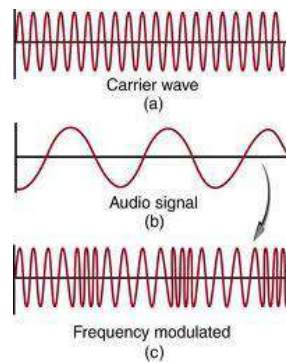




Public Utilities
Regulatory Authority
Equity in development

TECHNICAL GUIDELINES FOR FM BROADCAST STANDARDS



Directorate of Technical Regulations

February 2014

Contents

1.	DEFINITIONS	2
2.	INTRODUCTION	3
3.	CLASSES OF FM BROADCAST STATIONS	3
3.1	Public/Commercial FM station	3
3.2	Community Fm Stations	3
3.3	Educational/Scientific FM station [Non Commercial]	3
4.	FREQUENCY SPACING	3
5.	TECHNICAL REQUIREMENTS	4
5.1	Safety Requirements	4
5.2	Transmitting Facilities	4
5.3	Antenna System	4
6.	TRANSMITTER AND ASSOCIATED EQUIPMENT	5
6.1	Electrical Performance Standard	5
7.	CONSTRUCTION	6
7.1	Interlock of Doors	6
7.2	Wiring and Shielding	6
7.3	Metering	6
7.4	Technical Data	6
7.5	Frequency Monitor	7
8.	STEREOPHONIC TRANSMISSION STANDARDS	7
9.	STUDIO EQUIPMENT AND ALLIED FACILITIES	7
9.1	Studio Location and Layout	7
9.2	Spare Component Parts	8
9.3	Frequency Bands and Transmitter Power Output Authorised	8
9.4	Operating Requirements	8
9.5	Operating Hours	8
10.	TECHNICAL OPERATING REQUIREMENTS	9
10.1	Log Requirement	9
10.2	Program Log Book	9
10.3	In The Operating (Technical) Log Book	9
11.	OPERATION DURING AN EMERGENCY	10

1. DEFINITIONS

Antenna height above terrain:

- i. The height of the radiation center of the antenna above the terrain 3 to 16 km from the antenna.
- ii. When circular polarization is employed, the height of the antenna above average terrain shall be based upon the height of the radiation center of the antenna, which transmits the horizontal component of radiation.

Broadcasting channel:

A band of frequencies 300KHz wide and is designated by its center frequency. Channels for FM broadcasting stations begin at 82.1 MHz and continue in successive steps of 300KHz to and including 107.9 KHz.

Center frequency:

This is the frequency assigned by the Authority.

Effective radiated power (ERP) :

The product of the transmitter power multiplied by: -

- i. Antenna field gain squared
- ii. Antenna power gain.

Field intensity –

Electromagnetic intensity in the horizontal direction.

FM broadcast band:

Radio Frequency spectrum from 88MHz to108MHz.

Frequency swing:

The instantaneous departure of the frequency of the emitted wave from the center frequency resulting from modulation.

Multiplexing:

Implies that two or more independent sources of information are combined at the transmission end and are separated at the receiving end.

2. INTRODUCTION

The basic objective of any Broadcasting Station is to Educate, Entertain and Inform its listeners .It is therefore extremely important that AUTHORITIES set up Guidelines for Broadcasting standards in order to ensure that Listeners receive high quality Broadcast signals completely free of all types of interferences

Broadcasting is the cheapest method for providing Universal Access to the most remote areas of the country. As we live in an INCLUSIVE INFORMATION SOCIETY the Rural poor is as important as the rich urban dweller as far as access to information is concerned. Radio and Television Broadcasting are the most cost effective and efficient tools for eradicating illiteracy in the country. Therefore Regulating the Broadcasting sector becomes even more important.

But for Regulation to be effective, it must be directed at achieving policy objectives, it must be achievable in the sense that compliance must be within the control of the regulated entity and it must be enforceable to achieve standards.

AS the Broadcasting sector faces new challenges posed by the Internet and Digital media, it will be important for stakeholders in broadcasting to continue to coordinate their activities in a manner that best achieves the policy objective. At this stage of development in Broadcasting particularly as we move closer to the digital migration switch on date of 2015, our national policy and Regulation documents should reflect this important change to enhance our policy objectives.

