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RIYADH (AFFILIATE)

S2444 SAT-MSC-20020325-00054
Compass Systems, Inc.
Southpoint 2

MAR 25 2002

FCC

Received
APR 2 2002
Satellite Policy Branch
International Bureau

March 20, 2002

VIA COURIER

Federal Communications Commission
International Bureau – Satellites
P.O. Box 358210
Pittsburgh, PA 15251-5210

Re: Compass Systems, Inc.
Application for Authorization to Construct a Direct Broadcast Satellite System

Dear Sir or Madam:

Enclosed for filing on behalf of Compass Systems, Inc. ("CSI") is an original and four copies of an application for a direct broadcast satellite ("DBS") system. Also enclosed is a check in the amount of the required filing fee of $2,710 and an original completed FCC Form 159.

Please address any inquiries regarding this matter to the undersigned.

Sincerely,

Antoinette Cook Bush
Compass Systems, Inc.

Enclosures

NORTHPOINT TECHNOLOGY LTD.
ONE HARBOUR PLACE SUITE 475
PORTSMOUTH, NH 03801

CITIZENS FUNDS
(800) 223-7010
PAYABLE THRU
ANDROSCOGGIN BANK, NA
LEWISTON, ME 04243

2361

52-7252/2112

March 20, 2002

PAY TO THE ORDER OF *** Federal Communications Commission ******** $ 2,710.00

***** twenty seven hundred ten and .00/100 ************* DOLLARS

MEMO Filing Fee

⑆211272520⑆ 79036669⑈ 2361

NORTHPOINT TECHNOLOGY LTD.

2361

Federal Communications Commission 3/20/02

Application Filing Fee

READ INSTRUCTIONS CAREFULLY BEFORE PROCEEDING

(1) LOCKBOX # 358210

FEDERAL COMMUNICATIONS COMMISSION

REMITTANCE ADVICE

Approved by OMB 3060-0589

Page No 1 of __

SPECIAL USE

FCC USE ONLY

SECTION A - PAYER INFORMATION

(2) PAYER NAME (if paying by credit card, enter name exactly as it appears on your card) Northpoint Technology, Ltd.	(3) TOTAL AMOUNT PAID (U.S. Dollars and cents) $2,710.00
(4) STREET ADDRESS LINE NO. 1 One Harbour Place	
(5) STREET ADDRESS LINE NO. 2 Suite 475	
(6) CITY Portsmouth	(7) STATE NH — (8) ZIP CODE 03801
(9) DAYTIME TELEPHONE NUMBER (include area code) (603) 431-5511	(10) COUNTRY CODE (if not in U.S.A.) U.S.A.

FCC REGISTRATION NUMBER (FRN) AND TAX IDENTIFICATION NUMBER (TIN) REQUIRED

(11) PAYER (FRN) 0004-2773-64	(12) PAYER (TIN) 74-2856870

IF PAYER NAME AND THE APPLICANT NAME ARE DIFFERENT, COMPLETE SECTION B
IF MORE THAN ONE APPLICANT, USE CONTINUATION SHEETS (FORM 159-C)

(13) APPLICANT NAME Compass Systems, Inc.	
(14) STREET ADDRESS LINE NO. 1 One Harbour Place	
(15) STREET ADDRESS LINE NO. 2 Suite 475	
(16) CITY Portsmouth	(17) STATE NH — (18) ZIP CODE 03801
(19) DAYTIME TELEPHONE NUMBER (include area code) (603) 431-5511	(20) COUNTRY CODE (if not in U.S.A.) U.S.A.

FCC REGISTRATION NUMBER (FRN) AND TAX IDENTIFICATION NUMBER (TIN) REQUIRED

(21) APPLICANT (FRN) 0006-7431-16	(22) APPLICANT (TIN) 01-0634463

COMPLETE SECTION C FOR EACH SERVICE, IF MORE BOXES ARE NEEDED, USE CONTINUATION SHEET

(23A) CALL SIGN/OTHER ID	(24A) PAYMENT TYPE CODE MTD	(25A) QUANTITY 1
(26A) FEE DUE FOR (PTC) $2,710.00	(27A) TOTAL FEE $2,710.00	FCC USE ONLY
(28A) FCC CODE 1	(29A) FCC CODE 2	
(23B) CALL SIGN/OTHER ID	(24B) PAYMENT TYPE CODE	(25B) QUANTITY
(26B) FEE DUE FOR (PTC)	(27B) TOTAL FEE	FCC USE ONLY
(28B) FCC CODE 1	(29B) FCC CODE 2	

SECTION D - CERTIFICATION

(30) CERTIFICATION STATEMENT

I, SOPHIA COLLIER, certify under penalty of perjury that the foregoing and supporting information is true and correct to the best of my knowledge, information and belief. SIGNATURE [signature] DATE 3.20.02

SECTION E - CREDIT CARD PAYMENT INFORMATION

(31)

☐ MASTERCARD

☐ VISA

MASTERCARD/VISA ACCOUNT NUMBER:

EXPIRATION DATE:

I hereby authorize the FCC to charge my VISA or MASTERCARD for the service(s)/authorization herein described.

SIGNATURE ____________________ DATE __________

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

Application of	)	
	)	FCC File No. ____________
Compass Systems, Inc. for Authority to Construct an International Direct Broadcast Satellite System	)	

To: Chief, International Bureau

APPLICATION FOR AUTHORITY TO CONSTRUCT A DIRECT BROADCAST SATELLITE SYSTEM

Compass Systems, Inc. ("CSI") hereby applies for authority to construct the Compass direct broadcast satellite ("DBS") system ("Compass") which comprises two hybrid DBS-Fixed-Satellite Services ("FSS") space stations—Southpoint 1 and Southpoint 2.[1] Using Compass, CSI will provide diverse video and audio programming, including local broadcast stations, national cable networks, and interactive and high-definition television, and broadband Internet access services. CSI will provide these services nationwide, including to the underserved residents of

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[1] Under the rules of the Federal Communications Commission ("Commission" or "FCC"), applicants seeking DBS licenses are not required to apply for such licenses using a particular FCC form. Instead, applicants merely are required to provide a narrative description of: (i) the type of service that will be provided; (ii) the technology that will be employed; and (iii) unspecified "other pertinent information." 47 C.F. R. § 100.13(a).

Alaska and Hawaii and to rural subscribers, in competition with existing domestic multichannel video programming distributors ("MVPDs"). CSI also will provide service internationally to Mexico, Canada, and the Asia-Pacific region. Accordingly, CSI requests the Commission to assign to CSI the 32 DBS channels associated with the 157° W.L. and 166° W.L. western orbital slots, which were assigned to the United States by the International Telecommunications Union ("ITU") as part of its Region 2 broadcast satellite service ("BSS") plan ("BSS Plan").[2] In addition, CSI requests the Commission to grant CSI authority to operate a nationwide integrated terrestrial platform ("ITP") using its assigned DBS spectrum. Through terrestrial spectrum reuse, Compass's ITP will enable CSI to make the most efficient possible use of its assigned spectrum and to offer the full panoply of programming services necessary to compete with the two established DBS providers, EchoStar Satellite Corporation ("EchoStar) and DIRECTV, Inc. ("DIRECTV"), and other MVPD providers. For the reasons set forth herein, CSI respectfully requests the Commission expeditiously to grant the instant application ("Application").

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[2] In the United States, the term "DBS" is used interchangeably with "BSS." The ITU Radio Regulations divide the world into three Regions. Generally, Region 1 includes Africa, Europe, and Northern and Western portions of Asia, Region 2 includes the Americas and Greenland, and Region 3 includes Southern portions of Asia, Australia and the South Pacific. See ITU Radio Regulations Article S5, Section I. DBS orbital locations and channels have been assigned to countries in Region 2 under the BSS Plan, which was adopted at the 1983 Regional Administrative Radio Conference. The BSS Plan allocates 32 channels of 24 MHz each at each of eight orbital locations to the United States from which to provide domestic DBS service (175°, 166°, 157°, 148°, 119°, 110°, 101°, and 61.5° W.L.). The BSS Plan also specifies the technical parameters under which DBS systems are to operate, but the BSS Plan may be modified to permit non-standard satellites and operations, provided that they do not affect satellites operating in compliance with the U.S. Plan or certain other services.

I. INTRODUCTION

As set forth below, by approving the Application, the Commission can introduce a new, nationwide DBS competitor despite the stranglehold that incumbent DBS licensees have on the spectrum associated with orbital slots from which DBS service can be provided to the entire continental United States ("full-CONUS"). Compass will enhance competition in the highly consolidated MVPD market by increasing the American public's choice of facilities-based MVPDs.[3] Further, the Commission can reduce the market power of local cable franchises nationwide by offering MVPD subscribers another DBS alternative to cable. Compass will place

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[3] By granting CSI authority to construct the Compass integrated satellite-terrestrial DBS system, the Commission can prevent EchoStar-DIRECTV from obtaining a monopoly in the DBS industry if their proposed merger ("Merger") is approved and consummated. See EchoStar Communications Corporation, General Motors Corporation, and Hughes Electronics Corporation Seek FCC Consent For a Proposed Transfer of Control, Public Notice, CS Docket No. 01-348, DA 01-3005 (rel. Dec. 21, 2001) ("Merger Application"). EchoStar and DIRECTV are the only two DBS licensees that have launched and currently operate DBS satellites. R/L DBS Company, L.L.C. ("R/L DBS") has not yet launched a DBS satellite or initiated DBS service. On December 28, 2000, the Commission granted a 36-month extension of time to R/L DBS to launch and commence operating a DBS satellite. See Petition of R/L DBS Company, L.L.C. For Extension of its Direct Broadcast Satellite Construction Permit, Memorandum Opinion and Order, 16 FCC Rcd 9 (2001). On May 17, 1999, the Commission granted Dominion Video Satellite, Inc. ("Dominion") authority to commence operation of a DBS service using an EchoStar satellite currently in orbit, and Dominion currently offers 19 video channels over an EchoStar satellite. See Dominion Video Satellite, Inc. Application for Minor Modification of Authority to Construct and Launch and to Continue Construction and Launch of Planned Satellite at 61.5 [degrees] W.L., File No. 12-SAT-ML-97, IBFS File No. SAT-MOD-19961108-00132; Application for Launch Authority, Order and Authorization, 14 FCC Rcd 8182 (1999). According to the Commission, Dominion expects to launch its own satellite sometime in 2003. See Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, Eighth Annual Report, 17 FCC Rcd 1244, ¶ 55 n. 184 (2001) ("Video Competition Report").

downward pressure on MVPD pricing nationwide and incentivize existing MVPDs to provide new and innovative services.

In addition, Compass will offer local and national content producers a new national distribution platform. Unaffiliated content providers often find it difficult to obtain carriage in the increasingly consolidated MVPD industry, in which many of the largest MVPD providers are affiliated or vertically integrated with established, global entertainment companies. Thus, authorization of Compass also will increase the diversity of programming available to the American public.

Compass will be able to achieve these public interest benefits despite the dearth of available full-CONUS DBS orbital slots by using DBS spectrum more efficiently than existing DBS providers. All of the full-CONUS orbital slots assigned to the United States under the BSS Plan currently are held by EchoStar and DIRECTV. This has proven to be an insurmountable barrier to entry by new DBS providers and is the primary reason that the spectrum assigned to the western orbital slots requested by CSI herein currently lies fallow. CSI will overcome this barrier by terrestrially reusing DBS spectrum throughout the United States to provide a comprehensive bundle of MVPD services. CSI will offer every community nationwide individualized services, such as local broadcast stations and broadband Internet access, via a network of terrestrial antennas which will use the same DBS spectrum that Compass's satellites will use to offer programming of national interest, such as cable networks and superstations. This integrated satellite and terrestrial co-frequency spectrum sharing is highly efficient ana will dramatically increase the capacity of the DBS spectrum requested by CSI.

II. AUTHORITY REQUESTED AND GENERAL TECHNICAL INFORMATION

A. Compass Satellite Platform: Southpoint 1 and Southpoint 2

1. Authority to Construct DBS satellites

CSI requests authorization to construct the Southpoint 1 and Southpoint 2 satellites, which are described in detail in Appendix A attached hereto.[4] Both satellites will utilize 48 24 MHz transponders to generate three fixed beams and a steerable spot beam. Southpoint 1, which is described in Annex 1 to Appendix A will be located at 166° W.L., and its fixed beams will serve: (i) Alaska; (ii) Hawaii; and (iii) the continental United States, except for the East Coast. Southpoint 2, which is described in Annex 2 to Appendix A will be located at 157° W.L. Its fixed beams will serve: (i) the continental United States, except the East Coast; (ii) Canada; and (iii) Mexico. The steerable beams of both satellites will provide services to Region 3, which includes Australia, New Zealand, Papua New Guinea, and other population centers. Both satellites will operate using service links in the 12.2-12.7 GHz band and feeder links in the 17.3-17.8 GHz band. In addition, each satellite will utilize a return link from the Asia-Pacific region in the 14-14.5 GHz band that will enable transmissions originating from Region 3 to be delivered to the Region 2 areas covered by Southpoint 1's and Southpoint 2's fixed beams.

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[4] The Southpoint satellites ultimately may be constructed as multiple satellite payloads which are then co-located at the same orbital slot. More refined technical descriptions of the satellites will be filed with CSI's application to construct and launch Compass.

The satellites will use primary and redundant feeder link gateway and tracking, telemetry, and command ("TT&C") earth stations.[5] The gateway earth stations will operate in the 17.3-17.8 GHz band for the fixed beams and the 14-14.5 GHz band for the steerable spot beam, and the TT&C earth stations will operate in the lower and upper portions of the service and feeder links.

Satellite	Orbital Location	DBS Channels Requested	Regions to be Served
Southpoint 1	166° W.L.	32	• Fixed beam 1: Alaska • Fixed beam 2: Hawaii • Fixed beam 3: CONUS United States, except the East Coast • Steerable beam: Region 3
Southpoint 2	157° W.L.	32	• Fixed beam 1: Canada • Fixed beam 2: Mexico • Fixed beam 3: CONUS United States, except the East Coast • Steerable beam: Region 3

2. *Assignment of DBS orbital slots and DBS channels*

CSI requests the Commission immediately to assign to CSI the 166° W.L. and 157° W.L. orbital slots and the 32 DBS channels associated with each orbital slot. No Commission rule prevents the Commission from doing so prior to granting CSI's second-phase application for authority to construct and launch its DBS system, which CSI intends to file expeditiously after

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[5] Compass will file separate applications to operate the Compass primary and redundant gateway and TT&C earth stations at a later date. The TT&C earth stations will be located in geographically disperse areas in North America, and the gateway earth stations operating the fixed beams will be located in Hawaii and the western United States. Additional gateway earth stations, which will be operated in conjunction with the steerable beams, will be located in the Asia-Pacific region and therefore will not be U.S.-licensed.

grant of the instant Application.[6] Such an interim assignment will enable CSI to deploy its proposed ITP as early as possible to commence commercial service in competition with EchoStar and DIRECTV, and thereby rapidly will introduce needed additional competition to the increasingly consolidating MVPD market. Further, no DBS licensee ever has provided service from these western orbital slots and CSI is the first party to seek access to the orbits since they became available several years ago.[7] Thus, no party will be prejudiced by such an interim assignment by the Commission. Moreover, immediate assignment of these orbital slots and DBS

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[6] The three-phase DBS application process and their interplay with the DBS due diligence requirements is further discussed in Section IV, infra. The Commission's standard practice has been to assign particular orbital slots and DBS channels upon granting a DBS applicant's request for authority to construct and launch its DBS system. Grant of a second-phase DBS application generally occurs when the applicant demonstrates to the FCC that it has entered into a contract for the construction of the satellites comprising the proposed system. See, e.g., Processing Procedures Regarding the Direct Broadcast Satellite Service, Memorandum Opinion and Order, 95 F.C.C.2d 250, ¶¶ 7 (1983) ("[T]he Commission will neither reserve nor grant specific orbital locations and frequency assignments until the [first due diligence] condition has been met."); EchoStar Satellite Corporation, Memorandum Opinion and Order, 15 FCC Rcd 6727, ¶ 2 (1999) ("[T]he Commission determined that [the applicant] had met the necessary due diligence requirements to justify the assignment of specific orbital positions and frequencies . . . ."). Section IV, infra, for a further discussion of the interplay of the three-phase DBS application process and the DBS due diligence requirements.

[7] See International Bureau Satellite Policy Branch Information, Public Notice, 13 FCC Rcd 17892 (1998) (providing notice of the surrender by R/L DBS Company, L.L.C. of 11 DBS channels at 166° W.L.); Tempo Satellite, Inc. Application for Extension of Time to Complete the Construction and Operation of a Direct Broadcast Satellite System, Memorandum Opinion and Order, 13 FCC Rcd 11068 (1998) (denying Tempo Satellite, Inc. an extension of its deadline to complete the due diligence requirement applicable to its eleven channel authorization at 166° W.L.); Application of Hughes Communications Galaxy, Inc., Memorandum Opinion and Order, 9 FCC Rcd 3187 (1994) (noting that Hughes Communications Galaxy, Inc. held authority to use 27 channels at 157° W.L.). CSI was unable to locate a published Commission decision indicating the revocation or surrender of the 157° W.L. DBS channels originally assigned to Hughes Communications Galaxy, Inc. ("Hughes"), but was told by the Commission that Hughes had surrendered its license.

channels will facilitate CSI's ability to raise financing for the construction and operation of Compass, which will expedite the deployment of the Compass system.

3. Modification of BSS Plan

The analyses in Annexes 1 and 2 to Appendix A demonstrate that the launch and proposed location and operation of Southpoint 1 and Southpoint 2 are: (i) in compliance with the ITU's BSS Plan, or (ii) to the extent that Compass does not fully conform to Appendices S30 and S30A of the ITU Radio Regulations,[8] will not cause greater interference to other satellite networks operated in accordance with the ITU Radio Regulations than that interference which would occur from the current BSS Plan assignments for the orbital slots requested herein by CSI.

To the extent that Compass does not fully conform to Appendices S30 and S30A of the ITU Radio Regulations, CSI requests the Commission immediately to request the ITU to modify its Region 2 BSS Plan and its associated feeder link plan.[9] CSI understands that its satellite

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[8] Annex 1 of Appendices S30 (Region 2 BSS downlinks between 12.2-12.7 GHz) and S30A (Region 2 BSS feeder links between 17.3-17.8 GHz) provide the methodology and criteria for determining whether a proposed satellite system (i.e., a proposed modification to the BSS Plan) might interfere with frequency assignments in accordance with the Region 2 Plan and its associated feeder link plan, other satellite systems, or terrestrial services.

[9] When the limits in Annex 1 of Appendices S30 and S30A of the ITU Regulations are exceeded by an authorized DBS system, in order to accommodate such system the Commission must coordinate with countries that have assignments in the BSS Plan that can be affected by a modification of the plan. Procedures for modifying the Plan are set forth in Appendices 30 and 30A of the ITU Regulations. See EchoStar Satellite Corporation, Application for Minor Modification of Direct Broadcast Satellite Authorization, Launch and Operating Authority for EchoStar 7, Order and Authorization, DA 02-118, File Nos. SAT-MOD-20010810-00071, SAT-A/O-20010810-00073, Call Sign DBS8801, ¶ 5 (rel. Jan. 16, 2002) (noting that the Commission

operations are not guaranteed protection from interference from systems licensed by foreign administrations that are operating in accordance with the ITU Radio Regulations until the Region 2 BSS Plan and its associated feeder link plan is modified to include the technical parameters applicable to Compass. Consistent with the Commission's action in its EchoStar 7 decision,[10] CSI requests the Commission to authorize CSI to construct its proposed DBS system while such ITU coordination efforts are pending. CSI will provide the Commission with continuing documentation, as necessary, to facilitate both the ITU coordination and agreement-seeking process.

4. FSS components of Southpoint 1 and Southpoint 2

Although allocated for BSS in Region 2, the spectrum utilized by the steerable beams on Southpoint 1 and Southpoint 2 is allocated for FSS in Region 3, which is the region which the beams will serve. As a result, operation of these beams is required to be coordinated through the ITU in Region 3 under the appropriate ITU coordination procedure for geostationary FSS satellites operating in the Ku-band.[11] Under the Commission's rules, Part 25 FSS providers are

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will request the modification of the BSS Plan in conformance with applicable ITU regulations to accommodate the EchoStar 7 satellite) ("EchoStar 7").

[10] EchoStar 7, ¶¶ 6-7.

[11] The Commission permits applicants proposing hybrid satellite systems that operate in two different frequency bands to seek Commission authority for both bands using a single application. See Amendment of the Commission's Space Station Licensing Rules and Policies, Notice of Proposed Rulemaking and First Report and Order, IB Docket No. 02-34, IB Docket No. 00-248, FCC 02-45 (rel. Feb. 28, 2002) ("[F]acilitating hybrid satellite deployment, which would enable satellite operators to reduce their costs and the rates they charge for satellite services, is another public interest benefit that may flow from the adoption of our proposals."). The instant Application proposes operation in two frequency bands (the 12.2-12.7 GHz BSS

not required to obtain prior Commission approval to commence construction of their satellite systems, but instead only are required to notify the Commission that they intend to construct such system.[12] CSI will comply with this requirement and understands that any such construction of the FSS component of Compass prior to obtaining launch and operation authorization from the Commission will be undertaken by CSI at its own risk, inasmuch as the Commission ultimately may not license the FSS component. CSI intends to file an application for authority to launch and operate the FSS component of Compass simultaneously with, or prior to, CSI's filing of its second-phase DBS application seeking authority to construct and launch the DBS component of Compass.

B. Compass Integrated Terrestrial Platform

1. Blanket authorization to operate ITP

CSI requests nationwide authorization to deploy and operate its Compass ITP immediately upon assignment by the Commission of the orbital slots and DBS channels requested in this Application. The terrestrial component of Compass is described in Annex 4 to Appendix A attached hereto. As noted in the annex, the terrestrial component of Compass will

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band and the 14-14.5 GHz FSS band), one of which is allocated differently in the two different ITU regions served by Southpoint 1 and Southpoint 2 (12.2-12.7 GHz is allocated to BSS in Region 2 and FSS in Region 3).

[12] See Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures, Report and Order, 11 FCC Rcd 21581, ¶¶ 6-9 (1996).

not cause harmful interference to any incumbent licensees.[13] Therefore, CSI requests that its DBS license include blanket authorization to immediately begin operating the Compass ITP.[14]

The Compass ITP will operate on an integrated, ancillary basis with Southpoint 1 and Southpoint 2 and will reuse spectrum assigned to these satellites. By using patented Northpoint Technology as described in Annex 3, in some cases, consumers will obtain Compass programming and services using a combined satellite terrestrial antenna. In other instances, services will be received with one or more traditional 45 centimeter dishes. As prescribed by the Northpoint Technology, satellite transmissions will be received by a satellite antenna component facing the southern sky, and terrestrial transmission will be received by a terrestrial antenna component using the same frequency but travelling on a different transmission path. This will enable CSI's DBS satellite constellation to transmit video programming of national interest, such as broadcast superstations and national cable networks, while the ITP provides more individually

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[13] In adopting the Multichannel Video and Data Distribution Service ("MVDDS"), the Commission expressly determined that terrestrial use of DBS spectrum can be accomplished without causing unacceptable interference to DBS licensees or the newly allocated Ku-band Fixed-Satellite Service Nongeostationary ("NGSO FSS") service which shares spectrum with the DBS service. See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, First Report and Order and Further Notice of Proposed Rulemaking, 16 FCC Rcd 4096, ¶ 1 (2000) ("First Report and Order").

[14] The Commission proposed to authorize certain Mobile-Satellite Service ("MSS") licensees to operate ancillary terrestrial components to their MSS satellite systems by modifying the licensees' satellite licenses. Flexibility for Delivery of Communications by Mobile-Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band, Notice of Proposed Rulemaking, 16 FCC Rcd 15532, ¶ 33 (2001) ("MSS Flexibility NPRM"). Similarly, Compass requests the Commission to grant Compass terrestrial authority on an ancillary basis as part of Compass's DBS authorization to construct a DBS system.

targeted programming and services, such as local broadcast stations, interactive television, and broadband Internet access. By terrestrially reusing DBS spectrum in each community nationwide, the ITP will benefit from tremendous spectrum-use efficiencies which will provide Compass with a much higher transmission capacity per DBS channel than is possible with a satellite-only DBS system. A further technical discussion of these spectrum efficiencies is attached hereto as Annex 5 to Appendix A.

2. Flexible use policy

The Commission has a long standing policy to support the flexible use of spectrum, including spectrum allocated to satellite services.[15] This policy dictates grant of blanket authority for CSI to operate Compass's ITP. Section 303(y) of the Communications Act of 1934, as amended (the "Act"), expressly authorizes the Commission to modify spectrum allocations to provide licensees with flexible use of spectrum if doing so serves the public convenience, interest, and necessity and the following criteria are met:

> (1) such use is consistent with international agreements to which the United States is a party; and
>
> (2) the Commission finds, after notice and an opportunity for public comments, that—
>
> (A) such allocation would be in the public interest;

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[15] Commission Chairman Michael Powell has emphasized the importance of the Commission's flexible-use policy to future regulation of spectrum by the Commission. See, e.g., Heather Forsgren Weaver, Powell Urges Moving Away From 'Command and Control' Spectrum-Allocation Policy, RCR Wireless News, October 29, 2001 (quoting Powell: "It is important that the [FCC] move from its traditional spectrum management paradigm of 'command and control' to a paradigm of market-orientated allocation policy *to provide more flexible allocations that allow multiple uses so that spectrum can be put to its highest and best use.*") (emphasis added).

