

### Executive Summary

The NIST Communications Technology Laboratory mission is to promote the development and deployment of advanced communications technologies through dissemination of high-quality measurements, data, and research supporting U.S. innovation, industrial competitiveness, and public safety. CTL was founded in 2014 after a re-organization that brought together NIST research programs with an emphasis on metrology to support communications technology. The following list of publications is a comprehensive list of publications since the founding of CTL. The metrics associated with these publications are summarized in Table 1 and Figures 1 through 4. Although we have included publication and citation data through May 2019 in our data set, it is generally agreed that publications must be at least two years old for citation reporting to be meaningful (Abramo, et al. 2011; Clarivate Analytics 2018b). Therefore, it should be noted that the citation data for the more recent publications is preliminary and is most likely not indicative of their eventual impact.

Summary Metrics	
Total number of publications	327
Total times cited/minus self-citations	1,808 / 1,528
Total number of citing publications/minus self-citations	1,391 / 1,274
Average citations per publication	5.53

Table 1. Common bibliometric indicators. An h-index of 23 indicates that this group of 327 publications includes 23 papers that each have received 23 or more citations.

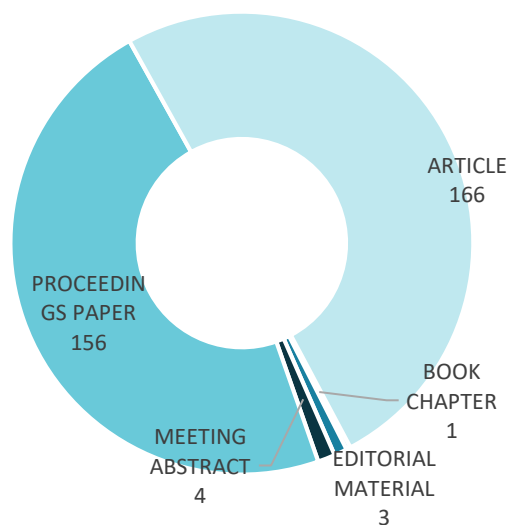


Figure 1. Publication types.

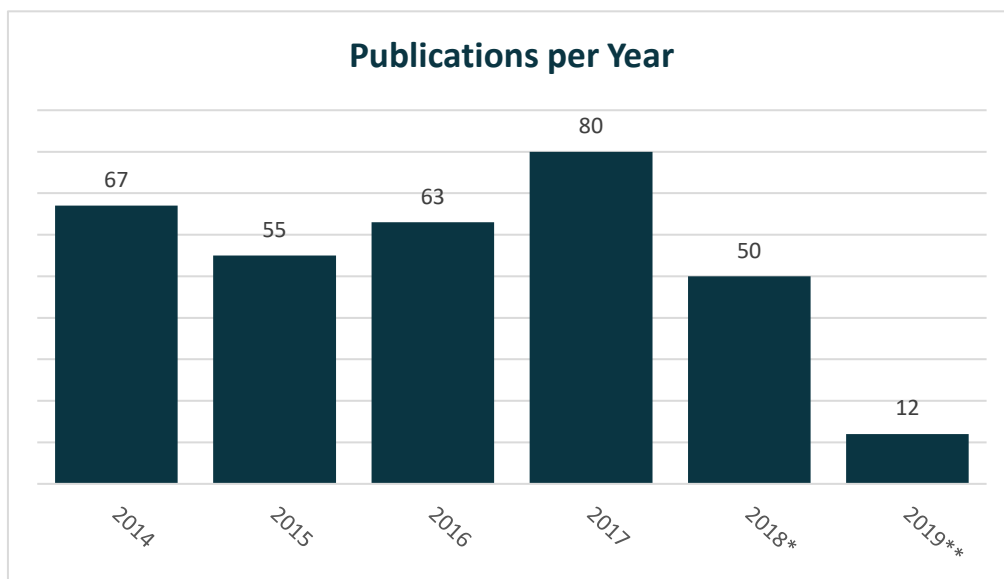


Figure 2. CTL publications per year. \*Due to lag times in database reporting and indexing, 2018 data is preliminary. \*\*As of May 22, 2019.

Because a large share of CTL’s publications appears in conference proceedings, we have listed journals and conference papers separately in the two charts below.

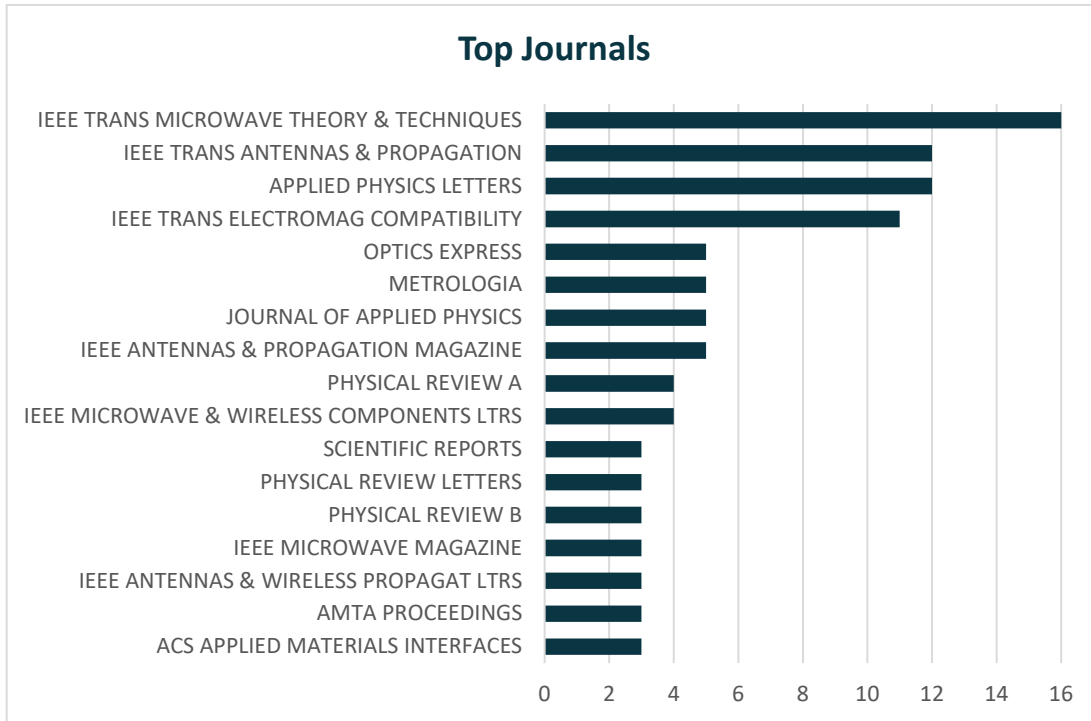


Figure 3. Journals in which CTL has published three or more times.

