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Datasheet for the decision of 22 June 2010

Case Number: T 0758/07 - 3.5.02

Application Number: 03763216.3

Publication Number: 1525664

IPC: H03M 13/00

Language of the proceedings: EN

Title of invention:
Methods and system for memory management in low density parity check (LDPC) decoders

Applicant:
DTVG LICENSING, INC

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 83, 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Sufficiency of disclosure - yes"
"Added subject-matter - no (after amendment)"
"Novelty and inventive step - yes"

Decisions cited:
-

Catchword:
-

b

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0758/07 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 22 June 2010

Appellant: DTVG LICENSING, INC
2230 East Imperial Highway
El Segundo CA 90245 (US)

Representative: Jackson, Richard Eric
Carpmaels & Ransford
43-45, Bloomsbury Square
London WC1A 2RA (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 November 2006 refusing European patent application No. 03763216.3 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Ruggiu
Members: M. Rognoni
P. Mühlens

Summary of Facts and Submissions

I. The appellant (applicant) appealed against the decision of the examining division refusing European patent application No. 03 763 216.3.

II. In the contested decision, the examining division found, *inter alia*, that claim 1 extended beyond the content of the application as originally filed (Article 123 (2) EPC). Furthermore, its subject-matter was not new with regard to the following prior art under Article 54 (3) EPC:

D2: WO-A-02/103 631.

In item IV of the contested decision under the heading "Further remarks which are not part of the decision", the examining division expressed the view that the application did not meet the requirements of Article 83 EPC because the claimed invention was not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

III. Oral proceedings before the Board were held on 22 June 2010.

IV. The appellant requested that the decision under appeal be set aside and that a patent be granted in the following version:

- Claims 1 and 2, filed in the oral proceedings of 22 June 2010,

- Description: pages 1, 3 and 30 filed in the oral proceedings of 22 June 2010,
  page 2, filed with a letter dated 21 March 2006,
  pages 5 to 29 as originally filed,

- Drawings: sheets 1/16 to 16/16 as originally filed.

V. Claim 1 reads as follows:

"A method for processing a low density parity check (LDPC) coded signal, the method comprising:
generating an LDPC encoded signal using a structured parity check matrix specifying the connection of bit nodes to check nodes;
transmitting the LDPC encoded signal across a communication channel to a receiver;
receiving the LDPC encoded signal at the receiver;
retrieving, from memory in the receiver, edge values associated with the structured parity check matrix used to generate the LDPC coded signal,
outputting a decoded signal corresponding to the LDPC coded signal based on the retrieved edge values,

wherein the edge values specify a relationship of bit nodes and check nodes,

wherein the bit nodes are divided into groups of 392,

wherein the edge values in the retrieving step are stored in memory (1501, 1503) according to a predetermined scheme,

characterised in that the memory comprises top edge RAM and bottom edge RAM,

wherein the bottom edge RAM stores the edge values for bit nodes of degree two,

wherein the top edge RAM stores the edge values for bit nodes of degree greater than two,

wherein storage of edge values in the top edge RAM is defined by one of tables 1 - 4 below,

wherein each successive row of each table denotes the row indices and starting column indices for corresponding successive groups of 392 bit nodes for a particular LDPC encoding scheme having the code rate stated in the title of each table,

wherein a first number at each table location in each table denotes a row index for storage of edge values in the top edge RAM and a second number at each table location denotes a starting column index for storage of edge values in the top edge RAM of successive bit nodes in a corresponding group of bit nodes,

wherein successive table locations in each row denote the row and column indices for corresponding successive edge values for said corresponding group of bit nodes,

such that a group of 392 bit nodes and 392 check nodes can be selected for processing at one time,

wherein for bit node processing, in the retrieving step, for a group of bit nodes of degree two, two consecutive rows of bottom edge RAM are accessed, and, for a group of bit nodes of degree, d, greater than two, the edge values are obtained from d rows of top edge RAM,

wherein for check node processing, in the retrieving step, q consecutive rows are accessed from top edge RAM and two consecutive rows are accessed from bottom edge RAM,

wherein $q = d_c - 2$, where d_c is the degree of the check nodes dependant on the predetermined scheme, wherein $d_c = 7$ for code rate 1/2, $d_c = 10$ for code rate 2/3, $d_c = 16$ for code rate 3/4 and $d_c = 22$ for code rate 5/6,

wherein the tables 1- 4 are as follows:

