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March 31, 2009

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
c/o Natek, Inc.
236 Massachusetts Avenue, N.E.
Suite 110
Washington, DC 20002

Re: In the Matter of Petition for Declaratory Ruling of the City of Lansing, Michigan, on Requirements for a Basic Service Tier and for PEG Channel Capacity Under Sections 543(b)(7), 531(a), and the Commission's Ancillary Jurisdiction Under Title I, CSR-8127, MB Docket No.09-13

Petition for Declaratory Ruling of Alliance for Community Media, et al., that AT&T's Method of Delivering Public, Educational, and Government Access Channels Over Its U-verse System is Contrary to the Communications Act of 1934, as Amended, and Applicable Commission Rules, CSR-8126, MB Docket No. 09-13

Petition for Declaratory Ruling Regarding Primary Jurisdiction Referral in *City of Dearborn et al. v. Comcast of Michigan III, Inc. et al.*, CSR-8128, MB Docket No. 09-13

Dear Ms. Dortch:

Pursuant to Rule 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, AT&T respectfully submits this *ex parte* letter with the attached document, entitled "Revised Declaration of Gustavo de Veciana in Support of AT&T's Opposition to Petitions for Declaratory Ruling." The only difference between this Revised Declaration and the original version submitted as Exhibit C to the Comments of AT&T Opposing Petitions for Declaratory Ruling (filed Mar. 9, 2009), is the single sentence in paragraph 11 containing material that has been redacted for public inspection.

Thank you for your kind assistance with this matter.

Sincerely,

Geoffrey M. Klineberg

Attachment

cc: Holly Sauer
Media Bureau
FCC

John Norton
Media Bureau
FCC

ATTACHMENT

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of Petition for Declaratory Ruling of the City of Lansing, Michigan, on Requirements for a Basic Service Tier and for PEG Channel Capacity Under Sections 543(b)(7), 531(a), and the Commission's Ancillary Jurisdiction Under Title I	CSR-8127 MB Docket No. 09-13
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In the Matter of Petition for Declaratory Ruling Regarding Primary Jurisdiction Referral in *City of Dearborn et al. v. Comcast of Michigan III, Inc. et al.*	CSR-8128 MB Docket No. 09-13

REVISED DECLARATION OF GUSTAVO DE VECIANA IN SUPPORT OF AT&T'S OPPOSITION TO PETITIONS FOR DECLARATORY RULING

1. I am a Professor in the Department of Electrical and Computer Engineering at The University of Texas at Austin. My office address is Applied Computational and Engineering Sciences Building (ACES 3.120), University of Texas, Austin, TX 78712.

2. I received my B.S., M.S., and Ph.D. in Electrical Engineering and Computer Sciences from the University of California-Berkeley. My Ph.D. was awarded in June 1993. I have taught in the Department of Electrical and Computer Engineering at the University of Texas at Austin since September 1993. I teach undergraduate and graduate level courses in digital communications, communications networks, information theory, and related

areas. My professional research is focused on the design, analysis, and control of telecommunication networks, including Network Management and Performance, Wireless and Sensor Networks, and Computer Aided Design ("CAD") and Nanotechnology. My educational and professional background and a list of my publications are set out in detail in my curriculum vitae attached as Exhibit A.

3. I make this declaration to summarize:

a. The basic technological and operational differences between AT&T's Internet Protocol ("IP") based video service and the cable services provided by traditional cable TV operators; and

b. How AT&T uses its IP video technology to deliver PEG programming and commercial programming on its U-verse network.

I. TRADITIONAL CABLE SERVICE VERSUS IP VIDEO SERVICE

4. Traditional cable services operate in the same basic way as do over-the-air broadcast television stations. In both, each television channel is assigned a specific frequency band. For example, each analog TV station is assigned and carried on an exclusive frequency band of width 6 MHz. The cable system and traditional TV stations both broadcast their programming concurrently to all customers in the communities that they serve all the time. This way of partitioning resources across television channels is referred to as frequency division multiplexing, and allows users to effectively "turn a dial" to "tune" their TV/set top box to the frequency band corresponding to the program they wish to view. For present purposes, the only difference between broadcast TV stations and

traditional cable systems is that TV stations broadcast their TV signals through the airwaves, whereas traditional cable services broadcast TV signals over coaxial cables (sometimes fibers) that are connected to the homes of their customers.

