

Dish Network LLC, v. Entropic Communications, LLC
Case No.: IPR2024-00373
U.S. Patent No. 7,594,249

Patent Owner Demonstrative Slides

Monday, May 12, 2025
10:00 A.M. Eastern

Demonstrative Only - Not Evidence

Network Composition and Device Capability

- **The Petition Ignores The Coaxial Limitations of the '249 Patent**
 - The '249 Patent addresses challenges specific to the coaxial medium
 - The '249 Patent requires the claimed equalization to be performed by a specific device
- **The Petition Relies on Fundamentally Different Prior Art in DSL**
 - DSL is not analogous art
 - Techniques used in DSL do not apply to or function in the claimed network

Demonstrative Only - Not Evidence PO-2

'249 Patent - Independent Claim 10

10. A broadband local area network for transmitting modulated signals using coaxial cable building wiring containing a plurality of branches comprising:

a filter located at the point of entry of the building wiring that rejects network signals originating in the building wiring such that the rejected network signals do not pass through the filter, but rather are reflected by the filter back into all branches of the building wiring;

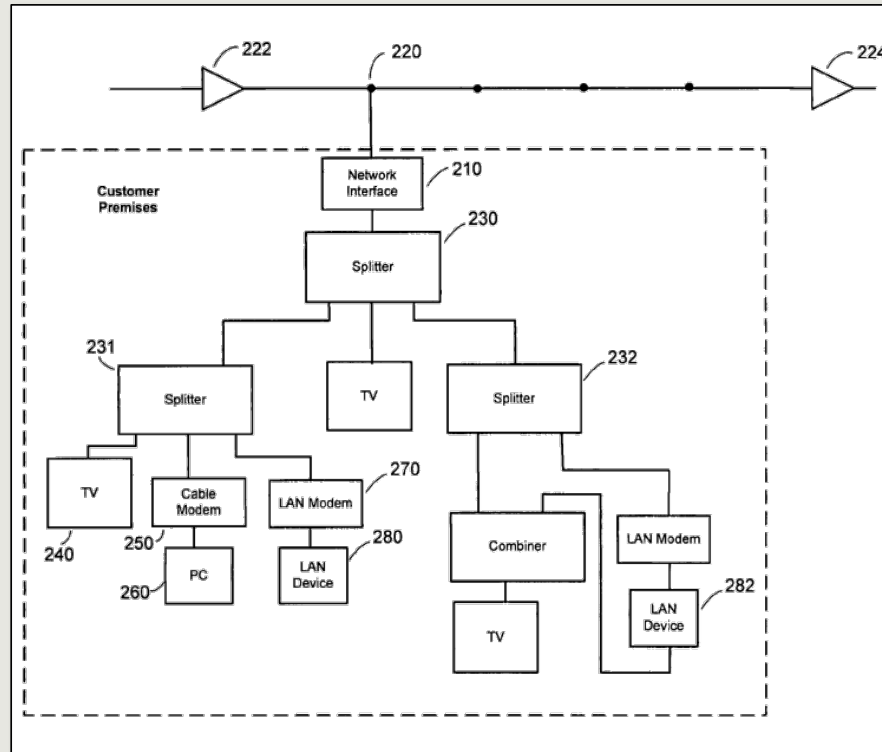
at least one signal splitter;

I a plurality of terminal devices connected to the wiring branches, each terminal device capable of communicating with other terminal devices the reflected signal path created by the filter, wherein the terminal devices perform equalization on the received signal that restores a flat frequency response to overcome communication channel impairments caused by the reflected signals.

Ex. 1001, cl. 10

Demonstrative Only - Not Evidence PO-3

The '249 Patent Addresses Problems Relating to Splitter Use In a Coaxial System



Ex. 1001, Fig. 2; POR, 30

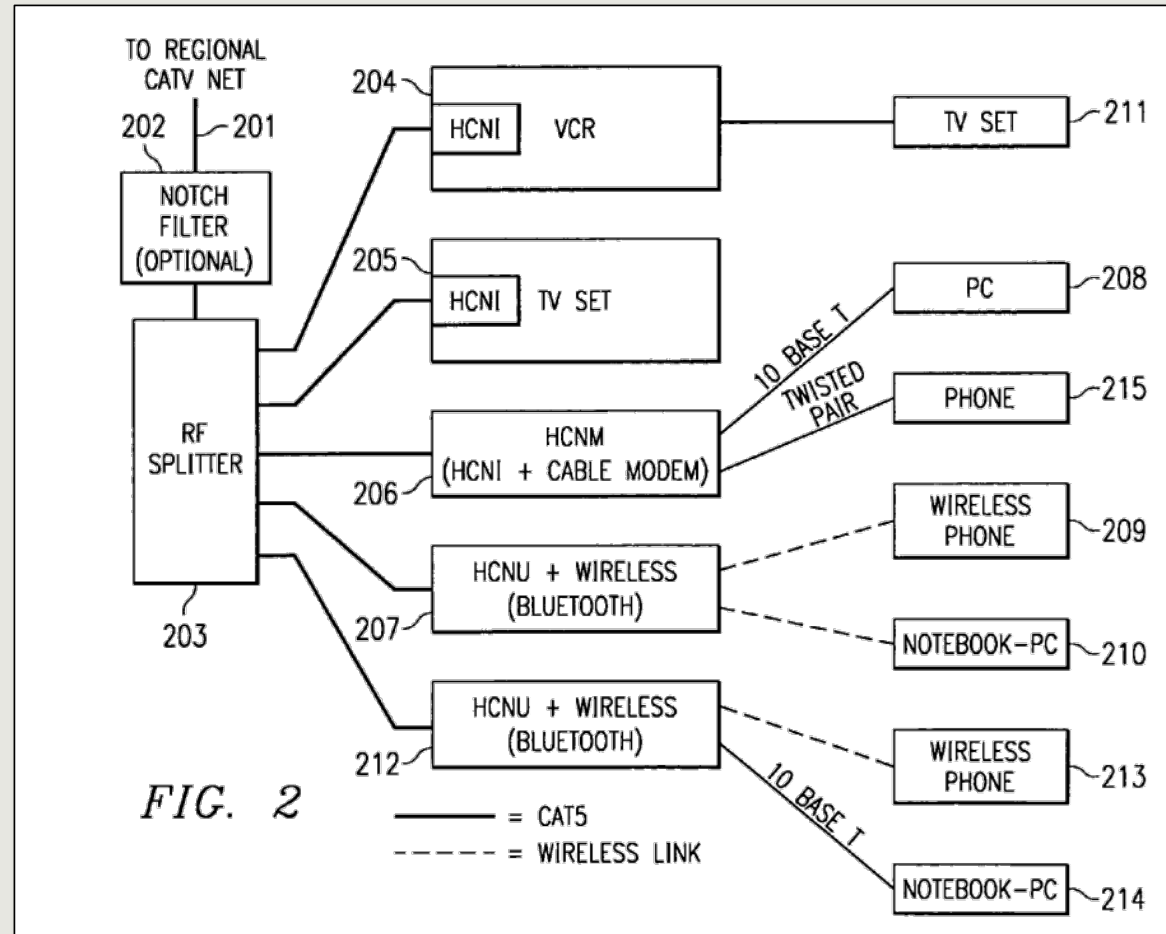
None of these references addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal communication in a coaxial cable wired building.

Ex. 1001, 3:4-7; POR, 33

The present invention uses a frequency selective network interface device placed at the building point of entry (POE) to reflect upstream signals transmitted by terminal devices back into the building distribution whereby the signals may be received by other terminal devices. By reflecting upstream signals back into the building as downstream signals, the network interface device provides a path for terminal devices to transmit to and receive from other terminal devices. This overcomes the problem of port-to-port isolation in the signal splitter/combiners.

Ex. 1001, 3:11-20; POR, 4

Amit's Terminal Devices



Ex. 1005, Fig. 2; POR, 10-11

Demonstrative Only - Not Evidence PO-5

Amit's Low-Cost, Simple, Compatible Solutions

The present invention presents a solution of transferring the data between these nodes, when the data is not required to be transferred to the headend.

The present invention presents a low cost solution, which is very important to enable a solution to the mass market.

While Local Area Networks (LANs) constitute a well-accepted part of the communications environment for businesses, LANs infrastructure is not commonly deployed in the home. This is due to several technical and logistical reasons.

Ex. 1005, 17:10-11, POR at 62

Success in the consumer market requires that a home networking technology be inexpensive, easy to install, and easy to use. To be truly effective and embraced by consumers, a home networking solution must meet these criteria:

1. No new wiring.

Most existing homes are not wired for traditional networking equipment. Rewiring the home is too expensive and a hassle for most consumers.

2. Simple to install and use.

3. Must be low cost to allow the mass market to enjoy the benefits of home networking.

4. The range must be adequate to operate within a typical home.

5. Support high data rate.

6. The networking capability must grow with user applications without obsoleting existing devices.

7. The network must be secure.

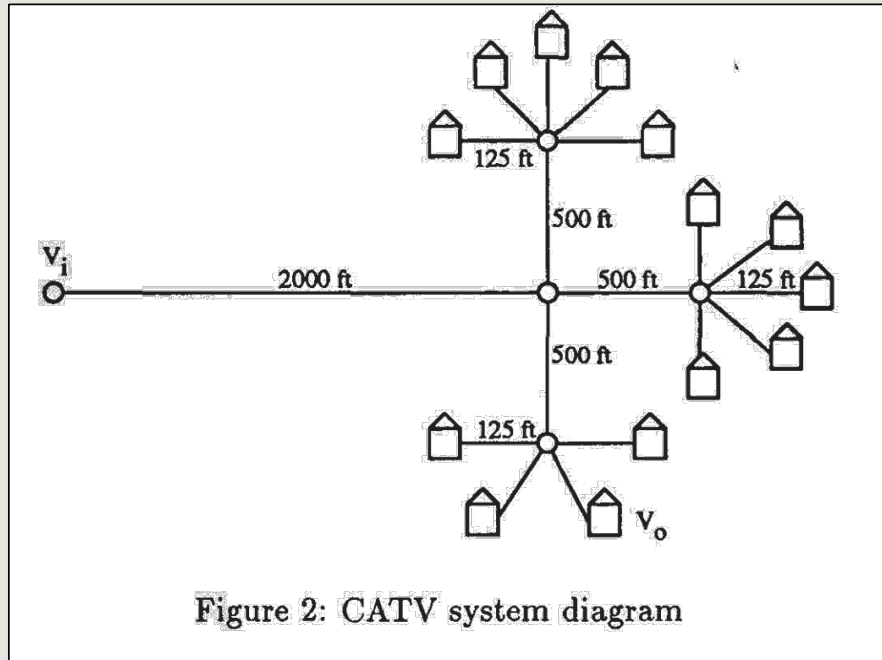
The network data must remain private; it must not be accessible to neighbors or anyone outside the home.

8. The solution must not interfere with other systems, appliances and services.

Ex. 1005, 18:24-44, POR at 62

Demonstrative Only - Not Evidence PO-6

Jacobsen Does Not Discuss Equalization in Terminal Devices



Ex. 1007, Figure 2; POR, 21

200. Second, A POSITA seeking to improve Amit's system would not look to Jacobsen. Jacobsen describes a regional cable network. Ex. 1007 [Jacobsen] Figure 2. In fact, the equalization performed by Jacobsen would be performed, or facilitated by the CMTS, not a terminal device. In contrast, Amit's Single Home network has a notch filter which separates the LAN from communicating with the larger regional network. Ex. 1005 [Amit] 7:16-19, 7:25-28.

Ex. 2007, ¶1200; POR, 19

No Terminal Device Equalization – Claim 10 – Mr. Bates

Q. Did any of the coax networks you worked on use pre-equalization in your career?

A. If we were working with a cable company, they might have been doing it. Because the CMTS would have been smart enough — so the CMTS would be smart enough to be able to provide it because of the intelligence.

The terminal devices back then — I think I mentioned terminals could have been dumb terminals, so as a result, they wouldn't have been able to do much of anything other than you would be able to key into it.

Using the 249, we're moving all of that intelligence and all of that capability down to the terminal device.

Ex. 1029, 200:25-201:12; PO-SR, 19

200. Second, A POSITA seeking to improve Amit's system would not look to Jacobsen. Jacobsen describes a regional cable network. Ex. 1007 [Jacobsen] Figure 2. In fact, the equalization performed by Jacobsen would be performed, or facilitated by the CMTS, not a terminal device. In contrast, Amit's Single Home network has a notch filter which separates the LAN from communicating with the larger regional network. Ex. 1005 [Amit] 7:16-19, 7:25-28.

Ex. 2007, ¶1200; POR, 19

Demonstrative Only - Not Evidence PO-8

The ID Correctly Found That Jacobsen Does Not Render Obvious Claim 10

“Patent Owner correctly argues that Jacobsen teaches that multicarrier modulation performs better than single carrier modulation with equalization at least by some measures under some circumstances. Prelim. Resp. 51 (citing Ex. 1007, 15). Accordingly, on the current record, Petitioner has not shown a reasonable likelihood that claim 10 would have been obvious over the combination of Amit and Jacobsen.” *(ID, Paper 9)*

The results of our simulations indicate that discrete multitone modulation is more computationally efficient than single-carrier modulation with equalization for the transmission of digital data over CATV channels with rippled passbands. Furthermore, DMT can easily adapt to a variety of channel degradations, optimizing the system bit rate for a given channel and complexity. Because system reliability is important for any consumer service, a digital transmission system must maintain a certain level of performance under a wide variety of circumstances. Given our simulation results, multicarrier modulation appears to be better equipped than single-carrier modulation to accomplish this objective.

Ex. 1007, 15; POR, 19

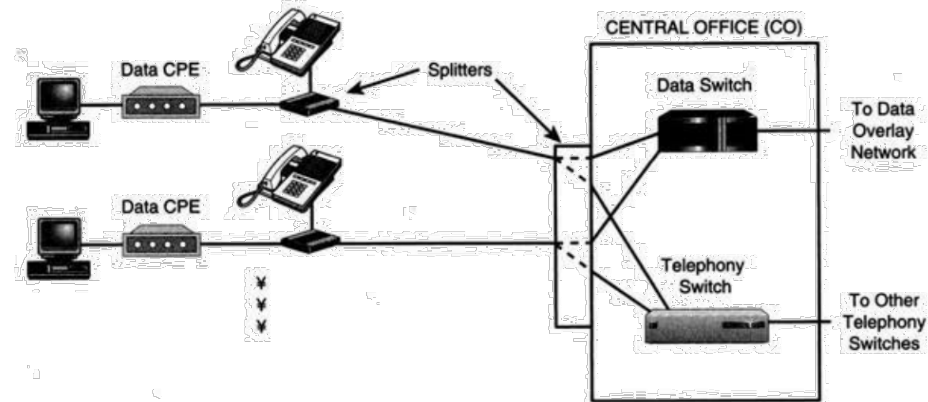
Demonstrative Only - Not Evidence PO-9

Amit: local coaxial network; ADSL/VDSL: Wide-area network over phone lines

Home networking is a key technology for the evolving home infotainment market, and it is expected to become a very large market by itself within the next decade. Home networks will connect between computing devices (personal computers, palm computers, network computers, etc.), entertainment devices (TV, VCR, DVD player, video camera, audio systems, etc.), I/O devices (printer, scanner, headsets, keyboards, remote controls, mouse, loud-speakers, etc.), home appliances, and modems (such as cable modems, DSL modems, and PSTN modems) that connect the home outside. The home network will enable a wide range of

Ex. 1005, 1:15-25; PO-SR, 24

Figure 1.2 A conventional telephone system coexisting with a data overlay network.



