



NGCN30...

- Changelog:

- 마지막 슬라이드 10 dB를 10dBm으로 수정



NGCN30...

Experiment 1:

Introduction to EECE443/NGCN302

포항공과대학교 전자전기공학과
Communication and Intelligent Systems Lab. (CISL)

Outline

1. About the Course
2. Introduction to LabVIEW, USRP, Spectrum Analyzer
3. Today's Experiment
4. About Report

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1. About the Course
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About the Course

- Course Title
 - NGCN302 Laboratory for Communications and Network
 - An elective course for the Next Generation Communications and Network (NGCN) minor
 - EECE443 Laboratory for Communications and Network
 - An elective course for the EE major in Communications and Signal Processing

About the Course

- Course Outline
 - LabVIEW, USRP, Spectrum Analyzer
 - Modulation and demodulation, symbol mapping and detection
 - Pulse shaping filter, matched filter, SRRC filter
 - TX, RX with USRP, carrier/intermediate frequency
 - Synchronization and equalization
 - Implementation of total communication system
 - Wireshark, IP/MAC address
 - TCP, UDP, IP packet, encapsulation

About the Course

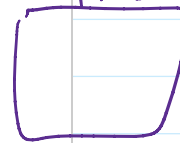
- Class hour
 - 강의 : 월요일 17:00 ~ 17:50
 - 실험 : 월요일 19:00 ~ 22:20
- 장소
 - 강의: LG연구동 102호
 - 실험: LG연구동 205호
- 성적 평가
 - 실험 보고서 : 100%
 - 매 실험 결과를 다음 강의시간 전까지 pdf 형식의 보고서로 각자 조교에게 제출
- 실험 문의
 - TA: 최재현, jhchoi0226@postech.ac.kr

About the Course

- 실험 조 편성 (2024. 9. 2.(월) 기준)
 - A조: 하성영, 오용정, 강유진, 이주영
 - B조: 권나영, 홍은혜, 문진혁, 이창호
 - C조: 박동훈, 김균서, 김제윤, 임지훈
 - D조: 최문규, 이민규, 서어진, 윤정하

LG 205
0205

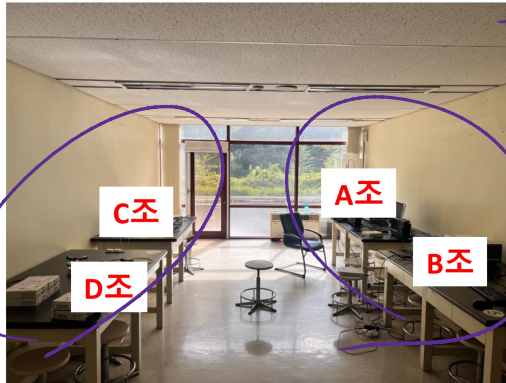
102: 17:00
205: 17:50



No 에러 Report.

결과
(2월 23)

power meter

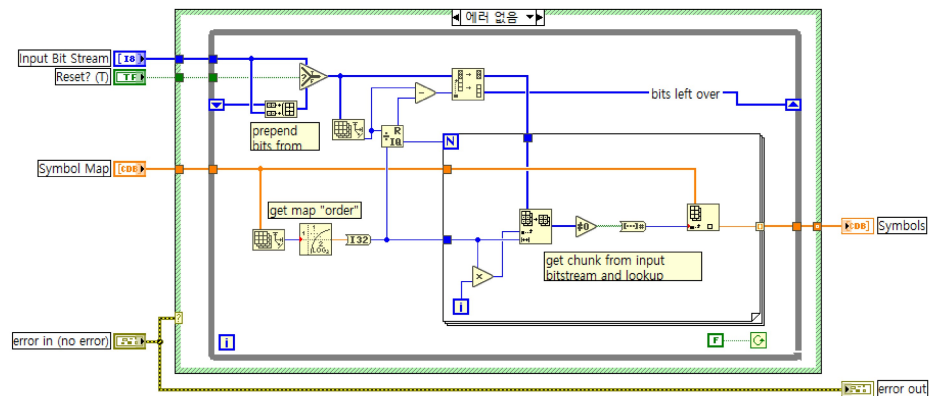


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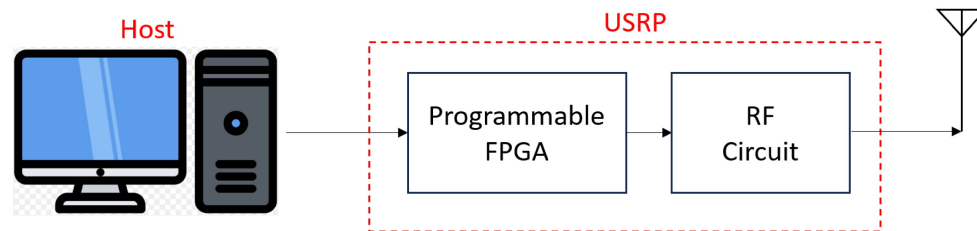
Introduction to LabVIEW, USRP, Spectrum Analyzer

