A BUSINESS CASE FOR S-UMTS

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Abstract: *This paper reports work carried out in the context of the SATIN[1] project, on the role and potential of emerging satellite systems (S-UMTS) to complement terrestrial 3G networks, from a market perspective. The need for realistic market assessment in pointed out from previous experience and two approaches for the synergy of T/S-UMTS at service level are presented along with a discussion of relevant service scenarios. Then satellite addressable market aspects are assessed and a business case is presented with a sensitivity analysis indicating the conditions that guarantee the financial viability of an S-UMTS system venture.*

1. INTRODUCTION

For decades, satellite communication has been dedicated to long distance intercontinental connectivity for the national telephone and TV operators. Narrowband Very Small Aperture Terminal (VSAT) applications emerged in the mid-80s, but remained a niche market due to the cost of satellite transponder and size / cost of terminals. VSAT terminals were less than half a million worldwide by the end of 2000 [1], thus only addressing the needs of wide-area enterprise networks. It was the emergence of Direct-to-Home (DTH) TV broadcasting business that led satellite industry growth in the 90s. Nevertheless, the expectations for increase in the number of TV broadcasting transponders in the short / mid-term are moderate. Undoubtedly the new driving force is the Internet and the trend for personal communications.

Most of the satellites to be launched up to 2010 are targeting Internet applications. For a considerable number of "isolated" areas, satellite links are the only means of remotely connecting local ISPs to the Internet backbone. Still, the satellite industry is not anticipating a sustained growth in the number of ISP satellite connections, as there will be increased competition from terrestrial operators, rapidly deploying high capacity fiber optic infrastructures. On the other hand, satellites can be used for applications with significant broad/multi-cast traffic requirements. This comes as a direct consequence of their coverage properties, i.e. increased broad/multi-cast efficiency and cost sharing between numerous simultaneous users. Considering that broad/multi-cast multimedia services (MBMSs) will play a fundamental role in upcoming 3G mobile systems ([2], [3]) satellite becomes a competitive solution for "one way access" applications (e.g. IP traffic delivery based on low cost DVB-S terminals). Moreover, the emergence of new technologies introducing "2 way access schemes" (DVB-RCS, DVB-S + TDMA on the return link), or "1 way hybrid" (satellite forward + terrestrial return channel), makes such systems even more attractive.

Although the situation seems to favour "3G satellite systems" in terms of technology potential, it is at the same time becoming more than ever established within the satellite industry, that in order to create revenues from satellite services, much more than technology availability is required. Identification of the actual market potential and realistic forecasts are indisputably the most significant aspects of any satellite venture. This paper addresses these issues for the emerging satellite part of UMTS (S-UMTS).

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2. S/T-UMTS SERVICE INTEGRATION APPROACHES

The principal question traditionally posed for satellite systems is whether they should address a mass / consumer market, or target specific limited size niche markets. The satellite-specific niche market is already served by players such as INMARSAT, EUTELSAT, etc., i.e. there is high competition for S-UMTS in entering such a market (currently estimated at 500,000 users) with established players. The 'failure' of IRIDIUM and –more generally- experience with 2G S-PCN systems (GLOBALSTAR, ICO) proved that satellite systems cannot capture the predominant voice market and furthermore acquire a position in the mass market as stand-alone systems. Still, there is a common understanding within the satellite community, that S-UMTS services will only justify their investment, if they can penetrate the consumer market ([4],[5]). Therefore, the role of satellites within 3G systems aiming at this market becomes critical. There are different levels and granularities of integration between T-UMTS and S-UMTS having a direct impact on the system and terminal cost. In [6] three different levels are identified: terminal level, network level and service level interoperability. At the service level - and irrespective of the network level integration - there is a consensus within the European satellite community upon the *complementary* role of S-UMTS with reference to T-UMTS. SATIN identified [7] two approaches, where - w.r.t. T-UMTS - S-UMTS may constitute:

- ***A geographical complement / early service proposition***: The complementary role of S-UMTS in this approach lies in that it expands the reach of T-UMTS services in areas not adequately covered by T-UMTS. These include: *Coverage extension* (physically isolated regions), *Coverage completion* (gaps in T-UMTS network coverage), *Disaster-proof availability* (areas where telecommunications permanently, or temporarily, collapse due to disaster or conflict), *Dynamic traffic management* (absorption of excessive traffic, while optimising the dimensioning of terrestrial infrastructure) and *Rapid service deployment,* in areas where there is no infrastructure yet, for the purpose of testing the potential of an emerging market for new service propositions.

