THALES

Conclusions on antennas impacts and software evolutions for non-contiguous availability measurements

HFIA Channel Availability Working Group
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Introduction

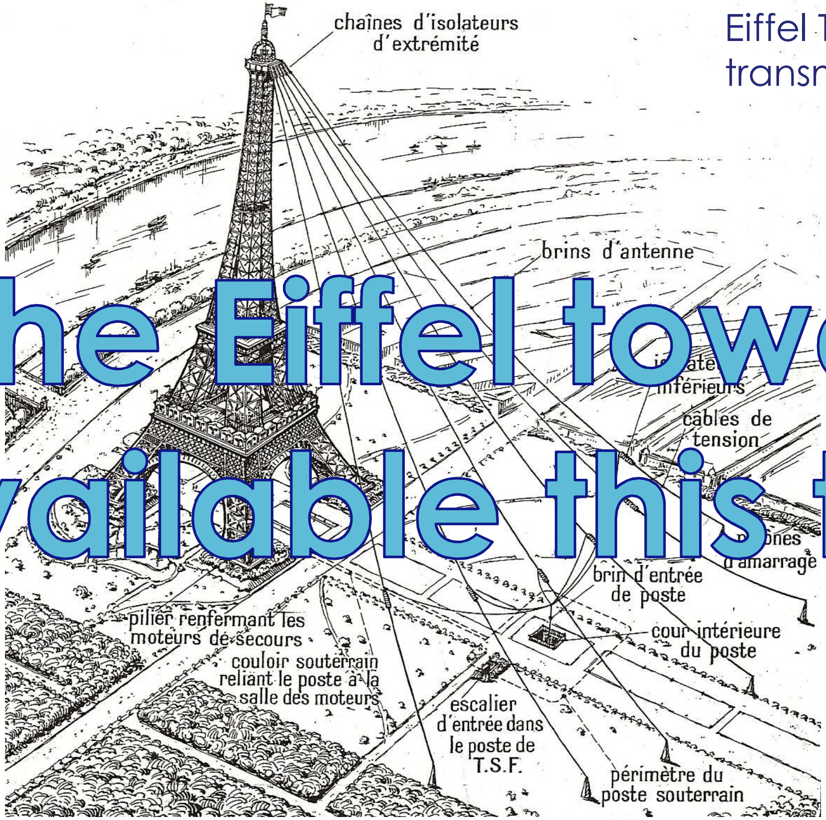
Making good and reliable measurements is very difficult

- Simultaneous measurement with different antenna shows very different results
  - what is the representativity of measures done with the Clifton antenna when compared to real communication antenna?
- Bad installations will give wrong and incoherent results
  - Cf. recommendations to ensure good and usable measures
- High noise levels will show a lower channel occupancy
  - Reconsider the noise level estimations (different for short active antennas and Rx/Tx typical ones) … analyze them and link them to ITU references **POINT 1**

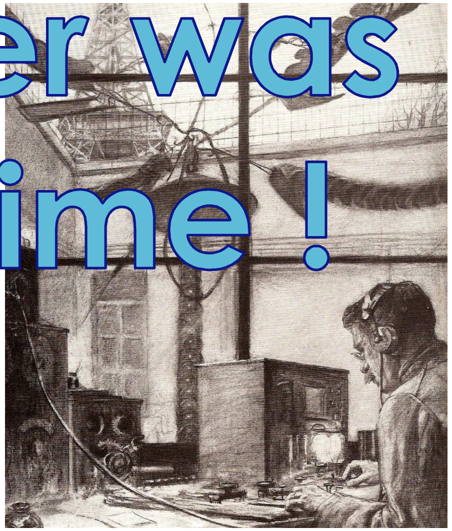
Ultimate questions:

- How to integrate in the software both models: contiguous and not contiguous? **POINT 2**
- What is the level of confidence we can expect form channel availability measurement campaigns, and how reach conclusions agreed upon by the whole *ad hoc* group? **POINT 3**

Measurement set-up … circa 1914



Eiffel Tower in 1914 as a radio transmitter antenna mast



Sorry, the Eiffel tower was not available this time !

2016 analysis campaign

3 Measurement campaigns

- In Belgium (presented in San Diego on February 2016)
  - active whip ("Clifton") versus loop antenna ("Pixel")
  - Rural site

- In Toulon
  - HF communication antenna (wide band Thomson CSF spiral antenna "Volubilis") versus active whip
  - Urban site

- On the Gennevilliers THALES site
  - roof versus ground
  - Industrial and urban site

2016 analysis campaign

Rationale, addressing POINT 1

- Channel Availability estimation is based on S/N (signal over noise) ratio
  - A bad, or inconsistent Noise level estimation will lead to inconsistent results

  ➔ so we decided to concentrate on this noise level measurement in an attempt to correlate or consistently be able to compare channel availability measurements done in different locations, with different setup, at different times.

- Assumptions of isotropic noise
  - Following the ITU, we consider the noise sources as isotropic
  - For comparisons purposes, we want to assess the noise level obtained similarly to the ITU publications as an ambient noise factor over thermal noise Fa in dB.

- Initially, we made the assumption that we would be able to compare measurements done with the Clifton whip antenna and the results from communication antennas … and found out interestingly different results …

Noise level estimation

Standard noise level model

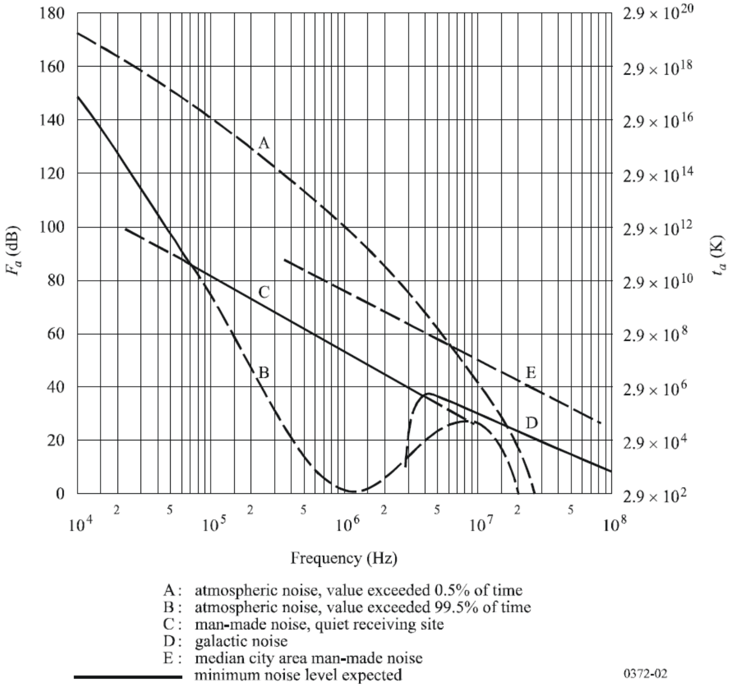
- Following convention followed in the ITU-R P.372-10, we will represent ambient noise levels as a noise factor $Fa = 10\, log_{10}(fa)$
- fa is the ratio or actual measured noise density kTa to the standard thermal noise level $kT0$

The question is then: how to express Fa?

- Solution 1 : use Antenna model as per Rec. ITU-R P.372-10 i.e. ideal half-wave dipole in free space or a ideal short (*h* << λ) vertical monopole above a perfect ground plane => not realistic or consistent with real antennas.
- **Solution 2 : derive it based on measurements**

FIGURE 2

F_a versus frequency (10^4 to 10^8 Hz)



Noise level estimation

Antenna models and noise level : let us express Fa for our two antennas

- Short whip or loop active antennas
  - Short whip or short loop active antenna characterized by the effective height : $h_{e,}$ with the signal is (relatively) constant over frequency
  - The proposed Clifton whip, the pixel loop and any "active" measuring antenna falls into this category.
  - The received signal is proportional to incident E or H field

- Communications antennas (e.g. Volubilis)
  - Communications antennas, wide-band or tuned with an ATU falls into another category
  - This category is characterized by a gain over isotropic antenna
  - Received signal is proportional to the gain and inversely proportional to the frequency

Noise level estimation (details, can be discussed further at break)

Antenna response for short whip versus communications antenna comparison

For a short ship active antenna, the antenna factor is

$$\boldsymbol{AF} = \frac{E}{V}$$

Where E is the incident electrical field, and V the antenna output voltage

In dB, where he is the effective height, or the physical antenna length for a short whip

$$AF[dB.m^{-1}] = 20\, log10(\frac{1}{he})$$

For a tuned antenna or “matched” antenna, in an equivalent way, we can compute an equivalent Antenna Factor $AFeq$

$$AFeq = \frac{\sqrt{\frac{4\,\pi\, Z0}{R0}}}{\lambda\,\sqrt{Gi}}$$

Where λ, is the wavelength, Gi the gain over isotropic antenna.

We see that for a given received electrical field E, both antennas will have a different output level amplitude in function of the frequency.

Noise level estimation (details, can be discussed further at break)

Antenna output noise level due to an isotropic noise source kTa
Noise level in the ITU is expressed as a noise level above the standard ambient noise temperature or noise factor fa or Fa

For a short active whip antenna :
Pm the received power expressed in W/Hz

$$fa = \frac{kTa}{kT0} = \frac{Pm}{kT0}\frac{R0}{4.Ra}$$

Where Pm is the received power (in W) and Ra, the equivalent radiation resistance (which is frequency dependent).
Expressed In dB

$$Fa[dB] = Pm[dBm_{Hz}] - 173.98 + 10.log_{10}\left(\frac{R0}{4.Ra}\right)$$

Accessorily, we can compute a correction factor for estimating Fa

$$Q = 10.log_{10}\left(\frac{R0}{4.Ra}\right)$$

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Noise level estimation (details, can be discussed further at break)

For a wideband or narrow band tuned antenna

For the simplicity, we will consider a lossless antenna and tuner : $Gi = Di$
The radiation resistance is matched to the receiver resistance : $Ra = R0$

$$en_m{}^2 = k\,Ta\,R0$$

$$Ta = \frac{en_m{}^2}{k\,R0}$$

Which gives the antenna noise factor

$$fa = \frac{en_m{}^2}{kT0\,R0} = \frac{Pm}{kT0}$$

Pm is in W/Hz
Expressed in dB

$$Fa[dB] = Pm[dBm_{Hz}] - 173.98$$

For a lossless tuned antenna the Q factor is :

$$Q = 0$$

For more details on antenna and noise measurements, do not hesitate to refer yourself to Harald Wickenhauser course in last Nordic HF ☺

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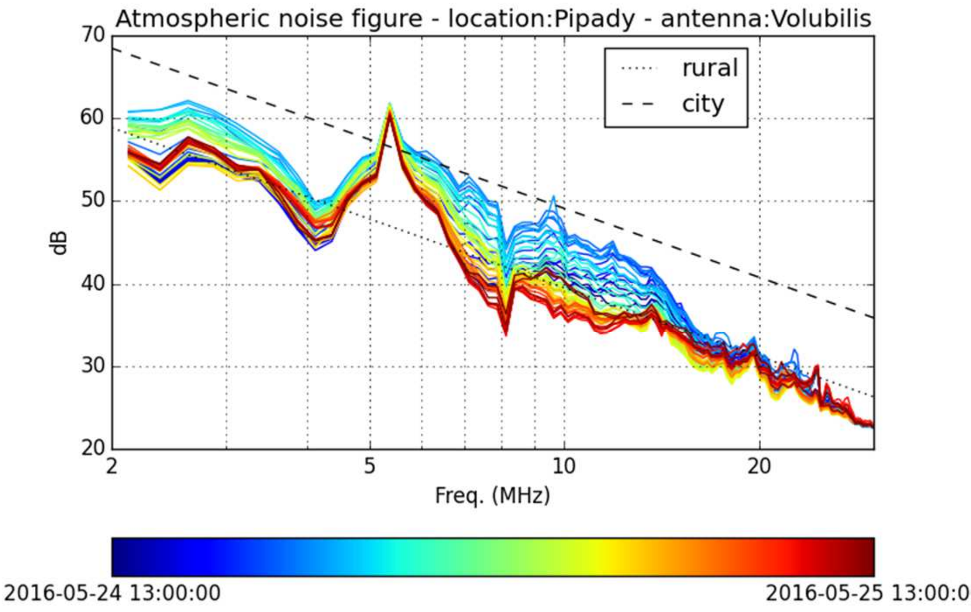
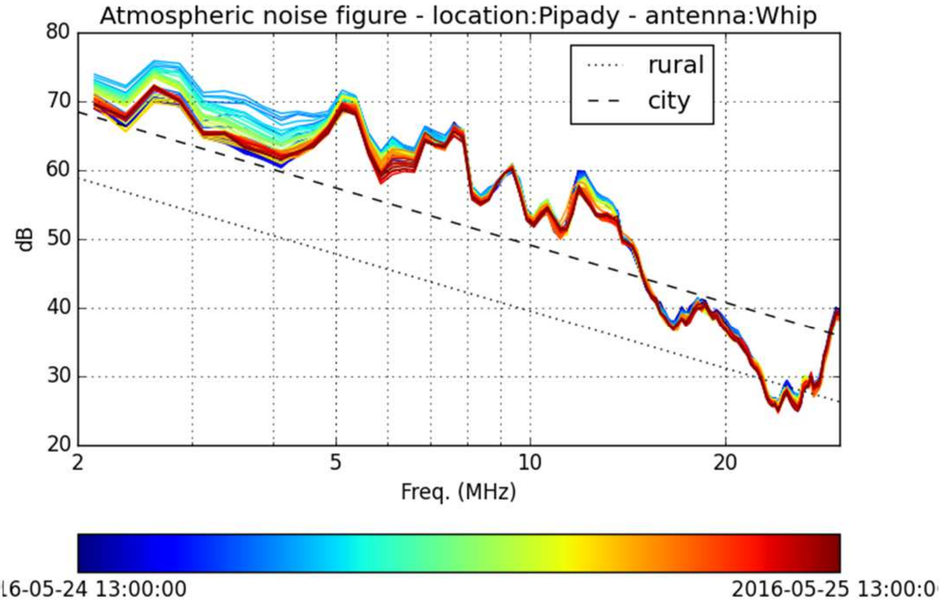
Noise level estimation: obtained curves (Toulon, France)

