

# **CIGRE Study Committee C4**

## **System Technical Performance**

### **Liaison Report**

**Presented to IEC TC 77, CISPR and ACEC**  
**Dr. William Radasky, CIGRE Study Committee C4 Liaison**  
**October 2020**

# Introduction

- **This liaison report is intended to inform the IEC EMC committees of the ongoing work in CIGRE Study Committee C4**
- **The Scope and Tasks of SC C4 are reviewed**
- **At the CIGRE Conference in Paris in even years (latest was scheduled for August 2020) preferential subjects are defined ahead of time to invite papers to be presented and discussed**
  - **Full conference has been postponed until August 2021**
- **Active WGs are listed along with those that have recently completed their work**

# Study Committee C4 – Mission Statement

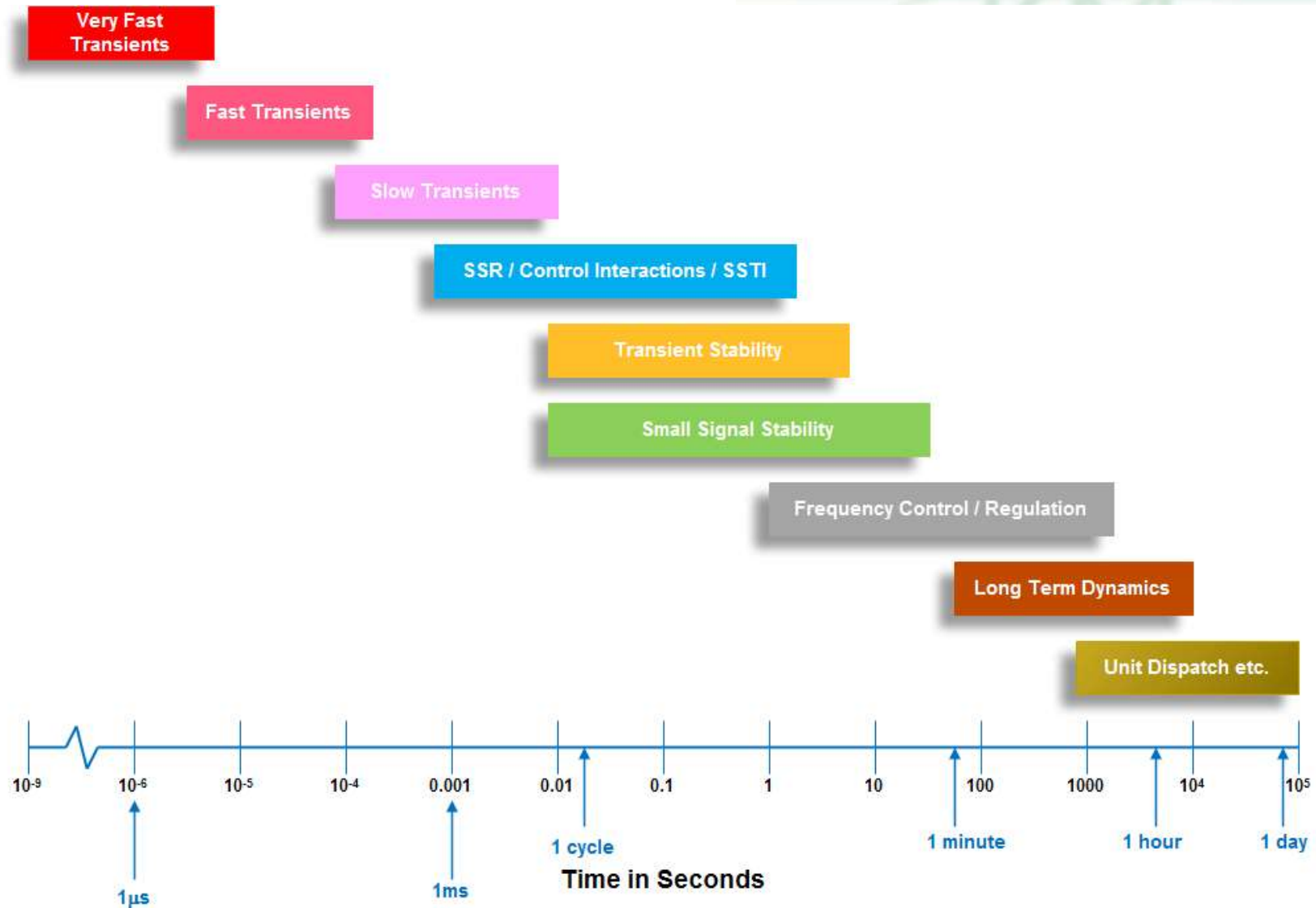
- **SC C4 deals with methods and tools for analysis related to power systems, with particular reference to dynamic and transient conditions and to the interaction between the power system and its apparatus/sub-systems, between the power system and external causes of stress and between the power system and other installations.**
- **Specific issues related to the design and manufacturing of components and apparatus are not in the scopes of SC C4, as well as those specifically related to planning and operation and control, apart from those cases in which component/apparatus/subsystem behaviour depends on, or significantly interacts with, the performance of the nearby power system.**
- **Chairman of Study Committee C4: Dr. Zia Emin, UK**
- **Secretary of Study Committee C4: Dr. Genevieve Lietz, DE**

