

APPLICATION FOR EQUIPMENT FREQUENCY ALLOCATION		CLASSIFICATION UNCLASSIFIED	DATE	FORM APPROVED OMB No. 0704-0188 Page <u>1</u> of <u>9</u> Pages
DOD GENERAL INFORMATION				
TO		FROM		
1. APPLICATION TITLE				
2. SYSTEM NOMENCLATURE				
3. STAGE OF ALLOCATION ☐ a. STAGE 1 ☐ b. STAGE 2 ☐ c. STAGE 3 ☐ d. STAGE 4 <i>(X one)</i> CONCEPTUAL EXPERIMENTAL DEVELOPMENTAL OPERATIONAL				
4. FREQUENCY REQUIREMENTS a. FREQUENCY(IES) b. EMISSION DESIGNATOR(S)				
5. TARGET STARTING DATE FOR SUBSEQUENT STAGES				
a. STAGE 2		b. STAGE 3		c. STAGE 4
6. EXTENT OF USE				
7. GEOGRAPHICAL AREA FOR				
a. STAGE 2				
b. STAGE 3				
c. STAGE 4				
8. NUMBER OF UNITS				
a. STAGE 2		b. STAGE 3		c. STAGE 4
9. NUMBER OF UNITS OPERATING SIMULTANEOUSLY IN THE SAME ENVIRONMENT				
10 OTHER J/F 12 APPLICATION NUMBER(S) TO BE ☐ a. SUPERSEDED J/F 12/ ☐ b. RELATED J/F 12/			11. IS THERE ANY OPERATIONAL REQUIREMENT AS DESCRIBED IN THE INSTRUCTIONS FOR PARAGRAPH 11? ☐ a. YES ☐ b. NO ☐ c. NAvail	
12. NAMES AND TELEPHONE NUMBERS				
a. PROGRAM MANAGER		(1) COMMERCIAL		(2) AUTOVON
b. PROJECT ENGINEER		(1) COMMERCIAL		(2) AUTOVON
13. REMARKS				
DOWNGRADING INSTRUCTIONS N/A		CLASSIFICATION UNCLASSIFIED		

CLASSIFICATION UNCLASSIFIED		PAGE 2 of 9 Pages	
TRANSMITTER EQUIPMENT CHARACTERISTICS			
1. NOMENCLATURE, MANUFACTURER'S MODEL NO. Wave Relay 2.3 GHz Radio (WR-RAD-03)		2. MANUFACTURER'S NAME Persistent Systems, LLC	
3. TRANSMITTER INSTALLATION		4. TRANSMITTER TYPE 802.11	
5. TUNING RANGE 2.312-2.507 GHz		6. METHOD OF TUNING Frequency Synthesized Local Oscillator	
7. RF CHANNELING CAPABILITY 2.312 GHz, 5 MHz increments, 40 channels		8. EMISSION DESIGNATOR(S) see Table 1	
9. FREQUENCY TOLERANCE 20 PPM			
10. FILTER EMPLOYED (<i>X one</i>) ☐ a. YES ☒ b. NO			
11. SPREAD SPECTRUM (<i>X one</i>) ☒ a. YES ☐ b. NO		12. EMISSION BANDWIDTH (<i>X and complete as applicable</i>) ☐ CALCULATED ☒ MEASURED	
13. MAXIMUM BIT RATE 144 Mbps (after FEC coding)		a. -3 dB see Table 2	
14. MODULATION TECHNIQUES AND CODING see Tables 3 and 4		b. -20 dB	
		c. -40 dB	
		d. -60 dB	
		e. OC-BW	
15. MAXIMUM MODULATION FREQUENCY NA		16. PRE-EMPHASIS (<i>X one</i>) ☐ a. YES ☒ b. NO	
17. DEVIATION RATIO: NA		18. PULSE CHARACTERISTICS NA	
19. POWER a. MEAN 0.6 W b. PEP 2.0 W		a. RATE	
20. OUTPUT DEVICE Hybrid combined pair of Anadigics AWL6153		b. WIDTH	
		c. RISE TIME	
		d. FALL TIME	
		e. COMP RATIO	
21. HARMONIC LEVEL		22. SPURIOUS LEVEL -49 dBc @1600 MHz	
23. FCC TYPE ACCEPTANCE NO. NA		a. 2nd -65 dBc at antenna connector	
		b. 3rd -75 dBc at antenna connector	
		c. OTHER Not Available	
24. REMARKS Item 4. Transmitter Type: Transmitter uses COTS 802.11 radio module. Item 8: Continued on Page 3, Table 1 Item 11: Continued on Page 4, Table 4 Item 12: Continued on Page 3, Table 2 Item 14: Continued on Page 3, Table 3 and Page 4, Table 5			
CLASSIFICATION UNCLASSIFIED			

