



**STANDARDS TO ACCESS  
AND OPERATE  
SATELLITE SERVICES**

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## I. Scope

When transmitting to the Eutelsat Americas satellite fleet, technical Standards are intended to provide signal quality of service by preventing harmful interference at the satellite networks and between adjacent satellites.

This document defines standards in two groups: first, criteria for Bandwidth and Power resources are defined for each type of service; second group includes earth station requirements for transmission on the Eutelsat Americas fleet, it spans from stability and features at transmission chain before antenna, until emissions from the antenna towards cross polarization and adjacent satellites.

Requirements and criterions shown in this document are mandatory for network operation at Eutelsat Americas fleet. Any exception will be reviewed on a case by case basis.

A new version of this document is going to be released once any of its standards gets updated. Eutelsat Americas reserves the right to modify and update any portion of this document without formal notice.

## II. Bandwidth and Power Standards

### A. Bandwidth (BW) Allocation and Measurement

Allocated bandwidth is a span of frequencies depending on the features of the transmitted signal and performance of transmitting equipment.

Occupied radiofrequency (RF) bandwidth is measured after satellite re-transmission by means of calibrated instruments by the Eutelsat Americas Network Operations Center (NOC).

Considerations for bandwidth allocation and measurement are described below:

#### 1. Bandwidth of a digital carrier per customer.

- a. When allocating bandwidth for a digital carrier, 40% of roll off (RO) is considered relative to the symbol rate.
- b. Allocated bandwidth is rounded to the next 100 kHz step from the above calculation.
- c. Start and stop frequencies of the allocated bandwidth shall correspond to 100 kHz steps.

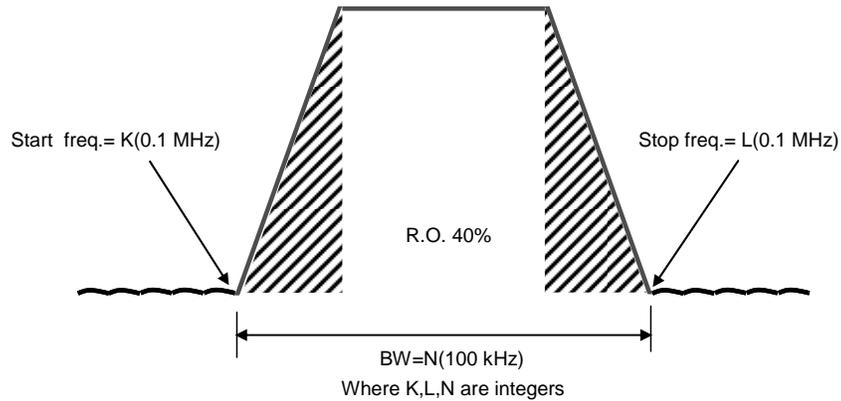


Figure 1. Bandwidth for a single carrier per segment.

- d. If satellite customer requests another roll-off value, application shall be supported by modem manufacturer specification, bandwidth is then verified by test and measured by Eutelsat Americas NOC. Then bandwidth is allocated according to 1b and 1c criteria.
- e. Customer can modify carrier transmission parameters (e.g. Data Rate, FEC or modulation) in order to fit it within the allocated bandwidth.

**2. Bandwidth of a segment with more than a carrier per customer.**

- a. Total allocated bandwidth is rounded to the 100 kHz steps
- b. Initial and final carriers on the segment shall consider 40% of roll-off (RO) relative to the symbol rate.
- c. Start frequency of initial carrier and stop frequency of final carrier within a customer segment, shall correspond to 100 kHz steps.
- d. 40% roll-off is also recommended for intermediate carriers.
- e. Bandwidth of initial or final carrier of a segment can be modified after a test showing a different roll-off; alternately, transmission parameters can also be modified, if standards 2a and 2c are accomplished.

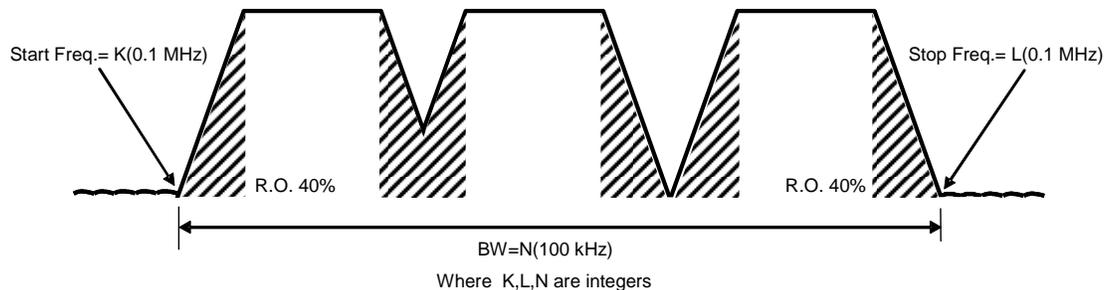


Figure 2.- Allocated segment for more than one carrier.