During transitory phase from 2nd to 3rd generation, satellites may offer day-one global roaming solutions whereas terrestrial UMTS is more likely to be deployed firstly over limited 'islands' of coverage. Hence there would be an opportunity for an early development of worldwide MM services. Outside T-UMTS coverage areas, S-UMTS offers the same set of services as T-UMTS.

- ***A service complement / "close co-operative" approach***: So far the lack of cheap and efficient point-to-multipoint transfer mechanisms, and the traffic costs of pure point-to-point solutions have restricted the wide use of MM services. However, the increasing demand for such services is likely to favour the dominance of multi / broadcast services in the near future. Thus the vision for S-UMTS is not to attempt to offer voice or interactive services, being less efficient as compared to the terrestrial networks, but to focus on multi/broad-cast services, where it has the potential to be more cost-efficient.

Moreover, satellites provide capabilities for creating new services (e.g. fleet management, route guidance, etc) with added value to existing terrestrial-based ones. This is why major niche markets should not be neglected. Nevertheless, it is the broad/multi-cast market that bears the potential to become the mass market[2] for satellite. This approach implies a maximum level of integration and co-operation with T-UMTS, with a number of potential advantages for the end-users enjoying innovative services at a low cost, as well as for operators of both satellite and terrestrial networks, in terms of shared infrastructure investment.

[2] The penetration level of streaming, multicasting and broadcasting services is estimated to be around 13% and 20% of the total corporate and consumer UMTS market respectively [8] implying a real mass market.

3. SATIN SERVICE DELIVERY OPTIONS

The two approaches identified above were further refined into five service delivery scenarios [7], based on the introduction of two differentiation factors:

- Direct (integrated terminal) vs Indirect (distributed terminal) access to the satellite
- Individual (e.g. vehicular) vs Collective (e.g. "remote islands") access configurations.

Analysis indicated that there is not a single system configuration that can simultaneously fulfill all the conditions for a mass market penetration & in parallel secure the presence of S-UMTS in all (or most) of the environments with a real market potential. To promote chances for mass-market penetration & faster deployment of 3G services, S-UMTS should be based on an "indirect" configuration, allowing end-users to receive the promised services with any standard (single/multiple mode T-UMTS) terminal of their choice, in both indoors and outdoors environments. On the other hand, direct configurations (based on dual mode terminals with built-in satellite receivers and return link through terrestrial networks) seem better suited for penetrating the traditional ("vertical") sat-com markets. A broadcast-oriented scenario allowing terminals to be operated indoors (indirect access configuration) is essential to address requirements from "low mobility" end-users of 2G+/3G services, primarily interested in a cost efficient alternative to wired access. This group of users seems to be a key for mass-market penetration. On the other hand a coverage-oriented scenario featuring a collective configuration, is best placed to facilitate terrestrial fill-in and selective expansion of T-UMTS in rural areas, or to gain the very important cruiser/ ferry maritime market segment. Despite the fact that the five different configurations identified, seem to adequately capture and categorize S-UMTS service delivery options, a lot of similarities exist and the building of a single system falling into several categories (and thus comprising a variety of critical services) appears as a promising option.

4. S -UMTS ADDRESSABLE MARKET ASSESSMENT

Having defined the scope of integration at service level, as well as the different delivery options, the next step was to assess the anticipated markets for S-UMTS. These include:

- **Traditional niche market segments** comprising of *Maritime* (Merchant / Fishing fleet, Cruise / Ferry market), *Land Mobile* (Peace keeping / Aid organisations, Government Agencies, Press & Media, Transportation & commercial vehicles, Oil/Gas/Mining companies and other industries), *Aviation* (Commercial aircraft) segments.
- **Emerging market segments**[3] comprising of *SME Intranets & Extranets* (IP-based connectivity), *2/2.5/3 G Terrestrial extensions* (mobile network users), *Fixed / semi-fixed satellite users* (terrestrial / satellite broadband users).

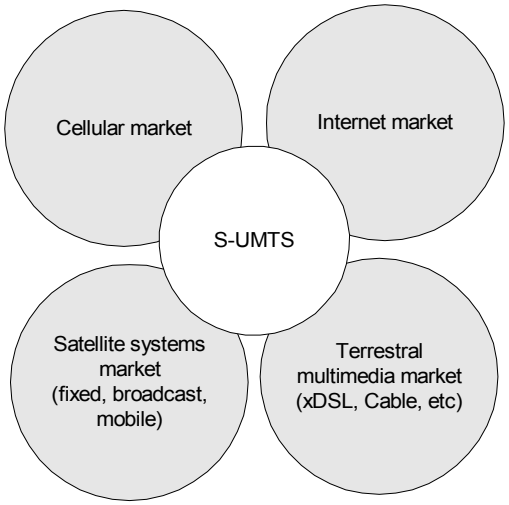

Figure 1: *UMTS Market - the macro environment – source UMTS Forum*

[3] According to the UMTS Forum [10], S-UMTS would be able to address segments that are "traditionally" covered by terrestrial broadband systems like xDSL, cable, or existing VSATs, or targeted by the forth-coming broadband fixed satellite services systems (TELEDESIC, SES Global, etc) as well as those segments served by existing mobile satellite systems (INMARSAT), personal communication systems (like GLOBALSTAR), or targeted by the forthcoming advanced mobile systems (such as B-GAN).

S-UMTS is thus positioned, as a potential player in a very wide market (fig.1) which although composed of a series of well defined vertical segments (business or consumer oriented), its overall size calls for a "mass" market that would justify the investments required to build and operate the satellite infrastructure. Still, the actual size of the market to be acquired by S-UMTS is only subject to wide speculations as mobile markets have proved to be most difficult to forecast. After considering a number of studies ([11],[4],[5]), SATIN approached the issue by identifying three different hypotheses:

- *Average:* none of the highly sensitive issues (terminal cost, technical feasibility, mass-market awareness of mobile MM) experiences remarkable evolution in the coming years.
- *Pessimistic:* UMTS schedule is delayed due to consistent regulatory and standardisation problems, operators are reluctant / unable to produce low-cost MM handsets, and Value Added Services are not sufficiently developed. S-UMTS no longer correlated with market demands, suffers a major setback in terms of subscriber numbers.
- *Optimistic:* Fast Internet / intranets evolution, appropriate regulatory framework, and proliferation of new and well-marketed services, make satellite mobile MM feasible and commercially attractive. New small handsets now benefit from evolved display capabilities, user-friendly I/Fs, and robust satellite reception.

Assuming that mass-market interest in S-UMTS will be proportional to the dissatisfaction caused by shortcomings of terrestrial networks, UMTS MM services will be as common to the 2005 user, as is voice today, and that price difference between terrestrial and satellite solution will remain within the same order, we can use S-PCN market forecasts to estimate that a potential S-UMTS market will represent 1% of global UMTS MM market by 2005 in Europe, and less than 2% elsewhere (excluding basic telephony users). Relying on [11], we derive numbers ranging from 200,000 (pessimistic) to 2 million (average) and 5 million (optimistic) S-UMTS users in 2005. These figures are based on a "stand alone" S-UMTS rationale, but still indicate that there is considerable possibility for a mass market in the medium/longer term. This essentially means that industry should move beyond the average projections, or it is very likely that current players, or early newcomers will continue to dominate the market. Investors interested in S-UMTS should certainly adopt an approach (i.e. "close cooperative") that will allow them to gradually create such a mass market. To achieve this, S-UMTS should be built upon services where it is more efficient than T-UMTS, (broadcast / multicast) without excluding any other service types to meet requirements from certain niche markets that could assure an initial customer base for the new systems during the first period of system deployment. This approach would imply different assumptions and predictions for the number and type of potential users (see assumptions in section 5).

