

University of Balamand

NEMLAR – TTS Validation Report

January 26, 2006

Executive summary

This document considers the specifications of the validation criteria for the Arabic TTS database within the Nemlar project and gives an overview of the aspects of the database which are validated. According to the validation report provided, the following aspects of the validation criteria are addressed:

1. Documentation.
2. Database structure, file names and contents.
3. Database items and completeness.
4. Acoustic quality of the speech files.
5. Annotation files.
6. Lexicon.
7. Recording conditions.
8. Transcription quality.

The following sections describe the data validated and the procedure undertaken at Balamand for this purpose.

1 Documentation

- No documentation was found with the database we validated.

2 Database Structure, File Names and Contents

2.1 *File names for label files and speech files and directory names*

- The database we downloaded does not comply with the directory structure described in the validation report. We have a single folder called tts with the following subdirectories:

- Orthographic_Trans
- Pich_Markes
- Prompt_Sheet
- Prosodic_Trans
- Segmentations
- WAV

In addition we have a file sample.rar. All filenames correspond to the template.

2.2 *Other requirements*

- ✓ Empty files are illegal. This is of special relevance for speech and label files – **no empty files but the orthographic transcription files listed below were corrupt and could not be opened.**

Subcorpus 11:

T7B11010123.txt
T7B11010128.txt
T7B11010143.txt
T7B11010151.txt
T7B11010154.txt

T7B11010172.txt
T7B11010173.txt
T7B11010174.txt
T7B11010175.txt
T7B11010177.txt

T7B11010182.txt
T7B11010186.txt
T7B11010187.txt
T7B11010188.txt
T7B11010192.txt

Subcorpus 20:

T7B20010317.txt
T7B20010319.txt
T7B20010322.txt
T7B20010344.txt
T7B20010352.txt
T7B20010361.txt
T7B20010362.txt
T7B20010363.txt
T7B20010368.txt

T7B20010370.txt
T7B20010371.txt
T7B20010374.txt
T7B20010376.txt
T7B20010377.txt
T7B20010386.txt
T7B20010418.txt
T7B20010419.txt
T7B20010425.txt

T7B20010429.txt
T7B20010433.txt
T7B20010436.txt
T7B20010446.txt
T7B20010448.txt
T7B20010449.txt
T7B20010455.txt
T7B20010458.txt
T7B20010460.txt

As for the wave files, there were two corrupt files T7B20010461.wav and T7B20010462.wav.

✓ For each label file there must be one corresponding speech file and vice versa. – 1 missing file: T7B20010380.wav

✓ Obviously the database should not be infected by any viruses. - OK

3 Database Items and Completeness

3.1 Mandatory items specifications

The two corpuses checked were C1.1_T and C2_T.

4 Acoustic Quality of the Speech Files

The acoustic quality of the recorded speech was not checked for everything except the format: 96 kHz, 24 bits, 2 channels. Otherwise, all files sounded ok except for the corrupt and nonexistent wave files.

→ There were no corresponding laryngograph files. These were created for the corpus with subcode 20 using Goldwave.

5 Label Files

There are some label (*.lab) files in the folder segmentations which were used for the segmentation task.

6 Lexicon

No Lexicon!

7 Recording Conditions

All wave files were synchronized signals recorded from a large microphone and a laryngograph has to be provided. As mentioned before, *Goldwave* was used to extract the right channel with the laryngograph recording for the Pitch Mark tests.

8 Transcription

8.1 Annotation levels

The speech, the orthographic transcription, prosodic transcription, segmentation and pitch mark files have identical names. The names of the validated files are shown in the tables below and the appendix.

8.2 Speaker information

Cannot be done because documents with speaker information are not available.

8.3 Orthographic transcription

Total number of files processed: Subcorpus 11 (60 files) Subcorpus 20 (46 files).

- The WER (Word Error Rate) was 0.7% if spelling mistakes were not taken into consideration and 0.8% if they were.
- Approximately 3K words were validated.

The tables in the appendix depict the validated files for both subcorpora as well as the errors found.

8.4 Prosodic transcription

Check is conducted on the same set of files used for checking the manual segmentation. Nothing was found for automatic segmentation set.

- The number of errors found is 3 which implies a rate less than 5%.

8.5 Segmentation

Three files have been selected for checking the manual segmentation. These files are:

- T7B20010317
- T7B20010418
- T7B31010394

The result of the checking is presented in the following table.

File	Nb of Phones	Nb of errors (dev. > 20ms)	Nb of small deviations	Nb of errors in transcription
T7B20010317	216	3 (1.38%)	5 (2.31%)	0
T7B20010418	74	0	0	0
T7B31010394	221	0	5 (2.26%)	2 (0.90%)
Total	511	3 (0.58%)	10 (1.95%)	2 (0.39%)

- The results show that the wrong segmentation is much less than 5%.

Two files have been selected for checking the automatic segmentation. These files are:

- T7B11010119
- T7B11010171

File	Nb of Phones	Nb of errors (dev. > 20ms)	Nb of small deviations	Nb of errors in transcription
T7B11010119	372	9 (2.41%)	24 (6.45%)	4 (1.07%)
T7B11010171	215	10 (4.65%)	18 (8.37%)	0
Total	587	19 (3.23%)	42 (7.15%)	4 (0.68%)

- The results show that the wrong segmentation is much less than 10%.

Note: There is a difference between manual and automatic transcriptions in the phone set used. This needs to be corrected. All transcription mistakes can be found in the appendix.

8.6 Pitch marks

As noted in the validation report, this should be done for the files chosen in the orthographic transcription part. However, the pitch marks were not available for subcorpus ID 11 so only the pitch marks of the files in the subcorpus ID 20 were taken into consideration.

Procedure:

First, the laryngograph signals were extracted using *Goldwave*. Then, using *wavesurfer 1.4.1*, the pitch marks were calculated and saved in a file. Two pitch methods are provided with this software, AMDF and ESPS. Both were tried and the results were plotted versus time along with the corresponding Pitch Marks file of the database for comparison purposes. The maximum deviation from the reference pitch mark should be 5%. Therefore the reference marks (produced by *wavesurfer 1.4.1*) were plotted twice with an increment and decrement of 5% in value in addition to a restriction of 0.5ms to facilitate the procedure. It was concluded that these files do not match but are symmetric with respect to $y \approx 125$.

Therefore we first tried to validate the reference pitch marks calculated from the laryngograph signals. Random points were taken from random files and calculated manually using the formula:

$$f = \frac{1}{T} \quad \text{where } f \text{ is the frequency (Hz) and } T \text{ is the period (s)}$$

The values were found to match those produced by *wavesurfer 1.4.1* therefore it was deduced that the software is functioning properly and the reference values are correct.

As for the voiced/unvoiced errors which should not exceed 3%, these were also checked and seem to be correct.

The tables and figures in the appendix give more details about this task.

To conclude, the voiced/unvoiced detection seems working fine but the pitch values are far from the reference values with a strange symmetry observed.

8.7 Spelling check

→ Very few spelling mistakes were found while checking orthographic. These can be seen in the orthographic transcription tables in the appendix.

8.8 Summary

Despite the absence of documentation and the directory structure described in the validation report, two corpuses C 1.1_T and C 2_T were checked. There were several corrupt transcription and wave files which affected the validation process. The orthographic transcriptions were checked for 106 files (approx 3K words) instead of 250 files (at least 5K words) and the WER was found to be 0.8% including the spelling mistakes errors. This exceeds the permitted WER of 0.1%. As for the prosodic transcription and the manual segmentation WER, the checks produced error rates much less than the permitted 5%. The automatic segmentation results were although much less than the permitted error rate of 10%. Finally, to make up for the missing laryngograph files, Goldwave was used to create our own. The pitch marks were extracted from these new files and compared to the reference files

found in the database. However, this comparison could not be completed because of the major differences between the files. This is discussed in detail in the Pitch Marks section.

