Industry Canada Industrie Canada

RSS-129
Issue 2
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Spectrum Management and Telecommunications Policy

Radio Standards Specification

# 800 MHz Dual-Mode CDMA Cellular Telephones

Canada

Aussi disponible en français - CNR-129

# PREFACE

This issue replaces issue 1 (RSS -129, Issue 1, Provisional), entitled *800 MHz Dual-Mode CDMA Cellular Telephones*, and its amendments to RSS-129 Issue 1, Provisional, *800 MHz Dual-Mode CDMA Cellular Telephones*, the latter dated August 24, 1996.

## Changes

The following are the main changes:

1. Cordless-Mode Cellular Base Station authorization protocol: restrictions on its principle of operation have been revised (section 5.15.6).

2. Standard on multiple-band operation has been added (section 5.16).

3. Frequency and power stability method of measurement has been revised (sections 7.2.1 and 7.2.2).

4. Permissible receiver spurious emission levels have been revised (section 10).

5. Exposure of Humans to RF Fields: evaluation requirements are specified (section 11).

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# 1. Scope

1.1 This document and the TIA/EIA IS-95 Compatibility Standard referenced to in section 3.10 set out the minimum standards for transmitters and receivers for the dual-mode (analogue and CDMA) cellular telephone system in the 824-849 MHz and 869-894 MHz paired bands.

A technical acceptance certificate (TAC) is required, pursuant to subsection 4(2) of the *Radiocommunication Act* and the *Radiocommunication Regulations*. Before certification is granted, the applicant shall show that the applicable standards have been complied with.

1.2 The equipment is subject to licensing pursuant to subsection 4(1) of the *Radiocommunication Act.*

# 2. General

## 2.1 Quality Control

Periodic testing shall be carried out by the manufacturer or importer to ensure continuing compliance with the standard. Non-compliance problems shall be corrected by the manufacturer or importer. The Department of Industry (also known as Industry Canada) will conduct audit checks from time to time to ensure compliance.

## 2.2 Inquiries about This Standard

Inquiries about this Standard may be directed to Industry Canada's local office or to:

Manager, Radio Equipment Standards
Industry Canada
300 Slater Street
Ottawa, Ontario
Canada, K1A 0C8
Tel: (613) 990-4699 / Fax: (613) 990-3158
E-mail: Lum.kwai@ic.gc.ca

However, inquiries concerning **equipment certification** matters should be directed to Chief, Certification and Engineering Bureau (see address in section 14).

## 3. Related Documents

The following are related documents. Radio Standards Procedure 100 (RSP-100) and Telecommunications Regulation Circular 49 (TRC-49) provide guidance and the fee schedule when applying for equipment certification. The Standard Radio System Plan 503 (SRSP-503), provides information on channelling plans, permissible effective radiated powers (ERPs) and antenna heights relevant to the equipment governed by this Radio Standards Specification (RSS).

If the radio device (e.g., the base station of a radio link – see example in section 5.15 is intended for connection to a public switched telecommunication network (PSTN), the device shall also comply with the standard CS-03 and be certified under the Terminal Attachment Program procedure CP-01 as well as under the radio equipment certification procedure RSP-100. However, **regular** cellular base station equipment, even though they interconnect with the PSTN, are exempt from CP-01 certification.

| | | |
|---|---|---|
| 3.1 | RSP-100: | "Radio Equipment Certification Procedure". |
| 3.2 | TRC-49: | "Certification Service Fees". |
| 3.3 | SRSP-503: | "Technical Requirements for Cellular Radiotelephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz". |
| 3.4 | CP-01: | "Certification Procedure for Terminal Equipment". |
| 3.5 | CS-03: | "Certification Standard for Terminal Equipment". |
| 3.6 | RSS-102: | "Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields" |
| 3.7 | RSS-210: | "Low Power Licence-Exempt Radiocommunication Devices". |
| 3.8 | RSS-212: | "Test Facilities and Test Methods for Radio Equipment". |
| 3.9 | RIC 66: | "Addresses and Telephone Numbers of Regional and District Offices of Industry Canada" |
| 3.10 | TIA/EIA IS-95: | "Mobile station - Base station compatibility standard for dual-mode wideband spread spectrum cellular system". |
| 3.11 | TIA/EIA IS-97: | "Recommended minimum performance standards for base stations supporting dual-mode wideband spread spectrum cellular mobile stations". |
| 3.12 | TIA/EIA IS-98: | "Recommended minimum performance standards for 800 MHz dual-mode wideband spread spectrum cellular mobile stations". |

Industry Canada documents (items 3.1 to 3.9) are available in English and French on the Internet at:

http://strategis.ic.gc.ca/spectrum (English version)
http://strategis.ic.gc.ca/spectre (French version)

For assistance on documentation, please contact the Documentation Centre: DOSP-P, 300 Slater Street, Ottawa, Ontario, K1A 0C8; e-mail: spectrum_pubs@ic.gc.ca; telephone (613) 990-4761 / fax (613) 952-9871.

The above TIA/EIA documents (English version only) may be obtained from the American National Standards Institute, 11 West 42nd Street, New York, N.Y., 10036, U.S.A. Telephone: (212) 642-4900, or 1-800-854-7179, ext 436.

# 4. Test Instruments

## 4.1 Test Instruments List

The test report shall list all test instruments used. The list shall identify instruments by manufacturer, type and model number. Some specific test instrument requirements are given below.

## 4.2 Test Instruments for Analogue Mode Tests

### 4.2.1 Test Receiver

If required for any tests, the test receiver shall consist of a configuration of test equipment complying with the following minimal requirements.

