

# APPENDIX I: RAD1/2 and TNR frequency lists

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## I-1 RAD1 receiver frequency lists

These lists can also be found online on the *megasr* machine at */home/wind/*  
 The nomenclature for a list consists of the following 4 information:

Receiver (RAD1 or RAD2), scan type (log, lin, Ulysses, TKR), number of frequencies, ROM number

RAD1, Log, 16, ROM 0

RAD1, Lin 16, ROM 1

Raw values (kHz)	Frequency achievable	Number of frequency
20	20	0
26.02	28	2
33.87	36	4 <sup>(1)</sup>
44.08	44	6
56.36	60	10 <sup>(2)</sup>
74.65	76	14
97.15	96	19
126.42	124	26 <sup>(3)</sup>
164.52	164	36
214.11	216	49
278.63	280	65
362.6	364	86
614,09	616	149
614,09	616	149
799,16	796	194 <sup>(4)</sup>
1040	1040	255

Raw values (kHz)	Frequency achievable	Number of frequency
20	20	0
88	88	18
156	156	34
224	224	51
292	292	68
360	360	85
428	428	102
496	496	119
564	564	136
632	632	153
700	700	171
768	768	187
836	836	204
904	904	221
972	972	238
1040	1040	255

The frequencies in this list follow the distribution:  
 $F_n = 20 \text{ kHz} + n \times 68 \quad n = 0, \dots, 15.$

<sup>1</sup> The 32 kHz frequency is closer, but by choosing 36 kHz, the difference between the frequencies is more regular (see diagram)

<sup>2</sup> Frequency 56 is interfered

<sup>3</sup> The 128 kHz frequency is a spurious frequency.

<sup>4</sup> The 800 kHz frequency is a spurious frequency.

RAD1, Log, 32 , ROM 4 and 5

Raw values (kHz)	Frequency achievable	Number of frequency
20	20	0
22,72	24	1
25,8	28	2
29,3	32	3
33,3	36	4
37,83	40	5
42,97	44	6
48,81	48	7
55,45	56	8
62,98	64	10
71,54	72	13
81,27	80	15
92,32	92	18
104,87	104	21
119,12	120	24
135,32	136	29
153,71	152	33
174,61	176	39
198,34	200	44
225,31	224	51
255,93	256	59
290,73	292	68
330,25	332	78
375,14	376	89
426,14	428	102
484,07	484	116
549,87	548	132
624,62	624	151
709,53	708	172
805,98	804	196
915,54	916	224
1040,00	1040	255

RAD1, Lin, 32, ROM 6 and 7

Raw values (kHz)	Frequency achievable	Number of frequency	
20	20	0	
52,90	52	8	
85,81	80	15	Frequency 88 interfered
118,71	116	24	Frequency 120 interfered
151,61	152	33	
184,52	184	41	
217,42	216	49	
250,32	252	58	
283,23	284	66	
316,13	316	74	
349,03	348	82	
381,93	380	90	
414,84	416	99	
447,74	448	107	
480,64	480	115	
513,55	512	123	
546,45	548	132	
579,35	580	140	
612,26	612	148	
645,16	644	156	
678,06	680	165	
710,97	712	173	
743,87	744	181	
776,77	776	189	
809,68	808	197	
842,58	844	206	
875,48	876	214	
908,39	908	222	
941,29	940	230	
974,10	972	238	Frequency 976 interfered
1007,10	1008	247	
1040,00	1040	255	

RAD1, Ulysses, 12, ROM 2

Values Ulysses/Urap (kHz)	Achievable frequencies (kHz)	Number of frequency
-	20	0
-	28	2
-	40	5
52	52	8
63	60	10
81	80	15
100	104	21
120	124	26
148	148	32
196	196	44
272	272	63
387	388	92
540	540	130
740	740	180
940	940	230
-	1040	255

RAD1, TKR, 12, ROM 3

Raw values (kHz)	Frequency achievable	Number of frequency
		5
		7
		10
		13
		15
		21
		26
		33
		41
		51
		62
		77
		94
		114
		140
		169