## Scope of SC C4 – Topics

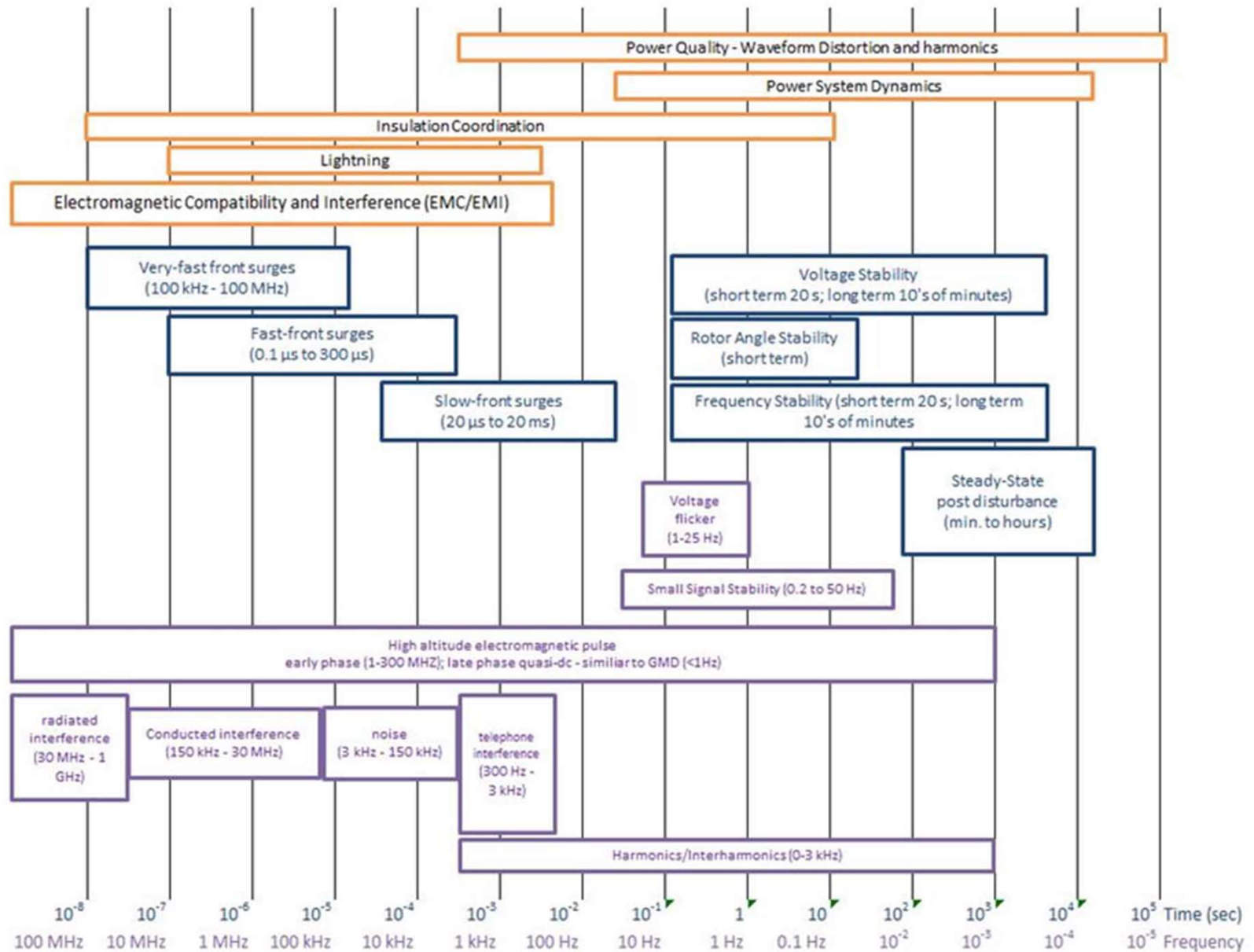
The scope of SC C4 covers system technical performance phenomena that range from nanoseconds to many hours. SC C4 focuses on methods and tools for analysis of system technical performance. SC C4 has been engaged in the following topics:

- Power Quality
- EMC/EMI
- Insulation Coordination
- Lightning
- Power systems performance models and numerical analysis

# Scope of SC C4 – Range of Times of Interest



# Scope of SC C4 – Specific Aspects



# **Preferential Subjects Planned for Paris Meeting (August 2020)**

**Preferential Subject 1: Improving power system technical performance through the use of advanced methods, models and tools**

**Preferential Subject 2: Modelling of the future grid based on lessons learned from system events**

**Preferential Subject 3: Methods and techniques for evaluating lightning, power quality and insulation coordination to enhance the performance of the evolving grid**



# Preferential Subject Number 1

## **PS1: Improving power system technical performance through the use of advanced methods, models and tools**

- The analysis of widespread dynamic security issues including [intentional] electromagnetic interference, weather, and geomagnetically induced currents
- The assessment of frequency stability, system strength, or power quality using Big Data analytics
- Development of emerging metrics and tools for quantifying power system reliability, resiliency, and flexibility



# Preferential Subject Number 2



## PS2: Modelling of the future grid based on lessons learned from system events

- Experience gained from Smart Grid projects
- High penetration levels of inverter-based devices
- Deployment of energy storage systems

# Preferential Subject Number 3

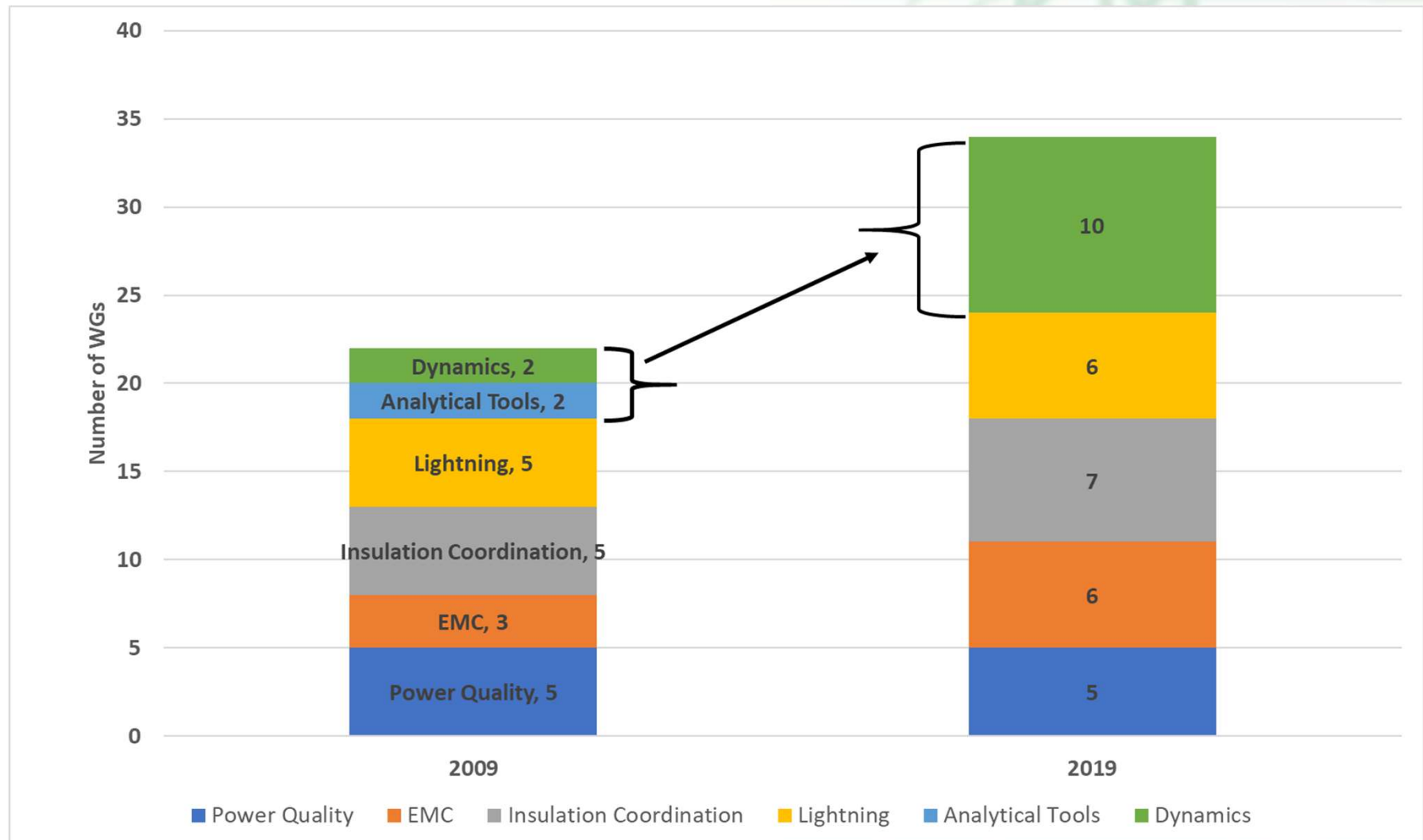


**PS3: Methods and techniques for evaluating lightning, power quality and insulation coordination to enhance the performance of the evolving grid**

- **UHV AC and/or DC systems**
- **Renewable generation, inverter-oriented power systems, and traction loads**
- **Harmful interactions between power system components**

# Evolution of WGs in SC C4 from 2009 until 2019

Increased focus on system dynamics and numerical analysis as well as EMC