5. By contrast, AT&T's IP video service uses the same fundamental technology used to provide Internet access services. Internet service providers use packet switching to establish two-way communication between a customer and one or more Internet servers/web sites. Similarly, AT&T's IP video service uses packet switching to deliver the individualized video programming each customer wants to view. On AT&T's network, video programming shares the same transport resources (including the same fiber, and twisted pair copper wire) that are used for high speed Internet access service, voice over IP telephone service, and potentially an array of other services and applications. These resources can be shared because all these services use IP packets to carry the associated data, and these can in turn be queued and scheduled for transmission across various network resources – this is sometimes referred to as statistical multiplexing. Thus, rather than portioning resources using frequency division multiplexing, the network resources can be dynamically shared on an as needed basis. By contrast with cable systems, AT&T's network delivers the information required to view a particular program *only* to those customers who have requested to view the particular television program. The delivery of information required to view a program on the AT&T network is realized via a multicasting service (described below).

II. DELIVERY OF PEG AND COMMERCIAL PROGRAMMING ON AT&T'S U-VERSE IP VIDEO SERVICE

6. AT&T uses its IP video technology to deliver both PEG and commercial programming. For both, the information necessary to display the television programming on a specific channel is transported to a customer's set top box via IP packets upon request of the customer. Below I compare the specifics of the video compression, transport facilities, and transport protocols used for PEG and commercial channels on U-verse; however, the principal difference between PEG and commercial programming on U-verse is the manner by which a customer requests the programming. For a commercial channel, a customer indicates he wishes to view a particular television program by selecting it in the electronic program guide. By contrast, for PEG programming, a customer must first open an application (by either choosing Channel 99 on the program guide or selecting the Government Education and Public Access Button on the main menu), which displays the available PEG programming, and from that display can select the program he wishes to view.

A. Video compression: ATT PEG and commercial programming.

7. The goal of video compression is to take the video source, be it analog or digital, and produce a compressed representation - a stream of bits, e.g., 0s and 1s - which has minimal average rate, bits/sec, from which the source content can still be recovered. Such compression is desirable from the point of view of reducing the resources to store and/or deliver video service.

8. There are a wide variety of standards for video compression. The relationship between the amount of information, or raw bit rate in bits/sec, used to represent the video program and the eventual perceptual quality seen by a viewer is a complex one. Indeed the video compression process is typically lossy, which means that some information is discarded, but this is done judiciously to attempt to ensure that viewers would not notice a degradation in quality. For example if one wished to communicate a long sequence of bits, say of 1000 zeros followed by a 1, one could either actually communicate the long sequence, or instead, transmit a substantially shorter message indicating that 1000 zeros should be followed by a 1. In the latter case the message is a very compact description of the original information – so it effectively compresses the original. Either approach conveys the same information to the receiver. Such compression is very desirable as it can substantially reduce the resources required to transport a video program. By analogy, because there are frequencies humans can not hear, one can compress audio signals by discarding information associated with those frequency bands without leading to a perceptual degradation in audio quality.

9. For digital video, the raw data (the 0s and 1s) is used to recreate the video program on a display. The resolution of the displayed program is usually measured in terms of the number of pixels, denoted as a horizontal versus vertical matrix. From one video frame to the next, certain pixels will remain the same. So, another example of a technique used for video compression is to only specify the information corresponding to pixels that change from frame to frame. For instance, if the background behind a talk show host stays the same from frame to frame, the information necessary to display that background need only be sent once, or at least infrequently. The multitude of video compression

standards reflect the variety of techniques that can be used to attempt to more or less aggressively compress the information required to reconstruct the video program without compromising quality.

10. Because some video compression standards are more efficient than others, the raw bit rate resulting from different compression standards is not necessarily a good metric for measuring video quality. Besides the efficiency of the compression standard, other factors can affect video quality. For instance, it is not unusual in video delivery systems for a compressed video stream to have to be transcoded, i.e., decoded from the standard in which it is received and then re-compressed using a different standard. Since the compression standards are typically lossy, transcoding may lead to changes in the eventual user perceived quality, which are difficult to assess, and may depend on the order in which compression standards are applied during the transcoding process. Further, although the goal of compression standards is to define precisely what operations should be carried out, and how information should be encoded, during video compression, the actual implementation of such standards can vary, giving different results.

