

Certification Draft Interim Report

Version 0.90

Date: 26 February 2026

Contents

1	Summary	4
2	Background	4
3	Scope of the Expert Group’s work	5
4	The new Network Code requirements.....	5
5	EV/EVSE combinations with an AC or DC connection between EV and EVSE	7
6	Relevant standards and their role.....	7
7	Grid Code interoperability	9
8	Certification.....	9
8.1	Existing NC RfG certification approaches.....	9
8.2	Options.....	10
8.2.1	EVSE.....	10
8.2.2	EVs.....	11
8.3	Governance.....	11
9	Discussions with ENTSO-e	12
10	Technical Annex Development	12
10.1	Workstream discussions	12
10.2	Workstream Consultation.....	14
10.3	Consultation key themes	15
10.3.1	Governance	15
10.3.2	Technical comments	15
11	Implementation	16
11.1	AC EV/EVSE combination	16
11.2	EVs.....	16
12	Recommendations	16
12.1	The technical annex	16
12.2	NC RfG 2.0 legal text	17
12.3	Recommendations for international standards bodies	17
12.4	Future work of the EV Workstream	17
12.5	Treatment of DC V2G EVSE/PPM combinations	17
	Annexes.....	19
	A1 – EG EV workstream members	20
	A2 – Terms of Reference for the ESC Expert Group	22
	A3- The Technical Annex.....	28
	A4 - Relevant NC RfG 2.0 Articles.....	62
	A5 – Recommendations for standards bodies.....	69

A6 – Responses to the consultation..... 70

Foreword

[Foreword for the 26 February 2026 draft.

This draft is prepared for the 04 March ESC meeting. As at 26 February there are two issues not fully resolved. Although these are important points of detail which are expected to be resolved during March 2026, they do not have a significant effect on the text of the this report.

It is expected that the issues will be resolved in March and that the ESC will agree to accept the updated report via an offline meeting, or other approach to be agreed at the 04 March ESC Meeting.

The outstanding issues relate to the speed with which an AC V2G EV will respond to a LFSM event, and the definition of “minimum safe state of charge” This timing point appears in 4.4 of the technical annex in Annex 3, and in Article 13a.5(f) and 13a.6(g) in Annex 4. “Minimum safe state of charge” occurs in two places in Annex 4.]

This report is the first formal report from the European Stakeholder Committee Expert Group on the Development of Certification Schemes. It is produced in time to inform the European Commission’s process for publishing the revision of the Network Code Requirements for Generators, scheduled for mid-2026.

The Expert Group expects to produce further reports later in 2026 detailing briefing and communications material supporting the recommendations in this report, and detailing recommendations for the Commission’s revision of the NC Demand Connection, scheduled for later in 2026. A second report will be required to provide a technical annex for the NC Demand Connection, covering the certification of unidirectional EV charging and heat pumps.

1 Summary

This report is the first part of an overall report to encompass the work of the Expert Group on the certification requirement for both the NC RfG 2.0 and the NC DC 2.0. This first part only addressed the detailed requirements of the NC RfG 2.0 for the certification of electric vehicles and electric vehicle supply equipment (EVs and EVSE). The proposed second part of the Expert Group's report to the ESC will follow in due course and cover the certification requirements of the NC DC 2.0 for EVs and EVSE and for heat pumps.

This report explains the legal background for the need for the work in this report and provides the details of the compliance schemes that will be required to allow EVs and EVSE to be certified. Certification is a requirement of the NC RfG 2.0 and NC DC 2.0. The main output of the Expert Group's work for the NC RfG 2.0 is a draft technical annex intended to form part of the NC RfG 2.0, and this is attached as Annex A3.

Certification for EVs and EVSE is based on EVs and EVSE being certified separately, but also certified as being interoperable, ie any new EV with any new EVSE. The draft technical annex states the division of requirements between EVs and EVSE, and provides the technical detail for how EVs and EVSE should be tested for certification purposes.

As part of the detail work of the Expert Group a small number of improvements have been identified to the draft NC RfG 2.0 legal text. These are also included in Annex A4.

The Expert Group intends to organize briefings for affected and relevant stakeholders starting in Spring 2026.

The Expert Group recommends that the European Commission adopts the technical annex and the revised legal text attached in Annexes A3 and A4, and that the Expert Group proceeds with its proposal to brief stakeholders.

2 Background

The draft Network Code Requirements for Generators (NC RfG 2.0) both imposes new electrical requirements on EVs and EVSE, and also includes a requirement for mandatory independent certification of vehicle-to-grid (V2G) EVs and associated EV supply equipment (EVSE) that ensures interoperability between EVs and EVSEs. Similarly, the draft Network Code for Demand Connection (NC DC 2.0) also imposes new requirements on V1G EVs and associated EVSE (and heat pumps – although this report does not cover heat pumps) and requires mandatory independent certification of those requirements.

The work of this Expert Group draws on the work completed by the Expert Group "Harmonization of Certification and product Family Grouping" which reported to the ESC GC in March 2023, with follow up actions for draft legal text reported to the September and December 2023 ESC GC meetings. The report laid out the organizational and legal requirements to support the implementation of equipment certification within the scope of the NC RfG and the NC DC. That report's recommendations have been taken into consideration in the drafting of the NC RfG 2.0 and NC DC 2.0.

Several member states have existing compliance schemes that include formal equipment certificates; other member states do not. Those without will need to modify their compliance schemes to include certification, and even where formal certification is required, the schemes will

need to be extended to include the specific requirement of the NC RfG 2.0 and NC DC 2.0 for EVSE, EVs and heat pumps.

However, the international standards and associated technical specifications for EVs (and EVSE) are only now becoming mature and complete. These developments are to be incorporated in the relevant mandatory equipment certification schemes. In addition, there are a large number of directly affected parties, including all European DSOs, international equipment manufacturers, testing laboratories and authorised certifiers, many of whom will be looking for guidance as to what is required of them when the certification regime becomes mandatory

A specific consideration is the existing national requirements for interface protection (including anti-islanding protection) for generation and electricity storage. These are pre-existing national rules, which will apply to V2G EVs and EVSE and which are differentiated on a national basis, ie they are not standard. Although not in the direct scope of the requirements of the NC RfG, the approach to certification needs to take this into account to ensure full interoperability of EVs when connecting in different member states.

As EVs and EVSE are mass market products it is essential that the processes for certification are simple for manufacturers, certifiers and DSOs, well understood, and also fully functioning before the end of the implementation period. The processes should be such that domestic customers who become owners of EVs, EVSE do not need to engage with the compliance process, and that the engagement for larger customers (eg EV charge park owners) are minimized.

3 Scope of the Expert Group's work

The scope of the Expert Group's work is confined to the specific requirements of the NC RfG 2.0 and NC DC 2.0, and associated grid code requirements for interoperability. There are many other legal and regulatory requirements which EVs and EVSE have to meet, for example the Low Voltage Directive; the Electromagnetic Compatibility Directive; the Radio Equipment Directive; etc. Compliance with these and other legislation is outside the scope of the Expert Group's work: these are existing requirements which EV and EVSE manufacturers already have to comply with and have existing approaches which are largely independent of the NC RfG 2.0 and NC DC 2.0 requirements. They have not been specifically addressed in the Expert Group's work.

The work also does not consider grid forming requirements. The draft NC RfG 2.0 does not place any requirements on the EV1 and EV2 classes of V2G EV/EVSE, although it does make it an option for EV3 V2G EV/EVSE. However as EV3 is for maximum capacities of 50kW and above, EV3 are expected to be universally DC connected, in which case any grid forming requirements would be specified in the relevant system operator's grid code and subject to national compliance arrangements.

This report has been produced for the Expert Group by the Expert Group's EV/EVSE workstream.

4 The new Network Code requirements

The original NC RfG 1.0 and the NC DC 1.0 were introduced into EU law in 2016. The 1.0 versions had no specific provisions for EVs.

The expected growth of EVs represents a potential challenge to the EU's electricity system, and the NC RfG 2.0 and NC DC 2.0 now contain provisions for EVs which are designed to ensure that in relation to extreme events affecting the EU electricity system, EVs have a benign characteristic that at worst does not aggravate the event, but ideally also helps reduce or resolve the event. These provisions relate mainly to the immunity of all EVs to short circuit faults on the transmission system

and the voltage distortions so caused (fault ride through and rate of change of frequency immunity), and to the behaviour during extreme frequency excursions (limited frequency sensitive mode – underfrequency). There is also a requirement for limited frequency sensitive mode – overfrequency for EVs operating in vehicle to grid mode.

Crucially the NC RfG 2.0 and NC DC 2.0 require that these technical capabilities are formally certified, with the certification scheme including third party assessment. When the NC RfG 2.0 and NC DC 2.0 are enacted it will not be legal to connect a new EV (to a new EVSE) to charge or discharge it unless it (and the EVSE) has been certified.

To understand the timescales of the introduction of the NCs RfG and DC 2.0 requirements and compliance deadlines, reference needs to be made to Articles 4.1, 4.2 and 72 in the NC RfG 2.0 and Articles 4 and 59 in the NC DC 2.0.

The description now focuses on the NC RfG 2.0, although the NC DC 2.0 is essentially the same. NC RfG 2.0 Article 4.1 explains that the NC RfG 2.0 does not apply to existing PGMs, and Article 4.2 explains that a PGM (which includes V2G EVs and associated V2G EVSEs) will be considered existing if it was already connected before Entry into Force or if not physically existing, if a contract for the purchase of the main plant has been formalized within two years of Entry into Force. This is sometimes referred to as the grandfathering period.

Article 72 allows that the main requirements of the NC RfG 2.0, and compliance with these requirements, do not take effect until 3 years after publication. This is the grace period.

The following Figure 1 shows this diagrammatically.

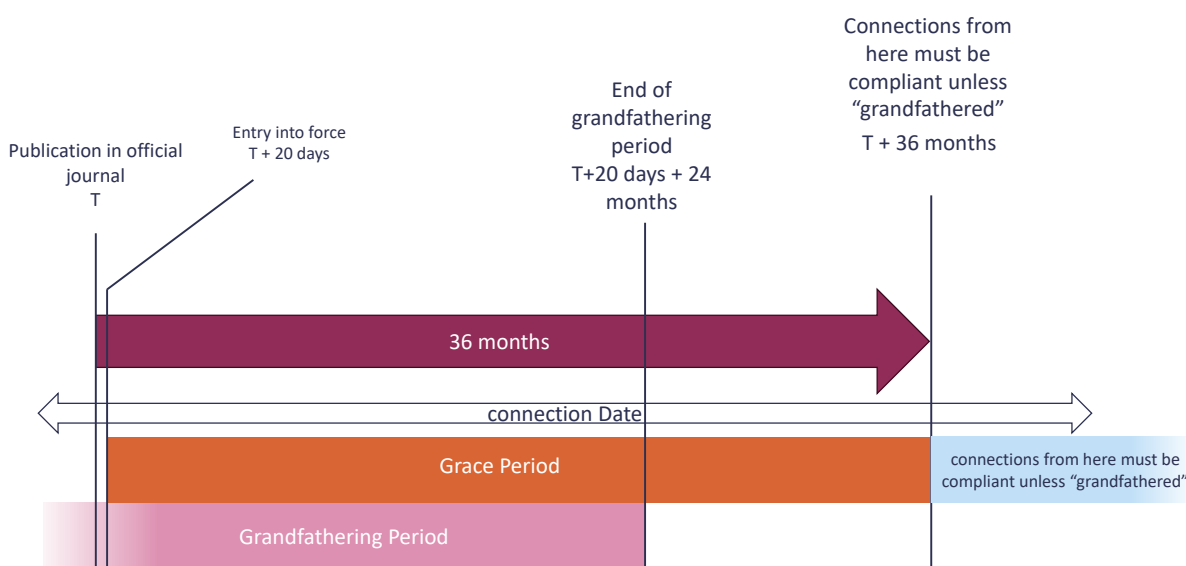


Figure 1

At the time of drafting this report, the Expert Group understands that the European Commission is actively considering the implications of including the certification of EVs (as opposed to EVSEs) in the whole vehicle type approval process required by EU law. Resolution of this within the Commission may subtly change, in future, the recommendations of the Expert Group.

The draft NC RfG 2.0 can be found in Annex 1¹ of ACER's recommendation to the European Commission on ACER's website².

5 EV/EVSE combinations with an AC or DC connection between EV and EVSE

Although the NC RfG 2.0 and NC DC 2.0 make no distinction between EV/EVSE combinations with an AC or DC connection between EV and EVSE combination, the certification regime must ensure full compliance and interoperability in all cases.

For DC connected EVs, the situation is generally simpler in that all the relevant electrical characteristics are contained entirely within the DC EVSE. But for AC connected EVs as the converter is, by definition, in the AC connected EV the certification needs to allow for the distribution of relevant functions between the AC connected EV and the AC EVSE, noting that most of the relevant functions will be in the AC EV.

Throughout the rest of this report no distinction between AC and DC connected EV/EVSE is made in general, although where there are specific differences, these will be highlighted.

6 Relevant standards and their role

There are seven key international standards relevant for NC compliance for EV/EVSE combinations:

- (i) ISO 5474 - 2 EV - Functional and safety requirements for AC power transfer
- (ii) ISO 5474 - 3 EV - Functional and safety requirements for DC power transfer
- (iii) ISO 15118-20 Communication interface between EV and EVSE
- (iv) IEC 61851-1 Standard for AC EV charging stations
- (v) IEC 61851-23 Standard for DC EV charging stations
- (vi) EN 50549-1 Standard for small generation and storage equipment
- (vii) EN 50549-10 Conformity assessment against EN 50549-1

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https://www.acer.europa.eu/sites/default/files/documents/Recommendations_annex/ACER_Recommendation_03-2023_Annex_1_NC_RfG_clean.pdf

² https://www.acer.europa.eu/documents/search?search_api_fulltext=ACER+Recommendation+03-2023

Their use and relationship are shown diagrammatically in Figure 2 below.

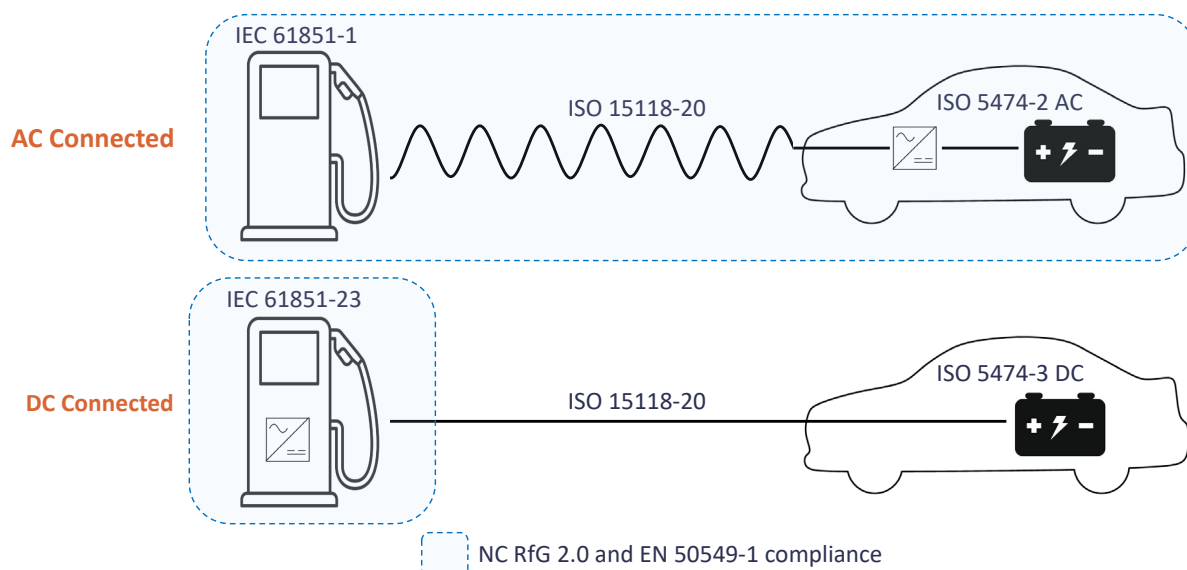


Figure 2

These standards are all existing, but do not fully reflect all the necessary requirements for compliance with the NC 2.0. The standards bodies governing them are engaged in updating them to ensure alignment with the NC 2.0. The current status of these amendments is:

Standard	Status	Plan
ISO 5474 – 2 ED1 AMD1	DIS submitted for publication	FDIS 09/26; IS 01/27
ISO 5474 – 3 ED1	No revision planned yet. Waiting for a stable version of EN 61851-23 ED3	
ISO 15118-20 ED1 AMD 1	FDIS preparation for submission	FDIS 02/26; IS 05/26
EN 61851-1 ED4	CDV comment resolution	FDIS 07/26; IS 12/26
EN 61851-23 ED3	1st CD comment resolution	CDV 12/26; FDIS 12/27; IS 07/28
EN 50549-1	Under review, but not yet addressing NC 2.0	Post NC RfG 2.0 publication
EN 50549-10	Under review, but not yet addressing NC 2.0	Post NC RfG 2.0 publication

Where:

- ED = Edition
- AMD = Amendment
- CDV = Committee draft for vote;
- FDIS = Final draft international standard;
- IS = International standard.

No change to technical requirements is possible after CDV comment resolution.

Except for the two EN 50549 standards, all the relevant revisions will be completed in advance of the NC RfG 2.0 and NC DC 2.0 entering into force. The earliest date expected for entry into force is early 2029 given the development and consultation stages outstanding.

For NC RfG 2.0 compliance, the most critical standards are IEC 61851-1 and ISO 5474-2 as these govern the collective behaviour of an AC connected EV/EVSE combination. For DC connected EV/EVSE

combinations, the key electrical behaviour mandated by the NC RfG 2.0 and NC DC 2.0 is contained within the EVSE, and currently the Expert Group does not see that compliance is dependent on communication between the EV and EVSE.

The electrical behaviour for compliance is determined by EN 50549-1. Although this standard is not perfectly aligned with NC RfG 2.0, the differences are minor and are related to parameters and limits. For manufacturing and certification process, the Expert Group believes that the application of EN 50549-1 and EN 50549-10, with certain values substituted from the technical annex, will be perfectly workable. In time, following the publication of the NC RfG 2.0 CENELEC is expected to update the EN 50549 series to reflect the NC RfG 2.0 requirements, but as explained above this is not necessary in the short term for NC RfG 2.0 compliance.

7 Grid Code interoperability

The existing NC RfG 1.0 specifies a number of technical requirements. These requirements relate to TSOs' management of entire power systems, but do not cover all the requirements necessary for connexion to local grids. In addition, the technical requirements, although common in scope and format, are tailored to local conditions by the TSOs and DSOs of that locale. For EVs, which can move between member states, this is clearly a challenge and the NC RfG 2.0 standardises all its requirement across the whole of the EU (with a couple of minor exceptions). Whilst this is ideal, it does not deal with the local grid code requirements.

The Expert Group believes that EN 50549-1 provides for all the requirements which may additionally be required by local grid codes, with the exception of DSOs' requirements for interface protection including islanding detection (as EN 50549-1 does not specify it).

The Expert Group has determined that the challenge of interface protection can be resolved by ensuring that the interface protection including islanding detection is always implemented in the EVSE. This is also the approach which the work on revising IEC 61851-1 and ISO 5474-2 is taking. This approach has been codified in the draft technical annex.

All the functions to be certified and any local requirements for a DC connected EV/EVSE are contained just within the EVSE itself; the DC connected EV does not implement any of the requirements. This means that the EVSE can be certified under the existing (or appropriately modified) arrangements in the relevant country.

In contrast for AC connected EV/EVSE, the EV needs to be certified against the exhaustive requirements of the NC RfG 2.0 but also be capable of implementing local grid code requirements. The Expert Group believes that all local grid code requirements for an AC connected EV are contained within the requirements of EN 50549-1. Hence if the EV/EVSE combination can always meet the EN 50549-1 requirements and, provided the communication between the EVSE and the EV is capable of transferring the local requirements to the converter in the EV, then any EV/EVSE combination should always be compliant. The proposed certification regime specifically addresses this by including the certification of all relevant EN 50549-1 requirements and the transmission of appropriate parameters between EVSE and EV.

8 Certification

8.1 Existing NC RfG certification approaches

The NC RfG 1.0 requires that all generation connected after entry into force of NC RfG 1.0 is compliant with the requirements of NC RfG 1.0. The NC RfG also makes provision for compliance to be certified

by an appropriately accredited certifier, which eliminates the need for the on-site compliance testing of those elements of the NC RfG 1.0 that are included within the scope of the certificate. Although certification is an option in NC RfG 1.0, mainly aimed at small mass-produced generation, it is not mandated.

In contrast to NC RfG 1.0, the NC RfG 2.0 takes a different approach both EVs and EVSE and mandates that Equipment Certificates are supplied by manufacturers in both cases, and that the interoperability is also certified.

Equipment Certificates can only be granted by certifiers authorized in accordance with EU 765/2008 “Requirements for accreditation and market surveillance”, and implicitly by authorised certifiers operating a compliance scheme in accordance with ISO 17067 “Conformity assessment – Fundamentals of product certification and guidelines for product certification schemes.”

Some countries have already effectively mandated Equipment Certificates for all generation and storage, whereas other countries have less formal arrangements for the establishment of compliance. The scope of the certification is also non-standard. All compliance schemes, whether involving certification or not, are based both on the NC RfG requirements, but also on the local grid code requirements.

8.2 Options

In determining the appropriate approach for the future certification of EVs and EVSE a number of potential options and routes were discussed. As EVs and EVSE are manufactured quite separately by different companies, the design of the certification arrangements needs to take into account the following objectives:

- guarantee the interoperability of all EV and EVSE combinations;
- be as simple and lightweight as possible to minimise additional burden on manufacturers, installers, customers and DSOs;
- make as much use of existing compliance and/or certification arrangements as possible.

8.2.1 EVSE

For EVSE the options discussed were essentially:

1. Create a single scheme for the whole of the EU;
2. Include the necessary certification requirements within the Ecodesign/CE marking requirements;
3. Extend to EVs and adapt the existing national compliance requirements for small generation and storage.

Options 1 and 2 are similar: option 1 would involve creating a new stand-alone scheme for the EU, which would need some infrastructure and administration creating to support it. Option 2 is the same in concept, but would make use, following legal adaptation, of the existing Ecodesign regulations – which would then provide the administration and governance.

The Expert Group concluded that both options 1 and 2 are more problematic than extending the existing national compliance arrangements, ie option 3. It does not seem that there would be significant differences in introducing the required schemes into those countries with and without a formal certification scheme currently. In both cases the DSOs (and TSOs) would need to adopt the test requirements within the technical annex as the basis for the compliance and certification

scheme for their grid codes. In many cases these will be either identical or very similar to existing requirements, albeit with some new fixed parameters as defined in the NC RfG 2.0. Authorised certifiers would then need to create conformity assessment procedures for these revised grid code requirements, which in many cases would be a simple amendment of the requirements for that country.

In option 3 the resulting Equipment Certificate for the EVSE would state compliance with the grid codes requirements for the interface protection, with the exhaustive RfG requirements and the ability to transmit any necessary parameters to the EV (for AC connected EVs) so that the grid code requirements performed by the EV's converter would be compliant (noting that the EV's converter compliance with the ability to accept and operate to these parameters is separately certified by the EV manufacturer).

It is a future task for the Expert Group to develop appropriate briefing materials to explain the implementation of the compliance/certification scheme to manufacturers, system operators and regulators.

8.2.2 EVs

The Expert Group discussed similar options to those available for EVSE as in 8.2.1 above. Given that there are no national distinctions necessary for the EV a standard scheme across the whole of the EU is possible, and the Expert Group did finally determine that a single scheme for the whole EV implemented in the whole vehicle type approval process.

At the time of writing this report the European Commission is considering the implications of including the required certification for the NC RfG 2.0 into the whole vehicle type approval process. Whether or not this is the actual legal approach taken, the technical content of the technical annex will be unchanged, and the uncertainties are those around the administrative details of the compliance scheme and appointment of a certifier(s).

8.3 Governance

The technical requirements for compliance are contained within the technical annex, and for EVSE implemented via compliance schemes in each member state, whereas the technical requirements for EV are implemented by manufacturers in accordance with the technical annex. In both cases there may be future needs to amend or update the technical requirements. This could be for a variety of reasons: new legislative requirements, identification of simplifications or efficiencies, correction of manifest errors etc. As such some entity needs to take responsibility for making the necessary investigations, consultation and eventual update. For the specific RfG and interoperability requirements the working assumption, agreed with the ESC, is that the ESC would formally adopt this role. This would be an extension of the ESC responsibilities in taking forward the recommendations from this Expert Group report.

As with the inception of these new certification schemes, it would fall to manufacturers, [EC homologation governance], system operators and authorised certifiers to implement.

The Expert Group is unsure whether the details of the governance arrangements which the Expert Group believes are appropriate should remain within the body of the technical annex, or whether these requirements would be better placed within the main body of the Network Code. This remains a point to resolve with the European Commission.

9 Discussions with ENTSO-e

During August to November 2024 ACER organized a series of workshops between ENTSO-e and EV stakeholders to review the interpretation of key parts of the NC DC 2.0 in relation to EVs and EVSE, with the discussions mainly focussing on the limited frequency sensitive mode – underfrequency. These discussions were helpful and produced some agreed minor modifications to ACER’s draft legal text (which was submitted to the European Commission in December 2023). It is expected that the Commission will adopt the agreed changed text in the final version. The agreed amended text is posted on ENTSO-e website³.

Subsequently, in the detailed technical discussions within the EV Workstream in early 2025 a small number of other implications and issues of interpretation arose in regard to the NC RfG 2.0 draft. These were:

- (i) Resolution of maximum capacity (P_{max}) and maximum consumption capacity where the EV and EVSE have different nominal power ratings;
- (ii) Agreement on the definition of P_{ref} for the LFSM-U droop characteristic and clarification of LFSM-U presentation;
- (iii) Clarifications of the requirements in relation to the minimum technical operating level and minimum state of charge;
- (iv) Clarification of “remaining connected” in relation to fault ride through capabilities, recognizing the inherent behaviour of EV/EVSE combinations to voltage profiles associated with network faults;
- (v) Requirements for active power recovery following a fault ride through event and where the voltage does not recover to the pre-fault value.
- (vi) A lack of alignment on the detailed interpretation of the response time diagrams in the draft NC RfG 2.0 and EN 50549-10 respectively.

In addition a small number of editorial points were identified and agreed.

[To be concluded when final agreement reached with ENTSO-e etc. As at 26/02/26 only (ii) and (iii) are outstanding]

10 Technical Annex Development

10.1 Workstream discussions

The EV workstream began meeting in January 2025 and by April had settled into a rhythm of meeting every week or every two weeks throughout the rest of 2025, with a break in the summer, and then into early 2026 and up to the present time.

Following informal interaction between workstream members and the European Commission, the notion of creating a technical annex to the NC RfG 2.0 (and NC DC 2.0) was discussed. Such an annex would be legally part of the NC RfG 2.0. It would contain the necessary requirements for certification of EVs and EVSE, and form the de-facto basis for the compliance and certification schemes which manufacturers and authorised certifiers would need to adhere to.

There are proposed to be three main parts to the technical annex:

³ https://www.entsoe.eu/network_codes/esc/#gesc

- (i) A description of the compliance and certification scheme, its scope and the requirements for its governance;
- (ii) A clear split of the functions between the AC EV and the AC EVSE.
- (iii) A set of requirements and test procedures to be used to confirm compliance.

(ii) is needed to ensure interoperability between all AC EV and AC EVSE (and reflects the parallel development of the relevant standards). (iii) is based largely on the requirements of EN 50549-1, the test setups defined in EN 50549-10, but updated to reflect the NC RfG 2.0 requirements (where they are different from EN 50549-1).

The discussions within the workstream were necessarily painstaking and detailed, to ensure that the requirements were appropriately specified and recognizing the specific characteristics of the converters and control systems required for EV and EVSE.

Agreement on the structure of the draft technical annex was achieved by the Spring of 2025, and the remaining work has been to elaborate at appropriate detail the split of functions between the EV and EVSE, and to create the corresponding compliance conformity requirements. The compliance conformity requirements are largely based on EN 50549-10. References to EN 50549-10 are limited to the general arrangements for testing that EN 50549-10 suggests, whereas the detailed requirements are written out in full within the technical annex. This approach fulfils two purposes. Firstly it accommodates the necessary adaptations to account for the NC RfG 2.0 requirements which do not currently align with EN 50549-1. These differences are all minor, but it does mean that EN 50549-1 and -10 cannot simply be used with no amendment. The second advantage is that it avoids the European Commission delegating compliance requirements to a CENELEC standard. It is generally legally inappropriate for EU law to cite standards directly, except where special arrangements have been made to do so.

A key part of the technical annex is explaining how manufacturers can re-use existing certified designs. This is a common approach in the certification of generating units, where units of the same design, but of different rating, can be certified based on compliance tests undertaken on an appropriate representative example, and where the manufacturer can demonstrate to the certifier that other units within the same family behave in the same way. This approach can also be used to re-use certified components in new products, without having to recertify those components.

In applying existing certifications to family products, or to new products, it is important that all relevant technical aspects are unchanged, including software. In this context unchanged means the same software. Any updating of software is an issue which would normally invalidate the existing certification unless the certifying body explicitly and formally agrees that the revised version does not affect the certified functions.

The necessary inclusion of software in the behaviour and responses of the EV/EVSE combination to events on the grid prompted significant discussion, because changes to software or protocols have the potential to radically change behaviour. The approach taken in the draft technical annex is high level and outlines the necessity for ensuring continuous overall compliance as manufacturers make updates to software etc. This is an issue which is already a key feature of the certification of generating units, and forms a key responsibility of authorised certifiers to agree specifically the certification implications on a case by case basis with manufacturers.

