



Spectrum Management and Telecommunications

Guideline

Guidelines for the Preparation of Radio Frequency (RF) Exposure Compliance Reports for Radiocommunication and Broadcasting Antenna Systems

Preface

This guideline, GL-08, issue 3, *Guidelines for the Preparation of Radio Frequency (RF) Exposure Compliance Reports for Radiocommunication and Broadcasting Antenna Systems*, replaces GL-08, issue 2, published in July 2019.

The main changes are listed below:

1. synchronized the reporting requirements with those found in [GL-01 issue 4](#)
2. introduced requirements for radar installations
3. made editorial changes and clarifications, as appropriate

Issued under the authority of
the Minister of Innovation, Science and Industry

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30 **Contents**

31

32 1. Scope 4

33 2. Introduction 4

34 3. Safety Code 6 evaluation 4

35 4. Elements to include in RF exposure reports 6

36 4.1. Title Page 6

37 4.2. Description of site and proposed installation 6

38 4.3. Safety Code 6 assessment 11

39 4.3.1. Detailed calculations 11

40 4.3.2. Measurements 13

41 4.3.3. Mitigation and corrective measures 14

42 4.4. Safety Code 6 compliance statement 14

43 5. Related documents 15

44 Appendix A. Example of declaration of RF exposure compliance 16

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48 **1. Scope**

49
50 This document provides guidelines and establishes **minimum parameters required** to be
51 included in radio frequency (RF) exposure compliance reports prepared by proponents
52 and operators of all radiocommunication and broadcasting antenna installations. While
53 this document provides guidance, it is the responsibility of proponents and operators to
54 provide all relevant information to demonstrate compliance with Health Canada's Safety
55 Code 6, [Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the](#)
56 [Frequency Range from 3 kHz to 300 GHz](#) (SC6), as may be amended from time to time
57 for the protection of the general public. To this end, Innovation, Science and Economic
58 Development Canada can at any time request clarification or additional information
59 during its assessment of RF exposure compliance reports.

60
61 For enquiries **related to the compliance of a site with SC6**, proponents and operators
62 **may contact their [local Innovation, Science and Economic Development Canada \(ISED\)](#)**
63 **[office](#).**

64 65 **2. Introduction**

66
67 As outlined in CPC-2-0-03, [Radiocommunication and Broadcasting Antenna Systems](#), it
68 is the responsibility of proponents and operators of radiocommunication and
69 broadcasting installations to ensure that their facilities comply with SC6 at all times,
70 taking into consideration the local radio environment.

71
72 Compliance with SC6 is an ongoing obligation and operators of antenna installations
73 must retain copies of all information related to SC6 compliance such as analyses,
74 measurements and compliance reports. At any time, ISED may request operators to
75 provide detailed compliance information for individual installations. As specified in [CPC-](#)
76 [2-0-03](#), operators must provide the requested information within **five days** of the
77 request. Information requests may include a site layout drawing or map which details
78 access control measures and locations, area demarcation (signs), any proposed
79 changes to station operating parameters, and any other relevant information.

80 81 **3. Safety Code 6 evaluation**

82
83 As per [CPC-2-0-03](#), compliance with SC6 requirements may be demonstrated by
84 providing one, **or a combination of**, the following:

- 85
86
 - theoretical calculations or simulations;
 - field measurements;
- 87

- 88 • detailed plan demonstrating corrective measures taken to ensure compliance.

89

90 Note that for broadcasting undertakings, the specific requirements outlined in section 8
91 of [BPR-1](#) shall be verified when evaluating SC6.

92

93 When calculations are used to show compliance, a description of the mathematical
94 prediction model(s) used must be included in the RF exposure report. In the case of
95 computational evaluations, a description of the software used should also be provided.
96 Figure(s) (displaying north bearing and a scale in the legend to indicate distances)
97 clearly identifying SC6 compliance contours should be provided. Near field and far field
98 considerations and a description of how field reflections are being considered must be
99 addressed in the report. See section 4.3.1 for details.

100

101 When calculations, using worst case assumptions (methodology outlined in [TN-261](#) or
102 other comparable methods), show that RF exposure levels exceed the uncontrolled
103 environment limits of SC6 in any area accessible to the general public, field
104 measurements, or the implementation of permanent mitigation measures restricting
105 public access (see [CPC-2-0-20](#) for details), shall be detailed in the report in order to
106 demonstrate compliance.

107

Note: A site will be deemed non-compliant if, at any publicly accessible location, the report indicates RF exposure levels exceeding 100% of the uncontrolled environment limits of SC6, including the expanded uncertainty budget of the measurement equipment.