## I-2 RAD2 receiver frequency lists

### RAD2, Log 16, ROM 1

Raw values (kHz)	Frequency achievable	Number of frequency
1075	1075	0
1274,56	1275	4
1511,16	1525	9
1791,68	1775	14
2124,27	2125	21
2518,6	2525	29
2986,15	2975	38
3540,48	3525	49
4197,71	4175	62
4976,94	4975	78
5900,83	5925	97
6996,22	6975	118
8294,95	8275	144
9834,77	9825	175
11660,4	11675	212
13825	13825	255

Raw values (kHz)	Frequency achievable	Number of frequency
1075	1075	0
1925	1925	17
2275	2275	34
3625	3625	51
4775	4775	68
5325	5325	85
6175	6175	102
7025	7025	119
7875	7875	136
8725	8725	153
9575	9575	170
10425	10425	187
11275	11275	204
12125	12125	221
12975	12975	238
13825	13825	255

$$F_n = 1075 \text{ kHz} + n \times 850 \text{ kHz} \quad n = 0, \dots, 15$$

### RAD2, log, 12, ROM 2

Raw values (kHz)	Frequency achievable	Number of frequency
1075	1075	0
1355,97	1375	6
1710,38	1725	13
2157,41	2175	22
2721,29	2725	33
3432,54	3425	47
4329,70	4325	65
5461,34	5475	88
6888,75	6875	116
8689,25	8675	152
10960,3	10975	198
13825	13825	255

### RAD2, lin, 12, ROM 3

Raw values (kHz)	Frequency achievable	Number of frequency
1075	1075	0
2234,09	2225	23
3393,18	3375	46
4552,27	4575	70
5711,36	5725	93
6870,45	6875	116
8029,55	8025	139
9188,64	9175	162
10347,7	10325	185
11506,8	11525	209
12665,9	12675	232
13825	13825	255

Raw values (kHz)	Frequency achievable	Number of frequency
1075,00	1075	0
1167,32	1175	2
1267,57	1275	4
1376,44	1375	6
1494,65	1475	8
1623,01	1625	11
1762,40	1775	14
1913,75	1925	17
2078,11	2075	20
2256,58	2275	24
2450,38	2475	28
2660,82	2675	32
2889,34	2875	36
3137,48	3125	41
3406,93	3425	47
3699,52	3675	52
4017,24	4025	59
4362,25	4375	66
4736,89	4725	73
5143,70	5125	81
5585,45	5575	90
6065,13	6075	100
6586,02	6575	110
7151,63	7125	123 <sup>(*)</sup>
7765,83	7775	134
8432,77	8425	147
9156,99	9175	162
9943,41	9925	177
10797,4	10775	194
11724,7	11725	213
12731,6	12725	233
13825,0	13825	255

Raw values (kHz)	Frequency achievable	Number of frequency
1075	1075	0
1486,29	1475	8
1897,58	1875	16
2308,87	2325	25
2720,16	2725	33
3131,45	3125	41
3542	3525	49
3954,03	3925	57
4365,32	4375	66
4776,61	4775	74
5187,90	5175	82
5599,19	5525	90
6010,48	6025	99
6421,77	6425	107
6833,06	6825	115
7244,35	7225	123
7655,65	7675	132
8066,94	8075	140
8478,23	8475	148
8889,52	8875	156
9300,81	9325	165
9712,10	9725	173
10123,4	10125	181
10534,7	10525	189
10946,0	10925	197
11357,3	11375	206
11768,5	11775	214
12179,8	12175	222
12591,1	12575	230
13002,4	13025	239
13413,7	13425	247
13825,0	13825	255

(\*) Frequencies 7075 and 7125 are interfered.



### I-3 Centre frequencies of the digital filters of the TNR receiver

We recall the expressions of the central frequencies of the digital filters of the TNR instrument:

$$16 \text{ channels case} \quad f_c^{(i)} = f_{c,min} \cdot (2)^{i/8} \quad 0 \leq i < 16$$

$$32 \text{ channels case} \quad f_c^{(i)} = f_{c,min} \cdot (2)^{i/16} \quad 0 \leq i < 32$$

With  $f_{c,min}$  taking the values: 4 kHz, 8 kHz, 16 kHz, 32 kHz, 64 kHz.

