

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Based on information presently available, Apex Beam Technologies LLC (“Apex Beam”) contends that Defendants Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung”) infringe claims 1-5 and 11-15 (the “Asserted Claims”) of U.S. Patent No. 10,944,527 (the “527 Patent”) through the Accused Products which are manufactured, sold, offered for sale, used, imported into the United States, and/or exported from the United States by Samsung.

The Accused Products comprise all 5G mobile devices made, used, sold, offered for sale, imported into the United States, and/or exported from the United States or otherwise provided, after October 29, 2019. Apex Beam reserves the right to amend this list of Accused Products as discovery progresses.

Samsung directly infringes each of the Asserted Claims by using, importing, testing, selling, offering for sale, importing into the United States, and/or exporting from the United States the Accused Products in violation of 35 U.S.C. § 271(a).

Samsung indirectly infringes the Asserted Claims in violation of 35 U.S.C. § 271(b) by inducing third parties, including its users and/or customers, to directly infringe through their operation and use of the Accused Products. Samsung has knowingly and intentionally induced this direct infringement by, inter alia, (i) selling, offering to sell, importing, exporting, or otherwise providing the Accused Products to third parties with the intent that the Accused Products will be operated and used in a manner that practices the Asserted Claims; and (ii) marketing and advertising the Accused Products. Samsung’s marketing and promotional materials for the Accused Products are found, for example, on Samsung’s website, and on distributor websites on which the Accused Products are made available. For example, Samsung’s website offers customers downloadable User Manuals for the Accused Products that instruct customers to, among other things, use the accused services in the Accused Products. Samsung’s website also offers support to customers, including instruction to, among other things, to operate their devices on 5G networks. On information and belief, Samsung knows that its actions will result in infringement of the Asserted Claims, or subjectively believes that there is a high probability that its actions will result in infringement of the Asserted Claims but has taken deliberate actions to avoid learning these facts.

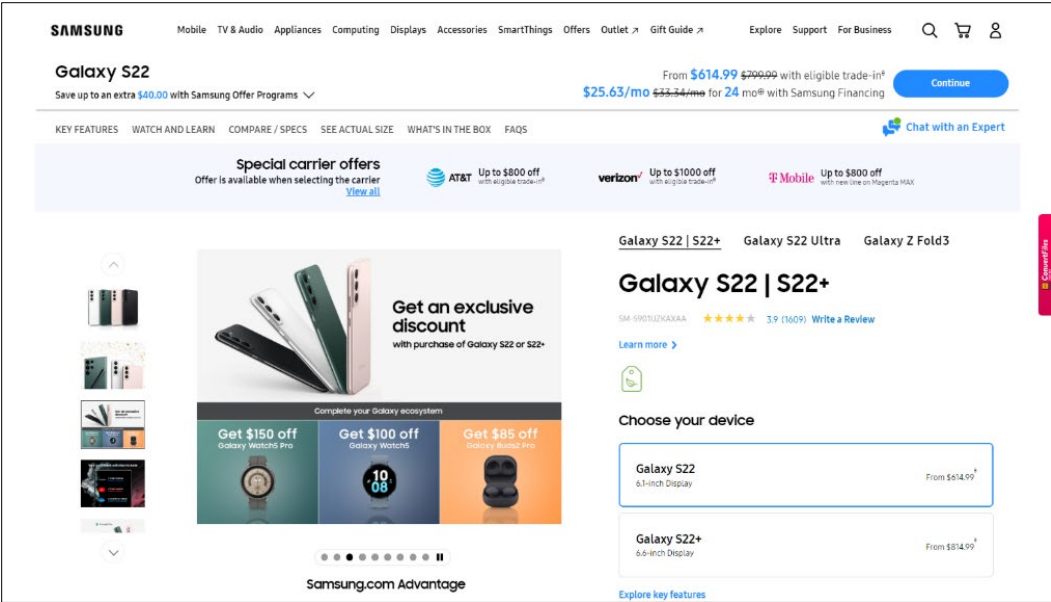
Samsung also contributorily infringes each of the Asserted Claims in violation of 35 U.S.C. § 271(c) by selling, importing, offering for sale, and otherwise providing the Accused Products, which when used directly infringe the Asserted Claims. The Accused Products constitute a material part of the Asserted Claims.

On information and belief, the charted version of the Samsung Galaxy S22 is representative of all versions of the Accused Products as all Samsung 5G devices implement the GSMA 3GPP 5G standards including, but not limited to, the Galaxy A13 5G, Galaxy A22 5G, Galaxy A32 5G, Galaxy A33 5G, Galaxy A42 5G, Galaxy A51 5G, Galaxy A52 5G, Galaxy A52s 5G, Galaxy A53 5G, Galaxy A71 5G, Galaxy A73 5G, Galaxy A90 5G, Galaxy Book Go 5G, Galaxy Book Pro 360 5G, Galaxy F42 5G, Galaxy F52 5G, Galaxy Fold 5G, Galaxy M32 5G, Galaxy M42 5G, Galaxy M52 5G, Galaxy Note 10 5G, Galaxy Note 10+ 5G, Galaxy Note 20 5G, Galaxy Note 20 Ultra 5G, Galaxy Quantum 2, Galaxy S10 5G, Galaxy S20 5G, Galaxy S20 FE 5G, Galaxy S20 Ultra 5G, Galaxy S20 UW, Galaxy S20+ 5G, Galaxy S21 5G, Galaxy S21 Ultra 5G, Galaxy S21+ 5G, Galaxy S22, Galaxy S22 5G, Galaxy S22 Ultra, Galaxy S22+, Galaxy Tab S7 5G, Galaxy Tab S7 FE 5G, Galaxy Tab S7+ 5G, Galaxy Tab S8+ 5G, Galaxy Z Flip 5G, Galaxy Z Flip3 5G, Galaxy Z Flip4, Galaxy Z Fold 2 5G, Galaxy Z Fold3 5G, and the Galaxy Z Fold4 (the “Accused Products”).

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Apex Beam does not concede that any claims of the '527 Patent that are not listed below are not infringed by the identified Accused Products. Moreover, the citations to certain documents and other information below are intended to be exemplary only and in no way foreclose Apex Beam from citing or relying on additional documents, information, source code, and/or testimony at a later time. These contentions are preliminary in nature, and an analysis of Samsung's products, internal documentation, source code, and/or testimony from relevant witnesses may more fully and accurately describe the infringing features of its Accused Products. Accordingly, Apex Beam reserves the right to supplement, correct, modify, and/or amend these contentions once such additional information is made available to Apex Beam. Furthermore, Apex Beam reserves the right to supplement, correct, modify, and/or amend these contentions as discovery in this case progresses; in view of the Court's claim construction order(s); in view of any positions taken by Samsung, including, but not limited to, positions on claim construction, invalidity, and/or non-infringement; and in connection with the preparation and exchange of expert reports.

The contents of every below claim cell on which another claim cell depends are expressly incorporated by reference in that dependent cell, as if set forth in their entirety therein.