108

109 When field measurements are used to demonstrate compliance, information such as
110 dates when measurements were taken, weather conditions, and whether transmitters
111 were operating at maximum power at the time of measurement must be noted in the RF
112 exposure report. In addition, the measurement methodology used (i.e. scanned spatial
113 averaging versus detailed spatial averaging) should be described (see section 4.3.2 for
114 details). When measurements are used to assess compliance of new installations or
115 existing installations being modified, these should be taken immediately after the station
116 is turned on for testing.

117

118 A description of each piece of equipment used for field measurement, as well as the
119 equipment manufacturer's expanded measurement uncertainty and calibration
120 information of each measurement device (e.g. the accuracy of measurements in dB)
121 must be included. The expanded measurement equipment uncertainty must be added
122 to each measurement point.

123

Note 1: As specified in [GL-01](#), when the measured value plus the equipment manufacturer's expanded measurement equipment uncertainty exceeds the SC6 limits for uncontrolled environments (UE), in any publicly accessible locations, the site will be considered as non-compliant.

In such cases, corrective measures shall be implemented without delay in order for the site to be considered compliant with the SC6 requirements as specified in [CPC-2-0-03](#) and [CPC-2-0-20](#).

124

Note 2: ISED does not prescribe requirements on how manufacturers must evaluate the expanded uncertainty budget of their equipment. Nonetheless, ISED will only accept detailed expanded uncertainty budgets based on sound engineering practices such as those referenced in the [Guide to the expression of uncertainty in measurement](#).

125

126 The maximum normalized percentages (%) of the Safety Code 6 limit for uncontrolled
127 environments, as well as their locations, must be clearly identified in the report. See
128 section 4.3.2 for details. In addition, the RF exposure report shall conclude with a clear
129 statement attesting SC6 compliance (see annex A for an example).

130

131 **4. Elements to include in RF exposure reports**

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133 This section provides a template of the key information that should be included in the
134 RF exposure report.

135

136 **4.1. Title Page**

137

138 The title page must contain the assessment date, company name, site name (where the
139 antenna system is located), name(s) of person(s) conducting the RF exposure
140 compliance study including title and **signature**, and date on which the report was signed.

141

142 **4.2. Description of site and installation**

143

144 The RF exposure report must contain general information on the site such as the site
145 name, address and coordinates. A description of the site location and antenna structure,
146 as well as a summary of the installation, should also be included (see tables 1, 2 and 3).

147

148 A description, including calculations and/or measurements, of all publicly accessible
149 locations (e.g. balconies, viewing points, observation decks, parking lots) in the vicinity
150 of the antenna site must also be included in the report.

151
 152 The RF exposure report must contain an elevation plan or sketch showing the location
 153 of all antennas at the site, including all guy-wire placements. It must also contain the
 154 location of all signage and access control mechanisms such as locked doors, fences
 155 and locked gates. Where fencing (or other suitable barriers, as specified in [CPC-2-0-](#)
 156 [20](#)), are used to ensure compliance of guy-wires and associated anchor points, its
 157 relative location and separation from the guy-wires and associated anchor points must
 158 be clearly indicated in the report. Rooftop sites must include a site plan clearly
 159 identifying all access points to the rooftop and showing the location of each transmit
 160 antenna on the rooftop.

161
 162 **Table 1: General information on the site**

General information	
Site name:	
Address:	
Site coordinates: LAT/LONG (WGS84)	
Weather conditions:	
Date:	

163
 164 **Table 2: Description of the site location**

Site description	
Structure type (e.g. rooftop (with locked access), water tower, monopole, mast, lattice tower (with anti-climb))	
Is tower using guy wires?	YES/NO
Owner of the building and/or antenna structure	
Overall height of the antenna-supporting structure from the ground level (m) (and above rooftops if applicable (m))	
Is the structure shared?	YES/NO
Have all on-site antenna systems been included in the report?	YES/NO
Objects (e.g. reflectors, guy wires, scatterers) in the vicinity of the proposed site that may affect the RF field strength	

Other towers* (broadcast within 1 km and radiocommunication transmitters within 100 m)	
Rooftop/tower access is restricted and locked at all times	YES/NO

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* In addition to the RF installations at the site under study, nearby transmitting antennas can also impact the calculations, especially if they are high-power stations. It is important to assess the full radio environment when evaluating Safety Code 6 compliance. Mathematical predictions and field measurements have demonstrated that non-broadcast wireless stations beyond 100 m have negligible impact on the overall exposure level. Close attention should be given to broadcast stations within 1 km of the proposed site. If it is suspected that there are stations nearby that may impact RF levels at the site under study, these must be taken into account in the detailed calculations. Rationale must be provided as to why any nearby stations were excluded from the calculations.



