

An Examination of 48 kHz WB HF Channel Availability in the US and UK

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- Introduction
- Measurement System Overview
- Results – Expanded to include 48 kHz channels
- Summary / Way Forward

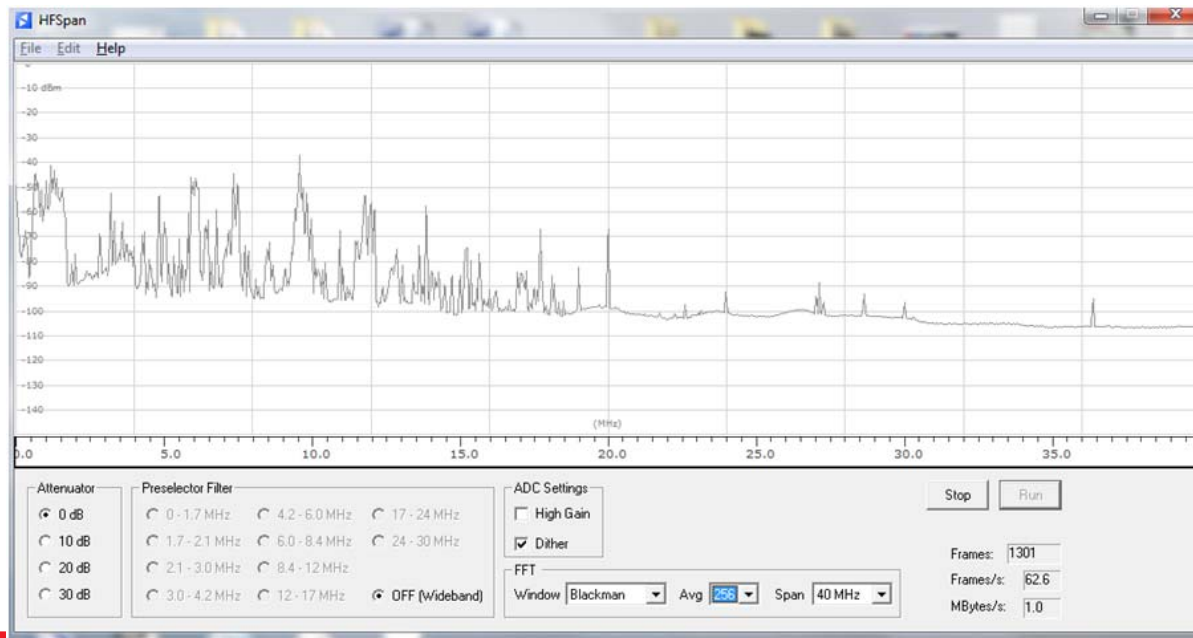
- HF continues to be an important data communications technology
- Increasing need by the user community for higher data rates
- Recent US MIL-STD-188-110C defines a family of wideband HF data waveforms which spans contiguous bandwidths from 3 to 24 kHz
- Other channel–bonding approaches combine multiple 3 kHz channels to achieve higher data rates
- An important consideration when fielding a wideband HF data system is the channel availability
- This presentation extends a presentation given at last years Nordic HF13 Conference, and processes the same collected data to examine 48 kHz channel availability

- Harris has developed an adaptive system that selects the best channel, determines available bandwidth and offset for wideband communications.
- To gauge the suitability of wideband HF over specific links needed to be able to survey and measure channel availability
- Channel availability measurements need a quick revisit time so that links that are suitable for tactical messages, with short wideband ALE signaling and adaptive data link protocols, can be properly detected



- Perseus SDR
 - Full HF Coverage
 - 14 bit 80 MS/s
 - FPGA can shift LO and decimate to 48 kS/s through 2 MS/s
 - USB interface to DSP
 - Software Developers Kit
 - Same SDR as used by Berg
- Clifton Labs Z1501D
 - Active Antenna
 - Short whip
 - 20 kHz to 30 MHz
 - FET to couple to 50 ohm

- Monitoring was done at locations in the Rochester, NY and Wokingham UK area in May and June 2013
- Approximately one week of 24 hour data was collected at each site
- Perseus HFSpan utility used to spot check for any local interference



US Results 3 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
0	0.74	0.57	0.75	0.90	0.82	0.77	0.79	0.75	0.93	0.82	0.88	0.86	0.85	0.86	0.95	0.91	0.96	0.99	0.98	0.98	0.99	0.99	1.00	0.99	0.97	0.94	1.00	0.99	
1	0.76	0.64	0.72	0.85	0.76	0.71	0.83	0.72	0.89	0.78	0.87	0.92	0.86	0.87	0.94	0.90	0.96	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.96	0.90	0.99	0.99	
2	0.82	0.67	0.72	0.83	0.75	0.71	0.83	0.70	0.90	0.78	0.85	0.89	0.85	0.91	0.95	0.91	0.95	0.98	0.99	0.99	1.00	0.99	1.00	0.99	0.98	0.94	0.99	0.99	
3	0.85	0.71	0.74	0.84	0.75	0.75	0.83	0.76	0.93	0.79	0.84	0.87	0.85	0.88	0.96	0.91	0.97	0.99	0.99	0.99	1.00	0.99	1.00	1.00	1.00	0.98	0.99	0.99	
4	0.79	0.71	0.73	0.83	0.75	0.78	0.82	0.80	0.93	0.78	0.86	0.87	0.85	0.84	0.96	0.91	0.98	0.99	0.99	0.99	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.99	
5	0.79	0.71	0.76	0.86	0.78	0.86	0.83	0.86	0.94	0.78	0.87	0.85	0.84	0.83	0.96	0.92	0.97	0.99	0.99	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.99	0.98	
6	0.79	0.71	0.76	0.86	0.81	0.87	0.83	0.89	0.95	0.81	0.88	0.85	0.88	0.84	0.97	0.94	0.99	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99	0.98	0.99	0.98	
7	0.72	0.67	0.72	0.87	0.84	0.92	0.84	0.92	0.96	0.85	0.90	0.87	0.93	0.89	0.98	0.94	0.99	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99	1.00	0.99	
8	0.71	0.68	0.72	0.86	0.87	0.93	0.85	0.92	0.97	0.91	0.93	0.90	0.97	0.95	0.98	0.96	0.99	0.99	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.98	
9	0.69	0.70	0.73	0.88	0.85	0.93	0.87	0.91	0.97	0.92	0.94	0.94	0.98	0.96	0.99	0.97	1.00	0.99	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.99	0.98	
10	0.59	0.61	0.73	0.88	0.87	0.93	0.87	0.87	0.97	0.88	0.94	0.92	0.98	0.93	0.98	0.96	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99	1.00	0.98	
11	0.59	0.59	0.72	0.91	0.91	0.90	0.87	0.85	0.97	0.83	0.91	0.89	0.97	0.86	0.98	0.90	0.99	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99	0.99	0.99	
12	0.64	0.53	0.75	0.94	0.93	0.88	0.91	0.87	0.97	0.82	0.93	0.90	0.95	0.84	0.97	0.86	0.98	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	
13	0.64	0.49	0.77	0.97	0.95	0.88	0.88	0.90	0.96	0.88	0.93	0.90	0.93	0.79	0.97	0.86	0.98	1.00	0.99	0.97	1.00	1.00	1.00	1.00	0.99	0.98	1.00	1.00	
14	0.67	0.49	0.76	0.98	0.95	0.91	0.85	0.93	0.97	0.89	0.93	0.90	0.92	0.78	0.97	0.86	0.98	0.99	0.99	0.97	0.99	1.00	1.00	1.00	1.00	0.97	0.99	0.99	
15	0.68	0.51	0.75	0.98	0.94	0.95	0.87	0.94	0.98	0.91	0.93	0.91	0.92	0.81	0.98	0.88	0.98	1.00	1.00	0.97	0.99	0.99	1.00	1.00	0.99	0.97	0.99	0.99	
16	0.73	0.50	0.75	0.97	0.95	0.97	0.88	0.95	0.97	0.94	0.93	0.91	0.93	0.80	0.97	0.92	0.98	0.99	0.99	0.97	0.99	0.99	1.00	1.00	1.00	0.96	0.98	0.98	
17	0.73	0.50	0.76	0.98	0.96	0.97	0.86	0.95	0.98	0.93	0.94	0.90	0.94	0.78	0.97	0.89	0.97	0.99	0.99	0.96	0.99	0.99	0.99	1.00	0.99	0.96	0.99	0.98	
18	0.74	0.50	0.76	0.97	0.95	0.97	0.85	0.94	0.98	0.94	0.93	0.88	0.96	0.80	0.97	0.90	0.97	0.99	1.00	0.97	1.00	0.99	0.99	1.00	0.99	0.96	1.00	0.99	
19	0.74	0.54	0.76	0.98	0.95	0.97	0.85	0.94	0.98	0.92	0.91	0.90	0.95	0.82	0.97	0.92	0.98	0.99	1.00	0.97	0.99	0.99	0.99	0.99	0.99	0.97	0.94	1.00	0.98
20	0.76	0.56	0.78	0.97	0.94	0.95	0.85	0.92	0.98	0.87	0.89	0.91	0.93	0.83	0.98	0.91	0.98	0.99	0.99	0.98	0.99	0.98	0.99	0.99	0.98	0.96	0.99	0.99	
21	0.77	0.57	0.79	0.98	0.94	0.94	0.85	0.88	0.98	0.85	0.87	0.91	0.92	0.86	0.97	0.91	0.96	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.95	0.99	0.98	
22	0.74	0.59	0.79	0.97	0.92	0.89	0.82	0.83	0.96	0.86	0.87	0.90	0.90	0.89	0.96	0.90	0.96	0.99	0.99	0.97	0.98	0.98	0.99	0.99	0.96	0.95	0.98	0.99	
23	0.76	0.61	0.78	0.95	0.89	0.84	0.80	0.76	0.95	0.86	0.89	0.87	0.87	0.87	0.96	0.91	0.96	0.99	0.99	0.98	0.99	0.98	0.99	0.99	0.97	0.95	0.99	0.99	

