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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

November 3, 2000

Via HAND DELIVERY

Ms. Magalie Roman Salas
Office of the Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
12th Street Lobby, TW-A325
Washington, D.C. 20554

Re: **CTIA Petition for Rulemaking (RM-9920);**
SIA Petition for Rulemaking (RM-9911)

Dear Ms. Salas:

Enclosed on behalf of WorldCom, Inc. are an original and nine copies of a paper entitled "Preliminary Analysis of Spectrum Capacity Requirements for Two-Way Digital Broadband MMDS/ITFS Services." Please associate this paper with the above-referenced rulemaking petitions.

Also enclosed is a duplicate copy to be date stamped and returned. If you have any questions regarding this filing or need any additional information, please contact me at the telephone number listed above.

Respectfully submitted,

Philip L. Malet

Counsel for WorldCom, Inc.

Enclosures

cc: Julius Knapp

November 3, 2000

WORLDCOM, INC.

Preliminary Analysis of
Spectrum Capacity Requirements for Two-Way Digital Broadband MMDS/ITFS Services

WorldCom, along with other MMDS/ITFS licensees, is in the process of deploying state-of-the-art two-way digital broadband fixed wireless services on a wide scale basis in the MMDS and ITFS bands. Many of the markets where WorldCom plans to deploy service are second and third tier markets that either do not have any access to high-speed data services or only have limited alternatives and no competition for such broadband services. The loss of access to any of this spectrum would have a dramatic negative impact on WorldCom's ability and willingness to deploy these services in the United States, for the reasons set forth below.

The Commission has allocated approximately 200 MHz of spectrum in the 2.1 and 2.5-2.7 GHz bands for MMDS and ITFS services. See Attachment 1 ("MDS-ITFS-MMDS Assigned Frequencies"). These point-to-multipoint services have been in existence for over forty years and have numerous transmission and reception points throughout the country. In 1996, MMDS operators bid on and were awarded spectrum at an FCC auction. While deployment of systems in this spectrum in the past has mostly been for wireless cable services and the delivery of one-way educational video programming, important regulatory changes approved in 1998 opened the way for licensees of these frequencies to upgrade their facilities to provide two-way digital broadband offerings for homes, schools and businesses.

It is critical to understand that the MMDS and ITFS bands are highly interdependent. Only eleven 6 MHz channels are allocated to MMDS, while twenty 6 MHz channels are allocated to ITFS. Some of these ITFS and MMDS channels are interleaved in the upper portion of the 2.5 - 2.7 GHz band requiring close coordination between the two services in order to avoid interference. MMDS operators are dependent on using ITFS channels in order to have adequate channel capacity to launch commercially viable two-way broadband access systems. Many ITFS operators are also dependent on MMDS operators for technical and financial support for state-of-the-art distribution of educational programming.

In partnership with ITFS licensees, WorldCom has begun the commercial deployment of two-way digital services. In addition to the experimental/developmental licenses it has received for Boston, Dallas, Memphis, Jackson, MS and Baton Rouge to commence MMDS two-way trials, WorldCom filed 380 applications for two-way digital authority in 77 markets, many of which are second and third tier markets, during the Commission's first filing window (August 14 – 18, 2000). See Attachment 2 ("WorldCom Two-Way Filing Summary for 1st FCC Window"). WorldCom plans to deploy service in approximately 30 of these markets by the end of 2001. WorldCom will file additional applications upon the opening of the FCC's rolling window and continuously thereafter.

To turn the Commission's vision of using this spectrum for high-capacity broadband fixed wireless services into a reality, WorldCom and other MMDS/ITFS operators must have access to all of the allocated MMDS/ITFS spectrum currently available in the markets they desire to serve, especially those small and medium size markets that WorldCom plans to serve by means of single cell sites. Any reallocation of MMDS/ITFS spectrum at this critical time would seriously impede the deployment of these state-of-the-art systems and seriously impact the business cases for entering these markets. In order to appreciate why this is the case, it is important to understand the constraints that currently exist for using the MMDS/ITFS frequencies.

First, there already is substantial usage of the bands by MMDS and ITFS analog systems providing nearly one million customers with wireless cable services and tens of thousands of educational users with important distance learning services. These services are primarily being offered over high power one-way video platforms on a point-to-multipoint basis. Many of these services are expected to continue and expand after the upgrading of the spectrum to two-way digital networks, resulting in an expected need for between five to six 6 MHz video channels (i.e., 30 – 36 MHz) depending on the market.

