



SCHOOL OF ENGINEERING AND NATURAL SCIENCES

Department of Electrical and Electronics Engineering

ASELSAN A.Ş. Internship Report

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Student's Advisor	:
Date	: 17.08.2020 – 14.09.2020

1. Overall Description of the Activities/Projects Involved

The internship was completed in Aselsan A.Ş which includes Radar and Electronic warfare systems. This company aims to meet the defense electronics needs of the Turkish Armed Forces and Turkey as a reliable and innovative solution partner and to become a highly competitive technology company in the world markets by using its knowledge gained through scientific approaches.

The internship in Aselsan was completed in the Process design and Product Development department. After the introduction of the department, some laboratory was visited such as Environmental Stress Screening Test and Printed Circuit Board (PCB) Manufacturing Laboratory. PCB production was learnt step by step by observing the devices which are used in the manufacturing processes. The usage purposes and working principles of the devices were explained. These devices were Jet Printer, reflow oven, PCB cleaning, optic inspection, 3D optic inspection, selective soldering machine, environmental test chamber, X-ray PCBA analyzer, Flying Probe Test and conformal coating.

During the internship, research has been done on what is a jet printer, s parameters, and measurement of these parameters, vector network analyzer, the spectrum analyzer, the main differences between vector network analyzer and spectrum analyzer and the qualification tests of PCB. Temperature testing was made to the connectors to test them. After test procedure, the s parameter values of these connectors were collected by using PNA network analyzer.

Afterwards, pin to pin mapping in unit which is used in a project in Aselsan has been completed to make the unit design. A detailed research has been done on power amplifier module voltage regulator module and signal generator unit to understand them properly.

2. About the Company

ASELSAN is a company of Turkish Armed Forces Foundation, established in 1975 in order to meet the communication needs of the Turkish Armed Forces by national means. Currently 74, 20% of the shares are owned by the Foundation whereas the remaining 25, 8% runs in İstanbul Borsa stock market.

ASELSAN is the largest defense electronics company of Turkey whose capability/product portfolio comprises communication and information technologies, radar and electronic warfare, electro-optics, avionics, unmanned systems, land, naval and weapon systems, air defense and missile systems, command and control systems, transportation, security, traffic, automation and medical systems. Today ASELSAN has become an indigenous products exporting company, investing in international markets through various cooperation models with local partners and listed as one of the top 100 defense companies of the world (Defense News Top 100).

ASELSAN, together with the technology emphasis in its vision, has targeted to be a company that maintains its sustainable growth by creating value in the global market; preferred due to its competitiveness, trusted as a strategic partner, and caring for the environment and people.

Together with the highly qualified engineering staff within more than 7.000 employees, being the main driving factor of the company's success, ASELSAN allocates 7% of its annual income for self-financed research and development activities.

Manager's Name and position within the company:

Contact Info:

3. Internship Activities

Week 1		Date	17.08.2020- 21.08.2020
Tasks Planned for the Weeks : Talking about the procedure and devices which are used in the printed circuit board manufacturing.			
Weekly Activity : Internship documents were delivered to the human resources department. The identification badge was received. A briefing was made on how to complete online occupational health and safety training. Online occupational health and safety training was made without being in the company. This training was include first aid, technical issues etc. After that, electrostatic discharge topic protection training was made. Online occupational health and safety training was completed. Afterwards, orientation about Aselsan was given as online. Every intern was dispatched to their department according to their interests. I was assigned to the "Process design and Product Development" department under the "Radar and Electronic Warfare Systems". The production workplace in the department were introduced and a brief information was given about the devices produced and the ongoing projects. The anechoic room ^[1] was visited and observed. Environmental Stress Screening Test Laboratory ^[2] was visited and test devices which are found in that laboratory such as climatic, solar, salt fog, humidity and temperature were studied and investigated. Printed Circuit Board (PCB) Manufacturing Laboratory was visited and PCB production was examined step by step. During the observation, the information about the devices which are used in the manufacturing processes was obtained. The usage purposes and working principles of the devices were explained. These devices were the following, respectively; Jet Printer ^[3] , reflow oven, PCB cleaning ^[4] , optic inspection ^[5] , 3D optic inspection ^[6] , selective soldering machine ^[7] , environmental test chamber ^[8] , X-ray PCBA analyzer ^[9] , Flying Probe Test ^[10] and conformal coating ^[11] .			
Completed Tasks for the Week: Laboratory was visited such as Environmental Stress Screening Test and Printed Circuit Board Manufacturing Laboratory. PCB production was learnt step by step by observing the devices which are used in the manufacturing processes. The usage purposes and working principles of the devices were explained			
Manager		Sign, Seal, and Date	

Week 2		Date	24.08.2020- 28.08.2020
Tasks Planned for the Weeks : Understanding the s parameters and the techniques of the measurement of these parameters.			
Weekly Activity : <p>Detailed research has been done on what is a jet printer, how to use it, how does it work, what are its features that make it stand out in the sector, what are its functions. The connectors, whose first measurements were made, were taken to the environmental test laboratory for temperature testing. Ten cycles were applied here with a temperature change from -45 degrees to 100 degrees. While waiting for the test to be completed, literature search has been done on what are the s parameters^[12], how are these parameters measured, what is a vector network analyzer^[13], how does it work, what is the spectrum analyzer^[14], what are the main differences between these two analyzers, and the qualification tests of PCB. The connectors which were put to the temperature tests in the environmental test laboratory were taken for post-test measurements. The s parameter values of optic torna, suhner, optic connector and sri jet connector were collected by using PNA network analyzer. Then, the capacitance values of the capacitors from the temperature test were measured and recorded. A detailed research was conducted on the working principles, advantages and disadvantages of vacuum vapor phase soldering^[15]. The solution search for the tombstone problem^[16] which is frequently encountered after the manufacturing of the PCB in this device has been completed.</p>			
Completed Tasks for the Week: Research has been done on what is a jet printer, s parameters, and measurement of these parameters, vector network analyzer, the spectrum analyzer, the main differences between vector network analyzer and spectrum analyzer and the qualification tests of PCB.			
Manager		Sign, Seal, and Date	

