Middle East Technical University

Department of Electrical and Electronics Engineering

EE400 Summer Practice II
Report

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Contents

1 Introduction

I performed my summer practice in ASELSAN A.Ş., one of leading defence industry companies in Turkey. my internship lasted 20 days and Pınar Kırıkkanat, an electronics engineer in ASELSAN was my supervisor and assisted me in my summer practice.

The summer practice started with an orientation program that briefly explains the company and how the works are handled. Following that, mandatory educations like occupational safety and health education is given to the interns by the company. After the educations, inters were sent to their assigned departments and division. I was similarly sent to HBT division to perform my summer practice.

In the first half of my internship, I was given time to observe, learn and participate the mechanical and electrical test conducted at our division. Mainly on ASELSAN 9661 Series Radios, I mostly observed and participated on the environmental tests of the equipments produced at the Communication & Information Technologies Vice Presidency, known as HBT. .

In the second part of my internship, I was given time to observe the work done behind the testing, in other words process design and management. In this part of my internship, I participated on documentation and research activities for the ULAK Base station of the ASELSAN. Since the work done at this stage can be mostly considered as classified information, I will mention the basics of what I have done in this part.

In this, report, I start with an introduction, that covers what was done in my summer practice. Then, I continued with a company description section in which the general description about ASELSAN is given. After that part, the work done in my summer practice is explained. Lastly, I finished the report with an conclusion part.

2 Description of the Company

In this chapter, I will introduce the company in five main parts:

2.1 Company Name

ASELSAN A.Ş. or **AS**KERİ **EL**EKTRONİK **SAN**AYİ A.Ş.

2.2 Company Locations

ASELSAN has six campuses in Turkey, one of them being in Istanbul, other campuses are located at Ankara. Throughout my summer practice, I spent my time at **Macunköy** Facilities .

Address / Macunköy Facilities: Mehmet Akif Ersoy Mahallesi 296. Cadde No: 16, 06370 Yenimahalle-Ankara, Türkiye

Phone: +90 (312) 592 10 00

Fax: +90 (312) 354 13 02 / +90 (312) 354 26 69

2.2.1 Macunköy Facilities

Macunköy Facilities was established on an area of total 186.000 m2, 110.000 m2 of which is the closed area. **General Directorate**, **SST** Group, **UGES** Group and parts of **HBT** and **REHİS** Groups are at Aselsan Macunköy Facilities.

2.2.2 Other Facilities

- Akyurt Facilities (**MGEO** Group)
- Gölbaşı Facilities (**REHİS** Group)
- ODTÜ TEKNOKENT (SATGEB Building) (Part of **HBT** Group)
- ODTÜ TEKNOKENT (TİTANYUM Building) (Part of **HBT** Group)
- İstanbul Facilities (Part of **SST** Group)

2.3 General Description of the Company

ASELSAN is a company of Turkish Armed Forces Foundation, established in 1975 after Cyprus Peace Operation 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 25,70% runs in İstanbul Borsa stock market.

As one of the largest defence industry companies of Turkey, ASELSAN's product portfolio includes communication and information technologies, radar and electronic warfare, electro-optics, avionics, unmanned systems, land, naval and weapon systems, air defence and missile systems, command and control systems, transportation, security, traffic, automation and medical systems[10] as can be seen from the *Figure 1*.

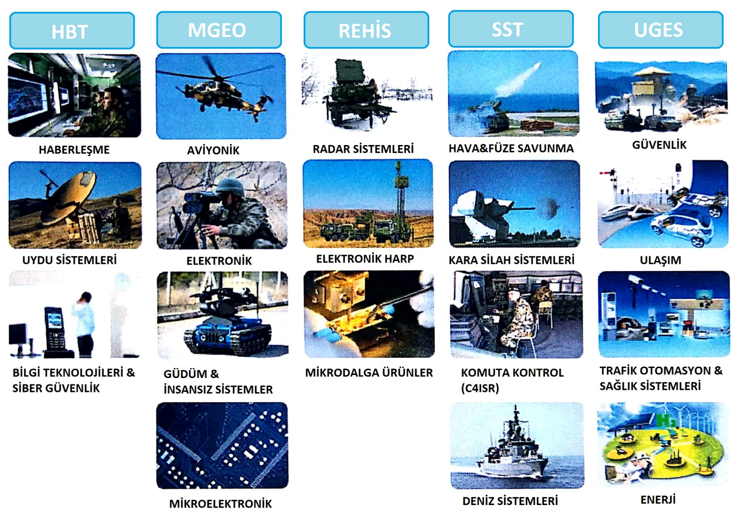
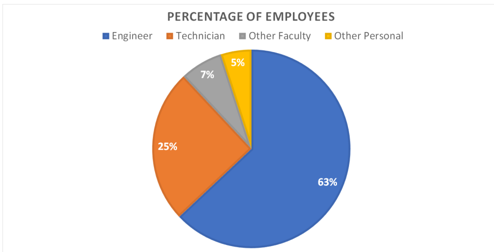
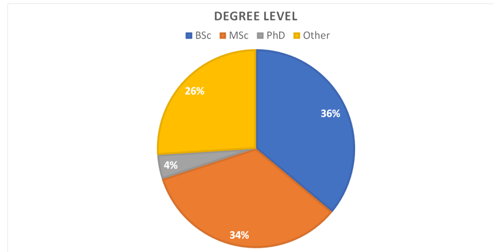


Figure 1: Business Fields of ASELSAN

In 2018, ASELSAN is listed as 55th biggest defense company worldwide in DefenseNews' Top 100 list[2]. And as of July 2018, ASELSAN has 5364 employees. 63% of them being engineer exact distribution of the employees can be seen at *Figure 2a*, while the academic distribution of the working engineers can be seen at *Figure 2b*.



