Attachment B – Regulatory Compliance Matrix

Reference	Reference Location	Topic / Reason for (n/a)
25.114(a)(1)	FCC Form 312, Schedule S, Attachment C	See generally Application Materials
25.114(a)(2)	n/a	NGSO constellation
25.114(a)(3)	n/a	Application filed pursuant to two-step procedure
25.114(b)	Form 312	Waiver required by 47 U.S.C §304
25.114(c)(1)	Form 312	Applicant information
25.114(c)(2)	Form 312	Info for correspondence person
25.114(c)(3)	Form 312	Type of authorization
25.114(c)(4)(i)	Schedule-S	Channel frequency, bandwidth and polarization
25.114(c)(4)(ii)	Schedule-S	Maximum EIRP and EIRP density of TX beams
25.114(c)(4)(v)	Schedule-S	RX beam: G/T, SFD
25.114(c)(4)(vi)(A)	Schedule-S	GSO: Antenna Gain Contours
25.114(c)(4)(vi)(B)	n/a	NGSO: Antenna Gain Contours
25.114(c)(4)(vi)(C)	n/a	Shapeable Beams: Antenna Gain Contours
25.114(c)(4)(vi)(D)	n/a	Steerable, non-shapeable beams
25.114(c)(4)(vii)(A-C)	n/a	GSO: Large number of spot beams
25.114(c)(5)(i-v)	Schedule-S	GSO: Orbital parameters
25.114(c)(6)(i-ix)	n/a	NGSO: Orbital parameters
25.114(c)(7)	Schedule-S	Frequency Bands, Types of Service and Coverage Areas
25.114(c)(8)	Schedule-S, See §25.208	TX Beams: PFD
25.114(c)(10)	Schedule-S	Operational Lifetime
25.114(c)(11)	Schedule-S	Common Carrier Status
25.114(c)(13)	n/a	17/24 GHz BSS polarization isolation
25.114(d)(1)	Narrative, Attachment C - Section 2	Overall description
25.114(d)(6)	Narrative	Public Interest
25.114(d)(7)	See §25.140(a)	Interference Analysis
25.114(d)(8)	n/a	L-Band MSS
25.114(d)(9)	n/a	MSS: Multiple Satellites
25.114(d)(10)	n/a	L/S-Band MSS
25.114(d)(11)	n/a	DBS
25.114(d)(12)	n/a	NGSO FSS
25.114(d)(13)(i-ii)	n/a	DBSS
25.114(d)(14)(i-v)	Attachment D – Space Debris Mitigation Plan	Space Debris Mitigation Plan
25.114(d)(15)(i-v)	n/a	17/24 GHZ BSS
25.114(d)(16)	n/a	17/24 GHZ BSS
25.114(d)(17)	n/a	17/24 GHZ BSS
25.114(d)(18)	n/a	17/24 GHZ BSS

Reference	Reference Location	Topic / Reason for (n/a)
25.140(a)(3)(i)	n/a	C-band limits
25.140(a)(3)(ii)	Attachment C - Section 14	Ku-band limits
25.140(a)(3)(iii)	n/a	Ka-band limits
25.140(a)(3)(iv)	n/a	24.75-25.25 GHz band
25.140(a)(3)(v)	n/a	AP30B limits
25.140(a)(3)(vi)	n/a	2°-spacing interference analysis
25.202(e)	Attachment C - Section 7	Frequency Tolerance
25.202(f)(1-3)	Attachment C - Section 8	Out of band - emissions
25.208(a-g)	Attachment C - Section 12	PFD Analysis
25.210(f)	Attachment C - Section 9	Full Frequency Reuse
25.210(j)	Schedule-S	EW Station keeping tolerance
25.283(a-c)	Attachment D - Space Debris Mitigation Plan	End-of-life Disposal
25.207	Attachment C - Section 10	Cessation of Emissions

Attachment C - Engineering Statement

1. Scope

This Attachment contains additional information regarding the EUTELSAT 12 West B satellite required by Section 25.114 and other sections of the Part 25 rules that cannot be entered into the Schedule S online submission system.

