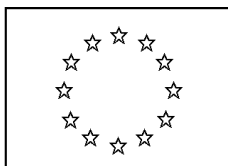


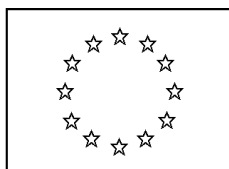
REPORT
ON THE 11TH JOINT CROSS-BORDER
EMC MARKET SURVEILLANCE CAMPAIGN
(2019)

SOLAR PANEL INVERTERS



CONTENTS

| S/N | ITEM | PAGE |
|------------|---|-------------|
| A. | EXECUTIVE SUMMARY | 3 |
| B. | ELEMENTS OF THE CAMPAIGN | 5 |
| 1. | Reasons for the campaign | 5 |
| 2. | Scope of the campaign | 5 |
| 3. | Participation in the campaign | 6 |
| 4. | Timing | 6 |
| 5. | Sampling | 6 |
| 6. | Documents | 7 |
| 7. | Tests performed | 7 |
| 8. | Administrative requirements | 7 |
| C. | RESULTS | 8 |
| 1. | Number and origin of products | 8 |
| 2. | Administrative compliance | 8 |
| 2.1 | CE marking | 8 |
| 2.2 | EC Declaration of conformity | 9 |
| 2.3 | Technical documentation (TD) | 9 |
| 2.4 | Traceability Requirements | 10 |
| 3. | Compliance with harmonised standards | 10 |
| 3.1 | Emissions requirements | 10 |
| 3.2 | Immunity requirements | 10 |
| 4. | Other evaluations | 11 |
| 4.1 | DoC compliance vs. compliance with emissions requirements | 11 |
| 5. | Overview of findings | 11 |
| D. | CONCLUSIONS AND RECOMMENDATIONS | 12 |
| 1. | Conclusions | 12 |
| 2. | Recommendations | 12 |



A. EXECUTIVE SUMMARY

As a result of the discussions at the 43rd EMC Administrative Cooperation Working Group (EMC ADCO) meeting in Solin, it was decided that the twelfth joint cross-border EMC market surveillance campaign will assess the compliance of Solar panel inverters intended for use by consumers. This campaign was planned to start in January 2019.

Solar photovoltaic (PV) modules generate electricity from sunlight. Using an inverter, this electricity can be fed into the mains electrical supply of a building, or directly into the public electricity grid. Grid-connected solar panel systems intended to be used by consumers are already widely used throughout Europe and the market is growing continuously.

An inverter for solar energy installations is an apparatus that converts DC (Direct Current) into AC (Alternating Current). The current generated by solar panels needs to be converted to 230 Volt AC, before it can be used in the electricity network. To extract the maximum power from the solar panels the Maximum Power Point (MPP) Tracker in the inverter searches the most optimum combination of voltage and current. The power of the inverter needs to be adapted to the joint power of all the connected solar panels. Many inverters offer the possibility to monitor the revenues of the solar panels via a build-in display and/or the internet.

There are different inverters on the market

String inverter: Mostly used and the cheapest type. One or more strings (= series of solar panels) are attached. In one string all solar panels are oriented in the same direction, e.g. south. At different angles of inclination and orientations an inverter with multiple strings and MPP-trackers can reduce the losses. However it remains sensitive to shadow positions. The inverter is often mounted in-house.

Micro-inverter: Each solar panel has its own inverter and therefore its own MPP-tracker. This type of inverter is being installed outside, behind the panel. All inverters are connected in parallel and directly connected to 230V-AC. This is the most expensive solution but easy to expand. Often used in small systems with different angles of inclination and orientations. The long cable (from the roof down) is 230V AC.

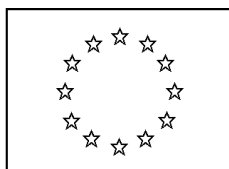
Optimizer: Looks much like a micro-inverter, however the output of the converter is still DC. A string of optimizers is offered to a special inverter. That inverter does only have to convert DC into AC. Optimizers-systems do have a higher revenue, but they are more expensive than string inverters. Optimizers are placed outside behind the panels, the inverter itself inside.

This report provides an overview of the findings and makes recommendations on next steps and future actions.

