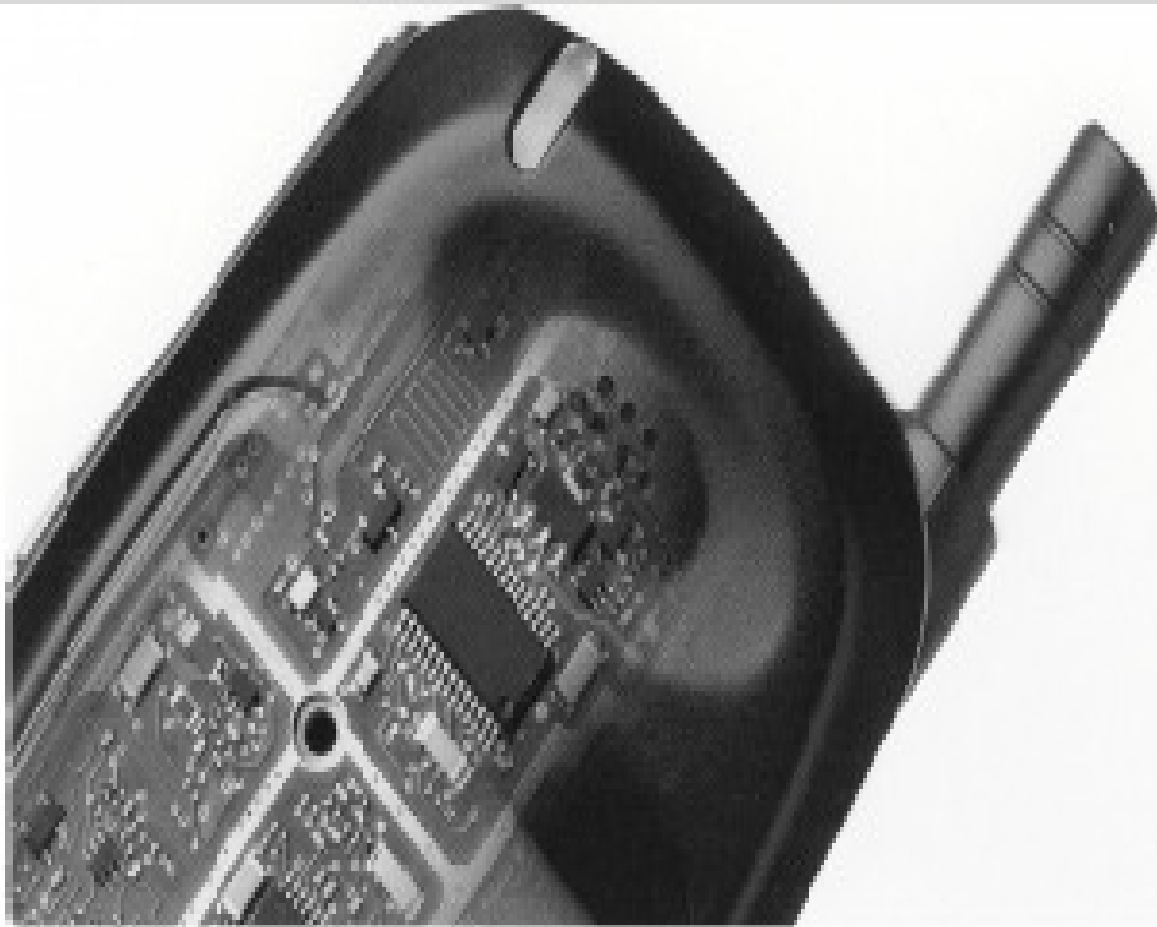


Antene ročnega mobilnega telefona¹

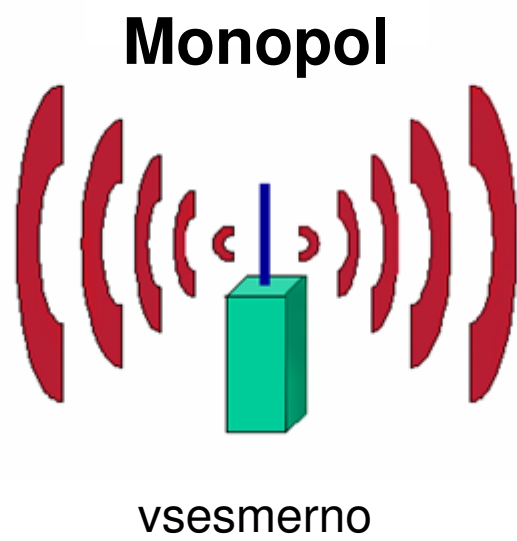
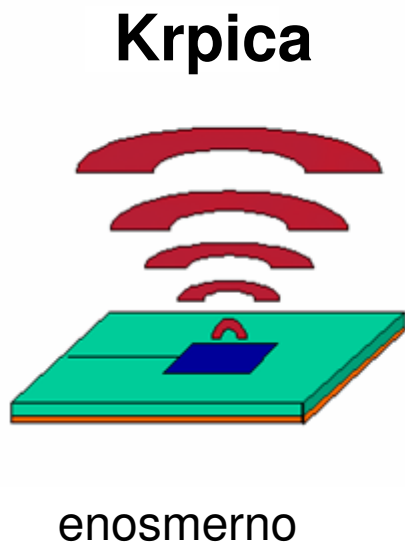
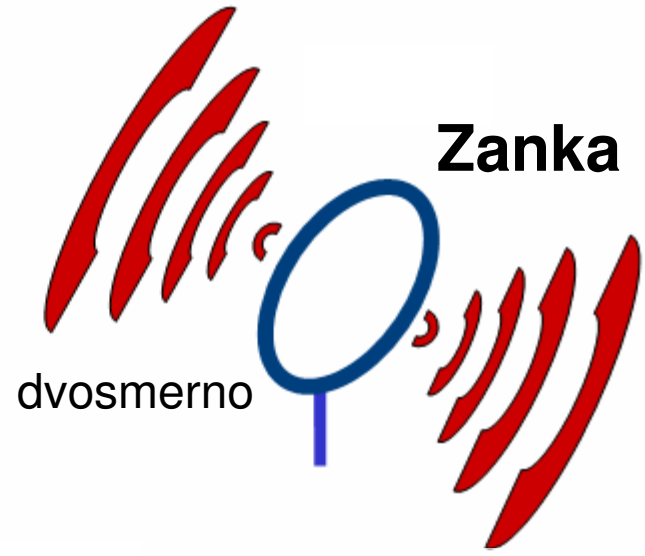
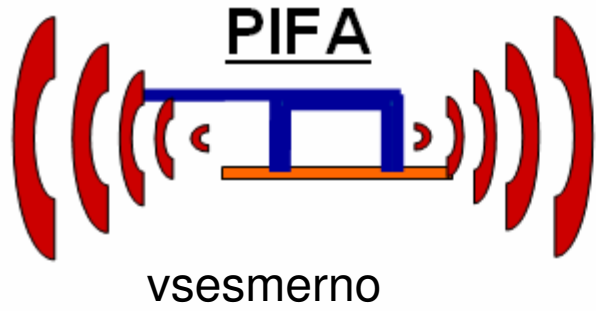


Mobitel d.d.,
izobraževanje

18. 12. 2009,
predavanje 30

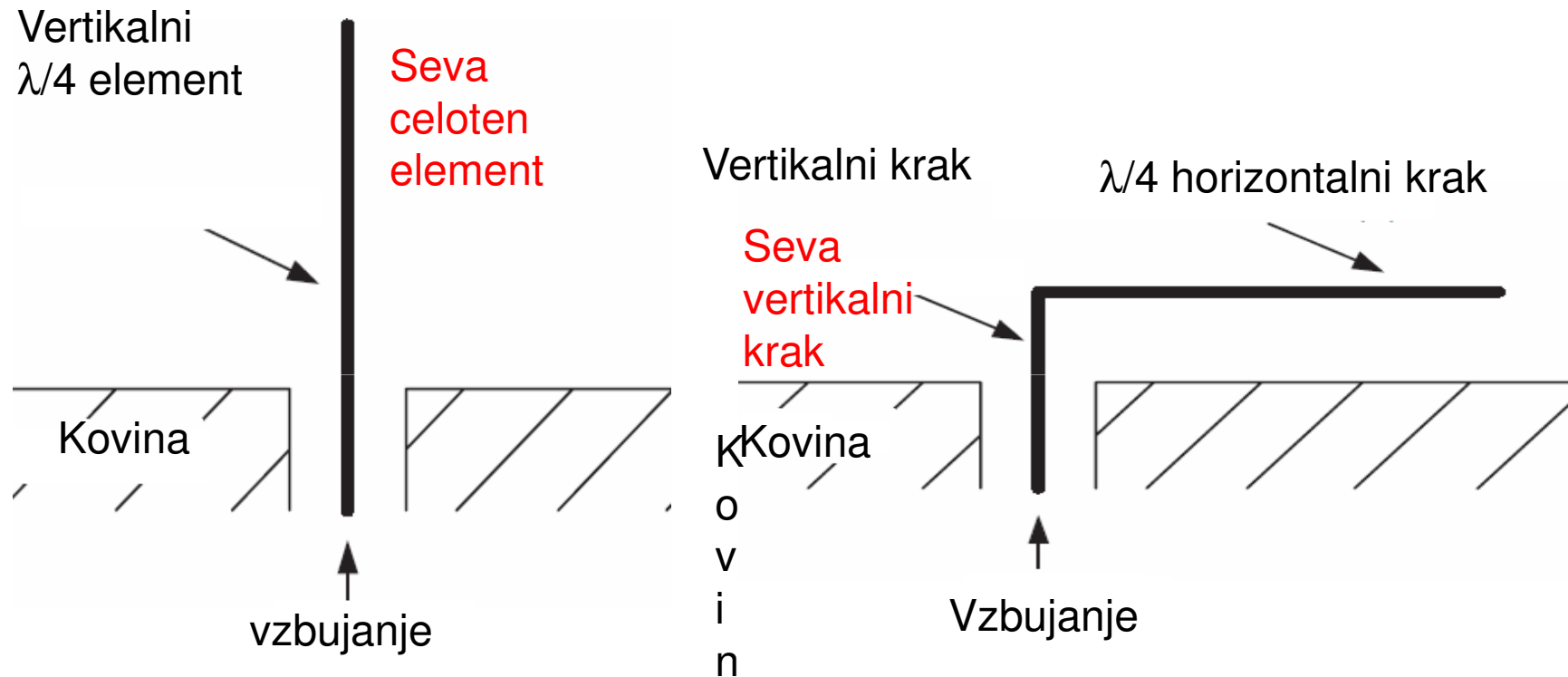
Prof. dr. Jožko
Budin

Vrste anten in smeri sevanja



Izhodiščni modeli anten

3

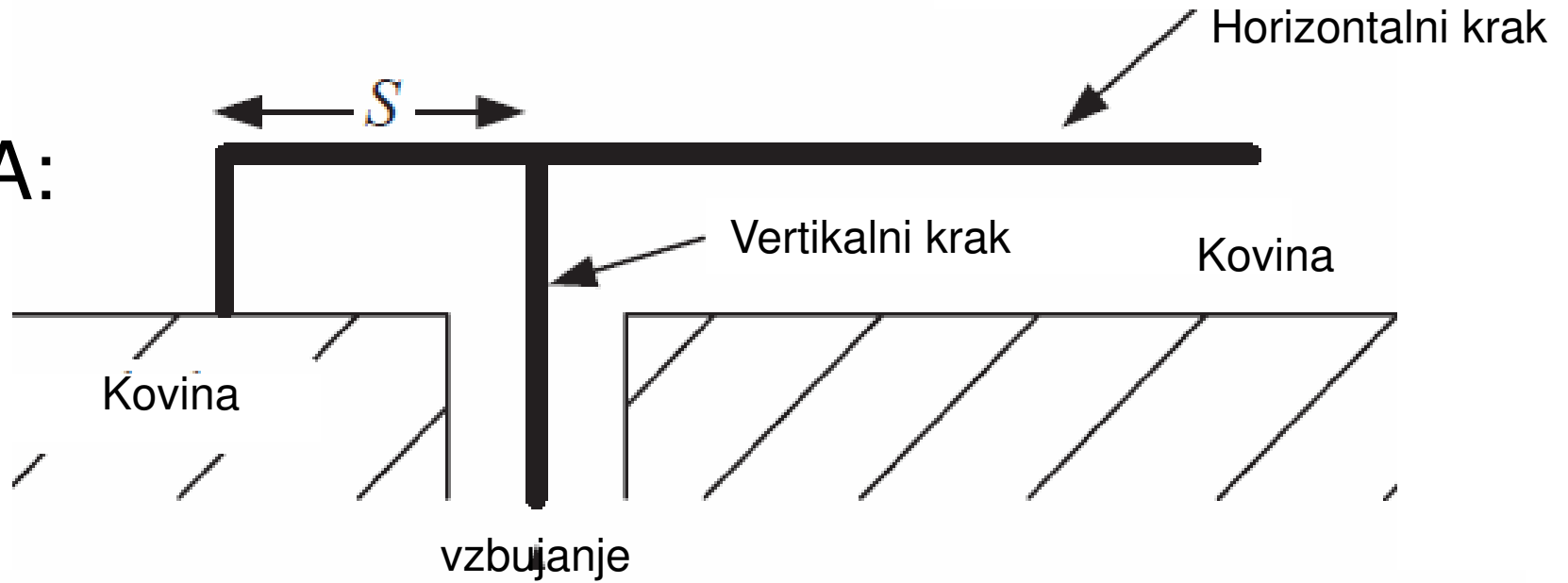


Četrtnovalovni monopoli

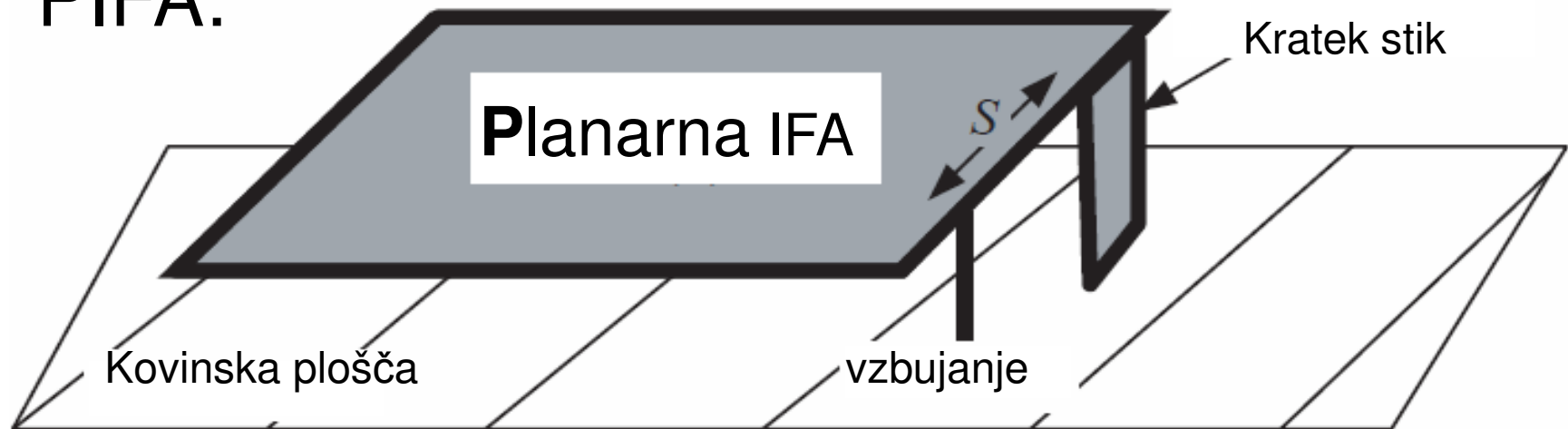
ILA - Inverted L Antenna

IFA in PIFA

IFA:

