European Satellite Operators Association

OFCOM SPECTRUM REVIEW (April 2012)

1. THE IMPORTANCE OF SATELLITE ACCESS TO SPECTRUM

Satellite systems and networks require hundreds of millions of Euros of investment, and years of advance planning and construction prior to deployment. Investment decisions related to development of networks are made based on the business case and require market access on reasonable terms to the countries in the footprint. Once a satellite is operational, commercial viability depends on the availability of spectrum and the applicable regulatory regimes that the satellite network will be serving.

Spectrum is the essential ingredient of all wireless communications systems. As satellites are a transnational, wireless-based technology, satellite operators heavily depend upon the global spectrum allocations of the United Nations' International Telecommunication Union ("ITU").

Satellite companies use their satellites to deliver a full range of services including among others: broadcast and other program distribution; broadband; maritime; aeronautical; government and emergency communications; telecommunications and private data networks, mobile fleet / traffic management and telemedicine. In particular, satellite has been at the forefront of digital TV & high definition television ("HDTV") development and should also be considered as one of the best platforms for the further growth of HDTV and the development of 3-D and interactive on demand digital services in Europe. Taking advantage of the high reliability of their infrastructure, European satellite operators have also long used their networks to connect Europe and the world during the most difficult man-made and natural disasters. Furthermore, satellite is the only available means of communications able to efficiently and immediately deliver broadband to all underserved or un-served areas of Europe.

For example satellites are an ideal means of providing affordable broadband connectivity to rural and remote areas in Europe which, according to the Commission, roughly represent 10 million citizens. Satellites also provide critical emergency services to first responders particularly when other means of communications are unavailable.

The success and stability of satellite services for users is inextricably linked to the ability of the satellite operator to access enough spectrum that is free of damaging interference, and without the risk that such spectrum may be taken away after the investment has been made.

Ensure Operators Fees are Predictable and Fostering Investments & Innovation. Satellite systems are typically based on long business cycles (15-20 years), which require that rules and charges associated with them are predictable and remain stable over time.

Regulators within the EU should take into account the general objectives of the EU telecoms regulatory framework, which include "encouraging efficient investment in infrastructure and promoting innovation, taking into account investment risks" as well as "promoting regulatory predictability."

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2. C BAND SPECTRUM (3400-4200 MHz for downlinks and 5725-6725 MHz for uplinks)

C-band needs to be looked at globally.

Within the C-band spectrum, our sector has designed and is developing future communications systems. The band 3400 – 4200 MHz is very important for satellite communications in Europe, as in the rest of the world. Satellite service providers are using the C-band for global communications across continents, notably within Europe as well as between Europe and other regions.

For over 40 years, the satellite sector has used the whole 3400 - 4200 MHz frequency bands (C-band) for FSS. New C-band earth stations are being deployed all around the world on a regular basis, not to mention the countless number of Receive Only Earth Station (ROES) antennas used for TV reception that are distributed globally.

Governments, non-governmental organisations (NGOs), intergovernmental organisations (IGOs), businesses as well as individual consumers from everywhere in the world all depend on and benefit from the crucial services that are provided by FSS in the C-band.

Although the prospects of increased use of part of this spectrum for fixed and mobile terrestrial services such as WiMAX and the LTE limit the FSS business confidence to be able to use it, as it will likely cause harmful interference into satellite services using this band, the existing and planned uses of the 3400-4200 MHz band demonstrate that C-band will remain very important spectrum for the satellite sector.

The mobile terrestrial community argues that several of the bands identified at WRC-2007 for IMT are not consistent across the Regions or even in some cases within a Region, impacting adversely on global development of IMT. Further, they indicate that some of the bands identified for IMT have complex regulatory provisions. The UMTS Forum has published a report in 2011 making this type of claims.[1]

The above arguments reflect what the satellite industry has already been indicating since before WRC-2007, i.e. *C-band was, and remains an unsuitable band to be used for IMT and other terrestrial access technologies*.

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[1] In particular, look at slides 15-17 of:
http://www.google.com/url?sa=t&rct=j&q=umts+forum+c+band&source=web&cd=1&ved=0CCYQFjAA&url=http%3A%2F%2Fwww.umts-forum.org%2Fcomponent%2Foption%2Ccom_docman%2Ftask%2Cdoc_download%2Fgid%2C2409%2FItemid%2C213%2F&ei=cZNsT6PLIeO-0QXN4LS5Bg&usg=AFQjCNFdq81tKRvVzcdNzPcCtTy65oUGvg

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Sharing difficulties have not changed.