(a) It shall be tunable over the applicable range of radio frequencies.

(b) It shall be capable of measuring positive and negative peak values of carrier frequency deviations up to ±15 kHz with an accuracy of 5% or better.

(c) It shall incorporate a switchable 6 dB/octave de-emphasis network whose audio response characteristic for a constant signal deviation does not vary by more than ±1 dB from a 750 microsecond de-emphasis characteristic over the frequency range 50 to 6000 Hertz.

(d) It shall incorporate a switchable 2:1 expander (2 dB output change for every 1 dB change in input)

(e) The nominal 3 dB audio band pass shall be from 50 Hertz to 20 kHz and the variation in the response shall not exceed ±0.5 dB within the range 300 to 3000 Hertz with the expander switched off.

(f) Distortion due to signal processing shall not exceed 1 %.

(g) Inherent hum and noise input shall be at least 50 dB below the level of a signal with standard test modulation.

(h) It shall be properly terminated during all tests and a switchable "C" message weighted filter shall be incorporated.

(i) It shall be capable of processing wideband data transmitted at a 10 kilobits/sec rate.

#### 4.2.2 Spectrum Analyser

(a) It shall have a dynamic range of at least 70 dB.
(b) It shall be capable of measuring relative levels of input signal components with an accuracy of ±1 dB or better.

#### 4.2.3 Distortion Meter

The distortion meter shall be equipped with a 1000 Hz notch-filter.

### 4.3 Test Instruments for Digital Mode Tests

Instrument types to be stated in the test report.

## 5. Equipment Requirements

### 5.1 Equipment Labels

Equipment that is certified under this RSS shall be permanently labelled on each item or inseparable combination. The label shall contain the following:

(a) The certification number, prefixed by the name "Canada";
(b) The manufacturer's name or trade name or brand name;
(c) A model name or number.

Equipment for which a certificate has been issued is not considered certified if it is not properly labelled. **Note:** The information on the Canadian label can be combined with the manufacturer's other labelling requirements.

### 5.2 Testing Methods

(a) Tests are to be conducted in accordance with good engineering practices.

(b) When the antenna is detachable, the transmitter output power may be measured by replacing the antenna with a spectrum analyser of internal resistance equal to the impedance specified for the antenna.

(c) When the antenna is not detachable, field strength measurement should be made using a calibrated open area test site, at the prevailing ambient temperature, provided that the prevailing temperature is within the design range for the equipment. A description of the method of measurement that is acceptable to Industry Canada is found in RSS-212.

(d) In either method and except specified otherwise, the transmitter shall be modulated with signals representative of those encountered in a real system operation.

(e) When using a spectrum analyser to measure power, a resolution bandwidth narrower than that specified, plus numerical integration to sum the power, is permitted. The method used shall be described in the test report.

## 5.3 Allocated Bands and Channel Spacing

The bands allocated to the cellular mobile service are:

| | |
|---|---|
| Mobile transmit | 824.000 MHz to 849.000 MHz |
| Base transmit | 869.000 MHz to 894.000 MHz |

Standard channel spacing is 30 kHz for analogue channels and 1.23 MHz for CDMA channels.

### Analogue Channels

The mobile transmitter centre frequencies are 824.040 MHz (ch. 991) to 825.000 MHz (ch. 1023), and 825.030 MHz (ch. 1) to 848.970 MHz (ch. 799). The corresponding base transmitter centre frequencies are 869.040 MHz (ch. 991) to 870.000 MHz (ch. 1023), and 870.030 MHz (ch.1) to 893.970 MHz (ch. 799). For further details of the allocated bands and channels for signalling purposes, see document SRSP-503.

### CDMA Channels

The permissible carrier frequencies (midband frequencies) are given in Table 5.1.

## 5.4 External Controls

The device shall not have any external controls accessible to the user that can be adjusted and operated in violation of the limits of this RSS. Furthermore, information on internal adjustments or reconfiguration to the equipment shall only be made available to service depots and agents of the supplier and NOT to the public.

## 5.5 Associated Equipment

Associated equipment shall be that normally used with the transmitter and/or receiver. The equipment shall be operated in the cabinet supplied and in accordance with the manufacturer's published instructions.

### 5.6 Standard Atmospheric Conditions

Except where otherwise specified, tests shall be conducted under ambient conditions of atmospheric pressure and humidity and at a temperature of 20ºC ±5º.

### 5.7 Standard Test Frequency

Except where otherwise specified, all tests shall be conducted on a frequency which is near the middle of the frequency range within which the equipment is designed to operate. This frequency shall be stated in the test report.

