

无线 si4432/adf7021/cc1100 数据传输关键技术/透明传输开发之经验

前几天公司在黄总在吃年夜饭,当时轮到我发言,现在想一想,说了,“不为挣钱,只为生活。”我不大会喊口号,但是我真的是想为民族做点贡献,也只有把自己的起点订得高高的.才不会被当下的困难所吓倒,才会严于要求自己做出产品,重新定位人生的意义.至少我是这样认为的,当然我也想赚到钱,发了工资,交房贷,老大的奶粉,老二也要出生了.....虽然这样,还是满怀信心的活着,慢慢地品尝着生活的滋味,现在就是最幸福的时刻.我从来不怀疑自己赚不到钱,我也清楚的明白,满足就好这个道理,至少我们一家平安健康的在一起,至少周日会去教堂做礼拜,听听教会的弟兄们分享神的话语.

这一年即将过去,直得欣慰的是无线的产品开发完成,我也犹豫了许久,对于其关键技术,如果公开的话,自己以什么为生,公司又何以技术优势.但是,我想明白了生活的目的不是赚钱,也希望跟我一起研究无线的同行们少走弯路,也让我们国家的无线电产品更为快捷普及.也希望兄弟们多多分享自己的经验(不过可能性比较小)

有时也感叹,向我这样的人,向我们这样的公司,是不是应该有国家资金的支持,我也想被评为高新企业,至少我们是在实实在在地做事,而且开发出来的产品,绝大多数没有同行在做.

以下几点供大家分享,可以思路比较混乱, 见谅

1.传输速率与接收灵敏度成反比:最早我们用的是 ia4420,ia4421 传输 mp3 数据流,用 dsp 进行编解码;当时选择了 32kbps(mp3),rf 用了 64kbps,没有加纠错; 在星海名城租的房子里转悠,而且一转身信号就没有了;后来考虑到:mp3 数据流:(1) 延时太大;(2)相对于 2.4G 没有太大的优势,于是就放弃了这种做法,改用 GSM 早期 13kbps 进行编解码,针对人的声音进行传输,放弃了音乐传输;rf 用了 20kbps,终于可以走出房间,到电梯处溜达溜达;但是后来发射音质不是很好,又重头来过,用了标准的 g.729h 8kbps,达到了手机的通话音质,rf 用了 13kbps,这时可以座着电梯上下几层楼,到外面测试测试.到后来我们买了仪器,才发射其中一些大致关系;经验值:数据量加大一倍,灵敏度下降 4dbm;比如说 rf 13kbps ,-110dbm;那么 -20kbps,灵敏度大约在 -106dbm.当然做得好一点的可以在 3dbm.

2.LNA 的作用:最早我们用 RF ia4420; 后来改用 cc1100,距离提高了一倍,但是觉得就是不满意;最后曾工告诉他们出的产品加了安捷伦的 36063 低噪放大;记得当时我们调通的是他们公司晚上,我们兴奋好久,蛮以为开发到此为至了,似乎看到了很多的订单.现在想一想,无疑 lna 的作用非常大,但是没有必要用 36063(正品很难买,价钱高,电流大),用一颗 nxp w2p 三极管二角钱就可以了;lna 最大的作用就是改变了无线速率与灵敏度的线性关系;同时也提高了 4-5dbm.。仪器测试: adf7021 16kbps,-115dbm, 8kbps,-117dbm;2.4kbps,-120dbm.可以看到数据量加大一倍,灵敏度下降约为 2dbm.真正的高手,用便宜的东西,做出优质特性的产品.

3.纠错的作用.以上的二点,说得很容易,但是时间上已经过去二年了,也在近最,感觉对无线的理解更为深刻.后为我们公司搬到了龙华元芬工业区,当时我也没有多少事;有同学在好易通做数字对讲机,当时他就提到了纠错这个概念;但是他又说不出为什么这样做,我就提出一个问题:你的数据量大了一倍,你的灵敏度不是下降了吗?虽然纠错可以提高灵敏度,这不就扯平了. 在实际我们测试过程中,发现一个问题,如果没有纠错算法,接收端如果突然转身,天线晃动,或者到了一定的距离时候,会出现数据出错严重,(因为我们传输的是语音,所以可以带耳机听出来).这个工作我们一直也没有进行.后来我们接到一个广州的客户,他说需要数传模块,本以为是小案子一桩,却让我迷惑许久.我首先收集了很多的资料,发现网名“龙笑天”的网友说得很有道理,无需用纠错算法,他们用的是 8-10 码进行去直流分量,还说纠错算法在实际当中越纠越错;现在想一想,简直就是在放屁,那是最初级的做法.当时我确实是用这种方法做的,后来寄给客户发现一个问题;当一发一收靠得很近的时候,数据出错;给客户的解释是出现的饱和现象(cc1100 确实存在这样

的问题).当我们购了上海一家的数据模块发射别人 500mw 发射与接收直接用馈线连接的情况下一样传输正常。这才发现自己的思路有问题,现在才明白,好的纠错算法,在纠错的同时也去除了直流分量,而且在适当的时候加上交织,情况会更好。文章最后给出二个广泛应用的纠错算法,有兴趣的朋友自己研究研究;仪器测试:确实数量量加大以后灵敏度会下降,但是考虑到有纠错算法,灵敏度反而提高了 1-2dbm,而且在距离也提高了。关键的问题我想在于数字 Rf 的灵敏度测试的条件是在一定的误码率,如之前测试千分之一的误码率是 -113dbm;当加大数据量,如果此时误码率按 百分之一进行测试的话,可能测试的结果为 -115dbm.

4.前导码技术.前导码之前总是在官方网站给出的,当时还没有留意一个非常特殊的问题。在 si4432 出了第二版本的情况,我们测试的时候发现,在下楼梯的时候总会丢帧,但是站住,马上又恢复正常工作;这样走走停停可以走很远的距离;约过了半年,我们又参照了 adf7021 的程序,发现这一个问题没有了;当时觉得是 adf7021 的灵敏度太高;也就是在无数的测试,才得出结论;我们每次出现数据错误,都是同步字出错了,只要是同步字正确,纠错算法都会纠回来。所以才明白当初为什么 4432 会出现那种现象,解决的办法也很简单,1.同步字加大;2.允许同步字 bit 出错;举一个例,假设同步字是 0x2dd4,我们允许一个 bit 出错也认为它正确,0x0dd4 也认为它为同步字;这要根据自己的实际进行调整。对于同步字,我也测试了:1.传统的连续同步字检测;2.把同步字一个 bit 一个 bit 离散的分散到数据包里面,每收到一个 bit 进行测试一次;按道理应该第二种方法要好一些,不幸的是,我测试的结果是两种方法的效果一致。于是安慰自己,我不是聪明的人,因为大家都是这样做的,必然有其道理。

5.发射功率 20dbm.想必很多人都用过 si4432 的主要原因是因为它的功率大,省成本;不过在接触的很多网友,他们发现了 si4432 很多的问题,其实他们还是觉得 cc1100 好用,性能比较好,其实我认为 cc1100 加上 lna 效果也不会差多少。至少功率的话更容易,加一颗 五毛钱的 p1 三极管就可以实现了(由于我是软件工程师,三极管的型号我记不到)大家可以到网搜其型号: marking code p1.

6.天线的选择及安装.想必大家测试开始的时候用的是仪器,当用天线的时候,发现相差太远了,特别是 si4432;cc1100 还好很多,为此大家得选用好的天线,至今我见过最好的天线(用仪器扫描及实际测试)是摩托罗拉对讲机撤出来的弹簧天线。到后来,接触北京一家公司“亮光星(北京)科技有限公司”,他们也寄来样品,效果还可以;有一句让我感触比较深:他们要求把板及外壳寄去;我认为这是对的,大家如果有需要可以联系一下他们。服务态度很不错。

7.仪器的作用:推荐一款仪器,mt8801c;寄可以测试灵敏度,也可以测试功率;测试灵敏度的虽然是用于测试对讲机,但是选择与自己设定的频偏的话,他是完成可以测试数字对讲机的灵敏度。只能说仪器很重要,推荐一个供应商:深圳明泰的曾小姐,QQ: 349847614.一台仪器大约在 18000 元,八成新。我们也去看过安捷伦的东西,确实不错,但是太旧了,而且太贵了。

8.RF IC 的选择建议.从性能上来说,首先 adi,其实 cc1100,最后 si4432.不过现在叫我来选的话应该是 adi,si4432,cc1100.si4432 应该可以用,毕竟安美通在出货,关键点在于软件,硬件大家抄袭就好了。对于软件我认为有一个地方比较重要,发射端的功率,应该有一个渐近最大的过程,否则会影响本振信号,导致死机现象。可以参考英文” PA Ramping :When the PA is switched on or off quickly, its changing input impedance momentarily disturbs the VCO output frequency. This process is called VCO pulling, and it manifests as spectral splatter or spurs in the output spectrum around the desired carrier frequency. Some radio emissions regulations place limits on these PA transient-induced spurs (for example, the ETSI EN 300 220 regulations).

