

1 **Dark Fiber**

2

3 **Q. Let's turn to the fifth section of your testimony. Can you begin by summarizing**
4 **Verizon's dark fiber proposal?**

5 A. Verizon has not filed a proposed tariff for dark fiber. However, in its testimony filed on
6 August 11, 2000, Verizon explains that a CLEC will be able to order dark fiber between
7 central offices (which it classifies as interoffice fiber or "IOF") and connecting central
8 offices (COs) to end users (which it classifies as "loop"). [Sanford and Stern Direct Panel
9 Testimony, p. 31]. These witnesses further explain:

10

11 Unbundled IOF dark fiber originates and terminates at separate Verizon
12 PA COs where the CLEC has collocation arrangements, or originates at a
13 Verizon PA CO and terminates at a CLEC CO or point of presence
14 ("POP"). Unbundled IOF dark fiber is offered on a route-direct basis. For
15 dark fiber terminating at the CLEC's CO/POP, a dispatch out is required
16 to install the jumper to the demarcation point and to perform a continuity
17 test.

18

19 An unbundled loop dark fiber network element originates at a collocation
20 arrangement in a Verizon PA central office and terminates at Verizon
21 PA's hard termination point in the main telco room at an end-user
22 premises within that SWC. [Id.]

23

24 **Q. Have you identified any problems associated with Verizon's dark fiber proposal?**

25 A. Yes. First, the rates proposed by Verizon are too high, because they allocate an
26 unreasonably large amount of underground conduit cost to the dark fibers. Second, I have
27 some concerns regarding Verizon's proposal to set aside certain fibers for its own use.
28 Third, I have some questions regarding Verizon's definition of dark fiber as a
29 "continuous" strand, and its proposed restrictions on eligible points of origination and
30 termination. Fourth, there are problems with the manner in which Verizon calculated
31 distance sensitive costs and rates. Finally, it appears Verizon has used excessive annual
32 cost factors which are not consistent with the Commission's decision in the Global Order.

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Conduit Costs

Q. Let’s discuss the first problem. What has Verizon done concerning conduit costs?

A. A substantial portion of the proposed dark fiber rates is derived from the portion of Verizon’s cost study relating to underground conduit investments. Verizon begins with an estimated cost of [Begin proprietary] \$ [End proprietary] per duct foot. It applies a fill factor of [Begin proprietary] [End proprietary] and it assumes each duct can hold just [Begin proprietary] [End proprietary] fiber sheaths. The net effect of these assumptions is to calculate an effective conduit cost of [Begin proprietary] [End proprietary] per installed sheath foot.

Q. Do you agree with Verizon’s conduit assumptions?

A. No. Among other problems, Verizon’s methodology largely ignores the fact that a typical copper cable sheath occupies much more conduit space than a typical fiber cable sheath. At one point in Verizon’s calculations, it lumps copper and fiber sheaths together, as if they both occupy equivalent amounts of conduit capacity, and it makes the implicit, incorrect assumption that conduit feet can be directly compared to sheath feet, as if each duct can only hold one sheath. In reality, copper cable tends to be very bulky, and thus it will sometimes occupy the entire amount of space available in a single duct. Of course, even with copper cable, exceptions exist. For instance, some ducts may be large enough to hold several copper cable sheaths. Even where this is the case, the number of fiber sheaths which can fit into the duct is likely to be far greater than the number of copper cable sheaths. In any event, it is not reasonable to allocate costs between fiber and copper cables on a per-sheath foot basis, because the amount of required duct space tends to be much smaller for a fiber system, (due to the much smaller number of cable pairs in a typical fiber sheath).

1 Furthermore, the conduit system costs developed by Verizon include more than
2 just the ducts. They also include the cost of manholes and underground vaults which are
3 used to gain access to the cable, and to install and maintain splices within the cable. Here
4 again, it is not reasonable to allocate the costs of the system on a per sheath foot basis, as
5 if copper and fiber cables were equivalent. In general, it is reasonable to assume that the
6 cost of manholes and underground vaults is disproportionately attributable to copper
7 cable, since this type of cable is likely to require more frequent splicing (due to its size
8 and weight, reels of copper cable tend to be relatively short). Also, depending upon the
9 network configuration involved, there is likely to be a greater need to provide
10 intermediate points of access to copper cable.

11 For all of these reasons, it is not reasonable to allocate conduit costs between
12 copper and fiber cable on a per sheath-foot basis. Consider, for example, a situation in
13 which a conduit system holds a fiber cable connecting two central offices, as well as
14 copper feeder cables which connect those central offices to customers. In this situation,
15 manholes and/or underground vaults will be required at frequent intervals along the route
16 to access the copper cable, whereas there might be very limited need to gain access to the
17 fiber at intermediate points along the route. Yet, under Verizon's methodology, this
18 difference is ignored, and the cost of the manholes and underground vaults is largely
19 treated on a uniform per sheath foot basis.