Week 3		Date	31.08.2020- 04.09.2020
Tasks Planned for the Weeks : Making a literature survey about the spectrum and network analyzer measurement.			
Weekly Activity : A detailed research was conducted on spectrum and network analyzer measurements. The questions which are what are they, what purpose they are used, how they are work and what are the working principles of them were tried to be answered. The unit design of the systems which are used in a project carried out by Aselsan was observed and investigated. Pin to pin mapping in unit has been completed to make the unit design. While doing this, the pin-to-pin mapping of the components was performed by the help of the documents that belong to these components. A detailed research has been done on power amplifier module [17], voltage regulator module [18] and signal generator unit [19] to understand them properly. A detailed research was made on how the “speed print” soldering with the sieve method works and for what purpose it is used.			
Completed Tasks for the Week: Pin to pin mapping in unit which is used in a project in Aselsan has been completed to make the unit design. A detailed research was completed about the power amplifier module voltage regulator module and signal generator unit.			
Manager		Sign, Seal, and Date	

Week 4		Date	07.09.2020- 11.09.2020
Tasks Planned for the Weeks : Comparing the jet printer which is no stencil printer and “speed print” which is surface mount technology stencil printer.			
Weekly Activity : How the “jet printer” and “speed print” ^[20] devices which are for the soldering process of the PCB used during soldering work, their working principles and the features that make them stand out in the sector were investigated in detail. A report which compares these two devices in terms of properties was prepared, together with the information in the research conducted. The connectors which will be used in the project conducted by the Aselsan were measured after the environmental test. The s parameter values of these connectors were collected by using PNA network analyzer. Besides, the capacitance values of the capacitors after the vibration test were measured and recorded. At the end of the internship, a presentation was made that summarizes the devices and methods which learned or used during the internship.			
Completed Tasks for the Week: The report that is included comparison of the stencil and without stencil printer devices was made. The presentation of the information learned during the internship was presented.			
Manager		Sign, Seal, and Date	

[1] The Anechoic Room (Chamber)

An anechoic chamber is a shielded room that has absorbing material applied to the walls, ceiling, and floor. Chambers may be table top sized enclosures, but are normally room sized enclosures where engineers can enter and work. Anechoic means without echoes. Simply put, it is a chamber (a box or room) without reflections from the walls, ceiling, or floor. It may be an acoustic anechoic chamber, where the walls are treated with fiberglass sound absorbers to suppress echoes. In RF study, we are talking about a shielded room, where the inner surfaces have been treated with radio wave absorbers. Typical absorbers may be foam pyramids loaded with carbon which is for frequencies above 500 MHz, or ferrite tiles which are for frequencies below 500 MHz. In RF engineering, the anechoic chamber is used for “Over the Air” (OTA) measurements, as opposed to “conducted” (in coax) measurements. The RF anechoic chamber environment allows antenna patterning and radiated measurements from antennas or devices with embedded antennas without reflections or ambient radio signals.

The Anechoic Chamber Far-Field Test Facility is uniquely designed to accommodate large test articles, such as spacecraft mockups with antennas mounted on them. The microwave material that covers the wall and door surfaces adsorbs electromagnetic energy, thereby allowing the Anechoic Chamber to simulate a space environment. The Chamber is air-conditioned, has artificial lighting, shielded personnel doors, and a shielded sliding high bay door that allows for easy entry and exit of large mockups. The Chamber has the capability to accommodate lower frequency testing down to 200 MHz in an effort to bring all testing from 200 MHz to 40 GHz indoors.



[2] Environmental Stress Screening Test Laboratory

In this process for product reliability, materials and products are subjected to high-speed temperature cycles to reveal possible defects and make necessary corrections. Testing at the physical environmental conditions (shock, vibration, temperature, altitude, humidity, etc.) which simulate those encountered over the operational life of the component. Random vibration and temperature cycling have proven to be the most successful forms of environmental testing in terms of effective flaw precipitation. It refers to the process of exposing a newly manufactured or repaired product or component typically electronic to stresses such as thermal cycling and vibration in order to force latent defects to manifest themselves by permanent or catastrophic failure during the screening process. The

surviving population, upon completion of screening, can be assumed to have a higher reliability than a similar unscreened population.

A stress profile is developed and applied and the profile simulates the environmental conditions encountered during transportation, storage, handling, and operational use phases. Environmental testing is the measurement of the performance of equipment under specified environmental conditions, such as climatic, solar, salt fog, humidity and temperature.

[3] Jet Printer

Jet printing is a non-contact printing process that applies solder paste directly onto the PCB pad, without the need to use any stencil tooling. Small solder paste deposits are placed at a rate of over 1 million dots per hour, to accurately construct the optimum solder paste typography for each and every pad position on the board. Such close control allows us to obtain the optimum reflow conditions first time and every time. Jet printing removes the limitations of traditional stencils, to deliver a new level of reliability for rigid and flexible substrates, board cavities, package-on-package, QFNs and new components with small process windows. By optimizing the solder paste process we are able to remove the typical production errors, such as floating QFN devices, excessive and insufficient solder, that lead to poor production yields, higher build costs and the inevitable time delays. Assured delivery times can be achieved without the constraints of using stencils. We are able to adopt a lean, fast and cost-effective approach to SMT/PCB production, regardless of lead-time and complexity.