Row Index/Starting Column Index (Rate 2/3)
0/0 433/323 242/150 91/117 323/112 147/93 35/105 227/232 196/311 292/180 52/244 180/250 20/335
8/0 121/326 178/109 299/157 195/338 99/232 251/107 411/263 364/199 28/218 276/370 108/80 84/130
16/0 281/359 18/112 83/180 115/264 163/149 355/321 11/206 268/100 436/79 252/316 420/280 380/335
24/0 345/122 146/365 107/40 283/363 123/368 379/340 3/156 124/15 220/187 356/127 188/71 156/82

32/0 425/177 234/46 267/219 67/224 171/275 219/306 387/87 372/56 140/31 36/339 116/36 316/288
40/0 417/214 122/188 339/58 235/72 187/26 75/302 19/362 164/285 132/109 148/189 60/65 412/303
48/0 89/312 362/214 43/21 419/219 427/378 395/10 347/167 68/221 260/310 396/54 308/268 388/176
56/0 73/69 434/266 155/277 435/360 363/183 51/165 331/181 12/232 404/193 172/175 324/349 348/98
64/0 177/354 34/172 243/141 139/362 259/151 179/166 307/56 76/367 244/121 100/299 428/12 284/133
72/0 145/264 194/335 131/362 403/326 315/180 275/137 203/86 204/303 4/5 228/360 300/76 92/17
80/0 377/382 394/243 27/109 59/237 371/175 211/358 291/353 340/161 212/94 332/333 44/117 236/200
88/0 65/365 378/142
96/0 57/285 226/108
104/0 97/161 250/133
112/0 129/184 114/44
120/0 337/130 50/178
128/0 401/389 170/258
136/0 25/330 82/372
144/0 321/309 162/170
152/0 185/38 386/128
160/0 49/376 90/331
168/0 265/293 314/166
176/0 297/86 282/193
184/0 217/117 42/210
192/0 201/124 306/86
200/0 313/377 138/97
208/0 193/247 202/163
216/0 209/377 186/212
224/0 233/238 26/22
232/0 329/152 410/271
240/0 9/245 106/170
248/0 409/190 58/289
256/0 113/375 154/44
264/0 33/232 274/268
272/0 153/339 218/145
280/0 289/319 98/4
288/0 41/209 130/23
296/0 385/42 210/267
304/0 17/7 258/227
312/0 169/166 290/330
320/0 241/107 66/111
328/0 137/39 418/182
336/0 249/137 354/218
344/0 161/73 2/79
352/0 105/280 266/282
360/0 257/69 298/51
368/0 81/185 338/118
376/0 369/228 370/202
384/0 225/71 74/136
392/0 1/314 346/289
400/0 353/286 322/166
408/0 305/81 330/301

416/0 273/170 402/282
424/0 393/227 10/312
432/0 361/379 426/364
5/0 350/140 263/166
13/0 102/110 87/335
21/0 174/333 215/219
29/0 422/227 31/273
37/0 406/168 175/11
45/0 254/42 279/201
53/0 230/347 47/291
61/0 214/139 55/92
69/0 358/131 199/344
77/0 86/374 183/298
85/0 118/118 407/25
93/0 318/221 39/66
101/0 54/256 79/202
109/0 374/195 119/162
117/0 238/89 207/243
125/0 366/78 95/96
133/0 46/216 351/9
141/0 326/99 127/87
149/0 134/75 319/102
157/0 158/154 15/65
165/0 286/158 143/362
173/0 190/146 191/205
181/0 62/4 343/262
189/0 94/239 271/38
197/0 198/207 231/297
205/0 22/32 167/205
213/0 246/385 303/246
221/0 390/368 439/220
229/0 334/207 247/262
237/0 398/378 63/211
245/0 150/340 359/100
253/0 294/75 415/189
261/0 222/321 391/78
269/0 166/343 159/105
277/0 126/93 239/166
285/0 110/113 151/373
293/0 302/144 71/18
301/0 262/368 111/193
309/0 414/332 375/389
317/0 142/256 103/242
325/0 278/22 7/154
333/0 342/192 423/330
341/0 14/181 431/16
349/0 38/367 383/16
357/0 270/91 223/195
365/0 182/211 287/313
373/0 310/170 135/230
381/0 78/15 295/220
389/0 430/353 335/91
397/0 30/141 367/216
405/0 382/36 311/98
413/0 206/377 255/372

