



Annex 5.3 to the Ordinance of 26 May 2016 of the Federal Office for Communications (OFCOM) on Telecommunications Equipment (CC 784.101.21 / 5.3)

Technical and administrative regulations

regarding

radio equipment that is intended in order to safeguard public security to be operated by the authorities: Mobile jammers

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1 General

These technical and administrative regulations (TAV) constitute the content of Annex 5.3 of the VFAV [3] (cf. Art. 4 and 5 VFAV). They are based on Article 32a TCA [1] and on Article 26 paragraph 5 and Article 27 paragraph 1 FAV [2].

The purpose of these regulations is to define the type approval requirements for mobile jammers that fall within the scope of Article 6, paragraph 2 FAV [2] in such a way that the telecommunications traffic and broadcasting outside the bands to be jammed are not affected. The operating conditions, in particular the permitted jamming frequencies and transmitting powers will be stated in the operating authorisation in accordance with Articles 53 to 56 VNF [4].

The type approval of mobile jammers is one of the conditions for their making available on the market (Art. 26 para. 1 FAV [2]).

1.1 Scope

These technical and administrative regulations apply to mobile jammers that fall within the scope of Article 6 paragraph 2 FAV [2]. They do not apply to permanently installed jamming equipment (see VFAV [3], Annex 5, TAV 5.2).

1.2 References

- [1] CC 784.10
Telecommunications Act of 30 April 1997 (TCA)
- [2] CC 784.101.2
Ordinance of 25 November 2015 on Telecommunications Installations (FAV)
- [3] CC 784.101.21
OFCOM Ordinance of 26 May 2016 on Telecommunication Installations (VFAV)
- [4] CC 784.102.1
Ordinance of 18 November 2020 on Use of the Radio Frequency Spectrum (VNF)
- [5] EN 61000-6-4: Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
- [6] EN 61000-6-2: Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
- [7] Recommendation ITU-R SM.329-12 (09/2012)
Unwanted emissions in the spurious domain
- [8] ETSI TS 103 052 V1.1.1 Electromagnetic compatibility and Radio Spectrum Matters (ERM);
Radiated measurement methods and general arrangements for test sites up to 100 GHz
- [9] European directive on radio equipment 2014/53/EU
- [10] EN 300 220: Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard covering the essential requirements of Article 3.2 of Directive 2014/53/EU for non-specific radio equipment
- [11] EN 300 440: Short Range Devices (SRD): Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonised Standard covering the essential requirements of Article 3.2 of Directive 2014/53/EU

All legal texts with CC references are published in the systematic collection of federal law and can be accessed on the website <https://www.fedlex.admin.ch/>. They can also be obtained from the Federal Office for Buildings and Logistics (FOBL), CH-3003 Bern.

The technical and administrative regulations can be obtained from the Federal Office of Communications, Zukunftstrasse 44, P.O. Box, 2501 Biel, Switzerland, or from www.bakom.admin.ch > OFCOM > Legal framework > Practical implementation > Appliances and installations > Other regulations.

1.3 Abbreviations and definitions

Band	Range in the frequency spectrum intended for a specific application or service (e.g. 2400 - 2483,5 MHz for WiFi and Bluetooth or 925 MHz - 960 MHz for MFCN base stations)
Channel	Part of a band, e.g. a channel of a certain bandwidth
EIRP	Effective isotropically radiated power
EMC	Electromagnetic compatibility
ERP	Effective radiated power
ETSI	European Telecommunications Standards Institute
Mobile jamming equipment	Depending on the context, other words with the same meaning are used in this document: jammer, jamming equipment or equipment
MFCN	Mobile/Fixed Communications Networks (mobile communications)
OBW	Occupied bandwidth
RF	Radio frequency
RBW	Resolution bandwidth
RIR	Technical Interface Regulations
RMS	Root mean square
VBW	Video bandwidth

2 General requirements

The following requirements must be fulfilled for the type approval of mobile jamming equipment:

- Mobile jammers must correspond to the state of the art and must ensure an efficient use of the frequency spectrum.
- Interference on other frequency bands must not occur.
- For reactive jammers, the trigger sensitivity of the detectors must be adjustable.
- The status of the mobile jamming equipment must be indicated in real-time.
- Systems that are intended to jam mobile communications are only permitted if they operate on the down link, i.e. on the RF channel from the base station to a mobile phone.
- Mobile drone jammers must not transmit continuously. Transmission must only occur when a button is pressed. In the case of automated drone jammers, a timeout mechanism must be activated at the latest five minutes after transmission.
- Automated jamming equipment must have a mechanism that informs the operator on site in real time that the jamming equipment has been switched on.
- Automated jamming equipment must have an adjustable time-out mechanism that switches the jamming equipment off automatically (0-5 minutes).
- Mobile drone jammers must have a directive radiation pattern (both horizontal and vertical).
- Mobile jamming equipment must be measured in all operating modes. Alternatively, the equipment can be measured against the worst case; in this case, the worst case must be declared and justified as such.

3 Type approval

3.1 General

Anyone wishing to offer on the market mobile jamming equipment as described under section 1.1 must initiate an approval process by submitting an application to OFCOM using the form provided on the OFCOM website. Type approval documents must also be submitted. Once all necessary documents have been submitted, OFCOM will examine whether the conditions for approval have been met and, if so, grant approval for the equipment in question.

3.2 Type approval documents

The following information and documents must be submitted:

- the intended use(s);
- a declaration by the manufacturer that the equipment has undergone a conformity assessment procedure and meets the essential requirements for electrical safety and health (Art. 26 para. 2 FAV [2]).
- the following parts of the technical documentation in accordance Article 14 FAV [2] concerning EMC requirements and frequency spectrum use requirements (Art. 26, para. 3 FAV [2]):
 1. A general description of the equipment comprising:
 - 1.1. photographs or illustrations showing external features, markings and internal layout,

- 1.2. versions of software or firmware affecting compliance with essential requirements concerning EMC and frequency spectrum use,
 - 1.3. user information referred to in Article 19, paragraph 1 FAV [2];
 - 1.4. installation instructions.
2. A list of the technical standards in accordance with Article 31, paragraph 2, letter a TCA, applied in full or in part, and, where those standards have not been applied, descriptions of the solutions adopted to meet the essential EMC requirements as set out in the FAV [2], including a list of other relevant technical specifications applied; in the event of partly applied standards in accordance with Article 31, paragraph 2, letter a TCA, the technical documentation shall specify the parts which have been applied.
 3. Test reports on EMC requirements (according to section 4.4) and frequency spectrum use (according to sections 4.5 to 4.8).

OFCOM may request the following documents if they are necessary for the approval of the equipment:

4. Conceptual design and manufacturing drawings and schemes of components, sub-assemblies, circuits and other relevant similar elements;
5. Descriptions and explanations necessary for the understanding of those drawings and schemes and the operation of the equipment.

The correspondence address is as follows:

Federal Office of Communications OFCOM
Radio Monitoring and Equipment
RA/MK
Zukunftstrasse 44
P.O. Box
CH-2501 Biel/Bienne

3.3 Type approval number

After examining the documents, OFCOM assigns the applicant the type approval number. The type approval number must be attached to every item of equipment, which is identical in terms of hardware and software.

3.4 Modifications to approved equipment

Any modification of approved equipment that could change the radio parameters must be announced in advance and approved by OFCOM. If necessary, a new approval procedure must be carried out.

4 Content of the test reports

4.1 Identification of the equipment

The test reports must precisely identify the measured equipment by means of the following information:

- identification information referred to in Article 18, paragraph 4 FAV [2]: type, batch, serial number or any other element allowing its identification;
- make and type of all components involved in the system (RF cables, antennas, filters, amplifiers, controllers, detectors, circulators, combiners, isolators, etc.);

- hardware version numbers/software version numbers;
- photos.

4.2 Technical data

The test reports must contain the following technical data of the equipment declared by the manufacturer:

- channels, bands;
- radiated transmitting powers (ERP, EIRP) per channel, per band;
- description of the modulation types per band, per channel;
- operation mode: continuous, reactive, manual mode etc.;
- sensitivity adjustment range of the detectors (only applies to reactive equipment);
- output power control range per channel, per band.

4.3 General

In the event of failure to comply with one or more limit values in the field of EMC (according to section 4.4.) and frequency spectrum use (sections 4.5 to 4.8), an explanation of the reasons for failure to comply must also be provided along with the measurements.

The test reports must contain a decision (PASS/FAIL) on compliance with the limits in sections 4.4, 4.5 and 4.8, i.e. whether the measured values comply (PASS) or do not comply (FAIL) with the respective applicable limits.

4.4 EMC

Mobile jammers must comply with the EMC aspects in accordance with Article 7 paragraph 1 letter b FAV [2]. EMC test reports of individual components are not sufficient to be able to assume conformity of the complete system. The EMC test reports must prove the conformity of the entire equipment. Measurements must be performed in accordance with the standards [5] and [6] and documented in a test report. The radiated unwanted emissions according to [5] are not mandatory, since they are covered by section 4.5 of this document.

4.5 Unwanted emissions in the spurious domain

4.5.1 Definition of the spurious domain / out-of-band domain

The upper and lower frequency limits of the spurious domain are defined in Table 4. Excluded from the spurious domain are the band to be jammed and the out-of-band domain above and below the band to be jammed (see Figure 1). The out-of-band domain is defined according to sections 4.5.2 to 4.5.5. The manufacturer of the jamming equipment is free to choose one of the four definitions of the out-of-band domain. The manufacturer must document in the test report which definition of the out-of-band domain was applied. OFCOM does not set any limits within the out-of-band domain. However, signal strength in the out-of-band domain must continuously decrease.

