TSG-RAN Working Group 1 meeting #10
Beijing, China
January 18 – January 21, 2000

TSGR1#10(00)0037

Agenda item: AH 10

Source: Ericsson

Title: CR 25.211-0025 and CR 25.213-0020: Consistent numbering of scrambling code groups

Document for: Decision

TS 25.211 V3.0.1:

The numbering of the scrambling code groups for the SCH in section 5.3.3.4 is not consistent with the numbering used in section 5.2.2 of TS 25.213. It is proposed to change the numbering for the scrambling code groups from 1…64

Furthermore, an editorial correction is proposed to the last paragraph in section 5.3.3.4 where figure 17 instead of figure 18 should be referred to.

TS 25.213 V3.1.0:

The numbering of the scrambling code groups in Table 4 in section 5.2.3.2 of TS 25.213 is not consistent with the numbering used in section 5.2.2. It is proposed to change the numbering for the scrambling code groups in Table 4 from 1…64 to 0…63.

Furthermore, some editorial corrections are proposed in section 5.2.1 and 5.2.2.

Document ***??99???***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.211 CR 025 Current Version: 3.0.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Ericsson **Date:** 2000-01-08

Subject: Consistent numbering of scrambling code groups

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:** Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change: The numbering of scrambling code groups (from 1 to 64) in section 5.3.3.4 is not consistent with the numbering used in TS 25.213 (from 0 to 63).

In the last paragraph of 5.3.3.4, figure 17 should be referred to instead of figure 18.

Clauses affected: 5.3.3.4

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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5.3.3.4 Synchronisation Channel (SCH)

The Synchronisation Channel (SCH) is a downlink signal used for cell search. The SCH consists of two sub channels, the Primary and Secondary SCH. The 10 ms radio frames of the Primary and Secondary SCH are divided into 15 slots, each of length 2560 chips. Figure 17 illustrates the structure of the SCH radio frame.

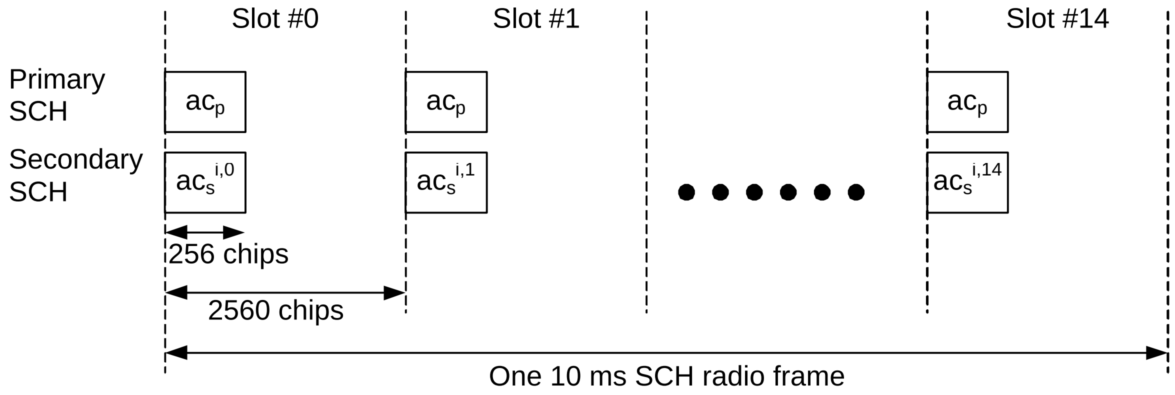

Figure 17: Structure of Synchronisation Channel (SCH)

The Primary SCH consists of a modulated code of length 256 chips, the Primary Synchronisation Code (PSC) denoted c_p in figure 17, transmitted once every slot. The PSC is the same for every cell in the system.

The Secondary SCH consists of repeatedly transmitting a length 15 sequence of modulated codes of length 256 chips, the Secondary Synchronisation Codes (SSC), transmitted in parallel with the Primary SCH. The SSC is denoted $c_s^{i,k}$ in figure 18, where *i* = 0~~1~~, 1~~2~~, …, 63~~4~~ is the number of the scrambling code group, and *k* = 0, 1, …, 14 is the slot number. Each SSC is chosen from a set of 16 different codes of length 256. This sequence on the Secondary SCH indicates which of the code groups the cell's downlink scrambling code belongs to.

The primary and secondary synchronization codes are modulated by the symbol *a* shown in figure 17~~8~~, which indicates the presence/ absence of STTD encoding on the P-CCPCH and is given by the following table:

P-CCPCH STTD encoded	a = +1
P-CCPCH not STTD encoded	a = -1

3GPP TSG RAN WG1 Meeting #10
Beijing, China, Jan 18 – Jan 21, 2000

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CHANGE REQUEST

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25.213 CR 020 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Ericsson **Date:** 2000-01-11

Subject: Consistent numbering of scrambling code groups

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X	
A	Corresponds to a correction in an earlier release		
B	Addition of feature		
C	Functional modification of feature		
D	Editorial modification		

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: The numbering of the scrambling code groups in Table 4 in section 5.2.3.2 of TS 25.213 is not consistent with the numbering used in section 5.2.2. It is proposed to change the numbering for the scrambling code groups in Table 4 from 1…64 to 0…63. Furthermore, some editorial corrections are proposed in section 5.2.1 and 5.2.2.

Clauses affected: 5.2.1, 5.2.2, 5.2.3.2

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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5.2 Code generation and allocation

5.2.1 Channelization codes

The channelization codes of figure 8 are the same codes as used in the uplink, namely Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between downlink channels of different rates and spreading factors. The OVSF codes are defined in figure 4 in section 4.3.1.

The channelization code for the Primary CPICH is fixed to $C_{ch,256,0}$ and the channelization code for the Primary CCPCH is fixed to $C_{ch,256,1}$.The channelization codes for all other physical channels are assigned by UTRAN.

With the spreading factor 512 a specific restriction is applied. When the code word $C_{ch,512,n}$, with n=0,2,4….510, is used in soft handover, then the code word $C_{ch,512,n+1}$ is not allocated in the Node Bs where timing adjustment is to be used. Respectively if $C_{ch,512,n}$, with n=1,3,5….511 is used, then the code word $C_{ch,512,n-1}$ is not allocated in the Node B where timing adjustment is to be used. This restriction shall not apply for the softer handover operation or in case UTRAN is synchronised to such a level that timing adjustments in soft handover are not used with spreading factor 512.

When compressed mode is implemented by reducing the spreading factor by 2, the OVSF code used for compressed frames is:

- $C_{ch,SF/2,\lfloor n/2 \rfloor}$ if ordinary scrambling code is used
- ~~c_{ch}~~$C_{ch,SF/2,n \bmod SF/2}$ if alternative scrambling code is used (see section 5.2.2)

where ~~c_{ch}~~$C_{ch,SF,n}$ is the channelization code used for non-compressed frames.

In case the OVSF code on the PDSCH varies from frame to frame, the OVSF codes shall be allocated such a way that the OVSF code(s) below the smallest spreading factor will be from the branch of the code tree pointed by the smallest spreading factor used for the connection. This means that all the codes for UE for the PDSCH connection can be generated according to the OVSF code generation principle from smallest spreading factor code used by the UE on PDSCH.

In case of mapping the DSCH to multiple parallel PDSCHs, the same rule applies, but all of the branches identified by the multiple codes, corresponding to the smallest spreading factor, may be used for higher spreading factor allocation.

5.2.2 Scrambling code

A total of 2^{18}-1 = 262,143 scrambling codes, numbered 0…262,142 can be generated. However not all the scrambling codes are used. The scrambling codes are divided into 512 sets each of a primary scrambling code and 15 secondary scrambling codes.

The primary scrambling codes consist of scrambling codes n=16*i where i=0…511. The i:th set of secondary scrambling codes consists of scrambling codes 16*i+k, where k=1…15.

There is a one-to-one mapping between each primary scrambling code and 15 secondary scrambling codes in a set such that i:th primary scrambling code corresponds to i:th set of secondary scrambling codes.

Hence, according to the above, scrambling codes k = 0, 1, …, 8191 are used. Each of these codes are associated with a left alternative scrambling code and a right alternative scrambling code, that may be used for compressed frames. The left alternative scrambling code corresponding to scrambling code k is scrambling code number k + 8192, while the right alternative scrambling code corresponding to scrambling code k is scrambling code number k + 16384. The alternative scrambling codes can be used for compressed frames. In this case, the left alternative scrambling code is used if n<SF/2 and the right alternative scrambling code is used if n≥SF/2, where $c_{ch,SF,n}$ is the channelization code used for non-compressed frames. The usage of alternative scrambling code for compressed frames is signalled by higher layers for each physical channel respectively.

The set of primary scrambling codes is further divided into 64 scrambling code groups, each consisting of 8 primary scrambling codes. The j:th scrambling code group consists of primary scrambling codes 16*8*j+16*k, where j=0..63 and k=0..7.

Each cell is allocated one and only one primary scrambling code. The primary CCPCH and primary CPICH are always transmitted using the primary scrambling code. The other downlink physical channels can be transmitted with either the primary scrambling code or a secondary scrambling code from the set associated with the primary scrambling code of the cell.

The mixture of primary scrambling code and secondary scrambling code for one CCTrCH is allowable.

The scrambling code sequences are constructed by combining two real sequences into a complex sequence. Each of the two real sequences are constructed as the position wise modulo 2 sum of 38400 chip segments of two binary *m*-sequences generated by means of two generator polynomials of degree 18. The resulting sequences thus constitute segments of a set of Gold sequences. The scrambling codes are repeated for every 10 ms radio frame. Let *x* and *y* be the two sequences respectively. The *x* sequence is constructed using the primitive (over GF(2)) polynomial $1+X^7+X^{18}$. The y sequence is constructed using the polynomial $1+X^5+X^7+X^{10}+X^{18}$.

The sequence depending on the chosen scrambling code number *n* is denoted z_n, in the sequel. Furthermore, let $x(i)$, $y(i)$ and $z_n(i)$ denote the *i*:th symbol of the sequence *x*, *y*, and z_n, respectively

The *m*-sequences *x*and *y* are constructed as:

Initial conditions:

x is constructed with x (0)=1, x(1)= x(2)=...= x (16)= x (17)=0

y(0)=y(1)= … =y(16)= y(17)=1

Recursive definition of subsequent symbols:

$x(i+18) = x(i+7) + x(i)$ modulo 2, $i=0,\dots,2^{18}-20$,

$y(i+18) = y(i+10)+y(i+7)+y(i+5)+y(i)$ modulo 2, $i=0,\dots,2^{18}-20$.

The n:th Gold code sequence z_n, $n=0,1,2,\dots,2^{18}-2$, is then defined as

$z_n(i) = x((i+n) \text{ modulo } (2^{18}-1)) + y(i)$ modulo 2, $i=0,\dots,2^{18}-2$.

These binary sequences are converted to real valued sequences Z_n by the following transformation:

$$Z_n(i) = \begin{cases} +1 & if\ \ z_n(i) = 0 \\ -1 & if\ \ z_n(i) = 1 \end{cases} \quad for \quad i = 0,1,\dots,2^{18}-2.$$

Finally, the n:th complex scrambling code sequence $S_{dl,n}$ is defined as:

$S_{dl,n}(i) = Z_n(i) + j\, Z_n((i+131072) \text{ modulo } (2^{18}-1))$, $i=0,1,\dots,38399$.

Note that the pattern from phase 0 up to the phase of 38399 is repeated.

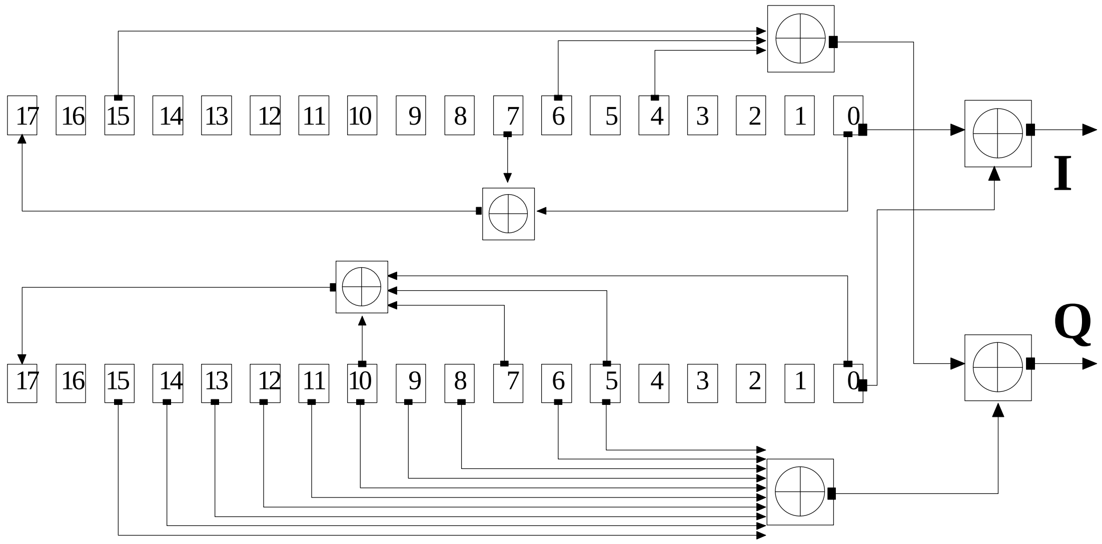

Figure 10: Configuration of downlink scrambling code generator

5.2.3 Synchronisation codes

5.2.3.1 Code generation

The primary synchronisation code (PSC), C_{psc} is constructed as a so-called generalised hierarchical Golay sequence. The PSC is furthermore chosen to have good aperiodic auto correlation properties.

Define

$a = <x_1, x_2, x_3, \ldots, x_{16}> = <1, 1, 1, 1, 1, 1, -1, -1, 1, -1, 1, -1, 1, -1, -1, 1>$

The PSC is generated by repeating the sequence *a* modulated by a Golay complementary sequence, and creating a complex-valued sequence with identical real and imaginary components. The PSC C_{psc} is defined as

$C_{psc} = (1 + j) \times <a, a, a, -a, -a, a, -a, -a, a, a, a, -a, a, -a, a, a>$,

where the leftmost chip in the sequence corresponds to the chip transmitted first in time

The 16 secondary synchronization codes (SSCs), $\{C_{ssc,1},\ldots,C_{ssc,16}\}$, are complex-valued with identical real and imaginary components, and are constructed from position wise multiplicationof a Hadamard sequence and a sequence *z*, defined as

$z = <b, b, b, -b, b, b, -b, -b, b, -b, b, -b, -b, -b, -b, -b>$, where

$b = <x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, -x_9, -x_{10}, -x_{11}, -x_{12}, -x_{13}, -x_{14}, -x_{15}, -x_{16}>$.

The Hadamard sequences are obtained as the rows in a matrix H_8 constructed recursively by:

$$H_0 = (1)$$
$$H_k = \begin{pmatrix} H_{k-1} & H_{k-1} \\ H_{k-1} & -H_{k-1} \end{pmatrix}, \quad k \geq 1$$

The rows are numbered from the top starting with row *0* (the all ones sequence).

Denote the *n*:th Hadamard sequence as a row of H_8 numbered from the top, n = 0, 1, 2, …, 255, in the sequel.

Furthermore, let $h_n(i)$ and $z(i)$ denote the *i*:th symbol of the sequence h_n and z, respectively where $i = 0, 1, 2, \ldots, 255$ and $i = 0$ corresponds to the leftmost symbol.

The *k*:th SSC, $C_{ssc,k}$, $k = 1, 2, 3, \ldots, 16$ is then defined as

$$C_{ssc,k} = (1 + j) \times \langle h_m(0) \times z(0), h_m(1) \times z(1), h_m(2) \times z(2), \ldots, h_m(255) \times z(255) \rangle,$$

where $m = 16\times(k - 1)$ and the leftmost chip in the sequence corresponds to the chip transmitted first in time.

5.2.3.2 Code allocation of SSC

The 64 secondary SCH sequences are constructed such that their cyclic-shifts are unique, i.e., a non-zero cyclic shift less than 15 of any of the 64 sequences is not equivalent to some cyclic shift of any other of the 64 sequences. Also, a non-zero cyclic shift less than 15 of any of the sequences is not equivalent to itself with any other cyclic shift less than 15. Table 4 describes the sequences of SSCs used to encode the 64 different scrambling code groups. The entries in table 4 denote what SSC to use in the different slots for the different scrambling code groups, e.g. the entry "7" means that SSC $C_{ssc,7}$ shall be used for the corresponding scrambling code group and slot.

Table 4: Allocation of SSCs for secondary SCH.

Scrambling Code Group	slot number														
	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14
Group 0~~1~~	1	1	2	8	9	10	15	8	10	16	2	7	15	7	16
Group 1~~2~~	1	1	5	16	7	3	14	16	3	10	5	12	14	12	10
Group 2~~3~~	1	2	1	15	5	5	12	16	6	11	2	16	11	15	12
Group 3~~4~~	1	2	3	1	8	6	5	2	5	8	4	4	6	3	7
Group 4~~5~~	1	2	16	6	6	11	15	5	12	1	15	12	16	11	2
Group 5~~6~~	1	3	4	7	4	1	5	5	3	6	2	8	7	6	8
Group 6~~7~~	1	4	11	3	4	10	9	2	11	2	10	12	12	9	3
Group 7~~8~~	1	5	6	6	14	9	10	2	13	9	2	5	14	1	13
Group 8~~9~~	1	6	10	10	4	11	7	13	16	11	13	6	4	1	16
Group 9~~10~~	1	6	13	2	14	2	6	5	5	13	10	9	1	14	10
Group 10~~11~~	1	7	8	5	7	2	4	3	8	3	2	6	6	4	5
Group 11~~12~~	1	7	10	9	16	7	9	15	1	8	16	8	15	2	2
Group 12~~13~~	1	8	12	9	9	4	13	16	5	1	13	5	12	4	8
Group 13~~14~~	1	8	14	10	14	1	15	15	8	5	11	4	10	5	4
Group 14~~15~~	1	9	2	15	15	16	10	7	8	1	10	8	2	16	9
Group 15~~16~~	1	9	15	6	16	2	13	14	10	11	7	4	5	12	3
Group 16~~17~~	1	10	9	11	15	7	6	4	16	5	2	12	13	3	14
Group 17~~18~~	1	11	14	4	13	2	9	10	12	16	8	5	3	15	6
Group 18~~19~~	1	12	12	13	14	7	2	8	14	2	1	13	11	8	11
Group 19~~20~~	1	12	15	5	4	14	3	16	7	8	6	2	10	11	13
Group 20~~21~~	1	15	4	3	7	6	10	13	12	5	14	16	8	2	11
Group 21~~22~~	1	16	3	12	11	9	13	5	8	2	14	7	4	10	15
Group 22~~23~~	2	2	5	10	16	11	3	10	11	8	5	13	3	13	8
Group 23~~24~~	2	2	12	3	15	5	8	3	5	14	12	9	8	9	14
Group 24~~25~~	2	3	6	16	12	16	3	13	13	6	7	9	2	12	7
Group 25~~26~~	2	3	8	2	9	15	14	3	14	9	5	5	15	8	12
Group 26~~27~~	2	4	7	9	5	4	9	11	2	14	5	14	11	16	16
Group 27~~28~~	2	4	13	12	12	7	15	10	5	2	15	5	13	7	4
Group 28~~29~~	2	5	9	9	3	12	8	14	15	12	14	5	3	2	15
Group 29~~30~~	2	5	11	7	2	11	9	4	16	7	16	9	14	14	4
Group 30~~31~~	2	6	2	13	3	3	12	9	7	16	6	9	16	13	12
Group 31~~32~~	2	6	9	7	7	16	13	3	12	2	13	12	9	16	6
Group 32~~33~~	2	7	12	15	2	12	4	10	13	15	13	4	5	5	10
Group 33~~34~~	2	7	14	16	5	9	2	9	16	11	11	5	7	4	14
Group 34~~35~~	2	8	5	12	5	2	14	14	8	15	3	9	12	15	9
Group 35~~36~~	2	9	13	4	2	13	8	11	6	4	6	8	15	15	11
Group 36~~37~~	2	10	3	2	13	16	8	10	8	13	11	11	16	3	5
Group 37~~38~~	2	11	15	3	11	6	14	10	15	10	6	7	7	14	3
Group 38~~39~~	2	16	4	5	16	14	7	11	4	11	14	9	9	7	5
Group 39~~40~~	3	3	4	6	11	12	13	6	12	14	4	5	13	5	14
Group 40~~41~~	3	3	6	5	16	9	15	5	9	10	6	4	15	4	10
Group 41~~42~~	3	4	5	14	4	6	12	13	5	13	6	11	11	12	14
Group 42~~43~~	3	4	9	16	10	4	16	15	3	5	10	5	15	6	6
Group 43~~44~~	3	4	16	10	5	10	4	9	9	16	15	6	3	5	15
Group 44~~45~~	3	5	12	11	14	5	11	13	3	6	14	6	13	4	4
Group 45~~46~~	3	6	4	10	6	5	9	15	4	15	5	16	16	9	10
Group 46~~47~~	3	7	8	8	16	11	12	4	15	11	4	7	16	3	15
Group 47~~48~~	3	7	16	11	4	15	3	15	11	12	12	4	7	8	16
Group 48~~49~~	3	8	7	15	4	8	15	12	3	16	4	16	12	11	11
Group 49~~50~~	3	8	15	4	16	4	8	7	7	15	12	11	3	16	12

Scrambling Code Group	slot number														
	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14
Group 50~~51~~	3	10	10	15	16	5	4	6	16	4	3	15	9	6	9
Group 51~~52~~	3	13	11	5	4	12	4	11	6	6	5	3	14	13	12
Group 52~~53~~	3	14	7	9	14	10	13	8	7	8	10	4	4	13	9
Group 53~~54~~	5	5	8	14	16	13	6	14	13	7	8	15	6	15	7
Group 54~~55~~	5	6	11	7	10	8	5	8	7	12	12	10	6	9	11
Group 55~~56~~	5	6	13	8	13	5	7	7	6	16	14	15	8	16	15
Group 56~~57~~	5	7	9	10	7	11	6	12	9	12	11	8	8	6	10
Group 57~~58~~	5	9	6	8	10	9	8	12	5	11	10	11	12	7	7
Group 58~~59~~	5	10	10	12	8	11	9	7	8	9	5	12	6	7	6
Group 59~~60~~	5	10	12	6	5	12	8	9	7	6	7	8	11	11	9
Group 60~~61~~	5	13	15	15	14	8	6	7	16	8	7	13	14	5	16
Group 61~~62~~	9	10	13	10	11	15	15	9	16	12	14	13	16	14	11
Group 62~~63~~	9	11	12	15	12	9	13	13	11	14	10	16	15	14	16
Group 63~~64~~	9	12	10	15	13	14	9	14	15	11	11	13	12	16	10