With its highly accurate, on-the-fly solder paste jet printing, it allowed the most demanding manufacturers to achieve optimal solder joints of any shape and size – on demand. The Jet Printer allows you to produce complex boards with unmatched precision at a speed of more than one million dots per hour. It handles flexible substrates, board cavities and package on package applications with ease. Its high-precision, non-contact nozzle ensures perfect solder paste deposits to reduce re-work and increase overall throughput.

Features of the device can be ordered as design freedom, superior quality, software driven, fast NPIs, no stencils and repeatability, quick offline programming, reduced lead times, increased product quality and increased profitability. There are many benefits of the jet printer as elimination of manual data as needed ones, fast BoM to cad comparison, fast setup for new projects, gaining time from the manual machine teaching, the time that is gained from the teaching and offline programming is used to build more boards, engineering changes are fast and central management of part number databases.

[4] PCB Cleaning

When cleaning assemblies (PCB cleaning, PCBA cleaning), the primary goal is to remove resin and flux residues from filled boards and hybrids, as well as manufacturing-related debris from machining. While the use of "unclean" works well in many inferior manufacturing processes, high-end assemblies for use in industries such as automotive, telecommunications, military and aerospace require the use of a specific PCB cleaning agent. It is found in almost all electrical devices, including circuit boards, computers, and industrial equipment. Over time, water, dust and dirt can enter your company's devices and accumulate to a point where you need to act to prevent permanent damage to the equipment. Fans responsible for keeping the equipment temperature in a cool environment suitable for proper functionality can attract airborne debris and dirt adhering to nearby surfaces. Unwanted material formation causes overheating and component failure.

This is almost mandatory today, especially in the senior field. These cards (assembled / assembled PCBs) must be thoroughly cleaned of manufacturing debris and possible environmental and

transport debris to ensure reliable further processing and subsequent trouble-free performance. Especially where sensitive and therefore often expensive modules are used, such as the aviation industry, automotive industry, medical technology or telecommunications, combined PCB cleaning is a complete and insignificant production step. But even in so-called unclean production, these components may need to be cleaned to prevent breakdowns. Complete removal of flux residues, rosin, resin, oxides and solder materials, printed circuit boards, active and passive electronic components, BGA, flip chip, relays, inductors, etc. These are the main tasks in cleaning. It is not only a necessary prerequisite for reliable bonding and / or varnishing, etc. for climate security / prevention of existing leaks. Cleaning assembled PCBs also allows debugging, thus preserving the value of false prints and / or guaranteeing the optical quality of electronic components.

[5] Optic Inspection

Automatic Optical Inspection (AOI) is an automatic visual inspection of a Printed Circuit Board (PCB) where a camera is used to scan the board in extremely fine detail to check for any defects or defects. Assuming your PCB design is correct, your product will work if you install the right parts in the right place. In manufacturing, this means focusing too much on the detection and correction of any manufacturing defects or Manufacturing Defects Analysis. AOI is a vital inspection system that allows you to measure and monitor the quality of your PCB production and fix any problem or defect at any strategic point in the process flow. The AOI process provides the real-time control required by an EMS and provides invaluable experimental data for process control and improvement as production volumes increase. An AOI system uses a number of strategies to analyze whether a PCB is manufactured to the required standards. Pattern matching algorithms keep track of both successful and failed PCB assemblies.

The effectiveness of AOI depends on the type of equipment used, capabilities available and integration into the PCB manufacturing process. Depending on CM's operations, equipment can range from a single isolated device used to sample test boards, to multiple machines strategically placed at various points or steps during production to analyze board quality throughout the manufacturing and / or assembly stages. For more advanced PCBA manufacturing facilities, AOI is combined with software to increase quality and provide automation and amplification for smarter circuit board construction.

There are many quality control options that CMs can use during production. However, AOI is one of the most effective methods as it can identify many defects that would otherwise not be detected. In fact, this test method can even be used to compare the actual board with the idealized CAD design created by PCB design software. Below is a list of some AOI uses that can be used to optimize the quality of your fabricated and assembled board.

[6] 3D Optic Inspection

There are technological factors that make a 2D or 3D AOI system the better choice for a particular application. However, there are other factors to consider such as cost and the intended use of the PCB assembly. In some cases, implementation, cost factors, and acceptable process parameters may make a 2D machine the better choice, but in other cases the same factors may make a 3D AOI system the better choice. Ideally, an AOI system using both 2D and 3D technology provides optimal control capability, as some board, component, and solder properties are best perceived by 2D technology while 3D technology is best for others. The convenient blend of 2D and 3D technology provides the widest

range of recognition and inspection capabilities with the most accurate inspection and measurement results and lowest false search and escape rates.

3D inspection technology has been available for years, but has typically only been used to examine solder paste build-up in PCDs immediately after screen printing. However, 3D inspection has recently been added to other areas. Laser measurement is used to provide 3D measurement of height sensitive devices. This method helps to detect coplanarity defects that may be overlooked by 2D inspection methods.

Advantages of 3D Systems:

- True coplanarity control capability
- Volumetric inspection data
- Reduced false call rate

Limitations of 3D Systems:

- Emerging technology
- Cannot control 2D elements
- Significant cost increase
- Significant reduction in speed
- Height limitation, approx. 5 mm maximum
- Shading issues
- No color control

[7] Selective Soldering Machine

Selective soldering is a form of wave soldering mainly used for soldering printed circuit boards assembled with partially or fully perforated components. In Nordson SELECT selective soldering machines, nitrogen inactivation is standard, and the soldering pot is designed with titanium material to resist the corrosive effects of aggressive lead-free solder alloys. In most cases, selective soldering consists of three steps; 1) fluxing or liquid flux application, 2) preheating or printed circuit board assembly, and 3) soldering with a site-specific soldering nozzle. Thanks to Nordson SELECT software, even programming has been perfectly developed so that operators without prior knowledge can set up a program in minutes. Due to its inherent process flexibility, selective soldering can be successfully used to solder a wide variety of printed circuit board assemblies and has many different advantages, including:

- a) Process optimization can be achieved safely and quickly
- b) Provides reliable solder connections without overheating components
- c) Process repeatability guaranteed
- d) Eliminates the use of expensive opening wavy solder pallets or masks

With the growing popularity of SMT technology, through-hole technology takes up less space in a PCB assembly. But perforated pins are still required for many boards and still need to be soldered. While this process can be cumbersome, many manufacturers have turned to selective soldering as a precise and cost-effective way to solder through-through technology. Prior to the rise of reflow soldering, a process now more frequently used due to the increasing complexity of PCBAs, boards with a large number of open-hole pins were subjected to wave soldering, a process in which a board goes through a

solder wave. For the switch technology, this caused a few problems; the pins could withstand more thermal shock and were much cheaper. However, SMT packages are more precise and expensive and must be soldered in a reflow furnace. However, some cards still require punched pins. This poses a minor problem because the hollow pins cannot be soldered in a reflow furnace and must be soldered separately. This can be done by hand or with a selective soldering machine.

[8] Environmental Test Chamber

The Environmental Test Chamber (ETC) is a high temperature Smart Swap™ accessory that uses a combination of radiant and convective heating and has a temperature range of -160 °C to 600 °C with heating rates up to 60 °C / min. This hybrid temperature control design provides fast response and temperature stability over a continuous range of 760 °C. ETC is a very popular option for polymer applications and can be used with parallel plate, cone and plate, disposable plate, DMA clamps for rectangular torsion and solids, and SER3 for elongation viscosity measurements. Typical materials that can be tested include thermoplastics, thermosets, elastomers, fillers and adhesives, solid polymers, asphalt binder and oils and greases.

An environmental chamber, also called a climate chamber or climate chamber, is an enclosure used to test the effects of certain environmental conditions on biological items, industrial products, materials, and electronic devices and components. Such a room can be used as an independent test for environmental effects on test specimens, the preparation of test specimens for further physical testing or chemical tests, environmental conditions for testing samples. An environmental test room artificially replicates the conditions that machines, materials, devices or components may be exposed to. It is also used to accelerate the effects of exposure to the environment, sometimes under actually unexpected conditions. Chamber testing involves the exposure and testing of products to various environmental conditions in a controlled environment. The Climate Chamber test and the Thermal Shock test are part of the chamber test. Climate Chamber testing is a broad category of ways to simulate exposure to climatic or extreme environmental conditions for a product or material under laboratory-controlled but accelerated conditions. On the other hand, Thermal Shock testing is used to simulate how materials will react when subjected to changes in extreme climatic conditions such as moving from extreme cold to extreme hot conditions in a very short time (usually just a few seconds).

[9] X-Ray PCBA Analyzer

The PCBA analyzer is a high resolution micro focus X-ray system equipped with an open tube from x-ray dedicated to the study of printed circuit board assemblies. X-ray inspection technology is a technology used to examine target objects or their hidden properties. Products that are sources of X-rays. Today, X-ray examination is widely used in many applications such as medical, industrial control and aerospace. When it comes to PCB inspection, X-ray is extensively used in the PCB assembly process to test the quality of PCBs, which is one of the most important steps for quality-oriented PCB manufacturers.

In recent years, field array packages including BGAs and QFNs, flip chips and CSPs, industrial control, communications, military industry, aviation, etc. It is widely used in all kinds of fields such as and hides solder joints under packages this fact makes it impossible for traditional control devices to play their role perfectly in PCB inspection. In addition, because the appearance of the surface mount technology (SMT) that makes both the packages and the ends is reduced, traditional inspection methods,

including optical, ultrasonic and thermal imaging, fall short because PCBs have higher density, with solder joints hidden and holes buried or blind. . Also, while considering the X-ray control system with increasing miniaturization in terms of semiconductor component package, both current and future component miniaturization trend cannot be neglected. Compared to other inspection methods, X-ray can enter the inner packaging and inspect the quality of solder joints. So it is taken.

[10] Flying Probe Test

In testing printed circuit boards, a flying probe test can be used to test low and medium volume production, prototypes, and boards with accessibility issues. Flying probes are electro-mechanically controlled to access components in printed circuit assemblies. The probes are moved around the tested board using an automatically operated two-axis system, and one or more test probes touch the components of the board or test points on the printed circuit board. The flying probe test is often used for testing analog components, analog signature analysis, and testing short / open circuits. They can be classified as in-circuit test systems or Manufacturing Defect Analyzers. They provide an alternative to the nail bed technique for contact with components on printed circuit boards. The main advantage of flying probe testing is the substantial cost. Flying probes also allow for easy replacement of the test fixture when the PCBA design changes. A test cycle of 30 seconds in such a system could take up to an hour with flying probes. However, as board designs become more complex and compact, net access for traditional nail bed testing becomes more challenging.

The flying probe tester performs programming easier and faster than traditional ICT (in-circuit testing) systems, for example flying probe testing. To implement the flying probe test program, test personnel must first convert the CAD (computer-aided design) data provided by the engineers into a workable file. Then the newly created file will be passed through a testing program containing new files with the corresponding formats created. Finally, all files will be created in accordance with the UUT test requests and requirements. As soon as test programming is finished, the authentic flying probe test is just around the corner. A test item must first be identified, shorts. Next, the data of reference points suitable for the UUT must be extracted from the CAD data. As soon as the UUT is secured to the platform, programming will be done to examine production or assembly issues. It is worth noting that debugging must be done before official tests. What's more, debugging of flying probe test can be completed in less time compared to traditional ICT test.

