SAGI / TNU SUMMER SCHOOL of
OBSERVATIONAL PHYSICS

08/08/2025

FINDING RADIO QUIET AREAS WITH RADIO ANTENNA

Supervisors: Shih-Hao Wang, Quang Nguyen

Group participants: Baruffaldi Sofia, Lorden Becky, Nguyen Ly Anh Huy, Quach Hai Dang, Luc Gia Nghi Anh, Bui Huu Chung, Tran Bao Thach, Nguyen Gia Phuc, Nguyen Tung Lam

SCIENTIFIC CONTEXT

Use a radio antenna to measure background noise and find a suitable location for a radio telescope.

In total measurements were taken from 4 locations from Vietnam, and one from Mongolia, Taiwan and Korea

PROJECT GOALS

1. Use antenna to record multiple radio signals from across Vietnam (as well as from Taiwan, Mongolia and Korea).
2. Plot noise spectra in CSV files taken at different sights as well as the overall receiver response.
3. Estimate signal spectrum by subtracting (in dB scale) each spectra by the receiver response.
4. Analyse whether the noise power at each location is at an acceptable level for the use of a telescope.

STRUCTURE OF RADIO ANTENNA

ANTENNA → HPF, LPF → LNA1 → LNA2 → Bias Tee → (40m Coaxial Cable) → Receiver

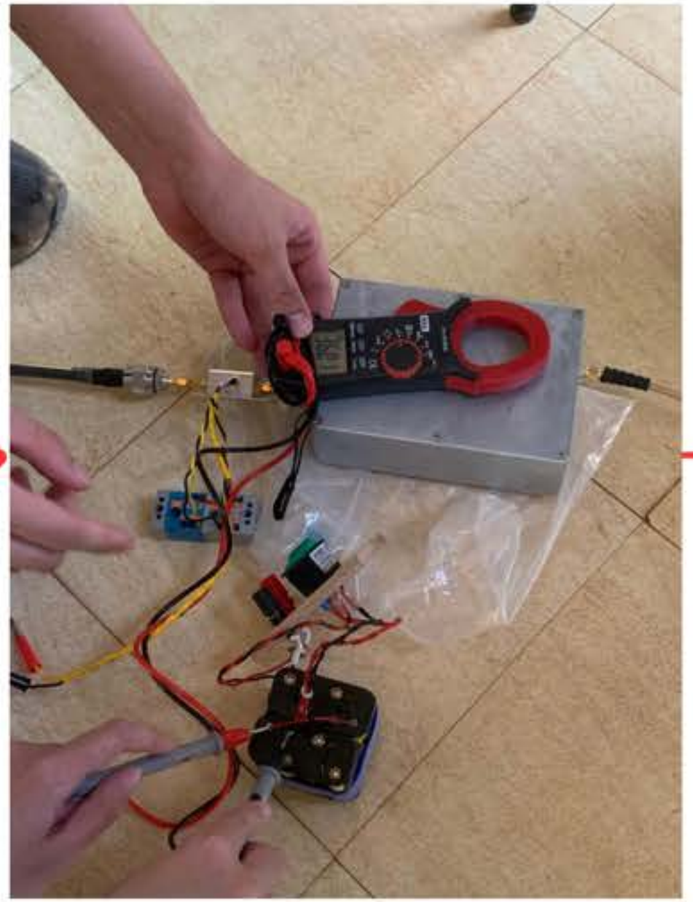
Measure the radio wave: flux density (sensitivity, amplify the signal), bandwidth (frequency 400 – 800 MHz), directionality (beam)

