

Experiment 2:

USRP RX power measurement

포항공과대학교 전자전기공학과
Communication and Intelligent Systems Lab. (CISL)

Outline

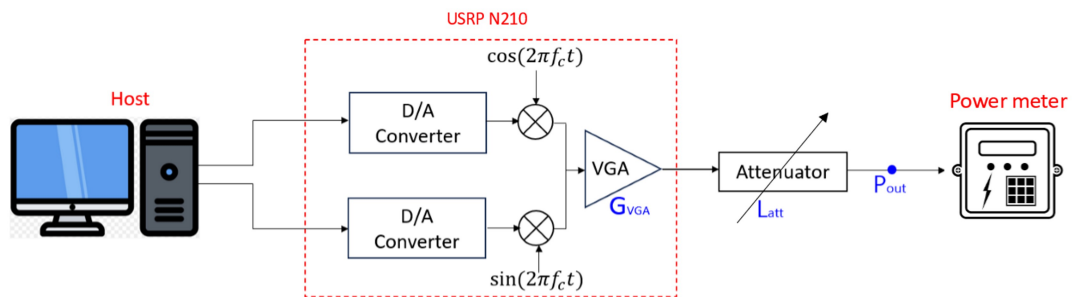
1. Review
2. Today's experiment
3. About report

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Review

- 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



← 수신기

Review

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



Q. m당 0.1 dB loss라면
20km cable loss는?
A 2000 dB.

vs.
Radio channel
 ≈ 130 dB loss.
Radio Commun. 채널 ~
 $\frac{1}{r^2} = -20 \text{ dB/decade}$
 $-20 \log r$

Review

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PRODUCT FEATURES

PRODUCT DRAWING (PDF)

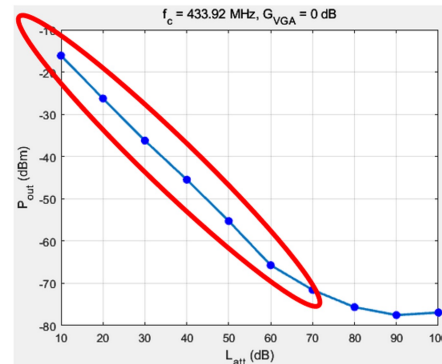
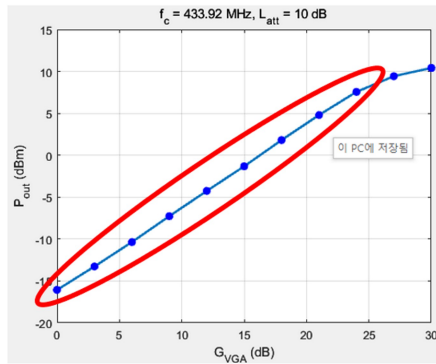
- RG58 Reverse Polarity TNC Male to Type N Male Coaxial Cable Assembly
- The Summer of Savings Continues at Cables on Demand Thru 8/31: Get \$80.00 OFF Your First Online Order Over \$350.00 Automatically at Checkout
- Military-grade RG58C/U rated 50 Ohm coax with 95% braid coverage
- Impedance-matched 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: -40C to +85C
- 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

주파수 dependent!

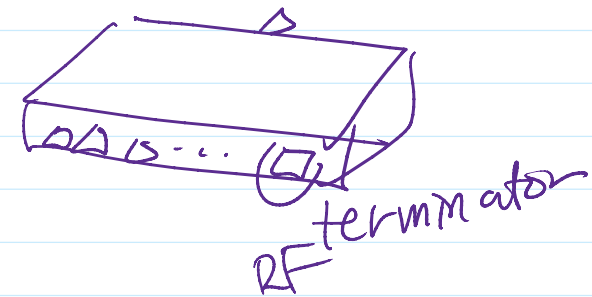
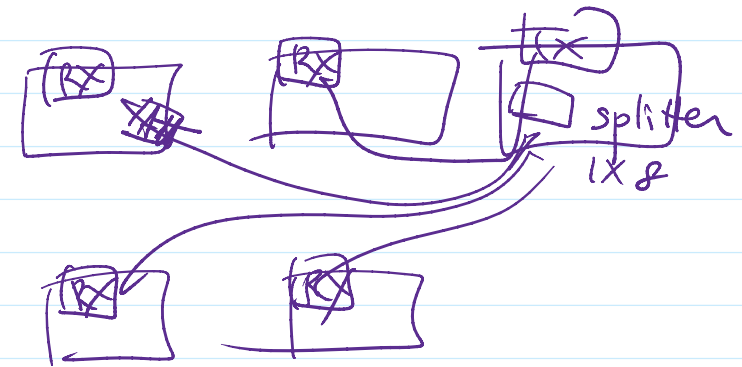
[Amphenol CO-058TNCRPTN-025 Reverse Polarity TNC \(RP-TNC\) Male to Type N Male Coax Cable \(RG58\) 50 Ohm Coaxial Cable Assembly 25 ft \(cablesondemand.com\)](#)

Review

- 장비마다 다르고, cable에 따라서도 다르다.
 - 결과 예시 (power meter : E4419A, power sensor : ECP-E26A)



$$P_{out} \text{ (dBm)} = -6.13 \text{ (dBm)} + G_{VGA} \text{ (dB)} - L_{att} \text{ (dB)}$$

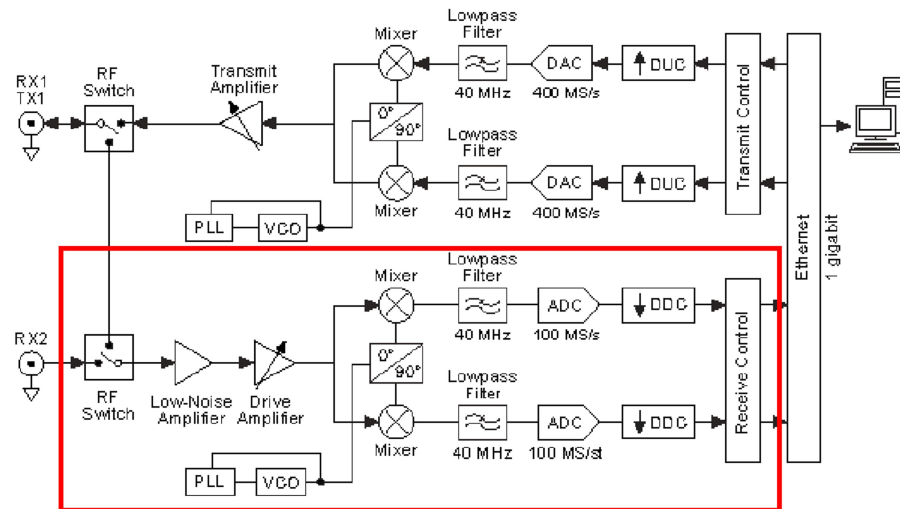


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Today's experiment

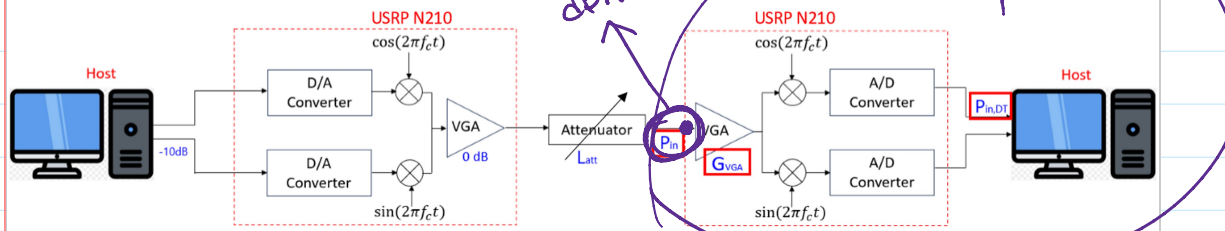
- USRP를 수신 mode로 사용.



Today's experiment

- USRP 수신 power와 DT signal power의 관계식을 구해 보자.

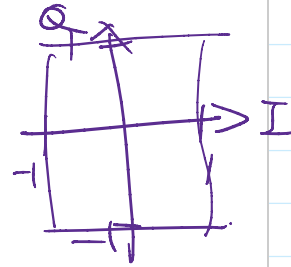
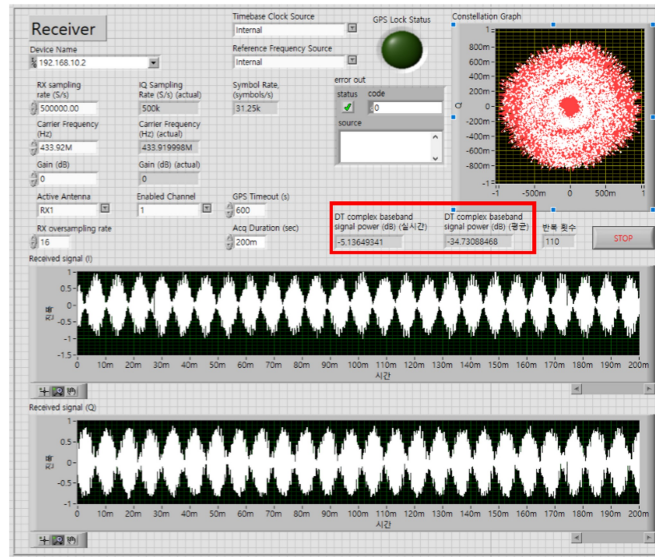
- 1. USRP, Attenuator 연결하여 signal 송신
- 2. 반대편 단자를 수신단에 back-to-back으로 연결
- 3. Rx code 실행 후 DT signal power 측정
- 4. Rx VGA Gain, Attenuator loss 바꾸면서 반복.



$$P_{in} \text{ (dBm)} = f(G_{VGA}, P_{in,DT})$$

Today's experiment

- RX front panel 구조



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About report

- Due : 2024. 9. 16.(월)
- Must be included :
 - USRP input power vs. DT signal power
 - Linear region에서의 USRP input power, DT signal power, VGA gain 관계
 - Nonlinear region이 발생하는 이유
- jhchoi0226@postech.ac.kr 로 제출

Wi-Fi dBm.
3G dBm
GPS dBm
20 20 H2O cover 2nd
individual 5 page