



Spectrum Management and Telecommunications

Radio Standards Specification

# Zone Enhancers

## Preface

Radio Standards Specification RSS-131, issue 4, *Zone Enhancers*, replaces issue 3 of RSS-131, *Zone Enhancers*, dated May 2017.

The main changes are listed below:

- updated the list of applicable radio standards, resulting in the *expansion of equipment* covered by the scope of this standard
- applicable standards are now referenced by a link to a webpage.
- updated the definitions section to include new terms and improved language, as appropriate
- updated test report requirements as outlined in section [4.7](#)
- improved language related to anti-oscillation requirements in section [6.1.1](#) to increase clarity
- revised noise measurement requirements for fibre connected remote/host DAS zone enhancer systems in section [10.4](#)
- modernized to reflect the current Radio Standards Specification structure
- made editorial changes and clarifications, as appropriate

Inquiries may be submitted by one of the following methods:

1. Online using the [General Inquiry](#) form (in the form, select the Directorate of Regulatory Standards radio button and specify “RSS-131” in the General Inquiry field)
2. By mail to the following address:  
  
Innovation, Science and Economic Development Canada  
Engineering, Planning and Standards Branch  
Attention: Regulatory Standards Directorate  
235 Queen Street  
Ottawa ON K1A 0H5  
Canada
3. By email to <mailto:consultationradiostandards-consultationnormesradio@ised-isde.gc.ca>

Comments and suggestions for improving this standard may be submitted online using the [Standard Change Request](#) form or by mail or email to the above addresses.

All Innovation, Science and Economic Development Canada publications related to spectrum and telecommunications are available on the [Spectrum Management and Telecommunications](#) website.

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

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Director General  
Engineering, Planning and Standards Branch

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## 1. Scope

This Radio Standards Specification (RSS) sets out the certification requirements for zone enhancers, including Distributed Antenna Systems (DASs) and External Radio Frequency Power Amplifiers (ERFPAs), used in conjunction with licensed radio equipment in certain radio services.

Only zone enhancers used to increase the signal strength of radio equipment, certified under the applicable radio standard specifications (RSS), as prescribed on the [RSS-131 applicability list](#), are permitted to be certified under this RSS.

ERFPAs are permitted to be certified if the equipment is used with a base station or fixed equipment which is certified under [RSS-119](#). ERFPAs are considered to be Industrial Zone Enhancers and shall comply with requirements specified in [section 10](#) of this RSS.

### 1.1 Exclusion

A radio frequency (RF) power amplifier used solely as an integral component of a particular hardware version identification number (HVIN) of radio equipment is considered to be an internal amplifier. This type of internal amplifier is a component of the HVIN of radio equipment which shall be certified under the applicable RSS for that type of radio equipment. Therefore, such internal amplifiers shall not be certified under RSS-131 and are not listed in the [Radio equipment list](#).

### 1.2 Prohibition

One-way Wideband Consumer Zone Enhancers (i.e. uplink only, downlink only, uplink impaired and downlink impaired) are prohibited.

Class B zone enhancers (see [section 10.1](#)) shall be certified only for use with equipment certified under [RSS-119](#) and for fixed operation. Mobile operation of class B zone enhancers is prohibited.

Except for DASs, the passband of a class B zone enhancer shall not encompass both the land mobile (for commercial and general use) and public safety bands.

## 2. Purpose and Application

This RSS applies to zone enhancers, including DAS equipment and ERFPAs.

Requirements for consumer zone enhancers, wideband consumer zone enhancers and provider-specific consumer zone enhancers are outlined in Sections 6, 7 and 8 of this standard, respectively. In this document, “provider” refers to “radiocommunication service provider”. These zone enhancers can be used with equipment certified under the applicable RSS. [Section 9](#) of this document outlines requirements for industrial zone enhancers working with equipment certified under the applicable radio standard specifications except [RSS-119](#).

Requirements for industrial zone enhancers working with equipment certified under [RSS-119](#), including ERFPAs and DASs, are outlined in [Section 10](#) of this standard.