# Disbanded WG/JWG Since June 2019

## (Technical Brochures have been prepared)

- **JWG C4/B4.38 “Network Modelling for Harmonic Studies”**
- **WG C4.32 “Understanding of the Geomagnetic Storm Environment for High Voltage Power Grids”**
- **WG C4.33 “Impact of Soil-Parameter Frequency Dependence on the Response of Grounding Electrodes and on the Lightning Performance of Electrical Systems”**
- **WG C4.37 “Electromagnetic Computation Methods for Lightning Surge Studies with Emphasis on the FDTD Method”**
- **WG C4.28 “Extrapolation of measured values of power frequency magnetic fields in the vicinity of power links”**
- **WG C4.31 “EMC between Communication Circuits and Power Systems”**

Note: Red indicates EMC oriented topics

# Active Working Groups in 2020 - 1



WG/JWG		Status	Submission expected
WG C4.23	Guide to Procedures for Estimating the Lightning Performance of Transmission Lines	Late	31/12/2020
WG C4.36	Winter Lightning – Parameters and Engineering Consequences for Wind Turbines	Late	30/09/2020
WG C4.39	Effectiveness of line surge arresters for lightning protection of overhead transmission lines	Late	31/12/2020
JWG C4.40/CIRED	Revisions to IEC Technical Reports 61000-3-6, 61000-3-7, 61000-3-13, and 61000-3-14	Late	31/12/2021
JWG C4/B5.41	Challenges with series compensation application in power systems when overcompensating lines	Late	30/09/2020
JWG C4.42/CIRED	Continuous assessment of low-order harmonic emissions from customer installations	Late	imminent
WG C4.43	Lightning problems and lightning risk management for nuclear power plants	OK	31/12/2020
WG C4.44	EMC for Large Photovoltaic Systems	Late	31/07/2021
WG C4.45	Measuring techniques and characteristics of fast and very fast transient overvoltages in substations and converter stations	OK	31/03/2021
WG C4.46	Evaluation of Temporary Overvoltages in Power Systems due to Low Order Harmonic Resonances	Late	Q3/Q4 2021
WG C4.47	Power System Resilience	?	?
WG C4.48	Overvoltage Withstand Characteristics of Power System Equipment 35-1200 kV	OK	31/10/2021