Nothing has changed from the sharing point of view during the recent study cycle (in the last 4-5 years). If anything, the results of the studies performed in the study cycle leading up to WRC-07 have been reconfirmed by the 2011 Report ITU-R S.2199 on the "Studies on compatibility of broadband wireless access (BWA) systems and fixed-satellite service (FSS) networks in the 3400-4 200 MHz band". This report was approved jointly by ITU-R Study Groups 4 and 5.

There is work going on in the Study Groups on potential sharing techniques between IMT systems and FSS networks in the 3.4-3.6 GHz band, but these techniques can only be used in respect of a very limited number of earth stations at known locations and working in a specified frequency band. Some of the techniques would also have a significant impact on the cost of the earth stations and would require modifications to the existing earth station installations.

Moreover, these techniques do not provide any solution in respect of protection of transportable earth stations or deployment of new earth stations. Therefore these techniques do not provide any basis for potential consolidation of this band for IMT or other terrestrial access technologies. Any techniques to improve sharing would have substantial disadvantages for one or both of the sharing parties.

It should also be highlighted that most FSS applications today operate in the range 3 600-4200 MHz and therefore WRC-07 limited changes to the Radio Regulations to frequencies below this band, i.e. 3 400-3 600 MHz, where there are fewer FSS applications currently in operation. Sharing between IMT and FSS applications would be even more challenging in the band 3 600-4 200 MHz.

The EU in 2008 has opened the sub-band 3400-3800 MHz to fixed and mobile terrestrial Broadband Wireless Access (BWA) systems, resulting in the need to protect satellite networks from interference and assure that critical coordination takes place. It is to be reminded that the EC Decision on the "Harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services"[2] requires Member States to protect existing services.

The EC Decision further requires that implementation of the EC Decision shall not preclude the use of the band by other services, which means that Member States need to protect existing *and* future FSS services on a 'first come, first served basis'. It is likely that in many instances IMT systems serving mobile terminals will have to operate with exclusion zones around FSS earth stations within their service areas in order to protect those earth stations.

[2] EC Decision 2008/411/EC

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Satellite C-band continues to grow in Europe.

Even excluding military satellites using C-band and satellites using C-band for Telemetry, Telecommand and Control (TT&C), but not for their communications payload, there are currently more than 160 C-band satellites in orbit (i.e. there is a C-band satellite at almost every 2° around the entire geostationary arc).

30% of existing C-band satellites provide coverage of all or part of Europe. In particular, satellite service providers are using the C-band for global communications within Europe and also to interconnect Europe with other regions. (*e.g.*, Africa, Middle East).

In addition, more satellites using the C-band are under construction. Satellite operators will launch 7 new satellites that include C-band payloads and that will serve Europe within the next 2 years, all including spectrum from 3630 to 4200 MHz (SES and Intelsat) or 3550-3700 MHz (Inmarsat).

The transponder demand in all regions shows healthy growth rates based on Euroconsult forecasts. New C-band earth stations are being deployed all around the world on a regular basis, not to mention the countless number of TVRO (Television Receive Only) antennas that are distributed globally. In Europe, for example, the number of registered C-band earth stations (i.e. not including TVROs) has been increasing at a rate of about 13% per annum in recent years.

C-band uplink spectrum 5725-6725 MHz

The band 5925-6725 MHz is shared between the FSS and FS in the UK. New fixed links and earth stations are coordinated on a first come-first served basis. Much of the discussion above related to the C-band downlink spectrum is equally applicable to the uplink spectrum. The entire frequency range will continue to be required and ESOA supports that this band continues to be shared with the fixed point-to-point links on the current basis. ESOA would oppose the use of this band for fixed access systems or mobile systems as such use would limit or prevent the potential use of this band for new earth stations.