[11] Conformal Coating

The protective coating is a 25-75 μm thick protective coating or polymer film that "conforms" to the circuit board topology. Its purpose is to protect electronic circuits from harsh environments that can include high humidity, various airborne contaminants and varying temperatures. As an electrically insulator, it maintains long-term surface insulation resistance (SIR) levels and thus ensures the operational integrity of the assembly. It also provides a barrier for airborne pollutants from the working environment such as salt water, thus preventing corrosion. Protective coatings are a breathable protective layer that will protect against the specific environment PCA is exposed to by filtering out airborne contaminants and preserving long-term surface insulation resistance, but will also allow any moisture trapped in the circuit board to escape. The advantages of the conformal coating can be ordered like;

- Insulation properties may allow a reduction in PCB conductor spacing

- Can help eliminate the need for complex, advanced containment
- Ensure a longer service life by doing the following:
 1. Protection against moisture, chemicals and physical attacks
 2. Protection against thermal changes and shocks
 3. Protection against vibration and mechanical shocks

[12] S-Parameters (Scattering Parameters)

Scattering parameters or S parameters (elements of a scattering matrix or S matrix) are parameters that describe the behavior of linear electrical circuits being excited by electrical signals in the steady state. S parameters are used in electrical engineering, electronics engineering, communication systems, and especially microwave engineering. S parameters are members of a family of similar purpose parameters. Other examples from this family can be listed as Y parameters, Z parameters, H parameters, T parameters and ABCD parameters. S parameters, unlike other examples, use the appropriate load state rather than open or short circuit conditions to characterize the behavior of the linear circuit. Many electrical properties of circuit elements (inductance, capacitor, resistance) such as gain, return loss, voltage standing wave ratio, reflection coefficient and amplifier stability can be expressed using S parameters.

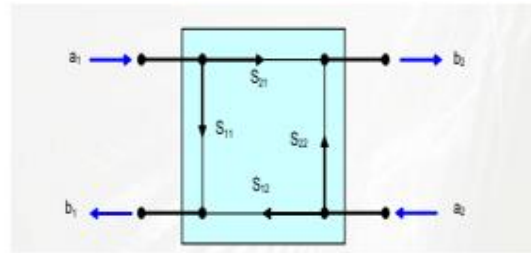
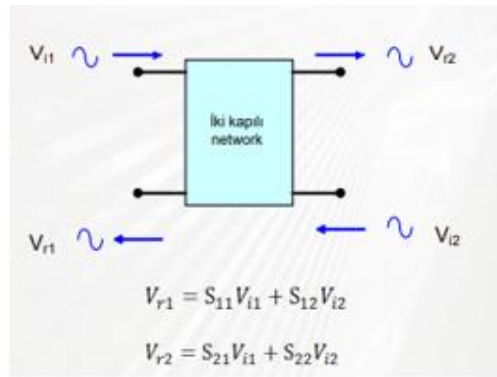
The term scattering is used more in optical engineering than RF; describes the effect seen when a plane electromagnetic wave encounters obstacle or transitions between different dielectric media. In the context of S parameters, scattering refers to the current and voltage advancing in a transmission line being affected by the discontinuity they encounter as a result of the line being interrupted by a circuit. This situation is equivalent to the wave encountering an impedance of different magnitude than the characteristic impedance of the line. Although S parameters are valid at all frequencies, they are mostly used in circuits operating in radio frequency (RF) and microwave frequencies where signal power and energy are calculated more easily than currents and voltages. S parameters are frequency dependent values. For this reason, for any given S parameter value, besides the characteristic impedance and system impedance, the frequency value of the parameter must be specified. S parameters can be easily written in matrix form and matrix algebra rules can be applied on them.

The black box is also called a network (line).

S_{11} → reflection coefficient

S_{12} → the ratio of the wave leaving gate 1 and entering gate 2

Assuming a two-port line, the wave representations will be as follows;



Radio frequency (RF) signals are high frequency signals, and since there are not enough devices to measure current and voltage of high frequencies, s-parameters are used, in which power values are used instead of current and voltage variably to overcome this problem.

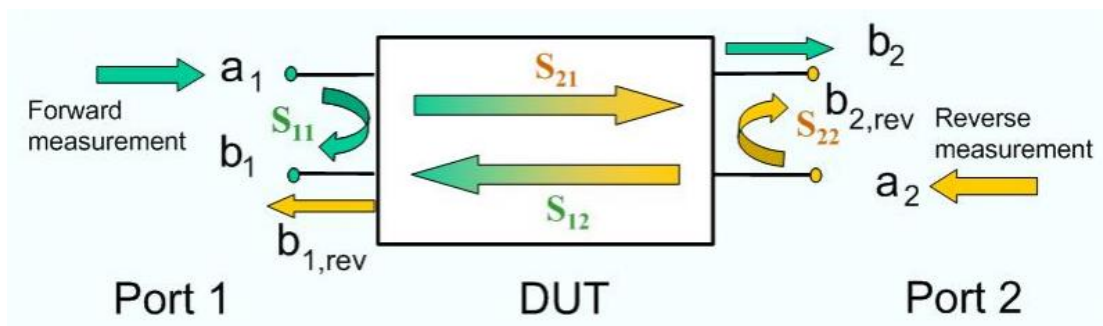
[13] Vector Network Analyzer

It can measure complex input / output impedances, gain-losses and phase differences in the system, more broadly s-parameters, by making measurements on the wave character of voltage and current. The concept of network here has nothing to do with the computer networks we know. Said a radio frequency system (network) inputs and outputs. This is a filter, amplifier, or passive circuit element, etc. may be.

The main function of the network analyzer is to apply a signal of known amplitude and phase to the input of the system to be tested and to give information about the system structure by looking at the signal at the output of the system. Basically, a network analyzer contains a signal generator and 2 receivers. Many parameters such as how much of the produced signal continues on its way on the tested system, how much of it is reflected back, how much it is distorted in terms of amplitude and phase at the output of the system, and how long it is delayed can be tested.

How does a Vector Network Analyzer (VNA) work?

A Vector Network Analyzer includes both a source used to generate a known stimulus signal and a set of receivers used to determine changes in that stimulus caused by the device or DUT under test. The stimulus signal is injected into the DUT, and the Vector Network Analyzer measures both the signal reflected by the input and the signal passed to the output side of the DUT. Vector Network Analyzer receivers measure the acquired signals and compare them with the known stimulus signal. The measured results are then processed by an internal or external PC and sent to a screen.



Vector Network Analyzer performs two types of measurements, transmission and reflection. Transmission measurements pass the Vector Network Analyzer exciter signal through the device under test, which is then measured by the Vector Network Analyzer receivers on the other side. The most common transmission S parameter measurements are S21 and S12.

[14] Spectrum Analyzer

The spectrum analyzer is an electronic equipment used to measure the magnitude of a given input signal over the full frequency range of the device. It is primarily used to measure the strength of the spectrum of known and unknown signals. The spectrum displays data in a graph representing amplitude on the y-axis and frequency on the x-axis. The spectrum analyzer is used to measure carrier power level, noise harmonics, etc. and spectrum analyzers measure the parameters of a signal and not a device.

In addition, in the spectrum analyzer, it is possible to measure the amplitudes of these signals by looking at the amplitudes of the signals of different frequencies, to find out which signals are present and so on. As such, the spectrum analyzer is a particularly important test equipment for anyone testing and measuring circuits and systems containing radio frequency or RF signals. In addition, it can be used for a variety of applications including spectrum analyzers, audio analysis and the like.

The list of the main usage purposes of the spectrum analyzer as follows:

- To see if the overall spectrum of a modulated signal is wide enough or too narrow. (If it's too broad then it can affect users on neighboring channels.)
- To investigate for any false or unwanted signals. (These signals may cause interference to users on other frequencies, signals are transmitted.)
- To find out if a signal is at the correct frequency and not in another band for example.

In general, the variation of amplitude over time is examined using an oscilloscope to see an electrical sign. However, the time plane does not provide a general information about the entire sign. In order to see all the information about the signal, the signal must be examined in the frequency plane.

[15] Vacuum Vapor Phase Soldering

A special form of vapor phase soldering is vacuum vapor phase brazing. After the solder paste is completely melted, air is pumped into the process chamber. The negative pressure ensures that the gaseous inclusions are displaced substantially outward at the soldering points and thus separates from the soldered joint. The result is gap-free solder joints. This technology is particularly advantageous when solder joints need to dissipate heat, as air inclusions increase the thermal resistance of the solder joint. Additionally, voids impair the mechanical load-bearing capacity. Vapor phase (VP) soldering was once considered the reflow soldering technology of choice in the early days of assembling printed circuit boards (PCBs) with surface mount technology (SMT) components. VP soldering provides excellent heat transfer and can quickly and evenly heat large circuit areas with tightly controlled peak temperature. However, it can also be subject to rapid temperature increases with limited control of temperature profiles.

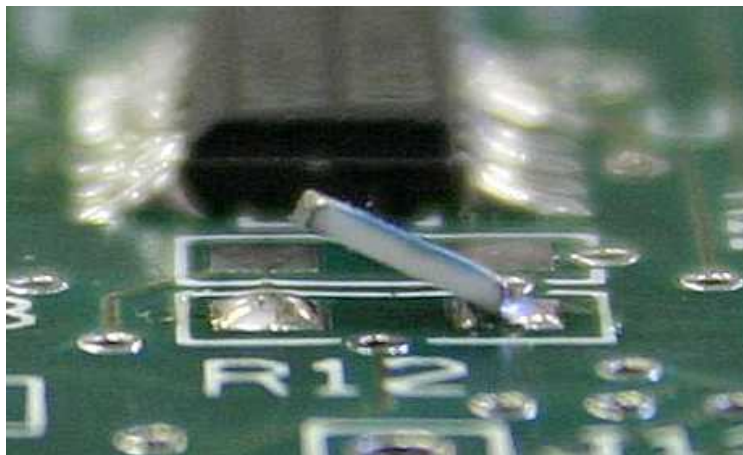
Vapor phase brazing has also become competitive for high volume production. State-of-the-art machines offer high efficiency with high quality results. Steam, like all gases, tends to fill a given sphere

evenly, such as a vapor phase process chamber. While uniform temperature distribution on the plates is automatically achieved by this physical effect, the cross profile in a convection oven may change in terms of temperature. Physical limitation of the maximum temperature in a vapor phase system does not require any more control mechanisms to prevent overheating. This quality feature also provides the highest benefits in the long-term reliability of soldered electronic cards today.

[16] Tombstone Problem

The tombstone phenomenon is a defect that occurs when passive SMT components are partially or completely lifted from the PCB pad. What usually occurs is that one end of chip is soldered on the PCB pad while opposite end of the chip stand up vertically, looking similar to a tombstone in a cemetery.

The root cause of the tombstone phenomenon is that the wetting properties (e.g., different wetting speeds) cause an imbalanced torque at the two ends of the chip terminals when the solder paste starts to melt. The primary cause of the tombstone defect is the difference in the wetting effect / surface tension of the molten solder on the pads of the small passive components.



The main reason for the tombstone phenomenon is that the wetting properties (for example, different wetting speeds) cause an unstable torque at both ends of the chip terminals as the solder paste starts to melt. There are other reasons for the tombstone phenomenon:

- Solder pads incorrectly designed:
- Because the gap between the two pads is so wide, the terminals of the components are not covered by more than 50% of the PCB pads.
- The two pads are designed in different sizes.
- Solder paste print is not smooth.
- Component placement is incorrect.
- Reflow oven temperature uneven.
- The thermal conductivity of the PCB material has different heating capacities.
- The presence of nitrogen tends to increase the occurrence of the tombstone defect.
- Placing the chip parallel to the conveyor of the reflow oven.

[17] Power Amplifier Module

Power amplifiers are electronic circuits that transfer some of the power drawn from the supply sources to the load in the form of an input signal or as a part of this signal. Power amplifier means increasing the power level of the signal applied to the input in a circuit. In order to obtain large power at the output, the input signal voltage must also be large. For this reason, in electronic systems, voltage amplifiers are generally ahead of power amplifiers, and power amplifiers are called large signal amplifiers. In fact, power boosters do not increase power.

The power amplifier actually draws energy from a DC power source and converts this energy into a ready-to-use AC signal by referencing the input signal. The type of AC power signal at the output terminal of the power amplifier is controlled by the input signal. Therefore, power amplifiers can be defined as devices that provide DC power conversion.

[18] Voltage Regulator Module

These are the cards that are fed by two or more batteries and produce by regulating the voltages at the output. A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator can use a simple feed forward design or may contain negative feedback. It may use an electromechanical mechanism or electronic components. Depending on the design, it can be used to regulate one or more AC or DC voltage.

Electronic voltage regulators stabilize the DC voltages used by this processor and other elements in the power supply with devices such as computers. As automobiles, alternators and central power station generator mechanisms, voltage regulators control the plant outlet. In an electrical power distribution system, voltage regulators can be fitted with a transformer or distribution lines, so that all customers receive constant voltage regardless of how much power is drawn from the line.

[19] Signal Generator Unit

A signal generator, also known as a test signal generator, is an electronic device designed to generate electrical impulses. The signal generator is a piece of test equipment that generates an electrical signal in the form of a wave. This is used as a stimulant for the tested item. Signal generators of all their forms are widely used in test and development systems, along with other test equipment.

Looking at what a signal generator is, it will be seen that these come in many forms - there are many types of signal generator each used to provide a different signal format. Some provide RF signals, some provide audio signals, some can provide different waveform shapes, and others can only provide pulses. Signal generators have been used for many years. The early types were very basic by the standard of today's different types of signal generator. Performance levels and the variety of facilities available have increased and improved.

Signal generators come in a variety of formats that can generate a variety of waveforms for different testing applications. Some of these testers appeal to the RF testing area, while others are for sound testing, possibly a sine wave generator, etc. And others are probably used to provide pulses for exciting digital circuits. There are thousands of different applications for signal generators. However,

they differ from measurement testers such as oscilloscopes, digital multimeters, and spectrum analyzers because instead of measuring a signal, they generate a signal that will be applied to a unit under test.

[20] Speed Print

SP700 series SMT stencil printers are designed to be at home in low, medium or high volume Surface Mount Technology production processes. Essentially, they provide a flexible solution that is ideal for high-mix, fast product set-up and transition environments. The core of the SP700 series is the Dual Travel camera system. Uniquely developed by Speed print, this vision platform advances printer technology by using twin camera units in a "look down" configuration. This was designed with ease of use, maintenance and low cost of ownership in mind.

- Some of the standard features in the SP700 series are:
- Automatic rail width adjustment
- Fully automatic template loading and extraction
- Fully programmable wet / dry vacuum under the Stencil Cleaner
- Solder bead inspection in the template

When you need to produce a product at the micron level, the resolution of your control and measurement system should be as good as possible. All Speed print products have always used the most advanced drive control technology available at the heart of this design is the use of 1 micron resolution solid state linear encoders in all axes. This is truly the only way to guarantee the highest level of performance throughout the life of the machine.

ASELSAN ÖĞRENME VE GELİŞİM UYGULAMALARI MÜDÜRLÜĞÜ'ne,

.....tarihinde

Müdürlüğü'ndeişgünü yapmak üzere başladığım stajım
tarihinde sona erecektir.

Gereğini arz ederim.

Adı-Soyadı

Tarih-İmza

Uygundur

(Bölüm Yöneticisi İmzası)

	<p style="text-align: center;">T.C. İSTANBUL MEDİPOL ÜNİVERSİTESİ MÜHENDİSLİK VE DOĞA BİLİMLERİ FAKÜLTESİ Staj Değerlendirme Formu <i>İSTANBUL MEDİPOL UNIVERSITY</i> <i>SCHOOL OF ENGINEERING AND NATURAL SCIENCES</i> <i>Internship Evaluation Form</i></p>	
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Kurum Adı: <i>Company Name:</i>	
Yetkili Kişi Adı-Soyadı: <i>Supervisor Name:</i>	
Yetkili Kişi Unvanı ve Bölümü: <i>Supervisor Title and Department:</i>	
Yetkili Kişi Telefon Numarası: <i>Supervisor Phone Number:</i>	

Öğrenci Adı-Soyadı: <i>Student Name:</i>	
Kurumda Çalıştığı Bölüm: <i>Department Performed Internship:</i>	
Başlangıç Tarihi (Gün/Ay/Yıl): <i>Start Date (Day/Month/Year):</i>	
Bitiş Tarihi (Gün/Ay/Yıl): <i>End Date (Day/Month/Year):</i>	
Çalıştığı Toplam İş Günü: <i>Total Work Days:</i>	