Item 8. Emission Designator(s)

Waveform Type	Modulation	Coding	Emission Designator at Channel Width			
			5 MHz	10 MHz	20 MHz	40 MHz
DSSS	BPSK	11-chip Barker	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	11-chip Barker	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	4-seq 8-chip CCK	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	64-seq 8-chip CCK	3M85G1D	7M7G1D	15M4G1D	-
OFDM	BPSK	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	BPSK	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	QPSK	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	QPSK	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	16-QAM	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	16-QAM	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	64-QAM	2/3-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	64-QAM	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D

Table 1

Item 12. EMISSION BANDWIDTH (Measured in MHz)

Waveform Type	OFDM				DSSS			
Channel Width	5MHz	10MHz	20MHz	40MHz	5MHz	10MHz	20MHz	40MHz
-3 dB	4.1	8.3	16.3	32.6	2.3	5.2	11.0	-
-20 dB	4.6	9.0	17.2	34.6	4.5	8.7	17.0	-
-40 dB	9.9	18.2	34.6	58.2	8.9	18.6	36.3	-
-60 dB	17.0	35.5	71.7	129.3	14.0	29.4	59.6	-
OC-BW	4.4	8.3	16.5	32.9	3.9	7.8	15.4	-

Table 2

Item 14: MODULATION TECHNIQUES AND CODING

Waveform Type	Modulation	Coding	Effective Data Rate (Mbit/s) at Channel Width			
			5 MHz	10 MHz	20 MHz	40 MHz
DSSS	BPSK	11-chip Barker	0.25	0.5	1.0	-
DSSS	QPSK	11-chip Barker	0.50	1.0	2.0	-
DSSS	QPSK	4-seq 8-chip CCK	1.38	2.8	5.5	-
DSSS	QPSK	64-seq 8-chip CCK	2.75	5.5	11.0	-
OFDM	BPSK	1/2-rate Convolutional	1.50	3.0	6.0	12.0
OFDM	BPSK	3/4-rate Convolutional	2.25	4.5	9.0	18.0
OFDM	QPSK	1/2-rate Convolutional	3.00	6.0	12.0	24.0
OFDM	QPSK	3/4-rate Convolutional	4.50	9.0	18.0	36.0
OFDM	16-QAM	1/2-rate Convolutional	6.00	12.0	24.0	48.0
OFDM	16-QAM	3/4-rate Convolutional	9.00	18.0	36.0	72.0
OFDM	64-QAM	2/3-rate Convolutional	12.00	24.0	48.0	96.0
OFDM	64-QAM	3/4-rate Convolutional	13.50	27.0	54.0	108.0