By gradually ramping the PA on and off, PA transient spurs are minimized.” Adf7021 pdf 文档上有。

9.大功率无线发射 IC 的选取.大功率 IC 2w,4w 上海士康科技的 srt3602,srt3604 效率非常高,价钱也不高,是一个不错的东西,而且免费提供样品,现成的 demo 板及原理图。之所以这样提,是我们以前做过无数次大功率的产品都失败了,特别是 pa2460;我们用了士康是唯一一次发出来的,而且效率也很高,服务也不错。有需要大家可以联系他们的秦经理:13817506785. 说是晶慧通陈工介绍的。不过,在开发的过程当中,有段英文大家要需要:” Voltage Controlled Oscillator (VCO) To minimize spurious emissions, the on-chip VCO operates from 1724 MHz to 1912 MHz. The VCO signal is then divided by 2 to give the required frequency for the transmitter and the required LO frequency for the receiver”

以上就是我所有对 RF 的认识,其实关键技术也很简单,只是外行人中途放弃罢了,越发显得其神秘。如有不正确的地方,请指正;深圳晶慧通科技陈工,网名因果:QQ:3637323. 手机 13510479435.在公司的网站上 www.sokutek.com;上面还有我写的其它技术文章。大家相互交流。

有点晕,生两个小孩,在深圳如要办少儿医保,大人要做节扎手术。也只有祈求天父眷顾我们一家人。

```
#define BYTE unsigned char
#define WORD unsigned int
BYTE RX_Flag ;
```

```
#define bit0    0x01
#define bit1    0x02
#define bit2    0x04
#define bit3    0x08
#define bit4    0x10
#define bit5    0x20
#define bit6    0x40
#define bit7    0x80
```

```
#define B0000_0000 0x00
#define B0000_0001 0x01
#define B0000_0010 0x02
#define B0000_0011 0x03
#define B0000_0100 0x04
#define B0000_0101 0x05
#define B0000_0110 0x06
#define B0000_0111 0x07
#define B0000_1000 0x08
#define B0000_1001 0x09
#define B0000_1010 0x0A
#define B0000_1011 0x0B
#define B0000_1100 0x0C
```

```
#define B0000_1101 0x0D
#define B0000_1110 0x0E
#define B0000_1111 0x0F
```

```
#define B0001_0000 0x10
#define B0001_0001 0x11
#define B0001_0010 0x12
#define B0001_0011 0x13
#define B0001_0100 0x14
#define B0001_0101 0x15
#define B0001_0110 0x16
#define B0001_0111 0x17
#define B0001_1000 0x18
#define B0001_1001 0x19
#define B0001_1010 0x1A
#define B0001_1011 0x1B
#define B0001_1100 0x1C
#define B0001_1101 0x1D
#define B0001_1110 0x1E
#define B0001_1111 0x1F
```

```
#define B0010_0000 0x20
#define B0010_0001 0x21
#define B0010_0010 0x22
#define B0010_0011 0x23
#define B0010_0100 0x24
#define B0010_0101 0x25
#define B0010_0110 0x26
#define B0010_0111 0x27
#define B0010_1000 0x28
#define B0010_1001 0x29
#define B0010_1010 0x2A
#define B0010_1011 0x2B
#define B0010_1100 0x2C
#define B0010_1101 0x2D
#define B0010_1110 0x2E
#define B0010_1111 0x2F
```

```
#define B0011_0000 0x30
#define B0011_0001 0x31
#define B0011_0010 0x32
#define B0011_0011 0x33
#define B0011_0100 0x34
#define B0011_0101 0x35
```

```
#define B0011_0110 0x36
#define B0011_0111 0x37
#define B0011_1000 0x38
#define B0011_1001 0x39
#define B0011_1010 0x3A
#define B0011_1011 0x3B
#define B0011_1100 0x3C
#define B0011_1101 0x3D
#define B0011_1110 0x3E
#define B0011_1111 0x3F
```

```
#define B0100_0000 0x40
#define B0100_0001 0x41
#define B0100_0010 0x42
#define B0100_0011 0x43
#define B0100_0100 0x44
#define B0100_0101 0x45
#define B0100_0110 0x46
#define B0100_0111 0x47
#define B0100_1000 0x48
#define B0100_1001 0x49
#define B0100_1010 0x4A
#define B0100_1011 0x4B
#define B0100_1100 0x4C
#define B0100_1101 0x4D
#define B0100_1110 0x4E
#define B0100_1111 0x4F
```

```
#define B0101_0000 0x50
#define B0101_0001 0x51
#define B0101_0010 0x52
#define B0101_0011 0x53
#define B0101_0100 0x54
#define B0101_0101 0x55
#define B0101_0110 0x56
#define B0101_0111 0x57
#define B0101_1000 0x58
#define B0101_1001 0x59
#define B0101_1010 0x5A
#define B0101_1011 0x5B
#define B0101_1100 0x5C
#define B0101_1101 0x5D
#define B0101_1110 0x5E
#define B0101_1111 0x5F
```

```
#define B0110_0000 0x60
#define B0110_0001 0x61
#define B0110_0010 0x62
#define B0110_0011 0x63
#define B0110_0100 0x64
#define B0110_0101 0x65
#define B0110_0110 0x66
#define B0110_0111 0x67
#define B0110_1000 0x68
#define B0110_1001 0x69
#define B0110_1010 0x6A
#define B0110_1011 0x6B
#define B0110_1100 0x6C
#define B0110_1101 0x6D
#define B0110_1110 0x6E
#define B0110_1111 0x6F
```

```
#define B0111_0000 0x70
#define B0111_0001 0x71
#define B0111_0010 0x72
#define B0111_0011 0x73
#define B0111_0100 0x74
#define B0111_0101 0x75
#define B0111_0110 0x76
#define B0111_0111 0x77
#define B0111_1000 0x78
#define B0111_1001 0x79
#define B0111_1010 0x7A
#define B0111_1011 0x7B
#define B0111_1100 0x7C
#define B0111_1101 0x7D
#define B0111_1110 0x7E
#define B0111_1111 0x7F
```

```
#define B1000_0000 0x80
#define B1000_0001 0x81
#define B1000_0010 0x82
#define B1000_0011 0x83
#define B1000_0100 0x84
#define B1000_0101 0x85
#define B1000_0110 0x86
#define B1000_0111 0x87
#define B1000_1000 0x88
```

```
#define B1000_1001 0x89
#define B1000_1010 0x8A
#define B1000_1011 0x8B
#define B1000_1100 0x8C
#define B1000_1101 0x8D
#define B1000_1110 0x8E
#define B1000_1111 0x8F
```

```
#define B1001_0000 0x90
#define B1001_0001 0x91
#define B1001_0010 0x92
#define B1001_0011 0x93
#define B1001_0100 0x94
#define B1001_0101 0x95
#define B1001_0110 0x96
#define B1001_0111 0x97
#define B1001_1000 0x98
#define B1001_1001 0x99
#define B1001_1010 0x9A
#define B1001_1011 0x9B
#define B1001_1100 0x9C
#define B1001_1101 0x9D
#define B1001_1110 0x9E
#define B1001_1111 0x9F
```

```
#define B1010_0000 0xA0
#define B1010_0001 0xA1
#define B1010_0010 0xA2
#define B1010_0011 0xA3
#define B1010_0100 0xA4
#define B1010_0101 0xA5
#define B1010_0110 0xA6
#define B1010_0111 0xA7
#define B1010_1000 0xA8
#define B1010_1001 0xA9
#define B1010_1010 0xAA
#define B1010_1011 0xAB
#define B1010_1100 0xAC
#define B1010_1101 0xAD
#define B1010_1110 0xAE
#define B1010_1111 0xAF
```

```
#define B1011_0000 0xB0
#define B1011_0001 0xB1
```

```
#define B1011_0010 0xB2
#define B1011_0011 0xB3
#define B1011_0100 0xB4
#define B1011_0101 0xB5
#define B1011_0110 0xB6
#define B1011_0111 0xB7
#define B1011_1000 0xB8
#define B1011_1001 0xB9
#define B1011_1010 0xBA
#define B1011_1011 0xBB
#define B1011_1100 0xBC
#define B1011_1101 0xBD
#define B1011_1110 0xBE
#define B1011_1111 0xBF
```

```
#define B1100_0000 0xC0
#define B1100_0001 0xC1
#define B1100_0010 0xC2
#define B1100_0011 0xC3
#define B1100_0100 0xC4
#define B1100_0101 0xC5
#define B1100_0110 0xC6
#define B1100_0111 0xC7
#define B1100_1000 0xC8
#define B1100_1001 0xC9
#define B1100_1010 0xCA
#define B1100_1011 0xCB
#define B1100_1100 0xCC
#define B1100_1101 0xCD
#define B1100_1110 0xCE
#define B1100_1111 0xCF
```

```
#define B1101_0000 0xD0
#define B1101_0001 0xD1
#define B1101_0010 0xD2
#define B1101_0011 0xD3
#define B1101_0100 0xD4
#define B1101_0101 0xD5
#define B1101_0110 0xD6
#define B1101_0111 0xD7
#define B1101_1000 0xD8
#define B1101_1001 0xD9
#define B1101_1010 0xDA
#define B1101_1011 0xDB
```

```
#define B1101_1100 0xDC
#define B1101_1101 0xDD
#define B1101_1110 0xDE
#define B1101_1111 0xDF
```

```
#define B1110_0000 0xE0
#define B1110_0001 0xE1
#define B1110_0010 0xE2
#define B1110_0011 0xE3
#define B1110_0100 0xE4
#define B1110_0101 0xE5
#define B1110_0110 0xE6
#define B1110_0111 0xE7
#define B1110_1000 0xE8
#define B1110_1001 0xE9
#define B1110_1010 0xEA
#define B1110_1011 0xEB
#define B1110_1100 0xEC
#define B1110_1101 0xED
#define B1110_1110 0xEE
#define B1110_1111 0xEF
```

```
#define B1111_0000 0xF0
#define B1111_0001 0xF1
#define B1111_0010 0xF2
#define B1111_0011 0xF3
#define B1111_0100 0xF4
#define B1111_0101 0xF5
#define B1111_0110 0xF6
#define B1111_0111 0xF7
#define B1111_1000 0xF8
#define B1111_1001 0xF9
#define B1111_1010 0xFA
#define B1111_1011 0xFB
#define B1111_1100 0xFC
#define B1111_1101 0xFD
#define B1111_1110 0xFE
#define B1111_1111 0xFF
```

```
unsigned char Current_RD_N_Tab[512]=
{
    B0010_0111 ,B0000_0100 ,//D00.0 000 00000
    B0001_1101 ,B0000_0100 ,//D01.0 000 00001
    B0010_1101 ,B0000_0100 ,//D02.0 000 00010
```