421/0 438/225 399/148 429/0 70/182 327/105 437/0 6/277 23/94

Table 1

Row Index/Starting Column Index (Rate 5/6)
0/0 221/158 442/14 503/323 283/150 104/117 384/112 165/93 45/105 266/232 226/311 347/180 67/244 20/0 101/369 162/326 323/359 23/112 124/180 144/264 205/149 405/321 6/206 306/100 507/79 287/316 40/0 201/285 302/12 63/134 243/68 264/238 344/375 105/259 345/213 246/75 66/148 327/100 167/220 60/0 381/141 422/112 443/125 223/47 204/375 504/214 145/188 385/58 206/72 166/26 87/302 7/362 80/0 461/383 82/80 143/61 463/106 284/196 4/94 85/104 285/235 386/3 426/218 27/38 107/161 100/0 41/310 482/66 343/376 403/166 324/265 404/236 245/230 445/63 186/343 486/88 427/202 267/362 120/0 61/31 502/317 123/25 163/139 424/269 164/309 25/56 505/260 406/279 346/148 367/315 47/382 140/0 421/362 462/206 263/297 83/384 244/287 184/132 225/140 125/14 506/216 106/311 447/87 487/264 160/0 441/191 382/360 423/282 203/2 84/58 64/347 425/249 5/267 466/232 46/275 127/385 187/26 180/0 501/296 222/324 3/73 43/6 364/319 444/204 185/82 65/259 26/90 286/155 307/181 147/366 200/0 301/325 102/119 383/285 103/84 304/121 484/352 365/102 485/107 86/9 366/76 387/229 467/52 220/0 341/331 322/242 483/275 303/293 464/166 44/283 305/232 465/86 126/193 146/184 207/38 407/117 240/0 21/314 362/289 363/211 183/120 24/286 224/166 325/186 265/144 446/81 326/301 227/4 247/199 260/0 161/91 142/78 280/0 241/209 2/119 300/0 141/87 342/147 320/0 281/55 42/46 340/0 261/213 182/145 360/0 181/264 62/88 380/0 1/96 262/184 400/0 361/30 282/126 420/0 81/202 202/206 440/0 481/156 242/263 460/0 401/170 22/126 480/0 321/42 402/21 500/0 121/272 122/337 8/0 289/369 190/223 28/0 369/313 130/127 48/0 189/92 290/241 68/0 509/124 210/56 88/0 489/23 430/101 108/0 309/208 510/162

128/0 349/147 330/242
148/0 29/263 490/54
168/0 69/312 250/377
188/0 249/315 270/116
208/0 49/176 170/58
228/0 109/337 10/55
248/0 469/65 110/187
268/0 209/105 470/362
288/0 229/164 150/80
308/0 9/293 410/374
328/0 329/122 310/152
348/0 149/124 390/382
368/0 389/160 230/92
388/0 169/357 370/368
408/0 449/296 90/377
428/0 269/32 70/212
448/0 409/59 450/257
468/0 89/291 30/234
488/0 429/130 350/95
508/0 129/276 50/38
11/0 292/349 133/372
31/0 492/271 253/248
51/0 192/149 273/378
71/0 352/265 153/37
91/0 332/244 293/199
111/0 152/354 393/243
131/0 312/144 213/184
151/0 92/219 173/11
171/0 392/182 473/325
191/0 232/219 193/30
211/0 372/157 13/63
231/0 12/108 333/359
251/0 112/33 513/88
271/0 72/207 413/9
291/0 272/100 93/357
311/0 432/166 233/272
331/0 412/265 33/210
351/0 132/155 493/50
371/0 512/292 453/214
391/0 172/387 53/114
411/0 32/233 433/177
431/0 252/113 373/52
451/0 212/347 353/90
471/0 52/89 73/198
491/0 452/285 313/233
511/0 472/103 113/84
14/0 55/43 36/361
34/0 355/70 116/287
54/0 115/137 196/57
74/0 95/161 416/206
94/0 295/273 336/209
114/0 255/184 296/287
134/0 435/11 376/38
154/0 155/356 16/379
174/0 135/251 76/10

194/0 235/314 256/293
214/0 75/296 216/326
234/0 275/314 356/116
254/0 455/133 156/165
274/0 375/292 436/283
294/0 515/227 456/337
314/0 315/111 176/155
334/0 175/98 276/334
354/0 335/7 476/87
374/0 415/161 136/15
394/0 395/338 496/98
414/0 495/82 396/269
434/0 195/312 516/187
454/0 475/100 56/356
474/0 15/163 316/195
494/0 35/197 96/145
514/0 215/301 236/381
17/0 18/321 459/4
37/0 398/236 139/8
57/0 338/117 439/84
77/0 438/97 499/93
97/0 298/292 19/215
117/0 218/224 419/275
137/0 98/229 299/27
157/0 378/133 339/232
177/0 118/191 359/271
197/0 478/272 159/386
217/0 498/262 119/219
237/0 418/282 519/297
257/0 238/33 379/339
277/0 258/230 179/350
297/0 158/27 59/188
317/0 518/249 399/229
337/0 278/333 279/330
357/0 138/276 239/49
377/0 178/34 219/304
397/0 458/344 199/181
417/0 58/312 479/158
437/0 358/377 259/364
457/0 78/157 319/380
477/0 318/75 99/57
497/0 38/296 79/26
517/0 198/115 39/342

Table 2

Row Index/Starting Column Index (Rate 1/2)
240/0 306/249 387/194 98/132 268/80 219/33 64/252 108/54
245/0 146/169 37/233 183/243 233/207 9/336 54/91 363/391
250/0 196/123 242/31 63/103 118/277 344/177 339/46 173/219
255/0 216/36 287/288 318/43 83/327 34/28 354/114 53/84
260/0 316/69 377/8 323/110 308/250 314/209 214/101 298/134
265/0 256/186 257/166 23/196 68/68 234/41 144/249 333/11
270/0 201/192 32/38 213/255 203/124 84/285 264/12 263/134
275/0 36/100 247/220 388/286 273/339 89/334 154/192 223/148
280/0 396/141 132/112 283/125 163/47 79/375 14/214 138/188
285/0 31/189 82/65 18/303 313/92 299/317 129/18 373/356
290/0 381/332 332/312 258/214 43/21 364/219 274/378 198/10
295/0 121/66 217/124 338/346 48/380 189/155 199/79 278/224
300/0 71/260 22/248 193/240 288/248 284/237 224/268 38/263
305/0 46/232 282/193 293/175 378/349 169/98 184/165 168/31
310/0 156/116 87/62 208/390 113/287 69/354 269/172 343/141
315/0 311/12 192/133 143/43 58/75 124/176 324/24 383/346
320/0 16/118 372/259 368/265 133/59 309/321 289/272 104/80
325/0 336/114 7/90 123/190 228/181 114/324 319/240 244/246
330/0 226/71 112/218 358/348 398/83 179/121 119/366 394/197
335/0 21/383 142/80 158/61 218/106 329/196 4/94 49/104
340/0 221/97 2/252 178/174 13/190 164/166 99/130 204/9
345/0 126/76 67/120 78/183 243/53 134/140 149/197 359/239
350/0 96/221 392/290 28/163 353/297 279/147 294/343 374/314
355/0 176/230 367/63 73/343 393/88 174/202 259/362 249/256
360/0 241/60 202/21 348/66 328/351 139/144 94/258 384/41
365/0 26/374 262/54 303/391 153/132 254/145 209/307 74/126
370/0 91/25 382/139 238/269 128/309 239/56 24/260 369/279
375/0 151/213 317/133 253/161 188/92 399/371 194/116 39/302
380/0 296/140 307/14 93/216 148/311 389/87 334/264 109/335
385/0 286/76 222/17 33/116 8/191 304/360 19/282 379/2
390/0 106/217 212/188 103/68 248/264 29/48 44/174 349/274
395/0 281/269 162/333 3/243 88/320 159/75 59/300 229/136
0/0 346/176 157/302
5/0 171/47 42/1
10/0 86/124 267/2
15/0 321/291 197/8
20/0 236/149 147/50
25/0 1/168 347/191
30/0 386/257 252/12
35/0 301/64 397/176
40/0 341/340 272/97
45/0 101/201 122/134
50/0 136/201 57/343
55/0 131/169 292/299
60/0 166/389 352/216
65/0 76/132 297/33
70/0 211/261 167/45
75/0 161/323 12/150
80/0 116/93 107/105
85/0 246/180 322/244
90/0 261/190 342/297
95/0 366/385 177/103

