

SIMULATOR FOR SYNTHETIC MODULE

At

BHARAT ELECTRONICS LTD.

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Outline:

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- ✓ Breaf about EW systems
- ✓ Synthetic Channel
- ✓ Familiarization of IC's
- ✓ Results & Analysis
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Project Overview

The aim of the project is to develop a PC based simulator jig for testing a subsystem called *Synthetic Module* of an Electronic Warfare systems.

The core activities are fabrication/assembling of a PCB consisting of micro-controller and field programmable array logic, Developing code for interfacing with PCB through PC and checking the output bit pattern with simulation of commands.

RADAR Concept

- 1940 by US Navy
- Radio Detection And Ranging
- RDF-Range and Direction Finding
- Electronic eye
- Functions:

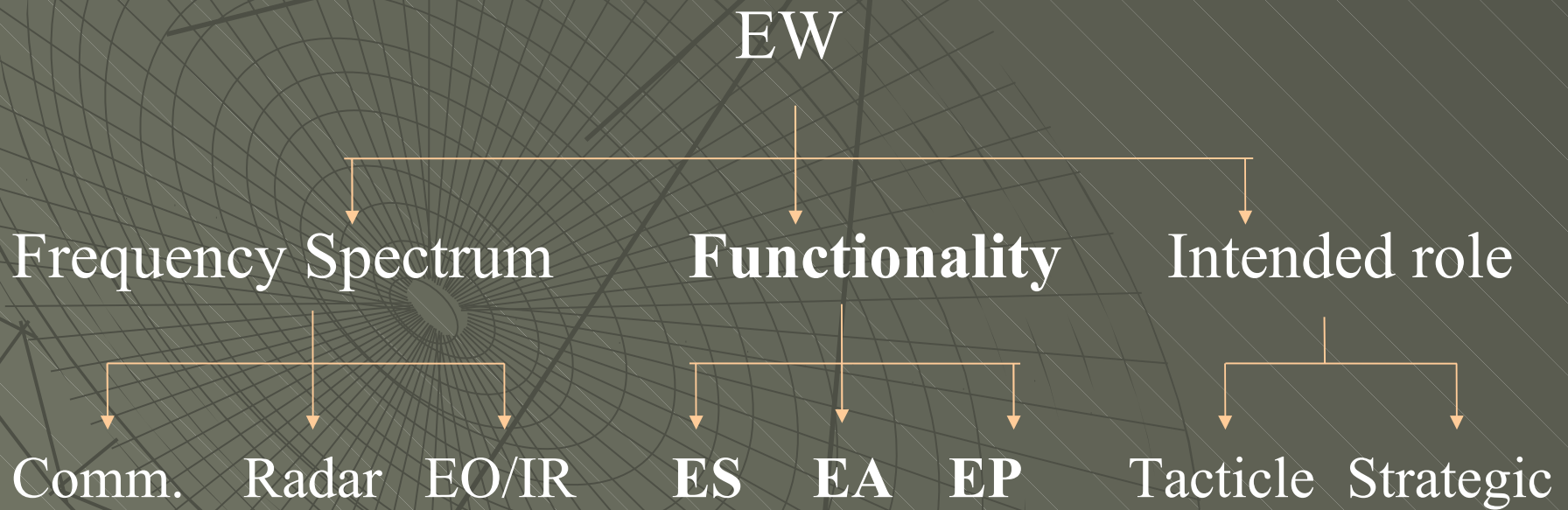
Range

Velocity

Angle

Electronic Warfare Systems

Involving the use of electromagnetic energy to control the electromagnetic spectrum or to attack the enemy.