- LabVIEW란?
 - 그래픽 기반의 프로그래밍 언어
 - Hardware 제어에 최적화(especially, NI 장비)



Introduction to LabVIEW, USRP, Spectrum Analyzer

- USRP(Universal Software Radio Peripheral)
 - NI사의 RF Transceiver
 - RF circuit과 programming 가능한 FPGA로 구성.
 - FPGA 기본 탑재 기능 : ADC, DAC, DDC, DUC
 - TX : Baseband Digital data을 Bandpass Analog signal로 변환
 - RX : Bandpass Analog signal을 Baseband Digital data로 변환



Introduction to LabVIEW, USRP, Spectrum Analyzer

- 사용할 model : NI USRP N210

2952R
2954R



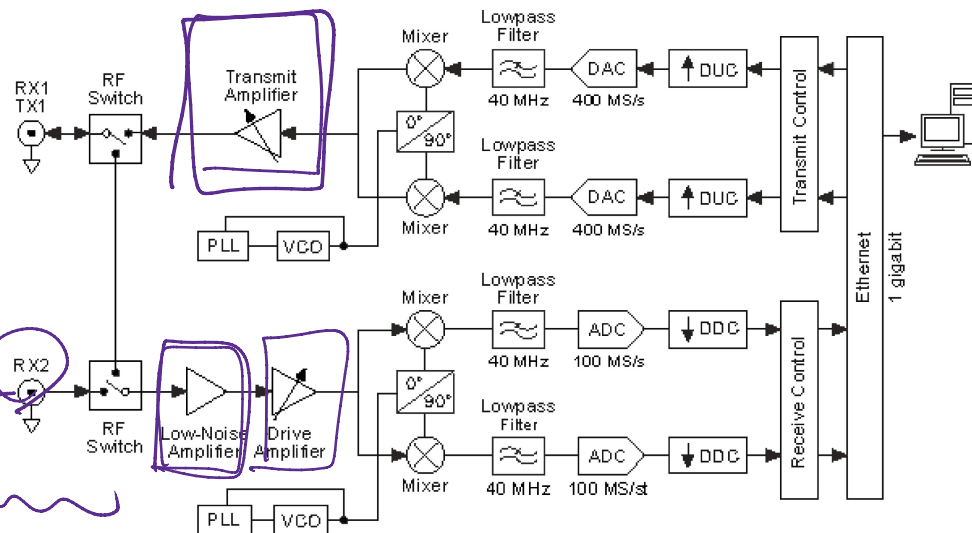
SPECIFICATIONS

Spec	Typ.	Unit	Spec	Typ.	Unit
POWER			RF PERFORMANCE (W/ WBX)		
DC Input	6	V	SSB/LO Suppression	35/50	dBc
Current Consumption	1.3	A	Phase Noise (1.8 GHz)		
w/ WBX Daughterboard	2.3	A	10 kHz	-80	dBc/Hz
CONVERSION PERFORMANCE AND CLOCKS			100 kHz	-100	dBc/Hz
ADC Sample Rate	100	MS/s	1 MHz	-137	dBc/Hz
ADC Resolution	14	bits	Power Output	15	dBm
ADC Wideband SFDR	88	dBc	IIP3	0	dBm
DAC Sample Rate	400	MS/s	Receive Noise Figure	5	dB
DAC Resolution	16	bits	PHYSICAL		
DAC Wideband SFDR	80	dBc	Operating Temperature	0 to 55°	C
Host Sample Rate (8b/16b)	50/25	MS/s	Dimensions (l x w x h)	22x16x5	cm
Frequency Accuracy	2.5	ppm	Weight	1.2	kg
w/ GPSDO Reference	0.01	ppm			

