

**MPT 1322**

**PERFORMANCE SPECIFICATION**

**Angle modulated MF and VHF  
radio equipment for use at base  
and hand portable stations in the  
Cordless Telephone Service**

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## FOREWORD

It is a requirement of the Wireless Telegraphy Act 1949 that no radio apparatus shall be installed or used in the United Kingdom except under the authority granted by the Secretary of State. It is a condition of this authority that the performance of the apparatus must meet certain minimum standards. These minimum standards of performance are given in specifications prepared by the Radiocommunications Agency in consultation with the relevant manufacturers.

Applicants who wish to submit equipment for type approval testing should apply to one of the accredited test houses. Guidance for applicants is given in the RA Information Sheet 'RA 207 (Rev 1): Type Approval - UK Type Approval Requirements for Land Mobile and Maritime Mobile Radiocommunications Equipment'. This is available on a single copy basis free from the RA Information & Library Service.

Equipment will be considered for approval purposes either:

- a) by direct compliance with MPT 1322 or;
- b) by compliance with a national standard or government regulation of any Member State of the European Community, or any Member State which is contracting party to the EEA Agreement or;
- c) by compliance with any relevant international standard or regulation recognised in a member State of the European Community, or a Member State which is a contracting party to the EEA Agreement;
- d) and, where appropriate, by compliance with manufacturing rules and procedures of a Member State of the European Communities, or a Member State which is a contracting party to the EEA Agreement, relating to quality control operations during manufacture of the equipment where they form part of a standard or technical regulations in a) or c) as above;

provided that in case b) or c) the regulation is deemed to comply with MPT 1322.

The results of tests to such a standard will be taken into consideration if carried out by authorised and accredited test houses in accordance with ISO guides 25 and 38 or EN45001 and EN45002 or a national standard conforming to these requirements.

Notwithstanding the provisions of the EMC Directive, the following sub clauses shall be applied for spectrum management:

transmitter spurious emissions, subclause 5.6  
receiver spurious radiations, subclause 6.1

The EMC tests carried out on the basis of article 10.5 of the EMC Directive 89/336/EEC by the notified bodies established in other Member States would not normally be repeated for licensing purposes in the United Kingdom.

Applicants who wish to demonstrate compliance with the EMC directive are advised to refer to the RA Information sheets 'RA 200: Electromagnetic Compatibility for Radio' and 'RA 227 (Rev. 1): EMC - The EC Type Examination Route to compliance for Radiocommunication Transmission Apparatus'. These are available on a single copy basis free from the RA Information & Library Service.

It may be necessary for amendments to this specification to be issued. Amendment sheets will be available from the RA Information and Library Service.

For the latest information concerning Type Approval Status and Licensing conditions, refer to the RA Information Sheet 'RA 275: Status of Land Mobile Radio Specifications (MPT 1300 series)'. This publication also contains contact names and telephone numbers for Agency staff who are able to assist you with licensing and technical enquiries and is available on a single copy basis free from the RA Information & Library Service.

This revision was required in order to allow for;

- a) This document to be updated in line with the Agency's current Standard format and layout for the MPT 1300 series specifications.
- b) Amendments made to Clause 1.2 of this document to be incorporated into the document. The amendments to Clause 1.2 were made in order to ease channel congestion problems and appeared as annexes in previous versions of this document. The first version of this document only permitted fixed channel equipments; this was subsequently amended due to perceived channel congestion to allow either manual selection of one of 2 channel pairs, or dynamic selection of one of the eight available channel pairs.

The Radiocommunications Agency has a 'web site' which can be accessed on <http://www.open.gov.uk/radiocom/rahome.htm>. It is planned that all of the MPT 1300 series of specifications will be available on here.

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## 1 GENERAL

### 1.1 Scope of Specification

This specification covers the minimum performance requirements for angle modulated radio equipments, comprising base station, and hand-portable transmitters and receivers for use in the Cordless Telephone Service. The Cordless Telephone Service is intended to provide a cable-free telephone extension employing duplex transmission of speech and signalling up to a range of approximately 200m from the point of connection to the public telephone network. Where the equipment is intended for connection to the telephone network, the equipment will be required to meet the requirements of this specification. Additionally the equipment will be required to comply with the standards for cordless telephones laid down by the British Standards Institution and/or British Telecommunications.

