

EXHIBIT C1

Patent Number: US 10,448,430

Patent Title: Group based random access method device and system

Filing Date: 2016-05-13

Publication Date: 2019-10-15

Claim 1: A random access method, comprising:

sending, by a first User Equipment (UE) in a UE group, a preamble to an evolved Node B (eNB) over a time-frequency resource, the time-frequency resource comprising a time domain resource and a frequency domain resource;

monitoring, by at least one of the first UE or a second UE in the UE group, a Random Access Response (RAR) corresponding to the preamble and sent by the eNB, wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group; and

after monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB:

sending, by at least one of the first UE or the second UE, a message 3 according to a Uplink (UL) grant allocated thereto, wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number.

Accused Product: Samsung Galaxy A13 5G Smartphone

References Used:

Samsung Galaxy A13 5G Highlights

Samsung Galaxy A13 5G Models

Samsung Galaxy A13 5G Compare

Buy Samsung Galaxy A13 5G (Unlocked)

3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control)

3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2)

3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification)

Reference Links:

<https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXXAA>

<https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXXAA#models>

<https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXXAA#compare>

<https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>

https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf

https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf

https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf

Overview

Plaintiff accuses the making, using, selling, offering for sale and/or importation of Defendant Samsung (fka SAMSUNG ELECTRONICS CO., LTD.) and Defendant’s parents, affiliates, subsidiaries (“Samsung” or “Defendant”) accused system and method, including without limitation the products implementing 3GPP 5th generation telecommunications technology standard (5G) features (Galaxy A13 5G Smartphone) and all other substantially similar products (the “Accused Device(s)”) of directly infringing U.S. Patent No. (the “’430 Patent”). The term “Accused Device(s)” includes the associated computer hardware and internal semiconductors, software and data, and processes and methods related thereto. The foregoing infringing products includes operating characteristics that infringe upon the claims of the ’430 Patent which teaches a random-access method intended to save PRACH resources and meet requirements for a huge number of machine communications. The technical solution of the ’430 Patent enables a group of UEs to only occupy a PRACH resource (including a time domain resource, a frequency domain resource and a preamble) in a random access, so that PRACH resources can be greatly saved, thereby meeting requirements for a huge number of machine communications.

Plaintiff further accuses Samsung of indirectly infringing the ’430 Patent by providing its customers and others the Accused Devices to utilize in an infringing manner. Samsung intends to cause infringement by its customers and users as Samsung instructs the users to use the Accused Device in an infringing manner for example, by providing features like HyperFast downloads, lag-free gaming and streaming, HD video calling, etc. Samsung further instructs users to operate the Accused Device in an infringing manner, for example, by providing instructions on using 5G enabled features like HyperFast downloads, lag-free gaming and streaming, HD video calling, etc. Samsung also provides support services for the Accused Device, including providing instructions, configurations, guides, online materials and technical support.

The asserted claims include elements that are implemented, at least in part, by proprietary electronics, firmware and software in the Accused Device. The precise designs, processes, and algorithms used in them are held secret, at least in part, and are not publicly available in their entirety. An inspection of the Accused Device, and an analysis of Samsung’s documentation and/or source code may be necessary to fully and accurately describe all infringing features and functionality of the Accused Device and, accordingly, Plaintiff reserves the right to supplement these contentions once such information is made available to Plaintiff. Furthermore, Plaintiff reserves the right to revise these contentions, including as discovery in the case progresses, in view of the Court's final claim construction in this action and in connection with the provision of its expert reports.

10,448,430 Claim 1	Evidence
1. A random access method, comprising:	This is the preamble of the claim and is not limiting. This element, if construed as a limitation, is present literally and under the doctrine of equivalents in the Accused Device. The Accused Device is a smartphone device comprising Octa-Core processor, PLS TFT LCD display, high resolution front and rear cameras, 4GB RAM with 64GB internal storage and 5000mAh battery. The Accused Device is configured to support features like Side Sensor Fingerprint, expandable memory etc.

The Accused Device is available in different models varying based on Cell Phone Carrier, Internal Memory and Color. The various models available for the Accused Device are A136UZKDXAA, SM-A136ULGDXAA, SM-A136UZKAATT, SM-A136ULGAATT, SM-A136UZKAXAU, and SM-A136UZKAUSC.



Galaxy A13 5G (Unlocked)

SM-A136UZKDXAA ★★★★★ 5.0 (2) [Share your product experience](#)

Galaxy A13 5G¹ is our most affordable 5G phone, offering you the blazing-fast speed² and connectivity you need at a price you'll love.

DEVICE

GALAXY A02S

GALAXY A03S

GALAXY A12

GALAXY A13 5G

GALAXY A32 5G

CARRIER

Unlocked \$249.99

T Mobile \$249.99

AT&T \$249.99

uscellular \$249.99

CAPACITY

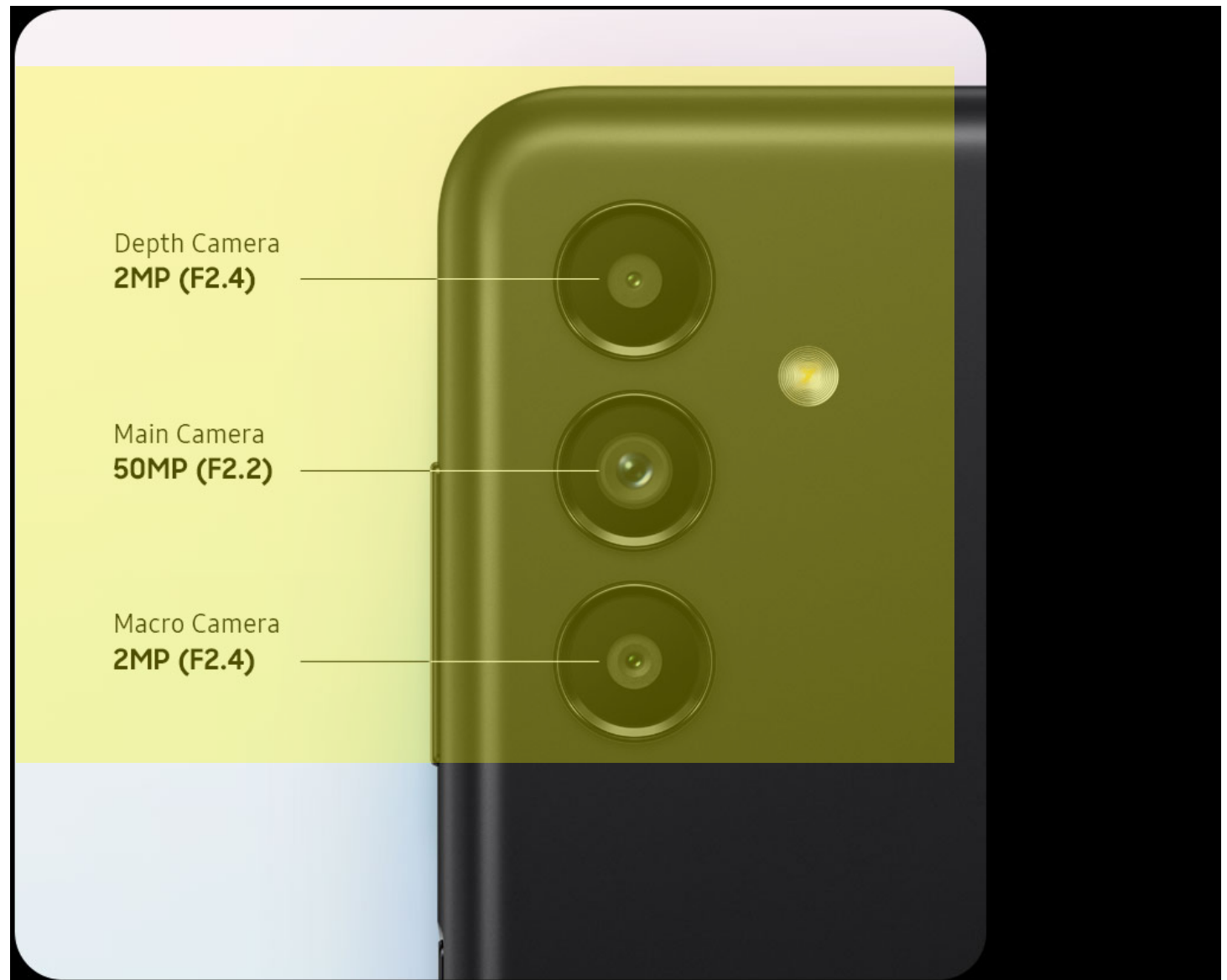
64GB

COLOR Black

Image of the Accused Device Galaxy A13 5G Smartphone SM-A136UZKDXAA (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).



Screenshot showing Image of the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXXAA#models>).



Screenshot showing camera of the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

Processor
Octa-core

RAM
4GB

Storage
64GB
+ Up to 1TB (microSD card)



Screenshot showing features of the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

			Galaxy A13 5G
			● Black
	Colors		
	Screen size*		6.5"
	Internal Storage		64GB
	RAM		4GB
	Expandable Storage**		up to 1TB
	Cellular & Wireless***		5G, Sub 6

	<table><tr><td>Display type</td><td>Flat</td></tr><tr><td>Fingerprint Sensor</td><td>Side Fingerprint Sensor</td></tr><tr><td>Front Camera</td><td>5MP Selfie Camera</td></tr><tr><td>Rear Camera</td><td>50MP Main Camera 2MP Macro Camera 2MP Depth Camera</td></tr><tr><td>Battery Capacity****</td><td> 5000mAh (typical)</td></tr></table> Screenshot showing features of the Accused Device (available from https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#compare). The Accused Device can be configured as a mobile terminal to support 5G telecommunications standard for providing services like blazing-fast speed, and virtually lag-free download and stream.	Display type	Flat	Fingerprint Sensor	Side Fingerprint Sensor	Front Camera	5MP Selfie Camera	Rear Camera	50MP Main Camera 2MP Macro Camera 2MP Depth Camera	Battery Capacity****	 5000mAh (typical)
Display type	Flat										
Fingerprint Sensor	Side Fingerprint Sensor										
Front Camera	5MP Selfie Camera										
Rear Camera	50MP Main Camera 2MP Macro Camera 2MP Depth Camera										
Battery Capacity****	 5000mAh (typical)										



Galaxy A13 5G

● Black

Colors

Screen size*

6.5"

Internal Storage

64GB

RAM

4GB

Expandable Storage**

up to 1TB

Cellular & Wireless***

5G, Sub 6

Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#compare>).

Galaxy A13 5G⁸

Everything you need, plus 5G

We added 5G to powerful core features like a versatile triple camera and expandable storage² so you can download, stream, and connect virtually lag-free.

Starting from \$174.99 with eligible trade in⁹

Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#models>).

Galaxy A13 5G (Unlocked)

♥ Wishlist

SM-A136UZKDXAA



5.0 (1)

[Share your product experience](#)

Galaxy A13 5G¹ is our most affordable 5G phone, offering you the blazing-fast speed² and connectivity you need at a price you'll love.

Network 2G GSM GSM850, GSM900, DCS1800, PCS1900	3G UMTS B1(2100), B2(1900), B4(AWS), B5(850), B8(900)	4G FDD LTE B1(2100), B2(1900), B3(1800), B4(AWS), B5(850), B7(2600), B12(700), B13(700), B14(700), B20(800), B25(1900), B26(850), B29(700), B30(2300), B66(AWS-3), B71(600)
4G TDD LTE B38(2600), B39(1900), B40(2300), B41(2500), B48(3600)	SIM Slot Type SIM 1 + SIM 2 + MicroSD	5G FDD Sub6 N2(1900), N5(850), N66(AWS-3), N71(600)
5G TDD mmWave N41(2500), N48(3500), N77(3700)		

Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

Upon information and belief, the Accused Device is configured as a User Equipment Terminal and supports 3GPP 5G Standard, including but not limited to 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control), 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2) and 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification).

ETSI TS 138 213 V16.5.0 (2021-04)



**5G;
NR;
Physical layer procedures for control
(3GPP TS 38.213 version 16.5.0 Release 16)**

1 Scope

The present document specifies and establishes the characteristics of the physical layer procedures for control operations in 5G-NR.

Screenshot showing the scope of standard 3GPP TS 38.213 version 16.5.0 Release 16 supported by the Accused Device (available on page 7 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

ETSI TS 138 300 V16.5.0 (2021-04)



**5G;
NR;
NR and NG-RAN Overall description;
Stage-2
(3GPP TS 38.300 version 16.5.0 Release 16)**

1 Scope

The present document provides an overview and overall description of the NG-RAN and focuses on the radio interface protocol architecture of NR connected to 5GC (E-UTRA connected to 5GC is covered in the 36 series). Details of the radio interface protocols are specified in companion specifications of the 38 series.