This gives the following tables (values are given in kHz):

#### 32-frequency case

	Band	4.000000	4.177095	4.362031	4.555154	4.756828	4.967431	5.187358	5.417022
	Band	5.656854	5.907305	6.168843	6.441961	6.727171	7.025009	7.336032	7.660826
Band B	A	8.000000	8.354190	8.724062	9.110309	9.513657	9.934862	10.37472	10.83404
		11.31371	11.81461	12.33769	12.88392	13.45434	14.05002	14.67206	15.32165
	Band	16.00000	16.70838	17.44812	18.22062	19.02731	19.86972	20.74943	21.66809
		22.62742	23.62922	24.67537	25.76785	26.90869	28.10003	29.34413	30.64330
Band D	C	32.00000	33.41676	34.89625	36.44123	38.05463	39.73945	41.49887	43.33618
		45.25483	47.25844	49.35075	51.53569	53.81737	56.20007	58.68826	61.28661
	Band	64.00000	66.83352	69.79250	72.88247	76.10925	79.47890	82.99773	86.67236
		90.50967	94.51688	98.70149	103.0714	107.6347	112.4001	117.3765	122.5734
		E	128.0000	133.6670	139.5850	145.7649	152.2185	158.9578	165.9955
		181.0193	181.0198	181.0190	181.0198	181.0195	181.0193	181.0190	181.0194

#### 16-frequency case

	Band	4.00000	4.36203	4.75682	5.18735	5.65685	6.16884	6.72717	7.33603
Band B	A	8.00000	8.72406	9.51365	10.3747	11.3137	12.3376	13.4543	14.6720
	Band	16.0000	17.4481	19.0273	20.7494	22.6274	24.6753	26.9086	29.3441
Band D	C	32.0000	34.8962	38.0546	41.4988	45.2548	49.3507	53.8173	58.6882
	Band	64.0000	69.7925	76.1092	82.9977	90.5096	98.7014	107.634	117.376
	E	128.000	139.585	152.218	165.995	181.019	197.403	215.269	234.753

# APPENDIX II: Computer organization

Preliminary remark: we present here technical information which may be machine-dependent in some cases and are therefore likely to be out of date with software and hardware evolutions. Logical names are used whenever possible to describe directory and disk names.

## II-1 Locations of the software library

The WIND/Waves software library has been installed on VAX/VMS and SUN/Solaris. It is currently being ported to DEC/Alpha stations. The implementation sites are as follows:

Name of the platform	Location	Operating system
WAVES	University of Minnesota (Keith Goetz)	VMS
URAP	GSFC (ULYSSE machine)	VMS
LEPMLK	GSFC/LEP (Mike L. Kaiser)	UNIX
ISTP	CDHF (Bill Mish)	UNIX, VMS
BOREE	DESPA (Claude Perche)	UNIX
MEGASR	DESPA (L. Sitruk - C. Perche)	VMS
MEGASV	DESPA	VMS
MEGASW	DESPA (Robert Manning)	VMS

In principle, the WIND/Waves software library operates identically at all implementation sites, both before and after launch, for real-time and delayed access to data. It evolves regularly and the various sites mentioned above are kept up to date, possibly remotely, with each new version of the software<sup>5</sup>.

The `wind_version` keyboard command provides the current software version number and logical name information.

## II-2 Physical data carrier

At DESPA, the level zero data are physically distributed on disks `WIND_1` and `WIND_3` of the DEC MEGASJ station. The data in CDF format are located on the `WIND_2` disk of the DEC MEGASV station. These disks are "exported" (TCP/IP command) to be visible outside the "cluster" of VMS machines, in particular from DESPA Unix machines (`megasr`, `bored`).

In Unix<sup>6</sup>, the `WIND_DATA` variable contains the default directory where WIND data is searched. The Unix:

```
echo $WIND_DATA indicates: /waves/data/cdhf/lz/waves
```

---

<sup>5</sup> A client/server type architecture is envisaged in the longer term. This would avoid in particular the maintenance of the software on several machines. The items `WIND_LIB_VERSION` and `WIND_LIB_VERSION_I4` indicate the current version of the WIND/Waves software library.