Finally the draft technical annex also includes requirements for the ongoing management and governance of the compliance schemes.

The work stream did discover one apparent discrepancy between the NC RfG 2.0 requirements and the evolution of standards. When an AC V2G EV/EVSE has been selected to operate in consumption mode only for a session, it should still nevertheless conform to the NC RfG 2.0 for the timing of any LFSM-U response needed. The approach in standards needs to recognize that an AC V2G EV/EVSE combination must still conform to the NC RfG 2.0 in this regard, rather than defaulting to the NC DC 2.0 requirements. The workstream believes that this needs to be picked up by the standards bodies involved, particularly for ISO 15118-20, but also possibly affecting the other relevant standards too. This recommendation is summarised in Annex A5.

One workstream discussion which is not within the scope of the technical annex but which the workstream realised has the potential to cause confusion and disagreement is the treatment of EVs which are coupled at DC to other DC assets, such as batteries. In this case a common power electronic converter is providing the interface to the AC system for assets (eg EV and electricity storage) with different NC RfG 2.0 requirements. This raises the question as to whether the converter should be treated, for compliance purposes, as EVSE or ESM, as there are subtle differences between the requirements for these two types of asset. The workstream has the preliminary view that since the EV may or may not be present, it would make sense to treat the converter as an ESM. Given that these asset classes are all treated for compliance on a national basis, it may be that this can be left to national implementation -but the workstream believes it is an uncertainty gap that should be closed through the development of the final NC RfG 2.0.

10.2 Workstream Consultation

Although stakeholders are already well represented within the workstream, the Expert Group nevertheless wanted to ensure as much exposure as possible to the implications and details of the technical annex. All Expert Group and ESC members were asked to circulate the draft technical annex to all their relevant contacts, especially within industry trade bodies. The invitation was issued on or before 20 January 2026, with a response deadline of 06 February 2026.

A total of 210 individual comments were received from 17 respondents. The respondents were a mix of manufacturers, stakeholder associations and individuals. The manufacturers association ACEA submitted comments on behalf of four global manufacturers.

Of the 210 comments, 91 have been accepted as requiring changes to the consultation version of the draft technical annex. Of these 91, 58 are purely editorial whilst there were 33 classed as technical.

Sections 1 and 2 of the report relate to the legal, regulatory and governance aspects of the technical annex, whilst sections 3 and 4 contain the detailed technical requirements. 75 of the comments related to sections 1 and 2, with the remaining 135 being relating to the technical sections 3 and 4.

Section	Title	Comments	Accepted
1	General Provisions	11	2
2	Certification Governing Processes	64	19
3	Function Allocation & Common Requirements	52	24
4	Certification Modules	83	46

For sections 1 and 2 the rejected comments mainly relate to issues around the legal establishment of the compliance schemes, their integration into existing and new law and details of certification practices which are already contained in the legal arrangements and standards for certification.

Section 2 contains the guidance on certification issues such as the need to recertify changes in products, in the transferability of certification to similar products in the same product family, and the production, storage, visibility of certificates. The Expert Group has provided what it believes to be appropriate guidance, but recognizes that authorised certifiers have their own legal responsibilities and will take the lead in determining the details of these issues as part of the certificate process.

Hence, although many comments have not been accepted by the Expert Group, some of these issues may still be relevant for consideration by the European Commission in formulating the final version of the legislation.

For the technical sections, many of the comments relate to minor misunderstandings, in some cases the text can be improved, or the issue explained in the Expert Group's response to the comment. A number of comments related to gaps in detail in the underlying standards, particularly EN 50549-1 and EN 50549-10. The Expert Group has tried to fill these gaps where it believes it is appropriate to do so (noting that an output from the Expert Group is a summary of issues for standards bodies to consider), but in some cases, where the point is not considered to be material, noted this in the response to those comments.

Of course, with 210 comments from 17 respondents, many of the comments are exact or near duplicates of each other.

All the comments were returned to their originators, with a note of what the Expert Group had done with the comments, by 24 February 2026.

10.3 Consultation key themes

10.3.1 Governance

Section 2 of the technical annex is a description of the expected compliance regime, in line with the existing certification schemes already operating in many member states for power generating modules. As such the extension to EV/EVSE combination should be able to build on the experience and existing legal responsibilities of established authorised certifiers. Some of the concerns of respondents focussed particularly on the approach to the certification of families of components, and the implication that software updates/releases etc has on certification.

The technical annex is not overly prescriptive here: it is trying to outline the existing practices between manufacturers and authorised certifiers. For both the certification and re-use of certification for members of a recognised family of components, certifiers have an existing responsibility to agree with their client manufacturers the limits of certificate re-use both for families and for software updates.

The workstream has now amended section 2 of the technical annex to try to provide as much clarity on future processes as possible, taking into account the comments received.

10.3.2 Technical comments

There were three areas generating the most comment from sections 3 & 4: times for required responses after defined stimuli; clarity on the bidirectional requirements when consuming power as well as producing it (ie V2G) and clarity on 3 phase versus single phase measurements. All of these resulted in discussions within the workgroup and modifications to the relevant text in section 4.

Many of the other comments on sections 3 and 4 of the technical annex relate to the clarity of the requirements and are of an editorial nature. Examples include the alignment between the draft NC

RfG 2.0 and EN 50549-1. The workstream believes there are a number of minor changes now made to the technical annex in light of all these comments which should reduce the risk of misunderstanding etc. Some comments also show slight misunderstandings of the underlying requirements. The brief answers provided to consultees are intended to help dispel these misapprehensions.

11 Implementation

11.1 AC EV/EVSE combination

Section 3 of the technical annex gives an overview of the needed function split between AC V2G EV and AC V2G EVSE. Section 4 of the technical annex forms a detailed compliance scheme for the NC RfG 2.0 and its interoperability requirements. It will need to be adopted without any additions or changes by each system operator in every member state and incorporated into each system operator's existing compliance requirements, noting that all system operators' compliance requirements will need to be updated in any event for the other changes introduced by the NC RfG 2.0. In most member states this will be an exercise undertaken centrally for all DSOs in that member state (and similarly for TSOs).

System operators will need to publish the revised certification schemes within two years of entry into force of the NC RfG 2.0 (Article 7.5). In practice, given this is an extension of the existing NC RfG 1.0 obligations, this deadline should be easily met. Then the relevant national regulatory authority has six months to approve the revised certification scheme.

In parallel authorised certifiers can make themselves aware of the new compliance conformity requirements (as for the relevant technical annex requirements, publication and approval should only be a formality) and prepare to apply the new requirements for when manufacturers seek certification.

Clearly there are a large number of affected parties and experts who will need to assimilate all these new requirements, and to make the necessary arrangements for implementation. The Expert Group has a remaining task to create briefing information on the new arrangements and to find way to reach out to brief those who need to know. Clearly there key roles for DSOs, TSOs and national regulatory authorities, as well as changed requirements for certifiers and manufacturers. The Expert Group is working to be in a position to launch briefings and briefing material at or before entry into force of the NC RfG 2.0.

11.2 EVs

At the time of writing of this report the expected implementation of certification of EVs is still under consideration by the European Commission. The outstanding questions relate to the administrative arrangements for compliance, but the technical requirements remain as defined in sections 3 and 4 of the technical annex. The Expert Group expects that the Commission will make its intentions known in due course, and those will inform any future work the Expert Group needs to undertake.

12 Recommendations

12.1 The technical annex

The technical annex encompasses all the tests which the Expert Group believes are necessary for certifiers to be able to confirm the compliance of EV and EVSE with the technical and interoperability requirements of the NC RfG 2.0.

The Expert Group recommends that the technical annex should be incorporated in the final version of the NC RfG 2.0 to give clarity to all relevant parties as to how compliance can be achieved and certified.

The technical annex is attached as annex A1 to this report.

12.2 NC RfG 2.0 legal text

The Expert Group has determined, in collaboration with ENTOS-e, a number of suggested minor changes to the draft legal text which was initially agreed in the ACER workstreams of Autumn 2024. These changes arise from the detailed work the Expert Group undertook in translating the legal requirements into the technical annex.

The Expert Group recommends that the European Commission should adopt the recommended legal text of Annex A4.

12.3 Recommendations for international standards bodies

Annex A5 includes a brief summary of a recommendation which should be picked up by the relevant international standards bodies.

12.4 Future work of the EV Workstream

The EV workstream has proposed that it organizes stakeholder briefing sessions in Spring 2026, focussing on socialising the technical requirements of the technical annex. Subsequently as the final legal draft of the NC RfG 2.0 emerges, there will be a need for follow-up briefings on the new administrative arrangements for certification. The EV Workstream will be well placed to undertake both the preparation of material for, and delivery of, such briefings.

The workstream has already started to consider the needs for a technical annex for the NC DC 2.0 and will continue to develop this over the next few months.

12.5 Treatment of DC V2G EVSE/PPM combinations

Although not directly within the scope of the draft Technical Annex, the implementation of the NC RfG solution needs to recognize the potential conflict between the EV and the electricity storage requirements for power electronic converters which act as both an EVSE and an electricity storage module at the same time. The European Commission should give some thought as to how this can be resolved, either at an EU level, or nationally.

V	Date	Description
0.12	02/02/2026	Draft circulated to Expert Group Certification
0.13	04/02/2026	Erroneous paragraph numbering removed from Appendix D
0.21	18/02/2006	Updated with results of consultation.
0.22	20/02/2026	Initial draft for ESC GC
0.90	26/02/2026	Version tabled at ESC GC on 04 March 2026

Annexes

A1 – EG EV workstream members

Name		Organization
Bartsch	Leonhard	ACEA
Benedict	Florentien	DSO Entity
Birger	Fricke	ACEA
Bolat	Serdar	DSO Entity
Cezanne	Glenn	CharIn
Deruy	Didier	ACEA
Diefenbach	Ingo	CEN/CENELEC
Guilherme	Crispim Ferreira	CharIn
Hakvoort	Rudi	DSO Entity
Hamzova	Andrea	DSO Entity
Haub	Dennis	CEN/CENELEC
Hell	Stephan	ChargeUp Europe
Jean	Elise	AMPERE
Kampl	Tobias	CharIn
Kay	Mike	DSO Entity
Kreitmeier	Bernd	CEN/CENELEC
Kreutzer	Nico	ACEA
Langenhuizen	Sander	Elaad
Levaniemi	Erno	DSO Entity
Martinez	Miguel	CEN/CENELEC
Mather	Sebastien	CEN/CENELEC
Monnier	Edouard	DSO Entity
Moskal	Thomas	ACEA
Muller	Stefan	CEN/CENELEC
Pagett	Mark	ACEA
Pop	Adriana	ACEA
Rudi	Hakvoort	DSO Entity
Schepers	Joren	ChargeUp Europe
Schowe	Bernhard	EFAC
Sulzenbacher	Andreas	CharIn
Treichel	Julian	CharIn

Van Wijk	Thijs	Elaad
Wargers	Arjan	Elaad
Wix	Lynrick	Solar Power Europe

A2 – Terms of Reference for the ESC Expert Group

Expert group: Development of certification schemes, particularly for EVs and heat pumps

Chair: Mike Kay

Vice-Chairs: Florentien Benedict and Erno Leväniemi

Problem Statement

The draft NC RfG 2.0 includes for the mandatory certification of vehicle-to-grid (V2G) EVs (and associated EV supply equipment (EVSE)). Similarly the draft NC DC 2.0 requires the mandatory certification of V1G EVs (and associated EVSE) and heat pumps.

Much good work was completed by the Expert Group “Harmonization of Certification and product Family Grouping” which reported to the GC ESC in March 2023, with follow up actions for draft legal text reported to the September and December 2023 GC ESC meetings. The report laid out the organizational and legal requirements to support the implementation of equipment certification for power generating units within the scope of the NC RfG 2.0 and the NC DC 2.0. That report’s recommendations have been taken into consideration in the drafting of the NC RfG 2.0 and the NC DC 2.0.

For power generating modules, only some member states have existing compliance schemes that include formal equipment certificates, but other member states do not. Those without will need to modify their compliance schemes to include certification for EVs/EVSEs, and even where formal certification is already required, the schemes will need to be extended to include the specific requirement of the NC RfG 2.0 and NC DC 2.0 for EVs (and associated EVSE). For heat pumps it is believed that no member state has a certification scheme for technical requirements, as currently all requirements are assured via the CE Mark process.

However, the international standards and associated technical specifications for EVs (and EVSE) and heat pumps are not yet mature or complete. Consequently there are a number of uncertainties in implementing the relevant mandatory equipment certification schemes. In addition to the still evolving standards, there is a large number of directly affected parties, including all European DSOs, international equipment manufacturers, testing laboratories and authorised certifiers, many of whom will be looking for guidance as to what is required of them when the certification regime becomes mandatory. Although the focus might be on the testing of equipment, there are also requirements for appropriate software simulation models, and these should also be in scope of this work.

Wherever possible, existing testing and/or modelling schemes should be adopted or adapted, particularly those in existing standards.

A further consideration is the existing national requirements for interface protection (including anti-islanding protection) for generation and electricity storage. These are pre-existing national rules and which will apply to V2G EVs and EVSE, and which are differentiated on a national basis, ie they are not standard. Although not in the direct scope of the requirements of the NC RfG 2.0, manufacturers and DSOs will need to consider how these requirements sit alongside the new mandatory certification requirements, and how any resulting additional complexity and costs can be minimised.

The implementation period for mandatory equipment certificates is expected to be three years after entry into force of the revised NCs RfG 2.0 and NC DC 2.0. It would be ideal if the issues foreseen in this proposal could be resolved and briefed to DSOs, manufacturers, testing laboratories and potential certifiers as soon as possible after entry into force so that processes and systems are all in place for when certification becomes mandatory. Since important international product standards eg IEC 61851-

1 (product standards for V1G and V2G AC EV supply equipment) are under revision right now this proposal needs to recognize the likely outcome of those revisions.

As heat pumps and EVs and EVSE are mass market products it is essential that the processes for certification are simple for manufacturers, certifiers and DSOs, well understood, and also fully functioning before the end of the implementation period. The processes should be such that domestic customers who become owners of EVs, EVSE and heat pumps do not need to engage with the compliance process, and that the engagement for larger customers (eg EV charge park owners) are minimized.

In reviewing the implications for EVs, the expert group should consider the implications, if any, that arise from whether the V2G EV is connected via AC or DC, and whether there is any impact from the vehicle homologation regulation and the Alternative Fuels Infrastructure Regulation.

Due to the nature of electric vehicles having various and undetermined connection points to the electrical grid, some additional thoughts should be given on digital compliance labelling and whether this would be a useful facility for owners, DSOs or others.

Target (objectives)

- Understand the relevant international landscape for standards on technical requirements.
- Identify legitimate relevant associated technical requirements which are specified nationally.
- Understand the existing state of compliance schemes and certification nationally and internationally.
- For EVs consider if and how certification can be integrated with the mandatory (mandatory via other EU regulation) homologation process. For EV supply equipment define an appropriate conformity assessment including clarification about requirements that can be harmonised and those that need to be certified on national level.
- For heat pumps identify whether CE marking in combination with an appropriate conformity assessment would be appropriate for the requirements under the NC DC 2.0 and if not whether there is a possibility to include these requirements under an already existing CE marking regulation such as ecodesign.
- Identify gaps in existing schemes of conformity evaluation and assessment of the relevant products, and gaps in relevant international standards.
- Recommend how identified gaps can be closed by appropriate additional specification, and by appropriate evaluation measures (testing, modelling, manufactures' data) including by specific advice from, or actions by, this Expert Group. The Expert Group's recommendations may include possible harmonisation and mutual recognition of the existing and new certification schemes in terms of the technical requirements under the NC RfG 2.0 and NC DC 2.0.
- Recommend steps to be taken by the EC, standards bodies, manufacturers, certifiers and DSOs to close the remaining gaps.
- Ensure relevant briefing material etc is available to all those parties who have future responsibilities for the operation of compliance certification for EVs and heat pumps.

Legislative background and standards

Commission Regulation (EU) 2016/631 Commission Regulation (EU) 2016/1447

Commission Regulation (EU) 2018/858

Commission Regulation (EU) 2023/180

Decision No 768/2008/EC

Regulation (EC) No 765/2008

Regulation (EU) 2024/1781

Commission Regulation (EU) No 813/2013

[Draft NC RfG 2.0](#)

[Draft NC DC 2.0](#)

EN 50549-x

IEC 61851-x

ISO 5474-x

ISO 15118

IECRE OD 009

EG HCF Final Report (eepublicdownloads.blob.core.windows.net)

The appendix contains an explanation of the timeline of the introduction of the new requirements, and also has an extract of the relevant clauses from the NC RfG 2.0 and NC DC 2.0 (at the current stage of drafting).

Task description

- Review technical requirements with the NC RfG 2.0 and NC DC 2.0, international standards and further national grid code implementations within the Member States
- Review existing compliance schemes within EU Member States using information to be gathered from manufacturers, DSOs, authorised certifiers and Expert Group members. Summarise the certification scheme landscape, drawing out apparent attractive and negative features of the schemes examined.
- From an understanding of what is required, suggest what gaps exist in compliance schemes and standards, particularly in relation to DSO requirements which are not within the scope of the NC RfG 2.0 and 50549-1, -2/, -10.
- Review CE marking legislation and identify the possibility of introducing it as a proof of conformity in the different Member States instead of developing new certification schemes (which may or may not be harmonised). Consider what legislative vehicles could be appropriate for this if the NC RfG 2.0 and NC DC 2.0 are not suitable and identify what additional work that is necessary to introduce a CE marking scheme for the requirements under the NC RfG 2.0 and NC DC 2.0.
- Consider what additional work is necessary to create appropriate compliance schemes for EVs and heat pumps in each Member State, and also look to see if existing compliance arrangements can or should be modified to allow for a more consistent approach between Member States, particularly in relation to the necessary actions by manufacturers in order to provide efficient pan-European market access. Ideally each Member State's scheme should be identical (to match the exhaustive NC requirements), but if not to include the possibility of mutual recognition of the certification schemes. Consideration should be given to whether a joint European/international certification scheme can be established that would be recognized by all Member States.
- Using the information gathered, propose a standard or proforma compliance scheme referring to respective equipment certificates and that can be adopted by DSOs as appropriate for the local/national needs.

- Maintain a dialogue with relevant parties, including the EU Commission, ACER, ENTSO-e, DSO Entity, manufacturers' associations, etc.
- From the information and experience developed through the workstream's tasks, engage as appropriate with ACER, ENTSO-e and the EU Commission to try to refine the NC RfG 2.0 and NC DC 2.0 drafting.
- A proposal for standard requirements for any necessary local or national feature which does not currently exist in the NCs RfG 2.0 and NC DC 2.0 or in international standards, and which will be part of the DSOs' compliance schemes. Comprehensive briefing material related to the bullet above.

Deliverables

The main deliverables from this Expert Group will be:

1. A comprehensive report on the work, findings and recommendations of the Expert Group.
2. Outline additional technical requirements resulting from national grid code survey that can be provided as requirements to international standardisation committee work.
3. A set of recommendations for the EC, standards bodies, manufacturers, prospective certifiers and DSOs
4. A pro-forma or example compliance and certification scheme that can be adopted by DSOs as appropriate for their existing local or national arrangements, and which is intended to achieve the maximum uniformity of approach.
5. Recommendations for the establishment and ongoing management of compliance schemes for EVs, EVSE and heat pumps.
6. Draft technical annexes which the EU Commission may wish to include in the final versions of NC RfG 2.0 and NC DC 2.0.
7. In addition, briefing material on (3) for use with affected parties in advance of the compliance deadline.

Timing

- estimated 24 months from October 2024.

Team (updated 25/11/25)

The following nominations to participate in EG Certification have been received (name and association):

Name		Representation at GC ESC
Ahmet	Fatteh	EHPA
Al Fakhri	Lama	EHPA
Alcazar	Freddy	EUGINE
Alonso	Frederic	DSO Entity
Antonopoulos	Georgios	ACER
Auvray	Melanie	EHPA
Bartsch	Leonhard	ACEA
Beelaerts	Veerle	EHI

Benedict	Florentien	DSO Entity
Benedit	Laurent	EHI
Birger	Fricke	ACEA
Bolat	Serdar	DSO Entity
Cezanne	Glenn	CharIn
Chambers	Keith	EUROPGEN
De Branader	Koen	EHPA
Dell'Olio	Giuseppe	CEN/CENELEC
Deruy	Didier	ACEA
Diefenbach	Ingo	CEN/CENELEC
Gabrijel	Uros	ACER
Gasperi	Lorenzo	CEN/CENELEC
Giner Folques	Juan	ENTSO-E
Gruber	Artjom	EHPA
Guilherme	Crispim Ferreira	CharIn
Hakvoort	Rudi	DSO Entity
Hamzova	Andrea	DSO Entity
Haub	Dennis	CEN/CENELEC
Hell	Stephan	ChargeUp Europe
Houtart	Adeline	EHPA
Jean	Elise	AMPERE
Kampl	Tobias	CharIn
Kay	Mike	DSO Entity
Kentor	Bari	EHPA
Konuk	Emre	EHI
Kreitmeier	Bernd	CEN/CENELEC
Kreutzer	Nico	ACEA
Langenhuizen	Sander	Elaad
Levaniemi	Erno	DSO Entity
Manzini	Ezequiel	CEN/CENELEC
Martinez	Miguel	CEN/CENELEC
Martinez Villanueva	Sergio	ENTSO-E
Masquelier	Richard	EHI
Mather	Sebastien	CEN/CENELEC
Meljac	Laure	EHPA
Moskal	Thomas	ACEA
Muller	Stefan	CEN/CENELEC
Pagett	Mark	ACEA

Poalella	Matteo	EHPA
Pop	Adriana	ACEA
Popella	Hartmut	ENTSO-E
Prevost	Milan	EHPA
Rouffignon	Arnaud	DSO Entity
Rudi	Hakvoort	DSO Entity
Schepers	Joren	ChargeUp Europe
Schirrwagen	Michael	ACEA
Schowe	Bernhard	EFAC
Schumacher	Georg	ENTSO-E
Selinger	Ingo	EHPA
Sulzenbacher	Andreas	CharIn
Treichel	Julian	CharIn
Van Wijk	Thijs	Elaad
Wargers	Arjan	Elaad
Wix	Lynrick	Solar Power Europe
Yousefian	Ali	EHI
Zaccaria	Marco	ENTSO-E

Estimated workload

- monthly (or other appropriate timing) virtual plenary meetings;
- workstream meetings as required
- possible commitment of 40 days per member (not expected to be exceeded).

Target audience

- Manufacturers
- DSOs
- TSOs
- Standards bodies
- Authorised certifiers
- GC ESC
- Relevant and/or interested stakeholders on the Connection Network Codes

A3- The Technical Annex

[The draft technical annex inserted in this version -2.3 - is near final, but with two points still to resolve with ENTSO-e. These points are important details, but has very little effect on the overall drafting. The open points relates to the exact timings of LFMS-U and LFMS-O responses, and the definition of “minimum safe state of charge”. The report will remain draft until these are agreed and the agreement reflected in Annex 3 and Annex 4.]

Proposed EV/EVSE Technical Annex for NC RfG 2.0 Certification Requirements

This Technical Annex establishes the framework for the Network Code certification of components and systems of V2G electric vehicles (EV), V2G electric vehicle supply equipment (EVSE), and their bidirectional charging functionalities, subject to the NC RfG 2.0. It defines the procedures and criteria required to demonstrate conformity with the technical requirements of the Network Code.

The certification framework is based on a functional split between EV and EVSE, allowing each to be assessed and certified individually. The Annex is designed to enable interoperability between EV and EVSE across manufacturers and system operators.

This Annex shall serve as a reference for system operators, manufacturers, and certifiers in the implementation of compliance processes under the NC RfG 2.0 and shall support the development of harmonised certification practices across Member States, while respecting the distinct certification pathways for mobile and stationary components.

1. General Provisions

1.1 Purpose

This Technical Annex establishes the legally binding framework for verifying compliance with the technical requirements of interoperable V2G EV and V2G EVSE set out in the NC RfG 2.0. It defines the procedures and methodologies necessary for demonstrating conformity of V2G electric vehicles (EVs) and V2G electric vehicle supply equipment (EVSE) with the grid connection requirements.

1.2 Scope

This Technical Annex applies to:

- Entities responsible for the operation, compliance verification, and certification of the EV and EVSE below, including manufacturers, system operators, and authorized certifiers.
- EVs with bidirectional capability (V2G EV) and all EVSE with bidirectional capability (V2G EVSE) that are designed to be connected to the public electricity network and fall within the scope of the NC RfG 2.0. These are:
 - AC V2G EV
 - DC V2G EVSE
 - AC V2G EVSE

DC V2G EVs are not included above as the NC RfG and grid code compliance requirements are fulfilled within the DC V2G EVSE. In addition, grid forming requirements are not addressed. The draft NC RfG 2.0 does not place any requirements on the EV1 and EV2 classes of V2G EV/EVSE, although it does make it an option for EV3 V2G EV/EVSE. However as EV3 is for maximum capacities of 50kW and above, EV3 are expected to be universally DC connected, in which case any grid forming requirements would

be specified in the relevant system operator's grid code and subject to national compliance arrangements outside of the scope of the technical annexe for certification.

1.3 Legal Effect

This Technical Annex shall be considered an integral part of the NC RfG 2.0 and shall be enforceable under the same legal provisions. Compliance with the Annex shall be mandatory for all interoperable V2G EV and V2G EVSE falling within its scope, unless explicitly exempted under the historic application provisions of the NC RfG 2.0.

DRAFT

2. Certification Governing Process

2.1 Establishment and Maintenance of Compliance Schemes

2.1.1 Establishment

Compliance schemes for V2G EVs and EVSE shall be developed and managed under the coordination of the European Stakeholder Committee – Grid Connection (ESC GC). These schemes shall define the certification framework for components subject to the NC RfG 2.0.

- For AC V2G EVs, a unified EU-wide compliance scheme shall be established and adopted by all relevant system operators and manufacturers operating within the European Union.
- For DC V2G EVSE and AC V2G EVSE, this technical annex forms the core compliance scheme defined at EU level. However, each Member State may implement a formal national compliance scheme, incorporating specific grid code requirements applicable within its jurisdiction. These national schemes shall be adopted by all relevant system operators within the respective Member State.

Member States shall ensure that their system operators actively contribute to the development and documentation of national EVSE compliance schemes and adopt the relevant EV and EVSE compliance schemes accordingly. For AC-connected EVs the system operators shall apply the EU-wide compliance scheme as defined in clauses 3 and 4 of this document without adding or modifying requirements to guarantee cross-border traffic.

2.1.2 Maintenance and Update

The ESC GC shall oversee the ongoing maintenance of compliance schemes, ensuring alignment with evolving technical standards, regulatory developments, and stakeholder needs. Updates affecting all Member States and manufacturers shall be coordinated through the ESC GC.

Relevant system operators have the statutory duty to maintain effective compliance schemes for the EVSE.

The ESC GC shall ensure transparent stakeholder engagement for the EU level compliance schemes.

2.2 Certification Process and Functional Split

Certification shall follow a functional split between the mobile (EV) and stationary (EVSE) component within a V2G system. Each component shall be certified individually, based on its contribution to grid code compliance.

The conformity assessment shall be based on test setups, configuration range, parameter sets and acceptance criteria defined in EN 50549-10:2022, with specific adaptations for V2G EV and V2G EVSE detailed in Chapters 3 and 4 of this Annex.

Certification shall be conducted by authorized certifiers accredited under EN ISO/IEC 17065 and recognized by the national affiliate of the European Cooperation for Accreditation (EA), in accordance with Regulation (EC) No 765/2008.

2.2.1 EVSE-Based Compliance

Where compliance with NC RfG 2.0 or national grid codes is fulfilled by the V2G EVSE (AC or DC), the V2G EVSE manufacturer shall provide a country-specific certificate. Certificates may be stored in national databases.

2.2.2 EV-Based Compliance

Where compliance is fulfilled by the AC V2G EV, the EV manufacturer shall provide an EU-wide equipment certificate in accordance with NC RfG 2.0 Article 42(5) as required by the Whole Vehicle type Approval (WVTA) framework.

Before the legal incorporation of the NC RfG 2.0 requirements into the WVTA, and also for all AC V2G EVs excluded from the WVTA framework, the V2G EV manufacturer shall provide an EU-wide equipment certificate showing compliance with NC RfG 2.0 and this technical annex. This certificate shall be stored in a designated compliance database.

2.3 EV & EVSE Families

V2G EV or V2G EVSE certificates may be extended to include other models in the same certificate without repetition of tests if the following conditions are met.

2.3.1 AC V2G EV family

'AC V2G EV System' comprises of the following components within the EV:

- Electronic converters within the AC V2G EV that ensure the power delivery from, or into, the AC V2G EV energy storage system to the connection point (ie the DC/AC converter).
- Low voltage electronic logic circuits within the AC V2G EV which controls the electronic converters and communicates with the AC V2G EVSE.

'AC V2G EV System Family' means a group of AC V2G EV systems from the same manufacturer with equivalent characteristics to the representative system which has satisfactorily undergone conformance tests (certified system) of its electrical performance.

An AC V2G EV system is considered as part of an AC V2G EV system family if the following conditions are met:

- **Electrical performance:** The power conversion stage and filter circuitry of the AC V2G EV system shall be technically equivalent in design and control technology in regard to their electrical properties, and shall have a power range of between $\pm 50\%$ of the rated power (P_n) of the certified AC V2G EV system
- **Communication protocols:** The AC V2G EV system shall operate the same software segments regarding the grid code compliance as that of the certified AC V2G EV system family.
- **Control Algorithm:** The grid code compliance segments of the control algorithm software implemented in the AC V2G EV system shall be the same as that of the certified AC V2G EV system family.

