1. ITU Registration Information for the exactView-1 Satellite

The exactView-1 Satellite (EV1, formerly known as ADS-1B) has been registered with the ITU as part of the ADS satellite network and its frequency assignments have been recorded in the Master International Frequency Register:

UNION INTERNATIONALE DES TÉLÉCOMMUNICATIONS
BUREAU DES RADIOCOMMUNICATIONS

INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION BUREAU

UNIÓN INTERNACIONAL DE TELECOMUNICACIONES
OFICINA DE RADIOCOMUNICACIONES

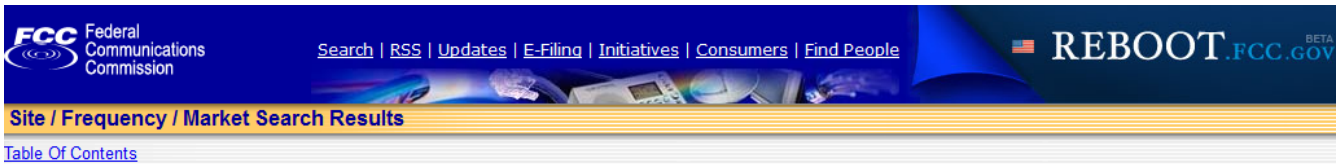
RÉSEAU À SATELLITE SATELLITE NETWORK RED DE SATÉLITE	ADS			PARTIE PART PARTE	II-S
STATION TERRIENNE EARTH STATION ESTACIÓN TERRENA	---			BR IFIC / DATE BR IFIC / DATE BR IFIC / FECHA	2805 / 13.10.2015
ADM. RESPONSABLE RESPONSIBLE ADM. ADM. RESPONSABLE	CAN	LONGITUDE NOMINALE NOMINAL LONGITUDE LONGITUD NOMINAL	NGSO	NUMÉRO D'IDENTIFICATION IDENTIFICATION NUMBER NÚMERO DE IDENTIFICACIÓN	114500168
RENSEIGNEMENTS REÇUS PAR LE BUREAU LE / INFORMATION RECEIVED BY THE BUREAU ON / INFORMACIÓN RECIBIDA POR LA OFICINA EL					17.12.2014

Assignations de fréquence inscrites dans le Fichier de référence au titre de		Frequency assignments recorded in the Master Register under		Asignaciones de frecuencia inscritas en el Registro con arreglo al	
X	Article 11 du Règlement des radiocommunications	X	Article 11 of the Radio Regulations	X	Artículo 11 del Reglamento de Radiocomunicaciones
	Article 5 des Appendices 30 et/ou 30A		Article 5 of Appendices 30 and/or 30A		Artículo 5 de los Apéndices 30 y/o 30A
	Article 8 de l'Appendice 30B		Article 8 of Appendix 30B		Artículo 8 del Apéndice 30B

Pour plus d'informations sur les dispositions réglementaires et l'explication des codes ou symboles utilisés dans cette publication, veuillez consulter la Préface.	For more details on the regulatory provisions and the explanation of the codes or symbols used in this publication, please consult the Preface.	Para más detalles sobre las disposiciones reglamentarias y la explicación de los códigos o símbolos utilizados en esta publicación, sírvase consultar el Prefacio.

2. FCC Licensee Database: Search Results for 5150–5250 MHz in Alaska

A February 16, 2016 search of the FCC's General Menu Reports system for currently licensed operations in the state of Alaska in the 5150–5250 MHz band reveals only three operations, all by GUSA Licensee, LLC (affiliate of Globalstar Licensee, LLC):



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Site / Frequency / Market Search Results

Search Criteria: State = AK, Frequency Range = 5150 MHz through 5250 MHz, Currently Licensed Facilities only

International Bureau Filing System Database

Callsign: E050345	**File Number:** SESMFS2010110801413	**Applicant:** GUSA Licensee LLC	**FRN:** 0015272669	**Grant Date:** 06/07/2011	**Expiration:** 01/04/2022	**Status:** ATPN **Sub-System:** SES
Site: WSLA-3	**Description:** WASILLA	**City:** Wasilla	**State:** AK	**Coordinates:** 61° 35' 24.9" N, 149° 29' 9.6" W		
Frequency: 00005096.00000000-00005250.00000000						
Callsign: E050346	**File Number:** SESMFS2010110801414	**Applicant:** GUSA Licensee LLC	**FRN:** 0015272669	**Grant Date:** 06/07/2011	**Expiration:** 01/04/2022	**Status:** ATPN **Sub-System:** SES
Site: 1	**Description:** WASILLA	**City:** Wasilla	**State:** AK	**Coordinates:** 61° 35' 24.1" N, 149° 29' 6" W		
Frequency: 00005096.00000000-00005250.00000000						
Callsign: E050347	**File Number:** SESMFS2010110801415	**Applicant:** GUSA Licensee LLC	**FRN:** 0015272669	**Grant Date:** 06/07/2011	**Expiration:** 01/04/2022	**Status:** ATPN **Sub-System:** SES
Site: 1	**Description:** WASILLA	**City:** Wasilla	**State:** AK	**Coordinates:** 61° 35' 24.6" N, 149° 29' 2.4" W		
Frequency: 00005096.00000000-00005250.00000000						