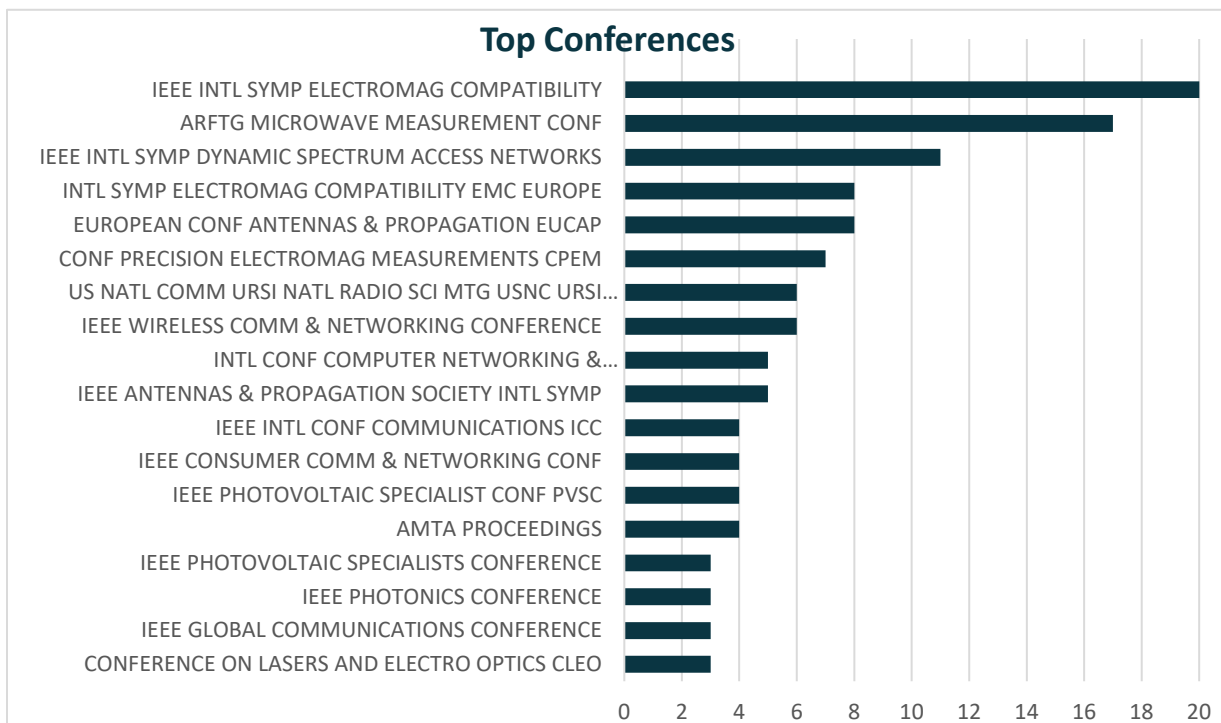


Figure 4. Conference series in which CTL has published three or more times.

## 2019

Max Lees, Adam Wunderlich, Peter Jeavons, Paul Hale, Michael Souryal "Deep Learning Classification of 3.5 GHz Band Spectrograms with Applications to Spectrum Sensing" Journal - IEEE Transactions on Cognitive Communications and Networking, (15-Feb-2019)

Christopher Holloway, Edward Kuester "Using reflection and transmission coefficients to retrieve surface parameters for an anisotropic metascreen: With a discussion on conversion between TE and TM polarizations" Journal - Journal of Applied Physics, (12-Feb-2019)

Jasper Drisko, Ari Feldman, Franklyn Quinlan, James Booth, Nathan Orloff, Christian Long "Impedance tuning with photoconductors to 40 GHz" Journal - IEEE Microwave and Wireless Components Letters, (22-Jan-2019)

Dylan Williams, Laurence Stant, Martin Salter, Nick Ridler, Peter Aaen "Propagating Measurement Uncertainty to Microwave Amplifier Nonlinear Behavioral Models" Journal - IEEE Transactions on Microwave Theory and Techniques, (01-Feb-2019)

Yao Ma, Daniel Kuester, Jason Coder, William Young "Slot Jamming Effect and Mitigation Between LTE-LAA and WLAN Systems With Heterogenous Slot Durations" Journal - IEEE Transactions on Communications, (05-Mar-2019)

Angela Stelson, Minghui Lu, Charles Little, Christian Long, Nathan Orloff, Nicolas Stephanopolous, James Booth "Label-Free Detection of Conformational Changes in Switchable DNA Nanostructures with Microwave Microfluidics" Journal - Nature, (12-Mar-2019)

Dazhen Gu, Jeffrey Jenkins "Noise-Synthesis Technique in Time~Domain for Metrology Application" Journal - IEEE Transactions on Instrumentation and Measurement, (11-May-2019)

Dazhen Gu, Xifeng Lu, Benjamin Jamroz, Dylan Williams, Xiaohai Cui, Aric Sanders "NIST-Traceable Microwave Power Measurement in Waveguide Calorimeter with Correlated Uncertainties" Journal - IEEE Transactions on Instrumentation and Measurement, (11-May-2019)

Charles Little, Angela Stelson, Nathan Orloff, Christian Long, James Booth "Measurement of Ion-Pairing Interactions in Buffer Solutions with Microwave Microfluidics" Journal - IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology, (01-Jan-2019)

Jeffrey Jargon, Dylan Williams, Aric Sanders "Three-Port Vector-Network-Analyzer Calibrations using the NIST Microwave Uncertainty Framework" Conference - 92nd ARFTG Microwave Measurement Conference, (19-Jan-2019)

Jeanne Quimby, David Michelson, Mustapha Bennai, Catherine Remley, Joshua Kast, Alec Weiss "Interlaboratory Millimeter-Wave Channel Sounder Verification" Conference - 13th European Conference on Antennas and Propagation Proceedings, (31-Mar-2019)

Catherine Remley "Let's Keep Women in Microwaves" Journal - IEEE Microwave Magazine, (01-Mar-2019)

Christopher Holloway, Matthew Simons, Abdulaziz Haddab, Joshua Gordon "A Rydberg Atom-Based Mixer: Measuring the Phase of a Radio Frequency Wave" Journal - Applied Physics Letters, (18-Mar-2019)

Joshua Gordon, Christopher Holloway, Matthew Simons, Abdulaziz Haddab "Weak Electric-Field Detection with Sub-1 Hz Resolution at Radio Frequencies Using A Rydberg Atom-Based Mixer" Journal - Applied Physics Letters, (25-Apr-2019)

Munsuk Kim, Ye Na Kim, Sukyoung Lee, Nada Golmie, SeungSeob Lee "A User Application-Based Access Point Selection Algorithm for Dense WLANs" Journal - PLoS One, (16-Jan-2019)

Chiehping Lai, Roy Sun, Camillo Gentile, Peter Papazian, Jian Wang, Jelena Senic "Methodology for Multipath-Component Tracking in Millimeter-Wave Channel Modeling" Journal - IEEE Transactions on Antennas and Propagation, (01-Mar-2019)

Anirudha Sahoo, Timothy Hall, Robert Hagwood "Optimal Dynamic Spectrum Access Scheme for Utilizing White Space in LTE Systems" Conference - IEEE Wireless Communications and Networking Conference (WCNC), (15-Apr-2019)

