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Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz

Preface

Radio Standards Specification 119, Issue 11, *Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz*, replaces RSS-119, Issue 10, *Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz*, dated April 2010.

This document will be in force as of the publication date of *Canada Gazette* notice SMSE-007-11, after which the public has 120 days to submit comments. These comments will be taken into account in the preparation of the next version of the document.

Listed below are the changes:

- (1) Requirements for equipment with a 25 kHz channel spacing and an occupied bandwidth greater than 20 kHz operating in the frequency bands 406.1-430 MHz, 450-470 MHz, 806-821/851-866 MHz and 821-824/866-869 MHz have been added.
- (2) The requirement that equipment operating in the land mobile service in the frequency band 138-470 MHz meet the required spectrum efficiency has been clarified.

Issued under the authority of
the Minister of Industry

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1. Scope

This Radio Standards Specification (RSS) sets out requirements for radio transmitters and receivers for the land mobile and fixed services in bands allocated within the 27.41 MHz to 960 MHz range.

1.1 Exclusion

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

1.2 Equipment Operating in the Land Mobile Service in the Frequency Bands 138-470 MHz

Within the frequency ranges 138-470 MHz, equipment in the land mobile service which operates with a channel bandwidth of more than 12.5 kHz shall be certified only if it is also capable of operating with a smaller channel bandwidth to meet the minimum spectrum efficiency of one voice channel per 12.5 kHz bandwidth (e.g. two voice channels per 25 kHz).

1.3 Equipment in the Bands 764-776 MHz and 794-806 MHz

Equipment in the bands 764-776 MHz and 794-806 MHz shall be eligible for certification until the implementation of the digital television (DTV) transition date, August 31, 2011.¹ After that date, new equipment shall be certified only for the bands 768-776 MHz and 798-806 MHz.

2. General Information

Land mobile and fixed equipment certified under this standard is classified as Category I equipment, and 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

In addition to related documents specified in RSS-Gen, *General Requirements and Information for the Certification of Radiocommunication Equipment*, the following documents should be consulted:

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

¹ Broadcasting Public Notice CRTC 2007-53, available at <http://www.crtc.gc.ca/eng/archive/2007/pb2007-53.htm>

TIA Standard 102.BAAA	<i>Project 25 – FDMA Common Air Interface – New Technology Standards Project – Digital Radio Technical Standards</i>
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 Control Protocol (RCP) – 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 MHz-944 MHz</i>
SRSP-511	<i>Technical Requirements for Land Mobile and 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>

SRSP – Standard Radio System Plan

TIA – Telecommunications Industry Association

Industry Canada documents (all of the above except the TIA documents) are available on the [Spectrum Management and Telecommunications website](http://www.ic.gc.ca/spectrum) at <http://www.ic.gc.ca/spectrum>, under *Official Publications*.

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

3. General Requirements

3.1 RSS-Gen Compliance

RSS-119 shall be used in conjunction with RSS-Gen, for general specifications and information relevant to the equipment for which this standard applies.

3.2 User Manual

If the radio terminal has a data port, the user manual shall contain the manufacturer's technical parameters for interfacing external data sources, as follows:

- (a) the input voltage (volts peak-to-peak) required from a modem for proper modulation;
- (b) the maximum recommended data rate; and
- (c) the designed impedance for this port.

As well, the design impedances of all interface ports (i.e. voice ports, data ports, antenna terminals, etc.) should be stated in the user manual.

3.3 Test Reports

In addition to the requirements listed in RSS-Gen, the test report shall indicate whether there is a data port in the radio terminal.

3.4 Transmitter 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, or service technician/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; or

- (2) transmitters are programmed for frequencies through controls inaccessible to the user; or
- (3) transmitters are programmed for frequencies through use of external devices or specifically programmed modules made available only to service/maintenance personnel; or
- (4) transmitters are programmed through cloning (i.e. copying a program directly from another transmitter) using devices and procedures which are available only to service/maintenance personnel.

4. Measurement Methods

4.1 Transmitter Output Power

In conjunction with the measurement method described in RSS-Gen for the measurement of the output power, the transmitter shall be operated at the manufacturer's rated power and modulated with signals as follows:

- (a) if the audio input signal is voice and the transmitter is FM, modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce 50% of the desired frequency deviation.
- (b) for non-FM transmitters, a signal representative (i.e. typical) of those encountered in a real system operation should be used. However, if the transmission is not continuous, this must be so indicated in the test report.

Measure and record the transmitter output power, using a measurement (resolution) bandwidth at least two to three times 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.

