

**Program: BE EXTC**  
**Curriculum Scheme: Revised 2016**  
**Examination: Final Year Semester VIII**  
**Course Code: ECC801 and Course Name: RF Design**  
**Time: 1 hour**  
**Max Marks:50**

- 1 In composite filter which value of 'm' is selected while connecting the terminating sections in order to acquire proper impedance matching and constant characteristic impedance throughout the passband?
- (a) 0.9
  - (b) 0.3
  - (c) 0.6
  - (d) 0.12
- 2 In 'm' derived T section low pass filter the value of series inductor can be calculated by using the expression
- (a)  $mL/2$
  - (b)  $mL$
  - (c)  $L/2$
  - (d)  $2mL$
- 3 In 'm' derived  $\pi$  section low pass filter the value of shunt capacitor can be calculated by using the expression
- (a)  $C/2$
  - (b)  $2C$
  - (c)  $2mC$
  - (d)  $mC/2$
- 4 In 'm' derived T section high pass filter the value of series capacitors can be calculated by using the expression
- (a)  $2C/m$
  - (b)  $2C$
  - (c)  $mC/2$
  - (d)  $C/m$
- 5 In 'm' derived  $\pi$  section high pass filter the value of shunt inductors can be calculated by using the expression
- (a)  $L/2$
  - (b)  $m/2L$
  - (c)  $2L/m$
  - (d)  $mL/2$
- 6 In a Low pass composite T section filter the bisected terminating sections have the series inductances equal to
- (a)  $mL/2$
  - (b)  $mL$
  - (c)  $L/2$
  - (d)  $L/m$
- 7 The insertion loss for the Chebyshev case is \_\_\_\_\_ greater than the binomial response at any given frequency where  $\omega \gg \omega_c$
- (a)  $(2^N)/4$
  - (b)  $(2^{2N})/4$
  - (c)  $(2N)/4$
  - (d)  $(N^2)/4$
- 8 For the insertion loss method the low-pass to high-pass transformation, after impedance scaling  $L'_k =$  \_\_\_\_\_
- (a)  $1/(R_0 \omega_c C_k)$
  - (b)  $1/(R_0 \omega_c L_k)$
  - (c)  $R_0/(\omega_c C_k)$