### 1.2 Operating Frequencies

The equipment shall provide for transmission and reception of angle modulated emissions on not more than two pairs of radio frequencies by manual means, or on one pair of frequencies by dynamic means.

Channel No	Base Unit Transmit Frequencies	Portable Unit Transmit Frequencies
1	1642.00 kHz	47.45625 MHz
2	1662.00 kHz	47.46875 MHz
3	1682.00 kHz	47.48125 MHz
4	1702.00 kHz	47.49375 MHz
5	1722.00 kHz	47.50625 MHz
6	1742.00 kHz	47.51875 MHz
7	1762.00 kHz	47.53125 MHz or 47.44375 MHz <sup>1</sup>
8	1782.00 kHz	47.54375 MHz

If the equipment is capable of operation on more than one pair of frequencies, the operating frequencies shall be selected by means of manual switches at the base and handset units. The transmit and receive frequencies shall not be separately selectable.

Alternatively, one channel pair from the eight available channel pairs may be selected by dynamic means.

Equipment submitted for type approval may be operational on any one or two of the channels listed above. If the equipment is capable of operation on more than one channel, it shall be so equipped at the time of submission for testing.

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<sup>1</sup> The frequency 47.44375 MHz may be used as an alternative to 47.53125 MHz where problems are experienced due to the 27th harmonic relationship between 1762.0 kHz and 47.53125 MHz

### 1.3 Permitted effective radiated power

For the VHF transmission from the handportable equipment the effective radiated power shall not exceed 10 mW. The maximum DC power supplied to the output stage of the MF transmitter in the base unit shall not exceed 1 W. The effective radiated power of the transmission from the base station unit shall not exceed 10 mW.

NOTE: The antenna associated with the base station MF transmitter will be comprised of an insulated wire or rod of between 1m and 3m in length permanently attached to the base unit. To minimise coupling of MF radio frequency energy into the AC mains supply or telephone network, the antenna shall not be part of any cable form containing other connecting wires to the base station unit. The loading coil associated with this antenna must be contained within the base station and not accessible to the user. The antenna system shall be so designed as to prevent the radiated power being increased when the external wire or rod is electrically extended beyond the length of that supplied by the manufacturer.

### 1.4 Labelling

The equipment shall be provided with a clear indication of the type number or description under which it is submitted for type testing. Each type number shall be unique and in the event that the testing authority finds two manufacturers have used a similar type number, one manufacturer will be asked to change the type number.

### 1.5 Controls

Those controls, which if maladjusted might increase the interfering potentialities of the equipment, shall not be easily accessible.

### 1.6 Declarations by the manufacturer

When submitting an equipment for type testing, the manufacturer shall supply the following information:

- Transmitters
  - nominal frequency or frequencies
  - Crystal frequency and carrier generation formula or technique of frequency generation
  - Crystal type where applicable
- Receivers
  - nominal frequency or frequencies
  - Crystal frequency and local oscillator generation
  - Crystal type
- Power supply
  - Nominal supply voltage
  - Type of battery where applicable
  - Battery end point voltage where applicable

## 2 TEST CONDITIONS, POWER SUPPLIES AND ATMOSPHERIC CONDITIONS

### 2.1 General

Tests shall be made under normal test conditions (Clause 2.3) and also, where stated, under extreme test conditions (Clause 2.4)

## **2.2 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 2.3.2 and 2.4.2 and also capable of being reduced continuously over the range from the normal equipment operating voltage to zero voltage to simulate a power supply failure.

The internal impedance of the test power source shall be low enough for its effects on the test results to be negligible.

For the purposes 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.

## **2.3 Normal test conditions**

### **2.3.1 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 %

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.

### **2.3.2 Normal test source voltage**

#### **2.3.2.1 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 specification, 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.

#### **2.3.2.2 Nickel cadmium battery**

When the equipment is intended for operation from the usual type of nickel cadmium battery the normal test voltage shall be the nominal voltage of the battery (1.2V per cell).

#### **2.3.2.3 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.

## **2.4 Extreme test conditions**

### **2.4.1 Extreme temperatures**

For tests at extreme temperatures, measurements shall be made in accordance with the procedures specified in Clause 2.5 at an upper value of 40°C and at a lower value of 0°C.

### **2.4.2 Extreme test source voltages**

#### **2.4.2.1 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.

#### **2.4.2.2 Nickel cadmium battery**

When the equipment is intended for operation from the usual type of nickel cadmium battery, the extreme test voltages shall be 1.25 and 0.85 times the nominal voltage of the battery.

#### **2.4.2.3 Other power sources**

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

- for Leclanché type battery - 0.85 times the nominal voltage
- for mercury type of battery - 0.9 times the nominal voltage
- for other types of primary battery - 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 declared by the equipment manufacturers and shall be recorded with the test results.

### **2.5 Procedure for tests at extreme temperatures**

#### **2.5.1 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 obtained. 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.

#### **2.5.2 Test procedure**

##### **2.5.2.1 Equipment designed for continuous operation**

For tests at the upper temperature, after thermal balance has been attained (Clause 2.5.1) the equipment shall be switched on 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 2.5.1) the equipment shall be switched on for one minute, after which the appropriate tests shall be carried out.

## **3. ELECTRICAL TEST CONDITIONS FOR THE VHF TRANSMITTER AND RECEIVER**

### **3.1 Transmitter artificial load**

Tests on the transmitter shall be carried out using a 50 ohm non-reactive, non-radiating load connected to the antenna terminals. If necessary an impedance matching device may be used for testing.

## **3.2 Test fixture**

### **3.2.1 General**

A test fixture will be required to permit relative measurements to be made on the sample<sup>2</sup>.

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

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

Over the radio frequency measurement range, the following characteristics shall apply to the test fixture:

- the coupling loss shall be as low as possible, and not greater than 30 dB;
- the variation of coupling loss shall not cause errors in measurement exceeding 2 dB;
- the coupling device shall not incorporate any non-linear elements.

## **3.3 Test site and general arrangements for measurements involving the use of radiated fields.**

### **3.3.1 Test site**

The test site shall be located on a surface or ground which is reasonably level. On this site, a ground plane of at least 5m diameter shall be provided. In the middle of this ground plane, a non-conducting support, capable of rotation through 360° in the horizontal plane, shall be used to support the test sample at 1.5m above the ground plane. The test site shall be large enough to allow the erection of a measuring or transmitting antenna at a distance from the test sample of not less than half the wavelength corresponding to the lower frequency to be considered. The distance actually used shall be recorded with the results of the test carried out on the site. Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site and ground reflections do not degrade the measurements.

### **3.3.2 Test antenna**

The test antenna is used to detect the radiation from both the test sample and the substitution antenna, when the site is used for radiation measurements. This antenna is mounted on a support capable of allowing the antenna to be used either horizontally or vertically polarised and for the height of its centre above ground to be varied over the range 1 to 5m. Preferably test antennas with pronounced directivity should be used. The size of the test antenna along the measurement axis shall not exceed 20% of the measuring distance. For radiation measurements, the test antenna is connected to a test receiver, capable of being tuned to any frequency under investigation and of measuring accurately the relative levels of signals at its input.

### **3.3.3 Substitution antenna**

The substitution antenna shall be a  $\lambda/2$  dipole resonant at the frequency under consideration, or a shortened dipole, calibrated against the  $\lambda/2$  dipole. The centre of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the point at which the external antenna is connected.

The distance between the lower extremity of the dipole and the ground shall be at least 0.3m.

The substitution antenna shall be connected to a calibrated signal generator when the site is used for radiation measurements.

The signal generator and the receiver shall be operating at the frequency under investigation and shall be connected to the antenna through suitable matching and balancing networks and shall be positioned such as to minimise any effect on the measurement.

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<sup>2</sup> 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

### 3.4 Normal test modulation

Where stated, the transmitter shall have normal test modulation as follows:

The modulation frequency shall be 1 kHz and the resulting frequency deviation shall be 60% of the maximum permissible frequency deviation (Clause 5.4.3).

### 3.5 Method of applying modulating signals

To facilitate the application of audio frequency input signals to the hand portable transmitter, the manufacturer shall provide temporary electrical connections.

## 4 ELECTRICAL TEST CONDITIONS FOR THE MF TRANSMITTER AND RECEIVER

### 4.1 Transmitter artificial load (used for tests of transmitter terminal power frequency modulation and adjacent channel power)

The antenna shall be disconnected from the base station unit and replaced by the artificial load. The artificial load will be a combination of elements which will allow the measurement of maximum antenna current and measurement of the relative levels of carrier and adjacent channel power. (see Figure 1).

