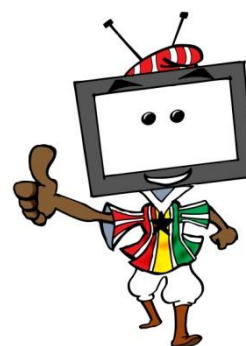


NATIONAL DIGITAL BROADCASTING MIGRATION TECHNICAL COMMITTEE



REPORT TO THE GOVERNMENT OF GHANA ON THE MIGRATION FROM ANALOGUE TO DIGITAL BROADCASTING IN GHANA

FINAL VERSION

AUGUST 2010

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PART I: OVERVIEW OF THE COMMITTEE'S WORK

1.0 Introduction

The Honourable Minister of Communications inaugurated a National Digital Broadcasting Migration Technical Committee (“the Committee”) on 13th January, 2010 to among others make policy recommendations to the Government to enable Ghana achieve a cost effective and timely migration from analogue to digital broadcasting.

The Committee held its first meeting on 1st February, 2010, after which it held several sub-committee and plenary meetings, stakeholder consultations, engagement with the press and a capacity building workshop. This report is the culmination of the Committee’s work. It discusses the salient issues that arise from the migration from analogue to digital broadcasting and makes recommendations for the way forward.

2.0 Objectives of the Report

The report of the National Digital Broadcasting Migration Technical Committee (“the Committee”) is primarily aimed at achieving the following objectives:

- ❖ Report on the activities of the Committee
- ❖ Present a discussion of the salient issues involved in the migration from analogue to digital broadcasting
- ❖ Identify the various options available to the country
- ❖ Recommend appropriate policy, legal and regulatory initiatives in line with the terms of reference to ensure successful migration from analogue to digital broadcasting in Ghana.

3.0 Terms of Reference

The terms of reference of the Committee were as follows:

1. To make policy recommendations to achieve the following:

- a. to situate the transition from analogue to digital broadcasting transmission networks within the broader context of strengthening and developing Ghana's information infrastructure; and
 - b. to determine how the transition of existing broadcasting services to digital broadcasting transmission networks and the introduction of new services will facilitate the implementation of national government priorities.
2. Recommend appropriate National Standards for Digital Broadcasting in Ghana
 3. Propose a switchover timetable for the approval of Government
 4. Elaborate on the role of the regulator in implementing digital broadcasting, eg.
 - a. Managing Frequencies
 - b. Licensing
 - c. Supporting national government priorities
 - d. Protecting public interest and
 - e. Promoting investment and stability in the sector;
 5. Investigate the impact of transition on existing broadcasting services:
 - a. Determine need for protection;
 - b. Licence and frequency arrangements during transition
 - c. Impact of licensing new services on existing services during transition;
 6. Develop a framework to ensure a coordinated, cost-effective and environmentally friendly switchover process that ensures universal access to television services within a stipulated timeframe considering the following:

Economic Issues

- a. In what way will digital migration contribute to socio economic priorities of capital investment, job creation, economic distribution to all regions, etc?

- b. What investment incentives, support measures and consumer demand stimulation should be used to achieve rapid digital migration?
- c. What are the possible economic risks that may be associated with digital migration and how can these risks be addressed?
- d. What progressive indicators should be used to monitor economic performance associated with digital migration?
- e. What capital expenditure and Human Capital investment is required for digital migration?
- f. What funding means should be used to capitalize digital migration?

Consumer Issues

- g. To achieve Universal Access and to prevent marginalization resulting from digitization. Should the basic access devices such as set-top-boxes be leased or subsidized in a digitized environment? Investigate cost of basic STB
- h. What kind of support can be provided for the vulnerable in the society?
- i. Should the importation of analogue TV sets be banned? When?
- j. How do we prevent the dumping of old TV sets from Europe into the country?
- k. How do we ensure that transmission points are harmonized for each area to ensure environmental sanity and consumer reception satisfaction?
- l. How can gullible and illiterate consumers be protected from exploitation?
- m. What other measures need to be put in place to ensure digitization enhances the provision of broadcasting services in Ghana?

Production and Engineering Issues

- n. To consider production and engineering issues in a digital domain and to assess the capacity of broadcasters and independent producers in this regard, considering the following factors:
 - i. Human resource capacity, training and development
 - ii. Technology and standards
 - iii. Financial implications including potential new revenue models
 - iv. Multi-media distribution platforms and interactivity

- v. Compatibility with export markets

To consider copyright and Intellectual Property issues in the digital environment.

4.0 Methodology of the Committee's Work

The Committee held its first meeting on 1st February 2010, at which the following methodology was adopted:

1. Divide the work of the committee into the following four (4) sub-committees:
 - i. **Technical:** chaired by Dr. Kwasi Diawuo and assisted by Ing. Dr. Adam Imoro.
 - ii. **Economics:** chaired by Mr. Joshua Peprah and assisted by Mr. Emmanuel Adisi.
 - iii. **Policy/Regulatory:** chaired by Major Emmanuel Owusu-Adansi (Rtd.) assisted by Chief Crystal Djirackor.
 - iv. **Consumer Affairs and Public Relations:** chaired by Mr. R. Kofi Nyantakyi and assisted by Chief Crystal Djirackor.
2. Hold periodic plenary meetings to consider reports of sub-committees.
3. Invite presentations from vendors of digital broadcasting transmission and receiving equipment.
4. Engage players in the broadcasting industry through:
 - i. Meetings with specific organisations and groups
 - ii. Workshops for entire broadcasting industry facilitated by international experts
5. Engage the press to:
 - i. sensitise them on digital broadcasting issues, and
 - ii. validate public education strategy
6. Subject draft report to public comment
7. Present final report to Government.

4.1 Stakeholder Consultations

The Committee engaged the industry stakeholders by holding meetings to brief them and to elicit their views and concerns on the migration process. The following is a list of meetings held with various stakeholders:

1. Meeting with the Board of the Ghana Broadcasting Corporation (GBC)
2. Meeting with the Council of the Ghana Independent Broadcasters Association (GIBA)
3. Meeting with Operating TV Stations
4. Meeting with Private TV Stations who were yet to commence operations
5. Capacity Building Workshop
6. Stakeholder workshop on Public Private Partnership (PPP)
7. Press Engagement
8. Interaction with Equipment Vendors and Technology Companies

4.1.1 Press Engagement

The Committee held a Press Engagement session on 5th May, 2010 at the Fiesta Royale Hotel, Dzorwulu, Accra and presented an introduction to digital broadcasting, its preliminary recommendations on the migration and its communications strategy to the press. The mascot and theme song were unveiled at the event. There was widespread media reportage on the event which was chaired by the Minister of Information, Honourable John Akologo Tia.

4.1.2 Meeting with private TV Stations which were yet to commence operations

The Committee, represented by the Co-chair and Secretary, met with licensed TV stations that were yet to commence operations on 11th May, 2010, at the NCA Boardroom to brief them about the committee's work and its preliminary recommendations. The stations were advised not to make any investments in the area of analogue transmitters since the digitalization was imminent.

The following stations were represented at the meeting:

- | | | |
|-----------------------------------|---|----------------------|
| 1. 3ABN Ghana | - | Dr. Elizabeth Asante |
| 2. Smart Multimedia Ghana Limited | - | Mr. Nana Yaw Konadu |

4.1.3 Meeting with Operating Private TV Stations

The Committee, represented by the Co-chair and Secretary, met with currently operating terrestrial broadcasters at the NCA Boardroom on 18th May, 2010. The following stations were represented:

- | | | |
|------------|---|-------------------------------------|
| 1. Net2 TV | - | Mr. Ernest Quaye Arday |
| 2. Viasat1 | - | Ms. Louise Becker, Mr. Rune Skogeng |

- | | | |
|------------------|---|--|
| 3. Coastal TV | - | Mr. Selete Nyomi, Ms. Eyram Dugah |
| 4. Skyy Digital | - | Mr. Wilson Arthur |
| 5. Metro TV | - | Mr. Fadi Fattal, Mr. Alhassan Haruna |
| 6. TV Africa | - | Mr. Berifi Apenteng |
| 7. GBC | - | Mr. Yao Apaloo |
| 8. TV3 | - | Mr. A. B. Dickson, Mr. R. Kofi Nyantakyi |
| 9. Black Star TV | - | Mr. Ashim Morton |
| 10. Crystal TV | - | Chief P. Crystal Djirackor |

The stations were briefed on the work of the committee and its preliminary recommendations including the proposed market structure in the digital broadcasting domain.

4.1.4 Capacity Building Workshop

The Committee held a capacity building workshop for the industry on Tuesday 29th – Wednesday 30th June 2010 at the Ghana-India Kofi Annan Centre for Excellence in ICT, Ridge, Accra. The seminar was facilitated by the following international experts:

1. Alan Downie, *Commonwealth Broadcasters Association (CBA), London*
2. John Bigeni, *DVB, Geneva, Switzerland*
3. Michael Starks, *Principal Editor of the International Journal of Digital Television, Oxford University, UK*
4. Pham Nhu Hai, *Head, Broadcasting Services Division, ITU Radiocommunication Bureau, Geneva, Switzerland*. Mr. Hai delivered his presentation from Geneva via Skype.
5. Chris Gandy, *Broadcast Consultant, Tadworth, England*. Mr. Gandy delivered his presentation from England via Skype.
6. Stuart Jack, *Nordicity, Canada*
7. Anton Lan, *Business Development Director, Altech UEC, Durban, South Africa*
8. Mlu Mhlungu, *Sales Manager, Altech UEC, Durban, South Africa*

Some of the topics discussed at the workshop included the following:

- ❖ Digital Migration Policy and Regulation

- ❖ Drivers for speedy uptake of DTV services (compelling content, affordable STBs, etc)
- ❖ Digital Migration Worldwide and International Frequency Plan
- ❖ Business Models in Digital Broadcasting Domain
- ❖ National Network Planning
- ❖ DVB-T Systems Review
- ❖ Set Top Boxes
- ❖ The Consumer Perspective to Digital Migration

4.1.5 Meeting with the Board of the Ghana Broadcasting Corporation (GBC)

The Committee represented by the Chairman, Co-chair, Secretary, Chairmen and Vice Chairs of the sub-committees, Mr. Alex Bannerman and Mr. Oscar Nchor, met with the Board of Directors of the Ghana Broadcasting Corporation (GBC) on Tuesday, 27th July, 2010 at the GBC Boardroom. The following members of the GBC Board were present:

1. Prof J.B.K. Aheto – Chairman
2. Mr. Edward B. Asare – Member
3. Mr. Yaw Wiredu Peprah – Member
4. Mrs. Vicky Wereko Andoh – Member
5. Mr. Gayheart Mensah – Member
6. Mr. Abdulai Dramani – Member
7. Mrs. Ophelia Ablorh – Member
8. Mr. Kwaku Mensah Bonsu – Member
9. Mr. William Ampem-Darko – Member/Director-General
10. Mr. Enoch Aboagye – Board Secretary

A presentation was made to the GBC Board to apprise them of the work of the migration committee. The Committee further sought clarifications from the Board on its relationship with NGB/Smart TV since its potential impact on the migration process was deemed disruptive. The GBC Board took note of the concerns of the Committee on the GBC/NGB relationship and its negative impact on the confidence of private broadcasters in sharing transmission resources with GBC.

The GBC Board also took note of the Committee’s intention to recommend to government and the NCA to license three distinct segments in the digital broadcasting value chain, namely: content, multiplexing and transmission. Broadcasters would be required to concentrate on content production and may not be licensed to perform functions of multiplexing and transmission in order to ensure a fair playing ground for all broadcasters who share a multiplex.

GBC notified the Committee of its intentions to separate its multiplexing and transmission units from the mainstream content generation activities. The committee discussed the concept of a Public Private Partnership (PPP) that could employ the relevant existing infrastructure and human capital of the state broadcaster, GBC and that of the private broadcasters in Ghana to form an independent transmission entity. The value of the assets contributed to the new entity could determine the share value of participating organizations in the PPP. The governance structure should be agreed upon by the participating organizations.

The GBC Board requested the Committee to explore other options for the establishment of the transmission company considering issues of National Security and GBC’s strategic role as a state broadcaster. The Board also committed to consider the committee’s recommendations in determining the future of GBC’s transmission operations.

4.1.6 Meeting with the Council of Ghana Independent Broadcasters Association (GIBA)

The Committee represented by the Chairman, Co-chair, Secretary, Chairmen and Vice Chairs of the sub-committees and Mr. Alex Bannerman met with the Council of the Ghana Independent Broadcasters Association (GIBA) on Thursday, 5th August, 2010 at the NCA Boardroom. The members of GIBA present at the meeting were:

- | | |
|---|----------------|
| 1. Mr. Alhassan Haruna (Deputy MD, Metro TV) | President |
| 2. Chief Paul Crystal Djirackor (CEO, Crystal TV) | Vice President |
| 3. Mr. Kwasi Agyemang (COO, e-TV Ghana) | Council Member |
| 4. Mr. James Appiah (CEO, Atlantis Radio) | Council Member |
| 5. Mr. Wilson Arthur (CEO, Skyy Digital) | Member |
| 6. Mr. Kennedy Arthur (CTO, Skyy Digital) | Member |

The Committee briefed GIBA on the benefits of digital broadcasting, the activities of the Committee and its preliminary recommendations. The issue of having a single signal distributor in Ghana was extensively discussed. GIBA expressed certain concerns about the option of establishing the signal distributor through a PPP. Some of these were:

- Apparent instability in the governance of GBC which could impact the new entity.
- Current perceived inefficiencies in GBC's operations which could be transferred to the new entity.
- The creation of a monopoly which could have a negative effect on pricing for broadcasters.

The meeting discussed these issues at length including the experiences of Arqiva in the UK and Sentech in South Africa, who operate monopoly signal distribution networks for TV broadcasters.

GIBA asked for time to discuss the issues raised at the meeting with its membership to enable them submit a position paper to the Committee. This paper was yet to be received by the Committee as of the time of preparing this report.

4.1.7 Stakeholder Workshop on Public Private Partnership (PPP)

The Committee organised a workshop on the concept of establishing a single signal distribution entity for broadcasting in Ghana through a Public Private Partnership (PPP) on Thursday, 19th August, 2010 at the Ghana-India Kofi Annan Centre for Excellence in ICT, Ridge, Accra.

The workshop was facilitated by the following experts from the Ghana Institute of Management and Public Administration (GIMPA):

- ❖ Nana Bright Oduro-Kwateng, *Associate Dean at the Greenhill College, GIMPA Business School*

- ❖ Dr. Koryoe Anim-Wright, *Director, Centre for Management Development, GIMPA Business School.*

The workshop was attended by a cross-section of the broadcasting industry including GBC (represented by its Board Chairman), Metro TV, Crystal TV, TV3, TV Africa, Net2TV, Multiple Concepts, 3ABN, Skyy Digital, MultiChoice Ghana, eTV Ghana, Multi TV, Dawuro Digital, Black Star TV and members of the Committee.

