

Seasonal Characteristics of Overreach Interferences from Japan and Korea in Digital TV Waves

Shotaro Taniyama, Koichi Shin and Masahiro Nishi
 Graduate School of Information Sciences, Hiroshima City University,
 3-4-1, Ozuka-Higashi, Asa-Minami-ku, Hiroshima, Japan
 taniyama@wave.info.hiroshima-cu.ac.jp

Abstract – In western Japan, the terrestrial digital TV waves have possibilities of influences by co-channel overreach interferences from not only Japan but also Korea. We have been observing the interferences based on our original measurement method using FM waves for identifying the interference of TV wave. In this study, we evaluated seasonal characteristics of overreach interferences from Japan and Korea using our method. It was found that the main overreach interferences were from Korea, not from Japan.

Index Terms — Overreach Interferences, Digital TV waves, Analog FM waves, Ducting.

1. Introduction

In Japan and Korea, almost the same UHF (Ultra High Frequency) bands have been assigned for digital terrestrial TV broadcastings. Therefore it is important to clear overreach characteristics of UHF band TV waves to maintain a reception quality of TV services. In Kyushu and Chugoku region, western Japan, there exists some co-channel interferences of TV waves from Korea[1]. It is difficult to identify interferences of TV waves in this situation. To identify the source of the interference, the author have proposed a measurement method monitoring both RSSI (Received Signal Strength Indicator) and CNR (Carrier to Noise power Ratio) of the digital TV waves, and RSSI of FM broadcasting waves from several stations at the same time[2][3]. Based on the proposed method, we developed the measurement system to evaluate the co-channel interference in digital TV waves, and installed the system at KIT (Kyushu Institute of Technology) in Fukuoka prefecture. At the measurement point, there are some candidates of overreach interference sources transmitting TV waves with same frequency, not only in Korea but also in Japan.

In this study, we tried to estimate the seasonal characteristics of overreach interferences based on our proposed method, monitoring FM waves transmitted from stations nearby the several candidates of TV interference sources located in both Japan and Korea.

2. Measurement Method

We started measuring both TV waves and FM waves at KIT from September, 2014. Fig. 1 illustrated the proposed measurement method using TV waves and FM waves for identifying the interference source of the TV waves. TV0 is

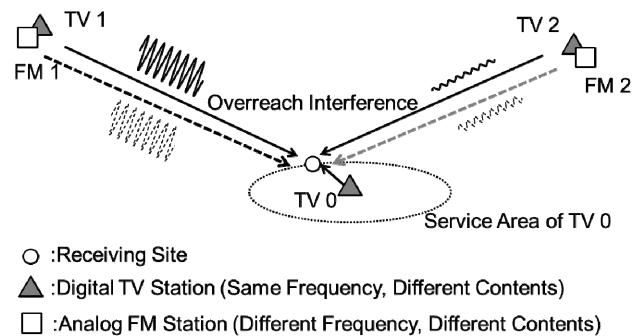


Fig. 1 Our proposed measurement method using TV and FM waves

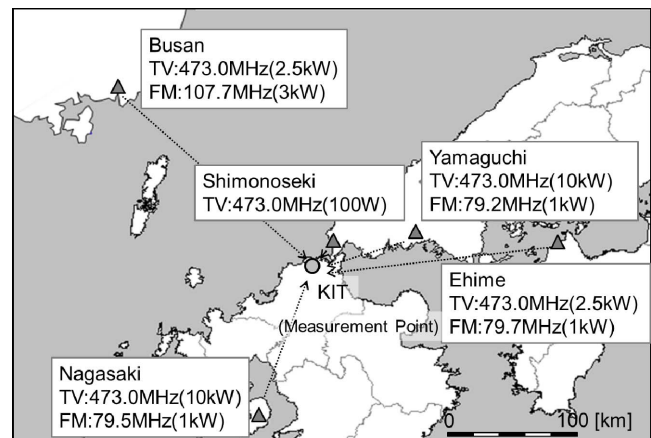


Fig. 2 Locations of the measurement point and the broadcasting stations of TV and FM waves

the desired TV waves in this measurement. And, there are TV1 and TV2 which use same frequency and difference contents. In this case, we aren't able to determine which TV is overreach interference, but by measuring FM1 and FM2 waves with different frequency and contents, we are able to identify the source of overreach interference.

Fig.2 depicts the measurement environment showing locations of broadcasting station of TV and FM waves and our measurement pointed installed at KIT. We tried to measure 473 MHz TV waves from Shimonoseki station as desired one. This frequency is used for TV waves from Yamaguchi, Ehime and Nagasaki in Japan, and Busan in Korea. In this environment, we also measure FM waves from the FM stations located near the TV stations.

