

## 8.8.4 IARU Region 1 Technical Recommendation FM.2

### TECHNICAL STANDARDS FOR FM REPEATERS IN THE 145 MHz and 435 MHz BANDS

1. Polarisation: Antennas in the repeater service shall have vertical polarisation.
2. Operation: Without a new selective call the operating time for a repeater shall be between 3 - 10 minutes. The frequency of the selective call shall be 1750  $\pm$  50 Hz. As an alternative the CTCSS and/or DTMF as described in below can be used. When the signal to be relayed has disappeared or the operating time has come to an end the repeater station shall send its own call, and 15 seconds thereafter the transmission shall be interrupted. It should not be possible to interrupt the automatic identification transmission by a selective call. For the station identification F2A modulation shall be used.  
When working through a repeater station the lowest usable power consistent with good communication is recommended.
3. Power : The effective radiated power of the repeater transmitter shall not exceed 15 Watts.
4. Traffic mode: Simplex using demodulation/remodulation on a single channel / frequency pair.
5. Deviation: The maximum deviation of the repeater transmitter shall be  $\pm$  3 kHz ( 12K0F3E).
6. A.F. response: Audio frequency response shall be 300 - 3000 Hz. Outside this band the response shall go down with 12 dB/octave.
7. Pre-emphasis: The transmitter pre-emphasis shall be +6 dB/octave.
8. De-emphasis: The receiver de-emphasis shall be -6 dB/octave.
9. Responsibility: The repeater shall be under the control of the national IARU member society or their agent. The member society shall be responsible for the allocation of the adopted channel frequencies.
10. CTCSS: The use of CTCSS as an alternative or an addition to 1750Hz tone access shall be encouraged for VHF and UHF repeaters in Region 1 with the aim of reducing inadvertent interference by users to repeaters sharing the same input channel. **To minimise mutual unwanted interference, all FM repeaters will incorporate CTCSS tones on receivers as well as on transmitters. The transition period ends by the end of 2014.**  
For CTCSS the frequencies listed in table FM2.1 shall be adopted as a standard so that compatibility between repeater systems in different countries can be maintained, aiding the traveller who moves between countries.(The frequencies shall be accurate  $\pm$  1%)  
~~The CTCSS frequencies shall be allocated by member societies to their country's repeaters. The reference letters shown in the table may be used to identify CTCSS frequencies in a compact way.~~
11. DTMF: The DTMF system as specified below can be used as an alternative to the control of repeaters, voice mail boxes etc.  
The hardware part of the DTMF system consists of a keyboard with 12 push-buttons using the symbols #,\*,A,B,C,D and figures from 0 to 9. When pressed each push-button will activate 2 tones simultaneously, one above, the other below 1000 Hz, according to the following scheme in table FM.2.2.  
For example, if No. 5 is pressed, the tone combination 770 Hz/1336 Hz will be the result. The tone frequencies have to be accurate within  $\pm$  1.5 % .  
Each tone burst should be between 65 and 105 msec long. The pause between tones should be at least 200 msec.
12. User functions: To control the basic functions of repeaters and voice-mailboxes, the following codes should be used :  
Basic commands :  
\* Repeater opens, ( like the 1750 Hz )  
\* + 0 Repeater opens and transmits call sign, location and - if necessary- the CTCSS tone.  
\* + 1..9 Additional functions ( squelch control, power level and others )  
These basic commands can be extended and it is possible to control special functions of the repeaters or voice-mailboxes