### 3. Definitions

For the purpose of this standard, the following definitions apply:

**Automatic Gain Control (AGC)**

A circuit that automatically controls the gain of a zone enhancer by applying more gain to weaker received signals and less (or no) gain to stronger received signals.

**Band of Operation**

A frequency band that is covered under a specific RSS for specific service.

**Base Station Coupling Loss (BSCL)**

The minimum coupling loss (in dB) between the zone enhancer's donor port and the base station.

**Block Edges**

The edges at the end of a specified frequency block in allocated frequency bands.

**Composite Power**

Total power output of all channels amplified by a wideband zone enhancer.

**Consumer Zone Enhancer**

A **bidirectional zone enhancer**, which is used by individuals to improve wireless coverage within a limited area. Consumer Zone Enhancers are designed to be installed without third party professional assistance and to be used "out-of-the-box" without fine tuning or other technical adjustments.

Consumer Zone Enhancers can be operated only with approved antennas, cables and/or coupling devices as specified by the manufacturer of the Consumer Zone Enhancer.

**Distributed Antenna System (DAS)**

A network of spatially separated antenna nodes connected to a common source via a transport medium, that provides wireless service within a geographic area or inside a structure. A DAS is a zone enhancer when the network of internal antennas communicates with an amplifier that is connected to an external antenna that communicates with a base station wirelessly.

**Donor Port**

The RF port on a zone enhancer that receives downlink signals from a base station and which also retransmits an amplified uplink signal received from subscriber equipment.

**Downlink Frequency Band**

The transmitted frequency band from the base station to the subscriber.

**External Radio Frequency Power Amplifier (ERFPA)**

A device which, inserted between a radio transmitter (as a signal source) and an antenna, is capable of amplification of that signal and is not an integral part of a radio transmitter. ERFPA's shall have only one transmit antenna port.

**Fixed Consumer Zone Enhancer**

A Consumer Zone Enhancer designed to be operated in a fixed location in a building.

**Industrial Zone Enhancer**

All zone enhancers other than Consumer Zone Enhancers. The Industrial Zone Enhancer category includes a wide variety of devices that are designed for installation by licensees or installers approved by licensees. These devices are typically designed to serve multiple users simultaneously and to cover larger areas, such as stadiums, airports, office buildings, tunnels and educational campuses. Industrial Zone Enhancers include ERFPA, repeaters, fibre optic zone enhancers and other similar internal RF distribution methods, such as a single RF internal antenna or a DAS (an array of internal antennas).

**Mobile Consumer Zone Enhancer**

A Consumer Zone Enhancer designed to be operated in a vehicle. The zone enhancer's uplink and downlink antennas must be installed in a way where the minimum separation distance between the antennas and a user (or bystander) specified by the manufacturer is always maintained.

**Mobile Station Coupling Loss (MSCL)**

The minimum coupling loss (in dB) between the wireless subscriber device which uses the Consumer Zone Enhancer and the server port of the Consumer Zone Enhancer.

**Provider-Specific Consumer Zone Enhancer**

A Consumer Zone Enhancer, which can be operated only on specific frequency ranges within an applicable licensed frequency band(s).

**Received Signal Strength Indication (RSSI)**

The downlink composite received signal power (in dBm) at the zone enhancer donor port in the band of operation. RSSI is expressed in negative dBm.

**Repeater**

A device that retransmits a signal to another station. Repeaters are different from zone enhancers in that they include frequency conversion. These devices are typically single channel but can also be multiple channels.

**Server Port**

The RF port on a zone enhancer that receives the uplink signal from subscriber equipment and which also transmits the amplified downlink signal received from a base station.

**Oscillations**

The feedback between the donor and server antennas of a zone enhancer system results in oscillations. In general, oscillations are caused by insufficient isolation/separation distance between the server and donor antennas.

**Uplink Frequency Band**

The transmitted frequency band from the subscriber to the base station.



**Zone Enhancer**

A device or system that automatically receives, amplifies and retransmits the signals received from base, fixed, mobile or portable stations with no change in operating frequency or channel bandwidth. It is also commonly referred to as a **Bi-Directional Amplifier (BDA)** or **signal booster**.

