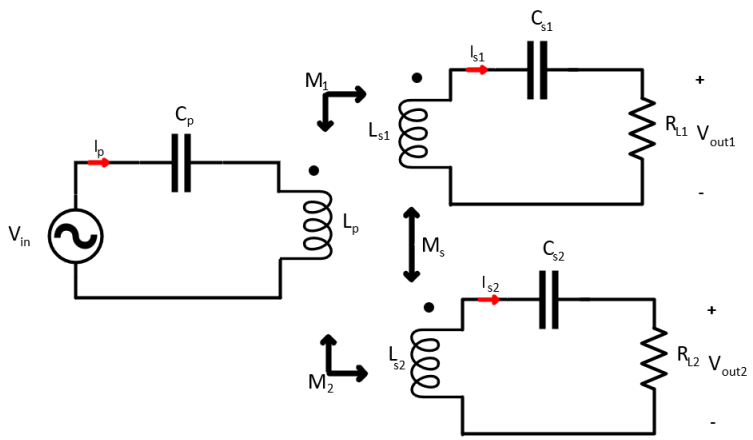
BRIEF EXPLANATION

In this presentation, we try to validate our proposed methods to share current in paralled connected common DC Bus series-series WPT system.

The experiment data will be compared with each others and LTSpice models.



Test-Setup-Measurement

Decoupled Receiver				Cross-coupled receivers			
Full-Aligned		Misaligned		Full-Aligned		Misaligned	
150kHz Resonant Cap	135kHz Resonant Cap	150kHz Resonant Cap	135kHz Resonant Cap	150kHz Resonant Cap	135kHz Resonant Cap	150kHz Resonant Cap	135kHz Resonant Cap
Tx Current	Tx Current	Tx Current	Tx Current	Tx Current	Tx Current	Tx Current	Tx Current
Rx-1 Current	Rx-1 Current	Rx-1 Current	Rx-1 Current	Rx-1 Current	Rx-1 Current	Rx-1 Current	Rx-1 Current
Rx-2 Current	Rx-2 Current	Rx-2 Current	Rx-2 Current	Rx-2 Current	Rx-2 Current	Rx-2 Current	Rx-2 Current
Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)	Tx Voltage (Square)

First mission : We investigate the secondary coupling effect by using the test data which are decoupled 150Khz resonant capacitor and cross-coupled 150kHz resonant capacitor for both aligned and misaligned conditions. (Column 1-5 and column 3-7)

Second mission: We investigate the effect of resonance frequency of receeiver side by using test data which are decoupled 150kHz and 135kHz resonant capacitor for both aligned and misaligned condition.
Column 1-2 and column 3-4)

For first and second missions, we took the inductance matrice data and output resistance and voltage. We will establish Spice model and it will be compared with our experiment results.

The inductance matrices for Full-Aligned and Misaligned conditions for both decoupled and coupled conditions are given.

