

3. tiha vaja iz VISOKOFREKVENČNE TEHNIKE - 2.12.2016

1. Toplotni merilnik visokofrekvenčne moči zahteva umerjanje ničle termočlena pred veljavno meritvijo moči. Merilnik pomotoma umerjamo, ko je prisotna VF moč $P_0=100\mu\text{W}$. Kolikšno moč $P'=?$ pokaže napačno umerjeni merilnik, ko na vhod pripeljemo $P=300\mu\text{W}$?

- (A) $100\mu\text{W}$ (B) $200\mu\text{W}$ (C) $300\mu\text{W}$ (D) $400\mu\text{W}$

2. Kolikšno šumno temperaturo $T_s=?$ lahko doseže nizkošumni ojačevalnik z GaAlAs/GaAs HEMT-om pri frekvenci $f=3\text{GHz}$? Celotno vezje ojačevalnika hladimo s tekočim dušikom na $T_{LN2}=77\text{K}$ in poskrbimo za prilagoditev impedanc za najnižji šum.

- (A) 1000K (B) 100K (C) 10K (D) 1K

3. Čip silicijeve diode je vgrajen v Mini-MELF SMD ohišje. Na ohišju je en sam barvni obroček. Pomen barvnega obročka je naslednji:

- (A) anodni priključek (B) prebojna napetost (C) toleranca kapacitivnosti (D) katodni priključek

4. Moč širokopasovnega toplotnega šuma P_N merimo s spektralnim analizatorjem pri ločljivosti $B=1\text{MHz}$ in video situ $B_V=1\text{kHz}$. Katero video sito $B_V'=?$ potrebujemo, da opletanje rezultata ΔP_N zmanjšamo za faktor 10-krat?

- (A) 10Hz (B) 100Hz (C) 300Hz (D) 10kHz

5. Satelitski sprejemnik z visokim ojačanjem $G_s \gg 1$ je priključen na šumno glavo z $\text{ENR}=5\text{dB}$ in hladno temperaturo $T_1=T_0=290\text{K}$ enako sobni temperaturi. Izmerjeno razmerje vroče hladno znaša $\gamma=4\text{dB}$. Kolikšna je šumna temperatura sprejemnika $T_s=?$

- (A) 75K (B) 125K (C) 189K (D) 290K

6. DVB-T oddajnik uporablja QPSK-OFDM z $N=1705$ podnosilci. Kolikšna je teoretska vršna moč oddajnika $P_{\text{MAX}}=?$, če od oddajnika zahtevamo, da proizvaja povprečno visokofrekvenčno izhodno moč $\langle P \rangle = 400\text{W}$?

- (A) 235mW (B) 400W (C) 16.5kW (D) 682kW

7. Naš oddajnik $f_{\text{TX}}=168\text{MHz}$ moti naš sprejemnik $f_{\text{RX}}=158\text{MHz}$ samo takrat, ko sta oba povezana preko frekvenčne kretnice na skupno anteno na stolpu. Kateri dodatni oddajniki so potrebni, če sumimo PIM (pasivno intermodulacijsko popačenje) na antenskem stolpu?

- (A) 89MHz in 99MHz (B) samo 99MHz (C) 99MHz in 148MHz (D) samo 148MHz

8. Izhodna stopnja WiFi OFDM oddajnika dosega izkoristek $\eta=3\%$ pri povprečni izhodni moči $\langle P \rangle = 200\text{mW}$. Kolikšna je pričakovana moč 1dB nasičenja $P_{1\text{dB}}=?$, če močnostni ojačevalnik deluje v razredu A?

- (A) +13dBm (B) +23dBm (C) +33dBm (D) +43dBm

9. Dvostopenjski ojačevalnik vsebuje tri enake gradnike $G_e=10\text{dB}$ in $P_{\text{IP3e}}=100\text{W}$. v krmilni stopnji uporabimo en gradnik, v izhodni stopnji pa vzporedno vezavo dveh gradnikov. Kolikšna je $P_{\text{IP3}}=?$ verige, če prilagoditev impedanc ne vnaša izgub?

- (A) 100W (B) 167W (C) 200W (D) 333W

10. Močnostni ojačevalnik v vezavi Doherty vsebuje dva podobna ojačevalnika in dva četrt-valovna zakasnilna voda na vходу in izhodu. Ojačevalnika se razlikujeta v nastavitvi delovnih točk, kjer vezava Doherty zahteva razreda:

- (A) A in B (B) B in dualni B (C) B in C (D) A in C

11. Mikrovalovni izolator vsebuje cirkulator, ki ima tretji priključek zaključen na prilagojeno breme. Idealni mikrovalovni izolator ima naslednje S parametre:

- (A) $|S_{12}|=|S_{21}|=1$ in $S_{21}=S_{22}=0$ (B) $|S_{11}|=|S_{22}|=1$ in $S_{12}=S_{21}=0$ (B) $|S_{11}|=1$ in $S_{12}=S_{21}=S_{22}=0$ (B) $|S_{21}|=1$ in $S_{11}=S_{12}=S_{22}=0$

12. Frekvenčno pasovno-prepustno sito izdelamo z votlinskim rezonatorjem, ki v vezju sita doseže obremenjeni $Q_L=300$ pri frekvenci $f=2\text{GHz}$. Kolikšna je največja skupinska zakasnitev $t_g=?$ takšnega pasovnega sita?