2.3.2 DC V2G EVSE family

'DC V2G EVSE family' means a group of DC V2G EVSE from the same manufacturer with specified characteristics in relation to a representative DC V2G EVSE which has undergone conformance tests (certified product) of its electrical performance.

A DC V2G EVSE is considered part of an DC V2G EVSE family if the following conditions are met:

- **Electrical Performance:** The hardware and filter circuitry of the DC V2G EVSE shall be technically equivalent in design and control technology in regard to their electrical properties, and shall have a P_n between $\pm 50\% P_n$ of the certified DC V2G EVSE.
- **Communication Protocols:** The DC V2G EVSE shall operate the same software segments regarding grid code compliance as that of the certified DC V2G EVSE.
- **Control Algorithm:** The grid code compliance segments of the control algorithm software implemented in the DC V2G EVSE shall be the same, as that of the certified DC V2G EVSE.

2.3.3 AC V2G EVSE family

'AC V2G EVSE family' means a group of AC V2G EVSE from the same manufacturer, with specified characteristics to a representative AC V2G EVSE which has undergone conformance tests (certified product), of its electrical performance.

An AC V2G EVSE is considered part of an AC V2G EVSE family if the following conditions are met:

- **Functional Equivalence:** The AC V2G EVSE exhibits equivalent or comparable performance in terms of grid interface capabilities, including switching behaviour, protection coordination, and fault response, as the certified AC V2G EVSE certified and shall have a P_n of between $\pm 50\% P_n$ of the certified AC V2G EVSE.
- **Communication Protocols:** The AC V2G EVSE shall operate the same software segments regarding the grid code compliance as that of the certified AC V2G EVSE.
- **Control Logic:** The control logic implemented in the EVSE demonstrates equivalent behaviour in terms of timing, response characteristics, and interaction with the AC V2G EV and grid operator, as those of the certified AC V2G EVSE.

2.4 EV Certification and Reusability

EV Certification shall be conducted on AC V2G EV Systems. Certified AC V2G EV Systems may be integrated into other vehicle models, forming an AC V2G EV system family, provided the integration does not alter the certified characteristics.

2.5 Application of Compliance Requirements

The requirements of NC RfG 2.0 shall not apply to:

- EVs registered prior to the compliance date.
- EVSE installed prior to the compliance date.

The compliance date for EVSE is [3 years after entry into force of the NC RfG 2.0]. The compliance date for EVs is [to be determined by legal incorporation of RfG requirements into WVTA].

Certificates remain valid unless the relevant component is modified. Upon changes to the compliance scheme, an assessment by the ESC GC shall determine whether re-certification is required. The outcome shall be publicly communicated by the ESC GC, regardless of whether existing certifications remain valid or require renewal.

From entry into force of the NC RfG 2.0 and until the unified EU compliance scheme for the AC V2G EV and national compliance schemes for the AC V2G EVSE and DC V2G EVSE are fully operational, compliance for the AC V2G EV may alternatively be demonstrated by manufacturer as defined in clause 2.2.2 of this technical annex. Such evidence shall be accepted by all RSOs during the transitional period

2.6 NC 2.0 compliance requirements for new and existing EV/EVSE combinations

The certification framework shall enable interoperability between EVs and EVSE across the EU. Once a V2G EV is certified under NC RfG 2.0, it shall be permitted to charge and operate bidirectional charging functionality throughout the EU. In particular:

- New EVSE shall provide unidirectional charging capabilities to all EVs.
- New EVSE shall provide bidirectional charging capabilities to all EVs compliant with NC RfG 2.0.
- Existing EVSE shall provide unidirectional charging capabilities for all new as well as existing EVs.
- Exceptionally existing AC V2G EVSE connected to new AC V2G EVs may provide bidirectional charging if the new AC V2G EV is RFG 2.0 homologated AND the AC V2G EV manufacturer has separately included the specific compliance requirements of the AC V2G EV for compatibility with that specific EVSE, implementing the applicable RSO's grid code.

Exceptionally existing AC V2G EVs connected to new AC V2G EVSE may provide bidirectional charging if the new AC V2G EVSE is RFG 2.0 certified AND the AC V2G EVSE manufacturer has separately included the specific compliance requirements of the AC V2G EVSE for compatibility with that specific EV, implementing the applicable RSO's grid code

These requirements are summarised in table 1 below:

Table 1: Compatibility of “existing” and “new” EV/EVSE combinations for the NC 2.0.

		EVSE			
		New V2G EVSE	Existing V2G EVSE	New V1G EVSE	Existing V1G EVSE
EV	New V2G EV	Comply NC RfG 2.0	RSO requirements*	Comply NC DC 2.0	RSO requirements*
	Existing V2G EV	RSO requirements*	RSO requirements*	RSO requirements*	RSO requirements*
	New V1G EV	Comply NC DC 2.0	RSO requirements*	Comply NC DC 2.0	RSO requirements*
	Existing V1G EV	RSO requirements*	RSO requirements*	RSO requirements*	RSO requirements*

* the requirements of the relevant system operator (RSO) shall apply. This may include NC 2.0 compliance depending on the requirements of the relevant transmission system operator, in accordance with article 4a.2 of the NC RfG 2.0.

DRAFT

3. Function allocation between EV and EVSE and common requirements

3.1 DC-connected EV and EVSE function allocation

In systems where a DC bidirectionally charging electric vehicle (DC V2G EV) is connected to the public electricity network via a DC electric vehicle supply equipment (DC V2G EVSE), all certification-relevant grid functions are implemented within the DC V2G EVSE.

Accordingly, only EVSE-Based compliance as defined in clause 2.2.1 of this document, applies.

The DC V2G EV shall remain connected and continue to transfer power in the case that the DC V2G EVSE deviates from the EV's target values in order to fulfil grid code requirements, provided this is still within the capability of the EV. As this behaviour is expected to be part of the standardized functionality of the V2G EV, no additional compliance testing is required for this aspect under the scope of this Technical Annex.

For the purpose of certifying a DC V2G EVSE, a V2G DC EV reference test device, simulating a DC-connected EV, shall be used. This reference test device shall simulate the behaviour of a DC V2G EV and shall include the following capabilities:

- Reception and interpretation of relevant signals via digital communication protocols;
- A storage system or storage simulator capable of responding to control commands and supporting dynamic grid support functions during testing.

Note: The use of a reference test device ensures that the digital communication interface between the DC V2G EV and the DC V2G EVSE functions correctly. Therefore, full protocol stack certification of the digital communication is not required under this Annex.

A V2G capable EV connected to a V2G capable DC V2G EVSE can use the unidirectional charging communication service for unidirectional charging.

3.2 AC connected EV and EVSE function allocation

3.2.1 General

In systems where an AC bidirectionally charging electric vehicle (AC V2G EV) is connected to the public electricity network via an AC electric vehicle supply equipment (AC V2G EVSE), a clear function split as given in table 3 is required, to enable interoperability and an individual certification. Accordingly, EV based and EVSE based compliance as defined in Chapter 2.2, applies.

3.2.2 AC V1G and AC V2G EV capabilities

Table 2 gives an overview of the supported grid-code functions depending on the AC V1G and AC V2G EV capabilities. The table also clarifies for an AC V2G EV, that based on the actual international standardization, a differentiation between unidirectional and bidirectional charging is needed. After the digital communication standards are updated, to allow grid

code parameter exchange between AC V2G EVs and AC V2G EVSE, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex.

Table 2: Overview of AC V1G EV and AC V2G EV capabilities

		V1G capable EV ¹⁾	V2G capable EV	
			Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)
Common requirements of NC DC 2.0 and NC RfG 2.0	Frequency and voltage operating range	No difference		
	ROCOF	No difference		
	LFSM	LFSM-UC	LFSM-U-EV	
	FRT (max. Recovery time)	≤ 60s	≤ 1s	
Additional requirements of this technical annex	Additional National requirements	Not supported	Not currently enabled ²⁾	Supported ³⁾
¹⁾ V1G capable EV means EV equipped with a unidirectional on-board charger (ie limited to NC DC 2.0 support) ²⁾ Capability to apply requirements of NC RfG 2.0 (+technical annex) when charging is given by hardware but can only be enabled after a revision of the digital communication standard to communicate the grid code parameter. ³⁾ see table 3 of this technical annex				

Common rules for individual certification

- (a) For the individual certification of an AC V2G EV a AC V2G EVSE reference test device shall be used. This AC V2G EVSE reference test device shall transmit all relevant parameters via digital communication.

NOTE 1: By using this test procedure it is ensured that the digital communication between AC V2G EV and AC V2G EVSE works properly. Therefore, full protocol stack certification of the digital communication is not required under this Annex.

NOTE 2: All other functions dedicated to the AC V2G EVSE according to table 3 are to be tested by the function specific test setup required by EN 50549-10:2022.

- (b) For the individual certification of an AC V2G EVSE a AC V2G EV reference test device shall be used. This AC V2G EV reference test device shall provide the following capabilities:
- (c) Reception and correct interpretation of the country or RSO specific data set including a means to evaluate automatically the received parameters (eg an active power control curve);
- (d) Generator which is able to generate a stable unintentional island on a parallel resonant circuit with a quality factor equal to one;
- (e) Generator which is able to provide grid support functions;

NOTE 3: By using this test procedure it is ensured that the digital communication between AC V2G EV and AC V2G EVSE works properly. A complete certification of the digital communication is therefore not required.

NOTE 4: All other function dedicated to the AC V2G EV according to Table 3 are tested by the function specific test setup required by EN 50549-10:2022.

- (f) If the rated power of the AC V2G EV differs from the rated power of the AC V2G EVSE, the AC V2G EV and the AC V2G EVSE shall apply the following rated power for all grid code functions:

$$S_{max} = P_{max} = \text{Min}(P_{maxEV}, P_{maxEVSE}) \quad (1)$$

$$\text{Maximum Consumption Capacity (MCC)} = \text{Min}(MCC_{EV}, MCC_{EVSE}) \quad (2)$$

- (g) For the aspect of control accuracy, an AC V2G EV that is connected to an AC V2G EVSE with a lower rated power, shall provide the relevant control accuracy.
- (h) Example: AC V2G EV with 22 kW connected to an AC V2G EVSE with 11 kW: The AC V2G EV needs to comply with control accuracy requirements for an 11 kW AC V2G EV.
- NOTE 5: Usually, grid codes refer to S_{max} . An AC V2G EVSE is limited only by current. Therefore, S_{max} is equal to P_{max} also for the AC V2G EV.
- (i) There is no requirement for an AC V2G EV to be able to operate outside a power factor range of 0.90 underexcited to 0.90 overexcited.
- (j) Measurements of all relevant quantities, ie current, voltage, power etc, shall be RMS values measured over ten cycles, unless indicated otherwise in each module. Measurement of frequency shall be with a resolution of 10mHz. Active power measurement shall be evaluated as 1 minute averages.
- (k) Note that although the LFSM requirements in 4.4 explicitly cover both production and consumption cases, all other tests described for production need also to be demonstrated for consumption.
- (l) In the case where the AC V2G EV receives grid code related parameters outside of its certified ranges, the AC V2G EV shall not start any power output or shall ignore the grid code request if already producing or consuming.

3.2.3 AC V2G EV an AC V2G EVSE function split and certification module overview

Table 3 provides an overview of the function split between AC V2G EV and AC V2G EVSE for both active power consumption (ie charging) and active power output (ie production). For each function the certification relevant details are shown in clause 4.

Note that for bidirectional charging the requirements summarised in Table 3 need to be demonstrated for both production (using P_{max}) and consumption (using MCC).

Table 3: AC V2GAC V2G EV and AC V2GAC V2G EVSE function split and certification module overview

Grid Code Function	AC V2G capable EV		AC V2G capable EVSE		Remarks
	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	
Storage of grid codes					
Storage of local grid code parameter setting	-	-	X	X	Country specific certification of the AC V2G EVSE. Transmission of parameters is dealt with in each line below.
Relevant System Operator data exchange interface	-	-	X	X	Country specific certification of the AC V2G EVSE Transmission of parameters is dealt with in respective lines below.
Interface Protection ¹⁾					
The inclusion of relevant national interface protection. Typical requirements may include: <ul style="list-style-type: none"> - Detection of abnormal voltage and frequency with single fault tolerance - Interface Switch with single fault tolerance²⁾ - Storage of local interface protection events - Digital input(s) (transfer trip, switch to narrow frequency band) - Autotest 	-	-	-	X	Country specific certification of the AC V2G EVSE

Grid Code Function	AC V2G capable EV		AC V2G capable EVSE		Remarks
	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	
Means to detect islanding situation (loss of supply network)	-	-	-	X	Country specific certification of the AC V2G EVSE
(Re-)connection after tripping of Interface Protection					
Automatic reconnection after tripping of the interface protection	-	X	-	X	Verify the abilities of the AC V2GAC V2G EV and the AC V2GAC V2G EVSE as defined in clause 4.2 of this technical annex.
Starting to generate electrical power					
Starting to generate electrical power	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and the AC V2G EVSE as defined in clause 4.2 of this technical annex.
Active Power Control					
Active response to frequency deviation (P(f))	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and AC V2G EVSE as defined in clause 4.4 of this technical annex.
Voltage related active power reduction (P(U))	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and AC V2G EVSE as defined in clause 4.5 of this technical annex.
Active power limitation for distribution grid security	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and V2G EVSE as defined in clause 4.3 of this technical annex.
Reactive Power Control					

Grid Code Function	AC V2G capable EV		AC V2G capable EVSE		Remarks
	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	
Voltage related control mode (Q(U))	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and AC V2G EVSE as defined in clause 4.6 of this technical annex.
Power related control mode (cos ϕ (P), Q(P))	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and AC V2G EVSE as defined in clause 4.7 of this technical annex.
Setpoint control modes (Q setpoint, cos ϕ setpoint)	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and AC V2G EVSE as defined in clause 4.8 of this technical annex.
EMC and power quality					
Harmonic emissions	X	X	X	X	Verify the ability of the AC V2G EV and the AC V2G EVSE to limit harmonic emissions as defined in clause 4.10 of this technical annex.
Flicker and voltage fluctuations	X	X	X	X	Verify the abilities of the AC V2G EV and the AC V2G EVSE to limit flicker and voltage fluctuations as defined in clause 4.10 of this technical annex.
DC injection (differential mode) prevention	X	X	X	X	Verify the ability of the AC V2G EV to limit DC injection as defined in clause 4.11 of this technical annex.
Immunity to disturbances					

Grid Code Function	AC V2G capable EV		AC V2G capable EVSE		Remarks
	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	
Immunity to under-voltage ride through (UVRT) and over-voltage ride through (OVRT)	X	X	X	X	a.) UVRT: Verify the immunity of the AC V2G EV and V2G EVSE against undervoltage fault-ride-through as defined in clause 4.9.1 of this technical annex. b.) OVRT: Verify the immunity of the AC V2G EV and AC V2G EVSE against over-voltage ride through as defined in clause 4.9.2 of this technical annex.
Immunity to frequency variation (ROCOF immunity)	X	X	X	X	Verify the immunity to frequency variations of AC V2G EV and AC V2G EVSE as defined in clause 4.12.
Immunity to phase jump	X	X	X	X	Verify immunity to phase jumps of the AC V2G EV and AC V2G EVSE as defined in clause 4.13 of this technical annex.
Operating range					
Normal operating range frequency, voltage	X	X	X	X	Verify the ability of the AC V2G EV and the AC V2G EVSE to operate in the frequency and voltage ranges as defined in clauses 4.14.1 and 4.14.2.1 of this technical annex.
Voltage support during faults and voltage steps / UVRT and OVRT operating range	X ³⁾	X	X ³⁾	X	Verify the abilities of the AC V2G EV and the AC V2G EVSE to provide voltage support during faults and voltage steps

Grid Code Function	AC V2G capable EV		AC V2G capable EVSE		Remarks
	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	Unidirectional charging (V1G mode / consume only)	Bidirectional charging (V2G mode / consume and inject)	
					as defined in clause 4.14.2.2 of this technical annex.
<p>1) Interface protection including islanding detection are completely solved within the electrical installation. National grid codes define the detailed interface protection concepts, ie if a dedicated interface protection function needs to be provided in the AC V2G EVSE or within the upstream installation.</p> <p>2) For certification of the single fault tolerance of the interface switch it should be considered that a single disconnection device is sufficient if the following requirements are met:</p> <ul style="list-style-type: none"> - short circuit withstand capability (without welding) is coordinated with the upstream short-circuit capability of the electrical installation. - mirror contact or equivalent is provided for end-of-life detection. <p>NOTE: In case of welded contact detection, the AC V2G EVSE the AC V2G EV is triggered to provide at least simple separation which is defined in the applicable product standards.</p> <p>3) Not currently enabled in standards. (see table 2, footnote 2)</p>					

4. Certification modules

4.1 Verification of applying to a dedicated active and reactive power control hierarchy by an V2G EV/EVSE combination

If different requirements on the AC V2G EV and associated AC V2G EVSE interfere with each other, the following hierarchy in descending order shall be applied by an AC V2G EV:

1. self-protection;
2. Voltage support during faults and voltage steps (see 4.14.2.2);
3. the lower value of: remote control command on active power limitation for distribution grid security and LFSM-O-EV (see 4.4);
4. LFSM-U-EV (see 4.4);
5. reactive power (Q(U), $\cos \varphi$ (P), Q(P), Q setpoint, $\cos \varphi$ setpoint) (see 4.6, 4.7, 4.8) and P(U) (see 4.5) controls;
6. other control commands on active power set point for e.g. market, economic reasons, self-consumption optimization.

NOTE 1: Only one reactive power control function can be activated at a time.

NOTE 2: According to table 2 in clause 3.2.2 of this document, interface protection (including active islanding detection) is handled by the AC V2G EVSE. The AC V2G EVSE will switch off independently from the AC V2G EV in case of an interface protection event or in case of an unintended island.

Compliance for the AC V2G EV is checked by the documentation of the design approach by the manufacturer and including as appropriate the inspection of the control algorithms of the control unit or by tests for which different test setups according to EN 50549-10:2022 needs to be combined.

4.2 Verification of automatic reconnection after tripping and starting to generate electrical power by an AC V2G EV and AC V2G EVSE

In case of reconnection after tripping of the interface protection or in case of starting to generate electrical power, the active power generated by AC V2G EV shall not exceed a specified gradient expressed as a percentage of P_{\max} per minute with an accuracy of 5% of P_{\max} . If no gradient is specified, the default setting is 10 % P_{\max}/min . The range of the gradient shall be limited to a value between 6% – 3000% P_{\max}/min .

To apply the specified behaviour the AC V2G EVSE shall calculate the required power ramp over time and shall send the limit active power values over digital communication.

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received power ramp over time within the AC V2G EV reference test device.

The AC V2G EV shall cease or reduce the received active power limit values within a maximum of 5s.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.10 adding an AC V2G EVSE reference test device that can provide the power ramp over time.

Beside parametrization as defined by the relevant system operator, the AC V2G EVSE shall control the (re)connection process depending on the voltage and frequency bands as well as the observation time. The following default values apply:

1. In case of starting to generate electric power an AC V2G EVSE may autonomously connect to the network under the following conditions:
 - i. Voltage within the range on all phases: $0.9 \text{ pu} \leq U \leq 1.1 \text{ pu}$;
 - ii. Frequency range: $49.8 \text{ Hz} \leq f \leq 50.1 \text{ Hz}$;
 - iii. Minimum observation time: 5 s.
2. In case of reconnection after tripping of the interface protection an AC V2G EVSE may autonomously reconnect to the network under the following conditions:
 - i. Voltage within the range on all phases: $0.9 \text{ pu} \leq U \leq 1.1 \text{ pu}$;
 - ii. Frequency range: $49.8 \text{ Hz} \leq f \leq 50.1 \text{ Hz}$;
 - iii. Minimum observation time: 60 s.

For before mentioned functions of the AC V2G EVSE country specific certification applies.

4.3 Verification of applying active power limitation by an AC V2G EV and AC V2G EVSE

An AC V2G EV and AC V2G EVSE shall be capable of carrying out the active power output reduction to the respective limit within an envelope of not faster than $0,66 \% P_{\text{max}}/ \text{s}$ and not slower than $0,33 \% P_{\text{max}}/ \text{s}$ with an accuracy of 5 % of P_{max} as defined in clause 3.2.

To apply the specified behaviour the AC V2G EVSE shall:

1. be capable of receiving active power limitation remotely by the relevant system operator. The active power limitation values shall be adjustable in the complete operating range from P_{max} to minimum regulating level. The adjustment of the limit value shall be possible with a maximum increment of 10% of P_{max} .
2. calculate the required power ramp over time and shall send the limit active power values by digital communication. If the AC V2G EVSE is configured to receive an active power limitation by an external source, the AC V2G EVSE shall forward the limitation by digital communication within a processing time of 4s.

NOTE: The AC V2G EVSE processing time starts on receiving the setpoint from an external source, and end when the setpoint is sent via digital communication.

Compliance for the AC V2G EVSE is checked by measurement of the processing time.

The AC V2G EV shall cease or reduce the received active power limit values within a maximum of 5s.

NOTE: Digital communication can take up to 1s.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.10 adding an AC V2G EVSE reference test device that can provide the active power limitation.

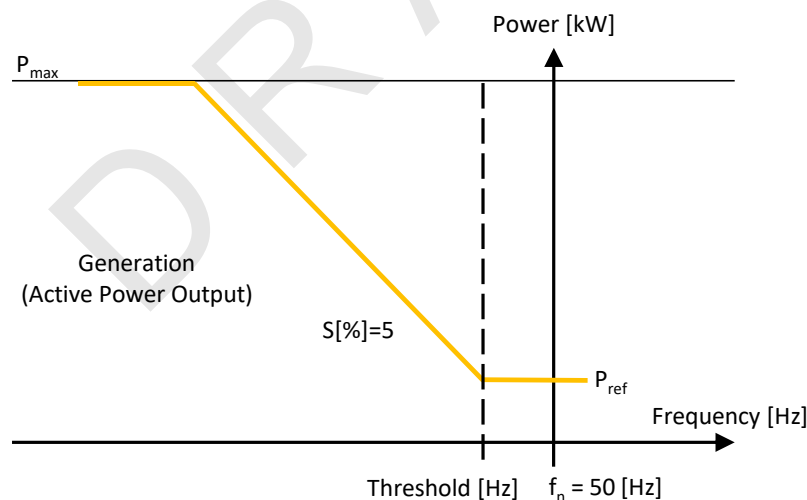
4.4 Verification of applying P(f) curve by an AC V2G EV and AC V2G EVSE

Limited frequency sensitive mode – underfrequency (LFSM-U-EV)

1. When producing active power, an AC V2G EV shall be capable of activating the provision of active power frequency response from the current active power output (P_{ref}) automatically up to P_{max} as negotiated between AC V2G EV and AC V2G EVSE according to the indicative Figure (9) YY2a at a frequency threshold and with the droop setting. Note that the equivalent response when consuming active power is shown in Figure (9) YY2b;
2. The droop setting shall be 5%;
3. The frequency threshold shall be 49,8 Hz inclusive, except for synchronous area IE and Nordic where the frequency threshold shall be 49,5 Hz inclusive;
4. An AC V2G EV shall stay and operate stably in this specific mode as long as the frequency is below the frequency threshold and according to the content of energy and the minimum safe state of charge, or maximum capacity of the traction battery. If the frequency recovers, the AC V2G EV shall follow the same power-frequency characteristic until it is back to its prior state of active power input/output;
5. The response time, T_{resp} in Figure (9) YY2c, shall be less or equal to 0,5 s for an active power setpoint change of 30% of P_{ref} with an accuracy of 10% of P_{max} ;

Figure (9) YY2a

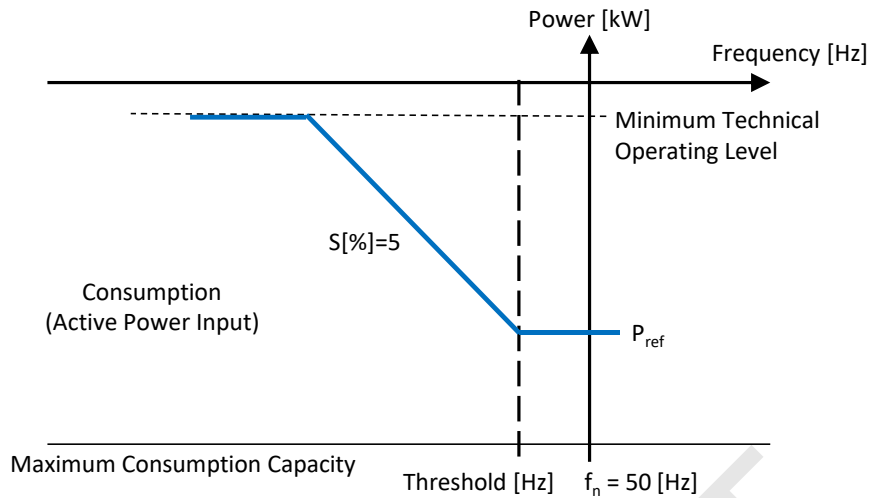
Active power output frequency response capability of an AC V2G EV in LFSM-U-EV



P_{ref} is the actual active power output at the moment the LFSM-U-EV threshold is reached.

Figure (9) YY2b

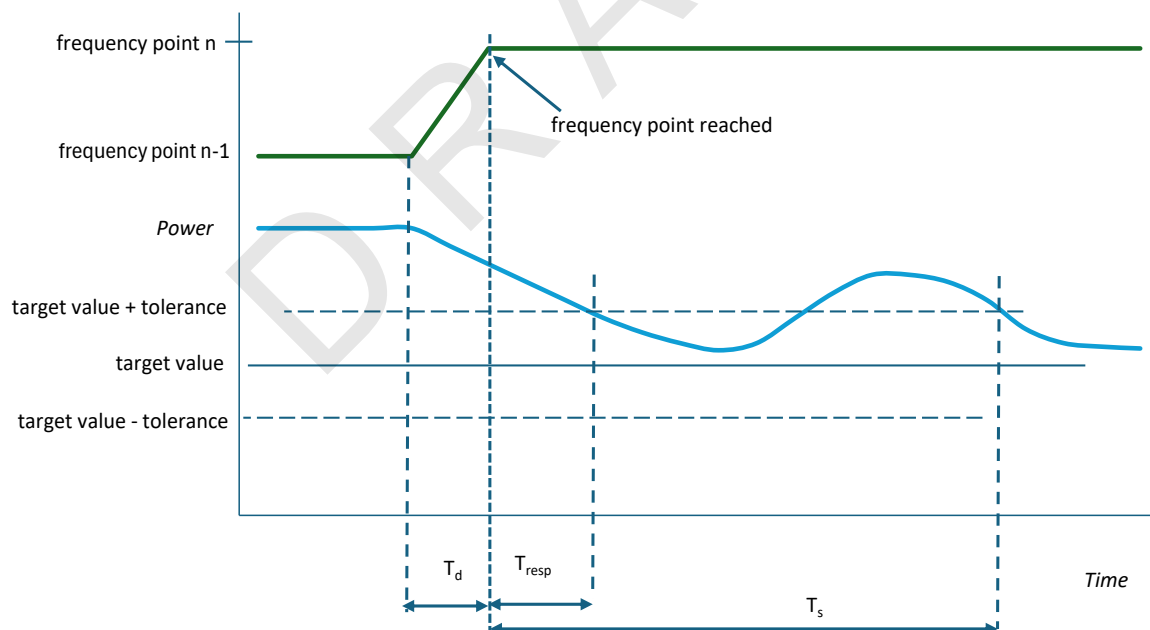
Active power input frequency response capability of an AC V2G EV in LFSM-U-EV



P_{ref} is the actual active power input at the moment the LFSM-U-EV threshold is reached.

Figure (9) YY2c

Definition of response parameters



T_d : Dead time
 T_{resp} : Step response time
 T_s : Settling time

Limited frequency sensitive mode – overfrequency (LFSM-O-EV)

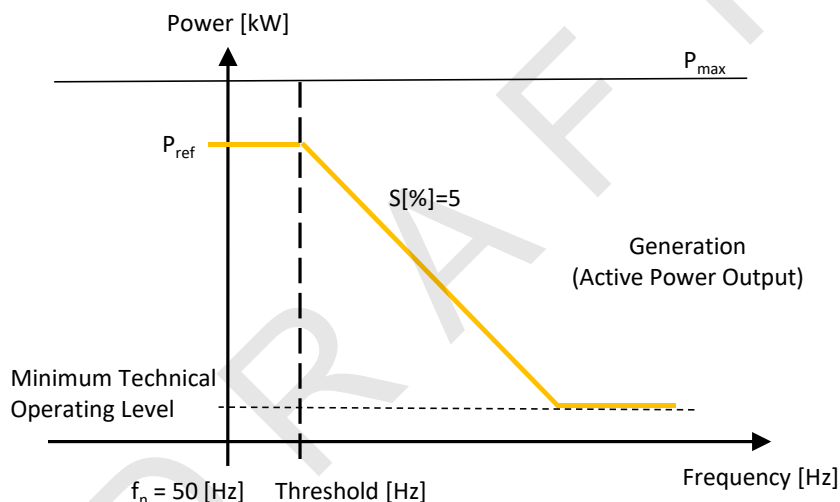
1. When producing active power, an AC V2G EV shall be capable of activating the provision of active power frequency response from the current active power output (P_{ref})

automatically down to the minimum technical operational level according to the indicative Figure (10) YY2a at a frequency threshold and with the droop setting. Note that the equivalent response when consuming active power is shown in Figure (10) YY2b;

2. The droop setting shall be 5%;
3. The frequency threshold shall be 50,2 Hz inclusive, except for synchronous area IE and Nordic where the frequency threshold shall be 50,5 Hz inclusive;
4. An AC V2G EV shall stay and operate stably in this specific mode as long as the frequency is above the frequency threshold and according to the content of energy and the minimum safe state of charge, or the maximum capacity of the traction battery. If the frequency recovers, the AC V2G EV shall follow the same power-frequency characteristic until it is back to its prior state of active power input/output;
5. The response time, T_{resp} in Figure (9) YY2c, shall be less or equal to 0.5 s for an active power setpoint change of 30% of P_{ref} with an accuracy of 10% of P_{max} .