G~20dB
P~10^(20/10)
P~100 times input

Convert analog to Digital signal

Spectral analyzer

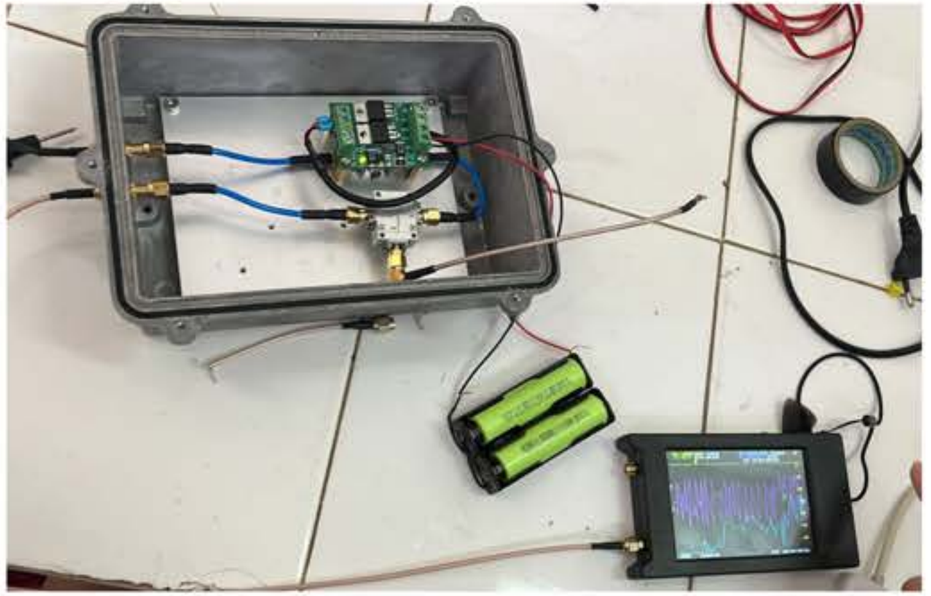
SETTING UP THE ANTENNA



TESTING THE COMPONENTS

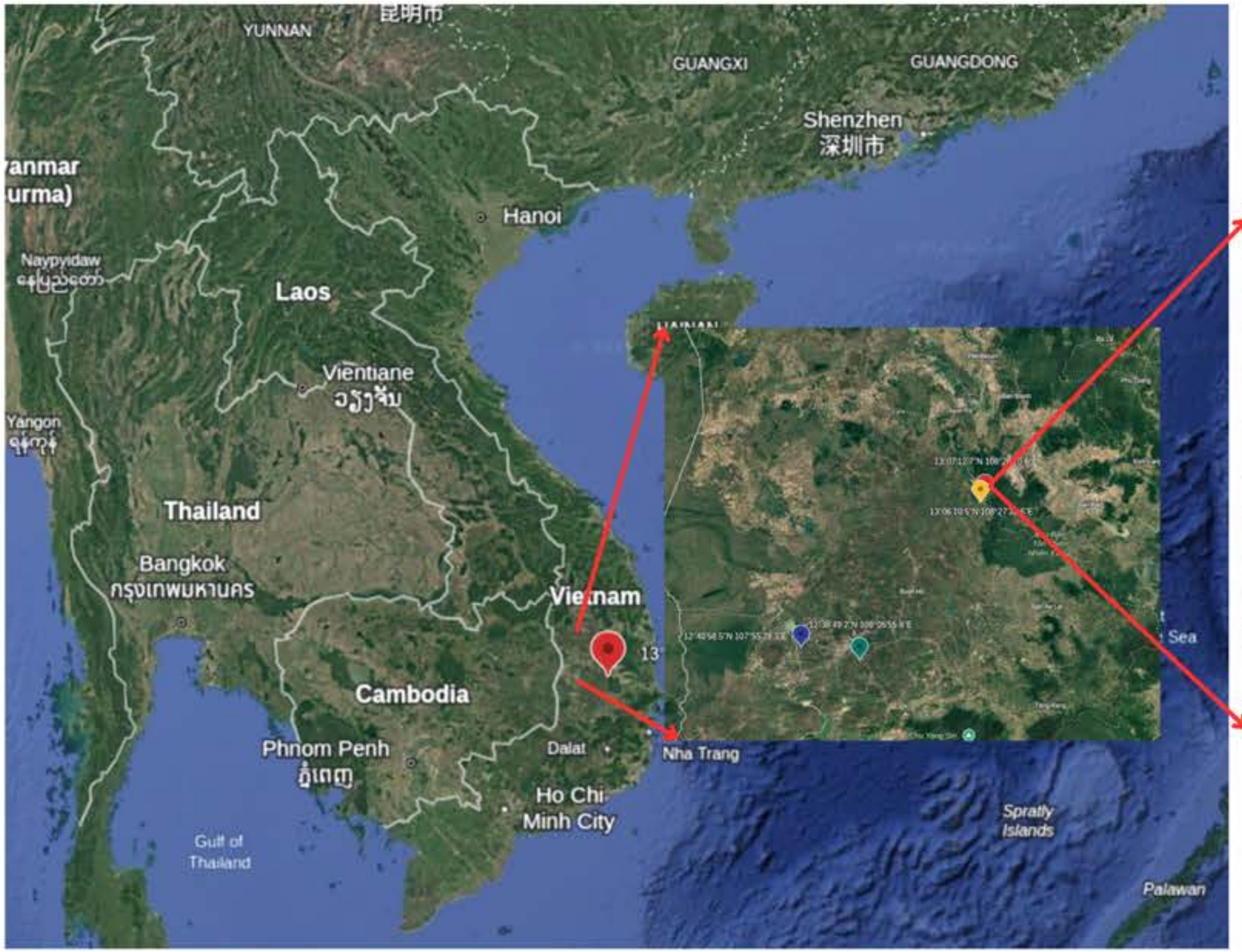
Testing battery