B0011_0001 ,B0000_1011 ,//D03.0 000 00011
B0011_0101 ,B0000_0100 ,//D04.0 000 00100
B0010_1001 ,B0000_1011 ,//D05.0 000 00101
B0001_1001 ,B0000_1011 ,//D06.0 000 00110
B0011_1000 ,B0000_1011 ,//D07.0 000 00111
B0011_1001 ,B0000_0100 ,//D08.0 000 01000
B0010_0101 ,B0000_1011 ,//D09.0 000 01001
B0001_0101 ,B0000_1011 ,//D10.0 000 01010
B0011_0100 ,B0000_1011 ,//D11.0 000 01011
B0000_1101 ,B0000_1011 ,//D12.0 000 01100
B0010_1100 ,B0000_1011 ,//D13.0 000 01101
B0001_1100 ,B0000_1011 ,//D14.0 000 01110
B0001_0111 ,B0000_0100 ,//D15.0 000 01111
B0001_1011 ,B0000_0100 ,//D16.0 000 10000
B0010_0011 ,B0000_1011 ,//D17.0 000 10001
B0001_0011 ,B0000_1011 ,//D18.0 000 10010
B0011_0010 ,B0000_1011 ,//D19.0 000 10011
B0000_1011 ,B0000_1011 ,//D20.0 000 10100
B0010_1010 ,B0000_1011 ,//D21.0 000 10101
B0001_1010 ,B0000_1011 ,//D22.0 000 10110
B0011_1010 ,B0000_0100 ,//D23.0 000 10111
B0011_0011 ,B0000_0100 ,//D24.0 000 11000
B0010_0110 ,B0000_1011 ,//D25.0 000 11001
B0001_0110 ,B0000_1011 ,//D26.0 000 11010
B0011_0110 ,B0000_0100 ,//D27.0 000 11011
B0000_1110 ,B0000_1011 ,//D28.0 000 11100
B0010_1110 ,B0000_0100 ,//D29.0 000 11101
B0001_1110 ,B0000_0100 ,//D30.0 000 11110
B0010_1011 ,B0000_0100 ,//D31.0 000 11111
B0010_0111 ,B0000_1001 ,//D00.1 001 00000
B0001_1101 ,B0000_1001 ,//D01.1 001 00001
B0010_1101 ,B0000_1001 ,//D02.1 001 00010
B0011_0001 ,B0000_1001 ,//D03.1 001 00011
B0011_0101 ,B0000_1001 ,//D04.1 001 00100
B0010_1001 ,B0000_1001 ,//D05.1 001 00101
B0001_1001 ,B0000_1001 ,//D06.1 001 00110
B0011_1000 ,B0000_1001 ,//D07.1 001 00111
B0011_1001 ,B0000_1001 ,//D08.1 001 01000
B0010_0101 ,B0000_1001 ,//D09.1 001 01001
B0001_0101 ,B0000_1001 ,//D10.1 001 01010
B0011_0100 ,B0000_1001 ,//D11.1 001 01011
B0000_1101 ,B0000_1001 ,//D12.1 001 01100
B0010_1100 ,B0000_1001 ,//D13.1 001 01101
B0001_1100 ,B0000_1001 ,//D14.1 001 01110

B0001_0111 ,B0000_1001 ,//D15.1 001 01111
B0001_1011 ,B0000_1001 ,//D16.1 001 10000
B0010_0011 ,B0000_1001 ,//D17.1 001 10001
B0001_0011 ,B0000_1001 ,//D18.1 001 10010
B0011_0010 ,B0000_1001 ,//D19.1 001 10011
B0000_1011 ,B0000_1001 ,//D20.1 001 10100
B0010_1010 ,B0000_1001 ,//D21.1 001 10101
B0001_1010 ,B0000_1001 ,//D22.1 001 10110
B0011_1010 ,B0000_1001 ,//D23.1 001 10111
B0011_0011 ,B0000_1001 ,//D24.1 001 11000
B0010_0110 ,B0000_1001 ,//D25.1 001 11001
B0001_0110 ,B0000_1001 ,//D26.1 001 11010
B0011_0110 ,B0000_1001 ,//D27.1 001 11011
B0000_1110 ,B0000_1001 ,//D28.1 001 11100
B0010_1110 ,B0000_1001 ,//D29.1 001 11101
B0001_1110 ,B0000_1001 ,//D30.1 001 11110
B0010_1011 ,B0000_1001 ,//D31.1 001 11111
B0010_0111 ,B0000_0101 ,//D00.2 010 00000
B0001_1101 ,B0000_0101 ,//D01.2 010 00001
B0010_1101 ,B0000_0101 ,//D02.2 010 00010
B0011_0001 ,B0000_0101 ,//D03.2 010 00011
B0011_0101 ,B0000_0101 ,//D04.2 010 00100
B0010_1001 ,B0000_0101 ,//D05.2 010 00101
B0001_1001 ,B0000_0101 ,//D06.2 010 00110
B0011_1000 ,B0000_0101 ,//D07.2 010 00111
B0011_1001 ,B0000_0101 ,//D08.2 010 01000
B0010_0101 ,B0000_0101 ,//D09.2 010 01001
B0001_0101 ,B0000_0101 ,//D10.2 010 01010
B0011_0100 ,B0000_0101 ,//D11.2 010 01011
B0000_1101 ,B0000_0101 ,//D12.2 010 01100
B0010_1100 ,B0000_0101 ,//D13.2 010 01101
B0001_1100 ,B0000_0101 ,//D14.2 010 01110
B0001_0111 ,B0000_0101 ,//D15.2 010 01111
B0001_1011 ,B0000_0101 ,//D16.2 010 10000
B0010_0011 ,B0000_0101 ,//D17.2 010 10001
B0001_0011 ,B0000_0101 ,//D18.2 010 10010
B0011_0010 ,B0000_0101 ,//D19.2 010 10011
B0000_1011 ,B0000_0101 ,//D20.2 010 10100
B0010_1010 ,B0000_0101 ,//D21.2 010 10101
B0001_1010 ,B0000_0101 ,//D22.2 010 10110
B0011_1010 ,B0000_0101 ,//D23.2 010 10111
B0011_0011 ,B0000_0101 ,//D24.2 010 11000
B0010_0110 ,B0000_0101 ,//D25.2 010 11001
B0001_0110 ,B0000_0101 ,//D26.2 010 11010

B0011_0110 ,B0000_0101 ,//D27.2 010 11011
B0000_1110 ,B0000_0101 ,//D28.2 010 11100
B0010_1110 ,B0000_0101 ,//D29.2 010 11101
B0001_1110 ,B0000_0101 ,//D30.2 010 11110
B0010_1011 ,B0000_0101 ,//D31.2 010 11111
B0010_0111 ,B0000_0011 ,//D00.3 011 00000
B0001_1101 ,B0000_0011 ,//D01.3 011 00001
B0010_1101 ,B0000_0011 ,//D02.3 011 00010
B0011_0001 ,B0000_1100 ,//D03.3 011 00011
B0011_0101 ,B0000_0011 ,//D04.3 011 00100
B0010_1001 ,B0000_1100 ,//D05.3 011 00101
B0001_1001 ,B0000_1100 ,//D06.3 011 00110
B0011_1000 ,B0000_1100 ,//D07.3 011 00111
B0011_1001 ,B0000_0011 ,//D08.3 011 01000
B0010_0101 ,B0000_1100 ,//D09.3 011 01001
B0001_0101 ,B0000_1100 ,//D10.3 011 01010
B0011_0100 ,B0000_1100 ,//D11.3 011 01011
B0000_1101 ,B0000_1100 ,//D12.3 011 01100
B0010_1100 ,B0000_1100 ,//D13.3 011 01101
B0001_1100 ,B0000_1100 ,//D14.3 011 01110
B0001_0111 ,B0000_0011 ,//D15.3 011 01111
B0001_1011 ,B0000_0011 ,//D16.3 011 10000
B0010_0011 ,B0000_1100 ,//D17.3 011 10001
B0001_0011 ,B0000_1100 ,//D18.3 011 10010
B0011_0010 ,B0000_1100 ,//D19.3 011 10011
B0000_1011 ,B0000_1100 ,//D20.3 011 10100
B0010_1010 ,B0000_1100 ,//D21.3 011 10101
B0001_1010 ,B0000_1100 ,//D22.3 011 10110
B0011_1010 ,B0000_0011 ,//D23.3 011 10111
B0011_0011 ,B0000_0011 ,//D24.3 011 11000
B0010_0110 ,B0000_1100 ,//D25.3 011 11001
B0001_0110 ,B0000_1100 ,//D26.3 011 11010
B0011_0110 ,B0000_0011 ,//D27.3 011 11011
B0000_1110 ,B0000_1100 ,//D28.3 011 11100
B0010_1110 ,B0000_0011 ,//D29.3 011 11101
B0001_1110 ,B0000_0011 ,//D30.3 011 11110
B0010_1011 ,B0000_0011 ,//D31.3 011 11111
B0010_0111 ,B0000_0010 ,//D00.4 100 00000
B0001_1101 ,B0000_0010 ,//D01.4 100 00001
B0010_1101 ,B0000_0010 ,//D02.4 100 00010
B0011_0001 ,B0000_1101 ,//D03.4 100 00011
B0011_0101 ,B0000_0010 ,//D04.4 100 00100
B0010_1001 ,B0000_1101 ,//D05.4 100 00101
B0001_1001 ,B0000_1101 ,//D06.4 100 00110

B0011_1000 ,B0000_1101 ,//D07.4 100 00111
B0011_1001 ,B0000_0010 ,//D08.4 100 01000
B0010_0101 ,B0000_1101 ,//D09.4 100 01001
B0001_0101 ,B0000_1101 ,//D10.4 100 01010
B0011_0100 ,B0000_1101 ,//D11.4 100 01011
B0000_1101 ,B0000_1101 ,//D12.4 100 01100
B0010_1100 ,B0000_1101 ,//D13.4 100 01101
B0001_1100 ,B0000_1101 ,//D14.4 100 01110
B0001_0111 ,B0000_0010 ,//D15.4 100 01111
B0001_1011 ,B0000_0010 ,//D16.4 100 10000
B0010_0011 ,B0000_1101 ,//D17.4 100 10001
B0001_0011 ,B0000_1101 ,//D18.4 100 10010
B0011_0010 ,B0000_1101 ,//D19.4 100 10011
B0000_1011 ,B0000_1101 ,//D20.4 100 10100
B0010_1010 ,B0000_1101 ,//D21.4 100 10101
B0001_1010 ,B0000_1101 ,//D22.4 100 10110
B0011_1010 ,B0000_0010 ,//D23.4 100 10111
B0011_0011 ,B0000_0010 ,//D24.4 100 11000
B0010_0110 ,B0000_1101 ,//D25.4 100 11001
B0001_0110 ,B0000_1101 ,//D26.4 100 11010
B0011_0110 ,B0000_0010 ,//D27.4 100 11011
B0000_1110 ,B0000_1101 ,//D28.4 100 11100
B0010_1110 ,B0000_0010 ,//D29.4 100 11101
B0001_1110 ,B0000_0010 ,//D30.4 100 11110
B0010_1011 ,B0000_0010 ,//D31.4 100 11111
B0010_0111 ,B0000_1010 ,//D00.5 101 00000
B0001_1101 ,B0000_1010 ,//D01.5 101 00001
B0010_1101 ,B0000_1010 ,//D02.5 101 00010
B0011_0001 ,B0000_1010 ,//D03.5 101 00011
B0011_0101 ,B0000_1010 ,//D04.5 101 00100
B0010_1001 ,B0000_1010 ,//D05.5 101 00101
B0001_1001 ,B0000_1010 ,//D06.5 101 00110
B0011_1000 ,B0000_1010 ,//D07.5 101 00111
B0011_1001 ,B0000_1010 ,//D08.5 101 01000
B0010_0101 ,B0000_1010 ,//D09.5 101 01001
B0001_0101 ,B0000_1010 ,//D10.5 101 01010
B0011_0100 ,B0000_1010 ,//D11.5 101 01011
B0000_1101 ,B0000_1010 ,//D12.5 101 01100
B0010_1100 ,B0000_1010 ,//D13.5 101 01101
B0001_1100 ,B0000_1010 ,//D14.5 101 01110
B0001_0111 ,B0000_1010 ,//D15.5 101 01111
B0001_1011 ,B0000_1010 ,//D16.5 101 10000
B0010_0011 ,B0000_1010 ,//D17.5 101 10001
B0001_0011 ,B0000_1010 ,//D18.5 101 10010

B0011_0010 ,B0000_1010 ,//D19.5 101 10011
B0000_1011 ,B0000_1010 ,//D20.5 101 10100
B0010_1010 ,B0000_1010 ,//D21.5 101 10101
B0001_1010 ,B0000_1010 ,//D22.5 101 10110
B0011_1010 ,B0000_1010 ,//D23.5 101 10111
B0011_0011 ,B0000_1010 ,//D24.5 101 11000
B0010_0110 ,B0000_1010 ,//D25.5 101 11001
B0001_0110 ,B0000_1010 ,//D26.5 101 11010
B0011_0110 ,B0000_1010 ,//D27.5 101 11011
B0000_1110 ,B0000_1010 ,//D28.5 101 11100
B0010_1110 ,B0000_1010 ,//D29.5 101 11101
B0001_1110 ,B0000_1010 ,//D30.5 101 11110
B0010_1011 ,B0000_1010 ,//D31.5 101 11111
B0010_0111 ,B0000_0110 ,//D00.6 110 00000
B0001_1101 ,B0000_0110 ,//D01.6 110 00001
B0010_1101 ,B0000_0110 ,//D02.6 110 00010
B0011_0001 ,B0000_0110 ,//D03.6 110 00011
B0011_0101 ,B0000_0110 ,//D04.6 110 00100
B0010_1001 ,B0000_0110 ,//D05.6 110 00101
B0001_1001 ,B0000_0110 ,//D06.6 110 00110
B0011_1000 ,B0000_0110 ,//D07.6 110 00111
B0011_1001 ,B0000_0110 ,//D08.6 110 01000
B0010_0101 ,B0000_0110 ,//D09.6 110 01001
B0001_0101 ,B0000_0110 ,//D10.6 110 01010
B0011_0100 ,B0000_0110 ,//D11.6 110 01011
B0000_1101 ,B0000_0110 ,//D12.6 110 01100
B0010_1100 ,B0000_0110 ,//D13.6 110 01101
B0001_1100 ,B0000_0110 ,//D14.6 110 01110
B0001_0111 ,B0000_0110 ,//D15.6 110 01111
B0001_1011 ,B0000_0110 ,//D16.6 110 10000
B0010_0011 ,B0000_0110 ,//D17.6 110 10001
B0001_0011 ,B0000_0110 ,//D18.6 110 10010
B0011_0010 ,B0000_0110 ,//D19.6 110 10011
B0000_1011 ,B0000_0110 ,//D20.6 110 10100
B0010_1010 ,B0000_0110 ,//D21.6 110 10101
B0001_1010 ,B0000_0110 ,//D22.6 110 10110
B0011_1010 ,B0000_0110 ,//D23.6 110 10111
B0011_0011 ,B0000_0110 ,//D24.6 110 11000
B0010_0110 ,B0000_0110 ,//D25.6 110 11001
B0001_0110 ,B0000_0110 ,//D26.6 110 11010
B0011_0110 ,B0000_0110 ,//D27.6 110 11011
B0000_1110 ,B0000_0110 ,//D28.6 110 11100
B0010_1110 ,B0000_0110 ,//D29.6 110 11101
B0001_1110 ,B0000_0110 ,//D30.6 110 11110