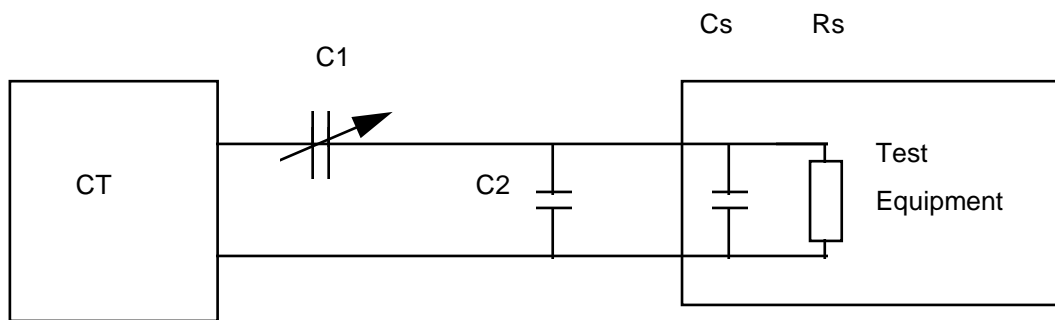


Figure 1

The capacitor C2 is chosen to have a low impedance relative to the capacitance of the antenna wire, a suitable value being 1000 pF. The capacitive load of the test equipment, Cs, is assumed to be negligible, and its input resistance (Rs) very high (this implies the use of high impedance probes to buffer 50 ohm inputs). The variable capacitor C1 is a low loss (airspaced) type covering the range 5 to 50 pF.

### 4.2 Test site (used for transmitter harmonic and receiver spurious output measurements).

#### 4.2.1 Test site

The test site shall be located on a surface or ground which is reasonably level. On this site, the sample under test shall be placed on a non-conducting support, capable of rotation through 360° in the horizontal plane, at a height of 1.5 m above the ground. The test antenna of a field strength measuring receiver shall be located at a distance of not less than 10m from the sample. (Note: this distance will depend on the field strength levels to be measured, the effects of co-channel interference and the sensitivity of the measuring receiver). The distance between the sample and the measuring antenna used in any tests shall be recorded along with the test results. Sufficient precautions shall be taken to ensure that reflections from extraneous objects and ground reflections do not degrade the measurements.

In the case of measurements on the base station transmitter;

the mains lead from the transmitter shall be arranged to descend vertically down from the sample under test to the ground, and then along the ground at an angle of 90° to the line between the test sample and measuring antenna;

the transmitter antenna shall be orientated as to produce the maximum field strength at which measurements are made. For the purpose of these tests, if a flexible wire antenna is used it shall be held in a straight line away from the transmitter case by means of a suitable non-conductive support.

#### **4.2.2 Field strength measuring receiver**

The field strength measuring receiver shall be a quasi peak instrument in accordance with British Standard BS 727:1967, and in the frequency range 0.5 to 30 MHz.

#### **4.3 Normal test modulation**

Normal test modulation shall be applied as defined in Clause 3.4.

#### **4.4 Method of applying modulating signals**

Audio modulating signals shall be applied with, where necessary, a direct current bias via the telephone line interface. To accomplish this it may be necessary to activate the base station receiver by a transmission from the portable unit.

### **5 TRANSMITTER TESTS**

#### **5.1 Frequency error**

##### **5.1.1 Definition**

The frequency error of the transmitter is the difference between the measured carrier frequency and its nominal value.

##### **5.1.2 Method of measurement**

- a) The transmitter shall be placed in the test fixture (Clause 3.2) or connected to the artificial load (Clause 4.1) as applicable. The transmitter shall be operated in accordance with the manufacturer's instructions to obtain normal output power.
- b) The emission shall be monitored by a frequency counter and the carrier frequency shall be measured in the absence of modulation.
- c) The measurement shall be made under normal test conditions (Clause 2.3) and repeated under extreme conditions (Clauses 2.4.1 and 2.4.2 applied simultaneously)
- d) For the MF base station transmitter only, the test shall be repeated under normal conditions, except that the variable capacitor in the artificial load shall be slowly adjusted over its entire range whilst the carrier frequency is monitored. Any change in carrier frequency due to this variation load shall be noted.

##### **5.1.3 Limit**

The frequency error, under both normal and extreme test conditions, or in the case of the MF base station transmitter with any value of load impedance applied to the transmitter output shall not exceed  $\pm 2.0$  kHz.