The following topics were discussed at the workshop:

- ❖ Overview of Digital Broadcasting
- ❖ Description of the PPP option for Ghana
- ❖ Implementation of some PPP strategies in Ghana
- ❖ Roles and Options of Stakeholders
- ❖ Experience of PPPs in other countries
- ❖ Mechanisms for Partnerships and Participation
- ❖ Challenges of PPPs

Extensive discussions ensued after the presentations with stakeholders expressing their fears, concerns and understanding of the concept. It was agreed that as far as the concept was laudable, more consultations need to be undertaken to ensure that the entity is well structured and governed to deliver the expected benefits.

4.1.8 Interaction with Equipment Vendors and Technology Companies

The committee met with representatives of the following equipment vendors and technology suppliers:

1. Net Insight, AB from Sweden & Harris Corporation, American equipment manufacturer
2. Japanese Technical Engineering and Consulting (JTEC) Services & NEC, Ghana
3. Avartec Pte Ltd., Singapore

The following companies made contacts with the Committee with the view to making presentations to the National Committee:

1. Media Broadcast GmbH, Germany

Media Broadcast signed a contract in 2009 with the Ghana Broadcasting Corporation (GBC) to install digital transmitter infrastructure in Ghana. Phase 1 of this DTT project was completed in second quarter 2010. Media Broadcast intended to present the results of Phase 1 and to propose a way to extend the network of transmitters nationwide by 2013 to achieve the desired results by way of coverage and reception.

However, the request to interact with the Committee came less than one week to the completion of the Committee's work. Therefore, the National Communications Authority would receive the presentation when notified.

2. Beijing Novel-Super Digital TV Technology Co., Ltd from China

This company has a contract with Multi TV Ghana and wanted to take advantage of their planned visit to Ghana to present their DTT solutions to the Committee. The company is yet to confirm a date for the presentation. Therefore, the National Communications Authority would receive the presentation when notified.

4.1.7.1 Interaction with Net Insight

Net Insight introduced their 'multi-service provisioning platform for a nationwide DTT distribution and contribution network' to the Committee. According to Net Insight, their Nimbra Platform is already implemented and in use in over 30 DTT networks worldwide and can be used to transport signals of all kinds and over any type (or mix) of network(s). This allows broadcasters to be able to benefit from existing Telco infrastructure for traditional TV/radio/etc broadcast until funds are cleared for building and implementation of own network. The multiservice function enables one network to provide multiple services which automatically reduces amount of investment (one network for TV/radio/other services). Net Insight indicated that their platform is scalable and so allows for growing in phases both with regard to sites as well as services. For example, digital radio broadcast can be added at later stage if required using same network as the digital TV broadcast.

Net Insight recommended that Ghana should implement a terrestrial network based on a combination of dark fibre and microwave links since terrestrial networks are future proof and enable the broadcast network operator to add further services from all sites. According to Net Insight, contribution and data services, as well as Video on Demand (VoD), data, Mobile TV (mTV), Digital Audio Broadcasting (DAB) or IPTV services, for example, could all be carried on the same network. A terrestrial network is also more secured against weather impact such as storms, rain, etc compared to satellite signals.

The Nimbra platform allows local insertion and also enables local languages, news, speeches, etc to be broadcast to specific locations only when required. They claimed their platform can transport up to 6 DTT multiplexes on one single STM-1 link. This makes it possible for a number of multiplexes to be carried throughout the network using the national fibre backbone and microwave links.

4.1.7.2 Interaction with Harris Corporation

Harris Corporation is a well known developer and manufacturer of television and radio broadcast systems and services, including transmission, infrastructure and networking. The company made a presentation to the Committee to describe its transmitter solutions and also to offer price estimates to give the Committee an idea of the costs of a nationwide transmission network.

Harris presented price estimates for transmitters, Program Input Equipment (PIE), antenna systems, combiners, generators and Uninterruptible Power Supplies (UPS), test and measurement equipment. Harris also shared insights from some of the DVB-T projects they have been involved in, in other countries.

Harris strongly recommended that a site survey should be carried out to determine the actual requirements and therefore, costs of a national network.

4.1.7.3 Interaction with JTEC & NEC

Japan Telecommunications Engineering and Consulting Service (JTEC) had carried out feasibility studies of GBC's studios and transmission network. Their work suggested that GBC required about 40 transmitting sites at about a cost of 8,400 million yen to accomplish a nation-wide terrestrial digital television transmission.

JTEC recommended that GBC/Government should apply for a Japanese Government Soft Loan to roll-out the public network. They indicated that two loans/assistance had already been agreed with the Government of Ghana in the areas of Roads and Irrigation. JTEC indicated their preference for the Integrated Services Digital Broadcasting (ISDB) standard. However, Ghana's choice of terrestrial TV standard would not be a precondition for a loan. They added that Japanese companies such as NEC manufacture DVB equipment for their clients in Europe.

The Committee considered the arguments for the ISDB standard but decided that the DVB family of standards would be ideal for Ghana as discussed in Part II of this report.

4.1.7.4 Interaction with Avartec Pte Ltd.

In June 2010 AVARTEC executed a field study in Accra to provide insight and first-hand data on consumer behaviours, technical transmission and coverage details including a test of AVARTEC products in the correct environment. The study involved the following:

- ❖ Existing DVB-T transmission network design, field strength, coverage maps and projections.
- ❖ Testing of current DVB-T transmission signal strength and signal quality from existing multiplexers with indoor and outdoor receiver solutions using AVARTEC STB TV receivers' indoor antenna and AVARTEC pocket TV receivers with built-in antenna.
- ❖ Testing of current DVB-T transmission signal strength and signal quality from existing multiplexers on the road using AVARTEC in-vehicle mobile TV receivers with outdoor antenna.
- ❖ Survey and analysis of how the Ghanaian public is currently receiving Analogue TV in both landed house, apartments, hotels and shopping centres and public buildings.

The results of the study were as follows:

- ❖ A customized last-mile solution should be implemented to take in consideration the characteristic of Ghana's DVB-T transmission network and consumer behaviours.
- ❖ The introduction and distribution in the country of basic and low quality STB could result in high level of complaints from the public for poor or unavailable reception creating rejection factors and frustration.
- ❖ The selection of a proper last-mile solution (Digital STB) must take into consideration the available DVB-T transmission coverage and installation methodology to minimize the effort from the public to replace the master antenna (MATV) with a digital version:
 - ❖ Receiver antenna selection must provide for both indoors reception as well as outdoor reception and must be offered with roof mounted or pole-mounted installation with sufficient cable lengths and mounting gears.
 - ❖ Receiver user manual must provide clear and detailed installation procedure with a step-by-step guide on how to replace the MATV antenna including a well-defined warranty and returning policy and customer care to contact for on-demand installation.
 - ❖ Receiver market distribution should be supported with on-demand installation service to be carried by trained installers to guarantee a proper customer service experience.

The company informed the Committee of its plans to enter into full scale production, by setting up an assembly and manufacturing facility in Accra to transfer its know-how and to support self sustaining high-quality product lines under a strict manufacturing QoS. According to them, the facility will guarantee a lower entry-level product cost that will facilitate the service pick-up to the public in Ghana and will also provide long-term job creation on both assembly lines as well as installation and distribution teams nationwide.

**PART II: MIGRATION FROM ANALOGUE TO DIGITAL BROADCASTING IN
GHANA**

5.0 Background to Ghana's Broadcasting Industry

The build up to digital broadcasting in Ghana has followed a long tradition of analogue broadcasting that started in 1935 with a BBC relay station established in Accra by the British colonial rulers. Broadcasting has grown from a monopoly industry to a highly competitive sector following the establishment of the converged electronic communications regulatory body in 1996. An overview of the major milestones in the history of Ghana's broadcasting sector is shown in Table 5-1.

Table 5-1: History of Broadcasting in Ghana

1935	First radio broadcasting system code-named radio ZOY (a relay service of the BBC) opened in Accra
1936	Radio station opened in Cape Coast, Central Region
1940	Building of Broadcasting House (BH2)
1954	National service of the Gold Coast Broadcasting System was set up
1956	Locally produced programmes increased, educational broadcasts to schools and teacher training colleges were started and outside events were broadcast live into homes
1957	Gold Coast Broadcast System became the Ghana Broadcasting System or Radio Ghana
1961	External service of Radio Ghana launched
1965	Television(Black/White) Service was launched/introduced on 31 July 1965
1968	Ghana Broadcasting Corporation (GBC) established by the National Liberation Council Decree 226 (NLCD 226) of 1968
1977	Ghana Frequency Registration and Control Board (GFRCB) established
1985	Colour Television launched in Ghana
1986	GBC began Frequency Modulation [FM] Broadcast in Accra
1993	National Media Commission (NMC) established by Act 449
1994-2002	GBC establishes 10 FM Services in all ten Regions
1995/96	GFRCB issues institutional, community and private radio station authorizations
1995/96	GFRCB issues private TV broadcasting authorizations
1996	Crystal TV starts transmission in Kumasi as first private TV station
1996	National Communications Authority established by Act 524
1997-2008	Metro TV, TV3, TV Africa, Viasat 1, Net 2 TV, Coastal TV begin terrestrial analogue VHF/UHF transmissions in major cities. Skyy (MMDS) established in Takoradi & Cable Gold (cable & MMDS Pay TV) established in Accra/Tema DSTV (First Digital Satellite Pay TV) & Multi TV (First free to view Digital Satellite TV) established in Ghana
2007	Mobile TV using Terrestrial Digital Multimedia Broadcasting (TDMB)

	technology launched by Black Star TV in Accra
2008	Pilot terrestrial digital video broadcasting system installed by GBC in Accra
2008	NCA Act 524 repealed and replaced by National Communications Authority Act, 2008, Act 769 and Electronic Communications Act, 2008, Act 775
2009	Digital video broadcast to hand held (DVB-H) launched by Multichoice Ghana Ltd. Commercial Terrestrial digital video broadcast launched by Skyy Digital in Takoradi & Accra.
Jan 2010	Establishment of Digital Broadcasting Migration Technical Committee
May 2010	GBC launches DVB-T transmissions in Accra and Kumasi

5.1 Legal and Regulatory Framework

Ghana's broadcasting sector is governed by Laws, Government Policies and regulations. The bodies of law and Government policy documents that affect the broadcasting industry include:

5.1.1 Policies

- ❖ NMC National Media Policy, 2000
- ❖ National Telecommunications Policy (NTP), 2005

5.1.2 Laws

- ❖ Ghana Broadcasting Corporation Decree, 1968, (NLCD 226)
- ❖ National Media Commission Act, 1993 (Act 449)
- ❖ National Communications Authority Act, 1996 (Act 524), repealed and replaced by:
 - ✓ National Communications Authority Act, 2008 (Act 769) and
 - ✓ Electronic Communications Act, 2008, (Act 775)

5.1.3 Regulations and Guidelines

- ❖ NMC Broadcasting Standards, 2000
- ❖ National Communications Regulations, 2003, (L.I. 1719)
- ❖ NMC Guidelines for Local Language Broadcasting, 2009
- ❖ Guidelines for the Deployment of Communications Infrastructure, 2010

The Ministry of Communications and Ministry of Information are responsible for giving Policy direction to the broadcasting industry in Ghana. Regulatory oversight of the broadcasting industry is administered by the National Communications Authority (NCA) and the National Media Commission (NMC). NCA administers broadcasting authorizations and technical standards whereas NMC oversees content issues.

5.2 Industry Statistics

Since the liberalization of broadcasting in Ghana, FM radio broadcasting has grown significantly albeit in the private/commercial segment. The distribution of FM radio stations in Ghana is shown in Figures 5-1 and 5-2. Figure 5-3 shows the distribution of Television broadcasting services in Ghana.

Satellite TV covers the entire country whereas Terrestrial TV covers approximately 80% of the population. Ghana Television (GTV), operated by the Ghana Broadcasting Corporation (GBC), currently has the most extensive Terrestrial TV coverage in the country. Appendices IX & X gives details of the terrestrial TV transmission network in Ghana.

Terrestrial TV is the most dominant TV reception platform in Ghana followed by satellite and cable respectively.

There was insufficient information available to enable the Committee estimate the number of TV sets available in the country. However, data from the Ministry of Trade and Industry (see Figure 5-4) indicates that three million, one hundred and eighty seven thousand, three hundred and thirty nine (3,187,339) TV sets were imported into the country from January 2007 to June 2010. It is interesting to note that the number of TV imports for the first half of 2010 already exceeds the annual figures for all the other years. However, the value of the imports for half year 2010 is less than the value of imports for 2009 (see Figure 5-5). This could point either to a reduction in the cost of TV sets or an indication of a high number of used TV sets which tend to be very cheap. If the latter scenario is the case, then the dumping of analogue TV sets due to digital switchover in many developed countries may have already started.

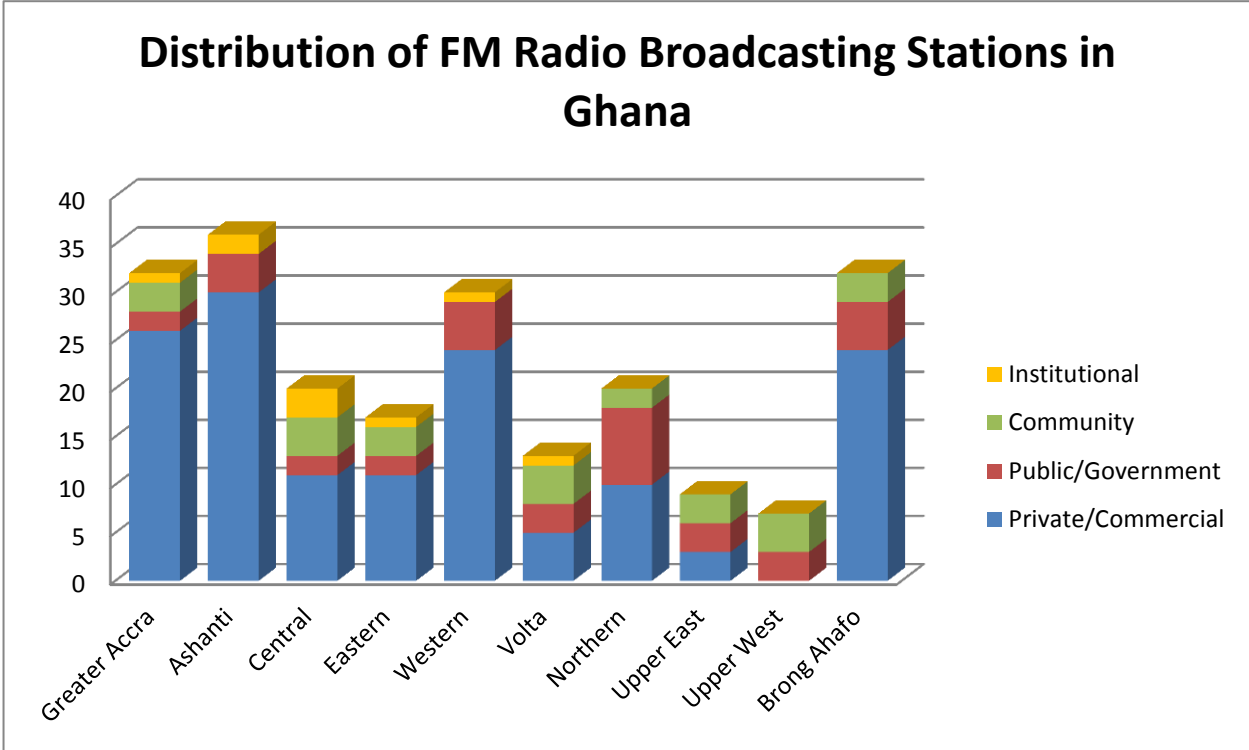


Figure 5-1: Disbriution of FM Radio Broadcasting Stations in Ghana (Data from NCA, 31 Dec 2009)