Full-Aligned Coupled

TD	Tx	Rx-1	Rx-2
Tx	83.3	X	X
Rx-1	176.25	65.6	X
Rx-2	179.95	112.96	68.8

M	Tx	Rx-1	Rx-2
Tx	83.3	X	X
Rx-1	13.675	65.6	X
Rx-2	13.925	-10.72	68.8

C	Tx	Rx-1	Rx-2
Tx	1	X	X
Rx-1	0.184992	1	X
Rx-2	0.183941	-0.15957	1

Miss-Aligned Coupled

TD	Tx	Rx-1	Rx-2
Tx	82.96	X	X
Rx-1	177.6	65.35	X
Rx-2	177.6	154.95	68.65

M	Tx	Rx-1	Rx-2
Tx	82.96	X	X
Rx-1	14.645	65.35	X
Rx-2	12.995	10.475	68.65

C	Tx	Rx-1	Rx-2
Tx	1	X	X
Rx-1	0.1989	1	X
Rx-2	0.1722	0.1563907	1

Full-Aligned Decoupled

TD	Tx	Rx-1	Rx-2
Tx	83.5	X	X
Rx-1	177	65.6	X
Rx-2	178	124.85	65.4

M	Tx	Rx-1	Rx-2
Tx	83.5	X	X
Rx-1	13.95	65.6	X
Rx-2	14.55	-3.075	65.4