Table 3

Item 11. DSSS Characteristics

Channel Width (MHz)	Modulation	Coding	Emission Designator	SSCR ¹ (Mchips/s)	CRR ² (MHz)	Transmission Bit Rate (Mbps)	Processing Gain (dB)
5	BPSK	11-chip Barker	3M85G1D	2.75	0.25	2.75	10.40
5	QPSK	11-chip Barker	3M85G1D	2.75	0.25	2.75	10.40
5	QPSK	4-seq 8-chip CCK	3M85G1D	2.75	0.34	2.75	9.03
5	QPSK	64-seq 8-chip CCK	3M85G1D	2.75	0.34	2.75	9.03
10	BPSK	11-chip Barker	7M7G1D	5.5	0.5	5.5	10.40
10	QPSK	11-chip Barker	7M7G1D	5.5	0.5	5.5	10.40
10	QPSK	4-seq 8-chip CCK	7M7G1D	5.5	0.69	5.5	9.03
10	QPSK	64-seq 8-chip CCK	7M7G1D	5.5	0.69	5.5	9.03
20	BPSK	11-chip Barker	15M4G1D	11	1.0	11.0	10.40
20	QPSK	11-chip Barker	15M4G1D	11	1.0	11.0	10.40
20	QPSK	4-seq 8-chip CCK	15M4G1D	11	1.38	11.0	9.03
20	QPSK	64-seq 8-chip CCK	15M4G1D	11	1.38	11.0	9.03

1. Spread Spectrum Chip Rate
2. Code Repetition Rate

Table 4

Item 14. OFDM Characteristics

Channel Width (MHz)	Modulation	Coding	Emission Designator	Effective Data Rate (Mbps)	Transmission Bit Rate (Mbps)
5	BPSK	1/2-rate Convolutional	4M06D1D	1.50	3.0
5	BPSK	3/4-rate Convolutional	4M06D1D	2.25	3.0
5	QPSK	1/2-rate Convolutional	4M06D1D	3.00	6.0
5	QPSK	3/4-rate Convolutional	4M06D1D	4.50	6.0
5	16-QAM	1/2-rate Convolutional	4M06D1D	6.00	12.0
5	16-QAM	3/4-rate Convolutional	4M06D1D	9.00	12.0
5	64-QAM	2/3-rate Convolutional	4M06D1D	12.00	18.0
5	64-QAM	3/4-rate Convolutional	4M06D1D	13.50	18.0
10	BPSK	1/2-rate Convolutional	8M13D1D	3.0	6.0
10	BPSK	3/4-rate Convolutional	8M13D1D	4.5	6.0
10	QPSK	1/2-rate Convolutional	8M13D1D	6.0	12.0
10	QPSK	3/4-rate Convolutional	8M13D1D	9.0	12.0
10	16-QAM	1/2-rate Convolutional	8M13D1D	12.0	24.0
10	16-QAM	3/4-rate Convolutional	8M13D1D	18.0	24.0
10	64-QAM	2/3-rate Convolutional	8M13D1D	24.0	36.0
10	64-QAM	3/4-rate Convolutional	8M13D1D	27.0	36.0
20	BPSK	1/2-rate Convolutional	16M3D1D	6.0	12.0
20	BPSK	3/4-rate Convolutional	16M3D1D	9.0	12.0
20	QPSK	1/2-rate Convolutional	16M3D1D	12.0	24.0
20	QPSK	3/4-rate Convolutional	16M3D1D	18.0	24.0
20	16-QAM	1/2-rate Convolutional	16M3D1D	24.0	48.0
20	16-QAM	3/4-rate Convolutional	16M3D1D	36.0	48.0
20	64-QAM	2/3-rate Convolutional	16M3D1D	48.0	72.0
20	64-QAM	3/4-rate Convolutional	16M3D1D	54.0	72.0
40	BPSK	1/2-rate Convolutional	32M5D1D	12.0	24.0
40	BPSK	3/4-rate Convolutional	32M5D1D	18.0	24.0
40	QPSK	1/2-rate Convolutional	32M5D1D	24.0	48.0
40	QPSK	3/4-rate Convolutional	32M5D1D	36.0	48.0
40	16-QAM	1/2-rate Convolutional	32M5D1D	48.0	96.0
40	16-QAM	3/4-rate Convolutional	32M5D1D	72.0	96.0
40	64-QAM	2/3-rate Convolutional	32M5D1D	96.0	144.0
40	64-QAM	3/4-rate Convolutional	32M5D1D	108.0	144.0

