

Lab 3

Contents of SSB, MIB

SSB and its contents

- First, UE is doing cell search: UE receives SSB, which contains MIB
- MIB tells where to find SIB1 in PDCCH
 - CORESET contains common and UE specific search spaces for PDCCH candidates

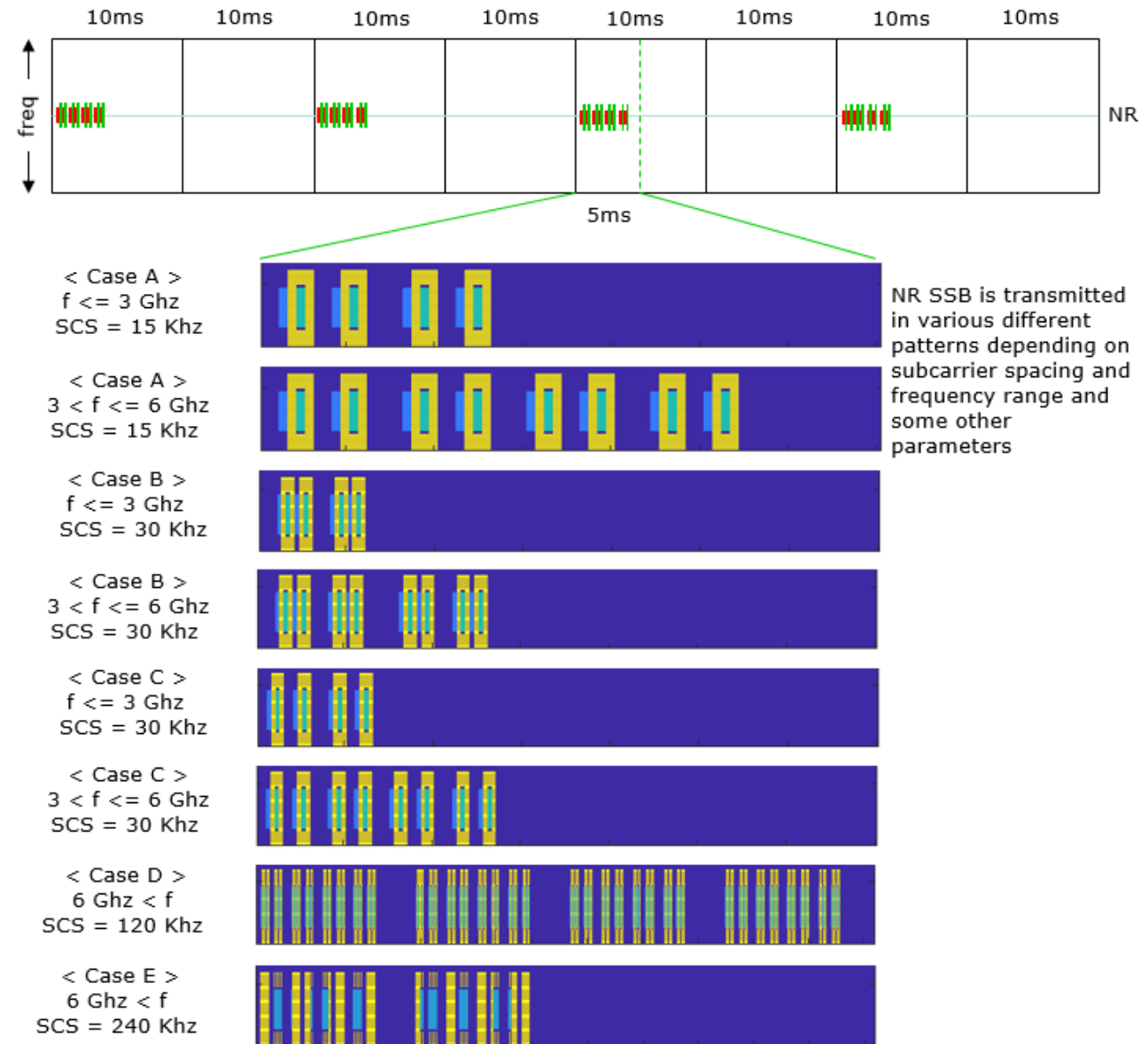
SSB - Synchronization Signal Block

MIB - Master Information Block

SIB1 - System Information Block 1

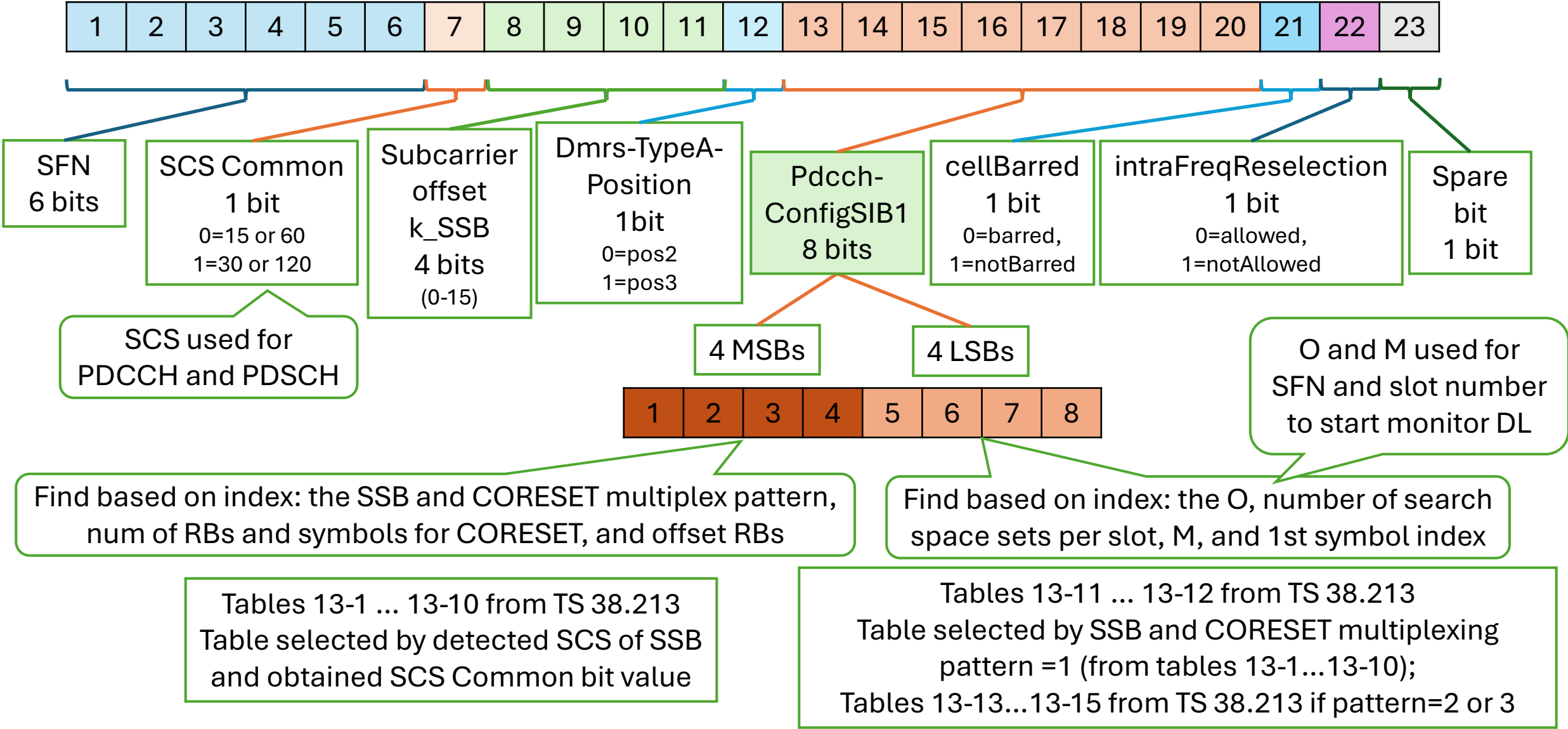
CORESET - Control resource set

PDCCH - Physical Downlink Control Channel

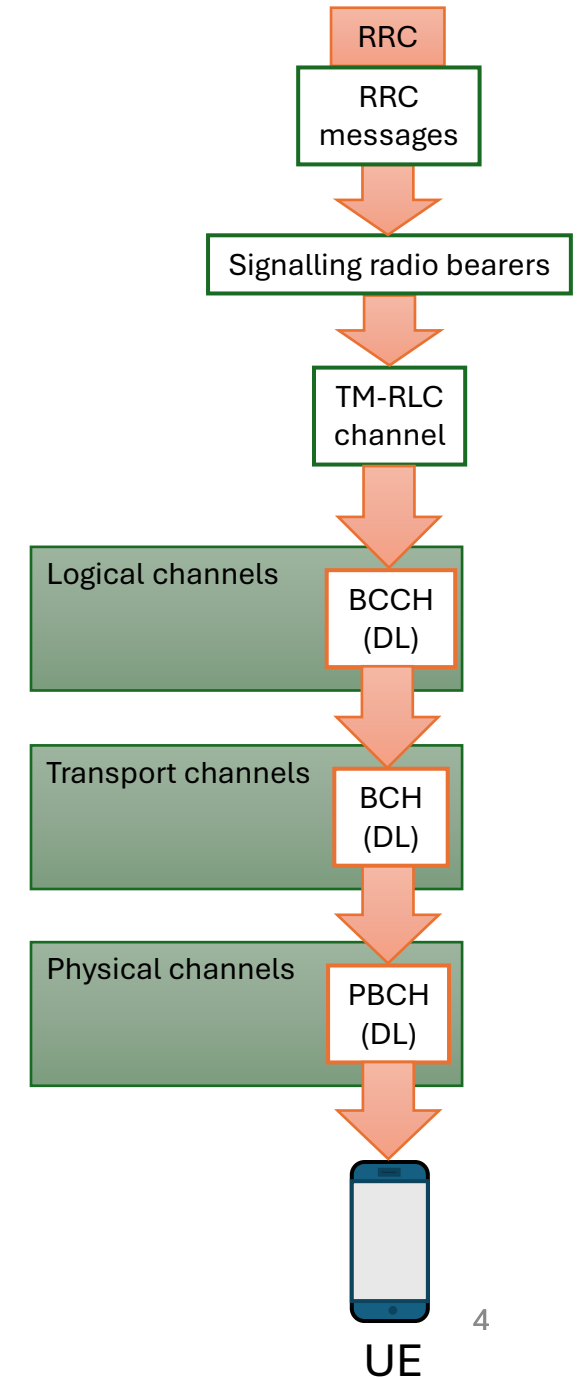
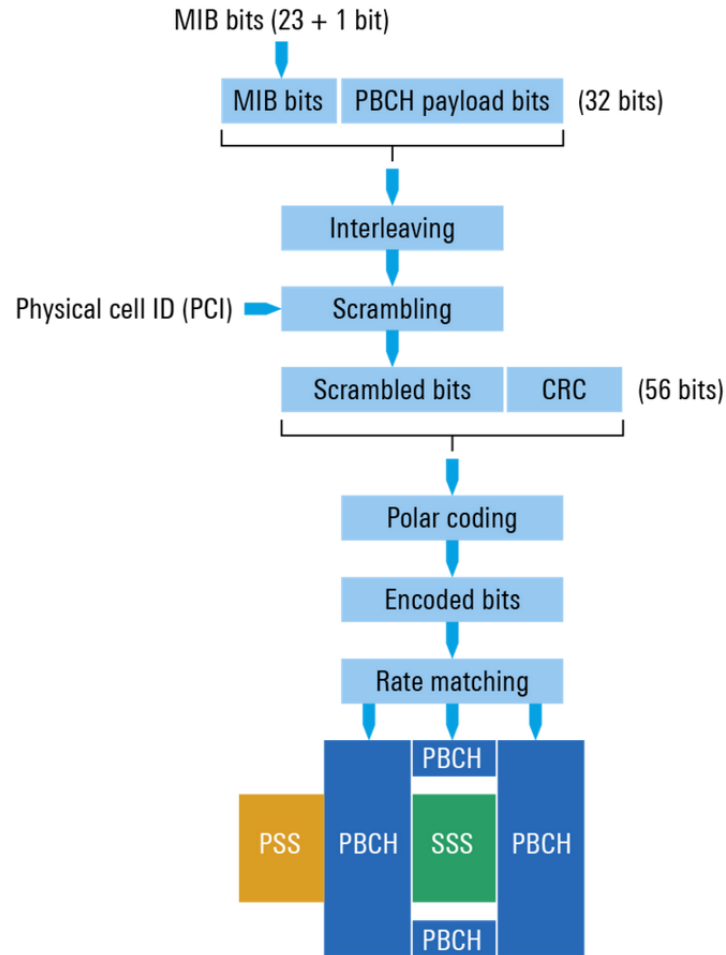


SFN=System Frame Number

How to search where is SIB1 from MIB



MIB processing before transmission



[1] 5G New Radio. Fundamentals, procedures, testing aspects. 2020. Rohde&Schwarz [Online]. Available: <https://gloris.rohde-schwarz.com/ebooks/5G>

Fig. 2-13 Channel coding chain for the master information block (MIB) in 5G NR.

How to find SIB1 info from MIB (R&S book [1])

- From MIB field *pdccchConfigSIB1* the UE obtains CORESET for common search space to obtain SIB1
- SIB1 contains:
 - cellSelectionInfo
 - cellAccessRelatedInfo
 - ConnEstFailureControl
 - SI-SchedulingInfo
 - ServingCellCommonSIB
 - Support for IMS emergency support and support for eCall over IMS
 - UE-TimersAndConstants
 - Info related to unified access control (UAC)
- Other system information: UE requests and network sends messages

[1] 5G New Radio. Fundamentals, procedures, testing aspects. 2020.Rohde&Schwarz [Online].

Available: <https://gloris.rohde-schwarz.com/ebooks/5G>

Example 1 of scanner results

Channel	Message	Category	Sub-Category	Path	IE	Value
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	Cell Status Info	_MIB/cellBarred	cellBarred	1
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	Reference Signals Info	_MIB/dmrs_TypeA_Position	dmrs_TypeA_Position	0
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	Cell Selection Info	_MIB/intraFreqReselection	intraFreqReselection	0
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	PDCCH CORESET Info	_MIB/pdcch_ConfigSIB1/c ontrolResourceSetZero	controlResourceSetZero	2
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	PDCCH CORESET Info	_MIB/pdcch_ConfigSIB1/s earchSpaceZero	searchSpaceZero	8
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	SS/PBCH Block Info	_MIB/ssb_SubcarrierOffset	ssb_SubcarrierOffset	8
5G NR Channel 1 @ 24353.760 MHz (2018395) [7/7]	BCCH BCH Message	BCH MIB Parameters	Sub Carrier Spacing Info	_MIB/subCarrierSpacingC ommon	subCarrierSpacingCom mon	1

Example 2 of scanner results

Channel	Message	Category	Sub-Category	Path	IE	Value
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	Cell Status Info	_MIB/cellBarred	cellBarred	1
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	Reference Signals Info	_MIB/dmrs_TypeA_Position	dmrs_TypeA_Position	0
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	Cell Selection Info	_MIB/intraFreqReselection	intraFreqReselection	0
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	PDCCH CORESET Info	_MIB/pdcch_ConfigSIB1/c ontrolResourceSetZero	controlResourceSetZero	2
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	PDCCH CORESET Info	_MIB/pdcch_ConfigSIB1/s earchSpaceZero	searchSpaceZero	8
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	SS/PBCH Block Info	_MIB/ssb_SubcarrierOffset	ssb_SubcarrierOffset	8
5G NR Channel 1 @ 24353.760 MHz (2018395) [3/3]	BCCH BCH Message	BCH MIB Parameters	Sub Carrier Spacing Info	_MIB/subCarrierSpacingC ommon	subCarrierSpacingCom mon	1

Examples

5G NR Channel 1 @ 3426.240 MHz (628416)

gNodeB - ID:n.a. PCI:121 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x22) '100010'B systemFrameNumber[] (34) 34 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	gNodeB - ID:n.a. PCI:162 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x3b) '111011'B systemFrameNumber[] (59) 59 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	gNodeB - ID:n.a. PCI:321 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x01) '000001'B systemFrameNumber[] (1) 1 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	gNodeB - ID:n.a. PCI:322 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x14) '010100'B systemFrameNumber[] (20) 20 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B
gNodeB - ID:n.a. PCI:60 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x0d) '001101'B systemFrameNumber[] (13) 13 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	gNodeB - ID:n.a. PCI:261 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x23) '100011'B systemFrameNumber[] (35) 35 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	gNodeB - ID:n.a. PCI:258 BCCH BCH Message _BCCH_BCH_Message message: mib systemFrameNumber (0x34) '110100'B systemFrameNumber[] (52) 52 subCarrierSpacingCommon (1) scs30or120 ssb_SubcarrierOffset 10 dmrs_TypeA_Position (1) pos3 pdccch_ConfigSIB1 2 controlResourceSetZero 12 searchSpaceZero 4 cellBarred (1) notBarred intraFreqReselection (0) allowed spare (0x00) '0'B	

Tasks

- Explain the contents of one example of scanner results of decoded MIB
- Based on scanner results examples of decoded MIB use wireless waveform generator (Downlink)
- Show positions of CORESETs in resource grid to search for SIB1

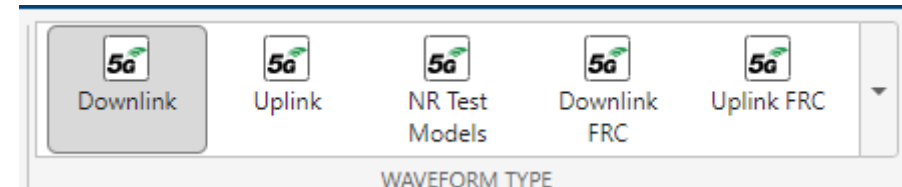


Table 13-1 of 3GPP TS 38.213 V15.15.0

Table 13-1: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {15, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{sym}^{CORESET}$	Offset (RBs)
0	1	24	2	0
1	1	24	2	2
2	1	24	2	4
3	1	24	3	0
4	1	24	3	2
5	1	24	3	4
6	1	48	1	12
7	1	48	1	16
8	1	48	2	12
9	1	48	2	16
10	1	48	3	12
11	1	48	3	16
12	1	96	1	38
13	1	96	2	38
14	1	96	3	38
15	Reserved			

Table 13-2 of 3GPP TS 38.213 V15.15.0

Table 13-2: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {15, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{symbol}^{CORESET}$	Offset (RBs)
0	1	24	2	5
1	1	24	2	6
2	1	24	2	7
3	1	24	2	8
4	1	24	3	5
5	1	24	3	6
6	1	24	3	7
7	1	24	3	8
8	1	48	1	18
9	1	48	1	20
10	1	48	2	18
11	1	48	2	20
12	1	48	3	18
13	1	48	3	20
14	Reserved			
15	Reserved			

Table 13-3 of 3GPP TS 38.213 V15.15.0

Table 13-3: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{sym}^{CORESET}$	Offset (RBs)
0	1	48	1	2
1	1	48	1	6
2	1	48	2	2
3	1	48	2	6
4	1	48	3	2
5	1	48	3	6
6	1	96	1	28
7	1	96	2	28
8	1	96	3	28
9	Reserved			
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-4 of 3GPP TS 38.213 V15.15.0

Table 13-4: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 5 MHz or 10 MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{sym}^{CORESET}$	Offset (RBs)
0	1	24	2	0
1	1	24	2	1
2	1	24	2	2
3	1	24	2	3
4	1	24	2	4
5	1	24	3	0
6	1	24	3	1
7	1	24	3	2
8	1	24	3	3
9	1	24	3	4
10	1	48	1	12
11	1	48	1	14
12	1	48	1	16
13	1	48	2	12
14	1	48	2	14
15	1	48	2	16

Table 13-5 of 3GPP TS 38.213 V15.15.0

Table 13-5: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 15} kHz for frequency bands with minimum channel bandwidth 40MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{symb}^{CORESET}$	Offset (RBs)
0	1	48	1	4
1	1	48	2	4
2	1	48	3	4
3	1	96	1	0
4	1	96	1	56
5	1	96	2	0
6	1	96	2	56
7	1	96	3	0
8	1	96	3	56
9	Reserved			
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-6 of 3GPP TS 38.213 V15.15.0

Table 13-6: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {30, 30} kHz for frequency bands with minimum channel bandwidth 40MHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{sym}^{CORESET}$	Offset (RBs)
0	1	24	2	0
1	1	24	2	4
2	1	24	3	0
3	1	24	3	4
4	1	48	1	0
5	1	48	1	28
6	1	48	2	0
7	1	48	2	28
8	1	48	3	0
9	1	48	3	28
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-7 of 3GPP TS 38.213 V15.15.0

Table 13-7: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {120, 60} kHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{syms}^{CORESET}$	Offset (RBs)
0	1	48	1	0
1	1	48	1	8
2	1	48	2	0
3	1	48	2	8
4	1	48	3	0
5	1	48	3	8
6	1	96	1	28
7	1	96	2	28
8	2	48	1	-41 if $k_{SSB} = 0$ -42 if $k_{SSB} > 0$
9	2	48	1	49
10	2	96	1	-41 if $k_{SSB} = 0$ -42 if $k_{SSB} > 0$
11	2	96	1	97
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-8 of 3GPP TS 38.213 V15.15.0

Table 13-8: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {120, 120} kHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{sym}^{CORESET}$	Offset (RBs)
0	1	24	2	0
1	1	24	2	4
2	1	48	1	14
3	1	48	2	14
4	3	24	2	-20 if $k_{SSB} = 0$ -21 if $k_{SSB} > 0$
5	3	24	2	24
6	3	48	2	-20 if $k_{SSB} = 0$ -21 if $k_{SSB} > 0$
7	3	48	2	48
8	Reserved			
9	Reserved			
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-9 of 3GPP TS 38.213 V15.15.0

Table 13-9: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {240, 60} kHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{symb}^{CORESET}$	Offset (RBs)
0	1	96	1	0
1	1	96	1	16
2	1	96	2	0
3	1	96	2	16
4	Reserved			
5	Reserved			
6	Reserved			
7	Reserved			
8	Reserved			
9	Reserved			
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-10 of 3GPP TS 38.213 V15.15.0

Table 13-10: Set of resource blocks and slot symbols of CORESET for Type0-PDCCH search space set when {SS/PBCH block, PDCCH} SCS is {240, 120} kHz

Index	SS/PBCH block and CORESET multiplexing pattern	Number of RBs $N_{RB}^{CORESET}$	Number of Symbols $N_{syms}^{CORESET}$	Offset (RBs)
0	1	48	1	0
1	1	48	1	8
2	1	48	2	0
3	1	48	2	8
4	2	24	1	-41 if $k_{SSB} = 0$ -42 if $k_{SSB} > 0$
5	2	24	1	25
6	2	48	1	-41 if $k_{SSB} = 0$ -42 if $k_{SSB} > 0$
7	2	48	1	49
8	Reserved			
9	Reserved			
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Reserved			

Table 13-11 of 3GPP TS 38.213 V15.15.0

Table 13-11: Parameters for PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 1 and FR1

Index	O	Number of search space sets per slot	M	First symbol index
0	0	1	1	0
1	0	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
2	2	1	1	0
3	2	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
4	5	1	1	0
5	5	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
6	7	1	1	0
7	7	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
8	0	1	2	0
9	5	1	2	0
10	0	1	1	1
11	0	1	1	2
12	2	1	1	1
13	2	1	1	2
14	5	1	1	1
15	5	1	1	2

Table 13-12 of 3GPP TS 38.213 V15.15.0

Table 13-12: Parameters for PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 1 and FR2

Index	O	Number of search space sets per slot	M	First symbol index
0	0	1	1	0
1	0	2	1/2	{0, if i is even}, {7, if i is odd}
2	2.5	1	1	0
3	2.5	2	1/2	{0, if i is even}, {7, if i is odd}
4	5	1	1	0
5	5	2	1/2	{0, if i is even}, {7, if i is odd}
6	0	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
7	2.5	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
8	5	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
9	7.5	1	1	0
10	7.5	2	1/2	{0, if i is even}, {7, if i is odd}
11	7.5	2	1/2	{0, if i is even}, { $N_{\text{synt}}^{\text{CORESET}}$, if i is odd}
12	0	1	2	0
13	5	1	2	0
14	Reserved			
15	Reserved			

Table 13-13 of 3GPP TS 38.213 V15.15.0

Table 13-13: PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 2 and {SS/PBCH block, PDCCH} SCS {120, 60} kHz

Index	PDCCH monitoring occasions (SFN and slot number)	First symbol index ($k = 0, 1, \dots, 15$)
0	$\text{SFN}_C = \text{SFN}_{\text{SSB},i}$ $n_C = n_{\text{SSB},i}$	$0, 1, 6, 7$ for $i = 4k, i = 4k + 1, i = 4k + 2, i = 4k + 3$
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

Table 13-14 of 3GPP TS 38.213 V15.15.0

Table 13-14: PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 2 and {SS/PBCH block, PDCCH} SCS {240, 120} kHz

Index	PDCCH monitoring occasions (SFN and slot number)	First symbol index ($k = 0, 1, \dots, 7$)
0	$\text{SFN}_C = \text{SFN}_{\text{SSB},i}$ $n_C = n_{\text{SSB},i} \text{ or } n_C = n_{\text{SSB},i} - 1$	$0, 1, 2, 3, 0, 1 \text{ in } i = 8k, i = 8k + 1, i = 8k + 2, i = 8k + 3,$ $i = 8k + 6, i = 8k + 7 \text{ (} n_C = n_{\text{SSB},i} \text{)}$ $12, 13 \text{ in } i = 8k + 4, i = 8k + 5 \text{ (} n_C = n_{\text{SSB},i} - 1 \text{)}$
1		Reserved
2		Reserved
3		Reserved
4		Reserved
5		Reserved
6		Reserved
7		Reserved
8		Reserved
9		Reserved
10		Reserved
11		Reserved
12		Reserved
13		Reserved
14		Reserved
15		Reserved

Table 13-15 of 3GPP TS 38.213 V15.15.0

Table 13-15: PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 3 and {SS/PBCH block, PDCCH} SCS {120, 120} kHz

Index	PDCCH monitoring occasions (SFN and slot number)	First symbol index ($k = 0, 1, \dots, 15$)
0	$\text{SFN}_C = \text{SFN}_{\text{SSB},i}$ $n_C = n_{\text{SSB},i}$	$4, 8, 2, 6$ in $i = 4k, i = 4k + 1, i = 4k + 2, i = 4k + 3$
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	