(a) Distribution of the Employees



(b) Degree Levels of the Engineers

Figure 2: Statistics about ASELSAN Employees

2.4 ASELSAN'S Vision & Mission

2.4.1 Vision

To be a reliable, competitively preferred, environment-friendly and human conscious technology firm which preserves its sustainable growth in the global market via the values created for stakeholders, as well as serving its establishment purposes[10].

2.4.2 Mission

By focusing primarily on the needs of the Turkish Armed Forces; to provide high-value-added, innovative and reliable products and solutions to both local and foreign customers in the fields of electronic technologies and system integration; continuing activities in line with global targets as well as increasing brand awareness and contributing to the technological independence of Turkey[10].

2.5 A Brief History of the Company

- **1978** : The first premises in Macunköy Facility were completed and the manufacturing operation started.
- **1980** : The first manpack and tank wireless radios were delivered to the Turkish Armed Forces.
- **1983** : The first export was realized.
- **1982-1985** : New products such as Field Telephones, Computer Controlled Central Systems and Laser Distance Measurement Appliances were included in the inventory.
- **1987** : ASELSAN was included in a common project attended by 4 NATO countries for the manufacturing of Stinger Missile and started the required investment for the thick film hybrid circuit production.
- **1988** : ASELSAN produced the first avionic appliance for the F-16 program.
- **1989** : The first technology transfer to Pakistan was realized. Wireless radio production was started with ASELSAN license in NTRC facilities in Pakistan.
- **1990** : On date 21.05.1990, the ASELSAN shares were offered to the public and as of date 01.08.1990, the shares were started to be traded in IMKB (İstanbul Stock Exchange)
- **1992** : The Radar systems were included in the ASELSAN product range.
- **1996** : The TASMUS agreement was executed.
- **1997** : ASELSAN 1919 Mobile Phone was launched to the market.
- **1998** : Thermal cameras, thermal weapon sight and thermal vision devices with target coordination addressing devices were submitted to the use of Turkish Armed Forces.
- **1999** : Agreements for Air Defence Early Warning and Command Control System, MILSIS Electronic Warfare and X-Band Satellite Communication System were executed.

- **2001** : ASELSAN took over 72% of the shares of ASELSAN MİKES A.Ş.
- **2002** : The equity capital of the company increased two and a half times compared to the previous year and reached the level of approximately one fourth of the aggregate resources.
- **2005** : HEWS, Helicopter Laser Warning Receiver system (LIAS) Project and Turkish Land Forces Avionic System Modernization Project was executed.
- **2007** : The construction of ASELSAN Integration Hall Building was completed and settlement activities were realized.
- **2007** : MILGEM war system supply project was executed.
- **2008** : ATAK agreement and Multi Band Digital Common Wireless Radio (ÇBSMT) Project were executed and ASELSAN delivered the first originally developed Air Defense Radar.
- **2009** : In 2009, four Research and Development Centrals were established, Leopard-1 Tank modernization was completed, MILGEM Warfare System 2nd Vessel Project, Ammunition Transfer system Project for Self-Propelled Howitzer (Fırtına- Storm) Ammunition vehicle and SAR / Reconnaissance System Supply Integration Project were executed.
- **2012** : Turkey's first national Air Defense System "Pedestal Mounted Stinger System" which has been designed and produced by ASELSAN, and whose delivery took nearly 23 years, last 5 pieces has been delivered to Turkish Armed Forces.
- **2013** : ASELSAN has continued its climb for the aim of being one of the top 50 defense companies, and ranked 74th according to annual sales.
- **2013** : ASELSAN was the company who has participiated most at the 11th International Defence Industry Fair (IDEF 2013).

2.6 The Organizational Chart of the Company

The organizational chart of ASELSAN can be seen in *Figure 3*.

