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RADIATION LIMITS AND MEASUREMENT METHODS

FOR

IN-BUILDING COAXIAL CABLE DISTRIBUTION SYSTEM
(IBCCDS)



TELECOMMUNICATIONS AUTHORITY
HONG KONG

FOREWORD

1. This specification sets out the radiation limits and measurement methods to be adopted for the In-Building Coaxial Cable Distribution System (IBCCDS). The IBCCDS may include Communal Aerial Broadcast Distribution (CABD) Systems, Satellite Master Antenna Television (SMATV) Systems, Closed Circuit Television (CCTV) Systems, Cable Television (CTV) Systems or any combination of these systems.
2. The Telecommunications Authority (TA) reserves the right to revise the contents of this specification without prior notice.
3. In case of any doubt about the interpretation of this specification and the methods of carrying out the tests, the decision of the TA shall be final.
4. The HKTA series specifications are issued by the TA. The documents can be downloaded directly through the OFTA's Internet Home Page at <http://www.ofta.gov.hk>.
5. The publications from the British Standards Institution (BSI) can be obtained from

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Customer Services
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W4 4AL
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6. If further information is required, please contact:

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CONTENTS

1. INTRODUCTION
2. MEASUREMENT OF RADIATION IN THE FREQUENCY RANGE 300 kHz - 30 MHz
3. MEASUREMENT OF RADIATION IN THE FREQUENCY RANGE 30 MHz - 3000 MHz
4. PERMITTED LIMITS

1. INTRODUCTION

- 1.1 In-Building Coaxial Cable Distribution System (IBCCDS) employing coaxial cable for distribution purposes can be a source of interference to a wide range of services that utilizes the radio frequency spectrum. These include not only the emergency services, safety of life, broadcasting, aeronautical and radio navigation services but also land mobile and amateur radio services.
- 1.2 Because there is a need to protect existing and future radio services, the Telecommunications Authority (TA) has determined the limits for radiation from the IBCCDS and methods by which the radiation shall be measured.
- 1.3 The procedure outlined in this document are intended to determine the overall level of radiation from an operational IBCCDS.

2. MEASUREMENT OF RADIATION IN THE FREQUENCY RANGE 300 kHz - 30 MHz

2.1 PRINCIPLE

- 2.1.1 The method describes the measurement of electromagnetic radiation from complete systems at the distribution frequencies in use and at other relevant frequencies as covered in clause 2.3.

2.2 EQUIPMENT

- 2.2.1 A field strength measuring set complying with BS (British Standard) 727:1983 and with frequency and sensitivity ranges appropriate to the system under examination.
- 2.2.2 A calibrated loop antenna covering the frequency range 300 kHz to 30 MHz with sensitivity such that when connected to the receiver the system is capable of measuring field strengths down to 0 dB μ V/m.
- 2.2.3 A tripod or other suitable means of mounting the loop antenna at a height of between 1.5 and 2 metres above ground level in the vertical plane, with a facility for orientating the loop in the horizontal plane.
- 2.2.4 The test equipment and interconnections used shall be well matched and correctly terminated.

2.3 MEASUREMENT FREQUENCIES

2.3.1 Measurements shall be taken at the highest and lowest significant carrier frequencies in use and at a selection of intervening frequencies chosen to give a realistic representation of the radiation level over the frequency range 300 kHz to 30 MHz. But when this frequency occurs in an off-air channel, the next higher or lower carrier frequency should be used. Measurements shall also be taken at frequencies where harmonically related products of the signal frequencies, or of frequency converters, may be expected to lie. Particular attention should be given to those harmonically related products which fall in prohibited bands.

2.4 PROCEDURE

2.4.1 Ensure that the IBCCDS is operating with normal signal levels at the subscribers' outlets. If the system is interactive, typical levels of reverse path (upstream) signalling should be maintained during the tests.

2.4.2 Using the calibrated loop antenna and measuring receiver carry out a mobile survey of the IBCCDS at the frequencies indicated in clause 2.3. The loop antenna should be mounted vertically and orientated for maximum signal pick up as indicated on the field strength measuring receiver. A check shall first be made to ensure that signals other than those being measured do not materially affect the results.