20 Needless to say, Verizon's methodology is unreasonable. For example, for the
21 cost of a conduit system which is capable of accommodating a typical large copper cable
22 sheath, one could build a conduit system which can accommodate numerous small fiber
23 cable sheaths. While Verizon partially compensates for this flaw in its methodology by
24 assuming that **[Begin proprietary]** **[End proprietary]** fiber cable sheaths will
25 occupy each duct, this does not go far enough. The net effect of its approach is to allocate
26 an excessive share of the overall conduit system costs to fiber, and thus to users of the
27 dark fiber UNEs.
28

1 **Q. Have you quantified the impact of correcting this problem?**

2 A. Yes. There are several ways this problem could be solved. For instance, one could
3 prepare a detailed analysis of conduit costs, to determine the forward looking cost of
4 building a conduit system which accommodates both copper and fiber cables, and then
5 determine what fraction of the total cost should be allocated to each fiber sheath, and
6 what fraction to each copper sheath, taking into account differences in sheath size, the
7 need for intermediate access points, and so forth. Another approach would be to
8 determine the incremental costs which are incurred when a conduit system which
9 primarily accommodates copper cables is expanded to also accommodate fiber cables.
10 Either of these approaches would be reasonable and would potentially produce
11 considerably different results than Verizon's methodology, but they would involve
12 considerable amount of data gathering and effort.

13 For purposes of this proceeding, I recommend using a much simpler, and
14 hopefully less controversial solution to the problem. I would modify Verizon's
15 methodology as discussed above, and make one very significant change. Specifically,
16 where Verizon makes the assumption that each duct can hold just **[Begin proprietary]**

17 **[End proprietary]** fiber sheaths, I recommend substituting an assumption that each
18 duct can hold four sheaths. This is a reasonable, albeit conservative, assumption for two
19 reasons: (1) conduit systems can accommodate as many as six or more fiber sheaths in
20 each duct (using an inner duct design) and (2) this assumption does not explicitly deal
21 with the less frequent need for manholes and underground vaults to provide access to a
22 typical fiber cable.

23 The results of making this simple adjustment to Verizon's study are presented in
24 the table below.

25 **Table 2**
26 **Conduit Investment**
27 **Using 4 Fiber Cables per Duct**
28 **[Begin Proprietary]**
29

	2 Fiber Cables per	4 Fiber Cables	
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	Duct	per Duct	% change

[End Proprietary]

The impact of this adjustment on the total monthly cost of each dark fiber pair will be summarized at the end of this section.

Availability of Unlit Fibers

Q. Can you now explain the problems associated with the availability of unlit fibers?

A. Verizon proposes to reserve many unlit fibers for its own use, including an allowance for unspecified growth, as well as emergency spares, making it difficult or impossible for CLECs to gain access to these fibers. Verizon provides the following explanation:

In order to maintain the integrity and reliability of the BA network and meet known, near-term customer service requirements, a reasonable quantity of fibers will not be available for assignment for dark fiber services. This includes maintenance fibers used for emergency repairs and/or network rearrangements, fibers allocated for known near term customer service requirements, and fibers identified for network survivability projects. [Verizon’s Dark Fiber Service Description]

I am concerned that there is a potential conflict between Verizon’s stated policy and other aspects of Verizon’s approach. To appreciate the potential conflict, it is important to realize that CLECs will already be paying for some of Verizon’s spare fiber capacity, because the proposed dark fiber rates were developed using “fill” factors (for both the fiber itself and the conduit system) which effectively provide Verizon with a reserve, or cushion, which it can use to accommodate many of the same needs mentioned above.

1 For example, because Verizon is using an 85% fill factor, within a cable sheath
2 containing 84 fiber strands, dark fiber users will be contributing to the cost of setting
3 aside approximately 12 strands which can be used by Verizon for maintenance,
4 emergency repairs, network rearrangements, and network survivability projects.
5 Similarly, because Verizon is using a fill factor in developing its conduit costs, dark fiber
6 users will be contributing to the cost of setting aside spare duct space which could be
7 used by Verizon to accommodate additional fiber cable. This provides Verizon with a
8 cost-effective alternative if its inventory of unlit fiber runs low, it needs to replace
9 existing fibers which are failing to work properly, or if it needs more fibers to
10 accommodate growth.

11 Under Verizon's approach, it retains the right to reserve a substantial number of
12 unlit fibers for its internal needs, yet it requires the CLECs who rent dark fiber to
13 contribute to the cost of maintaining much, if not all, of this spare inventory.
14 Furthermore, Verizon requires these CLECs to also contribute to the cost of maintaining
15 spare conduit capacity, which could potentially accommodate the installation of
16 additional fiber cable, if Verizon's reserve supply of unlit fibers ever runs out.

17
18 **Q. Have other states expressed any concerns regarding this policy of holding spare**
19 **fiber in reserve for Verizon's internal use?**

20 A. Yes. For instance, the Massachusetts Department of Telecommunications and Energy
21 DTE has expressed concern about a policy which would allow Verizon to hold in reserve
22 an excessive amount of fiber:

23
24 a general statement by NYNEX that fiber is needed for unspecified or
25 general future growth, *or even for a particular customer's potential long-*
26 *term growth*, will not suffice to relieve it of its obligation to offer the dark
27 fiber for resale. [Order, D.P.U. Docket Nos. 96-73/74, 96-75, 96-80/81,
28 96-83, 96-94, Phase 3, December 4, 1996, p. 50]
29

