

Title (en)

RAILWAY TRAIN OPERATION CONTROL METHOD AND SYSTEM

Title (de)

EISENBAHNZUGBETRIEBSSTEUERUNGSVERFAHREN UND -SYSTEM

Title (fr)

PROCÉDÉ ET SYSTÈME DE COMMANDE DE FONCTIONNEMENT DE TRAIN

Publication

EP 3744605 B1 20230104 (EN)

Application

EP 19912800 A 20191122

Priority

- CN 201910085204 A 20190129
- CN 2019120150 W 20191122

Abstract (en)

[origin: EP3744605A1] Provided is a railway train operation control method. The method comprises: determining whether a train meets an automatic driving condition, and if so, outputting prompt information indicating that the train is allowed to enter an automatic driving mode; if it is detected that an ATO starting button on an operating platform of a driver has been triggered, controlling the train to enter the automatic driving mode; determining whether the train is at an intermediate station, and whether the train is in a non-dispatched state, and if so, determining whether the train is in the automatic driving mode, wherein the intermediate station refers to stations other than a starting station and a terminal station in a train travel route; and when the train is located at an intermediate station, is in the non-dispatched state, and is in the automatic driving mode, and if the ATO starting button has been triggered by the driver, controlling, by means of the automatic driving mode, the train to automatically depart from a station, automatically operate between stations, automatically stop at a station, perform a door-opening protection function, and perform linked control of train doors/platform doors.

IPC 8 full level

B61L 27/04 (2006.01); **B61C 17/00** (2006.01); **B61C 17/12** (2006.01); **B61L 15/00** (2006.01)

CPC (source: CN EP)

B61C 17/00 (2013.01 - CN); **B61C 17/12** (2013.01 - EP); **B61L 15/0072** (2013.01 - EP); **B61L 27/04** (2013.01 - EP)

Citation (opposition)

Opponent : AZD Praha s.r.o. (CZ)

- CN 102267481 A 20111207
- EP 2746132 A1 20140625 - BEIJING NAT RAILWAY RES & DESIGN INST OF SIGNAL & COMM CO LTD [CN]
- EP 3395642 A1 20181031 - ALSTOM TRANSP TECH [FR]
- US 2018312182 A1 20181101 - PRESTAIL ANDY [FR], et al
- US 2012197466 A1 20120802 - YOSHIMOTO KOKI [JP], et al
- ANONYMOUS: "ATO over ETCS Operational Requirements (Document version: 1.7)", ERTMS USERS GROUP, EUG REFERENCE: 13E137, 20 December 2016 (2016-12-20), XP093165637
- ANONYMOUS: "ERTMS/ETCS - Glossary of Terms and Abbreviations", ERA * UNISIG * EEIG ERTMS USERS GROUP, 12 May 2014 (2014-05-12), XP093165670, Retrieved from the Internet <URL:https://www.era.europa.eu/system/files/2023-01/sos2_index003_-_subset-023_v310.pdf>
- ANONYMOUS: "ATO OVER ETCS GLOSSARY (Document version : 1.6)", ERTMS USERS GROUP; EUG REFERENCE: 13E154, 3 May 2018 (2018-05-03), XP093165680
- SHAOTONG ZHU: "Research on Key Equipment for CTCS3+ATO System of High Speed Railway", CHINA RAILWAY, vol. 2018, no. 10, 1 October 2018 (2018-10-01), pages 1 - 8, XP093137131
- VILLALBA MANUEL: "Pioneering ATO over ETCS Level 2", RAILWAY GAZETTE INTERNATIONAL, 1 September 2016 (2016-09-01), pages 1 - 3, XP093135656, Retrieved from the Internet <URL:https://www.unife.org/wp-content/uploads/2021/03/Pioneering-ATO-over-ETCS-Level-2-Railway-Gazette.pdf> [retrieved on 20240228]
- COSTA RAÚL, VILLALBA MANUEL: "The application of the upcoming standard on ATO over ETCS", 360.REVISTA DE ALTA VELOCIDAD, 1 June 2018 (2018-06-01), XP093136429, Retrieved from the Internet <URL:https://www.tecnica-vialibre.es/documentos/Articulos/360AV05_3.6.CostaVillalba.pdf> [retrieved on 20240229]
- ANONYMOUS: "A TO over ETCS System Requirements Specification (Subset-125 0.1.0)", SHIFT 2 RAIL, 4 May 2018 (2018-05-04), pages 1 - 84, XP093135651
- ANONYMOUS: "SkyTrain (Vancouver)", WIKIPEDIA, 21 January 2019 (2019-01-21), XP093168114, Retrieved from the Internet <URL:https://en.wikipedia.org/w/index.php?title=SkyTrain_(Vancouver)&oldid=879412567>

Opponent : Alstom Holdings

- CN 103010230 A 20130403 - BEIJING TRAFFIC CONTROL TECH
- US 2012197466 A1 20120802 - YOSHIMOTO KOKI [JP], et al
- US 2017190340 A1 20170706 - JUNG JONG-CHUL [KR], et al
- CN 105109522 A 20151202 - CSR NANJING PUZHEN CO LTD
- CN 201037910 Y 20080319 - NANJING NRIET INDUSTRY CORP [CN]
- EP 2746132 A1 20140625 - BEIJING NAT RAILWAY RES & DESIGN INST OF SIGNAL & COMM CO LTD [CN]
- CN 103237044 A 20130807 - CN RAILWAY SIYUAN SURVEY & DES
- CN 103863364 A 20140618 - BEIJING THSOFT INFOTECH CO LTD
- CN 104787091 A 20150722 - UNIV BEIJING JIAOTONG
- CN 108163013 A 20180615 - TRAFFIC CONTROL TECH CO LTD
- CN 114655260 A 20220624 - ZHEJIANG DAFENG RAIL TRANSP EQUIPMENT CO LTD
- ANONYMOUS: "ATO over ETCS System Requirements Specification (Subset-125 0.1.0)", SHIFT 2 RAIL, 4 May 2018 (2018-05-04), pages 1 - 84, XP093135651
- ZHU SHAOTONG: "Research on Key Equipment for CTCS3+ATO System of High Speed Railway", CHINA RAILWAY, vol. 2018, no. 10, 31 December 2018 (2018-12-31), CN , pages 1 - 6, XP009523125, ISSN: 1001-683X, DOI: 10.19549/j.issn.1001-693x.2018.10.001
- VILLALBA MANUEL: "Pioneering ATO over ETCS Level 2", 1 September 2016 (2016-09-01), pages 1 - 3, XP093135656, Retrieved from the Internet <URL:https://www.unife.org/wp-content/uploads/2021/03/Pioneering-ATO-over-ETCS-Level-2-Railway-Gazette.pdf> [retrieved on 20240228]
- ANONYMOUS: "ATO over ETCS Operational Requirements V 1.7 ", ERTMS USERS GROUP, 20 December 2016 (2016-12-20), pages 1 - 35, XP093135659
- ANONYMOUS: "ATO over ETCS operational principles V 1.4", ERTMS USERS GROUP, 10 May 2017 (2017-05-10), pages 1 - 18, XP093135670

- ANONYMOUS: "ATO over ERTMS operational scenarios V 1.7 ", ERTMS USERS GROUP, 29 August 2017 (2017-08-29), pages 1 - 35, XP093135682
- ANONYMOUS: "ATO-OB ETCS-OB FFFIS Application Layer ", SUBSET 130, 4 May 2018 (2018-05-04), pages 1 - 24, XP093135690
- ANONYMOUS: "ATO over ETCS Operational Requirements ", ERTMS USERS GROUP, no. V 1.10, 21 December 2017 (2017-12-21), pages 1 - 33, XP093135694
- ANONYMOUS: "ATO-OB / Vehicle Interface Specification FIS ", UNSING, no. 0.0.9, 1 July 2018 (2018-07-01), pages 1 - 14, XP093135697
- ANONYMOUS: "ATO-OB / ATO-TS FFFIS Application Layer ", USING, no. 0.0.16, 7 May 2018 (2018-05-07), pages 1 - 36, XP093135702
- ANONYMOUS: "ATO over ERTMS Glossary ", ERTMS USERS GROUP, no. 1.2, 13 September 2013 (2013-09-13), pages 1 - 22, XP093135707
- ANONYMOUS: "ATC OVER ERTMS OPERATIONAL SCENARIOS ", ERTMS USERS GROUP, 3 October 2013 (2013-10-03), pages 1 - 100, XP093135710
- ANONYMOUS: "Signet go the distance ", 1 January 2018 (2018-01-01), pages 1 - 40, XP093135724, Retrieved from the Internet <URL:https://webinfo.uk/webdocssl/irse-kbase/ref-viewer.aspx?refno=1558775503&document=irse%20news%20246%20(jul-aug%202018).pdf> [retrieved on 20240228]
- ANONYMOUS: "X2Rail-1 ATO over ETCS (up to GoA4)", 15 November 2017 (2017-11-15), pages 1 - 17, XP093135732, Retrieved from the Internet <URL:https://www.era.europa.eu/system/files/2022-11/ccrcc_2017_ato_era_en.pdf> [retrieved on 20240228]
- ANONYMOUS: "ATO OVER ERTMS OPERATING PRINCIPLES ", ERTMS USERS GROUP, no. V 1.2, 13 September 2013 (2013-09-13), pages 1 - 24, XP093135748
- BOOTH PAUL: "ETCS and ATO through the Thameslink core", RAILWAY GAZETTE INTERNATIONAL, 1 September 2015 (2015-09-01), pages 33 - 37, XP093135755

Opponent : CAF Signalling S.L.

- US 5613654 A 19970325 - GELLERMANN WOLF-DIETER [DE], et al
- ANONYMOUS: "ATO over ETCS System Requirements Specification (Subset 125 0.1.0)", SHIFT 2 RAIL, 4 May 2018 (2018-05-04), pages 1 - 84, XP093135647
- ANONYMOUS: "ATO over ETCS Operational Requirements V 1.7 ", ERTMS USERS GROUP, 20 December 2016 (2016-12-20), pages 1 - 35, XP093135659
- ZHU SHAOTONG: "Research on Key Equipment for CTCS3+ATO System of High-Speed Railway", INSTITUTE OF COMMUNICATION SIGNALLING, 31 December 2018 (2018-12-31), XP093136393, [retrieved on 20240229]
- SIMMONS ANDREW, NICOLA FURNESS: "The main line ATO journey (2019", IRSE - KNOWLEDGE BASE, 23 January 2019 (2019-01-23), XP093108284, [retrieved on 20231204]
- VILLALBA MANUEL: "Pioneering ATO over ETCS Level 2", RAILWAY GAZETTE INTERNATIONAL, 1 September 2016 (2016-09-01), pages 107 - 109, XP093136411
- ANONYMOUS: "ATO OVER ETCS GLOSSARY, version 1.6", ERTMS USERS GROUP; EUG REFERENCE: 13E154, 3 May 2018 (2018-05-03), XP093136401, [retrieved on 20240229]

Opponent : GTS Deutschland GmbH

- CN 104340236 A 20150211 - BEIJING TRAFFIC CONTROL TECH
- CN 107792122 A 20180313 - CRSC WANQUAN SIGNAL EQUIPMENT CO LTD
- DE 69610494 T2 20010503 - WESTINGHOUSE BRAKE & SIGNAL [GB]
- CN 108116455 A 20180605 - TRAFFIC CONTROL TECH CO LTD
- DI CLAUDIO MARIANO; FANTECHI ALESSANDRO; MARTELLI GIACOMO; MENABENI SIMONE; NESI PAOLO: "Model-based development of an automatic train operation component for communication based train control", 17TH INTERNATIONAL IEEE CONFERENCE ON INTELLIGENT TRANSPORTATION SYSTEMS (ITSC), IEEE, 8 October 2014 (2014-10-08), pages 1015 - 1020, XP032685894, DOI: 10.1109/ITSC.2014.6957821
- SHAOTONG ZHU: "CTCS3+ATO high-speed train Research on key equipment for autonomous driving systems", CHINA RAILWAY, 1 October 2018 (2018-10-01), pages 1 - 6, XP093108295, DOI: 10.19549/j.issn.1001-683x.2018.10.001
- ANONYMOUS: "Automatic Train Operation", WIKIPEDIA, 3 December 2018 (2018-12-03), XP093137121, Retrieved from the Internet <URL:https://de.wikipedia.org/wiki/Automatic_Train_Operation> [retrieved on 20240304]
- SIAVASHI ALI, MOAVENI BIJAN, : "The Journal of Mathematics and Computer Science", TJMCS, vol. 1, no. 4, 1 January 2010 (2010-01-01), pages 247 - 257, XP093137123
- HERZFELD SVEN: "ETCS: Modes", EUROPEAN TRAIN CONTROL SYSTEM - MODES, 18 November 2018 (2018-11-18), pages 1 - 5, XP093137125, Retrieved from the Internet <URL:https://www.svenherzfeld.de/bahnen/ETCS/modes.htm> [retrieved on 20240304]
- BIENFAIT BENOIT: "ATO over ETCS", ALSTOM, 10 February 2016 (2016-02-10), pages 1 - 30, XP093137127, [retrieved on 20240304]
- ANONYMOUS: "ATO over ETCS operational requirements", ERTMS USERS GROUP, 20 December 2016 (2016-12-20), pages 1 - 35, XP093137130, [retrieved on 20240304]
- SHAOTONG ZHU: "Research on Key Equipment for CTCS3+ATO System of High Speed Railway", CHINA RAILWAY, vol. 2018, no. 10, 1 October 2018 (2018-10-01), pages 1 - 8, XP093137131
- EUROPEAN UNION AGENCY FOR RAILWAYS: "X2Rail-1 ATO over ETCS (up to GoA4)", CCRCC 2017, 15 November 2017 (2017-11-15), XP093137132, [retrieved on 20240304]
- ANONYMOUS: "Agenda", CCRCC 2017, 15 November 2017 (2017-11-15), XP093137134, [retrieved on 20240304]
- ANONYMOUS: "CCRCC 2017 Conference files", CCRCC 2017, 25 December 2015 (2015-12-25), XP093137136, [retrieved on 20240304]
- ANONYMOUS: "Workshop on DAS/ATO and energy efficiency to be held on 10 February 2016 at UIC", ENEWS, 8 December 2015 (2015-12-08), XP093137137, Retrieved from the Internet <URL:https://uic.org/com/enews/nr/477/article/workshop-on-das-ato-and-energy> [retrieved on 20240304]

Opponent : HITACHI RAIL STS S.p.A.

- CN 109649418 A 20190419 - CRRC CHANGCHUN RAILWAY VEHICLES CO LTD
- EP 3744605 A1 20201202 - CRRC CHANGCHUN RAILWAY VEHICLES CO LTD [CN]
- CN 108116455 A 20180605 - TRAFFIC CONTROL TECH CO LTD
- CN 108163013 A 20180615 - TRAFFIC CONTROL TECH CO LTD
- CN 108674447 A 20181019 - UNIV BEIJING JIAOTONG
- US 2018354535 A1 20181213 - CHO BONG KWAN [KR], et al
- CN 108146467 A 20180612 - SIGNAL & COMMUNICATION RES INSTITUTE OF CHINA ACADEMY OF RAILWAY SCIENCES, et al
- CN 109017884 A 20181218 - UNIV BEIJING JIAOTONG
- KR 101851971 B1 20180427 - KRRI [KR]
- CN 107264576 A 20171020 - SIGNAL & COMMUNICATION RES INSTITUTE OF CHINA ACADEMY OF RAILWAY SCIENCES, et al
- CN 106938656 A 20170711 - UNIV BEIJING JIAOTONG
- KR 20160047025 A 20160502 - HYUNDAI ROTEM CO [KR]
- WO 2012063439 A1 20120518 - TOSHIBA KK [JP], et al
- KR 20110000272 A 20110103 - SHALOM ENGINEERING CO LTD [KR], et al
- AU 2009202469 A1 20100114 - ANSALDO STS AUSTRALIA PTY LTD, et al
- CN 107985342 A 20180504 - TRAFFIC CONTROL TECH CO LTD
- WO 2018121691 A1 20180705 - BYD CO LTD [CN]
- COSTA RAÚL, VILLALBA MANUEL: "The application of the upcoming standard on ATO over ETCS", 360.REVISTA DE ALTA VELOCIDAD, 1 June 2018 (2018-06-01), XP093136429, Retrieved from the Internet <URL:https://www.tecnica-vialibre.es/documentos/Articulos/360AV05_3.6.CostaVillalba.pdf> [retrieved on 20240229]
- VILLALBA MANUEL: "Pioneering ATO over ETCS Level 2", RAILWAY GAZETTE INTERNATIONAL, 1 September 2016 (2016-09-01), pages 107 - 109, XP093108298

- ZHU SHAOTONG: "Research on Key Equipment for CTCS3+ATO System of High Speed Railway", CHINA RAILWAY, SIGNAL & COMMUNICATION RESEARCH INSTITUTE, CHINA ACADEMY OF RAILWAY SCIENCES CORPORATION LIMITED, CN, vol. 2018, no. 10, 31 December 2018 (2018-12-31), CN, pages 1 - 6, XP009523125, ISSN: 1001-683X, DOI: 10.19549/j.issn.1001-693x.2018.10.001
- ANONYMOUS: "Automated Train Operation", INNOTRANS 2018 ATO OVER ETCS - SHAPING CONNECTED MOBILITY; BERLIN, GERMANY; 18 - 21 SEPTEMBER 2018, SIEMENS MOBILITY GMBH, 1 September 2018 (2018-09-01) - 21 September 2018 (2018-09-21), pages 1 - 36, XP093136874
- ANONYMOUS: "Innotrans 2018", FERROVIE DELLO STATO ITALIANE - MEDIA - EVENTS - INNOTRANS 2018, FERROVIE DELLO STATO ITALIANE, 18 September 2018 (2018-09-18), pages 1 - 2, XP093136881, Retrieved from the Internet <URL:https://www.fsitaliane.it/content/fsitaliane/en/media/events/2018/9/18/innotrans-2018.html> [retrieved on 20240301]
- ANONYMOUS: "ATO over ETCS System Requirements Specification (Subset 125 0.1.0)", SHIFT 2 RAIL, 4 May 2018 (2018-05-04), pages 1 - 84, XP093135647
- ANONYMOUS: "Start-up activities for Advanced Signalling and Automation Systems", DELIVERABLE D4.1 ATO OVER ETCS – GOA2 SPECIFICATION, 1 September 2016 (2016-09-01), XP093136459, [retrieved on 20240229]
- ANONYMOUS: "ATO over ETCS Operational Requirements V 1.7", ERTMS USERS GROUP, 20 December 2016 (2016-12-20), pages 1 - 35, XP093135659
- ANONYMOUS: "Notice of the Ministry of Railways on the issuance of the "Technical Specifications for CTCS-3 Level Train Control Vehicle-mounted Equipment (Interim)"", RAILWAY TRANSPORT, MINISTRY OF RAILWAYS REQUIREMENTS, no. 211, 11 September 2012 (2012-09-11), pages 1 - 133, XP093136909
- BBC LONDON: "Self-driving trains – BBC London News", YOUTUBE, XP093136473, Retrieved from the Internet <URL:https://www.youtube.com/watch?v=TZalk8jsSNs> [retrieved on 20240229]

Opponent : KNORR-BREMSE Systeme für Schienenfahrzeuge GmbH

- CN 109649418 A 20190419 - CRRC CHANGCHUN RAILWAY VEHICLES CO LTD
- CN 102267481 A 20111207
- EP 2746132 A1 20140625 - BEIJING NAT RAILWAY RES & DESIGN INST OF SIGNAL & COMM CO LTD [CN]
- CN 105109522 A 20151202 - CSR NANJING PUZHEN CO LTD
- KR 20170080168 A 20170710 - LSIS CO LTD [KR]
- US 2017190340 A1 20170706 - JUNG JONG-CHUL [KR], et al
- CN 103010230 A 20130403 - BEIJING TRAFFIC CONTROL TECH
- CN 108163013 A 20180615 - TRAFFIC CONTROL TECH CO LTD
- US 2012197466 A1 20120802 - YOSHIMOTO KOKI [JP], et al
- CN 104787091 A 20150722 - UNIV BEIJING JIAOTONG
- CN 201037910 Y 20080319 - NANJING NRIET INDUSTRY CORP [CN]
- CN 103863364 A 20140618 - BEIJING THSOFT INFOTECH CO LTD
- CN 103237044 A 20130807 - CN RAILWAY SIYUAN SURVEY & DES
- CN 104340236 A 20150211 - BEIJING TRAFFIC CONTROL TECH
- KR 20080078158 A 20080827 - HYUNDAI ROTEM CO [KR]
- US 2013171590 A1 20130704 - KUMAR AJITH KUTTANNAIR [US]
- CN 104554299 A 20150429 - BEIJING TRAFFIC CONTROL TECH
- CN 109229160 A 20190118 - TRAFFIC CONTROL TECH CO LTD
- CN 105480259 A 20160413 - BEIJING TRAFFIC CONTROL TECH
- US 2016059874 A1 20160303 - MIYAJIMA YUTAKA [JP], et al
- US 9469310 B2 20161018 - KERNWEIN JEFFREY D [US], et al
- ANONYMOUS: "ATO over ETCS. System Requirements Specification. Draft", pages 1 - 82, XP093097854, [retrieved on 20231103]
- OLIVIER LEVÉQUE: "ETCS Implementation Handbook", UNION INTERNATIONAL DES CHEMINS DE FER (UIC), PARIS, Paris, pages 1 - 79, XP055100452, ISBN: 9782746114999, Retrieved from the Internet <URL:https://www.uic.org/download.php/publication/190_15E.pdf> [retrieved on 20140205]
- MAIN LINE ATO BECOMES A REALITY - RAIL ENGINEER

Opponent : Siemens Mobility GmbH

- WO 2017162472 A1 20170928 - SIEMENS AG [DE]
- EP 2857255 A1 20150408 - TOSHIBA KK [JP]
- ANONYMOUS: "ATO over ETCS System Requirements Specification (Subset 125 0.1.0)", SHIFT 2 RAIL, 4 May 2018 (2018-05-04), pages 1 - 84, XP093135647
- ANONYMOUS: "ATO over ETCS Operational Requirements (Document version: 1.7)", ERTMS USERS GROUP, EUG REFERENCE: 13E137, 20 December 2016 (2016-12-20), XP093165637
- ANONYMOUS: "ERTMS/ETCS - Glossary of Terms and Abbreviations", ERA * UNISIG * EEIG ERTMS USERS GROUP, 12 May 2014 (2014-05-12), XP093165670, Retrieved from the Internet <URL:https://www.era.europa.eu/system/files/2023-01/sos2_index003_-_subset-023_v310.pdf>
- ANONYMOUS: "ATO OVER ETCS GLOSSARY (Document version : 1.6)", ERTMS USERS GROUP; EUG REFERENCE: 13E154, 3 May 2018 (2018-05-03), XP093165680
- ANONYMOUS: "InnoTrans2018 Report", INNOTRANS REPORT, 18 September 2018 (2018-09-18), XP093165614
- ANONYMOUS: "Trainguard MT", SIEMENS, 1 January 2018 (2018-01-01), XP093165663

Opponent : Stadler Rail AG

- EP 3381769 A1 20181003 - COORDEM TRANSP TECH CO LTD [CN]
- KR 20160001852 A 20160107 - HYUNDAI ROTEM CO [KR]
- ANONYMOUS: "ATO over ETCS. System Requirements Specification. Draft", 4 May 2018 (2018-05-04), pages 1 - 82, XP093097854, [retrieved on 20231103]
- SIMMONS ANDREW, NICOLA FURNESS: "The main line ATO journey (2019)", IRSE - KNOWLEDGE BASE, 23 January 2019 (2019-01-23), XP093108284, [retrieved on 20231204]
- SIMMONS ANDREW, NICOLA FURNESS: "The IRSE in 2019 ... and beyond", IRSE NEWS, vol. 251, 23 January 2019 (2019-01-23), XP093108286
- ALSTOM: "X2Rail-1. Start-up activities for Advanced Signalling and Automation Systems", DELIVERABLE D4.1 ATO OVER ETCS – GOA2 SPECIFICATION, 4 June 2018 (2018-06-04), pages 1 - 8, XP093108289, [retrieved on 20231204]
- ANONYMOUS: "UNISIG. AN INDUSTRIAL CONSORTIUM TO DEVELOP ERTMS/ETCS TECHNICAL SPECIFICATIONS", UNIFE - FACTSHEETS, 1 July 2021 (2021-07-01), pages 1 - 2, XP093108292, Retrieved from the Internet <URL:https://www.ertms.net/wp-content/uploads/2021/07/ERTMS_Factsheet_8_UNISIG.pdf> [retrieved on 20231204]
- SHAOTONG ZHU: "CTCS3+ATO high-speed train Research on key equipment for autonomous driving systems", CHINA RAILWAY, 中国铁道科学研究院集团有限公司 通信信号研究所, 北京, 100081, 1 October 2018 (2018-10-01), pages 1 - 6, XP093108295, [retrieved on 20231204], DOI: 10.19549/j.issn.1001-683x.2018.10.001
- VILLALBA MANUEL: "Pioneering ATO over ETCS Level 2", RAILWAY GAZETTE INTERNATIONAL, 1 September 2016 (2016-09-01), pages 107 - 109, XP093108298

Cited by

CN113309440A; CN114620078A; EP3744605B1

Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

DOCDB simple family (publication)

EP 3744605 A1 20201202; EP 3744605 A4 20220309; EP 3744605 B1 20230104; CN 109649418 A 20190419; SG 11202008372P A 20200929;
WO 2020155803 A1 20200806

DOCDB simple family (application)

EP 19912800 A 20191122; CN 201910085204 A 20190129; CN 2019120150 W 20191122; SG 11202008372P A 20191122