C	Tx	Rx-1	Rx-2
Tx	1	X	X
Rx-1	0.188485979	1	X
Rx-2	0.196893274	-0.04694662	1

TD	Tx	Rx-1	Rx-2
Tx	83.5	X	X
Rx-1	177.5	65.6	X
Rx-2	177.5	124.85	65.4

M	Tx	Rx-1	Rx-2
Tx	83.5	X	X
Rx-1	14.2	65.6	X
Rx-2	14.3	-3.075	65.4

C	Tx	Rx-1	Rx-2
Tx	1	X	X
Rx-1	0.191863864	1	X
Rx-2	0.193510228	-0.04694662	1

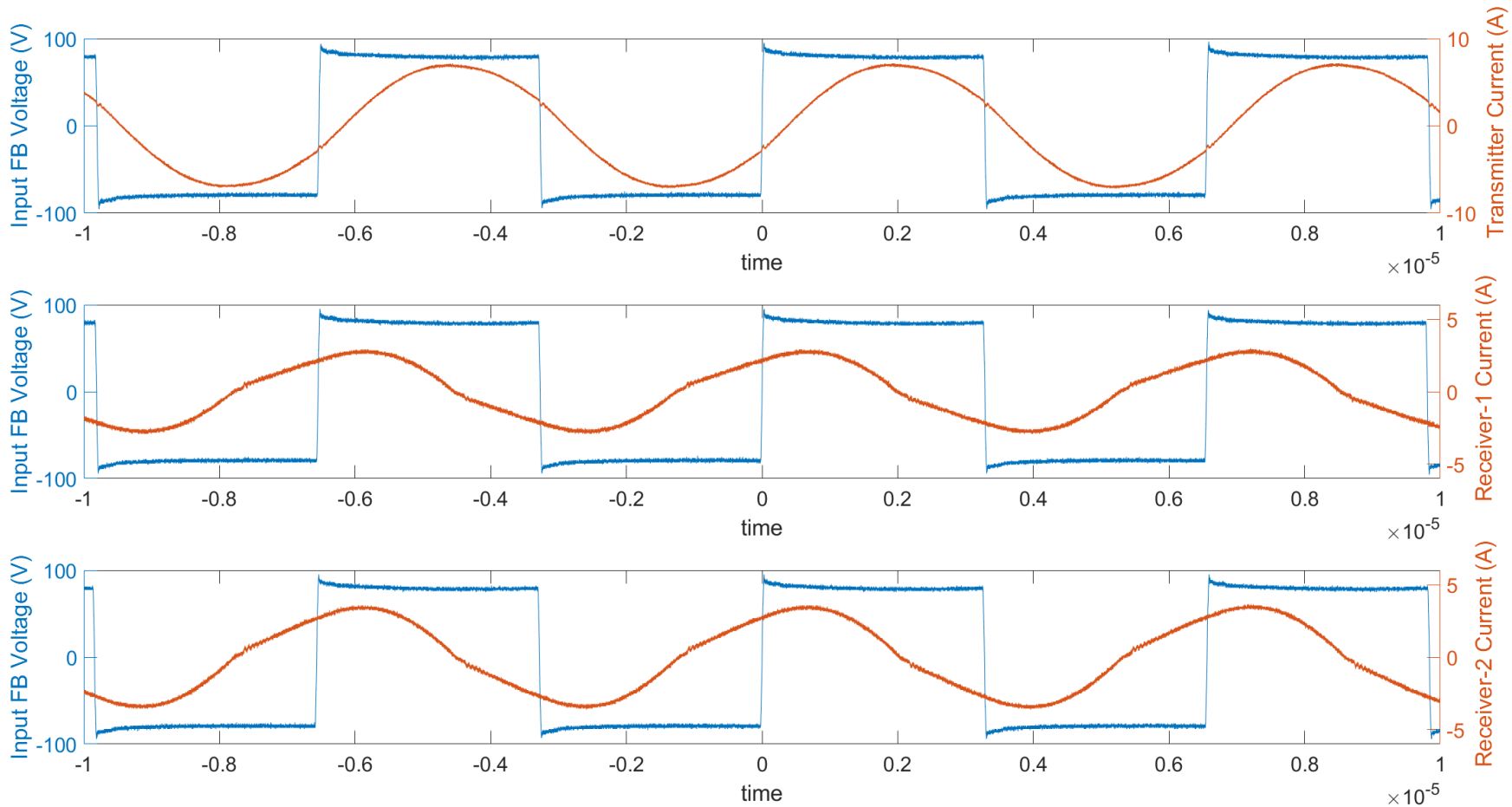
Miss-Aligned Decoupled

TD	Tx	Rx-1	Rx-2
Tx	83.45	X	X
Rx-1	173.8	65.7	X
Rx-2	179.5	125	65.6

M	Tx	Rx-1	Rx-2
Tx	83.45	X	X
Rx-1	12.325	65.7	X
Rx-2	15.25	-3.125	65.6

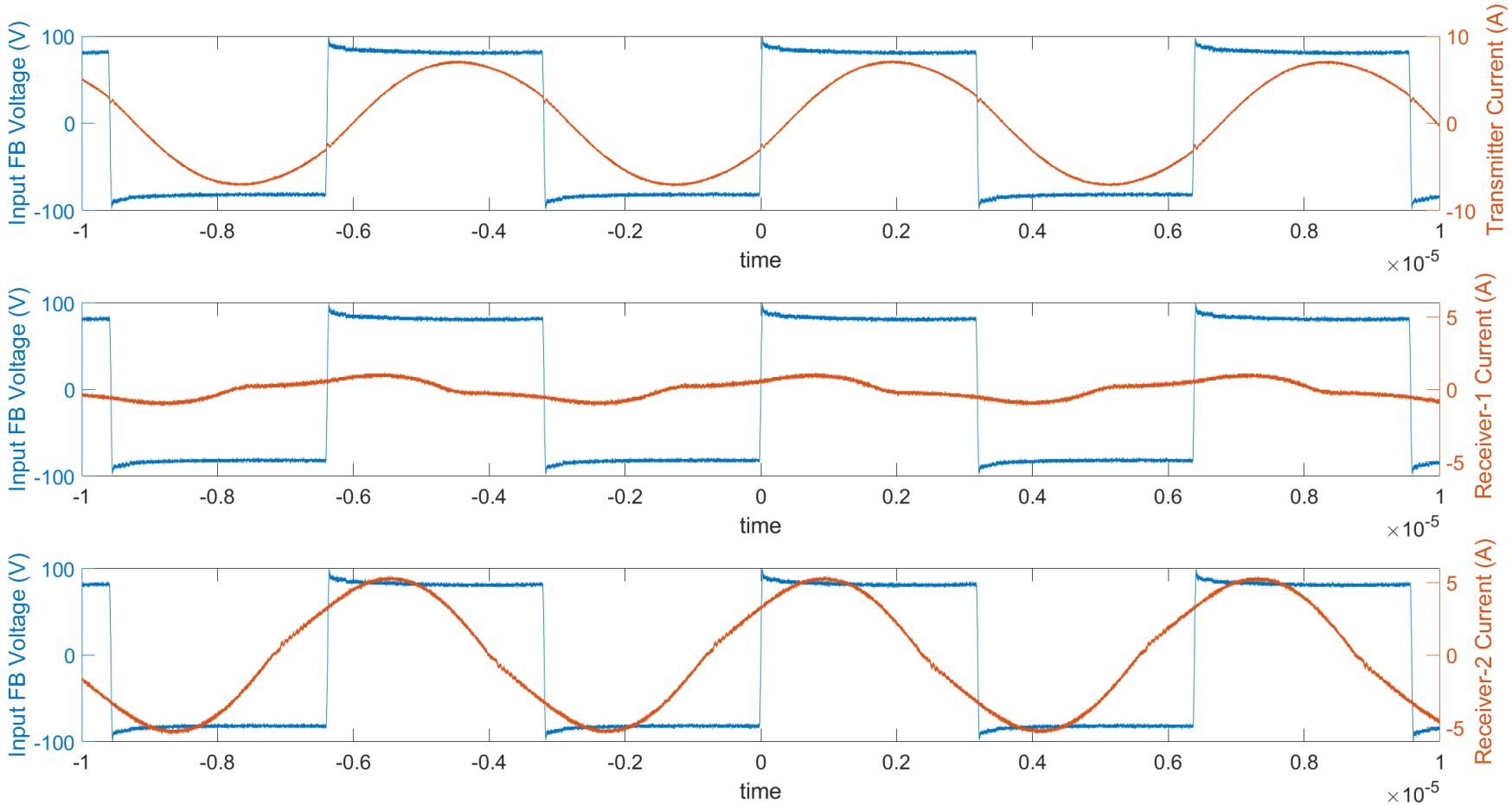
C	Tx	Rx-1	Rx-2
Tx	1	X	X
Rx-1	0.166452788	1	X
Rx-2	0.206191294	-0.047619079	1

FA-Decoupled-150kHz (1)



