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Response to FCC's Inquiry Regarding Selection of Frequencies in the Hopping Sequences  
(ABEST's WPBX-9000 WiNGS™ Based Wireless PBX)

## 1. Adaptiveness of Hopping Sequences

At system initialization, before the system's base and handsets start transmitting, the base unit selects 5 frequency segments ("slices") from the available 10 (see Table 1 in the attached appendix). These slices are selected using a minimal interference criterion based on measurements of received levels of interference performed throughout the initialization period. Once this selection has been made, the order of frequencies is set according to a randomization & scrambling algorithm. The various transmitters in the system transmit at different time slots (TDMA), and hence never occupy two frequencies simultaneously, or collide with each other. Collisions with other systems in the environment are possible, since the frequency use of each systems is not coordinated with that of others.

The hopping sequences for each device are dynamically and independently modified further according to packet reception failures throughout their use. The system holds a separate error counter for each frequency slice (shared amongst 5 frequencies), and once this counter exceeds a predefined parameter, the frequency slice is considered inappropriate, and is replaced with a spare one that hasn't been in use at that time.

This complies with the FCC rules (15.247h), allowing the intelligent selection of frequencies based on reception indications, since the system does not coordinate its frequency use with that of other systems by any means.

## 2. Contents and Randomness of Hopping Sequences

The frequency hopping sequences in the WPBX-9000 are based on a periodic use of **25** frequencies, which is the minimal number of frequencies required for systems transmitting up to 0.25W (the transmission power in the WPBX-9000 is 100mW). The order of appearance of the selected frequencies is randomized and scrambled by means of software to obtain a pseudo-random pattern. The calculation of the scrambling parameter used as a randomization seed, is based on the following: the RSSI levels corresponding to the reception of noise/interference, the system's unique 6-byte identification number, and a random value determined by the system's clock. This ensures both the random nature of the hopping sequence and its orthogonality with other sequences generated similarly in other neighboring systems.

During the operation of the system, each of the handsets which communicates with the base has an individual frequency hopping link with the base, with multiplexing performed on the time axis (TDMA). Each of these separate channels is monitored and dynamically changed according to the link failures encountered in it. Consequently, the system may end up using different frequency sequences for the various handsets in it, depending on the link conditions of each of them.

The 25 frequencies selected for a specific transmitter at a certain time will always comprise 5 frequency slices, each containing 5 different channels. Table 1 in the attached appendix lists all 50 available hopping channels, as they are arranged in frequency slices. Apart from frequency slice #9, which contains frequencies at which the system's reception sensitivity is slightly degraded, the frequency slices are arranged in their order of appearance on the frequency axis. Table 2 describes a typical pseudo-random sample sequence generated by the system.

**Table 1 - List of Carrier Frequencies**

Frequency slice	1	2	3	4	5
<b>0</b>	902.5	903.0	903.5	904.0	904.5
<b>1</b>	905.0	905.5	906.5	907.0	907.5
<b>2</b>	908.0	908.5	909.0	909.5	910.0
<b>3</b>	910.5	911.0	911.5	912.5	913.0
<b>4</b>	913.5	914.0	914.5	915.0	915.5
<b>5</b>	916.0	916.5	917.0	918.5	919.0
<b>6</b>	919.5	920.0	920.5	921.0	921.5
<b>7</b>	922.0	922.5	923.0	923.5	924.5
<b>8</b>	925.0	925.5	926.0	926.5	927.0
<b>9</b>	906.0	912.0	917.5	918.0	924.0

**Table 2 – Hopping Sequence Sample**

Order of Appearance in Sequence	Hopping Sequence (Slices 0,1,2,3,4 selected)		
	index	slice	Frequency in slice
1	17	3	3
2	11	2	2
3	3	0	4
4	24	4	5
5	8	1	4
6	16	3	2
7	19	3	5
8	12	2	3
9	6	1	2
10	4	0	5
11	13	2	4
12	23	4	4
13	18	3	4
14	7	1	3
15	21	4	2
16	0	0	1
17	14	2	5
18	10	2	1
19	22	4	3
20	15	3	1
21	5	1	1
22	1	0	2
23	20	4	1
24	9	1	5
25	2	0	3