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# **Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz**

## Preface

Radio Standards Specification RSS-119, Issue 12, *Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz*, replaces RSS-119, Issue 11, *Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz*, dated June 2011.

This document will be in force as of its publication on the Industry Canada website.

Listed below are the changes:

- (1) Requirements for equipment with a 6.25 kHz channel bandwidth operating in the frequency bands 806-821/851-866 MHz and 821-824/866-869 MHz have been added.
- (2) The provision for equipment with channel aggregation has been clarified to include mobile equipment where applicable.
- (3) An alternative provision for frequency stability with which fixed and base equipment must comply has been added.
- (4) The frequency stability for mobile equipment operating in the frequency bands 406.1-430 MHz, 450-470 MHz, 806-821/851-866 MHz and 821-824/866-869 MHz with an occupied bandwidth greater than 20 MHz has been modified.
- (5) The frequency bands 764-768 MHz and 794-798 MHz assigned for public safety services have been removed.
- (6) Limits for the transmitter output power of equipment have been added and clarified.
- (7) The date by which equipment operating in the frequency bands 768-776 MHz and 798-806 MHz must comply with a minimum data rate of 4.8 kbps or one voice channel per 6.25 kHz has been removed.
- (8) The requirement for equipment operating in the frequency bands 768-776 MHz and 798-806 MHz to have a minimum data rate of 128 kbps per 50 kHz has been removed.
- (9) The adjacent channel power (ACP) limits for equipment operating in the frequency bands 768-776 MHz and 798-806 MHz have been modified.
- (10) The requirement for including data port specifications in the user manual has been removed.

(11) The requirement for receiver spurious emissions has been removed because it is specified in RSS-Gen, *General Requirements for Compliance of Radio Apparatus*.

Issued under the authority of  
the Minister of Industry

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## 1. Scope

This Radio Standards Specification (RSS) sets out requirements for land mobile and fixed equipment operating in frequency bands within the range 27.41-960 MHz, as specified in Table 1 of this standard.

### 1.1 Exclusion

For the bands 27.41-28 MHz and 29.7-50 MHz, RSS-125, [Land Mobile and Fixed Radio Transmitters and Receivers, 1.705 to 50.0 MHz, Primarily Amplitude Modulated](#), shall be used for equipment certification if the equipment's signal is amplitude modulated.

### 1.2 Land Mobile Equipment Operating in the Frequency Range 138-470 MHz

Within the frequency bands 138-174 MHz, 406.1-430 MHz and 450-470 MHz, equipment used for the land mobile service operating with a channel bandwidth of more than 12.5 kHz shall be certified only if it is also able to meet the equivalent of one voice channel in a 12.5 kHz bandwidth (*e.g.*, two voice channels per 25 kHz).

## 2. General Information

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

### 2.1 Licensing Requirements

The equipment covered by this standard is subject to licensing, pursuant to subsection 4(1) of the [Radiocommunication Act](#).

### 2.2 Related Documents

All [Spectrum Management and Telecommunications](#) publications are available on Industry Canada's website at [www.ic.gc.ca/spectrum](http://www.ic.gc.ca/spectrum) under *Official Publications*.

The TIA standards can be obtained from the [Telecommunications Industry Association](#)'s website at <http://www.tiaonline.org>.

The following documents should be consulted:

TIA Standard 603                      *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*

TIA Standard 102.BAAA              *Project 25 – FDMA Common Air Interface – New Technology Standards Project – Digital Radio Technical Standards*

