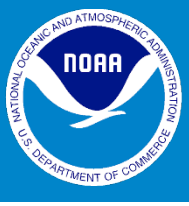

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2019 EK 60 & EK 80 Calibration Report

NOAA Ship Okeanos Explorer

EX-19-02: ROV and Mapping Shakedown

Adrienne Copeland
University of Hawaii, NOAA Office of Ocean Exploration and Research
adrienne.copeland@noaa.gov

Derek Sowers
Cherokee Nation Strategic Programs, NOAA Office of Ocean Exploration and Research
derek.sowers@noaa.gov

Shannon Hoy
Cherokee Nation Strategic Programs, NOAA Office of Ocean Exploration and Research
shannon.hoy@noaa.gov

Meme Lobecker
Cherokee Nation Strategic Programs, NOAA Office of Ocean Exploration and Research
elizabeth.lobecker@noaa.gov

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Introduction

Calibration of the Simrad EK 60 echosounders on NOAA Ship *Okeanos Explorer* took place May 2019 in the Gulf of Mexico during cruise EX-19-02. Three EK 60 frequencies (18, 120, and 200 kHz) were calibrated at the pulse length of 1.024 milliseconds (ms) and max power for each frequency. The 18 kHz was calibrated at the additional pulse length of 4.096 ms. A 70 kHz wide band transceiver (WBT) was also calibrated at both the continuous wave (CW) and frequency modulated (FM) modes at 1.024 and 2.048, and 1.024, 2.048, 4.096, and 8.192 ms pulse lengths, respectively. The 38 kHz frequency was not successfully calibrated as it had very low detections of the sphere in three quadrants at the known target strength (a similar issue was documented in 2018). Further updates from the ship indicate that the 38 kHz transducer might have an impedance issue, and is already planned for replacement during the next drydock period with a newer version that supports FM pulses.

Location and Conditions

- The ship was located in the Gulf of Mexico at location 24.7411° N, 83.2095° W
- The vessel was drifting in waters deeper than 50 meters
- A CTD cast was performed before the calibration to obtain the required water properties necessary for calibration including the temperature and salinity at the depth of the sphere
- Average speed of sound at the transducer face was 1543 ms-1
- Average speed of sound at the calibration depth (12 m) for the 70 (FM all pulse durations and CW at 2.048 ms), 120, and 200 kHz transducers was 1542.9 ms-1
- At 12 meters the average temperature was 27.9°C and average salinity was 37 psu
- Average speed of sound at the calibration depth (17 m) for the 70 kHz (CW at 1.024 ms) was 1542.21 ms-1
- At 17 meters the average temperature was 27.5°C and average salinity was 37 psu
- Average speed of sound at the calibration depth (35 m) for the 18 kHz transducer was 1537.3 ms-1
- At 35 meters the average temperature was 25.3 °C and average salinity was 36.5 psu

Calibration Parameters

- All frequencies were calibrated with a pulse length of 1.024ms. The 18 kHz was calibrated at the additional pulse lengths 4.096 ms, the 70kHz CW was calibrated at 2.048 ms and the 70 kHz FM was calibrated at 1.024, 2.048, 4.096, and 8.192 ms.
- Ping rate was 1 ping/second
- Power was maximum for each frequency

- See Table 1 of this document for a complete list of parameters used during calibration

Table 1. List of relevant parameters and initial settings used during the 2019 calibration of the EK 60 echosounders. For more information, see Appendix 1 containing the channel tab for each frequency calibrated.

Frequency (kHz)	18	18	70 (CW)	70 (CW)	70 (FM)	70 (FM)	70 (FM)	70 (FM)	120	200
Frequency Range (kHz)					45 to 90	45 to 90	45 to 90	45 to 90		
GPT/WBT serial number	GPT	GPT	WBT 746998	WBT 746998	WBT 746998	WBT 746998	WBT 746998	WBT 746998	GPT	GPT
EK 80 software version	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0	1.12.2.0
Transducer model	ES18	ES18	ES70-7C	ES70-7C	ES70-7C	ES70-7C	ES70-7C	ES70-7C	ES120-7C	ES200-7C
Transducer serial number	0	0	0	0	0	0	0	0	0	0
Transducer draft setting (m)	4.42	4.42	4.42	4.42	4.42	4.42	4.42	4.42	4.42	4.42
Transmit power (W)	2000	2000	750	750	750	750	750	750	250	150
Pulse length (ms)	4.096	1.024	2.048	1.024	8.192	4.096	2.048	1.024	1.024	1.024
Slope (%)	0.00	0.00	1.395	2.790	0.543	1.085	2.048	4.340	0.00	0.00
Two-way beam angle (dB)	-17.0	-17.0	-20.70	-20.70	-20.70	-20.70	-20.70	–20.70	–20.70	-20.70
Transducer peak gain (dB)	20.54	20.09	26.71	26.65	21.68 to 29.23	21.91 to 29.62	22.85 to 28.87	21.72 to 29.56	26.25	26.34
Sa correction (dB)	-0.47	-0.68	0.25	-0.36	-0.36	-0.36	-0.36	0.08	-0.38	-0.36

Absorption coefficient (dB/km)	0.001777	0.001777	0.019942	0.020189	0.018698	0.018698	0.018695	0.018695	0.048409	0.093174
Speed of sound (m/s)	1537.34	1537.34	1542.92	1542.21	1542.90	1542.90	1542.92	1542.92	1542.90	1542.90
3 dB beamwidth (º) alongship/athwartship	10.29/11.24	11.64/11.84	6.27/5.96	6.50/6.60	*see XML file	*see XML file	*see XML file	*see XML file	6.49/6.75	6.76/6.88
Angle offset (º) alongship/athwartship	-0.02/-0.08	0.12/0.14	-0.02/-0.44	0.05/0.36	*see XML file	*see XML file	*see XML file	*see XML file	-0.10/0.09	0.04/0.13

Calibration Procedure

To minimize the time and setup required, we used one sphere (38.1mm tungsten carbide with a 6% cobalt binder sphere) for all frequencies except for the 18 kHz which used a 64mm copper sphere.

Calibration was performed using Simrad's EK 80 calibration software and custom software from the NOAA Northeast Fisheries Science Center (NEFSC) to control the downriggers. For the setup of the downriggers, consult the EK 60/EK 80 Calibration SOP. For the pod setup calibration, the sphere was suspended about 5 meters (15 feet) below the swivels and a five pound lead fishing weight, for stability, was suspended about 3 meters (10 feet) below the sphere. For the 18 kHz calibration, the sphere was suspended about 10 meters below the swivels and a five pound lead fishing weight, for stability, was suspended about 15 meters below the sphere.

The three calibration lines were joined using typical calibration procedures (lowering a rope under the bow with the port side calibration line attached to the end of it and retrieving the rope from the starboard side once passed under the keel). For the 18 kHz calibration, the reciprocal was used with the line being attached to the starboard side and pulling up on the port side. Prior to deployment the sphere was soaked in a soapy water solution to break surface tension. The sphere was then lowered to a depth of approximately 15 m and 35 m from the surface of the water for the pod and 18 kHz calibration, respectively (range of about 10 m and 30 m from the transducers). This depth was achieved by having 80 feet of line out of each downrigger for the pod. For the 18 kHz calibration, the line out count was about 100 feet at the water line for each downrigger.

Calibration Results

Beam Coverage: For each frequency we initially positioned the sphere in the center of the beam (on-axis) and recorded for several minutes. We then moved the sphere throughout the beam to achieve adequate coverage. We had very good coverage for all frequencies and root mean square (RMS) error values below the recommended 0.4 threshold (per Simrad recommendations) aside from the 38 kHz. See Appendix 5 for beam coverage and error values of each of the calibrated frequencies. See Appendix 3 for the total number of sphere detections in the beam for each frequency calibrated. See Appendix 6 for a complete list of the .raw files and .xml files recorded during calibration.

Table 2. Target strength (TS) values of the spheres used during calibration based on the values calculated in the Simrad EK 80 calibration software from the CTD provided temperature and salinity.

Frequency (kHz)	64 mm diameter copper sphere TS (dB)	38.1 mm diameter tungsten carbide sphere TS (dB)
18	-34.3	N/A
70 CW	N/A	-41.46
70 FM	N/A	*See Appendix 1
120	N/A	-40.12
200	N/A	-38.89

Table 3. 2018-2019 calibration results. During 2019, the 38kHz system was not successfully calibrated. See Appendix 4 for the screenshots detailing the results from the 2019 calibration.

18 kHz: Pulse length: 4.096 ms	**March 2018 results**	**May 2019 results**
Transducer peak gain (dB)	20.54	22.68
Sa correction (dB)	-0.47	0.11
Beamwidth (º) alongship/athwartship	12.05/11.70	9.94/10.31
Beam offset (º) alongship/athwartship	0.41/-0.08	0.01/0.11
RMS deviation (dB)	0.35	0.24
18 kHz: Pulse length: 1.024 ms	**March 2018 results**	**May 2019 results**
Transducer peak gain (dB)	20.09	22.28
Sa correction (dB)	-0.68	0.01
Beamwidth (º) alongship/athwartship	11.64/11.84	10.29/11.24
Beam offset (º) alongship/athwartship	0.12/0.14	-0.02/-0.08
RMS deviation (dB)	0.37	0.20
70 kHz (CW): Pulse length: 2.048 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	26.76	26.69
Sa correction (dB)	-0.24	-0.36
Beamwidth (º) alongship/athwartship	6.50/6.60	6.73/6.70
Beam offset (º) alongship/athwartship	0.05/0.36	0.19/0.35
RMS deviation (dB)	0.16	0.34
70 kHz (CW): Pulse length: 1.024 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	26.65	27.40
Sa correction (dB)	-0.36	0.08
Beamwidth (º) alongship/athwartship	6.79/6.51	6.00/5.94
Beam offset (º) alongship/athwartship	-0.03/-0.28	-0.19/-0.29
RMS deviation (dB)	0.38	0.38
70 kHz (FM): Pulse length: 8.192 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	N/A	22.32 to 29.12
Sa correction (dB)	N/A	0.00
Beamwidth (º) alongship/athwartship	N/A	*See XML file
Beam offset (º) alongship/athwartship	N/A	*See XML file
RMS deviation (dB)	N/A	0.2033 to 0.7637
70 kHz (FM): Pulse length: 4.096 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	N/A	21.68 to 29.23
Sa correction (dB)	N/A	0.00
Beamwidth (º) alongship/athwartship	N/A	*See XML file
Beam offset (º) alongship/athwartship	N/A	*See XML file
RMS deviation (dB)	N/A	0.2446 to 0.4616
70 kHz (FM): Pulse length: 2.048 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	N/A	21.72 to 29.56
Sa correction (dB)	N/A	0.00
Beamwidth (º) alongship/athwartship	N/A	*See XML file
Beam offset (º) alongship/athwartship	N/A	*See XML file
RMS deviation (dB)	N/A	0.2557 to 0.4686
70 kHz (FM): Pulse length: 1.024 ms	**March 2018 GPT results**	**May 2019 WBT results**
Transducer peak gain (dB)	N/A	21.91 to 29.62

Sa correction (dB)	N/A	0.00
Beamwidth (º) alongship/athwartship	N/A	*See XML file
Beam offset (º) alongship/athwartship	N/A	*See XML file
RMS deviation (dB)	N/A	0.2785 to 0.4557
120 kHz: Pulse length: 1.024 ms	**March 2018 results**	**May 2019 results**
Transducer peak gain (dB)	26.25	26.00
Sa correction (dB)	-0.38	-0.03
Beamwidth (º) alongship/athwartship	6.49/6.75	6.46/6.35
Beam offset (º) alongship/athwartship	-0.10/0.09	0.16/-0.14
RMS deviation (dB)	0.22	0.28
200 kHz: Pulse length: 1.024 ms	**March 2018 results**	**May 2019 results**
Transducer peak gain (dB)	26.34	26.27
Sa correction (dB)	-0.36	0.01
Beamwidth (º) alongship/athwartship	6.76/6.88	6.50/6.26
Beam offset (º) alongship/athwartship	0.04/0.13	0.11/0.00
RMS deviation (dB)	0.23	0.14

Appendix 1 - Channel Results

18 kHz: 4.096 ms

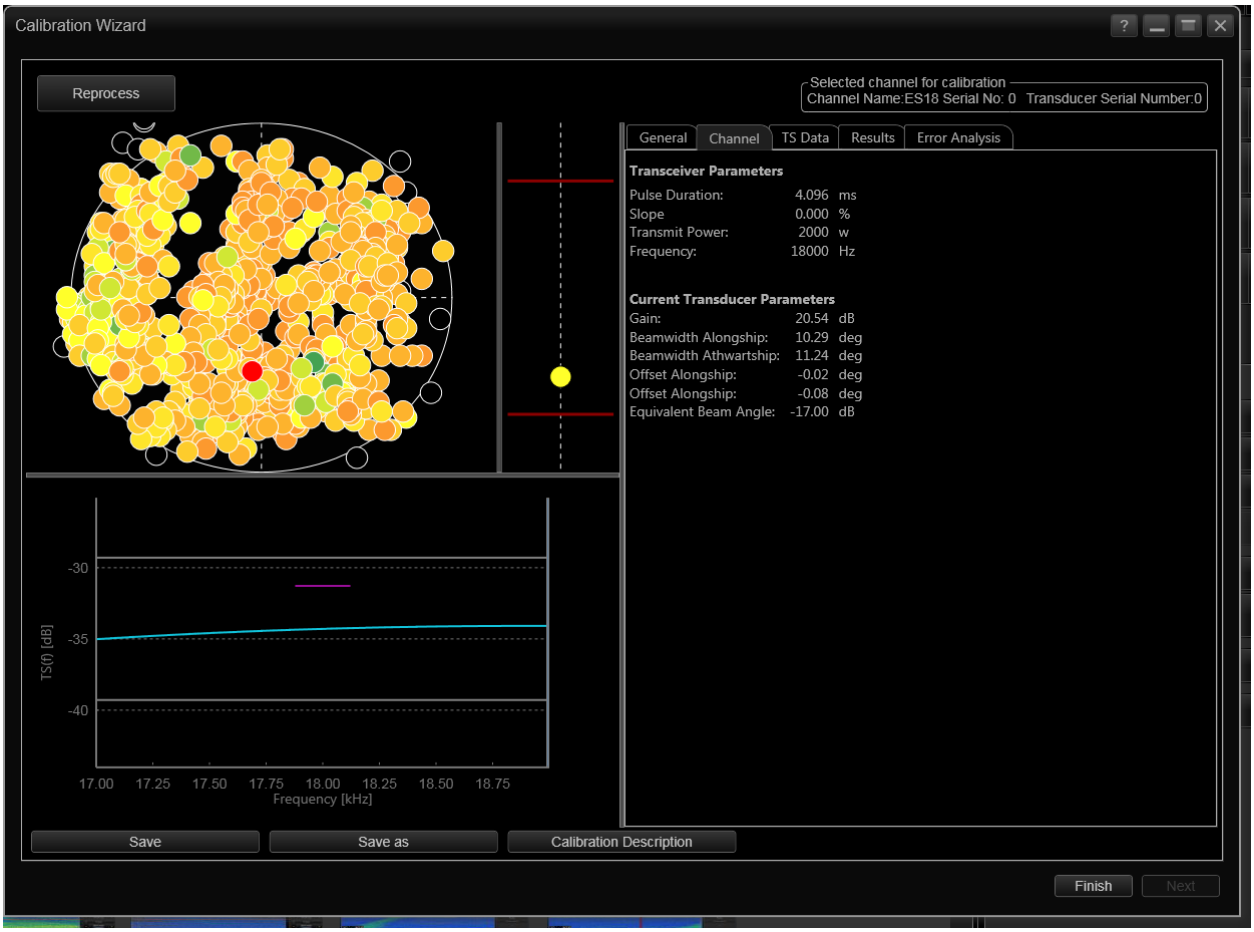

Figure 1. Screenshot of EK 80 Calibration Wizard. Channel results for 18 kHz calibration at 4.096 ms.

18 kHz: 1.024 ms

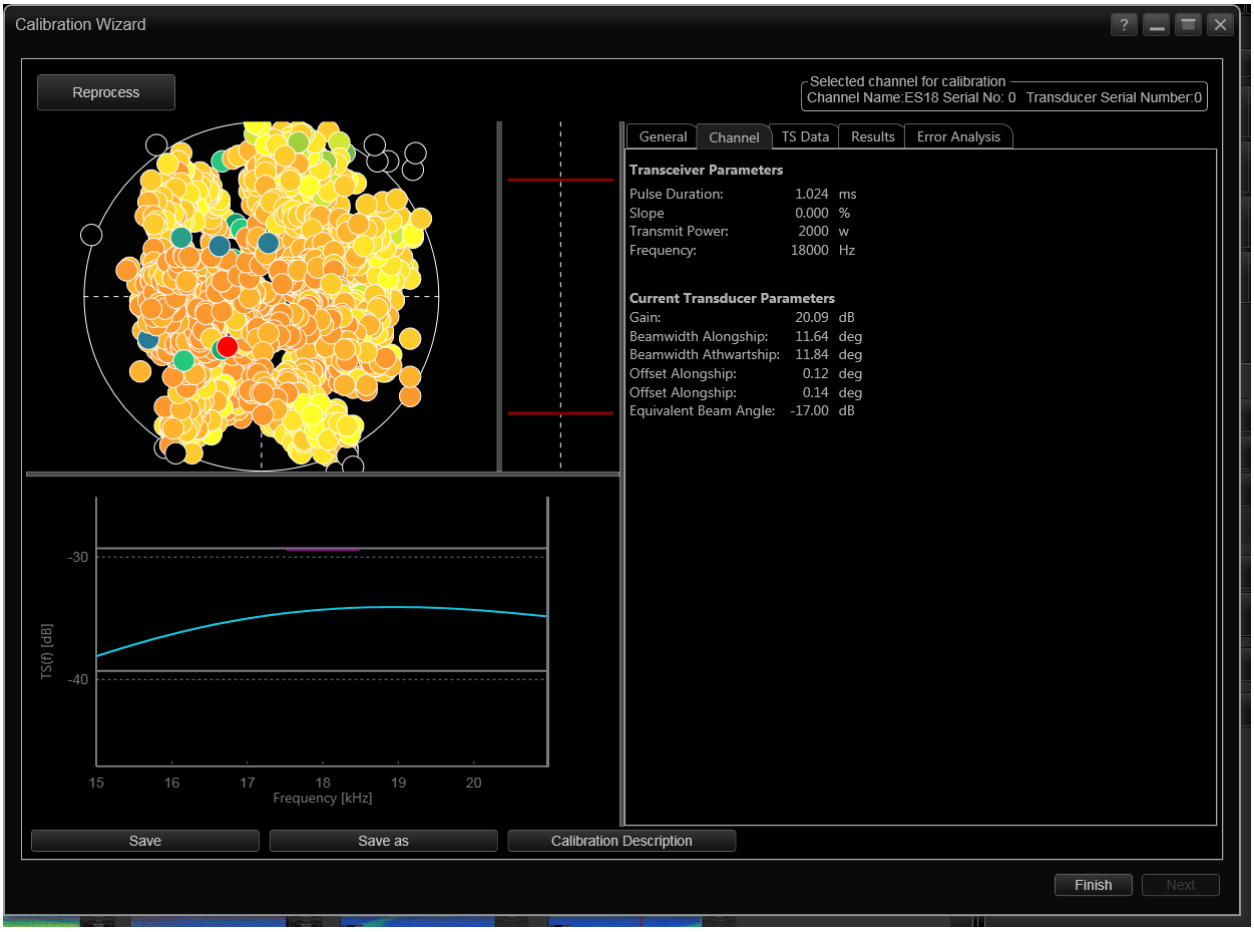

Figure 2. Screenshot of EK 80 Calibration Wizard. Channel results for 18 kHz calibration at 1.024 ms.

70 kHz (CW): 2.048 ms

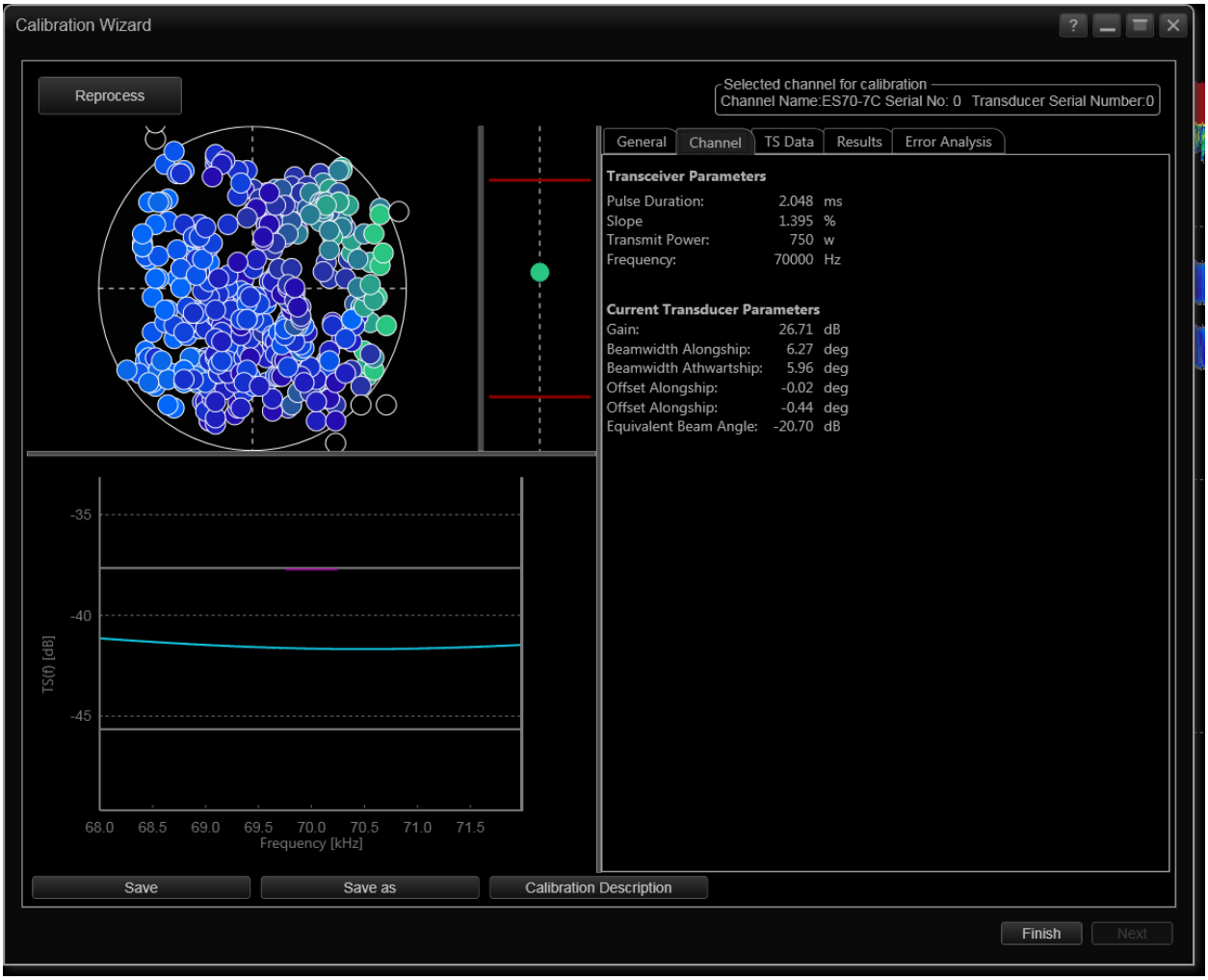

Figure 3. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 2.048 ms in continuous wave (CW) mode.

70 kHz (CW): 1.024 ms

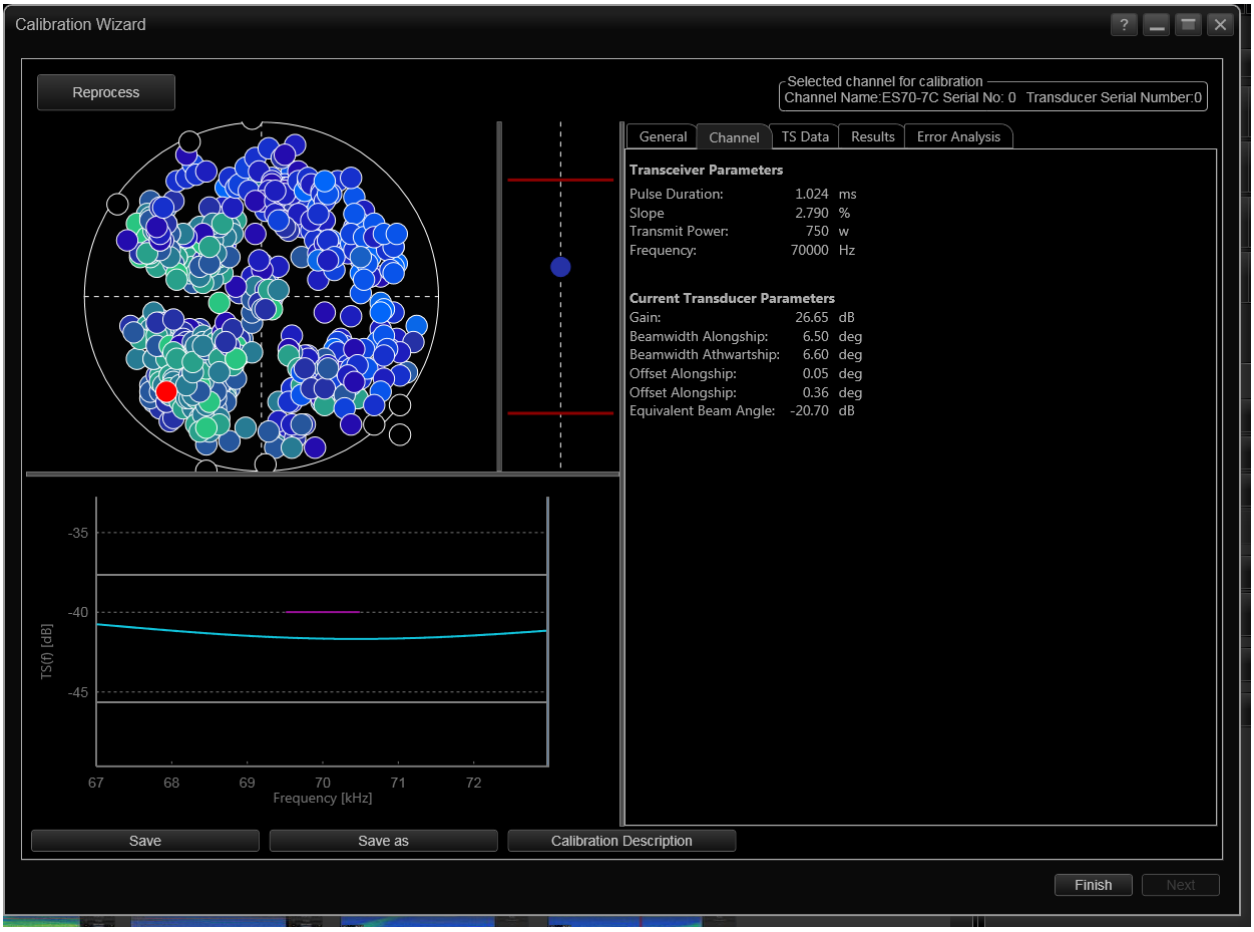

Figure 4. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 1.024 ms in continuous wave (CW) mode.

