ANNEX 4

Congestion of Ku-band in Europe leads satellite operators to use Ka-band in order to accommodate growth

Table 1 lists the satellites covering Europe in the Ku unplanned FSS bands (10.95-11.20 GHZ, 11.45-11.70 GHz, 12.50-12.75 GHz and 13.75-14.50 GHz), together with their orbital positions and the orbital separation with the nearest satellite located on the western side.

Longitude (degrees East)	Satellite name	Orbital separation with western position (Degrees)
50.0	Intelsat 26 (incl. 4.0°)	
	Galaxy 26	
48.0	Eutelsat 48A (incl. 2.7°)	2.0
	Eutelsat 48B	
47.5	Intelsat 702 (incl. 0.7°)	0.5
45.0	Galaxy 27	2.4
	Intelsat 12	
42.0	Türksat 2A	3.0
	Türksat 3A	
40.0	Express AM1 (incl. 1.7°)	2.0
39.0	Hellas Sat 2	1.0
36.0	Eutelsat 36A	3.0
	Eutelsat 36B	
33.0	Eutelsat 33A	3.0
31.0	Intelsat 24 (incl. 3.4°)	2.0
28.5	Eutelsat 28A	2.5
28.2	Astra 1N	0.3
	Astra 2A	
	Astra 2B	
	Astra 2D	
26.0	Badr 4	2.2
	Badr 5	
	Badr 6	
25.5	Eutelsat 25A	0.5
23.5	Astra 3A	2.0
	Astra 3B	
21.6	Eutelsat 21A	1.9
19.2	Astra 1H	2.4
	Astra 1KR	
	Astra 1L	
	Astra 1M	
	Astra 2C	

Longitude (degrees East)	Satellite name	Orbital separation with western position (Degrees)
16.0	Eutelsat 16A	3.2
	Eutelsat 16B (incl. 0.5°)	
13.0	Eutelsat Hot Bird 13A	3.0
	Eutelsat Hot Bird 13B	
	Eutelsat Hot Bird 13C	
10.0	Eutelsat 10A	3.0
7.0	Eutelsat 7A	3.0
4.8	Astra 4A	2.2
	Astra 1E (incl. 1.7°)	
3.0	Eutelsat 3C	1.8
2.0	Astra 1C (incl. 5.0°)	1.0
-1.0	Intelsat 10-02	3.0
-3.0	ABS 3 (incl. 1.1°)	2.0
-4.0	Amos 2	1.0
	Amos 3	
-5.0	Eutelsat 5 West A	1.0
-8.0	Telecom 2D (incl. 5.3°)	3.0
	Eutelsat 8 West A	
-11.0	Express AM44	3.0
-12.5	Eutelsat 12 West A	1.5
-15.0	Telstar 12	2.5
-18.0	Intelsat 901	3.0
-20.0	NSS-7	2.0
-22.0	SES-4	2.0
-24.5	Intelsat 905	2.5
-27.5	Intelsat 907	3.0
-30.0	Hispasat 1C	2.5
	Hispasat 1D	
	Hispasat 1E	
-34.5	Intelsat 903	4.5
-37.6	Telstar 11N	3.1
-40.5	NSS 806	2.9
-45.0	Intelsat 14	4.5

Table 1: Ku unplanned FSS satellites over Europe April 2012 – Source: www.lyngsat.com

As shown by Table 1, the orbital separation between two neighboring satellites is three degrees or less in most of the cases. It is generally recognized that an orbital separation of at least two degrees is required between a given satellite and its neighbors to be able

to provide services using the same frequencies and over the same geographical area without creating interference into the transmissions of the neighboring satellites. It can therefore be concluded that it is in general not possible to start transmissions in Ku-band from a new orbital position in the European arc due to potential interference into the neighboring satellites. When the Ku-band capacity at existing orbital positions is fully used by existing services, satellite operators have to launch new satellites that include Ka-band in order accommodate their growth.

In the case of SES, in order to accommodate the growth of demand at existing orbital positions, a number of Ka-band payloads with European coverage were implemented on new satellites or on satellites under construction because no Ku-band spectrum was available. This applies to the following orbital positions:

- 4.8E/5E: Astra 4A (in operation) includes the bands 18.80-19.30 GHz, 19.70-20.2 GHz, 21.50-21.75 GHz and 29.15-30.00 GHz. SES-5 (launch Q2 2012) includes the bands 28.10-29.15 GHz;
- 19.2E: Astra 1H and Astra 1L (in operation) both include the bands 18.30-18.80 GHz and 29.50-30.00 GHz;
- 23.5E: Astra 3B (in operation) includes the bands 21.4-22.0 GHz, 27.90-28.40 GHz and 28.95-29.45 GHz;
- 28.2E: Astra 2E (launch 2013) includes the bands 18.85-20.20 GHz, 21.4-22.0 GHz and 27.85-30.00 GHz;
- 28.2E: Astra 2F (launch Q3 2012) includes the bands 18.85-20.20 GHz, 21.4-22.0 GHz and 27.85-30.00 GHz;
- 28.2E: Astra 2G (launch 2014) includes the bands 18.85-20.20 GHz, 21.4-22.0 GHz and 27.85-30.00 GHz; and
- 31.5E: Astra 5B (launch Q4 2013) include the bands 18.85-20.20 GHz, 21.4-22.0 GHz and 27.85-30.00 GHz.

The Ka-band is and will be used to provide broadband services to consumers or SNG services (Ka-band links between gateway in Europe and satellite, and Ka-band links between satellite and end-users in Europe), or to provide data services to enterprise and governments (Ka-band links between gateway in Europe and satellite, Ku-band links between satellite and end-user in or outside Europe).

It should also be noted that other European satellite operators have the same approach and are implementing Ka-band at their Ku-band orbital positions which come to saturation. Some examples include:

- Eutelsat: Eutelsat 7A (in operation) at 7E, HotBird 13A (in operation) at 13E; Eutelsat 16A (in operation) at 16E, Eutelsat 25B (launch 2013) at 25.5E and Eutelsat 3B (launch 2014) at 3E;
- RSCC: Express AM8 (launch 2013) at 14W and Express AT2 at 36E (launch 2013);
- Telenor: Thor 7 at 0.8W (launch 2013); and
- Turksat: Turksat 4A (launch 2013) at 42E and Turksat 4B (launch 2014) at 50E.