**Table 5.1: CDMA Channel Numbers and Corresponding Frequencies**

| System | Valid CDMA Frequency Assignments | Analog Channel Count | CDMA Channel Number | Transmitter Frequency Assignment (MHz) Mobile | Base |
|---|---|---|---|---|---|
| A" (1 MHz) | xxxxxxxxx | 22 | 991 to 1012 | 824.040 to 824.670 | 869.040 to 869.670 |
| | CDMA | 11 | 1013 to 1023 | 824.700 to 825.000 | 869.700 to 870.000 |
| A (10 MHz) | CDMA | 311 | 1 to 311 | 825.030 to 834.330 | 870.030 to 879.330 |
| | xxxxxxxxx | 22 | 312 to 333 | 834.360 to 834.990 | 879.360 to 879.990 |
| B (10 MHz) | xxxxxxxxx | 22 | 334 to 355 | 835.020 to 835.650 | 880.020 to 880.650 |
| | CDMA | 289 | 356 to 644 | 835.680 to 844.320 | 880.680 to 889.320 |
| | xxxxxxxxx | 22 | 645 to 666 | 844.350 to 844.980 | 889.350 to 889.980 |
| A' (1.5 MHz) | xxxxxxxxx | 22 | 667 to 688 | 845.010 to 845.640 | 890.010 to 890.640 |
| | CDMA | 6 | 689 to 694 | 845.670 to 845.820 | 890.670 to 890.820 |
| | xxxxxxxxx | 22 | 695 to 716 | 845.850 to 846.480 | 890.850 to 891.480 |
| B' (2.5 MHz) | xxxxxxxxx | 22 | 717 to 738 | 846.510 to 847.140 | 891.510 to 892.140 |
| | CDMA | 39 | 739 to 777 | 847.170 to 848.310 | 892.170 to 893.310 |
| | xxxxxxxxx | 22 | 778 to 799 | 848.340 to 848.970 | 893.340 to 893.970 |

Frequencies shown (xxxxx) are not valid for CDMA carrier frequency assignments.

### 5.8 Standard Input and Output Terminations

The input and output termination values of the equipment under test and of the test equipment shall be recorded in the test report. All input and output terminals shall be properly terminated under all test conditions.

### 5.9 Frequency Deviation (Analogue)

The maximum permissible frequency deviation shall be ± 12 kHz for voice, ±8 kHz (nominal) for wideband data, and ± 2 kHz (nominal) for the Supervisory Audio Tone (SAT). Simultaneous voice and SAT produce a peak frequency deviation of ± 14 kHz (nominal).

### 5.10 Standard Test Modulation (Analogue)

Standard test modulation (voice) shall be a 1.0 kHz sinusoidal audio input signal having 1% or less total harmonic distortion applied at the level required to produce ± 8 kHz frequency deviation.

### 5.11 Standard Test Modulation (Data)

The standard test modulation (data) shall be that required to produce a pseudo-random 10 kilobit/second data pattern at nominal ±8 kHz peak frequency deviation. Information regarding the pseudo-random data pattern used should be included with the test report. A sequence of length 511 bits or greater shall be used.

### 5.12 Supply Voltage

Tests shall be performed at the manufacturer's rated supply voltage, except for the frequency stability tests of sections 7 and 9. The test voltage shall be stated in the test report.

### 5.13 Cellular Digital Packet Data (CDPD) Systems

Cellular digital packet data (CDPD) transmission systems are permitted in the cellular bands. The equipment shall comply with the relevant sections of this RSS and be certified by Industry Canada. However, systems that cannot conform to the RSS should be referred to Manager, Radio Equipment Standards, Industry Canada, for evaluation on a case-by-case basis (see section 2.2). Examples are systems using different modulation techniques and hence test modulation conditions, to represent the CDPD signals in a real system operation, that are different from those specified in this RSS.

**Note:** Adaptation of a certified piece of equipment, from voice-mode to data transmission, by means of a software change that does not violate the permissible output RF spectrum mask will not require re-certification **provided that** the model numbering of the equipment is unchanged.

### 5.14 Electronic Serial Number (ESN)

The electronic serial number (ESN) is a 32 bit number that uniquely identifies a cellular mobile station to any cellular system. (**Note:** Other ESN schemes may be considered by Industry Canada.)

(a) Each mobile transmitter in service must have a unique ESN.

(b) The ESN host component must be permanently attached to a main circuit board of the mobile transmitter and the integrity of the unit's operating software must not be alterable. The ESN must be isolated from fraudulent contact and tempering. If the ESN host component does not contain other information, that component must not be removable, and its electrical connections must not be accessible. If the ESN host component contains other information, the ESN must be encoded using one or more of the following techniques:

(1) Multiplication or division by a polynomial;
(2) Cyclic coding; or
(3) The spreading of ESN bits over various non-sequential memory locations.

(c) The ESN must be factory set and not alterable, transferable, removable or otherwise able to be manipulated. Cellular mobile equipment must be designed such that any attempt to remove, tamper with, or change the ESN chip, its logic system, or firmware originally programmed by the manufacturer will render the mobile transmitter inoperative.

### 5.15 Cordless-Mode Cellular Base Stations (CCBS)

5.15.1 Cordless-mode cellular base stations (CCBS) are permitted. The CCBS is intended to form a cordless telephone system in conjunction with a cellular handset or handsets. The communication between the handsets and the CCBS will use the service provider's cellular frequency band. Such a cordless system is intended for short range and/or in building usage. When the CCBS is certified (this RSS is still to be used for certification), operation is permitted under the cellular service provider's licence.

5.15.2 The CCBS shall comply with this RSS as well as the standard CS-03 and be certified under both the radio certification procedure RSP-100 and the terminal attachment program procedure CP-01. (**Note:** On the other hand, regular cellular base stations are exempt from CP-01 certification.)

5.15.3 The CCBS and the handset shall incorporate a security code of a minimum of 8 bits or equivalent to prevent unintentional line seizure, dialling or ringing. A description of the implementation of the code is required, i.e. testing is not required. If more details are required, please see RSS-210, section on "Cordless Telephones: General Conditions".

5.15.4 The RF output power shall not exceed a level that is required for reliable communication. Relaxed frequency stability and spectrum mask requirements can be considered for the lower power usage, on a case by case basis by the Manager, Radio Equipment Standards (see section 2.2).

