Unit Testing of ETSI EVS Codec

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ABSTRACT
As a part of software development process, the small testable parts are individually tested for correctness.

A superwideband audio coding standard called Enhanced Voice services provides 20kHz audio bandwidth. The standard intends to provide robustness to delay jitter and packet losses as the coding is channel aware.

Here the problem at hand is the EVS Codec code provided by ETSI. The encoder and decoder c code is made in linux into executable files and sample linux scripts are used determine the correctness of coding and decoding.

The successful running of test ensures quality of product.

General Terms
UMTS: Universal Mobile Telecommunications System
EVS: Codec for Enhanced Voice Services

Keywords
EVS, superwideband, bandwidth, Codec, unit testing.

1. INTRODUCTION
As a part of software development process, the small testable parts are individually tested for correctness.

A superwideband audio coding standard called Enhanced Voice services provides 20kHz audio bandwidth. The standard intends to provide robustness to delay jitter and packet losses as the coding is channel aware.

To considerably improve network capacity and voice quality [1], 3GPP has standardized voice services. The quality of speech rendered matches that of stored music.

The codec has a lot of new features which improve operation in harsh environments. The Codec makes use of ACELP and MDCT to switch between speech and audio compression modes. A collaborative effort amongst handset and infrastructure manufacturers resulted in the evolution of the standard [2].

The codec gives higher quality, better frame/packet error resilience and provides better compression efficiency. [4]

The codec is cost effective and provides better connectivity.

In the previous years, only a small part of the dynamic range of human voice was transmitted. With the emergence of this codec it looks as if we are talking face to face with the other person.

Here the problem at hand is the EVS Codec code provided by ETSI. The encoder and decoder c code is made in linux into executable files and sample linux scripts are used determine the correctness of coding and decoding.

Although the technical rigor of understanding and coding the standard is immense, the level of testing [5] where individual components are validated is by no means trivial.

Each of the individual program modules are tested by creating representative meaningful test stimuli and the outcome is verified against an already available benchmark. [6]

The goal of unit testing is to isolate each part of the program and ensure that individual parts are working correctly. [7]

Sometimes developers try to cut costs by performing minimal testing which introduces defects which percolate through the final product. [8]

This increases the cost of system testing, alpha and beta testing. [9]

2. THE MAKE PROCESS
The code is loaded in a Linux machine and a standard makefile is used to compile the code. The targets EVS_cod and EVS_dec are made

Compiling lib_enc/ACcontextMapping_enc.c
Compiling lib_enc/acelp_core_enc.c
Compiling lib_enc/acelp_core_switch_enc.c
Compiling lib_enc/acelp_enc_util.c
Compiling lib_enc/amr_wb_enc.c
Compiling lib_enc/analy_lp.c
Compiling lib_enc/analy_sp.c
Compiling lib_enc/ari_enc.c
Compiling lib_enc/ari_hm_enc.c
Compiling lib_enc/arith_coder_enc.c
Compiling lib_enc/avq_cod.c
Compiling lib_enc/bass_psfilter_enc.c
Compiling lib_enc/bw_detect.c
Compiling lib_enc/cng_enc.c
Compiling lib_enc/cod2t32.c
Compiling lib_enc/cod4t64.c
Compiling lib_enc/cod_ace.c
Compiling lib_enc/cod_tcx.c
Compiling lib_enc/cod_uv.c
Compiling lib_enc/comvad_decision.c
Compiling lib_enc/core_enc_2div.c
Compiling lib_enc/core_enc_init.c
Compiling lib_enc/core_enc_init.c
Compiling lib_enc/core_enc_reconf.c
Compiling lib_enc/core_enc_switch.c
Compiling lib_enc/core_enc_updt.c
Compiling lib_enc/core_switching_enc.c
Compiling lib_enc/corr_xh.c
Compiling lib_enc/cor_shif.c
Compiling lib_enc/decision_matrix_enc.c
Compiling lib_enc/detect_transient.c
Compiling lib_enc/diffcod.c
Compiling lib_enc/dtx.c
Compiling lib_enc/enc_acelp.c
Compiling lib_enc/enc_acelp_tcx_main.c
Compiling lib_enc/enc_amr_wb.c
Compiling lib_enc/enc_gain.c
Compiling lib_enc/enc_gen_voic.c
Compiling lib_enc/enc_higher_acelp.c
Compiling lib_enc/enc_nelp.c
Compiling lib_enc/encoder.c
Compiling lib_enc/enc_pit_exc.c
Compiling lib_enc/enc_ppp.c
Compiling lib_enc/enc_prm.c
Compiling lib_enc/enc_tran.c
Compiling lib_enc/enc_uv.c
Compiling lib_enc/enc_energy.c
Compiling lib_enc/eval_pit_contr.c
Compiling lib_enc/evs_enc.c
Compiling lib_enc/ext_sig_ana.c
Compiling lib_enc/fd_cng_enc.c
Compiling lib_enc/FEC_enc.c
Compiling lib_enc/find_tar.c
Compiling lib_enc/find_tilt.c
Compiling lib_enc/find_uv.c
Compiling lib_enc/find_wsp.c
Compiling lib_enc/frame_spec_dif_cor_rate.c
Compiling lib_enc/gain_enc.c
Compiling lib_enc/gaus_enc.c
Compiling lib_enc/gp_clip.c
Compiling lib_enc/gs_enc.c
Compiling lib_enc/guided_plc_enc.c
Compiling lib_enc/hf_cod_amrwb.c
Compiling lib_enc/hq_classifier_enc.c
Compiling lib_enc/hq_core_enc.c
Compiling lib_enc/hq_env_enc.c
Compiling lib_enc/hq_hr_enc.c
Compiling lib_enc/hq_lr_enc.c
Compiling lib_enc/hq_mfc_enc.c
Compiling lib_enc/hq_cntl_enc.c
Compiling lib_enc/hq_exc_enc.c
Compiling lib_enc/hq_mrc_enc.c
Compiling lib_enc/hq_mdct_classif.c
Compiling lib_enc/hq_mdct_selector.c
Compiling lib_enc/hq_msvq_enc.c
Compiling lib_enc/hq_multimode.c
Compiling lib_enc/hq_smvc_enc.c
Compiling lib_enc/hq_vq_enc.c
Compiling lib_enc/hq_vq_gen_enc.c
Compiling lib_enc/hq_vq_smvc_enc.c
Compiling lib_enc/hq_vq_vmr_enc.c
Compiling lib_enc/hq_vq_wmr_enc.c
Compiling lib_enc/hqv_enc.c
Compiling lib_enc/igf_enc.c
Compiling lib_enc/igf_scf_enc.c
Compiling lib_enc/init_enc.c
Compiling lib_enc/long_enr.c
Compiling lib_enc/lsf_enc.c
Compiling lib_enc/lsf_msvq_ma_enc.c
Compiling lib_enc/ltd_stable.c
Compiling lib_enc/mdct_classifier.c
Compiling lib_enc/mdct_selector.c
Compiling lib_enc/mslvq_enc.c
Compiling lib_enc/multi_harm.c