**Wideband Consumer Zone Enhancer**

A **Consumer Zone Enhancer** that can operate on one or more frequency bands.

**4. General requirements and references**

This section sets out the general requirements and references related to this RSS.

**4.1 Coming into force and transition period**

This document will be in force as of the date of its publication on Innovation, Science and Economic Development Canada's (ISED) website.

However, **a transition period of six months** from the publication date will be provided. During this period, all applications for certification under RSS-131, issue 3 or issue 4, will be accepted. After this period, only applications for the certification of equipment under RSS-131, issue 4, will be accepted, and equipment manufactured, imported, distributed, leased, offered for sale, or sold in Canada, shall comply with this present issue.

A copy of RSS-131, issue 3, may be requested by [email at consultationradiostandards-consultationnormesradio@ised-isde.gc.ca](mailto:email_at_consultationradiostandards-consultationnormesradio@ised-isde.gc.ca).

**4.2 Certification requirements**

Equipment covered by this standard is classified as **Category I equipment** and shall be certified. Either a technical acceptance certificate (TAC) issued by the Certification and Engineering Bureau of ISED or a certificate issued by a certification body (CB) is required.

**4.3 RSS-Gen compliance**

RSS-131 shall be used in conjunction with RSS-Gen, [General Requirements for the Compliance of Radio Apparatus](#), for general requirements and information relevant to the equipment to which this standard applies.

**4.4 Related documents**

All Spectrum Management and Telecommunications publications are available on the [official publications](#) web page. The following documents should be consulted:

- **CPC-2-1-05**, [Zone Enhancers](#)
- **RSS-Gen**, [General Requirements for Compliance of Radio Apparatus](#)

- [RSS-119](#), [Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz](#)
- [RSS-131 applicability list](#)

#### Acronyms

- CPC: Client Procedures Circular
- RSS: Radio Standards Specification

#### 4.5 Labelling and user manual requirements

Zone enhancer manufacturers shall ensure that all zone enhancers meet the labelling requirements in this section. Information required for the label shall be displayed in compliance with the labelling format specified in Radio Standards Specification RSS-Gen, [General Requirements for Compliance of Radio Apparatus](#).

In addition to the requirements outlined in RSS-Gen, the following advisories shall be included in one of the following locations:

- [in the user manual and installation instructions](#), either printed and included with the equipment, or available online
  - in the latter case, instructions on how to access the online user manual and installation instructions shall be provided to the end user with each equipment
- [on the outer packaging](#) of the device
- [on a label affixed to the device](#)

[The text to be included](#) shall be as follows:

1) [For Consumer Zone Enhancers](#):

*This is a CONSUMER device.*

*BEFORE USE, you must meet all requirements set out in [CPC-2-1-05](#).*

*This device **MUST ONLY** be operated with approved antennas and cables as specified by the manufacturer. Antennas must be installed in a way where the minimum separation distance between the antennas and a user (or bystander) specified by the manufacturer is **ALWAYS** maintained.*

*In order to reduce oscillations it is recommended that sufficient separation distance is maintained between the donor and server antennas of the zone enhancer system.*

*You **MUST** cease operation of this device immediately if requested by ISED or a licensed*

*wireless service provider.*

**WARNING:** *E911 location information may not be provided or may be inaccurate for calls served by using this device.*

*Ce produit est un appareil GRAND PUBLIC.*

*AVANT DE L'UTILISER, vous devez vous conformer à toutes les exigences établies dans la [CPC-2-1-05](#).*

*Cet appareil NE DOIT ÊTRE UTILISÉ qu'avec des antennes et des câbles approuvés, conformément aux indications du fabricant. Les antennes doivent être installées de manière à ce que la distance minimale de séparation entre les antennes et un utilisateur (ou un passant) spécifiée par le fabricant soit TOUJOURS respectée.*