3. CLASSES OF FM BROADCAST STATIONS

3.1 Public/Commercial FM station

This class of FM stations shall have an authorized transmitter power not exceeding 5kw and an Effective Radiated Power (ERP) not exceeding 37db and limited in antenna height of 80metres above average terrain.

3.2 Community Fm Stations

It shall have an authorized transmitter power not exceeding 500 watts and limited in antenna height of 30 metres above average terrain.

3.3 Educational/Scientific FM station [Non Commercial]

It shall have an authorized transmitter power not exceeding 50 watts and limited in antenna height of 15 metres above average terrain

All classes of FM stations shall be protected to the 1mv/m contour or 60dBu contour.

4. FREQUENCY SPACING

FREQUENCY SPACING (KHZ)	RF SIGNAL RATIO
0	60dBu: 15dBu
200	60dBu: 53dBu
400	60dBu: 80dBu

The intermediate frequency amplifiers of most FM receivers are designed to operate on 10.7MHz and because of this reason, assignment of two stations in the same area, one with frequency 10.6MHz and the other 10.8MHz removed from that of the other, should be avoided.

FM broadcast station shall not be authorized to operate in the same cities or cities next to each other with a frequency separation of not less than 400KHz.

5. TECHNICAL REQUIREMENTS

5.1 Safety Requirements

- i. In Conformity with Electrical Wiring Rules, all equipment using electrical power shall comply with the provisions of British / European Electrical Code or any International Electrical/Electronic Code to ensure safety of equipment, personnel and public in general.
- ii. All component parts shall be in accordance with generally accepted International standards.

5.2 Transmitting Facilities

- i. Any site particularly suitable for FM broadcasting in any area, in the absence of other comparable sites may be shared by and be made available to as many applicants as possible.
- ii. The transmitting site should be selected consistent with the purpose of the station, that is, whether it is intended to serve a city, or a metropolitan area. The location should be chosen such that line-of-site can be obtained from the antenna over the principal city.

5.3 Antenna System

- i. It shall be standard to employ vertical polarization. However, circular polarization of the clockwise or counter clockwise rotation may be employed.
- ii. ii. Antenna must be constructed such that it is clear of all surrounding buildings or objects that would cause shadow problems.
- iii. iii. In the event that a common tower is used by two or more licensees for antenna and /or antenna supporting purpose, the licensee who owns the tower shall assume full responsibility for the maintenance of the tower structure, painting and light requirements. In case of shared ownership, only one licensee shall assume full responsibility.

For the protection of Air Navigation, the antenna and supporting structure shall be painted and illuminated in accordance with International Air Transport Safety Regulations

6. TRANSMITTER AND ASSOCIATED EQUIPMENT

6.1 Electrical Performance Standard

The general design of the FM Transmitting system (from input terminal of microphone pre amplifiers through audio facilities at the studio through lines or other circuit between studio and transmitter, and through the transmitter but not exchanging equalizers for the correction of deficiencies in microphone response) shall be in accordance with the following principles and specifications:-

- i. The transmitter shall operate satisfactorily in the operating power range with a frequency swing of 75KHz, which is defined as 100% modulation.
- ii. The transmitter system shall be capable of transmitting a band of frequencies from 50Hz to 15KHz. Pre-emphasis shall be employed in accordance with impedance – frequency characteristics of a series inductance –resistance having a time constant of 75/us. The deviation of the system response from the standard pre-emphasis curve shall lie between two limits. The upper of these limits shall be uniform (no deviation) from 50Hz to 15KHz. The lower limit shall be uniform from 100Hz to 7.5kHz and 3dB below the upper limit, shall fall from the 3dB limit at uniform rate of 1dB octave from 7.5KHz to 15KHz.
- iii. Any modulating frequency between 50hz and 15KHz and at modulation percentage of 25, 50, and 100, the combined audio frequency harmonic measured in the output of the system shall not exceed the 200-mean-square values given in the table below.

MODULATION FREQUENCY	DISTORTION
50---100KHz	3.5%
100---7.5KHz	2.5%
7.5KHz to 15KHz	3.0%

- iv. The transmitting system output noise level in the band 50Hz to 15KHz shall be at least 50dBu below the level representing 100% amplitude modulation. The noise measuring equipment shall be provided with a standard 75/us de-emphasis and the ballistic characteristic of the instrument shall be similar to those of the standard VU meter.
- v. Automatic means shall be provided in the transmitter to maintain assigned center frequency the allowable tolerance of (± 2 KHz)
- vi. The transmitter shall be equipped with suitable indicating instrument for the determination of Transmitter output power, Reflected power for proper adjustment, operation and maintenance of the equipment.
- vii. Adequate provision shall be made for varying the transmitter output power to compensate for excessive variation in the voltage or for the factors affecting the out power.
- viii. Allowance should be provided in all components to avoid over heating at the rated maximum output power.

- ix. Any emission appearing on a frequency removed from the carrier by more than 240KHz and up including 600KHZ shall be attenuated at least 35db below the level of the un modulated carrier.

7. CONSTRUCTION

In general the transmitter shall be constructed either on racks and panels or in total enclosed frames protected as required by relevant international standards.

The transmitter shall comply with the following:

- i. The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by barrier or other equivalent means. All metallic parts shall be connected to ground.
- ii. All metallic handles and controls accessible to the operating personnel shall be effectively grounded. No circuit in access of 100V shall have a part expose to direct contact.

7.1 Interlock of Doors

- i. All access doors shall be provided with interlocks, which will disconnect all voltages in excess of 350V when any door access is open.
- ii. Means should be provided to make all tuning adjustments requiring voltage in access of 350V to be applied to the circuit, from the front of the panels with all access doors closed.
- iii. All plate supply and other high voltage equipment including transformers, filters, rectifiers and motor generators shall be protected so as to prevent injury to operating personnel.

7.2 Wiring and Shielding

- i. The transmitter panels or unit shall be wired in accordance with standard switchboard practice, either with insulated lead properly cabled and supported or with right bus bar properly insulated and protected.
- ii. Circuit carrying radio frequency energy between units shall be coaxial, or properly shielded.
- iii. All stages or units shall be adequately shielded and filtered to prevent radiation and interaction.

7.3 Metering

Transmission line meters and any other radio-frequency instrument that may be necessary for the operators to read shall be installed as to be easily and accurately read without the operator having to risk contact with circuits carrying high potential radio frequency energy.

7.4 Technical Data

An accurate circuit diagram as furnished by the manufacturer of the equipment shall be retained at the transmitter location.

7.5 Frequency Monitor

Each FM radio station is encouraged to have in operation at the transmitter end a frequency monitor of a type supported by the Authority, which shall be independent of the frequency control of the transmitter

8. STEREOPHONIC TRANSMISSION STANDARDS

- i. The modulating signal for the main channel shall consist of the sum of left and right signals.
- ii. Pilot subcarrier at $19\text{KHz} \pm 2\text{KHz}$ shall be transmitted that shall frequency modulate the main carrier between the limit of 8 and 10 percent.
- iii. The stereophonic sub-carrier shall be supreme to a level less than 1% modulation of the main carrier.
- iv. The stereophonic subcarrier shall be the second harmonic of the pilot sub-carrier.
- v. The stereophonic sub-carrier shall be capable of accepting audio frequencies from 50Hz to 15KHz.
- vi. The modulating carrier for the stereophonic sub-carrier shall be equal to the difference of the left and right signal.
- vii. The pre-emphasis characteristic of the stereophonic sub carrier shall be identical with those of the main channel with respect to plane and amplitude at all frequencies.
- viii. The sum of the side bands resulting from amplitude modulation of the stereophonic sub-carrier shall not cause a peak deviation of the main carrier in excess of 45% of the total modulation when only a left (or right) signal exist.
- ix. The maximum modulation of the main carrier by all subcarriers shall be limited to only 10%.
- x. The ratio of peak main channel deviation to peak stereophonic sub-channel deviation, when only steady state left (or right) signal exist shall be within ± 3.5 of unity for levels of this signal and all frequencies from 50Hz to 15KHz.
- xi. Cross-link into the main channel caused by a signal in the stereophonic sub-channel shall be attenuated at least 40dB below 90% modulation.
- xii. For required transmitter performance the maximum modulation to be employed is 90% rather than 100%.
- xiii. For electrical performance standards of the transmitter and associated equipment 100% modulation is referred to include pilot sub-carrier.

9. STUDIO EQUIPMENT AND ALLIED FACILITIES

9.1 Studio Location and Layout

- i. Each studio shall be associated with a control room from which the operational area (OA) of the studio may be viewed however, when the studio and the control room are integrated into one an announcer shall perform a simple front panel type functions like level adjustments and switching.

- ii. Studio and control room shall be constructed that they are insulated from source of extraneous noise and vibration, and the acoustic treatment of such studios and control shall be in accordance with good engineering practice.

9.2 Spare Component Parts

In order to cut down time during schedule on air operations, a reasonable variety and number of spare components appropriate to the equipment installed at the site shall be kept on hand.

9.3 Frequency Bands and Transmitter Power Output Authorised

STUDIO –TO- TRANSMITTER LINK (SLT)

BAND A	300-315MHZ
BAND B	734-752MHZ
BAND C	942-952MHZ

Maximum power allowable for STL bands A, B. and C is 15 watts.

9.4 Operating Requirements

9.5 Operating Hours

- i. **MINIMUM OPERATING SCHEDULE** -the licensee of each FM station shall maintain a minimum operating schedule $\frac{2}{3}$ of the total hours that it is authorized to operate except in emergencies when, due to cause beyond the cause of the licensee, it becomes impossible to continue operating. The station may cease operation for a period not exceeding 14 days.
- ii. Broadcast outside the authorized regular operating schedule may be aired without prior authorization from PURA provided the program falls under an emergency category in this case the information shall be entered into the station's Log Book at the time the broadcast is aired.
- iii. If permanent discontinuance of operation is being contemplated, then the licensee shall notify the authority in writing 4 to 9 days before the actual discontinuance is effected.

10. TECHNICAL OPERATING REQUIREMENTS

- i. The center frequency of each FM broadcast station shall be maintained within 2KHz of the assigned center frequency.
- ii. The percentage of modulation shall be maintained as high as possible consistent with good quality of transmission and in no case less than 85% nor more than 100% on peaks of frequent reoccurrence during any selection which normally is transmitted at the highest level of the program under consideration.
- iii. The operating power of each FM station shall be maintained as near as practicable to the authorized operating power, and shall not exceed the limits of 5% and 10% below the authorized power, except that in an emergency when it becomes impossible to operate within the authorized power, the station may be operated with a reduced power.
- iv. The station equipment shall be operated, tuned and adjusted that emission outside the authorized channel does not cause harmful interference to the reception of other radio stations.
- v. Should harmful interference to the reception of other radio station occur, the licensee may be required to take such further steps as may be necessary to eliminated the interference.

10.1 Log Requirement

The licensee of each FM broadcast station shall maintain separate program and operating logs and shall require entries to be made as follows:-

10.2 Program Log Book

- i. An entry of the time each station identification announcement (call letter, frequency, and location) is made.
- ii. An entry briefly describing each program broadcast such as music, drama, speech, etc. together with the name at the beginning and ending of the complete program.
- iii. An entry showing that each sponsored program broadcast has been announced as sponsored, paid for, or furnished by the sponsor.

10.3 In The Operating (Technical) Log Book

- i. An entry of the time the station begins and the time it ends transmission.
- ii. An entry of the time the program begins and ends.
- iii. An entry of each interruption to the carrier waves, and duration, as an interruption of program transmission.
- iv. Any other entry required by the instruments of authorization.
- v. An entry of the date and time of removal from restoration to service of any of the following.
- vi. Final RF stage voltmeter readings.
- vii. The transmission line RF voltage current or power meter reading.

- viii. The entries required concerning quarterly inspections of the condition of tower lights and associated control equipment, example, when a tower is cleaned or repainted.
- ix. Log Book of FM broadcast station shall be retained by the licensee for a period of two (2) years.
- x. For logs involving communication incidents or involved in investigation by the regulator and concerning which the licensee has been notified, shall be retained by the licensee until he is specifically authorized by the Authority to destroy them
- xi. A log shall be kept in orderly manner in suitable form and in such detail that the data required are readily available.
- xii. No log or portion thereof shall be erased, obligated, will fully destroyed within the retention period provided by the rules. Only the person originating the entry who shall strike out the erroneous portion, initial correction made and indicates the date of correction, shall make any necessary correction.

11. OPERATION DURING AN EMERGENCY

During an emergency, all FM Radio Stations operate under the command of the state that is, the state appointed agency.