Jarrett Booz, Wei Yu, Guobin Xu, David Griffith, Nada Golmie "A Deep Learning-Based Weather Forecast System for Data Volume and Recency Analysis" Conference - International Conference on Computing, Networking and Communications (ICNC 2019), (18-Feb-2019)

Munsuk Kim, Tanguy Ropitault, SuKyoung Lee, Nada Golmie "Efficient MU-MIMO Beamforming Protocol for IEEE 802.11ay WLANs" Journal - IEEE Communications Letters, (01-Jan-2019)

Amirshahram Hematian, Wei Yu, David Griffith, Nada Golmie "Performance Assessment of Smart Meter Traffic over LTE Network Using SDR Testbed" Conference - International Conference on Computing, Networking and Communications (ICNC 2019), (18-Feb-2019)

Anirudha Sahoo, Thao Nguyen, Timothy Hall "A Practical Approach to Place Coastal Sensors for Spectrum Sharing in the 3.5 GHz Band" Conference - IEEE Wireless Communications and Networking Conference (WCNC), (15-Apr-2019)

Camillo Gentile, Andreas Molisch, Jack Chuang, Anuraag Bodi, Anmol Bhardwaj, Ozgur Ozdemir, Ismail Guvenc, Zihang Cheng, Thomas Choi, Robert Mueller "System Distortion Model for the Cross-Validation of Millimeter-Wave Channel Sounders" Conference - European Conference on Antennas and Propagation, (01-Apr-2019)

Robert Hagwood, Anirudha Sahoo, Timothy Hall "Analytical Modeling of White Space Utilization for a Dynamic Spectrum Access System" Conference - IEEE Wireless Communications and Networking Conference, (15-Apr-2019)

Yishen Sun, Wesley Garey, Richard Rouil, Priam Varin "Access Time Analysis of MCPTT Off-Network Mode over LTE" Journal - Wireless Communications and Mobile Computing, (02-Apr-2019)

Richard Rouil, Chunmei Liu, Antonio Izquierdo Manzanares "Guidelines for Generating Public Safety Benchmark Scenario Set" Nist Publication - NISTIR, (01-May-2019)

## 2018

Christopher Holloway "Generalized Sheet Transition Conditions (GSTCs) for a Metascreen" Journal - IEEE Transactions on Antennas and Propagation, (01-May-2018)

Maria Becker, Robert Horansky, Damir Senic, Vincent Neylon, Catherine Remley "Spatial Channels for Wireless Over-the-Air Measurements in Reverberation Chambers" Conference - OTA Characterization of Antennas and Wireless Devices (Convened session title), (10-Apr-2018)

Derek Houtz, Dazhen Gu "G-band Reflectivity Results of Conical Blackbody for Radiometer Calibration" Conference - Proceedings of Microwave Measurement Conference (ARFTG) by IEEE, 2017 90th ARFTG, (15-Jan-2018)

Azizollah Kord "On the Impacts of In-Band LTE Emissions" Conference - 2017 URSI the national Academics of Sciences-Engineering-Medicine, (04-Jan-2018)

Perry Wilson, Catherine Remley, William Young, Camillo Gentile, John Ladbury, Dylan Williams "EMC and Metrology Challenges for 5G and Beyond" Other, (07-Dec-2018)

Aric Sanders, Ronald Ginley, Christian Long, Jasper Drisko, Nathan Orloff, Richard Chamberlin "Qualitative Multidimensional Calibration Comparison" Conference - 90th ARFTG Microwave Measurement Conference, (15-Jan-2018)

Nathan Orloff, Jasper Drisko, Angela Stelson, Charles Little, James Booth, Jordi Mateu, Christian Long "How to extract distributed circuit parameters from the scattering parameters of a transmission line" Conference - 90th ARFTG Microwave Measurement Conference, (15-Jan-2018)

Johannes Markkanen, Alexey Yuffa, Joshua Gordon "Numerical Validation of a Boundary Element Method With E and dE/dN as the Boundary Unknowns" Conference - 2018 International Applied Computational Electromagnetics Society (ACES) Symposium, (25-Mar-2018)

Catherine Remley "Bringing Precision to Measurements for mmWave 5G Wireless" Talks - IEEE Electromagnetic Compatibility Society's Distinguished Lecturer Program, (03-Dec-2018)

Joseph Diener, Jeanne Quimby, Catherine Remley, Atef Elsherbeni "Millimeter-wave Frequency FDTD Simulation for Error Vector Magnitude of Modulated Signals" Conference - 2018 International Applied Computational Electromagnetics Society (ACES) Symposium, (25-Mar-2018)

Dazhen Gu "Thermal Noise Metrology with Time-Based Synthesis" Conference - Conference on Precision Electromagnetic Measurements, (09-Jul-2018)

Christopher Holloway, Joshua Gordon, Matthew Simons, Marcus Kautz "Electromagnetically Induced Transparency (EIT) and Autler-Townes (AT) splitting in the Presence of Band-Limited White Gaussian Noise" Journal - Journal of Applied Physics, (31-May-2018)

Maria Becker, Michael Frey, Sarah Streett, Catherine Remley, Robert Horansky, Damir Senic "Correlation-Based Uncertainty in Loaded Reverberation Chambers" Journal - IEEE Transactions on Electromagnetic Compatibility, (01-Oct-2018)

Dazhen Gu, Xifeng Lu, Benjamin Jamroz, Dylan Williams, Billy Riddle, Xiaohai Cui "A Self-Calibrated Transfer Standard for Microwave Calorimetry" Conference - 2018 Conference on Precision Electromagnetic Measurements, (09-Jul-2018)

Nina Basta, Jasper Drisko, Aaron Hagerstrom, Joshua Orlicki, Jennifer Sietins, Daniel Knorr, Jr., Edward Garboczi, Christian Long, Nathan Orloff "Determining Carbon Fiber Composite Loading by Flip-Chip on a Coplanar Waveguide to 110GHz" Conference - European Microwave Week, (22-Nov-2018)

Damir Senic, Catherine Remley, Maria Becker, Christopher Holloway "Spatial Uniformity Study in a Loaded Reverberation Chamber at Millimeter-Wave Frequencies" Conference - Proceedings of the 2018 IEEE International Symposium on Electromagnetic Compatibility, Signal and Power Integrity, (30-Jul-2018)

Richard Chamberlin, Dylan Williams "Measurement and Modeling of Heterogeneous Chip-Scale Interconnections" Journal - IEEE Transactions on Microwave Theory and Techniques, (22-Oct-2018)

Jeffrey Guerrieri, David Novotny, Joshua Gordon, Alexandra Curtin, Michael Allman, Kim Hassett, Quang Ton "The New Large Antenna Positioning System for Over-The-Air Testing at the National Institute of Standards and Technology" Conference - 12th European Conference on Antennas and Propagation, (09-Apr-2018)

Aaron Hagerstrom, Xifeng Lu, Natalie Dawley, H. Nair, Jordi Mateu, Robert Horansky, Charles Little, James Booth, Christian Long "Sub-nanosecond Tuning of Microwave Resonators Fabricated on Ruddlesden-Popper Dielectric Thin Films" Journal - Journal of Advanced Materials, (09-Jul-2018)

