

PROSPECTS OF NIGCOMSAT-1R FOR WEST AFRICAN SUB-REGION

By

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■ PREAMBLE

-Communications Satellite is based on the same principle and has the same goal as that of a terrestrial television broadcasting. The only major difference between satellite and terrestrial television broadcasting network is the placement and the required number of repeaters. In geostationary communications satellite, just one repeater placed at a distance of 35768 km directly above the equator suspends a solid angle of about 17.4° with the earth. This translates to about 11000 km of land span.

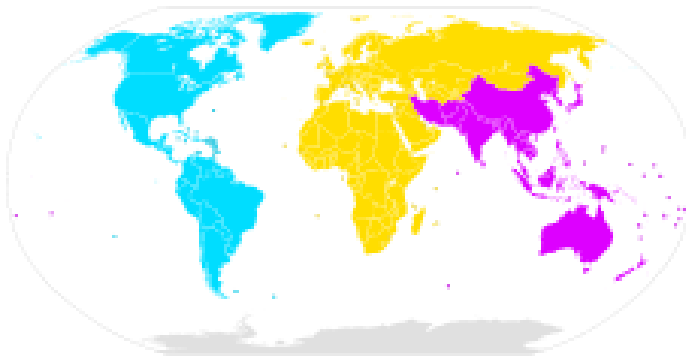
Therefore, a single satellite has a visibility of 11000 km of the earth which is about 27% of the earth's circumference. Hence, only four satellites or repeaters are needed to cover the whole world. However, three satellites suffice to cover the entire world considering the fact that a vast amount of the earth is covered by un-inhabited seas. This fewer number of repeaters, in comparison to corresponding thousands of repeaters in terrestrial broadcasting, to cover the world accounts for the numerous advantages and extensive applications of satellite broadcasting over the terrestrial broadcasting.

Traditionally, telecommunications network, either terrestrial or satellite, has two real time payloads, namely, audio and video signals. These two signals are adversely affected by excessive attenuation and long delay, that is degradation in quality of service, QoS, which is worse for digital audio and video.

In order to minimise attenuation and delay of satellite signal, ITU divided the world into three regions, namely, region1, region 2, and region 3. Region1 covers Europe, Africa, and Middle East with longitudes ranging from 40°W to 45°E . The region2 consists of North, Central, and South America having longitudes 40°W to 160°W . And region3 covers India, Asia, and the Pacific at longitudes of 160°W to 45°E as shown in Fig. 1.

Another source of satellite's signal degradation due to ground noise is low elevation angle. ITU stipulates minimum of 10° elevation angle. At the equator where the latitude is 0° , when the longitude of an earth station is the same with that of the satellite, the resulting elevation that the dish makes is 90° while at the artic the elevation angle will be approaching 0° . Also it is possible to experience low elevation angle when close to the equator if the differential longitude angle between a site and

satellite is high. For example, if an earth station at NASRDA, Abuja (7.49°E, 9.06°N) is aimed at a communications satellite at 80° longitude results in elevation angle of 8.6° which is below the stipulated minimum. While the same earth station pointed to NigComSat-1R to be located at 42.5°E would give 49° elevation angle. But if pointed to a satellite at 7.5°E the elevation angle will be 79°.



ITU regions.

- Region 1: Europe, Africa, Middle East, & Persian Gulf (West), Soviet Union, & Mongolia
- Region 2: Americas, Greenland, Pacific Islands (Eastern)
- Region 3: Asia, Iran, Oceania

Fig. 1 ITU Satellite Regions

Nigeria, of course, falls in ITU Region 1, hence satellite viewable from Nigeria or the West African sub-region must be between 40°W to 45°E. However, the closer a satellite location to its earth station the lesser the signal's delay and attenuation.

The four bands of frequencies often used by satellites are, namely, L band, C band, Ku band, and Ka band. The L band with frequency between 1 and 2 GHz; C band has frequency range of 3.7 to 6.6 GHz; Ku is in the range of 10 to 14 GHz; and Ka is often in the range of 20 to 30 GHz. The major challenge here is that above 10 GHz, rain has significant adverse effect on the signal.