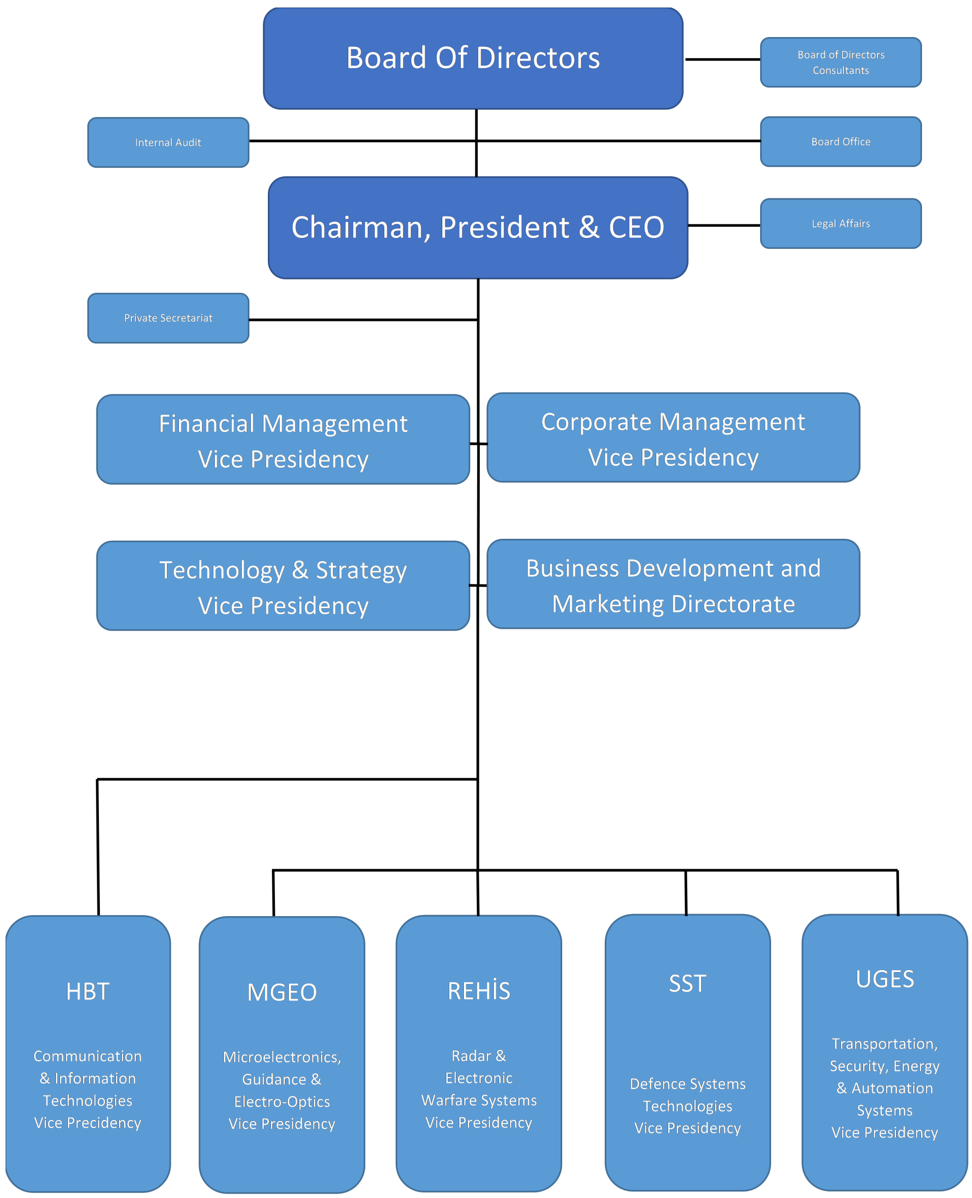


Figure 3: The Organizational Chart of ASELSAN

3 Orientation and Mandatory Education

3.1 Orientation

My summer practice at ASELSAN started with an orientation program. The program lasted about one day mainly focused on the company and the work done there. Chapter 2 mostly summaries what was covered in the orientation. After the orientation, we were given necessary mandatory educations in order to be allowed to work inside the ASELSAN facilities.

3.2 Mandatory Educations

As required by the 4857/77 numbered law, all employers in the Republic of Turkey is obligated to train their employees in order to prevent the unnecessary work related accidents. In ASELSAN, we were given obligatory Occupational Safety and Health (OSH) Education and Electrostatic Discharge (ESD) Education to be able to work in the ASELSAN facilities safely.

3.2.1 Electrostatic Discharge (ESD) Education

Electrostatic discharge (ESD) is the sudden flow of electricity between two electrically charged objects caused by contact, an electrical short, or dielectric breakdown. A buildup of static electricity can be caused by tribocharging or by electrostatic induction. The ESD occurs when differently-charged objects are brought close together or when the dielectric between them breaks down, often creating a visible spark. [**2**]

A very casual example of electrostatic discharge can be given as lighting. However, not all ESD events are not as loudly or large-scale as lightnings. The less dramatic forms may be neither seen nor heard, but they can still be large enough to cause damage to sensitive electronic devices.

ESD can cause harmful effects of importance in industry, including explosions in gas, fuel vapor and coal dust, as well as failure of solid state electronics components such as integrated circuits. In order to prevent this unwanted side effects of ESD, companies such as ASELSAN prefers to train their workers not just for their health but also protect their product lines.

3.2.2 Occupational Safety and Health (OSH) Education

ASELSAN as a company in Turkey is required to satisfy the conditions deternmined by the 6331 number Occupational Safety and Health (OSH) Education Law.

Occupational safety and health (OSH), also commonly referred to as occupational health and safety (OHS), is a multidisciplinary field concerned with the safety, health, and welfare of people at work. These terms also refer to the goals of this field, so their use in the sense of this article was originally an abbreviation of occupational safety and health program/department etc.[**3**]

Occupational safety and health programs aims to foster a safe and healthy work environment. OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment.

Just in 2014, 221.336 worker had an work accident imn Turkey and 494 of them suffered from work related diseases. 1.626 workers died due to this accidents according to ÇSGB.[**4**] The importance of Occupational Safety and Health (OSH) Educations comes from the fact that these deaths can be prevented if the necessary precautions are taken.

4 Work Done at SP Company

I have performed my summer practice in the Test & Process Design Department of the **HBT** Division. In this section, I will mainly explain what I have done in this department throughout my summer practice.

In my first days I was assigned to observe and participate the tests conducted at the Environmental Test Laboratory. The test conducted there was mainly on ASELSAN 9661 Series Radios as well as other radio handsets and base stations. I mainly observed the these tests and participated in them as much as I could. I also observed and took part in the test about ASELSAN'S base station named ULAK.

4.1 Electrical & Mechanical Tests at the Environmental Tests Laboratory

After my arrivel to the Environmental Test Laboratory, I started observing the test mainly done on ASELSAN 9661 series V/UHF radio. Before getting into the details for the electrical test, I will give some information about the device itself.

4.1.1 ASELSAN 9661 Radio Family

The 9661 HF Radios are a software defined radio covering the HF 1.6-30MHz band. Software ins,de the radio supports various radio waveforms and EPM techniques. Beyond line of sight communication is made possible based on the HF technology via use of NATO STANAGs and Military Standards[11].

Figure 4: ASELSAN 9661 Radio Series

While voice and data can be transmitted over a preset fixed frequency, it is also possible to employ an Automatic Channel Selection mechanism which determines the usable frequency for communication.

9661 HF Radio family has three configurations for Manpack, Vehicle and Fixed Station usage. 20W can be used for Manpack and Vehicle configurations and 150 W can be used for Vehicle and Fixed Station configurations. The product line can be seen at *Figure 4*. As I spent my time at the laboratory, the test I observed were for the 100 W Vehicular/Base Station models.