*Afin de réduire les oscillations, il est recommandé de maintenir une distance de séparation suffisante entre les antennes du donateur et du serveur du système d'enrichisseur de zone.*

*Vous DEVEZ cesser d'utiliser cet appareil immédiatement à la demande d'ISDE ou d'un fournisseur de services sans fil autorisé.*

**AVERTISSEMENT :** *Les informations relatives à la localisation pour le service E911 peuvent être non fournies ou inexactes pour les appels transitant par cet appareil.*

- 2) **For Consumer Zone Enhancers certified for fixed operation**, in addition to the text specified under item 1, the following text shall also be included:

*This device may operate in a fixed location only, for in-building use.*

*Cet appareil peut fonctionner seulement à un emplacement fixe à l'intérieur d'un bâtiment.*

- 3) **For Industrial Zone Enhancers:**

**WARNING:** *Industrial zone enhancers are NOT consumer devices. They are designed for installation by ISED licensees and qualified installers who have recognized RF training. You MUST be an ISED licensee or have the express consent of an ISED licensee to install or operate this device.*

**AVERTISSEMENT :** *Les enrichisseurs de zone industriels ne sont PAS des appareils de CONSOMMATION. Ils sont conçus pour être installés par des titulaires de licence d'ISDE et des installateurs qualifiés qui ont reçu une formation reconnue en RF. Vous DEVEZ être le titulaire de licence d'ISDE ou avoir le consentement exprès du titulaire de*

 *licence d'ISDE pour installer ou exploiter cet appareil.*

#### **4.5.1 User manual for Consumer Zone Enhancers**

The user manual must include a link to [ISED's CPC-2-1-05](#).

#### **4.6 Antenna kits for Consumer Zone Enhancers**

All Consumer Zone Enhancers certified under the applicable radio standard specifications (RSS) listed on the [RSS-131 applicability list](#) shall be sold together with antennas, cables, and/or coupling devices that meet the requirements of this standard, and Consumer Zone Enhancer user manuals shall specify all antennas and cables that meet the requirements in this standard. This does not apply to zone enhancers certified to be used with equipment covered under [RSS-119](#) as this standard is only applicable to industrial zone enhancers.

Applicants seeking certification are required to submit documentation with the certification application which shows compliance with the requirements in this standard regarding all antennas, cables and/or coupling devices, including any antennas or equipment upgrade options that may be available at the initial purchase or as a subsequent upgrade.

#### **4.7 Test report**

In addition to the information required in [RSS-Gen](#), the test report shall contain the following information and/or measurements for each band of operation:

1. the zone enhancer's nominal gain
2. the zone enhancer's gain-versus-frequency response
3. the zone enhancer's rated mean output power,  $P_{\text{rated}}$ , and its output signal coupling attenuation
4. the calculated or measured Mobile Station Coupling Loss (MSCL) for Wideband Consumer Zone Enhancers
5. the Base Station Coupling Loss (BSCL) for the Provider-Specific Consumer Zone Enhancer, as determined in [section 5.2](#)
6. the zone enhancer's input and output ports impedance

In addition, the certification applicant shall submit documents that show compliance of all antennas, cables and/or coupling devices with the requirements in section 5, including any antenna or equipment upgrade options that may be available at initial purchase or as a subsequent upgrade.

#### 4.8 Licensing requirements

Equipment covered by this standard is subject to licensing requirements pursuant to subsection 4(1) of the *Radiocommunication Act*. For information regarding licensing of zone enhancers, refer to ISED's Client Procedures Circular CPC-2-1-05, [Zone Enhancers](#).

### 5. Measurement Methods

Compliance with the requirements in this standard shall be performed according to procedures listed on ISED's [Normative Test Standards and Acceptable Alternate Procedures](#) web page and in accordance with the requirements of [RSS-Gen](#).

#### 5.1 Output power

Unless indicated otherwise in the applicable standards of the equipment with which the zone enhancer is to be used, the output power and noise limit of the zone enhancer shall be measured in terms of root-mean-square (RMS) average value.