100/0 391/240 77/328 105/0 266/327 182/182 110/0 181/73 47/322 115/0 191/126 72/135 120/0 251/115 227/161 125/0 276/85 172/213 130/0 371/17 327/236 135/0 66/326 62/109 140/0 141/232 357/107 145/0 271/218 207/370 150/0 56/252 127/20 155/0 61/143 97/305 160/0 11/383 237/214 165/0 376/359 337/112 170/0 186/149 277/321 175/0 206/79 92/316 180/0 291/315 362/135 185/0 51/93 232/326 190/0 6/197 102/103 195/0 331/142 187/122 200/0 361/363 27/368 205/0 326/15 152/187 210/0 111/82 52/214 215/0 41/385 312/150 220/0 356/387 137/254 225/0 81/175 302/84 230/0 351/11 17/303 235/0 231/55 117/265

Table 3

Row Index/Starting Column Index (Rate 3/4)
0/0 113/334 100/308 423/175 493/163 32/370 116/20 467/48 243/275 370/284 356/114 77/201 7/214 14/0 29/350 44/366 185/335 3/40 494/155 144/324 383/185 229/96 230/376 188/182 427/304 385/269 28/0 435/215 366/165 101/329 17/221 46/276 74/130 341/4 313/169 314/11 272/267 21/376 273/122 42/0 155/306 240/253 353/325 451/355 312/33 88/27 47/23 327/90 286/87 34/201 483/221 175/39 56/0 197/263 492/185 283/223 367/316 60/241 228/91 145/175 439/3 454/168 202/98 133/214 203/82 70/0 463/384 352/298 269/9 129/294 256/303 214/387 5/316 285/257 90/282 48/376 399/317 329/102 84/0 1/159 170/317 409/245 255/173 270/11 438/179 271/224 89/131 300/144 328/199 343/321 231/338 98/0 211/266 450/256 199/279 171/358 242/192 466/378 187/100 19/70 62/98 384/313 35/382 245/164 112/0 141/386 128/357 87/172 465/64 424/35 354/238 117/300 257/174 146/154 496/182 161/232 91/355 126/0 15/196 296/183 395/218 73/356 452/367 158/342 173/70 131/251 258/268 76/176 455/172 119/109

140/0 57/265 58/45 437/175 59/369 284/357 102/53 103/286 33/318 412/49 160/25
105/120 371/188
154/0 323/272 198/11 31/140 227/330 410/150 298/113 61/249 495/207 244/190
426/233 63/30 189/283
168/0 477/41 408/85 311/63 45/301 326/13 200/292 159/218 481/99 20/171 174/192
217/102 315/178
182/0 43/340 212/289 381/152 115/273 172/111 368/2 75/34 369/291 132/92 482/375
413/195 301/219
196/0 225/338 436/232 479/161 339/50 340/372 396/293 355/218 397/80 468/212
342/375 497/351 259/314
210/0 253/84 30/254 297/89 241/165 382/65 18/60 299/186 425/104 440/255 398/62
441/191 469/14
224/0 449/109 478/333 325/82 143/94 186/39 130/44 453/22 411/329 6/168 118/357
287/119 357/258
238/0 169/152 310/308 213/159 157/365 480/361 4/64 201/245 215/92 104/185 216/189
147/125 49/310
252/0 267/180 380/44
266/0 71/132 184/228
280/0 281/48 268/91
294/0 393/59 254/241
308/0 379/129 86/21
322/0 127/319 114/57
336/0 85/227 282/298
350/0 491/101 324/74
364/0 309/378 226/317
378/0 239/220 2/201
392/0 407/135 156/221
406/0 365/360 394/114
420/0 183/335 422/129
434/0 421/105 464/120
448/0 295/245 142/160
462/0 351/37 338/29
476/0 337/16 72/305
490/0 99/220 16/347
8/0 23/384 346/305
22/0 415/118 444/373
36/0 65/28 24/211
50/0 261/130 80/113
64/0 275/316 220/366
78/0 205/109 206/255
92/0 51/110 38/74
106/0 373/262 304/363
120/0 345/250 472/134
134/0 37/173 388/301
148/0 359/272 430/234
162/0 429/71 150/189
176/0 93/332 94/299
190/0 163/385 416/307
204/0 289/144 164/50
218/0 457/140 290/145
232/0 79/42 360/26
246/0 387/59 262/196
260/0 233/93 66/21
274/0 303/116 136/28
288/0 121/176 276/279