(B) such use would not deter investment in communications services and systems, or technology development; and

(C) such use would not result in harmful interference among users.[16]

CSI's request for blanket authorization to operate the Compass ITP satisfies each of these criteria. The Commission previously determined that ancillary terrestrial operation using DBS spectrum: (i) is not in violation of any international agreements if appropriate service rules are adopted relating to licensee operations near the Canadian and Mexican borders;[17] (ii) is in the public interest;[18] (iii) will not deter investment;[19] and (iv) will not cause harmful interference.[20]

In addition, the Commission clearly enunciated its flexible use policy in its 1999 Reallocation Policy Statement.[21] In the Reallocation Policy Statement, the Commission set forth

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[16] 47 U.S.C. § 303(y).

[17] First Report and Order, ¶¶ 309-310.

[18] Id. at ¶ 167 ("We find that the public interest would be served by allowing MVDDS operations in this band.").

[19] The Commission noted that terrestrial licenses would be used to provide "a wide array of video programming . . . and data services . . . in both urban and rural areas." Id. at ¶ 167. Such new services are likely to cause, rather than deter, investment.

[20] Id. at ¶ 1 ("[W]e conclude that a new terrestrial fixed [service] can operate in the 12.2-12.7 GHz band on a non-harmful interference basis with incumbent [DBS], and on a co-primary basis with the NGSO FSS.").

[21] Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, Policy Statement, 14 FCC Rcd 19868, ¶ 2 (1999) ("This Policy Statement sets forth guiding principles for the Commission's spectrum management activities as we move into the new millennium.").

the general policy considerations that would dictate its future spectrum use and allocation decisions. According to the Commission:

> Flexible allocations may result in more efficient spectrum markets. Flexibility can be permitted through the use of relaxed service rules, which would allow licensees greater freedom in determining the specific services to be offered.[22]

In addition, the Commission stressed the importance of allowing flexible use of spectrum to facilitate the introduction of new technologies.[23]

Consistent with this policy, on several occasions over the past several years, the Commission has expanded, or proposed to expand, the operational authority of licensed services to enable the licensees to make the highest and best use of their assigned spectrum.[24] The Commission has taken such action to benefit the public interest even though the new, flexible

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[22] Id. at ¶ 9.

[23] Id. at ¶ 10.

[24] See, e.g., Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services, First Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd 8965, ¶ 1, 3 (1996) (authorizing CMRS licensees service flexibility to stimulate competition, and to "encourage innovation and experimentation" in the development of wireless services); Amendment of the Commission's Rules Part 27, to Establish the Wireless Communications Service, Report and Order, 12 FCC Rcd 10785, ¶¶ 2, 26 (1997); see also 47 C.F.R. § 27.2 (authorizing WCS licensees to "provide any service for which [their] frequency bands are allocated" subject to technical and other rules contained in Part 27 to encourage "deployment of new telecommunications services and products to consumers" and to enable licensees to offer customers "a mix of services and technologies"); Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, First Report and Order, 15 FCC Rcd 476, ¶ 4 (2000) (authorizing television broadcasters flexibility to use their digital spectrum assignments to provide other wireless services in addition to traditional broadcast services to "enable the most efficient and intensive use" of the broadcast spectrum and thereby increase competition and further the interests of consumers).

authority constituted a fundamental change in the transmission characteristics of the spectrum allocations. For example, the Commission last year proposed to authorize ancillary terrestrial use of L-band, 2 GHz, and Big LEO Mobile-Satellite Service ("MSS") satellite spectrum in conjunction with MSS constellations to facilitate reception by MSS subscribers indoors and in urban areas where MSS satellite services are attenuated.[25] Moreover, the Commission proposed in 1997 to authorize licensees of Digital Audio Radio Services ("DARS"), the satellite radio equivalent of DBS, to operate networks of ancillary terrestrial repeaters in conjunction with their satellite-based audio programming services.[26] Last year, the Commission authorized DARS licensees to operate terrestrial networks using their DARS satellite spectrum assignments pursuant to special temporary authority.[27] In addition, last year the Commission authorized Instructional Television Fixed Service ("ITFS") and Multichannel Multipoint Distribution Service ("MMDS") licensees to offer mobile services using their fixed service spectrum

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[25] MSS Flexibility NPRM, ¶ 2 ("Flexibility has been the Commission's favored approach to spectrum management and licensing in recent years.").

[26] Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754, 5810 (1997).

[27] See Application for Special Temporary Authority to Operate Satellite Digital Audio Radio Service Complementary Terrestrial Repeaters, DA 01-2171, File No. SAT-STA-20010724-00064 (rel. Sept. 17, 2001) (granting STA to Sirius Satellite Radio Inc.) ("Sirius STA"); Application for Special Temporary Authority to Operate Satellite Digital Audio Radio Service Complementary Terrestrial Repeaters, DA 01-2172, File No. SAT-STA-20010724-00063 (rel. Sept. 17, 2001) (granting STA to XM Radio Inc.) ("XM STA"). In the STA proceedings, the Commission indicated its likely intention to authorize terrestrial repeaters on a permanent basis, noting that the Commission "clearly contemplated that the repeaters were to be part of the proposed satellite systems." Sirius STA at ¶ 7; XM STA at ¶ 7.

assignments.[28] Three years earlier, in 1998, the Commission expanded the operational authority of these initially one-way licenses to enable the licensees to offer two-way services.[29]

3. DBS non-conforming use policy

In the alternative, the Commission should authorize CSI to operate the Compass ITP as a "non-conforming" use of DBS spectrum. According to the Commission, DBS licensees are permitted to "make unrestricted use of [their assigned DBS] spectrum" assignments to provide non-conforming services prior to launching and commencing operation of their DBS systems.[30] The Commission enacted this policy "to provide DBS operators with a source of early revenues

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[28] See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, First Report and Order and Memorandum Opinion and Order, 16 FCC Rcd 17222, ¶¶ 2, 20 (2001) ("We find that adding a mobile allocation to the 2500-2690 band will further promote the public interest by providing an additional option to service providers in the band.").

[29] Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions, Report and Order, 13 FCC Rcd 19112, ¶ 1 (1998) ("In this Report and Order, we amend [the Commission's rules] to provide [MMD and ITRS] licensees with increased technical and operational flexibility."), recon., 14 FCC Rcd 12764 (1999), further recon., 15 Rcd 14566 (2000).

[30] See The Commission Requests Further Comment in Part 100 Rulemaking Proceeding on Non-Conforming Use of Direct Broadcast Satellite Service Spectrum, Public Notice, 15 FCC Rcd 24418, at 1 (seeking comment, inter alia, on whether the non-conforming use policy should be further liberalized for DBS licensees that hold licenses in the western portion of the orbital arc, such as the licenses requested by Compass herein) ("Non-Conforming Uses Order"); see also Petition of United Satellite Broadcasting Company, Inc., Memorandum Opinion and Order, 1 FC Rcd 977, ¶ 12 (1986) ("[T]he clarification rendered here will permit the maximum allowable usage of the DBS allocation . . ., and non-conforming uses which do not detract from the goal of introducing DBS service, and which may help to advance it, will be permitted to an extent which can be expected to help develop a DBS operator's service.").

[to] help operators meet the very high up-front costs of launching a DBS system."[31] This rationale equally justifies permitting CSI to use assigned DBS spectrum to operate the Compass ITP on an ancillary basis. When it originally adopted its DBS non-conforming uses policy, the Commission envisioned that DBS licensees would provide non-conforming services, i.e., services other than video entertainment programming, using their satellite transponders.[32] The public interest will be served, however, by including terrestrial reuse of DBS spectrum on an ancillary basis in the Commission's non-conforming uses policy provided that such operations do not cause harmful interference to incumbent licensees. Given the Commission's determination in its proceeding creating the Multichannel Video Distribution and Data Service ("MVDDS") that co-frequency sharing of DBS spectrum between terrestrial licensees and DBS licensees is possible,[33] there is no legal or policy reason not to permit ancillary terrestrial reuse of such spectrum as a permissible non-conforming use under the Commission's DBS non-conforming uses policy.

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[31] Non-Conforming Uses Order, ¶ 2.

[32] See Revision of Rules and Policies for the Direct Broadcast Satellite Service, Report and Order, 11 FCC Rcd 9712, ¶ 13 (1995) (permitting non-conforming uses of DBS spectrum on transponders also used to provide DBS service).

[33] First Report and Order, ¶ 1.

4. Docket 98-206 proceeding

In response to a 1998 petition for rulemaking ("Petition") filed by Northpoint Technology. Ltd. ("Northpoint"),[34] the parent company of CSI, the Commission initiated a proceeding to address ancillary terrestrial use of DBS spectrum.[35] In 2001, the Commission established in this proceeding a new terrestrial fixed service for the provision of video programming and data services,[36] thus demonstrating the feasibility of reusing DBS spectrum in the manner for which CSI requests authority in the instant Application. Further, in January 1999, Northpoint affiliates (collectively "Broadwave USA") filed 69 applications ("Broadwave Applications") under the Commission's Part 101 terrestrial fixed service rules to provide terrestrial video programming and data services using DBS spectrum.[37] The Commission has not yet acted on the Petition or the Broadwave Applications. However, the Commission has sought comment on whether or not to assign geographic terrestrial licenses via competitive bidding.[38]

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[34] Northpoint Technology Petition for Rulemaking to Modify Section 101.47(p) of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Digital Broadcast Satellite Licensees and Their Affiliates, RM 9245 (filed Mar. 6, 1998) ("Petition").

[35] See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, Notice of Proposed Rulemaking, 14 FCC Rcd 1131 (1998).

[36] See First Report and Order, ¶ 217 ("[W]e will permit a terrestrial point-to-multipoint video and data distribution service, which we will refer to as the MVDDS, to operate under Part 101 of our Rules in the 12.2-12.7 GHz band.")

[37] See First Report and Order, ¶¶ 211 n. 449, 263.

[38] First Report and Order, ¶¶ 331-336.

As set forth below, and as Northpoint has maintained throughout the Docket 98-206 proceeding, such a course of action is contrary to the public interest. Accordingly, CSI requests the Commission to refrain from determining to auction terrestrial licenses, and instead requests the Commission to grant the instant Application for authority to construct Compass.

Grant of ancillary terrestrial authority to a nascent DBS licensee, such as CSI, is the only means available to the Commission to develop a competitive satellite-based MVPD market. EchoStar and DIRECTV currently are the only two national DBS providers operating in the United States capable of competing with national cable operators. These licensees, which have requested Commission consent to merge to create a DBS monopoly, control all of the full-CONUS DBS spectrum assigned to the United States under the BSS Plan—1500 MHz.[39] In today's MVPD market, a new entrant must provide a comprehensive bundle of video programming services, including local broadcast stations, national cable networks, interactive and high-definition television, and broadband Internet access. Further, the entrant must benefit from the economies of scale necessary for the entrant to negotiate competitive carriage rates for programming and competitive manufacturing costs for consumer equipment, including antennas and receivers. Without such capacity and the benefits of nationwide economies of scale, a

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[39] This spectrum is comprised of the 32 channels available at each of the three full-CONUS orbital slots, 101° W.L., 110° W.L., and 119° W.L. In addition, EchoStar also operates 19 channels of the 32 channels available at 61.5° W.L. and 24 channels of the 32 channels available at 148° W.L., which amounts to an additional 1000 MHz of DBS spectrum. See Merger Application, Exhibit 1 to Engineering Statement.

fledgling MVPD start up simply cannot compete with the entrenched incumbents and, therefore, there will be no additional MVPD competition.[40]

To enable another DBS licensee to compete in the MVPD market, it is essential that the remaining, unassigned DBS spectrum be aggregated and authority to use that spectrum on an ancillary terrestrial basis be granted to a single new entrant—CSI. CSI is the only DBS applicant that has access to the Northpoint Technology necessary to develop and deploy an ITP. Northpoint Technology is the only terrestrial DBS sharing technology that has passed independent testing by the MITRE Corporation as required by Congressional mandate.[41] The spectrum efficiencies that can be generated by terrestrial reuse of DBS spectrum will assist CSI to overcome the substantial competitive advantage that EchoStar, DIRECTV, or, in the event that the proposed Merger is approved, EchoStar-DIRECTV will have over CSI in the provision of DBS services. However, if the Commission divides ancillary terrestrial DBS authority among numerous terrestrial licensees, this potential will be lost. Although at some expense individual companies may be able to obtain blocks of geographical area terrestrial licenses, these licensees nevertheless will be unable to achieve sufficient economies of scale. At best, they will be regional operators. Further, without integrated DBS satellite capacity, terrestrial licensees will

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[40] In fact, if the Merger is approved and cable operators continue to consolidate as industry analysts anticipate, there will be far less MVPD competition in the future than currently exists. See, e.g., Robert Frank, Cable Industry Mergers? Let's Count the Ways, WALL ST. J., Jan. 22, 2002, at C1; Merger is Watchword in Industry in 2002, Experts Predict, COMM. DAILY, Jan. 3, 2002.

[41] See Launching Our Communities' Access to Local Television Act of 2000, Pub L. No. 106-553, App. B, Tit. X, § 1012(a), 114 Stat. 2762, 2762A-128, 2762A-141.

be unable to aggregate sufficient national transmission capacity to offer competitive MVPD services. By contrast, CSI will use the proprietary, integrated DBS and terrestrial platforms of Compass to introduce additional nationwide competition to the MVPD market.[42]

Grant of the instant Application is consistent with Northpoint's initial Petition in which Northpoint expressly requested that authority to terrestrially reuse DBS spectrum be granted to DBS licensees.[43] As demonstrated in the attached Annex 4, the Commission only can realize the unique efficiencies that can be generated from such terrestrial reuse of DBS spectrum by allowing the creation of a combined terrestrial-satellite system, which has only been demonstrated to be possible through the use of patented Northpoint Technology. Only a hybrid satellite-terrestrial DBS system, such as Compass, will be able to divide local and national programming between terrestrial and satellite transmission capacity, respectively, to derive a seamless, integrated, and comprehensive bundled MVPD service. However, the DBS industry has changed considerably since Northpoint first requested the Commission to authorize ancillary terrestrial use of DBS spectrum. At the time that Northpoint filed its Petition, EchoStar and DIRECTV were fledgling companies.[44] They now are the sixth and third largest MVPD

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[42] Although Compass believes that such spectrum aggregation is sufficient to launch a competitive new DBS service, it is not clear that a new entrant will be able to remain competitive over the long term without access to full-CONUS DBS satellite coverage. Accordingly, as stated above, Compass will continue to explore innovative means of obtaining such coverage.

[43] Northpoint Petition, at 13 ("Northpoint envisions a terrestrially-originated supplement to DBS").

[44] As of June 2001, DIRECTV and EchoStar had 10 million and 6 million subscribers, respectively, and the DBS industry served 18% of all MVPD households. Video Competition

providers, respectively, in terms of subscribers and they control the vast majority of all DBS spectrum, including all of the most valuable full-CONUS spectrum.[45] Consequently, given today's DBS industry, it would be contrary to the public interest to authorize EchoStar or DIRECTV to terrestrially reuse DBS spectrum.[46] Doing so would raise further barriers to competitive entry by a new DBS provider, not advance competition in the DBS market. Terrestrial reuse of DBS spectrum by a nascent DBS licensee with a technology demonstrated by independent testing is the only way to offset the substantial competitive disadvantage imposed on new entrants by the superior, full-CONUS DBS spectrum rights held by the incumbent licensees. Thus, to retain competition in the DBS market and increase competition in the more general MVPD market, terrestrial spectrum rights must reserved for a new DBS entrant, such as CSI.

The instant Application is not mutually exclusive to the Broadwave Applications. Like CSI, Broadwave is a Northpoint affiliate. As a result, CSI will privately coordinate with

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Report, ¶ 57. By contrast, in June 1998, all satellite-based video programming providers combined served 7.2 million subscribers (this figure includes subscribers of DIRECTV, EchoStar, several other very small DBS providers, and Primestar, which provided video programming in the FSS band). This represented less than 10% of all MVPD households. Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, Fifth Annual Report, Fifth Annual Report, 13 FCC Rcd 24284, ¶¶ 7, 62 (1998).

[45] Id. at ¶ 57.

[46] In fact, the Commission proposed in its First Report and Order to prohibit existing DBS providers from obtaining terrestrial licenses. First Report and Order, ¶ 298 ("Based on our preliminary analysis, incumbent local cable operators and existing DBS service providers may have both the ability and incentive to acquire MVDDS licenses in order to anticompetitively foreclose entry by a new MVPD provider.").

Broadwave terrestrial use of the requested DBS spectrum and is amenable to Commission imposition of a licensing condition requiring such privately negotiated coordination.[47]

III. DESCRIPTION OF OPERATIONS

A. Satellite Operations

The satellite-component of Compass primarily will provide digital video and audio programming, including national cable networks, directly to residential and business subscribers, but also will be capable of providing certain data and multimedia services. Like all other DBS providers licensed by the Commission, CSI intends to operate Compass on a non-broadcast,[48] non-common carrier basis, by providing DBS satellite services to paid subscribers.[49]

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[47] Northpoint has explained in detail to the Commission in the context of the Docket 98-206 proceeding that the applications of PDC Broadband Corporation and Satellite Receivers, Ltd., which purport to be mutually exclusive to the Broadwave Applications, failed either to undertake or to complete independent testing of their proposed systems as required by Congress, and thus should be summarily dismissed by the Commission. See Comments of Northpoint Technology, Ltd. and Broadwave USA, Inc. on MITRE Corporation Report, ET Docket 98-206, RM 91-47, RM-9245 (filed Mar. 15, 2002).

[48] See 47 C.F.R. § 100.17 (stating that licenses for non-broadcast DBS systems will be issued for a period of ten years).

[49] CSI also may use its DBS satellites for conventional non-conforming uses consistent with the practices of EchoStar and DIRECTV. For example, CSI may sell and/or lease a portion of its capacity on a non-common carrier basis for complementary business purposes. See Non-conforming Uses Order. As required under the Commission's non-conforming uses policy, Compass will notify the Commission of any conventional non-conforming services provided by Compass using its Southpoint satellites and further describe its service offering in such notification. See Revision of Rules and Policies for the Direct Broadcast Satellite Service, Report and Order, 11 FCC Rcd 9712, ¶ 18 (1995).

B. Terrestrial Operations

The Compass ITP will be used to provide local programming, including local broadcast stations, and individualized services, such as certain interactive television functions (including video-on-demand and music downloads) and broadband Internet access. The ITP will terrestrially reuse DBS spectrum assigned to CSI in communities nationwide. Terrestrial transmissions will be integrated with satellite transmissions in subscribers' receivers to form an integrated and comprehensive bundle of MVPD programming and services.

C. International Operations

Pursuant to a 1996 Commission order authorizing DBS providers to provide service to foreign countries using their DBS spectrum assignments,[50] CSI is requesting authority to construct an international DBS system that serves the United States, Mexico, Canada, and portions of the ITU Region 3, including Australia, New Zealand, Papua New Guinea, and other population centers. The Commission recently affirmed its 1996 international DBS policy in its

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[50] Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems and DBSC Petition for Declaratory Rulemaking Regarding the Use of Transponders to provide International DBS Service, Report and Order, 11 FCC Rcd 2429, ¶ 1 (1996) ("With this Report and Order, we adopt a policy that permits all . . . direct-broadcast satellite service ("DBS") systems to offer both domestic and international services. This will remove outdated regulatory barriers to greater competition in satellite communications services.").

decision granting EchoStar Satellite Corporation authority to construct and launch the EchoStar 7 satellite, which will include one transponder aimed at Mexico.[51]

Further, as an international satellite system, this Application is not subject to the competitive bidding procedures set forth in Sections 100.71 through 100.80 of the Commission's rules.[52] Under the Open-Market Reorganization for the Betterment of International Telecommunications Act ("ORBIT Act"),[53]

> [n]otwithstanding any other provision of law, the Commission shall not have the authority to assign by competitive bidding orbital locations or spectrum used for the provision of international or global satellite communications services.[54]

The Commission's rules are subordinate to the ORBIT Act, which was enacted into law in 2000—several years after the promulgation by the Commission of the relevant competitive bidding rules and after the only Commission auction of DBS channels and orbital slots.[55]

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[51] EchoStar 7, at ¶ 5 ("Commission policy allows satellite operators flexibility in the technical design of their space stations to best implement their business plans. In addition, we note that the Commission permits DBS licensees to provide DBS service in other countries, in accordance with U.S. treaty obligations, from U.S. DBS orbit locations, provided the satellite operator obtains all necessary approvals from the foreign administration.") ("EchoStar 7").

[52] 47 C.F.R. §§ 100.71-100.80.

[53] Open-Market Reorganization for the Betterment of International Telecommunications (ORBIT) Act, 106 P.L. 180, 114 Stats. 48 (codified as amended at 47 U.S.C. §§ 701, 761 to 769).

[54] 47 U.S.C. § 765(f). The ORBIT Act does not contain a definition for the term "international satellite communications service."

IV. DEPLOYMENT SCHEDULE

Under the Commission's rules, applicants requesting Commission authorization for their DBS systems file three stages of applications. First, applicants file an application for authority to construct a DBS system. Grant of this first application in the form of a construction permit triggers the running of the DBS due diligence implementation milestone deadlines: (i) within one year of the grant of a construction permit, the applicant must enter into a satellite construction contract for each of the satellites that comprise the applicant's DBS system;[56] (ii) within four years, the applicant must have completed construction of its first satellite;[57] and (iii) within six years, the satellites must be in operation.[58] Upon entering into a satellite construction contract, an applicant files its second-phase application seeking authority to construct and launch its DBS system. Upon the launch of its DBS system and placement of the satellites in their intended orbits, a DBS applicant files a license to operate the system.

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[55] S.376 was enacted by Congress as the ORBIT Act on March 17, 2000. See 106 P.L. 180, 114 Stats. 48. The Commission's DBS competitive bidding rules were enacted in 1995. See Revision of Rules and Policies for the Direct Broadcast Satellite Service, Report and Order, 11 FCC Rcd 9712 (1995). The only two DBS auctions took place in January 1996. See EchoStar DBS Corporation Wins 24 DBS Channels at the 148 Degree Orbital Location With a High Bid of $ 52,295,000, News Release, 1996 FCC LEXIS 299 (rel. Jan. 26, 1996); Application of MCI Telecommunications Corporation For Authority To Construct, Launch and Operate a Direct Broadcast Satellite System at 110° W.L., Order, 11 FCC Rcd 16275 (1996) (granting the DBS licenses MCI won through competitive bidding).

[56] See 47 C.F.R. § 100.19(a).

[57] See 47 C.F.R. § 100.19(b).

[58] See 47 C.F.R. § 100.19(a)-(b).

In compliance with the Commission's DBS due diligence rules, CSI expeditiously will enter into a satellite construction contract for the manufacture of Southpoint 1 and Southpoint 2 within one year of the issuance of a construction permit by the Commission covering the satellites. Upon executing the contract, CSI will file its second-phase application, which will include a more detailed technical description of the Southpoint 1 and Southpoint 2 satellites. As stated in Section I, supra, CSI herein requests the Commission to assign to CSI its requested orbital slots and DBS channels prior to the filing by CSI of a second-phase application. Consistent with the Commission's DBS non-conforming uses policy, CSI may immediately deploy its ITP in selected communities upon interim assignment by the Commission to CSI of DBS orbital slots and channel assignments.[59] CSI's target launch date for the terrestrial component of its service is January 1, 2003 or sooner if the Commission grants interim orbital slots and DBS channels to CSI.

V. APPLICANT QUALIFICATIONS

A. Legal Qualifications

CSI is fully qualified to be a DBS licensee. CSI's ownership and legal qualifications to be a Commission licensee are set forth in the FCC Form 430 attached hereto as Appendix B.

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[59] Under the Commission's DBS non-conforming uses policy, DBS providers are permitted to prove non-conforming services using their DBS spectrum prior to initiating DBS services. Non-conforming Uses Order, at 1.

B. Financial Qualifications

The Commission does not require applicants seeking authority to construct DBS systems to demonstrate their financial qualifications. Instead, to prevent the warehousing of DBS spectrum, the Commission relies on the application of the DBS due diligence milestones once a DBS system is authorized.[60] CSI will comply with each of these due diligence requirements.

VI. PUBLIC INTEREST CONSIDERATIONS

A. Grant of the Instant Application Will Greatly Enhance MVPD Competition

By granting CSI an authorization to construct Compass, the Commission can greatly enhance competition in the increasingly consolidated MVPD market generally and, in particular, in the DBS market. Moreover, the Commission will ensure that rural MVPD consumers that do not have access to cable are nevertheless not subject to the exercise of monopoly power by a combined EchoStar-DIRECTV. CSI will increase competition and thereby put downward

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[60] See EchoStar Satellite Corporation, Directsat Corporation, EchoStar DBS Corporation; Application for Authority to Make Minor Modifications to Direct Broadcast Satellite Authorizations, Launch, and Operational Authority and Directsat Corporation, Direct Broadcasting Satellite Corporation, EchoStar DBS Corporation, EchoStar Satellite Corporation; Request to Change Milestone Dates for Direct Broadcast Satellite Systems and Request for Special Temporary Authority to Test a Direct Broadcast Satellite, Memorandum Opinion and Order, 13 FCC Rcd 8595, ¶ 10 (1998) ("The Commission's policy with regard to the assignment of DBS channels has traditionally been to impose milestone requirements at specific orbital locations rather than to establish stringent financial qualifications to ensure development and use of valuable DBS resources."); See also Inquiry into the development of regulatory policy in regard to Direct Broadcast Satellites for the period following the 1983 Regional Administrative Radio Conference, 90 F.C.C.2d 676, ¶ 114 (1982) ("In lieu of stringent financial showings and

pressure on MVPD prices and incentivize market participants to innovate, thus resulting in better, less expensive television service for American consumers. Further, CSI will increase the distribution options available to content producers and thereby increase the diversity of programming available to the viewing public.