Catherine Remley, Dylan Williams, Robert Horansky "A NIST Testbed Approach to Verifying mmWave Wireless Communication Signals" Talks - 3rd NSF mmWave Research Coordination Network Workshop, (18-Jan-2018)

Christopher Holloway, Alexandra Artusio-Glimpse, Matthew Simons, Ivan Ryger "Measurement of Radio-Frequency Radiation Pressure" Journal - Physics Arxiv, (13-Feb-2018)

Roy Sun, Camillo Gentile, Jelena Senic, Peter Vouras, Peter Papazian, Nada Golmie, Catherine Remley "Millimeter-Wave Propagation Channels vs. Synthetic Beamwidth" Journal - IEEE Communications Magazine, (07-Dec-2018)

John Ladbury "Problems with Stirred Immunity Measurements in a Reverberation Chamber -- Corrections to DO-160G Section 20.6" Conference - 2018 Joint IEEE EMC & APEMC, (14-May-2018)

Matthew Simons, Joshua Gordon, Christopher Holloway "Fiber-coupled Vapor Cell for a Portable Rydberg Atom-based RF Electric Field Sensor" Journal - Applied Optics, (01-Aug-2018)

Robert Horansky, Thomas Meurs, Chih-Ming Wang, Maria Becker, Catherine Remley "Statistical Considerations for Total Isotropic Sensitivity of Wireless Devices Measured in Reverberation Chambers" Conference - International Symposium and Exhibition on Electromagnetic Compatibility (EMC EUROPE 2018), (27-Aug-2018)

Jeffrey Jargon, Dylan Williams "A New Calibration Method for Achieving High Insertion-Loss Measurements with a Vector Network Analyzer" Conference - 91st ARFTG Microwave Measurement Symposium, (15-Jun-2018)

Angela Stelson, Charles Little, Nathan Orloff, Christian Long, James Booth "Measuring Ion-Pairing in Buffer Solutions with Microwave Microfluidics" Conference - IEEE-MTT-S International Microwave Biomedical Conference, (14-Jun-2018)

Benjamin Jamroz, Dylan Williams, Catherine Remley, Robert Horansky "Importance of Preserving Correlations in Error-Vector-Magnitude Uncertainty" Conference - 91st ARFTG Microwave Measurement Conference, (15-Jun-2018)

Diogo Ribeiro, Dylan Williams, Richard Chamberlin, Nuno Carvalho "Impact of Phase Calibration on EVM Measurement Quality" Conference - 91st ARFTG Microwave Measurement Symposium, (15-Jun-2018)

Alirio De Jesus Soares Boaventura, Dylan Williams, Gustavo Avolio, Paul Hale "Traceable Characterization of Broadband Pulse Waveforms Suitable for Cryogenic Josephson Voltage Applications" Conference - International Microwave Symposium, (20-Aug-2018)

Christopher Holloway, Matthew Simons, Joshua Gordon "Development and Applications of a Fiber-Coupled Atom-Based Electric Field Probe" Conference - International Symposium and Exhibition on Electromagnetic Compatibility: EMC Europe 2018, (27-Aug-2018)

Christopher Holloway, Alexandra Artusio-Glimpse, Ivan Ryger, John Lehman "Measurement of Radio-Frequency Radiation Pressure: The Quest for a NEW SI Traceable Power Measurement" Conference - International Symposium and Exhibition on Electromagnetic Compatibility (EMC EUROPE 2018), (27-Aug-2018)

Paul Hale, Dylan Williams, Andrew Dienstfrey "Waveform metrology: Signal measurements in a modulated world" Journal - Metrologia, (03-Aug-2018)

Dylan Williams, Jerome Cheron, Benjamin Jamroz, Richard Chamberlin "On-Wafer Transistor Characterization to 750 GHz –the approach, results, and pitfalls" Conference - BiCMOS and Compound Semiconductor Integrated Circuits and Technology Symposium Digest, (15-Oct-2018)

Jeffrey Jargon, Dylan Williams, Aric Sanders "The Relationship Between Switch-Term-Corrected Scattering-Parameters and Wave-Parameters Measured with a Two-Port Vector Network Analyzer" Journal - IEEE Microwave and Wireless Components Letters, (24-Sep-2018)

Joshua Gordon, Steven Borenstein "An invisible-stylus-based coordinate measurement system via scaled orthographic projection" Journal - Precision Engineering-Journal of the International Societies for Precision Engineering and Nanotechnology, (08-Dec-2018)

Yao Ma, William Young, Eric Anderson, Jason Coder "Probability of Coexistence of LTE-LAA and WLAN Systems Based on Delay Constraints" Conference - The 27th International Conference on Computer Communications and Networks (ICCCN 2018), (30-Jul-2018)

Yao Ma "Analysis of Channel Access Priority Classes in LTE-LAA Spectrum Sharing System" Conference - The 27th International Conference on Computer Communications and Networks (ICCCN 2018), (30-Jul-2018)

Matthew Simons, Marcus Kautz, Joshua Gordon, Christopher Holloway "Uncertainties in Rydberg Atom-based RF E-field Measurements" Conference - International Symposium and Exhibition on electromagnetic compatibility: EMC Europe 2018, (08-Oct-2018)

Jake Rezac, Andrew Dienstfrey, Nicholas Vlajic, Akobuije Chijioke, Paul Hale "Generalized source-conditions and uncertainty bounds for deconvolution problems" Conference - Journal of Physics: Conference Series, (01-Oct-2018)

Christopher Holloway, Dave Anderson, Georg Raithel "High-resolution antenna near-field imaging and sub-THz measurements with a small atomic vapor-cell sensing element" Conference - GSMM 2018, (22-May-2018)

Eric Marksz, Christian Long, James Booth, Ichiro Takeicjo, Nathan Orloff "Frequency -and electric field-dependent physical model of ferroelectric materials in the 10s of GHz" Conference - IEEE MTT-S International Microwave Workshop Series on Advanced Materials and Processes, (16-Jul-2018)

Jerome Cheron, Dylan Williams, Konstanty Lukasik, Richard Chamberlin, Benjamin Jamroz, Erich Grossman, Wojciech Wiatr, Dominique Schreurs "Propagation of Compact-Modeling Measurement Uncertainty to 220 GHz Power-Amplifier Designs" Conference - The Asia-Pacific Microwave Conference (APMC) 2018, (06-Nov-2018)

Catherine Remley, Maria Becker "Bringing Precision to 5G Test: Activities in the U.S." Conference - 12th European Conference on Antennas and Propagation, (09-Apr-2018)

David Novotny, Joshua Gordon "Practical Considerations When Using Commercial Robotic Arms for Antenna Metrology" Conference - 2018 International Symposium on Antennas and Propagation, (23-Oct-2018)