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B0010_1011 ,B0000_0110 ,//D31.6 110 11111
B0010_0111 ,B0000_0001 ,//D00.7 111 00000
B0001_1101 ,B0000_0001 ,//D01.7 111 00001
B0010_1101 ,B0000_0001 ,//D02.7 111 00010
B0011_0001 ,B0000_1110 ,//D03.7 111 00011
B0011_0101 ,B0000_0001 ,//D04.7 111 00100
B0010_1001 ,B0000_1110 ,//D05.7 111 00101
B0001_1001 ,B0000_1110 ,//D06.7 111 00110
B0011_1000 ,B0000_1110 ,//D07.7 111 00111
B0011_1001 ,B0000_0001 ,//D08.7 111 01000
B0010_0101 ,B0000_1110 ,//D09.7 111 01001
B0001_0101 ,B0000_1110 ,//D10.7 111 01010
B0011_0100 ,B0000_1110 ,//D11.7 111 01011
B0000_1101 ,B0000_1110 ,//D12.7 111 01100
B0010_1100 ,B0000_1110 ,//D13.7 111 01101
B0001_1100 ,B0000_1110 ,//D14.7 111 01110
B0001_0111 ,B0000_0001 ,//D15.7 111 01111
B0001_1011 ,B0000_0001 ,//D16.7 111 10000
B0010_0011 ,B0000_0111 ,//D17.7 111 10001
B0001_0011 ,B0000_0111 ,//D18.7 111 10010
B0011_0010 ,B0000_1110 ,//D19.7 111 10011
B0000_1011 ,B0000_0111 ,//D20.7 111 10100
B0010_1010 ,B0000_1110 ,//D21.7 111 10101
B0001_1010 ,B0000_1110 ,//D22.7 111 10110
B0011_1010 ,B0000_0001 ,//D23.7 111 10111
B0011_0011 ,B0000_0001 ,//D24.7 111 11000
B0010_0110 ,B0000_1110 ,//D25.7 111 11001
B0001_0110 ,B0000_1110 ,//D26.7 111 11010
B0011_0110 ,B0000_0001 ,//D27.7 111 11011
B0000_1110 ,B0000_1110 ,//D28.7 111 11100
B0010_1110 ,B0000_0001 ,//D29.7 111 11101
B0001_1110 ,B0000_0001 ,//D30.7 111 11110
B0010_1011 ,B0000_0001 //D31.7 111 11111
};

```

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unsigned char code Current_RD_P_Tab[512]=

```

```
{
B0001_1000 ,B0000_1011 ,//D00.0 000 00000
B0010_0010 ,B0000_1011 ,//D01.0 000 00001
B0001_0010 ,B0000_1011 ,//D02.0 000 00010
B0011_0001 ,B0000_0100 ,//D03.0 000 00011
B0000_1010 ,B0000_1011 ,//D04.0 000 00100
B0010_1001 ,B0000_0100 ,//D05.0 000 00101
B0001_1001 ,B0000_0100 ,//D06.0 000 00110
B0000_0111 ,B0000_0100 ,//D07.0 000 00111
B0000_0110 ,B0000_1011 ,//D08.0 000 01000
B0010_0101 ,B0000_0100 ,//D09.0 000 01001
B0001_0101 ,B0000_0100 ,//D10.0 000 01010
B0011_0100 ,B0000_0100 ,//D11.0 000 01011
B0000_1101 ,B0000_0100 ,//D12.0 000 01100
B0010_1100 ,B0000_0100 ,//D13.0 000 01101
B0001_1100 ,B0000_0100 ,//D14.0 000 01110
B0010_1000 ,B0000_1011 ,//D15.0 000 01111
B0010_0100 ,B0000_1011 ,//D16.0 000 10000
B0010_0011 ,B0000_0100 ,//D17.0 000 10001
B0001_0011 ,B0000_0100 ,//D18.0 000 10010
B0011_0010 ,B0000_0100 ,//D19.0 000 10011
B0000_1011 ,B0000_0100 ,//D20.0 000 10100
B0010_1010 ,B0000_0100 ,//D21.0 000 10101
B0001_1010 ,B0000_0100 ,//D22.0 000 10110
B0000_0101 ,B0000_1011 ,//D23.0 000 10111
B0000_1100 ,B0000_1011 ,//D24.0 000 11000
B0010_0110 ,B0000_0100 ,//D25.0 000 11001
B0001_0110 ,B0000_0100 ,//D26.0 000 11010
B0000_1001 ,B0000_1011 ,//D27.0 000 11011
B0000_1110 ,B0000_0100 ,//D28.0 000 11100
B0001_0001 ,B0000_1011 ,//D29.0 000 11101
B0010_0001 ,B0000_1011 ,//D30.0 000 11110
B0001_0100 ,B0000_1011 ,//D31.0 000 11111
B0001_1000 ,B0000_1001 ,//D00.1 001 00000
B0010_0010 ,B0000_1001 ,//D01.1 001 00001
B0001_0010 ,B0000_1001 ,//D02.1 001 00010
B0011_0001 ,B0000_1001 ,//D03.1 001 00011
B0000_1010 ,B0000_1001 ,//D04.1 001 00100
B0010_1001 ,B0000_1001 ,//D05.1 001 00101
B0001_1001 ,B0000_1001 ,//D06.1 001 00110
B0000_0111 ,B0000_1001 ,//D07.1 001 00111
B0000_0110 ,B0000_1001 ,//D08.1 001 01000
B0010_0101 ,B0000_1001 ,//D09.1 001 01001
B0001_0101 ,B0000_1001 ,//D10.1 001 01010
```

B0011_0100 ,B0000_1001 ,//D11.1 001 01011
B0000_1101 ,B0000_1001 ,//D12.1 001 01100
B0010_1100 ,B0000_1001 ,//D13.1 001 01101
B0001_1100 ,B0000_1001 ,//D14.1 001 01110
B0010_1000 ,B0000_1001 ,//D15.1 001 01111
B0010_0100 ,B0000_1001 ,//D16.1 001 10000
B0010_0011 ,B0000_1001 ,//D17.1 001 10001
B0001_0011 ,B0000_1001 ,//D18.1 001 10010
B0011_0010 ,B0000_1001 ,//D19.1 001 10011
B0000_1011 ,B0000_1001 ,//D20.1 001 10100
B0010_1010 ,B0000_1001 ,//D21.1 001 10101
B0001_1010 ,B0000_1001 ,//D22.1 001 10110
B0000_0101 ,B0000_1001 ,//D23.1 001 10111
B0000_1100 ,B0000_1001 ,//D24.1 001 11000
B0010_0110 ,B0000_1001 ,//D25.1 001 11001
B0001_0110 ,B0000_1001 ,//D26.1 001 11010
B0000_1001 ,B0000_1001 ,//D27.1 001 11011
B0000_1110 ,B0000_1001 ,//D28.1 001 11100
B0001_0001 ,B0000_1001 ,//D29.1 001 11101
B0010_0001 ,B0000_1001 ,//D30.1 001 11110
B0001_0100 ,B0000_1001 ,//D31.1 001 11111
B0001_1000 ,B0000_0101 ,//D00.2 010 00000
B0010_0010 ,B0000_0101 ,//D01.2 010 00001
B0001_0010 ,B0000_0101 ,//D02.2 010 00010
B0011_0001 ,B0000_0101 ,//D03.2 010 00011
B0000_1010 ,B0000_0101 ,//D04.2 010 00100
B0010_1001 ,B0000_0101 ,//D05.2 010 00101
B0001_1001 ,B0000_0101 ,//D06.2 010 00110
B0000_0111 ,B0000_0101 ,//D07.2 010 00111
B0000_0110 ,B0000_0101 ,//D08.2 010 01000
B0010_0101 ,B0000_0101 ,//D09.2 010 01001
B0001_0101 ,B0000_0101 ,//D10.2 010 01010
B0011_0100 ,B0000_0101 ,//D11.2 010 01011
B0000_1101 ,B0000_0101 ,//D12.2 010 01100
B0010_1100 ,B0000_0101 ,//D13.2 010 01101
B0001_1100 ,B0000_0101 ,//D14.2 010 01110
B0010_1000 ,B0000_0101 ,//D15.2 010 01111
B0010_0100 ,B0000_0101 ,//D16.2 010 10000
B0010_0011 ,B0000_0101 ,//D17.2 010 10001
B0001_0011 ,B0000_0101 ,//D18.2 010 10010
B0011_0010 ,B0000_0101 ,//D19.2 010 10011
B0000_1011 ,B0000_0101 ,//D20.2 010 10100
B0010_1010 ,B0000_0101 ,//D21.2 010 10101
B0001_1010 ,B0000_0101 ,//D22.2 010 10110

B0000_0101 ,B0000_0101 ,//D23.2 010 10111
B0000_1100 ,B0000_0101 ,//D24.2 010 11000
B0010_0110 ,B0000_0101 ,//D25.2 010 11001
B0001_0110 ,B0000_0101 ,//D26.2 010 11010
B0000_1001 ,B0000_0101 ,//D27.2 010 11011
B0000_1110 ,B0000_0101 ,//D28.2 010 11100
B0001_0001 ,B0000_0101 ,//D29.2 010 11101
B0010_0001 ,B0000_0101 ,//D30.2 010 11110
B0001_0100 ,B0000_0101 ,//D31.2 010 11111
B0001_1000 ,B0000_1100 ,//D00.3 011 00000
B0010_0010 ,B0000_1100 ,//D01.3 011 00001
B0001_0010 ,B0000_1100 ,//D02.3 011 00010
B0011_0001 ,B0000_0011 ,//D03.3 011 00011
B0000_1010 ,B0000_1100 ,//D04.3 011 00100
B0010_1001 ,B0000_0011 ,//D05.3 011 00101
B0001_1001 ,B0000_0011 ,//D06.3 011 00110
B0000_0111 ,B0000_0011 ,//D07.3 011 00111
B0000_0110 ,B0000_1100 ,//D08.3 011 01000
B0010_0101 ,B0000_0011 ,//D09.3 011 01001
B0001_0101 ,B0000_0011 ,//D10.3 011 01010
B0011_0100 ,B0000_0011 ,//D11.3 011 01011
B0000_1101 ,B0000_0011 ,//D12.3 011 01100
B0010_1100 ,B0000_0011 ,//D13.3 011 01101
B0001_1100 ,B0000_0011 ,//D14.3 011 01110
B0010_1000 ,B0000_1100 ,//D15.3 011 01111
B0010_0100 ,B0000_1100 ,//D16.3 011 10000
B0010_0011 ,B0000_0011 ,//D17.3 011 10001
B0001_0011 ,B0000_0011 ,//D18.3 011 10010
B0011_0010 ,B0000_0011 ,//D19.3 011 10011
B0000_1011 ,B0000_0011 ,//D20.3 011 10100
B0010_1010 ,B0000_0011 ,//D21.3 011 10101
B0001_1010 ,B0000_0011 ,//D22.3 011 10110
B0000_0101 ,B0000_1100 ,//D23.3 011 10111
B0000_1100 ,B0000_1100 ,//D24.3 011 11000
B0010_0110 ,B0000_0011 ,//D25.3 011 11001
B0001_0110 ,B0000_0011 ,//D26.3 011 11010
B0000_1001 ,B0000_1100 ,//D27.3 011 11011
B0000_1110 ,B0000_0011 ,//D28.3 011 11100
B0001_0001 ,B0000_1100 ,//D29.3 011 11101
B0010_0001 ,B0000_1100 ,//D30.3 011 11110
B0001_0100 ,B0000_1100 ,//D31.3 011 11111
B0001_1000 ,B0000_1101 ,//D00.4 100 00000
B0010_0010 ,B0000_1101 ,//D01.4 100 00001
B0001_0010 ,B0000_1101 ,//D02.4 100 00010

B0011_0001 ,B0000_0010 ,//D03.4 100 00011
B0000_1010 ,B0000_1101 ,//D04.4 100 00100
B0010_1001 ,B0000_0010 ,//D05.4 100 00101
B0001_1001 ,B0000_0010 ,//D06.4 100 00110
B0000_0111 ,B0000_0010 ,//D07.4 100 00111
B0000_0110 ,B0000_1101 ,//D08.4 100 01000
B0010_0101 ,B0000_0010 ,//D09.4 100 01001
B0001_0101 ,B0000_0010 ,//D10.4 100 01010
B0011_0100 ,B0000_0010 ,//D11.4 100 01011
B0000_1101 ,B0000_0010 ,//D12.4 100 01100
B0010_1100 ,B0000_0010 ,//D13.4 100 01101
B0001_1100 ,B0000_0010 ,//D14.4 100 01110
B0010_1000 ,B0000_1101 ,//D15.4 100 01111
B0010_0100 ,B0000_1101 ,//D16.4 100 10000
B0010_0011 ,B0000_0010 ,//D17.4 100 10001
B0001_0011 ,B0000_0010 ,//D18.4 100 10010
B0011_0010 ,B0000_0010 ,//D19.4 100 10011
B0000_1011 ,B0000_0010 ,//D20.4 100 10100
B0010_1010 ,B0000_0010 ,//D21.4 100 10101
B0001_1010 ,B0000_0010 ,//D22.4 100 10110
B0000_0101 ,B0000_1101 ,//D23.4 100 10111
B0000_1100 ,B0000_1101 ,//D24.4 100 11000
B0010_0110 ,B0000_0010 ,//D25.4 100 11001
B0001_0110 ,B0000_0010 ,//D26.4 100 11010
B0000_1001 ,B0000_1101 ,//D27.4 100 11011
B0000_1110 ,B0000_0010 ,//D28.4 100 11100
B0001_0001 ,B0000_1101 ,//D29.4 100 11101
B0010_0001 ,B0000_1101 ,//D30.4 100 11110
B0001_0100 ,B0000_1101 ,//D31.4 100 11111
B0001_1000 ,B0000_1010 ,//D00.5 101 00000
B0010_0010 ,B0000_1010 ,//D01.5 101 00001
B0001_0010 ,B0000_1010 ,//D02.5 101 00010
B0011_0001 ,B0000_1010 ,//D03.5 101 00011
B0000_1010 ,B0000_1010 ,//D04.5 101 00100
B0010_1001 ,B0000_1010 ,//D05.5 101 00101
B0001_1001 ,B0000_1010 ,//D06.5 101 00110
B0000_0111 ,B0000_1010 ,//D07.5 101 00111
B0000_0110 ,B0000_1010 ,//D08.5 101 01000
B0010_0101 ,B0000_1010 ,//D09.5 101 01001
B0001_0101 ,B0000_1010 ,//D10.5 101 01010
B0011_0100 ,B0000_1010 ,//D11.5 101 01011
B0000_1101 ,B0000_1010 ,//D12.5 101 01100
B0010_1100 ,B0000_1010 ,//D13.5 101 01101
B0001_1100 ,B0000_1010 ,//D14.5 101 01110