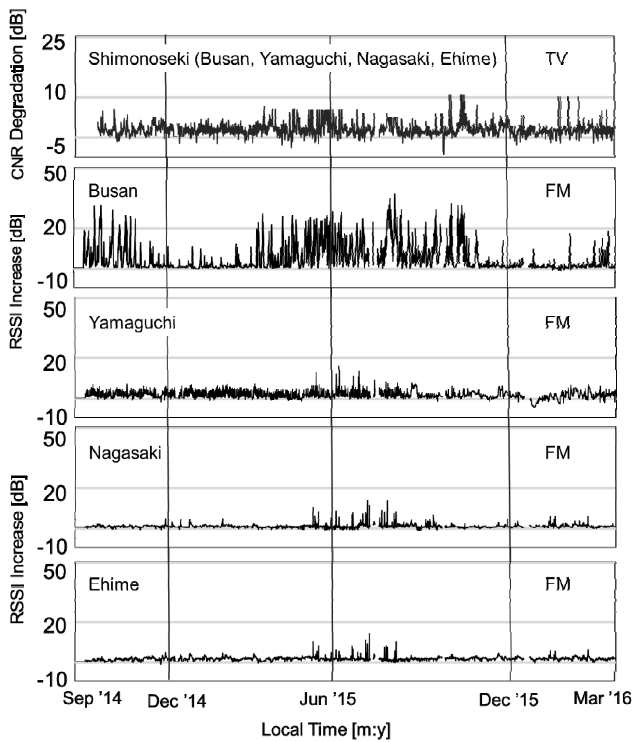


Fig. 3 Seasonal characteristics of CNR degradations and RSSI increases calculated from measurement data

3. Measurement results

In this study, to clarify seasonal characteristics of the overreach propagations, we tried to evaluate CNR degradations of TV waves and RSSI increases of FM waves. CNR degradations are defined as the difference between the mode value calculated every month and the cumulative 1% value of 3 hour CNR data. The RSSI increases are defined as the difference between the mode value calculated every month and the cumulative 99% value of 3 hours RSSI data.

Fig. 3 shows seasonal characteristics of CNR degradations and RSSI increases calculated from measurement data. We found that CNR degradations were large except for in winter season. And RSSI increases of FM waves from Busan were large as same as CNR degradations. On the other hand, we can found that RSSI increases were almost stable in FM waves from Japan. We confirmed that the RSSI of FM waves from Yamaguchi, Ehime and Nagasaki were measured around summer seasons in 2015, and variations of were caused by sporadic E layer.

Fig. 4 depicts cumulative probabilities in RSSI increases of FM waves from Dec. 2014 to Feb. 2015. We found that all measurement data have few difference in FM waves from both Japan and Korea. On the other hand, Fig. 5 depicts cumulative probabilities from Jun. 2015 to Aug. 2015. RSSI fluctuations of FM waves from Busan come to 21 dB with 10% of probability. But, RSSI fluctuations of Japan come to about 1 dB or 5 dB with 10% of probability. From these results, we found that almost all overreach interferences were mainly from Busan in summer.

From our measurement, it was found that when the CNR was decreased in TV waves, the overreach interferences were mainly from Busan in Korea not from Japan.

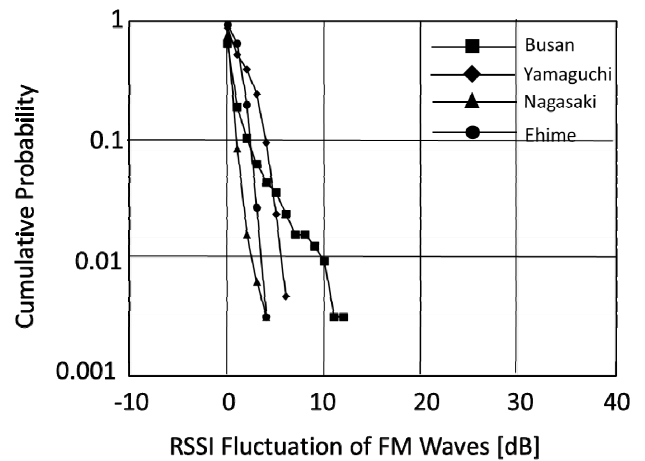


Fig. 4 Cumulative probabilities of RSSI of FM waves in winter (from Dec. 2014 to Feb. 2015)

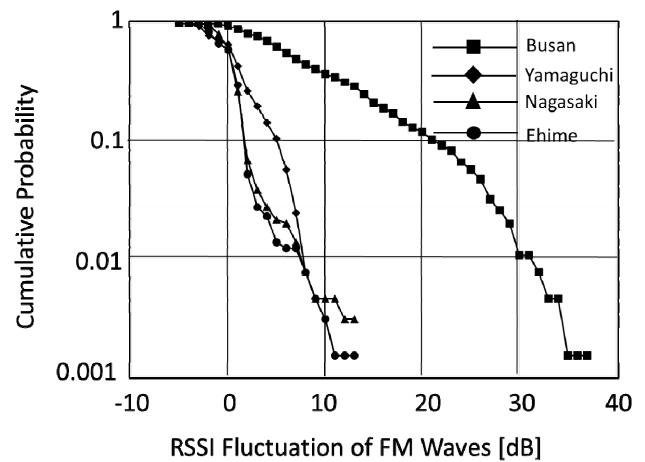


Fig. 5 Cumulative probabilities of RSSI of FM waves in summer (from Jun. 2015 to Aug. 2015)

4. Conclusion

In this study, we tried to estimate the overreach interference source based on our proposed method monitoring FM waves transmitted from both Japan and Korea. From our measurement results of seasonal characteristics in CNR degradations and RSSI increases, it was found that when the CNR was decreased in TV waves, the overreach interferences were mainly from Busan in Korea.

References

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