HKTA 1006
ISSUE 3
FEBRUARY 2003

PERFORMANCE SPECIFICATION

FOR CORDLESS TELEPHONE

OPERATING IN THE 1.7 MHz AND 47 MHz BANDS

TELECOMMUNICATIONS AUTHORITY
HONG KONG

FOREWORD

1. This specification is prescribed under section 32D of the Telecommunications Ordinance (Cap 106) ("the Ordinance") to set out the technical and evaluation requirements for cordless telephone operating in the 1.7 MHz and 47 MHz bands, as covered by the Telecommunications (Telecommunications Apparatus)(Exemption from Licensing) Order ("the Order").

2. Under section 39 of the Ordinance, a person is exempted from the obligation to hold a licence under the Ordinance so long as the conditions set out in the Order are satisfied. Radiocommunications apparatus falling into the scope of this specification shall meet the requirements stipulated to fulfil the conditions of the Order.

3. At present, the Office of the Telecommunications Authority (OFTA) operates a **H**ong **K**ong **T**elecommunications Equipment **E**valuation and **C**ertification (HKTEC) Scheme. Details of the HKTEC Scheme can be found in the information note OFTA I 421. Under the Scheme, suppliers or manufacturers of the radiocommunications apparatus may apply to OFTA for certification of their apparatus against this specification. The application procedures for certification of radiocommunications apparatus can be found in the information note OFTA I 401. A prescribed label may be affixed to the equipment which has been certified by the Telecommunications Authority (TA). Details of the labelling arrangement can be found in the Standardisation Guide HKTA 3211.

4. In addition to this specification, radiocommunications apparatus capable of being used for connection as customer premises equipment (CPE) to the public telecommunications networks (PTNs) in Hong Kong should comply with the relevant network connection specification(s) issued by the TA. Manufacturers or suppliers may also apply for a separate certification by the TA to verify conformity of the apparatus with the relevant specification(s) before it is connected to the PTNs. Details concerning the application procedure for certification of CPE by the TA can be found in the information note OFTA I 412.

5. Cordless telephones operating in the 1.7 MHz and 47 MHz bands are required to operate on a "no-interference no-protection" basis, i.e. they may not cause radio interference and cannot claim protection from interference. Manufacturers or suppliers of such cordless telephones are advised to consider the potentiality of interference due to the shared use of the frequencies.

6 The TA reserves the right to give separate certification to models he considers to be technical variants and the performance of which may differ between models.

7. The TA may amend any part of this specification as and when he deems necessary.

8. In case of doubt about the interpretation of this specification, the methods of carrying out the test and the validity of statements made by the equipment manufacturers or suppliers about the equipment, the decision of the TA shall be final.

9. The HKTA specifications and information notes are issued by the TA. The documents can be obtained through one of the following methods :-

- downloading direct through the OFTA's Internet Home Page. The Home Page address is http://www.ofta.gov.hk;
- making a request for hard copies to :-

  Radio Laboratory, Standards Section
  Office of the Telecommunications Authority,
  29/F Wu Chung House,
  213 Queen's Road East, Wanchai, Hong Kong.

  Fax : +852 2343 5824
  Email : radiolab@ofta.gov.hk

10. Enquiries about this specification may be directed to :-

  Radio Laboratory, Standards Section,
  Office of the Telecommunications Authority,
  29/F Wu Chung House,
  213 Queen's Road East, Wanchai, Hong Kong.

  Fax : +852 2343 5824
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AMENDMENT TABLE

Item	Issue No.	Paragraph	Descriptions
1.	Issue 3	Title	Re-title document from "Performance Specification for Radio Equipment Operating in the Bands 1.7 MHz and 47 MHz for Cordless Telephone Service" to "Performance Specification for Cordless Telephone Operating in the 1.7 MHz and 47 MHz Bands"
2.	Issue 3	Foreword	Add information of HKTEC Scheme and other editorial changes
3.	Issue 3	Body	Replace the term "handportable unit" by "portable unit" and amend Clause 1.1 on "Scope of Specification" and Clause 1.6 on "Electrical Safety Requirements".

