

KIE 3003 INDUSTRIAL TRAINING

SEMESTER 3 SESSION 2021/2022

INDUSTRIAL TRAINING REPORT

**NAME :** WEE GIM FUNG

**MATRIC NUMBER :** 17204859/1

**COMPANY NAME :** TEXAS INSTRUMENTS ELECTRONICS MALAYSIA

**COMPANY ADDRESS :** TEXAS INSTRUMENTS ELECTRONICS

MALAYSIA SDN BHD 197101001165 (11523-W) BATU BERENDAM FREE TRADE ZONE 75350 MELAKA, MALAYSIA

**TRAINING PERIOD :** 25th JULY 2022 – 7th OCTOBER 2022

**FACULTY SUPERVISOR :** DR. WONG WEI RU

**INDUSTRIAL TRAINING DECLARATION FORM**

I, **Wee Gim Fung** (Name of the student) **17204859/1** (Matric No.) hereby declare that I have undergone my 10 weeks of industrial training for the requirement of the subject KIA 3008 INDUSTRIAL TRAINING (5 credit hours) in the company under the supervision of ~~Ir/Engr~~/Mr/~~Ms/Mrs.~~ **Tey Fu Hao** during the period as mentioned below.

The log book and the final industrial training report were prepared by me and duly supervised by my Supervisor during the course of training. The work presented in this report is my own, and has not been submitted previously in whole or in part, to qualify for any other academic award.

Company Name and Address: **Texas Instruments Electronics Malaysia Sdn Bhd**

**Texas Instruments Electronics Malaysia Sdn Bhd 197101001165 (11523-W) Batu Berendam Free Trade Zone 75350 Melaka, Malaysia**

**Tel: 06-251 5100 Fax: 06-231 3040**

Dates of Training: **25/7/2022 – 7/10/2022**

Supervisor’s Name: **Mr. Tey Fu Hao**

Student Signature:

Full Name: **Wee Gim Fung**

NRIC No.: **001129-04-0295**

Matric No.: **17204859/1**

This is to confirm that I have read the report and that the information enclosed is correct and contains no confidential information.

Supervisor’s Signature (Industrial): Name: **Tey Fu Hao**

Date: **7/10/2022**

Company Stamp:

**ACKNOWLEDGEMENT**

It was definitely a good experience having this industrial training which had exposed me to the real environment of industry while learning a lot of technical and soft skills. Hereby, I would like to express my gratitude to those who had given me opportunities and guidance.

First and foremost, I would like to thank to Universiti Malaya for giving us this golden opportunity to work in industry as an intern so that we can know how the industry is operating, although it was just a mere 3 months training. Thanks to Texas Instruments Electronics Malaysia (TIEM) as well for giving me a chance to have my industrial training at its place to fulfil the requirement of the syllabus to have this internship. This experience will surely benefit me in the future career path.

Next, I would like to thank my industrial mentors, Mr. Devan, the electrical and fire protection engineer, and Mr. Zafri, the control engineer in TIEM, for their selfless sharing of knowledge and also career insights to me. Thanks for all the inputs from them and their patience in guiding me along the way to grow my potential as an electrical engineer. Also, my industrial supervisor, Mr. Tey Fu Hao, the engineering manager in TIEM, for all the advices and experience he has shared with me.

Finally, I would like to thank our internship coordinator, Dr. Nurulafiqah Nadzirah Binti Mansor for updating us with all industrial training information from time to time and giving us a lot of encouragement and motivation along the internship. Without her, our internship would not run smoothly.

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**ABSTRACTS**

All students of Bachelor of Electrical Engineering in University of Malaya are compulsory to go through minimum 10 weeks of industrial training as required by Engineering Accreditation Council Malaysia (EAC). During the period, each student is assigned to an industrial supervisor from the company and a faculty supervisor. They will guide and evaluate the performance of the student.

I had my industrial training at a semiconductor company, Texas Instruments Electronics Malaysia, which is a multinational semiconductor company based in Dallas, Texas. I was placed in Facilities Engineering department, which will be in charged of upgrading all the utilities to support for greater output capacity, more advanced technology with more functions and safety measures, enhanced reliability, automation and higher efficiency that could generate cost savings. For the 11 weeks duration, I was placed under electrical engineer and control system engineer as they are both related to my course of study. The projects I have been involved in were:

* Data Center Reliability Upgrade and Consolidation
* Switchgear Upgrade for 11kV SS1
* Rh & Temp Wireless Sensors Installation
* Panel Rectification

Throughout my internship, I have learnt a lot in power system protection & distribution, power calculation, SCADA system and Control system, which are very applicable and useful when I apply for job after I have completed my degree. This report is divided into few parts as below:

1. Introduction to company
2. Job description on what I usually do
3. Project details
4. Summary of my experience
5. Reflection on how I achieved all the CLO’s

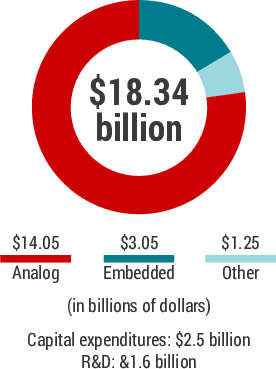
# Chapter 1: Introduction



*Figure 1 Texas Instruments Electronics Malaysia*

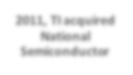
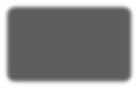
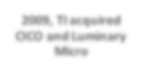
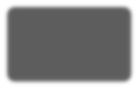
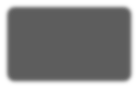
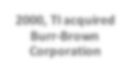
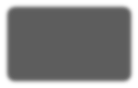
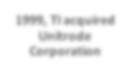
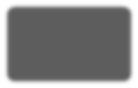
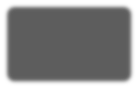
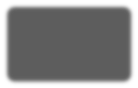
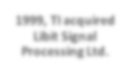
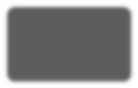
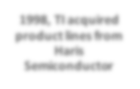
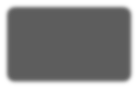
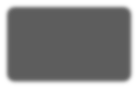
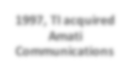
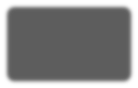
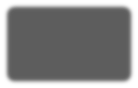
Texas Instruments (TI) is a global semiconductor company that designs, manufactures, tests and sells analog and embedded processing chips, with a passion to create a better world by making electronics more affordable through semiconductors. TI is the pioneer in the transition of the world from vacuum tubes to transistors and then to integrated circuits (ICs) – and they have been advancing IC technology and the ability to reliably produce ICs in high volumes for decades. Each generation of innovation builds upon the last to make technology smaller, more efficient, more reliable and more affordable – making it possible for semiconductors to go into electronics everywhere. TI’s approximately 80,000 products help over 100,000 customers efficiently manage power, accurately sense and transmit data and provide the core control or processing in their designs, going into markets such as industrial, automotive, personal electronics, communications equipment and enterprise systems. Aside from these, TI also produces Digital Light Processing technology and education technology products including calculators, microcontrollers and multi-core processors.

Texas Instruments emerged in 1951 after a reorganization of [Geophysical](https://en.wikipedia.org/wiki/Geophysical_Service_Incorporated) [Service Incorporated,](https://en.wikipedia.org/wiki/Geophysical_Service_Incorporated) a company founded in 1930 that manufactured equipment for use in the seismic industry, as well as defense electronics. The headquarter of TI is located at Dallas,Texas, with 15 manufacturing sites worldwide, including 11 wafer fabs, 7 assembly and test factories and multiple bump and probe facilities. As of 2021, the total number of employees has come to nearly 31,000 across the globe. The total revenue for 2021 was $18.34 billion, with larger portion of it generating from analog products as shown in the figure 2. Viewing from the revenue by markets pie chart, Industrial, Automotive and Personal Electronics hold a significant portion in the revenue as compared to the other markets. TI has been considered as one of the top 10 semiconductor companies worldwide based on sales volume and they have been holding 45,000 patents worldwide as of 2016.



*Figure 2 Total Revenue and Market Share of TI*

Following is the roadmap of acquisitions by TI to expand the structure of their company in order to achieve their ambitions.