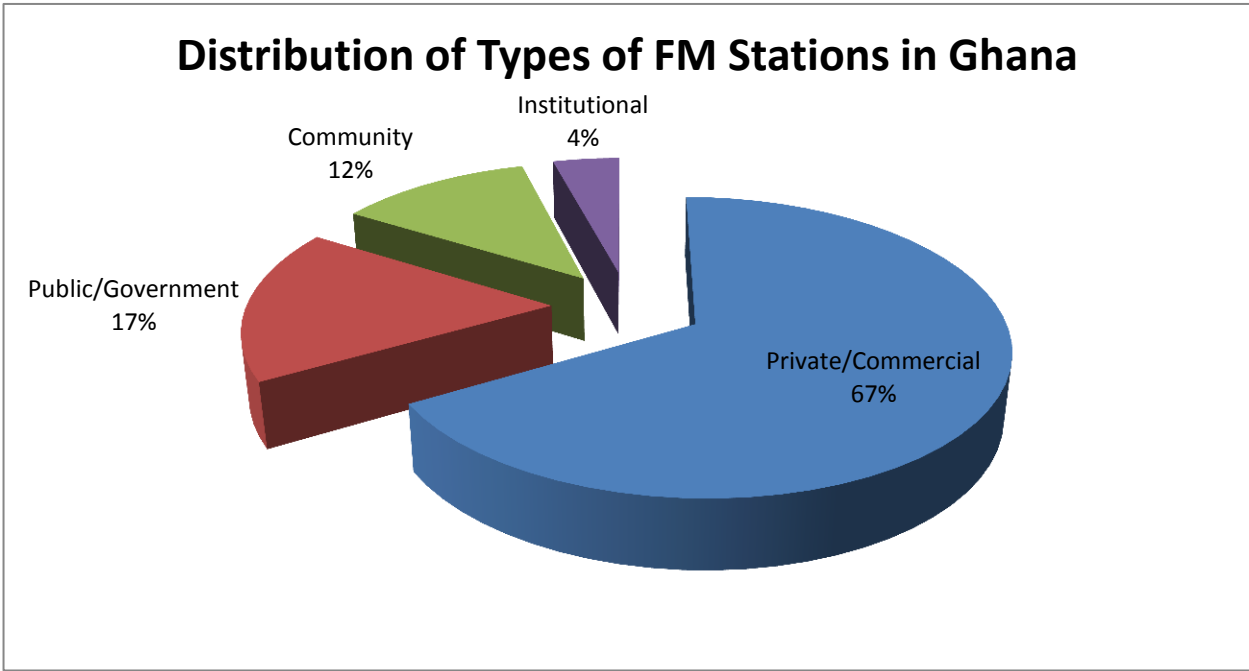


Figure 5-2: Distribution of Types of FM Stations in Ghana (Data from NCA, 31 Dec 2009)

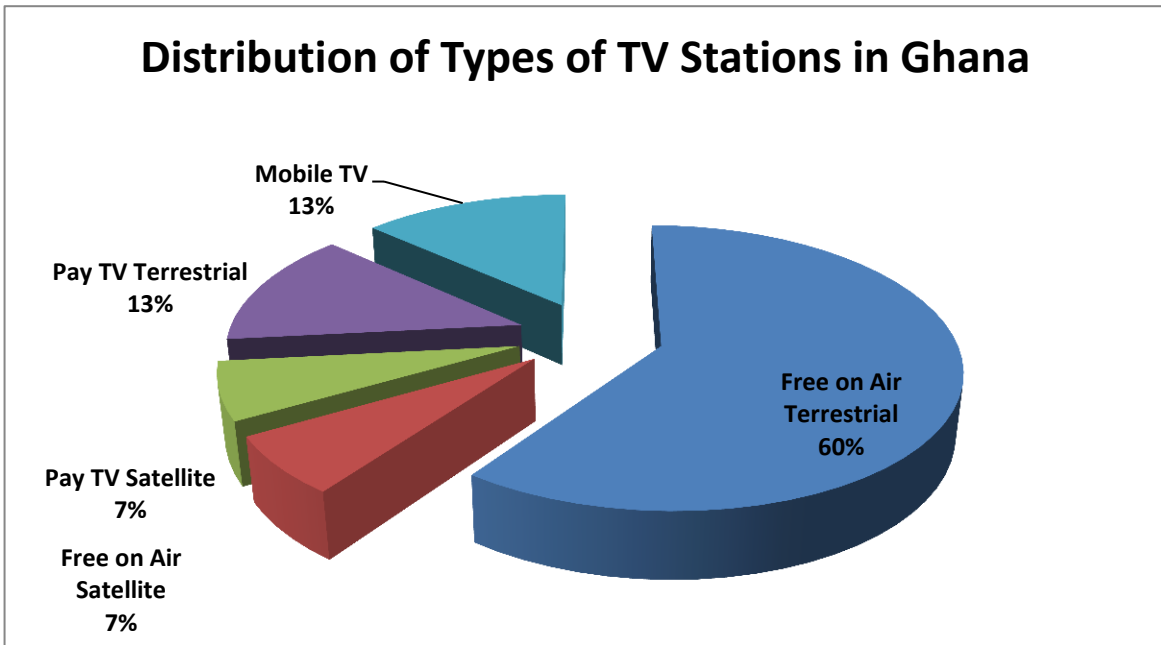


Figure5- 3: Distribution of Types of TV Stations in Ghana (Data from NCA, 31 Dec 2009)

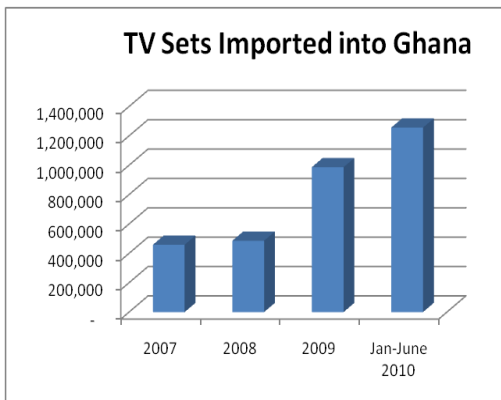


Figure 5-4 Imports of Television sets into Ghana (Data provided by Ministry of Trade and Industry)

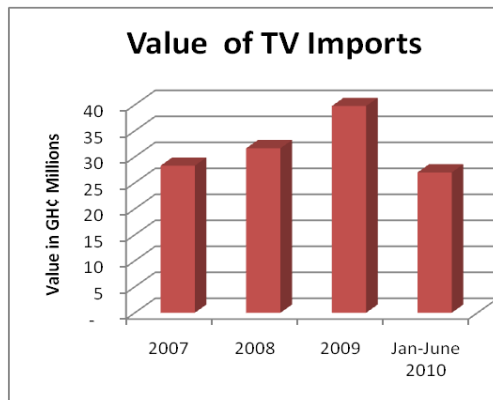


Figure 5-5 Imports of Television sets into Ghana (Data provided by Ministry of Trade and Industry)

6.0 Why Migrate from Analogue to Digital Broadcasting?

Digital broadcasting is the application of digital techniques and encoding of audio and video signals to transmit digital data rather than analogue waveforms on networks to end users / consumers. This results in clearer pictures, better sound, enhanced interactivity and higher spectrum efficiency.

Digital TV can be offered on various platforms including satellite, cable, terrestrial and handhelds (or mobile TV). Each delivery system brings its own advantages and challenges. Currently, satellite, cable and mobile TV broadcasting in Ghana are already digitized. The terrestrial platform is the only platform that is yet to be fully digitized even though it remains the dominant platform for TV reception in Ghana. The work of the National Digital Broadcasting Migration Technical committee focused on the digital terrestrial television broadcasting platform which is described in Appendix III.

6.1 Benefits of Digital Broadcasting

The salient features and benefits of Digital TV include:

- ❖ Higher Spectrum Efficiency as shown in Figure 6-1.
 - a single frequency channel can be used to transmit multiple programme channels
 - Adjacent channels can be used which is impossible in analogue broadcasting
- ❖ Better Picture quality as shown in Figure 6-2 (no ghosting, blurred images, etc)
- ❖ Clearer Sound (CD quality audio)
- ❖ More Stations and therefore more choices
- ❖ More Interactivity (including electronic programming guides (EPG), games, etc)

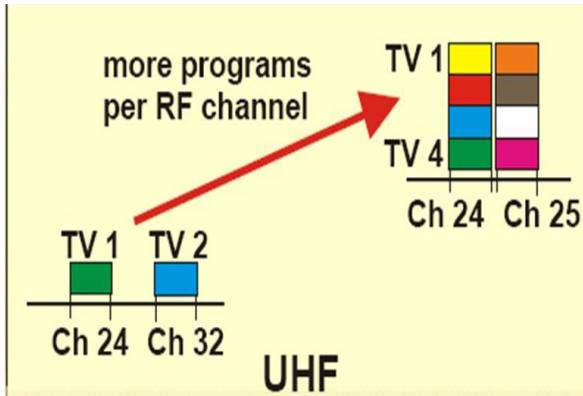


Figure 6-1: Spectrum Efficiency of Digital Broadcasting

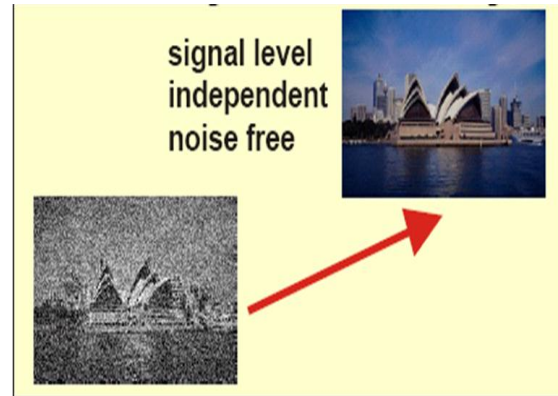


Figure 6-2: Enhanced picture quality of Digital Broadcasting

6.2 Reasons for the Migration

The migration from analogue to digital is necessary and urgent for the following reasons:

- ❖ To comply with and adopt the tenets of the GE-06 Agreement.
- ❖ To rapidly adopt spectrum efficient methods in the management of the scarce RF spectrum to broaden its utility as a resource in the interest and benefit of stakeholders.
- ❖ To prevent dumping of obsolete analogue transmission equipment into the country to protect the environment, investors and consumers.
- ❖ To enhance the quality and experience of TV viewers in Ghana by improving terrestrial TV transmission and reception.
- ❖ To promote environmental sanity through co-location of broadcast transmission infrastructure.

6.3 Digital Migration and National Government Priorities

His Excellency the President has set out the government's vision of creating a **'Better Ghana'**; through a transformed and prosperous nation providing opportunities for a better life for all Ghanaians. The Committee explored various ways in which the migration from analogue to digital can contribute to the vision of the Government. The following three (3) areas were identified:

1. Employment Generation

2. e-Governance and
3. Assistance for the most Vulnerable

6.3.1 Employment Generation

The migration from analogue to digital broadcasting creates some avenue for employment generation through the establishment of set-top box (STB) assembly plants. It is expected that over six (6) million set-top boxes may be required to convert analogue TV sets to receive digital signals. It was observed that an electronics assembly industry is emerging in Ghana following the successful establishment of computer/laptop assembly plants, mobile phone assembly plants and flat screen monitors/TV set assembly plants in the last few years. It is therefore recommended that an enabling environment should be created within the framework of the Ghana Industrial Policy, 2010 to encourage the establishment of local STB assembly plants. This would ensure the transfer of technology and knowledge to Ghana.

In addition to the employment that can be generated from STB assembly plants, there could be more employment opportunities from the sales, installation and maintenance of STBs in all ten (10) regions of the country.

The capability of digital transmitters to carry more programme channels presents opportunities for the growth of the creative industries. It is expected that more investment would be channelled into local content generation. This could generate more employment for people with creative talents: script writers, TV/movie directors, actors, artists, video editors, etc.

6.3.2 e-Governance

e-Governance is another priority area of Government. e-Governance leverages Information and Communication Technology (ICT) to strengthen and improve the quality and efficiency of public administration. It improves Government communication with citizens and businesses, lowers costs and speeds up internal processes substantially. It also raises the quality and transparency of public services considerably to everyone's benefit.

The interactive services that can be delivered through digital broadcasting offer an opportunity to extend e-government services to many more citizens. There are three different types of interactive services that can be delivered through digital television:

- ❖ Stand alone information services
- ❖ Transactional services
- ❖ Enhanced programming

These services, or ‘content’ may be delivered in two ways via digital television:

- ❖ Transmitted as TV channels and
- ❖ Video On Demand

With interactive digital television, the TV becomes a means of gaining access to new kinds of information and entertainment. e-government, e-health and distance learning can be provided over the digital television platform. Viewers can also use interactive TV access for simple applications such as e-mail, home shopping, gambling and games. This provides an opportunity to bridge the digital divide and to further enhance e-government initiatives. A bundled DTV/internet offering is expected to be very attractive to the proportion of the population that do not have a personal computer with which to gain internet access.

The Committee therefore recommends that the Government and Metropolitan, Municipal and District Assemblies (MMDAs) consider the potential of Digital Television to enhance their strategies for e-government and bridging the digital divide.

6.3.3 Assistance for the most vulnerable

Consistent with the vision of creating a ‘better Ghana’ for all, the Committee recommends that the Government establishes a Digital Broadcasting Migration Help Scheme to assist the extremely poor and vulnerable to ensure that no citizen of Ghana who currently watches television is deprived of that right through the migration from analogue to digital broadcasting. It is recommended that this Help Scheme should be designed as part of the National Social Protection Strategy (NSPS) and the Livelihood Empowerment Against Poverty (LEAP) Programme.

7.0 Standards

7.1 Terrestrial TV standards

There is no worldwide standard for digital broadcasting. Different markets have developed or adopted different standards. Europe and Africa have mainly adopted Digital Video Broadcasting (DVB), North America has mainly adopted Advanced Television Systems Committee (ATSC) and the Japanese and some South American states have adopted Integrated Services Digital Broadcasting (ISDB) standards.

