AES17 IASATC04 ADC Tests

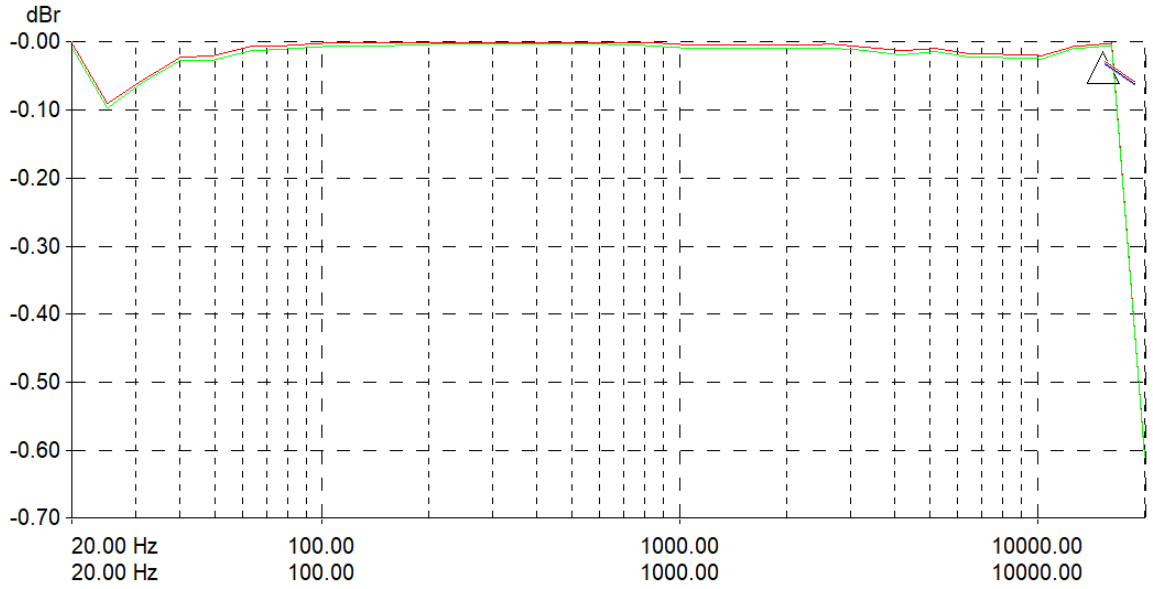
Sample Rate = 96Khz
Toslink Rate = 48Khz

Frequency Response

Frequency Response: For an A/D sampling frequency of 48 kHz, the measured frequency response will be better than ± 0.1 dB for the range 20 Hz to 20 kHz. For an A/D sampling frequency of 96 kHz, the measured frequency response will be better than ± 0.1 dB for the range 20Hz to 20 kHz, and ± 0.3 dB for the range 20 kHz to 40 kHz. For an A/D sampling frequency of 192 kHz, the frequency response will be better than ± 0.1 dB for the range 20Hz to 20 kHz, and ± 0.3 dB from 20 kHz to 50 kHz (reference audio signal = 997 Hz, amplitude -20 dB FS).

NB: The PrismSound DScope implementation of the AES 17 tests are currently limited to an upper frequency of 20Khz