Compiling lib_enc/nelp_enc.c
Compiling lib_enc/noise_adjust.c
Compiling lib_enc/nois_est.c
Compiling lib_enc/normalizecoeffs.c
Compiling lib_enc/peak_vq_enc.c
Compiling lib_enc/pitch_num2c
Compiling lib_enc/pitch_ol2.c
Compiling lib_enc/pitch_ol.c
Compiling lib_enc/pitch_exc.c
Compiling lib_enc/plc_enc_ext.c
Compiling lib_enc/ppp_enc.c
Compiling lib_enc/pvq_core_enc.c
Compiling lib_enc/pvq_encode.c
Compiling lib_enc/q_gain2p.c
Compiling lib_enc/qlpc_avq.c
Compiling lib_enc/qlpc_stoch.c
Compiling lib_enc/range_enc.c
Compiling lib_enc/re8_cod.c
Compiling lib_enc/re8_norm.c
Compiling lib_enc/reorder_norm.c
Compiling lib_enc/rst_enc.c
Compiling lib_enc/set_impulse.c
Compiling lib_enc/setmodeindex.c
Compiling lib_enc/sig_clas.c
Compiling lib_enc/SNR_calc.c
Compiling lib_enc/spec_center.c
Compiling lib_enc/spec_flatness.c
Compiling lib_enc/speech_music_classif.c
Compiling lib_enc/stat_noise_uv_enc.c
Compiling lib_enc/subband_fft.c
Compiling lib_enc/swb_bwe_enc.c
Compiling lib_enc/swb_bwe_enc_hr.c
Compiling lib_enc/swb_bwe_enc_lr.c
Compiling lib_enc/swb_pre_proc.c
Compiling lib_enc/swb_the_enc.c
Compiling lib_enc/tcq_core_enc.c
Compiling lib_enc/tcx_ltp_enc.c
Compiling lib_enc/tcx_utils_enc.c
Compiling lib_enc/tfa_enc.c
Compiling lib_enc/tns_base_enc.c
Compiling lib_enc/transient_detection.c
Compiling lib_enc/transition_enc.c
Compiling lib_enc/update_decision.c
Compiling lib_enc/updt_enc.c
Compiling lib_enc/updt_tar.c
Compiling lib_enc/vad.c
Compiling lib_enc/vad_param_updt.c
Compiling lib_enc/vad_proc.c
Compiling lib_enc/vbr_average_rate.c
Compiling lib_enc/vlpc_1st_cod.c
Compiling lib_enc/vlpc_2st_cod.c
Compiling lib_enc/voiced_enc.c
Compiling lib_enc/waveadjust_fec_cod.c
Compiling lib_com/ACcontextMapping.c
Compiling lib_com/ari.c
Compiling lib_com/ari_hm.c
Compiling lib_com/arithmetic_encoder.c
Compiling lib_com/basop32.c
Compiling lib_com/basop_com_lpc.c
Compiling lib_com/basop_lsf_tools.c
Compiling lib_com/basop_mpy.c
Compiling lib_com/basop_tcx_utils.c
Compiling lib_com/basop_util.c
Compiling lib_com/bitalloc.c
Compiling lib_com/bitallocsum.c
Compiling lib_com/bits_alloc.c
Compiling lib_com/bitstream.c
Compiling lib_com/calc_st_com.c
Compiling lib_com/cb_shape.c
Compiling lib_com/cldfb.c
Compiling lib_com/cng_enc.c
Compiling lib_com/codec_tcx_common.c
Compiling lib_com/core_com_config.c
Compiling lib_com/deemph.c
Compiling lib_com/delay_comp.c
Compiling lib_com/disclaimer.c
Compiling lib_com/dlpc_bfi.c
Compiling lib_com/edct.c
Compiling lib_com/enh1632.c
Compiling lib_com/enh40.c
Compiling lib_com/enhancer.c
Compiling lib_com/enr_1_az.c
Compiling lib_com/env_adj.c
Compiling lib_com/env_stab.c
Compiling lib_com/env_stab_trans.c
Compiling lib_com/est_tilt.c
Compiling lib_com/id_enc_com.c
Compiling lib_com/flt.c
Compiling lib_com/fit_cldfb.c
Compiling lib_com/fit_rela.c
Compiling lib_com/fill_spectrum.c
Compiling lib_com/findpulse.c
Compiling lib_com/fine_gain_bits.c
Compiling lib_com/frame_ener.c
Compiling lib_com/g192.c
Compiling lib_com/get_gain.c