The Committee recommends the adoption of DVB-T (EN 300 744) for terrestrial digital television broadcasting, in accordance with the decisions taken at RRC-06 for the following reasons:

- ❖ DVB-T was the standard used in the GE06 Agreement, to which Ghana is a signatory. The standard has been proven to deliver all the benefits expected from digital broadcasting. Implementing it in Ghana would ensure harmonization with neighbouring states.
- ❖ The Japanese (see interaction with JTEC in section 4.1.7.3) have strongly recommended the adoption of the ISDB standard. However, DVB-T has been proven to deliver all the functionalities that ISDB can offer.
- ❖ In September 2009, the second generation terrestrial DVB standard (EN 302 755), popularly called DVB-T2 was published. DVB-T2 is said to offer about 50% increase in efficiency over any other DTT standard in the world. However, since DVB-T systems have already been deployed in Accra, Cape Coast, Koforidua, Kumasi and Takoradi, the same standard should be deployed across the country until the completion of the switchover from analogue to digital broadcasting. The benefits of DVB-T2 can be harnessed for the deployment of additional services after analogue switch-off.
- ❖ The immediate adoption of DVB-T2 or ISDB may prevent the country from benefitting from the economies of scale that have significantly reduced the costs of DVB-T receiving equipment.

The Committee also recommends the adoption of **H.264/AVC/MPEG-4 (part 10) and Advanced Audio Coding (AAC)** as the standard for video and audio source coding/compression respectively. The reasons for the above recommendation are:

- ❖ To provide for more spectrum efficiency (e.g. H.264/AVC offers a compression rate half that of MPEG-2 for the same perceived quality).
- ❖ To provide for interoperability with other multimedia platforms eg. Internet video/audio, handhelds (mobile TV), etc.
- ❖ To facilitate the seamless introduction of HDTV in the future.
- ❖ To prevent commencing digital broadcasting on legacy system (EU is consulting on “Ensuring the availability of a compression standard on all DTT receivers sold after 1 January 2012 that is at least as efficient as the H.264/MPEG-4 AVC standard” within its community)
- ❖ Most MPEG-4 set-top boxes are backward compatible with MPEG-2.

7.2 Satellite and Cable TV Standards

It is recommended that the DVB-S and DVB-C standards should be adopted for digital satellite and digital cable television respectively. These standards have already been implemented in the country. DVB-S2 and DVB-C2 should be adopted when appropriate.

7.3 Mobile TV Standards

It is recommended that a technology neutral approach is adopted for mobile TV because at least two (2) mobile TV standards have been commercially introduced in the country. Digital Video Broadcasting for Handhelds (DVB-H) was adopted by Multichoice Limited for their *DSTV Mobile* service, whereas Black Star TV Limited adopted the Terrestrial Digital Multimedia Broadcasting (T-DMB) standard for their *Fone TV* service. It is the opinion of the Committee that both standards should be allowed to operate because Mobile TV would mainly remain a premium service.

7.3 Standards for Digital TV Receivers

Digital TV Receivers refer to all devices capable of receiving DVB-T signals in order to present the audio and video content transmitted. The two main types of digital receivers are:

- i. Integrated Digital Television (iDTV) sets and
- ii. Set Top Boxes (STBs)

It is anticipated that set-top boxes would be the primary means by which many Ghanaian households would view digital television. Digital receivers are very vital to the success of the migration from analogue to digital broadcasting. The Committee extensively discussed the minimum specifications for digital TV receivers (both iDTV & STB) with the aim of balancing the need to have the most up to date technology with the need to keep prices at an affordable level. The minimum specifications for set-top boxes are detailed out in Appendix IV.

The Committee recommends that the Ghana Standards Board (GSB) should be resourced and mandated to conduct receiver compliance testing for Free-to-air Digital TV receivers. Those receivers which pass the tests and thereby meeting Ghana's National DTT specification would be eligible to be licensed to use the receiver certification logo shown in Figure 7-1. The logo will confirm to consumers that the receiver is Ghana DTT compliant.



Figure 7-1 Receiver certification logo

Manufacturers/distributors who wish to supply DTT receivers in Ghana would have to arrange for testing of samples prior to local production / importation.

It is also recommended that after analogue switch-off, all television receivers made, assembled or imported into Ghana should contain a digital tuner that conforms to the national standards. Furthermore, six (6) months to the date announced by the Minister of Communications for the commencement of analogue switch-off, TV receivers that do not conform to the standards should be identified by sellers at the point-of-sale as not conforming to Ghana's DTT standard. This is

aimed at providing consumers with accurate information to assist them in making their choice of purchase.

The conformance certification should be applied strictly to enhance the success of the migration.

8.0 Policy, Legal and Regulatory Framework

8.1 Role of Government in the Migration

The migration from analogue to digital television broadcasting would have an impact on almost every citizen of this country considering the pervasiveness of television access and the reliance of the populace on TV for information dissemination, education and entertainment. The profound impact of the migration process makes it a national priority and therefore must be of serious concern to the Government (of the Republic) who is currently providing overall leadership in the process.

It is the objective of the Government that in the migration from analogue to digital broadcasting:

- ❖ Citizens and households would be protected from losing their rights to watch free-on-air television. In this vein:
 - Existing analogue terrestrial free-on-air TV transmissions must continue for a reasonable period of time after digital transmissions have been introduced to enable citizens prepare adequately for the analogue switch-off.
 - Citizens should be well informed of the migration process and about all the options available to make them ready for analogue switch-off.
 - Equipment for converting digital signals for viewing on existing analogue television sets should be broadly available and affordable.
- ❖ Spectrum should be used efficiently as a scarce national resource.
- ❖ The fledgling democracy of Ghana should be deepened by the increasing availability of information and interactivity through the opportunities offered by digital broadcasting.
- ❖ Fairness, equitable access and an enabling environment for growth and profitability should be promoted in the broadcasting industry.

To help achieve the objectives of Government, it is expected among other things that Government would do the following:

- ❖ Publish appropriate Policy Statement including a timetable for the process.

- ❖ Ensure the passing of appropriate legislation or amendment of existing laws to provide the legal framework for the migration process.
- ❖ Develop and implement appropriate fiscal measures to promote affordable access to set-top boxes and the deployment of efficient broadcasting infrastructure.
- ❖ Provide the required financial resources for the consumer campaign and education.
- ❖ Provide an enabling environment for the growth of the local content development industry and also provide protection for investors.
- ❖ Facilitate the creation of employment opportunities identified in the process.
- ❖ Assist broadcasters during the transition period by way of policy interventions to cushion them from the impact of the migration.

8.2 Legal Framework

To have a successful public change programme, unequivocal Government and regulator support underpinned by appropriate laws/statutes is essential. It is therefore recommended that the appropriate legal backing for the migration process should be put in place as soon as possible. This would prevent any setbacks that may arise as a result of legal proceedings.

Since the migration process borders mainly on the change of analogue transmission technologies to digital technologies, the Committee recommends that an Amendment of the Electronic Communications Act, 2008, (Act 775), should be undertaken to provide for the following:

- ❖ Empower the Minister of Communications to:
 - Announce a date for the switch-off of analogue television transmission under certain conditions such as the availability of digital TV signals and an appreciable level of uptake by the citizenry.
 - Announce a date to outlaw the importation of television receivers that do not have built-in digital tuners and to mandate sellers of television receivers to indicate at the point of sale if receivers do not have built-in digital tuners.
 - To establish and resource a Digital Broadcasting Migration Implementation Body, which would be a special purpose vehicle to oversee the migration program and which would cease to exist six (6) months after analogue switch-off is complete.
- ❖ Mandate the National Communications Authority (NCA) to:

- Replace licenses of existing broadcasters and to impose obligations on them towards the migration from analogue to digital broadcasting.
 - Impose obligations on signal distributor(s) including co-location of transmitters for the same coverage target.
 - Impose must-carry obligations on satellite and cable operators when it deems it necessary
- ❖ Other issues incidental to the migration from analogue to digital broadcasting.

It is also recommended that the Broadcasting Law under deliberation and review by both Cabinet and the Legislature should incorporate digital broadcasting as a critical component. The law must also make provisions for the regulation of broadcast content including the promotion of local content.

8.3 Regulatory Framework

8.3.1 Market Structure

Three distinct market segments (see Figure 8-1) have been identified in the digital broadcasting value chain:

- ❖ Content producers/broadcasters,
- ❖ multiplex operators and
- ❖ signal distributors/transmission network operators.

This has implications for licensing and/or authorising of services in the digital broadcasting domain (see Section 8.3.3). It is recommended that at the inception of digital broadcasting, the broadcasting value chain should be **segmented into two**:

- ❖ broadcaster and
- ❖ signal distributor and multiplexer

This means that signal distributor should also be allowed to operate multiplex(es). A strict separation between content provision and multiplexing is however required to ensure fair competition for all broadcasters.

In the long term, the multiplexing function may be separated from signal distribution depending on the dynamics of the market, as well as acquired capabilities and capacities in evolving business models.

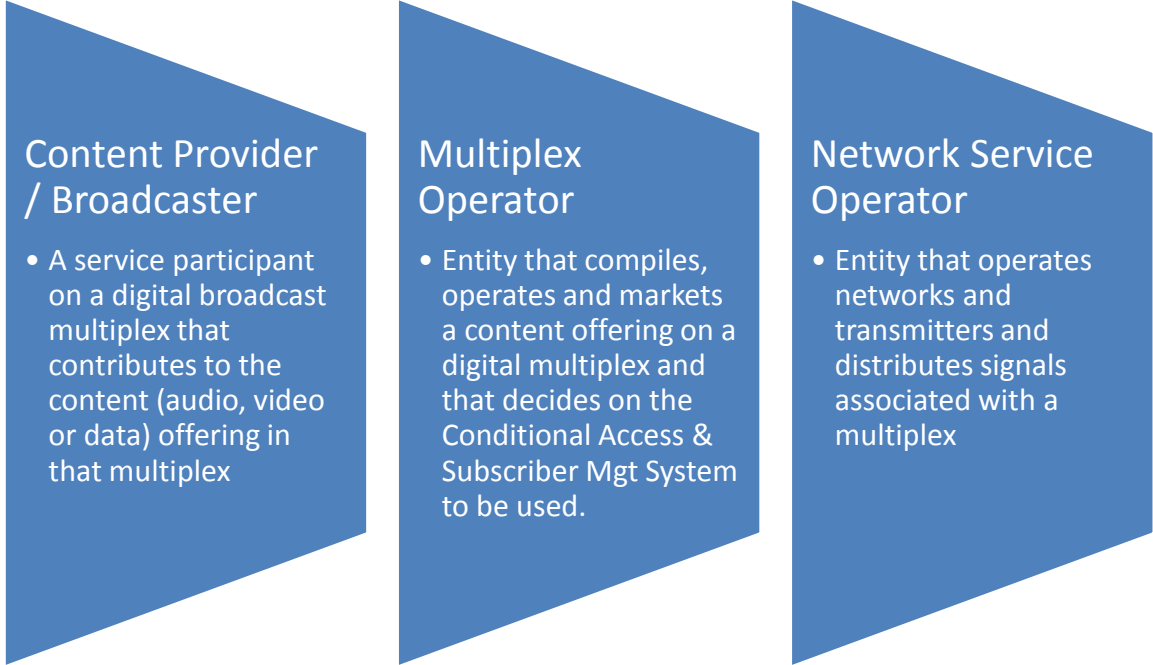


Figure 8-1 The Digital Broadcasting Value Chain

8.3.2 Signal Distribution Entity

In the existing analogue broadcasting market place, broadcasters establish studios for content production and build their own transmission networks. Capital and operational expenditure of broadcasters are greatly increased by the establishment and maintenance of transmission networks in addition to content generation and/or acquisition. These account for the limited coverage of most private broadcasters in Ghana who tend to cover economically active urban areas and their environs.

The lack of infrastructure sharing among broadcasters has resulted in the varied location of transmitters targeted at covering the same geographical area. This makes it difficult for viewers using a single directional antenna to receive all the channels clearly. For example, in Accra, it is rare to receive all eleven (11) free on air terrestrial channels clearly at any one location using a

single receiving antenna. Most viewers using directional antennas often receive one (1) or two (2) channels clearly and experience ghosting, blurred images, wavy lines across images and/or poor sound on the other channels. It is therefore important that all line-of-sight broadcast systems, especially television broadcast transmitters are co-located.

In addition to cost and poor reception, the setting up of several parallel transmission networks results in the deployment of several masts. There have recently been several complaints from a cross-section of the general public craving for environmental sanity; specifically environmental aesthetics, noise limits from generators and protection from the perceived potential health hazards of antennae radiation emission. In response to public concerns, agencies with jurisdiction over construction of masts particularly the Environmental Protection Agency (EPA), have taken tougher stances in the issuance of permits, thus causing delays in the construction of new transmission sites. To address these challenges, the Government established an Inter-Ministerial Group (IMG) composed of the Ministers of Communications, Science & Environment and Local Government to develop a scheme that will over the long-term facilitate a one-stop-shop mechanism to speed up the permit acquisition process, to enable operators deploy the necessary assets to enhance coverage and quality of service.

Digital broadcasting offers an opportunity to overcome some of the challenges, since one transmission network can carry multiple programme channels. In fact, facility sharing is convenient, environmentally friendly, less hazardous and cost effective in the digital broadcasting domain.

The Committee considered that one (1) independent signal distribution entity established through a Public Private Partnership (PPP) would be ideal for the digital broadcasting market in Ghana. However, considering the interests of certain private investors to establish private broadcasting infrastructure to promote competition, market efficiencies and offer choice and/or redundancy to broadcasters, the committee recommends **that at most two (2)** signal distributors should be licensed at the inception of digital broadcasting.

It is recommended that at least one (1) one signal distributor should be an **independent** entity, established through a PPP. The relevant existing transmission infrastructure assets of GBC could represent the public contribution to the new entity. The Committee took note of the installation of DVB-T systems in Accra and Kumasi by GBC using public funds provided by the State. However, the stakeholder consultations revealed that most private broadcasters were apprehensive about depending solely on a signal distribution entity established and operated by GBC or a wholly owned subsidiary of GBC. It was observed that most private broadcasters harboured a seeming mistrust and a perception of inefficiency and unstable governance arising from regular changes in GBC's leadership, staff agitations, perceived government interference, etc., that could negatively impact the signal distribution company.

The fact however remains; that the State has over the years invested in GBC to develop some of the best transmission sites across the country. GBC currently has the most extensive transmission infrastructure in the country and its resources would be critical in deploying digital TV transmitters across the country.

The Committee is of the opinion that a transparent and independent signal distribution entity that is established through a Private Public Partnership (PPP) would help facilitate the working together amongst the public and private broadcasters. It could enable all the parties to better utilize resources by promoting efficiency and transferring the various levels of risk to those who are best equipped to manage it. Ghana stands to benefit from the successful synergy between the public and private sectors in broadcasting. The establishment and operation of a broadcast signal distribution entity through a PPP would help achieve the following:

- ❖ Allow public and private broadcasting organizations to accomplish more in concert than they could separately.
- ❖ Improve infrastructure and service delivery efficiency.
- ❖ Ensure that competition in broadcasting is based on content and not coverage which in the case of free-to-air broadcasting would be for the public good.