- (d)  $R_0/(\omega_c L_k)$
- For a maximally flat low-pass filter prototype with cutoff frequency of 2 GHz, impedance of 50 ohms, and at least 15 dB insertion loss at 3 GHz ( $N=5$ ), beginning with a shunt element, with  $g_1, g_2, g_3, g_4, g_5$  being 0.6180, 1.6180, 2.0000, 1.6180, 0.6180, 1.0000 respectively then  $C'_1 =$  \_\_\_\_\_
- (a) 0.984 pF  
(b) 3.183 pF  
(c) 6.438 pF  
(d) 6.18 pF
- For a maximally flat low-pass filter prototype with cutoff frequency of 2 GHz, impedance of 50 ohms, and at least 15 dB insertion loss at 3 GHz ( $N=5$ ), beginning with a shunt element, with  $g_1, g_2, g_3, g_4, g_5$  being 0.6180, 1.6180, 2.0000, 1.6180, 0.6180, 1.0000 respectively then  $L'_2 =$  \_\_\_\_\_
- (a) 0.984 nH  
(b) 3.183 nH  
(c) 40.45 nH  
(d) 6.438 nH
- The shunt capacitor of the low-pass prototype is converted to series LC circuits for a bandstop filter (without impedance scaling) then  $L'_k$  and  $C'_k$  are given by \_\_\_\_\_, \_\_\_\_\_ respectively.
- (a)  $1/(\omega_c \Delta L_k), \Delta C_k/(\omega_c)$   
(b)  $1/(\omega_c \Delta C_k), \Delta L_k/(\omega_c)$   
(c)  $1/(\omega_0 \Delta C_k), \Delta C_k/(\omega_0)$   
(d)  $1/(\omega_0 \Delta L_k), \Delta L_k/(\omega_0)$
- Using Kuroda's identity, an equivalent circuit of an open circuited shunt stub ( $Z_2$ ) followed by a unit element ( $Z_1$ ) is transformed into \_\_\_\_\_ respectively.
- (a)  $(Z_1)/n^2, (Z_2)/n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(b)  $(Z_2)/n^2, (Z_1)/n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(c)  $(Z_1)*n^2, (Z_2)*n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(d)  $(Z_2)*n^2, (Z_1)*n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]
- Using Kuroda's identity, an equivalent circuit of a short circuited shunt stub ( $Z_1$ ) followed by a unit element ( $Z_2$ ) is transformed into \_\_\_\_\_ respectively.
- (a)  $(Z_1)/n^2, (Z_2)/n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(b)  $(Z_2)/n^2, (Z_1)/n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(c)  $(Z_1)*n^2, 1/((Z_2)*n^2)$  [where  $n^2=1+(Z_2/Z_1)$ ]  
(d)  $(Z_2)*n^2, (Z_1)*n^2$  [where  $n^2=1+(Z_2/Z_1)$ ]
- For a design of a low-pass filter for fabrication using microstrip lines the cutoff frequency is 4 GHz, impedance is 50  $\Omega$ , and a third-order 3 dB equal-ripple passband response. The normalized low-pass prototype element values are  $g_1 = 3.3487 = L_1, g_2 = 0.7117 = C_2, g_3 = 3.3487 = L_3, g_4 = 1.0000 = R_L$ , Applying Kuroda's identity to the series stubs and converting them to shunt stubs at the both ends of the filter we get the value of  $Z_0$  without scaling as
- (a) 4.35  
(b) 1.405  
(c) 1.35  
(d) 1.299
- For a design of a low-pass filter for fabrication using microstrip lines the cutoff frequency is 4 GHz, impedance is 50  $\Omega$ , and a third-order 3 dB equal-ripple passband response. The normalized low-pass prototype element values are  $g_1 = 3.3487 = L_1, g_2 = 0.7117 = C_2, g_3 = 3.3487 = L_3, g_4 = 1.0000 = R_L$ , Applying Kuroda's identity to the series stubs and converting them to shunt stubs at the both ends of the filter we get the value of  $Z_0$  after scaling as
- (a) 64.9  $\Omega$   
(b) 217.5  $\Omega$   
(c) 70.3  $\Omega$   
(d) 50  $\Omega$

- 16 In 2 port amplifier design which gain will remain constant?
- GL
  - Gs
  - Go
  - GT
- 17 For class A amplifier under large signals which small signal S parameter changes ?
- S11
  - S12
  - S21
  - S22
- 18 What does the larger value of  $\mu$  in stability test signify?
- Larger Stability
  - Lesser Stability
  - Larger Instability
  - Smaller Gain
- If a transistor has the following S parameter
- S11 = 0.61  $\angle$  -170
- S12 = 0
- 19 S21 = 2.24  $\angle$  32
- S22 = 0.72  $\angle$  -83
- What is the maximum unilateral gain (GTU max)?
- 12.2 dB
  - 10.2 dB
  - 14.2 dB
  - 15 dB
- If the MESFET has the following S parameters
- S11 = 0.75  $\angle$  -120
- S12 = 0
- 20 S21 = 2.5  $\angle$  80
- S22 = 0.6  $\angle$  -70
- Specified Source gain is 2 dB (1.58) and maximum source gain is 3.6 dB (2.285) find the radius of constant gain circle for source section.
- 0.594
  - 0.494
  - 0.394
  - 0.294
- If the MESFET has the following S parameters
- S11 = 0.75  $\angle$  -120
- S12 = 0
- 21 S21 = 2.5  $\angle$  80
- S22 = 0.6  $\angle$  -70
- Specified Source gain is 2 dB (1.58) and maximum source gain is 3.6 dB (2.285) find the centre of constant gain circle for source section.
- 0.627  $\angle$  -120
  - 0.627  $\angle$  120
  - 0.627  $\angle$  -100
  - 0.627  $\angle$  -100
- If the MESFET has  $\Gamma_S = 0.5 \angle 120$ ,  $\Gamma_L = 0.4 \angle 90$  and the S parameter are given as
- S11 = 0.6  $\angle$  -160
- 22 S12 = 0.045  $\angle$  16
- S21 = 2.5  $\angle$  30
- S22 = 0.5  $\angle$  -90 what is the value of  $\Gamma_{in}$  ?
- 0.627  $\angle$  164.6
  - 0.627  $\angle$  -164.6
  - 0.471  $\angle$  -97.63
  - 0.471  $\angle$  97.63

If the MESFET has  $\Gamma_S = 0.5 \angle 120^\circ$ ,  $\Gamma_L = 0.4 \angle 90^\circ$  and the S parameters are given as

$$S_{11} = 0.6 \angle -160^\circ$$

23  $S_{12} = 0.045 \angle 16^\circ$

$$S_{21} = 2.5 \angle 30^\circ$$

$$S_{22} = 0.5 \angle -90^\circ \text{ what is the value of } \Gamma_{OUT} ?$$

(a)  $0.627 \angle 164.6^\circ$

(b)  $0.627 \angle -164.6^\circ$

(c)  $0.471 \angle -97.63^\circ$

(d)  $0.471 \angle 97.63^\circ$

If the S parameters of a GaAs FET is given as

$$S_{11} = 0.894 \angle -60.6^\circ$$

24  $S_{12} = 0.02 \angle 62.4^\circ$

$$S_{21} = 3.122 \angle 123^\circ$$

$$S_{22} = 0.78 \angle -27.6^\circ$$

$\Delta = 0.696 \angle -83^\circ$  find the radius of output stability circle

(a) 0.6

(b) 0.5

(c) 0.4

(d) 0.3

If the S parameters of a GaAs FET is given as

$$S_{11} = 0.894 \angle -60.6^\circ$$

25  $S_{12} = 0.02 \angle 62.4^\circ$

$$S_{21} = 3.122 \angle 123^\circ$$

$$S_{22} = 0.78 \angle -27.6^\circ$$

$\Delta = 0.696 \angle -83^\circ$  find the center of source stability circle

(a)  $0.13 \angle 68.5^\circ$

(b)  $1.13 \angle -68.5^\circ$

(c)  $1.13 \angle 68.5^\circ$

(d)  $0.13 \angle -68.5^\circ$

If the S parameters of a GaAs FET is given as

$$S_{11} = 0.894 \angle -60.6^\circ$$

26  $S_{12} = 0.02 \angle 62.4^\circ$

$$S_{21} = 3.122 \angle 123^\circ$$

$$S_{22} = 0.78 \angle -27.6^\circ$$

$\Delta = 0.696 \angle -83^\circ$  find the value of  $\mu$

(a) 0.66

(b) 1.56

(c) 1

(d) 0.86

If the S parameters of a GaAs FET is given as

$$S_{11} = 0.62 \angle 140^\circ$$

$$S_{12} = 0.06 \angle -10^\circ$$

27  $S_{21} = 2.58 \angle 20^\circ$

$$S_{22} = 0.53 \angle -120^\circ$$

$$K = 1.18$$

Find Maximum Transducer Gain ( $G_T \max$ )

(a) 10.76 dB

(b) 15.76 dB

(c) 13.76 dB

(d) 18.76 dB

If the S parameters of a BJT is given as

$$S_{11} = 0.73 \angle 175^\circ$$

28  $S_{12} = 0$

$$S_{21} = 4.45 \angle 65^\circ$$

$$S_{22} = 0.22 \angle -80^\circ$$

Find Maximum Unilateral Transducer Gain ( $G_{TU \max}$ )

- (a) 16.4 dB
- (b) 15.4 dB
- (c) 12.5 dB
- (d) 20 dB

If the S parameter of a transistor is given as

$$S_{11} = 0.45 \angle -65^\circ$$

29  $S_{12} = 0.01 \angle 5^\circ$

$$S_{21} = 2.2 \angle 86^\circ$$

$$S_{22} = 0.48 \angle -65^\circ$$

Find Unilateral Figure of Merit (U)

- (a)  $7.742 \times 10^{-3}$
- (b)  $7.742 \times 10^3$
- (c) 0.5
- (d) -0.5

If the S parameter of a transistor is given as

$$S_{11} = 0.45 \angle -65^\circ$$

30  $S_{12} = 0.01 \angle 5^\circ$

$$S_{21} = 2.2 \angle 86^\circ$$

$$S_{22} = 0.48 \angle -65^\circ$$

Comment on stability

- (a) Unconditionally Stable
- (b) Potentially unstable
- (c) Conditionally stable
- (d) Unstable

