2016

NATIONAL COMMUNICATIONS AUTHORITY

MINIMUM STANDARDS FOR THE ESTABLISHMENT AND OPERATION OF FM BROADCASTING STATION IN GHANA

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1 Introduction

The National Communications Authority (NCA) hereinafter referred to as "the Authority", is mandated under Section 2 of the Electronic Communications Act, 2008, Act 775 to regulate the radio spectrum designated or allocated for broadcasting services in accordance with the standards and requirements of the International Telecommunications Union (ITU) and its Radio Regulations as agreed to or adopted by the Republic. In furtherance of carrying out this function, the law mandates the Authority to determine technical and other standards and issue guidelines for the operation of broadcasting organizations and bodies providing broadcasting services.

The FM sound broadcasting service involves the broadcasting of sound which may be accompanied by associated text/data, using a transmitter and other ancillary equipment in the VHF band II (87.5 to 108 MHz).

It is currently one of the key services regulated by the Authority, with over 420 authorised FM radio stations across Ghana as at the end of the first quarter of 2016. It is therefore important that the Authority sets out guidelines to govern the operation of FM broadcasting stations in Ghana to ensure that quality broadcasting service is delivered to the general public.

2 Scope

This document sets out the minimum standards for the establishment and operation of FM Sound Radio Broadcasting in the VHF Band II in Ghana.

3 Legal and Administrative

An authorised FM radio station shall:

1. Commence the construction and installation of facilities for the provision of the broadcast service within two (2) years after the date of the grant of the frequency authorisation in accordance with Regulation 54(1) of the Electronic Communications Regulations, 2011, L.I. 1991;

a. Upon completion of construction, installation and engineering tests, the authorisation holder shall invite the Authority to inspect the station. In accordance Regulation 54(2) of L.I. 1991, the Authority may make technical recommendations which the operator shall comply with.
b. The Authority shall issue a test certificate or 'Test Transmission Letter' before the station can commence operations.
c. If after inspection, the station's setup is incomplete, the station shall be notified in writing and the Authority shall carry out a second inspection upon receiving an invitation, which cost shall be borne by the authorisation holder.
d. In the event that the station's facilities do not meet the standard set by the Authority after the second inspection, the Authority in accordance with Regulation 54(4) of L.I. 1991, shall on written notice of not less than thirty days from the date of the second inspection to the operator, cancel the frequency authorisation.

2. Have a means of contact for the public i.e. telephone number(s), email address, location address and postal address.
3. Have a Security post/desk with security personnel at post during all the hours the station is on air.
4. Install a signage/signboard close to its premises for purposes of identifying the station.
5. Acquire fire certificate from the Ghana National Fire Service (GNFS) for their premises and shall have fire extinguishers installed at the studio premises, transmission site, and other vantage points as directed by the GNFS.
6. Make provisions for alternative source of power as backup to the supply from the National Grid to ensure station is always on-air during the hours of operation.
7. Keep a copy of Specification Sheet of the following installed equipment readily available for the purposes of verification and data collection by the Authority:
    - **Antenna**: Make, Model, Gain (dB), Mast Height (meters)
    - **Transmitter**: Make, Model, Rated Power (watts), Operational Power (watts)
    - **Antenna Cable**: Make, Model, Length (meters), loss (dB/meter)
    - **Studio Equipment**: List of equipment installed at the studio and their quantities

8. Ensure that Programs and Visitors Logbook is maintained at the studio premises and made available to the Authority on request.
9. Communicate to the Authority regarding any intended amendment in their equipment installation (transmitter, antenna and transmission cable) prior to the implementation of such amendments.
10. Provide sufficient security for the on-air studio to prevent intruders and other unauthorised persons from entering the studio.

4 Technical

4.1 Studio Setup

The studio shall be setup such that:

1. On-Air light is installed at its entrance.
2. Security door locking system is installed at its entrance.
3. The on-air studio is acoustically treated to deal with echoes, reverberations and noise.
4. It is well ventilated and/or temperature controlled for health and safety of the users and optimum operation of studio equipment.

4.2 Transmission System

The FM radio transmission station;

1. Shall deploy the Stereophonic pilot tone system (System 4) with maximum frequency deviation of ±75kHz.
2. Shall transmit within a bandwidth of 200 kHz.
3. Shall design and operate its transmission system such that the signal strength at the periphery of its coverage area shall not exceed 54dBμV/m.
4. Shall not install external Radio Data System (RDS) Encoder/transmission system without prior approval from the Authority.

5. Shall ensure that Unwanted emissions (Spurious, Out-of-band emissions and cabinet radiations) remain within the limits indicated in Annex 2 of this document, in accordance with the provisions of Appendix 3 (Rev. WRC-12) of the ITU Radio Regulations as well as ITU-R Recommendations SM.329-7, SM.328-10, SM.329-12 and SM.1541-6 and European standard EN 302 018-1 [14].
6. Shall install cavity filters at the output of its transmitter with an isolation (attenuation) of not less than 70 dBc to ensure compliance with 5 above.
7. Shall install directional antennas if the transmitting station is located at a distance of 45km or less from the border with a neighbouring country.
8. Operating a Studio-to-Transmitter Link (STL) shall ensure that:
    - The maximum power for STL transmitter shall be 15W;
    - The STL shall operate within the frequency band 350-380 MHz;
    - The STL antenna shall be directional;
    - The channel bandwidth for the STL shall be 200 kHz;
9. Shall ensure the antenna mast(s) and other equipment are properly earthed.
10. Shall ensure that the transmitter room/compartment shall be ventilated and/or temperature controlled.

4.3 Radio Data System (RDS)

Radio Data System **(**RDS) is the technical standard that allows FM transmitters to broadcast additional types of information through encoded digital signals that can be displayed on RDS-compatible FM radio receivers.

The operation of RDS in Ghana must be in accordance with the European Standard EN 50067 [4] and ITU-R Recommendation BS 450-3 [3].

In addition, the RDS must meet the following minimum conditions:

1. The insertion of the RDS signals must not affect the reception quality of the main non-RDS receivers.
2. The operation of the RDS must not interfere with other radio transmissions.
3. The maximum deviation of the main carrier by the total baseband signal shall not exceed ±75 kHz.

5 Environment and Safety

The safety of the working environment on and in the vicinity of radio sites must always remain at a consideration of high importance to site operators and engineers.

5.1 Electrical Safety

1. Electrical installations in the transmitter site, the studio and other departments of the FM station shall conform to the requirements of the Energy Commission's Electrical Wiring Regulations, 2012, L.I. 2008.
2. There shall not be exposed electrical wires and loose electrical sockets in the FM station's premises.
3. All electrical installations shall be earthed according to the Energy Commission's Electrical Wiring Regulations, 2012, L.I. 2008.

5.2 Design and Construction of Mast

1. The Authorisation holder shall obtain the necessary permits from the Metropolitan, Municipal or District Assembly, Environmental Protection Agency and where applicable the Ghana Civil Aviation Authority for the design and construction of mast.
2. The mast design and construction shall comply with the Guidelines for the deployment of Communications Towers, 2010 [11] and Ghana Civil Aviation Authority Guidance on lighting and Marking of Obstacles [10].
3. The Authorisation holder shall install lightning arrestors at the apex of the Mast/Tower(s) which shall be earthed.

5.3 Radio Frequency Radiation

Radio frequency (RF) radiation is a source of hazard to personnel at a radio site. Exposure to high levels of RF radiation may cause damage to body tissues, as a result of electric shock, RF burns, or heating effects, according to the frequencies in use. Therefore, exposure of personnel to high level RF fields near transmitters or antenna systems must be avoided.

Careful consideration should be given to the safety of personnel working in radio site environments and in particular, the level of exposure experienced whilst climbing an antenna support structure.

i. FM Operators must ensure that specific exposure limits are in conformity with those of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which are recommended by the World Health Organization (WHO), to protect workers and the general public against excessive exposure to RF fields [11].

ii. The following Technical Standards and Specifications must be complied with to mitigate against any harmful effects of human exposure to Radiofrequency Electromagnetic Fields:

   a. Basic Restrictions for public and occupational exposures as set out in Annex 3a;
   b. Where the Basic Restrictions are exceeded, the Reference Levels for public and occupational exposure as set out in Annex 3b shall apply; and
   c. Limits on Simultaneous exposures to different radio frequencies as set out in Annex 3c.

6 References

1. Rec. ITU-R BS 450-3; Transmission Standards for FM Sound Broadcasting at VHF
2. BEST-6; Technical Standards and Requirements for FM Broadcasting Transmitters, Industry Canada.
3. Recommendation ITU-R BS.643-3; Radio data system for automatic tuning and other applications in FM radio receivers for use with pilot-tone system
4. EN 50067; Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87.5 to 108.0MHz.
5. Rec. ITU-R SM. 329-10; Unwanted emissions in the spurious domain
6. ETR-132 (ETSI Technical Report) Radio Broadcasting Systems; Code of practice for Site Engineering Very High Frequency (VHF) frequency modulated, sound broadcasting transmitters
7. ITU-R Recommendation SM.329-12: "Unwanted emissions in the spurious domain".
8. ITU-R Recommendation SM.1541-6: "Unwanted emissions in the Out-of-Band Domain".
9. ITU Radio Regulations, 2012: Appendix 3; "Maximum permitted power levels for unwanted emissions in the spurious domain".
10. Ghana Civil Aviation Authority: ASAS TP-02; Guidance on lighting and Marking of Obstacles
11. Government of Ghana: Guidelines for deployment of Telecommunications Towers
12. ITU-T Recommendation K.52, 2004: Guidance on complying with limits for human exposure to electromagnetic fields.
13. ICNIRP, Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic field (up to 300 GHz).
14. ETSI EN 302 018-1: "Electromagnetic compatibility and Radio Spectrum Matters (ERM); Transmitting equipment for the Frequency Modulated (FM) sound broadcasting service; Part 1: Technical characteristics and test methods''.

7 Annexure

Annex 1: FM Broadcasting Station Self-Inspection Checklist

An FM broadcasting operator, preparing to commence operation shall complete the attached self-inspection checklist before inviting the Authority to conduct an inspection at its premises. This checklist provides an opportunity for the operator to review and correct any anomalies/lapses associated with its installation for the operation of the FM station prior to the visit by the Authority.

The following checks are provided to the list of items to aid the operator in determining the station's compliance with the conditions of operating an FM broadcasting station in Ghana:

- **COMPLETE** = this item indicates full compliance with the standards set out in this document.
- **INCOMPLETE** = this item indicates partial compliance with the standards set out in this document.

If any of the item(s) is/are checked **"INCOMPLETE"**, it implies noncompliance with the conditions and terms of operating an FM broadcasting station, and the operator should therefore take immediate steps to correct it.

FM SELF-INSPECTION CHECKLIST		Status (Tick as Applicable)	
No.	**Item**	**COMPLETE**	**INCOMPLETE**
1	24 Hour security post/desk and personnel		
2	Programs/Visitors logbook		
3	Signage/Signboard		
4	Fire extinguishers installed at all vantage points and Fire Certificate		
5	Availability of backup power source		
6	Specification Sheet of installed equipment		
7	Permit from EPA approving mast/tower installation		
8	Air conditioners installed in studio and transmitter room		
9	On-Air light installed at entrance of studio		
10	Studio is acoustically panelled		
11	Studio door is adequately secured		
12	Directional antenna and pointed in the appropriate direction (for FM stations less than 50km from a neighbouring country only)		

13	Cavity filter with isolation of 70dBc installed		
14	Lightning arrestor installed on mast/tower(s)		
15	Aviation Warning light installed on mast/tower(s)		
16	Mast/tower(s) is/are properly earthed		
17	Mast/tower(s) is/are painted to the specification described in the guideline		

Annex 2: Unwanted Emission Limits for FM Broadcasting Transmitting Equipment

a. **Spurious Emissions**

Definition

Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

Limit

Spurious emissions shall not exceed the values set out in table 1 below

Table 1 Spurious Emission Limits for FM Broadcast Transmitter

Mean power of the transmitter, P	**Limits** **Mean power absolute levels (dBm) or relative levels (dBc) below the power supplied to the antenna port in the reference bandwidth**
P < 9 dBW	-36 dBm
9 dBW < P < 29 dBW	75 dBc
29 dBW < P < 39 dBW	-16 dBm
39 dBW < P < 50 dBW	85 dBc
50 dBW < P	-5 dBm

b. **Out-of-band emissions**

Definition

Emission on a frequency or frequencies immediately outside the necessary bandwidth, which results from the modulation process, but excludes spurious emissions.

Limit

Out of band emissions shall not exceed the values set out in table 2 below.

Table 2 Out-of-band emission limits for FM Broadcast Transmitters

Frequency relative to the centre of the channel (kHz)	**Relative level (dBc)**
-500	-85
-300	-85
-200	-80
-100	0
100	0
200	-80
300	-85
500	-85

c. **Cabinet Radiation**

Definition

Emissions from the equipment, radiated from the enclosure port, other than those present at the antenna port.

Limit

Radiated emissions shall not exceed the values set out in table 3 below.

This test shall be performed at a distance of 10 m, where feasible. When size and/or power requirements necessitate testing in a manufacturing facility, other distances may be used (see notes 1 to 3). Tests shall not be carried out in the exclusion band (see note 2 in table 3).

Table 3 Limits for radiated unwanted emissions for FM Broadcast Transmitter

Quasi-peak limits (dBµV/m) at 10m (see notes 1 and 2)	**Frequency range**
30 dBµV/m ≤ 60 + 10 $\log_{10}$ (P_0/2 000) ≤ 70 dBµV/m	30 MHz to 230 MHz
NOTE 1: P_0 = RF output power in W. NOTE 2: The exclusion band for the transmitter extends from F_c - 300 kHz to F_c + 300 kHz, where F_c is the operating frequency in MHz.	