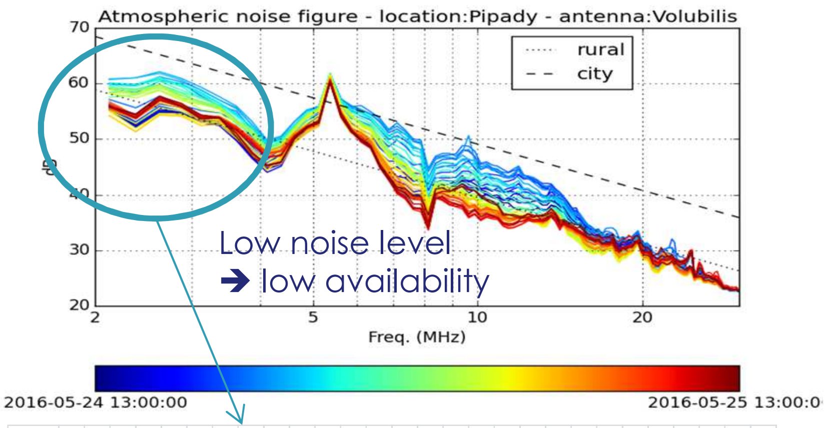
Volubilis (communication antenna), ground level



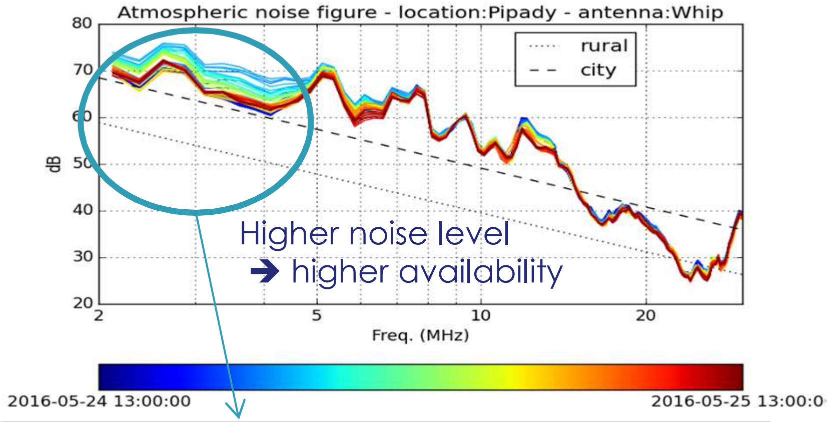
Clifton on top of a 4m building



Comparison between a communication antenna and a Clifton whip

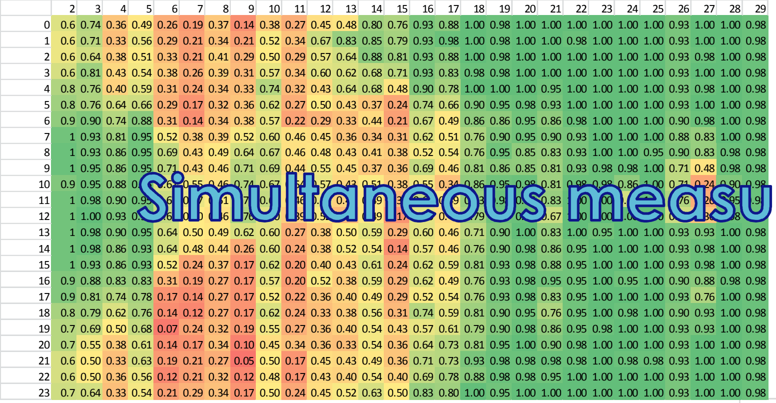


Low noise level
➔ low availability

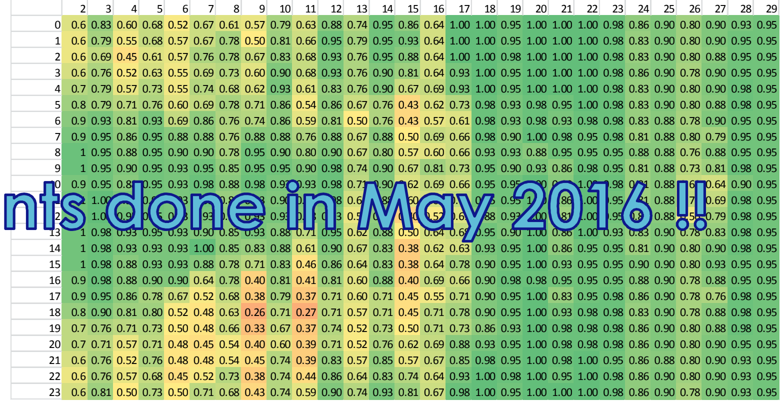


Higher noise level
➔ higher availability

Simultaneous measurements done in May 2016 !!



	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	0.6	0.74	0.36	0.49	0.26	0.19	0.37	0.14	0.38	0.27	0.45	0.48	0.80	0.76	0.93	0.88	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
1	0.6	0.71	0.33	0.56	0.29	0.21	0.34	0.21	0.52	0.34	0.67	0.83	0.85	0.79	0.93	0.98	1.00	0.98	1.00	1.00	0.98	1.00	1.00	1.00	0.93	1.00	1.00	0.98
2	0.6	0.64	0.38	0.51	0.33	0.21	0.41	0.29	0.50	0.29	0.57	0.64	0.88	0.81	0.93	0.88	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.98	1.00	0.98
3	0.6	0.81	0.43	0.54	0.38	0.26	0.39	0.31	0.57	0.34	0.60	0.62	0.68	0.71	0.93	0.83	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
4	0.8	0.76	0.40	0.59	0.31	0.24	0.34	0.33	0.74	0.32	0.43	0.64	0.68	0.48	0.90	0.78	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.93	0.98	1.00	0.98
5	0.8	0.76	0.64	0.66	0.29	0.17	0.32	0.36	0.62	0.27	0.50	0.43	0.37	0.24	0.74	0.66	0.90	0.95	0.98	0.93	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
6	0.9	0.90	0.74	0.88	0.31	0.14	0.34	0.38	0.57	0.22	0.29	0.33	0.44	0.21	0.67	0.49	0.86	0.86	0.95	0.86	0.98	1.00	1.00	1.00	0.90	0.98	1.00	0.98
7	1	0.93	0.81	0.95	0.52	0.38	0.39	0.52	0.60	0.46	0.45	0.36	0.34	0.31	0.62	0.51	0.76	0.90	0.95	0.90	0.93	1.00	1.00	1.00	0.88	0.83	1.00	0.98
8	1	0.93	0.86	0.95	0.69	0.43	0.49	0.64	0.67	0.46	0.48	0.43	0.41	0.38	0.52	0.54	0.76	0.95	0.85	0.83	0.93	1.00	1.00	0.95	0.90	0.83	0.98	0.98
9	1	0.95	0.86	0.95	0.71	0.43	0.46	0.71	0.69	0.44	0.55	0.45	0.37	0.36	0.69	0.46	0.81	0.86	0.85	0.81	0.93	0.98	0.98	1.00	0.71	0.48	0.98	0.98
10	0.9	0.95	0.88	[illegible]	[illegible]	0.55	0.46	0.74	0.67	[illegible]	0.57	0.43	0.51	0.38	0.55	0.34	0.86	0.95	0.98	0.81	0.98	0.98	0.86	1.00	0.71	0.24	0.90	0.98
11	1	0.98	0.90	0.95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.49	[illegible]	[illegible]	0.49	[illegible]	[illegible]	[illegible]	0.83	[illegible]	[illegible]	[illegible]	[illegible]	0.76	[illegible]	0.95	[illegible]
12	1	1.00	0.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.49	[illegible]	[illegible]	0.79	[illegible]	[illegible]	[illegible]	0.67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	1	0.98	0.90	0.95	0.64	0.50	0.49	0.62	0.60	0.27	0.38	0.50	0.59	0.29	0.60	0.46	0.71	0.90	1.00	0.83	1.00	0.95	1.00	1.00	0.93	0.93	1.00	0.98
14	1	0.98	0.86	0.93	0.64	0.48	0.44	0.26	0.60	0.24	0.38	0.52	0.54	0.14	0.57	0.46	0.76	0.90	0.98	0.86	0.95	1.00	1.00	1.00	0.93	0.98	1.00	0.98
15	1	0.93	0.86	0.93	0.52	0.24	0.37	0.17	0.62	0.20	0.40	0.43	0.61	0.24	0.62	0.59	0.81	0.93	0.98	0.88	0.95	1.00	1.00	1.00	0.93	0.98	1.00	0.98
16	0.9	0.88	0.83	0.83	0.31	0.19	0.27	0.17	0.57	0.20	0.52	0.38	0.59	0.29	0.62	0.49	0.76	0.93	0.98	0.95	0.95	1.00	0.95	1.00	0.90	0.88	0.98	0.98
17	0.9	0.81	0.74	0.78	0.17	0.14	0.27	0.17	0.52	0.22	0.36	0.40	0.49	0.29	0.52	0.54	0.76	0.93	0.98	0.83	0.95	1.00	1.00	1.00	0.93	0.76	1.00	0.98
18	0.8	0.79	0.62	0.76	0.14	0.12	0.27	0.17	0.62	0.24	0.33	0.38	0.56	0.31	0.74	0.59	0.81	0.90	0.95	0.76	0.95	1.00	0.98	1.00	0.90	0.93	1.00	0.98
19	0.7	0.69	0.50	0.68	0.07	0.24	0.32	0.19	0.55	0.27	0.36	0.40	0.54	0.43	0.57	0.61	0.79	0.90	0.98	0.86	0.95	0.98	1.00	1.00	0.93	0.93	1.00	0.98
20	0.7	0.55	0.38	0.61	0.14	0.17	0.34	0.10	0.45	0.34	0.36	0.33	0.54	0.36	0.64	0.73	0.81	0.95	1.00	0.90	0.98	1.00	1.00	1.00	0.93	1.00	1.00	0.98
21	0.6	0.50	0.33	0.63	0.19	0.21	0.27	0.05	0.50	0.17	0.45	0.43	0.49	0.36	0.71	0.73	0.93	0.98	0.98	0.98	0.98	1.00	0.98	0.98	0.93	1.00	1.00	0.98
22	0.6	0.50	0.36	0.56	0.12	0.21	0.32	0.12	0.48	0.17	0.43	0.40	0.54	0.40	0.69	0.78	0.88	0.98	0.98	0.95	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
23	0.7	0.64	0.33	0.54	0.21	0.29	0.34	0.17	0.50	0.24	0.45	0.52	0.63	0.50	0.83	0.80	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98