Currently, over 86% of all television households receive their video programming from an MVPD provider,[61] and about two-thirds of all television households subscribe to cable.[62] Moreover, 87% of all cable subscribers are served by just ten cable companies.[63] These companies increasingly control the market for the distribution of video programming and thus control the access of Americans to such programming. The DBS industry also is becoming increasingly consolidated.[64] Nevertheless, DBS is the only credible alternative to cable available to most Americans. If the Merger of EchoStar and DIRECTV is approved and consummated, there only will be one national DBS provider to compete with the cable industry. Further, a single company will have monopoly control over the only MVPD distribution platform capable of reaching all Americans nationwide.

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subsequent Commission analysis, we will require that parties granted authorizations proceed with diligence in constructing interim DBS systems.").

[61] See Video Competition Report, ¶ 6.

[62] See Id at ¶ 18.

[63] See Video Competition Report, ¶ 14.

[64] See Video Competition Report, ¶ 57.

In the near future, the vast majority of Americans may have only two choices for MVPD services—their local cable system, which is overwhelmingly likely to be controlled by one of ten national cable companies, or a single consolidated DBS provider. By granting the instant Application, the Commission can eliminate the coming national MVPD duopoly by injecting a new competitor into local MVPD markets across the country. CSI will provide most Americans with a third choice for comprehensive MVPD services. CSI also will provide American consumers with a choice of DBS providers, which will be the only choice of MVPD services for the approximately three million, largely rural television households that have no access to cable.[65] Further, CSI will provide content producers with an additional distribution platform for video programming. CSI will prevent the combined EchoStar-DIRECTV from obtaining monopoly control over DBS content distribution, which is the only distribution method capable of reaching every household nationwide.

B. CSI Will Use Spectrum in a More Efficient Manner Than Any Other DBS Licensee

By integrating the terrestrial and satellite components of its Compass DBS system, CSI will achieve a far more efficient use of DBS spectrum than has ever before been possible. In fact, as more fully explained in Annex 4 to Exhibit A, the Compass ITP will be as much as 80 times more spectrally efficient than a spot beam DBS satellite for the transmission of local broadcast stations and as much as 1500 times more efficient with respect to broadband Internet

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[65] Numerous commenters in the Commission's proceeding to review the proposed Merger of EchoStar and DIRECTV discussed at length the dangers to rural consumers of permitting all DBS facilities to be controlled by a single licensee.

access. Spectrum efficiencies will be achieved by "team-broadcasting" integrated terrestrial and satellite signals on the same DBS frequencies to each subscriber. In addition to this co-frequency spectrum sharing between the terrestrial and satellite components of Compass, CSI also will terrestrially reuse the same DBS spectrum in numerous communities nationwide to provide video programming, interactive and high-definition television, and related services targeting particular communities. For example, in addition to receiving national cable networks by satellite, residents of Los Angeles and Seattle also will receive via Compass's ITP on the same DBS channels different programming which has been specifically targeted to those communities, such as local broadcast channels. This will eliminate the spectrally inefficient practice of uplinking local channels to a satellite for the sole purpose of downlinking them to subscribers a few miles from the original source of the local signal, while simultaneously blocking many other viewers across the country from receiving the signal.

Moreover, the spectrum efficiencies that can be realized by the provision of broadband Internet access via Compass are even more significant. Currently satellite-only broadband Internet access offerings transmit Internet content to be received by a single user across a very wide geographic foot print—frequently as large as the whole United States. This practice is extremely wasteful of valuable spectrum resources and will be eliminated by providing individualized content through the Compass ITP.

VII. SECTION 304 WAIVER

In accordance with Section 304 of the Act,[66] CSI hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise.

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[66] 47 U.S.C. § 304.

VIII. CONCLUSION

For the foregoing reasons, CSI respectfully requests the Commission to: (i) grant this Application to construct Compass; (ii) assign CSI the requested DBS orbital slots and DBS channels on an interim basis; and (iii) authorize CSI to deploy and commence operation of its ITP.

Respectfully Submitted,

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TABLE OF APPENDICES

Technical Characteristics of Compass Systems, Inc. Satellite: 166°W

1. Introduction

The Compass Systems, Inc. satellite network will utilize a long-unoccupied BSS orbital location to provide broadcast programming to CONUS, Alaska and Hawaii in conformance to the ITU Radio Regulations Appendix S30 and 30A plans. The planned satellite will be equipped to provide a full 32-channel capacity that will be distributed among beams covering CONUS, Alaska and Hawaii. The Asia-Pacific link will be provided by means of a steerable spot beam that will have the capability to rebroadcast to the selected Region 3 coverage area up to 16 of the 32 channels received by the satellite. Return channels are provided for this link. The satellite will offer delivery of direct-to-home and direct-to-business video, data and multimedia services. The service may be implemented on one satellite providing the full complement of 32 BSS channels, or on several co-located payloads. The satellite will be procured through a competitive procurement process, and would be compatible with a range of commercially available satellite busses and launch vehicles.

2. System Overview

The Compass Systems, Inc. satellite at 166° W longitude will consist of the full complement of thirty-two 24 MHz channels utilizing the 17.3-17.8 GHz band for the feeder link and the 12.2-12.7 GHz band for the service link. The satellite will have fixed antennas covering the western U.S. (CONUS), Alaska and Hawaii respectively. An additional 4.7° beamwidth spot beam will be steerable in Region 3 to provide 14/12.2-12.7 GHz service. The steerable spotbeam can utilize up to sixteen of the 32 channels received by the satellite, and transmit them to the designated location, and will incorporate a return link to CONUS.

This is discussed in greater detail in the following sections.

2.1 System Coverage from 166°W

The satellite will have fixed antennas covering the western U.S. (CONUS), Alaska and Hawaii, respectively. An additional fully steerable, 4.7° beamwidth spotbeam antenna will be available to cover market areas within Region 3 in the Asia-Pacific region. The satellite will have thirty-two 24 MHz channels available to provide DTH video services to CONUS, Alaska and Hawaii consistent with the Region 2 BSS plan. In addition to these U.S. service beams, sixteen additional channels will be available to provide a selected group of channels between U.S. and the Asian locations. It is expected that digital transmission will be the primary method of modulation employed. Figure 2-1 shows the planned area coverages for the U.S. and Asia Pacific beams; the steerable beam is shown for illustrative purposes covering Australia.

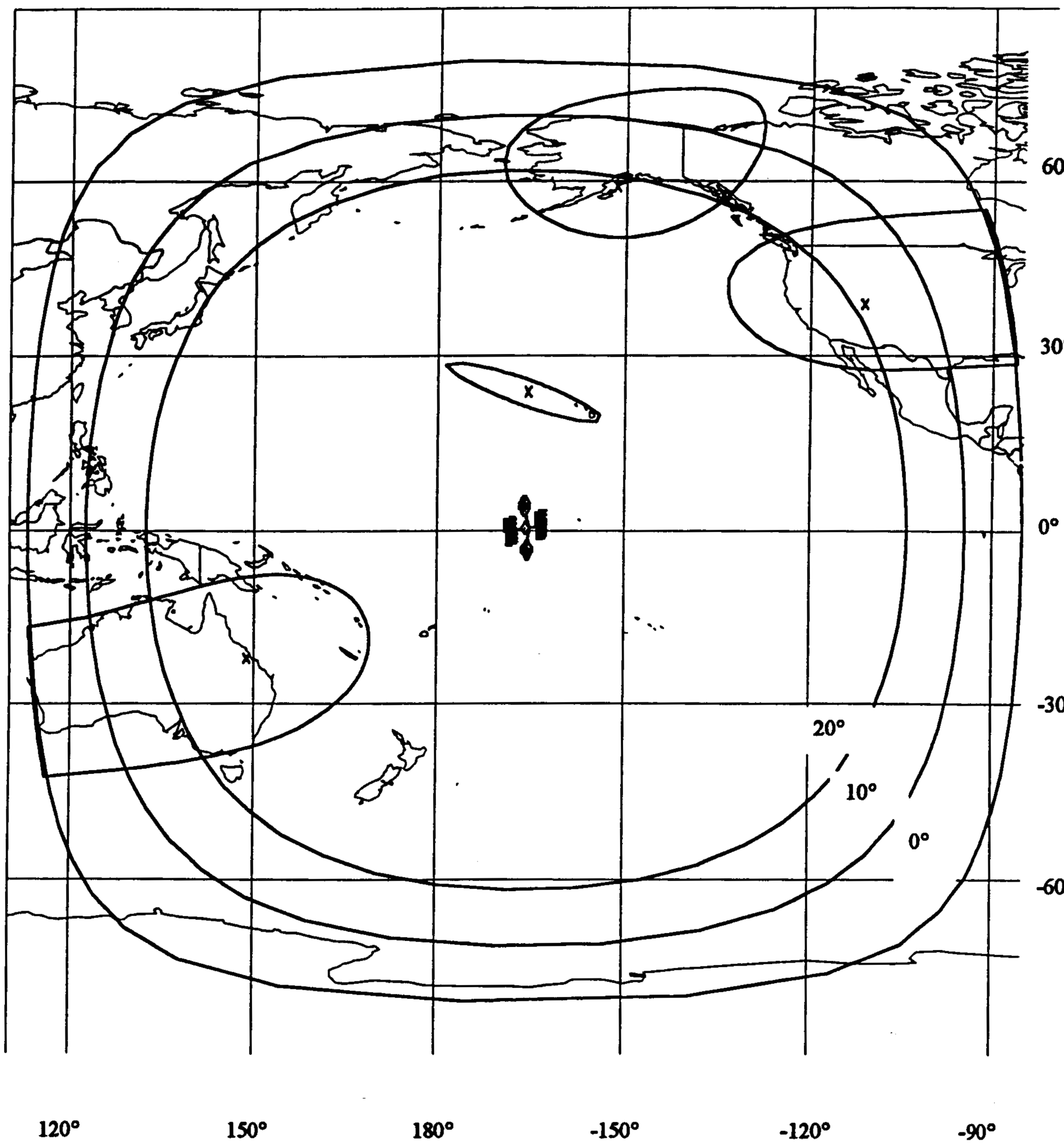

Figure 2-1
-166° Satellite, Beams Covering Alaska, Hawaii, CONUS, and APR
Shown As An Example Over Australia
(-3 dB Contours)

The uplink BSS feeder link earth stations will be located at sites in CONUS and Hawaii. Diverse sites may also be employed to provide redundancy. The antenna will be in the range of 7 to 13 meters, consistent with characteristics in the BSS Plan.

The typical DTH satellite receive antennas will be 0.45 m in diameter at the U.S. receive locations. Depending on the selected pointing area chosen for the steerable antenna, the user receive antenna may be similar in size or slightly larger, depending on the local propagation conditions.

2.2 Radio Frequency Plan

The uplink feeder link will use the 17.3-17.8 GHz frequency band. The thirty-two uplink channels are connected by a switch matrix to the thirty-two associated downlink channels in the 12.2–12.7 GHz frequency band and transmitted down from the Alaska, Hawaii and CONUS antennas. An uplink channel can be transmitted to one or more downlink beams as required. The range of cross-connection capability will be based on the output of service requirements under study. Table 2-1 shows the pairing and polarization of the feeder link and the service link for odd channels and Table 2-2 shows the pairing and polarization of the feeder link and service link for the even channels. In addition, a parallel connection capability is provided so that up to sixteen uplink channels can be switched to the sixteen transponders connected to the steerable spotbeam. The uplink and downlink frequencies for the steerable spot beam are shown in Table 2-3.

Table 2-1. Compass Systems, Inc. Frequency and Polarization Plan (odd channels)

Channel #	Polarization	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
1	RHCP	17,324.00	12,224.00
3	RHCP	17,353.16	12,253.16
5	RHCP	17,382.32	12,282.32
7	RHCP	17,411.48	12,311.48
9	RHCP	17,440.64	12,340.64
11	RHCP	17,469.80	12,369.80
13	RHCP	17,498.96	12,398.96
15	RHCP	17,528.12	12,428.12
17	RHCP	17,557.28	12,457.28
19	RHCP	17,586.44	12,486.44
21	RHCP	17,615.60	12,515.60
23	RHCP	17,644.76	12,544.76
25	RHCP	17,673.92	12,573.92
27	RHCP	17,703.08	12,603.08
29	RHCP	17,732.24	12,632.24
31	RHCP	17,761.40	12,661.40

Table 2-2. Compass Systems, Inc. Frequency and Polarization Plan (even channels)

Channel #	Polarization	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
2	LHCP	17,338.58	12,238.58
4	LHCP	17,367.74	12,267.74
6	LHCP	17,396.90	12,296.90
8	LHCP	17,426.06	12,326.06
10	LHCP	17,455.22	12,355.22
12	LHCP	17,484.38	12,384.38
14	LHCP	17,513.54	12,413.54
16	LHCP	17,542.70	12,442.70
18	LHCP	17,571.86	12,471.86
20	LHCP	17,601.02	12,501.02
22	LHCP	17,630.18	12,530.18
24	LHCP	17,659.34	12,559.34
26	LHCP	17,688.50	12,588.50
28	LHCP	17,717.66	12,617.66
30	LHCP	17,746.82	12,646.82
32	LHCP	17,775.98	12,675.98

Table 2-3. Compass Systems, Inc. Ku-band Frequency Example

Channel #	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
1	14,024.00	12,224.00
2	14,053.16	12,253.16
3	14,082.32	12,282.32
4	14,111.48	12,311.48
5	14,140.64	12,340.64
6	14,169.80	12,369.80
7	14,198.96	12,398.96
8	14,228.12	12,428.12
9	14,257.28	12,457.28
10	14,286.44	12,486.44
11	14,315.60	12,515.60
12	14,344.76	12,544.76
13	14,373.92	12,573.92
14	14,403.08	12,603.08
15	14,432.24	12,632.24
16	14,461.40	12,661.40

2.3 Orbit Location

The Compass Systems, Inc. satellite at 166° W longitude will bring into service a currently unoccupied BSS location that is allocated to the US in the ITU BSS and feeder link plans. Western locations like the one at 166° W longitude are the more favorable locations for serving Alaska and Hawaii. One of Compass Systems, Inc.'s mission is to expand service offerings for these often under served locations. According to the Radio Regulations AP30 Plan the 166° W longitude location can serve CONUS, Alaska and Hawaii. The inclusion of CONUS and the Asia Pacific Region as part of the service area for this location is key for making service from this location economically viable.

3. Satellite Description

A summary of major satellite parameters is shown in Table 3-1 below.

The planned satellite will be a body stabilized spacecraft operating in Ku-band with four downlink beams and three uplink beams. The TT&C subsystem will operate at C-band during Geostationary Transfer Orbit (GTO) and at Ku-band when the satellite is on station.

From this orbital location, 166° W longitude, fixed downlink beams operating in the 12 GHz band will cover CONUS, Alaska and Hawaii. The other downlink beam, also operating in the 12 GHz band is steerable in Region 3. Uplink beams operating in the 17 GHz band will operate with fixed CONUS and Hawaii receive antennas. The steerable antenna receives an uplink beam operating in the 14 GHz band.

3.1 Communications Subsystem

Figure 3-1 provides a graphical representation of the on-board connectivity

3.2 Antennas

The antenna system will consist of three fixed Ku-band antennas, one steerable Ku-band antenna, and one C-band TT&C Omni antenna for use in GTO. The three fixed antennas will be shaped reflectors that are stowed for launch.

3.3 TT&C

TT&C will be provided at either or both edges of allocated bands. The design will select frequency, polarization and coding to minimize interference.

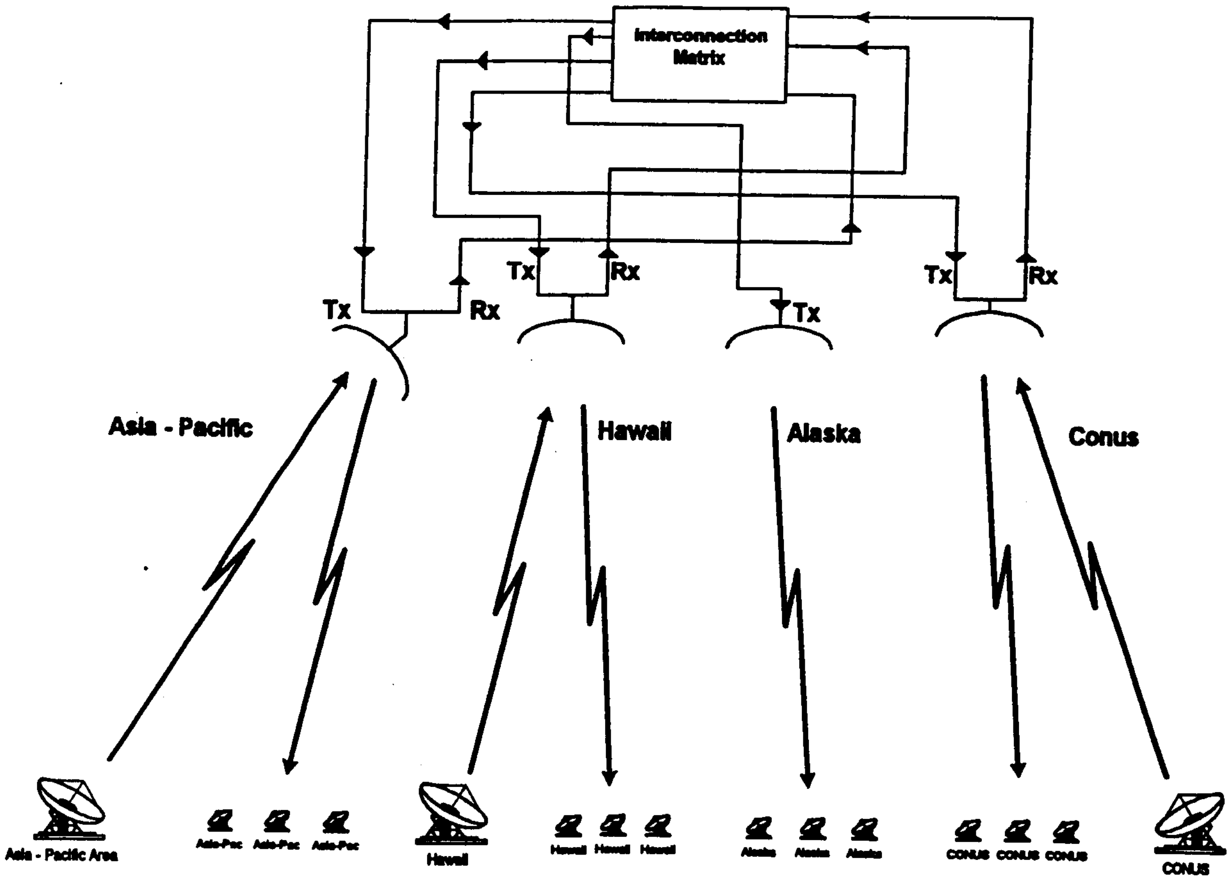
Interconnection Matrix
Tx
Rx
Tx
Rx
Tx
Tx
Rx
Asia - Pacific
Hawaii
Alaska
Conus
Asia - Pacific Area
Asia-Pac Asia-Pac Asia-Pac
Hawaii
Hawaii Hawaii Hawaii
Alaska Alaska Alaska
CONUS CONUS CONUS
CONUS

Figure 3-1

3.4 Spacecraft Characteristics and Configuration

The spacecraft will be body stabilized with North-South solar arrays. The spacecraft mass in GTO could be as high as 4500 kg, including the apogee motor and its propellant. This is somewhat dependent on the latitude of the launch site.

The basic payload will consist of forty-eight transponders, which will include forty-eight 120 watt Ku-band Traveling Wave Tubes (TWT's). The required end-of-life spacecraft power will be about 13 kW, so one of the larger spacecraft buses will be required. There are a number of spacecraft buses available in this size regime. No discussions have been held with any prime contractors at this time.

Buses of this size usually use multiple junction gallium arsenide solar cells on rigid lightweight panels and advanced nickel hydrogen batteries, with some going to even more advanced lithium-ion batteries. These will all be choices made in cooperation with the prime contractor to ensure high performance along with high reliability.

The satellite will be station at its location, ± 0.1° north-south and ± 0.05° east-west, for fifteen years. Stationkeeping propellant will be adequate for in orbit relocation as well as removal from operational orbit at the end-of-life. The stationkeeping propellant will also be chosen in cooperation with the prime contractor as different bus manufacturers utilize different on-board propulsion systems, i.e., bi-propellants, arcjets, ion thrusters, Hall effect thrusters. Performance and reliability will once again be the prime considerations.

The apogee motor will utilize on-board bi-propellants and multiple firings to efficiently achieve the final orbital location. The amount of propellant required will depend on the latitude of the launch site and whether a super synchronous transfer orbit is required.

Spacecraft buses of this size (~13 kW) usually require deployable radiators and heat pipes in order to fit within the launch vehicle fairing. Designs of this type have been space qualified and should not present a problem.

The body stabilization system can be either a biased momentum or a zero momentum system. Both types have been space qualified and are well proven. Attitude sensors for determining errors about the pitch and roll axes can be earth sensors, either scanning or static types. Ground RF beacons can also be used. Yaw attitude error sensing is more difficult, but is required during stationkeeping maneuvers, and can be accomplished with sun sensors and/or gyros. The beam pointing accuracy will be maintained at 1/10 of the beam width or better, in this case ± 0.04°.

The spacecraft design life is twelve years with sufficient onboard propellant to provide fifteen years of stationkeeping and attitude control. Component and system redundancy will be used to ensure the required reliability. An overall system reliability for all transponders operating within specifications for twelve years should be greater than 0.7.

The Traveling Wave Tubes (TWT's) will be arranged with ring redundancy, for example, four rings of twelve tubes, each ring with twelve for eight redundancy.

Table 3-1 SPACECRAFT CHARACTERISTICS

General	
Spacecraft bus	commercially procured existing bus
Stabilization	3-axis body stabilized
Mission life	15 years
Design life	12 years
Eclipse capability	100 percent (48 channels)
Stationkeeping	
North-South (orbital inclination)	±0.1°
East-West (longitudinal drift)	±0.05°
Antenna pointing	±0.4° N-S & E-W
Communications	
Frequency	
Receive	500 MHz in 14 -14.5 GHz (Asian beam) 17.3-17.8 GHz (CONUS beam) 17.5-17.8 GHz (HAW beam)
Transmit	12.2-12.7 GHz
Polarization	LHCP & RHCP on U.S.uplinks & downlinks LHCP or RHCP Asian beam
Number of transponders	48
Channel bandwidth	24 MHz
Receive G/T	0 dB/°K
Receive saturation	nominally –95 dBW/m^2
Transmit EIRP	56.3 dBW max.
Transmitter (TWTA) RF power	120 watts
Transmitter redundancy	12 for 8
Out of Band Emission limitations (percentage of authorized bandwidth)	
50 – 100%	> 20 db attenuation in any 4 kHz
100 – 250%	> 40 db attenuation in any 4 kHz
Greater than 250%	> 50 dB attenuation in any 4 kHz
Tracking, Telemetry and Command	
Frequency Band	
Transfer orbit	C-band
On station	
Command Uplink	in lower/top 12 MHz of 17.3-17.8 GHz
Telemetry Downlink	in lower/top 12 MHz of 12.2-12.7 GHz

Even with the large spacecraft bus, there is compatibility with multiple launch vehicles, i.e., Ariane 4, Ariane 5, Sea Launch, Proton, Atlas V, Delta IV Medplus and Long March. If the final spacecraft design is smaller and lighter because it is implemented on two spacecraft, a smaller bus and launch vehicles would satisfy the requirements.

4. Earth Terminal

There will be three types of Earth terminal functions in the Compass System, Inc. satellite system. The first type of station will be a Gateway terminal. The Gateway terminal will be used to uplink signals in the feeder link to the satellite. The most common terminal in the network will be the user terminal. The user terminal will be a receive-only terminal that will be used by individual subscribers to receive programming from the satellite. The third type of terminal in the network will be a TT&C terminal that will be used to control and monitor the operation of the satellite.

4.1 Gateway Terminal

The Gateway terminals will be located in the western portion of the continental United States, in Hawaii, and in the Asia Pacific region. Co-located with the uplinking facility will be a broadcasting center that will be the interface with the content providers who want to use the system. Programming will be routed to the broadcast center using terrestrial fiber, a wireline network or satellite link. Programming will be delivered in an analog or digital format. The broadcast center will take all these inputs and put them into a standard MPEG format for further processing. To maximize the use of the capacity of the satellite, the programming will be compressed and multiplexed into a digital stream for transmission to the satellite. The degree of compression that is used for a particular program will depend on the content. Typically, sporting events require wider bandwidths than talk shows to capture the movement of the athletes without distortion. After the compression and the multiplexing are completed the digital stream will be encoded and then modulated for transmission over the satellite.

The Gateway antennas will be in the 7-13 meter range depending on the number of uplink carriers that is being supported by any one station. Compass Systems, Inc. anticipates that it will own some of the Gateways while others may be privately owned by broadcasters.

A Gateway terminal in the U.S. will monitor the transmissions that it can see in the 12.2-12.7 GHz band, to assess the quality of the transmissions. In the Alaska and Hawaii downlinks, remote monitoring stations will be placed that will allow the Gateway to dial in and take readings of the transmissions in those beams. The Asia Pacific Gateway will perform the same function in that beam.

4.2 User Terminals

User terminals will consist of a small satellite dish that is typically mounted on the roof of a dwelling and an interconnecting cable that will be used to transport the received signal from the satellite to a digital integrated receiver/decoder (IRD), which is located inside the premises. The IRD is used to receive the composite signal from one of the satellite transponders and pick out the desired channel from the digital stream it is processing. The IRD then decompresses the channel and translates the digital signal back to an analog format so it can be received and displayed on a television. The user terminal at U.S. service locations will be a receive-only terminal that has a reflector size in the 45 to 60 cm range with a G/T in the range of 11 to 15 dB/°K. Depending on the precise location chosen for the Asian spot beam, the user terminal may be of this size or larger, such as one meter, with the typical antenna chosen to match propagation characteristics.