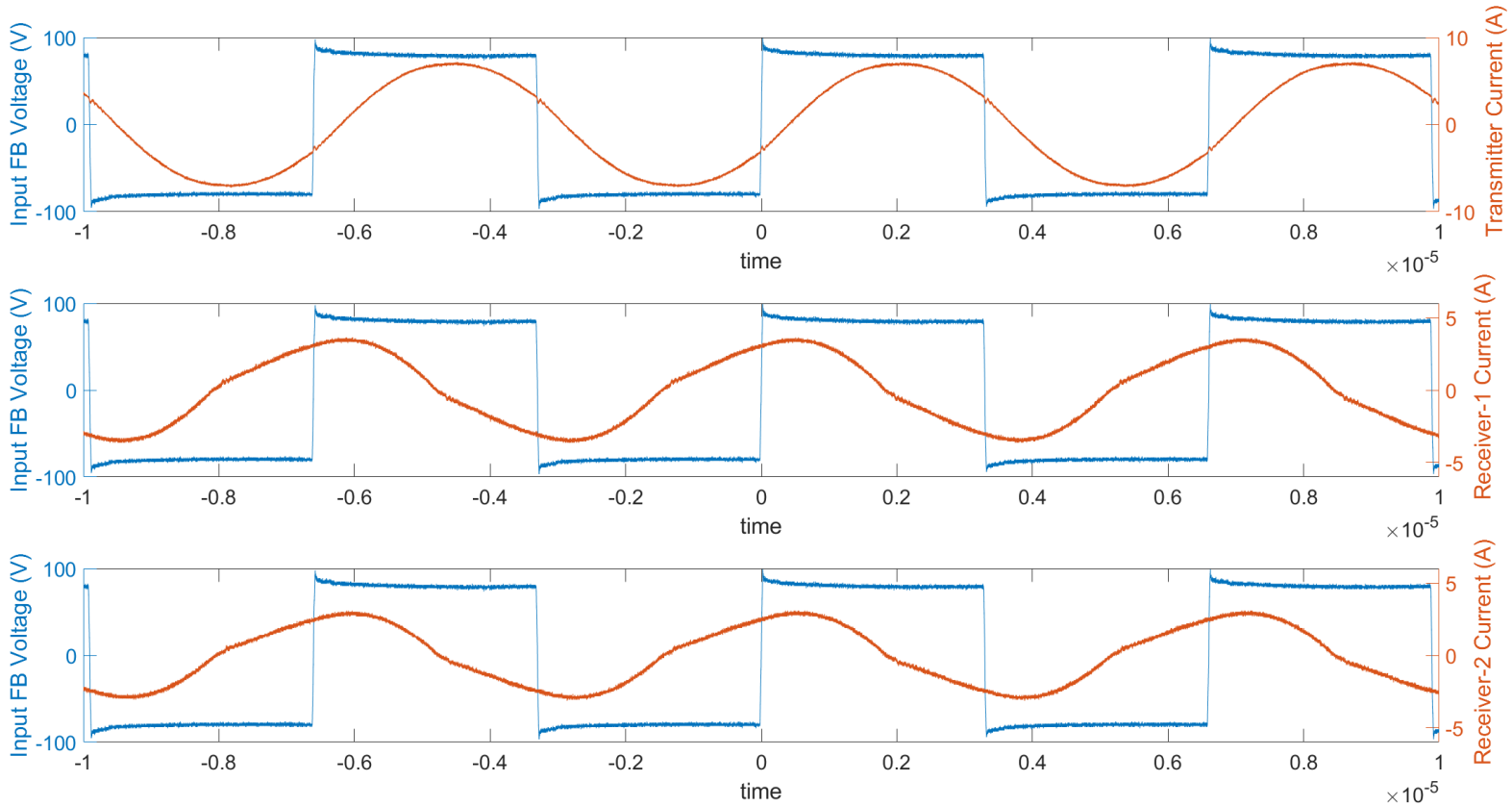
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
152kHz	7.17A	2.93A	3.57A	19.93	67.5	65.2

MA-Decoupled-150kHz (3)



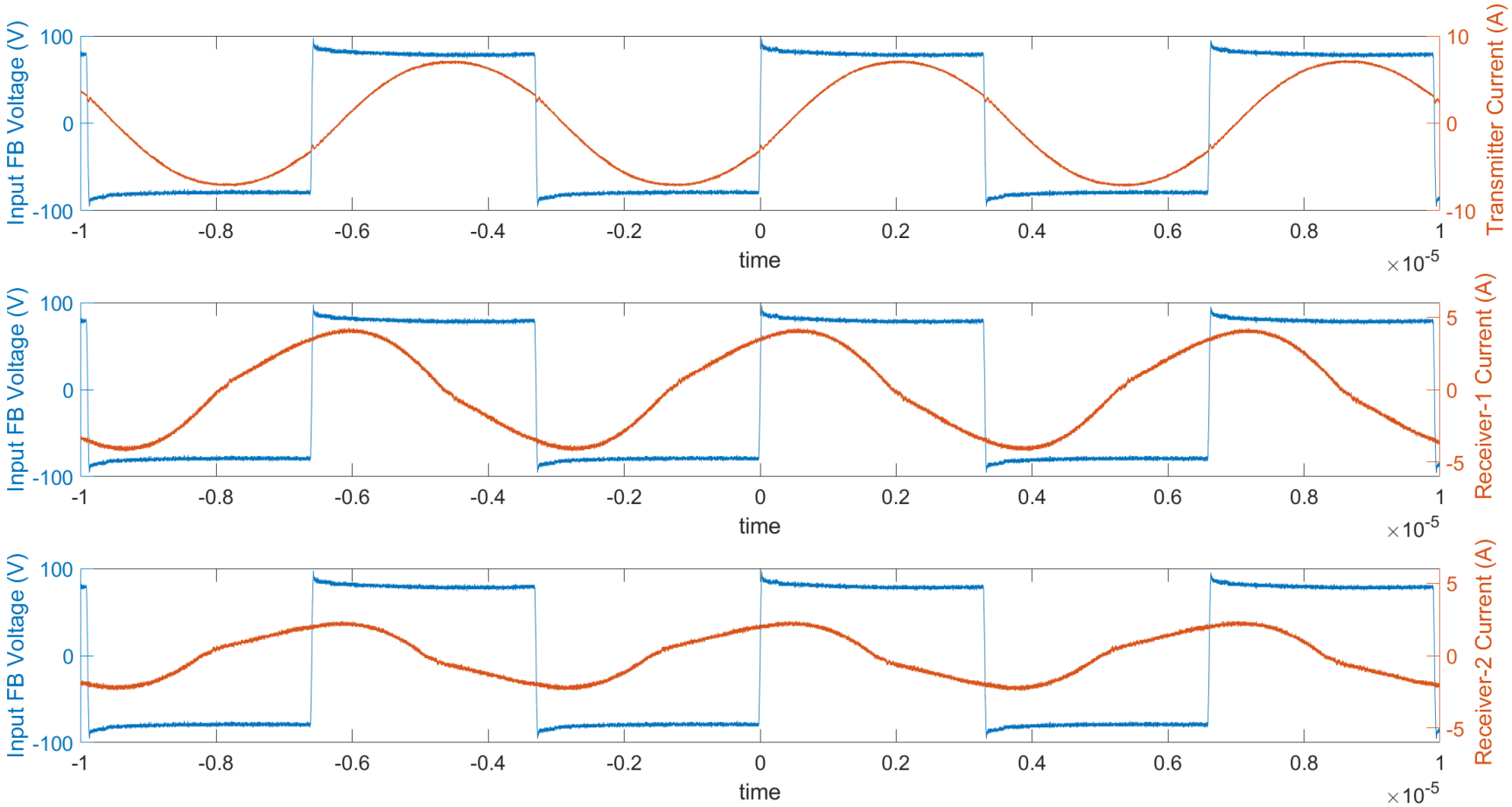
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
156.8kHz	7.25A	1.17A	5.09A	22.8711	74.8448	44.1957