5.15.5 The applicant for certification shall provide a letter from one of the following appropriate Cellular service providers stating that the CCBS authorization protocol has been tested and found to work satisfactorily:

(i) Mobility Canada, 2920 Matheson Boulevard East, Mississauga, Ontario, L4W 5J4. Telephone: (905) 282-3302 / Fax : (905) 202-3337 *or*

(ii) Rogers Cantel, One, Mount Pleasant Road, Toronto, Ontario, M4Y 2Y5. Telephone: (416) 935-1100.

5.15.6 An authorization protocol shall be put in place to allow the operation of the CCBS based on the following principles:

(a) The CCBS shall be controlled by the network of the Cellular service provider in order to receive permission to operate. Such controlling mechanism may be provided by wireline or wireless facilities. The operation of a CCBS must only be on frequencies within the frequency sub-band assigned for use to the cellular service provider (and not just the cell site frequencies) and must operate only within the radio service coverage of the network by which the CCBS is controlled.

(b) Upon reception of the permission to operate from the network and under no other circumstances, a CCBS will enable its transmitter, permit communication with any associated certified handsets and provide service, using the frequency spectrum and operating parameters specified and/or permitted by the Cellular service provider

(c) Until authorized for service by the network, neither the CCBS nor the handset shall be able to transmit in their cordless mode.

### 5.16 Multiple Band Operation

Equipment that can operate in a set of multiple bands, e.g., in the 800 MHz cellular and 2 GHz PCS frequency bands, shall comply with the requirements of each of the bands in which it serves. For equipment certification under multiple standards, please contact the Certification and Engineering Bureau (address in section 14).

Specifically, any active or spurious emissions shall comply with those bands in which the equipment is active. When transitioning between bands, the equipment shall not actively transmit and its spurious emissions shall not exceed those required by either the original or the destination band.

## 6. Transmitter Tests (Analogue Mode)

Test results are to be presented in graphical form wherever possible. The graph shall also include the specification limits.

If the RF output power is internally adjustable or remotely controllable, adjust or control it to the maximum rated power of the range for which equipment certification is sought.

### 6.1 Modulation Deviation Limiting

Modulation deviation limiting refers to the ability of the transmitter circuits to prevent the transmitter from producing deviation in excess of rated system deviation.

#### Method of Measurement

Adjust the audio input frequency to 1.0 kHz and peak frequency deviation to ±8 kHz, with the 2:1 compressor enabled and the Supervisory Audio Tone (SAT) disabled.

The audio input shall be increased by 20 dB in one step (rise time between the 10-percent and 90-percent points shall be a maximum of 100 milliseconds). However, if the increase in audio input level is instantaneous, a 50% overshoot in frequency deviation within the initial 100 milliseconds is permissible.

Both the maximum initial and the subsequent steady state values of the peak frequency deviation, at and following the time of the 20 dB increase, shall be measured and recorded.

With the input level held constant at the 20 dB level, vary the frequency and observe the deviation for all frequencies between 300 Hz and 3.0 kHz.

**Minimum Standard**

The maximum initial and subsequent steady-state peak frequency deviations shall not exceed the rated system peak frequency deviation of ±12 kHz. This requirement excludes the supervisory audio tone (SAT) and 10 kilobit/second wideband data signals.

## 6.2 Transmitter Audio Low Pass Filter

Except as provided in section 6.3.2 (b), the transmitter shall employ a low pass filter between the deviation limiter and the modulator to reduce undesired high frequency audio signal components from being applied to the modulator since they can generate unwanted transmitter signal components outside the channel of operation.

**Method of Measurement**

Operate the transmitter with the compressor disabled.

An audio signal of 1.0 kHz shall be applied to the input of the filter, set at a level high enough to ensure that an attenuation of at least 40 dB is measurable. The output level of the filter shall be measured.

Using the level measured at 1.0 kHz as a reference (0 dB), vary the frequency from 3 kHz to 20 kHz, and record the change in output level while maintaining a constant input level.

Variations to this measurement method are permitted. Table 6.1 values assume a pre-emphasis network of flat gain above 3 kHz. Therefore, the audio low pass filter shall have compensating attenuation for any pre-emphasis gain above 3 kHz.

**Minimum Standard**

Between 3.0 kHz and 30 kHz the response of the audio low pass filter in mobile and base stations shall meet the limits in Table 6.1.

**Table 6.1: Audio Low Pass Filter**

| Frequency band | Minimum attenuation relative to 3.0 kHz | |
|---|---|---|
| 3.0 - 5.9 kHz | 40 $\text{Log}_{10}(f/3)$ dB | where f is in kHz. |
| 5.9 - 6.1 kHz | 35 dB | |
| 6.1 - 15.0 kHz | 40 $\text{Log}_{10}(f/3)$ dB | where f is in kHz. |
| 15.0 - 30.0 kHz | 28 dB | |

No filtering is required of the F3D supervisory audio tones, the F3D signalling tones or the F1D wideband data signals.

## 6.3 Unwanted Emissions

Unwanted emissions are emissions on a frequency or frequencies outside the necessary bandwidth which result from the modulation process, from spurious emissions and harmonics.

### 6.3.1 Method of Measurement

The spectrum of the transmitter shall be determined with a spectrum analyser in averaging (mean) power mode and of the following resolution bandwidths:

(1) When operating in the F3E radiotelephony mode or the F3D supervisory audio tone mode:

(i) For any emission less than or equal to 45 kHz removed from the carrier frequency ($f_c$): 300 Hz; and
(ii) For any emission greater than 45 kHz removed from the carrier frequency: 30 kHz.

