Memory Sweep Analysis for Memorial Polynomials 2nd edition

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Contents

1 Introduction

In this document (as a continue of the previous report), we are going to start with analyze a calibration with considering 9th polynomial order since it is becoming non-neglible in the high frequency case if we look at the spectrums. The memory order will be 5 again, and you can find the related memory sweep table below for the first part of report.

Memory Sweep	$x(t)$	$x(t-1)$	$x(t-2)$	$x(t-3)$	$x(t-4)$	$x(t-5)$
$0b0000$	**Exists**	Not Exists	Not Exists	Not Exists	Not Exists	**Exists**
$0b0001$	**Exists**	Not Exists	Not Exists	Not Exists	**Exists**	**Exists**
$0b0010$	**Exists**	Not Exists	Not Exists	**Exists**	Not Exists	**Exists**
$0b0011$	**Exists**	Not Exists	Not Exists	**Exists**	**Exists**	**Exists**
$0b0100$	**Exists**	Not Exists	**Exists**	Not Exists	Not Exists	**Exists**
$0b0101$	**Exists**	Not Exists	**Exists**	Not Exists	**Exists**	**Exists**
$0b0110$	**Exists**	Not Exists	**Exists**	**Exists**	Not Exists	**Exists**
$0b0111$	**Exists**	Not Exists	**Exists**	**Exists**	**Exists**	**Exists**
$0b1000$	**Exists**	**Exists**	Not Exists	Not Exists	Not Exists	**Exists**
$0b1001$	**Exists**	**Exists**	Not Exists	Not Exists	**Exists**	**Exists**
$0b1010$	**Exists**	**Exists**	Not Exists	**Exists**	Not Exists	**Exists**
$0b1011$	**Exists**	**Exists**	Not Exists	**Exists**	**Exists**	**Exists**
$0b1100$	**Exists**	**Exists**	**Exists**	Not Exists	Not Exists	**Exists**
$0b1101$	**Exists**	**Exists**	**Exists**	Not Exists	**Exists**	**Exists**
$0b1110$	**Exists**	**Exists**	**Exists**	**Exists**	Not Exists	**Exists**
$0b1111$	**Exists**	**Exists**	**Exists**	**Exists**	**Exists**	**Exists**

Table 1: Memory sweep states considering 4 previous time steps

As a second part of this report, we are going to see the effect of the terms related to $x(t-5)$. We are going to exclude and include to see how much it contributes to calibration. To do so, we need a new memory sweep variable assignment. Then, we will analyze them in a single plot. We will focus on couple of cases like we did before. You can find the new memory sweep variables in the following table.

Memory Sweep	$x(t)$	$x(t-1)$	$x(t-2)$	$x(t-3)$	$x(t-4)$	$x(t-5)$
0*b*00000	**Exists**	Not Exists	Not Exists	Not Exists	Not Exists	Not Exists
0*b*00001	**Exists**	Not Exists	Not Exists	Not Exists	Not Exists	**Exists**
0*b*00010	**Exists**	Not Exists	Not Exists	Not Exists	**Exists**	Not Exists
0*b*00011	**Exists**	Not Exists	Not Exists	Not Exists	**Exists**	**Exists**
0*b*00100	**Exists**	Not Exists	Not Exists	**Exists**	Not Exists	Not Exists
0*b*00101	**Exists**	Not Exists	Not Exists	**Exists**	Not Exists	**Exists**
0*b*00110	**Exists**	Not Exists	Not Exists	**Exists**	**Exists**	Not Exists
0*b*00111	**Exists**	Not Exists	Not Exists	**Exists**	**Exists**	**Exists**
0*b*01000	**Exists**	Not Exists	**Exists**	Not Exists	Not Exists	Not Exists
0*b*01001	**Exists**	Not Exists	**Exists**	Not Exists	Not Exists	**Exists**
0*b*01010	**Exists**	Not Exists	**Exists**	Not Exists	**Exists**	Not Exists
0*b*01011	**Exists**	Not Exists	**Exists**	Not Exists	**Exists**	**Exists**
0*b*01100	**Exists**	Not Exists	**Exists**	**Exists**	Not Exists	Not Exists
0*b*01101	**Exists**	Not Exists	**Exists**	**Exists**	Not Exists	**Exists**
0*b*01110	**Exists**	Not Exists	**Exists**	**Exists**	**Exists**	Not Exists
0*b*01111	**Exists**	Not Exists	**Exists**	**Exists**	**Exists**	**Exists**
0*b*10000	**Exists**	**Exists**	Not Exists	Not Exists	Not Exists	Not Exists
0*b*10001	**Exists**	**Exists**	Not Exists	Not Exists	Not Exists	**Exists**
0*b*10010	**Exists**	**Exists**	Not Exists	Not Exists	**Exists**	Not Exists
0*b*10011	**Exists**	**Exists**	Not Exists	Not Exists	**Exists**	**Exists**
0*b*10100	**Exists**	**Exists**	Not Exists	**Exists**	Not Exists	Not Exists
0*b*10101	**Exists**	**Exists**	Not Exists	**Exists**	Not Exists	**Exists**
0*b*10110	**Exists**	**Exists**	Not Exists	**Exists**	**Exists**	Not Exists
0*b*10111	**Exists**	**Exists**	Not Exists	**Exists**	**Exists**	**Exists**
0*b*11000	**Exists**	**Exists**	**Exists**	Not Exists	Not Exists	Not Exists
0*b*11001	**Exists**	**Exists**	**Exists**	Not Exists	Not Exists	**Exists**
0*b*11010	**Exists**	**Exists**	**Exists**	Not Exists	**Exists**	Not Exists
0*b*11011	**Exists**	**Exists**	**Exists**	Not Exists	**Exists**	**Exists**
0*b*11100	**Exists**	**Exists**	**Exists**	**Exists**	Not Exists	Not Exists
0*b*11101	**Exists**	**Exists**	**Exists**	**Exists**	Not Exists	**Exists**
0*b*11110	**Exists**	**Exists**	**Exists**	**Exists**	**Exists**	Not Exists
0*b*11111	**Exists**	**Exists**	**Exists**	**Exists**	**Exists**	**Exists**