International Bureau Filing System Files: 3

Back to original search

3. Coordination with Globalstar

exactEarth coordinated operations for the ADS satellite network, of which exactView-1 is a part, with Globalstar Licensee, LLC, as confirmed by the email below:

From: David Weinreich [mailto:David.Weinreich@globalstar.com]
Sent: Friday, August 20, 2010 10:55 PM
To: Angela Kulig
Cc: Binda.shah@globalstar.com; Bob Vaddiparty; Paul Monte; Bob Bowen; stevek@telecommstrategies.com
Subject: RE: FW: ADS Coordination with Globalstar

Angela,

Based on then information contained in the ITU filing for ADS and the further information that you provided to us, Globalstar sees no problem with interference from the downlinks of ADS, in the 5.1 GHz frequency range, to the feeder uplinks of the Globalstar system, in the same frequency range.

Globalstar would appreciate being kept apprized of activities with the ADS spacecraft in order to monitor our feeder uplinks for possible interference.

If you have any questions or need further information, please do not hesitate to contact me.

Best regards,

David Weinreich
Manager,
Spectrum and Regulatory Engineering

4. Additional Technical Information for the exactView-1 Satellite

ExactView-1

ExactView-1 (formerly known as ADS-1B) was launched from Baikonur in Kazakhstan on July 22, 2012. It's NORAD ID is 38709 and is registered by Canada with the ITU under the name ADS.

EV1 is the highest detection performance Automatic Identification System (AIS) satellite ever built and utilizes high-speed C-band downlinks to frequently downlink mission data to ground stations in Svalbard, Norway. TT&C operations are performed from Guildford, UK.

EV1 was built under contract for exactEarth by SSTL with COM DEV Europe (UK) supplying the advanced AIS transceiver payload system for this mission. Table 1 lists EV1's key spacecraft characteristics and Figure 1 shows an image of the satellite.

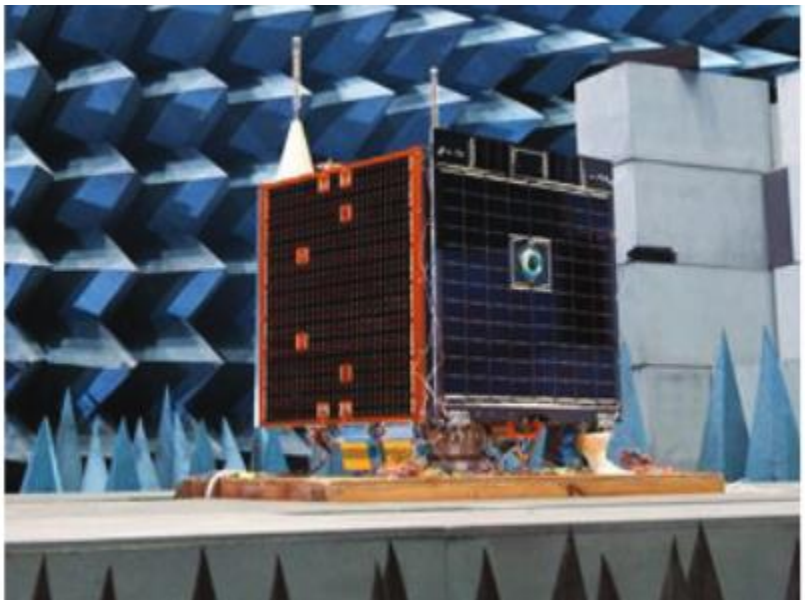


Figure 1 – The EV1 satellite

Table 1: EV1 Key Spacecraft Characteristics

Parameter	Value
Volume	600 x 600 x 620 mm
Mass	87.7 kg
Communication Mission Data Downlink	40 Mbps C-Band
Attitude Control	Nadir pointing, 3-axis stabilized using reaction wheels and magnetic torque rods
DC Power	~ 65 W orbital average at BOL

Propulsion	Cold gas

EV1 Orbit

EV1's orbit is sun-synchronous with an altitude of approximately 817 km and an inclination of 99 degrees. Due to its high inclination, the spacecraft has global coverage multiple times a day. Figure 2 shows EV1's high inclination orbit.