4.1.2 Electrical Configuration/Performance Test

4.1.2.1 Reference Sensitivity Test

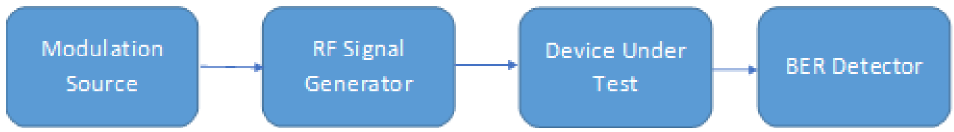


Figure 5: Reference Sensitivity Test System Diagram

4.1.3 Transmitter FM Hum/Noise Ratio Test

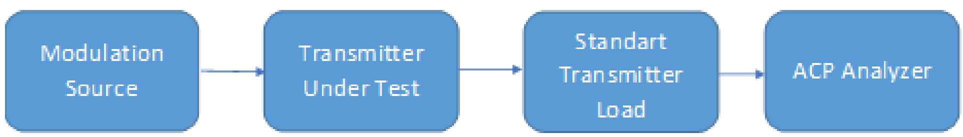


Figure 6: Transmitter FM Hum/Noise Ratio Test System Diagram

4.1.3.1 C4FM Modulation

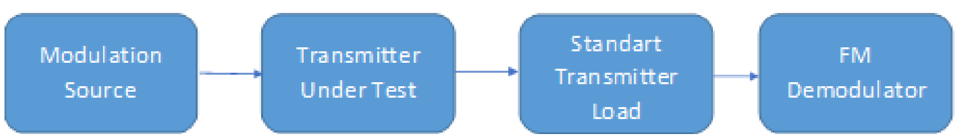


Figure 7: C4FM Modulation Calculation System Diagram

4.1.4 Electrical Audio Performance Test

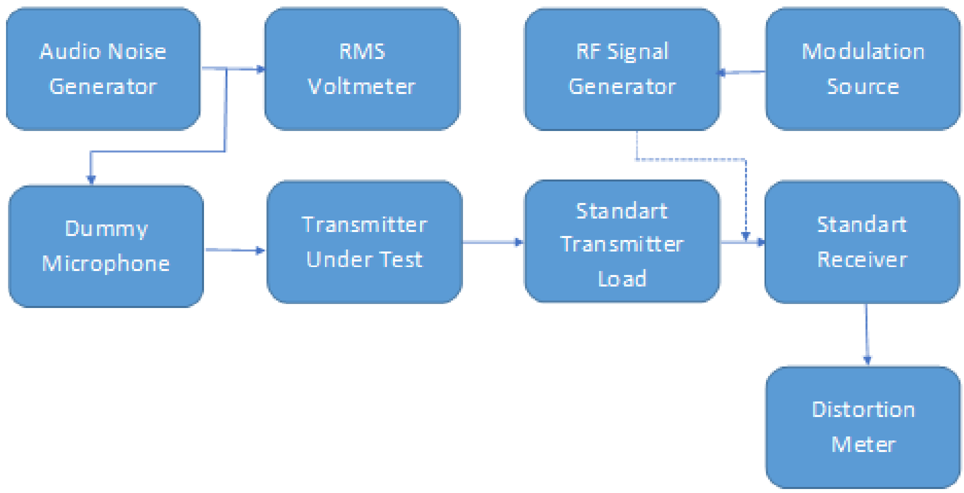


Figure 8: Electrical Audio Performance Test System Diagram

4.1.5 Modulation Fidelity Test

Modulation fidelity is defined as the degree of closeness to which the modulation follows the desired ideal theoretical modulation by the P25(TIA/EIA-102) standard[9]. This is a very important measurement for P25 C4FM modulation as it is an indication of the quality of the signal being transmitted by the radio. Before we can understand the modulation fidelity measurement, we will need to look at the type of modulation that this measurement analyses.

4.1.5.1 C4FM Modulation

P25 uses a type of modulation called C4FM, which is an acronym for "compatible 4 level frequency modulation"[9]. Basically, it is a special type of 4FSK modulation developed for the TIA/EIA-102 standard. P25 uses this type of modulation to transmit digital information in the form of digital

"1's" and "0's". 4FSK uses four different frequency "states" or "deviation points" to indicate a "symbol". This symbol then equates to 2 bits of data as one of the four frequency shifts. The frequency shifts that correspond to each 2 bits of data are shown in *Table 1.*

Bits	Symbols	C4FM Deviation
00	+3	+0.6 kHz
01	+1	+1.8 kHz
10	-1	-0.6 kHz
11	-3	-1.8 kHz

Table 1: modfide

This information is sent at the "symbol rate". For P25, this symbol rate is transmitted 4800 times per second. This results with a bit rate of 9600 bits per second.

As part of modulation fidelity, it is desired to measure the deviation of each of the symbols that the radio under test generates and compare them with the ideal four deviation points indicated in *Table 1.* This measurement will actually result in producing three important values that together will be indicators of the modulation fidelity of the radio under test.

4.1.5.2 Frequency Error

The first value that we can calculate from the measured deviation of each of the symbols is the frequency error. Frequency error in this measurement refers to RF carrier frequency error.

To understand this, think about the relationship between the four frequency deviations used in C4FM and RF carrier frequency error. A carrier frequency error would tend to shift all four of the deviations by the same amount. A positive frequency error would move all four of the deviation points in the positive direction. Let's use a real world scenario for our example. In Chart 2.0 below, a 100 Hz frequency error might give the following results:

Bits	Symbols	C4FM Deviation
00	+3	+0.72 kHz
01	+1	+1.9 kHz
10	-1	-0.54 kHz
11	-3	-1.68 kHz

Table 2: modfide2

The fidelity is determined by from observations of the signal at the output of an integrate and dump filter, that is preceded by an FM demodulator. The filtered FM modulation trajectories for C4FM and CQPSK are different at all points in time except at the symbol decision points.

