

Measurement results of radio noise over Sub-1 GHz band emitted from mini PC and laptop PC

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Introduction

The sub-1 GHz band is used by not only IEEE 802.11ah and IEEE 802.15.4, but also other radio systems. Moreover, several kinds of machinery emit powerful radio noise in this frequency band, and it may have a large impact on the system performance of wireless communication systems.

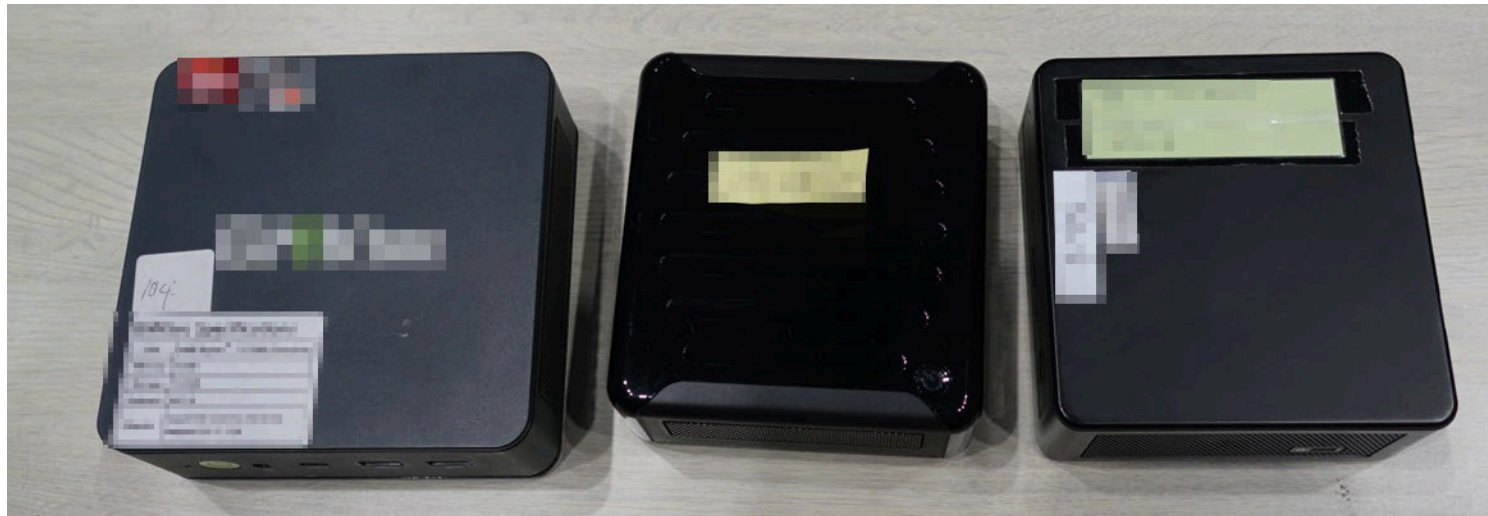
Initial measurement results of radio noise emission over the Sub-1 GHz bands from Mini PCs were reported [1].

This contribution reports new measurement results about...

- Radio noise emission from three mini PCs with new measurement setup (at different measurement distances from DUT).
- Radio noise emission from two laptop PCs.

DUTs (mini PCs)

We measured radio emission from three different mini PCs as in [1]. They are made in different countries/area.



Mini PC-C

Mini PC-B

Mini PC-A

CPU: AMD Ryzen 7 5700U
1.8-4.3 GHz

CPU: AMD Ryzen5 7535U
2.0-4.55 GHz

CPU: Intel Core i7-1165G7
2.8-4.7 GHz

DUTs (laptop PCs)

We also measured radio emission from two different laptop PCs. They are manufactured by different vendors.