The primary purpose of the campaign is to assess the compliance of the equipment under test ('EUT'), samples taken from the European market, with the essential requirements of the EMC Directive 2014/30/EU.

This campaign has several goals, which include:

The primary purpose of the campaign is to assess the compliance of the equipment under test ('EUT'), samples taken from the European market, with the essential requirements of the EMC Directive 2014/30/EU (for apparatus placed on the market from 20 April 2016).



**EMC ADMINISTRATIVE
CO-OPERATION WORKING GROUP**
11th EMC Market Surveillance Campaign 2019



This campaign has several goals, which include:

- to determine the administrative and technical compliance levels of Solar panels inverters available within the EU market;
- to apply the measures of new EMC Directive 2014/30/EU (including safeguard procedure) for solar panel inverters placed on the market from 20 April 2016.
- to take appropriate compliance actions to rectify non-compliances;
- to propose further actions;
- to improve cooperation and information exchange between MSA's;
- to increase knowledge of the solar panels inverters industry;
- to improve the knowledge of manufacturers; importers; distributors; and economic operators of their obligations under the EMC Directive;
- to use the ICSMS DRPI and become familiar with it.
- to compare results with 6th EMC Market surveillance Campaign 2014.

Administrative compliance

The results of the administrative assessment of EUT showed:

- 33% of EUT were considered administratively compliant.
- 92% of EUT had the correct CE marking.
- Declarations of Conformity (DoC) were available for 11 EUT; and 5 of them were compliant.
- From the requested Technical Documentation ('TD') of one inverter, it was found to be non-compliant.

Technical compliance with harmonised standards

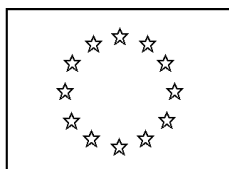
For the purposes of this campaign, technical compliance is to be understood as compliance with an applicable harmonised standard.

The results of the technical assessment of Solar panel inverters showed that only 3 of tested EUT were compliant (i.e. 25% overall compliance to harmonised standards).

Summary of Results

Six national Market Surveillance Authorities ('MSA') EMC ADCO members participated in the campaign. 13 products were assessed between the 1st January 2019 and the 30th September 2019. In general, the level of compliance with the administrative and technical requirements was considered as very low. Overall, 8 % of the Equipment Under Test ('EUT') were assessed as compliant.

Based on this campaign EMC ADCO has formulated conclusions and recommendations which can be found in Chapter D of this report.



B. ELEMENTS OF THE CAMPAIGN

1. Reasons for the campaign

As a result of the discussions at the 43rd EMC Administrative Cooperation Working Group (EMC ADCO) meeting in Solin, it was decided that the twelfth joint cross-border EMC market surveillance campaign will assess the compliance of Solar panel inverters apparatus intended for use by consumers. This campaign started in January 2019.

Solar panels inverters were checked before in an EMC MSC in 2014. Only 9% of the apparatus was then compliant, with 33% compliant on emissions and 38% compliant on administrative requirements. It is opportunity to investigate if compliance levels have improved.

2. Scope of the campaign

The primary purpose of the campaign was to assess the compliance of samples taken from the market with the provisions of the EMC Directive 2014/30/EU. Administrative compliance was checked against the CE marking, Declaration of Conformity, traceability. Technical documentation of the acquired EUT were assessed on voluntary basis. For the purposes of this campaign, it was decided to assess compliance with the EMC essential requirements (i.e. generated electromagnetic disturbances of EUT) by testing against a relevant harmonised standard¹. Immunity aspects were not assessed.

The campaign was also intended to provide MSA with the opportunity to participate in EMC market surveillance, to improve the exchange of information and to raise economic operator and consumer's awareness of the need for conformity with the requirements of the EMC Directive.

It was agreed that following the analysis of the results of the campaign, a report would be prepared and presented to the EMC Working Party for subsequent publication by the Commission. The present document constitutes the report of the campaign.

3. Participation in the campaign

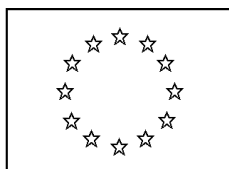
Participation in the campaign was voluntary, and was open to all members of EMC ADCO. Each MSA was responsible for the costs of obtaining the EUT and tests.