Testing battery with amplifier



Testing radio telescope with filter

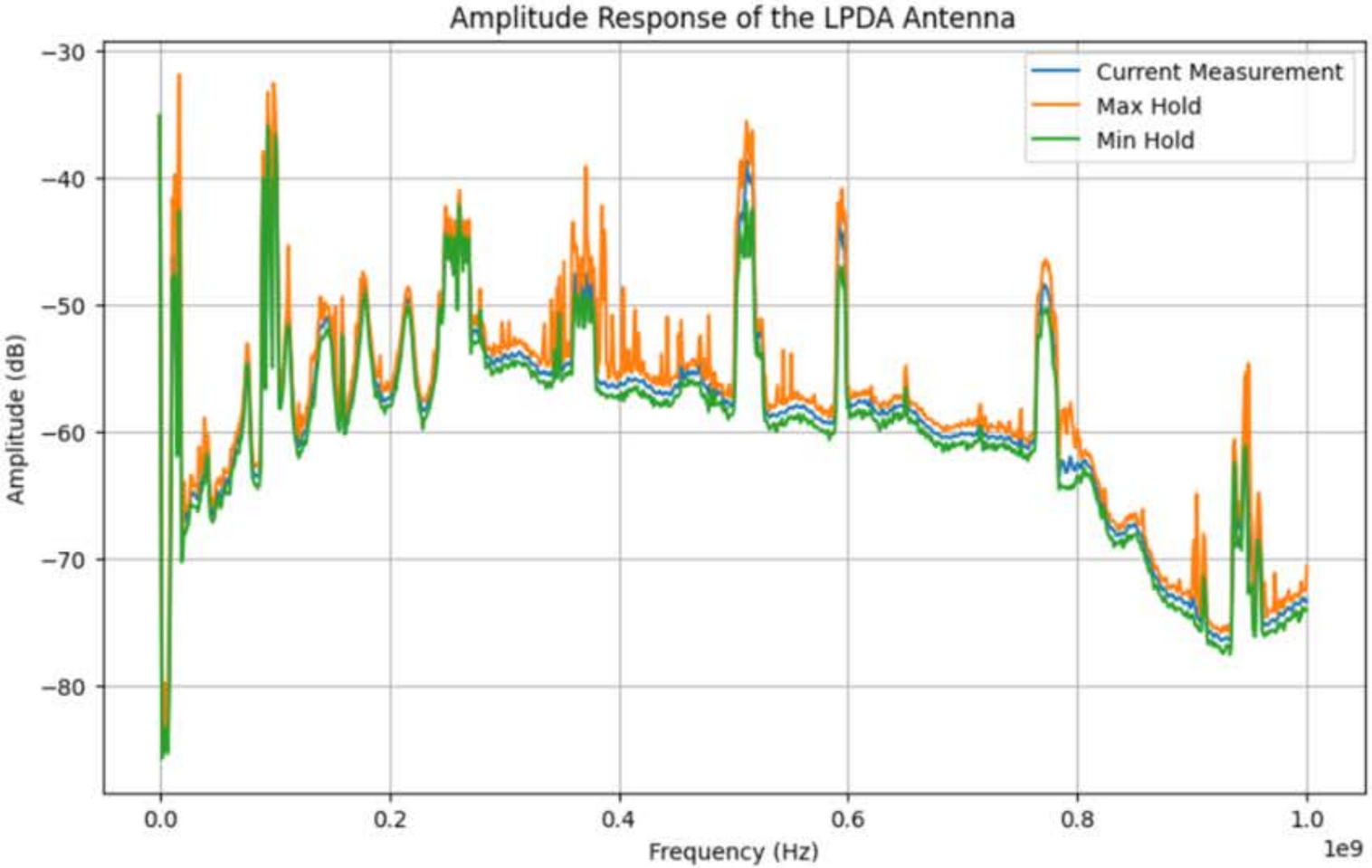
DINH MA THIEN



Dinh Ma Thien

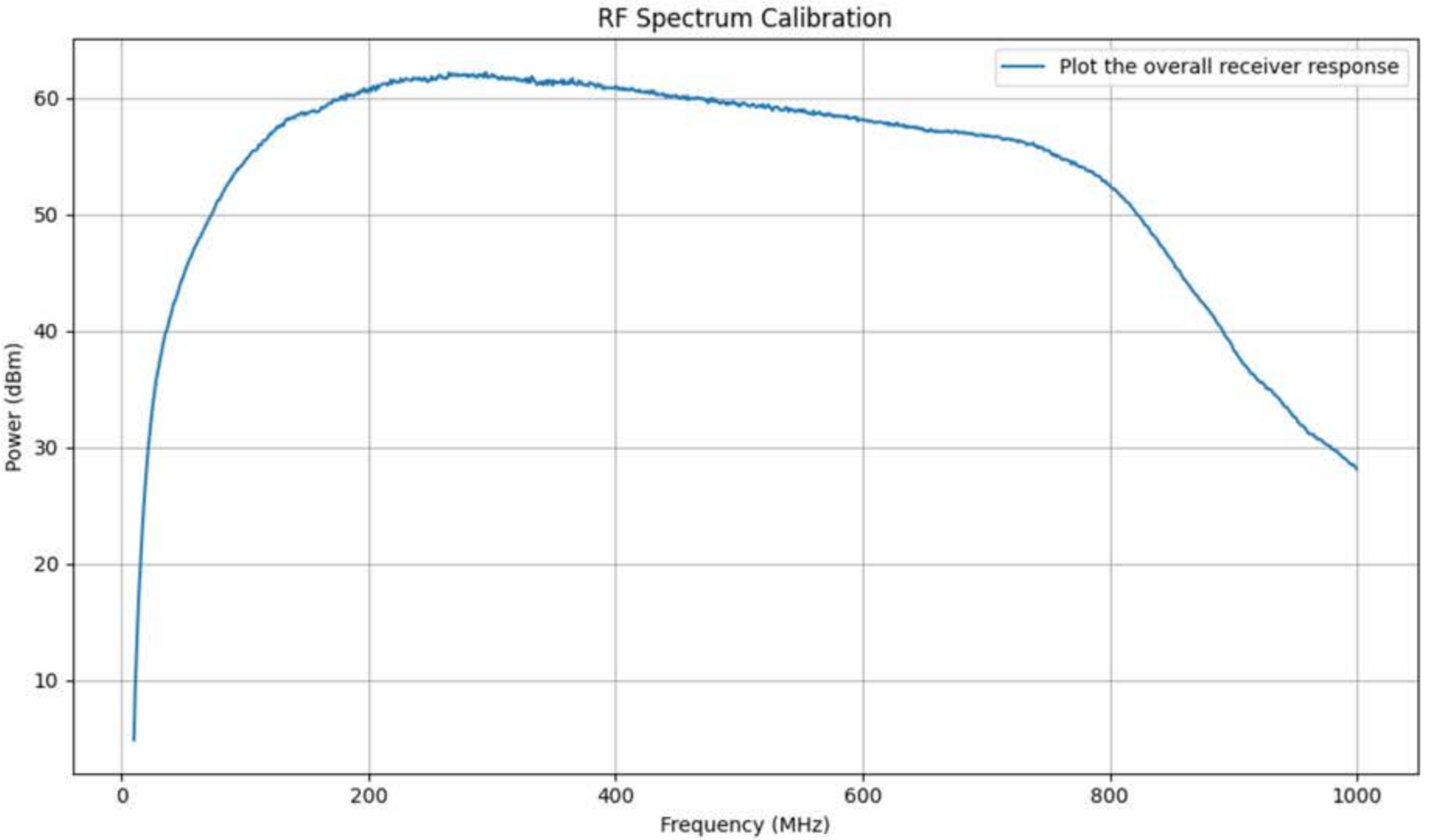
https://earth.google.com/earth/d/1HMtZfRJUgPKszmEXqHm2XSgZC5q0V3P6?usp=sharing