2. General Description (Section 25.114(d)(1))

The EUTELSAT 12 West B satellite is currently operating at the 12.5° W.L. orbital location. It was launched on September 20th, 2001. The EUTELSAT 12 West B satellite was positioned to its current location and renamed EUTELSAT 12 West B in October 2015. The satellite was originally called Atlantic Bird 2.

The EUTELSAT 12 West B satellite employs 26 Ku-band transponders using both linear polarizations thereby providing dual-frequency reuse. The satellite employs two (2) fixed Ku-band beams and one (1) steerable Ku-band beam for each of the uplink and downlink bands. The EUTELSAT 12 West B satellite is currently operating with a 0.5˚ inclination angle, the satellite's inclination is increasing at a rate of 0.9° per year and the anticipated end of life of the satellite is 31 December 2020.

3. Spacecraft Overview

EUTELSAT 12 West B was manufactured and supplied by Alcatel Space and is based on the Spacebus 3000-B2 bus platform. The satellite is 3-axis stabilized and uses both electric propulsion (Xenon propellant) and bi-propellant propulsion (hydrazine propellant) systems for spacecraft orientation and for correction of the spacecraft orbit.

The EUTELSAT 12 West B has the following characteristics:

- 19-year operational life
- 3-axis stabilized
- 26 Ku-band transponders, 3 pair of Ku-band uplink/downlink beams
- 6.4 kW total power at end of life

The spacecraft will operate in the Ku-band frequencies listed below:

Table 1 Ku-Band Frequency Plan

Uplink	13.75 - 14.0 GHz
	14.0 – 14.5 GHz
Downlink	10.95 – 11.2 GHz
	11.45 – 11.7 GHz
	12.5 – 12.75 GHz[1]

The spacecraft provides the following Ku-band coverage (illustrations of the beam coverage areas are provided in Exhibit 2).

Table 2 Ku-Band Coverage Areas

Europe (fixed)	Europe
Americas (fixed)	Eastern North America, Bahamas, Caribbean, South America
Steerable	North Atlantic

4. Telemetry, Tracking and Control (TT&C)

The EUTELSAT 12 West B TT&C sub-system provides for communications during on-station operations, as well as during spacecraft emergencies. Ku-band telecommand transmissions are received through a near omni-directional antenna during on-station operations, transfer orbit, and emergency operations. Ku-band telemetry communications are transmitted by the spacecraft through a horn antenna during on-station operations and through a near omni-directional antenna during both transfer orbit and emergency operations.

EUTELSAT 12 West B utilizes three Ku-band telemetry/beacon channels and two Ku-band commanding channels. The Ku-band telemetry channel center frequencies are 11704.0 MHz, 11705.2 MHz and 12500.5 MHz with a bandwidth of 0.4 MHz. The Ku-band commanding channel center frequencies are 13752.5 MHz and 14001.5 MHz with a bandwidth of 1.0 MHz. TT&C operations will be conducted from Paris, France.

The TT&C beams used for orbital maneuvers and on-station emergencies have gain contours that vary by less than 8 dB across the surface of the Earth; accordingly, the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Commission's rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S.

[1] The 12.5 – 12.75 GHz band is included in the European beam that could potentially be reoriented to have some overlap with U.S. territory.

Contact details for the control stations are provided below:

TT&C Teleport:	Control Center:
Rambouillet Teleport Route de Cerqueuse 78660 Prunay en Yvelines France Telephone 24/7: +33 1 45 57 06 66 Email: csc@eutelsat.com	Eutelsat 70 rue Balard 75015 Paris France Telephone 24/7: +33 1 45 57 06 66 Email: csc@eutelsat.com

5. Uplink Power Control

EUTELSAT 12 West B utilizes three Ku-band ULPC beacon channels. The Ku-band ULPC channel center frequencies are 11704.0 MHz, 11705.2 MHz and 12500.5 MHz. The beacon polarizations are Horizontal for 11704.0 MHz, Horizontal for 11705.2 MHz and Horizontal for 12500.5 MHz.

6. Frequency Plan

The following tables list the uplink and downlink Ku-band channels planned for EUTELSAT 12 West B. This information is also provided in the accompanying Schedule S but is included here for completeness.