Table 5

CLASSIFICATION UNCLASSIFIED				PAGE 5 of 9 Pages	
RECEIVER EQUIPMENT CHARACTERISTICS					
1. NOMENCLATURE, MANUFACTURER'S MODEL NO. Wave Relay 2.3 GHz Radio (WR-RAD-03)				2. MANUFACTURER'S NAME Persistent Systems, LLC	
3. RECEIVER INSTALLATION				4. RECEIVER TYPE Homodyne 802.11	
5. TUNING RANGE 2.312-2.507 GHz				6. METHOD OF TUNING Frequency Synthesized Local Oscillator	
7. RF CHANNELING CAPABILITY 2.312 GHz, 5 MHz increments, 40 channels				8. EMISSION DESIGNATOR(S) see Table 5	
9. FREQUENCY TOLERANCE 20 PPM					
10. IF SELECTIVITY	1 st	2 nd (wb)	2 nd (nb)	11. RF SELECTIVITY (X and complete as applicable) ☐ CALCULATED ☒ MEASURED	
a. -3 dB	Not Applicable	Not Applicable	Not Applicable		
b. -20 dB	Not Applicable	Not Applicable	Not Applicable		
c. -40 dB	Not Applicable	Not Applicable	Not Applicable		
12. IF FREQUENCY				d. Preselection Type SAW Filter	
a. 1 st Not Applicable				13. MAXIMUM POST DETECTION FREQUENCY Not Applicable	
b. 2 nd Not Applicable				14. MINIMUM POST DETECTION FREQUENCY Not Applicable	
c. 3 rd Not Applicable				16. MAXIMUM BIT RATE 14472 Mbps (after FEC coding)	
15. OSCILLATOR TUNED	1 st NA	2 nd NA	3 rd NA	17. SENSITIVITY	
21. ABOVE TUNED FREQUENCY				a. SENSITIVITY see Table 6	
b. BELOW TUNED FREQUENCY				b. CRITERIA PER 10%	
c. EITHER ABOVE OR BELOW THE FREQUENCY				c. NOISE FIGURE 6 dB	
21. DE-EMPHASIS (X one) ☐ a. YES ☒ b. NO				d. NOISE TEMP Not Applicable	
19. IMAGE REJECTION: NA				20. SPURIOUS REJECTION: NA	
21. REMARKS Item 4. Receiver uses COTS 802.11 radio module. Item 8: Continued on Page 6, Table 5 Item 17a: Continued on Page 6, Table 6					
CLASSIFICATION UNCLASSIFIED					

Item 8. Emission Designator(s)

Waveform Type	Modulation	Coding	Emission Designator at Channel Width			
			5 MHz	10 MHz	20 MHz	40 MHz
DSSS	BPSK	11-chip Barker	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	11-chip Barker	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	4-seq 8-chip CCK	3M85G1D	7M7G1D	15M4G1D	-
DSSS	QPSK	64-seq 8-chip CCK	3M85G1D	7M7G1D	15M4G1D	-
OFDM	BPSK	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	BPSK	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	QPSK	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	QPSK	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	16-QAM	1/2-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	16-QAM	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	64-QAM	2/3-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D
OFDM	64-QAM	3/4-rate Convolutional	4M06D1D	8M13D1D	16M3D1D	32M5D1D

Table 5

Item 17a. Sensitivity

Waveform Type	Channel Width			
	5 MHz	10 MHz	20 MHz	40 MHz
DSSS	-95.3 dBm	-95.3 dBm	-92.5 dBm	-
OFDM	-91.3 dBm	-91.5 dBm	-90.5 dBm	-88.2 dBm