US Results 12 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.71	0.50	0.70	0.85	0.72	0.66	0.69	0.62	0.88	0.74	0.80	0.76	0.76	0.76	0.91	0.85	0.93	0.98	0.98	0.96	0.98	0.98	0.99	0.99	0.94	0.90	0.99	0.99
1	0.71	0.55	0.63	0.78	0.64	0.58	0.72	0.60	0.83	0.67	0.78	0.84	0.76	0.78	0.91	0.83	0.93	0.98	0.99	0.97	0.98	0.99	0.99	0.99	0.94	0.84	0.99	0.98
2	0.78	0.56	0.62	0.77	0.63	0.59	0.73	0.58	0.84	0.67	0.74	0.83	0.76	0.83	0.91	0.84	0.93	0.98	0.98	0.99	0.99	0.98	0.99	0.99	0.97	0.90	0.99	0.99
3	0.81	0.61	0.65	0.77	0.64	0.62	0.73	0.64	0.87	0.69	0.73	0.79	0.77	0.80	0.93	0.85	0.95	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00	0.96	0.99	1.00
4	0.75	0.62	0.63	0.76	0.65	0.67	0.71	0.68	0.87	0.67	0.74	0.79	0.77	0.74	0.93	0.85	0.96	0.99	0.99	0.99	1.00	0.99	1.00	1.00	1.00	0.96	0.97	0.99
5	0.75	0.63	0.66	0.79	0.69	0.75	0.72	0.75	0.89	0.69	0.76	0.76	0.76	0.72	0.94	0.87	0.95	0.99	0.99	0.99	1.00	0.98	0.99	1.00	0.99	0.97	0.99	0.98
6	0.75	0.63	0.68	0.81	0.73	0.78	0.74	0.80	0.90	0.70	0.78	0.75	0.80	0.74	0.95	0.89	0.98	0.99	0.99	1.00	1.00	0.97	1.00	1.00	0.99	0.97	0.99	0.98
7	0.68	0.59	0.65	0.82	0.76	0.87	0.74	0.85	0.92	0.76	0.81	0.80	0.88	0.81	0.96	0.89	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	1.00	0.99	0.99	0.99
8	0.67	0.61	0.65	0.81	0.80	0.89	0.77	0.86	0.95	0.85	0.87	0.84	0.95	0.91	0.97	0.93	0.98	0.99	1.00	1.00	1.00	0.98	0.99	1.00	0.99	0.97	0.97	0.98
9	0.65	0.61	0.65	0.84	0.78	0.90	0.80	0.85	0.95	0.87	0.90	0.89	0.96	0.91	0.98	0.95	0.99	0.99	1.00	1.00	1.00	0.99	1.00	1.00	0.99	0.97	0.99	0.98
10	0.55	0.53	0.66	0.84	0.79	0.88	0.79	0.78	0.95	0.79	0.89	0.86	0.97	0.88	0.96	0.92	0.99	1.00	0.99	1.00	1.00	0.99	0.99	1.00	0.99	0.98	0.99	0.98
11	0.56	0.50	0.68	0.87	0.85	0.84	0.79	0.74	0.96	0.72	0.84	0.81	0.95	0.76	0.96	0.83	0.98	1.00	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.98	0.99	0.99
12	0.60	0.47	0.72	0.91	0.89	0.81	0.85	0.79	0.95	0.73	0.88	0.82	0.92	0.74	0.94	0.77	0.97	0.99	1.00	0.97	1.00	0.99	1.00	1.00	0.99	0.98	0.99	1.00
13	0.60	0.44	0.74	0.96	0.92	0.81	0.82	0.85	0.94	0.79	0.88	0.83	0.88	0.68	0.95	0.77	0.96	0.99	0.99	0.95	0.99	0.99	1.00	1.00	0.99	0.97	0.99	1.00
14	0.64	0.44	0.73	0.98	0.92	0.85	0.81	0.88	0.96	0.83	0.88	0.84	0.87	0.66	0.94	0.77	0.96	0.99	0.99	0.95	0.99	0.99	1.00	1.00	0.99	0.95	0.98	0.99
15	0.65	0.46	0.73	0.98	0.92	0.92	0.84	0.90	0.97	0.86	0.88	0.85	0.86	0.70	0.95	0.81	0.96	0.99	1.00	0.95	0.99	0.99	1.00	1.00	0.99	0.94	0.99	0.99
16	0.70	0.45	0.72	0.97	0.92	0.95	0.84	0.91	0.96	0.90	0.89	0.83	0.88	0.68	0.94	0.87	0.95	0.98	0.99	0.95	0.98	0.97	1.00	0.99	0.99	0.93	0.97	0.98
17	0.70	0.45	0.74	0.98	0.93	0.95	0.82	0.92	0.97	0.89	0.90	0.82	0.90	0.65	0.94	0.81	0.95	0.99	0.98	0.93	0.98	0.99	0.99	1.00	0.98	0.92	0.98	0.98
18	0.70	0.45	0.73	0.97	0.92	0.95	0.82	0.90	0.97	0.89	0.88	0.80	0.92	0.69	0.95	0.83	0.95	0.99	1.00	0.95	1.00	0.98	0.98	1.00	0.98	0.93	0.99	0.98
19	0.70	0.49	0.73	0.97	0.93	0.95	0.81	0.90	0.97	0.85	0.84	0.84	0.90	0.74	0.95	0.86	0.96	0.98	0.99	0.95	0.99	0.98	0.98	0.99	0.95	0.90	0.99	0.98
20	0.72	0.51	0.75	0.96	0.92	0.92	0.81	0.86	0.98	0.77	0.81	0.85	0.87	0.75	0.96	0.85	0.95	0.99	0.98	0.97	0.99	0.97	0.98	0.99	0.97	0.93	0.99	0.98
21	0.73	0.53	0.76	0.97	0.91	0.89	0.80	0.80	0.97	0.76	0.78	0.85	0.86	0.80	0.94	0.86	0.94	0.98	0.98	0.97	0.99	0.98	0.98	0.99	0.94	0.91	0.98	0.98
22	0.70	0.54	0.77	0.97	0.88	0.81	0.76	0.73	0.94	0.77	0.79	0.83	0.83	0.83	0.93	0.85	0.93	0.99	0.98	0.95	0.97	0.97	0.98	0.98	0.94	0.91	0.97	0.98
23	0.72	0.56	0.74	0.93	0.82	0.74	0.71	0.64	0.92	0.78	0.82	0.79	0.78	0.79	0.92	0.87	0.93	0.99	0.99	0.96	0.98	0.97	0.99	0.98	0.95	0.91	0.98	0.99