PPPs can be quite complex, since the different participants may each have a different perspective, which may not always be fully understood by the other participants. The Committee

therefore recommends that Government establishes a working group comprising representatives from the Ministry of Information, Ministry of Communications, Ministry of Finance and Economic Planning (Project and Financial Analysis Unit), National Media Commission, National Communications Authority, Ghana Broadcasting Corporation and the Ghana Independent Broadcasters Association (GIBA) to negotiate the creation and governance structure of the signal distribution entity. It is important that this working group is guided by the following principles:

- ❖ Value for Money
- ❖ Accountability
- ❖ Transparency
- ❖ Equitable distribution of risk, reward and control
- ❖ Protecting the public interest

8.3.3 Licensing Framework

To formalize industry collaboration and partnership in the migration process, it is recommended that the National Communications Authority (NCA) should develop licenses as follows:

- ❖ Digital Replacement Licenses for existing licensed broadcasters to
 - Switch off analogue by the official analogue switch-off date announced by Government and switchover to a digital platform.
 - Relinquish all VHF/UHF TV frequencies assigned by NCA upon analogue switch-off.
 - Require communication with viewers and co-operation with other stakeholders
- ❖ Digital Television Service Authorisation for new commercial broadcasters seeking to provide digital television programme content after they have negotiated carriage on a multiplex.
- ❖ Multiplex Licence for companies who demonstrate the capacity to aggregate content to fill a multiplex and provide other services necessary to manage a multiplex. A multiplex

licensee must have the ability to get signals distributed to specified coverage areas that match the National Digital Broadcasting Migration timetable and coverage targets.

A multiplex operator that aggregates content of different local broadcasters should not itself be a broadcaster.

- ❖ Wireless Infrastructure Licence to independent entities to operate a network of transmitters to cover specified areas nationwide.

The Committee recommends that in considering applications for Digital Television Service Licenses, a joint Working Committee of the National Communications Authority (NCA) and the National Media Commission (NMC) should be formed. This would ensure that adherence to broadcasting standards and guidelines are properly enforced.

9.0 Proposed Timetable for the Migration

The migration from analogue to digital will normally involve three stages:

- Digital Switch on (which has already commenced with the operation of digital terrestrial TV transmissions in some cities in Ghana)
- Double illumination / simulcast (i.e. the period when programs are broadcast in both analogue and digital formats as is the case for GBC and the existing free-to-air operators on the GTV& Skyy multiplexes).
- Analogue switch-off (i.e. the date from which analogue broadcasting transmissions will be terminated)

9.1 Analogue Switch-off

The factors considered in determining an appropriate analogue switch-off target date include:

- ❖ Mitigating the overall cost of the switchover by choosing a minimal simulcast period as possible. A date that gives the best economic outcome through bringing forward the digital dividend and reducing cost duplication during the transitional period is desirable.
- ❖ Spectrum efficiency. A date that ensures delivery of spectrum efficiency (as soon as possible), is desirable.
- ❖ Universal Access to broadcasting signals. A target date that does not widen the 'digital divide' between equipment have and have-nots is desirable. It is undesirable and unacceptable to deprive any citizen of access to television signals through the migration process.
- ❖ Keeping up with international deadline to cease protection for analogue signals by 17 June 2015. A target date that allows room to manoeuvre in relation to the global ITU-RRC agenda for digital migration is desirable.

The several possible approaches to analogue switch-off, include the following three main methods:

- ❖ Phased switch-off of analogue services where analogue switch-off can take (takes) place region by region. In this process a national switch-off timetable is prepared indicating when each region switches off analogue. This method was employed in the United Kingdom. The benefits of this approach include:
 - Lessons learnt in one phase or region can be applied to improve the process in another region.
 - If no government subsidies are provided on set-top boxes, this method allows for areas where DTV take up is likely to be slow for economic and other reasons to switch-off at later dates, making sure that citizens are not deprived of access to television viewing.
 - Frequencies released from a neighbouring region could be re-used in another to increase coverage and expand services.

- ❖ Nation-wide switch-off of analogue services where analogue switch-off takes place at the same time nationwide. This approach was used in the United States of America (USA). This approach allows all viewers to simultaneously benefit from the advantage of digital switchover, ensuring that all viewers are treated equally and given the same access to all services. However, Government subsidy on receiving equipment might be necessary if the time frame for analogue switch-off is relatively short.

- ❖ Partial switch-off of analogue services where some analogue terrestrial TV services are ended in order to release frequencies for a subsequent digital broadcasting launch. This is necessary where finding available digital channels compatible with existing analogue channels is a challenge. This also eliminates the need for a prolonged double illumination period. However, viewers will temporarily lose access to some terrestrial TV services until they are restored on the digital platform.

After reviewing all the available options and the desirable factors for setting a date for analogue switch-off, the Committee **recommends a phased analogue switch-off process** according to the following timetable:

9.2 Proposed Timetable for Digital Migration in Ghana

Table 9-1: Proposed Timetable for Digital Migration

Item	Activity	Start Date	End Date	Action By
1.	NDBMTC Final Report to Govt	13 th Jan 2010	30 th August, 2010	
2.	Development of Legal Framework (Amendment of Electronic Communications Act 775)	September 2010	December 2010	MoC AG NCA NDBMTC
3.	Public Awareness Campaign	September 2010	December 2010	NDBMTC
4.	Establishment of National Digital Migration Implementation Body	January 2011		GOG, MOC, MoI, MoFEP, NCA, NMC, GBC, GIBA
5.	Licences for Digital TV	January 2011	March 2011	NCA NCA/NMC Sub-committee
6.	Public Awareness Campaign	January 2011	December 2014	National Digital Migration Implementation Body
7.	Nationwide Roll-out of Digital TV (Simulcast Period)	April 2011	2013	National Digital Migration Implementation Body
8.	Coverage of all Regional Capitals & environs	By December 2012		National Digital Migration Implementation Body
9.	Phased Analogue Switch-off	To be determined according to locations and conditions		National Digital Migration Implementation Body
10.	Completion of Switchover	December 2014 (target date)		
11.	Appraisal Report of Switchover Process	Six (6) months after completion of switchover		

9.3 National Digital Migration Implementation Body

To ensure a successful delivery of the migration from analogue to digital broadcasting in Ghana, the Committee recommends that a new, single-purpose, centralised delivery vehicle should be established with a clear remit to lead the implementation of the project. This body is most likely to deliver the migration on time and within cost.

It is important that people with relevant knowledge of the broadcasting industry and digital broadcasting issues, project management and mass communication are engaged to run this new body. Sufficient budgetary allocations should be made to ensure that this body is able to carry out its functions.

The new body must be impartial and should therefore have no prejudices. This would enable it to develop fresh and unbiased relationships with stakeholders as it carries out its role of organising programme activity, supporting and co-ordinating stakeholder activity towards a common goal.

10.0 Public Education/Consumer Communications Strategy

The Committee identified the need for comprehensive and extensive public education considering the relatively high illiteracy rate in the country and the relative complexity of the switchover from analogue to digital television. It is therefore recommended that a well coordinated public education programme should be undertaken to prepare the populace for the migration process in order to avert chaos, panic and anxiety.

The committee recommends that the content of the public education materials should be *carefully* selected. Furthermore, the message should be *simple* and *straight forward*.

It is recommended that public education materials should be transmitted in at least the following languages identified to be widely spoken in Ghana:

- ❖ English
- ❖ Twi
- ❖ Dagomba
- ❖ Ga
- ❖ Nzema
- ❖ Ewe
- ❖ Hausa

Where necessary other local dialects should be employed to ensure that no citizen of Ghana is marginalised in the migration process.

A multi-faceted communications strategy to create awareness, encourage uptake of Digital TV services and educate the public on recommended migration options and digital TV equipment.

It is recommended that all media platforms including electronic (TV, FM Radio, websites, sms broadcasts, etc), print (newspapers, brochures, handbills, etc) and outdoor (bill boards, posters, etc) should be employed in the public awareness programme.

The communications programme should be layered as follows:

- National advertising (to raise overall awareness)
- Regional advertising (to increase awareness and promote understanding)
- District Advertising (to promote understanding and encourage action)
- Local Area advertising using information vans (to promote understanding and encourage action).

10.1 Mascot

The committee recommends the use of an animated mascot, 'Koo Digi' shown in Figure 10-1.

Koo Digi is an animated TV set with human features. It wears a full 'batakari' costume beautifully woven with the national colours sporting a thumb up for 'It's Digi Time' in Ghana. The mascot was designed by Cecil Jones Abban for Parables Productions. The animation of the mascot is attached to this report.

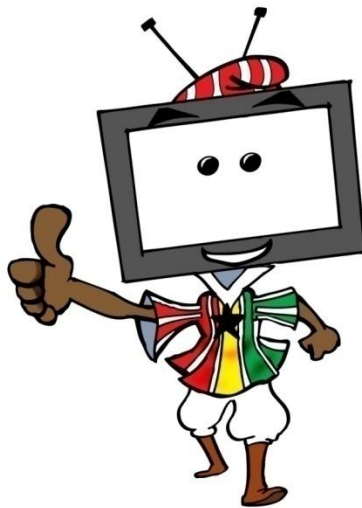


Figure 10-1: Koo Digi, Mascot for the Digital Broadcasting Migration Campaign

10.2 Migration Theme Song

The committee recommends the use of a theme song that carries the salient features and benefits of Digital TV to the consumer. A song composed and produced by Zapp Mallet for Title Track

Productions entitled, 'TV will never be the same' is recommended for use in the public promotion. The lyrics of the song are as follows:

*Do you know that change is taking place; Ghana is going digital Oh Oh!
Your television will never be the same; we are going digital Oh Oh!*

*Its digitime here in Ghana, clearer picture and better sound,
Your television will never be the same.
We are going digital Oh Oh!*

*It's digitime here in Ghana
You have more stations on your TV
Your television will never be the same.*

*We are going digital. It's digitime,
We are going digital. It's digitime.*

Your television will never be the same, we are going digital.

It's digitime in Ghana!

A copy of the song is contained on the CD attached to this report.

11.0 Estimated Costs of the Migration

The committee has put together the following cost estimates for various segments of the migration process to serve as a guide for budgetary purposes. It is recommended that the appropriate procurement processes in line with the Public Procurement Act, 2003, Act 663 wherever public funds would be employed.

11.1 Transmission Infrastructure costs

The cost elements in rolling out the transmission infrastructure would cover the following:

- ✓ Studio Multiplex Links (SMLs)
- ✓ Multiplex-Transmitter Links (terrestrial/satellite microwave, fibre)
- ✓ DVB-T Transmitters
- ✓ Programme Input Equipment (PIE) Equipment
- ✓ Antenna Systems
- ✓ Feeder Cable & Connectors
- ✓ x Port Combiners
- ✓ Standby Generators
- ✓ Automatic Voltage Regulators
- ✓ Uninterruptible Power Supplies (UPS)
- ✓ Test and Measurement Equipment
- ✓ Transport links
- ✓ Civil Works
- ✓ Towers/Masts or their modification to suit digital transmission

Estimates considered by the Committee for about forty two (42) sites, ranged from Twenty Six Million, One Hundred and Forty One Thousand Dollars to Ninety Eight Million, Three Hundred and Ninety Thousand Dollars (US\$ 26,141,000 – US\$ 98,390,000). These wide ranging figures may be as a result of varying assumptions. To ascertain real costs, it is recommended that a Request for Proposals (RFP) outlining exactly what is required should be published by the appropriate procuring agency.

It is also recommended that a site survey should be carried out to ascertain which towers, antenna systems and existing transport links can be re-used in the digital broadcasting roll-out. The survey is also necessary to inform suppliers about the terrain, the height and location of existing towers and population areas to enable them recommend optimum power levels and antennae to optimize coverage and minimize costs. The site survey for about forty two (42) sites nationwide is estimated at between Four Hundred Thousand to Five Hundred Thousand Dollars (US\$400,000 – US\$500,000.00).

11.2 Costs of receivers (set-top boxes, iDTVs, etc)

The Committee's survey found out that the Free on Board (FOB) price for MPEG-4 DVB-T set-top boxes ranged from US\$23.50 to US\$45 depending on the functionalities. It is estimated that over six (6) million set-top boxes may be required to convert existing analogue television sets to digital. This would mean that the total expenditure on receivers could exceed the expenditure on transmitter networks.

The success of the migration would depend on the affordability of receivers and attractiveness of the content available, especially free-to-air content. Low cost receivers would mean higher early penetration and consequently a rapid migration. The Committee therefore recommends that the Government considers the appropriate fiscal policy to ensure the general affordability of set-top boxes in Ghana. Furthermore, Government should consider waiving taxes on set-top box components to encourage local assembly of the boxes in Ghana. Local content developers should also be incentivised to produce more attractive content to speed up voluntary uptake of set-top boxes.

11.3 Cost of Public Education

The Committee has already overseen the design of the mascot, the theme song and the receiver certification logo which have been paid for by the National Communications Authority (NCA).

The cost elements in the public education campaign include the following:

- ❖ Production for print, TV & Radio

- ❖ Nationwide Media Placements for Print, Radio and TV
- ❖ Press Relations, media interviews, stories, features and documentaries
- ❖ Community outreach events
- ❖ Agency service charges

The committee estimates that the cost of an intensive 3 month campaign would cost from GH¢1,245,000 – GH¢1,875,000. It is recommended that an intensive 3 month campaign should be run at the beginning of the simulcast period and another one at the beginning of the analogue switch off. It is important that the communications team works side-by-side with the technical infrastructure teams to facilitate accurate and timely communication.

11.4 Cost of the Digital Broadcasting Migration Help Scheme

The Committee was unable to ascertain the cost of the recommended help scheme. It is recommended that the Government mandates the Ministries of Finance & Economic Planning, and Employment & Social Welfare to work out a package to assist the vulnerable as part of the National Social Protection Strategy (NSPS).

12.0 Conclusion

The Committee considers migration from analogue to digital broadcasting as a very important process that would keep the country in touch with global developments in broadcasting technology and also deliver the following benefits

- ❖ Higher Spectrum Efficiency which could provide avenues to generate more revenue to the State.
 - a single frequency channel can be used to transmit multiple programme channels
 - Adjacent channels can be used which is impossible in analogue broadcasting
- ❖ Better Picture quality (no ghosting, blurred images, etc) and Clearer Sound (CD quality audio) for citizens
- ❖ More Stations and therefore more choice which could further entrench the freedoms of the Ghanaian people and deepen our democracy.
- ❖ More Interactivity (including electronic programming guides (EPG), games, etc).
Interactivity also presents an opportunity for Government and local assemblies to deploy services electronically (e-governance) where necessary.
- ❖ Generate Employment through the local assembly of set-top boxes, installation, creative content development, etc.