30 The DTE further held:

1
2 In summary, the concern we raised in the Phase 3 Order about an artificial
3 barrier to competition remains valid. We find that Bell Atlantic's proposed
4 language would codify the excuse of an unspecific service obligation to
5 limit the availability of dark fiber to its competitors. Accordingly, unless
6 Bell Atlantic has received a specific order for fiber-related service from a
7 given customer, it may not reserve the use of a fiber strand for that
8 customer and thereby limit its availability to CLECs. The compliance
9 filing shall reflect this provision. [Order, D.P.U./D.T.E. Docket Nos. 96-
10 73/74, 96-75, 96-80/81, 96-83, 96-94, Phase 4-N, December 13, 1999,
11 pp.19-20.]
12

13 The DTE also expressed reservations about providing Verizon with unlimited discretion
14 to reserve unlit fibers for “maintenance” and emergency purposes, and it endorsed some
15 guidelines in this regard which had been proposed by AT&T. [Id., pp. 20-21] AT&T's
16 witness suggested that five percent of fibers in a sheath should be presumed to be
17 reserved for maintenance. However, in smaller cables, including those with 12 or 24
18 fibers, a minimum of two fibers should be reserved for maintenance. In an extremely
19 large fiber cable, no more than 12 fibers should be reserved for maintenance. [Id.] The
20 DTE held that “if, in the course of denying dark fiber service to a CLEC, Bell Atlantic is
21 relying on reserving fibers for maintenance in excess of that proposed by AT&T, it shall
22 inform the CLEC that it is doing so and the reasons therefore”. [Id., p. 21]
23

24 **Q. What are your recommendations concerning this issue?**

25 A. First, I recommend that the Commission reject any effort by Verizon to insert vague
26 language into its dark fiber tariff which would give it wide discretion to reserve unlit
27 fibers for itself, or to deny CLECs reasonable access to unlit fibers. Instead, the
28 Commission should limitations similar to those required by the Massachusetts DTE. Such
29 limitations will ensure that Verizon does not have unbridled discretion to deny CLECs
30 access to its unlit fibers. Second, I recommend CLECs should be allowed to dip into this
31 reserve supply of unlit fibers in the event that one of the fibers they are renting from
32 Verizon fails. Unless CLECs are provided with some assurance that dark fibers that fail

1 will be replaced from Verizon’s inventory of emergency spares, each CLEC may be
2 forced to rent additional spare fibers in order to provide their own emergency reserve.
3 The approach I recommend is far more efficient than if each carrier is forced to maintain
4 its own separate inventory of reserve fibers. This policy is also appropriate because
5 CLECs are contributing, through the fiber fill factor, to the cost of the spare fibers which
6 Verizon sets aside for emergencies. If CLECs have with access to these reserve fibers in
7 the event of an emergency, they will receive value in return for their contribution toward
8 the cost of maintaining this inventory.

9
10 *Definition of Dark Fiber*

11
12 **Q. Let’s turn to your concerns regarding Verizon’s proposed definition of dark fiber,**
13 **and their proposed delineation of originating and terminating locations. Can you**
14 **describe your concerns?**

15 A. Verizon defines dark fiber as an “unlit continuous fiber optic strand...” and states that a
16 strand is not considered continuous “if splicing is required to provide fiber continuity
17 between locations.” [Dark Fiber Service Description, page 1]. Verizon’s proposal makes
18 it extremely difficult, if not impossible, for CLECs to design their networks efficiently.
19 Although Verizon has not fully explained the process through which CLECs would find
20 out where dark fiber is available in Pennsylvania, it appears that Verizon intends to
21 require CLECs to submit requests for dark fiber which identify specific originating and
22 terminating locations. The net effect is something of a “Catch 22.” CLECs are not told
23 where Verizon’s fibers originate and terminate, and to find out where dark fiber is
24 available, they have to submit specific inquiries about particular locations. This approach,
25 especially when combined with the definitions set forth in Verizon’s dark fiber service
26 description, will make it needlessly difficult and costly for CLECs to gain access to
27 Verizon’s unlit fibers. Under this approach, Verizon may be able to “hide” its unlit fibers
28 from CLEC’s, or at least force them to pay for costly “records reviews” in an effort to
29 determine whether, and to what extent, unlit fiber is available which a CLEC might find

1 useful in connecting from one area to another. Instead of requiring CLECs to submit
2 multiple request for dark fiber information, Verizon should be required to provide dark
3 fiber location, conduit maps, and other information that would enable CLECs to identify
4 appropriate dark fiber solutions to design their networks efficiently.

5
6 **Q. Can you be more specific as to how dark fiber might be “hidden” from CLECs, and**
7 **why there could be problems with the proposed language which defines dark fiber**
8 **as continuous strands?**

9 A. Certainly. Consider a simplified example as shown on Schedule 1: Assume a CLEC
10 needs some fiber to transport traffic between Verizon wire centers A and D, and the
11 CLEC pays Verizon to find out if any dark fiber is available between these locations. If a
12 continuous fiber optic strand does not currently exist all the way from A to D, Verizon
13 will report back to the CLEC that dark fiber is “not available”. Verizon could report that
14 dark fiber is “not available” even if it has plenty of unlit fibers that could be used for this
15 purpose. For instance, it might have fibers connecting A and B, as well as fiber
16 connecting B and D. Similarly, it might have fibers available along the route from A to C,
17 from C to F and from E to D.