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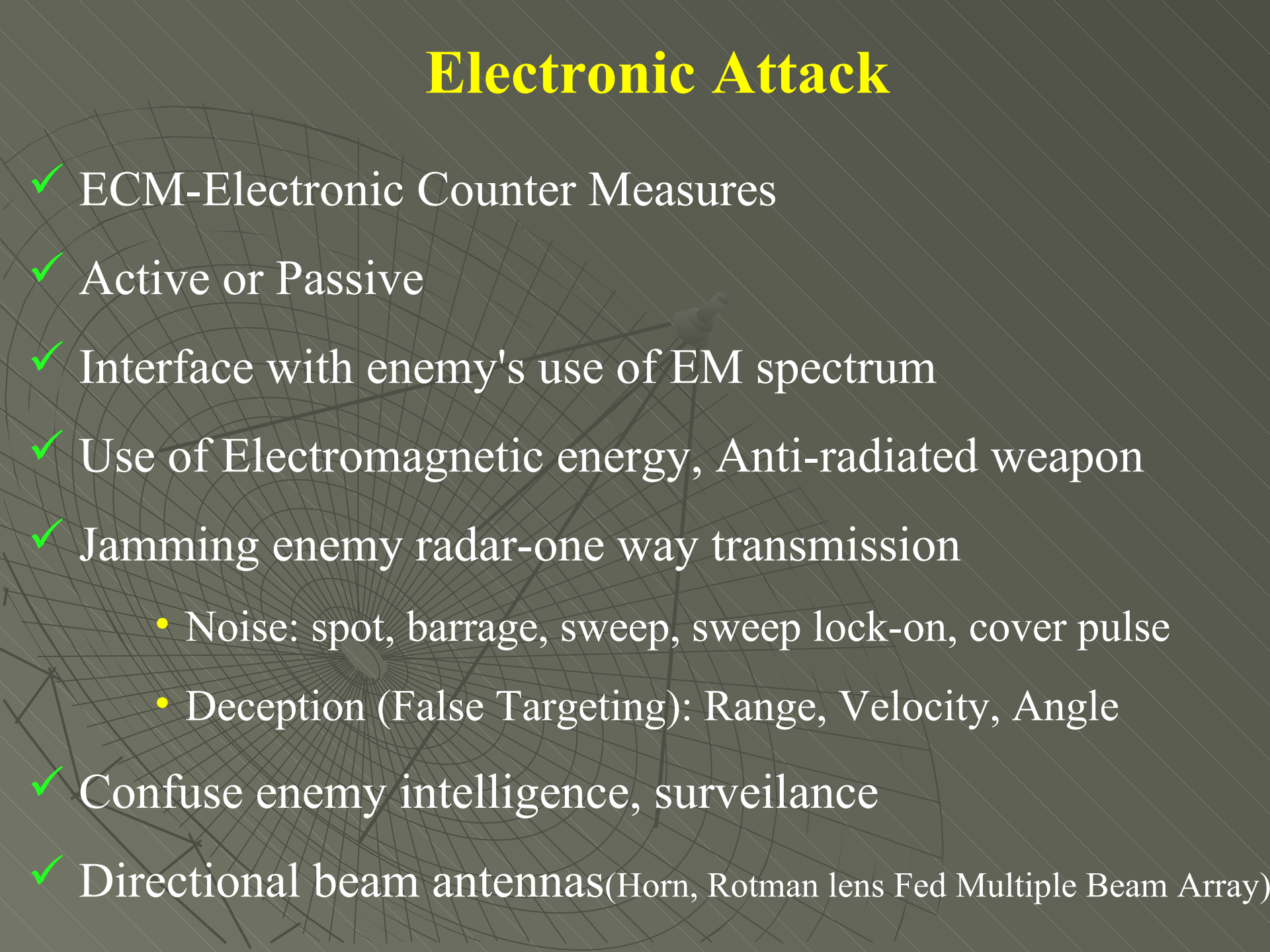
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Electronic Support

- ✓ ESM-Electronic Support Measures
- ✓ Passive listening
- ✓ Search, intercept, identify, locate, record
- ✓ Parameters like freq, DOA, AOA, PW
- ✓ Analyze radiated EM energy
- ✓ Wide open in freq, wide spatial angle
- ✓ Provides surveillance, warning information required for decisions involving EA, EP, tactical employment of forces