TIA Standard 102.BABA	<i>Project 25 – Vocoder Description</i>
TIA Standard 102.BAEA	<i>Project 25 – Data Overview – New Technology Standards Project – Digital Radio Technical Standards</i>
TIA Standard 102.BAEB	<i>Project 25 – Packet Data Specification – New Technology Standards Project – Digital Radio Technical Standards</i>
TIA Standard 102.BAEE	<i>Project 25 – Radio Management Protocols – New Technology Standards Project – Digital Radio Technical Standards</i>
SRSP-500	<i>Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 138-144 MHz and 148-174 MHz</i>
SRSP-501	<i>Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 406.1-430 MHz and 450-470 MHz</i>
SRSP-502	<i>Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 806-821/851-866 MHz and 821-824/866-869 MHz</i>
SRSP-504	<i>Technical Requirements for Radio Paging Systems Operating in the Band 929-932 MHz</i>
SRSP-505	<i>Technical Requirements for Multipoint Communications Systems Operating in the Bands 928-929/952-953 MHz and 932-932.5/941-941.5 MHz</i>
SRSP-506	<i>Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 896-901 MHz and 935-940 MHz</i>
SRSP-507	<i>Technical Requirements for Line-of-Sight Radio Systems Operating in the Fixed Service in the Bands 932.5-935 MHz and 941.5-944 MHz</i>
SRSP-511	<i>Technical Requirements for Land Mobile Radio Services Operating in the Bands 768-776 MHz and 798-806 MHz</i>
SRSP-512	<i>Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Band 220-222 MHz</i>

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SRSP – Standard Radio System Plan

TIA – Telecommunications Industry Association

### **3. General Requirements**

#### **3.1 RSS-Gen Compliance**

RSS-119 shall be used in conjunction with RSS-Gen, [\*General Requirements for Compliance of Radio Apparatus\*](#), for general specifications and information relevant to the equipment covered by this standard.

#### **3.2 Transmitters With External Frequency Selection Controls**

In order to prevent radio interference caused by end-user transmissions on unauthorized frequencies, transmitters with external frequency selection controls and/or frequency programming capability shall conform to the following:

- (a) Transmitters with external frequency selection controls shall operate only on authorized channels which have been preset by the manufacturer, equipment supplier, service technician or maintenance personnel.
- (b) Transmitters with frequency programming capability must have at least one of the following design characteristics, which prevent the user from altering the preset frequencies:
  - (1) Transmitters with external controls available to the user can only be internally modified to place the equipment in the programmable mode. Furthermore, while in the programmable mode, the equipment is not capable of transmitting. The procedure for making the modification and altering the frequency program is not available to the user of the equipment.
  - (2) Transmitters are programmed for frequencies through controls that are inaccessible to the user.
  - (3) Transmitters are programmed for frequencies through the use of external devices or specifically programmed modules that are available only to the service technician or maintenance personnel.
  - (4) Transmitters are programmed through cloning (*i.e.*, copying a program directly from another transmitter) using devices and procedures that are available only to the service technician or maintenance personnel.

### **4. Measurement Methods**

The transmitter shall be operated at the manufacturer's rated power and tested in accordance with the measurement method described in RSS-Gen with signals modulated as follows:

- (a) If the audio input signal is voice and the transmitter is FM, the transmitter shall be modulated with a 2.5 kHz tone at a level 16 dB higher than that required to produce 50% of the maximum frequency deviation.

- (b) For all other transmitters, a signal representative (*i.e.*, typical) of those encountered in a real system operation shall be used. If the transmission is not continuous, this must be indicated in the test report.

#### **4.1 Transmitter Output Power**

Measure and record the transmitter output power using a measurement (resolution) bandwidth at least two to three times the width of the occupied bandwidth for transmitters equipped with masks D and E to capture the true peak emission of the equipment under test. For transmitters equipped with other masks, a measurement bandwidth wider than the occupied bandwidth of the transmitter shall be used.

#### **4.2 Transmitter Unwanted Emissions**

When the transmitter unwanted emissions are being measured, a sufficient number of sweeps must be measured to ensure that the emission profile is developed. The video bandwidth shall be at least three times the width of the instrument resolution bandwidth.

For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated carrier power refers to the total output power contained in the occupied bandwidth when the transmitter is modulated with signals representative of those encountered in a real system operation.

##### **4.2.1 Emission Masks B, C, G, I and J**

Unwanted emission measurements can be in peak or averaging mode, provided that the same parameter, peak power or average power, used for the transmitter's output power measurement is also used for the unwanted emission measurements.

Except where otherwise stated, on any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth, a resolution bandwidth of at least 100 kHz must be used for frequencies to be measured at or below 1 GHz, and a resolution bandwidth of at least 1 MHz must be used for frequencies to be measured above 1 GHz. If a narrower resolution bandwidth is used, power integration shall be applied.