<sup>6</sup> For the Unix system, we will take the example of the DESPA `megasr` station.

which corresponds to the WIND\_1 disk. For a default search on the WIND\_3 disk, we will do

```
setenv WIND_DATA /waves/data3/cdhf/lz/waves
```

The Unix commands "mount" and "df" indicate the links between the unix tree and the VMS disks.

```
megasr{sitruk}46: df
Filesystem                kbytes    used avail    capacity
Mounted on
/dev/sd6a                 15388      7436 6414 54%      /
/dev/sd6g                 303983    263482 10103 96%      /usr
/dev/sd6h                 232648    177712 31672 85%
  /home
/dev/sd0b                 225383    114098 88747 56%
  /oracle
/dev/sd0a                 137039    52410 70926 42%      /tmp
/dev/sd0d                 186919    158822 9406 94%    /ulyse
/dev/sd0e                 409319    216896 151492 59%
  /wind
/dev/sd2g                 1571062   1328198 164311 89%
  /wind1
/dev/sd4a                 1215499   1003822 90128 92%      /a
/dev/sd4b                 1215499   679645 414305 62%      /b
/dev/sd4d                 1215499   963313 130637 88%
  /wind2
/dev/sd4e                 1215499   764543 329407 70%      /e
/dev/sd4f                 390694    343350 8275 98%      /f
megasv:/vms_wind2/wind_2/wind 1310802 1310784 18 100%
/wind_kp_root
megasj:/vms_wind3/wind_3/wind 2097151 1885119 212032 90%
/waves/data3
```

It allows to check that the disks are well "seen" from the UNIX megas station (above, we see that it is not the case for WIND\_1). You can also use the command:

```
cat /etc/fstab
```

Under root, we'll do `mount -av`, to mount the disks if it's not already done.

Under VMS, we will:

```
SHO DEV D
```

## II-3 Setting up the software environment

Setting up the software environment of the WIND/Waves software library at DESPA on a VMS system requires executing the command (which the user can place in his login.com file) from the keyboard:

```
@MEGASV$dka300:[wind_lib]login_wind
```

The execution of this command is essential before any use of the WIND/Waves software library. In particular, it is essential for compilation, link editing and execution.

- Under VMS:

We will execute the following lines on the keyboard or, in a more permanent way, we will place them in our login.com file:

```
$ wind :==@megasv$dka300:[wind_lib]login_wind
$wd3
           :==defi/nolog/trans=concwind_lz_root
megasj$dka100:[wind_3.wind.cdhf.lz.]
$wd1
           :==defi/nolog/trans=concwind_lz_root
megasj$dka500:[wind_1.wind.cdhf.lz.]
```

Then type the command: wd3 or wd1 depending on whether you want to access the data on the WIND\_1 disk (old data) or WIND\_3 (recent data).

In case of doubt, the data search directory should be consulted as follows:

```
$sho log wind_data
$sho log wind_lz_root
```

- Under Unix:

Once the application has been built, a small number of environment variables must be set so that the WIND/Waves library is able to find the data files, etc. These variables are defined in the /home/wind/startup directory. Under Unix, you have the command, which you can place in your .cshrc file:

```
source /home/wind/startup
```

We also have:

```
alias hw3 'setenv WIND_DATA /waves/data3/cdhf/lz/waves'
```

Then type the command hw3 if you want to access the data on the WIND\_3 disk. In case of doubt, we will inquire about the data search directory in the following way:

```
echo $WIND_DATA
```

## II-4 FORTRAN language

Compiling and linking a source program written in the FORTRAN language is done as follows:

- Under VMS

```
Compilation: $For prog
              Link editing :$Link prog, wind_lib/lib
Run:         $Run prog
```

Under VMS, four examples of the software library usage can be found in the `WIND_EXAMPLES` directory.

- Under Unix

```
Compiling and Link Editing: % f77 my_prog.for -o my_prog $wind_lib
Run:                        %my_prog
```

where the environment variable `wind_lib` is defined as follows (example of the megasr station):

```
setenv WINDHOME /home/wind
set wind_lib = "-L$WINDHOME/lib -lWAVES -lV77"
```

Or, equivalently:

```
% f77 my_prog.for -o my_prog -L/home/wind/lib -lWAVES
```

The `-L` option specifies the path to the WIND/Waves library. The `-l` option specifies that the WIND/Waves library must be included as a module to build the executable file. The `/home/wind` path may not always be the top of the WIND/Waves tree; if in doubt about the correct path, ask your system administrator. Note that the WIND/Waves library is a shared library, which means that it can continue to evolve without users having to re-edit their application links - unless there is a specific reason to do so.