(2) When operating in the F1D wideband data mode or the F3D signalling tone mode:

(i) For any emission less than or equal to 60 kHz removed from the carrier frequency: 300 Hz; and
(ii) For any emission greater than 60 kHz removed from the carrier frequency: 30 kHz.

### 6.3.2 For F3E Voice Mode Measurements

The transmitter shall have its compressor disabled and shall be modulated with a 2.5 kHz sine wave at a level 13.5 dB greater than that required to produce ±8 kHz peak frequency deviation at 1.0 kHz.

**Minimum Standard**

(a) Except as provided in (b), the mean power of emissions from the transmitter with modulated carrier shall be attenuated below the mean power of the unmodulated carrier (see 7.2.2 for mean power measurement) in accordance with the schedule below:

(a1) On any frequency removed from the carrier frequency by more than 20 kHz up to and including 45 kHz: at least 26 dB.

(a2) On any frequency removed from the carrier frequency by more than 45 kHz: at least 60 dB or 43 + 10 $Log_{10}$(mean output power in watts) dB, whichever is the less stringent. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency) up to 3rd harmonic of the highest frequency generated or used, without exceeding 23 GHz.

(a3) The mean power of emissions in the base station transmit frequency band (869-894 MHz) from mobile transmitters shall be attenuated to a level not to exceed -80 dBm/30 kHz at the transmit antenna connector.

(b) In lieu of the requirements of (a1) and (a2) above and the requirements of the audio filter of section 6.2, compliance with the following emission specifications may be demonstrated for transmitters operating in the F3E radiotelephony mode. The mean power of any emission removed from the carrier frequency by a displacement frequency ($f_d$ in kHz) shall be attenuated below the mean power of the unmodulated carrier in accordance with the following schedule:

(b1) On any frequency removed from the carrier frequency by more than 12 kHz up to and including 20 kHz: at least 117 $Log_{10}$ ($f_d$/12) dB;

(b2) On any frequency removed from the carrier frequency by more than 20 kHz: at least 100 $Log_{10}$ ($f_d$/11) dB or 60 dB or 43+10 $Log_{10}$ (mean output power in watts) dB, whichever is less stringent. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency) up to 3rd harmonic of the highest frequency generated or used, without exceeding 23 GHz.

(b3) Mobile stations must still demonstrate that the RF signal corresponding to the audio input signal of 5.9 – 6.1 kHz is attenuated by at least 35 dB relative to that at 1.0 kHz.

### 6.3.3 For F1D Wideband Data Mode Measurements

The transmitter shall be modulated with a pseudo-random 10 kilobit/second data pattern at ±8 kHz peak frequency deviation.

#### Minimum Standard

The mean power of emissions from the transmitter with modulated carrier shall be attenuated below the mean power of the unmodulated carrier in accordance with the schedule below:

(1) On any frequency removed from the carrier frequency by more than 20 kHz up to and including 45 kHz: at least 26 dB.

(2) On any frequency removed from the carrier frequency by more than 45 kHz up to and including 90 kHz: at least 45 dB; and

(3) On any frequency removed from the carrier frequency by more than 90 kHz: at least 60 dB or 43 + 10 $Log_{10}$ (mean output power in watts) dB, whichever is less stringent. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency) up to 3rd harmonic of the highest frequency generated or used, without exceeding 23 GHz.

(4) The mean power of emissions in the base station transmit frequency band (869-894 MHz) from mobile transmitters shall be attenuated to a level not to exceed -80 dBm/30 kHz at the transmit antenna connector.

### 6.3.4 For F3D supervisory audio tone mode measurements

The transmitter shall be modulated with a 6000 Hz Supervisory Audio Tone (SAT) frequency with ±2.0 kHz peak frequency deviation.

**Minimum Standard**

The mean power of emissions from the transmitter with modulated carrier shall be attenuated below the mean power of the unmodulated carrier in accordance with sections 6.3.2(a1), (a2) and (a3), 6.3.2(b1) and (b2).

### 6.3.5 For F3D signalling tone mode measurements

The transmitter shall be modulated with a 10 kHz signalling tone frequency with ±8 kHz peak frequency deviation.

**Minimum standard**

The mean power of emissions from the transmitter with modulated carrier shall be attenuated below the mean power of the unmodulated carrier in accordance with section 6.3.3.

## 7. Output Power and Frequency Stabilities (Analogue Mode)

Output power stability and frequency stability for mobile transmitters, and frequency stability for base station transmitters, are to be tested. In addition, the output power of base station

transmitters shall be verified that they are capable of being adjusted to within ±1.0 dB of the manufacturer's rated power. Measurement may be carried out at the antenna connector of the transmitter.

### 7.1 Permissible Output Powers

For MOBILE stations, the permissible nominal output powers are:

class I: +6 dBW ERP;
class II: +2 dBW ERP;
class III: -2 dBW ERP.

where ERP (effective radiated power) is with respect to a half-wave dipole.

**Note:** Typically, Classes I, II, and III represent equipment for vehicle, transportable and handheld, respectively.

For a BASE station transmitter, the rated output power is to be stated by the manufacturer.

### 7.2 Method of Measurement

The transmitter shall be installed in an environmental test chamber whose temperature is controllable.

The operating frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up.

If the RF output power is internally adjustable or remotely controllable, adjust or control it to the maximum rated power of the range for which equipment certification is sought.

All measurements shall be recorded.