Spectrum calculations [7] added a precious piece to the S-UMTS market assessment puzzle. The conclusion was that the spectrum currently allocated to MSS, i.e. 2*30MHz overall, is enough to support the subscribers forecasted for 2005 and 2010 according to a pessimistic hypothesis. However, for the numbers predicted in the average and optimistic hypotheses, the allocated MSS spectrum may prove inadequate to support the expected subscribers. Therefore it becomes of vital importance for the satellite world, to at least secure the existing spectrum allocations, and investigate solutions to support the average and optimistic scenarios to guarantee the long-term viability of the 3G-satellite business. Although an obvious solution would be the allocation of additional spectrum (not very likely given the current trends), a more attractive alternative, would be to secure a total number of 1-2 million broad/multi-cast users, which can be served with the current spectrum allocations[4].

[4] However, if such a broadcast oriented system has to be implemented in addition to one supporting also point-to-point transport, there could well be a requirement for more MSS spectrum. This requirement becomes stronger as the volume of potential users increases, and/or the mix of services favours point-to-point connections.

5. SATIN S-UMTS BUSINESS CASE

To conclude the study, a **Business Case** was built [7] focusing on a sensitivity analysis of the financial aspects for the deployment of an S-UMTS system. The overall target was to indicate the conditions - in terms of *number / type of users*, *way of using the system, and Average Revenue Per User* - under which an investment in S-UMTS produces a positive Net Present Value (NPV), and extract conclusions on the potential *mix of services* and *T/S-UMTS synergy approach* required to attract the volume of users that are essential for a viable investment.

5.1 System & Operating Costs

Regarding the overall system cost a number of - as realistic as possible - assumptions were taken for both physical (hardware) and non-physical (software, engineering) investments:

- *Space Segment* - the system was based on a GEO constellation providing global coverage and comprising of 5 basic plus 2 spare GEO satellites of 15 years life expectancy. Cost of satellites, launch vehicles & services, insurance, etc was considered.
- *Ground Segment* - Up to 20 Gateways, control centers, billing functionality, hardware to route traffic to UMTS core / Internet, fixed assets including office equipment, furniture, etc.
- *System Development* – Anticipated engineering and R&D costs.
- *Working Capital* – invested or leveraged required for covering pre-operational expenses such as salaries or interest expenses up to launch.

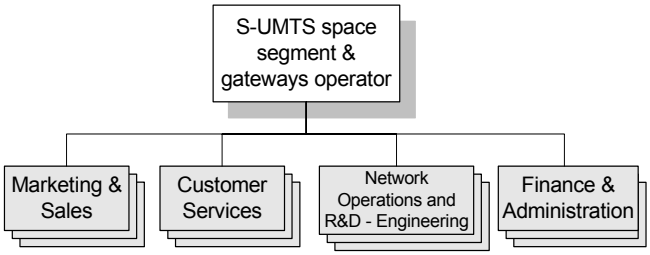

***Figure 2**: S-UMTS organisation structure*

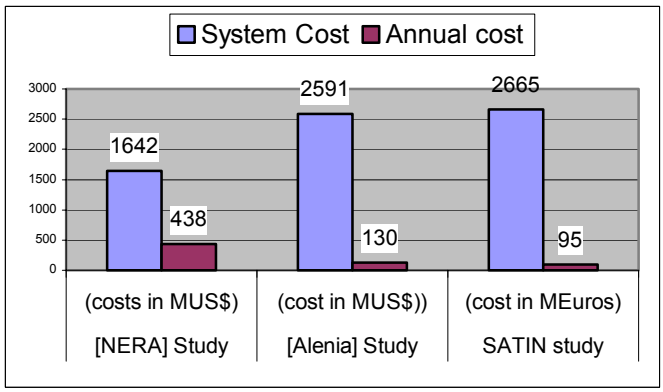

***Figure 3**: S-UMTS system & operating costs*

System cost considerations did not include terminals[5] and Intermediate Module Repeaters[6]. Regarding operating costs, a breakdown of the organization structure, employing approximately 800 people in the post pre-operational period, is depicted in fig.2. It's worth noting that sales / marketing & financial operations are partly undertaken by terrestrial value chain partners assuming the "close co-operative" approach. Fig.3 depicts an estimation of the anticipated operating costs per annum ([7]) and the accumulated system costs, as compared to ESA similar studies conducted by NERA [4] and ALENIA [5].

5.2 Type, Number and ARPU of Users

For the sake of the financial analysis we categorize S-UMTS potential users into 3 groups: "**Direct**", i.e. users that have no other terrestrial alternative, in principal subscribers of the S-UMTS network that may (occasionally) roam in a terrestrial network. These users belong to traditional niche market segments. "**Roamers**" that are, in principal, subscribers of T-UMTS

[5] Initial order / sponsoring of terminals is not necessarily a part of the satellite operator costs. This depends on the business model used and is allocated to value chain partners (e.g. SPs) directly or via ACRPU.

[6] The IMR concept, introduced at a latter stage in the SATIN architecture, could well be hosted in the terrestrial 3G base stations infrastructure (according to the close "co-operative approach"), or considered in terminal costs.

or 2G, 2G+ networks and only occasionally use S-UMTS when out of coverage of their home network and belong basically to emerging niche market segments. The anticipated revenue of the S-UMTS operator comes from roaming charges only. "**B-M users**" i.e. users of broad / multicast services that will normally use the S-UMTS network, even though they move in areas where T-UMTS or 2G(+) networks are available. These users can be T-UMTS and / or S-UMTS subscribers and belong basically to emerging market segments.

Our hypothesis is that the S-UMTS operator will, probably, operate on one hand *in cooperation with terrestrial UMTS operators,* but on the other hand *in competition with other AMSS systems* (such as B-GAN) or other regional/ global systems offering a "similar" set of services (DVB / DVB-RCS). In view of this complex and highly competitive market landscape, our assumption is that share to be obtained by S-UMTS is a 33% - 62% of the addressable global market, i.e. wide enough to encompass all reasonable error margins and unpredicted fluctuations. We consider forecasts in [4], [5] as indications of the size of the overall market (addressed by the S-UMTS system operator as well as the direct competitors).

Fig.4 depicts the assumed evolution of the subscriber base time-wise[7] according to the identified user groups and assumptions in §4.

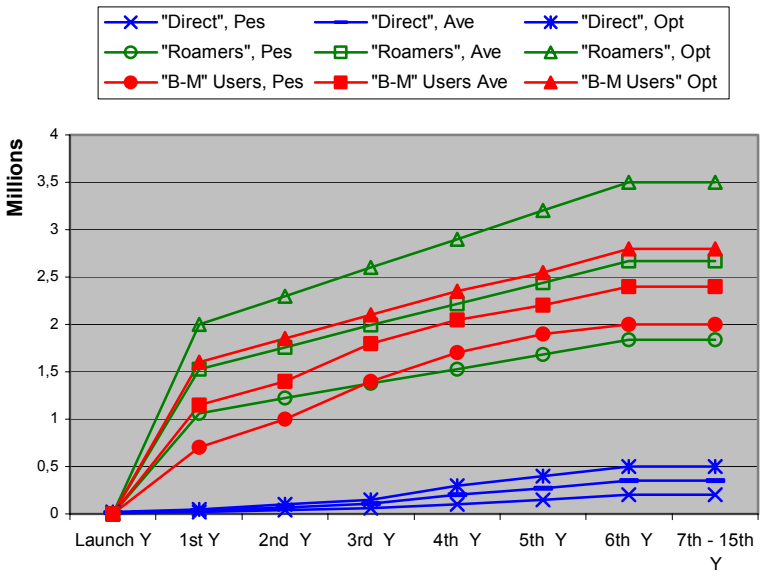

Figure 4: *S-UMTS subscriber base evolution*

Regarding Annual average Revenues per User (ARPUs), and although studies from the UMTS forum and major operators (France Telecom, BT, DT) provide estimations in the area of €1000 up to €3000, we are assuming (see [7]) significantly moderate figures. The reason is that in a "co-operative" approach, tariffs will be highly influenced by the terrestrial mobile markets, thus leading to lower ARPUs[8]. The B-M user generates revenues from airtime subscription, advertising and transactions while using his "home" network, while a "roamer" will normally generate revenues from airtime when visiting S-UMTS. The average projected difference in revenues between these two categories is in the order of €340 (2nd op. Yr) to €240 (6th op. Yr), i.e. a range of €28 to €20 per month. This amount is considered as a "realistic" difference, users would be willing to pay for receiving adding value to their standard UMTS services.

5.3 Sensitivity Analysis & Financial Projections

Analysis was conducted, on the basis of the Discount Cash Flows method (discount rate 14%). Thirteen different scenarios (9 in Table 1) were evaluated based on different hypothesis on number of users and type of system use [7]. The overall study period was 18 years from investment decision, while the first satellite is launched in the 3rd year. Two additional satellites will be launched during the 5th year from investment decision, another two in the 7th

[7] The first satellite launch year is placed between 2004 and 2005.

[8] Direct users ARPUs are assumed in a range of €1450-1400 with a low cost of revenue 10%-20%, while Roamers and B-M users' ARPUs are significantly lower (€400-600 aver.) but with a high ACRPU (40%-60%).

year and the final two in the 9th year. Commercial operations start as soon as the first satellite is launched, however the first complete year of commercial operations is the 4th year from investment decision. In this respect, financial analysis covers 15 complete years of commercial operation. Furthermore, we assume that the number of users and ARPUs remain constant at the levels achieved in the 10th year from investment decision (7th year of commercial operation).

Figures 5 to 8 illustrate the expected financial performance of the investment for the various scenarios included in the analysis, in terms of expected *Net Present Value (NPV), profitability (net margin)* and *NPV Break even and gross earning* expectations from scenarios producing positive cash flows.

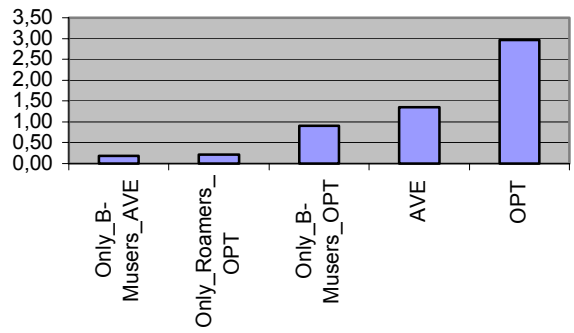

Figure 5: *Scenarios producing positive cash flows & NPVs at 10th Yr. from investment decision*

5.4 Conclusions

Summing up financial projections, the following are concluded:

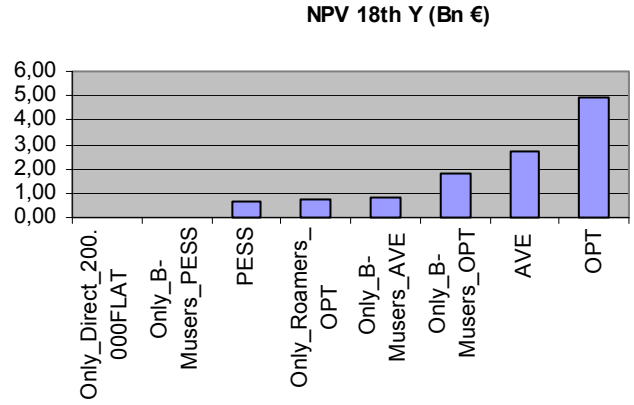

Figure 6*: Scenarios producing positive cash flows & NPVs at 18th Yr. from investment decision*

Scenario ID	Users 1st op. Y (M)	Users 6th op. Y (M)
Only_Direct_200.000FLAT	0.2	0.2
Only_B-Musers_AVE	1.15	2.4
Only_B-Musers_OPT	1.6	2.8
Only_B-Musers_PESS	0.7	2
PESS	1.78	4.04
Only_Roamers_OPT	2	3.5
OPT	3.65	6.8
AVE	2.72	5.42
Only_Roamers_AVE	1.53	2.67