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Table 1: Satellites in GSO with active C-band [1] payloads covering all or part of Europe in early 2012

(Excepting military satellites) [2]

°Long	Name	Operator	No. of C-band Transponders	°Long	Name	Operator	No. of C-band Transponders
45W	Intelsat 14	Intelsat	40	25E	Inmarsat-3 F5	Inmarsat	4 [3]
43W	Intelsat 11	Intelsat	16	25E	Inmarsat-4 F2	Inmarsat	8 [3]
54W	Inmarsat-3 F4	Inmarsat	4 [3]	26E	Arabsat 4C	Arabsat	24
40.5W	NSS 806	SES	36	31E	Arabsat 5A	Arabsat	16
37W	NSS 10	SES	49				
34W	Intelsat 903	Intelsat	44	40E	Express AM1	Russia	9
29W	Intelsat 801	Intelsat	38	47.5E	Intelsat 702	Intelsat	33
27W	Intelsat 907	Intelsat	44	49E	Yamal 202	Russia	18
24W	Intelsat 905	Intelsat	44	50E	Intelsat 26	Intelsat	12
22W	NSS 7	SES	49	57E	NSS 12	SES	40
22W	SES-4	SES	52	60E	Intelsat 904	Intelsat	44
20W	NSS 5	SES	47	62E	Intelsat 902	Intelsat	44
18W	Intelsat 901	Intelsat	44	64E	Intelsat 906	Intelsat	44
15W	Inmarsat-3 F2	Inmarsat	4 [3]	64E	Inmarsat-3 F1	Inmarsat	4 [4]
14W	Express A4	Russia	12	66E	Intelsat 17	Intelsat	24
11W	Express A3	Russia	12	68.5E	Intelsat 10	Intelsat	24
11W	Express AM 44	Russia	10	68.5E	Intelsat 7	Intelsat	14
5W	Eutelsat 5West A	Eutelsat	14	72E	Intelsat 706	Intelsat	26
1W	Intelsat 10-02	Intelsat	70	74E	Insat 3C	India	24
3E	Rascom 1	Africa	8	75E	ABS-1	Asia Br'g Co	28
3E	Eutelsat 3A	Eutelsat	7	76.5E	Telstar 10	IDirect	28
10E	Eutelsat 10A	Eutelsat	20	78.5E	Thaicom 5	Thailand	25
11.5E	Intelsat 603	Intelsat	38	80E	Express MD1	Russia	8
34.5E	Arabsat 2B	Arabsat	22	83E	Insat 2E	India	6

Total: **48** satellites operating C-band beams over Europe (including 19 Intelsat, 6 SES and 5 Inmarsat)

[1] (i.e. down-link within 3400-4200 MHz band, up-link within 5900-6400 MHz band)

[2] (Additionally it is known that a comparatively small number of military satellites use frequencies within C- band, for example Measat 1 & 2 at 46E & 6E and Leasat-5 at 72E.)

[3] (For Inmarsat satellites, C-band is used for feeder links and TT&C. The channelisation is not based on 36 MHz transponders used in most FSS satellites, but the numbers shown are indicative of the quantity of spectrum for comparison.)