## 5.2 Carrier power VHF transmitters

### 5.2.1 Definition

For the purpose of this specification the carrier power shall be the maximum value of effective radiated power of an unmodulated carrier.

### 5.2.2 Radiated power

#### 5.2.2.1 Method of measurement under normal test conditions

- a) On a test site fulfilling the requirements of Clause 3.3.1 the equipment shall be placed on the support in the following position:

equipment with internal antenna shall be arranged with that axis vertical which is closest to vertical in normal use,

for equipment with rigid external antenna, the antenna shall be vertical

for equipment with non-rigid external antenna, the antenna shall be extended vertically upwards and held by a non-conducting support.

- b) The transmitter shall be switched on, without modulation, and the test receiver shall be tuned to the frequency of the signal being measured.
- c) The test antenna shall be orientated for vertical polarisation and shall be raised or lowered through the specified height range until a maximum signal level is detected on the test receiver.<sup>3</sup> (Clause 3.3.2)
- d) The transmitter shall then be rotated through 360° until the maximum signal level is received.
- e) The transmitter shall be replaced by the substitution antenna and the signal generator as defined in Clause 3.3.3 and the antenna raised or lowered as necessary to ensure that the maximum signal is still received.
- f) The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the test receiver.
- g) The carrier power is equal to the power supplied to the substitution antenna, increased by the known relationship if necessary.
- h) Steps (a) to (g) shall be repeated by any alternative integral antenna supplied by the manufacturer.
- i) A check shall be made at other planes of polarisation to ensure that the value obtained in (g) above is the maximum. If larger values are obtained this fact shall be recorded in the test report.

#### 5.2.2.2 Method of measurement under extreme test conditions

The equipment shall be placed in the test fixture (Clause 3.2) connected to the artificial load (Clause 3.1) with a means of measuring the power delivered to this load.

In the absence of modulation, the transmitter shall be operated in accordance with the manufacturer's instructions. The carrier power shall then be measured.

The measurement shall be made under normal test conditions (Clause 2.3) and repeated under extreme test conditions (Clauses 2.4.1 and 2.4.2 applied simultaneously).

### 5.2.3 Limits

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<sup>3</sup> The maximum may be a lower value than that obtainable at heights outside the specific range

The effective radiated power measured under normal test conditions in accordance with Clause 5.2.2.1 shall not exceed 10mW. The carrier power under extreme test conditions shall not be more than 3 dB above that measured under normal conditions in accordance with Clause 5.2.2.1.

### 5.3 Carrier power MF base station transmitter

#### 5.3.1 Definition

For the purpose of this specification the carrier power to the MF transmitter shall be the power that would be dissipated in the resistive component of the self-impedance of the antenna with which the transmitter is designed to operate.

#### 5.3.2 Method of measurement

The carrier power of the MF base station transmitter is evaluated by the measurement of the current that can be delivered into an artificial load having an impedance similar to that into which the transmitter is designed to operate (Clause 4.1).

##### 5.3.2.1 Measurement under normal test conditions (Clause 2.3)

- a) The transmitter under test shall be connected to the artificial load as described in Clause 4.1.
- b) The transmitter shall be operated, without modulation, in accordance with the manufacturer's instructions.
- c) Whilst observing the radio frequency voltage across the fixed capacitor C2 in the artificial load the variable capacitor C1 shall be adjusted to resonate the antenna matching circuit within the base station transmitter (i.e. for a peak in the voltage reading)
- d) The radio frequency voltage is measured across C2 at resonance. The carrier power of the MF base station transmitter shall be calculated from the formula:

Carrier Power (P) =  $6.93 \times 10^{-13} V^2 C_2^2 f^4 L^2 W$ , where "V" is the RMS voltage across the fixed capacitor C2, "C2" the value of capacitor C2 in F; "f" the frequency of the emission in Hz, and "L" the length in metres of the antenna for which the transmitter is designed to operate.

##### 5.3.2.2 Measurement under extreme conditions

The test of carrier power (Clause 5.3.2.1) shall be repeated but under extreme conditions (Clauses 2.4.1 and 2.4.2 applied simultaneously)<sup>4</sup>.

#### 5.3.3 Limits

The carrier power shall not exceed 10mW under test conditions with any value of load resistance. The carrier power under extreme conditions, shall not exceed the highest measured value under normal conditions by more than 3 dB.