Second, operations in many markets will be significantly restricted by co-frequency operations of MMDS and ITFS in neighboring markets. This is especially the case where adjacent markets are relatively close together and the 35-mile contours of each market overlap one another. In such situations, the available number of channels in each market will be reduced substantially due to interference concerns.

Third, in order to avoid self-interference from upstream and downstream transmissions in the MMDS/ITFS bands, it is necessary to maintain at least a 30 MHz (five channel) separation between the two paths. Otherwise, the cost of filtering becomes excessive and commercially nonviable. These channels could be used efficiently in some markets for ITFS video services.

Fourth, there is a need for guardband spectrum between the higher power video ITFS and MMDS downstream channels and lower power channels. There may also need to be guardband channels separating the edges of the MMDS/ITFS bands from neighboring allocations to protect against inter-service interference. The total amount of this guardband spectrum could reach 12 - 18 MHz depending on the market and infrastructure configuration.

The need for spectrum to provide broadband fixed wireless access is directly related to a number of factors, including the size of the market being served, the expected penetration rate and competition in that market, the service quality and pricing point objectives, and the capacity requirements of the planned network. Many of these factors directly affect the business model and infrastructure decisions for each market. For example, in most second and third tier markets, the expected number of subscribers will only support the introduction of two-way digital MMDS/ITFS service through the use of a single cell (also called a supercell) deployment. This infrastructure comprises a relatively large tower or high transmitter site located in or near a population center with a high-power transmitter that can serve up to a 30-35 mile radius circle.

For purposes of explanation only, assume that in a relatively small third tier market the expected MMDS subscriber base would be about 2000 customers. Using WorldCom's models for product mix and service levels, WorldCom calculates that approximately 180 Mbps of total capacity is needed for both upstream and downstream connections to provide these customers with guaranteed levels of service. This throughput capacity can be translated into total spectrum requirements through the use of the following simplified formula:

Total Bandwidth = Total Capacity / [(Modulation Factor) x (Reuse Factor)]

Where for a supercell architecture,

	Downstream Capacity	**Upstream Capacity**
Modulation Factor	3.45 bps/Hz	1.1 bps/Hz
Reuse Factor	1.0	2.0
Total Bandwidth	180 Mbps/ (3.45 bps/Hz x 1.0) = 52 MHz or **54 MHz** (9 6 MHz Channels)	180 Mbps/ (1.1 bps/Hz x 2.0) = **82 MHz** (12 6 MHz Channels + MDS Channels 1 & 2A)

In the above example, the total amount of bandwidth required to serve supercell MMDS markets is 54 MHz for downstream transmissions and 82 MHz for upstream transmissions for a total bandwidth requirement of 136 MHz. When combined with the separation and guardband requirements, as well as the expected ITFS usage and adjacent interference considerations, it becomes clear that all of the existing MMDS/ITFS spectrum will be needed by the fixed broadband wireless community in the 2.1 and 2.5 - 2.7 GHz bands to serve most second and third tier markets. Any reduction in spectrum would result in: (a) a degradation of service quality (from a guaranteed service quality to a "best effort" commitment); (b) the inability to provide voice service (which requires packet prioritization); (c) provisioning of fewer subscribers for a fixed capital investment; and/or (d) more capital investment for a fixed number of subscribers. Any one of these alternatives is unacceptable because it would degrade the business case beyond economic viability.

Nor can an MMDS operator simply add more cell sites to compensate for lost spectrum in a second or third tier market. This is because these smaller markets simply cannot support the considerable additional expense of deploying more cell sites. As spectrum is reduced, the number of cells needed to achieve the same capacity is increased substantially. Moreover, each MMDS cell site is by necessity a stand-alone site requiring the full complement of equipment plus substantial backhaul capacity that is necessary to support broadband services. In most

cases, if a supercell is or becomes inadequate to serve a smaller market because of insufficient spectrum, the system design would usually dictate deployment of at least four (4) cell sites – thereby quadrupling the cost of the infrastructure.[1] Such an increase in cost would effectively destroy the business case for MMDS deployment in that market. While higher order modulation schemes could be used to increase capacity somewhat, they would impermissibly sacrifice WorldCom's quality of service objectives, which include guaranteeing throughput levels to its customers.