2.4.3 Identify those locations within the IBCCDS area where the radiation appears excessive and the frequencies at which this occurs.

2.4.4 Determine the electromagnetic field strength level of the radiation emanating from the IBCCDS at these locations using the following procedure.

2.4.5 Mount the loop antenna vertically on a tripod or other supporting structure with the base of the antenna at a height of between 1.5 and 2 metres above ground level, at a minimum distance of 10 metres from the system.

2.4.6 Rotate the loop antenna in the horizontal plane for maximum signal pick up as indicated on the field strength measuring receiver.

2.4.7 Record the field strength reading (allowing for any correction factors provided by the antenna and instrument manufacturers). Take two further field strength measurements at approximately one metre either side of the first at the same distance from the source.

2.4.8 If the last two results do not differ from the first by more than 1.0 dB, then record the first reading as the radiated field at that location.

2.4.9 If the field strength measured deviate by more than 1.0 dB, then record a median field strength value derived from the three measurements.

- 2.4.10 The field strength should be expressed in dB μ V/m. For vision carriers the field strength shall be expressed in terms of the r.m.s. value at the peak of the modulation envelope.

3. MEASUREMENT OF RADIATION IN THE FREQUENCY RANGE 30 MHz - 3000 MHz

3.1 PRINCIPLE

- 3.1.1 The method describes the measurement of radiation from complete systems at the distribution frequencies in use and at other relevant frequencies as covered in clause 3.3.

3.2 EQUIPMENT

- 3.2.1 A field strength measuring set complying with BS 727:1983 and with frequency and sensitivity ranges appropriate to the system under examination.
- 3.2.2 Calibrated dipole antennas covering the frequency range 30 MHz to 3000 MHz, suitable for connection to the field strength measuring set.
- 3.2.3 A four metre non-metallic mast with accessories suitable for mounting and orienting dipole antennas in the horizontal and vertical planes.
- 3.2.4 A low noise broadband preamplifier with a minimum of 20 dB gain.
- 3.2.5 A tunable bandpass filter to prevent local off-air signals overloading the preamplifier.
- 3.2.6 The test equipment and interconnections used shall be well matched and correctly terminated.

3.3 MEASUREMENT FREQUENCIES

- 3.3.1 Measurement shall be at the highest and lowest vision carrier frequency used in each band, except when this frequency occurs in an off-air channel, in which case the next higher or lower vision carrier frequency should be used and at a selection of intervening frequencies chosen to give a realistic representation of the radiation level over the operating frequency range. Measurements should also be made at frequencies where harmonically related products of the signal frequencies, or of frequency converters, may be expected to lie. Particular attention should be given to those harmonically related products which fall in prohibited bands.

3.4 PROCEDURE

- 3.4.1 Ensure that the IBCCDS is operating with normal operating signal levels at the subscribers' outlets.
- 3.4.2 With the equipment connected as shown in Figure 1 carry out a mobile survey of the IBCCDS at the frequencies given in clause 3.3 using vertical and horizontal polarisation of the monitoring antenna. A check shall first be made to ensure that signals other than those being monitored do not materially affect the measurements. For horizontal polarisation, the dipole should have its elements in line with the direction of travel.

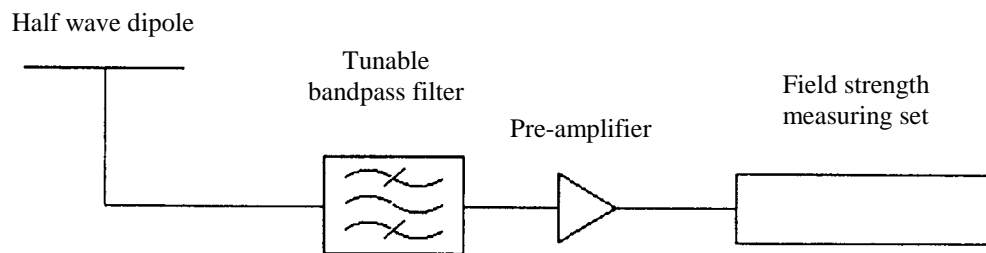


Figure 1 Arrangement of test equipment for the measurement of radiation from complete systems