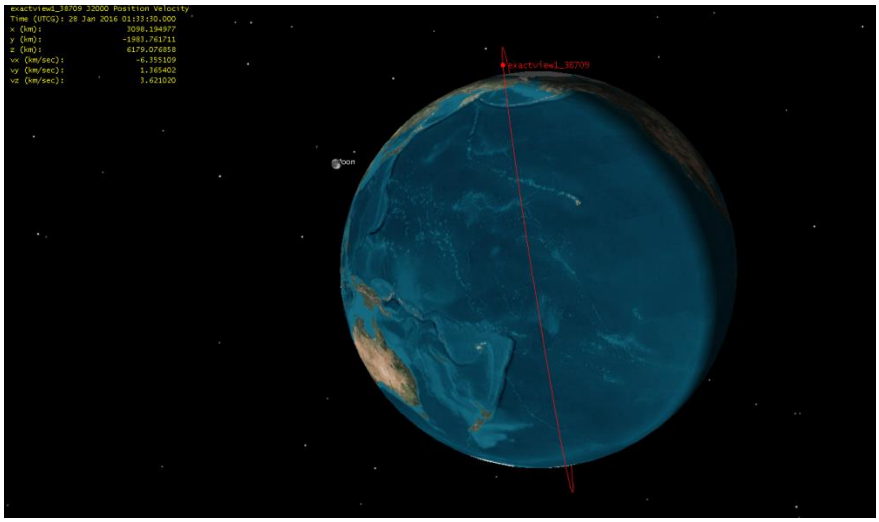


Figure 2. High Inclination Orbit of EV1

Alaska Ground Station Coverage and Access with EV1

A ground station situated in Fairbanks has access to EV1 roughly 10 times a day. The mean pass duration is approximately 11.5 minutes. Figure 3 shows a typical Alaska – EV1 access pattern for a day. It can be seen that there is a single maximum access gap of almost 7 hours and this happens earlier in the day.

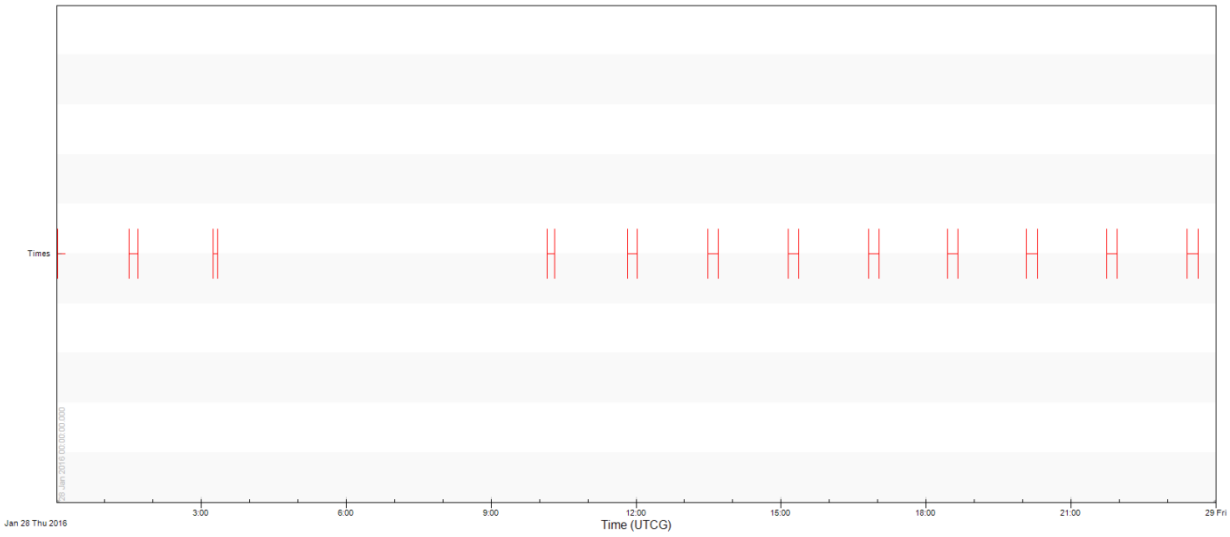


Figure 3. EV1 – Alaska access pattern

Figure 4 shows the Az-El tracks of all passes of EV1 over Alaska plotted for one full week. It shows the satellite never passes over certain azimuths due to the inclination not being exactly 90 degrees.