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<sup>4</sup> if resonance cannot be achieved with the capacitor in the range 5 to 50pF this indicates the equipment is designed to generate maximum power when used with an antenna of length greater than 3m which is unacceptable within the terms of this specification

## 5.4 Frequency Deviation

### 5.4.1 Definition

The frequency deviation between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency in the absence of modulation. For test purposes, only the maximum value of the frequency deviation available in the transmitter shall be measured.

### 5.4.2 Maximum Permissible deviation

#### 5.4.2.1 Definition

The maximum permissible deviation is the maximum value of frequency deviation under any conditions of modulation including switching and presence of any signalling tones.

#### 5.4.2.2 Method of measurement

- a) If the equipment is a base station, it shall be connected to the artificial load (Clause 4.1) and if handportable, it shall be placed in the test fixture (Clause 3.2). The equipment shall be operated in accordance with the manufacturer's instructions to obtain normal power input.
- b) The emission shall be monitored by a modulation meter capable of measuring the peak value of both positive and negative frequency deviation including that due to any harmonics and intermodulation products which may be produced in the transmitter.
- c) The transmitter shall then be modulated by an audio frequency signal 20 dB above the level necessary to produce normal test modulation (Clause 3.4) and the modulation frequency varied from 0.3 to 3.4 kHz.
- d) At each test frequency, the peak deviation shall be measured.

### 5.4.3 Limit

Under any conditions of modulation, the frequency deviation shall not exceed:

- ±4.0 kHz for the MF base station transmitter
- ±2.5 kHz for the VHF handportable transmitter

### 5.4.4 Response of the transmitter at modulation frequencies above 3.4 kHz

#### 5.4.4.1 Definition

The response of the transmitter at modulation frequencies above 3.4 kHz is the frequency deviation expressed as a function of modulation frequencies above 3.4 kHz.

#### 5.4.4.2 Method of measurement

- a) The transmitter shall be arranged as described in Clause 3.2 or 4.1 as applicable and modulated with normal test modulation (Clause 3.4)
- b) With a constant input level of the modulating signal, the frequency shall be varied from 3.4 to 30 kHz.
- c) At each test frequency, the resulting frequency deviation shall be measured. Where signalling tone(s) are employed, these should be removed or where this is not possible, the deviation due to signalling tone(s) shall be measured and subtracted from the deviation resulting from the composite signal.

#### 5.4.4.3 Limits

The frequency deviation at modulation frequencies between 3.4 and 7 kHz shall not exceed the frequency deviation at a modulation frequency of 3.4 kHz. At 7 kHz the deviation shall not exceed 50% of the maximum permissible frequency deviation. At modulation frequencies above 7 kHz the deviation shall fall at a rate equal to, or greater than 3 times per octave.

### 5.5 Adjacent Channel Power

#### 5.5.1 Definition

The adjacent channel power is that part of the total power output of a transmitter, under defined conditions of modulation, which falls within the bandwidth of a receiver of the type normally used in the system and operating in either of the adjacent channels.

#### 5.5.2 Method of measurement using a spectrum analyser

The adjacent channel power may be measured with a spectrum analyser which conforms to Clause 5.5.3. The transmitter shall be placed in the test fixture (Clause 3.2) and operated at the carrier power (Clause 5.2 or 5.3 as applicable) under normal test conditions (Clause 2.3). The radio frequency output of the test fixture shall be applied to the input of a spectrum analyser at a level that is appropriate. The transmitter shall be modulated by a 1250 Hz signal at a level which is 20 dB greater than that required to produce 60% of the maximum permissible frequency deviation (Clause 5.4.3) together with the normal signalling tone(s).

The spectrum analyser shall be adjusted so that the spectrum of the transmitter output, including that part which falls in the adjacent channels is displayed.

The amplitudes of the discrete components and the noise power level due to the transmitter shall be measured in each of the adjacent channels.

The adjacent channel power shall be calculated by summing the powers of all the components falling in the appropriate bandwidth. For the purpose of this test, the bandwidth of a receiver of the type normally used in the system shall be taken to be:

- 16 kHz for 25 kHz channel spacing
- 14 kHz for 20 kHz channel spacing
- 8.5 kHz for 12.5 kHz channel spacing

with a tolerance of  $\pm 10\%$ .