##### **4.2.2 Emission Masks D, E, F and Y**

In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak mode. For emissions beyond 50 kHz from the edge of the authorized bandwidth, the resolution bandwidth shall be 100 kHz for frequencies at or below 1 GHz, and 1 MHz for frequencies above 1 GHz. However, for emission mask F, at a displacement frequency of less than 3.75 kHz, the resolution bandwidth shall be 30 Hz.



### **4.3 Adjacent Channel Power (ACP) Measurement for Equipment in the Bands 768-776 MHz and 798-806 MHz**

The ACP measurements shall be made with a spectrum analyzer capable of making direct ACP measurements. For all measurements, modulate the transmitter signal as it would be modulated in normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be taken under TDMA operation only during time slots when the transmitter is active. All measurements are taken at the transmitter output port.

#### **(1) Reference power level**

Set the transmitter to its maximum output power. Set the spectrum analyzer's measurement bandwidth to the channel size. For example, for a 50 kHz transmitter, set the measurement bandwidth to 50 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the centre frequency of the instrument to the assigned centre frequency to measure the average power level of the transmitter. Record this power level in dBm as the reference power level.

#### **(2) Non-swept power measurement**

Set the spectrum analyzer's measurement bandwidth and the frequency offset from the assigned centre to the values shown in the tables in Section 5.8.9 according to the equipment's channel size. With a resolution bandwidth of less than 2% of the measurement bandwidth, measure the power level in dBm. These measurements shall be made at the transmitter's maximum power. The ACP measured in this step shall be lower than the reference power level as measured in (1) above by an amount greater than or equal to the absolute value of the maximum relative ACP given in the tables in Section 5.8.9.

#### **(3) Swept power measurement**

Set the spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and average detection. Set the reference power level of the spectrum analyzer to the average value of the transmitter power, as measured in (1) above. Sweep above and below the carrier frequency to the limits defined in the tables in Section 5.8.9 according to the equipment's channel bandwidth. The ACP measured in this step shall be lower than the reference power level by an amount greater than or equal to the absolute value of the maximum relative ACP given in the tables in Section 5.8.9.

## **5. Transmitter and Receiver Specifications**

### **5.1 Interface Impedance**

The preferred impedance is a resistive load of 600 ohms for audio frequencies, and 50 ohms for radio frequencies.

## **5.2 Types of Modulation**

Equipment that operates in the bands 768-776 MHz and 798-806 MHz shall use digital modulation. Mobile and portable transmitters that operate in these bands may have analogue modulation capability only as a secondary mode in addition to their primary digital mode. However, mobile and portable transmitters that operate only on the low-power channels as defined in SRSP-511 may employ any type of modulation.

## **5.3 Transmitter Frequency Stability**

The carrier frequency shall not depart from the reference frequency in excess of the values given in Table 1. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in Table 1, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in [RSS-Gen](#).

**Table 1 – Transmitter Frequency Stability**

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power > 2 W	Output Power ≤ 2 W
27.41-28 and 29.7-50	20	20	20	50
72-76	20	5	20	50
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5
217-218 and 219-220	12.5	1	5	5
220-222 (Note 1)	5	0.1	1.5	1.5
406.1-430 and 450-470 (Note 6)	25 (Note 2)	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1
768-776 and 798-806 (Note 3)	25 12.5 6.25	0.1	0.4 (Note 4)	0.4 (Note 4)
	50	1	1.25 (Note 5)	1.25 (Note 5)
806-821/851-866 and 821-824/866-869 (Note 6)	25 (Note 2)	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4
896-901/935-940 (Note 6)	12.5	0.1	1.5	1.5
929-930/931-932	25	1.5	N/A	N/A
928-929/952-953 and 932-932.5/941-941.5	25	1.5	N/A	N/A
	12.5	1	<sup>3</sup> (for remote station)	N/A
932.5-935/941.5-944	25	2.5	N/A	N/A
	12.5	2.5	N/A	N/A

**Notes:**

1. Mobile units may use synchronizing signals from associated base stations to achieve the specified carrier stability.
2. This provision is for digital equipment with a channel bandwidth of 25 kHz and an occupied bandwidth greater than 20 kHz. The mobile station's frequency stability values given in Table 1 are for mobile, portable and control transmitters using automatic frequency control (AFC) to lock onto the base station signal. When the mobile, portable and control transmitters

are operating without using AFC to lock onto the base station signal, the frequency stability limit shall be better than 1 kHz and the equipment's unwanted emissions measured with maximum frequency shift shall still comply with emission mask Y (Section 5.8.10) at nominal carrier frequency.