### 3. Bandwidth of one carrier per transponder.

- a. Maximum allocated bandwidth for one carrier saturating a transponder is the nominal transponder bandwidth.

### 4. Bandwidth of a segment without transmission plan.

- a. Bandwidth is allocated in 100 kHz step size.
- b. Start and stop frequencies of the allocated bandwidth shall correspond to 100 kHz steps.
- c. None carrier will fall outside frequencies stated at 4b.

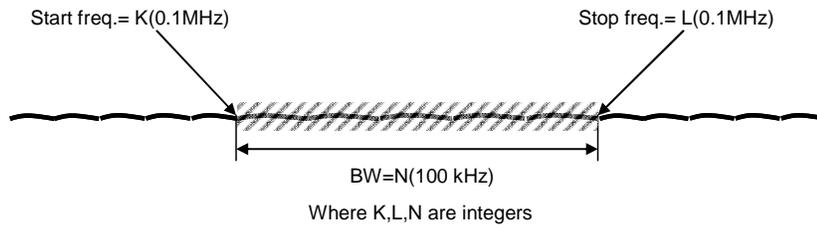


Figure 3.- Bandwidth of a segment without Transmission Plan.

## B. Satellite EIRP Allocation

Maximum allocated EIRP shall not exceed the Power Equivalent Bandwidth (PEB) of the segment.

Considerations for EIRP allocation are described below, for several operating scenarios.

### 1. Power density at transmit antenna flange.

Maximum power density at the antenna flange shall be:

C Band:	-49.4 dBW/Hz
Ku band	-52 dBW/Hz @ BW < 1 MHz
	-53 dBW/Hz @ BW ≥ 1 MHz

Table 1.- Maximum power density at antenna flange

### 2. Power of one carrier allocated in a full transponder.

Maximum allocated EIRP is the saturated EIRP of the transponder spread over the transponder bandwidth.

### 3. Satellite EIRP for segments inside a multicarrier transponder

- a. Maximum allocated EIRP shall be the Power Equivalent Bandwidth (PEB).
- b. PEB is defined as:

$$PEB = P_{sat} - OBOT_p + 10 \log(B/B_{Tp})$$

Where: **P<sub>sat</sub>** is the transponder saturated EIRP.  
**OBO<sub>TP</sub>** is the transponder Output Back-Off being driven by 2 or more carriers.  
**B** is the bandwidth of the leased segment or carrier.  
**B<sub>TP</sub>** is the nominal transponder bandwidth.

- c. Consideration above applies to the following cases:
- Allocated Segment without carrier information.
  - Allocated segment for one carrier.
  - Allocated segment with two or more carriers.

#### 4. Power Balanced Network

Supported on the technical information submitted by customer (Annex 1), regarding the ground segment hardware; network analysis are performed under the following criterions:

- a. For a segment in a transponder containing **n** carriers belonging to one customer, for the same contract type (Permanent or Occasional), maximum allocated EIRP shall be equal to the Power Equivalent Bandwidth (PEB) of the segment.

$$EIRP_1 + EIRP_2 + EIRP_3 + \dots + EIRP_n = PEB_{Tot}$$

- b. For Ku band networks, allocated EIRP assumes:
- Link margin is equal or greater than 0.0 dB, taking into account the uplink and downlink combined effect, for the rain availability requested by customer.
  - If transmitting Earth Station has Uplink Power Control (ULPC) Systems, then link margin is equal or greater than 0.0 dB taking into account only downlink effect.
- c. For C band networks, allocated EIRP assumes:
- Link margin is equal or greater than 0.5 dB, for clear sky condition at both transmit and receive sites.
- d. if a guard band is needed to meet points 4b & 4c, then:
- A guard band is defined as a non carrier segment whose EIRP is added to other carrier(s) belonging to the same customer with the same contract type and channel.
  - If guard band is allocated contiguous to the customer carrier segment then total segment shall comply with the bandwidth standard (2a and 2C) considering the guard band PEB.
  - If guard band is not allocated contiguous to a segment of the same customer, then it shall comply with bandwidth standard (2a),

### III. Standards for Earth Station Emissions.

#### A. In-Band Emissions

Satellite EIRP is measured by Eutelsat Americas NOC which can request an Earth Stations power adjustment at any time.