Six European countries participated in the campaign: Cyprus, Finland, Germany, Lithuania, Netherlands, and the Slovenia.

4. Timing

The campaign commenced on the 1st January 2019. The information gathering, testing and data reporting phases of the campaign were of nine months duration, ending on the 30th of September 2019. Within that

¹ EUT were assessed against harmonised standards as stated in the DoC (if available). See chapter 7 for the applicable standards.



period, MSA carried out their actions to their own timescales. During the last months all results of testing and administrative assessment were collected together and the final report of the joint action was prepared.

5. Sampling

The aim was to obtain the broadest possible view of the investigated product group in the European marketplace. Therefore, a quasi-random sampling should be performed over the whole price range, and from all origins (national, EEA, and imported from third countries). However, to avoid double sampling, participating MSA were encouraged to upload details of their selections into ICSMS as early in the course of campaign as possible.

The number of selected EUT was recommended between 1 and 3 of different individual types for each participating MSA, but MSA were free to select any number of EUT for this campaign. Selections may include products purchased on the internet (from eBay, Amazon, Alibaba, etc.). In order to maximise the value of this campaign and increase knowledge of the marketplace the aim was to select products from the broadest range possible.

6. Documents

A Code of Practice was drawn up to provide guidance and a common understanding of the purpose of the campaign and to ensure, as far as possible, the adoption of harmonised practices during the carrying out of the campaign. The results of the assessment of each EUT were recorded on a common electronic data input form for EMC (EMC DIF V4.0).

7. Tests performed

For the purposes of the campaign, it was agreed to assess compliance to the EMC essential requirements by measuring against the harmonised standards according to the DoC issued by the manufacturer.

Actual situation for conducted and radiated emissions test:

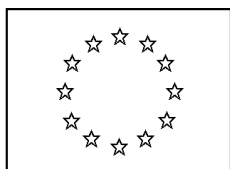
Harmonised standards under 2014/30/EU directive applicable for this Campaign:

EN 55011:2009 + EN 55011:2009/A1:2010 *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement*;

NOTE 1. The new edition of the standard EN 55011:2016 and amendments EN 55011:2016/A1:2017 + EN 55011:2016/A11:2020, became harmonised under EMCD only starting from 4 November 2020 by Commission implementing decision (EU) 2020/1630 of 3 November 2020. Therefore, this edition was not used as harmonised standard for the purposes of this Campaign.

EN 61000-6-3:2007 + EN 61000-6-3:2007/A1:2011 *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments*

There is not harmonised standard, which could also be applicable:



**EMC ADMINISTRATIVE
CO-OPERATION WORKING GROUP**
11th EMC Market Surveillance Campaign 2019



EN 62920:2017 + EN 62920:2017/A11:2020 *Photovoltaic power generating systems - EMC requirements and test methods for power conversion equipment*

For the purposes of the Campaign it is agreed to assess compliance with the EMC essential requirements (only emission, immunity aspects could be assessed on voluntary basis) by measuring against the appropriate standards according to the DoC issued by the manufacturer.

If DoC is not available for the EUT, then the assessment for the RF emissions should be done against the actual harmonised standards under 2014/30/EU directive.

MSA assessed:

1. Conducted disturbances, mains port, in the frequency range 0.15 to 30 MHz;
2. Conducted disturbances, DC port, in the frequency range 0.15 to 30 MHz;
3. Radiated disturbances in the frequency range 30 MHz to 1000 MHz.

To assist in achieving the maximum consistency of results between different testing laboratories and to simplify reporting procedures, products should be tested to the full and exact testing procedures of the appropriate parts of the relevant standards.

8. Administrative requirements

8.1. Checking for CE marking

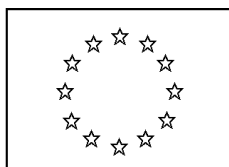
The EUT were checked for the presence and correctness of the CE marking.

8.2. Declarations of Conformity

MSA shall seek to obtain a copy of the DoC for the EUT checked. The results of the assessment and all standards used by manufacturer were filled in the EMC data input form. As the DoC and its content are important key elements for this Campaign, an entry “not checked” in the DoC section of the EMC data input form is not acceptable.

8.3. Technical Documentation

Technical documentation was assessed on voluntary basis. The relevant parts of the technical documentation of the acquired EUT were requested from the responsible economic operators. The results of the assessment were filled in the EMC data input form.



C. RESULTS

1. Number and origin of products

MSA had to report on the country where EUT has been manufactured; the information “Made in” present either on the EUT itself, on its packaging or on the accompanying documents and finally from the DoC (where available). The “country of origin” therefore refers not generally to the economic operator who is responsible for placing the product on the EU market.

A total of thirteen products were selected and evaluated, as follows:

| Table 1 – Number and origin of products | | |
|--|-------------------------------|---|
| Country of origin | Number of evaluated inverters | Level of compliance of assessed administrative and technical requirements during the campaign: number (%) |
| China | 9 | 1 |
| EU | 3 | 0 |
| All origins | 12 | 1 (8 %) |

Conclusion: the solar panel inverters were made mainly in China (75 %).

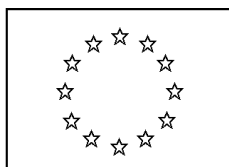
2. Administrative compliance

The EUT were assessed for the presence and format of CE marking, the availability and compliance of the DoC, and technical documentation.

| Table 2 – Compliance with administrative requirements | | |
|--|------------------|---------------|
| Number checked | Number compliant | Compliant (%) |
| 12 | 4 | 33 |

2.1 CE marking

All assessed EUT were CE marked, all but one fulfils the layout requirements, and all fulfil CE mark height (5 mm) requirement.



**EMC ADMINISTRATIVE
CO-OPERATION WORKING GROUP**
11th EMC Market Surveillance Campaign 2019



| Table 3 – Compliance with CE marking requirements | | | | |
|--|-----------------|-----------------------|----------------------------|--|
| Number EUT assessed | Missing CE mark | Fulfil CE mark layout | Fulfil CE mark 5 mm height | Overall CE marking compliance number (%) |
| 12 | 0 | 11 | 12 | 11 (92%) |

2.2 EC Declarations of Conformity (DoC)

MSA assessed 12 EUT against the DoC requirements. 1 DoC were not made available. From 11 DoC available, 5 DoC were found compliant.

4 DoC were issued in EU, 6 DoC were issued in China, and one in Israel.

| Table 4 – Compliance with DoC requirements | | | | |
|---|---------------|------------------------|---------------|------------------------------|
| Number of EUT assessed | DoC available | DoC not made available | DoC compliant | Overall DoC compliance (%) * |
| 12 | 11 | 1 | 5 | 42 |

* overall compliance of DoC (i.e. not made available = non compliant).

2.3 Technical documentation (TD)

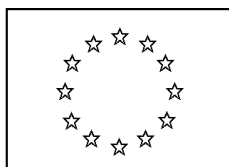
On voluntary basis MSA requested TD for 1 of the 12 EUT. This one was found to be non-compliant.

| Table 5 – Compliance with TD requirements | | |
|--|--------------|---------------------------|
| Number assessed | TD compliant | Overall TD compliance (%) |
| 1 | 0 | 0 |

2.4 Traceability Requirements

Manufacturers shall ensure that products which they have placed on the market bear a type, batch or serial number or other element allowing its identification. Manufacturers and importers (if manufacturer is not established in the EU) shall indicate, on the product, their name, registered trade name or registered trade mark and the postal address at which they can be contacted.

A total of 12 products were assessed, as follows.



| Table 6 – Compliance with traceability requirements | | |
|---|------------------|----------------|
| Requirement of traceability | Number compliant | Compliance (%) |
| Identification requirements (type designation) | 11 | 92 |
| Name of the manufacturer | 10 | 83 |
| Address of the manufacturer | 9 | 75 |
| Name of the importer | 4* | 58 |
| Address of the importer | 3 * | 50 |

* In 3 cases the information of importer was stated as not required (manufacturer is established within community).