Figure (10) YY2a

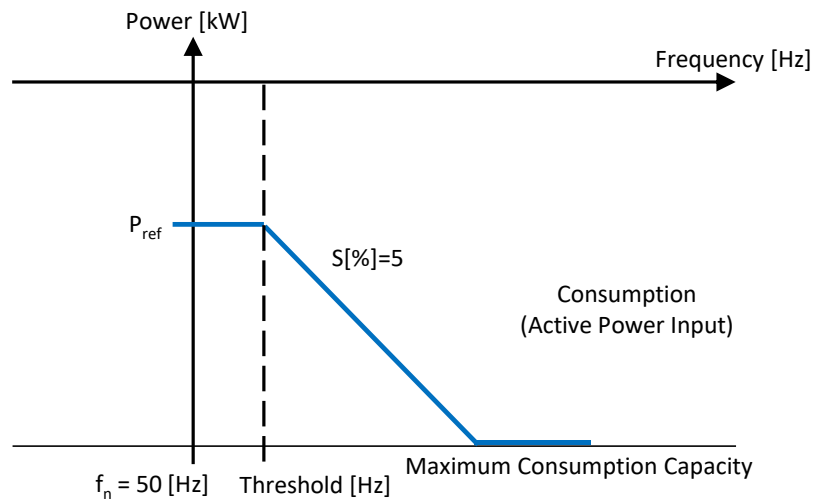
Active power output frequency response capability of an AC V2G EV in LFSM-O-EV



P_{ref} is the actual active power output at the moment the LFSM-O-EV threshold is reached.

Figure (10) YY2b

Active power input frequency response capability of an AC V2G EV in LFSM-O-EV



P_{ref} is the actual active power input at the moment the LFSM-O-EV threshold is reached.

All parameters for LFSM-O-EV and LFSM-U-EV are provided by the AC V2G EVSE to the AC V2G EV via digital communication.

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received LFSM-O-EV and LFSM-U-EV curves within the AC V2G EV reference test device.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.4 adding an AC V2G EVSE reference test device that can provide the LFSM-O-EV and LFSM-U-EV curves. The AC V2G EV shall show compliance at both 49.8Hz (for CE) and 49.5Hz (for IE and Nordic) frequency thresholds for LFSM-U-EV and at both 50.2Hz (for CE) and 50.5Hz (for IE and Nordic) for LFSM-O-EV and starting active power levels of 50% of P_{max} , 50% of MCC, 100% of MCC (LFSM-U-EV only) and 100% of P_{max} (LFSM-O-EV only).

4.5 Verification of applying P(U) curve by an AC V2G EV and AC V2G EVSE

The AC V2G EV shall reduce the active power output depending on the grid voltage (P(U)). The P(U) curve shall be provided by the AC V2G EVSE to the AC V2G EV via digital communication.

The accuracy of the voltage measurement within the AC V2G EV shall be at least 1 % of the nominal voltage and the accuracy of the power adjustment shall be better than 10% of P_{max} . The AC V2G EV shall evaluate all phase-neutral-voltages of all connected phases individually.

For voltage-controlled active power reduction, the AC V2G EV shall limit the active power output based on the highest voltage value either of each phase individually or symmetrically. The relevant system operator can choose between two methods:

- a. Limitation of the maximum permissible active power output according to Figure XXX (a). If the voltage U_{Start} is exceeded, the AC V2G EV shall linearly reduce the active power output from P_{max} at U_{Start} down to 0 at U_{Stop} .

- b. Limitation of the maximum permissible active power output according to Figure XXX (b). If the voltage U_{Start} is exceeded, the AC V2G EV shall linearly reduce the active power output from P_M at U_{Start} down to ΔP (with $\Delta P = P_{\text{max}} - P_M$) at U_{Stop}

U_{Start} and U_{Stop} shall be adjustable from 1pu – 1,25pu.

Figure XXX (a)

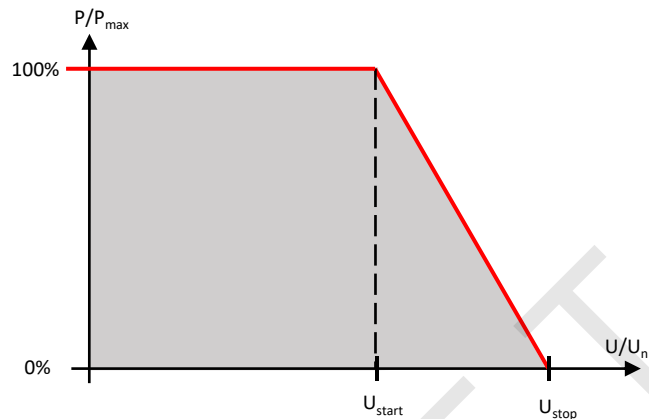
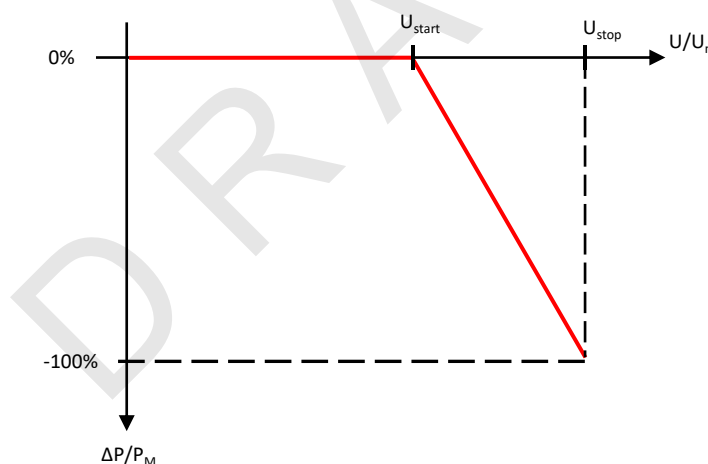


Figure XXX (b)



The dynamics of the $P(U)$ control correspond to a step response or a first-order filter with a configurable time constant between 3 s and 60 s, with a default value of 5 s. The $P(U)$ control shall be activated by the AC V2G EV after a jump in setpoint after the shortest possible initial time delay (maximum 3 s).

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received $P(U)$ -curve and time constant within the AC V2G EV reference test device.

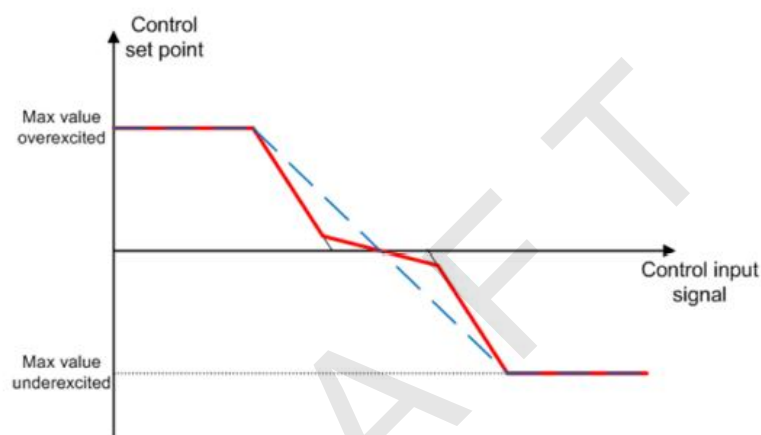
Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.6 adding an AC V2G EVSE reference test device that can provide the $P(U)$ curve.

4.6 Verification of applying Q(U) curve by an AC V2G EV and AC V2G EVSE

The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the voltage measured by the AC V2G EV ($Q = f(U)$).

A Q(U) function with a characteristic with a minimum and maximum value of Q and three connected lines according to Figure AA shall be configurable within the AC V2G EVSE and shall be transmitted to the AC V2G EV by digital communication.

Figure AA
Example characteristics for Q control mode



Note: Figures AA and CC show a generic representation of how the set point for reactive power varies with the relevant control input. In Figure AA the control input signal is the EV terminal voltage. In Figure CC the control input is active power, whilst the control set point is $\cos \varphi$.

In addition, the AC V2G EVSE shall allow to set and transmit the following configurations:

- 1.) The response to a voltage change as a time constant of a first order filter with a configurable range of 3s to 60s;
- 2.) Two methods to limit the reactive power at low active power by:
 - a minimum $\cos \varphi$ configurable in the range of 0-0,95;
 - two active power levels both with at least the range of 0% to 100% of P_{\max} . The lock-in value turns the Q(U) mode on, the lock-out value turns Q(U) off. If lock-in is larger than lock-out a hysteresis is given.

The AC V2G EV shall apply all received configurations.

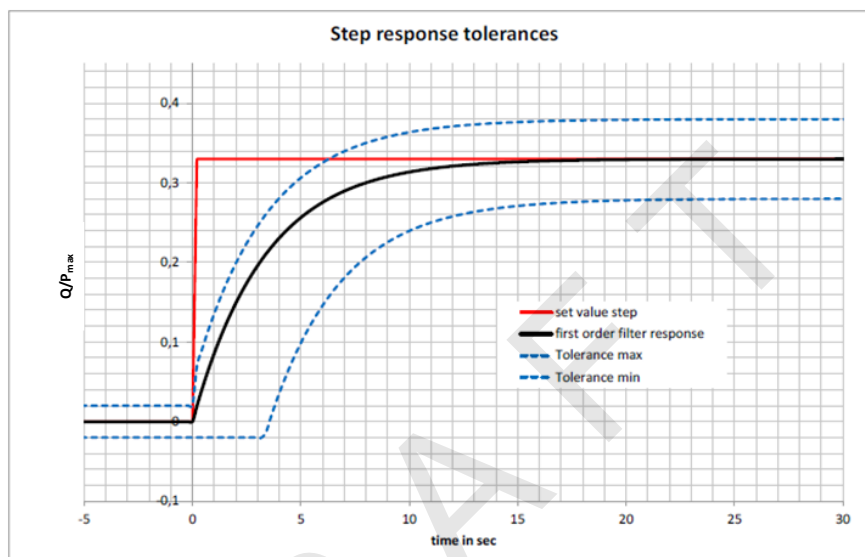
The arithmetic mean of the RMS values of the measured phase-neutral-voltages is the target for the reactive power that the AC V2G EV shall feed-in on all external conductors.

The voltage measurement of the AC V2G EV shall not exceed a maximum measurement error of $\pm 1\%$.

When operating above or equal to 10 % of S_{\max} , the static reactive power capability of the AC V2G EV shall be provided with an accuracy of $\pm 2\%$ S_{\max} . Below 10% of S_{\max} a static accuracy of $\pm 10\%$ of S_{\max} applies.

The dynamic accuracy of the AC V2G EV shall be in accordance with Figure BB with a maximum tolerance of $\pm 5\%$ of P_{\max} , plus a time delay of 3 s deviating from the ideal first order filter response.

Figure BB
Example of dynamic control response and tolerance band for a step from $Q=0$ to $Q=33\%P_{\max}$ with $\tau=3,33s$



Note 1: The dynamic response of the EV/EVSE to voltage changes is not considered here.

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received $Q(U)$ -curve and additional configurations within the AC V2G EV reference test device.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.5.2.4 adding an AC V2G EVSE reference test device that can provide the $Q(U)$ curve.

4.7 Verification of applying $\cos \varphi (P) / Q(P)$ curve by an AC V2G EV and AC V2G EVSE

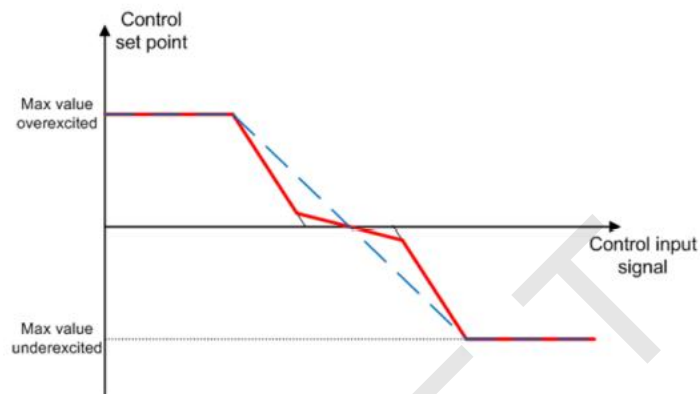
The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid depending on the current active power measured by the AC V2G EV ($\cos \varphi = f(P)$, or $Q = f(P)$).

For three phase AC V2G EV the value for the reactive power is the derived from the arithmetic mean of the three RMS values of P_M that the AC V2G EV shall feed-in on all external line conductors.

4.7.1 $\cos \varphi = f(P)$

A $\cos \varphi (P)$ function with a characteristic with a minimum and maximum value of $\cos \varphi$ and three connected lines according to Figure CC shall be configurable within the AC V2G EVSE and shall be transmitted to the AC V2G EV by digital communication.

Figure CC
Example characteristics for Q control mode



Note: In Figure CC for $\cos \varphi = f(P)$ the control input is active power, whilst the control set point is $\cos \varphi$.

The AC V2G EV shall apply all received configurations and shall apply a new reactive power setpoint latest within 10s after the corresponding active power value is reached.

The arithmetic mean of the RMS values of P_M is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors.

For three phase AC V2G EV the target for the reactive power is the arithmetic mean of the three RMS values of P_M that the AC V2G EV shall feed-in on all external line conductors. "

When operating above or equal to 10 % of S_{max} , the static reactive power capability of the AC V2G EV shall be provided with an accuracy of $\pm 4 \% S_{max}$. Below 10% of S_{max} a static accuracy of $\pm 10 \%$ of S_{max} applies.

The dynamic accuracy of the AC V2G EV shall be in accordance with Figure BB (see clause 4.6) with a maximum tolerance of $\pm 5\%$ of P_{max} , plus a time delay of 3 s deviating from the ideal first order filter response.

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received $\cos \varphi (P)$ curve within the AC V2G EV reference test device.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.5.2.5 adding an AC V2G EVSE reference test device that can provide the $\cos \varphi (P)$ -curve.

4.7.2 $Q = f(P)$

A $Q = f(P)$ function with a characteristic with a minimum and maximum value of Q and three connected lines according to Figure CC shall be configurable within the AC V2G EVSE and shall be transmitted to the AC V2G EV by digital communication.

Note: In Figure CC for $Q = f(P)$ the control input is active power, whilst the control set point is Q .

The AC V2G EV shall apply all received configurations and shall apply a new reactive power setpoint value latest within 10s after the corresponding active power value is reached.

The arithmetic mean of the RMS values of P_M is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors.

For three phase AC V2G EV the target for the reactive power is the arithmetic mean of the three RMS values of P_M that the AC V2G EV shall feed-in on all external line conductors. "

When operating above or equal to 10 % of S_{max} , the static reactive power capability of the AC V2G EV shall be provided with an accuracy of $\pm 4\%$ S_{max} . Below 10% of S_{max} a static accuracy of $\pm 10\%$ of S_{max} applies.

The dynamic accuracy of the AC V2G EV shall be in accordance with Figure BB (see clause 4.6) with a maximum tolerance of $\pm 5\%$ of P_{max} , plus a time delay of 3 s deviating from the ideal first order filter response.

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received $Q(P)$ curve within the AC V2G EV reference test device.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.5.2.5 adding an AC V2G EVSE reference test device that can provide the $Q(P)$ curve.

4.8 Verification of applying reactive power setpoints by an AC V2G EV and AC V2G EVSE

The AC V2G EV shall apply to reactive power setpoints received via digital communication from the AC V2G EVSE. Depending on the required setpoint control mode at the POC the AC V2G EVSE communicates Q setpoint or $\cos \varphi$ setpoint values.

In the case of change of the setpoint the total settling time for a new setpoint shall be adjustable between 10s and 60s. The total settling time starts with the reception of the setpoint value by the AC V2G EVSE and ends with the adaption of the value by the AC V2G EV.

To apply the specified behaviour the AC V2G EVSE shall forward the setpoint values over digital communication with an adjustable processing time of 4s to 55s.

NOTE: The AC V2G EVSE processing time starts with receiving the setpoint by an external source and ends with sending the setpoint via digital communication.

The AC V2G EV shall apply the received setpoint within a maximum of 5 s.

NOTE: Digital communication can take up to 1s.

Compliance for the AC V2G EVSE is checked by measurement of the processing time.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.5.2.3 adding an AC V2G EVSE reference test device that can provide the reactive power setpoint values.

4.9 Verification of immunity to disturbances

4.9.1 Verification of UVRT immunity of an AC V2G EV and AC V2G EVSE

An AC V2G EV and AC V2G EVSE, when operating above the minimum stable operating level, shall be capable of remaining connected to the network and continuing to operate stably after the power system has been disturbed by faults in the transmission network according to a voltage-against-time-profile in line with Figure DD.

Figure DD

Under-voltage fault-ride-through capability of AC V2G EV and AC V2G EVSE

OBJ:

NOTE: The voltage-against-time-profile expresses a lower limit of the profile of the lowest phase-to-phase voltage (or single phase to neutral voltages for single phase AC V2G EV) on the network voltage level during a symmetrical fault, as a function of time before, during and after a fault. U_{ret} is the retained voltage at the connection point during a fault, t_{clear} is the instant when the fault has been cleared. U_{rec1} , U_{rec2} , t_{rec1} , t_{rec2} and t_{rec3} specify certain points of lower limits of voltage recovery after fault clearance.

The lowest phase to neutral voltage or if no neutral is present the lowest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE.

To apply the specified behaviour the AC V2G EVSE shall keep all switching devices closed and maintain stable communication to the AC V2G EV as defined by the relevant system operator.

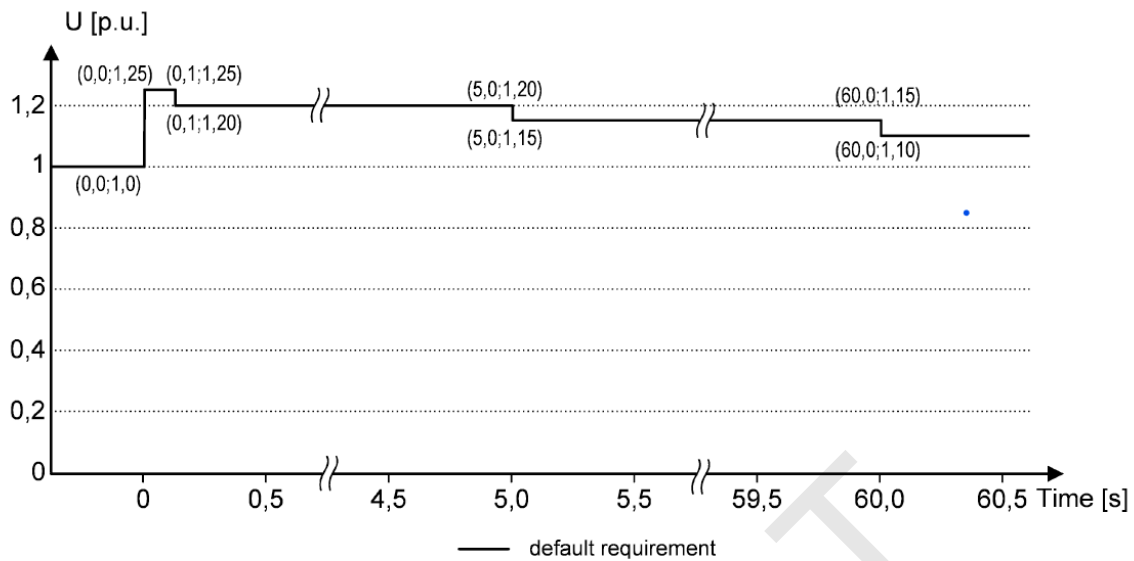
For the capability of remaining connected to the network and to continue to operate stable country specific certification applies for the AC V2G EVSE.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.3.

4.9.2 Verification of OVRT immunity of an AC V2G EV and AC V2G EVSE

An AC V2G EV and AC V2G EVSE shall be capable of remaining connected to the network and continuing to operate stably as long as the voltage at the point of connection remains below the voltage-time curve of Figure EE.

Figure EE
Over-voltage fault-ride-through capability of an AC V2G EV and AC V2G EVSE



The highest phase to neutral voltage or if no neutral is present the highest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE.

To apply the specified behaviour the AC V2G EVSE shall keep all switching devices closed and maintain stable communication to the AC V2G EV as defined by the relevant system operator.

Compliance for the capability of remaining connected to the network and to continue to operate stable country specific certification applies for the AC V2G EVSE.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.3.

4.10 Verification of harmonic emissions and flicker of an AC V2G EV and an AC V2G EVSE

Individually, the AC V2G EV and the AC V2G EVSE shall limit the harmonic emissions in accordance with the requirements in EN IEC 61000-3-2:2019+A1:2021 and flicker in accordance with the requirements in EN 61000-3-3:2013+A1:2019+A2:2021+AC:2022 independent of the rated power of the AC V2G EV and AC V2G EVSE.

Compliance for the AC V2G EV and AC V2G EVSE is individually checked by a test setup defined in EN 50549-10:2022 clause 5.7.2.2 for harmonic emissions and clause 5.7.2.3.2 for flicker.

4.11 Verification of limitation of DC injection of an AC V2G EV

The AC V2G EV shall not inject DC currents into individual phases greater than 0,5 % of the nominal current (I_n) or 20 mA whatever is the higher value. I_n is considered the minimum of I_{n_EV} and I_{n_EVSE} .

Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and evaluate automatically the received limit within the AC V2G EV reference test device.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.7.2.4 adding an AC V2G EVSE reference test device that can provide the DC injection limit.

4.12 Verification of ROCOF immunity of an AC V2G EV and AC V2G EVSE

The AC V2G EV and AC V2G EVSE shall be capable of remaining connected to the network and operate:

(i) at rates-of-change-of-frequency up to the following values:

- $\pm 4,0$ Hz/s over a period of 0,25s
- $\pm 2,0$ Hz/s over a period of 0,5s
- $\pm 1,5$ Hz/s over a period of 1s
- $\pm 1,25$ Hz/s over a period of 2s

(ii) the sequence of rates-of-change-of-frequencies which are defined considering the overfrequency against time profiles given in Figure (7)XX.c and the underfrequency against time profiles given in Figure (8)XX.d;

If the power output of the generating unit has no influence on the capability of the generating unit to cope with the ROCOF variation, the generating unit can be tested at any power within the active power range declared by the manufacturer.

Figure (7)XX.c
Overfrequency against time profile of an AC V2G EV

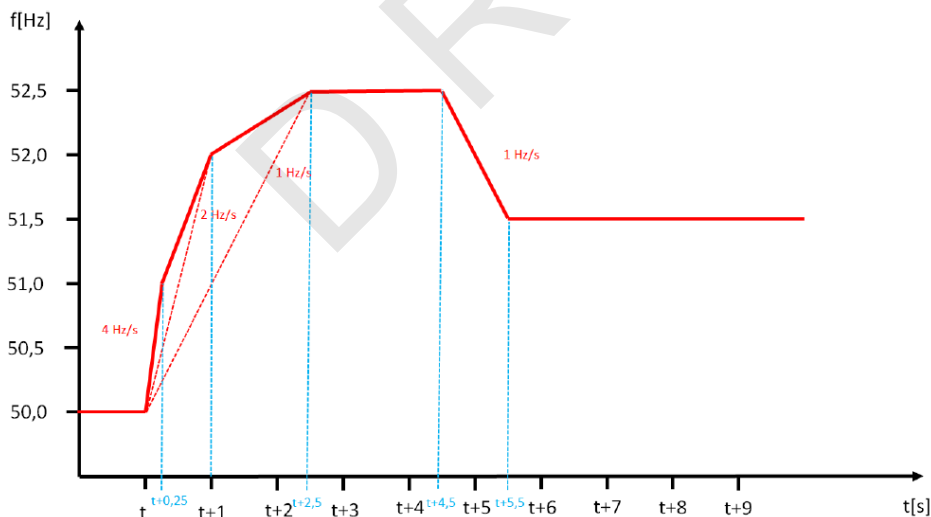
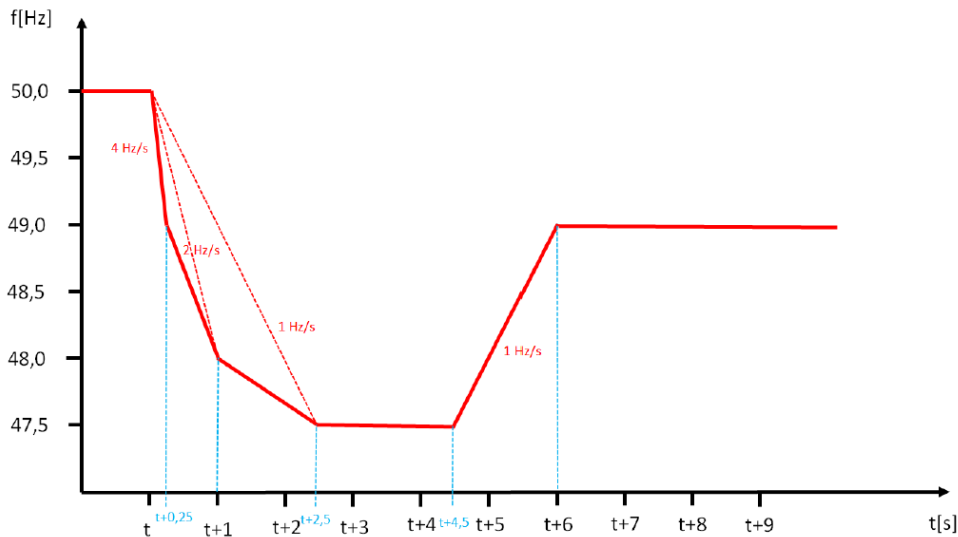


Figure (8)XX.d
Underfrequency against time profile of an AC V2G EV



For AC V2G EV and AC V2G EVSE compliance is checked by a test setup defined in EN 50549-10:2022 clause 5.3.1 with frequency ride through curves as defined in Figure (8)XX.d and Figure (7)XX.c.

4.13 Verification of phase jump immunity of an AC V2G EV and AC V2G EVSE

The AC V2G EV shall have phase jump immunity equal to or exceeding 20° in the case of a symmetrical phase jump.

After the phase jump, 90 % of pre-fault power or available power whichever is the smallest shall be resumed latest within 1 s.

Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2.

The AC V2G EVSE shall keep all switching devices closed and maintain stable communication to the AC V2G EV as defined by the relevant system operator.

For the AC V2G EVSE country specific certification applies and compliance is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2

4.14 Verification of frequency and voltage operating range of an AC V2G EV and an AC V2G EVSE

4.14.1 Frequency operating range

The AC V2G EV & EVSE shall be capable of remaining connected to the network and operate within the frequency ranges and time periods specified in Table (3)XY;

Table (3)XY

Minimum time periods for which an AC V2G EV & EVSE shall be capable of operating on different frequencies, deviating from a nominal value, without disconnecting from the network

Frequency Range	Time period for operation
47.5 Hz – 48.5 Hz	30 minutes
48.5 Hz – 49.0 Hz	30 minutes
49.0 Hz – 51.0 Hz	Unlimited
51.0 Hz – 51.5 Hz	30 minutes
51.5 Hz – 52.5 Hz	10 seconds

Compliance for the AC V2G EV and EVSE is checked by the test setup defined in EN 50549-10:2022 clause 5.2.1.

4.14.2 Voltage operating range

4.14.2.1 Continuous operating range

For continuous operating range the AC V2G EV shall be capable of remaining connected to the network and operate continuously within the range of 0,85 pu - 1,1 pu at the connection point.

For continuous operating range, compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.2.2.

For the AC V2G EVSE country specific certification applies.

4.14.2.2 Voltage support during faults and voltage steps / UVRT and OVRT operating range

For UVRT and OVRT operating range the AC V2G EV shall reduce its current output within 100ms down to or below 10 % of the rated current of Pmax as appropriate when the voltage is outside of a static voltage range communicated by the AC V2G EVSE via digital communication. The static voltage range shall be adjustable from 0,05 pu – 1 pu for the undervoltage boundary and from 1 pu - 1,25 pu for the overvoltage boundary. The default setting shall be 0,85 pu for the undervoltage boundary and 1,1 pu for the overvoltage boundary. Each phase to neutral voltage or if no neutral is present each phase-to-phase voltage shall be evaluated by the AC V2G EV.

At voltage re-entry into the static voltage operating range, the AC V2G EV shall resume with a linear or first order filter response behaviour to 90% of pre-fault active power or available power, whichever is the smallest. The re-entry time and all response behaviour shall be adjustable between 1 s and 60 s, as communicated by the AC V2G EVSE via digital communication. The re-entry voltage value shall be adjustable from 0,05 pu – 1 pu for the undervoltage re-entry and from 1 pu - 1,25 pu for the overvoltage re-entry. Both are communicated by the AC V2G EVSE via digital communication.

For compliance with the UVRT and OVRT operating ranges the AC V2G EV is checked by the test setup in EN 50549-10:2022, clause 5.3.3 adding an AC V2G EVSE reference test device that provides all settings defined in this clause.

The AC V2G EVSE shall keep all switching devices closed and maintain stable digital communication to the AC V2G EV as defined by the relevant system operator.

For the AC V2G EVSE country specific certification applies. For the transmission of all settings defined in this clause, compliance for the AC V2G EVSE is checked by setting the applicable parameters at the input terminals of the AC V2G EVSE and automatically evaluate the received settings within the AC V2G EV reference test device.

DRAFT

Version history

V	Date	Description
1.0	20/01/2026	First complete draft for circulation to ESC and stakeholders.
1.01	20/01/2026	Minor editorial corrections to figures Figure (9) YY2a and Figure (10) YY2a
1.02	31/01/2026	Update to table 1 following discussion with EC and ACER
2.0	09/02/2026	Intermediate minor updates pre 2.1
2.1	16/02/2026	Text updated to accommodate comments received following public consultation on the 1.0 draft.
2.2	17/02/2026	Version incorporating all comments, circulated for further comments before 20/02/26. This is the version circulated on 20 February to EG and to ESC.
2.3	23/02/2026	Minor changes: wording change 3.2.3(i); Tresp label corrected in fig (9)YY 2C. Dynamic accuracy added to 4.7.

A4 - Relevant NC RfG 2.0 Articles

This annex contains the proposed legal text changes identified by the Expert Group Certification. With two exceptions as at 26 February 2026 these amendments have been agreed with ENTSO-e. The remaining issues to be finalised are:

1. The timing requirements for response in Article 13a.5(f) and Article 13a.6(g);
2. The limit on discharge to the “minimum safe state of charge” in Article 13a.6(e);

In the following legal text extracts, the text is coloured as explained in this legend:

- Black: Original ACER recommendation to DG ENER
- Orange: Amendment proposals
- Red: Deleted text and deleted proposals

Network Code on Requirements for grid connection of generators (ACER Recommendation)

Article 2

(80) “minimum safe state of charge means the level of minimum charge set by the manufacturer, which cannot be changed by the EV user and is presented to the user as zero charge”

Article 13a

5. With regard to the limited frequency sensitive mode – underfrequency (LFSM-U-EV):

(a) **When consuming active power a**, A type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall be capable of activating the provision of active power frequency response from the current active power ~~input/output~~ (Pref) automatically up to the maximum capacity **(maximum generation active power negotiated between EV and EVSE)** according to the indicative Figure (9)YY2**a** at a frequency threshold and with the droop setting;

(b) When producing active power, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall be capable of activating the provision of active power frequency response from the current active power input (Pref) automatically down to the minimum technical operational level according to the indicative Figure (9)YY2b at a frequency threshold and with the droop setting;

~~(b)~~ The droop setting shall be 5%;

~~(c)~~ The frequency threshold shall be 49,8 Hz inclusive, except for synchronous area IE **and Nordic** where the frequency threshold shall be 49,5 Hz inclusive;

~~(d)~~ A type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall stay and operate stably in this specific mode as long as the frequency is below the frequency threshold and according to ~~it's~~ **the** content of

energy and the minimum safe state of charge, or maximum capacity, of the traction battery. If the frequency recovers, the V2G electric vehicle and associated V2G electric vehicle supply equipment shall follow the same power-frequency characteristic until it is back to its prior state of active power input/output. When LFSM-O is active, the LFSM-O setpoint will prevail over any other active power setpoints which would result in an increase of power above the LFSM-O setpoint;

(e) The response time, T_{resp} , in Figure (11)XX3, shall be less or equal to 0,5 s for an active power setpoint change of ~~100% of~~ 30% of P_{ref} , less or equal to 1,0s for an active power setpoint change of 60% of P_{ref} and less or equal to 1.5s for an active power setpoint change of 90% of P_{ref} . ~~P_{max} excluding the time for switching from consumption to generation or vice versa, and excluding the time needed to activate from the charging pause;~~

~~(f) Switching from consumption to generation and vice versa should be as fast as technically feasible.~~

Figure (9)YY2
Active power frequency response capability of type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment in LFSM-U-EV

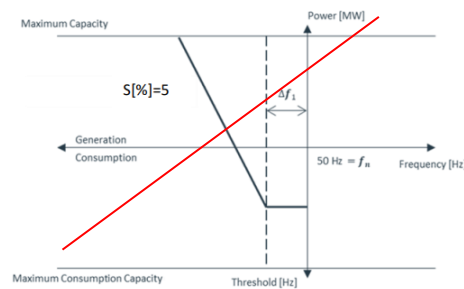
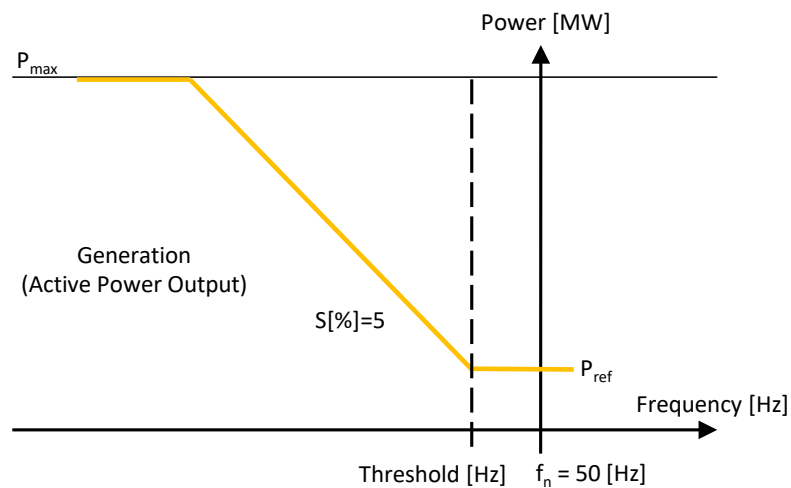


Figure (9)YY2a

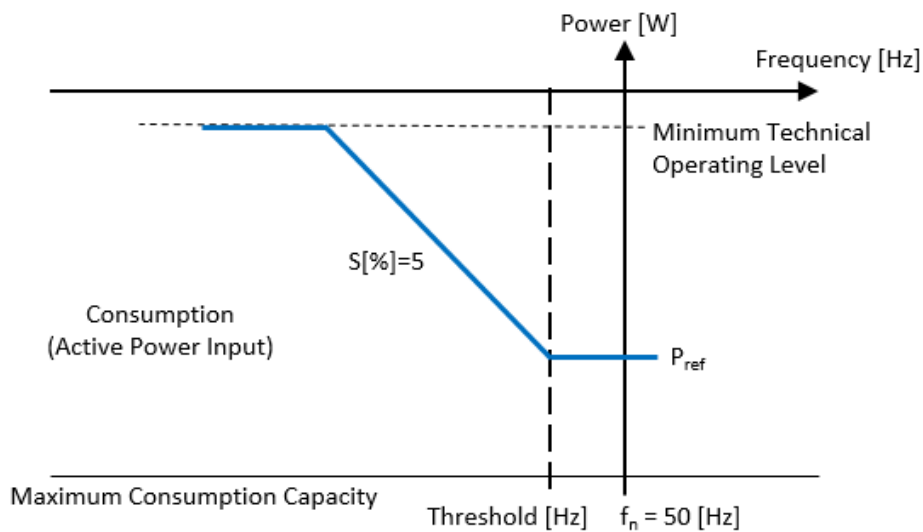
Active power output frequency response capability of type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment in LFSM-U-EV



P_{ref} is the actual active power output at the moment the LFSM-U-**EV** threshold is reached.

Figure (9)YY2b

Active power input frequency response capability of type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment in LFSM-U-**EV**



P_{ref} is the actual active power input at the moment the LFSM-U-**EV** threshold is reached.

6. With regard to the limited frequency sensitive mode – overfrequency (LFSM-O-EV):

(a) When producing active power, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall be capable of activating the provision of active power frequency response from the current active power output (P_{ref}) automatically down to the minimum technical operational level according to the indicative Figure (10)YY2a at a frequency threshold and with the droop setting;

~~which is consuming active power during an overfrequency event shall increase the active power consumption according to the LFSM-O characteristic, to the extent that is technically feasible. The type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall consume power up to filling the maximum energy that it is able to store, then it may cease consumption.~~

(b) When consuming active power, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall be capable of activating the provision of active power frequency response from the current active power input (Pref) automatically up to the maximum consumption capacity (maximum consumption active power negotiated between EV and EVSE) according to the indicative Figure (10)YY2b at a frequency threshold and with the droop setting; ~~which is injecting active power during an overfrequency event, shall activate the provision of active power frequency response according to Figure (10)1X1 at the frequency threshold Δf_1 equal to 50,2 Hz (inclusive), except for synchronous area IE where the frequency threshold shall be 50,5 Hz (inclusive);~~

(c) The droop setting shall be 5%;

(d) Any unintentional delay shall be as short as possible;

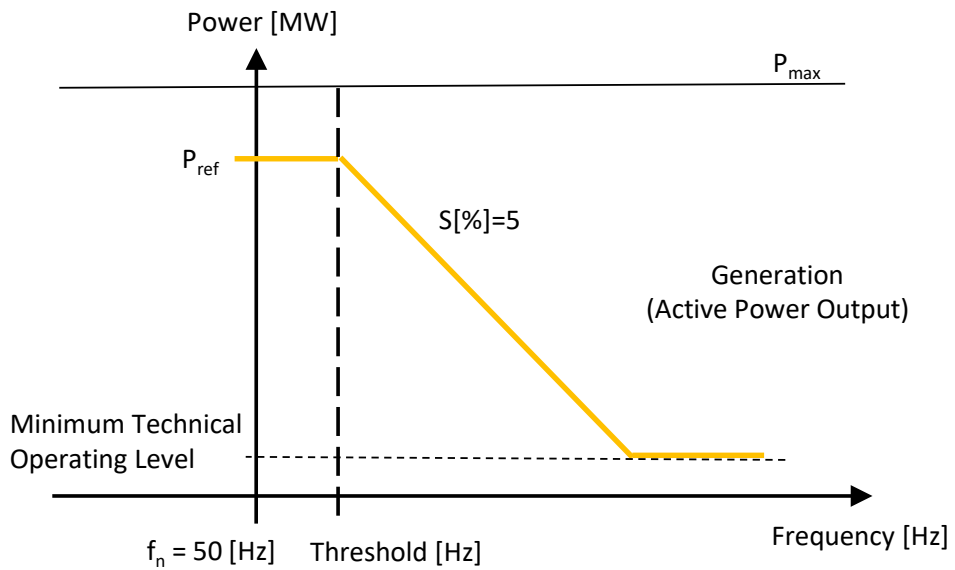
(e) The frequency threshold shall be 50,2 Hz inclusive, except for synchronous area IE and Nordic where the frequency threshold shall be 50,5 Hz inclusive;

(f) A type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall ~~be capable of operating~~ stay and operate stably in this specific mode as long as the frequency is above the frequency threshold and according to the content of energy and the minimum safe state of charge, or the maximum capacity, of the traction battery. If the frequency recovers, the V2G electric vehicle and associated V2G electric vehicle supply equipment shall follow the same power-frequency characteristic until it is back to its prior state of active power input/output. ~~during LFSM-O operation.~~ When LFSM-O is active, the LFSM-O setpoint will prevail over any other active power setpoints which would result in an increase of power above the LFSM-O setpoint;

(g) The response time, T_{resp} , in Figure (11)XX3 ~~for active power decrease in case of increasing frequency~~, shall be less or equal to 20.5 s for an active power setpoint change of 30% of maximum power Pref, less or equal to 1,0s for an active power setpoint change of 60% of Pref and less or equal to 1.5s for an active power setpoint change of 90% of Pref.

Figure (10)YY2a

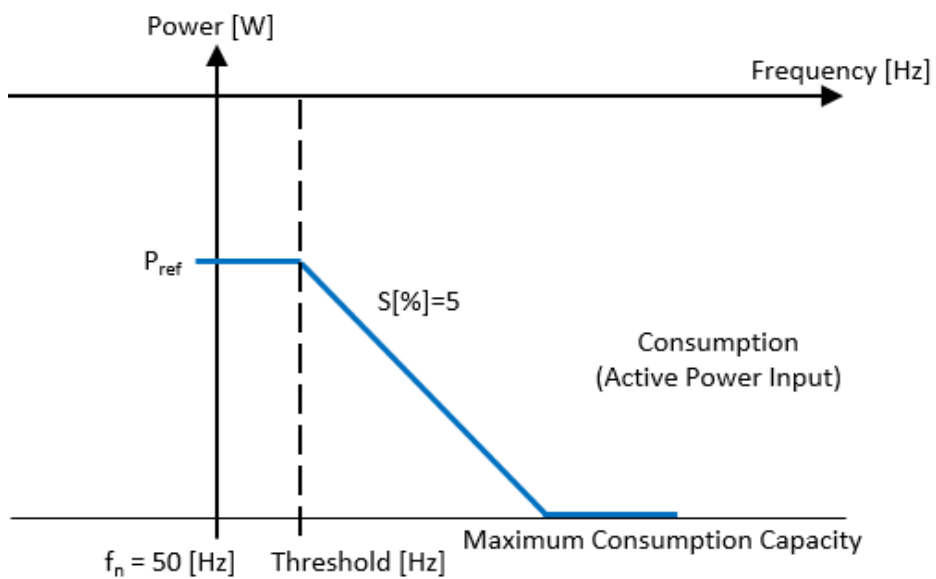
Active power output frequency response capability of type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment in LFSM-O-EV



P_{ref} is the actual active power output at the moment the LFSM-O-EV threshold is reached.

Figure (10)YY2b

Active power input frequency response capability of type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment in LFSM-O-EV



P_{ref} is the actual active power input at the moment the LFSM-O-**EV** threshold is reached.

....

8. With regard to voltage stability, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall be capable of remaining connected to the network and operate continuously within the range of 0,85 –u - 1,1 pu at the connection point. Beyond these voltage range values, the under voltage ride through immunity limits as specified in paragraph 9 apply. **In case of voltages below U_n , it is allowed to reduce the apparent power to within the current limits of the electric vehicle and associated electric vehicle supply equipment. The reduction shall be as small as technically feasible.**

9. A type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment, when operating above the minimum stable operating level, shall be capable of ~~remaining connected to the network and~~ continuing to operate stably after the power system has been disturbed by faults in the transmission network according to a voltage-against-time-profile in line with Figure (12)3 at the connection point and with the set points in ~~10.~~ Table (4) x.1.1 and Table (5) x.1.2.

Table (4) x.1.1

Voltage parameters for Figure (12)3 for fault-ride-through capability of type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment

Voltage parameters (pu)	
U_{ret} :	0.05
U_{clear} :	0.15
U_{rec1} :	0.15
U_{rec2} :	0.85

Table (5) x.1.2

Time parameters for Figure (12)3 for fault-ride-through capability of type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment

Time parameters(seconds)	
t_{clear} :	0.15

t _{rec1} :	0.15
t _{rec2} :	0.15
t _{rec3} :	0.30

140. The voltage-against-time-profile expresses a lower limit of the profile of the lowest phase-to-phase voltages (or single phase to neutral voltages for single phase type EV1 and EV2 V2G electric vehicles and associated V2G electric vehicle supply equipment) on the network voltage level during a symmetrical fault, as a function of time before, during and after the fault.

11. 12. When the network voltage resumes, after the fault has been cleared, to a value within the voltage range of 0,85 pu – 1,1 pu, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall recover its active power output production level to its pre-fault value. Where the post fault network voltage is less than 1.0pu and active power production is constrained by the maximum current rating of the EV1 or EV2 V2G electric vehicle and associated electric vehicle supply equipment, the active power output shall be reduced below its pre fault value in proportion to the post fault to pre fault network voltage.. The recovery time shall not exceed a maximum of 1s.

12. When the network voltage resumes, after the fault has been cleared, to a value within the voltage range of 0,85 pu – 1,1 pu, a type EV1 and EV2 V2G electric vehicle and associated V2G electric vehicle supply equipment shall recover its active power consumption level to its pre fault value. Where the post fault network voltage is less than 1.0pu and active power production is constrained by the maximum current rating of the EV1 or EV2 V2G electric vehicle and associated electric vehicle supply equipment, the active power consumption shall be reduced below its pre fault value in proportion to the post fault to pre fault network voltage. The recovery time shall not exceed a maximum of 1 s.

A5 – Recommendations for standards bodies.

Bidirectional EV/EVSE set to “charging only”	Relevant for
<p>When a bidirectional EV/EVSE combination has been selected to operate unidirectionally, ie to charge the EV battery only, the combination must still meet the requirements defined in the NC RfG 2.0 + technical annex.</p> <p>However, the services for “charging only” within the ISO 15118-20 protocol do not include all necessary parameters to be able to transmit the grid code related information. Ie ISO 15118-20 needs to be ammended to enable the full NC RfG 2.0 compliance for “charging only”.</p> <p>The expert group recommends to inform the relevant committee to start the work on such an ammendment of ISO 15118-20. Moreover, the committees in chagre of the product standards for AC EV (ISO 5474-2), AC EVSE (IEC 61851-1), DC EV (ISO 5474-3 and DC EVSE (IEC 61851-23) should be informed to analyse possible impacts on their standards to work on possible adaptions for the “charging only” use case.</p>	<p>ISO 15118-20 IEC 61851-1; ISO 5474-2 IEC 61851-23; ISO 5474-3</p>

A6 – Responses to the consultation

Respondent	Number of Comments	Technical	Other	Accepted
Bender GmbH	3	3	0	3
BMW	11	3	8	8
Robert Bosch GmbH	8	7	1	1
Compleo	5	4	1	2
EDF	51	26	25	13
EDF RD	27	15	12	9
Respondent 06	12	5	7	4
ACEA - Ford	1	1	0	0
Guiseppe Dell'Olio	13	10	3	6
ACEA - Honda	4	3	1	1
ACEA - Member	4	3	1	2
JM Romero Gordon	5	4	1	3
Renault Group	5	3	2	3
Tesla	3	1	2	0
ACEA - Honda	4	2	2	2
ACEA – Volkswagen Group	47	8	39	22
Respondent 04	7	1	6	5
Total	210	99	111	84

[as at 26/02/2026]

Consolidated comments

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
BMW	4.10		G	Both, the AC V2G EV and the AC V2G EVSE shall limit the harmonic emissions in accordance with the requirements in EN IEC 61000-3-2:2019+A1:2021 and flicker in accordance with the requirements in EN 61000-3-3:2013+A1:2019+A2:2021+AC:2022 independent of the rated power of the AC V2G EV and AC V2G EVSE. <i>Compliance for the AC V2G EV and AC V2G EVSE is checked by a test setup defined in EN 50549-10:2022 clause 5.7.2.2 for harmonic emissions and clause 5.7.2.3.2 for flicker.</i> <ul style="list-style-type: none"> It is not clear that the evaluation is done separately for the EV and the EVSE 	Change to: Both, Individually the AC V2G EV and the AC V2G EVSE shall limit the harmonic emissions in accordance with the requirements in EN IEC 61000-3-2:2019+A1:2021 and flicker in accordance with the requirements in EN 61000-3-3:2013+A1:2019+A2:2021+AC:2022 independent of the rated power of the AC V2G EV and AC V2G EVSE. <i>Compliance for the AC V2G EV and AC V2G EVSE is individually checked by a test setup defined in EN 50549-10:2022 clause 5.7.2.2 for harmonic emissions and clause 5.7.2.3.2 for flicker.</i>	Accepted
BMW	3.2.4	Tabel 13 Active response to frequency deviation (P(f))	G	Verify the ability of the AC V2G EV to follow a P(f) curve communicated by the AC V2G EVSE as defined in clause 4.4 of this technical annex. Ot could be read as if the EVSE shall verify the ability of the EV	Change to Verify according to 4.4 Or Verify the ability of the AC V2G EV to follow a P(f) curve as defined in clause 4.4 of this annex. Verify the ability of communicating a P(f) curve by the V2G EVSE as defined in clause 4.4 of this annex.	Accepted
BMW	3.2.4		G	See to 3.2.4 above. This is also valid for <ul style="list-style-type: none"> Voltage related active power reduction (P(U)) Voltage related control mode (Q(U)) Power related control mode (cos φ (P), Q(P)) Setpoint control modes (Q setpoint, cos φ setpoint)	Change according to 3.2.4.above	Accepted
BMW	2.3.2		E	In this clause 2.3.2 'DC V2G EVSE' shall include components of a DC V2G EVSE which the manufacturer has chosen to be independently certified, and the requirements below interpreted appropriately for the component to be certified.	In this clause 2.3.2 'DC V2G EVSE' shall include components of a DC V2G EVSE which the manufacturer has chosen to be independently certified, and the requirements below interpreted appropriately for the component to be certified.	Not accepted – "in" needed for grammar
BMW	2.3.1		T	Communication protocols: The AC V2G EV system shall operate the same software regarding the bidirectional charging functionalities as that of the certified AC V2G EV system family. Synchronize to DC V2G EVSE and AC V2G EVSE	Change to: The AC V2G EV system shall operate the same software regarding the bidirectional charging grid code compliance functionalities as that of the certified AC V2G EV system family.	Accepted
BMW	2.5		E	EVSE is [3 years after EIF for the NC RfG 2.0	Change to EVSE is [3 years after entering into force for the NC RfG 2.0	Accepted
BMW	Table 2		E	charger (ie limited to NC DC 2.0 support	charger (ie limited to NC DC 2.0 support)	Accepted
BMW	4.7		E	4.7 Verification of applying cos φ (P) / Also in the following text not correct.	4.7 Verification of applying cos φ(P) /	Accepted – we have split the cos φ from the Q function.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
BMW	3.1		E	Accordingly, only EVSE-Based compliance as defined in clause 2.22.2 of this document, applies. Wrong reference.	Accordingly, only EVSE-Based compliance as defined in clause 2.2.2 of this document, applies.	Accepted
BMW	4.8		T	The AC V2G EV shall apply to reactive power setpoints received via digital communication from the AC V2G EVSE. Depending on the required setpoint control mode at the POC the AC V2G EVSE communicates Q setpoint or cos φ setpoint values. In the case of change of the setpoint the settling time for the new setpoint shall be less than one minute. What is the definition of POC	It should be clear that the time starts when the signal has reached the EVSE.	Accepted
BMW	4.4		T	Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the POC and evaluate automatically the received LFSM-O-EV and LFSM-U-EV curves within the AC V2G EV reference test device. What will happen, if the EVSE sends parameter outside the range of the EV?	Add: In case of sending parameters outside the range of the AC V2G EV, the bidirectional charging process shall not start. (or the EV does not offer a certain function, e.g. FrequencyWattType) This is also valid for other functions, where paramters are transferred.	Accepted This text inserted in 3.2.3 (l) In the case where the AC V2G EV receives grid code related parameters outside of its certified ranges, the AC V2G EV shall not start any power output.
ACEA Volkswagen Group	1.2	Second bullet point	E	"falls"	"fall"	Accepted
ACEA Volkswagen Group	1.2	Last paragraph	G	Please mention why V2G WPT is not in scope yet.	Requirements for V2G WPT are under consideration.	Not accepted The charging medium is not discussed in the technical annex, so it is intended to be technology neutral. The workstream has suggested some wording changes to the NC RfG 2.0 to make it technology neutral in this respect too.
ACEA Volkswagen Group	2.1.1	Second bullet point	G	I cannot clearly identify the "core compliance scheme" for DC V2G EVSE and AC V2G EVSE. Clause 3.1 and 4 say that national certification shall be done. Only the function split is described, which could be some kind of "core compliance scheme".	Clarify what this core compliance scheme is about. Otherwise delete it.	Accepted. Now reads For DC V2G EVSE and AC V2G EVSE , this technical annex forms the core compliance scheme defined at EU level. However, each Member State may implement a formal national compliance scheme, incorporating specific grid code requirements applicable within its jurisdiction. These national schemes shall be adopted by all relevant system operators within the respective Member State
ACEA Volkswagen Group	2.1.1	Last paragraph	E	"EV and EVSE schemes"	"EV and EVSE compliance schemes"	Accepted
ACEA Volkswagen Group	2.1.2	Paragraph 2	G	" Relevant system operators have the statutory duty to maintain effective compliance schemes for the EVSE." Contradictory to this, 2.1.1 says: "[...] each Member State may implement a formal national compliance scheme, incorporating specific grid code requirements applicable within its jurisdiction. These national schemes shall be adopted by all relevant system operators within the respective Member State."	Change to "Member states have the statutory duty to maintain effective compliance schemes."	Not accepted. The NC RfG 2.0, as is the case with NC RfG 1.0, places the legal responsibility on the RSO. Member states may choose to harmonize between RSOs, but this is not required in the NC RfG. However it is worth bringing this to the attention of the European Commission for consideration in their final approach to the legal framework.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				So, national schemes shall be adopted by all relevant system operators, but the relevant system operators shall maintain the compliance schemes? This must be also done by the member states.		
ACEA Toyota	2.2			The certification requirements are described in Chapter 2 of Regulation (EC) No 765/2008. To clarify that this is a quotation from the certification requirements section, Chapter 2 will be added.	Certification shall be conducted by authorized certifiers accredited under EN ISO/IEC 17065 and recognized by the national affiliate of the European Cooperation for Accreditation (EA), in accordance with Chapter 2 of Regulation (EC) No 765/2008.	Not accepted. We believe this is not necessary. Authorised certifiers understand their responsibility and the underlying requirement in NC RfG 2.0 does not go beyond citing the Regulation title and reference.
ACEA Volkswagen Group	2.2	Paragraph 3	G	Also mention EN ISO/IEC 17025 for the test laboratories	Add: "Testing shall be conducted by an authorized test laboratory accredited under EN ISO/IEC 17025."	Not accepted This is not necessary. Certifiers know what their legal responsibilities are.
ACEA Volkswagen Group	2.2.1	Paragraph 1	G	"Certificates may be stored in national databases." If it is only may, it can be also deleted. I think the proposed change on the right could make sense:	Change to: "If a national certificate database exists, the certificates shall be stored in the respective national database."	Not accepted This is not possible as different member states have different detailed requirements. The certification of the EV can be EU wide, because compliance with EN 50549-1 ensures that all RSO requirements, apart from interface protection (incl. islanding detection), can be fulfilled by the EV. Interface protection (incl. islanding detection) is required to be in the EVSE, thus allowing local requirements to be implemented.
ACEA Volkswagen Group	2.2.1	Additional	G	The existing system of national or local grid codes and compliance scheme is outdated for all kinds of inverters and does not conform to the intention of the EU. Therefore, also for EVSE, an EU-wide certificate shall be sufficient. Please talk to the EU Commission and use their power to require this from the member states and system operators.	Change clause to: "Where compliance is fulfilled by the AC V2G EVSE, the EVSE manufacturer shall provide an EU-wide equipment certificate in accordance with NC RfG 2.0 Article 42(5). This certificate shall be stored in a designated compliance database."	Not accepted The sentence is permissive, not directive. We do not believe that change is necessary."
ACEA Volkswagen Group	2.2.2	Last paragraph	G	"This certificate shall be stored in a designated compliance database." Who owns the database and which one is it?	Provide more details on the designated compliance database, e.g. "The compliance database is hosted by ACER."	Not accepted . Database will be handle by each local authority and the certification bodies store too this database
ACEA Volkswagen Group	2.2.2	Additional	G	There is a discussion going on to enable a PKI (public key infrastructure) to provide digital certificates to ensure that only certified EVs get a digital certificate, if they are capable of doing AC V2G and are grid code certified. Please add this as some kind of outlook.	Add: "Digital certificates, with which an AC V2G EV can identify its existing equipment certificate to an AC V2G EVSE via digital communication, are under consideration."	Not accepted Having digital certificates installed within the EV is only one part of the story. The main effort is on the infrastructure side to establish a complete digital certification scheme including digital certificate handling/revocation etc. Nothing is defined in this regard and there is absolutely no agreement with the EVSE manufacturers to go in this direction.
ACEA Volkswagen Group	2.3.1	Paragraph electrical performance	T	"Electrical performance: The power conversion stage of the AC V2G EV system shall employ the same topology as that of the certified AC V2G EV system...and shall have a power range of between ±50% of the rated power (Pn) of the certified AC V2G EV system" To ensure cost savings for manufacturers and to stick to other grid codes, which allow +/- 100% and more, we propose to change it to +/- 100%. This would enable to certify an 11kW OBC and use the certificate for a 22kW OBC.	Change 50% to 100%.	Not accepted. The EG decided to limit the range to 50%. The EG noted that the most common/likely ratings of AC Evs are 32A and 16A. A 32A EV/EVSE certificate would then be viable for 16A.
ACEA Volkswagen Group	2.3.1			"The control algorithm software for grid code compliance implemented in the AC V2G EV system shall be the same as that of the certified AC V2G EV system family." The	"The control algorithm software for grid code compliance (reacting on parameter settings received from an AC V2G EVSE) implemented in the AC V2G EV system shall	Partially accepted. This clause has been subject to a lot of discussion and the final wording chosen to be an appropriate balance