Claim	Accused Products
[1P]. A method for multi-antenna transmission in a user equipment, comprising:	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice a method for multi-antenna transmission in a user equipment.  https://www.samsung.com/us/smartphones/galaxy-s22/buy/galaxy-s22-128gb-unlocked-sm-s901uzkaxaa/

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Claim	Accused Products
	Compare / Specs Samsung Galaxy S22 Ultra Samsung Galaxy S22+ Samsung Galaxy S22  Colors    Battery 5,000 mAh¹ 4,500 mAh¹ 3,700 mAh¹ Wireless Powershare Yes Yes Yes Storage Options 128GB 256GB 512GB 1TB 128GB 256GB 128GB 256GB Processor Snapdragon 8 Gen 1 Snapdragon 8 Gen 1 Snapdragon 8 Gen 1 RAM Options 8GB 12GB 8GB 8GB S Pen Integrated N/A N/A Cellular & Wireless The latest network technology with the power of 5G.² The latest network technology with the power of 5G.² The latest network technology with the power of 5G.² https://www.samsung.com/us/smartphones/galaxy-s22/buy/galaxy-s22-128gb-unlocked-sm-s901uzkaxaa/

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	Release 1563GPP TS 38.214 V15.0.0 (2017-12) 1Scope The present document specifies and establishes the characteristics of the physicals layer procedures of data channels for 5G-NR. 2References The following documents contain provisions which, through reference in this text, constitute provisions of the present document. [1]3GPP TR 21.905: "Vocabulary for 3GPP Specifications" [2]3GPP TS 38.201: " NR; Physical Layer – General Description" [3]3GPP TS 38.202: "NR; Services provided by the physical layer" [4]3GPP TS 38.211: "NR; Physical channels and modulation" [5]3GPP TS 38.212: "NR; Multiplexing and channel coding" [6]3GPP TS 38.213: "NR; Physical layer procedures for control" [7]3GPP TS 38.215: "NR; Physical layer measurements" [8]3GPP TS 38.101: "NR; User Equipment (UE) radio transmission and reception" [9]3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception" [10]3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification" [11]3GPP TS 38.133: "NR; Requirements for support of radio resource management" [12]3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification" [13]3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities" [14]3GPP TS 38.423: "NG-RAN; Xn signalling transport" TS38.214 V15.0.0

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	5.1.1 Uplink shared channel The physical-layer model for Uplink Shared Channel transmission is described based on the corresponding PUSCH physical-layer-processing chain, see Figure 5.1.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue. - Higher-layer data passed to/from the physical layer - CRC and transport-block-error indication - FEC and rate matching - Data modulation - Mapping to physical resource - Multi-antenna processing - Support of L1 control and Hybrid-ARQ-related signalling Figure 5.1.1-1: Physical-layer model for UL-SCH transmission TS38.202 V15.1.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.

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Claim	Accused Products
[1A] receiving a first radio signal from a base station; and	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice receiving a first radio signal from a base station. For example, the Accused Products receive a first radio signal (<i>e.g.</i>, CSI-RS or SS/PBCH) from a base station (<i>e.g.</i>, gNB). For example, the first radio signal comprises CSI-RSresources and/or SS/PBCH Block resources. 5.2.1 Channel state information framework The time and frequency resources that can be used by the UE to report CSI are controlled by the gNB. CSI consists of Channel Quality Indicator (CQI), precoding matrix indicator (PMI), CSI-RS resource indicator (CRI), strongest layer indication (SLI), rank indication (RI) and/or and L1-RSRP. For CQI, PMI, CRI, SLI, RI, L1-RSRP, a UE is configured by higher layers with $N \geq 1$ <i>ReportConfig</i> Reporting Settings, $M \geq 1$ <i>ResourceConfig</i> Resource Settings, and a single <i>MeasConfig</i> measurement setting containing $L \geq 1$ Links. A <i>MeasConfig</i> contains a list of reporting configurations (<i>ReportConfigList</i>), a list of resource configurations (<i>ResourceConfigList</i>), a list of link configurations (<i>MeasLinkConfigList</i>) and a list of trigger states (<i>ReportTrigger</i>). TS38.214 V15.0.0 5.2.1.2 Resource settings Each Resource Setting <i>ResourceConfig</i> contains a configuration of $S \geq 1$ CSI-RS Resource Sets (higher layer parameter <i>ResourceSetConfig</i>), with each Resource Set consisting of CSI-RS resources (higher layer parameters <i>NZP-CSI-RS-ResourceConfigList</i> and <i>CSI-IM-ResourceConfigList</i>) and SS/PBCH Block resources used for L1-RSRP computation (higher layer parameter <i>resource-config-SS-list</i>). Each Resource setting is located in the BWP identified by the higher layer parameter <i>BWP-info</i>, and all linked Resource Settings of a CSI Report Setting have the same BWP. TS38.214 V15.0.0

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[1B] receiving a first signaling from the base station;	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice receiving a first signaling from the base station For example, the Accused Products receive a first signaling (<i>e.g.</i>, SearchSpace IE, ConfiguredGrantConf IE, DCI format 1_0, DCI format 1_1, or DCI format 0_1) from the base station. 6.3.2Radio resource control information elements –SearchSpace The IE <i>SearchSpace</i> defines how/where to search for PDCCH candidates. Each search space is associated with one <i>ControlResourceSet</i>. TS38.331 V15.1.0 6.3.2Radio resource control information elements –ConfiguredGrantConfig The IE <i>ConfiguredGrantConfig</i> is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (type1) or provided via the PDCCH (addressed to CS-RNTI) (type2). TS38.331 V15.1.0 7.3.1.2.1Format 1_0 DCI format 1_0 is used for the scheduling of PDSCH in one DL cell. The following information is transmitted by means of the DCI format 1_0: TS38.212 V15.0.0

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	7.3.1.2.2 Format 1_1 DCI format 1_1 is used for the scheduling of PDSCH in one cell. The following information is transmitted by means of the DCI format 1_1: TS38.212 V15.0.0 7.3.1.1.2 Format 0_1 DCI format 0_1 is used for the scheduling of PUSCH in one cell. The following information is transmitted by means of the DCI format 0_1: TS38.212 V15.0.0 6.2.1 UE sounding procedure The following SRS parameters are semi-statically configurable by higher layer parameter <i>SRS-ResourceConfig</i> for trigger type 0 and for trigger type 1. TS38.214 V15.0.0 6.3.2 Radio resource control information elements – <i>SRS-Config</i> The <i>SRS-Config</i> IE is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI). TS38.331 V15.1.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.

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[1C] wherein the first radio signal is transmitted by K antenna port groups of the base station; the antenna port group includes a positive integer number of antenna port(s); a first antenna port group is one of the K antenna port groups;	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice wherein the first radio signal is transmitted by K antenna port groups of the base station; the antenna port group includes a positive integer number of antenna port(s); a first antenna port group is one of the K antenna port groups. For example, the first radio signal (e.g., CSI-RS or SS/PBCH) is transmitted by K antenna port groups of the base station. For example, the first radio signal comprises K CSI-RS resources / SS/PBCH block resources. The K antenna port groups correspond to the K CSI-RS resources / SS/PBCH block resources, respectively, with each antenna port group comprises one or more ports included in the corresponding CSI-RS resource / SS/PBCH block resources. The antenna port group includes a positive integer number of antenna port(s) (e.g., number of ports). A first antenna port group (e.g., one or more ports included in one CSI-RS or SS/PBCH) is one of the K antenna port groups. 5.2.1.2 Resource settings Each Resource Setting <i>ResourceConfig</i> contains a configuration of $S \geq 1$ CSI-RS Resource Sets (higher layer parameter <i>ResourceSetConfig</i>), with each Resource Set consisting of CSI-RS resources (higher layer parameters <i>NZP-CSI-RS-ResourceConfigList</i> and <i>CSI-IM-ResourceConfigList</i>) and SS/PBCH Block resources used for L1-RSRP computation (higher layer parameter <i>resource-config-SS-list</i>). Each Resource setting is located in the BWP identified by the higher layer parameter <i>BWP-info</i>, and all linked Resource Settings of a CSI Report Setting have the same BWP. For periodic and semi-persistent CSI Resource Settings, $S=1$. Each set s contains $K_s \geq 1$ CSI-RS resources (higher layer parameter <i>CSI-RS-ResourceConfig</i>) each of which includes at least mapping to REs, number of ports and time-domain behavior as described in Subclause 5.2.2.3.1. The allowable antenna port values and resource mapping patterns are given in Subclause 7.4.1.5 of [4, TS 38.211]. The time domain behavior of the CSI-RS resources which are part of sets within a CSI-RS Resource Setting are indicated by the higher layer parameter <i>ResourceConfigType</i> and can be aperiodic, periodic, or semi-persistent. TS38.214 V15.0.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.

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[1D] the first signaling is used to determine a first time resource pool;	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice the first signaling is used to determine a first time resource pool. For example, the first time resource pool is the time domain resource occupied by a search space set. In other examples, the first time resource pool is the time domain resource occupied by a PUSCH. In other examples, the first time resource pool is the time domain resource occupied by a PDSCH or an SRS resource. In one example, the first signaling (<i>e.g.</i>, IE SearchSpace) is used to determine a first time resource pool (<i>e.g.</i>, monitoringSlotPeriodicityAndOffset; monitoringSymbolsWithinSlot). 6.3.2 Radio resource control information elements

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Claim	Accused Products – <i>SearchSpace</i> The IE <i>SearchSpace</i> defines how/where to search for PDCCH candidates. Each search space is associated with one <i>ControlResourceSet</i>. <i>SearchSpace</i> information element <pre>-- ASN1START -- TAG-SEARCHSPACE-START SearchSpace ::= SEQUENCE { -- Identity of the search space. SearchSpaceId = 0 identifies the SearchSpace configured via PBCH (MIB) or ServingCellConfigCommon. -- The searchSpaceId is unique among the BWPs of a Serving Cell. searchSpaceId SearchSpaceId, -- The CORESET applicable for this SearchSpace. -- Value 0 identifies the common CORESET configured in MIB and in ServingCellConfigCommon -- Values 1..maxNrofControlResourceSets-1 identify CORESETs configured by dedicated signalling controlResourceSetId ControlResourceSetId OPTIONAL, -- Cond SetupOnly -- Slots for PDCCH Monitoring configured as periodicity and offset. Corresponds to L1 parameters 'Monitoring-periodicity-PDCCH-slot' and -- 'Monitoring-offset-PDCCH-slot' (see 38.213, section 10) monitoringSlotPeriodicityAndOffset CHOICE { s11 NULL, s12 INTEGER (0..1), s14 INTEGER (0..3), s15 INTEGER (0..4), s18 INTEGER (0..7), s110 INTEGER (0..9), s116 INTEGER (0..15), s120 INTEGER (0..19) } OPTIONAL, -- Cond Setup -- Symbols for PDCCH monitoring in the slots configured for PDCCH monitoring (see monitoringSlotPeriodicityAndOffset). -- The most significant (left) bit represents the first OFDM in a slot. The least significant (right) bit represents the last symbol. -- Corresponds to L1 parameter 'Monitoring-symbols-PDCCH-within-slot' (see 38.213, section 10) monitoringSymbolsWithinSlot BIT STRING (SIZE (14)) OPTIONAL, -- Cond Setup } </pre> TS38.331 V15.1.0 In another example, the first signaling (<i>e.g.</i>, IE ConfiguredGrantConfig) is used to determine a first time resource pool (<i>e.g.</i>, timeDomainOffset; timeDomainAllocation). 6.3.2 Radio resource control information elements
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	– <i>ConfiguredGrantConfig</i> The IE <i>ConfiguredGrantConfig</i> is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (type1) or provided via the PDCCH (addressed to CS-RNTI) (type2). <i>ConfiguredGrantConfig</i> information element <pre>-- ASN1START -- TAG-CONFIGUREDGRANTCONFIG-START ConfiguredGrantConfig ::= SEQUENCE {</pre> ... <pre>rrc-ConfiguredUplinkGrant SEQUENCE { -- Offset related to SFN=0 timeDomainOffset INTEGER (0..5119), -- Corresponding to the DCI field of time domain resource assignment, and the maximum bit width is 4. --(see 38.214, section 6.1.2 and 38.212, section 7.3.1) timeDomainAllocation INTEGER (0..15), -- RAN1 indicated just "Mapping-type,Index-start-len" -- Corresponding to the DCI field of freq domain resource assignment. -- (see 38.214, section 6.1.2, and 38.212, section 7.3.1) frequencyDomainAllocation BIT STRING (SIZE(18)), -- UE-specific DMRS configuration: corresponding to the DCI field of antenna ports, and the maximum bitwidth is 5. -- (see 38.214, section 6.1.2, and 38.212, section 7.3.1)</pre> TS38.331 V15.1.0 In another example, the first signaling (<i>e.g.</i>, DCI format 1_0; DCI format 1_1; DCI format 0_1) is used to determine a first time resource pool (<i>e.g.</i>, time domain resource assignment). 7.3.1.2.1 Format 1_0 DCI format 1_0 is used for the scheduling of PDSCH in one DL cell. The following information is transmitted by means of the DCI format 1_0: - Identifier for DCI formats – [1] bits - Frequency domain resource assignment – $\left\lceil \log_2(N_{RB}^{UL,BWP}(N_{RB}^{UL,BWP} + 1)/2) \right\rceil$ bits - Time domain resource assignment – X bits TS38.212 V15.0.0

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	7.3.1.2.2Format 1_1 DCI format 1_1 is used for the scheduling of PDSCH in one cell. The following information is transmitted by means of the DCI format 1_1: ... - Time domain resource assignment –1, 2, 3, or 4 bits as defined in Subclause X.X of [6, TS38.214]. The bitwidth for this field is determined according to the higher layer parameter XXX. TS38.212 V15.0.0 7.3.1.1.2Format 0_1 DCI format 0_1 is used for the scheduling of PUSCH in one cell. The following information is transmitted by means of the DCI format 0_1: ... - For resource allocation type 1, the $\left\lceil \log_2(N_{RB}^{UL,BWP}(N_{RB}^{UL,BWP} + 1)/2) \right\rceil$ LSBs provide the resource allocation as defined in Subclause 6.1.2.2.2 of [6, TS38.214]- Time domain resource assignment – 1, 2, 3, or 4 bits as defined in Subclause X.X of [6, TS38.214]. The bitwidth for this field is determined according to the higher layer parameter XXX. TS38.212 V15.0.0 In another example, the first signaling (<i>e.g.</i>, SRS-ResourceConfig) is used to determine a first time resource pool (<i>e.g.</i>, Slot level periodicity; slot level offset; number of OFDM symbols in the SRS resource; starting OFDM symbol of the SRS resource within a slot including repetition factor R). 6.2.1UE sounding procedure

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	The following SRS parameters are semi-statically configurable by higher layer parameter <i>SRS-ResourceConfig</i> for trigger type 0 and for trigger type 1. - <i>SRS-ResourceConfigId</i> determines SRS resource configuration identify. - Number of SRS ports as defined by the higher layer parameter <i>NrofSRS-Ports</i> in Subclause 6.4.1.4 of [4, TS 38.211] for trigger type 0 and trigger type 1. - Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter <i>SRS-ResourceConfigType</i>, which can be periodic, semi-persistent, aperiodic SRS transmission as defined in Subclause 6.4.1.4 of [4, TS 38.211]. - Slot level periodicity and slot level offset as defined by the higher layer parameter <i>SRS-SlotConfig</i> in Subclause 6.4.1.4 of [4, TS 38.211] for an SRS resource of type periodic or semi-persistent. - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter <i>SRS-ResourceMapping</i> in Subclause 6.4.1.4 of [4, TS 38.211] for trigger type 0 and trigger type 1. TS38.214 V15.0.0 In another example, the first signaling (<i>e.g.</i>, SRS-Config IE) is used to determine a first time resource pool (<i>e.g.</i>, startPosition; nrofSymbols; repetitionFactor). 6.3.2Radio resource control information elements —SRS-Config The <i>SRS-Config</i> IE is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI). SRS-Config information element ... SRS-Resource ::=SEQUENCE {srs-ResourceIdSRS-ResourceId,nrofSRS-PortsENUMERATED {port1, ports2, ports4}, ...

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	-- OFDM symbol location of the SRS resource within a slot including number of OFDM symbols (N = 1, 2 or 4 per SRS resource), -- startPosition (SRSSymbolStartPosition = 0..5; "0" refers to the last symbol, "1" refers to the second last symbol) and -- RepetitionFactor (r = 1, 2 or 4). -- Corresponds to L1 parameter 'SRS-ResourceMapping' (see 38.214, section 6.2.1 and 38.211, section 6.4.1.4). -- FFS: Apparently, RAN1 considers replacing these three fields by a table in RAN1 specs and a corresponding index in ASN.1?! resourceMapping SEQUENCE { startPosition INTEGER (0..5), nrofSymbols ENUMERATED {n1, n2, n4}, repetitionFactor ENUMERATED {n1, n2, n4} }, TS38.331 V15.1.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.
[1E] at least one of a first antenna virtualization vector and a second antenna virtualization vector is associated with the first antenna port group; the first antenna virtualization vector is an antenna virtualization vector available to the base station in the first time resource pool; the second antenna virtualization vector is an antenna virtualization vector available to the user equipment in the first time resource pool; and the K is a positive integer greater than 1.	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice at least one of a first antenna virtualization vector and a second antenna virtualization vector is associated with the first antenna port group; the first antenna virtualization vector is an antenna virtualization vector available to the base station in the first time resource pool; the second antenna virtualization vector is an antenna virtualization vector available to the user equipment in the first time resource pool; and the K is a positive integer greater than 1. For example. the selection of the receiving depends on, for example, the QCL obtained and on the basis of that a spatial Receive (Rx) parameter is used by the UE as recited in claim element 1E. For example, according to TS38.331 v15.1.0 – clause 6.3.2, a search space set is associated with a CORESET. According to D2 – clause 10.1, a TCI-state is configured for a CORESET, which indicates at least one RS(CSI-RS or SS/PBCH, see TS38.331 v15.1.0 clause 6.2.3) providing QCL information for PDCCH reception in this CORESET (i.e., in the associated search space set in the first time resource pool). The first antenna port group contains the port(s) of the RS indicated by the TCI state. According to the definition of QCL in TS 38.214 v15.0.0 – clause 5.1.5, the QCL information include spatial Rx parameters. Spatial Rx parameters include Rx antenna vitalization vector. Therefore, the second antenna virtualization vector is associated with the first antenna port group. In another example, according to TS38.331 v15.1.0 clause 6.3.2 and TS38.212 v15.0.0 – clause 7.3.1.1.2, an SRI(SRS resource indicator) is indicated for a PUSCH (i.e., in the first time resource pool). The SRI indicates an SRS resource which is further associated with a CSI-RS or SS/PBCH (see TS38.214 v15.0.0 – clause 6.2.1). The first antenna port group contains port(s) of the CSI-RS or SS/PBCH associated with the SRS resource indicated by the SRI. According to TS38.214 v15.0.0 – clause 6.1.1, a PUSCH is transmitted over the ports in the SRS resource indicated by SRI, which means that the UE uses the same spatial domain transmission

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Claim	Accused Products
	filter to transmit the PUSCH and the SRS resource indicated by SRI. According to TS38.214 v15.0.0 – clause 6.2.1, a UE transmit the SRS resource, i.e., the PUSCH in the first time resource pool, with the same spatial domain transmission filter used for the reception of the associated CSI-RS or SS/PBCH. The spatial domain transmission filter includes a transmit antenna virtualization vector, so the second antenna virtualization vector is associated with the first antenna port group. In another example, according to TS38.214 v15.0.0 – clause 5.1.5, when there is no TCI field in a DCI (e.g., DCI format 1_0), a default TCI state is used for the PDSCH (i.e., in the first time resource pool). The first antenna port group contains port(s) of the RS indicated by the default TCI state. According to the definition of QCL in TS38.214 v15.0.0 – clause 5.1.5, the QCL information includes spatial Rx parameters. Spatial Rx parameters include Rx antenna virtualization vector. Therefore, the second antenna virtualization vector is associated with the first antenna port group. In another example, according to TS38.212 v15.0.0 – clause 7.3.1.2.2, a TCI (Transmission Configuration Indication) state is indicated in DCI format 1_1 for a PDSCH (i.e., in the first time resource pool), which refers to a CSI-RS or SS/PBCH for QCL information. The first antenna port group contains port(s) of the RS indicated by the TCI state. According to the definition of QCL in TS38.214 v15.0.0 – clause 5.1.5, the QCL information includes spatial Rx parameters. Spatial Rx parameters include the Rx antenna virtualization vector. Therefore, the second antenna virtualization vector is associated with the first antenna port group. In another example, according to TS38.214 v15.0.0 – clause 6.2.1, a CSI-RS or SS/PBCH is configured for an SRS resource (i.e., in the first time resource pool), and a UE transmit the SRS resource with the same spatial domain transmission filter used for the reception of the CSI-RS or SS/PBCH. The first antenna port group contains port(s) of the CSI-RS or SS/PBCH. The spatial domain transmission filter includes a transmit antenna virtualization vector, so the second antenna virtualization vector is associated with the first antenna port group. 6.3.2 Radio resource control information elements