**1996, TI acquired**

**Tartan**

**1999, TI acquired**

**Unitrode**

**Corporation**

**2000, TI acquired**

**Burr-Brown**

**Corporation**

**1997, TI acquired**

**Amati**

**Communications**

**1999, TI acquired**

**Telogy NEtworks**

**2006, TI acquired**

**Chipcon**

**1998, TI acquired**

**GO DSP**

**1999, TI acquire**

**Butterfly VLSI Ltd.**

**2009, TI acquired**

**CICO and Luminary**

**Micro**

**1998, TI acquired**

**product lines from Haris Semiconductor**

**1999, TI acquired**

**Libit Signal**

**Processing Ltd.**

**2011, TI acquired**

**National**

**Semiconductor**

*Figure 3 TI expansion roadmap*

Over the years, TI has been playing its role as a corporate citizen. There has been more than $400 million in philanthropic giving since 2010, including TI Foundation grants, matching gifts and in-kind donations. On top of that, TI has also been recognized as one of the best places to work as follows:

* Recognized by *WayUp* as a *Top 100 Internship Program*
* Recognized by *Glassdoor* as one of the *Best Places to Work in 2022*
* Recognized by *Barron's* as one of the *Top 100 Most Sustainable Companies* for 2022
* Recognized by the *Human Rights Campaign Foundation* as one of the *Best Places to Work in 2022 for LGBTQ+ Equality*

In order to continue building a stronger and greater company, TI introduced a special culture to thrive for the long term, and that is what they refer as ‘Living Our Values’ that basically symbolizes how they operate daily. The ambitions planted in each of the employee through the special culture functions as a strong moral support to strive the effort of making the company greater than ever, and they are:

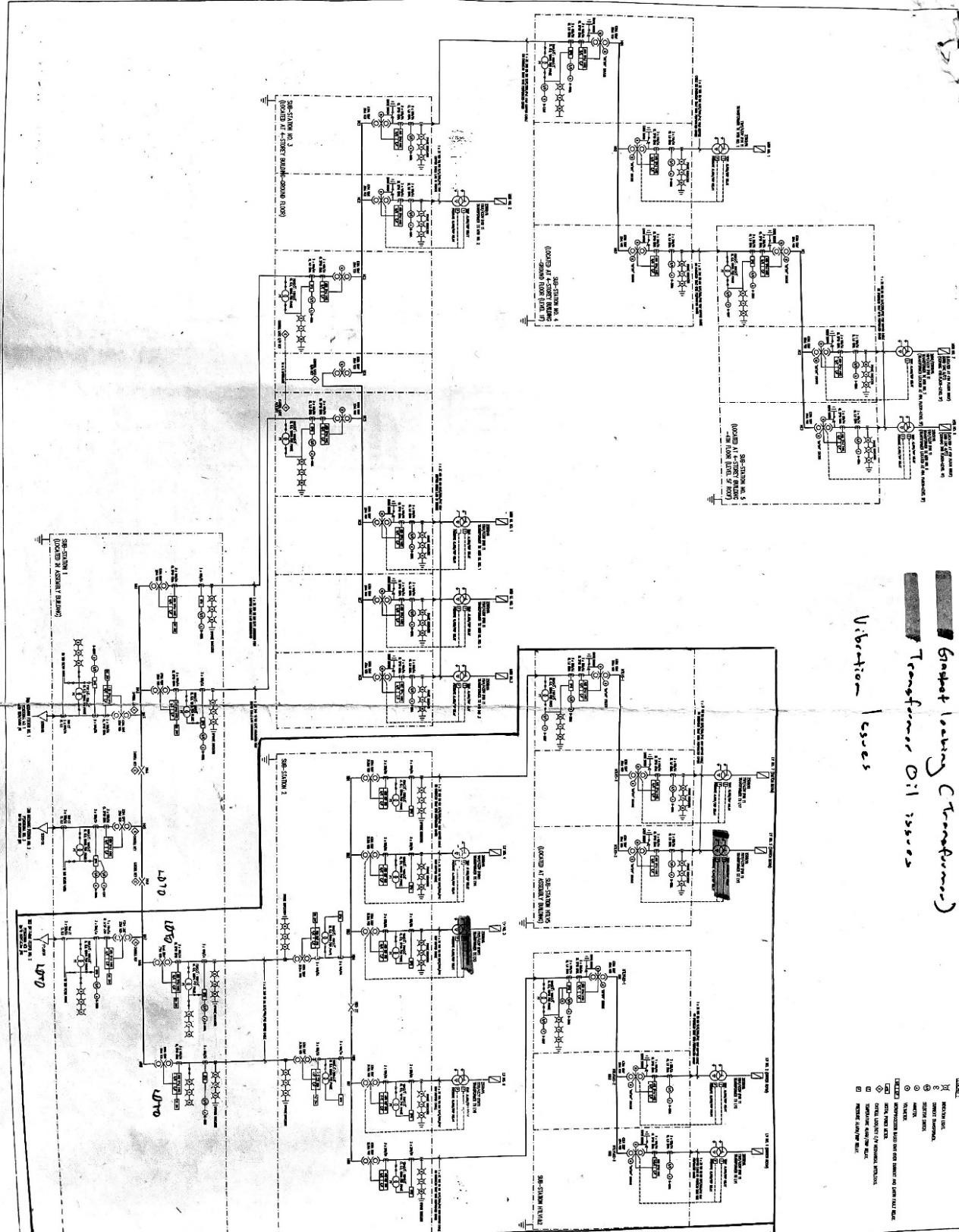
* We will act like owners who will own the company for decades.
* We will adapt and succeed in a world that is ever-changing.
* We will be a company that we’re personally proud to be a part of and would want as our neighbor.

The five values (Trustworthy, Inclusive, Innovative, Competitive, Result- oriented) delivered to each of the employee has definitely helped the team to emerge stronger and improve continuously. Act with integrity and react in socially responsible way, respect each other, encourage thoughts and ideas, curious, persistent and determined to overcome barriers, and attract, develop and retain the best people have been the up-hold values by each of the employee, from the management down to every engineer.

# Chapter 2: Job Description

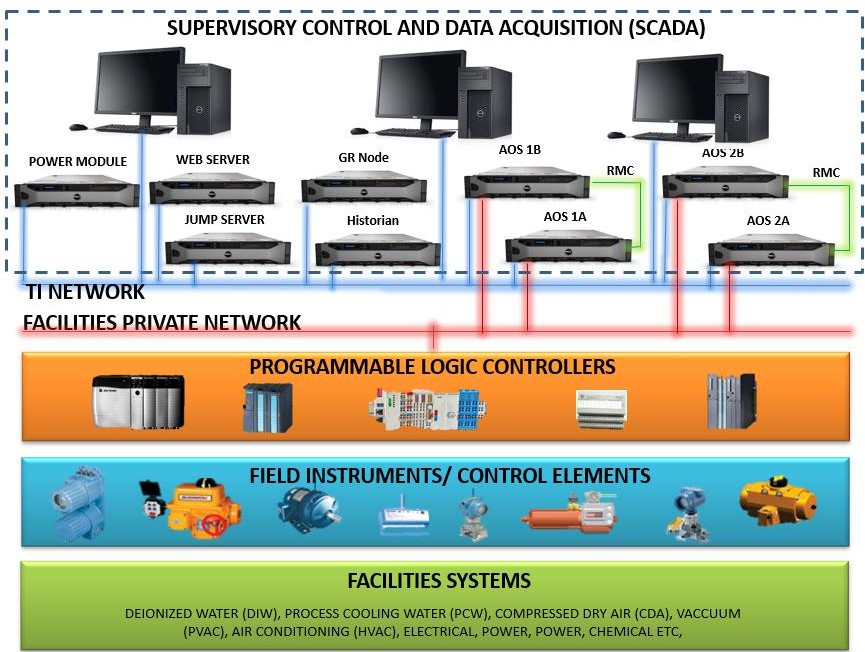
The position offered for my internship here is Facilities Engineering. Throughout my internship, I have been working with Electrical System and Control System.

The first thing I did was to understand the overall power distribution system in Texas Instruments Electronics Malaysia (TIEM). Since this is an Assembly and Test site, the buildings are separated and so for the power distribution. We have 3 incoming 11kV feeders from the TNB, going into our Sub-Station 1(SS1), the main distributor room. After that, incoming feeder #1 will go to our SS2, which is the distributing station for our Assembly building and incoming feeder #3 will go to our SS3, which is the distributing station for Test building, while incoming feeder #2 is the standby feeder in case either one of the running incoming feeder is down. Beyond SS2 and SS3 will be the switchgears, transformers to step down from 11kV to 415V and 415V to 240V and those main switchboards (MSB), sub switchboards (SSB) that will go to each floor, each location and each panel to supply the power to every machine and equipment as illustrated in the SLD drawing in Figure 4. At this stage, I had a thorough comprehension on all the devices installed in power distribution, such as different types of circuit breakers according to voltage levels, overcurrent and earth fault relays that trigger tripping of circuit breaker, digital power meter to check amperage and voltage of each phase, current transformer and potential transformer for relay and DPM purpose, and capacitor bank to supply the reactive power required in order to improve the power factor as excessive usage of reactive power from TNB will be charged accordingly.



*Figure 4 Main Power Distribution Layout*

Other than Electrical System, I studied on the overall control system here as well, e.g. SCADA system, from field devices to PLCs and to our supervisory computers, or we call it as clients. Every data/reading from the sensors and actuators from the PLC will go through a MOXA gateway, which acts as our TI internal firewall before going into our network switches and then the TI environment to be reflected on SCADA. There might also be language converter if the communication protocol used in certain PLC is not the same with the commonly accepted one here, which is Modbus TCP/IP. Everyone has access to the SCADA system in their laptop, but for monitoring purpose only. All the operations can only be done at local HMI located at the site. The flow of overall process has been shown below in Figure 5.



*Figure 5 Flowchart of SCADA System*

As part of the facilities team, I had the opportunity to learn the basics and overall flow chart of the other systems that is beyond my field of expertise, such as PVAC, HVAC, wastewater and deionized water treatment, and fire protection system. Professionals from other TI sites were invited to host the training sessions as it is beneficial for us to understand facilities in a whole, which will also ease us in calculating utility cost for the whole plant. Understanding is important as there were incidents from time to time and one can only understand what the technicians are troubleshooting if he knows how the equipment operate. Figure 6(a) (b) (c) below illustrate the structure of the systems mentioned above.



*(a) (b) (c) Figure 6(a)(b)(c): AHU, Fire Protection, Wastewater Treatment*

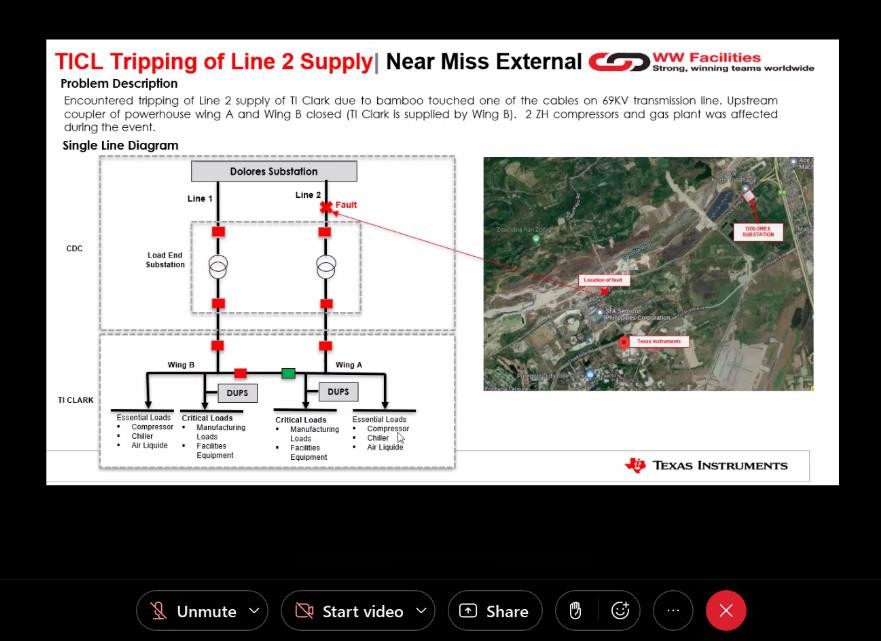
Generally, Facilities team will need to ensure that the operation in the production line is uninterrupted. Hence, the team will need to solve all the emergencies immediately and so we have technicians working shift, and engineers will need to be standby 24 hours to help the technicians to solve the problems. In addition, they will need to support as in power supplies, deionized water, vacuum, exhaust, process cooling water, steam, AHU and everything else the production people require if the production line is expanding or there is upgrade on the machines being done that will introduce certain changes on the default requirement. Being the back-end member, Facilities team deal with every department in the factory and so their connection is broader. In addition, they will need to look for cost saving opportunities and so the workload is more than other departments.

Meeting production line requirement is the job of Facilities Engineering and Facilities O&M. There are still Requested Services that in charge of the facilities of building like walkway etc., Security and ESH (Environment, Safety and Health). Therefore, the engineers will need to make sure that every action that the contractor is performing is within safety compliance and all the works being carried out are according to the work permit submitted and verified by Safety person. Failing to comply will put the project on hold and it will be recorded as a finding.

Being an intern here, I will attend the morning meeting everyday which is to update everyone on the projects we are carrying out for the day, review on issues happened yesterday and put on safety sharing to all the contractors working on site. Sometimes, there might be cases from other TI sites in which we will put up as a sharing to learn together and avoid similar mistake. Next, I will need to update alarm management record tracked from SPOTFIRE for every system for the last one week to review the scoring, as shown in figure 7. Other than these two routine tasks, the other routine tasks will be to attend weekly PST meeting, that will involve all the electrical engineers from each TI site around the globe to review FMEA (Failure Mode Effect Analysis), FIFO (Fan-In-Fan-Out), Commissioning Checklist, Capital Project Presentation, Alarm Update, and all the incidents happened in other sites, together with root cause analysis and solutions (Figure 8). Other than that, every week there will be professionals from each system organizing training to the interns and new hires with the objective to introduce working principle of every system in Facilities. Occasionally, there will be free webinars/sharing session by the external companies to introduce their new technologies to us for future consideration.



*Figure 7 Alarm Management Template*



*Figure 8 Incidents Sharing from other TI Sites*

Aside from all the routine tasks, my main function will be to assist electrical engineers and control engineer on their projects. This includes discussion with consultants, vendors and Global Service Team (GSC) of TI, drafting scope of work to request for quotation, jotting down meeting minutes/action tracking plan, researching on market technologies, presenting the project in weekly PST meeting, reviewing the drawings & documents sent by consultant, and helping them to monitor the contractors and progress during project commissioning. I was also lucky enough to have joined the GRC Audit session and observed how audit is being done at the industrial level. Other than all the technical jobs, I was also assigned to present on safety sharing where I shared about ‘Effective Communication & Maintaining Transparency’ and ‘Importance of PPE’. At times, my mentor will send me the procedures on how equipment testing is being done whenever there are postings on social media for me to learn as I reflected my issue of lack of knowledge in the maintenance field.

# Chapter 3: Reports on Projects Involved

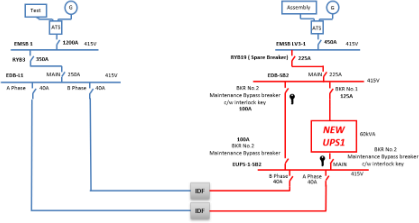
## Data Center Reliability Upgrade

### Problem

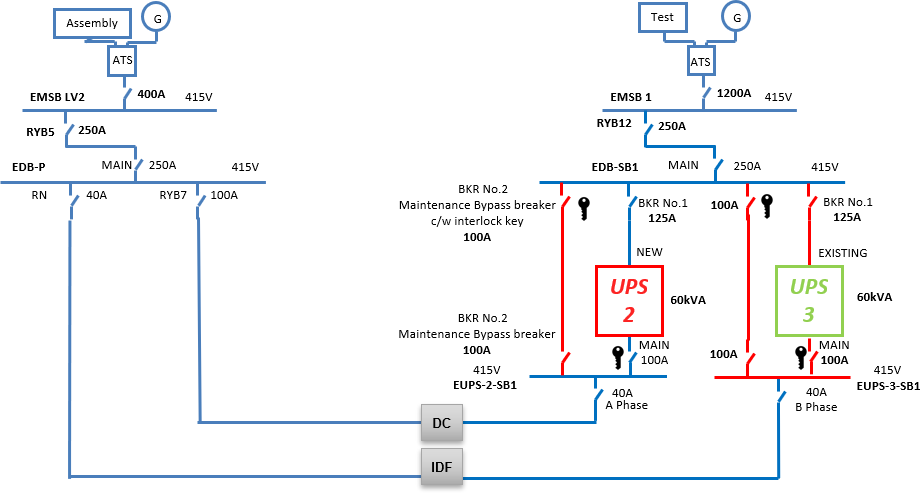
This project was a request from the IT department as most of their IDF (Intermediate Distribution Frame) has only a single source of supply, and some equipped with more than 10 years old rack-mounted UPS which has a very low reliability and sustaining duration, that cannot support for 2-3 minutes before we start up the backup generator manually in the event of power failure. The IDF is important as different areas and tools in the production communicate with each other through network, and so the process will delay if IDF is down. For example, previously there was fire happened at the panel supplying power to the data center, and the team cannot trace back the past 1-hour data, which is a huge impact to the production line. One of the processes involved is that the image uploaded by probe is traced back in assembly area through the barcode scanned and uploaded to server, so the operation will have to pause while data center is down.

Hence, there is a need to remove all the old rack-mounted UPS installed in every Test building IDF, and put up a new central modular UPS that is taking power from the Assembly building to ensure power diversification to the IDF. This is achievable as the network switches in use has dual power input port and so Test and Assembly power source will back up each other as illustrated below in Figure 9. The second part of the project, shown in Figure 10 is to remove the existing declared obsolete UPS that is supporting the Assembly Data Center, and replace it with a new Modular UPS, while the existing one will be utilized for Assembly IDFs, which did not have any backup supply before this. Through this project, we are providing 2x protection to the data center and IDF as there will still be 15 minutes backup battery by the UPS if both the incoming fails.

This is a capital project that involves 3 persons, 1 from IT department, my mentor and me. My main role here was to brainstorm on how to do maintenance on the UPS while ensuring minimum downtime/continuous operation to the IDF, verifying the specifications of circuit breaker through full load calculation, selecting the power rating and type of UPSand drafting scope of work to the vendors. IT people will provide location of IDF, model of network switch in use and amount of the network switch for each IDF. My mentor will specify number of poles on circuit breaker and relays, specify the cable diameter and length according to the routing done, and do the SoW for civil and fire protection works.



*Figure 9 Part 1: Addition of UPS for Test IDFs (highlighted in red is new addition)*

**

*Figure 10 Part 2: Layout of Assembly UPS Installation (Green indicates existing UPS)*

**Research Methods Internet**

I looked for maintenance bypass for UPS online. Searched on what are the concerns on doing maintenance on UPS and found the maintenance bypass technique. There is actually bypass mode, static mode and normal mode 3-in- 1 technology in current UPS market, but the concern is on the electrical safety when doing maintenance as we need to open up the UPS while the UPS is live so there might be risk of electrical shock if human error is present. Hence, we designed another path for the maintenance bypass that basically based on the bypass mode designed in UPS. Internet is also utilized to look for data sheet of network switch model for its power consumption under full load and to study which type of UPS is the current trend together with the advantages of it.