Ex. 2017, 18; POR, 13; Ex. 2007, ¶116

Demonstrative Only - Not Evidence PO-10

Ground 2: A POSITA Would Not Modify Amit with ADSL/VDSL

Significantly lower data-rates in DSL would not motivate a POSITA to look to DSL

Table 1.1 Capabilities of Various DSL Technologies

DSL	Upstream Rates	Downstream Rates	Symmetric/Asymmetric	POTS Coexistence	Standardization
ADSL	100-800 Kbps	1-8 Mbps	Asymmetric	Yes	Yes
HDSL	Fixed 784, 1544, 2048 Kbps	Fixed 784, 1544, 2048 Kbps	Symmetric	No	Yes
HDSL2	Fixed 1544, 2048 Kbps	Fixed 1544, 2048 Kbps	Symmetric	No	Yes
IDSL	Fixed 128 Kbps	Fixed 128 Kbps	Symmetric	No	No
MDSL	64-200 Kbps	800-2000 Kbps	Asymmetric	Yes	No
SDSL	384 Kbps	384 Kbps	Symmetric	Yes	No
VDSL	Up to 25 Mbps	Up to 25 Mbps	Both	Yes	Under development

Ex. 1006, 14 (Table 1.1); POR, 37

This structure enables information sending in very high rates (e.g. 40 Mbps) for each direction.

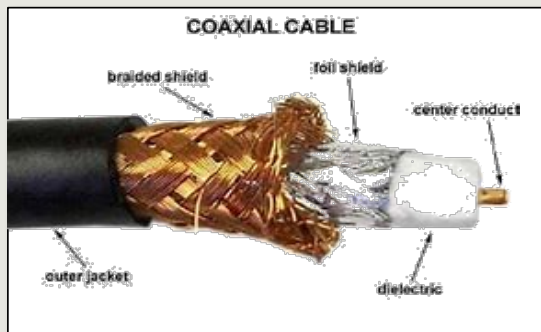
Ex. 1005, 1:21:21-22, POR, 37

Demonstrative Only - Not Evidence PO-11

Ground 2: A POSITA Would Not Modify Amit with ADSL/VDSL

Data-rates are driven by the construction of the medium

112. Twisted pair telephonic lines are unshielded to save costs of manufacturing. See Ex. 2011 [Signal-Integrity] 121 (“This is what Ethernet uses – unshielded twisted pair (UTP). This is important because, as one might guess, the unshielded cable is cheaper than shielded.”). Twisted pair provide two unshielded wires transmitting a signal and the inverse of that signal. When the communication is received, the signal and inverse signal are summed resulting in a boosted transmission without interference. This is fundamentally different than with coaxial cables, which provide a single copper core that carries all transmissions.



Ex. 2007, ¶180; POR, 6

Ex. 2007, ¶112; POR, 35

Demonstrative Only - Not Evidence PO-12

Ground 4: The Petition Identifies No DSL-Book Teaching of Terminal Equalization

3. Claims 10-13

(a) Claim 10

Amit-Jacobsen-DSL-Book renders obvious independent claim 10. DISH-1003, ¶¶354-358. As discussed above, Amit-Jacobsen renders obvious claim 10, and DSL-Book's teachings further render obvious [10.c.iii]. DISH-1003, ¶¶355-358. DSL explains that "channel distortion **could** cause inter-subchannel interference," which "is caused by amplitude attenuation and phase delay differences between subchannels," but "[t]he inter-subchannel interference **can** be **minimized** by selecting a lower baud rate or **by using a channel equalizer**." DISH-1008, 440.

As described in [10.c.iii], §IV.C.3.(c), Amit and Jacobsen both recognize how the reflections from the filter can cause frequency selective channel impairments, and these impairments can be overcome using the equalization described above to restore a flat frequency response.

Petition at 82

Demonstrative Only - Not Evidence PO-13

'249 Patent - Independent Claim 10

10. A broadband local area network for transmitting modulated signals using coaxial cable building wiring containing a plurality of branches comprising:

a filter located at the point of entry of the building wiring that rejects network signals originating in the building wiring such that the rejected network signals do not pass through the filter, but rather are reflected by the filter back into all branches of the building wiring;

at least one signal splitter;

I a plurality of terminal devices connected to the wiring branches, each terminal device capable of communicating with other terminal devices the reflected signal path created by the filter, wherein the terminal devices perform equalization on the received signal that restores a flat frequency response to overcome communication channel impairments caused by the reflected signals.

Ex. 1001, cl. 10

Demonstrative Only - Not Evidence PO-14

DSL Is Not Analogous Art

Demonstrative Only - Not Evidence PO-15

Neither ADSL/VDSL or DSL-Book are Analogous Art

“A reference qualifies as prior art for an obviousness determination...**only when it is analogous** to the claimed invention.” *In re Klein*, 647, F.3d 1343, 1348 (Fed. Cir. 2011).

“**Petitioner bears the burden** of showing by a preponderance of evidence that the asserted prior art references are analogous art[.]” *Schott Gemtrom Corp. v. SSW Holding Co., Inc.*, IPR2013-00358, Paper 106, 26 (PTAB Aug. 20, 2014).

To be analogous, a reference must be either (1) from the same **field of endeavor** as the patent-at-issue, or (2) be **reasonably pertinent to the particular problem** with which the inventor of the challenged patent is involved. *In re Clay*, 966 F.2d 656, 658-59 (Fed. Cir. 1992).

Demonstrative Only - Not Evidence PO-16

Neither ADSL/VDSL or DSL-Book are Analogous Art

“Clay's field of endeavor is the ***storage of refined liquid hydrocarbons***. The field of endeavor of Sydansk's invention, on the other hand, is the ***extraction of crude petroleum***. The Board clearly erred in considering Sydansk to be within the same field of endeavor as Clay's.”

In re Clay, 966 F.2d at 659.

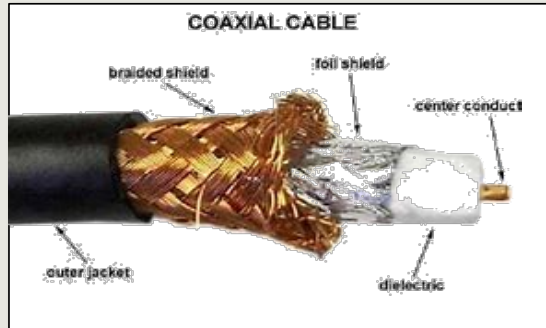
“The pertinence of the reference as a source of solution to the inventor's problem must be recognizable with the ***foresight*** of a person of ordinary skill, ***not*** with the ***hindsight of the inventor's successful achievement***.” *Airbus S.A.*, 941 F.3d at 1382 (quoting *Sci. Plastic Prods., Inc. v. Biotage AB*, 766 F.3d 1355, 1359 (Fed. Cir. 2014)).

Demonstrative Only - Not Evidence PO-17

Field of Endeavor: Local Area Broadband Coaxial Networks

OFDM. None of these references addresses the problem of **tap port-to-port isolation** and providing a suitable signal path for terminal-to-terminal communication in a **coaxial cable** wired building.

Ex. 1001, 3:4-7



Ex. 2007, ¶180; POR, 6

NETWORK INTERFACE DEVICE AND BROADBAND LOCAL AREA NETWORK USING **COAXIAL CABLE**

Ex. 1001, Title; POR, 30

(57)

ABSTRACT

A local area network uses **coaxial cable** wiring for interconnection of terminal devices. A frequency selective network interface device is placed at the building point of entry or another point in the wiring to reflect network signals transmitted by terminal devices back into the building distribution to be received by other terminal devices. By reflecting network upstream signals back into the building as downstream signals, the network interface provides a path for terminal devices to transmit to and receive from other terminal devices.

Ex. 1001, Abstract; POR 30

Demonstrative Only - Not Evidence PO-18

Field of Endeavor: Local Area Broadband Coaxial Networks

1. A signal distribution network comprising:
a filter located at the point of entry of a building tuned to reject network signals originating in the building, such that the network signals originating in the building do not pass through the filter, but rather are reflected back into the building;
at least one signal splitter, the signal splitter having a common port and a plurality of tap ports, the common port of the signal splitter being coupled to the filter; and
a plurality of terminal devices, each terminal device being coupled to a tap port of at least one signal splitter, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;
wherein the reflections from the filter provide a path for terminal devices back through the tap port of the signal splitter and out each other tap port to transmit signals to other terminal devices thus allowing terminal devices to communicate directly with each other to form the signal distribution network.

Ex. 1001, cl. 1

5. A broadband local area network using coaxial cable building wiring as a communication channel, the network comprising:

Ex. 1001, cl. 5

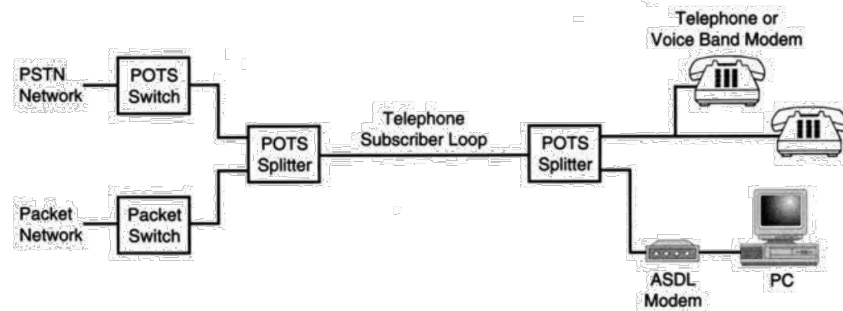
10. A broadband local area network for transmitting modulated signals using coaxial cable building wiring containing a plurality of branches comprising:

Ex. 1001, cl. 10

Demonstrative Only - Not Evidence PO-19

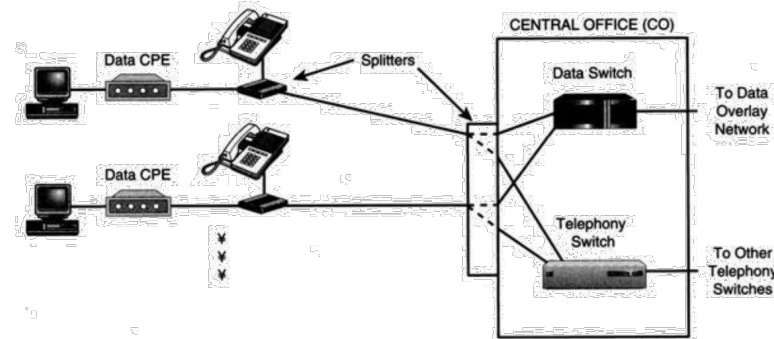
ADSL/VDSL and DSL-Book relate to Wide-Area, Not Local, Networks

Figure 1.3 Digital Access Through a POTS Splitter



Ex. 2009, 26; POR, 13; Ex. 2007, ¶1118

Figure 1.2 A conventional telephone system coexisting with a data overlay network.



Ex. 2017, 18; POR, 13; Ex. 2007, ¶1116

Demonstrative Only - Not Evidence PO-20

ADSL/VDSL relate to copper telephone networks, not coaxial cable networks

For every section, there are many twisted pairs sharing the same electrical sheath and plastic covering within a single twisted-pair cable. Crosstalks exist between adjacent twisted pairs. Because twisted-pair telephone cables are originally engineered for the voice band, the crosstalk noise level could become quite severe for DSL applications. Besides the telephone loop plant background noise, the crosstalk noise is a limiting factor for the performance of a DSL system. There are Near End Crosstalk (NEXT) noise and Far End Crosstalk (FEXT) noise. The effect of NEXT is usually worse than that of FEXT.

Ex. 2009, 27; POR 13

This book discusses networks capable of delivering high-speed data to all end users. Specifically, the book discusses having widespread users connected to the network using traditional telephone lines with access rates in excess of 1 Mbps. Digital Subscriber Line (DSL) technologies, a family of relatively new and exciting high-speed access technologies using ordinary telephone lines, are especially well suited for the access portion or “on ramp” of such a network.

Ex. 1006, 3; POR 13

ADSL/VDSL discourages use of coaxial cable networks: “the upstream *direction from the subscriber back to the coax distribution point traditionally has not been used to transfer information* and, in many areas, *does not support transmission*. Reconditioning the infrastructure to support upstream transmission is costly and time consuming, and deployment in a geographical area cannot be done until the entire infrastructure in that area is upgraded.”

Ex. 2017, 29-30; PO-SR, 9

Demonstrative Only - Not Evidence PO-21

Medium matters: DSL teachings are not applicable to coaxial networking

Coaxial Cable	Twisted Pair
Shielded – less susceptible to noise	Unshielded – more susceptible to noise
LAN – shorter distances (tens of feet)	WAN – longer distances (thousands of feet)
Utilizes higher frequencies (900 MHz to 6 GHz)	Filters out higher frequencies (lower frequency communication (15MHz))
Reflections off splitters/impedance mismatch	Avoid reflections

Ex. 2007, ¶¶ 107, 111, 113, 114, 115

Demonstrative Only - Not Evidence PO-22

The '249 Patent Is Concerned With Tap-Port Isolation in Coaxial Splitters

The tap port isolation of splitters used in a typical cable TV distribution configuration presents a problem to shared usage of the cable for a LAN system.

Ex. 1001, 2:39-41; PO-SR 10

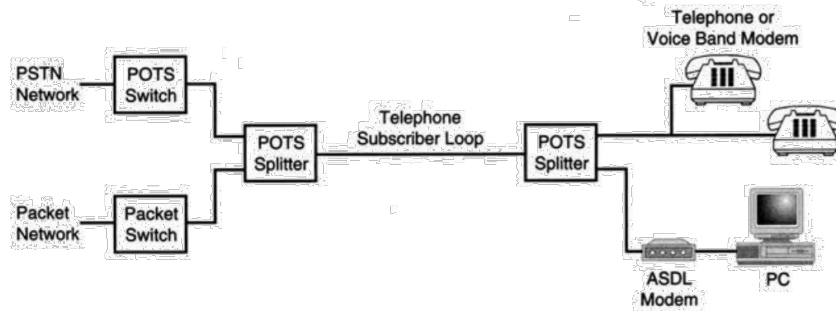
None of these references addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal communication in a coaxial cable wired building.