Laptop PC-A

CPU: Intel Celeron 3865U (Kaby Lake), 1.8 GHz

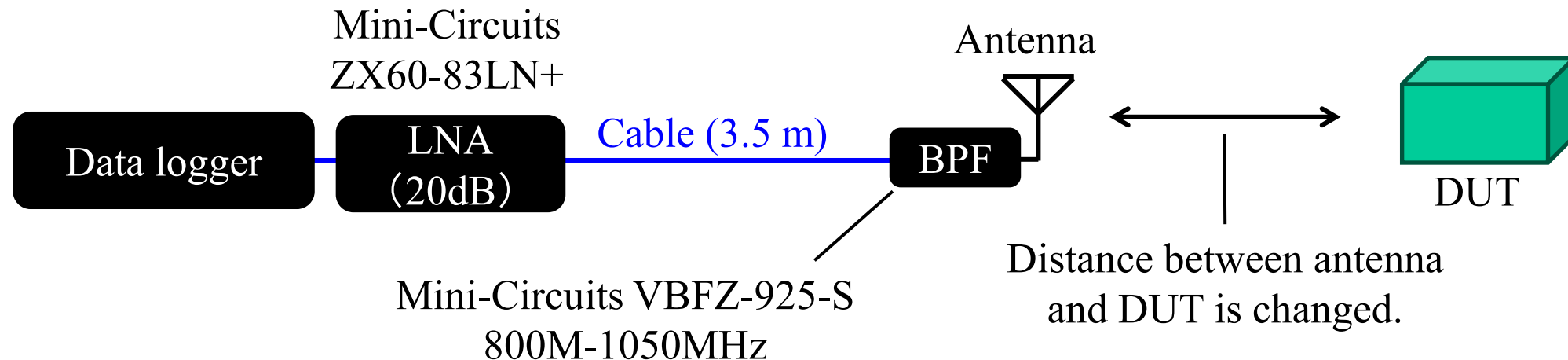


Laptop PC-B

CPU: Intel Core i5-7200U, 2.50-3.10 GHz

Measurement experiment

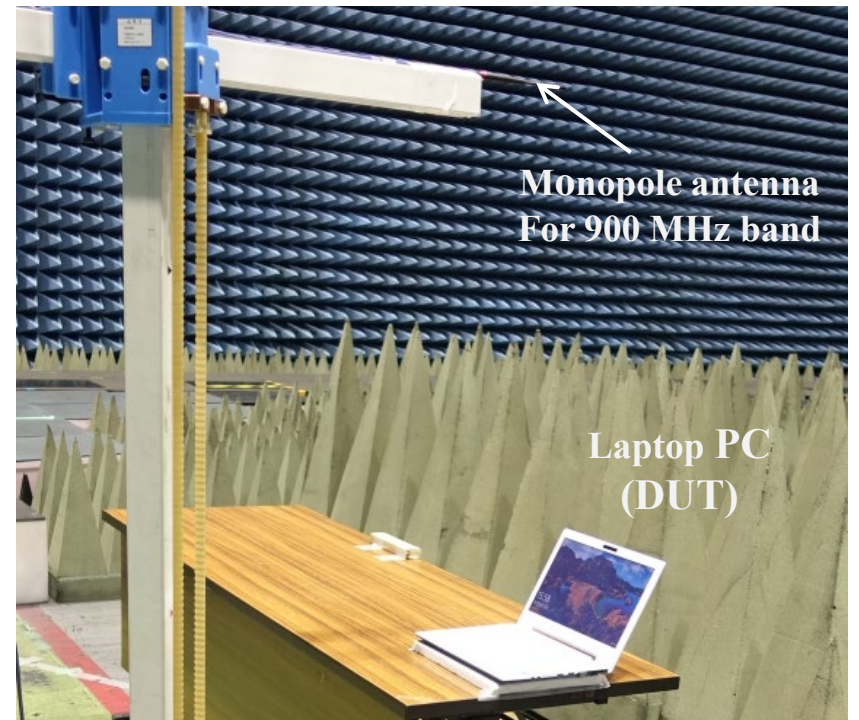
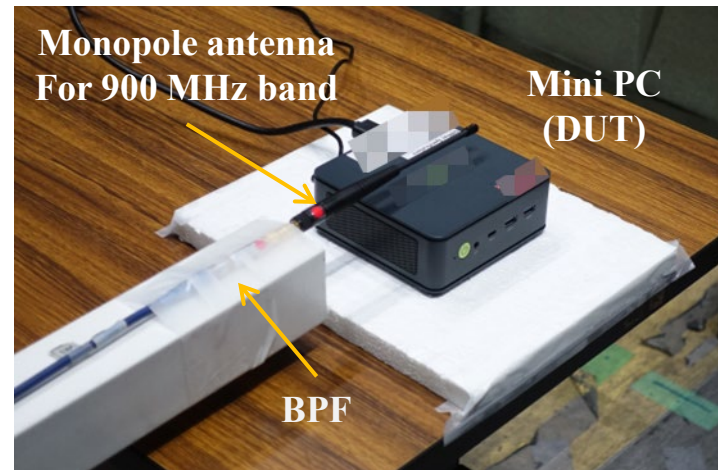
- We conducted measurement in an anechoic chamber. In the experiment, IQ sampling data was recorded by a data logger during 60 seconds in booting the PCs. Measurement covers the Sub-1 GHz bands in EU, USA (US) and Japan (JP).
- The recorded I/Q data was converted to spectrogram.