Christopher Holloway, Matthew Simons, Marcus Kautz, Abdulaziz Haddab, Joshua Gordon "Using Rydberg Atoms for a New SI-Traceable Radio-Frequency Power Measurement Technique in Rectangular Waveguides" Journal - Applied Physics Letters, (22-Jun-2018)

Christopher Holloway, Matthew Simons, Dave Anderson, Georg Raithel "High-resolution near-field imaging and far-field antenna measurements with atomic sensors" Conference - International Symposium And Exhibition On Electromagnetic Compatibility (EMC Europe 2018), (27-Aug-2018)

Audrey Puls "Antenna Radiation Pattern Measurements in Reverberation Chamber" Conference - 36th Annual Symposium of the Antenna Measurement Techniques Association (AMTA), (04-Nov-2018)

Alexey Yuffa, Benjamin Jamroz, Jake Rezac, Dylan Williams "A Systematic Study: Channel Sounding via Modal Expansion" Conference - 2018 Antenna Measurement Techniques Association Symposium (AMTA), (04-Nov-2018)

Matthew Simons, Marcus Kautz, Abdulaziz Haddab, Joshua Gordon, Christopher Holloway, Thomas Crowley "Rydberg Atom-based RF Power Measurements" Conference - 2018 Antenna Measurement Techniques Association Symposium (AMTA), (04-Nov-2018)

Joshua Gordon, David Novotny, Michael Allman "Precision Optical Antenna Alignment System for Tracking Antennas in 6-DOF" Conference - 2018 Antenna Measurement Techniques Association Symposium (AMTA), (04-Nov-2018)

Christopher Holloway, Matthew Simons, David Novotny, John Lehman, Paul Williams, Gordon Shaw "Using Radiation Pressure to Develop a Radio-Frequency Power Measurement Technique Traceable to the Redefined SI" Journal - Applied Physics Letters, (15-Oct-2018)



Alexey Yuffa, Ronald Wittmann, Michael Francis, Joshua Gordon, David Novotny "A Possible Advantage of Using Bi-directional S-Parameters in Antenna Measurements" Conference - Proceedings of the Antenna Measurement Techniques Association, (01-Dec-2018)

Andre Rosete, Kenneth Baker, Yao Ma "Using LZMA Compression for Spectrum Sensing with SDR Samples" Conference - The 9th IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference, (10-Nov-2018)

Johannes Markkanen, Alexey Yuffa, Joshua Gordon "Numerical Validation of a Boundary Element Method with Electric Field and Its Normal Derivative as the Boundary Unknowns" Journal - Journal of Applied Computational Electromagnetics Society, (25-Mar-2018)

Nina Basta, Aaron Hagerstrom, Jasper Drisko, James Booth, Edward Garboczi, Christian Long, Nathan Orloff "Determining Carbon Fiber Composite Loading with Flip-Chip Measurements to 110 GHz" Journal - IEEE Transactions on Microwave Theory and Techniques, (01-Sep-2018)

Richard Rouil, Wesley Garey, Camillo Gentile, Nada Golmie "Increasing Public Safety Broadband Network Resiliency Through Traffic Control" Journal - Elsevier, (01-Feb-2018)

Jian Wang, Camillo Gentile, Jelena Senic, Roy Sun, Peter Papazian "Unsupervised Clustering for Millimeter-Wave Channel Propagation Modeling" Conference - 2017 IEEE Vehicular Technology Conference - Fall, (12-Feb-2018)

Camillo Gentile, Peter Papazian, Roy Sun, Jelena Senic, Jian Wang "Quasi-Deterministic-Channel-Propagation Model for a Data Center at 60 GHz" Journal - IEEE Antennas and Wireless Propagation Letters, (01-May-2018)

Aziza Ben Mosbah, David Griffith, Richard Rouil "Enhanced Transmission Algorithm for Dynamic Device-to-Device Direct Discovery" Conference - 2018 IEEE Consumer Communications and Networking Conference (CCNC), (12-Jan-2018)

Nada Golmie "Future Generation Wireless R&D Gaps Report" Nist Publication - NIST SP, (05-Feb-2018)

Jian Wang, Richard Rouil "Assessing Coverage and Throughput for D2D Communication" Conference - 2018 IEEE International Conference on Communications (ICC), (31-Jul-2018)

David Griffith, Fernando Cintron, Timothy Hall, Richard Rouil "Modeling and Simulation Analysis of the Physical Sidelink Shared Channel (PSSCH)" Conference - 2018 IEEE International Conference on Communications (ICC), (24-May-2018)

Yalong Wu, Wei Yu, Jin Zhang, David Griffith, Nada Golmie "A 3D Topology Optimization Scheme for M2M Communications" Conference - 19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD 2018), (29-Jun-2018)

Mudumbai Ranganathan, Anirudha Sahoo, Thao Nguyen, Timothy Hall "Sensor Placement and Detection Coverage for Spectrum Sharing in the 3.5 GHz Band" Conference - 29th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, (12-Sep-2018)

Camillo Gentile, Peter Papazian, Nada Golmie, Catherine Remley, Peter Vouras, Jelena Senic, Jian Wang, Jack Chuang, Ruoyu Sun "Millimeter-Wave Channel Measurement and Modeling: A NIST Perspective" Journal - IEEE Communications Magazine, (07-Dec-2018)

Priam Varin, Yishen Sun, Wesley Garey "Test Scenarios for Mission Critical Push-To-Talk (MCPTT) Off-Network Mode Protocols Implementation" Nist Publication - NISTIR, (31-Oct-2018)

Yalong Wu, Wei Yu, David Griffith, Nada Golmie "A Dynamic Rate Adaptation Scheme for M2M Communications" Conference - 2018 IEEE International Conference on Communications (ICC), (24-May-2018)

Michael Souryal, Thao Nguyen, Nickolas LaSorte "3.5 GHz Federal Incumbent Protection Algorithms" Conference - IEEE International Symposium on Dynamic Spectrum Access Networks, (22-Oct-2018)

Raied Caromi, Michael Souryal, Wen-Bin Yang "Detection of Incumbent Radar in The 3.5 GHz CBRS Band" Conference - IEEE Global Conference on Signal and Information Processing (GlobalSIP), (26-Nov-2018)

Peter Vouras "Gradient-Based Solution of Maximum Likelihood Angle Estimation for Virtual Array Measurements" Conference - Proceedings of the 2018 IEEE GlobalSIP Conference, (28-Nov-2018)

Fernando Cintron "Performance Evaluation of LTE Device-to-Device Out-of-Coverage Communication with Frequency Hopping Resource Scheduling" Nist Publication - NISTIR, (23-Jul-2018)

Raied Caromi, John Mink, Cosburn Wedderburn, Michael Souryal, Naceur El Ouni "3.5 GHz ESC Sensor Test Apparatus Using Field-Measured Waveforms" Conference - WinnComm 2018, (14-Nov-2018)

Hansong Xu, Wei Yu, David Griffith, Nada Golmie "A Survey on Industrial Internet of Things: A Cyber-Physical Systems Perspective" Journal - IEEE Access Journal, (04-Dec-2018)

Cosburn Wedderburn, Raied Caromi, Michael Souryal "Instructions for Running the RF Sensor Test Harness" Other, (08-Nov-2018)