Ex. 1001, 3:4-7; POR 33

Demonstrative Only - Not Evidence PO-23

ADSL/VDSL and DSL-Book Are Not Pertinent To the '249 Patent's Problem

Figure 1.3 Digital Access Through a POTS Splitter



Ex. 2009, 26; POR, 13; Ex. 2007, ¶118

THE WITNESS: So if we take the traditional passive coaxial splitter, you make one coaxial connection into two, and that involves a signal loss of approximately half the power on either side.

Q. So one signal comes in. Two identical signals come out, and those two identical signals have less power individually than the signal that came in?

A. Perfect.

Ex. 2019, 44:20-45:6; PO-SR, 11

- “Splitters” perform fundamentally different functions in POTS and cable networks
- Cable: Send same signal to all tap ports but isolate ports from each other
- POTS / DSL: Separate voice and data and send different signals to different ports

Demonstrative Only - Not Evidence PO-24

Level of Skill in the Art

Demonstrative Only - Not Evidence PO-25

Level of Ordinary Skill in the Art

Petitioner's Proposal	Patent Owner's Proposal
Petitioner's Proposal: "A Bachelor's degree in electrical engineering, computer engineer, or a related field, and 2-3 years of experience in design or development of signal processing and <u>communication systems</u> or networks."	PO's Proposal: "A POSITA would have a bachelor's degree in electrical engineering, or a related field, and at a minimum two to three years of experience in development and design of broadband networks <u>over coaxial cables.</u> "

Demonstrative Only - Not Evidence PO-26

Level of Ordinary Skill in the Art – Inventors' focus on coaxial environments

1. A signal distribution network comprising:
a filter located at the point of entry of a building tuned to reject network signals originating in the building, such that the network signals originating in the building do not pass through the filter, but rather are reflected back into the building;
at least one signal splitter, the signal splitter having a common port and a plurality of tap ports, the common port of the signal splitter being coupled to the filter; and
a plurality of terminal devices, each terminal device being coupled to a tap port of at least one signal splitter, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;
wherein the reflections from the filter provide a path for terminal devices back through the tap port of the signal splitter and out each other tap port to transmit signals to other terminal devices thus allowing terminal devices to communicate directly with each other to form the signal distribution network.

Ex. 1001, cl. 1

10. A broadband local area network for transmitting modulated signals using coaxial cable building wiring containing a plurality of branches comprising:

a filter located at the point of entry of the building wiring that rejects network signals originating in the building wiring such that the rejected network signals do not pass through the filter, but rather are reflected by the filter back into all branches of the building wiring;

at least one signal splitter;

I a plurality of terminal devices connected to the wiring branches, each terminal device capable of communicating with other terminal devices the reflected signal path created by the filter, wherein the terminal devices perform equalization on the received signal that restores a flat frequency response to overcome communication channel impairments caused by the reflected signals.

Ex. 1001, cl. 10

Demonstrative Only - Not Evidence PO-27

Level of Ordinary Skill in the Art – Inventors' focus on coaxial environments

NETWORK INTERFACE DEVICE AND BROADBAND LOCAL AREA NETWORK USING COAXIAL CABLE

(57) **ABSTRACT**

A local area network uses coaxial cable wiring for interconnection of terminal devices. A frequency selective network interface device is placed at the building point of entry or another point in the wiring to reflect network signals transmitted by terminal devices back into the building distribution to be received by other terminal devices. By reflecting network upstream signals back into the building as downstream signals, the network interface provides a path for terminal devices to transmit to and receive from other terminal devices.

Ex. 1001, Title, Abstract; POR, 30

Demonstrative Only - Not Evidence PO-28

Level of Ordinary Skill in the Art

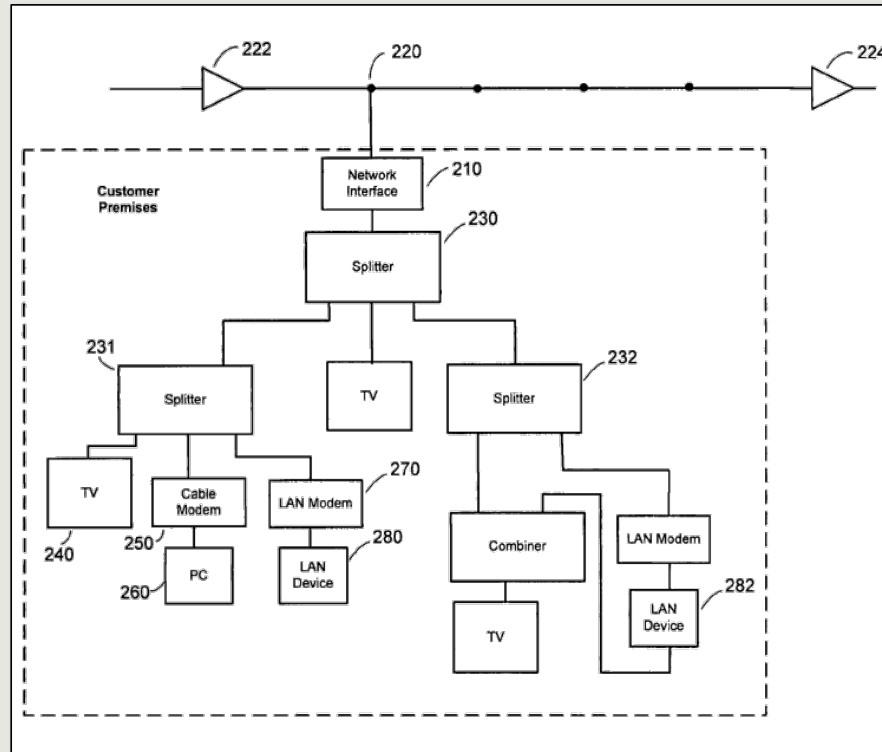
Dr. Acton stated regarding the level of skill:

and I believe the definition I gave was unbelievably broad, even accepting on-the-job experience as a substitute for some formal education. That's my opinion.

Ex. 2019, 36:4-7; PO-SR, 2

Demonstrative Only - Not Evidence PO-29

Overview of the '249 Patent



Ex. 1001, Fig. 2; POR, 30

None of these references addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal communication in a coaxial cable wired building.

Ex. 1001, 3:4-7; POR, 33

The present invention uses a frequency selective network interface device placed at the building point of entry (POE) to reflect upstream signals transmitted by terminal devices back into the building distribution whereby the signals may be received by other terminal devices. By reflecting upstream signals back into the building as downstream signals, the network interface device provides a path for terminal devices to transmit to and receive from other terminal devices. This overcomes the problem of port-to-port isolation in the signal splitter/combiners.

Ex. 1001, 3:11-20; POR, 4

'249 Patent - Independent Claim 10

10. A broadband local area network for transmitting modulated signals using coaxial cable building wiring containing a plurality of branches comprising:

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at least one signal splitter;

I a plurality of terminal devices connected to the wiring branches, each terminal device capable of communicating with other terminal devices the reflected signal path created by the filter, wherein the terminal devices perform equalization on the received signal that restores a flat frequency response to overcome communication channel impairments caused by the reflected signals.

Ex. 1001, cl. 10

Demonstrative Only - Not Evidence PO-31

Independent Claims 1 and 5

1. A signal distribution network comprising:
a filter located at the point of entry of a building tuned to reject network signals originating in the building, such that the network signals originating in the building do not pass through the filter, but rather are reflected back into the building;
at least one signal splitter, the signal splitter having a common port and a plurality of tap ports, the common port of the signal splitter being coupled to the filter; and
a plurality of terminal devices, each terminal device being coupled to a tap port of at least one signal splitter, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;
wherein the reflections from the filter provide a path for terminal devices back through the tap port of the signal splitter and out each other tap port to transmit signals to other terminal devices thus allowing terminal devices to communicate directly with each other to form the signal distribution network.

Ex. 1001, cl. 1

5. A broadband local area network using coaxial cable building wiring as a communication channel, the network comprising:

a plurality of terminal devices, each terminal device communicating with other terminal devices using orthogonal frequency division multiplexing (OFDM) modulation, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;

a network of building cables coupled to the plurality of terminal devices; and

a filter having a first and second port, the first port connected to a building point of entry and the second port connected to the plurality of terminal devices via the network of building cables, wherein signals transmitted by any of the terminal devices and received at the second port of the filter are rejected by the filter such that such signals do not pass through the filter, but rather are reflected back into the network of building cables in order to create a communication path between the transmitting terminal device and at least one other terminal device coupled to the network of building cables.

Ex. 1001, cl. 5

Demonstrative Only - Not Evidence PO-32

Challenged Claims of the '249 Patent

Ground	Claims	Basis
1	1-2	§103: Amit
2	1-17	§103: Amit-ADSL/VDSL
3	1-2, 4-6, 8-10, 12-14, 16-17	§103: Amit-Jacobsen
4	2-3, 7, 9-13, 15, 17	§103: Amit-Jacobsen-DSL-Book

Petition, 2

Demonstrative Only - Not Evidence PO-33

Claim 10 - Ground 3

Demonstrative Only - Not Evidence PO-34

Ground 3: Institution Decision Regarding Amit and Jacobsen

“Patent Owner correctly argues that Jacobsen teaches that multicarrier modulation performs better than single carrier modulation with equalization at least by some measures under some circumstances. Prelim. Resp. 51 (citing Ex. 1007, 15). Accordingly, on the current record, Petitioner has not shown a reasonable likelihood that claim 10 would have been obvious over the combination of Amit and Jacobsen.” *(ID, Paper 9)*

The results of our simulations indicate that discrete multitone modulation is more computationally efficient than single-carrier modulation with equalization for the transmission of digital data over CATV channels with rippled passbands. Furthermore, DMT can easily adapt to a variety of channel degradations, optimizing the system bit rate for a given channel and complexity. Because system reliability is important for any consumer service, a digital transmission system must maintain a certain level of performance under a wide variety of circumstances. Given our simulation results, multicarrier modulation appears to be better equipped than single-carrier modulation to accomplish this objective.

Ex. 1007, 15; POR, 19

Demonstrative Only - Not Evidence PO-35

Ground 3: Dr. Acton's Opinions Regarding Jacobsen's Equalization

Dr. Acton's Deposition Opinion:

Q. In your opinion, does Jacobsen envision using equalization with multicarrier modulation?

A. I don't believe she was doing that.

Ex. 1029, 204:10-12; PO-SR, 15

Dr. Acton's Declaration Opinion:

18. In my opinion, a POSITA would be motivated to add equalization to Amit's system, irrespective of whether single-carrier or multicarrier modulation was in use. DISH-1003, ¶¶288-295. While Jacobsen does teach that multicarrier modulation performs better than single carrier modulation with equalization at least by some measures under some circumstances, a POSITA reading the entirety of Jacobsen would not come away with the conclusion that Jacobsen teaches away from adding equalization. Jacobsen teaches that "the complexity" of a single-carrier system with equalization "is at least 2.5 times the complexity" of a multicarrier system. DISH-1007, 310. This complexity had to do with the specific comparison between those

Ex. 1030, ¶18; PO-SR, 15

Demonstrative Only - Not Evidence PO-36

Ground 3: A POSITA Would Not Modify Amit's LAN with a WAN

The HomeCN operation modes are determined according to the existence/not existence of notch filter at the home entrance (see FIG. 2 [202]).

The notch filter in the entrance of the home is a one of the basic elements in the home network design. If this notch filter exists in the HomeCN is disconnected from the regional cable network, therefore its' design is more simple (single home network). When this filter does not exist the home network is part of the regional network, therefore its' design is more complicated, and some additional functionality is required.

The HomeCN Supports Two Operation Modes:

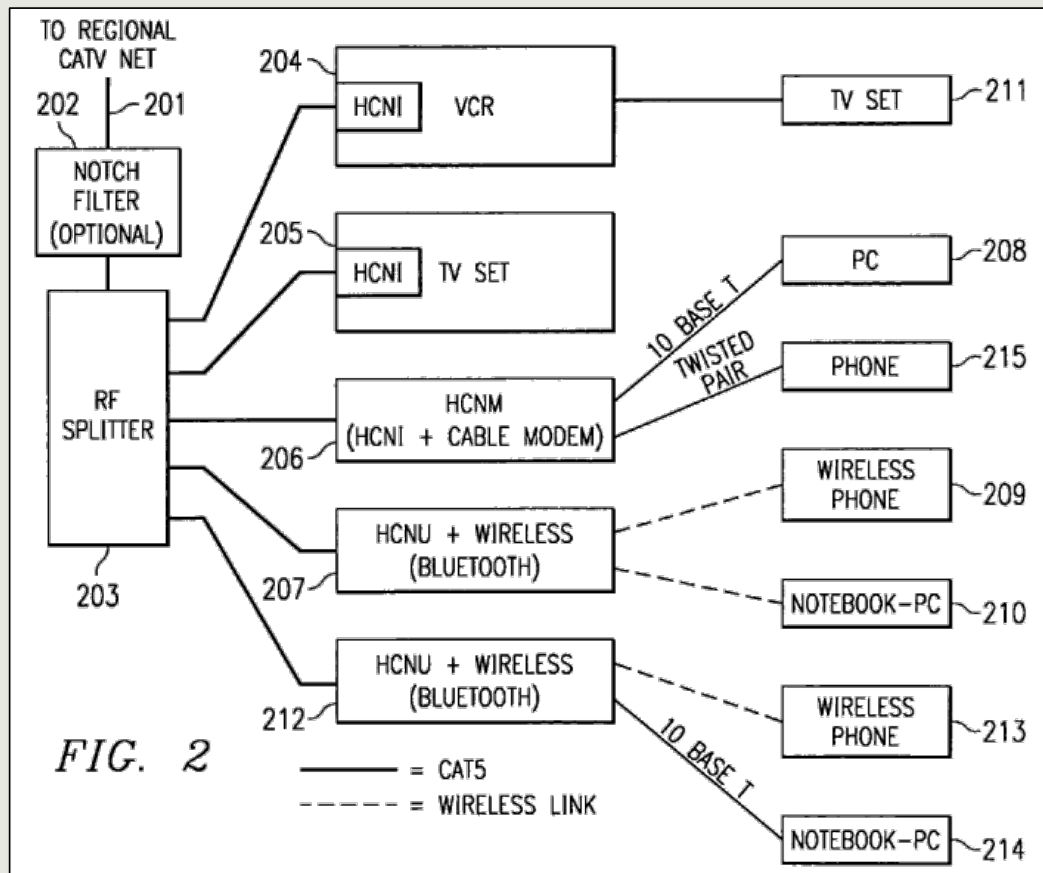
Single Home operation mode—This mode required a Notch filter, or an amplifier that usually supplies similar functionality, or it can be operated in a system that is not connected to the CATV plant.