Note: Red indicates EMC oriented topics

# Active Working Groups in 2020 - 2



WG/JWG		Status	Submission expected
WG C4.49	Wideband stability of grid-tied converter-based modern power systems	OK	31/03/2021
WG C4.50	Evaluation of Transient Performance of Grounding System in Substation and Its Influence on Secondary System	OK	30/06/2021
WG C4.51	Connection of Railway Traction Systems to Power Networks	OK	31/12/2021
JWG C4/B4.52	Guidelines for Sub-synchronous Oscillation Studies in Power Electronics Dominated Power Systems	OK	31/01/2022
JWG C4/A3.53	Advanced metal-oxide varistors for surge arresters with better protection properties	OK	28/02/2021
WG C4.54	Protection of high voltage power network control electronics from the High-altitude Electromagnetic pulse (HEMP)	OK	31/12/2023
WG C4.55	EMC-related very-fast transients in gas-insulated substations	OK	31/03/2022
WG C4.56	Electromagnetic transient simulation models for large-scale system impact studies in power systems having a high penetration of inverter connected generation	OK	31/03/2022
WG C4.57	Guidelines for the Estimation of Overhead Distribution Line Lightning Performance and its Application to Lightning Protection Design	OK	31/12/2022
JWG C4/C2.58/IEEE	Evaluation of Voltage Stability Assessment Methodologies in Transmission Systems	OK	31/12/2021
WG C4.59	Real-time Lightning Protection of the Electricity Supply Systems of the Future	OK	31/12/2022

Note: Red indicates EMC oriented topics

# Active Joint Working Groups in 2020

WG/JWG		Status	Submission expected
JWG A1/C4.52	Wind generators and frequency-active power control of power systems	Late	Q1 2021
JWG A2/C4.52	High-frequency transformer and reactor models for network studies	Late	31/12/2020
JWG B4/B1/C4.73	Surge and extended overvoltage testing of HVDC Cable Systems	Late	2020?
JWG B5/C4.61	Impact of Low Inertia Network on Protection and Control	OK	Q3/Q4 2021
JWG C1/C4.36	Review of Large City & Metropolitan Area power system development trends taking into account new generation, grid and information technologies	Late	30/09/2020
JWG C2/C4.41	Impact of high penetration of inverter-based generation on system inertia of networks	OK	2021?
JWG B1/C4.69	Recommendations for the insulation coordination on AC cable systems	OK	30/06/2022
JWG B2/C4.76	Lightning & Grounding Considerations for Overhead Line Rebuilding and Refurbishing Projects, AC and DC	OK	30/09/2022
JWG A1/C4.66	Guide on the Assessment, Specification and Design of Synchronous Condensers for Power Systems with Predominance of Low or Zero Inertia Generators	OK	31/12/2021
JWG A3/A2/A1/B1.44	Limitations in Operation of High Voltage Equipment Resulting of Frequent Temporary Overvoltage's	OK	08/2023
WG A2.63	Transformer impulse testing	OK	08/2023

Note: No EMC oriented work as SC C4 is the only study committee dealing with EMC 15



# For Further Information

- If further information is needed with regard to active working groups or recently published work, please contact Dr. Radasky (wradasky@aol.com)
- It is possible to join a working group initially as an expert without being a member of CIGRE or one of its National Committees (it is recommended that individuals join their NC after joining a WG)
  - One must be an expert in the scope of the working group
  - One must contact the Convenor of the working group to be added to the WG
  - Corresponding members are permitted
  - No more than 2 full members are permitted from a single country
  - Working Groups maintain their working progress and report it periodically to the officers of the responsible Study Committee