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				control algorithm highly depends on the parameter input of the EVSE, this should be reflected.	be the same as that of the certified AC V2G EV system family."	between the rights and obligations of manufacturers and certifiers.
ACEA Volkswagen Group	2.3.2 & 2.3.3	Whole clauses	G	While 2.3.1 describes both the 'AC V2G EV System' and the 'AC V2G EV System Family', chapter 2.3.2 and 2.3.3 only describe the families. I am wondering whether some description of a single DC V2G EVSE and AC V2G EVSE is missing?	Add descriptions if necessary.	Not accepted Different to the AC V2G EVSE and DC V2G EVSE for the EV only a specific part which we call the "AC V2G EV System" is considered as relevant for the certification. Therefore this is handled different to the EVSE cases. A single EVSE is a family with one member.
ACEA Volkswagen Group	2.4	Paragraph 1	G	It might make sense to also mention the newly introduced 'AC V2G EV System Family', otherwise the introduction of the definition before is useless.	Change to: "Certified AC V2G EV Systems may be integrated into other vehicle models, forming an AC V2G EV System Family, provided the integration does not alter the certified characteristics."	Accepted
ACEA Member	2.4	Paragraph 1	G	Clarification is required regarding the definition of the certification test object to determine whether it applies to the system or the vehicle.	To enhance clarity, a note should be added specifying that AC V2G EV system certification tests are valid in both the HILs environment (per EN 50549-10:2022, 4.2.11) and on the whole vehicle.	Not accepted The tech annex directs consideration of the assessment methods of EN 50549-10 will be used and HIL is one of them.
ACEA Toyota	2.5			The validity of vehicle certification should comply with the provisions of the WVTA and should not be addressed in this Annex.	Certificates of EVSE remain valid unless the relevant component is modified. Upon changes to the compliance scheme, an assessment shall determine whether re-certification is required. The outcome shall be publicly communicated, regardless of whether existing certifications remain valid or require renewal.	Not accepted. We accept the point, but this will be subsumed in the European Commission's implementation of certification within EVSE.
ACEA Volkswagen Group	2.5	Paragraph 1	G/E	"The requirements of NC RfG 2.0 shall not apply to: • EVs registered prior to the compliance date. • EVSE installed prior to the compliance date." Rephrase to a positive sentence. Reason: EV and EVSE should be allowed to apply the NC RfG 2.0 requirements earlier.	Change to: "The requirements of NC RfG 2.0 shall apply to: • EVs registered after the compliance date. • EVSE installed after the compliance date."	Not accepted The given formulation mirrors that in the NC RfG 2.0 Art 3.
ACEA Volkswagen Group	2.5	Last paragraph	G	"Upon changes to the compliance scheme, an assessment shall determine whether re-certification is required. The outcome shall be publicly communicated, regardless of whether existing certifications remain valid or require renewal." Who will do this assessment? And who has to publicly communicate the outcome where? Do manufacturers have to do the assessment for their products and then publish their assessment outcome on their website? This would be quite unusual. So probably it is a general assessment by the ESC GC?	Change to: "Certificates remain valid unless the relevant component is modified. Upon changes to the compliance scheme, an assessment by the ESC GC shall determine whether re-certification is required. The outcome shall be publicly communicated by the ESC GC , regardless of whether existing certifications remain valid or require renewal."	Accepted
ACEA Volkswagen Group	2.6	Above table	E	"These requirements are summarised in table 1 below"	Change to: "These requirements are summarised in Table 1 below"	Accepted
ACEA Volkswagen Group	2.6	Last paragraph	G	"Locally" is no legally defined term. Propose to adapt it to "nationally"	Change to: "Connection approval for new V2G EVSEs requires compliance with the grid code in force nationally at the time of installation"	Accepted - changed to RSO.
ACEA Volkswagen Group	3.1	Second paragraph	E	"Accordingly, only EVSE-Based compliance as defined in clause 2.22.2 of this document, applies." Correcting the reference and further minor corrections recommended.	Change to: "Accordingly, only EVSE-based compliance as defined in clause 2.2.1 of this document applies."	Accepted

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
ACEA Volkswagen Group	3.2.2	First paragraph	G	"After the standards are updated, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex." Some transition time for manufacturers is needed and not only EVs need to be updated, but EVSE as well. First of all, the Technical Annex will need to be updated.	"After the standards are updated, this Technical Annex shall be revised to enable and require interoperable AC V2G EVs and AC V2G EVSE to support all functions required by NC RfG 2.0 and this Technical Annex."	"Not accepted. The necessity for updating the technical Annex needs to be managed by the ESC / European Commission. This is not a process related question that is not be answered in this subclause."
ACEA Volkswagen Group	3.2.2	Table 2	E	"< 60s", "< 1s". It should be less or equal to.	<= 60s, <= 1s	Accepted
ACEA Volkswagen Group	3.2.2	Table 2	E/G	"V1G capable EV means EV equipped with a unidirectional on-board charger (ie limited to NC DC 2.0 support" Instead of unidirectional on-board charger, better say unidirectional charging system. An OBC enabling V2L only is also bidirectional.	"V1G capable EV means EV equipped with a unidirectional charging system (ie limited to NC DC 2.0 support)"	Not accepted No benefit in changing to charging system. We explicitly point to the inverter / OBC capabilities.
ACEA Volkswagen Group	3.2.3	General	G	If possible, to enable real interoperability, the "digital communication" must be defined with the exact standard and service: EN ISO 15118-20:2022+A1:2026 (under development) service AC DER IEC.	Add: "Digital communication: The digital communication between the AC V2G EVSE and the AC V2G EV shall include the service "AC DER IEC" of EN ISO 15118-20:2022+A1:2026 (under development)."	Not accepted European Commission (EC) asked the expert group to avoid to reference standards in regulatory text at the beginning, but may revise this. The Expert Group still decided to reference standards like EN 50549-10, which are relevant for testing. Product requirement standards were left out at the beginning, but could be included following consideration by DG ENER.
ACEA Volkswagen Group	3.2.3	Last bullet point	G	"Generator which is able to provide grid support functions" Since NC RfG 2.0 covers bidirectional charging (discharging and charging), a generator will be not enough, but a load will also be needed. So, I propose a storage instead of a generator.	"Electricity storage that is able to provide grid support functions"	Note accepted - storage is classed as a type of generation within the NC RfG 2.0
ACEA Honda	3.2.3	NOTE 3	Ed	between AC V2GAC V2G EV and AC V2GAC V2G EVSE works properly.	Correction as follows: between AC V2G EV and AC V2G EVSE works properly.	Accepted
ACEA Volkswagen Group	3.2.3	Note 3	E	"NOTE 3: By using this test procedure it is ensured that the digital communication between AC V2GAC V2G EV and AC V2GAC V2G EVSE works properly. A complete certification of the digital communication is therefore not required." Editorial changes necessary.	"NOTE 3: By using this test procedure it is ensured that the digital communication between AC V2G EV and AC V2G EVSE works properly. A complete certification of the digital communication is therefore not required."	Accepted
ACEA Volkswagen Group	3.2.3	Note 4	G	Smax is only mentioned in the note. Please add the official definition to the main text (out of the note).	Add: "Smax = Pmax (3)"	Accepted
ACEA - Ford	3.2.3	Paragraph 3 (last one)		If an EV is connected to an EVSE with a very low maximum power, the percentual accuracy requirements translate into very low absolute values, which can become infeasible to meet.	Limit control accuracy to a power range, like in IEEE 1547-2018 Section 4.4	"Not accepted The EV manufacturer needs to define the power range like it is done by each other PV, Battery Storage, ... manufacturer that is affected by the NC RfG 2.0"
ACEA Volkswagen Group	3.2.3	Additional	G	The reference test devices are just barely described. Different test institutes could have different implementations, which makes it difficult for manufacturers to prepare the technology for the compliance tests. The reference test devices must be standardized.	Add (also similarly to clause 3.1 for DC): "The European Commission shall mandate CENELEC to standardise the Reference AC V2G EV test device and AC V2G EVSE test device"	Not accepted Accredited certification bodies will handle this topic. Asking for a standardization mandate is not necessary at this very early stage of the technology. Moreover this is not a topic to be solved within the technical annex.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
ACEA Volkswagen Group	3.2.3	Additional	G	For the compliance tests, it is not clear, which EVSE to consider and thus which Pmax/Smax and MCC to consider. Is this up to the manufacturer? This would lead in the limitation of interoperability. There should be at least a sentence added, how manufacturers can face this issue practically. Reason: The Pmax has a significant impact on accuracy requirements, so it is important to know for the development of an AC V2G EV, which Pmax values to consider.	"If compliance is shown for a single-phase 16A EVSE, three-phase 16A EVSE, and according to its own Pmax_EV, the AC V2G EV is assumed to be interoperable and compliant in the whole EU."	Not accepted The EV manufacturer needs to define the power range like it is done by each other PV, Battery Storage, ... manufacturer that is affected by the NC RfG 2.0
ACEA Volkswagen Group	3.2.4	First paragraph	E	"For each function the certification relevant details are shown in clause 5."	"[...] clause 4"	Accepted
ACEA Volkswagen Group	3.2.4	Last paragraph	E	"Note that LFSM requirements in 4.4 explicitly cover both export and import cases, but other tests described for export need also to be demonstrated for import."	Use power "output" and "consumption" instead of export/inject and import, as these words are used in the main text.	Accepted
ACEA Volkswagen Group	3.2.4	Table	E	"Table 13: AC V2GAC V2G EV and AC V2GAC V2G EVSE function split and certification module overview" Table number is wrong and typos.	"Table 3: AC V2G EV and AC V2G EVSE function split and certification module overview"	Accepted
ACEA Volkswagen Group	3.2.4	Table 13	T	"Means to detect islanding situation (loss of supply network)" We are aware that this is a function of the interface protection and is assigned to the EVSE as in IEC 61851-1 ED4 CDV. But from a technical point of view, we would like to note that an active island detection method usually needs the inverter, which is located in the EV. So, technically, it could make more sense to allocate this function to the EV.	Review this at latest for the revision of the Technical Annex.	Note accepted. The technical annex is following the approach required in some member states and in the emerging international standards.
ACEA Volkswagen Group	3.2.4	Table 13	E/G	"Starting to generate electrical power" It is also relevant for the V1G mode. But in a V1G mode, you cannot talk about "generate", so the wording needs to be extended. Also to be reflected in clause 4 respectively.	"Starting to generate or consume electrical power"	Not accepted The group agreed to solve the question about the needed clarification by the given combination of 1st paragraph of 3.2.4 + table 3. The wording is in line with EN 50549-1.
ACEA Volkswagen Group	4	Additional	G	For most cases, when Pmax is mentioned in clause 4, also MCC would need to be mentioned, because the bidirectional V2G mode also contains charging. The statement at the end of 3.2.4 is not sufficient.	Add requirements for the unidirectional charging case (V1G mode / consume only) to each subclause of clause 4, where necessary.	Not accepted It was decided on purpose to clarify this by the combination of 3.2.4 (1st paragraph) + table 3 in which you can find the overview of functions required for unidirectional charging.
ACEA Volkswagen Group	4	Overall	G	Double-check aligned requirements with ENTSO-E.	Double-check aligned requirements with ENTSO-E.	
ACEA Volkswagen Group	4	Overall	G	There are some text passages and graphs copied from EN 50549-1. Is this allowed? Do you have to quote?	Double-check legal appropriateness for copied texts and graphs.	Partially accepted – this remains an open question with the Commission. The Commission informally supports the approach taken so far, but is reserving the right to review this aspect.
ACEA Volkswagen Group	4	Overall	E	Align the wording of the reference test devices, there are different orders of words used.	E.g. align to "Reference AC V2G EV Test Device"	Accepted
ACEA Honda	4.1		Te	The reference standard has not been selected according to the rated current. Both, the AC V2G EV and the AC V2G EVSE shall limit the harmonic emissions in accordance with the requirements in EN IEC 61000-3-2:2019+A1:2021 and	Change to follows: Both the AC V2G EV and the AC V2G EVSE shall limit harmonic emissions and flicker in accordance with the applicable standards:	Not accepted This is done on purpose to prevent a Short-Circuit-Ratio dependency. This is in line with the approach taken in IEC 61851-series.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				flicker in accordance with the requirements in EN 61000-3-3:2013+A1:2019+A2:2021+AC:2022 independent of the rated power of the AC V2G EV and AC V2G EVSE.	- for equipment with a rated current up to and including 16 A per phase, harmonic emissions shall comply with EN IEC 61000 3 2:2019+A1:2021 and flicker shall comply with EN 61000 3 3:2013+A1:2019+A2:2021+AC:2022; - for equipment with a rated current exceeding 16 A and up to 75 A per phase, harmonic emissions shall comply with EN 61000 3 12 and flicker shall comply with EN 61000 3 11.	
ACEA Honda	4.2		Ed,Te	The frequency range is unbalanced and inconsistent with the contents described later in this document. Voltage range: $0.9 \text{ pu} \leq U \leq 1.1 \text{ pu}$; Frequency range: $49.8 \text{ Hz} \leq f \leq 50.1 \text{ Hz}$; Minimum observation time: 5 s. Voltage range: $0.9 \text{ pu} \leq U \leq 1.1 \text{ pu}$; Frequency range: $49.8 \text{ Hz} \leq f \leq 50.1 \text{ Hz}$; Minimum observation time: 60 s. To confirm whether "50.1 Hz" is a typo. If it is intentional, let me know the rationale behind it.	Change to follows: Frequency range: $49.8 \text{ Hz} \leq f \leq 50.2 \text{ Hz}$;	Not accepted This requirement is derived from Article 13a of the ACER draft 2023-12.
ACEA Volkswagen Group	4.2	Overall	G	An automatic reconnection after tripping has not yet been defined. See IEC 61851-1, Ed. 4.; 23rd IEC/TC69/WG12 Meeting, 15.01.2026	Include reference or remark about a potential standard/procedure for automatic reconnection.	Not accepted IEC 61851-1 ED4 will define the automatic reconnection after tripping. The IEC 61851-1 ED4 will be 100% aligned with EN 50549 and the technical annex which is ensured by experts working in both working groups.
ACEA Volkswagen Group	4.4	LFSM-U-EV 6 and LFSM-O-EV 7	T	"The response time, T_{resp} in Figure (9) YY2c, shall be less or equal to 0,5 s for an active power setpoint change of 30% of P_{ref} with an accuracy of 10% of P_{max} ;" "The response time, T_{resp} in Figure (9) YY2c, shall be less or equal to 0.5 s for an active power setpoint change of 30% of P_{ref} with an accuracy of 10% of P_{max} ." Upon request by ENTSO-E, this needs to be revised again.	"The response time, T_{resp} in Figure (9) YY2c, shall be as fast as technically feasible, less or equal to 0.5 seconds for an active power setpoint change of 30% of P_{ref} , , less or equal to 1 second for an active power setpoint change of 60% of P_{ref} , and less or equal to 1.5 seconds for an active power setpoint change of 90% of P_{ref} , with an accuracy of 10% of P_{max} ."	Awaiting final agreement with ENTSO-e
ACEA Volkswagen Group	4.4	Additional	T	Does the frequency have to be measured on every single phase and power to be adopted on every single phase individually? Or is it sufficient to measure the frequency of one phase and take this as the reference to change the power on all phases symmetrically?	Add: "The AC V2G EV shall measure the network frequency on one phase and adopt the active power on all phases symmetrically."	Not accepted No need to define this because frequency on all phases is the same.
ACEA Volkswagen Group	4.4	Additional	T	As requested by ENTSO-E, add the requirement for the frequency resolution from EN 50549-1.	Add: "The resolution of the frequency measurement shall be $\pm 10 \text{ mHz}$ or less."	Accepted, but this is better placed in 3.2.3 (j) Measurements of all relevant quantities, ie current, voltage, power etc, shall be RMS values measured over ten cycles, unless indicated otherwise in each module. Measurement of frequency shall be with a resolution of 10mHz. Active power measurement shall be evaluated as 1 minute averages.
ACEA Volkswagen Group	4.4	Fig YY2a and others	E	Why is the Power rated in MW? Kilowatts are more appropriate for AC V2G.	Change rating to kW	Accepted

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ACEA Member	4.4	Paragraph 1	T	<ul style="list-style-type: none"> The accuracy requirement for determining Tresp is currently defined as 10% of Pmax. However, Pmax and MCC can differ. (1) If Pmax >> MCC: For the active power response P(f) during charging, the target step response might already fall within the 10% Pmax tolerance band. This renders the Tresp measurement meaningless or erroneously resulting in 0 seconds. (2) If Pmax << MCC: The measured Tresp could be disproportionately long compared to the actual system. 	<ul style="list-style-type: none"> It is proposed to apply different reference values based on the operation mode for determining Tresp: <ul style="list-style-type: none"> - Charging: Use 10% of MCC - Discharging: Use 10% of Pmax 	Not accepted. It is well understood by manufacturers of storage and by authorised certifiers that the consumption requirements of storage should be tested using the same requirements in EN 50549-1 and EN 50549-10, without all the consumption requirements being laid out separately from the production requirements.
ACEA Member	4.4	Figure (9) YY2c	T	<ul style="list-style-type: none"> There is a discrepancy in the definition of Tresp measurement start point compared to EN 50549-10:2022. <ul style="list-style-type: none"> - EN 50549-10:2022 Figure 12: Tresp is measured after the dead time ends. - This draft Figure YY2c: The dead time(Tid) is included within the Tresp duration. This inconsistency creates confusion in compliance testing contradicts the established testing methodology in EN 50549-10. 	<ul style="list-style-type: none"> It is proposed to replace the graph in Figure (9) YY2c with Figure 12 of EN 50549-10:2022 (or align the definition) to ensure harmonization with the compliance verification standard. Specifically, Tresp should be defined to start after the intentional delay or dead time. 	Accepted - figure (9) YY2c has been amended to align and Tresp does not now include the dead time.
ACEA Toyota	4.6			Based on the description in EN50549-1, which forms the basis of this requirement, it is assumed to be a typographical error.	The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid depending on the current voltage at the input terminals of the AC V2G EVSE (Q = f(U)).	Accepted with change "The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the current and voltage measured by the AC V2G EV"
ACEA Volkswagen Group	4.6	Paragraph 1	T	<p>"The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid depending on the current voltage at the input terminals of the AC V2G EVSE (Q = f(U))."</p> <p>I assume that the voltage measurement has to be done by the EV. So, either change it to the input terminals of the AC V2G EV, or add a sentence to clarify that the voltage measurement must be done by the EV.</p>	Add: "The voltage measurement shall be conducted by the AC V2G EV".	Accepted with change "The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the current and voltage measured by the AC V2G EV"
ACEA Volkswagen Group	4.6	Below graph	G	"Two methods to limit the reactive power at low active power by: a minimum cos φ configurable in the range of 0-0,95;" The text after the colon is copied for EN 50549-1. The introducing text before the colon might not be correct or descriptive enough. Although it is copied from EN 50549-1, it can be described better so that EV manufacturers can understand what to do. Furthermore: An automotive onboard charger might be able to operate within a range of 0,95 to 1 for inductive and 0,95 to 1,00 for capacitive scenarios. Is this a contradiction?	Change to: "The AC V2G EV shall support two methods to activate the Q(U) function: it receives a minimum cos φ (configurable in the range of 0-0,95) by the EVSE and the current cos φ is above this value;"	Accepted. The following clause has been added to 3.2.3 There is no requirement for an AC V2G EV to be able to operate outside a power factor range of 0.90 underexcited to 0.90 overexcited.
ACEA Volkswagen Group	4.7	Title and second paragraph and further paragraphs	G	"Verification of applying cos φ (P) / Q(P) curve by an AC V2G EV and AC V2G EVSE" [...] "A cos φ (P) / Q(P) function with a characteristic with a minimum and maximum value of cos φ / Q(P) and three connected lines according to Figure CC shall be configurable within the AC V2G EVSE and shall be transmitted to the AC V2G EV by digital communication." Please avoid slashes "/". It is not clear whether it means "and", "or" or "divided by" and certainly is not applicable for legal texts.	Replace "/" with "and"	Accepted. The requirements have been split into two subclauses

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ACEA Toyota	4.9.1			Based on the description in EN50549-1, which forms the basis of this requirement, it is assumed to be a typographical error.	The highest lowest phase to neutral voltage or if no neutral is present the highest lowest phase to phasevoltage shall be evaluated by the AC V2G EV and AC V2G EVSE.	Accepted
ACEA Member	4.11	Paragraph 1	T	<ul style="list-style-type: none"> The current definition of In as min(In_EV, In_EVSE) makes the compliance criteria dependent on the external EVSE, which is unknown during the EV design. Since the EV manufacturer cannot predict the In_EVSE, they are forced to design the EV to meet the strictest limit (20mA) to ensure compliance in all scenarios. This renders the proportional limit (0.5%) ineffective for the EV itself. 	<ul style="list-style-type: none"> It is proposed to define In as In_EV for the requirements applicable to the EV 	<p>Not accepted</p> <p>No need to state this because it is in the hands of the EV manufacturer to define the power range in which the EV supports RfG 2.0 + technical annex requirements</p> <p>The EV manufacturer needs to define the power range like it is done by each other PV, Battery Storage, ... manufacturer that is affected by the NC RfG 2.</p>
ACEA Volkswagen Group	4.11	Paragraph 2 and 3	G	<p>“The applicable DC injection limit of the POC is communicated by the AC V2G EVSE via digital communication.</p> <p>Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the POC and evaluate automatically the received limit within the AC V2G EV reference test device.”</p> <p>This functionality and test is not necessary, because the capability of the EV is verified in EU-wide compliance tests.</p>	Delete sentences and remove EVSE from clause	Accepted
ACEA Volkswagen Group	4.12.2.2	Second paragraph	T	<p>“At voltage re-entry into the voltage range, 90% of pre-fault active power or available power, whichever is the smallest, shall be resumed as fast as possible with a linear or first order filter response behaviour, as communicated by the AC V2G EVSE.”</p> <p>With ENTSO-E, another text is aligned.</p>	<p>“At voltage re-entry into the voltage range, the pre-fault active power, or, if post fault network voltage is less than 1.0pu and active power production is constrained by the maximum current rating of the AC V2G EV or AC V2G EVSE, the active power output shall be reduced below its pre fault value in proportion to the post fault to pre fault network voltage.”</p>	<p>Not accepted</p> <p>The actual text already says "or available power" - which would include power being limited by current saturation.</p>
Robert Bosch GmbH	2.2.2	EV-Based Compliance	T	In 2.2.1 EVSE-Based Compliance the database for certificates is optional “may”. Why is it mandatory for EV-Based Compliance (“shall”-requirement)? Who is responsible/accountable for the database?	Delete sentence “This certificate shall be stored in a designated compliance database.” or change it to “This certificate may be stored in a designated compliance database.”	<p>Not accepted.</p> <p>The sentence is permissive, not directive. We do not believe that change is necessary.</p>
Robert Bosch GmbH	2.3.1	AC V2G EV System Family' -- Electrical performance	T	<p>“including identical converter stage layout and filter placement” is too restrictive and could be read as “same PCB-Layout”.</p> <p>VDE-AR-N 4110/4105 requires “the design and the control technology relevant to the electrical properties, including the software used, are technically equivalent in these generating units”</p>	<p>Electrical performance:</p> <p>The power conversion stage and filter circuitry of the AC V2G EV system shall be technically equivalent in design and control technology in regards to the electrical properties, and shall have a power range of between 1/(square-root of 10) times and 2 times of the rated power (Pn) of the certified AC V2G EV system.</p>	<p>Accepted. The wording here has changed, but the 50% remains.</p> <p>The EG noted that the most common/likely ratings of AC Evs are 32A and 16A. A 32A EV/EVSE certificate would then be viable for 16A.</p>
Robert Bosch GmbH	2.3.1	AC V2G EV System Family' -- Electrical performance	T	<p>“and shall have a power range of between ±50% of the rated power (Pn) of the certified AC V2G EV system” restricts family to 11 / 22 kW OBCs; 7.2 or 3.6 kW chargers can not participate of family certificate, even if they are technically part of the family.</p> <p>VDE-AR-N 4110 allow family-certificate in wider range if either smallest and biggest specimen of family is measured or transfer certificate for a power range</p>	<p>Electrical performance:</p> <p>The power conversion stage and filter circuitry of the AC V2G EV system shall be technically equivalent in design and control technology in regards to the electrical properties, and shall have a power range of between 1/(square-root of 10) times and 2 times of the rated power (Pn) of the certified AC V2G EV system.</p>	<p>Accepted. The wording here has changed, but the 50% remains.</p> <p>The EG noted that the most common/likely ratings of AC Evs are 32A and 16A. A 32A EV/EVSE certificate would then be viable for 16A.</p>

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				between 1/(square-root of 10) -fold and square-root of 10-fold (for Type I plants) or between 1/(square-root of 10) times and 2 times (for Type II plants)		
Robert Bosch GmbH	2.3.1	AC V2G EV System Family' -- Electrical performance	T	Communication protocols: formulation too restrictive; hinders technical deployment scenarios. Meaning of "bidirectional charging functionalities" go beyond the to-be-certified functionalities	Communication protocols: The AC V2G EV system shall operate a software that is in terms of charging communication for bidirectional charging functionally equivalent to the one used in the certified AC V2G EV system family.	Partially accepted. The Expert Group has modified this text to be an appropriate balance between the rights and obligations of manufacturers and authorised certifiers.
Robert Bosch GmbH	2.3.1	AC V2G EV System Family' -- Electrical performance	T	Control Algorithm: formulation too restrictive; hinders technical deployment scenarios.	Control Algorithm: The control algorithm software for grid code compliance implemented in the AC V2G EV system shall be technically equivalent the same as that of the certified AC V2G EV system family.	Partially accepted. The Expert Group has modified this text to be an appropriate balance between the rights and obligations of manufacturers and authorised certifiers.
Robert Bosch GmbH	2.3.1	DC V2G EVSE family -- Electrical performance	T	AC EV argumentation should also apply to DC V2G EVSE family		Not accepted. It is not clear why the AC EV argumentation would replace the argumentation already elaborated for DC EVSE in 2.3.2.
Robert Bosch GmbH	3.2.3	Common rules for individual certification	T	Via digital communication the relevant grid codes shall be exchanged between EVSE and EV. If the EV cannot meet the applicable grid codes (e.g. low DC feed at very power-limited EVSE (6-8 A) of a high-power charger (48A)), the EV should not continue to request RPT service at the EVSE. Therefore, the EV should only be tested within its possibilities (according to the technical documentation of DUT), and if these limited values are met, pass the test, as long as the answer to stricter parameters is negative or is answered with the selection of an FPT service.	Add after "This reference AC V2G EVSE test device shall transmit all relevant parameters via digital communication." (eventually as a Note): If the EV cannot meet the applicable grid codes, the EV should not continue to request RPT service at the EVSE. The EV should only be tested within its possibilities (according to the technical documentation of DUT), and if these limited values are met, the test shall be rated as passed, as long as the answer to stricter parameters is negative or is answered with the selection of a FPT service.	Not accepted No need to state this because it is in the hands of the EV manufacturer to define the power range in which the EV supports RfG 2.0 + technical annex requirements
Robert Bosch GmbH		Table 1		Think about enabling xxA/phase in combination (New and existing V1G EVSE or ICCPD) and New V2G EV with vehicle user instruction and explicit consent for each V2G cycle. Instructions would need to explain the requirements to low voltage network topologies, influence on parallel wall sockets, load shedding mechanisms (which would not work adequately in case of V2G) and would be needed to be confirmed by user before starting V2G. Could be useful for home V2G with legacy V1G EVSE. User would need to fill in regional parameters manually, conservative default values. Alternatively control by OEM cloud or Home integration, supported by identification transponder-tag @EVSE for smartphone combined with location service...?		Not accepted. These electrical safety issues are under the responsibility of other EU regulations
Resp_04	General		G	Will there be a legend with the definition of the different acronyms (i.e LFSM-O-EV, LFSM-U-EV)?		Not accepting. Wording is taken from the main text (ACER recommendation for NC RfG 2.0), where they are defined.
Resp_04	2.5		T	What does imply that 'The outcome shall be publicly communicated, regardless of whether existing certifications remain valid or require renewal.'? Where does will need to be communicated?	Definition of protocols to 'public communicate' information needed.	Partially accepted - responsibility (pro tem depending views of the Commission) added in 2.5

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Resp_04	2.6	Table 1	E	Rephrase this sentence for better wording: In these cases the relevant manufacturer will have had to have made specific compliance requirements, in addition to NC RfG 2.0 certification requirements, for the local grid code compatibility for that specific EV/EVSE combination.	For: In these cases, the relevant manufacturer will have had to have made must have met specific compliance requirements, in addition to NC RfG 2.0 certification requirements, for the local grid code compatibility for that specific EV/EVSE combination.	Accepted, although the wording has been overtaken by another amendment.
Resp_04	3.1		E	There is an error in the following sentence: Accordingly, only EVSE-Based compliance as defined in clause 2.22.2 of this document, applies.	Update the sentence with correct reference: Accordingly, only EVSE-Based compliance as defined in clause 2.22.2 2.2.1 of this document, applies.	Accepted
Resp_04	3.2.4	Table 13	E	There is an error in the numbering of the table. It should be Table 3 instead of Table 13.	Update reference to Table 3.	Accepted
Resp_04	4.6		E	Compliance test should be in Italic letters.	Update it: <i>Compliance for the AC V2G EVSE is checked by setting the applicable parameters at the POC and evaluate automatically the received Q(U)-curve and additional configurations within the AC V2G EV reference test device. Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.5.2.4 adding an AC V2G EVSE reference test device that can provide the Q(U) curve.</i>	Accepted
Resp_04	4.9.2		E	Add Italic letters for the compliance test for AV V2G EVSE even though it is specific for each country.	<i>For the capability of remaining connected to the network and to continue to operate stable country specific certification applies for the AC V2G EVSE.</i>	Accepted
EDF RD	2.3.2 & 2.3.3		Te	<p>§ 2.3.2 states that “A DC V2G EVSE is considered part of an DC V2G EVSE family if the following conditions are met:</p> <ul style="list-style-type: none"> - Electrical Performance: The hardware of the DC V2G EVSE shall employ the same topology, including identical converter stage layout and filter placement, and shall have a Pn between ±50%Pn of the certified DC V2G EVSE. - ... - Control Algorithm: The control algorithm software for grid code compliance implemented in the DC V2G EVSE shall be the same, as that of the certified DC V2G EVSE. <p>1 ”</p> <p>§ 2.3.3 states that “An AC V2G EVSE is considered part of an AC V2G EVSE family if the following conditions are met:</p> <ul style="list-style-type: none"> - Functional Equivalence: The AC V2G EVSE exhibits equivalent or comparable performance in terms of grid interface capabilities, including switching behaviour, protection coordination, and fault response, as the certified AC V2G EVSE certified and shall have a Pn of between ±50%Pn of the certified AC V2G EVSE. - ... - Control Logic: The control logic implemented in the EVSE demonstrates equivalent behaviour in terms of timing, response characteristics, and interaction with the AC V2G EV and grid operator, as those of the certified AC V2G EVSE. 	Homogenize the requirements, especially including the functional equivalence of the AC EVSE related with grid interface, to the DC EVSE	<p>"Not accepted.</p> <p>The requirements to be certified for DC and AC EVSE are quite different - the wording has been chosen deliberately to accommodate these differences."</p>