FA-Coupled-150kHz (5)



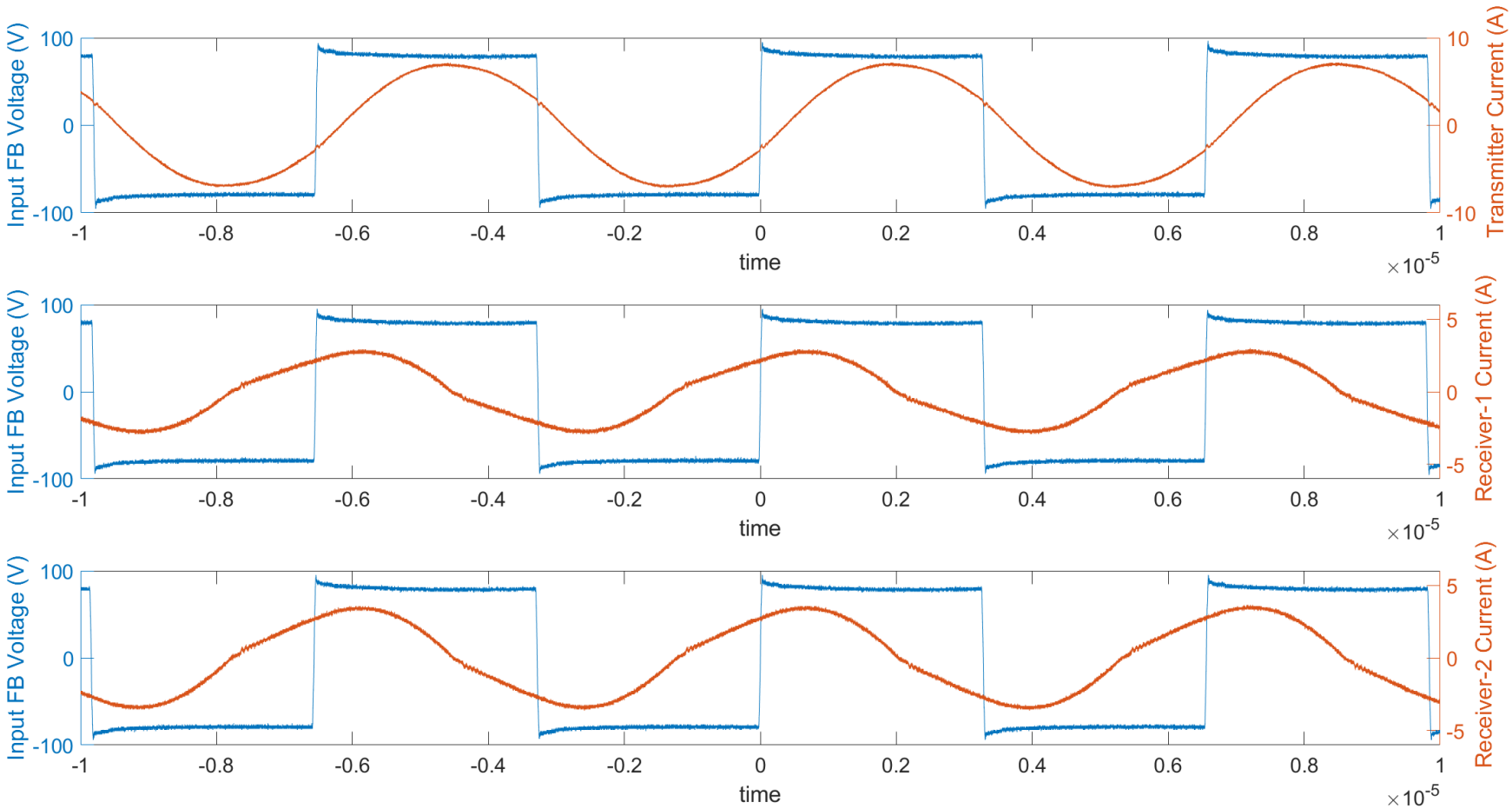
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
151.6kHz	7.17A	3.65A	3.09A	22.524	76.68	74.1722