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1	0.6	0.79	0.55	0.68	0.57	0.67	0.78	0.50	0.81	0.66	0.95	0.79	0.95	0.93	0.64	1.00	1.00	0.95	1.00	1.00	1.00	0.98	0.83	0.90	0.80	0.90	0.95	0.95
2	0.6	0.69	0.45	0.61	0.57	0.76	0.78	0.67	0.83	0.68	0.93	0.76	0.95	0.88	0.64	1.00	1.00	0.98	1.00	1.00	1.00	0.98	0.83	0.90	0.80	0.88	0.95	0.95
3	0.6	0.76	0.52	0.63	0.55	0.69	0.73	0.60	0.90	0.68	0.93	0.76	0.90	0.81	0.64	0.93	1.00	0.95	1.00	1.00	1.00	0.98	0.86	0.90	0.78	0.90	0.95	0.95
4	0.7	0.79	0.57	0.73	0.55	0.74	0.68	0.62	0.93	0.61	0.83	0.76	0.90	0.67	0.69	0.93	1.00	0.95	1.00	1.00	1.00	0.98	0.83	0.90	0.80	0.90	0.98	0.95
5	0.8	0.79	0.71	0.76	0.60	0.69	0.78	0.71	0.86	0.54	0.86	0.67	0.76	0.43	0.62	0.73	0.98	0.93	0.98	0.95	1.00	0.98	0.83	0.90	0.80	0.88	0.98	0.95
6	0.9	0.93	0.81	0.93	0.69	0.86	0.76	0.74	0.86	0.59	0.81	0.50	0.76	0.43	0.57	0.61	0.98	0.93	0.98	0.93	0.98	0.98	0.83	0.88	0.78	0.90	0.95	0.95
7	0.9	0.95	0.86	0.95	0.88	0.88	0.76	0.88	0.88	0.76	0.88	0.67	0.88	0.50	0.69	0.66	0.98	0.90	1.00	0.98	0.95	0.98	0.81	0.88	0.80	0.79	0.95	0.95
8	1	0.95	0.88	0.95	0.90	0.90	0.78	0.95	0.90	0.80	0.90	0.67	0.80	0.57	0.60	0.66	0.93	0.93	0.88	0.95	0.95	0.95	0.88	0.88	0.76	0.88	0.95	0.95
9	1	0.95	0.90	0.95	0.93	0.95	0.85	0.95	0.95	0.90	0.98	0.74	0.90	0.67	0.81	0.73	0.95	0.90	0.93	0.86	0.98	0.95	0.81	0.88	0.73	0.81	0.98	0.95
10	0.9	0.95	[illegible]	0.95	0.93	0.98	0.88	0.98	[illegible]	0.93	0.98	0.71	0.90	[illegible]	0.69	0.66	0.95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.88	[illegible]	0.64	0.90	0.95
11	[illegible]	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.95	[illegible]	[illegible]	[illegible]	0.95	[illegible]	0.88	[illegible]	0.69	0.98	0.95
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.88	[illegible]	0.79	0.98	0.95
13	1	0.98	0.93	0.95	0.93	0.90	0.85	0.93	0.88	0.71	0.95	0.62	0.88	0.50	0.64	[illegible]	0.95	0.90	1.00	0.86	1.00	0.93	0.83	0.90	0.78	0.83	0.98	0.95
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15	1	0.98	0.88	0.93	0.93	0.88	0.78	0.71	0.83	0.46	0.86	0.64	0.83	0.38	0.64	0.78	0.90	0.95	1.00	0.93	0.95	0.95	0.90	0.90	0.80	0.93	0.95	0.95
16	0.9	0.98	0.88	0.90	0.90	0.64	0.78	0.40	0.81	0.41	0.81	0.60	0.88	0.40	0.69	0.66	0.90	0.98	0.98	0.95	0.95	0.95	0.88	0.90	0.78	0.88	0.95	0.95
17	0.9	0.95	0.86	0.78	0.67	0.52	0.68	0.38	0.79	0.37	0.71	0.60	0.71	0.45	0.55	0.71	0.90	0.95	1.00	0.83	0.95	0.98	0.86	0.90	0.78	0.76	0.98	0.95
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19	0.7	0.76	0.71	0.73	0.50	0.48	0.66	0.33	0.67	0.37	0.74	0.52	0.73	0.50	0.71	0.73	0.86	0.93	1.00	0.98	0.98	0.98	0.86	0.90	0.80	0.88	0.98	0.95
20	0.7	0.71	0.57	0.71	0.48	0.45	0.54	0.40	0.60	0.39	0.71	0.52	0.76	0.62	0.69	0.88	0.93	0.95	1.00	0.98	0.98	0.98	0.86	0.90	0.80	0.90	0.95	0.95
21	0.6	0.76	0.52	0.76	0.48	0.48	0.54	0.45	0.74	0.39	0.83	0.57	0.85	0.57	0.67	0.85	0.98	0.95	1.00	0.98	1.00	0.95	0.86	0.88	0.80	0.90	0.93	0.95
22	0.6	0.76	0.57	0.68	0.45	0.52	0.73	0.38	0.74	0.44	0.86	0.64	0.83	0.74	0.64	0.93	1.00	0.98	1.00	0.95	1.00	0.98	0.86	0.90	0.80	0.90	0.93	0.95
23	0.6	0.81	0.50	0.73	0.50	0.71	0.68	0.43	0.74	0.59	0.90	0.74	0.93	0.81	0.67	0.98	1.00	0.95	1.00	1.00	1.00	0.98	0.86	0.90	0.78	0.90	0.93	0.95

Channel availability measurements

Comparison between contiguous and not contiguous, addressing POINT 2

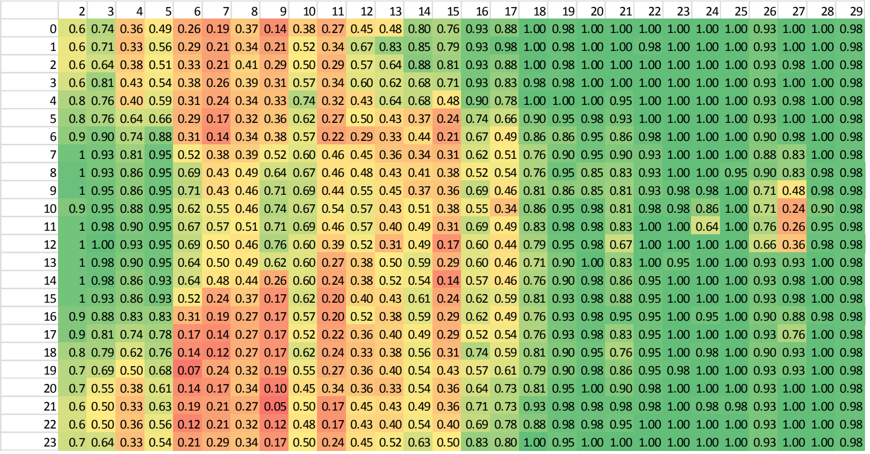
- THALES has transmitted to Bill Furman in July the source code and executable (.exe and python) for the proposed scanning scheme in previous presentations.

- We (you too!) are now able to compare the two PHY layers and compare availabilities with both modes
  - See parameters definition recalled in Feb. 2016

Results from Toulon measurements: non-contiguous vs. contiguous

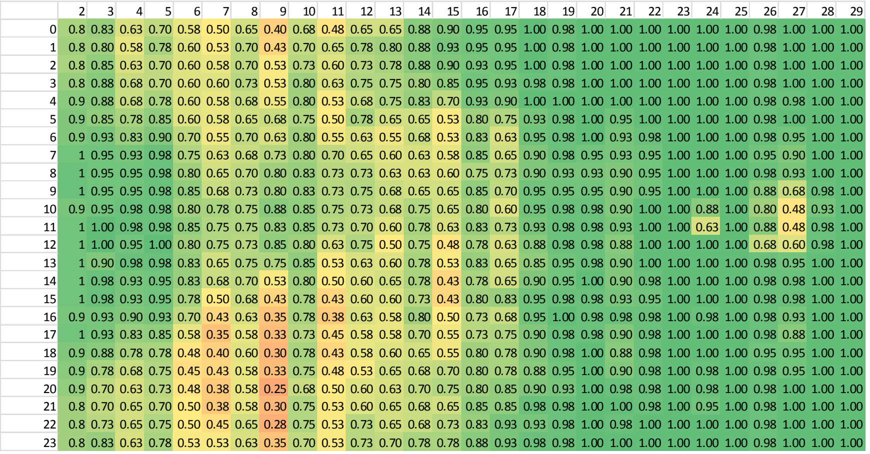
Using “Volubilis” Communication antenna

Volubilis 24kHz-110C



	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	0.6	0.74	0.36	0.49	0.26	0.19	0.37	0.14	0.38	0.27	0.45	0.48	0.80	0.76	0.93	0.88	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
1	0.6	0.71	0.33	0.56	0.29	0.21	0.34	0.21	0.52	0.34	0.67	0.83	0.85	0.79	0.93	0.98	1.00	0.98	1.00	1.00	0.98	1.00	1.00	1.00	0.93	1.00	1.00	0.98
2	0.6	0.64	0.38	0.51	0.33	0.21	0.41	0.29	0.50	0.29	0.57	0.64	0.88	0.81	0.93	0.88	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.98	1.00	0.98
3	0.6	0.81	0.43	0.54	0.38	0.26	0.39	0.31	0.57	0.34	0.60	0.62	0.68	0.71	0.93	0.83	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
4	0.8	0.76	0.40	0.59	0.31	0.24	0.34	0.33	0.74	0.32	0.43	0.64	0.68	0.48	0.90	0.78	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.93	0.98	1.00	0.98
5	0.8	0.76	0.64	0.66	0.29	0.17	0.32	0.36	0.62	0.27	0.50	0.43	0.37	0.24	0.74	0.66	0.90	0.95	0.98	0.93	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
6	0.9	0.90	0.74	0.88	0.31	0.14	0.34	0.38	0.57	0.22	0.29	0.33	0.44	0.21	0.67	0.49	0.86	0.86	0.95	0.86	0.98	1.00	1.00	1.00	0.90	0.98	1.00	0.98
7	1	0.93	0.81	0.95	0.52	0.38	0.39	0.52	0.60	0.46	0.45	0.36	0.34	0.31	0.62	0.51	0.76	0.90	0.95	0.90	0.93	1.00	1.00	1.00	0.88	0.83	1.00	0.98
8	1	0.93	0.86	0.95	0.69	0.43	0.49	0.64	0.67	0.46	0.48	0.43	0.41	0.38	0.52	0.54	0.76	0.95	0.85	0.83	0.93	1.00	1.00	0.95	0.90	0.83	0.98	0.98
9	1	0.95	0.86	0.95	0.71	0.43	0.46	0.71	0.69	0.44	0.55	0.45	0.37	0.36	0.69	0.46	0.81	0.86	0.85	0.81	0.93	0.98	0.98	1.00	0.71	0.48	0.98	0.98
10	0.9	0.95	0.88	0.95	0.62	0.55	0.46	0.74	0.67	0.54	0.57	0.43	0.51	0.38	0.55	0.34	0.86	0.95	0.98	0.81	0.98	0.98	0.86	1.00	0.71	0.24	0.90	0.98
11	1	0.98	0.90	0.95	0.67	0.57	0.51	0.71	0.69	0.46	0.57	0.40	0.49	0.31	0.69	0.49	0.83	0.98	0.98	0.83	1.00	1.00	0.64	1.00	0.76	0.26	0.95	0.98
12	1	1.00	0.93	0.95	0.69	0.50	0.46	0.76	0.60	0.39	0.52	0.31	0.49	0.17	0.60	0.44	0.79	0.95	0.98	0.67	1.00	1.00	1.00	1.00	0.66	0.36	0.98	0.98
13	1	0.98	0.90	0.95	0.64	0.50	0.49	0.62	0.60	0.27	0.38	0.50	0.59	0.29	0.60	0.46	0.71	0.90	1.00	0.83	1.00	0.95	1.00	1.00	0.93	0.93	1.00	0.98
14	1	0.98	0.86	0.93	0.64	0.48	0.44	0.26	0.60	0.24	0.38	0.52	0.54	0.14	0.57	0.46	0.76	0.90	0.98	0.86	0.95	1.00	1.00	1.00	0.93	0.98	1.00	0.98
15	1	0.93	0.86	0.93	0.52	0.24	0.37	0.17	0.62	0.20	0.40	0.43	0.61	0.24	0.62	0.59	0.81	0.93	0.98	0.88	0.95	1.00	1.00	1.00	0.93	0.98	1.00	0.98
16	0.9	0.88	0.83	0.83	0.31	0.19	0.27	0.17	0.57	0.20	0.52	0.38	0.59	0.29	0.62	0.49	0.76	0.93	0.98	0.95	0.95	1.00	0.95	1.00	0.90	0.88	0.98	0.98
17	0.9	0.81	0.74	0.78	0.17	0.14	0.27	0.17	0.52	0.22	0.36	0.40	0.49	0.29	0.52	0.54	0.76	0.93	0.98	0.83	0.95	1.00	1.00	1.00	0.93	0.76	1.00	0.98
18	0.8	0.79	0.62	0.76	0.14	0.12	0.27	0.17	0.62	0.24	0.33	0.38	0.56	0.31	0.74	0.59	0.81	0.90	0.95	0.76	0.95	1.00	0.98	1.00	0.90	0.93	1.00	0.98
19	0.7	0.69	0.50	0.68	0.07	0.24	0.32	0.19	0.55	0.27	0.36	0.40	0.54	0.43	0.57	0.61	0.79	0.90	0.98	0.86	0.95	0.98	1.00	1.00	0.93	0.93	1.00	0.98
20	0.7	0.55	0.38	0.61	0.14	0.17	0.34	0.10	0.45	0.34	0.36	0.33	0.54	0.36	0.64	0.73	0.81	0.95	1.00	0.90	0.98	1.00	1.00	1.00	0.93	1.00	1.00	0.98
21	0.6	0.50	0.33	0.63	0.19	0.21	0.27	0.05	0.50	0.17	0.45	0.43	0.49	0.36	0.71	0.73	0.93	0.98	0.98	0.98	0.98	1.00	0.98	0.98	0.93	1.00	1.00	0.98
22	0.6	0.50	0.36	0.56	0.12	0.21	0.32	0.12	0.48	0.17	0.43	0.40	0.54	0.40	0.69	0.78	0.88	0.98	0.98	0.95	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98
23	0.7	0.64	0.33	0.54	0.21	0.29	0.34	0.17	0.50	0.24	0.45	0.52	0.63	0.50	0.83	0.80	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.98