18 In this example, it is obvious that, with a bit of effort, Verizon could piece
19 together a continuous fiber optic path between A and D. There are multiple ways this
20 could be accomplished, yet, because a pre-existing “continuous strand” does not exist
21 with A and D as the specific originating and terminating points, under Verizon’s
22 proposal, it would be free to report back to the CLEC that dark fiber is not available. In
23 fact, under its proposal, the only way the CLEC could gain access to any of this dark
24 fiber would be if it were to submit (and pay for) enough queries concerning enough
25 potential points of origination and termination to learn about the segments of unlit fiber
26 which are available along various portions of the potential routes from A to D. If the
27 CLEC succeeded in learning about these segments, it would then need to rent the fibers in
28 question and establish a collocation arrangement in each of the central offices, in order to

1 splice these fiber segments together, in order to achieve the overall goal of connecting A
2 to D.

3
4 **Q. You mentioned that Verizon’s definition of dark fiber excludes potential routes that**
5 **could be achieved through splicing. Can you elaborate on how Verizon might “hide”**
6 **its Dark Fiber from CLECs as a result of its definition of a “continuous strand”?**

7 A. Yes. Look again at Schedule 1, and consider another possibility: Assume a CLEC wants
8 to rent some dark fiber to transport traffic between A and B. As it happens, fiber is
9 available along the entire route from A to B, but at one or more points along this route,
10 the fibers have not been spliced together. Because of these unspliced gaps in the fiber,
11 Verizon would be free to report back to the CLEC that dark fiber is not available from A
12 to B, because a continuous fiber optic strand does not currently exist between these two
13 points.

14 Unspliced gaps along a fiber route might exist for any number of reasons. For
15 instance, there may be uncertainty concerning future growth in the network (e.g. the
16 unspliced fibers could be spliced one way to connect A to B, or spliced another way to
17 connect A to a different wire center, or spliced still another way to connect A to a nearby
18 remote terminal. Rather than committing in advance to a particular network
19 configuration, Verizon might decide to leave some of the unlit fibers unspliced, thereby
20 assuring itself of maximum flexibility in deciding how they should be used in the future.
21 Needless to say, if Verizon’s approach to dark fiber is accepted, it would have an
22 economic incentive to leave unspliced gaps in its unlit fibers, thereby making it more
23 difficult or impossible for CLECs to learn about, or gain access to, these unlit fibers.
24 Even if the CLEC discovered that it exists, it might be prevented from renting the unlit
25 fibers if the gaps occur at locations along the route which are not allowable points of
26 origination or termination under the terms of Verizon’s tariff.

27

1 **Q. What is the process by which CLECs will determine if fiber is available along a**
2 **certain route?**

3 A. Verizon has proposed a non-recurring “records review” charge of \$224.67 which would
4 have to be paid by a CLEC which was interested in renting dark fiber. [Revised Exhibit 1,
5 Direct Panel Testimony]. Verizon explains that:

6
7 [T]his non-recurring charge will be assessed on all new dark fiber orders
8 and recovers the cost of the initial records review to determine if spare
9 fiber is available. The charge will be applied per dark fiber network
10 element based upon the quantity field in the ASR [(Access Service
11 Request).] [Panel Direct, p. 36]
12

13 Verizon’s filing in this proceeding does not include a detailed explanation of precisely
14 what this record review process entails, or how CLEC’s would be billed for this activity.
15 However, some additional information is included in at least two publicly available
16 Interconnection Agreement Amendments filed by Verizon in Pennsylvania. The
17 Amendment provides as follows:

18
19 (4) Prior to ordering access to a Dark Fiber Loop or Dark Fiber IOF
20 between two locations, [CLEC] shall make a request to BA that BA
21 review its existing cable records to determine whether spare Dark Fiber
22 Loop facilities or Dark Fiber IOF facilities (as the case may be) are
23 available between those locations. (...a “Dark Fiber Inquiry Request”). If
24 spare facilities are available, BA shall notify [CLEC] and provide [CLEC]
25 with an estimate of the mileage of those facilities....¹
26

27 While the language in the Amendment is somewhat ambiguous, it would seem that under
28 Verizon’s proposal in this proceeding, a CLEC would need to pay \$224.67 times the

¹ Joint Petition of Verizon Pennsylvania, Inc. (formerly Bell Atlantic-Pennsylvania, Inc.) and DSL NET Communications LLC d/b/a DSL.NET for Approval of Interconnection Agreement, Docket No. A-310824F0002, Amendment No. 3, Sec. 1(b)(4), filed September 6, 2000, p. 5 (attached hereto as Exhibit BJ-1). See also Joint Petition of Verizon Pennsylvania, Inc. (formerly Bell Atlantic-Pennsylvania, Inc.) and Fairpoint Communications Corporation for Approval of an Interconnection Agreement, Docket No. A-310725F0002, Amendment No. 2, Sec. 1(b)(4), filed September 5, 2000. The language in these amendments is virtually identical to the language in Bell Atlantic-Pennsylvania, Inc.’s template amendment as of June 2, 2000.

1 number of fiber strands it needs, for each potential point-pair combination it wants to
2 know about. The Amendment also describes another option, which CLECs could use in
3 an effort to discover where dark fiber might be available:
4

5 (5) Upon request, and subject to time and material charges to be quoted by
6 BA, BA shall provide to [CLEC] the following information:
7

8 (i) A fiber layout map that shows the streets within a wire center
9 where there are existing BA fiber cable sheaths. ... [CLEC]
10 acknowledges that fiber layout maps do not show whether or not
11 spare fiber facilities are available. BA shall provide fiber layout
12 maps to [CLEC] subject to a negotiated interval.
13

14 (ii) A field survey that shows the availability of dark fiber pairs
15 between two BA central offices, a BA central office and a [CLEC]
16 central office or a BA end office and the premises of a Customer,
17 shows whether or not such pairs are defective, shows whether or
18 not such pairs have been used by BA for emergency restoration
19 activity and tests the transmission characteristics of BA dark fiber
20 pairs.... BA shall perform a field survey subject to a negotiated
21 interval. If a [CLEC] submits an order for a dark fiber pair without
22 first obtaining the results of a field survey of such pair, [CLEC]
23 assumes all risk that the pair will not be compatible with [CLEC]'s
24 equipment, including, but not limited to, order cancellation
25 charges. [Id., p.6]
26

27 Verizon's proposed \$224.67 charge for a "records review" appears to correspond to the
28 activities described in paragraph 4 above; however, Verizon has provided little detail
29 regarding this charge. Verizon has not mentioned the other two options (described in
30 paragraph 5 above) in its filing in this proceeding.
31

32 **Q. You mentioned that a CLEC might have to pay multiple records review charges to**
33 **determine whether dark fiber is available between 2 points. Can you clarify this**
34 **concern?**

1 A. Yes. Consider again the diagram shown in Schedule 1. Suppose a CLEC wants to rent
2 dark fiber from wire center A to wire center D. It submits a record request for A to D, and
3 is told that no dark fiber is available between these particular points. It subsequently
4 submits a long series of requests, waiting for the response each time, before submitting
5 further requests. In this example, the sequence of requests might be as follows:

6
7 A to D? No.
8 A to B? No.
9 A to F? No.
10 A to C? Yes.
11 C to D? No.
12 C to E? No.
13 C to F? Yes.
14 F to D? No.
15

16 Depending upon how many requests are submitted at once, and how long each request
17 takes to process, months may have passed, and the CLEC still has not located any
18 continuous unlit strands between A and D. Assuming it does not give up in frustration, it
19 may consider renting fibers along the route from A to C and C to F, then installing its
20 own fiber from F to D. Or, it might continue the tedious process, patiently submitting a
21 series of additional requests, in hopes of finding a usable path, with the following results:

22
23 F to E? Yes.
24 E to D? No.
25 B to D? Yes.
26 C to B? No.
27 F to B? No.
28 E to B? Yes.
29 F to E? Yes.
30

31 Thus, the CLEC finally discovers that a circuitous route can be pieced together from A to
32 D, assuming the CLEC is willing to rent and splice together the following dark fiber
33 segments: A to C; C to F; F to E; D to B; B to D. However, it took the CLEC more than a

1 dozen requests to obtain this information, requiring a substantial expenditure of time,
2 money, and effort. In this example, if the CLEC indicated that it needed 4 dark fiber
3 strands, and therefore it was charged \$898.68 for each of the requests it submitted, it
4 would have paid Verizon \$13,480.2 for these record requests before finally discovering
5 how it can rent dark fiber from A to D. In addition, the CLEC would have to establish
6 collocation arrangements at C, F, and E and B, and pay all associated costs, in order to
7 implement the necessary splicing.

8 While this example illustrates the nature of the problem, it tends to understate the
9 degree of difficulty facing a CLEC seeking to identify and rent unlit fibers in Verizon's
10 network. Keep in mind that Schedule 1 is a highly simplified example, which only shows
11 a handful of wire centers and potential interoffice routes. In actual practice, a much wider
12 array of inter-office routes may exist, and it may be impossible for a CLEC to find out
13 about some of the dark fiber which it might want to rent.

14
15 **Q. Can you explain in greater detail why it may be impossible for a CLEC to learn**
16 **about dark fiber which it could potentially use?**

17 A. Yes. In the simplified interoffice examples we have been discussing, it may seem
18 relatively easy (albeit costly) for a CLEC to inquire about every potentially relevant point
19 pair combination, in an effort to discover where dark fiber might be available. Since a list
20 of all Verizon wire centers is readily available, the CLEC can potentially submit record
21 requests concerning every potentially relevant combination of these locations. However,
22 assuming a CLEC has sufficient capital to pay substantial amounts for dark fiber
23 requests, this "shotgun" approach will only work with a limited portion of Verizon's
24 cable. The CLEC cannot possibly know all of the other locations on where unlit fibers
25 might potentially originate or terminate. In practice, Verizon typically has fiber running
26 between many other points on its network, in addition to its inter-office routes. For
27 example, it may have fibers connecting its wire centers to some of its FDIs, and to some

1 of its end users. A CLEC has no practical way of discovering all of the locations where
2 dark fiber might potentially originate or terminate.