Değerlendirme / Evaluation

Performans Kriteri / <i>Performance Criterion</i>	Çok İyi <i>Excellent</i>	İyi <i>Good</i>	Orta <i>Fair</i>	Zayıf <i>Poor</i>	Çok Zayıf <i>Very Poor</i>
İşe devamlılık ve dakiklık / <i>Regularity and timeliness</i>					
Sorumluluk / <i>Responsibility</i>					
İlgi ve gayret / <i>Interest and effort</i>					
Bilgi / <i>Knowledge</i>					
Öğrenme isteği / <i>Desire to learn</i>					
Öğrenme yeteneği / <i>Ability to learn</i>					
İş arkadaşlarıyla iletişimi / <i>Communication with coworkers</i>					
Takım çalışmasına yatkınlık / <i>Teamwork</i>					
Dış görünüşü / <i>Physical appearance</i>					
Toplam Performans / <i>Overall Performance</i>					

Diğer yorumlarınız için sayfa ekleyebilirsiniz. / *You may attach additional papers for further comments.*

Lütfen bu formu doldurduktan sonra kapalı bir zarf içinde öğrenciye teslim ediniz.
Upon the completion of the form, please hand it to the student in a sealed envelope.

Yetkili Kişinin Adı-Soyadı / <i>Supervisor Name</i>	Tarih / <i>Date</i>	İmza ve Kaşe / <i>Signature and Company Seal</i>

	<p>T.C. İSTANBUL MEDİPOL ÜNİVERSİTESİ MÜHENDİSLİK VE DOĞA BİLİMLERİ FAKÜLTESİ Staj Yeri Değerlendirme Formu İSTANBUL MEDİPOL UNIVERSITY SCHOOL OF ENGINEERING AND NATURAL SCIENCES Internship Place Evaluation Form</p>	
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Öğrencinin: Adı-Soyadı: Rabia GÜL

Bölümü: Biyomedikal Mühendisliği

Sınıfı-Numarası: 62150005

1.

Kurumu Değerlendirme Kriterleri	Çok İyi	İyi	Orta	Yetersiz
Yöneticilerin stajyerlere yaklaşımı			X	
Çalışanların stajyerlere yaklaşımı		X		
Çalışma ortamının yeterliliği (Nem, gürültü, havasızlık, hijyenik koşullar, vb.)			X	
Çalışma koşullarının uygunluğu (Sürekli ayakta/oturarak, dar/geniş, kapalı/ açık mekan, düzensiz çalışma saatleri, molalar vb.)			X	
Çalışanlara sunulan sosyal imkanların yeterliliği				X
Çalışırken kullanılan araç-gereç ve sistemlerin yeterliliği		X		
Üstlerin, astların gelişimine verdikleri destek			X	
Çalışanlar arası iletişim				X

2.

Staj yapılan birim ya da birimlerde gerçekleştirilen çalışmalar yeterli ve uygun prosedürlerle yürütülüyor mu? Açıklayınız.	Evet yürütülüyor.
Staj süresince ilgili yönetici ve çalışanlardan gerekli desteği aldınız mı? Açıklayınız.	Kısmen aldım.
Stajınızı bu kurumda yapmış olmanın sağladığı avantaj ve dezavantajları belirtiniz	Kariyerime katkısı olacak bilgiler öğrendim.
Staj süresince kurumun size sağladığı imkanları belirtiniz.	<input checked="" type="checkbox"/> Ücret <input checked="" type="checkbox"/> Sigorta <input type="checkbox"/> Konaklama <input checked="" type="checkbox"/> Yemek <input checked="" type="checkbox"/> Ulaşım
Staj süresince teorik bilgilerinizi uygulayabilecek yeterli fırsatı bulabildiniz mi?	Kısmen buldum.
Staj yaptığınız bu kurumu staj yapacak diğer öğrenciler için de önerir misiniz?	Kısmen öneririm.
Sizce bu kurumda bölüm hedeflerine uygun staj yapılabilir mi? Açıklayınız	Kısmen yapılabilir.

3.

KURUMUN TARİHÇESİ: ASELSAN 1975'te Türk Silahlı Kuvvetleri'nin haberleşme ihtiyaçlarının milli ve özgün olarak karşılanması amacıyla başladığı faaliyetlerini geliştirerek bugün uluslararası ölçekte bir firma haline gelmiştir. Geliştirdiği ürünlerini dünyanın dört bir yanına ihraç etmekte, yarattığı teknolojik çözümlerle güvenliği ve barışı sağlama adına hizmet vermektedir.
KURUMUN YÖNETİM VE ORGANİZASYONU: 9 kişilik yönetim kuruluna destek amaçlı Hukuk birimi, Planlama ve koordinasyon birimi, İç denetim başkanlığı, 9 genel müdür yardımcılığı, 5'i teknik genel müdür yardımcılığı, 4'ü idari genel müdür yardımcılığı
KURUMUN FAALİYET ALANLARI: Türkiye'nin en büyük savunma elektroniği kuruluşu olan ASELSAN; başta Türk Silahlı Kuvvetleri olmak üzere yurtiçi ve yurtdışı ihtiyaç makamlarının, haberleşme ve bilgi teknolojileri, radar ve elektronik harp, elektro-optik, aviyonik, insansız sistemler, kara, deniz ve silah sistemleri, hava savunma ve füze sistemleri, komuta kontrol sistemleri, ulaştırma, güvenlik, trafik, otomasyon ve sağlık teknolojilerine yönelik ihtiyaçlarını karşılayabilecek çok geniş bir ürün yelpazesine sahip bulunmaktadır.
KURUMA BAĞLI İŞLETMELER: AselsanNET Ltd. ULAK Inc.

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