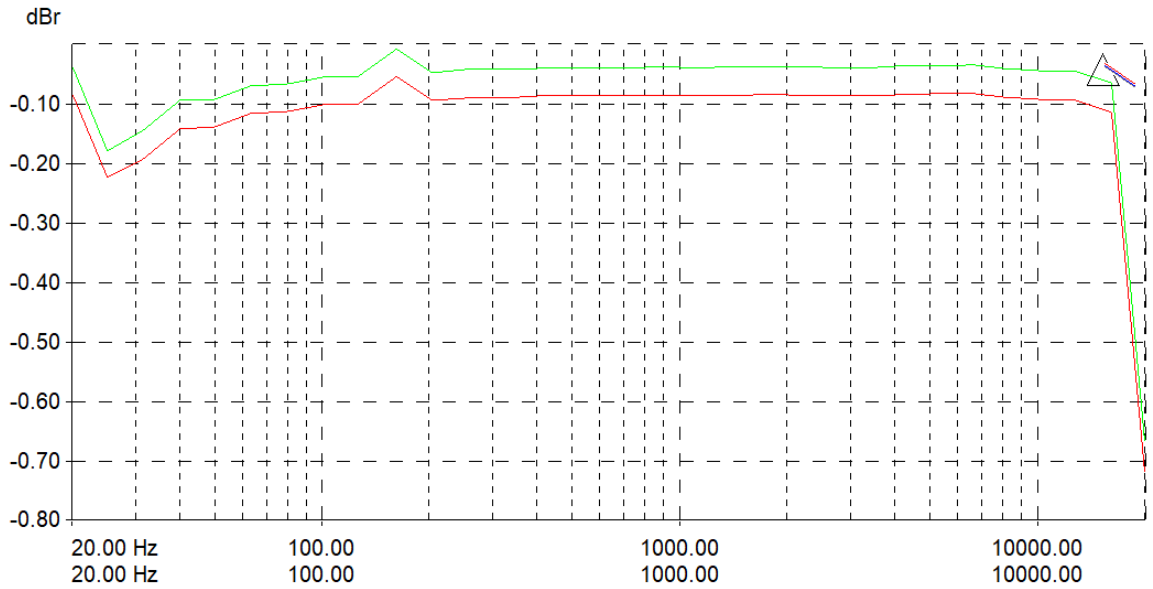
HiFi Berry



Channel A		Channel B	
X (Hz)	Y (dBr)	X (Hz)	Y (dBr)
20	-0.00999	20	-0.00425
25	-0.09596	25	-0.08998
31.5	-0.05783	31.5	-0.05396
40	-0.02637	40	-0.022
50	-0.02444	50	-0.01865
63	-0.01206	63	-0.00634
80	-0.00924	80	-0.00343
100	-0.00521	100	0.000445

125	-0.00496	125	0.000758
160	-0.00355	160	0.002206
200	-0.00221	200	0.003544
250	-0.00179	250	0.003863
315	-0.00184	315	0.003907
400	-0.00269	400	0.003021
500	-0.00266	500	0.003061
630	-0.00483	630	0.000817
800	-0.00572	800	3.32E-05
1000	-0.00935	1000	-0.00362
1250	-0.00928	1250	-0.00358
1600	-0.00931	1600	-0.00351
2000	-0.00923	2000	-0.00343
2500	-0.00826	2500	-0.00269
3150	-0.01228	3150	-0.00658
4000	-0.01825	4000	-0.01261
5000	-0.01452	5000	-0.00905
6300	-0.02188	6300	-0.01647
8000	-0.02427	8000	-0.01923
10000	-0.02485	10000	-0.0202
12500	-0.00928	12500	-0.00525
16000	-0.0045	16000	-0.00141
20000	-0.6517	20000	-0.65062

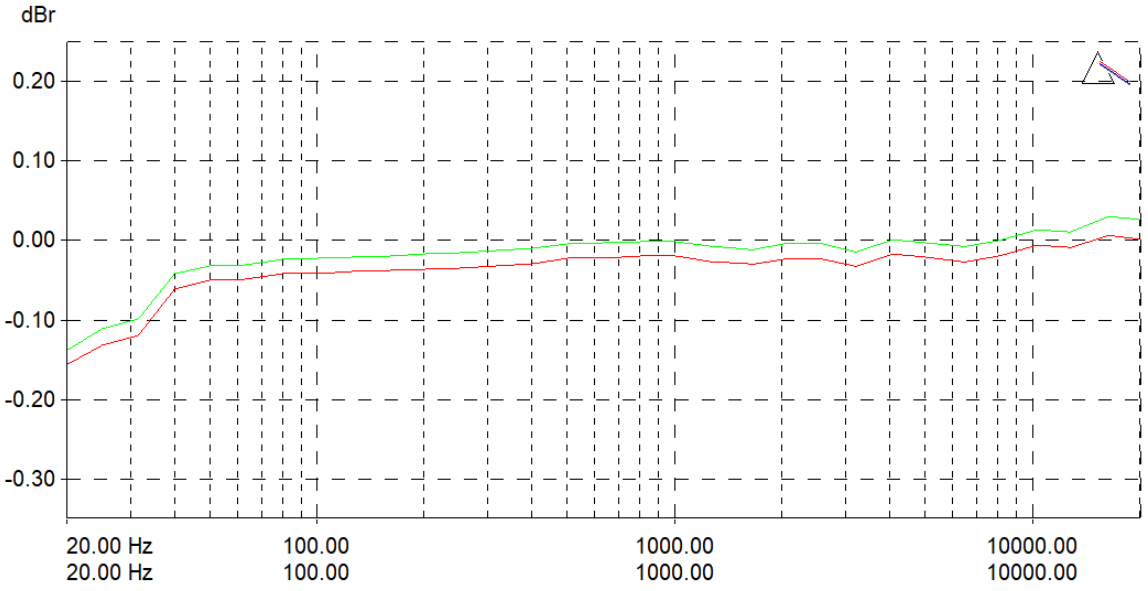
Scarlett 2i2 (4th Generation)