302/0	485/235	332/69
316/0	443/336	178/353
330/0	499/298	458/45
344/0	191/240	234/244
358/0	9/13	248/94
372/0	219/36	402/112
386/0	331/192	52/58
400/0	471/294	500/144
414/0	317/186	318/150
428/0	107/69	108/346
442/0	149/139	486/346
456/0	135/170	192/65
470/0	401/2	10/281
484/0	177/326	374/2
498/0	247/143	122/242
11/0	474/49	433/281
25/0	292/134	335/294
39/0	404/29	265/296
53/0	320/345	111/194
67/0	208/221	13/84
81/0	264/133	419/95
95/0	54/157	83/51
109/0	166/363	195/303
123/0	194/389	377/15
137/0	460/36	447/169
151/0	306/23	279/311
165/0	40/133	153/233
179/0	236/53	27/257
193/0	446/121	293/259
207/0	250/350	167/310
221/0	68/104	209/119
235/0	334/224	251/323
249/0	432/83	503/117
263/0	180/192	125/201
277/0	362/183	391/267
291/0	110/347	405/288
305/0	222/22	223/10
319/0	502/80	489/249
333/0	12/100	139/370
347/0	390/229	321/44
361/0	376/295	97/70
375/0	124/166	69/108
389/0	418/73	349/223
403/0	96/321	237/242
417/0	26/23	181/237
431/0	82/7	55/264
445/0	348/347	461/381
459/0	138/244	41/239
473/0	488/356	475/320
487/0	278/80	307/248
501/0	152/153	363/334

Table 4 ."

Claim 2 reads as follows:

"A system for processing a low density parity check (LDPC) coded signal, comprising:

an encoder for generating an LDPC encoded signal using a structured parity check matrix specifying the connection of bit nodes to check nodes and transmitting the LDPC encoded signal across a communication channel to a receiver

a receiver for receiving the LDPC encoded signal and comprising a decoder comprising:

memory (1501, 1503) for storing edge values associated with the structured parity check matrix used to generate the LDPC coded signal specifying a relationship of bit nodes and check nodes, wherein the bit nodes are divided into groups of 392

means for retrieving edge values from the memory (1501, 1503); and

means for outputting a decoded signal corresponding to the LDPC coded signal based on the retrieved edge values,

wherein the edge values are stored in memory according to a predetermined scheme,

characterised in that the memory comprises top edge RAM and bottom edge RAM,

wherein the bottom edge RAM stores the edge values for bit nodes of degree two,

wherein the top edge RAM stores the edge values for bit nodes of degree greater than two,

wherein storage of edge values in the top edge RAM is defined by one of tables 1 - 4 below,

wherein each successive row of each table denotes the row indices and starting column indices for corresponding successive groups of 392 bit nodes for a particular LDPC encoding scheme having the code rate stated in the title of each table,

wherein a first number at each table location in each table denotes a row index for storage of edge values in the top edge RAM and a second number at each table location denotes a starting column index for storage of edge values in the top edge RAM of successive bit nodes in a corresponding group of bit nodes,

wherein successive table locations in each row denote the row and column indices for corresponding successive edge values for said corresponding group of bit nodes,

such that a group of 392 bit nodes and 392 check nodes can be selected for processing at one time,

wherein for bit node processing, in the retrieving step, for a group of bit nodes of degree two, two consecutive rows of bottom edge RAM are accessed, and, for a group of bit nodes of degree, d, greater than two, the edge values are obtained from d rows of top edge RAM,

wherein for check node processing, in the retrieving step, q consecutive rows are accessed from top edge RAM and two consecutive rows are accessed from bottom edge RAM,

wherein $q = d_c - 2$, where d_c is the degree of the check nodes dependant on the predetermined scheme, wherein $d_c = 7$ for code rate 1/2, $d_c = 10$ for code rate 2/3, $d_c = 16$ for code rate 3/4 and $d_c = 22$ for code rate 5/6,

wherein the tables 1- 4 are as follows: [*see claim 1*]."