NOTE 1: The measurements can be carried out at other distances. In that case limits are modified according to the relation:

L(x) = L(10m) + 20 log (10/x) where x = distance in meter (m).

NOTE 2: Care should be taken if measuring at test distances below 10 m as this may be in the near field.

NOTE 3: In cases of dispute the measurement distance of 10 m shall take precedence.

Annex 3: Limits on Radiation Emissions for FM Transmitters

a. Basic Limits for Public and Occupational Exposure (ICNIRP)/ITU-T K.52

Explanations

The exposure limits for the general public are five (5) times lower than for occupational workers. This is because such workers are normally persons who may have been trained to be aware of RF hazards and have been medically assessed to be fit for work in RF fields.

Type of exposure	Frequency range	Whole body average SAR (W/kg)	Localized SAR (head and trunk (W/kg)	Localized SAR (limbs) (W/kg
Occupational Workers	10 MHz-10 GHz	0.4	10	20
General Public	10 MHz-10 GHz	0.08	2	4
NOTE: f is the frequency in Hertz. Whole body average SAR: Specific Absorption Rate averaged over the entire body. Localised SAR: Specific Absorption Rate averaged over a localised mass of tissue. SA: Specific Absorption of RF energy per pulse in a defined mass of tissue. Due to electrical inhomogeneity of the body, current densities should be averaged over a cross-section of 1 cm2 perpendicular to the current direction. All SAR values are to be measured in a period of 6-minutes. For a localized SAR averaging mass in any 10g of contiguous tissue, the maximum SAR obtained should be the value used for the estimation of exposure.				

b. Reference Levels for Public and Occupational Exposure (ICNIRP)/ITU-T K.52

Type of exposure	Frequency range	Electric field Strength (V/m)	Magnetic Field Strength (A/m)	Equivalent Plane Wave Power Density Seq (W/m2
Occupational Workers	10-400 MHz	61	0.16	10
General Public	10 MHz-10 GHz	28	0.073	2
NOTE f is as indicated in the frequency range column.				

For frequencies between 100 KHz and 10GHz, the averaging time is 6 minutes.

Between 100 KHz and 10MHz, peak values for the field strengths are obtained by interpolation from the 1.5-fold peak at 100MHz to the 32-fold peak at 10MHz. For frequencies exceeding 10MHz, it is suggested that the peak equivalent plane-wave power density, as averaged over the pulse width, does not exceed 1000 times the Seq limit, or that the field strength does not exceed the field strength exposure levels given in the above table.

c. Simultaneous Exposures to Different Radio Frequencies

In situations where simultaneous exposures occur from different RF sources, the possibility that these exposures will be additive in their effects has been assumed to occur by these Guidelines. Thus, a cumulative evaluation of the basic restrictions and reference levels for simultaneous exposure to multiple frequencies has to be performed separately for both electro stimulatory and thermal effects on the body. The equations for performing these calculations are as provided below:

Simultaneous exposure to multiple sources

For simultaneous exposure to fields at different frequencies, the compliance with the exposure limits is evaluated using the equations below. All conditions for the appropriate frequency ranges are to be satisfied.

$$\sum_{i=1kHz}^{1MHz} \frac{E_i}{E_{l,i}} + \sum_{i>1Mz}^{10MHz} \frac{E_i}{a} \leq 1$$

$$\sum_{j=1kHz}^{1MHz} \frac{H_j}{H_{l,j}} + \sum_{j>1Mz}^{10MHz} \frac{H_j}{b} \leq 1$$

Where:

E_i is the electric field strength at frequency i
$E_{l,i}$ is the reference limit at frequency i
H_j is the magnetic field strength at frequency j
$H_{l,j}$ is the reference limit at frequency j
a = 610 V/m for occupational exposure and 87 V/m for general public exposure.
b = 24.4 A/m for occupational exposure and 5 A/m for general public exposure.

$$\sum_{i=100kHz}^{1MHz}\left(\frac{E_i}{c}\right)^2+\sum_{i>1Mz}^{300GHz}\left(\frac{E_i}{E_{l,i}}\right)^2\leq 1$$

$$\sum_{j=100kHz}^{1MHz}\left(\frac{H_j}{d}\right)^2+\sum_{j>1Mz}^{300GHz}\left(\frac{H_j}{H_{l,j}}\right)^2\leq 1$$

Where:

E_i is the electric field strength at frequency i
$E_{l,i}$ is the reference limit at frequency i
H_j is the magnetic field strength at frequency j
$H_{l,j}$ is the reference limit at frequency j
c = 610/f V/m (f in MHz) for occupational exposure and 87/f1/2 V/m for general public exposure. d = 1.6/f A/m (f in MHz) for occupational exposure and 0.73/f for general public exposure