#### 5.2 Base Station Coupling Loss (BSCL) for Provider-Specific Consumer Zone Enhancers

In order of preference, the BSCL (in dB) shall be determined using one of the following methods:

1. determine path loss between the base station and the Provider-Specific Consumer Zone Enhancer by measuring the received forward pilot/control channel power at the zone enhancer and reading the pilot/control transmit power from the base station as defined in the system information messages sent by the base station
2. estimate the BSCL by assuming that the base station is transmitting at a level of 25 dBm per channel and by measuring the total received signal power in the channel (RPCH), received at the zone enhancer donor port (in dBm). BSCL is then calculated as  $BSCL = 25 - RPCH$
3. assume that the BSCL is 70 dB without performing any measurement

### 6. Equipment standard specifications for Consumer Zone Enhancers

This section outlines the requirements for Consumer Zone Enhancers, which include Wideband Consumer Zone Enhancers and Provider-Specific Consumer Zone Enhancers. The requirements outlined in this section are only applicable to RSSs listed on the [RSS-131 applicability list](#), except [RSS-119](#) (see section 10 for details regarding equipment requirements for zone enhancers certified under RSS-119). In addition to the requirements in this section, Consumer Zone Enhancers shall comply with the requirements in the applicable RSSs of the certified equipment with which they are designed to operate unless stated otherwise.

#### 6.1 Consumer Zone Enhancer network protection standard

All Consumer Zone Enhancers shall include the features below to prevent harmful interference to wireless networks.

### 6.1.1 Anti-oscillation

Consumer Zone Enhancers shall be able to detect and mitigate (i.e. by automatic gain control(AGC) and/or shut down) any oscillation in the uplink and downlink bands.

Oscillation detection and mitigation shall occur automatically within 0.3 seconds in the uplink bands and within one second in the downlink bands.

If the zone enhancer is unable to mitigate oscillation by means of AGC within the time periods specified above, it shall shut down and shall remain shut down for at least one minute before restarting. After five such restarts, the zone enhancer shall not resume operation and would require manual intervention for reset.

If the oscillation was mitigated by means of AGC within the time periods specified above, it shall continue to mitigate for at least one minute before attempting to resume normal operation. After five such restarts, the zone enhancer shall not resume operation and would require manual intervention for reset.

As for further detection and mitigation requirements, oscillation levels shall not exceed 12 dB above the minimum level occurring between adjacent oscillation peaks for any 30 kHz window. These oscillation levels must be reduced below 12 dB within 300 seconds. In the event that the oscillation levels are not reduced below the 12 dB threshold, the zone enhancer shall shut down, shall not resume operation and would require manual intervention for reset.

### 6.1.2 Automatic Gain control

Consumer Zone Enhancers shall have automatic limiting gain control to protect against excessive input signals that would cause output power and emissions in excess of the specified limits in the applicable frequency bands.

### 6.1.3 Power down

To protect wireless networks, Consumer Zone Enhancers shall automatically power down or cease amplification as they approach any affected base station.

### 6.1.4 Interference avoidance for wireless subsystems

Consumer Zone Enhancers using unlicensed or other frequency bands for wireless transmissions between donor and server subsystems for their internal operations shall employ interference mitigation methods to prevent interference to authorized spectrum bands.

## 6.2 Bidirectional capability

The maximum gain difference between the uplink and downlink of Consumer Zone Enhancers shall not exceed 9 dB. The conducted uplink power output shall be at least 17 dBm. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation. The Received Signal Strength Indication (RSSI) is measured after spectrum block filtering is applied in reference to the zone enhancer's input port for each band of operation.