#### 7.2.1 Carrier Frequency

The unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement:

(a) at temperatures of -30°C, +20°C and +50°C at the manufacturer's rated supply voltage, and

(b) at 85% and at 115% of the manufacturer's rated supply voltage, when the temperature is at +20°C.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

For handheld equipment that is only capable of operating from internal batteries, the frequency and output power stabilities tests shall be performed using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

**Minimum Standard for Frequency Stability (Mobile and Base Stations)**

The RF carrier frequency, when tested as above, shall not depart from the reference frequency (reference frequency is the frequency at +20°C and rated supply voltage) in excess of the following values:

| Equipment type | Frequency tolerances |
|---|---|
| (a) Base Station | ±1.5 parts per million |
| (b) Mobile Station | ±2.5 parts per million |

The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range.

### 7.2.2 Output Power Test

The resolution bandwidth of the spectrum analyser shall be greater than the occupied bandwidth of the transmitter. The transmitter (analogue mode) may be unmodulated or modulated per section 5.10.

For a base station, with the transmitter at rated supply voltage and room temperature, adjust the output power to within ±1.0 dB of the manufacturer's rated power. Measure and report the output power. **Note:** There is no output power stability test for base stations.

For a **mobile** station output power measurement, the temperature shall be -30°C, +20 °C, and +60°C in turn. At each temperature the supply voltage shall be adjusted, in turn, to the rated value, to -10% and +10%, before the power is measured.

#### Minimum Standard for Output Power (Mobile Station)

The output power must be maintained to within the range of +2 dB to -4 dB of the manufacturer's rated power, when tested over the temperature range of -30°C to +60°C, **and** over the supply voltage range of ±10 % from the nominal value, accumulatively.

#### Minimum Standard for Output Power (Base Station)

The output power shall be capable of being adjusted to within ±1.0 dB of the manufacturer's rated power. **Note:** There is no output power stability test for base stations.

## 8. Transmitter Tests (CDMA Mode)

Test results are to be presented in graphical form wherever possible. The graph shall also include the specification limits. If the RF output power is internally adjustable or remotely controllable, set or control it to the maximum rated power of the range for which equipment certification is sought.

### 8.1 Unwanted Emissions

Unwanted emissions are emissions on a frequency or frequencies outside the necessary bandwidth which result from the modulation process, from spurious emissions and harmonics.

#### 8.1.1 Unwanted Emissions from Mobile Stations

##### Method of Measurement

The spectrum of the transmitter shall be determined with a spectrum analyser of resolution bandwidths given in Table 8.1, in the average power mode.

Modulate the transmitter with a pseudo-random 9600 bps bit stream.

Set the mobile output power to -13 dBm/1.23 MHz as measured at the mobile station antenna connector.

Sweep the spectrum analyser over a frequency range from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency) up to the 5th harmonic of the highest frequency generated or used.

**Minimum Standard**

(1) The spurious emissions shall not exceed the limits in Table 8.1, where dBc is dB relative to the transmitter mean output power.

(2) The mean power of emissions in the mobile station receive band (869-894 MHz) shall be attenuated to a level not to exceed -80 dBm/1.23 MHz at the transmit antenna connector.

(3) In any 30 kHz outside the cellular band, the attenuation shall be at least $43+10 \text{ Log}_{10}$ (mean output power in watts) dB.

**Table 8.1**

**Mobile Station Spurious Emission Limits When Transmitting**

| Col. 1 | Col. 2 : Centre frequency offset by greater than 900 kHz for 30 kHz bandwidth or greater than 1.385 MHz for 1 MHz bandwidth. # | Col. 3: Centre frequency offset by greater than 1.98 MHz for 30 kHz bandwidth or greater than 2.465 MHz for 1 MHz bandwidth. # |
|---|---|---|
| Spurious emissions not to exceed (a), or both (b) and (c), whichever is less stringent. | (a) -42 dBc/30 kHz<br>(b) -60 dBm/30 kHz<br>(c) -55 dBm/ MHz | (a) -54 dBc/30 kHz<br>(b) -60 dBm/30 kHz<br>(c) -55 dBm/ MHz |

# See 5.2(e).
**Note:** In Table 8.1, the dBm values are to be measured at the antenna connector.

### 8.1.2 Unwanted Emissions from Base Stations

**Method of Measurement**

Same as 8.1.1.

**Minimum Standard**

(1) Suppression inside cellular band: For all base station transmit frequencies allocated to the same operator system, the total spurious emissions in any 30 kHz band shall be attenuated below the mean output power level in accordance with the following schedule:

(a) for all offset frequencies greater than 750 kHz from the CDMA centre frequency, at least 45 dB.

(b) for all offset frequencies greater than 1.98 MHz from the CDMA centre frequency, at least 60 dB.

(c) for all offset frequencies not allocated to the same operator system, at least 60 dB or -13 dBm, whichever is less stringent.

(2) In any 30 kHz outside the cellular band, the attenuation shall be at least $43+10 \text{ Log}_{10}$ (mean output power in watts) or 70, dB, whichever is the less stringent.

## 9. Output Power and Frequency Stabilities (CDMA Mode)

### 9.1 Permissible Output Powers

Table 9.1 lists the permissible radiated powers from mobile stations. For a BASE station transmitter, the rated output power is to be stated by the manufacturer.

**Table 9.1**

**Effective Radiated Power (ERP) at Maximum Output Power for Mobile Stations**

| Mobile station class. Note 1. | Minimum ERP | Maximum ERP |
|---|---|---|
| I | 1 dBW (1.25 watts) | 8 dBW (6.3 watts) |
| II | -3 dBW (0.5 watt) | 4 dBW (2.5 watts) |
| III | -7 dBW (0.2 watt) | 0 dBW (1.0 watt); Note 2 |

where ERP is with respect to a half-wave dipole.