4.3 TT&C Stations

The Compass Systems, Inc. satellite system will have a primary and backup TT&C facility that will either be owned by Compass Systems, Inc. or provided by an established satellite services provider. The stations will be located in North America and will be geographically dispersed to protect the system from catastrophic disasters. If owned by Compass Systems, Inc., it is expected that the TT&C facility will be integrated with the main CONUS Gateway. The telemetry data will be received and processed at both locations but only the on-line facility will issue commands to the satellites. When the satellite is on-station the command link will be in the 17.3-17.8 GHz band and the telemetry link will be in the 12.2-12.7 GHz band. During the transfer orbit the command and telemetry links will be in the extended C-band. The modulation characteristics of the command uplink and telemetry downlink vary with the manufacturer. Typically, the command uplink uses PSK modulation and the telemetry downlink FM modulation. The characteristics of these links will be provided to the Commission once the final selection of the spacecraft manufacturer is made. Compass Systems, Inc. will install in its TT&C stations the required manufacturer specified equipment needed to command and monitor the spacecraft.

5. Transmission Characteristics

Compass Systems, Inc. will employ the latest in digital video distribution technology on its satellite system. The Gateway earth station takes the input programming and digitizes it into an MPEG-2 format. These individual segments are multiplexed into digital streams for transmission to the satellite. Each stream is comprised of approximately 25 Mbps of programming. Then a 3/4 rate convolutional inner code and a Reed Solomon outer code is placed on the digital stream to increase the bit rate to approximately 40 Mbps. This digital stream is then QPSK-modulated for transmission over one of the satellite channels.

The receiver at the other end of the link tunes to one of the satellite carrier frequencies and demodulates the signal. The signal is then Reed Solomon and Viterbi decoded. The receiver demuxes the desired channel from the on coming stream and then decompresses it back into an analog format for viewing on a regular television. The representative signal characteristics are listed in Table 5-1. The final transmission characteristics will be provided to the Commission when the final selection of a modem manufacturer is made.

The Compass Systems, Inc. satellite network design goal is to provide a link availability in excess of 99.7% under all propagation conditions. Link outage is defined to occur when the carrier-to-noise ratio at the receiver falls below 5.1 dB, which an acceptable picture cannot be displayed on the television screen. Further drops in carrier-to-noise can result in loss of synchronization.

Table 5-1 – Digital Video Characteristics

Item	Description
Type of Modulation	QPSK
Bandwidth	24 MHz
Transmitted Symbol Rate	20 Msps
Information Rate	27.647 Mbps
Inner Code	3/4-rate convolutional
Outer Coding	Reed Solomon (204,188)
Transponder backoff	0 dB

Tables 5-2 to 5-5 provide nominal clear sky link calculations for the four areas of interest namely, broadcast links originating in the US and terminating in Alaska/US, Hawaii and Australia. The link calculations indicate that the design is compliant with the Radio Regulations APS30 plan and meets the PFD requirements for FSS links to Asia Pacific locations. In this region a two foot dish may be needed at the edge of coverage to close the link. As can be seen in each of these link calculations, ample margin is present to maintain these links with high availability.

Table 5-2
Clear Sky Link Calculation to Alaska/US

Uplink

Frequency	17.3 GHz
Elevation Angle	22°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	209.1
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
Uplink C/N dB	24.2

Downlink	Edge of Beam	Center of Beam
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	10°	22°
Satellite EIRP, dBW	53.3	56.3
Downlink Path Loss	206.3	206.1
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	12.6	12.6
Boltzmann's Constant, dBW	228.6	228.6
Downlink C/N, dB	13.4	17.4
Available C/N+I total	12.3	14.5
Downlink PFD, $dBW/m^2/4KHz$	-147.7	-144.4

Table 5-3
Clear Sky Link Calculation to Hawaii

Uplink

Frequency	17.3 GHz
Elevation Angle	22°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	209.1
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
	24.2
Uplink C/N dB	

Downlink	Edge of Beam	Center of Beam
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	64°	64°
Satellite EIRP, dBW	52.4	55.4
Downlink Path Loss	205.4	205.4
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	12.5	12.5
Boltzmann's Constant, dBW	228.6	228.6
Downlink C/N, dB	13.8	17.2
Available C/N+I total	11.8	14.4
Downlink PFD, $dBW/m^2/4KHz$	-147.6	-144.6

Table 5-4
Clear Sky Link Calculation to Australia

Uplink

Frequency	17.3 GHz
Elevation Angle	22°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	209.1
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
Uplink C/N dB	24.2

Downlink	Edge of Beam	Center of Beam
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	10°	22°
Satellite EIRP, dBW	53.3	56.3
Downlink Path Loss	206.4	206.1
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	15.1	15.1
Boltzmann's Constant, dBW	228.6	228.6
Downlink C/N, dB	11.4	15.0
Available C/N+I total	10.1	12.8
Downlink PFD, dBW/m^2/4KHz	-152.7	-149.4

Table 5-5
Clear Sky Link Calculation to Australia With Ku-Band Uplink

Uplink

Frequency	14 GHz
Elevation Angle	22°
Transmit EIRP, dBW	72.5
Uplink path loss, dB	207.3
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
Uplink C/N dB	22.2

Downlink	Edge of Beam	Center of Beam
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	10°	22°
Satellite EIRP, dBW	48.3	51.3
Downlink Path Loss	206.3	206.1
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	15.1	15.1
Boltzmann's Constant, dBW	228.6	228.6
Downlink C/N, dB	11.4	15.0
Available C/N+I total	10.3	12.9
Downlink PFD, dBW/m^2/4KHz	-152.7	-149.4

Table 5-6
Clear Sky Link Calculation to Hawaii With Hawaii Uplink

<u>Uplink</u>

Frequency	17.3 GHz
Elevation Angle	64°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	208.4
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
<u>Uplink C/N dB</u>	24.9

<u>Downlink</u>	<u>Edge of Beam</u>	<u>Center of Beam</u>
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	64°	64°
Satellite EIRP, dBW	52.4	55.4
Downlink Path Loss	205.4	205.4
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	12.5	12.5
Boltzmann's Constant, dBW	228.6	228.6
<u>Downlink C/N, dB</u>	13.9	17.3
Available C/N+I total	12.4	14.5
Downlink PFD, dBW/m^2/4KHz	-147.6	-144.6

6. <u>ITU Annex 1 of Appendix 30, Section 2</u>

<u>Limits to the change in the overall equivalent protection margin for frequency assignments in conformity with the Region 2</u>

The updated Region 2 BSS Plan (version April 1999, latest modification: May 2001downloaded from ITU website 18 Mar 02) has been modified in order to take into account the Compass System Satellite Network proposal.

The general configuration of the four beams in Group 1 (ALS00002, HWA00002, HWA01002, USAPSA02) in terms of channels, uplink/downlink beam size and boresight, test point locations and numbers remain the same. The changes involve modifications within the link parameters, i.e., earth station antenna size, transmit powers, eirp's, etc. to more effectively and efficiently utilize the space segment capacity. These are summarized below.

	ALS00002	**HWA00002**	**HWA01002**	**USAPSA02**
Carrier Designation	24M0G7W-			
Carrier Size	24.0 MHz			
Uplink				
E/S Transmitting Power	16.5 dBW			
E/S Transmitting Antenna Size	7.0 m			
E/S Transmitting Antenna Gain	59.9 dBi			
E/S Transmit eirp	76.4 dBW			
Satellite Receiving Antenna Gain	30.0 dBi			

Downlink

Satellite Transmitting Power	20.8 dBW	20.8	20.8 dBW	20.8 dBW
Satellite Transmitting Antenna Gain	35.5	34.6	34.6 dBi	35.5
Satellite Transmitting eirp	56.3	55.4	55.4 dBW	56.3
E/S Receiving Antenna Size	0.45 m	0.45 m	0.45 m	0.45 m
E/S Receiving Antenna Gain	34.4	34.4 dB	34.4 dBi	34.4

Attachment 1, Tables 1 through 5 show the details of the modifications and the resultant output.

The use of lower uplink and downlink e.i.r.p. values minimizes the potential for interference into adjacent satellite networks.

The result of MSPACEg (version 1.964) analysis of Region 2 Plan after the modifications described above is shown in the Attachment to Annex 1. The results indicate that there is no increase in interference to other networks in the Region 2 plan.

7. ITU Annex 1 of Appendix S30A, Section 5

Limits applicable to protect a frequency assignment in the bands 17.3-18.1 GHZ (Regions 1 and 3) and 17.3-17.8 GHz (Region 2) to a receiving space station in the fixed-satellite service (Earth-to-space)

A ΔT/T analysis has been performed in accordance with the method given in Appendix S8 of the ITU Radio Regulations in order to verify the compliance with Section 5 of ITU Annex 1 of APPENDIX S30A. The threshold criteria for the ΔT/T is 3%.

The results of ΔT/T calculations are shown in the table below. The closest Region 1 and 3 orbital locations (±90° from 166.0°W) have been taken into account. These calculations assume the use of the Peak Satellite Receiving Gain (provided in column 3, the actual discrimination angle between the interfering and the wanted source is always higher) for the Region 1 and 3 beams. The characteristics of the interfering beam are described below:

Location:	HAWAII Area and NE Arizona
Max Transmitting Power Density:	-57.3 dB(W/Hz)
Max Transmitting Antenna Gain:	59.9 dBi
Transmitting Antenna Pattern:	R2TES

Name	Satellite Orbital Location	Max Rx Antenna Gain	% Interf from Hawaii	% Interf from US
AUS00...*	164°	48.88	0.265	0.276
AUS00...*	152°	48.88	0.222	0.172
BRM29800	104°	37.02	0.012	0.010
CHN15...*	134°	31.39	0.004	0.003
CHN20000	122°	48.88	0.193	0.155
F ...*	140°	47.97	0.171	0.133
FJI19300	-178°	44.16	0.901	0.942
FSM00000	158°	35.38	0.010	0.005
INS035...*	104°	29.48	0.002	0.002
00BS-3N&J10...	109.85°	33.80	0.006	0.005
J111...*	110°	33.8	0.006	0.005
GUM33...*	122°	43.61	0.057	0.046
KIR 100	176°	42.6	0.227	0.237
KOR112...*	116°	43.43	0.054	0.043
KRE28600	140°	44.0	0.069	0.053
LAO28400	122.2°	42.18	0.041	0.033
MHL00000	146°	41.75	0.042	0.032
MRA33200	121.8°	43.61	0.057	0.046
NRU30900	134°	48.88	0.205	0.161
NZL 100	158°	48.88	0.227	0.176
OCE10100	-160°	32.58	0.355	0.380

PLM...& USA..*	170°	39.35	0.052	0.054
PLW00000	140°	45.53	0.098	0.076
RSTRSD...*	140°	38.4	0.019	0.015
RUS004...*	110°	38.4	0.016	0.013
SLM00000	128°	42.81	0.049	0.039
SMO05700	-178°	48.88	2.673	2.794
TMP00000	128°	48.5	0.183	0.144
TON21500	170.8°	44.64	0.192	0.199
TUV00000	176°	46.93	0.616	0.642
VTN32500	107°	36.64	0.011	0.009
VUT128...*	140°	44.3	0.073	0.057
LST...& L3...	116°	44.6	0.047	0.038
LST...& L4...	126°	44.6	0.049	0.039
US...	125°	38.57	0.012	0.010
US...	149°	37.7	0.011	0.009
US...	164°	48.84	0.175	0.182
US...	173°	40.6	0.065	0.067
GA3D...	105.3°	45	0.049	0.041
GA3...	108.2°	45	0.049	0.041
NB128...	128°	38.42	0.012	0.009
NB134...	134°	33.8	0.004	0.003
Nb144...	144°	38.42	0.013	0.010
NB154...	154°	38.42	0.013	0.010
NB162...	162°	38.42	0.014	0.014
US29...	132°	38.66	0.013	0.010
ASIABSS...	122°	39	0.013	0.011
ASIABSS...	116°	39	0.013	0.010
ASIABSS...	105.5°	39	0.012	0.010
LST...& L5...	119°	44.6	0.047	0.038
7DOL...	137.7°	40	0.018	0.014
7DOL...	157°	36.9	0.010	0.007
KSAT...	104°	42.5	0.027	0.023
KSAT...	122°	42.5	0.030	0.024
KSAT...	128°	42.5	0.031	0.024
KSAT...	134°	42.5	0.031	0.025
KSAT...	140°	42.5	0.032	0.025

* multiple beams; the highest Peak Gain has been assumed

In Column 4 and 5 are the calculated ΔT/T for the Uplink from Hawaii and Arizona respectively. These results clearly show that the ΔT/T is always below the 3% criterion.

ATTACHMENT 1 TO ANNEX 1

Table 1 – ALS00002 Beam

ALS00002	-166.20	USA	P	16 16	0.00	0.00	0.00	0.00	BSS REG2	ANALYSIS	
1	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.86	-109.94	6.04	1.11	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17324.00	17353.16	17382.32	17411.48	17440.64	17469.80	17498.96	17528.12				
17	19	21	23	25	27	29	31				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17557.28	17586.44	17615.60	17644.76	17673.92	17703.08	17732.24	17761.40				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1	CR 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
58.37	-149.66	3.76	1.24	170.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12224.00	12253.16	12282.32	12311.48	12340.64	12369.80	12398.96	12428.12				
17	19	21	23	25	27	29	31				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12457.28	12486.44	12515.60	12544.76	12573.92	12603.08	12632.24	12661.40				
7		R2RES		R123SS		0.0	0.0		0.00000	0.00	
54.67	60.00	64.00	69.75	71.00	65.50	54.83					
-130.67	-141.00	-141.00	-141.00	-156.50	-168.00	-164.00					
0	0	0	0	0	0	0					
D	D	C	A	A	C	D					
-2.16	0.04	-0.63	-1.35	-0.45	0.06	-0.15					
-3.27	-1.44	-2.06	-2.77	-2.05	-1.60	-1.84					

ANNEX 1 - Table 1 cont'd

-3.38	-1.54	-2.16	-2.88	-2.15	-1.70	-1.94					
-3.27	-1.44	-2.06	-2.77	-2.05	-1.60	-1.84					
-3.38	-1.54	-2.16	-2.88	-2.15	-1.70	-1.94					
-3.27	-1.44	-2.06	-2.77	-2.04	-1.60	-1.84					
-3.37	-1.54	-2.16	-2.88	-2.15	-1.70	-1.94					
-3.28	-1.45	-2.07	-2.79	-2.06	-1.62	-1.86					
-3.36	-1.49	-2.12	-2.83	-2.10	-1.65	-1.89					
-3.29	-1.43	-2.05	-2.76	-2.03	-1.58	-1.82					
-3.39	-1.53	-2.15	-2.87	-2.13	-1.68	-1.93					
-3.29	-1.43	-2.05	-2.76	-2.03	-1.58	-1.82					
-3.39	-1.53	-2.15	-2.87	-2.13	-1.68	-1.93					
-3.29	-1.43	-2.05	-2.76	-2.03	-1.58	-1.82					
-3.39	-1.53	-2.15	-2.87	-2.13	-1.68	-1.92					
-2.99	-0.99	-1.63	-2.36	-1.59	-1.13	-1.37					
ALS00002	-165.80	USA	P	16 16	0.00	0.00	0.00	0.00	BSS	REG2 ANALYSIS	
1 CL	0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.82	-109.83	6.03	1.12	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17338.58	17367.74	17396.90	17426.06	17455.22	17484.38	17513.54	17542.70				
18	20	22	24	26	28	30	32				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17571.86	17601.02	17630.18	17659.34	17688.50	17717.66	17746.82	17775.98				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1 CL	0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
58.52	-149.63	3.81	1.23	171.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12238.58	12267.74	12296.90	12326.06	12355.22	12384.38	12413.54	12442.70				
18	20	22	24	26	28	30	32				

Annex 1 - Table 1 cont'd

56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3		
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8		
12471.86	12501.02	12530.18	12559.34	12588.50	12617.66	12646.82	12675.98		
7		R2RES		R123SS		0.0	0.0	0.00000	0.00
54.67	60.00	64.00	69.75	71.00	65.50	54.83			
-130.67	-141.00	-141.00	-141.00	-156.50	-168.00	-164.00			
0	0	0	0	0	0	0			
D	D	C	A	A	C	D			
-3.02	-0.94	-1.56	-2.36	-1.63	-1.10	-1.30			
-3.22	-1.30	-1.90	-2.68	-1.99	-1.47	-1.67			
-3.33	-1.40	-2.01	-2.79	-2.09	-1.57	-1.78			
-3.22	-1.30	-1.90	-2.68	-1.99	-1.47	-1.67			
-3.33	-1.40	-2.01	-2.79	-2.09	-1.57	-1.78			
-3.22	-1.30	-1.90	-2.68	-1.99	-1.47	-1.67			
-3.32	-1.40	-2.01	-2.79	-2.09	-1.57	-1.78			
-3.26	-1.35	-1.95	-2.73	-2.04	-1.52	-1.73			
-3.33	-1.38	-1.99	-2.77	-2.07	-1.54	-1.75			
-3.34	-1.39	-2.00	-2.78	-2.08	-1.55	-1.76			
-3.34	-1.39	-2.00	-2.78	-2.08	-1.55	-1.76			
-3.34	-1.39	-2.00	-2.78	-2.08	-1.55	-1.76			
-3.34	-1.39	-2.00	-2.78	-2.07	-1.55	-1.76			
-3.34	-1.39	-2.00	-2.78	-2.08	-1.55	-1.76			
-3.34	-1.39	-2.00	-2.78	-2.07	-1.55	-1.76			
-2.17	0.14	-0.51	-1.30	-0.43	0.16	-0.01			

ATTACHMENT 1 TO ANNEX 1

Table 2 – HWA00002 Beam

HWA00002	-166.20	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.86	-109.94	6.04	1.11	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17324.00	17353.16	17382.32	17411.48	17440.64	17469.80	17498.96	17528.12				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1	CR 0.00	E 34.60	0	0.00	0.10	1.00	0.10	0.0		24.00	
23.42	-165.79	4.20	0.80	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12224.00	12253.16	12282.32	12311.48	12340.64	12369.80	12398.96	12428.12				
7		R2RES		R123SS		0.0	0.0		0.00000	0.00	
18.92	19.50	20.75	21.50	22.25	25.00	28.00					
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00					
0	0	0	0	0	0	0					
D	D	D	D	D	D	D					
0.67	0.85	0.73	0.93	0.92	1.27	0.80					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-1.28	-1.11	-1.22	-1.01	-1.01	-0.63	-1.14					
-0.78	-0.61	-0.71	-0.48	-0.48	-0.09	-0.65					
HWA00002	-165.80	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.82	-109.83	6.03	1.12	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
2	4	6	8	10	12	14	16				

Annex 1 - Table 2 cont'd

76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17338.58	17367.74	17396.90	17426.06	17455.22	17484.38	17513.54	17542.70				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1 CL	0.00	E 34.60	0	0.00	0.10	1.00	0.10	0.0		24.00	
23.32	-165.79	4.20	0.80	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12238.58	12267.74	12296.90	12326.06	12355.22	12384.38	12413.54	12442.70				
7		R2RES		R123SS		0.0	0.0		0.00000	0.00	
18.92	19.50	20.75	21.50	22.25	25.00	28.00					
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00					
0	0	0	0	0	0	0					
D	D	D	D	D	D	D					
-0.66	-0.60	-0.77	-0.55	-0.57	-0.15	-0.65					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
-1.17	-1.11	-1.29	-1.08	-1.10	-0.70	-1.15					
0.70	0.76	0.58	0.77	0.74	1.11	0.71					

ATTACHMENT 1 TO ANNEX 1

Table 3 – HWA01002 Beam

HWA01002	-166.20	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
23.42	-165.79	4.20	0.68	160.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
17	19	21	23	25	27	29	31				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17557.28	17586.44	17615.60	17644.76	17673.92	17703.08	17732.24	17761.40				
7		R2TES		R123SS		0.0	0.0		0.00000	0.00	
18.92	19.50	20.75	21.50	22.25	25.00	28.00					
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00					
0	0	0	0	0	0	0					
D	D	D	D	D	D	D					
1	CR 0.00	E 34.60	0	0.00	0.10	1.00	0.10	0.0		24.00	
23.42	-165.79	4.20	0.80	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
17	19	21	23	25	27	29	31				
55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12457.28	12486.44	12515.60	12544.76	12573.92	12603.08	12632.24	12661.40				
7		R2RES		R123SS		0.0	0.0		0.00000	0.00	
18.92	19.50	20.75	21.50	22.25	25.00	28.00					
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00					
0	0	0	0	0	0	0					
D	D	D	D	D	D	D					
0.73	0.91	0.79	0.99	0.98	1.34	0.87					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-1.18	-1.01	-1.12	-0.90	-0.91	-0.51	-1.04					
-0.65	-0.48	-0.57	-0.34	-0.34	0.06	-0.51					
HWA01002	-165.80	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
23.32	-165.79	4.20	0.68	160.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
18	20	22	24	26	28	30	32				

Annex 1 - Table 3 cont'd

76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17571.86	17601.02	17630.18	17659.34	17688.50	17717.66	17746.82	17775.98				

7		R2TES		R123SS		0.0	0.0		0.00000	0.00	
18.92	19.50	20.75	21.50	22.25	25.00	28.00					
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00					
0	0	0	0	0	0	0					
D	D	D	D	D	D	D					
1 CL	0.00	E 34.60	0	0.00	0.10	1.00	0.10	0.0		24.00	
23.32	-165.79	4.20	0.80	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
18	20	22	24	26	28	30	32				
55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12471.86	12501.02	12530.18	12559.34	12588.50	12617.66	12646.82	12675.98				

7		R2RES		R123SS		0.0	0.0		0.00000	0.00
18.92	19.50	20.75	21.50	22.25	25.00	28.00				
-155.67	-154.75	-156.00	-158.00	-159.33	-168.00	-178.00				
0	0	0	0	0	0	0				
D	D	D	D	D	D	D				
-0.55	-0.49	-0.66	-0.43	-0.46	-0.03	-0.54				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
-1.09	-1.03	-1.20	-0.99	-1.02	-0.60	-1.07				
0.87	0.93	0.74	0.95	0.91	1.29	0.88				

ATTACHMENT 1 TO ANNEX 1

Table 4 – USAPSA02 Beam

USAPSA02	-166.20	USA	P	16 16	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.86	-109.94	6.04	1.11	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17324.00	17353.16	17382.32	17411.48	17440.64	17469.80	17498.96	17528.12				
17	19	21	23	25	27	29	31				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17557.28	17586.44	17615.60	17644.76	17673.92	17703.08	17732.24	17761.40				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1	CR 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
40.58	-117.80	4.03	0.82	135.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12224.00	12253.16	12282.32	12311.48	12340.64	12369.80	12398.96	12428.12				
17	19	21	23	25	27	29	31				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12457.28	12486.44	12515.60	12544.76	12573.92	12603.08	12632.24	12661.40				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
49.00	45.00	31.33	48.40	49.00	40.40	34.60	32.50				
-111.00	-111.00	-109.00	-124.70	-122.80	-124.20	-120.70	-117.10				
0	0	0	0	0	0	0	0				
E	E	M	D	D	D	D	E				
-3.60	-3.96	-3.81	-2.38	-1.99	-3.00	-2.95	-2.56				
-4.54	-4.88	-4.93	-3.47	-3.10	-4.04	-3.98	-3.61				

Annex 1 - Table 4 cont'd

-4.65	-4.99	-5.02	-3.57	-3.20	-4.14	-4.08	-3.71				
-4.54	-4.88	-4.92	-3.47	-3.10	-4.04	-3.98	-3.61				
-4.64	-4.98	-5.01	-3.57	-3.20	-4.14	-4.08	-3.71				
-4.54	-4.88	-4.91	-3.47	-3.10	-4.04	-3.98	-3.61				
-4.64	-4.98	-5.01	-3.57	-3.20	-4.14	-4.08	-3.71				
-4.55	-4.89	-4.91	-3.49	-3.11	-4.06	-3.99	-3.62				
-4.58	-4.92	-4.93	-3.51	-3.14	-4.08	-4.02	-3.65				
-4.56	-4.90	-4.91	-3.49	-3.12	-4.07	-4.01	-3.63				
-4.63	-4.98	-4.98	-3.57	-3.19	-4.14	-4.08	-3.70				
-4.56	-4.90	-4.90	-3.49	-3.12	-4.07	-4.01	-3.63				
-4.63	-4.97	-4.97	-3.56	-3.19	-4.14	-4.07	-3.70				
-4.55	-4.90	-4.89	-3.49	-3.12	-4.07	-4.01	-3.63				
-4.63	-4.97	-4.96	-3.56	-3.19	-4.14	-4.07	-3.70				
-4.30	-4.64	-4.68	-3.19	-2.81	-3.77	-3.71	-3.34				
USAPSA02	-165.80	USA	P	16 16	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
1	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
36.82	-109.83	6.03	1.12	137.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17338.58	17367.74	17396.90	17426.06	17455.22	17484.38	17513.54	17542.70				
18	20	22	24	26	28	30	32				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17571.86	17601.02	17630.18	17659.34	17688.50	17717.66	17746.82	17775.98				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
1	CL 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
40.58	-117.79	4.04	0.82	135.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12238.58	12267.74	12296.90	12326.06	12355.22	12384.38	12413.54	12442.70				
18	20	22	24	26	28	30	32				