In-Band emission specifications of Earth Stations are shown below:

##### 1. EIRP Stability

EIRP of any earth station transmitting towards Eutelsat Americas satellite fleet, measured in a continuous 24 hours period, shall not vary by more than  $\pm 0.5$  dB.

##### 2. Nominal EIRP.

Satellite EIRP of a signal or segment is measured by Eutelsat Americas NOC as a result of averaging five continuous readings at the Monitoring System.

The carrier power transmitted by an earth station should be adjusted to meet the allocated satellite EIRP.

Earth stations equipped with Uplink Power Control (ULPC) systems shall not exceed the flux density that drives the allocated EIRP by more than 1.0 dB at any time.

#### B. Out of Band Emissions

Out of Band emissions are defined as all those generated along with a digital carrier outside its nominal bandwidth.

##### 1. Out of Band Emissions Mask for a digital carrier

Any digital transmission shall be adjusted such that the mask of Figure 4 is not exceeded. The mask depends on carrier's symbol rate (SR).

Mask Compliance is measured at the HPA output of transmitting earth station.

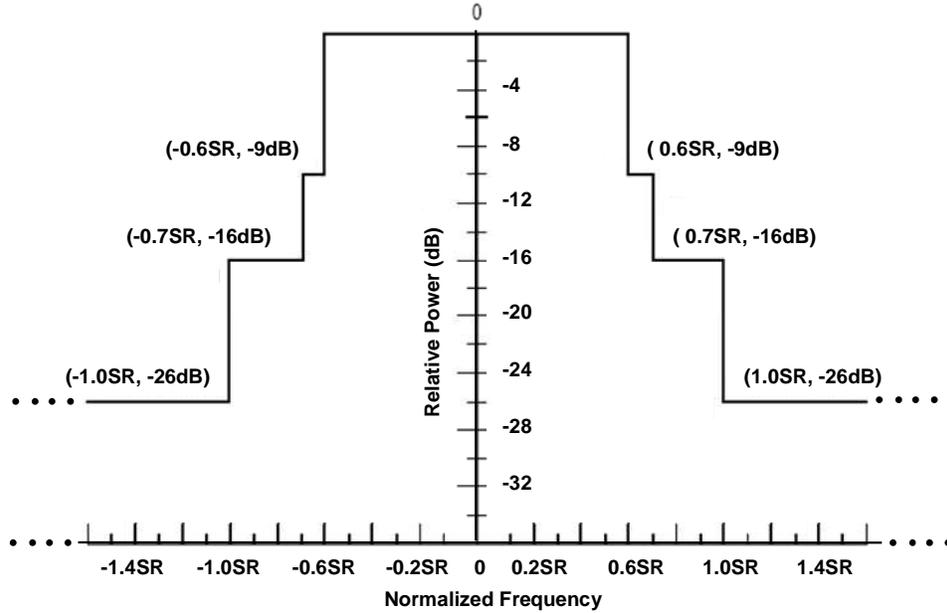


Figure 4. Mask based on the symbol rate, normalized to the center frequency of carrier

At Figure 4, normalized frequency is expressed in Hz and is a function of the symbol rate (SR) in symbols/s, and Relative power is referenced to the carrier's maximum power density.

### C. Emissions for cross-polarization discrimination

Due to re-use frequencies, a satisfactory transmit polarization isolation is required. Hence, any antenna that transmits carriers through Eutelsat Americas fleet must be properly aligned to avoid orthogonal polarization interference.

#### 1. Standard by design

- a. The following table shows the required values for cross-polarization discrimination (XPD) that shall be met by design at antenna boresight.

	Diameter (m)	XPD (dB)
C-Band	< 5.6	30
	≥ 5.6	35
Ku-Band	< 4.5	30
	≥ 4.5	35

Table 4.- Values for cross-polarization discrimination.

- b. By design, the minimum cross-polarization discrimination within the -1.0 dB peak gain contour shall be as follows:

	Diameter (m)	XPD (dB)
C-Band	< 5.6	25
	≥ 5.6	30
Ku-Band	< 4.5	25
	≥ 4.5	30

Table 5 .- Values for cross-polarization discrimination within the -1.0 dB peak gain contour.

## 2. Operational Standard

- a. The minimum XPD that shall be verified at earth station activation time, is shown below.

	Service Type	
	Permanent	Occasional
C-Band	30 dB	25 dB
Ku-Band	30 dB	25 dB

Table 6. - Minimum levels of cross-polarization discrimination

For this standard, an occasional service is shorter than 24 hours.

