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13:30	(초청논문)광학 나노이미징을 위한 자기 기전력 진단 시스템	
F2C-2	오정환(부경대)	279
14:00	(초청논문)랩온어칩안에서의 Dielectrophoresis 를 이용한 바이오품질 분석기술 소개	
F2C-3	이상우(연세대)	281

학술발표 F2D 광계측

13:00-14:30 좌장 : 민성욱(경희대)

13:00	(초청논문)(English Presentation)광자 계수 분석과 집적영상 복원을 이용한 부분적으로 가려진 표적의 인식에 관한 연구	
F2D-1	염석원(대구대)	283
13:30	(English Presentation)적외선 영역에서 SAI를 이용한 3차원 영상 인식	
F2D-2	Yong Seok Hwang(광운대), Bahram Javidi(Univ. of Connecticut, USA)	286
13:45	광 플립플롭에 기초한 전광 패킷 헤더와 페이로드 분리에 관한 연구	
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14:00	위상 천이 간섭계에서 위상 정보의 복구 기술	
F2D-4	박대서, 이윤석, 김대찬, 박세근, 오범환, 이일항, 이승걸(인하대)	290
14:15	초점형 타원계측기의 광 검출기 유효 면적에 의한 측정 오차	
F2D-5	예상현, 김수현, 광운근(KAIST), 조현모, 조용재, 제갈원(KRISS)	292

학술발표 F3A 광원소자(II)

14:50-16:20 좌장 : 김두근(중앙대)

14:50	(초청논문)선택적 영역 성장을 이용한 고효율 광대역 superluminescent diode	
F3A-1	송정호, 김기수, 임영안, 김경옥(ETRI)	294
15:20	(초청논문)삼각형과 사각형으로 이루어진 전반사 미러 기반의 링 공진기	
F3A-2	김두근, 오금윤, 최영완(중앙대), 김효진, 김선훈, 기현철, 김상택, 고향주, 김태언, 양명학, 김희종(KOPTI), 이종창(홍익대)	296
15:50	(초청논문)실리콘기반 질화물계 LED	
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학술발표 F3B 마이크로-포토닉스

14:50-16:20 좌장 : 윤호성(KT)

14:50	(초청논문)CMOS APD를 이용한 WLAN 용 Radio-over-Fiber 시스템	
F3B-1	강효순, 최우영(연세대)	300

CMOS APD 를 이용한 WLAN 용 Radio-over-Fiber 시스템

Radio-over-Fiber systems for WLAN using CMOS APD

강효순, 최우영

연세대학교 전기전자공학과

Abstract

We present radio-over-fiber (RoF) systems for IEEE 802.11a wireless local area network (WLAN) using a Si avalanche photodetector (APD) fabricated in 0.18 μm standard complementary metal-oxide-semiconductor (CMOS) process. The bias voltage of the APD is optimized and downlink data transmission of 20 Mb/s, 16 quadrature amplitude modulation data at 5.805 GHz with a wireless link is successfully performed.

As increasing demand for wireless communications including cellular services and wireless local area network (WLAN), radio-over-fiber (RoF) technology has been regarded as a promising candidate for extension of radio coverage using low loss and huge bandwidth of optical fiber [1]. For wide deployment of these systems, low-cost realization is indispensable especially due to reduced cell size such as pico-cell. There have been several approaches to reduce the cost of RoF systems using VCSELs and multimode fibers [2-3]. However, all the previous works concentrated only on the central stations (CS) and transmission medium despite the fact that low-cost implementation of remote antenna units (RAUs) is also very important.

CMOS compatible APDs (CMOS-APDs) can be an attractive solution for low-cost realization of RAU. Mature CMOS technologies make it possible to reduce fabrication cost of APDs which can detect 850 nm optical signals and integrate the RAU including the APD and necessary electronic circuits.

In this paper, we present RoF systems for 5 GHz band IEEE 802.11a WLAN based on the CMOS-APD. Bias voltage optimization and downlink data transmission of 20 Mb/s 16 quadrature

amplitude modulation (QAM) data at 5.805 GHz with a 0.5 m wireless link is performed.

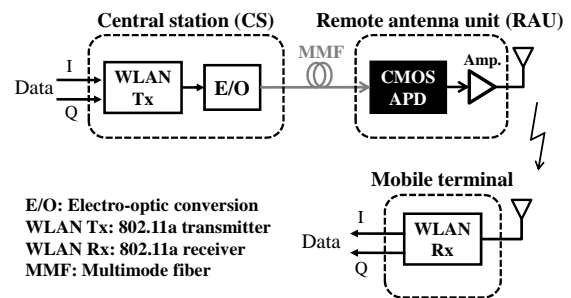


Fig. 1 Schematic diagram of RoF downlink systems for WLAN based on the CMOS-APD.

