Title:	Proposed Ray Mapping Text
File:	SCM-102_Ray_Mapping_Text.doc
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1. SUMMARY

This contribution provides text for a method of mapping arbitrary channel rays to discrete receiver samples for use in system simulations. This text is based on [1].

2. PROPOSED TEXT FOR RAY MAPPING

The following procedure is used to downsample the effective channel impulse response (including transmit and receive filters) for use with various discrete-time receiver algorithms. Figure 1 shows a block diagram of the effective continuous-time channel impulse response.

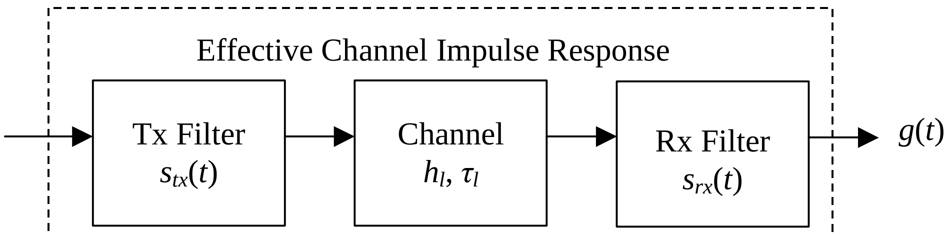

Figure 1. Continuous-time channel impulse response.

Step 1: Produce a 1/16 chip sampled version of the combined transmit and receive filters.

The convolution and sampling of the transmit and receive filters is shown in the equations below:

$$s(t) = s_{tx}(t) \otimes s_{rx}(t),$$

$$\mathrm{s}(n) = s(nT_s),$$

where s(n) is the sampled version of the combined Tx-Rx filter, $s(t)$ is the continuous time version of combined Tx-Rx filter, and T_s is the sampling interval of 1/16th of a chip.

Step 2: Quantize the channel ray delays.

Adjust the time delay of each ray produced by the SCM channel model to the nearest 1/16th chip interval,

$$n_l = fix\left(\frac{\tau_l}{T_s} + 0.5\right),$$

where τ_l is the continuous-time delay of the l-th ray, and n_l is the quantized delay in 1/16 chip samples of the l-th ray.

Step 3: Produce samples of the effective channel impulse response.

Based on the quantized transmit filter, the received samples can be expressed as:

$$g(m) = \sum_{l=1}^{L} h_l \cdot s(M \cdot m - n_l),$$

where g is the decimated version of the effective channel impulse response, M is the decimation factor (M=16 corresponds to chip spaced receiver sampling), s is the discrete-time version of the transmit filter sampled at 16 samples per chip, and h_l is the complex amplitude of the l-th ray. Figure 2 graphically represents the procedure.

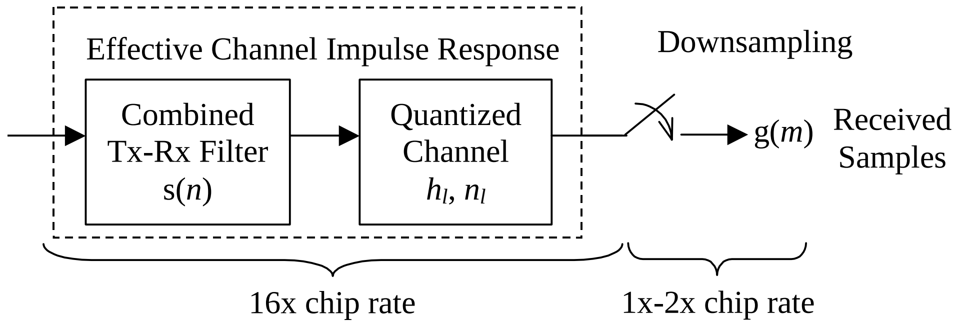

Figure 2. Channel impulse response with sampling.

Note that the final impulse response can be sampled at a rate of 1 or 2 samples per chip, depending on the receiver implementation.

3. CONCLUSIONS

Text was presented on an efficient channel impulse response sampling method that can be seen as a generalization of the methods of [2] and [3], allowing fractionally spaced equalizers and arbitrary choices of transmit and receive filters, while faithfully representing the spatial and temporal characteristics of the channel.

4. REFERENCES

[1] SCM-092, Motorola, "Details on Mapping Channel Rays to Samples for System Simulations," January 2003.

[2] SCM-087, Ericsson and Nokia, "Splitting Rays into Resolvable Paths," December 2002.

[3] SCM-088, Lucent, "Using the Unmodified Spatial Channel Model for System Simulations," December 2002.