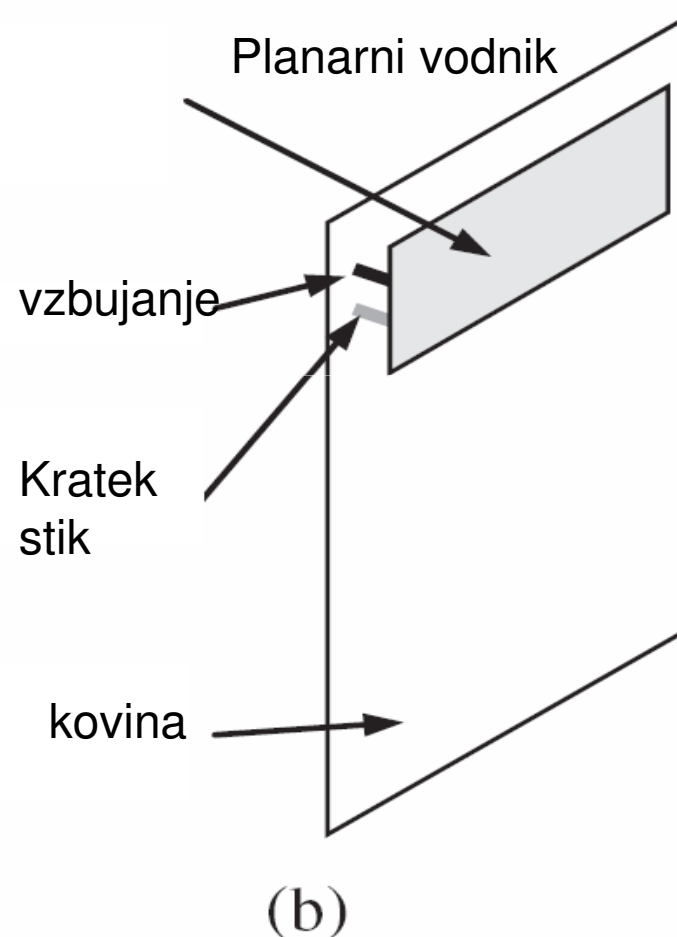
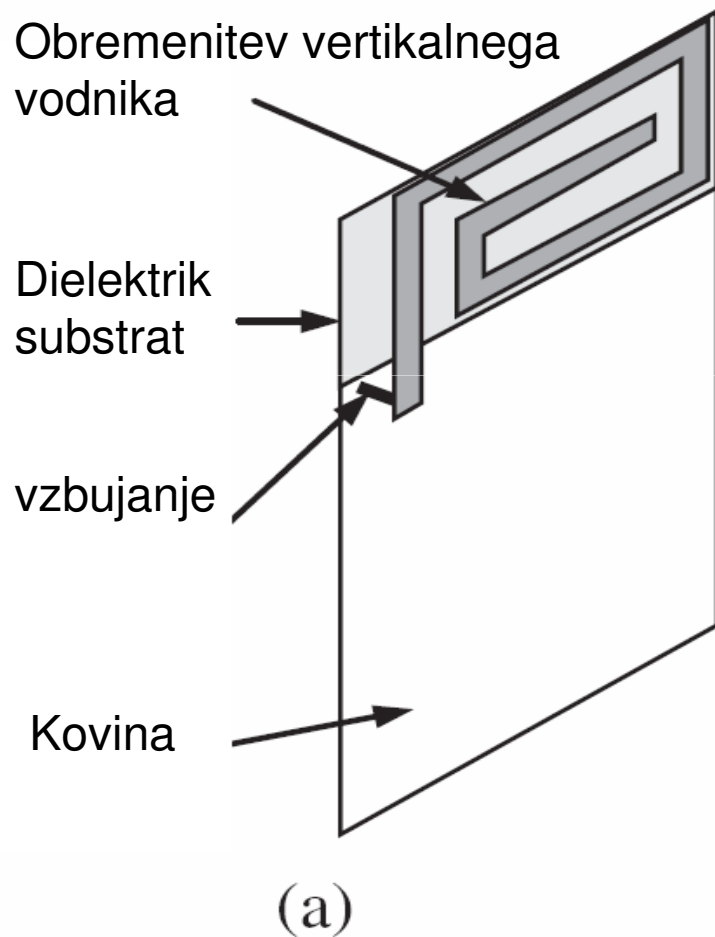


PIFA:

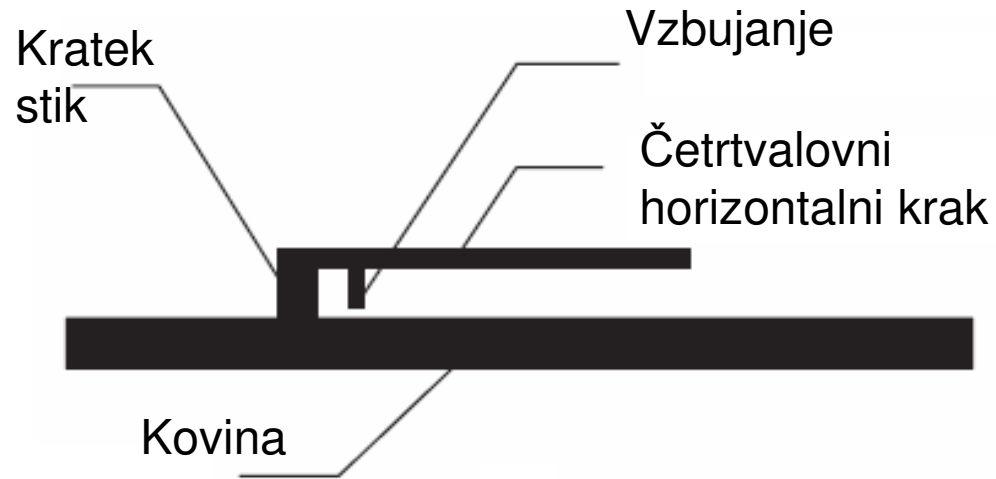


PIFA je najpogosteje uporabljena antena

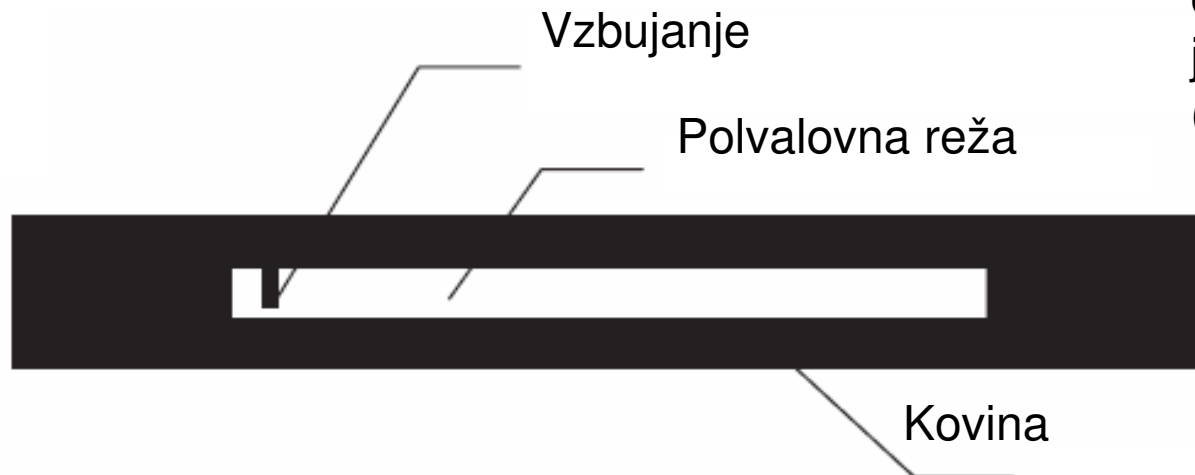
IFA in PIFA



IFA in reža

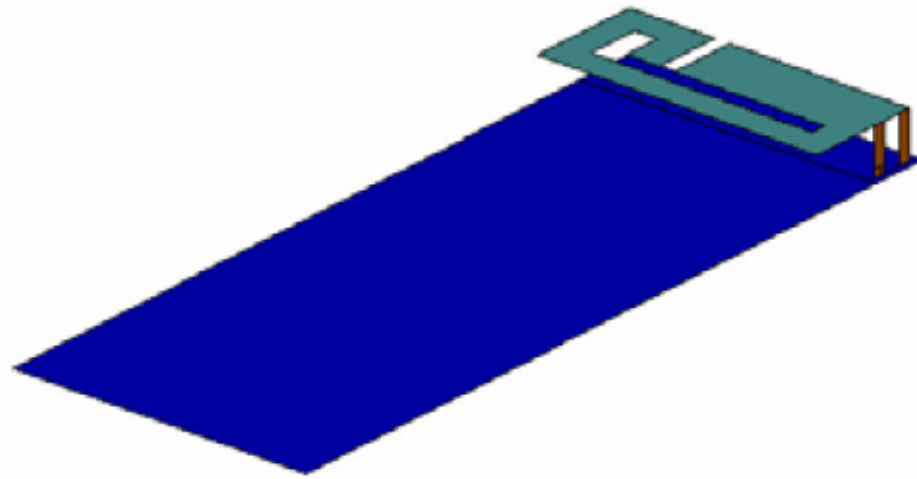


Seva enostransko. Potrebuje spodnjo kovinsko ploščo. Razdalja do plošče mora biti zadostna.

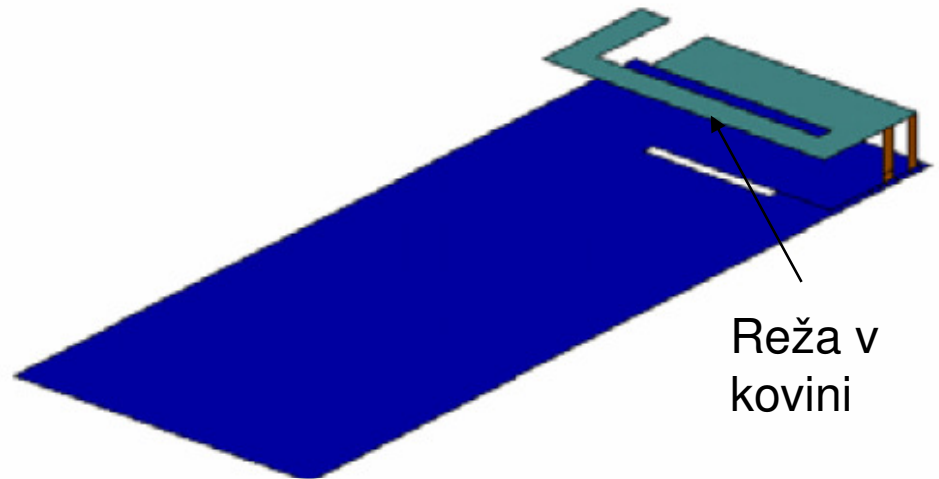


Seva dvostransko. Za enostransko sevanje je potreben reflektor (resonator).

PIFA - oblikovanje

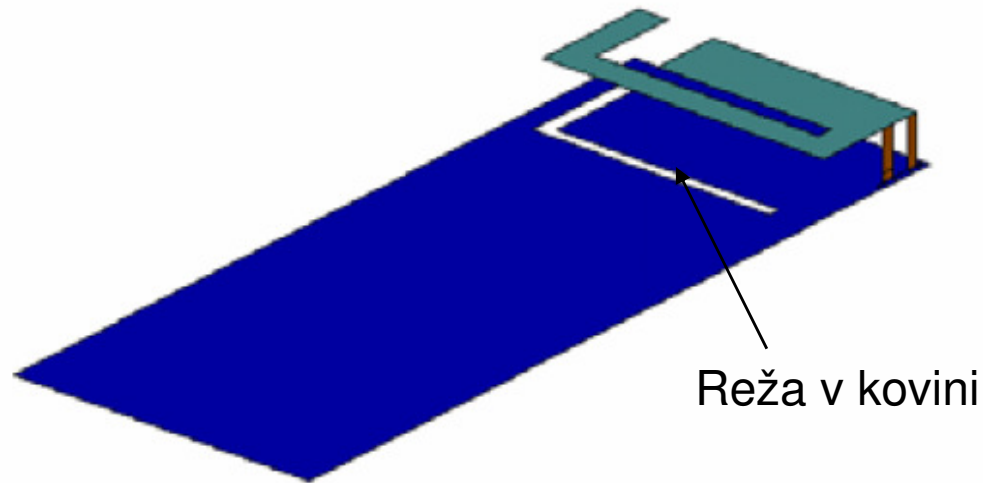


(a)



Reža v kovini

(b)



Reža v kovini

(c)

Karakteristični rodovi pravokotne plošče

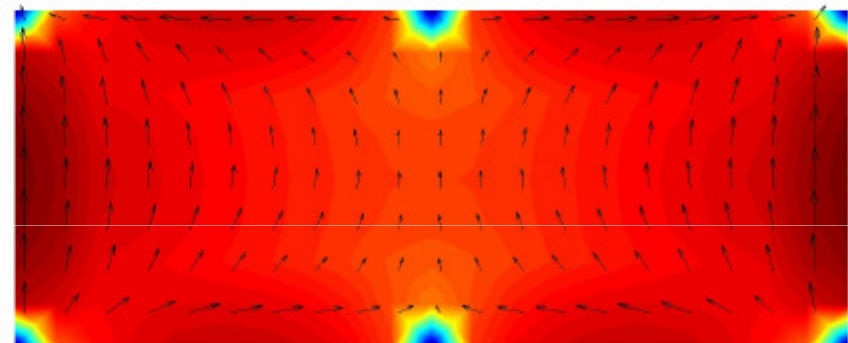
8

Dimenzije 100 × 40 mm

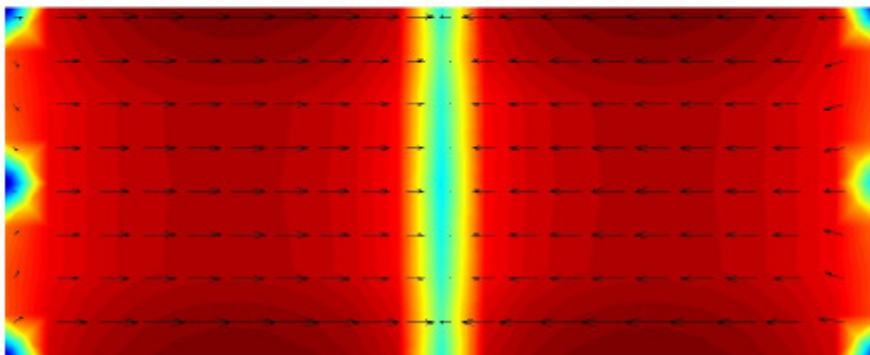
Rod 1 ($\lambda/2$ pri 1,3 GHz)



Transverzalni rod



Rod 2 (λ pri 2,9 GHz)

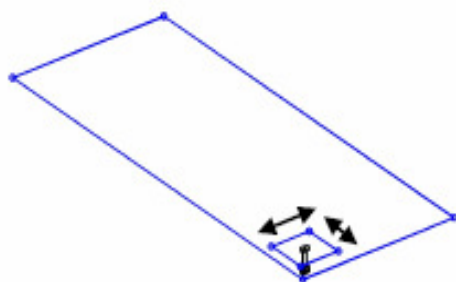


Pri nebalansiranih antenah (vzujanje $U,0$) postaja ohišje (plošča) antene njen sestavni del. Antena vzbuja tokove na ohišju, ki sevajo v prostor. Medsebojni vpliv antene in ohišja je bolj izrazit pri nižjih frekvencah.

Nokia

Mesto namestitve antene 2/2

Kovinska plošča

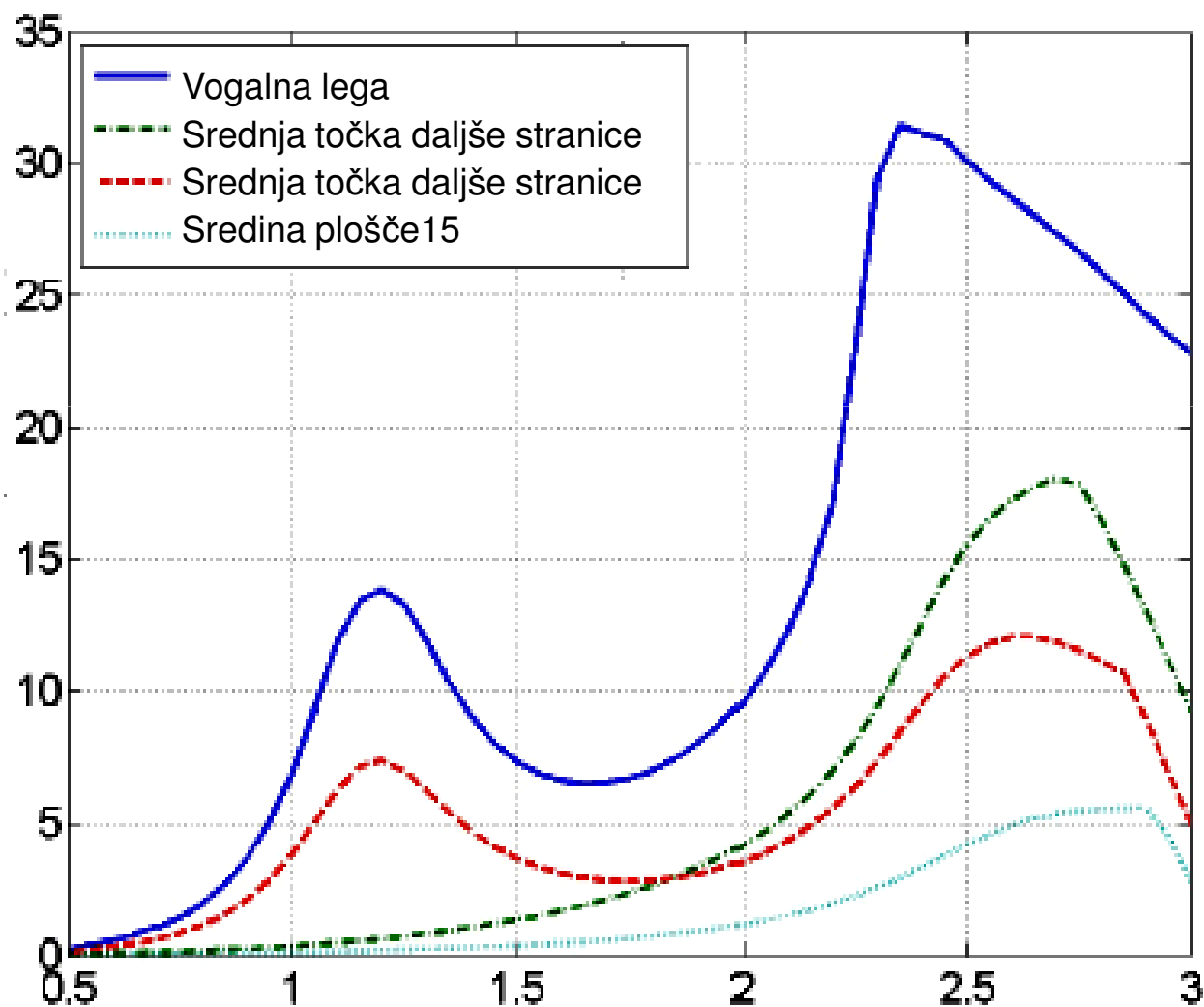


Pravilo: anteno namestimo v maksimum polja resonančnega rodu plošče

Zato namestimo anteno v vokalno lego nad kovinsko ploščo.