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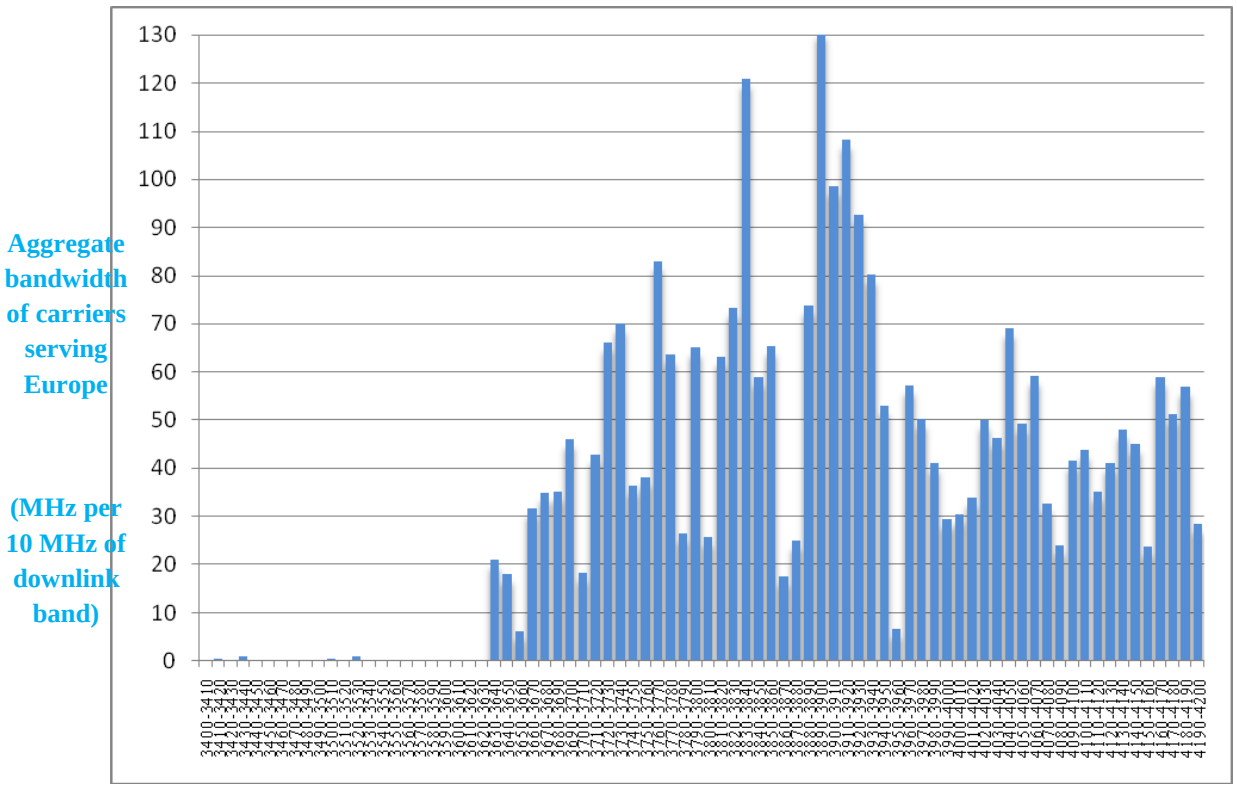
List of planned satellites having a C Band payload and a European coverage

Intelsat IS-20 in Q4 2012 at 68.5°E, with 24 transponders in the 3700-4200 MHz band;
Intelsat IS-22 in Q2 2012 at 72°E, with 48 transponders in the 3625-4200 MHz band;
Intelsat IS-23 in Q3 2012 at 53°W, with 44 transponders in the 3700-4200 MHz band;
Intelsat IS-21 in Q4 2012 at 58°W, with 24 transponders in the 3700-4200 MHz band;
Intelsat IS-27 in 2013 at 55°W, with 20 transponders in the 3700-4200 MHz band;
SES-5 in Q2 2012 at 5°E, with 28 transponders in the 3640-4200 MHz band;
SES-6 in 2013 at 40.5W, with 43 transponders in the 3625-4200 MHz band;
Alphasat in Q1 2013 at 25°E, with the equivalent in 8 transponders in the bands 3550-3700 MHz;
Eutelsat satellite deployments will see commercial operations in 24 equivalent transponders at 8°W and an increase in operational capacity at 3°E from 7 to 24 equivalent transponders.

Use of 3400-4200 MHz by down-link carriers from Intelsat satellites currently serving Europe



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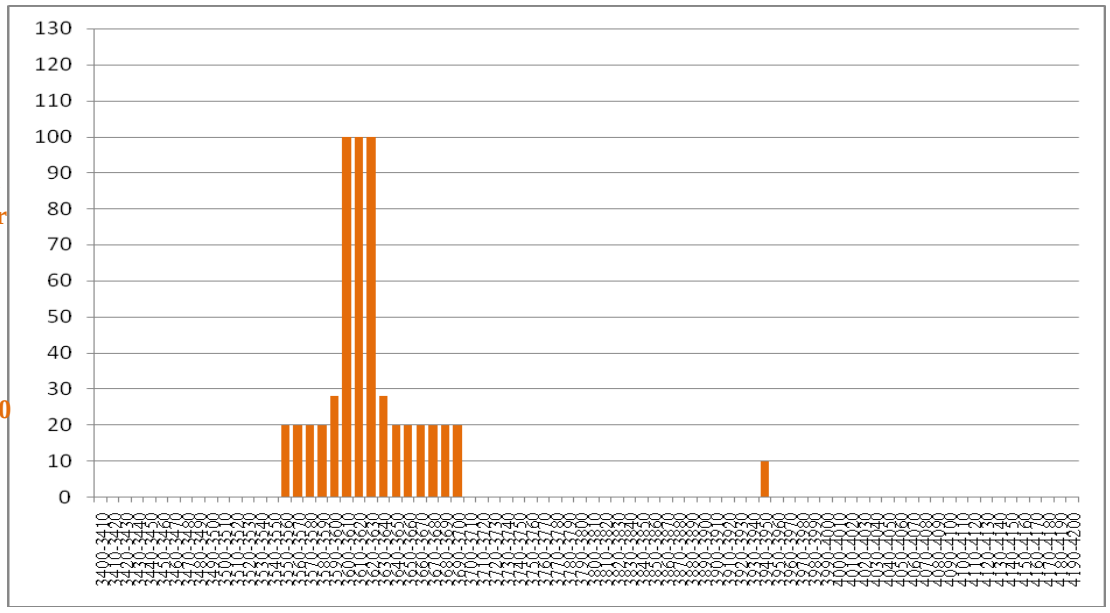
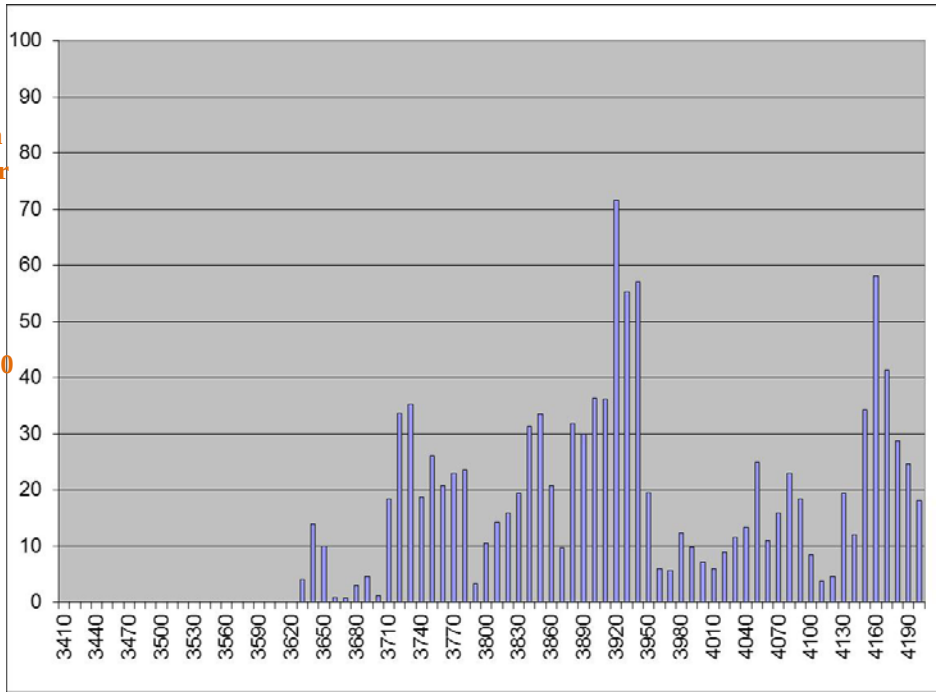
Down-link capacity in 3400-4200 MHz currently available to Europe on Inmarsat satellites



Use of 3400-4200 MHz by down-link carriers from SES satellites currently serving Europe



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3. Ka-BAND SPECTRUM (17.3-30.0 GHz)

Most of the satellite operators around the world have either already developed or are developing Ka-band satellite systems, but much of the Ka-band spectrum allocated to satellites is also allocated to other services or is reserved for exclusive government usage, which could constrain the development of new commercial satellite services. The Ka-band is of the utmost strategic importance to this industry, and has been under development for many years.

It is therefore essential that the national policies and decisions of NRAs continue to support the commercial satellite sector's access to this spectrum so as to protect existing services and to enable the development and roll-out of planned services that uniquely satisfy demand for state-of-the-art communications for governments, businesses and citizens.

Conformity with ITU and CEPT

- The Ka-band allows satellite operators to provide new and better services to key sectors:
  - The consumer sector (e.g. broadband internet access, advanced video services);
  - The government sector (e.g., policy goals such as Broadband For All; remote education and medicine; connectivity in remote or sparsely populated areas, emergency communication); and
  - The enterprise sector (e.g., cellular backhaul for LTE and 4G; global data communications services for both the mobile and fixed communities; redundancy communications for the oil and gas, and maritime communities).
- Satellite operators have invested heavily in Ka-band development. Due to saturation of the Ku-band, satellite operators in Europe already use and will increasingly develop this Ka-band spectrum for growth and expansion capacity for a broad range of services including video distribution (DTH, HD and 3D), public safety, broadband, private networks, satellite news gathering, backhaul, mobile as well as fixed applications and more.
- Ka-band is not limited to specific services such as broadband or public safety, as Ka-band is also essential for the growth and delivery of advanced audiovisual & media services (including HD and 3D), and for satellite news gathering and some private applications.
- To roll-out planned Ka-band services, satellite operators require regulatory certainty to assure access to Ka-band spectrum. To leave any doubt regarding satellite access to the Ka-band could place at risk the delivery of critical services to consumers as well as to the substantial underlying investments that are now being made in satellite infrastructure.

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- Taking into consideration the high susceptibility of links between the satellite and the end-user terminals to interference, and given the need to rely on large contiguous blocks of spectrum for links between the hub Earth stations and the satellite, the International Telecommunication Union (ITU) has allocated Ka-band spectrum in a way that some frequencies are exclusive to satellite and other frequencies are subject to specific sharing conditions (addressed in Europe by the current CEPT regulation).

- Any Ka-band policy effort must be made in conformity with ITU allocations as indicated in the Electronic Communications Framework (EU Telecoms Package) and with CEPT efforts to make it available to satellite communications services.

Why the need for more spectrum

As technology keeps evolving we see new services developing in the Ka-band, such as those requiring deployment of a large number of small transmit (uplink) - receive (downlink) user terminals. The general increase in demand for broadband communications is also driving the need for greater bandwidths for satellite terminals. Because of the sensitivity of satellite terminals to interference and the ubiquitous nature of these terminals, it is generally not possible for these Ka-band satellite services to share the same spectrum over the same geographical area with other services such as terrestrial fixed and mobile services.

Satellite access to downlink spectrum (17.7 – 20.2 GHz)

- FSS uncoordinated earth stations (space-to-Earth) in the band 17.7-19.7 GHz may operate within CEPT on an unprotected basis with respect to the Fixed Service (FS). The adjacent band 19.7-20.2 GHz which is allocated exclusively to satellite services, has so far been considered by satellite operators and administrations for widespread FSS earth station deployment. However, with the development of high capacity Ka-band satellites systems, and traffic asymmetry that requires more downlink spectrum than uplink, there is a critical need to enable the viable operation of FSS uncoordinated earth stations under acceptable FS interference conditions within the band 17.7-19.7 GHz on a sustainable long term basis.
- In urban areas, the 17.7-19.7 GHz range may be fully used by FS, or the prospect of reaching saturation is possible. While in rural and remote areas of the UK, it is quite likely that the saturation of FS will never be reached, even on the long term. One of the major identified applications in ECC Report 152 for Ka-band satellite systems is broadband connectivity for users beyond the coverage of terrestrial services. Therefore, the areas where spectrum would be most needed for Ka-band FSS broadband would generally be those of less need for the FS.
- Therefore, we would encourage Ofcom to characterise the FS interference environment as experienced by a FSS earth station, so that specific areas and/or sub-bands of 17.7-19.7 GHz in various rural and suburban areas and possibly urban areas can be identified as more favourable for Ka-band FSS use.

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- ESOA in particular recommends that Ofcom should take steps to encourage new fixed links to make use of alternative spectrum outside the range 17.7 - 19.7 GHz. This will progressively allow for sustainable use by broadband and other Ka-band FSS satellite systems to serve customers within the UK without risk of harmful interference from terrestrial FS links in those geographical areas and frequency segments.

Satellite access to uplink spectrum (27.5 – 30.0 GHz)

- The band segmentation between FS and FSS in the 28 GHz is provided by ECC Decision ECC/DEC (05)01 designating each frequency for either uncoordinated FSS earth station uplinks or FS. In the paired uplink band 27.5-29.5 GHz, the bands 27.5-27.8285 GHz, 28.4445-28.8365 GHz and 29.4525-29.5 GHz are identified for the use of uncoordinated FSS Earth stations. The only exception is in the band 28.8365 – 28.9485, designated for uncoordinated FSS, but taking into account that some FS networks were already licensed in some countries at the time the Decision was approved (*decides 2*). In this specific case, new FS links were to be limited to additions on the existing networks (*decides 4*). UK has not committed to implementing this Decision, and OFCOM has auctioned off various segments of 27.8285 – 27.9405 GHz band.