Table 1 Ku-Band Downlink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
B1	72000	10991.67	H
B2	72000	10991.67	V
B3	72000	11075	H
B4	72000	11075	V
B5	72000	11158.33	H
B6	72000	11158.33	V
D01	36000	11470.753	H
D02	36000	11470.753	V
D03	36000	11512.253	H
D04	36000	11512.253	V
D05	36000	11553.753	H
D06	36000	11553.753	V
D07	36000	11595.253	H
D08	36000	11595.253	V
D09	36000	11636.753	H
D10	36000	11636.753	V
D11	36000	11678.253	H
D12	36000	11678.253	V
F01	36000	12524.5	V
F02	54000	12533.5	H

F03	36000	12566	V
F04	36000	12586.75	H
F05	36000	12607.5	V
F06	36000	12628.25	H
F07	36000	12649	V
F08	36000	12669.75	H
F09	36000	12690.5	V
F10	54000	12723	H
F11	36000	12732	V
TT1	0.4	12500.5	H, R
TT2	0.4	11704	H, R
TT3	0.4	11705.2	H, R

Table 2 Ku-Band Uplink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
B1	72000	13791.67	V
B2	72000	13791.67	H
B3	72000	13875	V
B4	72000	13875	H
B5	72000	13958.33	V
B6	72000	13958.33	H
D01	36000	14270.753	V
D02	36000	14270.753	H
D03	36000	14312.253	V
D04	36000	14312.253	H
D05	36000	14353.753	V
D06	36000	14353.753	H
D07	36000	14395.253	V
D08	36000	14395.253	H
D09	36000	14436.753	V
D10	36000	14436.753	H
D11	36000	14478.253	V
D12	36000	14478.253	H
F01	36000	14024.5	H
F02	54000	14033.5	V
F03	36000	14066	H
F04	36000	14086.75	V
F05	36000	14107.5	H
F06	36000	14128.25	V
F07	36000	14149	H
F08	36000	14169.75	V

F09	36000	14190.5	H
F10	54000	14223	V
F11	36000	14232	H
TC1	1	13752.5	H, V, L, R
TC2	1	14001.5	H, V, L, R

7. Frequency Tolerance

EUTELSAT 12 West B will meet the frequency tolerance requirements of Section 25.202(e), which specifies that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency.

8. Out of Band Emissions

The out-of-band emission limits of Section 25.202(f)(1), (2) and (3) will be met.

9. Frequency Reuse

EUTELSAT 12 West B employs full frequency reuse on the Ku-band uplink and downlink by employing dual orthogonal linear polarization and frequency reuse across multiple regional beams.

10. Cessation of Emissions

All downlink transmissions can be turned on and off by ground telecommand, thereby causing cessation of emissions from the satellite, as required by Section 25.207 of the FCC's rules.

11. ITU Filings

The EUTELSAT 12 West B satellite is operating in the Ku-band based on the EUTELSAT 3-12.5W, F-SAT-KU2-E-12.5W, F-SAT-N-E-12.5W and F-SAT-N3-12.5W ITU filings.

12. PFD Analysis

The power flux density ("PFD") limits for space stations operating in the 10950–11200 MHz and 11450–11700 MHz bands are specified in Section 25.208 of the Commission's rules. Neither the Commission's rules nor rule No. 21.16 of the International Telecommunication Union ("ITU") Radio Regulations specify a PFD limit for FSS in the 12.5-12.75 GHz band in Region 2. However, the PFD limits specified by ITU No. 21.16 for Regions 1 and 3 are considered applicable to EUTELSAT 12 West B in Region 2 as well.

The maximum PFD levels for the EUTELSAT 12 West B transmissions were calculated for the bands 10950–11200 MHz, 11450–11700 MHz, and 12500-12750 MHz. The results, provided in Schedule S, show that the downlink PFD levels of EUTELSAT 12 West B's carriers do not exceed the limits specified in either Section 25.208 of the Commission's rules or in the ITU Radio Regulations.

Should the beams of EUTELSAT 12 West B be reoriented, the orientation of the beams and/or the downlink power density will be adjusted to ensure the PFD limits will still be ensured.

13. Link Budgets

Link analysis for EUTELSAT 12 West B was conducted for representative carriers in the Ku-band Americas regional fixed beam. The results of the link analysis are shown in Exhibit 1.

14. Interference Analysis

In this section, the interference analysis required by Section 25.140(a) is presented (as specified in Section 25.114(d)(7) when applying for authorizations for space stations in the FSS).

The maximum downlink EIRP density in the Ku band for EUTELSAT 12 West B is 15.4 dBW/4kHz which is 1.4 dB above the 2°-spacing limits defined in 25.140(a)(3)(ii). The nearest US licensed, co-frequency, co-coverage satellite is the Telstar 12V satellite at 15° W.L. Since this satellite is spaced 2.5° away, the receive antenna isolation (as dictated by the equation $29 – 25*\log_{10}(\theta)$) is more than 2.4 dB greater than the receive earth station antenna isolation for a satellite that is spaced two degrees away. As a result, the protection levels defined in 25.140(a)(3)(ii) are maintained. The associated uplink transmissions will not exceed applicable EIRP density envelopes in Sections 25.218, 25.222(a)(1), 25.226(a)(1) or 25.227(a)(1) unless the non-routine uplink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of EUTELSAT 12 West B at 12.5° W.L.

The nearest U.S. licensed BSS satellite is ECHOSTAR 16 at 61.65° W.L. With an orbital separation of 49.15°, there is no potential for EUTELSAT 12 West B to cause unacceptable interference in the 12.5-12.75 GHz band, no matter how the satellite might be reoriented to reposition the Europe beam.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

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 Part 25 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 and belief.

/s/

_____

David C Morse, Ph.D.
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Bellevue, WA USA
(425) 246-3080

EXHIBIT 1: EUTELSAT 12 West B LINK BUDGETS

eutelsat

	FWD	*RTN*
SPACE SEGMENT		
Satellite	E12WB	E12WB
Orbital Position	-12.5	-12.5
Transponder	B3	B5
Bandwidth (MHz)	72	72
Uplink frequency (MHz)	13875.0000	13958.3300
Downlink frequency (MHz)	11075.0000	11158.3300
Uplink Coverage	American Receive	American Receive
Downlink Coverage	American Transmit	American Transmit
Uplink Polarization	Y	Y
Downlink Polarization	X	X
IPFD setting (dBW/m²)	-86	-80.19
IBO Multicarrier (dB)	8.3	8.3
OBO Multicarrier (dB)	3.7	3.7
CARRIER PARAMETERS		
Service category	DATA	DATA
Topology	OUTBOUND	OUTBOUND
Modem Manufacturer	iDirect	iDirect
Modem reference	X5	X5
Technology	DVB-S2	DVB-S2
Pilots	ON	ON
Frame	Short	Short
Modulation	16 APSK	8 PSK
FEC	2/3	5/6
Spreading Factor	1	1
Roll Off (%)	20	20
Spectral efficiency (bps)	2.5	2.33
Reed Solomon (n/k)	1	1
Symbol rate (Mbaud)	30	0.256
Usefull Bit rate (Mbps)	75	0.596
Overall Bit rate (Mbps)	75	0.596
E_b/N_0 (dB)	5.8	5.9
E_s/N_0 (dB)	9.78	9.57
BER	0.	0.
CARRIER RESOURCES		
Transponder mode	ALC Single carrier	Linear
IBO carrier (dB)	0	32.
OBO carrier (dB)	1.5	27.4
Bandwidth consumption (MHz)	36	0.307
Power consumption (MHz)	72	0.307
IPFD carrier (dBW/m²)	-87.14	-114.62
GROUND SEGMENT - UPLINK		
Earth Station Code	Hub	Remote
Country	United States of America - US	Guyana FR - GF
Longitude (°)	-74.02	-52.34
Latitude (°)	40.72	3.17
Distance (km)	40289.01	37506.65
satellite G/T towards transmit station (dB/K)	1.14	2.43
Elevation angle (°)	12.7	43.79
Azimuth angle (°)	109.49	93.79
Antenna size (m)	5.6	1.2
Atmospheric losses (dB)	0.2	0.2
Uplink EIRP (dBW)	76.16	48.05
Post PA losses (dB)	4	4
Operating HPA Power (clear sky) (W)	120.77	4.02
HPA Rating (W)	240.96	8.02
GROUND SEGMENT - DOWNLINK		
Earth Station	Remote	Hub
Country	Guyana FR - GF	United States of America - US
Longitude (°)	-52.34	-74.02
Latitude (°)	3.17	40.72
Distance (km)	37506.65	40289.01
Antenna G/T towards satellite (dB/K)	19.86	32.54
Elevation angle (°)	43.79	12.7
Azimuth angle (°)	93.79	109.49
Antenna size (m)	1.2	5.6
Atmospheric Losses (dB)	0.3	0.3
Satellite EIRP towards receive station (dBW)	47.25	46.34
System temperature (K)	130	155
RESULTS		
Uplink Path Length (km)	40289.01	37506.65
Thermal Uplink C/N (dB)	23.53	17.98
Aggregated C/I Uplink (dB)	26.46	19.13
Uplink Propagation Losses (dB)	207.39	206.82
Downlink Path Length (km)	37506.65	40289.01
Thermal Downlink C/N (dB)	14.33	20.2
Aggregated C/I Downlink (dB)	19.16	17.53
Downlink Propagation Losses (dB)	204.81	205.5
C/N+I Overall (dB)	12.54	12.57
E_b/N_0 Overall (dB)	8.56	8.9
Clear Sky Link Margin (dB)	2.76	3.
SUMMARY		
Bandwidth (MHz)	36	0.307
Power Equivalent Bandwidth (MHz)	72	0.307

Exhibit 2: Service Areas

This exhibit illustrates the current service areas for the uplink and downlink beams in the accompanying Schedule S.

Americas

The current Americas Service Area includes the Eastern third of North America, most of South America, the Bahamas and the Caribbean and is illustrated in Figure 1 and Figure 2.

It reflects the service area for:

Uplink beams: F1H1, F1H2, F1V1 and F1V2

Downlink beams: F1H4, F1H5, F1V4 and F1V5

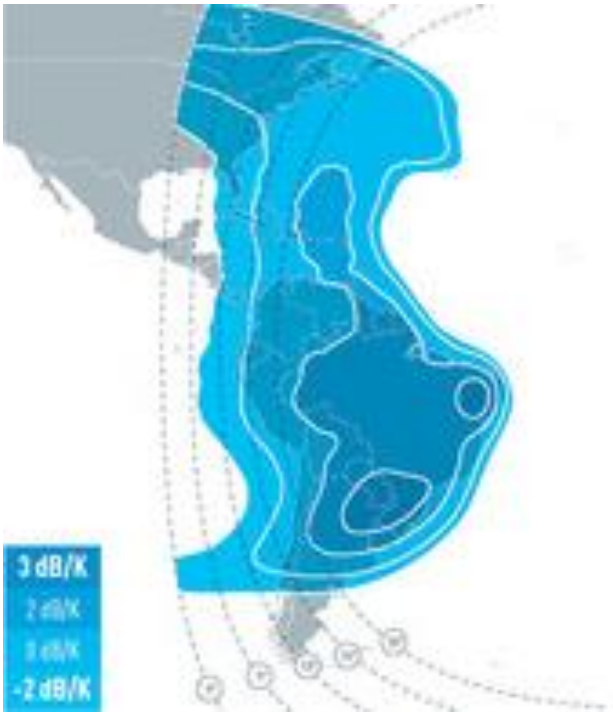

Figure 1 American Uplink Service Area - EUTELSAT 12 West B

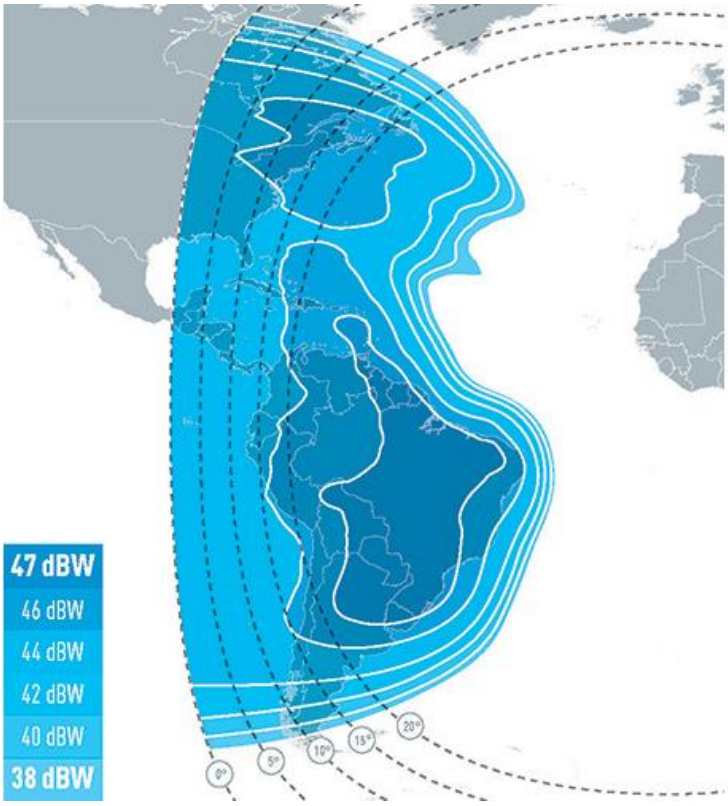

Figure 2 American Downlink Service Area - EUTELTSAT 12 West B

Europe

The current Europe Service Area includes the Europe, Western Russian and parts of North Africa and is illustrated in Figure 3 and Figure 4.

It reflects the service area for:

Uplink beams: F2H1, F2H2, F2V1 and F2V2

Downlink beams: F2H4, F2H5, F2H6, F2V4, F2V5 and F2V6

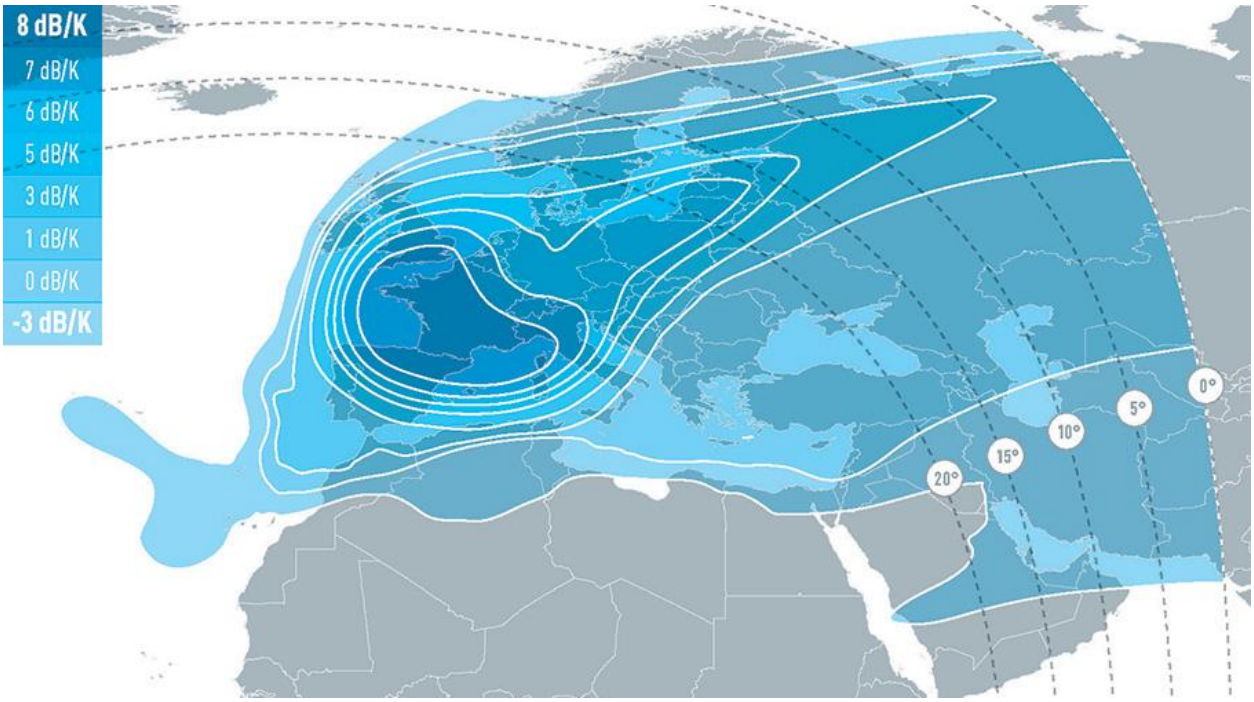

Figure 3 Europe Uplink Service Area - EUTELSAT 12 West B

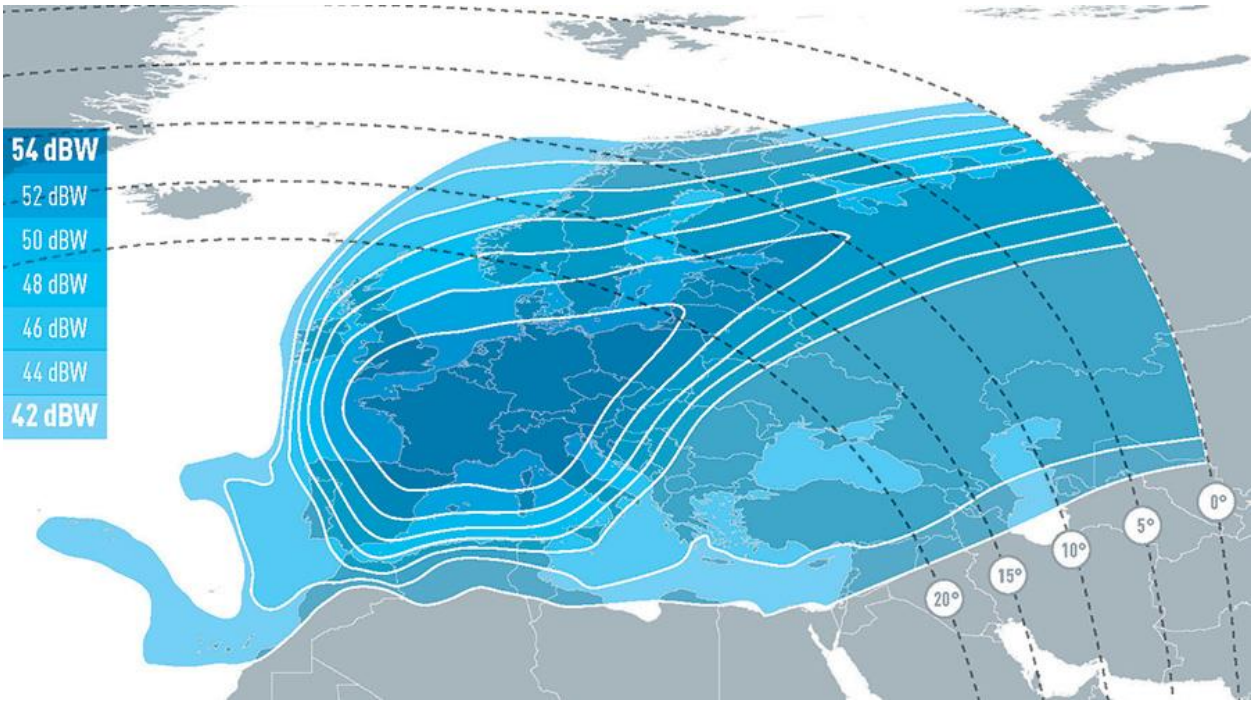

Figure 4 Europe Downlink Service Area - EUTELTSAT 12 West B

Steerable

The current Service Area for the Steerable uplink and downlink beams is illustrated in Figure 5 for the downlink and Figure 6 for the uplink.

It reflects the service area for:

Uplink beams: S1H1 and S1V1

Downlink beams: S1H4 and S1V4

Figure 5 Steerable Beam Downlink Service Area - EUTELSAT 12 West B

Figure 6 Steerable Beam Uplink Service Area - EUTELSAT 12 West B

Range of Possible Future Service Areas

The EUTELSAT 12 West B Satellite has a steerable beam and two fixed beams. The operator is considering alternate service options for the remaining life of the satellite and is considering various options to repoint both the satellite and the steerable beams to support new service concepts. The possible range of Service Areas for the Americas uplink/downlink beams, the Europe uplink/downlink beams and the Steerable uplink/downlink beams are all defined by the visible Earth as viewed from the orbital position 12.5° W.L. and is illustrated in Figure 7.

Figure 7 Americas, Europe and Steerable Beam Uplink/Downlink Service Area - EUTELSAT 12 West B