B0010_1000 ,B0000_1010 ,//D15.5 101 01111
B0010_0100 ,B0000_1010 ,//D16.5 101 10000
B0010_0011 ,B0000_1010 ,//D17.5 101 10001
B0001_0011 ,B0000_1010 ,//D18.5 101 10010
B0011_0010 ,B0000_1010 ,//D19.5 101 10011
B0000_1011 ,B0000_1010 ,//D20.5 101 10100
B0010_1010 ,B0000_1010 ,//D21.5 101 10101
B0001_1010 ,B0000_1010 ,//D22.5 101 10110
B0000_0101 ,B0000_1010 ,//D23.5 101 10111
B0000_1100 ,B0000_1010 ,//D24.5 101 11000
B0010_0110 ,B0000_1010 ,//D25.5 101 11001
B0001_0110 ,B0000_1010 ,//D26.5 101 11010
B0000_1001 ,B0000_1010 ,//D27.5 101 11011
B0000_1110 ,B0000_1010 ,//D28.5 101 11100
B0001_0001 ,B0000_1010 ,//D29.5 101 11101
B0010_0001 ,B0000_1010 ,//D30.5 101 11110
B0001_0100 ,B0000_1010 ,//D31.5 101 11111
B0001_1000 ,B0000_0110 ,//D00.6 110 00000
B0010_0010 ,B0000_0110 ,//D01.6 110 00001
B0001_0010 ,B0000_0110 ,//D02.6 110 00010
B0011_0001 ,B0000_0110 ,//D03.6 110 00011
B0000_1010 ,B0000_0110 ,//D04.6 110 00100
B0010_1001 ,B0000_0110 ,//D05.6 110 00101
B0001_1001 ,B0000_0110 ,//D06.6 110 00110
B0000_0111 ,B0000_0110 ,//D07.6 110 00111
B0000_0110 ,B0000_0110 ,//D08.6 110 01000
B0010_0101 ,B0000_0110 ,//D09.6 110 01001
B0001_0101 ,B0000_0110 ,//D10.6 110 01010
B0011_0100 ,B0000_0110 ,//D11.6 110 01011
B0000_1101 ,B0000_0110 ,//D12.6 110 01100
B0010_1100 ,B0000_0110 ,//D13.6 110 01101
B0001_1100 ,B0000_0110 ,//D14.6 110 01110
B0010_1000 ,B0000_0110 ,//D15.6 110 01111
B0010_0100 ,B0000_0110 ,//D16.6 110 10000
B0010_0011 ,B0000_0110 ,//D17.6 110 10001
B0001_0011 ,B0000_0110 ,//D18.6 110 10010
B0011_0010 ,B0000_0110 ,//D19.6 110 10011
B0000_1011 ,B0000_0110 ,//D20.6 110 10100
B0010_1010 ,B0000_0110 ,//D21.6 110 10101
B0001_1010 ,B0000_0110 ,//D22.6 110 10110
B0000_0101 ,B0000_0110 ,//D23.6 110 10111
B0000_1100 ,B0000_0110 ,//D24.6 110 11000
B0010_0110 ,B0000_0110 ,//D25.6 110 11001
B0001_0110 ,B0000_0110 ,//D26.6 110 11010

```

B0000_1001,B0000_0110,//D27.6 110 11011
B0000_1110,B0000_0110,//D28.6 110 11100
B0001_0001,B0000_0110,//D29.6 110 11101
B0010_0001,B0000_0110,//D30.6 110 11110
B0001_0100,B0000_0110,//D31.6 110 11111
B0001_1000,B0000_1110,//D00.7 111 00000
B0010_0010,B0000_1110,//D01.7 111 00001
B0001_0010,B0000_1110,//D02.7 111 00010
B0011_0001,B0000_0001,//D03.7 111 00011
B0000_1010,B0000_1110,//D04.7 111 00100
B0010_1001,B0000_0001,//D05.7 111 00101
B0001_1001,B0000_0001,//D06.7 111 00110
B0000_0111,B0000_0001,//D07.7 111 00111
B0000_0110,B0000_1110,//D08.7 111 01000
B0010_0101,B0000_0001,//D09.7 111 01001
B0001_0101,B0000_0001,//D10.7 111 01010
B0011_0100,B0000_1000,//D11.7 111 01011
B0000_1101,B0000_0001,//D12.7 111 01100
B0010_1100,B0000_1000,//D13.7 111 01101
B0001_1100,B0000_1000,//D14.7 111 01110
B0010_1000,B0000_1110,//D15.7 111 01111
B0010_0100,B0000_1110,//D16.7 111 10000
B0010_0011,B0000_0001,//D17.7 111 10001
B0001_0011,B0000_0001,//D18.7 111 10010
B0011_0010,B0000_0001,//D19.7 111 10011
B0000_1011,B0000_0001,//D20.7 111 10100
B0010_1010,B0000_0001,//D21.7 111 10101
B0001_1010,B0000_0001,//D22.7 111 10110
B0000_0101,B0000_1110,//D23.7 111 10111
B0000_1100,B0000_1110,//D24.7 111 11000
B0010_0110,B0000_0001,//D25.7 111 11001
B0001_0110,B0000_0001,//D26.7 111 11010
B0000_1001,B0000_1110,//D27.7 111 11011
B0000_1110,B0000_0001,//D28.7 111 11100
B0001_0001,B0000_1110,//D29.7 111 11101
B0010_0001,B0000_1110,//D30.7 111 11110
B0001_0100,B0000_1110 //D31.7 111 11111
};

```

```

unsigned char code DeCode_6_Tab[]=
{
B0010_0111,B0001_1000,//D.00 00000

```

```

B0001_1101 ,B0010_0010,//D.01 00001
B0010_1101 ,B0001_0010,//D.02 00010
B0011_0001 ,B0011_0001,//D.03 00011
B0011_0101 ,B0000_1010,//D.04 00100
B0010_1001 ,B0010_1001,//D.05 00101
B0001_1001 ,B0001_1001,//D.06 00110
B0011_1000 ,B0000_0111,//D.07 00111
B0011_1001 ,B0000_0110,//D.08 01000
B0010_0101 ,B0010_0101,//D.09 01001
B0001_0101 ,B0001_0101,//D.10 01010
B0011_0100 ,B0011_0100,//D.11 01011
B0000_1101 ,B0000_1101,//D.12 01100
B0010_1100 ,B0010_1100,//D.13 01101
B0001_1100 ,B0001_1100,//D.14 01110
B0001_0111 ,B0010_1000,//D.15 01111
B0001_1011 ,B0010_0100,//D.16 10000
B0010_0011 ,B0010_0011,//D.17 10001
B0001_0011 ,B0001_0011,//D.18 10010
B0011_0010 ,B0011_0010,//D.19 10011
B0000_1011 ,B0000_1011,//D.20 10100
B0010_1010 ,B0010_1010,//D.21 10101
B0001_1010 ,B0001_1010,//D.22 10110
B0011_1010 ,B0000_0101,//D.23 10111
B0011_0011 ,B0000_1100,//D.24 11000
B0010_0110 ,B0010_0110,//D.25 11001
B0001_0110 ,B0001_0110,//D.26 11010
B0011_0110 ,B0000_1001,//D.27 11011
B0000_1110 ,B0000_1110,//D.28 11100
B0010_1110 ,B0001_0001,//D.29 11101
B0001_1110 ,B0010_0001,//D.30 11110
B0010_1011 ,B0001_0100 //D.31 11111
};

```

```

unsigned char code DeCode_4_Tab[]=
{
B0000_1011 ,B0000_0100,B0000_0000 ,//D.x.0
B0000_1001 ,B0000_1001,B0010_0000 ,//D.x.1
B0000_0101 ,B0000_0101,B0100_0000 ,//D.x.2
B0000_1100 ,B0000_0011,B0110_0000 ,//D.x.3
B0000_1101 ,B0000_0010,B1000_0000 ,//D.x.4
B0000_1010 ,B0000_1010,B1010_0000 ,//D.x.5
B0000_0110 ,B0000_0110,B1100_0000 ,//D.x.6
B0000_1110 ,B0000_0001,B1110_0000 ,//D.x.P7
B0000_0111 ,B0000_1000,B1110_0000 //D.x.A7

```

```
};
```

```
short RandSeed;  
short RandOffset;
```

```
short random0()  
{  
    RandSeed = 57+109*RandSeed;  
    RandOffset = 11+RandOffset*21;  
    RandOffset=RandOffset*2+RandSeed;  
    return (31&RandOffset);  
}
```

```
BYTE data_8b10b_err;  
BYTE Prev_RD;  
BYTE OrignalBuf[60];  
BYTE EncodeBuf[120];  
BYTE DecodeBuf[60];
```

```
BYTE Decode_8b10b_Func(BYTE k6,BYTE k4)  
{  
    BYTE i,Hi3,Lo5;
```

```
    data_8b10b_err = 2;
```

```
    for(i = 0;i<64;i=i+2)  
    {  
        if( (DeCode_6_Tab[i]==k6) || (DeCode_6_Tab[i+1]==k6))  
        {  
            Lo5 = i/2;  
            data_8b10b_err--;  
            break;  
        }  
    }
```

```
    for(i = 0;i<27;i=i+3)  
    {  
        if( (DeCode_4_Tab[i]==k4) || (DeCode_4_Tab[i+1]==k4))  
        {  
            Hi3 = DeCode_4_Tab[i+2];  
            data_8b10b_err--;  
            break;  
        }
```

```

    }
}

return Hi3+Lo5;
}

```

Test810bitproc()

```

{

int i;
BYTE Encode6b,Encode4b;

Prev_RD = -1;
for(i = 0;i<256;i++)
{

    if(Prev_RD== -1)
    {
        Prev_RD = 1;
        Encode6b  = Current_RD_P_Tab[i*2];
        Encode4b = Current_RD_P_Tab[i*2+1];
    }
    else
    {
        Prev_RD = 1;
        Encode6b  = Current_RD_N_Tab[i*2];
        Encode4b = Current_RD_N_Tab[i*2+1];
    }
    if(i==Decode_8b10b_Func(Encode6b,Encode4b)) continue;
    break;
}
i++;

```

```

Prev_RD = 1;
for(i = 0;i<256;i++)
{

```

```

    if(Prev_RD== -1)
    {
        Prev_RD = 1;

```

```

        Encode6b  = Current_RD_P_Tab[i*2];
        Encode4b = Current_RD_P_Tab[i*2+1];
    }
    else
    {
        Prev_RD = -1;
        Encode6b  = Current_RD_N_Tab[i*2];
        Encode4b = Current_RD_N_Tab[i*2+1];
    }
    if(i==Decode_8b10b_Func(Encode6b,Encode4b)) continue;
    break;
}
i++;
}

```

//-----卷积纠错码编码器-----

```

void Convolutional_Coder(BYTE *ptr,BYTE len)
{
    BYTE  a=0,b=0;
    BYTE  i;

    for(i=0;i<len;i++)
    {
        b = ptr[i];
        b = b^a;
        a = ptr[i];
        ptr[len+i] =b;
    }
}

```

//-----卷积纠错码译码器-----

```

void Convolutional_Decoder(BYTE *ptr,BYTE len)
{
    BYTE  a=0,b=0,c=0,d=0,e=0;
    BYTE  m=0;

    while(m<len)
    {
        a=ptr[m];
        b=ptr[m+len] ;
        m++;
        c=ptr[m];
    }
}

```

```

        d=ptr[m+len];
        b=a^b;
        b=b^e;
        c=a^c ;
        c=c^d ;
        c=c&b ;
        a=a^c ;
        e=a;
        ptr[m-1]=a;
    }
}

```

BYTE Reg8;

RemovelDc()

```

{
    BYTE i,k;
    for(i = 0;i<8;i++)
    {

        k = 0;
        if(Reg8&0x01) k++;
        if(Reg8&0x20) k++;
        Reg8>>=1;
        if(k&0x01) Reg8|=0x80;
    }
}

```

WORD R1R0;

WORD FecEncode(BYTE R22)

```

{
    BYTE i,k;
    WORD R3R2;
    for(i = 0;i<8;i++)
    {
        k = 0;
        R1R0<<=1;
        if(R22&0x80) R1R0|=0x01;
        R22<<=1;

        if(R1R0&bit0) k++;
        if(R1R0&bit3) k++;
        if(R1R0&bit7) k++;
    }
}

```

```

        if(R1R0&0x200) k++;

        R3R2<<=1;
        if(R1R0&0x1) R3R2|=0x01;

        R3R2<<=1;
        if(k&0x1) R3R2|=0x01;
    }
    return R3R2;
}

```

```

BYTE Reg0;
BYTE Reg1;
BYTE Reg2;
BYTE Reg3;
BYTE Reg4;
BYTE Reg23;
BYTE Reg24;
BYTE p1E;

```

```

void FecDecIni()
{

    Reg0  = 0;
    Reg1  = 0;
    Reg2  = 0;
    Reg3  = 0;
    Reg4  = 0;
    Reg23 = 1;
    Reg24 = 2;
    p1E = 0;
}

```

```

BYTE FecDecode(BYTE Reg22)
{
    BYTE i,r5,r6;

    for(i = 0;i<8;i++)
    {

```

```
Reg1<<=1;
if(Reg0&0x80) Reg1++;
```

```
Reg0<<=1;
if(Reg4&0x80) Reg0++;
```

```
Reg4<<=1;
if(Reg22&0x80) Reg4++;
```

```
Reg22<<=1;
```

```
r5 = 0;
if(Reg0&bit0) r5++;
if(Reg0&bit3) r5++;
if(Reg0&bit7) r5++;
if(Reg1&bit1) r5++;
```

```
if(Reg4&0x80) r5++;
```

```
if(r5&bit0) Reg2|=bit0    ;
else
Reg2&=(~bit0);
```

```
Reg4<<=1;
```

```
if(Reg22&0x80) Reg4++;
Reg22<<=1;
```

```
if( (Reg2&bit0)|| (Reg2&bit2) ) p1E|=bit1;
else
p1E&=(~bit1);
```

```
if( (Reg2&bit0) || (Reg2&bit6) ) ;
else
p1E&=(~bit1);
```

```
if( (Reg2&bit0) || (Reg3&bit1) ) ;
else
p1E &=(~bit1);
```

```
if( (Reg2&bit2) || (Reg2&bit6) ) ;  
else  
p1E &=(~bit1);
```

```
if( (Reg2&bit2) || (Reg3&bit1) ) ;  
else  
p1E &=(~bit1);
```

```
if( (Reg2&bit6) || (Reg3&bit1) ) ;  
else  
p1E &=(~bit1);
```

```
r5 = 0;  
if(p1E&bit1) r5++;  
if(Reg1&bit1) r5++;
```

```
r6<=1;  
if(r5&bit0) r6++;  
r5>=1;
```

```
if(Reg3&bit0) Reg3|=bit1;  
else  
Reg3&=(~bit1);
```

```
if(Reg2&bit7) Reg3|=bit0;  
else  
Reg3&=(~bit0);
```

```
r5 = 0;  
if(p1E&bit1) r5++;  
if(Reg2&bit6) r5++;
```

```
if(r5&bit0) Reg2|=bit7;  
else  
Reg2&=(~bit7);
```

```
if(Reg2&bit5) Reg2|=bit6;  
else  
Reg2&=(~bit6);
```

```
if(Reg2&bit4) Reg2|=bit5;  
else
```

```

    Reg2&=(~bit5);

    if(Reg2&bit3) Reg2|=bit4;
    else
    Reg2&=(~bit4);

    r5 = 0;
    if(p1E&bit1) r5++;
    if(Reg2&bit2) r5++;

    if(r5&bit0)  Reg2|=bit3;
    else
    Reg2&=(~bit3);

    if(Reg2&bit1)  Reg2|=bit2;
    else
    Reg2&=(~bit2);

    r5 = 0;
    if(p1E&bit1) r5++;
    if(Reg2&bit0)  r5++;

    if(r5&bit0) Reg2|=bit1;
    else
    Reg2&=(~bit1);
}

return r6;

}

```

BYTE

```

bTestInput[]={0x00,0x01,0x02,0x03,0x04,0x05,0x06,0x07,0xcb,0xa8,0x45,0xaa,0xaa,0xaa,
0,0,0,0};

```

/*

```

WORD wTestOutput0[130]=
{
    0x33ba,0x2688,0xdc53,
    0xf4b8,0x76cc,0x9389,
    0x0a66,0x9335,0xe956,
    0x728e,0xd7b1,0xd7d0,
    0xe41e,0x8df6

```

```
};  
*/
```

```
WORD wTestOutput0[130]=  
{  
0x33b0,0x2680,0xdc50,  
0xf4b0,0x76cc,0x9389,  
0x0a66,0x9335,0xe956,  
0x728e,0xd7b1,0xd7d0,  
0xe41e,0x8df6  
};
```

```
WORD wTestOutput[130];
```

```
BYTE FecEncInBuf[1000];
```

```
main()
```

```
{
```

```
BYTE i,n,R22;
```

```
WORD temp0,temp1;
```

```
    n = 0;
```

```
    R1R0 = 0;
```

```
    Reg8 = 0x89;
```

```
    wTestOutput[n++] = FecEncode(0x5f);
```

```
    for(n = 1;n<13;n++)
```

```
    {
```

```
        RemovalDc();
```

```
        wTestOutput[n]= FecEncode(Reg8^bTestInput[n-1]);
```

```
        if(    (R1R0&0xff)==0xff)
```

```
            wTestOutput[n++]= FecEncode(0x7e);
```

```
    }
```

```
    wTestOutput[n++]= FecEncode(0xFF);
```

```
    wTestOutput[n++]= FecEncode(0xFF);
```

```
    wTestOutput[n++]= FecEncode(0xFF);
```

```
    wTestOutput[n++]= FecEncode(0xFF);
```

```
    for(temp0 = 0;temp0<1000;temp0++)    FecEncInBuf[temp0] = 0;
```

```
    temp1 = 6;
```

```
    for(i = 0;i<13;i++)
```

```

{
    temp0 = wTestOutput[i];
    for(n = 0;n<16;n++)
    {
        if( temp0&0x8000)
            FecEncInBuf[temp1]= 1;
        temp0<<=1;
        temp1++;
    }
}

```

```

temp1 = 0;
n = 0;
for(i = 0;i<50;i++)
{
    R22 = 0;
    for(n=0;n<8;n++)
    {
        R22<<=1;
        if( FecEncInBuf[temp1++]=1) R22++;
    }
    FecEncInBuf[i] = R22;
}

```

```

FecDecIni();
for(i = 0;i<30;i++)
{

    R22 = FecEncInBuf[i];
    Reg23++;
    if(Reg23&bit0) {Reg4 = R22;continue;}
    else
        n = FecDecode(R22);

    if(Reg23<6) continue;
    if( (Reg23==6) && (n==0x5f))  {Reg8 = 0x89;continue;}

    if(p1E&bit2)
    {

```

```

        if(n==0xff)
        {
            break;
        }
        else
        {
            Reg23-=2;
            n = 0xff;
        }

    }
    else
    {
        if(n==0xff)
        {
            p1E|=bit2;
            continue;
        }
    }

    p1E &=~(bit2);
    RemoveIDc();
    n = n^Reg8;
    FecEncInBuf[i/2-3] = n;

}
}

```