  Very little of this 27 / 28 / 29 GHz auctioned band by Ofcom in 2002/2003 has actually been used in the UK by the terrestrial spectrum rights owners and the vast majority of that spectrum is lying fallow. This represents highly inefficient and ineffective spectrum use. Some of those spectrum award blocks are coming up to their end of spectrum award term. There should no presumption for automatic extension of the spectrum award term to incumbent 28 GHz terrestrial spectrum rights owners.

- Based on the above analysis and future market trends for Ka-band FSS satellite services, ESOA recommends that Ofcom should release this un-utilised spectrum band segments which are coming up to their end of term for use by uncoordinated ‘license exempt’ FSS use. This in turn will allow the use of ubiquitous satellite user terminals to operate exclusively for satellite usage.

- Furthermore, ESOA considers it very important to be able to access the full uplink band 27.5-29.5 GHz on a shared basis for coordinated Ka-band gateway Permanent Earth Stations (PES), as implicitly recognized by ECC Decision ECC/DEC (05)01.

It is therefore essential that the national policies and decisions of NRAs continue to support the commercial satellite sector's access to this spectrum so as to protect existing services and to enable the development and roll-out of planned services that uniquely satisfy demand for state-of-the-art communications for governments, businesses and citizens.

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Current and Planned Ka-band Satellite Systems

As can be seen, many operators already have Ka-band satellites in operation as shown in Table 2 below and are providing service in countries across Europe, America, Asia and Africa. Other operators are developing Ka-band systems as shown in Table 3 below to be launched within the next few years that will lead to the availability and continue to meet the demand for Ka-band satellite systems globally.

Table 2: Launched Satellites With Ka-band [3]

Company	Satellite System
Arabsat	Arabsat-5A, Arabsat 5C
Avanti	HYLAS-1
Eutelsat	Eutelsat W series, Hotbird series, and Ka-Sat
Hispasat	Spainsat, Hispasat-1E
Hughes	Spaceway-3
Intelsat	Galaxy 28
Ipstar	Ipstar
Iridium	Iridium (LEO)
JAXA/NICT	Winds
Nilesat	Nilesat 201
SES	ASTRA 1H, ASTRA-1L, ASTRA-3B, ASTRA 4A, AMC-15, AMC-16, NSS-6
Spacecom	Amos 3
Telesat Canada	Nimiq 4
ViaSat	ViaSat-1, Wildblue -1, Anik-F2
Yahsat	Yahsat 1A

[3] as of November 2011 – in yellow are the satellites covering Europe

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Table 3: Planned Satellites With Ka-band [4]

Company	Satellite System
ABS	ABS-7, ABS-2
Arabsat	BADR 7
Avanti	HYLAS-2
Eutelsat	EUTELSAT-7B, EUTELSAT-3B
Eutelsat / ictQATAR	ES'HAIL / EUTELSAT 25-B
Hispasat	Hispasat AG1, Amazonas-3
Hughes	Jupiter-1
Inmarsat	Global Xpress
Inmarsat	Alphasat 1-XL
Insat	G-Sat 14
NBN Co	NBN-1 / NBN-2
NewSat	Jabiru 1
O3b Limited	O3b Networks (MEO)
RSCC	Express AM5 & AM6 & AM7
SES	ASTRA 2E, ASTRA 2F, ASTRA 2G, ASTRA 4B, ASTRA 5B
Spacecom	Amos 4 & 6
Telenor	Thor-7
Telesat Canada	Anik F3
Turksat	Turksat 4A / Turksat 4B
ViaSat	ViaSat -2
Yahsat	Yahsat 1B

The data in Tables 2 and 3 have been compiled from information on satellite operator websites, third party consultant reports and analyst reports; it is not intended to be an exhaustive list. It is however indicative of the extensive investments which have been made in developing Ka-band satellite systems to date and the further substantial investments already committed or planned for new Ka-band satellite systems.

[4] as of November 2011 – in yellow are the satellites covering Europe

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