~~Connected Home operation mode—This mode does not require a Notch Filter. This mode is more complex and requires additional functionality. Following are some functionalities that are required in the Connected Home operation mode: Wider frequency operation, frequency selection (FDM), multiple bandwidth, privacy, capability to be managed by the headend.~~

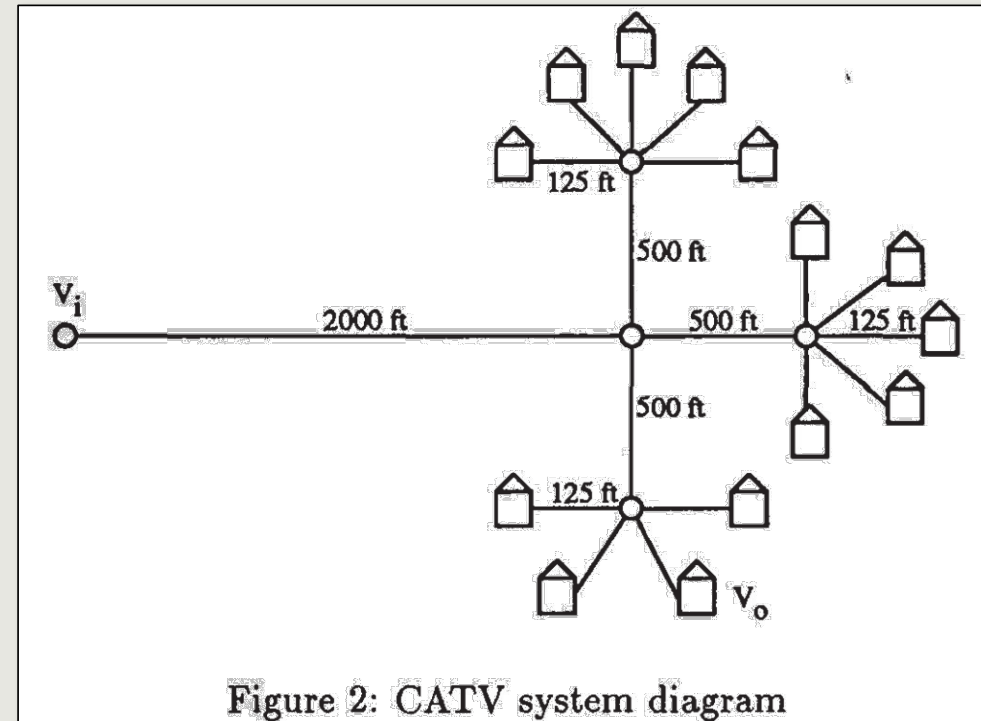
Ex. 1005, 7:12-35; POR, 20

Demonstrative Only - Not Evidence PO-37

Ground 3: A POSITA Would Not Modify Amit's LAN with a WAN



Ex. 1005, Fig. 2



Ex. 1007, Figure 2; POR, 21

Ground 3: No Motivation to Modify Amit per Jacobsen Due to Interference

The two-frequency mode exists to eliminate the echo problem that exists in some of the homes in the single frequency mode. The method is transmitting the information in a specific frequency range (e.g. 900–906 MHz) and receiving the information in a different frequency range (e.g. 910–916 MHz). The architecture of this solution appears in the following figure.

In the single frequency mode the information that is transferred from HCNU-2 to HCNU-3 is transferred through Splitter-I and in addition and echo from Splitter-main also received.

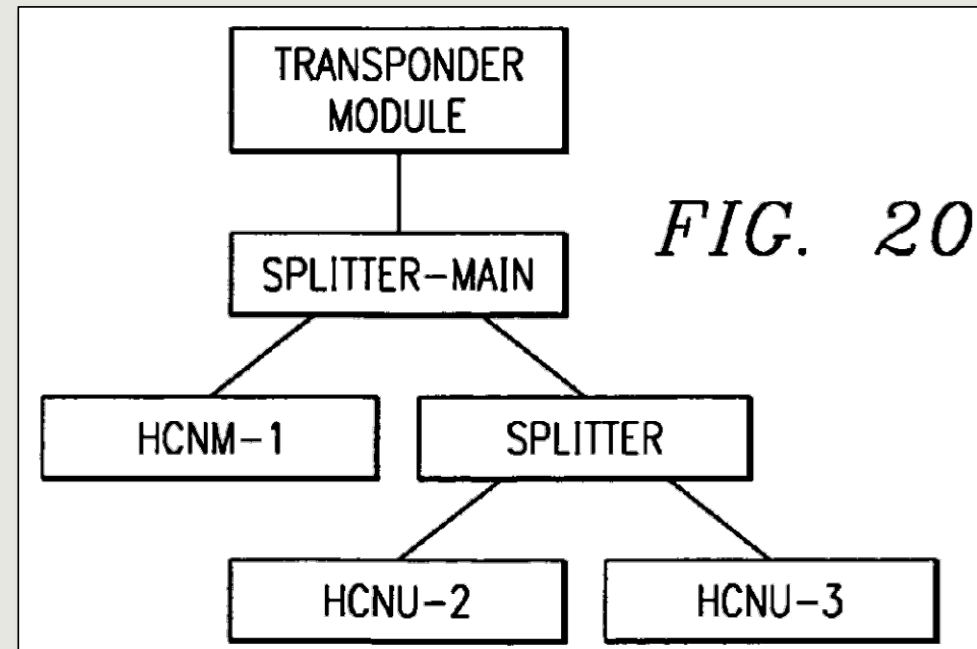
In the Dual Frequencies Mode the Transponder module is required to be added in the entrance to the home. The signal from HCNU-2 is transferred to the transponder module. The transponder module changes the signal frequency from the US frequency to the DS frequency and transmits it to the home. The HCNU-3 received this signal with no echo.

The transponder is a simple one that translates the input frequency to another, whether if it is with an up and down conversion or other technique such as conversion to base-band and back.

The HCNU can support the two modes, and according to the configuration the operation mode will be specified. The configuration can be done manually or automatically by verifying if the transponder exists (by sending a signal in the US channel and verifying if the signal arrived in the DS channel).

Therefore this module can be inserted in houses where there is a problem with reflection.

Ex. 1005, 20:15-43; POR, 23-24



Ex. 1005, Fig. 20; POR, 23-24

Ground 3: No Motivation to Modify Amit per Jacobsen Due to Interference

A second source of signal degradation in CATV networks is interference from other signals. For example, leaks in a CATV network caused by poorly shielded consumer devices or system hardware allow amateur radio (ham) signals to enter the CATV system. Because the frequency spectrum allocations for CATV and ham overlap, receivers on leaky CATV networks can tune interfering ham signals along with the desired signals. As a result, the received signal is degraded. Furthermore, the bandwidth of ham signals can vary from fewer than 100 Hz to several megahertz.[1] In addition, the duration, spectral location, and severity of ham interferers can vary. As a result, an effective digital transmission scheme must be able to maintain a desired performance level in the presence of interfering signals.

Ex. 1007, 9; POR, 22

Demonstrative Only - Not Evidence PO-40

Claim 10 - Ground 4

Demonstrative Only - Not Evidence PO-41

Ground 4: Amit, Jacobsen and DSL-Book

(12) **United States Patent**
Amit

(10) Patent No.: **US 7,127,734 B1**
(45) Date of Patent: **Oct. 24, 2006**

(54) **SYSTEM AND METHODS FOR HOME NETWORK COMMUNICATIONS**

(75) Inventor: **Mati Amit, Zur-Yigal (IL)**

(73) Assignee: **Texas Instruments Incorporated, Dallas, TX (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/548,048**

(22) Filed: **Apr. 12, 2000**

Related U.S. Application Data

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(51) Int. Cl. **H04N 7/18** (2006.01)

(52) U.S. CL. **725/809; 725/82**

(58) Field of Classification Search **725/74, 725/78, 80, 81, 82, 85, 111, 110, 131, 133, 725/139, 141, 151, 153; H04N 7/18, 7/16**
See application file for complete search history.

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* cited by examiner

Primary Examiner—Vivek Srivastava
(74) Attorney, Agent, or Firm—Abdul Zindani; W. James Brady, III; Frederick J. Telecky, Jr.

(57) **ABSTRACT**

The present invention provides the ability to use existing cable TV wires for home networking.

18 Claims, 8 Drawing Sheets

Ex. 1005, Title Page

An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network

Krista S. Jacobsen* and John M. Cioffi
Information Systems Laboratory
Stanford University
Stanford, California 94305-4055

Abstract

We present a comparison between the performances of single-carrier modulation with equalization and multicarrier modulation on simulated cable television (CATV) channels. Simulations indicate that for a given data rate, the complexity of multicarrier is significantly lower than that of a single-carrier system. Furthermore, multicarrier is able to reduce the effects of various distortions on a CATV network, including microreflections and interference from external signals such as amateur radio, with a reasonable computational complexity while achieving information bit rates on the order of 80 Mbits/s.

Introduction

The feasibility of offering high-speed interactive data services to customers on CATV networks or similar broadband coaxial networks is currently being investigated by a number of service providers. With over 92% of the homes in the United States passed by cable, the CATV network is a potential supplier of these interactive data services. However, there are several electrical transmission problems that must be overcome before these services can be supplied reliably over CATV networks.

Presently, CATV networks are generally simplex broadcast tree- or star-structured networks. However, this work was supported by NSF contract number NCR-9203131, JSEP contract number NCR-9203131, NASA contract number NAG2-842, and an NSF Graduate Fellowship.

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The transmission of digital signals over the CATV network is complicated by two general effects. First, the hardware in CATV networks is not ideal. Taps, amplifiers, and splitters can all cause signals to be reflected at their insertion points. In particular, splitters in subscriber homes are known to have poor isolation characteristics. The effect of reflected signals on the frequency transfer characteristic of a CATV channel is passband ripple, which is known to cause "ghosting" in received analog signals. The effects of rippling on digital signals, however, are more severe. Variations in a channel's frequency response cause successively transmitted symbols to interfere with one another, an effect known as intersymbol interference (ISI). Depending on the absolute deviations of the channel magnitude response (which are determined by the magnitudes of impedance mismatches on a CATV system) and the frequency with which those deviations occur in the frequency response (which depends on the length of coaxial cable between mismatches), a given symbol could interfere significantly with a large number of adjacent symbols. Without some scheme to combat ISI, a receiver would make detection errors. In turn, the detection errors could disable, for example, a digital video

Ex. 1007, 8



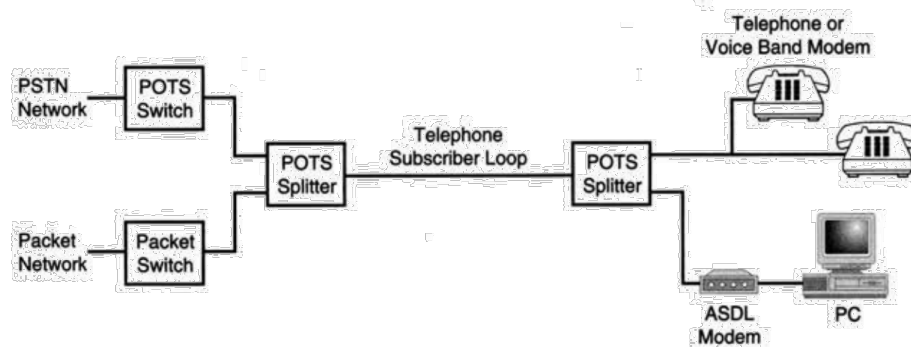
Ex. 2009, Front Cover

Ground 4: A POSITA Would Not Modify Amit-Jacobsen with DSL-Book

Twisted pair lines function differently than coaxial cables.

112. Twisted pair telephonic lines are unshielded to save costs of manufacturing. *See* Ex. 2011 [Signal-Integrity] 121 (“This is what Ethernet uses – unshielded twisted pair (UTP). This is important because, as one might guess, the unshielded cable is cheaper than shielded.”). Twisted pair provide two unshielded wires transmitting a signal and the inverse of that signal. When the communication is received, the signal and inverse signal are summed resulting in a boosted transmission without interference. This is fundamentally different than with coaxial cables, which provide a single copper core that carries all transmissions.

Figure 1.3 Digital Access Through a POTS Splitter



Ex. 2009, 26; POR, 35; Ex. 2007, ¶118

Ex. 2007, ¶112; POR, 35

DSL-Book provides a regional, not local network

Demonstrative Only - Not Evidence PO-43

Ground 4: A POSITA Would Not Modify Amit-Jacobsen with DSL-Book

	Connected Home operation mode	Single Home operation mode
Frequency range	higher than 860 MHz; usually 900–960 MHz	900–906 MHz
RF channel spacing (bandwidth)	8 MHz or lower, according to the required rate	6.25 MHz

Ex. 1005, 8:20-30; POR, 36

Table 1: Achievable bit rates on simulated channel

DMT SNR (dB)	Bit rate (Mbps)	
	$P_e = 10^{-7}$	$P_e = 10^{-9}$
40	65.256	57.493
43	71.251	63.485
46	77.246	69.479
49	83.243	75.474
52	89.240	81.471
55	95.237	87.467
58	101.23	93.464
61	107.23	99.461

Ex. 1007, 11; POR, 37

This structure enables information sending in very high rates (e.g. 40 Mbps) for each direction.

Ex. 1005, 21:21-22; POR, 37

Both Amit and Jacobsen have comparable or superior efficiency on a single channel than DSL-Book over the entire useable band.

Asymmetrical Digital Subscriber Lines (ADSL) were originally developed for such a video-on-demand service with a downstream (from a CO to a subscriber) transmission throughput of 1.544 Mbps and an upstream (from a subscriber to a CO) transmission throughput of between 16 and 64 kbps. With ADSL, one compressed video channel can be provided to all consumers connected with nonloaded telephone subscriber loops. At CSA range, up to four

Ex. 1008, 10; POR, 37

1.4.5 VDSL System Standards

To meet the demand of future all-purpose multimedia applications, Very-high-bit-rate Digital Subscriber Line (VDSL) has been under study since late 1995 for transmission throughputs of 13, 26, and 52 Mbps. The VDSL service range is expected to be between 1.5 to 4.5 kft. VDSL customers will be connected by short-distance copper twisted-pair loops to nearby Optical Network Units (ONUs) that are linked to a CO with fiber optical cables.

The VDSL transmit spectrum can occupy a bandwidth of up to 15 MHz where the Radio Frequency Interference (RFI), both ingress and egress, has become a chief concern. Under such a high transmission throughput, the requirement of delivering desired analog and digital semiconductor capabilities under a consumer product cost constraint becomes an incentive for VDSL system developers.

Ex. 1008, 5; POR, 37

Demonstrative Only - Not Evidence PO-44

Claims 17, 9 and 2 – Grounds 3, 4, and 2

Demonstrative Only - Not Evidence PO-45

Claim 17

17. The broadband local area network of claim 10, wherein at least one of the communication channels between terminal devices uses time division duplex protocol for communications and the communications are synchronized by broadcasting a beacon message on the network.