The above values shall be met before antenna starts operations, after network changes satellite, beam or polarization, when antenna hardware is modified or by NOC request.

The XPD test for antennas greater than 4.5 m in Ku-band and greater than 9.0 m in C-Band, shall be made when satellite is at Center of Box. The Eutelsat Americas satellites Center of Box are on the website ([www.eutelsatamericas.com](http://www.eutelsatamericas.com)).

## D. Emissions towards adjacent satellites

In order to avoid harmful interference towards adjacent satellites, requirements for antennas are described below

### 1. Standard by design

Any transmit antenna shall comply with design objective for off-axis transmit gain in the ranges described by ITU-R S.580 recommendation of International Telecommunications Union or section 25.209 of FCC title 47 part 25.

### 2. Operational Standard

- a. Any transmit earth station shall comply with a maximum EIRP density toward adjacent satellites at 1.9° of orbital separation in accordance with the values shown below

	Maximum EIRP density of earth station (dBW/MHz)
C-Band	32.6
Ku-Band	27.0

Table 7.-Maximum EIRP density per band

Note: For EIRP density calculation, it is considered that bandwidth is 1.2 times carrier's Symbol Rate (1.2 x SR)

b. Operational Cases

- i. Any transmit antenna can operate without restrictions if it meets 2a and its off-axis gain does not exceed the envelope given by:

$$G = 29 - 25 \log(\Theta) \text{ for } -1^\circ \leq \Theta < -7^\circ \text{ and } 1^\circ \leq \Theta < 7^\circ$$

- ii. Any transmit antenna that does not meet *i*, but complies with the envelope from -1.5° and 1.5° can operate, provided that it does not generate harmful interference to adjacent satellites

- iii. A transmit antenna can be allowed to operate with restrictions, if any sidelobe exceeds the envelope in the following ranges

$$G = 29 - 25 \log(\Theta) \text{ for } -1.5^\circ \leq \Theta < -2.4^\circ \text{ and } 1.5^\circ \leq \Theta < 2.4^\circ$$

$$G = 29 - 25 \log(\Theta) \text{ for } -3.5^\circ \leq \Theta < -4.6^\circ \text{ and } 3.5^\circ \leq \Theta < 4.6^\circ$$

The maximum power density allowable is additionally limited (regarding to 2a and 2bi) proportionally to the largest excess measured by antenna gain pattern test and/or adjacent satellite test.

c. Transmit antenna tests

i. Adjacent satellite test

- It is accomplished by NOC request to any antenna generating Adjacent Satellite Interference (ASI)
- It is for antennas transmitting signals in a permanent type service before starting operations:

At C band, antennas equal or greater than 2.4m  
At Ku band antennas equal or greater than 3.5m

ii. Antenna pattern test is carried out if:

- Adjacent satellite test shows that antenna gain exceeds the reference envelope
- It is not proved that antenna complies with standard by design
- Customer requests it, due to administrative procedures to supply its services



**EUTELSAT AMERICAS STANDARDS TO  
ACCESS AND OPERATE SATELLITE SERVICES**

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**ANNEX 1**

**Technical Information for Link Budget Analysis**

LINK									CENTER FREQUENCY		START FREQ (MHz)	END FREQ (MHz)	INFORMATION RATE (Kbps)	MODULATION TYPE	FEC	Eb/No Threshold (dB)	SATELLITE AVAIL. (%)	REED SOLOMON	ALLOCATED BANDWIDTH (MHz)	ACCESS TECHNIQUE	
TRANSMIT EARTH STATION (Location, State, Country) (Tx)	Longitude West (Degree)	Latitude North/South (Degree)	ANTENNA (m)	RECEIVE EARTH STATION (Location, Estate, Country) (Rx)	Longitude West (Degree)	Latitude North/South (Degree)	ANTENNA (m)	UPLINK (MHz)	DOWNLINK (MHz)												
1																					
2																					
3																					

EARTH STATION	Modem			Up and Down		HPA Information					LNA Information			Antenna Information				Total Number of Earth Stations				
	Manufacturer	Model	Eb/No Threshold (dB)	Manufacturer	Model	Manufacturer	Model	Type	Nominal Power (dBW)	Does it have Uplink Power Control?	Can it be adjusted or it works to saturation?	Manufacturer	Model	Noise Temperature (°K)	E/S G/T (dB/K)	Diameter (m)	Efficiency (%)		Manufacturer	Model		
1																						
2																						
3																						