



## Communications Division

# Market Share Analysis of Retail Communications in California June 2001 through June 2013

*Expanding Markets, Market Concentration,  
and the Impact of Intermodal Competition*

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# CALIFORNIA PUBLIC UTILITIES COMMISSION STAFF REPORT

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MARKET SHARE ANALYSIS OF RETAIL COMMUNICATIONS

IN CALIFORNIA

JUNE 2001 THROUGH JUNE 2013

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## I. Summary

In this Staff Report, the authors assess the level of concentration among service providers in California's communications market.<sup>1</sup> We examine subscribership data by technology modes: wireless voice, wireline voice,<sup>2</sup> voice-over-internet-protocol (VoIP),<sup>3</sup> and all modes of broadband with a subscription billing address in California.<sup>4</sup> We also assess the level of concentration across different technology modes.

This report focuses on California as a single statewide market, with market segment adjustments for technology mode, parent company ownership, and service provider territories. For more geographical granularity, we also compared urban and rural markets. Assessing California's communications markets on a statewide basis enables us to determine:

- The extent to which wireless, wireline, cable, and VoIP service providers compete for the same customers as an indicator of the health of competition; and
- The technologies to which California's business and residential consumers subscribe;<sup>5</sup>

Trends revealed by our analysis include:

- **The California communications market has doubled in size since 2001.** Relative to population, there are many more services available.
- **Intermodal voice and broadband markets are not monopolistic and exhibit only moderate HHI concentration.** The traditional wireline market is highly concentrated and concentration varies considerably among the other technology modes, however each are at, or above, levels considered moderately concentrated.
- **Market concentration is evident across the entire communications market.** The overall California market is led by two companies, AT&T and Verizon, who's combined market share totals 62.5 percent.
- **Past mergers have increased market concentration.**<sup>6</sup> Consolidation among wireline and wireless service providers in years 2004/2005, led to fewer providers, with the merged entities having increased market shares. While concentration has trended downward for intermodal communication services, the recent T-Mobile and MetroPCS merger has reversed this trend.

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<sup>1</sup> We use the term "market" to reflect retail offering of communications services available to business and residential subscribers broadly in California.

<sup>2</sup> We use the term 'wireline voice' as defined by the FCC's Form 477 to mean (ILEC-provided) traditional voice grade access line service. Typically, such service is provisioned via a 56 to 64 kbps, analog circuit at a frequency range of 300 to 3000 Hz.

<sup>3</sup> This category includes interconnected VoIP service capable of placing and receiving calls from the public switched telephone network. This excludes machine to machine VoIP, as those connections are not interoperable with the public switched telephone network.

<sup>4</sup> Herein we use 'subscription' as defined by the FCC in Form 477. 'Subscriptions' will exceed the number of 'subscribers'.

<sup>5</sup> By 'consumer' we include all entities purchasing services, including residences, businesses and community organizations.

<sup>6</sup> This report is limited to an analysis of subscribership data and does not address other effects due to merger activity.

- **Urban and rural areas have similarly concentrated markets.** Nonetheless, urban customers tend to have more provider choices for fixed-location services.

Due to intermodal substitution, California’s consumers have choices in both the voice and broadband markets. The Commission’s regulatory policy relies upon this intermodal competition as the foundation of its consumer choice policy.<sup>7</sup> Evaluation of markets by a single technology alone (e.g., wireline) as had been previously presented in reports to decision makers, is now an insufficient basis for determining the status of competition. Today an intermodal analysis is essential for understanding the overall communications market in California.

As the findings that follow illustrate, staff conclude that market concentration exists in California and the Commission’s continuing pledge to monitor the state’s communications market is appropriate. We also conclude that the market concentration analyses presented here are not determinative of the existence of exercised market power. Continued analysis is warranted to refine the picture of this rapidly-changing industry sector. Beyond the scope of this report are the other variables that need to be analyzed to contribute to the Commission’s understanding of how to optimize its participation / role in California’s communications market, consumer experience, and choice.<sup>8</sup>

## II. Introduction

The CPUC’s Uniform Regulatory Framework (URF) decision of 2006 found that wireless, cable and VoIP services are close and/or direct substitutes for local wireline telephone service.<sup>9</sup> The URF decision concluded that the potential entry of competitors offering these services, combined with unbundling requirements developed by the FCC and the CPUC, represent sufficient competitive options to check the market power of the four largest incumbent local exchange telephone companies (ILECs),<sup>10</sup> which are AT&T, Verizon, SureWest and Frontier. The decision determined, however, that “[t]here is an ample need for the Commission to remain vigilant in monitoring the voice communications marketplace in order to ensure that the market continues to serve California consumers well.”<sup>11</sup> Accordingly, this Staff Report updates the previously-issued

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<sup>7</sup> Decision 06-08-030, at 132 states; “Cross-platform competition, particularly that from wireless and VoIP technologies, provides an additional check that reduces market power of each carrier.” Additionally, General Order 168, Consumer Bill of Rights and Freedom of Choice states; “Consumers have a right to select telecommunications services and vendors of their choice.”

<sup>8</sup> Ongoing analyses of variables that may be indicative of market abuse such as consumer experience data, pricing trends and market entry, is necessary. Staff reports include; the June 2014 Cramming Report, The 2014 Limited English Proficiency Survey Report; the 2010 Affordability Basic Telephone Service Report, and the Market Pricing Survey of Retail Communications Services in California Report, among other reports. See;

<http://www.cpsc.ca.gov/PUC/Telco/generalInfo/CPUC+Reports+and+Presentations.htm>

<sup>9</sup> D.06-08-030, Findings of Fact 19, 20, 39, 44, 62 and 63.

<sup>10</sup> *Ibid.*, Finding of Fact 61. The consideration of the threat of entry as a sufficient indication of competition is based on contestable markets theory, which states that such markets’ “fundamental feature is low barriers to entry and exit; a perfectly contestable market would have no barriers to entry or exit.” William J. Baumol, John C. Panzar, & Robert D. Willig (1982). *Contestable Markets and the Theory of Industry Structure*.

<sup>11</sup> D.06-08-030, Finding of Fact 73.

Market Share Report of March 10, 2011, and joins other monitoring reports on conditions in California's voice and broadband marketplace.<sup>12</sup>

In prior staff reports, market competition was assessed by technology segment or mode.<sup>13</sup> During the regulatory experiment with the unbundling of the telephone network for competing providers to re-bundle into retail offerings, traditional local wireline service (and the unbundled "local loop") was the pre-eminent technology to provide communications services, and substitution between different technology modes was not as prevalent as today. Now most consumers have more than one technology option for their communications and often the different technology mode providers are direct competitors.<sup>14</sup>

'Market concentration' is the extent to which the largest company or companies in a market may dominate that market. Of regulatory concern is whether market concentration exists to the extent that there is an exercise of market power with an excessive transfer of wealth from buyers to sellers and/or a misallocation of resources and diminished innovation. Such could mean that both business and residential consumers have fewer choices and/or pay too much relative to a fully competitive market. However, concentration itself is not proof that market failure has occurred, as the degree of concentration can vary greatly. The Commission's URF policy relies on sufficient market competition to ensure that consumers have available services and options, and that competition will keep prices affordable. Herein we evaluate market concentration. However, we do not attempt to conclude whether market concentration has resulted in the exercise of market power. Our analysis is the first step in making such determinations.

For purposes of our market share analysis here, we use Federal Communications Commission (FCC) Form 477 data through June 2013, consisting of: (1) *wireline voice* service connections, (2) *wireless voice* connections directly billed, (3) *VoIP* service interconnected to the Public Switched Telephone Network, (4) *fixed broadband* connections,<sup>15</sup> and (5) *mobile broadband* subscriptions for data plans associated with smartphones, tablets, laptops and a variety of emerging devices.

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<sup>12</sup> In 2002 and 2003, in response to a legislative mandate, CD produced three reports documenting wireline, wireless and advanced services competition by sector. These previous reports did not include an HHI intermodal analysis. See; <http://www.cpuc.ca.gov/PUC/Telco/generalInfo/030326TelecommunicationsCompetition.htm>.

<sup>13</sup> The Status of Telecommunications Competition in California, 3rd report, submitted to the California State Legislature in compliance with P.U. Code Section 316.5 (no longer effective), CPUC, October 31, 2003

<sup>14</sup> An example is residential voice service where ILECs and cable service providers may compete for the same customer using different technology modes.

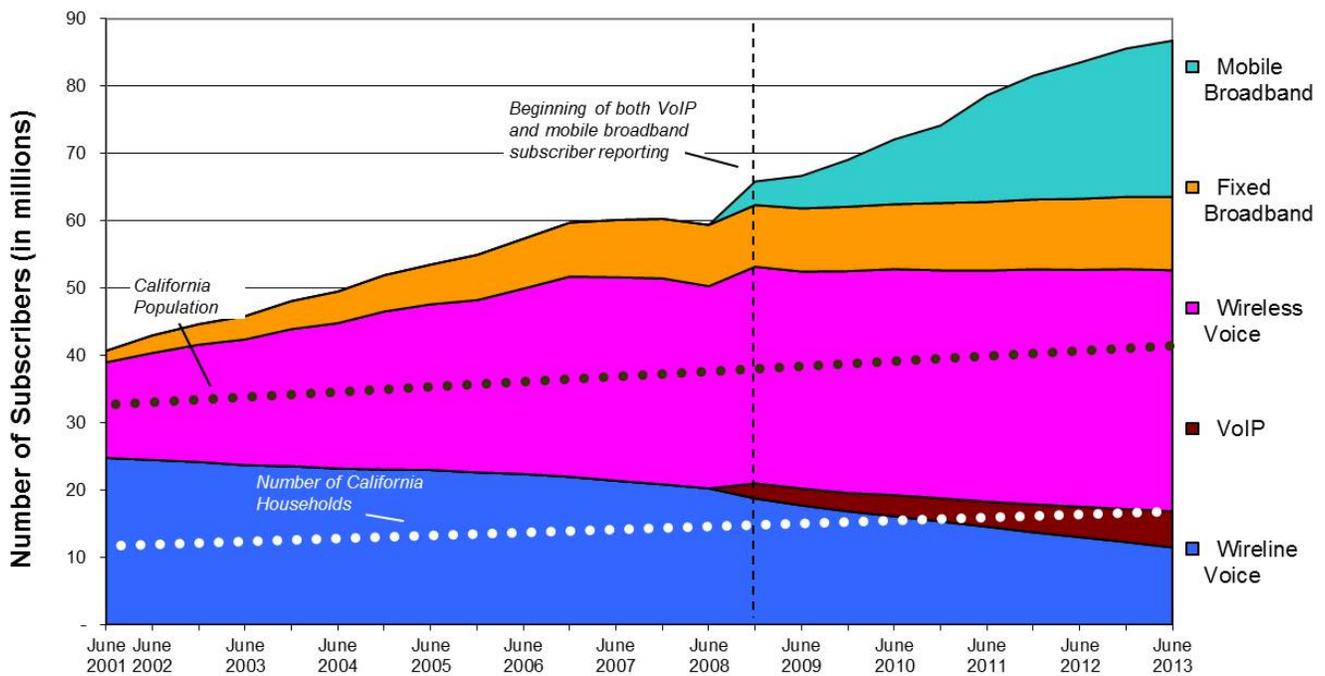
<sup>15</sup> Fixed Broadband technologies include Asymmetric xDSL, Cable Modem, Optical Carrier (Fiber to the End User), Satellite, Symmetric xDSL, Terrestrial Fixed Wireless, and Other Wireline.

### III. California’s Growing Communications Market

Since adoption of URF, California’s communications markets have continued to shift as customers embrace new technologies from old and new providers. Besides new services and devices, many households which had previously subscribed to multiple communications services from unaffiliated individual providers can now consolidate these separate services into provider-offered bundles or localize them onto a single wireless device.

The chart and table below shows the trends in the number of communications subscriptions by technology type.<sup>16</sup> This cumulative total comprises our estimate of the market for communications services delivered to residences, businesses and institutions.<sup>17</sup> The subscription trends are illustrative. Traditional wireline telephone service is shrinking in absolute terms and relative to the total subscriptions market.<sup>18</sup> Further, subscription in all technologies but traditional wireline telephone service is increasing, though some at a small rate. (See Appendix A for data used in charts and tables)

Chart 1  
**Subscribership Trend of All Communications Services In California by Technology (in Millions of Subscriptions)**



<sup>16</sup> Note: Required reporting of mobile broadband and VoIP subscribership on FCC Form 477 began with the December 31, 2008 reporting cycle.