CONTENTS

1 GENERAL

1.1. SCOPE OF SPECIFICATION

This specification covers the minimum performance requirements for cordless telephone operating in the 1.7 MHz and 47 MHz bands. The requirements apply to both portable unit and base unit of the cordless telephone.

1.2 OPERATING FREQUENCIES

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

Channel No.	Base Unit Transmit Frequencies (kHz)	Portable Unit Transmit Frequencies (MHz)
1	1 642.00	47.45625
2	1 662.00	47.46875
3	1 682.00	47.48125
4	1 702.00	47.49375
5	1 722.00	47.50625
6	1 742.00	47.51875
7	1 762.00	47.53125 or 47.44375
8	1 782.00	47.54375

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 portable 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. The selected channel shall be maintained for the duration of a call.

Equipment submitted for type testing may be operational on any one or two 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.

1.3 PERMITTED EFFECTIVE RADIATED POWER

For the VHF transmission from the portable 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 shall not exceed 10 mW.

The antenna associated with the base station MF transmitter shall be of an insulated wire or rod of between 1 m and 3 m in length permanently attached to the base station 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 wire 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 TYPE NUMBER

The brand name and type number of the cordless telephone shall be clearly indicated on the casing of the portable and the base unit. Each type number shall be unique. The manufacturer first submits to use a type number will have the priority to use that type number.

1.5 CONTROLS

Those controls, which if maladjusted might increase the interfering potentialities of the equipment, shall not be made accessible to the end user.

1.6 ELECTRICAL SAFETY REQUIREMENTS

The equipment shall comply with the electrical safety requirements set out in HKTA 2001 "Compliance Test Specification Safety and Electrical Protection Requirements for Subscriber Equipment Connected to the Public Telecommunications Networks in Hong Kong" issued by the Telecommunications Authority (TA).

1.7 DECLARATIONS BY THE MANUFACTURER OR ITS AGENT

When submitting an equipment for testing the manufacturer/equipment agent shall supply the following information :

1. Transmitters
   a) nominal frequency or frequencies
   b) crystal frequency and carrier generation formula or technique of frequency generation
   c) crystal type where applicable
2. Receivers
   a) nominal frequency or frequencies
   b) crystal frequency and local oscillator generation formula
   c) crystal type
3. Power supply
   a) nominal supply voltage
   b) type of battery where applicable
   c) battery end point voltage where applicable

2. TEST 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

The test power supply source for use in the testing shall be capable of producing normal and extreme test source voltages as specified in 2.3.2 and 2.4.2 and also capable of being reduced continuously over the range from the normal equipment voltage to zero voltage to simulate power supply failure.

The test power source shall have a low enough internal impedance so as to produce negligible effects on the test results.

For the purposes of tests, the supply voltage shall be measured at the input terminals of the equipment.

Equipment provided with permanently connected power cable shall have the test voltage measured at the point of connection of the power cable to the equipment.

The test power source voltage shall be maintained within a tolerance of ±3% relative to the voltage at the beginning of each test.

If the equipment incorporated with batteries, the test power source shall be applied as close to the battery terminals as possible.

2.3 NORMAL TEST CONDITIONS

2.3.1 Normal temperature and humidity

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

Temperature	15°C to 35°C
Relative Humidity.	10% to 80%

Whenever it is impracticable to carry out the tests under the above conditions, a note 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 the 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 for which the equipment was designed to operate. The frequency of the test power source shall be between 49 and 51 Hz.

2.3.2.2 Nickel cadmium battery

When the equipment is intended for operation from nickel cadmium battery the normal test voltage shall be the nominal voltage of the battery of 1.2 volts per cell.

2.3.2.3 Other power sources

For operation from other power sources the normal test source voltage shall be that declared by the equipment manufacturer.