11. On the AT&T U-verse system, the original PEG programming may be provided in a variety of formats by the municipality or PEG programmer (although typically via an analog signal), but AT&T or the PEG provider (depending on the jurisdiction) encodes the programming using Windows Media 9/ VC-1 Main standard, at a resolution of 480x480. The resulting raw bit rate associated with such a video stream is roughly 1.25 Mbps. In addition, digital data is included to allow reproduction of two standard audio

channels, i.e., stereo reproduction. Commercial programming is typically acquired in MPEG 2 format and then must be transcoded into MPEG 4 (H.264) at a resolution of 480x480. The resulting raw bit rate associated with such video streams is variable, with a maximum bit rate of **[***BEGIN CONFIDENTIAL***]** **[***END CONFIDENTIAL***]** The audio quality depends on the original material, but again typically would be two standard audio channels. Both of these compression standards are more efficient than the older compression standard used by digital cable providers (MPEG 2), which typically requires a raw bit rate of 2.5 to 4 Mbps to deliver a cable television standard definition channel.

12. As noted earlier, due to the subjectivity involved, making a fair comparison of video quality resulting from the compression standards used for PEG and commercial programming is not a simple matter. This would need to further account for a wide variety of factors, including differences in the original video material for PEG and commercial programming, the type of video programming, the fact that the commercial channels are generally subject to transcoding (because the PEG programming is typically received as an analog signal, it does not need to be decoded before it is encoded), the eventual display and user viewing position, and a variety of other factors. Still, although the compression standards are different, the resolution used in both cases is identical and the MPEG 4 and Windows Media 9 standards being used in the AT&T U-verse system are competing standards aiming to deliver standard quality video at a substantially reduced raw bit rate.

B. Transport Facilities and Protocols

13. Transport facilities refers to the network of fiber and copper wires that packets traverse to and from the source of video programming and the customer premises.

14. AT&T offers municipalities the option of providing its programming to AT&T over the AT&T managed network. If the municipality selects this option, IP packets associated with transporting PEG programming between the municipality and VHO are carried over a variety of possible facilities depending on the municipality, including (i) a T1 Managed Internet Service; (ii) a multilink point to point Managed Internet Service; or (iii) an Optical-Electronic Metropolitan Area Network with Ethernet direct Internet access. Thus the transport facilities from the municipality to the VHO may involve optical fiber and/or copper wire. In either case, mechanisms within the AT&T's network are in place to ensure that the packets exchanged between the VHO and customer's set top box see appropriate quality of service.

15. From the VHO to the subscriber, the PEG programming is typically transported via fiber to the node (Ethernet) and twisted copper from the node to the home. Again the network allocates sufficient bandwidth to ensure that customers will eventually receive the data required to reproduce high quality video programming.

16. In the case of commercial programming, AT&T receives the programming via fiber or satellite at the super hub office and/or VHO (local signals may be acquired over-the-air). Subsequently the same network infrastructure, as used for PEG programming, is used from the VHO to the subscriber.

17. In the AT&T U-verse network, a variety of protocols, which are used on the Internet, are used to deliver these packets to the customers, where eventually the video program can be reproduced.

18. In the case of PEG programming the Transmission Control Protocol (TCP) is used to transport packets from the municipality to the Video Hub Office (VHO). This is a point-to-point transport protocol, which involves bidirectional transmissions between the end points. This data is then transported from the VHO to the customers' set top boxes via a User Datagram Protocol (UDP) multicast session.

19. Multicasting involves a one-to-many transmission of packets on a 'tree' of links and resources from the VHO to the customers wishing to view the particular program. Unlike broadcasting done on cable networks (which involves all programming being sent to all customers), the data associated with a particular program is only sent to customers who select that programming. Such a multicasting based service, differs from one based on unicasting (typically used for transmissions from Internet websites), which involves the host server originating IP packets to each recipient who has requested information from the website.

20. Multicasting allows the network to allocate its resources more efficiently, since on any single network link, typically only one copy of each packet associated with a particular PEG station will be seen. Instead of sending multiple streams of IP packets from one source to all customers requesting specific programming (unicast), with multicast, a single copy of each IP packet is sent along each link and is replicated by routers in the network at the point where links on the tree diverge. For example, suppose a customer is

not currently viewing a given station and wishes to receive the programming on that station, his set top box will need to send an upstream packet to join the multicast distribution tree at the appropriate join point (the point closest to the customer in the network where there is a router that can copy the IP packets). Once this has occurred, when downstream packets associated with that multicast session arrive at the join point, a copy is made and transmitted down a tree branch so that customer which has joined the session receives it. When a user decides to view a different program, or turns his TV off, the set top box will send upstream packets indicating this set top box is leaving the multicast session. Subsequently the network would discontinue sending packets associated with the PEG program previously being viewed to that customer. As a result of these mechanisms, the network can be referred to as supporting a switched video service, where information flows are switched on and off, as users (set top boxes) join and leave the multicast session based on the programming they choose to view. Multicast delivers programming to customers without unnecessarily burdening the source of the programming and the customer's set top box, while using a minimum of network bandwidth. This enables AT&T's network to be exceedingly efficient in how its resources are used.

21. Transport of commercial programming on the AT&T network follows a similar process. The data associated with the video program arrives from the commercial provider to the VHO over fiber or satellite (or over-the-air for local channels). The transport protocol in this case may depend on the commercial provider. In turn, transport of data packets from the VHO to the customers is mediated via reliable UDP protocol, which again uses the same multicast strategy. Thus, once again, if a customer wishes to view a particular

commercial program, her set top box must send upstream packets to join the associated multicast session.

22. In summary, the transport facilities and protocols used by the AT&T U-verse system used to deliver PEG and commercial programming are substantially the same. In both cases, the same transport facilities are used from the VHO to the customers' premises. Also, in both cases, the customer's set top box must join a UDP multicast session which is associated with each video program. One area where the transport of PEG and commercial programming differ is that in the case of commercial programming, the U-verse system has implemented an additional mechanism enabling customer set top boxes to request unicast retransmission of packets that might have been lost along the multicast distribution tree. However, a key aspect of AT&T's network is that IP packets associated with PEG and commercial video programming are allocated sufficient bandwidth to ensure a high quality video signal. This ensures the network provides the required quality of service so that video programming can be reproduced on a timely basis at the customer premises.

23. In the Lansing petition, petitioner claims that AT&T delivers PEG channels as "low quality Internet webcasts available through web pages accessed by means of a series of click through menus." Lansing Pet. at 13. As is clear from the above discussion, this is simply not the case. First, the PEG channels are delivered on the AT&T network, just like the commercial channels, not on Internet web pages. Second, webcasts are unicast to users, whereas PEG channels are multicast just like commercial channels. Third, there is no security or quality of service ("QOS") with webcasts that have to pass through

multiple networks to get to a user. PEG channels, like commercial channels on AT&T's network, are subject to security controls and QOS. Finally, I would note that, although there is a wide variety of services one could call "webcasts" over the public Internet, they are typically encoded at no more than 300Kbps, which is indeed very far from the 1.25Mbps used to deliver PEG on the AT&T system.

C. Summary

24. AT&T's network is based on an IP packet technology, which is very different from cable TV network. Indeed it is not based on broadcasting over a shared medium, nor on partitioning shared resources via frequency division multiplexing, i.e., subdividing the spectrum into 6 MHz bands. For neither commercial nor PEG video programming is there a dedicated allocation of a frequency band on its network resources. Instead AT&T's network is designed to deliver packets associated with video, voice, and data services between VHOs and the customer set top boxes over shared resources using packet switching. AT&T's network can in principle deliver the same, and possibly enhanced, PEG and commercial programming and associated services but not in the manner based on dedicated 6 MHz frequency bands.

25. From the perspective of the video compression used in the AT&T U-verse product for PEG and commercial programming, two different, competing standards are being used, but the resolution for each is the same. The transport protocols used to deliver PEG and commercial programming on AT&T's network are the same Internet protocols, including UDP multicasting to the set top box. In the case of commercial programming, AT&T's network also includes a protocol which enables a set top box to request (unicast)

retransmission of packets which may have been lost along the multicast tree. The same access network resources, typically fiber to the node and copper to the home, are used to deliver video service. These are resources that are shared with other traffic, so to achieve quality of service, packets associated with video programming (PEG or commercial) are allocated sufficient bandwidth to ensure a high quality video can be reproduced at the customer premises. Overall, from a transport point of view, PEG and commercial programming are treated very similarly on AT&T's network. Assuming similar original PEG and commercial content, one might expect roughly the same user perceived video quality, but this would perforce be a subjective comparison.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 31, 2009.

Gustavo de Veciana

Gustavo de Veciana