Channel A		**Channel B**	
X (Hz)	Y (dBr)	X (Hz)	Y (dBr)
20	-0.03938	20	-0.08627
25	-0.17847	25	-0.22448
31.5	-0.14438	31.5	-0.1924
40	-0.09322	40	-0.14116
50	-0.09151	50	-0.13793
63	-0.06891	63	-0.11561
80	-0.06593	80	-0.11259
100	-0.0548	100	-0.10158
125	-0.05471	125	-0.10153
160	-0.00795	160	-0.05475
200	-0.04727	200	-0.09404
250	-0.04231	250	-0.08915
315	-0.04231	315	-0.08916
400	-0.03993	400	-0.08675
500	-0.03982	500	-0.08672
630	-0.03962	630	-0.08639
800	-0.03884	800	-0.08567
1000	-0.04028	1000	-0.08713
1250	-0.0387	1250	-0.08542
1600	-0.03793	1600	-0.08471
2000	-0.03861	2000	-0.08545
2500	-0.04012	2500	-0.08697
3150	-0.039	3150	-0.08597
4000	-0.03676	4000	-0.08379
5000	-0.03589	5000	-0.08314
6300	-0.03499	6300	-0.08252
8000	-0.0418	8000	-0.08954
10000	-0.04551	10000	-0.09379
12500	-0.04455	12500	-0.09359

16000	-0.06525	16000	-0.11547
20000	-0.70949	20000	-0.76197

Titan



Channel A		**Channel B**	
X (Hz)	Y (dBr)	X (Hz)	Y (dBr)
20	-0.13823	20	-0.15641
25	-0.11246	25	-0.13259
31.5	-0.0987	31.5	-0.11948
40	-0.04254	40	-0.06113
50	-0.03236	50	-0.05086
63	-0.03058	63	-0.04914
80	-0.02391	80	-0.0425
100	-0.02308	100	-0.04171
125	-0.02109	125	-0.03972
160	-0.02001	160	-0.03865
200	-0.01796	200	-0.03663
250	-0.01613	250	-0.03476
315	-0.01346	315	-0.03211
400	-0.01093	400	-0.02956
500	-0.0047	500	-0.02335
630	-0.00379	630	-0.02246
800	-0.00139	800	-0.02005
1000	-0.00335	1000	-0.02201
1250	-0.00946	1250	-0.02814
1600	-0.01314	1600	-0.03181
2000	-0.00489	2000	-0.02361

2500	-0.00528	2500	-0.02405
3150	-0.01573	3150	-0.03456
4000	0.000177	4000	-0.01878
5000	-0.00434	5000	-0.0235
6300	-0.00918	6300	-0.02863
8000	-3.6E-05	8000	-0.01997
10000	0.013544	10000	-0.00705
12500	0.010674	12500	-0.01096
16000	0.029825	16000	0.006215
20000	0.025402	20000	-0.00089

Total Harmonic Distortion + Noise (THD+N) vs Frequency

Total Harmonic Distortion + Noise (THD+N): With signal 997 Hz at - 1 dB FS, the A/D converter THD+N will be less than -105 dB unweighted, -107 dB A-weighted, 20 Hz to 20 kHz bandwidth limited. With signal 997 Hz at -20 dB FS, the A/D converter THD+N will be less than -95 dB unweighted, -97 dB A-weighted, 20 Hz to 20 kHz bandwidth limited.

HiFi Berry

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -1 dBFS	-84 dBr	-84 dBr	-84 dBr	-84 dBr
997Hz @ -20 dBFS	-74 dBr	-77 dBr	-74 dBr	-77 dBr

Scarlett 2i2 (4th Generation)

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -1 dBFS	-78 dBr	-76 dBr	-78 dBr	-76 dBr
997Hz @ -20 dBFS	-77 dBr	-79 dBr	-77 dBr	-79 dBr

Titan

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -1 dBFS	-103 dBr	-105 dBr	-103 dBr	-105 dBr
997Hz @ -20 dBFS	-92 dBr	-94 dBr	-92 dBr	-94 dBr

Dynamic Range (Signal to Noise)

Dynamic Range (Signal to Noise): The A/D converter will have a dynamic range of not less than 115 dB unweighted, 117 dB Aweighted. (Measured as THD+N relative to 0 dB FS, bandwidth limited 20 Hz to 20 kHz, stimulus signal 997 Hz at -60 dB FS).

HiFi Berry

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -60 dBFS	-94 dBr	-97 dBr	-94 dBr	-97 dBr

Scarlett 2i2 (4th Generation)

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -60 dBFS	-97 dBr	-97 dBr	-96 dBr	-96 dBr

Titan

	Channel A		Channel B	
Test Frequency & Level	Unweighted	A weighted	Unweighted	A weighted
997Hz @ -60 dBFS	-112 dBr	-114 dBr	-112 dBr	-114 dBr

Low Frequency Intermodulation Distortion (LF IMD)

Intermodulation Distortion (IMD): The A/D converter IMD will not exceed -90 dB. (AES17/SMPTE/DIN twin-tone test sequences, combined tones equivalent to a single sine wave at full scale amplitude).

HiFi Berry

Channel A	Channel B
-63.7 dB	-64.4 dB

Scarlett 2i2 (4th Generation)

Channel A	Channel B
-78.7 dB	-78.8 dB

Titan

Channel A	Channel B
-109.9 dB	-111.2 dB

High Frequency Intermodulation Distortion (HF IMD)

Intermodulation Distortion (IMD): The A/D converter IMD will not exceed -90 dB. (AES17/SMPTE/DIN twin-tone test sequences, combined tones equivalent to a single sine wave at full scale amplitude).

HiFi Berry

Channel A	Channel B
-74.9 dB	-72.9 dB

Scarlett 2i2 (4th Generation)

Channel A	Channel B
-74.2 dB	-73.9 dB

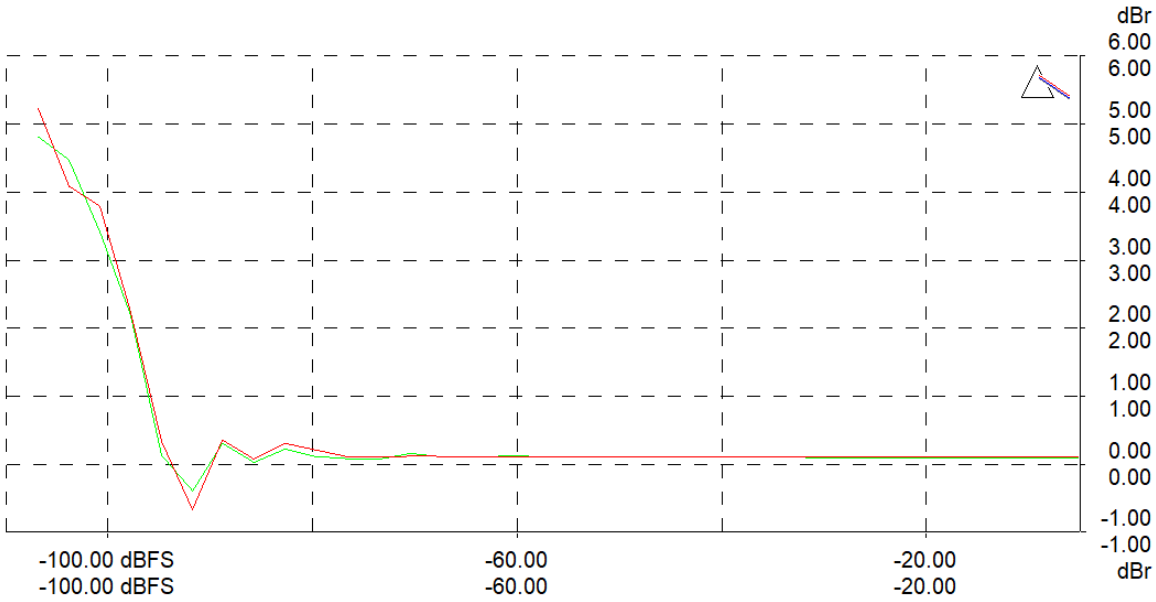
Titan

Channel A	Channel B
-107.0 dB	-107.6 dB

Amplitude Linearity

Amplitude Linearity: The A/D converter will exhibit amplitude gain linearity of ± 0.5 dB within the range -120 dB FS to 0 dB FS. (997 Hz sinusoidal stimuli).