Table 2: Memory sweep states considering 5 previous time steps

Input and output voltage waveform spectrum are shown below

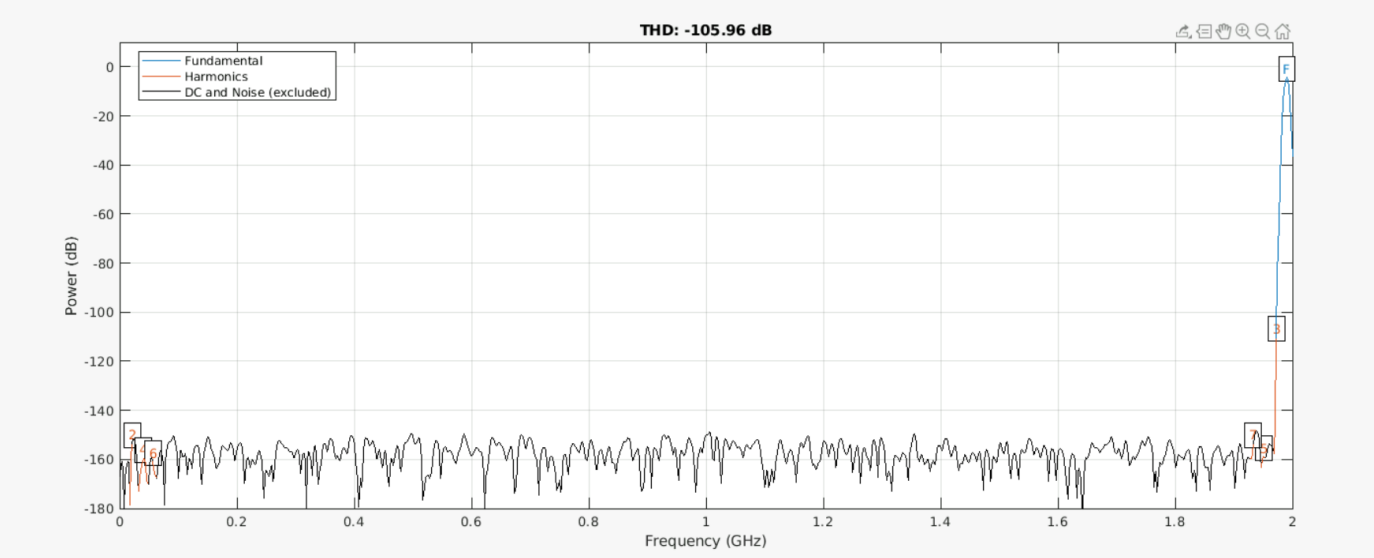

Figure 1: Input Voltage Waveform

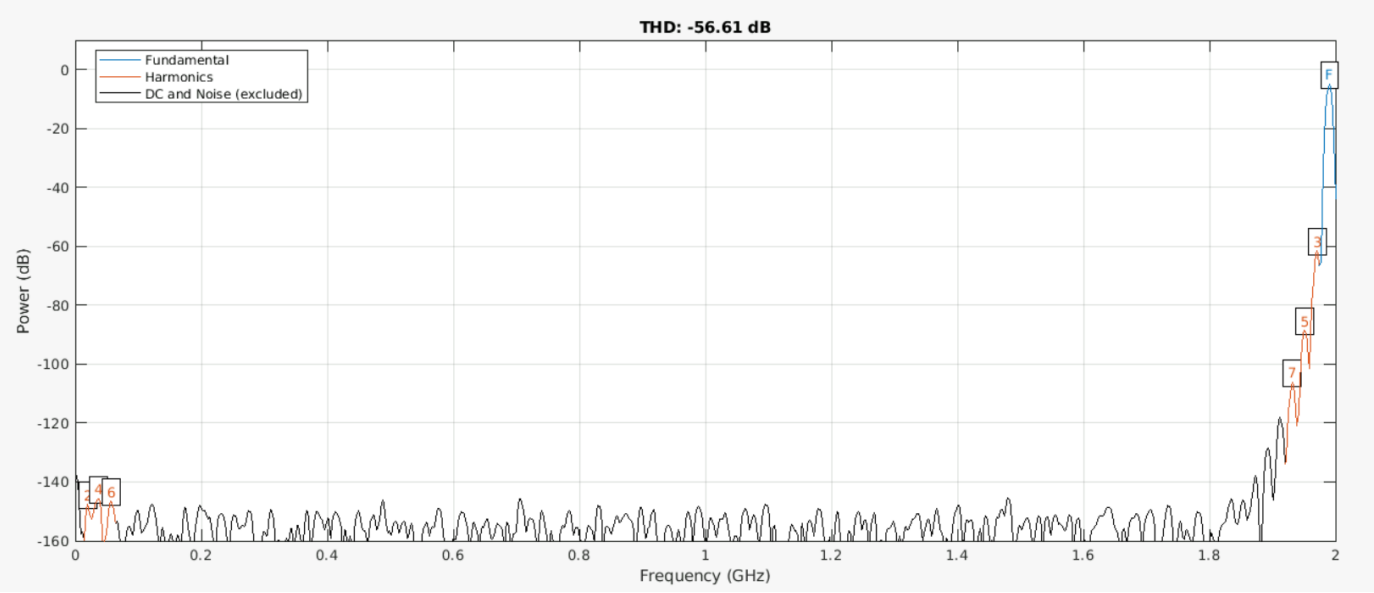

Figure 2: Output Voltage Waveform

2 Increasing polynomial order up to 9

These two subsection cases (polynomial order of 5 and 7) were already present in the previous report. However, in the previous report, the THD value was calculated up to 7th harmonics whereas now it is re-calculated based on up to 15th harmonics.