2.4 EXTREME TEST CONDITIONS

2.4.1 Extreme temperatures

For test 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 voltage

2.4.2.1 Mains voltage

The extreme test source voltage for equipment to be connected to an AC mains source shall be the nominal mains voltage ±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 voltage for equipment with power sources using primary batteries shall be as follows :

(a) for Leclanche type of battery - 0.85 times the nominal voltage

(b) for mercury type of battery - 0.9 times the nominal voltage

(c) 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 TEST 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 test at the upper temperature, after thermal balance has been attained (Clause 2.5.1) 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 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 50Ω non-reactive, non-radiating load connected to the antenna terminal. 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. This test fixture shall be provided by the manufacturer/equipment agent and shall preferably provide a 50Ω 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 :

(a) the coupling loss shall be as low as possible and not greater than 30 dB;
(b) the variation of coupling loss shall not cause errors in measurement exceeding 2 dB ;
(c) 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 5 m 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 m above the ground plane. The test site shall be large enough to allow the erection of the measuring or transmitting antenna at a perpendicular distance of not less than 3 m from the test sample. The distance actually used shall be recorded with the test results 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 4 m. Test antennas with pronounced directivity are preferred. 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 that can be tuned to any frequency under investigation and can measure accurately the relative levels of signals at its input.

3.3.3 Substitution antenna

This antenna shall be a half wave dipole resonant at the frequency under consideration. In the case of a shortened dipole calibration is made against a half wave dipole. The centre of this antenna shall coincide with the reference of the test sample it has replaced. The 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 0.3 metre.

The substitution antenna shall be connected to a calibrated signal generator in the 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.

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 resultant 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 portable transmitter, the manufacturer shall provide temporary electrical connections.

4. ELECTRICAL TEST CONDITIONS FOR THE MF TRANSMITTER AND RECEIVER

4.1 ARTIFICIAL LOAD FOR TRANSMITTER POWER, FREQUENCY MODULATION AND ADJACENT CHANNEL POWER MEASUREMENTS

The antenna shall be disconnected from the base station unit and replaced by the artificial load. This 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.

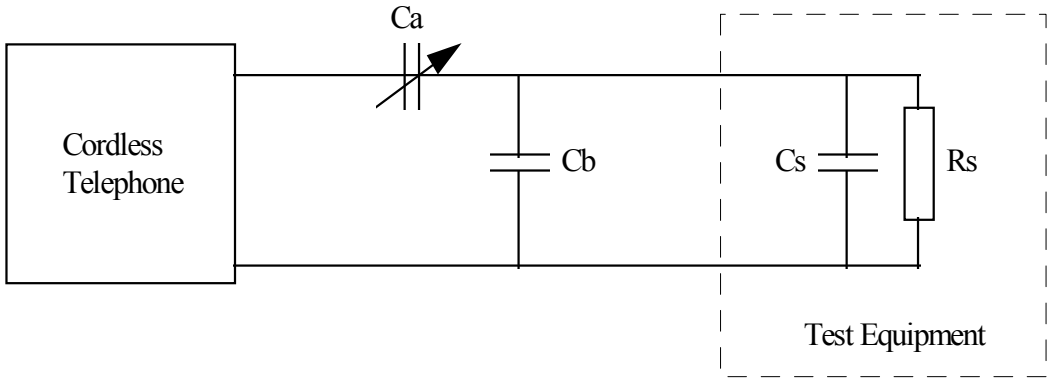

Figure 1. Artificial load for MF transmitter

The capacitor *Cb* 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* is very high. The variable capacitor *Ca* is low loss type covering the range 5 - 50 pF.

4.2 TEST SITE FOR MEASUREMENTS OF TRANSMITTER HARMONIC AND RECEIVER SPURIOUS OUTPUT

4.2.1 The test site shall be located on a surface or ground which is reasonably level. A non-conducting support shall be used to hold the sample and should be capable of rotating through 360° in the horizontal plane, at a height of 1 m above the ground. The test antenna of a field strength measuring receiver shall be located at a distance of not less than 10 m from the sample. This distance 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

(a) the mains lead from the transmitter shall be arranged to come down vertically 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 ;

(b) the transmitter antenna shall be orientated to obtain a maximum field strength reading on the test receiver on each frequency 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 a suitable non-conducting support.

4.2.2 Field strength measuring receiver

This shall be a quasi peak instrument complying with BS 727:1967, and covering a 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 (Clause 2.4.1 and Clause 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 in load shall be recorded.

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 ±2.0 kHz.

5.2 CARRIER POWER OF THE VHF TRANSMITTER

5.2.1 Definition

In 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 complying with Clause 3.3.1 the equipment shall be placed on the support in the following positions :-

(i) equipment with internal antenna shall be arranged with that axis vertical which is closest to vertical in normal use;
(ii) for equipment with rigid external antenna, the antenna shall be vertical ;
(iii) 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. (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 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) should be repeated for 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 shall be recorded in the test report.

5.2.2.2 Method of measurement under extreme test conditions

(a) 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.

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

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

5.2.3 Limits

The effective radiated power measured under normal test conditions in accordance with Clause 5.2.2.1 shall not exceed 10 mW. The carrier power under extreme test conditions shall not be more than 3 dB above that measured under normal conditions in accordance with Clause 5.2.2.2.

5.3 CARRIER POWER OF THE MF BASE STATION TRANSMITTER

5.3.1 Definition

In this specification the carrier power of 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 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

(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 *Cb* in the artificial load the variable capacitor *Ca* 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 *Cb* at resonance. The carrier power of the MF base station transmitter shall be calculated from the formula :

$$\textit{Carrier Power (P)} = 6.93 \times 10^{-13} \times V^2 \times Cb^2 \times f^4 \times L^2$$

Where *P* is in watt, *V* is rms voltage across *Cb*. *Cb* is in Farads, *f* is in Hertz, and *L* is the length in metres of the antenna for which the transmitter is designed to operate.

5.3.2.2 Measurements under extreme test conditions

The test of carrier power (Clause 5.3.2.1) shall be repeated under extreme conditions (Clause 2.4.1 and 2.4.2 applied simultaneously).,

5.3.3. Limits

The carrier power shall not exceed 10 mW under normal 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.

5.4 FREQUENCY DEVIATION

5.4.1 Definition

The frequency deviation is the difference 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 portable, 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 output power.

(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 :-

(a) ± 4.0 kHz for the MF base station transmitter
(b) ± 2.5 kHz for portable 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 the modulation frequencies above 3.4 kHz is the frequency deviation expressed as a function of modulation frequency 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 modulation signal, the frequency shall be varied from 3.4 to 30 kHz.

(c) At each test frequency, the resulting frequency deviation shall be measured.

5.4.4.3 Limits

The frequency deviation at modulation frequencies 3.4 and 7 kHz shall not exceed the frequency deviation at a modulating 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 the 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 analyzer

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 channels 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 :

(a) 16 kHz for 25 kHz channel spacing
(b) 14 kHz for 20 kHz channel spacing
(c) 8.5 kHz for 12.5 kHz channel spacing

with a tolerance of ± 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 made use 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 the signal 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 of 3 dB or more above the noise level of the spectrum analyser, as displayed on the screen to an accuracy of ± 2 dB, in the presence of a signal separated in frequency by :

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

(b) 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 1kHz.

The reading accuracy of the frequency marker shall be within ± 2% of the channel separation. The accuracy of relative amplitude measurements shall be within

±1dB. It shall be possible to adjust the spectrum analyser to allow the separation on its screen of two components with a frequency difference of 1kHz.

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 the 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 margin of at least 10 dB.

5.5.5 Limits

The adjacent channel power shall not exceed 1μW.

5.6 SPURIOUS EMISSIONS

5.6.1 Definition

These 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 the 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 30MHz)

(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 portable 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 to 137 MHz
470 to 790 MHz

Also the power of any spurious emissions at a frequency outside of these bands shall not exceed 0.25 μW.

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 dBμV/m at a distance of 30 metres at any frequency in the range 0.5 to 30 MHz.

Any spurious emissions from the base 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 to 137 MHz
470 to 790 MHz

The power of any spurious emission at a frequency outside of these bands shall not exceed 0.25 μW.

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 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 :

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

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

3. 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 VHF base station receiver.

6.1.3 Method of measurement - MF portable receiver

The method of measurement shall be as described in Clause 5.6.2 and 5.6.3 except that the test sample shall be the MF portable receiver.

6.1.4 Limits - VHF base station receiver

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

87 to 137 MHz
470 to 790 MHz

The power of any spurious emission at a frequency outside of these bands shall not exceed 0.25 μW.

6.1.5 Limits - MF portable receiver

Any spurious emissions from the portable receiver shall not generate a field strength of more than 34 dBμV/m at a distance of 30 metres at any frequency in the range 0.5 to 30 MHz.

Any spurious emissions from the receiver 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 to 137 MHz
470 to 790 MHz

Also the power of any spurious emissions at a frequency outside of these bands shall not exceed 0.25 μW.

7. SECURITY CODING

7.1 OUTGOING CALL SECURITY

7.1.1 Definition

Outgoing call security is the rejection by the base unit of line seizure commands and dialled information transmitted to it by portable units other than the one with which it is intended to work.

7.1.2 Requirements

All portable units shall be equipped with means for transmitting a coded signal for reception and recognition by the base unit. Each base unit shall be equipped with means for identifying the sequence from the portable unit with which it is intended to operate, and rejecting all other sequences. The sequence shall be a member of a set of sequences numbering at least 10,000. Sequences shall be allocated to the base and portable unit at the time of manufacture such as to minimise the probability of similar units with the same channel frequencies being allocated the same sequence. The means of storage of the code sequence within the unit shall be such that it is not possible to alter or directly identify (for the purposes of modification) the code sequence after manufacture without permanently disabling the equipment.

Passing of security codes must not cause interruption of the speech transmission path.

7.2 INCOMING CALL SECURITY

7.2.1 Definition

Incoming call security is the rejection by the portable unit of ringing commands transmitted to it from base units other than the base unit with which it is intended to work.

7.2.2 Requirements

All base units shall be equipped with means for transmitting a coded signal for reception and recognition by the portable unit. Each portable unit shall be equipped with means for identifying the sequence from the base unit with which it is intended to operate and rejecting all other sequences. The sequence set size and allocation procedure shall be as described in 7.1.2. The sequence used for incoming call security and outgoing call security shall be identical.

The security code shall be transmitted to the portable unit each time that ringing current is applied to the base unit. The portable unit shall generate a burst of audible ringing signal each time that the security code is received from the base unit.

8. POSITIVE CLEARDOWN

8.1.1 Definition

Positive cleardown is the opening of the telephone line loop by the base unit in response to an appropriate action on the portable unit, even in the presence of significant interfering signals on the portable to base carrier frequency.

8.1.2 Requirement

When the portable unit is switched from the state in which it is used for conversation and dialling ("talk" mode) to the state in which it is receptive to incoming calls ("standby" mode), or to the "off" state (if provided), the base unit will respond by reverting to the off line idle state within one second ("cleardown") in the absence of any other signal on the radio channels. This requirement shall also be met if the signal from the portable unit is removed by any other cause. When another portable unit (hereinafter called the interferer) using the same carrier frequencies is within operating range of the base unit and is in talk mode and the signal from the interferer is at any higher level relative to the signal from the portable unit the associated base unit shall cleardown within 30 seconds of the portable unit being switched back from "talk" to "standby".

9. BATTERY LOW INDICATION

The portable unit must incorporate a battery low indicator. This indicator should operate whilst the user is still able to establish a call thus giving warning that the batteries require re-charging before the portable unit begins to fail because of battery power run down. Testing will be by inspection.

10. ACCURACY OF MEASUREMENT

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

a)	dc voltage	± 3%
b)	ac mains voltage	± 3%
c)	ac mains frequency	±0.5%
d)	audio frequency voltage, power etc.	±0.5 dB
e)	audio frequency	± 1%
f)	distortion and noise etc. of audio frequency generators	1%
g)	radio frequency	±50Hz
h)	radio frequency voltage	± 2 dB
i)	radio frequency field strength	± 3 dB
j)	radio frequency carrier power (erp)	± 2 dB
k)	impedance of artificial loads, combining units, cables, plugs, attenuators etc.	± 5%
l)	source impedance of generators and input impedance of measuring receivers	±10%
m)	attenuation of attenuators	±0.5 dB
n)	temperature	± 1°C
o)	humidity	± 5%

-- END --