

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

***TSGR1#10(00)0118***

**Agenda item:** AH 10

**Source:** Ericsson

**Title:** CR 25.211-025r1 and CR 25.213-020r1: Consistent numbering of scrambling code groups

**Document for:** Decision

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**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 to 0...63.

Furthermore, an editorial correction is proposed to the last paragraph in section 5.3.3.4 where figure 16 instead of figure 17 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.



### 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 16 illustrates the structure of the SCH radio frame.

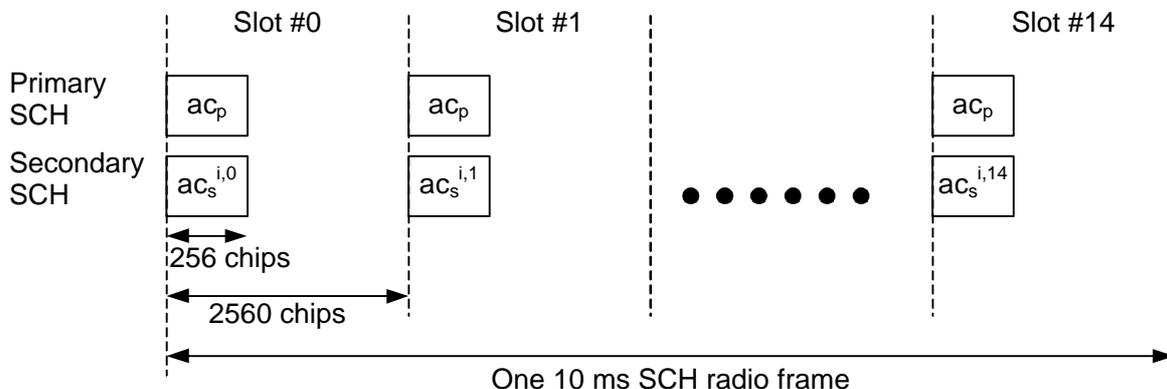


Figure 16: Structure of Synchronisation Channel (SCH)

The Primary SCH consists of a modulated code of length 256 chips, the Primary Synchronisation Code (PSC) denoted  $c_p$  in figure 16, 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 17, where  $i = 40, 21, \dots, 64-63$  is the number of the scrambling code group, and  $k = 0, 1, \dots, 14$  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 4716, 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	$a = -1$

<h2 style="margin: 0;">CHANGE REQUEST</h2>		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.
<b>25.213</b>	<b>CR</b>	<b>020r1</b>
GSM (AA.BB) or 3G (AA.BBB) specification number ↑		↑ CR number as allocated by MCC support team
Current Version: <b>3.1.0</b>		
For submission to: <b>TSG-RAN #7</b> <small>list expected approval meeting # here ↑</small>	for approval for information <input checked="" type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> <small>(for SMG use only)</small>

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  UTRAN / Radio  Core Network   
(at least one should be marked with an X)

**Source:** Ericsson **Date:** 2000-01-18

**Subject:** Consistent numbering of scrambling code groups

**Work item:**

<b>Category:</b>	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	<b>Release:</b>	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

**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

<b>Other specs affected:</b>	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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**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  $n=0,2,4,\dots,510$ , 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  $n=1,3,5,\dots,511$  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
- $e_{ch}C_{ch,SF/2,n \bmod SF/2}$  if alternative scrambling code is used (see section 5.2.2)

where  $e_{ch}C_{ch,SF,n}$  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  $0 \dots 262,142$  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  $i=0 \dots 511$ . The  $i$ :th set of secondary scrambling codes consists of scrambling codes  $16*i+k$ , where  $k=1 \dots 15$ .

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  $k = 0, 1, \dots, 8191$  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  $n \geq SF/2$ , 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:

$$x \text{ is constructed with } x(0)=1, x(1)=x(2)=\dots=x(16)=x(17)=0$$

$$y(0)=y(1)=\dots=y(16)=y(17)=1$$

Recursive definition of subsequent symbols:

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

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

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

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

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

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

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.