- 3.4.3 Identify those locations within the IBCCDS area where the radiation appears excessive, and the frequency at which this occurs.
- 3.4.4 Determine the median value of the IBCCDS radiation at these locations using the following procedure.
- 3.4.5 Tune the bandpass filter to the frequency to be monitored.
- 3.4.6 Adjust the length of the dipole to half-wavelength metres of the frequency to be monitored.
- 3.4.7 Rotate the dipole to achieve vertical polarisation.
- 3.4.8 Position the mast such that the centre of the dipole is 4 metres above ground level and a minimum of 10 metres from the system.
- 3.4.9 Record the field strength reading (allowing for any correction factors provided by the antenna and instrument manufacturers). The measurements shall be taken at 21 random sample points over a total measurement distance of 30 metres and at a minimum distance of 10 metres from the system. For vision carriers the field

strength shall be expressed in terms of the r.m.s value at the peak of the modulation envelope.

- 3.4.10 Repeat the procedure from clause 3.4.7 after adjusting the antenna for horizontal polarisation with its elements in line with the chosen sampling route.

3.5 EXPRESSION OF RESULTS

- 3.5.1 Determine the median (50 percentile) value of the field strength at each location for vertical and horizontal polarisations of the monitoring antenna at the test frequency, taking into account the preamplifier gain, cable and filter losses.
- 3.5.2 The median value of the field strength is obtained by arranging the 21 samples in order of increasing magnitude. The eleventh sample value is then the median field strength.

4. PERMITTED LIMITS

4.1 FREQUENCY RANGE 300 kHz - 30 MHz

The field strength value obtained at each location shall not exceed the maximum field strengths given in Table 1 for measurements at 10 metres distance from the system or the proportionally reduced value, in accordance with the values given in Table 2, for distances greater than 10 metres.

Table 1 Maximum permitted field strengths of IBCCDS for 300 kHz - 30 MHz

Frequency range	Maximum permitted interfering field strength at 10 metres distance from the system (dB μ V/m)
300 kHz - 30 MHz	33

Table 2 Distance correction factor

Distance (metres)	Reduction factor (dB)				
	300 kHz - 1.6 MHz	1.6 - 2 MHz	2 - 3.3 MHz	3.3 - 5 MHz	5 - 30 MHz
15	7.0	7.0	7.0	7.0	3.5
20	12.0	12.0	12.0	9.5	6.0
25	16.0	16.0	14.0	11.5	8.0
30	19.0	17.5	15.5	13.0	9.5

Note: Intermediate values of reduction factor should be obtained by interpolation.

4.2 FREQUENCY RANGE 30 MHz - 3000 MHz

The median value determined for vertical and horizontal polarisation at each location shall not exceed the maximum field strength given in Table 3 for measurements at 10 metres distance from the system or the proportionally reduced value, in accordance with the values given in Table 4 for distances greater than 10 metres.

Table 3 Maximum permitted field strengths of IBCCDS for 30 MHz - 3000 MHz

Frequency range (MHz)	Maximum permitted interfering field strength at 10 metres distance from the system (dB μ V/m)
30 - 74.8	30
74.8 - 75.2	21
75.2 - 108	30
108 - 117.975	21
117.975 - 121.3	20
121.3 - 121.7	use prohibited (Note 1)
121.7 - 137	20
137 - 156.6	30
156.6 - 157	use prohibited (Note 1)
157 - 230	30
230 - 242.8	37
242.8 - 243.2	use prohibited (Note 1)
243.2 - 1000	37
1000 - 3000	33

Note 1: The use of vision/sound/pilot carriers and colour subcarriers in these frequency ranges is prohibited. The radiated levels of any sidebands or any intermodulation products or spurious frequencies on the system falling within this frequency range shall not exceed + 21 dB μ V/m.

Table 4 - Distance correction factor

Distance (metres)	Reduction factor (dB)
15	3.5
20	6.0
25	8.0
30	9.5

Note: Intermediate values of reduction factor should be obtained by interpolation.