2.1 Polynomial Order: 5

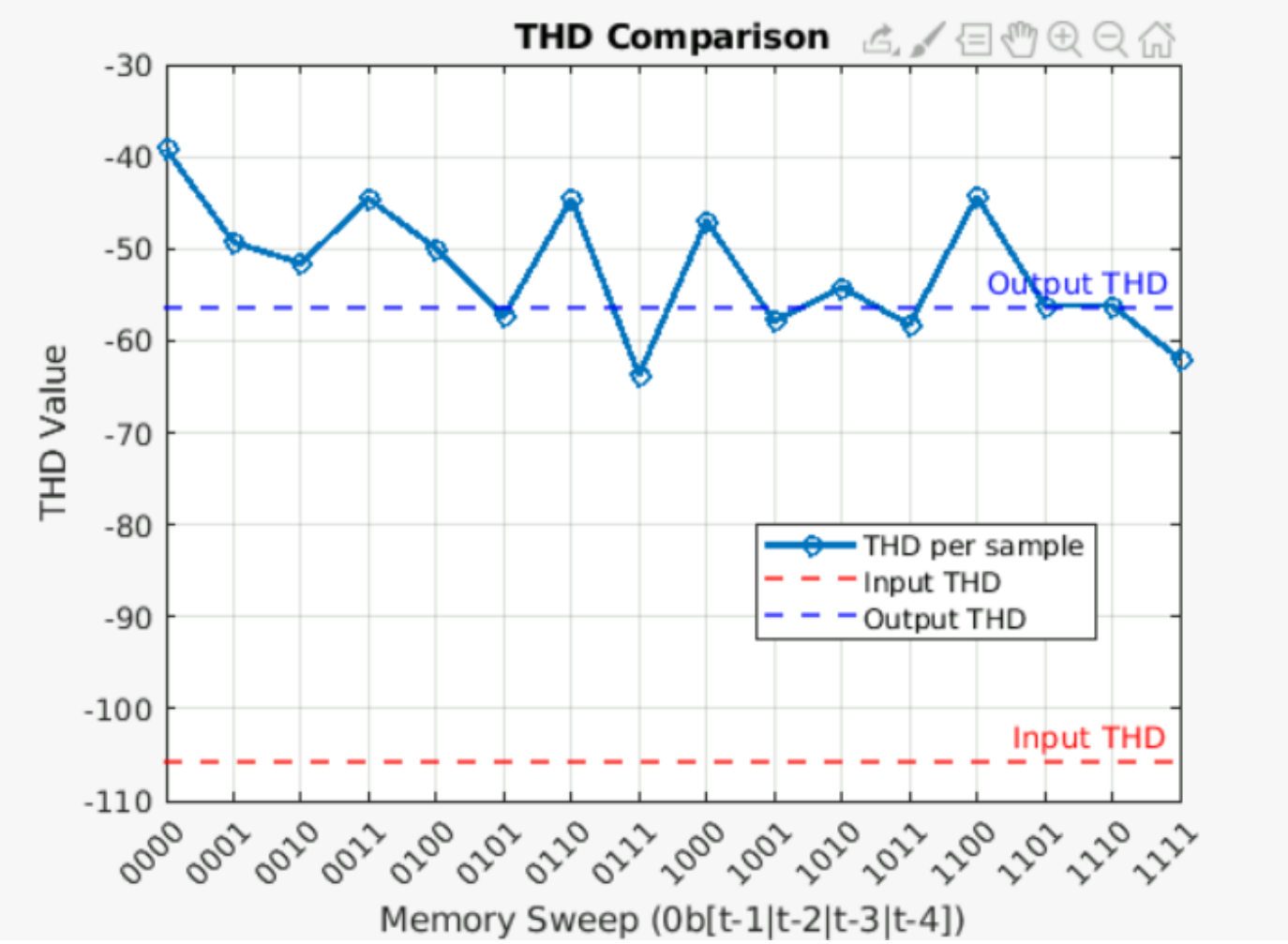

Figure 3: THD Values based on different memory sweep @ 2GHz

2.2 Polynomial Order: 7

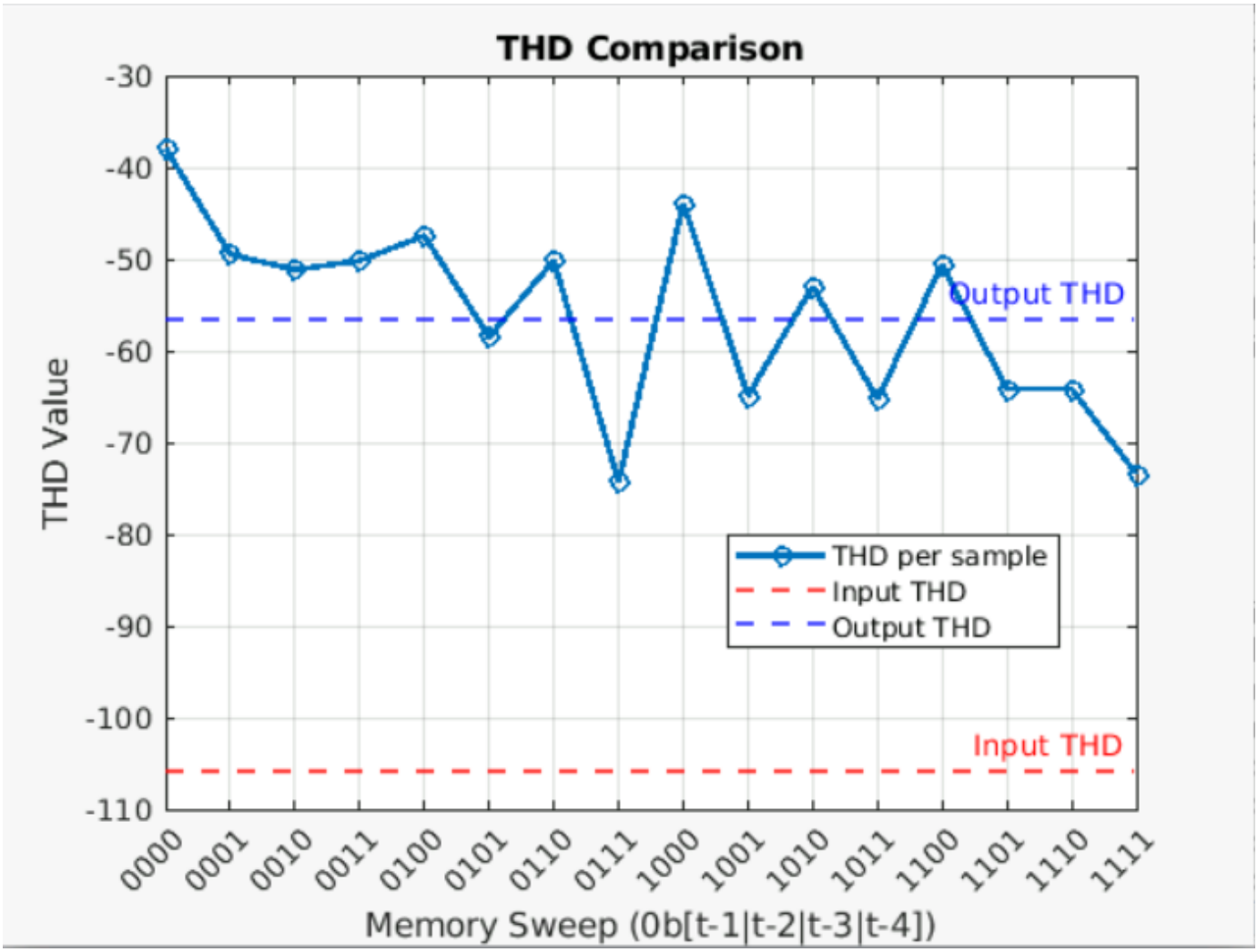

Figure 4: THD Values based on different memory sweep @ 2GHz

Plase note that cases 1111, 0111, and 1001 have the number of coefficients of *24, 20, and 16* respectively.

