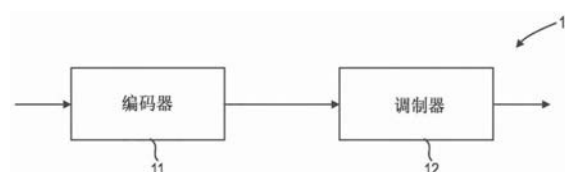(54) 发明名称
　解调和解码设备及方法、接收设备及方法以及存储介质

(57) 摘要

本公开提出了一种解调和解码设备及方法、接收设备及方法以及存储介质。该解调和解码设备包括：解调器电路，被配置为将星座值从接收的传输流解调为单元字；以及解码器电路，将该单元字解码为输出数据。该解调器电路被配置为根据星座的星座点的总数M和编码速率，使用来自一组或几组星座的非均匀星座，每组星座包括一个或多个星座。

1.一种解调和解码设备,包括:

解调器电路,被配置为将星座值从接收的传输流解调为单元字;以及

解码器电路,将所述单元字解码为输出数据,其中,

所述解调器电路使用具有总数M＝64的星座点和码率6/15的非均匀星座中的四个中的第一个,并且

所述四个中的第一个的所述星座点限定为:

| 0.5656+0.9499i |
| 0.2750+1.0676i |
| 0.8202+1.2651i |
| 0.3011+1.4529i |
| 0.9500+0.5641i |
| 1.0666+0.2744i |
| 1.2657+0.8178i |
| 1.4521+0.3005i |
| 0.3004+0.5417i |
| 0.2430+0.5607i |
| 0.2094+0.3579i |
| 0.1946+0.3566i |
| 0.5410+0.3002i |
| 0.5596+0.2431i |
| 0.3569+0.2094i |
| 0.3553+0.1948i |

并且四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

2.根据权利要求1所述的解调和解码设备,其中,所述四个中的第一个表示具有头两个有效位为零的单元字。

3.根据权利要求1所述的解调和解码设备,其中,从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

4.根据权利要求1所述的解调和解码设备,其中,所述非均匀星座的四个中的其他三个表示当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

5.根据权利要求1所述的解调和解码设备,其中,当由接收器电路利用不同于6/15的码率接收传输时,所述解调器电路使用不同的非均匀星座的不同的星座点。

6.根据权利要求1所述的解调和解码设备,其中,所述解调器电路做出关于从其解码单元字的所述星座点的软决定。

7.根据权利要求1所述的解调和解码设备,其中,笛卡尔坐标系的四个中的一个内的星座点以彼此不等的距离布置。

8.一种高级电视系统委员会(ATSC)接收器,包括:

根据权利要求1所述的解调和解码设备。

9.一种接收器,包括:

根据权利要求1所述的解调和解码设备,其中,

所述解码器电路和所述解调器电路被配置为在比特交织编码调制(BICM)数据上操作。

10.根据权利要求9所述的接收器,进一步包括前向纠错解码器。

11.一种解调和解码方法,包括:

将星座值从接收的传输流解调为单元字;并且

将所述单元字解码为输出数据,其中,

解调使用具有总数M＝64的星座点和码率6/15的非均匀星座中的四个中的第一个,

所述四个中的第一个的所述星座点限定为:

0.5656+0.9499i
0.2750+1.0676i
0.8202+1.2651i
0.3011+1.4529i
0.9500+0.5641i
1.0666+0.2744i
1.2657+0.8178i
1.4521+0.3005i
0.3004+0.5417i
0.2430+0.5607i
0.2094+0.3579i
0.1946+0.3566i
0.5410+0.3002i
0.5596+0.2431i
0.3569+0.2094i
0.3553+0.1948i

并且四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

12.根据权利要求11所述的解调和解码方法,其中,所述四个中的第一个表示具有头两个有效位为零的单元字。

13.根据权利要求11所述的解调和解码方法,其中,从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

14.根据权利要求11所述的解调和解码方法,其中,所述非均匀星座的四个中的其他三个表示当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

15.根据权利要求11所述的解调和解码方法,进一步包括做出关于从其解码单元字的所述星座点的软决定。

16.一种接收设备,包括:

接收器,接收一个或多个传输流;

解转换器,将所接收的一个或多个传输流解转换为非均匀星座的星座值,以及

解调器,被配置为使用以下具有总数M＝1024的星座点和码率8/15的非均匀星座,其中,所述星座点由长度v＝sqrt(M)/2-1的星座位置矢量u限定:

u1	1.0005
u2	2.0897
u3	2.0888
u4	3.9945
u5	3.9931
u6	5.3843
u7	5.3894
u8	7.5206
u9	7.6013
u10	9.3371
u11	9.8429
u12	11.9255
u13	13.3962
u14	15.8981
u15	19.1591

其中,位置矢量值标准化为单元平均功率。

17.根据权利要求16所述的接收设备,其中,值1被附加为所述矢量的第一元素。

18.根据权利要求16或17所述的接收设备,其中,当由接收器电路利用不同于8/15的码率接收信号时,所述解调器电路使用不同的非均匀星座的不同的星座点。

19.根据权利要求16或17所述的接收设备,其中,所述解调器电路做出关于从其解码单元字的所述星座点的软决定。

20.根据权利要求16或17所述的接收设备,其中,所述接收器包括被配置为在比特交织编码调制(BICM)数据上操作的解码器电路。

21.根据权利要求20所述的接收设备,其中,所述接收器进一步包括前向纠错解码器。

22.一种高级电视系统委员会(ATSC)接收器,包括:

根据权利要求16或17所述的接收设备的所述接收器。

23.一种接收方法,包括:

接收一个或多个传输流;

将所接收的一个或多个传输流解转换为非均匀星座的星座值,并且使用以下具有总数M=1024的星座点和码率8/15的非均匀星座,其中,所述星座点由长度v=sqrt(M)/2-1的星座位置矢量u限定:

u1	1.0005
u2	2.0897
u3	2.0888
u4	3.9945
u5	3.9931
u6	5.3843
u7	5.3894
u8	7.5206
u9	7.6013
u10	9.3371
u11	9.8429
u12	11.9255
u13	13.3962
u14	15.8981
u15	19.1591

以解调数据，其中，位置矢量值标准化为单元平均功率。

24.根据权利要求23所述的方法，其中，值1被附加为所述矢量的第一元素。

25.一种解调和解码设备，包括：

解调器电路，被配置为将星座值从接收的传输流解调为单元字；以及

解码器电路，将所述单元字解码为输出数据，其中，

所述解调器电路使用具有总数M＝16的星座点和码率10/15的非均匀星座中的四个中的第一个，并且

所述四个中的第一个的所述星座点限定为：

0.6186+0.2544i
0.2213+0.4416i
1.2080+0.5377i
0.4487+1.1657i

并且四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

26.根据权利要求25所述的解调和解码设备，其中，所述四个中的第一个表示具有头两个有效位为零的单元字。

27.根据权利要求25所述的解调和解码设备，其中，从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

28.根据权利要求25所述的解调和解码设备，其中，所述非均匀星座的四个中的其他三个表示当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

29.根据权利要求25所述的解调和解码设备，其中，当由接收器电路利用不同于10/15的码率接收传输时，所述解调器电路使用不同的非均匀星座的不同的星座点。

30.根据权利要求25所述的解调和解码设备，其中，所述解调器电路做出关于从其解码单元字的所述星座点的软决定。

31.根据权利要求25所述的解调和解码设备，其中，笛卡尔坐标系的四个中的一个内的星座点以彼此不等的距离布置。

32.一种高级电视系统委员会(ATSC)接收器，包括：

根据权利要求25所述的解调和解码设备。

33．一种接收器，包括：

根据权利要求25所述的解调和解码设备，其中，

所述解码器电路和所述解调器电路被配置为在比特交织编码调制(BICM)数据上操作。

34．根据权利要求33所述的接收器，进一步包括前向纠错解码器。

35．一种解调和解码方法，包括：

将星座值从接收的传输流解调为单元字；并且

将所述单元字解码为输出数据，其中，

解调使用具有总数M＝164的星座点和码率10/15的非均匀星座中的四个中的第一个，

所述四个中的第一个的所述星座点限定为：

0.6186+0.2544i
0.2213+0.4416i
1.2080+0.5377i
0.4487+1.1657i

并且四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

36．根据权利要求35所述的解调和解码方法，其中，所述四个中的第一个表示具有头两个有效位为零的单元字。

37．根据权利要求35所述的解调和解码方法，其中，从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

38．根据权利要求35所述的解调和解码方法，其中，所述非均匀星座的四个中的其他三个表示当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

39．根据权利要求35所述的解调和解码方法，进一步包括做出关于从其解码单元字的所述星座点的软决定。

40．一种解调和解码设备，包括：

解调器电路，被配置为将星座值从接收的传输流解调为单元字；以及

解码器电路，将所述单元字解码为输出数据，其中，

所述解调器电路使用具有总数M＝256的星座点和码率12/15的非均匀星座中的四个中的第一个，并且

所述四个中的第一个的所述星座点限定为：

1.1980+1.1541i
0.9192+1.2082i
1.2778+0.8523i
1.0390+0.9253i
0.6057+1.2200i
0.7371+1.4217i
0.6678+1.0021i
0.8412+0.9448i
1.2128+0.5373i
1.0048+0.5165i
1.4321+0.6343i
1.0245+0.7152i
0.6384+0.6073i
0.8175+0.5684i
0.6568+0.7801i
0.8311+0.7459i
0.1349+1.4742i
0.1105+1.2309i
0.0634+0.9796i
0.1891+1.0198i
0.4142+1.4461i
0.3323+1.2279i
0.4998+0.9827i
0.3467+1.0202i
0.0680+0.6501i
0.2016+0.6464i
0.0719+0.8075i
0.2088+0.8146i
0.4809+0.6296i
0.3374+0.6412i
0.4955+0.8008i
0.3431+0.8141i
1.2731+0.1108i
1.0794+0.0977i
1.5126+0.1256i
0.9029+0.0853i
0.5429+0.0694i
0.6795+0.0559i

0.5628+0.1945i
0.7326+0.1410i
1.2283+0.3217i
1.0269+0.3261i
1.4663+0.3716i
0.9085+0.2470i
0.6160+0.4549i
0.7818+0.4247i
0.5938+0.3170i
0.7600+0.2850i
0.0595+0.0707i
0.1722+0.0706i
0.0599+0.2119i
0.1748+0.2114i
0.4134+0.0701i
0.2935+0.0705i
0.4231+0.2066i
0.2979+0.2100i
0.0638+0.5002i
0.1905+0.4966i
0.0612+0.3552i
0.1810+0.3533i
0.4630+0.4764i
0.3231+0.4895i
0.4416+0.3397i
0.3083+0.3490i

四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

41. 根据权利要求40所述的解调和解码设备，其中，所述四个中的第一个表示具有头两个有效位为零的单元字。

42. 根据权利要求40所述的解调和解码设备，其中，从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

43. 根据权利要求40所述的解调和解码设备，其中，所述非均匀星座的四个中的其他三个表示当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

44. 根据权利要求40所述的解调和解码设备，其中，当由接收器电路利用不同于12/15的码率接收传输流时，所述解调器电路使用不同的非均匀星座的不同的星座点。

45. 根据权利要求40所述的解调和解码设备，其中，所述解调器电路做出关于从其解码单元字的所述星座点的软决定。

46. 一种高级电视系统委员会(ATSC)接收器，包括：
根据权利要求40所述的解调和解码设备。

47. 一种接收器，包括：
根据权利要求40所述的解调和解码设备，其中，
所述解码器电路和所述解调器电路被配置为在比特交织编码调制(BICM)数据上操作。

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48.根据权利要求47所述的接收器,进一步包括前向纠错解码器。

49.一种解调和解码方法,包括:

将星座值从接收的传输流解调为单元字;并且

将所述单元字解码为输出数据,其中,

解调使用具有总数M=256的星座点和码率12/15的非均匀星座中的四个中的第一个,

所述四个中的第一个的所述星座点限定为:

1.1980+1.1541i
0.9192+1.2082i
1.2778+0.8523i
1.0390+0.9253i
0.6057+1.2200i
0.7371+1.4217i
0.6678+1.0021i
0.8412+0.9448i
1.2128+0.5373i
1.0048+0.5165i
1.4321+0.6343i
1.0245+0.7152i
0.6384+0.6073i
0.8175+0.5684i
0.6568+0.7801i
0.8311+0.7459i
0.1349+1.4742i
0.1105+1.2309i
0.0634+0.9796i
0.1891+1.0198i
0.4142+1.4461i
0.3323+1.2279i
0.4998+0.9827i
0.3467+1.0202i
0.0680+0.6501i
0.2016+0.6464i
0.0719+0.8075i
0.2088+0.8146i
0.4809+0.6296i
0.3374+0.6412i
0.4955+0.8008i
0.3431+0.8141i
1.2731+0.1108i
1.0794+0.0977i
1.5126+0.1256i
0.9029+0.0853i
0.5429+0.0694i
0.6795+0.0559i
0.5628+0.1945i
0.7326+0.1410i
1.2283+0.3217i
1.0269+0.3261i
1.4663+0.3716i

0.9085+0.2470i
0.6160+0.4549i
0.7818+0.4247i
0.5938+0.3170i
0.7600+0.2850i
0.0595+0.0707i
0.1722+0.0706i
0.0599+0.2119i
0.1748+0.2114i
0.4134+0.0701i
0.2935+0.0705i
0.4231+0.2066i
0.2979+0.2100i
0.0638+0.5002i
0.1905+0.4966i
0.0612+0.3552i
0.1810+0.3533i
0.4630+0.4764i
0.3231+0.4895i
0.4416+0.3397i
0.3083+0.3490i

并且四个中的其他三个由从所述非均匀星座的所述四个中的第一个的对称导出。

50.根据权利要求49所述的解调和解码方法,其中,所述四个中的第一个表示具有头两个有效位为零的单元字。

51.根据权利要求49所述的解调和解码方法,其中,从所述四个中的第一个的星座点解调的所述单元字表示具有头两个有效位为零的单元字。

52.根据权利要求49所述的解调和解码方法,其中,所述非均匀星座的四个中的其他三个表示,当从其解调单元字时根据从其解调它们的所述非均匀星座的所述四个中的一个具有头两个有效位为01或10或11的星座点。

53.根据权利要求49所述的解调和解码方法,进一步包括做出关于从其解码单元字的所述星座点的软决定。

54.一种接收设备,包括:

接收器,用于接收具有码率20/30的一个或多个传输流,

解转换器,用于将所接收的一个或多个传输流解转换为星座值,以及

解调和解码设备,用于将星座的星座值解调为单元字并且用于将单元字解码为输出数据字,其中,使用所述星座的十六个星座点,所述十六个星座点定义表示具有第一轴上的实数部分和第二轴上的虚数部分的复数的笛卡尔坐标系上的位置,所述星座点为:

0.5061+0.2474i

0.2474+0.5061i

1.2007+0.4909i

0.4909+1.2007i

0.5061-0.2474i

0.2474-0.5061i

11

1.2007-0.4909i

0.4909-1.2007i

-0.5061-0.2474i

-0.2474-0.5061i

-1.2007-0.4909i

-0.4909-1.2007i

-0.5061+0.2474i

-0.2474+0.5061i

-1.2007+0.4909i

-0.4909+1.2007i，

并且每个星座点被分配给表示前向纠正数据字的位标签。

55.根据权利要求54所述的接收设备，其中，所述星座点

0.5061+0.2474i表示位0000

0.2474+0.5061i表示位0001

1.2007+0.4909i表示位0010

0.4909+1.2007i表示位0011

0.5061-0.2474i表示位0100

0.2474-0.5061i表示位0101

1.2007-0.4909i表示位0110

0.4909-1.2007i表示位0111

-0.5061-0.2474i表示位1000

-0.2474-0.5061i表示位1001

-1.2007-0.4909i表示位1010

-0.4909-1.2007i表示位1011

-0.5061+0.2474i表示位1100

-0.2474+0.5061i表示位1101

-1.2007+0.4909i表示位1110

-0.4909+1.2007i表示位1111。

56.一种接收设备，包括：

接收器，用于接收具有码率3/5的一个或多个传输流，

解转换器，用于将所接收的一个或多个传输流解转换为星座值，以及

解调和解码设备，用于将星座的星座值解调为单元字并且用于将单元字解码为输出数据字，其中，使用所述星座的十六个星座点，所述十六个星座点定义表示具有第一轴上的实数部分和第二轴上的虚数部分的复数的笛卡尔坐标系上的位置，所述星座点为：

0.2606+0.4718i

0.4718+0.2606i

0.4984+1.2088i

1.2088+0.4984i

0.2606-0.4718i

0.4718-0.2606i

0.4984-1.2088i

1.2088-0.4984i

-0.2606-0.4718i

-0.4718-0.2606i

-0.4984-1.2088i

-1.2088-0.4984i

-0.2606+0.4718i

-0.4718+0.2606i

-0.4984+1.2088i

-1.2088+0.4984i，

并且每个星座点被分配给表示前向纠正数据字的位标签。

57.根据权利要求56所述的接收设备，其中，所述星座点

0.2606+0.4718i表示位0000

0.4718+0.2606i表示位0001

0.4984+1.2088i表示位0010

1.2088+0.4984i表示位0011

0.2606-0.4718i表示位0100

0.4718-0.2606i表示位0101

0.4984-1.2088i表示位0110

1.2088-0.4984i表示位0111

-0.2606-0.4718i表示位1000

-0.4718-0.2606i表示位1001

-0.4984-1.2088i表示位1010

-1.2088-0.4984i表示位1011

-0.2606+0.4718i表示位1100

-0.4718+0.2606i表示位1101

-0.4984+1.2088i表示位1110

-1.2088+0.4984i表示位1111。

58.根据权利要求54或56所述的接收设备，其中，每个位标签表示4个位。

59.根据权利要求54或56所述的接收设备，其中，笛卡尔坐标系的象限内的所述星座点以彼此不等的距离布置。

60.根据权利要求54或56所述的接收设备，所述接收器是卫星传输接收器。

61.根据权利要求54或56所述的接收设备，所述传输流是具有加性高斯白噪声信道特征的信号。

62.根据权利要求54或56所述的接收设备，其中，所述解调和解码设备被配置为通过考虑软价值相对于所述星座点解码单元字。

63.一种接收方法，包括：

接收具有码率20/30的一个或多个传输流，

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将所接收的一个或多个传输流解转换为星座值,并且

将星座的星座值解调为单元字并且将单元字解码为输出数据字,其中,使用所述星座的十六个星座点,所述十六个星座点定义表示具有第一轴上的实数部分和第二轴上的虚数部分的复数的笛卡尔坐标系上的位置,所述星座点为:

0.5061+0.2474i

0.2474+0.5061i

1.2007+0.4909i

0.4909+1.2007i

0.5061-0.2474i

0.2474-0.5061i

1.2007-0.4909i

0.4909-1.2007i

-0.5061-0.2474i

-0.2474-0.5061i

-1.2007-0.4909i

-0.4909-1.2007i

-0.5061+0.2474i

-0.2474+0.5061i

-1.2007+0.4909i

-0.4909+1.2007i

并且每个星座点被分配给表示前向纠正数据字的位标签。

64.一种接收方法,包括:

接收具有码率3/5的一个或多个传输流,

将所接收的一个或多个传输流解转换为星座值,并且

将星座的星座值解调为单元字并且将单元字解码为输出数据字,其中,使用所述星座的十六个星座点,所述十六个星座点定义表示具有第一轴上的实数部分和第二轴上的虚数部分的复数的笛卡尔坐标系上的位置,所述星座点为:

0.2606+0.4718i

0.4718+0.2606i

0.4984+1.2088i

1.2088+0.4984i

0.2606-0.4718i

0.4718-0.2606i

0.4984-1.2088i

1.2088-0.4984i

-0.2606-0.4718i

-0.4718-0.2606i

-0.4984-1.2088i

-1.2088-0.4984i

-0.2606+0.4718i

-0.4718+0.2606i

-0.4984+1.2088i

-1.2088+0.4984i

并且每个星座点被分配给表示前向纠正数据字的位标签。

65.一种计算机存储介质,包括程序代码装置,用于在计算机上执行计算机程序时,所述程序代码装置使得所述计算机执行根据权利要求63或64所述的方法的步骤。

解调和解码设备及方法、接收设备及方法以及存储介质

[0001]　　本申请是申请日为2014年7月7日、国际申请号为PCT/EP2014/064404、发明名称为"使用非均匀星座的编码和调制设备"的PCT申请的中国国家阶段申请的分案申请,该中国国家阶段申请进入中国国家阶段的进入日为2016年1月4日、申请号为201480038379.3,其全部内容结合于此作为参考。

技术领域

[0002]　　本公开涉及一种解调和解码设备及方法。进一步,本公开涉及一种接收设备及方法。更进一步,本公开涉及一种计算机存储介质。

背景技术

[0003]　　除了其他元素以外,现代通信系统通常使用编码和调制设备(作为传输设备的一部分)和解码以及解调设备(作为接收设备的一部分)。编码和调制设备通常是所谓的BICM(位交错编码调制)设备的一部分,该设备通常包括(在传输器侧上)FEC(前向纠错)编码器、位交错器以及调制器的串行级联,通常使用光谱有效调制,例如,多级PAM(脉冲幅度调制)、PSK(正交相移键控)或QAM(正交调幅)。应注意的是,在后文中,每当提及QAM,就应理解为涵盖PAM、PSK以及QAM的一般术语。

[0004]　　由于使用交错器和/或FEC编码器,所以BICM允许在非衰落信道和衰落信道上具有良好的性能。具有合理的解码复杂性,与多级编码(MLC)编码方案相反,因此,频繁地用于通信系统中,例如,用于所有DVB系统、电力线通信(例如,Homeplug AV、DAB、LTE、WiFi等)中。

[0005]　　通常,编码和调制容量(例如,在使用BICM设备的系统中,BICM容量)被视为目标函数,并且期望找出最佳星座点,以便这个容量尽可能增大,通常经受功率规范化,即,星座点的平均功率应规范化为(例如)1。

[0006]　　在本文中提供的"背景"描述用于总体上介绍本公开的背景的目的。不明示也不暗示地承认在这个背景部分中描述的程度上目前称为发明人的工作以及在提交时没有资格作为先有技术的描述的方面,作为本公开的先有技术。

发明内容

[0007]　　一个目标在于,提供一种解调和解码设备和方法。进一步目标在于,提供一种接收设备和方法。更进一步目标在于,提供一种计算机存储介质,用于实现所述方法。

[0008]　　根据一个方面,提供了一种解调和解码设备,包括:解调器电路,被配置为将星座值从接收的传输流解调为单元字;以及解码器电路,将所述单元字解码为输出数据。该解调器电路被配置为根据星座的星座点的总数M和编码速率,使用来自一组或几组星座的非均匀星座,每组星座包括一个或多个星座。

[0009]　　根据进一步方面,提供了一种接收设备,包括:接收器,接收一个或多个传输流;解转换器,将所接收的一个或多个传输流解转换为非均匀星座的星座值,以及解调器,被配置为根据星座的星座点的总数M和编码速率,使用来自一组或几组星座的非均匀星座,每组星

座包括一个或多个星座。

[0010]　　根据更进一步方面,提供了:相应方法;一种计算机存储介质,包括程序代码装置,用于在计算机上执行所述计算机程序时,促使计算机执行在本文中公开的解调和解码方法的步骤。

[0011]　　应理解的是,所要求的方法、所要求的计算机程序以及所要求的计算机可读记录介质具有与所要求的设备相似和/或相同的优选实施方式。

[0012]　　本公开的一个方面在于,所使用的非均匀星座(在本文中也称为NUC)的星座点并非位于具有等距符号的规则网格上,而是位于优化位置上,依赖于前向纠错编码器的编码速率,例如,LDPC或涡轮码或任何其他已知的代码编码器(通常可另外提供另一个前向纠错编码器,例如,BCH编码器),依赖于所使用的星座的星座点的期望总数(在一些实施方式中,依赖于信道特征)

[0013]　　在表格中,提供各种星座,用于M的不同值并且用于不同的编码速率。应注意的是,在表格中表示的编码速率R不要理解为,特定的星座仅仅对正好这个编码速率有效,也对略微不同的编码速率有效,即,编码速率的范围R±1/30。例如,在所提出的表格中提供的编码速率(即,R＝6/15)的指示6/15表示相应的星座对编码速率的范围6/15±1/30有效,即,从11/30到13/30的编码速率的范围。

[0014]　　应注意的是,一个或多个以下"不变变换"不影响星座的性能:

[0015]　　1、将所有符号旋转任意的角度φ,

[0016]　　2、将第m位$y\_m＝b\in\{0,1\}$倒转为$y\_m＝\bar{b}$,其中,横杆表示倒转,

[0017]　　3、交换位位置y_{k1}和y_{k2},

[0018]　　4、在$Re\{x1\}$-和/或$Im\{x1\}$-轴上反射,

[0019]　　5、预失真(尤其对于组E的星座)。

[0020]　　因此,调制器还可使用通过围绕原点旋转角度,通过倒转所有星座点的位标签,通过交换所有星座点的位位置和/或在实数部分和/或虚数部分轴上反射,从来自任一组A、B、C、D或E的星座中获得的非均匀星座。例如,如果一个星座的具有用于16-QAM的位标签0010,那么所有第一位标签都可以倒转,以便这个点变成1010。进一步,通过任何其他简单操纵(例如,星座点位置凑整)所获得的星座通常被本发明覆盖。通过这些操作中的一个或多个,实现与在上面提及的四组中限定的星座的映射等效的映射。

[0021]　　在卫星传输的情况下,调制器可能也传输由所提出的星座点的预失真获得的不同星座点。这个预失真应可以用作在传输系统(具体而言,功率放大器)内的其他模块的非线性的对策。然而,传输系统的输出应对应于所提出的星座的传输,以便接收器可能假设传输了这些星座。

[0022]　　应注意的是,对于每个M-QAM,还可以考虑底层的sqrt(M)-PAM。进一步,应注意的是,在其他方面,在本发明中限定的这组星座包括更少的星座,例如,仅仅用于非衰落信道的星座、仅仅用于衰落信道的星座、仅仅用于所选择值M的星座、仅仅用于M-QAM或sqrt(M)-PAM的星座、和/或用于更少的SNR值的星座。换言之,在可用于供调制器选择并且随后使用的这组星座内,可包含更少的星座,即,可用于供调制器使用的这组星座可包括在发明中限定的一个或多个星座。因此,本公开还涉及一种编码和调制设备和方法,具有可使用的更小一组星座(如上所述)和/或更少的星座可用于特定的值M。

[0023]　　由M个星座点构成的QAM映射表示为M-QAM。在组A内概述这些星座。如果(均匀或非均匀)QAM允许分别编码和解码器两个维度(在该文献中,"同相"和"正交相位")中的每个,那么这个QAM称为N^2-QAM。这表示星座可以由两个N-PAM星座设计,每个维度具有一个星座。由于在M＝N^2时,但是在这两个维度不能分开时(通常是N-PSK的情况,例如,8-PSK,其中,8个点位于单位圆上),与N^2个点用于M-QAM相比,仅仅需要调查N个星座点,所以N^2-QAM对于ML解码具有明显更低的解码复杂度。此外,完全由星座的星座值的象限限定的QAM星座称为QQAM,从第一象限中获得星座值的其他三个象限。例如,由于具有对称性,所以正常的均匀方形QAM星座(UC)也是QQAM星座。在组C中概述这些QQAM星座。

[0024]　　然而,根据在本公开中考虑的实施方式的QAM星座的星座点不位于具有等距符号的规则网格上,而是位于优化位置上,依赖于编码速率。

[0025]　　根据本公开,考虑基于N-PAM优化的N^2-NUC优化,与星座点的数量的动态减少相结合,相对于不减少星座点的数量的N^2-NUC的性能,保证定义明确的性能。

[0026]　　考虑高达1024-QAM的星座尺寸,其中,能够具有大成形增益,尤其在高SNR区域中。通过动态减少(在下文中也称为压缩)彼此接近的星座点,星座点的数量以及因此所需要的储存和解码容量可大幅减少。在组B合D中概述这些星座。例如,为编码速率6/15优化的1024-Q-QAM星座可从1024减少为268星座点,而不明显影响性能。

[0027]　　应注意的是,在优选实施方式中限定的星座位置向量w不需要必须包含星座的星座点的第一象限的星座点,而是还可以包含这四个象限中的任一个象限的星座点。由于对称性(略微提供对称性,但是位标签不容易看到;星座点相对于象限总体上对称),这造成具有不同的位映射但是具有相同的性能的星座。因此,在本文中限定的表格中的星座位置向量w应视为具有不同的位映射但是具有相同的性能的全部4个对称星座的实例。

[0028]　　要理解的是,本公开的上述总体描述以及以下详细描述对本公开具有示例性,而非限制性。

附图说明

[0029]　　由于在结合附图考虑时,参照以下详细描述,更好地了解本公开的更完整的理解及其很多附随优点,所以容易获得本公开的更完整的理解及其很多附随优点,其中:

[0030]　　图1示出了根据本公开的编码和调制设备的实施方式;

[0031]　　图2示出了根据本公开的传输设备的实施方式;

[0032]　　图3示出了根据本公开的通信系统的实施方式;

[0033]　　图4示出了作为星座的简单实例的规则4-QAM星座;

[0034]　　图5A和图5B示出了8-PAM非均匀星座和64-QAM非均匀星座;

[0035]　　图6示出了通常限定星座点的64-QAM非均匀星座的星座;

[0036]　　图7示出了非均匀16-QQAM星座;

[0037]　　图8示出了说明非均匀N^2-QAM星座的性能的示图;

[0038]　　图9示出了根据本公开的实施方式的1D压缩的实例;

[0039]　　图10示出了根据本公开的实施方式的2D压缩的实例;

[0040]　　图11A至图11C示出了说明非均匀1024-QAM星座的示图;

[0041]　　图12A和图12B示出了说明非均匀64-QQAM星座的示图;

[0042]　　图13示出了组E的星座的示图；

[0043]　　图14示出了说明上述非均匀8进制QAM星座的成形增益的示图；以及

[0044]　　图15示出了优化了公开的星座的LDPC码的实例。

具体实施方式

[0045]　　现在，参照附图，其中，在这几幅图中，相似的参考数字表示相同或相应的部分，图1示出了根据本公开的编码和调制设备10的实施方式。该备包括：编码器11，将输入数据编码成单元字；以及调制器12，将所述单元字调制成非均匀星座的星座值。所述调制器12配置为根据星座的星座点的总数M和编码速率，使用来自几组星座中的一组星座的非均匀星座。下面更详细地解释那些不同组星座的细节。

[0046]　　在编码和调制设备10的其他实施方式中，可提供额外元件，例如，BCH编码器、LDPC编码器（其编码速率对由在本文中公开的调制选择和使用优选的星座有兴趣）、位交错器和/或多路分用器（用于将编码数据的位多路分用成单元字）。一些或所有这些元件可分离元件或者可能是编码器11的一部分。例如，在DVB系统的传输设备中通常使用的BICM装置可用作编码和调制设备10。

[0047]　　图2示出了根据本公开的传输设备20的实施方式，包括：在本文中提出的编码和调制设备21（在图1中由10参考），将输入数据编码和调制成星座值；转换器22，将所述星座值转换成要传输的一个或多个传输流；以及传输器23，传输所述一个或多个传输流。在示例性实施方式中，转换器22可包括一个或多个元件，例如，时间、单元和/或频率交错器、帧构造器、OFDM调制器等，例如，如在与DVB相关的各种标准中所描述的，并且如在即将推出的ATSC标准中在编码和调制设备中可提供的。根据其他标准（例如，DVB-S2或后续DVB-Sx标准）的其他编码和调制可不包括这些元件中的一个或多个。星座和星座值通常是预定的，并且例如，储存在星座存储器24内或者从外部源中检索。

[0048]　　在传输设备20的其他实施方式中，可提供额外元件，例如，输入处理单元、帧构造单元和/或OFDM生成单元，例如，如在DVB系统的传输设备中通常使用的。

[0049]　　图3示出了根据本公开的通信系统30的实施方式，包括在图2中显示的一个（或多个）传输设备20（Tx）以及一个或多个接收设备40、40'（Rx）。

[0050]　　接收设备40通常包括：接收器41，接收一个或多个传输流；解转换器42，将所接收的一个或多个传输流解转换成星座值；以及解调和解码设备43，将所述星座值解调和解码成输出数据。解调和解码设备43通常包括：解调器44，用于将非均匀星座的星座值解调成单元字；以及解码器45，用于将单元字解码成输出数据字，其中，根据星座的星座点的总数M和编码速率，从包括相同的预定星座的一组或几组星座中，选择非均匀星座，如在编码和调制设备10中所使用的。

[0051]　　优选的解调和解码考虑软价值，与硬决定值（0和1）相反。软价值通过不止两种状态（与在二进制（应）决定的情况中一样）表示连续分布的接收值（可能在A/D转换之后，包括量化）。原因在于，对于硬决定，NUC通常并非最佳。如今，BICM接收器无论如何都通常是软接收器。

[0052]　　通常，数据（例如，通信数据、广播数据等）通过传输信道50、50'从传输设备20中传输给一个或多个所述接收设备40。传输信道50、50'可以是单播信道、多播信道、广播信道，

并且可用作单向或双向信道(即,具有从接收设备到传输设备的返回信道)。

[0053] 在实施方式中,调制器12配置为根据星座的星座点的总数M、以dB为单位进行无误差解码所需要的信噪比SNR以及信道特征,使用非均匀星座。在广播应用中,通常不根据在接收器内的SNR,而是根据通过为预期的信道特征(例如,静态接收或多径衰落)所使用的信道代码(如果使用代码,例如,在DVB第二代传输系统的情况下,LDPC码)进行无误差解码所需要的SNR,选择星座。

[0054] 对于广播器,可具有权衡:使用小星座尺寸M和/或低编码速率R,允许稳健传输(也通过低SNR接收),但是系统的吞吐量随着$\log_2$(M)*R缩放。例如,具有编码速率R=3/4的16-QAM对于每个编码的QAM符号可以传输3个信息位。这造成较小的光谱效率。另一方面,高(光谱)效率需要大SNR。因此,星座应允许减小成功解码所需要的SNR,同时使效率恒定。这是优化星座的所谓的"成形增益"。

[0055] 通常,根据期望的有效载荷吞吐量以及FEC编码器的编码速率,选择星座点的总数M。用于典型的信道特征的无误差解码的SNR众所周知,例如,通过模拟。在广播中,不了解接收器的信道特征,即,选择折中。例如,在广播中,对于FEC编码器的每个编码速率,选择一个非均匀星座,优化用于作为所有信道特征的折中的SNR。

[0056] 传输器通常针对某个场景。例如,由于通常接收几个回声,所以通过电缆或卫星的广播传输将信道视为仅仅非衰落AWGN(合适的信道模型),而地面广播器将信道视为衰落信道,例如,通过瑞利分布。优选地,所提出的星座考虑最相关的信道特征。

[0057] 在另一个实施方式中,调制器12配置为根据星座的星座点的总数M、以dB为单位的信噪比SNR以及信道特征,自适应地选择非均匀星座,其中,从接收装置40中接收以dB为单位的所述信噪比SNR和信道特征,数据传输给该接收装置。星座的这种自适应选择通常仅仅可能在单播环境中通过返回信道进行。非均匀星座可调整,例如,在时域和/或频域中,例如,对于不同的OFDM子载波。

[0058] 信道特征描述信道的统计性能,例如,在传输器与接收器之间的传输信道的多径传播的程度。如果信道的特征在于没有多径传播,对应于AWGN信道,那么无误差解码所需要的SNR较低,即,必须为最佳性能相应地选择NUC。如果传输信道的特征在于强烈的多径传播,那么与没有多径传播的信道相比,无误差解码所需要的SNR更大,即,必须使用为更高的SNR优化的NUC。进一步,应优化NUC,考虑衰落特征,下面进行讨论。

[0059] 如上所述,根据期望的有效载荷吞吐量,选择星座的星座点的总数M。更大值M允许更高的数据吞吐量,但是需要更大的SNR,用于无误差接收。如果使用任何FEC编码器,那么这受到FEC编码器的编码速率的进一步影响。

[0060] 另一个解释(与优化任务密切相关)在于,应优化与具有某个编码速率的前向纠错码(例如,LDPC和/或BCH码)相结合的星座的性能。因此,对于各种代码,提出了编码速率优化的星座。另一个优化目标是容量。对于期望的SNR,例如,应保证15dB的SNR,选择M,其中,相应的优化的NUC产生最大容量。在一般情况下,对于低SNR,确实应选择低值M,反之亦然。但是从理论的角度来看,结果是高M通常最佳,例如,优选选择M=4096或M=1024,这是因为甚至对于低SNR,在几个点重叠时,优化的NUC"看起来(几乎)像"具有有效地更小M的星座。然而,调制和解调复杂度随着M的增大而增大,因此,考虑权衡。另一个目标在于,与使用"正常"(未优化的)星座的情况相比,减小BER(误码率)和/或FER(误帧率)和/或通过更低的SNR

实现相同的BER和/或FER。

[0061]　　在图4中显示了星座的简单实例。在此处,描述由星座点($e^{j\pi/4}$、$e^{j7\pi/4}$、$e^{3\pi/4}$、$e^{j5\pi/4}$)构成的规则4-QAM。平均符号功率是1(在此处,所有符号位于单位圆上)。以上符号向量($e^{j\pi/4}$、$e^{j7\pi/4}$、$e^{3\pi/4}$、$e^{j5\pi/4}$)要理解为第一条目($e^{j\pi/4}$)属于位向量00,第二条目($e^{j7\pi/4}$)属于位向量01,以此类推,即,这些条目属于具有更大值的位向量,其中,第一位位置是最高有效位(MSB),并且最后一个位位置是最低有效位(LSB)。这个4-QAM是N^2-QAM的特定情况,N=2。要注意的是,这个定义(作为N^2QAM)不仅仅要求N^2是平方数,而且星座对称并且可以由两个独立的N-PAM星座描述,在此处是2-PAM;同相部件(复杂符号的实数部分)是具有符号向量(1/sqrt(2)、-1/sqrt(2))的2-PAM,并且描述4-QAM的第一位,然而,正交相位部件(复杂符号的虚数部分)是相同的2-PAM,这次描述了4-QAM的第二位。进一步要注意的是,如果位标签根据通常应用(例如,在DVB系统中)的二进制反射的格雷映射,那么仅仅可以将N^2-QAM分解成两个N-PAM。

[0062]　　以上实例可以扩展为更高阶N^2-QAM,N>2。然后,底层N-PAM为一个部件描述第一、第三、第五位标签等,而为其他部件描述第二、第四、第六位标签等。

[0063]　　所有星座优选地完成功率限制,即,$\mathcal{P}_x = E_{x_l}[|x_l|^2] = \frac{1}{M}\sum_{l=0}^{M-1}|x_l|^2 \stackrel{!}{=} 1$,

[0064]　　其中,E[.]是期望算子,x_l是这组所有星座符号的特定符号。

[0065]　　优化了N^2-NUC,作为一个实施方式,N^2是16、64、256、1024(1k)。这表示优化这些星座,以允许规定的FEC编码速率具有最小BER/FER。对这些星座的限制在于,应该能够分成2个单独的一维PAM星座,允许在传输器上具有低复杂度映射并且在接收器上去映射。

[0066]　　作为一个实例,在此处描述的M=64NUC产生以下值(表格的实例可以产生这三个数,然后,在开头具有1(功率限制造成规范化),以此类推):

[0067]　　2.2794 4.6229 7.5291。

[0068]　　这表示正星座值是:

[0069]　　1 2.2794 4.6229 7.5291

[0070]　　(由于功率规范化,所以1是冗余,这在端部应用)。因此,符号向

[0071]　　量描述了底层1-dim.8-PAM NUC:

[0072]　　(1.6405 1.0073 0.2179 0.4967 -1.6405 -1.0073 -0.2179 -0.4967),

[0073]　　其中,这些值已经规范化为单位平均功率。

[0074]　　如前所述,第一条目(1.6405)对应于位标签000,下一个条目(1.0073)对应于001,以此类推。然后,由对称性获得2-dim.64-NUC,其中,NUC的同相和正交相位部件基于8-PAM NUC。

[0075]　　图5A和图5B描述了8-PAM NUC(图5A)和64-QAM NUC(图5B)。在整数((000→0,001→1,010→2等)中规定位标签。

[0076]　　下面,更详细地解释根据优化的自由度创建2-dim.NUC。

[0077]　　由于NUC的性能取决于优化NUC的SNR值,所以根据(FEC)编码速率,优选地执行彻底的选择,以实现最佳性能。如果已知信道特征,那么FEC会聚所需要的SNR值可由模拟确定。然后,为最佳性能选择为这个SNR值优化的NUC。如果在接收器上的SNR低于这个SNR解码阈值,那么星座并非最佳。然而,由于对于成功解码,容量无论如何都太低,所以这并非缺点。另一方面,如果在接收器上的SNR明显高于解码阈值,那么即使NUC对于这个SNR范围次

佳,充分量的容量也可用于成功解码。因此,NUC需要在FEC的瀑布区域(即,用于(准)无误差解码的解码阈值)上为SNR值优化。由于瀑布区域的SNR值取决于FEC的编码速率,所以为每个编码速率选择一个不同的NUC。

[0078]　用于(准)无误差解码的SNR值也取决于接收器的信道特征。例如,在AWGN信道内的DVB-T2LDPC码的无误差解码所需要的SNR是0.8dB,而在Rayleigh P1多径信道内需要2.5dB。因此,每个编码速率的所选的NUC在所有信道环境内并非最佳,并且在广播环境中,需要适合于在网络中的所有(或大部分)用户的权衡。在具有返回信道的点对点网络中,可根据在接收器内的测量的信道特征,选择最佳NUC。

[0079]　在下文中,提供关于非均匀QAM星座的定义的更多解释。使用非均匀QAM星座,调制每个输入单元字$(y_{0,q} \ldots y_{m-1,q})$(即,提供给调制器),以在规范化之前,提供星座点$z_q$,其中,m对应于每个QAM符号$m = \log_2(M)$的位数。应注意的是,在此处用于离散时间或子载波索引的参数q对应于参数k,如在上文中所使用的。在以下表格中,提供相关输入位$y_{0 \cdot m-1,q}$的每个组合的实数和虚数部件$Re(z_q)$和$Im(z_q)$的精确值,用于取决于NUC位置向量$u_{1 \ldots v}$的各种星座尺寸,这限定了非均匀星座的星座点位置。NUC位置向量u的长度由 $v = \dfrac{\sqrt{M}}{2} - 1$ 限定。

[0080]　在一个实例中,由NUC位置向量$(u_{1 \ldots 3}) = (2,5,6)$以及输入单元字$(y_{0,q} \ldots y_{m-1,q}) = (100111)$限定的64-QAM NUC的相应星座点$z_q$是$Re(z_q) = -u_2 = -5$和$Im(z_q) = u_1 = 2$。在图6中显示了这个NUC位置向量的整个星座,在相应的星座点上标记示例性输入单元字。

[0081]　非均匀星座的所产生的星座映射(也称为标签)在二进制反射格雷映射(标签)之后,即,相邻的星座点在仅仅一位中不同。星座点z_q的功率规范化,以便规范化的星座点f_q的期望值等于1,即,$E(|f_q|^2) = 1$。例如,均匀的16-QAM星座的规范化星座值f_q由 $f_q = \dfrac{z_q}{\sqrt{10}}$ 产生。

[0082]　以下表格限定了星座位置向量(在功率规范化之前)以及到星座点的数据单元字的位标签。

[0083]　16 QAM的实数部分的星座映射

y0,q y2,q	1 0	1 1	0 1	0 0	
Re(z$_q$)	-3	-1	1	3	均匀
	-u1	-1	1	u1	NUC

[0085]　16 QAM的虚数部分的星座映射

y1,q y3,q	1 0	1 1	0 1	0 0	
Im(z$_q$)	-3	-1	1	3	均匀
	-u1	-1	1	u1	NUC

[0087]　64 QAM的实数部分的星座映射

[0088]

y0,q	1	1	1	1	0	0	0	0	
y2,q	0	0	1	1	1	1	0	0	
y4,q	0	1	1	0	0	1	1	0	
Re(z_q)	-7	-5	-3	-1	1	3	5	7	均匀
	-u3	-u2	-u1	-1	1	u1	u2	u3	NUC

[0089]　64 QAM的虚数部分的星座映射

y0,q	1	1	1	1	0	0	0	0	
y2,q	0	0	1	1	1	1	0	0	
y4,q	0	1	1	0	0	1	1	0	
y6,q									
Im(z_q)	-7	-5	-3	-1	1	3	5	7	均匀
	-u3	-u2	-u1	-1	1	u1	u2	u3	NUC

[0090]

[0091]　256 QAM的实数部分的星座映射

y1,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
y3,q	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
y5,q	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
y7,q	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(z_q)	-15	-13	-11	-9	-7	-5	-3	-1	1	3	5	7	9	11	13	15	均匀
	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	1	u1	u2	u3	u4	u5	u6	u7	NUC

[0092]

[0093]　256 QAM的虚数部分的星座映射

y1,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
y3,q	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
y5,q	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
y7,q	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(z_q)	-15	-13	-11	-9	-7	-5	-3	-1	1	3	5	7	9	11	13	15	均匀
	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	1	u1	u2	u3	u4	u5	u6	u7	NUC

[0094]

[0095]　1024 QAM的实数部分的星座映射

Y0,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
y2,q y4,q y6,q y8,q	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Re(z_q)	-31	-29	-27	-25	-23	-21	-19	-17	-15	-13	-11	-9	-7	-5	-3	-1	均匀
	-u15	-u14	-u13	-u12	-u11	-u10	-u9	-u8	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	NUC

[0096]

Y0,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
y2,q y4,q y6,q y8,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	

[0097]

Re(z_q)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	均匀
	1	u1	u2	u3	u4	u5	u6	u7	u8	u9	u10	u11	u12	u13	u14	u15	NUC

[0098]　1024 QAM的虚数部分的星座映射

y1,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
y3,q y5,q y7,q y9,q	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(z_q)	-31	-29	-27	-25	-23	-21	-19	-17	-15	-13	-11	-9	-7	-5	-3	-1	均匀
	-u15	-u14	-u13	-u12	-u11	-u10	-u9	-u8	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	NUC

[0099]

y1,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
y3,q y5,q y7,q y9,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(z_q)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	均匀
	1	u1	u2	u3	u4	u5	u6	u7	u8	u9	u10	u11	u12	u13	u14	u15	NUC

[0100]　4096 QAM的实数部分的星座映射

[0101]

$Y_{0,q}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
$y_{2,q}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
$y_{4,q}$	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
$y_{6,q}$	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	
$y_{8,q}$	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	
$y_{10,q}$	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
$Re(z_q)$	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	-43	-41	-39	-37	-35	-33	均匀
	-u31	-u30	-u29	-u28	-u27	-u26	-u25	-u24	-u23	-u22	-u21	-u20	-u19	-u18	-u17	-u16	NUC
$Y_{0,q}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
$y_{2,q}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
$y_{4,q}$	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	
$y_{6,q}$	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	
$y_{8,q}$	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
$y_{10,q}$	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	

$Re(z_q)$	-31	-29	-27	-25	-23	-21	-19	-17	-15	-13	-11	-9	-7	-5	-3	-1	均匀
	-u15	-u14	-u13	-u12	-u11	-u10	-u9	-u8	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	NUC
$Y_{0,q}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
$y_{2,q}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
$y_{4,q}$	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
$y_{6,q}$	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	
$y_{8,q}$	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
$y_{10,q}$	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
$Re(z_q)$	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	均匀

[0102]

	1	u1	u2	u3	u4	u5	u6	u7	u8	u9	u10	u11	u12	u13	u14	u15	NUC
$Y_{0,q}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
$y_{2,q}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
$y_{4,q}$	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	
$y_{6,q}$	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	
$y_{8,q}$	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	
$y_{10,q}$	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
$Re(z_q)$	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	均匀
	u16	u17	u18	u19	u20	u21	u22	u23	u24	u25	u26	u27	u28	u29	u30	u31	NUC

[0103]　　　4096 QAM的虚数部分的星座映射

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[0104]

y1,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
y3,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
y5,q	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1		
y7,q y9,q y11,q	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0		
	0	0	1	1	1	0	0	1	1	1	0	0	0				
	0	1	1	0	0	1	1	0	0	1	1	0	0				
Im(z_q)	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	-43	-41	-39	-37	-35	-33	均匀
	-u31	-u30	-u29	-u28	-u27	-u26	-u25	-u24	-u23	-u22	-u21	-u20	-u19	-u18	-u17	-u16	NUC
y1,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
y3,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
y5,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
y7,q y9,q y11,q	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0		
	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0		

[0105]

	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(zq)	-31	-29	-27	-25	-23	-21	-19	-17	-15	-13	-11	-9	-7	-5	-3	-1	均匀
	-u15	-u14	-u13	-u12	-u11	-u10	-u9	-u8	-u7	-u6	-u5	-u4	-u3	-u2	-u1	-1	NUC
y1,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
y3,q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
y5,q	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		
y7,q y9,q y11,q	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0		
	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0		
	0	1	1	0	0	1	1	0	0	1	1	0	0				
Im(z_q)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	均匀
	1	u1	u2	u3	u4	u5	u6	u7	u8	u9	u10	u11	u12	u13	u14	u15	NUC
y1,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
y3,q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
y5,q	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
y7,q y9,q y11,q	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0		
	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0		
	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	
Im(z_q)	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	均匀
	u16	u17	u18	u19	u20	u21	u22	u23	u24	u25	u26	u27	u28	u29	u30	u31	NUC

[0106]　　在实施方式中，所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值，其中，所述调制器配置为根据星座的星座点的总数M和编码速率，使用来自组A星座的非均匀星座，这组星座包括由长度 v＝sqrt(M)/2-1 的星座位置向量u限定的一个或多个以下星座。

[0107]　　提出了在组A内包括的以下非均匀星座：

[0108]　A) 组A的M-QAM非均匀星座

[0109]　A1) 16-QAM NUC

[0110]

u/编码速率	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
u1	3.1169	3.1973	3.2334	3.2473	3.2436	3.2312	3.2149	3.1976

[0111]　A2) 64-QAM NUC

[0112]

u / 编码速率	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
u1	1.5409	2.1208	2.3945	2.6067	2.8505	2.912	2.9751	3.0032

[0113]

u2	3.5826	4.3237	4.6577	4.9074	5.1674	5.2201	5.2491	5.2489
u3	5.5069	6.8108	7.3475	7.7177	8.0398	8.068	8.0217	7.9528

[0114]　A3) 256-QAM NUC

[0115]

u/编码速率	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
u1	0.9918	0.9989	1.1155	1.3963	2.2282	2.6619	2.8437	2.9176
u2	2.2615	2.6086	2.8419	3.1795	4.1541	4.664	4.8758	4.956
u3	2.2873	2.7307	3.2659	3.9675	5.676	6.5386	6.8857	7.0096
u4	4.2761	4.6692	5.1383	5.9281	7.9072	8.8521	9.1906	9.282
u5	4.6871	5.3576	6.3082	7.4353	10.0292	11.2248	11.6157	11.6881
u6	6.5483	7.3828	8.4196	9.7825	12.8864	14.2018	14.5326	14.508
u7	8.6107	9.7612	11.0879	12.7927	16.5632	17.9894	18.1926	17.9984

[0116]　A4) 1024-QAM NUC

[0117]

u/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
u1	0.9997	1.0003	0.9994	1.0005	1.0023	1.0772	2.0789	2.5983	2.8638
u2	0.9916	1.0149	1.2742	2.0897	2.5667	2.8011	3.9147	4.5193	4.8422
u3	0.9911	1.0158	1.2749	2.0888	2.5683	2.9634	5.0664	6.1649	6.7392
u4	2.4349	2.6848	3.0323	3.9945	4.5468	4.8127	7.0579	8.2107	8.7961
u5	2.4346	2.6903	3.0371	3.9931	4.5636	5.1864	8.3596	9.9594	10.7659
u6	2.486	2.882	3.6813	5.3843	6.2876	6.7838	10.2901	12.0321	12.8844
u7	2.4864	2.8747	3.6718	5.3894	6.4073	7.5029	11.834	13.9574	14.98
u8	4.4576	4.7815	5.5854	7.5206	8.4282	9.238	14.0092	16.2598	17.2736
u9	4.4646	4.7619	5.5804	7.6013	8.8692	10.32	15.8419	18.4269	19.5552
u10	4.9706	5.5779	6.8559	9.3371	10.6112	12.0115	18.1472	20.9273	22.0472
u11	4.9552	5.6434	7.0475	9.8429	11.6946	13.5356	20.4243	23.4863	24.6335
u12	6.7222	7.3854	8.8436	11.9255	13.7334	15.6099	23.2381	26.4823	27.5337
u13	7.0327	7.8797	9.7042	13.3962	15.6274	17.7524	26.2322	29.7085	30.6651
u14	8.5382	9.635	11.727	15.8981	18.2933	20.5256	29.973	33.6247	34.3579
u15	10.4411	11.7874	14.2894	19.1591	21.7769	24.1254	34.7629	38.5854	38.9603

[0118]　A5) 4096-QAM NUC

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[0119]

u / 编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
u1	1.0004	0.9998	0.9988	0.9999	0.9999	1.0009	1.0043	2.031	2.7135
u2	1.0009	0.9984	0.9996	1.0004	1.0364	2.272	2.7379	3.8448	4.6426
u3	1.0008	0.9983	0.998	1.0013	1.037	2.2732	2.746	4.8763	6.3617
u4	0.9953	1.2356	2.0374	2.5341	2.7604	4.1332	4.6828	6.8402	8.3598
u5	0.9956	1.2354	2.0374	2.5347	2.7604	4.1327	4.7079	7.912	10.0999
u6	0.9956	1.2372	2.0374	2.5328	2.8536	5.4651	6.4365	9.7373	12.0627
u7	0.9957	1.2366	2.0366	2.5362	2.8534	5.4655	6.5065	10.8859	13.8413
u8	2.5769	2.9864	3.93	4.5077	4.7342	7.4777	8.4445	12.8891	15.9032
u9	2.5774	2.9867	3.931	4.5089	4.7345	7.478	8.6065	14.1091	17.7263
u10	2.5794	2.9906	3.9297	4.5202	5.0028	8.9382	10.254	15.9704	19.7625
u11	2.5793	2.9912	3.9294	4.5204	5.0025	8.9384	10.5627	17.2797	21.6431
u12	2.6756	3.5858	5.277	6.2318	6.6184	10.9166	12.3025	19.2948	23.7857
u13	2.6764	3.5859	5.2757	6.2314	6.6189	10.9185	12.8281	20.7185	25.7402
u14	2.6747	3.577	5.2792	6.3219	7.215	12.5855	14.3539	22.6727	27.9051
u15	2.6746	3.5775	5.2795	6.3212	7.2149	12.5908	15.1126	24.2439	29.9595
u16	4.6252	5.474	7.4011	8.3718	8.9581	14.7944	16.7817	26.3916	32.2702
u17	4.6243	5.4757	7.3997	8.372	8.9585	14.8184	17.7277	28.1062	34.4336
u18	4.6188	5.4675	7.4646	8.7429	9.94	16.6805	19.2664	30.2335	36.7993
u19	4.62	5.4681	7.4665	8.7398	9.9394	16.8025	20.3968	32.1242	39.1019
u20	5.246	6.7028	9.1828	10.5001	11.5978	18.9131	22.1002	34.4644	41.6513
u21	5.2441	6.7104	9.1919	10.4999	11.6041	19.325	23.4306	36.5679	44.1297
u22	5.2556	6.8816	9.641	11.4966	12.9965	21.168	25.1704	39.027	46.8305
u23	5.2584	6.8738	9.6278	11.5018	13.088	22.0945	26.7556	41.4123	49.5435
u24	7.0279	8.6613	11.7039	13.483	14.878	24.1425	28.7536	44.2002	52.5353

[0120]

u25	7.0459	8.6344	11.6913	13.5672	15.2586	25.575	30.6214	46.9287	55.5551
u26	7.4305	9.4101	12.9619	15.1187	16.8096	27.6541	32.829	50.0315	58.8707
u27	7.3941	9.5027	13.2128	15.6519	17.8237	29.6567	35.1146	53.2678	62.3471
u28	8.8516	11.1654	15.161	17.6098	19.6965	32.2679	37.8272	57.0085	66.2558
u29	9.1461	11.7322	16.204	19.1046	21.4926	35.0526	40.7685	61.0847	70.5087
u30	10.4828	13.5243	18.4804	21.5413	23.9997	38.6023	44.3725	65.9903	75.5397
u31	12.3176	15.7967	21.4433	24.7641	27.2995	43.2007	48.9596	72.1193	81.8379

[0121]　　　在下文中,描述Q-NUC优化,即,从单个象限中获得的二维星座的优化。N^2-QAM的上述优化需要优化sqrt(M)/2-1自由度。由于二维QAM星座的优化具有2*M自由度(每个星座点的实数和虚数部分),所以优化明显更耗时。由于16-QAM情况的最佳2D星座相对于星座的不同象限对称,所以可以应用以下简化,以描述这些星座:仅仅描述星座的星座点的总数的第一象限(例如,星座的第一象限),将表格项目的数量从2*M减少为M/2。从第一象限中可以获得剩余象限,造成所谓的QQAM星座。然而,应确保保持星座点的位标签的性能。例如,如果第一象限是格雷映射,提供属于相邻星座点的位标签的1的汉明距离,那么必须为QQAM星座的剩余象限确保相同内容。

[0122]　　　为了独特地限定16-QQAM,仅仅需要8个实值,对应于表示第一象限的星座点的4个复值。根据QQAM方法,优化了16-QQAM、32-QQAM、64QQAM、128-QQAM、256-QQAM以及1024-QQAM,明显胜过N^2-QAM星座。所提出的QQAM优化方法可以用于任何信道条件,例如,AWGN信道以及衰落信道。

[0123]　　　对于其他系统,例如,根据DVB-S2或Sx标准的卫星通信系统,优化了M=8星座点的向左。这些星座不能仅仅由星座点的象限描述。确切地说,明确描述全部9个复值。

[0124]　　　在实施方式中,所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值,其中,所述调制器配置为根据星座的星座点的总数M和编码速率,使用来自组C或组D星座的非均匀星座,这组星座包括一个或多个以下星座,其中,所述星座点由星座位置矢量$w_{0..b-1}$限定,b=M/4,其中,

[0125]　　　第一象限的星座点$x_{0..b-1}$限定为$x_{0..b-1}=w_{0...b-1}$;

[0126]　　　第二象限的星座点$x_{b..2b-1}$限定为$x_{b..2b-1}=conj(w_{0...b-1})$;

[0127]　　　第三象限的星座点$x_{2b..3b-1}$限定为$x_{2b..3b-1}=-conj(w_{0...b-1})$;并且

[0128]　　　第四象限的星座点$x_{3b..4b-1}$限定为$x_{3b..4b-1}=-w_{0...b-1}$,

[0129] 其中,conj是复共轭。

[0130] 提出了在组C内包括的以下非均匀星座(i＝srqt(-1)在虚数单元内):

[0131] C)组C的M-QAM非均匀星座

[0132] C1)16-QQAM NUC

[0133]

w/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w0	1.1928+0.5309i	0.2663+0.4530i	0.2626+0.4634i	0.2575+0.4819i	0.2474+0.5061i	0.6186+0.2544i	0.2881+0.9576i	-0.2949+0.2949i	-0.2999+0.2999i
w1	0.5309+1.1928i	0.4530+0.2663i	0.4634+0.2626i	0.4819+0.2575i	0.5061+0.2474i	0.2213+0.4481i	0.2881+0.2881i	-0.9555+0.2949i	-0.9540+0.2999i
w2	0.4633+0.28	0.5115+1.20	0.5023+1.21	0.4951+1.20	0.4909+1.20	1.2080+0.53	0.9576+0.95	-0.2949+0.95	-0.2999+0.95
w3	0.2842+0.46	1.2092+0.51	1.2100+0.50	1.2068+0.49	1.2007+0.49	0.4487+1.16	0.9576+0.28	-0.9555+0.95	-0.9540+0.95

[0134] C2)64-QQAM NUC

[0135]

w/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w0	1.0257+0.5960i	0.5656+0.9499i	0.2925+1.4892i	0.2920+1.4827i	0.2978+1.4669i	0.2878+1.4388i	-0.4661+0.9856i	1.0519-0.5188i	1.0854-0.5394i
w1	1.2181+0.7476i	0.2750+1.0676i	0.8449+1.2622i	0.8411+1.2563i	0.8421+1.2355i	0.8133+1.2150i	-0.4329+0.6825i	0.7146-0.4532i	0.7353-0.4623i
w2	1.1509+0.3069i	0.8202+1.2651i	0.2351+1.0196i	0.2174+1.0211i	0.2135+1.0389i	0.2219+1.0386i	-0.1534+1.0366i	1.0500-0.1642i	1.0474-0.1695i
w3	1.3888+0.3325i	0.3011+1.4529i	0.5555+0.8926i	0.5702+0.8798i	0.6055+0.8654i	0.6145+0.8494i	-0.1340+0.6796i	0.7170-0.1473i	0.7243-0.1504i
w4	0.5961+1.0257i	0.9500+0.5641i	1.4892+0.2925i	1.4827+0.2920i	1.4685+0.2859i	1.4656+0.2931i	-0.8178+1.1580i	1.0952-0.9115i	1.0693-0.9408i
w5	0.7476+1.2181i	1.0666+0.2744i	1.2622+0.8449i	1.2563+0.8410i	1.2516+0.8201i	1.2278+0.8230i	-0.8132+0.6913i	0.6868-0.8108i	0.7092-0.8073i
w6	0.3069+1.1510i	1.2657+0.8178i	1.0196+0.2351i	1.0211+0.2174i	1.0279+0.1981i	1.0649+0.2069i	-0.2702+1.4529i	1.4480-0.2403i	1.4261-0.2216i
w7	0.3325+1.3888i	1.4521+0.3005i	0.8926+0.5555i	0.8798+0.5702i	0.8857+0.5642i	0.8971+0.5677i	-1.2125+0.7097i	0.6406-1.1995i	0.6106-1.1783i
w8	0.4969+0.2870i	0.3004+0.5417i	0.1558+0.3029i	0.1475+0.3040i	0.1338+0.3767i	0.1177+0.4119i	-0.4145+0.1264i	0.1325-0.3998i	0.1392-0.4078i
w9	0.4161+0.2486i	0.2430+0.5607i	0.1712+0.3021i	0.1691+0.3028i	0.1752+0.3563i	0.2516+0.3998i	-0.4179+0.3948i	0.4122-0.4120i	0.4262-0.4205i
w10	0.4969+0.2500i	0.2094+0.3579i	0.2075+0.6586i	0.1871+0.6855i	0.1756+0.7261i	0.1559+0.7442i	-0.1353+0.1272i	0.1374-0.1295i	0.1407-0.1336i
w11	0.4084+0.2266i	0.1946+0.3566i	0.3354+0.6030i	0.3563+0.6126i	0.4023+0.6180i	0.4328+0.5954i	-0.1359+0.3877i	0.4185-0.1357i	0.4265-0.1388i
w12	0.2870+0.4969i	0.5410+0.3002i	0.3029+0.1558i	0.3040+0.1475i	0.2713+0.1337i	0.1678+0.1166i	-0.7330+0.1416i	0.1369-0.7073i	0.1388-0.7057i
w13	0.2486+0.4162i	0.5596+0.2431i	0.3021+0.1712i	0.3028+0.1691i	0.2748+0.1572i	0.3325+0.1582i	-0.7177+0.4018i	0.4044-0.7057i	0.4197-0.7206i
w14	0.2500+0.4969i	0.3569+0.2094i	0.6586+0.2075i	0.6855+0.1871i	0.6840+0.1578i	0.7408+0.1355i	-1.0718+0.1686i	0.1677-1.0405i	0.1682-1.0316i
w15	0.2266+0.4084i	0.3553+0.1948i	0.6030+0.3354i	0.6126+0.3563i	0.6145+0.3556i	0.6200+0.3227i	-1.4375+0.2732i	0.2402-1.4087i	0.2287-1.3914i

[0136] C3)256-QQAM NUC

[0137]

w/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w0	-0.3495+1.754	0.6800+1.692	0.7280+1.638	1.0804+1.378	1.6350+0.159	1.6097+0.154	0.1512+1.576	1.1980+1.154	1.1014+1.167
w1	-0.2804+1.429	0.3911+1.364	0.4787+1.349	1.0487+0.986	1.5776+0.473	1.5549+0.460	0.4510+1.525	0.9192+1.208	0.8557+1.242
w2	-0.2804+1.429	0.2191+1.752	0.2417+1.787	1.6464+0.742	1.3225+0.132	1.3226+0.129	0.1269+1.315	1.2778+0.852	1.2957+0.803
w3	-0.2635+1.361	0.2274+1.420	0.1966+1.447	1.3245+0.941	1.2742+0.392	1.2772+0.382	0.3773+1.272	1.0390+0.925	1.0881+0.895
w4	-0.9918+1.488	0.8678+1.248	0.9185+1.249	0.7198+1.242	1.2901+1.049	1.2753+1.024	1.0045+1.253	0.6057+1.220	0.5795+1.211
w5	-0.8109+1.211	0.7275+1.166	0.7448+1.152	0.8106+1.004	1.4625+0.774	1.4434+0.754	0.7386+1.416	0.7371+1.421	0.6637+1.421
w6	-0.8109+1.211	0.8747+1.047	0.9536+0.951	0.5595+1.031	1.0382+0.862	1.0491+0.847	0.8392+1.050	0.6678+1.002	0.6930+1.008

[0138]

w/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w7	-0.7744+1.151	0.7930+1.040	0.8912+0.946	0.6118+0.972	1.1794+0.637	1.1861+0.625	0.6172+1.184	0.8412+0.944	0.8849+0.964
w8	-0.2340+0.985	0.2098+0.976	0.2553+0.999	1.6768+0.200	0.9430+0.110	0.9326+0.097	0.0939+0.931	1.2128+0.537	1.2063+0.511
w9	-0.2349+1.011	0.2241+1.045	0.2988+1.068	0.9997+0.684	0.9069+0.282	0.8962+0.280	0.2781+0.897	1.0048+0.516	1.0059+0.495
w10	-0.2349+1.011	0.1858+0.987	0.1656+1.028	1.4212+0.476	1.0854+0.113	1.1044+0.110	0.1093+1.107	1.4321+0.634	1.4171+0.590
w11	-0.2356+1.037	0.1901+1.065	0.1779+1.114	1.1479+0.631	1.0441+0.329	1.0648+0.326	0.3230+1.070	1.0245+0.715	1.0466+0.693
w12	-0.5320+0.868	0.5547+0.831	0.5802+0.804	0.6079+0.656	0.7273+0.616	0.7325+0.607	0.6074+0.740	0.6384+0.607	0.6639+0.628
w13	-0.5496+0.887	0.5479+0.865	0.5788+0.853	0.7284+0.695	0.8177+0.484	0.8260+0.455	0.4499+0.832	0.8175+0.568	0.8353+0.585
w14	-0.5496+0.887	0.6073+0.818	0.6616+0.761	0.5724+0.703	0.8504+0.721	0.8744+0.715	0.7128+0.885	0.6568+0.780	0.6879+0.802
w15	-0.5674+0.905	0.5955+0.842	0.6574+0.787	0.6302+0.725	0.9638+0.540	0.9882+0.530	0.5259+0.995	0.8311+0.745	0.8634+0.762
w16	-1.7549+0.349	1.4070+0.179	1.4079+0.135	0.1457+1.401	0.1658+1.674	0.1646+1.640	1.6163+0.163	0.1349+1.474	0.1213+1.436
w17	-1.4293+0.280	1.7227+0.290	1.7492+0.285	0.1866+1.734	0.4907+1.608	0.4867+1.574	1.5486+0.481	0.1105+1.230	0.1077+1.209
w18	-1.4293+0.280	1.3246+0.256	1.3108+0.273	0.1174+1.103	0.1322+1.363	0.1363+1.357	1.3596+0.138	0.0634+0.979	0.0651+0.980
w19	-1.3614+0.263	1.3636+0.365	1.3393+0.403	0.1095+1.013	0.3929+1.310	0.4023+1.302	1.3018+0.407	0.1891+1.019	0.2009+1.011
w20	-1.4880+0.991	1.3708+1.283	1.3733+1.259	0.4357+1.363	1.0646+1.287	1.0542+1.258	1.2347+1.037	0.4142+1.446	0.3764+1.426
w21	-1.2116+0.810	1.6701+0.840	1.6601+0.819	0.5853+1.682	0.7949+1.477	0.7875+1.445	1.4193+0.776	0.3323+1.227	0.3237+1.213
w22	-1.2116+0.810	1.1614+0.790	1.1559+0.724	0.3439+1.068	0.8555+1.054	0.8687+1.040	1.0335+0.873	0.4998+0.982	0.5205+0.981
w23	-1.1516+0.774	1.2241+0.736	1.2163+0.689	0.3234+0.996	0.6363+1.206	0.6502+1.195	1.1905+0.656	0.3467+1.020	0.3615+1.016
w24	-0.9857+0.234	0.9769+0.186	0.9601+0.154	0.1092+0.617	0.1088+0.953	0.0982+0.974	0.9948+0.100	0.0680+0.650	0.0715+0.659
w25	-1.0112+0.234	0.9452+0.205	0.9220+0.168	0.1074+0.630	0.2464+0.927	0.2842+0.934	0.9492+0.295	0.2016+0.646	0.2116+0.659
w26	-1.0112+0.234	1.0100+0.218	1.0004+0.189	0.1109+0.699	0.1124+1.132	0.1142+1.144	1.1596+0.118	0.0719+0.807	0.0729+0.813
w27	-1.0372+0.235	0.9795+0.241	0.9581+0.204	0.1076+0.734	0.3160+1.091	0.3385+1.097	1.1091+0.346	0.2088+0.814	0.2158+0.824
w28	-0.8680+0.532	0.8241+0.485	0.8067+0.437	0.3291+0.626	0.5707+0.766	0.6062+0.746	0.7476+0.620	0.4809+0.629	0.5036+0.646
w29	-0.8870+0.549	0.8232+0.483	0.8071+0.431	0.3126+0.637	0.4490+0.846	0.4607+0.853	0.8645+0.471	0.3374+0.641	0.3526+0.657
w30	-0.8870+0.549	0.8799+0.539	0.8603+0.494	0.3392+0.699	0.6961+0.885	0.7263+0.876	0.8777+0.738	0.4955+0.800	0.5185+0.808
w31	-0.9058+0.567	0.8796+0.535	0.8598+0.487	0.3202+0.728	0.5229+1.003	0.5450+1.006	1.0128+0.557	0.3431+0.814	0.3593+0.824
w32	-0.1570+0.308	0.1376+0.334	0.1222+0.430	0.9652+0.106	0.3237+0.084	0.2655+0.074	0.0723+0.254	1.2731+0.110	1.2545+0.101
w33	-0.1564+0.306	0.1383+0.329	0.1222+0.427	0.9075+0.166	0.3228+0.086	0.2664+0.075	0.0761+0.256	1.0794+0.097	1.0676+0.095
w34	-0.1564+0.306	0.1363+0.332	0.1213+0.429	0.9724+0.117	0.4582+0.112	0.4571+0.085	0.0729+0.451	1.5126+0.125	1.4782+0.116
w35	-0.1557+0.303	0.1370+0.327	0.1213+0.426	0.9186+0.175	0.4545+0.125	0.4516+0.106	0.1145+0.443	0.9029+0.085	0.8981+0.088
w36	-0.1726+0.307	0.1655+0.326	0.1716+0.398	0.6342+0.137	0.2844+0.129	0.2559+0.179	0.2114+0.244	0.5429+0.069	0.5518+0.069
w37	-0.1716+0.305	0.1656+0.322	0.1708+0.397	0.6550+0.149	0.2853+0.130	0.2586+0.177	0.2043+0.250	0.6795+0.055	0.6903+0.055
w38	-0.1716+0.305	0.1634+0.324	0.1707+0.397	0.6290+0.139	0.3734+0.256	0.3592+0.281	0.3079+0.351	0.5628+0.194	0.5742+0.198
w39	-0.1707+0.302	0.1636+0.320	0.1700+0.396	0.6494+0.150	0.3799+0.251	0.3728+0.265	0.2673+0.381	0.7326+0.141	0.7374+0.156
w40	-0.2066+0.635	0.1779+0.684	0.1825+0.746	1.3127+0.124	0.7502+0.113	0.7706+0.092	0.0813+0.772	1.2283+0.321	1.2378+0.304
w41	-0.2071+0.640	0.1828+0.684	0.1898+0.737	0.9572+0.434	0.7325+0.208	0.7407+0.226	0.2345+0.741	1.0269+0.326	1.0518+0.303
w42	-0.2071+0.640	0.1745+0.682	0.1588+0.752	1.2403+0.263	0.6473+0.113	0.6180+0.092	0.0756+0.618	1.4663+0.371	1.4584+0.351
w43	-0.2075+0.646	0.1793+0.682	0.1666+0.741	1.0254+0.413	0.6339+0.170	0.6019+0.165	0.1815+0.594	0.9085+0.247	0.9107+0.260
w44	-0.3219+0.585	0.3547+0.600	0.3967+0.610	0.6096+0.421	0.5902+0.485	0.6007+0.498	0.5118+0.603	0.6160+0.454	0.6321+0.472
w45	-0.3250+0.589	0.3593+0.601	0.3971+0.609	0.6773+0.428	0.6355+0.418	0.6673+0.392	0.3821+0.680	0.7818+0.424	0.7880+0.439
w46	-0.3250+0.589	0.3576+0.599	0.4022+0.596	0.5995+0.410	0.4968+0.394	0.4786+0.393	0.4145+0.473	0.5938+0.317	0.6045+0.327
w47	-0.3285+0.593	0.3624+0.599	0.4020+0.595	0.6531+0.410	0.5231+0.364	0.5176+0.339	0.3230+0.534	0.7600+0.285	0.7629+0.296
w48	-0.3085+0.157	0.2697+0.144	0.2177+0.130	0.1250+0.115	0.0872+0.139	0.0757+0.100	0.0858+0.073	0.0595+0.070	0.0596+0.073
w49	-0.3061+0.156	0.2704+0.143	0.2168+0.130	0.1252+0.115	0.0871+0.139	0.0753+0.100	0.0860+0.072	0.1722+0.070	0.1767+0.073
w50	-0.3061+0.156	0.2644+0.144	0.2184+0.130	0.1245+0.115	0.0928+0.397	0.0777+0.478	0.5212+0.069	0.0599+0.211	0.0612+0.219
w51	-0.3037+0.155	0.2650+0.143	0.2174+0.130	0.1247+0.115	0.0937+0.397	0.0867+0.475	0.5118+0.089	0.1748+0.211	0.1815+0.219
w52	-0.3073+0.172	0.2763+0.163	0.2264+0.153	0.3768+0.124	0.1053+0.149	0.1023+0.224	0.2611+0.094	0.4134+0.070	0.4218+0.071
w53	-0.3050+0.171	0.2768+0.162	0.2255+0.153	0.3707+0.123	0.1052+0.149	0.1010+0.224	0.2628+0.089	0.2935+0.070	0.2978+0.072
w54	-0.3050+0.171	0.2715+0.163	0.2269+0.154	0.3779+0.126	0.1938+0.362	0.1950+0.391	0.4159+0.214	0.4231+0.206	0.4337+0.211
w55	-0.3028+0.170	0.2719+0.161	0.2260+0.154	0.3717+0.125	0.1909+0.362	0.1881+0.396	0.4287+0.192	0.2979+0.210	0.3057+0.216
w56	-0.6354+0.206	0.6488+0.169	0.6100+0.139	0.1161+0.369	0.1091+0.765	0.0930+0.812	0.8427+0.084	0.0638+0.500	0.0667+0.512
w57	-0.6404+0.207	0.6462+0.170	0.6146+0.137	0.1157+0.364	0.1699+0.753	0.2215+0.784	0.8036+0.244	0.1905+0.496	0.2008+0.509
w58	-0.6404+0.207	0.6456+0.174	0.5973+0.141	0.1176+0.346	0.1054+0.597	0.0937+0.651	0.6933+0.078	0.0612+0.355	0.0625+0.365
w59	-0.6460+0.207	0.6431+0.175	0.6021+0.140	0.1171+0.342	0.1230+0.594	0.1540+0.636	0.6649+0.179	0.1810+0.353	0.1899+0.364
w60	-0.5854+0.321	0.5854+0.318	0.5671+0.298	0.3530+0.389	0.4294+0.636	0.4810+0.630	0.6321+0.504	0.4630+0.476	0.4818+0.494
w61	-0.5893+0.325	0.5862+0.316	0.5699+0.295	0.3422+0.380	0.3744+0.674	0.3856+0.703	0.7279+0.389	0.3231+0.489	0.3380+0.505
w62	-0.5893+0.325	0.5864+0.327	0.5622+0.305	0.3614+0.375	0.3224+0.523	0.3527+0.523	0.5265+0.375	0.4416+0.339	0.4571+0.349
w63	-0.5937+0.328	0.5873+0.325	0.5648+0.301	0.3509+0.365	0.3016+0.534	0.3100+0.555	0.5885+0.307	0.3083+0.349	0.3216+0.359

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[0140]

w / 编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w0	1.9734+0.6475i	1.3555+1.1873i	0.1119+1.7802i	0.0966+1.7257i	0.1003+1.7258i	1.7268+0.8306i	0.0827+1.7001i	1.6707+0.0830i	0.0862+1.6154i
w1	1.7794+0.9784i	1.0871+1.4324i	0.2324+2.0028i	0.1799+1.9540i	0.1722+1.9393i	1.4295+1.1791i	0.2495+1.7069i	1.6596+0.2486i	0.2532+1.5973i
w2	0.4642+1.8997i	1.5003+1.4954i	0.1416+1.5629i	0.1216+1.5846i	0.0956+1.5505i	1.5265+0.9329i	0.0759+1.5315i	1.5191+0.0748i	0.0628+1.4840i
w3	0.8851+1.9829i	1.1127+1.7206i	0.1594+1.5242i	0.2925+1.5646i	0.2621+1.5384i	1.3311+0.9796i	0.2264+1.5296i	1.5087+0.2253i	0.1933+1.4746i
w4	0.2458+1.4077i	0.2080+2.0408i	0.8323+1.8356i	0.7016+1.7899i	0.6393+1.7656i	1.0476+1.3141i	0.5781+1.6238i	1.5860+0.5707i	0.5623+1.5170i
w5	0.2330+1.3704i	0.7958+1.4948i	0.5102+1.8340i	0.4407+1.8294i	0.3969+1.7846i	1.2433+1.3224i	0.4153+1.6700i	1.6299+0.4118i	0.4115+1.5641i
w6	0.2534+1.4887i	0.5864+1.9337i	0.4029+1.5128i	0.6347+1.5255i	0.6050+1.5226i	1.0060+1.1520i	0.5222+1.4586i	1.4405+0.5184i	0.4717+1.4136i
w7	0.2390+1.4079i	0.7534+1.6241i	0.4052+1.5296i	0.4512+1.5701i	0.4221+1.5525i	1.1831+1.1052i	0.3761+1.5021i	1.4814+0.3733i	0.3318+1.4521i
w8	2.0528+0.2197i	1.0007+1.0906i	0.1148+1.2394i	0.0862+1.3505i	0.0799+1.3199i	1.6816+0.6120i	0.0654+1.2745i	1.2786+0.0635i	0.0573+1.2656i
w9	1.6003+1.3185i	0.9660+1.1761i	0.1154+1.2420i	0.2378+1.3237i	0.2425+1.3020i	1.1961+0.7851i	0.1916+1.2647i	1.2678+0.1901i	0.1750+1.2589i
w10	0.1805+2.0047i	0.9193+1.0471i	0.1214+1.2990i	0.0908+1.3996i	0.0833+1.3795i	1.4907+0.7274i	0.0709+1.3936i	1.3905+0.0691i	0.0712+1.3686i
w11	1.3579+1.6516i	0.8984+1.1061i	0.1225+1.3035i	0.2515+1.3739i	0.2487+1.3670i	1.3242+0.7939i	0.2071+1.3855i	1.3801+0.2066i	0.2106+1.3583i
w12	0.1550+1.4302i	0.8715+1.0845i	0.3454+1.2010i	0.5334+1.2483i	0.5352+1.2272i	0.9444+0.8682i	0.4344+1.2067i	1.2103+0.4364i	0.4128+1.2072i
w13	0.1532+1.3846i	0.8468+1.2089i	0.3437+1.2030i	0.4112+1.2843i	0.3974+1.2734i	1.0778+0.8297i	0.3137+1.2425i	1.2453+0.3150i	0.2939+1.2391i
w14	0.1492+1.5422i	0.8508+1.0556i	0.3550+1.2490i	0.5634+1.3178i	0.5666+1.3364i	0.9728+1.0019i	0.4756+1.3240i	1.3174+0.4751i	0.4756+1.2940i
w15	0.1517+1.4313i	0.8263+1.1474i	0.3538+1.2523i	0.4201+1.3450i	0.4117+1.3592i	1.1117+0.9612i	0.3426+1.3612i	1.3555+0.3427i	0.3462+1.3333i
w16	0.7168+1.4422i	1.3097+0.8498i	1.0272+1.4142i	1.3853+1.1272i	1.4270+1.2101i	0.7139+1.4630i	1.1609+1.2807i	1.2549+1.1333i	1.1029+1.1970i
w17	0.7660+1.4662i	1.2703+0.7763i	0.9293+1.2912i	1.3369+1.3509i	1.2720+1.3913i	0.7740+1.6553i	1.0285+1.3890i	1.3567+1.0038i	0.9805+1.3006i
w18	0.7079+1.5478i	1.2081+0.7277i	1.0481+1.1977i	1.2114+1.0355i	1.2297+1.0783i	0.6485+1.3230i	1.0435+1.1532i	1.1390+1.0306i	0.9776+1.1396i
w19	0.7980+1.5832i	1.2071+0.6996i	1.0032+1.1946i	1.1082+1.1877i	1.1069+1.2225i	0.6195+1.1967i	0.9255+1.2490i	1.2324+0.9142i	0.8621+1.2273i
w20	0.5674+1.2974i	1.0048+0.6022i	0.8044+1.5410i	0.9388+1.6673i	0.8723+1.6736i	0.8720+1.3702i	0.7336+1.5577i	1.5191+0.7201i	0.7053+1.4577i
w21	0.5570+1.2867i	1.0126+0.5967i	0.7504+1.3903i	1.1497+1.5199i	1.0846+1.5470i	0.9942+1.5551i	0.8851+1.4823i	1.4492+0.8682i	0.8463+1.3878i
w22	0.5617+1.3143i	1.0323+0.6017i	0.6179+1.4465i	0.8175+1.4408i	0.7883+1.4518i	0.8479+1.1984i	0.6624+1.4006i	1.3816+0.6559i	0.6073+1.3617i
w23	0.5529+1.2989i	1.0417+0.5962i	0.6325+1.4075i	0.9821+1.3219i	0.9583+1.3483i	0.7405+1.1635i	0.7974+1.3323i	1.3154+0.7901i	0.7380+1.3004i
w24	0.8742+1.2358i	1.0660+0.8517i	0.8146+1.0099i	0.9456+0.9078i	0.9564+0.8979i	0.5584+0.9220i	0.8662+0.9554i	0.9559+0.8672i	0.8450+0.9697i
w25	1.0042+1.2986i	1.0641+0.8183i	0.8127+1.0327i	0.8986+0.9677i	0.8843+0.9882i	0.6047+0.9153i	0.7681+1.0353i	1.0355+0.7698i	0.7464+1.0441i
w26	0.8860+1.2440i	1.0285+0.8226i	0.8473+1.0124i	1.0292+0.9494i	1.0738+0.9718i	0.5599+1.0238i	0.9483+1.0473i	1.0408+0.9445i	0.9365+1.0264i
w27	1.0594+1.3586i	1.0409+0.7932i	0.8449+1.0337i	0.9610+1.0336i	0.9788+1.0896i	0.6007+1.0581i	0.8407+1.1336i	1.1266+0.8383i	0.8308+1.1108i
w28	0.7008+1.1590i	0.9638+0.7014i	0.5913+1.1381i	0.6851+1.1662i	0.6658+1.1650i	0.8173+0.9002i	0.5509+1.1608i	1.1624+0.5530i	0.5291+1.1627i
w29	0.6902+1.1593i	0.9746+0.6713i	0.6094+1.1512i	0.7736+1.1030i	0.7770+1.0888i	0.7235+0.9143i	0.6621+1.1020i	1.1043+0.6650i	0.6409+1.1079i
w30	0.7007+1.1521i	0.9707+0.7014i	0.5776+1.1648i	0.7229+1.2479i	0.7185+1.2809i	0.8457+1.0230i	0.6018+1.2720i	1.2643+0.6023i	0.6007+1.2427i
w31	0.6896+1.1523i	0.9855+0.6704i	0.5938+1.1785i	0.8384+1.1668i	0.8561+1.1944i	0.7336+1.0397i	0.7241+1.2084i	1.2025+0.7245i	0.7195+1.1826i
w32	0.1611+0.9287i	0.1594+1.5423i	0.1087+0.9091i	0.0966+1.0145i	0.0797+1.0130i	1.4546+0.3656i	0.0467+0.9059i	0.9195+0.0458i	0.0451+0.9145i
w33	0.1608+0.9363i	0.4384+1.3764i	0.1086+0.9089i	0.1317+1.0089i	0.1572+1.0022i	1.1503+0.4997i	0.1350+0.8973i	0.9105+0.1382i	0.1354+0.9073i
w34	0.1614+0.9216i	0.1970+1.5197i	0.1087+0.9043i	0.0967+1.0148i	0.0798+1.0164i	1.3573+0.4202i	0.0497+0.9867i	0.9998+0.0502i	0.0490+0.9960i
w35	0.1611+0.9285i	0.4247+1.3981i	0.1087+0.9041i	0.1321+1.0094i	0.1595+1.0061i	1.2496+0.4668i	0.1471+0.9764i	0.9903+0.1497i	0.1462+0.9883i
w36	0.1712+1.0245i	0.1795+1.6689i	0.2745+0.8789i	0.3350+0.9404i	0.3545+0.9275i	0.8612+0.5359i	0.3086+0.8542i	0.8664+0.3143i	0.3118+0.8700i
w37	0.1697+1.0409i	0.5087+1.4080i	0.2738+0.8784i	0.3155+0.9521i	0.3073+0.9500i	1.0300+0.5234i	0.2240+0.8802i	0.8929+0.2275i	0.2251+0.8927i
w38	0.1718+1.0083i	0.2493+1.6121i	0.2739+0.8757i	0.3367+0.9420i	0.3612+0.9352i	0.8730+0.5582i	0.3372+0.9296i	0.9434+0.3421i	0.3384+0.9473i
w39	0.1708+1.0242i	0.4934+1.4431i	0.2735+0.8752i	0.3169+0.9535i	0.3106+0.9572i	0.9827+0.5433i	0.2436+0.9574i	0.9718+0.2472i	0.2432+0.9721i
w40	0.1550+0.9260i	0.6215+0.9847i	0.1067+1.0307i	0.0929+1.1822i	0.0757+1.1766i	1.5800+0.4522i	0.0597+1.1699i	1.1777+0.0583i	0.0573+1.1691i
w41	0.1543+0.9335i	0.5972+1.0599i	0.1069+1.0300i	0.1873+1.1711i	0.2119+1.1624i	1.1744+0.6454i	0.1751+1.1583i	1.1673+0.1754i	0.1729+1.1617i
w42	0.1556+0.9190i	0.6316+0.9798i	0.1079+1.0156i	0.0940+1.1707i	0.0756+1.1591i	1.4318+0.5695i	0.0546+1.0770i	1.0856+0.0541i	0.0527+1.0803i
w43	0.1551+0.9258i	0.6074+1.0427i	0.1077+1.0150i	0.1834+1.1604i	0.2059+1.1425i	1.2928+0.6164i	0.1620+1.0654i	1.0759+0.1619i	0.1592+1.0726i
w44	0.1582+1.0189i	0.6300+1.0019i	0.3076+1.0010i	0.4382+1.0945i	0.4674+1.0931i	0.9085+0.7546i	0.3987+1.1039i	1.1138+0.4023i	0.3967+1.1112i
w45	0.1556+1.0360i	0.6093+1.0947i	0.3060+0.9997i	0.3734+1.1192i	0.3582+1.1287i	1.0445+0.6871i	0.2892+1.1363i	1.1461+0.2901i	0.2851+1.1427i
w46	0.1601+1.0026i	0.6399+0.9951i	0.3080+0.9912i	0.4257+1.0781i	0.4464+1.0591i	0.8937+0.6812i	0.3688+1.0131i	1.0258+0.3708i	0.3660+1.0273i
w47	0.1580+1.0187i	0.6168+1.0734i	0.3061+0.9896i	0.3674+1.1037i	0.3492+1.0994i	0.9938+0.6542i	0.2650+1.0458i	1.0553+0.2677i	0.2633+1.0553i
w48	0.4305+0.8503i	0.6548+0.5942i	0.6039+0.7137i	0.6162+0.7109i	0.6167+0.6970i	0.5415+0.5711i	0.6137+0.6750i	0.6837+0.6227i	0.6365+0.6957i
w49	0.4276+0.8519i	0.6548+0.5843i	0.6032+0.7136i	0.6144+0.7145i	0.6104+0.7078i	0.5649+0.5698i	0.5476+0.7291i	0.7398+0.5527i	0.5615+0.7517i
w50	0.4301+0.8475i	0.6527+0.5981i	0.6030+0.7126i	0.6198+0.7139i	0.6332+0.7078i	0.5433+0.6037i	0.6692+0.7370i	0.7451+0.6776i	0.6869+0.7563i
w51	0.4273+0.8489i	0.6524+0.5877i	0.6024+0.7124i	0.6179+0.7177i	0.6256+0.7206i	0.5681+0.6024i	0.5949+0.7949i	0.8068+0.6014i	0.6061+0.8169i
w52	0.4534+0.9213i	0.7095+0.5855i	0.4771+0.7956i	0.4894+0.8433i	0.4840+0.8400i	0.7445+0.5538i	0.3955+0.8179i	0.8322+0.3986i	0.3978+0.8394i
w53	0.4482+0.9250i	0.7116+0.5764i	0.4770+0.7949i	0.4962+0.8351i	0.5034+0.8211i	0.6842+0.5618i	0.4712+0.7798i	0.7900+0.4779i	0.4813+0.7997i
w54	0.4535+0.9141i	0.7054+0.5909i	0.4761+0.7943i	0.4924+0.8463i	0.4939+0.8521i	0.7494+0.5848i	0.4286+0.8921i	0.9065+0.4330i	0.4306+0.9123i
w55	0.4485+0.9174i	0.7071+0.5813i	0.4760+0.7936i	0.4995+0.8381i	0.5165+0.8320i	0.6877+0.5945i	0.5132+0.8496i	0.8606+0.5201i	0.5207+0.8689i
w56	0.4694+0.8468i	0.6632+0.6851i	0.6996+0.8382i	0.7823+0.8229i	0.8208+0.8194i	0.5534+0.7977i	0.7942+0.8748i	0.8797+0.7981i	0.7988+0.8850i
w57	0.4651+0.8471i	0.6607+0.6426i	0.6979+0.8370i	0.7702+0.8443i	0.7795+0.8678i	0.5889+0.7966i	0.7046+0.9484i	0.9527+0.7086i	0.7056+0.9563i
w58	0.4688+0.8444i	0.6646+0.6947i	0.6978+0.8327i	0.7576+0.8080i	0.7654+0.7871i	0.5501+0.7239i	0.7290+0.8039i	0.8102+0.7357i	0.7403+0.8193i
w59	0.4646+0.8447i	0.6610+0.6704i	0.6962+0.8314i	0.7479+0.8250i	0.7366+0.8230i	0.5813+0.7226i	0.6487+0.8706i	0.8771+0.6533i	0.6540+0.8851i
w60	0.5028+0.9103i	0.7067+0.6677i	0.5209+0.9384i	0.6015+1.0047i	0.5960+1.0246i	0.7892+0.7789i	0.5056+1.0627i	1.0703+0.5098i	0.5042+1.0698i
w61	0.4954+0.9108i	0.7094+0.6445i	0.5212+0.9362i	0.6374+0.9795i	0.6739+0.9765i	0.7107+0.7905i	0.6075+1.0087i	1.0160+0.6122i	0.6076+1.0178i
w62	0.5026+0.9052i	0.7058+0.6791i	0.5174+0.9321i	0.5872+0.9815i	0.5730+0.9785i	0.7731+0.7034i	0.4669+0.9761i	0.9854+0.4703i	0.4657+0.9891i
w63	0.4954+0.9055i	0.7074+0.6548i	0.5173+0.9297i	0.6168+0.9591i	0.6332+0.9357i	0.7020+0.7141i	0.5603+0.9273i	0.9357+0.5645i	0.5623+0.9416i
w64	1.5469+0.5626i	1.6936+1.0501i	1.9725+0.1409i	1.9480+0.1481i	1.8978+0.1329i	0.0599+1.4685i	1.7073+0.0837i	0.0829+1.6709i	1.6374+0.0732i
w65	1.5047+0.6160i	1.9944+0.7935i	1.9915+0.4357i	1.6746+0.0974i	1.6495+0.0908i	0.1246+1.8836i	1.7027+0.2504i	0.2503+1.6668i	1.6151+0.2229i
w66	1.3738+0.4946i	1.3942+0.1121i	1.6673+0.1308i	1.4082+0.0951i	1.3940+0.0760i	0.0726+1.3309i	1.5368+0.0756i	0.0746+1.5195i	1.5081+0.0892i
w67	1.3649+0.5049i	1.3717+0.1144i	1.6321+0.1768i	1.4516+0.1035i	1.4413+0.1092i	0.0737+1.2419i	1.5297+0.2272i	0.2237+1.5133i	1.4856+0.2487i
w68	1.3196+0.4650i	1.0307+0.1191i	1.5727+0.6014i	1.8289+0.4101i	1.8256+0.3950i	0.1916+1.5130i	1.6271+0.5805i	0.5739+1.5837i	1.5452+0.5306i
w69	1.3158+0.4688i	1.0338+0.1191i	1.8127+0.6892i	1.6508+0.2818i	1.6372+0.2691i	0.1084+1.6780i	1.6704+0.4169i	0.4139+1.6300i	1.5894+0.3775i
w70	1.2898+0.4456i	1.1039+0.1200i	1.5630+0.4516i	1.4163+0.3400i	1.4120+0.3476i	0.2135+1.3547i	1.4619+0.5241i	0.5163+1.4416i	1.4079+0.5384i
w71	1.2884+0.4467i	1.1098+0.1196i	1.6016+0.3840i	1.4507+0.3041i	1.4494+0.2700i	0.2135+1.2428i	1.5031+0.3768i	0.3716+1.4836i	1.4548+0.3961i
w72	1.6559+0.1897i	1.7938+0.1356i	1.3202+0.1147i	1.1659+0.1018i	1.1536+0.0892i	0.0613+0.9634i	1.2795+0.0648i	0.0639+1.2810i	1.2939+0.0694i
w73	1.5179+0.1778i	2.0345+0.2783i	1.3218+0.1223i	1.1609+0.1045i	1.1504+0.1147i	0.0608+0.9515i	1.2691+0.1929i	0.1907+1.2711i	1.2819+0.2049i

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[0142]

w74	1.4640+0.1827i	1.4715+0.1190i	1.3747+0.1240i	1.2293+0.1016i	1.2370+0.0895i	0.0653+1.0817i	1.3982+0.0700i	0.0695+1.3921i	1.3970+0.0586i
w75	1.4219+0.1747i	1.4204+0.1246i	1.3790+0.1334i	1.2169+0.1055i	1.2259+0.1210i	0.0672+1.1221i	1.3874+0.2089i	0.2069+1.3839i	1.3864+0.1843i
w76	1.4105+0.1820i	1.0246+0.1169i	1.2916+0.4109i	1.1530+0.3086i	1.1410+0.3239i	0.1830+0.9565i	1.2099+0.4372i	0.4372+1.2114i	1.2145+0.4581i
w77	1.3863+0.1750i	1.0275+0.1169i	1.2789+0.3878i	1.1493+0.3027i	1.1412+0.2881i	0.1815+0.9438i	1.2462+0.3168i	0.3150+1.2471i	1.2539+0.3338i
w78	1.3673+0.1851i	1.0922+0.1187i	1.3285+0.3971i	1.2238+0.3152i	1.2488+0.3303i	0.1937+1.0728i	1.3264+0.4784i	0.4753+1.3187i	1.3215+0.4564i
w79	1.3567+0.1780i	1.0982+0.1184i	1.3164+0.3727i	1.2129+0.3073i	1.2365+0.2820i	0.1984+1.1179i	1.3636+0.3452i	0.3425+1.3569i	1.3601+0.3221i
w80	1.1863+0.7845i	1.5434+0.7244i	1.2691+1.5656i	1.6390+1.1100i	1.5621+1.0168i	0.5319+1.5225i	1.2821+1.1603i	1.1360+1.2473i	1.2148+1.0841i
w81	1.2415+0.8159i	1.5406+0.6573i	1.4951+1.3067i	1.5553+0.8585i	1.5618+0.8013i	0.5499+1.7288i	1.3913+1.0297i	1.0132+1.3576i	1.3161+0.9594i
w82	1.1494+0.8291i	1.3607+0.4309i	1.2022+1.0523i	1.2808+0.8598i	1.3176+0.9273i	0.4997+1.3566i	1.1526+1.0455i	1.0324+1.1353i	1.0841+1.0388i
w83	1.1827+0.7792i	1.3555+0.4468i	1.2512+1.0757i	1.3544+0.7773i	1.3667+0.7657i	0.4782+1.2237i	1.2494+0.9275i	0.9181+1.2338i	1.1820+0.9284i
w84	1.1076+0.7355i	1.0258+0.3527i	1.4652+0.7406i	1.6452+0.5697i	1.6308+0.5333i	0.3541+1.5303i	1.5638+0.7384i	0.7279+1.5222i	1.4838+0.6792i
w85	1.1303+0.7414i	1.0288+0.3578i	1.6787+0.9971i	1.8084+0.7652i	1.7890+0.7298i	0.3305+1.7214i	1.4790+0.8844i	0.8723+1.4426i	1.4082+0.8235i
w86	1.0983+0.7232i	1.0909+0.3601i	1.3845+0.8297i	1.4221+0.5360i	1.4307+0.4998i	0.3534+1.3681i	1.4048+0.6656i	0.6568+1.3858i	1.3468+0.6764i
w87	1.1152+0.7262i	1.0957+0.3657i	1.4003+0.9431i	1.3824+0.5909i	1.3837+0.6127i	0.3443+1.2387i	1.3309+0.7987i	0.7900+1.3143i	1.2717+0.8072i
w88	1.0345+0.9742i	1.6599+0.4298i	1.0078+0.8244i	1.0340+0.7391i	1.0281+0.7705i	0.4341+0.9300i	0.9550+0.8673i	0.8674+0.9560i	0.9364+0.8864i
w89	1.1011+1.0156i	1.6784+0.4687i	1.0057+0.8180i	1.0451+0.7019i	1.0650+0.6889i	0.4208+0.9180i	1.0345+0.7695i	0.7705+1.0366i	1.0217+0.7923i
w90	1.0197+0.9589i	1.4321+0.3566i	1.0397+0.8590i	1.1099+0.7731i	1.1472+0.8418i	0.4493+1.0436i	1.0460+0.9487i	0.9433+1.0406i	1.0343+0.9303i
w91	1.0694+0.9950i	1.4129+0.3717i	1.0328+0.8510i	1.1202+0.7192i	1.1907+0.7241i	0.4518+1.1001i	1.1334+0.8419i	0.8396+1.1292i	1.1243+0.8240i
w92	0.9596+0.9120i	1.0173+0.3328i	1.2051+0.6323i	1.1139+0.5015i	1.1184+0.4819i	0.3046+0.9458i	1.1624+0.5543i	0.5539+1.1644i	1.1623+0.5765i
w93	0.9791+0.9149i	1.0197+0.3375i	1.1706+0.6245i	1.1120+0.5168i	1.1069+0.5409i	0.3045+0.9315i	1.1032+0.6643i	0.6655+1.1051i	1.0975+0.6885i
w94	0.9570+0.9021i	1.0770+0.3368i	1.2080+0.6634i	1.1853+0.5143i	1.2340+0.4863i	0.3191+1.0603i	1.2741+0.6060i	0.6027+1.2677i	1.2691+0.5857i
w95	0.9734+0.9037i	1.0813+0.3415i	1.1727+0.6492i	1.1855+0.5378i	1.2237+0.5735i	0.3265+1.1096i	1.2092+0.7268i	0.7240+1.2029i	1.2035+0.7094i
w96	0.9735+0.2722i	0.6486+0.1129i	0.9439+0.1093i	0.8385+0.0878i	0.8339+0.0846i	0.0563+0.5733i	0.9150+0.0466i	0.0457+0.9211i	0.9523+0.0461i
w97	0.9760+0.2688i	0.6481+0.1134i	0.9437+0.1096i	0.8386+0.0880i	0.8336+0.0873i	0.0563+0.5732i	0.9065+0.1343i	0.1367+0.9126i	0.9440+0.1381i
w98	0.9858+0.2783i	0.6394+0.1125i	0.9423+0.1100i	0.8388+0.0878i	0.8392+0.0851i	0.0562+0.6144i	0.9948+0.0500i	0.0499+1.0026i	1.0315+0.0501i
w99	0.9886+0.2747i	0.6388+0.1129i	0.9423+0.1101i	0.8388+0.0880i	0.8390+0.0880i	0.0561+0.6142i	0.9843+0.1473i	0.1484+0.9932i	1.0228+0.1507i
w100	0.9978+0.2866i	0.7450+0.1144i	0.9180+0.2421i	0.8158+0.2520i	0.8098+0.2558i	0.1687+0.5745i	0.8612+0.3092i	0.3131+0.8696i	0.9013+0.3169i
w101	1.0007+0.2829i	0.7438+0.1150i	0.9185+0.2421i	0.8156+0.2515i	0.8100+0.2529i	0.1685+0.5743i	0.8883+0.2248i	0.2258+0.8952i	0.9267+0.2286i
w102	1.0124+0.2932i	0.7230+0.1146i	0.9172+0.2415i	0.8167+0.2524i	0.8176+0.2581i	0.1683+0.6135i	0.9363+0.3378i	0.3412+0.9466i	0.9750+0.3455i
w103	1.0156+0.2894i	0.7219+0.1151i	0.9178+0.2417i	0.8165+0.2521i	0.8179+0.2549i	0.1682+0.6131i	0.9652+0.2442i	0.2456+0.9743i	1.0035+0.2492i
w104	1.0020+0.1705i	0.6508+0.1099i	1.1232+0.1104i	0.9987+0.0950i	1.0049+0.0907i	0.0575+0.8275i	1.1753+0.0596i	0.0588+1.1805i	1.2011+0.0566i
w105	1.0074+0.1670i	0.6502+0.1104i	1.1238+0.1134i	1.0002+0.0959i	1.0062+0.1014i	0.0576+0.8303i	1.1638+0.1759i	0.1753+1.1699i	1.1922+0.1721i
w106	1.0163+0.1718i	0.6412+0.1095i	1.1140+0.1133i	0.9842+0.0938i	0.9787+0.0904i	0.0560+0.7361i	1.0837+0.0551i	0.0537+1.0888i	1.1135+0.0544i
w107	1.0223+0.1679i	0.6407+0.1099i	1.1151+0.1163i	0.9858+0.0946i	0.9795+0.0992i	0.0559+0.7364i	1.0729+0.1619i	0.1620+1.0787i	1.1046+0.1637i
w108	1.0286+0.1747i	0.7492+0.1114i	1.0835+0.3155i	0.9815+0.2840i	0.9920+0.2940i	0.1725+0.8204i	1.1085+0.4018i	0.4022+1.1152i	1.1352+0.4033i
w109	1.0350+0.1706i	0.7480+0.1119i	1.0867+0.3167i	0.9827+0.2819i	0.9935+0.2797i	0.1726+0.8234i	1.1424+0.2906i	0.2901+1.1486i	1.1698+0.2887i
w110	1.0455+0.1760i	0.7273+0.1114i	1.0770+0.3117i	0.9640+0.2806i	0.9572+0.2864i	0.1682+0.7342i	1.1200+0.3694i	0.3708+1.0280i	1.0522+0.3750i
w111	1.0525+0.1716i	0.7261+0.1120i	1.0804+0.3126i	0.9653+0.2791i	0.9590+0.2755i	0.1680+0.7346i	1.0510+0.2673i	0.2674+1.0586i	1.0842+0.2706i
w112	0.7928+0.5945i	0.6514+0.3325i	0.7575+0.5588i	0.7081+0.5671i	0.7002+0.5651i	0.4176+0.5754i	0.6784+0.6112i	0.6203+0.6858i	0.7062+0.6318i
w113	0.7897+0.5907i	0.6514+0.3347i	0.7580+0.5589i	0.7084+0.5650i	0.7022+0.5593i	0.4108+0.5751i	0.7341+0.5461i	0.5514+0.7429i	0.7682+0.5621i
w114	0.8003+0.5948i	0.6438+0.3315i	0.7568+0.5578i	0.7111+0.5692i	0.7158+0.5744i	0.4190+0.6480i	0.7381+0.6680i	0.6762+0.7467i	0.7616+0.6876i
w115	0.7970+0.5910i	0.6438+0.3338i	0.7573+0.5581i	0.7113+0.5670i	0.7181+0.5674i	0.4118+0.6082i	0.7989+0.5949i	0.6008+0.8092i	0.8283+0.6116i
w116	0.8160+0.6049i	0.7361+0.3361i	0.8354+0.4419i	0.7707+0.4169i	0.7657+0.4118i	0.2872+0.5759i	0.8261+0.3941i	0.3968+0.8352i	0.8663+0.4030i
w117	0.8129+0.6005i	0.7356+0.3388i	0.8364+0.4424i	0.7706+0.4179i	0.7647+0.4153i	0.2885+0.5759i	0.7851+0.4703i	0.4768+0.7929i	0.8211+0.4847i
w118	0.8244+0.6048i	0.7203+0.3375i	0.8348+0.4413i	0.7726+0.4178i	0.7777+0.4162i	0.2872+0.6116i	0.8991+0.4288i	0.4321+0.9090i	0.9357+0.4393i
w119	0.8214+0.6005i	0.7199+0.3401i	0.8357+0.4419i	0.7727+0.4187i	0.7768+0.4204i	0.2887+0.6114i	0.8540+0.5134i	0.5196+0.8634i	0.8873+0.5281i
w120	0.7429+0.6578i	0.6521+0.3194i	0.8669+0.6851i	0.8775+0.6587i	0.8969+0.6804i	0.4293+0.8008i	0.8748+0.7945i	0.7985+0.8805i	0.8857+0.8048i
w121	0.7394+0.6522i	0.6520+0.3218i	0.8702+0.6831i	0.8810+0.6474i	0.9133+0.6445i	0.4175+0.8025i	0.9480+0.7052i	0.7091+0.9536i	0.9624+0.7150i
w122	0.7471+0.6586i	0.6441+0.3185i	0.8641+0.6821i	0.8558+0.6467i	0.8465+0.6504i	0.4251+0.7274i	0.8034+0.7296i	0.7351+0.8110i	0.8208+0.7452i
w123	0.7435+0.6530i	0.6441+0.3207i	0.8674+0.6805i	0.8591+0.6378i	0.8578+0.6258i	0.4152+0.7279i	0.8718+0.6493i	0.6536+0.8786i	0.8922+0.6622i
w124	0.7608+0.6810i	0.7398+0.3226i	0.9918+0.5150i	0.9442+0.4649i	0.9649+0.4631i	0.2916+0.8082i	1.0647+0.5073i	0.5098+1.0718i	1.0890+0.5137i
w125	0.7572+0.6740i	0.7392+0.3253i	0.9952+0.5177i	0.9446+0.4697i	0.9612+0.4859i	0.2941+0.8113i	1.0114+0.6096i	0.6126+1.0178i	1.0308+0.6179i
w126	0.7652+0.6815i	0.7233+0.3240i	0.9852+0.5133i	0.9241+0.4600i	0.9194+0.4551i	0.2877+0.7306i	0.9801+0.4685i	0.4703+0.9876i	1.0092+0.4766i
w127	0.7617+0.6746i	0.7228+0.3268i	0.9888+0.5164i	0.9246+0.4640i	0.9160+0.4712i	0.2900+0.7314i	0.9294+0.5603i	0.5649+0.9379i	0.9560+0.5733i
w128	0.1292+0.2157i	0.1046+0.9193i	0.0863+0.3377i	0.0692+0.0842i	0.0662+0.0839i	1.4412+0.0759i	0.0425+0.2306i	0.2331+0.0555i	0.0356+0.2800i
w129	0.1293+0.2160i	0.1097+0.9188i	0.0863+0.3374i	0.0693+0.0843i	0.0662+0.0839i	1.0926+0.0446i	0.0444+0.2300i	0.2334+0.0560i	0.0833+0.2651i
w130	0.1292+0.2152i	0.1045+0.9180i	0.0863+0.3374i	0.0693+0.0842i	0.0663+0.0838i	1.3092+0.0863i	0.0476+0.3236i	0.3231+0.0410i	0.0320+0.3485i
w131	0.1293+0.2155i	0.1095+0.9177i	0.0863+0.3371i	0.0693+0.0843i	0.0662+0.0838i	1.2012+0.0699i	0.0482+0.3229i	0.3229+0.0418i	0.0823+0.3458i
w132	0.1290+0.2197i	0.1041+0.9237i	0.0891+0.3353i	0.0693+0.0845i	0.0659+0.0848i	0.8295+0.0591i	0.0431+0.1967i	0.1828+0.0378i	0.0352+0.2157i
w133	0.1290+0.2200i	0.1094+0.9231i	0.0891+0.3350i	0.0693+0.0844i	0.0658+0.0848i	0.9538+0.0508i	0.0415+0.1973i	0.1828+0.0375i	0.0357+0.2042i
w134	0.1290+0.2192i	0.1039+0.9226i	0.0891+0.3349i	0.0692+0.0846i	0.0658+0.0847i	0.8321+0.0585i	0.0971+0.3204i	0.3359+0.1034i	0.1700+0.3635i
w135	0.1290+0.2195i	0.1091+0.9218i	0.0891+0.3348i	0.0693+0.0844i	0.0658+0.0847i	0.9265+0.0539i	0.0967+0.3186i	0.3352+0.1033i	0.1363+0.3448i
w136	0.1296+0.2151i	0.1540+0.8701i	0.1160+0.4413i	0.0699+0.5333i	0.0641+0.5375i	1.6156+0.0830i	0.0491+0.5030i	0.5231+0.0416i	0.0279+0.5173i
w137	0.1296+0.2154i	0.1581+0.8741i	0.1161+0.4411i	0.0698+0.5333i	0.0640+0.5374i	1.0810+0.1364i	0.0551+0.5022i	0.5212+0.0599i	0.0833+0.5156i
w138	0.1296+0.2146i	0.1538+0.8693i	0.1163+0.4410i	0.0697+0.5334i	0.0640+0.5377i	1.8273+0.1110i	0.0450+0.4214i	0.4318+0.0381i	0.0279+0.4291i
w139	0.1296+0.2149i	0.1579+0.8731i	0.1162+0.4409i	0.0697+0.5330i	0.0640+0.5377i	1.1228+0.1520i	0.0459+0.4205i	0.4318+0.0416i	0.0778+0.4336i
w140	0.1293+0.2191i	0.1530+0.8726i	0.1295+0.4371i	0.0818+0.5272i	0.0828+0.5271i	0.8365+0.1745i	0.1576+0.4806i	0.4974+0.1612i	0.2048+0.4951i
w141	0.1294+0.2194i	0.1571+0.8765i	0.1294+0.4370i	0.0817+0.5270i	0.0828+0.5270i	0.9617+0.1567i	0.1517+0.4814i	0.5029+0.1426i	0.1456+0.5085i
w142	0.1293+0.2186i	0.1527+0.8717i	0.1297+0.4368i	0.0817+0.5271i	0.0830+0.5271i	0.8394+0.1738i	0.1288+0.4032i	0.4196+0.1280i	0.1871+0.4221i
w143	0.1294+0.2189i	0.1569+0.8755i	0.1295+0.4367i	0.0816+0.5271i	0.0827+0.5271i	0.9441+0.1623i	0.1285+0.4037i	0.4202+0.1224i	0.1338+0.4355i
w144	0.1499+0.2251i	0.1387+0.6051i	0.1325+0.2882i	0.0839+0.2583i	0.0816+0.2715i	0.5274+0.0607i	0.1241+0.1723i	0.1832+0.1354i	0.1306+0.1707i
w145	0.1501+0.2254i	0.1385+0.6035i	0.1326+0.2882i	0.0838+0.2584i	0.0816+0.2716i	0.5432+0.0608i	0.1254+0.1726i	0.1834+0.1345i	0.1465+0.2102i
w146	0.1498+0.2247i	0.1386+0.6054i	0.1324+0.2881i	0.0840+0.2585i	0.0816+0.2716i	0.5274+0.0608i	0.1944+0.2361i	0.2526+0.1984i	0.2606+0.2717i
w147	0.1499+0.2250i	0.1385+0.6038i	0.1325+0.2881i	0.0839+0.2585i	0.0816+0.2716i	0.5432+0.0608i	0.1934+0.2367i	0.2521+0.1992i	0.2014+0.2359i

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w148	0.1501+0.2286i	0.1381+0.6038i	0.1347+0.2891i	0.0822+0.2580i	0.0765+0.2732i	0.7095+0.0603i	0.0829+0.1628i	0.1217+0.0561i	0.0802+0.1457i
w149	0.1502+0.2289i	0.1380+0.6021i	0.1347+0.2892i	0.0823+0.2580i	0.0765+0.2733i	0.6618+0.0606i	0.0848+0.1601i	0.1225+0.0560i	0.0348+0.1352i
w150	0.1500+0.2281i	0.1380+0.6041i	0.1347+0.2891i	0.0822+0.2583i	0.0765+0.2732i	0.7099+0.0602i	0.1720+0.2748i	0.3099+0.1696i	0.2175+0.3255i
w151	0.1501+0.2284i	0.1379+0.6025i	0.1347+0.2891i	0.0822+0.2583i	0.0765+0.2733i	0.6617+0.0606i	0.1725+0.2756i	0.3096+0.1709i	0.1851+0.2925i
w152	0.1503+0.2247i	0.1494+0.6226i	0.2521+0.3591i	0.1735+0.4189i	0.1940+0.4225i	0.5277+0.1827i	0.3327+0.3852i	0.3962+0.3429i	0.4097+0.4098i
w153	0.1504+0.2250i	0.1489+0.6207i	0.2522+0.3590i	0.1735+0.4189i	0.1941+0.4225i	0.5445+0.1827i	0.3285+0.3880i	0.4063+0.3289i	0.3696+0.4239i
w154	0.1502+0.2242i	0.1494+0.6229i	0.2521+0.3591i	0.1734+0.4187i	0.1939+0.4226i	0.5278+0.1823i	0.2737+0.3181i	0.3287+0.2818i	0.3109+0.3161i
w155	0.1503+0.2245i	0.1489+0.6211i	0.2524+0.3589i	0.1730+0.4187i	0.1940+0.4224i	0.5446+0.1824i	0.2748+0.3180i	0.3305+0.2788i	0.3384+0.3541i
w156	0.1505+0.2282i	0.1483+0.6210i	0.2493+0.3649i	0.1648+0.4258i	0.1700+0.4355i	0.7143+0.1797i	0.2463+0.4429i	0.4629+0.2415i	0.2626+0.4826i
w157	0.1506+0.2285i	0.1479+0.6193i	0.2493+0.3647i	0.1649+0.4258i	0.1699+0.4353i	0.6635+0.1813i	0.2507+0.4400i	0.4538+0.2587i	0.3138+0.4582i
w158	0.1504+0.2277i	0.1483+0.6214i	0.2493+0.3648i	0.1646+0.4255i	0.1700+0.4355i	0.7142+0.1794i	0.2140+0.3608i	0.3839+0.2101i	0.2496+0.3897i
w159	0.1505+0.2280i	0.1479+0.6197i	0.2493+0.3647i	0.1647+0.4256i	0.1699+0.4353i	0.6633+0.1811i	0.2148+0.3606i	0.3811+0.2145i	0.2856+0.3968i
w160	0.1384+0.6201i	0.1421+1.2512i	0.1151+0.7097i	0.0914+0.8604i	0.0802+0.8666i	1.4477+0.2272i	0.0444+0.8222i	0.8404+0.0429i	0.0413+0.8350i
w161	0.1390+0.6188i	0.2382+1.1965i	0.1150+0.7098i	0.0995+0.8584i	0.1059+0.8614i	1.1203+0.3790i	0.1214+0.8152i	0.8322+0.1261i	0.1250+0.8291i
w162	0.1381+0.6219i	0.1425+1.2561i	0.1148+0.7109i	0.0910+0.8610i	0.0800+0.8663i	1.3161+0.2454i	0.0454+0.7459i	0.7634+0.0391i	0.0386+0.7570i
w163	0.1386+0.6206i	0.2356+1.2021i	0.1148+0.7112i	0.0994+0.8588i	0.1055+0.8609i	1.2096+0.3196i	0.1052+0.7420i	0.7562+0.1141i	0.1144+0.7509i
w164	0.1387+0.6009i	0.1521+1.2137i	0.2018+0.6963i	0.2520+0.8084i	0.2667+0.8027i	0.8538+0.4205i	0.2798+0.7766i	0.7916+0.2874i	0.2870+0.7948i
w165	0.1391+0.5995i	0.2390+1.1744i	0.2019+0.6965i	0.2484+0.8118i	0.2541+0.8118i	0.9971+0.4062i	0.2069+0.7984i	0.8156+0.2082i	0.2067+0.8150i
w166	0.1384+0.6027i	0.1511+1.2191i	0.2020+0.6975i	0.2521+0.8090i	0.2654+0.8017i	0.8603+0.4160i	0.2499+0.7071i	0.7184+0.2607i	0.2642+0.7207i
w167	0.1389+0.6013i	0.2364+1.1788i	0.2021+0.6977i	0.2483+0.8124i	0.2530+0.8108i	0.9655+0.4069i	0.1934+0.7233i	0.7408+0.1901i	0.1898+0.7386i
w168	0.1398+0.6186i	0.3956+0.9473i	0.1161+0.6371i	0.0884+0.7037i	0.0734+0.7154i	1.6269+0.2588i	0.0518+0.5868i	0.6079+0.0387i	0.0311+0.6001i
w169	0.1404+0.6173i	0.3897+0.9873i	0.1161+0.6373i	0.0894+0.7033i	0.0772+0.7142i	1.0884+0.2705i	0.0688+0.5849i	0.6023+0.0822i	0.0947+0.5947i
w170	0.1395+0.6204i	0.3981+0.9439i	0.1157+0.6384i	0.0883+0.7037i	0.0734+0.7154i	1.8201+0.3520i	0.0495+0.6628i	0.6861+0.0374i	0.0347+0.6790i
w171	0.1400+0.6191i	0.3913+0.9827i	0.1157+0.6387i	0.0893+0.7035i	0.0772+0.7142i	1.1299+0.2516i	0.0856+0.6604i	0.6795+0.1006i	0.1047+0.6731i
w172	0.1401+0.5994i	0.3909+0.9535i	0.1747+0.6231i	0.1683+0.6742i	0.1809+0.6740i	0.8457+0.2930i	0.1845+0.5595i	0.5731+0.1989i	0.2220+0.5721i
w173	0.1406+0.5981i	0.3871+0.9933i	0.1748+0.6232i	0.1680+0.6747i	0.1796+0.6758i	0.9743+0.2827i	0.1701+0.5641i	0.5854+0.1576i	0.1586+0.5847i
w174	0.1398+0.6012i	0.3931+0.9500i	0.1751+0.6240i	0.1681+0.6742i	0.1808+0.6740i	0.8491+0.2938i	0.2149+0.6311i	0.6454+0.2320i	0.2421+0.6464i
w175	0.1403+0.5999i	0.3884+0.9890i	0.1748+0.6242i	0.1681+0.6749i	0.1797+0.6758i	0.9565+0.2825i	0.1814+0.6396i	0.6642+0.1725i	0.1741+0.6621i
w176	0.2908+0.5788i	0.4093+0.5865i	0.4759+0.5693i	0.4794+0.6184i	0.4901+0.6096i	0.5349+0.4466i	0.5570+0.6126i	0.6237+0.5684i	0.5883+0.6374i
w177	0.2913+0.5780i	0.4082+0.5813i	0.4761+0.5693i	0.4797+0.6188i	0.4892+0.6118i	0.5550+0.4455i	0.4996+0.6598i	0.6752+0.5053i	0.5182+0.6889i
w178	0.2904+0.5800i	0.4101+0.5870i	0.4760+0.5696i	0.4797+0.6185i	0.4866+0.6071i	0.5344+0.4359i	0.5027+0.5591i	0.5655+0.5162i	0.5425+0.5800i
w179	0.2909+0.5792i	0.4090+0.5818i	0.4764+0.5697i	0.4797+0.6190i	0.4858+0.6094i	0.5543+0.4350i	0.4587+0.5943i	0.6118+0.4591i	0.4782+0.6270i
w180	0.2860+0.5645i	0.4003+0.5867i	0.4146+0.6061i	0.3938+0.7103i	0.3909+0.7181i	0.7304+0.4323i	0.3616+0.7417i	0.7598+0.3644i	0.3667+0.7681i
w181	0.2864+0.5637i	0.3990+0.5817i	0.4147+0.6063i	0.3948+0.7082i	0.3949+0.7124i	0.6740+0.4376i	0.4272+0.7061i	0.7208+0.4365i	0.4442+0.7324i
w182	0.2857+0.5657i	0.4011+0.5872i	0.4147+0.6070i	0.3938+0.7106i	0.3886+0.7158i	0.7290+0.4235i	0.3335+0.6719i	0.6887+0.3313i	0.3373+0.6966i
w183	0.2862+0.5649i	0.3999+0.5822i	0.4148+0.6070i	0.3949+0.7084i	0.3924+0.7102i	0.6729+0.4278i	0.3844+0.6452i	0.6540+0.3956i	0.4091+0.6660i
w184	0.2982+0.5797i	0.4162+0.6419i	0.3951+0.4837i	0.3421+0.5305i	0.3503+0.5195i	0.5295+0.3071i	0.3879+0.4475i	0.4535+0.4040i	0.4524+0.4675i
w185	0.2986+0.5789i	0.4126+0.6321i	0.3954+0.4837i	0.3423+0.5305i	0.3505+0.5197i	0.5477+0.3068i	0.3776+0.4571i	0.4792+0.3721i	0.4008+0.5029i
w186	0.2978+0.5808i	0.4174+0.6433i	0.3953+0.4841i	0.3420+0.5303i	0.3509+0.5198i	0.5297+0.3097i	0.4424+0.5022i	0.5082+0.4618i	0.4977+0.5232i
w187	0.2983+0.5801i	0.4136+0.6334i	0.3952+0.4842i	0.3423+0.5303i	0.3511+0.5200i	0.5479+0.3092i	0.4191+0.5225i	0.5468+0.4147i	0.4386+0.5659i
w188	0.2930+0.5656i	0.4081+0.6402i	0.3670+0.5086i	0.3015+0.5757i	0.2929+0.5907i	0.7223+0.3006i	0.2791+0.5203i	0.5417+0.2697i	0.2843+0.5533i
w189	0.2935+0.5649i	0.4043+0.6309i	0.3672+0.5083i	0.3017+0.5754i	0.2932+0.5899i	0.6675+0.3031i	0.2927+0.5124i	0.5222+0.3074i	0.3447+0.5290i
w190	0.2928+0.5668i	0.4093+0.6415i	0.3672+0.5086i	0.3015+0.5755i	0.2932+0.5909i	0.7215+0.3022i	0.3056+0.5933i	0.6164+0.2990i	0.3097+0.6251i
w191	0.2932+0.5660i	0.4053+0.6321i	0.3672+0.5087i	0.3015+0.5753i	0.2936+0.5901i	0.6671+0.3051i	0.3356+0.5770i	0.5877+0.3530i	0.3756+0.5986i
w192	0.4268+0.1258i	0.1208+0.1207i	0.1311+0.0863i	0.2346+0.0773i	0.2289+0.0740i	0.0563+0.0613i	0.1787+0.0387i	0.0499+0.2055i	0.1765+0.0357i
w193	0.4268+0.1259i	0.1209+0.1209i	0.1311+0.0865i	0.2344+0.0773i	0.2289+0.0739i	0.0563+0.0613i	0.1788+0.0380i	0.0509+0.2049i	0.2273+0.0412i
w194	0.4259+0.1257i	0.1208+0.1206i	0.1310+0.0865i	0.2344+0.0772i	0.2290+0.0739i	0.0563+0.0613i	0.2844+0.0453i	0.0399+0.2999i	0.3691+0.0298i
w195	0.4258+0.1259i	0.1210+0.1208i	0.1312+0.0864i	0.2345+0.0773i	0.2290+0.0739i	0.0563+0.0614i	0.2853+0.0454i	0.0401+0.3002i	0.2911+0.0346i
w196	0.4251+0.1266i	0.1200+0.1205i	0.1315+0.0865i	0.2348+0.0806i	0.2295+0.0818i	0.1675+0.0612i	0.0534+0.0447i	0.0338+0.1277i	0.1117+0.0289i
w197	0.4251+0.1267i	0.1200+0.1206i	0.1317+0.0865i	0.2349+0.0804i	0.2296+0.0816i	0.1675+0.0612i	0.0536+0.0460i	0.0333+0.1274i	0.0382+0.0258i
w198	0.4242+0.1265i	0.1201+0.1205i	0.1314+0.0865i	0.2349+0.0804i	0.2296+0.0817i	0.1675+0.0612i	0.3158+0.0720i	0.0946+0.3296i	0.3643+0.0969i
w199	0.4242+0.1267i	0.1202+0.1207i	0.1318+0.0865i	0.2349+0.0804i	0.2296+0.0817i	0.1675+0.0613i	0.3142+0.0743i	0.0941+0.3290i	0.3097+0.0874i
w200	0.4273+0.1240i	0.1209+0.1196i	0.3858+0.0903i	0.4025+0.0825i	0.4038+0.0702i	0.0566+0.1845i	0.5089+0.0486i	0.0419+0.5217i	0.5699+0.0285i
w201	0.4272+0.1242i	0.1210+0.1197i	0.3857+0.0903i	0.4025+0.0825i	0.4038+0.0701i	0.0565+0.1845i	0.5084+0.0527i	0.0573+0.5200i	0.5487+0.0713i
w202	0.4263+0.1240i	0.1210+0.1197i	0.3857+0.0903i	0.4023+0.0825i	0.4037+0.0703i	0.0565+0.1839i	0.4222+0.0426i	0.0352+0.4266i	0.4393+0.0368i
w203	0.4263+0.1242i	0.1210+0.1197i	0.3857+0.0903i	0.4024+0.0824i	0.4038+0.0702i	0.0565+0.1839i	0.4214+0.0422i	0.0371+0.4263i	0.4820+0.0488i
w204	0.4256+0.1248i	0.1202+0.1194i	0.3861+0.0908i	0.3972+0.1073i	0.3965+0.1175i	0.1681+0.1844i	0.4864+0.1436i	0.1548+0.4959i	0.5432+0.1831i
w205	0.4255+0.1250i	0.1202+0.1195i	0.3858+0.0908i	0.3973+0.1073i	0.3966+0.1173i	0.1682+0.1844i	0.4880+0.1415i	0.1395+0.5007i	0.5356+0.1368i
w206	0.4246+0.1248i	0.1202+0.1194i	0.3858+0.0908i	0.3972+0.1073i	0.3965+0.1174i	0.1681+0.1838i	0.4019+0.1047i	0.1182+0.4140i	0.4214+0.1199i
w207	0.4246+0.1250i	0.1202+0.1196i	0.3858+0.0909i	0.3971+0.1071i	0.3964+0.1174i	0.1682+0.1838i	0.4023+0.1060i	0.1141+0.4149i	0.4661+0.1312i
w208	0.3887+0.1755i	0.1274+0.3523i	0.1425+0.1033i	0.2201+0.2167i	0.2148+0.2237i	0.4059+0.0609i	0.1614+0.0913i	0.1305+0.1866i	0.1610+0.1081i
w209	0.3888+0.1758i	0.1278+0.3529i	0.1428+0.1035i	0.2201+0.2167i	0.2148+0.2238i	0.4022+0.0608i	0.1612+0.0906i	0.1305+0.1856i	0.2042+0.1262i
w210	0.3882+0.1753i	0.1274+0.3523i	0.1427+0.1035i	0.2200+0.2167i	0.2149+0.2238i	0.4058+0.0609i	0.2488+0.1623i	0.1936+0.2536i	0.2978+0.2229i
w211	0.3883+0.1755i	0.1277+0.3529i	0.1427+0.1036i	0.2201+0.2168i	0.2148+0.2239i	0.4022+0.0609i	0.2488+0.1628i	0.1935+0.2542i	0.2455+0.1743i
w212	0.3877+0.1764i	0.1269+0.3519i	0.1430+0.1034i	0.2239+0.2131i	0.2225+0.2148i	0.2835+0.0610i	0.0659+0.0671i	0.0466+0.0504i	0.1014+0.0859i
w213	0.3877+0.1767i	0.1272+0.3525i	0.1434+0.1037i	0.2240+0.2131i	0.2225+0.2147i	0.2840+0.0610i	0.0654+0.0671i	0.0470+0.0503i	0.0352+0.0762i
w214	0.3872+0.1762i	0.1269+0.3520i	0.1432+0.1035i	0.2239+0.2131i	0.2225+0.2146i	0.2835+0.0611i	0.2866+0.1555i	0.1636+0.3085i	0.3374+0.1692i
w215	0.3872+0.1764i	0.1273+0.3525i	0.1432+0.1036i	0.2241+0.2131i	0.2225+0.2147i	0.2840+0.0610i	0.2872+0.1564i	0.1629+0.3082i	0.2914+0.1413i
w216	0.3879+0.1740i	0.1266+0.3485i	0.3522+0.1798i	0.3173+0.2993i	0.3152+0.3142i	0.4066+0.1836i	0.3982+0.3161i	0.3355+0.4003i	0.4468+0.3693i
w217	0.3879+0.1743i	0.1269+0.3490i	0.3521+0.1797i	0.3172+0.2993i	0.3152+0.3143i	0.4027+0.1835i	0.4005+0.3136i	0.3227+0.4102i	0.4545+0.3221i
w218	0.3874+0.1738i	0.1265+0.3485i	0.3522+0.1799i	0.3173+0.2993i	0.3153+0.3141i	0.4066+0.1831i	0.3333+0.2586i	0.2750+0.3318i	0.3539+0.2625i
w219	0.3874+0.1740i	0.1269+0.3490i	0.3520+0.1796i	0.3172+0.2994i	0.3152+0.3142i	0.4027+0.1830i	0.3330+0.2579i	0.2722+0.3342i	0.3954+0.2905i
w220	0.3869+0.1750i	0.1260+0.3482i	0.3523+0.1777i	0.3319+0.2783i	0.3453+0.2672i	0.2842+0.1841i	0.4515+0.2301i	0.2346+0.4627i	0.5230+0.2380i
w221	0.3869+0.1753i	0.1264+0.3486i	0.3522+0.1774i	0.3319+0.2783i	0.3451+0.2673i	0.2847+0.1841i	0.4493+0.2334i	0.2495+0.4548i	0.4892+0.2652i

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w222	0.3863+0.1747i	0.1261+0.3482i	0.3523+0.1777i	0.3320+0.2785i	0.3454+0.2671i	0.2842+0.1835i	0.3681+0.1950i	0.2020+0.3827i	0.3945+0.1942i
w223	0.3864+0.1750i	0.1263+0.3487i	0.3522+0.1775i	0.3319+0.2784i	0.3453+0.2671i	0.2847+0.1836i	0.3693+0.1954i	0.2054+0.3804i	0.4344+0.2178i
w224	0.7232+0.1962i	0.3800+0.1152i	0.7557+0.1088i	0.6890+0.0866i	0.6942+0.0765i	0.0567+0.4509i	0.8318+0.0442i	0.0421+0.8420i	0.8751+0.0419i
w225	0.7232+0.1961i	0.3800+0.1155i	0.7555+0.1086i	0.6890+0.0867i	0.6942+0.0771i	0.0566+0.4510i	0.8239+0.1192i	0.1247+0.8342i	0.8676+0.1257i
w226	0.7229+0.1975i	0.3828+0.1149i	0.7562+0.1088i	0.6898+0.0864i	0.6939+0.0763i	0.0568+0.4376i	0.7562+0.0454i	0.0384+0.7648i	0.7986+0.0381i
w227	0.7228+0.1973i	0.3829+0.1152i	0.7561+0.1087i	0.6896+0.0865i	0.6938+0.0770i	0.0568+0.4376i	0.7500+0.1031i	0.1132+0.7575i	0.7927+0.1144i
w228	0.7225+0.1978i	0.3600+0.1161i	0.7442+0.1635i	0.6675+0.2113i	0.6699+0.2221i	0.1691+0.4514i	0.7842+0.2789i	0.2858+0.7945i	0.8293+0.2896i
w229	0.7225+0.1977i	0.3600+0.1164i	0.7440+0.1634i	0.6675+0.2111i	0.6700+0.2217i	0.1691+0.4515i	0.8063+0.2068i	0.2067+0.8184i	0.8523+0.2091i
w230	0.7222+0.1991i	0.3626+0.1159i	0.7447+0.1638i	0.6683+0.2113i	0.6690+0.2216i	0.1694+0.4387i	0.7167+0.2465i	0.2585+0.7216i	0.7578+0.2626i
w231	0.7221+0.1990i	0.3627+0.1162i	0.7446+0.1637i	0.6683+0.2112i	0.6690+0.2210i	0.1693+0.4387i	0.7319+0.1921i	0.1886+0.7429i	0.7786+0.1893i
w232	0.7307+0.1679i	0.3794+0.1131i	0.5899+0.1041i	0.5532+0.0886i	0.5559+0.0719i	0.0568+0.3093i	0.5933+0.0507i	0.0401+0.6073i	0.6439+0.0332i
w233	0.7309+0.1677i	0.3795+0.1134i	0.5900+0.1043i	0.5532+0.0885i	0.5558+0.0720i	0.0568+0.3093i	0.5924+0.0642i	0.0800+0.6023i	0.6363+0.0929i
w234	0.7302+0.1691i	0.3821+0.1129i	0.5900+0.1041i	0.5532+0.0883i	0.5558+0.0719i	0.0567+0.3125i	0.6712+0.0500i	0.0378+0.6868i	0.7212+0.0348i
w235	0.7303+0.1689i	0.3822+0.1132i	0.5903+0.1041i	0.5532+0.0884i	0.5558+0.0720i	0.0568+0.3125i	0.6689+0.0819i	0.0991+0.6806i	0.7163+0.1032i
w236	0.7296+0.1697i	0.3592+0.1141i	0.5875+0.1188i	0.5399+0.1631i	0.5350+0.1768i	0.1690+0.3097i	0.5683+0.1760i	0.1934+0.5729i	0.6122+0.2069i
w237	0.7297+0.1695i	0.3593+0.1145i	0.5874+0.1191i	0.5398+0.1629i	0.5350+0.1768i	0.1690+0.3097i	0.5720+0.1640i	0.1567+0.5853i	0.6268+0.1493i
w238	0.7290+0.1709i	0.3621+0.1139i	0.5875+0.1189i	0.5397+0.1628i	0.5349+0.1770i	0.1690+0.3128i	0.6410+0.2092i	0.2285+0.6480i	0.6853+0.2349i
w239	0.7291+0.1707i	0.3621+0.1142i	0.5876+0.1192i	0.5397+0.1628i	0.5350+0.1769i	0.1689+0.3128i	0.6491+0.1788i	0.1719+0.6651i	0.7046+0.1699i
w240	0.5910+0.4140i	0.3928+0.3384i	0.6291+0.4134i	0.5675+0.4802i	0.5654+0.4901i	0.4128+0.4506i	0.6189+0.5514i	0.5654+0.6265i	0.6521+0.5790i
w241	0.5904+0.4138i	0.3935+0.3395i	0.6288+0.4137i	0.5675+0.4799i	0.5656+0.4890i	0.4075+0.4506i	0.6665+0.4960i	0.5027+0.6784i	0.7094+0.5138i
w242	0.5909+0.4147i	0.3945+0.3373i	0.6294+0.4138i	0.5677+0.4801i	0.5622+0.4879i	0.4124+0.4395i	0.5667+0.4955i	0.5121+0.5697i	0.6013+0.5265i
w243	0.5904+0.4145i	0.3952+0.3385i	0.6291+0.4139i	0.5678+0.4800i	0.5623+0.4869i	0.4073+0.4395i	0.6028+0.4546i	0.4555+0.6162i	0.6524+0.4667i
w244	0.5918+0.4100i	0.3772+0.3413i	0.6638+0.3651i	0.6155+0.3723i	0.6239+0.3628i	0.2866+0.4518i	0.7506+0.3592i	0.3624+0.7630i	0.7984+0.3673i
w245	0.5912+0.4098i	0.3780+0.3425i	0.6637+0.3650i	0.6155+0.3724i	0.6237+0.3634i	0.2875+0.4520i	0.7156+0.4239i	0.4347+0.7245i	0.7580+0.4428i
w246	0.5917+0.4107i	0.3790+0.3406i	0.6644+0.3652i	0.6160+0.3723i	0.6217+0.3615i	0.2868+0.4399i	0.6809+0.3299i	0.3286+0.6923i	0.7298+0.3325i
w247	0.5911+0.4105i	0.3797+0.3417i	0.6641+0.3653i	0.6161+0.3725i	0.6216+0.3621i	0.2876+0.4400i	0.6544+0.3786i	0.3924+0.6581i	0.6964+0.4016i
w248	0.5751+0.4230i	0.3886+0.3306i	0.5203+0.3091i	0.4402+0.3949i	0.4324+0.4076i	0.4087+0.3094i	0.4599+0.3752i	0.3972+0.4584i	0.5005+0.4181i
w249	0.5747+0.4228i	0.3891+0.3317i	0.5202+0.3090i	0.4404+0.3947i	0.4323+0.4075i	0.4044+0.3093i	0.4675+0.3645i	0.3657+0.4832i	0.5359+0.3697i
w250	0.5750+0.4237i	0.3904+0.3296i	0.5203+0.3093i	0.4401+0.3947i	0.4326+0.4080i	0.4087+0.3122i	0.5121+0.4317i	0.4563+0.5135i	0.5509+0.4732i
w251	0.5746+0.4235i	0.3909+0.3308i	0.5203+0.3093i	0.4402+0.3948i	0.4327+0.4079i	0.4044+0.3121i	0.5325+0.4077i	0.4093+0.5514i	0.5953+0.4196i
w252	0.5756+0.4178i	0.3727+0.3341i	0.5296+0.2915i	0.4747+0.3329i	0.4849+0.3128i	0.2855+0.3099i	0.5290+0.2684i	0.2657+0.5428i	0.5896+0.2686i
w253	0.5752+0.4176i	0.3733+0.3352i	0.5297+0.2912i	0.4748+0.3330i	0.4849+0.3128i	0.2861+0.3100i	0.5240+0.2788i	0.2996+0.5248i	0.5635+0.3210i
w254	0.5755+0.4185i	0.3746+0.3332i	0.5297+0.2913i	0.4746+0.3329i	0.4850+0.3129i	0.2855+0.3129i	0.6016+0.2998i	0.2962+0.6193i	0.6601+0.3001i
w255	0.5750+0.4183i	0.3751+0.3343i	0.5295+0.2913i	0.4745+0.3331i	0.4851+0.3130i	0.2861+0.3130i	0.5877+0.3267i	0.3481+0.5915i	0.6312+0.3619i

[0145]　　接下来,提供QQAM星座的定义。使用非均匀QQAM星座,调制每个输入单元字 $(y_0, \ldots, y_{m-1})$,以在规范化之前,提供星座点 z_q ,其中,m对应于每个QAM符号 $m = \log_2(M)$ 的位数。在上面显示的表格中,提供用于输入位 $y_{0 \cdot \cdot m-1}$ (对应于小数值)的所有组合的复杂星座点 $x_{0 \cdot \cdot M-1}$ 的向量,用于取决于QQAM位置向量 $w_{0 \cdots b-1}$ 的各种星座尺寸,这限定非均匀星座的第一象限的星座点位置。QQAM位置向量w的长度b由b=M/4限定。QQAM位置向量限定星座的第一象限,即,具有小数值0 ($y_{0 \cdot \cdot m}$ =0000,用于16-QQAM的实例)到b-1 ($y_{0 \cdot \cdot m}$ =0011,用于16-QQAM的实例)的星座点,而如下获得剩余的星座点:

[0146]　　$x_{0 \cdot \cdot b-1} = w_{0 \ldots b-1}$ (第一象限)

[0147]　　$x_{b \cdot \cdot 2b-1} = \mathrm{conj}(w_{0 \ldots b-1})$ (第二象限)

[0148]　　$x_{2b \cdot \cdot 3b-1} = -\mathrm{conj}(w_{0 \ldots b-1})$ (第三象限)

[0149]　　$x_{3b \cdot \cdot 4b-1} = -w_{0 \ldots b-1}$ (第四象限)

[0150]　　conj是复共轭。例如,由QQAM位置向量 $(w_{0 \ldots 3})$ =(0.2663+0.4530i 0.4530+0.2663i 0.5115+1.2092i 1.2092+0.5115i)和输入单元字 $(y_0 \cdot \cdot y_{m-1})$ =(1100) is $x_{12} = -w_0$ =-0.2663-0.4530i限定的16-QQAM的相应星座点是 $x_{12} = -w_0$ =-0.2663-0.4530i。在图7中显示了这个NUC位置向量(为编码速率6/15优化的)的整个星座,在相应的星座点上标记所有输入的单元字。

[0151]　　通过这种方式限定QQAM和 N^2 -NUC星座,以便按位的交互信息随着位位置增大,即,MSB(最左边的位标签)传送最大交互信息,而LSB(最右边的位标签)传送最少交互信息。如上所述,在本文中限定的星座位置向量w不必包含星座的象限(例如,第一象限)的星座点,但是还可以包含这四个象限中的任一个象限的星座点或者并非都位于单个象限内的星座点的象限。由于对称性,所以这造成星座具有不同的位映射,但是具有相同的性能。因此,在本文中限定的表格中的星座位置向量w应视为具有不同的位映射但是具有相同的性能的全部4个对称星座的实例。

[0152]　　使用 N^2 -QAM星座,从信息理论的角度来看,使用高星座阶具有意义,这是因为这些星座给优化提供更多的自由度,并且更接近Shannon容量执行,如在图8中所述。然而,随着

星座尺寸的增大，用于在接收器内去映射的复杂度也增大。由于对于大N^2-QAM星座，很多星座点在复平面内彼此非常接近，所以在Jonathan Stott，"CM and BICM limits for rectangular constellations"，DVB document server，document TM-MIMO0007，August 2012中提出了在优化工艺之前，通过促使特定的星座点具有相同的位置，"压缩"非均匀星座，与其"母星座"相比，接受小性能损失。这种星座在此处称为"ConQAM"（压缩的QAM），并且QQAM星座的压缩星座在此处称为"ConQQAM"。由于更少数量的"有效"星座点造成需要优化更少的自由度，并且在接收器中去映射的复杂度更低，所以这在优化工艺期间提供了更小的复杂度。在Jonathan Stott的上述文档中，压缩的16kQAM显示为具有仅仅3600个剩余的星座点位置，在从20到25dB的SNR区域内提供了良好的性能。

[0153]　　在优化之前进行压缩时，必须作出假设，表现良好的星座可能看起来如何（即，哪些星座点压缩，并且哪些不压缩）。这需要深入分析高星座尺寸。根据星座的所选结构的这些假设，通过相应数量的星座点，在SNR区域上进行优化（例如，268个压缩的星座点，而非1024个）。这种方法的缺点在于，对于不能考虑的每个SNR值，星座的最佳结构实际上变化。即，具有固定数量的星座点的所产生的ConQAM星座在宽SNR范围上并非最佳。因此，在此处获得并且优化不同的结构。

[0154]　　在优化之前压缩星座的一种提高的替换方法在于，在根据本公开提出的优化之后，减少星座点。因此，N^2-QAM星座的所有自由度需要优化，但是获得几个优点。在优化之后执行压缩时，可以获得需要最少所需数量的星座点的星座，已提供期望的性能。这允许所需数量的星座点在SNR范围之上无缝变化，与在Jonathan Stott的上述文档中提出的方法相比，这造成星座点的数量减少。由于为每个SNR点单独执行，所以这种方法称为动态压缩。在下文中，为N^2-QAM情况概述这种方法。

[0155]　　在图9中显示该算法的实例，用于PAM星座的17个星座点。具有小于阈值t的距离的星座点产生一组星座点，即，压缩成单个星座点位置。最好，剩下仅仅6个星座点。当然，该算法可以同样扩展为2D情况，如下面简单所解释的。

[0156]　　动态方法的所需数量的星座点明显更低，此外，相对于母星座保证最大性能代偿。这造成星座点数量减少，进一步降低去映射器的复杂度。

[0157]　　在实施方式中，所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值，其中，所述调制器配置为根据星座的星座点的总数M和编码速率，使用来自组B星座的非均匀星座，这组星座包括由长度v＝sqrt(M)/2-1的星座位置向量u限定的一个或多个以下星座，其中，在来自组B的星座的一个或多个星座位置矢量中，由于以前优化的初步星座位置压缩，所以两个或多个星座位置相同。

[0158]　　提出了在组B内包括的以下非均匀星座：

[0159]　　B) 组B的压缩的M-QAM非均匀星座

[0160]　　B1) 256-ConQAM NUC

[0161]

u / 编码速率	6/15	7/15	8/15	9/15

[0162]

u1	1	1	1	1
u2	2.2838	2.6712	2.6867	2.6537
u3	2.2838	2.6712	3.0876	3.3114
u4	4.2938	4.6718	4.8578	4.9478
u5	4.7065	5.3606	5.9639	6.2057
u6	6.5754	7.387	7.9599	8.1648
u7	8.6463	9.7667	10.4826	10.6773

[0163] B2) 1024-ConQAM NUC

[0164]

u/编码速率	5/15	6/15	7/15	8/15	9/15	10/15
u1	1	1	1	1	1	1
u2	1	1	1	2.0888	2.5646	2.7751
u3	1	1	1	2.0888	2.5646	2.7751
u4	2.4714	2.7615	2.6688	3.9929	4.55	4.8138
u5	2.4714	2.7615	2.6688	3.9929	4.55	4.8138
u6	2.4714	2.7615	3.2331	5.3856	6.3402	6.878
u7	2.4714	2.7615	3.2331	5.3856	6.3402	6.878
u8	4.4808	4.735	4.9096	7.5592	8.6388	8.8948
u9	4.4808	4.735	4.9096	7.5592	8.6388	9.9366
u10	4.9849	5.5675	6.1134	9.3349	10.5992	11.5652
u11	4.9849	5.5675	6.1134	9.8406	11.6813	13.0327
u12	6.9079	7.3286	7.7771	11.9228	13.7177	15.0299
u13	6.9079	7.819	8.5339	13.3931	15.6096	17.0928
u14	8.576	9.5608	10.3128	15.8944	18.2724	19.7629
u15	10.4874	11.6967	12.5661	19.1546	21.7521	23.229

[0165] B3) 4096-ConQAM NUC

[0166]

u/编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15
u1	1	1	1	1	1	1	1	1
u2	1	1	1	1	1	2.2716	2.7361	2.8773
u3	1	1	1	1	1	2.2716	2.7361	2.8773
u4	1	1	2.039	2.5335	2.7564	4.1311	4.6854	4.8671
u5	1	1	2.039	2.5335	2.7564	4.1311	4.6854	4.8671
u6	1	1	2.039	2.5335	2.7564	5.4628	6.4578	6.804
u7	1	1	2.039	2.5335	2.7564	5.4628	6.4578	6.804
u8	2.632	2.6741	3.9335	4.5125	4.7808	7.4745	8.5074	8.5047
u9	2.632	2.6741	3.9335	4.5125	4.7808	7.4745	8.5074	9.3098
u10	2.632	2.6741	3.9335	4.5125	4.7808	8.9342	10.3862	10.538
u11	2.632	2.6741	3.9335	4.5125	4.7808	8.9342	10.3862	11.4018
u12	2.632	3.2045	5.2825	6.2741	6.7922	10.9126	12.5386	12.7315
u13	2.632	3.2045	5.2825	6.2741	6.7922	10.9126	12.5386	13.671
u14	2.632	3.2045	5.2825	6.2741	6.7922	12.5824	14.7019	14.9604

u15	2.632	3.2045	5.2825	6.2741	6.7922	12.5824	14.7019	15.9972
u16	4.6312	4.8953	7.4395	8.5533	8.7969	14.7996	17.2181	17.4143
u17	4.6312	4.8953	7.4395	8.5533	8.7969	14.7996	17.2181	18.5456
u18	4.6312	4.8953	7.4395	8.5533	9.7606	16.7338	19.7895	19.9493
u19	4.6312	4.8953	7.4395	8.5533	9.7606	16.7338	19.7895	21.1969
u20	5.2613	6.077	9.1955	10.4959	11.3919	19.1103	22.0532	22.741
u21	5.2613	6.077	9.1955	10.4959	11.3919	19.1103	23.3808	24.129
u22	5.2613	6.077	9.6429	11.4947	12.8073	21.6213	25.1169	25.7517
u23	5.2613	6.077	9.6429	11.4947	12.8073	21.6213	26.6987	27.3256
u24	7.0507	7.7374	11.7079	13.5198	14.7968	24.1315	28.6925	29.1651
u25	7.0507	7.7374	11.7079	13.5198	14.7968	25.5633	30.5564	30.9655
u26	7.4269	8.4608	13.0989	15.1128	16.5067	27.6414	32.7592	33.0129
u27	7.4269	8.4608	13.0989	15.6457	17.5025	29.6431	35.04	35.1483
u28	8.869	9.9898	15.1744	17.6029	19.3416	32.2532	37.7468	37.6166
u29	9.1641	10.497	16.2183	19.0971	21.1053	35.0366	40.6819	40.3063
u30	10.5034	12.1004	18.4967	21.5328	23.5673	38.5846	44.2782	43.5432
u31	12.3418	14.1335	21.4623	24.7544	26.8076	43.1809	48.8556	47.6401

[0167]　　在优化非均匀QAM星座时，一些星座点易于合并。通过故意合并彼此接近的星座点，以便降低QAM去映射器（以及QAM映射器）的复杂度，通过简化软决定对数似然比（LLR）的计算，可以利用这个。这种星座称为压缩的QAM星座。如果小心选择，那么与未压缩的非均匀星座相比，性能损失可以忽略。作为一个实例，为编码速率6/15优化的1024-QQAM星座可以压缩为268个星座点位置，降低了去映射复杂度，同时保持性能。

[0168]　　在实施方式中，所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值，其中，所述调制器配置为根据星座的星座点的总数M和编码速率，使用来自一组D星座的非均匀星座，这组星座包括一个或多个以下星座，其中，所述星座点由星座位置矢量$w_{0\cdots b-1}$限定，b＝M/4，其中，

[0169]　　第一象限的星座点$x_{0\cdots b-1}$限定为$x_{0\dots b-1}＝w_{0\dots b-1}$；

[0170]　　第二象限的星座点$x_{b\cdots 2b-1}$限定为$x_{b\cdots 2b-1}＝conj(w_{0\dots b-1})$；

[0171]　　第三象限的星座点$x_{2b\cdots 3b-1}$限定为$x_{2b\cdots 3b-1}＝-conj(w_{0\dots b-1})$；并且

[0172]　　第四象限的星座点$x_{3b\cdots 4b-1}$限定为$x_{3b\cdots 4b-1}＝-w_{0\dots b-1}$，

[0173]　　其中，conj是复共轭，

[0174]　　其中，在来自组D的星座的一个或多个星座位置矢量中，由于以前优

[0175]　　化的初步星座位置压缩，所以两个或多个星座位置相同。

[0176]　　提出了在组D内包括的以下非均匀星座：

[0177]　　D）组D的压缩的M-QAM非均匀星座

[0178]　　D1）64-ConQQAM NUC

[0179]

w / 编码速率	5/15	6/15	7/15	8/15	9/15
w0	1.0257+0.5960i	0.5656+0.9499i	0.2925+1.4892i	0.2920+1.4827i	0.2978+1.4669i
w1	1.2181+0.7476i	0.2750+1.0676i	0.8449+1.2622i	0.8411+1.2563i	0.8421+1.2355i
w2	1.1509+0.3069i	0.8202+1.2651i	0.2351+1.0196i	0.2174+1.0211i	0.2135+1.0389i
w3	1.3888+0.3325i	0.3011+1.4529i	0.5555+0.8926i	0.5702+0.8798i	0.6055+0.8654i
w4	0.5961+1.0257i	0.9500+0.5641i	1.4892+0.2925i	1.4827+0.2920i	1.4685+0.2859i
w5	0.7476+1.2181i	1.0666+0.2744i	1.2622+0.8449i	1.2563+0.8410i	1.2516+0.8201i
w6	0.3069+1.1510i	1.2657+0.8178i	1.0196+0.2351i	1.0211+0.2174i	1.0279+0.1981i
w7	0.3325+1.3888i	1.4521+0.3005i	0.8926+0.5555i	0.8798+0.5702i	0.8857+0.5642i

[0180]

w8	0.4969+0.2685i	0.2717+0.5512i	0.1635+0.3025i	0.1583+0.3034i	0.1545+0.3665i
w9	0.4123+0.2376i	0.2717+0.5512i	0.1635+0.3025i	0.1583+0.3034i	0.1545+0.3665i
w10	0.4969+0.2685i	0.2020+0.3572i	0.2075+0.6586i	0.1871+0.6855i	0.1756+0.7261i
w11	0.4123+0.2376i	0.2020+0.3572i	0.3354+0.6030i	0.3563+0.6126i	0.4023+0.6180i
w12	0.2685+0.4969i	0.5503+0.2716i	0.3025+0.1635i	0.3034+0.1583i	0.2731+0.1455i
w13	0.2376+0.4123i	0.5503+0.2716i	0.3025+0.1635i	0.3034+0.1583i	0.2731+0.1455i
w14	0.2685+0.4969i	0.3561+0.2021i	0.6586+0.2075i	0.6855+0.1871i	0.6840+0.1578i
w15	0.2376+0.4123i	0.3561+0.2021i	0.6030+0.3354i	0.6126+0.3563i	0.6145+0.3556i

[0181]　　　D2) 256-ConQQAM NUC

[0182]

w / 编码速	5/15	6/15	7/15	8/15	9/15	10/15	11/15
w0	-0.3495+1.7549i	0.6800+1.6926i	0.7280+1.6384i	1.0804+1.3788i	1.6350+0.1593i	1.6097+0.1548i	0.1512+1.5761i
w1	-0.2804+1.4293i	0.3911+1.3645i	0.4787+1.3492i	1.0487+0.9862i	1.5776+0.4735i	1.5549+0.4605i	0.4510+1.5251i
w2	-0.2804+1.4293i	0.2191+1.7524i	0.2417+1.7872i	1.6464+0.7428i	1.3225+0.1320i	1.3226+0.1290i	0.1269+1.3158i
w3	-0.2635+1.3614i	0.2274+1.4208i	0.1966+1.4478i	1.3245+0.9414i	1.2742+0.3922i	1.2772+0.3829i	0.3773+1.2728i
w4	-0.9918+1.4880i	0.8678+1.2487i	0.9185+1.2490i	0.7198+1.2427i	1.2901+1.0495i	1.2753+1.0242i	1.0045+1.2537i
w5	-0.8109+1.2116i	0.7275+1.1667i	0.7448+1.1524i	0.8106+1.0040i	1.4625+0.7740i	1.4434+0.7540i	0.7386+1.4164i
w6	-0.8109+1.2116i	0.8747+1.0470i	0.9536+0.9516i	0.5595+1.0317i	1.0382+0.8623i	1.0491+0.8476i	0.8392+1.0508i
w7	-0.7744+1.1516i	0.7930+1.0406i	0.8912+0.9461i	0.6118+0.9722i	1.1794+0.6376i	1.1861+0.6253i	0.6172+1.1844i
w8	-0.2349+1.0113i	0.1978+0.9823i	0.2553+0.9993i	1.6768+0.2002i	0.9430+0.1100i	0.9326+0.0970i	0.0939+0.9317i
w9	-0.2349+1.0113i	0.2071+1.0557i	0.2988+1.0689i	0.9997+0.6844i	0.9069+0.2829i	0.8962+0.2804i	0.2781+0.8975i
w10	-0.2349+1.0113i	0.1978+0.9823i	0.1656+1.0288i	1.4212+0.4769i	1.0854+0.1139i	1.1044+0.1102i	0.1093+1.1073i
w11	-0.2349+1.0113i	0.2071+1.0557i	0.1779+1.1140i	1.1479+0.6312i	1.0441+0.3296i	1.0648+0.3267i	0.3230+1.0701i
w12	-0.5497+0.8869i	0.5660+0.8461i	0.5795+0.8287i	0.6079+0.6566i	0.7273+0.6160i	0.7325+0.6071i	0.6074+0.7404i
w13	-0.5497+0.8869i	0.5660+0.8461i	0.5795+0.8287i	0.7284+0.6957i	0.8177+0.4841i	0.8260+0.4559i	0.4499+0.8324i
w14	-0.5497+0.8869i	0.6073+0.8182i	0.6595+0.7742i	0.5724+0.7031i	0.8504+0.7217i	0.8744+0.7153i	0.7128+0.8852i
w15	-0.5497+0.8869i	0.5660+0.8461i	0.6595+0.7742i	0.6302+0.7259i	0.9638+0.5407i	0.9882+0.5300i	0.5259+0.9957i
w16	-1.7549+0.3495i	1.4070+0.1790i	1.4079+0.1358i	1.4457+1.4010i	0.1658+1.6747i	0.1646+1.6407i	1.6163+0.1632i
w17	-1.4293+0.2804i	1.7227+0.2900i	1.7492+0.2856i	0.1866+1.7346i	0.4907+1.6084i	0.4867+1.5743i	1.5486+0.4813i
w18	-1.4293+0.2804i	1.3246+0.2562i	1.3108+0.2733i	0.1174+1.1035i	0.1322+1.3631i	0.1363+1.3579i	1.3596+0.1381i
w19	-1.3614+0.2635i	1.3636+0.3654i	1.3393+0.4031i	0.1095+1.0132i	0.3929+1.3102i	0.4023+1.3026i	1.3018+0.4076i
w20	-1.4880+0.9918i	1.3708+1.2834i	1.3733+1.2596i	0.4357+1.3636i	1.0646+1.2876i	1.0542+1.2584i	1.2347+1.0376i
w21	-1.2116+0.8109i	1.6701+0.8403i	1.6601+0.8198i	0.5853+1.6820i	0.7949+1.4772i	0.7875+1.4450i	1.4193+0.7769i
w22	-1.2116+0.8109i	1.1614+0.7909i	1.1559+0.7249i	0.3439+1.0689i	0.8555+1.0542i	0.8687+1.0407i	1.0335+0.8734i
w23	-1.1516+0.7744i	1.2241+0.7367i	1.2163+0.6897i	0.3234+0.9962i	0.6363+1.2064i	0.6502+1.1951i	1.1905+0.6562i
w24	-1.0113+0.2349i	0.9774+0.2034i	0.9601+0.1792i	0.1083+0.6241i	0.1088+0.9530i	0.0982+0.9745i	0.9948+0.1006i
w25	-1.0113+0.2349i	0.9774+0.2034i	0.9601+0.1792i	0.1083+0.6241i	0.2464+0.9270i	0.2842+0.9344i	0.9492+0.2955i
w26	-1.0113+0.2349i	0.9774+0.2034i	0.9601+0.1792i	0.1093+0.7170i	0.1124+1.1327i	0.1142+1.1448i	1.1596+0.1180i
w27	-1.0113+0.2349i	0.9795+0.2417i	0.9601+0.1792i	0.1093+0.7170i	0.3160+1.0913i	0.3385+1.0973i	1.1091+0.3468i
w28	-0.8869+0.5497i	0.8236+0.4847i	0.8069+0.4342i	0.3208+0.6318i	0.5707+0.7662i	0.6062+0.7465i	0.7476+0.6205i
w29	-0.8869+0.5497i	0.8236+0.4847i	0.8069+0.4342i	0.3208+0.6318i	0.4490+0.8461i	0.4607+0.8538i	0.8645+0.4711i
w30	-0.8869+0.5497i	0.8798+0.5374i	0.8601+0.4908i	0.3297+0.7141i	0.6961+0.8850i	0.7263+0.8764i	0.8777+0.7384i
w31	-0.8869+0.5497i	0.8798+0.5374i	0.8601+0.4908i	0.3297+0.7141i	0.5229+1.0037i	0.5450+1.0067i	1.0128+0.5570i
w32	-0.1640+0.3056i	0.1509+0.3272i	0.1217+0.4285i	0.9688+0.1119i	0.3232+0.0858i	0.2660+0.0752i	0.0742+0.2556i
w33	-0.1640+0.3056i	0.1509+0.3272i	0.1217+0.4285i	0.9131+0.1709i	0.3232+0.0858i	0.2660+0.0752i	0.0742+0.2556i
w34	-0.1640+0.3056i	0.1509+0.3272i	0.1217+0.4285i	0.9688+0.1119i	0.4564+0.1187i	0.4544+0.0957i	0.0937+0.4473i
w35	-0.1640+0.3056i	0.1509+0.3272i	0.1217+0.4285i	0.9131+0.1709i	0.4564+0.1187i	0.4544+0.0957i	0.0937+0.4473i
w36	-0.1640+0.3056i	0.1509+0.3272i	0.1708+0.3974i	0.6419+0.1441i	0.2849+0.1302i	0.2572+0.1781i	0.2078+0.2475i
w37	-0.1640+0.3056i	0.1509+0.3272i	0.1708+0.3974i	0.6419+0.1441i	0.2849+0.1302i	0.2572+0.1781i	0.2078+0.2475i
w38	-0.1640+0.3056i	0.1509+0.3272i	0.1708+0.3974i	0.6419+0.1441i	0.3766+0.2539i	0.3660+0.2732i	0.2876+0.3664i
w39	-0.1640+0.3056i	0.1509+0.3272i	0.1708+0.3974i	0.6419+0.1441i	0.3766+0.2539i	0.3660+0.2732i	0.2876+0.3664i
w40	-0.2071+0.6406i	0.1786+0.6836i	0.1744+0.7444i	1.3127+0.1240i	0.7502+0.1138i	0.7706+0.0922i	0.0813+0.7729i
w41	-0.2071+0.6406i	0.1786+0.6836i	0.1744+0.7444i	0.9572+0.4344i	0.7325+0.2088i	0.7407+0.2260i	0.2345+0.7412i
w42	-0.2071+0.6406i	0.1786+0.6836i	0.1744+0.7444i	1.2403+0.2631i	0.6473+0.1138i	0.6180+0.0927i	0.0756+0.6187i
w43	-0.2071+0.6406i	0.1786+0.6836i	0.1744+0.7444i	1.0254+0.4130i	0.6339+0.1702i	0.6019+0.1658i	0.1815+0.5946i
w44	-0.3251+0.5895i	0.3585+0.6001i	0.3995+0.6028i	0.6207+0.4139i	0.5902+0.4857i	0.6007+0.4980i	0.5118+0.6039i
w45	-0.3251+0.5895i	0.3585+0.6001i	0.3995+0.6028i	0.6773+0.4284i	0.6355+0.4185i	0.6673+0.3928i	0.3821+0.6808i
w46	-0.3251+0.5895i	0.3585+0.6001i	0.3995+0.6028i	0.6207+0.4139i	0.5099+0.3795i	0.4786+0.3935i	0.4145+0.4734i
w47	-0.3251+0.5895i	0.3585+0.6001i	0.3995+0.6028i	0.6207+0.4139i	0.5099+0.3795i	0.5176+0.3391i	0.3230+0.5340i
w48	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.1249+0.1155i	0.0962+0.1443i	0.0755+0.1004i	0.0859+0.0728i
w49	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.1249+0.1155i	0.0962+0.1443i	0.0755+0.1004i	0.0859+0.0728i
w50	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.1249+0.1155i	0.0932+0.3972i	0.0822+0.4771i	0.5165+0.0795i
w51	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.1249+0.1155i	0.0932+0.3972i	0.0822+0.4771i	0.5165+0.0795i
w52	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.3743+0.1248i	0.0962+0.1443i	0.1016+0.2242i	0.2619+0.0919i
w53	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.3743+0.1248i	0.0962+0.1443i	0.1016+0.2242i	0.2619+0.0919i
w54	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.3743+0.1248i	0.1923+0.3624i	0.1916+0.3944i	0.4223+0.2036i
w55	-0.3056+0.1640i	0.2707+0.1533i	0.2219+0.1422i	0.3743+0.1248i	0.1923+0.3624i	0.1916+0.3944i	0.4223+0.2036i
w56	-0.6406+0.2071i	0.6459+0.1725i	0.6060+0.1399i	0.1166+0.3558i	0.1091+0.7656i	0.0930+0.8122i	0.8427+0.0848i
w57	-0.6406+0.2071i	0.6459+0.1725i	0.6060+0.1399i	0.1166+0.3558i	0.1699+0.7537i	0.2215+0.7840i	0.8036+0.2443i
w58	-0.6406+0.2071i	0.6459+0.1725i	0.6060+0.1399i	0.1166+0.3558i	0.1142+0.5964i	0.0937+0.6514i	0.6933+0.0788i

[0183]

w59	-0.6406+0.2071i	0.6459+0.1725i	0.6060+0.1399i	0.1166+0.3558i	0.1142+0.5964i	0.1540+0.6366i	0.6649+0.1793i
w60	-0.5895+0.3251i	0.5863+0.3220i	0.5660+0.3001i	0.3519+0.3779i	0.4294+0.6363i	0.4810+0.6306i	0.6321+0.5048i
w61	-0.5895+0.3251i	0.5863+0.3220i	0.5660+0.3001i	0.3519+0.3779i	0.3744+0.6744i	0.3856+0.7037i	0.7279+0.3892i
w62	-0.5895+0.3251i	0.5863+0.3220i	0.5660+0.3001i	0.3519+0.3779i	0.3120+0.5292i	0.3527+0.5230i	0.5265+0.3752i
w63	-0.5895+0.3251i	0.5863+0.3220i	0.5660+0.3001i	0.3519+0.3779i	0.3120+0.5292i	0.3100+0.5559i	0.5885+0.3076i

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[0185]

w /编码速率	5/15	6/15	7/15	8/15	9/15	10/15	11/15	12/15	13/15
w0	1.9734+0.6475i	1.3555+1.1873i	0.1119+1.7802i	0.0966+1.7257i	0.1003+1.7258i	1.7268+0.8306i	0.0827+1.7001i	1.6707+0.0830i	0.0862+1.6154i
w1	1.7794+0.9784i	1.0871+1.4324i	0.2324+2.0028i	0.1799+1.9540i	0.1722+1.9393i	1.4295+1.1791i	0.2495+1.7069i	1.6596+0.2486i	0.2532+1.5973i
w2	0.4642+1.8997i	1.5003+1.4954i	0.1416+1.5629i	0.1216+1.5846i	0.0956+1.5505i	1.5265+0.9329i	0.0759+1.5315i	1.5191+0.0748i	0.0628+1.4840i
w3	0.8851+1.9829i	1.1127+1.7206i	0.1594+1.5242i	0.2925+1.5646i	0.2621+1.5384i	1.3311+0.9796i	0.2264+1.5296i	1.5087+0.2253i	0.1933+1.4746i
w4	0.2393+1.3953i	0.2080+2.0408i	0.8323+1.8356i	0.7016+1.7899i	0.6393+1.7656i	1.0476+1.3141i	0.5781+1.6238i	1.5860+0.5707i	0.5623+1.5170i
w5	0.2393+1.3953i	0.7958+1.4948i	0.5102+1.8340i	0.4407+1.8294i	0.3969+1.7846i	1.2433+1.3224i	0.4153+1.6700i	1.6299+0.4118i	0.4115+1.5641i
w6	0.2534+1.4887i	0.5864+1.9337i	0.4040+1.5212i	0.6347+1.5255i	0.6050+1.5226i	1.0060+1.1520i	0.5222+1.4586i	1.4405+0.5184i	0.4717+1.4136i
w7	0.2393+1.3953i	0.7534+1.6241i	0.4040+1.5212i	0.4512+1.5701i	0.4221+1.5525i	1.1831+1.1052i	0.3761+1.5021i	1.4814+0.3733i	0.3318+1.4521i
w8	2.0528+0.2197i	1.0007+1.0906i	0.1151+1.2407i	0.0862+1.3505i	0.0799+1.3199i	1.6816+0.6120i	0.0654+1.2745i	1.2786+0.0635i	0.0573+1.2656i
w9	1.6003+1.3185i	0.9660+1.1761i	0.1151+1.2407i	0.2378+1.3237i	0.2425+1.3020i	1.1961+0.7851i	0.1916+1.2647i	1.2678+0.1901i	0.1750+1.2589i
w10	0.1805+2.0047i	0.9193+1.0471i	0.1219+1.3013i	0.0908+1.3996i	0.0833+1.3795i	1.4907+0.7274i	0.0709+1.3936i	1.3905+0.0691i	0.0712+1.3686i
w11	1.3579+1.6516i	0.8849+1.0953i	0.1219+1.3013i	0.2515+1.3739i	0.2487+1.3670i	1.3242+0.7939i	0.2071+1.3855i	1.3801+0.2066i	0.2106+1.3583i
w12	0.1534+1.4308i	0.8849+1.0953i	0.3445+1.2020i	0.5334+1.2483i	0.5352+1.2272i	0.9444+0.8682i	0.4344+1.2067i	1.2103+0.4364i	0.4128+1.2072i
w13	0.1532+1.3846i	0.8468+1.2089i	0.3445+1.2020i	0.4112+1.2843i	0.3974+1.2734i	1.0778+0.8297i	0.3137+1.2425i	1.2453+0.3150i	0.2939+1.2391i
w14	0.1492+1.5422i	0.8508+1.0556i	0.3544+1.2507i	0.5634+1.3178i	0.5666+1.3364i	0.9728+1.0019i	0.4756+1.3240i	1.3174+0.4751i	0.4756+1.2940i
w15	0.1534+1.4308i	0.8263+1.1474i	0.3544+1.2507i	0.4201+1.3450i	0.4117+1.3592i	1.1117+0.9612i	0.3426+1.3612i	1.3555+0.3427i	0.3462+1.3333i
w16	0.7168+1.4422i	1.3097+0.8498i	1.0272+1.4142i	1.3853+1.1272i	1.4270+1.2101i	0.7139+1.4630i	1.1609+1.2807i	1.2549+1.1333i	1.1029+1.1970i
w17	0.7660+1.4662i	1.2703+0.7763i	0.9293+1.2912i	1.3369+1.3509i	1.2720+1.3913i	0.7740+1.6553i	1.0285+1.3890i	1.3567+1.0038i	0.9805+1.3006i
w18	0.7079+1.5478i	1.2076+0.7137i	1.0481+1.1977i	1.2114+1.0355i	1.2297+1.0783i	0.6485+1.3230i	1.0435+1.1532i	1.1390+1.0306i	0.9776+1.1396i
w19	0.7980+1.5832i	1.2076+0.7137i	1.0032+1.1946i	1.1082+1.1877i	1.1069+1.2225i	0.6195+1.1967i	0.9255+1.2490i	1.2324+0.9142i	0.8621+1.2273i
w20	0.5597+1.2994i	1.0228+0.5992i	0.8044+1.5410i	0.9388+1.6673i	0.8723+1.6736i	0.8720+1.3702i	0.7336+1.5577i	1.5191+0.7201i	0.7053+1.4577i
w21	0.5597+1.2994i	1.0228+0.5992i	0.7504+1.3903i	1.1497+1.5199i	1.0846+1.5470i	0.9942+1.5551i	0.8851+1.4823i	1.4492+0.8682i	0.8463+1.3878i
w22	0.5597+1.2994i	1.0228+0.5992i	0.6252+1.4270i	0.8175+1.4408i	0.7883+1.4518i	0.8479+1.1984i	0.6624+1.4006i	1.3816+0.6559i	0.6073+1.3617i
w23	0.5597+1.2994i	1.0228+0.5992i	0.6252+1.4270i	0.9821+1.3219i	0.9583+1.3483i	0.7405+1.1635i	0.7974+1.3323i	1.3154+0.7901i	0.7380+1.3004i
w24	0.8801+1.2399i	1.0650+0.8350i	0.8299+1.0222i	0.9456+0.9078i	0.9564+0.8979i	0.5584+0.9220i	0.8662+0.9554i	0.9559+0.8672i	0.8450+0.9697i
w25	1.0042+1.2986i	1.0650+0.8350i	0.8299+1.0222i	0.8986+0.9677i	0.8843+0.9882i	0.6047+0.9153i	0.7681+1.0353i	1.0355+0.7698i	0.7464+1.0441i
w26	0.8801+1.2399i	1.0347+0.8079i	0.8299+1.0222i	1.0292+0.9494i	1.0738+0.9718i	0.5599+1.0238i	0.9483+1.0473i	1.0408+0.9445i	0.9365+1.0264i
w27	1.0594+1.3586i	1.0347+0.8079i	0.8299+1.0222i	0.9610+1.0336i	0.9788+1.0896i	0.6007+1.0581i	0.8407+1.1336i	1.1266+0.8383i	0.8308+1.1108i
w28	0.6953+1.1557i	0.9737+0.6861i	0.5930+1.1582i	0.6851+1.1662i	0.6658+1.1650i	0.8173+0.9002i	0.5509+1.1608i	1.1624+0.5530i	0.5291+1.1627i
w29	0.6953+1.1557i	0.9737+0.6861i	0.5930+1.1582i	0.7736+1.1030i	0.7770+1.0888i	0.7235+0.9143i	0.6621+1.1020i	1.1043+0.6650i	0.6409+1.1079i
w30	0.6953+1.1557i	0.9737+0.6861i	0.5930+1.1582i	0.7229+1.2479i	0.7185+1.2809i	0.8457+1.0230i	0.6018+1.2720i	1.2643+0.6023i	0.6007+1.2427i
w31	0.6953+1.1557i	0.9737+0.6861i	0.5930+1.1582i	0.8384+1.1668i	0.8561+1.1944i	0.7336+1.0397i	0.7241+1.2084i	1.2025+0.7245i	0.7195+1.1826i
w32	0.1580+0.9274i	0.1594+1.5423i	0.1087+0.9066i	0.1143+1.0119i	0.0797+1.0147i	1.4546+0.3656i	0.0467+0.9059i	0.9195+0.0458i	0.0451+0.9145i
w33	0.1580+0.9274i	0.4315+1.3873i	0.1087+0.9066i	0.1143+1.0119i	0.1584+1.0041i	1.1503+0.4997i	0.1350+0.8973i	0.9105+0.1382i	0.1354+0.9073i
w34	0.1580+0.9274i	0.1970+1.5197i	0.1087+0.9066i	0.1143+1.0119i	0.0797+1.0147i	1.3573+0.4202i	0.0497+0.9867i	0.9998+0.0502i	0.0490+0.9960i
w35	0.1580+0.9274i	0.4315+1.3873i	0.1087+0.9066i	0.1143+1.0119i	0.1584+1.0041i	1.2496+0.4668i	0.1471+0.9764i	0.9903+0.1497i	0.1462+0.9883i
w36	0.1644+1.0218i	0.1795+1.6689i	0.2739+0.8771i	0.3260+0.9470i	0.3578+0.9313i	0.8671+0.5471i	0.3086+0.8542i	0.8664+0.3143i	0.3118+0.8700i
w37	0.1644+1.0218i	0.5011+1.4256i	0.2739+0.8771i	0.3260+0.9470i	0.3089+0.9536i	1.0300+0.5234i	0.2240+0.8802i	0.8929+0.2275i	0.2251+0.8927i
w38	0.1644+1.0218i	0.2493+1.6121i	0.2739+0.8771i	0.3260+0.9470i	0.3578+0.9313i	0.8671+0.5471i	0.3372+0.9296i	0.9434+0.3421i	0.3384+0.9473i
w39	0.1644+1.0218i	0.5011+1.4256i	0.2739+0.8771i	0.3260+0.9470i	0.3089+0.9536i	0.9827+0.5433i	0.2436+0.9574i	0.9718+0.2472i	0.2432+0.9721i
w40	0.1580+0.9274i	0.6307+0.9904i	0.1073+1.0228i	0.0934+1.1764i	0.0757+1.1678i	1.5800+0.4522i	0.0597+1.1699i	1.1777+0.0583i	0.0573+1.1691i
w41	0.1580+0.9274i	0.6077+1.0677i	0.1073+1.0228i	0.1853+1.1657i	0.2089+1.1525i	1.1744+0.6454i	0.1751+1.1583i	1.1673+0.1754i	0.1729+1.1617i
w42	0.1580+0.9274i	0.6307+0.9904i	0.1073+1.0228i	0.0934+1.1764i	0.0757+1.1678i	1.4318+0.5695i	0.0546+1.0770i	1.0856+0.0541i	0.0527+1.0803i
w43	0.1580+0.9274i	0.6077+1.0677i	0.1073+1.0228i	0.1853+1.1657i	0.2089+1.1525i	1.2928+0.6164i	0.1620+1.0654i	1.0759+0.1619i	0.1592+1.0726i
w44	0.1644+1.0218i	0.6307+0.9904i	0.3069+0.9954i	0.4320+1.0863i	0.4674+1.0931i	0.9085+0.7546i	0.3987+1.1039i	1.1138+0.4023i	0.3967+1.1112i
w45	0.1644+1.0218i	0.6077+1.0677i	0.3069+0.9954i	0.3704+1.1115i	0.3537+1.1141i	1.0445+0.6871i	0.2892+1.1363i	1.1461+0.2901i	0.2851+1.1427i
w46	0.1644+1.0218i	0.6307+0.9904i	0.3069+0.9954i	0.4320+1.0863i	0.4464+1.0591i	0.8937+0.6812i	0.3688+1.0131i	1.0258+0.3708i	0.3660+1.0273i
w47	0.1644+1.0218i	0.6077+1.0677i	0.3069+0.9954i	0.3704+1.1115i	0.3537+1.1141i	0.9938+0.6542i	0.2650+1.0458i	1.0553+0.2677i	0.2633+1.0553i
w48	0.4479+0.8477i	0.6537+0.5911i	0.6031+0.7131i	0.6171+0.7142i	0.6214+0.7083i	0.5532+0.5705i	0.6137+0.6750i	0.6837+0.6227i	0.6365+0.6957i
w49	0.4479+0.8477i	0.6537+0.5911i	0.6031+0.7131i	0.6171+0.7142i	0.6214+0.7083i	0.5532+0.5705i	0.5476+0.7291i	0.7398+0.5527i	0.5615+0.7517i
w50	0.4479+0.8477i	0.6537+0.5911i	0.6031+0.7131i	0.6171+0.7142i	0.6214+0.7083i	0.5557+0.6030i	0.6692+0.7370i	0.7451+0.6776i	0.6869+0.7563i
w51	0.4479+0.8477i	0.6537+0.5911i	0.6031+0.7131i	0.6171+0.7142i	0.6214+0.7083i	0.5557+0.6030i	0.5949+0.7949i	0.8068+0.6014i	0.6061+0.8169i
w52	0.4509+0.9195i	0.7084+0.5835i	0.4765+0.7946i	0.4944+0.8407i	0.4937+0.8377i	0.7445+0.5538i	0.3955+0.8179i	0.8322+0.3986i	0.3978+0.8394i
w53	0.4509+0.9195i	0.7084+0.5835i	0.4765+0.7946i	0.4944+0.8407i	0.4937+0.8377i	0.6842+0.5618i	0.4712+0.7798i	0.7900+0.4779i	0.4813+0.7997i
w54	0.4509+0.9195i	0.7084+0.5835i	0.4765+0.7946i	0.4944+0.8407i	0.4937+0.8377i	0.7494+0.5848i	0.4286+0.8921i	0.9065+0.4330i	0.4306+0.9123i
w55	0.4509+0.9195i	0.7084+0.5835i	0.4765+0.7946i	0.4944+0.8407i	0.5165+0.8320i	0.6877+0.5945i	0.5132+0.8496i	0.8606+0.5201i	0.5207+0.8689i
w56	0.4479+0.8477i	0.6624+0.6779i	0.6979+0.8348i	0.7645+0.8251i	0.8208+0.8194i	0.5534+0.7977i	0.7942+0.8748i	0.8797+0.7981i	0.7988+0.8850i

w57	0.4479+0.8477i	0.6624+0.6779i	0.6979+0.8348i	0.7645+0.8251i	0.7795+0.8678i	0.5889+0.7966i	0.7046+0.9484i	0.9527+0.7086i	0.7056+0.9563i
w58	0.4479+0.8477i	0.6624+0.6779i	0.6979+0.8348i	0.7645+0.8251i	0.7654+0.7871i	0.5501+0.7239i	0.7290+0.8039i	0.8102+0.7357i	0.7403+0.8193i
w59	0.4479+0.8477i	0.6624+0.6779i	0.6979+0.8348i	0.7645+0.8251i	0.7366+0.8230i	0.5813+0.7226i	0.6487+0.8706i	0.8771+0.6533i	0.6540+0.8851i
w60	0.4991+0.9080i	0.7073+0.6615i	0.5192+0.9341i	0.5944+0.9931i	0.5960+1.0246i	0.7892+0.7789i	0.5056+1.0627i	1.0703+0.5098i	0.5042+1.0698i
w61	0.4991+0.9080i	0.7073+0.6615i	0.5192+0.9341i	0.6271+0.9693i	0.6739+0.9765i	0.7107+0.7905i	0.6075+1.0087i	1.0160+0.6122i	0.6076+1.0178i
w62	0.4991+0.9080i	0.7073+0.6615i	0.5192+0.9341i	0.5944+0.9931i	0.5730+0.9785i	0.7731+0.7034i	0.4669+0.9761i	0.9854+0.4703i	0.4657+0.9891i
w63	0.4991+0.9080i	0.7073+0.6615i	0.5192+0.9341i	0.6271+0.9693i	0.6332+0.9357i	0.7020+0.7141i	0.5603+0.9273i	0.9357+0.5645i	0.5623+0.9416i
w64	1.5469+0.5626i	1.6936+1.0501i	1.9725+0.1409i	1.9480+0.1481i	1.8978+0.1329i	0.0599+1.4685i	1.7073+0.0837i	0.0829+1.6709i	1.6374+0.0732i
w65	1.5047+0.6160i	1.9944+0.7935i	1.9915+0.4357i	1.6746+0.0974i	1.6495+0.0908i	0.1246+1.8836i	1.7027+0.2504i	0.2503+1.6668i	1.6151+0.2229i
w66	1.3694+0.4997i	1.3954+0.1171i	1.6673+0.1308i	1.4082+0.0951i	1.3940+0.0760i	0.0726+1.3309i	1.5368+0.0756i	0.0746+1.5195i	1.5081+0.0892i
w67	1.3694+0.4997i	1.3954+0.1171i	1.6321+0.1768i	1.4516+0.1035i	1.4413+0.1092i	0.0737+1.2419i	1.5297+0.2272i	0.2237+1.5133i	1.4856+0.2487i
w68	1.3034+0.4565i	1.0291+0.1180i	1.5727+0.6014i	1.8289+0.4101i	1.8256+0.3950i	0.1916+1.5130i	1.6271+0.5805i	0.5739+1.5837i	1.5452+0.5306i
w69	1.3034+0.4565i	1.0291+0.1180i	1.8127+0.6892i	1.6508+0.2818i	1.6372+0.2691i	0.1084+1.6780i	1.6704+0.4169i	0.4139+1.6300i	1.5894+0.3775i
w70	1.3034+0.4565i	1.1010+0.1192i	1.5630+0.4516i	1.4163+0.3400i	1.4120+0.3476i	0.2135+1.3547i	1.4619+0.5241i	0.5163+1.4416i	1.4079+0.5384i
w71	1.3034+0.4565i	1.1010+0.1192i	1.6016+0.3840i	1.4507+0.3041i	1.4494+0.2700i	0.2135+1.2428i	1.5031+0.3768i	0.3716+1.4836i	1.4548+0.3961i
w72	1.6559+0.1897i	1.7938+0.1356i	1.3210+0.1185i	1.1634+0.1032i	1.1520+0.1019i	0.0611+0.9575i	1.2795+0.0648i	0.0639+1.2810i	1.2939+0.0694i
w73	1.5179+0.1778i	2.0345+0.2783i	1.3210+0.1185i	1.1634+0.1032i	1.1520+0.1019i	0.0611+0.9575i	1.2691+0.1929i	0.1907+1.2711i	1.2819+0.2049i
w74	1.4640+0.1827i	1.4715+0.1190i	1.3768+0.1287i	1.2231+0.1035i	1.2370+0.0895i	0.0653+1.0817i	1.3982+0.0700i	0.0695+1.3921i	1.3970+0.0586i
w75	1.4062+0.1772i	1.3954+0.1171i	1.3768+0.1287i	1.2231+0.1035i	1.2259+0.1210i	0.0672+1.1221i	1.3874+0.2089i	0.2069+1.3839i	1.3864+0.1843i
w76	1.4062+0.1772i	1.0291+0.1180i	1.2996+0.3986i	1.1512+0.3056i	1.1410+0.3239i	0.1822+0.9501i	1.2099+0.4372i	0.4372+1.2114i	1.2145+0.4581i
w77	1.4062+0.1772i	1.0291+0.1180i	1.2996+0.3986i	1.1512+0.3056i	1.1412+0.2881i	0.1822+0.9501i	1.2462+0.3168i	0.3150+1.2471i	1.2539+0.3338i
w78	1.3620+0.1815i	1.1010+0.1192i	1.2996+0.3986i	1.2183+0.3113i	1.2488+0.3303i	0.1937+1.0728i	1.3264+0.4784i	0.4753+1.3187i	1.3215+0.4564i
w79	1.3620+0.1815i	1.1010+0.1192i	1.3164+0.3727i	1.2183+0.3113i	1.2365+0.2820i	0.1984+1.1179i	1.3636+0.3452i	0.3425+1.3569i	1.3601+0.3221i
w80	1.1845+0.7818i	1.5434+0.7244i	1.2691+1.5656i	1.6390+1.1100i	1.5621+1.0168i	0.5319+1.5225i	1.2821+1.1603i	1.1360+1.2473i	1.2148+1.0841i
w81	1.2415+0.8159i	1.5406+0.6573i	1.4951+1.3067i	1.5553+0.8585i	1.5618+0.8013i	0.5499+1.7288i	1.3913+1.0297i	1.0132+1.3576i	1.3161+0.9594i
w82	1.1399+0.7513i	1.3581+0.4388i	1.2022+1.0523i	1.2808+0.8598i	1.3176+0.9273i	0.4997+1.3566i	1.1526+1.0455i	1.0324+1.1353i	1.0841+1.0388i
w83	1.1845+0.7818i	1.3581+0.4388i	1.2512+1.0757i	1.3544+0.7773i	1.3667+0.7657i	0.4782+1.2237i	1.2494+0.9275i	0.9181+1.2338i	1.1820+0.9284i
w84	1.1070+0.7283i	1.0229+0.3452i	1.4652+0.7406i	1.6452+0.5697i	1.6308+0.5333i	0.3541+1.5303i	1.5638+0.7384i	0.7279+1.5222i	1.4838+0.6792i
w85	1.1399+0.7513i	1.0229+0.3452i	1.6787+0.9971i	1.8084+0.7652i	1.7890+0.7298i	0.3305+1.7214i	1.4790+0.8844i	0.8723+1.4426i	1.4082+0.8235i
w86	1.1070+0.7283i	1.0862+0.3510i	1.3845+0.8297i	1.4221+0.5360i	1.4307+0.4998i	0.3534+1.3681i	1.4048+0.6656i	0.6568+1.3858i	1.3468+0.6764i
w87	1.1070+0.7283i	1.0862+0.3510i	1.4003+0.9431i	1.3824+0.5909i	1.3837+0.6127i	0.3443+1.2387i	1.3309+0.7987i	0.7900+1.3143i	1.2717+0.8072i
w88	1.0412+0.9760i	1.6599+0.4298i	1.0154+0.8311i	1.0396+0.7205i	1.0281+0.7705i	0.4274+0.9240i	0.9550+0.8673i	0.8674+0.9560i	0.9364+0.8864i
w89	1.1011+1.0156i	1.6784+0.4687i	1.0154+0.8311i	1.0396+0.7205i	1.0650+0.6889i	0.4274+0.9240i	1.0345+0.7695i	0.7705+1.0366i	1.0217+0.7923i
w90	1.0412+0.9760i	1.4225+0.3641i	1.0397+0.8590i	1.1099+0.7731i	1.1472+0.8418i	0.4493+1.0436i	1.0460+0.9487i	0.9433+1.0406i	1.0343+0.9303i
w91	1.0412+0.9760i	1.4225+0.3641i	1.0154+0.8311i	1.1202+0.7192i	1.1907+0.7241i	0.4518+1.1001i	1.1334+0.8419i	0.8396+1.1292i	1.1243+0.8240i
w92	0.9673+0.9082i	1.0229+0.3452i	1.1891+0.6423i	1.1129+0.5091i	1.1184+0.4819i	0.3046+0.9387i	1.1624+0.5543i	0.5539+1.1644i	1.1623+0.5765i
w93	0.9673+0.9082i	1.0229+0.3452i	1.1891+0.6423i	1.1129+0.5091i	1.1069+0.5409i	0.3046+0.9387i	1.1032+0.6643i	0.6655+1.1051i	1.0975+0.6885i
w94	0.9673+0.9082i	1.0862+0.3510i	1.1891+0.6423i	1.1854+0.5260i	1.2340+0.4863i	0.3191+1.0603i	1.2741+0.6060i	0.6027+1.2677i	1.2691+0.5857i
w95	0.9673+0.9082i	1.0862+0.3510i	1.1891+0.6423i	1.1854+0.5260i	1.2237+0.5735i	0.3265+1.1096i	1.2092+0.7268i	0.7240+1.2029i	1.2035+0.7094i
w96	0.9871+0.2773i	0.6447+0.1114i	0.9430+0.1097i	0.8387+0.0879i	0.8364+0.0863i	0.0563+0.5733i	0.9150+0.0466i	0.0457+0.9211i	0.9523+0.0461i
w97	0.9871+0.2773i	0.6447+0.1114i	0.9430+0.1097i	0.8387+0.0879i	0.8364+0.0863i	0.0563+0.5733i	0.9065+0.1343i	0.1367+0.9126i	0.9440+0.1381i
w98	0.9871+0.2773i	0.6447+0.1114i	0.9430+0.1097i	0.8387+0.0879i	0.8364+0.0863i	0.0561+0.6143i	0.9948+0.0500i	0.0499+1.0026i	1.0315+0.0501i
w99	0.9871+0.2773i	0.6447+0.1114i	0.9430+0.1097i	0.8387+0.0879i	0.8364+0.0863i	0.0561+0.6143i	0.9843+0.1473i	0.1484+0.9932i	1.0228+0.1507i
w100	0.9871+0.2773i	0.7355+0.1132i	0.9179+0.2418i	0.8162+0.2520i	0.8138+0.2554i	0.1686+0.5744i	0.8612+0.3092i	0.3131+0.8696i	0.9013+0.3169i
w101	0.9871+0.2773i	0.7355+0.1132i	0.9179+0.2418i	0.8162+0.2520i	0.8138+0.2554i	0.1686+0.5744i	0.8883+0.2248i	0.2258+0.8952i	0.9267+0.2286i
w102	1.0140+0.2913i	0.7355+0.1132i	0.9179+0.2418i	0.8162+0.2520i	0.8138+0.2554i	0.1683+0.6133i	0.9363+0.3378i	0.3412+0.9466i	0.9750+0.3455i
w103	1.0140+0.2913i	0.7355+0.1132i	0.9179+0.2418i	0.8162+0.2520i	0.8138+0.2554i	0.1683+0.6133i	0.9652+0.2442i	0.2456+0.9743i	1.0035+0.2492i
w104	1.0186+0.1704i	0.6447+0.1114i	1.1190+0.1134i	0.9922+0.0948i	0.9923+0.0954i	0.0575+0.8289i	1.1753+0.0596i	0.0588+1.1805i	1.2011+0.0566i
w105	1.0186+0.1704i	0.6447+0.1114i	1.1190+0.1134i	0.9922+0.0948i	0.9923+0.0954i	0.0575+0.8289i	1.1638+0.1759i	0.1753+1.1699i	1.1922+0.1721i
w106	1.0186+0.1704i	0.6447+0.1114i	1.1190+0.1134i	0.9922+0.0948i	0.9923+0.0954i	0.0559+0.7363i	1.0837+0.0551i	0.0537+1.0888i	1.1135+0.0544i
w107	1.0186+0.1704i	0.6447+0.1114i	1.1190+0.1134i	0.9922+0.0948i	0.9923+0.0954i	0.0559+0.7363i	1.0729+0.1619i	0.1620+1.0787i	1.1046+0.1637i
w108	1.0186+0.1704i	0.7355+0.1132i	1.0819+0.3141i	0.9734+0.2814i	0.9927+0.2869i	0.1725+0.8219i	1.1085+0.4018i	0.4022+1.1152i	1.1352+0.4033i
w109	1.0186+0.1704i	0.7355+0.1132i	1.0819+0.3141i	0.9734+0.2814i	0.9927+0.2869i	0.1725+0.8219i	1.1424+0.2906i	0.2901+1.1486i	1.1698+0.2887i
w110	1.0490+0.1738i	0.7355+0.1132i	1.0819+0.3141i	0.9734+0.2814i	0.9581+0.2810i	0.1681+0.7344i	1.0200+0.3694i	0.3708+1.0280i	1.0522+0.3750i
w111	1.0490+0.1738i	0.7355+0.1132i	1.0819+0.3141i	0.9734+0.2814i	0.9581+0.2810i	0.1681+0.7344i	1.0510+0.2673i	0.2674+1.0584i	1.0842+0.2706i
w112	0.8068+0.5977i	0.6479+0.3266i	0.7574+0.5584i	0.7097+0.5670i	0.7091+0.5666i	0.4142+0.5752i	0.6784+0.6112i	0.6203+0.6858i	0.7062+0.6318i
w113	0.8068+0.5977i	0.6479+0.3266i	0.7574+0.5584i	0.7097+0.5670i	0.7091+0.5666i	0.4142+0.5752i	0.7341+0.5461i	0.5514+0.7429i	0.7682+0.5621i
w114	0.8068+0.5977i	0.6479+0.3266i	0.7574+0.5584i	0.7097+0.5670i	0.7091+0.5666i	0.4154+0.6084i	0.7381+0.6680i	0.6762+0.7467i	0.7616+0.6876i
w115	0.8068+0.5977i	0.6479+0.3266i	0.7574+0.5584i	0.7097+0.5670i	0.7091+0.5666i	0.4154+0.6084i	0.7989+0.5949i	0.6008+0.8092i	0.8283+0.6116i
w116	0.8068+0.5977i	0.7296+0.3314i	0.8356+0.4419i	0.7717+0.4178i	0.7712+0.4159i	0.2879+0.5759i	0.8261+0.3941i	0.3968+0.8352i	0.8663+0.4030i
w117	0.8068+0.5977i	0.7296+0.3314i	0.8356+0.4419i	0.7717+0.4178i	0.7712+0.4159i	0.2879+0.5759i	0.7851+0.4703i	0.4768+0.7929i	0.8211+0.4847i
w118	0.8068+0.5977i	0.7296+0.3314i	0.8356+0.4419i	0.7717+0.4178i	0.7712+0.4159i	0.2879+0.6115i	0.8991+0.4288i	0.4321+0.9090i	0.9357+0.4393i
w119	0.8068+0.5977i	0.7296+0.3314i	0.8356+0.4419i	0.7717+0.4178i	0.7712+0.4159i	0.2879+0.6115i	0.8540+0.5134i	0.5196+0.8634i	0.8873+0.5281i
w120	0.7522+0.6666i	0.6479+0.3266i	0.8672+0.6827i	0.8683+0.6477i	0.8969+0.6804i	0.4234+0.8016i	0.8748+0.7945i	0.7985+0.8805i	0.8857+0.8048i
w121	0.7522+0.6666i	0.6479+0.3266i	0.8672+0.6827i	0.8683+0.6477i	0.9133+0.6445i	0.4234+0.8016i	0.9480+0.7052i	0.7091+0.9536i	0.9624+0.7150i
w122	0.7522+0.6666i	0.6479+0.3266i	0.8672+0.6827i	0.8683+0.6477i	0.8521+0.6381i	0.4202+0.7277i	0.8034+0.7296i	0.7351+0.8110i	0.8208+0.7452i

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w123	0.7522+0.6666i	0.6479+0.3266i	0.8672+0.6827i	0.8683+0.6477i	0.8521+0.6381i	0.4202+0.7277i	0.8718+0.6493i	0.6536+0.8786i	0.8922+0.6622i
w124	0.7522+0.6666i	0.7296+0.3314i	0.9902+0.5156i	0.9344+0.4646i	0.9631+0.4745i	0.2928+0.8098i	1.0647+0.5073i	0.5098+1.0718i	1.0890+0.5137i
w125	0.7522+0.6666i	0.7296+0.3314i	0.9902+0.5156i	0.9344+0.4646i	0.9631+0.4745i	0.2928+0.8098i	1.0114+0.6096i	0.6126+1.0178i	1.0308+0.6179i
w126	0.7522+0.6666i	0.7296+0.3314i	0.9902+0.5156i	0.9344+0.4646i	0.9177+0.4631i	0.2889+0.7310i	0.9801+0.4685i	0.4703+0.9876i	1.0092+0.4766i
w127	0.7522+0.6666i	0.7296+0.3314i	0.9902+0.5156i	0.9344+0.4646i	0.9177+0.4631i	0.2889+0.7310i	0.9294+0.5603i	0.5649+0.9379i	0.9560+0.5733i
w128	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	1.4412+0.0759i	0.0435+0.2303i	0.2333+0.0558i	0.0356+0.2800i
w129	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	1.0926+0.0446i	0.0435+0.2303i	0.2333+0.0558i	0.0833+0.2651i
w130	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	1.3092+0.0863i	0.0479+0.3233i	0.3230+0.0414i	0.0320+0.3485i
w131	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	1.2012+0.0699i	0.0479+0.3233i	0.3230+0.0414i	0.0823+0.3458i
w132	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	0.8308+0.0588i	0.0423+0.1970i	0.1828+0.0377i	0.0355+0.2100i
w133	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	0.9538+0.0508i	0.0423+0.1970i	0.1828+0.0377i	0.0355+0.2100i
w134	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	0.8308+0.0588i	0.0969+0.3195i	0.3356+0.1033i	0.1532+0.3542i
w135	0.1398+0.2219i	0.1069+0.9206i	0.0877+0.3362i	0.0693+0.0844i	0.0660+0.0843i	0.9265+0.0539i	0.0969+0.3195i	0.3356+0.1033i	0.1532+0.3542i
w136	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	1.6156+0.0830i	0.0521+0.5026i	0.5221+0.0507i	0.0279+0.5173i
w137	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	1.0810+0.1364i	0.0521+0.5026i	0.5221+0.0507i	0.0833+0.5156i
w138	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	1.8273+0.1110i	0.0455+0.4209i	0.4318+0.0399i	0.0279+0.4291i
w139	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	1.1228+0.1520i	0.0455+0.4209i	0.4318+0.0399i	0.0778+0.4336i
w140	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	0.8380+0.1741i	0.1546+0.4810i	0.5001+0.1519i	0.2048+0.4951i
w141	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	0.9529+0.1595i	0.1546+0.4810i	0.5001+0.1519i	0.1456+0.5085i
w142	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	0.8380+0.1741i	0.1286+0.4035i	0.4199+0.1252i	0.1871+0.4221i
w143	0.1398+0.2219i	0.1554+0.8729i	0.1228+0.4390i	0.0757+0.5302i	0.0734+0.5323i	0.9529+0.1595i	0.1286+0.4035i	0.4199+0.1252i	0.1338+0.4355i
w144	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.5353+0.0608i	0.1248+0.1724i	0.1833+0.1349i	0.1306+0.1707i
w145	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.5353+0.0608i	0.1248+0.1724i	0.1833+0.1349i	0.1465+0.2102i
w146	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.5353+0.0608i	0.1939+0.2364i	0.2524+0.1988i	0.2606+0.2717i
w147	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.5353+0.0608i	0.1939+0.2364i	0.2524+0.1988i	0.2014+0.2359i
w148	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.7097+0.0603i	0.0839+0.1615i	0.1221+0.0560i	0.0802+0.1457i
w149	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.6618+0.0606i	0.0839+0.1615i	0.1221+0.0560i	0.0348+0.1352i
w150	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.7097+0.0603i	0.1723+0.2752i	0.3098+0.1703i	0.2175+0.3255i
w151	0.1398+0.2219i	0.1435+0.6124i	0.1336+0.2886i	0.0831+0.2583i	0.0790+0.2724i	0.6618+0.0606i	0.1723+0.2752i	0.3098+0.1703i	0.1851+0.2925i
w152	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.5362+0.1825i	0.3306+0.3866i	0.4013+0.3359i	0.4097+0.4098i
w153	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.5362+0.1825i	0.3306+0.3866i	0.4013+0.3359i	0.3696+0.4239i
w154	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.5362+0.1825i	0.2742+0.3181i	0.3296+0.2803i	0.3109+0.3161i
w155	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.5362+0.1825i	0.2742+0.3181i	0.3296+0.2803i	0.3384+0.3541i
w156	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.7143+0.1796i	0.2485+0.4415i	0.4583+0.2501i	0.2626+0.4826i
w157	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.6634+0.1812i	0.2485+0.4415i	0.4583+0.2501i	0.3138+0.4582i
w158	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.7143+0.1796i	0.2144+0.3607i	0.3825+0.2123i	0.2676+0.3932i
w159	0.1398+0.2219i	0.1435+0.6124i	0.2508+0.3619i	0.1690+0.4222i	0.1820+0.4289i	0.6634+0.1812i	0.2144+0.3607i	0.3825+0.2123i	0.2676+0.3932i
w160	0.1394+0.6100i	0.1470+1.2350i	0.1149+0.7104i	0.0953+0.8596i	0.0929+0.8638i	1.4477+0.2272i	0.0444+0.8222i	0.8404+0.0429i	0.0413+0.8350i
w161	0.1394+0.6100i	0.2373+1.1879i	0.1149+0.7104i	0.0953+0.8596i	0.0929+0.8638i	1.1203+0.3790i	0.1214+0.8152i	0.8322+0.1261i	0.1250+0.8291i
w162	0.1394+0.6100i	0.1470+1.2350i	0.1149+0.7104i	0.0953+0.8596i	0.0929+0.8638i	1.3161+0.2454i	0.0454+0.7459i	0.7634+0.0391i	0.0386+0.7570i
w163	0.1394+0.6100i	0.2373+1.1879i	0.1149+0.7104i	0.0953+0.8596i	0.0929+0.8638i	1.2096+0.3196i	0.1052+0.7420i	0.7562+0.1141i	0.1144+0.7509i
w164	0.1394+0.6100i	0.1470+1.2350i	0.2020+0.6970i	0.2502+0.8104i	0.2598+0.8068i	0.8570+0.4182i	0.2798+0.7766i	0.7916+0.2874i	0.2870+0.7948i
w165	0.1394+0.6100i	0.2373+1.1879i	0.2020+0.6970i	0.2502+0.8104i	0.2598+0.8068i	0.9971+0.4062i	0.2069+0.7984i	0.8156+0.2082i	0.2067+0.8150i
w166	0.1394+0.6100i	0.1470+1.2350i	0.2020+0.6970i	0.2502+0.8104i	0.2598+0.8068i	0.8570+0.4182i	0.2499+0.7071i	0.7184+0.2607i	0.2642+0.7207i
w167	0.1394+0.6100i	0.2373+1.1879i	0.2020+0.6970i	0.2502+0.8104i	0.2598+0.8068i	0.9655+0.4069i	0.1934+0.7233i	0.7408+0.1901i	0.1898+0.7386i
w168	0.1394+0.6100i	0.3931+0.9608i	0.1159+0.6379i	0.0888+0.7036i	0.0753+0.7148i	1.6269+0.2588i	0.0603+0.5859i	0.6079+0.0387i	0.0311+0.6001i
w169	0.1394+0.6100i	0.3931+0.9608i	0.1159+0.6379i	0.0888+0.7036i	0.0753+0.7148i	1.0884+0.2705i	0.0603+0.5859i	0.6023+0.0822i	0.0947+0.5947i
w170	0.1394+0.6100i	0.3931+0.9608i	0.1159+0.6379i	0.0888+0.7036i	0.0753+0.7148i	1.8201+0.3520i	0.0495+0.6628i	0.6861+0.0374i	0.0347+0.6790i
w171	0.1394+0.6100i	0.3931+0.9608i	0.1159+0.6379i	0.0888+0.7036i	0.0753+0.7148i	1.1299+0.2516i	0.0856+0.6604i	0.6795+0.1006i	0.1047+0.6731i
w172	0.1394+0.6100i	0.3931+0.9608i	0.1748+0.6236i	0.1681+0.6745i	0.1803+0.6749i	0.8474+0.2934i	0.1773+0.5618i	0.5731+0.1989i	0.2220+0.5721i
w173	0.1394+0.6100i	0.3877+0.9912i	0.1748+0.6236i	0.1681+0.6745i	0.1803+0.6749i	0.9654+0.2826i	0.1773+0.5618i	0.5854+0.1576i	0.1586+0.5847i
w174	0.1394+0.6100i	0.3931+0.9608i	0.1748+0.6236i	0.1681+0.6745i	0.1803+0.6749i	0.8474+0.2934i	0.2149+0.6311i	0.6454+0.2320i	0.2421+0.6464i
w175	0.1394+0.6100i	0.3877+0.9912i	0.1748+0.6236i	0.1681+0.6745i	0.1803+0.6749i	0.9654+0.2826i	0.1814+0.6396i	0.6642+0.1725i	0.1741+0.6621i
w176	0.2921+0.5723i	0.4046+0.5843i	0.4761+0.5695i	0.4796+0.6187i	0.4879+0.6095i	0.5447+0.4407i	0.5570+0.6126i	0.6237+0.5684i	0.5883+0.6374i
w177	0.2921+0.5723i	0.4046+0.5843i	0.4761+0.5695i	0.4796+0.6187i	0.4879+0.6095i	0.5447+0.4407i	0.4996+0.6598i	0.6752+0.5053i	0.5182+0.6889i
w178	0.2921+0.5723i	0.4046+0.5843i	0.4761+0.5695i	0.4796+0.6187i	0.4879+0.6095i	0.5447+0.4407i	0.5027+0.5591i	0.5655+0.5162i	0.5425+0.5800i
w179	0.2921+0.5723i	0.4046+0.5843i	0.4761+0.5695i	0.4796+0.6187i	0.4879+0.6095i	0.5447+0.4407i	0.4587+0.5943i	0.6118+0.4591i	0.4782+0.6270i
w180	0.2921+0.5723i	0.4046+0.5843i	0.4147+0.6066i	0.3943+0.7094i	0.3917+0.7141i	0.7297+0.4279i	0.3616+0.7417i	0.7598+0.3644i	0.3667+0.7681i
w181	0.2921+0.5723i	0.4046+0.5843i	0.4147+0.6066i	0.3943+0.7094i	0.3917+0.7141i	0.6735+0.4327i	0.4272+0.7061i	0.7208+0.4365i	0.4442+0.7324i
w182	0.2921+0.5723i	0.4046+0.5843i	0.4147+0.6066i	0.3943+0.7094i	0.3917+0.7141i	0.7297+0.4279i	0.3335+0.6719i	0.6887+0.3313i	0.3373+0.6966i
w183	0.2921+0.5723i	0.4046+0.5843i	0.4147+0.6066i	0.3943+0.7094i	0.3917+0.7141i	0.6735+0.4327i	0.3844+0.6452i	0.6540+0.3956i	0.4091+0.6660i
w184	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3422+0.5304i	0.3507+0.5198i	0.5387+0.3082i	0.3827+0.4523i	0.4664+0.3880i	0.4524+0.4675i
w185	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3422+0.5304i	0.3507+0.5198i	0.5387+0.3082i	0.3827+0.4523i	0.4664+0.3880i	0.4008+0.5029i
w186	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3422+0.5304i	0.3507+0.5198i	0.5387+0.3082i	0.4308+0.5124i	0.5082+0.4618i	0.4977+0.5232i
w187	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3422+0.5304i	0.3507+0.5198i	0.5387+0.3082i	0.4308+0.5124i	0.5468+0.4147i	0.4386+0.5659i
w188	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3015+0.5755i	0.2932+0.5904i	0.7219+0.3014i	0.2859+0.5163i	0.5417+0.2697i	0.2843+0.5533i

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w189	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3015+0.5755i	0.2932+0.5904i	0.6673+0.3041i	0.2859+0.5163i	0.5222+0.3074i	0.3447+0.5290i
w190	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3015+0.5755i	0.2932+0.5904i	0.7219+0.3014i	0.3056+0.5933i	0.6164+0.2990i	0.3097+0.6251i
w191	0.2921+0.5723i	0.4108+0.6369i	0.3812+0.4962i	0.3015+0.5755i	0.2932+0.5904i	0.6673+0.3041i	0.3356+0.5770i	0.5877+0.3530i	0.3756+0.5986i
w192	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.0563+0.0613i	0.1787+0.0384i	0.0504+0.2052i	0.1765+0.0357i
w193	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.0563+0.0613i	0.1787+0.0384i	0.0504+0.2052i	0.2273+0.0412i
w194	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.0563+0.0613i	0.2848+0.0454i	0.0400+0.3001i	0.3691+0.0298i
w195	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.0563+0.0613i	0.2848+0.0454i	0.0400+0.3001i	0.2911+0.0346i
w196	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.1675+0.0612i	0.0596+0.0562i	0.0336+0.1275i	0.1117+0.0289i
w197	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.1675+0.0612i	0.0596+0.0562i	0.0336+0.1275i	0.0382+0.0258i
w198	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.1675+0.0612i	0.3150+0.0732i	0.0944+0.3293i	0.3643+0.0969i
w199	0.4257+0.1254i	0.1205+0.1201i	0.1371+0.0950i	0.2347+0.0789i	0.2293+0.0778i	0.1675+0.0612i	0.3150+0.0732i	0.0944+0.3293i	0.3097+0.0874i
w200	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.4038+0.0702i	0.0565+0.1842i	0.5087+0.0506i	0.0496+0.5209i	0.5699+0.0285i
w201	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.4038+0.0702i	0.0565+0.1842i	0.5087+0.0506i	0.0496+0.5209i	0.5487+0.0713i
w202	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.4038+0.0702i	0.0565+0.1842i	0.4218+0.0424i	0.0362+0.4265i	0.4393+0.0368i
w203	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.4038+0.0702i	0.0565+0.1842i	0.4218+0.0424i	0.0362+0.4265i	0.4820+0.0488i
w204	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.3965+0.1174i	0.1681+0.1841i	0.4872+0.1426i	0.1472+0.4983i	0.5432+0.1831i
w205	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.3965+0.1174i	0.1681+0.1841i	0.4872+0.1426i	0.1472+0.4983i	0.5356+0.1368i
w206	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.3965+0.1174i	0.1681+0.1841i	0.4021+0.1054i	0.1161+0.4145i	0.4214+0.1199i
w207	0.4257+0.1254i	0.1205+0.1201i	0.3858+0.0906i	0.3998+0.0948i	0.3965+0.1174i	0.1681+0.1841i	0.4021+0.1054i	0.1161+0.4145i	0.4661+0.1312i
w208	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.4040+0.0609i	0.1613+0.0909i	0.1305+0.1861i	0.1610+0.1081i
w209	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.4040+0.0609i	0.1613+0.0909i	0.1305+0.1861i	0.2042+0.1262i
w210	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.4040+0.0609i	0.2488+0.1625i	0.1935+0.2539i	0.2978+0.2229i
w211	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.4040+0.0609i	0.2488+0.1625i	0.1935+0.2539i	0.2455+0.1743i
w212	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.2837+0.0610i	0.0596+0.0562i	0.0468+0.0504i	0.1014+0.0859i
w213	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.2837+0.0610i	0.0596+0.0562i	0.0468+0.0504i	0.0352+0.0762i
w214	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.2837+0.0610i	0.2869+0.1559i	0.1632+0.3084i	0.3374+0.1692i
w215	0.3876+0.1752i	0.1269+0.3505i	0.1371+0.0950i	0.2220+0.2149i	0.2186+0.2192i	0.2837+0.0610i	0.2869+0.1559i	0.1632+0.3084i	0.2914+0.1413i
w216	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3152+0.3142i	0.4047+0.1833i	0.3993+0.3148i	0.3291+0.4053i	0.4468+0.3693i
w217	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3152+0.3142i	0.4047+0.1833i	0.3993+0.3148i	0.3291+0.4053i	0.4545+0.3221i
w218	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3152+0.3142i	0.4047+0.1833i	0.3331+0.2583i	0.2736+0.3330i	0.3539+0.2625i
w219	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3152+0.3142i	0.4047+0.1833i	0.3331+0.2583i	0.2736+0.3330i	0.3954+0.2905i
w220	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3453+0.2672i	0.2845+0.1838i	0.4504+0.2317i	0.2421+0.4588i	0.5230+0.2380i
w221	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3453+0.2672i	0.2845+0.1838i	0.4504+0.2317i	0.2421+0.4588i	0.4892+0.2652i
w222	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3453+0.2672i	0.2845+0.1838i	0.3687+0.1952i	0.2037+0.3816i	0.3945+0.1942i
w223	0.3876+0.1752i	0.1269+0.3505i	0.3522+0.1787i	0.3246+0.2889i	0.3453+0.2672i	0.2845+0.1838i	0.3687+0.1952i	0.2037+0.3816i	0.4344+0.2178i
w224	0.7263+0.1835i	0.3711+0.1147i	0.7559+0.1087i	0.6893+0.0866i	0.6940+0.0767i	0.0567+0.4443i	0.8318+0.0442i	0.0421+0.8420i	0.8751+0.0419i
w225	0.7263+0.1835i	0.3711+0.1147i	0.7559+0.1087i	0.6893+0.0866i	0.6940+0.0767i	0.0567+0.4443i	0.8239+0.1192i	0.1247+0.8342i	0.8676+0.1257i
w226	0.7263+0.1835i	0.3711+0.1147i	0.7559+0.1087i	0.6893+0.0866i	0.6940+0.0767i	0.0567+0.4443i	0.7562+0.0454i	0.0384+0.7648i	0.7986+0.0381i
w227	0.7263+0.1835i	0.3711+0.1147i	0.7559+0.1087i	0.6893+0.0866i	0.6940+0.0767i	0.0567+0.4443i	0.7500+0.1031i	0.1132+0.7575i	0.7927+0.1144i
w228	0.7263+0.1835i	0.3711+0.1147i	0.7444+0.1636i	0.6679+0.2112i	0.6695+0.2216i	0.1692+0.4451i	0.7842+0.2789i	0.2858+0.7945i	0.8293+0.2896i
w229	0.7263+0.1835i	0.3711+0.1147i	0.7444+0.1636i	0.6679+0.2112i	0.6695+0.2216i	0.1692+0.4451i	0.8063+0.2068i	0.2067+0.8184i	0.8523+0.2091i
w230	0.7263+0.1835i	0.3711+0.1147i	0.7444+0.1636i	0.6679+0.2112i	0.6695+0.2216i	0.1692+0.4451i	0.7167+0.2465i	0.2585+0.7216i	0.7578+0.2626i
w231	0.7263+0.1835i	0.3711+0.1147i	0.7444+0.1636i	0.6679+0.2112i	0.6695+0.2216i	0.1692+0.4451i	0.7319+0.1921i	0.1886+0.7429i	0.7786+0.1893i
w232	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5532+0.0884i	0.5558+0.0719i	0.0568+0.3109i	0.5929+0.0575i	0.0601+0.6048i	0.6439+0.0332i
w233	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5532+0.0884i	0.5558+0.0719i	0.0568+0.3109i	0.5929+0.0575i	0.0601+0.6048i	0.6363+0.0929i
w234	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5532+0.0884i	0.5558+0.0719i	0.0568+0.3109i	0.6701+0.0660i	0.0378+0.6868i	0.7212+0.0348i
w235	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5532+0.0884i	0.5558+0.0719i	0.0568+0.3109i	0.6701+0.0660i	0.0991+0.6806i	0.7163+0.1032i
w236	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5398+0.1629i	0.5350+0.1769i	0.1690+0.3113i	0.5701+0.1700i	0.1750+0.5791i	0.6122+0.2069i
w237	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5398+0.1629i	0.5350+0.1769i	0.1690+0.3113i	0.5701+0.1700i	0.1750+0.5791i	0.6268+0.1493i
w238	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5398+0.1629i	0.5350+0.1769i	0.1690+0.3113i	0.6451+0.1940i	0.2285+0.6480i	0.6853+0.2349i
w239	0.7263+0.1835i	0.3711+0.1147i	0.5888+0.1116i	0.5398+0.1629i	0.5350+0.1769i	0.1690+0.3113i	0.6451+0.1940i	0.1719+0.6651i	0.7046+0.1699i
w240	0.5831+0.4164i	0.3840+0.3362i	0.6291+0.4137i	0.5676+0.4800i	0.5639+0.4885i	0.4100+0.4451i	0.6189+0.5514i	0.5654+0.6265i	0.6521+0.5790i
w241	0.5831+0.4164i	0.3840+0.3362i	0.6291+0.4137i	0.5676+0.4800i	0.5639+0.4885i	0.4100+0.4451i	0.6665+0.4960i	0.5027+0.6784i	0.7094+0.5138i
w242	0.5831+0.4164i	0.3840+0.3362i	0.6291+0.4137i	0.5676+0.4800i	0.5639+0.4885i	0.4100+0.4451i	0.5667+0.4955i	0.5121+0.5697i	0.6013+0.5265i
w243	0.5831+0.4164i	0.3840+0.3362i	0.6291+0.4137i	0.5676+0.4800i	0.5639+0.4885i	0.4100+0.4451i	0.6028+0.4546i	0.4555+0.6162i	0.6524+0.4667i
w244	0.5831+0.4164i	0.3840+0.3362i	0.6640+0.3652i	0.6158+0.3724i	0.6227+0.3624i	0.2871+0.4459i	0.7506+0.3592i	0.3624+0.7630i	0.7984+0.3673i
w245	0.5831+0.4164i	0.3840+0.3362i	0.6640+0.3652i	0.6158+0.3724i	0.6227+0.3624i	0.2871+0.4459i	0.7156+0.4239i	0.4347+0.7245i	0.7580+0.4428i
w246	0.5831+0.4164i	0.3840+0.3362i	0.6640+0.3652i	0.6158+0.3724i	0.6227+0.3624i	0.2871+0.4459i	0.6809+0.3299i	0.3286+0.6923i	0.7298+0.3325i
w247	0.5831+0.4164i	0.3840+0.3362i	0.6640+0.3652i	0.6158+0.3724i	0.6227+0.3624i	0.2871+0.4459i	0.6544+0.3786i	0.3924+0.6581i	0.6964+0.4016i
w248	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4402+0.3948i	0.4325+0.4078i	0.4066+0.3107i	0.4637+0.3699i	0.3814+0.4708i	0.5005+0.4181i
w249	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4402+0.3948i	0.4325+0.4078i	0.4066+0.3107i	0.4637+0.3699i	0.3814+0.4708i	0.5359+0.3697i
w250	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4402+0.3948i	0.4325+0.4078i	0.4066+0.3107i	0.5223+0.4197i	0.4563+0.5135i	0.5509+0.4732i
w251	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4402+0.3948i	0.4325+0.4078i	0.4066+0.3107i	0.5223+0.4197i	0.4093+0.5514i	0.5953+0.4196i
w252	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4746+0.3330i	0.4850+0.3129i	0.2858+0.3115i	0.5265+0.2736i	0.2826+0.5338i	0.5896+0.2686i
w253	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4746+0.3330i	0.4850+0.3129i	0.2858+0.3115i	0.5265+0.2736i	0.2826+0.5338i	0.5635+0.3210i
w254	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4746+0.3330i	0.4850+0.3129i	0.2858+0.3115i	0.5946+0.3133i	0.2962+0.6193i	0.6601+0.3001i

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[0189]

w255	0.5831+0.4164i	0.3840+0.3362i	0.5249+0.3002i	0.4746+0.3330i	0.4850+0.3129i	0.2858+0.3115i	0.5946+0.3133i	0.3481+0.5915i	0.6312+0.3619i

[0190] 为了进一步说明，图11A至图11C示例性示出了为27dB SNR（图11A）和8dB SNR（图11B）优化的两个所提出的1024-N²-NUC以及为8dB SNR（图11C）优化的N²-NUC的放大，说明了几个星座点易于通过低SNR合并。

[0191] 图12示例性示出了为10dB SNR（图12A）和15dB SNR（图12B）优化的两个64-QQAM。与矩形N²-NUC相比，QQAM星座具有圆形，与N²-NUC相比，降低了星座的峰值功率，避免了在角落附近的星座点。在通过低SNR优化时，大QQAM的星座点易于通过与N²-NUC相同的方式合并。例如，在通过在图12A中显示的10dB目标SNR优化的64-QQAM的内圆圈内是这种情况。

[0192]　　尤其如果为非常低的SNR优化，那么星座的压缩有时可造成星座的最低有效位(完全)刺穿。例如，对于为0dB SNR优化的256-N^2-NUC，是这种情况，这造成QPSK星座，一个象限的全部64个星座点具有完全相同的星座点位置。在接收器内去映射这种星座时，前两位可以通过4个不同的星座点位置恢复。在未编码系统的情况下，不能恢复剩余的6个最低有效位。然而，使用具有先有技术的前向纠错码的BICM链，能够这样做，这能够根据两个最高有效位的信息纠正剩余的位。因此，在根据本公开的通信系统的传输器和接收器内，优选地使用这种BICM链，例如，如通常在根据各种DVB标准的系统中使用的。优选地，假设在执行星座的优化时使用这种BICM链，并且在优化期间，BICM容量是目标容量。在上面提及的极端实例中，可以可替换地直接传输QPSK星座，该星座对于每个星座符号仅仅传送2个位，以避免更大的去映射复杂度。对于更高的SNR，然而，与更小的非均匀星座相比，从性能的角度来看，具有非常高的阶的压缩的非均匀星座的传输有利。

[0193]　　在另一个实施方式中，所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值，其中，所述调制器配置为根据星座的星座点的总数M和编码速率，使用通过围绕原点旋转角度从来自任一组A、B、C或D的星座中获得的非均匀星座。换言之，一个或多个以下"不变变换"不影响映射的性能：

[0194]　　1、将所有符号旋转任意的角度φ；

[0195]　　2、将第m位y_m＝b∈{0,1}倒转为y_m＝$\bar{b}$，其中，横杆表示倒转；

[0196]　　3、交换位位置y_k1和y_k2；

[0197]　　4、在Re{x1}-和/或Im{x1}-轴上反射；

[0198]　　在另一个实施方式中，所公开的编码和调制设备的调制器将所述单元字调制成非均匀星座的星座值，其中，所述调制器配置为根据星座的星座点的总数M和编码速率，使用来自组E星座的非均匀星座，包括点由星座位置矢量$w_{0..M-1}$限定的一个或多个以下星座。这种星座不能由QQAM的对称性通过直接的方式描述。因此，使用具有M个条目的整个星座位置向量。

[0199]　　提出了在组E内包括的以下非均匀星座：

[0200]　　E)组E的M-QAM非均匀星座

[0201]　　E1)8-QAM 2D NUC

[0202]

w/编码速率	100/180 或者 104/180	23/36	25/36 或者 13/18	32/45 (16200 长度代码)
w0	-0.2330	-0.2231	-0.2416	-0.2416 + 0.0000i
w1	-0.5414 - 0.8712i	-0.5520 - 0.8882i	-0.5547 - 0.8925i	-0.5547 - 0.8925i
w2	-0.5414 + 0.8712i	-0.5520 + 0.8882i	-0.5547 + 0.8925i	-0.5547 + 0.8925i
w3	-1.3570	-1.3279	-1.3165	-1.3165 + 0.0000i
w4	0.2330	0.2231	0.2416	0.2416
w5	0.5414 - 0.8712i	0.5520 - 0.8882i	0.5547 - 0.8925i	0.5547 - 0.8925i
w6	0.5414 + 0.8712i	0.5520 + 0.8882i	0.5547 + 0.8925i	0.5547 + 0.8925i
w7	1.3570	1.3279	1.3165	1.3165

[0203]

w/编码速率	19/30
w0	0.8753 + 0.5486i

[0204]

w1	+1.3470i
w2	+ 0.2266i
w3	-0.8753 + 0.5486i
w4	0.8753 - 0.5486i
w5	- 1.3470i
w6	- 0.2266i
w7	-0.8753 - 0.5486i

[0205] E2) 16-QAM 2D NUC

[0206]

w/ 编码速率	90/180 或者 96/180 或者 100/180	26/45	3/5	28/45 或者 23/36	25/36 或者 13/18	140/180 或者 154/180
w0	0.6186 + 0.2544i	0.4718 + 0.2606i	0.4718 + 0.2606i	0.4936 + 0.2530i	0.6186 + 0.2544i	0.6578 + 0.2571i
w1	-0.6186 + 0.2544i	-0.4718 + 0.2606i	-0.4718 + 0.2606i	-0.4936 + 0.2530i	-0.6186 + 0.2544i	-0.6578 + 0.2571i
w2	0.6186 - 0.2544i	0.4718 - 0.2606i	0.4718 - 0.2606i	0.4936 - 0.2530i	0.6186 - 0.2544i	0.6578 - 0.2571i
w3	-0.6186 - 0.2544i	-0.4718 - 0.2606i	-0.4718 - 0.2606i	-0.4936 - 0.2530i	-0.6186 - 0.2544i	-0.6578 - 0.2571i
w4	1.2080 + 0.5377i	1.2088 + 0.4984i	0.2606 + 0.4718i	0.2530 + 0.4936i	1.2080 + 0.5377i	1.2088 + 0.5659i
w5	-1.2080 + 0.5377i	-1.2088 + 0.4984i	-0.2606 + 0.4718i	-0.2530 + 0.4936i	-1.2080 + 0.5377i	-1.2088 + 0.5659i
w6	1.2080 - 0.5377i	1.2088 - 0.4984i	0.2606 - 0.4718i	0.2530 - 0.4936i	1.2080 - 0.5377i	1.2088 - 0.5659i
w7	-1.2080 - 0.5377i	-1.2088 - 0.4984i	-0.2606 - 0.4718i	-0.2530 - 0.4936i	-1.2080 - 0.5377i	-1.2088 - 0.5659i
w8	0.2213 + 0.4416i	0.2606 + 0.4718i	1.2088 + 0.4984i	1.2040 + 0.4925i	0.2213 + 0.4416i	0.2173 + 0.4189i
w9	-0.2213 + 0.4416i	-0.2606 + 0.4718i	-1.2088 + 0.4984i	-1.2040 + 0.4925i	-0.2213 + 0.4416i	-0.2173 + 0.4189i
w10	0.2213 - 0.4416i	0.2606 - 0.4718i	1.2088 - 0.4984i	1.2040 - 0.4925i	0.2213 - 0.4416i	0.2173 - 0.4189i
w11	-0.2213 - 0.4416i	-0.2606 - 0.4718i	-1.2088 - 0.4984i	-1.2040 - 0.4925i	-0.2213 - 0.4416i	-0.2173 - 0.4189i
w12	0.4487 + 1.1657i	0.4984 + 1.2088i	0.4984 + 1.2088i	0.4925 + 1.2040i	0.4487 + 1.1657i	0.4326 + 1.1445i
w13	-0.4487 + 1.1657i	-0.4984 + 1.2088i	-0.4984 + 1.2088i	-0.4925 + 1.2040i	-0.4487 + 1.1657i	-0.4326 + 1.1445i
w14	0.4487 - 1.1657i	0.4984 - 1.2088i	0.4984 - 1.2088i	0.4925 - 1.2040i	0.4487 - 1.1657i	0.4326 - 1.1445i
w15	-0.4487 - 1.1657i	-0.4984 - 1.2088i	-0.4984 - 1.2088i	-0.4925 - 1.2040i	-0.4487 - 1.1657i	-0.4326 - 1.1445i

[0207]

w／编码速率	20/30
w0	0.5061 + 0.2474i
w1	0.2474 + 0.5061i
w2	-0.5061 + 0.2474i
w3	-0.2474 + 0.5061i
w4	0.5061 - 0.2474i
w5	0.2474 - 0.5061i
w6	-0.5061 - 0.2474i
w7	-0.2474 - 0.5061i
w8	1.2007 + 0.4909i
w9	0.4909 + 1.2007i
w10	-1.2007 + 0.4909i
w11	-0.4909 + 1.2007i
w12	1.2007 - 0.4909i
w13	0.4909 - 1.2007i
w14	-1.2007 - 0.4909i
w15	-0.4909 - 1.2007i

[0208]

[0209]　　E3) 32-QAM 2D NUC

w／编码速率	2/3 或者 25/36	128/180 或者 132/180 或者 140/180
w0	0.1929 + 0.1744i	0.2121 + 0.1569i
w1	0.2283 + 0.5036i	-0.2121 + 0.1569i
w2	0.1929 - 0.1744i	0.2121 - 0.1569i
w3	0.2283 - 0.5036i	-0.2121 - 0.1569i
w4	-0.1929 + 0.1744i	0.7185 + 0.1739i
w5	-0.2283 + 0.5036i	-0.7185 + 0.1739i
w6	-0.1929 - 0.1744i	0.7185 - 0.1739i
w7	-0.2283 - 0.5036i	-0.7185 - 0.1739i
w8	0.3541 + 1.4168i	0.3478 + 1.4027i
w9	0.2627 + 0.9170i	-0.3478 + 1.4027i
w10	0.3541 - 1.4168i	0.3478 - 1.4027i
w11	0.2627 - 0.9170i	-0.3478 - 1.4027i
w12	-0.3541 + 1.4168i	1.2867 + 0.3209i
w13	-0.2627 + 0.9170i	-1.2867 + 0.3209i
w14	-0.3541 - 1.4168i	1.2867 - 0.3209i
w15	-0.2627 - 0.9170i	-1.2867 - 0.3209i
w16	0.6963 + 0.1782i	0.2258 + 0.5089i
w17	0.6364 + 0.4437i	-0.2258 + 0.5089i
w18	0.6963 - 0.1782i	0.2258 - 0.5089i

[0210]

w19	0.6364 - 0.4437i	-0.2258 - 0.5089i
w20	-0.6963 + 0.1782i	0.6431 + 0.5018i
w21	-0.6364 + 0.4437i	-0.6431 + 0.5018i
w22	-0.6963 - 0.1782i	0.6431 - 0.5018i
w23	-0.6364 - 0.4437i	-0.6431 - 0.5018i
w24	1.3162 + 0.3270i	0.2443 + 0.9172i
w25	0.9382 + 0.8637i	-0.2443 + 0.9172i
w26	1.3162 - 0.3270i	0.2443 - 0.9172i
w27	0.9382 - 0.8637i	-0.2443 - 0.9172i
w28	-1.3162 + 0.3270i	0.9274 + 0.8949i
w29	-0.9382 + 0.8637i	-0.9274 + 0.8949i
w30	-1.3162 - 0.3270i	0.9274 - 0.8949i
w31	-0.9382 - 0.8637i	-0.9274 - 0.8949i

[0212]　　E4）64-QAM 2D NUC

w/ 编码速率	132/180	140/180 或者 144/180	7/9 或者 4/5	150/180	5/6
w0	0.2878 + 1.4388i	0.9856 - 0.4661i	0.2775 + 1.4188i	1.0161 - 0.4912i	1.0161 - 0.4912i
w1	-0.2878 + 1.4388i	-0.9856 - 0.4661i	0.1138 + 0.3999i	1.0161 + 0.4912i	0.1287 - 0.4061i
w2	0.2878 - 1.4388i	0.9856 + 0.4661i	0.2177 + 1.0243i	-1.0161 - 0.4912i	1.0441 - 0.1581i
w3	-0.2878 - 1.4388i	-0.9856 + 0.4661i	0.1487 + 0.7260i	-1.0161 + 0.4912i	0.1321 - 0.1317i
w4	0.1177 + 0.4119i	1.1580 - 0.8178i	0.7921 + 1.2096i	0.1287 - 0.4061i	0.6966 - 0.4427i
w5	-0.1177 + 0.4119i	-1.1580 - 0.8178i	0.2891 + 0.3910i	0.1287 + 0.4061i	0.4025 - 0.4142i
w6	0.1177 - 0.4119i	1.1580 + 0.8178i	0.6056 + 0.8481i	-0.1287 - 0.4061i	0.6995 - 0.1411i
w7	-0.1177 - 0.4119i	-1.1580 + 0.8178i	0.4397 + 0.5853i	-0.1287 + 0.4061i	0.4035 - 0.1354i
w8	1.4656 + 0.2931i	0.1264 - 0.4145i	0.2775 - 1.4188i	1.1306 - 0.8649i	1.0161 + 0.4912i
w9	-1.4656 + 0.2931i	-0.1264 - 0.4145i	0.1138 - 0.3999i	1.1306 + 0.8649i	0.1287 + 0.4061i
w10	1.4656 - 0.2931i	0.1264 + 0.4145i	0.2177 - 1.0243i	-1.1306 - 0.8649i	1.0441 + 0.1581i
w11	-1.4656 - 0.2931i	-0.1264 + 0.4145i	0.1487 - 0.7260i	-1.1306 + 0.8649i	0.1321 + 0.1317i
w12	0.1678 + 0.1166i	0.1416 - 0.7330i	0.7921 - 1.2096i	0.1385 - 0.7199i	0.6966 + 0.4427i
w13	-0.1678 + 0.1166i	-0.1416 - 0.7330i	0.2891 - 0.3910i	0.1385 + 0.7199i	0.4025 + 0.4142i
w14	0.1678 - 0.1166i	0.1416 + 0.7330i	0.6056 - 0.8481i	-0.1385 - 0.7199i	0.6995 + 0.1411i
w15	-0.1678 - 0.1166i	-0.1416 + 0.7330i	0.4397 - 0.5853i	-0.1385 + 0.7199i	0.4035 + 0.1354i
w16	0.2219 + 1.0386i	1.0366 - 0.1534i	1.4730 + 0.3019i	1.0441 - 0.1581i	1.1306 - 0.8649i
w17	-0.2219 + 1.0386i	-1.0366 - 0.1534i	0.1419 + 0.1122i	1.0441 + 0.1581i	0.1385 - 0.7199i
w18	0.2219 - 1.0386i	1.0366 + 0.1534i	1.0895 + 0.2172i	-1.0441 - 0.1581i	1.4516 - 0.2578i
w19	-0.2219 - 1.0386i	-1.0366 + 0.1534i	0.7863 + 0.1337i	-1.0441 + 0.1581i	0.1689 - 1.0567i
w20	0.1559 + 0.7442i	1.4529 - 0.2702i	1.2124 + 0.8333i	0.1321 - 0.1317i	0.6874 - 0.8123i
w21	-0.1559 + 0.7442i	-1.4529 - 0.2702i	0.3733 + 0.1498i	0.1321 + 0.1317i	0.4017 - 0.7107i
w22	0.1559 - 0.7442i	1.4529 + 0.2702i	0.8988 + 0.5768i	-0.1321 - 0.1317i	0.6750 - 1.2072i
w23	-0.1559 - 0.7442i	-1.4529 + 0.2702i	0.6394 + 0.3211i	-0.1321 + 0.1317i	0.2558 - 1.4247i
w24	1.0649 + 0.2069i	0.1272 - 0.1353i	1.4730 - 0.3019i	1.4516 - 0.2578i	1.1306 + 0.8649i
w25	-1.0649 + 0.2069i	-0.1272 - 0.1353i	0.1419 - 0.1122i	1.4516 + 0.2578i	0.1385 + 0.7199i
w26	1.0649 - 0.2069i	0.1272 + 0.1353i	1.0895 - 0.2172i	-1.4516 - 0.2578i	1.4516 + 0.2578i
w27	-1.0649 - 0.2069i	-0.1272 + 0.1353i	0.7863 - 0.1337i	-1.4516 + 0.2578i	0.1689 + 1.0567i
w28	0.7408 + 0.1355i	0.1686 - 1.0718i	1.2124 - 0.8333i	0.1689 - 1.0567i	0.6874 + 0.8123i
w29	-0.7408 + 0.1355i	-0.1686 - 1.0718i	0.3733 - 0.1498i	0.1689 + 1.0567i	0.4017 + 0.7107i
w30	0.7408 - 0.1355i	0.1686 + 1.0718i	0.8988 - 0.5768i	-0.1689 - 1.0567i	0.6750 + 1.2072i
w31	-0.7408 - 0.1355i	-0.1686 + 1.0718i	0.6394 - 0.3211i	-0.1689 + 1.0567i	0.2558 + 1.4247i
w32	0.8133 + 1.2150i	0.6825 - 0.4329i	-0.2775 + 1.4188i	0.6966 - 0.4427i	-1.0161 - 0.4912i
w33	-0.8133 + 1.2150i	-0.6825 - 0.4329i	-0.1138 + 0.3999i	0.6966 + 0.4427i	-0.1287 - 0.4061i
w34	0.8133 - 1.2150i	0.6825 + 0.4329i	-0.2177 + 1.0243i	-0.6966 - 0.4427i	-1.0441 - 0.1581i
w35	-0.8133 - 1.2150i	-0.6825 + 0.4329i	-0.1487 + 0.7260i	-0.6966 + 0.4427i	-0.1321 - 0.1317i
w36	0.2516 + 0.3998i	0.6913 - 0.8132i	-0.7921 + 1.2096i	0.4025 - 0.4142i	-0.6966 - 0.4427i
w37	-0.2516 + 0.3998i	-0.6913 - 0.8132i	-0.2891 + 0.3910i	0.4025 + 0.4142i	-0.4025 - 0.4142i
w38	0.2516 - 0.3998i	0.6913 + 0.8132i	-0.6056 + 0.8481i	-0.4025 - 0.4142i	-0.6995 - 0.1411i
w39	-0.2516 - 0.3998i	-0.6913 + 0.8132i	-0.4397 + 0.5853i	-0.4025 + 0.4142i	-0.4035 - 0.1354i
w40	1.2278 + 0.8230i	0.3948 - 0.4179i	-0.2775 - 1.4188i	0.6874 - 0.8123i	-1.0161 + 0.4912i
w41	-1.2278 + 0.8230i	-0.3948 - 0.4179i	-0.1138 - 0.3999i	0.6874 + 0.8123i	-0.1287 + 0.4061i
w42	1.2278 - 0.8230i	0.3948 + 0.4179i	-0.2177 - 1.0243i	-0.6874 - 0.8123i	-1.0441 + 0.1581i
w43	-1.2278 - 0.8230i	-0.3948 + 0.4179i	-0.1487 - 0.7260i	-0.6874 + 0.8123i	-0.1321 + 0.1317i
w44	0.3325 + 0.1582i	0.4018 - 0.7177i	-0.7921 - 1.2096i	0.4017 - 0.7107i	-0.6966 + 0.4427i
w45	-0.3325 + 0.1582i	-0.4018 - 0.7177i	-0.2891 - 0.3910i	0.4017 + 0.7107i	-0.4025 + 0.4142i
w46	0.3325 - 0.1582i	0.4018 + 0.7177i	-0.6056 - 0.8481i	-0.4017 - 0.7107i	-0.6995 + 0.1411i

[0214]

w47	-0.3325 - 0.1582i	-0.4018 + 0.7177i	-0.4397 - 0.5853i	-0.4017 + 0.7107i	-0.4035 + 0.1354i
w48	0.6145 + 0.8494i	0.6796 - 0.1340i	-1.4730 + 0.3019i	0.6995 - 0.1411i	-1.1306 - 0.8649i
w49	-0.6145 + 0.8494i	-0.6796 - 0.1340i	-0.1419 + 0.1122i	0.6995 + 0.1411i	-0.1385 - 0.7199i
w50	0.6145 - 0.8494i	0.6796 + 0.1340i	-1.0895 + 0.2172i	-0.6995 - 0.1411i	-1.4516 - 0.2578i
w51	-0.6145 - 0.8494i	-0.6796 + 0.1340i	-0.7863 + 0.1337i	-0.6995 + 0.1411i	-0.1689 - 1.0567i
w52	0.4328 + 0.5954i	0.7097 - 1.2125i	-1.2124 + 0.8333i	0.4035 - 0.1354i	-0.6874 - 0.8123i
w53	-0.4328 + 0.5954i	-0.7097 - 1.2125i	-0.3733 + 0.1498i	0.4035 + 0.1354i	-0.4017 - 0.7107i
w54	0.4328 - 0.5954i	0.7097 + 1.2125i	-0.8988 + 0.5768i	-0.4035 - 0.1354i	-0.6750 - 1.2072i
w55	-0.4328 - 0.5954i	-0.7097 + 1.2125i	-0.6394 + 0.3211i	-0.4035 + 0.1354i	-0.2558 - 1.4247i
w56	0.8971 + 0.5677i	0.3877 - 0.1359i	-1.4730 - 0.3019i	0.6750 - 1.2072i	-1.1306 + 0.8649i
w57	-0.8971 + 0.5677i	-0.3877 - 0.1359i	-0.1419 - 0.1122i	0.6750 + 1.2072i	-0.1385 + 0.7199i
w58	0.8971 - 0.5677i	0.3877 + 0.1359i	-1.0895 - 0.2172i	-0.6750 - 1.2072i	-1.4516 + 0.2578i
w59	-0.8971 - 0.5677i	-0.3877 + 0.1359i	-0.7863 - 0.1337i	-0.6750 + 1.2072i	-0.1689 + 1.0567i
w60	0.6200 + 0.3227i	0.2732 - 1.4375i	-1.2124 - 0.8333i	0.2558 - 1.4247i	-0.6874 + 0.8123i
w61	-0.6200 + 0.3227i	-0.2732 - 1.4375i	-0.3733 - 0.1498i	0.2558 + 1.4247i	-0.4017 + 0.7107i
w62	0.6200 - 0.3227i	0.2732 + 1.4375i	-0.8988 - 0.5768i	-0.2558 - 1.4247i	-0.6750 + 1.2072i
w63	-0.6200 - 0.3227i	-0.2732 + 1.4375i	-0.6394 - 0.3211i	-0.2558 + 1.4247i	-0.2558 + 1.4247i

[0215]

w / 编码速率	21/30	23/30
w0	0.2994 + 1.4627i	0.2878 + 1.4388i
w1	0.8421 + 1.2279i	0.8133 + 1.2150i
w2	1.4625 + 0.2831i	0.2878 - 1.4388i
w3	1.2488 + 0.8125i	0.8133 - 1.2150i
w4	0.1299 + 0.4106i	-0.2878 + 1.4388i
w5	0.1823 + 0.3822i	-0.8133 + 1.2150i
w6	0.2512 + 0.1287i	-0.2878 - 1.4388i
w7	0.2598 + 0.1538i	-0.8133 - 1.2150i
w8	-0.2994 + 1.4627i	0.2219 + 1.0386i
w9	-0.8421 + 1.2279i	0.6145 + 0.8494i
w10	-1.4625 + 0.2831i	0.2219 - 1.0386i
w11	-1.2488 + 0.8125i	0.6145 - 0.8494i
w12	-0.1299 + 0.4106i	-0.2219 + 1.0386i
w13	-0.1823 + 0.3822i	-0.6145 + 0.8494i
w14	-0.2512 + 0.1287i	-0.2219 - 1.0386i
w15	-0.2598 + 0.1538i	-0.6145 - 0.8494i
w16	0.2994 - 1.4627i	0.1177 + 0.4119i
w17	0.8421 - 1.2279i	0.2516 + 0.3998i
w18	1.4625 - 0.2831i	0.1177 - 0.4119i
w19	1.2488 - 0.8125i	0.2516 - 0.3998i
w20	0.1299 - 0.4106i	-0.1177 + 0.4119i
w21	0.1823 - 0.3822i	-0.2516 + 0.3998i
w22	0.2512 - 0.1287i	-0.1177 - 0.4119i
w23	0.2598 - 0.1538i	-0.2516 - 0.3998i
w24	-0.2994 - 1.4627i	0.1559 + 0.7442i
w25	-0.8421 - 1.2279i	0.4328 + 0.5954i
w26	-1.4625 - 0.2831i	0.1559 - 0.7442i
w27	-1.2488 - 0.8125i	0.4328 - 0.5954i
w28	-0.1299 - 0.4106i	-0.1559 + 0.7442i
w29	-0.1823 - 0.3822i	-0.4328 + 0.5954i
w30	-0.2512 - 0.1287i	-0.1559 - 0.7442i
w31	-0.2598 - 0.1538i	-0.4328 - 0.5954i
w32	0.2187 + 1.0467i	1.4656 + 0.2931i
w33	0.6179 + 0.8606i	1.2278 + 0.8230i
w34	1.0296 + 0.1935i	1.4656 - 0.2931i
w35	0.8910 + 0.5575i	1.2278 - 0.8230i
w36	0.1749 + 0.7440i	-1.4656 + 0.2931i
w37	0.4168 + 0.6160i	-1.2278 + 0.8230i
w38	0.6759 + 0.1488i	-1.4656 - 0.2931i
w39	0.6111 + 0.3494i	-1.2278 - 0.8230i
w40	-0.2187 + 1.0467i	1.0649 + 0.2069i
w41	-0.6179 + 0.8606i	0.8971 + 0.5677i
w42	-1.0296 + 0.1935i	1.0649 - 0.2069i
w43	-0.8910 + 0.5575i	0.8971 - 0.5677i
w44	-0.1749 + 0.7440i	-1.0649 + 0.2069i
w45	-0.4168 + 0.6160i	-0.8971 + 0.5677i

w46	-0.6759 + 0.1488i	-1.0649 - 0.2069i
w47	-0.6111 + 0.3494i	-0.8971 - 0.5677i
w48	0.2187 - 1.0467i	0.1678 + 0.1166i
w49	0.6179 - 0.8606i	0.3325 + 0.1582i
w50	1.0296 - 0.1935i	0.1678 - 0.1166i
w51	0.8910 - 0.5575i	0.3325 - 0.1582i
w52	0.1749 - 0.7440i	-0.1678 + 0.1166i
w53	0.4168 - 0.6160i	-0.3325 + 0.1582i
w54	0.6759 - 0.1488i	-0.1678 - 0.1166i
w55	0.6111 - 0.3494i	-0.3325 - 0.1582i
w56	-0.2187 - 1.0467i	0.7408 + 0.1355i
w57	-0.6179 - 0.8606i	0.6200 + 0.3227i
w58	-1.0296 - 0.1935i	0.7408 - 0.1355i
w59	-0.8910 - 0.5575i	0.6200 - 0.3227i
w60	-0.1749 - 0.7440i	-0.7408 + 0.1355i
w61	-0.4168 - 0.6160i	-0.6200 + 0.3227i
w62	-0.6759 - 0.1488i	-0.7408 - 0.1355i
w63	-0.6111 - 0.3494i	-0.6200 - 0.3227i

[0217]　　E5）128-QAM 2D NUC

w / 编码速率	135/180	140/180
w0	1.1438 + 0.4323i	1.1021 + 0.4008i
w1	0.9006 + 0.4173i	0.8567 + 0.4063i
w2	0.5578 + 0.4216i	0.5499 + 0.4932i
w3	0.6797 + 0.3850i	0.6209 + 0.3666i
w4	1.1837 + 0.8001i	0.1083 + 0.5383i
w5	0.9008 + 0.6972i	0.1008 + 0.3768i
w6	0.5354 + 0.6351i	0.3317 + 0.5081i
w7	0.6549 + 0.7546i	0.3204 + 0.3654i
w8	1.1598 + 0.1437i	1.0961 + 0.1322i
w9	0.9102 + 0.1324i	0.8513 + 0.1298i
w10	0.5755 + 0.1222i	0.5343 + 0.0862i
w11	0.6787 + 0.1401i	0.6260 + 0.1694i
w12	1.4855 + 0.1793i	0.1082 + 0.0775i
w13	1.5681 + 0.5636i	0.1037 + 0.2076i
w14	0.9727 + 1.2109i	0.3325 + 0.0910i
w15	0.7102 + 1.0171i	0.3189 + 0.2137i
w16	0.1045 + 0.4578i	1.1805 + 0.7084i
w17	0.1067 + 0.3515i	0.8930 + 0.6876i
w18	0.3411 + 0.4189i	0.5622 + 0.6728i
w19	0.3088 + 0.3456i	0.6763 + 0.8371i
w20	0.1121 + 0.6749i	0.1170 + 0.7305i
w21	0.1179 + 0.8955i	0.1259 + 0.9453i
w22	0.3342 + 0.6628i	0.3446 + 0.7129i
w23	0.3585 + 0.8699i	0.3857 + 0.9233i
w24	0.1075 + 0.0988i	1.4038 + 0.1588i
w25	0.1136 + 0.1402i	1.5205 + 0.4861i
w26	0.3700 + 0.1151i	1.0743 + 1.1040i
w27	0.3294 + 0.1448i	0.7513 + 1.0912i
w28	0.1933 + 1.4991i	0.1870 + 1.5043i
w29	0.1440 + 1.1691i	0.1454 + 1.1973i
w30	0.5835 + 1.4250i	0.5736 + 1.4545i
w31	0.4344 + 1.1140i	0.4433 + 1.1606i
w32	-1.1438 + 0.4323i	1.1021 - 0.4008i
w33	-0.9006 + 0.4173i	0.8567 - 0.4063i
w34	-0.5578 + 0.4216i	0.5499 - 0.4932i
w35	-0.6797 + 0.3850i	0.6209 - 0.3666i
w36	-1.1837 + 0.8001i	0.1083 - 0.5383i
w37	-0.9008 + 0.6972i	0.1008 - 0.3768i
w38	-0.5354 + 0.6351i	0.3317 - 0.5081i
w39	-0.6549 + 0.7546i	0.3204 - 0.3654i
w40	-1.1598 + 0.1437i	1.0961 - 0.1322i
w41	-0.9102 + 0.1324i	0.8513 - 0.1298i
w42	-0.5755 + 0.1222i	0.5343 - 0.0862i
w43	-0.6787 + 0.1401i	0.6260 - 0.1694i
w44	-1.4855 + 0.1793i	0.1082 - 0.0775i
w45	-1.5681 + 0.5636i	0.1037 - 0.2076i
w46	-0.9727 + 1.2109i	0.3325 - 0.0910i
w47	-0.7102 + 1.0171i	0.3189 - 0.2137i
w48	-0.1045 + 0.4578i	1.1805 - 0.7084i
w49	-0.1067 + 0.3515i	0.8930 - 0.6876i
w50	-0.3411 + 0.4189i	0.5622 - 0.6728i

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w51	-0.3088 + 0.3456i	0.6763 - 0.8371i
w52	-0.1121 + 0.6749i	0.1170 - 0.7305i
w53	-0.1179 + 0.8955i	0.1259 - 0.9453i
w54	-0.3342 + 0.6628i	0.3446 - 0.7129i
w55	-0.3585 + 0.8699i	0.3857 - 0.9233i
w56	-0.1075 + 0.0988i	1.4038 - 0.1588i
w57	-0.1136 + 0.1402i	1.5205 - 0.4861i
w58	-0.3700 + 0.1151i	1.0743 - 1.1040i
w59	-0.3294 + 0.1448i	0.7513 - 1.0912i
w60	-0.1933 + 1.4991i	0.1870 - 1.5043i
w61	-0.1440 + 1.1691i	0.1454 - 1.1973i
w62	-0.5835 + 1.4250i	0.5736 - 1.4545i
w63	-0.4344 + 1.1140i	0.4433 - 1.1606i
w64	1.1438 - 0.4323i	-1.1021 + 0.4008i
w65	0.9006 - 0.4173i	-0.8567 + 0.4063i
w66	0.5578 - 0.4216i	-0.5499 + 0.4932i
w67	0.6797 - 0.3850i	-0.6209 + 0.3666i
w68	1.1837 - 0.8001i	-0.1083 + 0.5383i
w69	0.9008 - 0.6972i	-0.1008 + 0.3768i
w70	0.5354 - 0.6351i	-0.3317 + 0.5081i
w71	0.6549 - 0.7546i	-0.3204 + 0.3654i
w72	1.1598 - 0.1437i	-1.0961 + 0.1322i
w73	0.9102 - 0.1324i	-0.8513 + 0.1298i
w74	0.5755 - 0.1222i	-0.5343 + 0.0862i
w75	0.6787 - 0.1401i	-0.6260 + 0.1694i
w76	1.4855 - 0.1793i	-0.1082 + 0.0775i
w77	1.5681 - 0.5636i	-0.1037 + 0.2076i
w78	0.9727 - 1.2109i	-0.3325 + 0.0910i
w79	0.7102 - 1.0171i	-0.3189 + 0.2137i
w80	0.1045 - 0.4578i	-1.1805 + 0.7084i
w81	0.1067 - 0.3515i	-0.8930 + 0.6876i
w82	0.3411 - 0.4189i	-0.5622 + 0.6728i
w83	0.3088 - 0.3456i	-0.6763 + 0.8371i
w84	0.1121 - 0.6749i	-0.1170 + 0.7305i
w85	0.1179 - 0.8955i	-0.1259 + 0.9453i
w86	0.3342 - 0.6628i	-0.3446 + 0.7129i
w87	0.3585 - 0.8699i	-0.3857 + 0.9233i
w88	0.1075 - 0.0988i	-1.4038 + 0.1588i
w89	0.1136 - 0.1402i	-1.5205 + 0.4861i
w90	0.3700 - 0.1151i	-1.0743 + 1.1040i
w91	0.3294 - 0.1448i	-0.7513 + 1.0912i
w92	0.1933 - 1.4991i	-0.1870 + 1.5043i
w93	0.1440 - 1.1691i	-0.1454 + 1.1973i
w94	0.5835 - 1.4250i	-0.5736 + 1.4545i
w95	0.4344 - 1.1140i	-0.4433 + 1.1606i
w96	-1.1438 - 0.4323i	-1.1021 - 0.4008i
w97	-0.9006 - 0.4173i	-0.8567 - 0.4063i
w98	-0.5578 - 0.4216i	-0.5499 - 0.4932i
w99	-0.6797 - 0.3850i	-0.6209 - 0.3666i
w100	-1.1837 - 0.8001i	-0.1083 - 0.5383i
w101	-0.9008 - 0.6972i	-0.1008 - 0.3768i
w102	-0.5354 - 0.6351i	-0.3317 - 0.5081i
w103	-0.6549 - 0.7546i	-0.3204 - 0.3654i
w104	-1.1598 - 0.1437i	-1.0961 - 0.1322i
w105	-0.9102 - 0.1324i	-0.8513 - 0.1298i
w106	-0.5755 - 0.1222i	-0.5343 - 0.0862i
w107	-0.6787 - 0.1401i	-0.6260 - 0.1694i
w108	-1.4855 - 0.1793i	-0.1082 - 0.0775i
w109	-1.5681 - 0.5636i	-0.1037 - 0.2076i
w110	-0.9727 - 1.2109i	-0.3325 - 0.0910i
w111	-0.7102 - 1.0171i	-0.3189 - 0.2137i
w112	-0.1045 - 0.4578i	-1.1805 - 0.7084i
w113	-0.1067 - 0.3515i	-0.8930 - 0.6876i
w114	-0.3411 - 0.4189i	-0.5622 - 0.6728i
w115	-0.3088 - 0.3456i	-0.6763 - 0.8371i
w116	-0.1121 - 0.6749i	-0.1170 - 0.7305i
w117	-0.1179 - 0.8955i	-0.1259 - 0.9453i
w118	-0.3342 - 0.6628i	-0.3446 - 0.7129i
w119	-0.3585 - 0.8699i	-0.3857 - 0.9233i
w120	-0.1075 - 0.0988i	-1.4038 - 0.1588i
w121	-0.1136 - 0.1402i	-1.5205 - 0.4861i
w122	-0.3700 - 0.1151i	-1.0743 - 1.1040i
w123	-0.3294 - 0.1448i	-0.7513 - 1.0912i
w124	-0.1933 - 1.4991i	-0.1870 - 1.5043i
w125	-0.1440 - 1.1691i	-0.1454 - 1.1973i
w126	-0.5835 - 1.4250i	-0.5736 - 1.4545i

[0219]

[0220]

w127	-0.4344 - 1.1140i	-0.4433 - 1.1606i

[0221]　　E6) 256-QAM 2D NUC

[0222]

w / 编码速率	20/30	22/30
w0	1.6350 + 0.1593i	1.5977 + 0.1526i
w1	1.5776 + 0.4735i	1.3187 + 0.1269i
w2	0.9430 + 0.1100i	-1.5977 + 0.1526i
w3	0.9069 + 0.2829i	-1.3187 + 0.1269i
w4	0.3237 + 0.0849i	0.2574 + 0.0733i
w5	0.3228 + 0.0867i	0.4496 + 0.0807i
w6	0.7502 + 0.1138i	-0.2574 + 0.0733i
w7	0.7325 + 0.2088i	-0.4496 + 0.0807i
w8	0.1658 + 1.6747i	1.5977 - 0.1526i
w9	0.4907 + 1.6084i	1.3187 - 0.1269i
w10	0.1088 + 0.9530i	-1.5977 - 0.1526i
w11	0.2464 + 0.9270i	-1.3187 - 0.1269i
w12	0.0872 + 0.1390i	0.2574 - 0.0733i
w13	0.0871 + 0.1392i	0.4496 - 0.0807i
w14	0.1091 + 0.7656i	-0.2574 - 0.0733i
w15	0.1699 + 0.7537i	-0.4496 - 0.0807i
w16	-1.6350 + 0.1593i	0.9269 + 0.0943i
w17	-1.5776 + 0.4735i	1.1024 + 0.1086i
w18	-0.9430 + 0.1100i	-0.9269 + 0.0943i
w19	-0.9069 + 0.2829i	-1.1024 + 0.1086i
w20	-0.3237 + 0.0849i	0.7663 + 0.0867i
w21	-0.3228 + 0.0867i	0.6115 + 0.0871i
w22	-0.7502 + 0.1138i	-0.7663 + 0.0867i
w23	-0.7325 + 0.2088i	-0.6115 + 0.0871i
w24	-0.1658 + 1.6747i	0.9269 - 0.0943i
w25	-0.4907 + 1.6084i	1.1024 - 0.1086i
w26	-0.1088 + 0.9530i	-0.9269 - 0.0943i
w27	-0.2464 + 0.9270i	-1.1024 - 0.1086i
w28	-0.0872 + 0.1390i	0.7663 - 0.0867i
w29	-0.0871 + 0.1392i	0.6115 - 0.0871i
w30	-0.1091 + 0.7656i	-0.7663 - 0.0867i
w31	-0.1699 + 0.7537i	-0.6115 - 0.0871i
w32	1.3225 + 0.1320i	1.2701 + 1.0139i
w33	1.2742 + 0.3922i	1.0525 + 0.8406i
w34	1.0854 + 0.1139i	-1.2701 + 1.0139i
w35	1.0441 + 0.3296i	-1.0525 + 0.8406i
w36	0.4582 + 0.1123i	0.2487 + 0.1978i
w37	0.4545 + 0.1251i	0.3523 + 0.2915i
w38	0.6473 + 0.1138i	-0.2487 + 0.1978i
w39	0.6339 + 0.1702i	-0.3523 + 0.2915i
w40	0.1322 + 1.3631i	1.2701 - 1.0139i
w41	0.3929 + 1.3102i	1.0525 - 0.8406i
w42	0.1124 + 1.1327i	-1.2701 - 1.0139i
w43	0.3160 + 1.0913i	-1.0525 - 0.8406i
w44	0.0928 + 0.3970i	0.2487 - 0.1978i
w45	0.0937 + 0.3973i	0.3523 - 0.2915i
w46	0.1054 + 0.5979i	-0.2487 - 0.1978i
w47	0.1230 + 0.5949i	-0.3523 - 0.2915i
w48	-1.3225 + 0.1320i	0.7359 + 0.6043i
w49	-1.2742 + 0.3922i	0.8807 + 0.7105i
w50	-1.0854 + 0.1139i	-0.7359 + 0.6043i
w51	-1.0441 + 0.3296i	-0.8807 + 0.7105i
w52	-0.4582 + 0.1123i	0.6017 + 0.5019i
w53	-0.4545 + 0.1251i	0.4747 + 0.3996i
w54	-0.6473 + 0.1138i	-0.6017 + 0.5019i
w55	-0.6339 + 0.1702i	-0.4747 + 0.3996i
w56	-0.1322 + 1.3631i	0.7359 - 0.6043i
w57	-0.3929 + 1.3102i	0.8807 - 0.7105i
w58	-0.1124 + 1.1327i	-0.7359 - 0.6043i
w59	-0.3160 + 1.0913i	-0.8807 - 0.7105i
w60	-0.0928 + 0.3970i	0.6017 - 0.5019i
w61	-0.0937 + 0.3973i	0.4747 - 0.3996i
w62	-0.1054 + 0.5979i	-0.6017 - 0.5019i
w63	-0.1230 + 0.5949i	-0.4747 - 0.3996i
w64	1.6350 - 0.1593i	1.5441 + 0.4545i
w65	1.5776 - 0.4735i	1.2750 + 0.3775i
w66	0.9430 - 0.1100i	-1.5441 + 0.4545i
w67	0.9069 - 0.2829i	-1.2750 + 0.3775i
w68	0.3237 - 0.0849i	0.2586 + 0.0752i
w69	0.3228 - 0.0867i	0.4435 + 0.1065i

w70	0.7502 - 0.1138i	-0.2586 + 0.0752i
w71	0.7325 - 0.2088i	-0.4435 + 0.1065i
w72	0.1658 - 1.6747i	1.5441 - 0.4545i
w73	0.4907 - 1.6084i	1.2750 - 0.3775i
w74	0.1088 - 0.9530i	-1.5441 - 0.4545i
w75	0.2464 - 0.9270i	-1.2750 - 0.3775i
w76	0.0872 - 0.1390i	0.2586 - 0.0752i
w77	0.0871 - 0.1392i	0.4435 - 0.1065i
w78	0.1091 - 0.7656i	-0.2586 - 0.0752i
w79	0.1699 - 0.7537i	-0.4435 - 0.1065i
w80	-1.6350 - 0.1593i	0.8925 + 0.2771i
w81	-1.5776 - 0.4735i	1.0649 + 0.3219i
w82	-0.9430 - 0.1100i	-0.8925 + 0.2771i
w83	-0.9069 - 0.2829i	-1.0649 + 0.3219i
w84	-0.3237 - 0.0849i	0.7362 + 0.2279i
w85	-0.3228 - 0.0867i	0.5936 + 0.1699i
w86	-0.7502 - 0.1138i	-0.7362 + 0.2279i
w87	-0.7325 - 0.2088i	-0.5936 + 0.1699i
w88	-0.1658 - 1.6747i	0.8925 - 0.2771i
w89	-0.4907 - 1.6084i	1.0649 - 0.3219i
w90	-0.1088 - 0.9530i	-0.8925 - 0.2771i
w91	-0.2464 - 0.9270i	-1.0649 - 0.3219i
w92	-0.0872 - 0.1390i	0.7362 - 0.2279i
w93	-0.0871 - 0.1392i	0.5936 - 0.1699i
w94	-0.1091 - 0.7656i	-0.7362 - 0.2279i
w95	-0.1699 - 0.7537i	-0.5936 - 0.1699i
w96	1.3225 - 0.1320i	1.4352 + 0.7452i
w97	1.2742 - 0.3922i	1.1866 + 0.6182i
w98	1.0854 - 0.1139i	-1.4352 + 0.7452i
w99	1.0441 - 0.3296i	-1.1866 + 0.6182i
w100	0.4582 - 0.1123i	0.2523 + 0.1944i
w101	0.4545 - 0.1251i	0.3695 + 0.2695i
w102	0.6473 - 0.1138i	-0.2523 + 0.1944i
w103	0.6339 - 0.1702i	-0.3695 + 0.2695i
w104	0.1322 - 1.3631i	1.4352 - 0.7452i
w105	0.3929 - 1.3102i	1.1866 - 0.6182i
w106	0.1124 - 1.1327i	-1.4352 - 0.7452i
w107	0.3160 - 1.0913i	-1.1866 - 0.6182i
w108	0.0928 - 0.3970i	0.2523 - 0.1944i
w109	0.0937 - 0.3973i	0.3695 - 0.2695i
w110	0.1054 - 0.5979i	-0.2523 - 0.1944i
w111	0.1230 - 0.5949i	-0.3695 - 0.2695i
w112	-1.3225 - 0.1320i	0.8273 + 0.4493i
w113	-1.2742 - 0.3922i	0.9911 + 0.5243i
w114	-1.0854 - 0.1139i	-0.8273 + 0.4493i
w115	-1.0441 - 0.3296i	-0.9911 + 0.5243i
w116	-0.4582 - 0.1123i	0.6708 + 0.3859i
w117	-0.4545 - 0.1251i	0.5197 + 0.3331i
w118	-0.6473 - 0.1138i	-0.6708 + 0.3859i
w119	-0.6339 - 0.1702i	-0.5197 + 0.3331i
w120	-0.1322 - 1.3631i	0.8273 + 0.4493i
w121	-0.3929 - 1.3102i	0.9911 - 0.5243i
w122	-0.1124 - 1.1327i	-0.8273 - 0.4493i
w123	-0.3160 - 1.0913i	-0.9911 - 0.5243i
w124	-0.0928 - 0.3970i	0.6708 - 0.3859i
w125	-0.0937 - 0.3973i	0.5197 - 0.3331i
w126	-0.1054 - 0.5979i	-0.6708 - 0.3859i
w127	-0.1230 - 0.5949i	-0.5197 - 0.3331i
w128	1.2901 + 1.0495i	0.1646 + 1.6329i
w129	1.4625 + 0.7740i	0.1379 + 1.3595i
w130	0.7273 + 0.6160i	-0.1646 + 1.6329i
w131	0.8177 + 0.4841i	-0.1379 + 1.3595i
w132	0.2844 + 0.1296i	0.0736 + 0.0898i
w133	0.2853 + 0.1309i	0.0742 + 0.5054i
w134	0.5902 + 0.4857i	-0.0736 + 0.0898i
w135	0.6355 + 0.4185i	-0.0742 + 0.5054i
w136	1.0646 + 1.2876i	0.1646 - 1.6329i
w137	0.7949 + 1.4772i	0.1379 - 1.3595i
w138	0.5707 + 0.7662i	-0.1646 - 1.6329i
w139	0.4490 + 0.8461i	-0.1379 - 1.3595i
w140	0.1053 + 0.1494i	0.0736 - 0.0898i
w141	0.1052 + 0.1495i	0.0742 - 0.5054i
w142	0.4294 + 0.6363i	-0.0736 - 0.0898i
w143	0.3744 + 0.6744i	-0.0742 - 0.5054i
w144	-1.2901 + 1.0495i	0.0992 + 0.9847i
w145	-1.4625 + 0.7740i	0.1170 + 1.1517i

[0223]

w146	-0.7273 + 0.6160i	-0.0992 + 0.9847i
w147	-0.8177 + 0.4841i	-0.1170 + 1.1517i
w148	-0.2844 + 0.1296i	0.0894 + 0.8287i
w149	-0.2853 + 0.1309i	0.0889 + 0.6739i
w150	-0.5902 + 0.4857i	-0.0894 + 0.8287i
w151	-0.6355 + 0.4185i	-0.0889 + 0.6739i
w152	-1.0646 + 1.2876i	0.0992 - 0.9847i
w153	-0.7949 + 1.4772i	0.1170 - 1.1517i
w154	-0.5707 + 0.7662i	-0.0992 - 0.9847i
w155	-0.4490 + 0.8461i	-0.1170 - 1.1517i
w156	-0.1053 + 0.1494i	0.0894 - 0.8287i
w157	-0.1052 + 0.1495i	0.0889 - 0.6739i
w158	-0.4294 + 0.6363i	-0.0894 - 0.8287i
w159	-0.3744 + 0.6744i	-0.0889 - 0.6739i
w160	1.0382 + 0.8623i	1.0516 + 1.2481i
w161	1.1794 + 0.6376i	0.8742 + 1.0355i
w162	0.8504 + 0.7217i	-1.0516 + 1.2481i
w163	0.9638 + 0.5407i	-0.8742 + 1.0355i
w164	0.3734 + 0.2560i	0.0970 + 0.2450i
w165	0.3799 + 0.2517i	0.1959 + 0.4045i
w166	0.4968 + 0.3947i	-0.0970 + 0.2450i
w167	0.5231 + 0.3644i	-0.1959 + 0.4045i
w168	0.8555 + 1.0542i	1.0516 - 1.2481i
w169	0.6363 + 1.2064i	0.8742 - 1.0355i
w170	0.6961 + 0.8850i	-1.0516 - 1.2481i
w171	0.5229 + 1.0037i	-0.8742 - 1.0355i
w172	0.1938 + 0.3621i	0.0970 - 0.2450i
w173	0.1909 + 0.3627i	0.1959 - 0.4045i
w174	0.3224 + 0.5236i	-0.0970 - 0.2450i
w175	0.3016 + 0.5347i	-0.1959 - 0.4045i
w176	-1.0382 + 0.8623i	0.6150 + 0.7441i
w177	-1.1794 + 0.6376i	0.7345 + 0.8743i
w178	-0.8504 + 0.7217i	-0.6150 + 0.7441i
w179	-0.9638 + 0.5407i	-0.7345 + 0.8743i
w180	-0.3734 + 0.2560i	0.4932 + 0.6301i
w181	-0.3799 + 0.2517i	0.3620 + 0.5258i
w182	-0.4968 + 0.3947i	-0.4932 + 0.6301i
w183	-0.5231 + 0.3644i	-0.3620 + 0.5258i
w184	-0.8555 + 1.0542i	0.6150 - 0.7441i
w185	-0.6363 + 1.2064i	0.7345 - 0.8743i
w186	-0.6961 + 0.8850i	-0.6150 - 0.7441i
w187	-0.5229 + 1.0037i	-0.7345 - 0.8743i
w188	-0.1938 + 0.3621i	0.4932 - 0.6301i
w189	-0.1909 + 0.3627i	0.3620 - 0.5258i
w190	-0.3224 + 0.5236i	-0.4932 - 0.6301i
w191	-0.3016 + 0.5347i	-0.3620 - 0.5258i
w192	1.2901 - 1.0495i	0.4866 + 1.5660i
w193	1.4625 - 0.7740i	0.4068 + 1.3027i
w194	0.7273 - 0.6160i	-0.4866 + 1.5660i
w195	0.8177 - 0.4841i	-0.4068 + 1.3027i
w196	0.2844 - 0.1296i	0.0732 + 0.0899i
w197	0.2853 - 0.1309i	0.0877 + 0.4997i
w198	0.5902 - 0.4857i	-0.0732 + 0.0899i
w199	0.6355 - 0.4185i	-0.0877 + 0.4997i
w200	1.0646 - 1.2876i	0.4866 - 1.5660i
w201	0.7949 - 1.4772i	0.4068 - 1.3027i
w202	0.5707 - 0.7662i	-0.4866 - 1.5660i
w203	0.4490 - 0.8461i	-0.4068 - 1.3027i
w204	0.1053 - 0.1494i	0.0732 - 0.0899i
w205	0.1052 - 0.1495i	0.0877 - 0.4997i
w206	0.4294 - 0.6363i	-0.0732 - 0.0899i
w207	0.3744 - 0.6744i	-0.0877 - 0.4997i
w208	-1.2901 - 1.0495i	0.2927 + 0.9409i
w209	-1.4625 - 0.7740i	0.3446 + 1.1023i
w210	-0.7273 - 0.6160i	-0.2927 + 0.9409i
w211	-0.8177 - 0.4841i	-0.3446 + 1.1023i
w212	-0.2844 - 0.1296i	0.2350 + 0.7945i
w213	-0.2853 - 0.1309i	0.1670 + 0.6529i
w214	-0.5902 - 0.4857i	-0.2350 + 0.7945i
w215	-0.6355 - 0.4185i	-0.1670 + 0.6529i
w216	-1.0646 - 1.2876i	0.2927 - 0.9409i
w217	-0.7949 - 1.4772i	0.3446 - 1.1023i
w218	-0.5707 - 0.7662i	-0.2927 - 0.9409i
w219	-0.4490 - 0.8461i	-0.3446 - 1.1023i
w220	-0.1053 - 0.1494i	0.2350 - 0.7945i
w221	-0.1052 - 0.1495i	0.1670 - 0.6529i

[0224]

[0225]

w222	-0.4294 - 0.6363i	-0.2350 - 0.7945i
w223	-0.3744 - 0.6744i	-0.1670 - 0.6529i
w224	1.0382 - 0.8623i	0.7867 + 1.4356i
w225	1.1794 - 0.6376i	0.6561 + 1.1927i
w226	0.8504 - 0.7217i	-0.7867 + 1.4356i
w227	0.9638 - 0.5407i	-0.6561 + 1.1927i
w228	0.3734 - 0.2560i	0.0947 + 0.2451i
w229	0.3799 - 0.2517i	0.1865 + 0.4121i
w230	0.4968 - 0.3947i	-0.0947 + 0.2451i
w231	0.5231 - 0.3644i	-0.1865 + 0.4121i
w232	0.8555 - 1.0542i	0.7867 - 1.4356i
w233	0.6363 - 1.2064i	0.6561 - 1.1927i
w234	0.6961 - 0.8850i	-0.7867 - 1.4356i
w235	0.5229 - 1.0037i	-0.6561 - 1.1927i
w236	0.1938 - 0.3621i	0.0947 - 0.2451i
w237	0.1909 - 0.3627i	0.1865 - 0.4121i
w238	0.3224 - 0.5236i	-0.0947 - 0.2451i
w239	0.3016 - 0.5347i	-0.1865 - 0.4121i
w240	-1.0382 - 0.8623i	0.4677 + 0.8579i
w241	-1.1794 - 0.6376i	0.5537 + 1.0081i
w242	-0.8504 - 0.7217i	-0.4677 + 0.8579i
w243	-0.9638 - 0.5407i	-0.5537 + 1.0081i
w244	-0.3734 - 0.2560i	0.3893 + 0.7143i
w245	-0.3799 - 0.2517i	0.3110 + 0.5686i
w246	-0.4968 - 0.3947i	-0.3893 + 0.7143i
w247	-0.5231 - 0.3644i	-0.3110 + 0.5686i
w248	-0.8555 - 1.0542i	0.4677 - 0.8579i
w249	-0.6363 - 1.2064i	0.5537 - 1.0081i
w250	-0.6961 - 0.8850i	-0.4677 - 0.8579i
w251	-0.5229 - 1.0037i	-0.5537 - 1.0081i
w252	-0.1938 - 0.3621i	0.3893 - 0.7143i
w253	-0.1909 - 0.3627i	0.3110 - 0.5686i
w254	-0.3224 - 0.5236i	-0.3893 - 0.7143i
w255	-0.3016 - 0.5347i	-0.3110 - 0.5686i

[0226] 根据DVB-S2标准或其延伸DVB-Sx,来自组E的星座可以优选地用于编码和调制。特别注意星座可以与LDPC码以及来自DVB-Sx基线系统的位交错器设置一起使用。

[0227] 每当提出星座用于LDPC码,而非DVB-Sx基线的一部分时,例如,编码速率"x/30"的代码,优化星座,以便允许DVB-S2状位交错器。这表示可以应用相同的交错规则,如在DVB-S2中用于64k LDPC码一样(除了S2的编码速率3/5):逐列填充分块交错器,并且逐行读出,从左到右读取每行。根据位交错器模式,如在DVB-Sx基线中所讨论的,这会对应于位交错器模式[0,1,2,…M-1],其中,M是位/QAM符号的数量,例如,对于具有8个点的星座,M=3,对于具有16个点的星座,M=4,以此类推。

[0228] 应注意的是,优化组A、B、C、D以及E的星座的编码速率是LDPC编码器的编码速率。然而,由于使用额外的BCH编码器,所以总编码速率实际上更小。

[0229] 图13示出了用于编码速率R=100/180或104/180的8-NUC的组E的星座的示图。相应的星座点向量是:

[0230] w=(-0.2330,-0.5414-0.8712i,-0.5414+0.8712i,-1.3570,0.2330,

[0231] 0.5414-0.8712i,0.5414+0.8712i,1.3570)。

[0232] 图14示出了说明上述非均匀8进制QAM星座的成形增益的示图,可通过卫星用于与数字视频广播相关的标准。应用以下条件,获得曲线:AWGN系电脑、在50LDPC迭代之后的误码率和误帧率(BER、FER)以及外部BCH解码;使用64k LDPC码(代码长度=64800)。该图包括曲线,显示了BER(实线)和FER(虚线)。进一步,具有在使用基线星座的已知标准中所使用的传统星座的曲线以及8进制QAM的上面解释的NUC的曲线。可以看出,通过更低的SNR,可以实现相同的BER或FER。为编码速率13/18获得最佳结果:所提出的星座通过比传统星座更低的0.55dB的SNR运转。曲线通过该偏移几乎平行移到左边,具有优化的星座。对于编码速率25/36,实现0.5dB增益。

[0233]　　图15示出了优化了公开的星座的LDPC码的实例。给相应的代码提供代码长度和编码速率。

[0234]　　应注意的是,本公开要理解的为,本公开包括编码和调制设备的实施方式,星座表格的更少组可用于选择和/或使用星座,星座的更小表格可用于选择和/或使用星座,包括用于更少编码速率和/或更少值M的星座的表格可用于选择和/或使用星座,和/或仅仅从所有公开的星座之中所选的(单个)星座可用于选择和/或使用星座。

[0235]　　显然,鉴于以上教导内容,本公开能够具有多个修改和变更。因此,要理解的是,在所附权利要求的范围内,可实践本公开,而非在本文中明确描述(例如,如果NUC位置向量凑整为更小数量的数字)。

[0236]　　在发明中,措辞"包括"不排除其他元件或步骤,并且不定冠词"a"或"an"不排除多个。单个元件或其他单元可以履行在本发明中叙述的几个条目的功能。在相互不同的本发明的实施例中叙述某些措施这一事实不表示这些措施的组合不能加以利用。

[0237]　　至于本公开的实施方式描述为至少部分由软件控制的数据处理设备实现,要理解的是,传送这种软件(例如,光盘、磁盘、半导体存储器等)的永久性机器可读介质也视为表示本公开的实施方式。进一步,这种软件还可通过其他形式分布,例如,通过互联网或其他有线或无线电信系统。

[0238]　　可用于实现要求的设备的一个或多个元件的电路是电子元件的结构组合,包括传统的电路元件、包括专用集成电路的集成电路、标准集成电路、专用标准产品以及现场可编程门阵列。进一步,电路包括中央处理单元、图形处理单元以及微处理器,其根据软件代码编程或者配置。虽然电路包括上述硬件执行软件,但是电路不包括单纯的软件,在权利要求中的任何参考符号不应理解为限制范围。

55
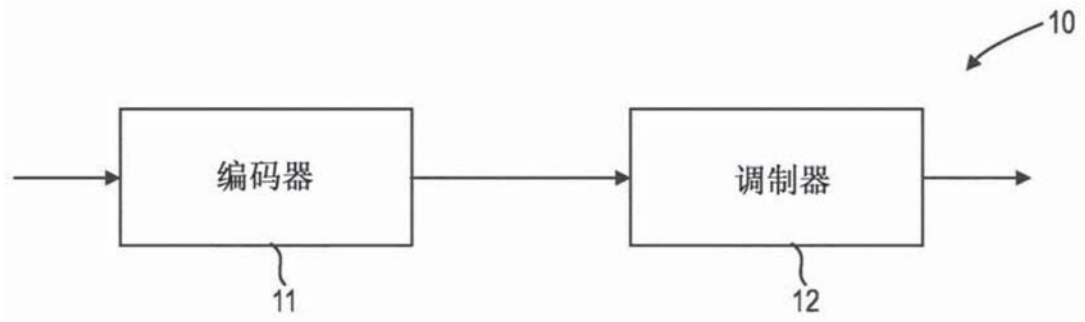
图1
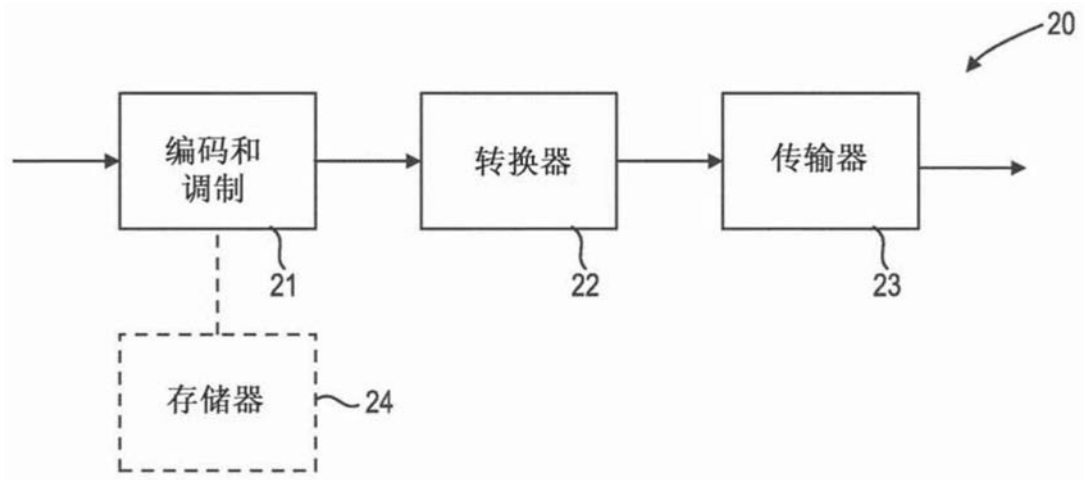
图2
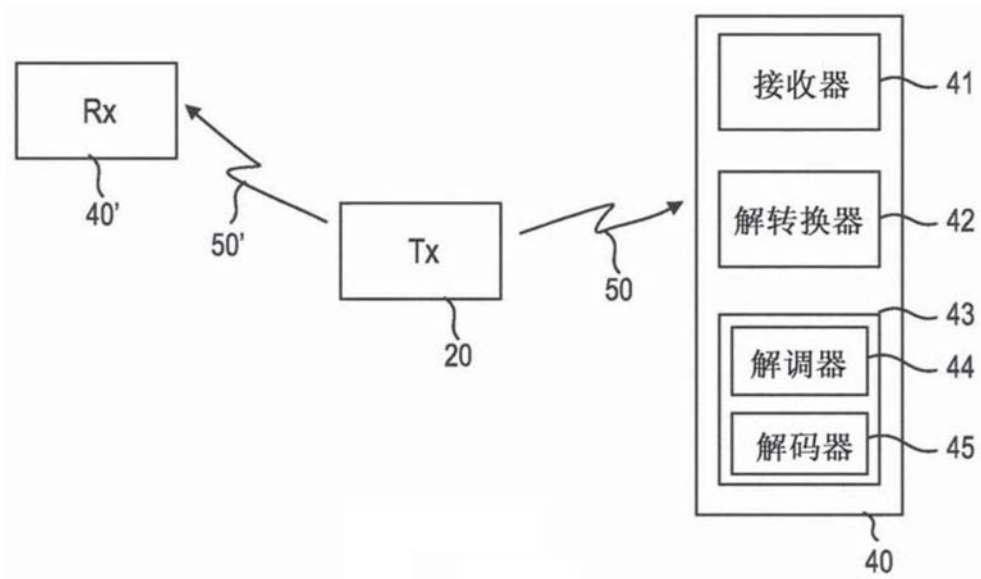
图3
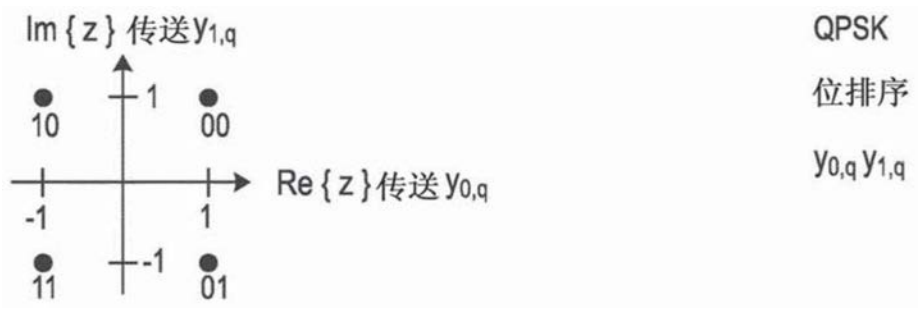
图4
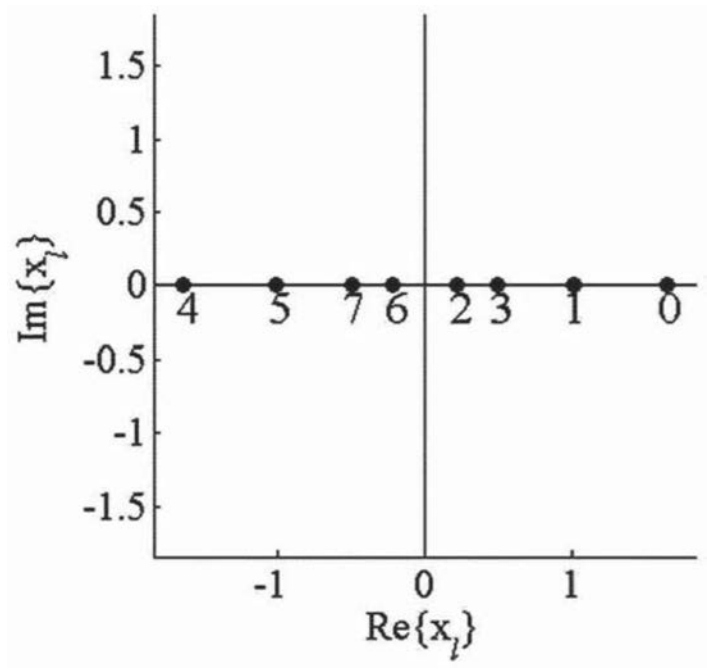
图5A
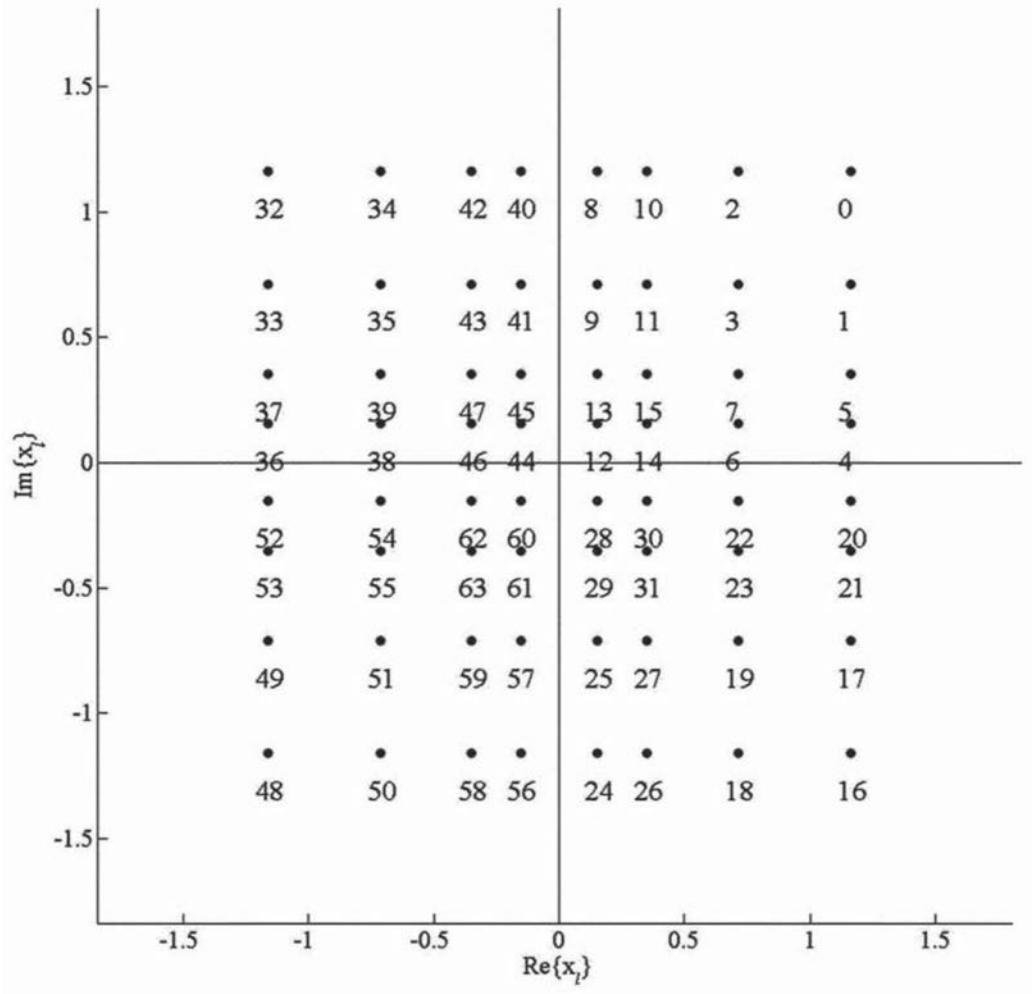
图5B
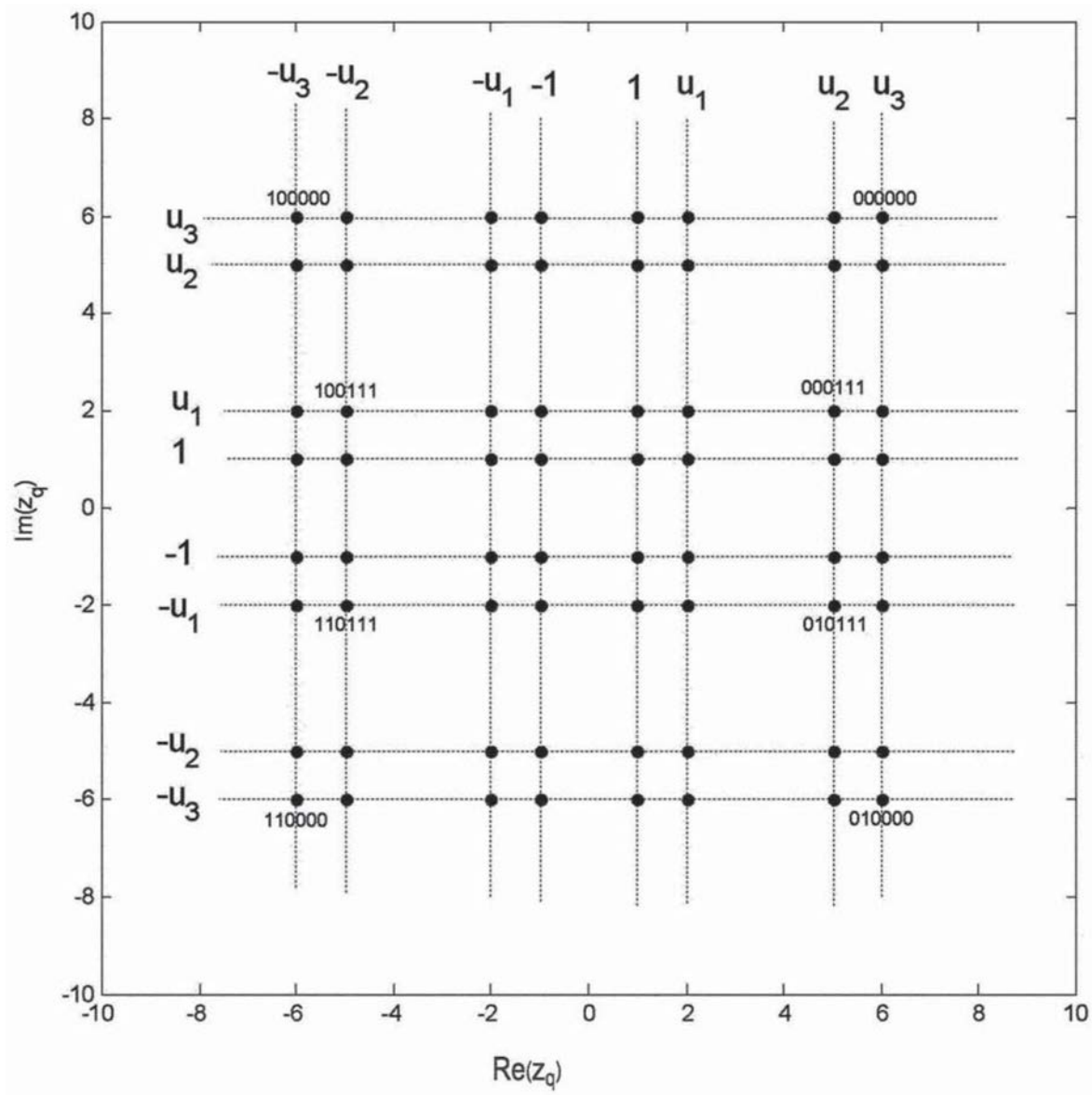
图6
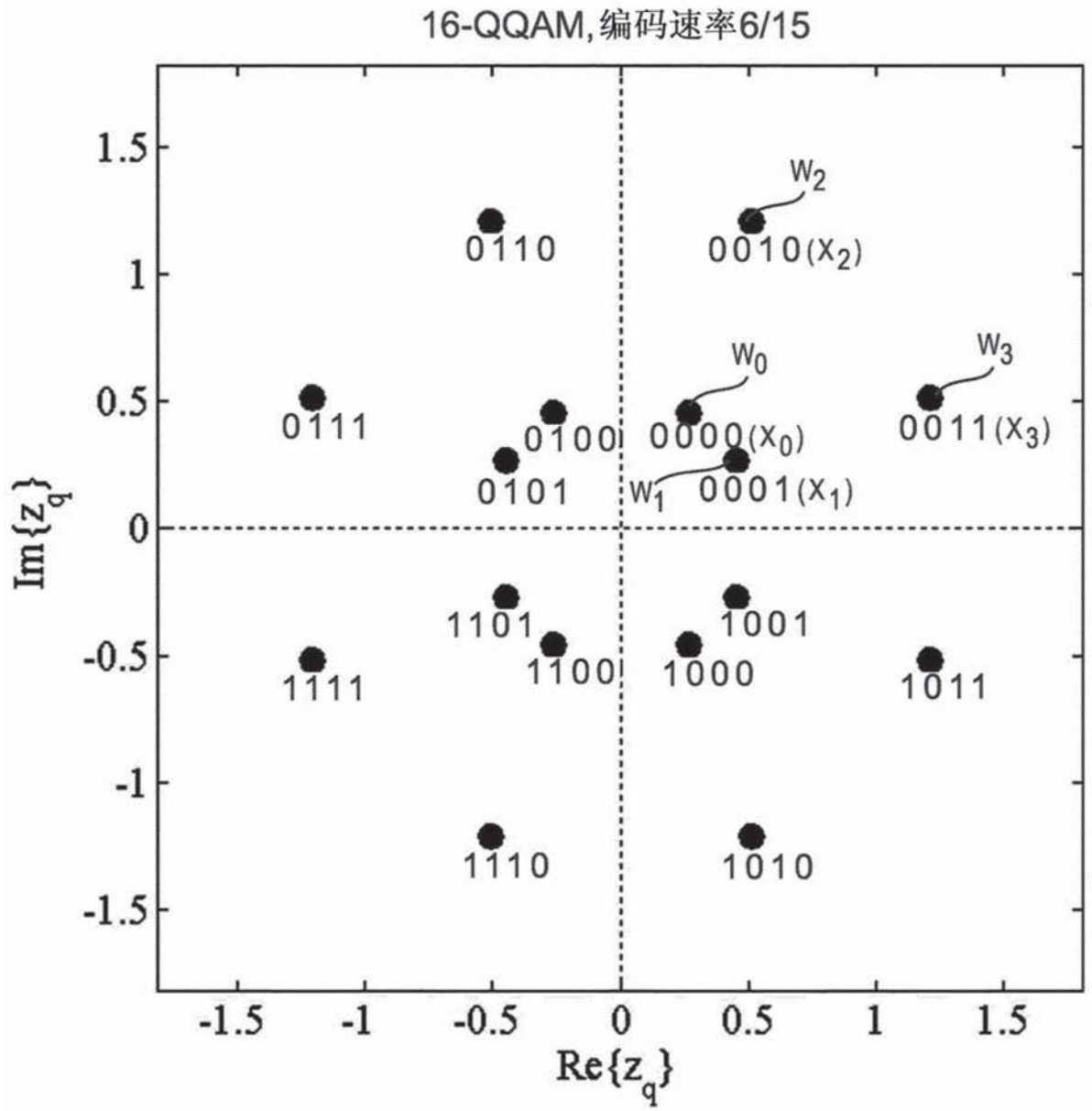
图7
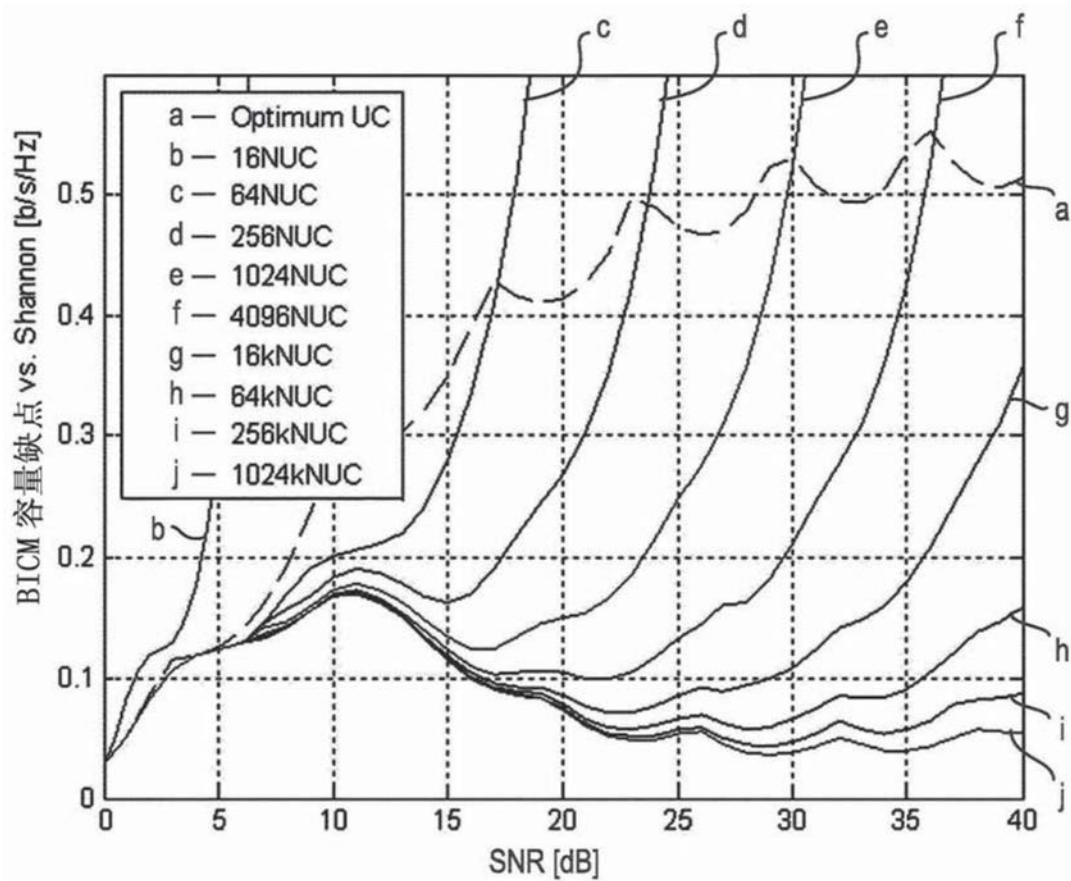
图8
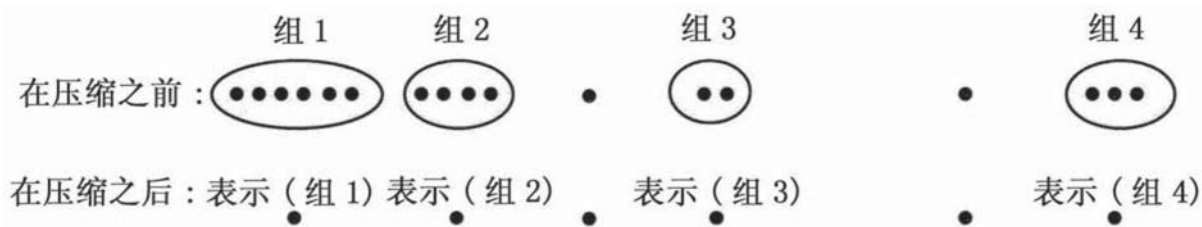
图9
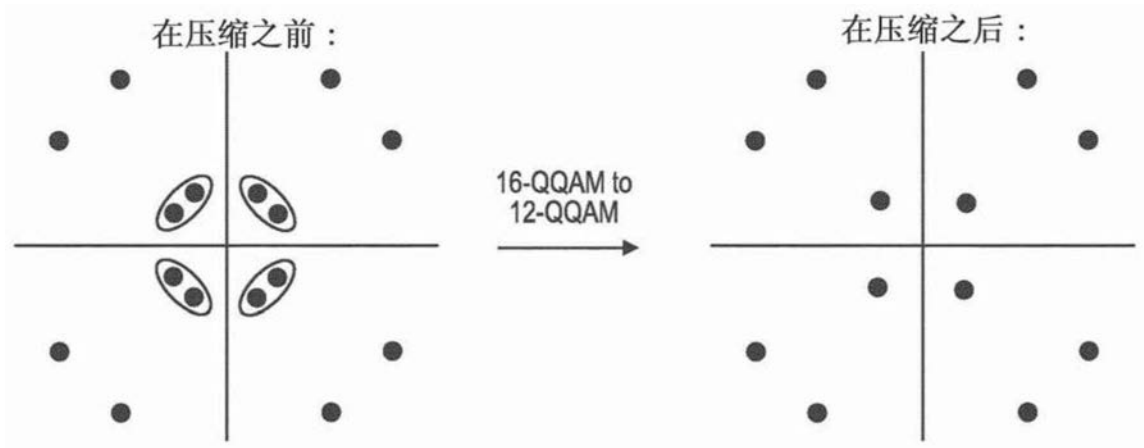
图10
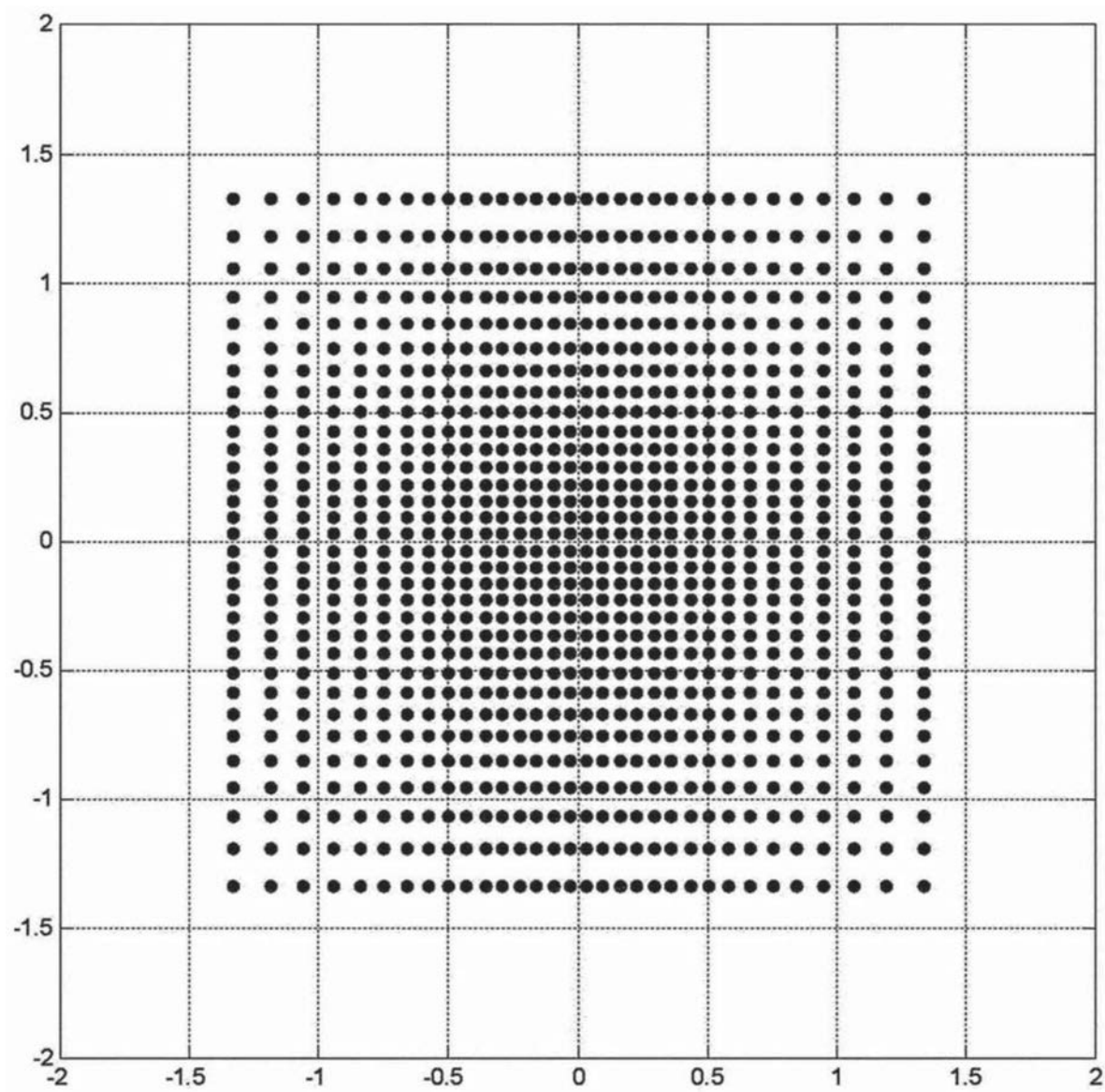
图11A
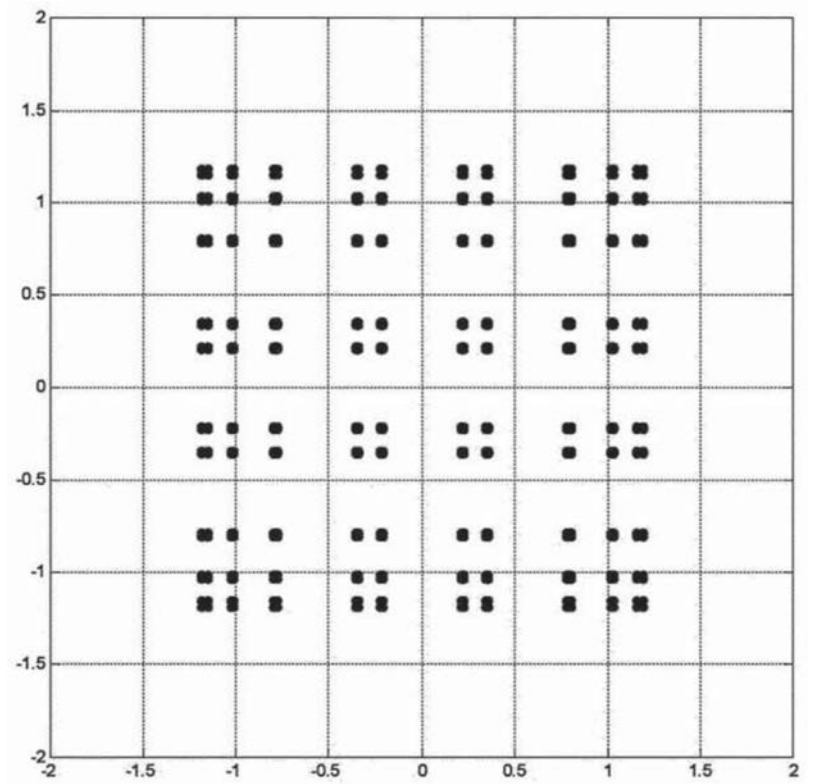
图11B
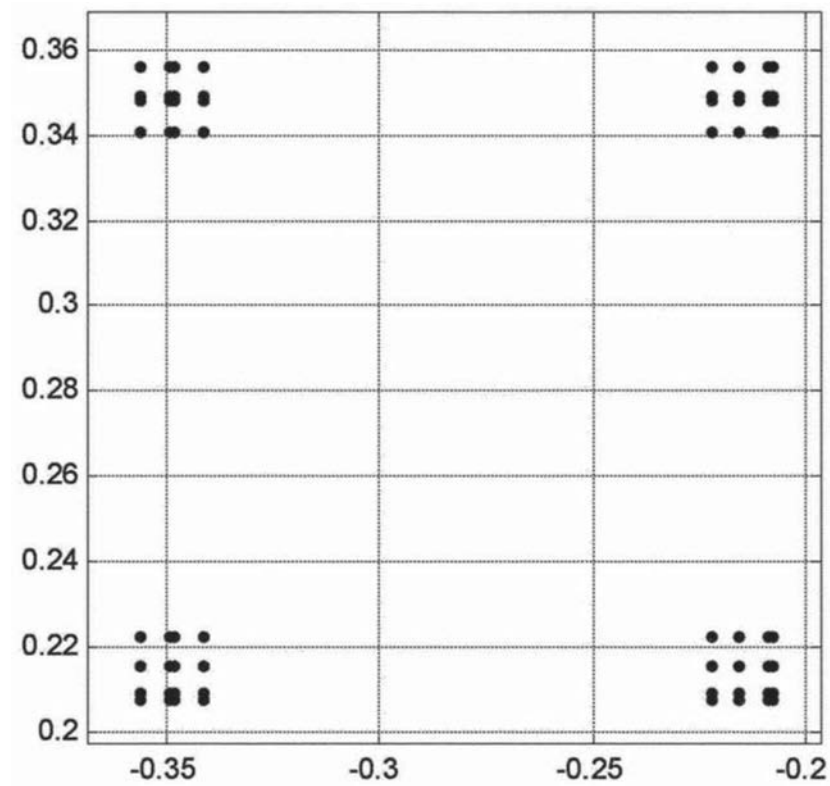
图11C
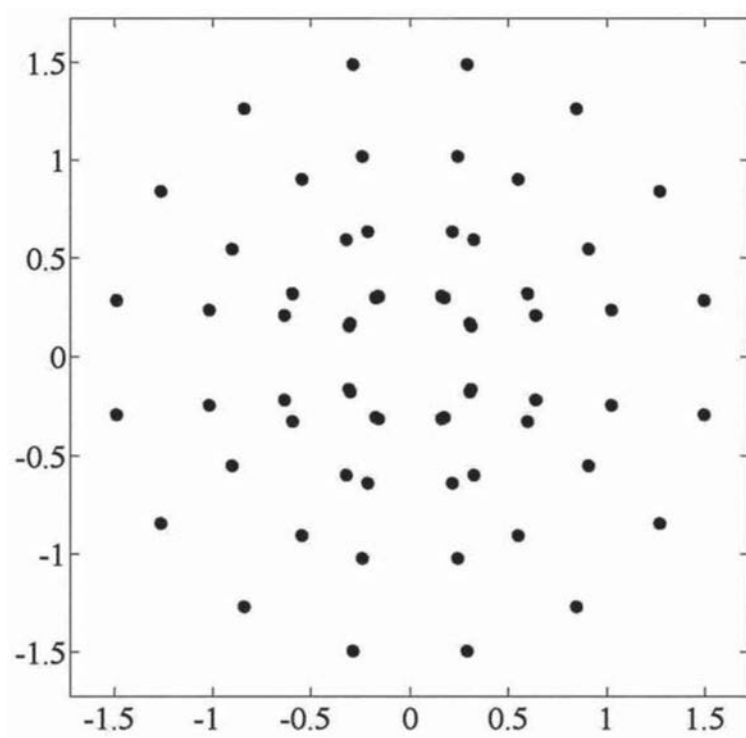
图12A
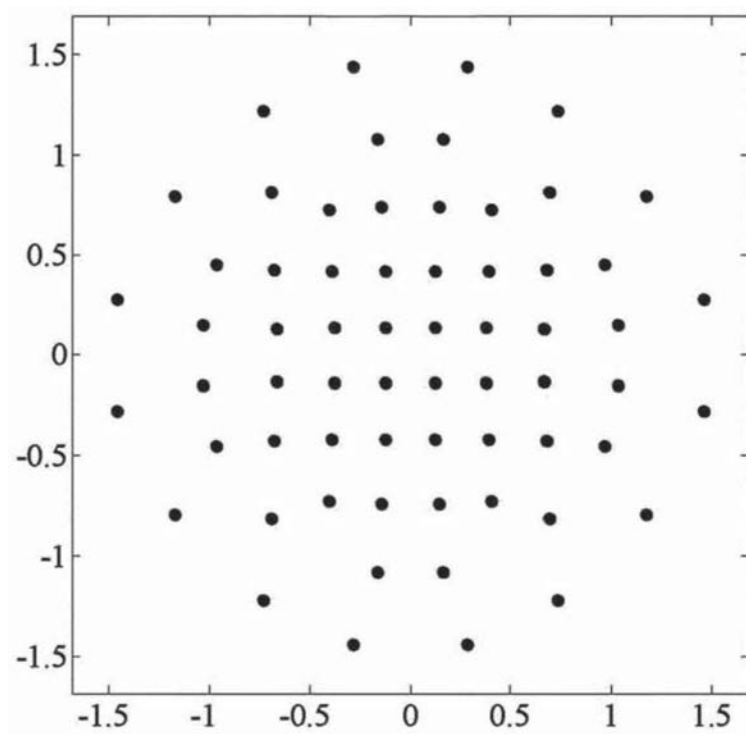
图12B
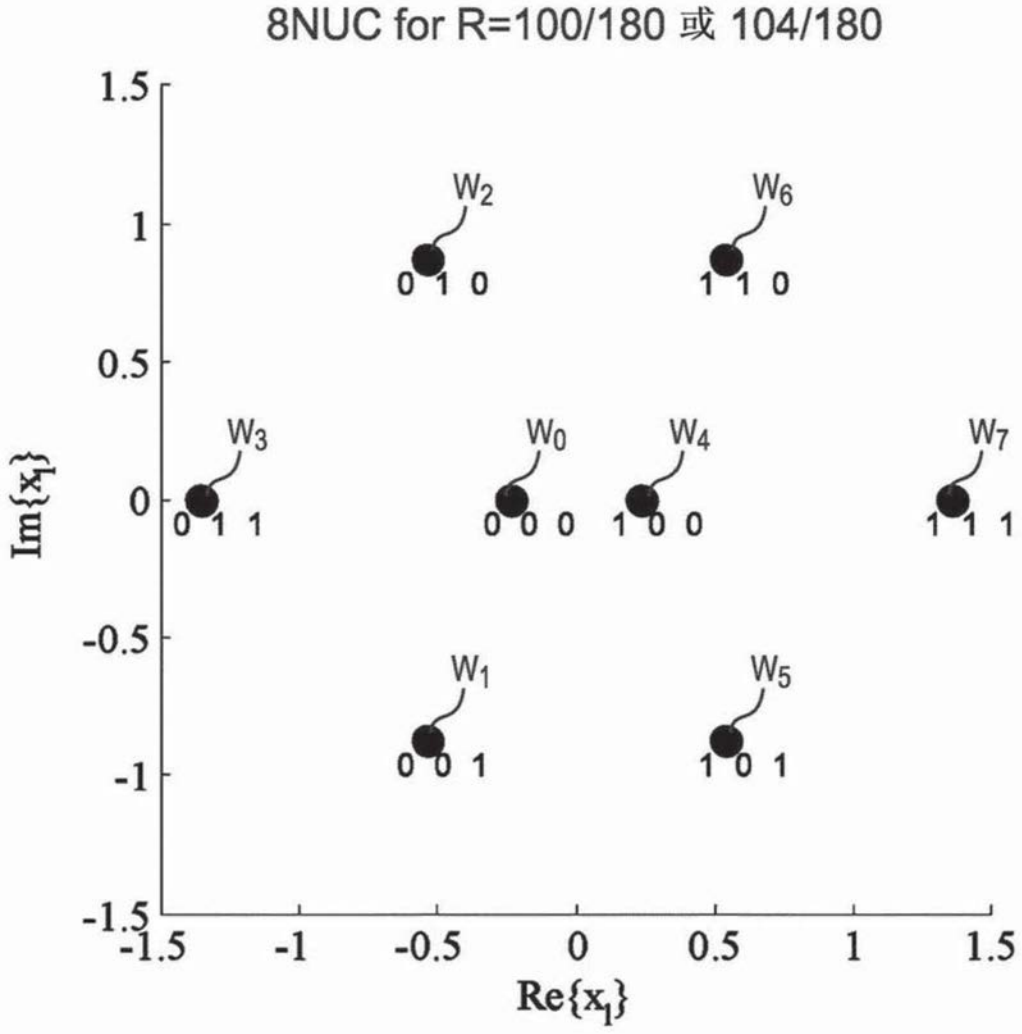
图13
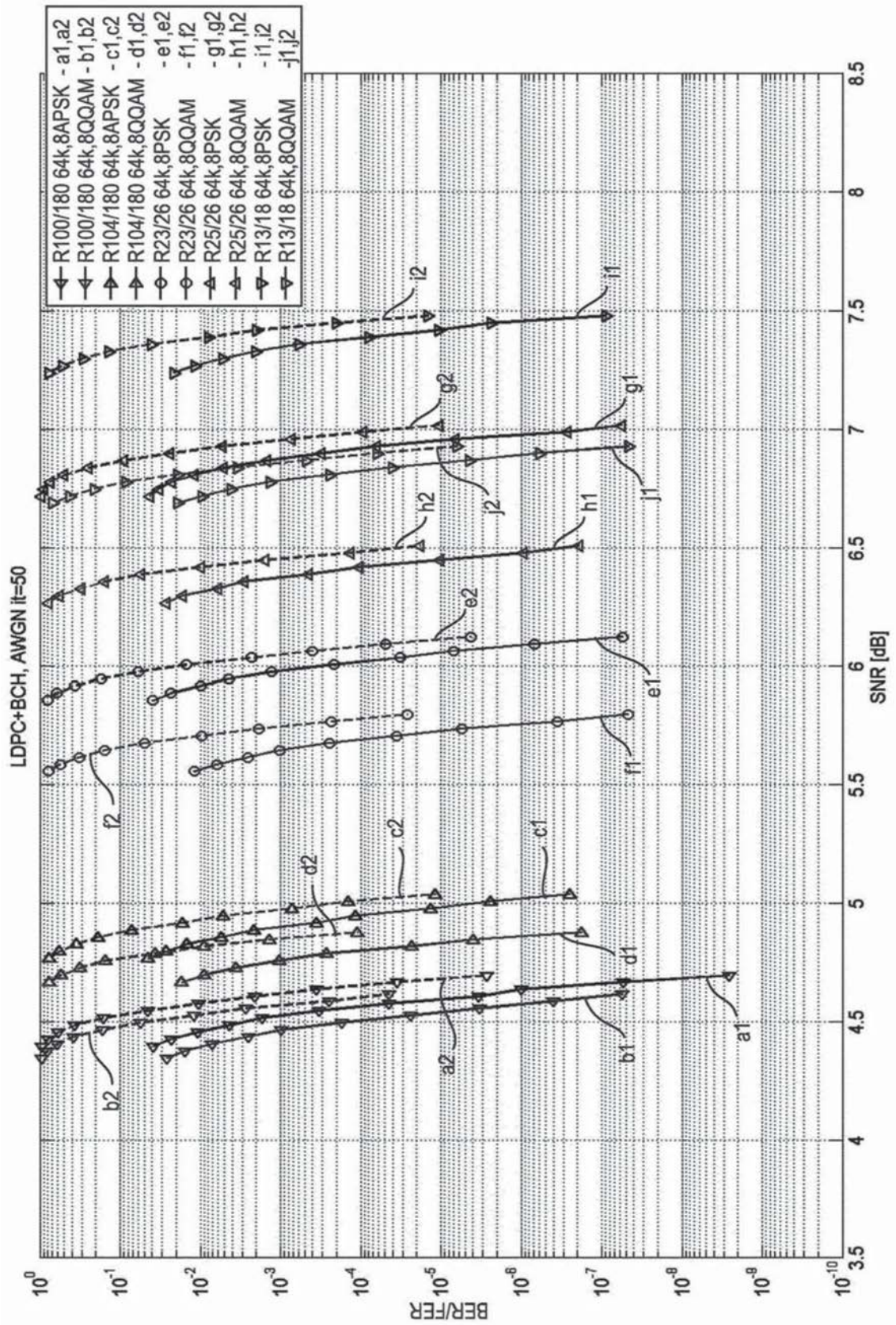
图14

编码长度=64800 位，速率=7/15：

2422 2919 3173 3795 4428 12681 13428 14654 17367 17687 19587 20017 23588 24353 25280 27167 29853 32040 32473 33170 33375

34 79 817 12478 12769 14798 15383 16688 16739 17538 21654 22792 25145 25588 26995 27388 31655 32133 32601 33452 34471

88 986 1907 2868 3657 6826 8595 11922 14704 17681 19503 20604 24251 28125 28612 29976 30687 31208 31464 33686 33909

526 3853 4486 6507 10616 11300 11453 13385 20007 21420 21441 22554 23794 24581 24959 27083 28710 30235 32852 34179 34327

43 1775 4405 5644 6553 8885 10337 11178 14114 15108 16189 16192 18490 18801 21475 22748 28269 28970 30758 31968 33554

27 624 1191 1470 4277 5054 5695 9632 10911 11365 13339 21097 23810 26677 27822 28433 29878 31026 32525 33335 33873

14 45 760 1098 1567 2003 6710 10195 12052 13024 13337 19088 22647 25050 25899 27035 28844 29927 33916 34033 34490

30 94 4493 11928 14051 17759 18541 20842 21277 24587 24948 25790 27442 31120 31205 31526 32107 32263 33696 34393 34529

3 4245 5284 7791 10196 10922 13992 14397 14947 16908 21032 24585 27219 30300 30981 32732 33362 33558 33725 34424 34537

78 6958 8297 15781 23302 23386 23863 25570 25734 31844 31919 32100 32815 33345 33531 33561 33889 34348 34504 34512 34530

52 90 775 3760 4099 6945 8954 11931 16578 20804 23252 26583 29420 32461 33695 33874 34018 34177 34483 34506

81 1162 3084 3986 4494 8523 10309 10934 12819 16784 23113 23803 25952 29134 29930 30530 32021 33343 33400 33664 33685

0 35 57 1564 9062 19694 24489 24737 26422 27021 30630 31513 33317 33425 33545 33624 33743 33869 33875 34046 34519

58 639 2340 3613 19319 21917 24284 29214 29430 29736 32496 32785 32830 32835 33176 33323 33711 33967 34197 34438 3446 8

71 77 88 953 4233 7365 8395 15176 16662 18280 21989 24348 26847 27645 31050 31890 34119 34223 34235 34548 34551

163 4304 4697 7470 11857 12787 18000 18472 18489 19730 27014 29653 29740 30070 30252 32769 33637 34382 34394 34555

7 29 79 7321 9770 11315 15354 16240 18888 19559 27783 28220 28924 30659 31474 33084 33310 33644 34282 34452 34557

8 24 41 4491 11252 14225 18230 25845 30258 30801 31349 32655 32932 32951 33058 33794 33889 34150 34338 34463 34494

13 13092 15747 23904 29675 29732 30199 31273 31928 32211 32704 32959 33056 33374 33646 33931 34043 34203 34426 34429 34509

6 11188 19937

11738 14763 34508

11 4674 25431

68

1408 15983 16148
6569 18901 23827
42 7606 25499
11193 13616 31040
8996 28561 30145
6335 23176 26286
6236 23314 24004
25452 30736 31684
3826 12150 21414
10711 17869 29177
13382 34510 34532
14491 16483 31945
77 16047 34221
17991 32178 32575
5508 6547 13800
4265 19226 25358
10154 23746 29274
3421 20929 34055
2976 9237 30748
17492 23256 34334
14069 21117 34122
2 30 34279
4782 18300 33733

6346 9658 31716
13231 32283 33193
19187 31166 33846
297 27886 32712
74 8683 24435
2200 20501 21571
25 10097 29631
4515 32145 33245
13010 26434 29967
0 30598 33940
1342 27835 33782
2253 7519 33030
9079 13091 29109
20124 20880 27383
14317 16550 26394
84 2860 33197
21726 28620 31525
12888 23822 32157
1221 10300 34113
15613 22759 28517
4889 28647 31367
22184 25784 30338
21714 26800 28577

69

153 4829 34472

6935 20289 25347

94 23931 34474

4955 13105 18305

3455 6361 16383

5195 13496 34289

1637 5512 18417

14082 20496 28064

12268 18659 23956

9430 22419 34549

6153 21548 24847

1995 12662 13605

13498 29840 31922

14059 14662 33208

20727 33280 34067

564 20975 23516

Code length=64800 bits, Rate=9/15:

113 1557 3316 5680 6241 10407 13404 13947 14040 14353 15522 15698 16079 17363 19374 19543 20530 22833 24339

271 1361 6236 7006 7307 7333 12768 15441 15568 17923 18341 20321 21502 22023 23938 25351 25590 25876 25910

73 605 872 4008 6279 7653 10346 10799 12482 12935 13604 15909 16526 19782 20506 22804 23629 24859 25600

1445 1690 4304 4851 8919 9176 9252 13783 16076 16675 17274 18806 18882 20819 21958 22451 23869 23999 24177

1290 2337 5661 6371 8996 10102 10941 11360 12242 14918 16808 20571 23374 24046 25045 25060 25662 25783 25913

28 42 1926 3421 3503 8558 9453 10168 15820 17473 19571 19685 22790 23336 23367 23890 24061 25657 25680

0 1709 4041 4932 5968 7123 8430 9564 10596 11026 14761 19484 20762 20858 23803 24016 24795 25853 25863

29 1625 6500 6609 16831 18517 18568 18738 19387 20159 20544 21603 21941 24137 24269 24416 24803 25154 25395

55 66 871 3700 11426 13221 15001 16367 17601 18380 22796 23488 23938 25476 25635 25678 25807 25857 25872

1 19 5958 8548 8860 11489 16845 18450 18469 19496 20190 23173 25262 25566 25668 25679 25858 25888 25915

7520 7690 8855 9183 14654 16695 17121 17854 18083 18428 19633 20470 20736 21720 22335 23083 25293 25403

48 58 410 1299 3786 10668 18523 18963 20864 22106 22308 23033 23107 23128 23990 24286 24409 24595 25802

12 51 3894 6539 8276 10885 11644 12777 13427 14039 15954 17078 19053 20537 22863 24521 25087 25463 25838

3509 8748 9581 11509 15884 16230 17583 19264 20900 21001 21310 22547 22756 22959 24768 24814 25594 25626 25880

21 29 69 1448 2386 4601 6626 6667 10242 13141 13852 14137 18640 19951 22449 23454 24431 25512 25814

18 53 7890 9934 10063 16728 19040 19809 20825 21522 21800 23582 24556 25031 25547 25562 25733 25789 25906

4096 4582 5766 5894 6517 10027 12182 13247 15207 17041 18958 20133 20503 22228 24332 24613 25689 25855 25883

0 25 819 5539 7076 7536 7695 9532 13668 15051 17683 19665 20253 21996 24136 24890 25758 25784 25807

34 40 44 4215 6076 7427 7965 8777 11017 15593 19542 22202 22973 23397 23423 24418 24873 25107 25644

1595 6216 22850 25439

1562 15172 19517 22362

7508 12879 24324 24496

6298 15819 16757 18721

11173 15175 19966 21195

59 13505 16941 23793

2267 4830 12023 20587

8827 9278 13072 16664

71

```
14419 17463 23398 25348
6112 16534 20423 22698
493 8914 21103 24799
6896 12761 13206 25873
2 1380 12322 21701
11600 21306 25753 25790
8421 13076 14271 15401
9630 14112 19017 20955
212 13932 21781 25824
5961 9110 16654 19636
58 5434 9936 12770
6575 11433 19798
2731 7338 20926
14253 18463 25404
21791 24805 25869
2 11646 15850
6075 8586 23819
18435 22093 24852
2103 2368 11704
10925 17402 18232
9062 25061 25674
18497 20853 23404
18606 19364 19551

7 1022 25543
6744 15481 25868
9081 17305 25164
8 23701 25883
9680 19955 22848
56 4564 19121
5595 15086 25892
3174 17127 23183
19397 19817 20275
12561 24571 25825
7111 9889 25865
19104 20189 21851
549 9686 25548
6586 20325 25906
3224 20710 21637
641 15215 25754
13484 23729 25818
2043 7493 24246
16860 25230 25768
22047 24200 24902
9391 18040 19499
7855 24336 25069
23834 25570 25852

1977 8800 25756
6671 21772 25859
3279 6710 24444
24099 25117 25820
5553 12306 25915
48 11107 23907
10832 11974 25773
2223 17905 25484
16782 17135 20446
475 2861 3457
16218 22449 24362
11716 22200 25897
8315 15009 22633
13 20480 25852
12352 18658 25687
3681 14794 23703
30 24531 25846
4103 22077 24107
23837 25622 25812
3627 13387 25839
908 5367 19388
0 6894 25795
20322 23546 25181
```

8178 25260 25437
2449 13244 22565
31 18928 22741
1312 5134 14838
6085 13937 24220
66 14633 25670
47 22512 25472
8867 24704 25279
6742 21623 22745
147 9948 24178
8522 24261 24307
19202 22406 24609

Code length=64800 bits, Rate=11/15:
696 989 1238 3091 3116 3738 4269 6406 7033 8048 9157 10254 12033 16456 16912
444 1488 6541 8626 10735 12447 13111 13706 14135 15195 15947 16453 16916 17137 17268
401 460 992 1145 1576 1678 2238 2320 4280 6770 10027 12486 15363 16714 17157
1161 3108 3727 4508 5092 5348 5582 7727 11793 12515 12917 13362 14247 16717 17205
542 1190 6883 7911 8349 8835 10489 11631 14195 15009 15454 15482 16632 17040 17063
17 487 776 880 5077 6172 9771 11446 12798 16016 16109 16171 17087 17132 17226
1337 3275 3462 4229 9246 10180 10845 10866 12250 13633 14482 16024 16812 17186 17241
15 980 2305 3674 5971 8224 11499 11752 11770 12897 14082 14836 15311 16391 17209

14787 16903 17061　0 3926 5869 8696 9351 9391 11371 14052 14172 14636 14974 16619 16961 17033 17237

381 3534 4294　3033 5317 6501 8579 10698 12168 12966 14019 15392 15806 15991 16493 16690 17062 17090

3149 6947 8323　981 1205 4400 6410 11003 13319 13405 14695 15846 16297 16492 16563 16616 16862 16953

12562 16724 16881　1725 4276 8869 9588 14062 14486 15474 15548 16300 16432 17042 17050 17060 17175 17273

7289 9997 15306　1807 5921 9960 10011 14305 14490 14872 15852 16054 16061 16306 16799 16833 17136 17262

5615 13152 17260　2826 4752 6017 6540 7016 8201 14245 14419 14716 15983 16569 16652 17171 17179 17247

5666 16926 17027　1662 2516 3345 5229 8086 9686 11456 12210 14595 15808 16011 16421 16825 17112 17195

4190 7798 16831　2890 4821 5987 7226 8823 9869 12468 14694 15352 15805 16075 16462 17102 17251 17263

4778 10629 17180　3751 3890 4382 5720 10281 10411 11350 12721 13121 14127 14980 15202 15335 16735 17123

10001 13884 15453　26 30 2805 5457 6630 7188 7477 7556 11065 16608 16859 16909 16943 17030 17103

6 2237 8203　40 4524 5043 5566 9645 10204 10282 11696 13080 14837 15607 16274 17034 17225 17266

7831 15144 15160　904 3157 6284 7151 7984 11712 12887 13767 15547 16099 16753 16829 17044 17250 17259

9186 17204 17243　7 311 4876 8334 9249 11267 14072 14559 15003 15235 15686 16331 17177 17238 17253

9435 17168 17237　4410 8066 8596 9631 10369 11249 12610 15769 16791 16960 17018 17037 17062 17165 17204

42 5701 17159　24 8261 9691 10138 11607 12782 12786 13424 13933 15262 15795 16476 17084 17193 17220

7812 14259 15715　88 11622 14705 15890

39 4513 6658　304 2026 2638 6018

38 9368 11273　1163 4268 11620 17232

1119 4785 17182　9701 11785 14463 17260

5620 16521 16729　4118 10952 12224 17006

16 6685 17242　3647 10823 11521 12060

210 3452 12383　1717 3753 9199 11642

466 14462 16250　2187 14280 17220

31 2116 16083
15837 16951 17031
5362 8382 16618
6137 13199 17221
2841 15068 17068
24 3620 17003
9880 15718 16764
1784 10240 17209
2731 10293 10846
3121 8723 16598
8563 15662 17088
13 1167 14676
29 13850 15963
3654 7553 8114
23 4362 14865
4434 14741 16688
8362 13901 17244
13687 16736 17232
46 4229 13394
13169 16383 16972
16031 16681 16952
3384 9894 12580
9841 14414 16165

11760 16008 16832
14543 17033 17278
16129 16765 17155
6891 15561 17007
12741 14744 17116
8992 16661 17277
1861 11130 16742
4822 13331 16192
13281 14027 14989
38 14887 17141
10698 13452 15674
4 2539 16877
857 17170 17249
11449 11906 12867
285 14118 16831
15191 17214 17242
39 728 16915
2469 12969 15579
16644 17151 17164
2592 8280 10448
9236 12431 17173
9064 16892 17233
4526 16146 17038

10548 12633 13962
1452 6005 16453
22 4120 13684
5195 11563 16522
5518 16705 17201
12233 14552 15471
6067 13440 17248
8660 8967 17061
8673 12176 15051
5959 15767 16541
3244 12109 12414
31 15913 16323
3270 15686 16653
24 7346 14675
12 1531 8740
6228 7565 16667
16936 17122 17162
4868 8451 13183
3714 4451 16919
11313 13801 17132
17070 17191 17242
1911 11201 17186
14 17190 17254

75

5013 17099 17115
2130 8941 17266
6907 15428 17241
16 1860 17235
2151 16014 16643
14954 15958 17222
3969 8419 15116
31 15593 16984
11514 16605 17255

Code length=64800 bits, Rate=13/15:

142 2307 2598 2650 4028 4434 5781 5881 6016 6323 6681 6698 8125
2932 4928 5248 5256 5983 6773 6828 7789 8426 8494 8534 8539 8583
899 3295 3833 5399 6820 7400 7753 7890 8109 8451 8529 8564 8602
21 3060 4720 5429 5636 5927 6966 8110 8170 8247 8355 8365 8616
20 1745 2838 3799 4380 4418 4646 5059 7343 8161 8302 8456 8631
9 6274 6725 6792 7195 7333 8027 8186 8209 8273 8442 8548 8632
494 1365 2405 3799 5188 5291 7644 7926 8139 8458 8504 8594 8625
192 574 1179 4387 4695 5089 5831 7673 7789 8298 8301 8612 8632
11 20 1406 6111 6176 6256 6708 6834 7828 8232 8457 8495 8602
6 2654 3554 4483 4966 5866 6795 8069 8249 8301 8497 8509 8623
21 1144 2355 3124 6773 6805 6887 7742 7994 8358 8374 8580 8611

76

335 4473 4883 5528 6096 7543 7586 7921 8197 8319 8394 8489 8636
2919 4331 4419 4735 6366 6393 6844 7193 8165 8205 8544 8586 8617
12 19 742 930 3009 4330 6213 6224 7292 7430 7792 7922 8137
710 1439 1588 2434 3516 5239 6248 6827 8230 8448 8515 8581 8619
200 1075 1868 5581 7349 7642 7698 8037 8201 8210 8320 8391 8526
3 2501 4252 5256 5292 5567 6136 6321 6430 6486 7571 8521 8636
3062 4599 5885 6529 6616 7314 7319 7567 8024 8153 8302 8372 8598
105 381 1574 4351 5452 5603 5943 7467 7788 7933 8362 8513 8587
787 1857 3386 3659 6550 7131 7965 8015 8040 8312 8484 8525 8537
15 1118 4226 5197 5575 5761 6762 7038 8260 8338 8444 8512 8568
36 5216 5368 5616 6029 6591 8038 8067 8299 8351 8565 8578 8585
1 23 4300 4530 5426 5532 5817 6967 7124 7979 8022 8270 8437
629 2133 4828 5475 5875 5890 7194 8042 8345 8385 8518 8598 8612
11 1065 3782 4237 4993 7104 7863 7904 8104 8228 8321 8383 8565
2131 2274 3168 3215 3220 5597 6347 7812 8238 8354 8527 8557 8614
5600 6591 7491 7696
1766 8281 8626
1725 2280 5120
1650 3445 7652
4312 6911 8626
15 1013 5892
2263 2546 2979
1545 5873 7406

67 726 3697
2860 6443 8542
17 911 2820
1561 4580 6052
79 5269 7134
22 2410 2424
3501 5642 8627
808 6950 8571
4099 6389 7482
4023 5000 7833
5476 5765 7917
1008 3194 7207
20 495 5411
1703 8388 8635
6 4395 4921
200 2053 8206
1089 5126 5562
10 4193 7720
1967 2151 4608
22 738 3513
3385 5066 8152
440 1118 8537
3429 6058 7716

5213 7519 8382
5564 8365 8620
43 3219 8603
4 5409 5815
5 6376 7654
4091 5724 5953
5348 6754 8613
1634 6398 6632
72 2058 8605
3497 5811 7579
3846 6743 8559
15 5933 8629
2133 5859 7068
4151 4617 8566
2960 8270 8410
2059 3617 8210
544 1441 6895
4043 7482 8592
294 2180 8524
3058 8227 8373
364 5756 8617
5383 8555 8619
1704 2480 4181

7338 7929 7990	347 3497 4033	6835 7900 7980
2615 3905 7981	1747 2613 8636	189 5722 8573
4298 4548 8296	1827 5600 7042	2680 4928 4998
8262 8319 8630	580 1822 6842	243 2579 7735
892 1893 8028	232 7134 7783	4281 8132 8566
5694 7237 8595	4629 5000 7231	7656 7671 8609
1487 5012 5810	951 2806 4947	1116 2291 4166
4335 8593 8624	571 3474 8577	21 388 8021
3509 4531 5273	2437 2496 7945	6 1123 8369
10 22 830	23 5873 8162	311 4918 8511
4161 5208 6280	12 1168 7686	0 3248 6290
275 7063 8634	8315 8540 8596	13 6762 7172
4 2725 3113	1766 2506 4733	4209 5632 7563
2279 7403 8174	929 1516 3338	49 127 8074
1637 3328 3930	21 1216 6555	581 1735 4075
2810 4939 5624	782 1452 8617	0 2235 5470
3 1234 7687	8 6083 6087	2178 5820 6179
2799 7740 8616	667 3240 4583	16 3575 6054
22 7701 8636	4030 4661 5790	1095 4564 6458
4302 7857 7993	559 7122 8553	9 1581 5953
7477 7794 8592	3202 4388 4909	2537 6469 8552
9 6111 8591	2533 3673 8594	14 3874 4844
5 8606 8628	1991 3954 6206	0 3269 3551

2114 7372 7926
1875 2388 4057
3232 4042 6663
9 401 583
13 4100 6584
2299 4190 4410
21 3670 4979

Code length=16200 bits, Rate=6/15:

113 88 136 188 398 794 855 918 954 1950 2762 2837 2847 4209 4342 5092 5334 5498 5731 5837 6150 6942 7127 7402 7936 8235 8307 8600 9001 9419 9442 9710
619 792 1002 1148 1528 1533 1925 2207 2766 3021 3267 3593 3947 4832 4873 5109 5488 5882 6079 6097 6276 6499 6584 6738 6795 7550 7723 7786 8732 9060 9270 9401
499 717 1551 1791 2535 3135 3582 3813 4047 4309 5126 5186 5219 5716 5977 6236 6406 6586 6591 7085 7199 7485 7726 7878 8027 8066 8425 8802 9309 9464 9553 9671
658 4058 7824 8512
3245 4743 8117 9369
465 6559 8112 9461
975 2368 4444 6095
4128 5993 9182 9473
9 3822 5306 5320
4 8311 9571 9669
13 8122 8949 9656
3353 4449 5829 8053
7885 9118 9674

7575 9591 9670
431 8123 9271
4228 7587 9270
8847 9146 9556
11 5213 7763

Code length=16200 bits, Rate=8/15:

32 384 430 591 1296 1976 1999 2137 2175 3638 4214 4304 4486 4662 4999 5174 5700 6969 7115 7138 7189

1788 1881 1910 2724 4504 4928 4973 5616 5686 5718 5846 6523 6893 6994 7074 7100 7277 7399 7476 7480 7537

2791 2824 2927 4196 4298 4800 4948 5361 5401 5688 5818 5862 5969 6029 6244 6645 6962 7203 7302 7454 7534

574 1461 1826 2056 2069 2387 2794 3349 3366 4951 5826 5834 5903 6640 6762 6786 6859 7043 7418 7431 7554

14 178 675 823 890 930 1209 1311 2898 4339 4600 5203 6485 6549 6970 7208 7218 7298 7454 7457 7462

4075 4188 7313 7553

5145 6018 7148 7507

3198 4858 6983 7033

3170 5126 5625 6901

2839 6093 7071 7450

11 3735 5413

2497 5400 7238

2067 5172 5714

1889 7173 7329

1795 2773 3499

80

2695 2944 6735
3221 4625 5897
1690 6122 6816
5013 6839 7358
1601 6849 7415
2180 7389 7543
2121 6838 7054
1948 3109 5046
272 1015 7464

Code length=16200 bits, Rate=10/15:

76 545 1005 1029 1390 1970 2525 2971 3448 3845 4088 4114 4163 4373 4640 4705 4970 5094
14 463 600 1676 2239 2319 2326 2815 2887 4278 4457 4493 4597 4918 4989 5038 5261 5384
451 632 829 1006 1530 1723 2205 2587 2801 3041 3849 4382 4595 4727 5006 5156 5224 5286
211 265 1293 1777 1926 2214 2909 2957 3178 3278 3771 4547 4563 4737 4879 5068 5232 5344
6 2901 3925 5384
2858 4152 5006 5202
9 1232 2063 2768
7 11 2781 3871
12 2161 2820 4078
3 3510 4668 5323
253 411 3215 5241

3919 4789 5040 5302
12 5113 5256 5352
9 1461 4004 5241
1688 3585 4480 5394
8 2127 3469 4360
2827 4049 5084 5379
1770 3331 5315 5386
1885 2817 4900 5088
2568 3854 4660
1604 3565 5373
2317 4636 5156
2480 2816 4094
14 4518 4826
127 1192 3872
93 2282 3663
2962 5085 5314
2078 4277 5089
9 5280 5292
50 2847 4742

Code length=16200 bits, Rate=12/15:
3 394 1014 1214 1361 1477 1534 1660 1856 2745 2987 2991 3124 3155

59 136 528 781 803 928 1293 1489 1944 2041 2200 2613 2690 2847
155 245 311 621 1114 1269 1281 1783 1995 2047 2672 2803 2885 3014
79 870 974 1326 1449 1531 2077 2317 2467 2627 2811 3083 3101 3132
4 582 660 902 1048 1482 1697 1744 1928 2628 2699 2728 3045 3104
175 395 429 1027 1061 1068 1154 1168 1175 2147 2359 2376 2613 2682
1388 2241 3118 3148
143 506 2067 3148
1594 2217 2705
398 988 2551
1149 2588 2654
678 2844 3115
1508 1547 1954
1199 1267 1710
2589 3163 3207
1 2583 2974
2766 2897 3166
929 1823 2742
1113 3007 3239
1753 2478 3127
0 509 1811
1672 2646 2984
965 1462 3230
3 1077 2917

1183 1316 1662
968 1593 3239
64 1996 2226
1442 2058 3181
513 973 1058
1263 3185 3229
681 1394 3017
419 2853 3217
3 2404 3175
2417 2792 2854
1879 2940 3235
647 1704 3060

Code length=64800 bits, Rate=6/15:

253 1553 2024 4493 5350 5664 6351 8563 8803 9576 9936 11995 12166 13193 13412 17088 21893 22167 22478 22673 23735 35313 36981 37527

1238 1701 2316 3621 7222 8387 9190 10178 10599 10744 11743 18179 22465 23562 23820 26493 28168 28515 28940 29982 31196 32946 33687 34305

1475 1874 2994 3168 3381 3988 7646 9309 11199 12856 15025 16586 20113 23155 24030 27491 28235 29392 30885 32896 33656 33785 34685 38713

512 721 1813 3144 3276 6198 13540 14553 15017 15548 16120 17449 19101 19763 24180 25629 27612 29682 30910 32038 35346 36607 36836 37876

333 1124 3269 4236 4920 5207 6154 7041 7282 7979 8472 9302 10033 14295 15888 16485 18963 24572 26642 27516 30242 31209 32000 33259

2528 4425 4656 6631 8875 10621 12590 13334 14011 16406 16937 18942 20315 24078 24889 27298 29555 30123 30513 33101 33403 33787 36651 37975

414 721 898 2093 3813 8358 9316 11235 12032 12568 14339 14908 15390 19210 19450 22689 22840 28044 31218 35042 35348 35863 37611 37837

979 3559 4988 6900 7254 7491 11518 12297 12928 14894 15473 15000 15513 16490 17423 18943 21094 22348 24182 26203 28328 32408 34284 38061 38259

353 1877 2171 5080 7140 7878 8762 11558 14836 15000 15513 16490 17423 18943 21094 22348 24182 26203 28328 32408 34284 38061 38259

142 1961 5219 5816 9555 10358 10675 15251 15716 16079 20566 21470 23007 25419 27130 28000 28693 30742 30862 33209 33472 33851 35546 36115

1388 4346 5764 6052 7940 9207 13401 13603 14233 14411 16310 16598 22524 22824 26535 27965 28433 30605 31984 34241 35730 36139 37261 37720

106 1441 3892 4300 5026 7207 8648 14012 15828 17007 19409 22942 26363 28363 28806 29351 29722 33033 35204 35315 35824 37901 38036 38643

2607 5309 6506 9122 9318 9889 10322 12074 13373 14058 15341 15774 18154 18749 21949 27887 29885 31294 31487 32769 32890 37983 38403 38879

2154 4374 10366 10605 11179 15994 18855 20342 23936 24777 25768 26371 26745 27049 27324 27493 27985 29781 30148 33240 33673 34441 35057 35731

3054 6385 6561 6755 7795 9366 10392 12042 12832 14851 16187 17441 18536 20967 21792 24084 24505 26677 28167 28334 35199 36745 37533 37786

2735 3833 10268 17606

559 9607 17652 34573

9528 12139 14306 38416

11978 17094 25891 30040

14811 15531 27333 31274

12926 28602 32103 35600
8616 14917 18992 23478
7416 8568 10248 36672
3611 15521 17793 32467
4662 7908 8894 32722
8156 28077 32840 35719
977 17949 23380 26181
7655 9515 12185 17821
1107 8520 16782 23241
16942 19784 22031 22955
1054 23163 23793 37789
8509 17981 22306 33327
2253 11397 16225 30826
23654 30073 31421 33140
18286 19445 29945 38405
7535 8608 21915 38260
11082 13972 17895 18931
8114 25376 25660 33718
3380 5946 20124 37272
10159 18822 22456 29291
15289 18016 18512 37003
18471 19326 27834 28119

15326 28272 36142 37826
12277 20646 22411 22658
12199 23328 35495 36055
17318 24311 29009
1528 32815 33640
15978 19141 25776
8683 11960 16957
15799 20829 29164
574 5582 20145
8814 18673 31081
8394 25659 36739
23615 32879 37483
12766 30755 35696
4302 18788 25093
13205 14424 33529
864 16070 22924
7120 10085 31057
5399 13946 32583
1364 12423 19355
12356 24958 32026
11997 25582 36581
6074 9516 18414

7102 22587 33797
8709 19457 38831
9502 10266 24362
1801 12579 34408
471 34954 37293
1666 3123 8513
9160 11576 26384
14311 20399 33952

Code length=64800 bits, Rate=8/15:

2768 3039 4059 5856 6245 7013 8157 9341 9802 10470 11521 12083 16610 18361 20321 24601 27420 28206 29788
2739 8244 8891 9157 12624 12973 15534 16622 16919 18402 18780 19854 20220 20543 22306 25540 27478 27678 28053
1727 2268 6246 7815 9010 9556 10134 10472 11389 14599 15719 16204 17342 17666 18850 22058 25579 25860 29207
28 1346 3721 5565 7019 9240 12355 13109 14800 16040 16839 17369 17631 19357 19473 19891 20381 23911 29683
869 2450 4386 5316 6160 7107 10362 11132 11271 13149 16397 16532 17113 19894 22043 22784 27383 28615 28804
508 4292 5831 8559 10044 10412 11283 14810 15888 17243 17538 19903 20528 22090 22652 27235 27384 28208 28485
389 2248 5840 6043 7000 9054 11075 11760 12217 12565 13587 15403 19422 19528 21493 25142 27777 28566 28702
1015 2002 5764 6777 9346 9629 11039 11153 12690 13068 13990 16841 17702 20021 24106 26300 29332 30081 30196
1480 3084 3467 4401 4798 5187 7851 11368 12323 14325 14546 16360 17158 18010 21333 25612 26556 26906 27005
6925 8876 12392 14529 15253 15437 19226 19950 20321 23021 23651 24393 24653 26668 27205 28269 28529 29041 29292
2547 3404 3538 4666 5126 5468 7695 8799 14732 15072 15881 17410 18971 19609 19717 22150 24941 27908 29018

888 1581 2311 5511 7218 9107 10454 12252 13662 15714 15894 17025 18671 24304 25316 25556 28489 28977 29212

1047 1494 1718 4645 5030 6811 7868 8146 10611 15767 17682 18391 22614 23021 23763 25478 26491 29088 29757

59 1781 1900 3814 4121 8044 8906 9175 11156 14841 15789 16033 16755 17292 18550 19310 22505 29567 29850

1952 3057 4399 9476 10171 10769 11335 11569 15002 19501 20621 22642 23452 24360 25109 25290 25828 28505 29122

2895 3070 3437 4764 4905 6670 9244 11845 13352 13573 13975 14600 15871 17996 19672 20079 20579 25327 27958

612 1528 2004 4244 4599 4926 5843 7684 10122 10443 12267 14368 18413 19058 22985 24257 26202 26596 27899

1361 2195 4146 6708 7158 7538 9138 9998 14862 15359 16076 18925 21401 21573 22503 24146 24247 27778 29312

5229 6235 7134 7655 9139 13527 15408 16058 16705 18320 19909 20901 22238 22437 23654 25131 27550 28247 29903

697 2035 4887 5275 6909 9166 11805 15338 16381 18403 20425 20688 21547 24590 25171 26726 28848 29224 29412

5379 17329 22659 23062

11814 14759 22329 22936

2423 2811 10296 12727

8460 15260 16769 17290

14191 14608 29536 30187

7103 10069 20111 22850

4285 15413 26448 29069

548 2137 9189 10928

4581 7077 23382 23949

3942 17248 19486 27922

8668 10230 16922 26678

6158 9980 13788 28198

12422 16076 24206 29887

8778 10649 18747 22111
21029 22677 27150 28980
7918 15423 27672 27803
5927 18086 23525
3397 15058 30224
24016 25880 26268
1096 4775 7912
3259 17301 20802
129 8396 15132
17825 28119 28676
2343 8382 28840
3907 18374 20939
1132 1290 8786
1481 4710 28846
2185 3705 26834
5496 15681 21854
12697 13407 22178
12788 21227 22894
629 2854 6232
2289 18227 27458
7593 21935 23001
3836 7081 12282

7925 18440 23135
497 6342 9717
11199 22046 30067
12572 28045 28990
1240 2023 10933
19566 20629 25186
6442 13303 28813
4765 10572 16180
552 19301 24286
6782 18480 21383
11267 12288 15758
771 5652 15531
16131 20047 25649
13227 23035 24450
4839 13467 27488
2852 4677 22993
2504 28116 29524
12518 17374 24267
1222 11859 27922
9660 17286 18261
232 11296 29978
9750 11165 16295

4894 9505 23622
10861 11980 14110
2128 15883 22836
6274 17243 21989
10866 13202 22517
11159 16111 21608
3719 18787 22100
1756 2020 23901
20913 29473 30103
2729 15091 26976
4410 8217 12963
5395 24564 28235
3859 17909 23051
5733 26005 29797
1935 3492 29773
11903 21380 29914
6091 10469 29997
2895 8930 15594
1827 10028 20070

Code length=64800 bits, Rate=10/15:

501 1533 5943 9232 10258 10428 10965 11934 14081 14708 15509 17251 18380 19815 20075 20237

753 1266 2017 3107 4210 4770 6520 10861 11594 13191 14116 18342 18604 18825 19398 21479

2379 3029 3140 3398 4528 6562 8575 9593 11196 11585 12931 13064 13825 15886 20854 21010

733 1262 2250 4910 8165 8374 8698 10543 10930 12940 14520 14936 15752 16879 19226 20188

2056 2341 4237 4807 6469 7708 8895 9548 13274 13404 13481 14082 15647 17712 19377 19638

2882 3081 3633 4047 4755 5094 5589 6709 12526 12710 12910 13342 14196 17836 20353 21095

34 309 1187 3000 3097 3246 6280 6873 7074 8935 12615 13517 14363 16317 19856 20591

2181 2381 3551 6904 6995 8248 9023 9348 9433 11097 12914 17326 17671 18658 19585 20846

915 2036 2104 2790 3606 4763 6319 7807 8918 9311 13431 15723 19953 20935 21092 21286

1921 2131 2321 3114 4589 5133 5477 8265 9891 13941 14404 15777 17310 17787 18399 20916

1612 3502 3696 5084 6421 7410 7723 8467 8787 9434 11516 14329 14505 17723 19229 19308

2900 3311 3430 3984 4843 5422 6049 7374 7572 11037 15112 15173 17144 20378 20718 20854

4685 4896 7712 9120 10019 11988 12657 12907 13113 13519 14384 15347 16180 17125 19923 20661

189 2543 5548 6001 8979 9224 12641 13404 13505 13674 16011 16234 16820 17230 18945 19912

788 6540 7724 9898 13150 13817 15313 15554 15928 16118 17734 18170 18386 19422 20106 20931

4779 4964 6722 8474 9298 10620 11326 11471 12897 13482 15805 17076 18193 18260 20122 21392

385 2524 3486 4503 6708 7712 8632 8908 9283 10826 12081 12699 16551 16846 19058 20749

1405 1748 3058 4219 9053 9906 10581 11242 11515 14910 15143 16499 18395 18853 19454 21264

1875 2716 5358 6878 7089 8758 9659 11909 12290 12697 14631 17200 18305 18973 19159 21583

683 1564 1718 3350 3940 5672 6189 9361 11347 11915 13236 15946 16404 18372 21116 21282

962 4602 5035 5827 8007 10139 11524 11970 13479 13586 16061 18532 18705 19152 19625 20054

89

497 1698 1976 2383 2823 3479 7527 9948 11889 13649 14491 15431 16868 17232 18316 20453
1029 6199 8477 9707 10400 10913 11617 11923 12482 14690 14988 15796 16104 19272 20426 20731
95 953 1208 1818 5640 5797 8852 9399 9595 10877 11087 13129 15122 16631 17643 18867

75 18922 20730   12575 12680 15845
18712 20866 21302   5870 6972 16463
10674 13003 20481   2025 3655 7716
1914 6964 18238   4258 6387 14477
12972 13411 21559   12282 13274 18603
13207 16406 19548   1657 10810 12509
4021 6039 6320   839 8734 21409
4721 20336 20819   4038 5993 15640
2797 15321 20509   14005 15282 18931
8187 8774 19113   4342 7977 17828
3634 10487 13963   14144 16500 21426
3205 4325 12098   592 4952 13747
1444 4409 13667   8156 8859 18093
1163 5856 7623   5995 7267 9133
2324 10790 14560   5581 17111 17306
1468 12791 17743   3218 7635 14267
9765 12262 20117   5844 13026 18796
1456 4150 11096   5686 12821 15609
6900 9631 15217   3980 4228 7731
4009 5995 7322
10673 11315 17310
5792 10504 18221

6891 7654 15969
4002 13033 19217
7439 9192 13183
1390 8673 18485
24 4845 14633
6083 14765 15640
9652 13452 21404
7787 10616 17371
2959 6783 13581
11596 18575 20878
8318 14614 20870

4762 5268 8940
3494 6384 17600
3029 6710 11442
919 9289 19407
9130 17762 20598
5140 17911 20878
14153 16376 19323
3863 4847 21567
2608 4840 14455
1117 4061 5255
13468 14536 14928
9068 13023 13346
1139 14402 15445
2190 17004 17906
2989 5524 12399
8489 8899 15486
6683 6970 13387
3745 9975 17753
1250 4246 17193
9992 19441 19965
5796 7986 21297
2781 3232 16020

4748 14299 14994
4176 14868 20718
6147 15884 19749
9044 10345 20757
5817 7873 11969
3114 3924 8326
5535 6651 16116
7642 16391 17673
15798 17918 19172
1181 5291 17166
4220 4567 18197
1255 17730 19449
2099 5538 14774
6542 7475 17228
3418 4801 20715
1145 4245 16632
2034 11271 21000
7238 8108 15208
193 11374 15841
1333 5056 12441
8026 17906 18037
162 4432 8739

Code length=64800 bits, Rate=12/15:

584 1472 1621 1867 3338 3568 3723 4185 5126 5889 7737 8632 8940 9725
221 445 590 3779 3835 6939 7743 8280 8448 8491 9367 10042 11242 12917
4662 4837 4900 5029 6449 6687 6751 8684 9936 11681 11811 11886 12089 12909
2418 3018 3647 4210 4473 7447 7502 9490 10067 11092 11139 11256 12201 12383
2591 2947 3349 3406 4417 4519 5176 6672 8498 8863 9201 11294 11376 12184
27 101 197 290 871 1727 3911 5411 6676 8701 9350 10310 10798 12439
1765 1897 2923 3584 3901 4048 6963 7054 7132 9165 10184 10824 11278 12669
2183 3740 4808 5217 5660 6375 6787 8219 8466 9037 10353 10583 11118 12762

91

853 3281 3762 | 3294 8015 10513 | 73 1594 2146 2715 3501 3572 3639 3725 6959 7187 8406 10120 10507 10691
5201 5798 6413 | 1108 10374 10546 | 240 732 1215 2185 2788 2830 3499 3881 4197 4991 6425 7061 9756 10491
3882 6062 12047 | 5353 7824 10111 | 831 1568 1828 3424 4319 4516 4639 6018 9702 10203 10417 11240 11518 12458
4133 6775 9657 | 3398 7674 8569 | 2024 2970 3048 3638 3676 4152 5284 5779 5926 9426 9945 10873 11787 11837
228 6874 11183 | 7719 9478 10503 | 1049 1218 1651 2328 3493 4363 5750 6483 7613 8782 9738 9803 11744 11937
7433 10728 10864 | 2997 9418 9581 | 1193 2060 2289 2964 3478 4592 4756 6709 7162 8231 8326 11140 11908 12243
7735 8073 12734 | 5777 6519 11229 | 978 2120 2439 3338 3850 4589 6567 8745 9656 9708 10161 10542 10711 12639
2844 4621 11779 | 1966 5214 9899 | 2403 2938 3117 3247 3711 5593 5844 5932 7801 10152 10226 11498 12162 12941
3909 7103 12804 | 6 4088 5827 | 1781 2229 2276 2533 3582 3951 5279 5774 7930 9824 10920 11038 12340 12440
6002 9704 11060 | 836 9248 9612 | 289 384 1980 2230 3464 3873 5958 8656 8942 9006 10175 11425 11745 12530
5864 6856 7681 | 483 7229 7548 | 155 354 1090 1330 2002 2236 3559 3705 4922 5958 6576 8564 9972 12760
3652 5869 7605 | 7865 8289 9804 | 303 876 2059 2142 5244 5330 6644 7576 8614 9598 10410 10718 11033 12957
2546 2657 4461 | 2915 11098 11900 | 3449 3617 4408 4602 4727 6182 8835 8928 9372 9644 10237 10747 11655 12747
2423 4203 9111 | 6180 7096 9481 | 811 2565 2820 8677 8974 9632 11069 11548 11839 12107 12411 12695 12812 12890
244 1855 4691 | 1431 6786 8924 | 972 4123 4943 6385 6449 7339 7477 8379 9177 9359 10074 11709 12552 12831
1106 2178 6371 | 748 6757 8625 | 842 973 1541 2262 2905 5276 6758 7099 7894 8128 8325 8663 8875 10050
391 1617 10126 | 3312 4475 7204 | 474 791 968 3902 4924 4965 5085 5908 6109 6329 7931 9038 9401 10568
250 9259 10603 | 1852 8958 11020 | 1397 4461 4658 5911 6037 7127 7318 8678 8924 9000 9473 9602 10446 12692
3435 4614 6924 | 1915 2903 4006 | 1334 7571 12881
1742 8045 9529 | 6776 10886 12531 | 1393 1447 7972
7667 8875 11451 | 2594 9998 12742 | 633 1257 10597
4023 6108 6911 | 159 2002 12079 | 4843 5102 11056

8621 10184 11650
6726 10861 12348
3228 6302 7388
1 1137 5358
381 2424 8537
3256 7508 10044
1980 2219 4569
2468 5699 10319
2803 3314 12808
8578 9642 11533
829 4585 7923
59 329 5575
1067 5709 6867
1175 4744 12219
109 2518 6756
2105 10626 11153
5192 10696 10749
6260 7641 8233
2998 3094 11214
3398 6466 11494
6574 10448 12160
2734 10755 12780

1028 7958 10825
8545 8602 10793
392 3398 11417
6639 9291 12571
1067 7919 8934
1064 2848 12753
6076 8656 12690
5504 6193 10171
1951 7156 7356
4389 4780 7889
526 4804 9141
1238 3648 10464
2587 5624 12557
5560 5903 11963
1134 2570 3297
10041 11583 12157
1263 9585 12912
3744 7898 10646
45 9074 10315
1051 6188 10038
2242 8394 12712
3598 9025 12651

2295 3540 5610
1914 4378 12423
1766 3635 12759
5177 9586 11143
943 3590 11649
4864 6905 10454
5852 6042 10421
6095 8285 12349
2070 7171 8563
718 12234 12716
512 10667 11353
3629 6485 7040
2880 8865 11466
4490 10220 11796
5440 8819 9103
5262 7543 12411
516 7779 10940
2515 5843 9202
4684 5994 10586
573 2270 3324
7870 8317 10322
6856 7638 12909

583 7669 10781
8141 9085 12555
3903 5485 9992
4467 11998 12904

Code length=16200 bits, Rate=7/15:

432 655 893 942 1285 1427 1738 2199 2441 2565 2932 3201 4144 4419 4678 4963 5423 5922 6433 6564 6656 7478 7514 7892

220 453 690 826 1116 1425 1488 1901 3119 3182 3568 3800 3953 4071 4782 5038 5555 6836 6871 7131 7609 7850 8317 8443

300 454 497 930 1757 2145 2314 2372 2467 2819 3191 3256 3699 3984 4538 4965 5461 5742 5912 6135 6649 7636 8078 8455

24 65 565 609 990 1319 1394 1465 1918 1976 2463 2987 3330 3677 4195 4240 4947 5372 6453 6950 7066 8412 8500 8599

1373 4668 5324 7777

189 3930 5766 6877

3 2961 4207 5747

1108 4768 6743 7106

1282 2274 2750 6204

2279 2587 2737 6344

2889 3164 7275 8040

133 2734 5081 8386

437 3203 7121

4280 7128 8490

619 4563 6206

2799 6814 6991

244 4212 5925

1719 7657 8554

53 1895 6685

584 5420 6856

2958 5834 8103

94

Code length=16200 bits, Rate=9/15:

692 1041 1719 1963 2149 2318 2562 2740 2821 3358 3581 4188 4412 5033 5058 6033 6161 6478

85 158 231 454 942 981 1569 1762 1848 3152 3286 4691 5119 5351 5886 5905 6254 6281

44 111 626 857 1244 1381 1401 1912 2694 2934 3178 3627 3679 3941 4469 5128 5406 6373

230 646 1245 1848 1889 2111 2179 2583 2756 2988 3589 4353 4688 4744 5712 5908 5935 6329

102 845 1103 1471 1788 1883 1928 2311 2898 2967 3112 3483 3806 4712 5041 5176 5349 5674

118 263 1040 1835 2259 2472 3104 3760 3837 3865 3906 3943 4119 5081 5119 5222 5332 5520

533 2108 5631

2664 5557 5821

1421 3155 5644

57 305 4454

302 5023 6255

400 986 3215

1302 1979 6243

3735 4074 4998

4144 4354 6433

641 1592 2773

481 1661 5024

2862 3249 5667

2280 2685 6022

426 4768 6391

Code length=64800 bits, Rate=13/15:

812 1005 1572 1691 2092 2113
445 488 576 839 1059 1210
166 199 657 1259 1350 1712
162 771 820 1225 1412 1715
224 287 760 1071 1087 1194
64 241 1052 1335 1475 2130
44 267 307 1433 1632 1774
317 1255 1390 1437 1884 1946
716 774 808 1033 1505 1761
367 402 509 777 1454 1966
43 281 354 1142 1240 2043
65 352 570 705 751 956
893 903 1082
599 1200 2121
474 646 1729
1055 1408 1850
61 113 1418
730 1206 2138
811 1346 2085
35 1384 2106
1084 1245 1933

508 1643 4170
1790 2350 2672
791 3297 3495
777 2490 4118
358 643 1828
1107 2768 4014
137 1242 3096
621 673 1832
2609 3855 3961
2103 4150 4308
1514 2776 4080
1405 2323 2819
118 2177 3127
1400 1891 2558
344 1115 2937
1107 1720 2577
359 2944 4166
2301 3576 3866
40 1366 3157
1560 2574 4153

969 2636 4540
1288 4616 5550
3913 5042 5517
13 2656 4087
356 3306 5870
448 5729 6300
517 1816 6177

Code length=64800 bits, Rate=11/15:

191 507 760 1494 1713 1915 2438 2609 2928 3145 3392 3442
293 1177 1544 1563 2266 2508 2894 3285 3462 3703 3940 4223
530 708 822 1185 1282 1420 1715 2311 2715 2909 3776 3913
1168 1391 1424 1501 1557 1966 2227 2310 2940 3134 3219 4217
90 340 566 1393 1848 2251 2769 2931 3125 3383 3968 3994
378 559 827 1813 2124 2553 2734 3065 3374 3500 3951 4084
240 777 1022 1216 2303 2338 2581 2909 3183 3836 4038 4171
218 1601 2327
584 1204 1477
1380 2035 2571
1495 3429 4145
1878 2194 3025
1565 1704 2768

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25 974 1469
769 988 1230
358 1341 2130
894 1568 1839
268 499 1820
811 1127 1332
908 1575 1979
142 169 1707
1255 1296 2003
149 440 579
448 813 2034
107 1353 1700
178 1322 2053
323 976 1428
89 783 1285
1550 1881 2034
239 1578 1594
702 1747 1828
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图15