

California Plug Load Research Center

Residential Satellite TV Energy Consumption Study: Consumer-premises Equipment

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California Plug Load Research Center

California Institute for Telecommunications and Information Technology

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Test Methodology

- To test power consumption of residential satellite system under a variety of STB configurations
- Low-noise block down-converters (LNBS) and multi-switches are devices under test (DUT), also referred to as consumer-premise equipment
- DirecTV provided residential satellite system at CalPlug
- Energy Star compliant testing procedures are followed at CalPlug



DirecTV Satellite Dish with SL3S4NR2-02 LNB as tested



Power Testing Station



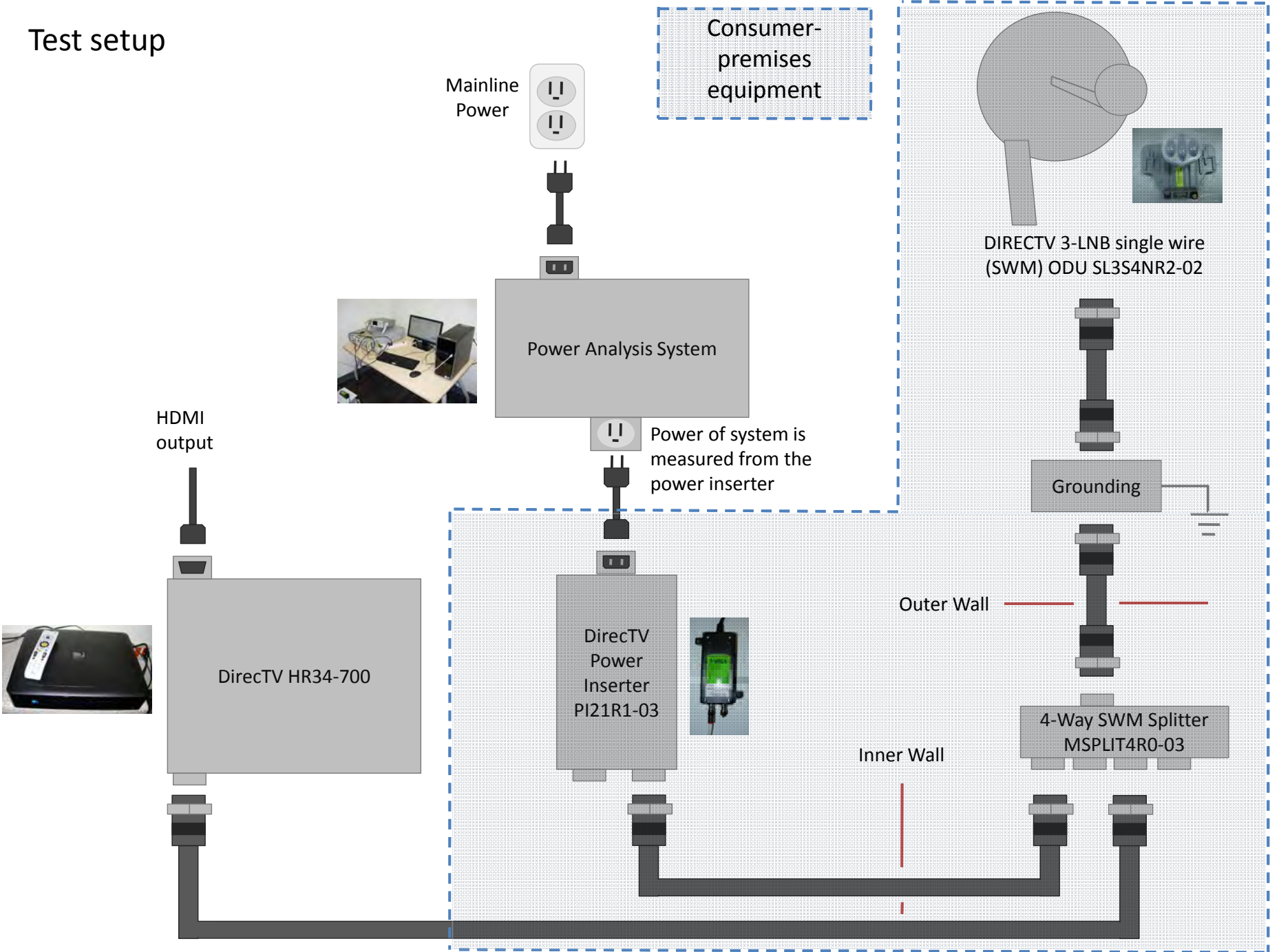
Residential Set-Top-Box
and TV



SL3S4NR2-02 LNB as tested

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Test setup



Test Methodology

- In this report, the power consumption of a typical residential type satellite system is analyzed. The entire residential system is powered by the PI21R1-03 model power inserter DirecTV employs. The inserter is capable of connecting up to 8 tuners to the system using DirecTV's Single Wire Multi-switch (SWiM) technology.
- The number of tuners that can be supported is primarily a function of the system design, the power supply is designed to support the SWiM device, and the power supply does not necessarily directly determine the number of tuners that can be supported.



PI21R1-03 power inserter as tested

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Test Methodology

- Since the STB is not a DUT, The conditions of interest are the number of tuners connected to the system and the channel that each tuner tuned to.
- A multi-tuner HR34-700 is activated for DirecTV service. The built-in 5 independent tuner system is utilized to simulate the configuration of single to multi-room setup.
- The external power supply does **NOT** provide power to the HR34 in this setup.



HR34-700 Set-Top-Box as tested

STB model/channel combinations

This is a list of the conditions of the HR34 for which the power consumption was tested.

Situation	Channels	Situation	Channels
Disconnected	N/A	Disconnected	N/A
Idle	N/A	Idle	N/A
1 tuner	7	1 tuner	205
1 tuner	56	1 tuner	204
1 tuner	204	3 tuners	204,205,207
1 tuner	207	5 tuners	204,205,206,207,208
1 tuner	350	5 tuners	7,56,204,207,350
1 tuner	508		
1 tuner	864		

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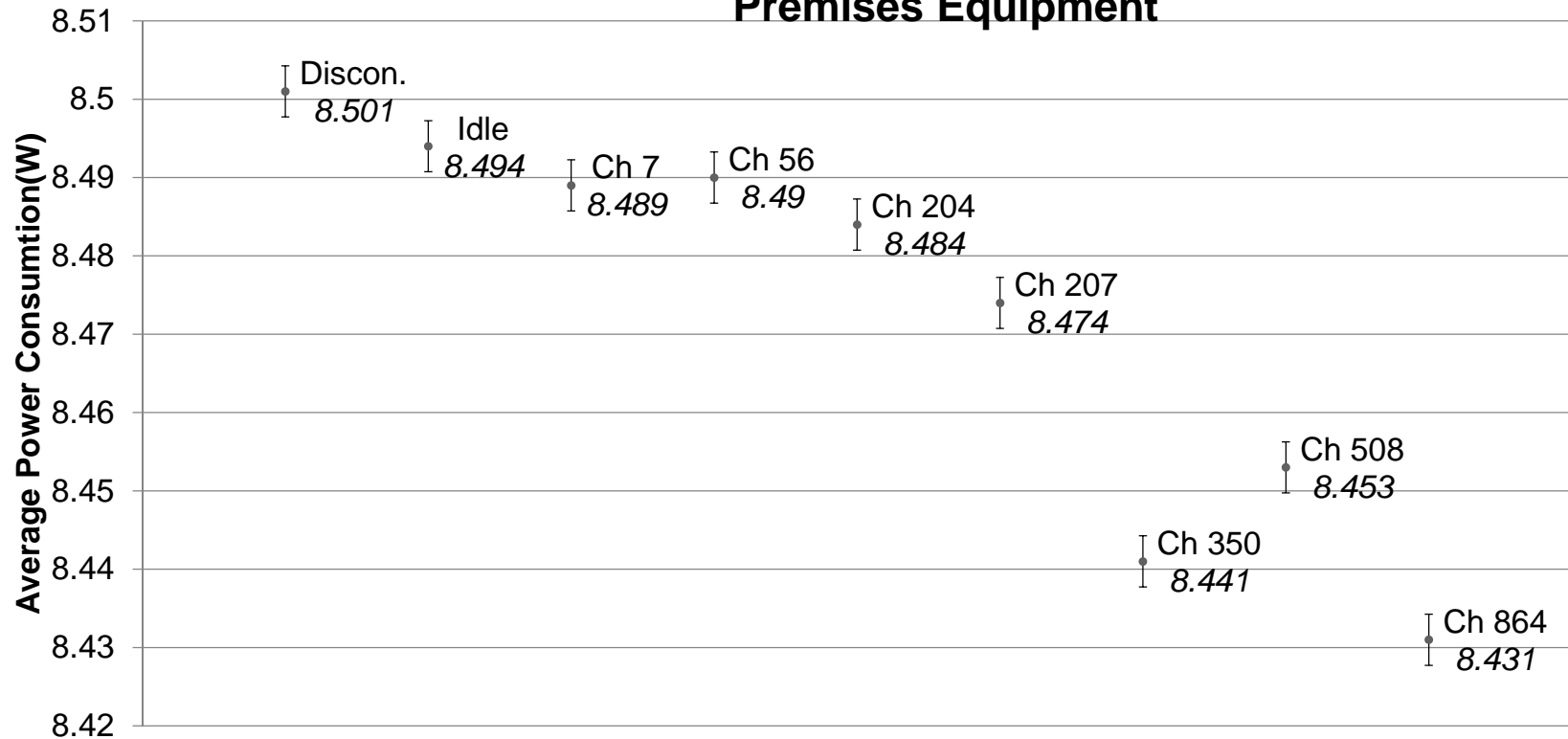
Key: Channels/Terms

- **Channels (DirecTV)**
 - 7 –(ABC) HD local
 - 56 –(KDOC) HD local
 - 204 –(HLN) SD
 - 205 –(SMX) SD
 - 206 –(ESPN) HD
 - 207 –(ESNHD) HD
 - 208 –(ESPNU) HD
 - 350 –(C-SPAN) SD
 - 508 –(HBO family) film
 - 864 –(Symphonic music)
- **Disconnected**
 - STBs are physically disconnected from the satellite system
- **Idle**
 - STB connected, but powered down to idle or standby mode.
- **Tuners**
 - Each tuner is activated by either directly viewing a channel, or used to record content in the background.