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				2 " Why are the requirements different for DC and AC V2G EVSE as the functional/electrical performance should be the same measured from the grid whether the EVSE is AC or DC ?		
EDF RD	2.6	Table 1	Te	For the boxes " Existing V2G EV \ New V2G EVSE ", "Existing V2G EVSE \ New V2G EV ", it is written "No NC 2.0 requirements* " whereas in the text above NC 2.0 requirements are required for respectively AC V2G EVSE is RFG 2.0 and AC V2G EV.	Correct the table for the boxes mentioned in the comments. Check for other potential inconsistencies in Table 1	Partially accepted. The last two bullets in the text above the table are exceptions that can be allowed - we will add the word "exceptionally" to both.
EDF RD	2.6	Table 2	Ed	V1G is not defined and is in general not appropriate. V2G means Vehicle To Grid, V1G does not refer to a proper acronym. The comment applies to the whole document, especially Table2	Change V1G by FPT-only-EV (Forward Power Transfer) or another appropriate acronym in line with the future IEC 61851-1 ed4	Not accepted V1G is not under the scope of the Rfg2.0 and V1G is defined in NC DC 2.0
EDF RD	3.1		Ed	Where is the "clause 2.22.2" in the document ?	Clarify / correct	Accepted
EDF RD	3.2.2		Ed	What does "C" mean in "LFSM-UC" ?	Clarify	Not accepted. It designates "consumption" see NC RfG DC Recommendation: Annex 2 – Amended DC Regulation, Article 2
EDF RD	3.2.2		Te	Is the sentence "After the standards are updated, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex." not in contradiction with the function split explained later in the document ?	Clarify	Partially accepted. There is no contradiction. The table only clarifies that if a customer only wants to charge with a V2G capable EV, not all functions (required by Rfg 2.0 + technical annex) can be enabled today due to the lack of digital communication standard for charging. The wording in 3.2.2 has been amended in the light of this and other comments.
EDF RD	3.2.3		Te	What is meant by the generator? An AC EVSE is only a "switching device", so it means that the AC mains emulation is outside the EVSE, and also the RLC device for islanding detection test. Also it's not clear what is meant by "able to provide grid support functions" as these will be done by the EVSE+EVSE system.	Distinguish the reference AC EVSE, the mains emulation and the IEC62116 circuit. It could be a reference test setup.	Not accepted. Mains emulation is not mentioned at all, because this topic is already handled in the basic test setup defined in EN 50549-10. Also the interface protection (IEC 62116) has to be in the EVSE.
EDF RD	3.2.3		Te	What is the Maximum Consumption Capacity and what is the link with the certification process ?	Clarify in this clause even if described in 4.4	Partially accepted Clarification is given in 3.2.4. ie how power consumption and power production is handled.
EDF RD	3.2.4		Ed	Table 13 is not correct	Write: Table 3	Accepted
EDF RD	3.2.4	Table 3	Te	Line : "Means to detect islanding situation (loss of supply network)" The anti-islanding detection should be possible also by the EV, not solely by the EVSE, as it is state of the art for PV inverters to fulfill IEC 62116 with active algorithm in the power electronic part, i.e. the EV in AC V2G	Put a X in the column "Bidirectional charging (V2G mode / consume and inject)"	Not accepted For interoperability a clear function split is needed which is completely in line with the function split defined in IEC 61851-1 ED4 and ISO 5474-2 AMD1 which are foreseen to be published end of 2026. Various arguments have been evaluated with a clear preference to put the RSO specific protection requirement on EVSE side.
EDF RD	4.1		Te	Note 2 is not appropriate as the EV is the "best player" to implement an anti-islanding algorithm and can fulfill the safety requirement not to sustain an unintentional island by switching off	Remove the note 2	"Not accepted For interoperability a clear function split is needed which is completely in line with the function split defined in IEC 61851-1 ED4 and ISO 5474-2 AMD1 which are foreseen

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
						to be published end of 2026. Various arguments have been evaluated with a clear preference to put the RSO specific protection requirement on EVSE side."
EDF RD	4.2		Te	<p>§ 5.10 of EN50549-10 refers to the test of the active power reduction to a new setpoint.</p> <p>It first tests the accuracy of the regulation with a 1 minute observation time of the active power reached (§ 5.10.3.2) and then the dynamic of the active power adjustment (§ 5.10.3.3).</p> <p>The test of the dynamic of the active power adjustment requires its gradient to be within a [0,33 Pn/s – 0,66 Pn/s] range to pass the test. A 0,5 Pn/s value is actually the target.</p> <p>Whereas in §4.2 of the "EV/EVSE Technical annex", the range of the gradient can be chosen between 6% and 3000% Pmax/min this is 0,001 to 0,5 Pmax/s, a much broader range than the one allowed in EN50549-10 §5.10.</p> <p>So the strict application of EN50549-10 §5.10 does not allow the test of the range of power gradient authorized by §4.2 of the "EV/EVSE Technical annex"</p>	<p>Modify the text as follows (see bold characters) :</p> <p>"Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.10 with an adaptation of the gradient tolerance in § 5.10.3.3, and by adding an AC V2G EVSE reference test device that can provide the power ramp over time. The gradient tolerance allowed is adapted as follows: for any given gradient, the target active power should be reached within a [-5% Pn, +5% Pn] tolerance and within a [-1 s ; +1 s] time tolerance defined for a 100% Pn active power variation "</p>	<p>Not accepted</p> <p>Clause 4.2 deals with ""starting to generate electrical power"" (as defined in EN 50549-1, clause 4.10.3) and ""automatic reconnection after tripping"" (as defined in EN 50549-1, clause 4.10.2) considering the special re-connection conditions defined in Article 13a of the ACER draft 2023-12.</p> <p>In both cases a dedicated gradient needs to be defined as a percentage value of the active nominal power of the unit per minute"</p>
EDF RD	4.2		Te	<p>The sentence in black characters "Beside parametrization as defined by the relevant system operator, the AC V2G EVSE shall control the (re)connection process depending on the voltage and frequency bands as well as the observation time. The following values apply" is in contradiction with the sentence "For before mentioned functions of the AC V2G EVSE country specific certification applies."</p>	<p>Write : "Beside parametrization as defined by the relevant system operator, the AC V2G EVSE shall control the (re)connection process depending on the voltage and frequency bands as well as the observation time. The following default values apply" and keep the sentence "For before mentioned functions of the AC V2G EVSE country specific certification applies."</p>	Accepted
EDF	4.2		Te	<p>The AC V2G EV shall be able to generate power just after the AC V2G EVSE has considered it ok with the voltage/frequency/observation time.</p>	<p>An appropriate maximum time to start power is needed after the EVSE has given the order to start</p>	
EDF RD	4.4		Ed	<p>P_{ref} is missing on the Figure (9) YY2a</p>	<p>Add Pref on the Figure</p>	Accepted
EDF RD	4.4		Te	<p>In Figure (9) YY2b, it seems that the power can't change from charge reduction to discharge as is required in EN50549-1 clause 4.6.2, same for figure (10) YY2a for overfrequency</p>	<p>Explain why there is a "minimum technical operating level" which does not seem to have any technical background</p>	<p>Not accepted</p> <p>It is agreed to go with the power reference of Pref being the instantaneous P. In this case no change from charging to discharging is needed. This is one of the major differences between a stationary storage system and the combination of an AC V2G EV and AC V2G EVSE.</p>
EDF RD	4.4		Ed	<p>P_{ref} is missing on the Figure (10) YY2b</p>	<p>Add Pref on the Figure</p>	Accepted
EDF RD	4.4		Te	<p>The droop setting shall be adjustable, either by EVSE parameters or by remote control</p>	<p>Add a sentence stating that 5% is the default value but it can be adjusted</p>	<p>Not accepted</p> <p>A fixed droop of 5% is derived from the ACER draft 2023-12</p>
EDF RD	4.5		Ed	<p>"The accuracy of the voltage measurement within the AC V2G EV shall be at least 1 % of the nominal voltage and the power adjustment shall be better than 10% of Pmax." Is not completely clear</p>	<p>Write : "The accuracy of the voltage measurement within the AC V2G EV shall be at least 1 % of the nominal voltage and the accuracy of the power adjustment shall be better than 10% of Pmax."</p>	Accepted
EDF RD	4.5		Ed	<p>What is P_{mom} ?</p>	<p>clarify</p>	Accepted. Replaced throughout with P _M , defined as instantaneous power.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
EDF RD	4.5		Ed	"b. Limitation of the maximum permissible active power output according to Figure XXX (b). If the voltage UStart is exceeded, the AC V2G EV shall linearly reduce the active power output from Pmom at UStart down to ΔP (with ΔP = Pmax – Pmom) at UStop" seems not to be correct. The figure seems to show an increase of the active power consumed, not produced.	Write : " Increase of the active power consumption according to Figure XXX (b). If the voltage UStart is exceeded, the AC V2G EV shall linearly increase the active power consumed from Pmom at UStart down to Pconso max at UStop"	Not accepted. The figure is derived from TOR Stromerzeugungsrichtlinien 1.3 and is considered as correct. XXX(a) is a special case of XXX(b), where in XXX(a) the starting power is Pmax as opposed to any value. And XXX(b) is DP/Pmom - so it is the right way up and is a decrease with increasing voltage (ie an increase in negative DP)"
EDF RD	4.6		Ed	"The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid depending on the current voltage at the input terminals of the AC V2G EVSE (Q = f(U))." Is in contradiction with the note of Figure AA : "Note: Figures AA and CC show a generic representation of how the set point for reactive power varies with the relevant control input. In Figure AA the control input signal is the EV terminal voltage."	Correct the text of the note: " Note: Figures AA and CC show a generic representation of how the set point for reactive power varies with the relevant control input. In Figure AA the control input signal is the <u>voltage at the AC V2G EVSE terminal.</u> "	Accepted - but with change to the wording. "The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the current and voltage measured by the AC V2G EV"
EDF RD	4.7		Te	The sentence "The arithmetic mean of the RMS values of Pmom is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors." is not clear. What is Pmom ? During which duration is the arithmetic mean of the RMS values calculated ? Why are values of an active power "targets" for a reactive power ?	Clarify / rewrite this sentence	Accepted. A new para added to 4.7: For three phase AC V2G EV the value for the reactive power is the derived from the arithmetic mean of the three RMS values of PM that the AC V2G EV shall feed-in on all external line conductors.
EDF RD	4.8		Te	The sentence "The AC V2G EVSE shall verify the processing time starting when receiving the setpoint up to sending the setpoint to the AC V2G EV. Processing time shall be stated in the manual." is not specific enough (what is the "manual" ?) and does not seem useful. It is already mentioned above that : "In the case of change of the setpoint the settling time for the new setpoint shall be less than one minute"	Cancel the sentence	Not accepted. The Expert Group has reviewed this text and changed and expanded it to recognise likely future grid code imperatives.
EDF RD	4.8		Te	This functionality seems to cover 4.6 and 4.7 as the EVSE could integrates the different ways to calculate the reactive setpoint to be sent to the EV (and followed by this one). For the sake of simplification it seems more appropriate to treat 4.6 and 4.7 in the EVSE	Change 4.6 and 4.7 to check that the EVSE is able to calculate the Q based on U or P	Not accepted In both cases 4.6 and 4.7 it is clarified that the configuration is done within the EVSE. Communication between EV and EVSE is too slow to achieve this.
EDF RD	4.10		Te	In discharge mode at least, harmonics shall be limited to the limits given in IEC 61000-3-16.	Add this requirement	Not accepted. Since IEC TS 61000-3-16 is only a technical specification there won't be an EN version.
EDF RD	4.12		Ed	"(ii) the sequence of rates-of-change-of-frequencies which are defined considering the overfrequency against time profiles given in Figure (7)XX.c and the underfrequency against time profiles given in Figure (8)XX.d;" is not correct	Write "(ii) <u>through</u> the sequence of rates-of-change-of-frequencies which are defined considering the overfrequency against time profiles given in Figure (7)XX.c and the underfrequency against time profiles given in Figure (8)XX.d;"	Not accepted. This requirement is derived from Article 13a of the ACER draft 2023-12.
EDF RD	4.13		Ed	"Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2." should be at the end of the paragraph to be homogeneous with the rest of the document	Put "Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2." at the end of the paragraph	Accepted.
RESP_06	2.1.1 / 2.2.1	Certification	G	The Annex allows EU core certification plus national schemes and country-specific EVSE certificates.	Add mutual recognition: national schemes limited to parameterization to avoid retesting for every member state	Not accepted

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
						For the EVSE RSO specific requirements apply which leads to the need of country specific certification. The requirements are not limited to pure parametrization.
RESP_06	2.2	§3	T	Certification is bound to product certification, till certifying authorities gain privilege; Testing authorities should be able to issue compliance reports to EN 50549-10:2022	Add a statement for duration till announcement of certifiers by national affiliates like following: "Till enlistment of certifiers manufacturers can draw means of compliance over ISO 17025 accredited laboratory test reports."	Not accepted – but see 2.5 which now has a para about pre RfG compliance. Note that 50549-1 compliance is not sufficient for interoperability. Also The NC RfG 2.0, as is the case with NC RfG 1.0, places the legal responsibility on the RSO. Member states may choose to harmonize between RSOs, but this is not required in the NC RfG. However it is worth bringing this to the attention of the European Commission for consideration in their final approach to the legal framework.
RESP_06	2.2.1	§1	G	Certificates will be generated by mentioned certifiers and those certificates will be publicly accessible there is no need to form an additional data base of certificates	Removal of sentence "Certificates may be stored in national databases."	Reject The sentence is permissive, not directive. We do not believe that change is necessary.
RESP_06	2.5	§4	G	Enforcement date will be 3 years after publication, since certification will be done via EU core certification plus national schemes national adaptations may take longer periods.	Until the EU core certification framework and national schemes are fully operational, compliance may alternatively be demonstrated by manufacturer declaration supported by accredited laboratory test reports against the relevant clauses of this Annex and EN 50549-10. Such evidence shall be accepted during a transitional period.	Accept - para included in 2.5 to this effect.
RESP_06	3	-	G	Communication references shall be made over specific ISO 15118-20 & ISO 15118-20 Amd1	Statement to be added for digital communication protocols means ISO 15118-20 & ISO 15118-20 Amd1	Not accepted European Commission (EC) asked the expert group to avoid to reference standards in regulatory text at the beginning, but may revise this. The Expert Group still decided to reference standards like EN 50549-10, which are relevant for testing. Product requirement standards were left out at the beginning, but could be included following consideration by DG ENER."
RESP_06	3.2.2	§1	T	Unambiguous standard statement needs to be corrected	Instead of "After the standards are updated" following statement can be used "After publication of 5474-x:202x standards publication" or similar statement for EV's under Art 2.5 can be used.	Not accepted. The development of the technical annex was done under the condition of not relying on the exact content of any particular standard
RESP_06	3.2.4	§1	E	On end of paragraph there is a referral to clause 5 but it is not available in the annex. Correct referral shall be clause 4	Clause 5 to be changed as clause 4	Accepted
RESP_06	3.2.4	§1	E	Export import statement	If same language as in IEC 61851-1 ED:4 is used its better for Export: RPT reverse power transfer and for import: Charging	Not accepted It is not intended to use the terminology from IEC 61851-1 since there is already a proposed wording given by RfG 2.0.
RESP_06	3.2.4	Table 13	E	Table 13 to be changed to Table 3	Table 13 to be changed to Table 3	Accepted
RESP_06	3.2.4	Table 13	T	Island detection is not clearly defined which method is allowed and needs to be clarified.	An article under clause 4 is needed for interface protection	Not accepted As part of the interface protection the requirements for islanding detection are handled on national basis. No methods shall be excluded as long as the final solution shows compliance with the RSO specific requirements.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
RESP_06	4	all	T	Terms like 'as fast as technically feasible' are not certifiable.	Replace globally with numeric response limits only.	Partially accepted. We can manage without mentioning “with no intentional delay” because in most cases the requested timing is part of the communicated parameters. (everywhere beside limitation of active power and setpoint control for reactive power)
RESP_06	4.8	§3	T	The clause requires that processing time shall be stated in the manual while simultaneously requiring EVSE to verify the processing time. It is unclear whether this refers to EV manual, EVSE manual, or both. EVSE cannot verify EV-internal processing delays. This creates ambiguous responsibility and unrealistic cross-vendor verification.	Replace with: “Each component (EV and EVSE) shall declare its own internal processing time in its respective technical documentation. Compliance shall be assessed solely based on observed response at the Point of Connection. EVSE shall not be required to verify EV-internal processing times.”	Partially accepted - 4.8 has been rewritten to pick up this issue.
Giuseppe Dell'Olio	2.1.1		G	“...each Member State may implement a...national compliance scheme, incorporating specific grid code requirements...” . Actually, requirements are already in RFG 2.0.	Reword: “compliance schemes” (incidentally, schemes are mentioned soon after)	Not accepted We would only expect on compliance scheme per member state. But the technical annex does not prohibit more than one per member state. But potentially there are two schemes – one for EVSE and a common one for EVs – depending on the EC's decision.
Giuseppe Dell'Olio	2.3.1		T	“...Communication protocols: The AC V2G EV system shall operate the same software regarding the bidirectional charging functionalities...” This is about communication protocols, rather than generic softwares.	Replace “software” with “communication protocol”	Not accepted. The expert panel debated this at length but agreed that the broader scope of software was appropriate, and in any event would expect the authorised certifier to agree the exact scope with the manufacturer. However the drafting has changed with the intention of a better balance between the rights and obligations of manufacturers and authorised certifiers.
Giuseppe Dell'Olio	2.3.1		T	“...as that of the certified AC V2G EV system family”. Certification is performed on a “system”, not on a “system family”. See a few lines above, same paragraph: “...representative system which has satisfactorily undergone conformance tests (certified system)...”	Delete “family”.	Not accepted Family is include in the definition to explain variant models
Giuseppe Dell'Olio	2.3.1		T	“...Control Algorithm: The control algorithm software...shall be the same as that of the certified AC V2G EV system family”. Same comment.	Delete “family”.	Not accepted Family is include in the definition to explain variant models
Giuseppe Dell'Olio	2.3.1		T	“ ‘AC V2G EV System Family’ means a group of AC V2G EV systems...with equivalent characteristics to the representative system...”. “Equivalent” seems generic and subjective.	Reword: “ ‘AC V2G EV System Family’ means a group of AC V2G EV systems from the same manufacturer with specified characteristics in relation to a representative system which has satisfactorily undergone conformance tests (certified system) of its electrical performance.”	Accepted with modification - deletion of 2nd para of 2.3.2
Giuseppe Dell'Olio	2.3.2		T	‘DC V2G EVSE family’ means a group of DC V2G EVSE...with equivalent characteristics to the representative DC V2G EVSE...”. “Equivalent” seems generic and subjective.	Reword: “ ‘DC V2G EVSE family’ means a group of DC V2G EVSE from the same manufacturer with specified characteristics in relation to a representative DC V2G EVSE which has undergone conformance tests (certified product) of its electrical performance.”	Not accepted. The authorised certifier is competent to make this judgement in co-operation with the manufacturer.
Giuseppe Dell'Olio	2.3.3		T	‘AC V2G EVSE family’ means a group of AC V2G EVSE...with equivalent technical characteristics to the representative AC V2G EVSE which has undergone conformance tests (certified product)...”. Here, too, “equivalent” seems subjective.	Reword: “ ‘AC V2G EVSE family’ means a group of AC V2G EVSE from the same manufacturer with specified characteristics in relation to a representative AC V2G EVSE which has undergone conformance tests (certified product) of its electrical performance.”	Not accepted. The authorised certifier is competent to make this judgement in co-operation with the manufacturer.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
Giuseppe Dell'Olio	2.3.3		T	"...Functional Equivalence: The AC V2G EVSE exhibits equivalent or comparable performance in terms of grid interface capabilities..." "Equivalent " and "comparable" seem both subjective: who is entitled to state that something is "equivalent " or "comparable" to something else?	Replace "equivalent or comparable" with "the same"	Not accepted. The authorised certifier is competent to make this judgement in co-operation with the manufacturer.
Giuseppe Dell'Olio	2.3.3			"...Control Logic: The control logic implemented in the EVSE demonstrates equivalent behaviour ...with the AC V2G EV and grid operator, as those of the certified AC V2G EVSE." "Equivalent" seems subjective and generic.	Replace "equivalent" with "same"	Not accepted. The authorised certifier is competent to make this judgement in co-operation with the manufacturer.
Giuseppe Dell'Olio	3.2.2		G	After the standards are updated, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex." Which standards exactly? This can hardly be written in a legislative text. Besides, any legislation can be updated by the same body that first issued it. No need to state it.	Delete "After the standards are updated, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex."	Accepted with additional modification.
Giuseppe Dell'Olio	4.7		G	"The arithmetic mean of the RMS values of P _{mom} is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors. " Unclear: does this mean the mean of the P _{mom} 's on each phase? Even if this is the case, there is some misunderstanding between P and Q.	Reword: "the control input signal is the arithmetic mean of P _{mom} on all line conductors; the control set point is the target for the cos φ (respectively, reactive power) that the AC V2G EV shall feed-in on all external line conductors".	Accepted with a slight rewording For three phase AC V2G EV the value for the reactive power is the derived from the arithmetic mean of the three RMS values of P _M that the AC V2G EV shall feed-in on all external line conductors.
Giuseppe Dell'Olio	4.9.1		T	"The highest phase to neutral voltage or if no neutral is present the highest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE.". With such a criterion, this paragraph would not apply to a single-phase fault", which hardly makes sense: this is about "Under" (and not "Over") Voltage Ride-through.	Rephrase: "The lowest phase to neutral voltage or if no neutral is present the lowest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE."	Accepted
Giuseppe Dell'Olio	4.12		T	The AC V2G EV and AC V2G EVSE shall be capable of remaining connected...: (i) at rates-of-change-of-frequency up to the following values: • ±4,0 Hz/s over a period of 0,25s...". The values (Hz/s and seconds) are not consistent with figures (7)XX.c and (8)XX.d. If they are additional requirements, they should be inserted in the corresponding figures. If they are not additional, they may be dropped altogether.	Delete point (i). If necessary, modify figures (7)XX.c and (8)XX.d to take into account the values of deleted point (i).	Not accepted This requirement is derived from Article 13a of the ACER draft 2023-12.
JM Romero Gordon	3.1		G	Don't understand what this sentence means: "The DC V2G EV shall remain connected and continue to transfer power in the case that the DC V2G EVSE deviates from the EV's target values, but still within the capability of the EV, in order to fulfil grid code requirements".	Clarify.	Partially accepted - we have reordered the sentence.
JM Romero Gordon	4.2	1-i, 2.i	T	In LV, it's not unlikely that supply voltages may be quite unbalanced. In such a case, which voltages are chosen?	0.9 p.u. ≤ U _{min} ≤ U _{max} ≤ 1.1 p.u being U _{min} the minimum of the 3 supply voltages and U _{max} the maximum (if dealing with a 3-phase supply).	Accepted - this requirement needs to apply to all phases.
JM Romero Gordon	4.5		T	As above, the U value is not defined for 3-phase supplies.	It could be the same definition as in 4.6: "the arithmetic mean of the RMS values of the measured phase-to-neutral voltages".	Accepted, but with redrafting. Modified text in 4.2 and 4.5.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
JM Romero Gordon	4.5		T	It is given the overall 3-phase active power, but not per phase (the imbalance could be non-negligible, especially during short periods of time, e.g. <10min).	Define what would be the active power per phase.	Accepted, but with redrafting. Modified text in 4.2 and 4.5.
JM Romero Gordon	4.6.		T	It is given the overall 3-phase reactive power, but not per phase (the imbalance could be non-negligible, especially during short periods of time, e.g. <10min).	Define what would be the reactive power per phase.	Not accepted. The differences in practice are not expected to be material to system operation, so no need to specify in any more detail
JM Romero Gordon	3.1		G	Don't understand what this sentence means: <i>"The DC V2G EV shall remain connected and continue to transfer power in the case that the DC V2G EVSE deviates from the EV's target values, but still within the capability of the EV, in order to fulfil grid code requirements"</i> .	Clarify.	Partially accepted - we have reordered the sentence.
JM Romero Gordon	4.2	1-i, 2.i	T	In LV, it's not unlikely that supply voltages may be quite unbalanced. In such a case, which voltages are chosen?	0.9 p.u. $\leq U_{min} \leq U_{max} \leq 1.1$ p.u being U_{min} the minimum of the 3 supply voltages and U_{max} the maximum (if dealing with a 3-phase supply).	Accepted - this requirement needs to apply to all phases.
JM Romero Gordon	4.5		T	As above, the U value is not defined for 3-phase supplies.	It could be the same definition as in 4.6: "the arithmetic mean of the RMS values of the measured phase-to-neutral voltages".	Accepted, but with redrafting. Modified text in 4.2 and 4.5.
JM Romero Gordon	4.5		T	It is given the overall 3-phase active power, but not per phase (the imbalance could be non-negligible, especially during short periods of time, e.g. <10min).	Define what would be the active power per phase.	Accepted, but with redrafting. Modified text in 4.2 and 4.5.
Tesla	4.2		T	Would be extremely beneficial to add an explanation to the difference between automatic connection (starting to generate electric power) and automatic reconnection to help better understand why there is a difference between the two.	We suggest adding the ENTSO-E explanation for automatic reconnection and connection for this.	Not accepted This issue is addressed in Section 2.6. There are remaining legal implementation issues which remain with the Commission to resolve. We know from discussions with them that they are aware of this issue.
Tesla	2.5		G	The whole idea of enforcing EVSE and EV type certificate, largely due to the interoperability requirements in article 42 of NC RfG 2.0 (although not mandated in the Annex), without a V2G system fully hitting the EU market is an incorrect way of regulating OEMs. OEMs should be allowed to freely deploy their V2G in their closed ecosystem of products (without or with interoperability) as this would allow OEMs and SOs to better understand the technological restrictions and improvements needed for a V2G system.	Propose to push the enforce date of EVSE and EV compliance from 3 to 5 years after NC RfG 2.0 is published.	Not accepted. The implementation date is a decision purely for the European Commission.
Tesla	1		G	<i>"The certification framework is based on a functional split between EV and EVSE, allowing each to be assessed and certified individually. The Annex is designed to enable interoperability between EV and EVSE across manufacturers and system operators, without imposing mandatory interoperability obligations."</i> Referring to this section and section 2.6 and as highlighted above, The whole idea of enforcing EVSE and EV type certificate, largely due to the interoperability requirements in article 42 of NC RfG 2.0 (although not mandated in the Annex), without a V2G system fully hitting the EU market is an incorrect way of regulating OEMs. OEMs should be allowed to freely deploy their	Propose to add wording that before the enforce date of EVSE and EV compliance, a V2G capable EVSE and EV shall be certified as a V2G (EV + EVSE) system and not certify 2 separate products. Furthermore, OEMs would only need to certify for the local EU grid code for their V2G systems. This would allow OEM to better understand the technological restrictions and improvements of their product line before the compliance enforce date of NC RfG 2.0.	Not accepted The technical annex is not the right document to include explanations given in the proposal. Every manufacturer that wants to bring products on the market needs to read additional documents e.g. EN 50549-series.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				V2G in their closed ecosystem of products (without or with interoperability) as this would allow OEMs and SO's to better understand the technological restrictions and improvements needed for a V2G system.		
EDF			G	This Annex is a very good initiative, because interoperability is key. However, revision of this important document would need more indepth verifications that are not compatible with the short period of the consultation		Noted. Thank you.
EDF			G	Will there be the same kind of annex for NC DC 2.0 (mentioned in Table 2 and 13) ?		Yes
EDF			G	« The Annex is designed to enable interoperability between EV and EVSE across manufacturers and system operators, without imposing mandatory interoperability obligations. » How can we enable interoperability without mandating it ?	Delete the end of the sentence	Accepted
EDF			G	ISO 15118-20 communication should at least be cited in this document to allow data exchange between EV and EVSE. Also IEC 61851-1 might be worth mentioning	Replace digital communication by ISO 15118-20 where applicable	Not accepted European Commission (EC) asked the expert group to avoid to reference standards in regulatory text at the beginning, but may revise this. The Expert Group still decided to reference standards like EN 50549-10, which are relevant for testing. Product requirement standards were left out at the beginning, but could be included following consideraion by DG ENER.
EDF	1.2		T	“DC V2G EVs are not included above as the NC RfG and grid code compliance requirements are fulfilled within the DC V2G EVSE.” How is it possible ? If DC V2G EV isn't able to provide enough energy, how will the EVSE comply with Ride through obligations ? Also, even if for dynamic mode DC V2G EV is a slave, in schedule mode (where EV drives the communication and charging process) might have to be checked. Timing constraints might also have to be clarified	Delete this sentence and add DC V2G EVs in the list, even if requirements might be lighter. For instance ISO 15118-20 is still needed, and some way to state EVs Capabilities in a coherent way	Not accepted due to following reasons: 1. The NC RfG 2.0 applies to a EV/EVSE combination. If the EV is not connected, there is no combination for the NC RfG 2.0 to apply to. 2. Only EU Member State, in which the inverter of a electric storage (battery) is tested together with the battery, is Italy. In other Member States, testing the inverter only is sufficient. 3. Digital communication is a prerequisite for DC charging and bidirectional charging in general. There is no special service in ISO 15118-20 to enable grid code communication for DC. 4. International standards, which are also applicable in Europe, will technically require EVs to be capable of communication and providing energy, even if there is a grid event. 5. Explanation is mentioned in clause 3.1.
EDF	1.3		E	“unless explicitly exempted under the historic application provisions of the NC RfG 2.0” This Annex is detailing the RfG 2.0, it shouldn't describe requirements for objects that are exempted under RfG in the first place	Check coherence of the annex with RfG2.0 before publishing it instead of putting a disclaimer	Not accepted. Although the comment is correct, the expectation is that the Commission will modify sections 1 and 2 for incorporation in the NC RfG 2.0. The text is left as is to help explain the technical annex in its current state before the Commission integrates it.
EDF	2.1.1		T	“For AC-connected EVs the system operators shall apply the EU-wide compliance scheme as defined in clauses 3 and 4 of this document without adding or modifying requirements to guarantee cross-border traffic. » is it possible to cover all EU DSOs/TSOs different requirements with one set of requirements ? If possible, this could be interesting too for the EVSE requirements		Noted Since some of the EVSE requirements will stay country specific (especially regarding interface protection) it was decided to limit the harmonization for the AC V2G EV. Of course this partly affects also the AC V2G EVSE which is explained in clauses 3+4.