## 7. Equipment standard specifications for Wideband Consumer Zone Enhancers

Wideband Consumer Zone Enhancers shall comply with all the requirements for Consumer Zone Enhancers outlined in sections 6.1 and 6.2, in addition to the following requirements:

### 7.1 Noise power limits

Wideband Consumer Zone Enhancers shall comply with the following noise power limits:

1. The transmitted uplink noise power (in dBm/MHz) of Wideband Consumer Zone Enhancers at their uplink output ports shall not exceed  $-103 \text{ dBm} - \text{RSSI}$ , where RSSI is the downlink composite received signal power (expressed in negative dBm) at the zone enhancer donor port for all base stations in the band of operation.
2. The transmitted noise power (in dBm/MHz) at the device's uplink and downlink output ports shall not exceed the following limits:
  - a.  $-102.5 \text{ dBm/MHz} + 20 \log_{10}(f)$ , where  $f$  is the uplink mid-band frequency of the operating frequency bands (in MHz), for fixed Wideband Consumer Zone Enhancers
  - b.  $-59 \text{ dBm/MHz}$  for mobile Wideband Consumer Zone Enhancers

### 7.2 Gain limits

Wideband Consumer Zone Enhancers shall comply with the following gain limits:

1. The uplink gain (in dB) of a Wideband Consumer Zone Enhancer referenced to its input and output ports shall not exceed  $-34 - \text{RSSI} + \text{MSCL}$
2. The uplink and downlink gain (in dB) of a fixed Wideband Consumer Zone Enhancer referenced to its input and output ports shall not exceed  $6.5 + 20 \log_{10}(f)$ , where  $f$  is the uplink mid-band frequency of the operating frequency bands (in MHz)
3. The uplink and downlink gain of a mobile Wideband Consumer Zone Enhancer referenced to its input and output ports shall not exceed:
  - a. 50 dB when using an inside antenna (e.g. inside a vehicle)
  - b. 23 dB when using direct contact coupling (e.g. cradle-type zone enhancers)
  - c. 15 dB when directly connected (with a physical connection)

### 7.3 Transmit power off mode

When the zone enhancer cannot otherwise meet the noise and gain limits defined herein, it shall operate in "Transmit Power Off Mode." In this mode, the transmitted uplink noise power shall not exceed  $-70 \text{ dBm/MHz}$  and the uplink and downlink gain shall not exceed 23 dB or the MSCL value, whichever



is lower.

#### 7.4 Power limits

The uplink composite conducted output power and equivalent isotropically radiated power (e.i.r.p.) of the Wideband Consumer Zone Enhancer shall not exceed 1 watt (30 dBm) for each uplink band of operation. The conducted uplink output power shall be at least 17 dBm, as stated in section 6.4.

The downlink composite conducted output power and e.i.r.p. of the Wideband Consumer Zone Enhancer shall not exceed 0.05 watt (17 dBm) for each downlink band of operation.

#### 7.5 Out-of-band emission limits

The out-of-band emission of a Wideband Consumer Zone Enhancer shall be at least 6 dB below the mobile unwanted emission limits for the supported mobile wireless device for the bands of operation as specified in the applicable RSS.

#### 7.6 Intermodulation limits

The power of the transmitted intermodulation products of a Wideband Consumer Zone Enhancer at its uplink and downlink output ports shall not exceed  $-19$  dBm with a 3 kHz measurement bandwidth.

#### 7.7 Uplink inactivity

When the zone enhancer is not serving an active device connection, after five minutes, the uplink transmitted noise power shall not exceed  $-70$  dBm/MHz.

### 8. Equipment standard specifications for Provider-Specific Consumer Zone Enhancers

Provider-Specific Consumer Zone Enhancers shall comply with all the requirements for Consumer Zone Enhancers outlined in sections 6.1 and 6.2, in addition to the following requirements:

#### 8.1 Noise power limits

Provider-Specific Consumer Zone Enhancers shall comply with the following noise power limits:

1. The transmitted noise power (in dBm/MHz) of Provider-Specific Consumer Zone Enhancers outside the licensee's spectrum blocks at their uplink ports shall not exceed  $-103$  dBm – RSSI. The RSSI is the downlink composite received signal power (in dBm) for frequencies in the band of operation, but outside the licensee's spectrum block as measured after the spectrum block filtering is applied in reference to the zone enhancer's donor port for each band of operation.
2. Provider-Specific Consumer Zone Enhancers with an MSCL less than 40 dB shall reduce the noise output power value (in dB) determined in item 1 above by 40 dB – MSCL.
3. The transmitted noise power (in dBm/MHz) at the device's downlink output ports shall not exceed:
  - a.  $-102.5$  dBm/MHz +  $20 \log_{10}(f)$ , where  $f$  is the uplink mid-band frequency of the operating frequency bands (in MHz), for fixed Provider-Specific Consumer Zone Enhancers



