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4 ``THE ROLE OF RECEIVERS IN A SPECTRUM SCARCE WORLD''

5 THURSDAY, NOVEMBER 29, 2012

6 House of Representatives,

7 Subcommittee on Communications and Technology

8 Committee on Energy and Commerce

9 Washington, D.C.

10 The Subcommittee met, pursuant to call, at 12:00 p.m.,
11 in Room 2322 of the Rayburn House Office Building, Hon. Greg
12 Walden [Chairman of the Subcommittee] presiding.

13 Members present: Representatives Walden, Terry, Stearns,
14 Blackburn, Gingrey, Latta, Guthrie, Eshoo, Markey, Barrow,
15 and Christensen.

16 Staff present: Ray Baum, Senior Policy Advisor/Director
17 of Coalitions; Andy Duberstein, Deputy Press Secretary; Neil
18 Fried, Chief Counsel, C&T; Debbie Keller, Press Secretary;

19 Andrew Powaleny, Deputy Press Secretary; David Redl, Counsel,
20 Telecom; Charlotte Savercool, Executive Assistant; Roger
21 Sherman, Democratic Chief Counsel; Shawn Chang, Democratic
22 Senior Counsel; David Strickland, Democratic FCC Detailee;
23 Margaret McCarthy, Democratic Staff; and Kara Van Stralen,
24 Democratic Special Assistant.

|
25 Mr. {Walden.} We will call to order the Subcommittee on
26 Communications and Technology and our hearing on ``The Role
27 of Receivers in a Spectrum Scarce World.'' First of all, I
28 want to thank our witnesses not only for your extraordinary
29 testimony--we appreciate it; I have read through it--but also
30 for your patience and that of our visitors here today as
31 well.

32 As you know, we are all in our organizational phases in
33 the Congress and we are giving courtesy to my colleagues on
34 the other side because they were having an organizational
35 meeting today. And we appreciate their breaking loose so we
36 could get this going even though we are a little delayed. So
37 it is what it is. Thank you. I will start with some opening
38 comments and then recognize my friend and colleague from
39 California.

40 Good fences make good neighbors. Where I come from in
41 Oregon, we know that is the case whether it is crowded city
42 blocks or sprawling ranches. In many places in my district,
43 the ranches stretch for miles and running out of space isn't
44 a problem. But in our digital world--in Oregon and around
45 the country--we are running out of room. Demand for spectrum
46 is far outpacing supply, and we need to figure out how to use
47 this room we have as efficiently as possible. In short, how

48 do we create good, strong fences to make sure everyone stays
49 within their spectrum bands so spectrum can be used as
50 efficiently as possible?

51 Now, why is this important? Simple. Spectrum equals
52 jobs. Telecommunications is the most vibrant and innovative
53 sector in America. Spectrum is the fuel that it runs on, but
54 there is a limit to our supply. As our subcommittee
55 continues its work to free up more spectrum, we are also
56 focused on maximizing the use of the existing spectrum. We
57 have taken a forward-looking approach--authorizing first-of-
58 its-kind incentive auctions and taking a look at making
59 government spectrum use more efficient and more available.

60 This hearing focuses on receivers and how interference
61 issues can impact our ability to roll out new broadband
62 services. While the controversy surrounding LightSquared and
63 GPS is one example, we have seen similar debates involving a
64 would-be broadband provider called M2Z networks. We have
65 seen it in satellite radio; we have seen it in unlicensed and
66 white-space devices. So that this issue is starting to recur
67 more frequently raises an important question: What
68 engineering techniques and smart strategies are available to
69 fit more mobile services in a crowded spectrum environment
70 without having to carve out larger and larger guard bands--
71 big, inefficient moats--to avoid interference? And how can

72 we do so without unreasonably increasing the costs of
73 services and devices?

74 Now, the Federal Communications Commission has
75 traditionally tried to combat interference by regulating
76 wireless transmitters and placing wireless services of a
77 similar type in neighboring bands--like a city planner
78 placing schools next to other schools and factories next to
79 other factories. While that has generally been successful in
80 the past, fitting additional users into existing spectrum is
81 becoming more difficult with the accelerating rise of the new
82 wireless technologies and services.

83 Recently, both the FCC and the President's Council of
84 Advisors on Science and Technology have taken a fresh look at
85 the way we manage interference and suggested that we need to
86 begin examining receiver performance to maximize our spectrum
87 resources. This is in part because receivers are developed
88 to meet current technological needs, not to anticipate a
89 changing spectrum environment. They are built for the
90 technology world of today or even a few years ago, which, as
91 we know, will look very different in just a few more years.
92 Again, we need to be prepared.

93 As a result, the FCC is increasingly either rejecting
94 new users to protect existing ones or turning to guard bands--
95 -bands of restricted-use spectrum to physically separate the

96 two licensed uses. Sometimes these guard bands are like
97 digging a big, wide moat between neighbors when a simple
98 fence will do. Neither rejecting new users, nor ordering
99 large guard bands, is ideal if we intend to remain the
100 world's most innovative wireless community and economy.

101 Today's witnesses include electrical engineers and a
102 physicist with expertise in radio engineering. So I look
103 forward to your guidance on how receiver performance
104 strategies in devices as different as televisions,
105 Smartphones, and GPS systems impact our ability to put
106 spectrum to its best use. I am also looking forward to your
107 thoughts on how to strike a balance so we can accommodate new
108 innovations in wireless technology without forcing
109 manufacturers to waste time and money over-engineering
110 receivers for unworkable future uses. Remember: spectrum
111 equals jobs, and we must make sure it continues to remain a
112 job-creation engine into the future. We must ensure that our
113 policies promote continued growth and innovation in this
114 sector without endangering our Nation's communications,
115 commerce, and security.

116 We are also looking forward to the full report from the
117 Government Accountability Office as we requested in our
118 spectrum legislation, which is now law, as they look at this
119 issue as well.

120 So, gentlemen, thank you for being here. I now would
121 recognize the gentlelady from California.

122 [The prepared statement of Mr. Walden follows:]

123 ***** COMMITTEE INSERT *****

|
124 Ms. {Eshoo.} Thank you, Mr. Chairman. And my thanks to
125 all of my Republican colleagues for your patience, as well as
126 that of the witnesses and everyone that has come to this
127 hearing today as the Democrats held their reorganizational
128 caucus. And I had no idea that it would take the amount of
129 time that it did, especially with unanimous nominations, but
130 the speeches went on and on. So thank you again for your
131 patience.

132 Mr. Chairman, harmful interference between adjacent
133 spectrum bands is becoming the new spectrum crisis. As time
134 in which demand for mobile broadband continues to skyrocket,
135 ensuring that every megahertz of spectrum is used efficiently
136 is as important as our ongoing effort to free up new spectrum
137 bands. And our subcommittee I think has worked very, very
138 hard on this certainly with the instruction of witnesses, our
139 terrific staffs, and others as well.

140 What happened to LightSquared, a promising company with
141 plans to inject new competition into the wireless broadband
142 market, is disappointing. But unfortunately, that ship has
143 sailed. What is just as unfortunate is that this isn't the
144 first time in which an incumbent has raised the problem of
145 receiver overload. Similar interference issues arose between
146 cellular and public safety radio systems, as well as between

147 satellite digital radio systems and proposed terrestrial data
148 services.

149 These are tough issues. Consumers want their
150 smartphones and tablets to provide fast, reliable broadband
151 service, but no one wants more expensive devices, a potential
152 outcome of setting standards on receiver performance. If we
153 successfully reconcile these competing goals, I believe
154 consumers win, new entrants will have greater certainty
155 before investing billions of dollars, and a thriving consumer
156 electronics industry will not be unduly burdened.

157 Like most members of this subcommittee, I am not an
158 engineer and I don't have the technical expertise to answer
159 questions such as how much interference is tolerable, what
160 the cost of imposing standards are on receiver performance,
161 and if such standards were imposed, how many megahertz of
162 unused guard bands could be repurposed for mobile broadband?
163 Recognizing the importance of spectrum efficiency, we
164 included a GAO study of receiver performance in the
165 bipartisan spectrum bill, which was signed into law earlier
166 this year. The results of this study, the work of the FCC's
167 Technological Advisory Council (the TAC) along with the
168 experts testifying before our committee today will guide us
169 as we tackle these challenging questions and determine
170 whether new legislation and FCC rulemaking or advancement in

171 technology or a blend of these things--I don't know--are the
172 appropriate path forward.

173 So thank you again, the patience of our witnesses. You
174 got to stay longer in Washington. Oh, joy, is right. But we
175 really appreciate your being here to be instructive to us.
176 We thank you for your important work that you have done and
177 what you will continue to do to promote spectrum efficiency.

178 And with that, I yield back, Mr. Chairman.

179 [The prepared statement of Ms. Eshoo follows:]

180 ***** COMMITTEE INSERT *****

|
181 Mr. {Walden.} I thank the gentlelady for her opening
182 statement and comments and now I turn to the vice chair of
183 the Subcommittee, Mr. Terry.

184 Mr. {Terry.} Thank you, Mr. Chairman, for holding this
185 important hearing on receivers. I can tell you that many in
186 Nebraska are very upset that wide receiver Kenny Bell was not
187 named All-Big Ten and have demanded a hearing for which I
188 appreciate you calling.

189 Seriously, though, we have before us a policy that is
190 especially difficult to solve. As recent disputes over
191 interference clearly illustrate that the center of these
192 conflicts is the question of who bears the cost of mitigating
193 interference, the incumbent or the newcomer? This
194 transaction cost is a big obstacle to efficient spectrum use.
195 And the efficiency of spectrum use is so vital because
196 spectrum is the lifeblood of the wide variety of wireless
197 services that see ever-increasing demand. Spectrum, like
198 valuable land, cannot lie fallow or else our economy really
199 bears the cost.

200 The problem before us requires us to look closely at the
201 costs involved with mitigating interference. I am very
202 interested in hearing our witnesses' ideas about how best to
203 handle these costs. If the FCC has a role here, what should

204 it be? Whatever the answer is, I understand that our task is
205 to ensure that the licensees are able to utilize their inputs
206 effectively, but we must also avoid the trap of imposing
207 inordinate costs on a single type of licensee or hampering
208 innovative uses of spectrum.

209 I look forward to working with all of my colleagues and
210 look forward to hearing from our witnesses.

211 Yield to the gentleman from Florida.

212 [The prepared statement of Mr. Terry follows:]

213 ***** COMMITTEE INSERT *****

|
214 Mr. {Stearns.} I thank my distinguished colleague from
215 Nebraska and I welcome this hearing.

216 And this hearing is an important follow-up from the
217 hearing of my Oversight and Investigations Subcommittee that
218 I chair that was held in September and that examined the
219 FCC's role in the LightSquared network. As we discussed
220 during that hearing, LightSquared's billion-dollar investment
221 has simply been put in jeopardy due to an overload
222 interference issue that is caused by faulty receivers and GPS
223 devices. I warned then that we must not let poor receiver
224 standards result in more interference issues down the road.
225 Therefore, I am very pleased that this subcommittee is
226 closely examining the issue and beginning an important
227 discussion in how we can address receivers going forward. It
228 is extremely important.

229 I agree with the witnesses today that we should be wary
230 of government mandates that would govern receiver designs.
231 However, I do believe that more must be done to ensure
232 maximum use of our spectrum.

233 So I look forward to their approaches and I yield back,
234 Mr. Chairman. Thank you.

235 [The prepared statement of Mr. Stearns follows:]

236 ***** COMMITTEE INSERT *****

|
237 Mr. {Walden.} The gentleman yields back.

238 Mr. Latta or Mr. Guthrie, any comments before we go on?

239 Seeing none, the time is yielded back.

240 Is there a request for time on your side, Dr.

241 Christensen?

242 It doesn't appear we have any other Members seeking

243 recognition at this time. So now we will move right--

244 Mr. {Terry.} Note this date in history.

245 Mr. {Walden.} They have waited long enough. So let's

246 start with Mr. Repasi. Thank you for being here from the

247 Federal Communications Commission. We appreciate your

248 testimony and look forward to your comments. And just kind

249 of pull that mike close, make sure it is on, and then we will

250 avoid any receiver or transmitter interference with your

251 comments.

|
252 ^STATEMENTS OF RON REPASI, DEPUTY CHIEF, OFFICE OF
253 ENGINEERING AND TECHNOLOGY, FEDERAL COMMUNICATIONS
254 COMMISSION; PIERRE DE VRIES, SENIOR ADJUNCT FELLOW, SILICON
255 FLATIRONS CENTER, UNIVERSITY OF COLORADO, BOULDER; AND BRIAN
256 MARKWALTER, SENIOR VICE PRESIDENT, RESEARCH AND STANDARDS,
257 CONSUMER ELECTRONICS ASSOCIATION

|
258 ^STATEMENT OF RON REPASI

259 } Mr. {Repasi.} Good afternoon, Chairman Walden, Ranking
260 Member Eshoo, and members of the Communications and
261 Technology Subcommittee.

262 My name is Ron Repasi and I am deputy chief of the FCC's
263 Office of Engineering and Technology. OET is the
264 Commission's primary resource for engineering expertise and
265 provides technical support to the chairman, commissions, and
266 the FCC's Bureaus and Offices.

267 I appreciate your bipartisan interest in receiver
268 standards and for this opportunity to testify concerning the
269 role of receivers in enabling spectrum to be used for new and
270 innovative communication services. I am pleased to report
271 that the FCC's efforts to explore the issue in a
272 comprehensive way that includes stakeholders and technical

273 experts in both the federal and private sectors.

274 There is no question that, without concerted action, the
275 demand for mobile broadband spectrum would quickly outpace
276 the available supply. The Commission has and continues to
277 take numerous steps to meet this demand, including
278 reallocating spectrum, fostering advanced spectrum sharing
279 techniques, and promoting improvement in efficient spectrum
280 use.

281 The Commission's spectrum management efforts have
282 focused primarily on transmitters by establishing limitations
283 on power and noise that they may generate outside their
284 designated frequency bands while the performance of receivers
285 has generally been left to the marketplace. Receivers are
286 expected to operate within the same parameters as their
287 associated transmitters. That is not always the case because
288 sometimes receivers pick up energy outside of the spectrum
289 provided for their service.

290 Receiver performance is becoming increasingly important
291 as a limiting factor as we move to repurpose spectrum and
292 pack more services closer together. The continuing challenge
293 for the Commission will be to maximize the amount of usable
294 spectrum for cost-effective deployment of new communication
295 services while sufficiently protecting incumbent receivers.
296 If receiver technology remains static or is unable to keep

297 pace with the rapid evolution of transmission technologies,
298 the challenges before the Commission will increase
299 dramatically.

300 In 2003, the Commission initiated a Notice of Inquiry to
301 consider incorporating receiver interference protection
302 standards into spectrum policy on a broader basis. The
303 proceeding was terminated in 2007 but the Commission found
304 that nothing precludes it from evaluating the issues raised
305 by parties in the context of other proceedings that are
306 frequency band or service specific.

307 Over the past several years, receiver performance issues
308 have arisen in certain band-specific instances as a conflict
309 between legacy stakeholders and new entrants. The Commission
310 is proactively addressing the issue of receiver performance
311 and its impact on spectrum access for new services. Earlier
312 this year, Chairman Genachowski initiated a review of
313 spectrum efficiency and receiver standards with a two-day
314 workshop at FCC headquarters, featuring a broad range of
315 experts and stakeholders, including licensees, equipment
316 manufacturers and consumers. Chairman Genachowski has also
317 tasked the Commission's Technological Advisory Council to
318 study the issue of receiver performance, and OET Chief
319 Julius Knapp has been working with the TAC as it develops its
320 recommendations. The TAC plans to finalize its

321 recommendations at this upcoming December 10 meeting and then
322 submit to the Commission those recommendations for
323 consideration.

324 Commission staff participated as well in various
325 technical groups organized by private sector entities and to
326 discuss ideas about how to address receiver spectrum issues.
327 Staff also met with filter and electronic component suppliers
328 to discuss technology developments that hold promise for
329 improving the interference rejection capabilities of
330 receivers. These efforts by the Commission to gain a broader
331 perspective on receiver performance have been conducted in
332 tandem with OET's cooperation with GAO as it carries out the
333 Job Creation Act requirements to the study receiver
334 performance and spectrum efficiency. We look forward to the
335 GAO report and consulting with Congress as we consider what
336 next steps may be appropriate following release of the
337 report.

338 Again, thank you for this opportunity to testify here
339 today. We look forward to working with you and your staff to
340 forge solutions to future engineering challenges. And I
341 would be happy to answer any questions you may have.

342 [The prepared statement of Mr. Repasi follows:]

343 ***** INSERT 1 *****

|
344 Mr. {Walden.} Thank you very much, Mr. Repasi. We
345 appreciate the good work of you and your staff and Julius
346 Knapp down at the FCC. We have called upon your or Julius
347 before for your engineering answers, and we appreciate all
348 that you do down there.

349 We are going to go now to Mr. Pierre de Vries, Senior
350 Adjunct Fellow, Silicon Flatirons Center, University of
351 Colorado, Boulder. Mr. de Vries, thank you for being here.
352 I appreciate your testimony and look forward to you offering
353 it orally.

|
354 ^STATEMENT OF PIERRE DE VRIES

355 } Mr. {de Vries.} Thank you, Chairman Walden, Ranking
356 Member Eshoo, and members of the subcommittee. It is a
357 pleasure and an honor to be here today.

358 Yes, I am the physicist. My name is Pierre de Vries. I
359 have been involved in spectrum issues for about a decade and
360 spent the last 4 years focusing on the issue that is the
361 subject of this hearing today.

362 I laid out my testimony under four headings, and I would
363 like to just summarize the key points: first, the ``spectrum
364 crunch.'' The spectrum crunch that matters is the need to
365 squeeze in evermore services into increasingly crowded
366 spectrum, and that requires the ability to improve receivers
367 and radio systems in general to tolerate interference in
368 adjacent bands if they are in a given band. In this regard,
369 I would like to compliment and commend you, Mr. Chairman and
370 the Committee, for your hard work on the incentive auction
371 legislation. That was a vital step in extracting maximum
372 value from this very scarce spectrum.

373 The FCC can also play its part, I believe, by drawing
374 boundary lines more clearly. That is by clarifying both the
375 rights that radio services have to be protected from harm and

376 their responsibilities to tolerate reasonable interference.

377 Second, yes, receiver performance is key. Receivers in
378 one band or in fact more accurately the receivers and the
379 transmitters together as a system in that band--receivers
380 that cannot tolerate reasonable levels of interference in an
381 adjacent band unfairly impose costs on others and they reap
382 the benefits themselves--for example, cheaper equipment. So
383 far, as we have heard, the FCC has handled such interference
384 almost entirely by placing the burden on the neighbor--for
385 example, by reducing their transmit power sometimes to zero,
386 effectively precluding the introduction of valuable new
387 services. However, the receiving system operator also needs
388 to bear some responsibility, but it needs to know what that
389 responsibility is.

390 So third, I believe we can go a long way towards solving
391 this problem by using harm claim thresholds, also known as
392 interference protection limits or interference limits, and
393 that is the proposal I am putting to you today. Harm claim
394 thresholds state the interference levels in adjacent
395 frequencies that a service needs to tolerate without being
396 able to bring a harmful interference claim. No FCC-mandated
397 receiver specifications or standards are required. Harm
398 claim thresholds let manufacturers and operators figure out
399 the best way to deal with interference--for example, by

400 deploying suitable receivers.

401 Now, there may well be a few cases where harm claim
402 thresholds won't be sufficient and additional measures,
403 perhaps even mandated standards, may be unavoidable in a few
404 cases, but they should be a last resort.

405 Finally, Congress and this committee in particular can
406 play a decisive role by continuing to focus attention on this
407 issue as you are doing by making clear that the FCC can use
408 approaches that don't mandate receiver standards like the one
409 I have mentioned and by funding the FCC to commission the
410 engineering studies that are necessary to inform smart
411 regulatory frameworks.

412 So Mr. Chairman, that concludes my testimony. Thank you
413 again for inviting me today. I would be very happy to
414 respond to any questions.

415 [The prepared statement of Mr. de Vries follows:]

416 ***** INSERT 2 *****

|
417 Mr. {Walden.} Thank you, Mr. de Vries. We appreciate
418 that. I was hoping you would give us your neighbor/tent
419 analogy. I thought that really put it in perfectly
420 understandable terms.

421 We will go now to Mr. Markwalter, who is the senior vice
422 president, Research and Standards, at the Consumer
423 Electronics Association. Mr. Markwalter, we appreciate your
424 testimony and look forward to your comments.

|
425 ^STATEMENT OF BRIAN MARKWALTER

426 } Mr. {Markwalter.} Thank you. Subcommittee Chairman
427 Walden, Ranking Member Eshoo, and members of the
428 subcommittee, on behalf of the Consumer Electronics
429 Association, thank you for the opportunity to testify at
430 today's hearing on ``The Role of Receivers in a Spectrum
431 Scarce World.'' My name is Brian Markwalter and I am senior
432 vice president of Research and Standards at CEA.

433 CEA's more than 2,000 member companies include almost
434 all the world's leading consumer electronics manufacturers
435 and hundreds of small business. CEA and its members have a
436 vital interest and an important role to play in ensuring the
437 most effective and efficient use of spectrum.

438 As we continue to examine how to make the most efficient
439 use of our Nation's spectrum, CEA believes that spectrum
440 management must include an approach that examines the
441 interaction between transmitters and receivers. This
442 approach need not cause a shift from command-and-control
443 spectrum management to command-and-control device regulation.
444 The pillars of spectrum policy in a world of overcrowded
445 airwaves must include better information about receivers in
446 the field and their ability to tolerate interference,

447 certainty on possible new allocations so that businesses and
448 federal spectrum users may make informed design and
449 investment decisions, and primary reliance on stakeholders to
450 find the cost and performance boundary between adjacent
451 systems.

452 Equipment manufacturers and wireless service providers
453 have a strong self-interest in developing and deploying
454 devices that are resistant to forms of interference and to
455 create as little interference as possible. Service providers
456 require that their receivers meet very stringent design
457 specifications to ensure non-interference.

458 Licensed mobile devices must meet applicable standards
459 bodies' requirements prior to use by wireless providers. The
460 two primary examples are the standards created by the Third
461 Generation Partnership Projects. Industry has developed
462 these standards to ensure the items such as reference
463 sensitivity levels, receiver input levels, adjacent channel
464 selectivity, and blocking characteristics are standardized
465 and controlled.

466 Digital TV receivers provide another example of
467 effective response by industry stakeholders to document the
468 RF environment and the associated tradeoffs made by receivers
469 to operate in the wide range of expected signal levels. The
470 standard in this case ATSC Recommended Practice A/74. CEA

471 believes that A/74 serves as a good starting point for the
472 industry-to-industry dialogue as needed to complete incentive
473 auctions and introduce new mobile broadband services as the
474 upper adjacent neighbor to the TV band.

475 The debate over efficient use of spectrum has moved
476 beyond knee-jerk reactions and entered a thoughtful,
477 solutions-oriented discussion in venues like the FCC's
478 Technological Advisory Council. The early calls for
479 government mandates on device design have faded as
480 stakeholders have come to understand that such approaches are
481 not the best solution we have to spectrum crowding. We look
482 forward to a broader review of the soon-to-be-released TAC
483 report.

484 As we work to mitigate interference between the services
485 and receivers in adjacent bands, CEA offers the following
486 principles to guide policymakers and industry:

487 First, reduce uncertainty. The ultimate goal of
488 spectrum management should be to make the interference
489 environment more transparent so that designers have all the
490 information needed to deliver cost-effective products that
491 allow more efficient use of adjacent bands.

492 Second, use voluntary performance principles and
493 industry standards, not device mandates. Instead of adopting
494 static regulations governing receiver design, we believe the

495 FCC should allow industry to develop standards responsive to
496 planned allocations.

497 Third, collect information. The FCC should continue to
498 carefully inventory what services are operating in each band
499 and work with industry and government users to understand the
500 types of receivers deployed and their interference immunity
501 characteristics.

502 Fourth, case-by-case analysis. Any regulatory action
503 regarding spectrum allocations and receiver performance
504 should be narrowly tailored to allow technological
505 advancement. These principles are explained in more detail
506 in my written testimony.

507 To conclude, CEA is encouraged by the numerous fresh
508 ideas on spectrum policy and the concerted effort to free up
509 spectrum for much-needed commercial use. We believe that the
510 right regulatory approach to spectrum management leverages
511 stakeholders' deep understanding of their system capabilities
512 and price points in response to any government-articulated
513 plans for future allocations.

514 I would be happy to answer any questions.

515 [The prepared statement of Mr. Markwalter follows:]

516 ***** INSERT 3 *****

|
517 Mr. {Walden.} Mr. Markwalter, thank you for your very
518 thoughtful testimony. We appreciate your being here today as
519 well.

520 I will lead off with the questions and I will start with
521 you just as you were giving your testimony and certainly, Mr.
522 de Vries. What did you think of Mr. de Vries' proposal for
523 our consideration regarding the harm claim threshold notion
524 of how you might--I won't say regulation in this space--but
525 provide guidance in this space? Is that something CEA would
526 be interested in? Is that something you see as workable?

527 Mr. {Markwalter.} Yes, well, we are definitely
528 interested. And we should confess we are both on the TAC and
529 so we are both working this issue very carefully, the
530 interference limits approach. There are a lot of details to
531 be worked out yet.

532 Mr. {Walden.} Um-hum.

533 Mr. {Markwalter.} What is very appealing about the
534 approach is it allows the problem to be stated and doesn't go
535 directly to the solution. So as Pierre, described, it sets up
536 the environment and allows--

537 Mr. {Walden.} A framework.

538 Mr. {Markwalter.} A framework.

539 Mr. {Walden.} Yeah.

540 Mr. {Markwalter.} And, you know, leaves in the hand of
541 the users to build equipment to meet those needs rather than
542 going directly to solutions by dictating specific device
543 performance. There are some complicated issues yet to be
544 worked out about how you would, you know, establish the
545 limits--

546 Mr. {Walden.} Um-hum.

547 Mr. {Markwalter.} --to begin with in different use
548 cases but--

549 Mr. {Walden.} I appreciate that and I want to encourage
550 the TAC and its work and you two, since you are here in
551 public and not back in your TAC world, to continue because
552 while trying to break loose spectrum is one of the most
553 enjoyable tasks we have here on the Subcommittee. It is
554 simple and easy and there is never any--well, there is a
555 limit what we can do. And so we are going to be looking at
556 all these efficiencies.

557 Mr. de Vries, the growing need to place varied wireless
558 services in neighboring spectrum bands has prompted the FCC
559 to increasingly rely on guard bands, and that is something
560 that I really want to drill in a bit here. How efficient a
561 solution is that? One of my underlying questions I guess is
562 how much guard band, how much spectrum lies fallow because we
563 have this problem between transmitter and receiver? Can you

564 kind of address that piece of this? And does anybody know
565 how much that is? That is not calculated, I assume.

566 Mr. {de Vries.} Mr. Chairman, I think the answer to it
567 is how long is an elastic band? It depends on how hard you
568 pull it. To go back to the levels analogy, so let's say I
569 have got a receiver in this band--

570 Mr. {Walden.} Um-hum.

571 Mr. {de Vries.} If I set the level of the maximum
572 interference that it can tolerate very low, that is
573 effectively a guard band.

574 Mr. {Walden.} Right.

575 Mr. {de Vries.} Right? If I set it very high, it is
576 not. And choosing exactly where--

577 Mr. {Walden.} Right.

578 Mr. {de Vries.} --one chooses that level influences how
579 much you free up.

580 Mr. {Walden.} Got it.

581 Mr. {de Vries.} And so that decision, which the way we
582 are thinking on the TAC probably--the discussion starts
583 amongst engineers in a multi-stakeholder space--may end up at
584 the FCC. But where that number is set influences how much
585 more we can squeeze in.

586 Mr. {Walden.} Right. Okay. Well, you know, in my
587 background I was in the radio broadcast business 22 years and

588 a licensed amateur radio operator and so I played a little in
589 this. And you know, we had to limit our transmission, can
590 have this exposure and, you know, we all argued about how
591 sloppy the front ends are on AM receivers, you know, and all
592 the interference you get from power lines and everything
593 else. And so it just has always struck me that there is
594 ability to improve in that side of the equation. So I
595 appreciate that.

596 Let me go to Mr. de Vries. In the license context there
597 is a licensee on the hook at the FCC that has an ongoing
598 relationship with both the subscriber and the manufacturer.

599 Mr. {de Vries.} Um-hum.

600 Mr. {Walden.} The licensee can try to get a solution
601 deployed in the marketplace, but when there is no licensee,
602 as was the case with the GPS device problems in the
603 LightSquared case, it is a lot harder to identify and help
604 the individually impacted customers. So what do you think
605 the remedy is in such cases short of prohibiting or limited
606 the proposed new service? Do we need to treat these
607 situations differently from the licensed ones? Do we need to
608 be particularly careful where and how we deploy such devices?

609 Mr. {de Vries.} I think one definitely needs to pay
610 additional care to these cases for exactly the reasons that
611 you state. I think that there are a variety of possible

612 solutions on offer, and the ones that are chosen depends on
613 one's assessment of the risk. So the simplest solution is to
614 say we will set the harm claim thresholds and we will assume
615 that it is a well run industry with a lot of consensus and
616 they will come up with industry standards and they will sort
617 it out.

618 On the other hand, if one has less appetite for risk,
619 you could say we are going to require manufacturers to self-
620 certify, not have the government tell them how to build their
621 devices, but say it is going to work. And then thirdly, and
622 that is the last resort that may be necessary for there to be
623 mandated standards for particular kind of devices.

624 Mr. {Walden.} Okay. My time has expired. Before I
625 turn over to my ranking member and friend from California I
626 just want to say publicly that the chairman of the FCC was
627 very helpful to me during the LightSquared GPS issue by
628 making Julius available for a closed-door meeting of
629 engineers from both sides. The poor legal folks and
630 lobbyists were, you know, apoplectic on the sidelines but we
631 tried to drill down in this space: is there an engineering
632 solution here? Are there notch filers? Are there other
633 things you can do in this space? So I appreciated his
634 willingness to let us do that.

635 I turn now to my friend from California.

636 Ms. {Eshoo.} Thank you very much, Mr. Chairman.

637 And thank you again to the witnesses not only again for
638 your patience but your excellent testimony, too. It is on a
639 very important subject.

640 Before I begin with the questions, I would just like to
641 ask--and you don't have to do it now--but in the majority's
642 memo for today's hearing it states that the PCAST report
643 recommended the establishment of minimum technical standards
644 for receivers, and I would just like to know where in the
645 report it says that? We don't find it, and as we are talking
646 about whether there should be or shouldn't be and how much, I
647 think that it is important to have that clear. So it is in
648 the memo but we don't find it in the PCAST report. But you
649 can get that to us?

650 Mr. {Walden.} Yeah, I didn't--

651 Ms. {Eshoo.} Yeah, afterward. All right?

652 Mr. {Walden.} We will be happy to find it.

653 Ms. {Eshoo.} But I think it is a semi-important point.

654 To Mr. de Vries, you have been an advisor, you know, to
655 PCAST, to the President's Council of Advisors in Science and
656 Technology. Can you describe how government users would
657 benefit from establishing objective criteria for harmful
658 interference conditions? And just be as brief as you can
659 because I want to get through the panel.

660 Mr. {de Vries.} Um-hum. I think government users would
661 benefit by there being clearer criteria for what counts as
662 harm, which means they would be able to engineer their
663 systems to be more interference-tolerant, jamming-tolerant.

664 Ms. {Eshoo.} And by putting in place what you just
665 described, does this require technological advances? Are
666 there costs to it? And how open would the defense community
667 be to it do you think, I mean in your estimation, because
668 that is really the largest nut to crack I think.

669 Mr. {de Vries.} The setting of the threshold is just a
670 number. And the engineering that is required is left to
671 industry.

672 Ms. {Eshoo.} Um-hum.

673 Mr. {de Vries.} I can't speak for the DOD. I would
674 observe I think that one of the benefits of having clearer
675 fences is that it makes sharing or coexistence more feasible,
676 which means that it is less necessary perhaps to relocate and
677 clear.

678 Ms. {Eshoo.} Um-hum.

679 Mr. {de Vries.} They may find that attractive.

680 Ms. {Eshoo.} Um-hum. Thank you.

681 Mr. Repasi, thank you again for your fine work and for
682 being here. We have heard today that in reallocating
683 spectrum, the FCC should consider an inventory of services

684 and receivers that are operating in adjacent bands. Does the
685 FCC do this today? And if not, from an engineering
686 perspective, would this information help you to better
687 anticipate potential concerns with harmful interference?

688 Mr. {Repasi.} Thank you. Currently, the FCC does not
689 collect an inventory of receives that are in adjacent bands.
690 We rely on--

691 Ms. {Eshoo.} How do you know?

692 Mr. {Repasi.} We rely on the information that is
693 supplied in the course of our rulemakings. Manufacturers who
694 have concerns about interference, whether it is on a band or
695 overload interference, will supply technical information to
696 support their arguments on what their threshold--

697 Ms. {Eshoo.} I mean wouldn't it be in the interest of
698 whomever is the applicant to bring forward what is
699 advantageous to their case and then you rely on that?

700 Mr. {Repasi.} That is correct. The earliest possible
701 opportunity, of course, would be when the Commission issues a
702 proposal for a new rule, whether it--

703 Ms. {Eshoo.} I think that is a little squishy, don't
704 you?

705 Mr. {Repasi.} Well, that is the first opportunity.

706 Ms. {Eshoo.} Well, I mean you may not want to say yes
707 to that, squishy, but I mean, you know, in this town people

708 obviously are going to advance and I think it is human nature
709 to advance the best case possible, to advance your case. But
710 if the information you are using is just that, it could be
711 biased and that is what I am concerned about. But maybe I am
712 off on the wrong track on this.

713 Mr. {Repasi.} But that information would go into what
714 proposals we present and we seek comment on those. And if
715 there were assumptions that we made that are challenged by
716 the public, we take that information into account. And
717 usually, supporting technical material is supplied in our
718 record to support the challenge to our assumptions.

719 Ms. {Eshoo.} Thank you very much.

720 Mr. Markwalter, thank you again for what you do. You
721 suggested in your testimony that equipment manufacturers have
722 a strong self-interest in developing and deploying products
723 that create as little interference as possible. I agree, but
724 is this a problem that has been many years in the making? I
725 mean to help expedite a long-term solution, would you support
726 the FCC reopening the formal proceeding on the matter? Does
727 it need that?

728 Mr. {Markwalter.} So I think given the time that has
729 passed and the amount of work that is even currently
730 underway--

731 Ms. {Eshoo.} Um-hum.

732 Mr. {Markwalter.} I would recommend we wait for the TAC
733 report to come out and see--

734 Ms. {Eshoo.} Um-hum.

735 Mr. {Markwalter.} --what work is teed up for the TAC
736 next year, because I think the interference limits, this
737 notion of clarifying rights and expectations is being
738 addressed pretty thoroughly.

739 Ms. {Eshoo.} Um-hum.

740 Mr. {Markwalter.} So I would leave it at that. I think
741 there is plenty of work--

742 Ms. {Eshoo.} Um-hum.

743 Mr. {Markwalter.} --for the industry yet to do in that
744 environment.

745 Ms. {Eshoo.} Thank you. That is most helpful. Thank
746 you to each witness.

747 And thank you, Mr. Chairman.

748 Mr. {Walden.} You are welcome.

749 The chair now recognizes the gentleman from Nebraska,
750 the very able vice chair of the Subcommittee on
751 Communications and Technology, Mr. Terry.

752 Mr. {Terry.} Well stated, just like I wrote it.

753 Thank you, Mr. Walden, for your able leadership over the
754 last two years. And certainly the receiver issue is one that
755 you have mentioned many, many times and I am glad we have

756 this hearing.

757 I am intrigued, Mr. de Vries, about this harm claim
758 threshold standard. It is almost a libertarian type of view
759 in how to resolve this issue. I have to work in examples, so
760 the first issue that I have is how do we resolve the
761 incumbent receiver? And so using the GPS versus LightSquared
762 issue, using the harm claim threshold, tell me how that would
763 require or force GPS receivers to upgrade to be able to
764 better filter out the delete over interference?

765 Mr. {de Vries.} The way I anticipate this might work is
766 when you start, you are going to have a lot of devices out
767 there. We are beginning a transition. So the thresholds
768 would be set very low. So I am the GPS receiver, very low
769 interference threshold so that all the existing receivers are
770 protected. That may be so low that no service can be
771 deployed. The FCC might then say or industry might agree
772 that 10 years from now it goes up to here at which point
773 these receivers have 10 years to build filters to accommodate
774 this increased signal.

775 Mr. {Terry.} All right. That is interesting. How
776 would they know how to predict what type of interference or
777 level of interference could occur in 10 years? So in a sense
778 would the FCC have to come back and say, hey, there is this
779 new standard? So now we are getting back to the standards

780 issue. So is that the way it would work? Because right now,
781 these GPS folks can just say we don't have any reason to
782 move.

783 Mr. {de Vries.} I am so glad you asked that question,
784 sir, because I wasn't clear. So the harm claim threshold
785 doesn't attempt to describe the actual interference
786 environment.

787 Mr. {Terry.} All right.

788 Mr. {de Vries.} It simply says if the interference is
789 below this number, you cannot claim harm.

790 Mr. {Terry.} Okay.

791 Mr. {de Vries.} If it is above the number, then you
792 can. So the FCC does not get into the business of trying to
793 predict what the environment will be.

794 Mr. {Terry.} But just where the threshold would be, the
795 harm threshold--

796 Mr. {de Vries.} Yes.

797 Mr. {Terry.} --would still be set by the FCC?

798 Now, Mr. Repasi, add a layer then on the involvement in
799 this plan of the FCC. How long would it take for the FCC to
800 establish a harm claim threshold and what would be the
801 processes to get there?

802 Mr. {Repasi.} Thank you. Well, as we know, currently,
803 the TAC is debating on how to flesh out this approach and

804 provide formal recommendations to the Commission. We also
805 have the GAO that is reviewing spectrum efficiency standards,
806 and that report is due by February of next year. We, of
807 course, would have to take the recommendations from the TAC
808 and then the recommendations--

809 Mr. {Terry.} Well, for further questions let's just
810 assume that TAC recommended an approach like the harm claim
811 threshold.

812 Mr. {Repasi.} Right. It would come down to where we
813 would apply it first. If it is applied in a specific case,
814 we would have to determine who the neighbors are before we
815 could adjudicate whether the harm claim threshold is
816 sufficient to protect the existing services, let alone
817 services that are--

818 Mr. {Terry.} So it would still have to be done on a
819 per-device level?

820 Mr. {Repasi.} I think it would still have to be on a
821 case-specific, band-specific basis, yes.

822 Mr. {Terry.} Okay.

823 Mr. {Repasi.} Because the interference to a receiver
824 that is looking into space for example, may be a much lower
825 threshold than for a receiver that is communicating with a
826 broadband advanced wireless system.

827 Mr. {Terry.} Some of the earlier discussions amongst us

828 is that the FCC preferred more of a standards-based. I would
829 assume the thinking would be that on a standards-based, then
830 it is clear; everyone knows what they have to manufacture to
831 or engineer up to. Any thoughts that you could share with
832 us? Is that where the FCC is? Are they waiting for the
833 report to come out?

834 Mr. {Repasi.} I think we are waiting for the report to
835 come out. We want to make sure we have all the facts in line
836 before we come out with a specific proposal on how to
837 implement some of the recommendations, including from the
838 GAO. So I think we are a little bit of a wait mode. But
839 nonetheless, we want to be sure that we don't curb
840 innovation. We did have that 2003 NOI that we released. We
841 got a lot of good comments from the industry. Some of the
842 comments still remain today. The sentiment still remains the
843 same. And there was concern expressed in the record there
844 that standards could equate to curbing innovation, and we
845 want to be careful not to be in a position to stop
846 innovation.

847 Mr. {Terry.} All right. Thank you.

848 Mr. {Walden.} The gentleman's time is expired.

849 Turn to our friend from the Virgin Islands, Dr.
850 Christensen.

851 Dr. {Christensen.} Thank you, Mr. Chairman.

852 And again thank you for your patience with us today.

853 I guess I would ask this question to the panel but
854 beginning with Mr. Repasi because I know you are familiar
855 with NTIA's work in the role of receivers in managing
856 spectrum for federal users. Do you or any of the other
857 panelists think that there are lessons that we can learn from
858 NTIA's approach to setting federal receiver standards?

859 Mr. {Repasi.} Thank you. Yes, I believe you are
860 referring to the NTIA study document that was produced in the
861 2003 time frame as well, and they listed several types of
862 standards for the fixed and mobile systems that were
863 operating through a range of spectrum. That of course is
864 helpful to know where things are on the federal side as far
865 as where they operate and what their thresholds are for
866 interference so that when we do get into looking at new uses
867 of spectrum that involve federal users, we at least know what
868 the starting point is.

869 Dr. {Christensen.} Any other comments from anyone else?
870 So I will just go on to another question.

871 Mr. {de Vries.} The one thing that I learned from that
872 report was how complicated receiver specifications become and
873 how service-specific they are and that they intend to imbed
874 assumptions about how things work today into requirements
875 that then live on perhaps for life.

876 Dr. {Christensen.} And as things change and new
877 innovation.

878 Just if you wanted to comment.

879 Mr. {Markwalter.} Thank you. And I agree with that.
880 It is a good reference point but a federal user is both user
881 and procurer, you know, manages everything about it. In a
882 commercial case, the allocations are done by the FCC but
883 equipment may be purchased by a licensee or may be done
884 independently. So there are a lot of parts at work that
885 doesn't map over from federal use to commercial use.

886 Dr. {Christensen.} And Mr. Markwalter, what tools do
887 you think are currently available to the FCC to incentivize
888 and improve receiver standards?

889 Mr. {Markwalter.} Yeah, so I know we are all kind of
890 falling back on the TAC report. I think there are some good
891 things that will be documented in the TAC report. The FCC
892 right now, you know, clearly can articulate the emissions
893 side. It is less clear what the authority is on regulating
894 receivers. And, you know, as we have said, we probably need
895 to see what the exact tools are being proposed before we
896 decide whether that is the right amount of authority or not.
897 And then as the previous cases show, they have the ability to
898 go in and work with users in adjacent bands and figure things
899 out, but the evidence I see is that the best case is when the

900 adjacent users, even if they are in conflict because the
901 problems are typically so technical and so case-specific, if
902 they can bring a solution to the FCC, that seems to be the
903 best outcome.

904 Dr. {Christensen.} Okay. So that was my next question
905 which I was going to pose to Mr. de Vries. What role do you
906 think manufacturers of receiver devices should play in
907 setting performance levels or defining a reasonable level of
908 interference?

909 Mr. {de Vries.} I think manufacturers do that as part
910 of their business. The discussion about what a good receiver
911 is is a negotiation between the provider and their customer
912 and that that is what happens when industry sets standards or
913 when purchasers like the Federal Government do it.

914 Dr. {Christensen.} Okay. Thank you, Mr. Chairman. I
915 will yield back the balance of my time.

916 Mr. {Walden.} I thank the gentlelady for yielding back.

917 I think we have each got a few other questions to ask.

918 I am going to throw one out that is just slightly
919 outside of what we came here to talk about but it plays into
920 it a bit, and that has to do with the notion of efficient use
921 of spectrum as opposed to just interference use. But do you
922 all look at things like how much spectrum there might be or
923 more usage capability if you have, for example, interoperable

924 devices in the cell phone world? Does LTE and that sort of
925 thing, does that begin to merge all that in when you are
926 looking at total number of users versus total amount of
927 spectrum? I mean do you all get into those discussions?

928 Mr. de Vries?

929 Mr. {de Vries.} Chairman, I grin because I have great
930 difficulty with the concept efficient use of spectrum.

931 Mr. {Walden.} Okay.

932 Mr. {de Vries.} I don't know what it means. To me
933 maybe because I am a geek, efficiency is a ratio. It is what
934 you get out for what you put in.

935 Mr. {Walden.} Um-hum.

936 Mr. {de Vries.} The number of frequencies that you put
937 in is not the only input.

938 Mr. {Walden.} Um-hum.

939 Mr. {de Vries.} There are things like investment costs-
940 -

941 Mr. {Walden.} Um-hum.

942 Mr. {de Vries.} --infrastructure costs, deployment
943 costs, and I think what I try to focus on is how do we
944 maximize the value of radio services.

945 Mr. {Walden.} Okay.

946 Mr. {de Vries.} And in fact that is somewhat of a
947 change from what we have traditionally done, which is how do

948 we minimize interference if we need to maximize value?

949 Mr. {Walden.} All right. Now, bring that down from
950 your physicist level. You know, we work better with
951 pictures--

952 Mr. {de Vries.} Yeah.

953 Mr. {Walden.} --and small words. So tell me what that
954 means for us as policymakers. I mean from your perch, from
955 your big-brained perspective, what is it we can do in this
956 space? I mean we all talk about crisis and spectrum. There
957 is spectrum out there right now. I think this is a down-the-
958 road spectrum crisis and hopefully technology eclipses that.
959 But what is it that we should be looking at that we are not?

960 Mr. {de Vries.} I think the first thing I would say is
961 that you have to keep all our noses to the grindstone.

962 Mr. {Walden.} That is what we are here for.

963 Mr. {de Vries.} As you have said, it is a long-term
964 problem and everybody's tendency is to punt and not deal with
965 the long-term ones because there are lots of short-term hard
966 problems.

967 Mr. {Walden.} Um-hum.

968 Mr. {Markey.} It is not just us, sorry, that likes to
969 punt things.

970 Mr. {Walden.} So what should we be looking at
971 specifically?

972 Mr. {de Vries.} What I, of course, would be saying is
973 two things: one, to focus on encouraging the FCC to set these
974 clear boundaries--

975 Mr. {Walden.} Um-hum.

976 Mr. {de Vries.} --because I have ended up thinking
977 about interference limits as the minimal effective step that
978 we need to take to make progress on this problem.

979 Mr. {Walden.} Um-hum.

980 Mr. {de Vries.} And I think part of that is to, if you
981 can, remove any uncertainty that the FCC has the ability to
982 do that because there have been doubts about FCC authority
983 regarding receiver standards. These are not receiver
984 standards; therefore, they should be able to move ahead.

985 Mr. {Walden.} Okay. Mr. Markwalter, do you have some
986 comments along these lines?

987 Mr. {Markwalter.} I don't think I have much to add.
988 There are some people who are looking at the question of the
989 complexity of band plans, especially for cell phones--

990 Mr. {Walden.} Um-hum.

991 Mr. {Markwalter.} --which is sort of related to what
992 you are talking about. One of the things that inhibits
993 phones that can be used across a lot of different carriers
994 and a lot of different bands is the fact that, you know, as
995 we find more spectrum, it is not all together--

996 Mr. {Walden.} Right.

997 Mr. {Markwalter.} --anymore. It is scattered around.

998 And so there is a separate part of the TAC working on that

999 issue as--

1000 Mr. {Walden.} Sort of--

1001 Mr. {Markwalter.} --it is sort of an unrelated problem.

1002 Mr. {Walden.} Right.

1003 Mr. {Markwalter.} You know, we conjecture that, you

1004 know, there is a time in the future where technology gets

1005 better and better where receivers can be more agile so--

1006 Mr. {Walden.} Um-hum. So you can skip across the bands

1007 and still--

1008 Mr. {Markwalter.} Correct. And we are clearly not

1009 there yet--

1010 Mr. {Walden.} Um-hum.

1011 Mr. {Markwalter.} --and we are having some discussion

1012 about how accurately we could project when that would happen.

1013 And really what you would like to do is have receivers that

1014 are cost-effective that can be agile in the future; then, you

1015 have got a shot at changing allocations.

1016 Mr. {Walden.} All right. Thank you.

1017 Once again, I am going to turn to Ms. Eshoo.

1018 Ms. {Eshoo.} Thank you, Mr. Chairman. I will be as

1019 brief as possible. I just have three quick questions to ask

1020 Mr. Repasi and yes or no will do.

1021 I would like to ask you to address the question that has
1022 been raised about the need for guard bands if receiver
1023 filters can dramatically improve spectral efficiency. Do you
1024 think based on today's filter technology that guard bands can
1025 be eliminated as an interference mitigating solution? Yes or
1026 no? No.

1027 Mr. {Walden.} Turn on your mike.

1028 Mr. {Repasi.} I am sorry. No, I don't think they can
1029 be eliminated in all cases when you have two adjacent
1030 services.

1031 Ms. {Eshoo.} Are you seeing any leaps in improvement of
1032 filter technology for public broadband services?

1033 Mr. {Repasi.} Seeing leaps, no; seeing improvements,
1034 yes. Filter technology is improving. As I mentioned in my
1035 testimony, we have met several times with equipment
1036 manufacturers and component designers, and at the component
1037 level, there are improvements being made mainly because of
1038 the demand for more broadband services. The demands are
1039 being placed on the component designers to come up with
1040 better filters that are sharper and able to better deal with
1041 interference issues because they have got the spectrum
1042 congestion issues.

1043 Ms. {Eshoo.} So in the foreseeable future we still need

1044 guard bands to separate mobile broadband services from
1045 adjacent services like over-the-air broadcast television?

1046 Mr. {Repasi.} Yes. With current technology, even in
1047 the PCS world where they are going to 4G deployments with
1048 LTE--

1049 Ms. {Eshoo.} Um-hum.

1050 Mr. {Repasi.} --remember, you have downlinks in one
1051 band and uplinks in another--

1052 Ms. {Eshoo.} Uplinks in the others, um-hum.

1053 Mr. {Repasi.} --with frequency division duplex
1054 technology--

1055 Ms. {Eshoo.} Um-hum.

1056 Mr. {Repasi.} --where there is a duplexer spacing in
1057 between the two out of necessity because the up- or downlink
1058 channel could interfere with the lower uplink channel if
1059 there is not sufficient--

1060 Ms. {Eshoo.} Um-hum.

1061 Mr. {Repasi.} --separation between the two. That is
1062 the equivalent of a guard band.

1063 Ms. {Eshoo.} Um-hum.

1064 Mr. {Repasi.} And this is with the state-of-the-art
1065 technology as it is now.

1066 Ms. {Eshoo.} Thank you.

1067 I yield back, Mr. Chairman.

1068 Mr. {Walden.} Thank you.

1069 Gentleman from Nebraska?

1070 Mr. {Terry.} Thank you. Mine is to the consumer
1071 electronic, Mr. Markwalter. So let's take the again
1072 GPS/LightSquared interference issue. And now the FCC is
1073 threatening or developing their harm threshold saying that
1074 now GPS devices have to have a higher level of being able to
1075 filter out the interference. What does that mean to the
1076 consumer electronics manufacturers who are making the GPS?
1077 What would be the burdens on them and what would be the
1078 potential cost to them to now develop the filters to meet
1079 this harm threshold?

1080 Mr. {Markwalter.} Sure. I think the industry and one
1081 of the things we have talked about a lot and I have included
1082 in my testimony is how important it is to have the industry
1083 directly involved in that. And in my mind, ideally, you want
1084 the industry to try to develop those numbers, to recognize
1085 the problem and try to develop those numbers because it is
1086 very hard as an outsider to understand the cost and
1087 performance impact.

1088 GPS in particular isn't a communication system as
1089 everybody has talked about. You know, it is a positioning
1090 system so it has different behaviors in how it is trying to
1091 pick up signals, so I won't even hazard to guess what the

1092 cost impact would be. And the truth is it depends on where
1093 you set the level. And so that is going to take some
1094 dialogue about, you know, how much impact do you want to have
1095 on this type of positioning system to in the future be able
1096 to get new use of the adjacent band.

1097 Mr. {Terry.} All right. And it still comes back to
1098 that. It is almost a device and some specific for the FCC
1099 would have different thresholds particularly on different
1100 devices, Mr. de Vries?

1101 Mr. {de Vries.} I don't think that would be
1102 appropriate. That actually to me would be a receiver
1103 specification. So if you build this device, you have got to
1104 do this. I believe that it is appropriate to set the harm
1105 claim threshold for a service. And so, for example, in a
1106 service like GPS, you could have a certain level for
1107 terrestrial operations. You might have another level, a
1108 different value, for aviation. But many more permutations
1109 like that and we get too--

1110 Mr. {Terry.} Right. That makes more sense to me. All
1111 right. Still, it means that incumbents would have a new
1112 standard put on them or threshold of harm that was different
1113 than perhaps when the manufacturers put the product out,
1114 whatever it would be. So they would have to redevelop
1115 technology for the next generation of device. All right. I

1116 wish I can come up with more questions but that did add some
1117 context and clarification. So thank you.

1118 Mr. {Walden.} The interesting thing in that is it is
1119 kind of what we all go through with updating computers and
1120 software.

1121 Ms. {Eshoo.} Absolutely.

1122 Mr. {Walden.} You know, I tried to download a little
1123 app on my older iPhone and the new app won't load on the old
1124 iPhone.

1125 Ms. {Eshoo.} Right. Right.

1126 Mr. {Walden.} I mean it just is the march of
1127 technology.

1128 Mr. {Terry.} That is a discussion some of us lay people
1129 were having in our office. What does it take? Is this
1130 simply writing new code or is the device going to have to
1131 have physical filter device chips in it? What does it take?

1132 Mr. {Walden.} I will let the engineer--

1133 Mr. {Terry.} Do we have an engineer here?

1134 Mr. {Markwalter.} So this also relates kind of to the
1135 other questions to me. I think most of what we are talking
1136 about here is a hardware question, what the engineers would
1137 call the RF front end, the radio part of the equipment. And
1138 so we are talking about things like filters for the most
1139 part. This other group that, you know, we are looking at

1140 these potential for future agile radios. What we hope to get
1141 to is where there is less of that sort of fixed, you know,
1142 these components that can't move; they are highly
1143 specifically designed to more of this, you know, digitally
1144 with processors and algorithms, you know, software as you
1145 talked about, but we are not there yet for very many things.
1146 Most of it is still much more cost-effective, performance is
1147 a lot higher, and the battery life is a lot better to
1148 separate out the RF front end.

1149 Mr. {Walden.} Okay.

1150 Mr. {Markwalter.} So for now it is hardware.

1151 Mr. {Walden.} Mr. Gingrey, do you have any questions
1152 for our witnesses or comments you would like to make? We
1153 have a transmitter issue here.

1154 Dr. {Gingrey.} Yeah, I--

1155 Mr. {Walden.} You might want to slip to the other
1156 microphone.

1157 Dr. {Gingrey.} Is it working?

1158 Mr. {Walden.} No.

1159 Ms. {Eshoo.} No.

1160 Dr. {Gingrey.} All right. I will move.

1161 Mr. {Walden.} I think you may have to move up to this
1162 level, which you have sought to do for some time.

1163 Ms. {Eshoo.} He can sit next to me.

1164 Dr. {Gingrey.} I am making progress.

1165 Mr. {Walden.} Watch the seniority grow, right there,
1166 before our very eyes.

1167 Dr. {Gingrey.} Mr. Chairman? All right. We are live.
1168 Mr. Chairman, thank you for calling today's hearing on
1169 another issue within the realm of spectrum, and of course,
1170 that is the receivers.

1171 And I also want to thank the panel, these technical
1172 experts in providing the Subcommittee with their perspective
1173 on this important issue. In my brief time this morning I
1174 will get right to my questions. And let me start with you,
1175 Mr. Markwalter.

1176 Based on your testimony, you voiced support for industry
1177 standards as opposed to FCC mandates when it comes to the
1178 interfering subordinates. Would FCC standards undermine what
1179 is already in place, and if so, how?

1180 Mr. {Markwalter.} Well, in some cases we already have
1181 very good industry standards in place, so I guess if the FCC
1182 did something on top of that, I would argue that it would
1183 undermine it because it would in effect overrule what maybe
1184 industry has already done. So when I talked about the cell
1185 phone industry has very robust standards and, you know, a
1186 very strong test regime to make sure products meet it. So
1187 overlaying mandates on top of that probably would have a bad

1188 effect. And, you know, what we would like to see is industry
1189 working on these voluntary standards because we think they
1190 understand their use cases better and what can be tolerated
1191 in terms of cost and efficiency and then figure out where
1192 there is regulation necessary or not from that point.

1193 Dr. {Gingrey.} Mr. de Vries, do you have a comment on
1194 that?

1195 Mr. {de Vries.} So I would actually echo that because
1196 the standards that industry set reflect what their best
1197 practices are. Very often--and Mr. Repasi can correct me--
1198 but the FCC does sometimes incorporate reference to industry
1199 standards in its rules deferring to industry. The difficult
1200 issue that the harm claim threshold and interference limit
1201 approach is trying to address is not one industry trying to
1202 referee interference from Verizon to AT&T to T-Mobile but
1203 from cellular to broadcast things, say, or vice versa. And
1204 typically, what we have seen is that broadcasters don't often
1205 read the cellular standards and the cellular guys don't read
1206 the broadcasting standards. That is an outstanding problem.

1207 Dr. {Gingrey.} Well, let me then move to Mr. Repasi and
1208 shift a few questions for you in your important position as
1209 part of FCC. Can you clarify for us whether the FCC
1210 currently has the authority to impose receiver standards?

1211 Mr. {Repasi.} Thank you. I am here to offer

1212 engineering and technical expertise. I am not in a position
1213 to offer a legal opinion on the Commission's authority but I
1214 can say that the approaches that are being considered within
1215 the TAC are certainly within our ability from a technical
1216 perspective to implement the approaches that are being
1217 highlighted in that process.

1218 Dr. {Gingrey.} Yeah, I was going to ask. I think maybe
1219 you just answered the question. I was going to ask you if
1220 this was a situation where we in Congress would need to act
1221 to grant FCC the necessary authority but you have kind of
1222 taken a pass on that in regard to your level of expertise.
1223 Personally, I think that it is unclear as to what authority
1224 the FCC has in this arena. Hypothetically speaking, and not
1225 to indicate support for further regulation, but does the
1226 Commission currently even have the resources to set technical
1227 standards for this wide variety of receivers out there? And
1228 would Congress need to authorize and appropriate new funding
1229 for this purpose under the FCC?

1230 Mr. {Repasi.} Thank you. Yeah, we do have the
1231 technical expertise to deal with the recommendations that
1232 come out of the TAC. Again, I think we have the expertise to
1233 implement those. As far as funding goes, we are in a
1234 position now where we would have to factor in any budgeting
1235 into the next fiscal year budget and we would have to address

1236 it when we deal with our budget issues for the following year
1237 as far funding new programs at the agency.

1238 Dr. {Gingrey.} Yeah, well, of course as I am sure you
1239 all have talked about in your testimony, there are untold
1240 number of receiver devices out there for hundreds of
1241 different purposes, and we see them all parts of society. So
1242 therefore, how would you anticipate receiver regulations even
1243 being implemented? I mean is this something that can be done
1244 and how costly would it be? How much more funding would be
1245 necessary for the FCC to take on this challenge?

1246 Mr. {Repasi.} I don't have a specific cost estimate or
1247 even a ballpark that I could offer up, but as far as the
1248 approach, I would imagine if we apply the approach in several
1249 frequency bands, it could be voluminous at first trying to
1250 manage the different type of receiver specifications. As Mr.
1251 de Vries had mentioned, broadcasters are not participating in
1252 3GPP. 3GPP participants aren't participating in the
1253 broadcast standard development. So it is going to be new, I
1254 think, across different industry sectors on understanding the
1255 underpinnings of each of the standards. So I think there is
1256 a hurdle there and it will take some time to get that level
1257 of understanding among the different industry sectors.

1258 And then as far as incorporation by reference to some of
1259 the standards, we are very familiar with 802.11 from IEEE.

1260 We are very familiar with the 3GPP standards. So again
1261 within the Commission we have the expertise. We know the
1262 underpinnings of those standards, so maybe it is less of a
1263 hurdle for us to deal with it.

1264 Dr. {Gingrey.} Well, thank you very much. I thank all
1265 three of you.

1266 And Mr. Chairman, I yield back.

1267 Mr. {Walden.} I thank the gentleman for yielding back.

1268 I recognize the gentleman from Massachusetts, Mr.
1269 Markey.

1270 Mr. {Markey.} Thank you, Mr. Chairman, very much.

1271 We are about to enter a brave new world where tens of
1272 thousands of domestic drones consume an increasing share of
1273 spectrum and crowd into already congested bands. The FAA
1274 Modernization and Reform Act passed in February requires the
1275 Federal Government to fully integrate government commercial
1276 and recreational drones into U.S. airspace by October of
1277 2015. There could be as many as 30,000 drones in the sky
1278 above the United States by 2020. Drones can carry
1279 surveillance equipment including video cameras, infrared
1280 thermal imagers, radar, and wireless network detectors.
1281 Drones may gather information, take measurements, snap
1282 photos, use GPS and communicate all this information back to
1283 its operators. All this requires spectrum and raises a

1284 number of questions about whether this dramatically expanded
1285 use of drones will cause interference problems.

1286 But we must also ensure that as drones take flight in
1287 domestic airspace, they don't take off without privacy
1288 protections for those along their flight path. Drones
1289 shouldn't interfere with our privacy and they also shouldn't
1290 interfere with other devices using neighboring spectrum.

1291 Mr. Repasi, what steps is the FCC taking to ensure
1292 potential interference problems are addressed as thousands of
1293 drones will soon fill our skies? Has the FCC staff met with
1294 FAA staff to address what receivers are necessary on drones
1295 to ensure interference is minimized? And what are you doing
1296 to protect privacy?

1297 Mr. {Repasi.} Thank you. As far as interference
1298 concerns with respect to drones, it is a case of interference
1299 scenario just like any other where you have radio
1300 communications equipment, whether it is used for video or
1301 whether it is used for controlling the aircraft. We have
1302 tradeoffs that we have to make with respect to the
1303 allocation, whether it is in an aeronautical band and who the
1304 neighbors are so we can deal with power levels and emissions
1305 to make sure that interference is not caused to those drones.

1306 As far as working with the FAA, we stand ready to work
1307 with the FAA to discuss these issues. In fact we have a team

1308 of folks who deal with the FAA regularly on the
1309 Interdepartment Radio Advisory Committee where not just the
1310 FAA but other federal agencies who are interested in the use
1311 of drones participate and discuss technical issues that we
1312 deal with from an interagency perspective.

1313 And I must say from a privacy perspective, I haven't
1314 been involved in privacy issues with respect to the
1315 Commission's work, but I would be more than happy to go back
1316 to the appropriate bureau and have somebody contact you
1317 directly to answer your questions.

1318 Mr. {Markey.} Well, today, Mr. Barton and I are
1319 releasing the FAA's response to our inquiry asking how the
1320 agency plans to ensure that the privacy of Americans will be
1321 protected as the agency permits the large expansion and use
1322 of drones in domestic airspace. What is clear from the FAA's
1323 response is that they have little interest in establishing
1324 privacy protections, public transparency into its current and
1325 future licensing process. The FAA is wrong. The FAA is dead
1326 wrong on this issue in terms of ensuring that privacy is
1327 protected.

1328 These 21st century eyes in the sky shouldn't become
1329 spies in the skies preying on the private lives of Americans
1330 all across our country, 30,000 drones without insurance that
1331 the information gathered is not compromised.

1332 All three of you, hopefully, would support legislation
1333 that establishes privacy rules of the sky that ensure private
1334 information on Americans is protected before drones are
1335 licensed. So the question that I have for each of you is do
1336 you think drone operators should have to disclose what data
1337 they collect, how long data is retained, and whether
1338 information is provided or sold to third parties? Does the
1339 public have a right to know where and when these drones will
1340 be flying over their backyards gathering information about
1341 their families? Mr. de Vries?

1342 Mr. {de Vries.} Sir, I am afraid I have no expertise.

1343 Mr. {Markey.} That is fine. Mr. Markwalter?

1344 Mr. {Markwalter.} The same. I am not familiar with the
1345 issue.

1346 Mr. {Markey.} Okay. Well, I will tell you who the
1347 experts are--your ordinary families. And as new technologies
1348 take off, they have to be accompanied by the human values
1349 which have animated civilization for 5,000 years and the
1350 protection of the sanctity of a family its privacy. What it
1351 does, where it goes is still central to the identity of us as
1352 a species. And I think it is important for this committee to
1353 play a role in ensuring it is built into this new technology.

1354 I thank you, Mr. Chairman.

1355 Mr. {Walden.} The gentleman's time is expired.

1356 I turn now to the gentleman from Florida, Mr. Stearns.

1357 Mr. {Stearns.} Yeah, thank you, Mr. Chairman.

1358 Mr. Markwalter, you stated in your testimony that an
1359 inventory of what services and receivers are operating in
1360 each band as an area of spectrum policy that needs more
1361 attention. And so I agree with you and have long called for
1362 various spectrum inventories to be conducted. Do you think
1363 there is a role for Congress here that there should be
1364 legislation that would apply to help bring this spectrum
1365 inventory to fruition?

1366 Mr. {Markwalter.} I think at this point we should see
1367 what the TAC tees up for next year because I think this
1368 question of the dearth of information on what is out there is
1369 going to become critical, and so we may see some work in that
1370 area. So I think we can wait for a couple more reports to
1371 come out and then address the issue of whether legislation is
1372 needed to push it.

1373 Mr. {Stearns.} And what time next year will this be?

1374 Mr. {Markwalter.} So presumably the TAC would lay out
1375 its work agenda early in the year. We have had quarterly
1376 meetings in the past. I would think within the first quarter
1377 of next year we would have both the GAO report and know what
1378 the TAC plans on working on.

1379 Mr. {Stearns.} Mr. de Vries, as you explained your

1380 testimony, ``wireless systems in one band that cannot
1381 tolerate reasonable signal levels in an adjacent band
1382 unfairly imposed cost on others, notably the operators in
1383 those adjacent bands, while reaping the benefits themselves,
1384 for example, by using cheaper receivers.'' You know, I think
1385 this is what exactly happened in LightSquared or the GPS
1386 case. As you stated, not only is this unfair, but it also
1387 prevents the addition of new wireless services that could
1388 foster innovation, improve public safety, and obviously
1389 create jobs. What do you believe either Congress or possibly
1390 the FCC, their role to prevent this situation from occurring
1391 again?

1392 Mr. {de Vries.} I believe the important role that the
1393 FCC can play is to foster the definition of these harm claim
1394 thresholds.

1395 Mr. {Stearns.} Okay.

1396 Mr. {de Vries.} And they can do that by fostering a
1397 multi-stakeholder process, bring parties from different
1398 industries, different services together, and then if
1399 necessary, to take steps to actually put those values into
1400 the rules.

1401 Mr. {Stearns.} Anyone else have a suggestion here? Mr.
1402 Markwalter?

1403 Mr. {Markwalter.} Yes, well, I agree. And as I

1404 mentioned earlier, we work on the TAC so you will probably
1405 get more alignment on our views than misalignment. I think
1406 we are sort of behind in the curve in all aspects. So none
1407 of our tools are in place to help us get in front of the
1408 problem and that is what we are trying to get to, a point
1409 where we can establish what we are trying to do with spectrum
1410 rather than build and then figure out we got a problem after
1411 the fact. So we really need to get some of these tools in
1412 place and unwind the problem a little bit. It is just not
1413 going to be solved overnight.

1414 Mr. {Stearns.} Mr. Repasi, you stated in your testimony
1415 that better awareness and coordination between entities in
1416 adjacent bands would go far in solving some of the receiver
1417 problems we have seen occur recently. What do you think the
1418 FCC's role is? Could they facilitate this process?

1419 Mr. {Repasi.} Yes, I think our rulemaking processes are
1420 open and transparent. We again make proposals based on
1421 assumptions. We expect that the folks who have an equity or
1422 stake in the use of that spectrum will come into our
1423 rulemaking process and challenge our assumptions, if there
1424 are concerns about interference, it would be brought up as
1425 early as possible in the process so that we could deal with
1426 those interference concerns before we go to final rule.

1427 Mr. {Stearns.} Any other folks on the panel have any

1428 other suggestions in how the FCC could facilitate this
1429 process? No?

1430 All right, Mr. Chairman, I yield back the balance of my
1431 time.

1432 Mr. {Walden.} The gentleman yields back the balance of
1433 time.

1434 The chair recognizes the future vice chair of the full
1435 committee, Mrs. Blackburn.

1436 Mrs. {Blackburn.} Thank you, Mr. Chairman.

1437 And thank you all for being here and for the hearing.

1438 I have just got a couple of questions and I know you all
1439 are ready to depart this room. And we are going to have
1440 votes in a couple of minutes.

1441 Mr. Repasi, if I could come to you first. And I want to
1442 thank you all for submitting your written testimony in a
1443 timely manner. That is always helpful.

1444 You suggested in your testimony that the FCC clarify
1445 what a license-holder's rights are in a band of spectrum,
1446 incentivize receiver manufacturers to respect those rights,
1447 and enforce those rights when one licensee in an adjacent
1448 band doesn't play by the rules. So this policy framework if
1449 you will really strikes me as looking at three goals. And I
1450 want to see if you agree with this: number one is recognition
1451 of a licensee's rights in a given band of spectrum with clear

1452 rules of the road to ensure that licensees respect other
1453 licensees' valuable property rights; and number two,
1454 promotion of new entrance to the wireless marketplace because
1455 they would have regulatory clarity from the onset; and number
1456 three, accomplishment of the aforementioned goals without
1457 stifling innovation in the wireless marketplace by imposing
1458 potentially crippling device or guard band mandates. So
1459 recognizing that the Commission's Technical Advisory
1460 Committee plans to give us a report on December 10 that could
1461 address these issues, I would like to ask what your
1462 professional and technical opinion is on how you would
1463 instruct the Commission to structure the rules of the road
1464 and to provide the clarity and the guidance on respecting
1465 property rights.

1466 It is to you, sir.

1467 Mr. {Repasi.} Thank you. We are, as you are aware,
1468 awaiting the recommendations for the TAC but are also
1469 awaiting the recommendations of the GAO. They are mandated
1470 by the Job Act to have their report by February of next year.
1471 We would need to take that information, those facts into
1472 account in a general process where we have input from the
1473 public who could be affected by whatever rules we would
1474 propose to set up to give them clarity, to identify what the
1475 environment would look like.

1476 Mrs. {Blackburn.} Yes, sir. But I am asking what your
1477 advice to them would be. What would your professional advice
1478 be?

1479 Mr. {Repasi.} I am sorry. To the Commission or to the
1480 public?

1481 Mrs. {Blackburn.} Yes. Yes.

1482 Mr. {Repasi.} To the Commission? Well, clarity is
1483 good. Clarity allows certainty. Certainty leads to
1484 investment. Investment leads to competition and innovation,
1485 which is important for this mobile wireless economy. So
1486 certainly in any technical tradeoffs that would weigh into
1487 the policies that would be presented before the Commission,
1488 the technical issues are one of several things. You have got
1489 the legal and economic issues as well, but certainly the
1490 technical issues are very important from that perspective.

1491 Mrs. {Blackburn.} Yes, specificity and clarity in a
1492 timely manner is a good thing. So I appreciated your
1493 testimony.

1494 Mr. Markwalter?

1495 Mr. {Markwalter.} Yes?

1496 Mrs. {Blackburn.} In your testimony you wrote, ``the
1497 early calls for government mandates on device design have
1498 faded as stakeholders have come together to understand that
1499 such approaches are not the best solution we have to spectrum

1500 crowding.' ' Now, I was pleased to read that because as
1501 anybody who has sat through these hearings has heard from me,
1502 I like seeing industry set best practices and guidelines and
1503 standards and come up with those rules of the road if you
1504 will. So in your view, what is the current status of the
1505 various private industry stakeholder proposals to address
1506 receiver standards? And do you think they are making
1507 progress in a voluntary self-regulation working framework?
1508 And is there anything out there, any kind of uncertainty or
1509 lack of clarity that is preventing the industry from making
1510 progress toward meeting the balance between flexible use and
1511 greater efficiency?

1512 Mr. {Markwalter.} Okay. Thank you. So I think
1513 industry--and I don't know if you are aware or not--CEA is
1514 one of those standard-setting organizations. In fact, our
1515 standards are incorporated by reference for closed-captioning
1516 for example. So because I am close to it, I guess I see the
1517 industry is always working on it. Where it might not be
1518 sufficient is the enter-industry relationships as we have
1519 mentioned a couple of times here today where we are trying to
1520 put two users next to each other like cell phones and
1521 broadcasters and to get those industries talking. That level
1522 of dialogue needs to be increased. I think to the extent we
1523 have a shortcoming it is in that area.

1524 Mrs. {Blackburn.} Okay.

1525 Mr. {Walden.} Okay.

1526 Mrs. {Blackburn.} Anybody want to add anything further
1527 to that on the progress or lack thereof? Okay.

1528 Yield back.

1529 Mr. {Walden.} Gentlelady yields back her time.

1530 I want to thank our witnesses for your testimony, your
1531 guidance, your counsel, your good work at TAC. I want to
1532 thank the FCC for your work in this area. Know that we care
1533 a lot about it and we are going to continue to be involved in
1534 it. And we will look forward to the report from TAC. We
1535 will look forward to the GAO report in February as well.

1536 The record will stay open for 10 days for further
1537 comments and questions or maybe some back to all of you,
1538 which would help us in our work.

1539 So again, thank you for your patience this morning as we
1540 got going and thank you for your comments and your testimony.

1541 With that, the Subcommittee is adjourned.

1542 [Whereupon, at 1:25 p.m., the Subcommittee was
1543 adjourned.]