

MPT 1316

CODE OF PRACTICE

**Selective signalling for use in the
Private Mobile Radio Services**

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1 INTRODUCTION

The term 'tone signalling system' defines a system in which the radio equipment is fitted with devices which at the transmitter generate a specified sequence of tones, having a short time duration, during transmission and at the receiver responds to a specific tone sequence.

2 APPLICATION OF THIS CODE OF PRACTICE

This code of practice covers the minimum performance considered necessary in order to make the best use of the available radio spectrum. It does not necessarily include all the characteristics which may be required by a user.

It applies to any tone signalling systems referred to as the CCIR, EEA, or ZVEI system or derivations thereof where the purpose of the system is to enable mobile station equipments to be selectively called or to give their status indication and to enable base station equipments to be selectively operated in the "talk-through" mode¹.

3 TEST CONDITIONS, ATMOSPHERIC CONDITIONS AND POWER SUPPLIES

3.1 General

Tests shall be made under normal test conditions (Clause 3.3) and also, where stated, under extreme test conditions (Clause 3.4). The tests will normally be carried out with the selective signalling system operated with representative radio equipment, and in the event that any clause in the appropriate radio equipment performance specification concerning extreme test conditions differs from the relevant clause in this code of practice, the clause for the radio equipment may be applied as an alternative. Otherwise, the test conditions and procedures shall be as specified in Clauses 3.2 to 3.5. Where applicable the manufacturer shall supply a test fixture permitting relative measurements to be made on the submitted sample²

This test fixture shall preferably provide a 50 ohms radio frequency terminal at the working frequencies of the equipment.

The test fixture shall provide input and output audio coupling and a means of connecting an external power supply.

The performance characteristics of this test fixture under normal and extreme conditions shall be subject to the approval of the testing authority. In particular the following characteristics shall apply:

the coupling loss shall be as low as possible, and in any case not greater than 30 dB;

the variation of coupling loss with frequency shall not cause errors in measurement exceeding 2 dB.

the coupling device shall not incorporate any non-linear elements.

3.2 Test power source

During tests, the power supply for the equipment may be replaced by a test power source, capable of producing normal and extreme test voltages as specified in Clauses 3.3.2 and 3.4.2. The internal impedance of the test power source shall be low enough for its effects on the test results to be negligible. For the purpose of tests, the supply voltage shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

¹ A code of practice covering the requirements for binary signalling systems has been published as MPT 1317

² Any connections provided on the equipment in order to facilitate relative measurements, shall not affect the performance of the equipment either in the test fixture or when making measurements involving the use of radiated fields

For the purpose of tests, the supply voltage shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

During the tests the power source voltage shall be maintained within a tolerance of $\pm 3\%$ relative to the voltage at the beginning of each test.

In equipment in which batteries are incorporated, the test power source shall be applied as close to the battery terminals as practicable.

3.3 Normal test conditions

3.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

Temperature	+ 15°C to + 35°C
Relative humidity	20 % to 75 %

NOTE: When it is impracticable to carry out the tests under the conditions stated above, a note to this effect, stating the actual temperature and relative humidity during the tests, shall be added to the test report.

3.3.2 Normal test source voltage

3.3.2.1 Mains voltage

The normal test source voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of this code of practice, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of the test power source corresponding to the AC mains shall be between 49 and 51 Hz.

3.3.2.2 Regulated lead-acid battery power sources

When the equipment is intended for operation from the usual type of regulated lead-acid battery source, the normal test source voltage shall be 1.1 times the nominal voltage of the battery (6 volts, 12 volts, etc.).

3.3.2.3 Other power sources

For operation from other power sources or types of battery, either primary or secondary, the normal test source voltage shall be that declared by the equipment manufacturer.

3.4 Extreme test conditions

3.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with the procedures specified in Clause 3.5, at an upper value of + 55°C and at a lower value of - 10°C.

3.4.2 Extreme test source voltages

3.4.2.1 Mains voltage

The extreme test source voltages for equipment to be connected to an AC mains source shall be the nominal mains voltage $\pm 10\%$. The frequency of the test power source shall be between 49 and 51 Hz

3.4.2.2 Regulated lead acid battery power sources

When the equipment is intended for operation from the usual type of regulated lead-acid power source the extreme test voltages shall be 1.3 and 0.9 times the nominal voltage of the battery.

3.4.2.3 Other power sources

The lower extreme test voltage for equipment with power sources using primary batteries shall be as follows:

For Leclanche type of battery; 0.85 times the nominal voltage of the battery.