VI. The appellant has essentially argued that the new claims addressed all the objections under Articles 83, 123 (2), 54 and 56 EPC raised in the course of the examination and appeal proceedings. Consequently, the application was now ready for grant.

Reasons for the Decision

1. The appeal is admissible.

2.1 The gist of the present invention consists essentially in applying a parity check matrix with a predetermined structure to generate an LDPC code signal so that the resulting codewords can be decoded by processing the edge values of the bit nodes and check nodes "in groups". In particular, as pointed out in the description (page 17, line 28 to page 18, line 6 of the application as published), the *"RAM of Figs. 15A and 15B are organized in a manner, whereby a large group of relevant edges can be fetched in one clock cycle; accordingly, these values are placed "together" in memory, according to a predetermined scheme or arrangement.....Therefore, the "togetherness", under the present invention, stems from the design of the parity check matrices themselves. That is, the check matrix design ensures that the relevant edges for a group of bit nodes and check nodes are simultaneously placed together in RAM"*.

As the present application teaches to arrange the edges in the RAM so that the edge locations relate to the corresponding bit nodes and check notes, it is, in principle, possible to determine the corresponding interconnections between check and bit nodes and thus the parity check matrix of a particular LDPC coding scheme on the basis of the memory addresses of the edges. In other words, a particular edge location defined in terms of the corresponding bit and check nodes implies an interconnection between such bit and check nodes and thus the presence of a "1" in the parity check matrix at the corresponding location.

2.2 Tables 2 to 5 of the application as published, corresponding to Tables 1 to 4 of claims 1 and 2, specify the locations of the edges for each group of bit nodes of degree greater than 2. As pointed out above, these tables allow the skilled person to derive the parity check matrix relating to bit nodes of degree greater than 2.
As to the bit nodes of degree 2, the description specifies that they are located in consecutive rows in the bottom edge RAM. The fact that neither one of the consecutive row addresses nor the corresponding starting column addresses for the edges of a group are specified means that it is left to the skilled person to establish the actual interconnections of the bit nodes of degree 2 to the check nodes. It is, however, clear that this variability in the

interconnections of the bit and check nodes does not affect the decoding scheme of the present invention which relies, *inter alia,* on locating the first and second edges for a group of bit nodes of degree 2 in consecutive rows which are selected when processing the group.

2.3 Hence, the Board agrees with the appellant that the present application describes the claimed subject-matter in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).

3.1 The subject-matter of claims 1 and 2 of the appellant's request is essentially based on the embodiments of the invention specified in paragraphs [81] to [88] of the application as published and on Tables 2 to 5. On pages 1 to 3 and 30 of the description, the appellant has made some editorial amendments which do not introduce any new subject-matter into the application as filed.

3.2 Thus, the amended application documents of the appellant's request are in compliance with Article 123 (2) EPC.

4.1 The subject-matter of claims 1 and 2 is new with respect to document D2, which forms part of the state of the art under Article 54(3) EPC 1973.

In fact, none of the available prior art documents discloses or suggests a method for processing a low density parity check coded signal comprising all the steps recited in claim 1 and in particular the arrangement of the edge values in a top edge RAM defined in Tables 1 to 4 and the corresponding scheme for retrieving the edge values required for processing groups of 392 check nodes and bit nodes.

4.2 Hence, the Board has no objection concerning the novelty and inventive step of the subject-matter of claims 1 and 2.

5. In summary, the Board finds that the application documents according to the appellant's request comply with the requirements of the EPC and that a patent can be granted on the basis thereof.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent in the following version:

   – Claims 1 and 2, filed in the oral proceedings of 22 June 2010,

   – Description: pages 1, 3 and 30 filed in the oral proceedings of 22 June 2010,
   page 2, filed with a letter dated 21 March 2006,
   pages 5 to 29 as originally filed,

   – Drawings: Sheets 1/16 to 16/16 as originally filed.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu