**COMMENTS OF THE  
ELECTRONIC FRONTIER FOUNDATION**

The Electronic Frontier Foundation (“EFF”) hereby submits these comments in connection with the Commission’s *Further Notice of Proposed Rulemaking*, FCC No. 03-273 (Nov. 4, 2003) (“*FNPRM*”) in the above-captioned proceeding.

**I. STATEMENT OF INTEREST**

EFF is a membership-supported nonprofit organization devoted to protecting civil liberties and free expression in the digital age. With more than 11,000 dues-paying members and over 35,000 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, having participated in all the meetings of the Broadcast Protection Discussion Group (BPDG) and submitted a minority opinion to the BPDG’s Final Report. EFF submitted comments and reply comments in response to the Commission’s earlier Notice of Proposed Rulemaking in the above-captioned proceeding.<sup>1</sup>

**II. SOFTWARE-BASED DEMODULATORS**

In its *FNPRM*, the Commission specifically sought additional comment regarding “the interplay between a flag redistribution control system and the development of open source software applications, including software

---

<sup>1</sup> See Comments of the Electronic Frontier Foundation, FCC MB Docket No. 02-230 (filed Dec. 6, 2002) (“EFF Comments”); Reply Comments of the Electronic Frontier Foundation, FCC MB Docket No. 02-230 (filed Feb. 18, 2003) (“EFF Reply Comments”).

demodulators, for digital broadcast television.”<sup>2</sup> EFF argued in its earlier filings against any regulation of software-defined demodulators.<sup>3</sup>

EFF notes at the outset that the “broadcast flag” regulations adopted by the Commission appear to exclude pure software-defined demodulators from its scope, as they are restricted to demodulators fashioned from “components.”<sup>4</sup> EFF urges the Commission to affirm and clarify this point to eliminate any doubt for software innovators. For both policy and constitutional reasons, the broadcast flag regulations should not apply to software-defined demodulators.

#### **A. Software-Defined Demodulators—What are they?**

Given the increasing power of general-purpose PCs and the convergence of PCs and home theater, it is clear that a DTV receiver (whether ATSC or QAM) can be implemented entirely in software on general purpose personal computers, 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.<sup>5</sup>

---

<sup>2</sup> *FNPRM* at 28, para. 60.

<sup>3</sup> EFF Comments at 19; EFF Reply Comments at 29.

<sup>4</sup> *See FNPRM* at 36, Appendix B, CFR § 73.9000(g) (defining “Demodulator” as “a component, or set of components, that is designed to perform the function” of demodulation). The original language proposed by the Motion Picture Association of America and its joint commenters expressly included “software.” The Commission’s definition chose not to adopt this language.

<sup>5</sup> Joseph Mitola III, “What Is A Software Radio,” available at <http://ourworld.compuserve.com/homepages/jmitola/whatisas.htm>.

SDR technology is the subject of active research by firms, academic projects, government, and individuals.<sup>6</sup>

One example of an SDR project aimed at DTV is GNU Radio, a free, open source project run by a group of international hobbyist contributors.<sup>7</sup> It currently includes complete implementations of FM audio and ATSC video demodulation functions. The Technical Advisory Committee of the Commission's Office of Engineering and Technology (OET TAC) saw a presentation about GNU Radio on December 4, 2002 and included a discussion of it in its TAC II Meeting Seven Report.<sup>8</sup> Although the demodulation of ATSC digital broadcast television signals is one capability of the GNU Radio software, it is capable of many uses, including many research uses for those interested in a wide variety of digital signal processing subjects.

GNU Radio and other pure software demodulators appear to be outside the scope of the regulations announced by the Commission in the *FNPRM*. First, with respect to the software itself, GNU Radio is not a "component," and thus outside the definition of "Demodulator" under § 73.9000(g). The hardware necessary for GNU Radio—a general purpose PC and high-speed analog-to-digital converter—also fall outside the definition of "Demodulator" because they are not designed to perform demodulation functions.

**B. Imposing Robustness and Compliance Requirements on Software-Defined Demodulators Would Exclude Open Source Software from the DTV Marketplace.**

Extending the broadcast flag regulatory regime to software-defined demodulators would be problematic for a number of reasons. First, the regulations in their present form, thanks to their "robustness" obligations, would eliminate open source developers from the digital broadcast television marketplace, artificially constraining competition and innovation.

---

<sup>6</sup> The Commission has recently begun an examination of the opportunities presented by SDR and cognitive radio technologies. *See generally Notice of Proposed Rulemaking in the Matter of Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies*, ET Docket No. 03-108, FCC No. 03-322 (Dec. 30, 2003).

<sup>7</sup> For information on GNU Radio, including complete source code, see:

<http://www.gnu.org/software/gnuradio/gnuradio.html>

<sup>8</sup> The presentation was given by Eric Blossom, lead engineer for the GNU Radio project. His presentation can be found:

[http://www.fcc.gov/oet/tac/GNU\\_Radio\\_12\\_4\\_02.pdf](http://www.fcc.gov/oet/tac/GNU_Radio_12_4_02.pdf)

The OET TAC II Seventh Meeting Report can be found:

[http://www.fcc.gov/oet/tac/TAC\\_II\\_Report\\_7.zip](http://www.fcc.gov/oet/tac/TAC_II_Report_7.zip)

Open source software has been a powerful force for competition and innovation in every market it has entered, whether in web server software, operating systems, or embedded systems. Blocking open source software from the digital television market would be unwise and unjustified.

Applying the Commission's broadcast flag regulations to open source SDR projects such as GNU Radio would likely render them *per se* unlawful, insofar as they could not satisfy the "robustness" requirements set forth in the broadcast flag regulations.<sup>9</sup> This requirement mandates that Covered Demodulators be designed so as to prevent "ordinary users" from being able to defeat or modify the "compliance" features of the demodulator. Open source software is, by its nature, user-modifiable. In fact, the point of releasing the source code of software like GNU Radio is to *encourage* end-user modification and improvement of every aspect of the software.

There is every reason to believe that "ordinary users" of open source software-based demodulators will be able to understand and modify the source code of GNU Radio. After all, most GNU Radio users today begin by downloading the source code and compiling it themselves. Many users today are also developers, making changes to the source code to suit their own needs and contribute to the advancement of the project. As a result, it is likely that GNU Radio, by its open source nature, could not satisfy the "tamper-resistance" requirements imposed by the "robustness" requirements of the Commission's current regulations.

Moreover, there has been no showing that would justify imposition of the broadcast flag regulations on software-defined demodulators. There has been absolutely no evidence in the record that suggests that open source software-defined demodulators represent a credible threat of internet redistribution. In fact, compared to the many gaping holes in the regulations as adopted, it seems clear that software-defined demodulators are particularly undeserving of regulation. For example, the Commission's existing regulations leave the following DTV receivers and outputs entirely *unregulated*:

**The Analog Hole:** the current regulations do not reach analog outputs (including high-resolution component outputs) on DTV devices.<sup>10</sup>

**The Legacy Hole:** the current regulations do not reach any DTV devices sold prior to July 2005, including the many inexpensive HDTV receiver cards intended for use with personal computers.

---

<sup>9</sup> See *FNPRM* at 43, Appendix B, § 73.9007.

<sup>10</sup> *Id.* at § 73.9003(a)(1).

**The DVI Hole:** the current regulations permit unprotected 480p digital outputs over DVI interfaces.<sup>11</sup>

Each of these represents a far more serious vulnerability to the existing broadcast flag regulations than do software-defined demodulators. In light of this, regulation of software-defined demodulators seems particularly unjustifiable.

**C. Extension of the Broadcast Flag Regulations to Software-Defined Demodulators Would Violate the First Amendment.**

Because an extension of the Commission's broadcast flag regulations to reach software-defined demodulators would effectively ban their publication, such an extension presents serious constitutional difficulties.

It is well-established that software, when published for expressive purposes, is entitled to First Amendment protection.<sup>12</sup> Accordingly, any regulation of software such as GNU Radio would have to survive constitutional scrutiny. The broadcast flag regulations at issue in this docket would fall far short if tested under First Amendment standards.

As discussed in EFF's earlier comments in this docket<sup>13</sup> (and echoed by many other commenters), the record before the Commission regarding the need for, and efficacy of, a broadcast flag mandate was woefully inadequate.

Proponents of the broadcast flag mandate argued that (1) DTV is uniquely vulnerable to "Internet piracy" and (2) this threat will result in high-quality content being withheld from terrestrial DTV broadcasters. Yet they were unable to come forward with *any* evidence demonstrating that Internet redistribution of DTV content poses a problem today or that it will in the near future.

Supporters of the broadcast flag mandate failed to document *a single instance* of a DTV broadcast being shared over the Internet. As documented in detail in prior filings in this docket, full-resolution DTV broadcasts are not being redistributed over the Internet because the resulting files are far too large. The Commission admitted as much when adopting the broadcast flag regulation.<sup>14</sup>

---

<sup>11</sup> *Id.* at § 73.9003(a)(7).

<sup>12</sup> *See, e.g., Universal City Studios v. Corley*, 273 F.3d 429, 446-49 (2d Cir. 2001); *Bernstein v. U.S. Dept. of Justice*, 176 F.3d 1132, 1141 (9th Cir.), *reh'g in banc granted and opinion withdrawn*, 192 F.3d 1308 (9th Cir. 1999); *U.S. v. Elcom Ltd.*, 203 F.Supp.2d 1111, 1126-27 (N.D. Cal. 2002); *Bernstein v. U.S. Dept. of State*, 922 F. Supp. 1426, 1434-36 (N.D. Cal. 1996).

<sup>13</sup> *See* EFF Reply Comments at 2-18.

<sup>14</sup> *See FNPRM* at 5, para. 8 ("Although we acknowledge that technological constraints will inhibit the redistribution of HDTV over the Internet for the immediate future, we anticipate that the potential for piracy will increase as technology advances.")

Proponents of the broadcast flag mandate also failed to come forward with credible evidence to suggest that the mandate would be effective at preventing Internet redistribution, were such a threat to develop in the future. In light of the many “holes” in the mandate, including the availability of high-resolution analog outputs and the failure to address legacy devices, it is clear that the broadcast flag mandate will not curtail internet redistribution of digital broadcast programming.

Despite this record, the Commission concluded that a broadcast flag mandate was justified as a “preventative action,” and that the broadcast flag regime “provides a satisfactory level of redistribution control.”

Assuming *arguendo* that the Commission’s conclusion might be sufficient to justify the broadcast flag mandate on devices under the traditional “rational basis” review accorded to actions that do not tread on First Amendment values, it plainly falls short when tested against the heightened standards mandated where expressive content is concerned.

The Supreme Court has made it plain that, where a regulation impinges on First Amendment expression, the FCC must *at least* demonstrate that “the recited harms are real, not merely conjectural, and that the regulation will in fact alleviate these harms in a direct and immediate way.”<sup>15</sup> The Commission may not simply “posit the existence of the disease sought to be cured.”<sup>16</sup> Unfortunately, that is exactly what the Commission appears to have done in adopting the broadcast flag mandate. Furthermore, the Commission has failed to examine the availability of less restrictive means to meet its goals. If extended to reach software-based demodulators, the regulations would cross the constitutional line.

### **III. TREATMENT OF OTA BROADCASTS ON BASIC TIER CABLE**

The Commission has sought comment regarding whether cable operators may encrypt DTV broadcast signals when retransmitting them as part of basic tier services.<sup>17</sup> As discussed at length in EFF’s comments in the “cable-CE plug & play” docket,<sup>18</sup> EFF believes that the Commission should reaffirm its policy of requiring that over-the-air broadcasts (whether analog or digital) be unencrypted when retransmitted as part of the basic tier on cable.

#### **A. Carriage of OTA digital broadcast signals unencrypted on**

---

<sup>15</sup> See *Turner v. FCC*, 512 U.S. 622, 664 (1994).

<sup>16</sup> See *id.*

<sup>17</sup> See *FNPRM* at 28, para. 59.

<sup>18</sup> See Comments of the Electronic Frontier Foundation, CS Docket No. 97-80/PP Docket No. 00-67 (filed March 28, 2003); Reply Comments of the Electronic Frontier Foundation, CS Docket No. 97-80/PP Docket No. 00-67 (filed April 28, 2003).

**cable will benefit consumers, innovation and will speed the DTV transition.**

It has long been Commission policy to foster the carriage of local over-the-air broadcasts on the “basic tier” of cable systems. This spares consumers the considerable confusion and inconvenience of having to use an antenna to receive local broadcasts while relying on cable for “premium” content. Furthermore, the Commission’s long-standing policy of requiring that the basic tier be unencrypted has fostered interoperability of equipment—basic cable subscribers have been able to avoid the hassles of cable boxes, “IR Blasters,” and the other incompatibilities that the Commission has wrestled with in its “navigation devices” dockets.

There is no reason to abandon these goals at the threshold of the DTV transition. The availability of over-the-air digital programming on an unencrypted basic tier will benefit consumers in at least two ways.

First, it would guarantee that legacy equipment that includes QAM tuners would continue to function as it does today. Devices capable of receiving unencrypted digital basic tier programming are already on the market. For example, Mitsubishi high-definition rear-projection televisions have included QAM-capable tuners since 2002, and thus are able to receive unencrypted digital cable programming.<sup>19</sup> Similarly, Zenith has announced two HD-capable PVRs that include QAM tuners for recording from digital cable services.<sup>20</sup> If cable providers encrypt the digital basic tier, the QAM tuners in these products will be useless. Because these devices do not include the POD/CardSlot modules envisioned by the Commission’s “plug & play” ruling, their owners will be forced to use a set-top box that may limit other features and compatibility. This outcome is likely to alienate “early adopter” consumers, whose enthusiasm and early investment may be critical in jump-starting the DTV transition.

Although QAM-capable receivers are not widespread today, their number can be expected to increase in the interim months before POD/CardSlot-capable devices enter the market. More importantly, the Commission should make every effort to *increase* the penetration of these interim QAM devices. After all, it would be a serious setback to the ongoing DTV transition if “early adopter” consumers were to put off their HD television purchases until POD/CardSlot-capable units arrived on the market.

---

<sup>19</sup> See Gary Merson, *Mitsubishi WS-55711 55” HD Rear-Projection Television*, THE PERFECT VISION (Nov./Dec. 2002) at p.59.

<sup>20</sup> See Zenith Press Release, “Zenith Digital TV Set-Top Receivers Include HDTV Digital Recorders” (Jan. 9, 2003) (available from [http://www.zenith.com/sub\\_news/news\\_Display.asp?action=view&id=485](http://www.zenith.com/sub_news/news_Display.asp?action=view&id=485)).

In addition to protecting legacy QAM-capable devices, an unencrypted basic tier will ensure “capability parity” for broadcast signals, whether received over-the-air or from basic tier cable service. This will spare consumers from having to rig up redundant antenna systems to receive over-the-air digital broadcast signals if their broadcast flag-compliant devices prove to be incompatible<sup>21</sup> with their digital cable boxes, or if they offer features that POD/CardSlot devices are not able to offer.

The Commission has indicated that it intends to approve a wide variety of content protection technologies for use in the broadcast flag regime. In contrast, it appears that the cable infrastructure will be dominated by a single content protection standard, DFAST/5C. This creates the likelihood that one or more of the broadcast-flag approved technologies will offer capabilities not permitted under DFAST/5C.

A consumer may want to take advantage of this “capability gap”—something that his cable-enabled devices won’t do, but his broadcast-flag compliant device will do. A consumer is certainly entitled to choose any broadcast-flag compliant device she likes in order to receive or record over-the-air broadcast programming. If the basic tier were encrypted, however, the consumer would have to rig up a separate ATSC antenna to take advantage of the additional capability, even though the very same content was also being delivered as part of his basic tier cable service.

**B. There is no reason to impose additional content protection requirements on OTA digital broadcast content when carried on cable.**

There is no justification for imposing *more* content protection on over-the-air digital broadcast programming when it is retransmitted over cable. The Commission has already fashioned a broadcast flag mandate to address the concerns of content-owners regarding internet redistribution of broadcast content. The mandate reaches all 64-QAM and 256-QAM capable tuners, thereby addressing tuners capable of receiving the digital basic tier.<sup>22</sup> So long as cable operators pass through the broadcast flag, content owners will enjoy precisely the same degree of protection on digital basic tier that they do with over-the-air broadcasts.

There is similarly no security risk for cable operators. Every cable subscriber must, at minimum, purchase basic tier service. Those who are not

---

<sup>21</sup> While the Commission’s regulations, as well as private sector undertakings, aim to prevent these incompatibilities, they will likely be inevitable during the early stages of the DTV transition.

<sup>22</sup> See *FNPRM* at 39, Appendix B, § 73.9000(g).



subscribers should be receiving no signal at all at their cable jack. Accordingly, it is difficult to see how unencrypted carriage of over-the-air digital broadcast programming would threaten the security of cable system operators.<sup>23</sup> Many major cable operators already retransmit digital broadcast content as part of their unencrypted basic tier digital service. Cox Communications, for example, includes over-the-air digital channels in its unencrypted digital basic tier service.

### **C. The Commission's Regulations Need Clarification.**

The Commission's rules appear to require that all basic tier services (whether analog or digital, and including all retransmitted over-the-air broadcasts) must be unencrypted (i.e. "unscrambled"). The Commission has previously ruled that, at least in the must carry context, both digital and analog broadcast signals must be available in a single, unitary basic tier.<sup>24</sup> The Commission's rules further provide that all basic tier services must be unencrypted.<sup>25</sup>

Unfortunately, the Commission's rules are not entirely clear on this point, and our conversations with stakeholders in the cable and consumer electronics industries indicate that they are uncertain regarding the issue. Accordingly, EFF asks the Commission to clarify and reaffirm its rules requiring that basic tier services remain unencrypted.

## **IV. REVOCATION**

The Commission has sought comment regarding the appropriate standard for revocation of broadcast flag content protection technologies previously approved by the Commission. EFF urges the Commission to adopt a stringent standard in order to protect consumer investment in DTV technologies.

Revocation is strong medicine. Depending on how it is accomplished, it could jeopardize literally millions of dollars of consumer investment in legacy technologies. For example, once consumers have invested in DTV displays, tuners, recorders, and other multimedia devices, it would be an extreme hardship to discover that next-generation devices refuse to interoperate with these devices

---

<sup>23</sup> To the extent a particular operator can demonstrate a special security risk, the Commission can retain the discretion to grant specific waivers.

<sup>24</sup> See First Report and Order and Further Notice of Proposed Rule Rulemaking, FCC No. 01-22 (released Jan. 23, 2001), at p. 46, ¶ 102. The Commission recognized, however, that this requirement would be lifted were the cable operator able to demonstrate that it faced effective competition under 47 U.S.C. §543(l)(1). *Id.*

<sup>25</sup> See 47 C.F.R. §76.630(a). This requirement is subject to waiver where a cable operator can "demonstrate either a substantial problem with theft of basic tier service or a strong need to scramble basic signals for other reasons." *Id.*

simply because the content protection technology used in them has been “revoked.”

EFF believes that any party seeking revocation should be required to demonstrate, with empirical evidence, that: (1) the technology has been compromised in a widespread, significant manner that permits ordinary users to defeat it; (2) the compromise has resulted in widespread unauthorized internet redistribution of digital over-the-air broadcast programming; and (3) revocation will have a substantial impact on such unauthorized internet redistribution. Put simply, before a party is allowed to devalue the DTV devices purchased by America’s consumers, it must demonstrate that revocation is necessary and that it will do some good.

With respect to the first test, revocation should never be justified unless the content protection technology has been compromised to such an extent that ordinary users are able to defeat it. The Commission’s own regulations impose a robustness standard that focuses on the ordinary user. This appears to admit of the possibility that a technology may be vulnerable to expert users and still be approved for use under the broadcast flag regime. It would be extremely perverse for the Commission to revoke such a technology at a later date simply because an expert could defeat it—that would be to impose a standard more stringent than the standard used for approval!

With respect to the second test, a party seeking revocation should have to demonstrate that the compromised technology is actually causing the harm that the technology was meant to prevent—namely, the unauthorized internet redistribution of over-the-air digital broadcast programming. Content owners should not be entitled to invoke the revocation power of the Commission to serve ends unrelated to the purpose of the broadcast flag mandate. So, for example, if an approved technology is compromised in such a way as to defeat certain copy protection controls (perhaps permitting a consumer to keep a copy on a PVR longer than was intended or enabling more DVD copies than originally authorized), that in itself should never justify revocation.

Turning to the third test, American consumers should never have to tolerate a federally-mandated devaluation of their DTV investment unless the party seeking revocation can demonstrate that the revocation is actually going to do some good. So, for example, revocation should never be justified if, at the time revocation is sought, digital over-the-air broadcast programming is already widely available over unauthorized channels from other sources.

Finally, EFF urges the Commission to ensure that revocations be authorized only on a going-forward basis. A consumer should never be put into a situation where, through no fault of her own, she suddenly finds that her

television or HD-DVD player will no longer play the library of media she has legitimately purchased. It is hard to imagine anything that would do more to deter consumers from embracing the DTV transition, as well as undermining the Commission's legitimacy in the eyes of the American public.

## **V. CONCLUSION**

For the reasons discussed above, EFF respectfully asks the Commission to:

- reaffirm its commitment to exclude pure software-defined demodulators from the scope of its broadcast flag mandate;
- reaffirm its requirement that all over-the-air broadcast signals be unencrypted when carried on the cable basic tier; and
- take steps to develop stringent, consumer-protective standards for revocation of content protection and recording technologies.

/s/

Fred von Lohmann  
Senior Intellectual Property Attorney  
Electronic Frontier Foundation  
454 Shotwell Street  
San Francisco, CA 94110  
+1 (415) 436-9333 x123

February 13, 2004