Table 1: *Scenarios population at the 1st and 6th yr of full commercial operation.*

- A global S-UMTS project is not viable assuming a user population that comprises only of "direct" users. Their numbers are simply not sufficient to support the investment (fig.5).
- An approach which will only focus on the needs of "roamers" can produce financially healthy results if the system operator will succeed to attract, from the very beginning, a number of users that will exceed 2 millions, which is highly unlikely, keeping in mind market forecasts' assessment. In the case where the portfolio of services includes broad / multi-cast services, the investment could be viable if the operator will succeed to attract a number of users in the area of 1.15 million willing to use them. This appears to be feasible, considering that B-M users are normally users in the urban, suburban areas that will seek to S-UMTS a cost efficient "alternative" for T-UMTS services.
- The analysis further suggests that to achieve high profitability, S-UMTS should address a mixed population of users with varying needs (fig.7). B/M-cast services should be the basis of the potential services portfolio, to minimise spectrum implications and secure higher ARPUs.

- All the scenarios with the potential to produce positive financial results assume a considerable population of users (in the order of millions and not thousands) from the very beginning of commercial operation. This imposes a very close "co-operative" approach for the system deployment with the terrestrial cellular operators to make sure that the initial user population of S-UMTS will be sought among their "home" (numerous) users and not the occasional "roamers".

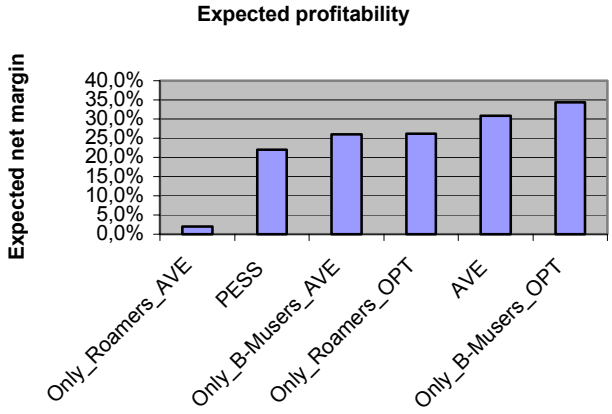

***Figure 7**: Expected profitability at 6[in] year form inv. Decision of scenarios with positive NPVs*

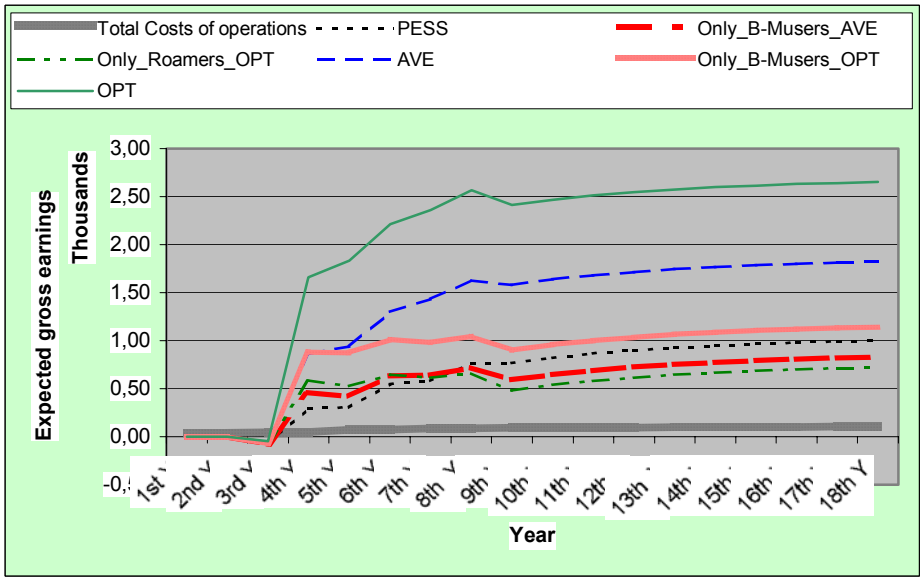

***Figure 8:** Break-even point & projected gross earnings*

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