<sup>17</sup> Includes all five technology categories that are tracked in Form 477: wireline voice, VoIP, wireless voice, fixed broadband, and mobile broadband, whether they are delivered to residences, businesses, or institutions.

<sup>18</sup> The Affordability of Basic Telephone Service Report, table 12, states 24% of California’s households rely solely upon traditional landline telephone service. <http://www.cpuc.ca.gov/PUC/Telco/generalInfo/2010AffordabilitySurveys.htm>

## California Communications Market Findings:

- **California's communications market growth outpaced population growth.** The total market grew 113 percent between June 2001 and June 2013. The state's population grew about 12 percent over the same period.<sup>19</sup>
- **Wireline voice is becoming an ever smaller proportion of the market.** This mode has fallen behind wireless voice and mobile broadband. In June 2001, wireline voice service represented about 61 percent of the total communications market whereas by June 2013, it declined to 13.2 percent of the total subscriptions market. Over that interval the absolute number of wireline telephone subscriptions declined about 54 percent.
- **Wireless voice and mobile broadband subscriptions continue to dominate growth in the overall voice and broadband market.** In June 2013, wireless voice and mobile broadband comprise 68 percent of all communications subscriptions in California.

Historically, the Commission's regulatory policies generally have focused on Incumbent Local Exchange Carriers and in particular the two largest carriers, AT&T of California (formerly Pacific Bell) and Verizon of California (formerly General Telephone of California). Chart 1 reflects change in the communications market and such change has been cause for policy makers to revise regulatory policies created when there were vastly different market conditions than exist today.

Some of the significant past policy revisions by the California Public Utilities Commission, Legislature, Federal Communications Commission and Congress include: open entry policies for competitive service providers, removal of inter and intra-LATA regulatory barriers, removal of rate and economic regulation for competing services and providers, permitting Bell Operating Companies into the long-distance market, removal of most regulatory tariffs, removal of the cross-ownership ban between video and communications, creation of the state video franchise, and efforts to make public policy programs technologically neutral, such as low-income access to subsidized phone service. Further, policy changes are under considerations at the FCC that would treat broadband as a universal service and reform how current universal service programs are funded.<sup>20</sup>

Regardless of the regulatory changes in the past two decades, the two historical service providers mentioned above continue to be the largest provider of retail communications services across the wireline, wireless, and mobile data technology platforms. However, they are not together the largest across all service categories, in particular not in VoIP and fixed broadband.

These data alone cannot construe whether the market is highly concentrated or is failing consumers. We attempt below to explore further the implications of market share and dominance utilizing concentration measures.

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<sup>19</sup> Sources are California Department of Finance estimates and <http://quickfacts.census.gov/qfd/states/06000.html>

<sup>20</sup> The CPUC is participating in these FCC proceedings.

## IV. Market Concentration by HHI Indicator

We use the Herfindahl-Hirschman Index (HHI) to assess the level of market concentration in California.<sup>21</sup> The higher the HHI the more concentrated the market; in a highly concentrated market, a few firms have most of the customers. A highly concentrated market is generally characterized by an HHI score greater than 2500 on a scale of 1 to 10,000 and moderately concentrated is characterized by an HHI score between 1500 and 2500 points (see Appendix B).<sup>22</sup>

We present two different HHI analysis of the California communications market: First is a technology mode analysis which assumes choice is limited within the technology mode. For example, each technology market is distinct such that wireline and wireless services are not substitutable services. Second is an intermodal analysis which assumes choice of services among the various technology modes. For example, a market exists among a group of different technologies, such that wireless and wireline technology providers compete.

Additionally, for both the technology mode and the intermodal analysis there are two mutually exclusive adjustments applied. First, a parent company may own multiple affiliate companies within a technology type and between technology types. Its' common ownership increases its market share when considering affiliated providers as one entity. Thus, we analyze HHI market share considering parent company ownership, such that its data are inclusive of affiliated subsidiaries also operating in the state. We call this the Parent Company Adjusted Analysis.<sup>23</sup>

Second, not all providers offer their services statewide.<sup>24</sup> Individual wireline and cable service provider service territories are typically geographically limited; reflecting their embedded geographical segmentation from legacy franchise service territories and do not overlap. Today's AT&T retail wireline phone services generally do not compete with the Verizon retail wireline phone services.<sup>25</sup> Similarly, the Time Warner cable retail fixed digital phone services generally do not compete in the territories served by the Comcast cable network where it offers digital phone services.<sup>26</sup> When calculating HHI, the number of statewide available services providers must be adjusted. Thus, we combine ILEC broadband data into a single broadband entity and their fixed wireline data into a single wireline entity.<sup>27</sup> Similarly, for cable companies, we separately combine broadband into a single entity

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<sup>21</sup> For a discussion of the market indices used in this Staff Report, see Appendix B.

<sup>22</sup> <http://www.justice.gov/atr/public/guidelines/hhi.html>. The U.S. Department of Justice and the Federal Trade Commission in their Horizontal Merger Guidelines define Unconcentrated Markets as having an HHI below 1500; Moderately Concentrated Markets as having an HHI between 1500 and 2500; and Highly Concentrated Markets as having an HHI above 2500.

<sup>23</sup> Even within a technology type there are cases where ILECs provide competing affiliated services and such adjustment is appropriate.

<sup>24</sup> No provider ubiquitously covers California; however AT&T Mobility and Verizon Wireless mobile voice and mobile broadband service coverage is much larger than that of wireline providers.

<sup>25</sup> To underscore this point, author attempted to subscribe to Verizon Home Phone and received the following response: "We are having trouble locating your address. Are you sure you input your zip code correctly? "Please review the zip code listed below and if it is incorrect, please re-enter your address. If the zip code listed below is correct, Verizon does not provide service in your area."

<sup>26</sup> Author's inquiry into Time Warner Cable service availability resulted in a website redirect to the local cable operator, Comcast. In both cases, author was unable to get service offered from the non-territorial serving entity.

<sup>27</sup> This means that for the purposes of the territory adjusted HHI analysis, AT&T, Verizon and the small incumbent local exchange carriers (ILECs) are combined into one entity.

and their VoIP data into an entity.<sup>28</sup> We call this the Territory Adjusted Analysis. No such adjustment for the large wireless and non-affiliated VoIP providers is made as they generally offer service almost ubiquitously throughout the state.<sup>29</sup>

Both adjustments are mutually exclusive and each has limitations. The parent adjustment is particularly useful for assessing overall market share owned by a parent company across technologies. However, the parent company analysis results in an overly liberal estimation of HHI due to its consideration of all named parent companies as being an equal competitive option regardless of actual service territory. The territory adjustment analysis corrects this by summing the HHI for each incongruent service provider, wireline, broadband and cable. However, in doing so it is no-longer possible to assess parent company ownership across technologies.<sup>30</sup> Thus, the territory adjustment understates parent company ownership as a factor when assessing the total subscriptions market.

### **HHI by Technology Mode**

Chart 2 below shows HHI concentration by market technology mode; wireline, wireless, fixed broadband, mobile broadband and interconnected VoIP adjusted for parent company ownership. The calculation is based upon combined affiliate data within each market technology type. Note that the VoIP category creation corresponds with an increase in wireline HHI. Previous to 2008, Comcast and Time Warner cable offered a non-VoIP wireline service. The VoIP category was created nearly coincident with their shift from non-VoIP service to VoIP service.

Chart 2 indicates that the wireline voice technology market appears highly concentrated and is well above the HHI concentration levels of the other technologies. The HHI measurements for the Mobile broadband and wireless voice markets appear are just above near the moderately concentrated threshold of 2,500, whereas fixed broadband, at 2,000 is in the midrange of the being moderately concentrated range of between 1,500 and 2,500. VoIP has the lowest concentration of all and appears not concentrated. Also of note in the trend lines is how merger activity has increased HHI concentration. The increase in wireline, wireless and fixed broadband show in years 2004/2005 are coincided with the mergers occurring in those years. In those two years, four of California's top five providers were involved in mergers.<sup>31</sup> In 2013, the merger of T-Mobile and MetroPCS coincides corresponds with a slight increase in wireless voice and mobile broadband market concentration.

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<sup>28</sup> This means that for the purposes of the territory adjusted HHI analysis, Comcast, Time Warner Cable, Charter, Cox and all the other cable companies are combined into one entity.

<sup>29</sup> Among wireless providers, geographical distinctions, if they exist, reflect a regional focus unrelated to wireline franchise territories. Wireless companies are usually national (or international) in scope (e.g., AT&T Mobility, Verizon Wireless (with Vodafone of Germany), Sprint, T-Mobile-Deutsche Telekom), and other wireless companies, while they may have a regional reach, provide roaming services to their customers that extend beyond these geographical focuses.

<sup>30</sup> Not entirely true as some weighting criteria could be established to assign relative HHI share to Parent companies, however such additional methodological step would add a questionable variable to outcomes.

<sup>31</sup> The proposed AT&T/T-Mobile merger failed to gain the approval of federal regulators in 2011. Had the merger been approved, both mobile broadband and wireless voice concentration would have increased.

Chart 2  
**HHI Market Concentration by Technology  
Adjusted for Parent Companies**

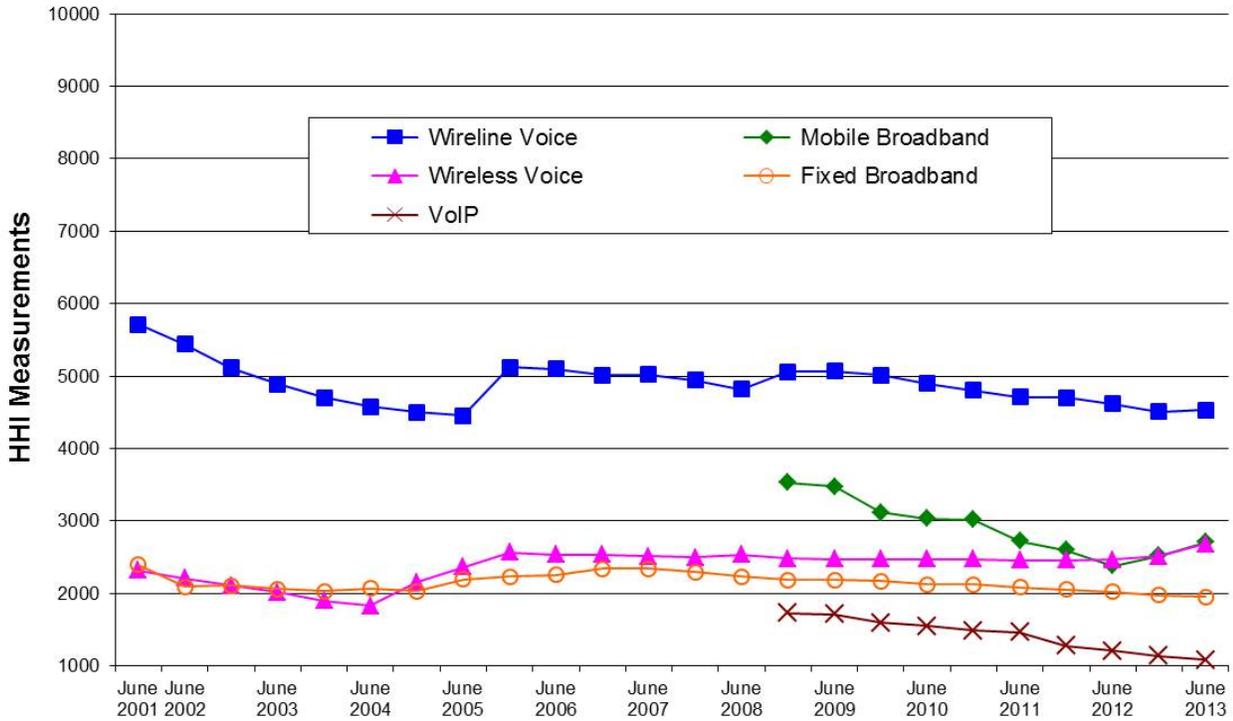
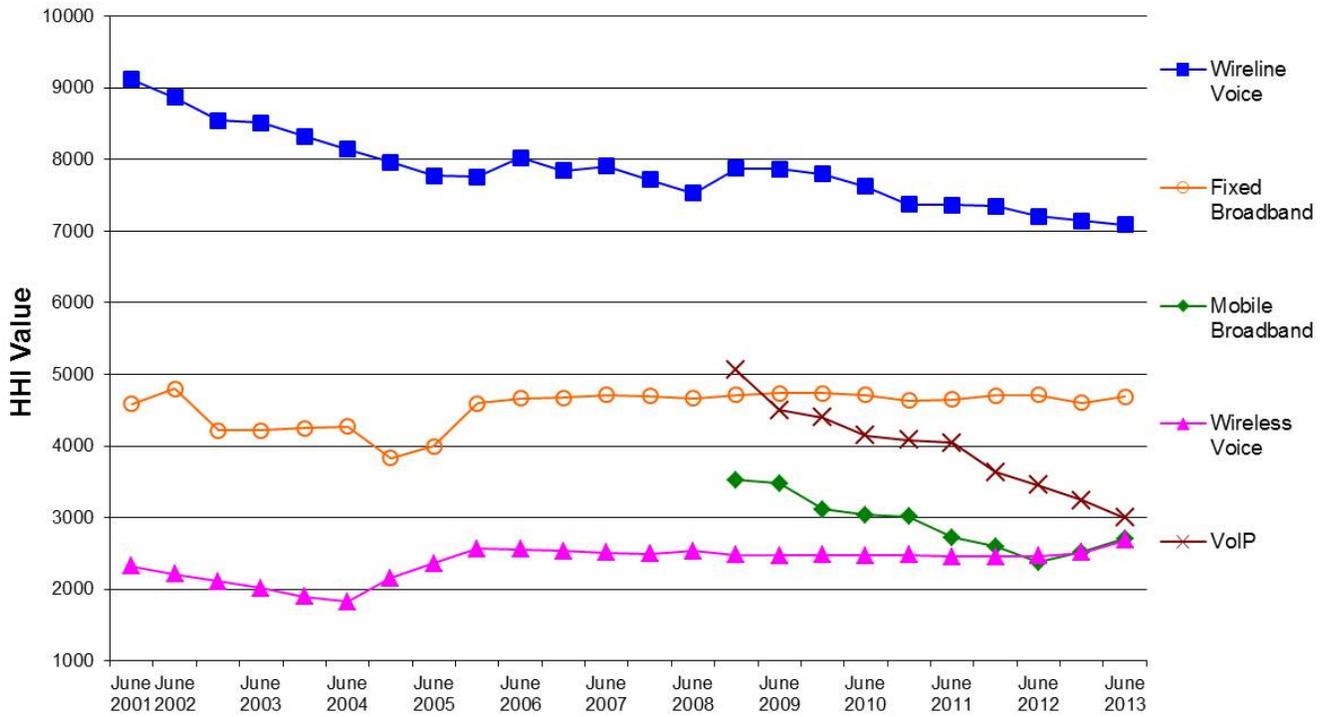


Chart 3 below represents HHI concentration using the Territory Adjusted method. ILECs in this method are no-longer considered competing wireline providers because their legacy franchise service territories (and therefore their local network facilities) do not overlap. With the territory adjustment, the HHIs for wireline voice, fixed broadband and VoIP increased significantly above those associated with the Parent Adjustment and are all in the highly concentrated regions above 2,500. For example, the territory adjusted HHI for fixed voice increased about 56 percent over the Parent Analysis to just above 7,000. This result is not surprising as it reflects that not all providers offer services statewide. For example, it is typical that CLECs compete with legacy ILEC providers in the wireline market. Chart 3 indicates that the wireline voice market has the highest level of market concentration and all other technology markets have HHIs significantly lower than it. Of additional note, the fixed broadband market concentration more than doubles above the previous values shown in Chart 2, and the VoIP HHI increases into the highly concentrated range.

Chart 3  
**HHI Market Concentration by Technology**  
 Adjusted for ILEC and Cable Service Territories



## HHI Concentration by Technology Market Findings:

- **Most of the separate communications technology markets in the state are *highly concentrated*.** Except for interconnected VoIP and fixed broadband in the parent adjusted HHI, measurements for all individual technologies have recently exceeded the 2500 point HHI threshold that characterizes a highly concentrated market.
- **The trends in wireline voice, VoIP and mobile broadband markets have generally improved since December 2008.** The market concentration trend for the wireless voice and fixed broadband markets has started to increase since December 2012.
- **Wireline voice has the *highest concentration level*** at almost three times the HHI threshold for highly concentrated markets. The declining HHI for wireline voice was affected by the 2005 SBC/ AT&T merger, and the 2006 Verizon/ Worldcom merger.
- **Previous wireless mergers have *increased* HHI market concentration values.** The HHI trend for wireless voice decreased after 2001, but then rose in December 2004 and December 2005 perhaps due in part to the respective mergers of Sprint/ Nextel, and of AT&T Mobility/ Cingular Wireless. In 2013 it rose above the 2,500 threshold for highly concentrated markets.
- **The HHI value of the territory adjusted fixed broadband market is *between* the HHI's of the wireline and wireless markets.** The HHI for fixed broadband shows little volatility since 2005.
- **The mobile broadband HHI concentration is declining relative to the fixed broadband market.** Mobile broadband capable devices first reported in June 2005 were provisioned by two service providers in the State, however since that time both service providers and subscribers have grown. The mobile broadband HHI measurements have fallen from 3,600 in 2008, 1,100 points above the highly concentrated threshold, to 2,400 in 2012, 100 points below the highly concentrated market threshold. However, the mobile broadband HHI measurement has risen again to 2,700 in 2013, 200 points above the threshold for highly concentrated markets.

## HHI for Intermodal Markets

An intermodal market considers substitute technologies and services. The combined intermodal analysis recognizes the range of technological options available and reveals the market power of large carriers offering multiple services, often sold as a single bundle. We examine two combined intermodal markets:

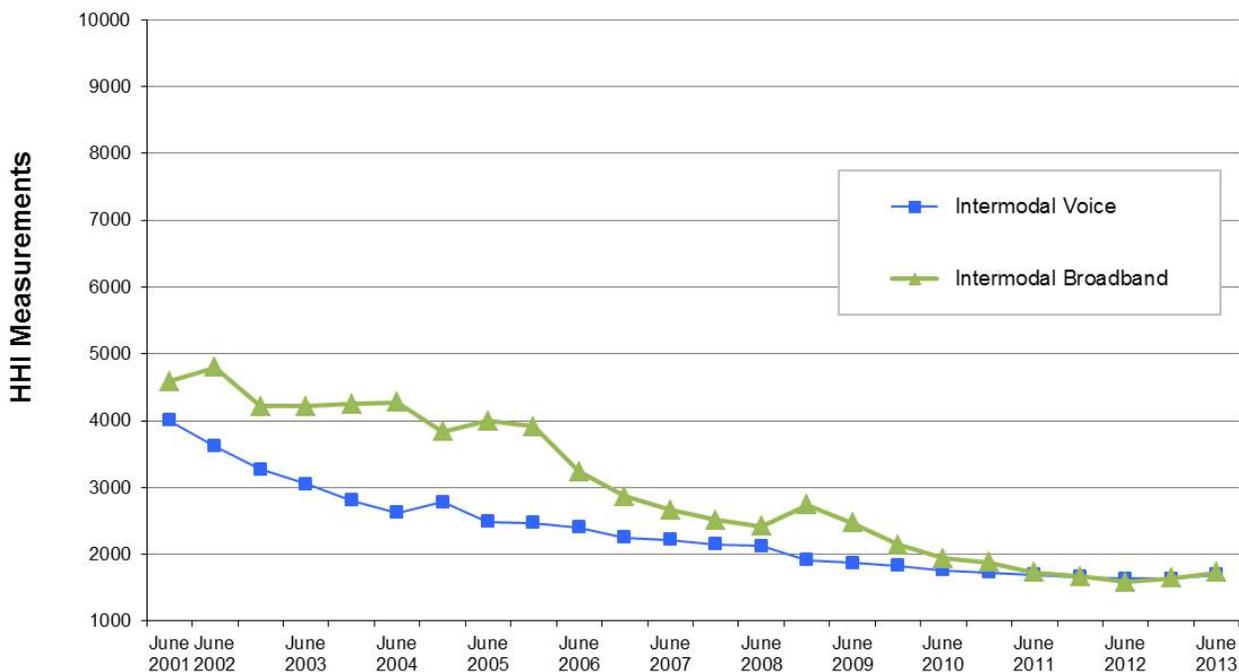
- 1) *Intermodal Voice* which includes interconnected VoIP, wireless and traditional landline wireline voice;
- 2) *Intermodal Broadband* which includes mobile broadband for smartphones and tablets, and all fixed broadband services such as DSL, coaxial cable modem, satellite and fiber-to-the-premise.

Because intermodal voice excludes broadband services, there is an assumption that broadband is not a direct substitute for voice services, though arguably for some it is particularly if they rely on “over-the-top voice applications.”<sup>32</sup> As previously described, CPUC policy recognizes intermodal voice communications competition and the substitutability of wireline and wireless *voice* services. Also, the substitutability of wireless and wireline *broadband* is assumed in the California Advanced Services Fund, which makes available infrastructure grants for broadband deployment regardless of broadband technology type. However, fixed and mobile *broadband* are not necessarily substitutable technologies and for many consumers may be complimentary services. In particular, mobile broadband can be more expensive than wireline broadband when comparing the data capped monthly allotment of usage compared to wireline broadband data usage.<sup>33</sup>

Chart 4, below shows the HHI concentration for the intermodal voice and intermodal broadband markets using the same territory adjusted data.

Chart 4

**HHI Market Concentration for Combined Intermodal Markets  
Adjusted for ILEC and Cable Service Territories**



<sup>32</sup> Over-the-top voice applications can include Google Voice, FaceTime, Skype, or other such IP or non-interconnected VoIP services.

<sup>33</sup> Studies show that wireless and wireline broadband can be complementary technologies. However, the market is not static and these studies below contain conclusions not reflecting changes in market offering, such as increased data caps, that have occurred in the interim. See: <http://www.pewinternet.org/2013/09/16/cell-internet-use-2013/>  
<http://www.amta.org.au/articles/Wireless.broadband.and.fixed.are.complementary.say.experts>

Of note is (a) the two lines converge in June 2011, approaching the 1,500 non-concentrated market threshold, (b) the two lines are much lower in concentration than the individual technology HHIs shown in Chart 2, and (c) that merger activity had a smaller overall impact.

As shown above in Chart 1, until approximately 2008, market growth was primarily in wireless *voice* subscriptions, whereas later, growth is primarily in wireless *broadband* subscriptions.<sup>34</sup> Wireless subscription growth has had an impact on both intermodal trend lines. In Chart 3, the intermodal broadband line pre 2006 is disparate from the other lines as it is primarily wireline based. Since 2008, the addition of wireless broadband reporting caused intermodal broadband to trend more closely with the line as the share of total subscriptions associated with wireless has increased.

### **HHI Concentration for Intermodal Markets findings:**

- **The California intermodal voice and broadband markets are moderately concentrated.** Both the parent and territory adjusted HHIs are at 1,800, only 300 points above a moderately concentrated market and well below the 2500 threshold for a highly concentrated market. It is reasonable to consider intermodal voice technologies as substitutes, however, such assumption of substitution between fixed and mobile broadband may not yet be accurate.
- **The intermodal voice market has lower concentration relative to disaggregated fixed and wireless markets.** The concentration that exists in the wireline voice market is greatly diluted when wireless is considered to be a competitive option.
- **The intermodal HHIs have approached the 1500 non-concentrated market threshold.** Intermodal broadband in June 2001 began at 4,500, well above the 2,500 HHI threshold for a highly concentrated market, but declined to 2,500 four year later in 2005, and as of June 2013, is measured at 1,800, only 300 points from the bottom threshold for a moderately concentrated market.

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<sup>34</sup> Prior to their required reporting in 2008, it is unknown whether providers reported on Form 477 their VoIP subscription in their wireline counts or whether broadband subscriptions were counted in their wireless subscriptions.

## V. Two-Firm and Four-Firm Concentration Ratios

The Concentration Ratio method of market analysis gives us another way to assess levels of concentration.<sup>35</sup> This ratio is calculated by simply adding the percentage market shares of the largest firms in a given market. For example, a Four-Firm Concentration Ratio (CR4) is the sum of the market shares of the top four firms. Likewise the Two-Firm Concentration Ratio (CR2) is the sum of market shares of the two largest firms. The higher the CR2 or CR4 value, the more concentrated the market. A concentrated market is generally characterized by CR4 ratios greater than 40%, and highly concentrated for ratios exceeding 70%, though these criteria are subject to debate.<sup>36</sup> This method does not consider the remaining market providers, regardless of how many there are in that particular market. Implications of a concentrated, consolidated or Oligopolistic market are addressed later in this report.

Tables 1 and 2 below, show the top two and four service providers in California by technology type and intermodal market, adjusted for parent company ownership.<sup>37</sup> Table 1, reveals that AT&T and Verizon are the dominant two providers in the wireline voice, wireless voice and mobile broadband markets, but not the VoIP and fixed broadband markets. However, when considering intermodal markets, AT&T and Verizon parent companies continue to dominate based on their affiliated company offerings.

Table 1

<b>California Two-Firm Concentration Ratio (CR2)</b>		
<b>June 2013</b>		
<b>(Parent Adjusted)</b>		
<b>Market Segment</b>	<b>CR2 %</b>	<b>Top Providers</b>
Wireline Voice	81.9%	AT&T, Verizon
VoIP	36.5%	Comcast, Time Warner
Wireless Voice	64.6%	Verizon, AT&T
Fixed Broadband	51.1%	AT&T, Time Warner
Mobile Broadband	68.3%	AT&T, Verizon
<b>Intermodal Market</b>		
Intermodal Voice	63.4%	AT&T, Verizon
Intermodal Broadband	60.1%	AT&T, Verizon
Total Subscriptions	62.5%	AT&T, Verizon

<sup>35</sup> The CR4, Four-Firm Concentration ratio is described in Appendix B. In Mark Hirschey's words, "Concentration ratios measure the percentage market share held by (concentrated in a group of top firms. When concentration ratios are low, industries tend to be made up of many firms, and competition tends to be vigorous. When concentration ratios are high, leading firms dominate and sometimes have the potential for pricing flexibility and economic profits. The Herfindahl-Hirschmann Index (HHI) is a measure of competitor size inequality that reflects size differences among both large and small firms." Hirschey adds, "From the public policy perspective, competitive forces must be understood if the rules governing the competitive process are to maximize social benefits." *Managerial Economics*, 12<sup>th</sup> Edition. Cengage Learning, 2009, p. 536.

<sup>36</sup> <http://info.umuc.edu/mba/public/AMBA607/IndustryStructure.html>; <http://www.economicexpert.com/a/Concentration:ratio.htm>; <http://www.unf.edu/~traynham/ch14%20edited%20lecture.pdf>

<sup>37</sup> Data combines for each parent company the affiliated entities' subscriptions by technology.

Table 2, below, shows the top four providers by technology type and intermodal market, adjusted for parent company ownership. Of interest is that cable providers have significant market share in the individual VoIP and fixed broadband markets, however in the Intermodal markets only appear as one-of-top-four in intermodal broadband.

Table 2

<b>California Four-Firm Concentration Ratio (CR4) and Providers</b>		
<b>June 2013</b>		
<b>(Parent Adjusted)</b>		
<b>Market Segment</b>	<b>CR4 %</b>	<b>Top Providers</b>
Wireline Voice	90.0%	AT&T, Verizon, U.S. TelePacific, Cox
VoIP	56.8%	Comcast, Time Warner, AT&T, Cox
Wireless Voice	98.9%	Verizon, AT&T, T-Mobile, Sprint
Fixed Broadband	80.9%	AT&T, Time Warner, Comcast, Verizon
Mobile Broadband	94.5%	AT&T, Verizon, T-Mobile, Sprint
<b>Intermodal Market</b>		
Intermodal Voice	87.2%	AT&T, Verizon, Sprint, T-Mobile
Intermodal Broadband	78.4%	AT&T, Verizon, Sprint, Time Warner
Total Subscriptions	83.3%	AT&T, Verizon, Sprint, T-Mobile

#### **CR2 and CR4 and Provider Findings:**

- **All technology segments are concentrated.**
- **The VoIP market segment is the least concentrated market segment followed by fixed broadband.** With the exception of CR2 for the VoIP segment, the CR2 and CR4 values are well above the concentration threshold of 40 percent.
- **Wireline voice has the highest CR2 value, but a lower CR4 value than both mobile broadband and wireless voice.** These metrics highlight the traditional duopoly in California’s wireline voice market and the high concentration (oligopoly) among the top four wireless voice and mobile broadband providers. Prior to the T-Mobile and MetroPCS merger in 2013, there had been five dominant national wireless providers in California.
- **The intermodal voice, broadband and total subscriptions market is highly concentrated.** The CR4 total subscriptions measurement of 83.3 percent is above the 70 percent threshold-indicative of a highly concentrated market.
- **Intermodal competition reduces market concentration.** Intermodal voice is less concentrated than wireline voice. Intermodal broadband is less concentrated than mobile broadband. Cross technology substitution, as evidenced in the Subscribership Trends Chart 1, reduces concentration, resulting in a more competitive market, as evidenced in the intermodal HHI graphs. However, the total market concentration ratios indicate a contradictory, highly concentrated assessment compared to the HHIs.

### Change in CR2 and CR4 from 2008 to 2013:

The following analysis compares changes in market concentration ratios since December 2008, the first available data since the FCC required service providers to report both VoIP and mobile broadband subscription as separate categories. The percentage change analysis is based on the data tables, contained in Appendix A.

Table 3, below, shows the percentage change in CR2 and CR4 values from December 2008 through June 2013. With the exception of wireless voice and fixed broadband, the individual technologies, have declining concentration. The comparison of the CR2 and CR4 trends in relation to each other demonstrates the relative change in market share between the top four firms. If a CR2 is declining more quickly than the corresponding CR4, it follows mathematically that the firms in third and fourth place are growing relative to the top two. It is possible that the lost subscribers of the top two are moving to the third and fourth provider rather than being spread among the smaller competitors.

Table 3

<b>California CR2 and CR4 Trends by Technology December 2008 – June 2013 (Parent Adjusted)</b>		
<b>Market Segment</b>	<b>Percentage Change</b>	
	<b>CR2</b>	<b>CR4</b>
Wireline Voice	-2.9%	-3.5%
VoIP	-16.1%	-44.2%
Wireless Voice	5.2%	8.0%
Fixed Broadband	-0.8%	-1.6%
Mobile Broadband	-3.6%	-5.3%
<b>Intermodal Market</b>		
Intermodal Voice	-0.4%	-0.6%
Intermodal Broadband	-3.4%	-5.5%

### Change in CR2 and CR4 Findings:

- **The CR2 and CR4 measurements show that except for wireless voice, all the markets have been becoming less concentrated since 2008.** All concentration values are declining with the exception of wireless voice CR2 and CR4.
- **Market shares are becoming more diffuse among the top four.** CR4 concentration is generally declining at a greater rate than CR2 concentration, with the exception of wireless voice having increasing concentration primarily due to the recent T-Mobile and MetroPCS merger.
- **Intermodal markets are decreasing in concentration relative to 2008.** Some CR4s have declined more quickly than their comparable CR2. This means that the Intermodal broadband market has become less concentrated more rapidly than the Intermodal voice market. Since all values are negative, this indicates overall improvement.

## VI. Urban vs. Rural Communications Markets

In the previous sections, we reported on statewide market concentration. In this section we attempt to compare urban markets to rural markets by examining counties by the predominance of rural or urban population. We investigate two general categories of services, fixed voice and fixed broadband services for residential and business consumers.<sup>38</sup>

In order to assess differences between urban and rural markets, we combine 477 data from the FCC with statistics from the US Census Bureau.<sup>39</sup> The US Census Bureau defines “rural” areas as encompassing “all population, housing, and territory **not** included within an urban area.”<sup>40</sup> Urban areas must contain at least 2,500 people living in contiguous census blocks or contiguous census tracts with densities of at least 1,000 people per square mile.<sup>41</sup> Of California’s 58 counties, 11 have a predominately (over 50 percent) rural population, leaving 47 as predominately urban.

In order to align the subscribership data with urban and rural demographics, we examine each category of service at the county level and assume that a single county represents one market.<sup>42</sup>

### Availability of Technologies

All counties throughout California have access to various fixed voice technologies, including traditional copper wireline, fixed wireless and interconnected VoIP telephone services. In addition, numerous fixed broadband technologies are deployed in all counties, but not necessarily throughout an entire county.<sup>43</sup> Some rural counties do not have all the options that are available to their urban counterparts. For example, Fiber to the End User and Symmetric xDSL appear in only half the counties where at least one out of every three people lives in a rural area. Cable Modem can be found in all counties except for Modoc County and Trinity County, which are two of the most rural counties in the State. Finally, Terrestrial Fixed Wireless does not appear in six counties, two of which have a population that is 100 percent rural.

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<sup>38</sup> Form 477 data does not include a geographic component for mobile wireless subscribers and is therefore our analysis does not take into account mobile wireless services.

<sup>39</sup> To address concerns regarding cross-ownership of companies, our analysis considers only parent company totals, so that the data are inclusive of affiliated subsidiaries operating within the same county.

<sup>40</sup> <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>

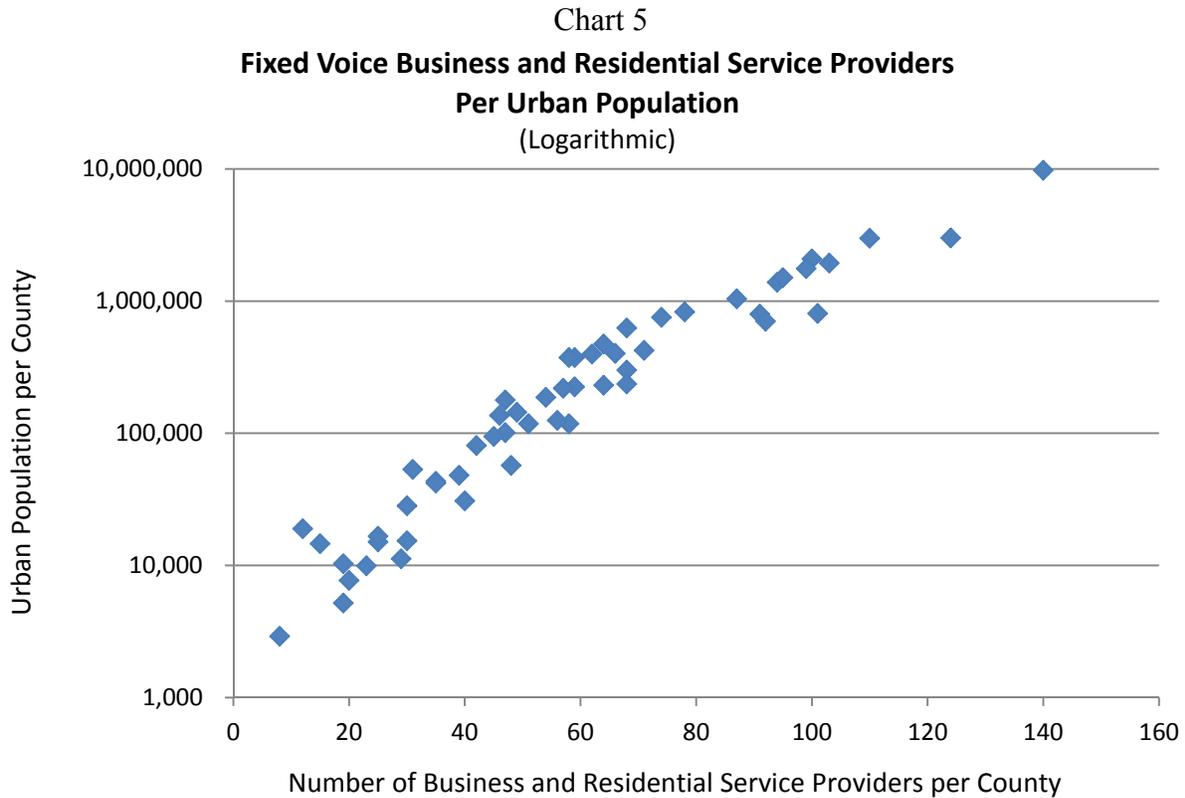
<sup>41</sup> To identify urban areas, “the Census bureau will begin the delineation process by identifying and aggregating contiguous census tracts, each having a land area of less than three square miles and a population density of at least 1,000 people per square mile” (Federal Register / Vol., 76, No. 164 / August 24,2011, pages 53039-53040).

<sup>42</sup> The fixed voice services were reported by ZIP Code, which do not perfectly align with county boundaries. According to [unitedstateszipcodes.org](http://unitedstateszipcodes.org), about 10% of ZIP Codes cross county lines. Nonetheless, converting ZIP Codes into counties allows us to approximate the demographics.

<sup>43</sup> See Appendix C for a list of the fixed broadband technologies deployed in each county.

## Number of Service Providers per County

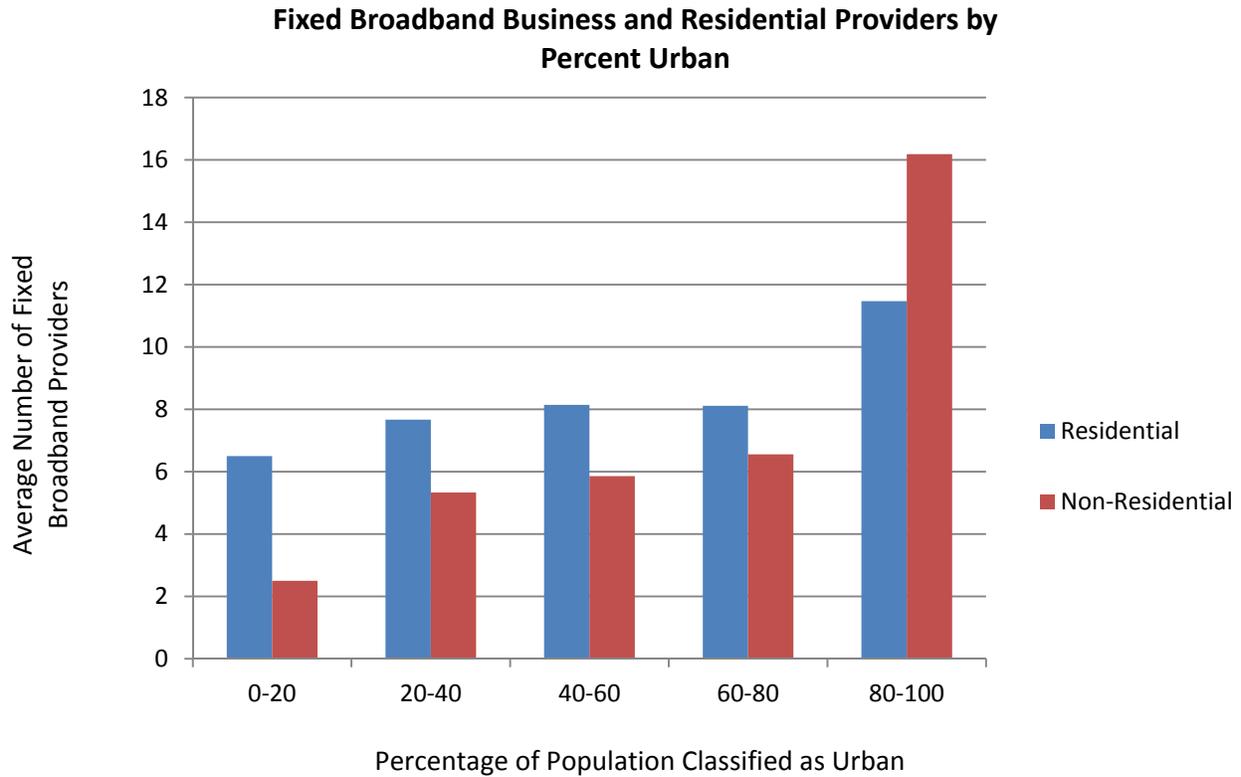
Urban business and residential markets tend to have more fixed voice service providers than rural markets. Chart 5, below plots all 58 counties according to the total urban population and the number of fixed voice service providers within that county.<sup>44</sup> As the urban population of a county increases, the number of fixed voice service providers reporting subscribers also increases in that county.



Likewise, urban markets tend to have more fixed broadband service providers than rural markets. As with fixed voice services, many fixed broadband providers serve only businesses. Chart 6 below, depicts the positive relationship between percentage of population classified as urban and the number of fixed broadband service providers present in a county.

<sup>44</sup> Note: The number of service providers per county may seem high to the casual viewer. The data represents a count of the number of providers reporting at least one customer in the county. Thus, the counts do not represent what is available to each subscriber and is not intended to represent the number of choices each customer may have.

Chart 6



The presence of more service providers or technologies might suggest higher levels of market competition. However, this is not necessarily true. The number of reporting service providers in a county does not in itself measure the level of market concentration of each provider. Further, the data does not represent the number of choices that any one customer may have. Many service providers offer service to few customers and/or where availability is limited.

**Urban vs. Rural Market Concentration**

Table 4, below shows the average CR2 and CR4 values of the residential and non-residential fixed broadband markets, according to either being in the Top 10 or having over 50 percent of urban or rural demographics.<sup>45</sup> In this analysis, each county is considered an individual market. Appendix D contains the calculated concentration values for each county. The CR2 and CR4 values in the table below indicate high levels of concentration in the fixed broadband rural and urban markets.

<sup>45</sup> We were unable to calculate the CR for voice service because Part 5 of 477 does not provide the number of lines (or number of subscribers) for telephone. Part 6 of 477 does provide the number of lines/subscribers for broadband, and thus our concentration analysis is limited to fixed broadband.

Table 4

<b>Urban vs Rural Fixed Broadband CR2 and CR4</b>				
<b>Average of Counties</b>				
<b>June 2013</b>				
	<b>Top 10 Rural</b>	<b>Over 50% Rural</b>	<b>Top 10 Urban</b>	<b>Over 50% Urban</b>
Residential CR2	76%	77%	84%	86%
Residential CR4	94%	94%	99%	98%
Non-Residential CR2	81%	81%	75%	79%
Non-Residential CR4	95%	95%	87%	91%

Though the rural residential market CR2 and CR4 appear to have less concentration than in urban markets, it is not advised to assume that rural areas overall have more competition. Because rural counties are likely to have a relatively greater percentage of population in unserved areas, the concentration ratio may not accurately represent the entire area of the county, especially in counties containing areas that lack service availability. A more accurate interpretation would be that where service is available, rural areas have less residential service market concentration than in urban areas.

For non-residential, the opposite appears- the non-residential rural market is more concentrated than urban. Because businesses tend to locate in populated areas that have service availability, the concentration ratio for non-residential rural is more likely representative of business conditions than is the residential number. The residential number represents concentration only in those areas where service is available and we know some rural populations live in areas without service availability.

#### **Urban vs Rural Findings:**

- **Customers in urban areas are more likely to have access to a greater array of fixed broadband services.** Rural counties are slightly less likely to have Fiber to the End User, Symmetric xDSL, and/or Terrestrial Fixed Wireless.
- **Urban areas tend to have more service providers than rural areas.** For categories of fixed voice and fixed broadband communication services, counties with a larger urban population, or as a larger percentage of population, have more service providers.
- **Though fixed broadband market concentration is high in all counties, rural counties have a higher level of concentration for non-residential subscribers and lower levels of concentration in residential services, where available, compared to urban.** The CR values suggest only moderate differences concentration, in all cases being less than ten points.

## VII. Factors Affecting Market Concentration

With the exception of intermodal voice and intermodal broadband (adjusted for ILEC and cable service territories), most HHI measurements in this report are near or well above 2,500 and CR4s generally exceed 70 percent. Therefore, our analysis shows that California has highly concentrated telecommunications markets. A market that is highly concentrated is assumed to be less competitive, therefore enabling the top providers to exercise market power; the ability to alter the market price of a good or service to the detriment of consumers. However, a market that is concentrated does not necessarily result in abusive market power.

A firm can gain market share via price reductions and/or by providing superior and innovative products and must continue to compete in order to maintain or increase its market share. Further, communications networks can have high capital costs and increasing returns to scale.<sup>46</sup> Given such, it is understandable that over time, individual markets relying on these networks become dominated by a few large firms.<sup>47</sup> Thus, high concentration is not evidence of any actual misuse of market power, but is an indicator of a market condition that is more susceptible to abuses.

We describe below some possible factors of the market leading toward and against market concentration and/or market power.

### **Factors increasing market concentration:**

- A relatively small number of sellers compared to buyers.
- Strategic technological barriers to entry, such as speed or mobility that defines product superiority.
- Scarce right-of-way resources that are hoarded or have availability limitations or are prohibitively expensive.
- Rules limiting access to rights-of-way. E.g., Pole access rules, spectrum allocation, environmental regulations and local permits that limit entry or deny placement of facilities.
- High Capital costs and economies of scale in fixed plant.
- Different products that utilize shared facilities (joint products) providing opportunities to customize product (economies of scope) that make competitive entry challenging.
- Lower long-run average cost compared to an entrant (absolute cost advantage)

### **Factors decreasing market concentration:**

- Availability of disruptive technologies and services. E.g., VoIP, “Facetime” and instant messaging.
- Intra-industry competition via direct substitutes. E.g., cable modem competing with DSL.
- Inter-industry competition via indirect substitutes. E.g., mobile competing with fixed broadband.
- Homogeneous products. E.g., smart phones differing by operating systems, size, etcetera, yet offering similar service. Fixed broadband offerings differing by speed yet offering similar service.

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<sup>46</sup> Returns to scale means revenue per customer, generally enabled by lower costs per customer. For communications access service providers, cost per customer goes down when there are more customers served in a particular geographic area. For example, a cable running the length of a city block has the same cost regardless of how many subscribers that provider serves. Since the cable is already there serving existing customers, additional customers on that block means more revenue but relatively little higher costs, thus increasing the return to scale.

<sup>47</sup> Krugman & Wells, *Microeconomics* 2d ed. (Worth 2009), accessed at wikipedia.org April 29, 2010

- Interoperability / usability of products over competing service provider networks. E.g., “iPhone” availability was initially limited to AT&T Mobility, later becoming available on other service provider networks whilst Android devices became available on all competing networks.
- Removal of regulatory barriers to entry. E.g., DIVCA legislation created a single state entity for licensing instead of negotiating licenses with many local entities.
- Open access rules. E.g., network and rights-of-way open access requirements via lease and resale arrangements reduce cost of investment. However, countervailing benefits of network open access requirements may be reduced investment incentives for network owners.<sup>48</sup>

Telephone service, franchise monopoly regulation with investment review and rate setting (a.k.a., economic regulation) in most markets has been replaced with rate flexibility for basic wireline voice telephone service and de-tariffing for other, ancillary services. Wireless, broadband and VoIP services have not been subject to economic regulation and have become important services in the communications market, as indicated in Chart 1, of this report. Yet, as this report has subsequently identified, market concentration remains. Despite this fact, a highly concentrated (oligopolistic) market should not require the same level of regulatory intervention as has previous conditions of market monopoly.<sup>49</sup>

Even where markets are concentrated, market participants may compete for market share via price competition resulting in lower prices. Further, in decreasing concentration markets, the dominant (incumbent) provider is not the likely entity to decrease price.<sup>50</sup> If we extrapolate our Chart 2 and Table 3 finding that the wireline market has declining market concentration, we could expect rational pricing behavior of the dominant provider to include it not lowering its prices as such is the expected action of less dominant providers to gain market share.

The rates in California of both incumbent wireline providers Verizon and especially AT&T have increased, though for AT&T their rates could reasonably be considered having started at “below market” levels.<sup>51</sup> Both the intermodal HHI and the CR2/CR4 data since 2008 in this report confirm that generally the California communications market has declining concentration, though the intermodal HHIs appear to have bottomed out.