Volubilis 24kHz-XL



	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	0.8	0.83	0.63	0.70	0.58	0.50	0.65	0.40	0.68	0.48	0.65	0.65	0.88	0.90	0.95	0.95	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
1	0.8	0.80	0.58	0.78	0.60	0.53	0.70	0.43	0.70	0.65	0.78	0.80	0.88	0.93	0.95	0.95	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
2	0.8	0.85	0.63	0.70	0.60	0.58	0.70	0.53	0.73	0.60	0.73	0.78	0.88	0.90	0.93	0.95	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
3	0.8	0.88	0.68	0.70	0.60	0.60	0.73	0.53	0.80	0.63	0.75	0.75	0.80	0.85	0.95	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
4	0.9	0.88	0.68	0.78	0.60	0.58	0.68	0.55	0.80	0.53	0.68	0.75	0.83	0.70	0.93	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	1.00	1.00
5	0.9	0.85	0.78	0.85	0.60	0.58	0.65	0.68	0.75	0.50	0.78	0.65	0.65	0.53	0.80	0.75	0.93	0.98	1.00	0.95	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
6	0.9	0.93	0.83	0.90	0.70	0.55	0.70	0.63	0.80	0.55	0.63	0.55	0.68	0.53	0.83	0.63	0.95	0.98	1.00	0.93	0.98	1.00	1.00	1.00	0.98	0.95	1.00	1.00
7	1	0.95	0.93	0.98	0.75	0.63	0.68	0.73	0.80	0.70	0.65	0.60	0.63	0.58	0.85	0.65	0.90	0.98	0.95	0.93	0.95	1.00	1.00	1.00	0.95	0.90	1.00	1.00
8	1	0.95	0.95	0.98	0.80	0.65	0.70	0.80	0.83	0.73	0.73	0.63	0.63	0.60	0.75	0.73	0.90	0.93	0.93	0.90	0.95	1.00	1.00	1.00	0.98	0.93	1.00	1.00
9	1	0.95	0.95	0.98	0.85	0.68	0.73	0.80	0.83	0.73	0.75	0.68	0.65	0.65	0.85	0.70	0.95	0.95	0.95	0.90	0.95	1.00	1.00	1.00	0.88	0.68	0.98	1.00
10	0.9	0.95	0.98	0.98	0.80	0.78	0.75	0.88	0.85	0.75	0.73	0.68	0.75	0.65	0.80	0.60	0.95	0.98	0.98	0.90	1.00	1.00	0.88	1.00	0.80	0.48	0.93	1.00
11	1	1.00	0.98	0.98	0.85	0.75	0.75	0.83	0.85	0.73	0.70	0.60	0.78	0.63	0.83	0.73	0.93	0.98	0.98	0.93	1.00	1.00	0.63	1.00	0.88	0.48	0.98	1.00
12	1	1.00	0.95	1.00	0.80	0.75	0.73	0.85	0.80	0.63	0.75	0.50	0.75	0.48	0.78	0.63	0.88	0.98	0.98	0.88	1.00	1.00	1.00	1.00	0.68	0.60	0.98	1.00
13	1	0.90	0.98	0.98	0.83	0.65	0.75	0.75	0.85	0.53	0.63	0.60	0.78	0.53	0.83	0.65	0.85	0.95	0.98	0.90	1.00	1.00	1.00	1.00	0.98	0.95	1.00	1.00
14	1	0.98	0.93	0.95	0.83	0.68	0.70	0.53	0.80	0.50	0.60	0.65	0.78	0.43	0.78	0.65	0.90	0.95	1.00	0.90	0.98	1.00	1.00	1.00	0.98	0.98	1.00	1.00
15	1	0.98	0.93	0.95	0.78	0.50	0.68	0.43	0.78	0.43	0.60	0.60	0.73	0.43	0.80	0.83	0.95	0.98	0.98	0.93	0.95	1.00	1.00	1.00	0.98	0.98	1.00	1.00
16	0.9	0.93	0.90	0.93	0.70	0.43	0.63	0.35	0.78	0.38	0.63	0.58	0.80	0.50	0.73	0.68	0.95	1.00	0.98	0.98	0.98	1.00	0.98	1.00	0.98	0.93	1.00	1.00
17	1	0.93	0.83	0.85	0.58	0.35	0.58	0.33	0.73	0.45	0.58	0.58	0.70	0.55	0.73	0.75	0.90	0.98	0.98	0.90	0.98	1.00	1.00	1.00	0.98	0.88	1.00	1.00
18	0.9	0.88	0.78	0.78	0.48	0.40	0.60	0.30	0.78	0.43	0.58	0.60	0.65	0.55	0.80	0.78	0.90	0.98	1.00	0.88	0.98	1.00	1.00	1.00	0.95	0.95	1.00	1.00
19	0.9	0.78	0.68	0.75	0.45	0.43	0.58	0.33	0.75	0.48	0.53	0.65	0.68	0.70	0.80	0.78	0.88	0.95	1.00	0.90	0.98	1.00	0.98	1.00	0.98	0.95	1.00	1.00
20	0.9	0.70	0.63	0.73	0.48	0.38	0.58	0.25	0.68	0.50	0.60	0.63	0.70	0.75	0.80	0.85	0.90	0.93	1.00	0.98	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00
21	0.8	0.70	0.65	0.70	0.50	0.38	0.58	0.30	0.75	0.53	0.60	0.65	0.68	0.65	0.85	0.85	0.98	0.98	1.00	1.00	0.98	1.00	0.95	1.00	0.98	1.00	1.00	1.00
22	0.8	0.73	0.65	0.75	0.50	0.45	0.65	0.28	0.75	0.53	0.73	0.65	0.68	0.73	0.83	0.93	0.93	0.98	1.00	0.98	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
23	0.8	0.83	0.63	0.78	0.53	0.53	0.63	0.35	0.70	0.53	0.73	0.70	0.78	0.78	0.88	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00

Confirms in urban area the results shown for rural in Feb. 2016

Paris (Gennevilliers Thales Premises)

Clifton antenna installation

- On the THALES campus in Gennevilliers (Paris)
- Urban

Roof

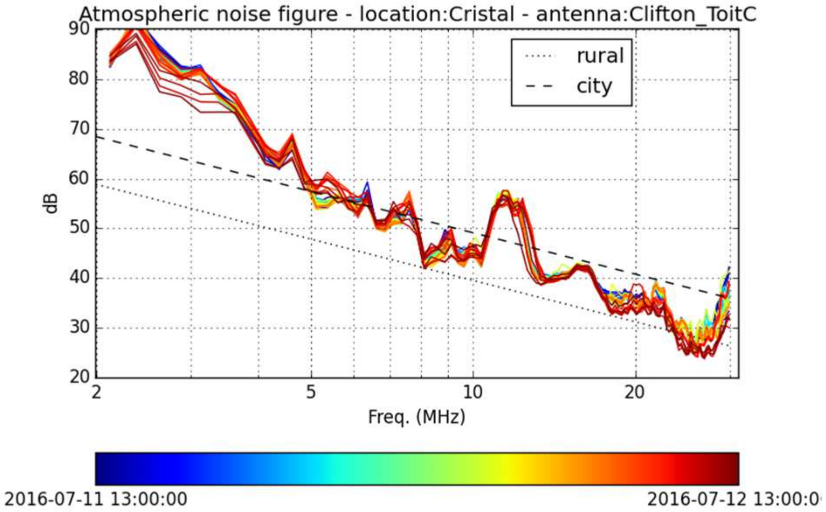
Ground

CRISTAL

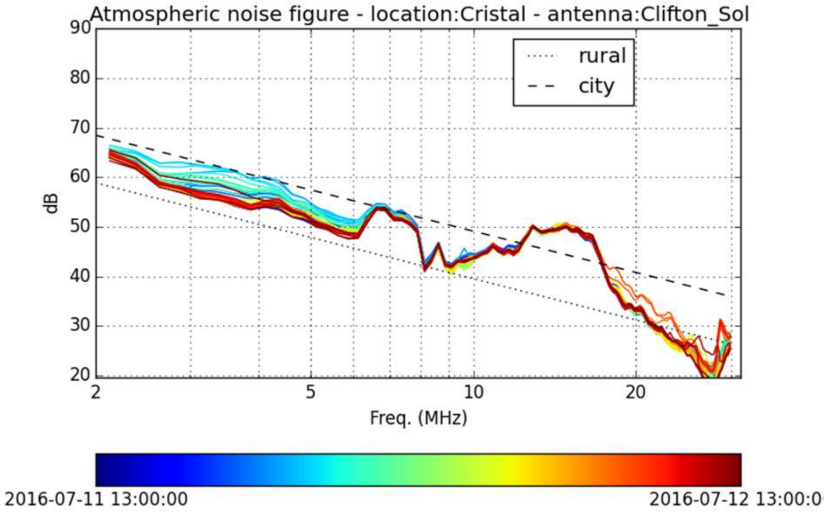
Results from Gennevilliers measurements: comparing the two Clifton antennas

Noise level comparison

Clifton roof Noise level



Clifton ground Noise level



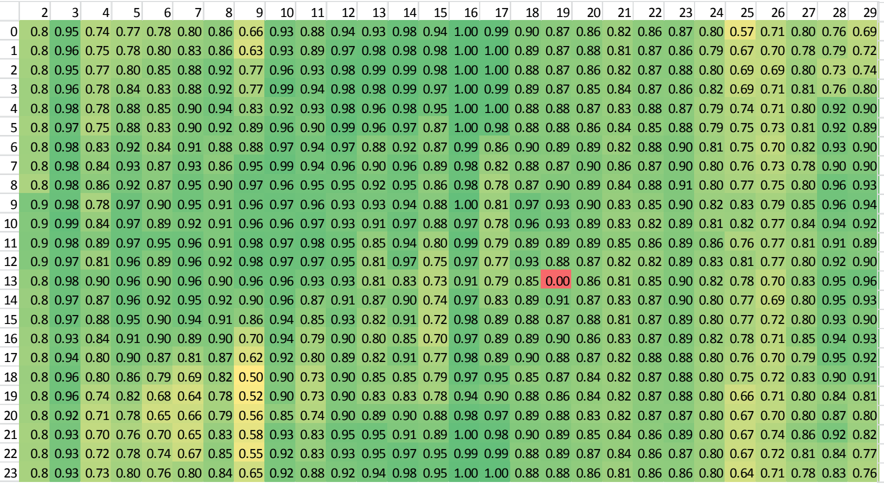
Simultaneous measurements done in July 2016 !!

Results from Toulon measurements: results for 3kHz band

Non contiguous channel availability for 3 kHz

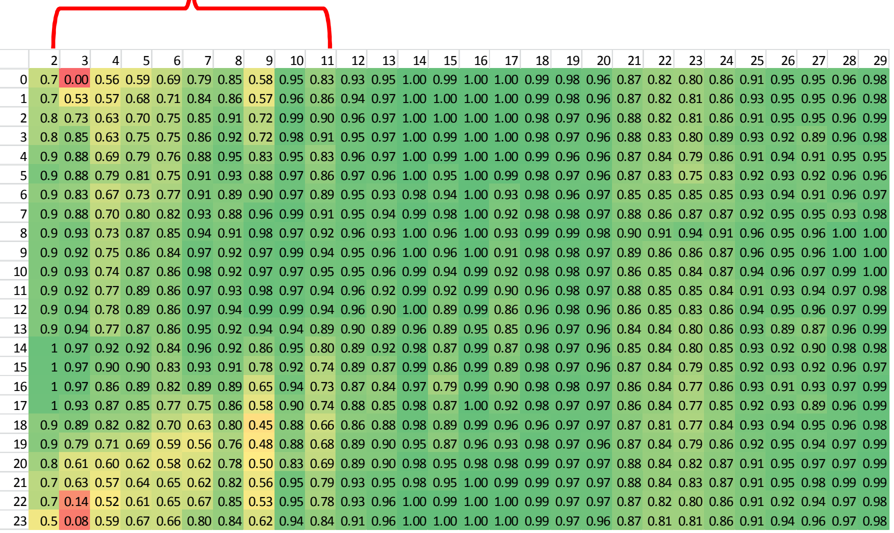
Low noise level shows lower availability

Clifton roof level 3 k



	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	0.8	0.95	0.74	0.77	0.78	0.80	0.86	0.66	0.93	0.88	0.94	0.93	0.98	0.94	1.00	0.99	0.90	0.87	0.86	0.82	0.86	0.87	0.80	0.57	0.71	0.80	0.76	0.69
1	0.8	0.96	0.75	0.78	0.80	0.83	0.86	0.63	0.93	0.89	0.97	0.98	0.98	0.98	1.00	1.00	0.89	0.87	0.88	0.81	0.87	0.86	0.79	0.67	0.70	0.78	0.79	0.72
2	0.8	0.95	0.77	0.80	0.85	0.88	0.92	0.77	0.96	0.93	0.98	0.99	0.99	0.98	1.00	1.00	0.88	0.87	0.86	0.82	0.87	0.88	0.80	0.69	0.69	0.80	0.73	0.74
3	0.8	0.96	0.78	0.84	0.83	0.88	0.92	0.77	0.99	0.94	0.98	0.98	0.99	0.97	1.00	0.99	0.89	0.87	0.85	0.84	0.87	0.86	0.82	0.69	0.71	0.81	0.76	0.80
4	0.8	0.98	0.78	0.88	0.85	0.90	0.94	0.83	0.92	0.93	0.98	0.96	0.98	0.95	1.00	1.00	0.88	0.88	0.87	0.83	0.88	0.87	0.79	0.74	0.71	0.80	0.92	0.90
5	0.8	0.97	0.75	0.88	0.83	0.90	0.92	0.89	0.96	0.90	0.99	0.96	0.97	0.87	1.00	0.98	0.88	0.88	0.86	0.84	0.85	0.88	0.79	0.75	0.73	0.81	0.92	0.89
6	0.8	0.98	0.83	0.92	0.84	0.91	0.88	0.88	0.97	0.94	0.97	0.88	0.92	0.87	0.99	0.86	0.90	0.89	0.89	0.82	0.88	0.90	0.81	0.75	0.70	0.82	0.93	0.90
7	0.8	0.98	0.84	0.93	0.87	0.93	0.86	0.95	0.99	0.94	0.96	0.90	0.96	0.89	0.98	0.82	0.88	0.87	0.90	0.86	0.87	0.90	0.80	0.76	0.73	0.78	0.90	0.90
8	0.8	0.98	0.86	0.92	0.87	0.95	0.90	0.97	0.96	0.95	0.95	0.92	0.95	0.86	0.98	0.78	0.87	0.90	0.89	0.84	0.88	0.91	0.80	0.77	0.75	0.80	0.96	0.93
9	0.9	0.98	0.78	0.97	0.90	0.95	0.91	0.96	0.97	0.96	0.93	0.93	0.94	0.88	1.00	0.81	0.97	0.93	0.90	0.83	0.85	0.90	0.82	0.83	0.79	0.85	0.96	0.94
10	0.9	0.99	0.84	0.97	0.89	0.92	0.91	0.96	0.96	0.97	0.93	0.91	0.97	0.88	0.97	0.78	0.96	0.93	0.89	0.83	0.82	0.89	0.81	0.82	0.77	0.84	0.94	0.92
11	0.9	0.98	0.89	0.97	0.95	0.96	0.91	0.98	0.97	0.98	0.95	0.85	0.94	0.80	0.99	0.79	0.89	0.89	0.89	0.85	0.86	0.89	0.86	0.76	0.77	0.81	0.91	0.89
12	0.9	0.97	0.81	0.96	0.89	0.96	0.92	0.98	0.97	0.97	0.95	0.81	0.97	0.75	0.97	0.77	0.93	0.88	0.87	0.82	0.82	0.89	0.83	0.81	0.77	0.80	0.92	0.90
13	0.8	0.98	0.90	0.96	0.90	0.96	0.90	0.96	0.96	0.93	0.93	0.81	0.83	0.73	0.91	0.79	0.85	0.00	0.86	0.81	0.85	0.90	0.82	0.78	0.70	0.83	0.95	0.96
14	0.8	0.97	0.87	0.96	0.92	0.95	0.92	0.90	0.96	0.87	0.91	0.87	0.90	0.74	0.97	0.83	0.89	0.91	0.87	0.83	0.87	0.90	0.80	0.77	0.69	0.80	0.95	0.93
15	0.8	0.97	0.88	0.95	0.90	0.94	0.91	0.86	0.94	0.85	0.93	0.82	0.91	0.72	0.98	0.89	0.88	0.87	0.88	0.81	0.87	0.89	0.80	0.77	0.72	0.80	0.93	0.90
16	0.8	0.93	0.84	0.91	0.90	0.89	0.90	0.70	0.94	0.79	0.90	0.80	0.85	0.70	0.97	0.89	0.89	0.90	0.86	0.83	0.87	0.89	0.82	0.78	0.71	0.85	0.94	0.93
17	0.8	0.94	0.80	0.90	0.87	0.81	0.87	0.62	0.92	0.80	0.89	0.82	0.91	0.77	0.98	0.89	0.90	0.88	0.87	0.82	0.88	0.88	0.80	0.76	0.70	0.79	0.95	0.92
18	0.8	0.96	0.80	0.86	0.79	0.69	0.82	0.50	0.90	0.73	0.90	0.85	0.85	0.79	0.97	0.95	0.85	0.87	0.84	0.82	0.87	0.88	0.80	0.75	0.72	0.83	0.90	0.91
19	0.8	0.96	0.74	0.82	0.68	0.64	0.78	0.52	0.90	0.73	0.90	0.83	0.83	0.78	0.94	0.90	0.88	0.86	0.84	0.82	0.87	0.88	0.80	0.66	0.71	0.80	0.84	0.81
20	0.8	0.92	0.71	0.78	0.65	0.66	0.79	0.56	0.85	0.74	0.90	0.89	0.90	0.88	0.98	0.97	0.89	0.88	0.83	0.82	0.87	0.87	0.80	0.67	0.70	0.80	0.87	0.80
21	0.8	0.93	0.70	0.76	0.70	0.65	0.83	0.58	0.93	0.83	0.95	0.95	0.91	0.89	1.00	0.98	0.90	0.89	0.85	0.84	0.86	0.89	0.80	0.67	0.74	0.86	0.92	0.82
22	0.8	0.93	0.72	0.78	0.74	0.67	0.85	0.55	0.92	0.83	0.93	0.95	0.97	0.95	0.99	0.99	0.88	0.89	0.87	0.84	0.86	0.87	0.80	0.67	0.72	0.81	0.84	0.77
23	0.8	0.93	0.73	0.80	0.76	0.80	0.84	0.65	0.92	0.88	0.92	0.94	0.98	0.95	1.00	1.00	0.88	0.88	0.86	0.81	0.86	0.86	0.80	0.64	0.71	0.78	0.83	0.76

Clifton ground level 3 k



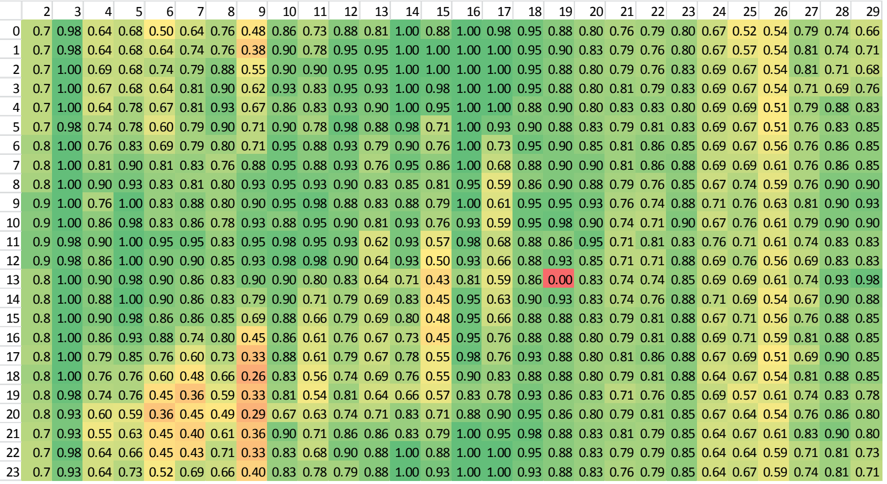
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.7	0.00	0.56	0.59	0.69	0.79	0.85	0.58	0.95	0.83	0.93	0.95	1.00	0.99	1.00	1.00	0.99	0.98	0.96	0.87	0.82	0.80	0.86	0.91	0.95	0.95	0.96	0.98
1	0.7	0.53	0.57	0.68	0.71	0.84	0.86	0.57	0.96	0.86	0.94	0.97	1.00	1.00	1.00	1.00	0.99	0.98	0.96	0.87	0.82	0.81	0.86	0.93	0.95	0.95	0.96	0.98
2	0.8	0.73	0.63	0.70	0.75	0.85	0.91	0.72	0.99	0.90	0.96	0.97	1.00	1.00	1.00	1.00	0.98	0.97	0.96	0.88	0.82	0.81	0.86	0.91	0.95	0.95	0.96	0.99
3	0.8	0.85	0.63	0.75	0.75	0.86	0.92	0.72	0.98	0.91	0.95	0.97	1.00	0.99	1.00	1.00	0.98	0.97	0.96	0.88	0.83	0.80	0.89	0.93	0.92	0.89	0.96	0.98
4	0.9	0.88	0.69	0.79	0.76	0.88	0.95	0.83	0.95	0.83	0.96	0.97	1.00	0.99	1.00	1.00	0.99	0.96	0.96	0.87	0.84	0.79	0.86	0.91	0.94	0.91	0.95	0.95
5	0.9	0.88	0.79	0.81	0.75	0.91	0.93	0.88	0.97	0.86	0.97	0.96	1.00	0.95	1.00	0.99	0.98	0.97	0.96	0.87	0.83	0.75	0.83	0.92	0.93	0.92	0.96	0.96
6	0.9	0.83	0.67	0.73	0.77	0.91	0.89	0.90	0.97	0.89	0.95	0.93	0.98	0.94	1.00	0.93	0.98	0.96	0.97	0.85	0.85	0.85	0.85	0.93	0.94	0.91	0.96	0.97
7	0.9	0.88	0.70	0.80	0.82	0.93	0.88	0.96	0.99	0.91	0.95	0.94	0.99	0.98	1.00	0.92	0.98	0.98	0.97	0.88	0.86	0.87	0.87	0.92	0.95	0.95	0.93	0.98
8	0.9	0.93	0.73	0.87	0.85	0.94	0.91	0.98	0.97	0.92	0.96	0.93	1.00	0.96	1.00	0.93	0.99	0.99	0.98	0.90	0.91	0.94	0.91	0.96	0.95	0.96	1.00	1.00
9	0.9	0.92	0.75	0.86	0.84	0.97	0.92	0.97	0.99	0.94	0.95	0.96	1.00	0.96	1.00	0.91	0.98	0.98	0.97	0.89	0.86	0.86	0.87	0.96	0.95	0.96	1.00	1.00
10	0.9	0.93	0.74	0.87	0.86	0.98	0.92	0.97	0.97	0.95	0.95	0.96	0.99	0.94	0.99	0.92	0.98	0.98	0.97	0.86	0.85	0.84	0.87	0.94	0.96	0.97	0.99	1.00
11	0.9	0.92	0.77	0.89	0.86	0.97	0.93	0.98	0.97	0.94	0.96	0.92	0.99	0.92	0.99	0.90	0.96	0.98	0.97	0.88	0.85	0.85	0.84	0.91	0.93	0.94	0.97	0.98
12	0.9	0.94	0.78	0.89	0.86	0.97	0.94	0.99	0.99	0.94	0.96	0.90	1.00	0.89	0.99	0.86	0.96	0.98	0.96	0.86	0.85	0.83	0.86	0.94	0.95	0.96	0.97	0.99
13	0.9	0.94	0.77	0.87	0.86	0.95	0.92	0.94	0.94	0.89	0.90	0.89	0.96	0.89	0.95	0.85	0.96	0.97	0.96	0.84	0.84	0.80	0.86	0.93	0.89	0.87	0.96	0.99
14	1	0.97	0.92	0.92	0.84	0.96	0.92	0.86	0.95	0.80	0.89	0.92	0.98	0.87	0.99	0.87	0.98	0.97	0.96	0.85	0.84	0.80	0.85	0.93	0.92	0.90	0.98	0.98
15	1	0.97	0.90	0.90	0.83	0.93	0.91	0.78	0.92	0.74	0.89	0.87	0.99	0.86	0.99	0.89	0.98	0.97	0.96	0.87	0.84	0.79	0.85	0.92	0.93	0.92	0.96	0.97
16	1	0.97	0.86	0.89	0.82	0.89	0.89	0.65	0.94	0.73	0.87	0.84	0.97	0.79	0.99	0.90	0.98	0.98	0.97	0.86	0.84	0.77	0.86	0.93	0.91	0.93	0.97	0.99
17	1	0.93	0.87	0.85	0.77	0.75	0.86	0.58	0.90	0.74	0.88	0.85	0.98	0.87	1.00	0.92	0.98	0.97	0.97	0.86	0.84	0.77	0.85	0.92	0.93	0.89	0.96	0.99
18	0.9	0.89	0.82	0.82	0.70	0.63	0.80	0.45	0.88	0.66	0.86	0.88	0.98	0.89	0.99	0.96	0.96	0.97	0.97	0.87	0.81	0.77	0.84	0.93	0.94	0.95	0.96	0.98
19	0.9	0.79	0.71	0.69	0.59	0.56	0.76	0.48	0.88	0.68	0.89	0.90	0.95	0.87	0.96	0.93	0.98	0.97	0.96	0.87	0.84	0.79	0.86	0.92	0.95	0.94	0.97	0.99
20	0.8	0.61	0.60	0.62	0.58	0.62	0.78	0.50	0.83	0.69	0.89	0.90	0.98	0.95	0.98	0.98	0.99	0.97	0.97	0.88	0.84	0.82	0.87	0.91	0.95	0.97	0.97	0.99
21	0.7	0.63	0.57	0.64	0.65	0.62	0.82	0.56	0.95	0.79	0.93	0.95	0.98	0.95	1.00	0.99	0.99	0.97	0.97	0.88	0.84	0.83	0.87	0.91	0.95	0.98	0.99	0.99
22	0.7	0.14	0.52	0.61	0.65	0.67	0.85	0.53	0.95	0.78	0.93	0.96	1.00	0.99	1.00	1.00	0.99	0.97	0.97	0.87	0.82	0.80	0.86	0.91	0.92	0.94	0.97	0.98
23	0.5	0.08	0.59	0.67	0.66	0.80	0.84	0.62	0.94	0.84	0.91	0.96	1.00	1.00	1.00	1.00	0.99	0.97	0.96	0.87	0.81	0.81	0.86	0.91	0.94	0.96	0.97	0.98

Results from Gennevilliers measurements: contiguous mode

Comparison between two antenna positions

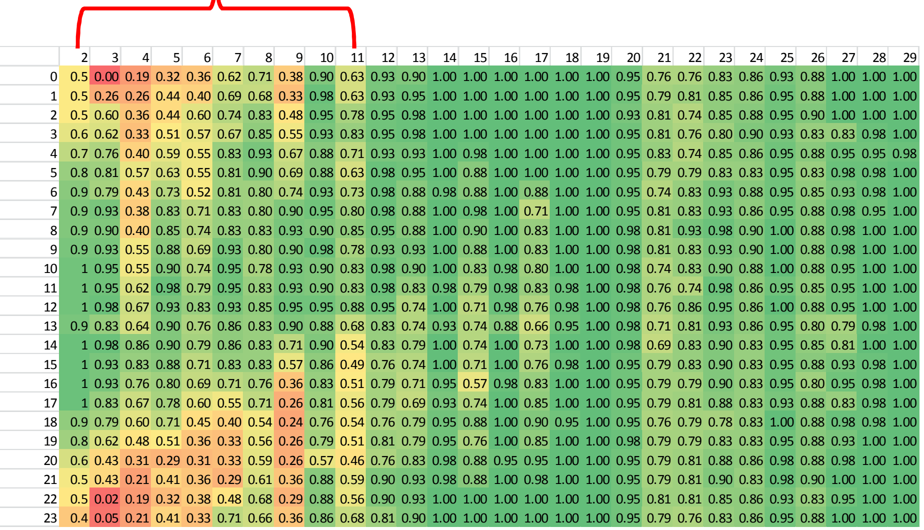
Low noise level shows lower availability

Clifton roof level 24 k Cont



	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	0.7	0.98	0.64	0.68	0.50	0.64	0.76	0.48	0.86	0.73	0.88	0.81	1.00	0.88	1.00	0.98	0.95	0.88	0.80	0.76	0.79	0.80	0.67	0.52	0.54	0.79	0.74	0.66
1	0.7	0.98	0.64	0.68	0.64	0.74	0.76	0.38	0.90	0.78	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.90	0.83	0.79	0.76	0.80	0.67	0.57	0.54	0.81	0.74	0.71
2	0.7	1.00	0.69	0.68	0.74	0.79	0.88	0.55	0.90	0.90	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.88	0.80	0.79	0.76	0.83	0.69	0.67	0.54	0.81	0.71	0.68
3	0.7	1.00	0.67	0.68	0.64	0.81	0.90	0.62	0.93	0.83	0.95	0.93	1.00	0.98	1.00	1.00	0.95	0.88	0.80	0.81	0.79	0.83	0.69	0.67	0.54	0.71	0.69	0.76
4	0.7	1.00	0.64	0.78	0.67	0.81	0.93	0.67	0.86	0.83	0.93	0.90	1.00	0.95	1.00	1.00	0.88	0.90	0.80	0.83	0.83	0.80	0.69	0.69	0.51	0.79	0.88	0.83
5	0.7	0.98	0.74	0.78	0.60	0.79	0.90	0.71	0.90	0.78	0.98	0.88	0.98	0.71	1.00	0.93	0.90	0.88	0.83	0.79	0.81	0.83	0.69	0.67	0.51	0.76	0.83	0.85
6	0.8	1.00	0.76	0.83	0.69	0.79	0.80	0.71	0.95	0.88	0.93	0.79	0.90	0.76	1.00	0.73	0.95	0.90	0.85	0.81	0.86	0.85	0.69	0.67	0.56	0.76	0.86	0.85
7	0.8	1.00	0.81	0.90	0.81	0.83	0.76	0.88	0.95	0.88	0.93	0.76	0.95	0.86	1.00	0.68	0.88	0.90	0.90	0.81	0.86	0.88	0.69	0.69	0.61	0.76	0.86	0.85
8	0.8	1.00	0.90	0.93	0.83	0.81	0.80	0.93	0.95	0.93	0.90	0.83	0.85	0.81	0.95	0.59	0.86	0.90	0.88	0.79	0.76	0.85	0.67	0.74	0.59	0.76	0.90	0.90
9	0.9	1.00	0.76	1.00	0.83	0.88	0.80	0.90	0.95	0.98	0.88	0.83	0.88	0.79	1.00	0.61	0.95	0.95	0.93	0.76	0.74	0.88	0.71	0.76	0.63	0.81	0.90	0.93
10	0.9	1.00	0.86	0.98	0.83	0.86	0.78	0.93	0.88	0.95	0.90	0.81	0.93	0.76	0.93	0.59	0.95	0.98	0.90	0.74	0.71	0.90	0.67	0.76	0.61	0.79	0.90	0.90
11	0.9	0.98	0.90	1.00	0.95	0.95	0.83	0.95	0.98	0.95	0.93	0.62	0.93	0.57	0.98	0.68	0.88	0.86	0.95	0.71	0.81	0.83	0.76	0.71	0.61	0.74	0.83	0.83
12	0.9	0.98	0.86	1.00	0.90	0.90	0.85	0.93	0.98	0.98	0.90	0.64	0.93	0.50	0.93	0.66	0.88	0.93	0.85	0.71	0.71	0.88	0.69	0.76	0.56	0.69	0.83	0.83
13	0.8	1.00	0.90	0.98	0.90	0.86	0.83	0.90	0.90	0.80	0.83	0.64	0.71	0.43	0.81	0.59	0.86	0.00	0.83	0.74	0.74	0.85	0.69	0.69	0.61	0.74	0.93	0.98
14	0.8	1.00	0.88	1.00	0.90	0.86	0.83	0.79	0.90	0.71	0.79	0.69	0.83	0.45	0.95	0.63	0.90	0.93	0.83	0.74	0.76	0.88	0.71	0.69	0.54	0.67	0.90	0.88
15	0.8	1.00	0.90	0.98	0.86	0.86	0.85	0.69	0.88	0.66	0.79	0.69	0.80	0.48	0.95	0.66	0.88	0.88	0.83	0.79	0.81	0.88	0.67	0.71	0.56	0.76	0.88	0.85
16	0.8	1.00	0.86	0.93	0.88	0.74	0.80	0.45	0.86	0.61	0.76	0.67	0.73	0.45	0.95	0.76	0.88	0.88	0.80	0.79	0.81	0.88	0.69	0.71	0.59	0.81	0.88	0.85
17	0.8	1.00	0.79	0.85	0.76	0.60	0.73	0.33	0.88	0.61	0.79	0.67	0.78	0.55	0.98	0.76	0.93	0.88	0.80	0.81	0.86	0.88	0.67	0.69	0.51	0.69	0.90	0.85
18	0.8	1.00	0.76	0.76	0.60	0.48	0.66	0.26	0.83	0.56	0.74	0.69	0.76	0.55	0.90	0.83	0.88	0.88	0.80	0.79	0.81	0.88	0.64	0.67	0.54	0.81	0.88	0.85
19	0.8	0.98	0.74	0.76	0.45	0.36	0.59	0.33	0.81	0.54	0.81	0.64	0.66	0.57	0.83	0.78	0.93	0.86	0.83	0.71	0.76	0.85	0.69	0.57	0.61	0.74	0.83	0.78
20	0.8	0.93	0.60	0.59	0.36	0.45	0.49	0.29	0.67	0.63	0.74	0.71	0.83	0.71	0.88	0.90	0.95	0.86	0.80	0.79	0.81	0.85	0.67	0.64	0.54	0.76	0.86	0.80
21	0.7	0.93	0.55	0.63	0.45	0.40	0.61	0.36	0.90	0.71	0.86	0.86	0.83	0.79	1.00	0.95	0.98	0.88	0.83	0.81	0.79	0.85	0.64	0.67	0.61	0.83	0.90	0.80
22	0.7	0.98	0.64	0.66	0.45	0.43	0.71	0.33	0.83	0.68	0.90	0.88	1.00	0.88	1.00	1.00	0.95	0.88	0.83	0.79	0.79	0.85	0.64	0.64	0.59	0.71	0.81	0.73
23	0.7	0.93	0.64	0.73	0.52	0.69	0.66	0.40	0.83	0.78	0.79	0.88	1.00	0.93	1.00	1.00	0.93	0.88	0.83	0.76	0.79	0.85	0.64	0.67	0.59	0.74	0.81	0.71

Clifton ground level 24 k Cont

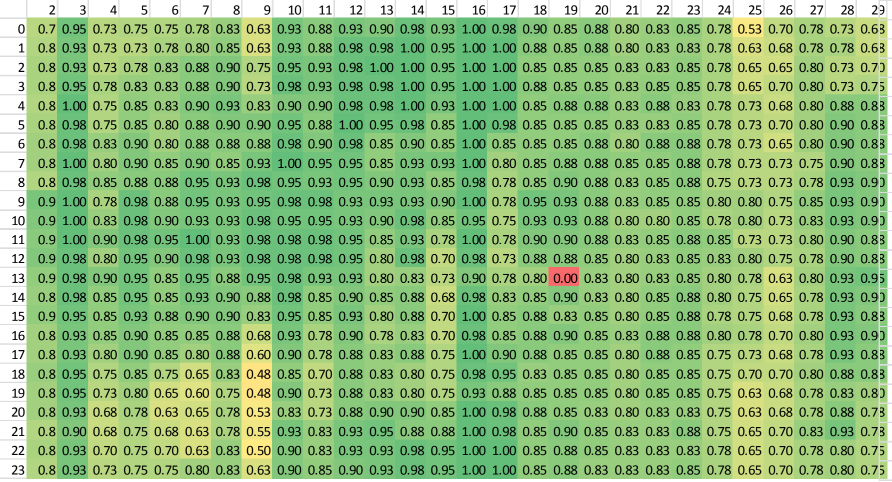


	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.5	0.00	0.19	0.32	0.36	0.62	0.71	0.38	0.90	0.63	0.93	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.76	0.76	0.83	0.86	0.93	0.88	1.00	1.00	1.00
1	0.5	0.26	0.26	0.44	0.40	0.69	0.68	0.33	0.98	0.63	0.93	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.81	0.85	0.86	0.95	0.88	1.00	1.00	1.00
2	0.5	0.60	0.36	0.44	0.60	0.74	0.83	0.48	0.95	0.78	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.81	0.74	0.85	0.88	0.95	0.90	1.00	1.00	1.00
3	0.6	0.62	0.33	0.51	0.57	0.67	0.85	0.55	0.93	0.83	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.81	0.76	0.80	0.90	0.93	0.83	0.83	0.98	1.00
4	0.7	0.76	0.40	0.59	0.55	0.83	0.93	0.67	0.88	0.71	0.93	0.93	1.00	0.98	1.00	1.00	1.00	1.00	0.95	0.83	0.74	0.85	0.86	0.95	0.88	0.95	0.95	0.98
5	0.8	0.81	0.57	0.63	0.55	0.81	0.90	0.69	0.88	0.63	0.98	0.95	1.00	0.88	1.00	1.00	1.00	1.00	0.95	0.79	0.79	0.83	0.83	0.95	0.83	0.98	0.98	1.00
6	0.9	0.79	0.43	0.73	0.52	0.81	0.80	0.74	0.93	0.73	0.98	0.88	0.98	0.88	1.00	0.88	1.00	1.00	0.95	0.74	0.83	0.93	0.88	0.95	0.85	0.93	0.98	1.00
7	0.9	0.93	0.38	0.83	0.71	0.83	0.80	0.90	0.95	0.80	0.98	0.88	1.00	0.98	1.00	0.71	1.00	1.00	0.95	0.81	0.83	0.93	0.86	0.95	0.88	0.98	0.95	1.00
8	0.9	0.90	0.40	0.85	0.74	0.83	0.83	0.93	0.90	0.85	0.95	0.88	1.00	0.90	1.00	0.83	1.00	1.00	0.98	0.81	0.93	0.98	0.90	1.00	0.88	0.98	1.00	1.00
9	0.9	0.93	0.55	0.88	0.69	0.93	0.80	0.90	0.98	0.78	0.93	0.93	1.00	0.88	1.00	0.83	1.00	1.00	0.98	0.81	0.83	0.93	0.90	1.00	0.88	0.98	1.00	1.00
10	1	0.95	0.55	0.90	0.74	0.95	0.78	0.93	0.90	0.83	0.98	0.90	1.00	0.83	0.98	0.80	1.00	1.00	0.98	0.74	0.83	0.90	0.88	1.00	0.88	0.95	1.00	1.00
11	1	0.95	0.62	0.98	0.79	0.95	0.83	0.93	0.90	0.83	0.98	0.83	0.98	0.79	0.98	0.83	0.98	1.00	0.98	0.76	0.74	0.98	0.86	0.95	0.85	0.95	1.00	1.00
12	1	0.98	0.67	0.93	0.83	0.93	0.85	0.95	0.95	0.88	0.95	0.74	1.00	0.71	0.98	0.76	0.98	1.00	0.98	0.76	0.86	0.95	0.86	1.00	0.88	0.95	1.00	1.00
13	0.9	0.83	0.64	0.90	0.76	0.86	0.83	0.90	0.88	0.68	0.83	0.74	0.93	0.74	0.88	0.66	0.95	1.00	0.98	0.71	0.81	0.93	0.86	0.95	0.80	0.79	0.98	1.00
14	1	0.98	0.86	0.90	0.79	0.86	0.83	0.71	0.90	0.54	0.83	0.79	1.00	0.74	1.00	0.73	1.00	1.00	0.98	0.69	0.83	0.90	0.83	0.95	0.85	0.81	1.00	1.00
15	1	0.93	0.83	0.88	0.71	0.83	0.83	0.57	0.86	0.49	0.76	0.74	1.00	0.71	1.00	0.76	0.98	1.00	0.95	0.79	0.83	0.90	0.83	0.95	0.88	0.93	0.98	1.00
16	1	0.93	0.76	0.80	0.69	0.71	0.76	0.36	0.83	0.51	0.79	0.71	0.95	0.57	0.98	0.83	1.00	1.00	0.95	0.79	0.79	0.90	0.83	0.95	0.80	0.95	0.98	1.00
17	1	0.83	0.67	0.78	0.60	0.55	0.71	0.26	0.81	0.56	0.79	0.69	0.93	0.74	1.00	0.85	1.00	1.00	0.95	0.79	0.81	0.88	0.83	0.93	0.88	0.83	0.98	1.00
18	0.9	0.79	0.60	0.71	0.45	0.40	0.54	0.24	0.76	0.54	0.76	0.79	0.95	0.88	1.00	0.90	0.95	1.00	0.95	0.76	0.79	0.78	0.83	1.00	0.88	0.98	0.98	1.00
19	0.8	0.62	0.48	0.51	0.36	0.33	0.56	0.26	0.79	0.51	0.81	0.79	0.95	0.76	1.00	0.85	1.00	1.00	0.98	0.79	0.79	0.83	0.83	0.95	0.88	0.93	1.00	1.00
20	0.6	0.43	0.31	0.29	0.31	0.33	0.59	0.26	0.57	0.46	0.76	0.83	0.98	0.88	0.95	0.95	1.00	1.00	0.95	0.79	0.81	0.88	0.86	0.98	0.88	0.98	1.00	1.00
21	0.5	0.43	0.21	0.41	0.36	0.29	0.61	0.36	0.88	0.59	0.90	0.93	0.98	0.88	1.00	0.98	1.00	1.00	0.95	0.79	0.81	0.90	0.83	0.98	0.90	1.00	1.00	1.00
22	0.5	0.02	0.19	0.32	0.38	0.48	0.68	0.29	0.88	0.56	0.90	0.93	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.81	0.81	0.85	0.86	0.93	0.83	0.95	1.00	1.00
23	0.4	0.05	0.21	0.41	0.33	0.71	0.66	0.36	0.86	0.68	0.81	0.90	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.76	0.83	0.86	0.95	0.88	1.00	1.00	1.00

Results from Toulon measurements: non-contiguous mode

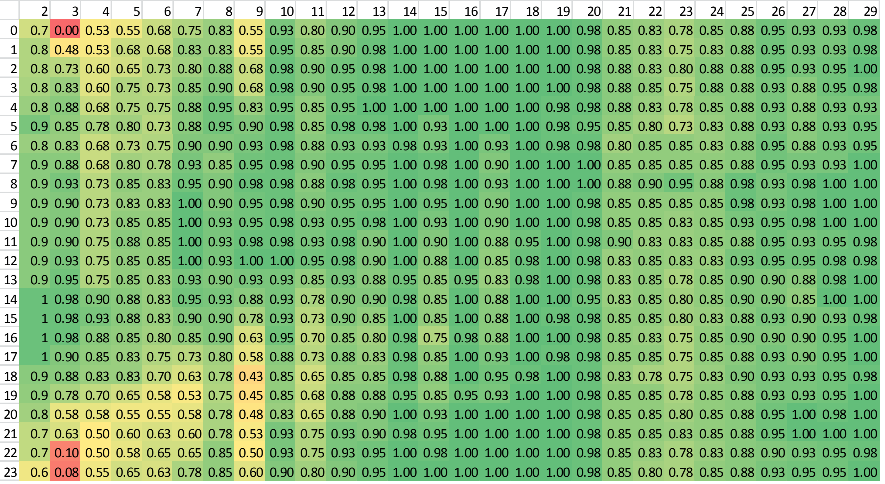
Non contiguous channel availability for 24 kHz

Clifton roof level 24 k XL



	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	0.7	0.95	0.73	0.75	0.75	0.78	0.83	0.63	0.93	0.88	0.93	0.90	0.98	0.93	1.00	0.98	0.90	0.85	0.88	0.80	0.83	0.85	0.78	0.53	0.70	0.78	0.73	0.63
1	0.8	0.93	0.73	0.73	0.78	0.80	0.85	0.63	0.93	0.88	0.98	0.98	1.00	0.95	1.00	1.00	0.88	0.85	0.88	0.80	0.83	0.83	0.78	0.63	0.68	0.78	0.78	0.63
2	0.8	0.93	0.73	0.78	0.83	0.88	0.90	0.75	0.95	0.93	0.98	1.00	1.00	0.95	1.00	1.00	0.85	0.85	0.85	0.83	0.83	0.85	0.78	0.65	0.65	0.80	0.73	0.70
3	0.8	0.95	0.78	0.83	0.83	0.88	0.90	0.73	0.98	0.93	0.98	0.98	1.00	0.95	1.00	1.00	0.88	0.85	0.85	0.83	0.85	0.85	0.78	0.65	0.70	0.80	0.73	0.75
4	0.8	1.00	0.75	0.85	0.83	0.90	0.93	0.83	0.90	0.90	0.98	0.98	1.00	0.93	1.00	1.00	0.85	0.88	0.88	0.83	0.88	0.83	0.78	0.73	0.68	0.80	0.88	0.83
5	0.8	0.98	0.75	0.85	0.80	0.88	0.90	0.90	0.95	0.88	1.00	0.95	0.98	0.85	1.00	0.98	0.85	0.85	0.85	0.83	0.83	0.85	0.78	0.73	0.70	0.80	0.90	0.83
6	0.8	0.98	0.83	0.90	0.80	0.88	0.88	0.88	0.98	0.90	0.98	0.85	0.90	0.85	1.00	0.85	0.85	0.85	0.88	0.80	0.88	0.88	0.78	0.73	0.65	0.80	0.90	0.83
7	0.8	1.00	0.80	0.90	0.85	0.90	0.85	0.93	1.00	0.95	0.95	0.85	0.93	0.93	1.00	0.80	0.85	0.88	0.88	0.85	0.85	0.88	0.78	0.73	0.73	0.75	0.90	0.83
8	0.8	0.98	0.85	0.88	0.88	0.95	0.93	0.98	0.95	0.93	0.95	0.90	0.93	0.85	0.98	0.78	0.85	0.90	0.88	0.83	0.85	0.88	0.75	0.73	0.73	0.78	0.93	0.90
9	0.9	1.00	0.78	0.98	0.88	0.95	0.93	0.95	0.98	0.98	0.93	0.93	0.93	0.90	1.00	0.78	0.95	0.93	0.88	0.83	0.85	0.85	0.80	0.80	0.75	0.85	0.93	0.90
10	0.9	1.00	0.83	0.98	0.90	0.93	0.93	0.98	0.95	0.95	0.93	0.90	0.98	0.85	0.95	0.75	0.93	0.93	0.88	0.80	0.80	0.85	0.78	0.80	0.73	0.83	0.93	0.90
11	0.9	1.00	0.90	0.98	0.95	1.00	0.93	0.98	0.98	0.98	0.95	0.85	0.93	0.78	1.00	0.78	0.90	0.90	0.88	0.83	0.85	0.88	0.85	0.73	0.73	0.80	0.90	0.83
12	0.9	0.98	0.80	0.95	0.90	0.98	0.93	0.98	0.98	0.98	0.95	0.80	0.98	0.70	0.98	0.73	0.88	0.88	0.85	0.80	0.83	0.85	0.83	0.80	0.75	0.78	0.90	0.83
13	0.9	0.98	0.90	0.95	0.85	0.95	0.88	0.95	0.98	0.93	0.93	0.80	0.83	0.73	0.90	0.78	0.80	0.00	0.83	0.80	0.83	0.85	0.80	0.78	0.63	0.80	0.93	0.95
14	0.8	0.98	0.85	0.95	0.85	0.93	0.90	0.88	0.98	0.85	0.90	0.85	0.88	0.68	0.98	0.83	0.85	0.90	0.83	0.80	0.85	0.88	0.80	0.75	0.65	0.78	0.93	0.90
15	0.9	0.95	0.85	0.93	0.88	0.90	0.90	0.83	0.95	0.85	0.93	0.80	0.88	0.70	1.00	0.85	0.88	0.83	0.85	0.80	0.85	0.88	0.78	0.75	0.68	0.78	0.93	0.83
16	0.8	0.93	0.85	0.90	0.85	0.85	0.88	0.68	0.93	0.78	0.90	0.78	0.83	0.70	0.98	0.85	0.88	0.90	0.85	0.83	0.88	0.88	0.80	0.78	0.70	0.80	0.93	0.90
17	0.8	0.93	0.80	0.90	0.85	0.80	0.88	0.60	0.90	0.78	0.88	0.83	0.88	0.75	1.00	0.90	0.88	0.85	0.85	0.80	0.88	0.85	0.75	0.73	0.68	0.78	0.93	0.83
18	0.8	0.95	0.75	0.85	0.75	0.65	0.83	0.48	0.85	0.70	0.88	0.83	0.80	0.75	0.98	0.95	0.83	0.85	0.85	0.80	0.85	0.85	0.75	0.70	0.70	0.80	0.88	0.83
19	0.8	0.95	0.73	0.80	0.65	0.60	0.75	0.48	0.90	0.73	0.88	0.83	0.80	0.75	0.93	0.88	0.85	0.85	0.85	0.80	0.85	0.85	0.75	0.63	0.68	0.78	0.83	0.80
20	0.8	0.93	0.68	0.78	0.63	0.65	0.78	0.53	0.83	0.73	0.88	0.90	0.90	0.85	1.00	0.98	0.88	0.85	0.83	0.80	0.83	0.83	0.75	0.63	0.68	0.78	0.88	0.73
21	0.8	0.90	0.68	0.75	0.68	0.63	0.78	0.55	0.93	0.83	0.93	0.95	0.88	0.88	1.00	0.98	0.85	0.90	0.85	0.83	0.83	0.88	0.75	0.65	0.70	0.83	0.93	0.73
22	0.8	0.93	0.70	0.75	0.70	0.63	0.83	0.50	0.90	0.83	0.93	0.93	0.98	0.95	1.00	1.00	0.85	0.88	0.85	0.83	0.83	0.83	0.78	0.65	0.70	0.78	0.80	0.75
23	0.8	0.93	0.73	0.75	0.75	0.80	0.83	0.63	0.90	0.85	0.90	0.93	0.98	0.95	1.00	1.00	0.85	0.88	0.83	0.83	0.83	0.85	0.78	0.65	0.70	0.78	0.80	0.75

Clifton ground level 24 k XL



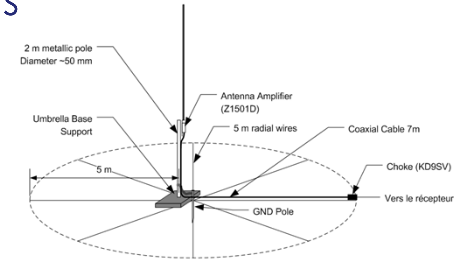
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0.7	0.00	0.53	0.55	0.68	0.75	0.83	0.55	0.93	0.80	0.90	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.85	0.83	0.78	0.85	0.88	0.95	0.93	0.93	0.98
1	0.8	0.48	0.53	0.68	0.68	0.83	0.83	0.55	0.95	0.85	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.85	0.83	0.75	0.83	0.88	0.95	0.93	0.93	0.98
2	0.8	0.73	0.60	0.65	0.73	0.80	0.88	0.68	0.98	0.90	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.88	0.83	0.80	0.88	0.88	0.95	0.93	0.95	1.00
3	0.8	0.83	0.60	0.75	0.73	0.85	0.90	0.68	0.98	0.90	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.88	0.85	0.75	0.88	0.88	0.93	0.88	0.95	0.98
4	0.8	0.88	0.68	0.75	0.75	0.88	0.95	0.83	0.95	0.85	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.88	0.83	0.78	0.85	0.88	0.93	0.88	0.93	0.93
5	0.9	0.85	0.78	0.80	0.73	0.88	0.95	0.90	0.98	0.85	0.98	0.98	1.00	0.93	1.00	1.00	1.00	0.98	0.95	0.85	0.80	0.73	0.83	0.88	0.93	0.88	0.93	0.95
6	0.8	0.83	0.68	0.73	0.75	0.90	0.90	0.93	0.98	0.88	0.93	0.93	0.98	0.93	1.00	0.93	1.00	0.98	0.98	0.80	0.85	0.85	0.83	0.88	0.95	0.88	0.93	0.95
7	0.9	0.88	0.68	0.80	0.78	0.93	0.85	0.95	0.98	0.90	0.95	0.95	1.00	0.98	1.00	0.90	1.00	1.00	1.00	0.85	0.85	0.85	0.85	0.88	0.95	0.93	0.93	1.00
8	0.9	0.93	0.73	0.85	0.83	0.95	0.90	0.98	0.98	0.88	0.98	0.95	1.00	0.98	1.00	0.93	1.00	1.00	1.00	0.88	0.90	0.95	0.88	0.98	0.93	0.98	1.00	1.00
9	0.9	0.90	0.73	0.83	0.83	1.00	0.90	0.95	0.98	0.90	0.95	0.95	1.00	0.95	1.00	0.90	1.00	1.00	0.98	0.85	0.85	0.85	0.85	0.98	0.93	0.98	1.00	1.00
10	0.9	0.90	0.73	0.85	0.85	1.00	0.93	0.95	0.98	0.93	0.95	0.98	1.00	0.93	1.00	0.90	1.00	1.00	0.98	0.85	0.85	0.83	0.85	0.93	0.95	0.98	1.00	1.00
11	0.9	0.90	0.75	0.88	0.85	1.00	0.93	0.98	0.98	0.93	0.98	0.90	1.00	0.90	1.00	0.88	0.95	1.00	0.98	0.90	0.83	0.83	0.85	0.88	0.95	0.93	0.95	0.98
12	0.9	0.93	0.75	0.85	0.85	1.00	0.93	1.00	1.00	0.95	0.98	0.90	1.00	0.88	1.00	0.85	0.98	1.00	0.98	0.83	0.85	0.83	0.83	0.93	0.95	0.95	0.98	0.98
13	0.9	0.95	0.75	0.85	0.83	0.93	0.90	0.93	0.93	0.85	0.93	0.88	0.95	0.85	0.95	0.83	0.98	1.00	0.98	0.83	0.85	0.78	0.85	0.90	0.90	0.88	0.98	1.00
14	1	0.98	0.90	0.88	0.83	0.95	0.93	0.88	0.93	0.78	0.90	0.90	0.98	0.85	1.00	0.88	1.00	1.00	0.95	0.83	0.85	0.80	0.85	0.90	0.90	0.85	1.00	1.00
15	1	0.98	0.93	0.88	0.83	0.90	0.90	0.78	0.93	0.73	0.90	0.85	1.00	0.85	1.00	0.88	1.00	0.98	0.98	0.85	0.85	0.80	0.83	0.88	0.93	0.90	0.93	0.98
16	1	0.98	0.88	0.85	0.80	0.85	0.90	0.63	0.95	0.70	0.85	0.80	0.98	0.75	0.98	0.88	1.00	1.00	0.98	0.85	0.83	0.75	0.85	0.90	0.90	0.90	0.95	1.00
17	1	0.90	0.85	0.83	0.75	0.73	0.80	0.58	0.88	0.73	0.88	0.83	0.98	0.85	1.00	0.93	1.00	0.98	0.98	0.85	0.85	0.75	0.85	0.88	0.93	0.90	0.95	1.00
18	0.9	0.88	0.83	0.83	0.70	0.63	0.78	0.43	0.85	0.65	0.85	0.85	0.98	0.88	1.00	0.95	0.98	1.00	0.98	0.83	0.78	0.75	0.83	0.90	0.93	0.93	0.95	0.98
19	0.9	0.78	0.70	0.65	0.58	0.53	0.75	0.45	0.85	0.68	0.88	0.88	0.95	0.85	0.95	0.93	1.00	1.00	0.98	0.85	0.85	0.78	0.85	0.88	0.93	0.93	0.95	1.00
20	0.8	0.58	0.58	0.55	0.55	0.58	0.78	0.48	0.83	0.65	0.88	0.90	1.00	0.93	1.00	1.00	1.00	1.00	0.98	0.85	0.85	0.80	0.85	0.88	0.95	1.00	0.98	1.00
21	0.7	0.63	0.50	0.60	0.63	0.60	0.78	0.53	0.93	0.75	0.93	0.90	0.98	0.95	1.00	1.00	1.00	1.00	0.98	0.85	0.85	0.83	0.85	0.88	0.95	1.00	1.00	1.00
22	0.7	0.10	0.50	0.58	0.65	0.65	0.85	0.50	0.93	0.75	0.93	0.95	1.00	0.98	1.00	1.00	1.00	1.00	0.98	0.85	0.83	0.78	0.83	0.88	0.90	0.93	0.95	0.98
23	0.6	0.08	0.55	0.65	0.63	0.78	0.85	0.60	0.90	0.80	0.90	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.85	0.80	0.78	0.85	0.88	0.93	0.95	0.95	1.00

Availability figures close to 3kHz ones …

Conclusions on channel availability measurements (POINT 3)

Results obtained on noise level and representativity of measurements

- the ITU isotropic Noise source model hypothesis is not true for our setup
  - Noise levels from an active whip antenna are critically dependent of the installation
  - Noise levels from an active whip antenna are not related to the actual noise levels in communications antenna
- As a consequence, channel availability estimation with Clifton antenna is not reliable even if we are careful and consistent in our installations
  - Good installation : 2 m mast and radials
  - Good position :
    - avoid built, urban or industrial areas
    - On the ground level



- The only useful result is using actual communication antennas, comparing multi narrow band versus contiguous configurations availability

Conclusions on channel availability measurements (POINT 3)

Results on availability: contiguous vs. non contiguous

- Availability of non contiguous XL channels is significantly higher than contiguous channels
    - Non contiguous channels availability is much closer to the 3 kHz channel availability
    - In all cases, a high ambient noise levels will underestimate channel availability

Next steps

- Without good answers to the presented issues here above, THALES will not work further on the channel availability analysis
    - The spectrum has been shown crowded in Europe (and probably Africa and Asia)
    - The modified software is available and remains nevertheless useful for site analysis
    - Within the limitations expressed here above, we showed that multi-narrow band channelization "XL" has a much higher availability than a contiguous channel

Annex

Distribution software description

- THALES introduced a 3rd mode of scanning in the Distribution07152016.zip file
- The C source code and executable is ready for acquisition
- In ***Distribution07152016\Analysis\Availability\format3*** directory, the « AcqAnalysis.py » file is a python executable ready for standard 24 h csv file for availability evaluation.
    - Tested Pyton distributions are WinPython, and Anaconda 3.0 + pycharm.
    - W7 and later is fine (XP is no longer supported)

THALES

Thank you for your attention.
If you have any questions?