It is required that there should be a minimum of 2° spacing between satellites. Table I tabulates the communications satellites in ITU region 1. Note that there is already a satellite named Turksat 2A, 3A at 42°E operating in the Ku band. NigComSat-1R is going to be located at 42.5°E.

Table I: ITU Region 1 Satellite (Europe, Africa, Middle East : 40°W – 45°E)

No. of Satellite as at March 2011: 51 ; Average Satellite Spacing: 1.7°

s/n	Sat. long.	Name of Satellite(s)	Services	s/n	Sat. long.	Name of Satellite(s)	Services
1.	40.5°w	NSS 806	C, Ku	26.	2.8°E	Rascom QAF 1R	C
2.	37.5°w	NSS 10, Telstar 11N	C, Ku	27.	4°E	Eurobird 4A	Ku
3.	34.5°w	Intelsat 903	C, Ku	28.	4.8°E	Astra 4A/1E (incl. 0.7°)	Ku
4.	33.5°w	Hylas 1	L,S,Ka	29.	7°E	Eutelsat W3A	Ku
5.	31.5°w	Intelsat 25	L,S,Ka	30.	9°E	Eurobird 9A	C,Ku
6.	30°w	Hispasat 1C/1D/1E	Ku, L,S,Ka	31.	10°E	Eutelsat W2A	C,Ku
7.	29.5°w	Intelsat 801 (incl. 2.2°)	L,S,Ka	32.	13°E	Hot Bird 6,7,9	Ku
8.	27.5°w	Intelsat 907	C, Ku	33.	15.8°E	Eutelsat, Sesat 1, W2M, Euro Bird 16	Ku
9.	24.5°w	Intelsat 905	C, Ku	34.	16°E	Turksat 1C (incl. 2.7°)	L, S,Ka
10.	22°w	NSS 7	C, Ku	35.	17°E	Amos 5	L,S,Ka
11.	20°w	NSS 5	C	36.	19.2°E	Astra H, 1KR, 1L, 1M	Ku
12.	18°w	Intelsat 901	C, Ku	37.	20°E	Arabsat 2E	C
13.	15°w	Telstar 901	C,Ku	38.	21.6°E	Eutelsat W6	Ku
14.	14°w	Express A4 (incl. 1.5°)	L,S,Ka	39.	23.5°E	Astra 3A, 3B	Ku
15.	12.5°w	Atlantic Bird 1	Ku	40.	25.5°E	Eurobird 2	Ku
16.	11°w	Express AM 44	C,Ku	41.	26°E	Badr 4,5,6	Ku
17.	8°w	Atlantic Bird 2	Ku	42.	28.2°E	Eurobird, Astra 2A, 2B,2D	Ku
18.	7.8°w	Telecom 2D	L,S,Ka	43.	30.5°E	Arabsat 5A	C,Ku
19.	7°w	Nilesat, Atlantic Bird 4A	Ku	44.	31.5°E	Astra 1G, 2C	Ku, L,S,Ka
20.	5°w	Atlantic Bird3	C,Ku	45.	33°E	Eurobird 3	Ku
21.	4.3°w	Thor 3 (incl. 0.8°)	L,S,Ka	46.	36°E	Eutelsat W4,W7	Ku
22.	4°w	Amos 2,3	Ku	47.	38°E	Paksat1	C,Ku
23.	0.8°w	Thor 5,6 ; Intelsat 10-02	C,Ku	48.	39°E	Hellas Sat 2	Ku
24.	1.8°E	Astra 1D (incl. 3.2°)	Ku	49.	40°E	Express AM 1 (incl. 2.7°)	C,Ku
25.	2°E	Astra 1C (incl. 4.1°)	Ku	50.	42°E 42.5°E	Turksat 2A, 3A NigComSat-1R	Ku L,C,Ku,Ka
				51.	45°E	Intelsat 12, Afrisat 2 (moving 0.6°)	Ku, L,S,Ka