For mercury type of battery; 0.9 times the nominal voltage of the battery.

For other types of primary batteries; End point voltage declared by the equipment manufacturer.

For equipment using other power sources or capable of being operated from a variety of power sources the extreme test voltages shall be those agreed between the equipment manufacturer and the testing authority and shall be recorded with the test results.

3.5 Procedure for tests at extreme temperatures

3.5.1 General

Before making measurements, the equipment shall be placed in a temperature controlled chamber for a period of one hour or for such period as may be judged necessary for thermal balance to be attained. The equipment shall be switched off during the temperature stabilisation period. The sequence of tests shall be chosen and the humidity content in the test chamber shall be controlled so that excessive condensation does not occur.

3.5.2 Test procedure

3.5.2.1 Equipment designed for continuous operation

For tests at the upper temperature, after thermal balance has been attained (Clause 3.5.1), the equipment shall be switched on in the transmit condition for half an hour, after which the appropriate tests shall be carried out. For tests at the lower temperature, after thermal balance has been attained (Clause 3.5.1), the equipment shall be switched on in the standby or receive condition for one minute, after which the appropriate tests shall be carried out³.

3.5.2.2 Equipment designed for intermittent operation only

The procedure shall be as described in Clause 3.5.2.1, except that at the upper temperature, the half hour transmit condition shall be replaced by one minute in the transmit condition followed by four minutes in the receive condition before measurements are made.

4 GENERAL CONDITIONS

4.1 Selective signalling code format

4.1.1 Definition

The selective signalling code format is the combination of five (or more) of the standard selective signalling frequencies to form a coded address having a nominal time duration.

³ If the equipment contains temperature stabilisation circuits designed to operate continuously, the equipment may be switched on for 15 minutes before measurements are made.

4.1.2 Selective signalling code format

	EEA System	CCIR System	ZVEI Systems
Start interval	100 msec min	100 msec min	140 msec \pm 15 msec
Tone duration	40 msec \pm 4 msec	100 msec \pm 10 msec	70 msec \pm 15 msec

4.2 Selective signalling tone frequency

4.2.1 Definition

The selective signalling tone frequency in Hz is the assigned audio frequency.

4.2.2 Standard frequencies

The standard frequencies available for assignment to each system are shown below.

Table 1: EEA System

Digit	CCIR	EEA	ZVEI	DZVEI
1	1124	1124	1060	970
2	1197	1197	1160	1160
3	1275	1275	1270	1160
4	1358	1358	1400	1270
5	1446	1446	1530	1400
6	1540	1540	1670	1530
7	1640	1640	1830	1670
8	1747	1747	2000	1830
9	1860	1860	2200	2000
0	1981	1981	2400	2200
Group	2400	1055	2800	2400
Repeat	2110	2110	2600	810

NOTE: The frequency 2600 Hz has been employed in 25 kHz channel spaced systems.

4.3 Normal test modulation

Normal test modulation shall be in accordance with that laid down in the relevant performance specification for the associated radio equipment and in accordance with the manufacturers instructions.

4.4 Normal coded test signal

This will be a train of correctly coded selective signal, separated from each other by a time of not less than the relevant call interval.

4.5 Monitoring facility

A means should be provided on all receiving equipment fitted with selective signalling for the operator to monitor the channel for a period sufficiently long to determine that it is free before transmitting a call.

4.6 Arrangements for test signals applied to the receiver

Sources of test signals for application to the:

- receiver input.
- test fixture input.

Shall be connected in such a way that the impedance presented to the relevant input is 50 ohms. This requirement shall be met irrespective of whether one or more signals are applied to the input simultaneously. The levels of the test signals shall be expressed in terms of the emf. at the relevant input terminals.

The effects of any intermodulation products and noise produced in the signal generators should be negligible.

5 SELECTIVE SIGNALLING ENCODER AND ASSOCIATED TRANSMITTER

5.1 Encoder tone frequencies

5.1.1 Method of measurement

- a) The transmitter and its associated encoder unit shall be connected via a suitable load and attenuator to a modulation meter. The transmitter shall be operated in accordance with the manufacturer's instructions, except that the encoder should be arranged to give transmission of each selective signalling tone in turn for a period of time not less than 10 seconds.
- b) The output of the modulation meter shall be connected to a frequency counter and the frequency of the selective signalling tone measured.
- c) The measurement shall be made under normal test conditions (Clauses 3.4.1 and 3.4.2 applied simultaneously).

