

Recommendation **ITU-T K.80 (11/2022)**

SERIES K: Protection against interference

**Electromagnetic compatibility requirements for
telecommunication network equipment in the
frequency range 1 GHz-40 GHz**



Recommendation ITU-T K.80

Electromagnetic compatibility requirements for telecommunication network equipment in the frequency range 1 GHz-40 GHz

Summary

Recommendation ITU-T K.80 presents electromagnetic compatibility (EMC) requirements for all types of telecommunication equipment in the frequency range between 1 GHz and 40 GHz.

History

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Introduction

This Recommendation completes the electromagnetic compatibility requirements for all types of telecommunication equipment contained in [ITU-T K.136] and [ITU-T K.137], specifying requirements for phenomena at frequencies between 1 GHz and 40 GHz.

Telecommunication equipment can be influenced or can influence the electromagnetic environment at frequencies between 1 GHz and 40 GHz.

The use of radio devices, including mobile phone International Mobile Telecommunications-2020, wireless local area networks, Internet of things and broadband access radio equipment, in this frequency range highlights the need for analysis.

The requirements given in specific product family Recommendations take precedence over those given in this Recommendation.

Recommendation ITU-T K.80

Electromagnetic compatibility requirements for telecommunication network equipment in the frequency range 1 GHz-40 GHz

1 Scope

This Recommendation applies to all types of telecommunication equipment and considers electromagnetic radiated emission and immunity phenomena at frequencies between 1 GHz and 40 GHz. This Recommendation describes general electromagnetic compatibility (EMC) requirements above 1 GHz. Specific EMC product Recommendations for telecommunication equipment take precedence over this Recommendation. Therefore, this Recommendation applies when no specific product EMC Recommendations are available.

EMC phenomena below 1 GHz are covered by product Recommendations such as [ITU-T K.136] and [ITU-T K.137].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU T K.114] Recommendation ITU-T K.114 (2022), *Electromagnetic compatibility requirements and measurement methods for digital cellular mobile communication base station equipment.*
- [ITU-T K.127] Recommendation ITU-T K.127 (2017), *Immunity requirements for telecommunication equipment in close proximity use of wireless devices.*
- [ITU-T K.136] Recommendation ITU-T K.136 (2022), *Electromagnetic compatibility requirements for radio telecommunication equipment.*
- [ITU-T K.137] Recommendation ITU-T K.137 (2022), *Electromagnetic compatibility requirements and measurement methods for wireline telecommunication network equipment.*
- [ITU-R SM.329] Recommendation ITU-R SM.329-12 (2012), *Unwanted emissions in the spurious domain.*
- [IEC CISPR 16-1-4] International Standard IEC CISPR 16-1-4:2020, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements.*
- [IEC CISPR 16-2-3] International Standard IEC CISPR 16-2-3:2019, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements.*
- [IEC 61000-4-3] International Standard IEC 61000-4-3:2020, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test.*

[IEC 61000-4-39] International Standard IEC 61000-4-39:2017, *Electromagnetic compatibility (EMC) – Part 4-39: Testing and measurement techniques – Radiated fields in close proximity – Immunity test.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 electromagnetic emission [b-IEC 60050-161]: Phenomenon by which electromagnetic energy emanates from a source.

3.1.2 immunity (to a disturbance) [b-IEC 60050-161]: The ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EMC Electromagnetic Compatibility

EUT Equipment Under Test

FSOATS Free Space Open Area Test Site

IP Internet Protocol

5 Conventions

None.

6 Radiated emission between 1 GHz and 40 GHz

Radiated emissions measurements shall be performed in a free space open area test site (FSOATS) as specified in [IEC CISPR 16-1-4] with the test methods specified in Table 1 and Table 2.

6.1 Limits

Telecommunication equipment installed inside telecommunication centres shall meet the radiated emission limits listed in Table 1 or Table 3. The emissions shall satisfy both limits when measured with the corresponding CISPR detector.

Telecommunication equipment installed outside telecommunication centres shall meet the radiated emission limits listed in Table 2 or Table 4. The emissions shall satisfy both limits when measured with the corresponding CISPR detector.

The limits presented in Tables 1 and 2 are specified at 3 m measurement distance.