3. Compliance with harmonised standards

3.1 Emissions requirements

The measured result was compared directly with the limit in the harmonised standard without taking into account the measurement uncertainty. A failure was recorded if any emission exceeded a certain limit when measured with the appropriate detector (i.e. quasi-peak and average) and under normal laboratory conditions

The compliance rate of the products tested for emissions was as follows:

| Table 7 – Compliance with the emissions requirements | | |
|--|------------------|-------------|
| Number tested | Number compliant | % compliant |
| 12 | 3 | 25 |

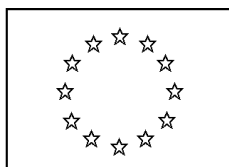
3.2 Immunity requirements

Immunity tests were not performed.

Other evaluations

4.1 DoC compliance vs. compliance with emissions requirements

EUT with a correct DoC had a better rate of technical compliance than those with not correct DoC.



**EMC ADMINISTRATIVE
CO-OPERATION WORKING GROUP**
11th EMC Market Surveillance Campaign 2019



| Table 8 – DoC compliance vs. compliance with emissions requirements | | | |
|--|---------------|--|----------------------------------|
| DoC | Number of DoC | Number of emissions compliant products | Emissions compliant products (%) |
| DoC not correct | 6 | 1 | 17 |
| DoC – not made available | 1 | 0 | 0 |
| DoC – available and correct | 5 | 2 | 40 |

5 Overview of findings

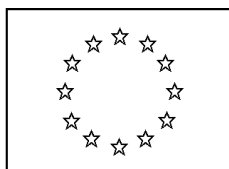
Comparison between MSC-EMC 11 (2019) and MSC-EMC 6 (2014) Campaigns

Table 10 summarises the overall compliance of EUT in terms of emissions and immunity against harmonised standards, overall administrative, CE marking and Declaration of Conformity requirements.

In Table 10 comparison is provided between overall findings of 6th EMC Market Surveillance Campaign in 2014 and this Campaign 2019 performed on Solar panel inverters.

| Table 9 – Overview and Comparison | | | | | | | |
|--|---------------|-----------------|------------------------|---|---|----------------|-----------|
| Campaign | MSA particip. | Number assessed | Overall compliance (%) | No issues found with disturbance emissions limits (%) | Administrative (assessed formal requirements) | | |
| | | | | | Overall administrative compliance (%) | CE Marking (%) | DoC (%) * |
| MSC-6 (2014) | 14 | 55 | 9 | 33 | 38 | 95 | 56 |
| MSC-11 (2019) | 6 | 12 | 8 | 25 | 33 | 92 | 42 |

* overall compliance of DoC (not made available = non compliant).



D. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

- The 11th EMC MSC showed the same low overall compliance results as 6th EMC MSC of 2014.
- Compliance to disturbance emissions limits was even worse as it was during 2014 campaign (25% of EUT compliant against 33%)
- The overall administrative compliance was almost the same level as it was during 2014 year Campaign (33% of EUT compliant against 38%)
- These results show that compliance of solar panel inverters in EU market with appropriate requirements of EMC Directive in the aspects of essential requirements and also administrative (formal) requirements seems does not improved after 5 years. The number of assessed products is low.
- Overall Compliance of apparatus in this Campaign 8% is very low. In general, the level of compliance with the administrative (33%) and technical requirements (25%) is considered as low.
- All EUT were found with CE mark, and 92% of assessed EUT were CE marked correctly.
- Only 42 % of the DoC provided were correct. In one case DoC were not made available to authorities.
- The use of ICSMS for sampling EUT was very helpful.
- The resource in conducting this type of campaign is significant. Activities including preparation (eg. drafting its Code of practice), coordination, tests and analysis of the results and the drafting of the report are carried out by EMC ADCO members supplemental to their national activities.

2. Recommendations

It is recommended that:

- The results of the campaign should be publicised widely throughout Europe. Publicity should target all economic operators in the area of solar photovoltaic modules industry.
- MSA should take the results of this campaign into consideration when making their plans as stated in the Regulation (EU) 2019/1020 of the European Parliament and of the Council of 20 June 2019 on market surveillance and compliance of products.
- The results of this campaign should be forwarded to the European Standardisation bodies in order to take into account in the development of the future EMC standards for the solar panel inverters.
- MSA who did not participate should be encouraged to join in future campaigns. Regulation (EU) 2019/1020 in Chapter VI and other articles promotes this type of cooperation and actions between MSA.
- MSA should use ICSMS in the future campaigns for sampling and exchange of information.
- Market surveillance actions for solar panel inverters should be continued.