PCC.III/REC.33(IX-97)

TECHNICAL AND PROCEDURAL FRAMEWORK FOR LOW POWER PCS IN THE USE OF 1910-1930 MHz BAND

The Ninth Meeting of the Permanent consultative Committee III; Radiocommunications,

CONSIDERING:

That the sixth PCC.III meeting included a seminar on "Applications in the 1910-1930 MHz band" to inform the members of CITEL of the new technologies, standards and applications available in this band;

That Resolution PCC.III/RES.42 (VI-96) resolved that PCC.III will consider developing a Recommendation on a technical and procedural framework that supports the operation of low power PCS devices and applications;

That the increased commercial deployment of low power PCS products offer a variety of applications and benefits in the 1910-1930 MHz band, and

That a common allotment of spectrum among CITEL countries, along with a recognized technical and procedural framework, will allow obtaining the benefits of economies of scale and multiple vendors providing compatible equipment.

RECOMMENDS:

That the member States of CITEL that plan to utilize the band 1910-1930 MHz for low power PCS systems and devices may consider adopting a technical and procedural framework, as the one shown in the attached annex, to ensure coexistence among systems operating in the same band and in the same geographic area.

INVITES:

The member countries to continue to contribute other technical and procedural frameworks that will serve as recommendations for other types of alternatives applicable to low power PCS systems in this band.

ANNEX

Technical and Procedural Framework for Low Power PCS in the 1910-1930 MHz Band

The technical and procedural framework that facilitates efficient shared use of the band is referred to as the "spectrum etiquette." It defines a broad envelope within which the low power PCS devices/systems must operate; this has been done in such a way to permit a significant degree of flexibility for manufacturers to develop a variety of innovative devices. A key feature of this etiquette is the requirement that devices monitor before transmitting in order to secure a frequency that is not in use at that instant in the immediate area. Thus sharing is invoked in three dimensions: frequency, time, and location. There are general provisions that apply to the entire 1910-1930 MHz band; for instance, PCS devices authorized for use in this band must use digital modulation and maximum power and power spectral density limits are established. The 1910-1920 MHz sub-band is reserved for asynchronous transmissions, i.e., data that is transmitted at irregular time intervals as typified by local area network data systems. The band 1920-1930 MHz is reserved for isochronous transmissions, i.e., devices that transmit at a regular interval, typified by time-division voice systems. A summary of the general technical provisions is given in Table 1.

Table 1. General Technical Provisions

Parameter	**Characteristic/Value**	**Reference***
Modulation	Digital	§15.319(b)
Data Characteristic	1910-1920 MHz: Asynchronous 1920-1930 MHz: Isochronous	§15.319(a)
Peak Transmit Power	< 100 microwatts times square root of emission bandwidth (to be reduced by amount that antenna gain exceeds 3dBi)	§15.319(c) §15.319(e)
Power spectral density	< 3 milliwatts in any 3 kHz bandwidth	§15.319(d)

* reference is to the FCC Rules (47CFR)

Table 2. Detailed technical Provisions		
Parameter	**1910-1920 MHz Band* Asynchronous Devices**	**1920-1930 MHz band (Isochronous Devices)**
Channelization	None	Operation to be contained within one of eight 1.25 MHz channels.
Device Bandwidth Limits	500 kHz minimum; 10 MHz maximum.	50 kHz minimum; 1.25 MHz maximum
Transmit Duration	Burst duration of individual or cooperative devices not to exceed 10 ms; intraburst gap between cooperating devices shall not exceed 25 μs.	Not more than 8 hrs without repeating access criteria.
Frame Period	Not applicable.	20 ms or 10/x ms (where x is a positive integer). Devices using time-division to maintain a duplex connection must maintain a frame repetition rate with frequency stability of at least 50 ppm and a frame interval jitter of 25 μs or less.
Frequency search strategy	Depends on bandwidth of device: a) BW < 1 MHz may not occupy center half if other spectrum is available; b) BW < 2.5 MHz: start within 3 MHz of either band edge and search inward; c) BW > 2.5 MHz: occupy center half of band.	Depends on bandwidth of device: a) BW <625 kHz: start within 3 MHz of lower band edge and search upward; b) BW>625 kHz: start within 3 MHz of upper band edge and search down.