MA-Coupled-150kHz (7)



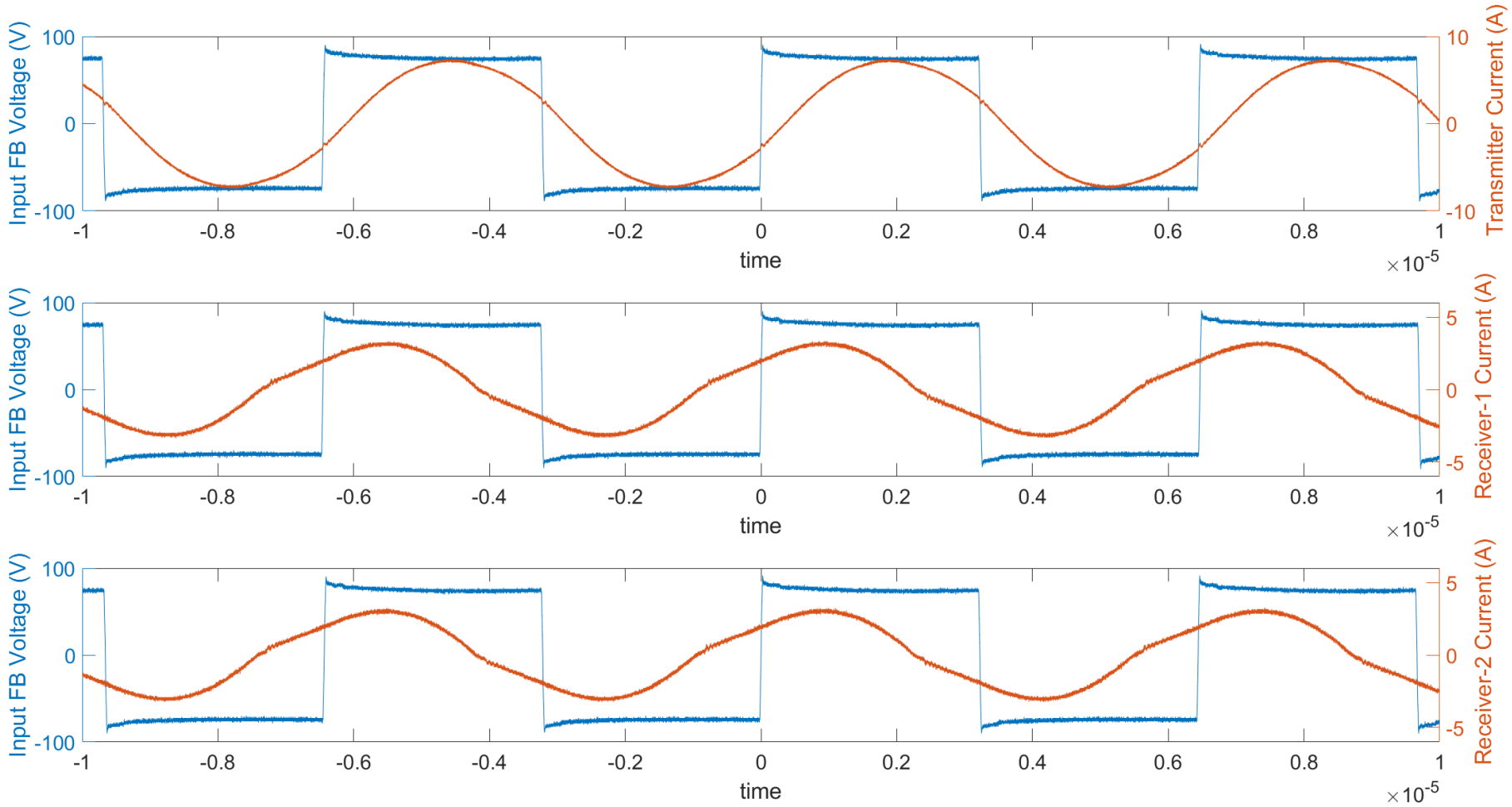
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
151.3kHz	7.17A	4.21A	2.37A	22.31	72.18	82.7542

FA-Decoupled-150kHz (1)