3 To clarify this point, consider again the diagram in Schedule 1. Assume a CLEC
4 wants to connect wire centers B and D, but no dark fiber is available between these two
5 locations. However, ample unlit fibers exist in Verizon's feeder network which could be
6 helpful to a CLEC in achieving its goal of connecting A to D. Assume, for example, that
7 unlit fibers are available in Verizon's feeder network running to a remote terminal
8 located roughly one-half mile southeast of wire center B, at the point marked "RT1" on
9 the diagram. Similarly, unlit fiber is available which runs to a remote terminal a little
10 more than a mile to the north of wire center D, located at the point marked "RT2". Thus,
11 a CLEC could potentially rent dark fiber from point A to RT1, as well as dark fiber
12 running from point D to RT2. To fully connect B to D, it would need to install an extra
13 half mile of fiber between RT1 and RT2. This approach might be an efficient and cost-
14 effective solution to the CLEC's goal of connecting B to D, under Verizon's proposal, the
15 CLEC might never discover the availability of these fiber segments, since it would not
16 necessarily know about either of these remote terminals, or have any reason to list them
17 on its request for a records review.

18 Under the approach proposed by Verizon, the problem just illustrated could occur
19 quite frequently, and thus CLECs will not be given a reasonable opportunity to rent dark
20 fibers that would be useful to them. To appreciate the magnitude of this problem,
21 consider just one more example. Assume Verizon has fiber running to a point just down
22 the street from a large office building. A CLEC wants to rent some dark fiber to serve an
23 end user located in this building. If the CLEC submits a request for dark fiber from this
24 building, it may be told that it is "not available," because Verizon's fiber system does not
25 penetrate into the building. Under Verizon's approach, it would not necessarily have to
26 disclose that dark fiber is readily available at a nearby point just down the street.

27

1 **Q. You also indicated that Verizon wants to limit the points where CLECs can rent**
2 **dark fiber. Can you elaborate on this concern?**

3 A. Yes. To begin with, Verizon defines Loop Dark Fiber as originating “at a collocation
4 arrangement in a BA Central Office” and terminating “at BA’s hard termination point in
5 the main telco room at an end user premises within the serving wire center”. [Panel
6 Direct Testimony, Attachment G, Dark Fiber Service Description] This is far too
7 restrictive. CLECs should be allowed to rent smaller segments of dark fiber, wherever
8 these exist within Verizon’s network and it is technically feasible for the CLEC to utilize
9 these segments. At a bare minimum, CLECs should be allowed to rent unlit fibers from
10 the central office to Verizon’s FDI’s. This would allow competitors to use these fibers in
11 conjunction with unbundled subloops (using Verizon’s copper distribution cable).
12 Similarly, CLECs should be allowed to rent unlit fibers from the central office to “nodes”
13 in Verizon’s fiber network, or any other point where it is technically feasible to provide
14 the CLEC with access to the cable. The Massachusetts DTE recently reached a similar
15 conclusion in this regard, when it required Verizon to make dark fiber available at all
16 splice points, as well as at all collocation and hard termination points. [Order, Docket
17 Nos. 96-73/74, 96-75, 96-80/81, 96-83, 96-94, August 17, 2000]

18
19 **Q. What do you recommend that the Commission do concerning the problems you**
20 **have been discussing?**

21 A. First, the Commission should insist on tariff language which makes it easier for CLECs
22 to identify the existence and location of unlit fibers, and to gain access to these fibers. For
23 instance, CLECs should not be required to specify the exact location where they want the
24 fiber to originate or terminate; instead, CLECs should be allowed to submit broadly
25 worded requests, so that a single request can uncover all potentially relevant unlit fiber.
26 Second, the tariff should provide CLECs with the option of splicing fiber segments
27 together under an efficient, low cost, “virtual collocation” arrangement. Third, the tariff
28 should incorporate appropriate tariff provisions which ensure that CLECs have the option

1 of renting unlit fiber segments between any combination of locations where it is
2 technically feasible to provide the CLEC with access to the fiber, including all
3 collocation and hard termination points, as well as all accessible splice points.
4

5 *Distance-Related Costs*

6
7 **Q. Could you explain your concern regarding distance related costs and rates?**

8 **A.** Verizon proposes to charge for IOF dark fiber in whole mile increments, rounded up to
9 the nearest mile. This proposal is unreasonable, and imposes excessive costs on CLECs.
10 The proposal to round up has the effect of allowing Verizon to charge, on average, for a
11 non-existent extra 1/2 mile of cable on every route. This proposal was rejected in
12 Massachusetts, where the DTE stated that this “rounding up” approach was:
13

14 [E]specially notable in this service offering, where many of the leased
15 fiber strands are likely to be in sub-mileage lengths or short mileage
16 lengths, reflecting service between a central office and a portion of a local
17 serving area. Thus, we need to select a billing unit that is appropriate to
18 the actual lengths of circuits being ordered. [Order, D.P.U./D.T.E Docket
19 Nos. 96-73/74, 96-75, 96-80/81, 96-83, 96-94, Phase 4-N, December 13,
20 1999. p. 37]
21

22 **Q. What do you recommend concerning distance measurements?**

23 **A.** I recommend that the distance sensitive rates be developed in much shorter increments,
24 such as 1/10 mile, rather than 1 mile increments; this is the approach adopted in
25 Massachusetts, where the DTE concluded that, “it appears to us that a billing unit of a
26 tenth of a mile is reasonable and should be employed.” [Id.] The DTE rejected Verizon’s
27 proposal to add an additional “billing” factor to the dark fiber rates to recover the alleged
28 costs of converting the Company’s billing systems. [Id.] Furthermore, it would be
29 reasonable to require Verizon to round up or down, as applicable, rather than always
30 rounding up.
31

1 **Q. Verizon also used an “air to route” factor to develop its proposed distance sensitive**
2 **rates. Does this concern you?**

3 A. Yes. This type of adjustment factor is sometimes used in cost studies to accommodate
4 differences between the nominal (straight-line) distance between two points and the
5 actual distance traversed, because the route does not actually follow a straight line. This
6 type of factor is typically used in situations where it is not feasible to measure the actual
7 distance traversed in connecting two points. The primary reason why the actual ground
8 distance, and therefore cable quantity, between two points might be larger than the air
9 distance between these points is that roads and streets does not necessarily follow a
10 straight line (the zigzag phenomena).