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	– <i>SearchSpace</i> The IE <i>SearchSpace</i> defines how/where to search for PDCCH candidates. Each search space is associated with one <i>ControlResourceSet</i>. <i>SearchSpace</i> information element <pre>-- ASN1START -- TAG-SEARCHSPACE-START SearchSpace ::= -- Identity of the search space. SearchSpaceId = 0 identifies the SearchSpace configured via PBCH (MIB) or ServingCellConfigCommon. -- The searchSpaceId is unique among the BWPs of a Serving Cell. searchSpaceId SearchSpaceId, -- The CORESET applicable for this SearchSpace. -- Value 0 identifies the common CORESET configured in MIB and in ServingCellConfigCommon -- Values 1..maxNrofControlResourceSets-1 identify CORESETs configured by dedicated signalling controlResourceSetId ControlResourceSetId OPTIONAL, -- Cond SetupOnly</pre> TS38.331 V15.1.0 10.1 UE procedure for determining physical downlink control channel assignment

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	For a serving cell, higher layer signalling provides a UE with P control resource sets. For control resource set p, $0 \leq p < P$ where a UE-specific search space, a Type2-PDCCH common search space, or a Type3-PDCCH common search space is mapped, the higher layer signalling provides: - a control resource set index by higher layer parameter <i>CORESET-ID</i>; - a DM-RS scrambling sequence initialization value by higher layer parameter <i>PDCCH-DMRS-Scrambling-ID</i>; - a number of consecutive symbols provided by higher layer parameter <i>CORESET-time-duration</i>; - a set of resource blocks provided by higher layer parameter <i>CORESET-freq-dom</i>; - a CCE-to-REG mapping provided by higher layer parameter <i>CORESET-CCE-to-REG-mapping-type</i>; - a REG bundle size, in case of interleaved CCE-to-REG mapping, provided by higher layer parameter <i>CORESET-REG-bundle-size</i>; - a cyclic shift for the REG bundle interleaver [4, 38.211] by higher layer parameter <i>CORESET-shift-index</i>; - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by higher layer parameter <i>TCI-StatesPDCCH</i>, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception; - an indication for a presence or absence of a transmission configuration indication (TCI) field for DCI format 1_0 or DCI format 1_1 transmitted by a PDCCH in control resource set p, by higher layer parameter <i>TCI-PresentInDCI</i>. TS38.213 V15.0.0 6.3.2 Radio resource control information elements

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	<pre> rrc-ConfiguredUplinkGrant SEQUENCE { -- Offset related to SFN=0 timeDomainOffset INTEGER (0..5119), -- Corresponding to the DCI field of time domain resource assignment, and the maximum bit width is 4. --(see 38.214, section 6.1.2 and 38.212, section 7.3.1) timeDomainAllocation INTEGER (0..15), -- RAN1 indicated just "Mapping-type,Index-start-len" -- Corresponding to the DCI field of freq domain resource assignment. -- (see 38.214, section 6.1.2, and 38.212, section 7.3.1) frequencyDomainAllocation BIT STRING (SIZE(18)), -- UE-specific DMRS configuration: corresponding to the DCI field of antenna ports, and the maximum bitwidth is 5. -- (see 38.214, section 6.1.2, and 38.212, section 7.3.1) antennaPort INTEGER (0..31), dmrs-SeqInitialization INTEGER (0..1) OPTIONAL, -- Cond NoTransformPrecoder precodingAndNumberOfLayers INTEGER (0..63), srs-ResourceIndicator INTEGER (0..15), </pre> TS38.331 V15.1.0 6.1.1.1 Codebook based UL transmission For codebook based transmission, the UE determines its PUSCH transmission precoder based on SRI, TRI and TPMI fields from the DCI, where the TPMI is used to indicate the preferred precoder over the SRS ports in the selected SRS resource by the SRI when multiple SRS resources are configured, or if a single SRS resource is configured TPMI is used to indicate the preferred precoder over the SRS ports. The transmission precoder is selected from the uplink codebook, as defined in Subclause 6.3.1.5 of [4, TS 38.211]. TS38.214 V15.0.0 6.1.1.2 Non-Codebook based UL transmission For non-codebook based transmission, the UE can determine its PUSCH precoder and transmission rank based on wideband SRI field from the DCI. The UE shall use one or multiple SRS resources for SRS transmission, where the number of SRS resources which can be configured to the UE for simultaneously transmission in the same RBs is being part of UE capability signalling Only one SRS port for each SRS resource is configured. Only one SRS resource set can be configured. The maximum number of SRS resources that can be configured for non-codebook based uplink transmission is 4. TS38.214 V15.0.0

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	5.1.5 Antenna ports quasi-colocation If a UE is configured with the higher layer parameter <i>TCI-PresentInDCI</i> is set as 'Enabled' for the CORESET scheduling the PDSCH, the UE assumes that the TCI field is present in the DL DCI of the PDCCH transmitted on the CORESET. If <i>TCI-PresentInDCI</i> is set as 'Disabled' for the CORESET scheduling the PDSCH, for determining PDSCH antenna port quasi co-location, the UE assumes that the TCI state for the PDSCH is identical wo the TCI state applied for the CORESET used for the PDCCH transmission. TS38.214 V15.0.0 7.3.1.2.2 Format 1_1 DCI format 1_1 is used for the scheduling of PDSCH in one cell. The following information is transmitted by means of the DCI format 1_1: ... - Time domain resource assignment –1, 2, 3, or 4 bits as defined in Subclause X.X of [6, TS38.214]. The bitwidth for this field is determined according to the higher layer parameter <i>XXX</i>. ... - Transmission configuration indication – 0 bit if higher layer parameter <i>tcj-PresentInDCI</i> is not enabled; otherwise 3 bits as defined in Subclause x.x of [6, TS38.214]. TS38.212 V15.0.0 7.3.1.1.2 Format 0_1 DCI format 0_1 is used for the scheduling of PUSCH in one cell. The following information is transmitted by means of the DCI format 0_1:

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	... - For resource allocation type 1, the $\left\lceil \log_2(N_{RB}^{UL,BWP}(N_{RB}^{UL,BWP} + 1)/2) \right\rceil$ LSBs provide the resource allocation as defined in Subclause 6.1.2.2.2 of [6, TS38.214]- Time domain resource assignment – 1, 2, 3, or 4 bits as defined in Subclause X.X of [6, TS38.214]. The bitwidth for this field is determined according to the higher layer parameter <i>XXX</i>. ... - SRS resource indicator – $\left\lceil \log_2\left(\sum_{k=1}^{L_{max}}\binom{N_{SRS}}{k}\right) \right\rceil$ or $\left\lceil \log_2(N_{SRS}) \right\rceil$ bits, where N_{SRS} is the number of configured SRS resources in the SRS resource set associated with the higher layer parameter <i>SRS-SetUse</i> of value '<i>CodeBook</i>' or '<i>NonCodeBook</i>', and L_{max} is the maximum number of supported layers for the PUSCH. TS38.212 V15.0.0 6.2.1 UE sounding procedure

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	The following SRS parameters are semi-statically configurable by higher layer parameter <i>SRS-ResourceConfig</i> for trigger type 0 and for trigger type 1. - <i>SRS-ResourceConfigId</i> determines SRS resource configuration identify. - Number of SRS ports as defined by the higher layer parameter <i>NrofSRS-Ports</i> in Subclause 6.4.1.4 of [4, TS 38.211] for trigger type 0 and trigger type 1. - Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter <i>SRS-ResourceConfigType</i>, which can be periodic, semi-persistent, aperiodic SRS transmission as defined in Subclause 6.4.1.4 of [4, TS 38.211]. - Slot level periodicity and slot level offset as defined by the higher layer parameter <i>SRS-SlotConfig</i> in Subclause 6.4.1.4 of [4, TS 38.211] for an SRS resource of type periodic or semi-persistent. - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter <i>SRS-ResourceMapping</i> in Subclause 6.4.1.4 of [4, TS 38.211] for trigger type 0 and trigger type 1. ... For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter <i>SRS-ResourceConfigType</i> is set to 'periodic': - if the UE is configured with the higher layer parameter <i>SRS-SpatialRelationInfo</i> set to 'SSB/PBCH', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the SSB/PBCH, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'CSI-RS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the periodic CSI-RS or of the semi-persistent CSI-RS, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'SRS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the transmission of the periodic SRS.

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Claim	Accused Products
	For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter <i>SRS-ResourceConfigType</i> is set to 'semi-persistent': - when a UE receives an activation command [10, TS 38.321] for SRS resourceset in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on SRS transmission corresponding to the configured SRS resource set shall be applied no later than the minimum requirement defined in [11, TS 38.133]. - when a UE receives a deactivation command [MAC spec citation, 38.321] for activated SRS resourceset in slot n, the corresponding actions in [10, TS 38.321] and UE assumption on cessation of SRS transmission corresponding to the deactivated SRS resource set shall apply no later than the minimum requirement defined in [11, TS 38.133]. - if the UE is configured with the higher layer parameter <i>SRS-SpatialRelationInfo</i> set to 'SSB/PBCH', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the SSB/PBCH, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'CSI-RS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the periodic CSI-RS or of the semi-persistent CSI-RS, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'SRS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the transmission of the periodic SRS or of the semi-persistent SRS.

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter <i>SRS-ResourceConfigType</i> is set to 'aperiodic': - the UE receives a configuration of SRS resource sets, - the UE receives a downlink DCI or an uplink DCI based activation command where a codepoint of the DCI may activate one or more SRS resource set(s). - if the UE is configured with the higher layer parameter <i>SRS-SpatialRelationInfo</i> set to 'SSB/PBCH', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the SSB/PBCH, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'CSI-RS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the reception of the periodic CSI-RS or of the semi-persistent CSI-RS, if the higher layer parameter <i>SRS-SpatialRelationInfo</i> is set to 'SRS', the UE shall transmit the SRS resource with the same spatial domain transmission filter used for the transmission of the periodic SRS or of the semi-persistent SRS or of the aperiodic SRS. TS38.214 V15.0.0 6.3.2Radio resource control information elements –SRS-Config The <i>SRS-Config</i> IE is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI). SRS-Config information element ... SRS-Resource ::=SEQUENCE { srs-ResourceIdSRS-ResourceId, nrofSRS-PortsENUMERATED {port1, ports2, ports4}, ... resourceMappingSEQUENCE { startPositionINTEGER (0..5), nrofSymbolsENUMERATED {n1, n2, n4}, repetitionFactorENUMERATED {n1, n2, n4} }, ...

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Claim	Accused Products
	spatialRelationInfo ssb-Index csi-RS-Index srs CHOICE { SSB-Index, NZP-CSI-RS-ResourceId, SRS-ResourceId

TS38.331 V15.1.0

5.1.5

Antenna ports quasi-colocation

The UE can be configured up to M *TCI-States* by higher layer signalling to decode PDSCH according to a detected PDCCH with DCI intended for the UE and the given serving cell where M depends on the UE capability. Each configured TCI state includes one RS set *TCI-RS-SetConfig*. Each *TCI-RS-SetConfig* contains parameters for configuring quasi co-location relationship between the reference signals in the RS set and the DM-RS port group of the PDSCH. The RS set contains a reference to either one or two DL RSs and an associated quasi co-location type (QCL-Type) for each one configured by the higher layer parameter QCL-Type. For the case of two DL RSs, the QCL types shall not be the same, regardless of whether the references are to the same DL RS or different DL RSs. The quasi co-location types indicated to the UE are based on the higher layer parameter *QCL-Type* and may take one or a combination of the following types:

- QCL-TypeA: {Doppler shift, Doppler spread, average delay, delay spread}
- QCL-TypeB: {Doppler shift, Doppler spread}
- QCL-TypeC: {average delay, Doppler shift}
- QCL-TypeD: {Spatial Rx parameter}

TS38.214 V15.0.0

6.3.2

Radio resource control information elements

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	– TCI-State The <i>TCI-State</i> IE associates one or two DL reference signals with a corresponding quasi-colocation (QCL) type. TCI-State information element <pre>-- ASN1START -- TAG-TCI-STATE-START TCI-State ::= SEQUENCE { tci-StateId TCI-StateId, qcl-Type1 QCL-Info, qcl-Type2 QCL-Info OPTIONAL, -- Need R nrofPTRS-Ports ENUMERATED {n1, n2} OPTIONAL, -- Need R ... } QCL-Info ::= SEQUENCE { -- The carrier which the RS is located in. If the field is absent, it applies to the serving cell in which the TCI-State is configured cell ServCellIndex OPTIONAL, -- Need R -- The DL BWP which the RS is located in. bwp-Id BWP-Id OPTIONAL, -- Cond CSI-RS-Indicated -- Cond NZP-CSIR-Indicated: mandatory if csi-rs or csi-RS-for-tracking is included, absent otherwise referenceSignal CHOICE { csi-rs NZP-CSIR-ResourceId, ssb SSB-Index, -- A set of CSI-RS resources for tracking csi-RS-for-tracking NZP-CSIR-ResourceSetId }, qcl-Type ENUMERATED {typeA, typeB, typeC, typeD}, ... } -- TAG-TCI-STATE-STOP -- ASN1STOP</pre> TS38.331 V15.1.0 For example, the PDCCH channel is monitored by UE during, for example, discontinuous reception. Thus, the first time resource pool is discontinuous in time domain. See https://telecompedia.net/lte-drx-discontinuous-reception/. Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
2. The method of claim 1, further comprising: receiving a second signaling; and operating a second radio signal in a first time resource sub-pool; wherein the operating is receiving from the base station, or the operating is transmitting to the base station; the second signaling is used to determine the first time resource sub-pool from the first time resource pool; and the second signaling is used to determine at least one of occupied frequency domain resources, an MCS, a HARQ process number, an RV, an NDI and (a) transmitting antenna port(s) of the second radio signal.	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice receiving a second signaling; and operating a second radio signal in a first time resource sub-pool; wherein the operating is receiving from the base station, or the operating is transmitting to the base station; the second signaling is used to determine the first time resource sub-pool from the first time resource pool; and the second signaling is used to determine at least one of occupied frequency domain resources, an MCS, a HARQ process number, an RV, an NDI and (a) transmitting antenna port(s) of the second radio signal. <i>See</i> claim 1. Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.
3. The method of claim 2, comprising; monitoring the second signaling in a second time resource pool, wherein the second signaling occupies one time resource block in the second time resource pool at most; and the second time resource pool includes a positive integer number of time resource block(s); or monitoring the second signaling in a second time resource pool and monitoring the first signaling in a third time resource pool, wherein the second signaling occupies one time resource block in the second time resource pool at most; the second time resource pool includes a positive integer number of time resource block(s); the first signaling is a dynamic signaling; the first signaling occupies one time resource block in the third time resource pool at most; the third time resource pool includes a positive integer number of time resource block(s); a minimum time interval between time resource blocks in the third time resource pool is greater than a minimum time interval between time resource blocks in the second time resource pool. <i>See</i> claim 1.	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice monitoring the second signaling in a second time resource pool, wherein the second signaling occupies one time resource block in the second time resource pool at most; and the second time resource pool includes a positive integer number of time resource block(s); or monitoring the second signaling in a second time resource pool and monitoring the first signaling in a third time resource pool, wherein the second signaling occupies one time resource block in the second time resource pool at most; the second time resource pool includes a positive integer number of time resource block(s); the first signaling is a dynamic signaling; the first signaling occupies one time resource block in the third time resource pool at most; the third time resource pool includes a positive integer number of time resource block(s); a minimum time interval between time resource blocks in the third time resource pool is greater than a minimum time interval between time resource blocks in the second time resource pool. <i>See</i> claim 1. Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
most; the second time resource pool includes a positive integer number of time resource block(s); the first signaling is a dynamic signaling; the first signaling occupies one time resource block in the third time resource pool at most; the third time resource pool includes a positive integer number of time resource block(s); a minimum time interval between time resource blocks in the third time resource pool is greater than a minimum time interval between time resource blocks in the second time resource pool.	
4. The method of claim 1, further comprising: receiving first information, wherein the first information is used to determine the first antenna port group; or transmitting second information, wherein the second information is used to determine K1 antenna port group(s); the K1 antenna port group(s) belong(s) to the K antenna port groups; the first antenna port group is one of the K1 antenna port group(s); the K1 is a positive integer.	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice receiving first information, wherein the first information is used to determine the first antenna port group; or transmitting second information, wherein the second information is used to determine K1 antenna port group(s); the K1 antenna port group(s) belong(s) to the K antenna port groups; the first antenna port group is one of the K1 antenna port group(s); the K1 is a positive integer. In one example, the first information is ControlResourceSet IE, or an indication for an antenna port quasi co-location for a CORESET. In another example, the first signaling is ConfiguredGrantConfig IE for Type-2 configured grant, the first information is a DCI format 0_1 used to activate the Type-2 configured grant configured by the first signaling. In another For example, the first information is ControlResourceSet IE or an indication for an antenna port quasi co-location corresponding to the CORESET used for the reception of the DCI format 1_0. 6.3.2 Radio resource control information elements

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	– ControlResourceSet The IE <i>ControlResourceSet</i> is used to configure a time/frequency control resource set (CORESET) in which to search for downlink control information (see 38.213, section FFS_Section). ControlResourceSet information element <pre>-- ASN1START -- TAG-CONTROLRESOURCESET-START</pre> <pre>ControlResourceSet ::= SEQUENCE { -- Corresponds to L1 parameter 'CORESET-ID' -- Value 0 identifies the common CORESET configured in MIB and in ServingCellConfigCommon -- Values 1..maxNrofControlResourceSets-1 identify CORESETs configured by dedicated signalling -- The controlResourceSetId is unique among the BWPs of a ServingCell. controlResourceSetId ControlResourceSetId,</pre> TS38.331 V15.1.0 10.1 UE procedure for determining physical downlink control channel assignment If the UE has not received an indication for an antenna port quasi co-location from the set of antenna port quasi co-locations provided by <i>TCI-StatesPDCCH</i>, the UE assumes that the DM-RS antenna port associated with PDCCH reception in the UE-specific search space is quasi co-located with the DM-RS antenna port associated with PBCH reception with respect to delay spread, Doppler spread, Doppler shift, average delay, and spatial Rx parameters. TS38.213 V15.0.0 7.3.1.1.2 Format 0_1 DCI format 0_1 is used for the scheduling of PUSCH in one cell. The following information is transmitted by means of the DCI format 0_1: ...

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	- SRS resource indicator – $\left\lceil \log_2 \left(\sum_{k=1}^{L_{\max}} \binom{N_{\text{SRS}}}{k} \right) \right\rceil$ or $\lceil \log_2(N_{\text{SRS}}) \rceil$ bits, where N_{SRS} is the number of configured SRS resources in the SRS resource set associated with the higher layer parameter <i>SRS-SetUse</i> of value 'CodeBook' or 'NonCodeBook', and $L_{\max}$ is the maximum number of supported layers for the PUSCH. TS38.212 V15.0.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.
[5P] The method of claim 1,	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice the method of claim 1. See claim 1.
[5A] wherein the first time resource pool is discontinuous in time domain; or	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice wherein the first time resource pool is discontinuous in time domain. In one example, according to TS38.213 v15.0.0 – clause 10.1, the PDCCH monitoring occasions in a search space set is periodic in time domain, which means that the time resource occupied by a search space set is discontinuous. In another example, according to TS38.214 v15.0.0 – clause 6.1.2.3, the time domain resources for configured grant is periodic, i.e., discontinuous. In another example, according to TS38.214 v15.0.0 – clause 6.2.1, the time domain resource occupied by an SRS resource can be periodic, i.e., discontinuous. 10.1 UE procedure for determining physical downlink control channel assignment

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	For each serving cell that a UE is configured to monitor PDCCH in a search space other than Type0-PDCCH common search space, the UE is configured the following: - a number of search space sets by higher layer parameter <i>search-space-config</i>; - for each search space set in a control resource set p - an indication that the search space set is a common search space set or a UE-specific search space set by higher layer parameter <i>Common-search-space-flag</i>; - a number of PDCCH candidates $M_p^{(L)}$ per CCE aggregation level L by higher layer parameters <i>Aggregation-level-1</i>, <i>Aggregation-level-2</i>, <i>Aggregation-level-4</i>, <i>Aggregation-level-8</i>, and <i>Aggregation-level-16</i>, for CCE aggregation level 1, CCE aggregation level 2, CCE aggregation level 4, CCE aggregation level 8, and CCE aggregation level 16, respectively; - a PDCCH monitoring periodicity of k_p slots by higher layer parameter <i>Monitoring-periodicity-PDCCH-slot</i>; - a PDCCH monitoring offset of o_p slots, where $0 \leq o_p < k_p$, by higher layer parameter <i>Monitoring-offset-PDCCH-slot</i>; TS38.213 V15.0.0

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	6.1.2.3 Resource allocation for uplink transmission without grant When PUSCH resource allocation is semi-statically configured by higher layers, Number of DMRS CDM groups, DMRS ports, and number of front-loaded symbols are determined as in Subclause 7.3.1.1 of [5, TS 38.212], and the antenna port value is provided by <i>UL-TWG-DMRS</i>. - In case of UL-TWG-type1 configuration, the resource allocation follows the received configuration according to [38.321]; - The row index of an RRC configured table [<i>pusch-symbolAllocation</i>] is determined by the higher layer parameter <i>UL-TWG-tim-dom</i>, - the I_{MCS} is provided by higher layer parameter <i>UL-TWG-MCS-TBS</i>, - In case of UL-TWG-type2 configuration, the resource allocation follows the received configuration and an UL grant after receiving the grant on a DCI according to [38.321]; The UE shall not transmit anything on the resources configured by <i>UL-TWG-type1</i> or <i>UL-TWG-type2</i> if the higher layers did not deliver a TB to transmit on the resources allocated for uplink transmission without grant. A set of allowed periodicities P are defined in table 6.1.2.3-1. TS38.214 V15.0.0 6.2.1 UE sounding procedure

Appendix D - Claim Chart for US Patent No. 10,944,527 Against Samsung Accused Products

Claim	Accused Products
	The following SRS parameters are semi-statically configurable by higher layer parameter <i>SRS-ResourceConfig</i> for trigger type 0 and for trigger type 1. - <i>SRS-ResourceConfigId</i> determines SRS resource configuration identify. - Number of SRS ports as defined by the higher layer parameter <i>NrofSRS-Ports</i> in Subclause 6.4.1.4 of [4, TS 38.211] for trigger type 0 and trigger type 1. - Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter <i>SRS-ResourceConfigType</i>, which can be periodic, semi-persistent, aperiodic SRS transmission as defined in Subclause 6.4.1.4 of [4, TS 38.211]. - Slot level periodicity and slot level offset as defined by the higher layer parameter <i>SRS-SlotConfig</i> in Subclause 6.4.1.4 of [4, TS 38.211] for an SRS resource of type periodic or semi-persistent. TS38.214 V15.0.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.
[5B] the first signaling is a semi-static signaling.	Samsung infringes this claim, either directly or indirectly, either literally or under the doctrine of equivalents, as set forth below. For example, Samsung and the Accused Products practice the first signaling is a semi-static signaling. For example, the first signaling is a semi-static signaling. 6.1.2.3 Resource allocation for uplink transmission without grant When PUSCH resource allocation is semi-statically configured by higher layers, Number of DMRS CDM groups, DMRS ports, and number of front-loaded symbols are determined as in Subclause 7.3.1.1 of [5, TS 38.212], and the antenna port value is provided by <i>UL-TWG-DMRS</i>.

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	TS38.214 V15.0.0 6.2.1 UE sounding procedure The following SRS parameters are semi-statically configurable by higher layer parameter <i>SRS-ResourceConfig</i> for trigger type 0 and for trigger type 1. - <i>SRS-ResourceConfigId</i> determines SRS resource configuration identify. TS38.214 V15.0.0 Plaintiff reserves the right to amend or supplement these contentions after the inspection of source code, after the issuance of any claim construction order, and for any other reason as permitted by the Court.
[11P] A user equipment (UE) for multi-antenna transmission, comprising:	See element [1P].
[11A] a first transceiver, receiving a first radio signal from a base station; and	See element [1A].
[11B] a second receiver, receiving a first signaling from the base station;	See element [1B].
[11C] wherein the first radio signal is transmitted by K antenna port groups of the base station; the antenna port group includes a positive integer number of antenna port(s); the first antenna port group is one of the K antenna port groups;	See element [1C].
[11D] the first signaling is used to determine a first time resource pool;	See element [1D].
[11E] at least one of a first antenna virtualization vector and a second antenna virtualization vector is associated	See element [1E].

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with the first antenna port group; the first antenna virtualization vector is an antenna virtualization vector available to the base station in the first time resource pool; the second antenna virtualization vector is an antenna virtualization vector available to the user equipment in the first time resource pool; and the K is a positive integer greater than 1.	
12. The UE of claim 11, comprising: a third receiver, receiving a second signaling; and a second transceiver, operating a second radio signal in a first time resource sub-pool; wherein the operating is receiving from the base station, or the operating is transmitting to the base station; the second signaling is used to determine the first time resource sub-pool from the first time resource pool; and the second signaling is used to determine at least one of occupied frequency domain resources, a MCS, a HARQ process number, a RV, a NDI and (a) transmitting antenna port(s) of the second radio signal.	See claim 2.
13. The UE of claim 12, the third receiver further monitors the second signaling in a second time resource pool, wherein the second signaling occupies one time resource block in the second time	See claim 3.

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Claim	Accused Products
resource pool at most; the second time resource pool includes a positive integer number of time resource block(s); or the third receiver further monitors the second signaling in a second time resource pool, and the second receiver further monitors the first signaling in a third time resource pool, wherein the second signaling occupies one time resource block in the second time resource pool at most; the second time resource pool includes a positive integer number of time resource block(s); the first signaling is a dynamic signaling; the first signaling occupies one time resource block in the third time resource pool at most; the third time resource pool includes a positive integer number of time resource block(s); a minimum time interval between time resource blocks in the third time resource pool is greater than a minimum time interval between time resource blocks in the second time resource pool.	
14. The UE of claim 11, wherein: the second receiver further receives first information, wherein the first information is used to determine the first antenna port group; or the first transceiver further transmits second information, wherein the second information is used to	See Claim 4.

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Claim	Accused Products
determine K1 antenna port group(s); the K1 antenna port group(s) belong(s) to the K antenna port groups; the first antenna port group is one of the K1 antenna port group(s); the K1 is a positive integer.	
[15P] The UE of claim 11,	See claim 5.
[15A] wherein the first time resource pool is discontinuous in time domain; or	See element [5A].
[15B] the first signaling is a semi-static signaling.	See element [5B].