The centre frequency of the bandwidth within which measurements shall be made shall have a separation from the nominal carrier frequency of the transmitter, equal to the channel separation for which the equipment is intended. The adjacent channel power is the sum of the power level of each of the discrete components and the noise falling in the appropriate bandwidth. This sum may be calculated or use made of an automatic power level integrating device (Clause 5.5.4). In the latter case, the relative power level of the unmodulated transmitter is initially measured by integration over the appropriate bandwidth, centred on the nominal frequency. With the transmitter modulated by a signal as described above the integration is repeated at this bandwidth centred on the nominal frequency of the adjacent channel and the input level to the integrating device is increased until the same power level at the output of the device is obtained.

The difference in the input levels, in dB, is the ratio of the adjacent channel power to the carrier power.

The adjacent channel power, expressed as an effective radiated power, is calculated by applying this ratio to the carrier power as determined in Clause 5.2 or 5.3 as appropriate. The measurement shall be repeated for the other adjacent channel.

### 5.5.3 Spectrum analyser specification

The specification shall include the following requirements:

It shall be possible to measure the amplitude of a signal or noise at a level 3 dB or more above the noise level of the spectrum analyser, as displayed on the screen to an accuracy of  $\pm 2$  dB, in the presence of a signal separated in frequency by:

10 kHz, at a level 90 dB above the level of the signal to be measured for 25 and 20 kHz channel spacing

and

6.25 kHz, at a level 80 dB above the level of the signal to be measured for 12.5 kHz channel spacing, at a resolution bandwidth of 1 kHz.

The reading accuracy of the frequency marker shall be within  $\pm 2\%$  of the channel separation. The accuracy of relative amplitude measurements shall be within  $\pm 1$  dB. It shall be possible to adjust the spectrum analyser to allow the separation on its screen of two components with a frequency difference of 1 kHz.

### 5.5.4 Integrating and power summing device

The integrating and power summing device shall be connected to the video output of the spectrum analyser, described in Clause 5.5.3.

It shall be possible to sum the effective power of all discrete components and the noise power falling in the selected bandwidth and to measure this as a ratio relative to the carrier power.

The position and width of the selected integrating range can be indicated on the spectrum analyser by brightening the trace.

When measuring power levels of the order of 50 nW, the output of the device shall exceed the internal noise level by at least 10 dB. The dynamic range shall permit measurement of the value required under Clause 5.5.5 with a reserve of at least 10 dB.

### 5.5.5 Limits

The adjacent channel power shall not exceed 1  $\mu$ W.

## 5.6 Spurious emission

### 5.6.1 Definition

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation, radiated by the equipment and its antenna.

### 5.6.2 Method of measurement - effective radiated power (frequency range 30 to 1000 MHz)

- a) On a test site fulfilling the requirements of Clause 3.3 the transmitter shall be placed at the specified height on the support.
- b) The transmitter shall be operated without modulation at the carrier power measured in Clause 5.2.2.1.
- c) Radiation of any spurious emissions shall be detected by the test antenna and receiver, over the frequency range 30 to 1000 MHz.
- d) At each frequency at which an emission is detected, the support shall be rotated to obtain maximum response.

- e) The transmitter shall be replaced by a signal generator and dipole antenna and the effective radiated power of the emission determined by a substitution measurement.
- f) The measurements shall be repeated with the test antenna in the orthogonal polarisation plane.
- g) The measurements shall be repeated with the transmitter modulated with normal test modulation (Clause 3.4).
- h) The measurements shall be repeated for any alternative integral antenna which can be supplied with the equipment.

#### **5.6.3 Method of measurement - radiated field strength (frequency range 0.5 to 30 MHz)**

- a) On a test site fulfilling the requirements of Clause 4.2 the transmitter with its integral antenna shall be placed at the specified height on the support.
- b) The transmitter shall be operated without modulation at the carrier power measured in Clause 5.3.
- c) Radiation of any spurious emissions shall be detected by the test antenna and receiver over the frequency range 0.5 to 30 MHz.
- d) At each frequency at which an emission is detected, the transmitter and its associated antenna shall be orientated to obtain maximum response.
- e) The measurements shall be repeated with the transmitter modulated with normal test modulation (Clause 3.4).

#### **5.6.4 Limits - VHF handportable transmitter**

Any spurious emission from the transmitter in the frequency range 30 to 1000 MHz expressed as a radiated power, in either plane of polarisation, shall not exceed 50 nW within the following frequency bands:

87.5 to 118 MHz  
135 to 136 MHz  
174 to 230 MHz  
470 to 862 MHz

The power of any spurious emission at a frequency outside of these bands shall not exceed 0.25  $\mu$ W.

#### **5.6.5 Limits - MF base station transmitter**

Any spurious emissions from the base transmitter shall not generate a field strength of more than 34 dB ( $\mu$ V/m) at a distance of 30 m at any frequency in the range 0.5 to 30 MHz.

Any spurious emissions from the base station transmitter in the frequency range 30 to 1000 MHz when expressed as a radiated power, in either plane of polarisation shall not exceed 50 nW within the following frequency bands:

87.5 to 118 MHz  
135 to 136 MHz  
174 to 230 MHz  
470 to 862 MHz

The power of any spurious emission at a frequency outside of these bands shall not exceed 0.25  $\mu$ W.

### **5.7 Prevention of misoperation due to adverse power supply conditions**

#### **5.7.1 Definition**

For the purpose of this specification misoperation shall be defined as the generation of emissions outside the specified limits due to a reduction of power supply voltages.

### 5.7.2 Method of measurement

- a) The transmitter under test shall be placed in the test fixture or connected to a suitable artificial load. The transmitter shall be operated without the application of any external modulating signals and the emission monitored on a spectrum analyser and frequency meter.
- b) The transmitter frequency and radiated spectrum shall be monitored whilst the supply voltage (AC or DC) shall be slowly reduced from the normal value to zero.
- c) The carrier frequency and spurious emission levels are continuously observed.
- d) The procedures in (b) and (c) shall be repeated but with normal test modulation applied to the transmitter.
- e) The levels of adjacent channel power and spurious emissions shall be measured and recorded.

### 5.7.3 Limits

The limits laid down in the relevant clauses for the various parameters shall not be exceeded at any level of supply voltage.

NOTES: If a back up power supply is provided in the base unit (i.e. a rechargeable battery ) the test shall be repeated with the battery replaced by a variable DC power supply)

Any non-repetitive transient condition (of duration less than 50 ms) shall be ignored.

The carrier frequency shall remain within the specified limits unless the carrier power be less than that permitted for spurious emissions or adjacent channel power as appropriate.

## 6 RECEIVER TESTS

### 6.1 Receiver spurious emissions

#### 6.1.1 Definition

Spurious emissions from receivers are any emissions radiated from an integral antenna or the chassis and case of the receiver.

#### 6.1.2 Method of measurement - VHF base station receiver

The methods of measurement shall be as described in Clause 5.6.2 except that the test sample shall be a VHF base station receiver.

#### 6.1.3 Method of measurement - MF handportable receiver

The method of measurement shall be described in Clauses 5.6.2 and 5.6.3 except that the test sample shall be the MF handportable receiver.

#### 6.1.4 Limits - VHF base station receiver

Any spurious emission, expressed as either a power into a test load or as a radiated power, shall not exceed 20 nW.

#### 6.1.5 Limits - MF handportable receiver

Any spurious emission in the frequency range 0.5 to 30 MHz shall not exceed a field strength of more than 34 dB ( $\mu\text{V}/\text{m}$ ) at a distance of 30m.

Any spurious emission in the frequency range 30 to 1000 MHz when expressed as a radiated power shall not exceed 20 nW.

## 7 ACCURACY OF MEASUREMENT

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

*	DC voltage	±3%
*	AC mains voltage	±3%
*	AC mains frequency	±0.5%
*	Audio frequency voltage, power etc.	±0.5 dB
*	Audio frequency	±1%
*	Distortion and noise etc., of audio frequency generators	1%
*	Radio frequency	±50 Hz
*	Radio frequency voltage	±2 dB
*	Radio frequency strength power	±3 dB
*	Radio frequency carrier power (erp)	±2 dB
*	Impedance of artificial load, combining units, cables, plugs, attenuators etc.	±5%
*	Source impedance of generators and input impedance of measuring receivers	±10%
*	Attenuation of attenuators	±0.5%
*	Temperature	±1°C
*	Humidity	±5%

## 8 INTERPRETATION OF THIS SPECIFICATION

In cases of doubt about the interpretation of this specification, 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.