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

4.2 Transmitter Unwanted Emissions

In measuring the transmitter unwanted emissions, a sufficient number of sweeps must be measured to ensure that the emission profile is developed. If video filtering is used, its bandwidth must be at least three times the instrument resolution bandwidth.

4.2.1 Emission Masks B, C, G, I, J and L

Unwanted emission measurements can be in peak or averaging mode, provided that the total transmitter output power and the unwanted emission mask are measured and expressed in similar units.

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 below 1000 MHz, and at least 1 MHz must be used for frequencies to be measured above 1000 MHz. If a narrower resolution bandwidth is used, power integration can be applied.

4.2.2 Emission Masks D, E and Y

In order to show compliance with the emissions 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 spectrum analyzer bandwidth shall be 100 kHz for frequencies below 1 GHz, and 1 MHz for frequencies above 1 GHz.

4.2.3 Emission Mask F

The unwanted emission shall be measured using the method as described in Section 4.2.2, but for emissions at a displacement frequency of less than 1.75 kHz, set the resolution bandwidth as per Table 8.

4.3 Adjacent Channel Power (ACP) Measurement for Equipment in the Bands 764-776 MHz and 794-806 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. If a transmitter has an integral antenna, a suitable power coupling device shall be used to couple the radio frequency signal to the measurement instrument. The coupling device shall substantially maintain the proper transmitter load impedance.

(1) Setting reference level

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

5. Transmitter and Receiver Specifications

5.1 Interface Impedance

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

5.2 Types of Modulation

Equipment that operates in frequency bands other than 764-776 MHz and 794-806 MHz may employ any type of modulation.

Equipment that operates in the bands 764-776 MHz and 794-806 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 channel 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 which have an output power of less than 120 mW, the frequency stability may comply with the limits listed in Table 1, or alternatively with the conditions in Section 5.10.

Table 1 - Transmitter Frequency Stability

Frequency Band (MHz)	Channel Spacing (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			>2 watts	≤ 2 watts
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
764-776 and 794-806 (Note 3)	6.25	0.1	0.4 (Note 4)	0.4 (Note 4)
	12.5			
	25			
	50	1	1.25 (Note 5)	1.25 (Note 5)
806-821/851-866 and 821-824/866-869 (Note 6)	25 (Note2)	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
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	3 (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

Note 1: Mobile units may use synchronizing signals from associated base stations to achieve the specified carrier stability.

Note 2: This provision is for digital equipment with a channel spacing of 25 kHz and an occupied bandwidth greater than 20 kHz.

Note 3: Mobile, portable and control transmitters operating in the 764-776 MHz and 794-806 MHz must normally use automatic frequency control (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.

Note 4: When the mobile, portable and control transmitters are operating in the 764-776 MHz narrowband segment and the AFC is not locked to the base station, the frequency stability must be at least 1.0 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).

Note 5: When the mobile, portable and control transmitters are operating in the 764-776 MHz wideband segment and the AFC is not locked to the base station, the frequency stability must be at least 5 ppm or better.

Note 6: Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

5.4 Transmitter Output Power

The output power shall be within ± 1.0 dB of the manufacturer's rated power.

5.4.1 For all Frequency Bands of Table 1 Except 72-76 MHz, 217-218 MHz, 219-220 MHz, 220-222 MHz, 764-776 MHz and 794-806 MHz

Typical transmitter output powers are 110 watts for base and/or fixed stations (paging transmitters excepted), and 30 watts for mobile stations. Higher powers may be certified, but it should be noted that mobile stations are normally only licensed up to 30 watts. See the SRSP relevant to the operating frequency for equipment power limits.

5.4.2 72-76 MHz

In this 72-76 MHz band, the maximum transmitter output power for mobile equipment is 1 watt. There is no power limit on fixed station transmitters.

5.4.3 217-218 MHz and 219-220 MHz

Equipment using these two bands may be certified to the transmitter powers listed in Section 5.4.1, but is generally licensed for less than 5 watts.

5.4.4 220-222 MHz

See SRSP-512 for power limits.

5.4.5 764-776 MHz and 794-806 MHz

The transmitter output power of mobile and control transmitters shall not exceed 30 watts.

The transmitter output power of portable transmitters shall not exceed 3 watts.

The e.r.p. of fixed transmitters shall not exceed the limits given in SRSP-511.

5.5 Channel Spacing, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel spacing is defined as the frequency spacing between the centre frequencies of two contiguous channels.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment’s frequency band.

