

LIST OF 128 HOPPING CHANNEL FREQUENCIES

Appendix B. Channel Frequency Assignment

Channel	Frequency
0	903420000
1	903600000
2	903780000
3	903960000
4	904140000
5	904320000
6	904500000
7	904680000
8	904860000
9	905040000
10	905220000
11	905400000
12	905580000
13	905760000
14	905940000
15	906120000
16	906300000
17	906480000
18	906660000
19	906840000
20	907020000
21	907200000
22	907380000
23	907560000
24	907740000
25	907920000
26	908100000
27	908280000
28	908460000
29	908640000
30	908820000
31	909000000
32	909180000
33	909360000
34	909540000
35	909720000
36	909900000
37	910080000
38	910260000
39	910440000
40	910620000
41	910800000
42	910980000
43	911160000
44	911340000

Channel	Frequency
45	911520000
46	911700000
47	911880000
48	912060000
49	912240000
50	912420000
51	912600000
52	912780000
53	912960000
54	913140000
55	913320000
56	913500000
57	913680000
58	913860000
59	914040000
60	914220000
61	914400000
62	914580000
63	914760000
64	914940000
65	915120000
66	915300000
67	915480000
68	915660000
69	915840000
70	916020000
71	916200000
72	916380000
73	916560000
74	916740000
75	916920000
76	917100000
77	917280000
78	917460000
79	917640000
80	917820000
81	918000000
82	918180000
83	918360000
84	918540000
85	918720000
86	918900000
87	919080000
88	919260000
89	919440000

Channel	Frequency
90	919620000
91	919800000
92	919980000
93	920160000
94	920340000
95	920520000
96	920700000
97	920880000
98	921060000
99	921240000
100	921420000
101	921600000
102	921780000
103	921960000
104	922140000
105	922320000
106	922500000
107	922680000
108	922860000
109	923040000
110	923220000
111	923400000
112	923580000
113	923760000
114	923940000
115	924120000
116	924300000
117	924480000
118	924660000
119	924840000
120	925020000
121	925200000
122	925380000
123	925560000
124	925740000
125	925920000
126	926100000
127	926280000

Table Index	Channel No.
0	43
1	111
2	117
3	13
4	45
5	24
6	113
7	20
8	7
9	46
10	54
11	25
12	36
13	3
14	108
15	5
16	23
17	124
18	11
19	102
20	58
21	123
22	39
23	15
24	14
25	55
26	120
27	100
28	63
29	4
30	12
31	33
32	71
33	92
34	6
35	127
36	121
37	73
38	1
39	93
40	105
41	77
42	106
43	56
44	82

Table Index	Channel No.
45	60
46	116
47	101
48	118
49	2
50	95
51	119
52	37
53	69
54	41
55	72
56	109
57	76
58	65
59	34
60	112
61	22
62	88
63	110
64	86
65	35
66	75
67	40
68	70
69	59
70	115
71	74
72	53
73	29
74	26
75	81
76	57
77	49
78	48
79	89
80	42
81	80
82	31
83	9
84	68
85	38
86	51
87	19
88	91
89	122

Table Index	Channel No.
90	47
91	78
92	84
93	10
94	16
95	52
96	21
97	64
98	114
99	126
100	90
101	17
102	94
103	66
104	8
105	85
106	32
107	67
108	125
109	50
110	27
111	30
112	62
113	44
114	98
115	107
116	0
117	28
118	96
119	83
120	87
121	79
122	104
123	97
124	18
125	61
126	99
127	103

CHANNEL FREQUENCY HOPPING ALGORITHM

1. There are 128 equally spaced channels that the RMI units use to communicate with a base station.

Frequency selection 128 frequencies are picked within the 902 to 928 MHz band. Each channel is evenly spaced 180 kHz apart. Depending on the sequence each remote chooses, each remote uses a contiguous block of 50 frequencies from the table of 128 possible frequencies.

Pseudo-Random Sequence: when a remote has not yet contacted a base it sends an ACQ packet which contains a 16-bit hop-sequence number. This ACQ packet is sent on all 50 ACQ frequencies, or until a BSC responds to the RMI. The hop sequence number does not describe the ACQ frequency behavior, but rather it describes which channel the RMI will come up on after it is assigned a time slot by the base. The lower 7 bits of the high byte are used to determine the starting point of the sequence in the table. The starting point and the next 49 elements in the table construct the sequence. If the sequence reaches the end of the table, it wraps around the table to get more elements. The lower 7 bits of the low byte are used to determine the current position the sequence. If the current position is outside the sequence, 50 is subtracted from it until it is inside the sequence.

For example: if the hop sequence is 37AB (hex), the starting point is 37 (hex) or 55 (decimal), the current position is 2B (hex) or 43 (decimal). Therefore, the sequence is (referring to the random table above)

{72, 109, 76, 65, 34, 112, 22, 88, 110, 94, 66, 8} (entry 55 to 104)

The first channel used for communication, after acquisition, is calculated by the entry $43 + 128 - 50 - 50 + 71$, which is channel 74. (The addition of 128 performs the wrapping, and subtractions of 50 place the value back into the proper range.) Subsequent communications proceed through the set of 50 channels for this remote.

2. Equal usage of each frequency on average requirement

One hundred twenty eight frequencies are picked within the 902 to 928 MHz band. Each channel is evenly spaced 180 kHz apart.

3. Receiver bandwidth and synchronization requirement

The Whisper RMI uses a Philips UAA2082 narrow-band FSK pager chip as the receiver. This pager contains a data-rate bandwidth Gyration Filter (built-in) that gets the channel bandwidth to that of the transmitted signal. The receiver is commanded by the microcontroller to step in synchronization with transmittal signal.

Each EMI unit uses the channel frequency equally allocated by the base. When the remote is out-of-sync with the base, it will eventually send the ACQ packet with a different hop-sequence so that a different sequence is picked. This will help to resolve a collision when two remotes from two systems happen to choose the same and the same starting point and the same time to transmit. They will continue to interfere each other; after they have lost sync with their bases, they will pick a different sequence. The randomization of timing of remote transmissions also will help to get some packets through. The base will recognize the high failure rate and instruct the remote to move a different point in the sequence to resolve the conflict. This is a better outcome than having the remote attempt a complete re-synchronization.

4. Minimum number of hopping channels requirements from Section 15.247 (a) (1) (i)

One hundred twenty eight hopping channel requirements within 902 to 928 MHz band.

5. Channel dwell time requirement

Channel dwell time 400 msec maximum set by timer.

6. Output power requirements from Section 15.247 (a) (1) (i)

The maximum peak output power of the transmitter is 160mW (+22dBm) which is less than 1 Watt.