Electronic Attack

- 
- A faint, stylized radar screen with concentric circles and radial lines, overlaid with a grid of thin lines. A small, dark, irregular shape is visible in the center of the radar, resembling a target or a jammer.
- ✓ ECM-Electronic Counter Measures
 - ✓ Active or Passive
 - ✓ Interface with enemy's use of EM spectrum
 - ✓ Use of Electromagnetic energy, Anti-radiated weapon
 - ✓ Jamming enemy radar-one way transmission
 - Noise: spot, barrage, sweep, sweep lock-on, cover pulse
 - Deception (False Targeting): Range, Velocity, Angle
 - ✓ Confuse enemy intelligence, surveillance
 - ✓ Directional beam antennas(Horn, Rotman lens Fed Multiple Beam Array)

Electronic Protection

- ✓ ECCM-Electronic Counter Counter Measure
- ✓ Degrade, neutralize, destroy
- ✓ Protect own platform against EA



RACK-1

Synthetic Channel(Port)

Technique Generator

Synthetic Channel(STBD)

ECM Processor

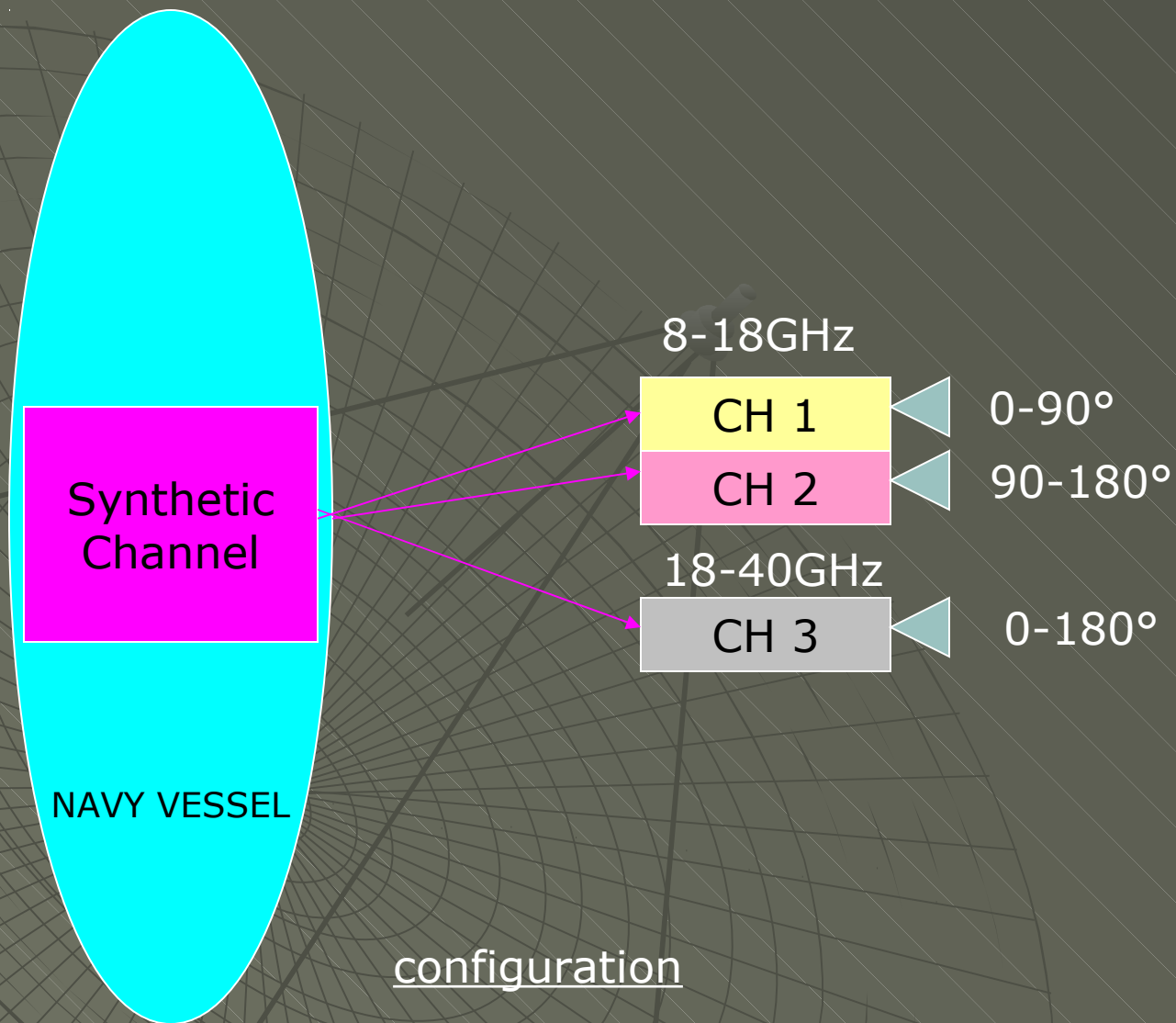
LVPS-4



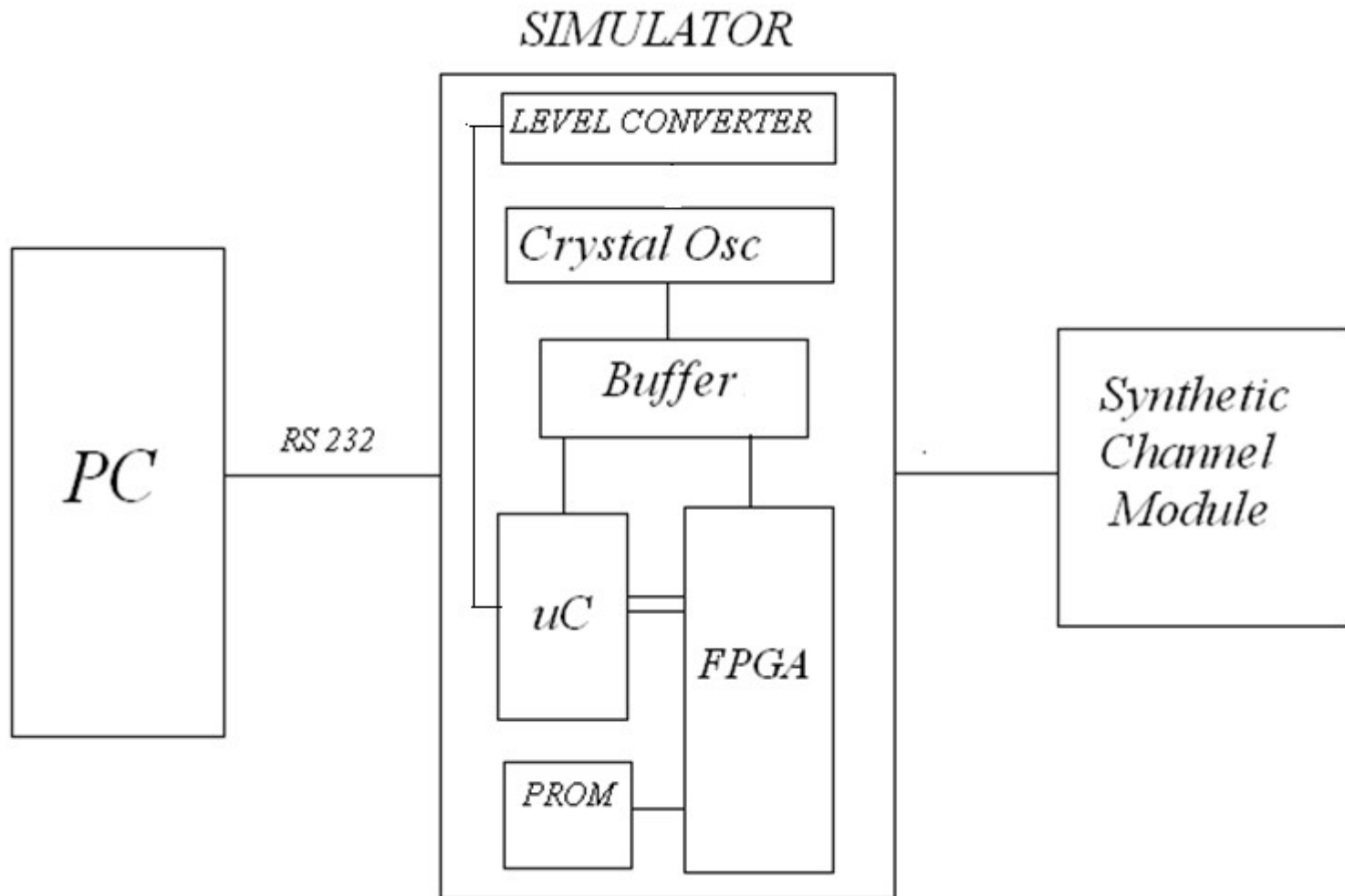
Synthetic Channel

- LRU
- Generate modulated RF in the range 8-18GHz
- Module connected to the radar of NAVY VESSEL
- Interface card and RF generator(DT0's, PCB's, RF comp)

