Integrated Device Technology, Inc.
6024 Silver Creek Valley Road, San Jose, CA 95138

PRODUCT/PROCESS CHANGE NOTICE (PCN)

PCN #: **A1906-01 (R1)** Date: December 20, 2019
Product Affected: GX74870-JIU

Date Effective: December 20, 2019

MEANS OF DISTINGUISHING CHANGED DEVICES:
- ■ Product Mark
- ☐ Back Mark
- ☐ Date Code
- ☐ Other

The serial number marked on the device includes the assembly site

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Attachment ■ Yes ☐ NO

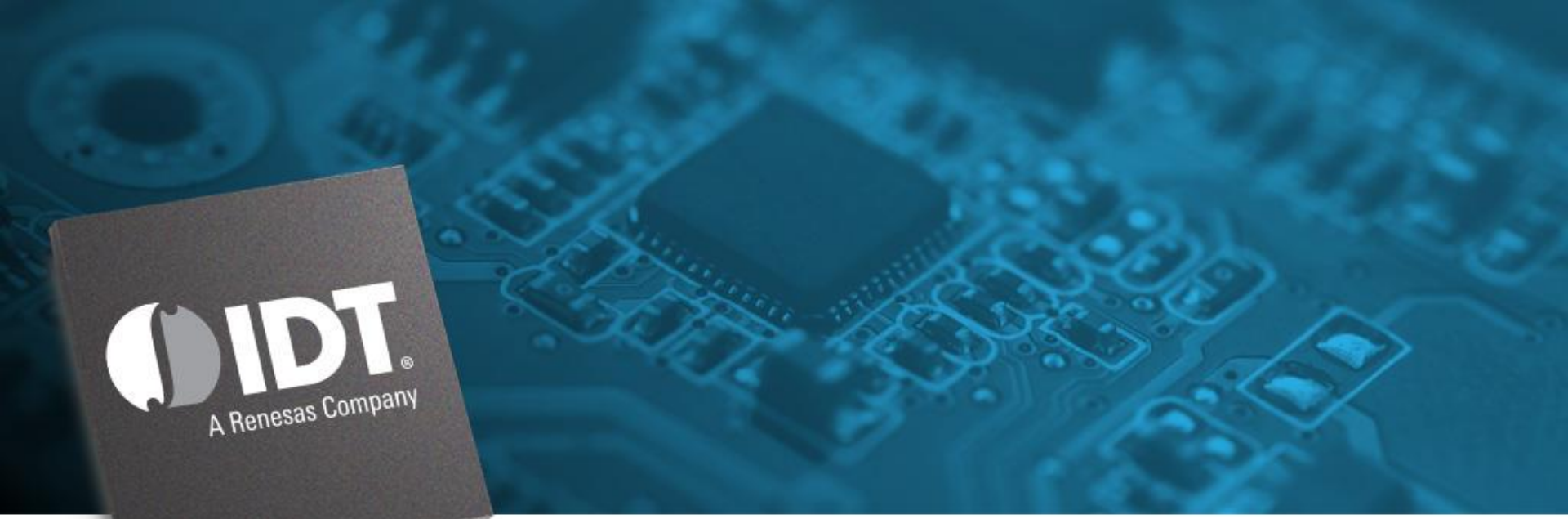
DESCRIPTION AND PURPOSE OF CHANGE:
- ☐ Die Technology
- ☐ Wafer Fabrication Process
- ■ Assembly
- ☐ Equipment
- ☐ Material
- ■ Test
- ☐ Manufacturing Site
- ☐ Data Sheet
- ☐ Other - Die Revision Change

Revison 1: This revised notice is to update the qualification results.

This notification is to advise our customers that IDT is transferring assembly and test location of GX74870-JIU to Fabrinet (FBN) Module Assembly and Test as San Jose Module Assembly and Test is being discontinued.

FBN is an IDT qualified Subcontractor which is currently assembling and testing other Nokia products from Renesas.

Refer to Attachment 1 for the FBN site qualification plan and results.



GX74870

FBN Site Qualification Plan and Status

WW49 2019

GX74870 Site Qualification Status & Summary

- All qualification testing complete and passed
- To ensure continuity of supply:
  - San Jose will ramp down and complete remaining material assembly during December of 2019. San Jose material will still be shipped during early 2020 until exhausted
  - FBN will ramp assembly and test during the 1st quarter of 2020

GX74870 Site Qualification

- IDT to transfer full production assembly and test to FBN in Thailand.
  - FBN has already assembly North and South substrates.
  - Transfer of final module assembly and test will move to FBN
- Due to product enhancement and manufacture discontinuance the following changes will occur:

Item	SJ	FBN	Reason of Changes	Additional Remark
Epoxy- RF absorber attach to LID	Epotek H54 (Part# 41-164-164)	Ablebond 84-3 (part# 41-167-167)	Std at FBN	84-3 is commonly use at stand-off and coil attach for Model#
Epoxy- LID attach to Housing	RJR Polymer (1609)	Ablebond 84-3 (part# 41-167-167)	Std at FBN	
Epoxy- Die Attachment (SPI, diodes, Cap, Res)	Epotek H35-175MP (part# 41-163-163)	Ablebond 84-1 (part# 41-168-168)	Std at FBN	84-1 is commonly use at stand-off and coil attach for Model#
Epoxy- Substrate to housing	Epotek H35-175MP (part# 41-163-163)	Ablebond 84-1 (part# 41-168-168)	Std at FBN	
Gold wire for SPI die	Gold wire 0.7 mil ball -wedge	Gold wire 1 mil ball-wedge	Std at FBN	Same bonders used for all other products using 1 mil wire
Drilled 50um Hole at LID	Gateway Laser Services (US)	JZ Laser (Penang)	Std at FBN	
Epoxy- Die Attachment (driver+predriver)	Namics DM6030	Namics XH9960-1	Part EOL	Replacement (New)

Epoxy-LID attach to Housing will stay with current RJR Polymer – See greyed box above

GX74870 Site Qualification

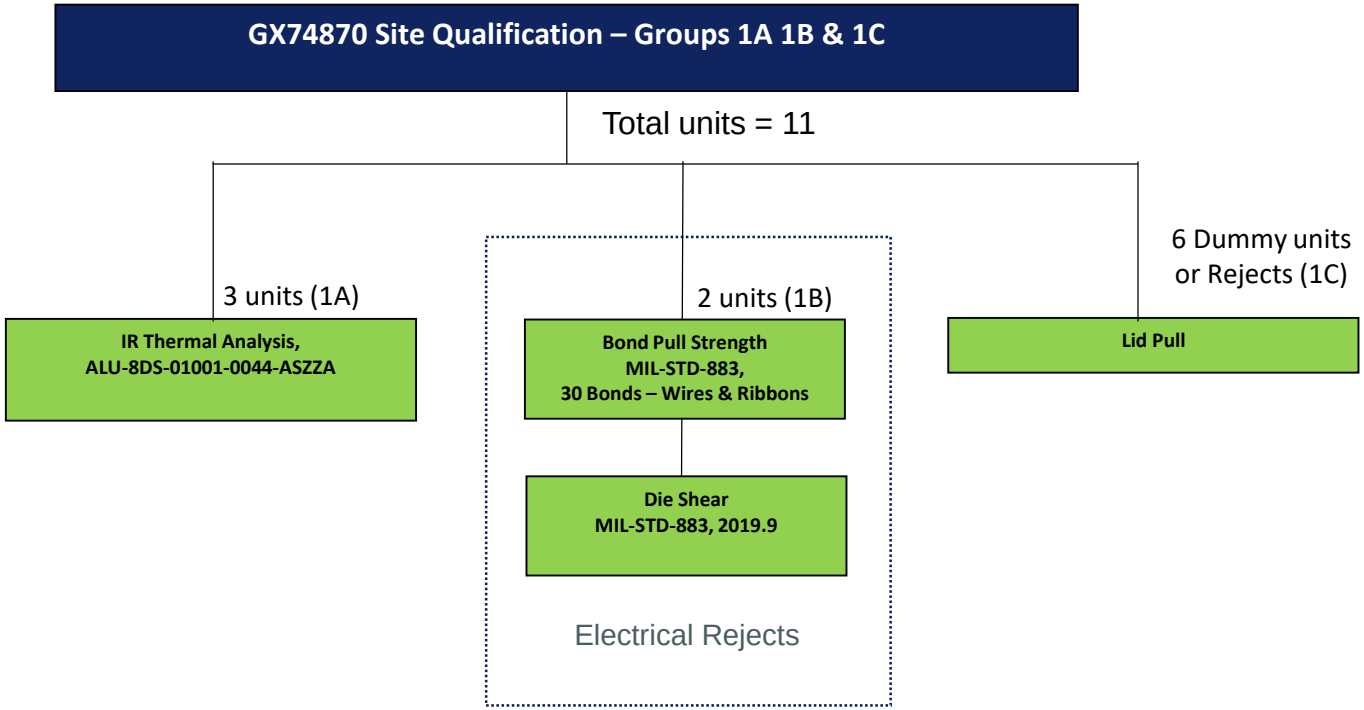
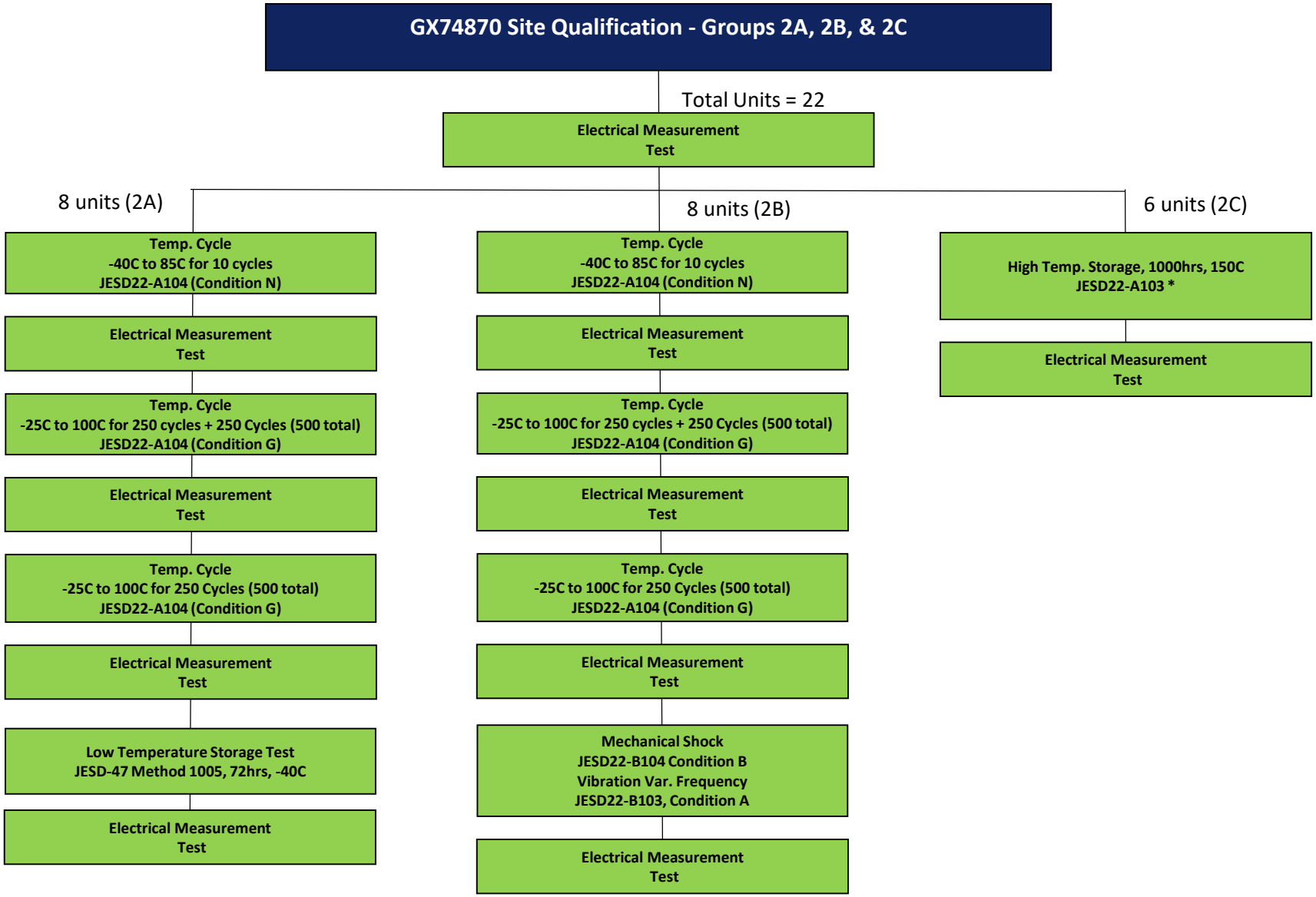


Chart Box Color Legend

- Task not done
- Task in progress
- Task complete
- Task fail/delay

GX74870 Site Qualification



Module Qualification Test Details

- Conditions:
  - T=55C, VDD=5.500V, VCC=3.300V, VEE=-4.0V
  - T=85C, VDD=5.225V, VCC=3.135V. VEE=-4.2V
- Measurements
  - ICC; IDD; IEE (+-10%)
  - THD (Vin =900mVpp, Vout=4.5Vpp, frequency 1 GHz) (Max 5.5%)
  - Gain Variation (@ 1 GHz) (+-0.9dB)
    - 4 gain settings; 9dB, 12.5dB, 15.5dB, and 19dB
- Test Points
  - T0, and Tpost stress

GX74870 Assembly & Test Transfer Serial Number Revision Codes

9.3 Construction of Serial Number

The serial number as proposed by Alcatel–Lucent is defined as follows:

YYSSMCVT1234

YY	Year of Manufacture
SS	Supplier Code (Assigned by ALU)
M	Month of Manufacture 1-9, O, N, D (where 1=January, 2=February, …, O=October, N=November, D=December)
C	Part Identifier or Code (Assigned by ALU)
V	Version A – Z (Begin with A. If the component undergoes changes, ALU may upgrade this field).
T	Type A – Z (Assigned by ALU)
1234	Device Serial Number (Extracted from supplier's original serial number)

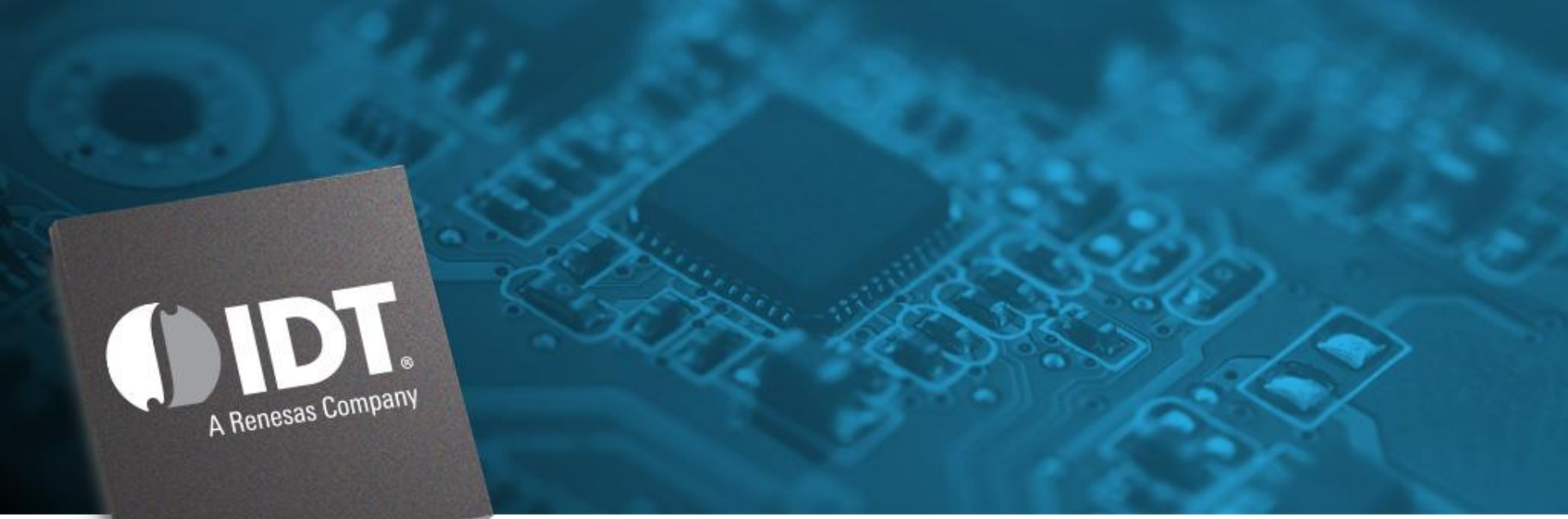
Example: 13AL5BAA1234

The Type field will be used to indicate location changes:

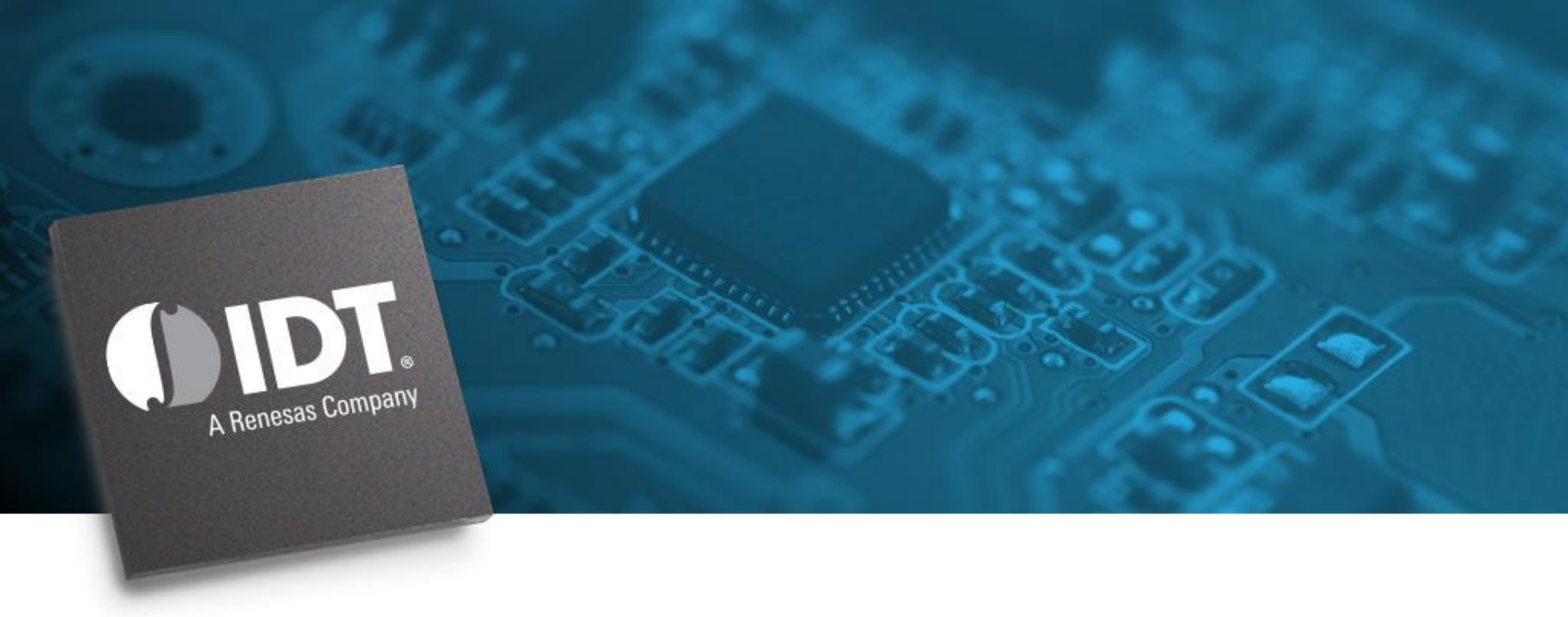
Current Production San Jose is E: YYSSMCVExxxx

Production FBN will be F: YYSSMCVFxxxx

Production CTK will be G: YYSSMCVGxxxx



Results



Group 1 Results

GX74870 – Bond Pull Results

fabrinet **Process Validation Report**

1. Part Number:	2. Part Name:
GX74870-JIU	*8X 45G LINEAR DRIVER*

Characteristic Accountability					Inspection / Test Results			
5. Test No.	6. Reference Location	7. Characteristic Designator	8. Requirement	9. Results	10. First Article Inspection Method	11. Production Inspection Method	12. Non-Conformance Number	13. Additional Data / Comments
1	*Substrates North & South*	*Wire Pull Test*	*>3gf*	*Pass 8.5gf*	*Pull test*	*Pull test*	*0*	*1mil gold wire. MIL-STD 883K METHOD 2011.9*
2	*Ribbon wires*	*Wire Pull Test*	*>9.5gf*	*Pass 16gf*	*Pull test*	*Pull test*	*0*	*4milx0.5mil ribbon gold wire, MIL-STD 883K METHOD 2011.9*
4	*Lid attach*	*Mechanical Pull Test*	*>3kgf*	*Pass 5.9kgf*	*Pull test*	*Pull test*	*0*	*MIL-STD 883K METHOD 2011.9, TEST A*

2.1336

nature indicates that all characteristics are accounted for; meet drawing requirements or are properly documented for dispo

14. Signature: *Komgrit Sungkhaphong*	15. Date: *7/24/2019*

GX74870 (North/South) – Bond Pull Results

fabrinet **Process Validation Report**

1. Part Number:	2. Part Name:
GX74870-200-21, GX74870-200-11	NORTH SUBSTRATE ASSEMBLY, SOUTH SUBSTRATE ASSEMBLY

Characteristic Accountability					Inspection / Test Results			
5. Drawing No.	6. Reference Location	7. Characteristic Designator	8. Requirement	9. Results	10. First Article Inspection Method	11. Production Inspection Method	12. Non-Conformance Number	13. Additional Data / Comments
1	IC5,6,7,8	Die Shear Test	>1.3kgf	Pass 2.6kgf	Push test	Push test	0	4 dies
	IC11,12	Die Shear Test	>2.5kgf	Pass 6.0kgf	Push test	Push test	0	2 dies
	IC1,2,3,4	Die Shear Test	>1.3kgf	Pass 2.3kgf	Push test	Push test	0	4 dies
	IC9,10	Die Shear Test	>2.5kgf	Pass 6.5kgf	Push test	Push test	0	2 dies
2	IC5,6,7,8	Wire Pull Test	>3gf	Pass 9.8gf	Pull test	Pull test	0	20 wires on IC5,6,7,8
	IC11,12	Wire Pull Test	>3gf	Pass 10.62kgf	Pull test	Pull test	0	24 wires on IC11,12
3	IC1,2,3,4	Wire Pull Test	>3gf	Pass 9.8gf	Pull test	Pull test	0	20 wires on IC1,2,3,4
	IC9,10	Wire Pull Test	>3gf	Pass 10.9kgf	Pull test	Pull test	0	24 wires on IC9,10
4	Ribbon wires	Wire Pull Test	>12.5gf	Pass 16.9gf	Pull test	Pull test	0	80 ribbons wires
5	Ribbon wires	Wire Pull Test	>12.5gf	Pass 16gf	Pull test	Pull test	0	80 ribbons wires

nature indicates that all characteristics are accounted for; meet drawing requirements or are properly documented for dispo

14. Signature: Komgrit Sungkhaphong **15. Date:** 7/24/2019

GX74870 Lid Pull Results

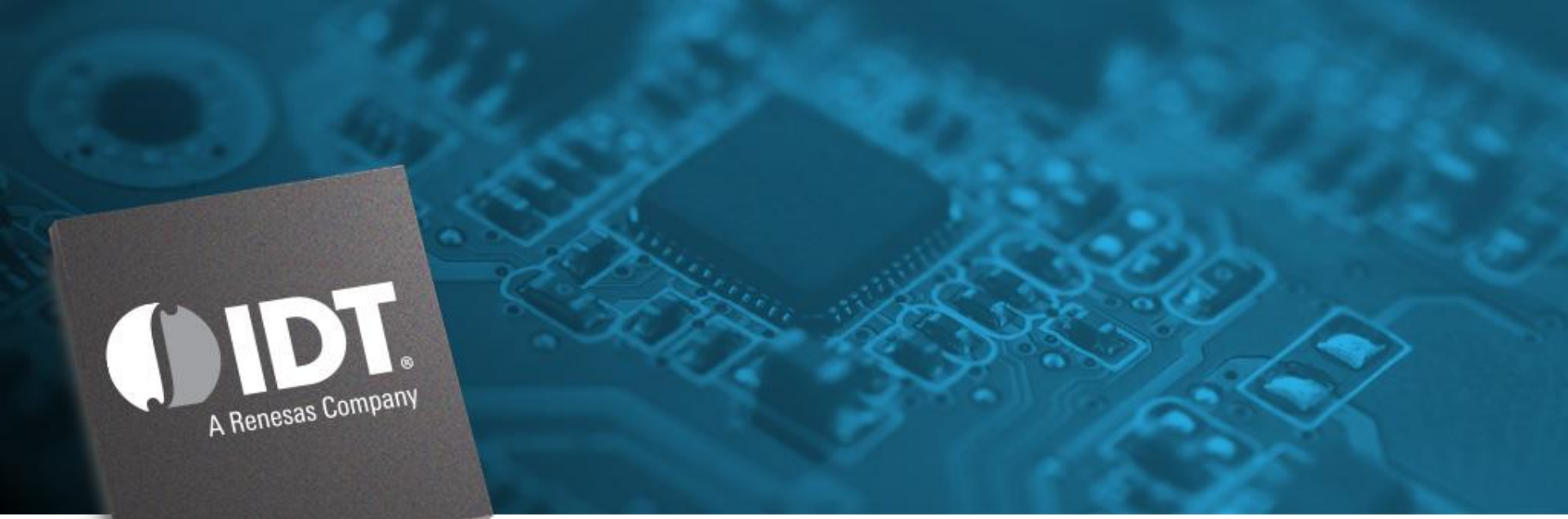
fabrinet **Process Validation Report**

1. Part Number:	2. Part Name:							
GX74870-JIU	8X 45G LINEAR DRIVER							
Characteristic Accountability					Inspection / Test Results			
5. Test No.	6. Reference Location	7. Characteristic Designator	8. Requirement	9. Results	10. First Article Inspection Method	11. Production Inspection Method	12. Non-Conformance Number	13. Additional Data / Comments
4	Lid attach	Mechanical Pull Test	>3kgf	Pass 5.9kgf	Pull test	Pull test	0	MIL-STD 883K METHOD 2011.9, TEST A

GX74870 IR

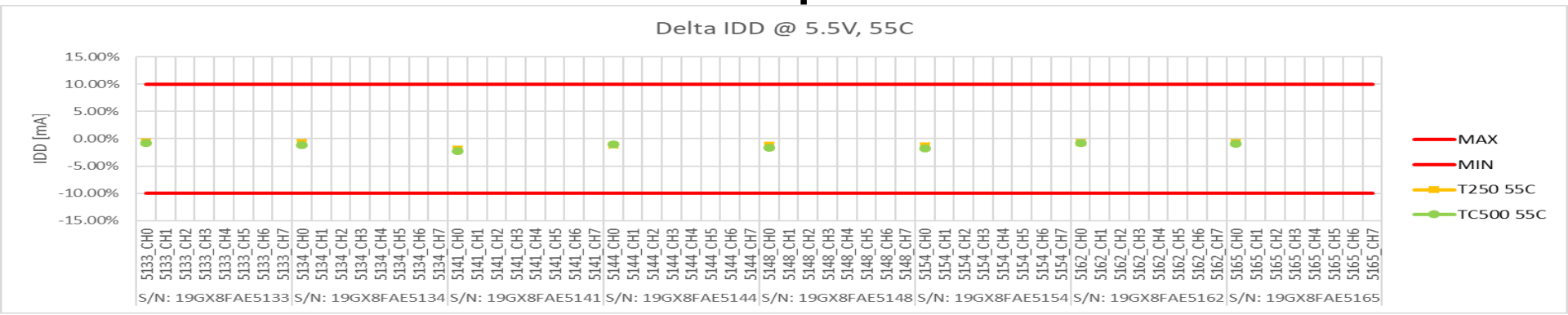
Serial Number	buildsheet	5124	5126	5139	5124	5126	5139	Minimum	Maximum	Average	Minimum	Maximum	Average
		Tj	Tj	Tj	ΔTj	ΔTj	ΔTj	Tj	Tj	Tj	ΔTj	ΔTj	ΔTj
IC Description		(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)
Pre Driver 1	IC1	**125**	**122.4**	**121**	45	42.4	41	117.6	127.0	121.7	37.6	47.0	41.7
Pre Driver 2	IC2	**125**	**122.4**	**121.2**	45	42.4	41.2						
Pre Driver 3	IC3	**127**	**118.8**	**122**	47	38.8	42						
Pre Driver 4	IC4	**127**	**118.1**	**122**	47	38.1	42						
Pre Driver 5	IC5	**125**	**117.9**	**121.8**	45	37.9	41.8						
Pre Driver 6	IC6	**125**	**117.9**	**121.8**	45	37.9	41.8						
Pre Driver 7	IC7	**120.5**	**117.6**	**121.2**	40.5	37.6	41.2						
Pre Driver 8	IC8	**120.5**	**117.6**	**121.2**	40.5	37.6	41.2						
Output 12	IC9	**120.5**	**119**	**121.4**	40.5	39	41.4	115.0	124.0	119.9	35.0	44.0	39.9
Output 34	IC10	**122**	**121**	**118.1**	42	41	38.1						
Output 56	IC11	**123**	**117.8**	**118.6**	43	37.8	38.6						
Output 78	IC12	**124**	**115**	**118.2**	44	35	38.2						
SPI South	IC13	**95**	**92**	**95.5**	15	12	15.5	92.0	96.0	95.0	12.0	16.0	15.0
SPI North	IC14	**96**	**96**	**95.5**	16	16	15.5						

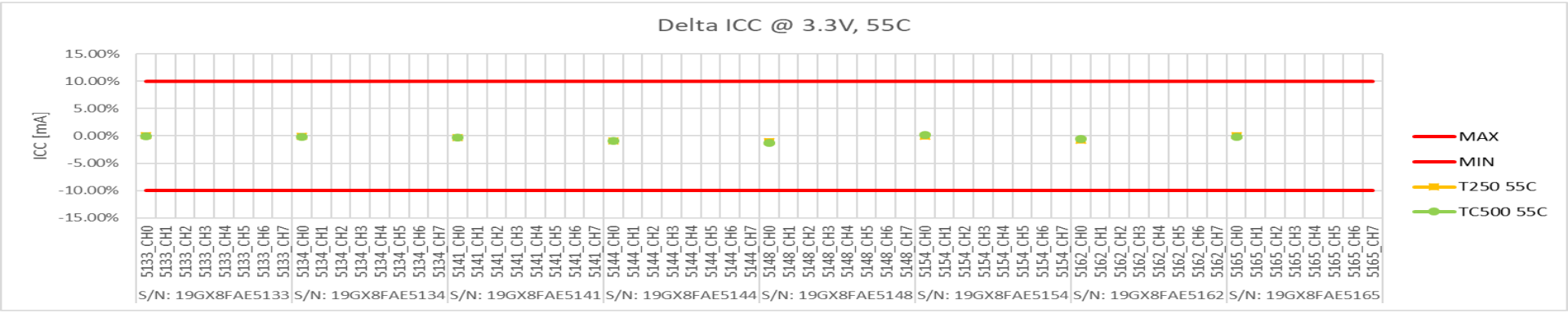
		5124	5126	5139
Backside (Flange) Temp (°C)	80	Hot (I)	Hot (I)	Hot (I)
Vdd	5.78V	**3A**	**3A**	**3A**
Vee	-4.00V	**8.3mA**	**8.3mA**	**8.3mA**
Vcc	3.46V	**160mA**	**161mA**	**156mA**