Compiling lib_com/gs_bitallocation.c
Compiling lib_com/gs_gains.c
Compiling lib_com/gs_inact_switching.c
Compiling lib_com/gs_noisefill.c
Compiling lib_com/gs_speech.c
Compiling lib_com/guided_plc_util.c
Compiling lib_com/hp50.c
Compiling lib_com/hq2_bit_alloc.c
Compiling lib_com/hq2_core_com.c
Compiling lib_com/hq2_noise_inject.c
Compiling lib_com/hq_bit_allocation.c
Compiling lib_com/hq_conf.c
Compiling lib_com/hq_tools.c
Compiling lib_com/hvq_pvq_bitalloc.c
Compiling lib_com/ifft_rela.c
Compiling lib_com/igf_base.c
Compiling lib_com/index_pvq_opt.c
Compiling lib_com/interleave_spectrum.c
Compiling lib_com/interpoly.c
Compiling lib_com/int_lsp.c
Compiling lib_com/isf_dec_amr_wb.c
Compiling lib_com/interleave_spectrum.c
Compiling lib_com/isf_dec_amr_wb.c
Compiling lib_com/lag_wind.c
Compiling lib_com/lerp.c
Compiling lib_com/limit_t0.c
Compiling lib_com/logarithm.c
Compiling lib_com/lognorm.c
Compiling lib_com/lpc_tools.c
Compiling lib_com/lsf_dec_bfi.c
Compiling lib_com/lsf_msvq_ma.c
Compiling lib_com/lsf_tools.c
Compiling lib_com/lsp_conv_poly.c
Compiling lib_com/modif_fs.c
Compiling lib_com/mslvq_com.c
Compiling lib_com/nelp.c
Compiling lib_com/parameter_mapping.c
Compiling lib_com/phase_dispersion.c
Compiling lib_com/ppp.c
Compiling lib_com/pred_l14.c
Compiling lib_com/preemph.c
Compiling lib_com/pvq_com.c
Compiling lib_com/rate_com.c
Compiling lib_com/re8_ppv.c
Compiling lib_com/re8_util.c
Compiling lib_com/realf.t.c
Compiling lib_com/recovernorm.c
Compiling lib_com/reordvct.c
Compiling lib_com/residu.c
Compiling lib_com/residu.c
Compiling lib_com/residu.c
Compiling lib_com/stat_noise_uv_mod.c
Compiling lib_com/swb_bwe_com.c
Compiling lib_com/swb_bwe_com_hr.c
Compiling lib_com/swb_bwe_com_hr.c
Compiling lib_com/swb_the_com.c
Compiling lib_com/syn_12k8.c
Compiling lib_com/syn_filt.c
Compiling lib_com/tcq_position_arith.c
Compiling lib_com/tcx_ltp.c
Compiling lib_com/tcx_mdct.c
Compiling lib_com/tcx_mdct_window.c
Compiling lib_com/tcx_utils.c
Compiling lib_com/tec_com.c
Compiling lib_com/tns_base.c
Compiling lib_com/tools.c
Compiling lib_com/trans_direct.c
Compiling lib_com/trans_inv.c
Compiling lib_com/vlpc_2st_com.c
Compiling lib_com/weight_a.c
Compiling lib_com/weight.c
Compiling lib_com/wi.c
Compiling lib_com/window.c
Compiling lib_com/window_ola.c
Compiling lib_com/wtda.c
Linking EVS cod
Compiling lib_dec/ACcontextMapping_dec.c
Compiling lib_dec/acelp_core_dec.c
Compiling lib_dec/acelp_core_switch_dec.c
Compiling lib_dec/amr_wb_dec.c
Compiling lib_dec/ari_dec.c
Compiling lib_dec/ari_hm_dec.c
Compiling lib_dec/arith_coder_dec.c
Compiling lib_dec/avq_dec.c
Compiling lib_dec/bass_psflter.c
Compiling lib_dec/cng_dec.c
Compiling lib_dec/core_dec_init.c
Compiling lib_dec/core_dec_reconf.c
Compiling lib_dec/core_dec_switch.c
Compiling lib_dec/core_switching_dec.c
Compiling lib_dec/dec2t32.c
Compiling lib_dec/dec4t64.c
Compiling lib_dec/dec_acce.c
Compiling lib_dec/dec_acelp.c
Compiling lib_dec/dec_acelp_tcx_main.c
Compiling lib_dec/dec_amr_wb.c