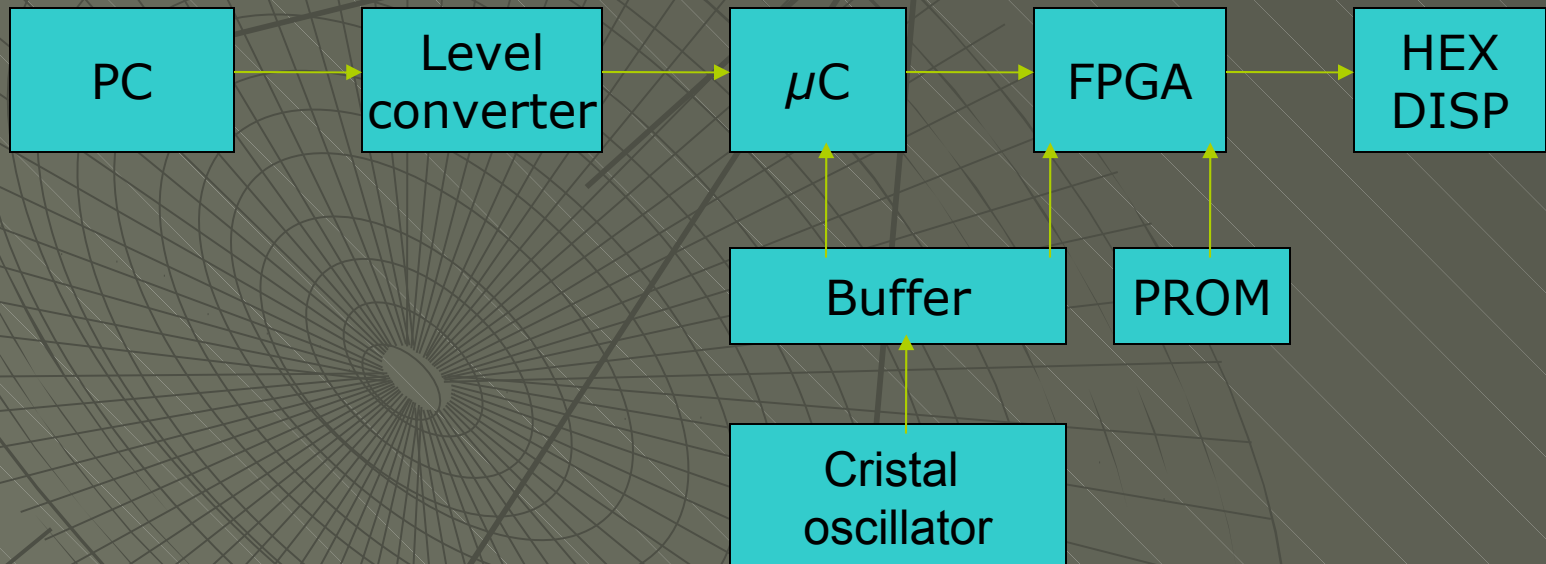




Block Diagram



Functional Diagram



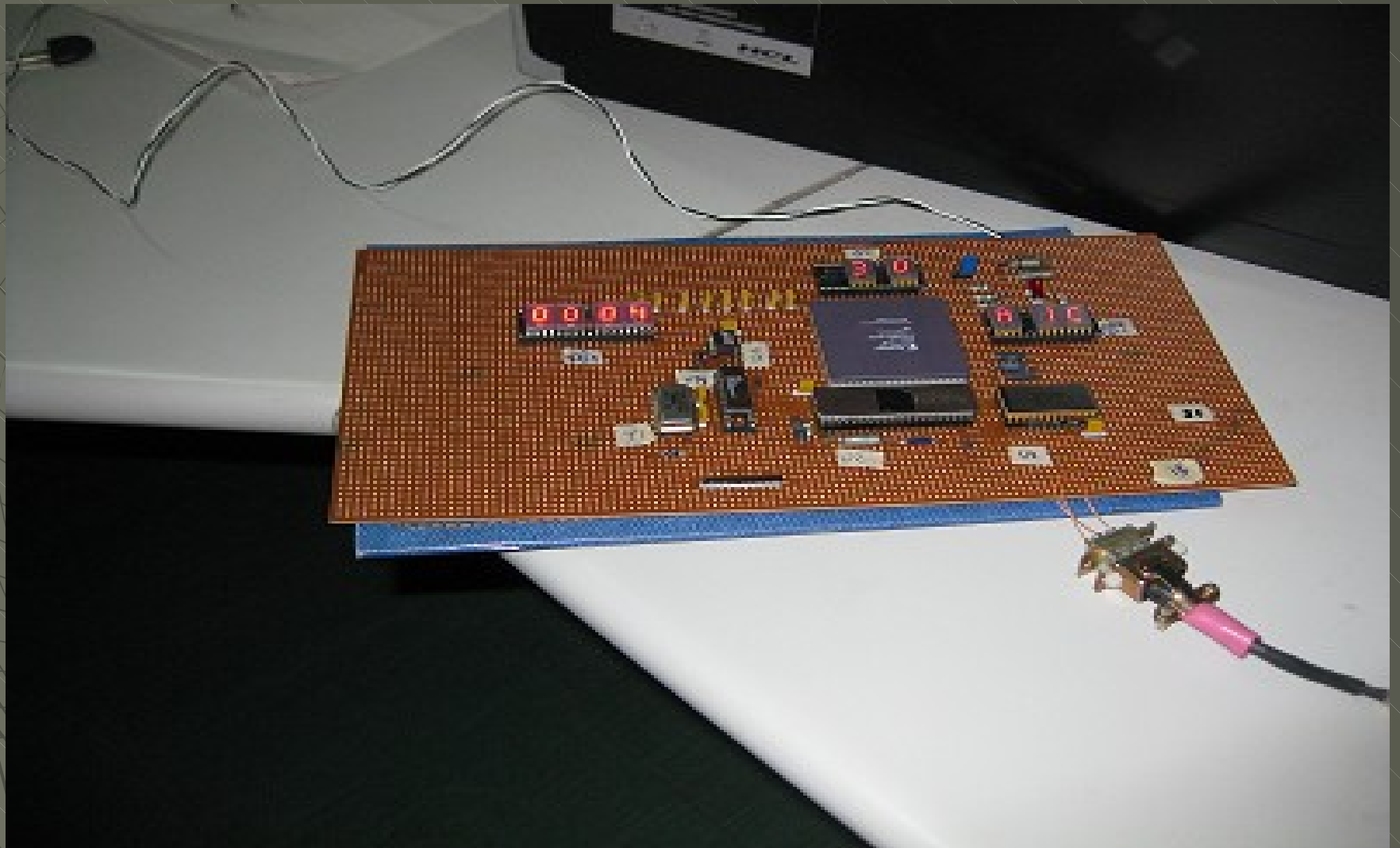


Fig.1 PCB designed TEST JIG



Fig.2 Experimental Test Setup

Familiarization of IC's

- *LEVEL CONVERTER (MAX 235)*
- *BUFFER (54F541)*
- *MICROCONTROLLER (87C51)*
- *FPGA (XC4013E SERIES)*
- *PROM (AT17lv256)*
- *CRISTAL OSCILLATOR(10MHz)*
- *HEX DISPLAY (4N54)*

Results & Analysis:



A screenshot of the Turbo C++ 3.0 IDE window. The title bar reads "Turbo C++ 3.0 IDE". The main text area is black with white text that says "enter the comm port 1 or 2 :_". The window has standard Windows-style controls (minimize, maximize, close) in the top right corner.

```
enter the comm port 1 or 2 :_
```



A screenshot of the Turbo C++ 3.0 IDE window. The title bar reads "Turbo C++ 3.0 IDE". The main text area is black with white text that says "Enter the threat number 1 to 10" and "<1 to 5 for stbd and 6 to 10 for port> :". The window has standard Windows-style controls (minimize, maximize, close) in the top right corner.