**Table 1 – Radiated emission limits
equipment installed inside a telecommunication centre**

Frequency range (GHz)	Average limit dB(μ V/m)	Peak limit dB(μ V/m)
1 to 6 (Note 2)	60	80
6 to 40 (Note 2)	60	–

NOTE 1 – The lower limit applies at the transition frequency.
 NOTE 2 – The limits are given for 3 m measurement distance in FSOATS. [IEC CISPR 16-1-4] and [IEC CISPR 16-2-3] specify the test instrumentation and the test method, respectively, up to 18 GHz. [b-IEEE/ANSI C63.4] specifies test instrumentation and a test method in the frequency range from 18 GHz to 40 GHz.

**Table 2 – Radiated emission limits
equipment installed outside a telecommunication centre**

Frequency range (GHz)	Average limit dB(μ V/m)	Peak limit dB(μ V/m)
1 to 6 (Note 2)	54	74
6 to 40 (Note 2)	54	–

NOTE 1 – The lower limit applies at the transition frequency.
 NOTE 2 – The limits are given for 3 m measurement distance in FSOATS. [IEC CISPR 16-1-4] and [IEC CISPR 16-2-3] specify the test instrumentation and the test method, respectively, up to 18 GHz. [b-IEEE/ANSI C63.4] specifies test instrumentation and a test method in the frequency range from 18 GHz to 40 GHz.

6.2 Emission frequency range

The equipment under test (EUT) shall meet these limits within a frequency range that is determined by the highest frequency present on the equipment as specified in Table 3.

Table 3 – Required highest frequency for radiated emission test

Highest internal frequency (F_x)	Measured up to highest frequency
$F_x \leq 108$ MHz	1 GHz
108 MHz $< F_x \leq 500$ MHz	2 GHz
500 MHz $< F_x \leq 1$ GHz	5 GHz
$F_x > 1$ GHz	$5 \times F_x$ up to a maximum of 40 GHz

F_x : highest fundamental frequency generated or used within the EUT or highest frequency at which it operates.

6.3 Emission from radio transmitter equipment

Radio transmitter equipment that meets the unintentional emissions requirements of [ITU-R SM.329] does not need additional testing.

The limits reported in [ITU-R SM.329] shall be selected in accordance with the national radio regulatory authority.

6.4 General test conditions

Prior to testing, telecommunication equipment shall be installed and configured at the test site in a manner that is representative of the normal installation conditions.

Equipment shall be tested within the rack or cabinet in which it is normally installed.

General test conditions for telecommunication equipment are specified in clause 8 of [ITU-T K.137], while those for radio telecommunication equipment are specified in clause 7 of [ITU-T K.136].

6.5 Specific test conditions

[ITU-T K.137] specifies test conditions for: access equipment (in its Annex D); Internet protocol (IP) router and switching equipment (in its Annex E); transmission network equipment (in its Annex F); cloud computing network equipment (in its Annex G); switching equipment (in its Annex H); and equipment with a power-over-Ethernet port (in its Annex I).

[ITU-T K.136] and [ITU T K.114] specifies test conditions for radio equipment such as: mobile access network equipment (including base stations); fixed radio links equipment (including microwave relay); fixed-satellite service equipment; radio navigation-satellite services equipment; short-range devices; mobile broadband access devices; mobile-satellite service equipment; and wireless access point devices.

7 Radiated immunity between 1 GHz and 6 GHz

Radiated immunity tests between 1 GHz and 6 GHz shall be performed in accordance with [IEC 61000-4-3].

7.1 Test level

The test level is listed in Table 4.

Table 4 – Immunity test level

Environmental phenomena	Test level	Units	Basic standard	Performance criteria	Frequency Range (MHz)
<i>Enclosure port</i>					
Radiofrequency electromagnetic field	10	V/m	[IEC 61000-4-3]	A	1 000-6 000

7.2 General test conditions

Prior to testing, telecommunication equipment shall be installed and configured at the test site in a manner that is representative of the normal installation conditions.

Equipment shall be tested within the rack or cabinet in which it is normally installed.

The test equipment and test environment shall meet the requirements of [IEC 61000-4-3].

General test conditions for telecommunication equipment are specified in clause 8 of [ITU-T K.137], while those for radio telecommunication equipment are specified in clause 7 of [ITU-T K.136].

7.3 Specific test conditions

[ITU-T K.137] specifies test conditions for different types of telecommunication equipment, these being: access equipment (in its Annex D); IP router and switching equipment (in its Annex E); transmission network equipment (in its Annex F); cloud computing network equipment (in its Annex G); switching equipment (in its Annex H); and equipment with a power-over-Ethernet port (in its Annex I).

[ITU-T K.136] and [ITU T K.114] specify test conditions for different types of telecommunication equipment, these being: mobile access network equipment (including base stations); fixed radio links

equipment (including microwave relay); fixed-satellite service equipment; radio navigation-satellite services equipment; short-range devices; mobile broadband access devices; mobile-satellite service equipment; and wireless access point devices.

7.4 Performance criteria

The general performance criteria specified in clause 9 of [ITU-T K.137] for telecommunication network equipment or clause 8 of [ITU-T K.136] for radio equipment shall be applied.

8 Immunity requirements in close proximity use of wireless devices

When wireless devices are close to telecommunication equipment, an intense electric field will locally permeate the equipment. Radiated immunity tests between 1 GHz and 6 GHz in close proximity shall be performed in accordance with [ITU-T K.127] for the test level and signal and [IEC 61000-4-39] for the test steps, test instrumentation and test method.

8.1 Test level

The test level is given in Table 5. This test level is the amplitude of the unmodulated carrier signal for level calibration, see clause 6.1 of [ITU-T K.127].

Tests shall be performed with the waveform listed in Table 6 and they shall be applied to the EUT individually.

Table 5 – Test level

Test level	Unit	Performance criterion	Basic standard	Frequency range (MHz)	Frequency step (MHz)
30 (Note 1)	V/m	A	[IEC 61000-4-39]	1 805-2 170 (Note 2) 2 400-2 485 5 150-5 875 (Note 3)	1 MHz
<p>NOTE 1 – The test level may be changed only if there are specific reasons requiring a different test level and there is agreement on this between telecommunication operators and manufacturers.</p> <p>NOTE 2 – The frequency range 1 805 MHz-2 170 MHz for the immunity test in close proximity applies only for applications outside telecommunication centres.</p> <p>NOTE 3 – The frequency range may be changed for deployment in some countries where the frequency bands used are not the same as those specified in this table.</p>					

Table 6 – Test waveforms (see clause 6.1 of [ITU-T K.127])

Test waveform	Specification	Figure in [ITU-T K.127] of test waveform
Amplitude modulation	Depth: 80% Rate: 1 kHz sine wave	1 b)
Pulse modulation	Duty cycle: 50% Modulation frequency: 217 Hz	1 c)

8.2 General test conditions

Prior to testing, telecommunication equipment shall be installed and configured at the test site in a manner that is representative of the normal installation conditions.

Equipment shall be tested within any rack or cabinet in which it is normally installed.

The test equipment and test environment shall meet the requirements of [ITU-T K.127].

General test conditions for telecommunication equipment are specified in clause 8 of [ITU-T K.137], while those for radio telecommunication equipment are specified in clause 7 of [ITU-T K.136].

8.3 Specific test conditions

[ITU-T K.137] specifies test conditions for different types of telecommunication equipment, these being: access equipment (in its Annex D); IP router and switching equipment (in its Annex E); transmission network equipment (in its Annex F); cloud computing network equipment (in its Annex G); switching equipment (in its Annex H); and equipment with a power-over-Ethernet port (in its Annex I).

[ITU-T K.136] and [ITU T K.114] specify test conditions for different types of telecommunication equipment, these being: mobile access network equipment (including base stations); fixed radio links equipment (including microwave relay); fixed-satellite service equipment; radio navigation-satellite services equipment; short-range devices; mobile broadband access devices; mobile-satellite service equipment; and wireless access point devices.

8.4 Performance criteria

The general performance criteria specified in clause 9 of [ITU-T K.137] for telecommunication network equipment or clause 8 of [ITU-T K.136] for radio equipment shall be applied.

Bibliography

- [b-IEC 60050-161] International Standard IEC 60050-161:1990, *International Electrotechnical Vocabulary. Chapter 161: Electromagnetic Compatibility.*
- [b-IEEE/ANSI C63.4] IEEE/ANSI C63.4-2014, *American National Standard for methods of measurement of radio noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.*

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