3. Mobile, portable and control transmitters operating in the bands 768-776 MHz and 798-806 MHz must normally use AFC to lock onto the base station signal. The mobile station's frequency stability values given in Table 1 are for mobile stations operating under this condition.
4. When the mobile, portable and control transmitters are operating with channel bandwidths equal to 6.25 kHz, 12.5 kHz or 25 kHz in the band 768-776 MHz and the AFC is not locked onto the base station signal, the frequency stability must be equal to or better than 1 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2-channel aggregate), and 2.5 ppm for 25 kHz (4-channel aggregate).
5. When the mobile, portable and control transmitters are operating with channel bandwidths equal to 50 kHz in the band 768-776 MHz and the AFC is not locked onto the base station signal, the frequency stability must be equal to or better than 5 ppm.
6. Control stations may operate with the frequency stability specified for associated mobile frequencies.

#### **5.4 Transmitter Output Power**

The output power shall be within  $\pm 1$  dB of the manufacturer's rated power listed in the equipment specifications.

The transmitter output power limits set forth in Table 2 will come into force upon the publication of Issue 12 of this standard and will apply to newly certified equipment.

**Table 2 – Transmitter Output Power**

Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
27.41-28 and 29.7-50	300	30
72-76	No limit	1
138-174	110	60
217-218 and 219-220	110	30*
220-222	See SRSP-512 for ERP limit	50
406.1-430 and 450-470	110	60
768-776 and 798-806	See SRSP-511 for ERP limit	30 3 W ERP for portable equipment
806-821/851-866 and 821-824/866-869	110	30
896-901/935-940	110	60
929-930/931-932	110	30
928-929/952-953 and 932-932.5/941-941.5	110	30
932.5-935/941.5-944	110	30

\*Equipment is generally authorized for effective radiated power (ERP) of less than 5 W.

### **5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks**

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

**Table 3 – Channel Bandwidths, Authorized Bandwidths and Spectrum Masks**

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
27.41-28 and 29.7-50	N/A	20	20	B	C
72-76	N/A	20	20	B	C
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E
217-218 and 219-220	N/A	12.5	11.25	D or I	D or J
220-222	SRSP-512	5	4	F	F
406.1-430 and 450-470	SRSP-501	25	20 22	B Y	C (G) (Note 1) Y
		12.5	11.25	D	D
		6.25	6	E	E
		6.25 12.5 25 50	(Note 2)	See Section 5.8.9	See Section 5.8.9
806-821/851-866 and 821-824/866-869	SRSP-502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E
896-901/935-940	SRSP-506	12.5	13.6	I	J (G) (Note 3)
929-930 and 931-932	SRSP-504 (for paging)	25	20	B	G
928-929/952-953 and 932-932.5/941-941.5	SRSP-505	25	20	B	G
		12.5	11.25	D	D
932.5-935/941.5-944	SRSP-507	25	20	B	G
		12.5	11.25	D	D

**Notes:**

1. Paging transmitters in the bands 406.1-430 MHz and 450-470 MHz are to use mask G.
2. Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

3. Mask G applies if two 12.5 kHz channels are aggregated. Alternatively, a mask may be used if it does not produce more adjacent channel interference than narrowband (12.5 kHz) channel equipment.

5.5.1 For the band 72-76 MHz, the channel carriers for fixed and mobile stations are given in tables 4(a) and 4(b) respectively. It is to be noted that 0.75 W licence-exempt radios (see RSS-210, [Licence-exempt Radio Apparatus \(All Frequency Banks\): Category I Equipment](#)) are permitted interstitially, 10 kHz offset to tables 4(a) and 4(b) frequencies, in the bands 72.01-72.99 MHz and 75.41-75.99 MHz.