11

12 **Q. The concept of using an air-to-route factor seems reasonable. Is there anything**
13 **wrong with Verizon’s specific proposal?**

14 A. Yes. Verizon has proposed to use a very high air-to-route factor, of **[Begin proprietary]**
15 **[End proprietary]** in their Dark Fiber studies. This greatly exceeds the typical
16 difference between the air distance and route distance between any two points, assuming
17 direct routing. In support of its proposed factor, Verizon cites to an internal study which
18 it apparently did not include in its filing in this proceeding. Given the large magnitude of
19 its proposed air-to-route factor, this study probably does not accurately measure direct
20 route distances, or else it reflects the impact of indirect and/or redundant routing.

21 If one were to look at total cable quantities installed in a network, and compare
22 this total to the minimum “air” distances between the points of origination and
23 termination in that network, the former figure will greatly exceed the latter figure,
24 because it is sometimes more efficient to connect two locations by way of one or more
25 other locations, in order to gain the benefit of increased economies of scale and the
26 benefits of redundant routing (e.g. SONET rings).

27 To the extent circuitous routing exists in Verizon’s network, this phenomenon
28 should not be dealt with through an air-to-route factor. The amount of redundancy and

1 indirect routing required by a CLEC's network configuration will not necessarily match
2 the amount which is present in Verizon's overall network configuration. More
3 importantly, a CLEC may rent dark fiber in a series of short segments (e.g. between wire
4 centers). To the extent the CLEC incorporates circuitous routing or redundancy into its
5 network configuration, it may be paying for this extra distance through the cumulative
6 effect of the series of short segments which it is renting. Thus, if circuitous or redundant
7 routing were reflected in the rate paid per mile, the CLEC would be forced to pay twice
8 for the same phenomenon (once through the per mile rate, and again through the number
9 of miles it is paying for).

10
11 **Q. Do you have a graphical example of how a CLEC might pay for circuitous routing**
12 **through the number of miles of fiber it is renting?**

13 A. Yes. I can illustrate this concept using Schedule 1. This shows a hypothetical interoffice
14 network consisting of six wire centers. In this example the IOF cable routes are
15 represented by the bold lines connecting the wire centers (the squares labeled A through
16 F). For simplicity, assume that the grid lines represent large city blocks, each of which is
17 1/4 mile long. Hence, the route distance between A and B is 3 miles (4 blocks east, then 4
18 blocks south, then 4 more blocks to the east). The dotted line drawn between A and B
19 represents the air distance between these two points. Using the Pythagorean theorem, this
20 distance is calculated to be 8.94 blocks or 2.24 miles. This indicates that the route
21 distance is 1.34 times the air distance ($3/2.24$), reflecting the zigzag phenomena
22 mentioned earlier.

23 Admittedly, the total amount of cable needed to connect two points will
24 sometimes be inflated by the need to rely upon circuitous routing. For instance, a CLEC
25 might want to rent fiber from A to D, and the only available path might follow the
26 circuitous route from C to E to F and then to D. The total distance traversed along this
27 indirect routing is approximately 12.75 miles. However, the air distance from A to D is
28 approximately 4.42 miles (using the Pythagorean theorem, as discussed above).

1 Consequently, the overall air-to-route ratio in this example is 2.88 (12.75/4.42). Under
2 Verizon's proposal, the CLEC might be charged for the air distance between A and D,
3 but it would nevertheless contribute to the cost of this additional cable, because the rate
4 per mile would be increased by a factor of **[Begin proprietary]** **[End**
5 **proprietary]**. In this particular situation, Verizon's approach does not necessarily cause a
6 serious problem, although it is not particularly accurate. The problem is that this is not
7 the only way a CLEC might rent fiber from A to D. For instance, it might rent a series of
8 short segments, from A to C, from C to E, from E to F and from F to D. In that situation,
9 Verizon's approach would grossly overcharge the CLEC, because the CLEC shoulder the
10 burden of circuitous routing once through the number of miles and again through the rate
11 per mile.

12
13 **Q. What is your proposed solution?**

14 A. Instead of charging for circuitous routing through the per-mile rate, it would be preferable
15 to charge for the actual number of miles traversed. For example, if a CLEC rents fibers
16 from A to D by way of C, E and F, it would pay for the mileage between each of these
17 points, regardless of whether it rents this fiber as a single continuous piece, or a series of
18 shorter segments originating and terminating in each of these wire centers. Either way,
19 the CLEC should pay for the actual quantity of cable rented, rather than paying a higher
20 rate per mile applied to a mileage quantity which will vary depending upon how the order
21 is placed.