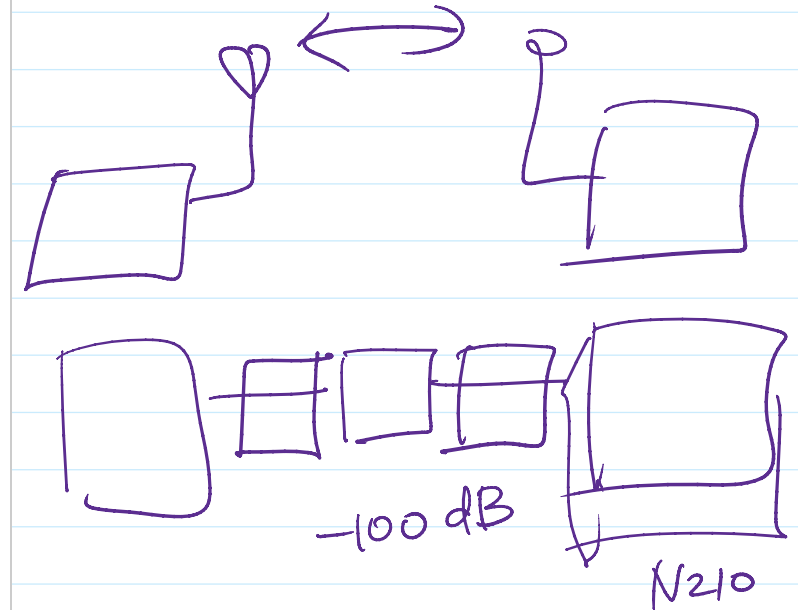
* All specifications are subject to change without notice.

Introduction to LabVIEW, USRP, Spectrum Analyzer

- General USRP Architecture

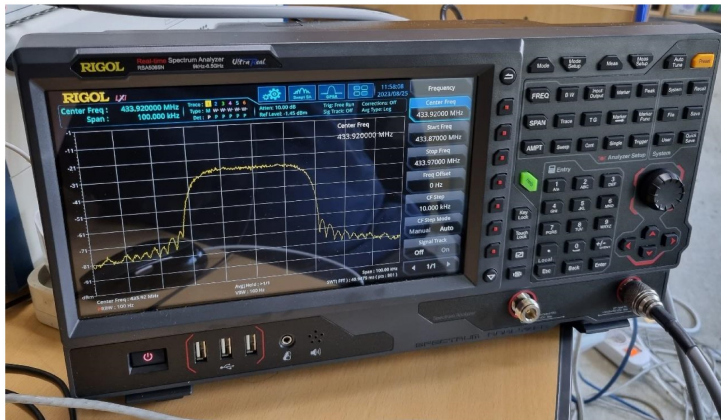


- https://kb.ettus.com/About_USRP_Bandwidths_and_Sampling_Rates



Introduction to LabVIEW, USRP, Spectrum Analyzer

- Spectrum Analyzer란?
 - Frequency Domain에서 신호의 세기를 시각화하는 장비.
 - 신호의 변조 방식이나 주파수 대역폭 분석에 필수.
 - 사용 장비 : RIGOL RSA5065N



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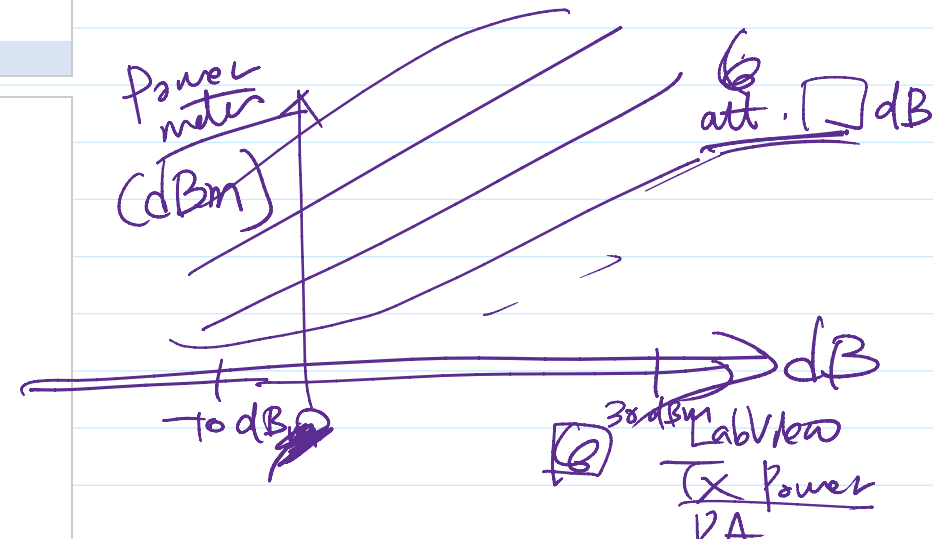
NGCN302

CISL (POSTECH)