Ex. 1001, cl. 17

All users are synchronized by a beacon message broadcast on the network. The beacon message provides a common time reference to the users and can include other network management information.

Ex. 1001, 6:44-48; POR, 5

Demonstrative Only - Not Evidence PO-46

Claims 9 and 2

9. The broadband local area network of claim **5**, wherein at least one of the communication channels between terminal devices uses time division duplex protocol for communications and the communications are synchronized by broadcasting a beacon message on the network.

Ex. 1001, cl. 9

2. The signal distribution network of claim **1**, wherein at least one of the communication channels between terminal devices uses time division duplex protocol for communications and the communications are synchronized by broadcasting a beacon message on the network.

Ex. 1001, cl. 2

Demonstrative Only - Not Evidence PO-47

Ground 3: Amit and Jacobsen

(12) **United States Patent**
Amit

(10) **Patent No.:** **US 7,127,734 B1**
(45) **Date of Patent:** **Oct. 24, 2006**

(54) **SYSTEM AND METHODS FOR HOME NETWORK COMMUNICATIONS**

(75) **Inventor:** **Mati Amit, Zur-Yigal (IL)**

(73) **Assignee:** **Texas Instruments Incorporated, Dallas, TX (US)**

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Ex. 1007, 8

Demonstrative Only - Not Evidence PO-48

Page 48 of 74

Amit's TDM is Not Possible in Utilized Embodiment

If this notch filter exists in the HomeCN is disconnected from the regional cable network, therefore its' design is more simple (single home network).

Ex. 1005, 7:16-19

TDM-
Time Domain
Multiplexing

Ex. 1005, 26:15-65; POR, 56-57

Requires synchronization, therefore, it require CMTS for synchronization.

Ex. 1005, 26:15-65; POR, 56-57

Method	Pros	Cons
FDM-Frequency Domain Multiplexing	Simple The frequency range can be updated according to the number of home-networks that share the same frequency, and according to the required bandwidth. Can use wide spectrum for the whole solution, when each home is required to use narrow range (less than 6 MHz). Very efficient, in particular when the number of home-networks in a specific 'branch' is low. Does not require synchronization and does not require CMTS for synchronization.	Not efficient in case of many home-networks on the same "branch" According to our estimations, this case is probably rare. CBR based; therefore it is not affective when the traffic is not CBR type.
FDM with frequency hopping	Does not require any configuration. I.e. not required configuration of the frequency that each home should use. Very efficient when the traffic is ABR type.	More complex then FDM. Hard to be managed by the Cable Operator. It is not efficient when the traffic is CBR type (e.g. digital movie playing on the DVD in the living room, when the TV is in the bad room). It has only disadvantage when the home is the only home on the branch.
TDM-Time Domain Multiplexing	The bandwidth allocation can be dynamic-according to the needs.	Requires synchronization, therefore, it require CMTS for synchronization. Can not use the wide spectrum (more than 10 MHz) in each channel group. Making Home Cable Networking Unit (HCNU) equipment is very complex, because this equipment is required to get the sync from the cable modem network. It is similar to FDM, but more complex, when the home is the only home on the branch.
CDM-Code Domain Multiplexing	The supplied bandwidth (data rate) can be dynamic-according to the needs.	Very complex Requires synchronization, therefore, it requires CMTS for synchronization. Making Home Cable Networking Unit (HCNU) equipment is very complex, because this equipment is required to get the sync from the cable modem network. Can not use wide spectrum (more than 10 MHz) in each channels group. The performances are low unless you are using complex equipment that supports wide spectrum sampling. It is similar to FDM, but more complex, when the home is the only home on the branch.

Ex. 1005, 26:15-65; POR, 56-57

Demonstrative Only - Not Evidence PO-49

Amit's TDM is not TDD

Mr. Bates:

Q. Would you consider TDD to be a form of TDM?

A. No.

Q. What is time division duplexing, TDD?

A. In a time division duplexing system we have two people, one on one end, one on the other, and we talk. I talk first. You talk second.

I can set it up in such a way that I can talk for two seconds, and you can only talk for one second. But on duplexing I'm using the capability of the two-way transmission, but it's a batting back and forth. It's like a Ping-Pong effect.

So time division duplexing says I can use a variable amount of time between the two ends and I'm going to use the Ping-Pong effect.

Time division multiplexing, if you recall, I said I could take 24 channels on one pipe, break it down into the time slots, and transmit. There would be an equal return channel. So in T1, for example, there was a T1 out and T1 in, 1.5 in each direction.

Ex. 1029, 88:6-24; POR, 20

The advantage of using TDD is that the transceiver design is simplified.

Ex. 1001, 6:39-40; POR, 4-5

Demonstrative Only - Not Evidence PO-50

Claim 17 – Ground 4: Amit, Jacobsen and DSL-Book

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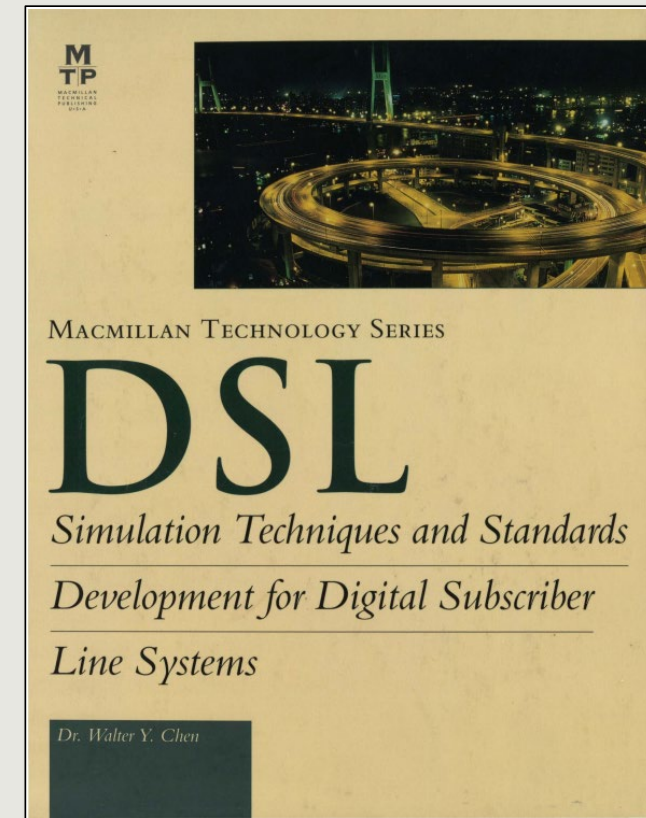
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Ex. 1007, 8



Ex. 2009, Front Cover

Demonstrative Only - Not Evidence PO-51

Claim 17 – A Pilot Tone is Not a Beacon Message

Pilot Tone for Timing Recovery

The clock synchronization between a DMT transmitter and a DMT receiver is maintained through a timing recovery circuit in at least one transmission direction. This synchronization is based on the configuration where the transmitter and the receiver at one end of an ADSL system use their own clock source, and the transmitter and receiver at the other end use the recovered clock.

The timing recovery circuit of a DMT system involves the transmission of a pilot tone at the clock source end and the recovery of the pilot tone at the other end. The pilot tone could have periodic phase shift to reduce its interference with other tones. The transmit power of the pilot tone is usually a little lower than other information bearing subcarriers. The recovered pilot tone is usually filtered with a phase locked loop to increase its stability. The transmit power of the pilot tone may actually be more than the nominal transmit power of the information bearing subcarriers, especially for longer loops.

Ex. 1008, 21, POR 21

Note

A pilot tone is a subcarrier dedicated only for the purpose of timing recovery. A pilot tone has a fixed amplitude and fixed or alternating phases.

Ex. 1008, 22; POR, 21

Demonstrative Only - Not Evidence PO-52

Claim 17 – Ground 2: Amit and ADSL/VDSL

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Amit

(10) **Patent No.:** US 7,127,734 B1
(45) **Date of Patent:** Oct. 24, 2006

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(58) **Field of Classification Search** 725/74, 725/78, 80, 81, 82, 85, 111, 110, 131, 133, 725/139, 141, 151, 153; H04N 7/18, 7/16
See application file for complete search history.

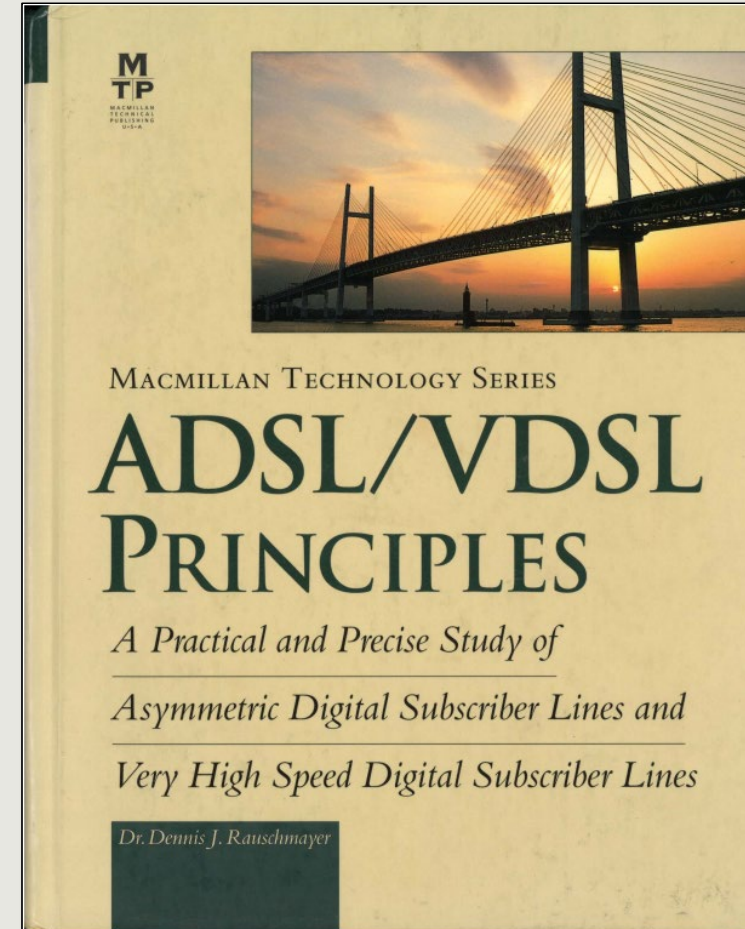
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5,499,047 A	3/1996	Terry et al.

18 Claims, 8 Drawing Sheets

Ex. 1005, Title Page



Ex. 2017, Front Cover

Demonstrative Only - Not Evidence PO-53

Claim 17 – A Pilot Tone is Not a Beacon Message

Pilot Tones

In both the upstream and downstream directions, one of the **DMT tones** is reserved for a pilot signal. In the downstream direction, the pilot tone is at 276 kHz, or equivalently tone 64. In the upstream direction, the pilot tone is at 69 kHz, or equivalently tone 16. The pilot tones can be used to resolve sample timing at the receiver. The pilot tones will never be used for data, but will always send bits (0,0) from a 4QAM constellation (the constellation point in the first quadrant).

Ex. 1006, 76, POR, 49-50

Final Words on SDMT

As a candidate for VDSL, SDMT has several advantages. First, the use of TDD allows for easy control over the upstream and downstream data rate ratio. Second, because SDMT is half-duplex, a hybrid is not needed on VDSL modems, and the sharing of digital circuitry between the transmitter and receiver (the FFT/IFFT circuitry for example) is possible, allowing for complexity reduction. Third, the nature of multicarrier modulation allows for flexibility in dealing with narrowband interference from RFI and can easily reduce egress in a band by simply reducing the power on a tone.

One issue related to SDMT is the requirement to properly synchronize frames for VDSL lines in a common binder group. If all lines emanate from a single ONU, this synchronization might be feasible by using a **common clock**. However, when independent ONUs feed VDSL into the same binder group, achieving frame synchronization is much more difficult.

Ex. 1006, 86; POR, 86

Demonstrative Only - Not Evidence PO-54

Claims 1 & 5

Demonstrative Only - Not Evidence PO-55

Claims 1 and 5 – Ground 3: Amit and Jacobsen

(12) **United States Patent**
Amit

(10) Patent No.: **US 7,127,734 B1**
(45) Date of Patent: **Oct. 24, 2006**

(54) **SYSTEM AND METHODS FOR HOME NETWORK COMMUNICATIONS**

(75) Inventor: **Mati Amit, Zur-Yigal (IL)**

(73) Assignee: **Texas Instruments Incorporated, Dallas, TX (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/548,048**

(22) Filed: **Apr. 12, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/128,810, filed on Apr. 12, 1999.

(51) **Int. Cl.**
H04N 7/18 (2006.01)

(52) **U.S. Cl.** **725/80; 725/82**

(58) **Field of Classification Search** **725/74, 725/78, 80, 81, 82, 85, 111, 110, 131, 133, 725/139, 141, 151, 153; H04N 7/18, 7/16**
See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Vivek Srivastava
(74) **Attorney, Agent, or Firm**—Abdul Zindani; W. James Brady, III; Frederick J. Telecky, Jr.

(57) **ABSTRACT**

The present invention provides the ability to use existing cable TV wires for home networking.

18 Claims, 8 Drawing Sheets

Ex. 1005, Title Page

An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network

Krista S. Jacobsen* and John M. Cioffi
Information Systems Laboratory
Stanford University
Stanford, California 94305-4055

Abstract

We present a comparison between the performances of single-carrier modulation with equalization and multicarrier modulation on simulated cable television (CATV) channels. Simulations indicate that for a given data rate, the complexity of multicarrier is significantly lower than that of a single-carrier system. Furthermore, multicarrier is able to reduce the effects of various distortions on a CATV network, including microreflections and interference from external signals such as amateur radio, with a reasonable computational complexity while achieving information bit rates on the order of 80 Mbits/s.

ever, these networks can be converted for duplex service, as some already have been, by replacing amplifier/repeater segments with so-called "duplex" filters and amplifiers that separate the downstream frequencies (50-550 MHz) from upstream frequencies (5-40 MHz) for interactive transmission. Some CATV networks can also have high-frequency attenuation reduced by the installation of equalizing duplex amplifiers that can boost the usable spectrum to 1 GHz. Even after such installation, however, the network operator finds that only some channels are available for new digital services. Consequently, the deployment of digital services is likely to be incremental and to demand high spectral efficiency in those channels allocated for the new services.