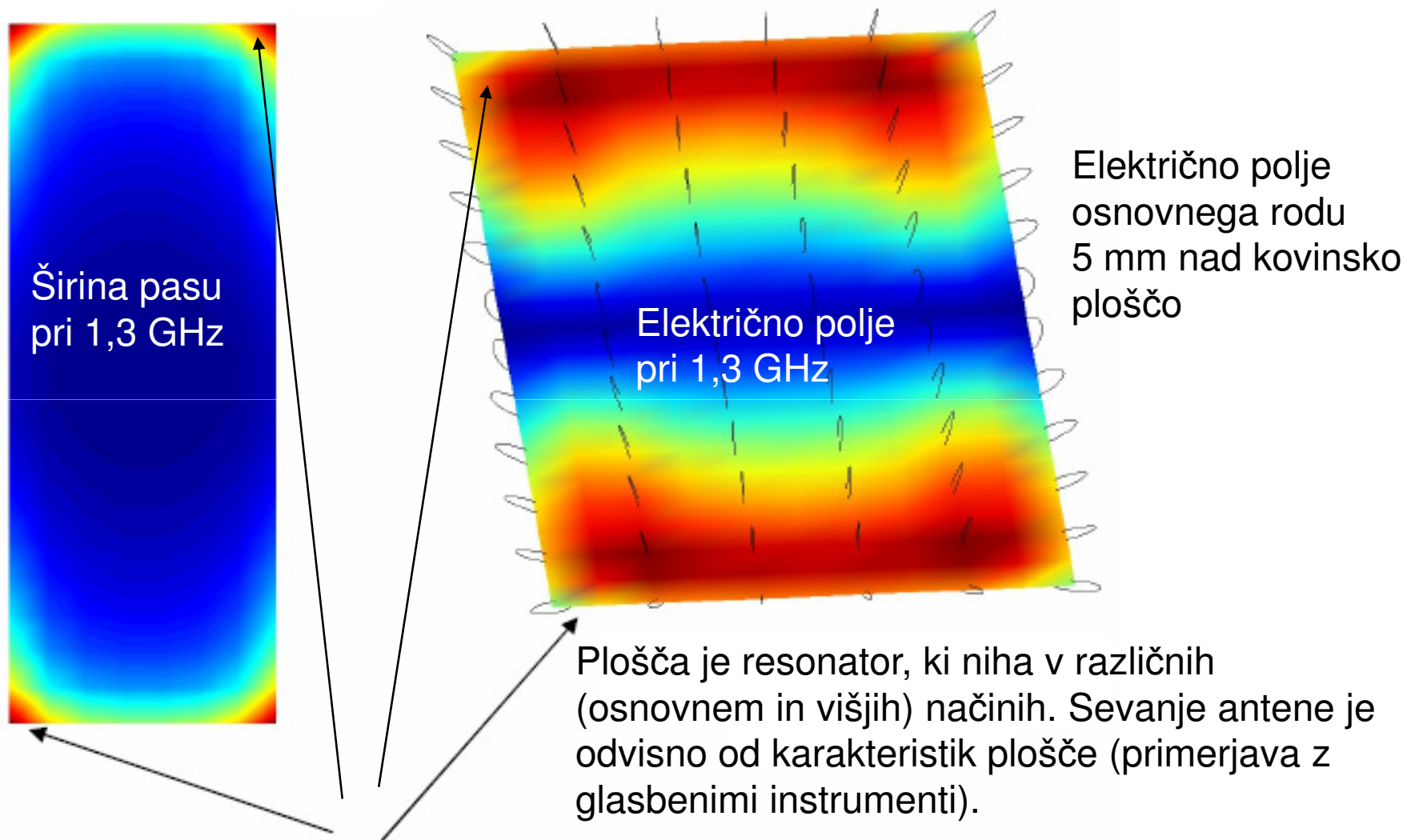
Primer majhne krpičaste antene

Širina pasu v %



Mesto namestitve antene 1/2

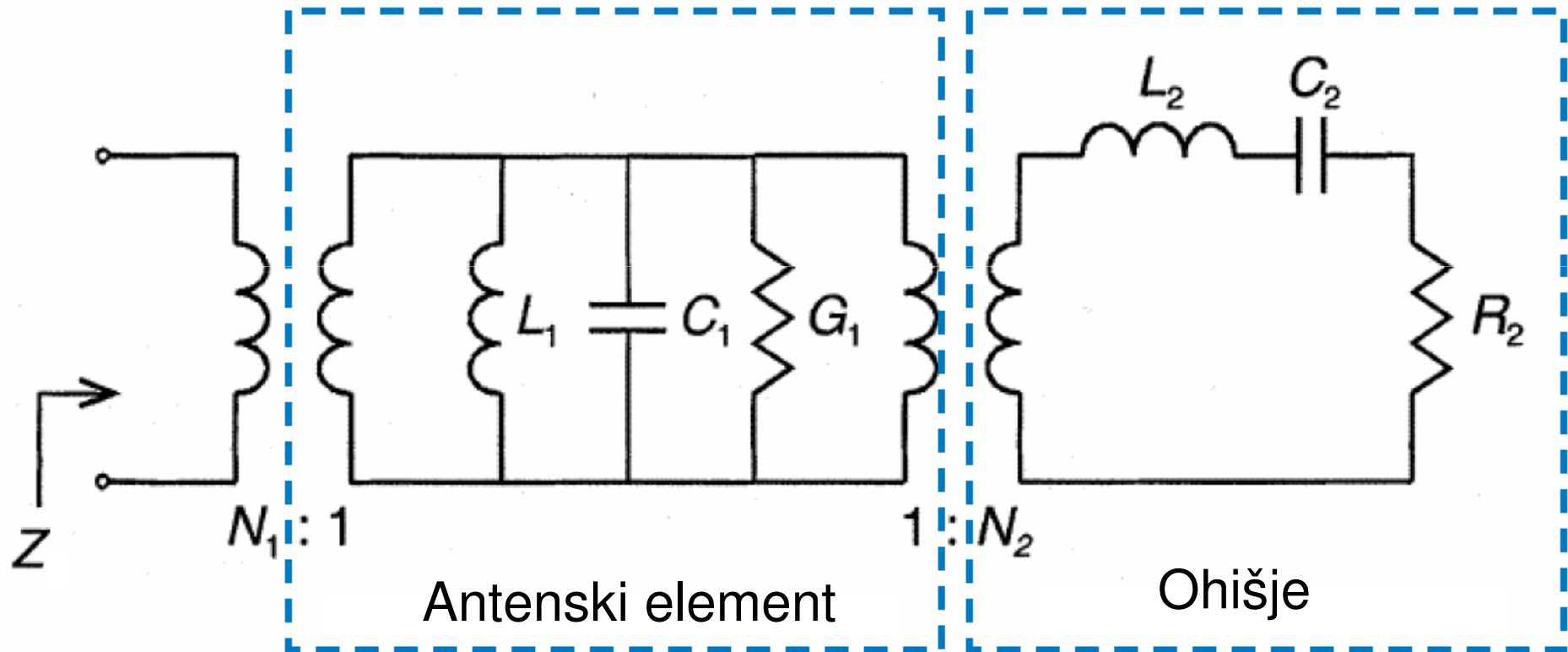
10



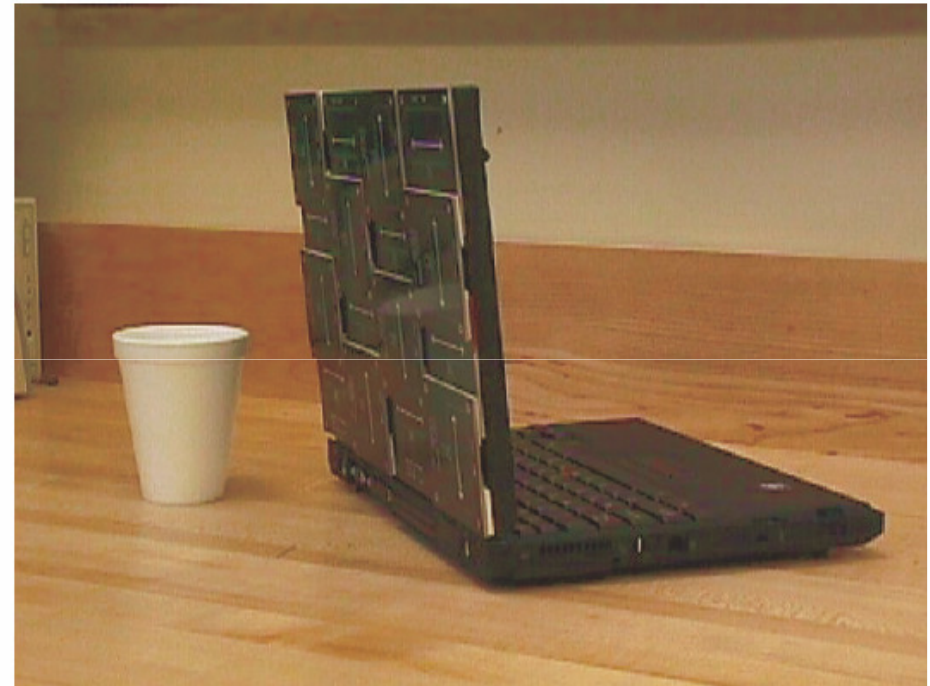
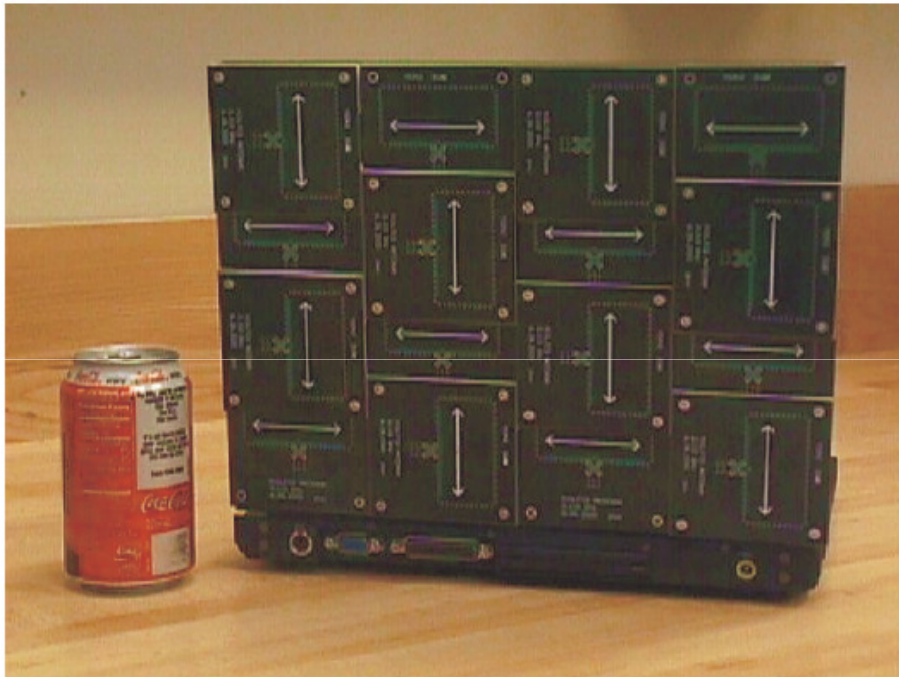
Namestitev antene v vogalnih legah daje najboljše rezultate.

Nokia 2007

Nadomestna vezava antene in ohišja ¹¹



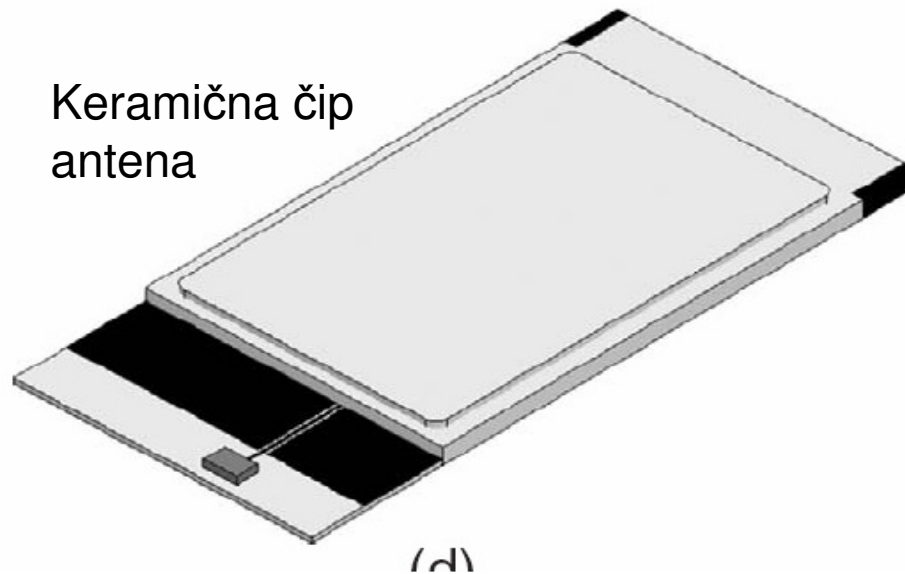
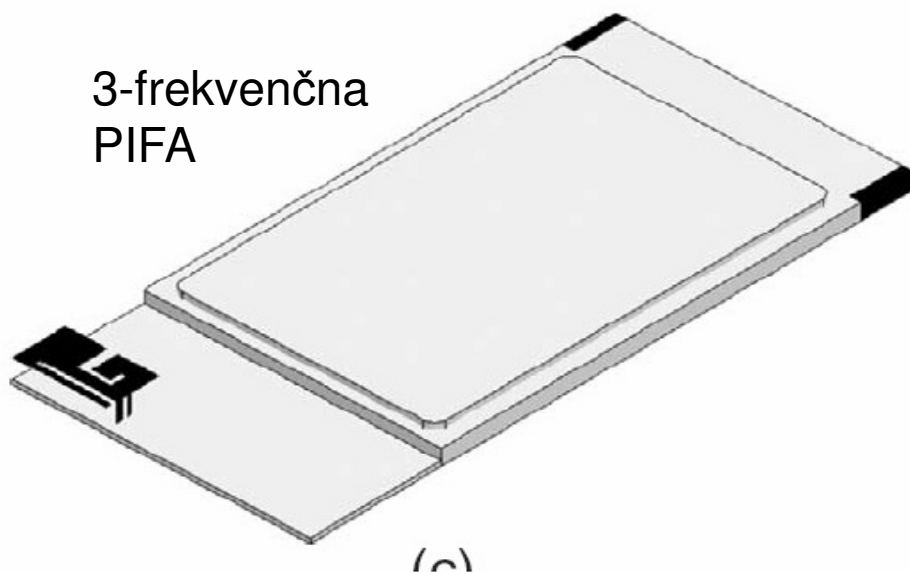
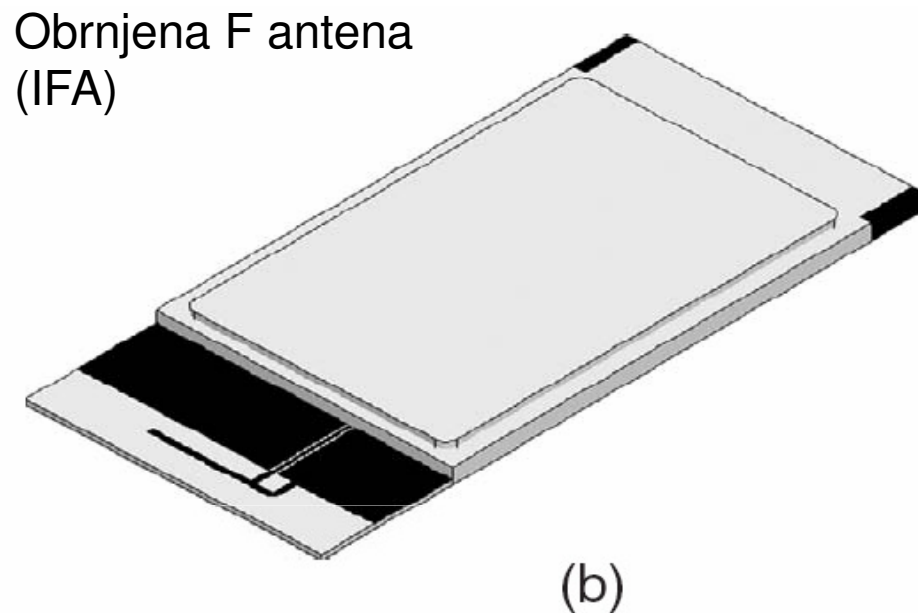
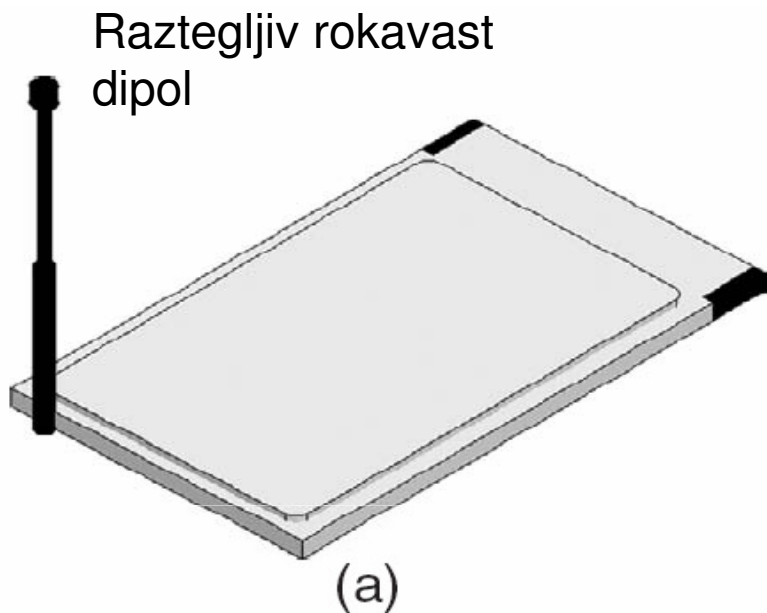
Antene v prenosnem računalniku ¹²