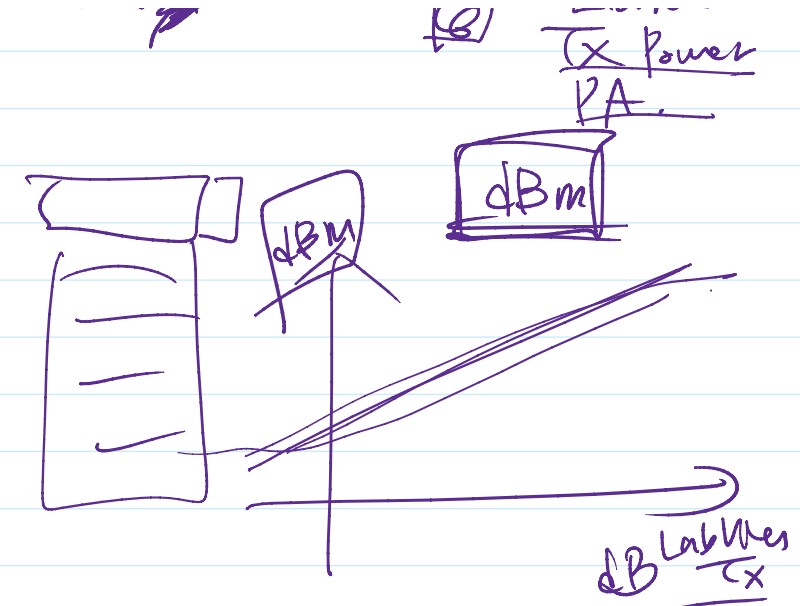
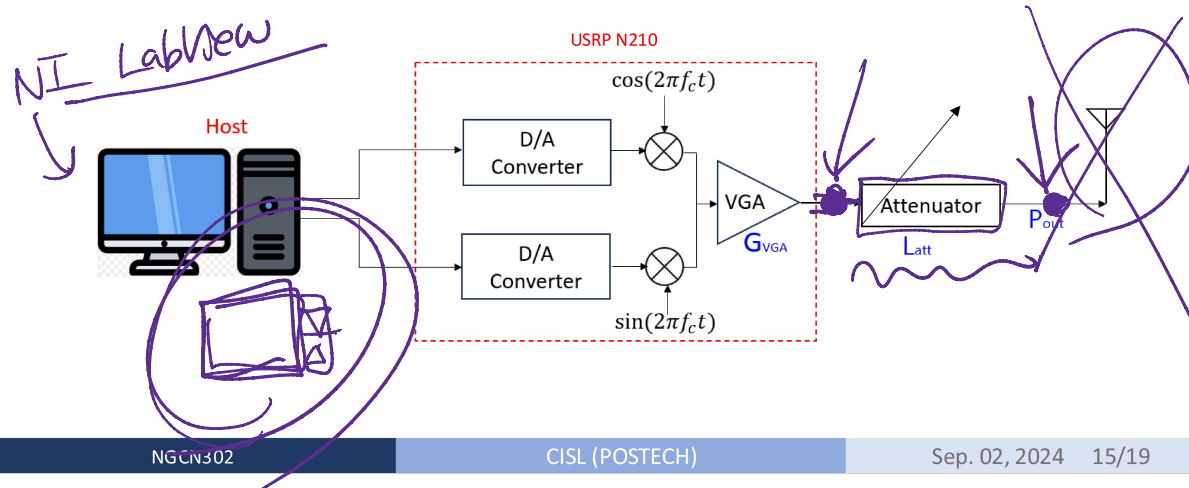
Sep. 02, 2024 14/19

Today's Experiment

- Experiment 1 : USRP 송신 power 측정
 - Attenuator loss, USRP VGA Gain 바꾸면서 power meter로 송신 power 측정
 - Power Attenuator loss, USRP VGA Gain 관계식 도출

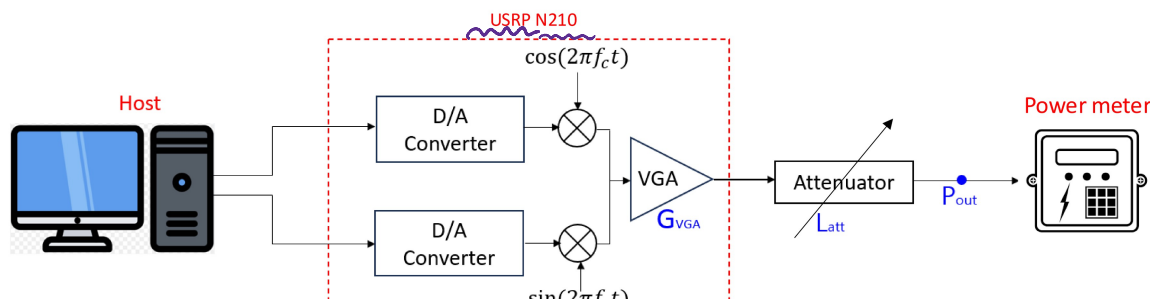


- Power, Attenuator loss, USRP VGA Gain 관계식 도출



NI- USRP

- Experiment 1 : USRP 송신 power 측정
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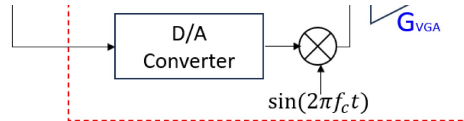


$\log_{10} \frac{A_1}{A_0}$
 $\frac{A_1}{A_0}$
 $\frac{A_1}{A_0}$
 $\frac{A_1}{A_0}$

1 Bell
 0 Bell
 0 dB
 10 dB

$\frac{A_1}{A_0} = 2 \approx 3 \text{ dB}$

dBm
 mW



Latt



NGCN302

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Sep. 02, 2024 16/19

Today's Experiment

- 장비마다 다르고, cable에 따라서도 다르다.
 - Cable loss (단위 : dB/m)
 - 동일한 cable이면 길이가 길 수록 loss 도 증가.

PRODUCT FEATURES

PRODUCT DRAWING (PDF)

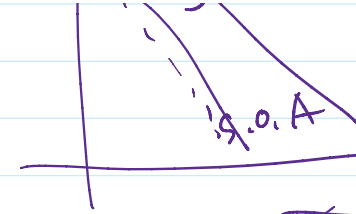
- RG58 Reverse Polarity TNC Male to Type N Male Coaxial Cable Assembly
- The Summer of Savings Continues at Cables on Demand Thru 8/31: Get \$80.00 OFF Your First Online Order Over \$350.00 Automatically at Checkout
- Military-grade RG58C/U rated 50 Ohm coax with 95% braid coverage
- Impedance-matched Amphenol brand RP-TNC & Type N male connectors
- Use this cable to easily connect your WiFi router to an external antenna
- Non-contaminating black PVC cable jacket and molded strain relief system
- Tinned Copper center conductor & braid for high frequency performance
- Gold-plated connector body & Gold-plated center pin contact
- Perfect for low-power RF, LAN, WiFi, broadcast, data, test & signal applications
- Stocked in a variety of common lengths to meet application requirements
- Insulation: Solid PE (Polyethylene)
- Outer Diameter: 0.195 inches nominal
- Velocity of Propagation: 66%
- Operating Temperature: -40°C to +85°C
- Loss @ 50 MHz: 3.30 dB per 100 ft
- Loss @ 100 MHz: 4.90 dB per 100 ft
- Loss @ 200 MHz: 7.30 dB per 100 ft
- Loss @ 400 MHz: 11.00 dB per 100 ft
- Loss @ 1000 MHz: 20.0 dB per 100 ft
- RoHS compliant

[Amphenol CO-058TNCRPTN-025 Reverse Polarity TNC \(RP-TNC\) Male to Type N Male Coax Cable \(RG58\) 50 Ohm Coaxial Cable Assembly 25 ft \(cablesondemand.com\)](https://cablesondemand.com)

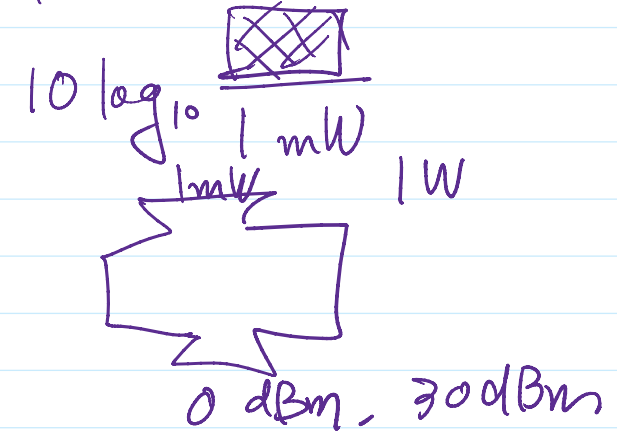
NGCN302

CISL (POSTECH)

Sep. 02, 2024 17/19



dBm
miliwatt.



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About report

- Due : 2024. 09. 09.(월)
- Must be included:
 - Linear region에서의 DT signal power (-10dBm 고정), attenuator loss, VGA gain 관계식
 - G_{VGA} vs P_{out} , L_{att} vs P_{out} 그래프 삽입
- Soft copy : jhchoi0226@postech.ac.kr 로 제출