The modulation fidelity is measured by determining the rms difference between the actual signal and the ideal C4FM deviation for the transmitted symbols as information.

Let s_K represents the C4FM deviation of the transmitted symbols, and z_K represents the detected signals at t_K sampling instants.

The transmitter can be modelled as

$$z_K \;=\; C_O + C_L * (s_K \;+\; e_K)$$

where C_O is a constant representing carrier frequency offset and the C_L is another constant called deviation errors that is resulting from gain errors in the transmitter's modulator baseband signal processing. And e_K is called residual deviation error.

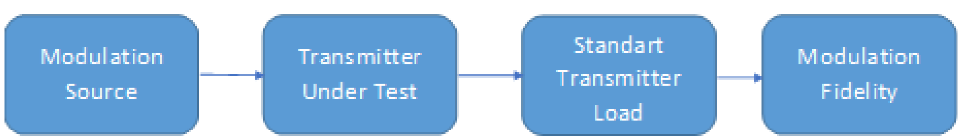


Figure 9: Modulation Fidelity Test System Diagram

4.1.6 Test Equipments

4.1.6.1 Attenuators

RF attenuators are a universal building block within the RF design arena. RF attenuators can be fixed, switched or even continuously variable.

Dependent upon their type, they can be designed using just resistors, they may need a switch, either mechanical or solid state, or they may use diodes to make them continuously variable over a given range.

As the name implies RF attenuators reduce the level of the signal, i.e. they attenuate the signal.

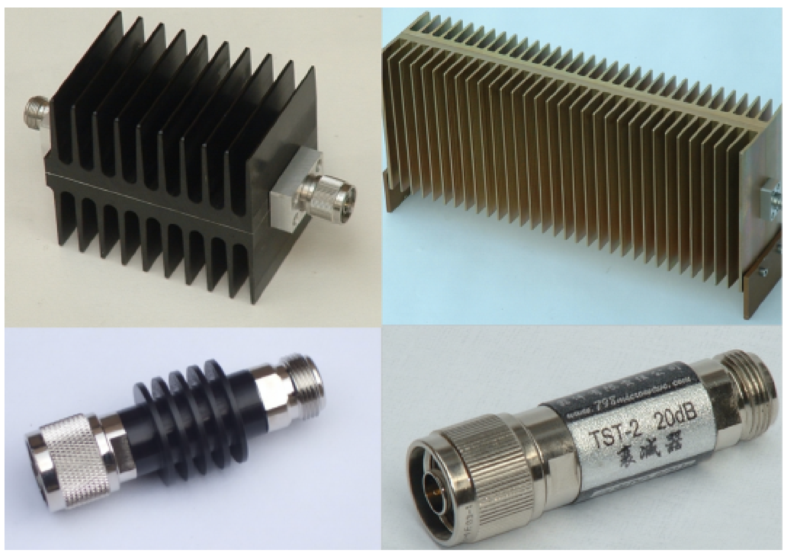


Figure 10: Some Attenuator Examples

This attenuation may be required to protect a circuit stage from receiving a signal level that is too high. Also an attenuator may be used to provide an accurate impedance match as most fixed attenuators offer a well-defined impedance, or attenuators may be used in a variety of areas where signal levels need to be controlled.

There are many used for these RF attenuators and although these may not seem obvious initially when asking what is an attenuator, they are widely used in RF applications.

RF attenuators are used in a wide variety of applications in RF circuits. They are a key building block used in many areas of RF design:

Reduce signal level: The basic concept behind an attenuator is to reduce the signal level. This can be required to control levels within a circuit to keep them within the required range.

Improve impedance match: By its very nature an impedance matched RF attenuator will improve the impedance match. This can be very useful when driving RF mixers that are match sensitive and their performance will be degraded if a poor match is seen.

Variable level control: RF attenuators can be used for level control on the output of items such as signal generators. It is far better to be able to generate an accurate fixed level from the basic generator and then used switch attenuators to reduce the signal to the required level.

RF attenuators are used widely within RF circuits for a variety of reasons. Fortunately these attenuators are easy to design and using surface mount technology their performance can be exceedingly good.

4.1.6.2 Analyzers & Oscilloscopes

The analysis of RF and microwave signals in the frequency domain used to be the forte of the spectrum analyzer, but now it's become a choice between signal analyzers and digital oscilloscopes.

Signal analyzers are really spectrum analyzers with digital signal processing (DSP) added to perform functions such as fast Fourier transforms (FFTs). Historically, digital oscilloscopes would not have been a good option for spectrum analysis because their bandwidths were too limited. Now digital scope bandwidths reach into the 100-GHz range. Combined with DSP, they have turned into very useful tools for frequency-domain analysis.

The core of spectral analysis in both instruments is modern DSP, especially the use of the FFT to efficiently convert sampled time-domain data into a frequency-spectrum display. The FFT can output spectral data as real/imaginary, or amplitude/phase formats, retaining phase information for further modulation analysis. The physical differences in these instruments can be seen in their functional block diagrams (see figure).

The signal analyzer is really a modern version of the older swept spectrum analyzer. The input RF signal is downconverted to a lower intermediate frequency (IF). Instead of an analog, variable bandwidth filter used in a traditional RF spectrum analyzer, a digitizer converts the analog IF signal into a digital signal. Now DSP algorithms, including the FFT, can be applied.