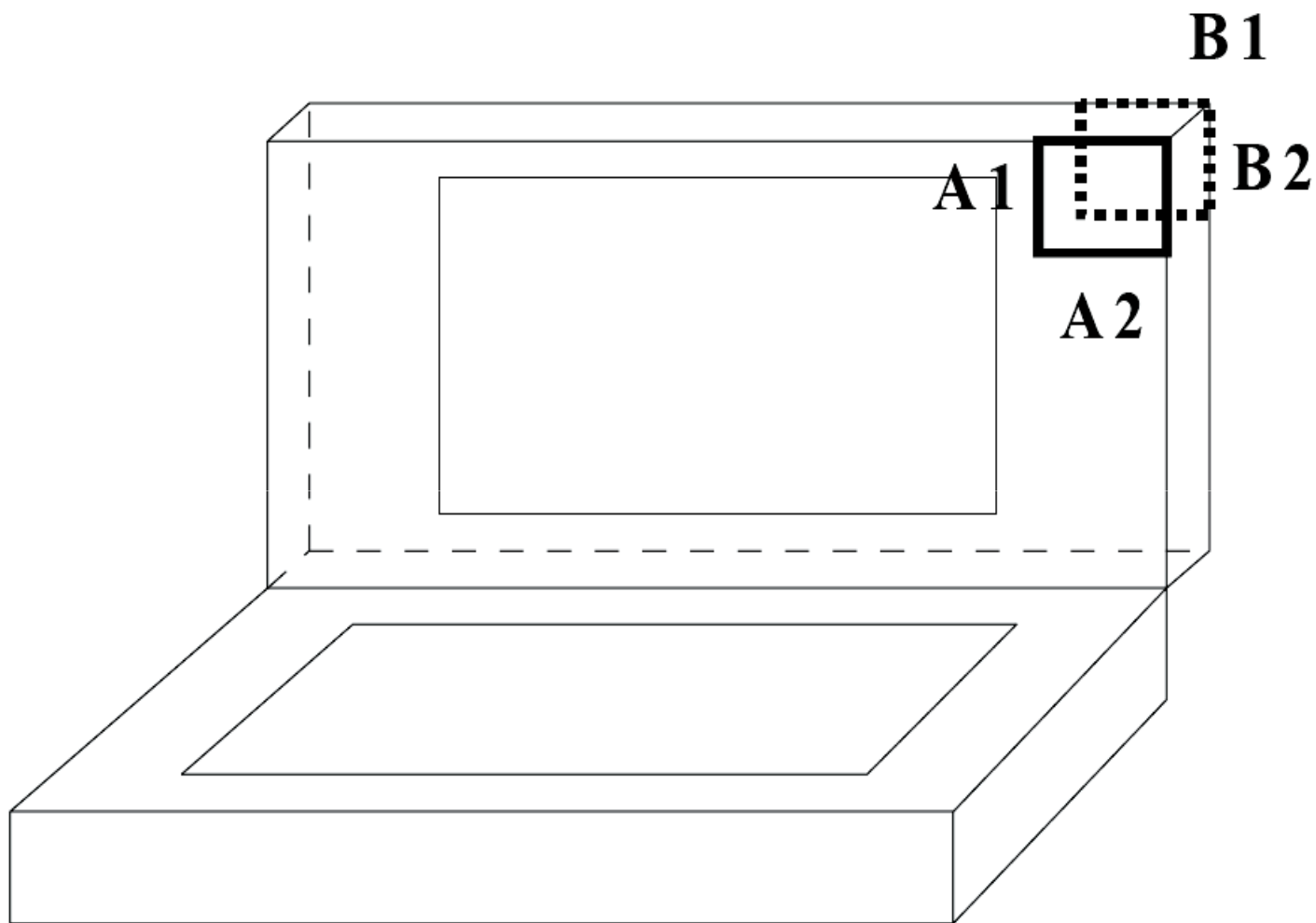
Prenosni računalnik in dlančnik nudita dovolj prostora za namestitev večjega števila anten.

Telo in antena mobilne naprave

13

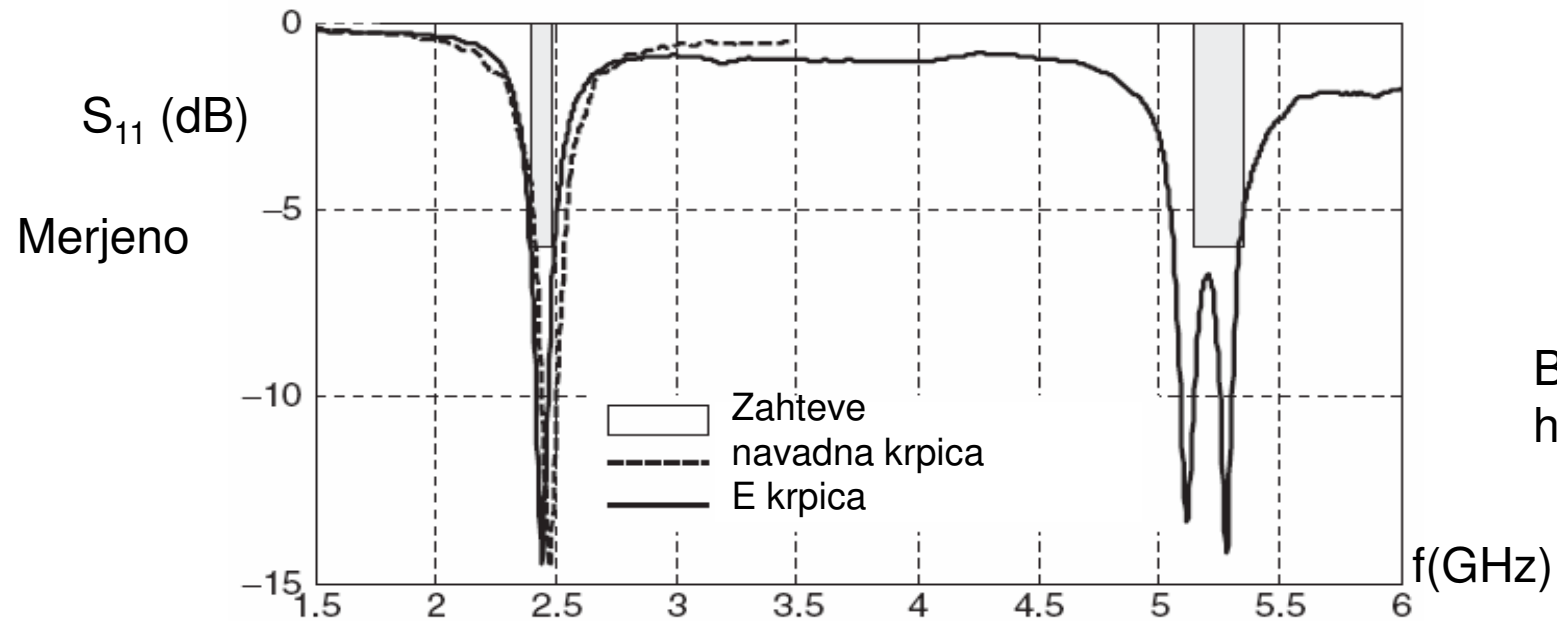
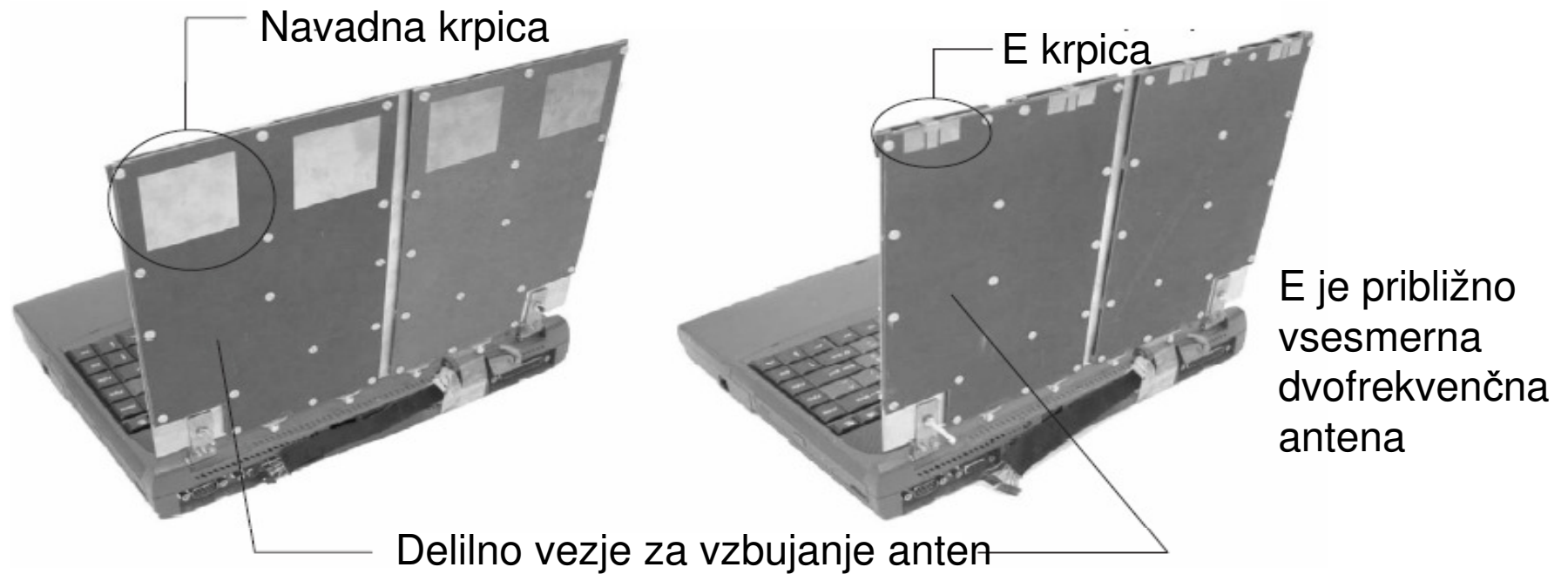


Namestitev antene prenosnega računalnika¹⁴

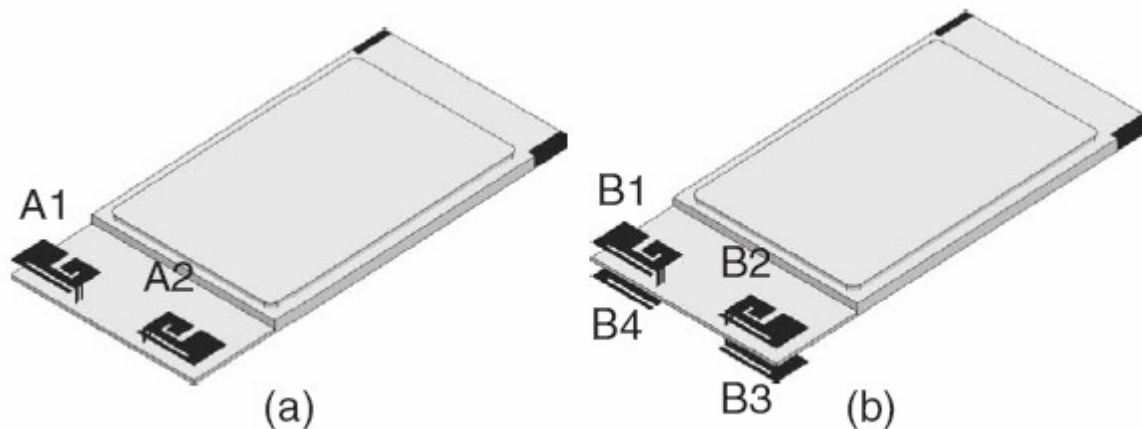


Antene prenosnega računalnika

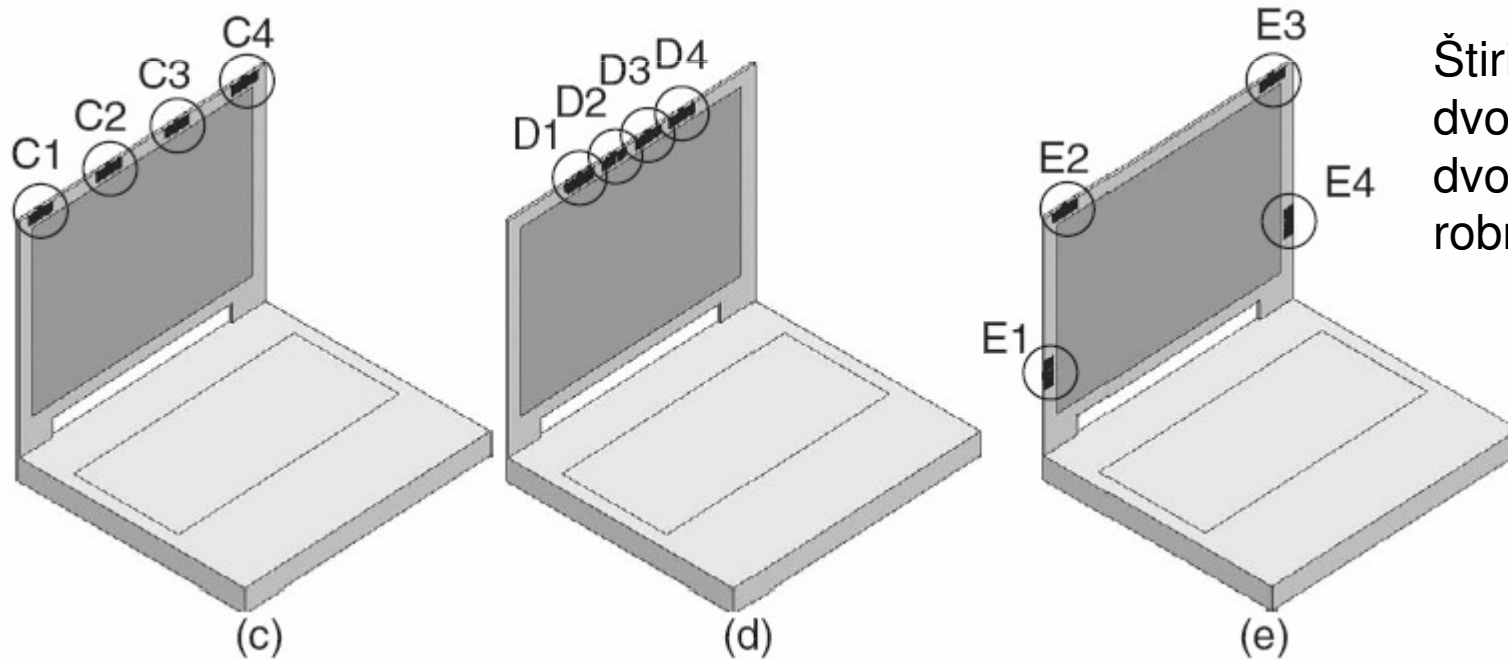
15



MIMO antenski sistemi

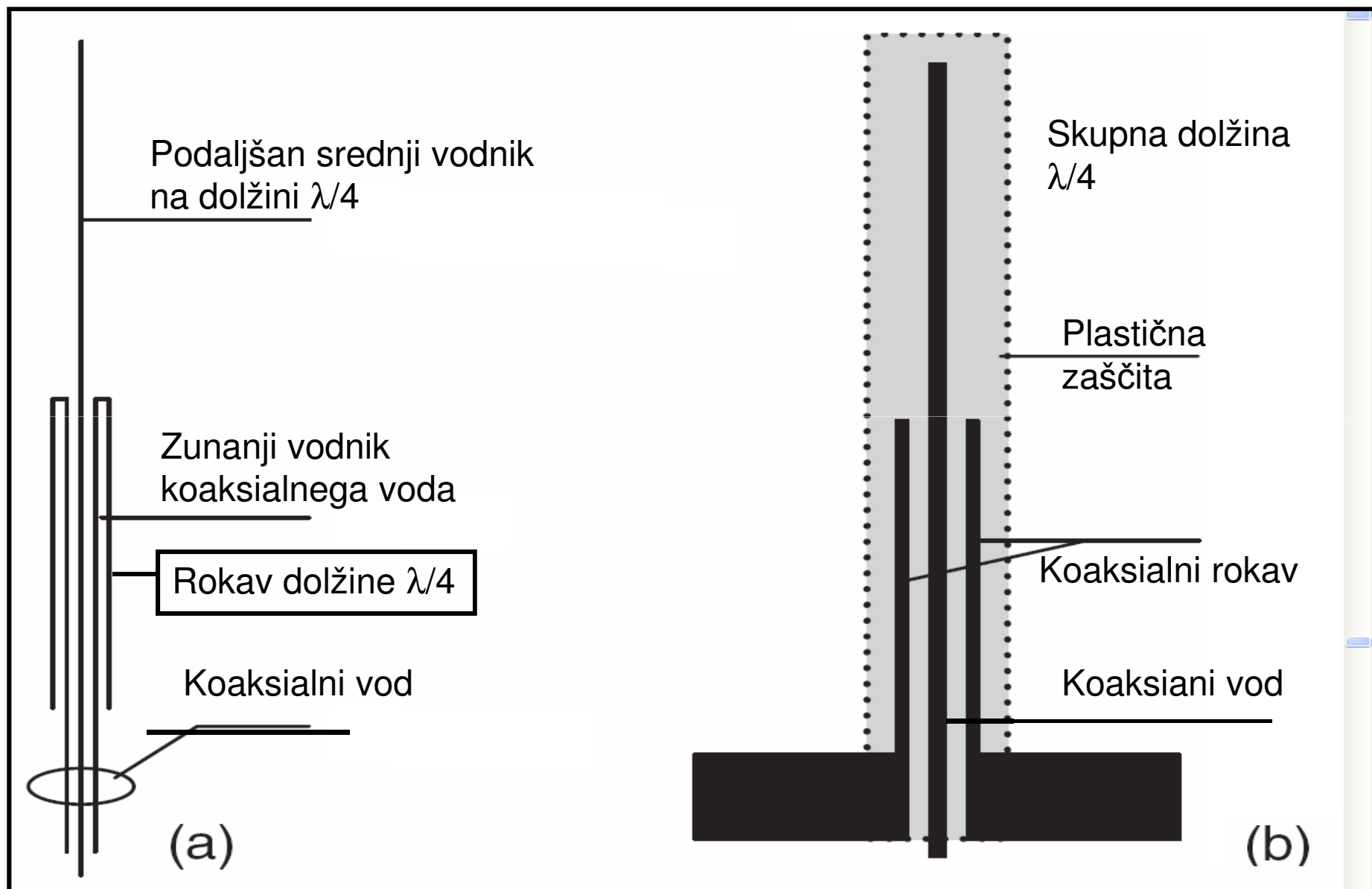


Dvo-elementna in štiri-elementna 3-frekvenčna PIFA



Štiri-elementna dvofrekvenčna dvostranska robna E krpica

Koaksialni dipol in rokavni monodipol ¹⁷



Primer antene PIFA

18

PIFA-
Planar Inverted-F
Antenna

Najbolj razširjena
antena

Ericsson T 68i

dvofrekvenčni

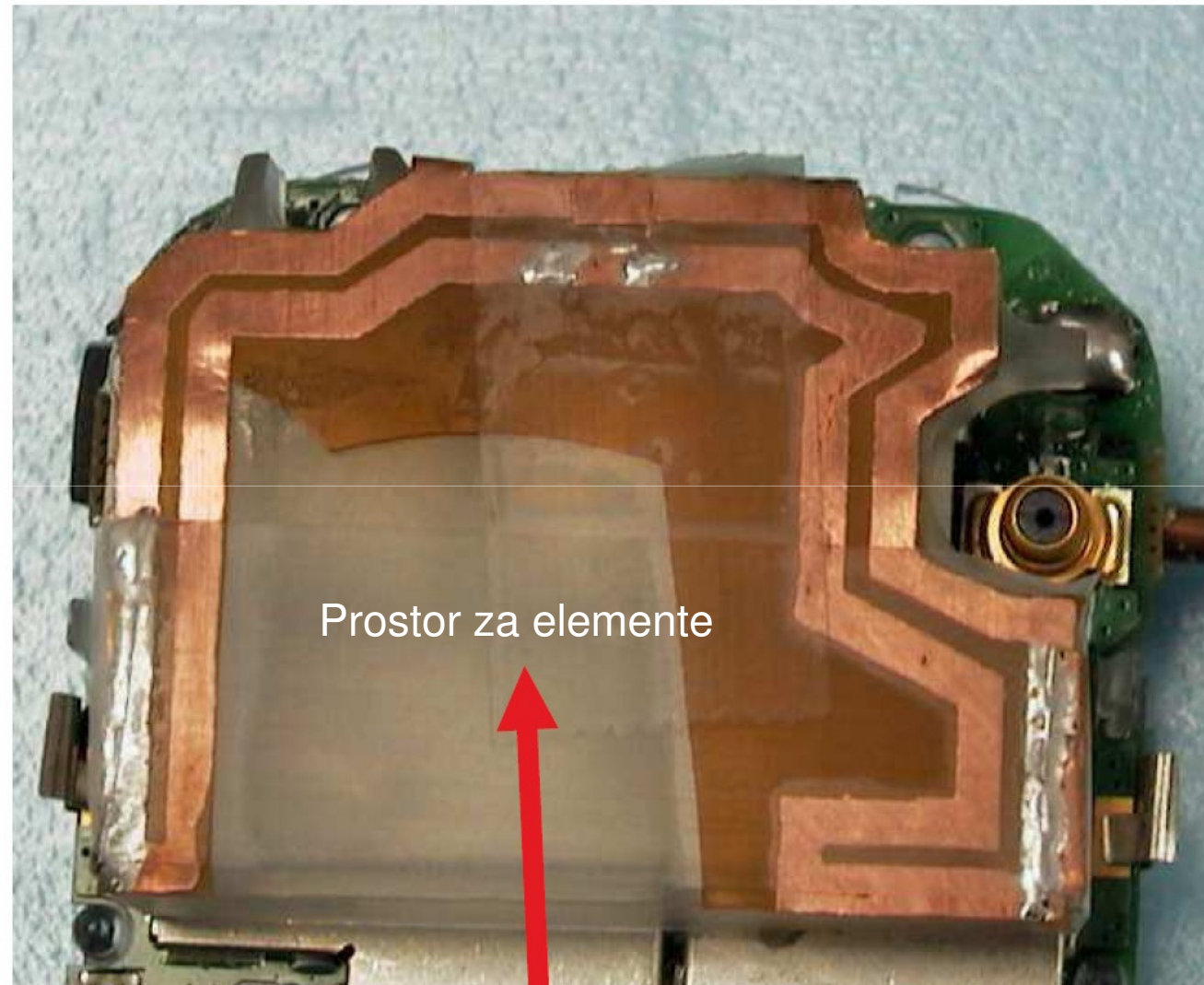


Primer antene FICA

FICA –
Folded Inverted
Conformal Antenna

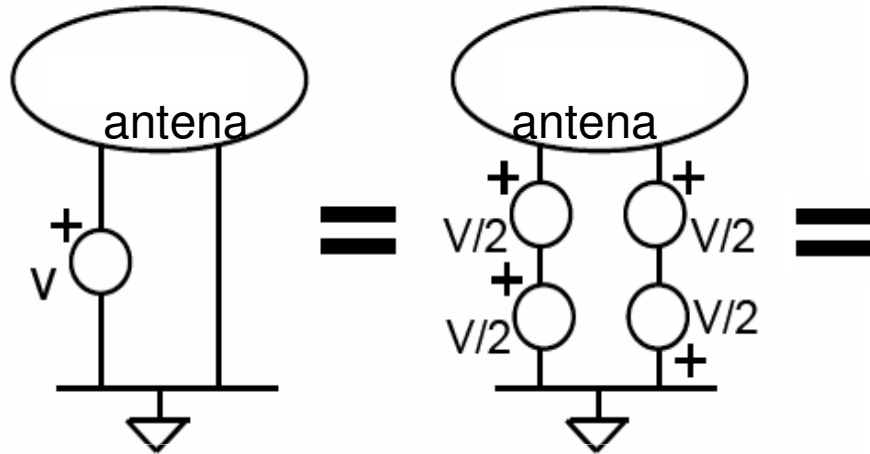
Motorola T 102

Dvofrekvenčni
Trofrekvenčni

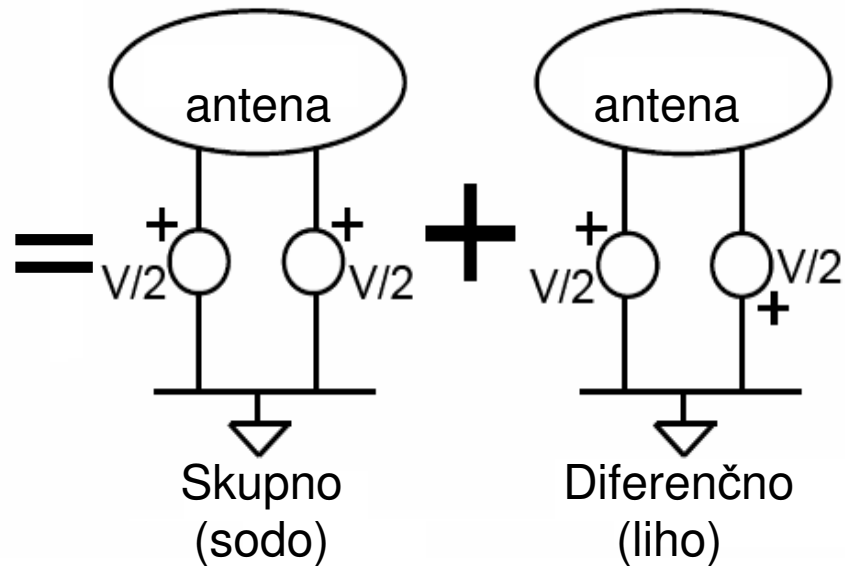


Načini vzbujanja FICA

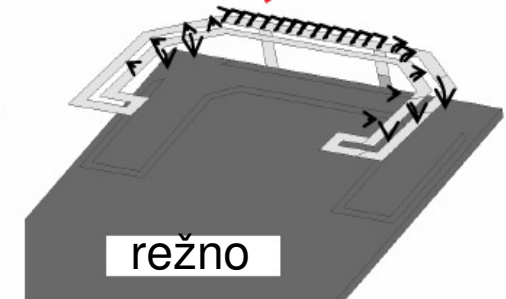
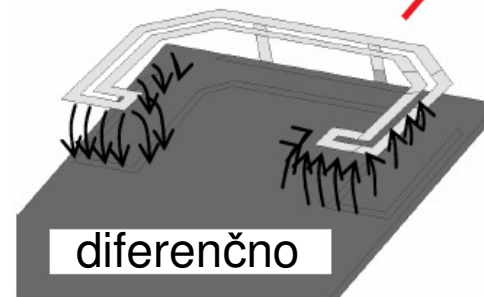
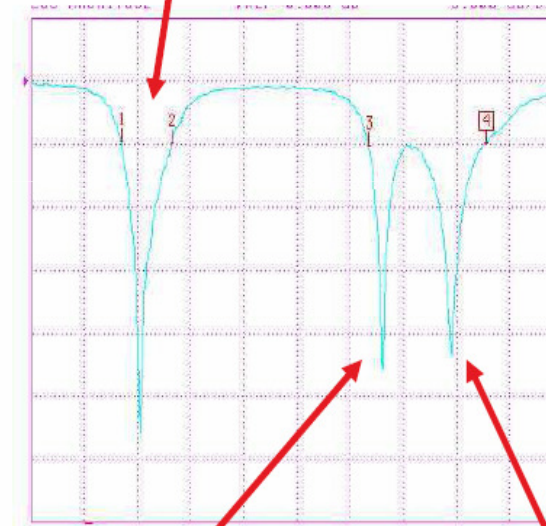
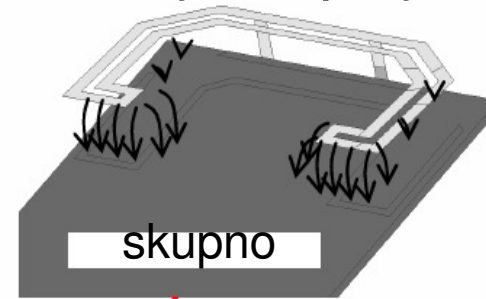
Vzbujanje



Nebalansirano (nesimetrično) vzbujanje

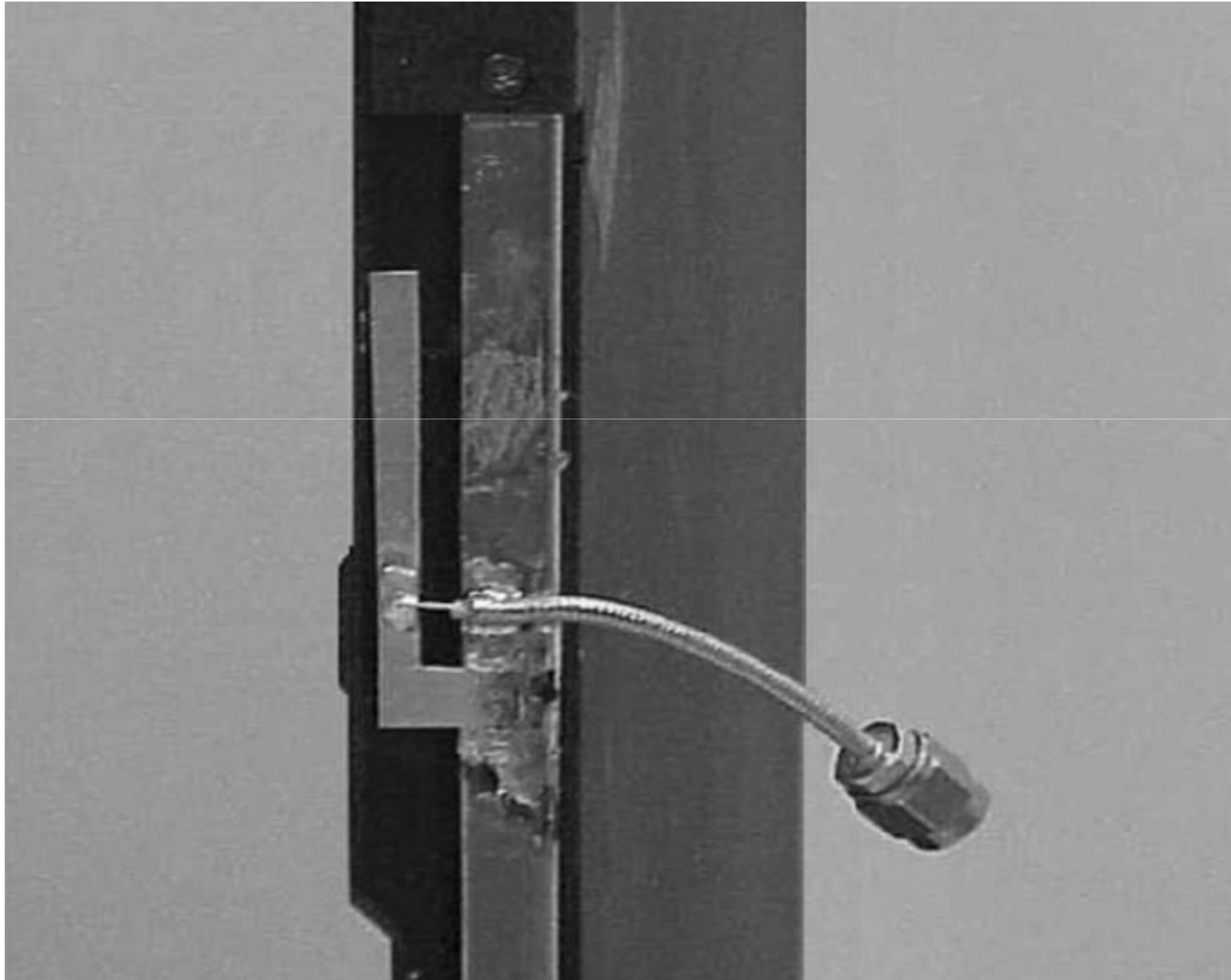


Vzbujeno polje



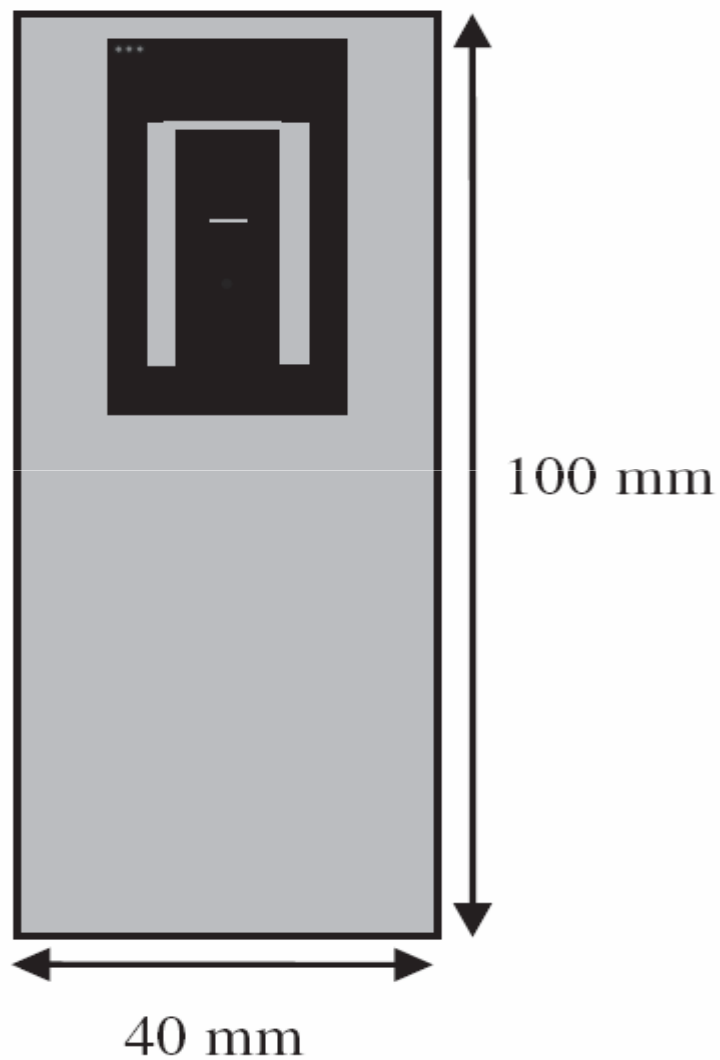
Primer antene IFA

21

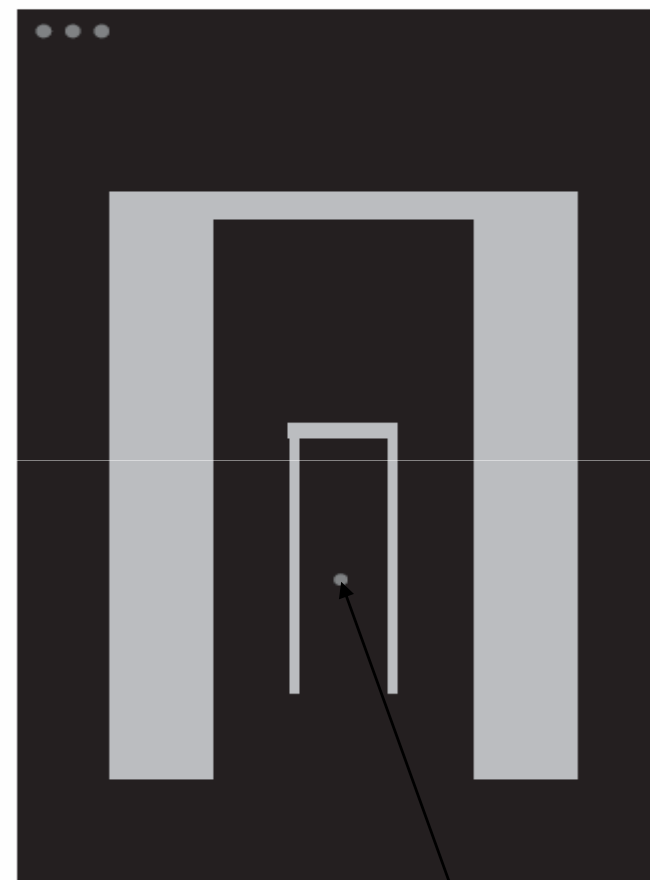


PIFA, trofrekvenčna antena

22



(a)

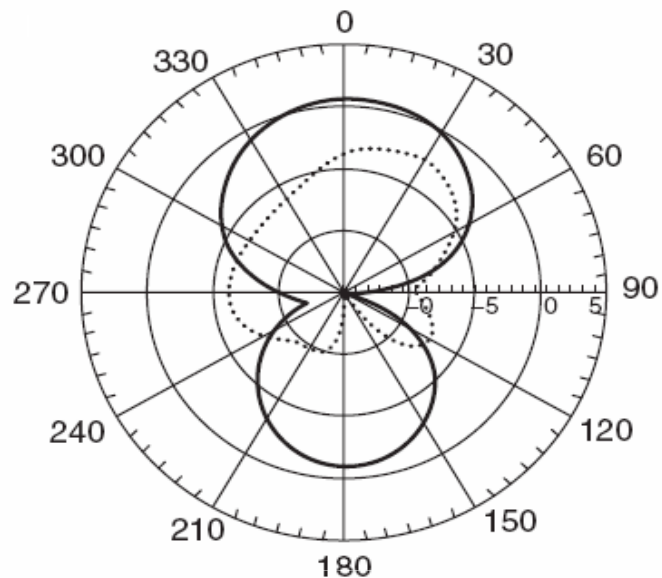


detajl

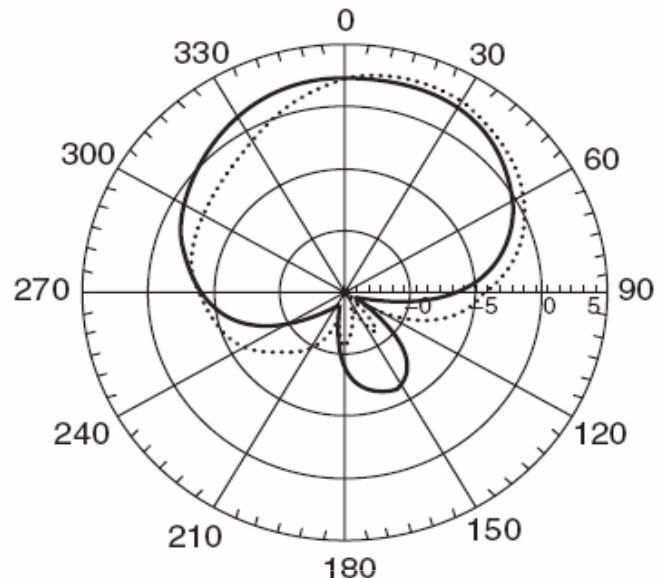
vzbujanje

(b)

Vpliv glave na sevalni diagram

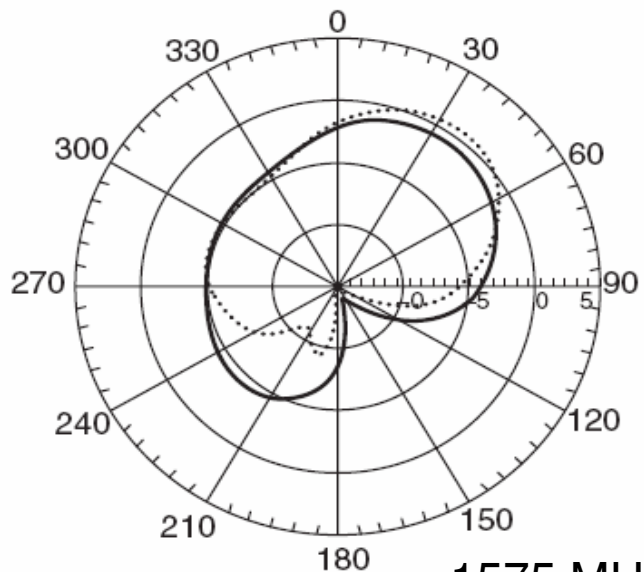


(a) 830 MHz, PIFA



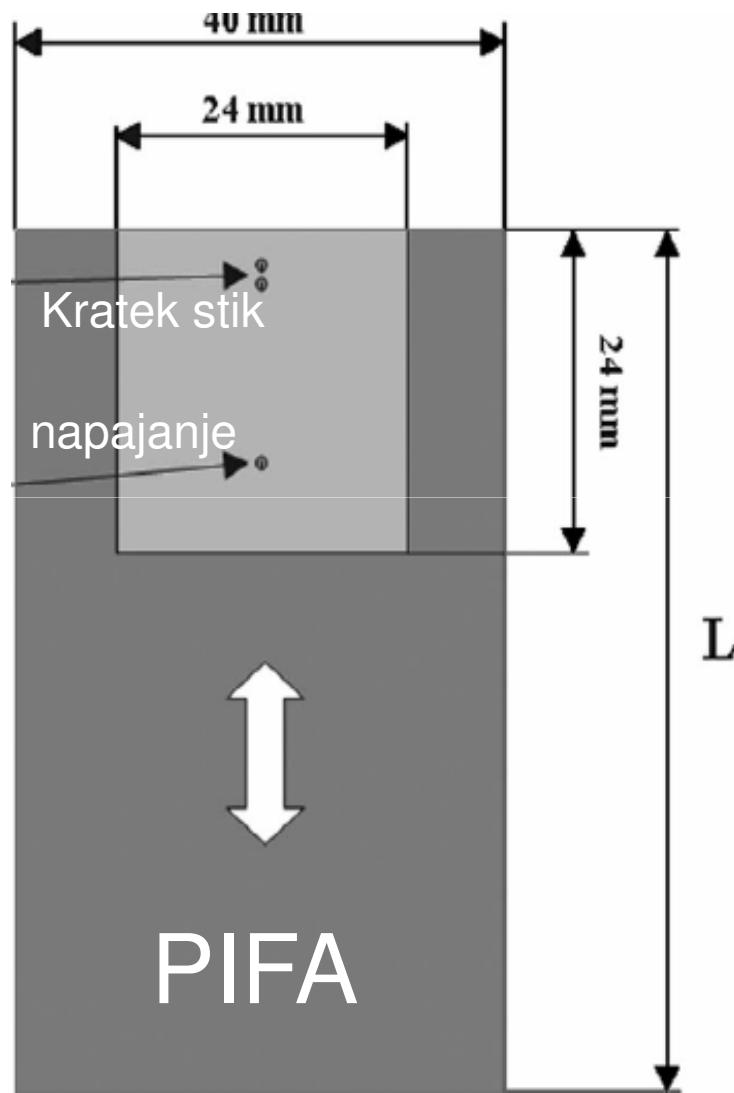
(b) 1930, PIFA

— Prazen prostor
..... Glava

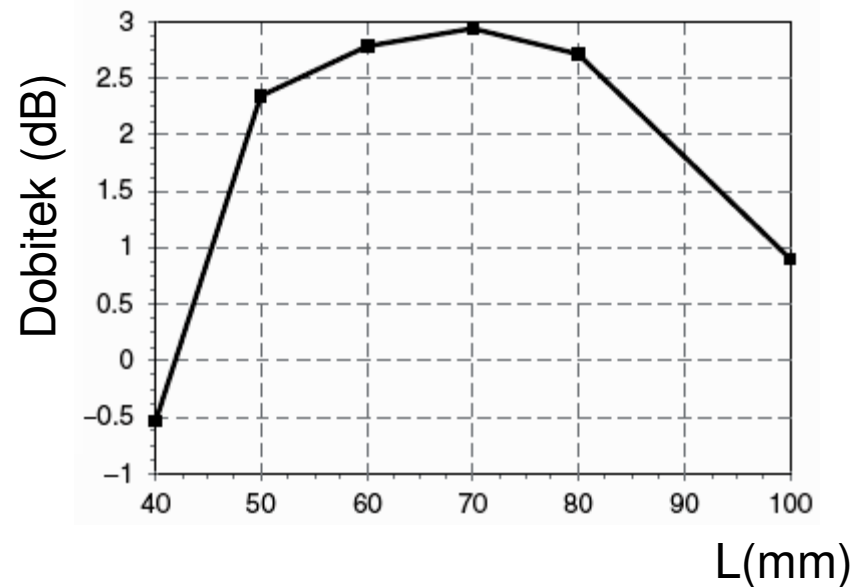
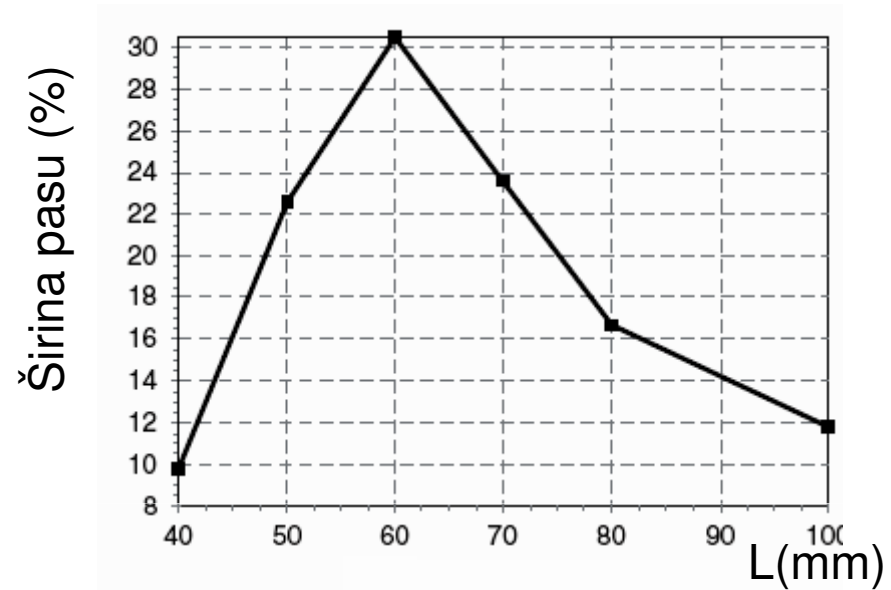


(c) 1575 MHz, IFA

Odvisnost parametrov antene od izmer²⁴

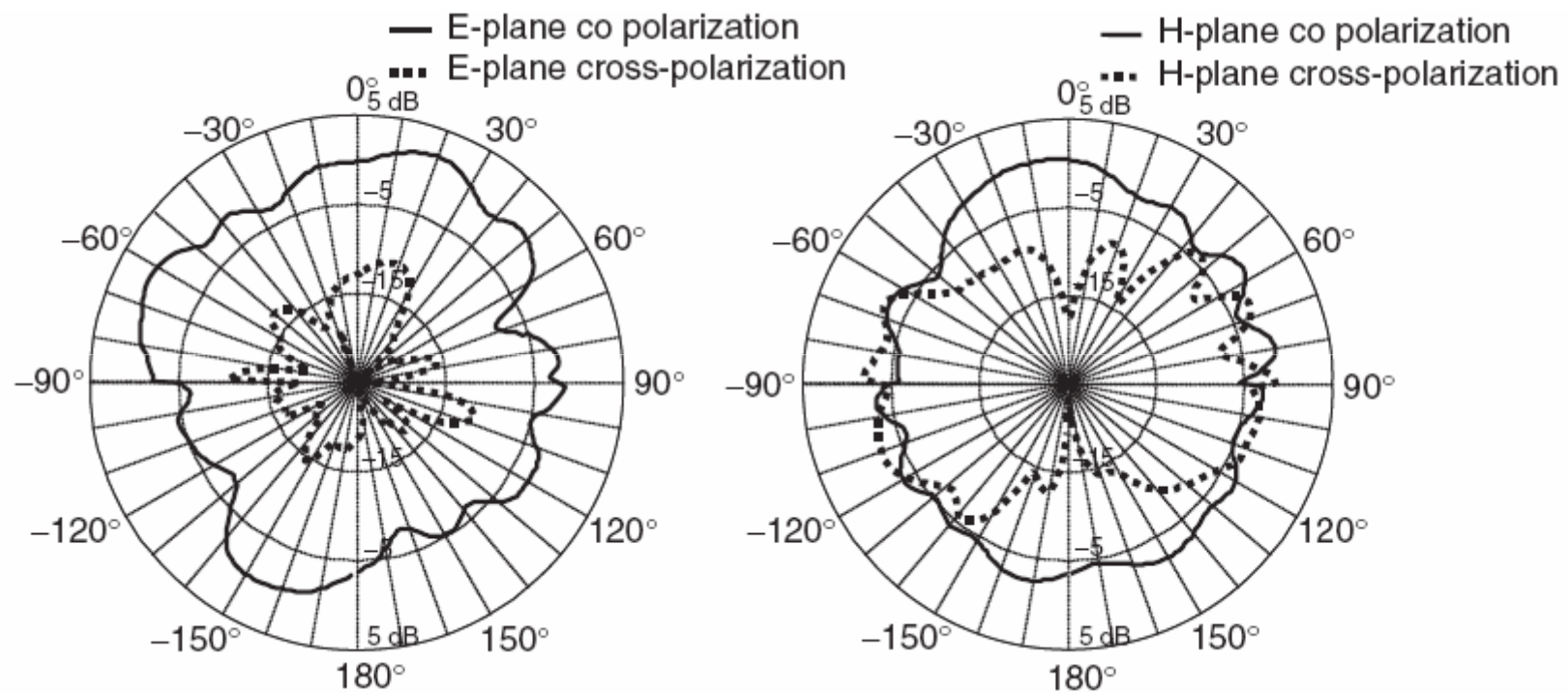


Odvisnost od dolžine plošče L



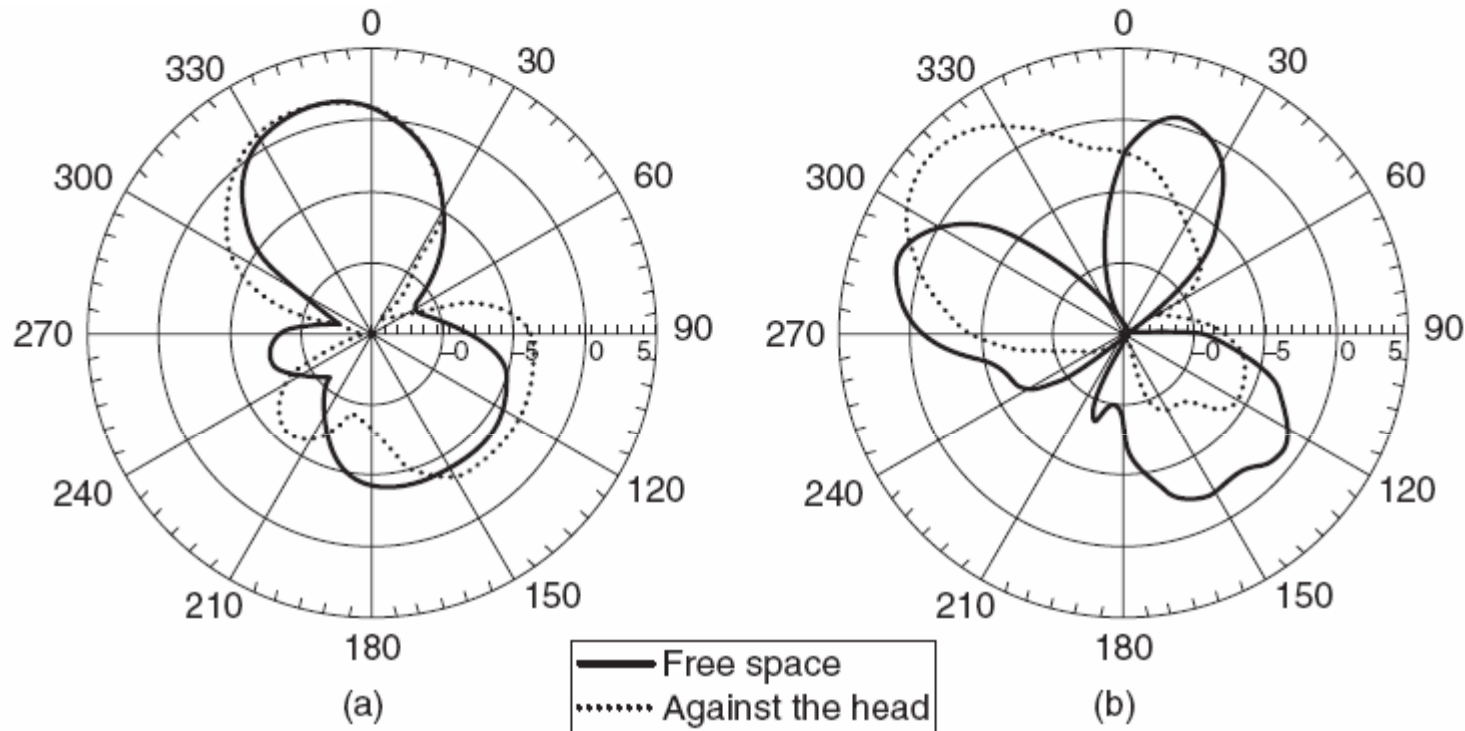
PIFA, smerni diagram

- $L = 60$ mm, $f = 2035$ MHz, merjeni diagrami:



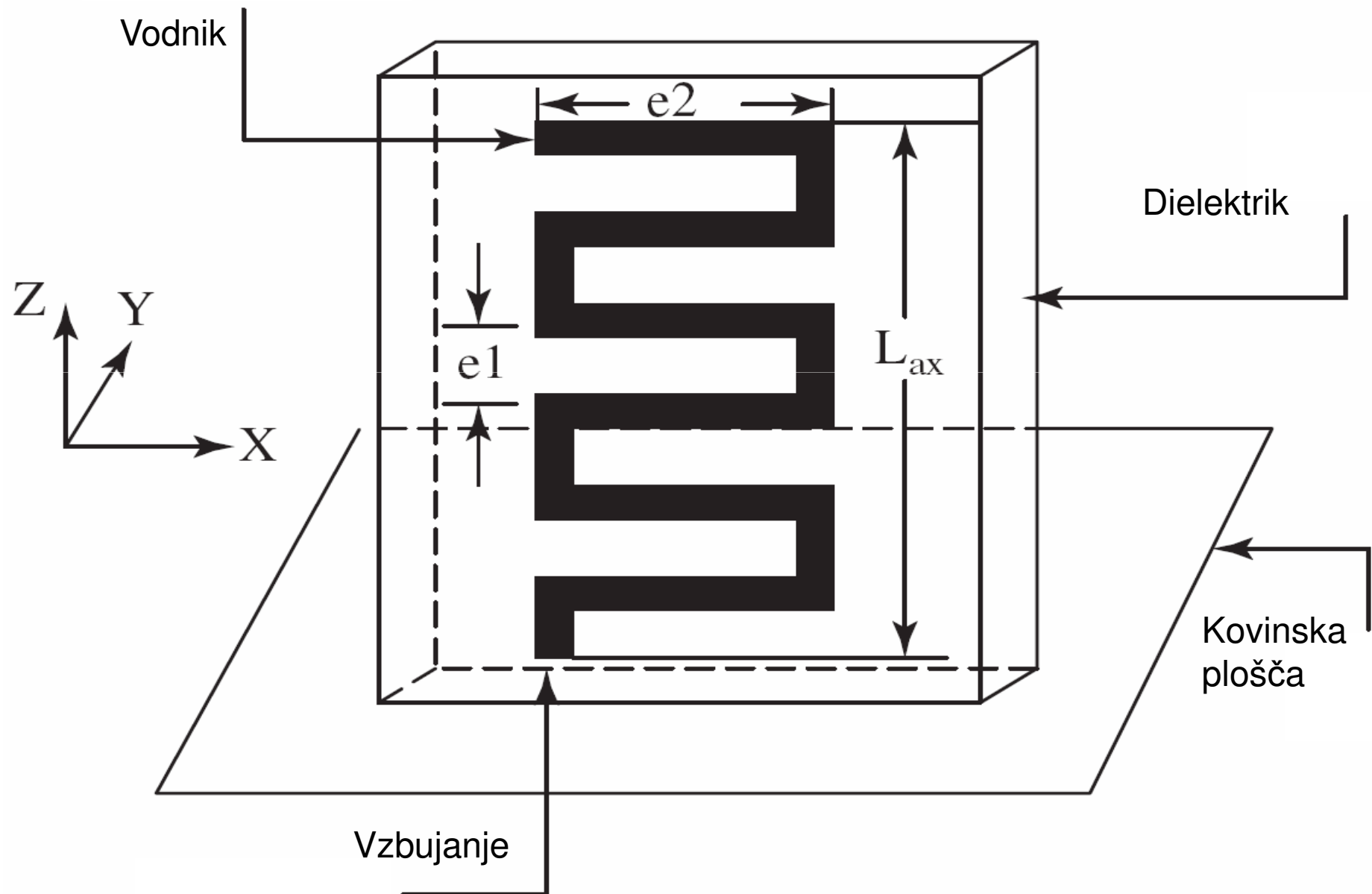
Smerni diagram monopola

26

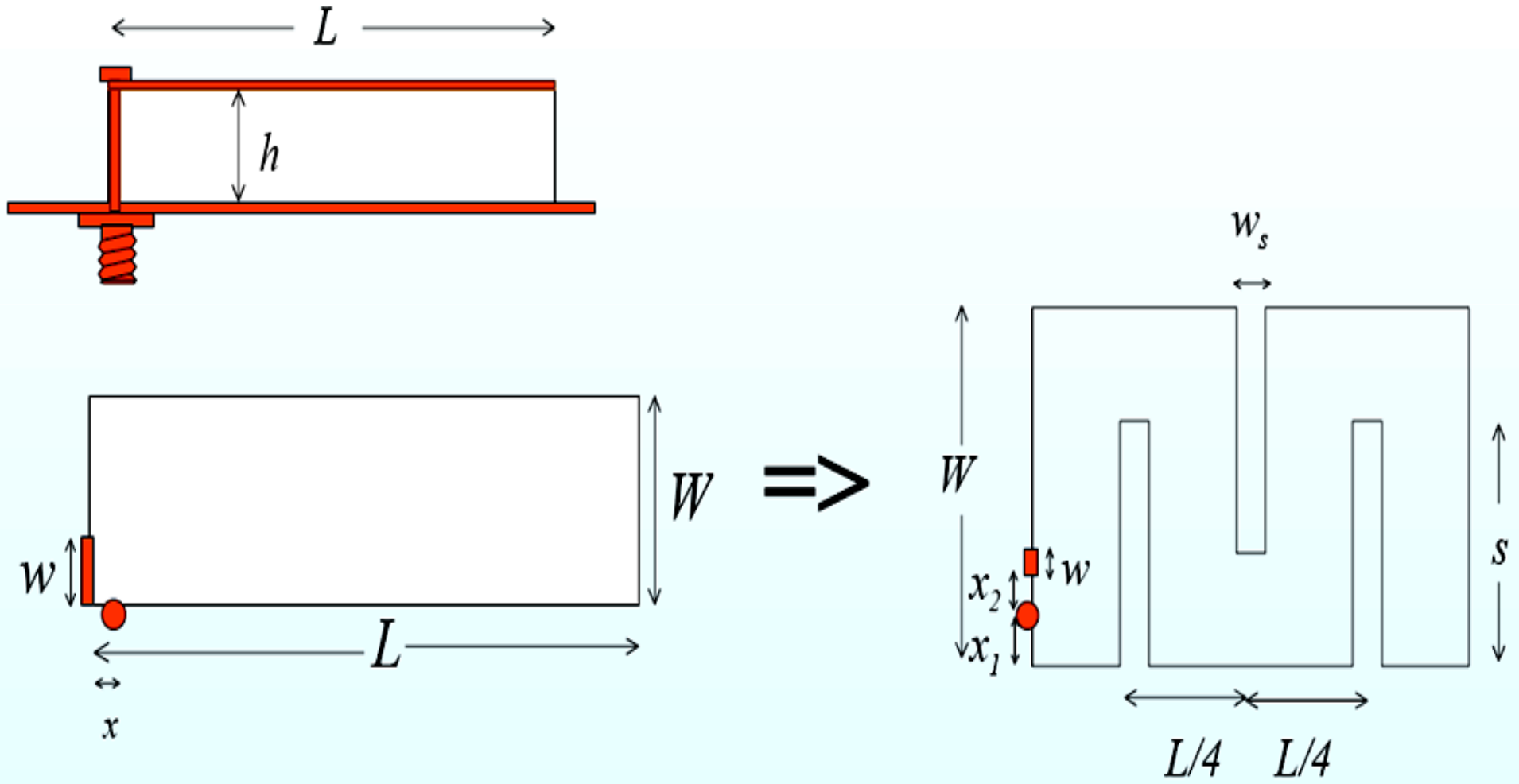


Monopolska antena ima za 3 dB večji dobitek v primerjavi z PIFA. To je njena velika prednost in je tudi razlog, da se še uporablja.

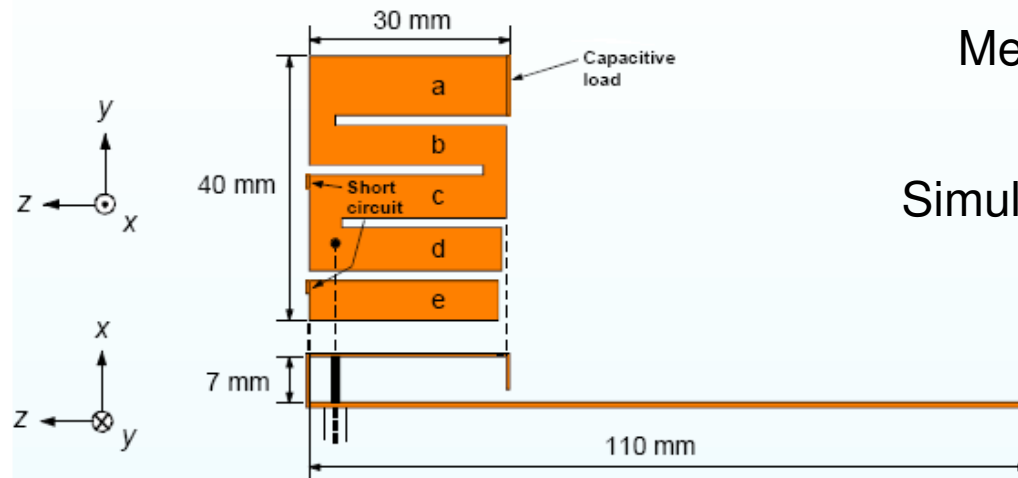
Vijugasta antena - meander



Kombinirana antena PIFA-meander



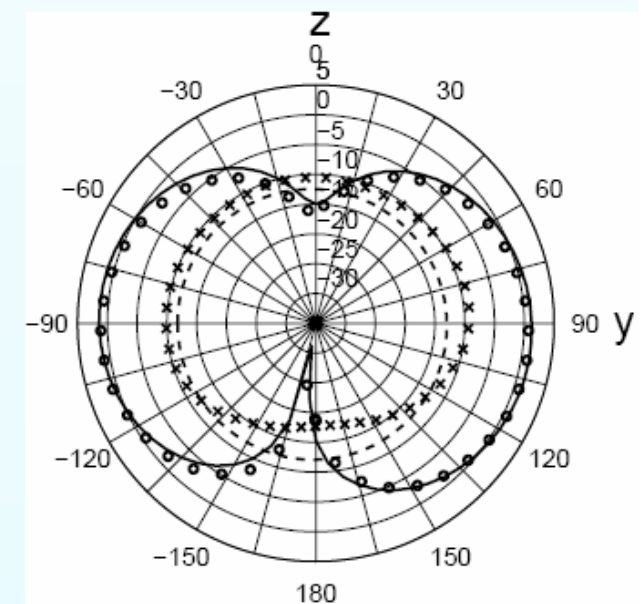
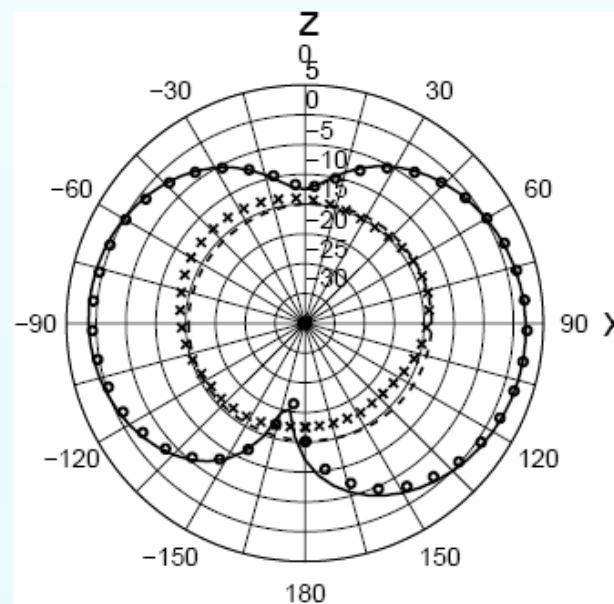
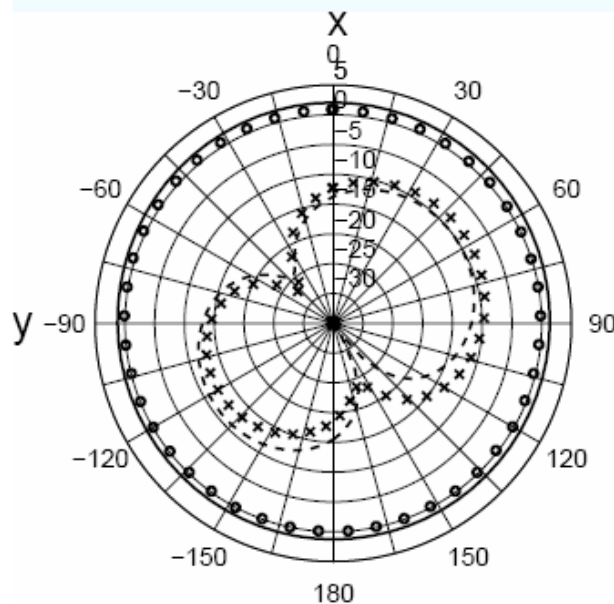
Kombinirana antena PIFA-meander



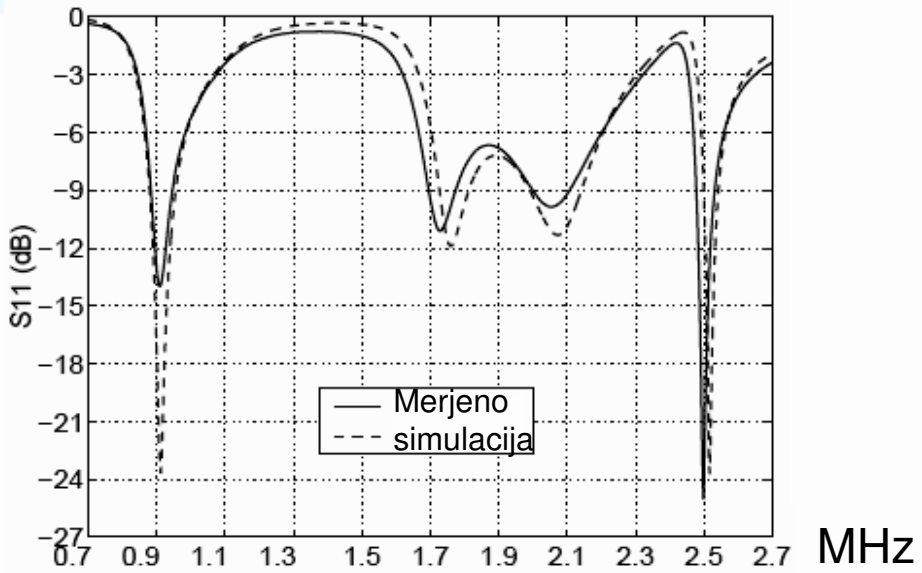
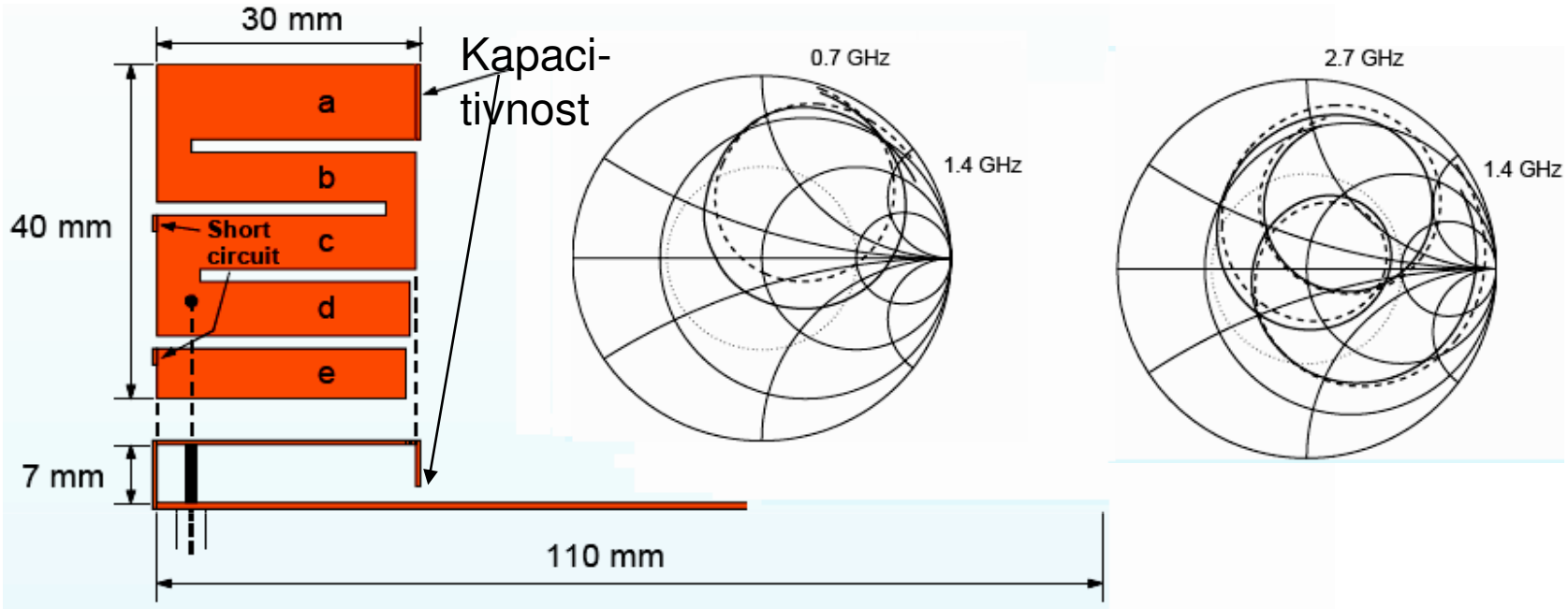
Meritev • $(\circ \circ \circ E_{\theta}, \times \times \times E_{\phi})$

