



MALTA COMMUNICATIONS AUTHORITY


# Electromagnetic Field (EMF) measurements in carriage ways around the towns and villages across the Islands of Malta and Gozo

**EMF Monitoring Programme - Nationwide Wideband EMF Measurement Program**

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## Disclaimer

The presentation of the material in this publication includes the EMF measurements as present at the time of the measurement activity, as well as the interpolation of the EMF measurements to cover the entire geographic areas of the Maltese Islands.

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## Executive Summary

The Malta Communications Authority (MCA) is the national regulatory authority responsible for electronic communication networks and services. One of its tasks is to ensure that the levels of non-ionising radiation emanating from radio transmitting apparatus are within the predefined levels. These levels are determined by the relevant competent authorities and refer to those published in the Guidelines of ICNIRP, the International Commission on Non-Ionising Radiation Protection.

The 2020 nationwide wideband electromagnetic field (EMF) measurement campaign proved to be beneficial for the MCA in carrying out its regulatory tasks. Hence, in 2022, as part of its EMF monitoring programme, the Authority engaged itself in conducting a similar measurement exercise. The latter had a two-fold scope. It helped to assess the compliance of newly deployed 5G radio transmitting apparatus and ensure that they were aligned with EMF regulatory obligations. In addition, it served to assure the general public that EMF levels in accessible areas, including those from 5G installations, are within the safe EMF reference limits as applicable at law. Indeed, the measured EMF emission levels in publicly accessible areas were very low (a Total Power Exposure Quotient [TEQ<sub>s</sub>] mean value less than 1%) when compared to the safe EMF reference levels currently in force.

Throughout the years, the MCA has undertaken a number of compliance activities with the intent of enforcing all obligations related to EMF emissions. Following the introduction of 5G technologies (5G DSS and 5G NSA), the MCA further re-iterated the need for nationwide wideband EMF measurements. Consequently, such practices have been incorporated within the Authority's EMF measurement portfolio, thus ensuring that they are periodically repeated in the future. Moreover, the MCA will be investigating alternative means of enhancing the analysis attained from the respective measurement campaigns.

## The Results

- In total, three hundred and sixty thousand (360,000) real-time EMF measurements were carried out across two thousand and five hundred kilometres (2500 Km) of carriage ways across the Maltese Islands. The resulting EMF levels were, in general, found to be within a small percentage of the EMF reference level for exposure to the general public as defined in the ICNIRP Guidelines.

Almost all real-time EMF measurements were recorded at well below 1% of the ICNIRP Guidelines reference exposure limit for the general public. The mean EMF exposure levels (TEQ<sub>s</sub>) recorded were 0.102% in Malta, and, 0.04% in Gozo. The highest EMF levels TEQ<sub>s</sub>, observed at specific points in time, were 15.8% in Malta and 3.18% in Gozo.

- The EMF levels (TEQ<sub>s</sub>) for 75% of the real-time EMF measurements (third inter quartile) were below 0.087% (Malta) and 0.033% (Gozo) of the ICNIRP Guidelines reference exposure limit for the general public.
- No significant increase in EMF emissions were noted across the Maltese islands when compared to the 2020 EMF levels. This adherence is even more noteworthy when considering the fact that the number of mobile subscriptions has increased since 2020, and mobile data usage has sky-rocketed since this same year too. Similar results were also recorded in those areas where 5G NSA and 5G DSS technologies were deployed in the year following the 2020 campaign.
- The measurements were taken in publicly accessible carriage ways across the towns and villages of Malta and Gozo. Furthermore, in converse to the 2020 measurement campaign, the 2022 one also included publicly accessible areas. The objective was to demonstrate that the public exposure levels, attributed to emissions from radio transmitting apparatus, were well within the EMF reference level for exposure to the general public (as established in the ICNIRP Guidelines).

## Background

The MCA is responsible for ensuring compliance of radio transmitting apparatus with the legally established EMF limits. To this effect, the Authority undertakes a range of compliance activities.

At present, the MCA's EMF Monitoring Portfolio includes in-situ EMF audits at pre-set test points around the Maltese islands (predefined EMF Audits) together with nationwide wideband EMF measurements, and EMF audits in specific locations following requests by the general public.