Configurations of measurement

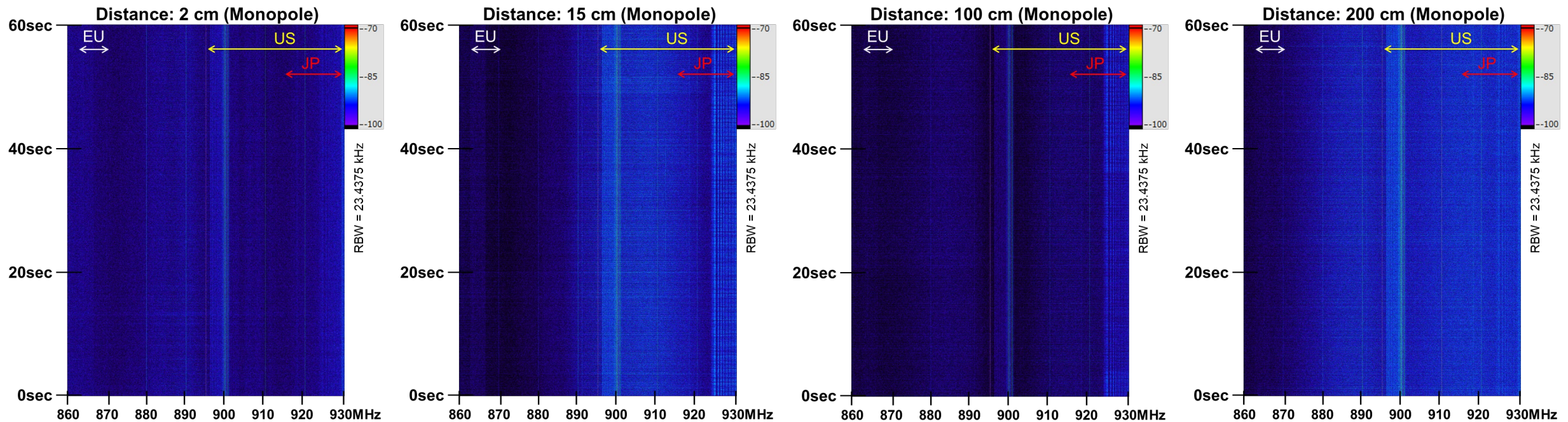
- **Sampling: 16-bit sampling for I/Q data @ 80 Msamples/s**
- **Center frequency: 895 MHz**
- **FFT size: 5120 (without overlapping)**
- **Window function: Hann window**
- **Antenna: Monopole antenna**
- **Measurement Distance: 2 cm, 15 cm, 100 cm, 200 cm**

