SUPPLEMENT TO FCC LICENSE APPLICATION FOR NON-INTERFERING USE OF VACANT TV CHANNELS

Robert H. Sternowski Rockwell Collins Inc. 13 March 2000

Statement of Government Contract Need

This experimental license is required to conduct field tests of a military radio communications system developed under Defense Advanced Research Projects Agency (DARPA) contract N66001-98-C-8501. Specifically, the contract is developing an adaptive (in frequency, data rate, protocol) wireless communications system for ground use by the US Army. Final testing of this system (under development for four years) requires a number of separated frequency bands to support the low-power, wideband direct sequence spread spectrum (DSSS) signal in order to test the adaptive features of the system. There are no military frequency allocations available that can tolerate the number and bandwidth of the 12 MHz wide signals.

Detailed Description of System and Frequency Allocation Request

The following describes in detail what Rockwell Collins is proposing to utilize the experimental license for, and the proposed conditions of use:

1. Purpose – The purpose for requesting use of vacant TV channels is to provide multiple frequencies for test and evaluation of a new wideband spread spectrum adaptive frequency communications network. This system was developed under a combination of Rockwell Collins and DARPA funding. It relies on radio transceivers that are able to quickly tune (but not frequency hop) between 20 and 2500 MHz, and is intended for military use only where global deployment into unknown spectral conditions and occupancy is required. The adaptive frequency selection algorithms used in this system may be constrained to any degree required by local spectrum rules, and indeed that test scenario is the reason for requesting the use of multiple, dispersed TV channels. A second purpose of the adaptive frequency algorithms is to avoid interference, jammers, and to optimize communications capacity as a function of the local geophysical environment (e.g., urban, forest, mountainous, etc.) under widely varying propagation conditions. This is to say that our system is capable of automatically and adaptively seeking the optimum communications channel from the frequency spectrum allocated to it, similar to HF ALE but instead operating in the VHF/UHF line-of-sight (LOS) bands and propagation environment.

2. Test Locations – Developmental testing will be primarily done at Rockwell Collins facilities in Richardson, TX (suburb of Dallas, TX); field testing will be done at Ft Monmouth, NJ, Ft Gordon, GA, and Ft Benning, GA. It is unlikely that any on-air testing will be done in Cedar Rapids, IA, but since some of the equipment is designed and built there, we have requested allocation for that location as well.

3. Test Schedule – *Only one location will be in use at any given time*, since there is only one experimental system in existence. Testing will commence 1 April in Texas, transition to Ft Benning, GA, in April, and move to Ft Monmouth in May. June, July and August will alternate among Texas, Ft Gordon and Ft Monmouth with an indeterminate schedule at this time. The exact schedule at each location may change due to logistics and equipment maintenance status. Testing will end 31 August 2000. Testing will be intermittent within the requested dates and hours.

4. Test Hours – The experimental network will be used during the hours of 0800 to 1700 local time, Monday through Friday.

5. Transmitter Characteristics – The system will utilize a maximum of 10 watts output power, with a wideband solid-state power amplifier designed and built by Rockwell Collins. Harmonics are attenuated a minimum of 35 db. Adaptive power control is also used, so that the power is usually significantly less than 10 watts output. The antennas are omnidirectional vertical discone antennas, with approximately 3 db of gain and a pattern parallel to the horizon. The normal antenna height is 6 feet above ground, with occasional tests with a 25 foot mast. The objective is to propagate around and through objects, so there is no plan or need to raise the antenna above the surrounding trees and structure.

6. Interference Abatement – Rockwell Collins is well aware of the sensitivity of broadcast service allocations. However, we are also aware that vacant "guard channels" are used between active channels in a city to prevent co-channel TV interference to relatively non-selective consumer TV receivers. We are confident that our proposed experimental allocation will not cause any local interference to TV reception for the following reasons:

    A. We are using a maximum of 20 watts EIRP, with adaptive power control down to more typical levels of 1-2 watts. This is far less than local TV transmitters, on the order of 30-60 db.
    B. We have imposed a vacant guard channel of our own adjacent to each local channel to avoid any remote possibility of interference.
    C. Harmonics of our transmissions are attenuated below any interfering levels.
    D. Our signals will be deliberately constrained by the vegetation and buildings of the military installations. Exceptions are Texas and Iowa, but in those cases (for lack of vegetation) the power will be 10-20 db lower than that used at the military installations to minimize the potential of interference.
    E. Actual transmit time is anticipated to be approximately 25% of the operating time, scattered across multiple channels. The network operates with 12 millisecond packet slots, with 0.5 to 11 milliseconds of each slot occupied by a transmitted signal depending upon the instantaneous traffic load.
    F. The signal density will be low, as the modulation is a BPSK spread spectrum signal with a fixed 6.4 MHz chip rate, and variable data rates from 1.6 mbps down to 0.2 mbps. The signal envelope is fixed at 12.8 MHz bandwidth. The second lobe is –60 dbc, employing waveshaping.

G. Antenna heights will be 6 feet above ground, except at the three military installations, where they ***may*** be elevated up to 25 feet to simulate use between command centers. They will still, however, be well shadowed by surrounding vegetation and structures.

7. Interference Emergency Plan – To preclude even the slightest risk of interference trouble, the chief engineers of the local television stations will be notified, in writing, of our planned operating periods in each location. Each of those chief engineers will also be given an emergency cell phone number at our operating location, which can be used to advise us of an interference condition, and upon receipt of which we will immediately cease operation on one or all of the operational channels, depending upon the nature of the problem.

8. Logging – The system has an inherent packet addressing and tracking scheme, and as such the experimental instrumentation used will log all activity to computer files. These can be made available to the FCC upon request, although some skill in reading them is required. Separately, we will maintain a log of periods of activity, including the frequencies, times, dates, power levels and antenna heights used at each location. This will be provided to the FCC upon request, either in electronic or paper form.

9. Specific Frequency Allocations Requested – Permission to utilize the following channels, by location, is requested for the period 1 April 2000 through 31 August 2000:

   Fort Gordon, GA: TV channels 8-10, 15-18, 22-52, 56-65

   Fort Benning, GA: TV channels 11-12, 15-26, 30-36, 40-52, 56-64

   Fort Monmouth, NJ: TV channels 15-19, 23-29, 33-39, 43-45, 52-53, 57-60, 65-66

   Richardson, TX: TV channels 15-19, 35-37, 41-45, 60-66

   Cedar Rapids, IA: TV channels 15-18, 22-26, 34-46, 50-65

   The TV channel allocation chart for these five locations is shown in an attached EXCEL spreadsheet file, showing the callsign of each active station in each of these locations as well as the vacant channels. The shaded areas represent the potential spectrum of interest, and the above requested channels are selected from those shaded selections.

Channel	F-Low	F-Hi	Ft Monmouth NJ	Fort Gordon GA	Fort Benning GA	Cedar Rapids IA	Dallas TX
2	54	60	WCBS (C)			KGAN (C)	KDTN (P)
3	60	66			WRBL (C)		
4	66	72	WNBC (N)				KDFW (F)
5	76	82	WNYW (F)				
6	82	88		WHBF (A)			
7	174	180	WABC (A)			KWWL (N)	
8	180	186					WFAA (A)
9	186	192	WWOR (U)		WTVM (A)	KCRG (A)	
10	192	198					
11	198	204	WPIX (WB)				KTVT (C)
12	204	210		WRDW (C)		KIIN (P)	
13	210	216	WNET (P)				KERA (P)
14	470	476					
15	476	482					
16	482	488					
17	488	494					
18	494	500					
19	500	506					
20	506	512		WCES (P)		KWKB (W)	
21	512	518	WLIW (P)				KTXA (U)
22	518	524					
23	524	530					KUVN (Sp)
24	530	536					
25	536	542					
26	542	548					
27	548	554					KDFI
28	554	560			WJSP (P)	KFXA (F)	
29	560	566					KMPX
30	566	572					
31	572	578	WPXN (Pax)				
32	578	584				KRIN (P)	
33	584	590					KDAF
34	590	596					
35	596	602					
36	602	608					
37	608	614					
38	614	620			WLTZ (N)		
39	620	626					KXTX
40	626	632					

41	632	638	WXTV (Sp)				
42	638	644					
43	644	650					
44	650	656					
45	656	662					
46	662	668					
47	668	674	WNJU				KTAQ
48	674	680				KPXR (Pax)	
49	680	686					KSTR
50	686	692	WNJN (P)				
51	692	698					
52	698	704					KFWD
53	704	710					
54	710	716		WFXG (F)	WXTX (F)		
55	716	722	WLNY				KLDT
56	722	728					
57	728	734					
58	734	740					KDTX
59	740	746					
60	746	752					
61	752	758					
62	758	764	WRNN				
63	764	770	WMBC				
64	770	776					
65	776	782					
66	782	788			WSWS (W)		
67	788	794		WBEK			
68	794	800	WHSE				KPXD (Pax)
69	800	806					