70 kHz (FM): 8.192 ms

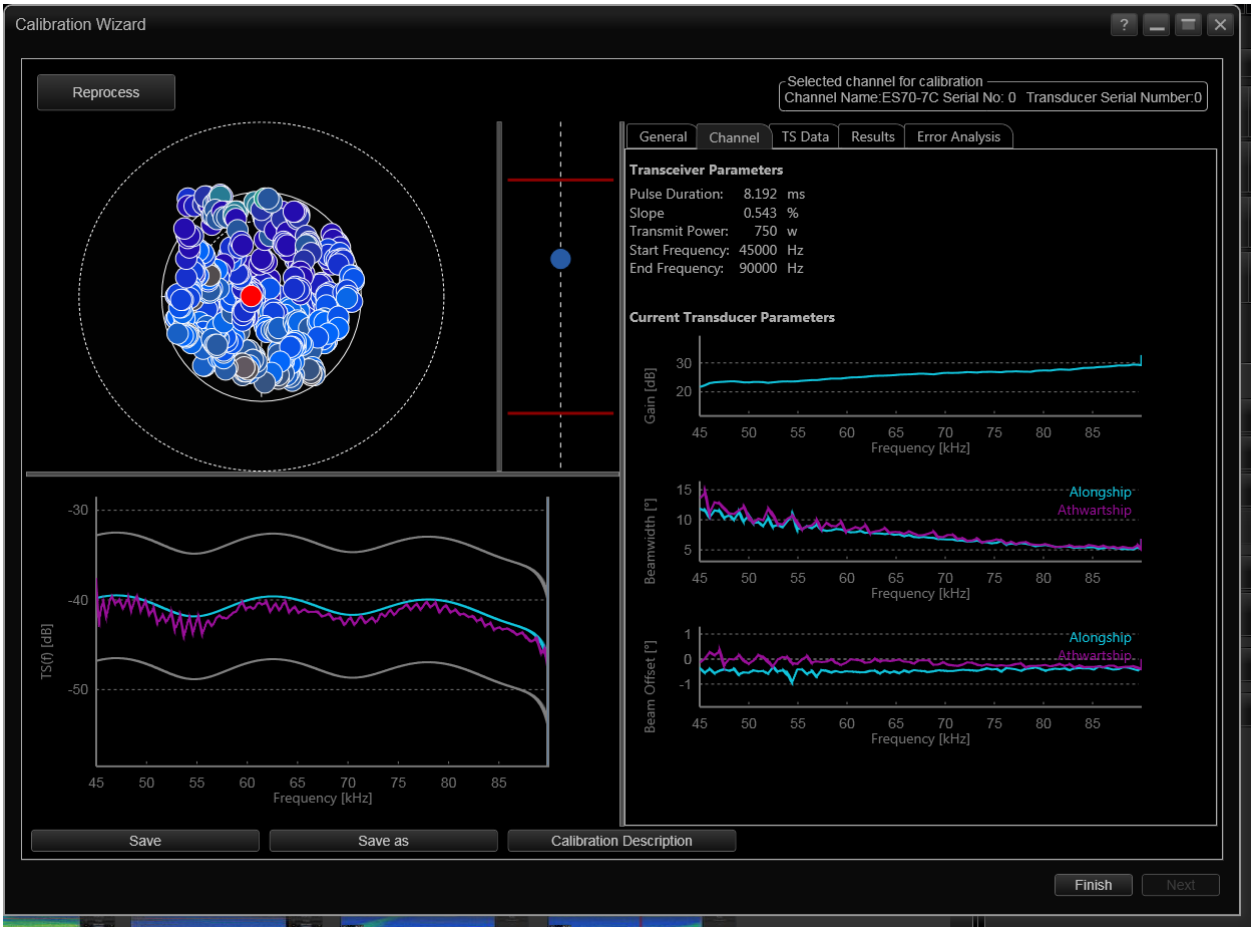

Figure 5. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 8.192 ms in frequency modulated (FM) mode.

70 kHz (FM): 4.096 ms

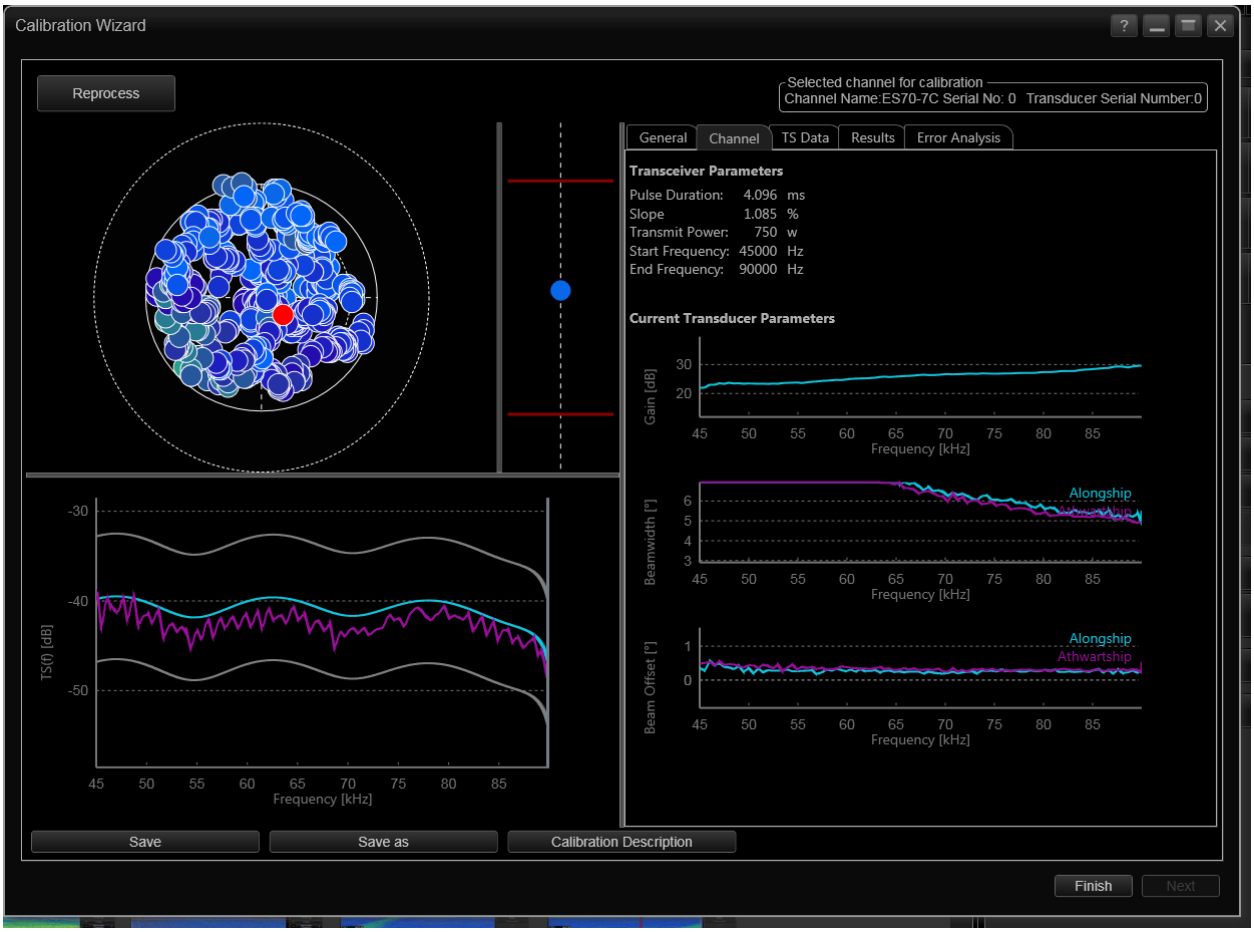

Figure 6. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 4.096 ms in frequency modulated (FM) mode.

70 kHz (FM): 2.048 ms

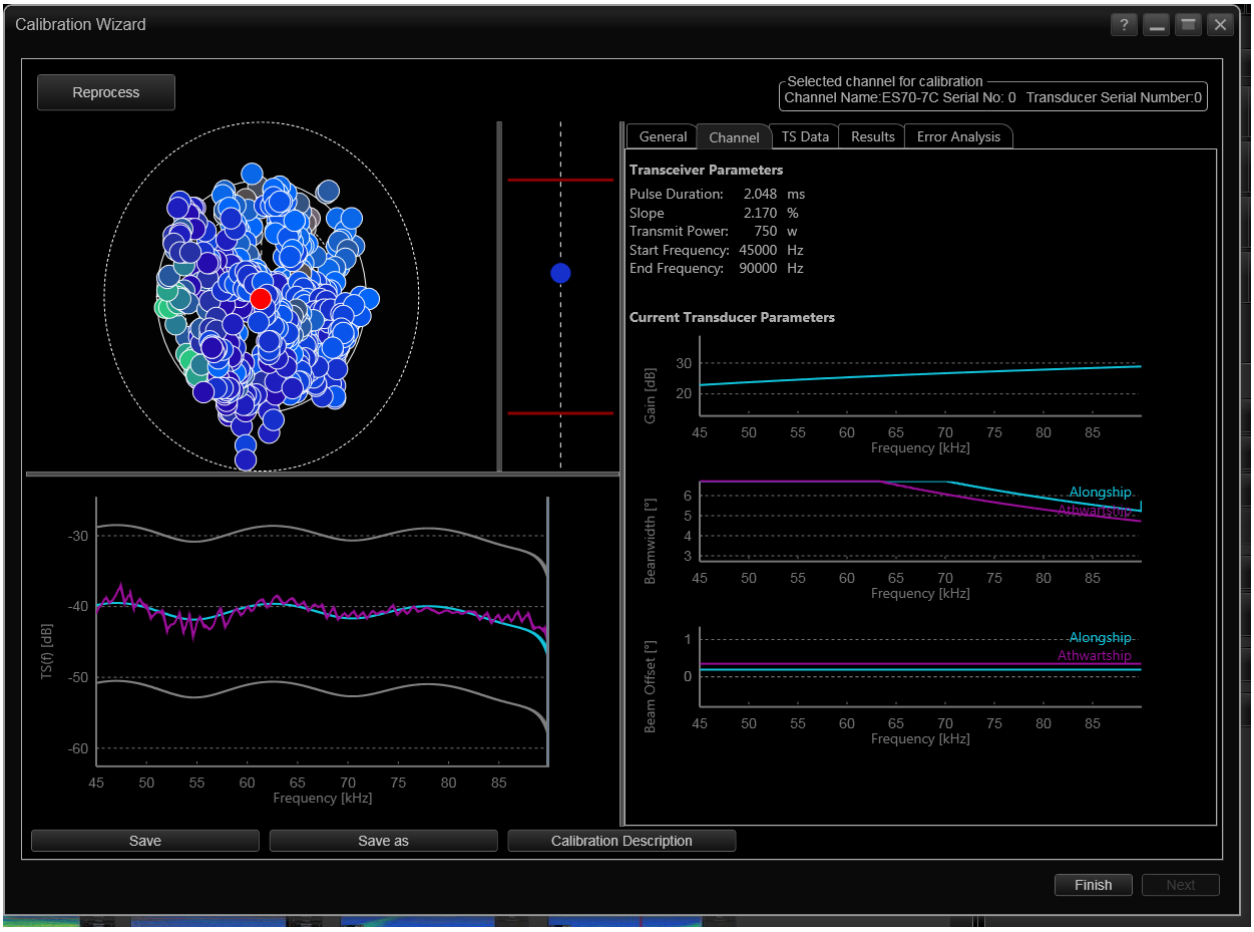

Figure 7. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 2.048 ms in frequency modulated (FM) mode.

70 kHz (FM): 1.024 ms

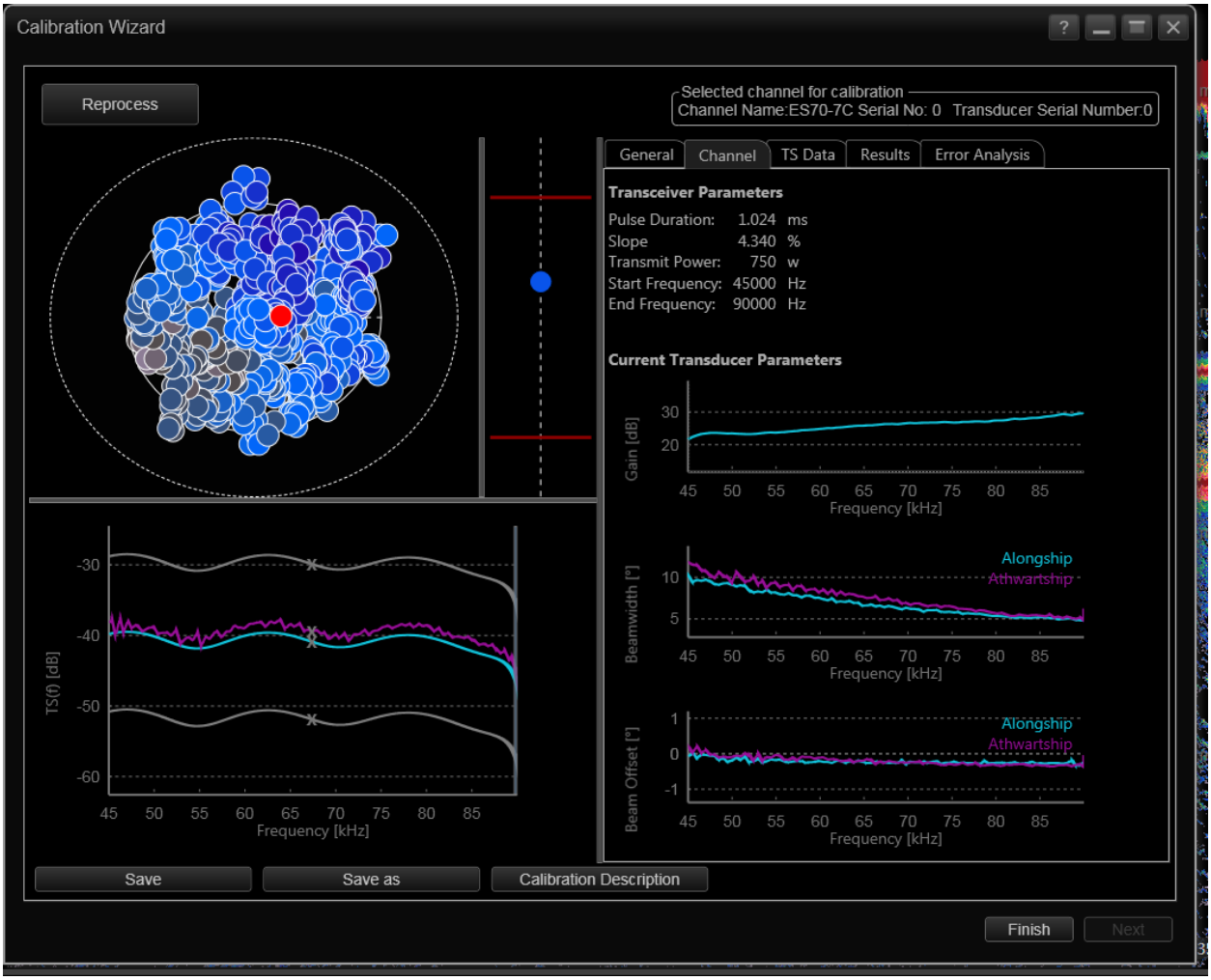

Figure 8. Screenshot of EK 80 Calibration Wizard. Channel results for 70 kHz calibration at 1.024 ms in frequency modulated (FM) mode.

120 kHz: 1.024 ms

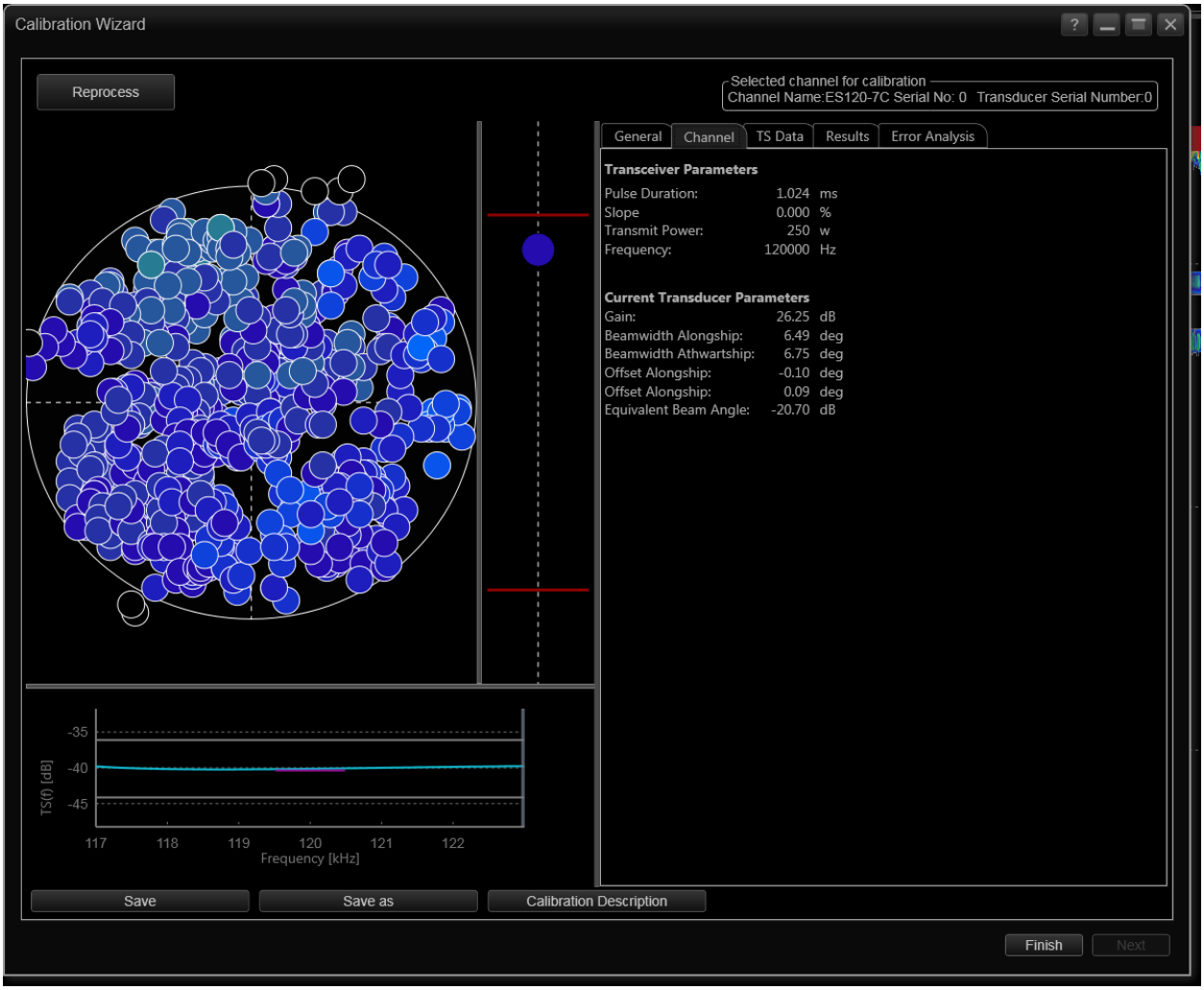

Figure 9. Screenshot of EK 80 Calibration Wizard. Channel results for 120 kHz calibration at 1.024 ms.

200 kHz: 1.024 ms

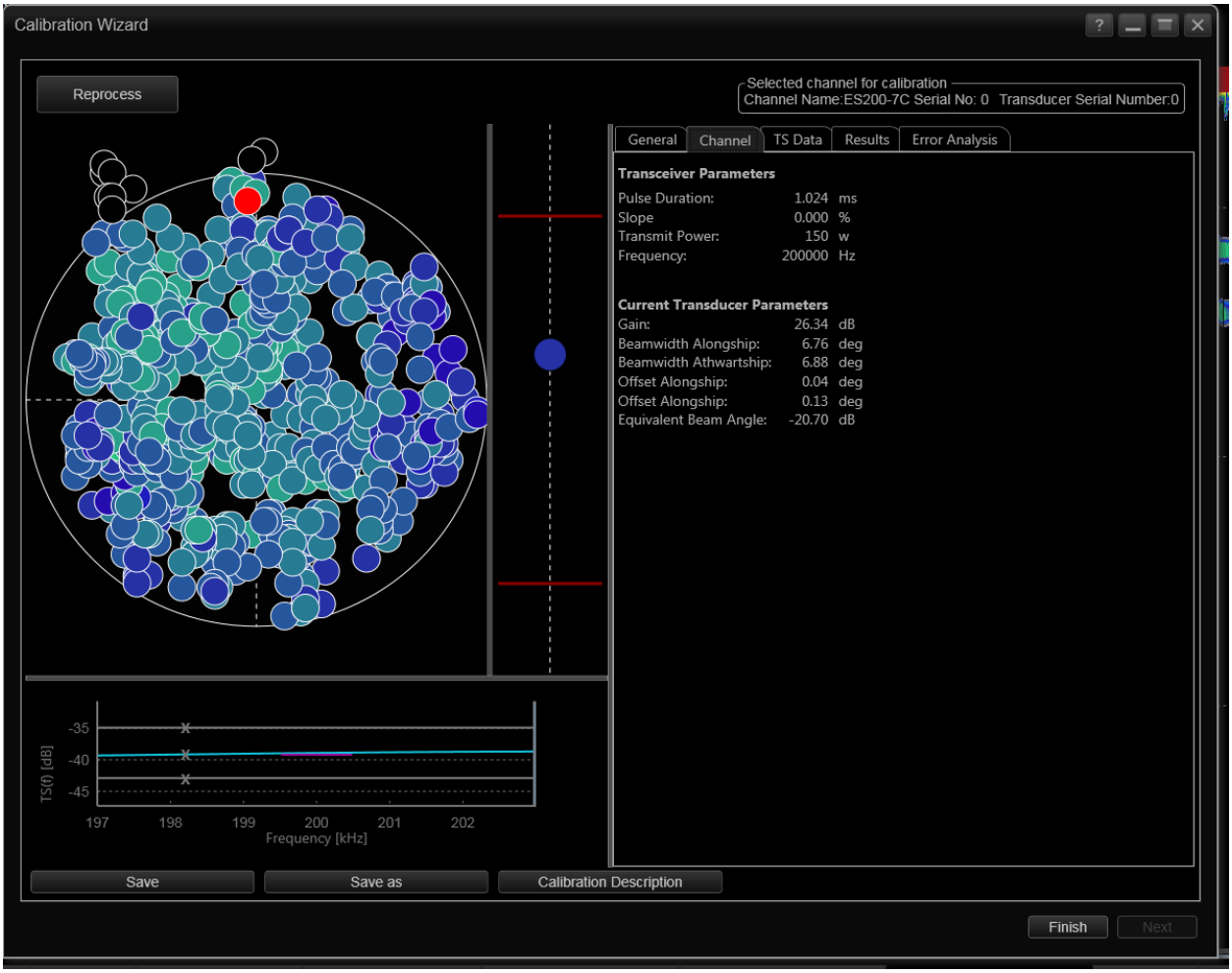

Figure 10. Screenshot of EK 80 Calibration Wizard. Channel results for 200 kHz calibration at 1.024 ms.

Appendix 2 - General Results

18 kHz: 4.096 ms

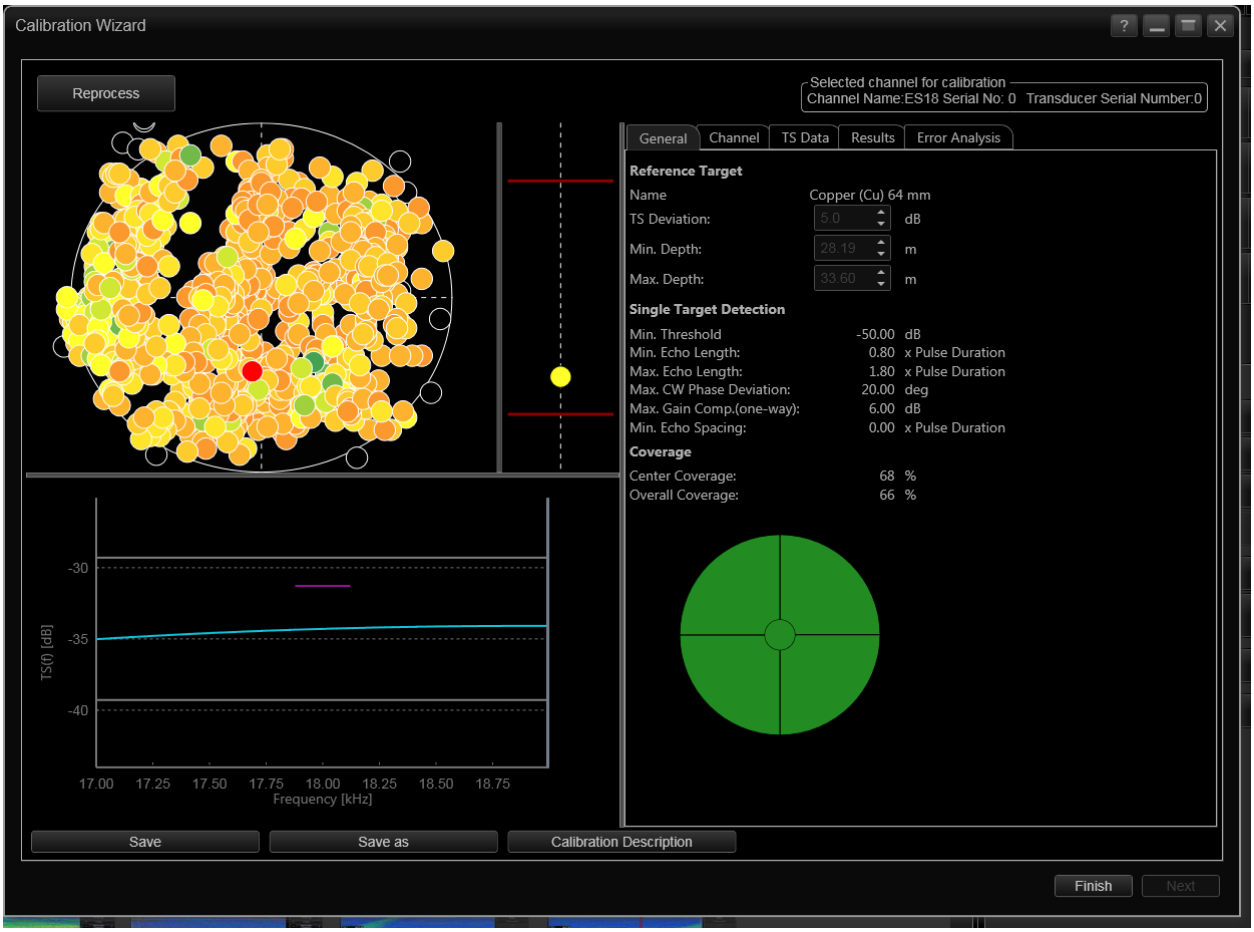

Figure 11. Screenshot of EK 80 Calibration Wizard. General results for 18 kHz calibration at 4.096 ms.

18 kHz: 1.024 ms

Figure 12. Screenshot of EK 80 Calibration Wizard. General results for 18 kHz calibration at 1.024 ms.

70 kHz (CW): 2.048 ms

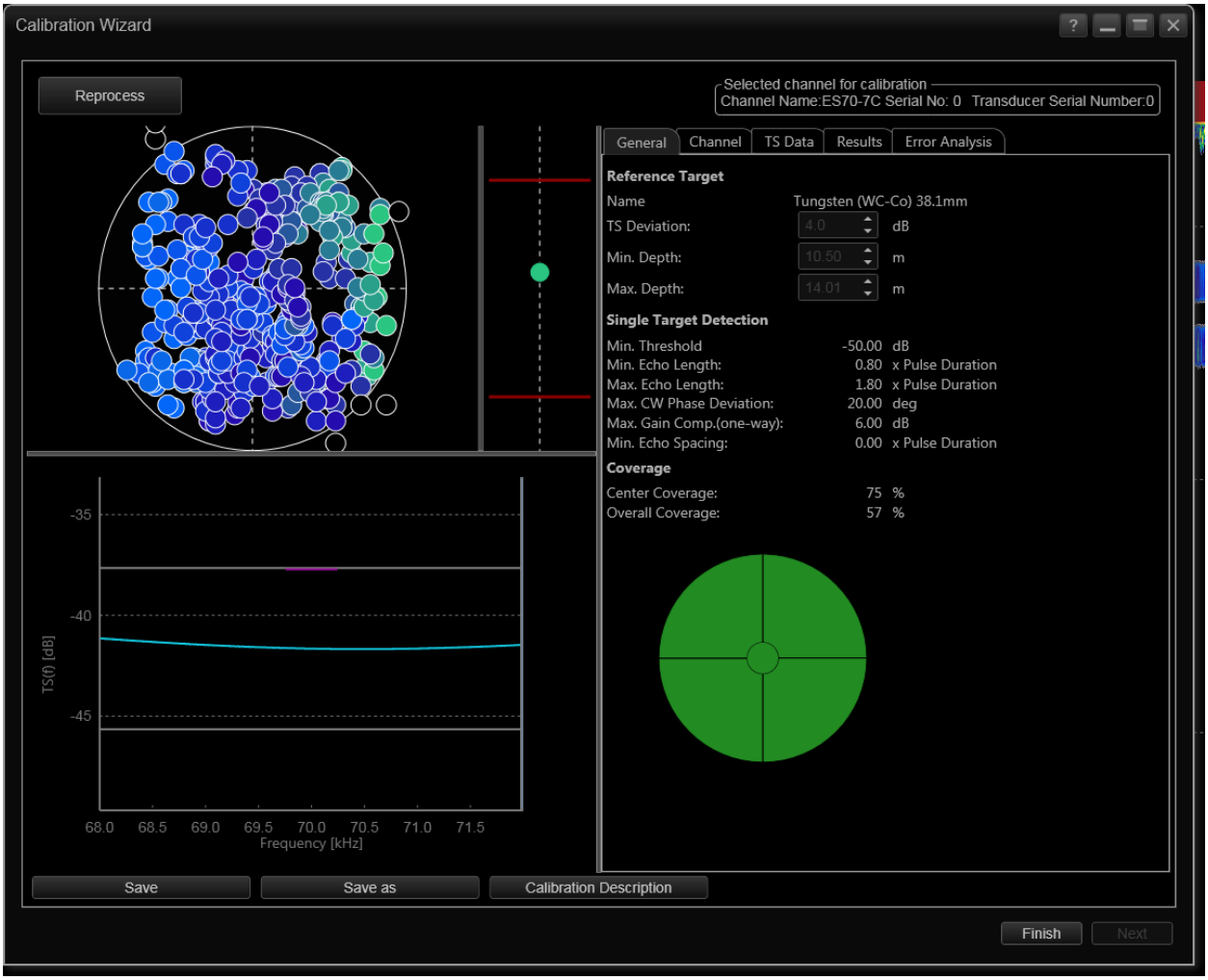

Figure 13. Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 2.048 ms in CW mode.

70 kHz (CW): 1.024 ms

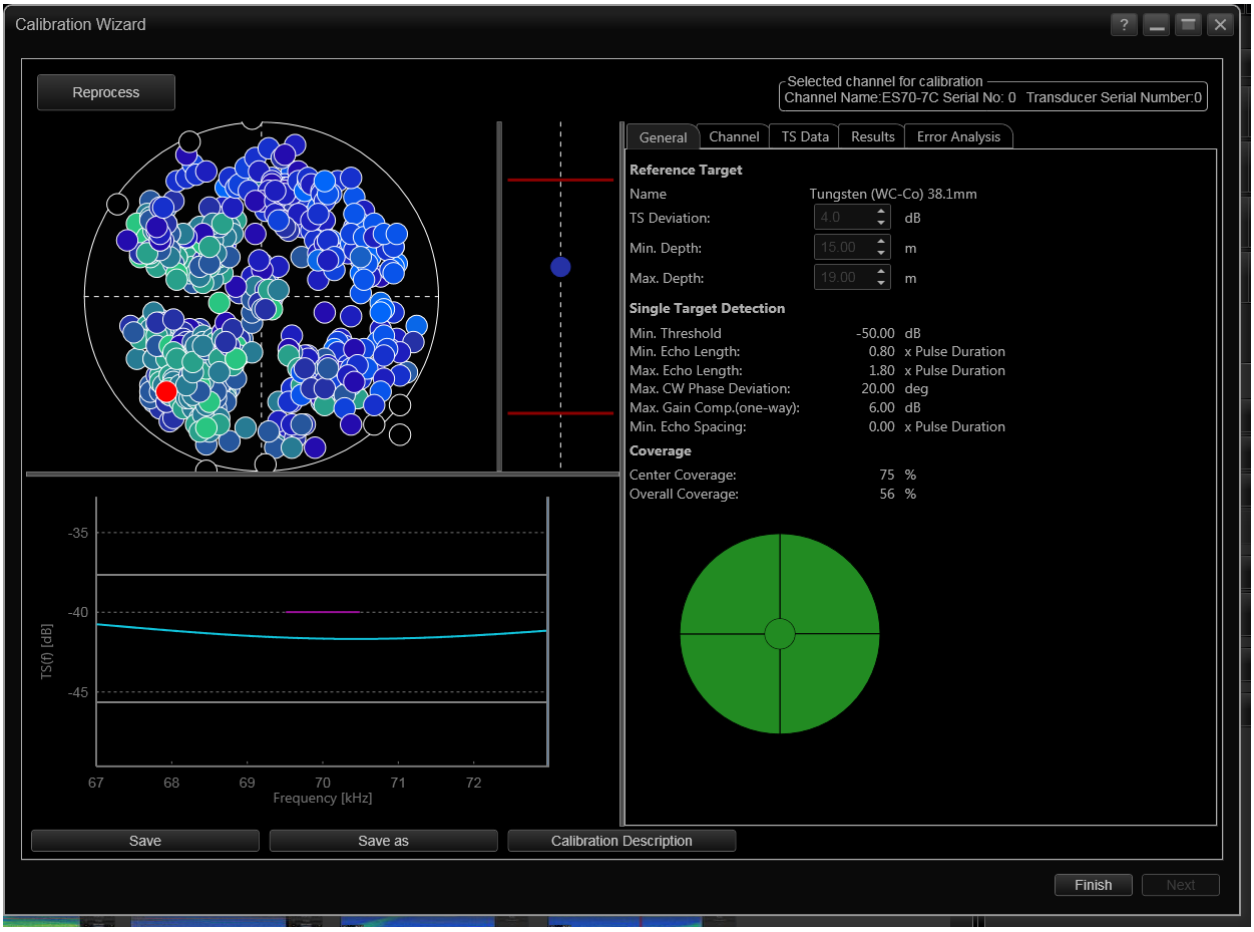

Figure 14. Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 1.024 ms in CW mode.

70 kHz (FM): 8.192 ms

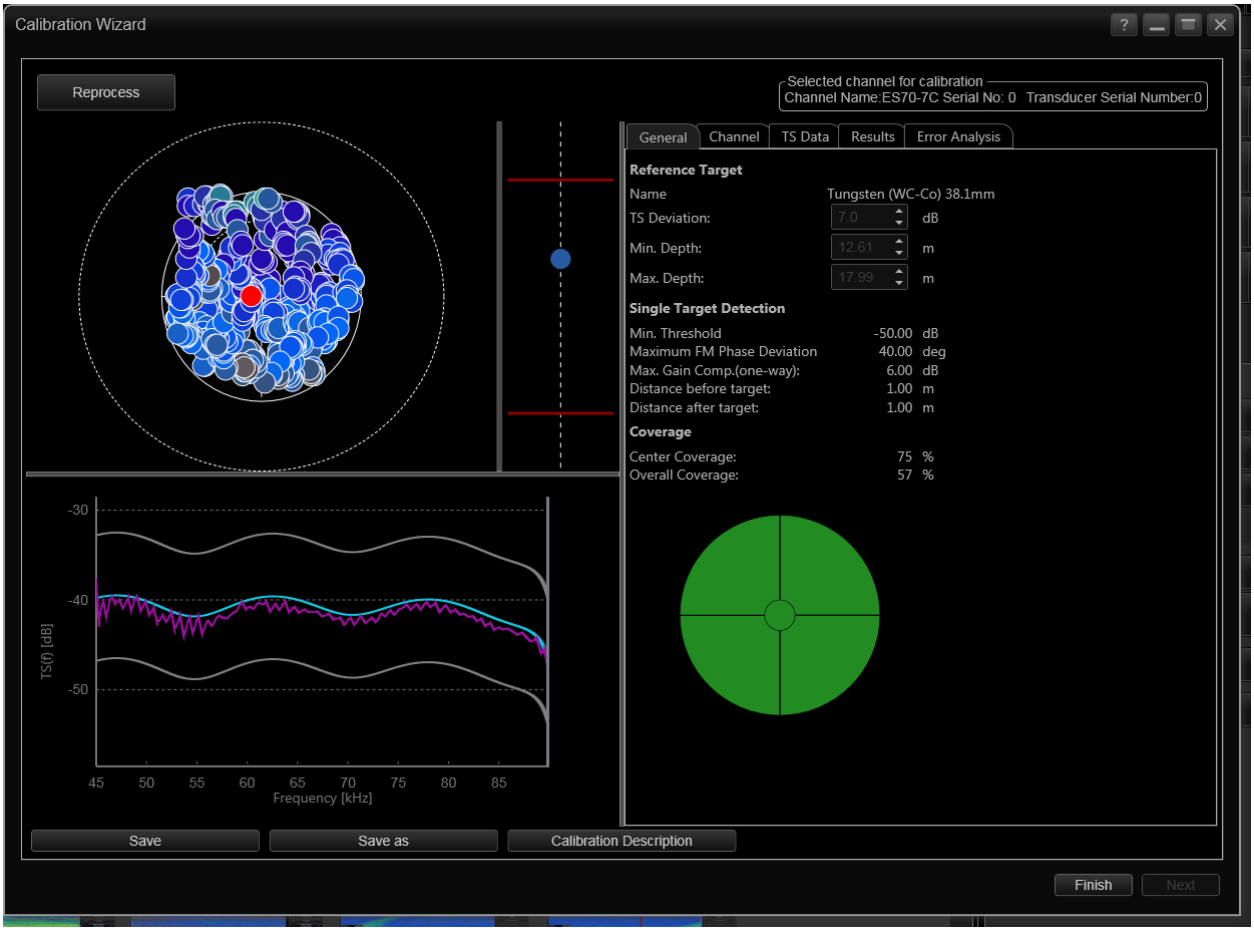

Figure 15.Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 8.192 ms in FM mode.

70 kHz (FM): 4.096 ms

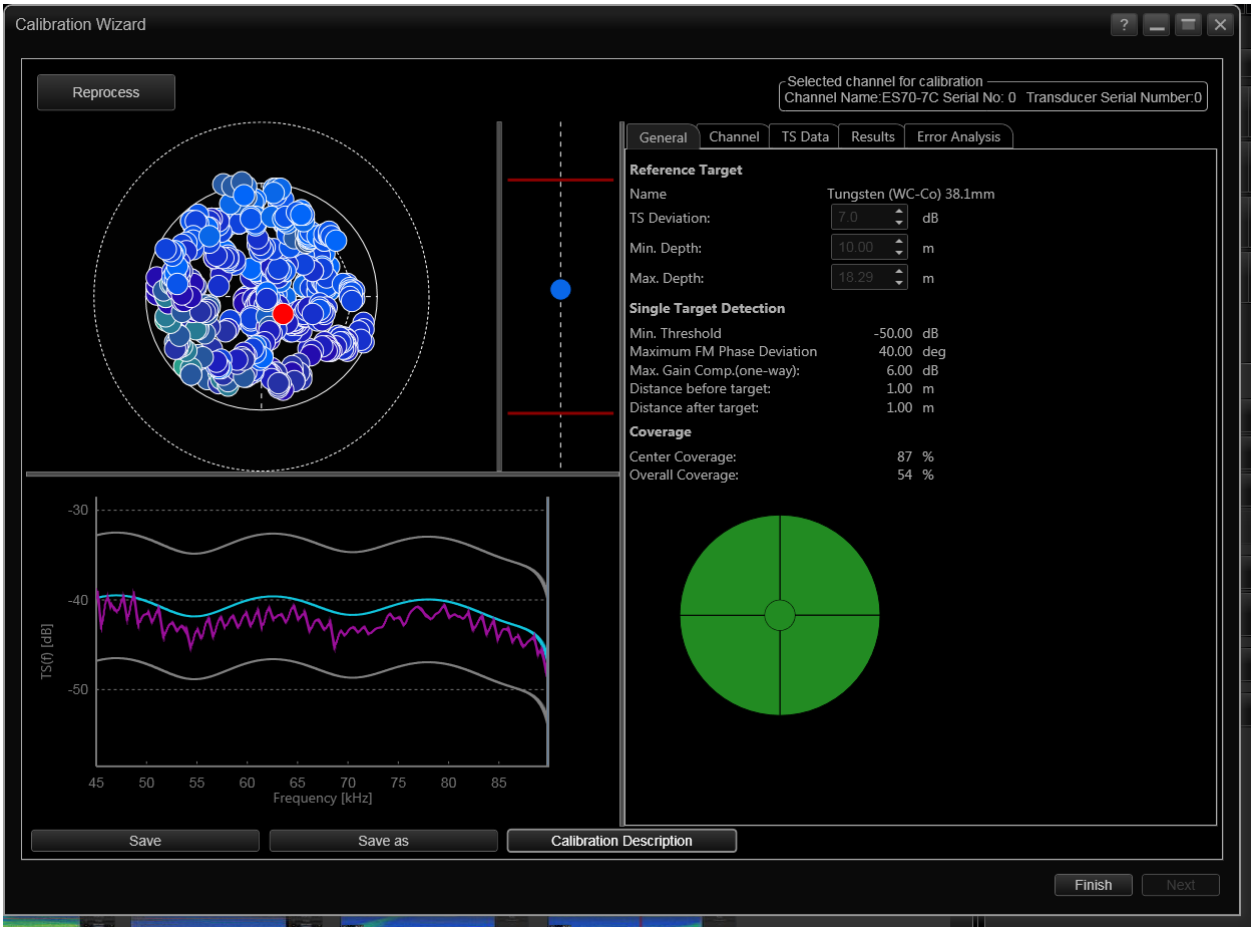

Figure 16. Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 4.096 ms in FM mode.

70 kHz (FM): 2.048 ms

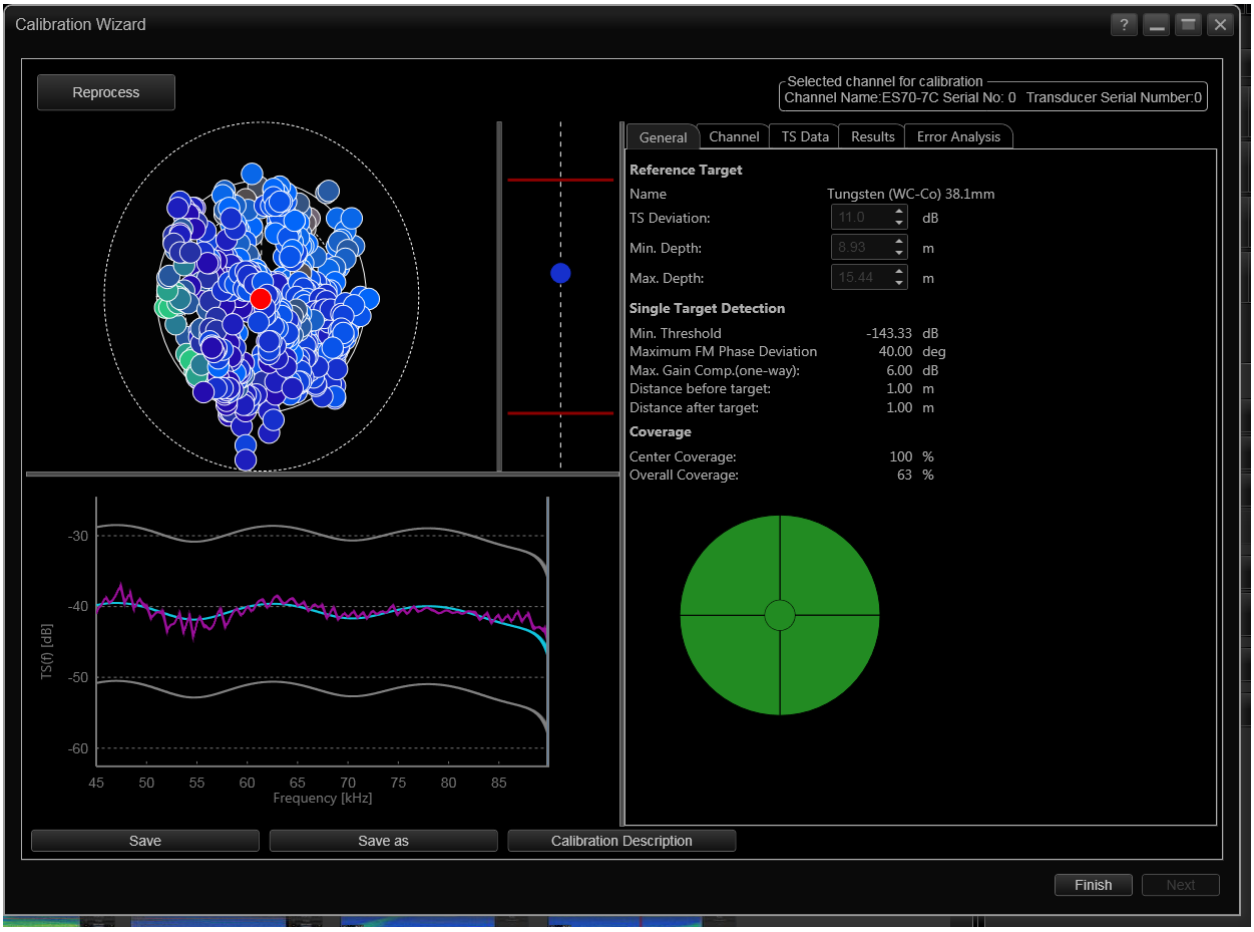

Figure 17. Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 2.048 ms in FM mode.

70 kHz (FM): 1.024 ms

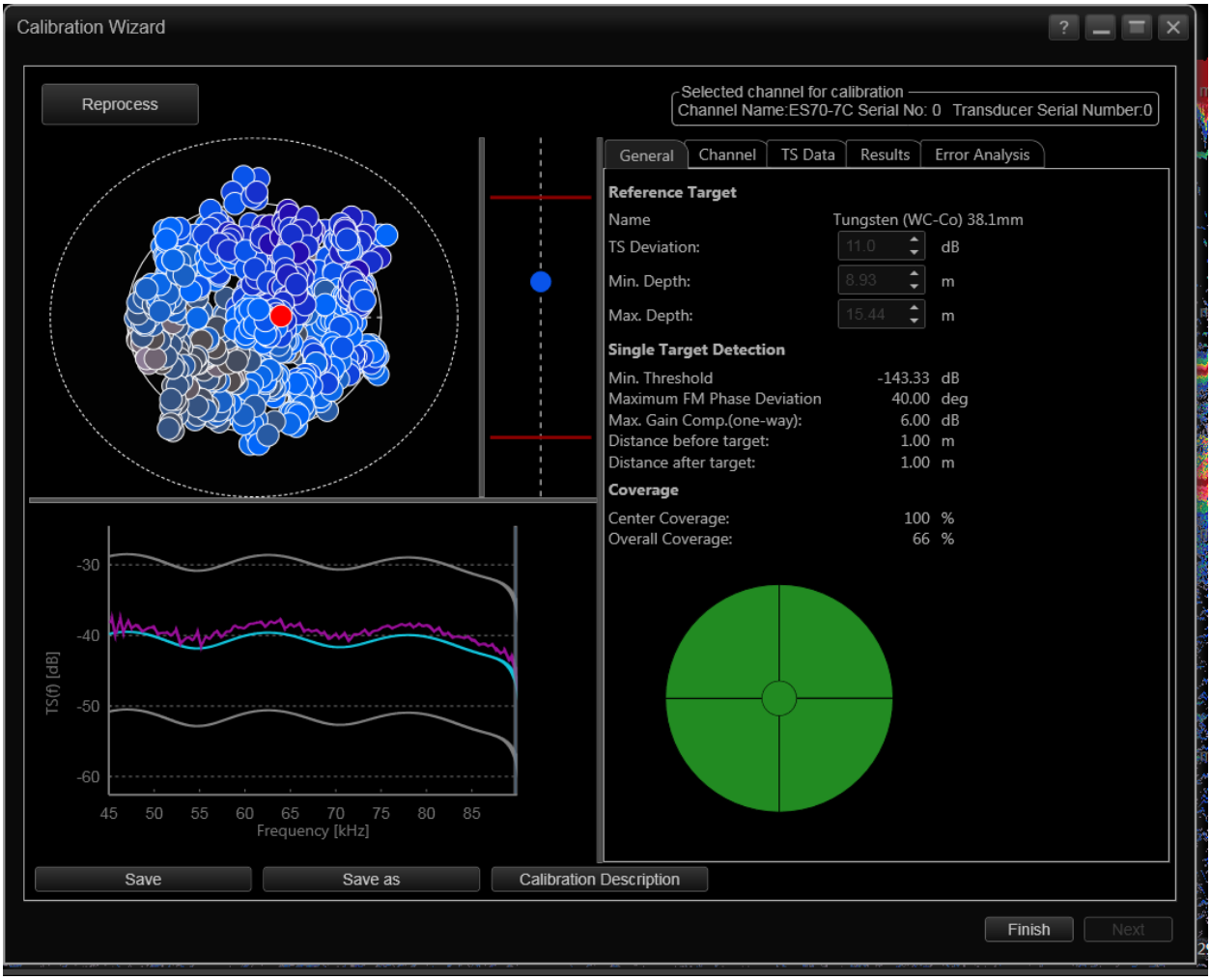

Figure 18. Screenshot of EK 80 Calibration Wizard. General results for 70 kHz calibration at 1.024 ms in FM mode.