- b.  $-59$  dBm/MHz for mobile Provider-Specific Consumer Zone Enhancers

## 8.2 Gain limits

Provider-Specific Consumer Zone Enhancers shall comply with the following gain limits:

1. The uplink and downlink gain (in dB) of a Provider-Specific Consumer Zone Enhancer referenced to its input and output ports shall not exceed  $BSCL - 28 - (40 - MSCL)$ .
2. The uplink and downlink gain (in dB) of a fixed Provider-Specific Consumer Zone Enhancer referenced to its input and output ports shall not exceed  $19.5 + 20 \log_{10}(f)$ , or 100 dB for systems having automatic gain adjustment based on isolation measurements between enhancer donor and server antennas, where  $f$  is the uplink mid-band frequency of the operating frequency bands (in MHz).
3. The uplink and downlink gain (in dB) of a mobile Provider-Specific Consumer Zone Enhancer referenced to its input and output ports shall not exceed
  - a. 50 dB when using an inside antenna(s) (e.g. inside a vehicle)
  - b. 23 dB when using direct contact coupling (e.g. cradle-type zone enhancers)
  - c. 15 dB when directly connected (with a physical connection)

For systems using an inside antenna, which have automatic gain adjustment based on isolation measurements between enhancer donor and server antennas and automatic feedback cancellation, the mobile zone enhancer gain shall not exceed 58 dB for frequencies below 1 GHz, and 65 dB for frequencies above 1 GHz.

## 8.3 Power limits

The uplink composite conducted power and e.i.r.p. of the Provider-Specific Consumer Zone Enhancer shall not exceed 1 watt (30 dBm) for each band of operation. The conducted uplink output power shall be at least 0.05 watts (17 dBm).

The downlink composite conducted power and e.i.r.p. of the Provider-Specific Consumer Zone Enhancer shall not exceed 0.05 watts (17 dBm) for each band of operation and shall not exceed 0.01 watts (10 dBm) per channel.

## 8.4 Out-of-band gain limits

The Provider-Specific Consumer Zone Enhancer shall have the following minimum attenuation in reference to the zone enhancer's gain in the centre of the passband of the zone enhancer:

1.  $-20$  dB at the block edges
2.  $-20$  dB to  $-30$  dB between the block edges and 1 MHz offset from the block edges (the limit varies linearly with the logarithm of frequency)

3.  $-30$  dB to  $-40$  dB between the 1 MHz offset from the block edges and the 5 MHz offset from the block edges (the limit varies linearly with the logarithm of frequency)

In addition, a Provider-Specific Consumer Zone Enhancer with a maximum gain greater than 80 dB (referenced to the centre of the passband) shall limit the out-of-band gain to 60 dB at 0.2 MHz offset from the block edges. When the offset is between 0.2 MHz and 1MHz from the block edges, the out-of-band gain limit varies, linearly with the logarithm of frequency, from 60 dB to 45 dB.

The block edges are the edges at the end of a specified frequency block in allocated frequency bands.

### 8.5 Out-of-band emission limits

The Provider-Specific Consumer Zone Enhancer's out-of-band emissions shall meet the mobile emission limit of the supported mobile wireless device for the bands of operation as specified in the applicable RSS of the supported mobile wireless device.

### 8.6 Intermodulation limits

The power of the transmitted intermodulation products of a Provider-Specific Consumer Zone Enhancer at its uplink and downlink ports shall not exceed  $-19$  dBm in a 3 kHz measurement bandwidth.

### 8.7 Transmit power off mode

When the Provider-Specific Consumer Zone Enhancer cannot otherwise meet the noise and gain limits defined herein, it shall operate in "Transmit Power Off Mode." In this mode, the uplink and downlink noise power shall not exceed  $-70$  dBm/MHz and the uplink gain shall not exceed 23 dB or the MSCL value, whichever is lower.