Annex 1 - Table 4 cont'd

56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3		
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8		
12471.86	12501.02	12530.18	12559.34	12588.50	12617.66	12646.82	12675.98		
8		R2RES		R123SS		0.0	0.0	0.00000	0.00
49.00	45.00	31.33	48.40	49.00	40.40	34.60	32.50		
-111.00	-111.00	-109.00	-124.70	-122.80	-124.20	-120.70	-117.10		
0	0	0	0	0	0	0	0		
E	E	M	D	D	D	D	E		
-4.34	-4.67	-4.71	-3.13	-2.75	-3.73	-3.68	-3.29		
-4.52	-4.87	-4.83	-3.38	-3.00	-3.98	-3.92	-3.52		
-4.60	-4.94	-4.91	-3.45	-3.07	-4.05	-3.99	-3.60		
-4.52	-4.86	-4.82	-3.38	-3.00	-3.98	-3.92	-3.52		
-4.60	-4.94	-4.90	-3.45	-3.07	-4.05	-3.99	-3.59		
-4.52	-4.86	-4.81	-3.38	-3.00	-3.98	-3.92	-3.52		
-4.60	-4.94	-4.89	-3.45	-3.07	-4.05	-3.99	-3.59		
-4.57	-4.92	-4.86	-3.44	-3.06	-4.04	-3.97	-3.57		
-4.60	-4.94	-4.87	-3.46	-3.08	-4.06	-4.00	-3.60		
-4.51	-4.86	-4.79	-3.37	-3.00	-3.98	-3.92	-3.52		
-4.61	-4.96	-4.88	-3.47	-3.09	-4.08	-4.01	-3.61		
-4.51	-4.86	-4.78	-3.37	-2.99	-3.98	-3.91	-3.51		
-4.61	-4.95	-4.87	-3.47	-3.09	-4.08	-4.01	-3.61		
-4.51	-4.85	-4.77	-3.37	-2.99	-3.98	-3.91	-3.51		
-4.61	-4.95	-4.86	-3.47	-3.09	-4.08	-4.01	-3.61		
-3.50	-3.86	-3.60	-2.21	-1.81	-2.86	-2.81	-2.39		

ATTACHMENT 1 TO ANNEX 1

Table 5 – Affected Beams and Channels (sorted by Orbital Position)

Input File C:\BR_SOFT\MSPACEg\Input.DAT\SAT83_02-3-14_10.txt
Input File Title ONLY VISIBLE TEST POINTS INCLUDED DOWN AND UP LINK SAT83 REGION 2 PLAN Version: 30 April 1999 X X
Output Database C:\BR_SOFT\MSPACEg\Input.DAT\SAT83_02-3-14_10.mdb
Analysis Version (in output database) 1 Completed on 19-March 2002 12:25

Orbital Position	Adm. Symbol	Satellite Name	Beam Name	Affected Channels
-166.20	USA	BSS REG2 ANALYSIS	ALS00002	1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31
-166.20	USA	BSS REG2 ANALYSIS	HWA00002	1,3,5,7,9,11,13,15
-166.20	USA	BSS REG2 ANALYSIS	HWA01002	17,19,21,23,25,27,29,31
-166.20	USA	BSS REG2 ANALYSIS	USAPSA02	1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31
-165.80	USA	BSS REG2 ANALYSIS	ALS00002	2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32
-165.80	USA	BSS REG2 ANALYSIS	HWA00002	2,4,6,8,10,12,14,16
-165.80	USA	BSS REG2 ANALYSIS	HWA01002	18,20,22,24,26,28,30,32
-165.80	USA	BSS REG2 ANALYSIS	USAPSA02	2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32

Technical Characteristics of Compass Systems, Inc. Satellite: 157°W

1. Introduction

The Compass Systems, Inc. satellite network will utilize a long-unoccupied BSS orbital location to provide broadcast programming to CONUS in conformance to the ITU Radio Regulations Appendix S30 and 30A plans. The planned satellite will be equipped to provide a full 32-channel capacity that will be distributed among beams covering CONUS, Canada, Mexico, and the Asia Pacific Region 3. The Asia-Pacific link will be provided by means of a steerable spot beam that will have the capability to rebroadcast on FSS bands to the selected Region 3 coverage area up to 16 of the 32 channels received by the satellite. Return channels are provided for this link. The satellite will offer delivery of direct-to-home and direct-to-business video, data and multimedia services. The service may be implemented on one satellite providing the full complement of 32 BSS channels, or on several co-located payloads. The satellite will be procured through a competitive procurement process, and would be compatible with a range of commercially available satellite busses and launch vehicles.

2. System Overview

The Compass Systems, Inc. satellite at 157° W longitude will consist of the full complement of thirty-two 24 MHz channels utilizing the 17.3-17.8 GHz band for the feeder link and the 12.2-12.7 GHz band for the service link. The satellite will have fixed antennas covering the western U.S. (CONUS), Mexico and Canada respectively. An additional 4.7° beamwidth spot beam will be steerable in Region 3 to provide 14/12.2-12.7 GHz service. The steerable spotbeam can utilize up to sixteen of the 32 channels received by the satellite, and transmit them to the designated location, and will incorporate a return link to CONUS.

This is discussed in greater detail in the following sections.

2.1 System Coverage from 157°W

The satellite will have fixed antennas covering the western U.S. (CONUS), Mexico and Canada, respectively. An additional fully steerable, 4.7° beamwidth spotbeam antenna will be available to cover market areas within Region 3 in the Asia-Pacific region. The satellite will have thirty-two 24 MHz channels available to provide DTH video services to CONUS consistent with the Region 2 BSS plan. In addition to the U.S. service beam, fixed antennas will cover Mexico and Canada, and sixteen additional channels will be available to provide a selected group of channels between U.S. and the Asian locations. It is expected that digital transmission will be the primary method of modulation employed. Figure 2-1 shows the planned area coverages for the U.S., Mexico, Canada and Asia Pacific beams; the steerable beam is shown for illustrative purposes covering New Zealand.

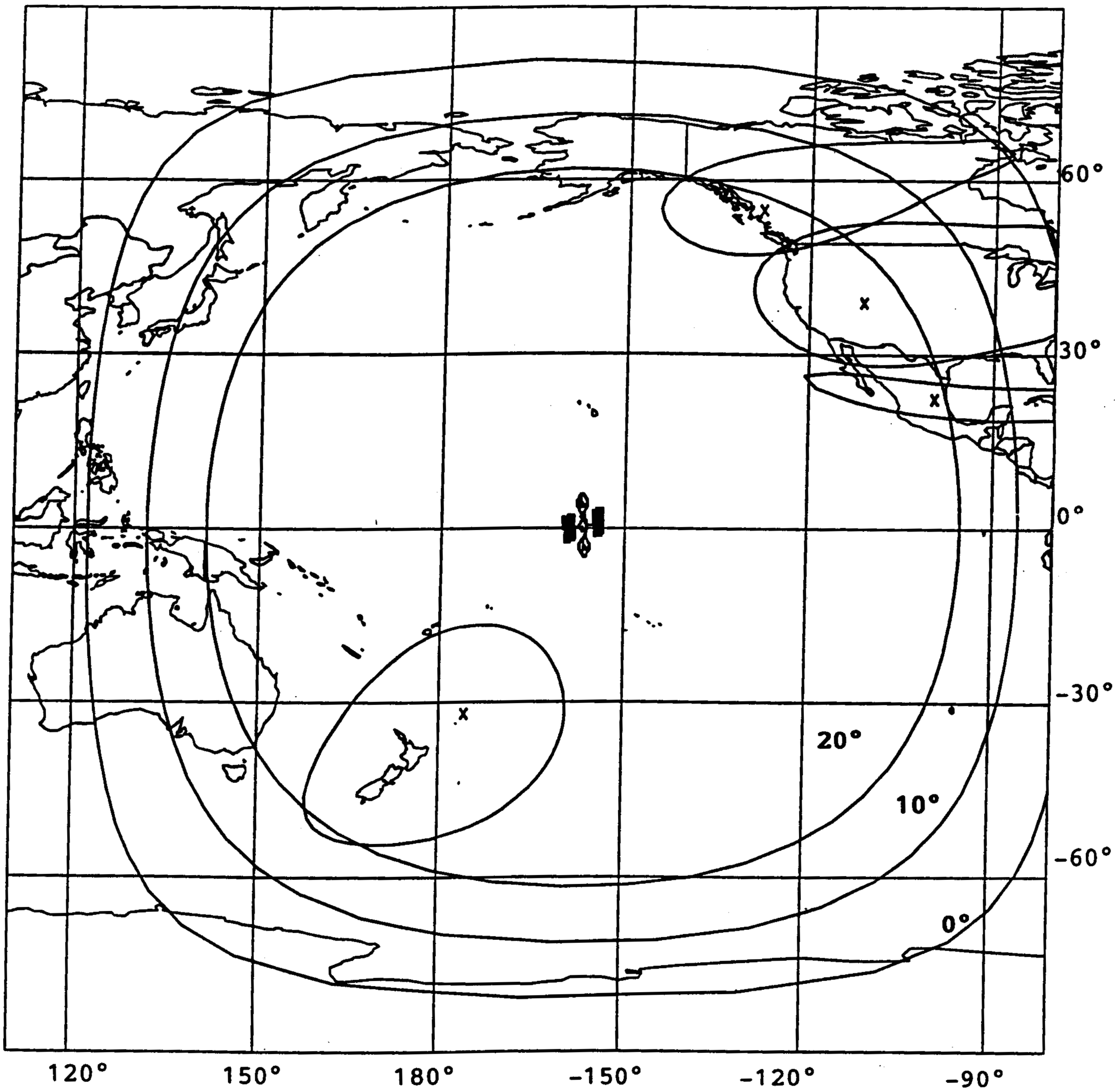

FIGURE 2-1
-157° SATELLITE, BEAMS COVERING ALASKA, HAWAII, CONUS AND APR, SHOWN AS AN EXAMPLE OVER NEW ZEALAND
(-3 dB CONTOURS)

The uplink BSS feeder link earth stations will be located at sites in western CONUS. Diverse sites may also be employed to provide redundancy. The antenna will be in the range of 7 to 13 meters, consistent with characteristics in the BSS Plan.

The typical DTH satellite receive antennas will be 0.45 m in diameter at the U.S. receive locations. Depending on the selected pointing area chosen for the steerable antenna, the user receive antenna may be similar in size or slightly larger, depending on the local propagation conditions.

2.2 Radio Frequency Plan

The uplink feeder link will use the 17.3-17.8 GHz frequency band. The thirty-two uplink channels are connected by a switch matrix to the thirty-two associated downlink channels in the 12.2 –12.7 GHz frequency band and transmitted down from the CONUS, Mexico and Canada antennas. An uplink channel can be transmitted to one or more downlink beams as required. The range of cross-connection capability will be based on the output of service requirements under study. Table 2-1 shows the pairing and polarization of the feeder link and the service link for odd channels and Table 2-2 shows the pairing and polarization of the feeder link and service link for the even channels. In addition, a parallel connection capability is provided so that up to sixteen uplink channels can be switched to the sixteen transponders connected to the steerable spotbeam. The uplink and downlink frequencies for the steerable spot beam are shown in Table 2-3.

Table 2-1. Compass Systems, Inc. Frequency and Polarization Plan (odd channels)

Channel #	Polarization	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
1	RHCP	17,324.00	12,224.00
3	RHCP	17,353.16	12,253.16
5	RHCP	17,382.32	12,282.32
7	RHCP	17,411.48	12,311.48
9	RHCP	17,440.64	12,340.64
11	RHCP	17,469.80	12,369.80
13	RHCP	17,498.96	12,398.96
15	RHCP	17,528.12	12,428.12
17	RHCP	17,557.28	12,457.28
19	RHCP	17,586.44	12,486.44
21	RHCP	17,615.60	12,515.60
23	RHCP	17,644.76	12,544.76
25	RHCP	17,673.92	12,573.92
27	RHCP	17,703.08	12,603.08
29	RHCP	17,732.24	12,632.24
31	RHCP	17,761.40	12,661.40

Table 2-2. Compass Systems, Inc. Frequency and Polarization Plan (even channels)

Channel #	Polarization	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
2	LHCP	17,338.58	12,238.58
4	LHCP	17,367.74	12,267.74
6	LHCP	17,396.90	12,296.90
8	LHCP	17,426.06	12,326.06
10	LHCP	17,455.22	12,355.22
12	LHCP	17,484.38	12,384.38
14	LHCP	17,513.54	12,413.54
16	LHCP	17,542.70	12,442.70
18	LHCP	17,571.86	12,471.86
20	LHCP	17,601.02	12,501.02
22	LHCP	17,630.18	12,530.18
24	LHCP	17,659.34	12,559.34
26	LHCP	17,688.50	12,588.50
28	LHCP	17,717.66	12,617.66
30	LHCP	17,746.82	12,646.82
32	LHCP	17,775.98	12,675.98

Table 2-3. Compass Systems, Inc. Ku-band Frequency Example

Channel #	RCV Center Frequency (MHz)	XMT Center Frequency (MHz)
1	14,024.00	12,224.00
2	14,053.16	12,253.16
3	14,082.32	12,282.32
4	14,111.48	12,311.48
5	14,140.64	12,340.64
6	14,169.80	12,369.80
7	14,198.96	12,398.96
8	14,228.12	12,428.12
9	14,257.28	12,457.28
10	14,286.44	12,486.44
11	14,315.60	12,515.60
12	14,344.76	12,544.76
13	14,373.92	12,573.92
14	14,403.08	12,603.08
15	14,432.24	12,632.24
16	14,461.40	12,661.40

2.3 Orbit Location

The Compass Systems, Inc. satellite at 157° W longitude will bring into service a currently unoccupied BSS location that is allocated to the US in the ITU BSS and feeder link plans. The location is used for expanded coverage in Mexico, Canada, and the Asia Pacific Region.

3. Satellite Description

A summary of major satellite parameters is shown in Table 3-1 below.

The planned satellite will be a body stabilized spacecraft operating in Ku-band with four downlink beams and three uplink beams. The TT&C subsystem will operate at C-band during Geostationary Transfer Orbit (GTO) and at Ku-band when the satellite is on station.

From this orbital location, 157° W longitude, fixed downlink beams operating in the 12 GHz band will cover CONUS, Mexico and Canada. The other downlink beam, also operating in the 12 GHz band is steerable in Region 3. Uplink beams operating in the 17 GHz band will operate with a fixed CONUS receive antenna. The steerable antenna receives an uplink beam operating in the 14 GHz band.

3.1 Communications Subsystem

Figure 3-1 provides a graphical representation of the on-board connectivity

3.2 Antennas

The antenna system will consist of three fixed Ku-band antennas, one steerable Ku-band antenna, and one C-band TT&C Omni antenna for use in GTO. The three fixed antennas will be shaped reflectors that are stowed for launch.

3.3 TT&C

TT&C will be provided at either or both edges of allocated bands. The design will select frequency, polarization and coding to minimize interference.

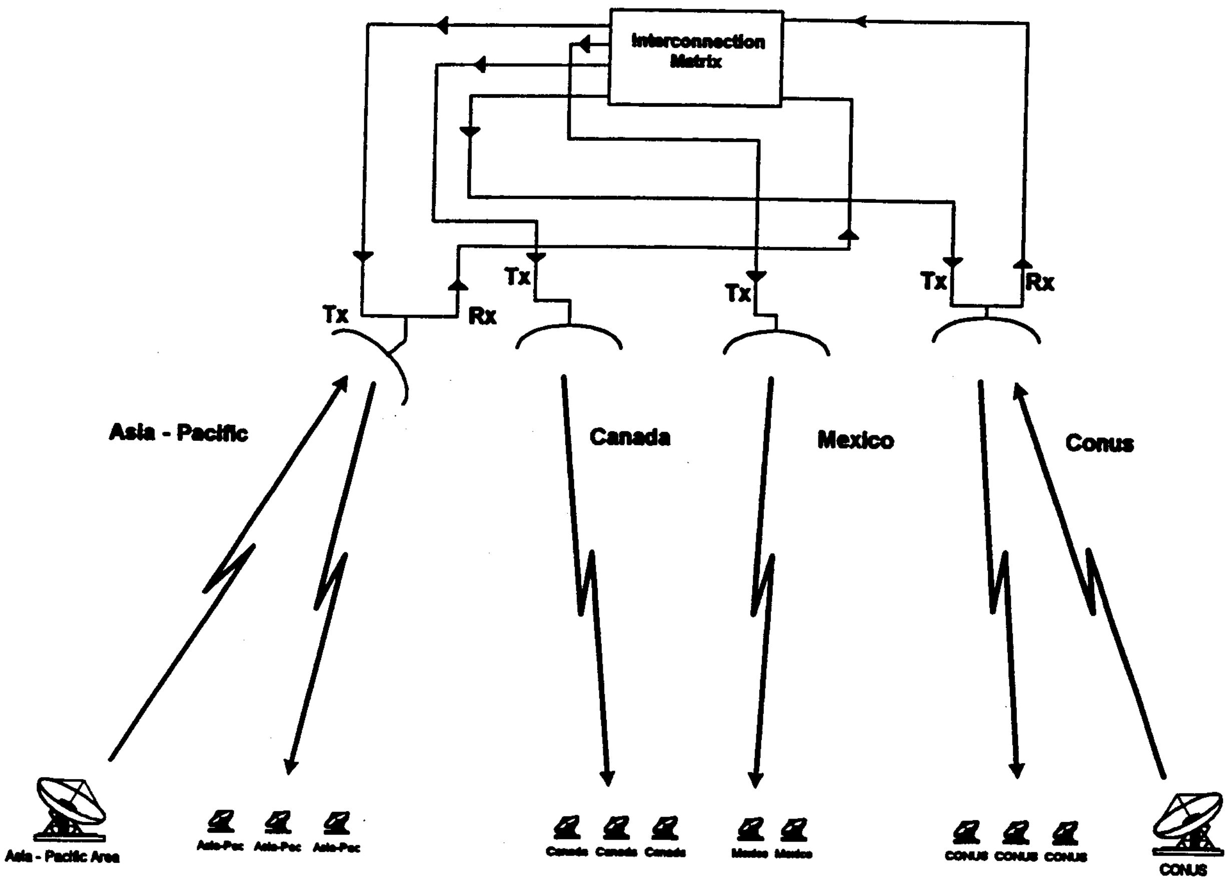
Interconnection Matrix
Tx
Rx
Tx
Tx
Tx
Rx
Asia - Pacific
Canada
Mexico
Conus
Asia - Pacific Area
Asia-Pac Asia-Pac Asia-Pac
Canada Canada Canada
Mexico Mexico
CONUS CONUS CONUS
CONUS

Figure 3-1

3.4 Spacecraft Characteristics and Configuration

The spacecraft will be body stabilized with North-South solar arrays. The spacecraft mass in GTO could be as high as 4500 kg, including the apogee motor and its propellant. This is somewhat dependent on the latitude of the launch site.

The basic payload will consist of forty-eight transponders, which will include forty-eight 120 watt Ku-band Traveling Wave Tubes (TWT's). The required end-of-life spacecraft power will be about 13 kW, so one of the larger spacecraft buses will be required. There are a number of spacecraft buses available in this size regime. No discussions have been held with any prime contractors at this time.

Buses of this size usually use multiple junction gallium arsenide solar cells on rigid lightweight panels and advanced nickel hydrogen batteries, with some going to even more advanced lithium-ion batteries. These will all be choices made in cooperation with the prime contractor to ensure high performance along with high reliability.

The satellite will be station kept at its location, ± 0.1° north-south and ± 0.05° east-west, for fifteen years. Stationkeeping propellant will be adequate for in orbit relocation as well as removal from operational orbit at the end-of-life. The stationkeeping propellant will also be chosen in cooperation with the prime contractor as different bus manufacturers utilize different on-board propulsion systems, i.e., bi-propellants, arcjets, ion thrusters, Hall effect thrusters. Performance and reliability will once again be the prime considerations.

The apogee motor will utilize on-board bi-propellants and multiple firings to efficiently achieve the final orbital location. The amount of propellant required will depend on the latitude of the launch site and whether a super synchronous transfer orbit is required.

Spacecraft buses of this size (~13 kW) usually require deployable radiators and heat pipes in order to fit within the launch vehicle fairing. Designs of this type have been space qualified and should not present a problem.

The body stabilization system can be either a biased momentum or a zero momentum system. Both types have been space qualified and are well proven. Attitude sensors for determining errors about the pitch and roll axes can be earth sensors, either scanning or static types. Ground RF beacons can also be used. Yaw attitude error sensing is more difficult, but is required during stationkeeping maneuvers, and can be accomplished with sun sensors and/or gyros. The beam pointing accuracy will be maintained at 1/10 of the beam width or better, in this case ± 0.04°.

The spacecraft design life is 12 years with sufficient onboard propellant to provide 15 years of stationkeeping and attitude control. Component and system redundancy will be used to ensure the required reliability. An overall system reliability for all transponders operating within specifications for 12 years should be greater than 0.7. The Traveling

Wave Tubes (TWT's) will be arranged with ring redundancy, for example, four rings of 12 tubes, each ring with 12 for 8 redundancy.

Even with the large spacecraft bus, there is compatibility with multiple launch vehicles, i.e., Ariane 4, Ariane 5, Sea Launch, Proton, Atlas V, Delta IV Medplus and Long March. If the final spacecraft design were smaller and lighter because it is implemented on two spacecraft, a smaller bus and launch vehicles would satisfy the requirements.

4. Earth Terminal

There will be three types of Earth terminal functions in the Compass Systems, Inc. satellite system. The first type of station will be a Gateway terminal. The Gateway terminal will be used to uplink signals in the feeder link to the satellite. The most common terminal in the network will be the user terminal. The user terminal will be a receive-only terminal that will be used by individual subscribers to receive programming from the satellite. The third type of terminal in the network will be a TT&C terminal that will be used to control and monitor the operation of the satellite.

4.1 Gateway Terminal

The Gateway terminals will be located in the west/central portion of the continental United States, and in the Asia Pacific region. Co-located with the uplinking facility will be a broadcasting center that will be the interface with the content providers who want to use the system. Programming will be routed to the broadcast center using terrestrial fiber, a wireline network or satellite link. Programming will be delivered in an analog or digital format. The broadcast center will take all these inputs and put them into a standard MPEG format for further processing. To maximize the use of the capacity of the satellite, the programming will be compressed and multiplexed into a digital stream for transmission to the satellite. The degree of compression that is used for a particular program will depend on the content. Typically, sporting events require wider bandwidths than talk shows to capture the movement of the athletes without distortion. After the compression and the multiplexing are completed the digital stream will be encoded and then modulated for transmission over the satellite.

The Gateway antennas will be in the 7-13 meter range depending on the number of uplink carriers that is being supported by any one station. Compass Systems, Inc. anticipates that it will own some of the Gateways while others may be privately owned by broadcasters.

A Gateway terminal in the U.S. will monitor the transmissions that it can see in the 12.2-12.7 GHz band, to assess the quality of the transmissions. In the Mexico and Canada downlinks, remote monitoring stations will be placed that will allow the Gateway to dial in and take readings of the transmissions in those beams. The Asia Pacific Gateway will perform the same function in that beam.

Table 3-1 SPACECRAFT CHARACTERISTICS

General	
Spacecraft bus	commercially procured existing bus
Stabilization	3-axis body stabilized
Mission life	15 years
Design life	12 years
Eclipse capability	100 percent (48 channels)
Stationkeeping	
North-South (orbital inclination)	±0.1°
East-West (longitudinal drift)	±0.05°
Antenna pointing	±0.4° N-S & E-W
Communications	
Frequency	
Receive	500 MHz in 14 -14.5 GHz (Asian beam) 17.3-17.8 GHz (CONUS beam)
Transmit	12.2-12.7 GHz
Polarization	LHCP & RHCP on CONUS, Mexico, Canada LHCP or RHCP Asian beam
Number of transponders	48
Channel bandwidth	24 MHz
Receive G/T	0 dB/°K
Receive saturation	nominally –95 dBW/m^2
Transmit EIRP	56.3 dBW max.
Transmitter (TWTA) RF power	120 watts
Transmitter redundancy	12 for 8
Out of Band Emission limitations (percentage of authorized bandwidth)	
50 – 100%	> 20 db attenuation in any 4 kHz
100 – 250%	> 40 db attenuation in any 4 kHz
Greater than 250%	> 50 db attenuation in any 4 kHz
Tracking, Telemetry and Command	
Frequency Band	
Transfer orbit	C-band
On station	
Command Uplink	in lower/top 12 MHz of 17.3-17.8 GHz
Telemetry Downlink	in lower/top 12 MHz of 12.2-12.7 GHz

4.2 User Terminals

User terminals will consist of a small satellite dish that is typically mounted on the roof of a dwelling and an interconnecting cable that will be used to transport the received signal from the satellite to a digital integrated receiver/decoder (IRD), which is located inside the premises. The IRD is used to receive the composite signal from one of the satellite transponders and pick out the desired channel from the digital stream it is processing. The IRD then decompresses the channel and translates the digital signal back to an analog format so it can be received and displayed on a television. The user terminal at U.S. service locations will be a receive-only terminal that has a reflector size in the 45-60 cm range with a G/T in the range of 11 to 15 dB/°K. Depending on the precise location chosen for the Asian spot beam, the user terminal may be of this size or larger, such as one meter, with the typical antenna chosen to match propagation characteristics.

4.3 TT&C Stations

The Compass Systems, Inc. satellite system will have a primary and backup TT&C facility that will either be owned by Compass Systems, Inc. or provided by an established satellite services provider. The stations will be located in North America and will be geographically dispersed to protect the system from catastrophic disasters. If owned by Compass Systems, Inc., it is expected that the TT&C facility will be integrated with the main CONUS Gateway. The telemetry data will be received and processed at both locations but only the on-line facility will issue commands to the satellites. When the satellite is on-station the command link will be in the 17.3-17.8 GHz band and the telemetry link will be in the 12.2-12.7 GHz band. During the transfer orbit the command and telemetry links will be in the extended C-band. The modulation characteristics of the command uplink and telemetry downlink vary with the manufacturer. Typically, the command uplink uses PSK modulation and the telemetry downlink FM modulation. The characteristics of these links will be provided to the Commission once the final selection of the spacecraft manufacturer is made. Compass Systems, Inc. will install in its TT&C stations the required manufacturer specified equipment needed to command and monitor the spacecraft.

5. Transmission Characteristics

Compass Systems, Inc. will employ the latest in digital video distribution technology on its satellite system. The Gateway earth station takes the input programming and digitizes it into an MPEG-2 format. These individual segments are multiplexed into digital streams for transmission to the satellite. Each stream is comprised of approximately 25 Mbps of programming. Then a 3/4 rate convolutional inner code and a Reed Solomon outer code are placed on the digital stream, expanding the bit rate to approximately 40 Mbps. This digital stream is then QPSK-modulated for transmission over one of the satellite channels.

The receiver at the other end of the link tunes to one of the satellite carrier frequencies and demodulates the signal. The signal is then Reed Solomon and Viterbi decoded. The receiver demuxes the desired channel from the incoming stream and then decompresses it back into an analog format for viewing on a regular television. The representative signal characteristics are listed in Table 5-1. The final transmission characteristics will be provided to the Commission when the final selection of a modem manufacturer is made.

The Compass Systems, Inc. satellite network design goal is to provide link availability in excess of 99.7% under all propagation conditions. A link outage occurs when the carrier-to-noise ratio at the receiver falls below 5.1 dB, at which point an acceptable picture cannot be displayed on the television screen. Further drops in carrier-to-noise can result in loss of synchronization.

Table 5-1 – Digital Video Characteristics

Item	Description
Type of Modulation	QPSK
Bandwidth	24 MHz
Transmitted Symbol Rate	20 Msps
Information Rate	27.647 Mbps
Inner Code	3/4-rate convolutional
Outer Coding	Reed Solomon (204,188)
Transponder backoff	0 dB

Tables 5-2 to 5-5 provide nominal clear sky link calculations for the four areas of interest namely, broadcast links originating in the US and terminating in the US, Mexico and Canada, and in the Asia Pacific. The link calculations indicate that the design is compliant with the Radio Regulations APS30 plan and meets the PFD requirements for FSS links to Asia Pacific locations. In this region a two foot dish may be needed at the edge of coverage to close the link. As can be seen in each of these link calculations, ample margin is present to maintain these links with high availability.

Table 5-2
Clear Sky Link Calculation to US/Canada

Uplink

Frequency	17.3 GHz
Elevation Angle	22°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	209.1
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
Uplink C/N dB	24.2

Downlink	Edge of Beam	Center of Beam
Frequency	12.2 GHz	12.2
Elevation Angle	10°	22°
Satellite EIRP, dBW	53.3	56.3
Downlink Path Loss	206.3	206.1
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	12.6	12.6
Boltzmann's Constant, dBW	228.6	228.6
Downlink C/N, dB	13.4	17.4
Available C/(N+I) total, dB	12.3	14.5
Downlink PFD, dBW/m²/4KHz	-147.7	-144.4

Table 5-3
Clear Sky Link Calculation to New Zealand

<u>Uplink</u>

Frequency	17.3 GHz
Elevation Angle	22°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	207.0
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
<u>Uplink C/N dB</u>	22.4

<u>Downlink</u>

Frequency	12.2 GHz
Elevation Angle	35°
Satellite EIRP, dBW	47.3
Downlink Path Loss	205.8
Atmospheric loss, dB	0.1
Earth Station G/T, dB/K	14.8
Boltzmann's Constant, dBW	228.6
<u>Downlink C/N, dB</u>	14.8
Available C/(N+I) total, dB	12.8
Downlink PFD, $dBW/m^2/4KHz$	-153.8

Table 5-4
Clear Sky Link Calculation to New Zealand With Ku-Band Uplink

Uplink

Frequency	14 GHz
Elevation Angle	35°
Transmit EIRP, dBW	72.5
Uplink path loss, dB	207.0
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
Uplink C/N dB	22.4

Downlink

Frequency	12.2 GHz
Elevation Angle	35°
Satellite EIRP, dBW	47.3
Downlink Path Loss	205.8
Atmospheric loss, dB	0.1
Earth Station G/T, dB/K	17.4
Boltzmann's Constant, dBW	228.6
Downlink C/N, dB	14.8
Available C/(N+I) total, dB	12.8
Downlink PFD, dBW/m^2/4KHz	-153.1

Table 5-5
Clear Sky Link Calculation to Mexico

<u>Uplink</u>

Frequency	17.3 GHz
Elevation Angle	64°
Transmit EIRP, dBW	76.4
Uplink path loss, dB	209.4
Atmospheric losses, dB	0.1
Satellite G/T, dB/K	2.2
Boltzmann's Constant, dBW	228.6
<u>Uplink C/N dB</u>	24.2

<u>Downlink</u>	<u>Edge of Beam</u>	<u>Center of Beam</u>
Frequency	12.2 GHz	12.2 GHz
Elevation Angle	30°	25°
Satellite EIRP, dBW	53.3	56.3
Downlink Path Loss	205.9	206.0
Atmospheric loss, dB	0.5	0.1
Earth Station G/T, dB/K	12.5	12.5
Boltzmann's Constant, dBW	228.6	228.6
<u>Downlink C/N, dB</u>	14.2	17.5
Available C/(N+I) total, dB	12.0	14.5
Downlink PFD, dBW/m^2/4KHz	-147.2	-144.3

6. ITU Annex 1 of Appendix 30, Section 2

Limits to the change in the overall equivalent protection margin for frequency assignments in conformity with the Region 2

The updated Region 2 BSS Plan (version April 1999, latest modification: May 2001downloaded from ITU website 18 Mar 02) has been modified in order to take into account the Compass System Satellite Network proposal.

To meet the expanded requirements, a new group (Group 30) has been created consisting of the original USAWH102 beam, and two new downlink beams MXC01002 (Mexican coverage) and CDN01002 (Canadian coverage). The new beams will use the lower part of the BSS Region 2 band, channels 1-16 in both the Circular left and Circular right polarization. The boresight of the associated uplink beam for both new beams is assumed to be located in the Salt Lake City (Utah) region. Uplink and downlink coverage areas are shown in Figures 1 to 4. Eight new test points for each of the new beams have been specified.

To accommodate the expanded frequency requirements, the original USAWH102 beam has been modified to use only channels 17 to 32 in order to avoid interference into and between all beams in this analysis.

The uplink/downlink parameters for the three beams are described below:

Carrier Designation	24M0G7W—
Carrier Size	24.0 MHz
Uplink	
Channels	Channels 1,3,5,7,9,11,13,15 (CR) and 2,4,6,8,10,12,14,16 (CL) for MXC01002 and CDN01002 Channels 17,19,21,23,25,27,29,31 (CR) and 18,20,22,24,26,28,30,32 (CL) for USAWH102
E/S Transmitting Power	16.5 dBW
E/S Transmitting Antenna Size	7.0 m
E/S Transmitting Antenna Gain	59.9 dBi
Satellite Receiving Antenna Gain	30.0 dBi
Satellite Receiving Beam Size	3.74°x1.78°
Downlink	
Satellite Transmitting Power	20.8 dBW
Satellite Transmitting Antenna Gain	35.5 dBi
Satellite Transmitting Beam Size	4.5°x0.68° for MXC01002 3.0°x1.24° for CDN01002 (the Tx beam size for USAWH102 wasn't changed)
E/S Receiving Antenna Size	0.45 m
E/S Receiving Antenna Gain	34.4 dBi

A detailed description of the modifications is shown in Attachment 1, Figures 1-4 and Tables 1-4.

The use of lower uplink and downlink e.i.r.p. values minimizes the potential for interference into adjacent satellite networks.

The result of MSPACEg (version 1.964) analysis of Region 2 Plan after the modifications described above is shown in the Attachment to Annex 2. The results indicate that there is no increase in interference to other networks in the Region 2 plan.

7. <u>ITU Annex 1 of Appendix S30A, Section 5</u>

<u>Limits applicable to protect a frequency assignment in the bands 17.3-18.1 GHZ (Regions 1 and 3) and 17.3-17.8 GHz (Region 2) to a receiving space station in the fixed-satellite service (Earth-to-space)</u>

A ΔT/T analysis has been performed in accordance with the method given in Appendix S8 of the ITU Radio Regulations in order to verify the compliance with Section 5 of ITU Annex 1 of APPENDIX S30A.

The results of ΔT/T calculations are shown in the table below. The closest Region 1 and 3 orbital locations (±90° from 157.0°W) have been taken into account. These calculations assume the use of the Peak Satellite Receiving Gain (provided in column 3, the actual discrimination angle between the interfering and the wanted source is always higher) for the Region 1 and 3 beams. The characteristics of the interfering beam are described below:

Location:	Salt Lake City Area
Max Transmitting Power Density:	-57.3 dB(W/Hz)
Max Transmitting Antenna Gain:	59.9 dBi
Transmitting Antenna Pattern:	R2TES

Name	Satellite Orbital Location	Max Rx Antenna Gain	% Interf. from US
AUS00...*	164°	48.88	0.182
AUS00...*	152°	48.88	0.174
CHN15...*	134°	31.39	0.003
CHN20000	122°	48.88	0.157
F ...*	140°	47.97	0.135
FJI19300	-178°	44.16	0.228
FSM00000	158°	35.38	0.008
GUM33...*	122°	43.61	0.047
KIR 100	176°	42.6	0.084
KOR112...*	116°	43.43	0.044

KRE28600	140°	44.0	0.054
LAO28400	122.2°	42.18	0.034
MHL00000	146°	41.75	0.033
MRA33200	121.8°	43.61	0.047
NRU30900	134°	48.88	0.163
NZL 100	158°	48.88	0.178
OCE10100	-160°	32.58	2.1
PLM...& USA..*	170°	39.35	0.024
PLW00000	140°	45.53	0.077
RSTRSD...*	140°	38.4	0.015
SLM00000	128°	42.81	0.040
SMO05700	-178°	48.88	0.675
TMP00000	128°	48.5	0.147
TON21500	170.8°	44.64	0.086
TUV00000	176°	46.93	0.228
VUT128...*	140°	44.3	0.058
LST...& L3...	116°	44.6	0.039
LST...& L4...	126°	44.6	0.040
US...	125°	38.57	0.010
US...	149°	37.7	0.009
US...	164°	48.84	0.121
US...	173°	40.6	0.027
NB128...	128°	38.42	0.010
NB134...	134°	33.8	0.003
Nb144...	144°	38.42	0.010
NB154...	154°	38.42	0.011
NB162...	162°	38.42	0.110
US29...	132°	38.66	0.010
ASIABSS...	122°	39	0.011
ASIABSS...	116°	39	0.011
LST...& L5...	119°	44.6	0.039
7DOL...	137.7°	40	0.014
7DOL...	157°	36.9	0.008
KSAT...	122°	42.5	0.024
KSAT...	128°	42.5	0.025
KSAT...	134°	42.5	0.025
KSAT...	140°	42.5	0.026

* multiple beams; the highest Peak Gain has been assumed

In Column 4 are the calculated $\Delta T/T$ for the Uplink from Utah. These results clearly show that the $\Delta T/T$ is always below the 3% criterion.

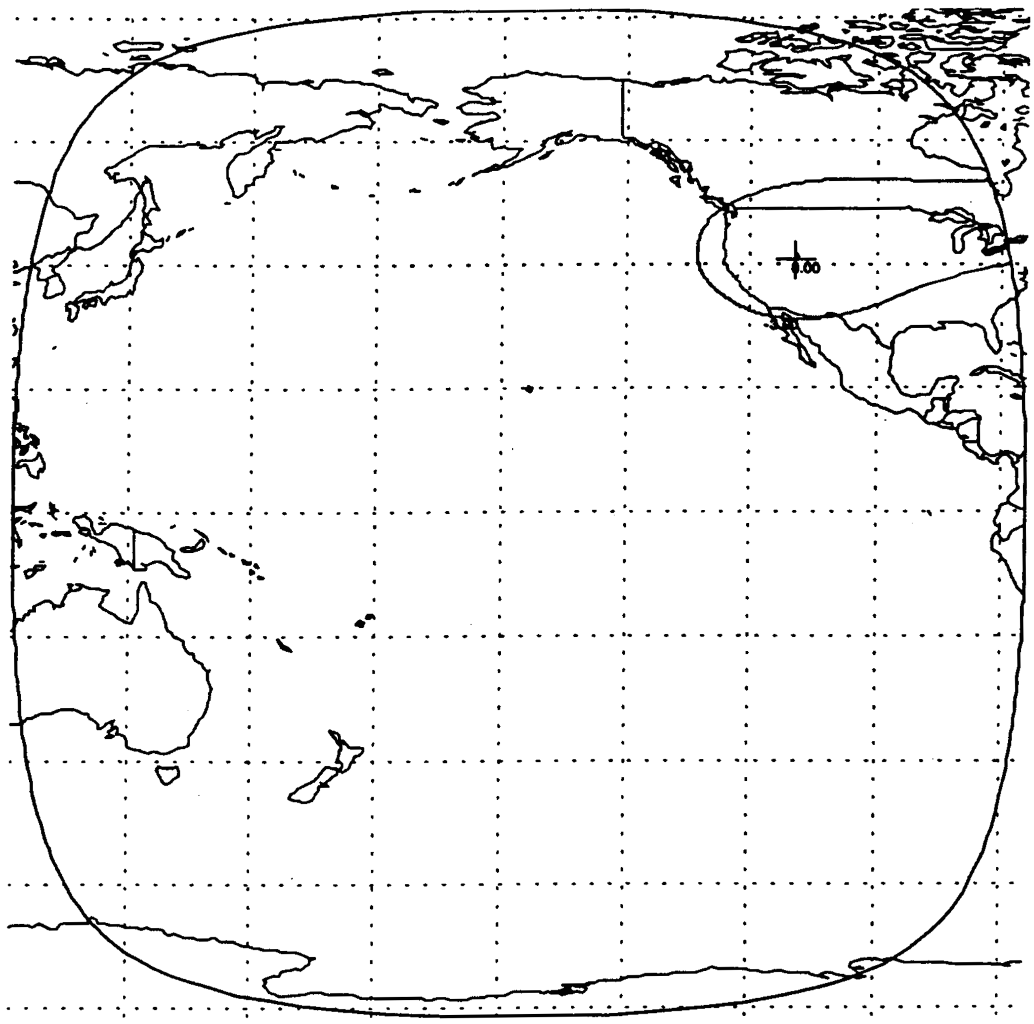

Figure 1 – MXC01002 Uplink Beam Contour

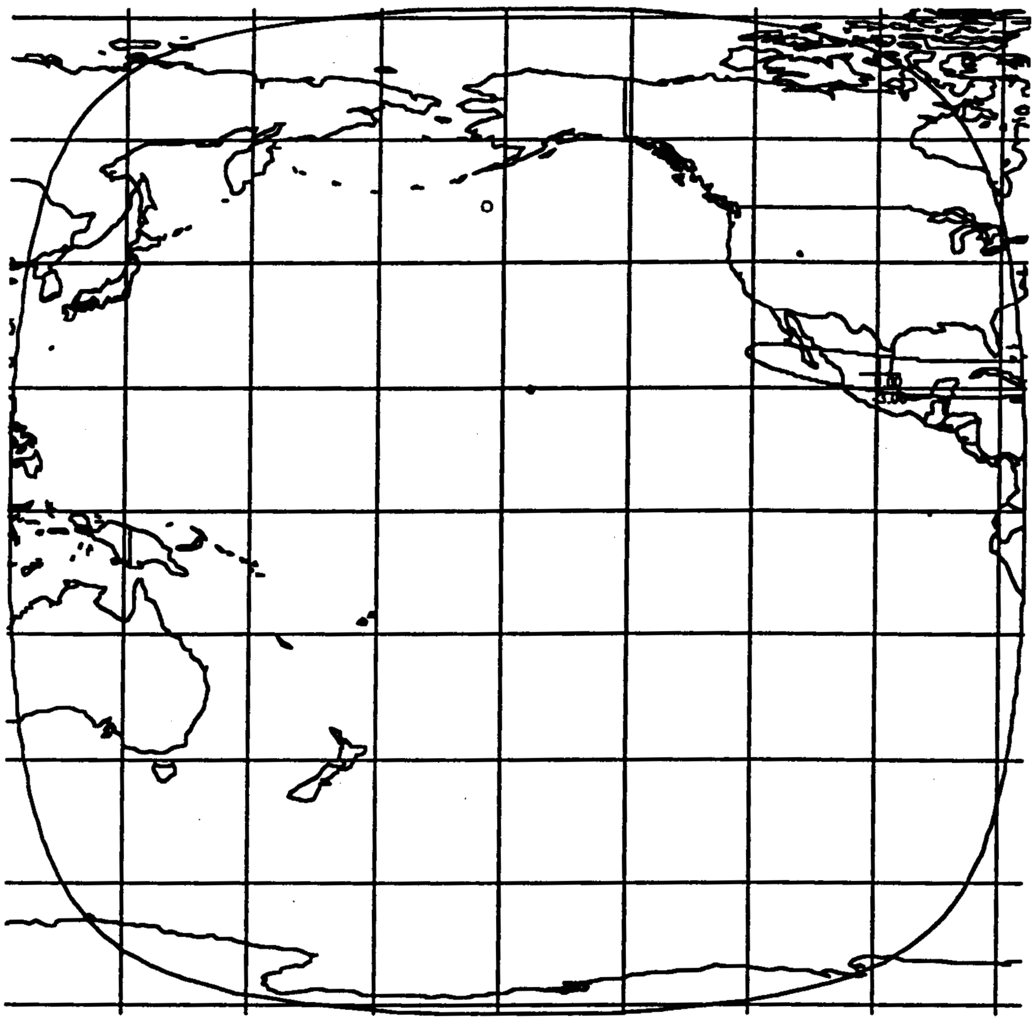

Figure 2 – MXC01002 Downlink Beam Contour

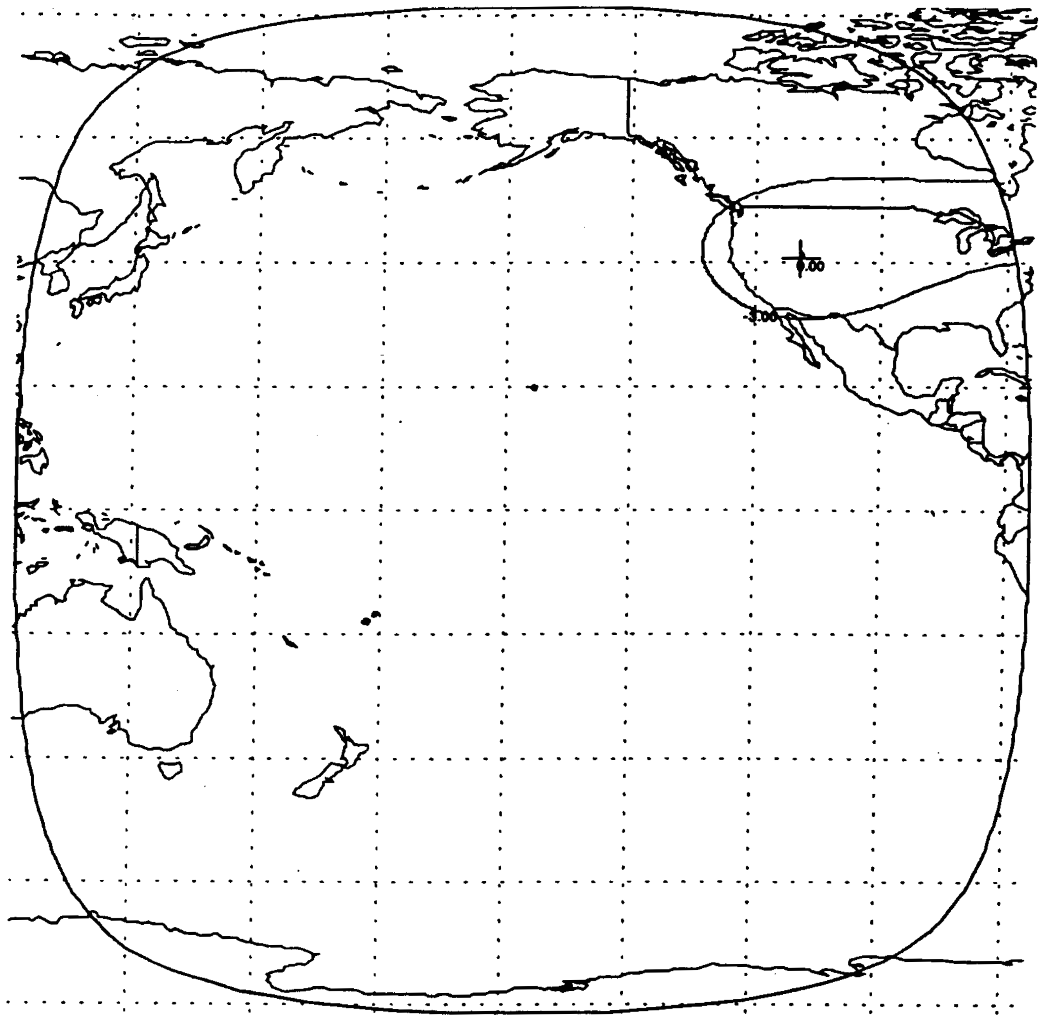

Figure 3 – CDN01002 Uplink Beam Contour

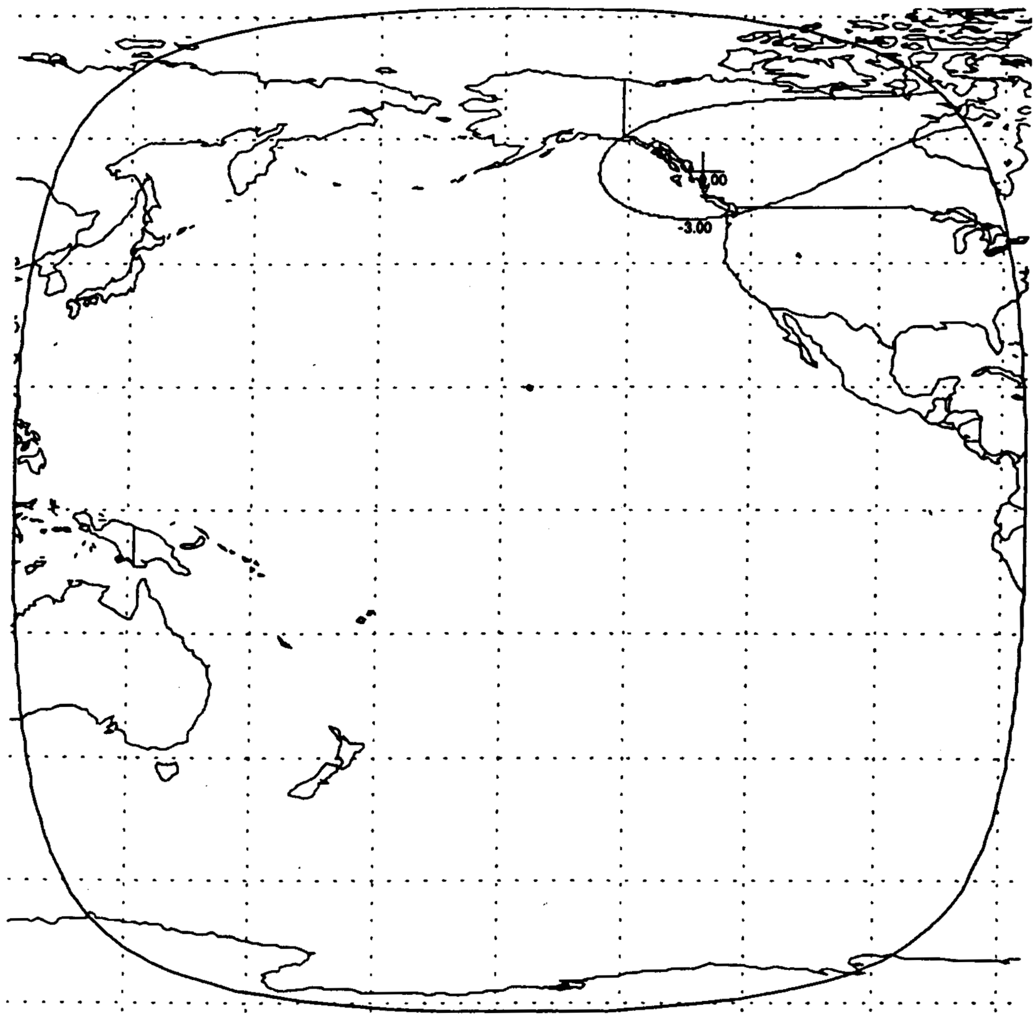

Figure 4 – CDN01002 Downlink Beam Contour

ATTACHMENT 1 TO ANNEX 2

Table 1 – USAWH102 Beam

USAWH102	-157.20	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
30	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.74	-113.07	3.72	1.78	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
17	19	21	23	25	27	29	31				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17557.28	17586.44	17615.60	17644.76	17673.92	17703.08	17732.24	17761.40				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0	CR 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
38.57	-111.41	5.51	1.54	138.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
17	19	21	23	25	27	29	31				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12457.28	12486.44	12515.60	12544.76	12573.92	12603.08	12632.24	12661.40				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
48.40	49.00	39.17	26.00	31.33	32.33	40.40	49.00				
-124.70	-97.25	-94.50	-97.20	-109.00	-117.10	-124.20	-122.80				
0	0	0	0	0	0	0	0				
D	K	K	M	M	E	D	D				
-2.80	-4.01	-3.65	-3.86	-2.45	-2.73	-3.01	-2.64				
-2.91	-4.08	-3.75	-3.96	-2.56	-2.84	-3.12	-2.74				
-2.87	-4.07	-3.72	-3.92	-2.52	-2.80	-3.07	-2.70				
-2.91	-4.07	-3.74	-3.95	-2.55	-2.84	-3.12	-2.74				
-2.87	-4.06	-3.71	-3.91	-2.51	-2.79	-3.07	-2.70				
-2.91	-4.06	-3.73	-3.94	-2.54	-2.84	-3.12	-2.74				
-2.87	-4.05	-3.70	-3.90	-2.50	-2.79	-3.07	-2.70				
-2.58	-3.79	-3.44	-3.69	-2.21	-2.48	-2.79	-2.41				
USAWH102	-156.80	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
30	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.71	-113.01	3.74	1.79	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
18	20	22	24	26	28	30	32				

Annex 2 - Table 1 cont'd

76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17571.86	17601.02	17630.18	17659.34	17688.50	17717.66	17746.82	17775.98				

2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0	CL 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
38.57	-111.40	5.51	1.55	138.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
18	20	22	24	26	28	30	32				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12471.86	12501.02	12530.18	12559.34	12588.50	12617.66	12646.82	12675.98				

8		R2RES		R123SS		0.0	0.0		0.00000	0.00
48.40	49.00	39.17	26.00	31.33	32.33	40.40	49.00			
-124.70	-97.25	-94.50	-97.20	-109.00	-117.10	-124.20	-122.80			
0	0	0	0	0	0	0	0			
D	K	K	M	M	E	D	D			
-2.79	-3.98	-3.63	-3.63	-2.42	-2.71	-3.00	-2.62			
-2.84	-4.02	-3.67	-3.66	-2.47	-2.77	-3.05	-2.68			
-2.80	-3.99	-3.64	-3.63	-2.43	-2.73	-3.01	-2.64			
-2.84	-4.01	-3.66	-3.65	-2.47	-2.77	-3.05	-2.68			
-2.80	-3.98	-3.63	-3.62	-2.43	-2.73	-3.01	-2.64			
-2.84	-4.00	-3.65	-3.64	-2.46	-2.77	-3.05	-2.68			
-2.80	-3.97	-3.62	-3.61	-2.42	-2.73	-3.01	-2.64			
-1.57	-2.61	-2.19	-2.18	-0.97	-1.46	-1.80	-1.43			

ATTACHMENT 1 TO ANNEX 2

Table 2 – MXC01002 Beam

MXC01002	-157.20	USA	P	8 8	0.00	0.00	0.00	0.00	BSS	REG2 ANALYSIS	
30	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.74	-113.07	3.74	1.78	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17324.00	17353.16	17382.32	17411.48	17440.64	17469.80	17498.96	17528.12				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0	CR 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
22.25	-99.62	4.50	0.68	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12224.00	12253.16	12282.32	12311.48	12340.64	12369.80	12398.96	12428.12				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
32.53	32.68	31.78	29.80	26.00	20.00	22.37	27.27				
-117.20	-114.73	-106.55	-101.47	-97.00	-105.83	-110.75	-115.52				
0	200	1144	200	0	0	0	0				
E	E	M	M	M	M	E	E				
-1.60	-2.72	-2.30	-2.58	-1.06	-1.48	-1.82	-1.45				
-2.91	-4.13	-3.79	-4.01	-2.59	-2.84	-3.12	-2.74				
-2.89	-4.13	-3.78	-3.98	-2.57	-2.82	-3.09	-2.72				
-2.91	-4.12	-3.78	-3.99	-2.58	-2.84	-3.12	-2.74				
-2.89	-4.12	-3.77	-3.97	-2.56	-2.82	-3.09	-2.72				
-2.91	-4.11	-3.77	-3.98	-2.57	-2.84	-3.12	-2.74				
-2.89	-4.12	-3.76	-3.96	-2.56	-2.82	-3.09	-2.72				
-2.93	-4.11	-3.78	-3.99	-2.58	-2.86	-3.14	-2.76				
MXC01002	-156.80	USA	P	8 8	0.00	0.00	0.00	0.00	BSS	REG2 ANALYSIS	
30	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.71	-113.01	3.74	1.79	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
2	4	6	8	10	12	14	16				

Annex 2 - Table 2 cont'd

74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17338.58	17367.74	17396.90	17426.06	17455.22	17484.38	17513.54	17542.70				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0 CL	0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
22.25	-99.62	4.50	0.68	160.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12238.58	12267.74	12296.90	12326.06	12355.22	12384.38	12413.54	12442.70				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
32.53	32.68	31.78	29.80	26.00	20.00	22.37	27.27				
-117.20	-114.73	-106.55	-101.47	-97.00	-105.83	-110.75	-115.52				
0	200	1144	200	0	0	0	0				
E	E	M	M	M	M	E	E				
-2.48	-3.79	-3.43	-3.45	-2.15	-2.38	-2.69	-2.31				
-2.85	-4.07	-3.72	-3.71	-2.50	-2.78	-3.06	-2.68				
-2.82	-4.05	-3.71	-3.70	-2.49	-2.75	-3.02	-2.65				
-2.85	-4.06	-3.71	-3.70	-2.50	-2.78	-3.06	-2.68				
-2.82	-4.05	-3.70	-3.69	-2.48	-2.75	-3.02	-2.65				
-2.85	-4.05	-3.70	-3.69	-2.49	-2.78	-3.06	-2.68				
-2.82	-4.04	-3.69	-3.68	-2.47	-2.75	-3.02	-2.65				
-2.91	-4.12	-3.77	-3.76	-2.56	-2.84	-3.12	-2.75				

ATTACHMENT 1 TO ANNEX 2

Table 3 – CDN01002 Beam

CDN01002	-157.20	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
30	CR 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.74	-113.07	3.74	1.78	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
76.4	76.4	76.4	76.4	76.4	76.4	76.4	76.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17324.00	17353.16	17382.32	17411.48	17440.64	17469.80	17498.96	17528.12				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0	CR 0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
54.63	-127.90	3.00	1.24	170.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
1	3	5	7	9	11	13	15				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12224.00	12253.16	12282.32	12311.48	12340.64	12369.80	12398.96	12428.12				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
70.00	70.00	53.70	49.00	48.30	49.40	52.60	60.30				
-141.00	-120.00	-120.00	-114.10	-123.90	-126.70	-132.20	-141.00				
450	750	1000	1500	2250	200	750	50				
A	A	B	E	D	D	D	D				
-0.86	-2.88	-2.13	-4.50	-3.23	-2.71	-1.63	-0.99				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.28	-3.94	-3.17	-5.26	-4.22	-3.81	-2.94	-2.42				
CDN01002	-156.80	USA	P	8 8	0.00	0.00	0.00	0.00	BSS REG2 ANALYSIS		
30	CL 0.00	E 30.00	0	0.10	0.10	1.00	0.10	0.0		24.00	
40.71	-113.01	3.74	1.79	149.00	0.00	7.00	0.00	0.60	59.90	0.00	24M0G7W--
2	4	6	8	10	12	14	16				

Annex 2 - Table 3 cont'd

74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.4				
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5				
17338.58	17367.74	17396.90	17426.06	17455.22	17484.38	17513.54	17542.70				
2		R2TES		R123SS		0.0	0.0		0.00000	0.00	
32.50	49.00										
-117.10	-122.80										
0	0										
B	D										
0 CL	0.00	E 35.50	0	0.00	0.10	1.00	0.10	0.0		24.00	
54.63	-127.90	3.00	1.24	170.00	0.00	0.45	0.00	0.80	34.40	0.00	24M0G7W--
2	4	6	8	10	12	14	16				
56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3				
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8				
12238.58	12267.74	12296.90	12326.06	12355.22	12384.38	12413.54	12442.70				
8		R2RES		R123SS		0.0	0.0		0.00000	0.00	
70.00	70.00	53.70	49.00	48.30	49.40	52.60	60.30				
-141.00	-120.00	-120.00	-114.10	-123.90	-126.70	-132.20	-141.00				
450	750	1000	1500	2250	200	750	50				
A	A	B	E	D	D	D	D				
-0.86	-2.88	-2.13	-4.50	-3.23	-2.71	-1.63	-0.99				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.81	-4.34	-3.58	-5.54	-4.59	-4.22	-3.43	-2.95				
-2.80	-4.34	-3.58	-5.54	-4.58	-4.22	-3.43	-2.94				
-2.28	-3.94	-3.17	-5.26	-4.22	-3.81	-2.94	-2.42				

ATTACHMENT 1 TO ANNEX 2

Table 4 – Affected Beams and Channels (sorted by Orbital Position)

Input File C:\BR_SOFT\MSPACEg\Input.DAT\SAT83_02-3-14_10.txt
Input File Title ONLY VISIBLE TEST POINTS INCLUDED DOWN AND UP LINK SAT83 REGION 2 PLAN Version: 30 April 1999 X X
Output Database C:\BR_SOFT\MSPACEg\Input.DAT\SAT83_02-3-14_10.mdb
Analysis Version (in output database) 1 Completed on 19-March 2002 12:25

Orbital Position	Adm. Symbol	Satellite Name	Beam Name	Affected Channels
-157.20	USA	BSS REG2 ANALYSIS	CDN01002	1,3,5,7,9,11,13,15
-157.20	USA	BSS REG2 ANALYSIS	MXC01002	1,3,5,7,9,11,13,15
-157.20	USA	BSS REG2 ANALYSIS	USAWH102	17,19,21,23,25,27,29,31
-156.80	USA	BSS REG2 ANALYSIS	CDN01002	2,4,6,8,10,12,14,16
-156.80	USA	BSS REG2 ANALYSIS	MXC01002	2,4,6,8,10,12,14,16
-156.80	USA	BSS REG2 ANALYSIS	USAWH102	18,20,22,24,26,28,30,32

ANNEX 3 TO APPENDIX A

TECHNICAL CHARACTERISTICS OF SOUTHPOINT 1 AND SOUTHPOINT 2 AND INTEGRATED TERRESTRIAL PLATFORM

I. INTRODUCTION

Compass Systems, Inc. ("CSI") requests in the instant application ("Application") that the Federal Communications Commission ("Commission") grant CSI authority to operate an integrated terrestrial platform ("ITP") as part of its proposed Compass direct broadcast satellite ("DBS") system using DBS spectrum requested by CSI in the Application. The ITP will implement technology patented by Northpoint Technology, Ltd. (the "Northpoint Technology"), which is a digital, wireless, cell-based, terrestrial transmission technology that reuses radio frequency spectrum assigned to satellite systems. Specifically, the Northpoint Technology allows the reuse of DBS spectrum by maintaining the terrestrial signal below the level at which interference would be caused to the satellite signal, but above the level required to provide reliable terrestrial service. As discussed below, this terrestrial reuse is accomplished through several means, including directional transmission.

The Compass ITP consists of directional broadcast antennas located on towers, poles, buildings, or mountains. ITP transmissions are oriented in a limited azimuth range, based on the look angles to the Compass satellites, which allows for harmonious, simultaneous co-channel satellite and terrestrial spectrum sharing. Thus, the spectrum is used efficiently by both the Compass satellites and ITP. When utilized in conjunction with Compass, the ITP will create significant synergies through efficient spectrum reuse. As further explained below, the ITP and

Compass DBS satellites together will comprise an integrated system of terrestrial and satellite audio, video, and data services.

II. CONCEPTUAL OVERVIEW

The ITP is designed to provide local content through local transmissions, and national content on a nationwide or broad coverage basis, as illustrated in Figure 1. National content may also be integrated with local content, as further explained below. CSI subscribers will have a choice among local and national packages, or can purchase a combination of both local and national programming.

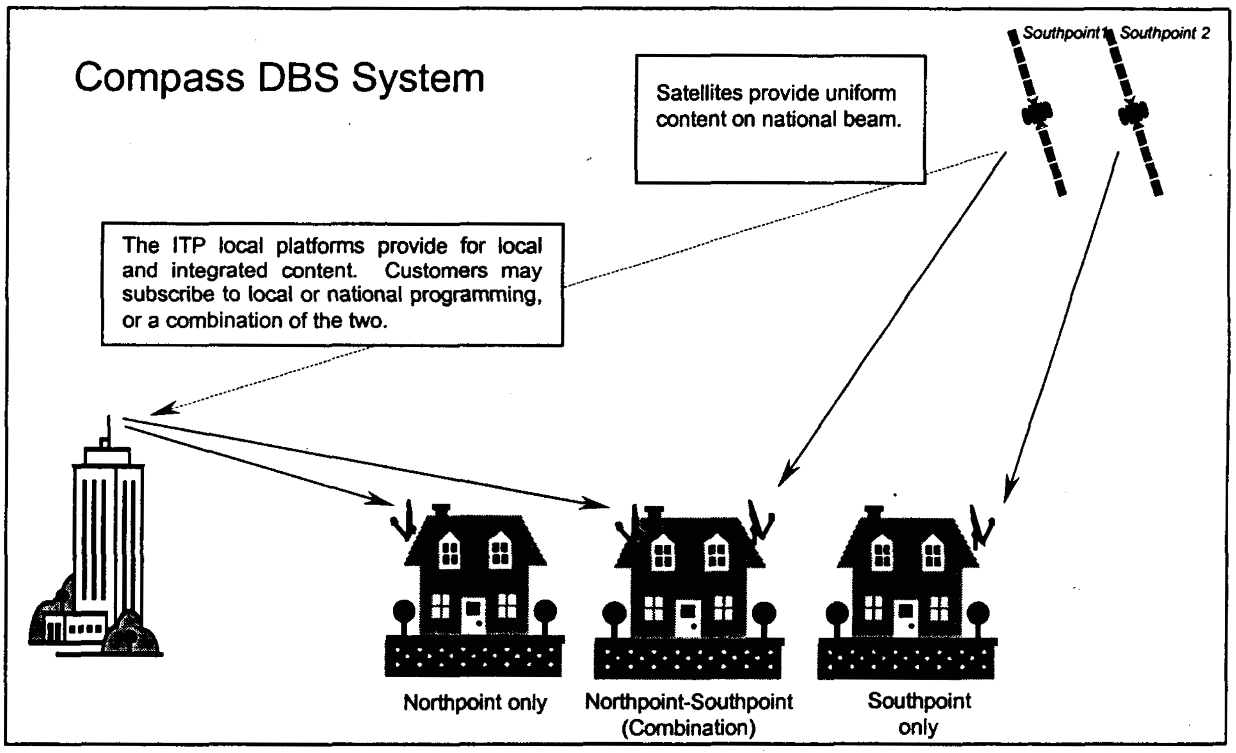

Figure 1. Integrated ITP-Satellite Conceptual Overview

A. Patented Technology

The Northpoint Technology is patented under U.S. and certain foreign patents, and additional Northpoint Technology patents are pending in the United States and other countries.[1] These patents describe the concept for sharing between terrestrial transmitters and geostationary satellites, as well as the specific implementation of the Northpoint Technology in the 12.2 – 12.7 GHz band for terrestrial sharing with existing DBS systems.

B. Difference from Microwave Point-to-Point Systems

Prior to the development of the Northpoint Technology, terrestrial systems shared spectrum with satellite systems through geographic separation and/or band segmentation. An example of prior terrestrial-satellite spectrum sharing is the band 10.7 – 11.7 GHz in the United States. Microwave relay stations operating using this spectrum share the spectrum with satellite earth stations. However, in this band the spectrum is not reused, because a geographic separation is required between the microwave transmitter and the satellite earth station. This separation distance is measured in the tens of kilometers, and is sometimes referred to as an "exclusion zone" or "coordination" threshold. In this configuration, spectrum is not shared or reused because only the satellite or terrestrial system may operate in a specific location. By contrast, the Northpoint Technology allows for co-channel operation without the substantial exclusion zones needed with prior systems.

C. ITP Coexistence with Compass Satellites

In the 12.2–12.7 GHz band, DBS satellites transmit from the geostationary arc with satellite spacing as close as 9°. Thus, a DBS reception antenna in this band must be capable of discriminating the desired satellite signal from multiple other DBS satellite signals that may be located as close as 9° off the boresight of the antenna. The typical DBS subscriber receives DBS transmission on a small (i.e., 18" diameter) parabolic offset feed antenna. The parabolic offset feed antenna discriminates against the other satellites that are spaced at 9° intervals along the geostationary arc. The gain pattern of the antenna provides 35 to 50 dB of discrimination to signals outside of the 9° boresight. In the United States, DBS satellite antennas must be directed generally southward to view a DBS satellite in the geostationary arc. The Compass ITP takes advantage of this fact by transmitting generally in a southerly direction, into the back or the side of the DBS customer antenna, avoiding the antenna boresight and thereby taking full advantage of the 35 – 50 dB of discrimination in the offset feed parabolic antenna.

Another principal factor in preventing interference to other co-frequency operations is that the Northpoint Technology is a low-power technology. By maintaining a received power ratio below the level at which co-frequency interference would be caused, the Compass ITP is able to operate at a co-frequency with satellite systems. All DBS signals in the United States are digital and require an overall carrier-to-noise ("C/N") level of around 5 dB to maintain a full

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[1] The Northpoint Technology holds the following U.S. patents: 5,761,605; 5,483,663; 6,208,864; 6208,636; and 6,169,878.

picture. Because DBS maintains a clear sky C/N ratio of around 12–15 dB, a carrier-to-interference ("C/I") ratio of 15–20 dB would not cause interference. The ITP received signal level, as measured at a DBS customer dwelling, is maintained below the value that could cause interference.

The Compass ITP will use a cell-based transmission network to achieve a broad coverage area in broadcast mode. However, point-to-point applications also are possible. The typical ITP transmit antenna pattern will use a cardioid that allows for maximum broadcast coverage while still maintaining directional transmissions, as shown in Figure 4. In the 12.2–12.7 GHz DBS service band, service will be provided to a distance of approximately ten miles, depending on the local terrain and rain region. The ITP transmitter will be located on hills, towers, or buildings, with the transmit antenna oriented along a range of azimuths—but always pointed generally southward. Pointing in other directions, such as north, however, is possible depending on the specific site and implementation.

Each ten-mile cell effectively reuses the spectrum terrestrially, and may carry different broadcast content. Through this frequency reuse in the 12.2–12.7 GHz band alone, over 100 GHz of spectrum nationwide can be re-harvested. Using this newly available spectrum, both video and data services will be provided over the ITP network.

III. NORTHPOINT 12.2–12.7 GHz TRANSMISSION CHARACTERISTICS

In the 12.2–12.7 GHz band, the transmission parameters are similar to those parameters found in recommendation ITU-R F.755-1, Point-to-Multipoint Systems Used in the Fixed

Service, with the exception that the Compass ITP will operate at lower power. The basic technical parameters are given in Table 1, below.

Parameter	**Typical Value**	**Range**	**Units**
Channel bandwidth	24	10 - 50	MHz
Frequency	12.5	12.2 - 12.7	GHz
Polarization	H	H/V/C	-
Transmit antenna gain	10	9 - 13	dBi
Transmit Power	-25	-22.5 to -15	dBW
EIRP	-17.5	-21.5 to -7.5	dBW
Transmit height above average terrain	100	30 – 4500[2]	meters
Transmit height above ground level	100	5 – 500	meters
Required Signal Strength at edge of cell	-156	-155 to -160	dBi (24 MHz)
Cell Size	16	10 – 20	km
Receive antenna gain	34	34 – 38	dBi
Availability objective	99.7	99.7 – 99.995	%

Table 1. Technical parameters of the 12 GHz implementation of the Northpoint Technology[3]

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[2] This value is likely to be over 1000 meters in the case of a transmit antenna located on a mountaintop.

[3] The parameters in the "Range" column are intended to provide guidance as to the typical range of values that will be used by the majority of ITP antenna. The actual values will be determined by local conditions and specific application, (e.g. video, data, etc.), and Table 1 is not intended to limit in any way the possibility of other values being used. For example, in the case of ITP transmitters on mountaintops, the transmitter height above the average terrain could be 2000 meters. In this case, the allowable EIRP may be much higher, and the transmitter tilt may be less than zero.

A. ITP Transmitter Characteristics

The Compass ITP will employ transmit antennas with a typical gain of 10 dBi. Transmissions will be oriented toward the south, facilitating sharing with the Compass DBS satellites and other geostationary systems. The antenna radiation pattern is designed to ensure a broad coverage broadcast beam, while minimizing the power received near the transmitter. Minimizing the power near the transmitter maintains the signal level below a level that might cause interference to co-frequency systems. Figure 2 depicts the Compass ITP isotropic received signal level in a 24 MHz bandwidth, on boresight of the transmitter, for two cases. This figure shows how the signal strength is minimized near the tower (solid line) due to the Northpoint Technology interference mitigation techniques.

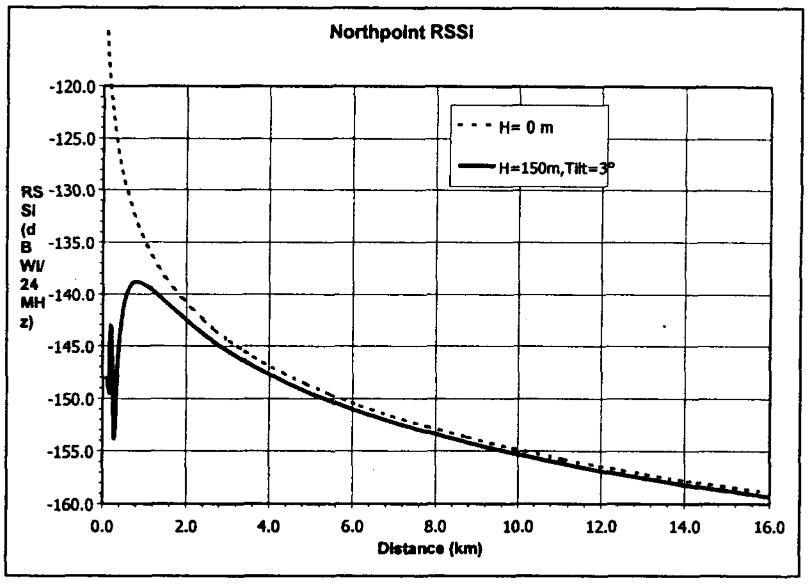

Figure 2. Northpoint isotropic signal level (24 MHz bandwidth)

B. Sharing Radio Frequency Spectrum with Other Systems

The Compass ITP employs a variety of interference mitigation techniques to minimize interference and enhance the sharing environment with satellite spectrum users:

- <u>Directional Transmission</u>–Transmission is generally southerly to minimize interference into satellite receivers.
- <u>Transmit Antenna Discrimination</u>–The transmit antenna pattern allows for 20-30 dB of discrimination in the area near the transmitter.
- <u>Beam Tilting</u>–By tilting the transmitter up from the horizon, signal level is further reduced in the area near the transmitter, as shown in the example in Figure 3.

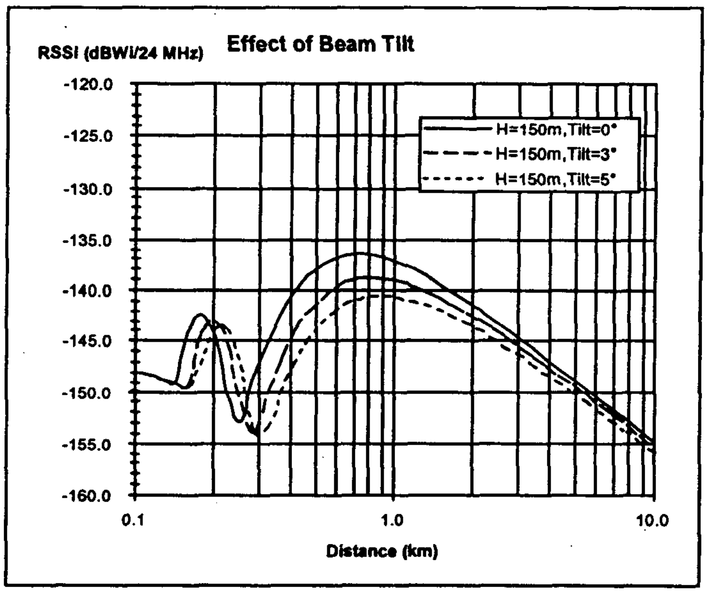

Figure 3. Effect of beam tilt on the received signal strength relative to isotropic (RSSi).

C. Compass ITP Availability

The Compass ITP is designed to provide a minimum 99.7% of availability at the edge of coverage. This is the same target availability as the DBS component of Compass. However, all CSI customers within the service area and not at the edge of coverage will experience higher terrestrial availability, with the average availability being higher than 99.95%. Using DBS spectrum, reliable service can be provided everywhere in the United States at 10-16 km from the transmitter, and more than 16 km in certain rain regions, which comprise about 50% of the United States

For those subscribers at the edge of coverage or in higher rain attenuation areas where the cell geometry dictates need for increased gain, a higher gain antenna provides for additional fade margin. With a higher gain receive antenna, cell sizes of 16 km throughout the country are assured. In any case, there is clearly sufficient margin to mitigate rain attenuation for all areas of the United States.

IV. OVERVIEW OF THE COMPASS ITP

The Compass ITP will be deployed throughout the United States, but each DMA will be managed locally. CSI currently intends to use the 210 Nielsen DMAs to define implementation areas. Each DMA will have a DMA control center, a head-end transmitter, and a series of repeaters each providing service to customer dwellings in different cells within the DMA.

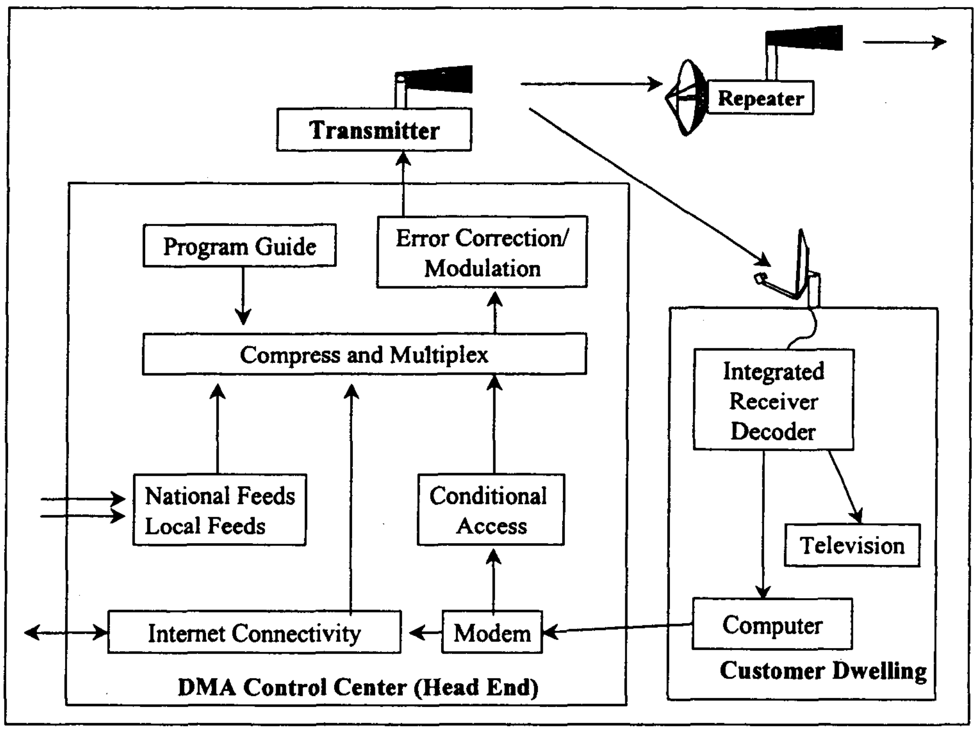

Figure 4. DMA Architecture

Figure 4 is a simplified schematic/block diagram of a Compass ITP DMA service area. Video and other information from a variety of sources are input to compressors and encoders. This implementation will use the digital video broadcast ("DVB") standard. The information is then modulated (QPSK), upconverted to 12 GHz band DBS spectrum and transmitted out of the head-end transmitter, which serves the DMA. Repeaters carry the information throughout the cells in the DMA. The information is received at the subscriber dwelling, decoded by an integrated receiver/decoder ("IRD") and displayed on the television or routed to the computer in the case of data.

A number of cells, each with a signal repeater, are required to serve a DMA. Most of the repeaters function as transparent transponders. However, repeating the signal in this fashion introduces noise into the system. In order to minimize this noise, some repeaters will be regenerative repeaters, decoding and re-encoding the data, which will reduce this source of noise. In addition, local content may be inserted at each repeater.

Decoding and re-encoding the data will not only eliminate a source of noise, but also will provide an opportunity to change the content being carried. This allows different information to be disseminated to different cells in the DMA as required, allowing for greater frequency reuse. For example, it will not be necessary to broadcast the same Internet traffic throughout the entire DMA. Instead, DBS spectrum will be reused on a cell-by-cell basis within some DMAs.

A. ITP Cells

ITP service within each DMA is enabled through a number of cells. Customers within each cell will be served by either a transmitter or repeater. A typical ITP cell is shown in Figure 5. The Northpoint Technology is a line of sight technology, and as such, cells may overlap to provide better coverage, especially in heavily forested or hilly areas of the country.

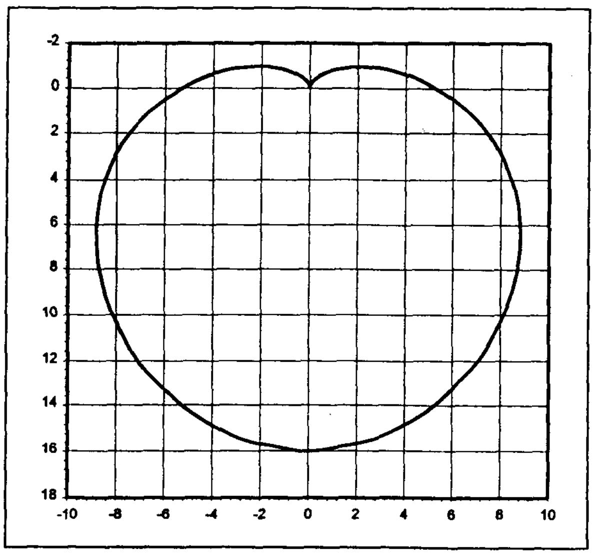

Figure 5. Typical service area using 12 GHz band DBS spectrum (transmitter located at [0,0], dimensions in km).

B. Service Provided Using the Compass ITP

The Compass ITP will provide two basic services: (i) multi-channel video programming (television); and (ii) data services, including high-data rate connectivity to the Internet. Finally, through integration with the satellite network, the ITP will provide a mechanism for a synergistic relationship between local and national entities—for example, broadcasters, advertisers, members of the press, members of the government.

Television/Video–The Compass ITP will have the capability to provide more than 100 channels of television programming while still providing broadband Internet access. The video programming will be targeted per cell given the needs of individual communities, but will include all "must carry" television stations within the relevant designated market area ("DMA"), popular national weather, business and entertainment channels, pay-per-view and video-on-demand services, interactive television services, and monthly subscription services, such as movie and sports channels.

Audio–The Compass ITP will have the capability to provide more than 100 channels of audio programming. As a result, in addition to commercial free audio broadcast on a national basis, locally oriented audio catering to local interests also can be provided.

Internet–Some portion of the bandwidth in each ITP cell may be dedicated to data services, subject to the establishment of a return link. Several options are being studied for the return link.

Synergistic Services–The ability to truly integrate local and national content provides for real efficiency in spectrum utilization. As an example, a national programming news service such as CNN could be integrated with local advertising broadcast terrestrially. Personalized messages and conditional access would be provided locally, rather than broadcast on a national beam. National programming information would be broadcast on the national platform and integrated with local programming to develop an integrated electronic program guide.

V. SUMMARY

The Compass ITP and Compass DBS satellites will be integrated to form a truly synergistic DBS system capable of providing local content locally, and national content on a national uniform beam. By reusing spectrum locally, true spectrum efficiencies can be realized eliminating the need for costly "spot-beam" satellites.

ANNEX 4 TO APPENDIX A

SPECTRUM EFFICIENCIES ACHIEVED VIA TERRESTRIAL REUSE OF DBS SPECTRUM BY INTEGRATED TERRESTRIAL PLATFORM

The analysis in this Annex 4 examines the spectrum efficiency of the integrated satellite-terrestrial Compass direct broadcast satellite ("DBS") system ("Compass") proposed by Compass Systems, Inc. ("CSI") in the instant application. The Annex demonstrates that it is significantly more spectrum efficient to integrate transmissions from both satellite and terrestrial sources than to operate a satellite-only or a terrestrial-only system. In this paper, the terrestrial component of Compass is referred to as the integrated terrestrial platform ("ITP"). This analysis also demonstrates that delivery of local content via satellite is much less spectrum efficient than a terrestrial-only or combined terrestrial-satellite system.

Compass employs a fully integrated satellite-terrestrial transmission system that provides national programming via broadcasting satellite and local channels and broadband Internet access through a terrestrial channel. System control signals, local electronic program guides ("EPG"), personalized messages to subscribers, certain conditional access features, and local insertion of content into national programming are also provided via ITP and support presentation of the satellite content to the end user.

I. CHARACTERISTICS OF SATELLITE AND TERRESTRIAL TRANSMISSIONS

Geostationary DBS satellites employ national, regional, or spot beams that cover large geographic areas. This architecture excels at the delivery of uniform content to broad geographic areas. Offloading local content to terrestrial systems allows maximum satellite bandwidth to be allocated to uniform satellite broadcasts. "Rightsizing" transmissions based on their content and geographic designation allows the terrestrial and satellite resources to each be applied to their highest and best use.

By contrast, terrestrial platforms are deployed as a network of cells, each of which is capable of providing unique content to a defined, much smaller geographic area. The terrestrial network excels at delivering local information and personalized services. Offloading the uniform content to a satellite platform maximizes the use of the terrestrial platform and provides the most possible capacity for local broadcasts or unique transmissions such as web service intended for a single user.

As further discussed below, two principles dominate any analysis of the efficiency of a geo-stationary satellite service: (i) every bit that comes down from a satellite must first go up, and (ii) every broadcast bit reaches the entire service area of the downlink beam.

A. There are no "feeder links" in the Compass System ITP

One clear advantage of the ITP is that there is no need to "uplink" data to terrestrial repeaters using a different frequency. In the Compass ITP, information is forwarded on the same frequency as the user links. The local broadcast is routed to a header and repeated in a cellular fashion. By contrast, each bit on a DBS satellite downlink must be first uplinked to the satellite, using feeder link spectrum that is unavailable for other uses. Therefore, terrestrial repeaters are more spectrum efficient than satellite downlinks because they do not need a feederlink. The allocation of spectrum to feederlinks makes sense only when the downlink is intended to provide a uniform broadcast to a large geographic area or a large number of dispersed users. The satellite segment is not efficient for point-to-point services like Internet access or local-into-local services.

B. Terrestrial cellular approach is significantly more efficient than satellite for delivery of local content

Terrestrial systems excel at delivering local content (including local television stations and one-to-one Internet services) because the size of the terrestrial cell can be much smaller than any satellite spot, regional, or national beam and the shape can be more precisely defined. Each terrestrial cell can re-use frequencies and thus provide distinct content to precise geographic areas. A satellite must broadcast all content across the full footprint of its service beam in order to provide this content to any user within the area served. As a result, satellites are significantly less efficient at providing local broadcast and internet services.

1. Terrestrial achieves greater than 50 to 1 efficiency in delivering local television service

As shown below the type of terrestrial cellular architecture used in the Compass ITP can achieve in excess 50 times greater efficiency in the delivery of local television services than the most efficient spot beam satellite-based service and 400 to 1 over national satellite beams.

There are approximately 1,650 television stations in each of the United States' 210 designated market areas for television ("DMAs") or an average of 8 television stations per market. Some markets have up to 24 stations. When a local station is transmitted on a nationwide satellite beam, this programming is intended to serve only the market where the station originates. Thus, only a tiny fraction (0.5% on average[1]) of the households in a national satellite footprint will use the transmission, even though the transmission is broadcast across the nation. When transmitted terrestrially, the size and shape of the area over which the signal is broadcast can be precisely designed, eliminating the need to use resources to transmit a single signal to large areas where the signal is not needed. After accounting for the spectrum required to uplink local programming, and the wastefulness of illuminating areas where the service is not required, terrestrial systems have a 400 to 1 advantage in efficiency over delivery of local television channels via national satellite beams.[2]

Certain DBS providers have begun to use spot beam satellites for a portion of their local service. This manner of transmission is an improvement from carrying local programming on a national beam, although it is still highly inefficient. Each local station must still be uplinked to the satellite, only to be downlinked on a spot beam that covers a footprint greater than a single market. Another factor limiting the efficacy of spot beams is the number of spot beams that can be provided on a single satellite and orbital slot due to self interference. For example, The DIRECTV 4S satellite is capable of using 44 transponders on each of six frequencies, for a re-use factor of 7.3 transponders per frequency channel. Similarly, the Echostar 7 satellite utilizes

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[1] Each of the United States' 210 television DMA represents about 0.5% of the total of the television market.

[2] Each beam provides a wanted signal to only 0.5% (1/200th) of the nation and uses twice as much spectrum as would be required terrestrially due to the need for satellite uplink resources.

25 transponders on each of five frequencies for a re-use factor of 5.0.[3] Dividing the 400 to 1 terrestrial-satellite advantage by a frequency re-use factor of between five and seven yields a spectrum efficiency advantage to terrestrial systems over spot beams ranging from 57 to 1 to 80 to 1.

This clearly demonstrates that even compared to the scenario most advantageous to DBS satellites, i.e., the use of targeted spot beams, local television "must carry" content is most efficiently delivered via a terrestrial cellular network. Doing so conserves spectrum resources, allowing additional local programming and broadband services to be offered.

2. *Terrestrial cellular achieves greater than 1500 to 1 efficiency for the provision of Internet access services*

Terrestrial delivery of internet content is radically more efficient than satellite delivery of the same service. Terrestrial transmissions can be targeted at very small areas, achieving substantial frequency re-use factors over satellite transmissions. In theory, any given frequency can be re-used in each of the approximately 15,000 terrestrial cells required for nationwide coverage, thus achieving 15,000 fold frequency re-use. While this is true in principle, in practice vagaries in coverage and demand will result in certain terrestrial cells operating in a "repeater" mode, similar to that manner in which local broadcast content is transmitted terrestrially in a local area. Even a conservative assumption yields that a terrestrial transponder frequency could be re-used at least every ten cells, leading to 1,500 fold frequency re-use.

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[3] Applications of Echostar and DirecTV for Echostar 7 and DirecTV 4S.

The analysis is even more striking when one considers the number of users that can be served by a satellite transponder. According to industry experience, each 24 MHz satellite transponder is capable of providing quality Internet access service for 5,000 customers,[4] a number that is likely to decrease, not increase as the service is deployed.

3. Overlooked flaw in satellite "users per transponder" traffic models

Estimates of the number of "users per satellite transponder" overlook the fact that once customers begin using a broadband connection, they also significantly increase the number of bits downloaded. Estimates that a single satellite transponder will support a high quality of service to 5,000 users are highly optimistic. It is more likely that each transponder will accommodate only 1,000 to 2,500 users as the service matures. Peer-to-peer file sharing services such as Napster, and the increase in multimedia content offered over the Internet will greatly increase the number of bits used by a typical user and will cause a corresponding reduction in the number of users possible per transponder.

Even if a satellite transponder could support 5,000 users, an entire satellite with a capacity of 32 transponders is needed to serve just 160,000 customers. To serve additional customers, another satellite would be required, and then another and another. If all of the 256 transponders available in United States' eight DBS slots were devoted exclusively to the delivery

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[4] "EchoStar… has managed to serve only 5,000 customers per transponder, instead of the 10,000 it had promised in its business plan." Pegasus Flaps Its Wings Harder, Business Week Online, April 17, 2001, available at http://www.businessweek.com/bwdaily/dnflash/dnflash/apr2001 bwdaily/nf20010417_382.htm.

of Internet content by satellite, fewer than 1.3 million users could be supported with the entire system capacity assuming 5,000 users per transponder. With a more realistic estimate of 2,500 users per transponder this number falls to only 650,000 subscribers. By using spot beams to increase the number of transponders, a DBS satellite system could support an estimated 5 million users, but, of course, all eight DBS orbital slots cannot be devoted to Internet services. These slots are already fully used for video programming. Thus, delivery of Internet content by a DBS satellite platform is impractical, even using spot beams.

It is interesting to note that Echostar recently estimated that there are 40,000,000 households without broadband access.[5] To serve the 40 million households, a satellite provider would need at least 8,000 transponders or 250 full 32 transponder satellites. This is more geo-stationary satellites than serve the United States today, in all frequency bands and for all services combined. By contrast, terrestrial deployment of Internet access can be done in tandem with deployment of nationwide video. The Internet access service would use the same infrastructure as video, re-using frequencies in each of a cluster of cells.

II. SUMMARY

This annex described the advantages of terrestrial delivery of local and point-to-point content, and how such delivery is vastly more efficient than delivery by satellite. It also notes that satellite services excel at delivering uniform content to large areas and can free up local

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[5] See "Local Channels and Competitive Broadband for All Americans" http://www.echostarmerger.com/5030/wrapper.jsp?PID=5030-7.

resources from redundant use. Thus, "rightsizing" transmissions by ensuring that the transmissions are carried on the most efficient platform given their intended audience can result in radical improvements in spectrum efficiencies.

APPENDIX B

FCC FORM 430

Federal Communications Commission
Washington, DC 20554

3060-0105

LICENSEE QUALIFICATION REPORT

See reverse for public burden estimate

INSTRUCTIONS:

A. The "Filer" of this report is defined to include: (1) An applicant, where this report is submitted in connection with applications for common carrier and satellite radio authority as required for such applications; or (2) A licensee or permittee, where this report is required by the Commission's Rules to be submitted on an annual basis.

B. Submit an original and one copy (sign original only) to the Federal Communications Commission, Washington, DC 20554. If more than one radio service is listed in Item 6, submit an additional copy for each such additional service. If this report is being submitted in connection with an application for radio authority, attach it to that application.

C. Do not submit a fee with this report.

1. Business Name and Address (Number, Street, State and ZIP Code) of Filer's Principal Office
Compass Systems, Inc.
1 Harbour Place
Suite 475
Portsmouth, NH 03801

2. (Area Code) Telephone Number
(603) 431-5511

3. If this report supersedes a previously filed report, specify its date
N/A

4. Filer is (check one):
☐ Individual ☐ Partnership ☒ Corporation
☐ Other (Specify):

5. Under the laws of what State (or other jurisdiction) is the Filer organized?
Delaware

6. List the common carrier and satellite radio services in which Filer has applied or is a current licensee or permittee:
Part 100 Direct Broadcast Satellite (DBS) service.

7 (a) Has the Filer or any party to this application had any FCC station license or permit revoked or had any application for permit, license or renewal denied by this Commission? *If "YES", attach as Exhibit 1 a statement giving call sign and file number of license or permit revoked and relating circumstances.* ☐ YES ☒ NO

(b) Has any court finally adjudged the Filer, or any person directly or indirectly controlling the Filer, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement, or other means of unfair methods of competition? *If "YES", attach as Exhibit II a statement relating the facts.* ☐ YES ☒ NO

(c) Has the Filer, or any party to this application, or any person directly or indirectly controlling the Filer ever been convicted of a felony by any state or Federal court? *If "YES", attach as Exhibit III a statement relating the facts.* ☐ YES ☒ NO

(d) Is the Filer, or any person directly or indirectly controlling the Filer, presently a party in any matter referred to in Items 7(b) and 7(c)? *If "YES", attach as Exhibit IV a statement relating the facts.* ☐ YES ☒ NO

8. Is the Filer, directly or indirectly, through stock ownership, contract or otherwise, currently interested in the ownership or control of any other radio stations licensed by the Commission? *If "YES", attach as Exhibit V the name of each such licensee and the licensee's relation to the Filer.* ☐ YES ☒ NO

If Filer is an individual (sole proprietorship) or partnership, answer the following and Item 11:

9 (a) Full Legal Name and Residential Address (Number, Street, State and ZIP Code) of Individual or Partners:
N/A

(b) Is Individual or each member of a partnership a citizen of the United States? ☐ YES ☐ NO
N/A

(c) Is Individual or any member of a partnership a representative of an alien or of a foreign government? ☐ YES ☐ NO
N/A

10 (a) Attach as Exhibit VI the names, addresses, and citizenship of those stockholders owning of record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries.

(b) List below, or attach as Exhibit VII the names and addresses of the officers and directors of the Filer.

(c) Is the Filer directly or indirectly controlled by any other corporation? [X] YES [ ] NO

If "YES", attach as Exhibit VIII a statement (including organizational diagrams where appropriate) which fully and completely identifies the nature and extent of control. Include the following: (1) the address and primary business of the controlling corporation and any intermediate subsidiaries; (2) the names, addresses, and citizenship of those stockholders holding 10 percent or more of the controlling corporation's voting stock; (3) the approximate percentage of total voting stock held by each such stockholder; and (4) the names and addresses of the president and directors of the controlling corporation.

(d) Is any officer or director of the Filer an alien? [ ] YES [X] NO

(e) Is more than one-fifth of the capital stock of the Filer owned of record or voted by aliens or their representatives, or by a foreign government or representative(s) thereof, or by a corporation organized under the laws of a foreign country? [ ] YES [X] NO

(f) Is the Filer directly or indirectly controlled: (1) by any other corporation of which any officer or more than one-fourth of the directors are aliens, or (2) by any foreign corporation or corporation of which more than one-fourth of the capital stock is owned or voted by aliens or their representatives, or by a foreign government or representatives thereof. [ ] YES [X] NO

(g) If any answer to questions (d), (e) or (f) is "YES", attach as Exhibit IX a statement identifying the aliens or foreign entities, their nationality, their relationship to the Filer, and the percentage of stock they own or vote.

11. CERTIFICATION

This report constitutes a material part of any application which cross-references it, and all statements made in the attached exhibits are a material part thereof. The ownership information contained in this report does not constitute an application for, or Commission approval of, any transfer of control or assignment of radio facilities. The undersigned, individually and for the Filer, hereby certifies that the statements made herein are true, complete and correct to the best of the Filer's knowledge and belief, and are made in good faith. The undersigned, individually and for the Filer, certifies that neither the applicant nor any other party to the application is subject to a denial of Federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance.

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. CODE, TITLE 47, SECTION 312(A)(1)), AND/OR FORFEITURE (U.S. CODE, TITLE 47, SECTION 503).

Filer (must correspond with that shown in Item 1)	Typed or Printed Name	
Compass Systems, Inc.	Sophia Collier	
Signature	Title	Date
[signature]	President	March 20, 2002

NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1995

The solicitation of personal information requested in this form is to determine if you are qualified to become or remain a licensee in common carrier or satellite radio service pursuant to the Communications Act of 1934, as amended. No authorization can be granted unless all information requested is provided. Your response is required to obtain the requested authorization or retain an authorization.

Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate, or any other aspect of this collection of information, including suggestions for reducing the burden to Federal Communications Commission, AMD-PERM, Washington, DC 20554, Paperwork Reduction Project (3060-0105), or via the Internet to jboley@fcc.gov. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS. **You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection unless it displays a currently valid OMB control number or if we fail to provide you with this notice.**

This notice is required by the Privacy Act of 1974, Public Law 93-579, December 31, 1974, 5 U.S.C. Section 552a(e)(3) and the Paperwork Reduction Act of 1995, Public Law 104-13, October 1, 1995, 44 U.S.C. 3507.

EXHIBIT VI: DIRECT OWNERSHIP OF COMPASS SYSTEMS, INC.

Compass Systems, Inc. ("Compass") is a corporation organized under the laws of the state of Delaware. 100% of the issued and outstanding shares of Compass are owned by Northpoint Technology, Ltd. ("Northpoint"), a U.S. limited partnership organized under the laws of Texas. The address of Northpoint is 1 Harbour Place, Suite 475, Portsmouth, NH 03801.

EXHIBIT VII: OFFICERS AND DIRECTORS OF COMPASS SYSTEMS, INC.

Compass Systems, Inc. ("Compass") is a corporation organized under the laws of the state of Delaware. The address of all officers and directors of Compass is 1 Harbour Place, Suite 475, Portsmouth, NH 03801. The following are the officers and directors of Compass:

Name	Position
Sophia Collier	President and Director
Saleem Tawil	Vice President and Director
Carmen Tawil	Secretary and Director
Katherine B. Reynolds	Treasurer and Director

EXHIBIT VIII: INDIRECT OWNERSHIP OF COMPASS SYSTEMS, INC.

Compass Systems, Inc. ("Compass") is a corporation organized under the laws of the state of Delaware. 100% of the issued and outstanding shares of Compass are owned by Northpoint Technology, Ltd. ("Northpoint"), a U.S. limited partnership organized under the laws of Texas. The address of Northpoint is 1 Harbour Place, Suite 475, Portsmouth, NH 03801. The parties holding 10% or more of the voting interests in Northpoint are as follows:

Name	Ownership Interest
NPT, Inc.	1% general partner
Saleem Tawil	24.75% limited partner
Carmen Tawil	24.75% limited partner
Sophia Collier	23.25% limited partner
Katherine B. Reynolds	23.25% limited partner

The following are the officers and directors of Northpoint:

Name	Position
Sophia Collier	President and Director
Saleem Tawil	Vice President and Director
Carmen Tawil	Secretary and Director
Katherine B. Reynolds	Treasurer and Director

The general partner of Northpoint is NPT, Inc. ("NPT"), a corporation organized under the laws of the state of Texas. The address of NPT is 1 Harbour Place, Suite 475, Portsmouth, NH 03801. The parties holding 10% or more of the voting stock of NPT are as follows:

Name	Ownership Interest
Saleem Tawil	25%
Carmen Tawil	25%
Sophia Collier	23.5%
Katherine B. Reynolds	23.5%

The following are the officers and directors of NPT:

Name	Position
Sophia Collier	President and Director
Saleem Tawil	Vice President and Director
Carmen Tawil	Secretary and Director
Katherine B. Reynolds	Treasurer and Director

APPENDIX C

ANTI-DRUG ABUSE ACT CERTIFICATION

Pursuant to Section 1.2002 of the Commission's rules, 47 C.F.R. § 1.2002, I certify that neither Compass Systems, Inc. ("CSI"), nor any party to the instant Application, including the shareholders, officers, and directors of CSI, are subject to a denial of federal benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. § 862.

By: [signature]
Antoinette Cook Bush
Vice President
COMPASS SYSTEMS, INC.

March 20, 2002

APPENDIX D

GENERAL CERTIFICATION

All statements made in this Application and in the attached appendices are a material part hereof, and are incorporated herein as if set out in full in this Application. The undersigned certifies individually and for CSI that the statements made in this Application are true, complete and correct to the best of her knowledge and belief, and are made in good faith.

By: ______________________________
Antoinette Cook Bush
Vice President
COMPASS SYSTEMS, INC.

March 20, 2002

APPENDIX E

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION SUBMITTED IN THIS APPLICATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this Application, that I am familiar with Parts 25 and 100 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in this Application, and that it is complete and accurate to the best of my knowledge.

By: ______________________
Robert Combs
Director of System Development
COMPASS SYSTEMS, INC.

March 20, 2002