Malcolm White, David Livigni, Rodney Leonhardt, Geiland Porrovecchio, Marek Smid "A Charge Integrator Amplifier and Trap Detector for pico-Joule Laser Pulse Energy Measurement" Journal - Metrologia, (10-Aug-2018)

Ivan Ryger, Alexandra Artusio-Glimpse, Paul Williams, Gordon Shaw, Matthew Simons, Christopher Holloway, John Lehman "MEMS non-absorbing electromagnetic power sensor employing the effect of radiation pressure" Conference - MDPI Proceedings, Vol.2, Issue 13, September 2018, EUROSENSORS 2018 Proceedings., (09-Sep-2018)

Richard Candell, Mohamed Hany, Kang Lee, Yongkang Liu, Jeanne Quimby, Catherine Remley "Guide to Industrial Wireless Systems Deployments" Nist Publication - NIST AMS, (21-May-2018)

John Garofolo, Khaled Abdelghany, May Yuan, Michael Hahsler, Andrew Weinert, Tyler Garner, Alex Hauptmann, Junwei Liang, David Blankinship, David Van Ballegooijen, Homa Alemzadeh "2018 Stakeholder Meeting Presentation, Day 2, Room 30B" Talks - 2018 Public Safety Broadband Stakeholder Meeting, (16-Oct-2018)

Jason Coder, Yao Ma "On the Susceptibility of Coded OFDM to Interference: A Simulation Study" Conference - Proceedings of the 2018 National Radio Science Meeting, (04-Jan-2018)

## 2017

William Young, Ari Feldman, Sheryl Genco, Azizollah Kord, Daniel Kuester, John Ladbury, Duncan McGillivray, Audrey Puls, Andre Rosete, Adam Wunderlich, Wen-Bin Yang "LTE impacts on GPS" Nist Publication - NIST TN, (15-Feb-2017)

Paul Hale, Jeffrey Jargon, Peter Jeavons, Michael Souryal, Adam Wunderlich, Mark Lofquist "3.5 GHz Radar Waveform Capture at Point Loma" Nist Publication - NIST TN, (11-May-2017)

Harris Feldman, Adam Danielson "2015 Location-Based Services R&D Summit Report" Conference - PSCR R&D Priority Topic Areas, (30-Jan-2017)

Jeremy Benson, Harris Feldman "2016 PSCR Analytics Summit Report" Nist Publication - OTHER, (30-Jan-2017)

Jeremy Benson, Harris Feldman, Marc Leh, Ryan Felts "Public Safety User Interface R&D Roadmap" Nist Publication - NIST TN, (26-Apr-2017)

Jason Kahn "Process Document for the NIST List of Certified Devices" Website - <https://www.nist.gov/publications/process-document-nist-list-certified-devices>, (24-Oct-2017)

Christopher Holloway, Matthew Simons, Joshua Gordon "Atom-Based RF Electric Field Metrology: From Self-Calibrated Measurements to SubWavelength and Near-Field Imaging" Journal - IEEE Transactions on Electromagnetic Compatibility, (01-Apr-2017)

Nathan Orloff, Song Liu, James Booth, Dylan Williams, Dominec Schreurs, Bart Nauwelaers, Iija Oclet, Charles Little "Hybrid Characterization of Nanolitre Dielectric Fluids in a Single Microfluidic Channel up to 110 GHz Song" Journal - IEEE Transactions on Microwave Theory and Techniques, (01-Dec-2017)

Christopher Holloway, Matthew Simons, Joshua Gordon "Atom-based RF electric field metrology above 100 GHz" Conference - SPIE: Photomics WEST, (16-Jul-2017)

Perry Wilson, John Ladbury, Galen Koepke, Capstick Myles, Niels Kuster, Sven Kuhn, Veronica Berdinas-Torres, Yijian Gong, David McCormick, James Gauger, Ronald Melnick "A Radio Frequency Radiation Reverberation Chamber Exposure System for Rodents" Journal - IEEE Transactions on Electromagnetic Compatibility, (17-Mar-2017)

Perry Wilson, John Ladbury, Galen Koepke, Yijian Gong, Myles Capstick, Keven Kuhn, David McCormick, Ronald Melnick, Niels Kuster "Life Time Dosimetric Assessment for Mice and Rats Exposed to Cell Phone Radiation in Reverberation Chambers" Journal - IEEE Transactions on Electromagnetic Compatibility, (17-Mar-2017)

Christopher Holloway, Matthew Simons, Joshua Gordon "Using Cs and Rb Rydberg Atoms Simultaneously to Perform SI-Traceable RF Electric Field Measurements via Electromagnetically Induced Transparency" Conference - EMC Europe 2016, (03-Sep-2017)

Arkadiusz Lewandowski, Wojciech Wiatr, Nathan Orloff, James Booth "A Multireflect-Thru Method of Vector-Network-Analyzer Calibration" Journal - IEEE Transactions on Microwave Theory and Techniques, (01-Mar-2017)

Joshua Gordon, David Novotny, Ronald Wittmann, Michael Francis, Jeffrey Guerrieri, Alexandra Curtin, Miranda Butler, Albin Gasiewski, Lavanya Periasamy "Characterization of Millimeter-wave 3D-printed Antennas For CubeSat Applications Using a Robotic Antenna Range" Journal - IEEE Antennas and Propagation Magazine, (21-Feb-2017)

Damir Senic, Antonio Sarolic, Christopher Holloway, John Ladbury "Whole-Body Specific Absorption Rate Assessment of Lossy Objects Exposed to a Diffuse Field Inside a Reverberant Environment" Journal - IEEE Transactions on Electromagnetic Compatibility, (01-Jul-2017)

Catherine Remley, Jeanne Quimby, Paul Hale, Dylan Williams, Jeffrey Jargon, Rodney Leonhardt "Channel Sounder Measurement Verification and Uncertainty" Website - <http://groups.winnforum.org>, (02-Jun-2017)

Jordi Mateu, C Collado, A Hueltes, D Garcia-Pastor, R Perera, Nikhil Joshi, Xifeng Lu, Nathan Orloff, James Booth "Comprehensive circuit model of auto-limiting superconductor devices and systems" Conference - IEEE Transactions on Applied Superconductivity, (01-Jun-2017)

Paul Hale, Kai Baaske, Thomas Kleine-Ostmann, Mark Bieler, Thorsten Schrader "An alternative to the geometric addition method for calculating the rise time of fast oscilloscopes and pulse generations" Journal - Technisches Messen, (02-Jan-2017)

Ruoyu Sun, Peter Papazian, Jelena Senic, Yeh Lo, Jae-Kark Choi, Catherine Remley, Camillo Gentile "Design and Calibration of a Double-directional 60 GHz Channel Sounder for Multipath Component Tracking\*" Conference - Proceedings of EuCAP 2017, (19-Mar-2017)

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Ronald Ginley "Kicking the Tires of the NIST Microwave Uncertainty Framework Part 2\*" Conference - 90th ARFTAG Conference, (28-Nov-2017)