120 kHz: 1.024 ms

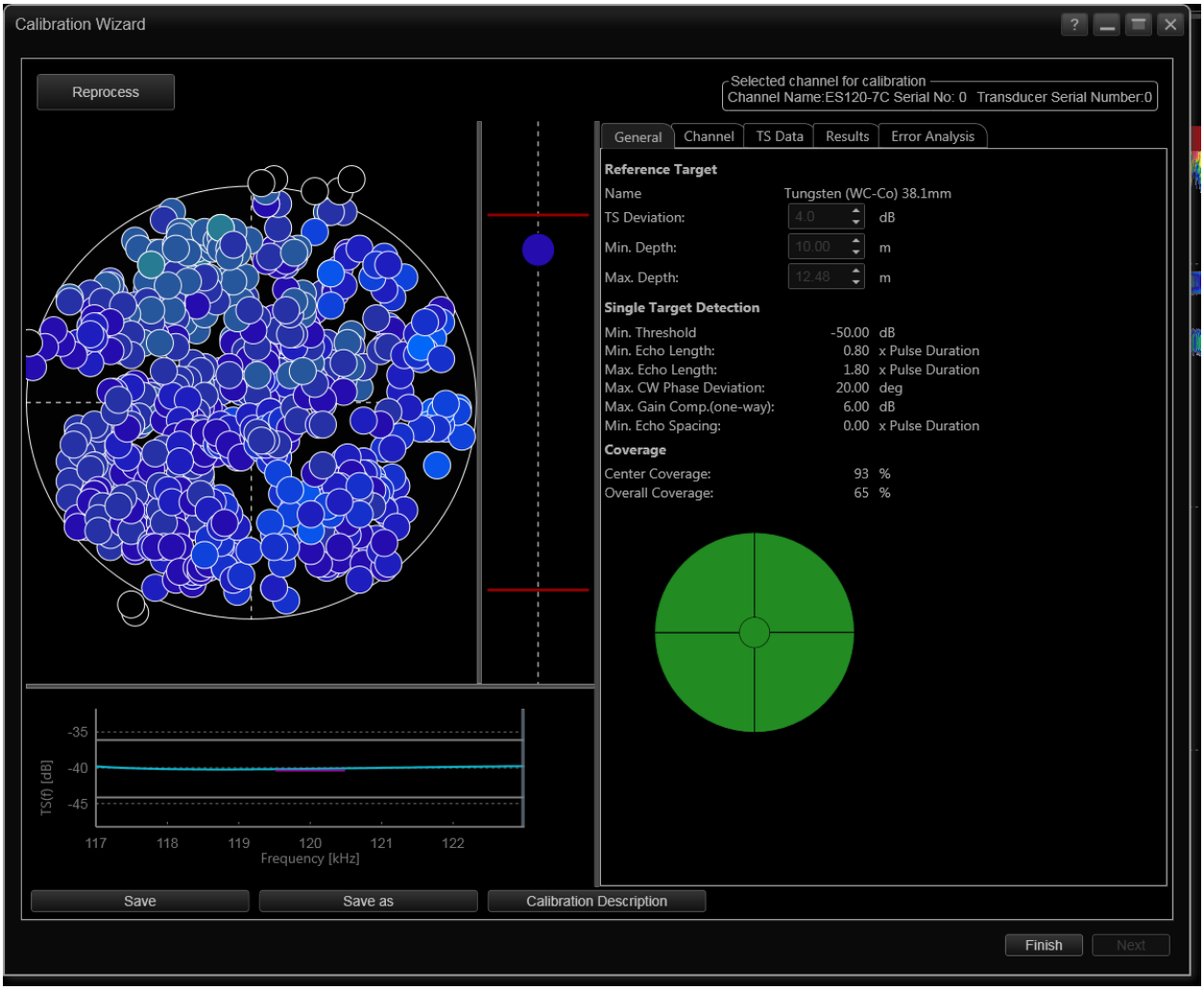

Figure 19. Screenshot of EK 80 Calibration Wizard. General results for 120 kHz calibration at 1.024 ms.

200 kHz: 1.024 ms

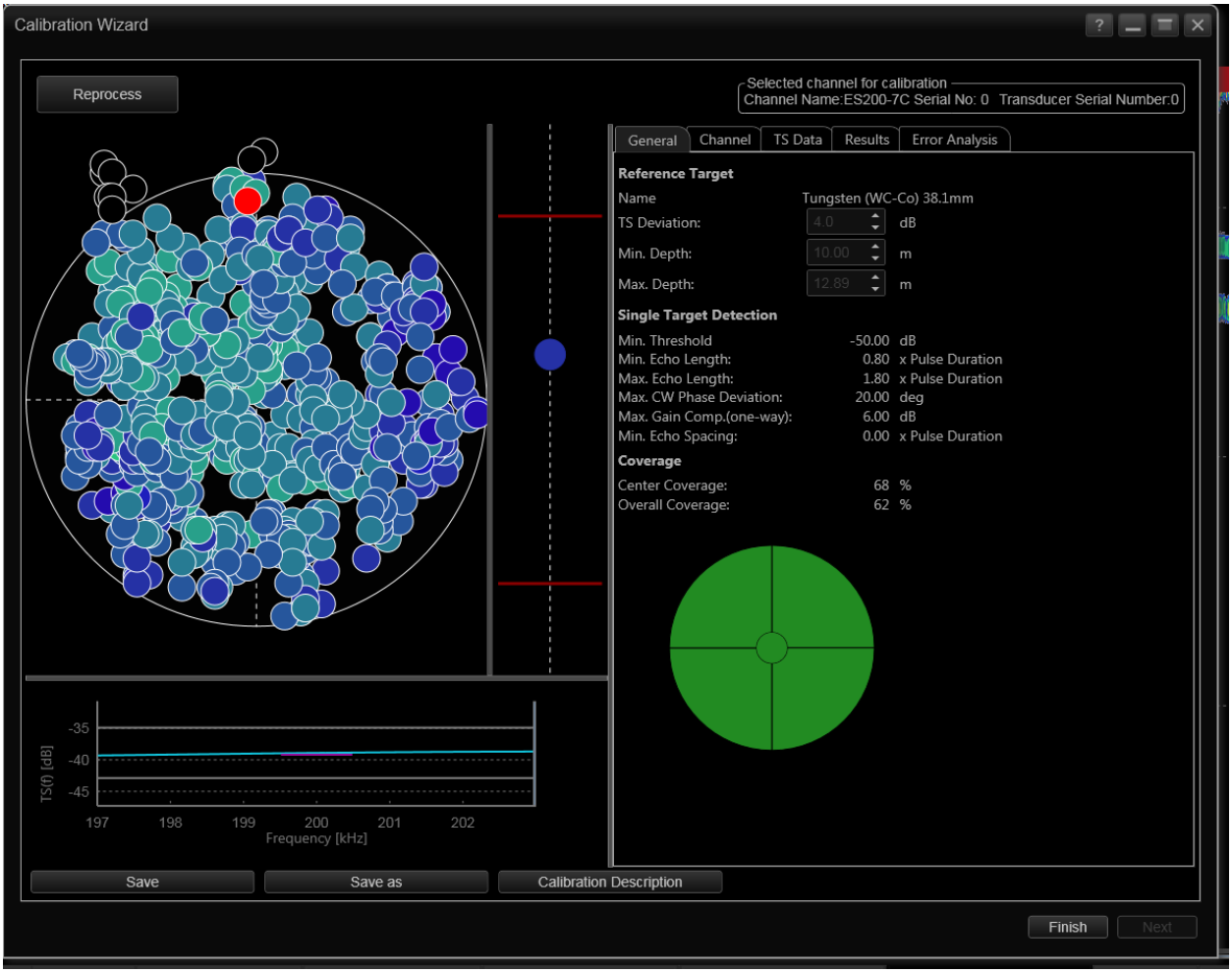

Figure 20. Screenshot of EK 80 Calibration Wizard. General results for 200 kHz calibration at 1.024 ms.

Appendix 3 – Target Strength (TS) Results

18 kHz: 4.096 ms

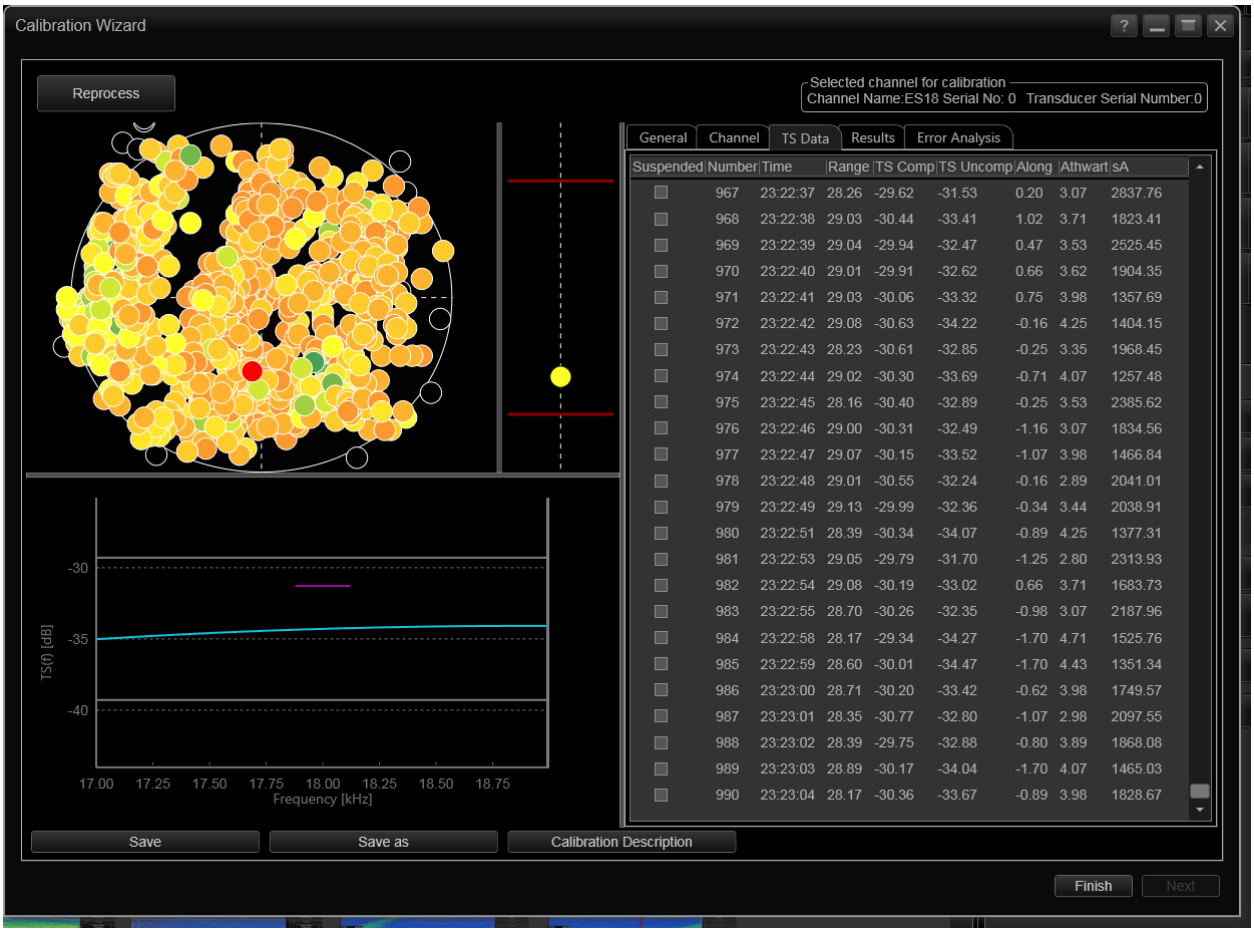

Figure 21. Screenshot of EK 80 Calibration Wizard. TS results for 18 kHz calibration at 4.096 ms.

18 kHz: 1.024 ms

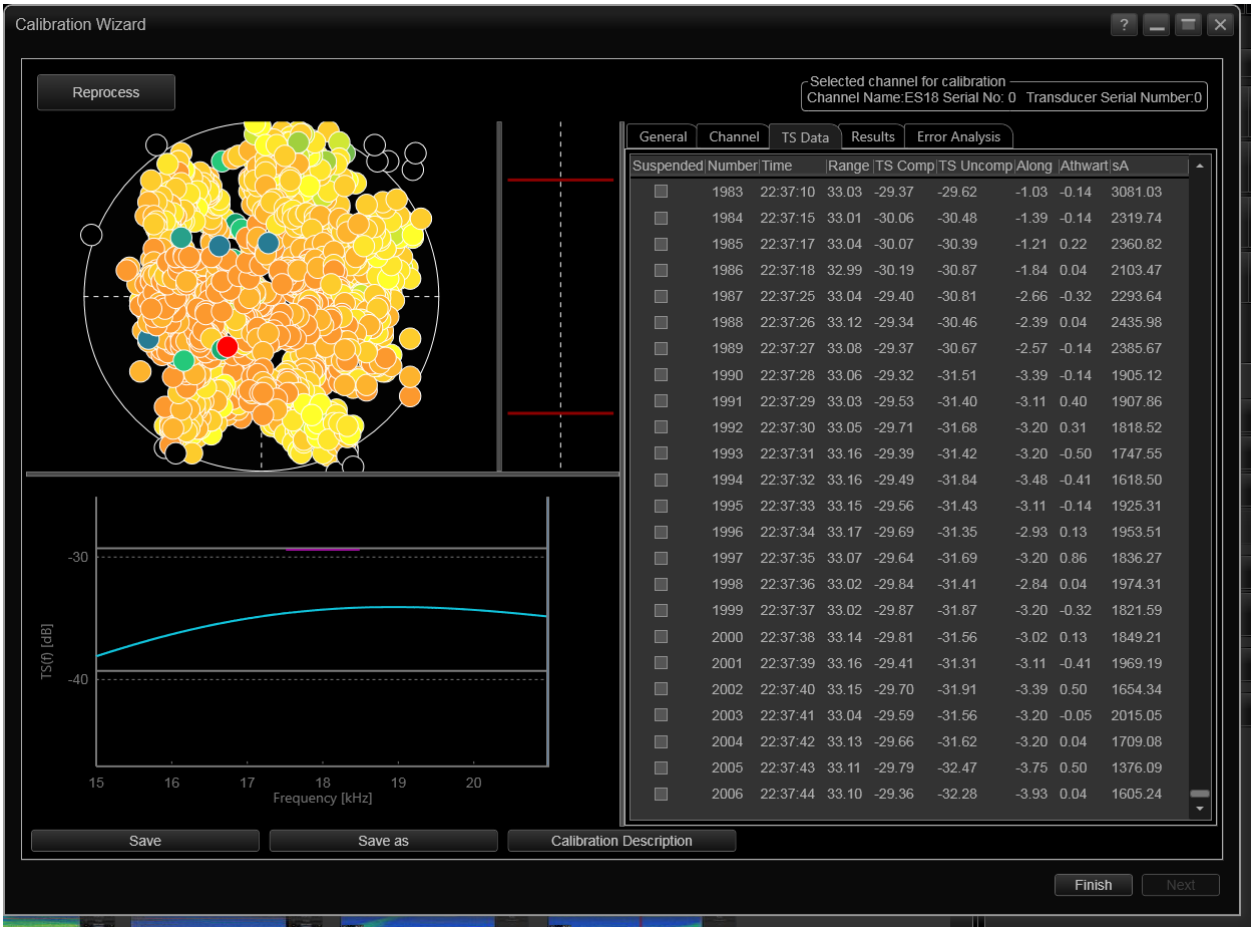

Figure 22. Screenshot of EK 80 Calibration Wizard. TS results for 18 kHz calibration at 1.024 ms.

70 kHz (CW): 2.048 ms

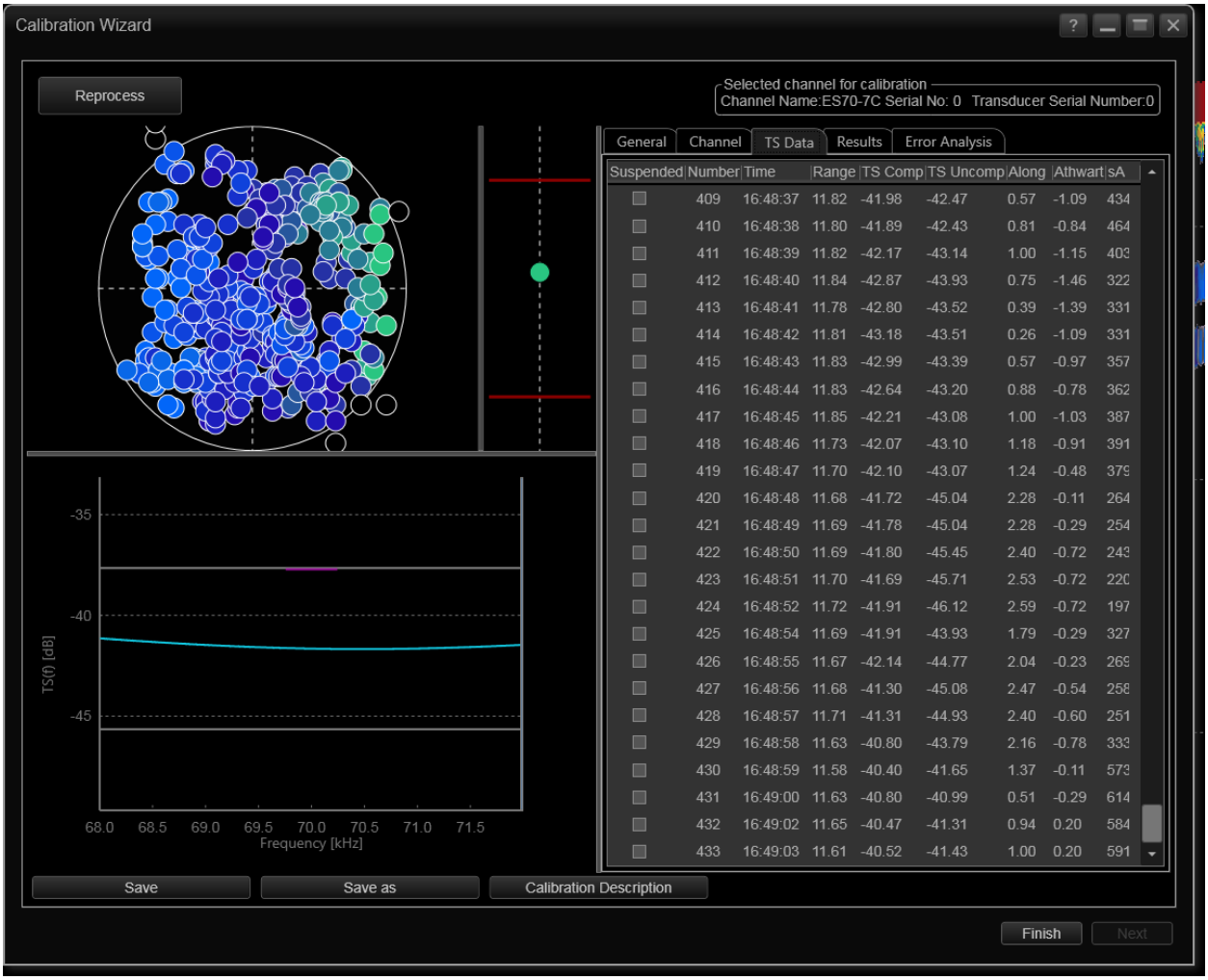

Figure 23. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 2.048 ms in CW mode.

70 kHz (CW): 1.024 ms

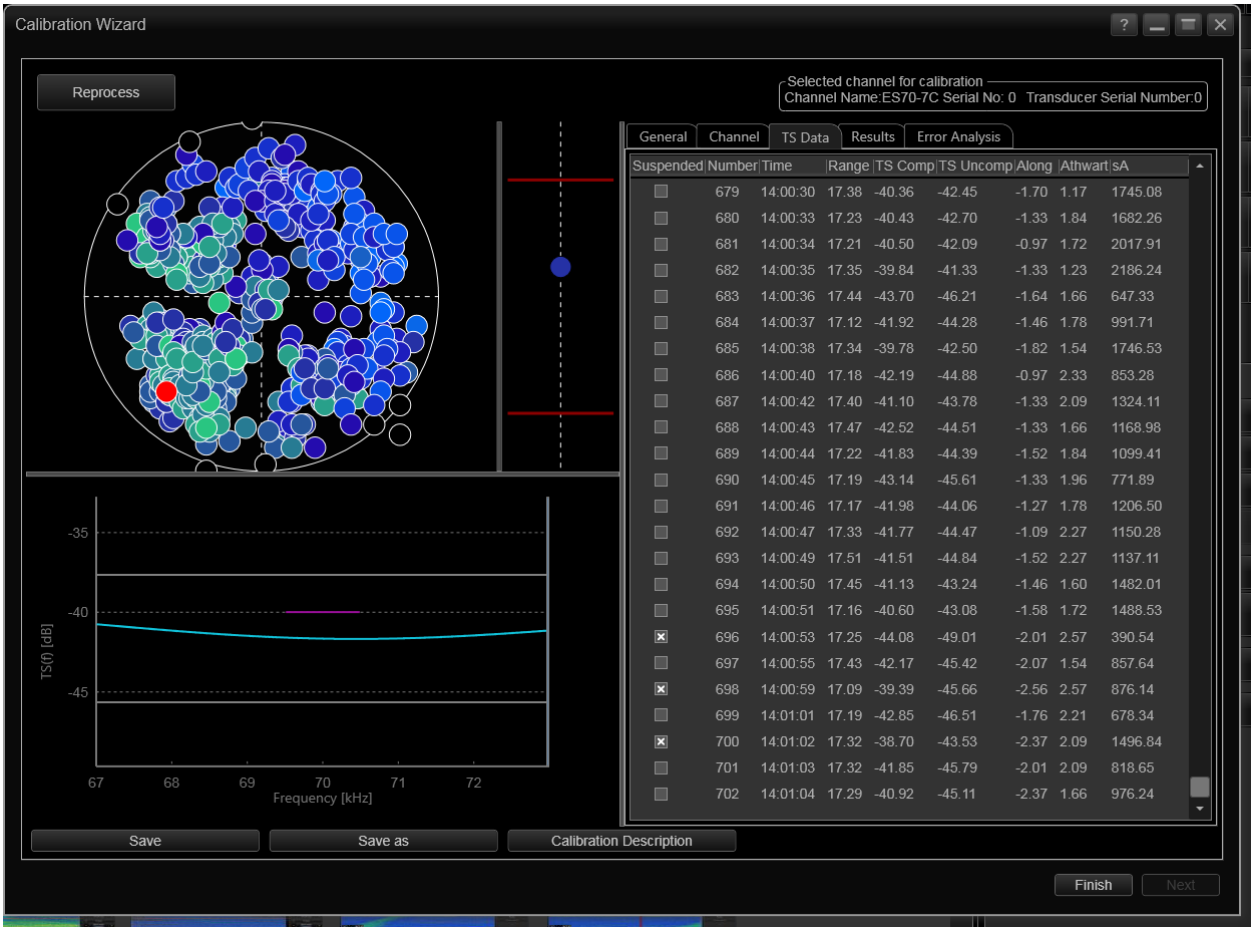

Figure 24. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 1.024 ms in CW mode.

70 kHz (FM): 8.192 ms

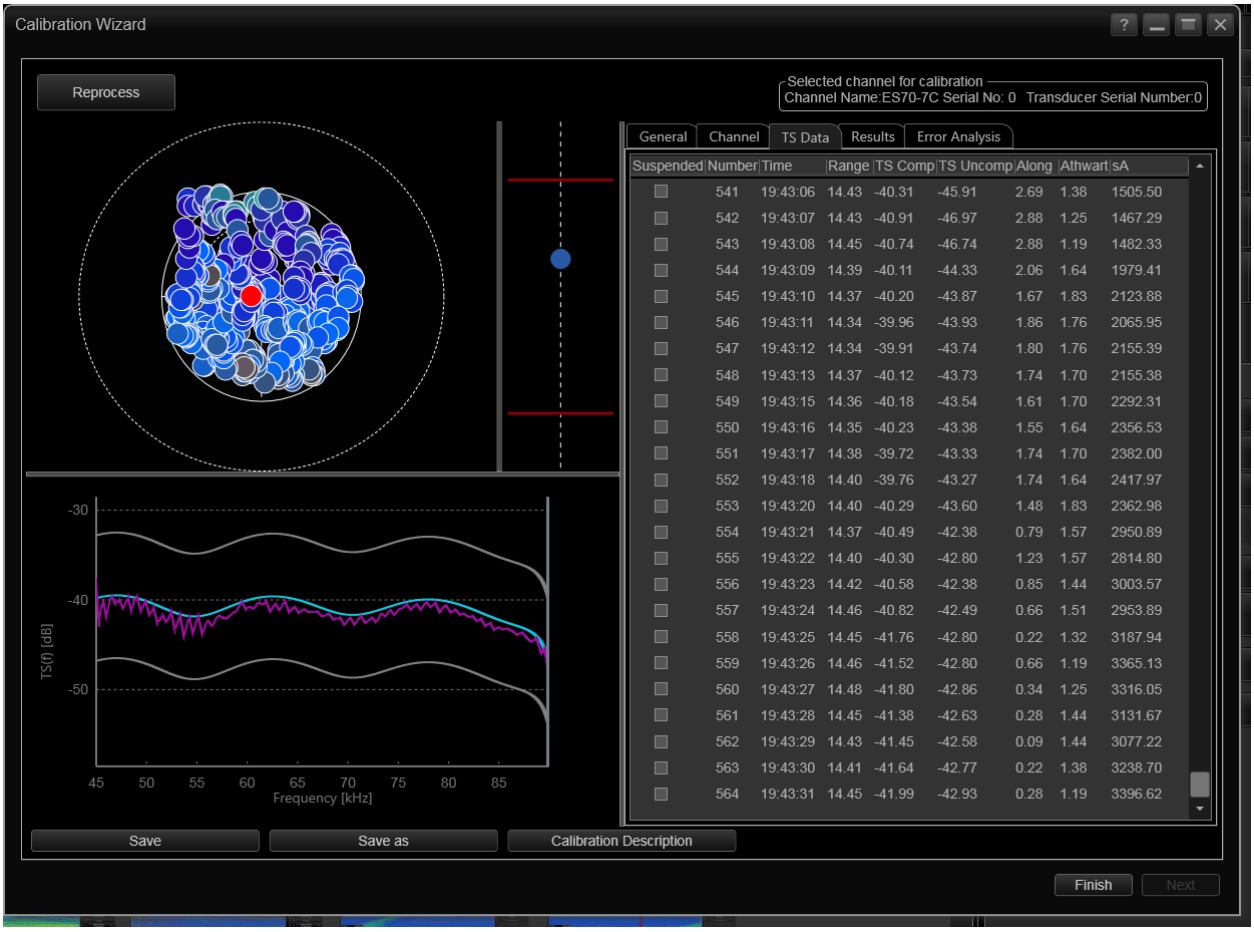

Figure 25. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 8.192 ms in FM mode.