Attached are generic band plans for different size markets and buildout characteristics. WorldCom's need for access to the entire MMDS/ITFS band is made clear by each of these band plans. Attachment 3 is the "Generic Supercell Channel Plan" which illustrates the spectrum requirements for a smaller market built with a supercell design. Attachment 4 is the "Generic Supercell with Mini-Cell Underlay Channel Plan" which illustrates the spectrum requirements for a mid-size market built initially with a supercell, but designed to support several mini-cell underlays that will increase capacity in certain portions of the market and/or overcome terrain obstacles. Attachment 5 is the "Generic Multi-Cell Channel Plan" which illustrates the unique challenges posed by a large market with significant ITFS requirements.

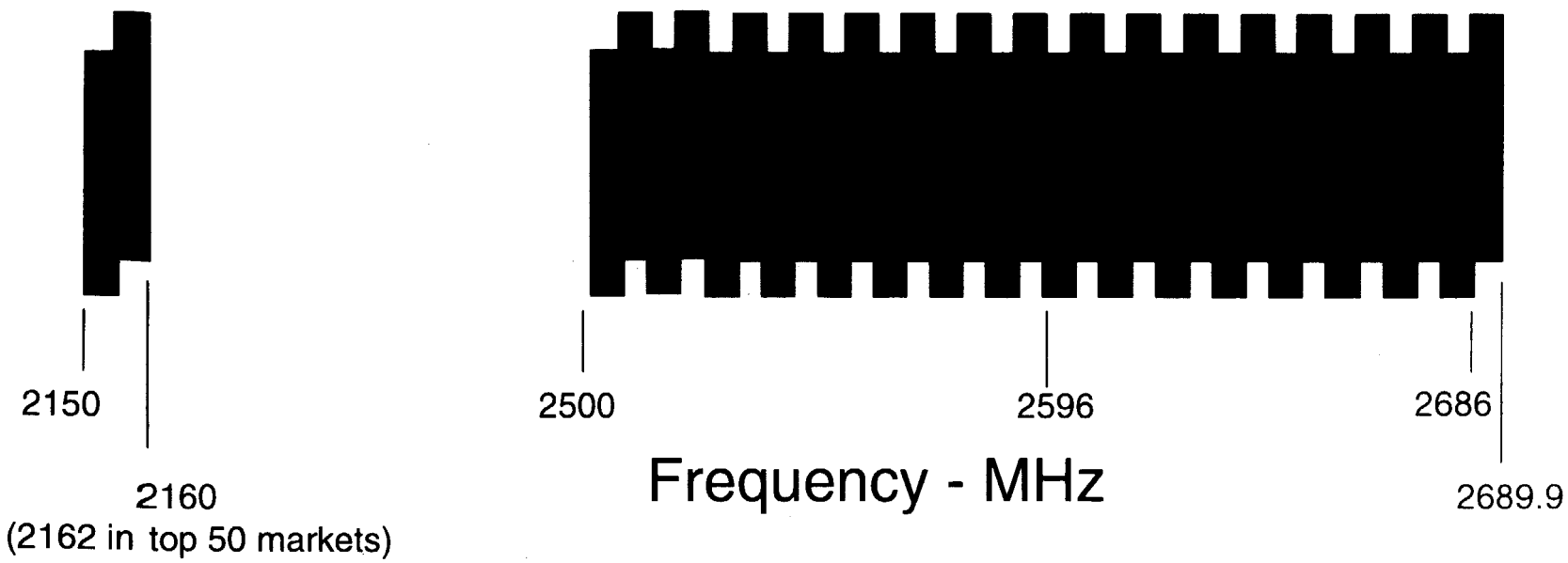
In summary, the loss of access to any spectrum in the existing MMDS/ITFS bands would have a dramatic negative impact on WorldCom's ability and willingness to deploy two-way broadband digital fixed wireless services in the United States. All of this spectrum is especially needed to serve the many second and third tier markets that either have no access to high-speed Internet connections or only a limited number of high-priced alternatives.

[1] Current narrowband cellular and PCS systems are able to do all processing in a single location, thereby reducing the marginal cost of adding additional cell sites. By contrast, the broadband, IP-based requirements of high-speed MMDS systems require distributed processing.