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Christopher Holloway, Edward Kuester "Using Generalized Sheet Transition Conditions (GSTCs) in the Analysis of Metasurfaces" Book Chapter - Surface Electromagnetics with Applications in Antenna, Microwave, and Optical Engineering, (22-Oct-2017)

Azza Ben Mosbah, Timothy Hall, Michael Souryal, Hossam Afifi "Analysis of the Vulnerability of the Incumbent Frequency to Inference Attacks in Spectrum Sharing" Conference - 2017 IEEE Consumer Communications and Networking Conference (CCNC), (08-Jan-2017)

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Audrey Puls, William Young, Catherine Remley, Jacob Healy, Luis Gonzalez "Development of Laboratory Test Methods for RF-Based Electronic Safety Equipment: Guide to the NFPA 1982 Standard" Nist Publication - NIST TN, (31-Oct-2016)

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Damir Senic, Catherine Remley, Dylan Williams, Diogo Ribeiro, Chih-Ming Wang, Christopher Holloway "Radiated Power Based on Wave Parameters at Millimeter-wave Frequencies for Integrated Wireless Devices" Conference - Automatic RF Techniques Group Microwave Measurements Conference Digest, (08-Dec-2016)

Ronald Ginley "Kicking the Tires of the NIST Microwave Uncertainty Framework," Conference - 88th ARFTG Microwave Measurement Symposium, (08-Dec-2016)

Catherine Remley "Measurement of Wireless Devices in Reverberation Chambers" Talks - IEEE Electromagnetic Compatibility Society's Distinguished Lecturer program, (07-Dec-2016)

Guobin Xu, Wei Yu, David Griffith, Nada Golmie, Paul Moulema "Performance Evaluation of Integrating Distributed Energy Resources and Storage Devices in the Smart Grid" Journal - IEEE Internet of Things, (15-Dec-2016)

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### **3<sup>rd</sup> Generation Partnership Project (3GPP) Service and System Aspects (SA6) Contributions**

As of November 18, 2016 - SA6#14 (Reno): 1[3]

S6-161520 (revision of S6-161458 [revision of S6-161307]) LS on Floor override without floor revoke  
S6-161506 (revision of S6-161290) Pseudo-CR on remote start application of MCDATA service

As of October 14, 2016 - SA6#13 (Sophia-Antipolis): 9[20]

S6-161214 (revision of S6-161121 [revision of S6-160985]) Pseudo-CR on definition modification

S6-161119 (revision of S6-160986) Pseudo-CR on editorial modification

S6-161122 (revision of S6-160987) Pseudo-CR on group regroup  
S6-161220 (revision of S6-161130 [revision of S6-160988]) Pseudo-CR on user profile corrections  
S6-161005 Example scenario demonstrating group-broadcast group behavior  
S6-161113 (revision of S6-161006) Information flows for group-broadcast group  
S6-161210 (revision of S6-161114 [revision of S6-161013]) Pseudo-CR on callback capability  
S6-161212 (revision of S6-161118 [revision of S6-161047]) Pseudo-CR on remotely initiated MCPTT call  
S6-161012 Public safety prioritization for MCDData and MCvideo functions, features and capabilities

As of May 27, 2016 - SA6#11 (Bangalore): 1[2]

S6-160505 (Revision of S6-160293) Incompleteness and inconsistency between 10.3.5.1.1 and 10.3.2.7.1

As of April 15, 2016 - SA6#10 (Ljubljana): 10[21]

S6-160226 Technical inconsistency with text and figure in clause 10.2 (not pursued)  
S6-160238 Incompleteness and inconsistency in 10.1.1 and Annex B (not pursued)  
S6-160345 (revision of S6-160288 [revision of S6-160239]) Incompleteness and inconsistency between 10.1.2.7 and 10.1.5.3  
S6-160289 (revision of S6-160243) Incompleteness and inconsistency in 10.6.2.4.2 (merged)  
S6-160339 (revision of S6-160292 [revision of S6-160242]) Incompleteness of message definitions in 10.4  
S6-160296 (S6-160246) Incompleteness of 10.5.3.5.1 (merged)  
S6-160271 (revision of S6-160247) Inclusion of participant type as example in floor control  
S6-160293 (revision of S6-160240) Incompleteness and inconsistency between 10.3.5.1.1 and 10.3.2.7.1  
S6-160294 (revision of S6-160241) Incompleteness and inconsistency in 10.3.5.2.1  
S6-160361 (revision of S6-160298 [revision of S6-160225]) Editorials, formats, spelling, grammar, and other inconsistencies

As of November 20, 2015 - SA6#08 (Anaheim): 5[7]

S6-151329 SA6 Terms of Reference Change  
S6-151539 (revision of S6-151330) Changes to figure 10.3-1 and steps  
S6-151331 Configuration concerns relating to Annex B and functional models - Discussion  
S6-151332 Configuration concerns relating to Annex B and functional models  
S6-151529 (revision of S6-151333) Removal of editor's note in 10.11.1.3.2

As of October 16, 2015 - SA6#07 (Belgrade): 7[16]

S6-151263 (revision of (S6-151212 (revision of S6-151001)) Changes to clause 10.12.1 floor control for on-network MCPTT service

S6-151134 Changes to figure 10.3-1 and steps (postponed)

S6-151268 (revision of S6-151247 [revision of S6-151135]) Edits to TS 23.179

S6-151200 (revision of S6-151148) Changes to Clause 8.4.2 Off-network group ID management

S6-151300 (revision of S6-151151) Clarification on 10.5, Subscription to MCPTT group metadata

S6-151251 (revision of S6-151152) Correct use of user and client for 10.7, Pre-established session

S6-151262 (revision of S6-151211 [revision of S6-151154]) Emergency and imminent peril information flow updates

As of August 21, 2015 - SA6#06 (Vancouver): 2[4]

S6-150778 An example of floor control

S6-150965 (revision of S6-150921 [revision of S6-150779]) Changes to clause 10.9.1 (postponed)

As of July 10, 2015 - SA6#05 (Seoul): 18[24]

S6-150599 Clause 2 Reference correction

S6-150600 Clause 3.1 Definitions changes (merged into S6-150642)

S6-150601 Clause 5.1.1 Service Continuity consistent use of terms

S6-150602 Clause 5.2.3 Media routing requirement consistent use of terms, Primary and Partner

S6-150603 Clause 5.2.5 group affiliation missing possibility

S6-150703 (revision of S6-150604) Lists written for clarity

S6-150605 Consistency in Figure 10.1-1 and text

S6-150672 (revision of S6-150606) What is the meaning of metadata?