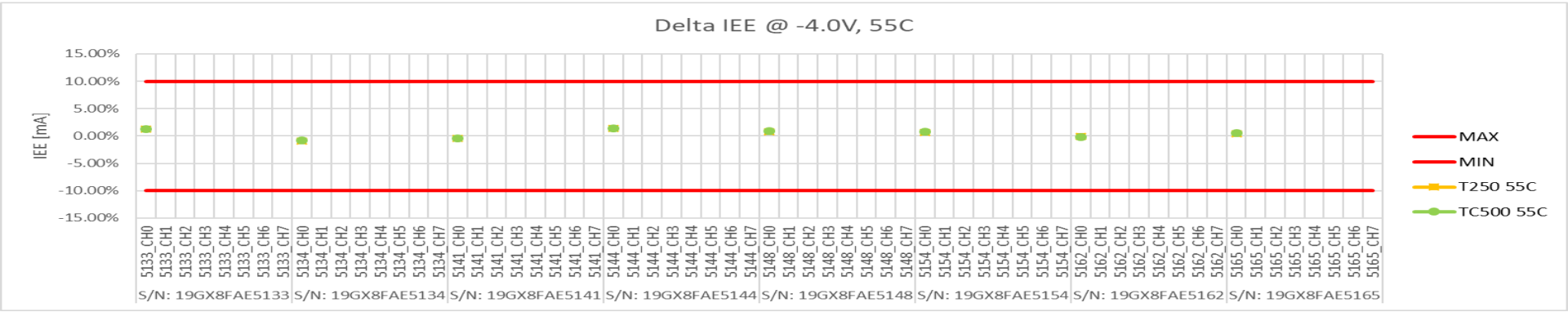


Group 2A Results

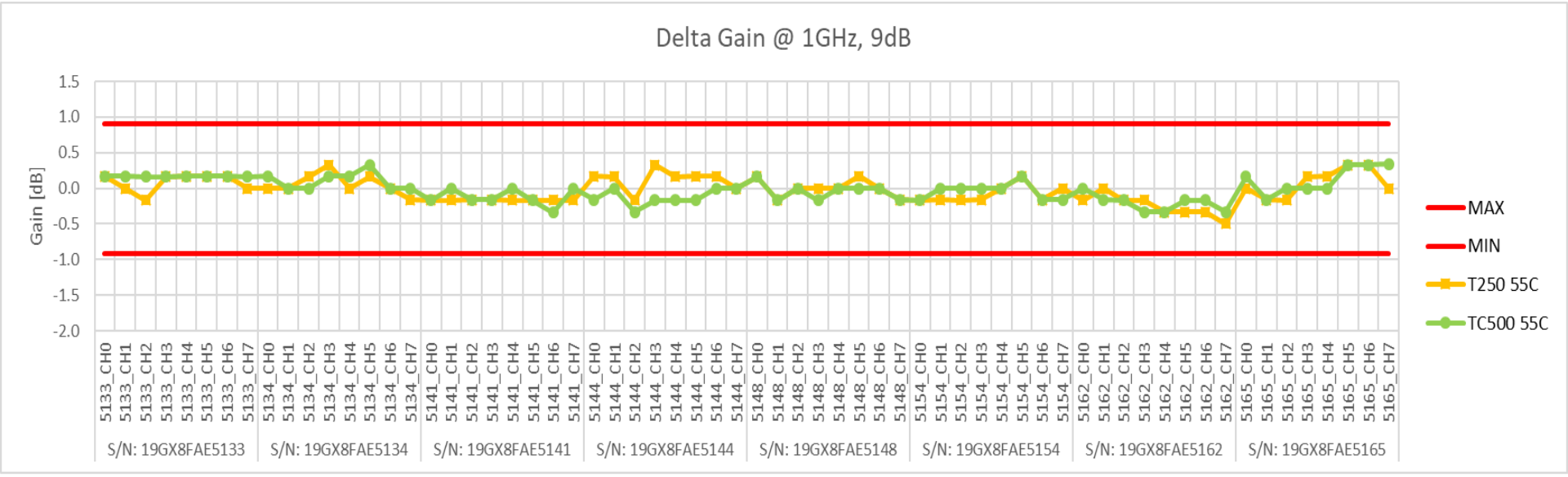
GX74870 Group 2A T/C @55

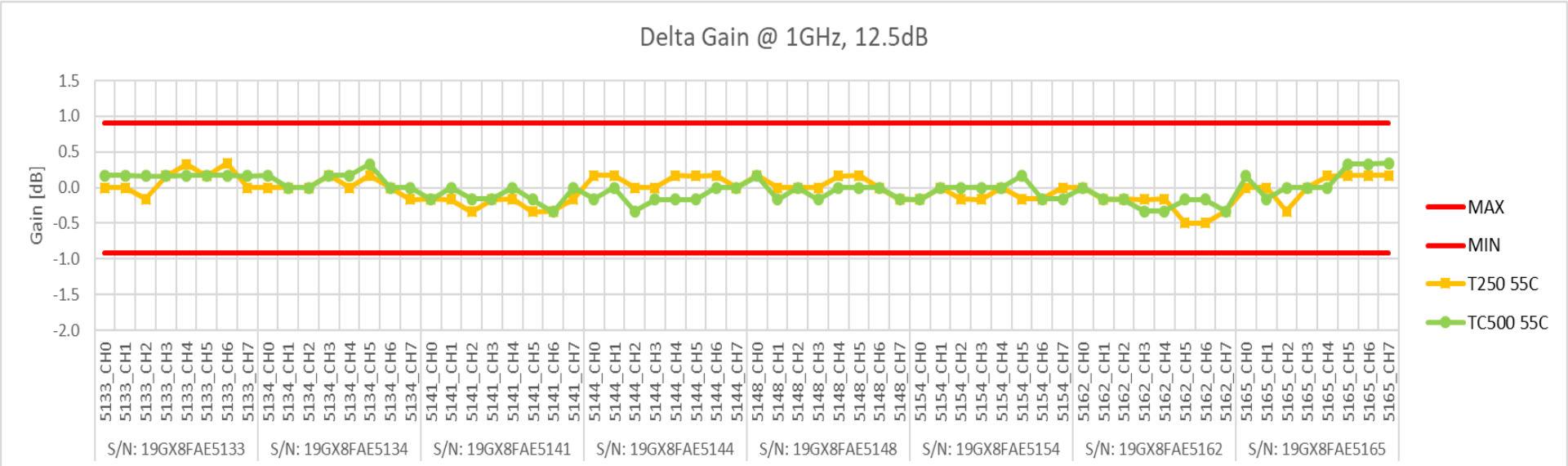




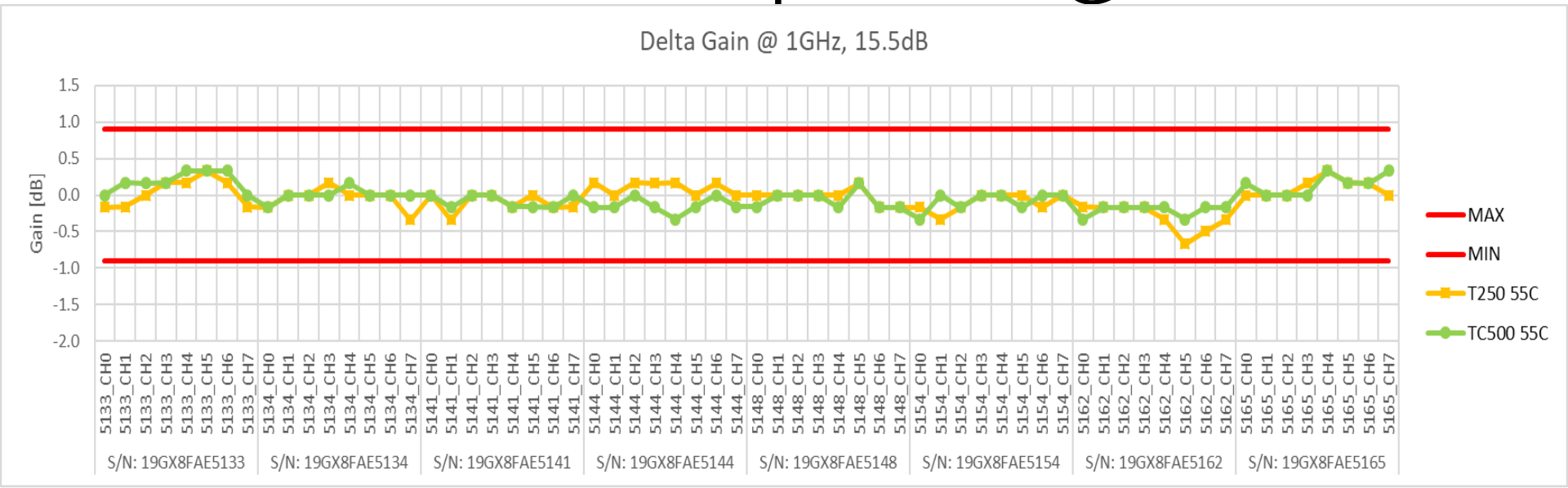


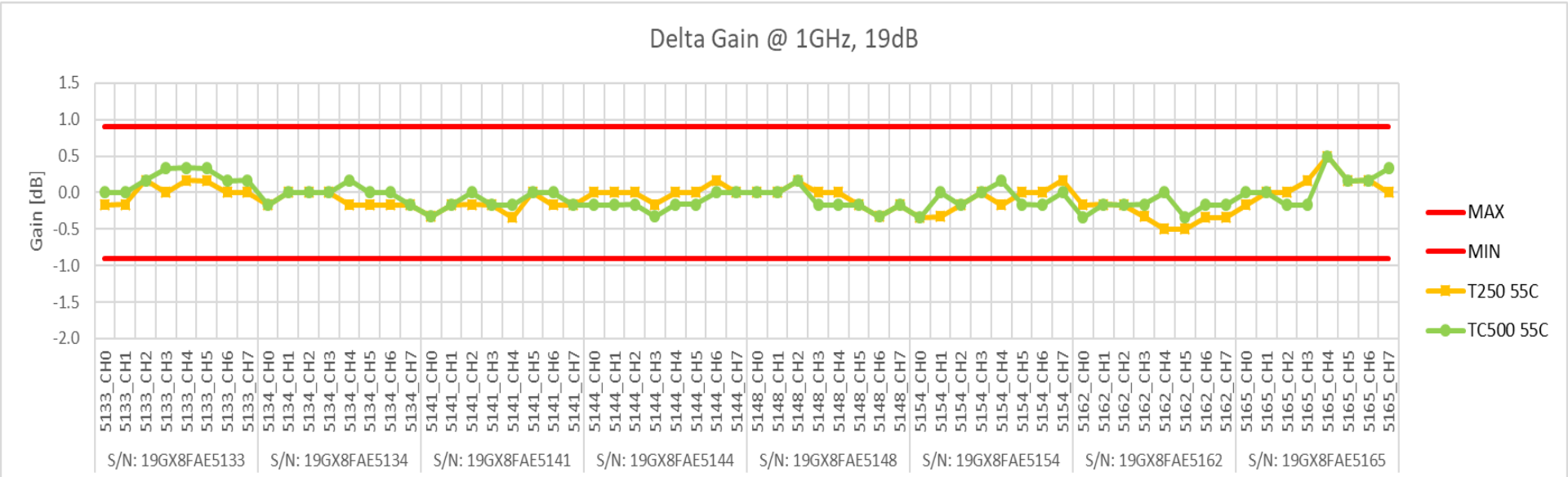
GX74870 Group 2A T/C @55C





GX74870 Group 2A T/C @55C





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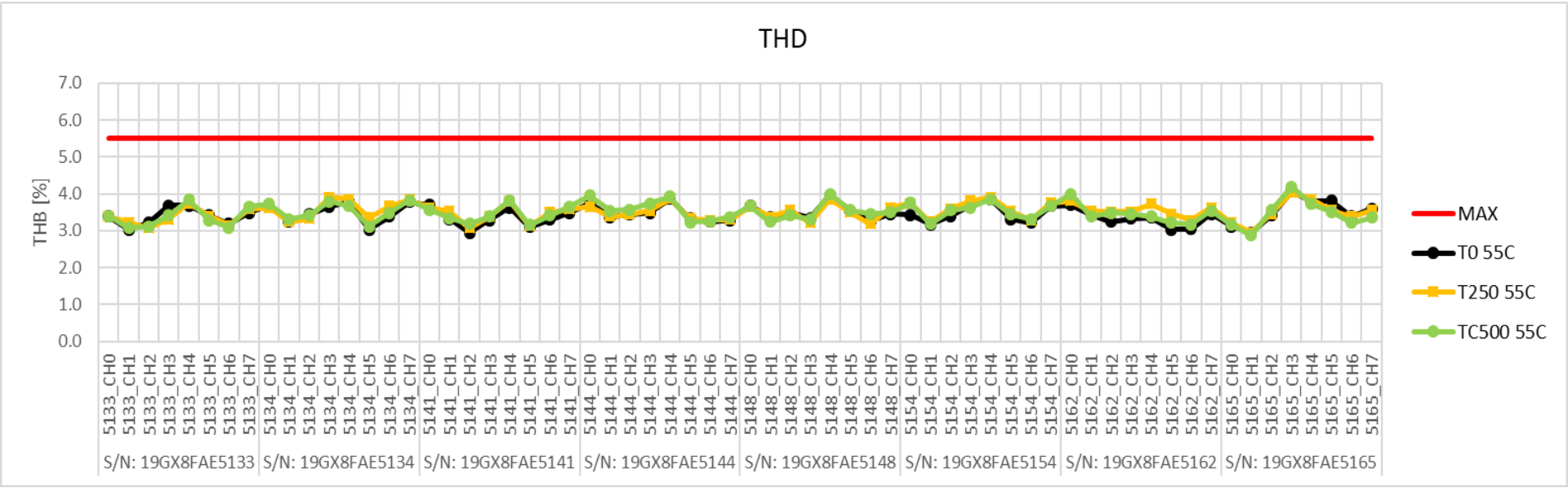
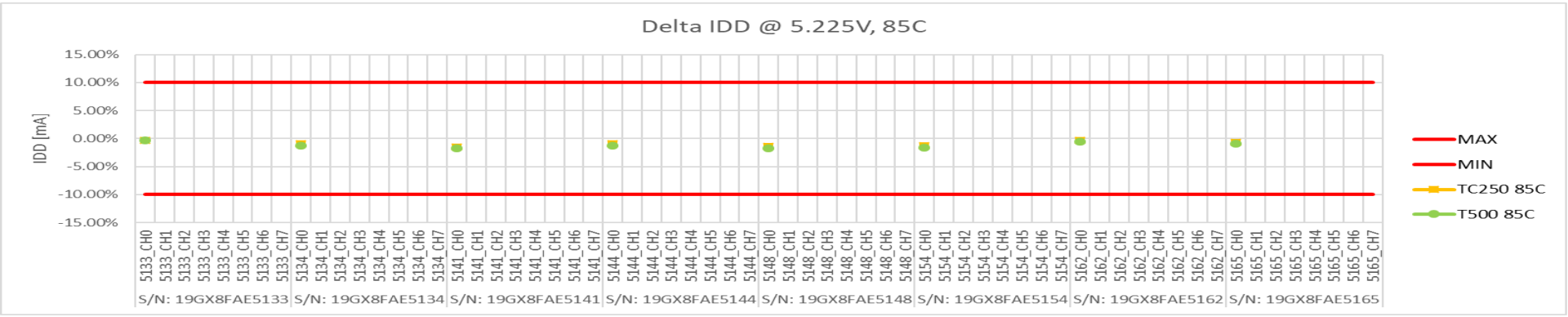
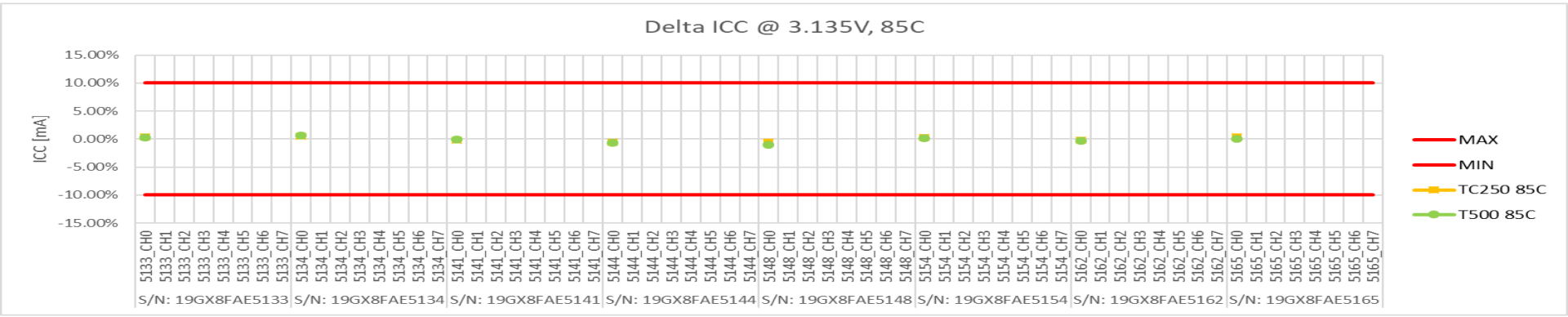
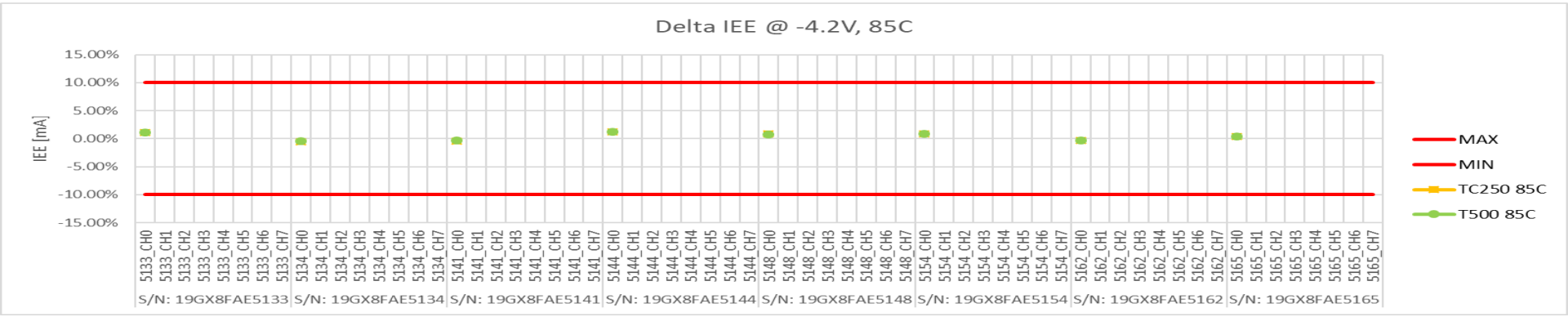


GX74870 Group 2A T/C @85C







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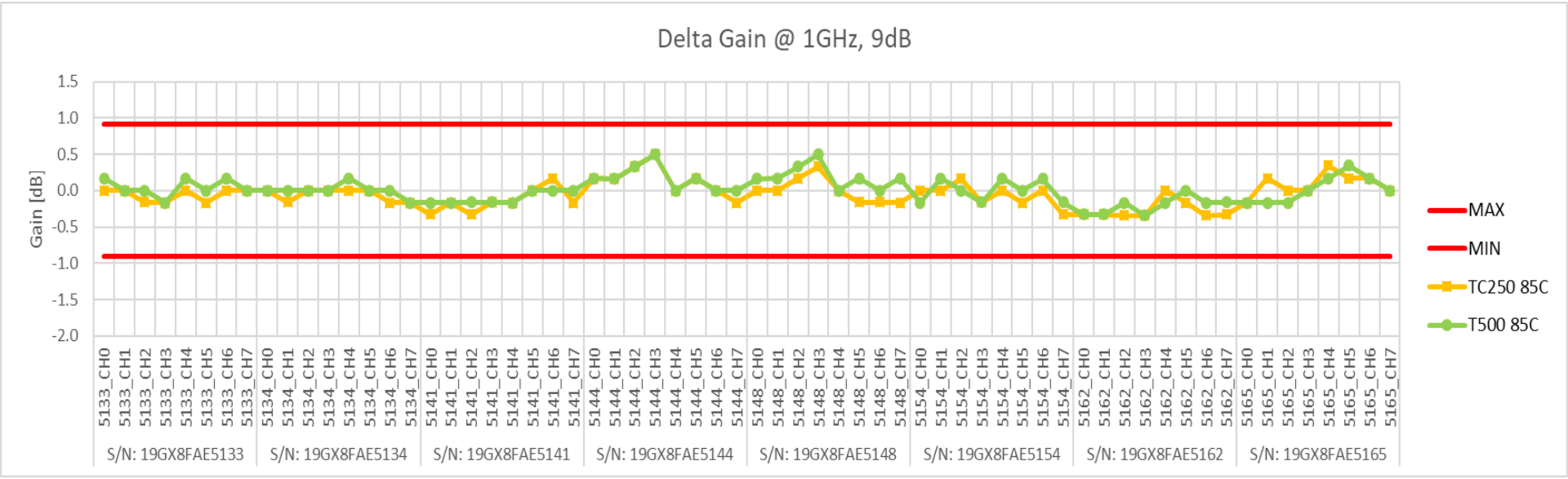

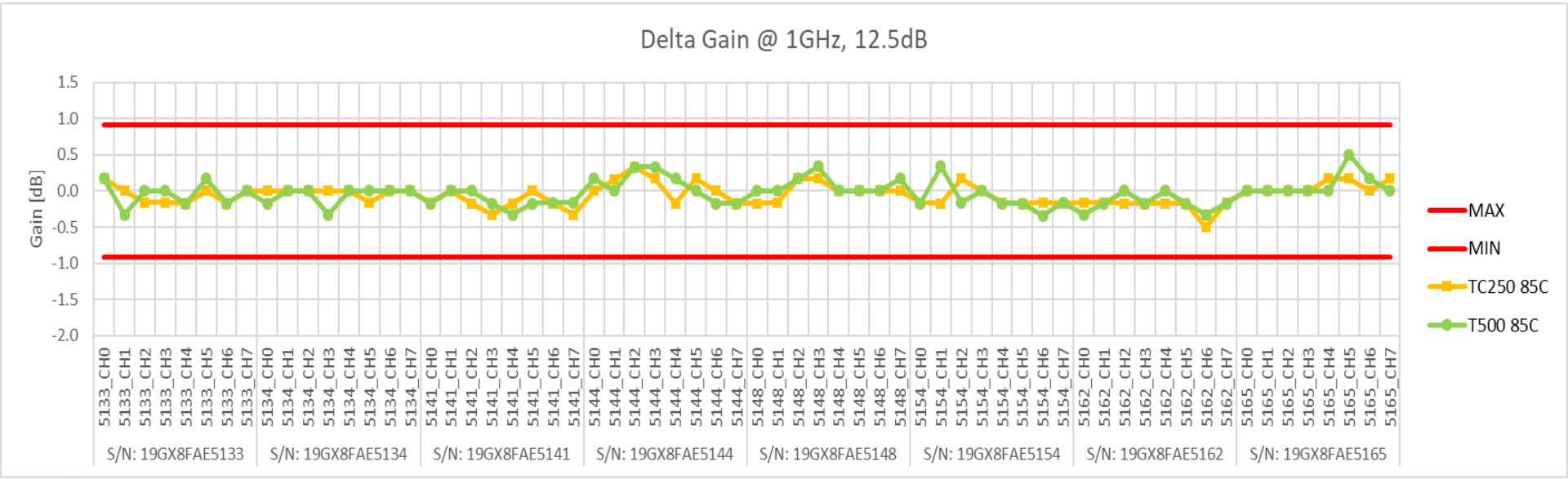

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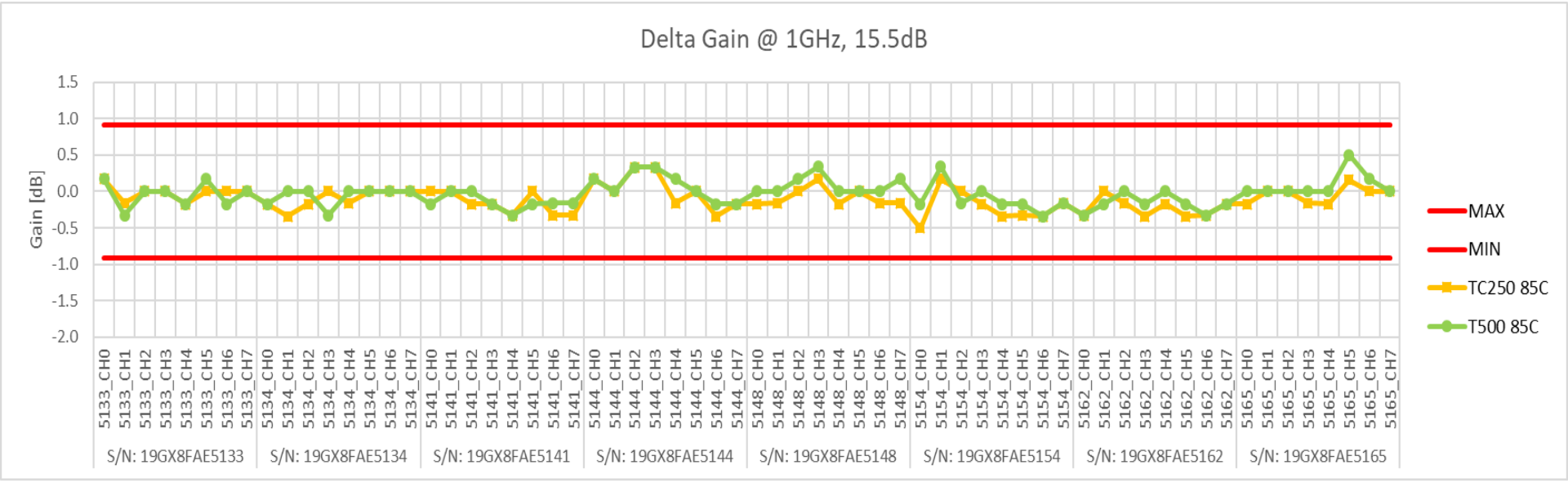
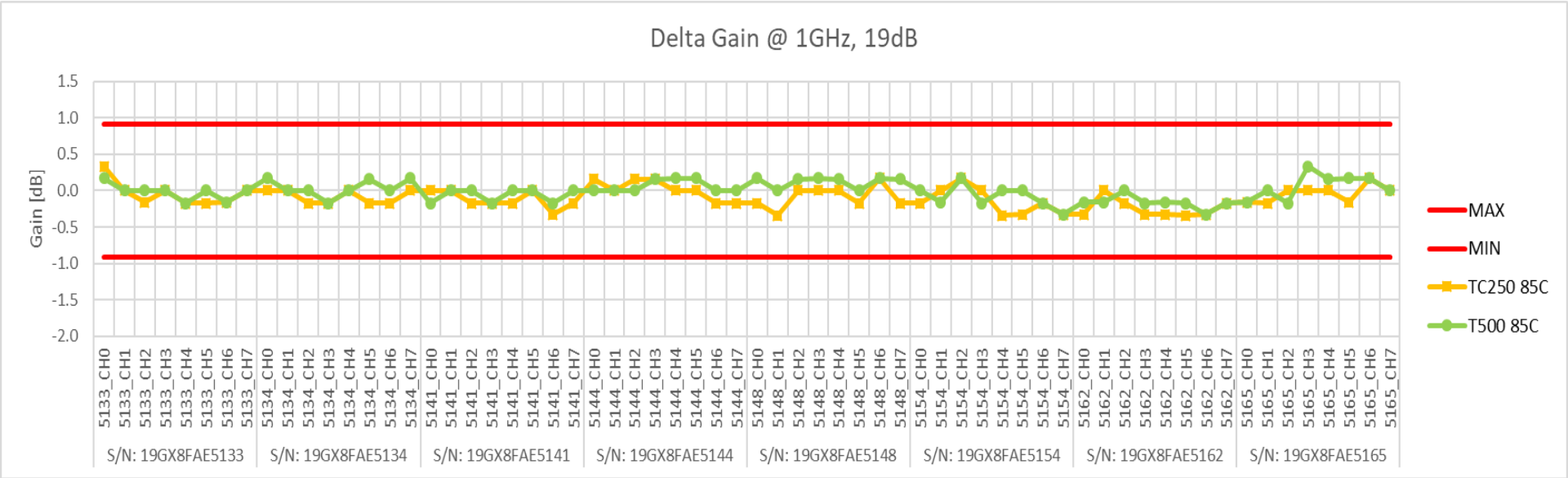
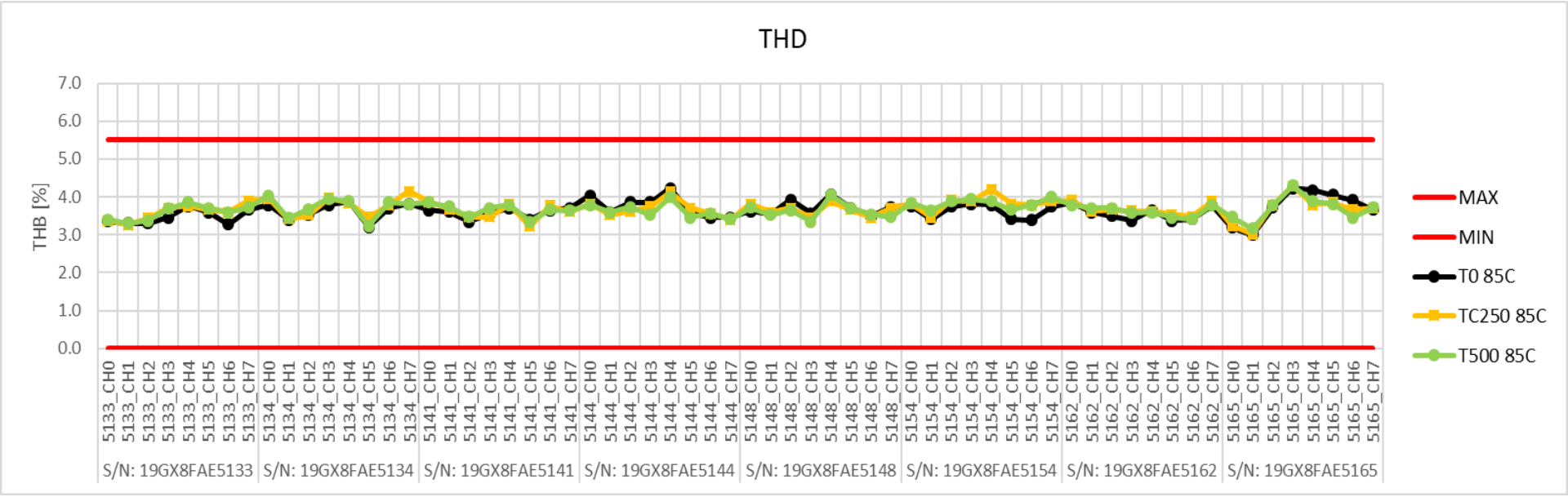
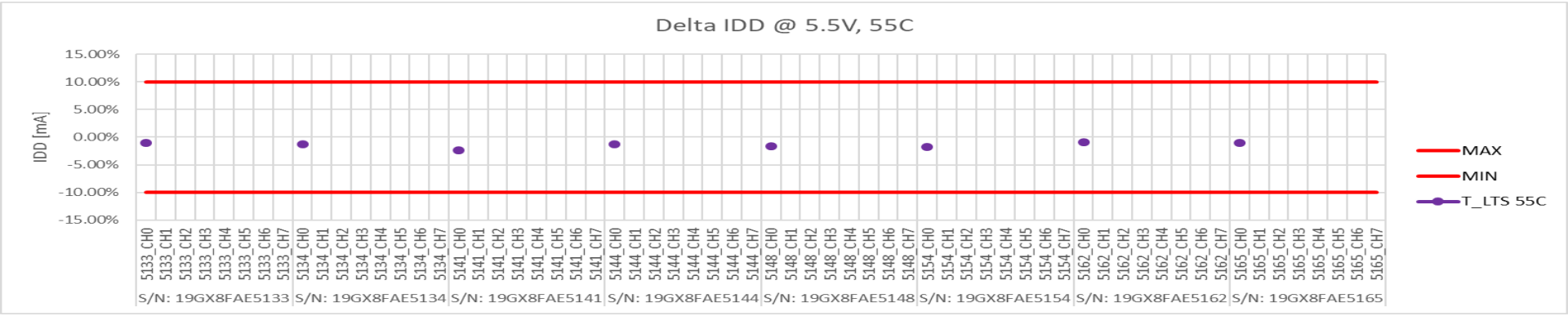


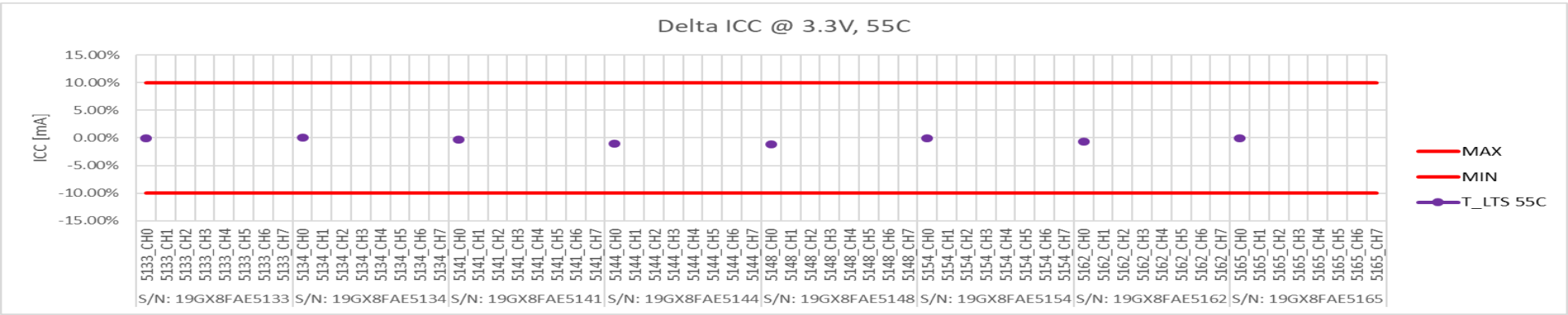


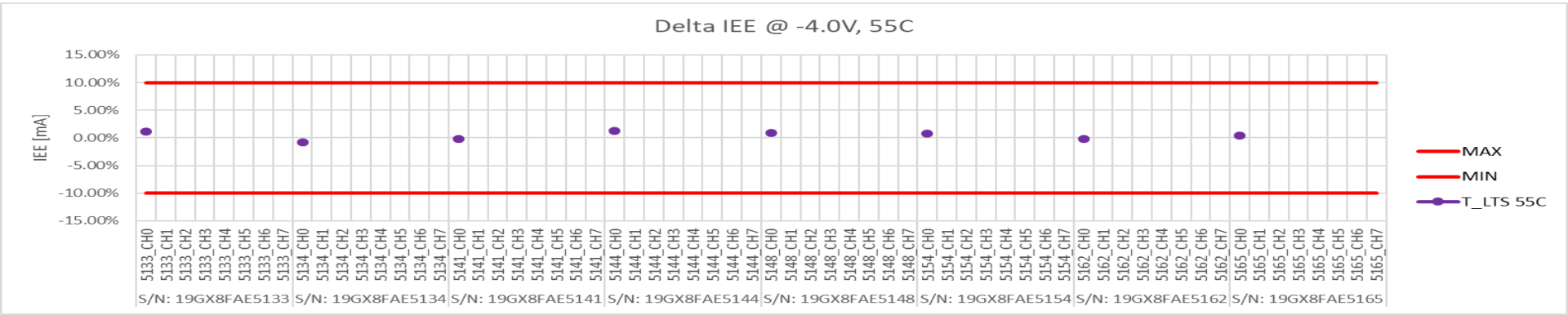
GX74870 Group 2A T/C @85C



GX74870 Group 2A LTS @55C







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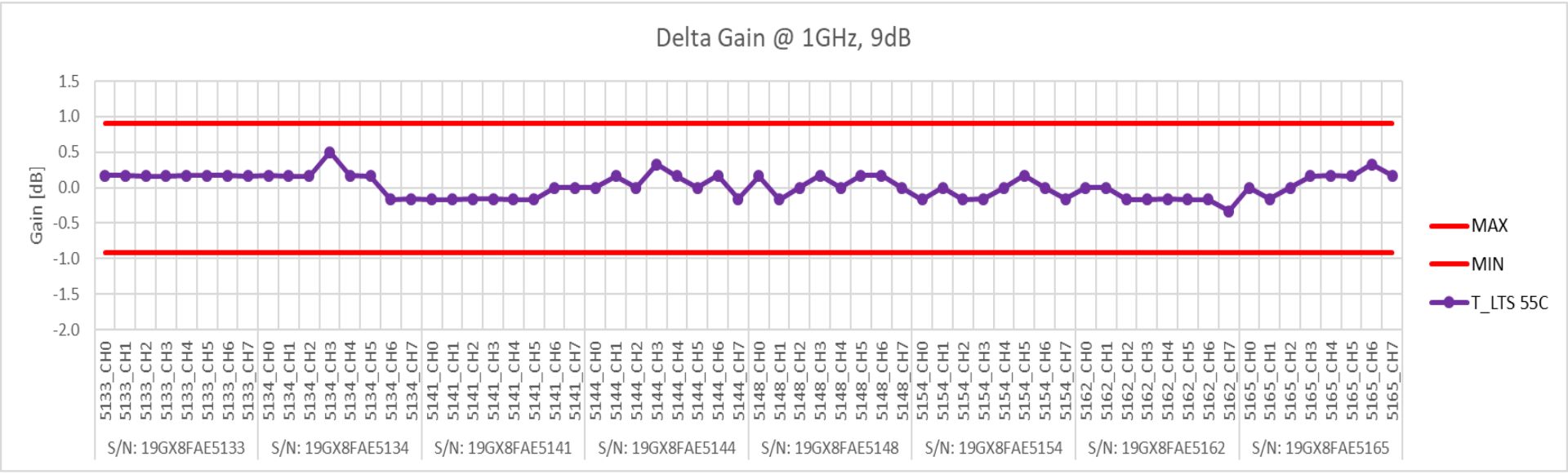

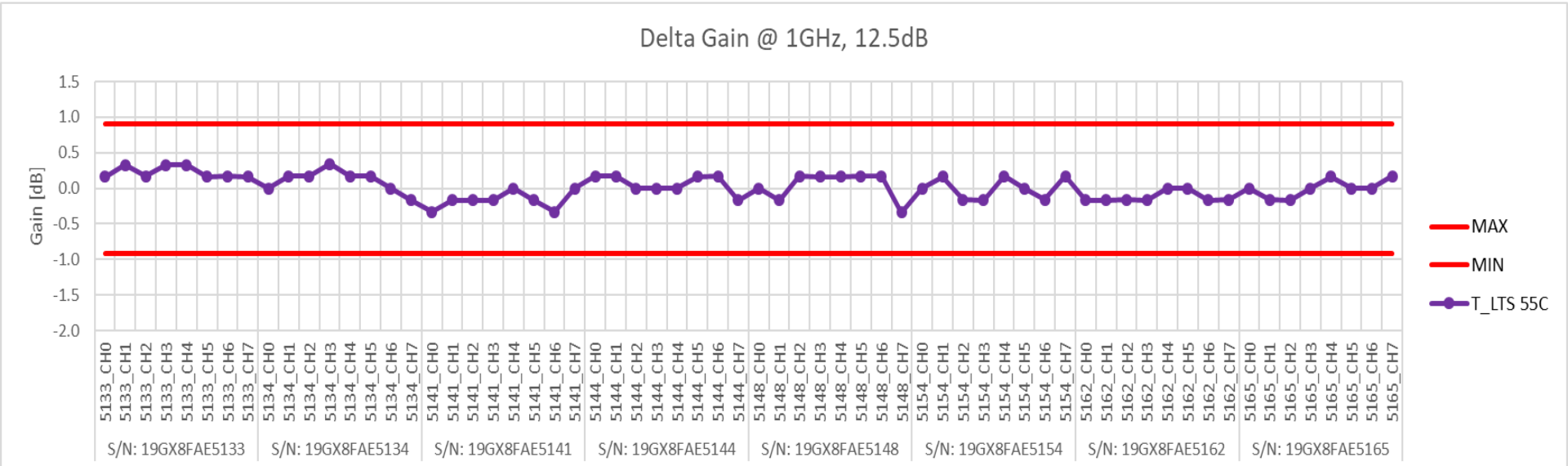

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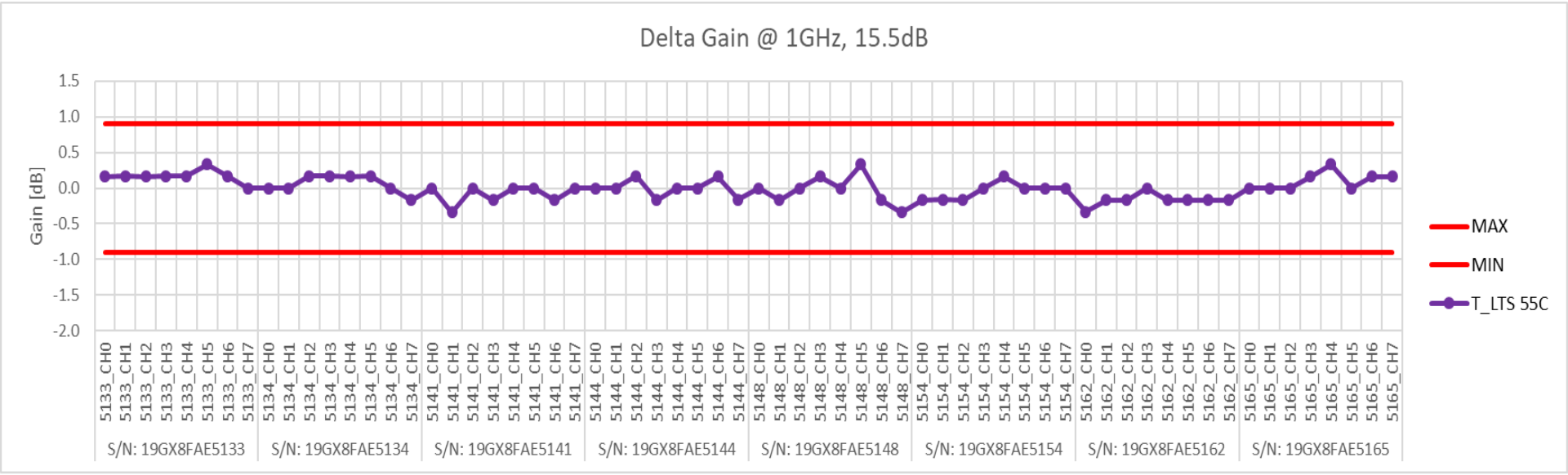

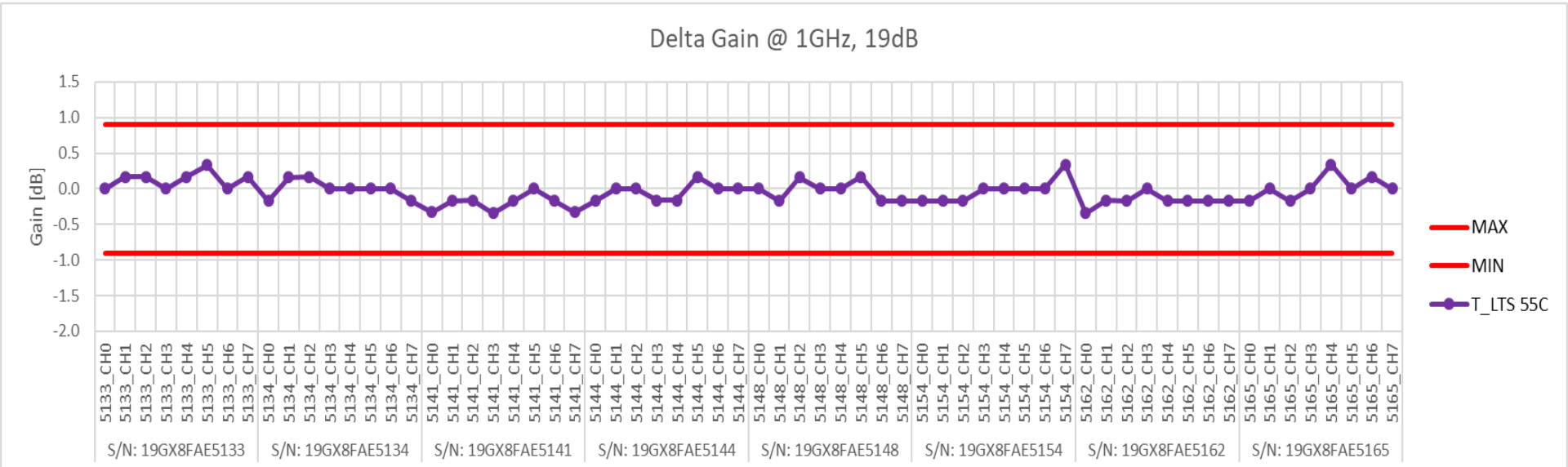

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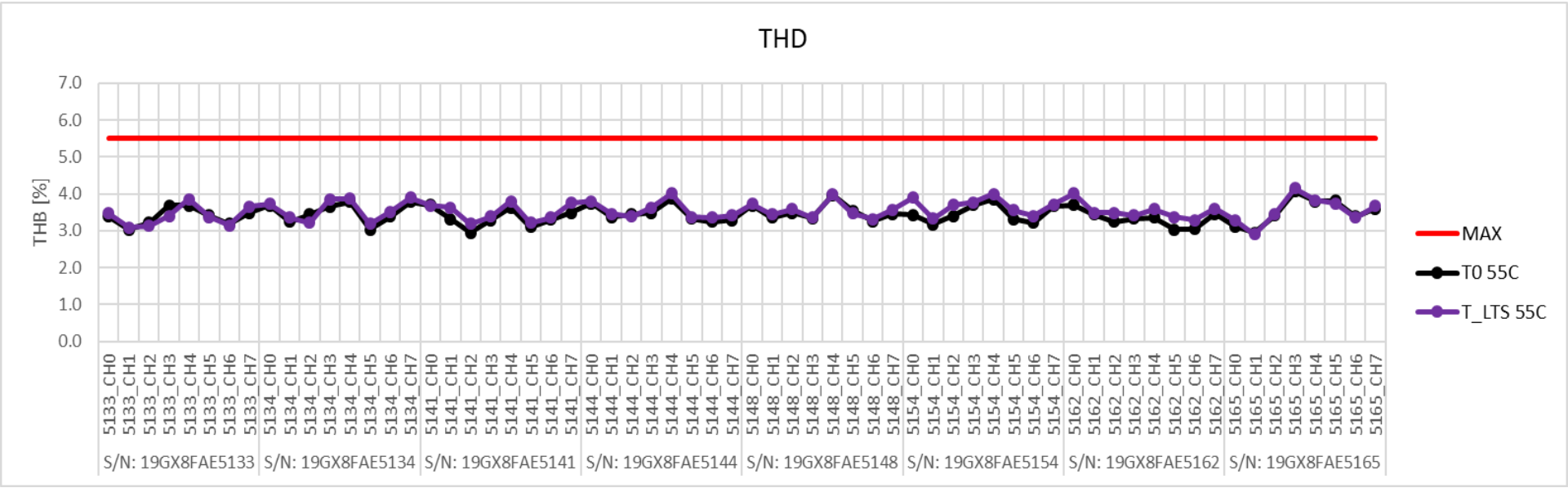
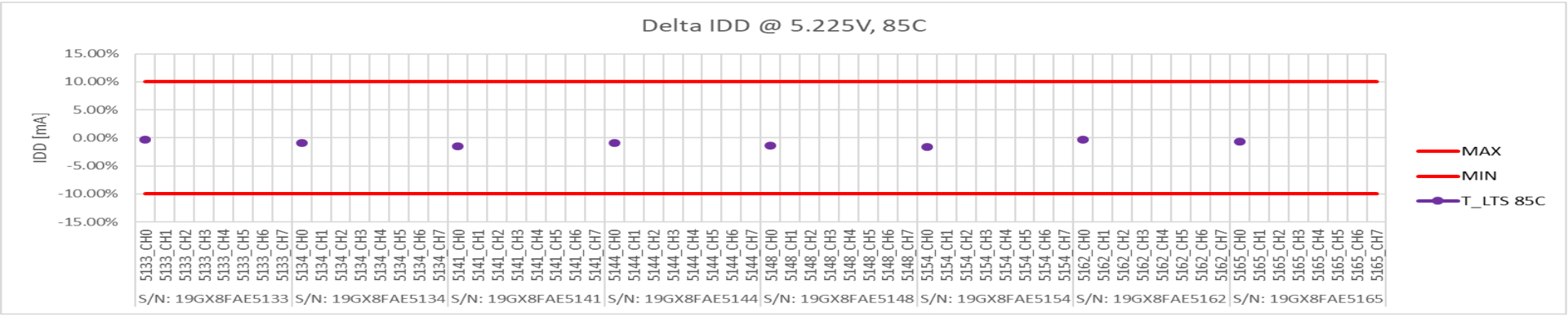
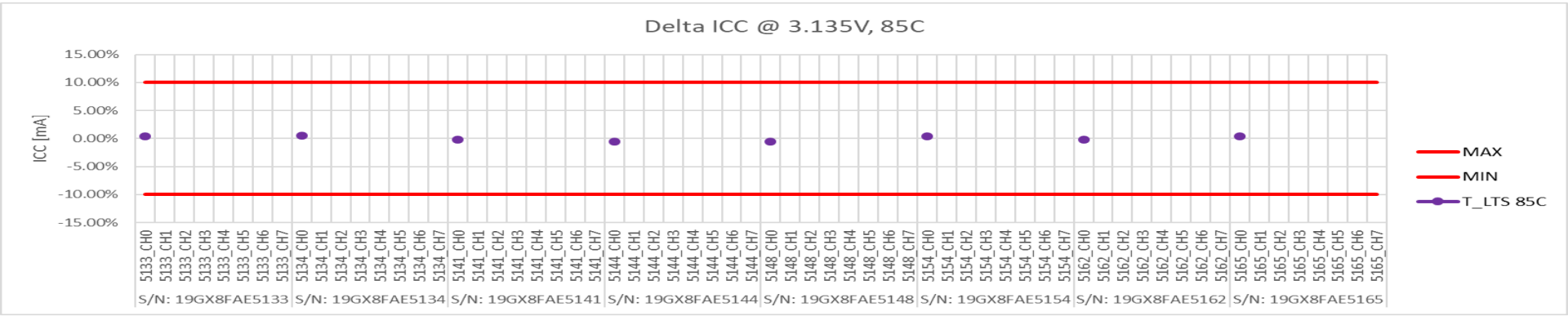
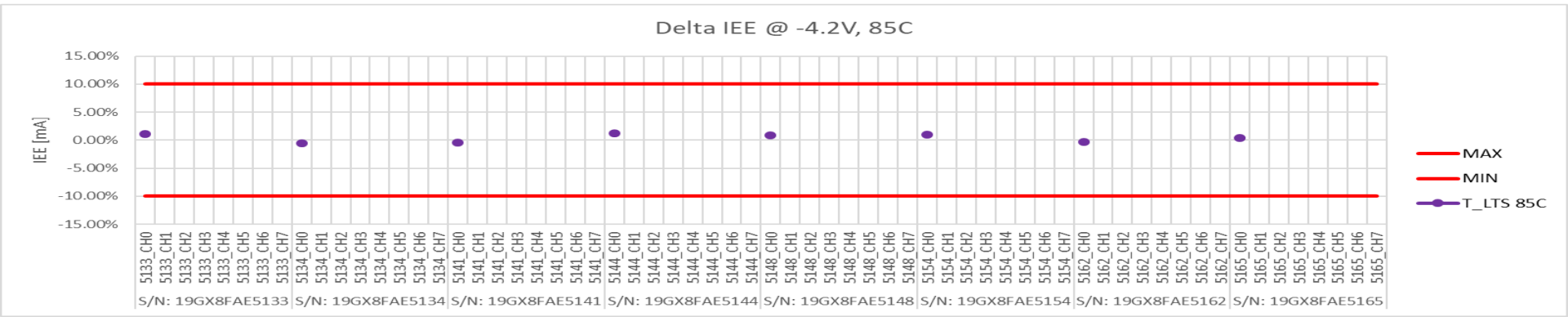


GX74870 Group 2A LTS @85C







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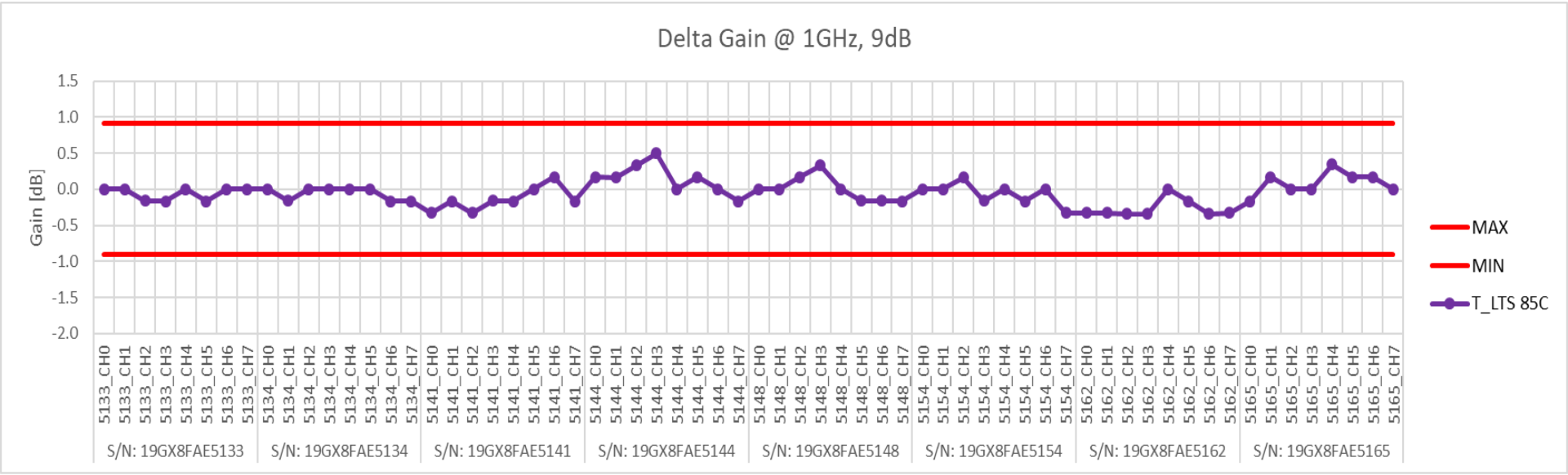
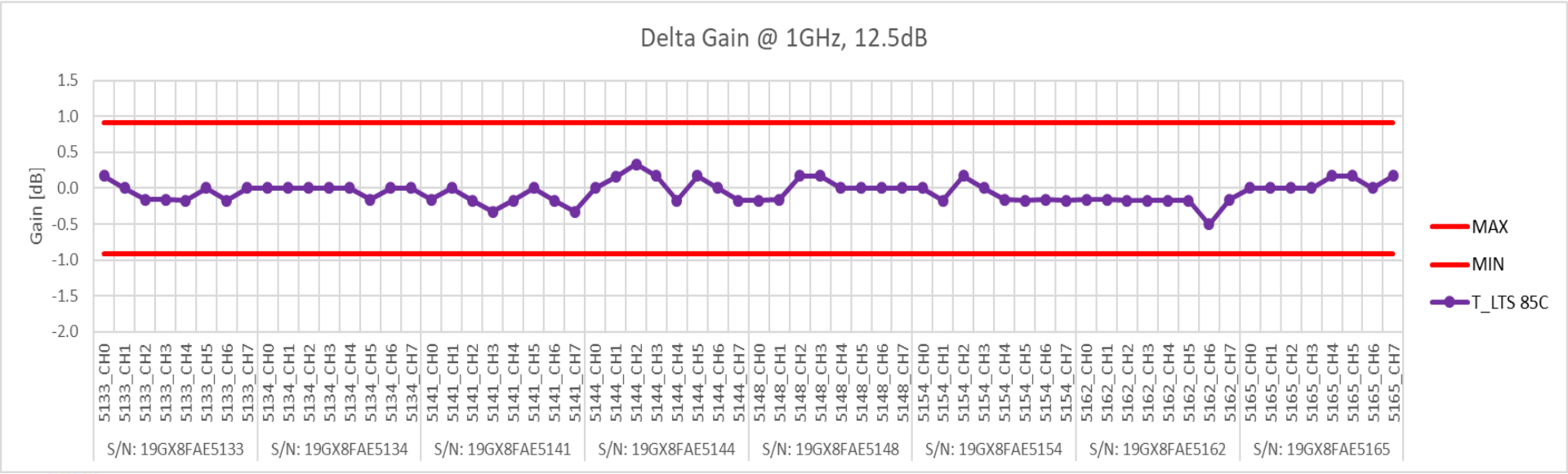
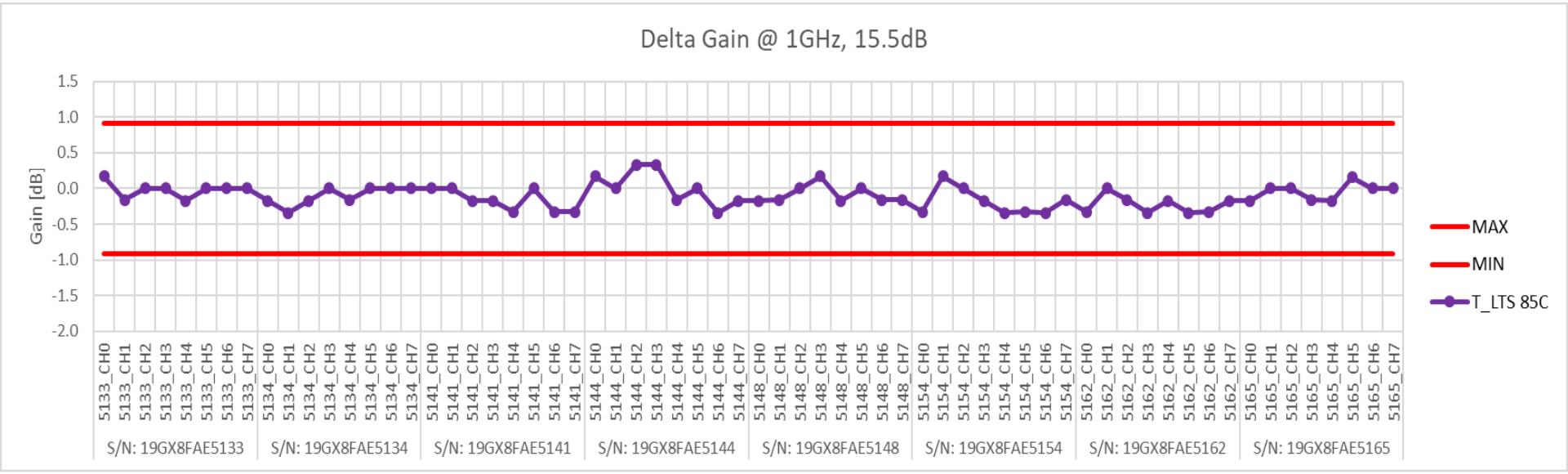
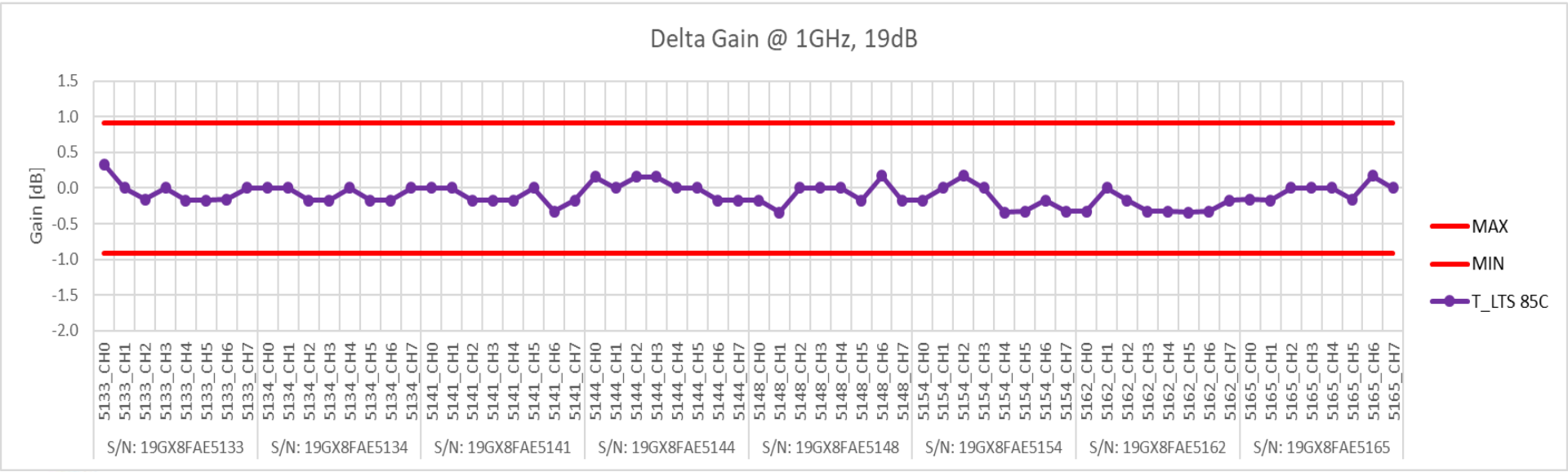




GX74870 Group 2A LTS @85C





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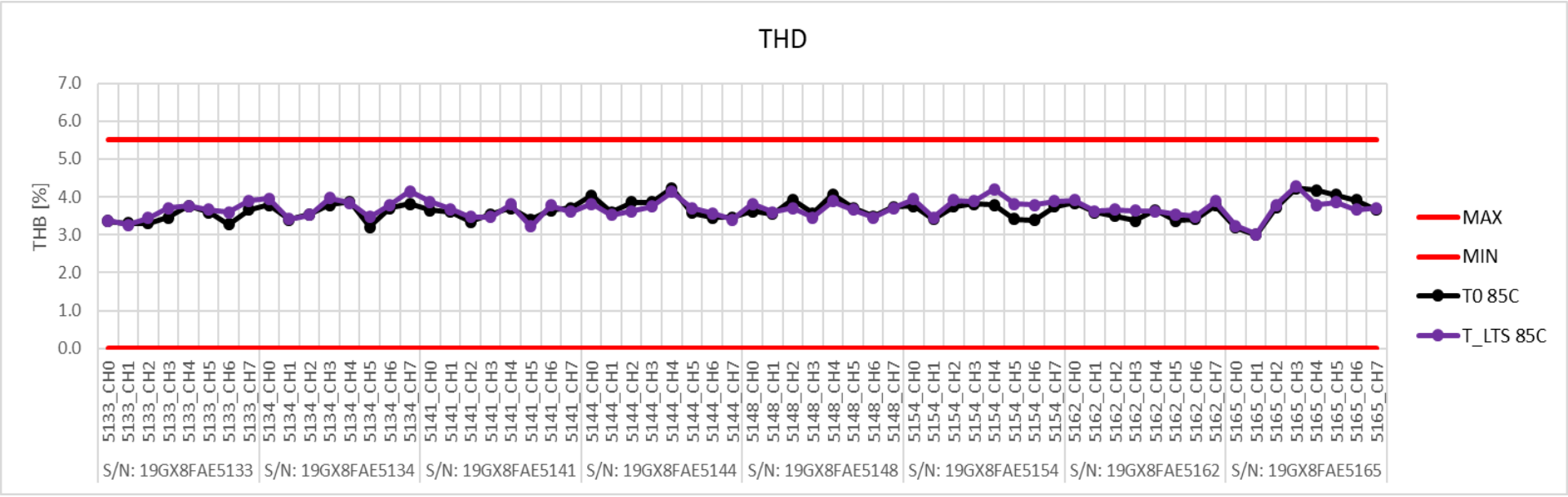
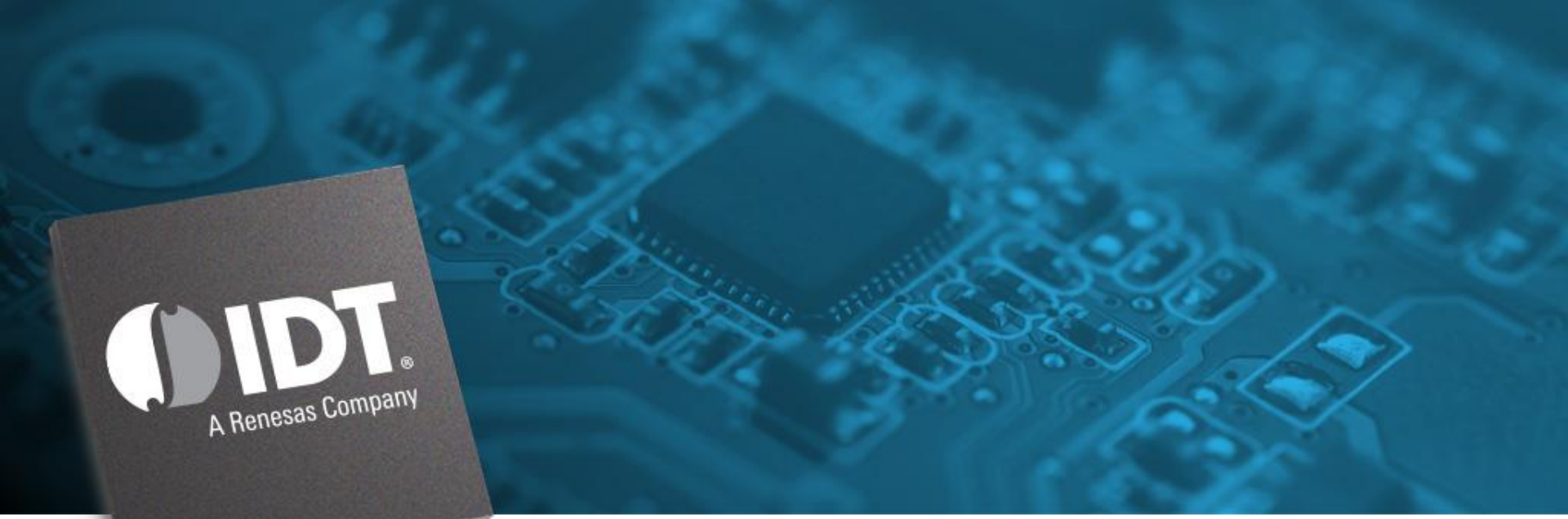
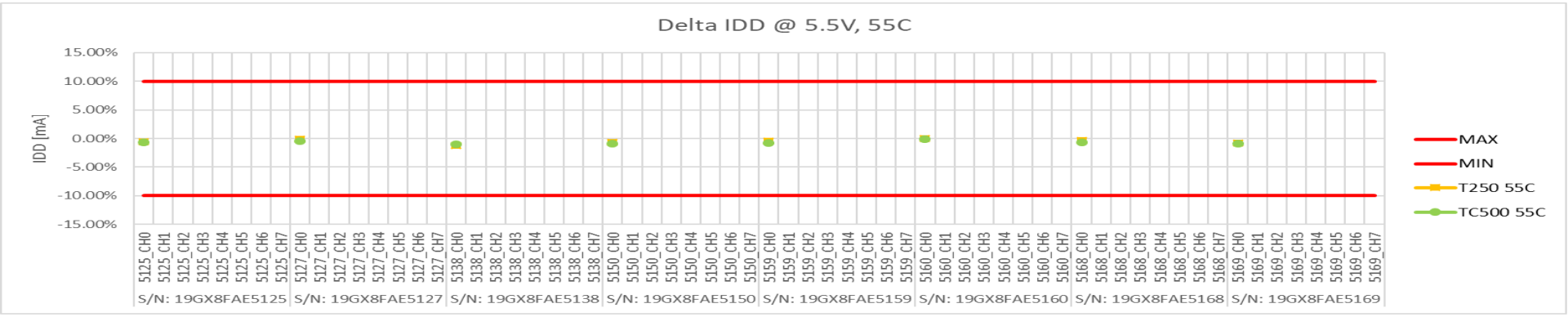
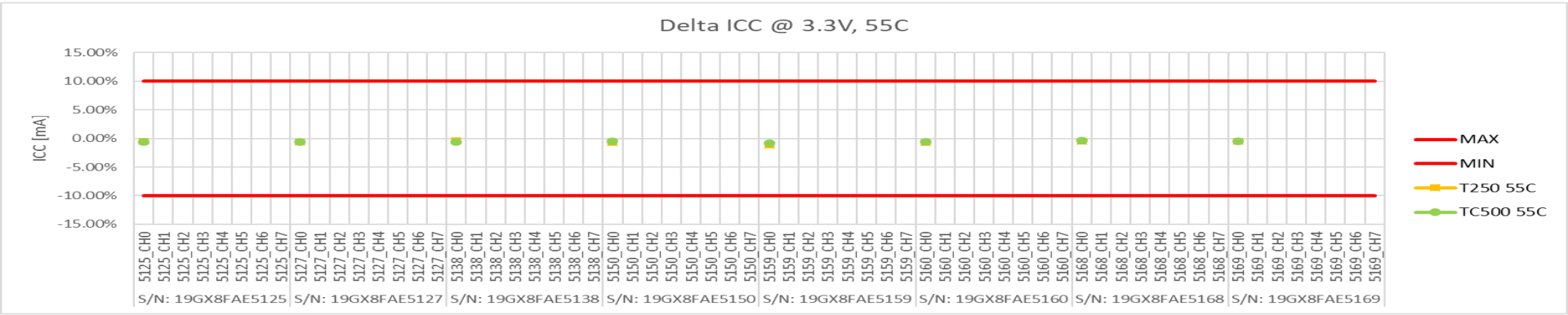


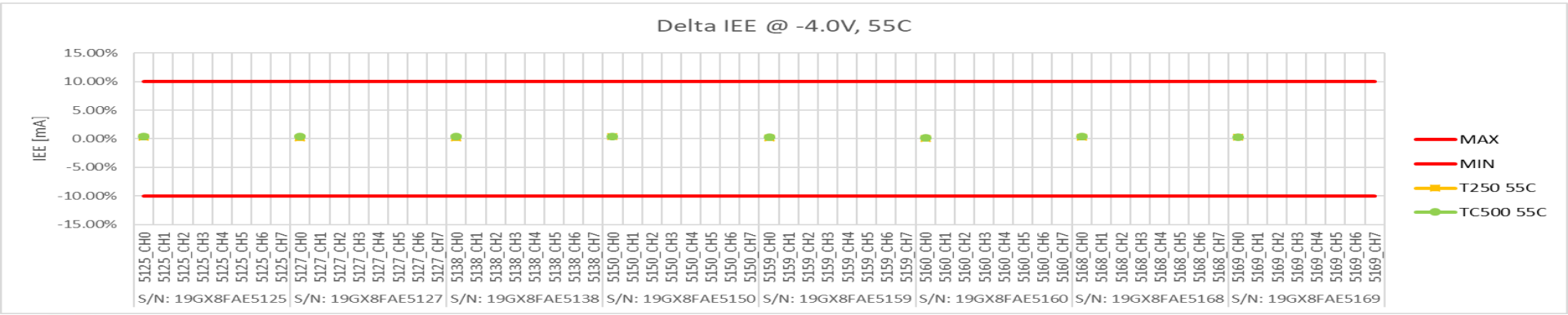


Group 2B Results

GX74870 Group 2B T/C @55C







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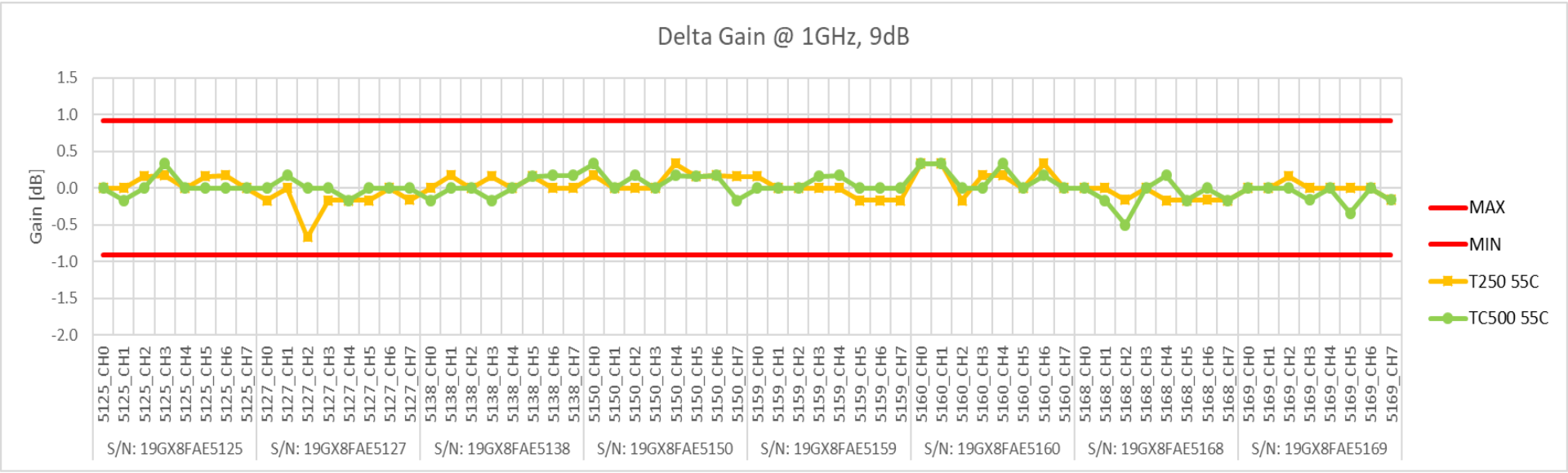

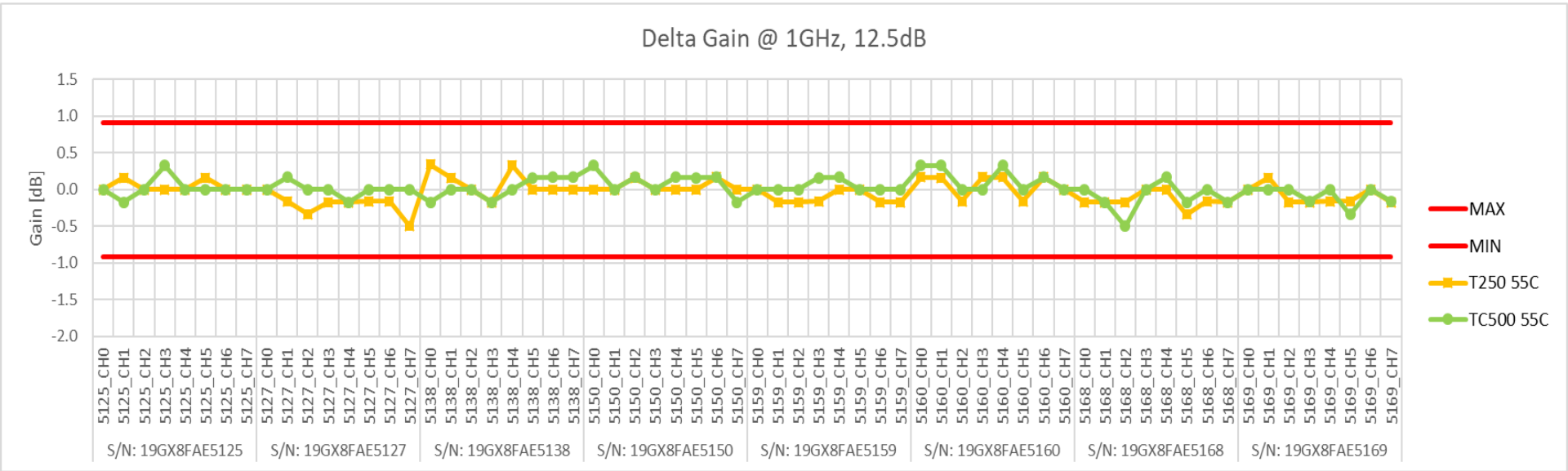

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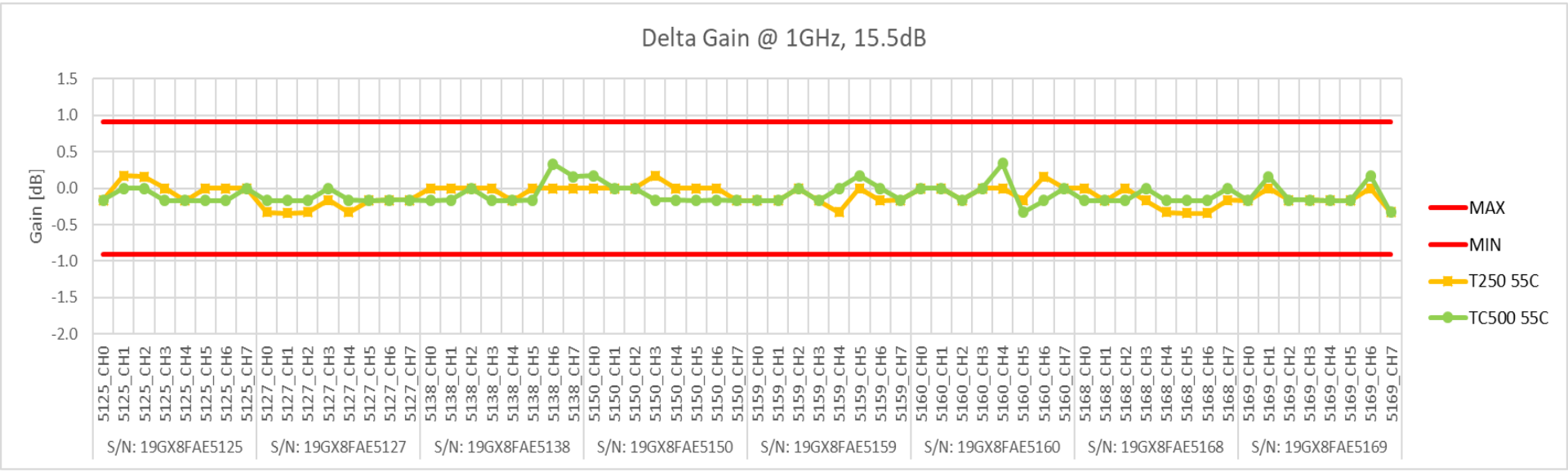

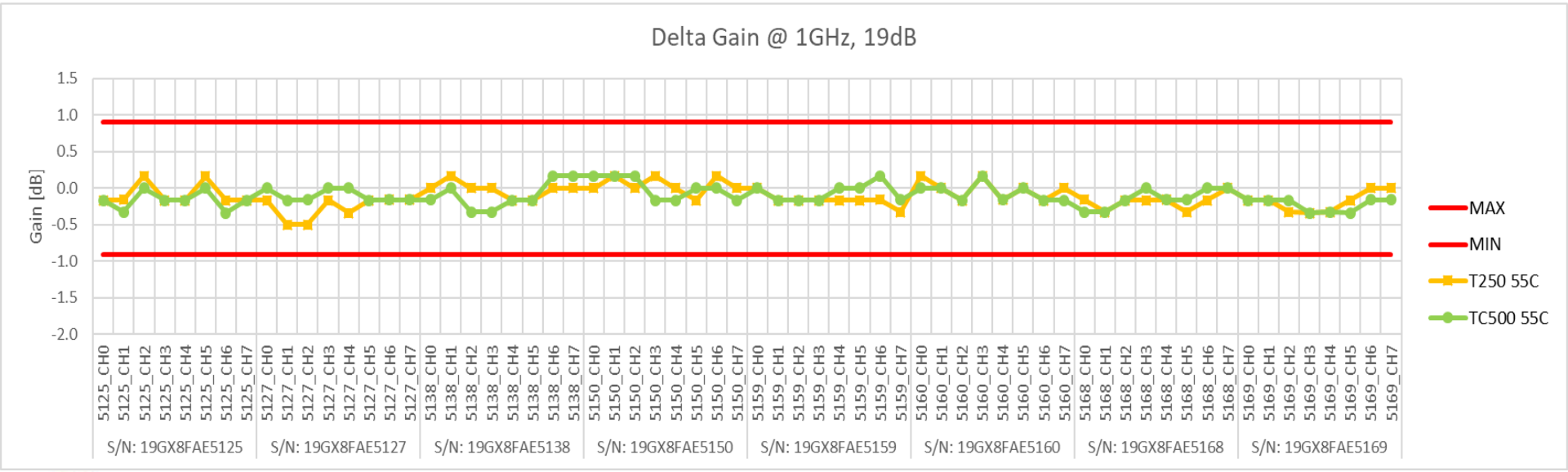

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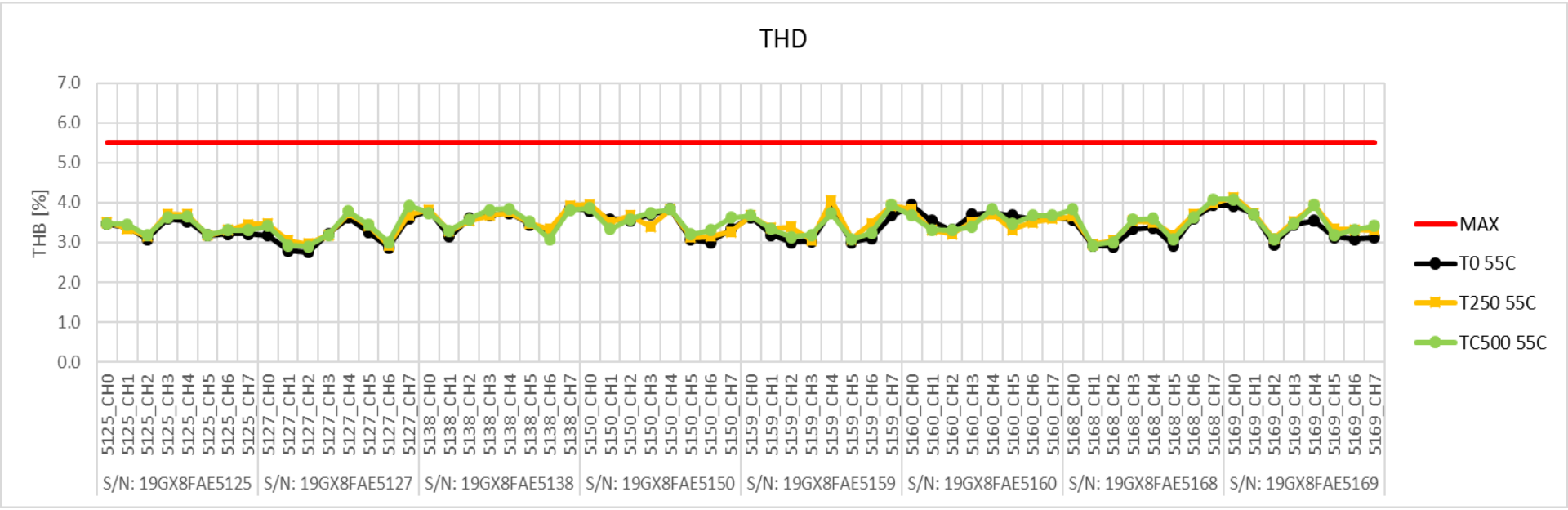
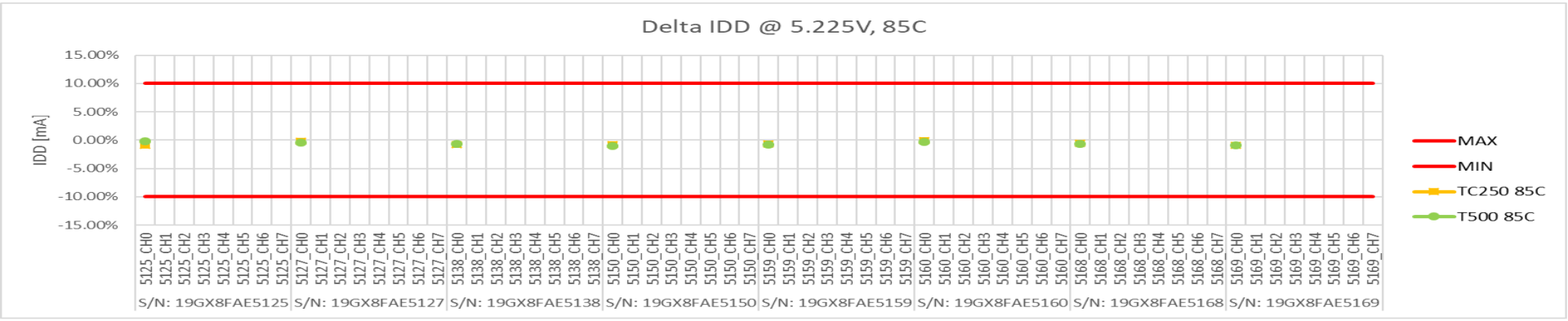
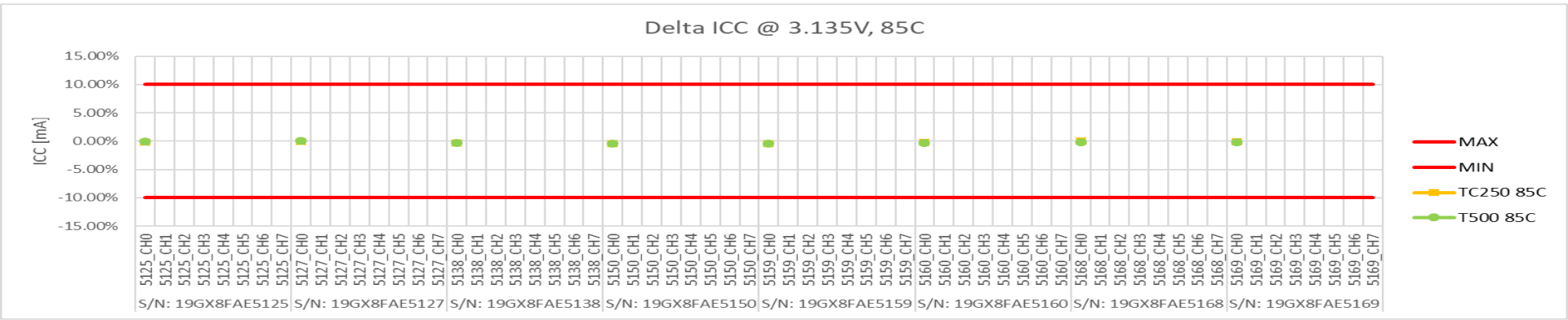
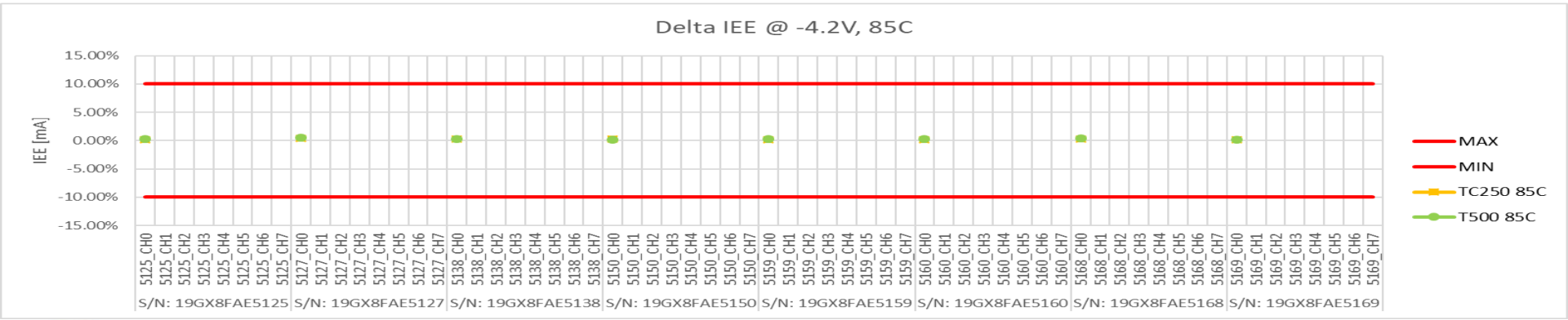


GX74870 Group 2B T/C @85C







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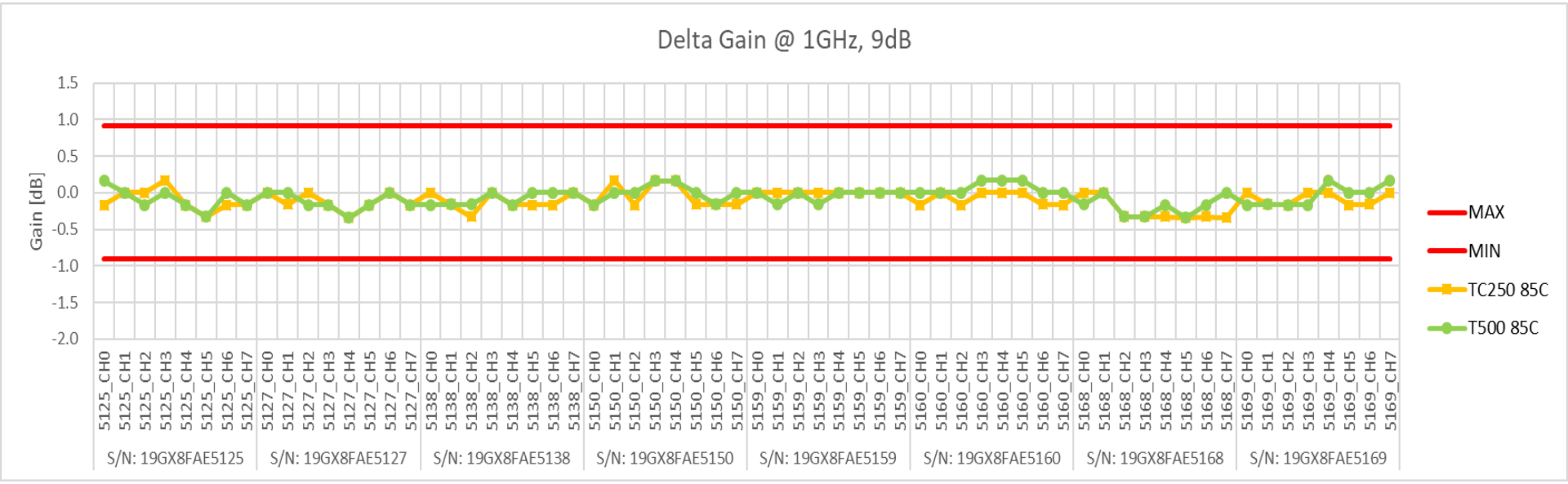

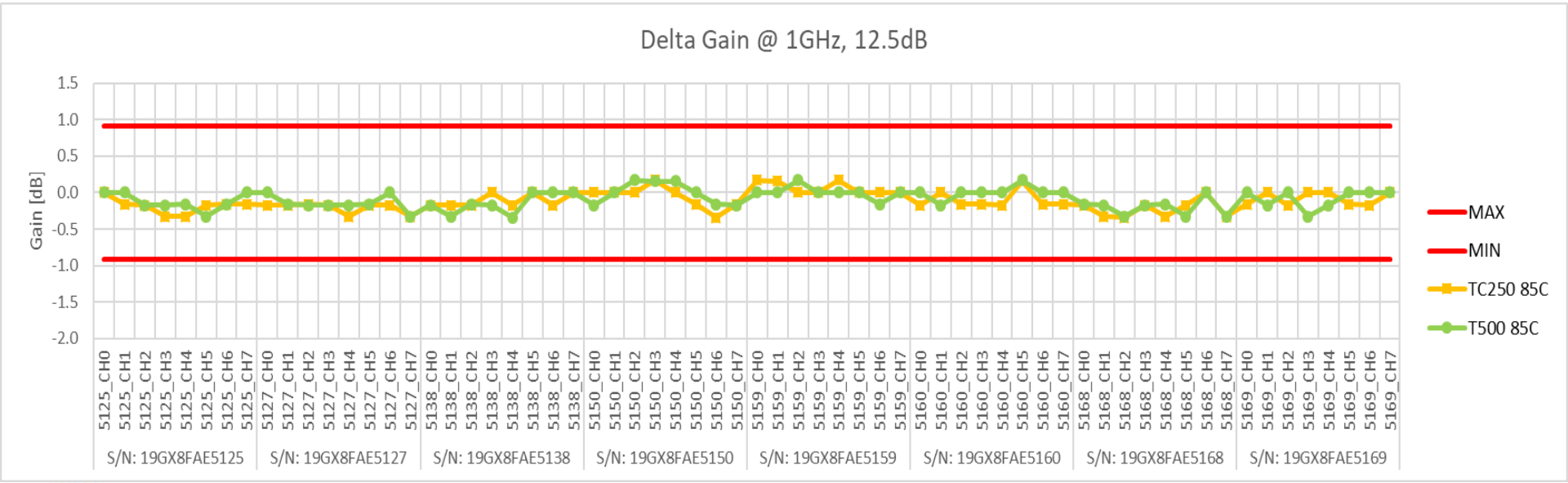

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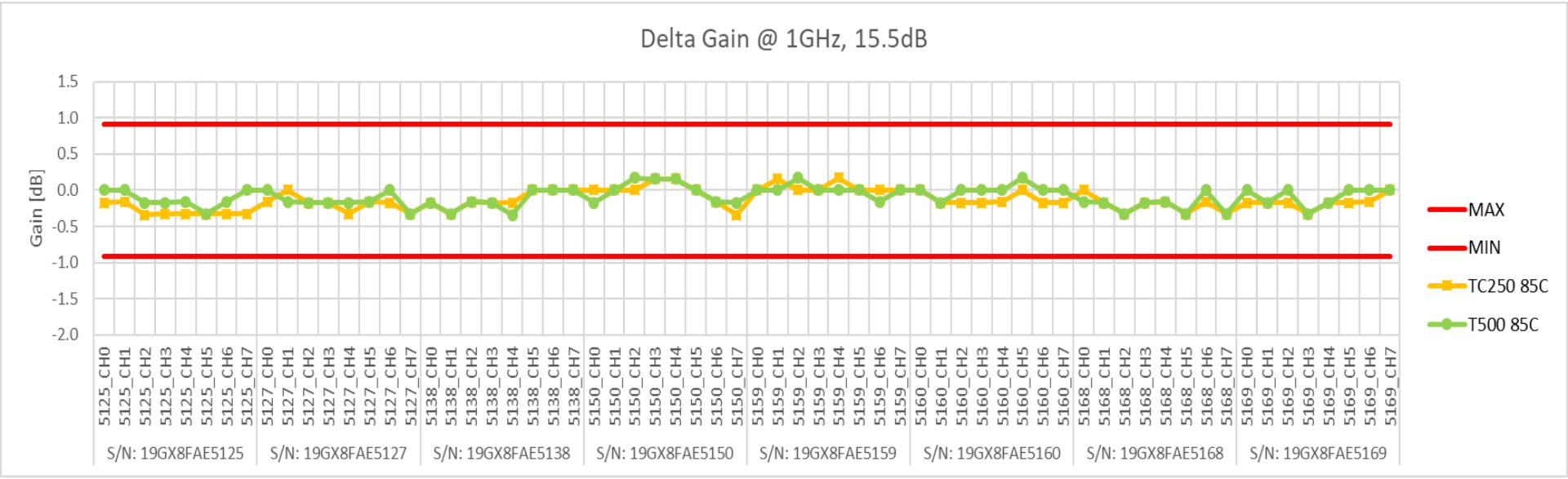
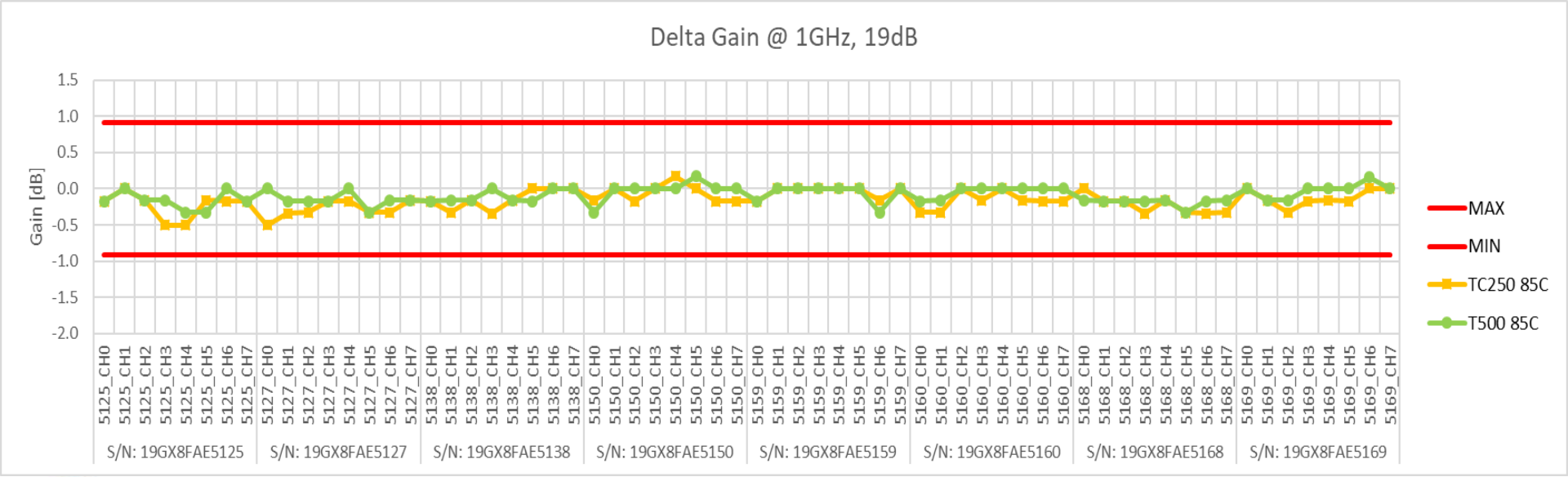
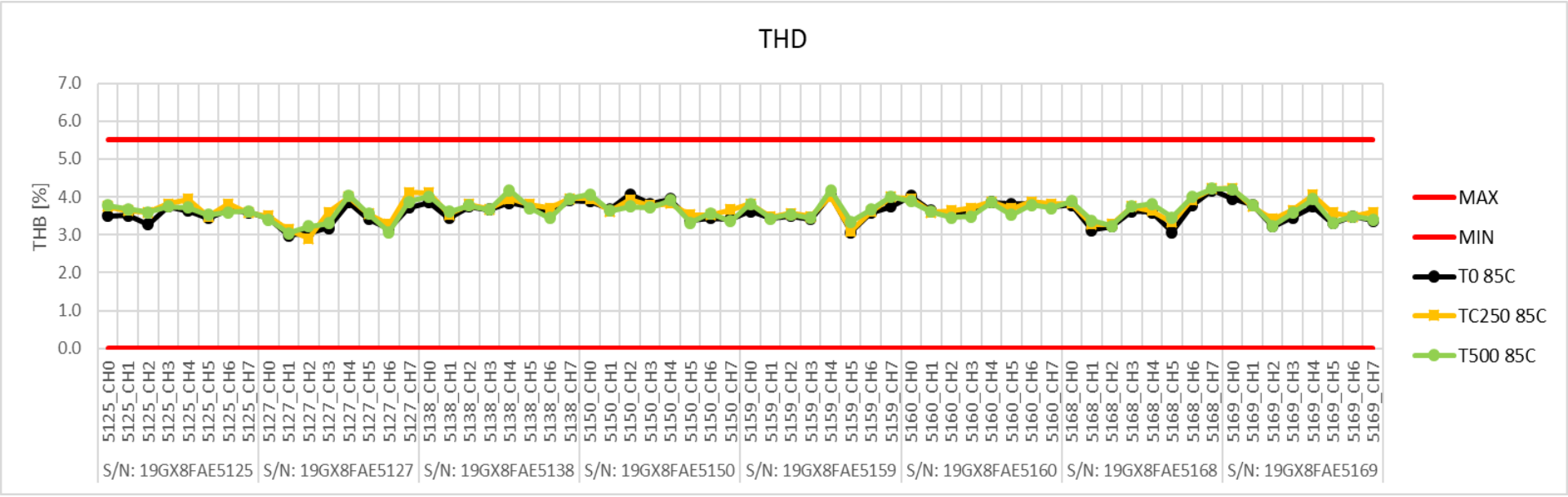
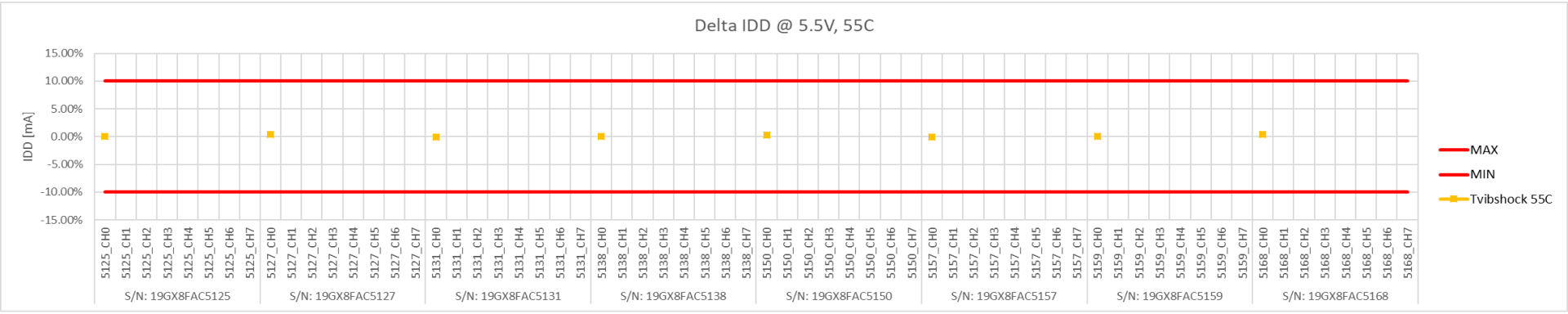


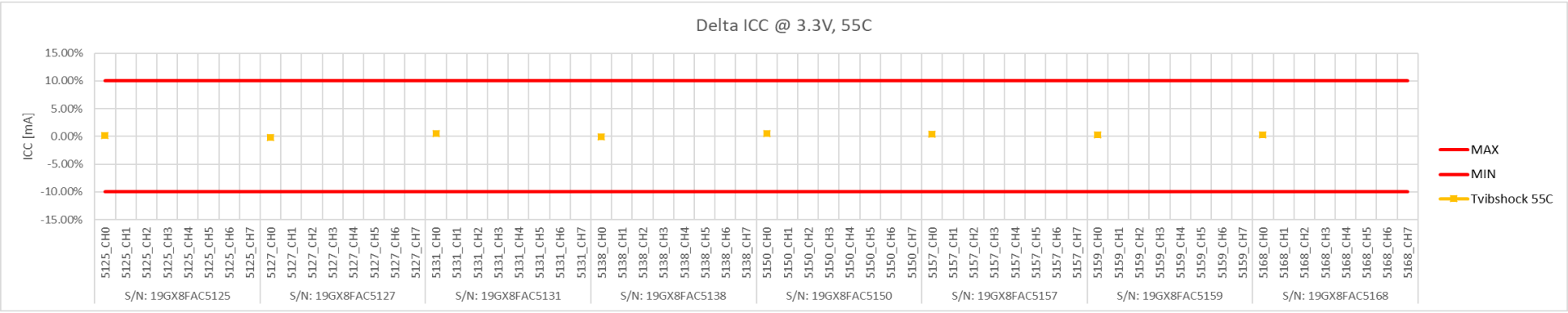


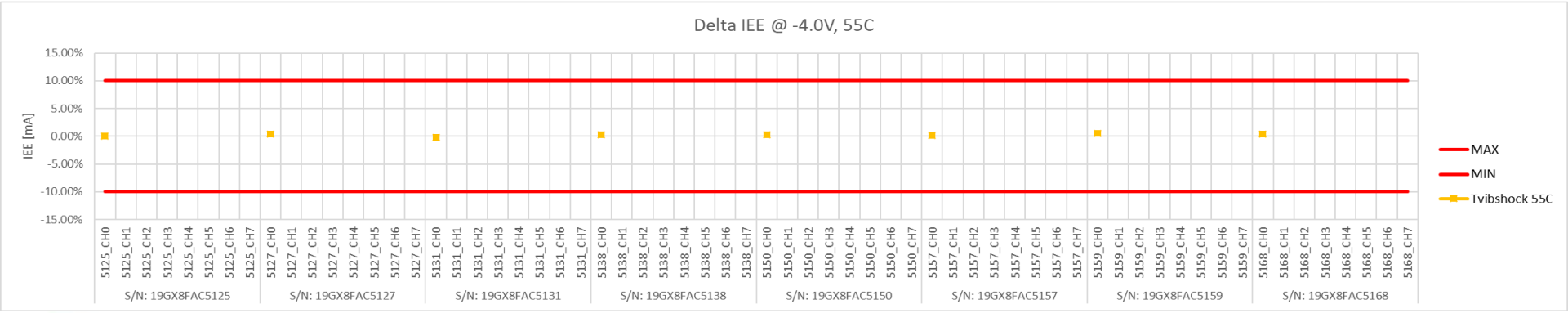
GX74870 Group 2B T/C @85C



GX74870 Group 2B Vib/Shock @55C







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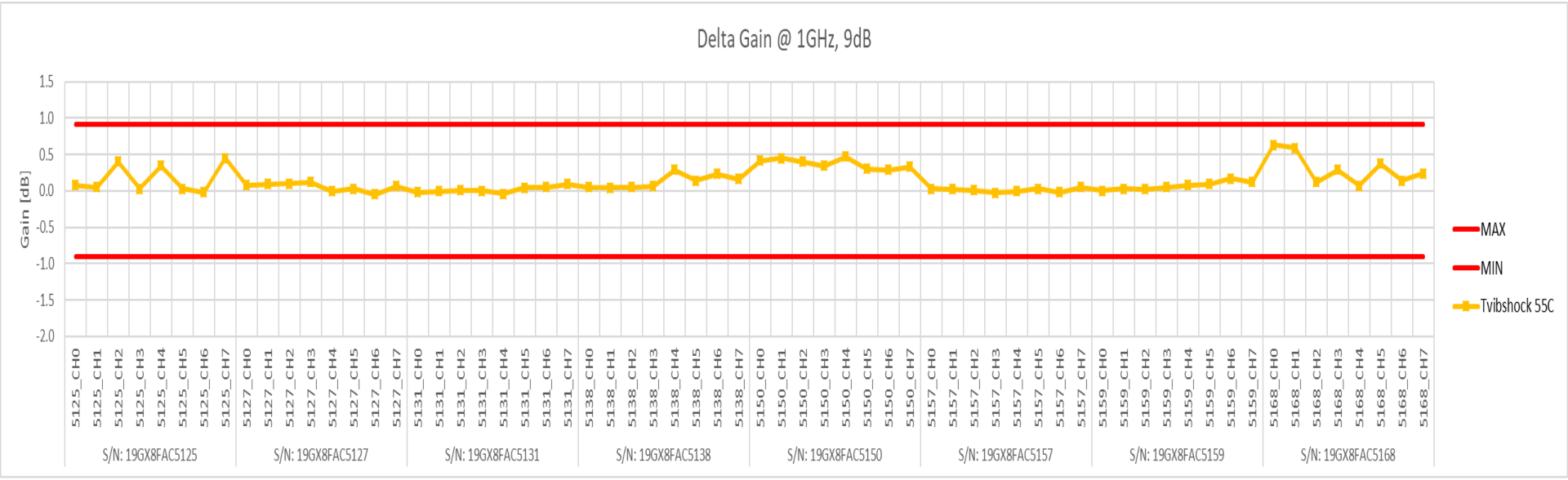