APPENDICES

Appendix I	Membership of the National Digital Broadcasting Migration Technical Committee (NDBMTC)
Appendix II	Membership of the Sub-Committees
Appendix III	Digital Terrestrial Television Broadcasting (DTTB) Model
Appendix IV	Set-top Box Standards
Appendix V	Standardisation Process in Ghana
Appendix VI	Network Planning
Appendix VII	Technical Comparison of DVB-T and DVB-T2
Appendix VIII	List of Authorised TV Stations in Ghana
Appendix IX	Details of Current Analogue Network of GBC
Appendix X	Details of Current Network of Private Broadcasters

Appendix I - Membership of the National Digital Broadcasting Migration Technical Committee (NDBMTC)

No.	Name	Designation/Organization	Contact Email	Signature
Co-Chairpersons				
1.	Mr. Joshua Peprah	Director, Regulatory Administration, NCA	joshua.peprah@nca.org.gh	
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9.	Mr. G. B. L. Siilo	Director, Finance & Administration, Ministry of Information	siilogbl@yahoo.com	
10.	Ms. Yvonne Quansah	Director, Aid and Debt Management Division, Ministry of Finance and	yodoi@mofep.gov.gh	

No.	Name	Designation/Organization	Contact Email	Signature
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13.	Mr. Bruce MacLean	Deputy Director, Ministry of Local Government & Rural Development	021-682024 0243209753	
Broadcast Industry Players				
14.	Mr. Alex Bannerman	Deputy Executive Secretary, National Media Commission (NMC)	Katey_bann@yahoo.co.uk	
15.	Mr. Oscar Nchor	Director, Technical Production, Ghana Broadcasting Corporation (GBC)	onchor@yahoo.com	
16.	Chief Crystal Djirakor	Vice President, Ghana Independent Broadcasters Association (GIBA)	crystaltvghana@yahoo.com	
17.	Mr. R. Kofi Nyantakyi	TV3	nyantakyi@tv3.com.gh , kofirkn@hotmail.com	
18.	Mr. Kwaw Ansah	TV Africa	tvafrica@4u.com.gh	
Other Stakeholder Agencies				
19.	Mr. John K. Agbosege	Chief Collector, Customs Excise and Preventive Service (CEPS)	jagbosege@gmail.com	
20.	Mr. J. K. Baiden	Principal Standards Officer, Ghana Standards Board	baidenjk@yahoo.com	

No.	Name	Designation/Organization	Contact Email	Signature
		(GSB)		
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22.	Mr. Ebenezer Appah-Sampong	Director, Environmental Assessment and Audit Department, Environmental Protection Agency (EPA)	esampong@epaghana.org	
Educational Institutions				
23.	Dr. Prosper K. Ashilievi	Dean, Faculty of Telecom Engineering, Ghana Telecom University College (GTUC)	Ashiko79@hotmail.com	
24.	Mr. Stanley Opoku Yeboah	Senior Technician, National Film and Television Institute (NAFTI)	stanyeboah@yahoo.com	
25.	Mr. Francis K. Boachie	Deputy Director, ICT Directorate, University of Ghana	fboachie@ug.edu.gh	
26.	Ing. Dr. Kwasi Diawuo	Dean, Faculty of Computer and Electrical/Electronic Engineering, Kwame Nkrumah University of Science & Technology (KNUST)	kdiawuo@yahoo.com kdiawuo.soe@knust.edu.gh	

Appendix II – Membership of the Sub-committees

Technical Sub-committee

1. Ing. Dr. K. Diawuo	KNUST	Chairman
2. Ing. Dr. Adam Imoro	GhIE	Vice Chair
3. Mr. Joshua Peprah	NCA	Member
4. Major E. Owusu-Adansi (Rtd)	NCA	Member
5. Ing. Henry Kanor	NCA	Member
6. Ing. Patrick Laryea	NCA	Member
7. Ing. Edmund Yirenkyi Fianko	NCA	Member
8. Chief P. A. Crystal-Djirakor	GIBA	Member
9. Mr. Oscar Nchor	GBC	Member
10. Mr. Emmanuel Ofori	MoC	Member
11. Mr. Francis K. Boachie	UG	Member
12. Dr. P.K Ashilevi	GTUC	Member
13. Mr. Stanley Opoku-Yeboah	NAFTI	Member
14. Mr. Kennedy Osei	MoC	Member
15. Ms. Hawa Yakubu	MoC	Member
16. Mr. Ebenezer Appah-Sampong	EPA	Member
17. Mr. J.K. Baiden	GSB	Member
18. Mr. R. Kofi Nyantakyi	TV3	Member
19. Mr. Kofi Gyekye-Adarkwa	NCA	Recorder

Policy/Regulatory Sub-committee

1. Major E. Owusu-Adansi (Rtd.)	NCA	Chairman
2. Chief P.A. Crystal-Djirakor	GIBA	Vice Chair
3. Mr. R. Kofi Nyantakyi	TV3	Member
4. Mr. Emmanuel Ofori	MoC	Member
5. Mr. Kwaw Ansah	TV Africa	Member
6. Ing. Adam I. Imoro	GhIE	Member

7. Miss Hawa Yakubu B.	MoC	Member
8. Mr. Edmund Fianko	NCA	Member
9. Mr. Patrick J. Laryea	NCA	Member
10. Mr. Robert Apaya	NCA	Member
11. Mr. Alex Bannerman	NMC	Member
12. Mr. Henry Kanor	NCA	Member
13. Mr. Oscar Nchor	GBC	Member
14. Mr. Joseph Codjoe	NCA	Member
15. Mr. Isaac Koduah	NCA	Recorder

Public Relations and Consumer Affairs Sub-committee

1. Mr. R. Kofi Nyantakyi	TV3	Chairman
2. Chief P. A. Crystal-Djirakor	GIBA	Member
3. Mr. John Agbosege	CEPS	Member
4. Mr. Emmanuel Adisi	MoTI	Member
5. Mr. Alex Bannerman	NMC	Member
6. Mr. Oscar Nchor	GBC	Member
7. Mr. Henry Kanor	NCA	Member
8. Ms. Afua Akyaa Mensah	NCA	Member
9. Mr. Edmund Fianko	NCA	Member
10. Mr. Ransford Odoom	NCA	Recorder

Economics Sub-committee

1. Mr. Joshua Peprah	NCA	Chairman
2. Major E. Owusu-Adansi	NCA	Member
3. Mr. John Agbosege	CEPS	Member
4. Mr. Emmanuel Adisi	MoTI	Member
5. Mr. Kennedy Osei	MoC	Member
6. Mr. Kofi R. Nyantakyi	TV3	Member

7. Mr. Bruce MacLean	MLG&RD	Member
8. Mr. Edmund Fianko	NCA	Member
9. Ms. Hawa Yakubu	MoC	Member
10. Ms. Yvonne Quansah	MoFEP	Member
11. Mr. Peter Djakwah	NCA	Recorder

Appendix III - Digital Terrestrial Television Broadcasting (DTTB) Model

The focus of the committee's work was terrestrial broadcasting. Therefore, the International Telecommunications Union Radio communications sector (ITU-R)'s Digital Terrestrial Television Broadcasting (DTTB) model was considered in reviewing the different aspects of the migration.

The ITU-R developed a model of Digital Terrestrial Television Broadcasting (DTTB) as shown in Figure A3-1. The model comprises four sub-systems:

- ❖ Source coding and compression;
- ❖ Service multiplex and transport
- ❖ The physical layer (modulation scheme) and
- ❖ Planning factors (including both the transmission and receiver planning factors) and implementation strategies.

Source Coding / Compression

Source coding also known as data compression refers to methods used to reduce the large amount of data stream (bits) created when images or sound are digitized in their raw form. It may also include error protection techniques that are appropriate for application on the video, audio, and ancillary digital data streams. The term "ancillary data" includes system control data, conditional access control data, or data associated with the program audio and video services such as closed captioning. Ancillary data can also refer to independent program services. The compression of the coded data minimizes the number of bits needed to represent the information and makes it possible to recreate a representation of the original source at the receiving point without noticeable or unacceptable degradation.

The committee after reviewing various source coding techniques and standards recommends the adoption of the MPEG-4 standard also known as ISO/IEC 14496. It is a family of open

international standards that provide tools for the delivery of multimedia. The latest MPEG-4 video codec (i.e. MPEG-4 part 10) is Advanced Video Codec (AVC) which is also standardized

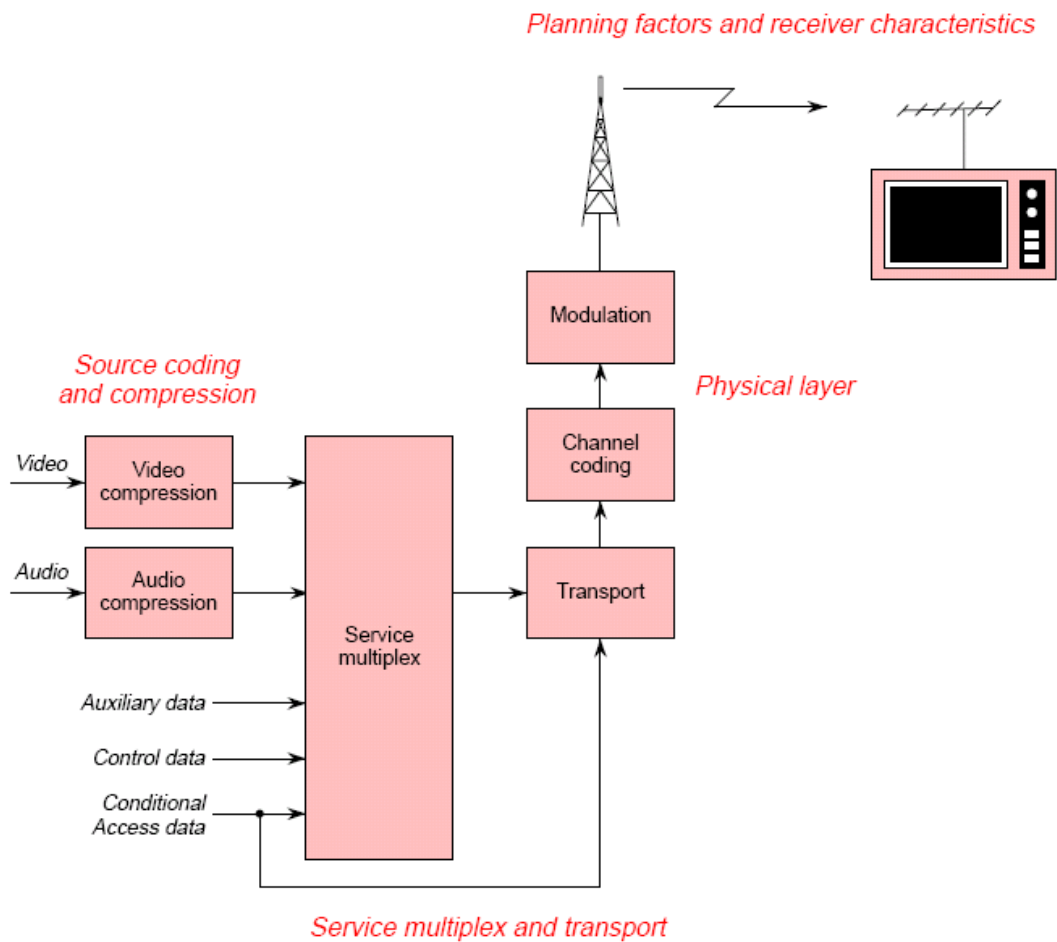


Figure A3-1: ITU-R Model for Digital Terrestrial Television Broadcasting (Source: ITU)

by the ITU as H.264. Therefore, for DTTB, **H.264/AVC/MPEG-4 (part 10)** is the recommended standard for video source coding and compression in Ghana. **MPEG-4 Advanced Audio Coding (AAC)** is also the recommended audio source coding.

Service Multiplex and transport

The service multiplex and transport refers to the means of dividing the digital data stream into packets of information, the means of uniquely identifying each packet or packet type, and the appropriate means of multiplexing the video data stream packets, the audio data stream packets, and the ancillary data stream packets into a single data stream. Multiplexing also provides the

capability of combining different program data streams into a single broadcast channel for simultaneous delivery. DVB-T employs the MPEG-2 transport layer defined in ISO/IEC 13818-1 and ETSI TS 101 154.

The Physical layer

The physical layer includes the channel coding and modulation scheme. The ETSI standard EN 300 744, titled “Digital Video Broadcasting (DVB): Framing structure, channel coding and modulation for Digital Terrestrial Television (DTT)” specifies the modulation and channel coding. The standard employs Orthogonal Frequency Division Multiplexing (OFDM) and has the following technical characteristics that make it very flexible:

- ❖ 3 modulation options (QPSK, 16QAM, 64QAM)
- ❖ 5 different forward error correction (FEC) rates (1/2, 2/3, 3/4, 5/6, 7/8)
- ❖ 4 Guard Interval options (1/4, 1/8, 1/16, 1/32)
- ❖ a choice of 2k (1,705 carriers) or 8k (6,817 carriers)
- ❖ can operate in 6, 7 or 8MHz channel bandwidths (with video at 50Hz or 60Hz)

Combinations of these parameters offer a number of options for digital broadcasting transmission companies. A table of the useful bit rates for all combinations of guard interval, constellation and code rate is provided in Table A3-1.

Table A3-1: Useful bitrate (Mbit/s) for all combinations of guard interval, constellation and code rate for non-hierarchical systems for 8MHz channels (irrespective of the transmission modes)

Modulation	Code rate	Guard interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4.98	5.53	5.85	6.03
	2/3	6.64	7.37	7.81	8.04
	3/4	7.46	8.29	8.78	9.05
	5/6	8.29	9.22	9.76	10.05
	7/8	8.71	9.68	10.25	10.56
16-QAM	1/2	9.95	11.06	11.71	12.06
	2/3	13.27	14.75	15.61	16.09

	3/4	14.93	16.59	17.56	18.10
	5/6	16.59	18.43	19.52	20.11
	7/8	17.42	19.35	20.49	21.11
64-QAM	1/2	14.93	16.59	17.56	18.10
	2/3	19.91	22.12	23.42	24.13
	3/4	22.39	24.88	26.35	27.14
	5/6	24.88	27.65	29.27	30.16
	7/8	26.13	29.03	30.74	31.67

Source: DVB

Planning Factors and Implementation Strategies

This section considers the characteristics of the transmission media and receivers; and strategies appropriate for the introduction and implementation of a DTTB service, taking into account other existing broadcasting services. The following sections discuss the issues contained in this part of the DTTB Model. The strategies for the introduction and implementation of DTTB are discussed in the remaining chapters of this report.

Aspect Ratio

Aspect ratio refers to the ratio of the width of the image to its height. Common Aspect ratio categories include: 4:3, 3:2, 16:9, 1.85:1, 2.39:1.

The standard aspect ratio for standard definition television is 4:3 (square screens) whereas 16:9 (for wide screens) is the standard aspect ratio for HDTV (*ITU-R Recommendation BT.709*).