31 Practical mixers in range of 1-10 GHz usually have a conversion loss between

- (a) 0dB and 2dB
- (b) 3dB and 5dB
- (c) 1dB and 3dB
- (d) 4dB and 7dB

32 Poor RF SWR is obtained in

- (a) image rejection mixer
- (b) balanced (180 degree) mixer
- (c) double balanced mixer
- (d) balanced (90 degree) mixer

33 In a transistor amplifier, if the input impedance is given as  $(-57-j1.4)$  ohms, then the terminating impedance(in ohms) required to create enough instability is:

- (a)  $(-57-j1.4)$
- (b)  $19+j1.4$
- (c)  $(-2.5-j1.4)$
- (d)  $57+j1.4$

34 If the input impedance of a diode used in the microwave oscillator is  $(65-j28)$  ohms, then the load impedance (in ohms) to achieve stable oscillation is:

- (a)  $65-j28$
- (b)  $(-65-j28)$
- (c)  $65+j28$
- (d)  $(-65+j28)$

35 If the equivalent impedance of the resonator at resonance is 14.5 ohms and the characteristic impedance of the feed line is 50 ohms, then the coupling coefficient is:

- (a) 1
- (b) 0.5
- (c) 0.75
- (d) 0.29

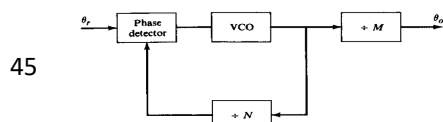
36 If the reflection coefficient between the feed line and the resonator is -0.2, then the equivalent impedance of the resonator at resonance given that the characteristic impedance of the microstrip line is 50 ohms is:

- (a) 50 ohms
- (b) 33.33 ohms

- (c) 75 ohms  
(d) 10 ohms
- 37 The number of diodes used in a double balanced mixer are  
(a) 2  
(b) 8  
(c) 6  
(d) 4
- 38 The conversion characteristics of which mixer are excellent  
(a) Balanced (180 degree) mixer  
(b) double balanced mixer  
(c) single ended mixer  
(d) image rejection mixer
- 39 A one port oscillator uses a negative resistance diode having input reflection coefficient 1.25  $\angle 40^\circ$  and  $Z_0 = 50$  ohms, then the input impedance in ohms will be  
(a)  $40.1 + j100$   
(b)  $(-48 - j100)$   
(c)  $(-39 + j122)$   
(d)  $(-43.4 + j124.1)$
- 40 A one port oscillator uses a negative resistance diode having input reflection coefficient as 1.25  $\angle 40^\circ$  and  $Z_0 = 50$  ohms, then the load impedance in ohms will be  
(a)  $30.1 + j100$   
(b)  $(-38 - j100)$   
(c)  $(-39 + j122)$   
(d)  $43.4 - j124.1$
- 41 The IS-54 digital cellular telephone system uses a receive frequency band of 869-894 MHz, with a first IF frequency range of 87 MHz, one possible range of local oscillator frequency is:  
(a) 750 to 784 MHz  
(b) 869 to 894 MHz  
(c) 650 to 800MHz  
(d) 782 to 807MHz

- In Indirect Frequency synthesizer the loop bandwidth should be \_\_\_\_\_ the reference frequency in order to minimize the effect of  $\phi_{ND}$ , which is dominated by spurious frequency components at the reference frequency and its harmonics. ( $\phi_{ND}$  is the noise created in phase detector)
- 42  
(a) Equal to  
(b) Greater than  
(c) Less than  
(d) Almost equal to

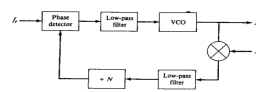
- 43 The diagram indicates \_\_\_\_\_  
(a) Harmonic Generator based Direct Frequency Synthesizer  
(b) A Double Mix Divide Module  
(c) Indirect Frequency synthesizer  
(d) Variable modulus dividers
- 44 In Variable Modulus divider the block ' $\div P$ ' is  
(a) Programmable Divider  
(b) Prescalar  
(c) Non-programmable Divider  
(d) Postscalar



- Frequency synthesizer with a postdivider for  
(a) Frequency synthesis  
(b) Decreased frequency resolution  
(c) Increased frequency resolution  
(d) No frequency resolution
- 46 In a programmable divider realized with dual modulus prescalar, for the method to work

- (a)  $N > A$   
 (b)  $N < A$   
 (c)  $N = A$   
 (d) The values of  $N$  and  $A$  are not important  
 In a PLL frequency synthesizer with down conversion, the Low pass filter following the mixer is used to filter(eliminate)

47



- (a)  $f_o$   
 (b)  $f_L$   
 (c)  $f_o + f_L$   
 (d)  $f_o - f_L$

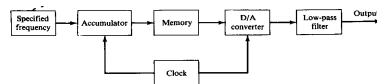
48

Determine frequency resolution of DDFS system with 32 bit accumulator and 10 MHz clock.

- (a) 2.33 mHz  
 (b) 2.33 kHz  
 (c) 2.33 Hz  
 (d) 2.33 MHz

49 What word length will be required in a DDFS if the output if the output spectral purity is to be at least 80 dB?

- (a) 13 bit  
 (b) 14 bit  
 (c) 15 bit  
 (d) -14bit



50

The diagtam represents

- (a) Direct Digital Frequency Synthesizer  
 (b) Indirect frequency synthesizer  
 (c) Harmonic generator based frequency synthesizer  
 (d) PLL based frequency synthesizer

51 The missing block in Direcr digital frequency synthesizer is

- (a) Comparator  
 (b) Mixer  
 (c) Oscillator  
 (d) Accumulator

52 In the following design of DDFS to cover the frequency range 0 to 10 kHz with a frequency resolution of at least 0.001 Hz, the spectral purity is to be at least 40 dB, the size of accumulator should be

- (a) 26 bit  
 (b) 24 bit  
 (c) 13 bit  
 (d) 12 bit

53 \_\_\_\_\_ are well suited for use as harmonic generators

- (a) Unipolar transistors  
 (b) Thyristors  
 (c) Diodes  
 (d) Bipolar transistors

54 The filter requirements can be reduced by using

- (a) An Offset frequency  
 (b) Doubled frequency  
 (c) Cut off frequency  
 (d) Critical frequency

55

If the two mixer input frequencies are 96MHz and 4MHz, the mixer output frequencies will be

- (a) 104MHz and 88MHz  
 (b) 100MHz and 92MHz

- (c) 24MHz and 12MHz
  - (d) 12MHz and 8MHz
- 56 If we design an indirect frequency synthesizer to generate 20 MHz frequency from 2 MHz reference oscillator then
- (a)  $N = 10$
  - (b)  $N = 0.1$
  - (c)  $N = 1$
  - (d)  $N$  is not defined
- 57 In US, EMI guidelines for commercial equipment are handled by
- (a) Federal Communication Commission
  - (b) National Telecommunications Regulatory Authority
  - (c) Information and Communications Technology Authority
  - (d) Telecommunications Regulatory Commission
- 58 Arcing is Electromagnetic Noise generation in electronic appliances during making and breaking of contact is due to
- (a) Drift Current
  - (b) Transient Current
  - (c) Diffusion Current
  - (d) Displacement Current
- 59 In Amplifier, Harmonic emission level
- (a) increases with decrease in Harmonic number.
  - (b) decreases with increase in Harmonic number.
  - (c) increases with increase in Harmonic number.
  - (d) decreases with decrease in Harmonic number.
- 60 Common mode currents are
- (a) Equal in magnitude & have same direction
  - (b) Equal in magnitude & have opposite direction
  - (c) Unequal in magnitude & have same direction
  - (d) Unequal in magnitude & have opposite direction
- 61 Differential mode currents are
- (a) Equal in magnitude & have same direction
  - (b) Equal in magnitude & have opposite direction
  - (c) Unequal in magnitude & have same direction
  - (d) Unequal in magnitude & have opposite direction
- 62 The natural source of EMI is
- (a) Automobile ignition
  - (b) Electrostatic discharge
  - (c) Digital circuits
  - (d) Microwave oven
- 63 The duration of each transient pulse (time duration for which the instantaneous intensity is at least 50 percent of the peak value) is typically,
- (a) 5 ns.
  - (b) 500 ns.
  - (c) 50 ns.
  - (d) 100 ns.
- 64 Grounding is a technique that provides a \_\_\_\_\_ between electrical or electronic equipment and the earth or common reference low-impedance plane
- (a) moderate-resistance path
  - (b) high-resistance path
  - (c) low-resistance path
  - (d) long-resistance path
- 65 Grounding is very much essential in
- (a) EMI
  - (b) EMC
  - (c) Shielding
  - (d) Filtering
- 66 In a communication circuit receptor is protected from
- (a) EMC