MDS-ITFS-MMDS Assigned Frequencies

ITFS and MMDS Channels
- Each Channel = 6 MHz
- ITFS = A, B, C, D, G
- MMDS = E, F, H
- MMDS Response = H4

MDS



Attachment 1

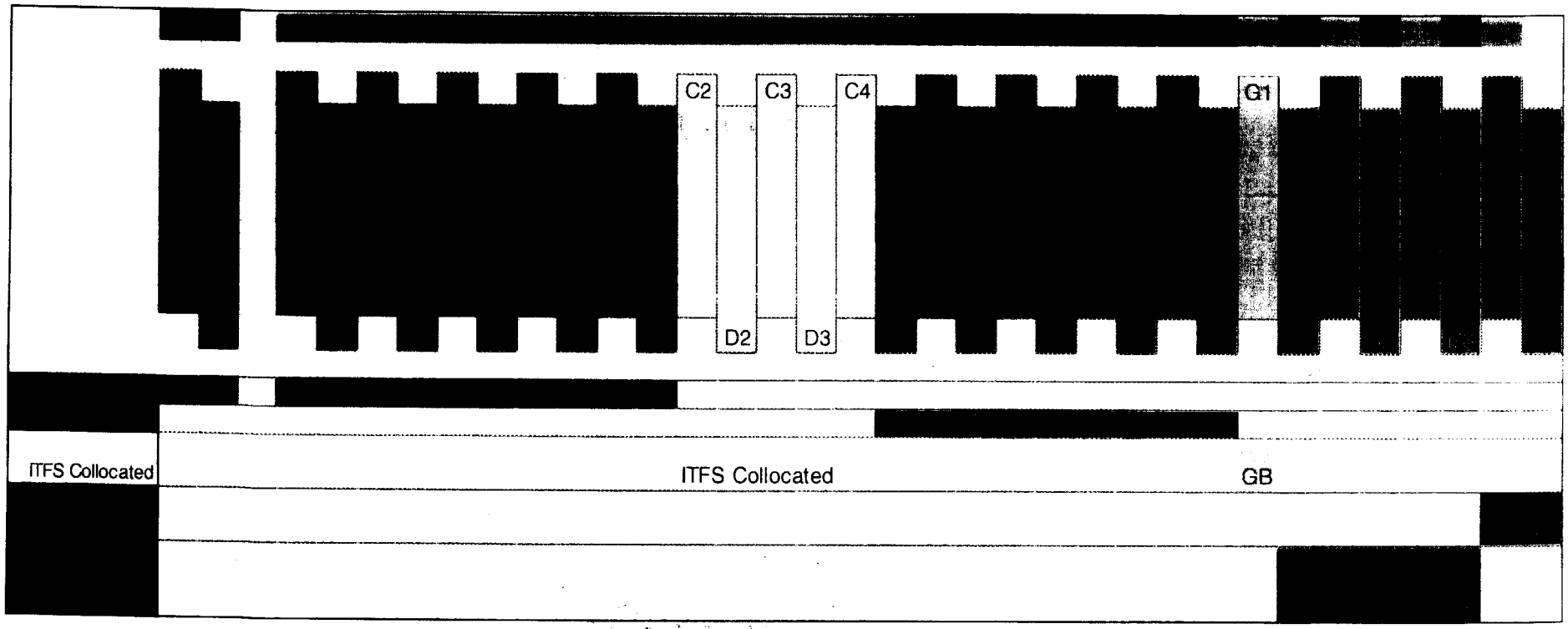
WorldCom Two-Way Filing Summary for 1st FCC Window

1	AL	Auburn
2	AL	Bankston
3	AL	Birmingham
4	AL	Bucks
5	AL	Demopolis
6	AL	Dothan
7	AL	Florence
8	AL	Gadsden
9	AL	Huntsville
10	AL	Mobile
11	AL	Montgomery
12	AL	Selma
13	AL	Six Mile
14	AL	Tuscaloosa
15	AR	Pine Bluff
16	CA	Bakersfield
17	CA	San Diego - Mt. San Miguel
18	CT	Hartford
19	FL	Fort Walton
20	FL	Mariana
21	FL	Panama City
22	FL	Pensacola
23	FL	Sebring
24	FL	Tallahassee
25	GA	Albany
26	GA	Brunswick
27	GA	Charing
28	GA	Columbus
29	GA	Hoggards Mill
30	GA	Jeffersonville
31	GA	Matthews (Augusta)
32	GA	Valdosta
33	GA	Vidalia
34	KS	Dodge City
35	KS	Nortonville (Effingham)
36	KS	Wellsville
37	LA	Alexandria
38	LA	Baton Rouge
39	LA	Bunkie
40	LA	Ferriday

41	LA	Lafayette
42	LA	Monroe
43	LA	Natchitoches
44	LA	Ruston
45	MA	Boston
46	MA	Hyannis
47	MA	Springfield
48	MA	Worcester
49	MO	Kansas City
50	MO	Maysville
51	MO	Sweet Springs
52	MS	Biloxi (Gulf Coast)
53	MS	Bude
54	MS	Columbus (Starkville)
55	MS	Hattiesburg
56	MS	Inverness (Delta)
57	MS	Jackson
58	MS	Meridian
59	MS	Oxford
60	MS	Tupelo
61	MT	Kalispell
62	NC	Asheville
63	NY	Rochester
64	NY	Buffalo
65	OH	Cleveland
66	PA	Philadelphia
67	PA	Pittsburgh
68	RI	Providence
69	TN	Chattanooga
70	TN	Lawrenceburg
71	TN	Memphis
72	TN	Tullahoma
73	TX	Dallas
74	TX	Ft Worth
75	TX	San Antonio
76	VA	Norfolk/Va. Beach
77	WV	Charleston

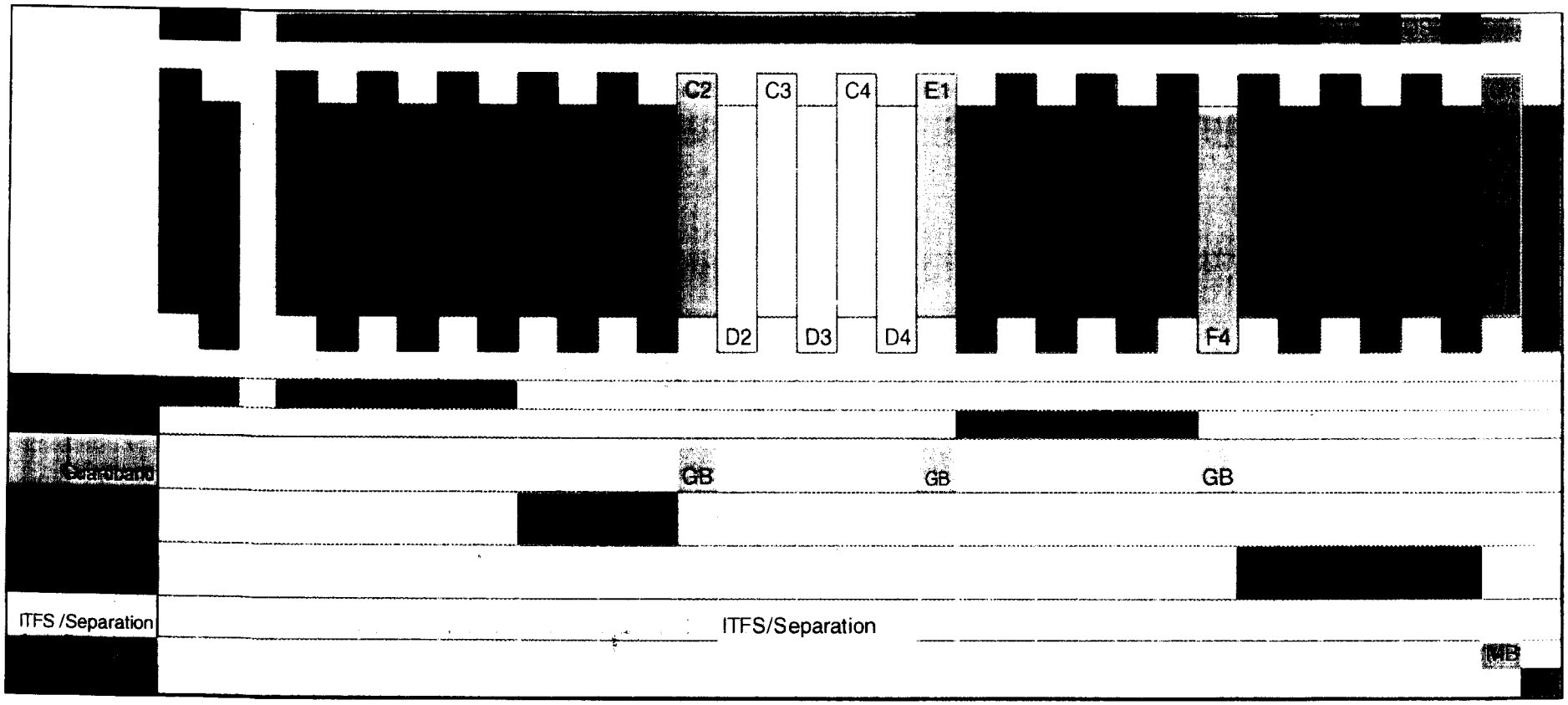
Attachment 2

Generic Supercell Channel Plan



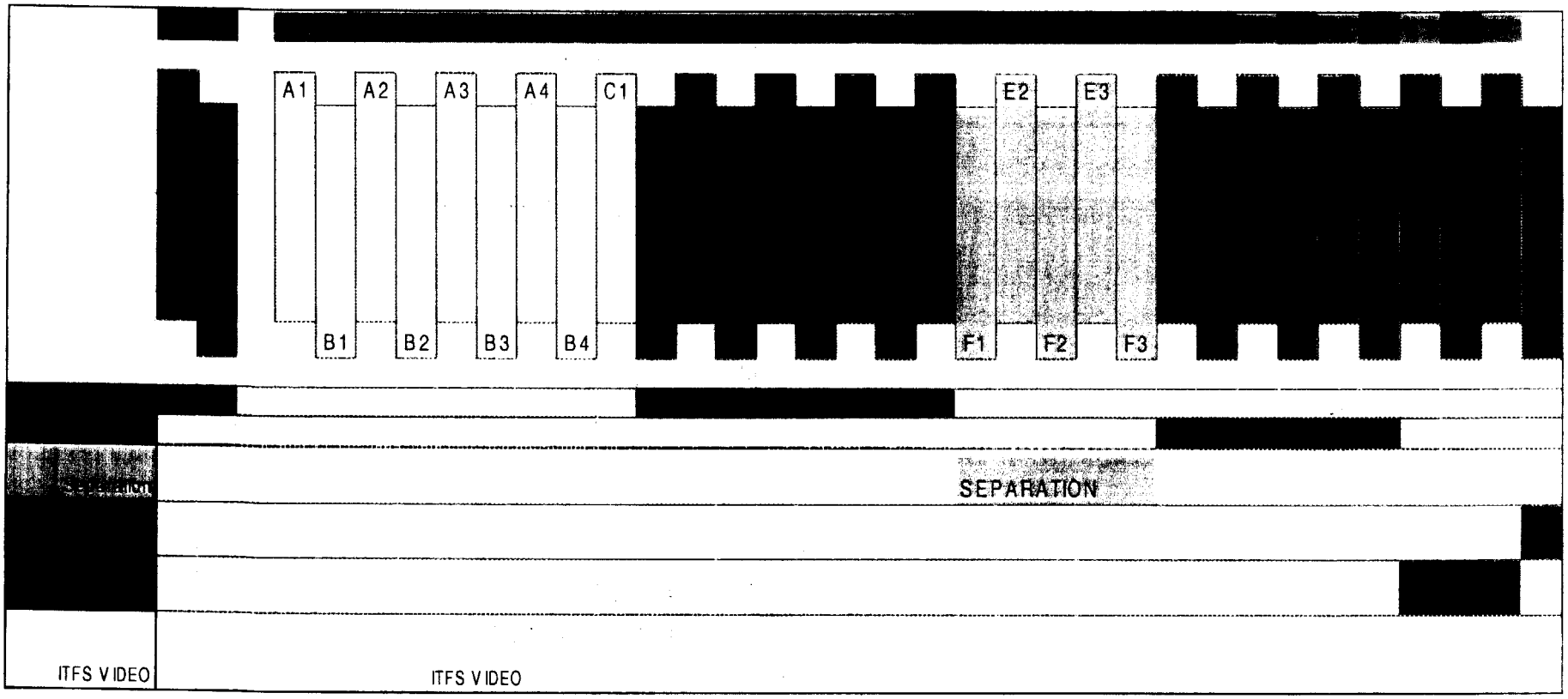
Attachment 3

Generic Supercell with Mini-Cell Underlay Channel Plan



Attachment 4

Generic Multi-Cell Channel Plan



Attachment 5