70 kHz (FM): 4.096 ms

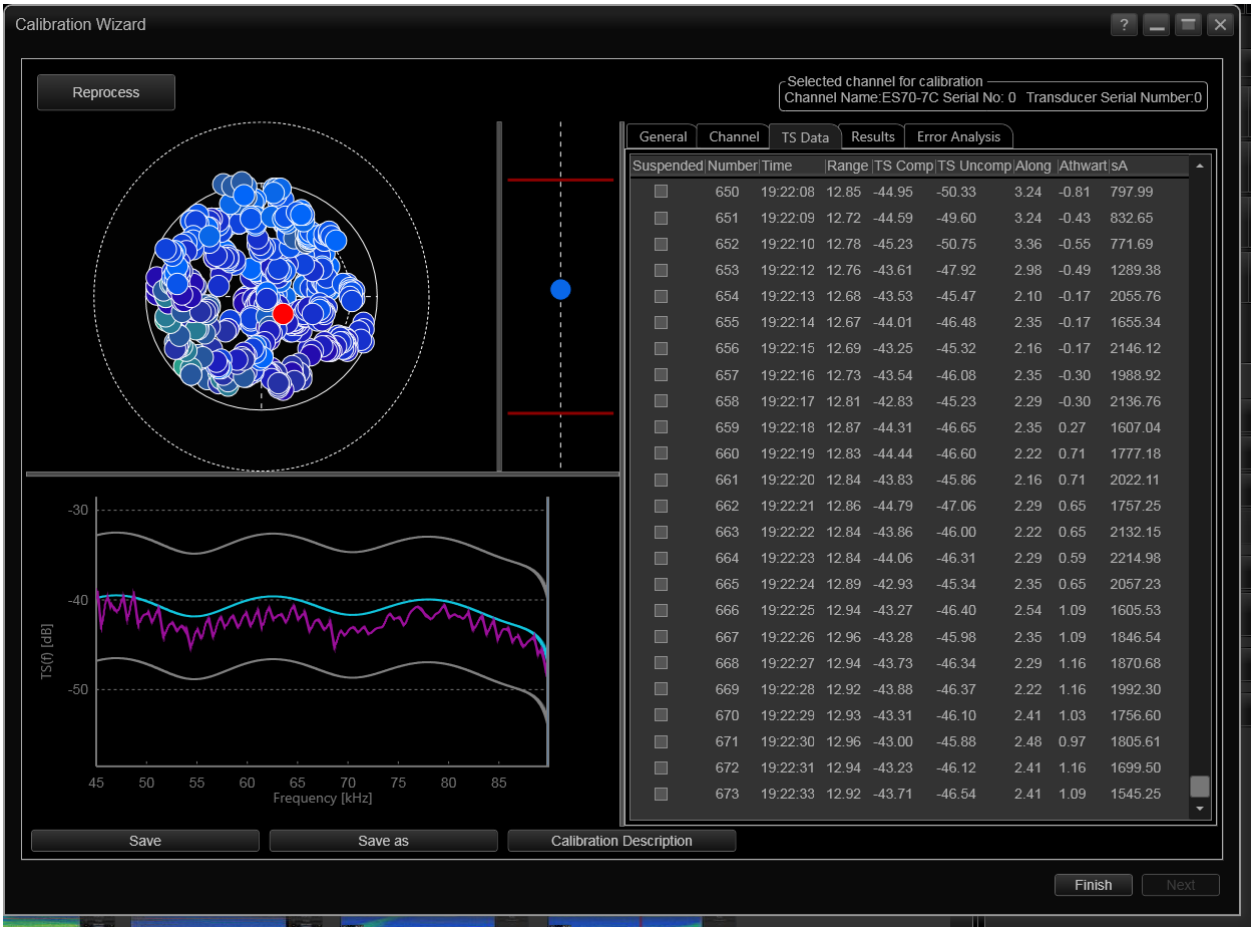

Figure 26. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 4.096 ms in FM mode.

70 kHz (FM): 2.048 ms

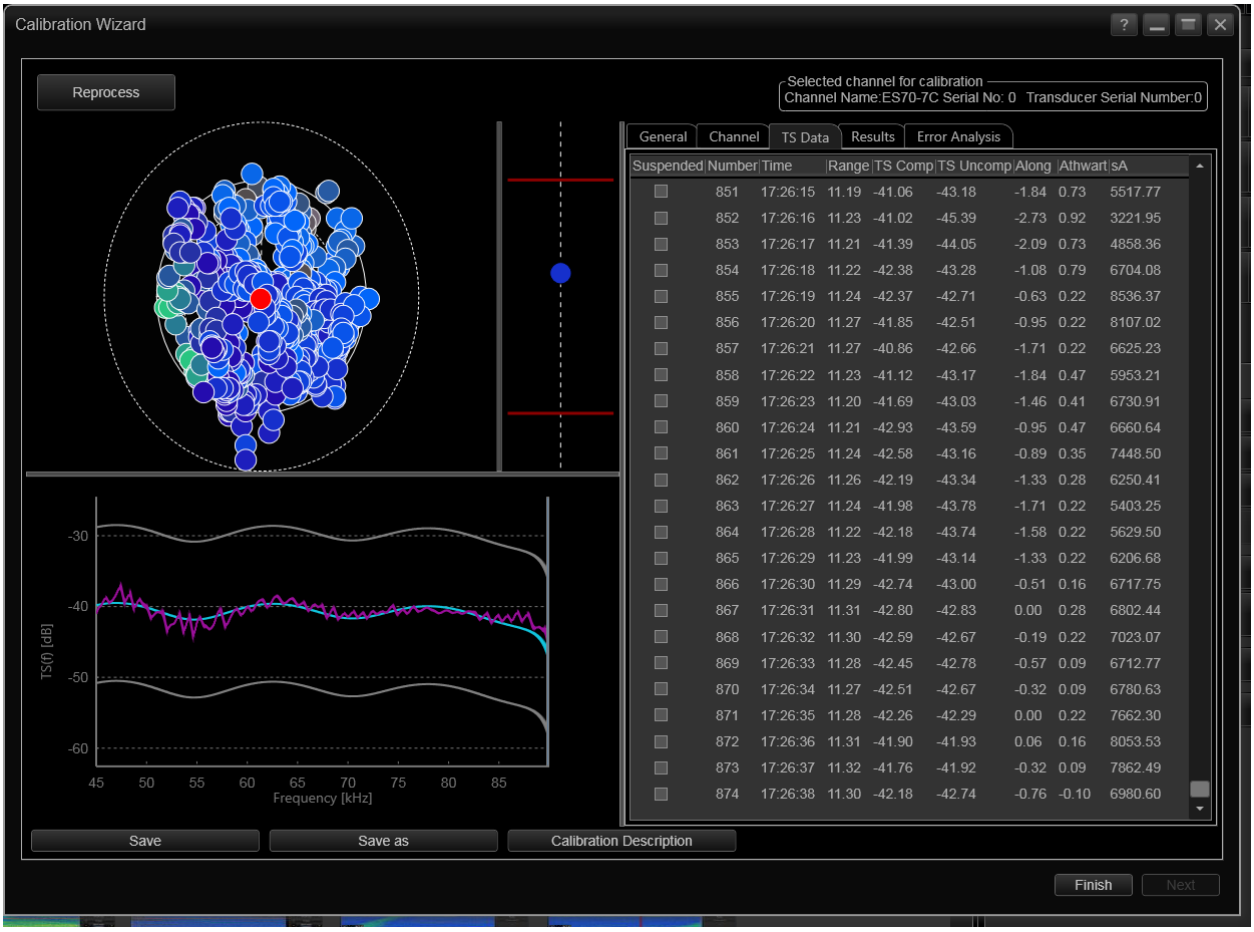

Figure 27. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 2.048 ms in FM mode.

70 kHz (FM): 1.024 ms

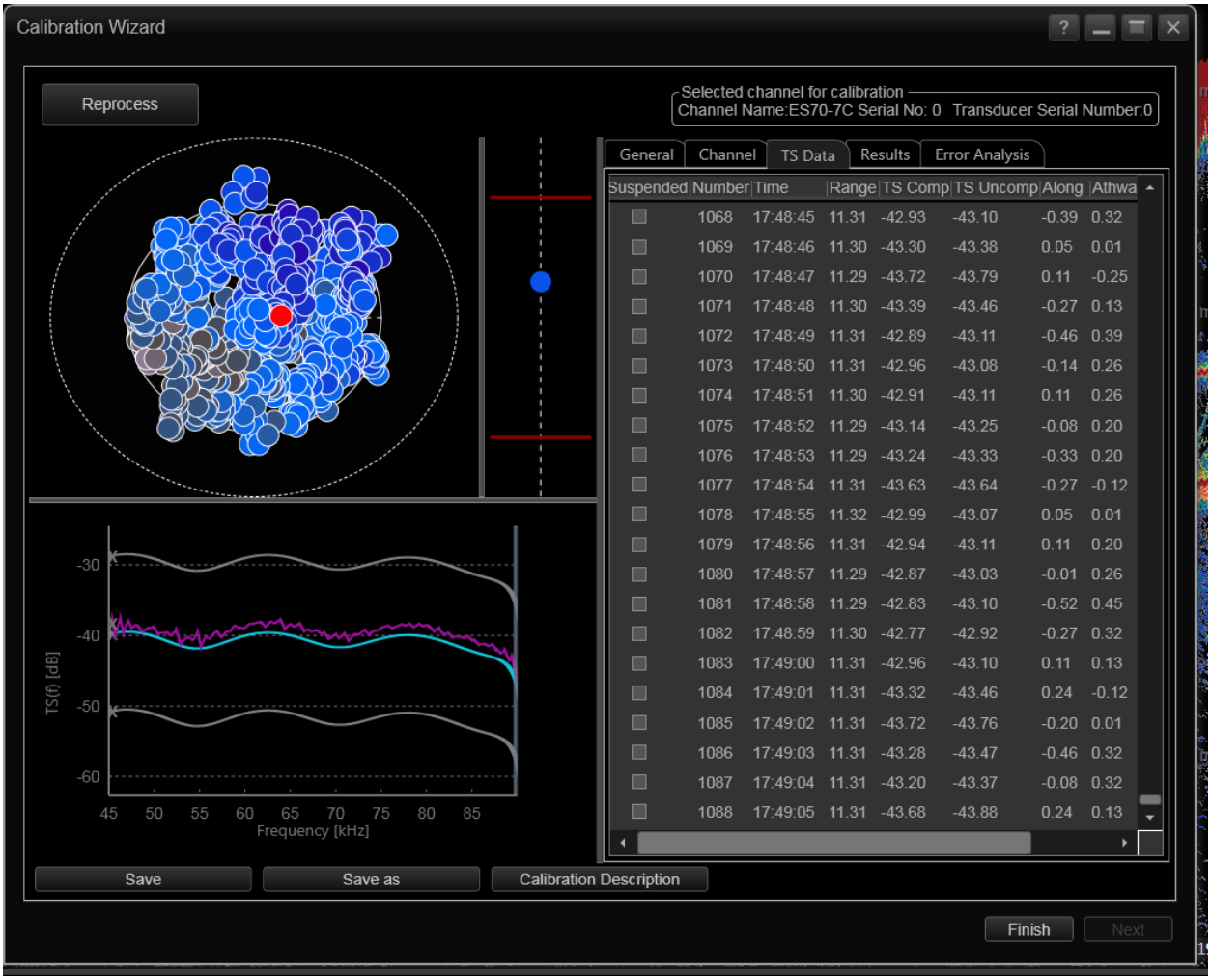

Figure 28. Screenshot of EK 80 Calibration Wizard. TS results for 70 kHz calibration at 1.024 ms in FM mode.

120 kHz: 1.024 ms

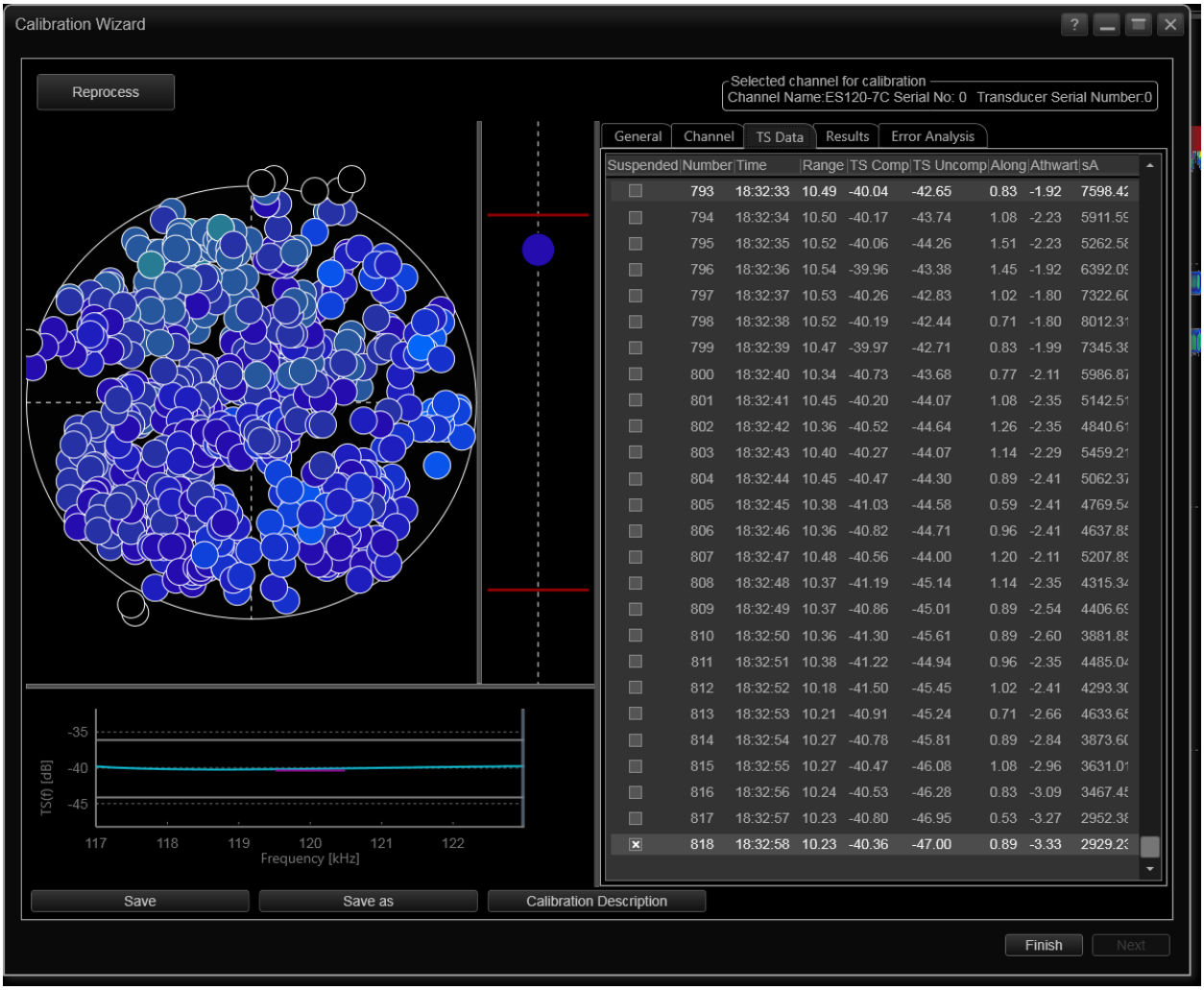

Figure 29. Screenshot of EK 80 Calibration Wizard. TS results for 120 kHz calibration at 1.024 ms.

200 kHz: 1.024 ms

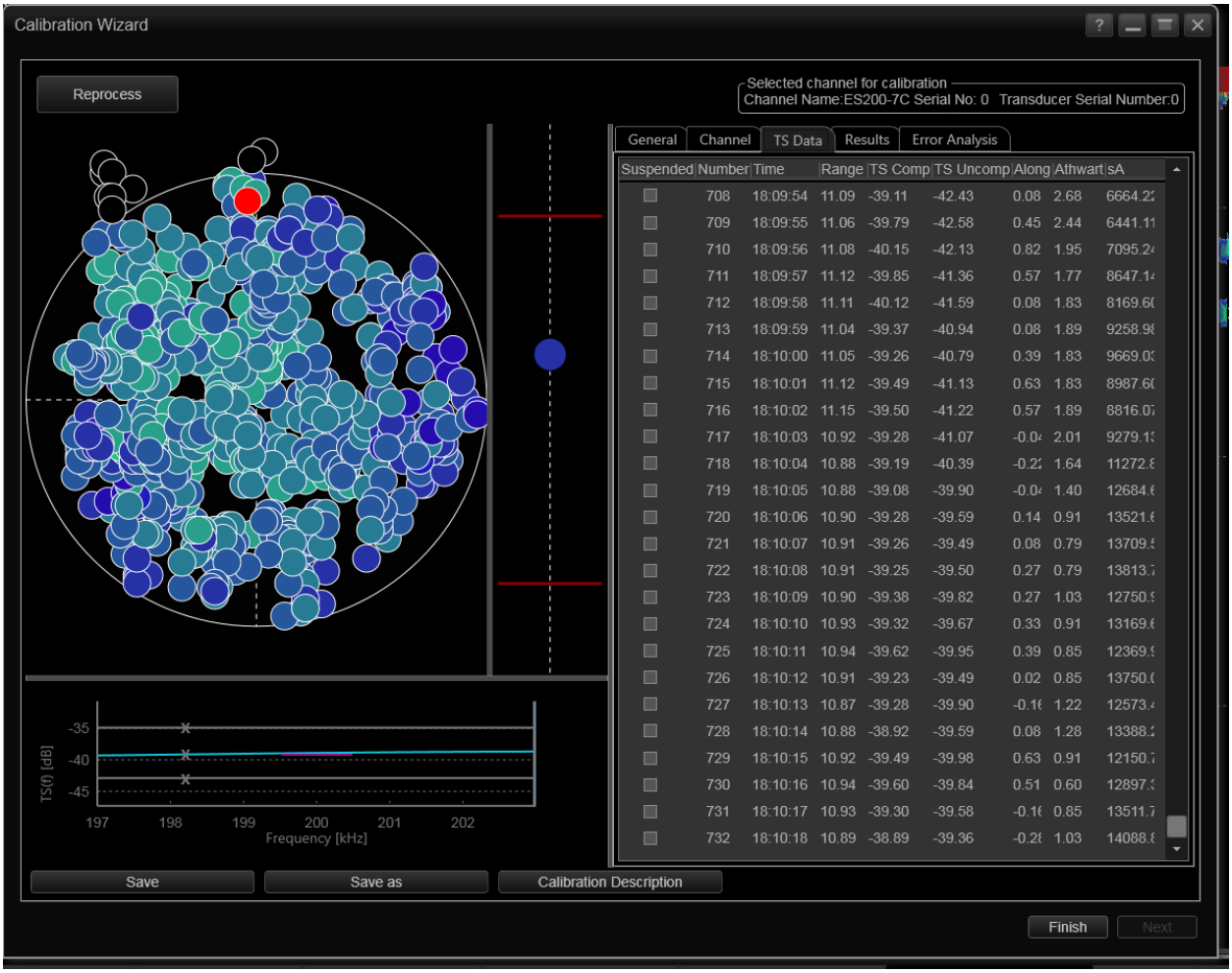

Figure 30. Screenshot of EK 80 Calibration Wizard. TS results for 200 kHz calibration at 1.024 ms.

Appendix 4 - Results

18 kHz: 4.096 ms

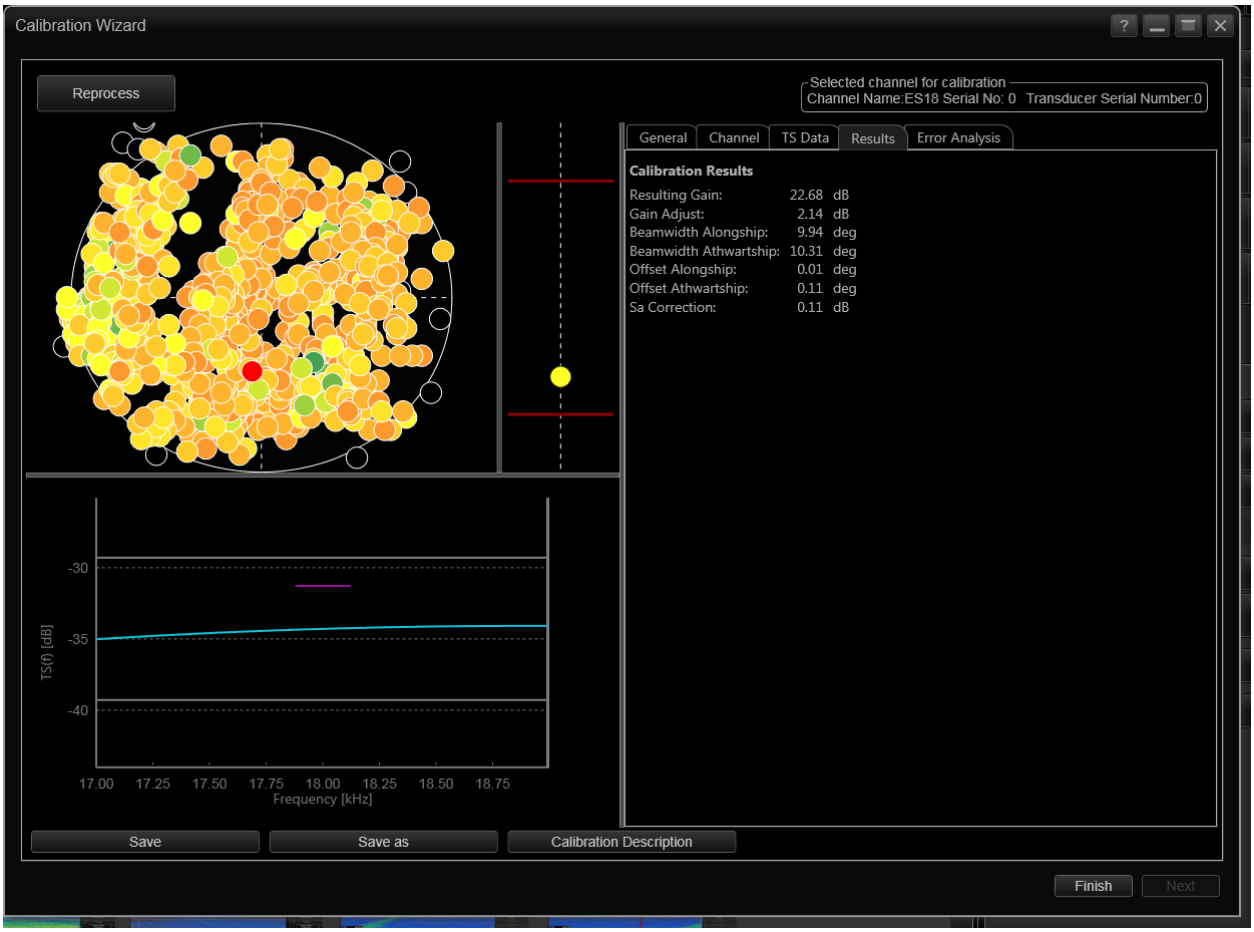

Figure 31. Screenshot of EK 80 Calibration Wizard. Results for 18 kHz calibration at 4.096 ms.