HiFi Berry



Channel A		**Channel B**	
X (dBFS)	Y (dBr)	X (dBFS)	Y (dBr)
-140		-140	
-137.08		-137.08	
-134.17		-134.17	
-131.25		-131.25	
-128.33		-128.33	
-125.42		-125.42	
-122.5		-122.5	
-119.58		-119.58	
-116.67		-116.67	
-113.75		-113.75	
-110.83		-110.83	
-107.92		-107.92	
-105		-105	

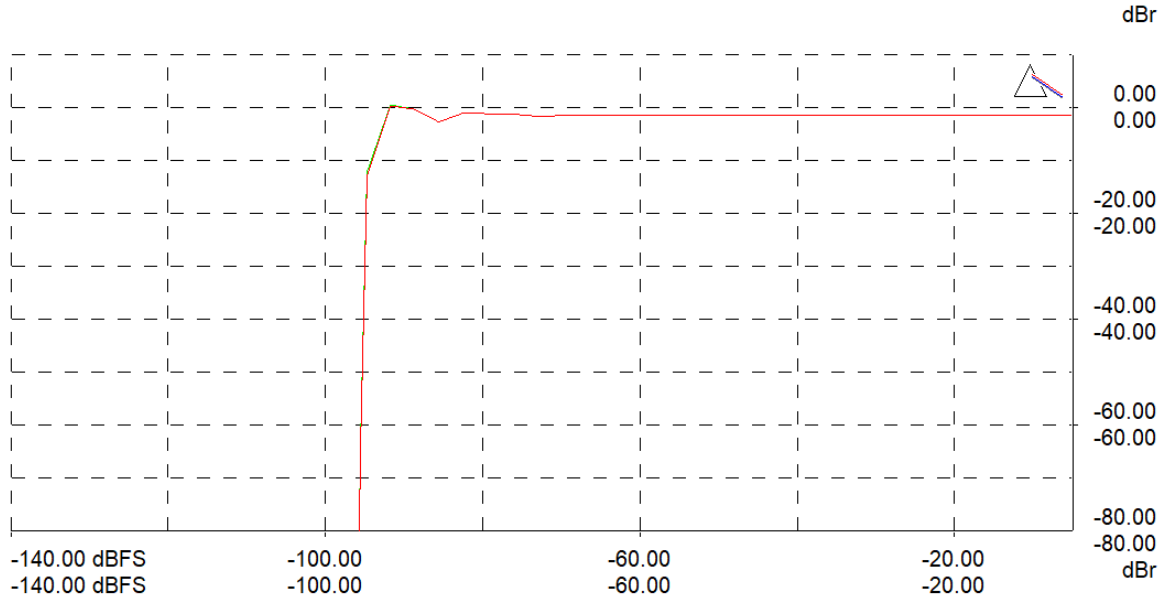
-110	6.147093	-110	5.199312
-107	4.828328	-107	5.243191
-104	4.487624	-104	4.084187
-101	3.426418	-101	3.797141
-98	2.188798	-98	2.233002
-95	0.118676	-95	0.326452
-92	-0.40816	-92	-0.67851
-89	0.300112	-89	0.343918
-86	0.022998	-86	0.065889
-83	0.217269	-83	0.299884
-80	0.109692	-80	0.203848
-77	0.071269	-77	0.102481
-74	0.075843	-74	0.104626
-71	0.157655	-71	0.118991
-68	0.107215	-68	0.106177
-65	0.111626	-65	0.104829
-62	0.118424	-62	0.103181
-59	0.111461	-59	0.101631
-56	0.110482	-56	0.104177
-53	0.111564	-53	0.09795
-50	0.104553	-50	0.10345
-47	0.106097	-47	0.106703
-44	0.108016	-44	0.105567
-41	0.106808	-41	0.105115
-38	0.110232	-38	0.103135
-35	0.109933	-35	0.103766
-32	0.094876	-32	0.101474
-29	0.094998	-29	0.103916
-26	0.094721	-26	0.103789
-23	0.097279	-23	0.103654

-20	0.097386	-20	0.101327
-17	0.093286	-17	0.099373
-14	0.093373	-14	0.103184
-11	0.093013	-11	0.102922
-8	0.092786	-8	0.102782
-5	0.092324	-5	0.102438

Worst case deviation from reference gain (-5 dBFS):
Channel A: 6.1dB
Channel B: 5.1dB

Sweep truncated as channel B level was within 5dB of idle channel noise level.

Scarlett 2i2 (4th Generation)



Channel A		**Channel B**	
X (dBFS)	Y (dBr)	X (dBFS)	Y (dBr)
-140		-140	
-137.08		-137.08	
-134.17		-134.17	
-131.25		-131.25	

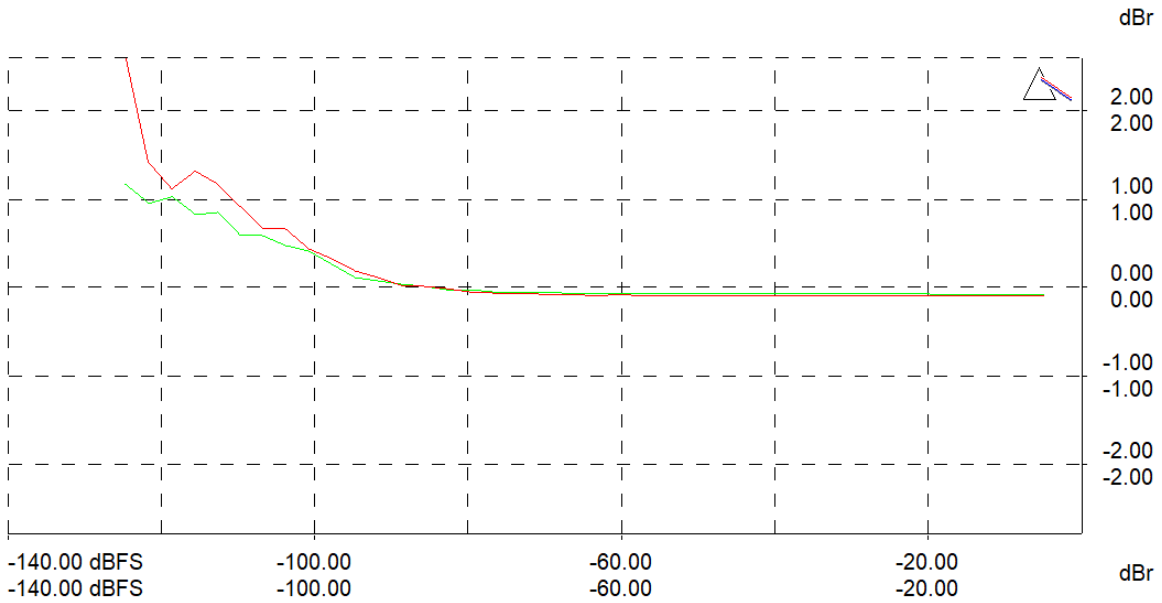
-128.33		-128.33	
-125.42		-125.42	
-122.5		-122.5	
-119.58		-119.58	
-116.67		-116.67	
-113.75		-113.75	
-110.83		-110.83	
-107.92		-107.92	
-105		-105	
-102.08		-102.08	
-99.17		-99.17	
-96.25		-96.25	
-93.33		-93.33	
-98	-202	-98	-202
-95	-12.1085	-95	-13.105
-92	0.465302	-92	0.384611
-89	-0.54408	-89	-0.55431
-86	-2.82035	-86	-2.85018
-83	-1.19512	-83	-1.21001
-80	-1.2922	-80	-1.3369
-77	-1.41166	-77	-1.44571
-74	-1.78571	-74	-1.83075
-71	-1.53024	-71	-1.60031
-68	-1.54539	-68	-1.60209
-65	-1.6159	-65	-1.65709
-62	-1.57571	-62	-1.6454
-59	-1.58968	-59	-1.66145
-56	-1.59489	-56	-1.63995
-53	-1.59219	-53	-1.64082
-50	-1.59329	-50	-1.63972