5.1.2 Limit

The measured selective signalling frequencies should under all test conditions be within $\pm 1.5\%$ of the standard frequencies.

5.2 Encoder modulation

5.2.1 Method of measurement

The equipment shall be arranged as in Clause 5.1.1 a, and the selective signalling modulation shall be measured.

The measurement shall be made under normal test conditions (Clause 3.3), and repeated under extreme test conditions (Clauses 3.4.1 and 3.4.2 applied simultaneously).

5.2.2 Limits

The selective signalling modulation should, under all test conditions be within the following limits:

Table 3

System	Amplitude	Angle
Channel spacing kHz	Modulation depth %	Peak deviation \pm kHz
12.5/25	70 \pm 20 %	70 \pm 20 % of maximum deviation referenced to the 6 dB per octave pre-emphases where applicable

5.3 Encoder response time

5.3.1 Definition

The encoder response time is the elapsed time from the moment the control circuit is activated at the transmitter until the selective signalling modulation value of the transmitter has reached 90 % of the steady state value.

5.3.2 Method of measurement

The transmitter and its associated encoder unit shall be connected via a load and an attenuator to a suitable demodulator.

The output of the demodulator shall be monitored by an oscilloscope.

A suitable synchronising pulse, for the calibrated horizontal scan of the oscilloscope, shall be derived from the signal that enables the encoder and transmitter.

The encoder response time shall be taken as the elapsed time from the enabling signal, until the envelope of the demodulated signal has reached 90 % of its steady state value⁴.

The measurement shall be made under normal test conditions (Clause 3.3)

5.3.3 Limits

The encoder response time should not exceed 150 msec.

In the case of transmitters where the radio-frequency rise time is appreciable, this rise time may be added to the above limit.

6 DECODER AND ASSOCIATED RECEIVER

6.1 Selective signalling threshold

6.1.1 Definition

The selective signalling threshold is the minimum radio frequency level of a signal at the normal operating frequency modulated by the normal coded test signal which will produce a successful calling rate of 80 %.

⁴ The rise time of the demodulator should not affect the result.

6.1.2 Method of measurement

A test signal at the nominal frequency of the receiver, and modulated with the normal coded test signal at the minimum value shown in Clause 5.2.2, shall be applied to the input of the receiver.

The level of the test signal shall be adjusted to find the minimum level at which a successful calling rate of 80 % is achieved.

The measurement shall be made under normal test conditions (Clause 3.3), and repeated under extreme test conditions (Clauses 3.4.1 and 3.4.2 applied simultaneously).

6.1.3 Limits

The selective signalling threshold should be less than the maximum usable sensitivity limit of the relevant mandatory receiver specification, under all test conditions. Under all test conditions, the decoder should not operate in the absence of a selective signalling input.

6.2 Selective signalling code selectivity

6.2.1 Definition

Selective signalling code selectivity is the ability of the selective signalling decoder to reject signals operating on the same radio frequency channel having any other selective signalling code in the relevant code format.

6.2.2 Method of measurement

A test signal at the nominal frequency of the receiver and at a level 60 dB above the selective signalling threshold (Clause 6.1) shall be applied to the input of the receiver.

The test signal shall be modulated at the maximum value shown in Clause 5.2.2, by the alternative code other than the one to which the decoder is set to.

The measurement shall be made under normal test conditions (Clause 3.3) and repeated under extreme test conditions (Clauses 3.4.1 and 3.4.2 applied simultaneously).

6.2.3 Limit

The decoder should not be operated by either of the alternate selective signalling code, under all conditions of test.

7 ACCURACY OF MEASUREMENT

The tolerance for the measurement of the following parameters shall be as given below:

* DC voltage	± 3 %
* AC mains voltage	± 3 %
* AC mains frequency	± 0.5 %
* Audio frequency voltage, power etc.	± 0.5 dB
* Audio frequency	± 1 %
* Distortion, noise etc. of audio frequency generators %	1
* Radio frequency voltage	± 2 dB

*	Impedance of artificial loads, cables, plugs attenuators etc.	$\pm 5 \%$
*	Source impedance of generators	$\pm 10 \%$
*	Temperature	$\pm 1 \text{ }^\circ\text{C}$
*	Humidity	$\pm 5 \%$

8 INTERPRETATION OF THIS CODE OF PRACTICE

In cases of doubt about the interpretation of this code of practice, the methods of carrying out the tests and the validity of statements made by the manufacturers of the equipment, the decision of the Radiocommunications Agency shall be final.