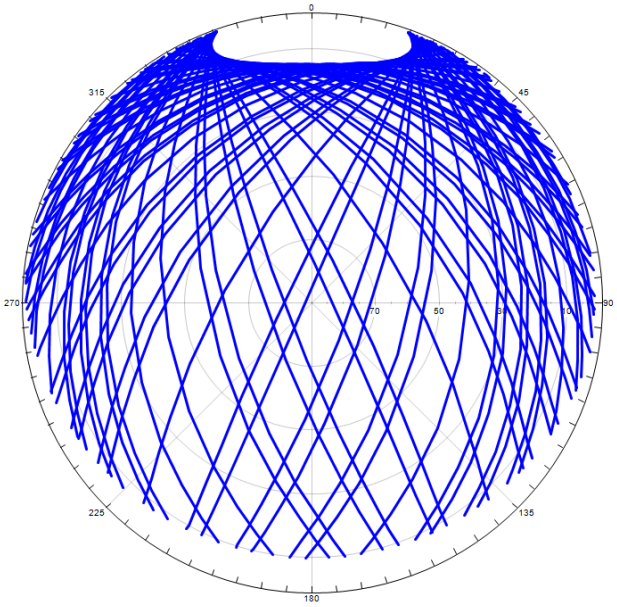


Figure 4. AZ-El access polar plot

The coverage extent of the Alaska station, assuming a minimum display elevation mask of 3 deg is shown in Figure 5.

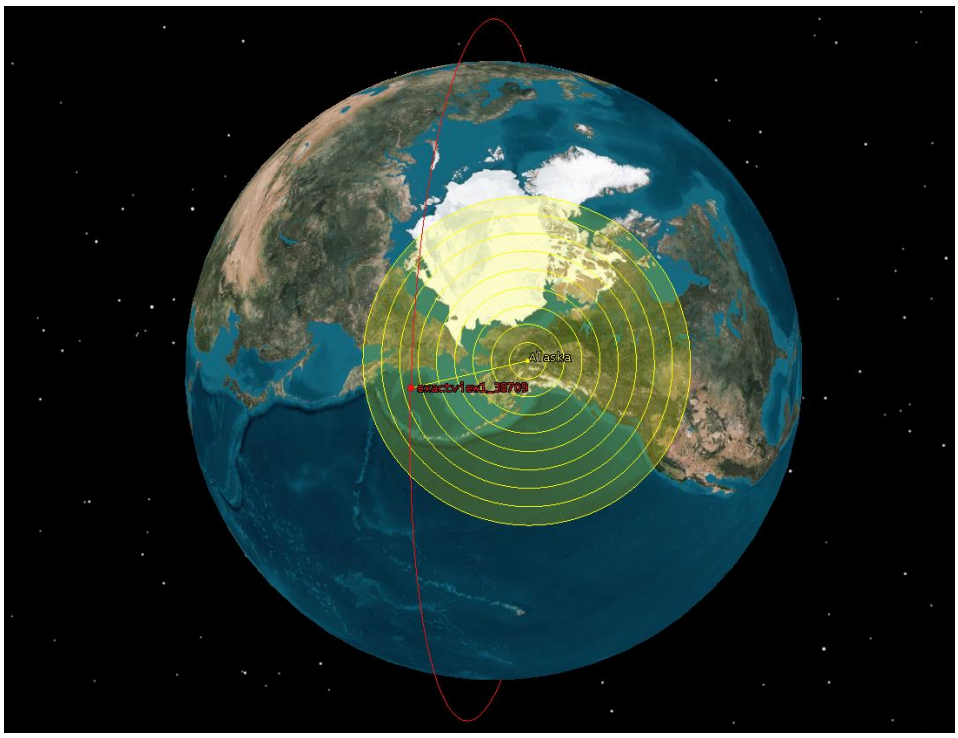


Figure 5. Coverage extent of the Alaska station

Downlink RF Specifications

EV1 uses an offset QPSK modulation scheme downlink with a fixed data rate of 40 Mb/s, 20 Mb/s uncoded. The transmitter RF power level is 2.95 W (4.97 dBW), with a maximum radiated EIRP of 8.7 dBW. The emission designator is 31M0G7DCT with 98% of the energy within a bandwidth of 31 MHz. The centre frequency of 5.183 GHz and is RHCP. The antenna design is based on a quadrafiler helix dimensioned and installed in such a manner such as to provide a quasi-isoflux radiation pattern (nadir/boresight referenced). The peak gain of the antenna is approximately 4 dBi at approximately at the Earth horizon (limb) as shown in Figure 6.

Power Flux Density (PDF) on Earth

The Flux density is calculated as:

$$Flux\ Density = \frac{EIRP}{4\pi \times d^2}$$

Where: d is the distance from spacecraft to the point on the ground.

EIRP is the Effective Isotropic Radiated Power of the Spacecraft.