Measurement environment



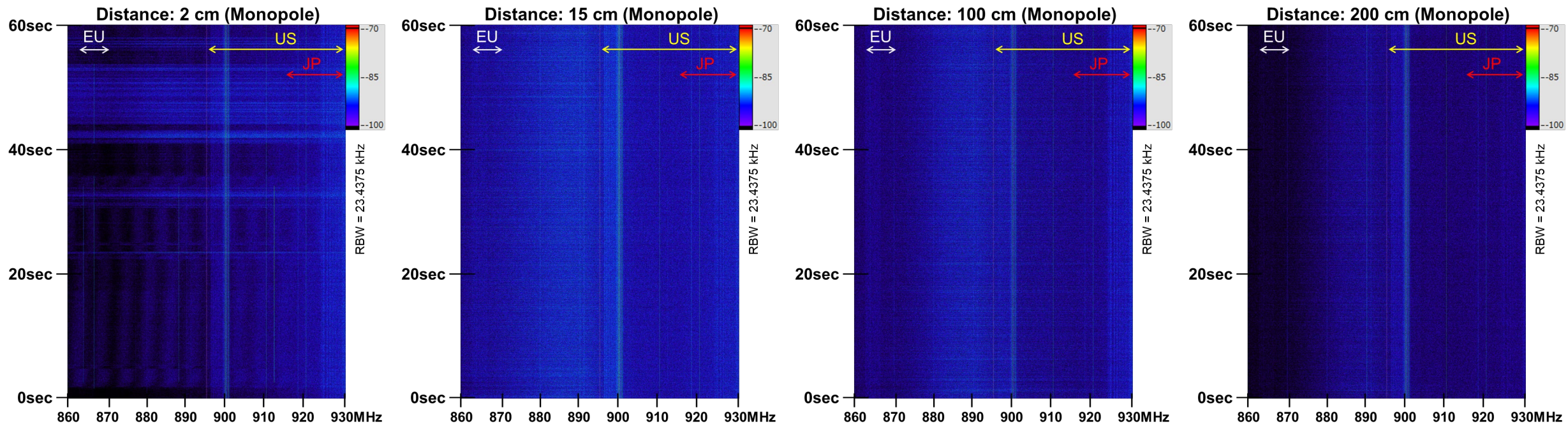
Measurement result for 60 seconds (without DUT)

- Radio emission from measurement equipment (data logger) is observed at some frequencies and measurement distances.



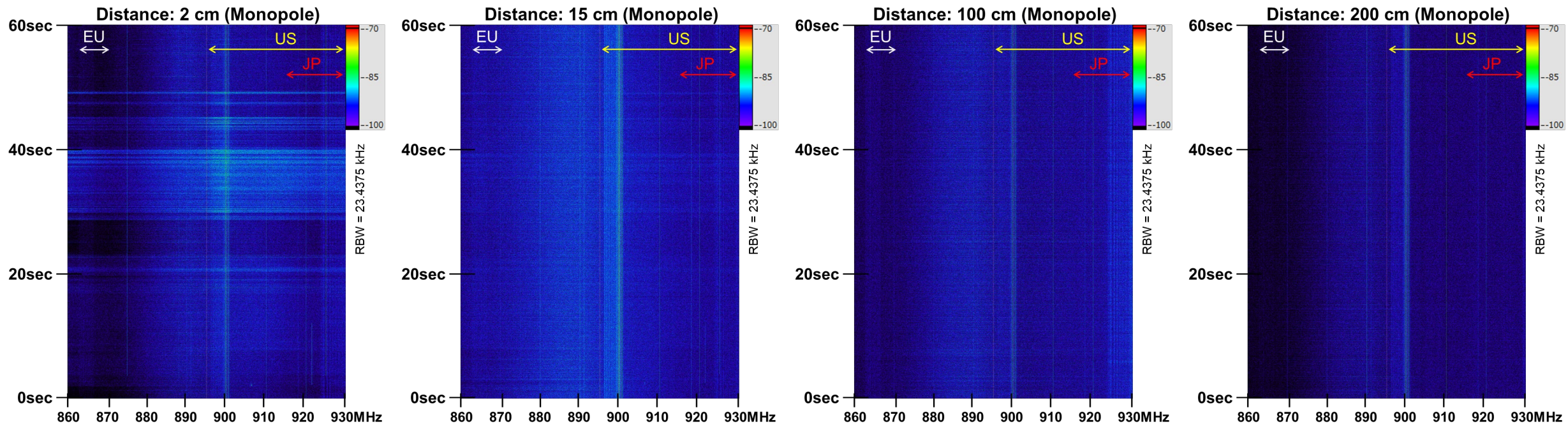
Measurement result for 60 seconds (mini PC-A)

- **Weak wideband radio emission is observed at 15 cm from mini PC-A. It may affect CCA results and/or transmission performance of IEEE 802.11/15.4 devices if they are operated at a low SNR.**



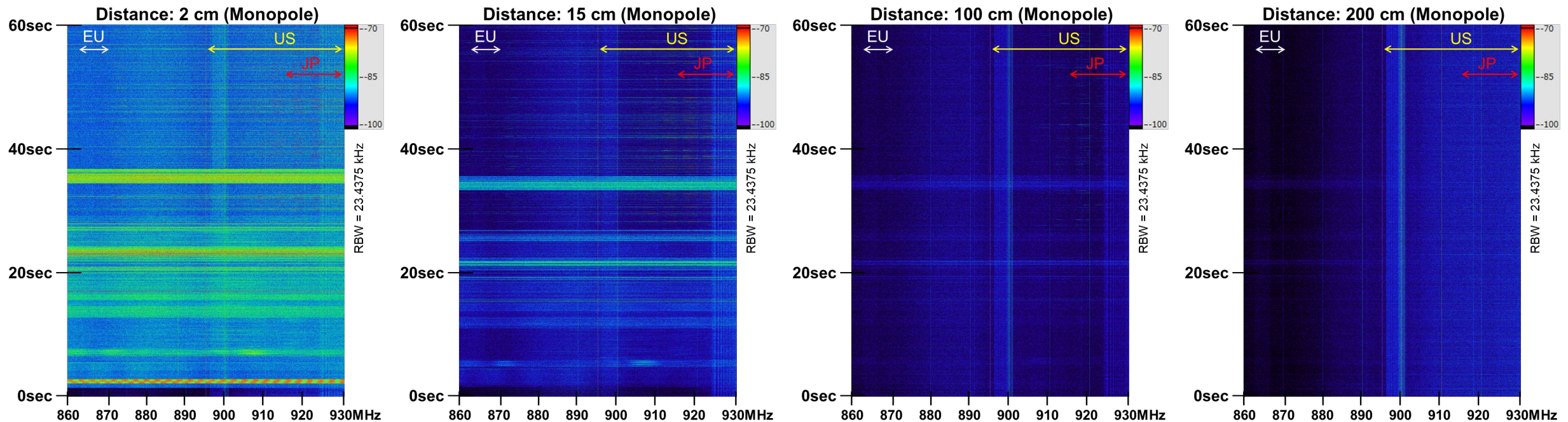
Measurement result for 60 seconds (mini PC-B)

- **Weak wideband radio emission is also observed at 15 cm from mini PC-B. It may affect CCA results and/or transmission performance of IEEE 802.11/15.4 devices if they are operated at a low SNR.**



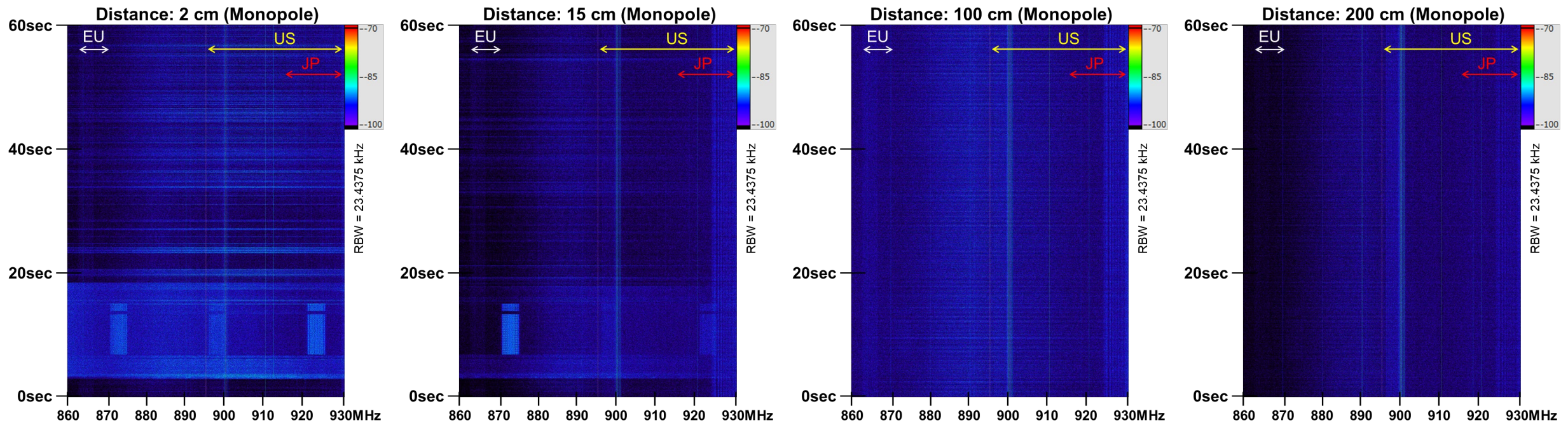
Measurement result for 60 seconds (mini PC-C)