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Single tuner power results

Average Power Consumption vs. Channels for Consumer Premises Equipment



*Vertical axis does not start from zero.

*Power for each condition is given in Watts below the name of the condition and italicized.

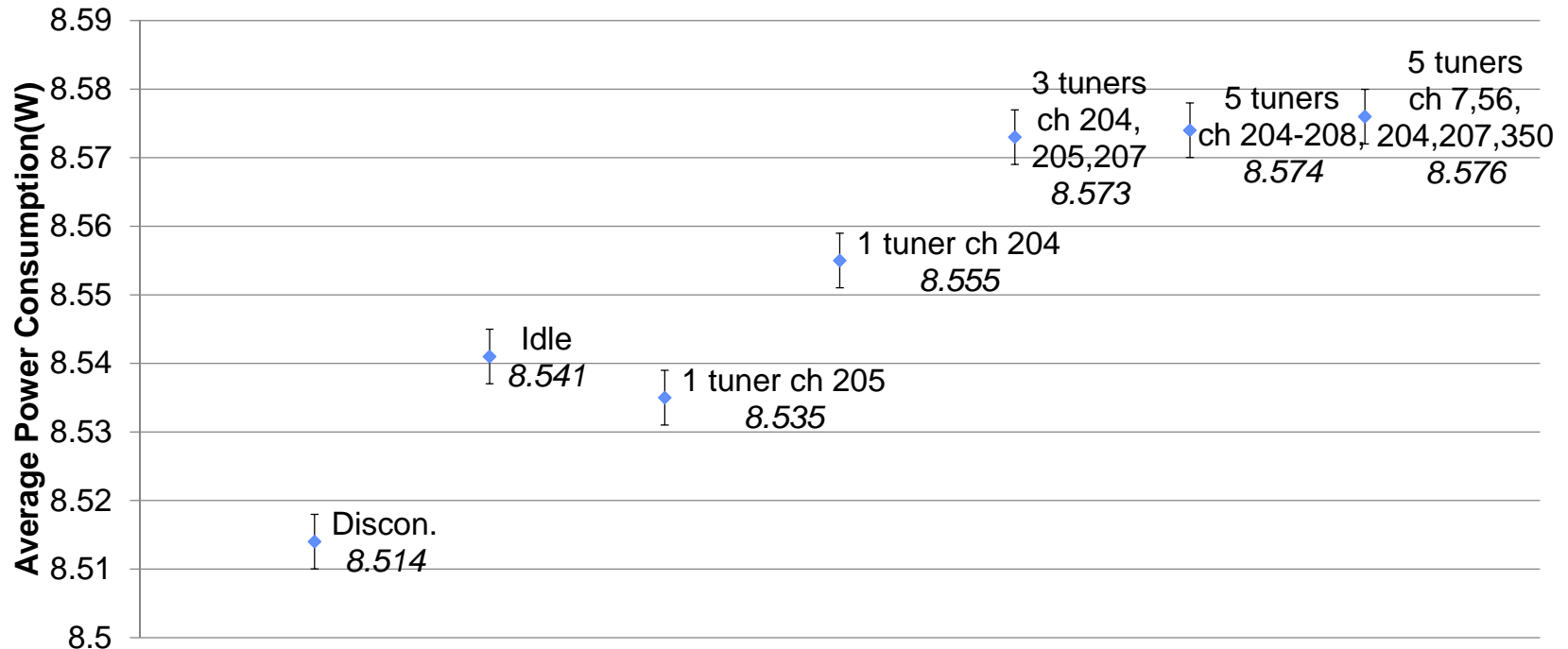
*See previous slide for explanation of conditions and channels.

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Multiple Tuner Power Results

Average Power Consumption vs. Number of Tuners Consumer Premises Equipment



*Vertical axis does not start from zero.

*Power for each condition is given in Watts below the name of the condition and italicized.

*See previous slide for explanation of conditions and channels.

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Preliminary Conclusions

- The Consumer-premises equipment including LNBS and multiswitch tested on average consume about **8.5 W**. This power fluctuates within **± 0.1 W** as multiple STBs are connected and playing various channels. The maximum effect an extra Set-Top-Box has on this system is **$\pm 1.2\%$** .
- Power consumption increases marginally with an increased number of tuners.
- Power consumption is marginally affected by the channel(s) tuned to.
- Therefore, multi-room STB system setup can share the fixed cost of energy on consumer-premise equipments to transmit TV signals.