The EIRP of the satellite changes with the antenna pattern due to a variable amount of gain that is radiated at different off-boresight angles. Pattern is symmetrical in the phi angular dimension. The antenna beam pattern can be seen in Figure 6 below. The satellite boresight is always oriented to the nadir direction immediately below the satellite, using the EV1 three-axis ADCS system.

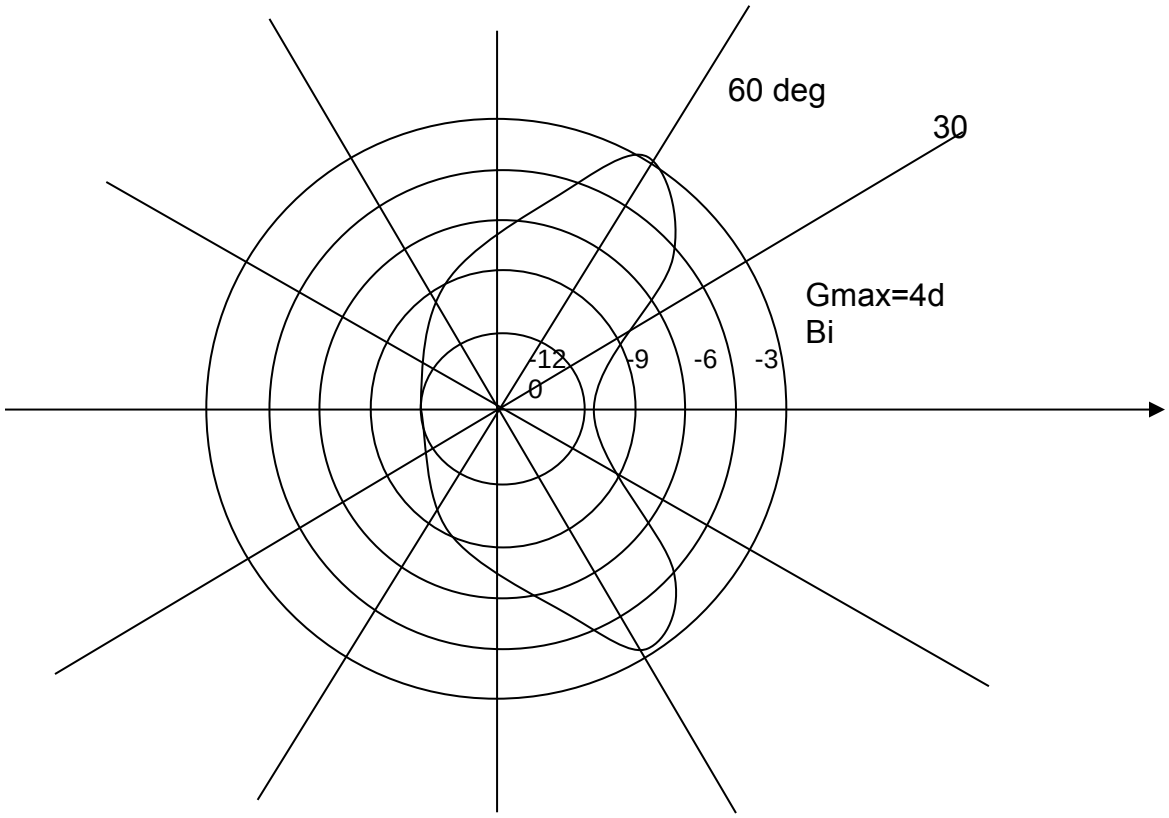


Figure 6. Transmit antenna gain pattern

By combining the antenna pattern with the change in distance as the satellite traverses a pass, the PFD versus elevation angle can be found in Figure 7. The red line shows the ITU PFD limit which must be respected. The predicted ground elevation angle versus PFD, in Figure 7, shows more than 1dB margin at the worst-case elevation angle of about 35 degrees.