Compiling lib_dec/dec_gen_voic.c
Compiling lib_dec/dec_higher_acelp.c
Compiling lib_dec/decision_matrix_dec.c
Compiling lib_dec/dec LPD.c
Compiling lib_dec/dec_nelp.c
Compiling lib_dec/decoder.c
Compiling lib_dec/dec_pit_exc.c
Compiling lib_dec/dec_post.c
Compiling lib_dec/dec_ppp.c
Compiling lib_dec/dec_prm.c
Compiling lib_dec/dec_tcx.c
Compiling lib_dec/dec_tran.c
Compiling lib_dec/d_gain2p.c
Compiling lib_dec/dlpc_avq.c
Compiling lib_dec/dlpc_stoch.c
Compiling lib_dec/er_dec_acelp.c
Compiling lib_dec/er_dec_acelp.c
Compiling lib_dec/er_dec_tcx.c
Compiling lib_dec/er_scale_syn.c
Compiling lib_dec/er_sync_exc.c
Compiling lib_dec/er_util.c
Compiling lib_dec/evs_dec.c
Compiling lib_dec/EvsRXlib.c
Compiling lib_dec/id_cng_dec.c
Compiling lib_dec/FEC_adapt_codebook.c
Compiling lib_dec/FEC.c
Compiling lib_dec/FEC_clas_estim.c
Compiling lib_dec/FEC_HQ_core.c
Compiling lib_dec/FEC_HQ_phase_ecu.c
Compiling lib_dec/FEC_lsf_estim.c
Compiling lib_dec/FEC_pitch_estim.c
Compiling lib_dec/FEC_scale_syn.c
Compiling lib_dec/gain_dec.c
Compiling lib_dec/gauss_dec.c
Compiling lib_dec/gs_dec_amr_wb.c
Compiling lib_dec/gs_dec.c
Compiling lib_dec/hdecnrm.c
Compiling lib_dec/hf_synth.c
Compiling lib_dec/hq_classifier_dec.c
Compiling lib_dec/hq_conf_fec.c
Compiling lib_dec/hq_core_dec.c
Compiling lib_dec/hq_env_dec.c
Compiling lib_dec/hq_hr_dec.c
Compiling lib_dec/hq_lr_dec.c
Compiling lib_dec/igf_dec.c
Compiling lib_dec/igf_scf_dec.c
Compiling lib_dec/init_dec.c
Compiling lib_dec/inov_dec.c
Compiling lib_dec/io_dec.c
Compiling lib_dec/jbm_jb4_circularbuffer.c
Compiling lib_dec/jbm_jb4_inputbuffer.c
Compiling lib_dec/jbm_jb4_imf.c
Compiling lib_dec/jbm_jb4sb.c
Compiling lib_dec/jbm_pcmdsp_apc.c
Compiling lib_dec/jbm_pcmdsp_fifo.c
Compiling lib_dec/jbm_pcmdsp_similarityestimation.c
Compiling lib_dec/jbm_pcmdsp_window.c
Compiling lib_dec/ld_music_post_filter.c
Compiling lib_dec/lead_deindexing.c
Compiling lib_dec/lp_exc_d.c
Compiling lib_dec/lst_dec.c
Compiling lib_dec/lsf_msvq_ma_dec.c
Compiling lib_dec/nelp_dec.c
Compiling lib_dec/peak_vq_dec.c
Compiling lib_dec/pitch_extr.c
Compiling lib_dec/pit_dec.c
Compiling lib_dec/post_dec.c
Compiling lib_dec/ppp_dec.c
Compiling lib_dec/pvq_core_dec.c
Compiling lib_dec/pvq_decode.c
Compiling lib_dec/range_dec.c
Compiling lib_dec/re8_dec.c
Compiling lib_dec/rom_dec.c
Compiling lib_dec/rst_dec.c
Compiling lib_dec/stat_noise_uv_dec.c
Compiling lib_dec/swb_bwe_dec.c
Compiling lib_dec/swb_bwe_dec_hr.c
Compiling lib_dec/swb_bwe_dec_lr.c
Compiling lib_dec/swb_tbe_dec.c
Compiling lib_dec/syn_outp.c
Compiling lib_dec/tcq_core_dec.c
Compiling lib_dec/tcx_utils_dec.c
Compiling lib_dec/tcq_base_dec.c
Compiling lib_dec/TonalComponentDetection.c
Compiling lib_dec/tonalMDCTconcealment.c
Compiling lib_dec/transitition_dec.c
Compiling lib_dec/updt_dec.c
Compiling lib_dec/vlpc_1st_dec.c
Compiling lib_dec/vlpc_2st_dec.c
Compiling lib_dec/voiced_dec.c
Compiling lib_dec/voip_client.c
Compiling lib_dec/waveadjust_fec_dec.c
3. THE ENCODE PROCESS