18 kHz: 1.024 ms

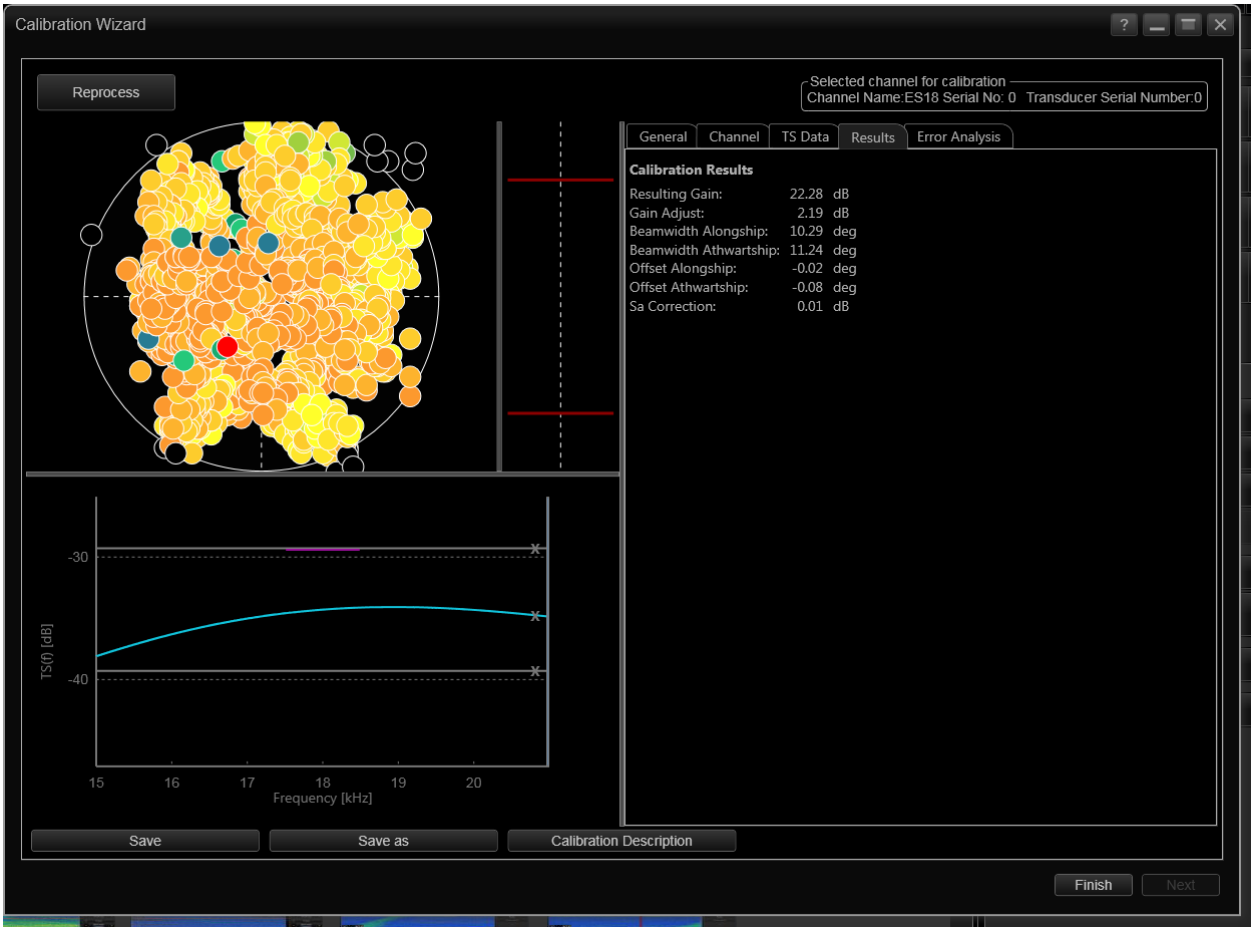

Figure 32Screenshot of EK 80 Calibration Wizard. Results for 18 kHz calibration at 1.024 ms.

70 kHz (CW): 2.048 ms

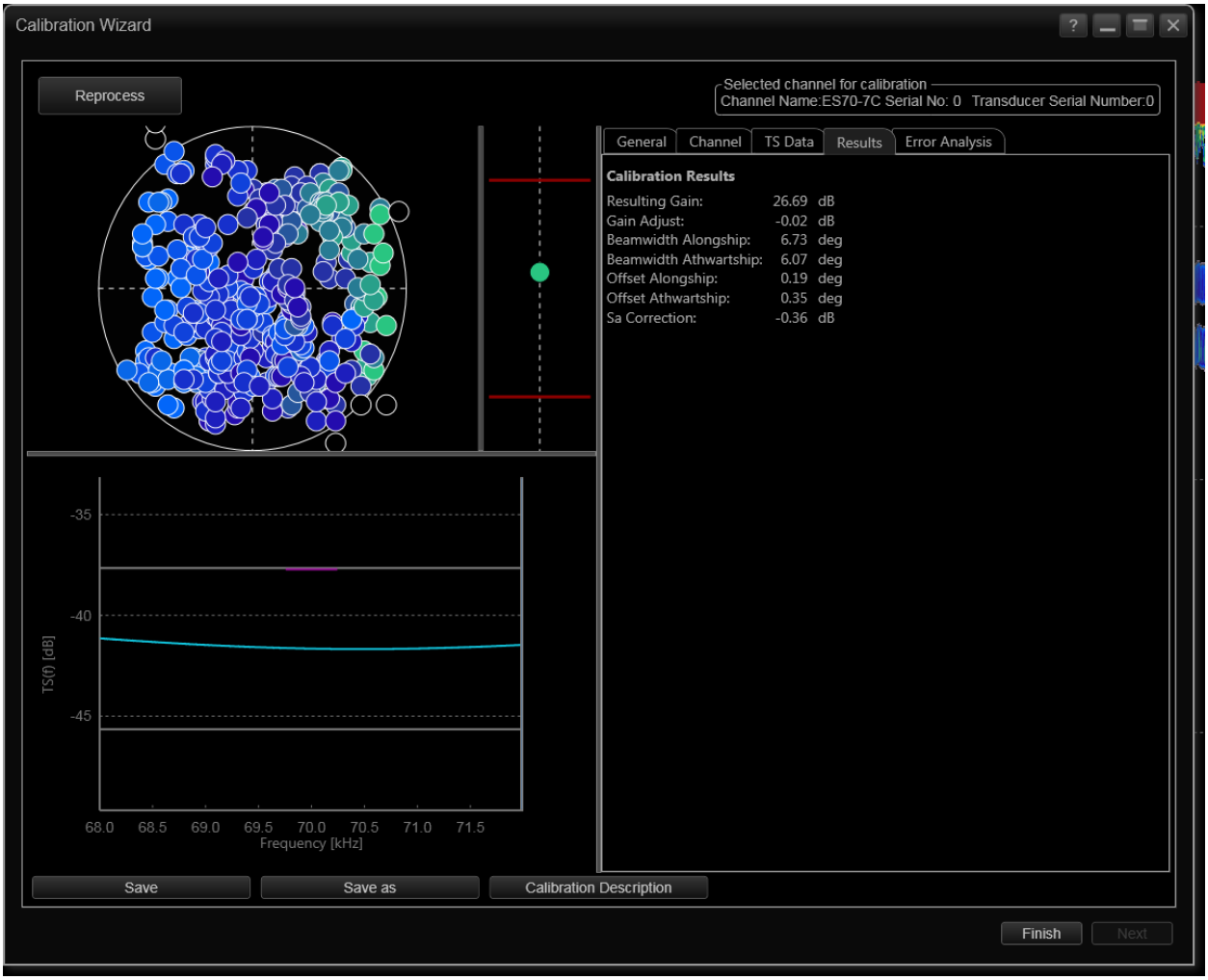

Figure 33. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 2.048 ms in CW mode.

70 kHz (CW): 1.024 ms

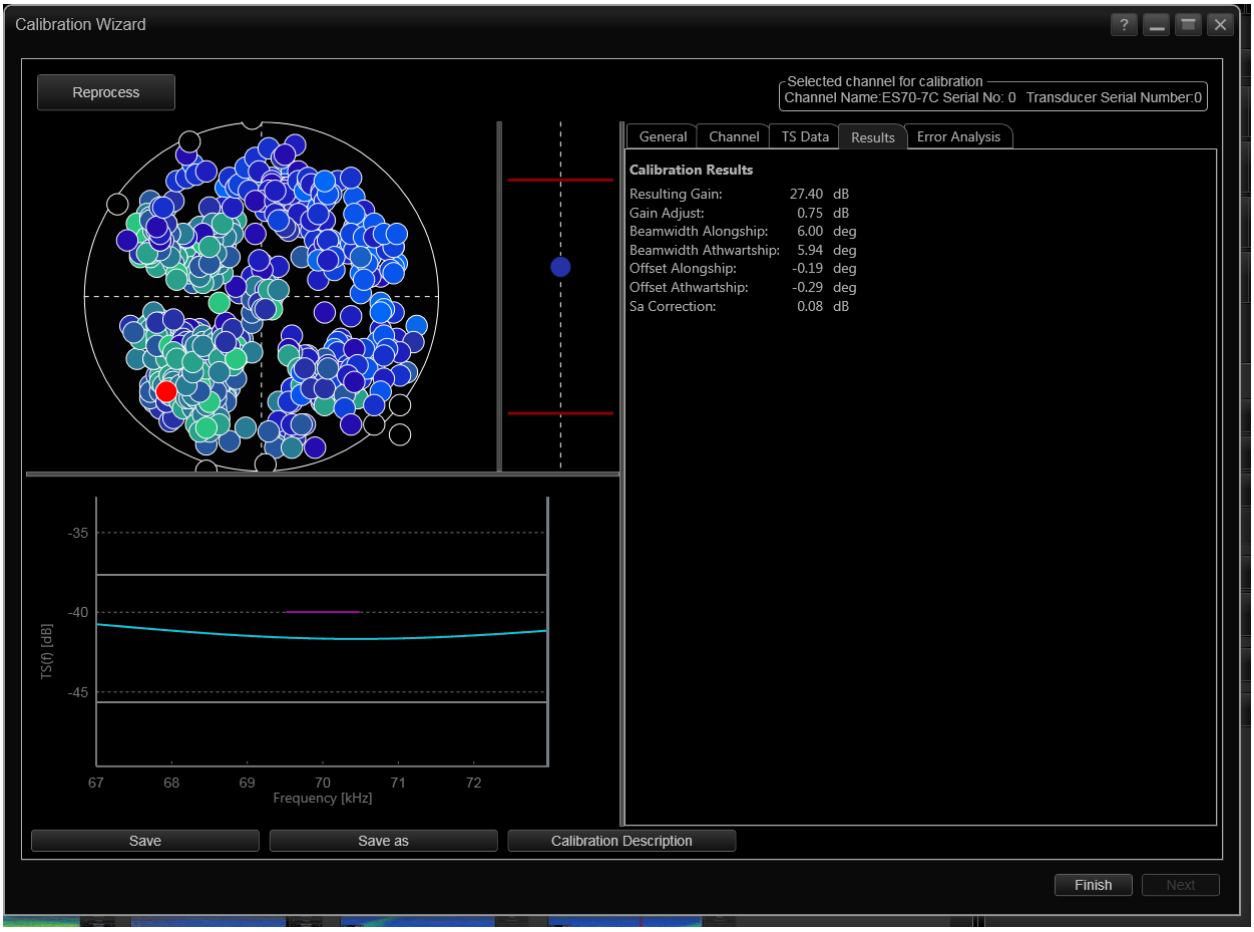

Figure 34. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 1.024 ms in CW mode.

70 kHz (FM): 8.192 ms

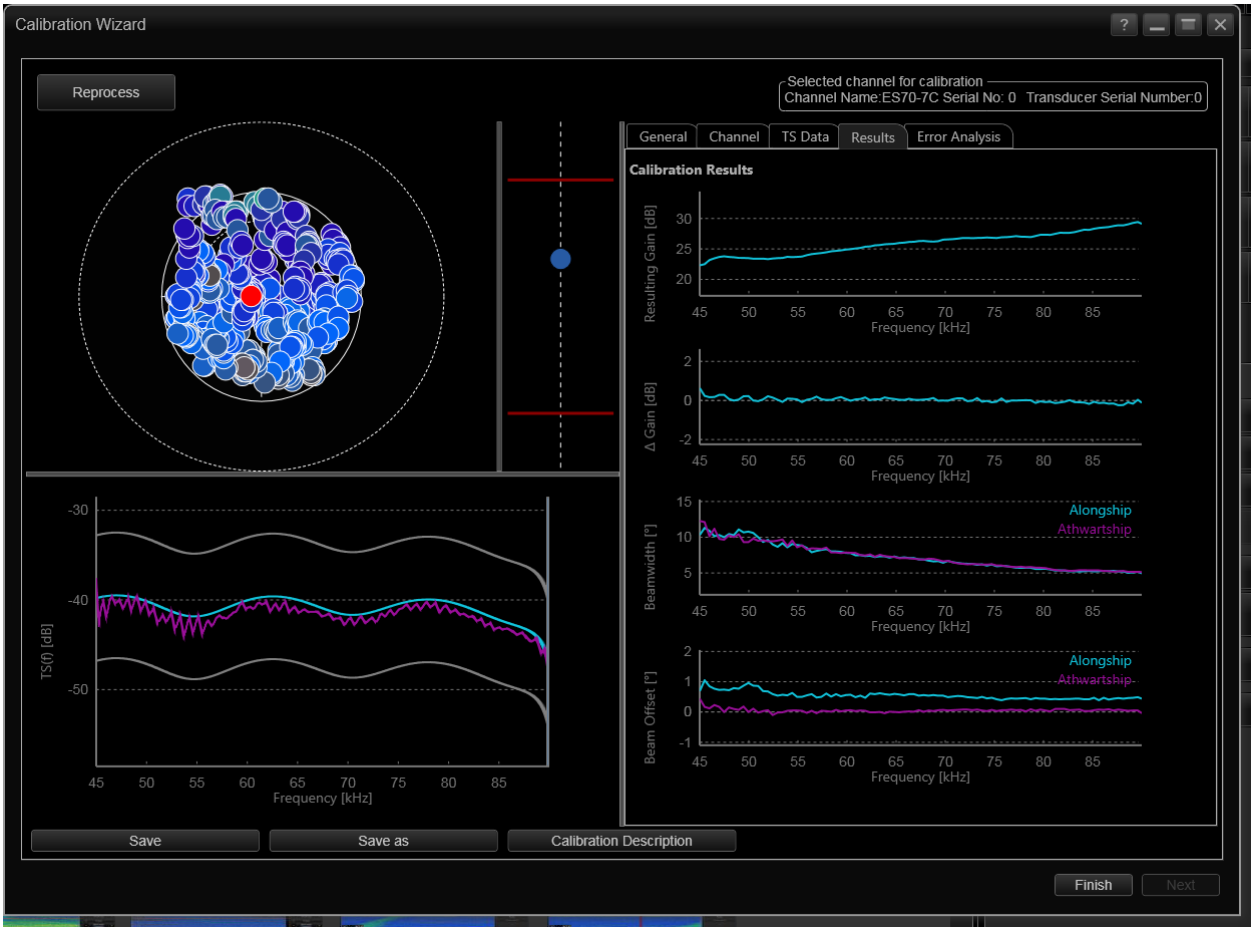

Figure 35. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 8.192 ms in FM mode.

70 kHz (FM): 4.096 ms

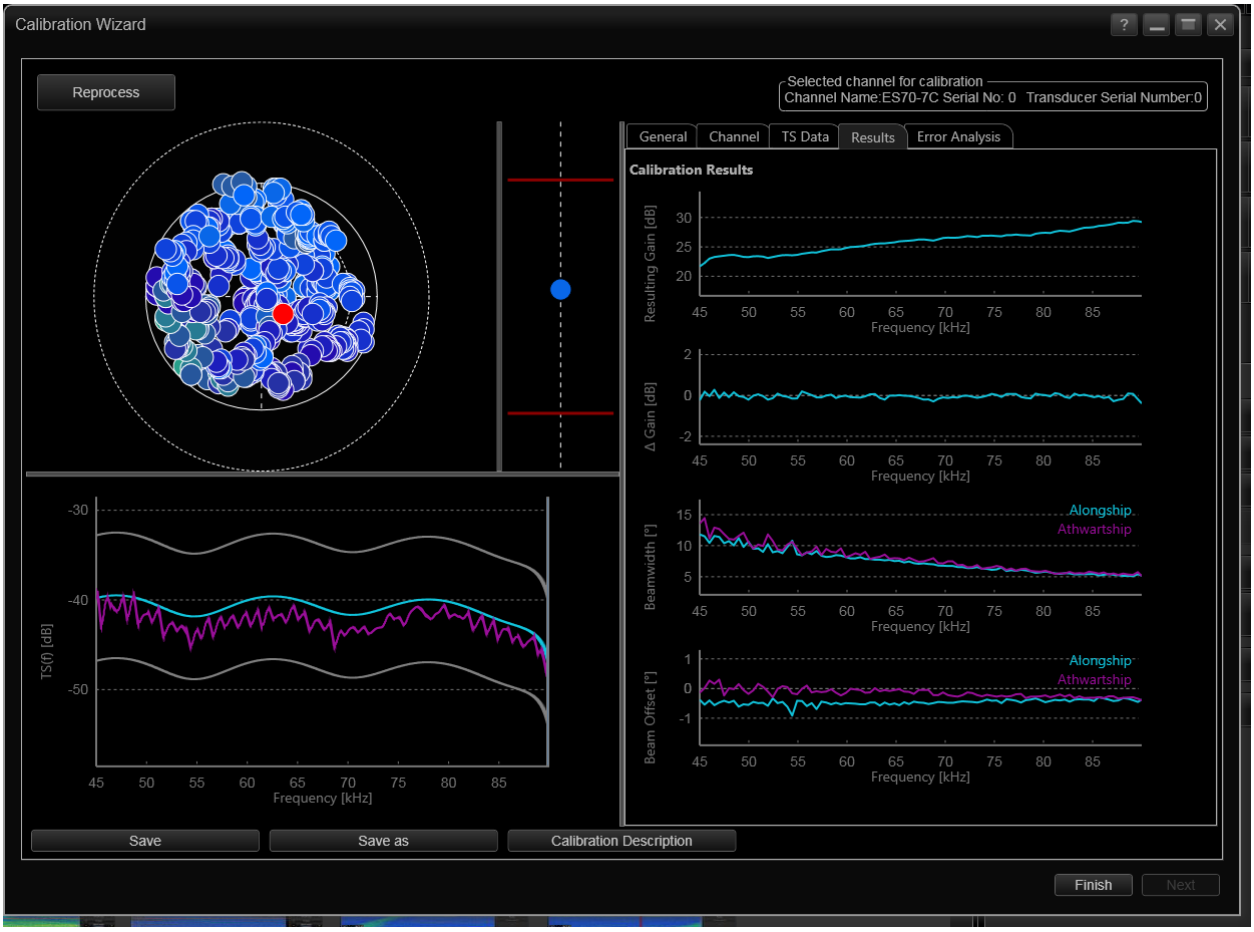

Figure 36. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 4.096 ms in FM mode.

70 kHz (FM): 2.048 ms

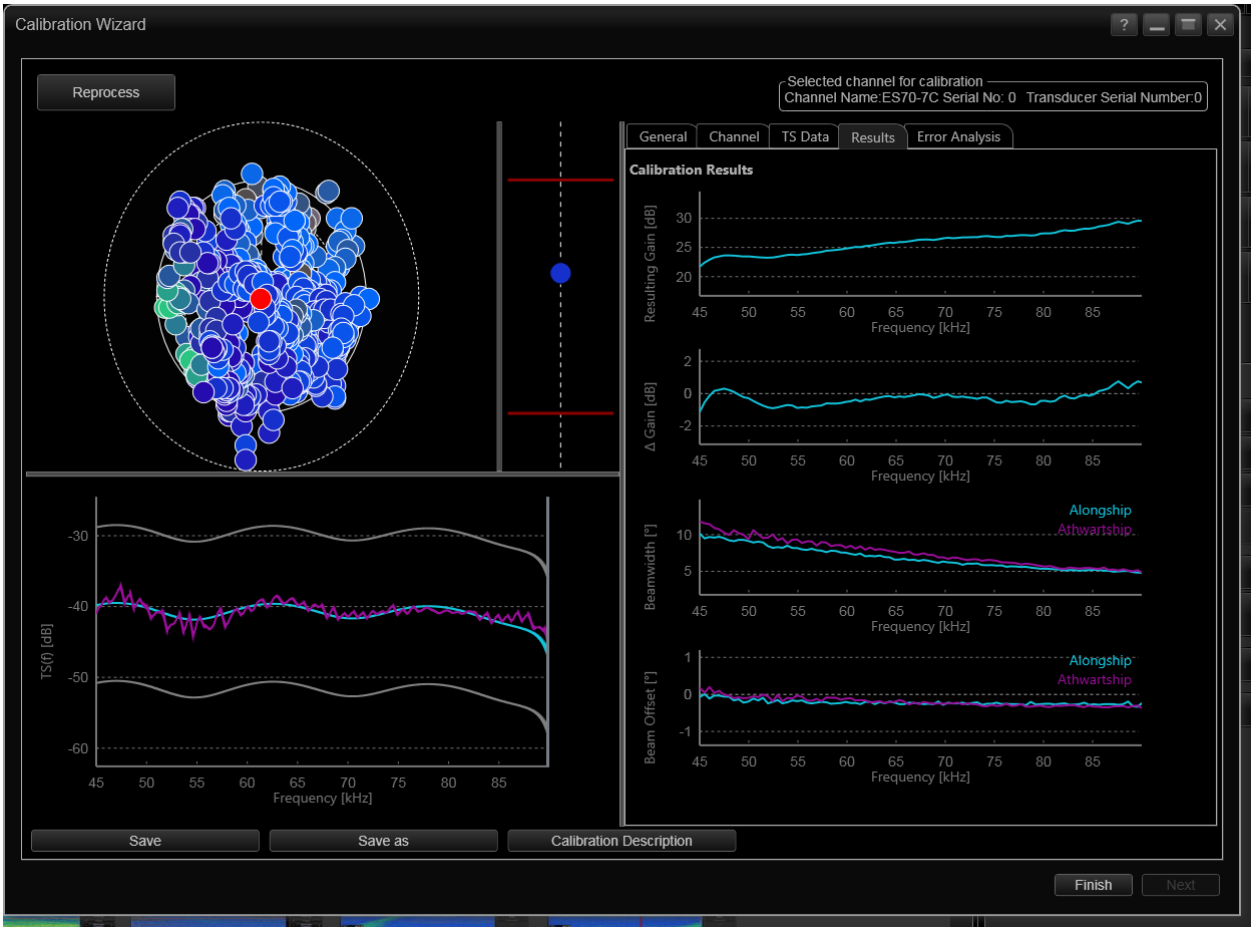

Figure 37. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 2.048 ms in FM mode.

70 kHz (FM): 1.024 ms

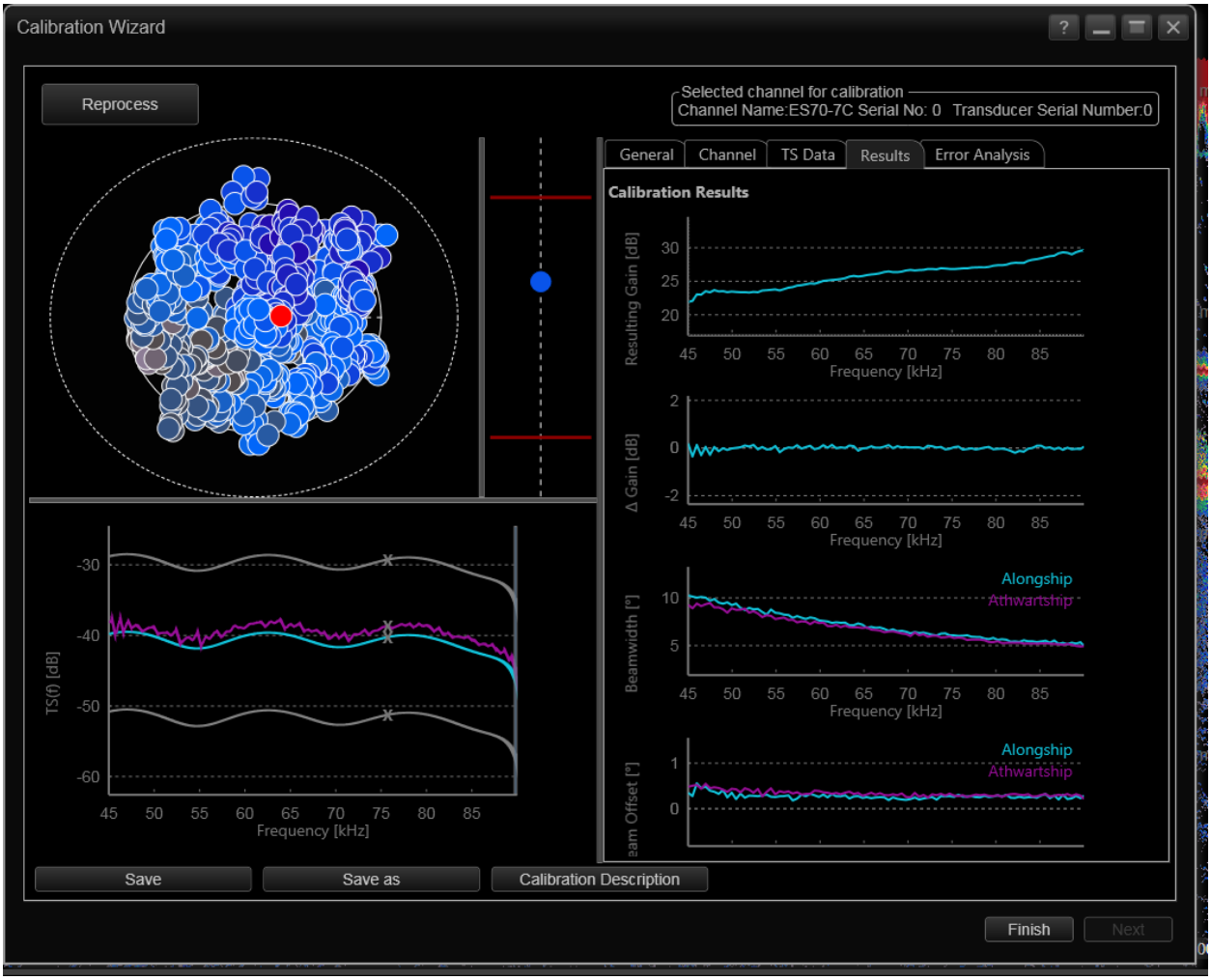

Figure 38. Screenshot of EK 80 Calibration Wizard. Results for 70 kHz calibration at 1.024 ms in FM mode.