These activities provide better assurance to the general public. They also address associated concerns frequently arising from people's lack of knowledge on EMF emissions and exposure levels.

In 2020, the Authority took the initiative and conducted a wideband EMF audit, at street level, in most of the carriage and pathways found in Malta and Gozo. The resulting outcome was both interesting and fruitful to the MCA. Therefore, in 2022, the MCA repeated the measurement campaign. This second round of audits aimed to further warrant the compliance of the radio transmitting apparatus to their EMF obligations particularly due to the fact that in the interim audit period mobile service providers had also commenced to offer 5G technology services. No significant issues were observed. Both the 2020 and the 2022 measurement campaign ensued EMF exposure limits to the general public well within those prescribed at law.

The audits focused on real-time, EMF radiation levels stemming from the radio transmitting apparatus active during the time of this measurement activity. The 2022 campaign included transmissions from mobile base stations<sup>1</sup>, radio and TV broadcast, PMR and radars amongst other sources.

This report highlights the salient points concluded from the 2022 EMF measurement campaign. The latter was carried out within a year time window; between the months of June 2022 and June 2023.

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<sup>1</sup> At the time of the audit, mobile communication services encompassed 2G, 3G and 4G+, 5G DSS and 5G NSA services.

## Sampling and Measurement Methodology

The wideband EMF measurements were taken along approximately two thousand and five hundred kilometres (2500 km) of carriageways and pathways. The measurement sample consisted of more than three hundred and sixty thousand (360,000) real time measurements (a total of three hundred and seventeen thousand (317,016) measurements in Malta and forty three thousand (43,094) measurements in Gozo). Every measurement covered the level of EMF present within the frequency range 100 KHz to 7 GHz.

The nationwide wideband EMF measurement program was conducted in accordance with the ITU-T K.113 Recommendation and the IEC 62232 Standard.

Recommendation ITU-T K.113 provides guidance on how to make radio-frequency electromagnetic field (RF-EMF) maps for assessing existing exposure levels over large areas of cities or territories and for an appropriate public disclosure of the results, in a simple and understandable way.

The drive test measurement method was adopted as the model for measurement. This method is described in Section 6.1 of the ITU-T K.113 Recommendation. The drive test method entails the continuous collection of the cumulative E-Field strength values in Volts per metre (V/m) from a moving vehicle. It requires the installation of measuring instruments equipped with a global positioning system on a vehicle. Measurements are completed within a distance of 5m for urban areas and within 10m for non-urban areas.

The movement of the vehicle does not permit measurements to be taken over an average time, as recommended by the ICNIRP 2020 Guidelines and IEC Standards. It, however, gives an approximation of the RF-EMF levels over large areas that otherwise would be impossible to cover. To overcome this limitation, static measurements were taken as reference to ensure that the order of magnitude of the static and in-motion measurements were similar.

Measurements were taken using a Narda AMB – 8059 Multi-band EMF area monitor. This instrument is equipped with a calibrated wide band measurement probe (Narda EP-1B-03) covering the radio frequency spectrum range 100KHz to 7GHz - the radio frequency spectrum band in which all radio transmitting equipment deployed in Malta operates in. The measurement equipment provided an overall E Field exposure level in V/m. The total EMF exposure level may then be expressed as a relative value in terms of percentage of the permitted reference levels established in the 2020 ICNIRP Guidelines<sup>2</sup>.

The recorded EMF exposure levels reflect the emissions of the combined signals present at the measurement location at that point in time. These values may not characterise the maximum EMF levels from the radio transmitting sources present in the vicinity.

All EMF measurements were taken during daylight hours.

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<sup>2</sup> All values of EMF exposure as measured by the MCA are relative to the lowest permitted reference levels for EMF exposure at 27.7V/m or 2W/m<sup>2</sup> as identified in Table 5 of the ICNIRP Guidelines - <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf>

## Measurement Results

This section provides a summary of the EMF measurements collated during the nationwide drive tests. The full set of the real-time EMF measurement data is made available to the public as open data on the MCA website.