Appendix

A. Orthographic transcription

The following tables give the results of the orthographic transcription task in the NEMLAR TTS validation project. The File ID's were used for both the wave and the transcription files – the ORT field is either NOK or OK, which denote “File could not be opened” and “No errors found” respectively. All corrections to be made are shown in red in the Comments field.

SubCorpus ID: 11

File ID	ORT	Comments
T7B11010119	OK	OK
T7B11010120	OK	المرحلة
T7B11010121	OK	المؤقتة
T7B11010122	OK	OK
T7B11010123	OK	قضية
T7B11010124	OK	OK
T7B11010125	OK	دائمة بإعلانها
T7B11010126	OK	OK
T7B11010127	OK	SPELLING للرؤساء SPELLING إيمل (total 35 words)
T7B11010128	OK	OK
T7B11010129	OK	OK
T7B11010130	OK	نوفمبر
T7B11010131	OK	OK
T7B11010132	OK	نظر
T7B11010133	OK	مستجدات إين
T7B11010134	OK	OK
T7B11010135	OK	مستجدات
T7B11010136	OK	OK
T7B11010137	OK	OK
T7B11010138	OK	OK
T7B11010139	OK	OK
T7B11010140	OK	OK
T7B11010141	OK	ألتفاق SHOULD BE إتفاق (total 46 words)
T7B11010142	OK	OK

T7B11010143	OK	OK
T7B11010144	OK	OK
T7B11010145	OK	OK
T7B11010146	OK	OK
T7B11010147	OK	OK
T7B11010148	OK	OK
T7B11010149	OK	OK
T7B11010150	OK	OK
T7B11010151	OK	OK
T7B11010152	OK	OK
T7B11010153	OK	OK
T7B11010154	NOK	OK
T7B11010155	OK	OK
T7B11010156	OK	OK
T7B11010157	OK	OK
T7B11010158	OK	OK
T7B11010159	OK	OK
T7B11010160	OK	OK
T7B11010161	OK	يَعْقِدُ KAAF NEEDS A FATHA
T7B11010162	OK	مليون مليونان يقارب
T7B11010163	OK	النرويجية SPELLING المانحة الدولة (total 32 words)
T7B11010164	OK	OK
T7B11010165	OK	سبعة
T7B11010166	OK	OK
T7B11010167	OK	OK
T7B11010168	OK	OK
T7B11010169	OK	OK
T7B11010170	OK	OK
T7B11010171	OK	OK
T7B11010172	OK	OK
T7B11010173	OK	تَجْرِبَةٌ
T7B11010174	OK	OK
T7B11010175	OK	OK
T7B11010176	OK	OK

T7B11010177	OK	إِنْدَبَرْت
T7B11010178	OK	OK
T7B11010179	OK	OK
T7B11010180	OK	مِن
T7B11010181	OK	OK
T7B11010182	OK	OK
T7B11010183	OK	OK
T7B11010184	OK	OK
T7B11010185	OK	OK
T7B11010186	OK	OK
T7B11010187	OK	OK
T7B11010188	OK	OK
T7B11010189	OK	OK
T7B11010190	OK	OK
T7B11010191	OK	OK
T7B11010192	OK	OK

SubCorpus ID: 20

File ID	ORT	Comments
T7B20010315	OK	يَهْتُمُ
T7B20010316	OK	OK
T7B20010317	OK	OK
T7B20010318	OK	لَيْلَةٌ فِي رَأْسِ (MISSING WORD فِي AND FATHA FOR TAA2)
T7B20010319	OK	OK
T7B20010320	OK	OK
T7B20010321	OK	نَكَزْتَنِي SHOULD BE لَكَزْتَنِي
T7B20010322	OK	OK
T7B20010341	OK	OK
T7B20010344	OK	OK
T7B20010346	OK	OK
T7B20010351	OK	OK
T7B20010352	OK	OK
T7B20010361	OK	OK
T7B20010362	OK	OK

T7B20010363	OK	OK
T7B20010368	OK	OK
T7B20010369	OK	OK
T7B20010370	OK	OK
T7B20010371	OK	OK
T7B20010373	OK	OK
T7B20010374	OK	OK
T7B20010375	OK	OK
T7B20010376	OK	يُضَايِقُكَ
T7B20010377	OK	OK
T7B20010378	OK	OK
T7B20010379	OK	OK
T7B20010380	OK	WAVE FILE MISSING
T7B20010384	OK	OK
T7B20010386	OK	OK
T7B20010417	OK	OK
T7B20010418	OK	OK
T7B20010419	OK	OK
T7B20010420	OK	OK
T7B20010421	OK	OK
T7B20010423	OK	OK
T7B20010425	OK	مُنْذُ SHOULD BE مُنْذُ
T7B20010429	OK	OK
T7B20010430	OK	OK
T7B20010431	OK	OK
T7B20010433	OK	OK
T7B20010436	OK	OK
T7B20010446	OK	OK
T7B20010448	OK	OK
T7B20010449	OK	OK
T7B20010453	OK	OK
T7B20010454	OK	OK
T7B20010455	OK	OK
T7B20010458	OK	حُضْنِه

T7B20010460	OK	OK
T7B20010461	OK	NOK
T7B20010462	OK	NOK

B. Manual segmentation and Prosodic transcription

Three files used were:

- T7B20010317
- T7B20010418
- T7B31010394

The corrections are shown in bolded red in the file extracts below:

FILE: T7B20010317

#
3.294000 121 sil
3.356219 121 b
3.406000 121 i
3.491406 121 l
3.530000 121 ?
3.609782 121 a
3.691188 121 m
3.782375 121 s
3.850969 121 i
3.876219 121 ?
3.934812 121 a
3.997406 121 X
4.072751 121 s
4.130812 121 a
4.206000 121 s
4.256813 121 t
4.324062 121 u
4.390594 121 f
4.511843 121 i:
4.603406 121 s`
4.664000 121 a
4.752000 121 w
4.841843 121 t
4.911843 121 i
4.964000 121 h
5.163406 121 i
5.247188 121 d
5.314812 121 i
5.423563 121 f
5.506000 121 ?
5.586812 121 a
5.668000 (5.70) 121 n
5.735188 121 m
5.774437 121 a
5.834000 121 s
5.929406 121 s
6.014000 121 a
6.045031 121 n
6.210000 121 i:

7.111687 121 sil
7.161406 121 n
7.249187 121 a
7.293406 121 D`
7.376812 121 a
7.415781 121 r
7.526000 121 a:
7.603468 121 t
7.679188 121 u
7.715188 121 h
7.833250 121 u:
7.880000 121 ?
7.962000 121 a
8.044000 121 j
8.098220 121 d`
8.182000 121 a
8.306374 121 n
8.620000 121 sil
8.655407 121 l
8.710220 121 a
8.772000 121 m
8.821406 121 t
8.879187 121 a
8.936153 121 k
9.002000 121 u
9.064220 121 n
9.150153 121 ?`
9.309187 121 a:
9.371253 121 d
9.412000 121 i
9.449560 121 j
9.535626 121 j
9.610594 121 a
9.681187 121 t
9.757780 121 a
9.858220 121 n
10.410000 121 sil
10.480594 121 k
10.577407 121 a:
10.622000 121 n
10.682000 121 a
10.710440 121 t
10.767034 121 t
10.816067 121 a
10.893626 121 S
10.956594 (10.946) 121 m
11.020000 121 a
11.052814 121 l
11.137560 121 u
11.170220 121 n

11.316000 121 i:
11.419780 121 k
11.484000 121 u
11.520000 121 l
11.576000 121 l
11.676373 121 i:
11.760154 121 f
11.859627 **(11.87)** 121 i:
11.973780 121 X
12.050000 121 a
12.096000 121 n
12.240000 121 a:
12.288814 121 n
12.364000 121 i
12.498000 121 n
12.583627 **(12.573)** 121 r
12.631033 121 a
12.737627 **(12.73)** 121 q
12.863847 121 i:
12.963253 121 q
13.032594 121 i
13.118814 121 n
13.192220 121 w
13.238000 121 a
13.266000 121 ?
13.350000 121 a
13.397407 121 n
13.540593 121 a:
13.628966 121 q
13.700000 121 a
13.776067 121 t
13.846000 121 i
13.984000 121 n
14.076660 121 r
14.198000 121 a:
14.247933 121 ?
14.346000 **(14.313)** 121 i
14.400000 121 ?`
14.454000 121 a
14.532000 121 h
15.278747 121 sil
15.312000 121 ?
15.357627 121 a
15.423186 121 X
15.482594 121 s
15.539407 121 a
15.595780 121 s
15.641626 121 t
15.713473 121 u
15.743406 121 ?