**Consultation & Discussion with colleagues**

I enquired my mentor on the techniques used by other TI site and we had a short meeting with electrical engineer from TI India to learn a little. There was also another document sent by my mentor for me to refer, which is published by GUTOR Electronic Ltd, which contains the SLD, functional descriptions and technical specifications. We have also conducted a meeting with the GSC electrical specialist regarding the maintenance bypass mode and the example and explanation given was similar with findings on Internet. Regarding the load calculation, I have contacted IT department and they provided me with the model and number of network switches for each IDF. Also, the location to install the new panels and UPS has to be discussed with IT department as it will be inside their IT store room and the placement has to comply to fire protection regulations. Lastly, I asked for a few SoW for the past electrical projects from my mentor and I refer to those examples in constructing the SoW.

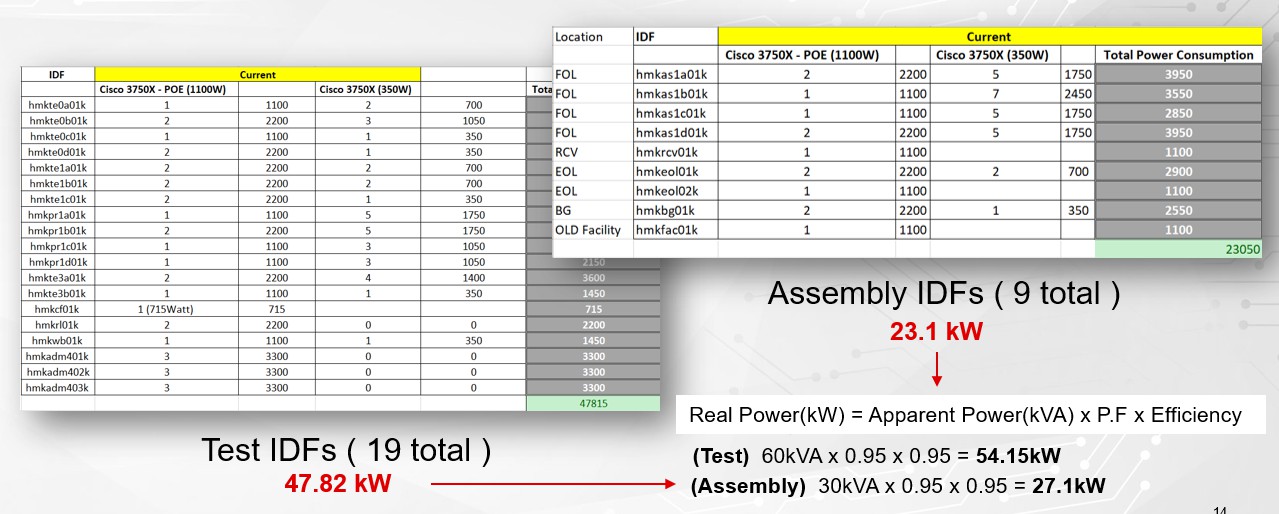
### Techniques

For maintenance bypass, our concern on using the current market technology is on electrical safety as we will have to do maintenance while the UPS is live and we are afraid that the power coming from main input will not be able to sync with maintenance bypass input after going through inverters and rectifiers which will introduce certain phase shifts, as the current technology is overlapping changes, meaning that it is a make-before-break technique. Our solution is to put on an external maintenance bypass path that basically mimics the design in the 3-in-1 bypass mode, which will introduce a few seconds downtime during switching as it is a break-before-make, but that is acceptable as we are going with dual power supply configuration.

For power rating of UPS, total power consumption was first calculated. Then, it was converted into kVA rating through the formula learnt in university, taking into account the power factor and efficiency of UPS that we were going to specify inside the SoW. After that, we verified the current consumption and circuit breaker availability from the current switchboard we are planning to take power supply from to check if it can support for another UPS and some portable air-cond. All these will be done through visual inspection on the digital power meter/ammeter installed. The selection of switchboard was done through SLD checking to see which switchboard has additional capacity or already has a spare circuit breaker installed since the past.

### Result & Discussion

The maintenance bypass is presented to my mentor, accepted and will be done with circuit breakers that come with interlock key as illustrated in figure 9 and figure 10 as we will need to shut off power supply from UPS first before we can turn on the breaker to supply power through maintenance bypass path as long as the concern of unsynchronized power exists. Also, we try our best to protect technicians from any electrical hazard while doing maintenance so the UPS must be de-energized first.



*Figure 11 Calculation of UPS Power Rating*

Referring to figure 10 above, the kVA rating selected for Test building (60kVA) and Assembly building (30kVA) is sufficient and comes with extra room for expansion. Also, the power factor we specified in SoW is 0.99 at least and efficiency is 0.95 at least. Since the UPS is modular, we can add in more power modules in the future to cater for higher demand, which is what a professional engineer will do.



*Figure 12 Current Consumption on Switchboard In-Use*

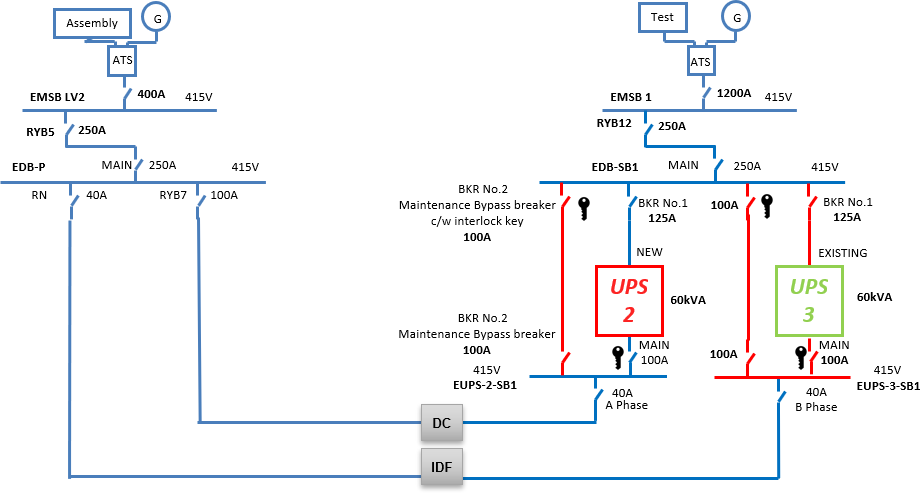
The current consumption is within safety limit as well after addition of UPS as shown through the calculation. The usual practice is to consume 60-70% of the current breaker limit at maximum, as the load consumption might fluctuate sometimes and we can hook up more loads if required in the future, saving cost for future installation works.



*Figure 13 Verification of circuit breaker availability*

To avoid wasting unnecessary money, we checked if we have suitable breaker can be used first. There is panel available, just that we have to replace the circuit breaker with higher rating and install a new breaker for second part of the project. The new breaker will come together with RCCB (residual current circuit breaker) to protect the devices from any current leakage. The new panels will come together with OCEF (Overcurrent & Earth Fault) Relay and

grounding to avoid any electrical hazard while protecting the equipment. The panel height and location will be properly considered as not to cause blockage to other equipment and ease for maintenance.

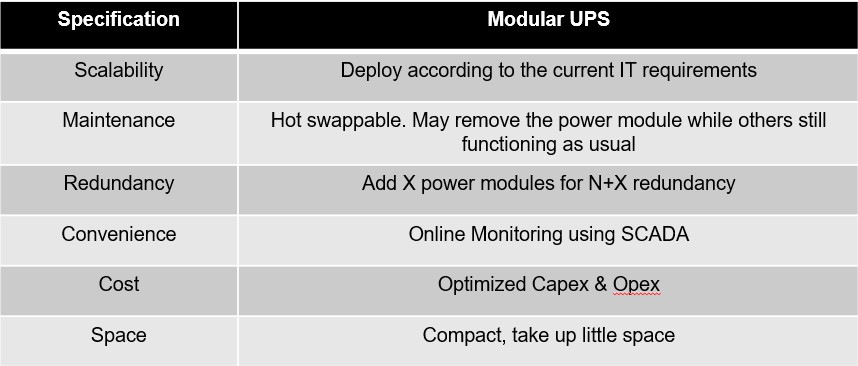


UPS 3

EUPS-3-SB1

EDB-SB1

*Figure 14 Location for Panels to be Installed*



*Figure 15 Advantages of Modular UPS*

While considering the options for UPS, the decision was modular UPS as it is very convenient for users in terms of deployment, maintenance, redundancy and monitoring purpose. Other than that, the cost of doing maintenance on one standalone central UPS is much cheaper than doing it on every single rack- mounted UPS that is located at different locations. Also, since it comes with a compact standalone one with all the features required, it attracted our attention as we have only limited space available in TIEM.



*Figure 16 Power Cable Routing*

The cable routing has been discussed with electrical vendor and checked on its feasibility. They opened up ceiling to check whether there is concrete wall and how do we bypass the concrete wall. The routing sketch was done taking into consideration the difficulty, length of route, rooftop space availability, and prone to damage or not.

### Conclusion

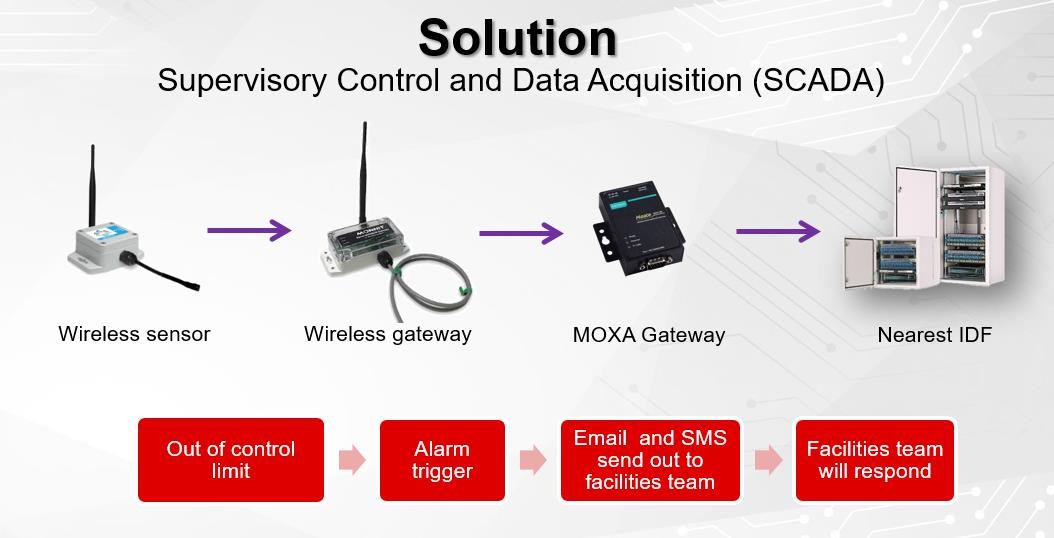
The experience gained from this project is valuable as it is a big project that involves two department. I was able to work closely with other TIer and learnt a lot in UPS technology. I went through stages that one should always consider while adding new tools and I applied what I have learnt in the university into the calculation. The initiation of this project is important as data center is one of the most important assets to the company, any down time will have a huge impact to the overall operation of the company so the reliability upgrade has to be carried out as soon as possible.

### Recommendation

I will suggest to use auto-synchronizer at the static switches of the UPS so that we will be able to utilize the bypass mode of UPS and save the cost for extra installation of external bypass path.

## Rh & Temp Wireless Sensors Installation

For control system, I was involved in Rh & Temp wireless sensors installation which objective is to enable online monitoring of the humidity and temperature condition at the production floor. The current practice is manual checking and recording the hygrometer reading every 8 hours, which is found to be inefficient as the situation cannot be escalated to the person-in-charge immediately if it breaks beyond the limit. This is crucial as high temperature will cause overheating in the machines and termination of test program, high humidity will form moisture on the wafer and low humidity will introduce static charge which will cause short circuit to the die. Hence, we are replacing the hygrometer to wireless sensors which we will be able to connect to our SCADA system and turn on alarm for any out of limit situation. On top of that, the project was started as manpower is needed to calibrate the sensors from time to time and renewal of paper roll is needed every six months. The placement of sensors was shown in figure 19 where the sensing element is placed close to the hygrometer sensing element. My main role here was to monitor the installation process and learn how the sensors are being connected to SCADA system.



*Figure 17 Wireless Rh & Temp Sensors Flow Chart*

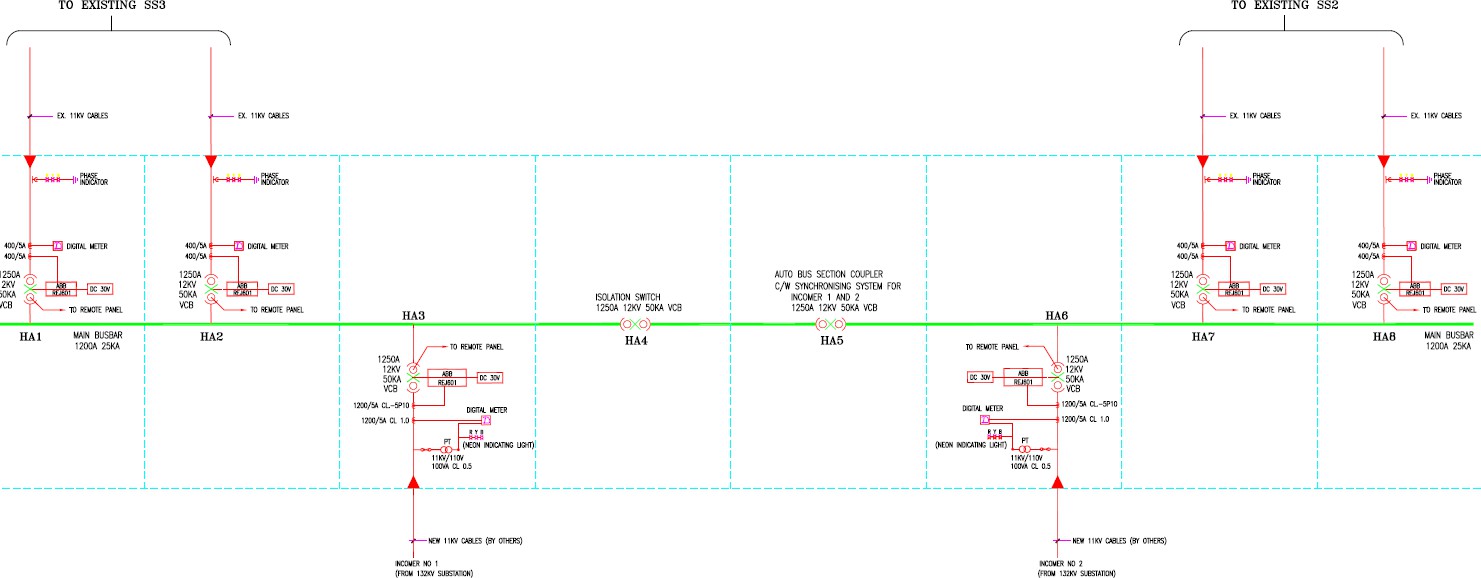


*Figure 18 Comparison chart for Rh & Temp Wireless Sensors Installation*

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*Figure 19 Wireless Sensors Installation*

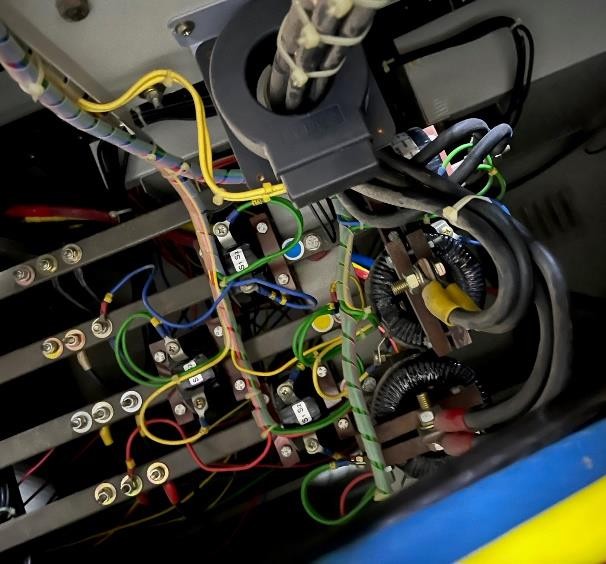
## 11kV SS1 Switchgear Upgrade

Switchgear upgrade was initiated as the current switchgear cannot support the entire site load with only one incoming feeder due to capacity limitations. Adding on to that, there is no automatic transfer in the event of site incoming feeder failure and manual switchover is needed, which will introduce certain downtime to part of the facilities. In this project, the current Vacuum Circuit Breaker (630A) will be upgraded to 1250A with the addition of one auto-synchronizing bus coupler that will be able to synchronize the two power supplies to ensure the two incoming feeders will be able to backup each other, keeping the production uninterrupted. If the current switchgear remains, it will require TIEM1 partial, momentarily shutdowns and load shed to allow TIEM 2 necessary repairs or maintenance because TIEM 1 will no longer take supply from TNB after TIEM 2 is built up, it will directly take supply from TIEM 2 and TIEM 2’s operation will be supplied by TNB through 132kV feeder. Power monitoring & SCADA for this switchgear will be included in this project as well. My role here was to verify drawings and documents sent by consultant, check if it is tally with our design, understand what are the concerns when designing and most importantly, to learn.

*Figure 20 New SS1 Switchgear Design*

## Panel Rectification Project

While for panel rectification project, there were multiple findings showing that there is compliance gap with the current Electrical Code Requirements, such as lack of protective sheet, absence of earthing wire at the panel, outdated capacity of RCCB, old model circuit breaker and lack of protective relays. Some panels are lacking of digital power meter or the ammeter and voltmeter installed was not functioning, which causes us some problems when we want to verify what is the issue that causes certain incidents. I was involved in phase 2 out of 3, rectifying a total of 74 panels. Complying to the standard and regulations is important as it mainly protects people from electroshock. Simulation was done like tripping check of protective relays, the duration until the circuit breaker trips and whether or not the circuit breaker trips when the injected current is more than maximum allowable limit. This is a great project for me to learn as I was able to understand the importance of having those protective devices and how the connection and tests are being done.



*Figure 21 Internal view of a Panel during Panel Rectification Project*

# Chapter 4: Conclusion

To sum up, my internship experience here was a fruitful one. I am more than grateful to have done my internship here as the colleagues are helpful and the working environment here is good and motivational. All the people at my department have a very strong teamwork and they help each other whenever necessary. The leadership is well-executed with an organized structure and a mindset that growing talent is one of the important responsibilities as a leader. Aside from engineering group, I worked with other groups in the facilities as well so this internship has given me the opportunity to explore facilities as a whole, including the culture, job scopes, working style and career path. My exploration is not limited to facilities department only, but I had the chance to know more about other departments like assembly, test, probe etc. during my line tour, this has definitely provided me with certain direction on the fields that I would probably devote to in the future.

Throughout this internship, I have picked up quite a lot of technical knowledge , mainly on the power distribution and control system. For example, I learnt how to pick the rating and type of different protective devices, compliance to electrical code requirements, UPS technology and switchgear design, such as bus bar rating, circuit breaker breaking capacity and auto-synchronizer system. Other than that, I was able to understand the structure of the transformer and determine whether the transformer is working fine or not, together with the tests that should be done to a transformer. Other than all the electrical information, I went through all the stages of implementation of SCADA system at industrial level, which is slightly different from what I learnt in the university as they will have certain firewalls to go through, dedicated communication protocol and different HMI SCADA software. The foundation to build a talent here is very systematic and matured, I was able to pick up all the knowledge and information within a short time. However, as there were materials that did not cover too detailed in university syllabus, so I did some research on my own in order for me to catch up the engineers’ understanding and progress.

In terms of soft skills, I realized the importance of the communication skill and presentation skill. These skills are the key factors in passing the correct information to

others, and also for one to build up life-long connections. Besides that, I was able to manage my work in an organized manner and able to do the task within time limit. Finally, I was able to apply engineering moral and ethics during my industrial training in TI as TI has been actively promoting ethics

It’s great that I have witnessed all the major events here like site visit and evaluation by the Vice President of Worldwide Facilities from Dallas, US, audit sessions, leadership role changes, and preparation works for shutdown activity. All these are the merits added to my internship here as I get to know all the top management leaders and what is their job at that position.

In a nutshell, internship over in TI gave me a great opportunity to explore the working environment as an engineer-in-future, providing insights to daily operation within a robust industry and will serve as an important factor in my future career pathway. This industrial training session complements all the theories we learnt from university courses, providing us a chance to improve our knowledges and broaden our views by applying all we learnt in the real industry.

# Chapter 5: Reflections

## CLO1: Ethics

TI has always put high attention into issues related to data security, which I believe goes concurrent with engineering ethics, to always maintain our work confidentiality whenever we are required to. Before joining TI, I was required to sign the non-disclosure agreement as part of our consent to not expose or leak any of TI’s work details. At times, IT department will be sending phishing emails to the staffs and failure to detect and report the phishing emails will be warned as we have one courses specifically for identifying phishing emails.

Throughout the internship, I always applied ethics and professional

electrical engineering practice in my workplace. I never did something that violated the engineering professional ethics, such as disclosing company confidential information to outsiders or accept financial or other valuable consideration from company competitors. Besides that, I took extra care to make sure that my logbook and report did not include any confidential data and I only proceed with sharing information, whether it is sensitive or non- sensitive after I have presented to my supervisor.

Next, I also completed every task within the time limit given and

always assist others after completing my part. I only performed tasks in area of my competence and did not give instructions or advice that I am not confident with. I respect all of my colleagues whether they are intern or staff, and I seek for their advice/opinions when I was brainstorming on ideas even if they are not my area of expertise. I value the differences between us and I learn from them to improve myself. Lastly, I make sure that the company’s professional reputation is always uphold and enhance the honor, integrity, and dignity of the engineering profession.

## CLO2: Lifelong Learning

During my industrial training, I always take initiative to study on the topics related to operation and connection of circuit breaker, protective relays and transformers. I also constantly read the reading materials provided by my mentor regarding maintenance and testing of those devices I mentioned above , and what are the faults that we usually see in practical. I make sure that I study on my own first before approaching my mentor to ask for the clarification. I logged down all my daily activities at work and got verification from my manager to keep as future reference. After completing each task, I got feedbacks from the supervisor and colleagues to improve myself in the related field so that I can do better next time.

I believe the knowledge and experiences that I obtained from observing how the technicians troubleshoot those power distribution system problems will be useful towards lifelong learning in my future career path as an electrical engineer. The connections I have made here will always be a strong platform for me to exchange opinions and seek advices from, as it involves not only the engineers here, but some leaders in the technical board and suppliers as well. As the technology advances, so do the engineers. Hence, we need to always improve ourselves by attending webinars, connecting with the suppliers and paying attention to all the technology news in order for us to catch up with the fast-paced world of technology.

## CLO3: Engineering and Society

During my industrial training, I have identified my responsibilit ies towards the society in terms of public health and safety issues while performing engineering tasks. I was assigned to design the maintenance bypass and select the appropriate rating of circuit breaker. Hence, I will need to make sure that the design of maintenance bypass is theoretically feasible and equipped with all necessary breaking devices, and all the devices that I picked must be able to trip the whole circuit when overcurrent or earth fault occurs. The breaking capacity has to be selected in a way that it can withstand large short-circuit current, able to break the circuit and does not explode which will cause fire to the whole UPS room, and put all the staffs in danger. On top of that, all the panels that will be installed has to be equipped with protective sheet to avoid touching to live wire and the grounding of panel must be properly connected to avoid electric shock in case of earth leakage. All the chargeman that will be operating the Circuit Breaker will need to wear their PPE to protect themselves which includes insulation gloves, arc flash suit and safety boots. In addition, I have also learnt that all the isolated room must come with fire protection system like CO2 sprinkler in case of fire outage and air-conditioning system to prevent overheating. While for the wireless sensors project, the panels are installed at a height above 6.5 foot to avoid any accident of not being aware of the panel.

Everything that we do in TI will be supervised by the ESH team. They will go through every procedure stated in the work permit on the job action and verify if safety measures are concerned and list down recommendations if there is any. All the chemicals will have to be registered first before bringing in to ensure they will be properly handled for the safety of others and also environment.

## CLO4: Individual and Teamwork

Furthermore, throughout the internship, I saw my growth as an individual and an aspiring engineer. Since facilities has always been the busiest department, with one person doing multiple projects, I had to manage my time better and be disciplined to get things done. This is an important skill to cultivate in the workplace so that I can work efficiently and effectively, and at the same time being able to balance between work and personal life. I also learned to manage my tasks and plan my time according to priority, which is an essential attribute as an engineer when handling multiple tasks. Moreover, I saw my development in teamwork when collaborating with other in tasks and assignments. Along the way, we had discussions which gave us the spark of ideas on task given. We also share with each other our information which made our works more efficient. I have learned to listen and engage with others during discussions and consider other people’s opinions in my decision making. Opportunities like these helped me to develop and improve my inter-personal skills, which are important and useful soft skills as I step into the working world in the future.

There were times where I need to help the engineers to monitor the contractors’ work as they were all busy with other projects, so it was a chance for me to actually work on my own, bringing contractors to different areas, communicating with them on their work schedule and updating the work progress to project owner. Teamwork was greatly highlighted when I needed to work with IT department on my data center reliability upgrade project. Numerous discussions were done between our own and between the global service team and us.

## CLO5: Communication

Communication is certainly an art that must be sharpened under any condition. It is one of utter importance for anyone to sharpen their ability to communicate well to send the correct messages thus avoiding confusions. Since we have different races here in facilities, all the common languages were used in daily conversation like BM, English and Mandarin. My sentences in other languages might not be grammatically correct and pronunciation might not be accurate, but the most important thing is that the message is properly conveyed, and I need to step out of my comfort zone and practice more.

Besides that, I had the opportunity to involve in several interactive sessions with senior manager of different departments. They had shared their working experience which gave me an insightful understanding to TI. By talking to my supervisor weekly, I learned to communicate and exchange thoughts with a superior, and form a good working relationship, which is an important aspect to master effectively in the workplace. Next, it is quite often that I need to write reports and letters to the management and government bodies for compliance related issues and so my professional writing skills was sharpened as time goes. Not only writing skills, my presentation skills was greatly improved as there were many opportunities for me to present in front of crowd, like safety sharing and also intern project sharing session and the managers have a good impression on my presentation skills.

Last but not least, this industrial training also encouraged me to write a professional engineering logbook and report. I learned to reflect upon my learning journey and summarize my thoughts and communicate them using written words, so that they can be used as a helpful reference in the future.

## CLO6: Design Aspect

One of my tasks is to do maintenance bypass path for the UPS maintenance. In this task, I was required to identify all the risks and propose my own solutions based on my engineering judgement. After I identified all the potential risk of the UPS system, I was able to formulate different solutions through online study materials and discussion with supervisor. For a real industry problem, there is no absolute solution, every solution that I proposed has their own advantages and disadvantages. Therefore, I need to think critically and evaluate all the solutions from different perspectives and propose a most convincing and beneficial solution.

After this internship, I have learned that the idea to solve a problem comes from the knowledge and experience that I have gained along the way. It is important for me to keep on improving my knowledge and accumulate more experiences from industry. Besides that, I also learnt to avoid common mistakes in problem solving such as formulating a solution immediately without understanding the problem statement and knowing the root cause. Lastly, all the proposed solutions must be fully tested and based on the engineering knowledge.

## CLO7: Environment and Sustainability

While doing my internship here, everything that we design and purchase were aiming for long sustainability to save cost and avoid waste of material to save space and environment. For example, the UPS that we purchased is modular UPS which can be deployed according to our current demand by adding more power modules. Through this, we will only purchase capacity needed and there is no need for extra compartment to install new UPS as we can add the power modules until the standalone UPS rack is full. Adding on that, we are always looking for energy saving opportunities that could provide a good ROI such as improving machine efficiency and optimizing operation time as we want to save cost as well. By reducing energy consumption, there will be less CO2 emission and reduced environmental pollution. Also, we tried to employ solar energy into our daily usage but the feedback from TNB was that solar can only be deployed through 132kV but we are using 11kV. Last but not least, all the current protective devices being installed are far safer than what were used to be, preventing any electrical hazards that could lead to fire and impact staffs’ safety and environmental pollution level. Also, Infrared Thermography checking will be done from time to time for loss prevention, risk engineering and preventive/predict ive maintenance.

Looking into wireless sensors project, one of the aims to change the hygrometer to wireless sensors is to reduce paper roll usage that will pollute the environment as there are over 100 hygrometers in use currently and every year we will have to change twice the paper roll, which sums up to be quite a big volume. Also, new design and technology will be able to sustain very long due to their robust outer design and more advanced inner chip that can survive better and longer even in harsh condition.

We strive to improve our products’ reliability so that all the chips that we made will be able to support and sustain the green technologies that the globe is currently focusing on to reduce environmental pollution.

# Chapter 6: Appendix

### INDUSTRIAL TRAINING RECORD

**Name of Trainee :** Wee Gim Fung

**Effective from :** 25/7/2022 – 7/10/2022

**Brief description of industrial training experience**

Generally, my internship training was a very interesting and fruitful one as I learnt a lot of technical knowledge which some I have never learnt in university before. Also, this internship has provided me with practical hands-on experience on what I have learnt in university, which complements the theories I have gone through. I am grateful to have my internship here at this period of the year because all the projects that I involved were capital projects where I worked with colleagues from other departments, having the chance to build up my connection. The top management and colleagues are very approachable and I did have the chance to talk to them, asking for their advices on my future career path. I met engineers coming from different disciplines and companies, and so I get to understand all the utility systems and their functions in a semiconductor company, albeit the level of knowledge is only at beginner level. Of course, I did not limit my knowledge to facilities team only, I had a line tour going through all the areas in production line, observing the formation of chip since wafer stage where they probe, mark, send to backgrind, die attach, wire bond and finally go to mold and plating before sending it to test floors. To sum up, I am blessed to have being selected into facilities team of TIEM, and this is somewhere I would definitely recommend my juniors to come in.

**Details of projects participated**

My first project is to install UPS for both test building and assembly building IDFs, and replace obsolete UPS that is supporting DC with a new one to achieve power diversification and enhanced reliability purpose so that there will be no downtime to the IDFs and DC. In this project, I designed an external maintenance bypass for the

UPS to ensure continuous flow of power to the IDFs. I was also tasked to calculate total load to select the suitable kVA rating for the UPS and circuit breaker rating. Since this project was raised for IT department, I had to work with IT department quite frequently to update them the design, getting information from them and deciding the location. Other than this, I was also involved in other electrical projects, which are 11kV SS1 switchgear upgrade and Panel rectification project. Switchgear upgrade was initiated as the current switchgear cannot support the entire site load with only one incoming feeder due to capacity limitations. Adding on to that, there is no automatic transfer in the event of site incoming feeder failure and manual switchover is needed, which will introduce certain downtime to part of the facilities. In this project, the current Vacuum Circuit Breaker (630A) will be upgraded to 1250A with the addition of one auto-synchronizing bus coupler that will be able to synchronize the two power supplies to ensure the two incoming feeders will be able to backup each other, keeping the production uninterrupted. While for panel rectification project, there were multiple findings showing that there is compliance gap with the current Electrical Code Requirements, such as lack of protective sheet, absence of earthing wire at the panel, outdated capacity of RCCB, old model circuit breaker and lack of protective relays. I was involved in phase 2 out of 3, rectifying a total of 74 panels. Complying to the standard and regulations is important as it mainly protects people from electroshock. Simulation was done like tripping check of protective relays, the duration until the circuit breaker trips and whether or not the circuit breaker trips when the injected current is more than maximum allowable limit.

For control system, I was involved in Rh & Temp wireless sensors installation which objective is to enable online monitoring of the humidity and temperature condition at the production floor. The current practice is manual checking and recording the hygrometer reading every 8 hours, which is found to be inefficient as the situation cannot be escalated to the person-in-charge immediately if it breaks beyond the limit. This is crucial as high temperature will cause overheating in the machines and termination of test program, high humidity will form moisture on the wafer and low humidity will introduce static charge which will cause short circuit to the die. Hence, we are replacing the hygrometer to wireless sensors which we will be able to

connect to our SCADA system and turn on alarm for any out of limit situation. On top of that, the project was started as manpower is needed to calibrate the sensors from time to time and renewal of paper roll is needed every six months.

**Type of skills/competencies obtained:**

* Leadership skills – What is the responsibilities as a leader and how to grow ur member
* Communication skill – Able to convey message clearly and adapt to the culture
* Time management skill – Completed all the tasks assigned within my internship
* Technical skill – SLD, communication protocol, electrical protective devices selection, UPS specification, electrical power distribution
* Practical skill - Relays calibration, tripping test, cable insulation test, transformer oil test

**Name of Supervising Engineer:**

**Signature & Stamp of Supervising Engineer:**

**COURSES ATTENDED (IF APPLICABLE)**

**Name of Trainee:** Wee Gim Fung

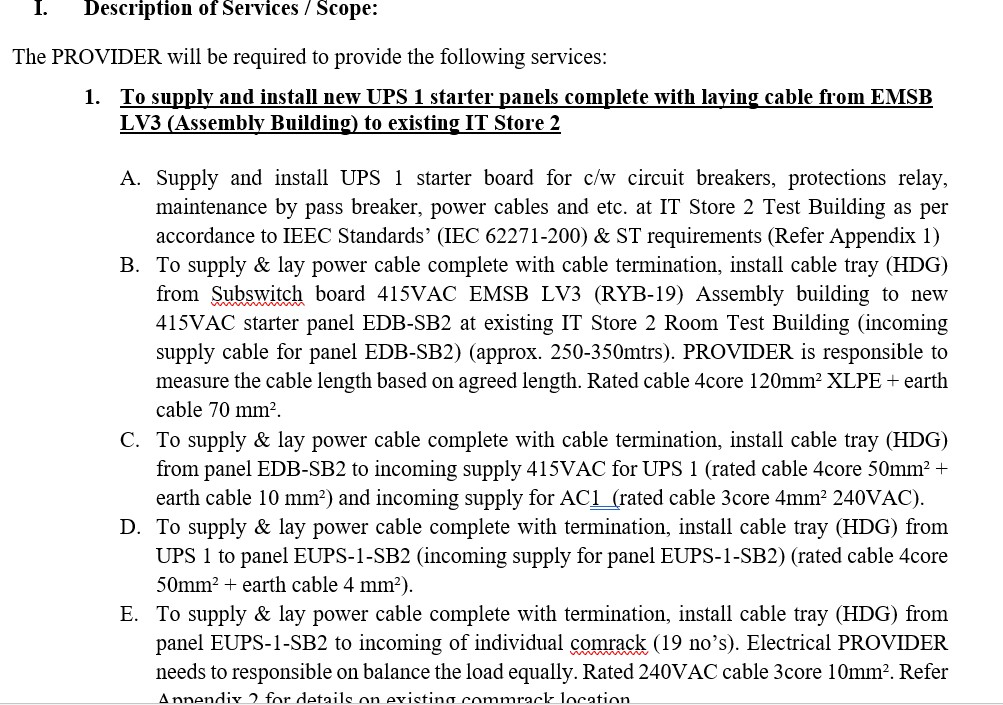
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **DESCRIPTION** | **DATE**  **ATTENDED** | **CONDUCTED**  **BY** | **CERTIFICATION** |
| 1 | Electrical System Intro | 28/7/2022 | Texas Instruments | - |
| 2 | DIW/IWWTP Systems Training | 4/8/2022 | Texas Instruments | - |
| 3 | Control System Training | 11/8/2022 | Texas Instruments | - |
| 4 | Log Out Tag Out Training | 16/8/2022 | Texas Instruments | - |
| 5 | Facilities HVAC Intro | 23/8/2022 | Texas Instruments | - |
| 6 | Bulk Gas System Intro | 31/8/2022 | Texas Instruments | - |
| 7 | Key Predictive Maintenance to  strategies to improve energy efficiency in manufacturing facilities | 13/9/2022 | FLUKE South East Asia Pte Ltd | - |
| 8 | Achieve Operation Reliability in  data center | 20/9/2022 | FLUKE South  East Asia Pte Ltd | Figure 21 Appendix |
| 9 | Increase Reliability and Reduce Unplanned Downtime in  operations | 27/9/2022 | FLUKE South East Asia Pte Ltd | Figure 22 Appendix |
|  |  |  |  |  |



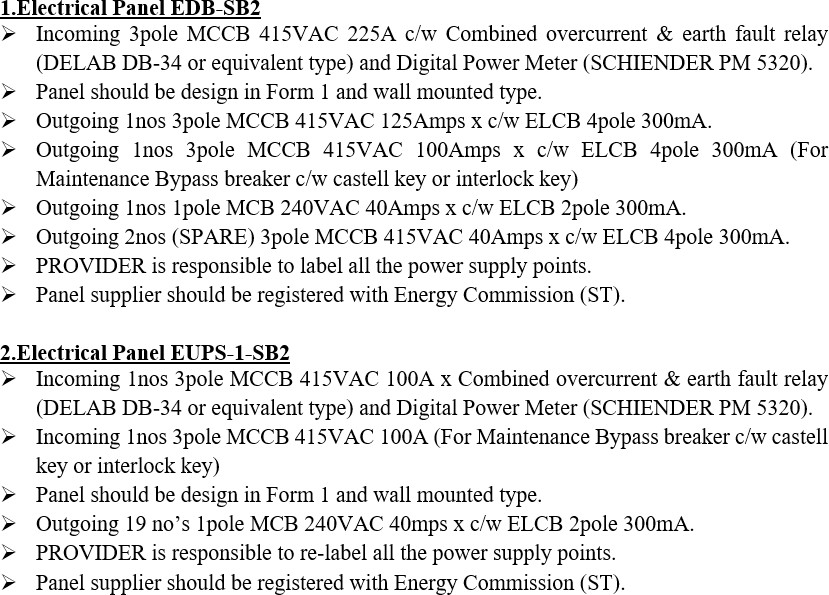
*Figure 22 Certificate of Attendance for 'Achieve Operation Reliability in Data Center'*

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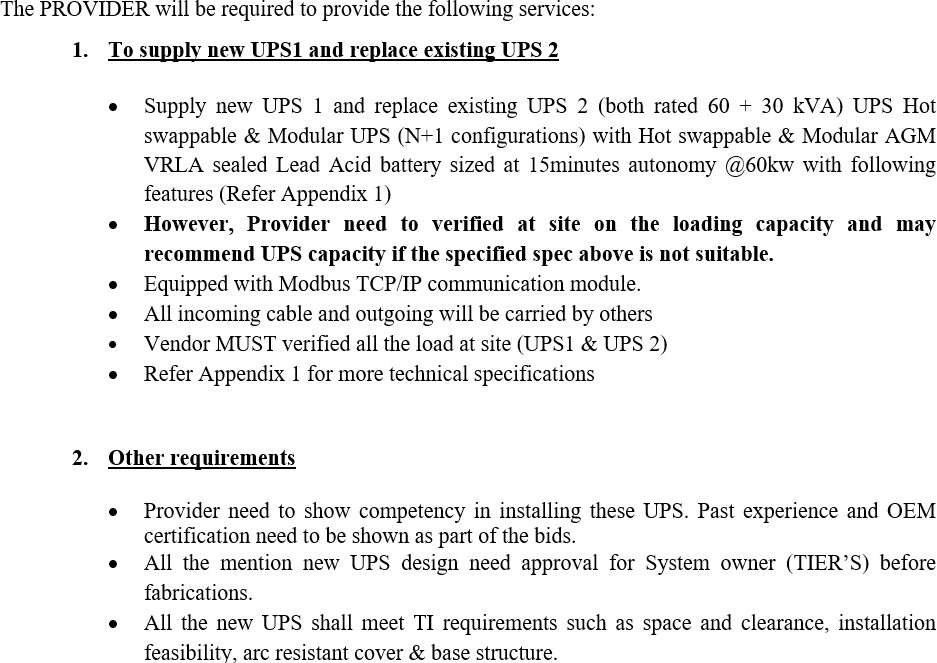
*Figure 23 Certificate of Completion for 'Increase reliability and reduce unplanned downtime in operations’*



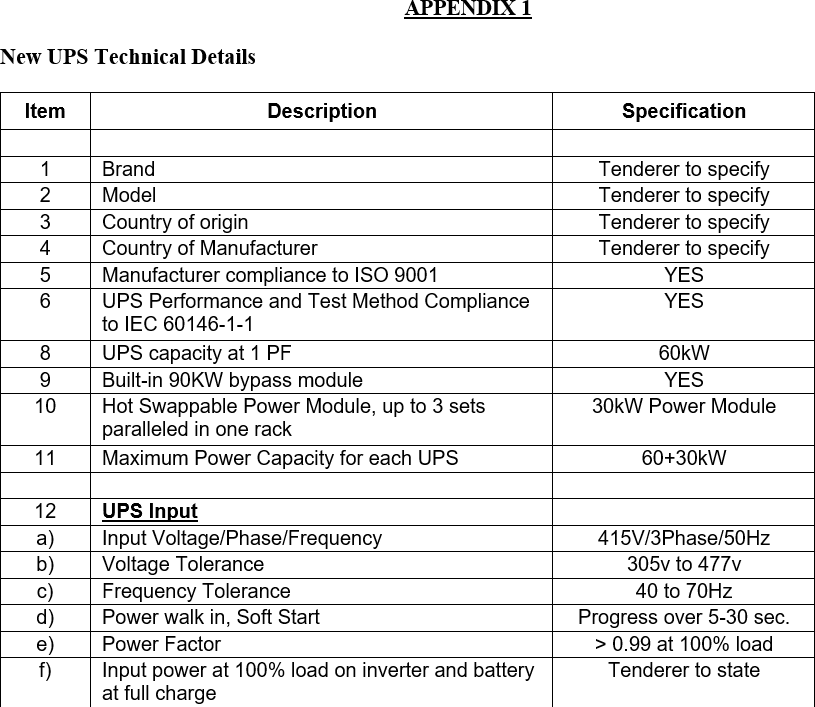
*Figure 24 SoW for Data Center Reliability Upgrade: Electrical Part I*



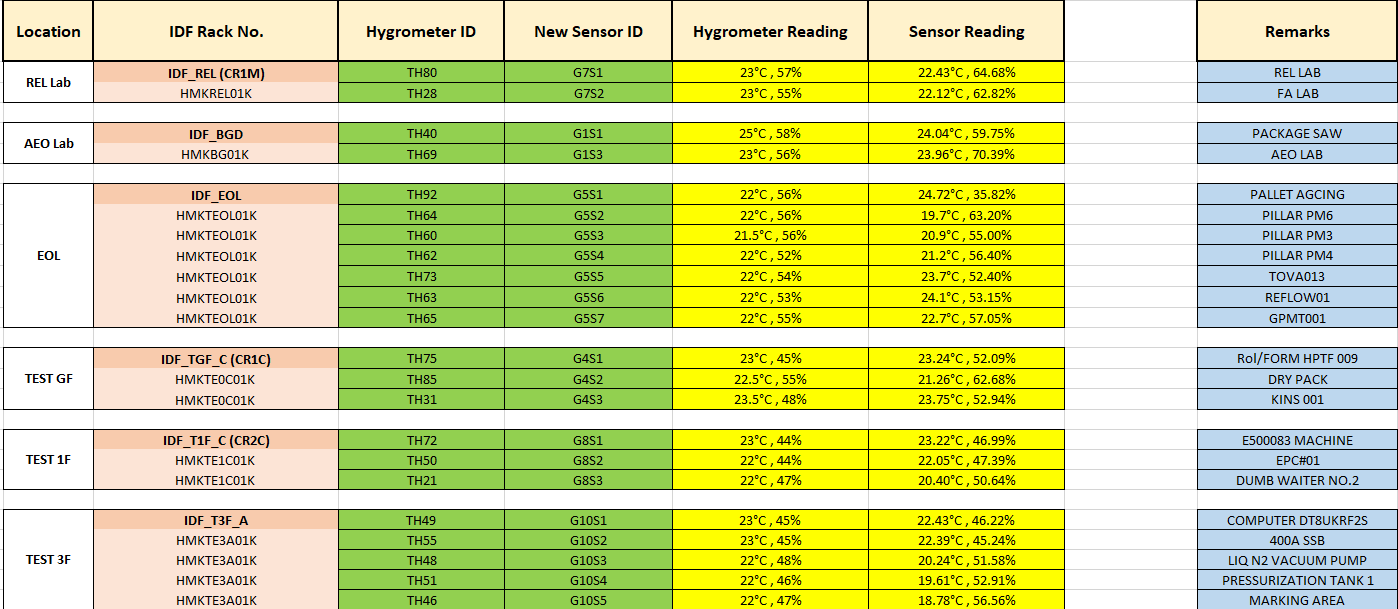
*Figure 25 SoW for Data Center Reliability Upgrade: Electrical Part II*



*Figure 26 SoW for Data Center Reliability Upgrade: UPS Part I*



*Figure 27 SoW for Data Center Reliability Upgrade: UPS Part II*



*Figure 28 Sensors Details Record for Rh & Temp Wireless Sensors Installation*

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*Figure 29 Existing SS1 Switchgear*