- Strong wideband radio emission is observed at 15 cm from mini PC-C.
- Even at 100 cm, weak emission is observed.



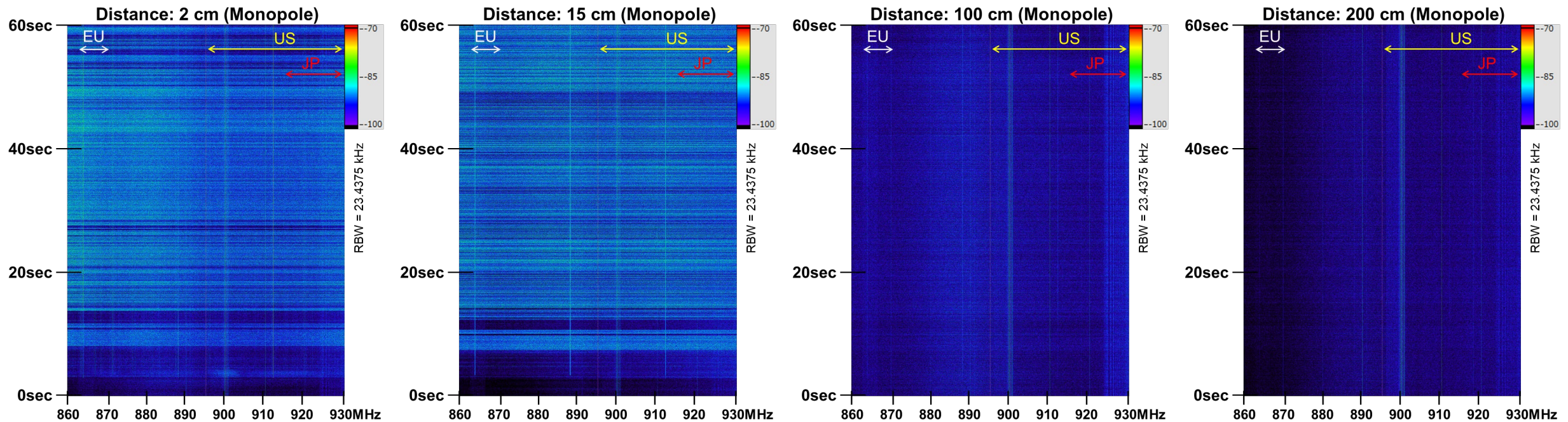
Measurement result for 60 seconds (laptop PC-A)

- Some band-and-time-limited radio emission is observed at several frequencies with an equal frequency interval.



Measurement result for 60 seconds (laptop PC-B)

- Strong radio emission is observed at 15 cm from laptop PC-B.
- Even at 100 cm, weak emission is observed.



Summary

- **We conducted measurement of radio noise emitted over the Sub-1 GHz bands from three mini PCs and two laptop PCs at different distances.**
- **One of mini PC and laptop PC emit wideband radio noise with a high duty. It is observed even at 100 cm from the noise sources. Such radio noise may affect CCA results and/or transmission performance of IEEE 802.11/15.4 devices if they are operated at a low SNR.**
- **Another laptop PC emits band-and-time-limited radio noise at a frequency interval. If there are various type of PCs around IEEE 802.11/15.4 devices, total emission pattern may become complex.**
- **We are planning to conduct an experiment to evaluate the impact of radio noise emission from various types of PCs on the communication performance of IEEE 802.11/15.4 devices.**

Reference

[1] doc. IEEE 802.19-24/0029r0