15.783406 121 a
15.814814 121 n
15.864000 121 n
15.924593 121 a
15.963627 121 h
16.061029 121 u:
16.108000 121 j
16.166811 121 u
16.205074 121 r
16.292595 121 i:
16.336376 121 d
16.398594 121 u
16.438217 121 ?
16.504000 121 a
16.547405 121 n
16.601784 121 j
16.655405 121 a
16.745565 121 m
16.825405 121 t
16.897783 121 a
16.952000 121 s`
17.065405 121 s`
17.148001 121 a
17.185406 121 n
17.312000 121 i:
17.352812 121 b
17.405405 121 i
17.458000 121 ?`
17.514000 121 a
17.576000 121 j
17.629999 121 n
17.686001 121 a
17.778595 121 j
17.842812 121 h
17.966000 121 i:
18.595783 121 sil
18.625999 121 l
18.655190 121 i
18.691406 121 j
18.732378 121 u
18.815622 121 x
18.879999 121 a
18.927999 121 b
18.999840 121 b
19.063999 121 i
19.102594 121 ?
19.207405 121 a
19.249405 121 n
19.384001 121 i:
19.454811 121 t

19.510218 121 a
19.615999 121 X
19.676811 121 t
19.747406 121 a
19.775406 121 r
19.813999 (19.85) 121 u
19.916811 121 m
20.020594 121 u:
20.122812 121 S
20.172001 121 i
20.222000 121 h
20.309999 (20.285) 121 i:
20.364435 121 ?`
20.408001 121 a
20.479624 121 n
20.570812 121 k
20.620594 121 u
20.653999 121 l
20.704811 121 l
20.784000 121 i
20.860001 121 l
20.911406 121 b
20.980972 121 a
21.071783 121 S
21.141405 121 a
21.209999 121 r
22.025999 121 sil

FILE: T7B20010418

1.650751 121 sil
1.679406 121 ?
1.748000 121 i
1.807719 121 j
1.906594 121 a:
1.950375 121 d
2.026000 121 u
2.082874 121 n
2.160594 121 h
2.190594 121 u
2.212812 121 w
2.262000 121 a
2.359406 121 k
2.416594 121 u
2.442000 121 l
2.486812 121 l
2.561031 121 u
2.627781 121 S
2.694000 121 a

2.790000 121 j
2.815625 121 ?
2.868000 121 i
2.938594 121 n
3.000000 121 f
3.099188 121 i:
3.149344 121 d
3.204594 121 u
3.251406 121 n
3.327625 121 j
3.440000 121 a:
3.588000 121 j
4.097782 121 sil
4.136000 121 w
4.184000 121 a
4.218000 121 l
4.288594 121 a:
4.381406 121 k
4.438219 121 i
4.465031 121 n
4.514000 121 n
4.595625 121 i:
4.692000 121 s
4.744000 121 a
4.792000 121 ?
4.872000 121 a
4.970969 121 q
5.034594 121 r
5.082969 121 a
5.117406 121 ?
5.220000 121 u
5.266219 121 r
5.322594 121 i
5.420156 121 s
5.547406 121 a:
5.576812 121 l
5.648437 121 a
5.712000 121 t
5.776000 121 a
5.822000 121 h
5.935406 121 u
6.024000 121 m
6.096000 121 a
6.144000 121 r
6.183187 121 r
6.276000 121 a
6.333563 121 t
6.398000 121 a
6.438000 121 n
6.492000 121 ?

6.546000 121 u
6.638000 121 x
6.698594 121 r
6.822000 121 a:
8.424000 121 sil

FILE: T7B31010394

0.930000 121 sil
0.964000 121 m
1.016000 121 a
1.104000 121 X
1.178812 121 k
1.252000 121 a
1.294000 121 m
1.359188 121 a
1.414219 121 t
1.480000 121 u
1.543188 121 n
1.620000 121 f
1.722000 121 i:
1.777406 121 m
1.890594 121 u:
1.984000 121 s
2.060157 121 k
2.204000 121 u:
2.556437 121 sil
2.620219 121 t
2.688000 121 u
2.720656 121 ?
2.785719 121 a
2.830000 121 j
2.906000 121 j
2.972000 121 i
3.015249 121 d
3.119625 121 u
3.189781 121 m
3.257031 121 u
3.344656 121 t'
3.470000 121 a:
3.504000 121 l
3.588000 121 a
3.632437 121 b
3.720000 121 a
3.806812 121 t
3.910218 121 a
4.035563 121 S
4.103781 121 a
4.132594 121 r
4.210218 121 i

4.264594 121 k
4.338000 121 a
4.412812 121 t
4.559187 (4.54) 121 i
4.610219 121 r
4.733250 121 u:
4.866000 (4.88) 121 s
4.960000 121 n
5.045843 121 i
5.120000 121 f
5.272000 121 t
5.543031 121 sil
5.584000 121 ?
5.658000 121 a
5.814812 121 l
5.972062 121 X
6.048000 121 u
6.146656 121 k
6.264812 121 u:
6.336000 121 m
6.384000 121 i
6.444000 121 j
6.539187 121 j
6.620000 121 a
6.717468 121 h
6.764000 121 sil
6.798000 121 ?
6.853658 (6.862) 121 a
6.901468 121 r
6.955781 121 r
7.046218 121 u:
7.156000 121 s
7.194000 121 i
7.228000 121 j
7.313781 121 j
7.384000 121 a
7.444219 121 h
7.854969 121 sil
7.896000 121 l
7.954218 121 i
8.032220 121 S
8.101187 121 a
8.129626 121 r
8.196373 121 i
8.249560 121 k
8.326593 121 a
8.391340 121 t
8.456660 121 i
8.544000 121 j
8.642373 (u) 121 u:

8.740220 121 k
8.821780 (u:) 121 u
8.926000 121 s
8.982000 121 ?
9.032813 121 a
9.074000 121 l
9.124220 121 m
9.173407 121 u
9.231780 121 t
9.296000 121 a
9.340000 121 ?`
9.385406 121 a
9.432794 121 T
9.514153 121 T
9.582000 121 i
9.617033 121 r
9.684000 121 a
9.756000 121 t
9.814814 121 i
9.856000 121 l
9.910593 121 i
9.950374 121 n
10.010000 121 n
10.070527 121 i
10.152000 121 f
10.270000 121 t`
10.600311 121 sil
10.670373 121 b
10.740000 121 i
10.772000 121 m
10.834000 121 a
10.876813 121 b
10.942813 121 l
11.004000 121 a
11.066000 121 G
11.120000 121 i
11.191847 121 T
11.219187 121 n
11.274000 121 a
11.336000 121 j
11.374813 121 n
11.418000 121 i
11.460000 121 w
11.507187 121 a
11.582000 121 s
11.631407 121 i
11.664000 121 t
11.721187 121 t
11.785407 121 i:
11.821187 121 n

11.870440 121 a
11.902440 121 w
11.925780 121 a
11.950220 121 ?
11.986593 121 a
12.040000 121 r
12.105186 121 b
12.152813 121 a
12.196067 121 ?
12.236593 121 a
12.274000 121 m
12.298000 121 i
12.339033 121 n
12.402000 121 ?
12.450813 121 a
12.548067 121 S
12.603187 121 r
12.658000 121 a
12.720000 121 m
12.768000 121 i
12.814000 121 l
12.885780 121 j
12.970000 **(12.96)** 121 a:
13.014000 121 r
13.068000 121 r
13.188000 121 u:
13.242440 121 b
13.330000 121 i
13.494000 121 l
14.262000 121 sil
14.301253 121 ?
14.345253 121 i
14.448000 121 T
14.506000 121 n
14.576000 121 a
14.678000 121 j
14.726813 121 n
14.802220 121 w
14.854880 121 a
14.882000 121 ?
14.947780 **(14.955)** 121 a
15.026593 121 r
15.086746 121 b
15.134374 121 a
15.183407 121 ?
15.240967 121 a
15.298000 121 t
15.336440 121 i
15.378966 121 n
15.412000 121 w

15.446000 121 a
15.478000 121 ?
15.514067 121 i
15.600373 121 S
15.670814 121 r
15.738593 121 i:
15.784813 121 n
15.872593 121 a
15.939187 121 m
15.988000 121 i
16.056000 121 n
16.146000 121 m
16.226000 121 i
16.282000 121 ?
16.341623 121 a
16.419373 121 h
16.708218 121 sil
16.769188 121 m
16.854000 121 i
16.927999 121 l
17.034000 121 j
17.203028 121 a:
17.265783 121 r
17.365406 121 d
17.458000 121 u:
17.498434 121 l
17.656651 121 a:
17.809999 121 r
18.516001 121 sil

C. Automatic segmentation and Prosodic transcription

Three files used were:

- T7B11010119
- T7B11010171

The corrections are shown in a bold red font in the file extracts below:

FILE: T7B11010119

```
signal T7B11010119
nfields 1
#
0.520906 125 sil
0.624000 125 w
0.716547 (0.736) 125 a
0.858466 125 ~h
0.933193 125 a
0.993659 125 t_h
1.060205 125 t_h
1.168438 125 a
1.266233 125 q
1.350000 125 u
1.398000 125 r
1.452000 (1.462) 125 i2
1.530000 125 ~@
1.602000 (1.61) 125 u
1.657712 (1.655) 125 R
// 1.716000 125 R
1.772493 (1.763) 125 a
1.828671 125 @
1.915945 125 i2
2.002987 125 s
2.072727 125 a
2.130000 125 l
2.184000 125 @
2.232000 125 a
2.322700 125 m
2.360106 125 r
2.457973 125 i2
2.561886 125 k
2.598000 (2.65) 125 i
2.688000 (2.74) 125 y
2.785868 (2.79) 125 a // y
2.835586 125 ~@
2.910000 125 a
2.952000 125 l
3.094453 (3.044) 125 a2
3.132963 (3.118) 125 @
3.181714 125 i
3.292987 125 q
3.354000 (3.365) 125 n
```

3.431374	125	a2	
3.498000	125	~@	
3.597427	125	i	
3.696000	125	s_h	
3.810000	(3.818)	125	a2
3.858000	(3.855)	125	R
4.008000	(3.932)	125	u2
4.128000	125	n	
4.462667	125	sil	
4.517539	(4.514)	125	b
4.602825	(4.595)	125	i
4.694365	(4.66)	125	w
4.757915	125	a	
4.842000	125	q	
4.967450	125	f	
5.071737	125	i	
5.142444	125	l	
5.214414	125	i	
5.286000	125	s	
5.370464	125	t	
5.477683	125	i2	
5.562745	125	T	
5.686482	125	a2	
5.746457	125	n	
5.823885	125	i	
5.925526	125	f	
5.967085	125	i	
6.078316	(6.03)	125	l
6.137029	125	@	
6.192000	(6.20)	125	a
6.231221	125	R	
6.394351	125	a2	
6.478204	125	D	
6.552000	(6.579)	125	i
6.655161	125	l	
6.749450	125	f	
6.786000	125	i	
6.846598	125	l	
6.941683	125	a	
7.023972	125	s	
7.106699	125	T	
7.194975	125	i2	
7.245434	125	n	
7.322455	125	i	
7.385683	125	y	
7.464500	(7.444)	125	y
7.519424	125	a	
7.592256	125	h	
8.074087	125	sil	
8.180779	125	w	

8.254011	125	a	
8.365754	125	w	
8.450640	125	a	
8.530820	125	q	
8.605711	125	f	
8.679972	125	i	
8.749478	125	t	
8.789046	125	a	
8.905380	125	h	
8.976087	125	w	
9.060000	125	i2	
9.130127	125	d	
9.188214	125	i	
9.242261	125	l	
9.356143	125	q	
9.426000	125	u	
9.505711	125	d	
9.638818	125	s	
10.241450	125	sil	
10.347692	125	b	
10.423852	125	i	
10.525614	125	l	
10.581170	125	@	
10.636674	125	i	
10.710000	125	D	
10.855631	125	a2	
10.952854	125	f	
11.032864	125	a	
11.124405	125	t	
11.236905	(11.22)	125	i
11.272259	125	@	
11.316330	125	i	
11.371255	125	l	
11.439902	125	a	
11.535868	125	l	
11.605312	125	j	
11.676650	125	i	
11.743711	125	d	
11.898000	125	a2	
11.946000	125	r	
12.016258	125	i	
12.069739	125	l	
12.190851	125	~@	
12.301969	125	a2	
12.411817	125	z	
12.470357	125	i	
12.630837	125	l	
13.397162	125	sil	
13.508905	125	w	
13.606668	125	a	

13.667364	125	t	
13.752929	125	a	
13.866000	125	S	
13.926085	125	r	
14.058147	(14.03)	125	i2
14.166000	125	~h	
14.286000	125	a2	
14.375218	125	t	
14.448000	125	u	
14.557711	125	q	
14.646000	125	u	
14.677099	125	r	
14.862844	(14.83)	125	i2
14.988464	125	~@	
15.156000	125	j	
15.246000	125	a2	
15.312000	125	@	
15.378000	125	a	
15.438000	125	t	
15.562985	125	q	
15.630000	125	a	
15.690000	(15.71)	125	b
15.740726	125	l	
15.838901	125	a	
15.924232	125	s	
16.000204	125	a2	
16.127888	125	~@	
16.266710	125	a2	
16.354677	125	t	
16.410000	125	i	
16.471186	125	n	
16.566000	125	m	
16.615760	125	i	
16.657721	125	n	
16.734057	125	a	
16.813660	125	j	
16.888321	125	t	
16.939923	125	i	
16.982852	(17.01)	125	m
17.107122	125	a2	
17.161959	125	~@	
17.236454	125	i	
17.334000	125	s_h	
17.472000	125	a2	
17.513002	125	R	
17.683411	(17.655)	125	u2
17.934000	125	n	
18.031105	125	b	
18.115959	125	i	
18.209999	125	b	

18.375679	(18.37)	125	u2
18.512191		125	s_h
18.835468		125	sil
18.922216		125	f
19.030453		125	i2
19.103054		125	m
19.174916		125	a
19.279714		125	z
19.326431		125	R
19.363972		125	a
19.428366		125	~@
19.495722		125	a
19.585484		125	t
19.710862		125	i
19.796720		125	h
19.923621		125	i
19.990540		125	sil
20.054992		125	b
20.118711		125	i
20.204969		125	t
20.269300		125	i
20.361599		125	k
20.458990		125	s
20.587185		125	a2
20.786313		125	s
21.336000		125	sil

FILE: T7B11010171

signal T7B11010171			
nfields 1			
#			
0.418377		125	sil
0.515231		125	w
0.591988		125	a
0.643756		125	~@
0.696786		125	a
0.753498		125	n
0.824574		125	T
0.911929		125	a
0.985792		125	b
1.112055		125	i2
1.206675	(1.19)	125	~@
1.282958		125	a
1.384599		125	t
1.464776	(1.515)	125	i
1.568822		125	h
1.655943		125	a
1.730176		125	~z
1.797357		125	i
1.881493		125	h

1.961670	125	i	
2.016594	125	z	
2.079726	125	z	
2.138686	125	i	
2.216614	125	y	
2.323306	(2.33) 125	a2	
2.367498	125	R	
2.479937	125	a	
2.587954	(2.57) 125	t	
2.633146	125	i	
2.707010	125	w	
2.792237	125	a	
2.848055	125	@	
2.908832	125	a	
2.975751	125	b	
3.057191	(3.04) 125	~@	
3.194342	125	a2	
3.268837	125	d	
3.368924	125	i	
3.491691	(3.47) 125	h	
3.620975	125	a2	
4.004736	125	sil	
4.092368	125	w	
4.130878	125	a	
4.194641	125	~@	
4.236939	(4.25) 125	a	
4.307015	125	l	
4.423937	125	a2	
4.556817	125	q	
4.660984	125	a2	
4.734847	125	t	
4.825096	125	i	
4.875601	125	t	
4.920424	125	t	
4.976782	125	a	
5.060024	125	~@	
5.164282	(5.15) 125	a2	
5.243196	125	w	
5.306853	125	u	
5.361146	125	n	
5.431853	125	i	
5.493061	125	l	
5.574424	125	m	
5.636292	(5.645) 125	a	
5.734777	(5.745) 125	g_h	
5.780232	125	r	
5.838823	125	i	
5.916475	125	b	
5.971999	(5.99) 125	i	
6.030374	125	y	

6.087192	125	y	
6.141762	125	i	
6.205525	125	l	
6.281808	125	@	
6.341768	125	i	
6.411937	125	s	
6.506541	125	p	
6.615652	125	a2	
6.680677	125	n	
6.752015	125	i	
6.811359	125	y	
6.886656	125	y	
7.538000	125	sil	
7.629470	125	y	
7.726061	125	a	
7.795768	125	t	
7.854097	125	a	
7.970259	125	~h	
8.042860	125	a	
8.090208	125	d	
8.139451	125	d	
8.240000	125	a	
8.322703	125	t_h	
8.431722	125	u	
8.487647	125	w	
8.562404	125	a	
8.674515	125	z	
8.772631	125	i2	
8.820611	125	R	
8.899419	125	u	
8.964430	125	l	
9.008636	125	@	
9.065334 (?)	125	i	
9.146000	125	~@	
9.204854	125	l	
9.312178	125	a2	
9.390000	125	m	
9.447818	125	i	
9.504636	125	l	
9.563349	125	m	
9.633935	125	a	
9.744769 (9.755)	125		g_h
9.803481	125	r	
9.852369	125	i	
9.924970	125	b	
9.979774	125	i	
10.033465	125	y	
10.091546	125	y	
10.155279	125	i	
10.223724	125	l	

10.305163	125	@	
10.389667	(10.375)	125	a
10.484364	125	s	
10.565406	125	b	
10.644000	125	a	
10.773925	125	q	
11.055462	125	sil	
11.158891	125	w	
11.211921	125	a	
11.288000	125	l	
11.388000	125	x	
11.483557	125	a	
11.555527	125	b	
11.700360	125	i2	
11.771946	(11.755)	125	R
11.912021	125	u	
12.006087	125	f	
12.107622	125	i2	
12.214000	125	s_h	
12.269238	125	u	
12.329844	125	@	
12.430102	(12.42)	125	u2
12.483764	125	n	
12.540674	125	i	
12.592350	125	l	
12.706880	(12.685)	125	~@
12.754229	125	a	
12.805536	125	l	
12.906000	125	a2	
13.036000	125	q	
13.136000	125	a2	
13.207562	125	t	
13.255542	125	i	
13.306678	125	l	
13.386118	125	m	
13.441042	125	a	
13.526977	125	g_h	
13.581902	125	r	
13.624123	125	i	
13.690304	125	b	
13.725027	125	i	
13.774900	125	y	
13.817198	125	y	
13.889168	125	a	
13.961937	125	t	
14.025134	(14.01)	125	i
14.074376	125	l	
14.143190	125	@	
14.204000	125	i	
14.274000	125	s	

14.357916	125	p		
14.455138	125	a2		
14.499592	125	n		
14.563355	125	i		
14.619910	125	y		
14.685198	125	y		
14.753011	125	a		
14.829386	(no need for h)	125	h	
15.201663	125	sil		
15.264794	125	m		
15.356335	125	u		
15.472000	125	~h		
15.526392	125	a		
15.588537	125	m		
15.649143	125	m		
15.719573	125	a		
15.786032	125	d		
15.845	(e) i			
15.888199	125	l		
16.034741	(16.0)	125	~@	
16.066306	125	a		
16.107265	125	R		
16.170473	125	a		
16.254992	125	b		
16.287806	125	l		
16.428128	125	m		
16.528000	125	a		
16.628000	125	s		
16.788842	(16.8)	125	a2	
16.865862	125	r		
17.038000	125	i2		
17.778502	125	sil		
17.884931	125	~@		
17.968265	125	a		
18.034815	125	n		
18.118119	125	~@		
18.197650	125	a		
18.264570	125	w		
18.318231	125	d		
18.402013	(18.39)	125	a	
18.458831	125	t		
18.526381	125	i		
18.584462	125	t_h		
18.646000	125	t_h		
18.714115	125	i_		
18.813231	125	q		
18.890883	125	a		
18.979160	125	t		
19.042923	125	i		
19.116155	125	b		

19.208236	125	i	
19.314296	125	k	
19.366695	125	u	
19.412135	125	l	
19.453171	125	l	
19.545251	125	i	
19.611524	125	@	
19.658690	125	a	
19.718664	125	b	
19.832932	125	~@	
19.936467	125	a2	
19.997584	125	d	
20.078392	(20.11)	125	i
20.186000	125	h	
20.309453	125	a2	
20.400362	125	b	
20.471580	(a)	125	i
20.537868	125	y	
20.598474	125	n	
20.662000	125	a	
20.712000	125	@	
20.790010	125	i	
20.862000	125	s	
20.935383	(20.95)	125	p
21.035670	125	a2	
21.095013	125	n	
21.155605	125	y	
21.246514	125	a2	
21.320000	125	w	
21.386000	125	a	
21.416000	125	l	
21.502075	125	m	
21.580989	125	a	
21.661166	(21.67)	125	g_h
21.721141	125	r	
21.793559	125	i	
21.870671	(21.90)	125	b
22.298489	125	sil	
22.348611	125	w	
22.392803	125	a	
22.460353	(22.50)	125	w
22.566414	125	u	
22.637923	125	j	
22.749666	125	u2	
22.795751	125	d	
22.906863	125	i	
22.980726	125	t	
23.072000	125	a	
23.138448	125	f	
23.237167	125	a2	