. Examples of programs with makefiles can be found in the `/home/wind/ex` directory.

## II-1 IDL language

Writing an IDL program using the WIND software library does not pose any particular problems. The names of the procedures remain unchanged. However, all variables must be declared in double precision. The documentation of the software library should be consulted.

In VMS, there are two possibilities:

1) Compile the procedures of the WIND software library written in IDL language before launching a program `file_name.pro`. To do this, place the line at the top of `filename.pro`:

```
@wind_idl:wind_idl.pro
```

```
sho log WIND_IDL gives: WIND_ROOT: [IDL.VMS]
sho log WIND_ROOT gives: _MEGASV$DKA300: [WIND_LIB.]
```

The expression `wind_idl:wind_idl.pro` is therefore

equivalent to:

```
WIND_ROOT: [IDL.VMS] WIND_IDL.PRO
```

This file `WIND_ROOT: [IDL.VMS] WIND_IDL.PRO` contains the definition of the FORTRAN procedures of the WIND software library, in the form of `call_external`<sup>7</sup>. For example:

```
X$ typ MEGASV$DKA300: [WIND_LIB.IDL.VMS] w_channel_open.pro

function w_channel_open, ch, context
ok = 0L
ok = call_external('wind_tm_lib', 'w_channel_open', ch, context)
return, ok
end
```

This method forces to compile all the procedures of the software library, which is quite heavy. Moreover, the `file_name.pro` does not usually use all these functions.

2) Tell the IDL software where to find the procedures of the WIND software library written in IDL. To do this, the logical name `IDL_PATH` must be set. This can be done under VMS in one of the following ways (you can place these commands in your `login.com` file):

or:

```
define IDL_PATH MEGASV$DKA300:[WIND_LIB.IDL.VMS]

define IDL_PATH "+idl_dir:[lib],MEGASV$DKA300:[WIND_LIB.IDL.VMS]"
```

or in an interactive way:

```
IDL> !PATH = !PATH+ ',MEGASV$DKA300:[WIND_LIB.IDL.VMS]'
```

---

<sup>7</sup> The IDL `call_external` procedure allows you to run a Fortran or C program from an IDL source program.

Under Unix, this will inform you of the value of the IDL\_PATH variable:

```
echo $IDL_PATH
```

We set this variable: setenv

```
$IDL_PATH ....
```

Once IDL\_PATH is set to include the wind\_lib directory, it is no longer necessary to include the line:  
@wind\_idl:wind\_idl at the top of IDL programs.

Note that it is always possible to check the value of the IDL\_PATH environment variable. To do this, use the command:

```
sho log IDL_PATH.
```

## II-6 Logical names in VMS

Logical names associated with the WIND experiment can be obtained, which give information about the location of directories<sup>8</sup>:

### \$sho logical wind\*

```
(LNM$PROCESS_TABLE)

"WIND_3DP"           ="WIND_KP_ROOT:[3DP]"
"WIND_AGENTS"       ="WIND_ROOT:[AGENTS]"
"WIND_ATTITUDE"     ="WIND_OA_ROOT:[ATTITUDE]"
"WIND_CDF_LIB"      ="WIND_SHARE:WIND_CDF_LIB"
"WIND_DATA"         ="WIND_LZ_ROOT:[WAVES]"
"WIND_DBMS"         ="WIND_ROOT:[DBMS]"
"WIND_DBMS_AUX"     ="WIND_ROOT:[DBMS.AUXILIARY_FILES]"
"WIND_DOC"          ="WIND_ROOT:[DOC]"
"WIND_EPACT"        ="WIND_KP_ROOT:[EPACT]"
"WIND_ETC"          ="WIND_ROOT:[000000]"
"WIND_EXAMPLES"     ="WIND_ROOT:[EXAMPLES]"
"WIND_FP_SUMMARY"   ="WIND_KP_ROOT:[SU.FIELDS_PARTICLES]"
"WIND_GIF"          ="WIND_PS_ROOT:[GIF]"
"WIND_GRAPHS"       ="WIND_ROOT:[PROGRAMS.GRAPH_LAYOUTS]"
"WIND_ICP"          ="WIND_ROOT:[ICP]"
"WIND_ICP_LIB"      ="WIND_SHARE:WIND_ICP_LIB"
"WIND_IDL"          ="WIND_ROOT:[IDL.VMS]"
"WIND_KAG"          ="WIND_ROOT:[KAG]"
"WIND_KONUS"        ="WIND_KP_ROOT:[KON]"
"WIND_KP_ROOT"      ="_MEGASV$DKA200:[WIND_2.WIND.CDHF.KP.]"
"WIND_LIB"          ="WIND_SHARE:WIND_SHR_LIB"
"WIND_LOG_SENDER"   ="WIND_SHARE:WIND_LOG_SENDER"
"WIND_LZ_ROOT"      ="_MEGASJ$DKA500:[WIND_1.WIND.CDHF.LZ.]"
"WIND_MEUDON"       ="WIND_ROOT:[MEUDON]"
"WIND_MFI"          ="WIND_KP_ROOT:[MFI]"
"WIND_MINNESOTA"    ="WIND_ROOT:[MINNESOTA]"
"WIND_OA_ROOT"      ="_MEGASV$DKA200:[WIND_2.WIND.CDHF.OA.]"
"WIND_OLB"          ="WIND_SHARE:WIND_LIB.OLB"
"WIND_OLD_ROOT"     ="_MEGASV$DKA300:[WIND_LIB_OLD.]"
"WIND_ORBIT"        ="WIND_OA_ROOT:[ORBIT]"
"WIND_PAGES"        ="WIND_ROOT:[PROGRAMS.PAGE_LAYOUTS]"
"WIND_PHYSICAL"     ="WIND_ROOT:[PHYSICAL]"
"WIND_POSTSCRIPT"   ="WIND_PS_ROOT:[POSTSCRIPT]"
"WIND_PRIME_ROOT"   ="_MEGASV$DKA300:[WIND_LIB.]"
"WIND_PRINT_LIB"    ="WIND_SHARE:WIND_PRINT_LIB"
"WIND_PRINT_PARAMETERS"="WIND_SHARE:WIND_PRINT_DEF.NML"
"WIND_PROGRAMS"     ="WIND_ROOT:[PROGRAMS]"
"WIND_PS"           ="WIND_PS_ROOT:[POSTSCRIPT]"
"WIND_PS_ROOT"      ="_MEGASJ$DKA500:[WIND_1.WIND.]"
"WIND_ROOT"         ="_MEGASV$DKA300:[WIND_LIB.]"
"WIND_RT_ROOT"      ="_MEGASJ$DKA500:[WIND_1.WIND.]"
"WIND_SCREEN"       ="WIND_ROOT:[PROGRAMS.SCREEN_LAYOUTS]"
"WIND_SHARE"        ="WIND_ROOT:[LIB.VAX]"
"WIND_SMS"          ="WIND_KP_ROOT:[SMS]"
"WIND_SPIN"         ="WIND_OA_ROOT:[SPIN_PHASE]"
"WIND_STRING_LIB"   ="WIND_SHARE:WIND_STRING_LIB"
"WIND_SWE"          ="WIND_KP_ROOT:[SWE]"
"WIND_SYS_LIB"      ="WIND_SHARE:WIND_SYS_LIB"
"WIND_TGRS"         ="WIND_KP_ROOT:[TGR]"
"WIND_TIME2_LIB"    ="WIND_SHARE:WIND_TIME2_LIB"
"WIND_TM_LIB"       ="WIND_SHARE:WIND_TM_LIB"
"WIND_VERSION"      ="1.3"
"WIND_WAV"          ="WIND_KP_ROOT:[WAV]"

(LNM$JOB_829B5100)

(LNM$GROUP_000200)

(LNM$SYSTEM_TABLE)

"WIND_1" = "MEGASJ$DKA500:[WIND_1.]"
```

<sup>8</sup> Tab characters have been inserted for better visualization.

```
"WIND_2" = "MEGASV$DKA200:[WIND_2.]"
```

```
(DECW$LOGICAL_NAMES)  
X$
```

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Personal notes

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