5.5.1 The permissible channel spacing, authorized bandwidths and spectrum masks are given in Table 2 for equipment having output power greater than 120 mW. For equipment with output power that does not exceed 120 mW, Section 5.10 applies.

5.5.2 For the band 72-76 MHz, the channel carriers for fixed and mobile stations are given in tables 2(a) and 2(b) respectively. It is to be noted that 0.75 watt licence-exempt radios (see RSS-210) are permitted interstitially (10 kHz offset to tables 2(a) and 2(b) frequencies) in the bands 72.01-72.99 MHz and 75.41-75.99 MHz.

Table 2(a) - 72-76 MHz Channel Carrier or Centre Frequencies for Fixed Stations

-- Channel 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 2(b) - 72-76 MHz Channel Carrier or Centre Frequencies for Mobile Stations

-- Channel 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

5.5.3 The 217-218 MHz and 219-220 MHz bands 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.

5.5.4 It is to be noted that the frequency 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.

5.5.5 The bands 764-776 MHz and 794-806 MHz are designated for use by public safety services. The bands are subdivided into narrowband and wideband channels. See SRSP-511 for channel assignments.

Before December 2014, transmitters operating in the narrowband segment 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. After December 2014, transmitters operating in this band shall be capable of having a minimum data rate of 4.8 kbps or one voice channel per 6.25 kHz bandwidth.

Transmitters operating in the wideband segment using digital modulation shall be capable of having a minimum data rate of 128 kbps per 50 kHz bandwidth.

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

5.5.7 Voice input to an FM transmitter may use the spectrum mask with audio filter if it is equipped with suitable filters to be used for the audio signal only and not for other purposes. Other modulations must comply with the masks *without audio filter*.

5.5.8 See the relevant SRSPs for the operating frequency of the equipment channelling plan.

Table 3 - Channel Spacing, Authorized Bandwidths and Applicable Spectrum Masks

Frequency Band (MHz)	Related SRSP for Channelling Plan and e.r.p.	Channel Spacing (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks with Audio Filter	Spectrum Masks Without Audio Filter
27.41-28.0 and 29.7-50.0	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	B	C (G, Note 1)
			22	Y	Y
		12.5	11.25	D	D
		6.25	6	E	E
764-776 and 794-806	SRSP-511	6.25	Note 2	Section 5.8.9	Section 5.8.9
		12.5			
		25			
		50			
806-821-/851-866 and 821-824/866-869	SRSP-502		20	B	G
		25	22	Y	Y
		12.5	11.25	D	D
896-901/935-940	SRSP-506	12.5	13.6	I	J (G, Note 3)
929-930 and 931-932	SRSP-504 (for aging)	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

Note 1: Paging transmitters in the bands 406.1-430 MHz and 450-470 MHz are to use Mask G.

Note 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.

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

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 provided that the equipment complies with the following:

- (1) the e.i.r.p. shall not be increased with increased occupied bandwidth; and
- (2) the equipment shall employ an emission mask which does not result in more adjacent channel interference than that of the standard narrowband channel equipment.

5.7 Equivalent Channels

When an actual or physical 25 kHz channel of a transmitter carries several voice channels to meet the required spectrum efficiency for a smaller bandwidth, the physical channel is still 25 kHz. Therefore, the equipment shall comply with the requirements for equipment with a 25 kHz channel spacing, such as authorized bandwidth, spectrum mask, frequency stability, etc., and not with those for the smaller bandwidth.

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 following sections.

Displacement frequency, f_d , is the difference between the channel frequency and the emission component frequency expressed in hertz, 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 4.

Table 4 - Emission Mask B

Displacement Frequency, f_d, (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 \leq f_d \leq 20$	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 5.

Table 5 - 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 attenuation: 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 6.

Table 6 - 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 attenuation: 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 7.

Table 7 - Emission Mask E

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$3.0 < f_d \leq 4.6$	whichever is the lesser attenuation: $30 + 16.67(f_d - 3)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 4.6$	whichever is the lesser attenuation: 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 8.

Table 8 - Emission Mask F

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$2 < f_d \leq 3.75$	whichever is the lesser attenuation: $30 + 20(f_d - 2)$ or $55 + 10 \log_{10}(p)$	30
$3.75 < f_d$	whichever is the lesser attenuation: 65 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.3

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 9.

Table 9 - Emission Mask G

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 50$	whichever is the lesser attenuation: 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 10.

Table 10 - Emission Mask I

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$6.8 < f_d \leq 9.0$	25	300
$9.0 < f_d \leq 15.0$	35	300
$f_d > 15.0$	whichever is the lesser attenuation: 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 11.