2.3 Polynomial Order: 9

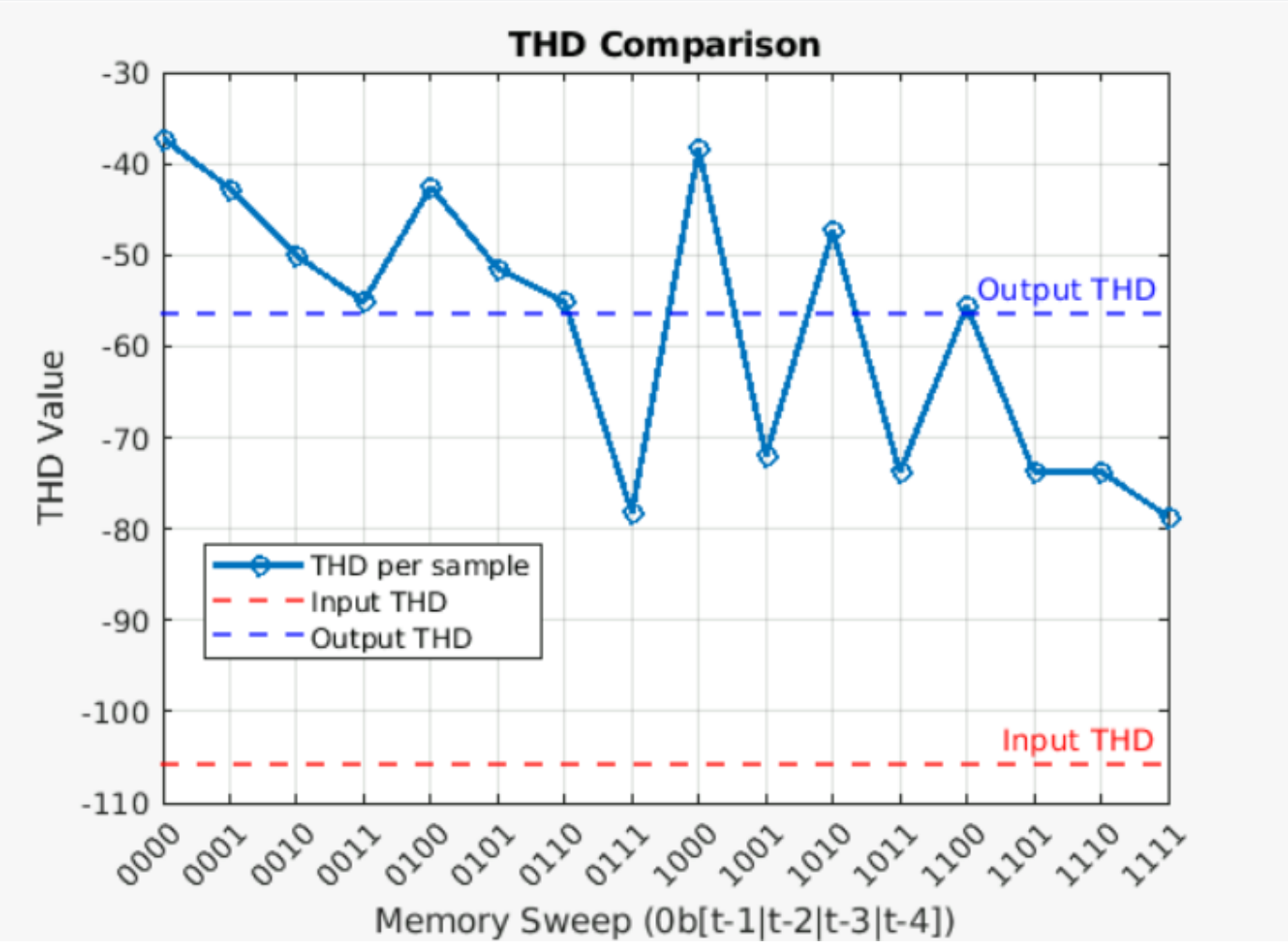

Figure 5: THD Values based on different memory sweep @ 2GHz

As shown in Figure 12 and Figure 11, there is nearly a 10 dB difference between the cases in terms of calibration performance. Therefore, we will analyze the same three cases: 1111, 0111, and 1001.

2.3.1 Memory Sweep 1111

As Table 1 and polynomial order of 9 shows that we have total of **30 coefficients**.

The calibrated voltage spectrum is

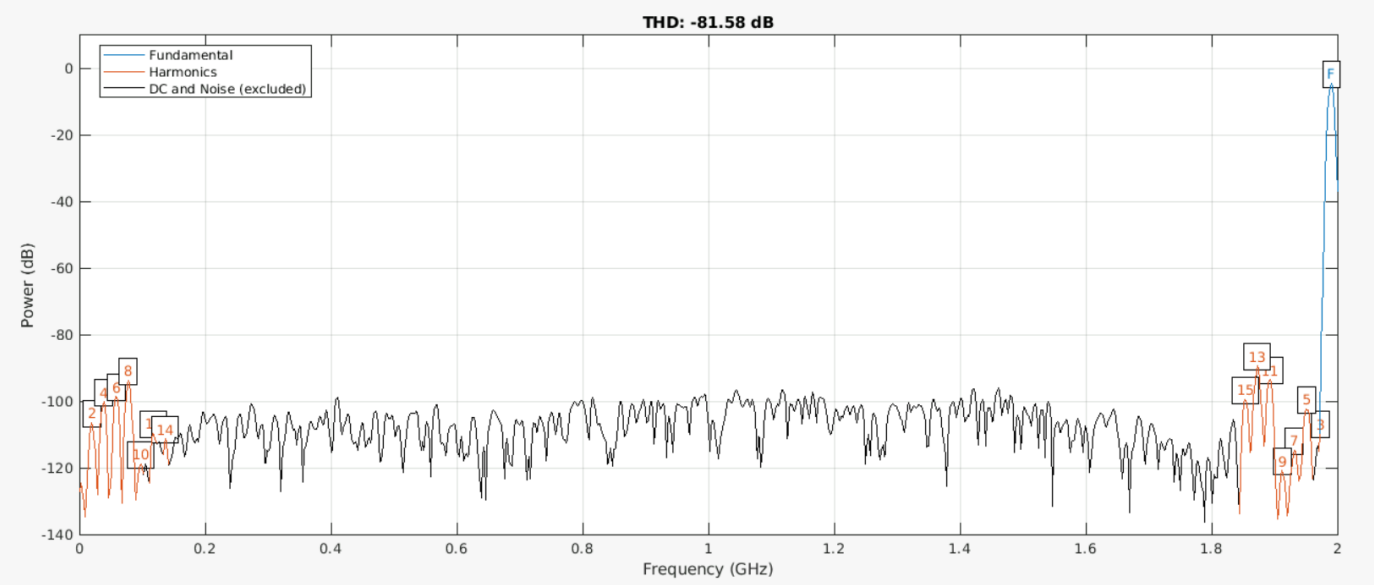

Figure 6: Calibrated output voltage waveform when memSweep is *0b1111*

2.3.2 Memory Sweep 0111

As Table 1 and polynomial order of 9 shows that we have total of **25 coefficients**.

The calibrated voltage spectrum is

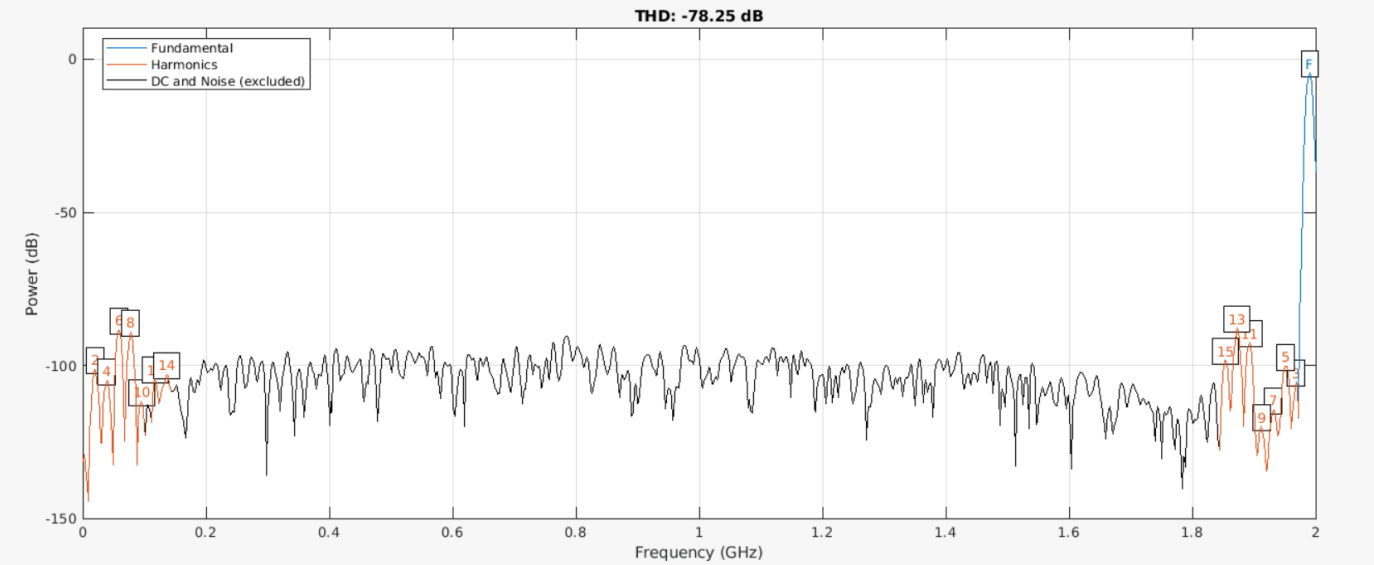

Figure 7: Calibrated output voltage waveform when memSweep is *0b0111*

2.3.3 Memory Sweep 1001

As Table 1 and polynomial order of 9 shows that we have total of **20 coefficients**.

The calibrated voltage spectrum is

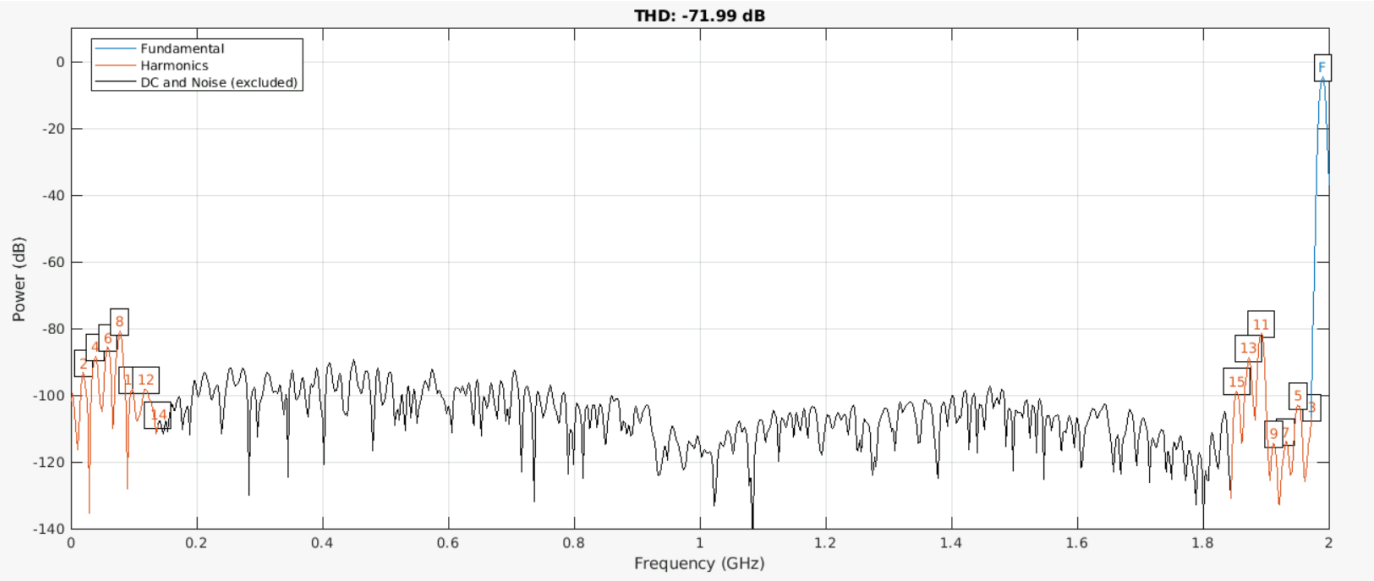

Figure 8: Calibrated output voltage waveform when memSweep is *0b1001*

3 Effects of $x(t-5)$ terms

3.1 Polynomial order: 3

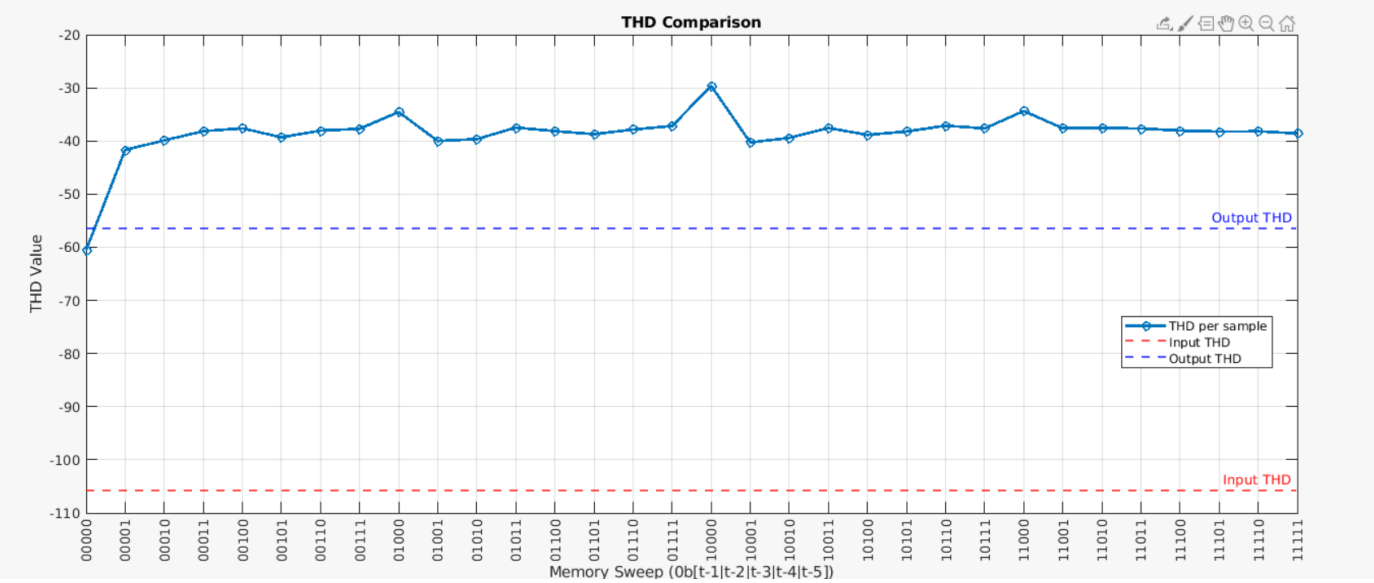

Figure 9: THD Values based on different memory sweep and polynomial order of 3 @ 2GHz

As expected, the calibration is not working at all since the polynomial order is 3.

3.2 Polynomial order: 5

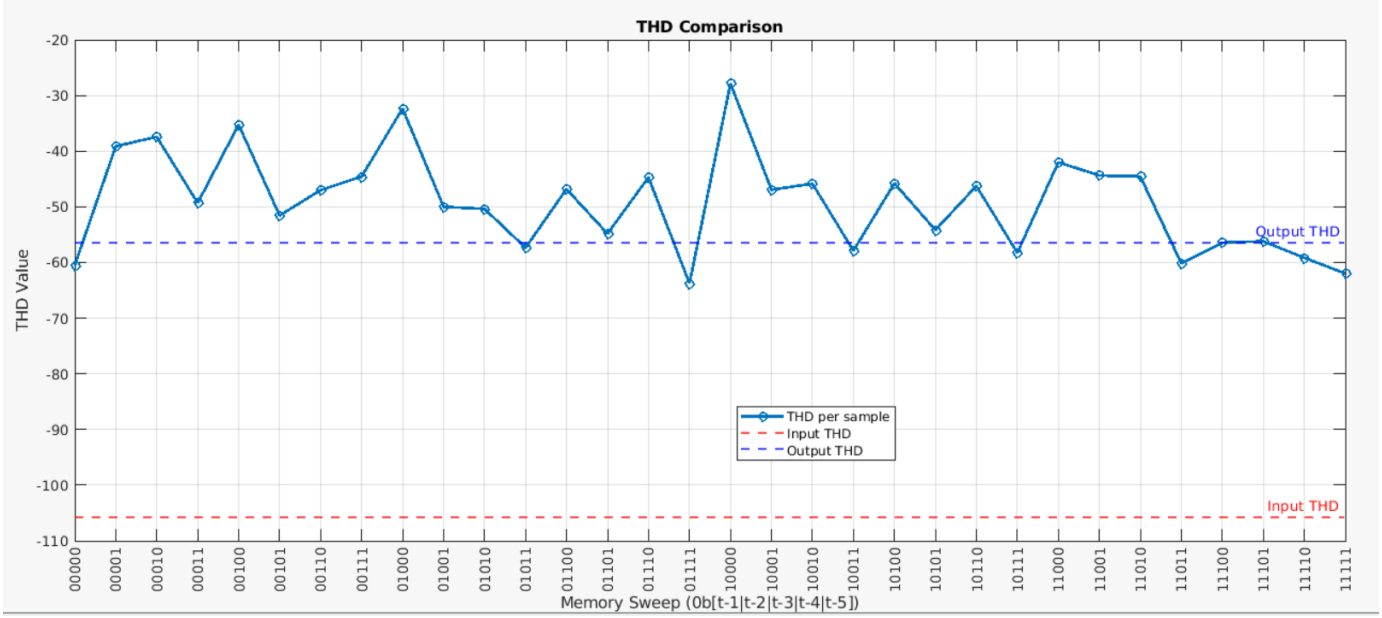

Figure 10: THD Values based on different memory sweep and polynomial order of 5 @ 2GHz

As we discussed in the before the report ad section, 5th order polynomial is just enough to calibrate the voltage waveform. Therefore, there is no case that is needed to investigate their spectrum in detail.

3.3 Polynomial order: 7

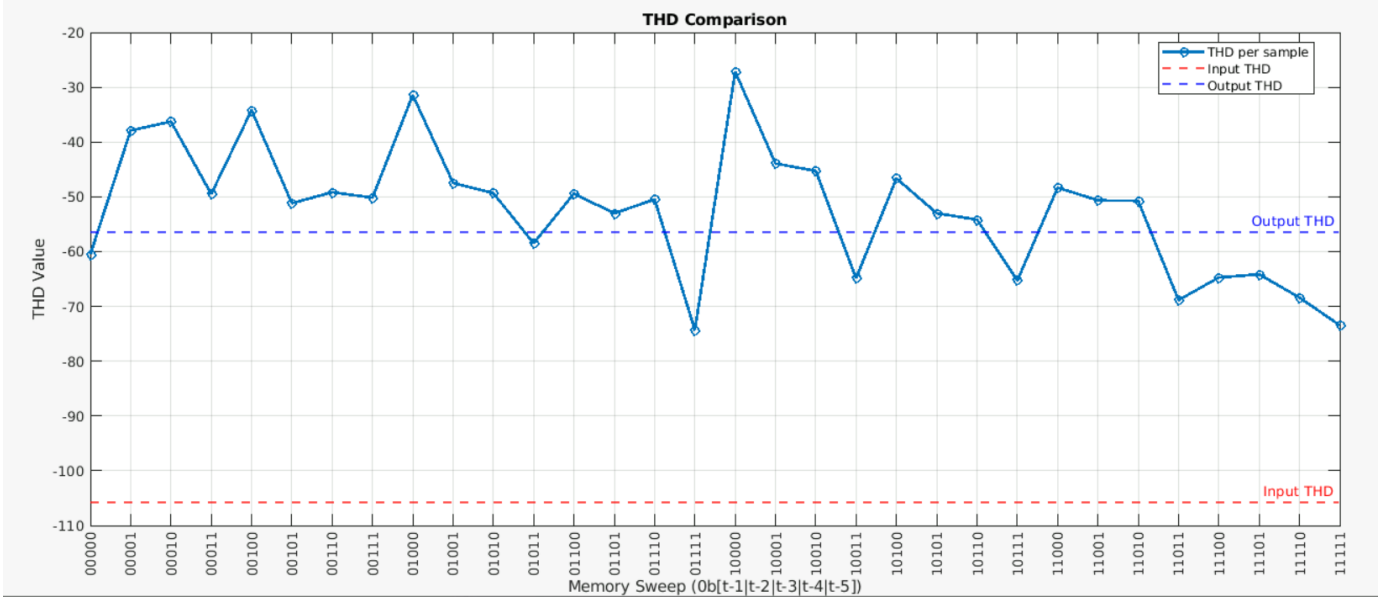

Figure 11: THD Values based on different memory sweep and polynomial order of 7 @ 2GHz

As Figure 11 represents, the system is getting calibrated up to nearly 80 dB. To be more specific, there might be worth to mention for some cases, *01111*, *10011*, *11011*, and *11111*. However, as it can be seen from the Figure 11 and the Table 2, if we have a 1 in the LSB bit position, it means we have the term x(t-5), which is already discussed in the previous report.

3.4 Polynomial order: 9

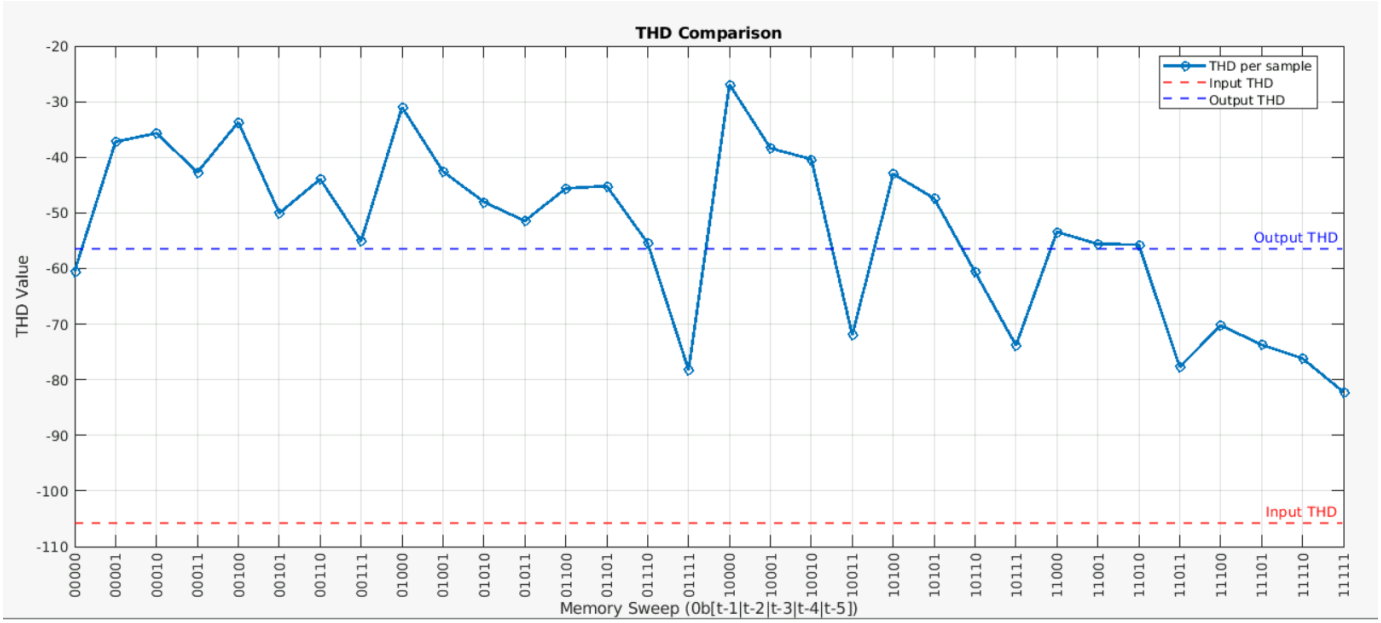

Figure 12: THD Values based on different memory sweep and polynomial order of 9 @ 2GHz

As in the case of polynomial order of 9, it has getting quite good results, and the same problem is still present. Furthermore, if you take a look at the cases where the x(t-5) terms are not present, it is obvious that cases 11110 and 11100 are giving the best results among them. As the Table 2 presents, they are basically memory order of 4 and 3 respectively, which is expected.

4 Memory Sweep For Order 7

In this section, we will try to increase the order of memory to see how the resulting THD changes. The main idea for the memorySweep variable is similiar to Table 2 and Table 1. Therefore, its full table won't be present in here.

Also, when the order is 7, as you might realize the number of cases become 127 ($= 2^7 - 1$). Therefore, its plot won't be easy to understand. To solve this issue, only fifty cases who has the least THD values will be plotted in the figures.

TODO: COMMENTS

4.1 Polynomial order : 3

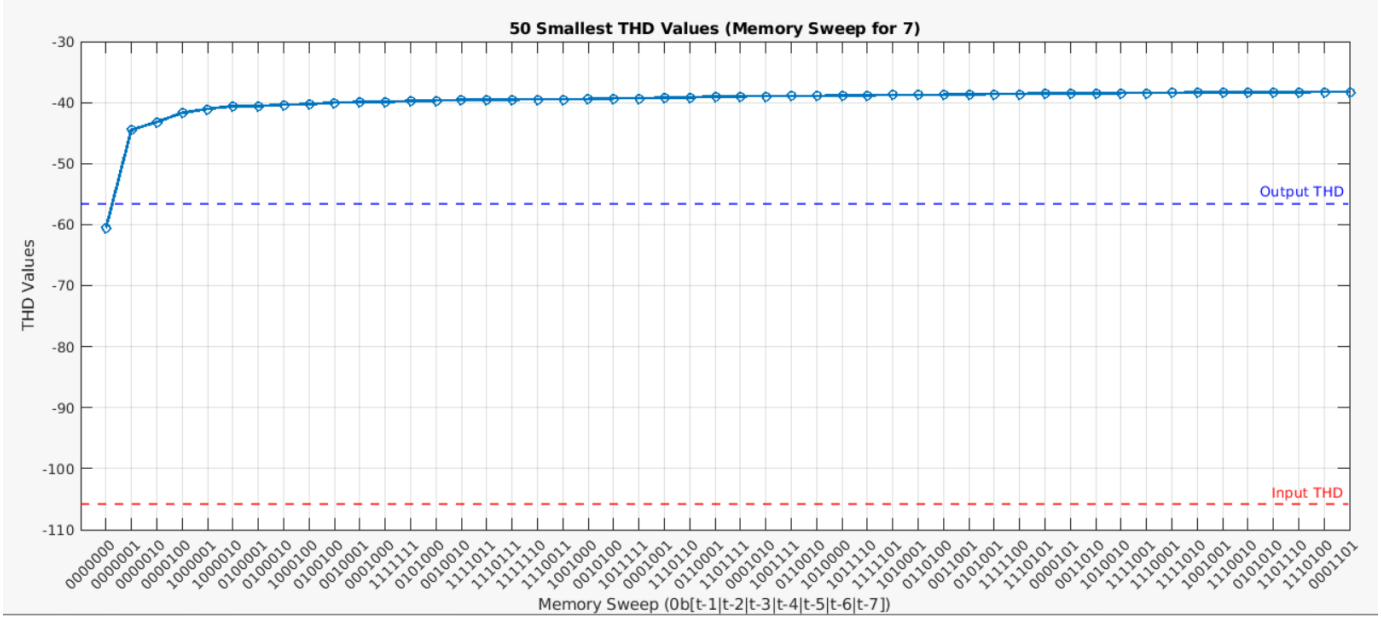

Figure 13: THD Values based on different memory sweep and polynomial order of 3 @ 2GHz

4.2 Polynomial order : 5

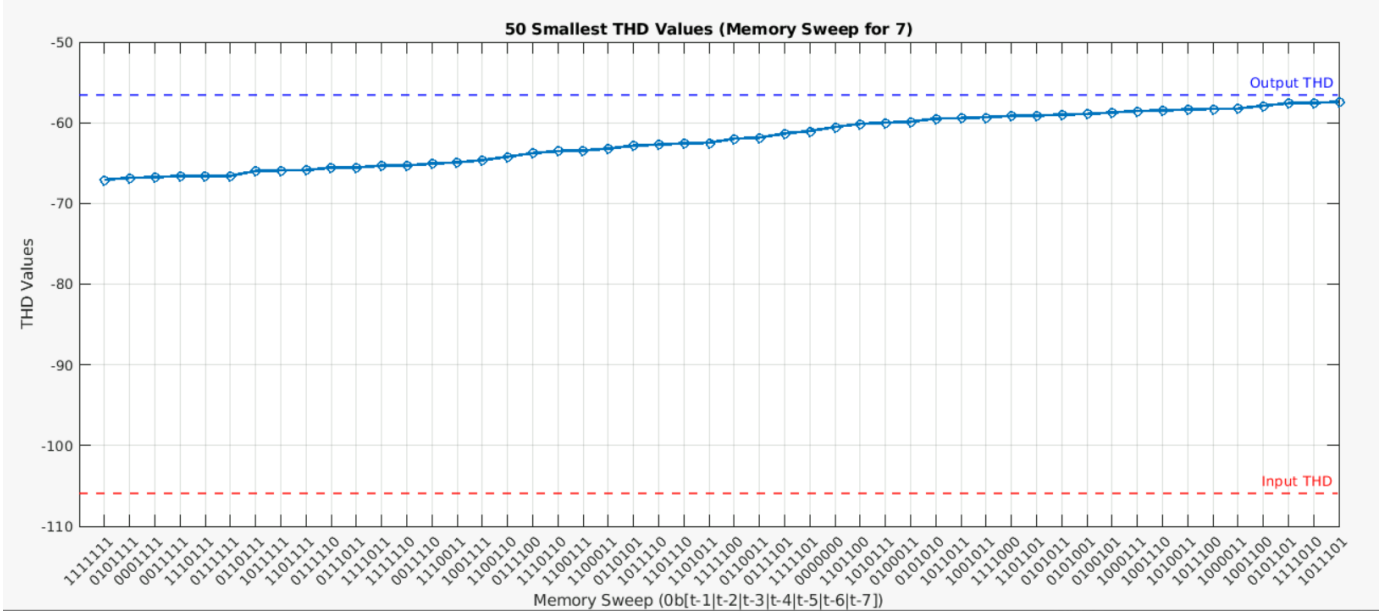

Figure 14: THD Values based on different memory sweep and polynomial order of 5 @ 2GHz

4.3 Polynomial order : 7

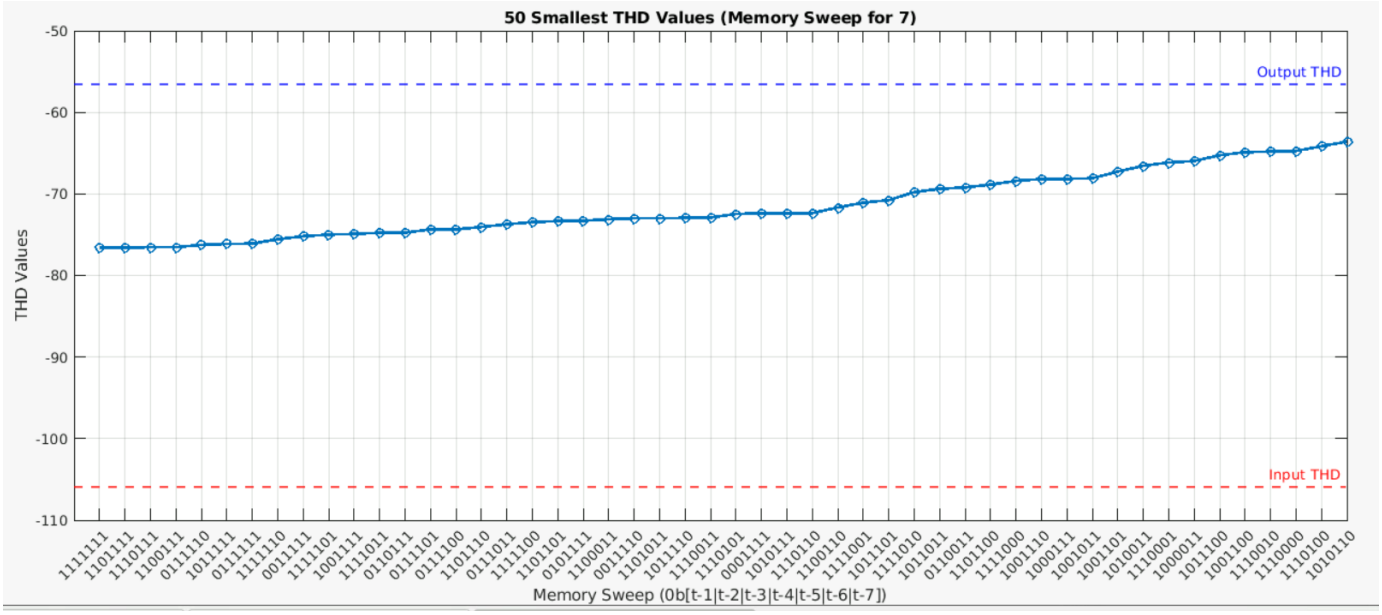

Figure 15: THD Values based on different memory sweep and polynomial order of 7 @ 2GHz

4.4 Polynomial order : 9

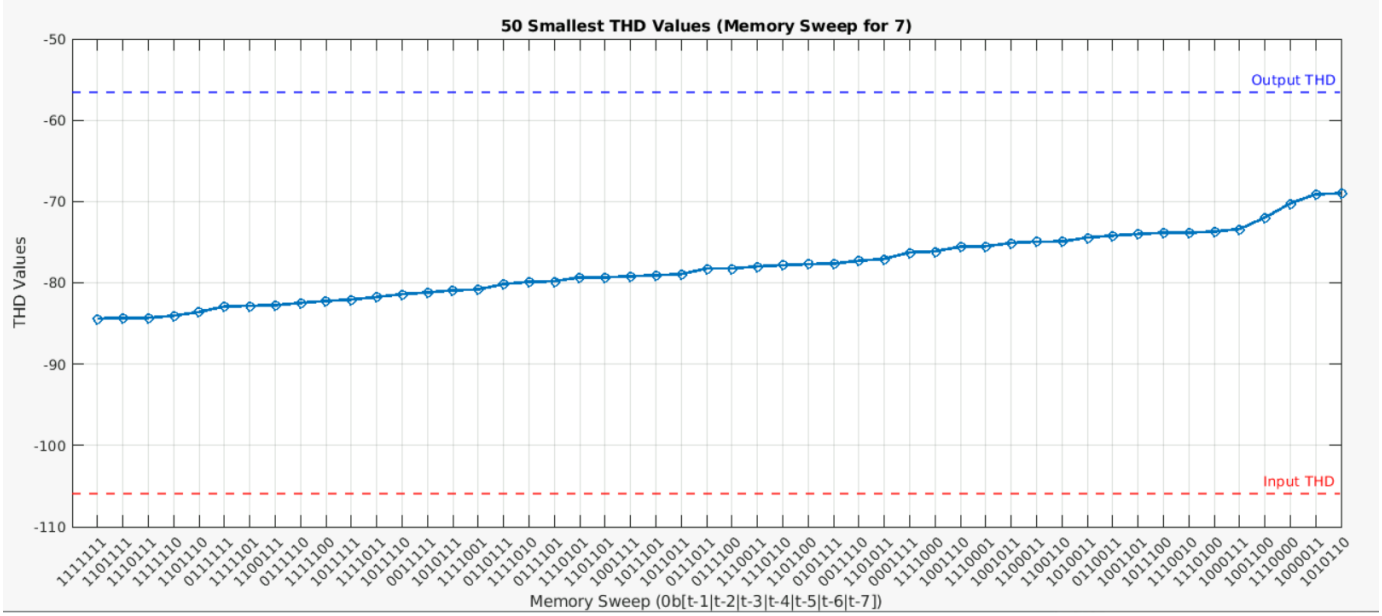

Figure 16: THD Values based on different memory sweep and polynomial order of 9 @ 2GHz