US Results 24 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
0	0.67	0.44	0.63	0.80	0.62	0.57	0.59	0.49	0.83	0.61	0.70	0.69	0.68	0.67	0.87	0.80	0.91	0.98	0.97	0.95	0.98	0.99	0.99	0.99	0.92	0.85	0.99	0.99	
1	0.66	0.45	0.53	0.70	0.51	0.48	0.63	0.50	0.77	0.54	0.68	0.79	0.67	0.70	0.87	0.75	0.90	0.98	0.99	0.96	0.97	0.99	0.98	0.99	0.91	0.79	0.98	0.98	
2	0.71	0.46	0.53	0.69	0.51	0.49	0.63	0.47	0.77	0.54	0.60	0.76	0.69	0.75	0.86	0.76	0.90	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.95	0.86	0.99	0.99	
3	0.76	0.51	0.55	0.70	0.52	0.52	0.64	0.52	0.81	0.58	0.61	0.69	0.70	0.72	0.90	0.78	0.93	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00	0.94	0.99	1.00	
4	0.70	0.52	0.53	0.68	0.55	0.56	0.62	0.57	0.81	0.55	0.64	0.69	0.70	0.64	0.90	0.79	0.95	0.98	0.99	0.99	1.00	0.99	1.00	1.00	1.00	0.95	0.97	0.99	
5	0.70	0.54	0.55	0.71	0.58	0.65	0.61	0.66	0.83	0.57	0.65	0.66	0.68	0.62	0.91	0.83	0.94	0.99	0.98	0.99	1.00	0.98	0.99	1.00	0.99	0.96	0.99	0.98	
6	0.70	0.55	0.59	0.74	0.65	0.70	0.64	0.70	0.86	0.55	0.66	0.66	0.73	0.63	0.92	0.83	0.97	0.99	0.99	1.00	1.00	0.97	0.99	1.00	0.99	0.97	0.99	0.98	
7	0.63	0.51	0.56	0.75	0.70	0.81	0.66	0.77	0.89	0.66	0.72	0.72	0.84	0.71	0.95	0.83	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	1.00	0.99	0.99	0.99	
8	0.62	0.53	0.56	0.74	0.73	0.83	0.69	0.80	0.92	0.78	0.81	0.79	0.93	0.87	0.96	0.90	0.98	0.99	0.99	1.00	1.00	0.98	0.99	1.00	0.99	0.97	0.97	0.98	
9	0.60	0.53	0.55	0.77	0.71	0.84	0.74	0.79	0.93	0.80	0.85	0.85	0.95	0.87	0.97	0.92	0.99	0.99	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.97	0.99	0.98	
10	0.51	0.46	0.58	0.78	0.73	0.82	0.72	0.68	0.93	0.68	0.85	0.80	0.96	0.81	0.94	0.88	0.99	0.99	0.99	1.00	1.00	0.99	0.99	1.00	0.99	0.97	0.99	0.98	
11	0.52	0.43	0.64	0.82	0.79	0.76	0.72	0.64	0.94	0.59	0.81	0.72	0.93	0.65	0.93	0.75	0.98	1.00	1.00	0.99	1.00	0.99	0.99	1.00	1.00	0.97	0.99	0.99	
12	0.56	0.41	0.69	0.89	0.86	0.72	0.80	0.69	0.94	0.60	0.85	0.72	0.88	0.60	0.91	0.67	0.96	0.99	1.00	0.96	1.00	1.00	1.00	1.00	1.00	0.99	0.98	1.00	1.00
13	0.57	0.39	0.72	0.95	0.90	0.75	0.77	0.79	0.92	0.67	0.84	0.75	0.83	0.56	0.92	0.66	0.96	0.99	0.98	0.94	0.99	1.00	1.00	1.00	1.00	0.98	0.96	1.00	1.00
14	0.60	0.40	0.71	0.98	0.90	0.79	0.77	0.85	0.95	0.75	0.84	0.78	0.81	0.54	0.91	0.66	0.95	0.98	0.99	0.92	0.99	0.99	0.99	1.00	0.99	0.93	0.99	0.99	
15	0.62	0.41	0.70	0.98	0.89	0.87	0.80	0.87	0.96	0.81	0.84	0.78	0.81	0.58	0.93	0.71	0.95	0.99	1.00	0.93	0.99	0.99	1.00	1.00	0.98	0.92	0.99	0.99	
16	0.65	0.40	0.69	0.96	0.90	0.92	0.80	0.89	0.95	0.86	0.85	0.77	0.83	0.55	0.91	0.80	0.94	0.98	0.99	0.92	0.98	0.97	0.99	0.99	0.99	0.90	0.97	0.98	
17	0.66	0.41	0.72	0.98	0.92	0.92	0.79	0.90	0.96	0.85	0.86	0.76	0.85	0.52	0.91	0.73	0.94	0.99	0.98	0.89	0.97	0.99	0.98	1.00	0.98	0.89	0.98	0.98	
18	0.66	0.41	0.70	0.97	0.90	0.93	0.78	0.87	0.97	0.84	0.83	0.74	0.88	0.58	0.92	0.76	0.94	0.98	0.99	0.93	1.00	0.99	0.98	1.00	0.97	0.90	0.99	0.98	
19	0.66	0.45	0.70	0.97	0.92	0.92	0.77	0.85	0.97	0.78	0.79	0.75	0.85	0.65	0.93	0.79	0.94	0.98	0.99	0.93	0.99	0.98	0.98	0.98	0.94	0.87	0.99	0.98	
20	0.68	0.47	0.72	0.96	0.89	0.88	0.77	0.79	0.97	0.68	0.74	0.78	0.82	0.67	0.94	0.79	0.94	0.99	0.98	0.96	0.99	0.97	0.98	0.99	0.95	0.90	0.99	0.98	
21	0.69	0.49	0.73	0.97	0.88	0.84	0.76	0.68	0.96	0.67	0.72	0.78	0.80	0.73	0.90	0.81	0.91	0.98	0.98	0.96	0.98	0.98	0.98	0.98	0.98	0.92	0.87	0.98	0.98
22	0.65	0.49	0.75	0.97	0.83	0.75	0.71	0.59	0.92	0.65	0.71	0.76	0.76	0.75	0.89	0.81	0.90	0.99	0.98	0.92	0.96	0.97	0.98	0.98	0.91	0.86	0.97	0.98	
23	0.69	0.51	0.70	0.92	0.75	0.65	0.64	0.52	0.88	0.69	0.73	0.71	0.70	0.70	0.88	0.82	0.91	0.99	0.99	0.93	0.98	0.97	0.98	0.98	0.93	0.86	0.98	0.99	

