DSRC Exhibit A

Channel Sounding in the 2.4 GHz Band

Three are the most common sounding techniques for wideband mobile radio channels[1]: direct pulse, swept frequency measurement, and spread sliding correlator measurements. Out of the three, the most universal but sophisticated form of multipath analysis is the sliding correlator spread spectrum channel sounder. For spread spectrum wireless engineers, this approach has been an additional benefit because it mimics the type of transmission and reception hardware that is used in code division multiple access (CDMA) telephone systems. There are some commercial sounders where the RF transmitted stimulus signal and the analysis receiver are tuned to within the band to be measured and the results are calculated and displayed in real-time. Our approach utilizes an off-line system where we record the data in real time for further processing.

We will use two vehicles for our mobile-to-mobile channel characterization. In one vehicle, we will have the signal generation or transmission as show in Fig. 1.

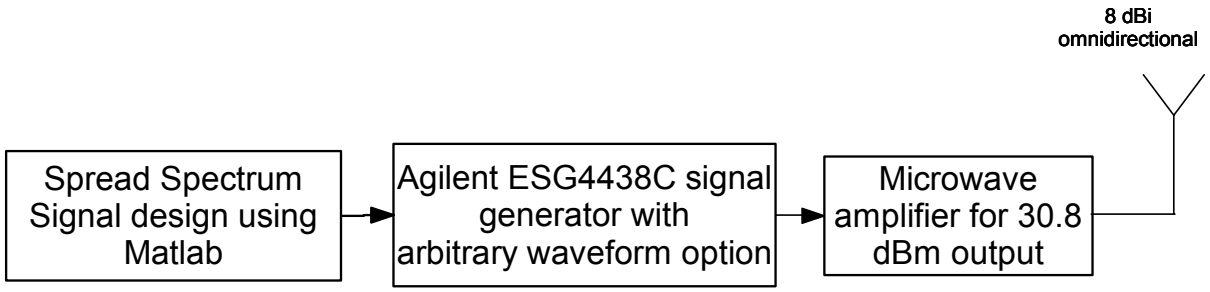


Figure 1. Channel Sounder Transmitter.

[1] Parsons, J. D.; Demery, D. A.; Turkmani, A. M. D., "Sounding techniques for wideband mobile radio channel: a review," *IEE Proceedings,* vol.138, No. 5, pp. 437-46, October 1991.

We will have the receiver in another vehicle. We show the receiver in Fig. 2.

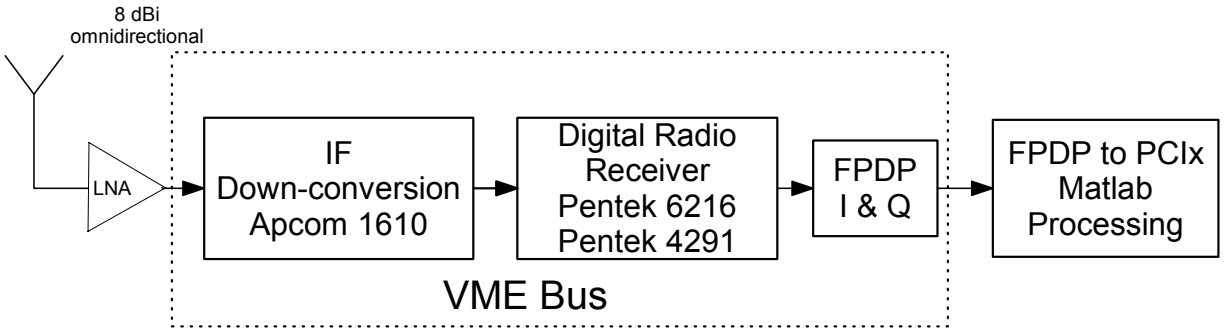


Figure 2. Channel Sounder Receiver.

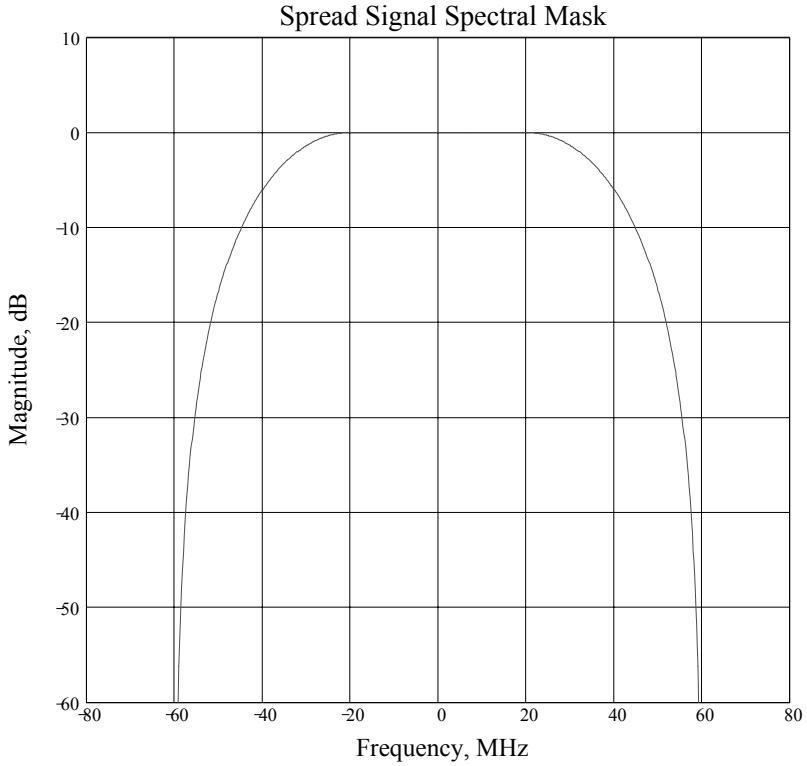
- Transmission signal

We plan to use a spread spectrum signal with the characteristics shown in Table 1.

Table 1. Channel Sounding Signal Specifications

Parameter	Value or Description
$T_c =$ chip period	25 nanoseconds
Spreading signal	Maximum length sequence (MLS) of order nine and length $2^9 - 1 = 511$
Primitive polynomial	$1 + x^4 + x^9$
Symbol modulation	bpsk
$T_b =$ symbol period	12.775 μs
Speed of keying	78277 bps
Code gain	54.16 dB
Bandwidth	40 MHz
Output Filter	Raised Cosine with rolloff factor $\beta = 0.5$

- Output Filter Mask


Spread Signal Spectral Mask
Magnitude, dB
10
0
-10
-20
-30
-40
-50
-60
-80
-60
-40
-20
0
20
40
60
80
Frequency, MHz