**Table 4(a) – 72-76 MHz Channel Carrier or Centre Frequencies for Fixed Stations**

Dashes (--) indicate that the channel is not available.

MHz	MHz	MHz	MHz	MHz	MHz	MHz	MHz
72.02	72.22	72.42	72.62	72.82	75.42	75.62	75.82
72.04	72.24	--	72.64	72.84	--	75.64	75.84
72.06	72.26	72.46	72.66	72.86	75.46	75.66	75.86
72.08	72.28	--	72.68	72.88	--	75.68	75.88
72.10	72.30	72.50	72.70	72.90	75.50	75.70	75.90
72.12	72.32	--	72.72	72.92	--	75.72	75.92
72.14	72.34	72.54	72.74	72.94	75.54	75.74	75.94
72.16	72.36	--	72.76	72.96	--	75.76	75.96
72.18	72.38	72.58	72.78	72.98	75.58	75.78	75.98
72.20	72.40	--	72.80	--	--	75.80	--

**Table 4(b) – 72-76 MHz Channel Carrier or Centre Frequencies for Mobile Stations**

Dashes (--) indicate that the channel is not available.

MHz	MHz	MHz	MHz	MHz	MHz
72.02	72.22	--	74.61	75.21	--
72.04	72.24	72.44	74.63	75.23	75.44
72.06	72.26	--	74.65	75.25	--
72.08	72.28	72.48	74.67	75.27	75.48
72.10	72.30	--	74.69	75.29	--
72.12	72.32	72.52	74.71	75.31	75.52
72.14	72.34	--	74.73	75.33	--
72.16	72.36	72.56	74.75	75.35	75.56
72.18	72.38	--	74.77	75.37	--
72.20	72.40	72.60	74.79	75.39	75.60

**5.5.2** The bands 217-218 MHz and 219-220 MHz are each segmented into 80 channels, with carrier frequencies evenly spaced at 12.5 kHz, the first and last carrier frequencies being 6.25 kHz from the band edges. **Note:** Equipment may be certified to operate in the entire band 217-220 MHz, but the sub-band 218-219 MHz may not be available for licensing.

**5.5.3** The bands 462-463 MHz and 467-468 MHz are to be used for licence-exempt Family Radio Service (FRS) and General Mobile Radio Service (GMRS). RSS-210 is to be used for equipment certification.

**5.5.4** The bands 768-776 MHz and 798-806 MHz are designated for use by public safety services. See SRSP-511 for channel assignments.

Transmitters using digital modulation shall be capable of having a minimum data rate of 4.8 kbps per 6.25 kHz bandwidth or one voice channel per 12.5 kHz bandwidth.

**5.5.5** The bands 821-824/866-869 MHz are to be used only for public safety purposes. The channelling plan is given in SRSP-502.

**5.5.6** FM transmitters with voice input may use the spectrum mask for equipment with an audio filter if they are equipped with suitable filters to be used for the audio signal only and not for other purposes. Equipment employing other modulations shall comply with the spectrum masks for equipment without an audio filter.

**5.5.7** See the relevant SRSPs for equipment channelling plans.



### 5.6 Fixed Equipment With an Occupied Bandwidth Larger Than the Authorized Bandwidth Permitted in This Standard

Fixed equipment requiring an occupied bandwidth larger than the authorized bandwidth shown in Table 3 may be permitted if that the equipment complies with the three following conditions:

- (1) The equipment is allowed to have aggregate channels as per the SRSP for its operating frequency bands.
- (2) The ERP shall not be increased with increased occupied bandwidth.
- (3) The equipment shall employ an emission mask that does not result in more adjacent channel interference than the standard narrowband channel equipment emission mask specified in Table 3.

### 5.7 Equivalent Channels

When a 25/30 kHz channel of a transmitter carries several voice channels to meet the required spectrum efficiency of one voice channel in a 12.5 kHz bandwidth, the physical channel is still 25/30 kHz. Therefore, the equipment shall comply with the requirements for equipment with a 25/30 kHz channel bandwidth, such as the requirements related to the authorized bandwidth, spectrum mask and frequency stability.