PLOT THE NOISE SPECTRA IN CSV FILES TAKEN AT DIFFERENT SITES

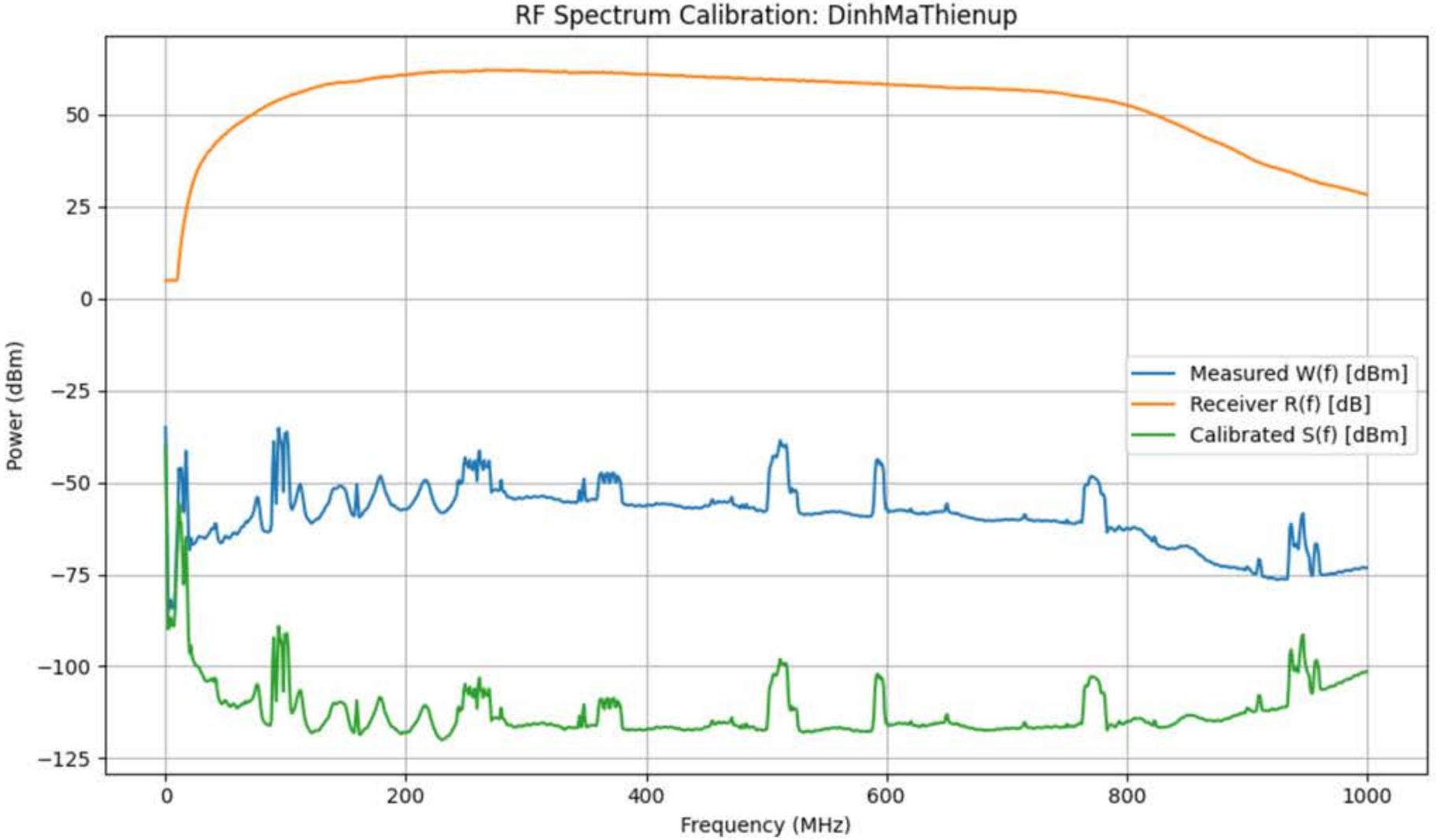


The response from Dinh Ma Thien

PLOT THE OVERALL RECEIVER RESPONSE



ANALYSIS

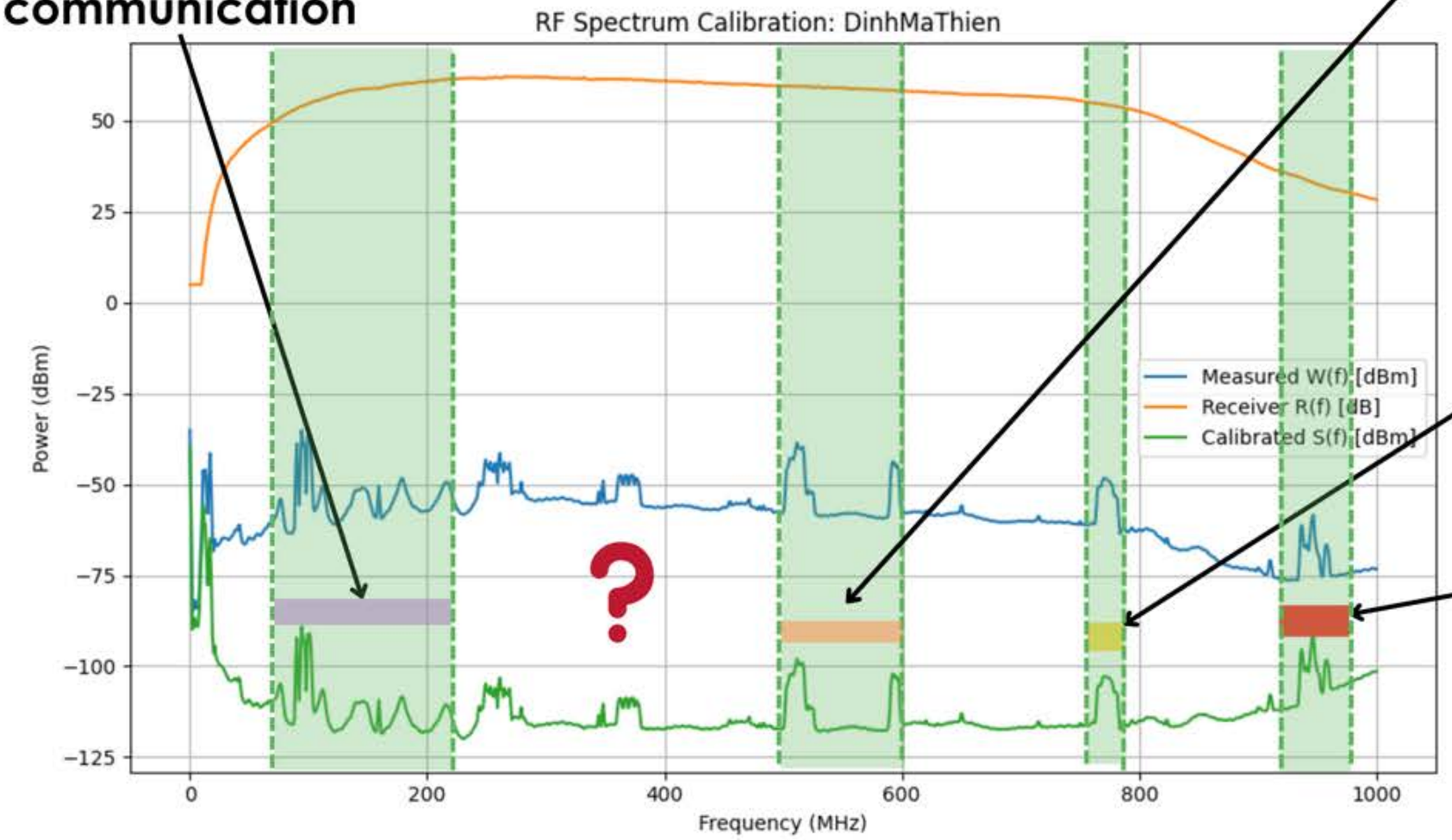


Spectrum Calibration of Dinh Ma Thien

ANALYSIS

Satelline communication

~538-600 MHz:
Digital TV



768-778 MHz:
Band n8 of Viettel

943.5-951.7MHz:
Band n28 of Viettel

Spectrum Calibration of Dinh Ma Thien

https://www.spectrum-tracker.com/Vietnam

FIND THE NOISE FLOOR

$$P_n = k_B T_{sys} B$$

$k_B = 1.380649 \times 10^{-23} m^2 kg s^{-2} K^{-1}$

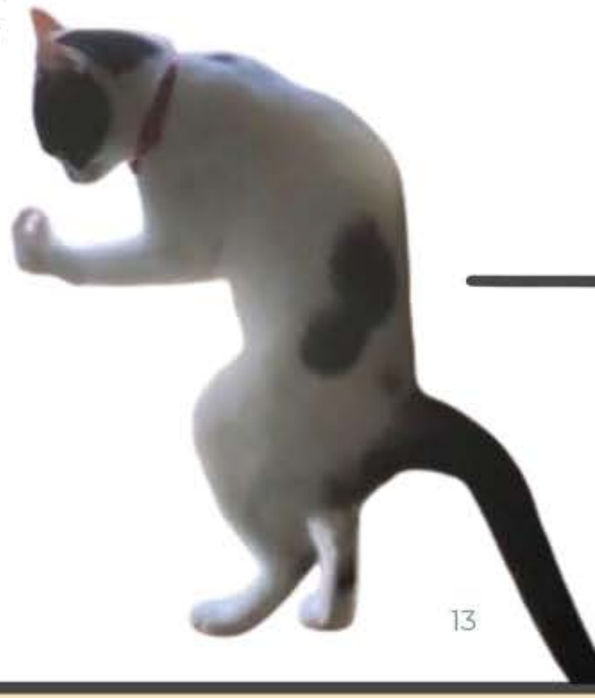
$T_{sys} = 300K$

$B = 1MHz$

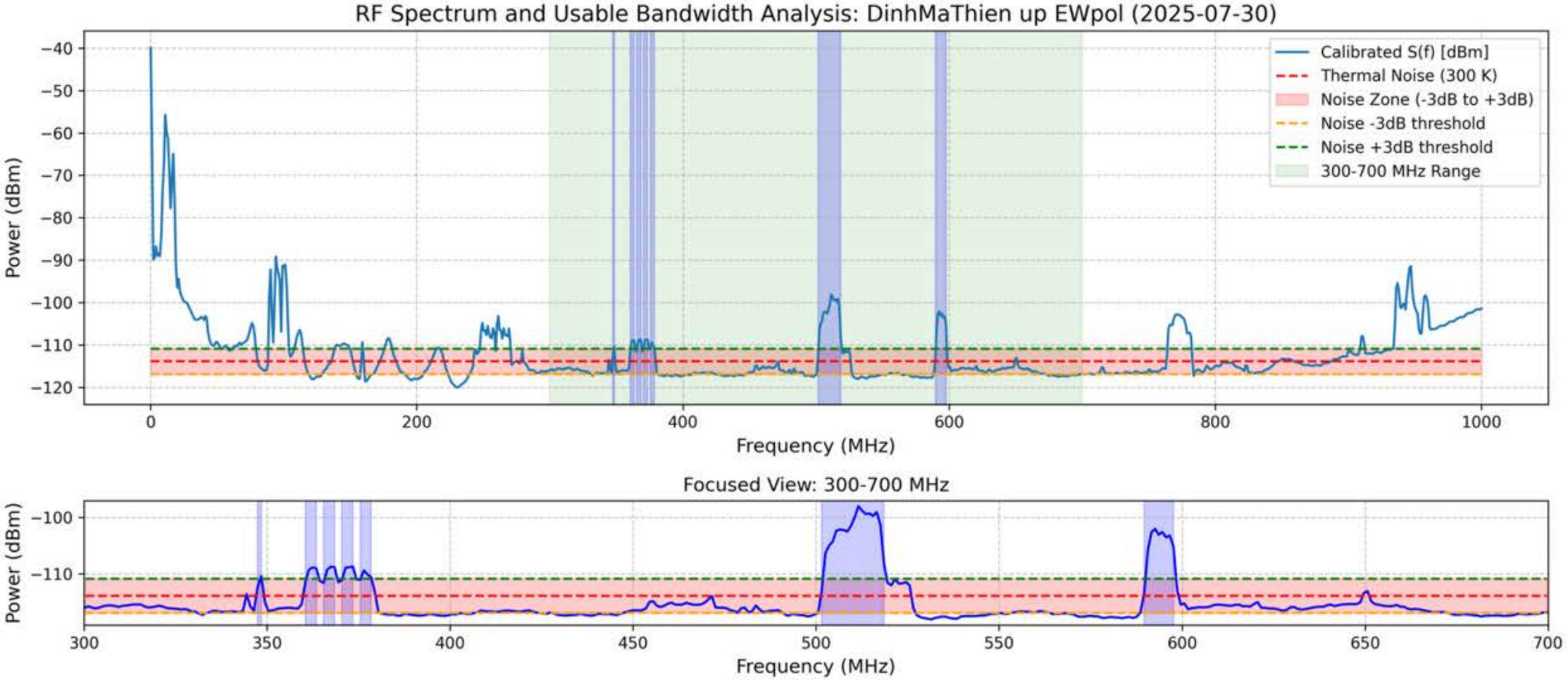
Lecture note by Prof. Sean Victor Hum (U. Toronto)