22 Ideally, the CLEC should pay for the exact mileage associated with the actual
23 fibers it rents. Thus, if the fiber it rents does not follow a straight-line path between two
24 points, the quantity of fiber which the CLEC is billed for should reflect this zigzag
25 phenomena. This approach would eliminate the necessity for using an air-to-route factor,
26 and it will tend to yield the most accurate billing, assuming Verizon maintains
27 sufficiently detailed engineering records to enable it to measure these distances
28 accurately.

1 Needless to say, under this billing approach, the CLEC should be informed of the
2 proposed route, and associated cable quantities, at the time it receives Verizon's response
3 to its initial request for a records review. This will enable it to make an informed
4 purchasing decision.

5
6 **Q. Do you have any other concerns relating to Verizon's proposed approach to billing**
7 **distances?**

8 A. Yes. Verizon proposes to charge for IOF-related dark fiber channel terminations to a
9 CLEC's point of presence (POP) based upon the statewide average loop length. This
10 proposal is unreasonable, and potentially imposes excessive costs on CLECs. There is no
11 basis for assuming that CLECs will locate their POP facilities a long way from Verizon's
12 wire centers. To the contrary, it is reasonable to assume that CLECs will tend to locate
13 their facilities near Verizon's wire centers for two reasons. For one thing, Verizon's wire
14 centers tend to be located near the heart of population clusters (e.g. in the center of town),
15 and an efficient CLEC is also likely to put its facilities near these same population
16 clusters (especially in smaller towns and cities). For another thing, a CLEC knows it
17 needs to interconnect with Verizon, and that the shorter the path between its facilities and
18 Verizon's, the more it can potentially reduce costs and improve quality. Accordingly,
19 CLECs will often situate their facilities as close to the incumbent carrier's wire centers as
20 possible. Rather than charging the CLEC for the statewide average loop length of **[Begin**
21 **proprietary]** **[End proprietary]**, CLECs should be charged for the actual
22 distance involved. Thus, if the CLEC locates its POP across the street from Verizon's
23 wire center, it should gain the benefit of the resulting efficiencies, rather than being
24 forced to pay as much as if it had located its facilities two miles away.

25
26 **Q. Verizon has proposed separate prices for unbundled dark fiber loops, based upon**
27 **density cells. Are there any distance related problems with this portion of its**
28 **proposal?**

1 A. Yes. Verizon proposes to charge based upon average loop lengths, giving no recognition
2 to the fact that most of the dark fiber segments which will be rented by CLECs will be
3 much shorter than the overall average loop length. At least in the near future, most
4 CLECs that rent dark fiber loop segments will be doing so in order to serve large business
5 customers with high bandwidth needs, as well as high density clusters of residential and
6 small business customers, who are likely to be located relatively close to Verizon's wire
7 centers. Since CLECs will tend to rent dark fiber in the higher density portions of the
8 wire center, where distances are relatively short, it is not appropriate to use a rate
9 structure based upon average distances. To correct for this problem, the loop fiber rates
10 should be set on a distance-sensitive basis, billed to the nearest tenth of a mile. Under this
11 approach, the CLEC would be billed for the actual distance between Verizon's wire
12 center and the point of termination. Thus, if the CLEC just rents a tenth of a mile of fiber,
13 that is all it would pay for. If the Commission concludes it is not practical to implement
14 this recommendation, then the dark fiber rates should be based upon average feeder
15 distances, by density cell, rather than upon total loop lengths.

16
17 *Cost of Capital*

18
19 **Q. Have you noticed any other problems with the dark fiber studies?**

20 A. Yes. It appears that Verizon has used the original cost of capital from the MFS III Order.
21 However, the Commission has subsequently rejected the use of this higher profit rate, and
22 required Verizon to use a lower estimate of its cost of capital, as described in the Global
23 Order:

24
25 Under the circumstances, we find that the use of an 11.9 percent
26 cost of capital is no longer appropriate, and that use of the 9.83
27 percent cost of capital within Scenario 9 is a more reasonable
28 assumption at this time. [Global Order, page 74]
29

1 All of the dark fiber rates should be reduced, to reflect the impact of the Scenario 9
2 assumptions, as adopted in the Global Order.

3

4 **Q. Have you quantified the impact of your dark fiber recommendations?**

5 A. Yes, to a degree. In the tables below, the first column shows Verizon’s proposed dark
6 fiber recurring monthly costs. The second column shows the impact of increasing the
7 number of fiber cables per duct from 2 to 4. The third column shows the impact of
8 charging for actual distances, thereby eliminating the air-to-route and average loop length
9 problems. To illustrate my recommended loop costs, I have assumed an actual fiber
10 distance which is half the average loop length in each density cell. For the Channel
11 Termination costs, I have assumed an actual fiber distance which is half the average
12 statewide loop length. The fourth column (“ACF”) shows the impact of using a cost of
13 capital of 9.83% instead of 11.9%. The final column shows the cumulative impact of all
14 these adjustments on the dark fiber costs.

15

Direct Testimony of Ben Johnson, Ph.D.
On Behalf of ATX Telecommunications Services, Inc. and NEXTLINK Pennsylvania, Inc.
Docket No. R-00005261

1
2
3
4
5

Table 3
Monthly Dark Fiber Costs
with Recommended Changes
[Begin Proprietary]

Loop Costs	Verizon Proposal	Conduit Change	Distance Change	ACF Change	Cumulative Change

6

[End proprietary]