■ The NigComSat-1R Satellite

NigComSat-1R is a Nigerian communications satellite to be launched into geostationary orbit in this month of December 2011 as a replacement for NigComSat-1 which was de-orbited. The features of this satellite are:

- **Location Longitude:** 42.5°E
- **Life Span:** 15 years
- **Payload:** 28 (active transponders) , and 12 (redundant transponders)
 - 2 (L-band)
 - 4 (C – band)
 - 14 (Ku –band)
 - 8 (Ka-band)
- Footprint:** As shown in Fig. 2
- EIRP:**
 - L-band: L1 = 33.5 dBW, L2: 31.5 dBW (navigation applications)
 - C-band: 55 dBW (ECOWAS) ; 52 dBW (Central and East Africa)
 - Ku-band : 46 dBW (ECOWAS, Central, & East Africa)
 - Ka-band: 58 dBW (Nigeria, South Africa, Europe)

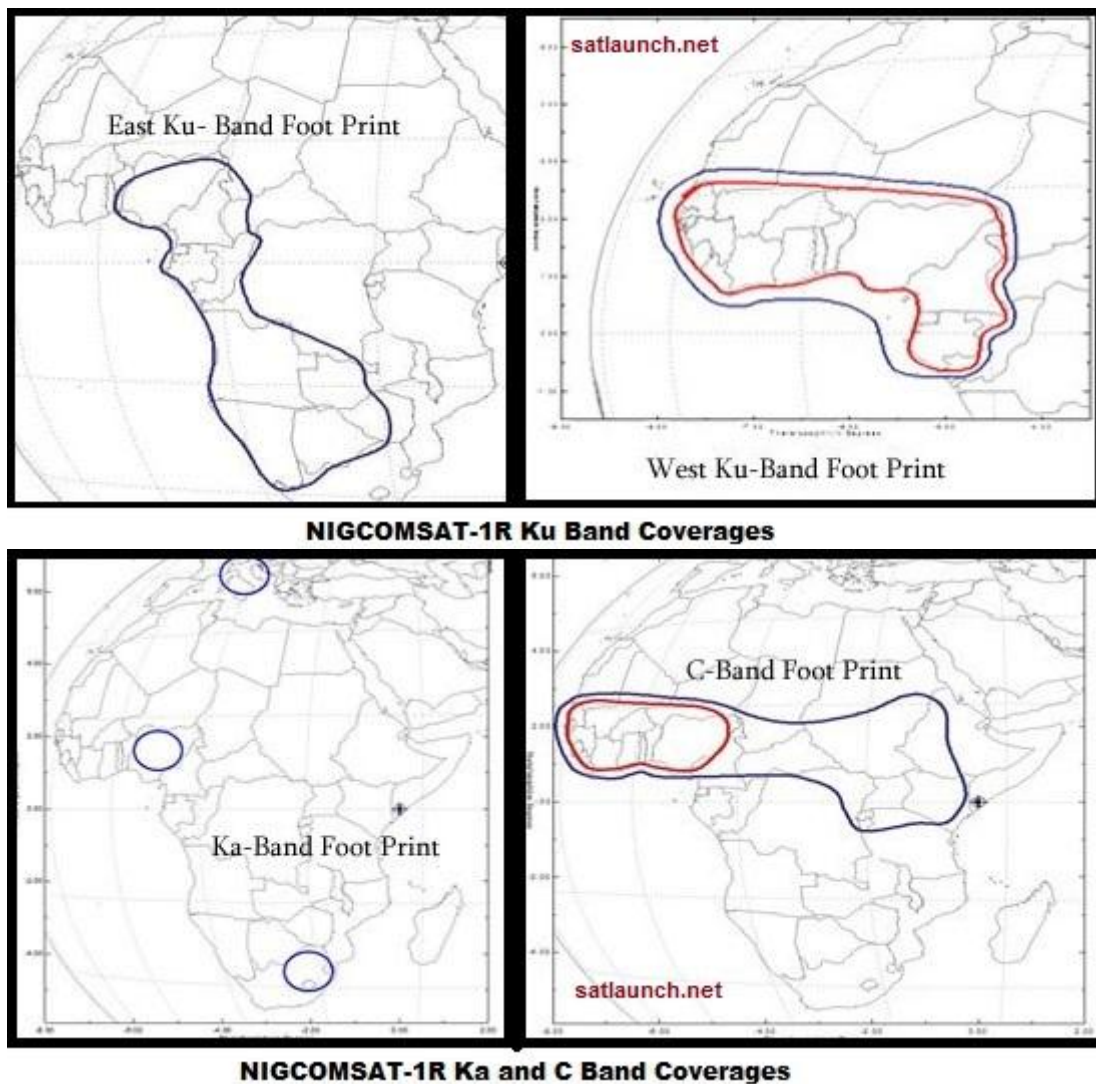


Fig. 2 NigComSat-1R Footprint

■ **NIGERIA AND NigComSat-1R Satellite**

Nigeria, with a population of about 167 Million people, covers an area of 923,768 sq meters made up of 910,768 sq meters of land area, and 13,000 sq meters of water area. It is located and encompassed by a geographic window with the lower left geographic coordinates of $(2^{\circ} 43.207' E, 4^{\circ} 17.825' N)$ and upper right geographic coordinates of $(14^{\circ} 54.685' E, 13^{\circ} 52.837' N)$ as shown in Fig 3.

Nigeria with longitudes ranging from $2^{\circ} 43.207''$ and $14^{\circ} 54.685''$ falls in ITU region1. Hence, can receive directly and effectively signals from satellites in region 1.

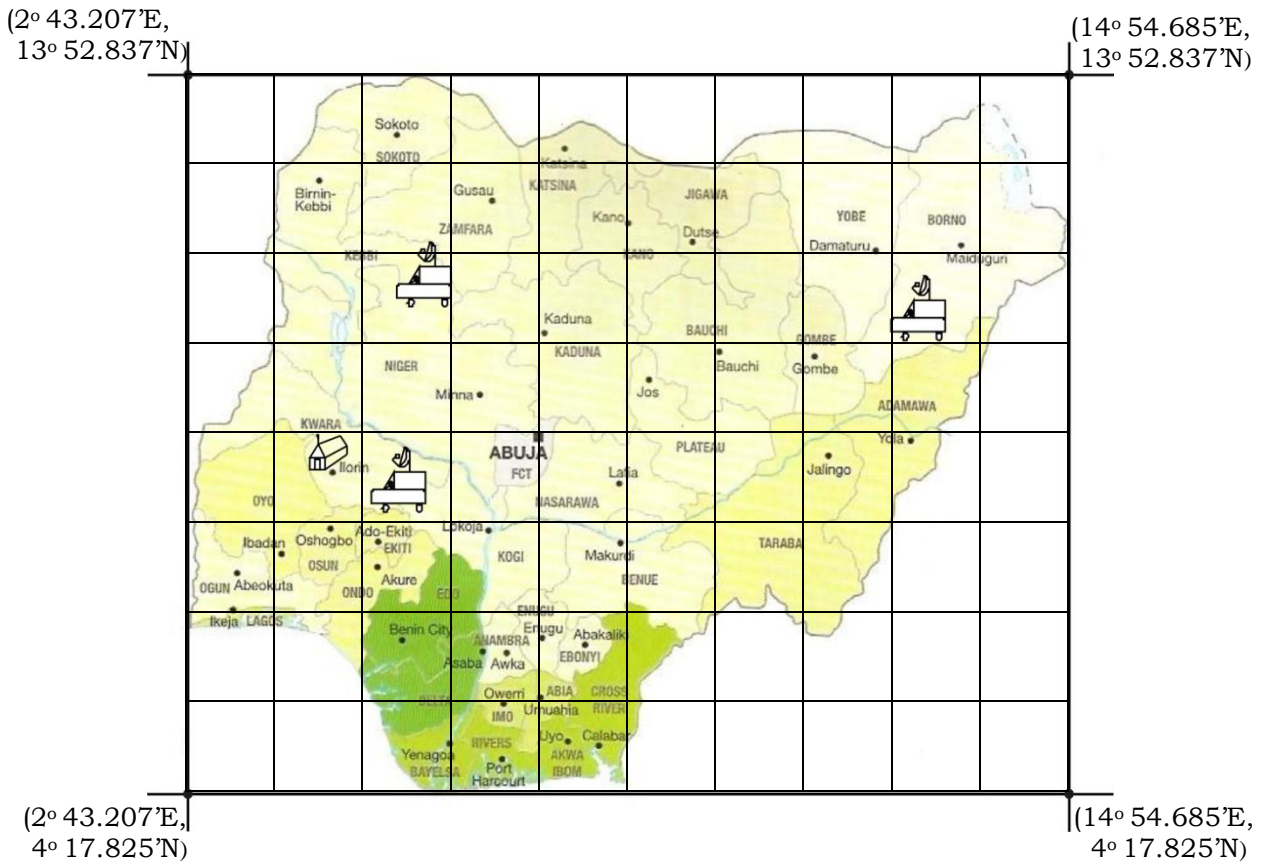


Fig. 3: Nigeria Geographic Location bounded by Rectangle with bottom left corner coordinate $(2^{\circ} 43.207'E, 4^{\circ} 17.825'N)$ and top right corner coordinate of $(14^{\circ} 54.685'E, 13^{\circ} 52.837'N)$

■ NigComSat-1R SOURCES OF RETURN ON INVESTMENT

The altitude of a satellite largely determines its payloads and applications as shown in Table 2:

Table 2: Satellite's Altitude, Payloads, and Applications

Orbit name	Orbit altitude (km)	Satellite type	Payload	Applications
LEO	500 -1000	Observatory	image sensor (camera)	Remote sensing, Disaster monitoring, etc
MEO	1000-2000	Navigation	distance & time sensors	GPS
GEO	35,768	Geostationary	Bandwidth (Channel)	Audio, video (Television, Telephoning)

Some of the identified sources of Return On Investment, RoI, of NigComSat-1R include:

(1) Availability of TV Programmes Nationwide

- The 36 states of Nigeria need about 6 transponders to make their state TV simultaneously programmes available nationwide and in the West Africa sub-region
- Also another 6 transponders are needed to make NTA TV programme in each state equally available
- Each of these tv programme can be made available in about three different languages
- Just government owned tv stations alone require about 12 transponders already in one application
- Private cable tv will no more be locally available but nationally and also in the West Africa sub-region
- Also, FM radio will be so available
- With NigComSat-1R , the 2012 digital tv switching is becoming a reality
- All these are also true for the ECOWAS nations

(2) E-Voting

- The process of voting at the polling booths across the nation can be monitored remotely in real time and available in each home life across the nation and in the countries where nigcomsat-1r has footprint

- Counting of vote can be so made available
- The high data throughput required by this exercise is supported by nigcomsat-1r Ka transponders
- Luckily, our general election in Nigeria is always during the dry season hence no fear of signal loss due to rain attenuation

(3) Distance E-Learning & Collaborative Research

- The merger of Tv and computer monitor vis-à-vis the merger of Internet and telecommunications make possible interactive, two-way tv; just as the merger of computer and telecommunications produced 2 way radio called gsm
- Hence, each student at a remote study centre is presented with a personalised teacher and just a personalised computer !
- The acute shortage of qualified lecturers in our higher institutions will be greatly reduced by this exercise via the satellite
- Virtual library and virtual laboratory become readily available across the nation and beyond
- Video conferencing and video telephoning for collaborative research become readily affordable with good QoS

(4) Internet

- Servers, hitherto, hosted outside Nigeria can be comfortably be repatriated , just as the charges by ISPs become affordable
- The rural dweller will benefit greatly from affordable vsat and monthly subscription
- The activities of the 419 on the Internet can be checked by making accepting business and official transactions via email only from email accounts with .ng top domain

(5) E- Banking

- Banking in a global village is facilitated by e-banking via satellite
- Hence, e-banking in Nigeria, West Africa, and across the globe will benefit from NigComSat-1R
- The era of just one bank world-wide is in the horizon !

(6) Tele-Medicine

- The acute shortage of medical personnels will be greatly reduced by this national carrier
- Complex surgery can be monitored and control in real-time via this national carrier
- Health care delivery can be made more available in the rural areas

(7) Video Conferencing & Video Phone

- Video conferencing and video telephoning become more readily available and affordable with good QoS
- E-governance will benefit immensely from video conferencing and video telephoning

(8) Surveillance, Security, and Military Applications

- NigComSat-1R will make possible simultaneous coverage of military operations across Nigeria and the west Africa sub-region if necessary
- Military's classified operations can be safely conducted nationwide via the national carrier

- Automatic vehicle plate number recognition and automatic driver's face image recording for suspect or offending driver can be conducted simultaneously across the nation and at our national borders, thanks to the NigComSat-1R
- This can greatly reduce the wave of Boko Haram's activities because on automatic recognition of a suspect vehicle, an unmanned bomb disposal robot can be sent in and controlled from a safer distance !

- Toll gate can be monitored nationwide for revenue collection
- Police can monitor our roads and sensitive areas 24/7 from their police stations and only respond to possible problem areas
- These services are also available to individuals and industries

(9) Unified Communication (Data, VoIP, IP-Tv)

- Computer network and the Internet were originally designed for non-real time data conveyed across the globe by packet switching

-Also, on the other hand, telecommunications networks including satellite network were originally designed for real-time analogue audio and video

-But the advent of IT has forced marriage of convenience between computer and telecommunications

-Telecommunications became a bride in this marriage with a change of “Analogue” as a maiden name to a new surname of “Digital”

-With this technological wedlock, data, audio, and video can now be conveyed by a unified communication network called the Internet

-Hitherto, three separate networks are required: Internet for data; Telephone network for phone; and Television network for video

-The Internet, i.e. the unified network, will soon be the only communications network mainly via satellite for data, telephoning , and video

-GSM operators may soon disappear !

-Also, universal personalised television set as handset which can be used as data, phone, and video terminal is already knocking on our doors

-And the “1R” in the NigComSat-1R may then be truly the no 1 redeemer and not just replacement for Nigcomsat-1.

■ **NigComSat-1R & Entrepreneurship**

-As access to phone is now highly personalised via ownership of gsm handset(s) by individuals

-So also will access to the Internet be so personalised via ownership of an Internet access device as a handset without a particular gsm operator’s sim card

-In addition to the enumerated sources of NigComSat-1R’s RoI, generation of numerous job opportunities, diverse entrepreneurs, and high technology transfer will be witnessed by the placement in orbit of the NigComSat-1R

-The questions are: Who makes the VSAT (dish, buc, Inb, etc) ? , Who makes the personalised interactive Television handset ?

-What an opportunity for NARSDA to create job opportunities, produce IT entrepreneurs, and to have enviable IGR !

■ RECOMMENDATIONS

It is therefore recommended that:

(1) The next Nigerian's communications satellite be positioned within $7.5^{\circ}\text{E} \pm 2^{\circ}$ with all its beams pointed to Nigeria to cover the entire country ;

(2) Federal Government to take a lead in the public awareness of the prospects of the NigCOMSat-1R by being the major subscriber ;

(3) Immediately after the launch of the NigComSat-1R, strategic plan to be started for the next Nigerian's communications satellite ;

(4) NASRDA (CSELT) to start a factory for the production of satellite parts (e.g. vsat dishes, bux, lnb, personalised interactive tv handset, etc) ;

(5) Federal Government to have a committee of professionals to work with NASRDA for the strategic planning, and development of entrepreneurship outlets for the NigComSat-1R and the subsequent Nigerian's satellites.

■ Conclusion

-Firstly, in conclusion, communism/socialism died because it was made an ideology instead of a technology ;

- But the good news is, communism has resurrected as technology with a change of name to Unified Communications ;

-Hence, the only way to go is to cash in now into this technology.

Thank you for listening.