- (b) EMI
  - (c) Heavy loading
  - (d) Impedance matching
- 67 Following is an example of EMC
- (a) Impedance matching
  - (b) Circuit breaker
  - (c) Phase shifter
  - (d) Filter
- 68 If the distance between the septum and the bottom plate of the TEM cell is 10 cm, the measured RF voltage is 50 volts, then the field strength in V/m is
- (a) 5
  - (b) 50
  - (c) 500
  - (d) 5000
- 69 In EMC, the narrowband tests deal with
- (a) Transients
  - (b) continuous wave mode emissions
  - (c) electrical surges
  - (d) High resistance circuits only
- 70 In EMC, broadband tests involve
- (a) DC signal
  - (b) continuous wave mode emissions
  - (c) High resistance circuits only
  - (d) Transients
- 71 A system is electromagnetically compatible with its environment if it satisfies some specific criteria. Which of the following are NOT the required criteria for the same.
- (a) It does not cause interference with itself.
  - (b) It does not cause interference with other systems.
  - (c) It is not susceptible to emissions from other systems.
  - (d) It should be electromagnetically coupled with other circuit components
- 72 Which of the following is TRUE in order to prevent interference?
- (a) Make the receptor more susceptible to the emission.
  - (b) Suppress the emission at its source.
  - (c) Make the coupling path as efficient as possible.
  - (d) Allow the radiations couple with each other.
- 73 Which of the following is a FALSE statement with respect to electromagnetic coupling (EMC) phenomenon?
- (a) Emissions of and susceptibility to electromagnetic energy occur not only by electromagnetic waves propagating through air but also by direct conduction on metallic conductors.
  - (b) Undesired signals may be radiated or picked up by the ac power cord, interconnection cables, metallic cabinets, or internal circuitry of the subsystems.
  - (c) Coupling path of direct conduction due to metallic conductors is inherently less efficient than
  - (d) External signals induced on circuit components may cause interference in the circuits.
- 74 Electric and magnetic field coupling come under which type of coupling phenomenon?
- (a) Conduction coupling
  - (b) Radiation coupling
  - (c) Impedance coupling
  - (d) Combination of radiation and conduction coupling
- 75 Which statement is TRUE with respect to multi-point grounding system?
- (a) Every equipment is heavily bonded to a solid ground conducting plane.
  - (b) System has one ground
  - (c) Each equipment has floating ground
  - (d) Every equipment has independent ground.
- 76 What is NOT the aim of EMC standards?
- (a) To set reasonable and rational limits for electromagnetic emission levels
  - (b) To set limit for immunity levels for equipments.
  - (c) To define test procedures for approximate measurements at high power levels.

- (d) To carefully define the test procedures and instrumentation used.
- 77 What does MIL-STD 461 stands for?
  - (a) Millimeter standard 461
  - (b) Military standard 461
  - (c) Milivolt standard 461
  - (d) Milimeter strand 461
- 78 Limit of radiated emission under MIL-STD 461D for RE 101 is?
  - (a) 30 Hz- 100 kHz
  - (b) 3 H-100kHz
  - (c) 30 Hz- 10 kHz
  - (d) 3 Hz- 10 kHz
- 79 What does the International Telecommunications Union (ITU) define?
  - (a) The signal modulation technique required for proper transmission.
  - (b) Use of each frequency band for radio receivers.
  - (c) Transmitter and receiver design characteristics.
  - (d) System's bandwidth requirement.
- 80 To improve measurements in case of electromagnetically susceptible circuit, which of the following can be implemented?
  - (a) The cables between the transmit/receive antenna are placed in underground trenches.
  - (b) The cables between the transmit/receive antenna are placed in the open environment.
  - (c) Transmitter and receiver antennas are placed in the shields.
  - (d) The circuit components are allowed to couple electromagnetically.