23.303455	125	h	
23.410041	125	u	
23.488955	125	m	
23.576076	125	i	
23.700445	125	n	
23.779807	125	@	
23.862000	125	i	
23.902000	125	s	
23.989636	125	t	
24.054662	125	R	
24.156303	125	a2	
24.228904	125	t	
24.322864	125	i2	
24.408091	125	j	
24.478075	125	i	
24.543732	125	y	
24.606232	125	y	
24.684394	125	i	
24.781616	125	n	
24.865581	125	w	
24.910404	125	a	
25.070000	(25.03)	125	~@
25.100000	125	a	
25.189353	125	s	
25.280000	125	k	
25.349323	125	a	
25.396041	125	r	
25.473863	125	i	
25.531313	125	y	
25.605176	125	y	
25.902652	125	sil	
26.029546	125	l	
26.116036	125	a	
26.180339	(26.20)	125	m
26.257990	125	y	
26.343849	125	a	
26.430000	125	n	
26.554878	125	q	
26.650000	125	a	
26.734065	125	T	
26.789621	125	i	
26.864000	125	~@	
27.010183	125	q	
27.084000	125	a	
27.251607	125	T	
27.548510	125	sil	
27.645888	125	~h	
27.723894	125	a	
27.794601	125	t	
27.846369	125	t	

27.964000	125	a2	
28.082020	125	f	
28.221157	125	i2	
28.307015	125	~Z	
28.388455	125	i	
28.436000	125	l	
28.479258	125	l	
28.604000	125	i	
28.716511	125	s	
28.816890	125	u2	
28.856662	125	@	
28.940000	125	i	
28.995722	125	t	
29.043702	125	t	
29.130000	125	a	
29.220000	125	f	
29.306222	125	a2	
29.417965	125	h	
29.495864	125	u	
29.592101	125	m	
29.664000	125	@	
29.724046	125	a	
29.768000	125	l	
29.822779	125	l	
29.907020	125	a	
29.984395	125	~z	
30.140000	125	i2	
30.254662	125	k	
30.374611	125	a2	
30.433955	125	n	
30.566000	125	a	
30.658844	125	s	
30.710335	125	a	
30.746597	125	n	
30.866900	125	a	
30.932000	125	t	
30.989546	125	a	
31.057097	125	@	
31.106970	125	a	
31.179571	125	l	
31.311133	125	f	
31.388784	(31.37)	125	a
31.512693	(31.485)	125	y
31.625066	(31.64)	125	n
31.757507		125	sil
31.889820		125	w
31.984148	(32.0)	125	a
32.129937		125	t_h
32.186617		125	n
32.264360	(32.245)	125	a

32.376642	(32.33)	125	y
32.475758		125	n
33.062000		125	sil

D. Pitch Marks

The procedure undertaken in the validation of pitch marks is described in the report. As mentioned earlier, it was noticed that the pitch marks found in the database are not within 5% error rate of the pitch marks obtained using *wavesurfer 1.4.1*. This is shown in the figures below:

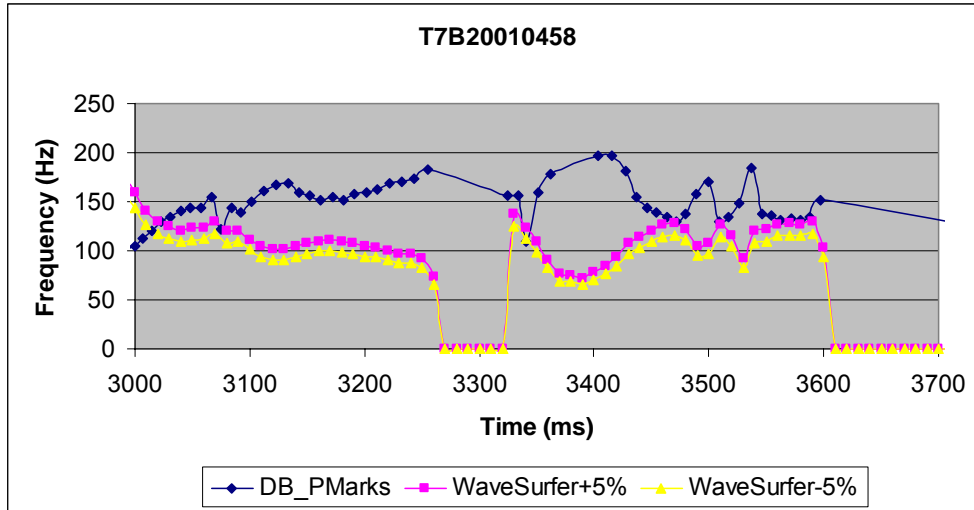


Figure 1 – Comparison of Pitch Mark values for T7B20010458

In addition, it was deduced that these are symmetric with respect to the line $y \approx 125$. The various figures below depict this symmetry from random time segments from the database analysis charts.