Table 2. Detailed technical Provisions		
Parameter	**1910-1920 MHz Band* Asynchronous Devices**	**1920-1930 MHz band (Isochronous Devices)**
Connection Criteria	Monitor spectrum to be used a minimum of 50 μs. If no signal is detected above the monitoring threshold, a transmission burst may commence in the monitored spectrum window.	Monitor spectrum to be used: 10 ms if transmit frame < 10 ms, 20 ms if transmit frame = 20 ms. If no signal is detected above the monitoring threshold, a transmission burst may commence in the monitored spectrum window. A duplex connection can be established by an initiating device, which does the monitoring if the responding device, can decode the signal. No device or group of cooperating devices located within 1 meter of each other shall occupy more than three 1.25 MHz channels during any frame period.
Acknowledgement required	Not applicable	Once access is obtained, must receive first acknowledgement within 1s, and subsequent periodic acknowledgements at least every 30s, or transmission must cease. For a control and signaling channel no acknowledgement is required but it must be reaccessed every 30s.
Wait before next transmission	Random within range of 50-70 μs; however, range is doubled if access fails up to a maximum of 12 ms. This range is re-initialized after each successful access attempt.	Random range of 10-150 ms for the same channel.
Monitoring bandwidth	Equal to or greater than emission bandwidth.	Equal to or greater than emission bandwidth.

Table 2. Detailed technical Provisions		
Parameter	**1910-1920 MHz Band* Asynchronous Devices**	**1920-1930 MHz band (Isochronous Devices)**
Reaction time to monitoring	Formulas depend on BW and signal level; not required to be faster than 50 μs for signal at threshold or 35 μs for signal 6 dB or more above threshold.	Formulas depend on BW and signal level; not required to be faster than 50 μs for signal at threshold or 35 μs for signal 6dB above threshold.
Monitoring threshold	Not greater than 32 dB above thermal noise power of emission bandwidth (kTB+32) of the device; but may increase level by same amount that transmit power is below the maximum limit.	Not greater than 30 dB, or the least interfering channel with a level between 30 dB and 50 dB, above thermal noise power of emission bandwidth 8kTB+30) of the device; but may increase level by same amount that transmit power is below the maximum limit.
Out of band emission limits	Emission below reference of 112 mW as follows: 30 dB from band edge to 1.25 MHz beyond; 50 dB between 1.25-2.5 MHz beyond edge; 60 dB at > 2.5 MHz beyond edge.	For BW=1.25 MHz, emission below reference of 112 mW as follows: 30 dB from channel edge to 1.25 MHz beyond; 50 dB between 1.25-2.5 MHz beyond edge; 60 dB at > 2.5 MHz beyond edge. (For smaller BW, similar rejection levels using actual BW points)
Frequency stability	Accounted for in access criteria & out-of-band emission limits.	+/- 10 PPM over a temperature range of –20 ° C to +50° C
Antenna requirements: only the antenna designed for and/or furnished with the device may be used. The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.		
Conduction limits: A device designed to be connected		

Technical provisions for asynchronous data devices using the band 1910-1920 MHz band afford a great deal of flexibility in terms of data rates and emission bandwidths. The band is not channelized; however, provisions related to the frequency search algorithms attribute a higher priority of access to the center of the band for devices requiring bandwidths greater than 2.5 MHz. On the other hand, isochronous data devices using the band 1920-1930 MHz shall confine their emissions to one of eight 1.25 MHz channels. A summary of the detailed technical provisions applicable to operation of devices in the two bands is given in Table 2.

In Table 2, the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emissions bandwidth of the device under measurement. The thermal noise power is the noise power in watts defined by the formula N=kTB where N is the noise power in watts, K is Boltzmann's constant, T is the absolute temperature in degrees Kelvin, and B is the emissions bandwidth of the device in hertz.

Due to the sophisticated technical nature of the spectrum etiquette, a standard measurement procedure was deemed necessary to ensure compatible operation of these devices. The American National Standards Institute (ANSI) developed the *Measurement Procedure for Unlicensed Personal Communications Services Devices* (ANSI C63.17). This document provides measurement procedures manufacturers should use to ensure compliance. It is available directly from the American National Standards Institute.