Table 6

CLASSIFICATION UNCLASSIFIED	PAGE 7 of 9 Pages
ANTENNA EQUIPMENT CHARACTERISTICS	
1. ☐ a. TRANSMITTING ☐ b. RECEIVING ☐ c. TRANSMITTING AND RECEIVING	
2. NOMENCLATURE, MANUFACTURER'S MODEL NO.	3. MANUFACTURER'S NAME
4. FREQUENCY RANGE	5. TYPE
6. POLARIZATION	7. SCAN CHARACTERISTICS N/A
8. GAIN	a. TYPE
a. MAIN BEAM 0 dBi	b. VERTICAL SCAN
b. 1st MAJOR SIDE LOBE N/A	(1) Max Elev
	(2) Min Elev
	(3) Scan Rate
9. BEAMWIDTH N/A (OMNI-DIRECTIONAL ANTENNA)	c. HORIZONTAL SCAN
a. HORIZONTAL	(1) Sector Scanned
b. VERTICAL	(2) Scan Rate
	d. SECTOR BLANKING (<i>X one</i>) ☐ (1) YES ☐ (2) NO
10. REMARKS	
CLASSIFICATION UNCLASSIFIED	

APPLICATION FOR SPECTRUM REVIEW	CLASSIFICATION: UNCLASSIFIED	PAGE 8 of 9 Pages
NTIA GENERAL INFORMATION		
1. APPLICATION TITLE		
2. SYSTEM NOMENCLATURE		
3. STAGE OF ALLOCATION (<i>X one</i>) ☐ a. STAGE 1 CONCEPTUAL ☐ b. STAGE 2 EXPERIMENTAL ☐ c. STAGE 3 DEVELOPMENTAL ☐ d. STAGE 4 OPERATIONAL		
4. FREQUENCY REQUIREMENTS a. FREQUENCY(IES) b. EMISSION DESIGNATOR(S)		
5. PURPOSE OF SYSTEM, OPERATIONAL AND SYSTEM CONCEPTS (WARTIME USE) (<i>X one</i>) ☐ a. YES <input style="margin-left: 20px;" type="checkbox"/> b. NO		
6. INFORMATION TRANSFER REQUIREMENTS		
7. ESTIMATED INITIAL COST OF THE SYSTEM		
8. TARGET DATE FOR		
a. APPLICATION APPROVAL	b. SYSTEM ACTIVATION	c. SYSTEM TERMINATION
9. SYSTEM RELATIONSHIP AND ESSENTIALITY		
10. REPLACEMENT INFORMATION		
11. RELATED ANALYSIS AND/OR TEST DATA		
12. NUMBER OF MOBILE UNITS		
13. GEOGRAPHICAL AREA FOR		
a. STAGE 2		
b. STAGE 3		
c. STAGE 4		
14. LINE DIAGRAM See page(s)	15. SPACE SYSTEMS See page(s)	
16. TYPE OF SERVICE(S) FOR STAGE 4	17. STATION CLASS(ES) FOR STAGE 4	
18. REMARKS		
DOWNGRADING INSTRUCTIONS N/A	CLASSIFICATION UNCLASSIFIED	

APPLICATION FOR FOREIGN SPECTRUM SUPPORT	CLASSIFICATION: UNCLASSIFIED	PAGE 9 of 9 Pages
FOREIGN COORDINATION GENERAL INFORMATION		
1. APPLICATION TITLE		
2. SYSTEM NOMENCLATURE		
3. STAGE OF ALLOCATION (<i>X one</i>) ☐ a. STAGE 1 CONCEPTUAL ☐ b. STAGE 2 EXPERIMENTAL ☐ c. STAGE 3 DEVELOPMENTAL ☐ d. STAGE 4 OPERATIONAL		
4. FREQUENCY REQUIREMENTS a. FREQUENCY(IES) b. EMISSION DESIGNATOR(S)		
5. PROPOSED OPERATING LOCATIONS OUTSIDE US&P		
6. PURPOSE OF SYSTEM, OPERATIONAL AND SYSTEM CONCEPTS		
7. INFORMATION TRANSFER REQUIREMENTS		
8. NUMBER OF UNITS OPERATING SIMULTANEOUSLY IN THE SAME ENVIRONMENT		
9. REPLACEMENT INFORMATION		
10. LINE DIAGRAM See page(s)	11. SPACE SYSTEMS See page(s)	
12. PROJECTED OPERATIONAL DEPLOYMENT DATE		
13. REMARKS		
DOWNGRADING INSTRUCTIONS N/A	CLASSIFICATION UNCLASSIFIED	