S6-150607 Consistency in pre-conditions, Figure 10.5.1.1-1, and text

S6-150608 Consistency of terms between Figure 10.6.2-1, and text

S6-150609 Consistency of terms between Figure 10.6.3-1, and text

S6-150610 Consistency of terms between Figure 10.7.1-1, and text (merged with S6-150683)

S6-150611 Consistency of terms between Figure 10.7.3-1, and text

S6-150612 Consistency of terms between Figure 10.7.4-1, and text

S6-150704 (revision of S6-150613) Editorial comments within TS 23.179

S6-150614 Clarification with Floor participant and Floor control server in 7.4.4, 9.3.2, and 9.3.7

S6-150682 (revision of S6-150619) Consistency of terms between Figure 10.6.4 -1, and text

S6-150728 (revision of S6-150641 [revision of S6-150544]) Terminology alignment

As of May 29, 2015 - SA6#04(Fukuoka): 2[2]

S6-150373 Differences between references to MCPTT UE and references to MCPTT User in TS 22.179

S6-150374 Example Selection of values for N4 and N6

As of April 17, 2015 - SA6#03 (SanJoseDelCabo) 1[1]

S6-150220 Additional Scenarios for consideration

### **3<sup>rd</sup> Generation Partnership Project (3GPP) Core Network and Terminals (CT1) Contributions**

- U.S. Department of Commerce (DoC) National Institutes of Standards and Technology (NIST) contribution
  - CI-163707 (revision of CI-163265) on off-network floor control corrections, which has been agreed in CTI.
- US DoC contributions (agreed) into CT1 (December 2017):
  - C1-175225, C1-175226, C1-174781, C1-174782 corrections to off-network Broadcast group call procedures
  - C1-175223, C1-175224, C1-174780 corrections to off-network call type control procedures: merge of two calls
- U.S. DoC NIST contributions (agreed) into CTI (August 2017):
  - CI-173438 Corrections to off-network floor control procedures TS 24.380 (Rel-13)
  - CI-173439 (revision of CI-172949) Corrections to off-network floor control procedures TS 24.380 (Rel-14)
  - CI-173440 explicit corrections to off-network floor control procedures and steps TS 24.380 (Rel-13)
  - CI-173441 (revision of CI-172950) explicit corrections to off-network floor control procedures and steps TS 24.380 (Rel-14)
  - CI-173449 corrections to off-network call control procedures TS 24.379 (Rel-13)
  - CI-173450 (revision of CI-173150) corrections to off-network call control procedures TS 24.379 (Rel-14)
- Over 50 contributions to SAG.
- As of March 24, 2017: 10 original contributions that resulted in 24 contributions before approval for SAG.

- October 2016
  - 56-161214 (revision of 56-161121 (revision of 56-160985)) Pseudo-CR on Definitions modifications.
  - 56-161119 (revision of 56-160986) Pseudo-CR on editorial modifications.
  - 56-161122 (revision of 56-160987) Pseudo-CR on group regroup.
  - 56-161220 (revision of 56-161130 {revision of 56-160988}) Pseudo-CR on user profile corrections.
  - 56-161005 Example scenario demonstrating group-broadcast group behavior.
  - 56-161113 {revision of 56-161006} Pseudo-CR on Information flows for group-broadcast group.
  - 56-161210 (revision of 56-161114 (revision of 56-161013)) Pseudo-CR on callback capability.
  - 56-161212 (revision of 56-161118 (revision of 56-161047)) Pseudo-CR on remotely initiated MCPTT call.
- November 2016
  - 56-161520 (revision of 56-161458 (revision of 56-161307)) LS on Floor override without floor revoke.
  - 56-161506 (revision of 56-161290) Pseudo-CR on remote start application of MCDATA service.
- As of September 20, 2017:
  - February 2017 (4 original contributions that resulted in 7 contributions before approval-for CTI)
    - CI-171007 {revision of CI-170558} TS24.380v13 Corrections to names, values, codings, and state machines.
    - CI-171015 {revision of CI-170559} TS24.481 Corrections to elements, identifiers, names, steps, and labels.
    - CI-171008 {revision of CI-170560} TS24.380v14 Corrections to names, values, codings, and state machines.
    - CI-170571 TS24.424 Pseudo-CR on Figure 4-1 graphical representation of Zero Or One.
  - August 2017 (26 original contributions that resulted in 48 contributions before approval or merger with another organization's contribution for CTICI-173400 (revision of CI-172955) Corrections to cross reference, coding, and labels TS 24.481 (Rel-13)
    - CI-173401 (revision of CI-172956) Corrections to cross reference, coding, and labels TS 24.481 (Rel-14)
    - CI-173402 {revision of CI-172990} Clause 4-Correction of occurrences of parameters TS 24.483 (Rel-13)
    - CI-173403 (revision of CI-172991) Clause 4 -Correction of occurrences of parameters TS 24.483 (Rel-14)
    - CI-173623 (revision of CI-173404 {revision of CI-172992}) Clause 5 - Correction of occurrences of parameters TS 24.483 {Rel-13}

- CI-173405 (revision of CI-172993) Clause 5 -Correction of occurrences of parameters TS 24.483 (Rel-14)
- CI-172999 Clause 6 -Correction of occurrences of parameters TS 24.483 (Rel-14)
- CI-173491 (revision of CI-173000) Clause 9 -Correction of occurrences of parameters TS 24.483 (Rel-14)
- CI-173492 (revision of CI-173001) Clause 10.2.2.3 -XML Schema correction TS 24.484 (Rel- 14)
- CI-173608 (revision of CI-173049) Clause 10 -Correction of names and formats of some parameters TS 24.483 (Rel-14)
- CI-173050 Clause 12 -Correction of occurrences of parameters TS 24.483 (Rel-14)
- CI-173051 Clause 13 -Correction of occurrences of parameters and their graphical representation TS 24.483 (Rel-14)
- CI-173626 (revision of CI-173445) Clause 8-Inclusion of missing timer TFG14 TS 24.483 (Rel-13)
- CI-173627 (revision of CI-173446 (revision of CI-173052)) Clause 8 -Inclusion of missing timer TFG14 TS 24.483 (Rel-14)
- CI-173447 Various corrections to TS 24.484 (Rel-13)
- CI-173448 {revision of CI-173053} Various corrections to TS 24.484 (Rel-14)
- CI-173174 Coding Error ABNF for the Warning text TS 24.379 (Rel-13)
- CI-173416 (revision of CI-173175) Coding Error ABNF for the Warning text TS 24.379 (Rel- 14)
- CI-173417 (revision of CI-173176) Correction of state naming for MIG 3, and MIG 4 TS 24.379 (Rel-13)
- CI-173418 {revision of CI-173177} Correction of state naming for MIG 3, and MIG 4 TS 24.379 (Rel-14)
- CI-173222 Correction of identifier <mcptt-calling-user-id> TS 24.379 (Rel-13)
- CI-173419 {revision of CI-173223} Correction of identifier <mcptt-calling-user-id> TS 24.379 (Rel-14)
- CI-173420 (revision of CI-173224) Correction of identifier for <imminentperil-ind> TS 24.379 (Rel-13)
- CI-173421 (revision of CI-173225) Correction of identifier for <imminentperil-ind> TS 24.379 (Rel-14)
- CI-173422 (revision of CI-173226) Correction of cross-referenced steps TS 24.379 {Rel-13}
- CI-173423 {revision of CI-173227} Correction of cross-referenced steps TS 24.379 (Rel-14)