### 5.8 Transmitter Unwanted Emissions

The spectrum plots of the unwanted emissions shall comply with the masks specified in Table 3.

Descriptions of these permissible emission masks are given in the sections that follow.

The term *displacement frequency*,  $f_d$ , used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and  $p$  is the transmitter output power in Watts.

#### 5.8.1 Emission Mask B for Transmitters Equipped With an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power  $P$  (dBW) as specified in Table 5.

**Table 5 – Emission Mask B**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 20$	25	300
$20 < f_d \leq 50$	35	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

### 5.8.2 Emission Mask C for Transmitters not Equipped With an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 6.

**Table 6 – Emission Mask C**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$5 < f_d \leq 10$	$83 \log_{10}(f_d/5)$	300
$10 < f_d \leq 50$	Whichever is the lesser: 50 or $29 \log_{10}(f_d^2/11)$	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

### 5.8.3 Emission Mask D for Transmitters Equipped With or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 7.

**Table 7 – Emission Mask D**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$5.625 < f_d \leq 12.5$	$7.27(f_d - 2.88)$	Specified in Section 4.2.2
$f_d > 12.5$	Whichever is the lesser: 70 or $50 + 10 \log_{10}(p)$	Specified in Section 4.2.2

### 5.8.4 Emission Mask E for Transmitters Equipped With or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 8.

**Table 8 – Emission Mask E**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$3 < f_d \leq 4.6$	Whichever is the lesser: $30 + 16.67(f_d - 3)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 4.6$	Whichever is the lesser: 57 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

**5.8.5 Emission Mask F for Transmitters Equipped With or Without an Audio Low-Pass Filter**

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 9.

**Table 9 – Emission Mask F**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$2 < f_d \leq 3.75$	Whichever is the lesser: $30 + 20(f_d - 2)$ or $55 + 10 \log_{10}(p)$	30
$3.75 < f_d$	Whichever is the lesser: 65 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

**5.8.6 Emission Mask G for Transmitters not Equipped With an Audio Low-Pass Filter**

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 10.

**Table 10 – Emission Mask G**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 50$	Whichever is the lesser: 70 or $116 \log_{10}(f_d/6.11)$ or $50 + 10 \log_{10}(p)$	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

**5.8.7 Emission Mask I for Transmitters Equipped With an Audio Low-Pass Filter**

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 11.

**Table 11 – Emission Mask I**

<b>Displacement Frequency, <math>f_d</math> (kHz)</b>	<b>Minimum Attenuation (dB)</b>	<b>Resolution Bandwidth (Hz)</b>
$6.8 < f_d \leq 9$	25	300
$9 < f_d \leq 15$	35	300
$f_d > 15$	Whichever is the lesser: 70 or $43 + 10 \log_{10}(p)$	300 for emissions at $f_d \leq 250\%$ of the authorized bandwidth. Specified in Section 4.2.1 for emissions at $f_d > 250\%$ of the authorized bandwidth.

**5.8.8 Emission Mask J for Transmitters not Equipped With an Audio Low-Pass Filter**

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 12.

**Table 12 – Emission Mask J**

<b>Displacement Frequency, <math>f_d</math> (kHz)</b>	<b>Minimum Attenuation (dB)</b>	<b>Resolution Bandwidth (Hz)</b>
$2.5 < f_d \leq 6.25$	$53 \log_{10}(f_d/2.5)$	300
$6.25 < f_d \leq 9.5$	$103 \log_{10}(f_d/3.9)$	300
$f_d > 9.5$	Whichever is the lesser: 70 or $157 \log_{10}(f_d/5.3)$ or $50 + 10 \log_{10}(p)$	300 for emissions at $f_d \leq 250\%$ of the authorized bandwidth. Specified in Section 4.2.1 for emissions at $f_d > 250\%$ of the authorized bandwidth.