US Results 48 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.60	0.37	0.53	0.72	0.48	0.46	0.48	0.32	0.74	0.47	0.58	0.54	0.56	0.48	0.82	0.69	0.87	0.98	0.96	0.93	0.96	0.98	0.97	0.99	0.88	0.78	0.99	0.98
1	0.58	0.36	0.41	0.62	0.39	0.38	0.50	0.33	0.65	0.38	0.57	0.67	0.56	0.53	0.82	0.63	0.86	0.98	0.99	0.94	0.96	0.98	0.97	0.99	0.86	0.73	0.97	0.97
2	0.63	0.35	0.42	0.62	0.36	0.36	0.51	0.30	0.64	0.37	0.48	0.64	0.58	0.60	0.79	0.66	0.85	0.97	0.98	0.97	0.99	0.98	0.98	0.98	0.91	0.81	0.99	0.99
3	0.70	0.40	0.42	0.63	0.37	0.37	0.51	0.36	0.70	0.40	0.50	0.55	0.60	0.56	0.84	0.69	0.89	0.98	0.98	0.98	0.99	0.99	1.00	1.00	1.00	0.93	0.99	0.99
4	0.65	0.41	0.38	0.61	0.38	0.41	0.48	0.44	0.71	0.35	0.54	0.56	0.60	0.49	0.85	0.70	0.93	0.98	0.99	0.98	0.99	0.98	0.99	1.00	0.99	0.94	0.97	0.99
5	0.65	0.45	0.43	0.64	0.43	0.47	0.45	0.49	0.73	0.40	0.50	0.52	0.56	0.44	0.87	0.73	0.92	0.99	0.97	0.99	1.00	0.97	0.98	1.00	1.00	0.95	0.99	0.98
6	0.65	0.47	0.47	0.69	0.50	0.52	0.49	0.55	0.75	0.39	0.51	0.55	0.62	0.49	0.88	0.74	0.96	0.99	0.99	1.00	1.00	0.96	0.99	1.00	0.99	0.96	0.99	0.97
7	0.58	0.42	0.43	0.69	0.55	0.67	0.53	0.65	0.80	0.55	0.60	0.62	0.75	0.60	0.92	0.74	0.98	1.00	1.00	1.00	1.00	0.99	0.98	1.00	0.99	0.98	0.99	0.98
8	0.57	0.45	0.42	0.68	0.58	0.70	0.59	0.69	0.88	0.66	0.72	0.68	0.89	0.80	0.94	0.84	0.98	0.99	1.00	1.00	1.00	0.98	0.99	1.00	0.99	0.96	0.96	0.97
9	0.54	0.44	0.40	0.70	0.59	0.73	0.63	0.69	0.89	0.66	0.78	0.73	0.94	0.78	0.96	0.87	0.99	0.99	1.00	1.00	1.00	0.98	0.99	1.00	1.00	0.97	0.99	0.97
10	0.45	0.36	0.44	0.73	0.62	0.70	0.60	0.55	0.89	0.56	0.77	0.66	0.95	0.66	0.93	0.83	0.99	0.99	0.99	1.00	1.00	0.98	0.98	1.00	0.99	0.96	0.99	0.98
11	0.44	0.34	0.57	0.76	0.69	0.64	0.60	0.49	0.92	0.48	0.73	0.56	0.89	0.47	0.91	0.68	0.97	1.00	1.00	0.99	1.00	0.99	0.98	1.00	1.00	0.98	0.99	0.99
12	0.48	0.36	0.65	0.85	0.78	0.65	0.71	0.57	0.90	0.49	0.77	0.59	0.83	0.39	0.86	0.53	0.95	1.00	1.00	0.93	1.00	1.00	1.00	1.00	0.98	0.98	1.00	1.00
13	0.49	0.35	0.71	0.94	0.86	0.67	0.69	0.72	0.88	0.54	0.76	0.64	0.76	0.38	0.87	0.54	0.93	0.99	0.98	0.89	0.99	1.00	1.00	1.00	0.97	0.95	1.00	1.00
14	0.51	0.37	0.69	0.99	0.88	0.70	0.72	0.78	0.94	0.65	0.76	0.66	0.72	0.36	0.87	0.54	0.91	0.98	0.99	0.89	0.98	0.99	0.99	0.99	0.98	0.91	0.98	0.99
15	0.54	0.39	0.68	0.98	0.86	0.79	0.76	0.81	0.95	0.74	0.75	0.69	0.72	0.37	0.89	0.56	0.93	0.99	1.00	0.91	0.99	0.99	0.99	0.99	1.00	0.97	0.88	0.99
16	0.59	0.38	0.67	0.97	0.89	0.88	0.75	0.85	0.94	0.82	0.74	0.64	0.74	0.35	0.87	0.67	0.91	0.97	0.99	0.90	0.97	0.96	0.99	0.99	0.98	0.87	0.97	0.98
17	0.60	0.38	0.70	0.98	0.90	0.88	0.75	0.84	0.94	0.78	0.76	0.64	0.78	0.33	0.87	0.57	0.90	0.98	0.98	0.85	0.97	0.98	0.97	1.00	0.97	0.84	0.97	0.97
18	0.61	0.39	0.67	0.97	0.87	0.89	0.74	0.81	0.96	0.73	0.75	0.61	0.81	0.40	0.89	0.57	0.91	0.98	0.99	0.89	1.00	0.97	0.97	1.00	0.95	0.87	0.99	0.98
19	0.60	0.42	0.66	0.97	0.89	0.88	0.74	0.76	0.96	0.66	0.69	0.61	0.76	0.54	0.90	0.65	0.91	0.98	0.99	0.89	0.99	0.96	0.96	0.98	0.91	0.84	0.99	0.98
20	0.62	0.43	0.69	0.96	0.85	0.83	0.73	0.66	0.96	0.59	0.63	0.64	0.72	0.55	0.91	0.66	0.90	0.98	0.97	0.93	0.98	0.96	0.97	0.98	0.92	0.87	0.98	0.97
21	0.62	0.46	0.70	0.96	0.83	0.75	0.71	0.53	0.94	0.59	0.60	0.66	0.69	0.60	0.85	0.72	0.87	0.98	0.97	0.96	0.96	0.97	0.97	0.97	0.88	0.82	0.97	0.97
22	0.58	0.47	0.72	0.97	0.76	0.63	0.65	0.45	0.87	0.56	0.59	0.63	0.65	0.64	0.83	0.72	0.86	0.98	0.97	0.90	0.93	0.95	0.96	0.97	0.86	0.81	0.96	0.98
23	0.62	0.46	0.65	0.88	0.63	0.51	0.53	0.38	0.80	0.56	0.61	0.55	0.59	0.57	0.84	0.74	0.87	0.98	0.99	0.92	0.96	0.96	0.96	0.98	0.89	0.80	0.97	0.98

- Availability does decrease as bandwidth increases
- Increased occupancy noted during evening hours
- As expected high availability noted for higher (non-propagating) frequencies
- Overall availability defined as 24 hr average 2-15 MHz
- 3 KHz bandwidth very high availability- Overall 85%
- 12 kHz slightly less availability – Overall 78%
- 24 kHz availability still greater than 50% during evening hours and greater than 75% during daytime hours
Overall 72%
- 48 kHz availability - Overall 63%

UK Results 3 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.81	0.91	0.57	0.66	0.49	0.72	0.71	0.66	0.96	0.88	0.87	0.77	0.91	0.88	0.95	0.91	0.92	0.98	0.98	0.99	1.00	1.00	0.91	1.00	0.99	0.95	0.99	0.98
1	0.81	0.91	0.52	0.61	0.45	0.75	0.71	0.65	0.96	0.88	0.84	0.77	0.95	0.91	0.96	0.90	0.92	0.98	0.98	0.99	1.00	1.00	0.92	0.99	0.99	0.97	0.99	0.98
2	0.81	0.92	0.52	0.60	0.51	0.78	0.70	0.64	0.97	0.87	0.80	0.79	0.97	0.94	0.96	0.92	0.93	0.98	0.98	0.99	1.00	1.00	0.94	1.00	0.99	0.99	0.98	0.98
3	0.82	0.92	0.52	0.58	0.54	0.81	0.69	0.75	0.97	0.89	0.84	0.80	0.97	0.94	0.96	0.93	0.94	0.98	0.98	0.99	1.00	1.00	0.94	1.00	0.99	0.99	0.99	0.97
4	0.85	0.93	0.58	0.61	0.58	0.81	0.73	0.79	0.98	0.89	0.83	0.82	0.97	0.90	0.95	0.92	0.93	0.98	0.98	0.99	1.00	1.00	0.91	1.00	0.99	0.99	0.99	0.98
5	0.90	0.93	0.61	0.64	0.59	0.86	0.71	0.87	0.98	0.86	0.84	0.84	0.95	0.84	0.94	0.90	0.93	0.97	0.98	0.99	1.00	1.00	0.88	0.99	0.99	0.99	0.99	0.98
6	0.93	0.95	0.55	0.68	0.56	0.87	0.70	0.87	0.98	0.84	0.87	0.82	0.93	0.81	0.95	0.81	0.93	0.97	0.98	0.99	1.00	0.99	0.92	1.00	0.99	0.99	0.98	0.98
7	0.96	0.99	0.65	0.69	0.72	0.86	0.72	0.90	0.98	0.90	0.90	0.88	0.94	0.84	0.93	0.71	0.92	0.97	0.97	0.98	1.00	0.99	0.90	1.00	0.99	0.99	0.99	0.98
8	0.97	0.99	0.63	0.73	0.71	0.87	0.72	0.94	0.98	0.92	0.90	0.86	0.97	0.90	0.94	0.77	0.92	0.97	0.97	0.99	0.99	1.00	0.89	1.00	0.99	0.98	0.99	0.98
9	0.98	1.00	0.66	0.74	0.75	0.91	0.75	0.95	0.99	0.95	0.90	0.91	0.98	0.89	0.94	0.82	0.93	0.98	0.98	0.98	1.00	1.00	0.91	1.00	0.99	0.99	0.99	0.98
10	0.98	1.00	0.66	0.71	0.76	0.94	0.71	0.97	0.98	0.97	0.91	0.94	0.98	0.90	0.94	0.82	0.93	0.97	0.98	0.96	1.00	0.99	0.89	1.00	0.99	0.98	0.99	0.98
11	0.98	1.00	0.66	0.73	0.76	0.95	0.77	0.98	0.98	0.98	0.93	0.93	0.98	0.88	0.94	0.80	0.94	0.95	0.97	0.95	1.00	1.00	0.93	1.00	0.99	0.99	0.98	0.98
12	0.98	1.00	0.65	0.72	0.78	0.95	0.82	0.98	0.99	0.98	0.95	0.89	0.97	0.87	0.94	0.80	0.93	0.96	0.98	0.94	1.00	1.00	0.93	1.00	0.99	0.99	0.98	0.98
13	0.98	1.00	0.68	0.73	0.76	0.96	0.83	0.96	0.98	0.97	0.93	0.86	0.97	0.83	0.93	0.76	0.92	0.97	0.98	0.94	1.00	1.00	0.94	1.00	0.99	0.99	0.99	0.98
14	0.97	0.99	0.70	0.73	0.75	0.97	0.83	0.95	0.98	0.96	0.92	0.89	0.98	0.79	0.93	0.77	0.92	0.98	0.98	0.96	1.00	1.00	0.93	1.00	0.98	0.99	0.99	0.98
15	0.99	1.00	0.66	0.73	0.74	0.97	0.82	0.92	0.98	0.92	0.90	0.86	0.97	0.77	0.94	0.78	0.93	0.98	0.98	0.96	1.00	1.00	0.94	1.00	0.99	0.99	0.98	0.98
16	0.93	0.98	0.68	0.75	0.75	0.93	0.85	0.85	0.98	0.85	0.87	0.81	0.97	0.69	0.94	0.85	0.93	0.98	0.98	0.97	1.00	1.00	0.95	1.00	0.99	0.99	0.98	0.98
17	0.84	0.95	0.72	0.78	0.74	0.85	0.86	0.75	0.98	0.76	0.83	0.83	0.97	0.68	0.94	0.84	0.92	0.98	0.98	0.96	1.00	1.00	0.94	1.00	0.98	0.98	0.99	0.98
18	0.89	0.97	0.68	0.71	0.71	0.76	0.79	0.61	0.96	0.67	0.83	0.80	0.94	0.70	0.94	0.84	0.90	0.97	0.98	0.96	1.00	1.00	0.94	1.00	0.98	0.97	0.98	0.98
19	0.84	0.95	0.69	0.70	0.60	0.64	0.72	0.52	0.95	0.66	0.76	0.78	0.90	0.75	0.93	0.84	0.90	0.97	0.97	0.95	1.00	1.00	0.93	1.00	0.98	0.96	0.98	0.98
20	0.88	0.95	0.70	0.70	0.55	0.50	0.70	0.49	0.94	0.65	0.78	0.79	0.86	0.75	0.93	0.86	0.90	0.97	0.98	0.97	1.00	1.00	0.94	1.00	0.99	0.97	0.98	0.98
21	0.86	0.91	0.74	0.71	0.54	0.45	0.69	0.53	0.93	0.69	0.83	0.81	0.84	0.79	0.93	0.89	0.90	0.97	0.98	0.98	1.00	1.00	0.87	1.00	0.99	0.97	0.98	0.98
22	0.79	0.90	0.67	0.75	0.55	0.56	0.72	0.65	0.95	0.75	0.87	0.87	0.87	0.85	0.94	0.90	0.92	0.97	0.98	0.99	1.00	0.99	0.89	1.00	0.98	0.98	0.99	0.98
23	0.79	0.91	0.65	0.77	0.54	0.63	0.71	0.63	0.94	0.80	0.89	0.85	0.88	0.88	0.95	0.91	0.92	0.97	0.98	0.99	1.00	0.99	0.91	1.00	0.99	0.98	0.98	0.98

UK Results 12 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.71	0.85	0.46	0.57	0.35	0.56	0.58	0.52	0.92	0.78	0.79	0.69	0.87	0.79	0.89	0.82	0.81	0.96	0.95	0.99	1.00	0.99	0.83	0.99	0.98	0.93	0.97	0.96
1	0.71	0.85	0.42	0.51	0.32	0.61	0.58	0.51	0.92	0.79	0.76	0.71	0.91	0.85	0.89	0.80	0.81	0.96	0.95	0.99	1.00	0.99	0.85	0.99	0.98	0.95	0.96	0.95
2	0.71	0.86	0.43	0.51	0.39	0.63	0.59	0.46	0.93	0.77	0.73	0.76	0.95	0.88	0.90	0.83	0.82	0.96	0.95	0.99	1.00	0.99	0.87	1.00	0.98	0.99	0.96	0.95
3	0.72	0.86	0.44	0.48	0.42	0.68	0.59	0.60	0.95	0.80	0.77	0.75	0.95	0.89	0.88	0.84	0.83	0.96	0.95	0.99	1.00	0.98	0.85	1.00	0.98	0.99	0.96	0.94
4	0.76	0.89	0.50	0.52	0.47	0.70	0.63	0.66	0.96	0.81	0.75	0.77	0.94	0.81	0.87	0.82	0.83	0.95	0.95	0.99	1.00	0.98	0.81	0.99	0.98	0.99	0.96	0.95
5	0.83	0.90	0.55	0.57	0.47	0.77	0.61	0.79	0.95	0.76	0.76	0.78	0.92	0.73	0.85	0.80	0.82	0.95	0.95	0.98	0.99	0.98	0.76	0.99	0.98	0.99	0.96	0.95
6	0.88	0.93	0.51	0.63	0.47	0.77	0.60	0.80	0.95	0.72	0.81	0.75	0.89	0.68	0.87	0.66	0.82	0.94	0.95	0.97	0.99	0.98	0.82	0.99	0.97	0.98	0.96	0.95
7	0.93	0.98	0.61	0.66	0.64	0.78	0.63	0.84	0.95	0.81	0.83	0.82	0.90	0.73	0.83	0.52	0.81	0.95	0.94	0.96	0.99	0.98	0.79	0.99	0.97	0.98	0.97	0.95
8	0.95	0.98	0.59	0.71	0.65	0.79	0.63	0.90	0.96	0.86	0.83	0.80	0.94	0.82	0.86	0.62	0.82	0.95	0.94	0.97	0.99	0.99	0.79	0.99	0.98	0.97	0.97	0.95
9	0.97	0.99	0.63	0.72	0.69	0.86	0.67	0.93	0.97	0.91	0.84	0.86	0.96	0.80	0.86	0.68	0.83	0.96	0.95	0.95	1.00	0.98	0.83	0.99	0.98	0.98	0.97	0.95
10	0.96	1.00	0.63	0.69	0.70	0.89	0.64	0.96	0.96	0.95	0.86	0.91	0.96	0.82	0.85	0.68	0.82	0.94	0.95	0.92	1.00	0.98	0.78	0.99	0.98	0.97	0.97	0.95
11	0.97	1.00	0.63	0.71	0.72	0.91	0.71	0.97	0.96	0.97	0.88	0.88	0.96	0.79	0.86	0.65	0.83	0.91	0.94	0.90	1.00	0.99	0.85	0.99	0.98	0.97	0.96	0.95
12	0.96	1.00	0.63	0.70	0.74	0.91	0.76	0.96	0.97	0.96	0.90	0.84	0.95	0.76	0.86	0.66	0.82	0.92	0.95	0.90	1.00	0.99	0.84	0.99	0.98	0.98	0.95	0.96
13	0.98	1.00	0.66	0.71	0.71	0.93	0.77	0.92	0.96	0.94	0.88	0.78	0.95	0.68	0.85	0.61	0.82	0.94	0.95	0.90	1.00	0.99	0.88	0.99	0.97	0.98	0.97	0.96
14	0.95	0.99	0.67	0.70	0.69	0.95	0.76	0.92	0.96	0.93	0.87	0.82	0.96	0.61	0.85	0.62	0.82	0.96	0.96	0.93	1.00	0.99	0.86	0.99	0.97	0.98	0.96	0.96
15	0.98	1.00	0.63	0.72	0.68	0.93	0.74	0.86	0.96	0.86	0.83	0.79	0.94	0.61	0.86	0.62	0.82	0.96	0.96	0.93	1.00	0.99	0.88	0.99	0.97	0.98	0.96	0.96
16	0.88	0.96	0.65	0.71	0.68	0.86	0.77	0.75	0.96	0.74	0.78	0.73	0.94	0.50	0.85	0.73	0.83	0.95	0.95	0.94	1.00	0.99	0.89	0.99	0.97	0.98	0.96	0.96
17	0.75	0.88	0.67	0.70	0.63	0.73	0.77	0.56	0.95	0.60	0.71	0.74	0.93	0.52	0.86	0.70	0.81	0.95	0.95	0.93	1.00	0.99	0.87	0.99	0.95	0.97	0.97	0.96
18	0.82	0.93	0.62	0.64	0.59	0.60	0.67	0.42	0.93	0.51	0.71	0.70	0.88	0.54	0.85	0.70	0.79	0.93	0.96	0.93	0.99	0.99	0.87	0.99	0.96	0.95	0.96	0.95
19	0.76	0.90	0.63	0.62	0.46	0.46	0.59	0.34	0.91	0.47	0.64	0.68	0.83	0.61	0.85	0.72	0.79	0.94	0.94	0.91	0.99	0.99	0.86	1.00	0.96	0.93	0.95	0.96
20	0.81	0.91	0.62	0.61	0.40	0.32	0.56	0.32	0.88	0.48	0.67	0.71	0.77	0.58	0.84	0.74	0.79	0.95	0.95	0.93	0.99	0.99	0.87	0.99	0.97	0.95	0.95	0.95
21	0.78	0.85	0.63	0.63	0.38	0.28	0.54	0.36	0.87	0.52	0.71	0.74	0.74	0.65	0.84	0.79	0.79	0.94	0.95	0.96	0.99	0.98	0.76	0.99	0.97	0.94	0.95	0.96
22	0.69	0.84	0.57	0.66	0.40	0.39	0.58	0.49	0.90	0.59	0.78	0.80	0.80	0.75	0.87	0.79	0.82	0.94	0.96	0.98	1.00	0.98	0.81	0.99	0.97	0.97	0.97	0.97
23	0.69	0.84	0.53	0.67	0.39	0.47	0.58	0.50	0.89	0.68	0.81	0.78	0.82	0.79	0.87	0.82	0.82	0.94	0.96	0.99	1.00	0.98	0.83	0.99	0.98	0.97	0.96	0.96

UK Results 24 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.59	0.77	0.39	0.48	0.21	0.39	0.45	0.39	0.89	0.68	0.70	0.61	0.82	0.67	0.82	0.70	0.76	0.94	0.93	0.99	1.00	0.98	0.76	0.99	0.98	0.90	0.97	0.94
1	0.58	0.76	0.34	0.41	0.20	0.46	0.47	0.35	0.90	0.70	0.66	0.66	0.87	0.73	0.82	0.69	0.77	0.94	0.93	0.99	1.00	0.98	0.77	0.99	0.98	0.93	0.96	0.92
2	0.59	0.79	0.37	0.41	0.27	0.48	0.48	0.32	0.91	0.65	0.64	0.72	0.93	0.80	0.83	0.75	0.78	0.94	0.93	0.98	1.00	0.99	0.81	0.99	0.98	0.98	0.95	0.91
3	0.59	0.78	0.40	0.38	0.30	0.54	0.50	0.44	0.93	0.72	0.68	0.71	0.93	0.81	0.82	0.77	0.80	0.94	0.93	0.98	1.00	0.99	0.78	0.99	0.98	0.98	0.95	0.90
4	0.64	0.84	0.44	0.42	0.35	0.57	0.54	0.53	0.95	0.73	0.67	0.72	0.92	0.71	0.81	0.72	0.80	0.93	0.93	0.98	0.99	0.98	0.72	0.99	0.98	0.98	0.95	0.91
5	0.74	0.86	0.49	0.49	0.36	0.66	0.52	0.70	0.93	0.65	0.67	0.71	0.88	0.61	0.79	0.68	0.79	0.92	0.93	0.97	0.99	0.98	0.66	0.98	0.98	0.98	0.96	0.91
6	0.81	0.89	0.46	0.57	0.36	0.66	0.50	0.70	0.93	0.56	0.71	0.68	0.84	0.53	0.81	0.50	0.79	0.92	0.92	0.95	0.99	0.98	0.74	0.98	0.98	0.97	0.96	0.91
7	0.89	0.96	0.56	0.64	0.55	0.69	0.54	0.78	0.93	0.73	0.74	0.76	0.85	0.60	0.76	0.37	0.77	0.93	0.92	0.94	0.99	0.98	0.70	0.99	0.97	0.98	0.97	0.92
8	0.93	0.98	0.55	0.68	0.58	0.72	0.55	0.86	0.94	0.80	0.76	0.74	0.91	0.71	0.79	0.45	0.78	0.93	0.92	0.96	0.98	0.99	0.70	0.99	0.98	0.95	0.97	0.92
9	0.95	0.99	0.59	0.71	0.63	0.79	0.58	0.90	0.95	0.86	0.79	0.81	0.94	0.67	0.79	0.51	0.79	0.94	0.93	0.93	0.99	0.98	0.75	0.99	0.98	0.97	0.97	0.92
10	0.95	0.99	0.60	0.66	0.65	0.83	0.56	0.93	0.94	0.92	0.80	0.87	0.94	0.72	0.78	0.50	0.78	0.91	0.93	0.87	0.99	0.97	0.69	0.98	0.98	0.94	0.96	0.91
11	0.96	0.99	0.60	0.69	0.67	0.87	0.63	0.95	0.95	0.94	0.84	0.84	0.94	0.68	0.79	0.49	0.79	0.88	0.92	0.85	0.99	0.98	0.78	0.99	0.98	0.96	0.96	0.92
12	0.96	1.00	0.60	0.68	0.68	0.88	0.69	0.95	0.96	0.94	0.85	0.78	0.91	0.64	0.79	0.50	0.78	0.89	0.93	0.85	0.99	0.98	0.77	0.99	0.97	0.96	0.94	0.93
13	0.97	1.00	0.63	0.69	0.66	0.90	0.71	0.88	0.95	0.91	0.83	0.70	0.92	0.53	0.77	0.42	0.78	0.92	0.93	0.85	1.00	0.99	0.81	0.99	0.98	0.97	0.96	0.93
14	0.94	0.98	0.65	0.68	0.64	0.93	0.69	0.87	0.94	0.89	0.80	0.75	0.95	0.49	0.76	0.45	0.77	0.94	0.94	0.89	1.00	1.00	0.79	0.99	0.97	0.97	0.96	0.93
15	0.97	1.00	0.61	0.70	0.62	0.90	0.65	0.77	0.94	0.76	0.75	0.71	0.91	0.48	0.78	0.44	0.78	0.94	0.93	0.90	1.00	0.99	0.80	0.99	0.97	0.97	0.95	0.94
16	0.84	0.94	0.60	0.68	0.60	0.81	0.68	0.61	0.95	0.59	0.69	0.62	0.92	0.34	0.78	0.56	0.79	0.93	0.93	0.92	1.00	0.99	0.83	0.99	0.97	0.96	0.95	0.93
17	0.66	0.82	0.62	0.65	0.54	0.60	0.68	0.41	0.92	0.44	0.64	0.62	0.89	0.40	0.78	0.53	0.76	0.92	0.93	0.90	1.00	1.00	0.80	0.99	0.96	0.95	0.95	0.93
18	0.76	0.90	0.56	0.57	0.46	0.44	0.56	0.26	0.89	0.35	0.62	0.56	0.83	0.40	0.78	0.52	0.73	0.90	0.93	0.89	0.99	0.99	0.80	0.99	0.95	0.92	0.95	0.92
19	0.67	0.85	0.57	0.54	0.32	0.28	0.45	0.17	0.86	0.31	0.52	0.57	0.75	0.50	0.76	0.55	0.72	0.91	0.92	0.86	0.99	0.99	0.78	0.99	0.95	0.89	0.93	0.93
20	0.73	0.87	0.55	0.52	0.23	0.16	0.43	0.20	0.83	0.32	0.56	0.60	0.67	0.42	0.76	0.57	0.72	0.93	0.93	0.90	0.99	0.99	0.80	0.99	0.97	0.91	0.94	0.92
21	0.67	0.79	0.54	0.53	0.21	0.13	0.40	0.22	0.81	0.37	0.62	0.67	0.65	0.46	0.75	0.68	0.73	0.92	0.93	0.94	0.99	0.99	0.65	0.99	0.97	0.91	0.94	0.93
22	0.60	0.78	0.46	0.57	0.24	0.21	0.43	0.36	0.85	0.41	0.69	0.73	0.74	0.58	0.79	0.69	0.77	0.92	0.94	0.98	0.99	0.98	0.73	0.99	0.97	0.96	0.96	0.95
23	0.59	0.76	0.43	0.58	0.25	0.29	0.45	0.36	0.84	0.55	0.71	0.72	0.76	0.66	0.80	0.72	0.77	0.92	0.94	0.99	1.00	0.98	0.75	0.99	0.98	0.95	0.95	0.93

UK Results 48 kHz



	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.50	0.62	0.22	0.36	0.12	0.23	0.30	0.19	0.83	0.53	0.60	0.50	0.75	0.50	0.78	0.49	0.67	0.92	0.90	0.99	1.00	0.98	0.64	0.99	0.99	0.87	0.92	0.85
1	0.48	0.62	0.19	0.31	0.11	0.29	0.32	0.17	0.84	0.50	0.59	0.56	0.81	0.59	0.79	0.48	0.69	0.93	0.90	0.99	1.00	0.98	0.65	0.98	0.99	0.92	0.91	0.81
2	0.50	0.65	0.23	0.29	0.15	0.31	0.36	0.12	0.85	0.46	0.54	0.65	0.89	0.71	0.81	0.57	0.71	0.93	0.90	0.98	1.00	0.99	0.68	0.99	0.99	0.97	0.90	0.80
3	0.50	0.64	0.27	0.27	0.18	0.37	0.37	0.27	0.89	0.55	0.58	0.63	0.89	0.73	0.80	0.61	0.73	0.93	0.90	0.98	1.00	0.98	0.66	1.00	1.00	0.97	0.90	0.78
4	0.55	0.74	0.33	0.32	0.22	0.41	0.41	0.36	0.93	0.58	0.59	0.63	0.88	0.54	0.76	0.54	0.74	0.91	0.90	0.97	0.99	0.98	0.60	0.99	1.00	0.96	0.90	0.79
5	0.63	0.77	0.39	0.40	0.25	0.48	0.42	0.55	0.91	0.50	0.55	0.63	0.82	0.43	0.72	0.46	0.71	0.89	0.90	0.95	0.98	0.98	0.55	0.98	1.00	0.97	0.91	0.78
6	0.71	0.79	0.39	0.47	0.25	0.53	0.43	0.57	0.91	0.38	0.56	0.60	0.75	0.36	0.76	0.25	0.72	0.88	0.90	0.94	0.98	0.97	0.62	0.98	0.99	0.97	0.91	0.79
7	0.84	0.93	0.49	0.57	0.43	0.60	0.45	0.68	0.91	0.62	0.62	0.65	0.75	0.50	0.69	0.16	0.68	0.90	0.89	0.88	0.98	0.98	0.57	1.00	0.99	0.97	0.94	0.81
8	0.89	0.97	0.47	0.64	0.50	0.61	0.48	0.81	0.92	0.67	0.66	0.64	0.86	0.55	0.73	0.21	0.71	0.90	0.89	0.94	0.97	0.98	0.59	0.99	0.99	0.93	0.95	0.82
9	0.92	0.99	0.53	0.69	0.54	0.68	0.52	0.88	0.93	0.76	0.68	0.71	0.91	0.48	0.72	0.27	0.73	0.93	0.91	0.88	0.99	0.98	0.63	0.99	1.00	0.94	0.95	0.81
10	0.92	0.99	0.55	0.63	0.57	0.76	0.49	0.88	0.92	0.86	0.71	0.81	0.91	0.57	0.70	0.27	0.71	0.87	0.92	0.82	0.99	0.98	0.55	0.99	0.99	0.91	0.93	0.79
11	0.93	0.99	0.55	0.67	0.59	0.80	0.55	0.91	0.93	0.89	0.76	0.76	0.90	0.55	0.72	0.33	0.73	0.82	0.90	0.77	0.99	0.98	0.65	0.99	0.99	0.93	0.90	0.81
12	0.94	1.00	0.56	0.66	0.62	0.82	0.59	0.90	0.94	0.88	0.79	0.68	0.86	0.50	0.71	0.31	0.71	0.84	0.90	0.76	0.99	0.98	0.65	0.99	0.98	0.94	0.87	0.84
13	0.95	1.00	0.59	0.66	0.59	0.86	0.62	0.81	0.93	0.78	0.76	0.57	0.88	0.39	0.69	0.22	0.73	0.88	0.91	0.76	0.99	0.99	0.68	0.98	0.99	0.96	0.91	0.85
14	0.91	0.97	0.60	0.65	0.55	0.91	0.60	0.81	0.93	0.78	0.71	0.65	0.92	0.33	0.70	0.24	0.71	0.93	0.92	0.82	1.00	1.00	0.67	0.98	0.98	0.95	0.91	0.85
15	0.95	1.00	0.56	0.67	0.53	0.85	0.54	0.63	0.92	0.62	0.58	0.59	0.87	0.29	0.72	0.20	0.71	0.92	0.91	0.85	1.00	1.00	0.68	0.98	0.99	0.95	0.89	0.85
16	0.75	0.88	0.50	0.64	0.50	0.69	0.59	0.37	0.93	0.45	0.53	0.47	0.88	0.20	0.70	0.32	0.73	0.90	0.91	0.89	1.00	0.99	0.71	0.99	1.00	0.93	0.90	0.85
17	0.53	0.69	0.51	0.58	0.43	0.41	0.56	0.19	0.89	0.29	0.54	0.47	0.83	0.23	0.71	0.34	0.70	0.89	0.90	0.86	0.99	1.00	0.67	1.00	0.97	0.92	0.92	0.84
18	0.64	0.82	0.45	0.47	0.33	0.22	0.44	0.09	0.85	0.17	0.50	0.43	0.74	0.24	0.70	0.26	0.66	0.86	0.91	0.83	0.99	1.00	0.67	0.99	0.95	0.88	0.91	0.82
19	0.51	0.75	0.46	0.41	0.21	0.10	0.32	0.05	0.81	0.18	0.42	0.42	0.62	0.37	0.67	0.28	0.64	0.87	0.89	0.78	0.98	1.00	0.65	0.99	0.94	0.84	0.88	0.85
20	0.62	0.79	0.44	0.39	0.15	0.06	0.27	0.02	0.76	0.19	0.43	0.46	0.54	0.28	0.68	0.32	0.66	0.91	0.90	0.84	0.98	1.00	0.67	0.99	0.97	0.86	0.87	0.82
21	0.60	0.68	0.38	0.39	0.12	0.04	0.23	0.03	0.72	0.25	0.46	0.47	0.52	0.31	0.66	0.49	0.65	0.89	0.90	0.91	0.98	0.99	0.52	0.99	0.97	0.87	0.86	0.84
22	0.50	0.65	0.29	0.42	0.14	0.08	0.26	0.13	0.77	0.30	0.60	0.52	0.64	0.44	0.72	0.54	0.69	0.88	0.92	0.97	0.99	0.98	0.63	0.99	0.98	0.94	0.92	0.89
23	0.49	0.60	0.26	0.43	0.13	0.09	0.29	0.13	0.76	0.41	0.60	0.60	0.67	0.49	0.74	0.53	0.70	0.89	0.93	0.98	0.99	0.98	0.63	0.99	0.99	0.93	0.91	0.85

- Overall 3 kHz results show less availability than US but still many cases greater than 75% during the day and 50% during the evening **Overall 82%**
- 12 kHz results show a slight drop in availability with some evening segments below 50% **Overall 75%**
- 24 KHz results illustrate further reduction in availability, however still considerable segments greater than 50%. The evening hours far the worse with some segments dropping below 50% availability **Overall 68%**
- **48 kHz - Overall 57%**
- UK results show some segments that indicate high availability all day, such as 3 and 10 MHz, that may be due to wider bandwidth local interference

- The analyzed data was further examined based on two different frequency band use case assumptions
 - NVIS 4-8 MHz
 - 2000km 8-15 MHz
- The average CMA was calculated for each frequency segment for each location and channel bandwidth
- Overall availability is lower in the UK, though still quite useable
- In the US availability is similar for both types of links
- In the UK, availability is lower for the NVIS links, possibly indicating a much higher occurrence of closer users eroding the availability

	U.S. 3 kHz	U.S. 12 kHz	U.S. 24 kHz	U.S. 48 kHz	U.K. 3 kHz	U.K. 12 kHz	U.K. 24 kHz	U.K. 48 kHz
NVIS 4-8 MHz	0.85	.80	0.74	0.66	0.71	0.62	0.54	0.43
2000 km 8-15 MHz	0.89	0.82	0.75	0.64	0.85	0.78	0.69	0.59

- Harris has fielded a low cost, easily transported, channel availability measurement system
- System has been used to do some preliminary measurements of wideband HF channel availability in 3, 12, 24 and 48 kHz bandwidths
- A data collection and analysis procedure has been proposed
- A new metric, the Channel-Minute availability has been proposed and used to more accurately capture channels that could be used by an adaptive wideband ALE based system for the conveyance of tactical HF messages
- Harris has tested an adaptive wideband HF system in a number of locations worldwide, all with good results
- Results show higher occupancy in the UK compared to US but still quite useable for the wider bandwidth channels

- Inexpensive system could be fielded by a number of countries/ organizations
- Collected data could be shared among all participants
- Harris could make available the data collection and data analysis software used for this paper
- Perhaps under the HFIA a working group could be established to define and agree upon the definition of availability metrics and the interpretation of results
- February 2014 – First Meeting of the HFIA WB HF Channel Availability Working Group