The transmission of digital signals over the CATV network is complicated by two general effects. First, the hardware in CATV networks is not ideal. Taps, amplifiers, and splitters can all cause signals to be reflected at their insertion points. In particular, splitters in subscriber homes are known to have poor isolation characteristics. The effect of reflected signals on the frequency transfer characteristic of a CATV channel is passband ripple, which is known to cause "ghosting" in received analog signals. The effects of rippling on digital signals, however, are more severe. Variations in a channel's frequency response cause successively transmitted symbols to interfere with one another, an effect known as intersymbol interference (ISI). Depending on the absolute deviations of the channel magnitude response (which are determined by the magnitudes of impedance mismatches on a CATV system) and the frequency with which those deviations occur in the frequency response (which depends on the length of coaxial cable between mismatches), a given symbol could interfere significantly with a large number of adjacent symbols. Without some scheme to combat ISI, a receiver would make detection errors. In turn, the detection errors could disable, for example, a digital video

Introduction

The feasibility of offering high-speed interactive data services to customers on CATV networks or similar broadband coaxial networks is currently being investigated by a number of service providers. With over 92% of the homes in the United States passed by cable, the CATV network is a potential supplier of these interactive data services. However, there are several electrical transmission problems that must be overcome before these services can be supplied reliably over CATV networks.

Presently, CATV networks are generally simplex broadcast tree- or star-structured networks. How-

*This work was supported by NSF contract number NCR-9203131, JSEP contract number NCR-9203131, NASA contract number NAG2-842, and an NSF Graduate Fellowship.

Ex. 1007, 8

Demonstrative Only - Not Evidence PO-56

Claims 1 and 5 – Require Multicarrier Modulation

1. A signal distribution network comprising:
a filter located at the point of entry of a building tuned to reject network signals originating in the building, such that the network signals originating in the building do not pass through the filter, but rather are reflected back into the building;
at least one signal splitter, the signal splitter having a common port and a plurality of tap ports, the common port of the signal splitter being coupled to the filter; and
a plurality of terminal devices, each terminal device being coupled to a tap port of at least one signal splitter, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;
wherein the reflections from the filter provide a path for terminal devices back through the tap port of the signal splitter and out each other tap port to transmit signals to other terminal devices thus allowing terminal devices to communicate directly with each other to form the signal distribution network.

Ex. 1001, cl. 1

5. A broadband local area network using coaxial cable building wiring as a communication channel, the network comprising:

- a plurality of terminal devices, each terminal device communicating with other terminal devices using orthogonal frequency division multiplexing (OFDM) modulation, at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal to noise ratio (SNR) is high;
- a network of building cables coupled to the plurality of terminal devices; and
- a filter having a first and second port, the first port connected to a building point of entry and the second port connected to the plurality of terminal devices via the network of building cables, wherein signals transmitted by any of the terminal devices and received at the second port of the filter are rejected by the filter such that such signals do not pass through the filter, but rather are reflected back into the network of building cables in order to create a communication path between the transmitting terminal device and at least one other terminal device coupled to the network of building cables.

Ex. 1001, cl. 5

Demonstrative Only - Not Evidence PO-57

Claims 1 and 5 – Require Multicarrier Modulation

THE WITNESS: So there's one claim element that mentions at least one of the terminal devices providing frequency bins with more transmit bits which occupy parts of the channel where the signal-to-noise ratio is high.

So I guess my answer would be it's not totally explicit, but it seems to hint at multicarrier.

Ex. 2008, 51:23-52:5; POR, 51

Demonstrative Only - Not Evidence PO-58

Claims 1 and 5 – Multicarrier Modulation Not Disclosed in Amit

The modulation method is QPSK, QAM 16, QAM 64 or QAM 256 according to the channel conditions, and according to the equipment capabilities.

The modulator of the home networking device **MUST** provide QPSK and QAM 16.

Ex. 1005, 8:30-34; POR, 52, 56, 58-59

Requires synchronization, therefore, it require CMTS for synchronization.

Ex. 1005, 26:15-65; POR, 46-48, 56-57

Method	Pros	Cons
FDM-Frequency Domain Multiplexing	Simple The frequency range can be updated according to the number of home-networks that share the same frequency, and according to the required bandwidth. Can use wide spectrum for the whole solution, when each home is required to use narrow range (less than 6 MHz). Very efficient, in particular when the number of home-networks in a specific 'branch' is low. Does not require synchronization and does not require CMTS for synchronization.	Not efficient in case of many home-networks on the same "branch" According to our estimations, this case is probably rare. CBR based; therefore it is not affective when the traffic is not CBR type.
FDM with frequency hopping	Does not require any configuration. I.e. not required configuration of the frequency that each home should use. Very efficient when the traffic is ABR type.	More complex then FDM. Hard to be managed by the Cable Operator. It is not efficient when the traffic is CBR type (e.g. digital movie playing on the DVD in the living room, when the TV is in the bad room). It has only disadvantage when the home is the only home on the branch.
TDM-Time Domain Multiplexing	The bandwidth allocation can be dynamic-according to the needs.	Requires synchronization, therefore, it require CMTS for synchronization. Can not use the wide spectrum (more than 10 MHz) in each channel group. Making Home Cable Networking Unit (HCNU) equipment is very complex, because this equipment is required to get the sync from the cable modem network. It is similar to FDM, but more complex, when the home is the only home on the branch.
CDM-Code Domain Multiplexing	The supplied bandwidth (data rate) can be dynamic-according to the needs.	Very complex Requires synchronization, therefore, it requires CMTS for synchronization. Making Home Cable Networking Unit (HCNU) equipment is very complex, because this equipment is required to get the sync from the cable modem network. Can not use wide spectrum (more than 10 MHz) in each channels group. The performances are low unless you are using complex equipment that supports wide spectrum sampling. It is similar to FDM, but more complex, when the home is the only home on the branch.

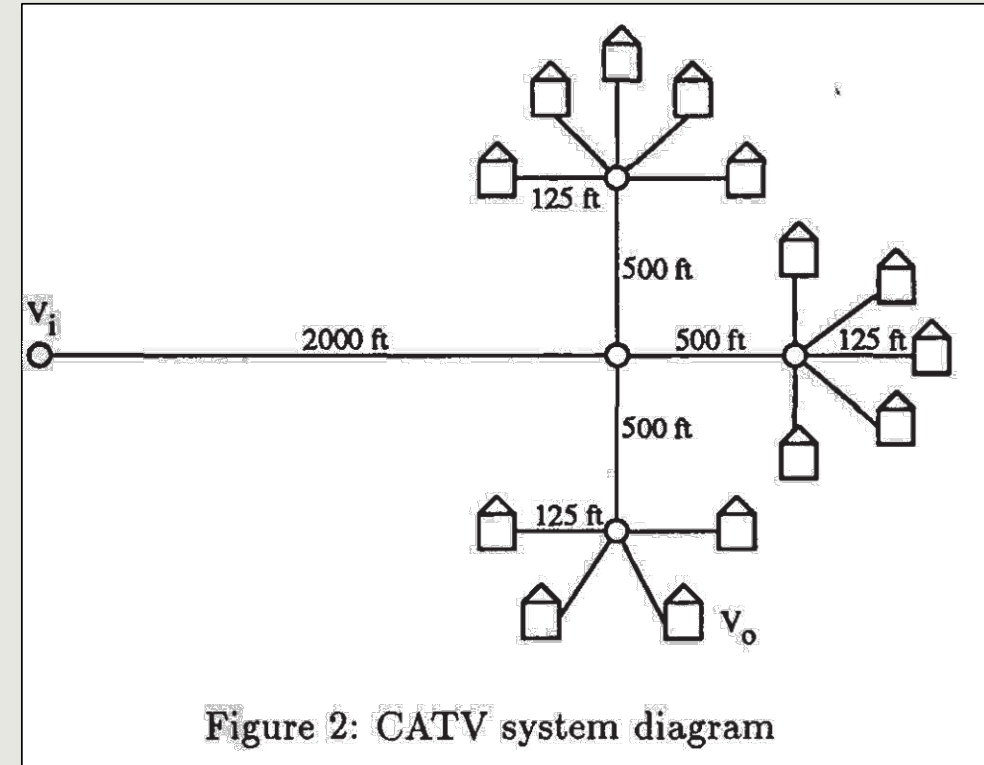
Ex. 1005, 26:15-65; POR, 46-48, 56-57

Demonstrative Only - Not Evidence PO-59

Claims 1 and 5 – Jacobson Does not Motivate Adding OFDM/DMT

Adding a filter at the flat/single user home entrance.
The advantage of this method is the ability of the end user to add the filter by himself.
Replace the house basement splitter that split the signals between the flats to a special splitter.
The advantage of this method is the ability of the MSO to change a single splitter to a special splitter that includes internal filter. This splitter enables more effective usage of the home networking for some flats (homes).
The disadvantage of this method exists only if the HomeCN uses the notch filter reflection. In this case the attenuation and the delay of the coaxial wire between the flat to the central splitter.

Ex. 1005, 13:34-36; POR, 24



Ex. 1007, Fig. 2 POR, 21

Demonstrative Only - Not Evidence PO-60

Claims 1 and 5 – OFDM Not Within Skill of POSITA

For example DOCSIS protocol can support high quantity of CM's (up to 8,000 CM's for a MAC chip) in particular **DOCSIS 1.1**.

Ex. 1005, 18:65-67; POR, 54

[0003] To accommodate higher peak rates, the Data Over Cable Service Interface Specification (DOCSIS) 3.1 specifications were developed and issued in **2013**. The DOCSIS 3.1 standard promises a great capacity potential by extending the spectrum in both the downstream (DS) and upstream (US) directions. **DOCSIS 3.1 extends the spectrum by using, in part, a modern PHY technology (i.e., Orthogonal Frequency Division Multiplexing (OFDM)), and improved Forward Error Correction (FEC) technology (i.e., Low Density Parity Check Codes (LDPC)).**

Ex. 2018, ¶13; POR 54

Europäisches Patentamt
European Patent Office
Office européen des brevets

(19)

(11) EP 1 065 855 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication: 03.01.2001 Bulletin 2001/01 (51) Int Cl.: H04L 27/26, H04L 1/12

(21) Application number: 99112402.5

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(84) Designated Contracting States: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States: AL LT LV MK RO SI

(71) Applicant: Sony International (Europe) GmbH
50829 Köln (DE)

(72) Inventors:
• Kanschak, Tino, c/o Sony Int. (Europe) GmbH
70736 Fellbach (DE)

(74) Representative: Körber, Martin, Dipl.-Phys. et al
Mitscherlich & Partner
Patentanwälte
Sonnenstrasse 33
80331 München (DE)

(54) Adaptation of cyclic extensions in an OFDM communication system

(57) The present invention relates to a communication apparatus (9, 26 or 28) and a method for transmitting and receiving information as OFDM-symbols in a wireless telecommunication system, in which between two consecutive OFDM-symbols a cyclic extension of a part of at least one of the OFDM-symbols is transmitted and received, respectively. In one embodiment, a communication apparatus (9) of the present invention comprises determining means (13, 14, 15, 16) for determining a delay value representing a channel delay of a transmission channel between the communication apparatus (9) and another communication apparatus of the wireless telecommunication system, setting means (17) for setting a value for the length of said cyclic extensions on the basis of said delay value determined in said determining means, and transmitting means (19) for transmitting said value for the length of said cyclic extensions. In another embodiment, a communication apparatus (26) according to the present invention comprises receiving means (27) for receiving a length value representing the length of said cyclic extension, inserting means (25) for generating and inserting a cyclic extension between two OFDM-symbols, whereby the length of said cyclic extension is set on the basis of said received length value, and transmitting means (19) for transmitting OFDM-symbols, whereby respective cyclic extension from said inserting means is inserted between two consecutive OFDM-symbols.

The present invention is particularly advantageous since the transmission overhead caused by the cyclic extensions can be significantly reduced by adapting the length of the cyclic extensions to the delay properties of the actually used transmission channel, while the transmission quality is maintained.

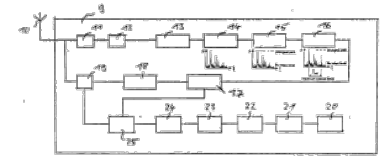


Fig. 4

Ex. 2015 Title page (Kanschak), POR 55

Demonstrative Only - Not Evidence PO-61

Claims 1 and 5 – Amit Does Not Disclose Binning

The modulation method is QPSK, QAM 16, QAM 64 or QAM 256 according to the channel conditions, and according to the equipment capabilities.

Ex. 1005, 8:30-33; POR, 52

Q. And so the presence of two different channels doesn't mean that multicarrier modulation is occurring, right?

A. The existence of multiple channels may or may not lead to a multicarrier modulation.

Ex. 2019, 17:11-15; POR, 6

Demonstrative Only - Not Evidence PO-62

Claims 1 and 5 – Ground 2: Amit & ADSL/VDSL

(12) **United States Patent**
Amit

(10) **Patent No.:** US 7,127,734 B1
(45) **Date of Patent:** Oct. 24, 2006

(54) **SYSTEM AND METHODS FOR HOME NETWORK COMMUNICATIONS**

(75) **Inventor:** **Mati Amit**, Zur-Yigal (IL)

(73) **Assignee:** **Texas Instruments Incorporated**, Dallas, TX (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** 09/548,048

(22) **Filed:** Apr. 12, 2000

Related U.S. Application Data

(60) Provisional application No. 60/128,810, filed on Apr. 12, 1999.

(51) **Int. CL.** *H04N 7/18* (2006.01)

(52) **U.S. CL.** 725/80; 725/82

(58) **Field of Classification Search** 725/74, 725/78, 80, 81, 82, 85, 111, 110, 131, 133, 725/139, 141, 151, 153; *H04N 7/18, 7/16*
See application file for complete search history.

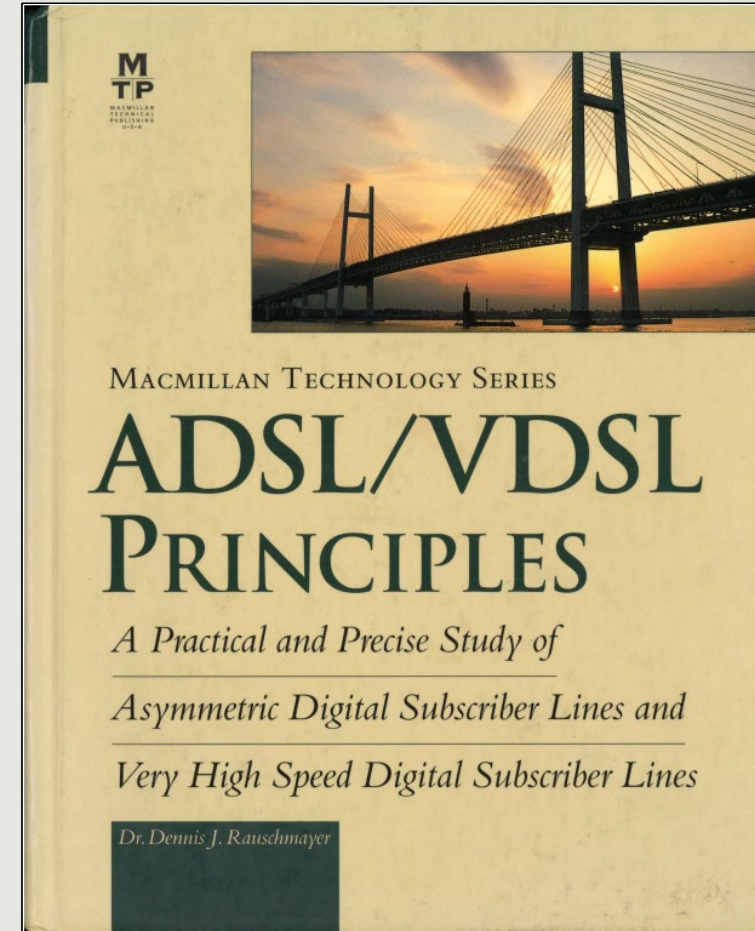
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5,499,047 A	3/1996	Terry et al.