**5.8.9 Emission Mask for Equipment in the Bands 768-776 MHz and 798-806 MHz**

**5.8.9.1 Adjacent Channel Power (ACP)**

The ACP of transmitters operating in the bands 768-776 MHz and 798-806 MHz shall comply with the requirements for various transmitter channel sizes provided in tables 13 to 16. Mobile station requirements apply to handheld, car-mounted and control station units. The tables specify a maximum value for the ACP relative to the maximum output power as a function of the displacement  $f_d$  from the channel centre frequency. In the tables, “s” indicates that a swept measurement may be used.

**Table 13 – ACP Requirements for 6.25 kHz Bandwidth Transmitters**

Displacement Frequency, $f_d$ (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
6.25	-40	-40	6.25
12.5	-60	-60	
18.75			
25	-65	-65	
37.5	-65	-65	25
62.5			
87.5			
150	-65	-65	100
250			
350			
$400 < f_d \leq 12$ MHz	-75	-80	30(s)
$12$ MHz $< f_d \leq$ paired receive band			
In the paired receive band	-100	-85	

**Table 14 – ACP Requirements for 12.5 kHz Bandwidth Transmitters**

Displacement Frequency, $f_d$ (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
9.375	-40	-40	6.25
15.625	-60	-60	
21.875			
37.5	-60	-60	25
62.5	-65	-65	25
87.5			
150	-65	-65	100
250			
350			
$400 < f_d \leq 12$ MHz	-75	-80	30(s)
$12$ MHz $< f_d \leq$ paired receive band			
In the paired receive band	-100	-85	

**Table 15 – ACP Requirements for 25 kHz Bandwidth Transmitters**

Displacement Frequency, $f_d$ (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
15.625	-40	-40	6.25
21.875	-60	-60	6.25
37.5	-60	-60	25
62.5	-65	-65	25
87.5			25
150	-65	-65	100
250			
350			
$400 \leq f_d \leq 12 \text{ MHz}$	-75	-80	30(s)
$12 \text{ MHz} \leq f_d \leq \text{paired receive band}$			
In the paired receive band			

**Table 16 – ACP Requirements for 50 kHz Bandwidth Transmitters**

Displacement Frequency, $f_d$ (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
50	-40	-40	50
100	-50	-50	
150			
200			
250			
300			
350		-60	
400			
450			
500			
550			
$600 \leq f_d < 1000$	-60	-65	30(s)
$1000 \leq f_d < 2000$	-65	-70	
$2000 \leq f_d < 9000$	-70	-75	
$9000 \leq f_d \leq \text{paired receive band}$			
In the paired receive band	-100	-85	

### 5.8.9.2 Out-of-Band Emission Limit

On any frequency outside of the ranges specified in the ACP tables 13 to 16, the power of any emission shall be attenuated below the mean output power P (dBW) by at least  $43 + 10 \log_{10}(p)$ , measured in a 100 kHz bandwidth for frequencies less than or equal to 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the bands 768-776 MHz and 798-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed:

- 70 dBW/MHz equivalent isotropically radiated power (e.i.r.p.) for wideband emissions, and
- 80 dBW/kHz e.i.r.p. for discrete emissions of less than 700 Hz bandwidth.

### 5.8.10 Emission Mask Y for Equipment With a 25 kHz Channel Bandwidth and an Occupied Bandwidth Greater Than 20 kHz

Equipment with a 25 kHz channel bandwidth and an occupied bandwidth greater than 20 kHz shall have the power of any emission attenuated below the transmitter output power P (dBW) as specified in Table 17.

**Table 17 – Emission Mask Y**

Displacement Frequency, $f_d$ (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$12.375 < f_d \leq 13.975$	Whichever is the lesser: $30 + 16.67(f_d - 12.375)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 13.975$	Whichever is the lesser: $57$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

## 5.9 Transient Frequency Behaviour

When a transmitter is turned on, the radio frequency may take some time to stabilize. During this initial period, the frequency error or frequency difference (*i.e.*, between the instantaneous and the steady state frequencies) shall not exceed the limits specified in Table 18.

Any suitable method of measurement can be used provided that it is fully described in the test report. A suitable and recommended method is given in TIA Standard 603.