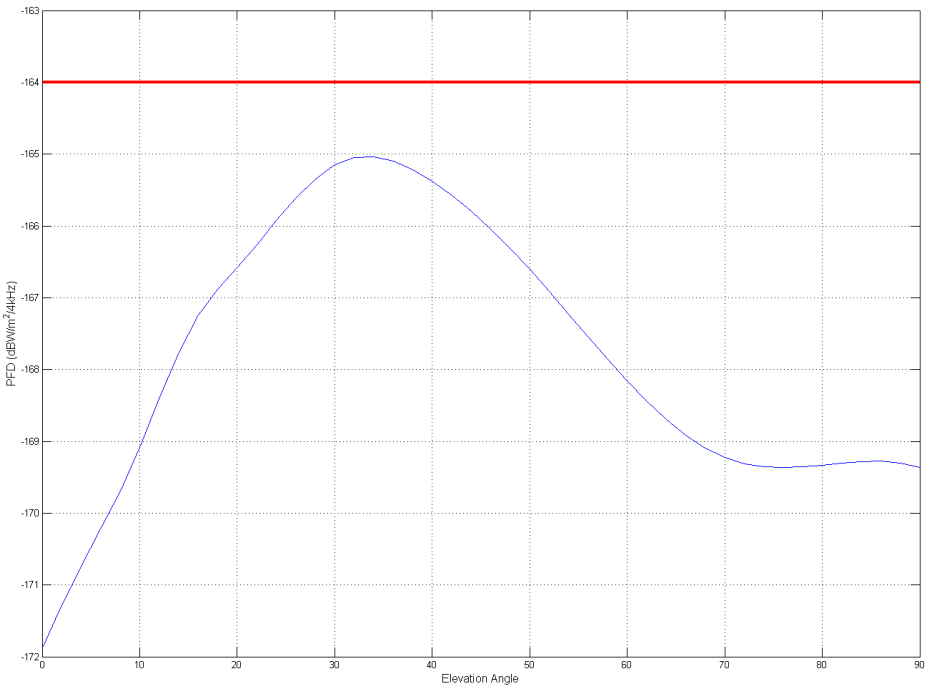


Figure 7. PFD vs. Elevation Angle

Table 2 below shows the PFD margin over elevation angles shown in Figure 7.

Table 2: PFD vs. Elevation Angle

Parameters	**Units**	**Nadir**										
GES Rx entenna elevation angle	Degrees	90.0	80.0	70.0	60.0	50.0	40.0	30.0	20.0	15.0	10.0	5.0
PFD in 4 kHz	dBW/m2/4kHz	-169.4	-169.3	-169.2	-168.2	-166.6	-165.4	-165.1	-166.6	-167.5	-169.1	-170.5
PFD limit per ITU 5.447B	dBW/m2/4kHz	-164	-164	-164	-164	-164	-164	-164	-164	-164	-164	-164
Margin (if antenna gain pattern is exact)	dB	5.4	5.3	5.2	4.2	2.6	1.4	1.1	2.6	3.5	5.1	6.5

The C-band PFD observed at the Alaska station for a single day is shown in Figure 8. The y-axis shows the PFD value and the x-axis is time in minutes during each satellite pass. The different colour curves represent the evolution of PFD level at the station for each of the different passes. For graphical clarity,

the centre point of each pass has been centred (note – lower elevation passes are shorter in duration and higher elevation passes are longer). This graph shows that a majority of the passes over the location do not reach the maximum PFD level and even those passes that do reach this peak level have significantly lower PFD for majority of the rest of the pass. Further insights into the likelihood of PFD levels over time are shown in Figure 9 in a 30-day simulation of all passes over the Alaska station. The 30-day simulation does not exhibit a higher level than the peak seen in a single day analysis (-165 dBm, below the maximum allowable PFD limit).

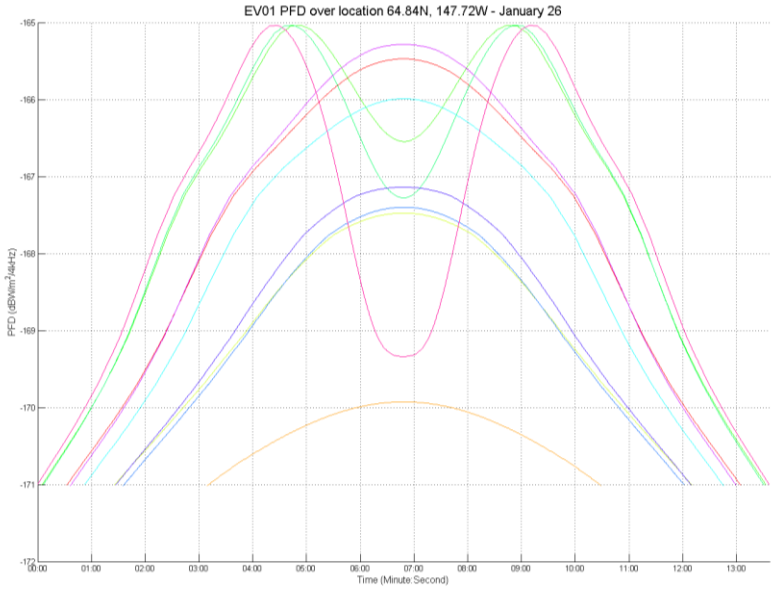


Figure 8: PFD levels for all EV1 satellite passes over Fairbanks Alaska – January 26, 2016

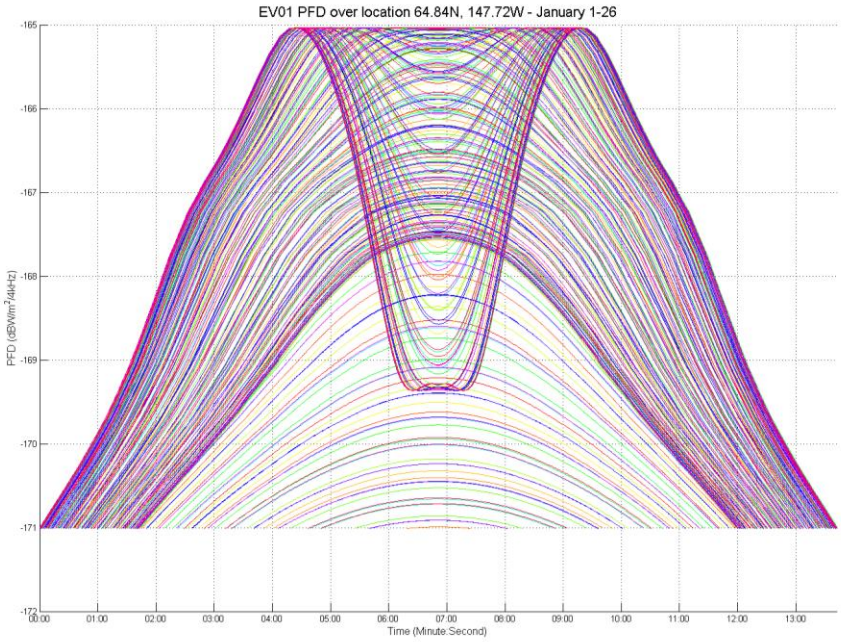
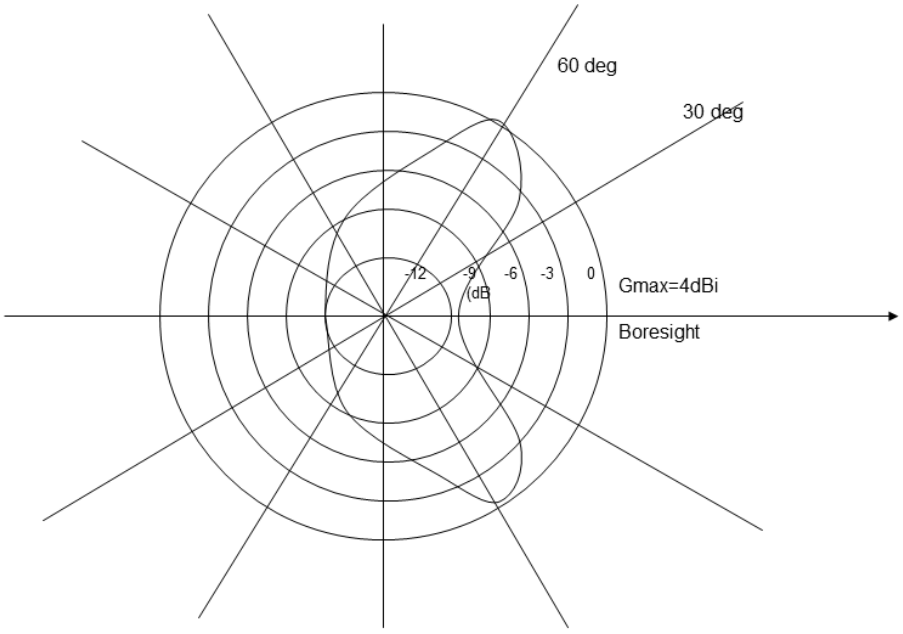


Figure 9: PFD levels for all EV1 satellite passes over Fairbanks Alaska – January 1 to 26, 2016