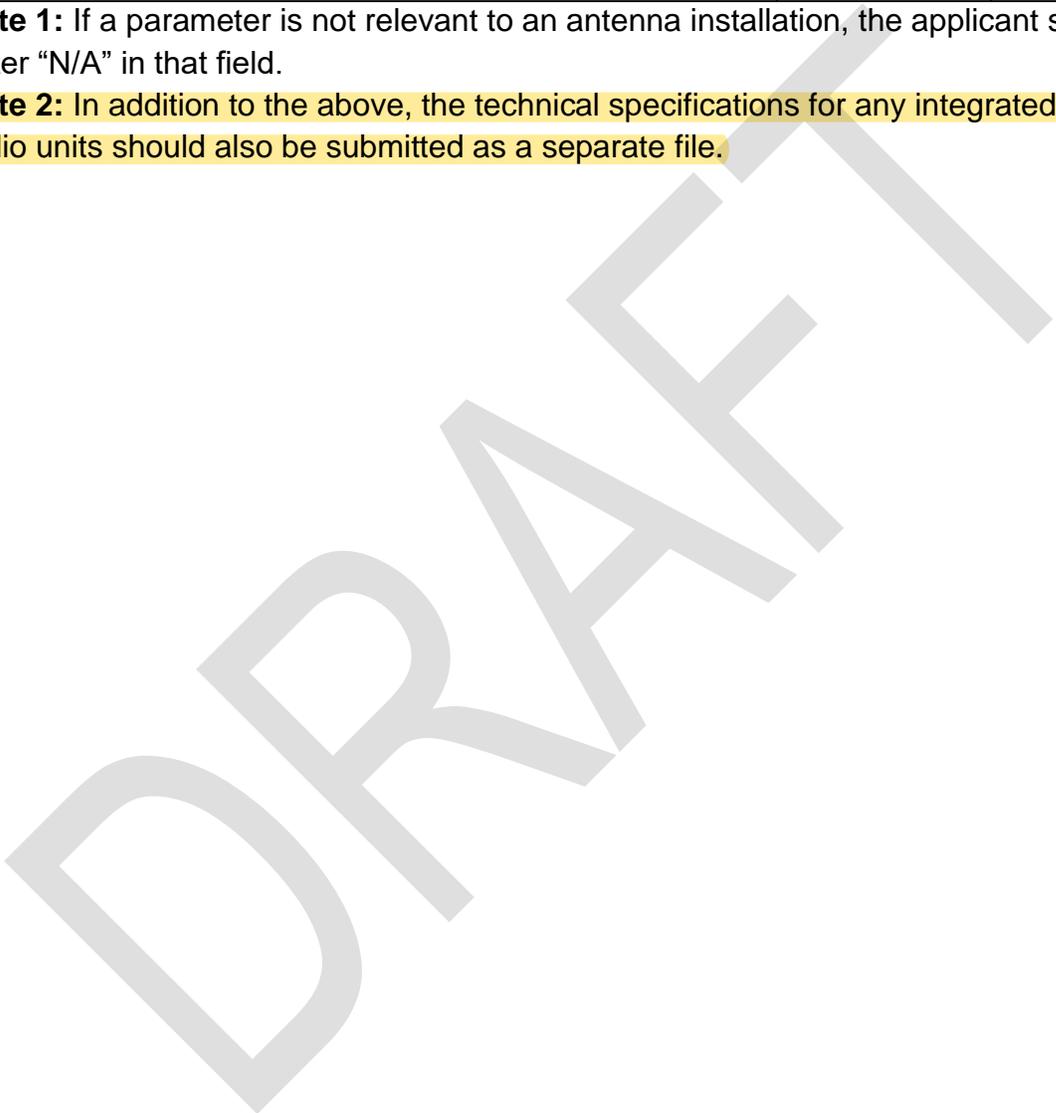
Table 3: Summary of the parameters of the proposed installation(s)