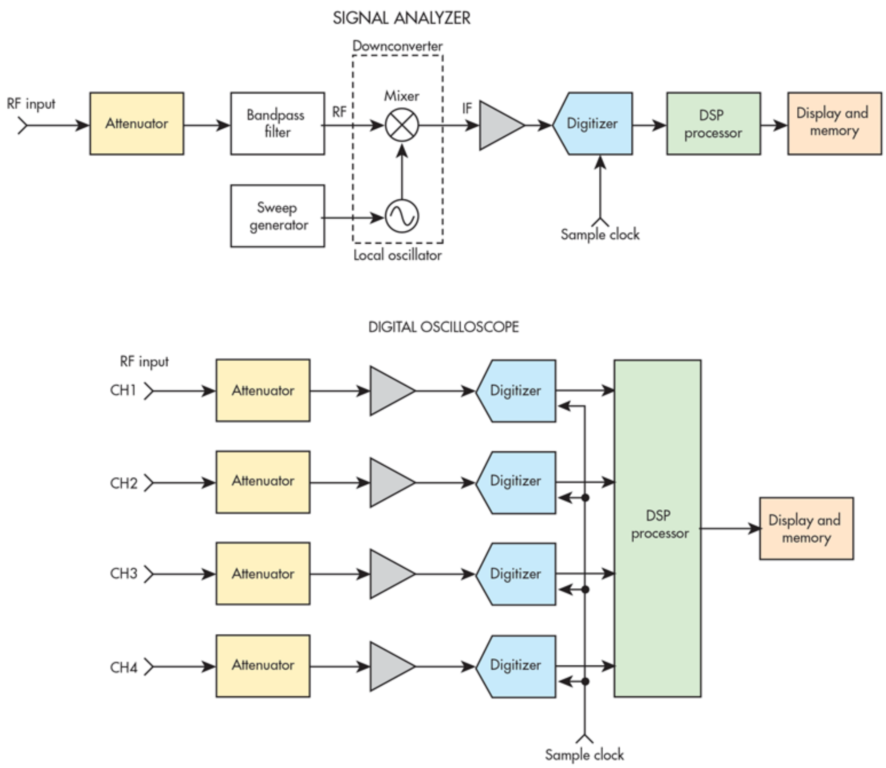


Figure 11: The Organizational Chart of ASELSAN

The signal analyzer is a spectrum analyzer that includes digital signal processing (DSP). The digital oscilloscope also has added DSP, and gains much higher bandwidths. Their differences in the context of frequency analysis derive from their front-end, signal-conversion approach.

In contrast to signal analyzers, the digital oscilloscope digitizes the RF signal directly. The resulting baseband spectrum is anchored at zero hertz (dc) and extends to the oscilloscope bandwidth, which is also related to its sample rate. As mentioned, oscilloscope bandwidth has greatly increased, up to 100 GHz.

In summary, the digital oscilloscope offers wider-bandwidth analysis and multiple channels, compared to the higher dynamic range and lower noise floor of the signal analyzer. The signal analyzer typically has a bandwidth of a few hundred megahertz around the center frequency.

Modulation Analyzer

Signal & Spectrum Analyzer A signal analyzer is an instrument that measures the magnitude and phase of the input signal at a single frequency within the IF bandwidth of the instrument. It employs digital techniques to extract useful information that is carried by an electrical signal.[1] In common usage the term is related to both spectrum analyzers and vector signal analyzers. While spectrum analyzers measure the amplitude or magnitude of signals, a signal analyzer with appropriate software or programming can measure any aspect of the signal such as modulation. Today's high-frequency signal analyzers achieve good performance by optimizing both the analog front end and the digital back end.[2]

Signal analyzers can perform the operations of both spectrum analyzers and vector signal analyzers. A signal analyzer can be viewed as a measurement platform, with operations such as spectrum analysis (including phase noise, power, and distortion) and vector signal analysis (including demodulation or modulation quality analysis) performed as measurement applications. These measurement applications can be built into the analyzer platform as measurement firmware or installed as changeable application software

A spectrum analyzer measures the magnitude of an input signal versus frequency within the full frequency range of the instrument. The primary use is to measure the power of the spectrum of known and unknown signals. The input signal that a spectrum analyzer measures is electrical; however, spectral compositions of other signals, such as acoustic pressure waves and optical light waves, can be considered through the use of an appropriate transducer. Optical spectrum analyzers also exist, which use direct optical techniques such as a monochromator to make measurements.

By analyzing the spectra of electrical signals, dominant frequency, power, distortion, harmonics, bandwidth, and other spectral components of a signal can be observed that are not easily detectable in time domain waveforms. These parameters are useful in the characterization of electronic devices, such as wireless transmitters.

The display of a spectrum analyzer has frequency on the horizontal axis and the amplitude displayed on the vertical axis. To the casual observer, a spectrum analyzer looks like an oscilloscope and, in fact, some lab instruments can function either as an oscilloscope or a spectrum analyzer.

Power Reflection Meter Directional power meters are used to measure power and reflection under operational conditions. Typical applications are in installation, maintenance and monitoring of transmitters, antennas and RF generators in industrial and medical fields.

Figure 12: UPV) Audio Analyzer

(UPV) Audio Analyzer

Digital Phosphor Oscilloscope The digital phosphor oscilloscope, DPO is another form of digital oscilloscope.

The DPO scope has a different architecture to that of the more traditional digital / digital storage types and this enables it to process signals more quickly. To achieve this, the DPO adopts a parallel processing architecture rather than the more straightforward serial technology.

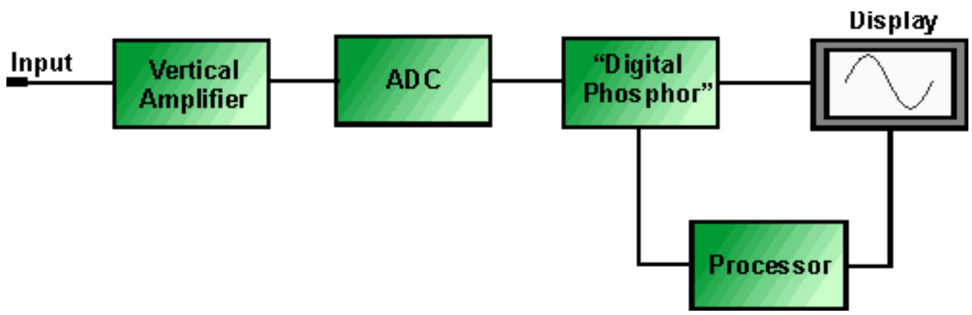


Figure 13: Working Principles of DPO

Although the name of the DPO may indicate that it relies on a chemical phosphor, this is not necessarily the case as more modern displays are used. However it possesses many of the aspects of a phosphor oscilloscope, displaying a more intense image the more often the waveform passes a certain point.

4.1.6.3 Signal Generators

Analog Signal Generator

Vector Signal Generator

Synthesized Signal Generator

4.1.6.4 3920 Digital Radio Test Set

Besides 9661 Series Radios, multiple radio hand-sets and the 4.5G Base Station were tested at Environmental Test Laboratory. Similar electrical tests applied to the 9661 radio series were partially applied to the these base stations. Since I was not able spent enough time on the tests of the base station, I will quickly introduce the base station itself and pass the next section.

4.2 ULAK 4.5G Macrocell Base Station

Based on Release 10 and Release 11 standards published by 3GPP, ULAK Macrocell Base Station is designed to support both Release 12 and Release 13 standards with flexible architecture that is open to software development without any hardware changes and is designed to work on different frequency bands for use in Commercial or Public Safety networks[12].

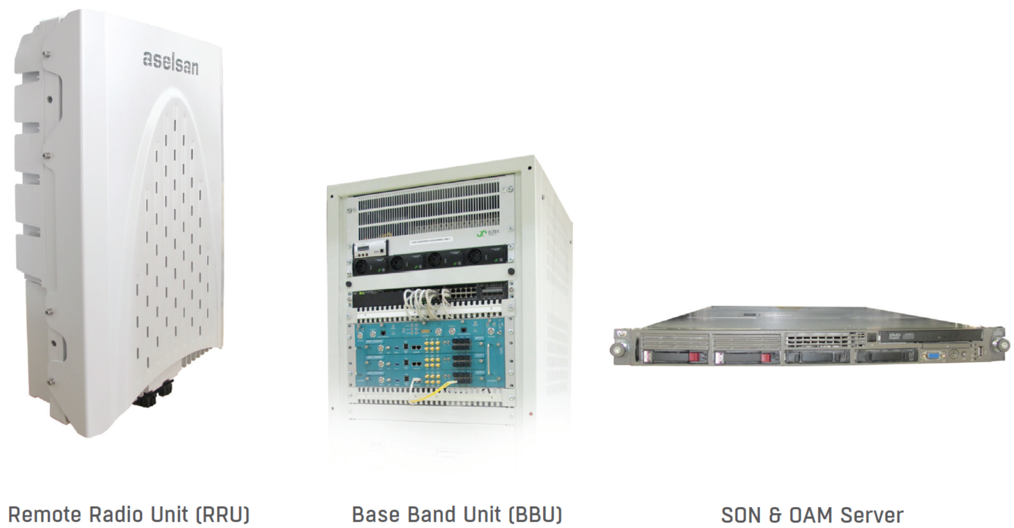


Figure 14: ULAK 4.5G Base Station[12]

To enrich the product portfolio; the following studies are currently carried out:

Integration of LTE-A to Narrowband Communication Systems, LTE-Advanced Mobile Terminal Safety Software With the development of 4.5G Communication Systems, it is aimed to meet the need of fast, secure and continuous communication of both mobile operators and public institutions[12].

4.3 Outer Space Simulations & Tests using TVAC

As I worked in the Test & Process Design Department, I did not spend my whole time at Environmental Test Laboratory, I also spent some of my time at the Space Simulation Laboratory of the Department. The laboratory was responsible for the outer space test of the electrical components of he TURKSAT 6-A project as I made summer practice. Before going into detail, I will give brief information about the thermal chambers used there.

4.3.1 Thermal Vacuum Chamber (TVAC)

A vacuum chamber is a rigid enclosure from which air and other gases are removed by a vacuum pump. This results in a low-pressure environment within the chamber, commonly referred to as a vacuum. A vacuum environment allows researchers to conduct physical experiments or to test mechanical devices which must operate in outer space (for example) or for processes such as vacuum drying or vacuum coating. Chambers are typically made of metals which may or may not shield applied external magnetic fields depending on wall thickness, frequency, resistivity, and permeability of the material used. Only some materials are suitable for vacuum use[7].