### 8.8 Uplink inactivity

When the Provider-Specific Consumer Zone Enhancer is not serving an active device connection, after five minutes, the uplink noise power shall not exceed  $-70$  dBm/MHz.

## 9. Equipment standard specifications for Industrial zone enhancers

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

### 9.1 Out-of-band rejection

The gain-versus-frequency response and the 20 dB passband bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

### 9.2 Input-versus-output spectrum

The spectral growth of the 26 dB bandwidth or occupied bandwidth of the output signal shall be less than 5% of the input signal spectrum.

### 9.3 Mean output power and zone enhancer gain

The zone enhancer gain shall not exceed the nominal gain (i.e the maximum gain at any frequency within the zone enhancer's passband) by more than 1.0 dB. Outside of the 20 dB passband bandwidth, the gain shall not exceed the gain at the 20 dB point.

### 9.4 Frequency stability

Industrial zone enhancers shall comply with the frequency stability given in the RSS that applies to the equipment with which the zone enhancer is to be used. In cases where the frequency stability limit is not given in the applicable RSS, the equipment shall comply with a frequency stability of  $\pm 1.5$  ppm.

For zone enhancers with no input signal processing capability such as modulation, or if the zone enhancer does not incorporate an internal oscillator circuit component, the frequency stability measurement in this section is not required.

## 10. Equipment standard specifications for zone enhancers working with equipment certified under RSS-119

This section contains requirements for zone enhancers, including ERFPA's and DAS's, working with equipment certified under [RSS-119](#).

There is no classification of consumer enhancers for zone enhancers certified under this section. These zone enhancers are considered to be Industrial Zone Enhancers.

### 10.1 Types of zone enhancers

Two types of zone enhancers can be used with equipment certified under [RSS-119](#):

1. **Class A Zone Enhancer:** A zone enhancer designed to retransmit signals on one or more specific channels. A zone enhancer is deemed to be a class A zone enhancer if none of its passbands bandwidth (20 dB bandwidth) for one or more specific channels exceed 75 kHz.
2. **Class B Zone Enhancer:** A zone enhancer designed to retransmit any signals within a wide frequency band. A zone enhancer is deemed to be a class B zone enhancer if it has a passband bandwidth (20 dB bandwidth) that exceeds 75 kHz.

## 10.2 Output power

The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used (as specified in [RSS-119](#)) and shall be within  $\pm 1.0$  dB of the manufacturer's rated output power listed in zone enhancer equipment specifications.

## 10.3 Intermodulation

The effective radiated power (ERP) of intermodulation products shall not exceed  $-30$  dBm in a 10 kHz measurement bandwidth.

## 10.4 Noise limits

Zone enhancers working with equipment certified under RSS-119 shall comply with the following noise limits:

1. The ERP of noise within the passband shall not exceed  $-43$  dBm in a 10 kHz measurement bandwidth.
2. The ERP of noise in spectrum more than 1 MHz outside of the passband shall not exceed  $-70$  dBm in a 10 kHz measurement bandwidth.
3. The noise figure of a zone enhancer shall not exceed 9 dB in either direction.

For DAS zone enhancer systems with fibre connected remote hosts, compliance to limits outlined in items 1 and 2 above shall be required; however, demonstration of compliance to the noise figure requirement outlined in item 3 is not required.

## 10.5 Spurious emissions

The spurious emissions of a zone enhancer shall not exceed  $-13$  dBm in any 100 kHz measurement bandwidth.

## 10.6 Other requirements

Zone enhancers shall meet the following requirements:

1. Minor departures from the exact reference frequencies of the input signals are permitted provided the retransmitted signals meet the frequency stability limit specified in [RSS-119](#) for the equipment with which the zone enhancer is to be used.
2. The retransmitted signals shall meet the unwanted emission limits in [RSS-119](#) that applies to the equipment with which the zone enhancer is to be used.