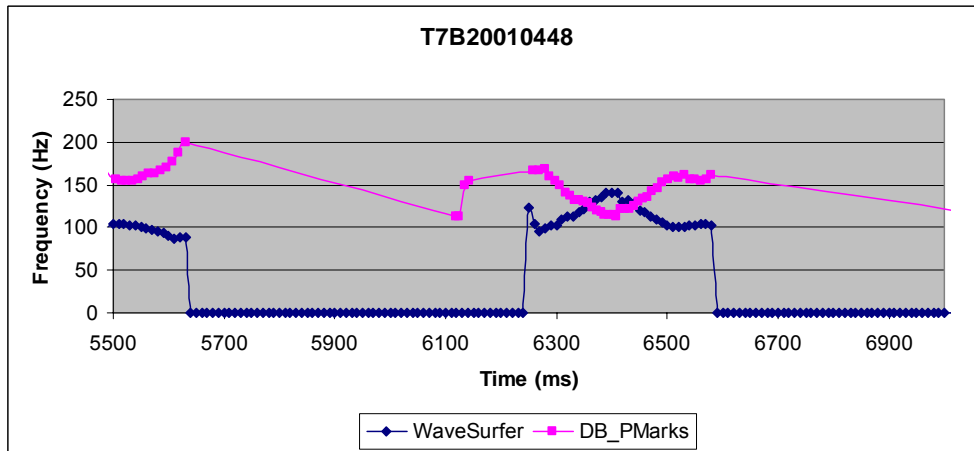


Figure 2 – Comparison of Pitch Mark values for T7B20010448

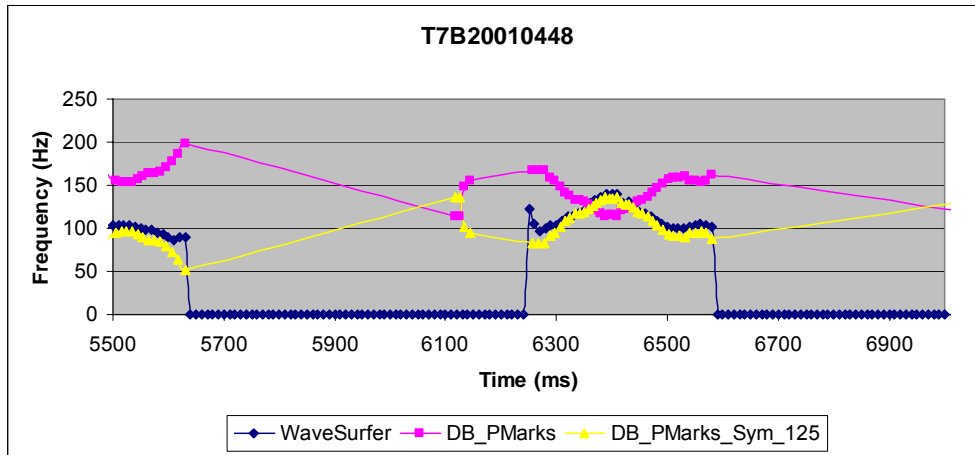


Figure 3 – T7B20010448 – Fig.2 with symmetry

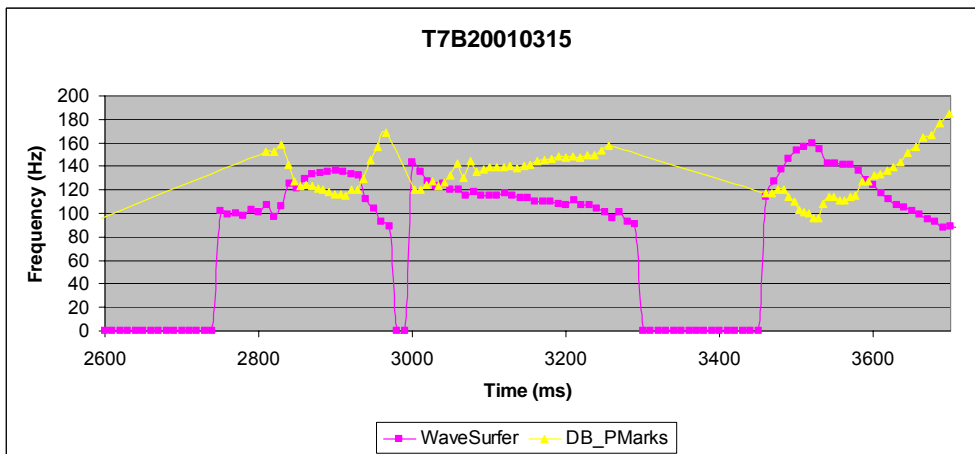


Figure 4 – Comparison of Pitch Mark values for T7B20010315

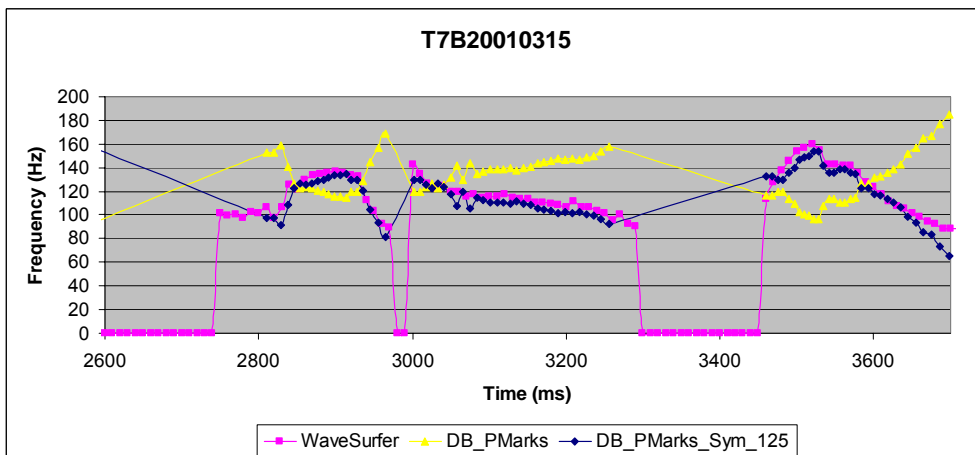


Figure 5 – T7B20010315 – Fig.4 with symmetry

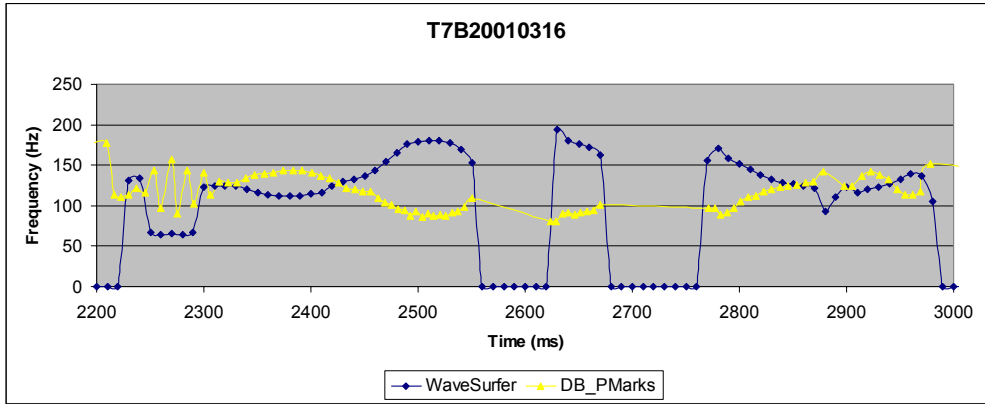


Figure 6 – Comparison of Pitch Mark values for T7B20010316

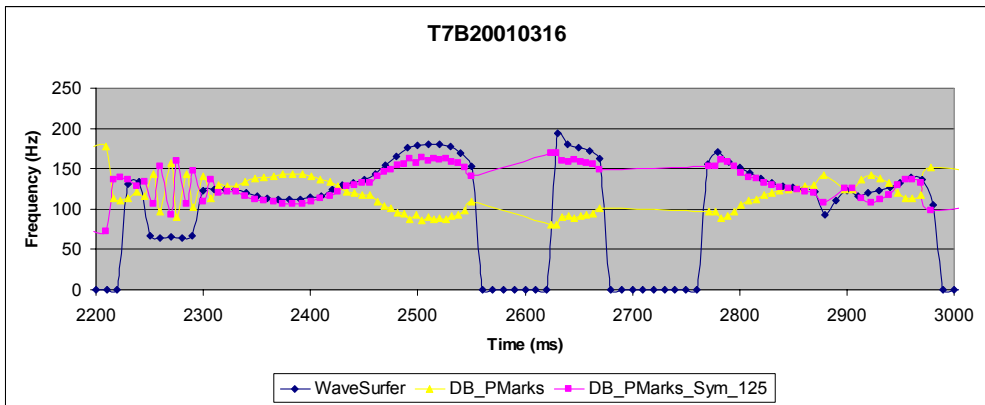


Figure 7 – T7B20010316 – Fig.6 with symmetry

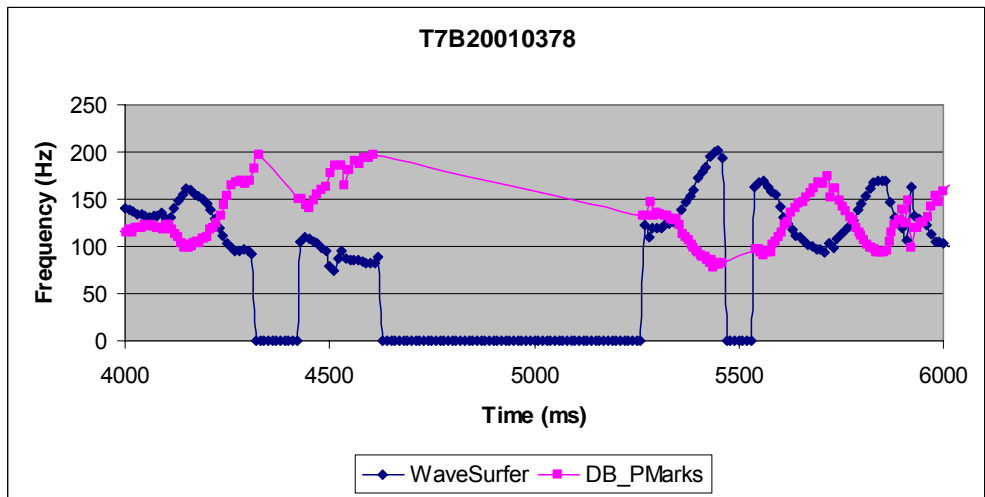


Figure 8 – Comparison of Pitch Mark values for T7B20010378

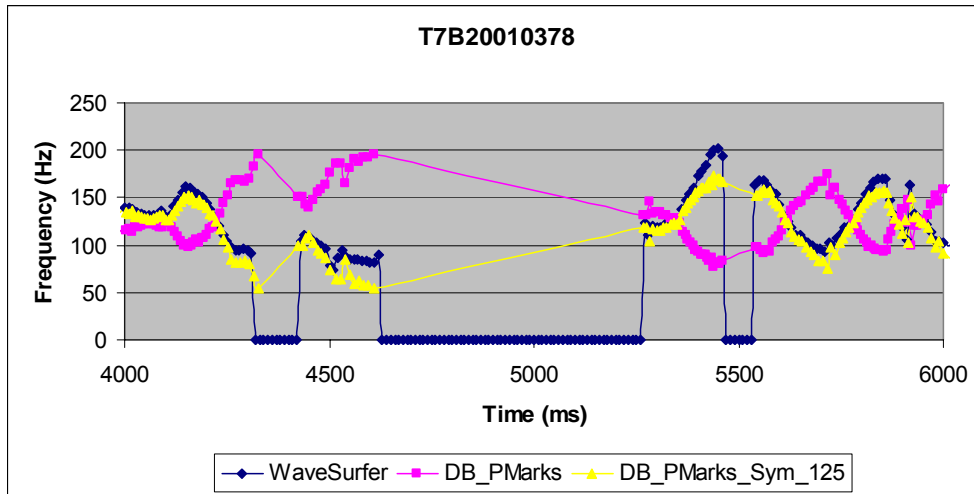


Figure 9 – T7B20010378 – Fig.8 with symmetry