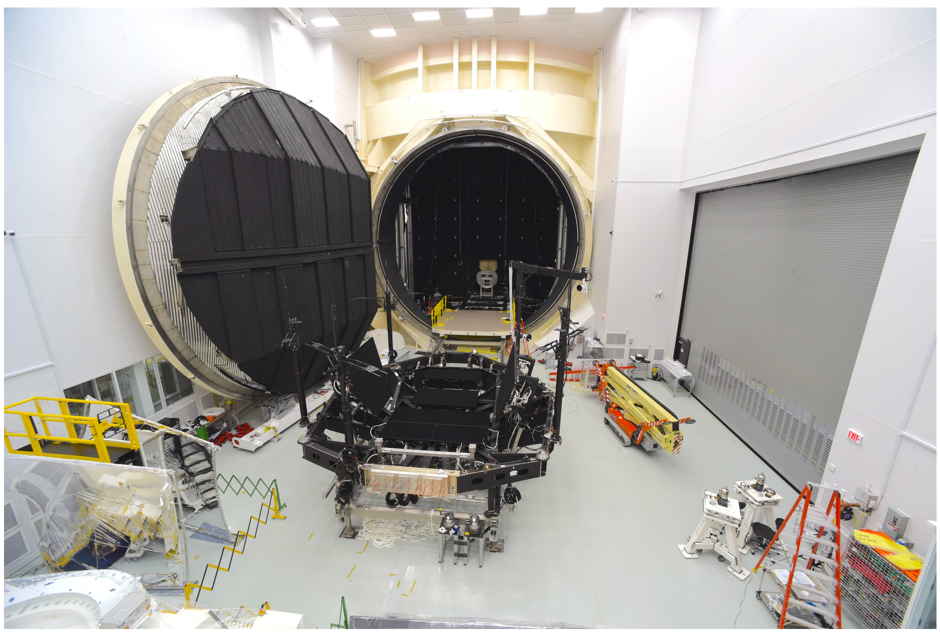


Figure 15: An Example Thermal Vacuum Chamber

A type of these vacuum chambers widely used in the spacecraft engineering field is a thermal vacuum chamber, which can simulate the thermal environment at which a spacecraft would be operating in space. In other words, a thermal vacuum chamber is a vacuum chamber in which the radiative thermal environment is controlled. One example for this type of chamber can be seen at *Figure 15* which is used in NASA.

There are two thermal vacuum chambers with different capacities in the

ASELSAN HBT Facilities. They are used mainly for the outer space simulation tests of the electronics parts of the TURKSAT 6A Project. The chambers can also be used by other project partners such as TAI and TURKSAT if needed.

4.3.2 Tests & Simulations Using Thermal Vacuum Chamber (TVAC)

To simulate the outer space, the pressure in the chamber must be reduced to 10^{-5} $mBar$ or below to satisfy the requirements for the test. This was done by pulling the oxygen and other major atmospheric gases and pumping liquid nitrogen to the system to push leftover gases. Liquid Nitrogen is also used to reach the required minimum temperature for the test.

According to the device under test's physical properties, two ways are used to reach the desired maximum temperature. One of them is using spacial thermal plates below the device. If the device should not be in contact with directly heat source second method for heating can be used. That is to use the infrared heaters inside the chambers.

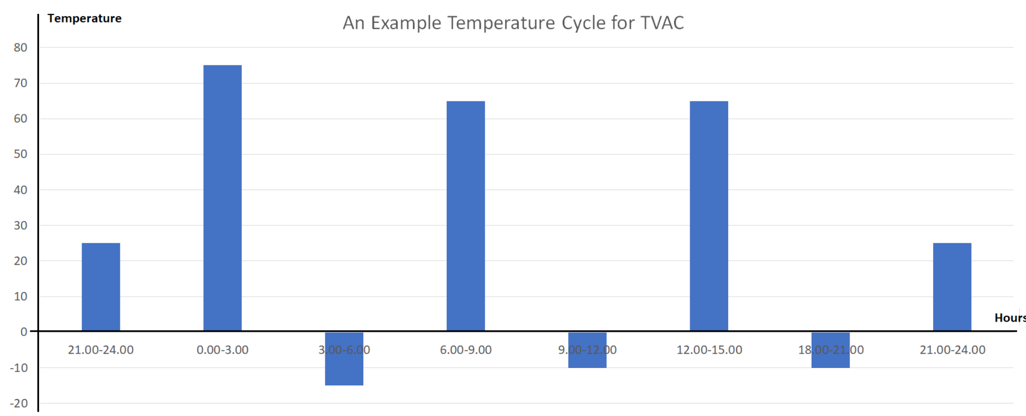


Figure 16: An Example Temperature Cycle

To initialize the test, the atmospheric pressure inside the vacuum is reduced to 10^{-5} $mBar$ or below at room temperature. The device is expected to operate in such pressure levels, therefore, the pressure level is conserved until the last cycle by the PID controller inside the chamber. After the necessary pressure requirements is met, the temperature is set according to the customer's will, in our case customer was TURKSAT A.Ş. as owner of TURKSAT 6A. An example test cycle for testing the device under test can be seen at *Figure 16*. Between each temperature change, the temperature inside the chamber is left unchanged up to six hours to ensure the stability of the operation of the device at that temperate. This can be done by taking the necessary measurement with half hours intervals. If the data are consistent with previous, temperature will be changed for next cycle. Unfortunately, I was not allowed the take screenshots for the test results or took pictures of other test steps, I will not be able to give further information about this topic.

4.4 Research on Components of ULAK 4.5G Base Station

Mainly on the second half of my internship, I also spent my time at the department itself besides the laboratories. In this part of my summer practice, I was responsible for making research on the components of the ULAK Base Station for possible upgrade for the device. Due to regulations, I will give some examples about the work done at this part of summer practice.

4.4.1 Misidentified Components

4.4.2 Alternate Components

5 Conclusion

I completed my summer practice in ASELSAN A.Ş.(ASELSAN Electronics Industry and Ticaret A.Ş.) in supervision of Pınar Kırıkkanat, an electronics engineer in ASELSAN, in Yenimahalle/Ankara. It was quite experiential time for me. Throughout my summer practice, I learned many things about professional work life.

Firstly, I understodd the importance of mandatory educations like occupational safety and health education thanks to given educations by ASELSAN. After the educations, I was sent to my division, where I performed my summer practice.

In the first half of my internship, I was given time to observe, learn and participate the mechanical and electrical test conducted at our division. Mainly on ASELSAN 9661 Series Radios, I mostly observed and participated on the environmental tests of the equipments produced at the Communication & Information Technologies Vice Presidency, known as HBT. .

In the second part of my internship, I was given time to observe the work done behind the testing, in other words process design and management. In this part of my internship, I participated on documentation and research activities for the ULAK Base station of the ASELSAN. Since the work done at this stage can be mostly considered as classified information, I will mention the basics of what I have done in this part.

In this, report, I start with an introduction, that covers what was done in my summer practice. Then, I continued with a company description section in which the general description about ASELSAN is given. After that part, the work done in my summer practice is explained. Lastly, I finished the report with an conclusion part.

Finally, I recommend my summer practice company for other students who want to start their summer practice at ASELSAN.

6 References

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