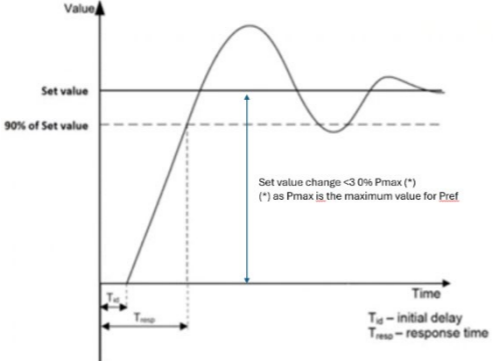
Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
EDF	2.2		G	EN 50549-10:2022 will be revised to take RfG2.0 into account. Specific adaptations for V2G might have to be discussed at CENELEC	Reference EN 50549-10 instead and discuss V2G adaptations in Cenelec TC8X	Not accepted Our legal advice is that any reference to a standard must be to the relevant published version.
EDF	2.2.1		G	“country-specific certificate” How can you explain that an AC EVSE would need country-specific certificate, when most of Grid Codes parameters that are country-specific apply to the (onboard) charger ?	An AC V2G EVSE might easily be compliant with EU wide requirements. Evaluate how an EU wide certification might be possible	Not accepted This is not possible as different member states have different detailed requirements. The certification of the EV can be EU wide, because compliance with EN 50549-1 ensures that all RSO requirements, apart from interface protection (incl. islanding detection), can be fulfilled by the EV. Interface protection (incl. islanding detection) is required to be in the EVSE, thus allowing local requirements to be implemented.
EDF	2.2.2		T	“for all AC V2G EVs excluded from the WVTA framework, » What are those EVs excluded from WVTA ?		Noted. All EV2 vehicles not caught by WVTA.
EDF	2.3.1, 2.3.2, 2.3.3		T	“and shall have a power range of between ±50% of the rated power (Pn) of the certified AC V2G EV system “ Do we have data that implies that this type of difference in rated power has no impact on Grid code compliance ?	State the Rational for this range	Noted The workstream noted that the most common/likely ratings of AC EVs are 32A and 16A. A 32A EV/EVSE certificate would then be viable for 16A.
EDF	2.3.1, 2.3.2, 2.3.3		T	“ Communication protocols: The AC V2G EV system shall operate the same software regarding the bidirectional charging functionalities as that of the certified AC V2G EV system family. » How do you verify that ? You can verify if it is the same software, but not that the “bidir” part is unchanged. And softwares will be updated, at least regarding cipher suites		Noted. This is an issue for authorised certifiers. The wording has been reviewed again by the Expert Group to find the right balance between the rights and obligations of manufacturers and authorised certifiers.
EDF	2.3.1, 2.3.2, 2.3.3		T	“Filter placement”, we should also have similar filters	“same (/similar ?) filter and same placement”	Accepted – see revised wording.
EDF	2.3.1, 2.3.2, 2.3.3		E	Missing “family” in a lot of sentences	Add “family” where needed	Not accepted -not clear where it is missing.
EDF	2.4		T	“provided the integration does not alter the certified characteristics . » How do we verify that ?	State what changes are possible, and what need to stay the same	Not accepted The authorised certifier is competent to make this judgement in co-operation with the manufacturer.
EDF	2.5		E	“The requirements of NC RfG 2.0 shall not apply to: • EVs registered prior to the compliance date. • EVSE installed prior to the compliance date. NC RfG EV_EVSE Technical Annex v1.0.docx 6 The compliance date for EVSE is [3 years after EIF for the NC RfG 2.0]. The compliance date for EVs is [to be determined by legal incorporation of RfG requirements into WVTA]/ » Compliance date should be part of RfG2.0 and not part of an annex	Include those dates in RfG2.0 and delete them from the Annex	Not accepted The European Commission will determine the exact formulation of compliance dates.
EDF	2.5		E	“the relevant component » What is the relevant component ?	State what is relevant component or replace by “a component”	Not accepted This is a decision of the authorised certifier that has capability to do this evaluation

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
EDF	2.6		T	<p>“New EVSE shall provide unidirectional charging capabilities to all EVs. »</p> <p>All EVs is too wide, for instance compatibility with Chademo is already planned to be dropped</p>	Refine the sentence	<p>Not accepted</p> <p>If chademo compatibility is not possible this product is not interoperable and cannot be certified.</p>
EDF	2.6		E	<p>“</p> <p>2) Capability to apply requirements of NC RfG 2.0 (+technical annex) when charging is given by hardware but can only be enabled after a revision of the digital communication standard to communicate the grid code parameter. »</p> <p>Is it a reference to ISO 15118-20 AMD 1 ?</p>	Add ISO 15118-20 AMD 1 reference for ease of comprehension	<p>Not accepted.</p> <p>Include reference to specific requirements in individual standards it is welcomed the European Commission.</p>
EDF	3.2.3		T	<p>“NOTE 1: By using this test procedure it is ensured that the digital communication between AC V2G EV and AC V2G EVSE works properly. Therefore, full protocol stack certification of the digital communication is not required under this Annex. »</p> <p>How can we be sure that there won't be any problem with the EV or EVSE when injecting if there is no full protocol stack certification?</p> <p>Interoperability has proven to be hard with ISO 15118. I wonder how we can ensure interoperability without testing the full stack</p>	Test standards of ISO 15118-20 series might help to have better interoperability (this should be their purpose or be updated accordingly)	<p>Not accepted.</p> <p>The idea is to do the grid code certification only by checking compliance to the relevant electrical grid code requirements.</p> <p>This shall be done by using reference test devices. ie it is ensured that the grid code related services works fine. From RfG 2.0 perspective there is no need to check e.g. for all other services and functions defined within the ISO 15118 protocol.</p> <p>If a "critical software part changes" an impact assessment needs to be provided by the manufacturer. If there is recertification needed is decided between manufacturer and certification body. This process is common practice and does not need to be explained in detail in this technical annex</p>
EDF	3.2.3 and Table 13		E	<p>« NOTE 3: By using this test procedure it is ensured that the digital communication between AC V2GAC V2G EV and AC V2GAC V2G EVSE works properly. A complete certification of the digital communication is therefore not required. »</p> <p>Typo</p>	Correct typo here and in table 13 name	Accepted
EDF	Table 13		G	It looks like a lot of functions are not split but present for EVs and EVSEs.	Precise what is meant by split functions and how It can be tested separately or correct the table	<p>Noted</p> <p>Table 3 only gives an overview about all functions. For the detailed function share please elaborate on the requirements given in clauses 4.x.</p>
EDF	2.3.2 & 2.3.3		Te	<p>§ 2.3.2 states that “A DC V2G EVSE is considered part of an DC V2G EVSE family if the following conditions are met:</p> <ul style="list-style-type: none"> - Electrical Performance: The hardware of the DC V2G EVSE shall employ the same topology, including identical converter stage layout and filter placement, and shall have a Pn between ±50%Pn of the certified DC V2G EVSE. - ... - Control Algorithm: The control algorithm software for grid code compliance implemented in the DC V2G EVSE shall be the same, as that of the certified DC V2G EVSE. <p>3 ”</p> <p>§ 2.3.3 states that “An AC V2G EVSE is considered part of an AC V2G EVSE family if the following conditions are met:</p>	Homogenize the requirements, especially including the functional equivalence of the AC EVSE related with grid interface, to the DC EVSE	<p>Not accepted.</p> <p>The requirements to be certified for DC and AC EVSE are quite different - the wording has been chosen deliberately to accommodate these differences.</p>

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				<p>- Functional Equivalence: The AC V2G EVSE exhibits equivalent or comparable performance in terms of grid interface capabilities, including switching behaviour, protection coordination, and fault response, as the certified AC V2G EVSE certified and shall have a Pn of between $\pm 50\%P_n$ of the certified AC V2G EVSE.</p> <p>- ...</p> <p>- Control Logic: The control logic implemented in the EVSE demonstrates equivalent behaviour in terms of timing, response characteristics, and interaction with the AC V2G EV and grid operator, as those of the certified AC V2G EVSE.</p> <p>4 "</p> <p>Why are the requirements different for DC and AC V2G EVSE as the functional/electrical performance should be the same measured from the grid whether the EVSE is AC or DC ?</p>		
EDF	2.6	Table 1	Te	For the boxes " Existing V2G EV \ New V2G EVSE ", "Existing V2G EVSE \ New V2G EV ", it is written "No NC 2.0 requirements* " whereas in the text above NC 2.0 requirements are required for respectively AC V2G EVSE is RFG 2.0 and AC V2G EV.	Correct the table for the boxes mentioned in the comments. Check for other potential inconsistencies in Table 1	Partially accepted. The table in v1.02 and v2.0 is correct. The last two bullets in the text above the table are exceptions that can be allowed - we will add the word "exceptionally" to both.
EDF	2.6	Table 2	Ed	V1G is not defined and is in general not appropriate. V2G means Vehicle To Grid, V1G does not refer to a proper acronym. The comment applies to the whole document, especially Table2	Change V1G by FPT-only-EV (Forward Power Transfer) or another appropriate acronym in line with the future IEC 61851-1 ed4	Not accepted. V1G is not under the scope of the Rfg2.0 and V1G is defined in NC DC 2.0
EDF	3.1		Ed	Where is the "clause 2.22.2" in the document ?	Clarify / correct	Accepted
EDF	3.2.2		Ed	What does "C" mean in "LFSM-UC" ?	Clarify	Noted. It designates "consumption" see NC RfG DC Recommendation ACER December 2023: Annex 2 – Amended DC Regulation, Article 2
EDF	3.2.2		Te	Is the sentence "After the standards are updated, AC V2G EVs shall support all functions required by NC RfG 2.0 and this technical annex." not in contradiction with the function split explained later in the document ?	Clarify	Noted. There is no contradiction. The table only clarifies that if a customer only wants to charge with a V2G capable EV, not all functions (required by Rfg 2.0 + technical annex) can be enabled today due to the lack of digital communication standard for charging. (see also Guiseppe Dell'Olio in line 89)
EDF	3.2.3		Te	What is meant by the generator? An AC EVSE is only a "switching device", so it means that the AC mains emulation is outside the EVSE, and also the RLC device for islanding detection test. Also it's not clear what is meant by "able to provide grid support functions" as these will be done by the EVSE+EVSE system.	Distinguish the reference AC EVSE, the mains emulation and the IEC62116 circuit. It could be a reference test setup.	Not accepted Mains emulation is not mentioned at all, because this topic is already handled in the basic test setup defined in EN 50549-10. Note also the interface protection (62116) has to be in the EVSE.
EDF	3.2.3		Te	What is the Maximum Consumption Capacity and what is the link with the certification process ?	Clarify in this clause even if described in 4.4	Noted. Clarification is given in 3.2.4. ie how power consumption and power production is handled.
EDF	3.2.4		Ed	Table 13 is not correct	Write: Table 3	Accepted.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
EDF	3.2.4	Table 3	Te	Line : “Means to detect islanding situation (loss of supply network)” The anti-islanding detection should be possible also by the EV, not solely by the EVSE, as it is state of the art for PV inverters to fulfill IEC 62116 with active algorithm in the power electronic part, i.e. the EV in AC V2G	Put a X in the column “Bidirectional charging (V2G mode / consume and inject)”	Not accepted For interoperability a clear function split is needed which is completely in line with the function split defined in IEC 61851-1 ED4 and ISO 5474-2 AMD1 which are foreseen to be published end of 2026. Various arguments have been evaluated with a clear preference to put the RSO specific protection requirement on EVSE side. Also the interface protection for compliance with IEC 62116 is required by standards to be in the EVSE.
EDF	4.1		Te	Note 2 is not appropriate as the EV is the “best player” to implement an anti-islanding algorithm and can fulfill the safety requirement not to sustain an unintentional island by switching off	Remove the note 2	Not accepted For interoperability a clear function split is needed which is completely in line with the function split defined in IEC 61851-1 ED4 and ISO 5474-2 AMD1 which are foreseen to be published end of 2026. Various arguments have been evaluated with a clear preference to put the RSO specific protection requirement on EVSE side. Also the interface protection for compliance with IEC 62116 is required by standards to be in the EVSE.
EDF	4.2		Te	§ 5.10 of EN50549-10 refers to the test of the active power reduction to a new setpoint. It first tests the accuracy of the regulation with a 1 minute observation time of the active power reached (§ 5.10.3.2) and then the dynamic of the active power adjustment (§ 5.10.3.3). The test of the dynamic of the active power adjustment requires its gradient to be within a [0,33 Pn/s – 0,66 Pn/s] range to pass the test. A 0,5 Pn/s value is actually the target. Whereas in §4.2 of the “EV/EVSE Technical annex”, the range of the gradient can be chosen between 6% and 3000% Pmax/min this is 0,001 to 0,5 Pmax/s, a much broader range than the one allowed in EN50549-10 §5.10. So the strict application of EN50549-10 §5.10 does not allow the test of the range of power gradient authorized by §4.2 of the “EV/EVSE Technical annex”	Modify the text as follows (see bold characters) : “Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.10 with an adaptation of the gradient tolerance in § 5.10.3.3, and by adding an AC V2G EVSE reference test device that can provide the power ramp over time. The gradient tolerance allowed is adapted as follows: for any given gradient, the target active power should be reached within a [-5% Pn, +5% Pn] tolerance and within a [-1 s ; +1 s] time tolerance defined for a 100% Pn active power variation ”	Not accepted Clause 4.2 deals with "starting to generate electrical power" (as defined in EN 50549-1, clause 4.10.3) and "automatic reconnection after tripping" (as defined in EN 50549-1, clause 4.10.2) considering the special re-connection conditions defined in Article 13a of the ACER draft 2023-12. In both cases a dedicated gradient needs to be defined as a percentage value of the active nominal power of the unit per minute
EDF	4.2		Te	The sentence in black characters “Beside parametrization as defined by the relevant system operator, the AC V2G EVSE shall control the (re)connection process depending on the voltage and frequency bands as well as the observation time. The following values apply ” is in contradiction with the sentence “For before mentioned functions of the AC V2G EVSE country specific certification applies.”	Write : “Beside parametrization as defined by the relevant system operator, the AC V2G EVSE shall control the (re)connection process depending on the voltage and frequency bands as well as the observation time. The following default values apply ” and keep the sentence “For before mentioned functions of the AC V2G EVSE country specific certification applies.”	Accepted.
EDF	4.2		Te	The AC V2G EV shall be able to generate power just after the AC V2G EVSE has considered it ok with the voltage/frequency/observation time.	An appropriate maximum time to start power is needed after the EVSE has given the order to start	Not accepted Since this is a limitation there is no need to specify a response time. The AC V2G EV is free to not output any active power.
EDF	4.4		Ed	P _{ref} is missing on the Figure (9) YY2a	Add Pref on the Figure	Accepted
EDF	4.4		Te	In Figure (9) YY2b, it seems that the power can't change from charge reduction to discharge as is required in	Explain why there is a “minimum technical operating level” which does not seem to have any technical background	Noted

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
				EN50549-1 clause 4.6.2, same for figure (10) YY2a for overfrequency		It is agreed to go with the power reference of Pref. In this case no change from charging to discharging is needed. This is one of the major differences between a stationary storage system and the combination of an AC V2G EV and AC V2G EVSE.
EDF	4.4		Ed	P _{ref} is missing on the Figure (10) YY2b	Add Pref on the Figure	Accepted
EDF	4.4		Te	The droop setting shall be adjustable, either by EVSE parameters or by remote control	Add a sentence stating that 5% is the default value but it can be adjusted	Not accepted A fixed droop of 5% is derived from the ACER draft 2023-12.
EDF	4.5		Ed	"The accuracy of the voltage measurement within the AC V2G EV shall be at least 1 % of the nominal voltage and the power adjustment shall be better than 10% of P _{max} ." Is not completely clear	Write : "The accuracy of the voltage measurement within the AC V2G EV shall be at least 1 % of the nominal voltage and the accuracy of the power adjustment shall be better than 10% of P _{max} ."	Accepted
EDF	4.5		Ed	What is P _{mom} ?	clarify	Accepted. Propose to add a new definition P _M being the current active power output. Pref is the reference power value that either needs to be set to P _{max} or P _M
EDF	4.5		Ed	"b. Limitation of the maximum permissible active power output according to Figure XXX (b). If the voltage U _{Start} is exceeded, the AC V2G EV shall linearly reduce the active power output from P _{mom} at U _{Start} down to ΔP (with ΔP = P _{max} – P _{mom}) at U _{Stop} " seems not to be correct. The figure seems to show an increase of the active power consumed, not produced.	Write : " Increase of the active power consumption according to Figure XXX (b). If the voltage U _{Start} is exceeded, the AC V2G EV shall linearly increase the active power consumed from P _{mom} at U _{Start} down to P _{conso max} at U _{Stop} "	Not accepted The figure is derived from TOR Stromerzeugungsrichtlinien 1.3 and is considered as correct. XXX(a) is a special case of XXX(b), where in XXX(a) the starting power is P _{max} as opposed to any value. And XXX(b) is DP/P _{mom} - so it is the right way up and is a decrease with increasing voltage (ie an increase in negative DP)
EDF	4.6		Ed	"The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid depending on the current voltage <u>at the input terminals of the AC V2G EVSE</u> (Q = f(U))." Is in contradiction with the note of Figure AA : "Note: Figures AA and CC show a generic representation of how the set point for reactive power varies with the relevant control input. In Figure AA the control input signal is the <u>EV terminal voltage</u> ."	Correct the text of the note: " Note: Figures AA and CC show a generic representation of how the set point for reactive power varies with the relevant control input. In Figure AA the control input signal is the <u>voltage at the AC V2G EVSE terminal</u> ."	Accepted - but with change to the wording. "The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the current voltage measured by the AC V2G EV"
EDF	4.7		Te	The sentence "The arithmetic mean of the RMS values of P _{mom} is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors." is not clear. What is P _{mom} ? During which duration is the arithmetic mean of the RMS values calculated ? Why are values of an active power "targets" for a reactive power ?	Clarify / rewrite this sentence	Accepted with a slight rewording For three phase AC V2G EV the value for the reactive power is the derived from the arithmetic mean of the three RMS values of PM that the AC V2G EV shall feed-in on all external line conductors.
EDF	4.8		Te	The sentence "The AC V2G EVSE shall verify the processing time starting when receiving the setpoint up to sending the setpoint to the AC V2G EV. Processing time shall be stated in the manual." is not specific enough (what is the "manual" ?) and does not seem useful. It is already mentioned above that : "In the case of change of the setpoint the settling time for the new setpoint shall be less than one minute"	Cancel the sentence	Not accepted but the para has been reworded following further workstream discussion.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
EDF	4.8		Te	This functionality seems to cover 4.6 and 4.7 as the EVSE could integrates the different ways to calculate the reactive setpoint to be sent to the EV (and followed by this one). For the sake of simplification it seems more appropriate to treat 4.6 and 4.7 in the EVSE	Change 4.6 and 4.7 to check that the EVSE is able to calculate the Q based on U or P	Not accepted In both cases 4.6 and 4.7 it is clarified that the configuration is done within the EVSE. Communication between EV and EVSE is too slow to achieve this. The AC V2G EV and AC V2G EVSE shall exchange reactive power with the grid dependent on the current voltage measured by the AC V2G EV
EDF	4.10		Te	In discharge mode at least, harmonics shall be limited to the limits given in IEC 61000-3-16.	Add this requirement	Not accepted Since IEC TS 61000-3-16 is only a technical specification there won't be an EN version. Moreover the limits defined in IEC TS 61000-3-16 seem to be less strict that those within IEC 61000-3-2 which makes it unnecessary to refer to a less strict standard.
EDF	4.12		Ed	"(ii) the sequence of rates-of-change-of-frequencies which are defined considering the overfrequency against time profiles given in Figure (7)XX.c and the underfrequency against time profiles given in Figure (8)XX.d;" is not correct	Write "(ii) <u>through</u> the sequence of rates-of-change-of-frequencies which are defined considering the overfrequency against time profiles given in Figure (7)XX.c and the underfrequency against time profiles given in Figure (8)XX.d;"	Not accepted This requirement is derived from Article 13a of the ACER draft 2023-12.
EDF	4.13		Ed	"Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2." should be at the end of the paragraph to be homogeneous with the rest of the document	Put "Compliance for the AC V2G EV is checked by the test setup defined in EN 50549-10:2022 clause 5.3.2." at the end of the paragraph	Accepted
Renault Group	4.4	LFSM-O-EV		"4- Any unintentional delay shall be as short as possible;" In our case there is no risk or "technical limitation" that lead to "unintentional delay as with 5% droop and Pref as reference there is no switch from injection to consumption or vice & versa. So I propose to remove for more clarity (who can explain what is an "unintentional delay" and what is "as short as possible")	Remove this unclear sentence	Accepted
Renault Group	4.4	Figure 9	E	Figure 9 about "response time" for LFSM We propose to clarify the "maximum step" to explain what is the <30% Pref requirement vs response time <0,5s Considering that the worst case is when Pref=Pmax 	Clarify what is requirement on figure 9	Not accepted This graph is just an graphical representation of step response behavior.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
Renault Group	4.14.2.2			<p>The static voltage range shall be adjustable from 0,05 pu – 1 pu for the undervoltage boundary and from 1 pu - 1,25 pu for the overvoltage boundary</p> <p>This value are out of existing standard requirements (EN 50 549 & VDE 4105) , We propose to change for</p> <p>The static voltage range shall be adjustable from 0,20 pu – 1 pu for the undervoltage boundary and from 1 pu - 1,20 pu for the overvoltage boundary to be in accordance with EN 50 549-1 CLAUSE 4.7.4.2.2 AND vde 4105 Clause 5.7.3.3</p>	No overspecification vs existing standard	Not accepted According to EN 50549-1, clauses 4.5.3 + ACER draft RfG2.0 Article 13a (UVRT) and 4.5.4 (OVRT) the worst case curves for non-synchronous generating technology go down to 0,05 and up to 1,25.
Renault Group	4.8			<p><i>In the case of change of the setpoint the settling time for the new setpoint shall be less than one minute.</i></p> <p><i>For independent certification, If we define requirement that involve EV and EVSE we should split/allocate the reaction time between Ev and EVSE.</i></p> <p><i>If the overall response time Is 60s we should for example, consider</i></p> <p><i>29 seconds for the EVSE from setpoint change receiving to setpoint change setting via ISO 15 118-20</i></p> <p><i>1 second for ISO 15 118-20 between EV and EVSE</i></p> <p><i>30 seconds for EV to execute setpoint change</i></p>	Independent certification need independant requirements	Accepted in principle- see the new text in 4.8
Renault Group	4.7			<p><i>The “arithmetic mean of the RMS values of Pmom” is the target for the reactive power that the AC V2G EV shall feed-in on all external line conductors.</i></p> <p><i>We should clarify as described in EN 50 549-10 that the Voltage, Current, Active power, Reactive power and Cos Phi are calculated as quadratic means over 10 periods</i></p>	Clarify number of period used to calculate RMS values	Accepted - added to section 3.2.3
Bender	4.3		T	There is no clarity about the max. allowed time for the EVSE and for the digital communication to ensure that EV and EVE stay within the limits of not being faster than 0,66 % P _{max} / s and not being slower than 0,33 % P _{max} / s	Change as follows: see proposal for 4.8 below	Accepted with minor change: The AC V2G EV shall not inject DC currents into individual phases greater than 0,5 % of the nominal current (I _n) or 20 mA whatever is the higher value. I _n is considered the minimum of I _{n_EV} and I _{n_EVSE} .
Bender	4.8		T	<p>Asking for a settling time of less than 60s leaves open 2 important points:</p> <p>1.) The minimum time is missing which is already implemented e.g. in Germany</p> <p>2.) There is no clarity about the max. allowed time for the EVSE, for the digital communication and for the EV.</p>	Change as follows: see proposal for 4.8 below	Accepted - new wording for 4.3.2 adopted.
Bender	4.11		T	Please clarify if the DC injection limit applies per phase or represents the sum of all phases.	If it is per phase, change as follows:	Accepted.

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
					<p>The AC V2G EV shall not inject DC currents greater than 0,5 % of the nominal current (In) or 20 mA whatever is the higher value. In is considered the minimum of In_EV and In_EVSE. The DC injection limit applies for each phase individually.</p> <p>If it is per phase, change as follows: The AC V2G EV shall not inject DC currents greater than 0,5 % of the nominal current (In) or 20 mA whatever is the higher value. In is considered the minimum of In_EV and In_EVSE. The DC injection limit applies for all phases together. An equal distribution of the DC current is not required.</p>	
Compleo	4.11		T	The addition is intended to exclude the potential possibility of DC injection protection monitoring as part of the AC V2G EVSE and clearly define it as a function in the AC V2G EV.	Consequently, the protection consisting of detection including monitoring and prevention of the direct current component feed-in into the grid is not integrated into the AC V2G EVSE but must be included in the bidirectional inverter of AC V2G EV.	<p>Not accepted</p> <p>The clause only deals with limitation of dc injection and not with DC "protection".</p> <p>Today this is only required by Italy and under discussion within IT committee. Anyway this can be handled by EVSE certification (not an issue for the technical annex)</p>
Compleo	3.2.4	Table 3	T	<p>DC injection protection monitoring should be excluded as a part of a function in AC V2G EVSE and clearly defined as a function in the AC V2G EV.</p> <p>Add "to monitor protection"</p>	Verify the ability of the AC V2G EV to monitor protection and limit DC injection as defined in clause 4.11 of this technical annex.	<p>Not accepted</p> <p>It is a design requirement for the EV to not exceed the limits defined in 4.11. If this is achieved by design or by monitoring and disconnection should be decided by the manufacturer.</p>
Compleo	3.2.4	Table 13	E	It should be table 3 not table 13	Table 3	Accepted
Compleo	3.2.3		T	<p>According to article 42 (5) of the RfG 2.0</p> <p>Add proposed comment to chapter 3.2.3</p>	<p>The functions according to table 3 based on individual type test certificates shall work independently and not hedge against incorrect or late reactions of the other counterpart but verify it's correct functionality in itself. In case of safety-critical situations a disconnection from the grid at any time is allowed by AC V2G EVSE as well as AC V2G EV.</p> <p>For example activated LFSM function in the AC V2G EV is not checked by the EVSE for compliance behaviour after grid code parameter set is successfully transmitted to EV.</p>	<p>Not accepted</p> <p>This topic of handling "safety-critical situations" is covered by clause 4.1 (hierarchy).</p>
Compleo	4.9.1		T	<p>"The highest phase to neutral voltage or if no neutral is present the highest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE."</p> <p>In UVRT condition, the lowest phase voltage needs to be evaluated.</p>	Change to: "The lowest phase to neutral voltage or if no neutral is present the lowest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE."	Accepted
Compleo	4.11		T	The addition is intended to exclude the potential possibility of DC injection protection monitoring as part of the AC V2G EVSE and clearly define it as a function in the AC V2G EV.	Consequently, the protection consisting of detection including monitoring and prevention of the direct current component feed-in into the grid is not integrated into the AC V2G EVSE but must be included in the bidirectional inverter of AC V2G EV.	<p>Not accepted</p> <p>The clause only deals with limitation of dc injection and not with DC "protection".</p> <p>Today this is only required by Italy and under discussion within IT committee. Anyway this can be handled by EVSE certification (not an issue for the technical annex)</p>

Respondent Initials	Clause/ Subclause (eg 3.1)	Paragraph/ Figure/ Table/ (eg Table 1)	Type of comment E/G/T	Comments	Proposed change	Observations of the secretariat
Compleo	3.2.4	Table 3	T	DC injection protection monitoring should be excluded as a part of a function in AC V2G EVSE and clearly defined as a function in the AC V2G EV. Add “to monitor protection”	Verify the ability of the AC V2G EV to monitor protection and limit DC injection as defined in clause 4.11 of this technical annex.	Not accepted It is a design requirement for the EV to not exceed the limits defined in 4.11. If this is achieved by design or by monitoring and disconnection should be decided by the manufacturer.
Compleo	3.2.4	Table 13	E	It should be table 3 not table 13	Table 3	Accepted
Compleo	3.2.3		T	According to article 42 (5) of the RfG 2.0 Add proposed comment to chapter 3.2.3	The functions according to table 3 based on individual type test certificates shall work independently and not hedge against incorrect or late reactions of the other counterpart but verify it's correct functionality in itself. In case of safety-critical situations a disconnection from the grid at any time is allowed by AC V2G EVSE as well as AC V2G EV. For example activated LFSM function in the AC V2G EV is not checked by the EVSE for compliance behaviour after grid code parameter set is successfully transmitted to EV.	Not accepted This topic of handling "safety-critical situations" is covered by clause 4.1 (hierarchy).
Compleo	4.9.1		T	“The highest phase to neutral voltage or if no neutral is present the highest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE.” In UVRT condition, the lowest phase voltage needs to be evaluated.	Change to: “The lowest phase to neutral voltage or if no neutral is present the lowest phase to phase voltage shall be evaluated by the AC V2G EV and AC V2G EVSE.”	Accepted