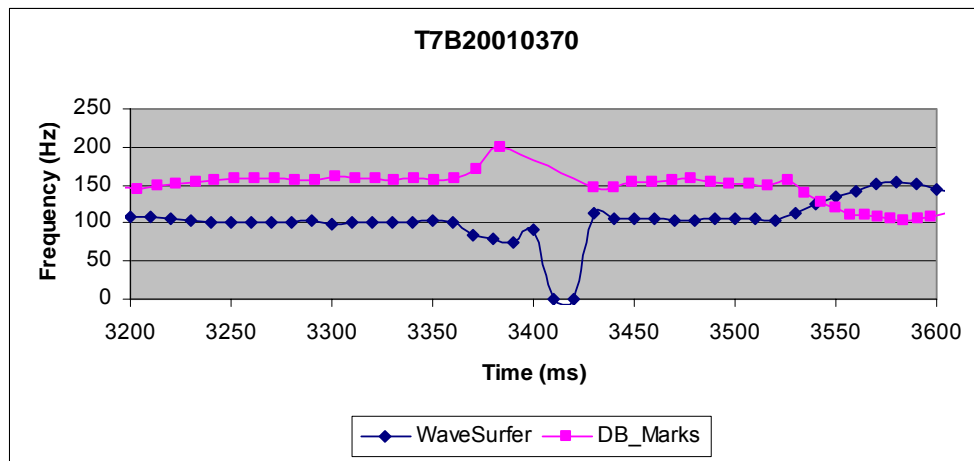


Figure 10 – Comparison of Pitch Mark values for T7B20010370

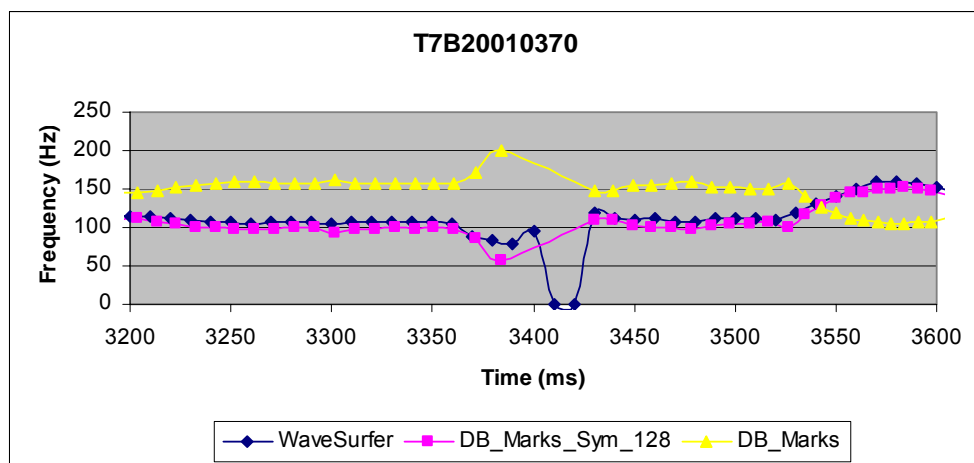


Figure 11 – T7B20010370 – Fig.10 with symmetry

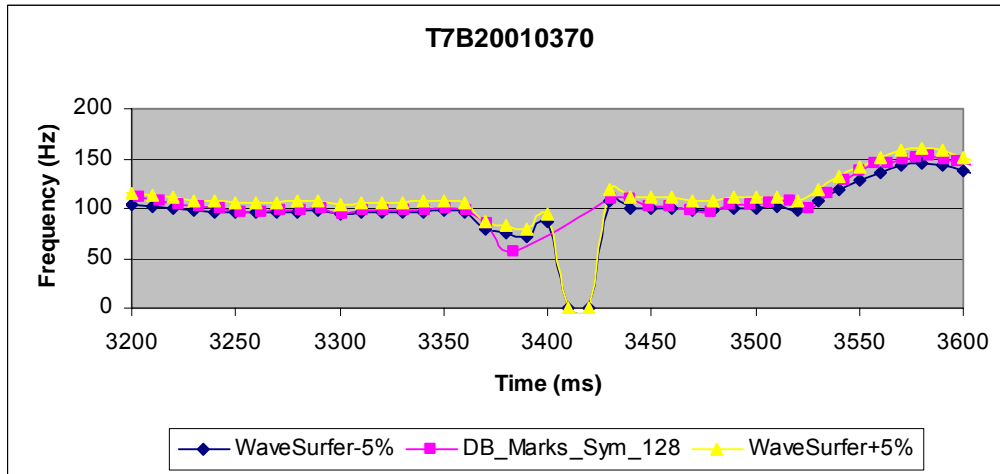


Figure 12 – T7B20010370 – with symmetry and 5% variation

As mentioned earlier, two methods (AMDF and ESPS) used to extract the pitch marks were compared for random files in the database. The results are shown in the figures below:

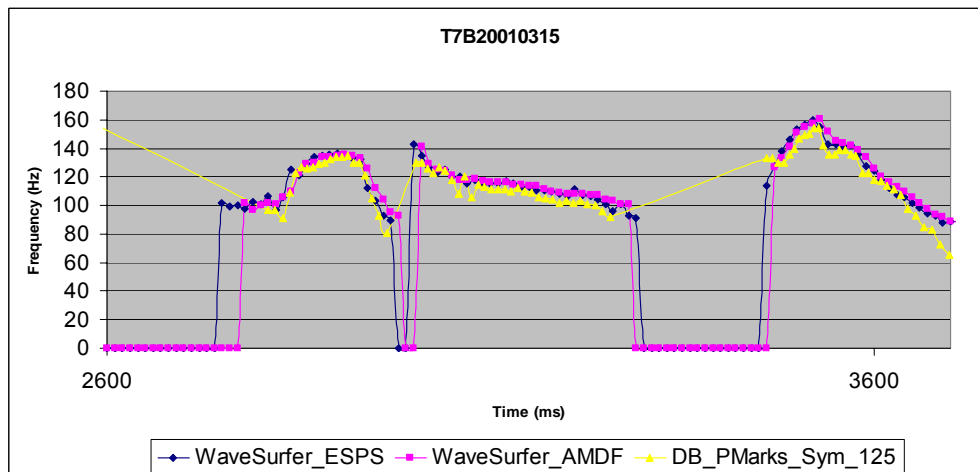


Figure 13 - Comparison of Pitch extraction methods with DB_PMarks

After comparing several random files as above, it was deduced that the ESPS method would be used for calculation of pitch marks. All data in the above graphs was calculated using ESPS.