3.1 The organization of source and input test files.
A set of input audio files are properly prepared and stored in the test directory. The directory lib_enc contains C source files for the encoder which forms the acelp and mdct part. The source files for the decoder are stored in the directory lib_dec. The common files are stored in lib_com directory. A Makefile is crafted to compile the encoder and decoder.

A test is performed on the codec by passing the input files one after the other on the command line to the input codec and the result is obtained as *.COD file. The entire process is encoded as a script. A part of the script is shown here for reference.

```
ENC_BIN=./EVS_cod # EVS encoder binary under test
DIFF_BIN=/usr/bin/diff # default test tool
LOG_FILE=Readme_EVS_enc_log.txt # test result log file
if (-f $LOG_FILE) ; then
  rm $LOG_FILE
fi
$ENC_BIN   ./switchPaths/sw_72_244.bin 8
$DIFF_BIN
```

3.2 The encoding script
Now the encoding process is initiated by passing the input files one after the other on the command line to the input codec and the result is obtained as *.COD file. The entire process is encoded as a script. A part of the script is shown here for reference.

ENC_BIN=./EVS_cod # EVS encoder binary under test
DIFF_BIN=usr/bin/diff # default test tool
LOG_FILE=Readme_EVS_enc_log.txt # test result log file
if [-f $LOG_FILE] ; then
  rm $LOG_FILE
fi
$ENC_BIN ./switchPaths/sw_72_244.bin 8
$DIFF_BIN

$DEC_BIN 8000 8 ./testv/input/nb/stv8c.INP
./output/bitstreams/stv8c_8000_8kHz.COD
$DIFF_BIN ./testv/bitstreams/nb/stv8c_8000_8kHz.COD
./output/bitstreams/stv8c_8000_8kHz.COD >> $LOG_FILE 2>&1

$ENC_BIN 9600 8 ./testv/input/nb/stv8c.INP
./output/bitstreams/stv8c_9600_8kHz.COD
$DIFF_BIN ./testv/bitstreams/nb/stv8c_9600_8kHz.COD
./output/bitstreams/stv8c_9600_8kHz.COD >> $LOG_FILE 2>&1

$ENC_BIN -dtx 5900 8 ./testv/input/nb/stv8c.INP
./output/bitstreams/stv8c_dtx_5900_8kHz.COD
$DIFF_BIN ./testv/bitstreams/nb/stv8c_dtx_5900_8kHz.COD
./output/bitstreams/stv8c_dtx_5900_8kHz.COD >> $LOG_FILE 2>&1