**Table 18 – Transient Frequency Behaviour**

Channel Bandwidth (kHz)	Time Intervals (Notes 1, 2)	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	406.1-512 MHz
25	t <sub>1</sub>	±25	5	10
	t <sub>2</sub>	±12.5	20	25
	t <sub>3</sub>	±25	5	10
12.5	t <sub>1</sub>	±12.5	5	10
	t <sub>2</sub>	±6.25	20	25
	t <sub>3</sub>	±12.5	5	10
6.25	t <sub>1</sub>	±6.25	5	10
	t <sub>2</sub>	±3.125	20	25
	t <sub>3</sub>	±6.25	5	10

**Notes:**

- t<sub>on</sub>: the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.  
 t<sub>1</sub>: the time period immediately following t<sub>on</sub>.  
 t<sub>2</sub>: the time period immediately following t<sub>1</sub>.  
 t<sub>3</sub>: the time period from the instant when the transmitter is turned off until t<sub>off</sub>.  
 t<sub>off</sub>: the instant when the 1 kHz test signal starts to rise.
- If the transmitter carrier output power rating is 6 W or less, the frequency difference during the time periods t<sub>1</sub> and t<sub>3</sub> may exceed the maximum frequency difference for these time periods. The corresponding plot of frequency versus time during t<sub>1</sub> and t<sub>3</sub> shall be recorded in the test report.

**5.10 Transmitters With an Output Power not Exceeding 120 mW**

Transmitters that have an output power that does not exceed 120 mW are exempt from the emission masks of Section 5.8, the transient frequency behaviour of Section 5.9, and the frequency stability limits of Section 5.3 provided that they comply with the following:

The sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a displacement frequency, f<sub>d</sub>, from the assigned frequency as shown in Table 19 is attenuated below the unmodulated carrier power by at least 30 dB, when measured with a resolution bandwidth of 300 Hz. If the unmodulated carrier power is not available, the modulated transmitter output power can be used instead. The transmitter output power is measured or integrated over its occupied bandwidth.



**Table 19 – Displacement Frequency for Required Attenuation for Transmitters Having an Output Power of Less Than 120 mW**

Equipment Channel Bandwidth (kHz)	Displacement Frequency, $f_d$ (kHz)
25	$f_d \geq 40$
30	
12.5	$f_d \geq 25$
15	
6.25	$f_d \geq 12.5$
7.5	

The frequency stability test as given in RSS-Gen shall be carried out to demonstrate the compliance of the attenuation above.

**5.11 Interoperability Technical Standards for Equipment in the Bands 768-776 MHz and 798-806 MHz**

Transmitters operating on those narrowband channels in the bands 768-776 MHz and 798-806 MHz designated for interoperability (see SRSP-511) shall comply with the requirements in the following sections and a statement of declaration of compliance shall be included in the test report.

**5.11.1 Voice Operation Equipment**

Transmitters designed for voice operation shall include a 12.5 kHz bandwidth mode of operation conforming to the following standards, which are incorporated by reference:

- (1) *Project 25 – FDMA Common Air Interface – New Technology Standards Project – Digital Radio Technical Standards*, Telecommunications Industry Association, TIA-102.BAAA; and
- (2) *Project 25 – Vocoder Description*, Telecommunications Industry Association, TIA-102.BABA.

**5.11.2 Data Transmission Equipment**

Transmitters designed for data transmission shall include a 12.5 kHz bandwidth mode of operation conforming to the following standards, which are incorporated by reference:

- (1) *Project 25 – Data Overview – New Technology Standards Project – Digital Radio Technical Standards*, Telecommunications Industry Association, TIA-102.BAEA;
- (2) *Project 25 – Packet Data Specification – New Technology Standards Project – Digital Radio Technical Standards*, Telecommunications Industry Association, TIA-102.BAEB;
- (3) *Project 25 – Radio Management Protocols – New Technology Standards Project – Digital Radio Technical Standards*, Telecommunications Industry Association, TIA-102.BAEE; and

- (4) *Project 25 – FDMA Common Air Interface – New Technology Standards Project – Digital Radio Technical Standards*, Telecommunications Industry Association, TIA-102.BAAA.
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