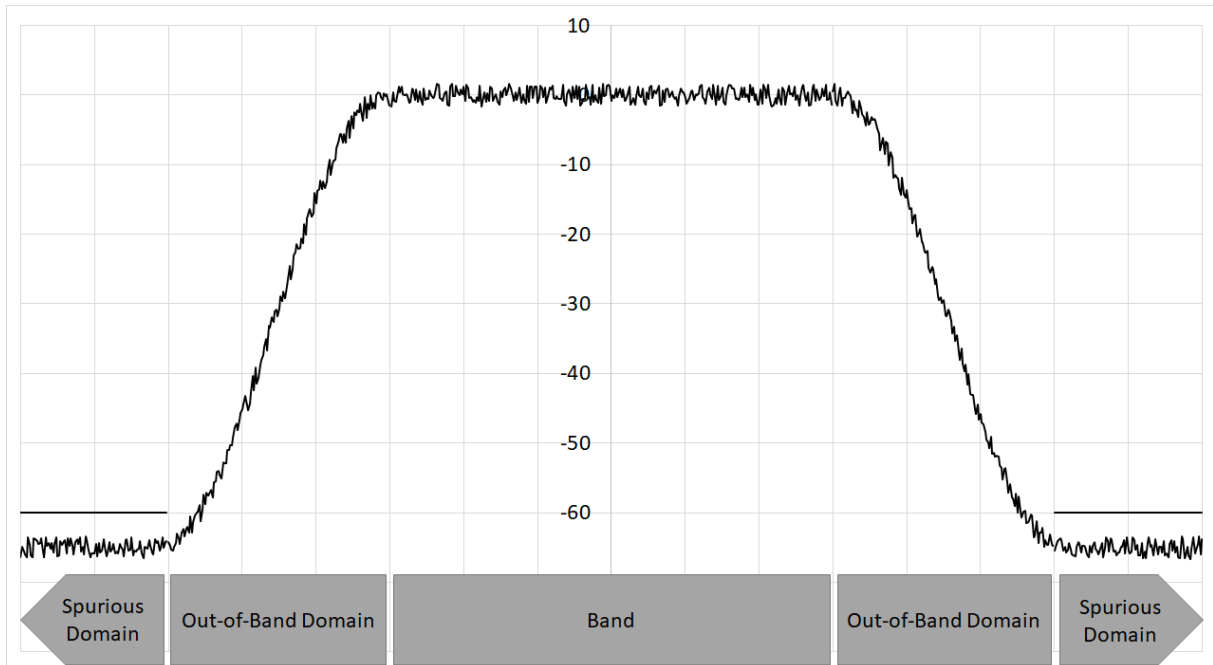


Figure 1: Graphical representation of the band to be jammed, the out-of-band domain and the spurious domain. In this example, a band to be jammed below 1 GHz, where -60 dBc is the limit for the unwanted emissions in the spurious domain for jammers used for short-term interference missions, without the need that unwanted emissions have to be below -36 dBm ERP.

4.5.2 Definition of the out-of-band domain: Variant 1

Depending on which band is jammed, the start/stop frequencies of the spurious domain are defined according to the current European harmonised ETSI standard (under Article 3.2 of the RED [9]), which is applicable for one specific band. It must be documented in the test report which definition of the spurious domain and which standard has been applied.

4.5.3 Definition of the out-of-band domain: Variant 2

Depending on which band is jammed, the start/stop frequencies of the spurious domain are equal to the start and stop frequencies of the according band defined in the applicable Radio Interface Regulation. It must be documented in the test report which definition of the spurious domain and which RIR has been applied. The steeper the edges and hence the more spectrum efficient the jammer is, the closer the jamming signal can approach the band edges.

4.5.4 Definition of the out-of-band domain: Variant 3

The spurious domain starts at 10 MHz below the lower band limit or 10 MHz above the upper band limit.

4.5.5 Definition of the out-of-band domain: Variant 4

The spurious domain starts at 2.5 times the channel width measured from the centre frequency of the uppermost or lowermost channel to be interfered. The channel width is exclusively the channel width of the radio application used in the respective band. The uppermost or lowermost channel channel to be interfered and the channel width of the radio application used in the respective band must be recorded in the test report.

4.5.6 Limit values

The following maximum limits apply to the unwanted emissions in the spurious domain (Source: Table 3 of the Recommendation ITU-R SM.329-12 [7]):

Category	Limit	Frequency range
1	≤ -70 dBc / ≤ -36 dBm ERP	< 1 GHz
1	≤ -64 dBc / ≤ -30 dBm EIRP	> 1 GHz
2	≤ -60 dBc / ≤ -36 dBm ERP	< 1 GHz
2	≤ -54 dBc / ≤ -30 dBm EIRP	> 1 GHz

Table 1: Limits regarding the unwanted emissions in the spurious domain in dBm E(I)RP and in dBc relative to the total E(I)RP per band, without the need to be below -30dBm / -36dBm E(I)RP

Category	Characteristic of the jammer
1	Jammer intended to be continuously operated
2	Jammer intended to be infrequently operated

Table 2: Definition of device categories

For the measurement of the unwanted emission in the spurious domain, the following resolution bandwidths and detector types are applicable. (Source: section 4.1 of Recommendation ITU-R SM.329-12 [7]):

Frequency range	Resolution bandwidth	Detector type
150 kHz - 30 MHz	10 kHz	Quasi peak detector
30 MHz - 1000 MHz	100 kHz	Quasi peak detector
> 1000 MHz	1 MHz	Peak detector

Table 3: Applicable detector types in the different frequency ranges

The following table shows, according to the maximum jamming frequency, the frequency up to which measurement of the unwanted emission must be performed (Source: Table 1 of Recommendation ITU-R SM.329-12 [7]):

Highest jamming frequency	Lower boundary	Upper boundary
9 kHz - 100 MHz	9 kHz	1 GHz
100 MHz - 300 MHz	9 kHz	10 th harmonic
300 MHz - 600 MHz	30 MHz	3 GHz
600 MHz – 5,2 GHz	30 MHz	5 th harmonic
5,2 GHz - 13 GHz	30 MHz	26 GHz

Table 4: Frequency ranges in which unwanted emissions must be measured

All measurement results and the associated screenshots of the measuring instruments, including images of the measurement setup, must be recorded in a test report and reproducibly documented. The test report must also contain the measurement results and the screenshots of the unwanted emissions at the boundary between the spurious domain and the out-of-band domain. To ensure that the unwanted emissions near the band to be jammed can be meaningfully displayed, the frequency span must be no wider than three times the width of the band to be jammed.