Simulacija • $(\text{—} E_{\theta}, \text{---} E_{\phi})$

• $f = 920 \text{ MHz}$, vrednosti v dB



PIFA-meander, impedanca in odbojnost

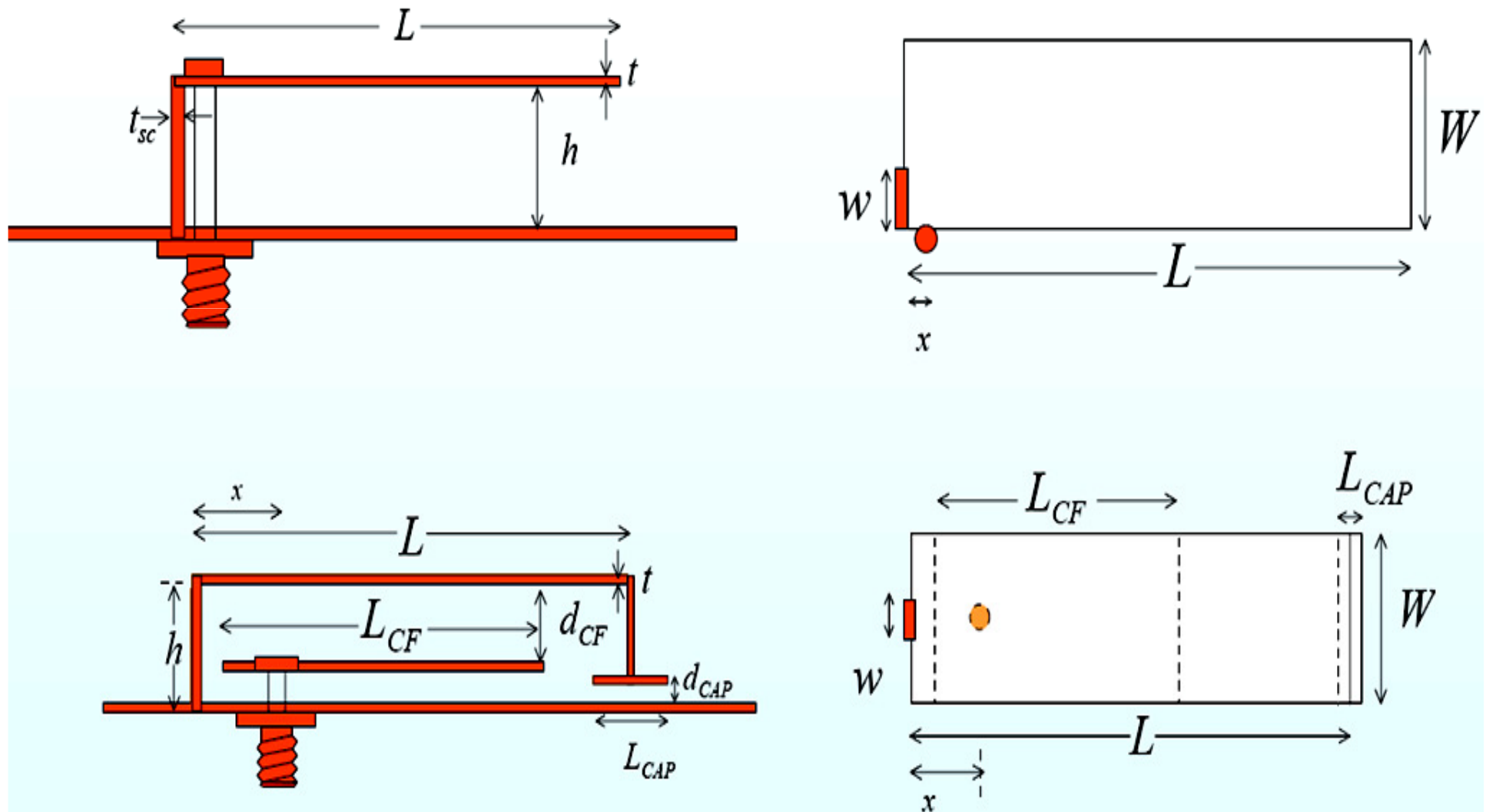


Frekvenčni pasovi:

- GSM 900 (880 – 960 MHz)
- GSM 1800 (1710 – 1880 MHz)
- UMTS (1920 – 2170 MHz)

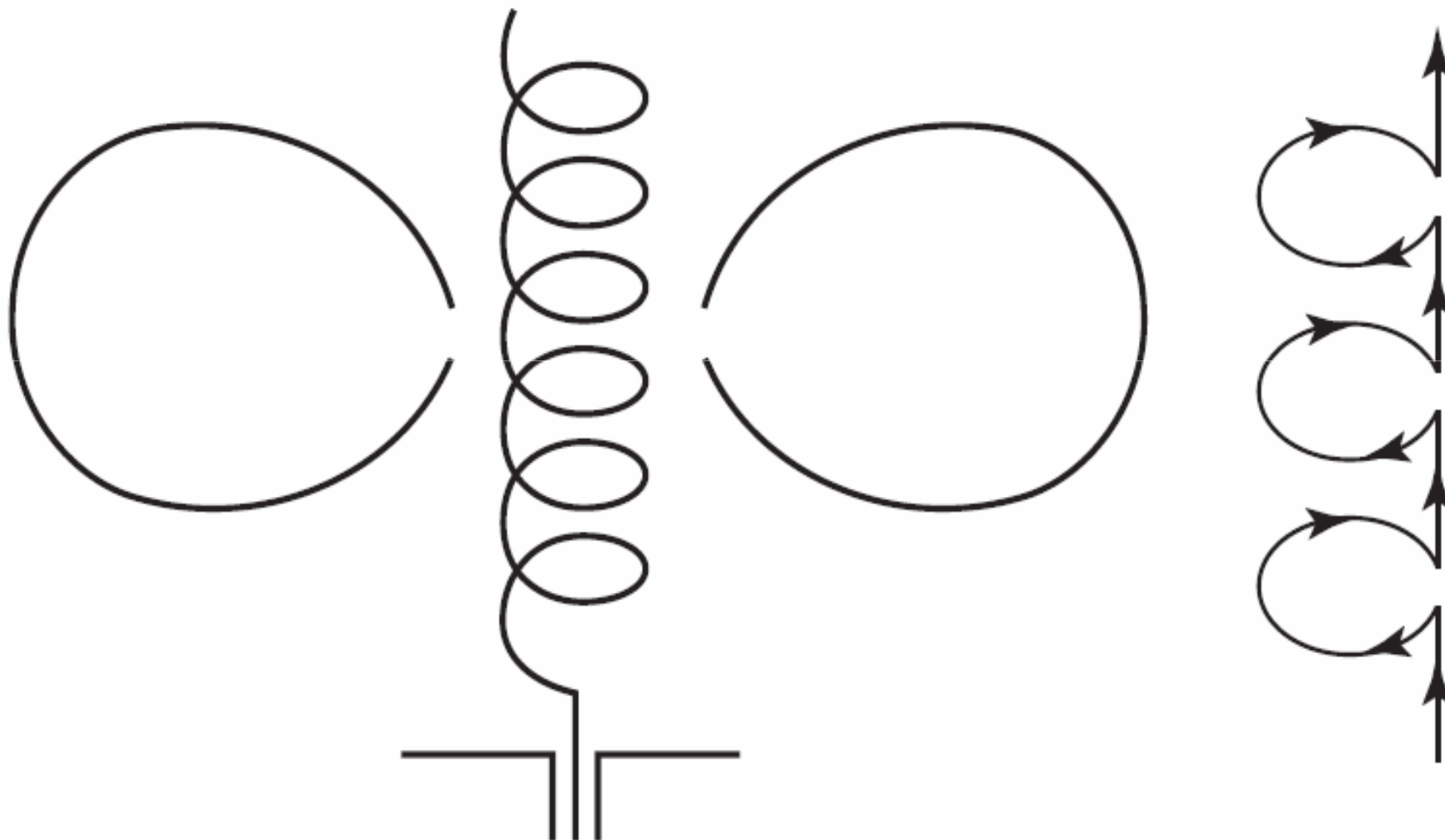
Pri frekvenci 926 MHz:
 Širina frekvenčnega pasu 12,4%
 Izkoristek = 0,95

PIFA – kapacitivni sklop



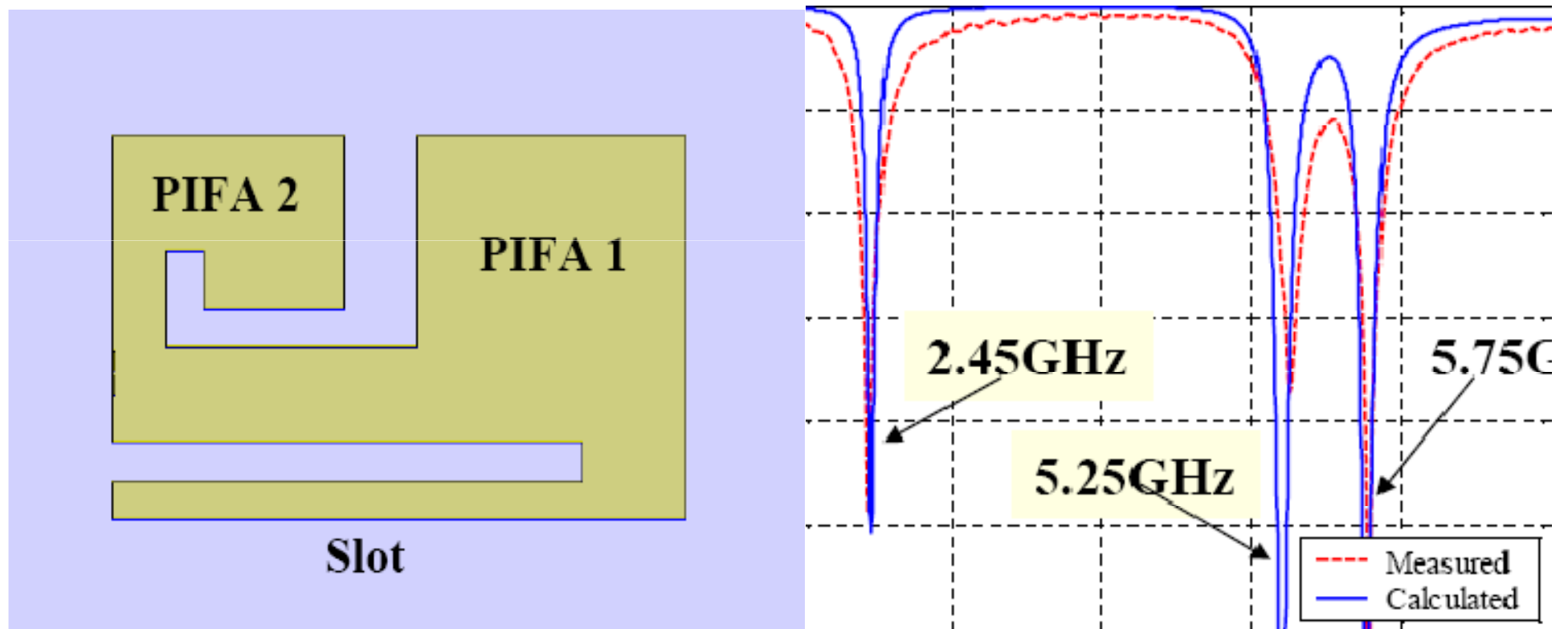
Vijačna antena (heliks)

32

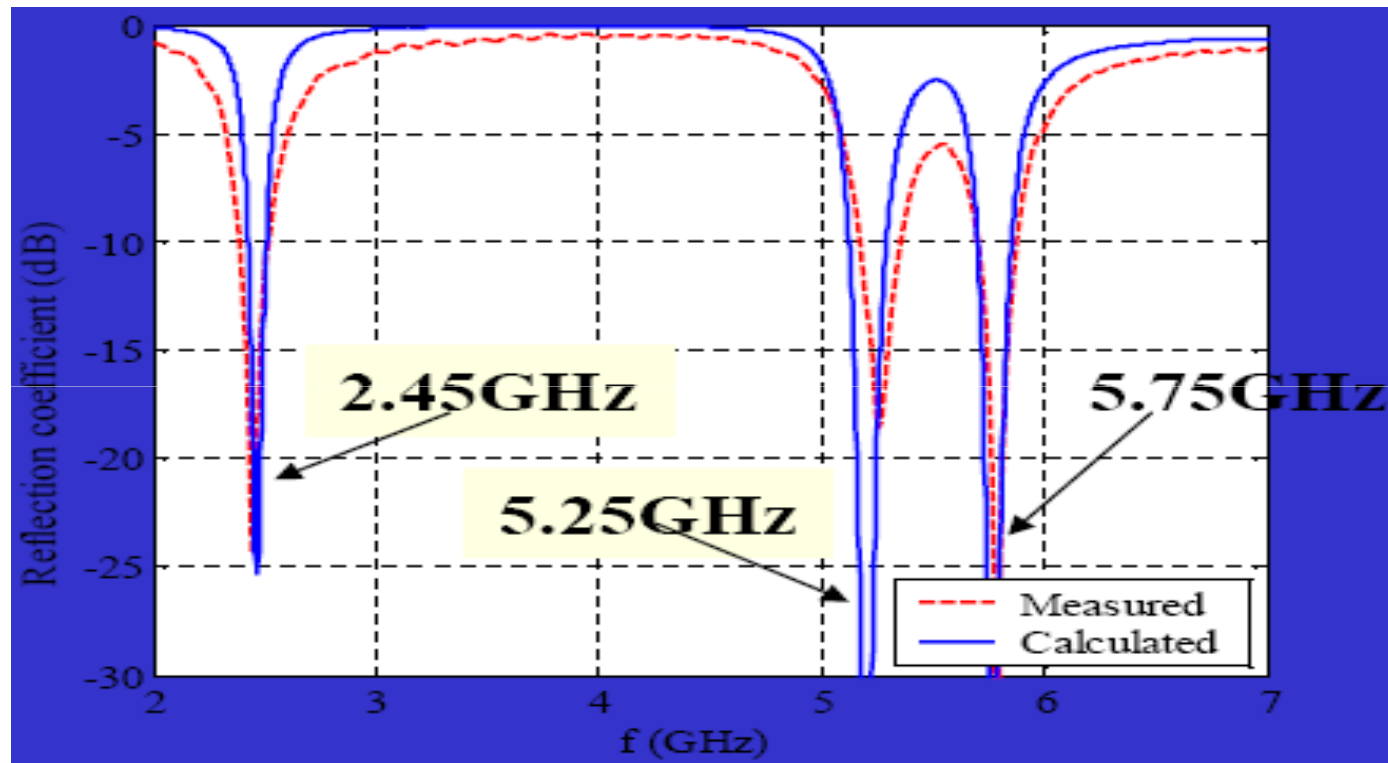


Tri-frekvenčna antena

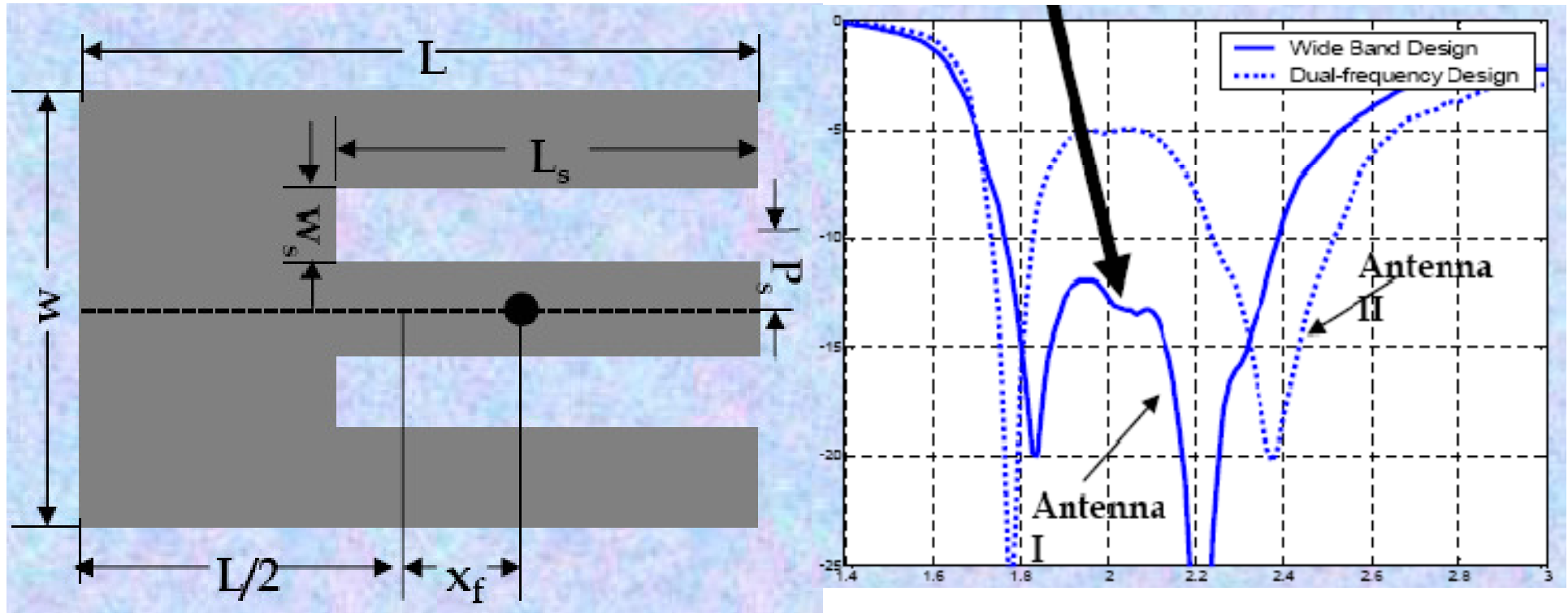
33



Ramat Samii



Krpica E



Sklep

36

- Z oblikovanjem antene ročnega mobilnega telefona lahko dosežemo velike izboljšave.