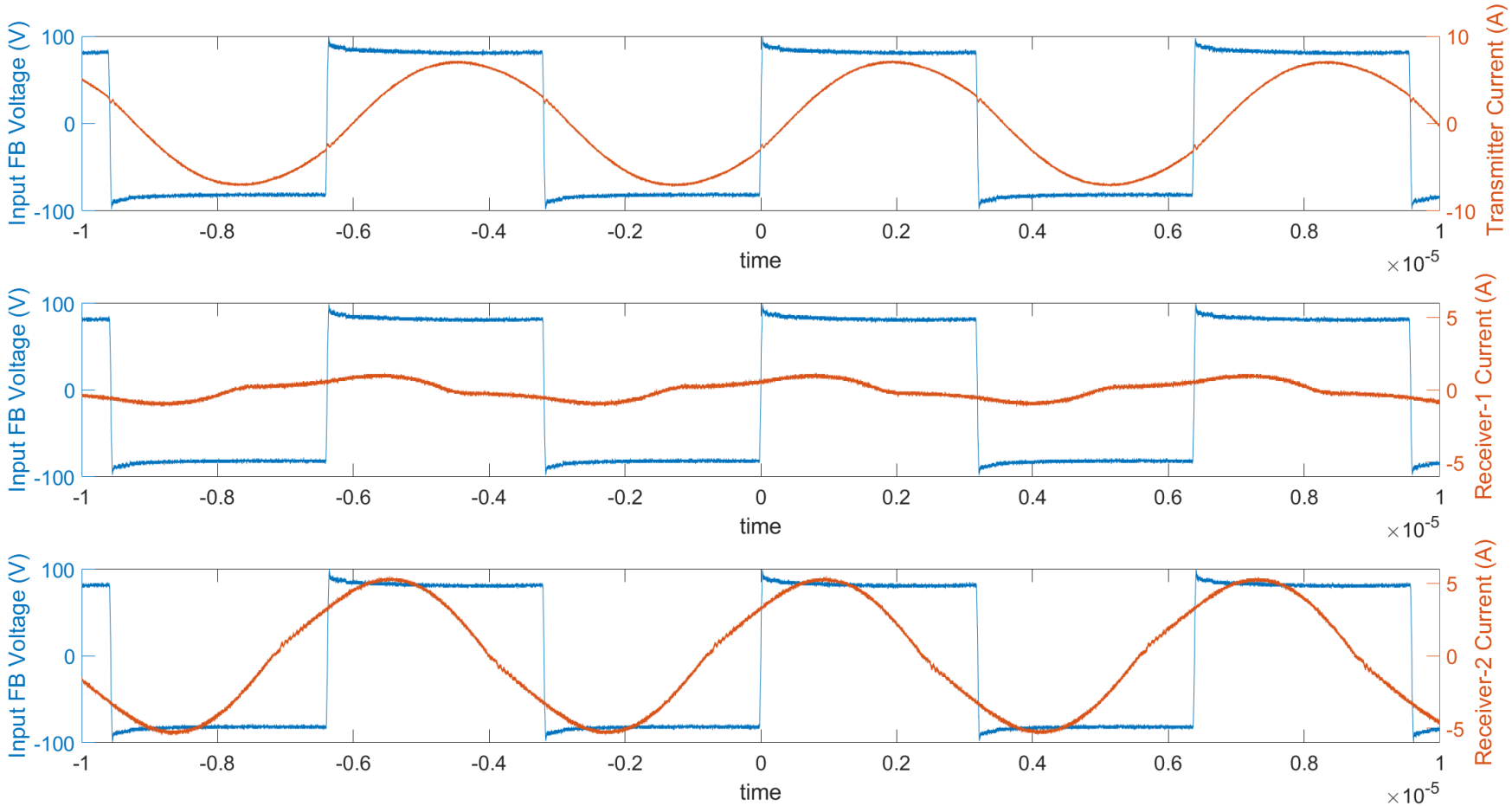
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
152kHz	7.17A	2.93A	3.57A	19.93	67.5	65.2

FA-Decoupled-135kHz (2)



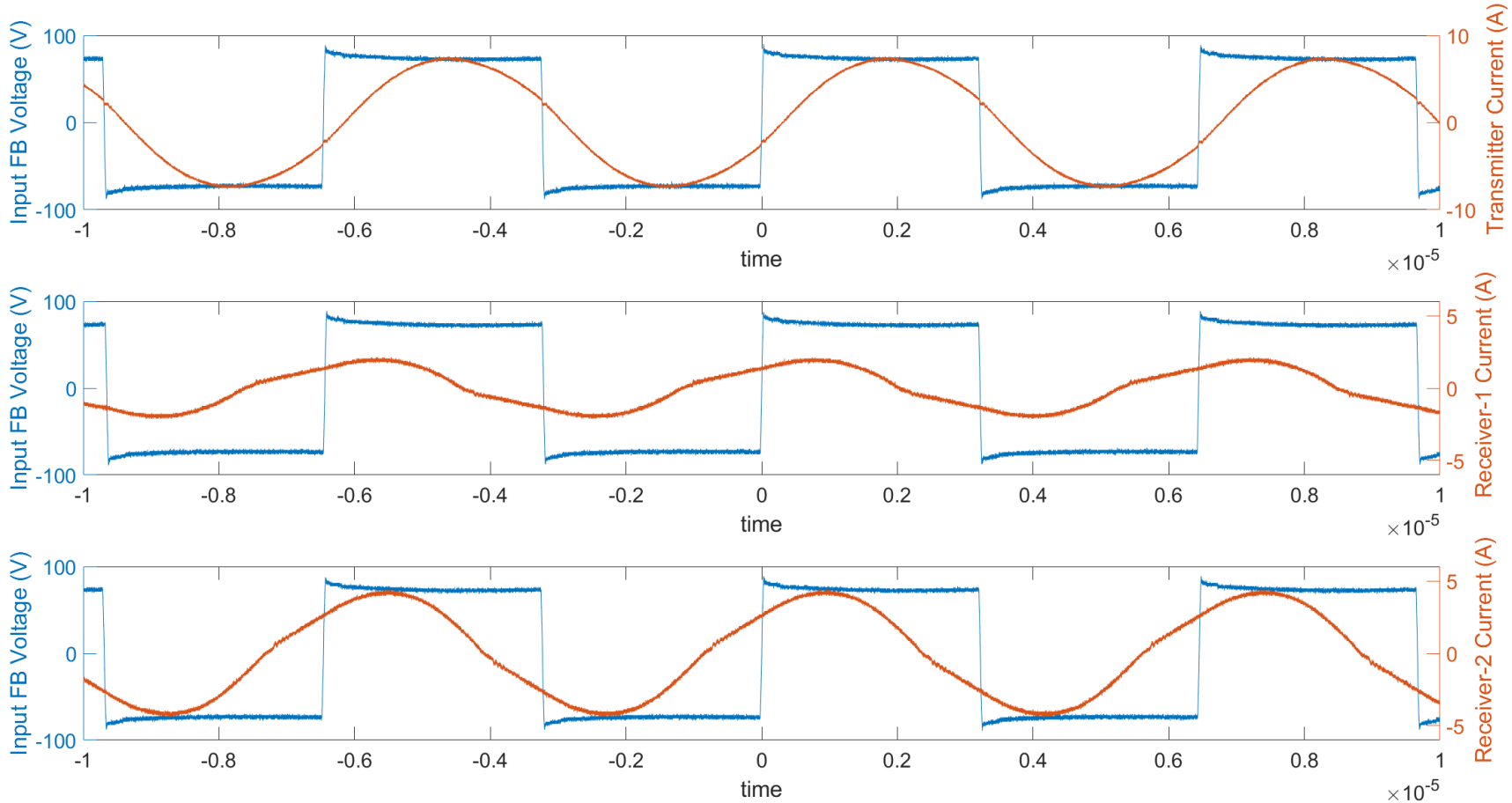
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
154.75kHz	7.41A	3.33A	3.17A	20.310	46.752	51.4652

MA-Decoupled-150kHz (3)



Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
156.8kHz	7.25A	1.17A	5.09A	22.8711	74.8448	44.1957

MA-Decoupled-135kHz (4)



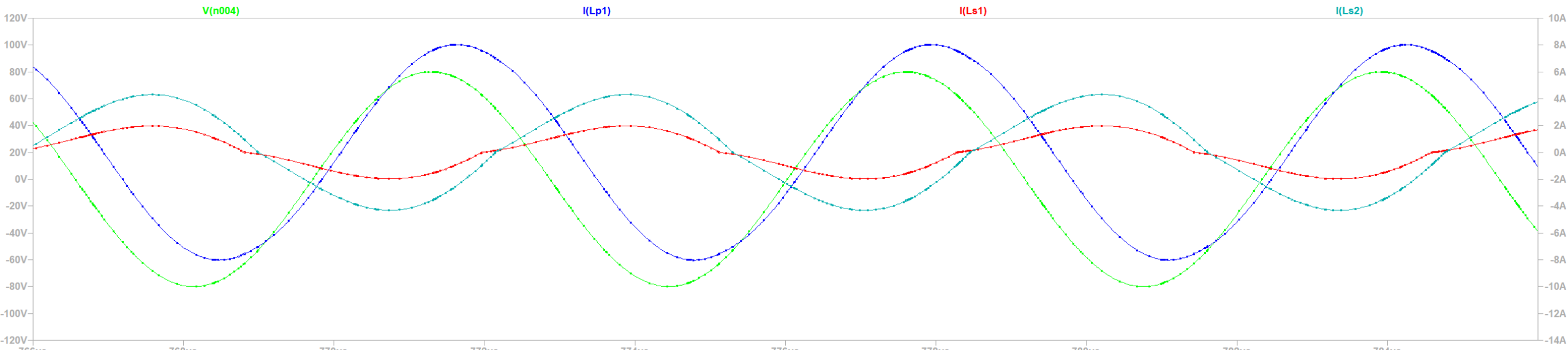
Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
155.3kHz	7.49A	2.13A	4.29A	18.34	65.75	47.75

SPICE MODELS

Case-1

Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
152kHz	7.17A	2.93A	3.57A	19.93	67.5	65.2

Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Vout
158.5kHz	7.98A	1.88A	4.273A	20.90	75.76



Case-5

Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Is1(angle)	Is2(angle)
154.75kHz	7.41A	3.33A	3.17A	20.310	46.752	51.4652

Frequency	Ip (peak)	Is1(peak)	Is2(peak)	Ip (angle)	Vout
158.5kHz	7.98A	1.88A	4.273A	20.90	75.76

Case-3

Case-7

Case-2

Case-4