Screenshot showing the scope of standard 3GPP TS 38.300 version 16.5.0 Release 16 supported by the Accused Device (available on page 11 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

ETSI TS 138 321 V16.4.0 (2021-04)



**5G;
NR;
Medium Access Control (MAC) protocol specification
(3GPP TS 38.321 version 16.4.0 Release 16)**

1 Scope

The present document specifies the NR MAC protocol.

Screenshot showing the scope of standard 3GPP TS 38.321 version 16.4.0 Release 16 supported by the Accused Device (available on page 9 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

Upon information and belief, the Accused Device is configured to perform the random access procedure. The random access procedure is triggered by a number of events.

5.1 Random Access procedure

5.1.1 Random Access procedure initialization

The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell shall only be initiated by a PDCCH order with *ra-PreambleIndex* different from 0b000000.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 17 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

9.2.6 Random Access Procedure

The random access procedure is triggered by a number of events:

- Initial access from RRC_IDLE;
- RRC Connection Re-establishment procedure;
- DL or UL data arrival during RRC_CONNECTED when UL synchronisation status is "non-synchronised";
- UL data arrival during RRC_CONNECTED when there are no PUCCH resources for SR available;
- SR failure;
- Request by RRC upon synchronous reconfiguration (e.g. handover);
- Transition from RRC_INACTIVE;
- To establish time alignment for a secondary TAG;
- Request for Other SI (see clause 7.3);
- Beam failure recovery;
- Consistent UL LBT failure on SpCell.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Accused Device is configured to support Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

Screenshot showing Type-1 L1 Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 41 from

https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the Accused Device is also configured to support 4-step RA type with MSG1. The RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA).

	Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below. The UE selects the type of random access at initiation of the random access procedure based on network configuration: - when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type; - when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type; - when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type. Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g., data processors and other internal components), and software (e.g., software and firmware).
1a. sending, by a first User Equipment (UE) in a UE group, a preamble to an evolved Node B (eNB) over a time-frequency resource, the time-frequency resource comprising a time domain resource and a frequency domain resource;	The Accused Device is configured as a first User Equipment (UE) in a UE group and can send a preamble to an evolved Node B (eNB) over a time-frequency resource, the time-frequency resource comprising a time domain resource and a frequency domain resource. Upon information and belief, the Accused Device is configured as a User Equipment Terminal and supports 3GPP 5G Standard, including but not limited to 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control), 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2) and 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification). The Accused Device is configured to select the type of random access at the initiation of the random access procedure based on the network configuration and sends a random access preamble to an evolved Node B (eNB). Upon information and belief, the Accused Device is also configured to select the 4-step RA type with MSG1. The MSG1 of the 4-step RA type consists of a preamble on PRACH wherein PRACH is a time-frequency resource.

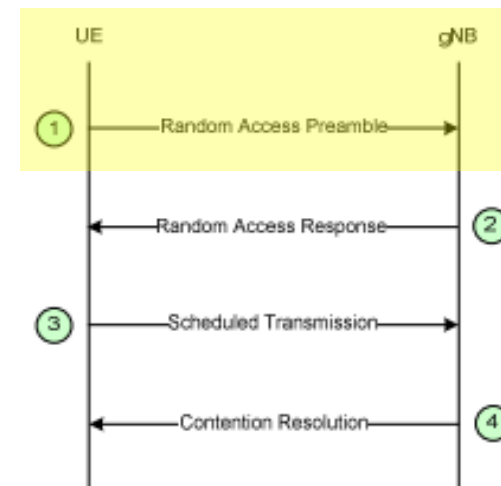
Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below.

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

5.3.4 Random access

Random access preamble sequences, of four different lengths are supported. Sequence length 839 is applied with subcarrier spacings of 1.25 and 5 kHz, sequence length 139 is applied with subcarrier spacings of 15, 30, 60 and 120 kHz, and sequence lengths of 571 and 1151 are applied with subcarrier spacings of 30 kHz and 15 kHz respectively. Sequence length 839 supports unrestricted sets and restricted sets of Type A and Type B, while sequence lengths 139, 571, and 1151 support unrestricted sets only. Sequence length 839 is only used for operation with licensed channel access while sequence length 139 can be used for operation with either licensed or shared spectrum channel access. Sequence lengths of 571 and 1151 can be used only for operation with shared spectrum channel access.

Multiple PRACH preamble formats are defined with one or more PRACH OFDM symbols, and different cyclic prefix and guard time. The PRACH preamble configuration to use is provided to the UE in the system information.

Screenshot showing PRACH resource from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 34 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Accused Device configured as the User Equipment (UE) transmits the Random Access Preamble with the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted. The RA-RNTI associated with the PRACH resource comprises a time domain resource and a frequency domain resource.

5.1.3 Random Access Preamble transmission

The MAC entity shall, for each Random Access Preamble:

- 1> if *PREAMBLE_TRANSMISSION_COUNTER* is greater than one; and
- 1> if the notification of suspending power ramping counter has not been received from lower layers; and
- 1> if LBT failure indication was not received from lower layers for the last Random Access Preamble transmission; and
- 1> if SSB or CSI-RS selected is not changed from the selection in the last Random Access Preamble transmission:
 - 2> increment *PREAMBLE_POWER_RAMPING_COUNTER* by 1.
- 1> select the value of *DELTA_PREAMBLE* according to clause 7.3;
- 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to $\text{preambleReceivedTargetPower} + \text{DELTA_PREAMBLE} + (\text{PREAMBLE_POWER_RAMPING_COUNTER} - 1) \times \text{PREAMBLE_POWER_RAMPING_STEP} + \text{POWER_OFFSET_2STEP_RA}$;
- 1> except for contention-free Random Access Preamble for beam failure recovery request, compute the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted;
- 1> instruct the physical layer to transmit the Random Access Preamble using the selected PRACH occasion, corresponding RA-RNTI (if available), *PREAMBLE_INDEX*, and *PREAMBLE_RECEIVED_TARGET_POWER*.

The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s_id + 14 \times t_id + 14 \times 80 \times f_id + 14 \times 80 \times 8 \times ul_carrier_id$$

where *s_id* is the index of the first OFDM symbol of the PRACH occasion ($0 \leq s_id < 14$), *t_id* is the index of the first slot of the PRACH occasion in a system frame ($0 \leq t_id < 80$), where the subcarrier spacing to determine *t_id* is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], *f_id* is the index of the PRACH occasion in the frequency domain ($0 \leq f_id < 8$), and *ul_carrier_id* is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier).

Screenshot showing Random Access Preamble transmission by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on pages 27 and 28 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

During the random access procedure, the following identities are also used:

- RA-RNTI: identification of the Random Access Response in the downlink;

Screenshot showing definition of RA-RNTI supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the UE receives a preamble index, a preamble SCS, PPRACH,target , a corresponding RA-RNTI, and a PRACH resource (time resources and frequency resources) from the higher layers (eNB). The PRACH resources are used for the transmission of preamble over a time-frequency resource.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

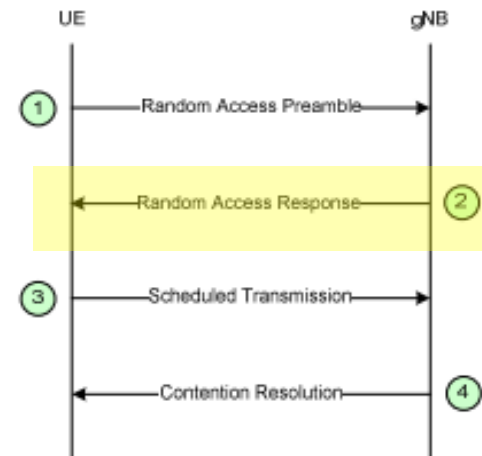
From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

8.1 Random access preamble

Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following:

- A configuration for PRACH transmission [4, TS 38.211].
- A preamble index, a preamble SCS, $P_{PRACH,target}$, a corresponding RA-RNTI, and a PRACH resource.

	A PRACH is transmitted using the selected PRACH format with transmission power $P_{\text{PRACH},b,f,c}(i)$, as described in Clause 7.4, on the indicated PRACH resource. For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>. Screenshot showing the transmission of random access preamble (Msg1) in a PRACH from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41 and 42 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
1b. monitoring, by at least one of the first UE or a second UE in the UE group, a Random Access Response (RAR) corresponding to the preamble and sent by the eNB, wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group; and	The Accused Device can be configured as the first UE or a second UE in the UE group. The Accused Device is configured to monitor a Random Access Response (RAR) corresponding to the preamble and sent by the eNB, wherein the first UE is at least one UE in the UE group, and the second UE is all or some UEs in the UE group. Upon information and belief, the Accused Device is configured to monitor a Random Access Response (RAR) corresponding to the preamble from the eNB. For contention-based random access (CBRA), the UE receives a Random Access Response (RAR) from the eNB. The UE monitors the physical downlink channel PDCCH for Random Access Response (RAR) while the ra-ResponseWindow is running. The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

5.1.4 Random Access Response reception

Once the Random Access Preamble is transmitted and regardless of the possible occurrence of a measurement gap, the MAC entity shall:

- 1> if the contention-free Random Access Preamble for beam failure recovery request was transmitted by the MAC entity:
 - 2> start the *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;
 - 2> monitor for a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* of the SpCell identified by the C-RNTI while *ra-ResponseWindow* is running.
- 1> else:
 - 2> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;
 - 2> monitor the PDCCH of the SpCell for Random Access Response(s) identified by the RA-RNTI while the *ra-ResponseWindow* is running.

Screenshot showing Random Access Response reception by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in Clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in Clause 10.1. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.

If the UE detects the DCI format 1_0 with CRC scrambled by the corresponding RA-RNTI and LSBs of a SFN field in the DCI format 1_0, if included and applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers parse the transport block for a random access preamble identity

(RAPID) associated with the PRACH transmission. If the higher layers identify the RAPID in RAR message(s) of the transport block, the higher layers indicate an uplink grant to the physical layer. This is referred to as random access response (RAR) UL grant in the physical layer.

Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 46 and 47 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the UE initiating the random access procedure may be UEs in RRC-IDLE and RRC-INACTIVE protocol states (UE group). The random access procedure is triggered by a number of events.

7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by *SIB1*.

For UEs in RRC_IDLE and RRC_INACTIVE, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4.

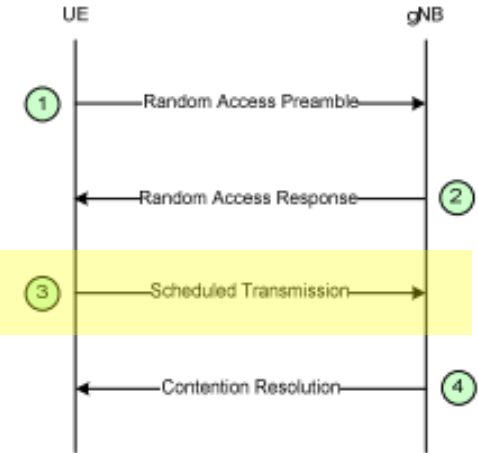
Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 54 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

7.2 Protocol States

RRC supports the following states which can be characterised as follows:

- **RRC_IDLE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging for mobile terminated data is initiated by 5GC;
 - DRX for CN paging configured by NAS.
- **RRC_INACTIVE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging is initiated by NG-RAN (RAN paging);
 - RAN-based notification area (RNA) is managed by NG- RAN;
 - DRX for RAN paging configured by NG-RAN;
 - 5GC - NG-RAN connection (both C/U-planes) is established for UE;
 - The UE AS context is stored in NG-RAN and the UE;
 - NG-RAN knows the RNA which the UE belongs to.

Screenshot showing Protocol States supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 52 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

	To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
1c. after monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB: sending, by at least one of the first UE or the second UE, a message 3 according to a Uplink (UL) grant allocated thereto, wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number.	The Accused Device can be configured as the first UE or a second UE in the UE group. The Accused Device is configured for, after monitoring the RAR corresponding to the preamble and sent by the eNB, sending a message 3 according to a Uplink (UL) grant allocated thereto, wherein the message 3 comprises a number of UEs having random access requests in the UE group or a number of UEs contained in the UE group or a pre-set UE number. Upon information and belief, for contention-based random access (CBRA), the Accused Device is configured to send a Msg3 using the UL grant scheduled in the response. The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.  <pre> sequenceDiagram participant UE participant gNB Note over UE: 1 UE->>gNB: Random Access Preamble Note over gNB: 2 gNB->>UE: Random Access Response Note over UE: 3 UE->>gNB: Scheduled Transmission Note over gNB: 4 gNB->>UE: Contention Resolution </pre> (a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Msg3 comprises a C-RNTI field which is a unique UE identification used as an identifier of the RRC Connection and for scheduling. The C-RNTI MAC CE field contains the C-RNTI of the MAC entity (User Equipment).

Upon information and belief, the C-RNTI MAC CE field comprises a pre-set UE number.

Msg3: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

Screenshot showing Msg3 definition from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

- 1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;
- 1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;
- 1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:
 - 2> if the C-RNTI MAC CE was included in Msg3:
 - 3> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI; or

Screenshot showing Msg3 transmission with C-RNTI from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

- 1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or
- 1> if an uplink grant has been received in a Random Access Response:
 - 2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:
 - 3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.
 - 2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:
 - 3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

Screenshot showing Msg3 transmission according to a Uplink (UL) grant from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 42 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

6.1.3.2 C-RNTI MAC CE

The C-RNTI MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2.

It has a fixed size and consists of a single field defined as follows (Figure 6.1.3.2-1):

- C-RNTI: This field contains the C-RNTI of the MAC entity. The length of the field is 16 bits.

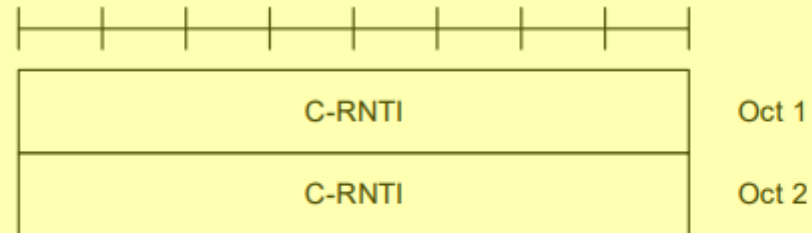


Figure 6.1.3.2-1: C-RNTI MAC CE

Screenshot showing C-RNTI MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.1 UE Identities

In this clause, the identities used by NR connected to 5GC are listed. For scheduling at cell level, the following identities are used:

- C-RNTI: unique UE identification used as an identifier of the RRC Connection and for scheduling;

Screenshot showing C-RNTI from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

8.3 PUSCH scheduled by RAR UL grant

An active UL BWP, as described in Clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

	A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI. Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321]. The UE always transmits the PUSCH scheduled by a RAR UL grant without repetitions. Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 49 and 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 2	Evidence
2. The method according to claim 1, wherein the first UE is at least one of the following: at least one fixed UE; or, at least one UE determined according to a pre-set rule; or, at least one UE notified by the eNB.	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. Upon information and belief, the Accused Device is a UE configured to perform random access procedure. The random access procedure is initiated by the MAC entity (UE) itself on receiving of a PDCCH order from the eNB, or is triggered by a number of events. PDCCH Order is a mechanism by which eNB force UE to initiate PRACH. The UE selects the type of random access at initiation of the random access procedure based on network configuration. 5.1 Random Access procedure 5.1.1 Random Access procedure initialization The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell shall only be initiated by a PDCCH order with <i>ra-PreambleIndex</i> different from 0b000000. Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 17 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by *SIB1*.

For UEs in RRC_IDLE and RRC_INACTIVE, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 54 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

9.2.6 Random Access Procedure

The random access procedure is triggered by a number of events:

- Initial access from RRC_IDLE;
- RRC Connection Re-establishment procedure;
- DL or UL data arrival during RRC_CONNECTED when UL synchronisation status is "non-synchronised";
- UL data arrival during RRC_CONNECTED when there are no PUCCH resources for SR available;
- SR failure;
- Request by RRC upon synchronous reconfiguration (e.g. handover);
- Transition from RRC_INACTIVE;
- To establish time alignment for a secondary TAG;
- Request for Other SI (see clause 7.3);
- Beam failure recovery;
- Consistent UL LBT failure on SpCell.

Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below.

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

If a random access procedure is initiated by a PDCCH order to the UE, a PRACH transmission is with a same SCS as a PRACH transmission initiated by higher layers.

	Screenshot showing Type-1 L1 Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 41 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g., data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 3	Evidence
3. The method according to claim 1, wherein at least one of the preamble, the time domain resource or the frequency domain resource is pre-set, or determined by a group Identifier (ID) of the UE group, or notified by the eNB.	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein at least one of the preamble, the time domain resource or the frequency domain resource is pre-set, or determined by a group Identifier (ID) of the UE group, or notified by the eNB. Upon information and belief, the UE receives a preamble index, a preamble SCS, $P_{\text{PRACH,target}}$, a corresponding RA-RNTI, and a PRACH resource (time resources and frequency resources) from the higher layers (eNB). 8 Random access procedure Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements. Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A. Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers: - Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission). - Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)). From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

	8.1 Random access preamble Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following: - A configuration for PRACH transmission [4, TS 38.211]. - A preamble index, a preamble SCS, $P_{\text{PRACH,target}}$, a corresponding RA-RNTI, and a PRACH resource. A PRACH is transmitted using the selected PRACH format with transmission power $P_{\text{PRACH,b,f,c}}(i)$, as described in Clause 7.4, on the indicated PRACH resource. For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>. Screenshot showing the transmission of random access preamble (Msg1) in a PRACH from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41 and 42 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g., data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 4	Evidence
4. The method according to claim 3, wherein at least one of the preamble, the time domain resource or the frequency domain resource corresponds to the number of UEs having random access requests in the UE group or the number of UEs contained in the UE group or the pre-set UE number.	Every claim limitation of claim 3 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein at least one of the preamble, the time domain resource or the frequency domain resource corresponds to the number of UEs having random access requests in the UE group or the number of UEs contained in the UE group or the pre-set UE number. Upon information and belief, the Accused Device configured as the User Equipment (UE) transmits the Random Access Preamble with the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted. The RA-RNTI associated with the PRACH resource comprises a time domain resource and a frequency domain resource.

5.1.3 Random Access Preamble transmission

The MAC entity shall, for each Random Access Preamble:

- 1> if *PREAMBLE_TRANSMISSION_COUNTER* is greater than one; and
- 1> if the notification of suspending power ramping counter has not been received from lower layers; and
- 1> if LBT failure indication was not received from lower layers for the last Random Access Preamble transmission; and
- 1> if SSB or CSI-RS selected is not changed from the selection in the last Random Access Preamble transmission:
 - 2> increment *PREAMBLE_POWER_RAMPING_COUNTER* by 1.
- 1> select the value of *DELTA_PREAMBLE* according to clause 7.3;
- 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to $\text{preambleReceivedTargetPower} + \text{DELTA_PREAMBLE} + (\text{PREAMBLE_POWER_RAMPING_COUNTER} - 1) \times \text{PREAMBLE_POWER_RAMPING_STEP} + \text{POWER_OFFSET_2STEP_RA}$;
- 1> except for contention-free Random Access Preamble for beam failure recovery request, compute the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted;
- 1> instruct the physical layer to transmit the Random Access Preamble using the selected PRACH occasion, corresponding RA-RNTI (if available), *PREAMBLE_INDEX*, and *PREAMBLE_RECEIVED_TARGET_POWER*.

The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s_id + 14 \times t_id + 14 \times 80 \times f_id + 14 \times 80 \times 8 \times ul_carrier_id$$

where *s_id* is the index of the first OFDM symbol of the PRACH occasion ($0 \leq s_id < 14$), *t_id* is the index of the first slot of the PRACH occasion in a system frame ($0 \leq t_id < 80$), where the subcarrier spacing to determine *t_id* is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], *f_id* is the index of the PRACH occasion in the frequency domain ($0 \leq f_id < 8$), and *ul_carrier_id* is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier).

Screenshot showing Random Access Preamble transmission by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on pages 27 and 28 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

During the random access procedure, the following identities are also used:

- RA-RNTI: identification of the Random Access Response in the downlink;

Screenshot showing definition of RA-RNTI supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

The UE receives a preamble index, a preamble SCS, PPRACH,target , a corresponding RA-RNTI, and a PRACH resource (time resources and frequency resources) from the higher layers (eNB). The PRACH resources are used for the transmission of preamble over a time-frequency resource.

Upon information and belief, the preamble, the time resource and the frequency resource correspond to the UE receiving the PDCCH order from eNB.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

	8.1 Random access preamble Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following: - A configuration for PRACH transmission [4, TS 38.211]. - A preamble index, a preamble SCS, $P_{\text{PRACH,target}}$, a corresponding RA-RNTI, and a PRACH resource. A PRACH is transmitted using the selected PRACH format with transmission power $P_{\text{PRACH,b,f,c}}(i)$, as described in Clause 7.4, on the indicated PRACH resource. For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>. Screenshot showing the transmission of random access preamble (Msg1) in a PRACH from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41 and 42 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 5	Evidence
5. The method according to claim 1, wherein monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises: descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises descrambling, by at least one of the first UE or the second UE, a Cyclic Redundancy Check (CRC) of Downlink Control Information (DCI) for scheduling the RAR according to a pre-set Random Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble, and receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant.

Access Radio Network Temporary Identity (RA-RNTI) or an RA-RNTI corresponding to the preamble, and receiving the RAR, the RAR comprising at least one of at least one Temporary Cell Radio Network Temporary Identity (TC-RNTI) or at least one Uplink (UL) grant; and	8.2 Random access response - Type-1 random access procedure In response to a PRACH transmission, a UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in Clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in Clause 10.1. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by <i>ra-ResponseWindow</i>. If the UE detects the DCI format 1_0 with CRC scrambled by the corresponding RA-RNTI and LSBs of a SFN field in the DCI format 1_0, if included and applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers parse the transport block for a random access preamble identity (RAPID) associated with the PRACH transmission. If the higher layers identify the RAPID in RAR message(s) of the transport block, the higher layers indicate an uplink grant to the physical layer. This is referred to as random access response (RAR) UL grant in the physical layer. Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 46 and 47 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).
5a. determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR; or monitoring, by at least one of the first UE or the second UE, the RAR corresponding to the preamble and sent by the eNB comprises: determining, by at least one of the first UE or the second UE, corresponding RA-RNTIs according to at least one of respective IDs or preambles,	The Accused Device is configured for determining at least one of a TC-RNTI or UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR.

descrambling a CRC of DCI for scheduling the RAR according to the corresponding RA-RNTIs, and receiving corresponding RARs, the RAR comprising at least one of a TC-RNTI or a UL grant allocated to the first UE or second UE.

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

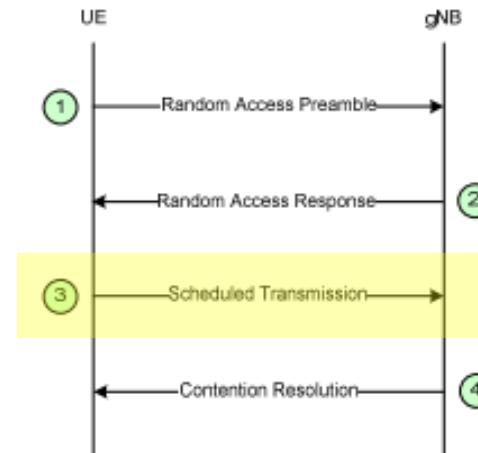
- 1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or
- 1> if an uplink grant has been received in a Random Access Response:
 - 2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:
 - 3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.
 - 2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:
 - 3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

Screenshot showing Uplink (UL) grant reception from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 42 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.3 PUSCH scheduled by RAR UL grant

An active UL BWP, as described in Clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

	A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI. Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321]. The UE always transmits the PUSCH scheduled by a RAR UL grant without repetitions. Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 49 and 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).
10,448,430 Claim 6	Evidence
6. The method according to claim 5, wherein determining, by at least one of the first UE or the second UE, at least one of the TC-RNTI or the UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR comprises: determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or a UL grant allocated thereto according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule.	Every claim limitation of claim 5 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein determining, by at least one of the first UE or the second UE, at least one of the TC-RNTI or the UL grant allocated thereto according to at least one of at least one TC-RNTI or at least one UL grant contained in the RAR comprises determining, by at least one of the first UE or the second UE, at least one of a TC-RNTI or a UL grant allocated thereto according to at least one of an ID of the first UE or the second UE in accordance with a pre-set rule. Upon information and belief, for contention-based random access (CBRA), the Accused Device is configured to send a Msg3 using the UL grant scheduled in the response. The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Msg3 comprises a C-RNTI field which is a unique UE identification used as an identifier of the RRC Connection and for scheduling. The C-RNTI MAC CE field contains the C-RNTI of the MAC entity (User Equipment).

Upon information and belief, the C-RNTI MAC CE field comprises a pre-set UE number.

Msg3: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

Screenshot showing Msg3 definition from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

- 1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;
- 1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;
- 1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:
 - 2> if the C-RNTI MAC CE was included in Msg3:
 - 3> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI; or

Screenshot showing Msg3 transmission with C-RNTI from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

- 1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or
- 1> if an uplink grant has been received in a Random Access Response:
 - 2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:
 - 3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.
 - 2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:
 - 3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

Screenshot showing Msg3 transmission according to a Uplink (UL) grant from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 42 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

6.1.3.2 C-RNTI MAC CE

The C-RNTI MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2.

It has a fixed size and consists of a single field defined as follows (Figure 6.1.3.2-1):

- C-RNTI: This field contains the C-RNTI of the MAC entity. The length of the field is 16 bits.

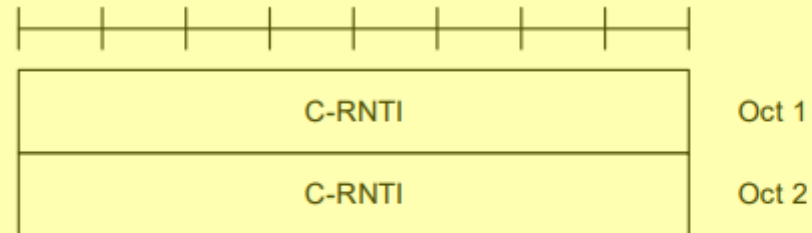


Figure 6.1.3.2-1: C-RNTI MAC CE

Screenshot showing C-RNTI MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.1 UE Identities

In this clause, the identities used by NR connected to 5GC are listed. For scheduling at cell level, the following identities are used:

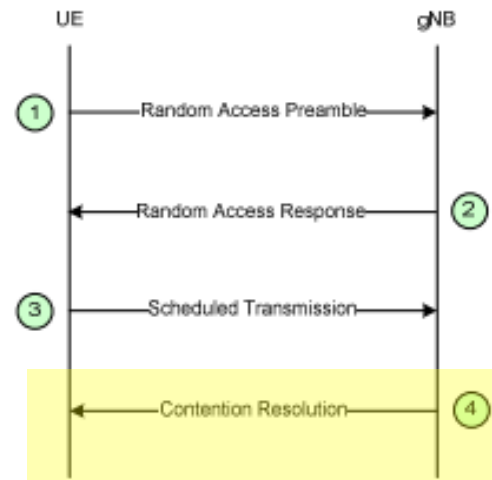
- C-RNTI: unique UE identification used as an identifier of the RRC Connection and for scheduling;

Screenshot showing C-RNTI from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

8.3 PUSCH scheduled by RAR UL grant

An active UL BWP, as described in Clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

	A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI. Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321]. The UE always transmits the PUSCH scheduled by a RAR UL grant without repetitions. Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 49 and 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 7	Evidence
7. The method according to claim 1, further comprising: after sending, by at least one of the first UE or the second UE, the message 3 according to the UL grant allocated thereto, receiving, by at least one of the first UE or the second UE, a message 4 sent by the eNB.	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured for after sending, by at least one of the first UE or the second UE, the message 3 according to the UL grant allocated thereto, receiving, by at least one of the first UE or the second UE, a message 4 sent by the eNB. Upon information and belief, for contention-based random access (CBRA), the Accused Device receives a message Msg4 as a contention resolution message. The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing Contention Resolution message received by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

Screenshot showing Contention Resolution message received by the Accused Device from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 41 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

- 1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;
- 1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;
- 1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:
 - 2> if the C-RNTI MAC CE was included in Msg3:

Screenshot showing Contention Resolution from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 35 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 8

Evidence

8. The method according to claim 7, wherein receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB comprises:
scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE.

Every claim limitation of claim 7 is present in the Accused Device as described above and incorporated herein by reference.

The Accused Device is configured wherein receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB comprises scrambling a CRC of DCI for scheduling the message 4 by using a TC-RNTI allocated to at least one of the first UE or the second UE.

8.4 PDSCH with UE contention resolution identity

In response to a PUSCH transmission scheduled by a RAR UL grant when a UE has not been provided a C-RNTI, the UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding TC-RNTI scheduling a PDSCH that includes a UE contention resolution identity [11, TS 38.321]. In response to the PDSCH reception with the UE contention resolution identity, the UE transmits HARQ-ACK information in a PUCCH. The PUCCH transmission is within a same active UL BWP as the PUSCH transmission. A minimum time between the last symbol of the PDSCH reception and the first symbol of the corresponding PUCCH transmission with the HARQ-ACK information is equal to $N_{T,1} + 0.5$ msec. $N_{T,1}$ is a time duration of N_1 symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured. For $\mu = 0$, the UE assumes $N_{1,0} = 14$ [6, TS 38.214].

Screenshot showing UE Contention Resolution from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 9	Evidence
9. The method according to claim 8, wherein the message 4 comprises at least one set of radio resources, radio resources allocated to at least one of the first UE or the second UE are determined by at least one of the first UE or the second UE according to at least one set of radio resources in the message 4; or the message 4 comprises a set of radio resources allocated to the first UE or second UE.	Every claim limitation of claim 8 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein the message 4 comprises at least one set of radio resources, radio resources allocated to at least one of the first UE or the second UE are determined by at least one of the first UE or the second UE according to at least one set of radio resources in the message 4 or the message 4 comprises a set of radio resources allocated to the first UE or second UE. Upon information and belief, the contention resolution message Msg4 comprises a Physical Downlink Shared Channel (PDSCH) allocated for contention resolution. The contention resolution message Msg4 comprises a UE Contention Resolution Identity identifying the MAC entity (UE).

8.4 PDSCH with UE contention resolution identity

In response to a PUSCH transmission scheduled by a RAR UL grant when a UE has not been provided a C-RNTI, the UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding TC-RNTI scheduling a PDSCH that includes a UE contention resolution identity [11, TS 38.321]. In response to the PDSCH reception with the UE contention resolution identity, the UE transmits HARQ-ACK information in a PUCCH. The PUCCH transmission is within a same active UL BWP as the PUSCH transmission. A minimum time between the last symbol of the PDSCH reception and the first symbol of the corresponding PUCCH transmission with the HARQ-ACK information is equal to $N_{T,1} + 0.5$ msec. $N_{T,1}$ is a time duration of N_1 symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured. For $\mu = 0$, the UE assumes $N_{1,0} = 14$ [6, TS 38.214].

Screenshot showing UE Contention Resolution from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

6.1.3.3 UE Contention Resolution Identity MAC CE

The UE Contention Resolution Identity MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-1.

It has a fixed 48-bit size and consists of a single field defined as follows (Figure 6.1.3.3-1):

- UE Contention Resolution Identity: This field contains the UL CCCH SDU. If the UL CCCH SDU is longer than 48 bits, this field contains the first 48 bits of the UL CCCH SDU.

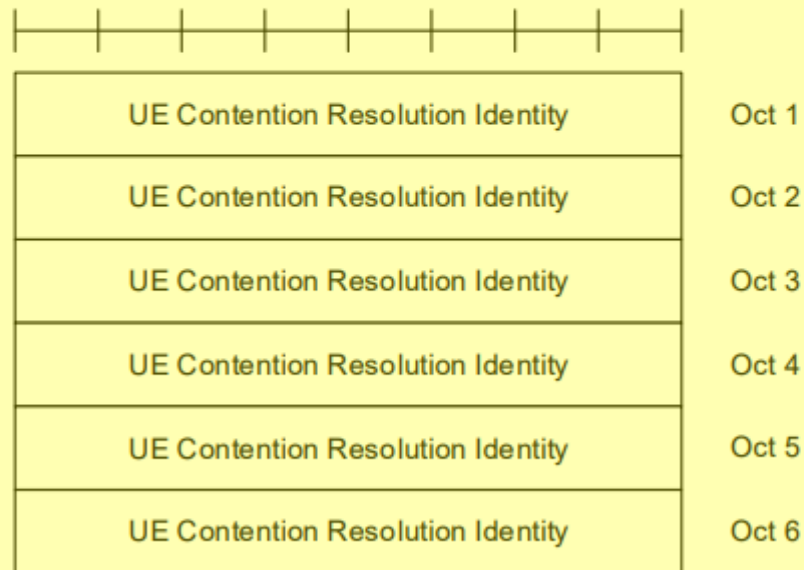


Figure 6.1.3.3-1: UE Contention Resolution Identity MAC CE

Screenshot showing UE Contention Resolution Identity MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 10	Evidence
10. The method according to claim 9, wherein the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule.	Every claim limitation of claim 9 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein the radio resources allocated to at least one of the first UE or the second UE are further determined by at least one of the first UE or the second UE according to an ID of at least one of the first UE or the second UE in accordance with a pre-set rule. Upon information and belief, the contention resolution message Msg4 comprises a UE Contention Resolution Identity identifying the MAC entity (UE). 8.4 PDSCH with UE contention resolution identity In response to a PUSCH transmission scheduled by a RAR UL grant when a UE has not been provided a C-RNTI, the UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding TC-RNTI scheduling a PDSCH that includes a UE contention resolution identity [11, TS 38.321]. In response to the PDSCH reception with the UE contention resolution identity, the UE transmits HARQ-ACK information in a PUCCH. The PUCCH transmission is within a same active UL BWP as the PUSCH transmission. A minimum time between the last symbol of the PDSCH reception and the first symbol of the corresponding PUCCH transmission with the HARQ-ACK information is equal to $N_{T,1} + 0.5$ msec. $N_{T,1}$ is a time duration of N_1 symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured. For $\mu = 0$, the UE assumes $N_{1,0} = 14$ [6, TS 38.214]. Screenshot showing UE Contention Resolution from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

6.1.3.3 UE Contention Resolution Identity MAC CE

The UE Contention Resolution Identity MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-1.

It has a fixed 48-bit size and consists of a single field defined as follows (Figure 6.1.3.3-1):

- UE Contention Resolution Identity: This field contains the UL CCCH SDU. If the UL CCCH SDU is longer than 48 bits, this field contains the first 48 bits of the UL CCCH SDU.

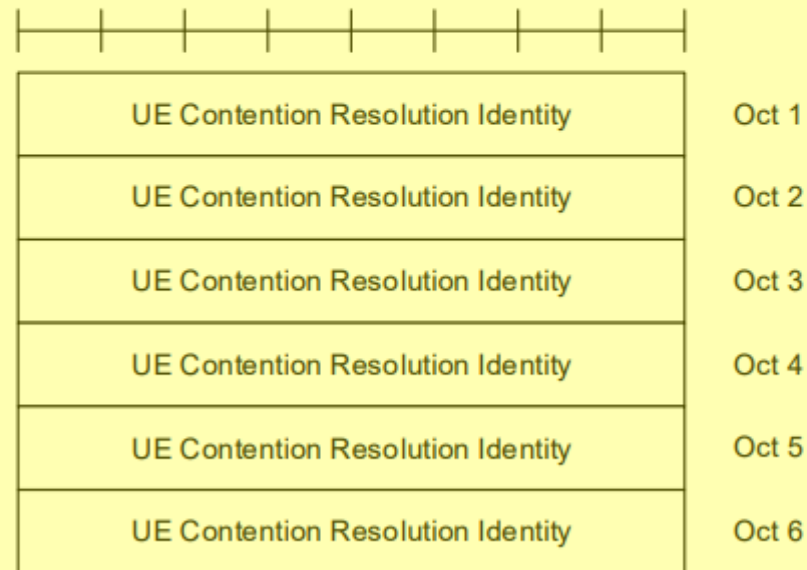


Figure 6.1.3.3-1: UE Contention Resolution Identity MAC CE

Screenshot showing UE Contention Resolution Identity MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 11	Evidence
11. The method according to claim 7, further comprising: after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, sending, by at least one of the first UE or the second UE, an indicating signal for notifying the eNB of a successful access of at least one of the first UE or the second UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) or an Acknowledgement (ACK) signal.	Every claim limitation of claim 7 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured such that after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, sending, by at least one of the first UE or the second UE, an indicating signal for notifying the eNB of a successful access of at least one of the first UE or the second UE to the eNB, wherein the indicating signal is a Scheduling Request (SR) or an Acknowledgement (ACK) signal. Upon information and belief, the Accused Device is configured to transmit an HARQ-ACK acknowledgement message to eNB in response to receiving the Physical Downlink Shared Channel (PDSCH) allocated for contention resolution. Further, in case the contention resolution procedure is successful, the UE acknowledge it to the higher layer (eNB). 8.4 PDSCH with UE contention resolution identity In response to a PUSCH transmission scheduled by a RAR UL grant when a UE has not been provided a C-RNTI, the UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding TC-RNTI scheduling a PDSCH that includes a UE contention resolution identity [11, TS 38.321]. In response to the PDSCH reception with the UE contention resolution identity, the UE transmits HARQ-ACK information in a PUCCH. The PUCCH transmission is within a same active UL BWP as the PUSCH transmission. A minimum time between the last symbol of the PDSCH reception and the first symbol of the corresponding PUCCH transmission with the HARQ-ACK information is equal to $N_{T,1} + 0.5$ msec. $N_{T,1}$ is a time duration of N_1 symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured. For $\mu = 0$, the UE assumes $N_{1,0} = 14$ [6, TS 38.214]. Screenshot showing UE Contention Resolution from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

	<pre> 2> else if the CCCH SDU was included in Msg3 and the PDCCH transmission is addressed to its TEMPORARY_C-RNTI: 3> if the MAC PDU is successfully decoded: 4> stop ra-ContentionResolutionTimer; 4> if the MAC PDU contains a UE Contention Resolution Identity MAC CE; and 4> if the UE Contention Resolution Identity in the MAC CE matches the CCCH SDU transmitted in Msg3: 5> consider this Contention Resolution successful and finish the disassembly and demultiplexing of the MAC PDU; 5> if this Random Access procedure was initiated for SI request: 6> indicate the reception of an acknowledgement for SI request to upper layers. </pre> Screenshot showing Contention Resolution from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 35 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 12	Evidence
12. The method according to claim 7, further comprising: after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating information, sent by the eNB, for indicating re-initiation of a random access of at	Every claim limitation of claim 7 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured such that after receiving, by at least one of the first UE or the second UE, the message 4 sent by the eNB, receiving, by at least one of the first UE or the second UE, indicating information, sent by the eNB, for indicating re-initiation of a random access of at least one of the first UE or the second UE. Upon information and belief, in case the contention resolution is not successful, the UE receives an indication from the eNB for re-initiation of the random access procedure by going back to Msg1 transmission.

least one of the first UE or the second UE.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.

Screenshot showing Random Access Procedure from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

1> if the Contention Resolution is considered not successful:

2> flush the HARQ buffer used for transmission of the MAC PDU in the Msg3 buffer;

2> increment *PREAMBLE_TRANSMISSION_COUNTER* by 1;

2> if *PREAMBLE_TRANSMISSION_COUNTER* = *preambleTransMax* + 1:

3> indicate a Random Access problem to upper layers.

3> if this Random Access procedure was triggered for SI request:

4> consider the Random Access procedure unsuccessfully completed.

2> if the Random Access procedure is not completed:

3> if the *RA_TYPE* is set to *4-stepRA*:

4> select a random backoff time according to a uniform distribution between 0 and the *PREAMBLE_BACKOFF*;

4> if the criteria (as defined in clause 5.1.2) to select contention-free Random Access Resources is met during the backoff time:

5> perform the Random Access Resource selection procedure (see clause 5.1.2);

4> else:

5> perform the Random Access Resource selection procedure (see clause 5.1.2) after the backoff time.

Screenshot showing Contention Resolution from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 36 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

Upon information and belief, in case the random access procedure is not successful, the HARQ operation performs retransmission of the random access resources as indicated in the Random Access Response (i.e. MAC RAR or fallbackRAR), or signalled in RRC.

5.4.2.1 HARQ Entity

The MAC entity includes a HARQ entity for each Serving Cell with configured uplink (including the case when it is configured with *supplementaryUplink*), which maintains a number of parallel HARQ processes.

The number of parallel UL HARQ processes per HARQ entity is specified in TS 38.214 [7].

Each HARQ process supports one TB.

Each HARQ process is associated with a HARQ process identifier. For UL transmission with UL grant in RA Response or for UL transmission for MSGA payload, HARQ process identifier 0 is used.

NOTE: When a single DCI is used to schedule multiple PUSCH, the UE is allowed to map generated TB(s) internally to different HARQ processes in case of LBT failure(s), i.e. UE may transmit a new TB on any HARQ process in the grants that have the same TBS, the same RV and the NDIs indicate new transmission.

The maximum number of transmissions of a TB within a bundle of the dynamic grant or configured grant is given by *REPETITION_NUMBER* as follows:

- For a dynamic grant, *REPETITION_NUMBER* is set to a value provided by lower layers, as specified in clause 6.1.2.1 of TS 38.214 [7];
- For a configured grant, *REPETITION_NUMBER* is set to a value provided by lower layers, as specified in clause 6.1.2.3 of TS 38.214 [7].

If *REPETITION_NUMBER* > 1, after the first transmission within a bundle, at most *REPETITION_NUMBER* – 1 HARQ retransmissions follow within the bundle. For both dynamic grant and configured uplink grant, bundling operation relies on the HARQ entity for invoking the same HARQ process for each transmission that is part of the same bundle. Within a bundle, HARQ retransmissions are triggered without waiting for feedback from previous transmission according to *REPETITION_NUMBER* for a dynamic grant or configured uplink grant unless they are terminated as specified in clause 6.1 of TS 38.214 [7]. Each transmission within a bundle is a separate uplink grant delivered to the HARQ entity.

Screenshot showing HARQ operation from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 45 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

	5.4.2.2 HARQ process Each HARQ process is associated with a HARQ buffer. New transmissions are performed on the resource and with the MCS indicated on PDCCH or indicated in the Random Access Response (i.e. MAC RAR or fallbackRAR), or signalled in RRC or determined as specified in clause 5.1.2a for MSGA payload. Retransmissions are performed on the resource and, if provided, with the MCS indicated on PDCCH, or on the same resource and with the same MCS as was used for last made transmission attempt within a bundle, or on stored configured uplink grant resources and stored MCS when <i>cg-RetransmissionTimer</i> is configured. If <i>cg-RetransmissionTimer</i> is configured, retransmissions with the same HARQ process may be performed on any configured grant configuration if the configured grant configurations have the same TBS. When <i>cg-RetransmissionTimer</i> is configured and the HARQ entity obtains a MAC PDU to transmit and LBT failure indication is received from lower layer, the corresponding HARQ process is considered to be pending. For a configured uplink grant, configured with <i>cg-RetransmissionTimer</i>, each associated HARQ process is considered as not pending when: Screenshot showing HARQ process from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 48 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 13	Evidence
13. The method according to claim 7, wherein the message 3 and the message 4 comprise a group ID of the UE group or a pre-set field.	Every claim limitation of claim 7 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein the message 3 and the message 4 comprise a group ID of the UE group or a pre-set field. Upon information and belief, the Msg3 comprises a C-RNTI field which is a unique UE identification used as an identifier of the RRC Connection and for scheduling. The C-RNTI MAC CE field contains the C-RNTI of the MAC entity (User Equipment). Upon information and belief, the C-RNTI MAC CE field comprises a pre-set UE number. Msg3: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

Screenshot showing Msg3 definition from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

- 1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;
- 1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;
- 1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:
 - 2> if the C-RNTI MAC CE was included in Msg3:
 - 3> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI; or

Screenshot showing Msg3 transmission with C-RNTI from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

- 1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or
- 1> if an uplink grant has been received in a Random Access Response:
 - 2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:
 - 3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.
 - 2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:
 - 3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

Screenshot showing Msg3 transmission according to a Uplink (UL) grant from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 42 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

6.1.3.2 C-RNTI MAC CE

The C-RNTI MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2.

It has a fixed size and consists of a single field defined as follows (Figure 6.1.3.2-1):

- C-RNTI: This field contains the C-RNTI of the MAC entity. The length of the field is 16 bits.

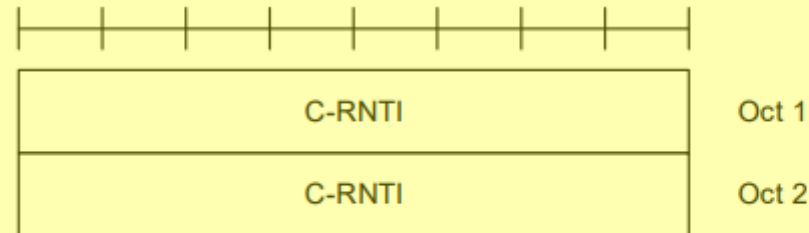


Figure 6.1.3.2-1: C-RNTI MAC CE

Screenshot showing C-RNTI MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.1 UE Identities

In this clause, the identities used by NR connected to 5GC are listed. For scheduling at cell level, the following identities are used:

- C-RNTI: unique UE identification used as an identifier of the RRC Connection and for scheduling;

Screenshot showing C-RNTI from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the contention resolution message Msg4 comprises a Physical Downlink Shared Channel (PDSCH) allocated for contention resolution. The contention resolution message Msg4 comprises a UE Contention Resolution Identity identifying the MAC entity (UE).

8.4 PDSCH with UE contention resolution identity

In response to a PUSCH transmission scheduled by a RAR UL grant when a UE has not been provided a C-RNTI, the UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding TC-RNTI scheduling a PDSCH that includes a UE contention resolution identity [11, TS 38.321]. In response to the PDSCH reception with the UE contention resolution identity, the UE transmits HARQ-ACK information in a PUCCH. The PUCCH transmission is within a same active UL BWP as the PUSCH transmission. A minimum time between the last symbol of the PDSCH reception and the first symbol of the corresponding PUCCH transmission with the HARQ-ACK information is equal to $N_{T,1} + 0.5$ msec. $N_{T,1}$ is a time duration of N_1 symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured. For $\mu = 0$, the UE assumes $N_{1,0} = 14$ [6, TS 38.214].

Screenshot showing UE Contention Resolution from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

6.1.3.3 UE Contention Resolution Identity MAC CE

The UE Contention Resolution Identity MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-1.

It has a fixed 48-bit size and consists of a single field defined as follows (Figure 6.1.3.3-1):

- UE Contention Resolution Identity: This field contains the UL CCCH SDU. If the UL CCCH SDU is longer than 48 bits, this field contains the first 48 bits of the UL CCCH SDU.

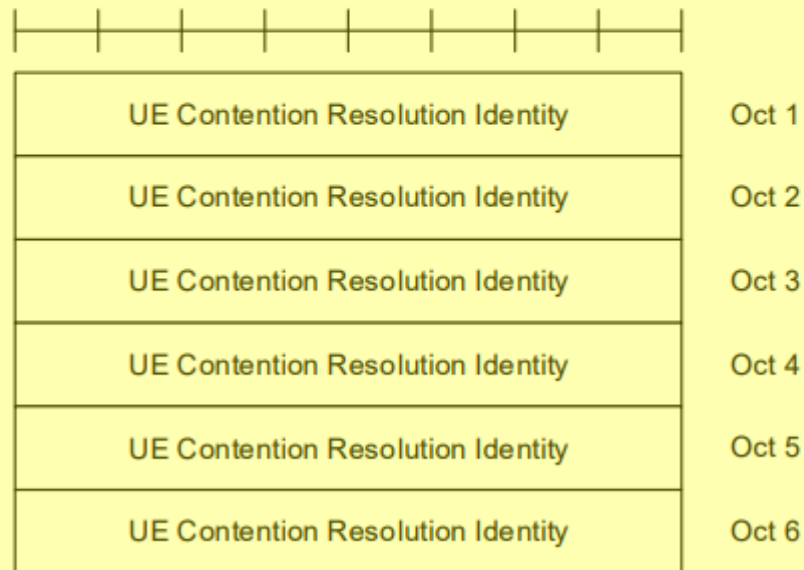


Figure 6.1.3.3-1: UE Contention Resolution Identity MAC CE

Screenshot showing UE Contention Resolution Identity MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 14	Evidence
14. The method according to claim 1, further comprising: before sending, by the first UE in the UE group, the preamble over the time-frequency resource, receiving, by at least one of the first UE or the second UE, Downlink Control Information (DCI) or a paging message or a Radio Resource Control (RRC) message sent by the eNB; or, receiving, by the first UE, random access request information sent by the second UE.	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured that before sending, by the first UE in the UE group, the preamble over the time-frequency resource, receiving, by at least one of the first UE or the second UE, Downlink Control Information (DCI) or a paging message or a Radio Resource Control (RRC) message sent by the eNB or receiving, by the first UE, random access request information sent by the second UE. Upon information and belief, the Accused Device is configured to perform the random access procedure. The random access procedure is triggered by RRC for a number of events. 5.1 Random Access procedure 5.1.1 Random Access procedure initialization The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell shall only be initiated by a PDCCH order with <i>ra-PreambleIndex</i> different from 0b000000. Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 17 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

9.2.6 Random Access Procedure

The random access procedure is triggered by a number of events:

- Initial access from RRC_IDLE;
- RRC Connection Re-establishment procedure;
- DL or UL data arrival during RRC_CONNECTED when UL synchronisation status is "non-synchronised";
- UL data arrival during RRC_CONNECTED when there are no PUCCH resources for SR available;
- SR failure;
- Request by RRC upon synchronous reconfiguration (e.g. handover);
- Transition from RRC_INACTIVE;
- To establish time alignment for a secondary TAG;
- Request for Other SI (see clause 7.3);
- Beam failure recovery;
- Consistent UL LBT failure on SpCell.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Paging messages allow the network to reach UEs in RRC_IDLE and in RRC_INACTIVE state for initiating random access procedure. Further, Paging messages are also used to notify UEs in RRC_IDLE, RRC_INACTIVE and RRC_CONNECTED state of system information change.

7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by *SIB1*.

For UEs in RRC_IDLE and RRC_INACTIVE, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 54 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

7.2 Protocol States

RRC supports the following states which can be characterised as follows:

- **RRC_IDLE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging for mobile terminated data is initiated by 5GC;
 - DRX for CN paging configured by NAS.
- **RRC_INACTIVE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging is initiated by NG-RAN (RAN paging);
 - RAN-based notification area (RNA) is managed by NG- RAN;
 - DRX for RAN paging configured by NG-RAN;
 - 5GC - NG-RAN connection (both C/U-planes) is established for UE;
 - The UE AS context is stored in NG-RAN and the UE;
 - NG-RAN knows the RNA which the UE belongs to.

Screenshot showing Protocol States supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 52 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

9.2.5 Paging

Paging allows the network to reach UEs in RRC_IDLE and in RRC_INACTIVE state through *Paging* messages, and to notify UEs in RRC_IDLE, RRC_INACTIVE and RRC_CONNECTED state of system information change (see clause 7.3.3) and ETWS/CMAS indications (see clause 16.4) through *Short Messages*. Both *Paging* messages and *Short Messages* are addressed with P-RNTI on PDCCH, but while the former is sent on PCCH, the latter is sent over PDCCH directly (see clause 6.5 of TS 38.331 [12]).

Screenshot showing Paging supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 52 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g., data processors and other internal components), and software (e.g., software and firmware).

10,448,430 Claim 15

Evidence

15. The method according to claim 14, wherein receiving, by at least one of the first UE or the second UE, the DCI or the paging message or the RRC message sent by the eNB comprises at least one of the following:
the DCI or a CRC of DCI for scheduling the paging message or the RRC message is scrambled by using a group ID of the UE group;
the DCI or the paging message or the RRC message comprises a group ID of the UE group;
the DCI or the paging message or the RRC message comprises an ID of at least one of the first UE or the second UE; or

Every claim limitation of claim 14 is present in the Accused Device as described above and incorporated herein by reference.

The Accused Device is configured such that wherein receiving, by at least one of the first UE or the second UE, the DCI or the paging message or the RRC message sent by the eNB comprises the DCI or the paging message or the RRC message comprises at least one of an ID of the preamble, the time domain resource of the preamble or the frequency domain resource of the preamble.

the DCI or the paging message or the RRC message comprises at least one of an ID of the preamble, the time domain resource of the preamble or the frequency domain resource of the preamble.

8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in Clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in Clause 10.1. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.

If the UE detects the DCI format 1_0 with CRC scrambled by the corresponding RA-RNTI and LSBs of a SFN field in the DCI format 1_0, if included and applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers parse the transport block for a random access preamble identity (RAPID) associated with the PRACH transmission. If the higher layers identify the RAPID in RAR message(s) of the transport block, the higher layers indicate an uplink grant to the physical layer. This is referred to as random access response (RAR) UL grant in the physical layer.

Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 46 and 47 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the UE receives a preamble index, a preamble SCS, PPRACH,target , a corresponding RA-RNTI, and a PRACH resource (time resources and frequency resources) from the higher layers (eNB). The PRACH resources are used for the transmission of preamble over a time-frequency resource.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

8.1 Random access preamble

Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following:

- A configuration for PRACH transmission [4, TS 38.211].
- A preamble index, a preamble SCS, $P_{PRACH,target}$, a corresponding RA-RNTI, and a PRACH resource.

A PRACH is transmitted using the selected PRACH format with transmission power $P_{PRACH,b,f,c}(i)$, as described in Clause 7.4, on the indicated PRACH resource.

For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

	Screenshot showing the transmission of random access preamble (Msg1) in a PRACH from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41 and 42 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 17	Evidence
17. The method according to claim 1, wherein sending, by the first UE in the UE group, the preamble over the time-frequency resource comprises: periodically sending, by the first UE, the preamble over the frequency domain resource.	Every claim limitation of claim 1 is present in the Accused Device as described above and incorporated herein by reference. The Accused Device is configured wherein sending, by the first UE in the UE group, the preamble over the time-frequency resource comprises periodically sending, by the first UE, the preamble over the frequency domain resource. Upon information and belief, the UE transmits the preamble firstly in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions and then in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot. 8.1 Random access preamble Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following: - A configuration for PRACH transmission [4, TS 38.211]. - A preamble index, a preamble SCS, $P_{\text{PRACH,target}}$, a corresponding RA-RNTI, and a PRACH resource.

A PRACH is transmitted using the selected PRACH format with transmission power $P_{\text{PRACH},b,f,c}(i)$, as described in Clause 7.4, on the indicated PRACH resource.

For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number Q of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB-PerSharedRO*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *msgA-SSB-SharedRO-MaskIndex* according to [11, TS 38.321].

For Type-2 random access procedure with separate configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

For Type-1 random access procedure, or for Type-2 random access procedure with separate configuration of PRACH occasions from Type 1 random access procedure, if $N < 1$, one SS/PBCH block index is mapped to $1/N$ consecutive valid PRACH occasions and R contention based preambles with consecutive indexes associated with the SS/PBCH block index per valid PRACH occasion start from preamble index 0. If $N \geq 1$, R contention based preambles with consecutive indexes associated with SS/PBCH block index n , $0 \leq n \leq N - 1$, per valid PRACH occasion start from preamble index $n \cdot N_{\text{preamble}}^{\text{total}} / N$ where $N_{\text{preamble}}^{\text{total}}$ is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure, or by *msgA-TotalNumberOfRA-Preambles* for Type-2 random access procedure with separate configuration of PRACH occasions from a Type 1 random access procedure, and is an integer multiple of N .

SS/PBCH block indexes provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* are mapped to valid PRACH occasions in the following order where the parameters are described in [4, TS 38.211].

- First, in increasing order of preamble indexes within a single PRACH occasion
- Second, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions
- Third, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot
- Fourth, in increasing order of indexes for PRACH slots

An association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that N_{Tx}^{SSB} SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains N_{Tx}^{SSB} from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*. If after an integer number of SS/PBCH block indexes to PRACH occasions mapping cycles within the association period there is a set of PRACH occasions or PRACH preambles that are not mapped to N_{Tx}^{SSB} SS/PBCH block indexes, no SS/PBCH block indexes are mapped to the set of PRACH occasions or PRACH preambles. An association pattern period includes one or more association periods and is determined so that a pattern between PRACH occasions and SS/PBCH block indexes repeats at most every 160 msec. PRACH occasions not associated with SS/PBCH block indexes after an integer number of association periods, if any, are not used for PRACH transmissions.

The PRACH occasions are mapped consecutively per corresponding SS/PBCH block index. The indexing of the PRACH occasion indicated by the mask index value is reset per mapping cycle of consecutive PRACH occasions per SS/PBCH block index. The UE selects for a PRACH transmission the PRACH occasion indicated by PRACH mask index value for the indicated SS/PBCH block index in the first available mapping cycle.

For the indicated preamble index, the ordering of the PRACH occasions is

- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions
- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot
- Third, in increasing order of indexes for PRACH slots

For a PRACH transmission triggered upon request by higher layers, a value of *ra-OccasionList* [12, TS 38.331], if *csirs-ResourceList* is provided, indicates a list of PRACH occasions for the PRACH transmission where the PRACH occasions are associated with the selected CSI-RS index indicated by *csi-RS*. The indexing of the PRACH occasions indicated by *ra-OccasionList* is reset per association pattern period.

Table 8.1-1: Mapping between PRACH configuration period and SS/PBCH block to PRACH occasion association period

PRACH configuration period (msec)	Association period (number of PRACH configuration periods)
10	{1, 2, 4, 8, 16}
20	{1, 2, 4, 8}
40	{1, 2, 4}
80	{1, 2}
160	{1}

Screenshot showing the transmission of random access preamble (Msg1) from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41-43 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the Accused Device configured as the User Equipment (UE) transmits the Random Access Preamble with the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted. The RA-RNTI associated with the PRACH resource comprises a time domain resource and a frequency domain resource.

5.1.3 Random Access Preamble transmission

The MAC entity shall, for each Random Access Preamble:

- 1> if *PREAMBLE_TRANSMISSION_COUNTER* is greater than one; and
- 1> if the notification of suspending power ramping counter has not been received from lower layers; and
- 1> if LBT failure indication was not received from lower layers for the last Random Access Preamble transmission; and
- 1> if SSB or CSI-RS selected is not changed from the selection in the last Random Access Preamble transmission:
 - 2> increment *PREAMBLE_POWER_RAMPING_COUNTER* by 1.
- 1> select the value of *DELTA_PREAMBLE* according to clause 7.3;
- 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to $\text{preambleReceivedTargetPower} + \text{DELTA_PREAMBLE} + (\text{PREAMBLE_POWER_RAMPING_COUNTER} - 1) \times \text{PREAMBLE_POWER_RAMPING_STEP} + \text{POWER_OFFSET_2STEP_RA}$;
- 1> except for contention-free Random Access Preamble for beam failure recovery request, compute the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted;
- 1> instruct the physical layer to transmit the Random Access Preamble using the selected PRACH occasion, corresponding RA-RNTI (if available), *PREAMBLE_INDEX*, and *PREAMBLE_RECEIVED_TARGET_POWER*.

The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s_id + 14 \times t_id + 14 \times 80 \times f_id + 14 \times 80 \times 8 \times ul_carrier_id$$

where *s_id* is the index of the first OFDM symbol of the PRACH occasion ($0 \leq s_id < 14$), *t_id* is the index of the first slot of the PRACH occasion in a system frame ($0 \leq t_id < 80$), where the subcarrier spacing to determine *t_id* is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], *f_id* is the index of the PRACH occasion in the frequency domain ($0 \leq f_id < 8$), and *ul_carrier_id* is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier).

Screenshot showing Random Access Preamble transmission by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on pages 27 and 28 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

	To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
10,448,430 Claim 18	Evidence
18. A User Equipment (UE), comprising: a sending unit and a monitoring unit,	This is the preamble of the claim and is not limiting. This element, if construed as a limitation, is present literally and under the doctrine of equivalents in the Accused Device. The Accused Device is a smartphone device comprising Octa-Core processor, PLS TFT LCD display, high resolution front and rear cameras, 4GB RAM with 64GB internal storage and 5000mAh battery. The Accused Device is configured to support features like Side Sensor Fingerprint, expandable memory etc. The Accused Device is available in different models varying based on Cell Phone Carrier, Internal Memory and Color. The various models available for the Accused Device are A136UZKDXAA, SM-A136ULGDXAA, SM-A136UZKAATT, SM-A136ULGAATT, SM-A136UZKAXAU, and SM-A136UZKAUSC.



Galaxy A13 5G (Unlocked)

Wishlist

SM-A136UZXKXAA



5.0 (2)

Share your product experience

Galaxy A13 5G¹ is our most affordable 5G phone, offering you the blazing-fast speed² and connectivity you need at a price you'll love.

DEVICE

GALAXY A02S

GALAXY A03S

GALAXY A12

GALAXY A13 5G

GALAXY A32 5G

CARRIER

Unlocked

\$249.99

T Mobile

\$249.99



\$249.99

uscellular

\$249.99

CAPACITY

64GB

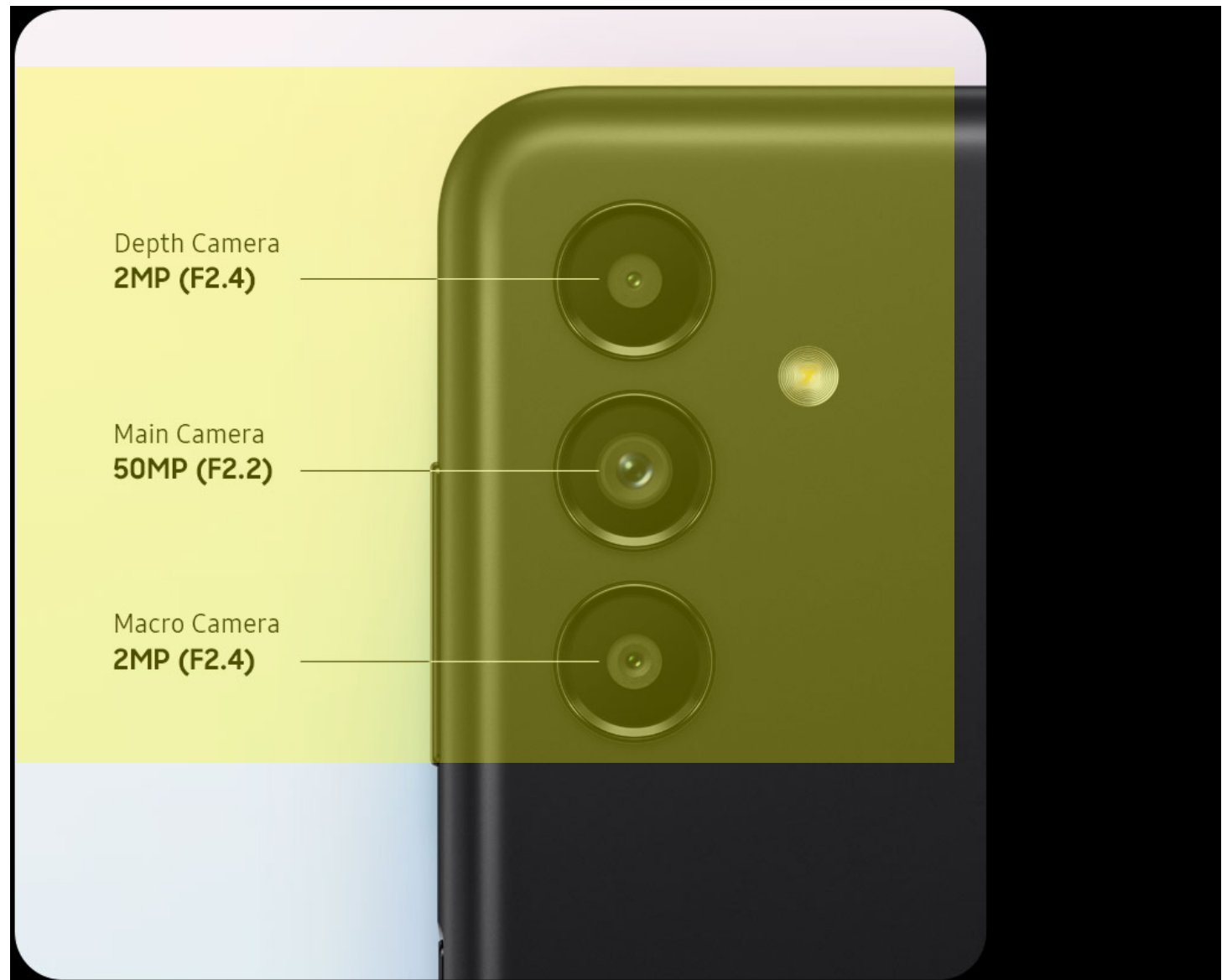
COLOR Black



Image of the Accused Device Galaxy A13 5G Smartphone SM-A136UZXKXAA (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).



Screenshot showing Image of the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDAA#models>).



Screenshot showing camera of the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

Processor
Octa-core

RAM
4GB

Storage
64GB
+ Up to 1TB (microSD card)



Screenshot showing features of the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

	<table><tr><td>Display type</td><td>Flat</td></tr><tr><td>Fingerprint Sensor</td><td>Side Fingerprint Sensor</td></tr><tr><td>Front Camera</td><td>5MP Selfie Camera</td></tr><tr><td>Rear Camera</td><td>50MP Main Camera 2MP Macro Camera 2MP Depth Camera</td></tr><tr><td>Battery Capacity****</td><td> 5000mAh (typical)</td></tr></table> Screenshot showing features of the Accused Device (available from https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#compare). Upon information and belief, the Accused Device comprises a sending unit and a monitoring unit for supporting various network and connectivity. The Accused Device comprises a processor configured for monitoring and processing the network signals.	Display type	Flat	Fingerprint Sensor	Side Fingerprint Sensor	Front Camera	5MP Selfie Camera	Rear Camera	50MP Main Camera 2MP Macro Camera 2MP Depth Camera	Battery Capacity****	 5000mAh (typical)
Display type	Flat										
Fingerprint Sensor	Side Fingerprint Sensor										
Front Camera	5MP Selfie Camera										
Rear Camera	50MP Main Camera 2MP Macro Camera 2MP Depth Camera										
Battery Capacity****	 5000mAh (typical)										

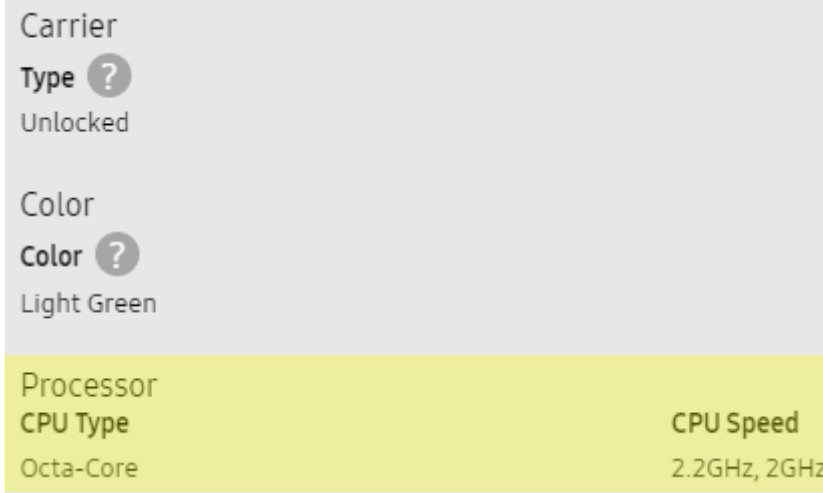
Processor
Octa-core

RAM
4GB

Storage
64GB
+ Up to 1TB (microSD card)



Screenshot showing processor supported by the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).



Screenshot showing processor supported by the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a13-5g/>).

The Accused Device can be configured as a mobile terminal to support 5G telecommunications standard for providing services like blazing-fast speed, and virtually lag-free download and stream.



Galaxy A13 5G

● Black

Colors

Screen size*

6.5"

Internal Storage

64GB

RAM

4GB

Expandable Storage**

up to 1TB

Cellular & Wireless***

5G, Sub 6

Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#compare>).

Galaxy A13 5G⁸

Everything you need, plus 5G

We added 5G to powerful core features like a versatile triple camera and expandable storage² so you can download, stream, and connect virtually lag-free.

Starting from \$174.99 with eligible trade in⁹

Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/smartphones/galaxy-a-series/?modelCode=SM-A136ULGDXAA#models>).

Galaxy A13 5G (Unlocked)

 Wishlist

SM-A136UZKDXAA



5.0 (1)

[Share your product experience](#)

Galaxy A13 5G¹ is our most affordable 5G phone, offering you the blazing-fast speed² and connectivity you need at a price you'll love.

Network 2G GSM GSM850, GSM900, DCS1800, PCS1900 4G TDD LTE B38(2600), B39(1900), B40(2300), B41(2500), B48(3600) 5G TDD mmWave N41(2500), N48(3500), N77(3700)	3G UMTS B1(2100), B2(1900), B4(AWS), B5(850), B8(900) SIM Slot Type SIM 1 + SIM 2 + MicroSD	4G FDD LTE B1(2100), B2(1900), B3(1800), B4(AWS), B5(850), B7(2600), B12(700), B13(700), B14(700), B20(800), B25(1900), B26(850), B29(700), B30(2300), B66(AWS-3), B71(600)	5G FDD Sub6 N2(1900), N5(850), N66(AWS-3), N71(600)
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Screenshots showing 5G technology standard supported by the Accused Device (available from <https://www.samsung.com/us/mobile/phones/galaxy-a/galaxy-a13-5g-unlocked-sm-a136uzkdxaa/>).

Upon information and belief, the Accused Device is configured as a User Equipment Terminal and supports 3GPP 5G Standard, including but not limited to 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control), 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2) and 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification).

ETSI TS 138 213 V16.5.0 (2021-04)



**5G;
NR;
Physical layer procedures for control
(3GPP TS 38.213 version 16.5.0 Release 16)**

1 Scope

The present document specifies and establishes the characteristics of the physical layer procedures for control operations in 5G-NR.

Screenshot showing the scope of standard 3GPP TS 38.213 version 16.5.0 Release 16 supported by the Accused Device (available on page 7 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

ETSI TS 138 300 V16.5.0 (2021-04)



**5G;
NR;
NR and NG-RAN Overall description;
Stage-2
(3GPP TS 38.300 version 16.5.0 Release 16)**

1 Scope

The present document provides an overview and overall description of the NG-RAN and focuses on the radio interface protocol architecture of NR connected to 5GC (E-UTRA connected to 5GC is covered in the 36 series). Details of the radio interface protocols are specified in companion specifications of the 38 series.

Screenshot showing the scope of standard 3GPP TS 38.300 version 16.5.0 Release 16 supported by the Accused Device (available on page 11 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

ETSI TS 138 321 V16.4.0 (2021-04)



**5G;
NR;
Medium Access Control (MAC) protocol specification
(3GPP TS 38.321 version 16.4.0 Release 16)**

1 Scope

The present document specifies the NR MAC protocol.

Screenshot showing the scope of standard 3GPP TS 38.321 version 16.4.0 Release 16 supported by the Accused Device (available on page 9 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

Upon information and belief, the Accused Device is configured to perform the random access procedure. The random access procedure is triggered by a number of events.

5.1 Random Access procedure

5.1.1 Random Access procedure initialization

The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell shall only be initiated by a PDCCH order with *ra-PreambleIndex* different from 0b000000.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 17 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

9.2.6 Random Access Procedure

The random access procedure is triggered by a number of events:

- Initial access from RRC_IDLE;
- RRC Connection Re-establishment procedure;
- DL or UL data arrival during RRC_CONNECTED when UL synchronisation status is "non-synchronised";
- UL data arrival during RRC_CONNECTED when there are no PUCCH resources for SR available;
- SR failure;
- Request by RRC upon synchronous reconfiguration (e.g. handover);
- Transition from RRC_INACTIVE;
- To establish time alignment for a secondary TAG;
- Request for Other SI (see clause 7.3);
- Beam failure recovery;
- Consistent UL LBT failure on SpCell.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Accused Device is configured to support Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

Screenshot showing Type-1 L1 Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on page 41 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the Accused Device is also configured to support 4-step RA type with MSG1. The RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA).

	Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below. The UE selects the type of random access at initiation of the random access procedure based on network configuration: - when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type; - when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type; - when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type. Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 87 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g., data processors and other internal components), and software (e.g., software and firmware).
18a. wherein the sending unit is configured to: send a preamble to an evolved Node B (eNB) over a time-frequency resource, the time-frequency resource comprising a time domain resource and a frequency domain resource;	The Accused Device is configured to comprise a sending unit wherein the sending unit is configured to send a preamble to an evolved Node B (eNB) over a time-frequency resource, the time-frequency resource comprising a time domain resource and a frequency domain resource. Upon information and belief, the Accused Device is configured as a User Equipment Terminal and supports 3GPP 5G Standard, including but not limited to 3GPP TS 38.213 version 16.5.0 Release 16 (5G; NR; Physical layer procedures for control), 3GPP TS 38.300 version 16.5.0 Release 16 (5G; NR; NR and NG-RAN Overall description; Stage-2) and 3GPP TS 38.321 version 16.4.0 Release 16 (5G; NR; Medium Access Control (MAC) protocol specification). The Accused Device is configured to select the type of random access at the initiation of the random access procedure based on the network configuration and sends a random access preamble to an evolved Node B (eNB). Upon information and belief, the Accused Device is also configured to select the 4-step RA type with MSG1. The MSG1 of the 4-step RA type consists of a preamble on PRACH wherein PRACH is a time-frequency resource.

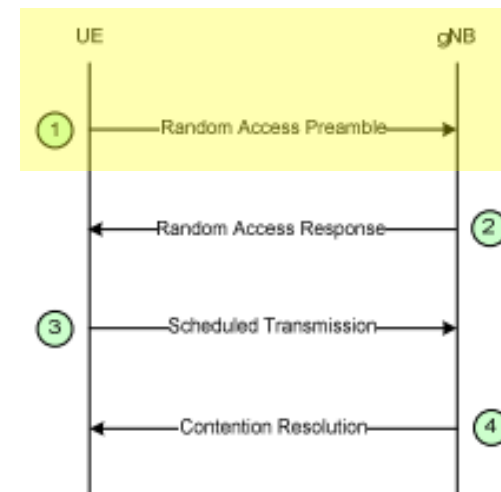
Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below.

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;
- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;
- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

5.3.4 Random access

Random access preamble sequences, of four different lengths are supported. Sequence length 839 is applied with subcarrier spacings of 1.25 and 5 kHz, sequence length 139 is applied with subcarrier spacings of 15, 30, 60 and 120 kHz, and sequence lengths of 571 and 1151 are applied with subcarrier spacings of 30 kHz and 15 kHz respectively. Sequence length 839 supports unrestricted sets and restricted sets of Type A and Type B, while sequence lengths 139, 571, and 1151 support unrestricted sets only. Sequence length 839 is only used for operation with licensed channel access while sequence length 139 can be used for operation with either licensed or shared spectrum channel access. Sequence lengths of 571 and 1151 can be used only for operation with shared spectrum channel access.

Multiple PRACH preamble formats are defined with one or more PRACH OFDM symbols, and different cyclic prefix and guard time. The PRACH preamble configuration to use is provided to the UE in the system information.

Screenshot showing PRACH resource from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 34 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Accused Device configured as the User Equipment (UE) transmits the Random Access Preamble with the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted. The RA-RNTI associated with the PRACH resource comprises a time domain resource and a frequency domain resource.

5.1.3 Random Access Preamble transmission

The MAC entity shall, for each Random Access Preamble:

- 1> if *PREAMBLE_TRANSMISSION_COUNTER* is greater than one; and
- 1> if the notification of suspending power ramping counter has not been received from lower layers; and
- 1> if LBT failure indication was not received from lower layers for the last Random Access Preamble transmission; and
- 1> if SSB or CSI-RS selected is not changed from the selection in the last Random Access Preamble transmission:
 - 2> increment *PREAMBLE_POWER_RAMPING_COUNTER* by 1.
- 1> select the value of *DELTA_PREAMBLE* according to clause 7.3;
- 1> set *PREAMBLE_RECEIVED_TARGET_POWER* to $\text{preambleReceivedTargetPower} + \text{DELTA_PREAMBLE} + (\text{PREAMBLE_POWER_RAMPING_COUNTER} - 1) \times \text{PREAMBLE_POWER_RAMPING_STEP} + \text{POWER_OFFSET_2STEP_RA}$;
- 1> except for contention-free Random Access Preamble for beam failure recovery request, compute the RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted;
- 1> instruct the physical layer to transmit the Random Access Preamble using the selected PRACH occasion, corresponding RA-RNTI (if available), *PREAMBLE_INDEX*, and *PREAMBLE_RECEIVED_TARGET_POWER*.

The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s_id + 14 \times t_id + 14 \times 80 \times f_id + 14 \times 80 \times 8 \times ul_carrier_id$$

where *s_id* is the index of the first OFDM symbol of the PRACH occasion ($0 \leq s_id < 14$), *t_id* is the index of the first slot of the PRACH occasion in a system frame ($0 \leq t_id < 80$), where the subcarrier spacing to determine *t_id* is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], *f_id* is the index of the PRACH occasion in the frequency domain ($0 \leq f_id < 8$), and *ul_carrier_id* is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier).

Screenshot showing Random Access Preamble transmission by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on pages 27 and 28 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

During the random access procedure, the following identities are also used:

- RA-RNTI: identification of the Random Access Response in the downlink;

Screenshot showing definition of RA-RNTI supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the UE receives a preamble index, a preamble SCS, PPRACH,target , a corresponding RA-RNTI, and a PRACH resource (time resources and frequency resources) from the higher layers (eNB). The PRACH resources are used for the transmission of preamble over a time-frequency resource.

8 Random access procedure

Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.

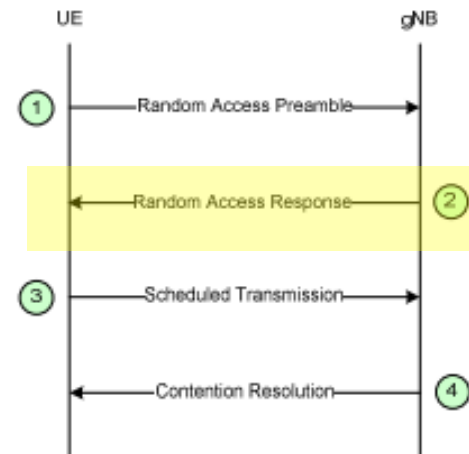
Prior to initiation of the physical random access procedure, Layer 1 may receive from higher layers an indication to perform a Type-1 random access procedure, as described in Clauses 8.1 through 8.4, or a Type-2 random access procedure as described in Clauses 8.1 through 8.2A.

Prior to initiation of the physical random access procedure, Layer 1 receives the following information from the higher layers:

- Configuration of physical random access channel (PRACH) transmission parameters (PRACH preamble format, time resources, and frequency resources for PRACH transmission).
- Parameters for determining the root sequences and their cyclic shifts in the PRACH preamble sequence set (index to logical root sequence table, cyclic shift (N_{CS}), and set type (unrestricted, restricted set A, or restricted set B)).

From the physical layer perspective, the Type-1 L1 random access procedure includes the transmission of random access preamble (Msg1) in a PRACH, random access response (RAR) message with a PDCCH/PDSCH (Msg2), and when applicable, the transmission of a PUSCH scheduled by a RAR UL grant, and PDSCH for contention resolution.

	8.1 Random access preamble Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following: - A configuration for PRACH transmission [4, TS 38.211]. - A preamble index, a preamble SCS, $P_{\text{PRACH,target}}$, a corresponding RA-RNTI, and a PRACH resource. A PRACH is transmitted using the selected PRACH format with transmission power $P_{\text{PRACH,b,f,c}}(i)$, as described in Clause 7.4, on the indicated PRACH resource. For Type-1 random access procedure, a UE is provided a number N of SS/PBCH block indexes associated with one PRACH occasion and a number R of contention based preambles per SS/PBCH block index per valid PRACH occasion by <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>. Screenshot showing the transmission of random access preamble (Msg1) in a PRACH from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 41 and 42 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf). To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
18b. the monitoring unit is configured to: monitor a Random Access Response (RAR) corresponding to the preamble and sent by the eNB; and	The Accused Device is configured to comprise a monitoring unit wherein the monitoring unit is configured to monitor a Random Access Response (RAR) corresponding to the preamble and sent by the eNB. Upon information and belief, the Accused Device is configured to monitor a Random Access Response (RAR) corresponding to the preamble from the eNB. For contention-based random access (CBRA), the UE receives a Random Access Response (RAR) from the eNB. The UE monitors the physical downlink channel PDCCH for Random Access Response (RAR) while the ra-ResponseWindow is running. The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

5.1.4 Random Access Response reception

Once the Random Access Preamble is transmitted and regardless of the possible occurrence of a measurement gap, the MAC entity shall:

- 1> if the contention-free Random Access Preamble for beam failure recovery request was transmitted by the MAC entity:
 - 2> start the *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;
 - 2> monitor for a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* of the SpCell identified by the C-RNTI while *ra-ResponseWindow* is running.
- 1> else:
 - 2> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission;
 - 2> monitor the PDCCH of the SpCell for Random Access Response(s) identified by the RA-RNTI while the *ra-ResponseWindow* is running.

Screenshot showing Random Access Response reception by the Accused Device from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in Clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in Clause 10.1. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.

If the UE detects the DCI format 1_0 with CRC scrambled by the corresponding RA-RNTI and LSBs of a SFN field in the DCI format 1_0, if included and applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers parse the transport block for a random access preamble identity

(RAPID) associated with the PRACH transmission. If the higher layers identify the RAPID in RAR message(s) of the transport block, the higher layers indicate an uplink grant to the physical layer. This is referred to as random access response (RAR) UL grant in the physical layer.

Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 46 and 47 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

Upon information and belief, the UE initiating the random access procedure may be UEs in RRC-IDLE and RRC-INACTIVE protocol states (UE group). The random access procedure is triggered by a number of events.

7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by *SIB1*.

For UEs in RRC_IDLE and RRC_INACTIVE, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4.

Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 54 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

7.2 Protocol States

RRC supports the following states which can be characterised as follows:

- **RRC_IDLE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging for mobile terminated data is initiated by 5GC;
 - DRX for CN paging configured by NAS.
- **RRC_INACTIVE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging is initiated by NG-RAN (RAN paging);
 - RAN-based notification area (RNA) is managed by NG- RAN;
 - DRX for RAN paging configured by NG-RAN;
 - 5GC - NG-RAN connection (both C/U-planes) is established for UE;
 - The UE AS context is stored in NG-RAN and the UE;
 - NG-RAN knows the RNA which the UE belongs to.

Screenshot showing Protocol States supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 52 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

	To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it. Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).
18c. the sending unit is further configured to: send a message 3 according to a Uplink (UL) grant allocated to the UE, wherein the message 3 comprises a number of UEs having random access requests in a UE group or a number of UEs contained in the UE group or a pre-set UE number.	The Accused Device comprises a sending unit which is further configured to send a message 3 according to a Uplink (UL) grant allocated to the UE, wherein the message 3 comprises a number of UEs having random access requests in a UE group or a number of UEs contained in the UE group or a pre-set UE number. Upon information and belief, the UE initiating the random access procedure may be UEs in RRC-IDLE and RRC-INACTIVE protocol states (UE group). The random access procedure is triggered by a number of events. 7.3.2 Scheduling The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by <i>SIB1</i>. For UEs in RRC_IDLE and RRC_INACTIVE, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4. Screenshot showing Random Access Procedure supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 54 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

7.2 Protocol States

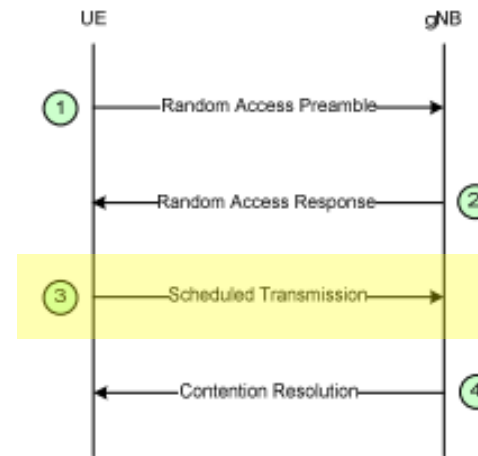
RRC supports the following states which can be characterised as follows:

- **RRC_IDLE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging for mobile terminated data is initiated by 5GC;
 - DRX for CN paging configured by NAS.
- **RRC_INACTIVE:**
 - PLMN selection;
 - Broadcast of system information;
 - Cell re-selection mobility;
 - Paging is initiated by NG-RAN (RAN paging);
 - RAN-based notification area (RNA) is managed by NG- RAN;
 - DRX for RAN paging configured by NG-RAN;
 - 5GC - NG-RAN connection (both C/U-planes) is established for UE;
 - The UE AS context is stored in NG-RAN and the UE;
 - NG-RAN knows the RNA which the UE belongs to.

Screenshot showing Protocol States supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 52 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, for contention-based random access (CBRA), the Accused Device is configured to send a Msg3 using the UL grant scheduled in the response.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.



(a) CBRA with 4-step RA type

Screenshot showing 4-step RA type with MSG1 supported by the Accused Device from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on pages 87 and 88 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

Upon information and belief, the Msg3 comprises a C-RNTI field which is a unique UE identification used as an identifier of the RRC Connection and for scheduling. The C-RNTI MAC CE field contains the C-RNTI of the MAC entity (User Equipment).

Upon information and belief, the C-RNTI MAC CE field comprises a pre-set UE number.

Msg3: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

Screenshot showing Msg3 definition from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.1.5 Contention Resolution

Once Msg3 is transmitted the MAC entity shall:

- 1> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission;
- 1> monitor the PDCCH while the *ra-ContentionResolutionTimer* is running regardless of the possible occurrence of a measurement gap;
- 1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:
 - 2> if the C-RNTI MAC CE was included in Msg3:
 - 3> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI; or

Screenshot showing Msg3 transmission with C-RNTI from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 30 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

5.4.1 UL Grant reception

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

- 1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or
- 1> if an uplink grant has been received in a Random Access Response:
 - 2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:
 - 3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.
 - 2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:
 - 3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

Screenshot showing Msg3 transmission according to a Uplink (UL) grant from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 42 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

6.1.3.2 C-RNTI MAC CE

The C-RNTI MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2.

It has a fixed size and consists of a single field defined as follows (Figure 6.1.3.2-1):

- C-RNTI: This field contains the C-RNTI of the MAC entity. The length of the field is 16 bits.

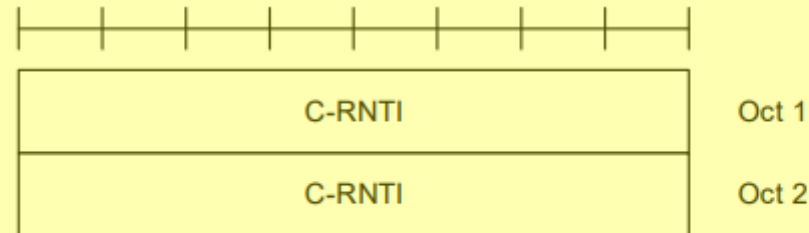


Figure 6.1.3.2-1: C-RNTI MAC CE

Screenshot showing C-RNTI MAC CE from standard 3GPP TS 38.321 version 16.4.0 Release 16 (available on page 114 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138321/16.04.00_60/ts_138321v160400p.pdf).

8.1 UE Identities

In this clause, the identities used by NR connected to 5GC are listed. For scheduling at cell level, the following identities are used:

- C-RNTI: unique UE identification used as an identifier of the RRC Connection and for scheduling;

Screenshot showing C-RNTI from standard 3GPP TS 38.300 version 16.5.0 Release 16 (available on page 57 from https://www.etsi.org/deliver/etsi_ts/138300_138399/138300/16.05.00_60/ts_138300v160500p.pdf).

8.3 PUSCH scheduled by RAR UL grant

An active UL BWP, as described in Clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI. Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321]. The UE always transmits the PUSCH scheduled by a RAR UL grant without repetitions.

Screenshot showing the Random Access Response from standard 3GPP TS 38.213 version 16.5.0 Release 16 (available on pages 49 and 51 from https://www.etsi.org/deliver/etsi_ts/138200_138299/138213/16.05.00_60/ts_138213v160500p.pdf).

To the extent that this step is not literally present in the Accused Device, the Accused Device would nevertheless infringe under the doctrine of equivalents, because the Accused Device performs a step that is, if not literally the step recited in the claim, then equivalent to it.

Plaintiff reserves the right to supplement these infringement contentions once it has been afforded the opportunity to review and inspect the internal hardware (e.g. data processors and other internal components), and software (e.g., software and firmware).