18 Claims, 8 Drawing Sheets

Ex. 1005, Title Page



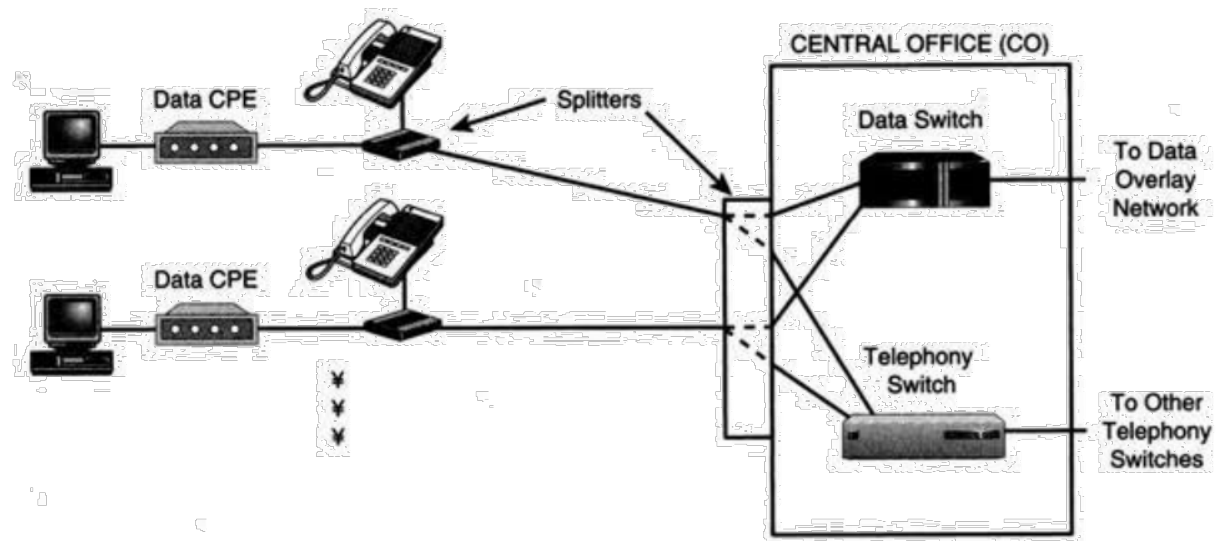
Ex. 2017, Front Cover

Demonstrative Only - Not Evidence PO-63

Claims 1 and 5 – ADSL/VDSL Control is in Network

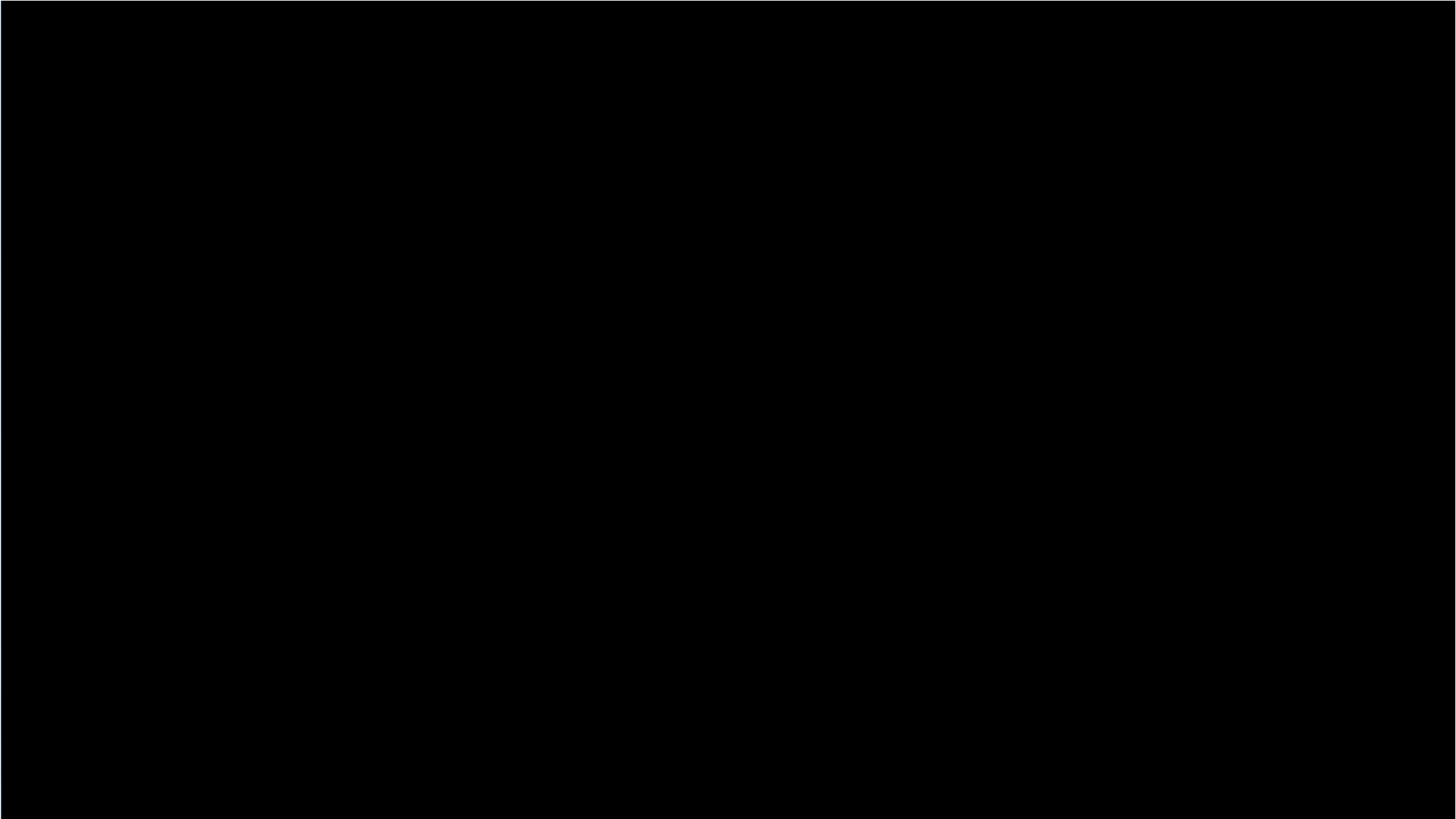
Figure 1.2

A conventional telephone system coexisting with a data overlay network.



Ex. 2017, 18; POR, 13; Ex. 2007, ¶116

Demonstrative Only - Not Evidence PO-64



Ground 3: No Motivation to Add Equalization to Amit - Cyzkwik

Q. So what do you think about the inconsistencies as far as complexity between Czylik and Jacobsen?

ATTORNEY SHARTZER: Objection to form.

THE WITNESS: I wouldn't characterize it as such, but I would also say that you're talking about two conference papers out of a body of thousands of such papers, and there's so many different scenarios and so many different setups. Of course we could get into the weeds and figure out what's different about Jacobsen and what's different about Czylik, but it's not surprising that those two could have the same complexity in a given scenario.

BY ATTORNEY HALVERSON:

Q. And Jacobsen found that in her study, the single carrier with equalization was more complex than the multicarrier without equalization, right?

A. I think that's correct. And Czylik

Ex. 2019, 26:3-23; PO-SR, 15

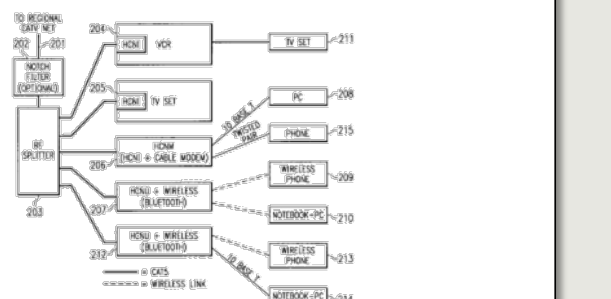
Demonstrative Only - Not Evidence PO-66

Petitioner's References

Demonstrative Only - Not Evidence PO-67

Overview of Amit

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(54) SYSTEM AND METHODS FOR HOME NETWORK COMMUNICATIONS	5,539,880 A 7/1996 Lakhani 5,565,910 A 10/1996 Rowse et al. 5,579,308 A 11/1996 Humphrean 5,585,837 A 12/1996 Nixon 5,766,822 A 6/1998 Zoultis 5,796,306 A 8/1998 Kopaenda 5,797,010 A 8/1998 Brown 5,805,806 A 9/1998 McArthur 5,811,930 A 9/1998 Savari 5,878,334 A * 3/1999 Borth et al. 9/1998 9/1998 4553.31 5,881,262 A 3/1999 Eldering et al. 6,061,719 A * 5/2000 Bendiselli et al. 709.218 6,069,899 A 5/2000 Foley 6,081,519 A 6/2000 Peller 6,091,480 A 7/2000 Kokkinen 6,091,932 A 7/2000 Langlais 6,112,232 A 8/2000 Ashar et al. 6,134,223 A 10/2000 Lovelless 6,161,911 A 12/2000 Goodle et al. 6,166,730 A 12/2000 Williams, Jr. et al. 6,175,861 B1 12/2001 Williams, Jr. et al. 6,188,397 B1 2/2001 Humphrean 6,189,148 B1 2/2001 Clark et al. 6,195,797 B1 2/2001 Williams, Jr. 6,209,025 B1 2/2001 Bellamy 6,210,718 A * 8/2001 Chevi et al. 725.81 6,452,923 B1 9/2002 Gerzberg et al. 6,515,407 B1 * 9/2002 Inaguma 725.78 6,622,364 B1 9/2003 Chahat 725.74 6,672,039 B1 * 10/2003 Klein 725.78
(75) Inventor: Matl Amrit, Zur-Yigal (IL)	
(73) Assignee: Texas Instruments Incorporated, Dallas, TX (US)	
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(d) by 0 days.	
(21) Appl. No. 09/548,048	
(22) Filed: Apr. 12, 2000	
Related U.S. Application Data	
Provisional application No. 60/128,810, filed on Apr. 12, 1999.	
(51) Int. Cl. H04N 7/08 (2006.01)	
(52) U.S. Cl. 725/80; 725/82	
(58) Field of Classification Search: 725/74, 725/78, 80, 81, 82, 85, 111, 116, 131, 133, 135, 139, 141, 151, 153, 186, 208, 716	
See application file for complete search history.	
(56) References Cited	* cited by examiner
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4,554,656 A 11/1985 Budnik et al.	(74) <i>Attorney, Agent, or Firm</i> —Abdul Zindani; W. James Brady, III; Frederick J. Telecky, Jr.
4,675,866 A 6/1987 Jaksoni et al.	(57) ABSTRACT
4,885,547 A 12/1989 Tugino	The present invention provides the ability to use existing cable TV wires for home networking.
4,932,934 A * 6/1990 Baxter 370.73	
5,235,267 A 10/1993 Hansen et al.	18 Claims, 8 Drawing Sheets
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5,351,234 A 1/1994 Beserle et al.	
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5,499,407 A 3/1996 Terry et al.	



Ex. 1005, Title Page

Home networking is a key technology for the evolving home infotainment market, and it is expected to become a very large market by itself within the next decade. Home networks will connect between computing devices (personal computers, palm computers, network computers, etc.), entertainment devices (TV, VCR, DVD player, video camera, audio systems, etc.), I/O devices (printer, scanner, headsets, keyboards, remote controls, mouse, loud-speakers, etc.), home appliances, and modems (such as cable modems, DSL modems, and PSTN modems) that connect the home outside. The home network will enable a wide range of

Ex. 1005, 1:15-26; PO-SR, 24

To use the Single Home operation mode that simplifies the equipment, a notch filter should be added. This filter can be added in the following points:

Adding a filter at the flat/single user home entrance.

The advantage of this method is the ability of the end user to add the filter by himself.

Ex. 1005; PO-SR, 24

Demonstrative Only - Not Evidence PO-68

Overview of Amit

The HomeCN operation modes are determined according to the existence/not existence of notch filter at the home entrance (see FIG. 2 [202]).

The notch filter in the entrance of the home is a one of the basic elements in the home network design. If this notch filter exists in the HomeCN is disconnected from the regional cable network, therefore its' design is more simple (single home network). When this filter does not exist the home network is part of the regional network, therefore its' design is more complicated, and some additional functionality is required.

The HomeCN Supports Two Operation Modes:

Single Home operation mode—This mode required a Notch filter, or an amplifier that usually supplies similar functionality, or it can be operated in a system that is not connected to the CATV plant.

Connected Home operation mode—This mode does not require a Notch Filter. This mode is more complex and requires additional functionality. Following are some functionalities that are required in the Connected Home operation mode: Wider frequency operation, frequency selection (FDM), multiple bandwidth, privacy, capability to be managed by the headend.

Ex. 1005, 7:12-35; POR, 10-11

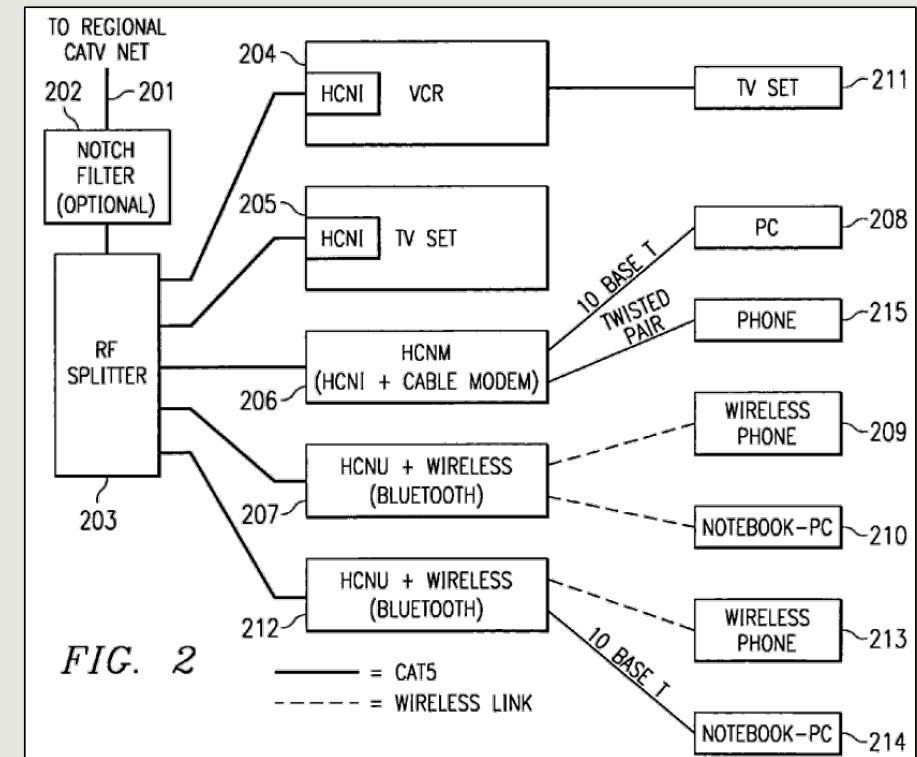


FIG. 2

Ex. 1005, Fig. 2; POR, 10-11

Demonstrative Only - Not Evidence PO-69

Overview of Amit

The two-frequency mode exists to eliminate the echo problem that exists in some of the homes in the single frequency mode. The method is transmitting the information in a specific frequency range (e.g. 900–906 MHz) and receiving the information in a different frequency range (e.g. 910–916 MHz). The architecture of this solution appears in the following figure.

In the single frequency mode the information that is transferred from HCNU-2 to HCNU-3 is transferred through Splitter-I and in addition and echo from Splitter-main also received.

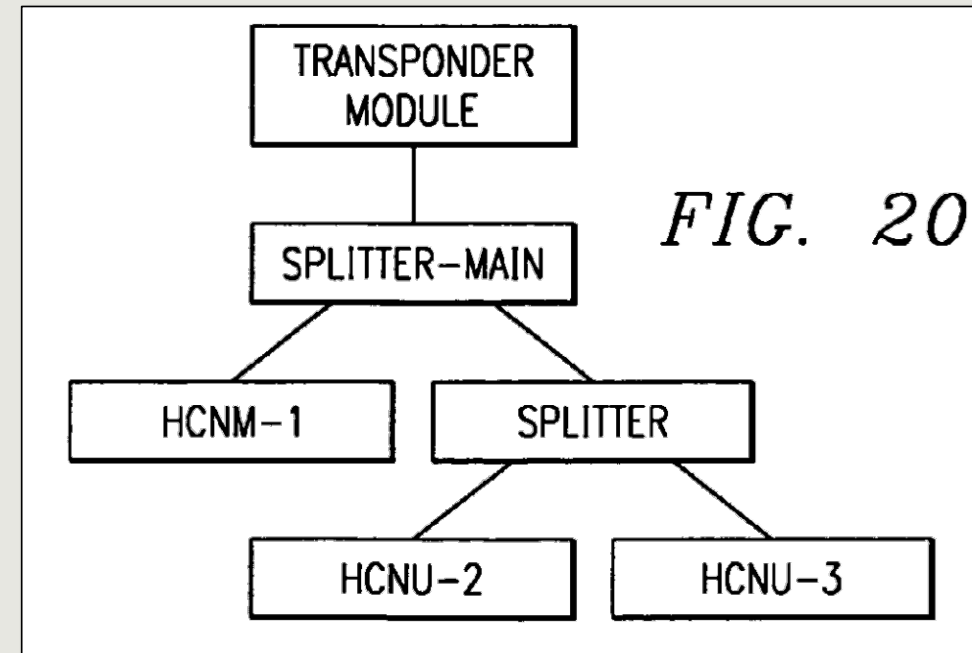
In the Dual Frequencies Mode the Transponder module is required to be added in the entrance to the home. The signal from HCNU-2 is transferred to the transponder module. The transponder module changes the signal frequency from the US frequency to the DS frequency and transmits it to the home. The HCNU-3 received this signal with no echo.

The transponder is a simple one that translates the input frequency to another, whether if it is with an up and down conversion or other technique such as conversion to base-band and back.

The HCNU can support the two modes, and according to the configuration the operation mode will be specified. The configuration can be done manually or automatically by verifying if the transponder exists (by sending a signal in the US channel and verifying if the signal arrived in the DS channel).

Therefore this module can be inserted in houses where there is a problem with reflection.

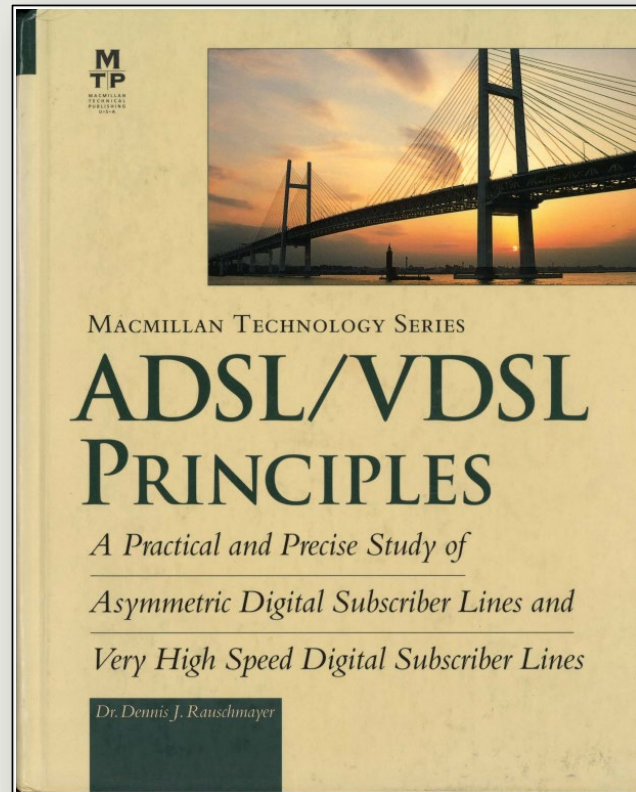
Ex. 1005, 20:15-43; POR 12



Ex. 1005, Fig. 20; POR 12

Demonstrative Only - Not Evidence PO-70

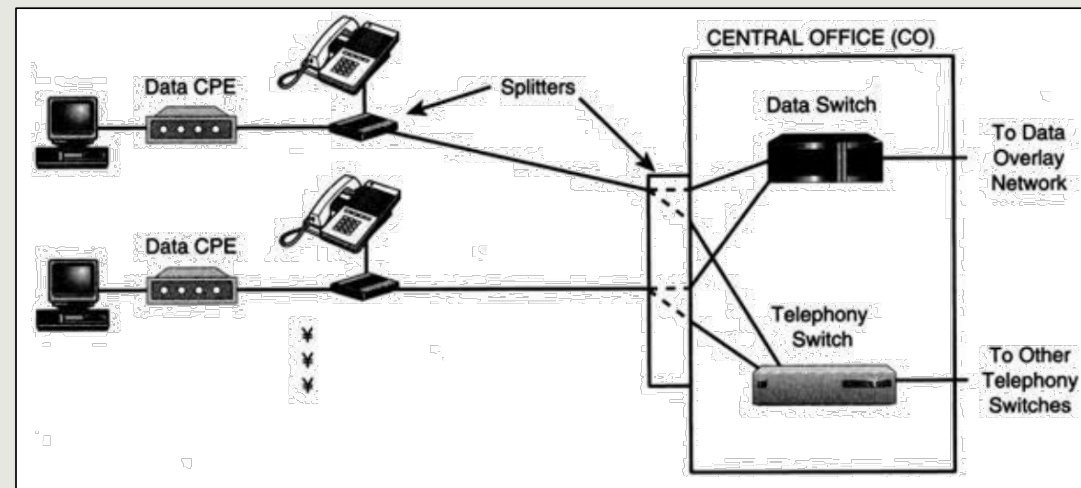
Overview of ADSL/VDSL



Ex. 2017, front cover

The principles of two specific DSL technologies, *Asymmetric Digital Subscriber Line* (ADSL) technology and *Very High Speed Digital Subscriber Line* (VDSL) technology, are the primary focus of this book, along with networks to which they allow access. ADSL provides an end user with data rates up to 8 Mbps in one direction and up to 800 Kbps in the other. VDSL provides even higher speeds as well as asymmetric or symmetric operation. This book presents in-depth discussions of ADSL and VDSL as well as how networks are designed to use them.

Ex. 1006, 3; POR, 13



Ex. 2017, 18; POR, 21

Demonstrative Only - Not Evidence PO-71

Overview of Jacobsen

An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network

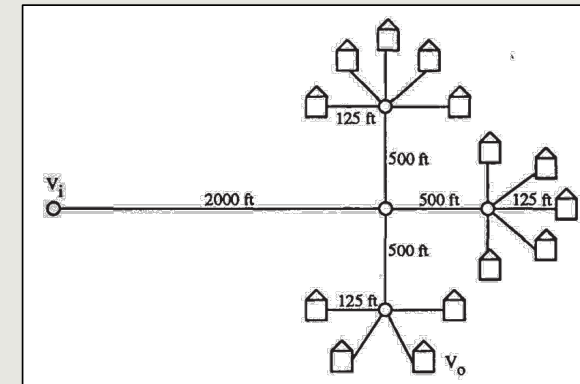
Krista S. Jacobsen* and John M. Cioffi
Information Systems Laboratory
Stanford University
Stanford, California 94305-4055

Ex. 1007, 8

Conclusion

The results of our simulations indicate that discrete multitone modulation is more computationally efficient than single-carrier modulation with equalization for the transmission of digital data over CATV channels with rippled passbands. Furthermore, DMT can easily adapt to a variety of channel degradations, optimizing the system bit rate for a given channel and complexity. Because system reliability is important for any consumer service, a digital transmission system must maintain a certain level of performance under a wide variety of circumstances. Given our simulation results, multicarrier modulation appears to be better equipped than single-carrier modulation to accomplish this objective.

Ex. 1007, 15; POR, 19



Ex. 1007, 10; POR, 19

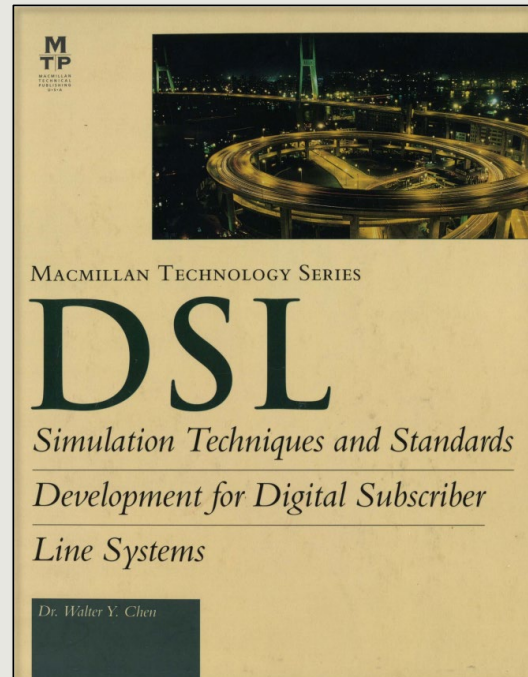
Abstract

We present a comparison between the performances of single-carrier modulation with equalization and multicarrier modulation on simulated cable television (CATV) channels. Simulations indicate that for a given data rate, the complexity of multicarrier is significantly lower than that of a single-carrier system. Furthermore, multicarrier is able to reduce the effects of various distortions on a CATV network, including microreflections and interference from external signals such as amateur radio, with a reasonable computational complexity while achieving information bit rates on the order of 80 Mbits/s.

Ex. 1007, 8; POR, 14

Demonstrative Only - Not Evidence PO-72

Overview of DSL-Book



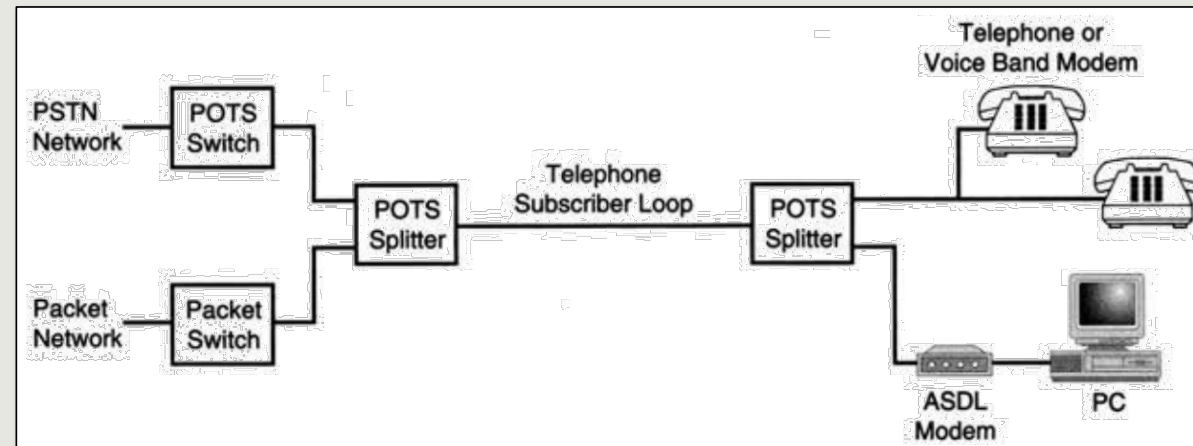
Ex. 2009, Front Cover

This book is a collection of simulation/implementation techniques and reference materials for the design and development of DSL systems. It is intended for practicing engineers working in DSL and related fields. Many techniques developed for DSLs can be very useful

Ex. 1008, 5; POR 13, 30

By bypassing the *Plain Old Telephone Set* (POTS) interface at a local CO, a DSL system can utilize the full potential of a copper telephone subscriber loop to deliver a transmission throughput of up to a few hundred times that of a voice band modem.

Ex. 1008, 4; POR, 35; Ex. 2007, ¶115



Ex. 2009, 26; POR, 41; Ex. 2007, ¶118

Jacobsen is Not Prior Art

“To qualify as a printed publication, a reference ‘must have been sufficiently accessible to the **public interested in the art.**” *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1348 (Fed. Cir. 2016) (quoting *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989)).

A. The MARC record does not tell us explicitly when a given issue of the periodical is made available.

Ex. 2020, 26:5-7; PO-SR, 12

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A. Not without speculating.

Q. Do you know the educational level attained by a POSITA in this proceeding?

A. I do not.

Q. Do you know what kind of work experience a POSITA in this proceeding would have had?

A. I do not, without speculating.

Ex. 2020, 10:13-22; PO-SR, 12

Demonstrative Only - Not Evidence PO-74