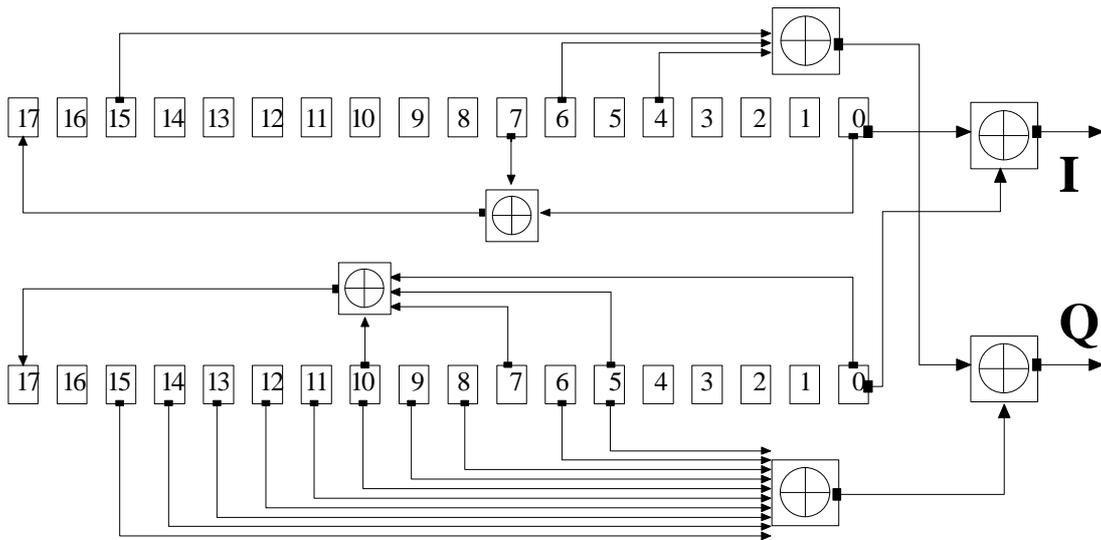


Figure 10: Configuration of downlink scrambling code generator

### 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

$$a = \langle x_1, x_2, x_3, \dots, x_{16} \rangle = \langle 1, 1, 1, 1, 1, 1, -1, -1, 1, -1, 1, -1, 1, -1, -1, 1 \rangle$$

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

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

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

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

$$z = \langle b, b, b, -b, b, b, -b, -b, b, -b, b, -b, -b, -b, -b \rangle, \text{ where}$$

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

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,  $n = 0, 1, 2, \dots, 255$ , 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  $i = 0, 1, 2, \dots, 255$  and  $i = 0$  corresponds to the leftmost symbol.

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

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

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  $C_{\text{ssc},7}$  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 <a href="#">40</a>	1	1	2	8	9	10	15	8	10	16	2	7	15	7	16
Group <a href="#">21</a>	1	1	5	16	7	3	14	16	3	10	5	12	14	12	10
Group <a href="#">32</a>	1	2	1	15	5	5	12	16	6	11	2	16	11	15	12
Group <a href="#">43</a>	1	2	3	1	8	6	5	2	5	8	4	4	6	3	7
Group <a href="#">54</a>	1	2	16	6	6	11	15	5	12	1	15	12	16	11	2
Group <a href="#">65</a>	1	3	4	7	4	1	5	5	3	6	2	8	7	6	8
Group <a href="#">76</a>	1	4	11	3	4	10	9	2	11	2	10	12	12	9	3
Group <a href="#">87</a>	1	5	6	6	14	9	10	2	13	9	2	5	14	1	13
Group <a href="#">98</a>	1	6	10	10	4	11	7	13	16	11	13	6	4	1	16
Group <a href="#">409</a>	1	6	13	2	14	2	6	5	5	13	10	9	1	14	10
Group <a href="#">4410</a>	1	7	8	5	7	2	4	3	8	3	2	6	6	4	5
Group <a href="#">4211</a>	1	7	10	9	16	7	9	15	1	8	16	8	15	2	2
Group <a href="#">4312</a>	1	8	12	9	9	4	13	16	5	1	13	5	12	4	8
Group <a href="#">4413</a>	1	8	14	10	14	1	15	15	8	5	11	4	10	5	4
Group <a href="#">4514</a>	1	9	2	15	15	16	10	7	8	1	10	8	2	16	9
Group <a href="#">4615</a>	1	9	15	6	16	2	13	14	10	11	7	4	5	12	3
Group <a href="#">4716</a>	1	10	9	11	15	7	6	4	16	5	2	12	13	3	14
Group <a href="#">4817</a>	1	11	14	4	13	2	9	10	12	16	8	5	3	15	6
Group <a href="#">4918</a>	1	12	12	13	14	7	2	8	14	2	1	13	11	8	11
Group <a href="#">2019</a>	1	12	15	5	4	14	3	16	7	8	6	2	10	11	13
Group <a href="#">2420</a>	1	15	4	3	7	6	10	13	12	5	14	16	8	2	11
Group <a href="#">2221</a>	1	16	3	12	11	9	13	5	8	2	14	7	4	10	15
Group <a href="#">2322</a>	2	2	5	10	16	11	3	10	11	8	5	13	3	13	8
Group <a href="#">2423</a>	2	2	12	3	15	5	8	3	5	14	12	9	8	9	14
Group <a href="#">2524</a>	2	3	6	16	12	16	3	13	13	6	7	9	2	12	7
Group <a href="#">2625</a>	2	3	8	2	9	15	14	3	14	9	5	5	15	8	12
Group <a href="#">2726</a>	2	4	7	9	5	4	9	11	2	14	5	14	11	16	16
Group <a href="#">2827</a>	2	4	13	12	12	7	15	10	5	2	15	5	13	7	4
Group <a href="#">2928</a>	2	5	9	9	3	12	8	14	15	12	14	5	3	2	15
Group <a href="#">3029</a>	2	5	11	7	2	11	9	4	16	7	16	9	14	14	4
Group <a href="#">3430</a>	2	6	2	13	3	3	12	9	7	16	6	9	16	13	12
Group <a href="#">3231</a>	2	6	9	7	7	16	13	3	12	2	13	12	9	16	6
Group <a href="#">3332</a>	2	7	12	15	2	12	4	10	13	15	13	4	5	5	10
Group <a href="#">3433</a>	2	7	14	16	5	9	2	9	16	11	11	5	7	4	14
Group <a href="#">3534</a>	2	8	5	12	5	2	14	14	8	15	3	9	12	15	9
Group <a href="#">3635</a>	2	9	13	4	2	13	8	11	6	4	6	8	15	15	11
Group <a href="#">3736</a>	2	10	3	2	13	16	8	10	8	13	11	11	16	3	5
Group <a href="#">3837</a>	2	11	15	3	11	6	14	10	15	10	6	7	7	14	3
Group <a href="#">3938</a>	2	16	4	5	16	14	7	11	4	11	14	9	9	7	5
Group <a href="#">4039</a>	3	3	4	6	11	12	13	6	12	14	4	5	13	5	14
Group <a href="#">4440</a>	3	3	6	5	16	9	15	5	9	10	6	4	15	4	10
Group <a href="#">4241</a>	3	4	5	14	4	6	12	13	5	13	6	11	11	12	14
Group <a href="#">4342</a>	3	4	9	16	10	4	16	15	3	5	10	5	15	6	6
Group <a href="#">4443</a>	3	4	16	10	5	10	4	9	9	16	15	6	3	5	15
Group <a href="#">4544</a>	3	5	12	11	14	5	11	13	3	6	14	6	13	4	4
Group <a href="#">4645</a>	3	6	4	10	6	5	9	15	4	15	5	16	16	9	10
Group <a href="#">4746</a>	3	7	8	8	16	11	12	4	15	11	4	7	16	3	15
Group <a href="#">4847</a>	3	7	16	11	4	15	3	15	11	12	12	4	7	8	16
Group <a href="#">4948</a>	3	8	7	15	4	8	15	12	3	16	4	16	12	11	11
Group <a href="#">5049</a>	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 <a href="#">5450</a>	3	10	10	15	16	5	4	6	16	4	3	15	9	6	9	
Group <a href="#">5251</a>	3	13	11	5	4	12	4	11	6	6	5	3	14	13	12	
Group <a href="#">5352</a>	3	14	7	9	14	10	13	8	7	8	10	4	4	13	9	
Group <a href="#">5453</a>	5	5	8	14	16	13	6	14	13	7	8	15	6	15	7	
Group <a href="#">5554</a>	5	6	11	7	10	8	5	8	7	12	12	10	6	9	11	
Group <a href="#">5655</a>	5	6	13	8	13	5	7	7	6	16	14	15	8	16	15	
Group <a href="#">5756</a>	5	7	9	10	7	11	6	12	9	12	11	8	8	6	10	
Group <a href="#">5857</a>	5	9	6	8	10	9	8	12	5	11	10	11	12	7	7	
Group <a href="#">5958</a>	5	10	10	12	8	11	9	7	8	9	5	12	6	7	6	
Group <a href="#">6059</a>	5	10	12	6	5	12	8	9	7	6	7	8	11	11	9	
Group <a href="#">6160</a>	5	13	15	15	14	8	6	7	16	8	7	13	14	5	16	
Group <a href="#">6261</a>	9	10	13	10	11	15	15	9	16	12	14	13	16	14	11	
Group <a href="#">6362</a>	9	11	12	15	12	9	13	13	11	14	10	16	15	14	16	
Group <a href="#">6463</a>	9	12	10	15	13	14	9	14	15	11	11	13	12	16	10	