$ENC_BIN 13200 8 ./testv/input/nb/stv8c.INP
./output/bitstreams/stv8c_13200_8kHz.COD
$DIFF_BIN ./testv/bitstreams/nb/stv8c_13200_8kHz.COD
./output/bitstreams/stv8c_13200_8kHz.COD >> $LOG_FILE 2>&1

4. THE DECODE PROCESS
Now the decoding process is initiated by passing the encoded *.COD through the EVS decoder to produce *.OUT files. These OUT files are compared to an existing benchmark file using the diff command. A portion of the decoder script is attached for reference.

4.1 The decoding script
DEC_BIN=./EVS_dec # EVS decoder binary under test
DIFF_BIN=diff # default test tool
LOG_FILE=Readme_EVS_dec_log.txt # test result log file
if [ -f $LOG_FILE ] ; then
  rm $LOG_FILE
fi
$DEC_BIN 8 ./testv/bitstreams/nb/stv8c_13200_8kHz.f06.COD
./output/decoded/stv8c_13200_8kHz.f06.OUT
$DIFF_BIN ./testv/decoded/nb/stv8c_13200_8kHz.f06.OUT
./output/decoded/stv8c_13200_8kHz.f06.OUT >> $LOG_FILE 2>&1

$DEC_BIN 8 ./testv/bitstreams/nb/stv8c_13200_8kHz.COD
./output/decoded/stv8c_13200_8kHz.COD
$DIFF_BIN ./testv/decoded/nb/stv8c_13200_8kHz.COD
./output/decoded/stv8c_13200_8kHz.COD >> $LOG_FILE 2>&1

$DEC_BIN 8 ./testv/bitstreams/nb/stv8c_13200_8kHz.b10.COD
./output/decoded/stv8c_13200_8kHz.b10.OUT
$DIFF_BIN ./testv/decoded/nb/stv8c_13200_8kHz.b10.OUT
./output/decoded/stv8c_13200_8kHz.b10.OUT >> $LOG_FILE 2>&1

$DEC_BIN 8 ./testv/bitstreams/nb/stv8c_8000_8kHz.b10.COD
./output/decoded/stv8c_8000_8kHz.b10.OUT
$DIFF_BIN ./testv/decoded/nb/stv8c_8000_8kHz.b10.OUT
./output/decoded/stv8c_8000_8kHz.b10.OUT >> $LOG_FILE 2>&1

5. THE UNIT TESTING PROCESS
A portion of the encoding log as a part of encoding is as shown below:

EVS Codec (Floating Point) 3GPP TS26.443 Apr 03, 2018.
Version 12.10.0 / 13.6.0 / 14.2.0

Bandwidth switching file: ./switchPaths/bw_switch_NB WB SWB_FB.txt
Bitrate switching file: ./switchPaths/bw_59_1280.bin
Input audio file: ./testv/input/fb/stv48n2.INP
Output bitstream file: ./output/bitstreams/stv48n2_bw_59_1280_48kHz.COD
Input sampling rate: 48000 Hz
Bitrate: 7.20 kbps
Bandwidth limited to WB. To enable FB coding, please use -max_band_FB.

Running the encoder ------
Frames processed: 700
Encoding finished

At the end of the total encoding and decoding process we get the log

TEST PASSED SUCCESSFULLY

6. DISCUSSION
Even when performing unit testing the task should not be considered as trivial. The quality of the output is dependent on how meticulously the unit test benchmarks are created. This process even though simple illustrates that unit testing is by no means a simple task. Lack of proper planning can result in a faulty product being handed over to the end customer.

7. REFERENCES
[1] Universal Mobile Telecommunications System (UMTS); LTE; Codec for Enhanced Voice Services (EVS); ANSI C code (fixed-point) (3GPP TS 26.442 version 14.2.0 Release 14).