The measurement of the unwanted emission must be performed radiated and carried out according to the substitution method (ETSI TS 103 052 V1.1.1 [8]). In its normal position during operation, the jammer must be rotated 360 degrees around its vertical axis in order to detect all radiation maxima. The measurement must be performed with the measuring antenna aligned vertically and horizontally.

4.6 Measuring the occupied bandwidth (OBW)

The occupied bandwidth (OBW) is the bandwidth containing 99% of the total power of the transmitted spectrum per band. The occupied bandwidth must be measured radiated and per band.

Step 1:

Align the main beam direction of the jammer with the measuring antenna and use the following settings:

Centre frequency:	The centre frequency of the band under test
Frequency span:	2 × the width of the band under test
Resolution BW:	0.5 - 1 % of the frequency span
Video BW:	3 × RBW
Detector mode:	RMS
Trace mode:	Max Hold
Sweep time:	1 s

Step 2:

Wait for the trace to stabilise.

Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

Use the 99% bandwidth function of the spectrum analyser to measure the occupied channel bandwidth of the jammer.

The trace resulting from step 2 and the measured occupied bandwidth must be recorded in the test report.

Make sure that the power envelope is sufficiently above the noise floor of the analyser in order to prevent the noise signals to the left and right of the power envelope being taken into account by this measurement.

4.7 Triggering sensitivity inside and outside the frequency bands to be monitored

This measurement must only be performed on reactive jammers. Reactive jammers are those that monitor a band x in its normal state and only begin to jam a band y when signals in band x have been detected. The detector of the jammer must only react to signals in band x. Signals outside the band x must not cause triggering of the jammer. The triggering sensitivity inside and outside the band x must be measured and documented in the test report. Bands x and y may be different or identical.

4.8 Radiated transmitter power within the frequency bands to be jammed

The transmission power measurements must be performed radiated and according to the substitution method described in [8]. Depending on the type of modulation and the occupied bandwidth of the transmission signal of the jammer, a suitable measurement of the radiated transmission power must be performed.

- Measurement in time-domain mode of the spectrum analyser *
- Measurement in frequency domain mode of the spectrum analyser
- Measurement with a wideband power sensor *

* The measurement bandwidth must be equal to or greater than the occupied bandwidth of the signal to be measured so that the entire signal is detected.

For pulsed systems, the transmission power during a pulse must be determined. In addition, the duty cycle per band must be recorded in the test report. The jammer must be positioned and measured in such a way that the direction with the greatest output is directed towards the measuring antenna. The measured power must deviate by no more than 6.25 dB from the power declared by the applicant. In cases where the radiation characteristics of the transmitting antennas are not known, e.g. by means of a data sheet, the radiation characteristics in the azimuth plane and elevation plane must be measured and documented in the test report (two diagrams: polar or Cartesian).

5 Requirements for the test laboratory

The type approval measurements must be carried out by a recognised test laboratory in accordance with Article 17 FAV [2] (VFAV [3], Annex 4, section 1.2). This applies to the efficient use of the frequency spectrum and to the EMC.

The test laboratory that carries out the type approval measurements must have the necessary qualifications and measuring capabilities for the following standards:

- with regard to electromagnetic compatibility, the generic standards EN 61000-6-4 [5] and EN 61000-6-2 [6];
- with regard to the efficient use of the frequency spectrum, the standards EN 300 220 [10] (for jammers with working frequencies from 25 to 1000 MHz) and/or for EN 300 440 [11] (for jammers with working frequencies from 1 GHz to 40 GHz), as their measuring methods of these standards are largely compatible or at least comparable with the current technical and administrative regulations (TAV).

Biel, 11 November 2021

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