```
Enter the threat number 1 to 10  
<1 to 5 for stbd and 6 to 10 for port> :
```

```
Turbo C++ 3.0 IDE
Enter the threat number 1 to 10
<1 to 5 for stbd and 6 to 10 for port> : 3
Enter the frequency value 8000 - 18000 : _
```

```
Turbo C++ 3.0 IDE
Enter the threat number 1 to 10
<1 to 5 for stbd and 6 to 10 for port> : 3
Enter the frequency value 8000 - 18000 : 10000
Enter the channel number 1 Or 2 : _
```

```
C:\Users\RAVI\Desktop\SYNTH_~1.EXE

1. DFO Frequency
2. Barrage jamming Technique
3. Spot jamming Technique
4. AFC
5. Exit
Enter the option : _
```

```
Turbo C++ 3.0 IDE

1. 100 MHz
2. 200 MHz
3. 400 MHz
4. 600 MHz
5. EXIT
Enter the option : 2_
```


Few Examples

SYN P_S	THREAT	FREQ	CHNL	TECH	B.W	ADDRES	DATA	CNTR
P	T1	8000	1	DTO	--	200	81AF	21
P	T2	9000	2	Barrage	100	204,219,207	A4F1,0004,0010	22
P	T3	10000	1	Spot	20	208,21A,20B	8832,0004,0004	24
P	T4	11000	2	AFC	--	20C,215,216	AB73,0AAA,007B	68
P	T5	18000	--	DTO	--	210	A597	30
S	T6	12000	1	DTO	--	A20	900F	21
S	T7	13000	2	Barrage	400	A24,A39,A27	B2A9,0004,0018	22
S	T8	14000	1	Spot	60	A28,A3A,A2B	9544,0004,000C	24
S	T9	15000	2	AFC	--	A2C,A15,A16	B7DF,0492,007B	68
S	T10	20000	--	Barrage	200	A30,A3C,A3D	AC1A,0004,0014	30

Conclusion:

Input through the PC and see the output in hex display. The addresses of the inputs which are stored in the microcontroller. Thus the required bit pattern is displayed according to the user selected frequency and threat is further given to the synthetic channel for the generation of the selected jamming technique.

Future Scope:

- Indian Defence systems – 40GHz
- U.S. Defence systems – 60GHz
- Allocation of higher bandwidth for the synthetic channel.
- No need to change Hardware,
- Just modify the program only i.e. Software.

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THANK YOU