**Note 1:** Typically, Classes I, II, and III represent equipment for vehicle, transportable and hand-held, respectively.

**Note 2:** For class III, the ERP (or output power) at maximum output power may drop by 2 dB at +60°C.

### 9.2 Method of Measurement

This is similar to section 7 for the analogue mode, except that for output power measurements, modulate the transmitter with a pseudo-random 9600 bps bit stream. Further information on testing methods may be found in TIA/EIA IS-97 for BASE stations and TIA/EIA IS-98 for Mobile stations.

### 9.2.1 Minimum Standard for Frequency Stability (Mobile and Base Stations)

The RF carrier frequency, when tested over the temperature range of -30°C to +50°C, **or** over the supply voltage range of ±15% from the nominal value, but non-accumulatively, shall not depart from the reference frequency (reference frequency is the frequency at +20°C and rated supply voltage) in excess of $5x10^{-8}$ (0.000005%), i.e. non-accumulatively. (**Note:** This frequency stability is required for satisfactory soft-handoff functions).

In addition, the mobile station transmit carrier frequency shall be 45.0 MHz ±300 Hz lower than the frequency of the base station transmit carrier as measured at the mobile station receiver. A suitable method of measurement is described in TIA/EIA IS-98.

### 9.2.2 Minimum Standard for Output Power (Mobile Station)

The effective radiated power (ERP) at maximum output power, when tested over the temperature range of -30°C to +60°C, **and** over the supply voltage range of ±10 % from the nominal value, accumulatively (using the antenna gain recommended by the mobile manufacturer) shall not exceed the limits in Table 9.1.

### 9.2.3 Minimum Standard for Output Power (Base Station)

The output power shall be capable of being adjusted to within ±1.0 dB of the manufacturer's rated power. **Note:** There is no output power stability test for base stations.

## 9.3 Standby Output Power Measurement (Mobile Station)

The mobile station shall disable its transmitter except when transmitting an access probe when in the System Access State or when in the Mobile Station Control on the Traffic Channel State.

### Minimum Standard

When the transmitter is disabled, the output noise density of the mobile station shall not exceed -60 dBm/1.23 MHz (or -61 dBm/MHz) for all frequencies within the mobile station's transmit band between 824 and 849 MHz.

## 9.4 Minimum Controlled Output Power (Mobile Station)

The output power of a mobile transmitter shall be tested with both closed loop and open loop power control functions set to minimum.

**Minimum Standard**

The mean output power of the mobile station shall not exceed -50 dBm/1.23 MHz (−51 dBm/MHz) for all frequencies within ±615 kHz of the centre frequency.

## 10. Receiver Spurious Emissions

Radiation measurement is the standard method (with the device's antenna in place).

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

(a) Radiation measurements are to be performed using a calibrated open-area test site. A description of the method of measurement that is acceptable to Industry Canada is found in RSS-212.

(b) But as an alternative, when the antenna is detachable, the receiver spurious signal may be measured by replacing the antenna with a spectrum analyser of internal resistance equal to the impedance specified for the antenna.

In either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

**Minimum Standard (Mobile Stations)**

(a) No spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz **spurious frequency in the band 30-1000 MHz or 5 nanowatts above 1 GHz**.

(b) No spurious output signals appearing at the antenna terminals and falling within the mobile station receive band (869-894 MHz) shall exceed 22.4 uV across 50 ohms, or equivalent output power of -80 dBm/30 kHz.

(c) No spurious output signals appearing at the antenna terminals and falling within the mobile station transmit band (824-849 MHz) shall exceed 224 uV across 50 ohms, or equivalent output power of -60 dBm/30 kHz.

(d) Except for the provisions of (a) and (b), all spurious emissions shall comply with the limits of Table 10.1. The resolution bandwidth of the spectrum analyser shall be 100 kHz for spurious emission measurements below 1.0 GHz and 1.0 MHz for measurements above 1.0 GHz.

**Table 10.1**

| Spurious Frequency (MHz) | Field Strength (microvolts/m) at 3 metres |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| 960-1610 | 500 |
| Above 1610 | 1000 |

**Minimum Standard (Base Station)**

Same limits as (a) and (d) for mobile stations.

## 11. Exposure of Humans to RF Fields

Before equipment certification is granted, the procedures of RSS-102 must be followed concerning exposure of humans to RF fields.

**Note:** A cordless-mode cellular base station (CCBS) (section 5.15) is considered a mobile station for the purpose of RSS-102.

## 12. Compliance with Cellular System Compatibility Standard

Technical requirements for compatibility are outlined in the TIA/EIA IS-95 document. An attestation shall be provided by the applicant that the equipment submitted for certification under this RSS complies with the requirements of the Compatibility Standard. Interoperability tests with other proven manufacturers' base stations or mobile stations (as appropriate) are also required. Details of the test, the test facility location, the date of the test, the testing officer's phone and fax numbers are to accompany an attestation that the equipment model requiring certification has been tested and found fully interoperable.

## 13. Licensing Requirements

The equipment is subject to licensing. Antenna gains (or EIRP limits) and height restrictions, if any, may be specified in the licence. For additional information regarding the licensing of these devices, please contact the local Industry Canada Office.

## 14. Equipment Certification and Test Report Submission

The test report, complete with measurement results, that addresses the requirements of this Standard, is to be submitted with the application for certification of a transmitter. For receiver certification, a detailed test report is not necessary; it is only required to report the receiver tuning range or ranges, and the spurious emission level.