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<sup>48</sup> “Case studies of eight European countries (Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, and the United Kingdom) confirm that facilities-based competition has served as the primary driver of investments in upgrading broadband networks.” U.S. vs. European Broadband Deployment: What Do the Data Say? Christopher S. Yoo, 2014

<sup>49</sup> “We find that deregulation and the strength of competition in network industries have removed justifications for structural separation as a remedy. Also, we argue that that deregulation and competition have effectively eliminated support for application of the essential facilities doctrine.” Abstract from; Antitrust, the Internet, and the Economics of Networks, in Oxford Handbook of International Antitrust Economics (Roger D. Blair & D. Daniel Sokol eds., Oxford University Press Christopher S Yoo with Daniel F. Spulber, forthcoming 2014)

<sup>50</sup> “Increasing concentration industries are more likely the ones where leading firms have lowered prices to gain share, while decreasing concentration industries are more likely the ones where smaller firms have lowered concentration by lowering prices. An additional conclusion is that the cost-reducing effects of changes in concentration are greater for increasing concentration industries, meaning that increasing concentration industries have lower price increases compared to decreasing concentration industries.” Vaughan Dickson, Concentration history and market power in US manufacturing industries. Applied Economics, Vol. 39, No. 16 (September 2007), pp. 2049-2055.

<sup>51</sup> Decision 08-09-042 states regarding rates in effect in 2008: “Monthly rates for AT&T customers in California are the lowest in the nation and more than \$8 per month lower than the nationwide average.” Also, see; Market Pricing Survey of Retail Communications Services in California, published December 2014.  
<http://www.cpuc.ca.gov/PUC/Telco/generalInfo/CPUC+Reports+and+Presentations.htm>

Market share loss in the most concentrated industry segment, wireline telecommunications, is due to competition via substitution products. These substitute products reduce market concentration, thereby reducing the opportunity for dominant providers to exercise market power. Contradicting this however, is that parent-corporations own affiliated companies across technologies— declining market share of one technology may not impact overall market dominance when the parent-company offers the substitute technology and substitution does not represent a loss of parent-company total market share. We have presented CR2 and CR4 data that corrects for this cross-ownership, and the data shows positive trends. Further, the territory adjusted intermodal HHI values are within the moderate concentration range (between 1500 and 2500).

**Factors Affecting Market Concentration Findings:**

- **The communications industry has features both tending toward increasing and decreasing market concentration.**
- **Intermodal competition is a key feature toward having decreased communications voice and broadband market concentration.**
- **Though concentrated, a market that is becoming less concentrated is a positive condition.**

## **VIII. Conclusion and Recommendation**

Given the parent and territory adjusted HHI, and the CR calculations that we have reviewed, we conclude that a significant degree of concentration characterizes individual technology modes, primarily wireline voice and to a lesser degree the fixed broadband communications market. However, when considering the intermodal voice and broadband markets, as measured by HHI, over time the level of concentration declines into the range of the moderately concentrated-market threshold.

Mergers of the last decade were a major occurrence that caused concentration levels to increase in the wireline and wireless technology modes. Any future mergers of entities that are in direct competition with each other would likely have a comparable impact and should remain a concern.

The dynamics of competition vary depending on the technology mode of interest. Wireline is highly concentrated whereas wireless is much less so. The Commission's regulatory policy espoused in its' Uniform Regulatory Framework decisions rely upon intermodal competition as the foundation of its' consumer choice policy contained in General Order 168. This policy is appropriate because competition exists among the voice and broadband technology modes via intermodal substitution. Our analysis considers parent-company ownership across technologies, indicating that despite cross-ownership, intermodal markets show declining concentration.

Our analysis of competition between urban and rural areas is limited to wireline voice and broadband service, and concludes that market concentration is similar between urban and rural areas, and that both are similarly disadvantaged in terms of lacking a fully competitive fixed broadband market.

Because market concentration does exist, the Commission's pledge to monitor the State's communications market is appropriate. We conclude that the HHI and CR analysis presented here is not determinative of the existence of exercised market power. Assessment of market abuse via market pricing or other means is beyond the scope of this report and requires separate analysis. Should CR or HHI market concentration significantly increase the potential exercise of market power becomes a greater concern.

# Appendix A - Description of Data and Data Tables

## Data Source Analysis:<sup>52</sup>

The FCC, under a nondisclosure agreement, provides California-specific data for wireline, wireless, and VoIP<sup>53</sup> telephone, and broadband subscribership data to the CPUC approximately every six months.<sup>54</sup> For our analysis here, CD staff primarily utilized data sets from the FCC's Form 477.

## FCC Form 477

Form 477 data was used to calculate retail communications access subscribership statistics at the State and, to a limited extent, ZIP code levels.

Form 477 data includes company-specific data on:

- the total number of voice grade (wireline) telephone subscriptions and the percentage that are residential;
- the total number of interconnected VoIP subscriptions and the percentage who are billed directly by the reporting company;
- the total number of wireless subscriptions and the percentage who are billed directly by the reporting company; and
- the total number of broadband access subscriptions and the percentage which are residential.

## Wireless Broadband/Mobile Data Connections

Included in the broadband connections data reported on Form 477 is a relatively new and rapidly expanding retail consumer communications broadband access service, wireless broadband (also called mobile data). Some 68 percent (over 23 million) of the 34.1 million California broadband connections reported in Form 477 data from June 2013 were mobile broadband connections, provided by wireless carriers to laptop computers, notebooks, and "smart phone" devices such as iPhones, Android smartphones, and Blackberries.<sup>55</sup>

One consequence of this trend is that the number of "residential broadband connections" reported in Form 477 does not identify the number of households with broadband service. Certainly there are a substantial number of mobile wireless subscribers who also subscribe to a separate fixed-location

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<sup>52</sup> In this report, CD staff uses FCC Form 477 data. Traditional market analysis may also employ revenue data, which is available through the FCC's Automated Reporting Management Information System (ARMIS). However, only the largest local telephone companies are required to submit ARMIS data.

<sup>53</sup> The FCC defines "voice telephone service" as local exchange or exchange access services that allow end users to originate and/or terminate local calls on the public switched network, whether used by the end user for voice telephone calls or for other types of calls carried over the public switched network. <<http://www.fcc.gov/Forms/Form477/477inst.pdf>>

<sup>54</sup> The FCC requires all facilities-based providers of broadband connections to end-user locations; local exchange carriers, including resellers as well as facilities-based carriers (including cable and VoIP); and commercial mobile radio service providers that serve mobile telephone service subscribers using licensed spectrum, to submit Form 477 data. <<http://www.fcc.gov/form477/>>

<sup>55</sup> FCC Form 477 classifies these connections as "terrestrial mobile wireless."

broadband connection within their homes. Some of these are within service bundles from one carrier, while other consumers could be customers of several communications companies.

Until December 2008, mobile broadband service providers reported the number of capable *devices* on FCC Form 477. Beginning with the December 2008 cycle, mobile broadband providers began reporting only those handsets where *subscribers* actually purchased a mobile broadband plan. Prior to December 2008, the number of mobile broadband connections reported to the FCC reflected the number of devices, not the number of subscriptions. We have elected to omit the pre-2008 data from the overall market analysis because, prior to 2008, this metric did not provide usable data on actual customers utilizing the service.

The FCC uses Form 477 data to calculate summary statistics of subscribership in retail communications services, which it publishes in its *Local Telephone Competition, High-Speed Services for Internet Access*, and annual *Commercial Mobile Radio Services* reports.<sup>56</sup> CD staff analysts utilize Form 477 data to calculate retail communications access subscribership statistics at the State level.

Companies with wireline telephone and/or broadband customers also provide lists of the ZIP codes in which they have at least one customer. Although the Form 477 data allows us to determine the total number of wireline telephone subscriptions, VoIP subscriptions, broadband connections, and wireless accounts billed directly, certain limitations in the data prevent a more thorough analysis that could include service type, customers of service bundles, or measures of market concentration at a city or county level.

- Limited detail is provided as to type of service a company's customers subscribe to over its lines/connections (i.e. basic vs. premium, or flat vs. measured, whether a voice service supplements another rather than replacing it);
- Form 477 data does not specify whether a company's voice customers also subscribe to broadband connections as part of a bundle, as opposed to stand-alone subscriptions.
- Lack of detail and geographic granularity precludes analysis of smaller geographic "markets" by region or population center. Many companies concentrate their business in one or several specific areas, thus each company's share of subscriptions may vary from region to region, even neighborhood to neighborhood.
- Subscribership to wireless broadband (mobile data for "smart" devices) was not reported until December 2008. Prior to that, figures were inflated by counts of devices rather than paying subscriptions. Overcounts, particularly for Verizon wireless, skewed mobile broadband and total connection data for the reporting periods before December 2008.

### **Form 477 Customer Type Reporting and Threshold Changes**

The reporting requirements for Form 477 changed between December 2004 and June 2005. First, the reporting threshold of 10,000 voice grade equivalent lines for wireline telephone and wireless subscriber, and 250 connections for broadband, were eliminated so that all carriers report Form 477 data, regardless of the size of their subscribership. This increased the total number of reporting entities and the total numbers of connections and subscriptions. Additionally, the FCC amended the requirement to indicate

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<sup>56</sup> Federal Communications Commission Local Telephone Competition and Broadband Deployment webpage <<http://www.fcc.gov/wcb/iatd/comp.html>>

what percentage of total subscriptions were residential or small business customers.<sup>57</sup> This has added quite a large number of new participants to 477 data. In 2013, some 66.1 percent of entities had fewer than 10,000 voice grade lines or fewer than 250 broadband connections. However, because the number of subscriber lines is small the impact of the reporting change for purposes of calculating the HHI should be negligible.

### **Form 477 Addition of Interconnected VoIP Reporting**

December 2008 was the first reporting cycle of FCC Form 477 data to include a category for VoIP services. The FCC defines Interconnected VoIP as a “service that enables real-time, two-way voice communications; requires a broadband connection from the user’s location; requires Internet-protocol compatible customer premises equipment; and permits users generally to receive calls that originate on the public switched telephone network and to terminate calls to the public switched telephone network.” Because digital voice services provisioned by cable service providers over coaxial cable are classified and reported to the FCC as VoIP lines,<sup>58</sup> the 477 data is skewed in the following ways:

- The wireline market appears more concentrated because of the absence of cable-provided digital voice and fixed interconnected VoIP from that category.
- Thus for the traditional wireline voice market, the biggest ILECs have gained market share in the traditional wireline sector even though their subscribership is declining.

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<sup>57</sup> *Report and Order In the Matter of Local Telephone Competition and Broadband Reporting*, rel. November 12, 2004 (FCC 04-266) <[http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-04-266A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-266A1.pdf)>

<sup>58</sup> <http://www.fcc.gov/form477/inst.htm#hotlink3>>

**Data Tables:**

The graphs depicted in the text are based on the following data tables.

<b>California Voice and Broadband Subscriptions By Technology (in Millions) for Chart 1</b>						
	<b>Total Subscriptions</b>	<b>Voice</b>			<b>Broadband</b>	
		<b>Wireline</b>	<b>Wireless</b>	<b>VoIP</b>	<b>Mobile</b>	<b>Fixed</b>
June 2001	40.7	24.8	14.2			1.7
June 2002	42.9	24.5	15.9			2.6
Dec 2002	44.6	24.2	17.4			3.0
June 2003	45.8	23.7	18.7			3.5
Dec 2003	48.1	23.5	20.4			4.2
June 2004	49.5	23.2	21.6			4.7
Dec 2004	51.9	23.0	23.5			5.4
June 2005	53.5	23.0	24.6			5.9
Dec 2005	55.6	22.6	26.3			6.7
June 2006	57.3	22.4	27.5			7.4
Dec 2006	59.7	22.0	29.7			8.0
June 2007	60.1	21.4	30.2			8.5
Dec 2007	60.3	20.8	30.6			8.8
June 2008	59.4	20.2	30.0			9.1
Dec 2008	65.8	18.7	32.2	2.2	3.5	9.2
June 2009	66.6	17.7	32.2	2.5	4.8	9.4
Dec 2009	69.0	16.8	32.9	2.7	7.0	9.6
June 2010	72.1	16.1	33.5	3.2	9.6	9.6
Dec 2010	74.1	15.3	33.8	3.5	11.5	10.0
June 2011	78.6	14.6	34.3	3.7	15.8	10.2
Dec 2011	81.5	13.7	34.9	4.2	18.4	10.4
June 2012	83.5	13.0	35.2	4.5	20.2	10.5
Dec 2012	85.5	12.3	35.6	4.9	22.0	10.7
June 2013	86.7	11.5	35.8	5.4	23.2	10.9

Both VoIP and mobile broadband subscribership became required reporting as of December 2008; Prior to this VoIP subscriptions were not reported and mobile broadband providers reported counts of capable handsets.

*sources: FCC Form 477 filings, June 2001 - June 2013*

**HHI Market Concentration by Technology Adjusted for Parent Companies for  
Chart 2**

	Wireline Voice	VoIP	Fixed Broadband	Mobile Broadband	Wireless Voice
June 2001	5,711		2,396		2,318
June 2002	5,438		2,091		2,212
Dec 2002	5,110		2,108		2,107
June 2003	4,885		2,058		2,019
Dec 2003	4,699		2,029		1,899
June 2004	4,577		2,069		1,826
Dec 2004	4,503		2,034		2,156
June 2005	4,453		2,193		2,363
Dec 2005	5,118		2,233		2,569
June 2006	5,097		2,259		2,532
Dec 2006	5,009		2,340		2,532
June 2007	5,018		2,340		2,509
Dec 2007	4,939		2,295		2,495
June 2008	4,816		2,236		2,535
Dec 2008	5,061	1,732	2,188	3,528	2,483
June 2009	5,066	1,715	2,187	3,476	2,470
Dec 2009	5,010	1,595	2,171	3,114	2,477
June 2010	4,899	1,546	2,121	3,035	2,472
Dec 2010	4,800	1,484	2,125	3,015	2,477
June 2011	4,709	1,463	2,088	2,723	2,457
Dec 2011	4,698	1,277	2,052	2,594	2,458
June 2012	4,618	1,208	2,026	2,378	2,464
Dec 2012	4,510	1,140	1,980	2,520	2,510
June 2013	4,352	1,081	1,952	2,706	2,680

*sources: FCC Form 477 filings, June 2001 -June 2013*

**HHI Market Concentration by Technology Adjusted for ILEC and Cable  
Service Territories for Chart 3**

	<b>Wireline Voice</b>	<b>VoIP</b>	<b>Wireless Voice</b>	<b>Fixed Broadband</b>	<b>Mobile Broadband</b>
June 2001	9,117		2,318	4,587	
June 2002	8,862		2,212	4,796	
Dec 2002	8,546		2,107	4,216	
June 2003	8,509		2,019	4,220	
Dec 2003	8,319		1,899	4,251	
June 2004	8,138		1,826	4,272	
Dec 2004	7,964		2,156	3,834	
June 2005	7,775		2,363	3,994	
Dec 2005	7,753		2,569	4,593	
June 2006	8,027		2,558	4,666	
Dec 2006	7,841		2,532	4,677	
June 2007	7,907		2,509	4,714	
Dec 2007	7,720		2,495	4,697	
June 2008	7,529		2,535	4,665	
Dec 2008	7,871	5,062	2,483	4,712	3,528
June 2009	7,868	4,502	2,470	4,735	3,476
Dec 2009	7,794	4,401	2,477	4,733	3,114
June 2010	7,619	4,150	2,472	4,715	3,035
Dec 2010	7,374	4,080	2,477	4,637	3,015
June 2011	7,365	4,047	2,457	4,646	2,723
Dec 2011	7,350	3,635	2,458	4,703	2,594
June 2012	7,205	3,450	2,464	4,715	2,378
Dec 2012	7,141	3,224	2,510	4,603	2,520
June 2013	7,086	3,001	2,680	4,687	2,706

*sources: FCC Form 477 filings, June 2001 - June 2013*

<b>HHI Market Concentration for Intermodal Voice and Intermodal Broadband Markets Adjusted for ILEC and Cable Service Territories for Chart 4</b>		
	<b>Intermodal Voice</b>	<b>Intermodal Broadband</b>
June 2001	4,003	4,587
June 2002	3,613	4,796
Dec 2002	3,268	4,216
June 2003	3,054	4,220
Dec 2003	2,811	4,251
June 2004	2,622	4,272
Dec 2004	2,785	3,834
June 2005	2,490	3,994
Dec 2005	2,470	3,912
June 2006	2,403	3,239
Dec 2006	2,254	2,866
June 2007	2,219	2,667
Dec 2007	2,151	2,513
June 2008	2,126	2,422
Dec 2008	1,914	2,738
June 2009	1,868	2,467
Dec 2009	1,830	2,138
June 2010	1,764	1,937
Dec 2010	1,731	1,882
June 2011	1,691	1,729
Dec 2011	1,662	1,672
June 2012	1,637	1,581
Dec 2012	1,635	1,642
June 2013	1,694	1,731

*sources: FCC Form 477 filings, June 2001 - June 2013*

**Two-Firm (CR2) Market Concentration By Technology Adjusted for Parent Companies for Table 1**

	Wireline Voice	VoIP	Wireless Voice	Fixed Broadband	Mobile Broadband
June 2001	92.1%		58.7%	58.1%	
June 2002	90.0%		57.1%	53.3%	
Dec 2002	87.7%		56.7%	53.6%	
June 2003	86.0%		55.1%	52.9%	
Dec 2003	84.3%		51.4%	52.6%	
June 2004	82.7%		49.1%	53.6%	
Dec 2004	81.9%		55.5%	53.5%	
June 2005	81.2%		62.4%	55.7%	
Dec 2005	86.3%		60.8%	56.2%	
June 2006	87.8%		61.0%	56.4%	
Dec 2006	86.7%		59.8%	55.7%	
June 2007	87.0%		60.8%	56.0%	
Dec 2007	85.9%		60.3%	55.5%	
June 2008	84.8%		63.0%	55.1%	
Dec 2008	86.9%	51.6%	62.7%	54.4%	81.6%
June 2009	86.9%	52.0%	62.8%	54.5%	80.9%
Dec 2009	86.5%	49.7%	63.6%	54.4%	73.8%
June 2010	85.6%	47.6%	63.9%	53.8%	70.9%
Dec 2010	84.6%	46.5%	63.4%	53.9%	67.1%
June 2011	83.8%	45.7%	63.2%	53.4%	67.1%
Dec 2011	83.7%	42.0%	63.2%	52.7%	65.5%
June 2012	82.8%	40.2%	63.3%	52.4%	63.1%
Dec 2012	81.8%	38.5%	64.3%	51.8%	66.6%
June 2013	81.9%	36.5%	64.6%	51.1%	68.3%

*sources: FCC Form 477 filings, June 2001 - June 2013*

<b>Four-Firm (CR4) Market Concentration By Technology Adjusted for Parent Companies for Table 2</b>					
	<b>Wireline Voice</b>	<b>VoIP</b>	<b>Wireless Voice</b>	<b>Fixed Broadband</b>	<b>Mobile Broadband</b>
June 2001	95.1%		88.7%	76.3%	
June 2002	94.1%		87.2%	74.1%	
Dec 2002	92.9%		84.2%	75.1%	
June 2003	92.4%		81.8%	74.2%	
Dec 2003	91.8%		79.2%	73.1%	
June 2004	91.0%		76.9%	73.1%	
Dec 2004	90.3%		85.1%	73.4%	
June 2005	88.7%		85.8%	76.2%	
Dec 2005	90.6%		96.3%	76.3%	
June 2006	92.0%		96.4%	76.8%	
Dec 2006	92.1%		96.3%	80.8%	
June 2007	92.3%		95.9%	81.3%	
Dec 2007	91.6%		96.0%	81.5%	
June 2008	90.8%		95.5%	81.1%	
Dec 2008	92.8%	72.9%	93.8%	81.7%	98.1%
June 2009	93.2%	73.9%	93.1%	82.0%	98.5%
Dec 2009	93.0%	69.9%	92.8%	82.1%	99.0%
June 2010	92.2%	69.2%	92.1%	82.0%	98.3%
Dec 2010	91.4%	66.4%	91.7%	82.1%	95.2%
June 2011	91.3%	66.4%	90.9%	82.1%	93.3%
Dec 2011	90.9%	61.5%	90.8%	81.8%	91.8%
June 2012	90.2%	59.9%	91.0%	81.7%	86.5%
Dec 2012	89.6%	58.2%	91.6%	81.1%	87.4%
June 2013	90.0%	56.8%	98.9%	80.9%	94.5%

*sources: FCC Form 477 filings, June 2001 - June 2013*

**Two-Firm (CR2) and Four-Firm (CR4) Market Concentration for Intermodal Voice and Intermodal Broadband Markets Adjusted for Parent Companies for Table 3**

	Intermodal Voice		Intermodal Broadband	
	CR2	CR4	CR2	CR4
June 2001	70.4%	87.1%	58.1%	76.3%
June 2002	66.6%	85.4%	53.4%	74.1%
Dec 2002	63.1%	83.1%	53.6%	75.1%
June 2003	60.5%	81.5%	52.9%	74.2%
Dec 2003	57.8%	79.3%	52.6%	73.1%
June 2004	56.2%	77.1%	53.6%	73.1%
Dec 2004	59.2%	76.8%	53.5%	73.4%
June 2005	54.3%	77.8%	55.7%	76.2%
Dec 2005	73.7%	93.0%	57.1%	78.4%
June 2006	73.0%	92.6%	61.2%	79.1%
Dec 2006	71.2%	92.2%	64.9%	82.5%
June 2007	71.7%	92.2%	66.9%	82.8%
Dec 2007	70.7%	91.9%	70.7%	83.6%
June 2008	71.8%	91.2%	69.2%	84.2%
Dec 2008	68.7%	87.5%	59.8%	81.7%
June 2009	68.2%	86.9%	61.2%	81.6%
Dec 2009	68.1%	86.5%	60.3%	78.6%
June 2010	67.3%	85.2%	60.2%	76.4%
Dec 2010	66.3%	84.5%	58.7%	77.0%
June 2011	65.4%	83.6%	59.6%	77.8%
Dec 2011	64.8%	83.1%	58.8%	76.1%
June 2012	64.2%	82.7%	57.3%	73.7%
Dec 2012	64.3%	82.7%	59.5%	74.1%
June 2013	63.9%	87.2%	60.5%	78.4%

*sources: FCC Form 477 filings, June 2001 - June 2013*

# Appendix B - Measuring Market Concentration Explained

## Herfindahl-Hirschman and Two and Four-firm Concentration Ratios

The Herfindahl-Hirschman Index (HHI) and Two-firm and Four-firm Concentration Ratios (CR2 and CR4) are three methods for measuring market concentration. Both methods rely on determining the market share of each individual firm within a given market.

### HHI

The HHI is calculated by taking the square of each firm's market share, and then adding all of these squared shares together. Where  $n$  is an individual company's total customers and  $t$  is the total number of customers in the market: Market share =  $n / t$

HHI =  $\sum ((n/t)^2)$  = the sum of squares of the individual market shares for every company participating in the market =  $(n_1 / t)^2 + (n_2 / t)^2 + (n_3 / t)^2 + \dots$

Often the HHI is expressed as that sum multiplied by 10,000 for a score of 1-10000 points.

For a perfectly competitive market with  $n$  firms and  $t$  total customers, each firm would have an equal share of the market ( $n/t$ ). If  $n = 10$  and  $t = 100$  (10 firms competing for 100 customers), HHI would be then be  $10 * (10/100)^2 = 1$

The HHI for a three-firm market where one firm has 80% of the market while the other two have 10% each would be  $(4/5)^2 + 2*(1/10)^2 = .66$  or 6,660. The HHI for a three-firm market where one firm has 50% of the market while the other two have 25% each would be  $(1/2)^2 + 2*(1/4)^2 = .375$  or 3,750. As the number of competitive firms increases infinite, the HHI approaches zero. This means that a higher HHI indicates a more concentrated, or oligopolistic, market.

Markets in which the HHI is between 1,500 and 2,500 points (0.1500 to 0.2500) are considered moderately concentrated and those in which the HHI is greater than 2,500 points (0.2500) are considered to be highly concentrated.<sup>59</sup> Below 1,500, the markets are considered not concentrated.

### CR2 and CR4

The CR4 is calculated by adding the market shares of the four largest firms in a given market. In a one-firm market, the CR4 would simply be 100 %. In a perfectly competitive market with, for example, 100 firms, the CR4 would be  $4 * (1/100) = 4$  %. A similar method is used for CR2, except only two firms are combined. An oligopoly is generally characterized by a CR4 ratio greater than 40%.<sup>60</sup>

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<sup>59</sup> <http://www.justice.gov/atr/public/guidelines/hhi.html>

<sup>60</sup> <http://info.umuc.edu/mba/public/AMBA607/IndustryStructure.html>;

<http://www.economicexpert.com/a/Concentration:ratio.htm>; <http://www.unf.edu/~traynham/ch14%20edited%20lecture.pdf>

After determining the market shares of individual companies, we calculated the HHI and CR4 for each separate service; for traditional wireline, VoIP and wireless accounts billed directly (wireline + VoIP + wireless); and for all services combined into one “market” (wireline + VoIP + wireless + broadband).

HHI and CR4 measurements provide snapshot views of a market at a single point in time; thus, they are static metrics and do not capture information regarding the nature of competition in the specific market. Rather, they serve as indices of firms’ likely behavior, based solely on the level of market concentration. An historical approach to HHI and CR4, which we have used in this analysis, allows us to observe how market concentration has changed in the time period for which CD has available data.<sup>61</sup>

Several factors justify calculating HHI and CR4 for wireline, wireless and broadband combined: a parent company may own, for example, both a wireline and a wireless service. Many ILECs own both a wireline telephone and a broadband service. Such a situation may reflect intermodal competition, but it does not reflect, and may in fact diminish, the possibility of entry into the market by an unaffiliated competitor in a given area or market segment. A parent company’s ownership of multiple types of voice service increases its market power. This fact is not captured when examining the three services in isolation.

Again, the HHI and CR2 & CR4 measurements are based on numbers reported for the entire state. We recognize that in certain that areas *within* the state smaller companies have larger shares than reflected in a statewide framework (see Telephone Penetration and Assumptions Regarding Availability of Service). It is also certain that, although these measurements indicate significant market concentrations on a statewide level, some markets are likely to be even more concentrated *locally* than is reflected in the statewide data. Smaller population centers and rural areas are likely to have fewer choices in service providers. By the same token, in large population centers, the local market may be less concentrated than statewide data would show.

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<sup>61</sup> The URF decision refrained from examining HHI or other market concentration measurements, stating that “market share tests are inherently backward looking and not a good predictor of future developments.” Since CD is concerned with identifying trends in market share since 2006 and before, it is appropriate here to examine these measurements.

## Appendix C – Fixed Broadband Service Technologies by County

X = Service is present in county

N/A = Service is not present in county

County	Population Percent Rural	Asymmetric xDSL	Cable Modem	Optical Carrier	Other Wireline	Satellite	Symmetric xDSL	Terrestrial Fixed Wireless
San Francisco	0.00	X	X	X	X	X	X	X
Orange	0.14	X	X	X	X	X	X	X
Alameda	0.39	X	X	X	X	X	X	X
Los Angeles	0.61	X	X	X	X	X	X	X
Contra Costa	0.79	X	X	X	X	X	X	X
Santa Clara	1.08	X	X	X	X	X	X	X
San Mateo	1.89	X	X	X	X	X	X	X
Sacramento	2.06	X	X	X	X	X	X	X
Ventura	3.12	X	X	X	X	X	X	X
San Diego	3.30	X	X	X	X	X	X	X
Solano	3.72	X	X	X	X	X	X	X
Riverside	4.62	X	X	X	X	X	X	X
San Bernardino	4.73	X	X	X	X	X	X	X
Santa Barbara	5.02	X	X	X	X	X	X	X
Marin	6.52	X	X	X	X	X	X	X
Yolo	6.93	X	X	X	X	X	X	X
Stanislaus	7.98	X	X	X	X	X	X	X
San Joaquin	8.47	X	X	X	X	X	X	X
Monterey	9.82	X	X	X	X	X	X	X
Kern	10.21	X	X	X	X	X	X	X
Fresno	10.81	X	X	X	X	X	X	X
Kings	10.85	X	X	N/A	X	X	X	N/A
Santa Cruz	12.04	X	X	X	X	X	X	X
Sonoma	12.35	X	X	X	X	X	X	X
Napa	13.40	X	X	X	X	X	X	X
Placer	13.79	X	X	X	X	X	X	X

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X = Service is present in county

N/A = Service is not present in county

County	Population Percent Rural	Asymmetric xDSL	Cable Modem	Optical Carrier	Other Wireline	Satellite	Symmetric xDSL	Terrestrial Fixed Wireless
Merced	14.27	X	X	X	X	X	X	X
Sutter	14.80	X	X	X	X	X	X	X
Tulare	15.48	X	X	X	X	X	X	X
San Luis Obispo	16.60	X	X	X	X	X	X	X
Imperial	17.42	X	X	X	X	X	X	X
Butte	18.90	X	X	X	X	X	X	X
San Benito	24.00	X	X	N/A	X	X	X	X
Yuba	26.22	X	X	X	X	X	X	X
Shasta	29.29	X	X	N/A	X	X	X	X
Humboldt	29.76	X	X	X	X	X	X	X
Colusa	31.72	X	X	N/A	X	X	N/A	X
Madera	32.92	X	X	X	X	X	X	X
Lake	33.11	X	X	X	X	X	X	X
Del Norte	33.67	X	X	N/A	X	X	N/A	N/A
El Dorado	34.70	X	X	X	X	X	X	X
Glenn	40.87	X	X	N/A	X	X	X	X
Nevada	42.13	X	X	X	X	X	X	X
Mendocino	45.23	X	X	N/A	X	X	X	X
Mono	45.83	X	X	X	X	X	N/A	N/A
Inyo	46.43	X	X	X	X	X	N/A	N/A
Tuolumne	48.97	X	X	X	X	X	X	X
Tehama	51.49	X	X	N/A	X	X	X	X
Amador	60.42	X	X	X	X	X	X	X
Siskiyou	65.83	X	X	X	X	X	N/A	X
Modoc	69.96	X	N/A	N/A	X	X	N/A	X
Lassen	70.53	X	X	N/A	X	X	N/A	X
Plumas	74.02	X	X	N/A	X	X	X	X
Calaveras	75.41	X	X	X	X	X	X	X
Sierra	99.72	X	X	N/A	X	X	N/A	X
Alpine	100.00	X	X	X	X	X	N/A	N/A
Mariposa	100.00	X	X	N/A	X	X	X	N/A
Trinity	100.00	X	N/A	N/A	X	X	N/A	X

## Appendix D– HHI and CRs of Fixed Broadband Markets by County

County	Population Percent Rural	Residential			Non-Residential		
		HHI	CR2	CR4	HHI	CR2	CR4
San Francisco	0.0%	4,715	95.1%	99.4%	3,185	73.8%	85.9%
Orange	0.1%	2,840	63.8%	98.5%	2,856	64.6%	83.1%
Alameda	0.4%	4,896	98.7%	99.9%	3,917	81.1%	88.9%
Los Angeles	0.6%	2,917	69.0%	98.0%	2,606	63.7%	83.7%
Contra Costa	0.8%	4,458	93.3%	99.7%	3,879	82.9%	89.9%
Santa Clara	1.1%	4,453	93.8%	98.7%	3,175	75.9%	86.3%
San Mateo	1.9%	4,276	91.2%	99.1%	3,673	80.7%	88.4%
Sacramento	2.1%	3,766	84.9%	99.5%	2,891	72.5%	83.2%
Ventura	3.1%	3,476	75.2%	99.4%	2,818	72.1%	88.6%
San Diego	3.3%	3,627	77.1%	99.4%	3,673	78.1%	87.2%
Solano	3.7%	4,670	96.0%	99.0%	3,821	80.3%	88.6%
Riverside	4.6%	3,107	74.4%	98.4%	2,767	68.6%	85.6%
San Bernardino	4.7%	3,258	73.7%	98.5%	3,375	66.4%	81.1%
Santa Barbara	5.0%	3,595	78.3%	98.9%	2,800	71.7%	89.3%
Marin	6.5%	5,477	94.7%	98.7%	3,587	82.9%	91.1%
Yolo	6.9%	4,159	79.6%	99.1%	3,509	66.9%	79.1%
Stanislaus	8.0%	4,255	83.6%	98.6%	4,012	79.7%	89.0%
San Joaquin	8.5%	4,290	92.3%	99.3%	3,501	80.1%	92.2%
Monterey	9.8%	4,588	95.1%	97.9%	4,374	90.3%	95.5%
Kern	10.2%	3,948	88.5%	95.5%	3,278	77.5%	89.5%
Fresno	10.8%	4,397	93.4%	97.2%	4,142	84.0%	91.8%
Kings	10.9%	4,808	98.0%	100.0%	4,552	90.0%	98.4%
Santa Cruz	12.0%	4,073	89.5%	98.4%	3,099	72.2%	90.7%
Sonoma	12.4%	4,482	93.1%	97.5%	2,892	71.5%	85.4%
Napa	13.4%	4,787	97.8%	99.4%	3,956	81.8%	91.8%
Placer	13.8%	2,125	52.6%	89.8%	2,488	67.3%	86.8%

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County	Population Percent Rural	Residential			Non-Residential		
		HHI	CR2	CR4	HHI	CR2	CR4
Merced	14.3%	3,958	87.6%	97.8%	3,643	79.1%	90.8%
Sutter	14.8%	4,648	95.9%	98.9%	3,565	82.8%	96.2%
Tulare	15.5%	4,515	87.5%	95.6%	4,279	79.4%	88.9%
San Luis Obispo	16.6%	4,668	95.7%	99.1%	3,645	80.1%	91.4%
Imperial	17.4%	4,301	91.9%	98.4%	5,531	92.0%	96.9%
Butte	18.9%	4,298	92.4%	98.8%	4,795	91.7%	96.8%
San Benito	24.0%	4,071	87.6%	97.7%	5,125	80.4%	93.9%
Yuba	26.2%	4,120	89.3%	95.7%	3,389	80.3%	95.4%
Shasta	29.3%	3,358	79.7%	95.2%	3,945	81.7%	95.6%
Humboldt	29.8%	4,757	90.8%	95.7%	3,857	82.2%	94.8%
Colusa	31.7%	3,890	86.9%	98.3%	3,930	87.4%	98.0%
Madera	32.9%	2,404	59.3%	92.0%	2,833	69.9%	93.3%
Lake	33.1%	4,359	92.9%	99.6%	5,052	94.6%	99.5%
Del Norte	33.7%	7,969	96.8%	99.8%	5,335	88.8%	97.1%
El Dorado	34.7%	3,513	78.9%	96.1%	4,503	81.3%	93.8%
Glenn	40.9%	4,946	82.0%	95.4%	5,204	82.6%	96.4%
Nevada	42.1%	3,312	72.5%	92.8%	5,795	87.4%	95.1%
Mendocino	45.2%	2,953	73.7%	94.5%	3,180	77.3%	94.9%
Mono	45.8%	4,107	90.1%	99.9%	5,537	87.2%	96.2%
Inyo	46.4%	4,658	87.2%	98.4%	3,107	69.0%	95.8%
Tuolumne	49.0%	3,600	80.3%	92.8%	5,199	83.0%	93.3%
Tehama	51.5%	4,409	81.2%	90.9%	5,651	84.5%	92.3%
Amador	60.4%	3,793	80.7%	94.6%	4,348	79.6%	91.5%
Siskiyou	65.8%	2,917	67.8%	92.1%	3,437	75.1%	97.2%
Modoc	70.0%	7,973	95.5%	99.9%	5,206	94.2%	97.7%
Lassen	70.5%	4,493	89.3%	96.2%	8,047	96.4%	99.3%
Plumas	74.0%	2,847	65.7%	93.6%	4,594	95.7%	99.0%
Calaveras	75.4%	2,709	64.3%	88.0%	3,164	71.3%	96.7%
Sierra	99.7%	3,272	75.5%	92.5%	8,871	97.1%	100.0%
Alpine	100.0%	2,553	64.6%	92.4%	1,747	44.1%	79.4%
Mariposa	100.0%	4,886	83.0%	93.6%	5,808	92.8%	97.5%
Trinity	100.0%	3,758	76.9%	98.6%	2,444	60.0%	93.3%