Fig. 1 shows schematic diagram of downlink RoF systems for WLAN based on the CMOS-APD. The CMOS-APD was fabricated using 0.18 μm standard CMOS technology and detailed device structure is shown in elsewhere [4]. Fig. 2 shows photodetection frequency response of the CMOS-APD at different bias voltages. It is seen that about 10-dB loss at 5 GHz band is inevitable due to roll-off of frequency response in order to utilize the CMOS-APD in RoF systems for IEEE 802.11a WLAN.

In the experiment of downlink data transmission system, baseband data of 20 Mb/s, 16 QAM are frequency up-converted using a WLAN transmitter and

modulated to optical signal using an 850 nm LD and electro-optic modulator in the CS. At the RAU, transmitted WLAN signal embedded in optical signal is photodetected by the CMOS-APD, amplified, and then radiated via an antenna. After transmission through 0.5 m wireless link, which has about 40-dB loss, received signal at mobile terminal is frequency down-converted using a WLAN receiver and demodulated by a vector signal analyzer (VSA) for the evaluation of system performance.

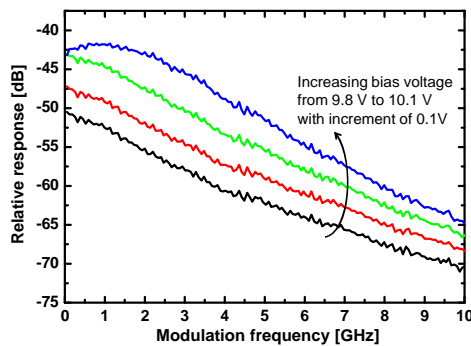


Fig. 2 Photodetection frequency response of the CMOS-APD at different bias voltages

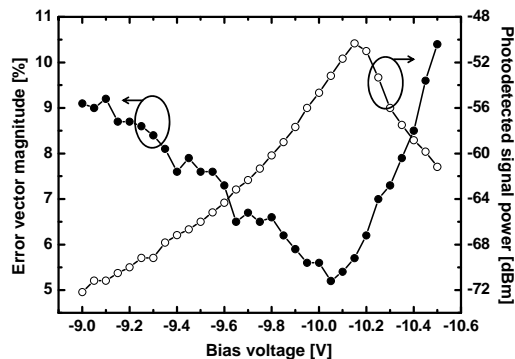


Fig. 3 EVM of data and photodetected signal power of 5.8 GHz CW signals as a function of bias voltages.

For the optimization of the CMOS-APD performance, error vector magnitude (EVM) of received data and photodetected signal power of 5.8 GHz CW signal dependent on the bias voltages are investigated as shown in Fig. 3. The bias voltage for maximum photodetected signal power is 10.15 V while EVM is minimized at 10.05 V. This slight difference of bias voltage is caused by increased noise in the avalanche regime. When the CMOS-

APD operates in avalanche region, the photodetected signal power is enhanced due to avalanche gain, however, noise also increases owing to multiplied dark currents. Therefore, the bias voltage of the CMOS-APD should be determined to optimize EVM performance. Fig. 4 shows the constellation and eye diagram of received data at 10.05 V. The EVM of about 5.5% corresponding 22.5 dB SNR is obtained in the RoF system.

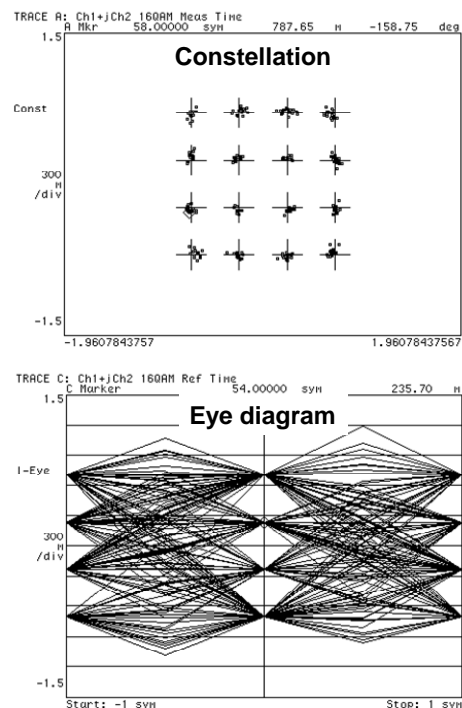


Fig. 4. Constellation and eye diagram of demodulated 20Mb/s 16 QAM data at VSA

RoF systems for IEEE 802.11a WLAN based on the CMOS-APD are presented. To optimize the CMOS-APD performance, bias voltage dependences of EVM are investigated and downlink data transmission of 20 Mb/s, 16 QAM data at 5.805 GHz is successfully demonstrated with a 0.5 m wireless link. In the experiments, 5.5 % EVM is obtained.

- [1] T. P. Kay et al., *JLT*, vol. 22, pp. 2370-2376, 2004
- [2] M. Y. W. Chia et al., *EL*, vol. 39, pp. 1143, 2003
- [3] M. L. Yee et al., *Proc. European Microwave Conference*, pp. 882-885, 2006
- [4] H.-S. Kang et al., *APL*, vol. 90, pp. 151118, 2007