FIND THE NOISE FLOOR

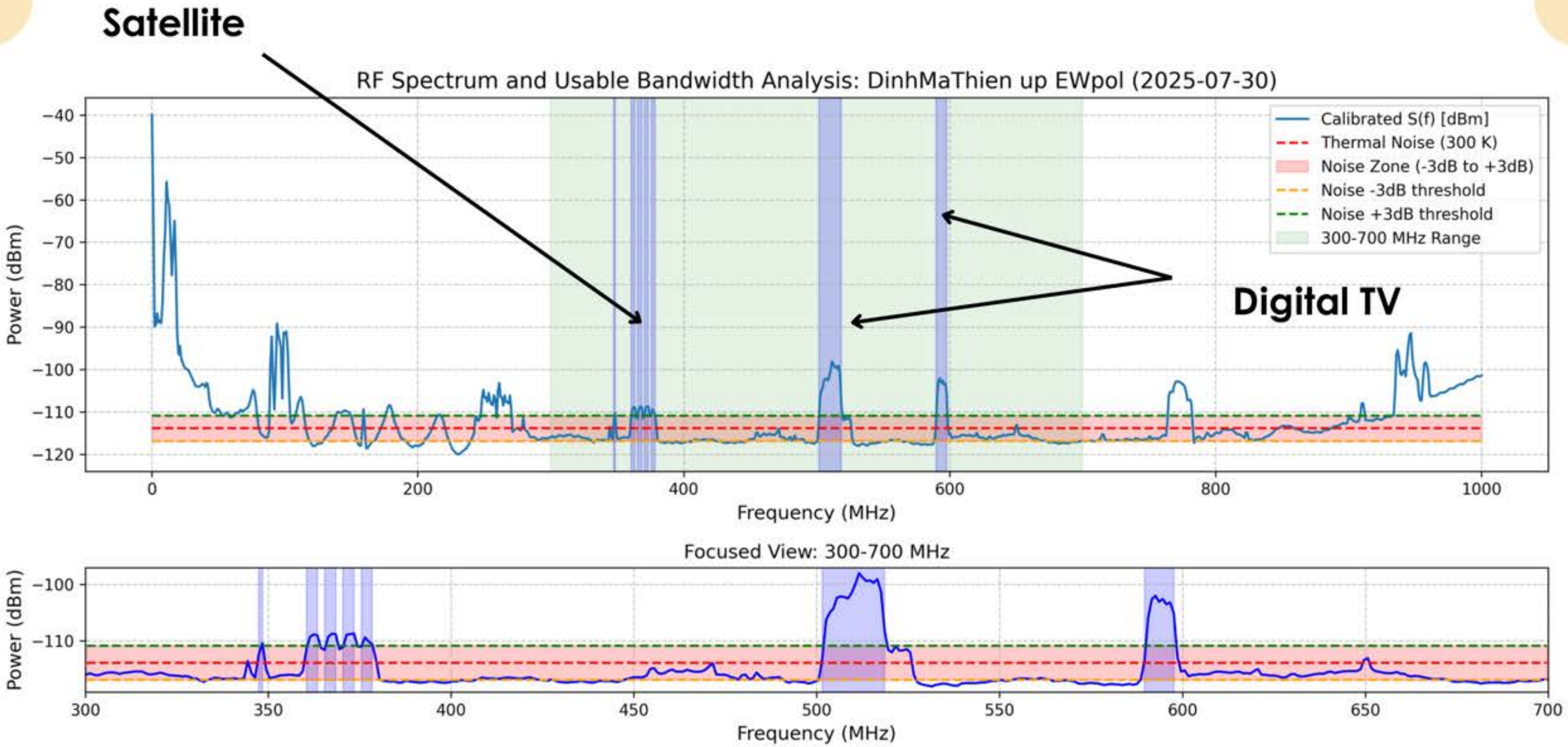
$$P_n = -114 dBm/MHz$$



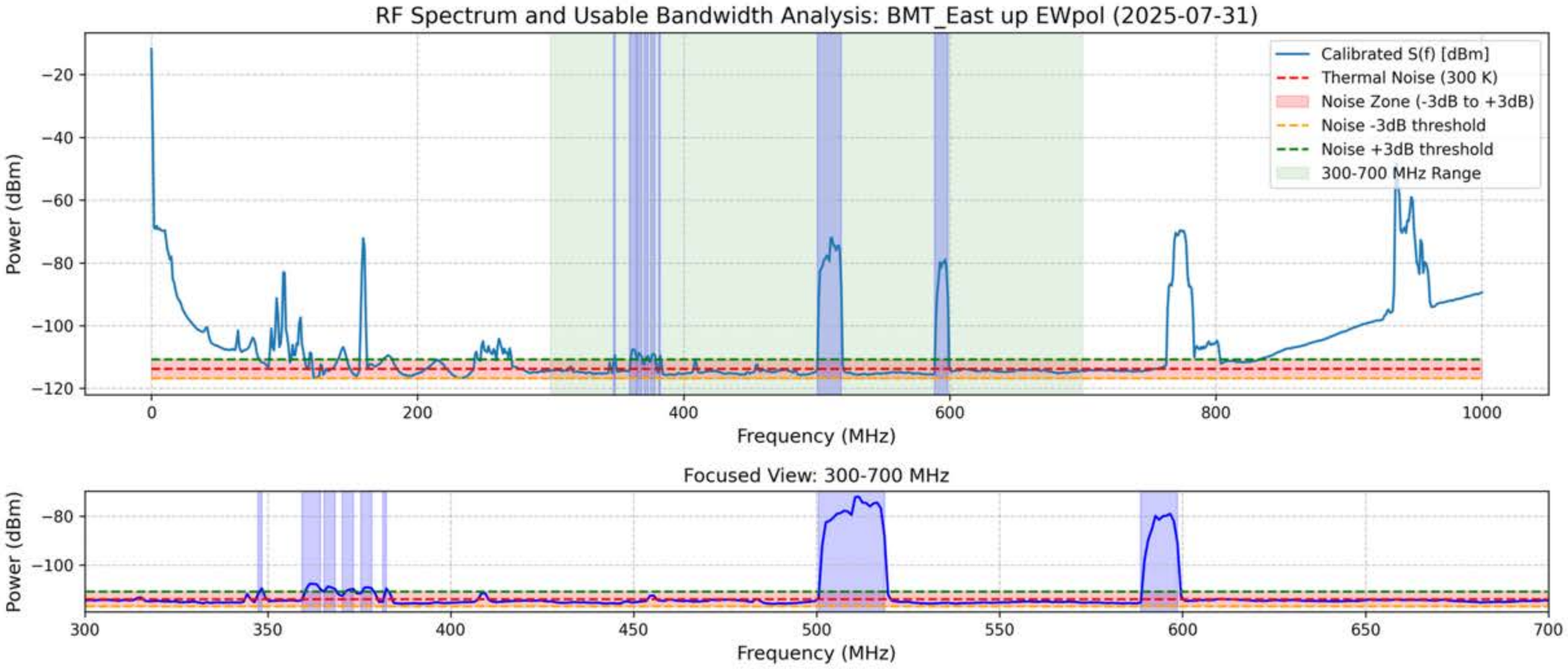
DINH MA THIEN



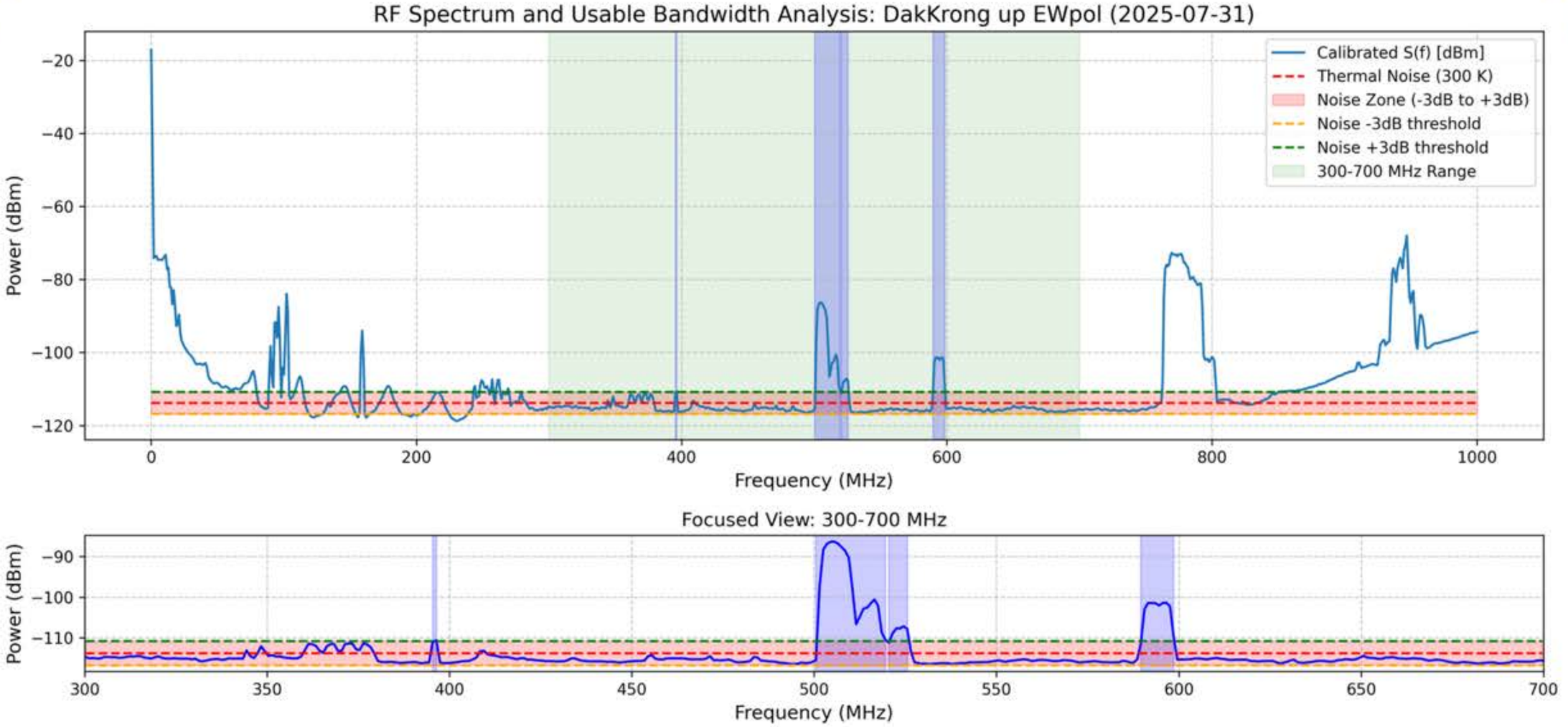
DINH MA THIEN



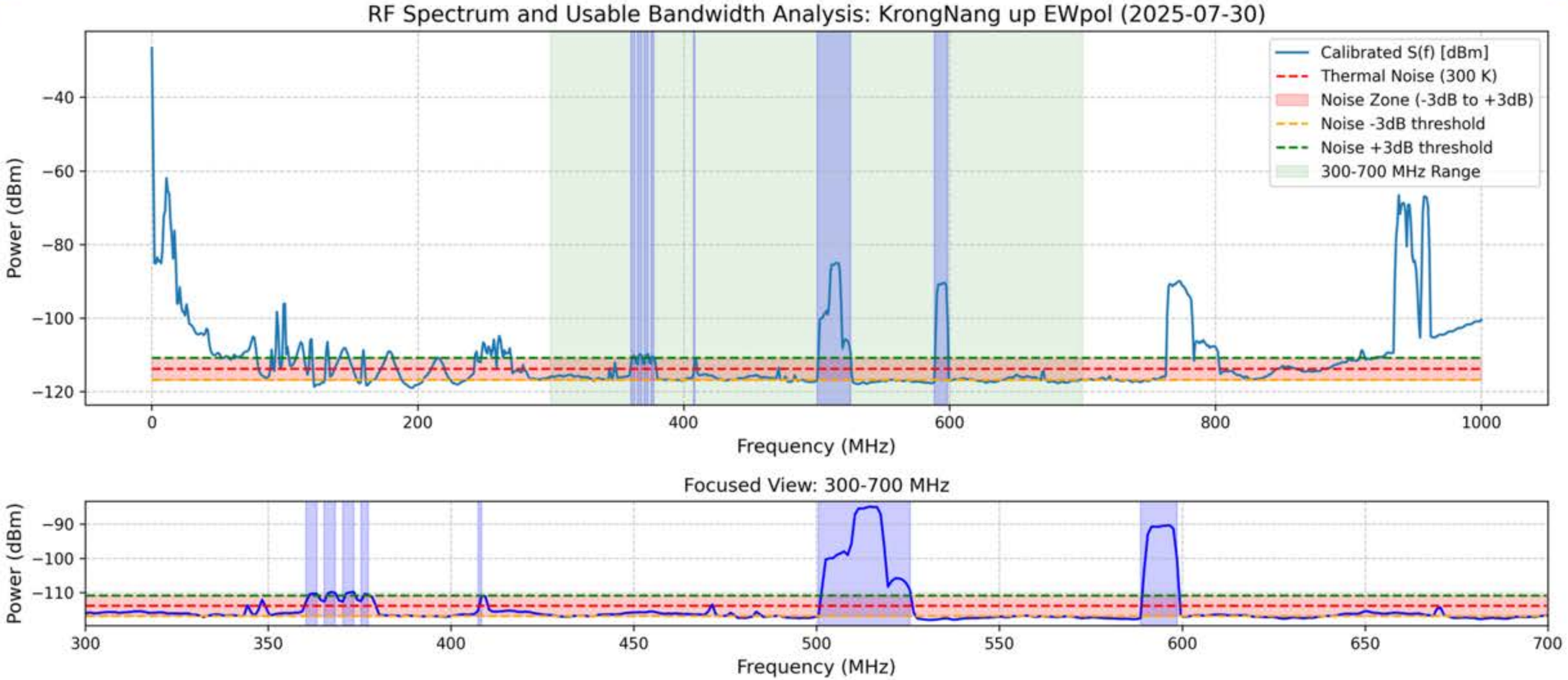
EASTERN SIDE OF BUON MA THUOT



DAK KRONG RIVER - BUON MA THUOT

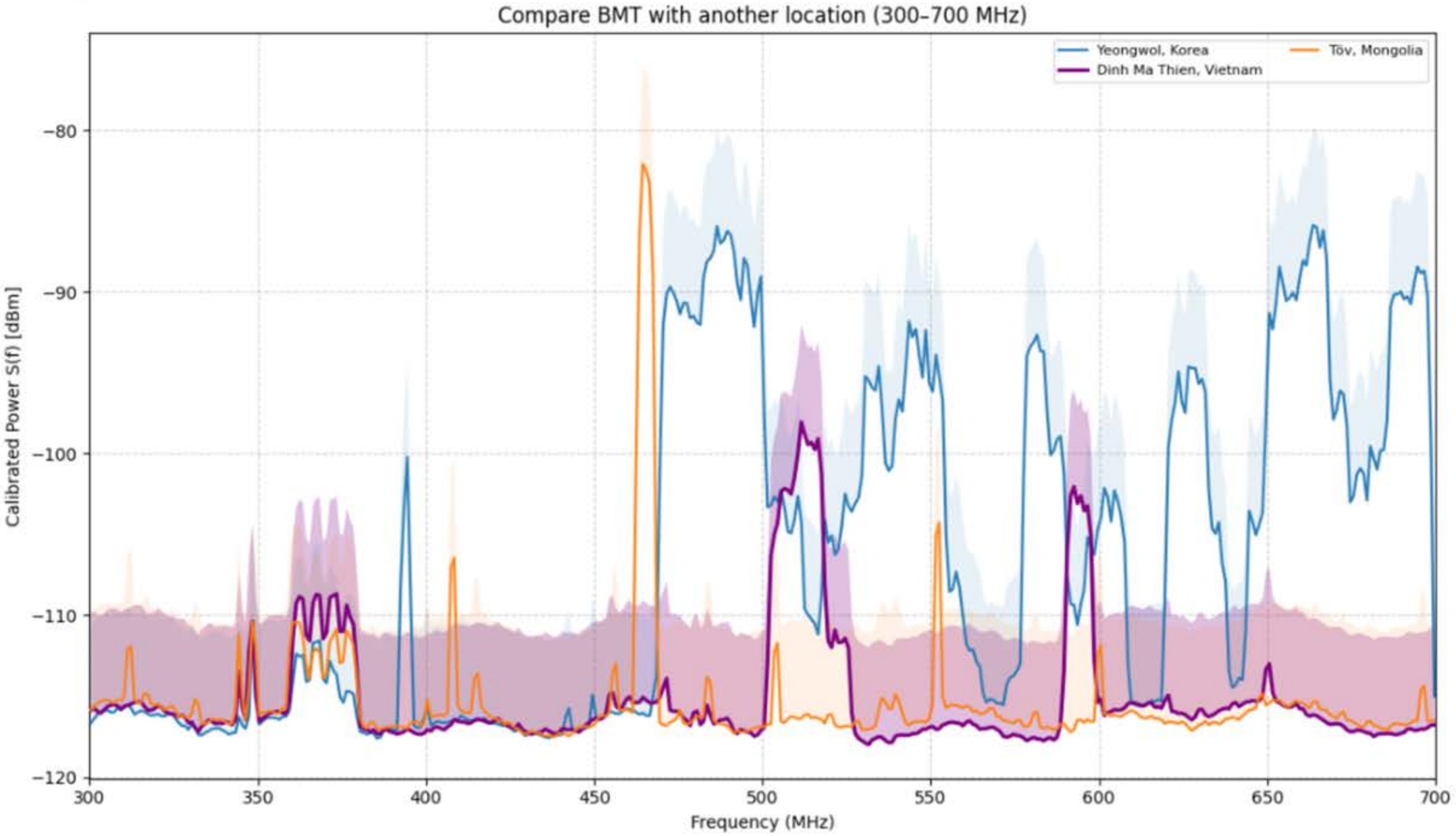


KRONG NANG DAK LAK



SUMMARY


Usable bandwidth width by Location in Vietnam (300-700 MHz)
Sum of Usable bandwidth width
380
375
370
365
360
355
350
381.0
377.0
373.0
372.0
Dinh Ma Thien, Gia Lai, Vietnam
Dak Krong river, Buon Ma Thuot, Vietnam
Krong Nang, Dak Lak, Vietnam
Eastern side of Buon Ma Thuot, Vietnam
Location


Compare BMT with another location (300–700 MHz)
Yeongwol, Korea
Dinh Ma Thien, Vietnam
Tõv, Mongolia
Calibrated Power S(f) [dBm]
−80
−90
−100
−110
−120
300
350
400
450
500
550
600
650
700
Frequency (MHz)

CONCLUSION

1. The results show a sligh difference in the amount of noise in each site.
2. These sites (except the BMT one) are pretty good for observation, no broadband RFI but only thermal noise.
3. The spectra for Korea and Taiwan are the quietest site we could find there. The Mongolia one is at almost an almost undeveloped region, and the results at Dak Lak are comparable.

THANK YOU FOR YOUR ATTENTION

Mr. Wang

Our source code can be found here:
https://drive.google.com/file/d/1XfWUVxT1EGb2DIb3YTL8CyeBGd-t8U46/view?usp=sharing