ELEKTRİK VE ELEKTRONİK MÜHENDİSLİĞİ BÖLÜMÜ BİTİRME PROJELERİ SERGİSİ

Karsis

DESIGN AND PRODUCTION OF A MULTIBAND JAMMER

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INTRODUCTION

In this project, a 900-1900 MHz frequency band (GSM900, GPS and GSM1800) is used for the jamming of wide-band or multi-band signals. For this purpose, a signal jammer system is designed and manufactured. In this design, being different from the others in the market, a simple design containing only one IF channel and a single RF channel composed of a voltage controlled oscillator, high-frequency amplifier, and an antenna is used for multi-band jamming.

THEORY

Downlink frequencies

To jam the devices, downlink frequencies more easier than uplink frequencies. Downlink frequency in the applications are

	Downlink frequency (MHz)
Turkcell (GSM 900)	935-947
Vodafone (GSM 900)	947-960
GPS	1575
Avea (GSM 1800)	1805-1820

Friss Transmission Equation

$$P_t(G_k G_a)\left(\frac{\lambda}{4\pi R}\right)^2 = P_r \Rightarrow$$

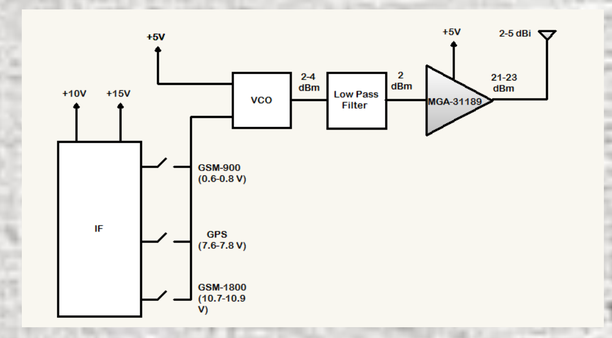
$$P_t = P_r\left(\frac{4\pi R}{\lambda}\right)^2\left(\frac{1}{G_k G_a}\right)$$

P_r = -30 dBm, f_{max} = 1900 MHz, R_{max} = 10 meters; G_a=2 dBi (the antenna gain of receiver device such as cell phone); $G_{jammer} = G_k$ = 5 dBi

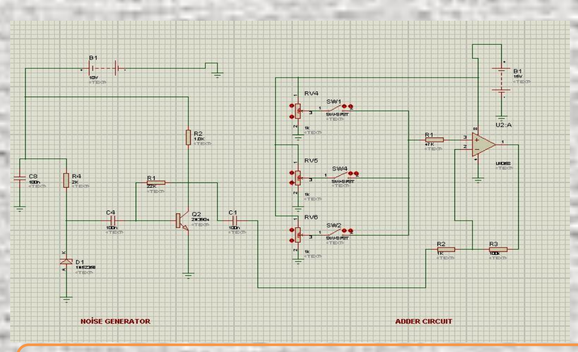
Transmitted Power (P_t) ≈ +23 dBm = 0.25 Watts

DESIGN

The Schematic of Complete Jammer



The Schematic of IF Section



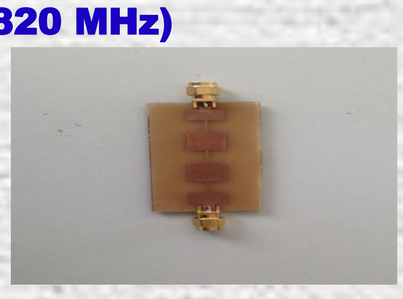
RF SECTION

VCO (ZX95-2500W+)

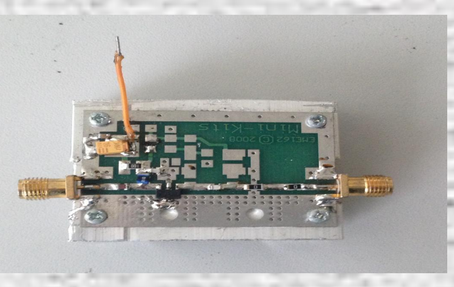
The frequency range: 800-2700 MHz
RF Output : 1-4 dBm

	Frequency Band (MHz)	Center Frequency (MHz)	Tuning Voltage (Volts)	Bandwidth (MHz)	Voltage Peak to Peak(V_{pp})
GSM-900	935-960	947.5	0.7	25	0.25
GPS	1565-1585	1575	7.7	20	0.22
GSM-1800	1805-1820	1812.5	10.8	15	0.2

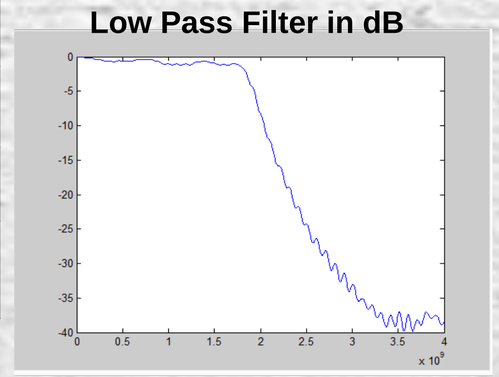
Low Pass Filter (Cutoff Frequency: 1820 MHz)



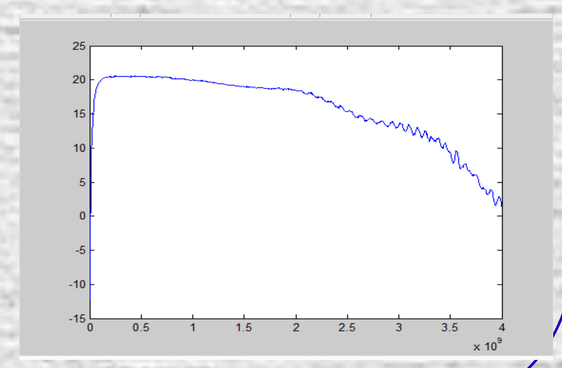
High Frequency Amplifier (MGA-31189)



Measured Insertion Loss of Low Pass Filter in dB

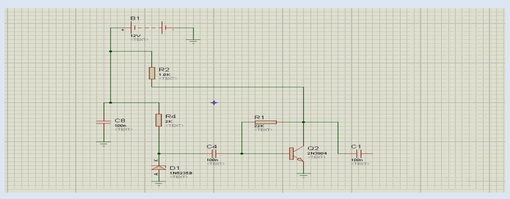


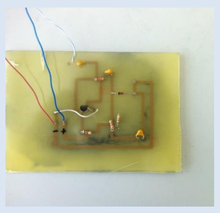
Measured Gain of MGA-31189 in dB

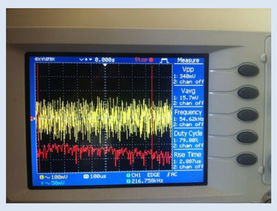


IF Section

Noise generator

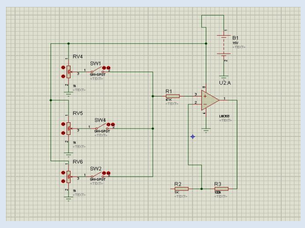


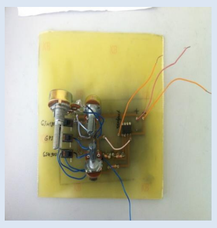


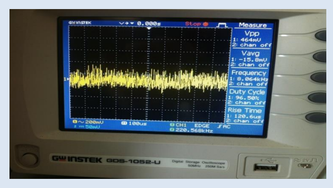


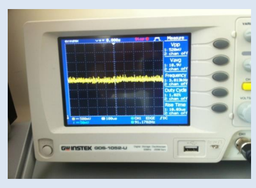
A noise signal with an effective of 180 mV peak-to-peak voltage is obtained (almost uniform frequency spectrum)

Adder





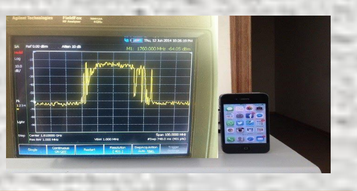




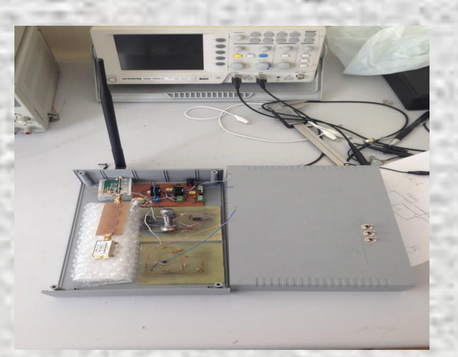
Noise signal with an effective of 300 mV peak-to-peak voltage is added to DC tune voltage successfully

JAMMING TESTS

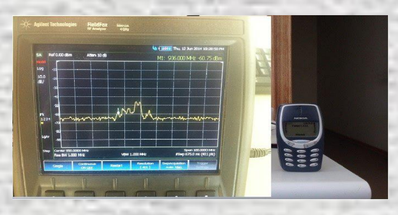
Jammer off (Avea)



Jammer on (Avea)



Manufactured Device



Jammer off (Turkcell)

Jammer on (Turkcell)

RESULTS

Effective Range

	GSM-900	GPS	GSM-1800
Jamming Distance (m)	5-10*	>100	5-10*

* Depends on the positions of base stations

DC Power Consumption

	Volts (V)	Currents (mA)	Power (mW)
Amplifier	5	80	400
VCO	5	35	175
Noise Generator	10	10	100
Adder	15	12	180
Total		137	855

Cost Analysis

VCO	60$
Amplifier	25$
Low Pass Filter	2$
Noise Generator	3$
Adder Circuit	3$
Voltage Regulator	2$
Antenna	6$
Box	15$
Others	4$
TOTAL	120$

- Multiband Jamming is done with a very simple IF channel, only one RF channel and a switching system
- In our project, we design cheaper device as compared to other examples in the market.

We thank to KARSİS Savunma for their support and guidance for this project.