The application for certification should be prepared in accordance with RSP-100 and sent to:

Chief, Certification and Engineering Bureau
Industry Canada
1241 Clyde Avenue
Ottawa, Ontario
Canada, K2C 1Y3
Tel: (613) 952-3200 / Fax: (613) 952-1088
E-mail: Corey.bob@ic.gc.ca

Issued under the authority of
the Minister of Industry

R.W. McCaughern
Director General
Spectrum Engineering

# Annex A

## Optional Receiver Standards (Analogue Mode)

A1. The receiver tests described in this annex are for the analogue mode. The tests are optional and therefore test results are not required to be submitted to the Department.

Although they are voluntary tests, compliance to the standards in this Annex is recommended in order to minimize potential interference from transmitters operating in adjacent bands. Frequency assignments on adjacent bands will be based upon engineering considerations compatible with the standards in this Annex. Therefore, cellular receivers **not** conforming to this Annex operate on a "**no-protection**" basis.

A2. **RF Sensitivity**

The usable sensitivity of the receiver is the RF level of the input signal modulated with a 1 kHz frequency to ±8 kHz peak frequency deviation that will result in 12 dB SINAD (C-message weighted), at the audio output of the receiver. SINAD is defined as the ratio (in dB) of the Signal plus Noise plus Distortion to the Noise plus Distortion.

**Method of Measurement**

(a) Enable the expander and the C-message weighting filter. Terminate the audio output of the receiver in the load specified by the manufacturer, and make SINAD measurements using a distortion meter.

(b) Apply a -50 dBm RF signal with 1000 Hz modulation at ±8 kHz peak frequency deviation to the receiver antenna input terminals.

(c) Connect a distortion meter with a switchable 1000 Hz notch filter to the receiver audio output terminals.

(d) Reduce the input signal level until the SINAD is 12 dB. The input RF signal level at this point defines the receiver sensitivity.

(e) SINAD is obtained by first measuring the composite of the audio signal with its noise and distortion components, next notching the audio signal with a 1000-Hz notch filter, and then measuring just the noise and distortion components.

(f) If a mobile station cannot be measured using the method of measurement described above, the sensitivity may be measured by a radiated measurement. Documentation shall be provided as to the basis of the measurement used.

**Minimum Standard**

The RF signal input level measured across the receiver antenna terminals shall not be more than -113 dBm.

## A3. Adjacent and Second Adjacent Channel Selectivities and Desensitizations

The adjacent channel selectivity and desensitization of a receiver is a measure of its ability to receive a modulated input desired signal on its assigned channel frequency in the presence of a second modulated input undesired signal frequency spaced either one channel (30 kHz) above or one channel below the assigned channel.

The second adjacent channel selectivity and desensitization of a receiver is a measure of its ability to receive a modulated input desired signal on its assigned channel frequency in the presence of a second modulated input undesired signal frequency spaced either two channels (60 kHz) above or two channels below the assigned channel frequency.

**Method of Measurement**

(a) Terminate the audio output of the receiver in its normally intended load, disable the expander, and make measurements using a C-message weighted filter.

(b) Connect two RF signal generators equally coupled to the receiver antenna input terminals through a suitable matching network.

Switch the second generator (undesired signal) off.

Set the first RF (desired) signal generator to the assigned channel frequency and modulate it with a 1000 Hz tone to ±8 kHz peak frequency deviation.

(c) Adjust the first RF signal generator level to produce a 12 dB SINAD measurement at the audio output terminal of the receive path. Record the RF signal level.

(d) Increase this first RF signal generator output by 3 dB.

(e) Set the frequency of the second RF signal generator to 30 and 60 kHz (in turn) above the frequency of the first RF signal generator and modulate it with a 400 Hz tone to ±8 kHz peak frequency deviation.

(f) Adjust the level of the second RF signal generator to reduce the desired signal SINAD back to 12 dB. Record the second generator (undesired) signal level.

(g) Repeat steps (e) and (f) with the frequency of the second RF signal generator set to 30 and 60 kHz (in turn) below the frequency of the first RF signal generator.

(h) Calculate the ratios, in dB, of the undesired signal levels measured in steps (e), (f) and (g) to the reference level obtained in (c). For each case of adjacent and second adjacent channel undesired input signals, the smaller of these ratios for the above- and below-channel undesired signals is the minimum selectivity.

**Minimum Standard**

The minimum adjacent channel selectivity shall be 16 dB. The minimum second adjacent channel selectivity shall be 60 dB.

## A4. Receiver Spurious Response Attenuation

The receiver spurious response attenuation is a measure of the receiver's ability to discriminate between the assigned input signal frequency and an undesired signal at any other frequency to which it is responsive, i.e. from the lowest intermediate frequency or radio frequency generated in the equipment to 2600 MHz, except sub-harmonics of the received channel band.

**Minimum Standard (Analogue)**

The spurious response attenuation (ratio of the undesired to the desired signal) should be at least 60 dB for all undesired signals 60 kHz or more removed from the assigned input signal frequency.

## A5. Intermodulation Spurious Response Attenuation

The intermodulation spurious response attenuation of the receiver is the measure of its ability to receive a modulated input RF signal frequency in the presence of two unmodulated interfering signals so separated from the assigned input signal frequency and from each other that the n'th order mixing of the two undesired signals can occur in the non-linear elements of the receiver, producing a third signal whose frequency is equal to that of the assigned input RF signal frequency.

**Minimum Standard (Analogue)**

All intermodulation spurious responses should be attenuated by at least 65 dB for mobile and base stations.