120 kHz: 1.024 ms

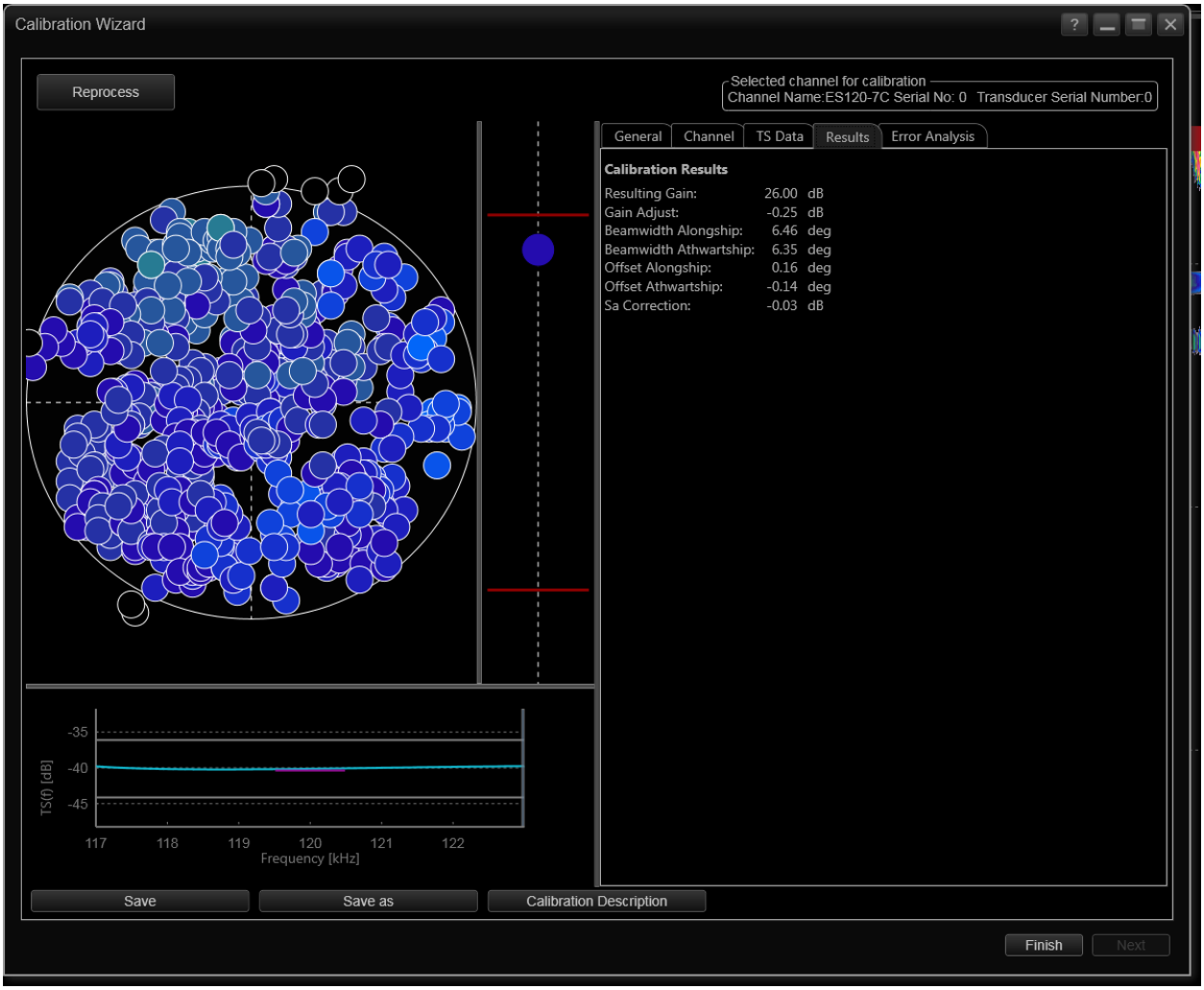

Figure 39. Screenshot of EK 80 Calibration Wizard. Results for 120 kHz calibration at 1.024 ms.

200 kHz: 1.024 ms

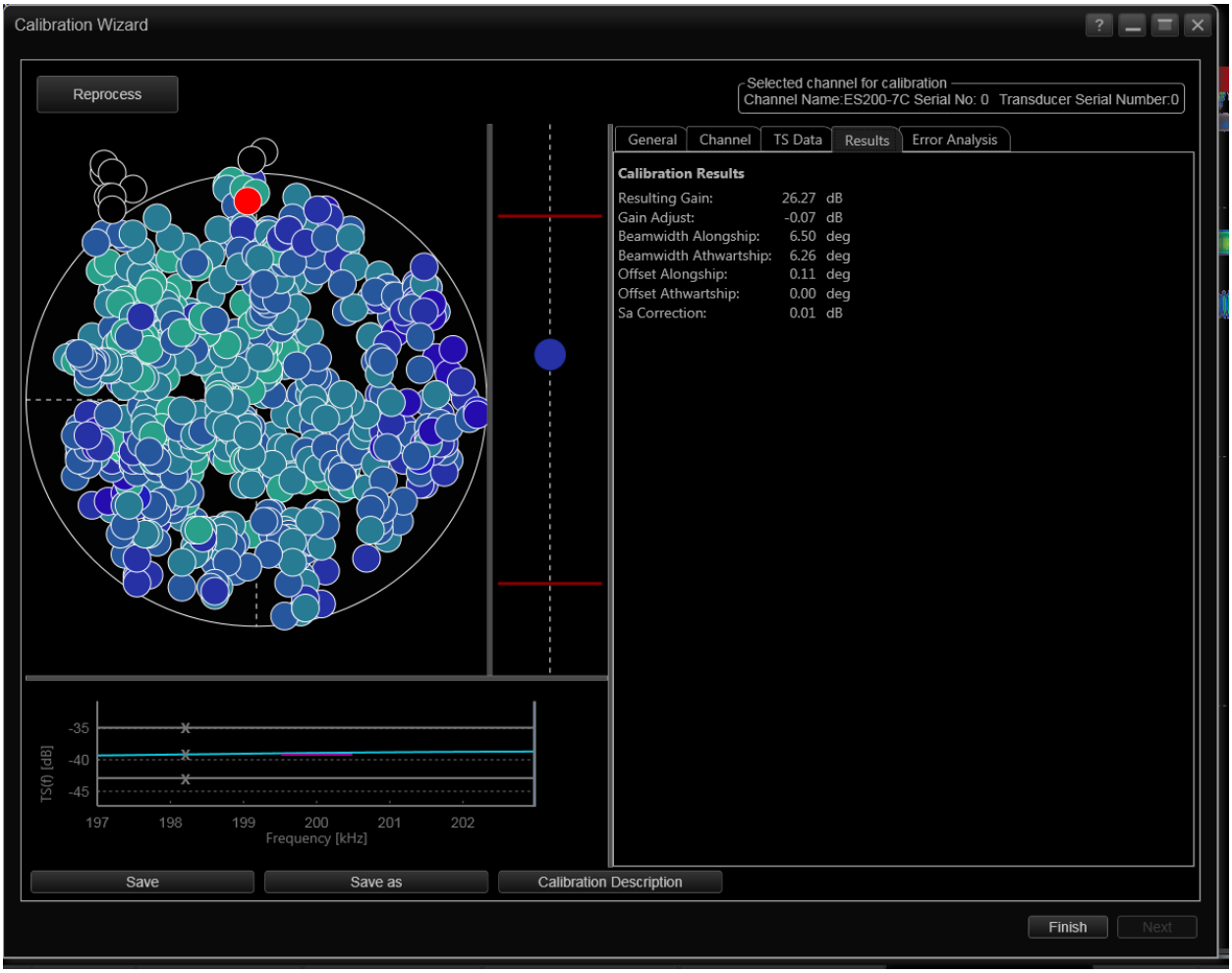

Figure 40. Screenshot of EK 80 Calibration Wizard. Results for 200 kHz calibration at 1.024 ms.

Appendix 5 - Error Analysis

18 kHz: 4.096 ms

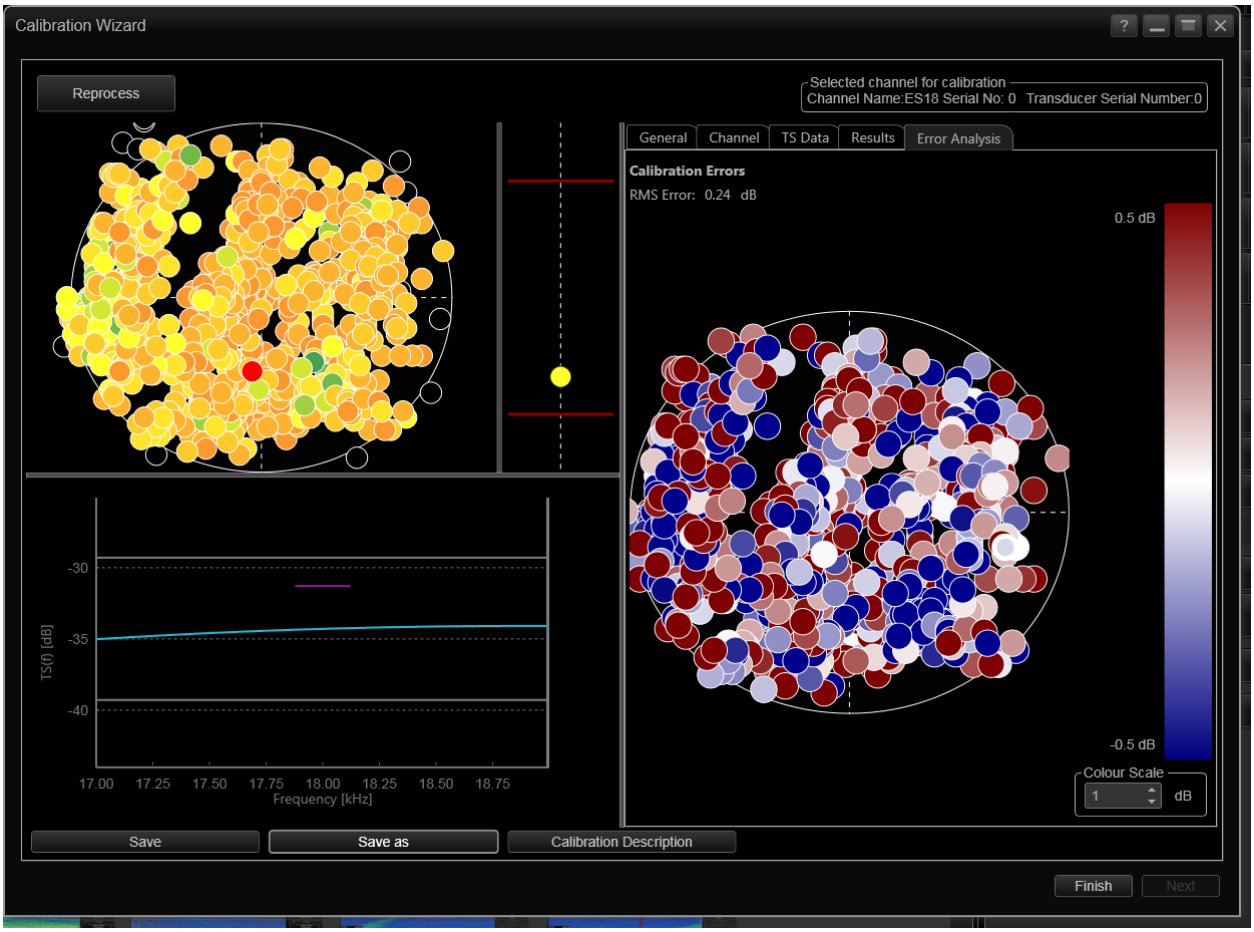

Figure 41. Screenshot of EK 80 Calibration Wizard. Error analysis for 18 kHz calibration at 4.096 ms.

18 kHz: 1.024 ms

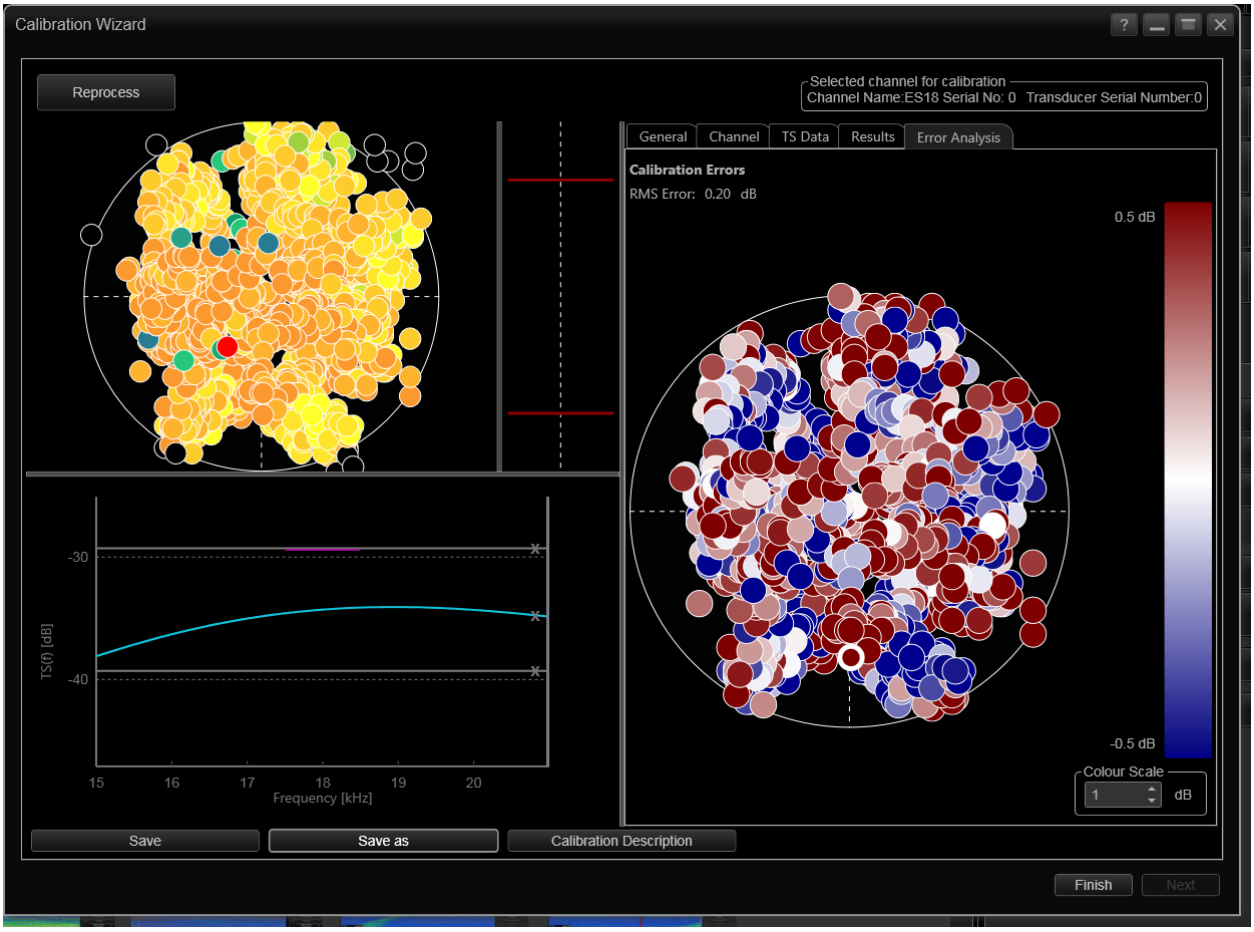

Figure 42. Screenshot of EK 80 Calibration Wizard. Error analysis for 18 kHz calibration at 1.024 ms.

70 kHz (CW): 2.048 ms

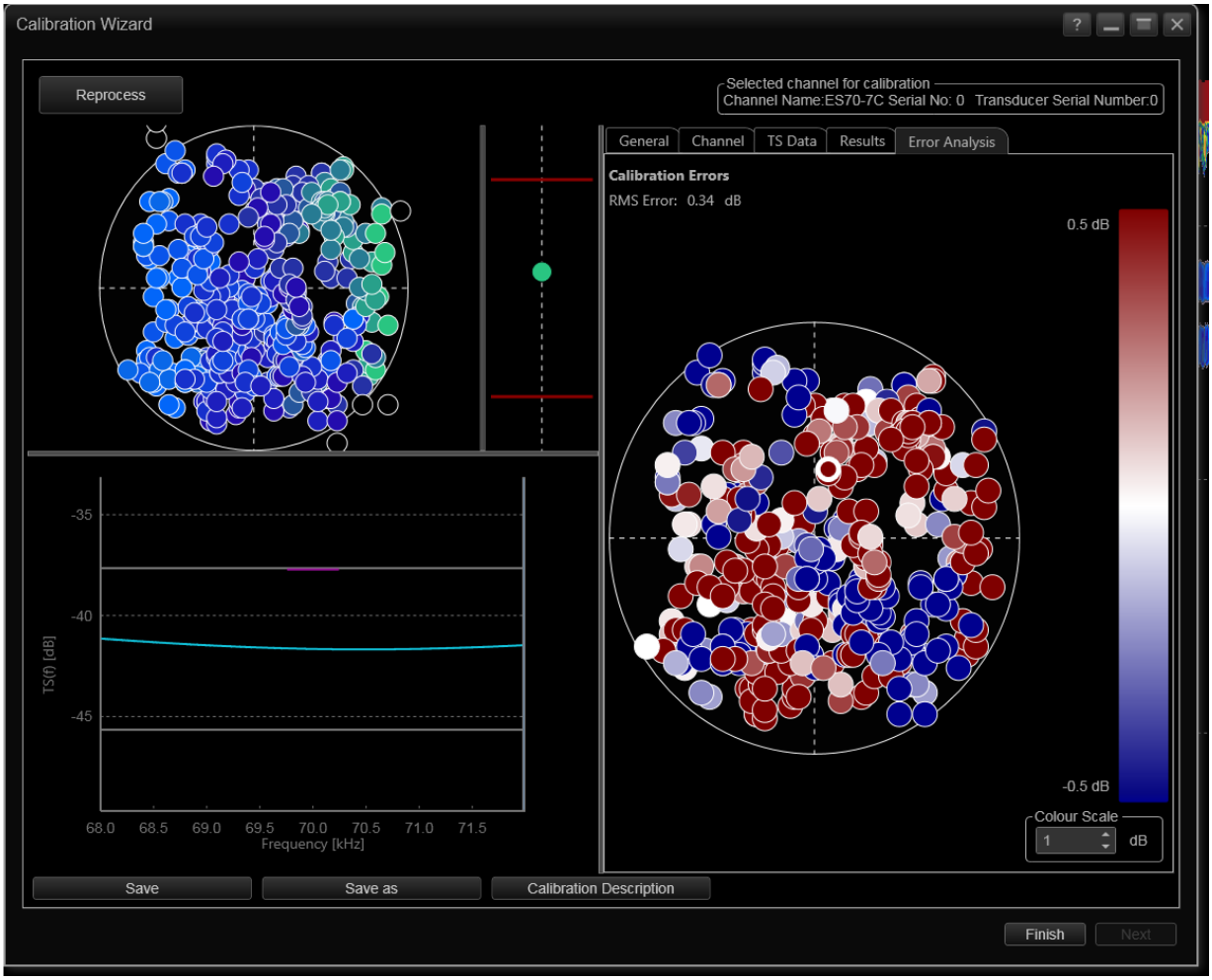

Figure 43. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 2.048 ms in CW mode.

70 kHz (CW): 1.024 ms

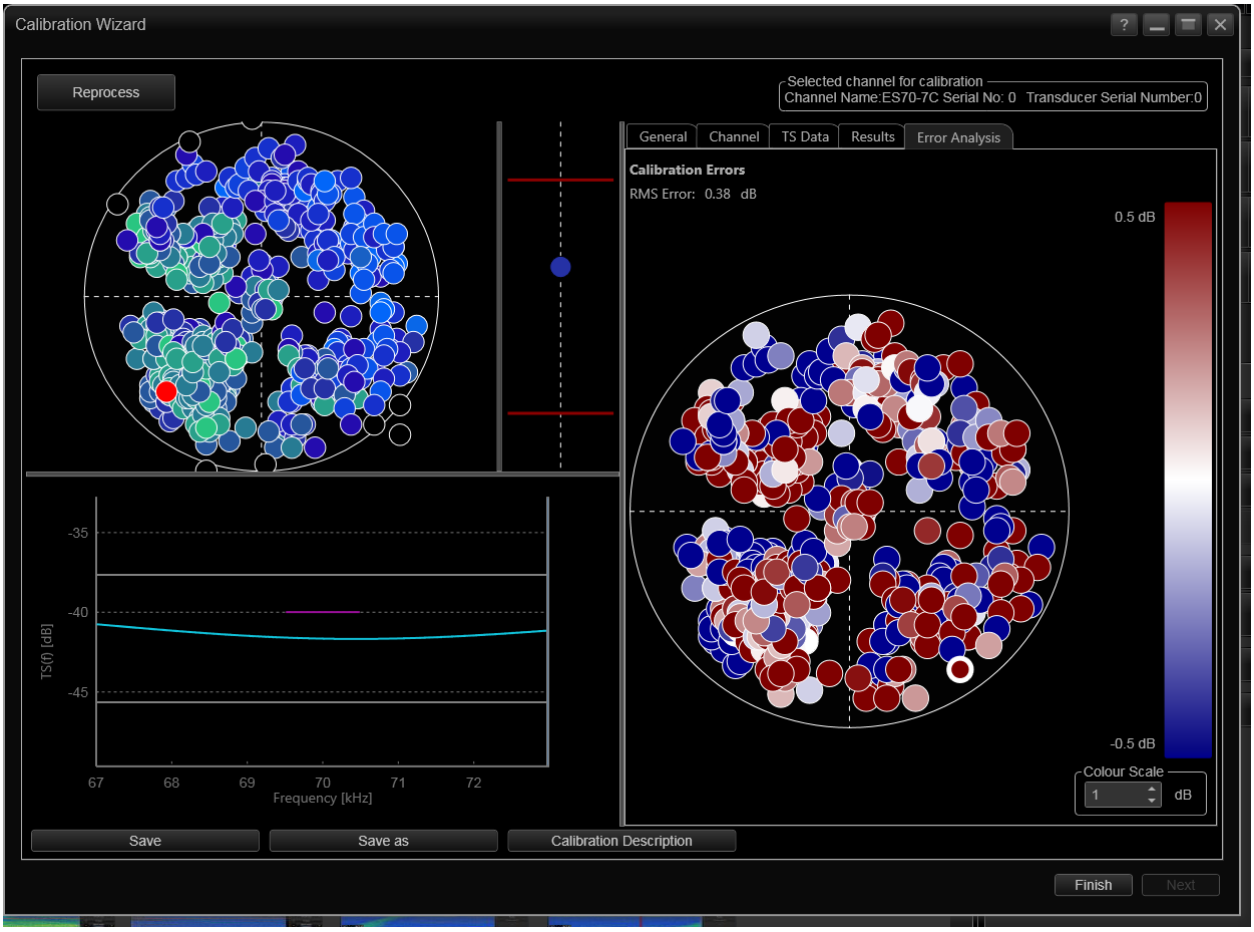

Figure 44. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 1.024 ms in CW mode.

70 kHz (FM): 8.192 ms

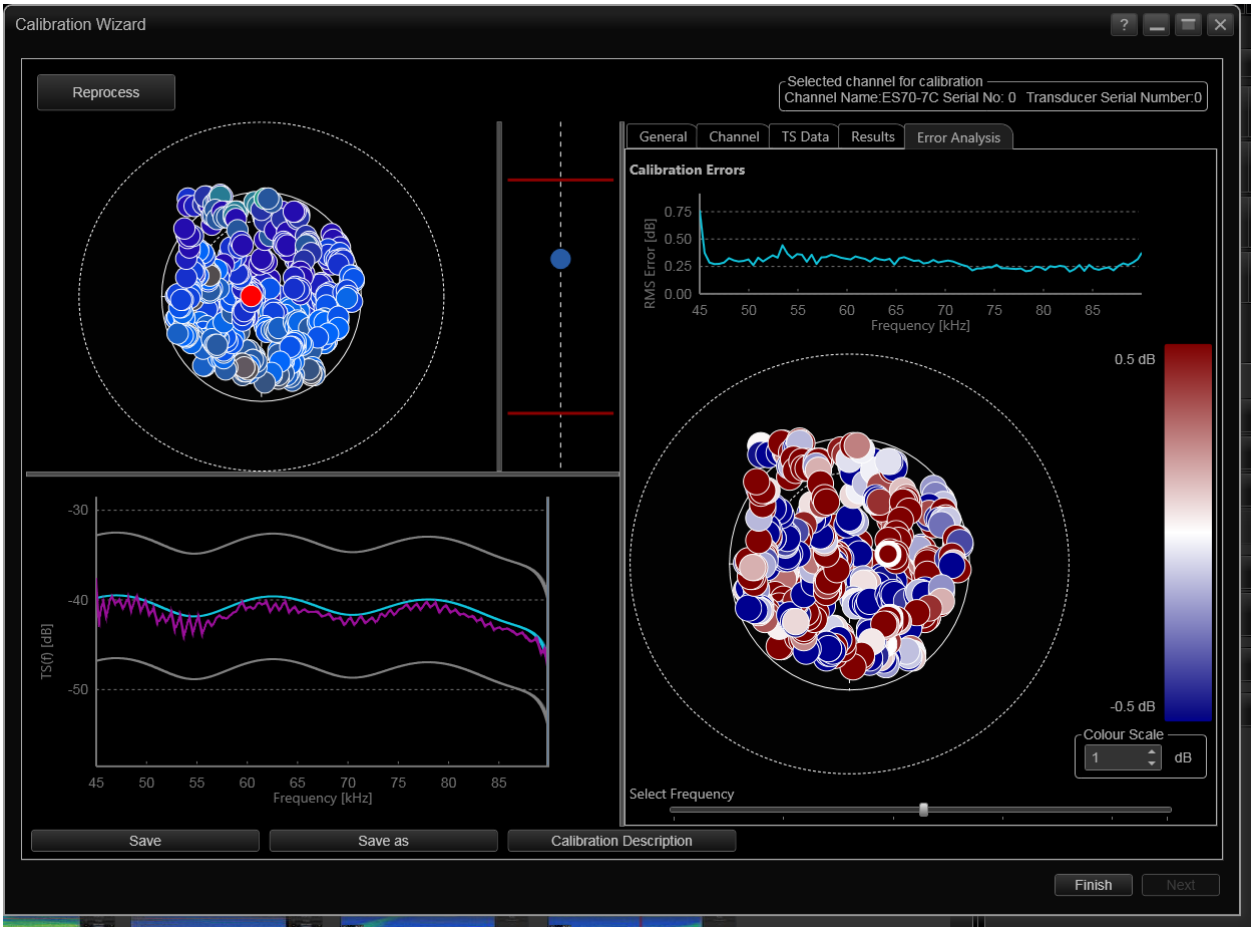

Figure 45. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 8.192 ms in FM mode.

70 kHz (FM): 4.096 ms

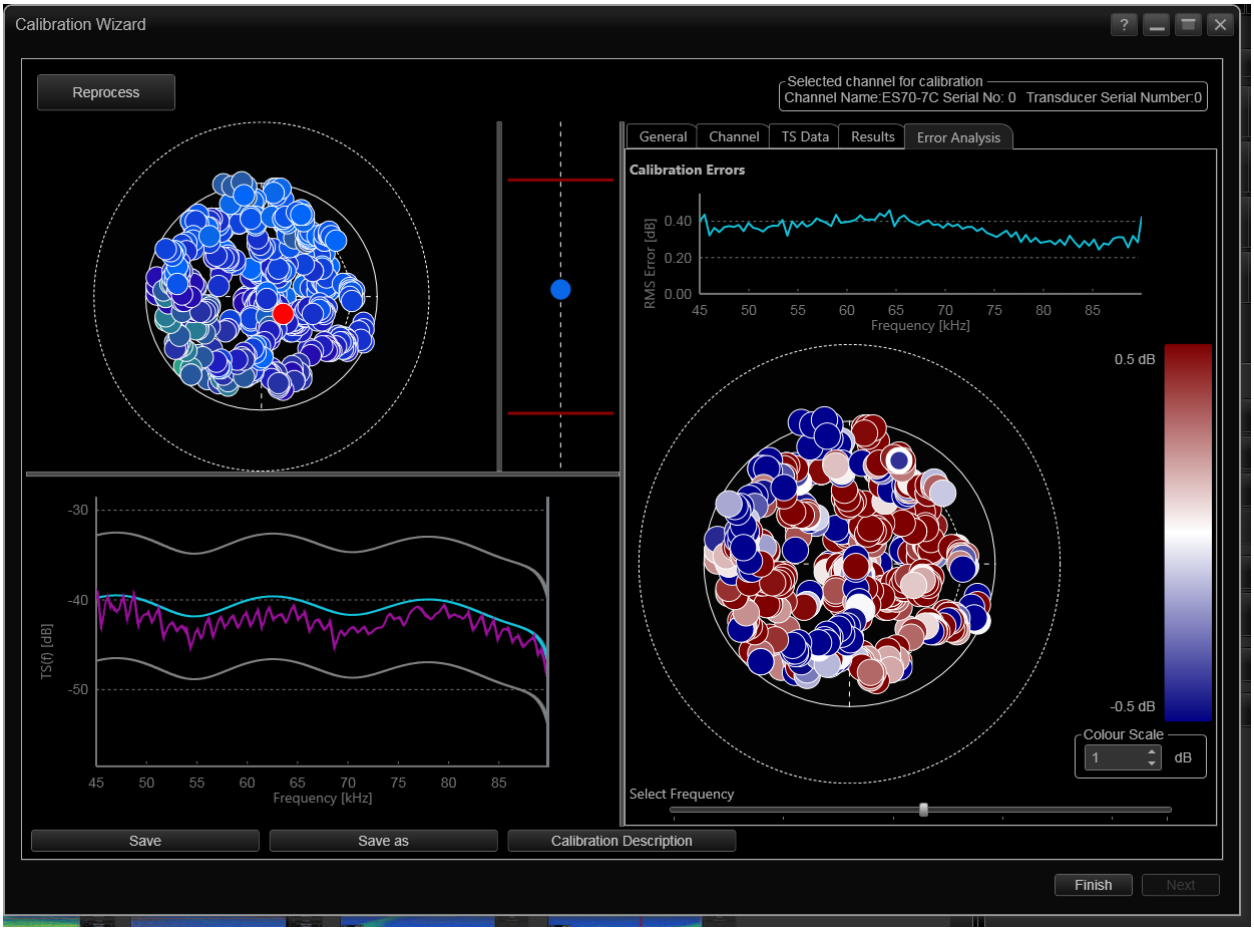

Figure 46. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 4.096 ms in FM mode.

70 kHz (FM): 2.048 ms

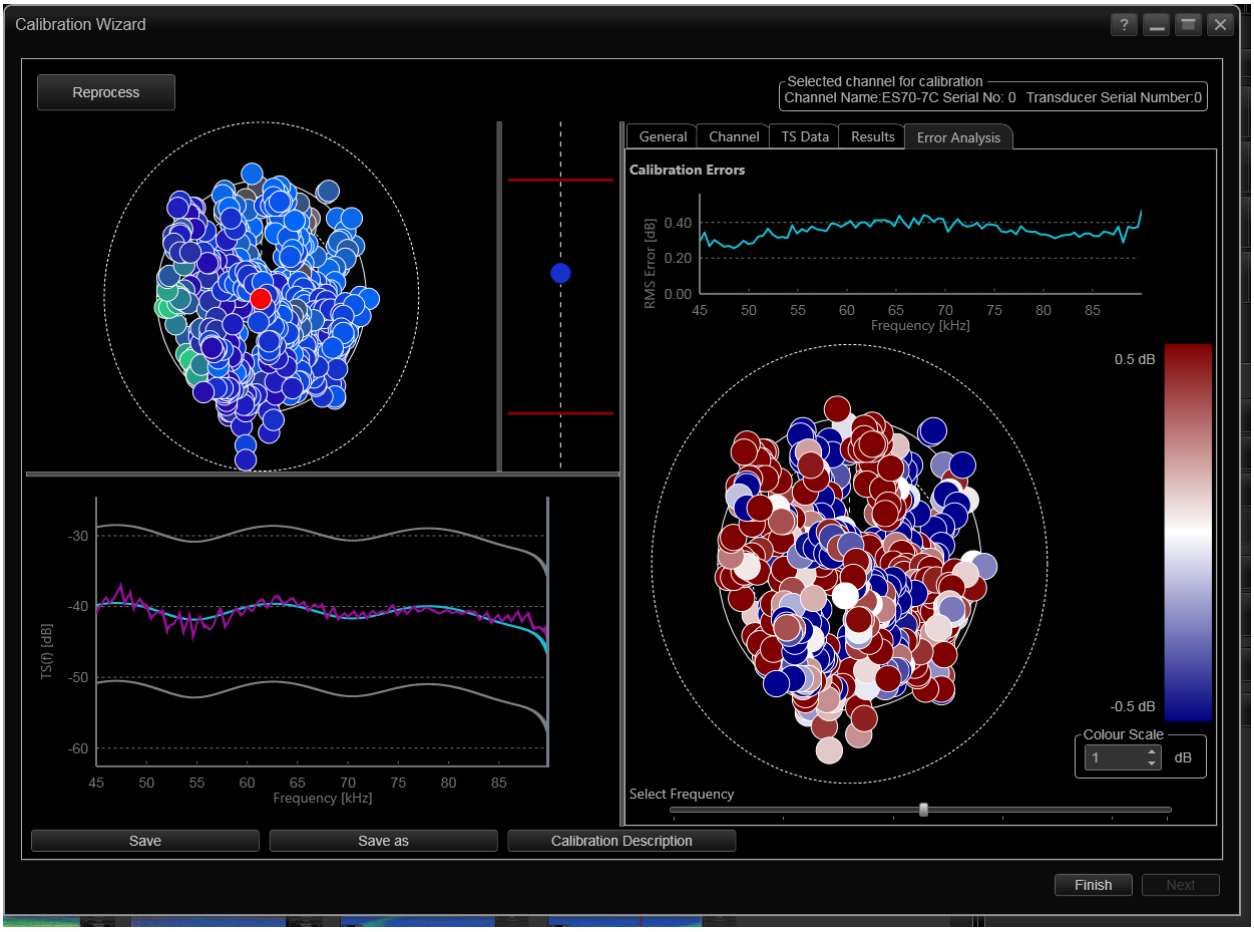

Figure 47. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 2.048 ms in FM mode.

70 kHz (FM): 1.024 ms

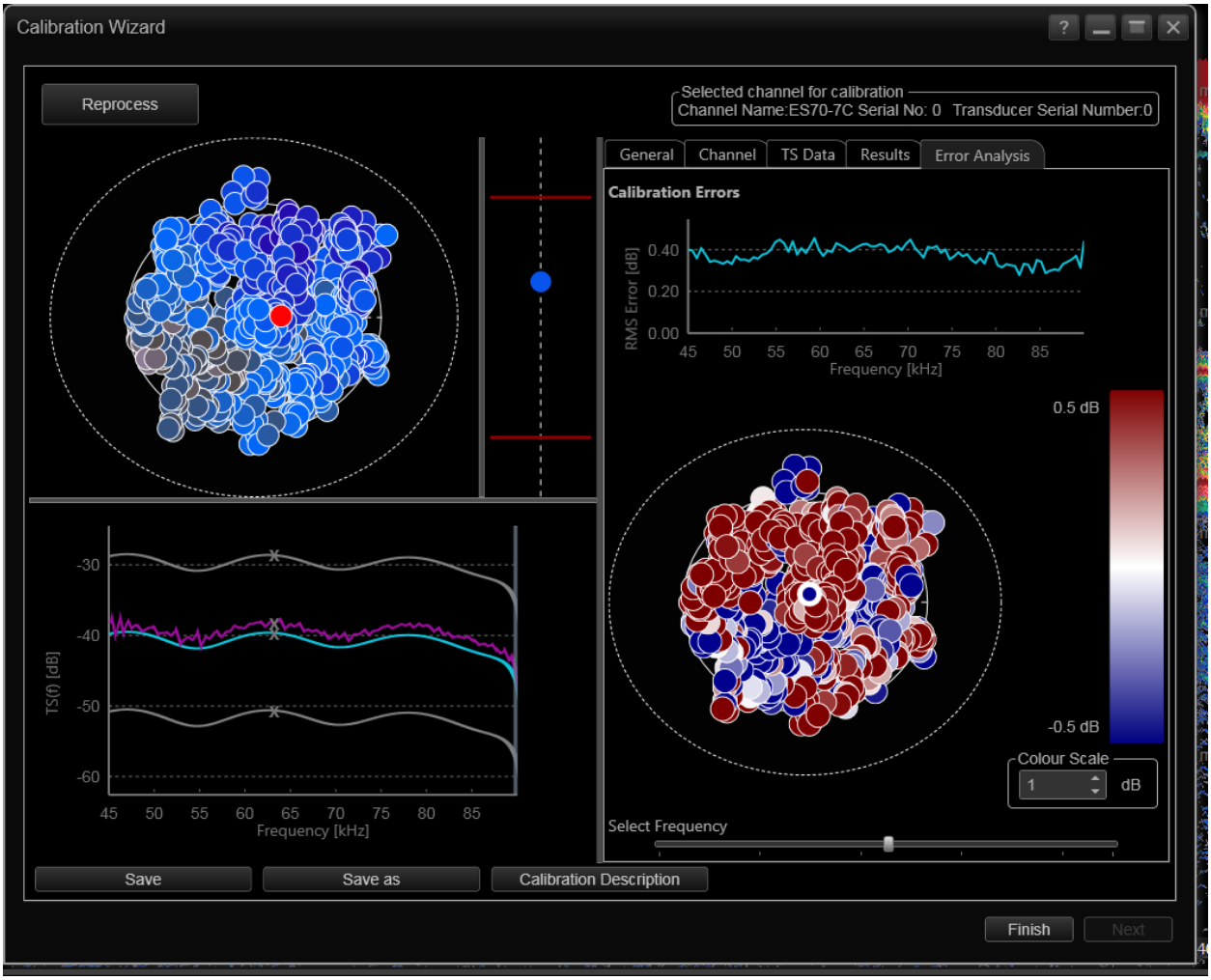

Figure 48. Screenshot of EK 80 Calibration Wizard. Error analysis for 70 kHz calibration at 1.024 ms in FM mode.

120 kHz: 1.024 ms

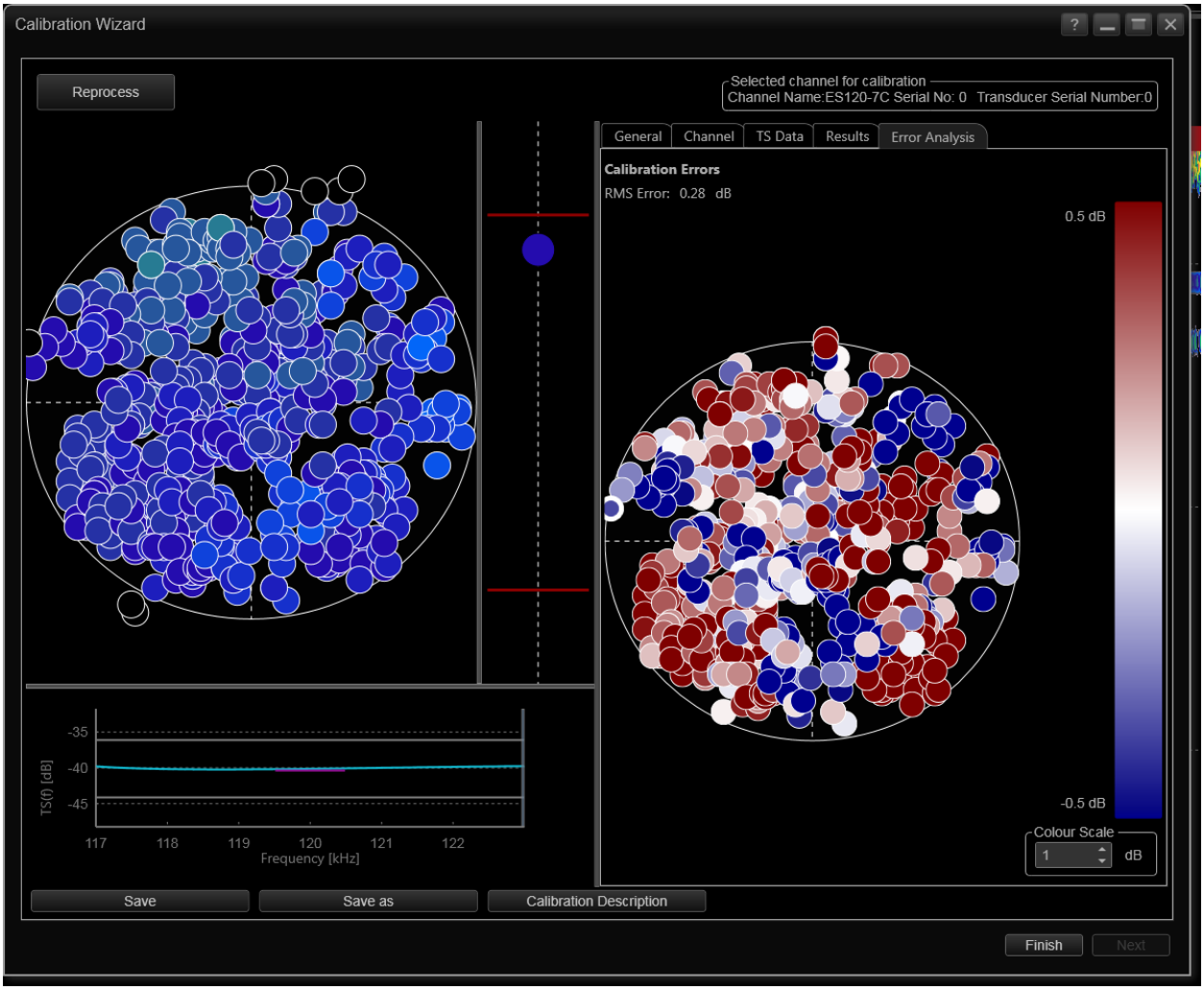

Figure 49. Screenshot of EK 80 Calibration Wizard. Error analysis for 120 kHz calibration at 1.024 ms.

200 kHz: 1.024 ms

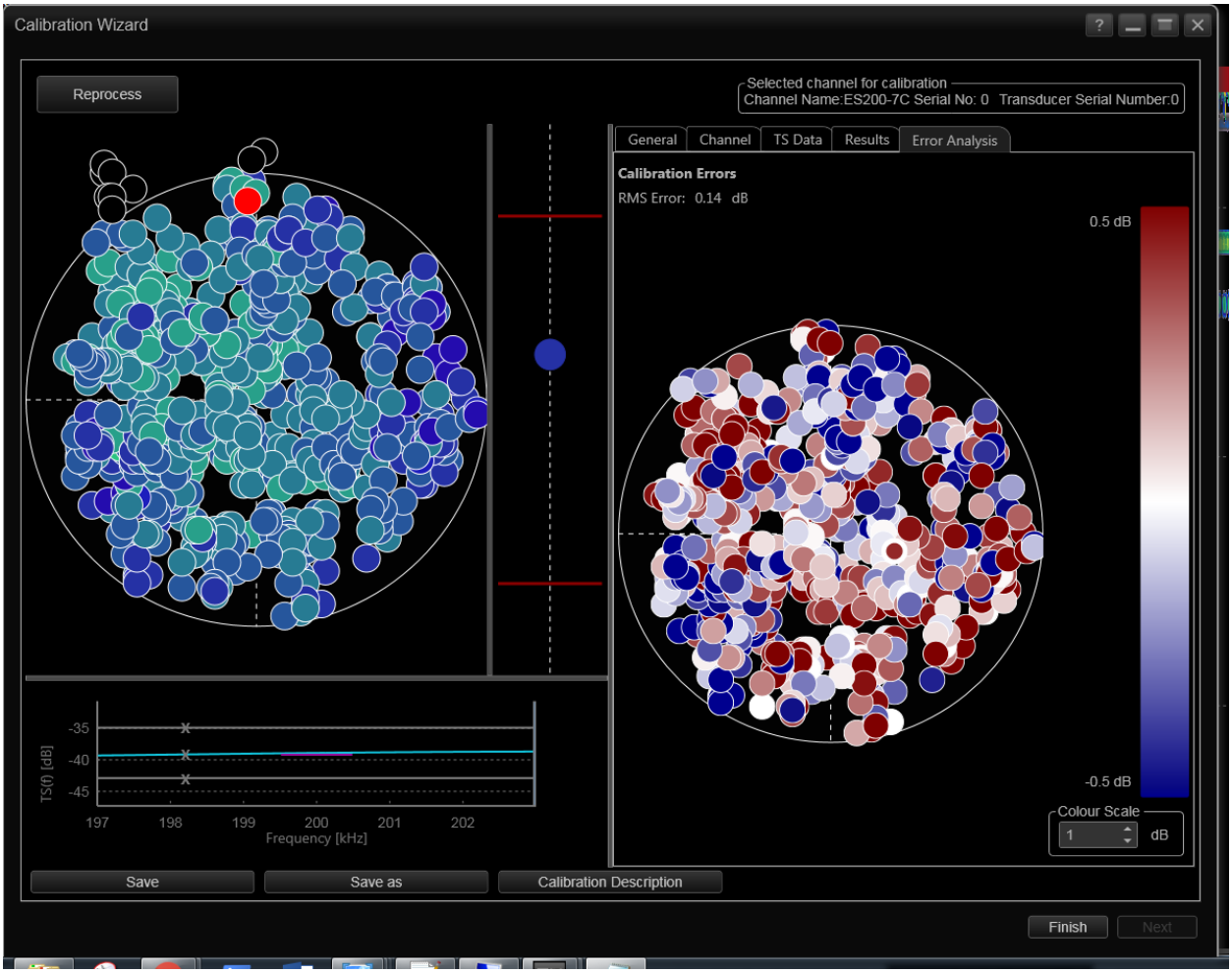

Figure 50. Screenshot of EK 80 Calibration Wizard. Error analysis for 200 kHz calibration at 1.024 ms.

Appendix 6 - Detailed List of .raw and .xml Calibration Files

EK file name	File Start Date UTC	File Start Time UTC	Transceiver Type(s) present in file 0 = GPT only	Channel 1 GPT or WBT	Channel 1 Frequency	Channel 2 GPT or WBT	Channel 2 Frequency	Channel 3 GPT or WBT	Channel 3 Frequency	Channel 4 GPT or WBT	Channel 4 Frequency	Channel 5 GPT or WBT	Channel 5 Frequency	Comment
D20190521-T134702.raw	5/21/2019	13:47:02	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz CW 1.024 ms
D20190521-T163824.raw	5/21/2019	16:38:24	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70kHz CW 2.048 ms
D20190521-T170525.raw	5/21/2019	17:05:25	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 2.048 ms
D20190521-T171708.raw	5/21/2019	17:17:08	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 2.048 ms
D20190521-T172956.raw	5/21/2019	17:29:56	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 1.024 ms
D20190521-T174138.raw	5/21/2019	17:41:38	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 1.024 ms
D20190521-T175718.raw	5/21/2019	17:57:18	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 200 kHz 1.024 ms
D20190521-T180901.raw	5/21/2019	18:09:01	0	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 200 kHz 1.024 ms
D20190521-T181916.raw	5/21/2019	18:19:16	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 120 kHz 1.024 ms
D20190521-T183059.raw	5/21/2019	18:30:59	1	GPT	ES18	GPT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 120 kHz 1.024 ms

EK file name	File Start Date UTC	File Start Time UTC	Transceiver Type(s) present in file 0 = GPT only	Channel 1 GPT or WBT	Channel 1 Frequency	Channel 2 GPT or WBT	Channel 2 Frequency	Channel 3 GPT or WBT	Channel 3 Frequency	Channel 4 GPT or WBT	Channel 4 Frequency	Channel 5 GPT or WBT	Channel 5 Frequency	Comment
D20190521-T191049.raw	5/21/2019	19:10:49	1	GPT	ES18	GPT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 4.096 ms
D20190521-T192232.raw	5/21/2019	19:22:32	1	GPT	ES18	GPT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 4.096 ms
D20190521-T192744.raw	5/21/2019	19:27:44	1	GPT	ES18	GPT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 8.192 ms
D20190521-T193928.raw	5/21/2019	19:39:28	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 70 kHz FM 8.192 ms
D20190521-T215517.raw	5/21/2019	21:55:17	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 18 kHz 1.024 ms
D20190521-T220658.raw	5/21/2019	22:06:58	0	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES200-7C	GPT	ES200-7C	Calibration File for 18 kHz 1.024 ms
D20190521-T221839.raw	5/21/2019	22:18:39	0	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES200-7C	GPT	ES200-7C	Calibration File for 18 kHz 1.024 ms
D20190521-T223020.raw	5/21/2019	22:30:20	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 18 kHz 1.024 ms
D20190521-T225128.raw	5/21/2019	22:51:28	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 18 kHz 4.092 ms
D20190521-T230312.raw	5/21/2019	23:03:12	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 18 kHz 4.092 ms
D20190521-T231456.raw	5/21/2019	23:14:56	1	GPT	ES18	WBT	ES38B	WBT	ES70-7C	GPT	ES120-7C	GPT	ES200-7C	Calibration File for 18 kHz 4.092 ms

.xml file name	Date	Frequency Calibrated (kHz)	Pulse Duration Calibrated (ms)
CalibrationDataFile-D20190521-T225106-18kHz-4096.xml	05/21/2019	18	4.096

CalibrationDataFile-D20190521-T215557-18kHz-1024.xml	05/21/2019	18	1.024
CalibrationDataFile-D20190521-T163816-70kHz-2048-FINAL.xml	05/21/2019	70 (CW)	2.048
CalibrationDataFile-D20190521-T134707-70kHz-1024-FINAL.xml	05/21/2019	70 (CW)	1.024
CalibrationDataFile-D20190521-T191055-70kHz-FM-8192.xml	05/21/2019	70 (FM)	8.192
CalibrationDataFile-D20190521-T191055-70kHz-FM-4096.xml	05/21/2019	70 (FM)	4.096
CalibrationDataFile-D20190521-T170533-70kHz-FM-2048.xml	05/21/2019	70 (FM)	2.048
CalibrationDataFile-D20190521-T170533-70kHz-FM-1024.xml	05/21/2019	70 (FM)	1.024
CalibrationDataFile-D20190521-T181910-120kHz-1024.xml	05/21/2019	120	1.024
CalibrationDataFile-D20190521-T175654-200kHz-1024.xml	05/21/2019	200	1.024