Parameters	Installation #1	Installation #2	...
Operator(s)			
Type of service currently at the site (e.g. TV, AM, FM radio, mobile, cellular, PCS, 3G, 4G, 5G, paging, etc.), power and technology used (e.g. ATSC, NTSC, 4G, LTE, 5G NR, beamforming, non beamforming, etc.) (all broadcast within 1 km and all radiocommunication transmitters within 100 m)			
Proposed new services			
Number of sector(s)			
Frequency bands (MHz)			
Antenna model/manufacturer and description (i.e. overall dimensions (length and width), number of bays, spacing between radiating elements, gain)			
Antenna patterns (details regarding vertical and horizontal radiation patterns)			
Height (m) above ground and/or rooftop to the radiating centre of the antenna			
Downlink Resource Allocation (or TDD DL/UL ratio)			
TDD frame structure and Downlink-uplink configurations.			
Azimuth (degrees) for each sector			
Downtilt (electrical) for each sector			
Downtilt (mechanical) for each sector			
Transmitter power (Watts or dBW)			
Maximum e.i.r.p. (Watts or dBW) (specify if per sector, per channel and/or per polarization)			
Is the actual maximum approach applied?	Yes/No	Yes/No	
Has the power control and monitoring mechanisms been validated by ISED?	Yes/No	Yes/No	
Actual maximum e.i.r.p. (Watts or dBW) (specify if per sector, per channel and/or per polarization)			

For each frequency band used, list the number of channels per antenna (if more than one) per technology			
Polarization (e.g. horizontal, vertical, circular, elliptical)			
Antenna displacement from site coordinates in table 1 (must indicate the number of metres north or south, number of metres east or west)			

178 **Note 1:** If a parameter is not relevant to an antenna installation, the applicant should
 179 enter “N/A” in that field.

180 **Note 2:** In addition to the above, the technical specifications for any integrated 5G NR
 181 radio units should also be submitted as a separate file.



182 **4.3. Safety Code 6 assessment**

183
 184 This section of the RF exposure report must include the detailed calculations, field
 185 measurements and/or mitigation and corrective measures, as applicable.
 186

187 **4.3.1. Detailed calculations**

188 If detailed calculations are used to demonstrate compliance, the following must be
 189 included:

- 190
- 191 • a description of the mathematical prediction model(s) used for calculations
 - 192 • a description of the software used (if any)
 - 193 • a discussion on near field and far field and how field reflections are considered
 - 194 • a technical description of RF installations considered in the calculations (using
 195 the format of table 3)
 - 196 • field levels should be determined at 2 m above ground, structure floor, or rooftop
 197 level
 - 198 • note that as part of the simulation, 2D vertical views of field levels must also be
 199 included for nearby structures, such as buildings with publicly accessible areas;
 200 and, 2D horizontal views of field levels at 2 m above rooftop level, balconies,
 201 etc. of nearby buildings
 - 202 • a legible site plan clearly identifying any publicly accessible areas (rooftop sites
 203 should identify rooftops access points (if locked or not) and show the location of
 204 each transmit antenna)
 - 205 • figure(s) displaying compliance contours (including north bearing and a scale in
 206 the legend to indicate distances)

207
 208 **4.3.1.1. Radar Installations**

209
 210 To assess SC6 compliance of radar installations with SC6 uncontrolled environment
 211 limits, in addition to the parameters listed in Table 3, the following parameters must also
 212 be submitted.

213
 214 **Table 4: Radar installations parameters**

Parameters	Installation #1	Installation #2	...
Transmitted peak power during the pulse duration for radar system			
Antenna gain			
Duty cycle, Pulse duration and Pulse repetition frequency			

Antenna dimensions (length and width)			
Antenna half-power (3 dB) Horizontal beamwidth			
Antenna half-power (3 dB) Vertical beamwidth			
Antenna efficiency			
Scan angle			
Antenna radar speed (or minimum and maximum rotational speed)			

215

216 Simulations or calculations must be performed to depict the worst-case operational
 217 mode of the radar for both stationary mode and rotational mode. In addition, a separate
 218 analysis must be performed to determine the time-averaged power density over the
 219 pulse width.

220

221 In cases where a lockout system (e.g. safe sector protection) is used to prevent the
 222 radars from transmitting RF energy while they are moving below a minimum velocity,
 223 predefined azimuth(s) and/or elevation angle(s), a description of the system must be
 224 included in the report.

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226 **4.3.1.2. For cellular installations**

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228 [GL-01](#) allows the use of computational modelling as a suitable alternative method of
 229 demonstrating RF exposure compliance, especially for complex cellular transmitting
 230 sites. The simulation software should be based on established mathematical modelling
 231 taking into account all transmitters, including those on the site as well as nearby
 232 installations.

233

234 The computational evaluation should normally be based on the theoretical maximum
 235 transmitted power or equivalent isotropically radiated power (EIRP). However, to avoid
 236 overly conservative predictions, for TDD sites, [GL-01](#) allows the prediction to be
 237 adjusted to account for the maximum transmitted power or EIRP taking into account the
 238 technology duty cycle.

239

240 In addition, prior to being allowed to conduct a prediction at the “actual maximum”
 241 transmitted power approach (based on a statistical analysis), the successful power
 242 control mechanisms must have been validated and approved by ISED.

243

244 For 2D or 3D simulations, the following parameters are recommended:

245

246

Table 5: Cellular installations parameters

Parameters	Installation #1	Installation #2	...
2D or 3D contours at 1%, 50% and 100% of the limits for an uncontrolled environment in Safety Code 6, with distance grids in metres and originating point (0, 0, 0) at the radiation centre of the antenna. Note: (0,0,0) are the displacements in the x, y, z planes; x (east/west) and y (north/south) are the horizontal displacements and z is the vertical displacement.			
2D plots should include a horizontal view at 2 m above any roof or ground level, or a vertical view that clearly specifies the azimuth of the view			
Generic ground plane image area of 400 x 400 m or satellite ground plane image of 400 x 400 m Note: In high RF environments ISED may request the radius of stations under study be extended to 1 km to account for all broadcast stations.			

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248 **4.3.2. Measurements**

249

250 If field measurements are used to demonstrate compliance, the following must be
 251 included:

252

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- date and weather conditions
- special conditions (e.g. stations not operating at authorized power or temporarily relocated)
- measurement equipment (description and calibration data)
- measurement methodology (including consideration to time and spatial averaging and near field environment)
- the manufacturer’s published expanded measurement equipment uncertainty and supporting documents for each device used
- legible site plan showing measurement locations, access control mechanisms (where necessary) and publicly accessible areas (rooftop sites should identify the location of each transmit antenna)

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- table(s) of measured values normalized to percentage of Safety Code 6 limits for uncontrolled environment, with and without equipment uncertainty, at different locations (see Table 6)

Note: Depending on the frequency of operation of cellular or radar installation, the time-averaged power density may be reported as the spatial max or the spatially averaged over the vertical extend of a human see section 3.2.3 of [GL-01](#) for details.

Table 6: Table Template for measurement values normalized to percentage of Safety Code 6 limit, with and without the equipment expanded measurement uncertainty, at different locations identified on plans or sketch

Location	Measured value normalized limit for uncontrolled environment (% of SC6) without expanded measurement equipment uncertainty	Measured value normalized limit for uncontrolled environment (% of SC6) with expanded measurement equipment uncertainty

4.3.3. Mitigation and corrective measures

Any mitigation measures implemented shall be documented. In cases where temporary measures were implemented to ensure compliance, formal engagement and implementation schedules of permanent solutions shall be included. Detailed descriptions of signage and access control mechanisms shall also be included and located on the plan.

4.4. Safety Code 6 compliance statement

A clear compliance statement, which includes all guy-wires and associated anchor points, must conclude every report. Refer to Appendix A for an example.

Note: Particular attention around metallic structures such as guy wires must be taken for sites with antenna systems operating at or below 110 MHz to ensure RF levels are below Safety Code 6 uncontrolled environment limits for induced and contact currents. [Section 3.3](#) of GL-01 provides a suitable methodology to assess induced and contact currents.

Furthermore, operators must ensure that RF levels are below Safety Code 6 uncontrolled environment limits for the electric field strength, magnetic field strength and power density limits (3 kHz to 300 GHz) in **all areas** accessible to the general public.

287

288 **5. Related documents**

289 The latest versions of the following publications should be used in conjunction with this
290 guideline.

- 291 • Broadcasting Procedures and Rules BPR-1, [General Rules](#)
- 292 • Client Procedures Circular CPC-2-0-03, [Radiocommunication and Broadcasting](#)
293 [Antenna Systems](#)
- 294 • Guideline GL-01, [Guidelines for the Measurement of Radio Frequency Fields at](#)
295 [Frequencies from 3 kHz to 300 GHz](#)
- 296 • Client Procedures Circular CPC-2-0-20, [Radio Frequency \(RF\) Fields — Signs](#)
297 [and Access Control](#)
- 298 • Safety Code 6, [Limits of Human Exposure to Radiofrequency Electromagnetic](#)
299 [Energy in the Frequency Range from 3 kHz to 300 GHz](#)
- 300 • Technical Note TN-261, [Safety Code 6 \(SC6\) Radio Frequency Exposure](#)
301 [Compliance Evaluation Template \(Uncontrolled Environment Exposure Limits\)](#)

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Appendix A. Example of declaration of RF exposure compliance

ATTESTATION: I attest that the information provided in this section is correct; that a technical report was prepared and information contained therein is correct; that the site evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed; and that the site, including all guy-wires and associated anchor points, is in compliance with the Safety Code 6 uncontrolled environment limits in all areas accessible to the general public.

Signature: _____ **Date:** _____

NAME (Please print or type): _____

TITLE (Please print or type): _____

COMPANY (Please print or type): _____

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