Digital TV Display Formats

There are four (4) main digital television display formats as follows¹:

- ❖ **480i** - (square-screen only) digital version of the best current television signals;
- ❖ **480p** - (square or widescreen) also known as standard definition (SD)- has the same detail as today's television signal but looks sharper;

- ❖ **720p** - (widescreen only) this HDTV format provides an image just about as good as 1080i, while allowing other 480p signals to be broadcast at the same time; and
- ❖ **1080i** - (widescreen only) the HDTV format that allows the most detailed image available from broadcast TV

The Committee recommends 480p as the format for standard definition because it supports both square screens and widescreens and offers a better picture quality than 480i. Furthermore, 720p and 1080i should be adopted as High Definition (HD) formats.

Digital TV Receivers

Digital TV Receivers refer to all devices capable of receiving DVB-T signals in order to present the audio and video content transmitted. The two main types of digital receivers are:

- iii. Integrated Digital Television (iDTV) sets and
- iv. Set Top Boxes (STBs)

An Integrated Digital Television (iDTV) set is a TV with a built-in digital tuner that is used for converting incoming signals for display on a TV screen.

A set-top box (STB) is a device that is connected to a television set to convert digital signals received via an antenna into content which can then be displayed on an analogue television screen. STBs represent a less costly option to receive digital TV signals using existing analogue TV sets.

Digital receivers are very vital to the success of the migration from analogue to digital broadcasting. The Committee extensively discussed the minimum specifications for digital TV receivers (both iDTV & STB) with the aim of balancing the need to have the most up to date technology with the need to keep prices at an affordable level.

Appendix IV – Set-top Box Standards

The following are the recommendations of the committee in respect of set-top boxes that would be used in Ghana.

- ❖ Allow reception of the DVB-T signal with all combinations of the following parameters:
 - ✓ Transmission mode: 2k and 8k COFDM
 - ✓ Modulation: QPSK, 16 QAM, 64QAM
 - ✓ Code rate: 1/2, 2/3, 3/4, 5/6, 7/8
 - ✓ Guard interval: 1/4, 1/8, 1/16, 1/32
- ❖ Allow reception of the DVB-T signal in environment with echoes according to EN 300 744
- ❖ Support at least -23dBm ($\approx 86\text{dB}\mu\text{V}$ at 75Ω) of input signal without degradation
- ❖ Demultiplexer compliant to the MPEG-2 transport layer defined in ISO/IEC 13818-1 and ETSI TS 101 154
- ❖ Decoder fully compliant with the ISO IEC 14496-10 standard for decoding MPEG 4/AVC/H.264 signals
- ❖ At least one stereo audio decoder that is able to meet minimum decoding requirements based on MPEG 1 Layer II ("Musicam" ISO/IEC 11172-3) and decoder for AC3. The audio decoder shall also support AAC decoding according to ISO/IEC 14496-3 subpart 4.
- ❖ Decoder which ensures synchronization between AUDIO and VIDEO as follows: audio shall never lead the video program by more than 20 ms, and shall never lag the video by more than 45 ms.
- ❖ Able to switch between 4:3 and 16:9 picture aspect ratios.
- ❖ Support Over The Air (OTA) upgrade according to the ETSI TS 102 006. A mechanism to detect corrupt downloaded system software should be provided. If received system software is corrupt the receiver shall keep current (working) version of system software, thus making the receiver operational. The failure to download should be indicated to the user with an error message that can be used in the contact with the customer service office. It should also be possible for the user to abort the download and continue to

operate with the receiver with the existing software (since in areas of bad reception quality, the download may take too long a time).

- ❖ A mandatory RF input and output slots.
- ❖ At least one tuner input connector in accordance with IEC 60169-2, part 2 and shall allow the connection to external antenna with connector type: IEC 169-2 male. The input impedance shall be 75 Ohm.
- ❖ At least one SCART Interface in accordance with EN 50049-1 and EN 50157-2-1.
- ❖ At least one analogue audio interface based on two RCA connectors, female type IEC 60603-14.
- ❖ Receive radio broadcast as part of the MPEG Transport stream.
- ❖ English language interface. Support for French and other languages are optional.
- ❖ Electronic Program Guides (EPG)
- ❖ Capable of decoding and displaying DVB subtitle services which are transmitted in conformance with ETSI EN 300 743 including characters from code table ISO/IEC 8859-2.
- ❖ Store and reset settings.
- ❖ A Remote Control. However, basic controls (power on/off, program up/down and volume control) should be provided on the receiver itself.
- ❖ Receive all free-on-air channels without the need for a conditional access card.
- ❖ Frequency Range:
 - 470 – 862 MHz
- ❖ Provide the following information within the user interface:
 - Signal Level (dBuV/m),
 - Signal Quality (BER, MER)
- ❖ Power requirements:
 - Frequency – 50 Hz
 - Input Voltage – 100-250 V

Appendix V – Standardisation Process in Ghana

To ensure that the standards recommended in this report are legally binding, it is recommended that they are published as Ghana Standards in accordance with the established procedures of the Ghana Standards Board (GSB).

Table A5-1 describes the various stages in the national standardisation process. A flow chart of the process is shown in Figure A5-1.

Table A5-1 Stages in the Development of National Standards (Source: Ghana Standards Board)

STAGES	HARMONISED	ACTIVITY	RESPONSIBLE OFFICER
Stage 1: PROPOSAL STAGE	10.00	Proposal for the development of a standard-proposal may be from the industry or from government-proposal should be in the form of a letter or e-mail	Relevant industry and / or Ministry
	10.20	Prioritization of proposal by team	Relevant HOD
	10.60	Include proposal in work programme	Relevant Technical Secretary (TS)
	10.98	Reject proposal	Relevant HOD
Stage 2: PREPARATORY STAGE	20.20	Research for information for the preparation of a working draft	Relevant TS
	20.60	Preparation of working draft (WD) for Committee discussion	Relevant TS
Stage 3: COMMITTEE STAGE	30.00	Registration of WD with the Standards Desk	Relevant TS
	30.20	Circulation of WD among TC members for their comments (by e-mail)-comments are collated and include in the agenda for the scheduled TC meeting. <u>Document ready for TC meeting now becomes a Committee Draft (CD)</u>	Relevant TS
	30.60	Discussion of CD at TC meetings. Draft now ready for public comments-draft is referred to as “Final Draft Ghana Standard” (FDGS)	Relevant Technical Committee

STAGES	HARMONISED	ACTIVITY	RESPONSIBLE OFFICER
Stage 4: PUBLIC COMMENTS STAGE	40.00	Standards ready for public comments are sent to the TCS/Standards Desk for registration	Relevant TS
	40.20	The draft documents are then forwarded to TCS secretariat for circulation: comments duration period is up to three months.	Standards Desk Officer
	40.60	End of public comments duration-memo sent to the relevant Technical Secretary via the HOD	TCS Secretariat/Std Desk Officer
Stage 5: APPROVAL STAGE	50.20	TC meeting to approve the Final Draft Ghana Standard (FDGS)	Relevant Technical Committee
	50.60	FDGS (electronic copy) is forwarded with a memo to TCS/Standards Desk for publication and gazetting.	Relevant TS through relevant HOD
Stage 6: PUBLICATION STAGE	60.00	FDGS is received at the Standards Desk	Stds Desk Officer
	60.20	All FDGS received in the month is collated and forwarded to the GSB Legal department through the Head of TCS.	Stds Desk Officer
	60.60	Ghana standard is gazette and reference copy published for the GSB library.	Stds Desk Officer

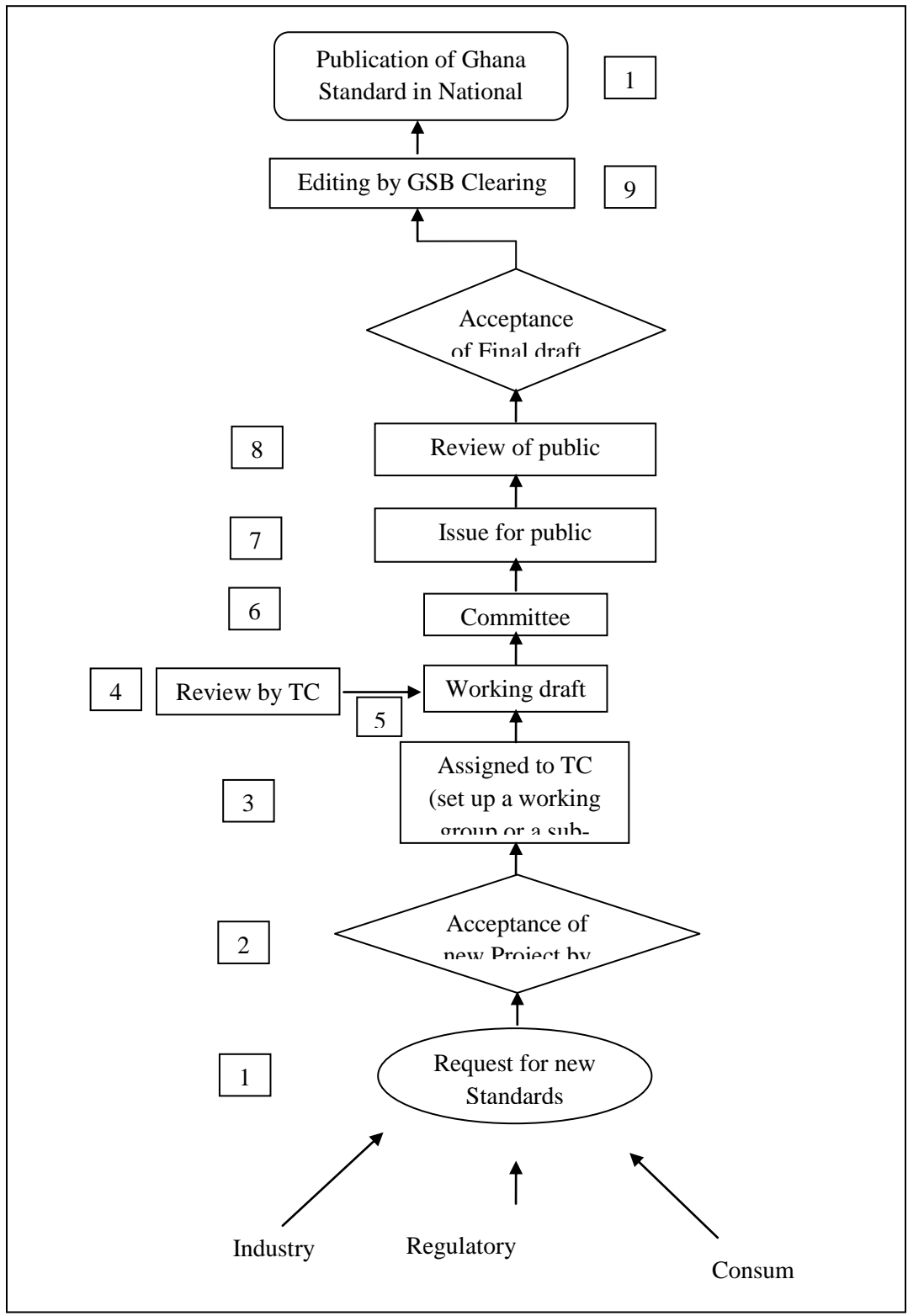


Figure A5-1: Flow Chart of Ghana's Standardisation Process

Appendix VI – Network Planning

Overview of Current Analogue Network

The planning of a terrestrial digital television network would to a large extent depend on the nature of the existing analogue TV network. GTV currently has the most extensive national network which is a multiple frequency network comprising thirty (30) transmitters operating in VHF Band III (CH 5 – 12) and nine (9) transposers operating in UHF Bands IV & V (CH 21 – 68). The details of GTV's analogue network are provided in Appendix IX of this report.

The independent private TV stations have limited coverage in regional capitals and neighbouring towns. TV3, Metro TV and TV Africa operate their networks in VHF Band III. The others operate their networks in VHF Bands IV & V. The details of the current analogue networks of the private independent TV stations are provided in Appendix X of this report.

Challenges with Current Analogue Network

The following challenges have been identified with the current analogue network:

❖ Poor Infrastructure Sharing/Co-location

Transmitting systems for the same target area have been sited in different locations. This makes it difficult for viewers using a single directional antenna to receive all the channels clearly. The use of omni directional receiving antennas minimize the challenge however, in Accra, for example, it is rare to receive all eleven (11) free on air terrestrial channels clearly at any one location using a single receiving antenna. It is important that all line-of-sight broadcast systems, especially television broadcast transmitters are co-located.

The costs of maintaining network infrastructure would also be reduced if TV operators share common infrastructure.

❖ **Poor Reception Conditions**

Currently analogue reception is generally sub-standard as most installed receiving antennas have not been professionally done. Environmental aesthetics are badly affected by the sight of long bamboo poles hoisting receiving antennas both in cities and rural settlements. TV reception in many parts of the country is characterised by ghosting. This has been tolerated because analogue transmission fails gradually and so allows viewers to see something albeit of a poor quality. This situation cannot be translated into the digital environment because digital signals fail abruptly (variously described as cliff-effect, brick-wall effect) which would mean you either see a clear picture or nothing! Digital TV network operator(s) would be required to factor this challenge in the DVB-T roll-out since most people may be turned-off if they experience regular freezing of pictures in the digital domain.

DTTB Roll-out Strategy

Co-location and Infrastructure Sharing

In rolling out the DTTB network, it is important to take the challenges of the analogue network into consideration. It is recommended that as much as possible transmitting systems for the same coverage target are commonly sited or from the same direction. In this regard, the experience of BBC, Arqiva and other networks in the United Kingdom (UK) would be useful to learn from. Cooperation from all broadcasters and multiplex operators would be required.

Frequency Configuration

It is recommended that generally a combination of Single Frequency Network (SFN) and Multi Frequency Network (MFN) should be used where appropriate. An SFN is a broadcast network where several transmitters simultaneously send the same signal over the same frequency channel. An MFN is a network of transmitting stations using several radio frequency (RF) channels.

An MFN configuration is suitable for situations where regional or local injection (drop and add) of programs are necessary. Such a possibility exists as the cultural diversity of Ghana may necessitate the insertion of local content in some regions. Currently one regional TV station, Coastal TV, has been established in the Central Region. Radio stations may be added at the

regional level on a multiplex. Therefore, the national network must be multi-frequency with single frequency networks deployed within a region or for a set of transmitters where necessary. The Ghana's requirements in the GE-06 plan were based on an MFN configuration.

Reception Modes

There are three main modes of television reception, namely:

- i. Fixed Reception
- ii. Portable Reception
- iii. Mobile Reception.

Fixed Reception

The Final Acts of RRC-06 defines Fixed Reception as reception where a directional receiving antenna mounted at roof level is used.

It is assumed that near-optimal reception conditions (within a relatively small volume on the roof) are found when the antenna is installed.

In calculating the field strength for fixed antenna reception, a receiving antenna height of 10 m above ground level is considered to be representative for the broadcasting service. Other heights might be used for other services.

Portable Reception

Portable antenna reception is defined by the Final Acts of RRC-06 as follows:

- ❖ class A (outdoor), which means reception where a portable receiver with an attached or built-in antenna is used outdoors at no less than 1.5 m above ground level;
- ❖ class B (ground floor, indoor), which means reception where a portable receiver with an attached or built-in antenna is used indoors at no less than 1.5 m above floor level in rooms with the following characteristics:
 - on the ground floor;
 - with a window in an external wall.

Portable indoor reception on the higher floors will be regarded as class B reception with signal level corrections applied, although indoor ground floor reception is likely to be the most common case.

In both classes A and B, it is assumed that:

- ❖ optimal receiving conditions will be found by moving the antenna up to 0.5 m in any direction;
- ❖ the portable receiver is not moved during reception and large objects near the receiver are also not moved;
- ❖ extreme cases, such as reception in completely shielded rooms, are disregarded.

Mobile Reception

The Final Acts of RRC-06 defines Mobile Reception as reception by a receiver in motion with an antenna situated at no less than 1.5 m above ground level. This could for example be a car receiver or handheld equipment.

Recommendations on coverage Planning

The Committee recommends that coverage planning for the migration process should target portable antenna reception at least in the major cities. Fixed reception could be the basis for planning in rural and/or dispersed settlements. It is considered that an improvement of the reception in the digital domain in respect of environmental aesthetics and convenience would greatly enhance the uptake of digital television.

Quality of Service

It is proposed that quality of service parameters be included in the licence conditions of multiplex operators/signal distributors. This is due to the 'rapid failure' characteristic of digital television reception near the edge of the service area or in any other areas of reduced signal caused by local obstructions.

The South African Digital Broadcasting Association (SADIBA) in 2002 proposed some parameters and values based on available theory as well as practical measurements with regards to the specification of a minimum acceptable grade of service.

The following factors play an important role in determining the quality of the digital television service received:

- ❖ Field strength (FS) in the vicinity of the receiving antenna.
- ❖ Carrier-to-noise ratio (C/N) at the input of the receiver.
- ❖ Bit error ratio (BER) before and after the receiver Viterbi decoder.
- ❖ Physical condition of the receiving antenna and interconnecting cable between the antenna and the receiver.
- ❖ Presence of reflections off buildings and other structures close to or in the vicinity of the receiving antenna.

Minimum Values for Acceptable Service

The following reception parameters provided an acceptable minimum receivable reception during field tests conducted in South Africa:

Table A6-1: Minimum values for acceptable service in mode FFT=8k, 64QAM, FEC=2/3, GI=1/32

Parameter	Value
FS at 10m in suburban areas	58dBuV/m
C/N at receiver input	23dB
BER after Viterbi decoding	2E-4

A certification program should be established for installers. To be certified, installers should undergo basic training and acquire installation test kits.

Most installation meters are fitted with Bit Error Rate meters and are used for DTT quality measurements. The "6dB Test" is a standard quality test used in countries that have already implemented DTT. This test entails placing a 6dB attenuator in the antenna feeder and confirming that an interference-free signal is still received at the television set. In effect this test checks that at least a 6dB "fade margin" is present to allow for degraded receive signals.

It is recommended that this test should be further investigated and adapted for quality measurement testing when DTT is implemented in Ghana.

Appendix VII – Technical Comparison of DVB-T and DVB-T2

The main features of DVB-T2 include:

- ❖ Low Density Parity Check (LDPC) error correcting codes (1/2; 3/5; 2/3; 3/4; 4/5; 5/6). It offers about 30% improvement over Reed Solomon coding used in DVB-T.
- ❖ Introduction of 256QAM
- ❖ Increased FFT range (1K; 2K; 4K; 8K; 16K; 32K)
- ❖ Increased Guard interval (1/4; 5/32; 1/8; 5/64; 1/16; 1/32; 1/64; 1/128)
- ❖ Extended Bandwidth
- ❖ Rotated Constellations
- ❖ OFDM Equalization (overhead reduction 8%)
- ❖ Differentiated Protection (PLP)
- ❖ Interleaving (Bit, Time, & Frequency)
- ❖ Transmit diversity (Alamouti coding 30% SFN)
- ❖ Peak / Average power reduction (PAPR - 20%)

Table A7-1: Technical Comparison of DVB-T & DVB-T2 (Source: DVB)

	DVB-T		DVB-T2	
COFDM	Guard Interval OFDM		Guard Interval OFDM	
FEC	5	Reed Solomon 1/2; 2/3; 3/4; 5/6; 7/8	6	Low Density Parity Check 1/2; 3/5; 2/3; 3/4; 4/5; 5/6
Modes	3	QPSK; 16QAM; 64QAM	4	QPSK; 16QAM; 64QAM; 256QAM
Guard Interval	4	1/4; 1/8; 1/16; 1/32	8	1/4; 5/32; 1/8; 5/64; 1/16; 1/32; 1/64; 1/128
FFT size	2	2k; 8k	6	1k; 2k; 4k; 8k; 16k; 32k
Scattered Pilots	12%		1%	

	DVB-T	DVB-T2
Continual Pilots	2.6%	0.35%

Source: DVB

Appendix VIII – List of Authorised TV Stations in Ghana

No.	Name and Address of Company	Brand Name	Type of Service	Area(s) of Operation	Date of First Authorisation	Date of Commencement of Service	
1.	Ghana Broadcasting Corporation (GBC)	GTV	Free To Air Terrestrial	Nationwide	Established by GBC Decree of 1968	31 July, 1965	
2.	TV3 Network Limited	TV3	Free To Air Terrestrial	<ul style="list-style-type: none"> • Greater Accra • Eastern • Western • Central • Ashanti • Brong Ahafo 	17 September 1996	17 September 1997	
3.	Metropolitan Entertainment Television	Metro TV	Free To Air Terrestrial	Nationwide (All ten regional capitals)	5 September 1997	4 August 1998	
4.	Television Africa Ltd.	TV Africa	Free To Air Terrestrial	<ul style="list-style-type: none"> • Greater Accra • Eastern • Central • Western • Ashanti 	21 November 1995	2003	
5.	Crystal Radiovision Network Ltd.	Crystal TV	Free To Air Terrestrial	<ul style="list-style-type: none"> • Greater Accra • Eastern 			

No.	Name and Address of Company	Brand Name	Type of Service	Area(s) of Operation	Date of First Authorisation	Date of Commencement of Service	
6.	Multichoice Ghana	DSTV	Pay TV • Digital Satellite (Ku)	Nationwide	14 April 2000	26 May 1999	
		DSTV Mobile	Mobile TV (DVB-H)	Accra			
7.	CATV Limited	Cable Gold	Pay TV • Cable • DVB-T	Accra / Tema			
8.	Net 2 TV Limited	Net 2 TV	Free To Air Terrestrial	• Greater Accra • Eastern	7 April 2004		
9.	Wilsad Support Promotion Services	Skyy Digital	Pay TV DVB-T	• Greater Accra • Eastern • Western • Ashanti	23 April 2004		
10.	Independent TV Limited	N/A	Free To Air Terrestrial	Not yet on air	1 April 2008	Not yet on air	
11.	K & N Investments Limited	e-TV Ghana	Free To Air Terrestrial	Greater Accra Eastern	19 October 2006		
12.	Multimedia Broadcasting Company Ltd.	Multi TV	Free To View Digital Satellite	Nationwide			
13.	Viasat Broadcasting Ltd.	Viasat 1	Free To Air Terrestrial	Greater Accra Eastern Central Western Ashanti	22 February 2008		
14.	Three Angels	N/A	Free To Air	Not yet on air	11 August	Not yet on air	

No.	Name and Address of Company	Brand Name	Type of Service	Area(s) of Operation	Date of First Authorisation	Date of Commencement of Service	
	Broadcasting Network (3ABN) Ghana		Terrestrial		2008		
15.	Black Star Television	Fon TV	Mobile TV (TDMB)	Greater Accra Ashanti			
16.	Integrated Media Xchange (IMX)	N/A	Free To Air Terrestrial	Not yet on air		Not yet on air	
17.	Multiple Concepts	N/A	Free To Air Terrestrial	Not yet on air	5 January 2009	Not yet on air	
18.	Smart Multimedia	N/A	Free To Air Terrestrial	Not yet on air	23 December 2008	Not yet on air	
19.	The Cardinal Foundation for Distance Learning	N/A	MMDS frequencies retrieved	Not yet on air	11 February 2005	Not yet on air	
20.	Centre for Intercultural Learning Talent & Development, AGORO	Coastal TV	Free To Air Terrestrial	Cape Coast	16 October 2007		
21.	Great KOSA Company Ltd.	N/A	Educational/Research station	Gomoa Mpota	27 August 2008	Not yet on air	
22.	Empire Broadcasting Network	N/A	Free To Air Terrestrial		23 December 2008	Not yet on air	

Appendix IX – Details of Current Analogue Network of GBC

No.	Region	Name of Site	Coordinates	Height of Mast (m)	Transmitter Power (kW)	Operating Frequency (CH)
1.	Greater Accra	Adjangote	05°43'27,12"N 0°14'05,28"W	130	10	9
2.	Ashanti	Kumasi		120	10	12
3.		Jamasi	06N59,521' 01°W26,721'	61	10	5
4.	Western	Sekondi	04°N55,694' 01°W44,954'	45	5	5
5.		Tarkwa	5°18'10,50"N 2°00'27,06"W	148	5	8
6.		Half Assini	05°N03,194' 02°W53,055'	57	1	6
7.		Osei Kojokrom	06°N39,498' 3°W14,049'	45	5	9
8.		Enchi	05° N 48' 02° W 49'	45	1	12
9.		Sefwi Wiawso	06°N11,682' 02°W27,541'	148	5	10
10.		Central	Cape Coast	5°06'53,46"N 01°14'49,38"W	52	
11.	Kissi			80	10	11
12.	Assin Fosu		5°41'45,36"N 1°16'54,72"W	100	10	7
13.	Dunkwa-on-Offin				0.1	39
14.	Ajumako Bisease				0.2	65
15.	Eastern	Koforidua (Obuotabiri)		33	0.2	32
16.		Mpraeso		137	5	6
17.		Akim Oda		30	0.2	31
18.		Akosombo			0.1	
19.		Somanya			0.1	42
20.	Brong Ahafo	Sunyani		150	10	7
21.		Kintampo		100	10	9
22.		Atebubu		45	10	11
23.		New Drobo		45	0.1	26
24.		Dormaa Ahenkro		40	0.1	39
25.	Northern	Tamale	09°N24,977' 00°W51,446'	150	10	8
26.		Yendi	09°N26,828' 00°W00,193'	76	10	11
27.		Bimbilla	08°N51,831'	45	5	6

			0°W03,113'			
28.		Damongo	09°N04,982' 01°W48,322'	150	10	5
29.		Gambaga	10°N31,939' 0°W25,857'	100	5	10
30.		Salaga	08°N33,427' 0°W30,695'	147	5	7
31.		Bole	09°N02,317' 02°W29,248'	102	5	10
32.	Volta	Amedzofe	06°N50,333' 00°E25,830'	70	10	10
33.		Akatsi	06°07'13,92"N 00°48'30,72"E	125	5	6
34.		Kete Krachi	07°N48,535' 0°W02,436'	150	10	12
35.		Ho			0.1	52
36.	Upper East	Bolgatanga	10°48'05,46"N 00°51'53,04"W	150	5	6
37.		Bawku			0.1	24
38.	Upper West	Wa	10°03'58,86"N 02°29'35,40"W	91	5	8
39.		Han	10°N41,287' 02°W27,869'	150	5	11

Appendix X – Details of Current Transmission sites of Private Broadcasters

No.	Region	Name of Station	Name of Site	Coordinates	Height of Mast (m)	Transmitter Power (kW)	Operating Frequency (CH)
1.	Greater Accra	Metro TV	Adjangote	05°43'27,12"N 000°14'05,28"W	130		5
2.		TV Africa	Adjangote			2.5	7
3.		TV3	Aburi	05° 50'396''N 000°11'350''W	80m	10kw	12
4.		Viasat 1	Brekuso	05°43'47.2"N 000°14' 48.0"W	100	10	30
5.		Net2 TV	Ahwerasi (Aburi)	055° 51' 35"N 000° 09' 52"W	60.95	2.3	44
6.		Crystal TV Extra	University of Ghana, Legon	05° 38' 56.2"N 000° 11' 52.2"W		1	39
7.		Crystal TV Plus	University of Ghana, Legon	05° 38' 56.2"N 000° 11' 52.2"W		1	42
8.		Crystal TV Prime	University of Ghana, Legon	05° 38' 56.2"N 000° 11' 52.2"W		1	52
9.		e-TV Ghana	Ahwerase (Aburi)	05°51'30.8"N 000°09'59.0"W	75	8	48
10.	Ashanti	Metro TV	Kumasi			2	10
11.		TV Africa	Kumasi			2	6
12.		TV3	Vodafone site Adum Kumasi	6° 41'29.808"N 1° 37'24.69"W	138m	5kw	8
13.		Viasat 1	Milicom House, 17 Old Bekwai Road Kumasi	06° 41' 11.94"N 000°36'13.50"W	92	10	30
14.	Western	TV3	Vodafone Site Kojo krom Takoradi		60m	2kw	10
15.		Viasat 1	Adiembra Secondary	04° 56' 37.8"N 001°44'06.7"W		10	30

No.	Region	Name of Station	Name of Site	Coordinates	Height of Mast (m)	Transmitter Power (kW)	Operating Frequency (CH)
			School (Takoradi)				
16.		Metro TV	Takoradi			1	8
17.		TV Africa	MelodyFM, (Takoradi)			1	12
18.	Central	Viasat 1	Sammo Secondary Sch. at Moree in the Central Region	05° 09' 01.2"N 001°12'24.9"W		10	30
19.		TV Africa	Radio Central (Cape Coast)			0.5	7
20.		TV3	Vodafone Site Cape-Coast		135m	1kw	
21.		Coastal TV	Ocean Lagoon View Hostel, 4 th Ridge Site	05°07'40.6"N 01°15'38.5"W	47m		
22.		Metro TV	Cape Coast			1	5
23.	Eastern	Metro TV	Koforidua	05°43'13"N 000°14'12W		0.5	5
24.		TV Africa	Vodafone (Koforidua)			0.5	7
25.	Brong Ahafo	TV Africa	Vodafone (Sunyani)			1	11
26.		TV3	Vodafone site Sunyani	07d. 33' 66"N 002d. 32' 858"W	105m	2kw	5
27.		Metro TV	Sunyani			1	9
28.	Northern	TV Africa	Vodafone (Tamale)			1	12
29.		Metro TV	Tamale			1	6
30.	Volta	TV Africa	Vodafone			0.5	12
31.		Metro	Ho			1	5

No.	Region	Name of Station	Name of Site	Coordinates	Height of Mast (m)	Transmitter Power (kW)	Operating Frequency (CH)
		TV					
32.	Upper East	Metro TV	Wa			1	6
33.	Upper West	Metro TV	Bolgatanga			1	8
34.							