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## **ANNEXURE C10**

### **SPECIALIST ASSESSMENTS**

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- MESA RFI & EMI Test Report



THE SCIENCE OF MEASUREMENT

## Technical Report

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### *EMI Characterisation of 75 MW [REDACTED] PV Plant*

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Prepared for: [REDACTED]



[REDACTED]

by

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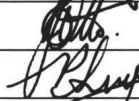

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## Document Approval

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## Document History

| Revision | Date of Issue | Comments                                      |
|----------|---------------|---|
| DRAFT    | 28 March 2014 | Draft Report                                  |
| 0        | 31 March 2014 | Final Technical Report #MUL/14/03/28/REP      |
| 1        | 24 April 2014 | Refinement of Statements in Executive Summary |
|          |               |   |

## Company Details

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## Executive Summary

MESA Solutions was asked by Mulilo Renewable Energy to characterise the 75 MW [REDACTED] photo-voltaic (PV) plant near De Aar in the Northern Cape.

The main conducted measurement findings are:

- TD conducted measurements on various cables in the “ON” mode of operation show the majority of the energy below 50 MHz.
- Equivalent FD measurements agree.
- Additional traces at 90 MHz to 100 MHz, as well as 170 MHz to 230 MHz are observed in FD. These are believed to be background noise (confirmed by radiated measurement results).
- Majority of the noise is shown to be in the vicinity of the inverter and the control circuitry (also confirmed with the radiated measurements).
- Switching of either the AC or DC breakers during the “ON” mode results in high amplitude, fast rising pulses that creates broadband interference.
- Switching of the breakers from the “ON” to “STANDBY” mode (or vice versa) will be less severe as there is no power generation or high current flow.
- Conducted measurements were made on the earth cable of the electric fence surrounding the PV plant. The majority of the energy is between 30 and 50 MHz.

The main radiated measurement findings are:

- Radiated results close to the inverters and transformers show measureable broadband interference across the band in both polarisations.
- The highest levels measured at a 1 m distance from the inverter when the system is on are: Vertical Pol 48.09 dB $\mu$ V/m @ 469 MHz, Horizontal Pol 52.91 dB $\mu$ V/m @ 457 MHz.
- For the system in standby mode the levels are: Vertical Pol 46.8 dB $\mu$ V/m @ 469 MHz, Horizontal Pol 47.42 dB $\mu$ V/m @ 457 MHz. An overall decrease in amplitude levels are seen when moving to 10 m.
- Multi-path destructive/constructive interference effects due to the surrounding conductive environment inside the plant are suspected to influence the decrease of measured interference from the inverters.
- Comparisons between “ON” and “STANDBY” modes of operation show a reduction in interference below 60 MHz.
- No significant differences in the higher frequency bands are observed suggesting the system is not completely off.
- Measurements at distances of 10 m, 30 m and 100 m around the perimeter of the plant indicates that all measureable interference drops below the noise floor of the measurement system. This is confirmed by the TD data as the amplitudes and corresponding frequency spectra at 30 m and 100 m remain similar

Radiated levels, particularly for horizontal polarisation, exceed the CISPR 22 Class B reference limit at 10 m from the inverters and transformers by between 3 dB and 9 dB above 230 MHz. Further propagation studies will have to be done by SKA-SA to determine the potential impact of these levels on the nearest SKA radio telescopes. Mitigation measures, such as EMC hardening of inverter and transformer cabinets, can be recommended if required.

Measurements were made on an earth cable of the electric fence surrounding the plant. Time domain results show levels reaching 300 mV with most of the frequency content between 30 MHz and 50 MHz. The FFT frequency spectrum shows the peak to exceed the CISPR 22 Class B equivalent current limit of 14 dB $\mu$ A by 66 dB but it is below the 70 MHz lower limit of SKA. While this could be a potential source of interference, it is self-defined.