Table 11 - Emission Mask J

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$2.5 < f_d \leq 6.25$	$53 \log_{10}(f_d/2.5)$	300
$6.25 < f_d \leq 9.5$	$103 \log_{10}(f_d/3.9)$	300
$f_d > 9.5$	whichever is the lesser attenuation: 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 764-776 MHz and 794-806 MHz

5.8.9.1 Adjacent Channel Power (ACP)

The ACP of transmitters operating in the bands 764-776 MHz and 794-806 MHz shall comply with the requirements in the following tables for various transmitter channel sizes. 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 12 - 6.25 kHz Transmitter ACP Requirements

Displacement Frequency, f_d , (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
6.25	-40	-40	6.25
12.50	-60	-60	
18.75			
25.00	-65	-65	25.00
37.50	-65	-65	
62.50			
87.50			
150.00	-65	-65	100.00
250.00			
350.00			
$400 < f_d \leq 12 \text{ MHz}$	-75	-80	30(s)
$12 \text{ MHz} < f_d \leq \text{paired receive band}$			
In the paired receive band	-100	-100	

Table 13 - 12.5 kHz Transmitter ACP Requirements

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			
37.50	-60	-60	25.00
62.50	-65	-65	25.00
87.50			
150.00	-65	-65	100.00
250.00			
350.00			
$400 < f_d \leq 12$ MHz	-75	-80	30(s)
12 MHz $< f_d \leq$ paired receive band			
In the paired receive band	-100	-100	

Table 14 - 25 kHz Transmitter ACP Requirements

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
37.50	-60	-60	25.00
62.50	-65	-65	25.00
87.50			
150.00	-65	-65	100.00
250.00			
350.00			
$400 \leq f_d \leq 12$ MHz	-75	-80	30(s)
12 MHz $\leq f_d \leq$ paired receive band			
In the paired receive band	-100	-100	

Table 15 - 50 kHz Transmitter ACP Requirements

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				-55	
350					
400	-60				
450					
500					
550	-60	-65		30(s)	
$600 \leq f_d < 1000$					
$1000 \leq f_d < 2000$			-65		-70
$2000 \leq f_d < 9000$			-70		-75
$9000 \leq f_d \leq$ 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 12 to 15, 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 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the 764-776 MHz and 794-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed -70 dBW/MHz 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 Spacing and an Occupied Bandwidth greater than 20 kHz

Equipment with a 25 kHz channel spacing 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 16.

Table 16 - 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 attenuation: $30 + 16.67(f_d - 12.375)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 13.975$	whichever is the lesser attenuation: 57 or $55 + 10 \log_{10}(p)$	

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 17.

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 17 - Transient Frequency Behaviour

Channel Spacing (kHz)	Time Intervals ^{1,2}	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	406.1-512 MHz
25	t_1	± 25	5	10
	t_2	± 12.5	20	25
	t_3	± 25	5	10
12.5	t_1	± 12.5	5	10
	t_2	± 6.25	20	25
	t_3	± 12.5	5	10
6.25	t_1	± 6.25	5	10
	t_2	± 3.125	20	25
	t_3	± 6.25	5	10

- ¹ t_{on} : the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
- t_1 : the time period immediately following t_{on} .
- t_2 : the time period immediately following t_1 .
- t_3 : the time period from the instant when the transmitter is turned off until t_{off} .
- t_{off} : the instant when the 1 kHz test signal starts to rise.

² If the transmitter carrier output power rating is 6 W or less, the frequency difference during the time periods t_1 and t_3 may exceed the maximum frequency difference for these time periods. The corresponding plot of frequency versus time during t_1 and t_3 shall be recorded in the test report.

5.10 Transmitters with Output Power not Exceeding 120 mW

Transmitters which have an output power that does not exceed 120 mW are exempt from the spectrum 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_d , from the assigned frequency as shown in Table 18 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 18 - Displacement Frequency for Required Attenuation for Transmitters Having Output Power Less than 120 mW

Equipment Channel Spacing (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 attenuation above.

5.11 Receiver Spurious Emissions

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

5.12 Internal Data Modem Tests

A data modem internal to the radio terminal shall contain level adjustment and pulse-shaping circuitry. The modem shall be tested and shall comply with the mask that is appropriate to the data rate.

5.13 Interoperability Technical Standards for Equipment in the Bands 764-776 MHz and 794-806 MHz

Transmitters operating on those narrowband channels in the bands 764-776 MHz and 794-806 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.

5.13.1 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.

5.13.2 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 Control Protocol (RCP) – 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.