<b>Table 1 – Overview of the nationwide EMF measurement Campaign 2022</b>	<b>Malta</b>	<b>Gozo</b>
<b>Total number of real-time measurements</b>	317,016	43,094
<b>Distance covered in km</b>	2220 km	350 km
<b>Mean EMF measured value in V/m</b>	0.62 V/m	0.35 V/m
<b>Median EMF measured value in V/m</b>	0.5 V/m	0.29 V/m
<b>Maximum EMF value registered in V/m</b>	11.14 V/m	5.0 V/m
<b>Q1 for EMF values at V/m</b>	0.22V/m	~ 0 V/m
<b>Q3 for EMF values at V/m</b>	0.83V/m	0.51 V/m
<b>Mean EMF exposure level as a % of ICNIRP Guidelines (TEQ<sub>s</sub>)</b>	0.102%	0.038%
<b>Median EMF exposure level as a % of ICNIRP Guidelines (TEQ<sub>s</sub>)</b>	0.031%	0.011%
<b>Maximum EMF exposure level as a % of ICNIRP Guidelines (TEQ<sub>s</sub>)</b>	15.8%	3.18%
<b>Q1 for EMF exposure level as a % of ICNIRP Guidelines (TEQ<sub>s</sub>)</b>	0.006%	0%
<b>Q3 for EMF exposure level as a % of ICNIRP Guidelines (TEQ<sub>s</sub>)</b>	0.087%	0.033%

Note 1 -The EMF exposure levels reported above are relative to the ICNIRP lowest public exposure limit of 2 W/m<sup>2</sup>

Note 2 - The results depicted in the table are based on the real-time EMF measurements



# EMF Exposure Levels

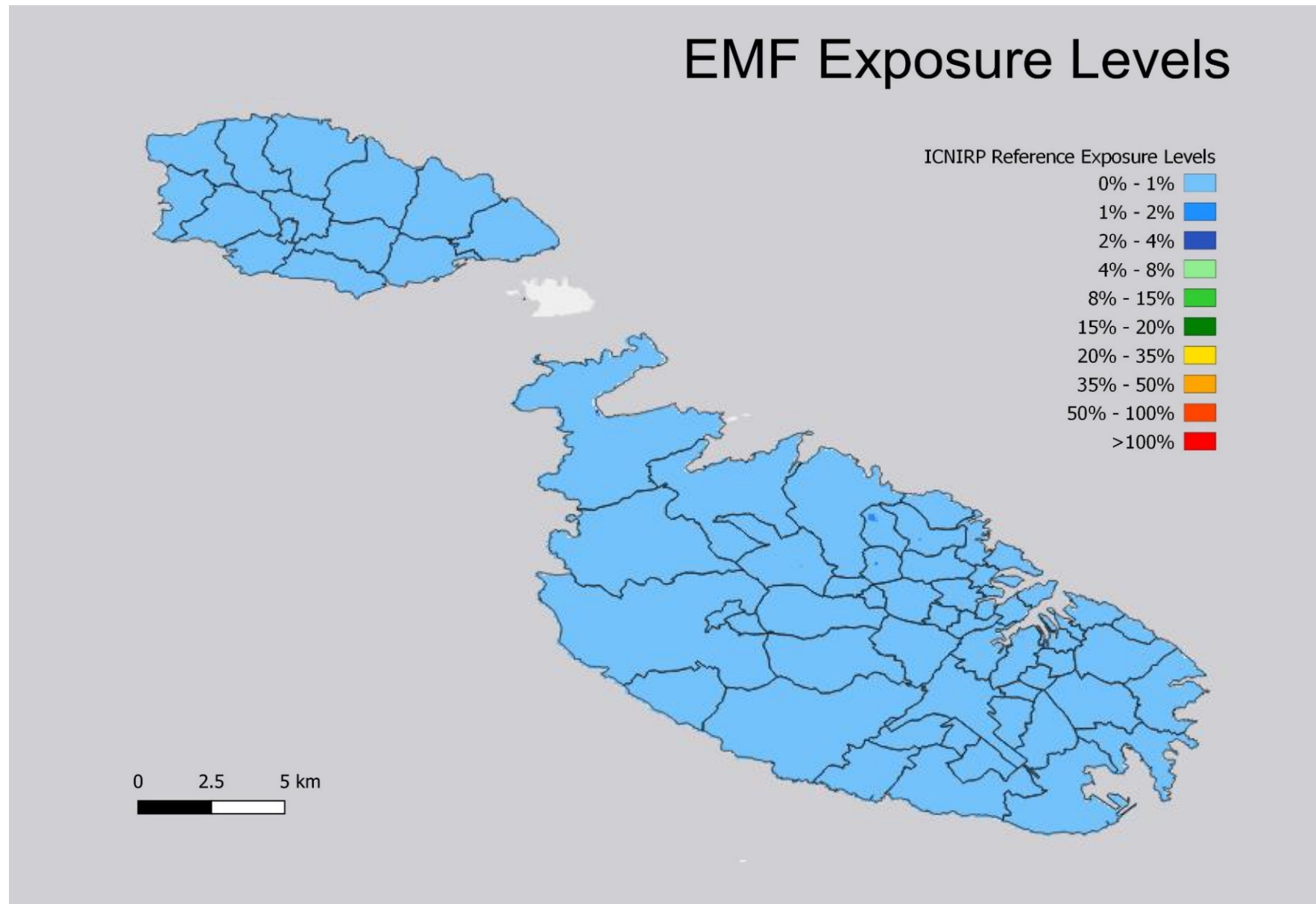


Figure 1: EMF Exposure Levels (TEQ<sub>s</sub>) relative to the ICNIRP lowest public exposure limit of 2W/m<sup>2</sup>

# E Field Exposure Level (V/m)

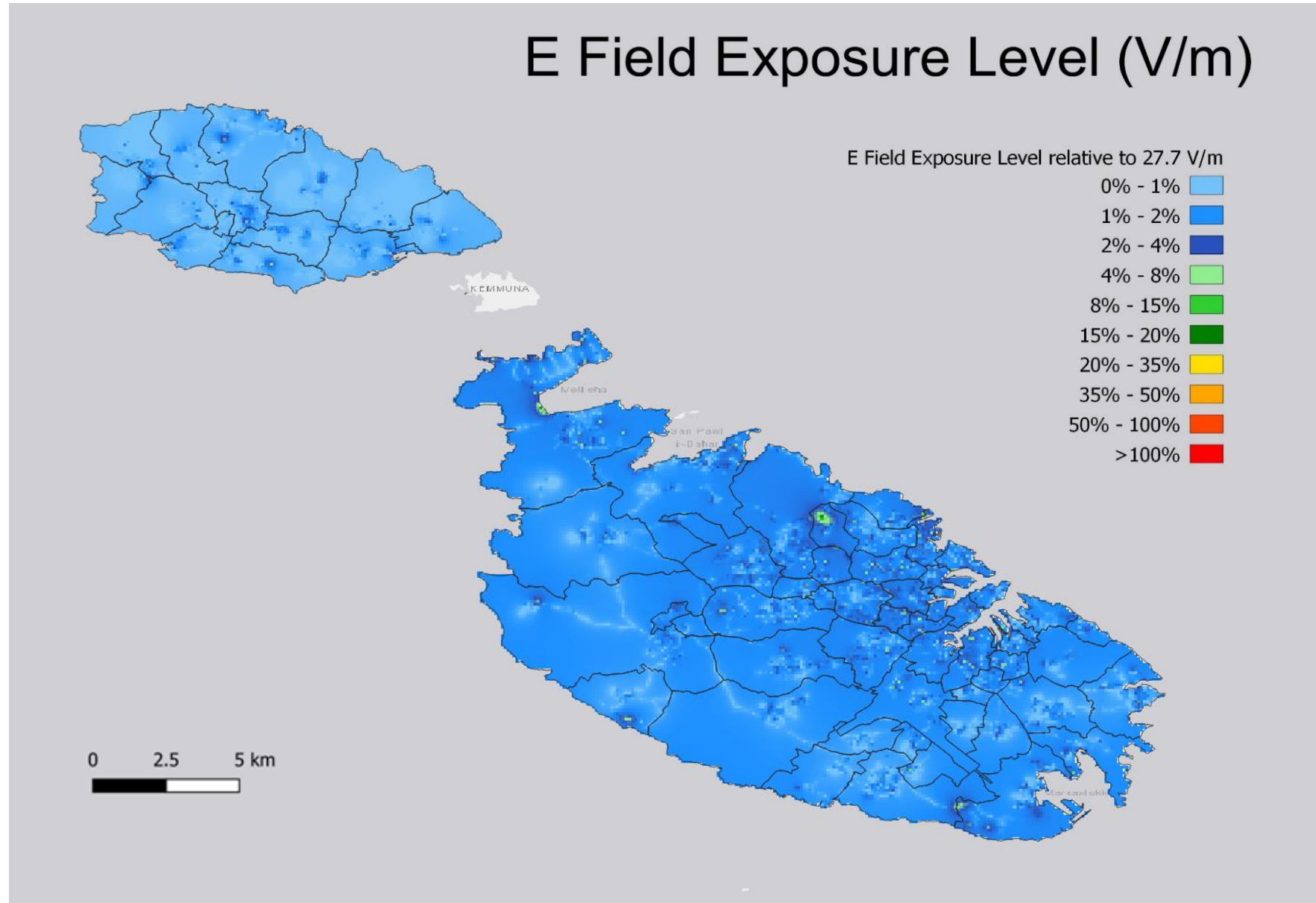


Figure 2: EMF Exposure Levels (TEQ<sub>E</sub>) relative to the ICNIRP lowest public exposure limit of 27.7 V/m

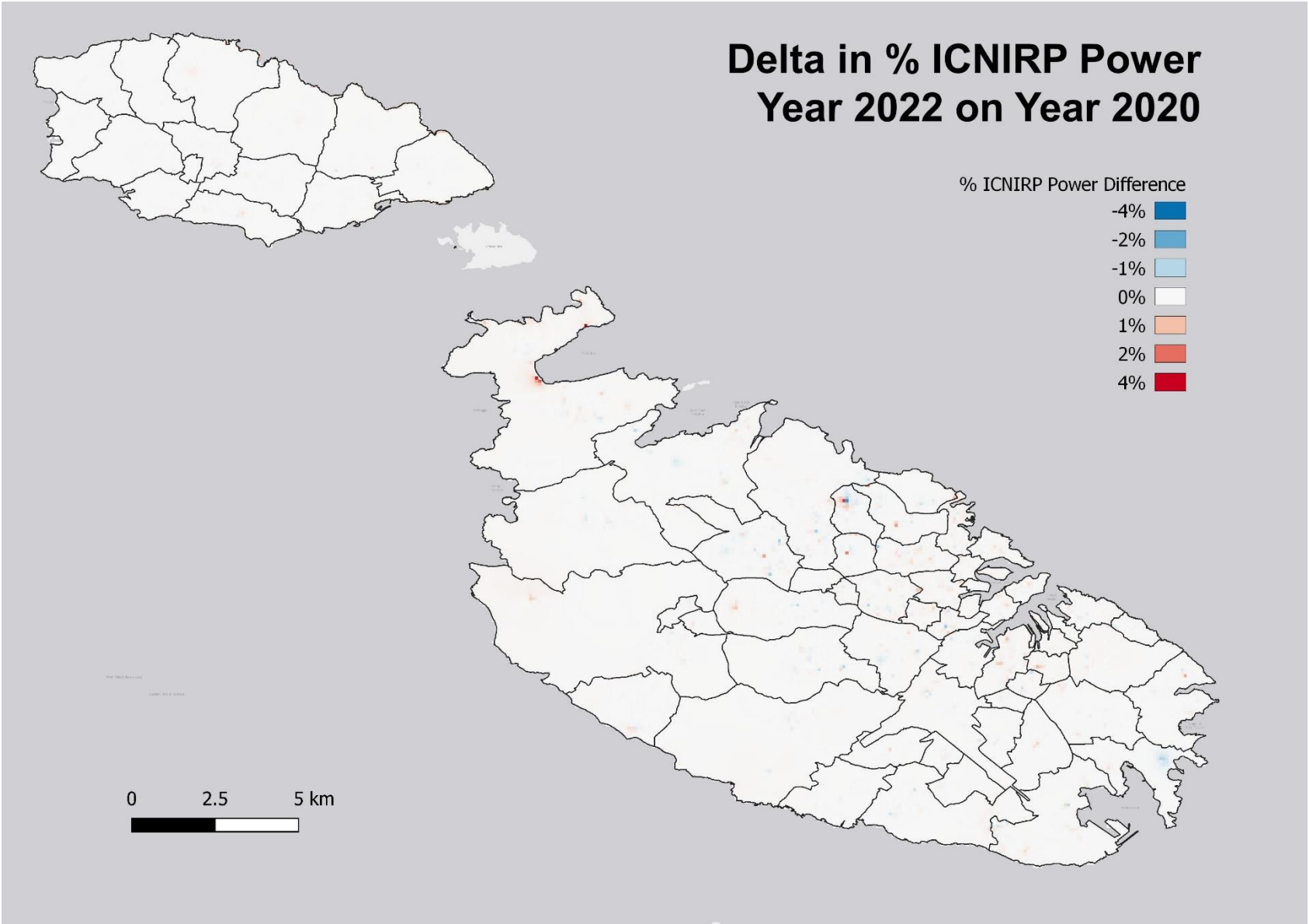


Figure 3: Delta in % ICNIRP Power – Year 2022 on Year 2020

## Summary of the Measurement Results

As illustrated in Table 1 above, the vast majority of the measured EMF levels are less than 1% of the lowest reference exposure level (as identified in the ICNIRP Guidelines). These last reference exposure levels vary according to the radio transmission frequency: 27.7V/m or 2W/m<sup>2</sup> for radio transmission at frequencies between 30MHz to 400MHz (used primarily for radio broadcasting) and up to 61V/m or 10W/m<sup>2</sup> for radio transmissions at frequencies above 400MHz (used primarily for TV broadcasting and mobile services).

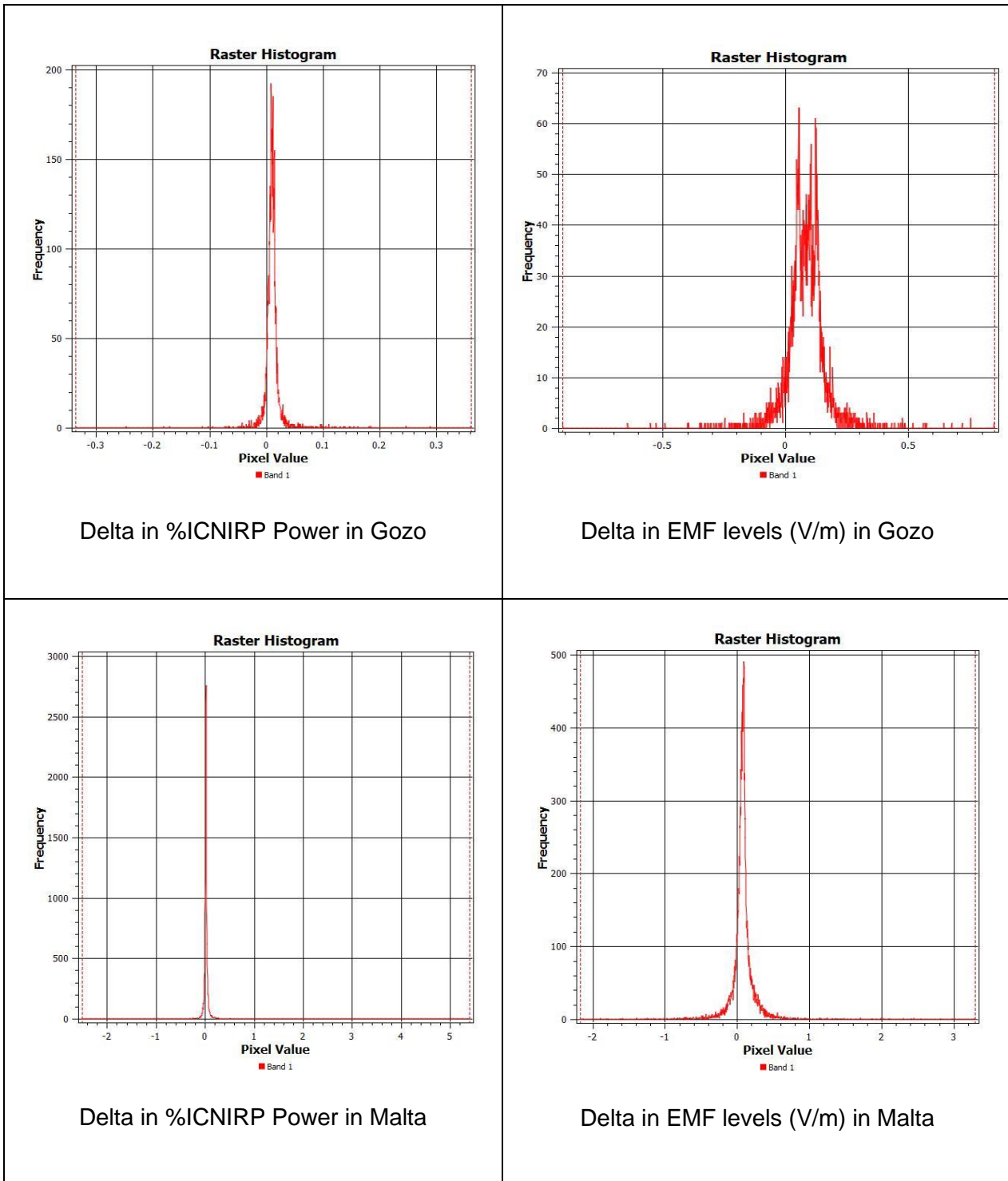
75% of the real-time EMF measurements fall below 0.087% (Malta) and 0.033% (Gozo) of the ICNIRP reference exposure level of 2W/m<sup>2</sup>. This leads to a calculated mean EMF exposure level of 0.102% (Malta) and 0.04% (Gozo) of the ICNIRP reference exposure level of 2W/m<sup>2</sup>. The highest EMF level recorded at a specific point was 15.8% (Malta) and 3.18% (Gozo) of the ICNIRP reference exposure level of 2W/m<sup>2</sup>. These EMF levels were, however, detected close to high power radio and TV broadcasting transmitters, aircraft ground radar and low-lying mobile radio base station.

A total of 361,010 real-time EMF measurements covering 2,500km of carriage ways in Malta and Gozo provided an appropriate measurement sample. To predict the EMF exposure levels across the entire geographic area of the Islands of Malta and Gozo, the measurement sample was extrapolated using the Inverse Distance Weighting extrapolation technique. This algorithm was selected since it reflects the propagation characteristics of electromagnetic waves. Figure 1 above depicts the extrapolated EMF exposure levels in W/m<sup>2</sup>. The extrapolated EMF exposure levels are below 1% of the ICNIRP reference exposure level of 2W/m<sup>2</sup> albeit for the areas in close proximity to high power radio or TV broadcasting stations, aircraft ground radar or mobile base stations installed relatively low to street level. Figure 2 above summarises the extrapolated E Field real-time measurements. These measurements are below 20% of the ICNIRP reference exposure level of 27.7 V/m, with the majority of the extrapolated E Field exposure levels well within 2% of the ICNIRP reference exposure level of 27.7 V/m. Figure 3, in turn, shows the percentage change in ICNIRP Power between the year 2022 and 2020. Except for two particular points in Malta, the change in power is negligible. A decrease in % of ICNIRP Power is observed in the southern tip of Malta. This is mainly due to the switch off of some DTTV channels in Marsaxlokk. In contrast, an increase in % of ICNIRP Power is noted in the northern tip of Malta. This increase is mainly due to the installation of low-lying mobile radio base stations.

One interesting result worth emphasizing is that, although nationwide rollout of 5G technology had been accomplished by one of the MNOs, at the time of measurement, no significant increase in EMF exposure was witnessed. This is clearly illustrated in Figure 3. The frequency distribution of the delta in % ICNIRP Power distribution referenced in Figure 3 is represented in Annex 1.

**The nationwide wideband EMF measurement campaign for 2022 therefore reconfirms and provides the assurance that the EMF public exposure levels at street level are well within the EMF reference level for exposure to the general public as established in the ICNIRP Guidelines. As a result any incremental emissions from new deployments of radio transmitting apparatus is unlikely to expose the general public to levels of EMF which are higher than the ICNIRP reference exposure levels for the general public**

# Annex 1 – Delta in EMF exposure Year 2022 on Year 2020







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