- (A) 48ns (B) 24ns (C) 12ns (D) 6ns

Priimek in ime:

Elektronski naslov:

1. A thermal RF power meter requires zero calibration of its thermocouple for any measurement to be valid. Erroneously the power meter is zeroed to an input power of $P_0=100\mu\text{W}$. What is the indicated power $P'=?$ when we connect it to a source $P=300\mu\text{W}$?
 (A) $100\mu\text{W}$ (B) $200\mu\text{W}$ (C) $300\mu\text{W}$ (D) $400\mu\text{W}$
2. What noise temperature $T_s=?$ can be achieved in a low-noise amplifier with a GaAlAs/GaAs HEMT at a frequency of $f=3\text{GHz}$? The whole amplifier is cooled with liquid nitrogen to $T_{LN2}=77\text{K}$ and impedance matching for optimum noise is used.
 (A) 1000K (B) 100K (C) 10K (D) 1K
3. A silicon-diode chip is installed in a Mini-MELF SMD package. The latter carries a single color ring. The meaning of this ring is the following:
 (A) anode connection (B) breakdown voltage (C) capacitance tolerance (D) cathode connection
4. A broadband thermal-noise power P_N is measured with a spectrum analyzer at a resolution bandwidth $B=1\text{MHz}$ and video filter $B_V=1\text{kHz}$. What video filter $B_V'=?$ is required for a 10-fold decrease of the measurement uncertainty ΔP_N ?
 (A) 10Hz (B) 100Hz (C) 300Hz (D) 10kHz
5. A high-gain $G_s \gg 1$ satellite receiver is connected to a noise source with an $\text{ENR}=5\text{dB}$ and cold temperature $T_1=T_0=290\text{K}$ equal to room temperature. The measured hot/cold ratio equals to $\gamma=4\text{dB}$. What is the noise temperature $T_s=?$ of the receiver?
 (A) 75K (B) 125K (C) 189K (D) 290K
6. A DVB-T transmitter uses QPSK-OFDM with $N=1705$ sub-carriers. What is the theoretical peak output power $P_{\text{MAX}}=?$ if the transmitter is required to produce an average RF output power $\langle P \rangle = 400\text{W}$?
 (A) 235mW (B) 400W (C) 16.5kW (D) 682kW
7. Our transmitter $f_{\text{TX}}=168\text{MHz}$ is causing interference to our receiver $f_{\text{RX}}=158\text{MHz}$ only if both are connected through a frequency duplexer to a common antenna on the tower. What additional transmitters are suspected to cause PIM (passive IMD) on the tower?
 (A) 89MHz & 99MHz (B) 99MHz only (C) 99MHz & 148MHz (D) 148MHz only
8. The output stage of a WiFi OFDM transmitter achieves an efficiency of $\eta=3\%$ at an average output power of $\langle P \rangle = 200\text{mW}$. What 1dB compression point $P_{1\text{dB}}=?$ is expected if the power amplifier operates in class A?
 (A) $+13\text{dBm}$ (B) $+23\text{dBm}$ (C) $+33\text{dBm}$ (D) $+43\text{dBm}$
9. A two-stage amplifier includes three identical building blocks with $G_e=10\text{dB}$ and $P_{\text{P13e}}=100\text{W}$. The driver stage uses one building block while the final stage uses two blocks in parallel. What is the overall $P_{\text{IP3}}=?$ if the impedance matching is loss-less?
 (A) 100W (B) 167W (C) 200W (D) 333W
10. A Doherty power amplifier includes two similar power amplifiers and two quarter-wave delay lines on the input and output. The two power amplifiers differ in their bias, where the Doherty circuit requires operation in the following classes:
 (A) A & B (A) B & dual B (C) B & C (D) A & C
11. A microwave isolator includes a circulator with the third port terminated into a matched load. An ideal microwave isolator has the following S parameters:
 (A) $|S_{12}|=|S_{21}|=1$ & $S_{21}=S_{22}=0$ (B) $|S_{11}|=|S_{22}|=1$ & $S_{12}=S_{21}=0$ (B) $|S_{11}|=1$ & $S_{12}=S_{21}=S_{22}=0$ (B) $|S_{21}|=1$ & $S_{11}=S_{12}=S_{22}=0$
12. A frequency band-pass filter includes a single cavity resonator with a loaded $Q_L=300$ at a central frequency of $f=2\text{GHz}$. What is the maximum group delay $t_g=?$ of such a band-pass filter?
 (A) 48ns (B) 24ns (C) 12ns (D) 6ns

Name:

Email: