



# Integrated Device Technology

---

## F1912 Settling Time

- AT0342
- August 15, 2016

Michael J. Virostko  
Principal Product Application Engineer



# Agenda

- Customer is using three F1912 Digital Step Attenuator to control the power in a channel.
- During testing they are intermittently seeing failures for attenuations values.
- During a conversation the following points were mentioned:
  - Power testing is done approximately every 500 ns.
  - Errors occur mostly at cold temperatures (-40 °C).
  - Testing is done in the parallel mode.

# Observations

- We specify the switching time as either 0.9  $\mu\text{s}$  or 1.8  $\mu\text{s}$  when switching for the minimum to maximum attenuation states.
- We specify the switching time in the serial mode.

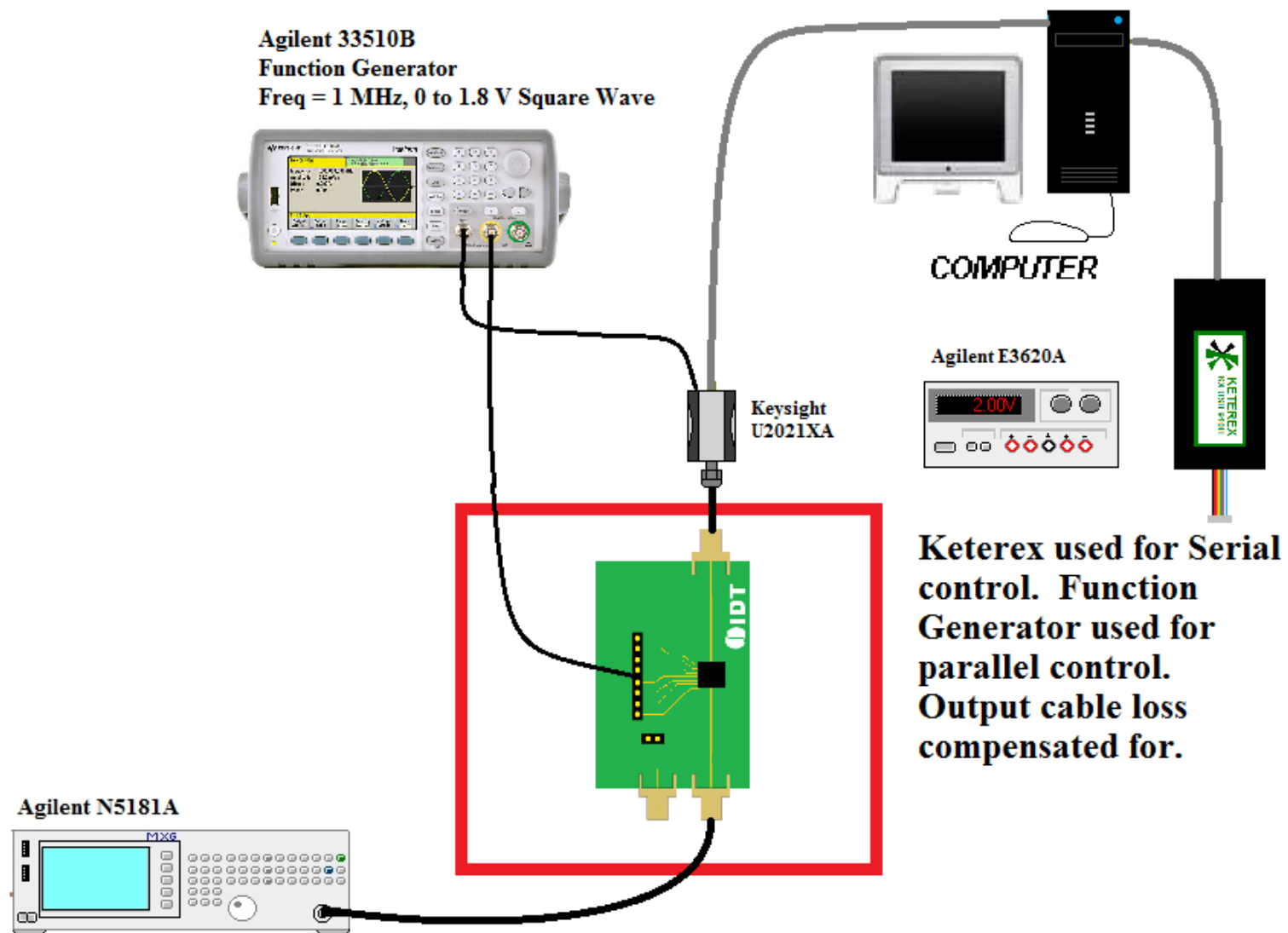
Specifications apply at  $V_{DD} = +3.3\text{ V}$ ,  $T_{CASE} = +25\text{ }^\circ\text{C}$ ,  $F_{RF} = 2000\text{ MHz}$ ,  $P_{in} = 0\text{ dBm}$ , Serial Mode ( $V_{mode} > V_{IH}$ ),  $Z_{source} = Z_{Load} = 50\ \Omega$  unless otherwise noted. EvKit losses are de-embedded.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
MSB Step Time	$T_{LSB}$	Start LE rising edge $> V_{IH}$ End $\pm 0.10\text{ dB}$ Pout settling for 15.5 dB to 16.0 dB transition		500		ns
Maximum spurious level on any RF port <sup>4</sup>	$Spur_{MAX}$			-140		dBm
Maximum Switching Frequency	$SW_{FREQ}$			25		kHz
DSA Settling time	$\tau_{SET}$	Max to Min Attenuation to settle to within 0.5 dB of final value		0.9		$\mu\text{s}$
		Min to Max Attenuation to settle to within 0.5 dB of final value		1.8		

# Observations

- We do not expect the switching time to change drastically over temperature or by using the parallel mode.
- Testing will show this to be true.

# Test Setup



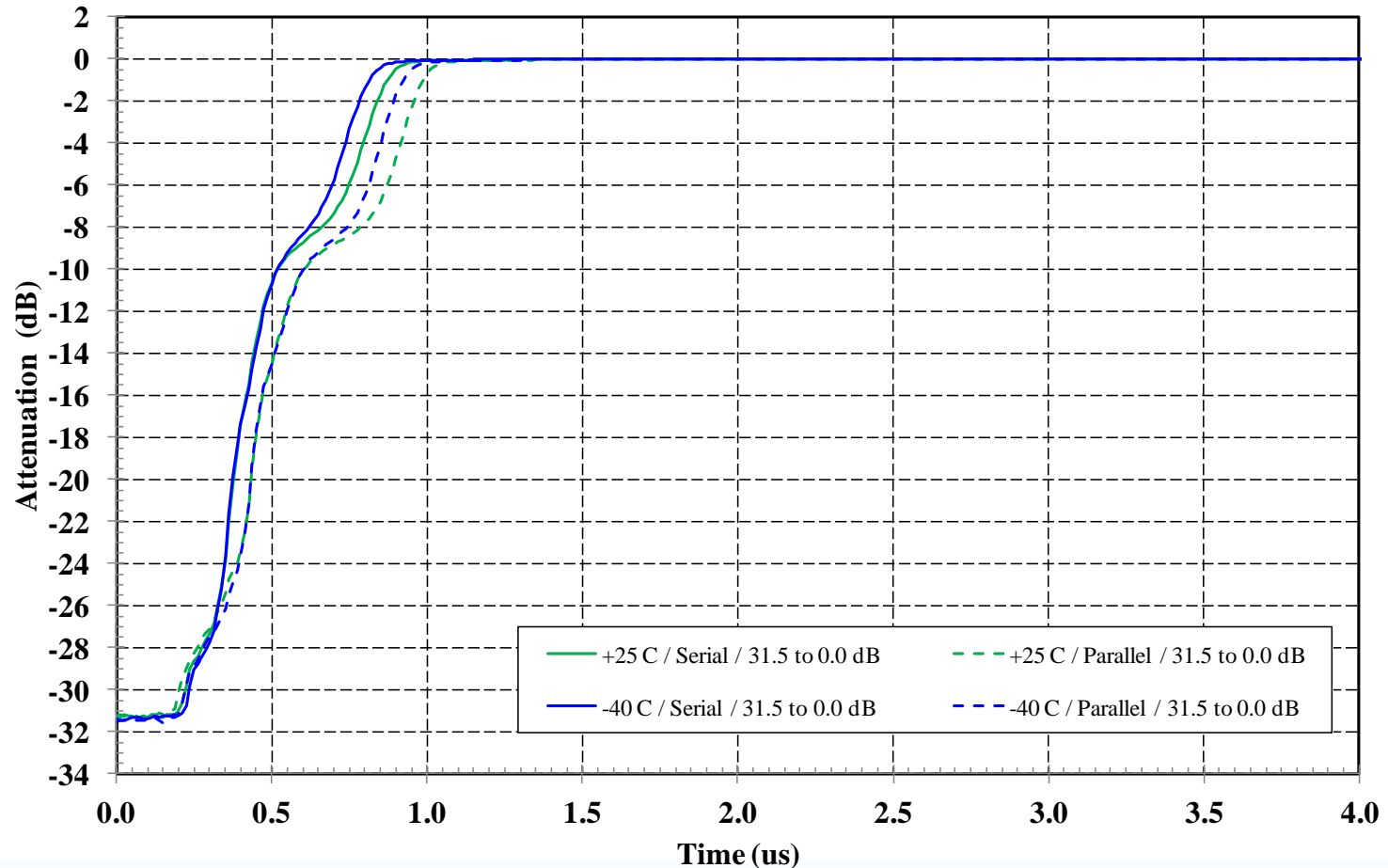
# Test Setup (continued)

- Keysight U2021XA is used to capture data since we can capture the full dynamic range ( $\sim 32$  dB) and the time measurement is greater than 200 ns.
- Output power is set for 18 dBm.
- Frequency is 1 GHz.



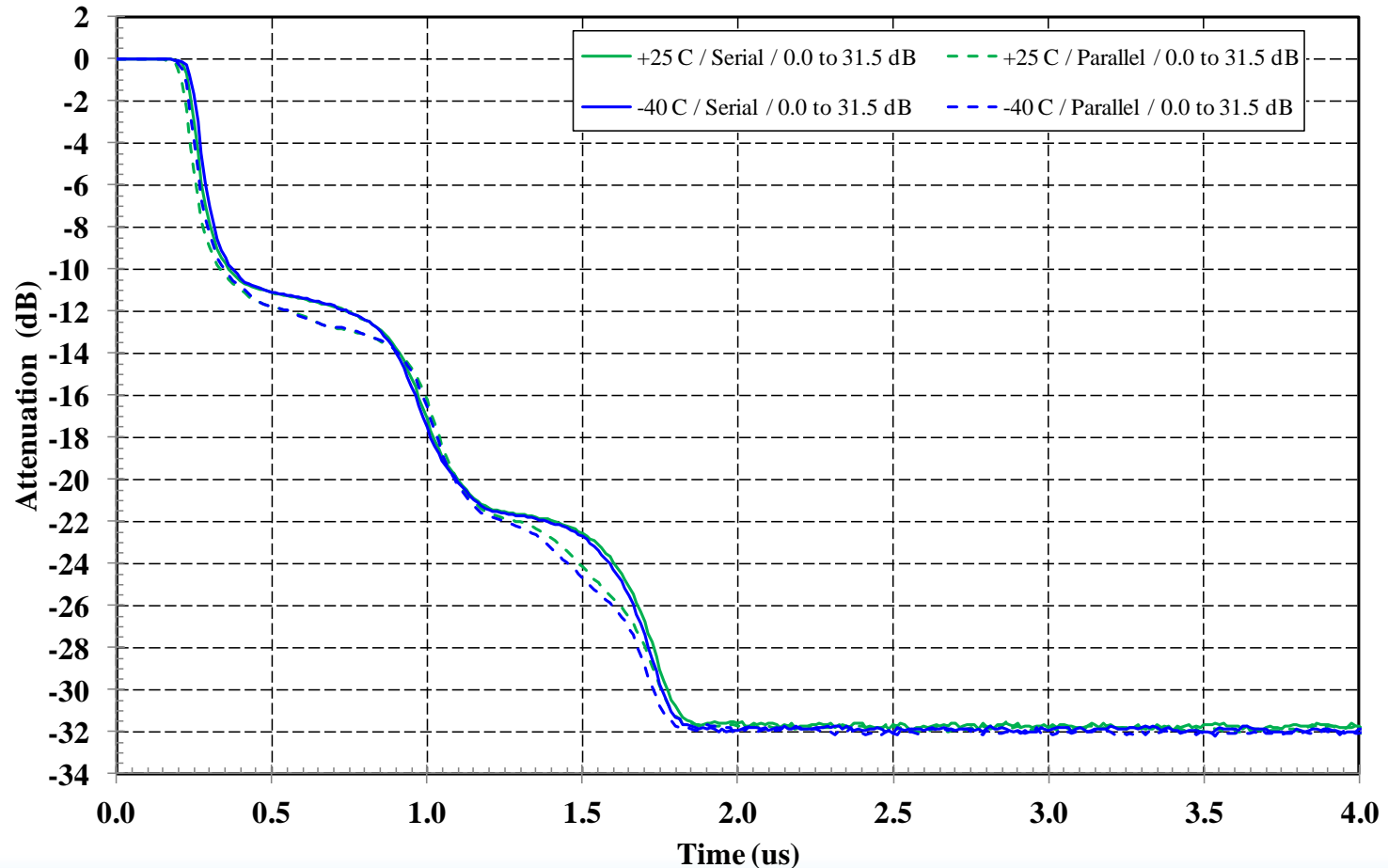
# Maximum to Minimum Settling Time

**F1912 - Switching Max to Min Attenuation**  
Data is to the evaluation board



# Minimum to Maximum Settling Time

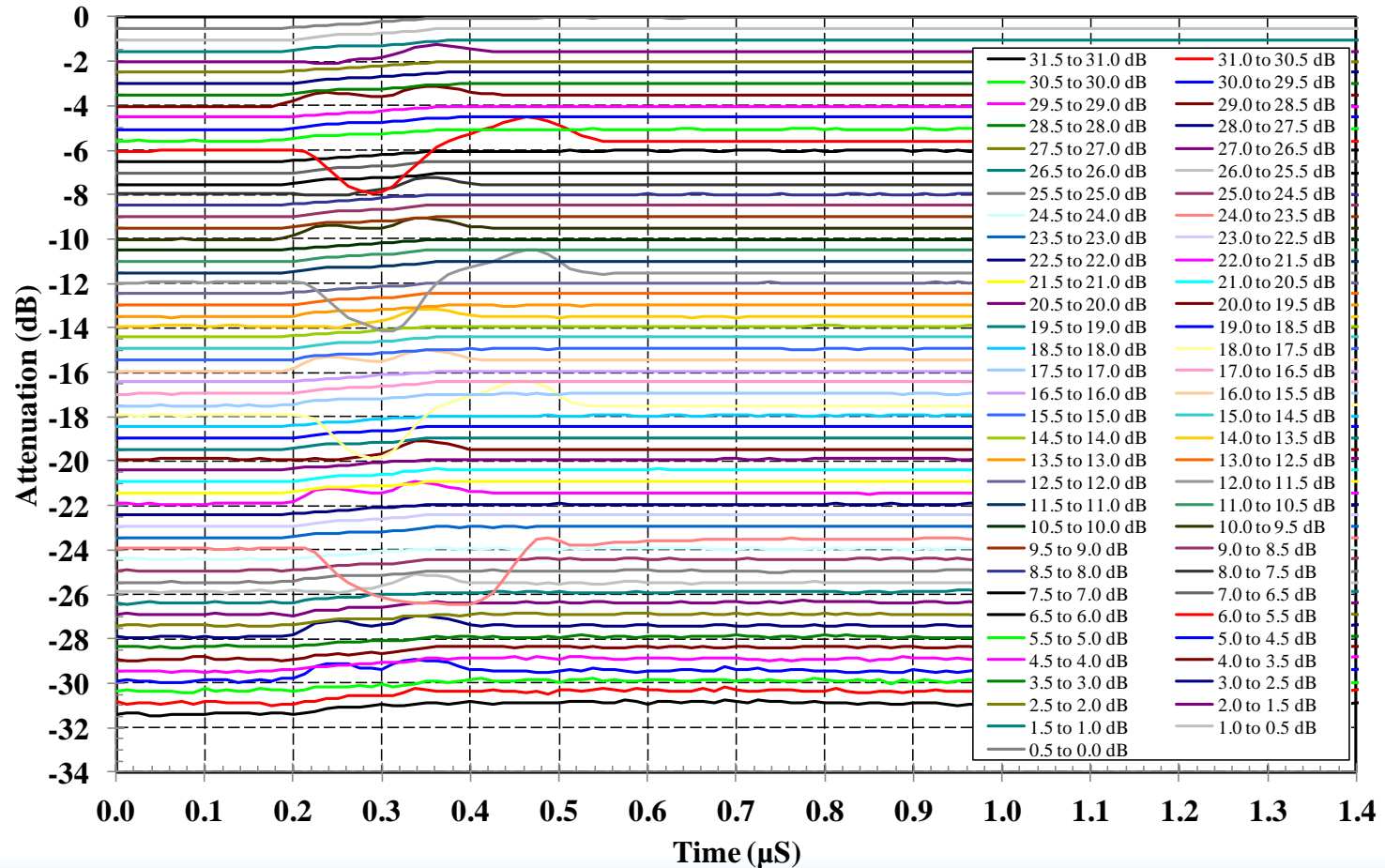
**F1912 - Switching Min to Max Attenuation**  
Data is to the evaluation board





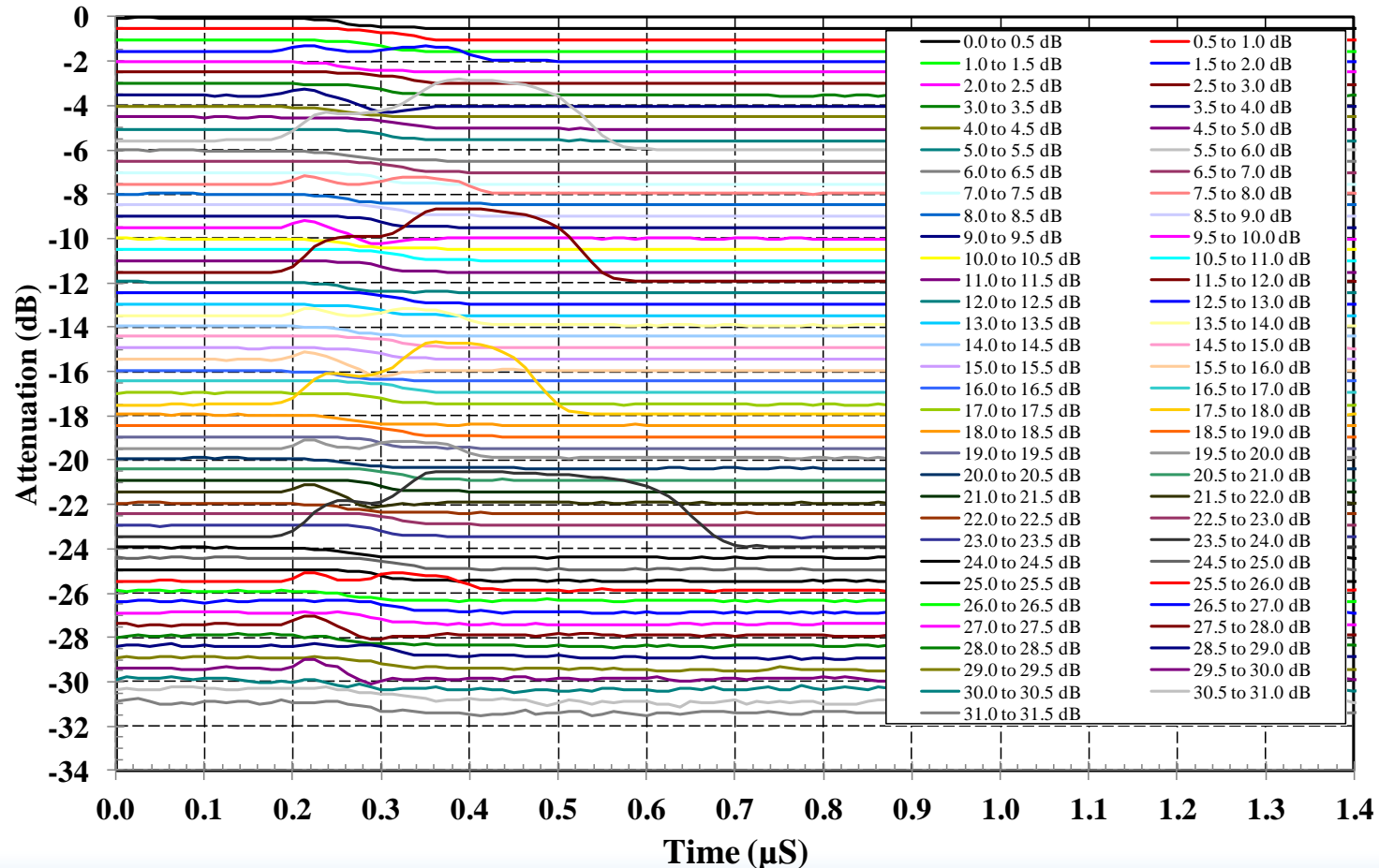
# 0.5 dB step for Max to Min Attenuation

**F1912 Attenuation**  
Data is to the evaluation Board using Serial Mode  
Attenuation change is 0.5 dB (Max to Min)



# 0.5 dB step for Min to Max Attenuation

**F1912 Attenuation**  
Data is to the evaluation Board using Serial Mode  
Attenuation change is 0.5 dB (Min to Max)



# Conclusion

- Switching all attenuators simultaneously does not show any difference over temperature or using either Parallel or Serial Mode.
- The datasheet values of 0.9 and 1.8  $\mu\text{s}$  are confirmed.
- There is a slightly different power profile between the Parallel and Serial mode.
- Changing the individual states sequentially show the maximum switching time is 0.72  $\mu\text{s}$  with most being under 0.4  $\mu\text{s}$ .
- We recommend a delay is added to the measurement so the device can settle out.