-47	-1.59172	-47	-1.63881
-44	-1.59304	-44	-1.63882
-41	-1.59011	-41	-1.63807
-38	-1.59138	-38	-1.63885
-35	-1.59112	-35	-1.6391
-32	-1.59497	-32	-1.6424
-29	-1.59756	-29	-1.64248
-26	-1.59533	-26	-1.64532
-23	-1.59543	-23	-1.64281
-20	-1.59502	-20	-1.64281
-17	-1.60439	-17	-1.64452
-14	-1.60407	-14	-1.64306
-11	-1.60653	-11	-1.64537
-8	-1.60382	-8	-1.64261
-5	-1.60416	-5	-1.64258

Worst case deviation from reference gain (@ -5 dBFS):

Channel A: -200.4 dB
Channel B: -200.4 dB

Titan



Channel A		**Channel B**	
X (dBFS)	Y (dBr)	X (dBFS)	Y (dBr)
-140		-140	
-137.08		-137.08	
-134.17		-134.17	
-131.25		-131.25	
-128.33		-128.33	
-125.42		-125.42	
-122.5		-122.5	
-119.58		-119.58	
-125	1.176929	-125	2.653488
-122	0.962572	-122	1.427698
-119	1.036046	-119	1.125968
-116	0.836613	-116	1.329492
-113	0.864012	-113	1.180343
-110	0.597462	-110	0.92271
-107	0.588387	-107	0.672236

-104	0.471073	-104	0.663728
-101	0.405026	-101	0.433994
-98	0.253514	-98	0.31973
-95	0.106099	-95	0.188036
-92	0.074827	-92	0.106181
-89	0.03288	-89	0.017309
-86	-0.00343	-86	0.007023
-83	-0.04236	-83	-0.03415
-80	-0.04408	-80	-0.06631
-77	-0.06805	-77	-0.078
-74	-0.06422	-74	-0.08157
-71	-0.07234	-71	-0.09711
-68	-0.08097	-68	-0.09689
-65	-0.0804	-65	-0.10709
-62	-0.07947	-62	-0.09979
-59	-0.08327	-59	-0.10227
-56	-0.08327	-56	-0.10175
-53	-0.08434	-53	-0.10511
-50	-0.08278	-50	-0.10384
-47	-0.08541	-47	-0.1072
-44	-0.08538	-44	-0.10489
-41	-0.08544	-41	-0.10493
-38	-0.08535	-38	-0.10748
-35	-0.0856	-35	-0.10661
-32	-0.08528	-32	-0.10385
-29	-0.083	-29	-0.10665
-26	-0.0853	-26	-0.1064
-23	-0.08274	-23	-0.10638
-20	-0.09284	-20	-0.11096
-17	-0.09287	-17	-0.10976

-14	-0.09304	-14	-0.10996
-11	-0.09297	-11	-0.10989
-8	-0.09249	-8	-0.10943
-5	-0.09938	-5	-0.11138

Worst case deviation from reference gain (-5 dBFS):
Channel A: 1.28dB
Channel B: 2.77dB

Sweep truncated as channel A level was within 5dB of idle channel noise level.

Spurious Aharmonic Signals

Spurious Aharmonic Signals: Better than -130 dB FS with stimulus signal 997 Hz at -1 dBFS

HiFi Berry

Greatest spurious aharmonic found at 6.802 KHz with level of -92 dBFS.

Scarlett 2i2 (4th Generation)

Greatest spurious aharmonic found at 6.802 KHz with level of -93.74 dBFS.

Titan

No measurable aharmonic present above noise floor (circa -120 dBFS).

Internal Sample Clock Accuracy

For an A/D converter synchronised to its internal sample clock, frequency accuracy of the clock measured at the digital stream output will be better than ±25 ppm

Unable to measure the internal sample rate of the ADCs, however the clock stability of the TOSLINK was as follows:

HiFi Berry
Deviation of ezco HDMI to TOSLINK converter clock = +21.7ppm

Scarlett 2i2 (4th Generation)

Deviation of ezco HDMI to TOSLINK converter clock = +22.5ppm

Titan
Deviation of Titan TOSLINK interface = -5ppm