5. Additional Technical Illustrations

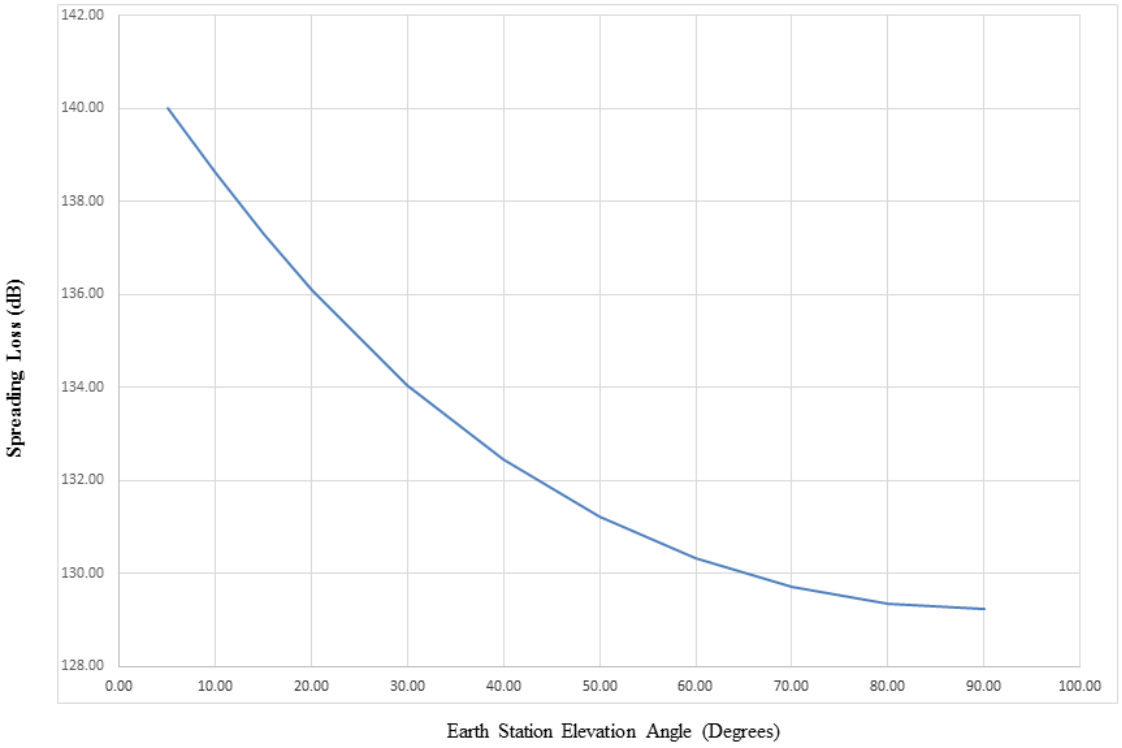


Attachment 3 MDC Transmit Beam Pattern

Attachment 5. Spreading Loss and Satellite Antenna Gain Vs. Elevation Angle

Earth Station Elev. (Degrees)	Satellite Off Nadir Angle (Degrees)	Range (km)	Spreading Loss (dB)	Satellite Antenna Gain (dBi) C Band
5	62.0	2820.2	-140.00	3.7
10	60.8	2401.9	-138.60	3.7
15	58.9	2066.0	-137.29	4.0
20	56.4	1799.5	-136.10	3.7
30	50.1	1421.7	-134.05	3.1
40	42.8	1182	-132.44	1.2
50	34.7	1026.9	-131.22	-1.2
60	26.3	926.2	-130.33	-3.7
70	17.6	863	-129.71	-5.3
80	8.9	828.1	-129.35	-5.8
90	0.0	817	-129.24	-5.9

See Attachment 5a for Graph



Attachment 5 (Continued) Spreading Loss as a Function of Earth Station Elevation, Satellite Altitude = 817 kM

Parameters	Units	Nadir										
GES Rx entenna elevation angle	Degrees	90.0	80.0	70.0	60.0	50.0	40.0	30.0	20.0	15.0	10.0	5.0
PFD in 4 kHz	dBW/m2/4kHz	-169.4	-169.3	-169.2	-168.2	-166.6	-165.4	-165.1	-166.6	-167.5	-169.1	-170.5
PFD limit per ITU 5.447B	dBW/m2/4kHz	-164	-164	-164	-164	-164	-164	-164	-164	-164	-164	-164
Margin (if antenna gain pattern is exact)	dB	5.4	5.3	5.2	4.2	2.6	1.4	1.1	2.6	3.5	5.1	6.5

Attachment 5 (Continued) PFD Margin

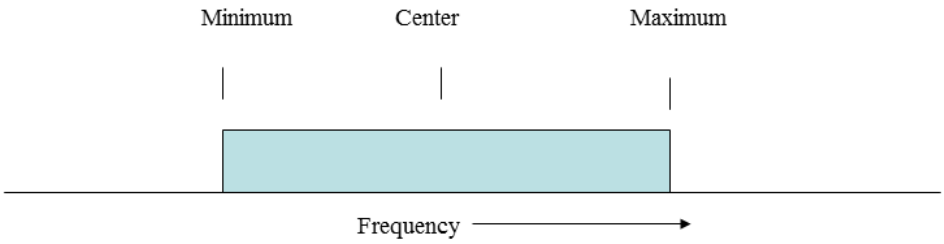
Satellite Altitude = 817 kM

Attachment 6. Multiple Access Data For all Groups

All data in each group is multiplexed into a single bitstream

Attachment 7. Spectrum Mask Diagram for all Groups

The Single carrier is uniformly spread in frequency



Attachment 8. Affected Regions for Spectrum Mask and Multiplexing

Worldwide, Regions XR1, XR2 and XR3