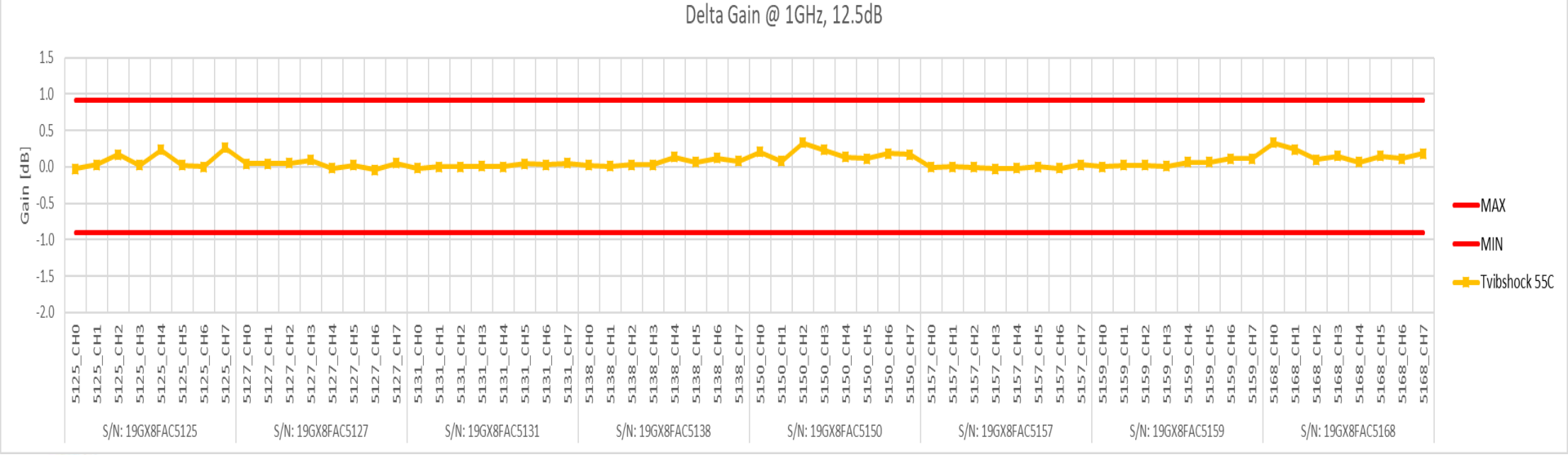

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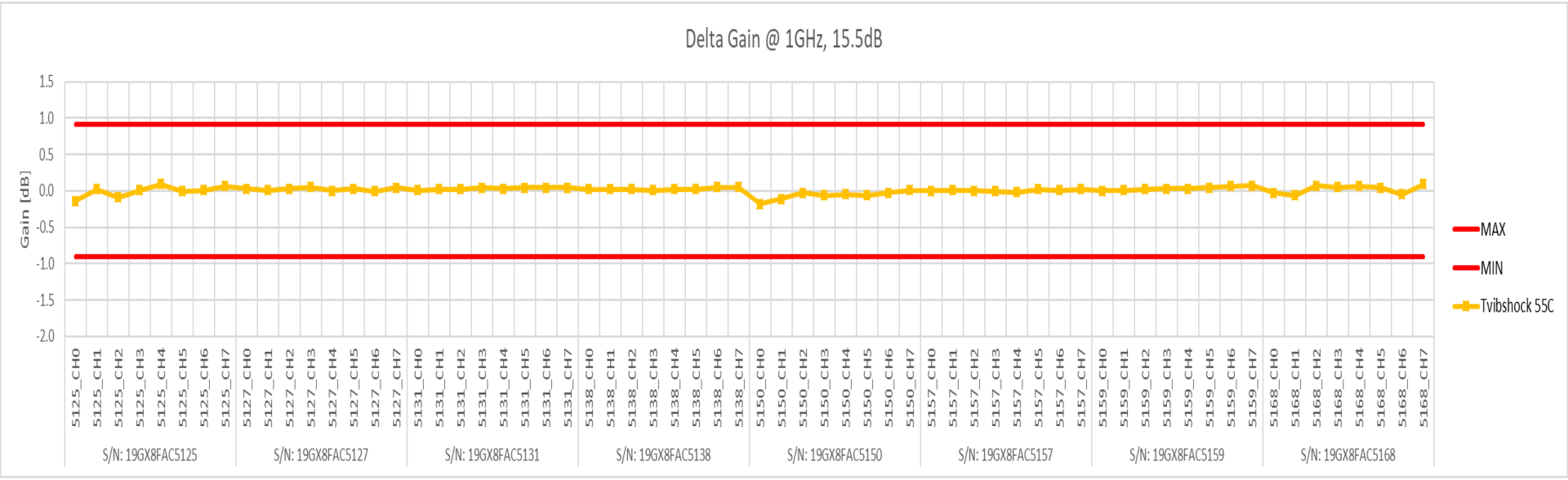
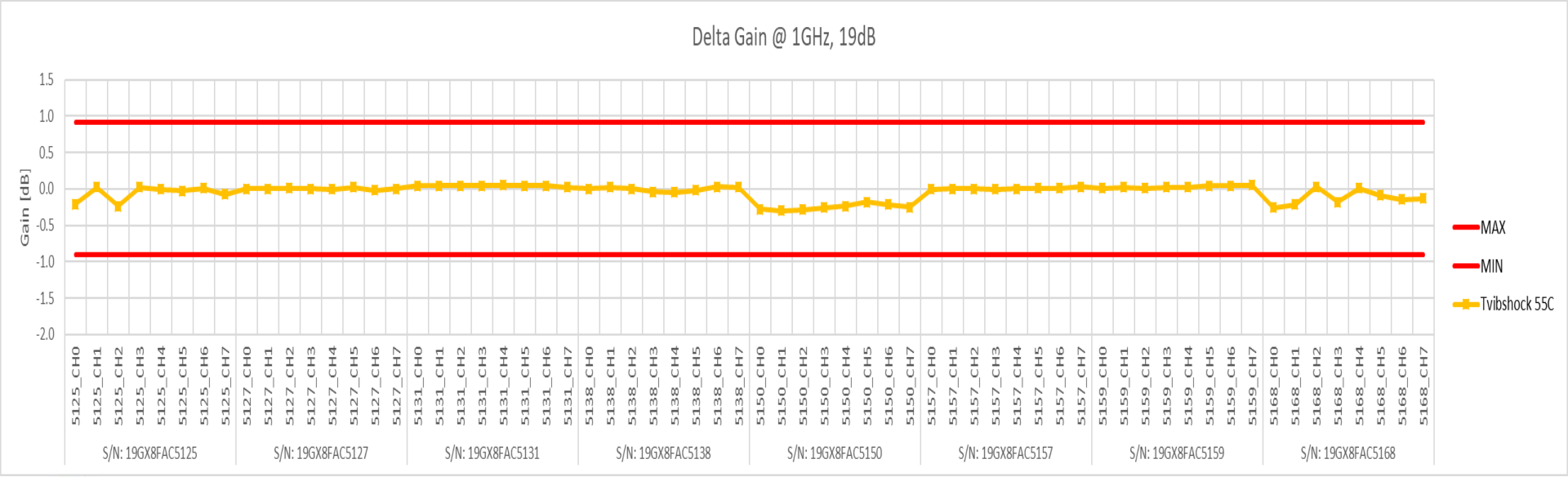
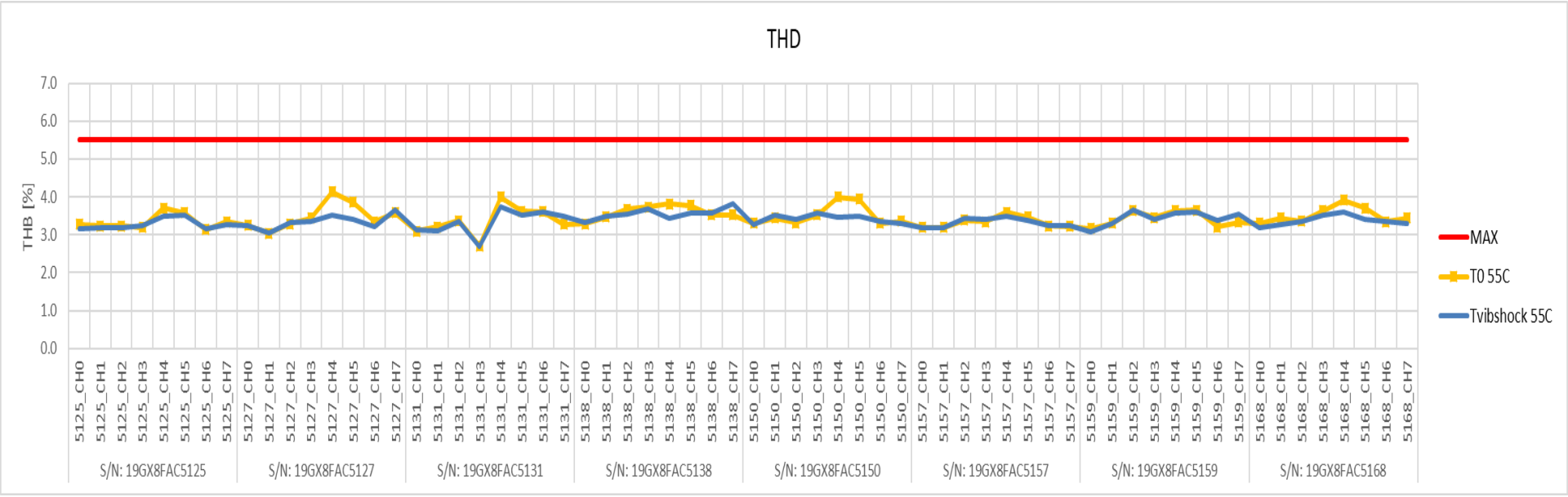
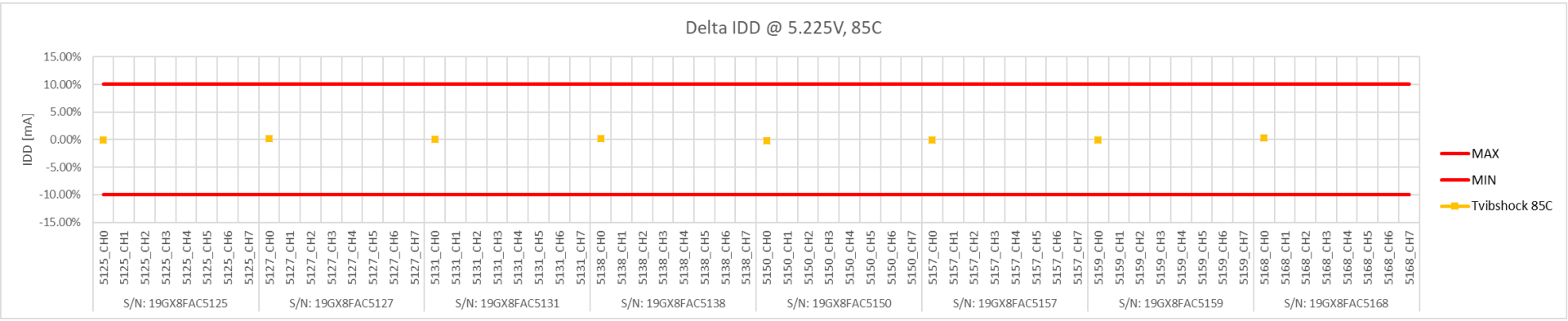


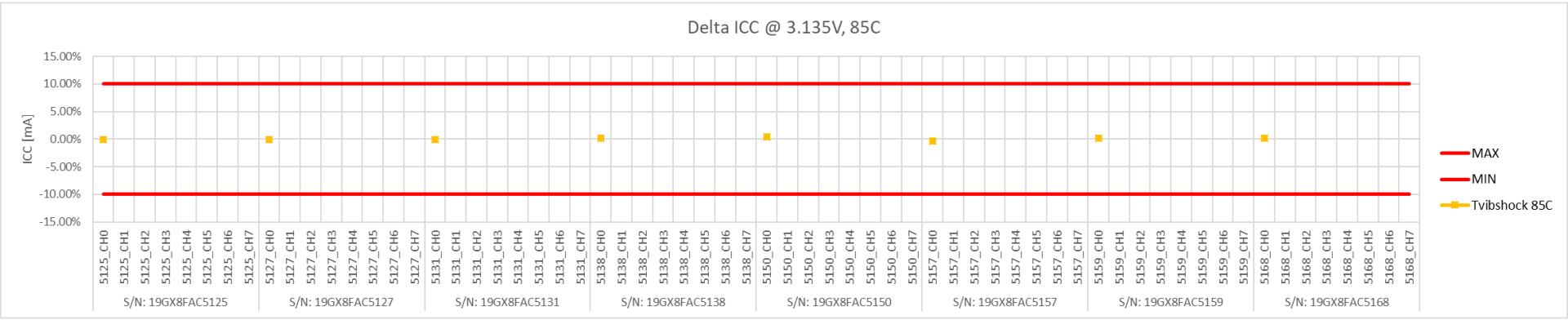


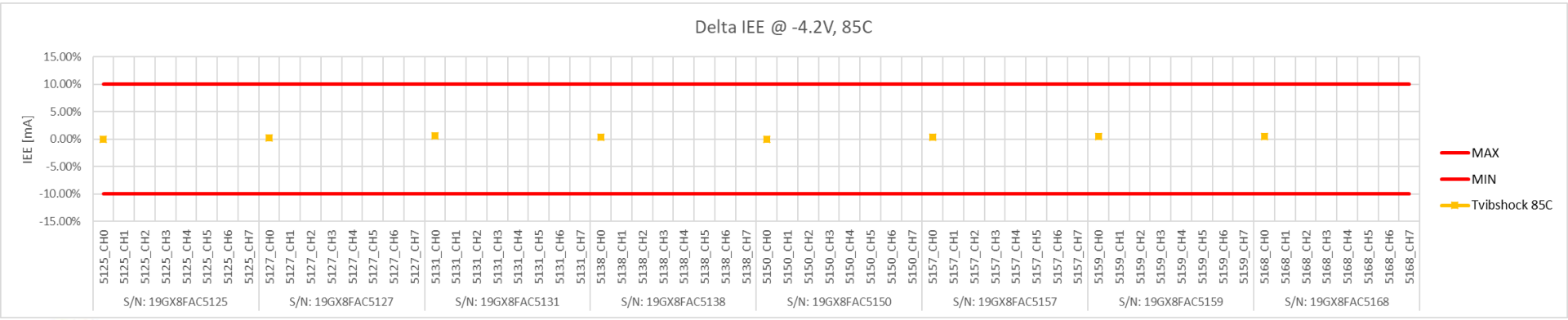
GX74870 Group 2B Vib/Shock @55C



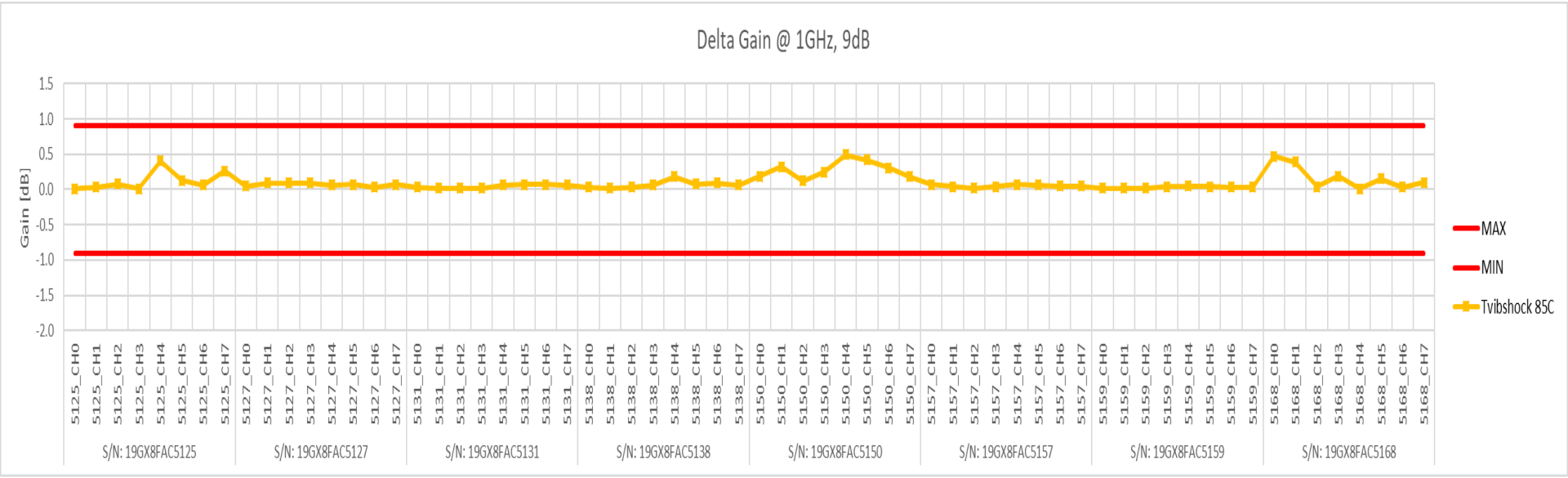
GX74870 Group 2B Vib/Shock @85C

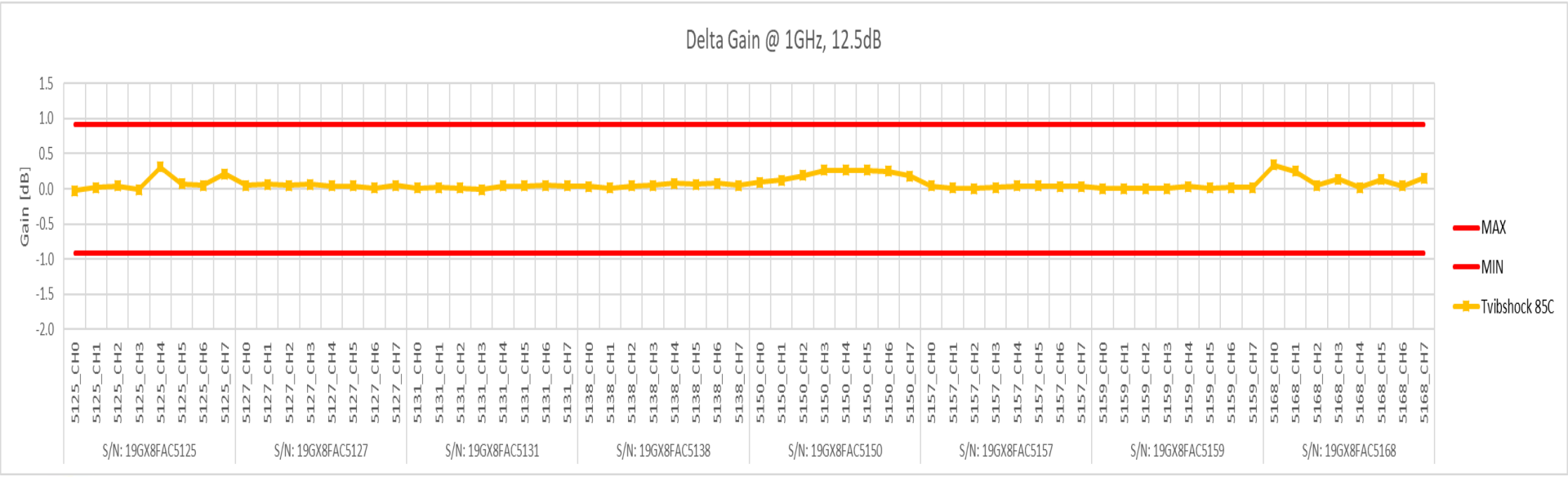




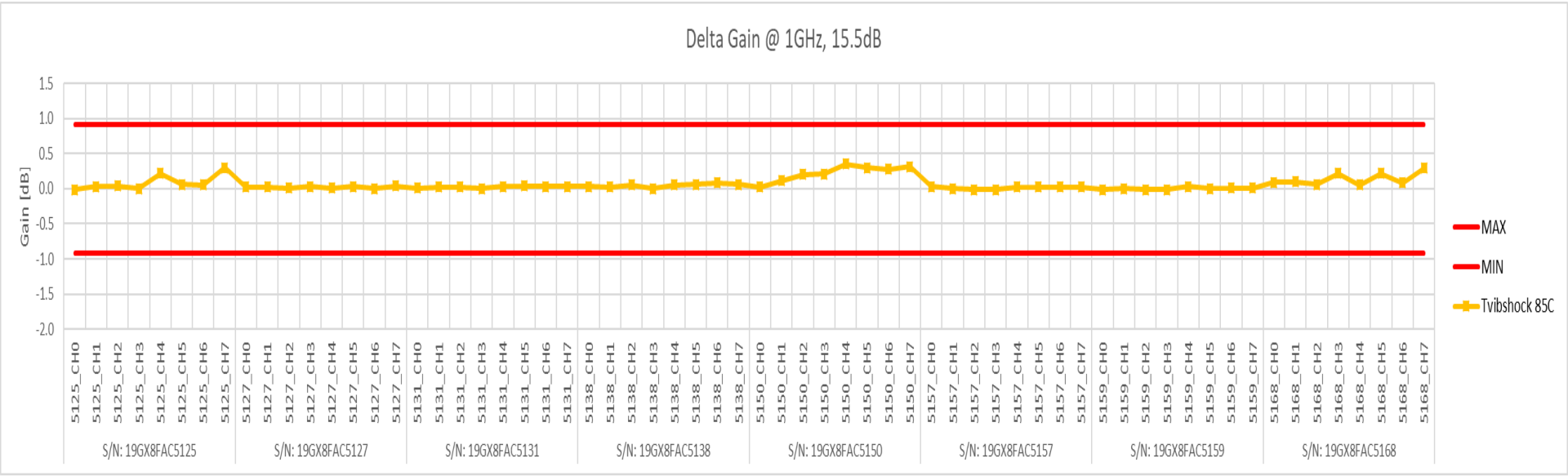


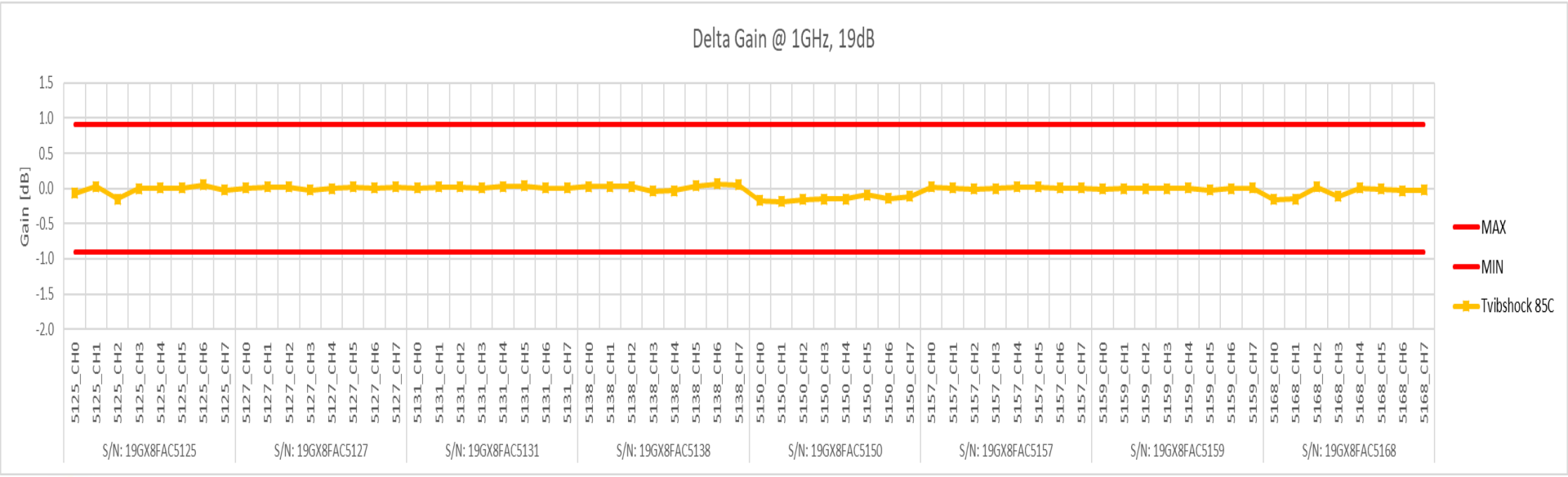
GX74870 Group 2B Vib/Shock @85C



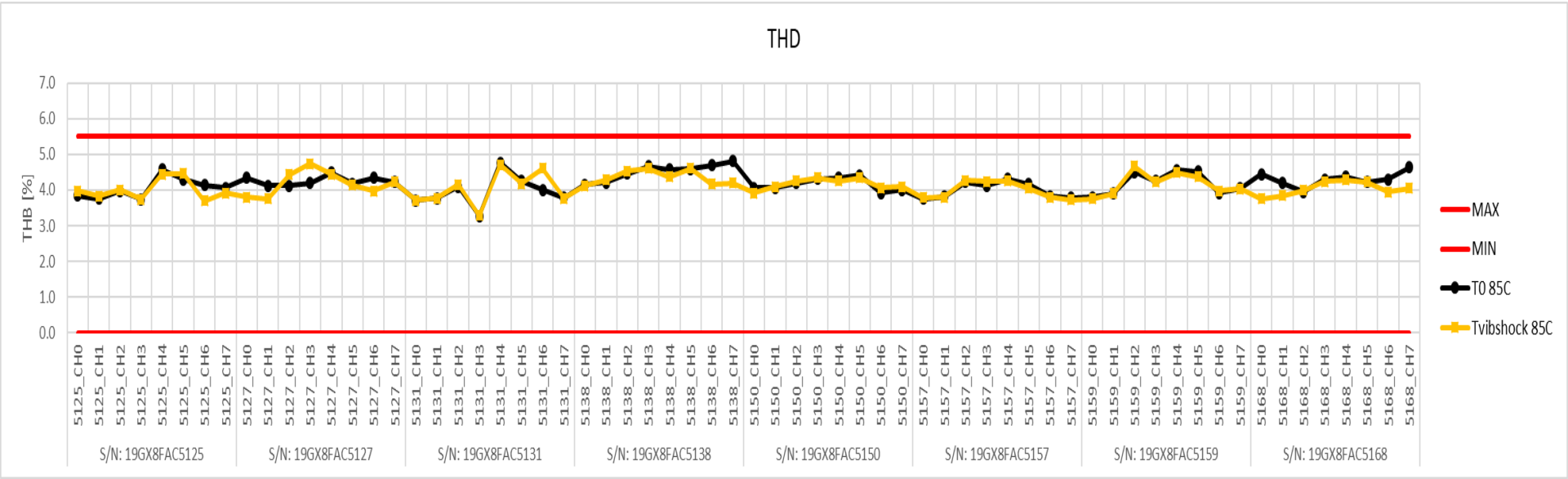


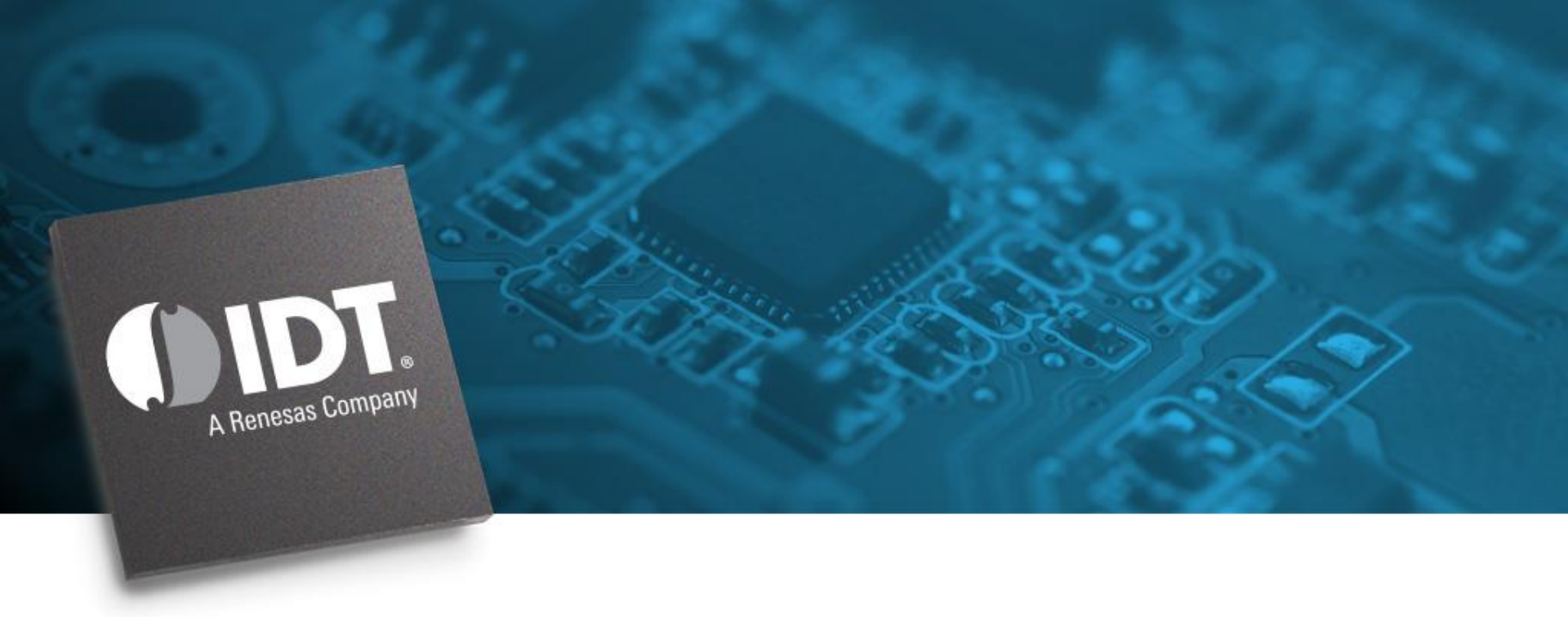
GX74870 Group 2B Vib/Shock @85C





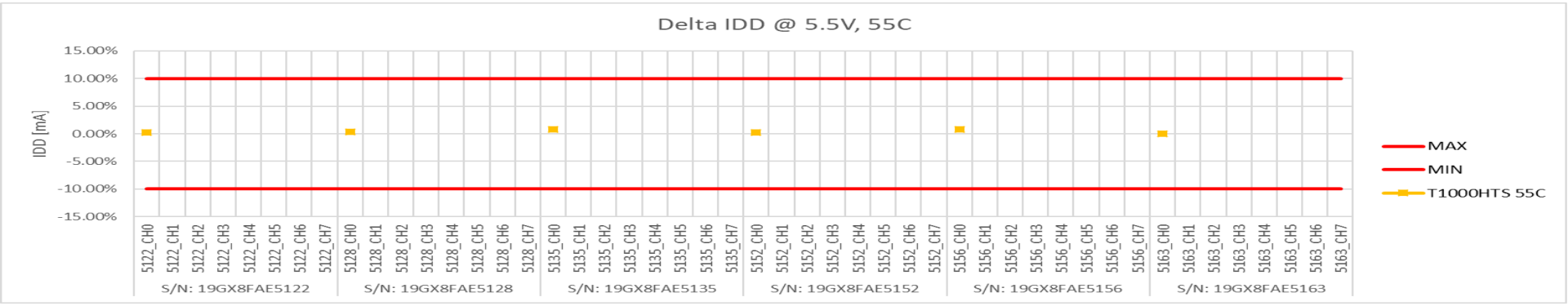
GX74870 Group 2B Vib/Shock @85C

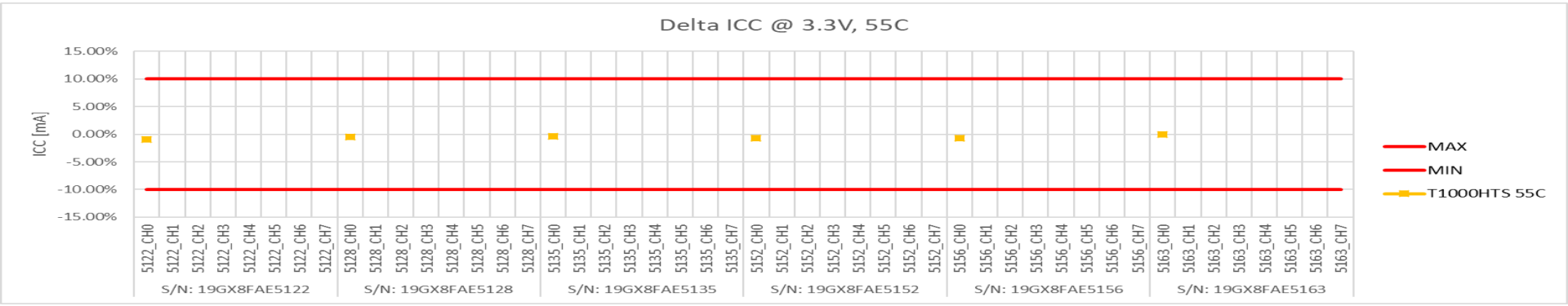


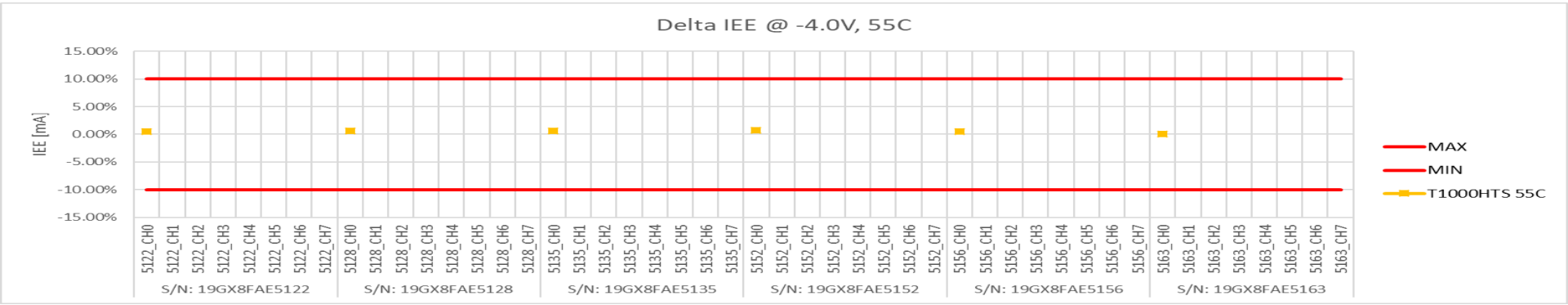


Group 2C Results

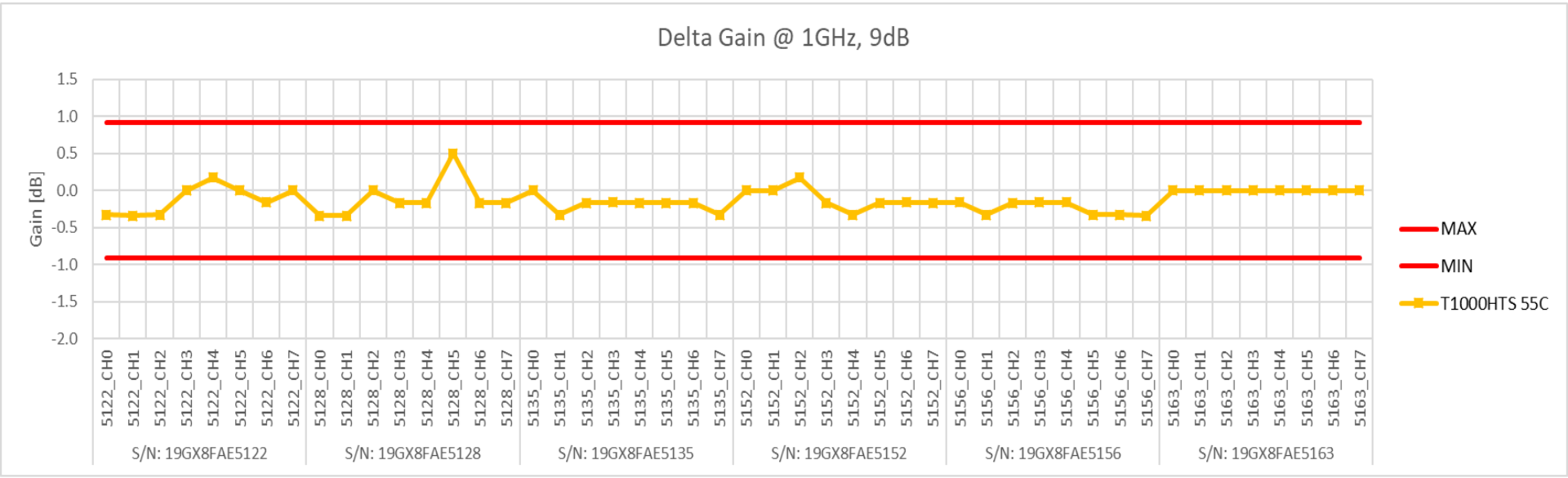
GX74870 Group 2C @55C

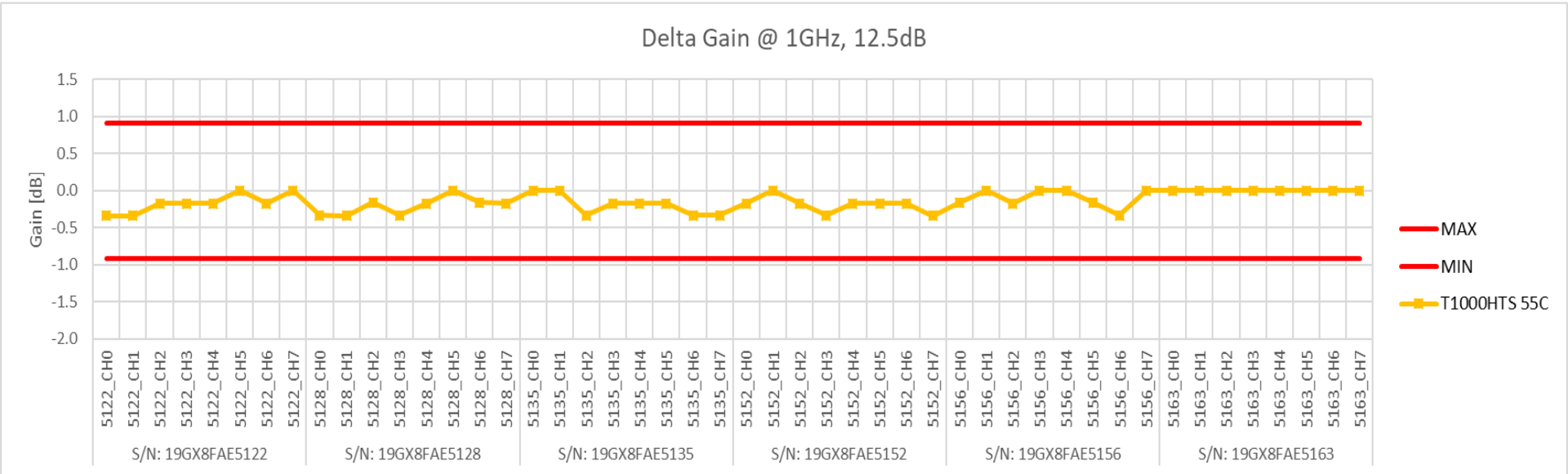




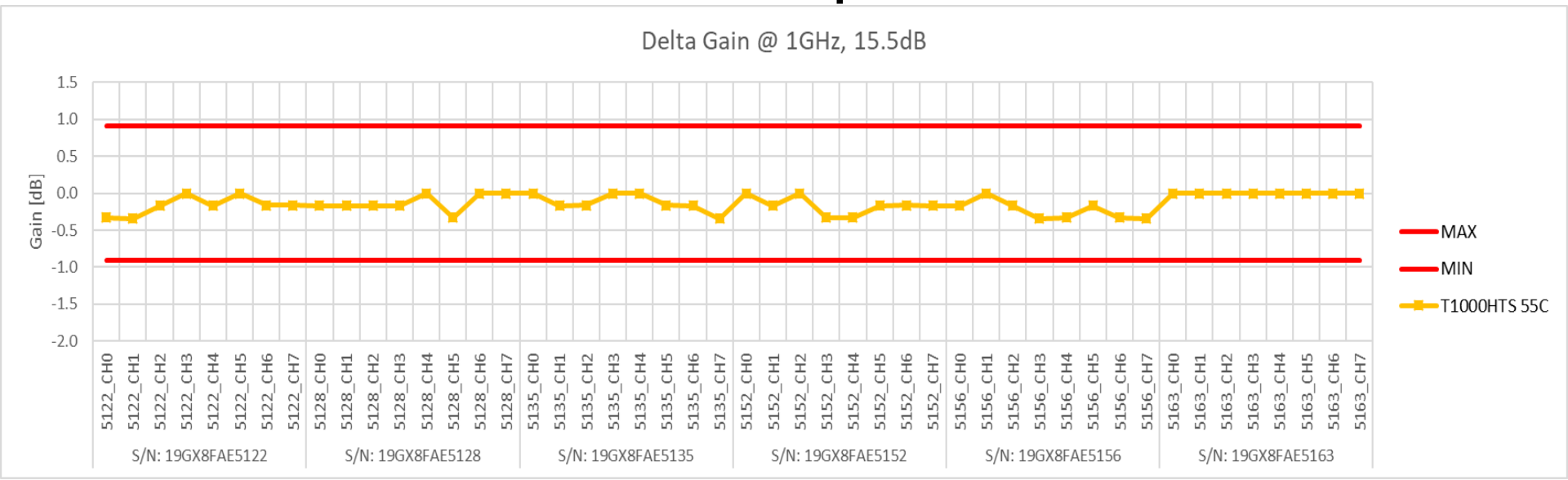


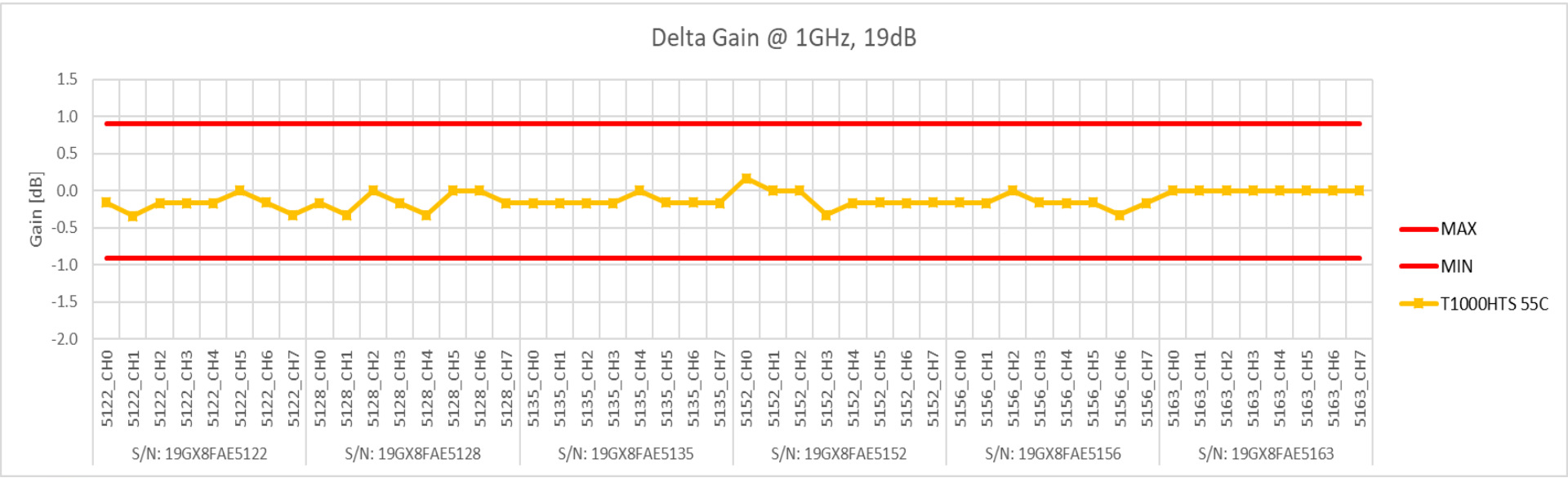
GX74870 Group 2C @55C



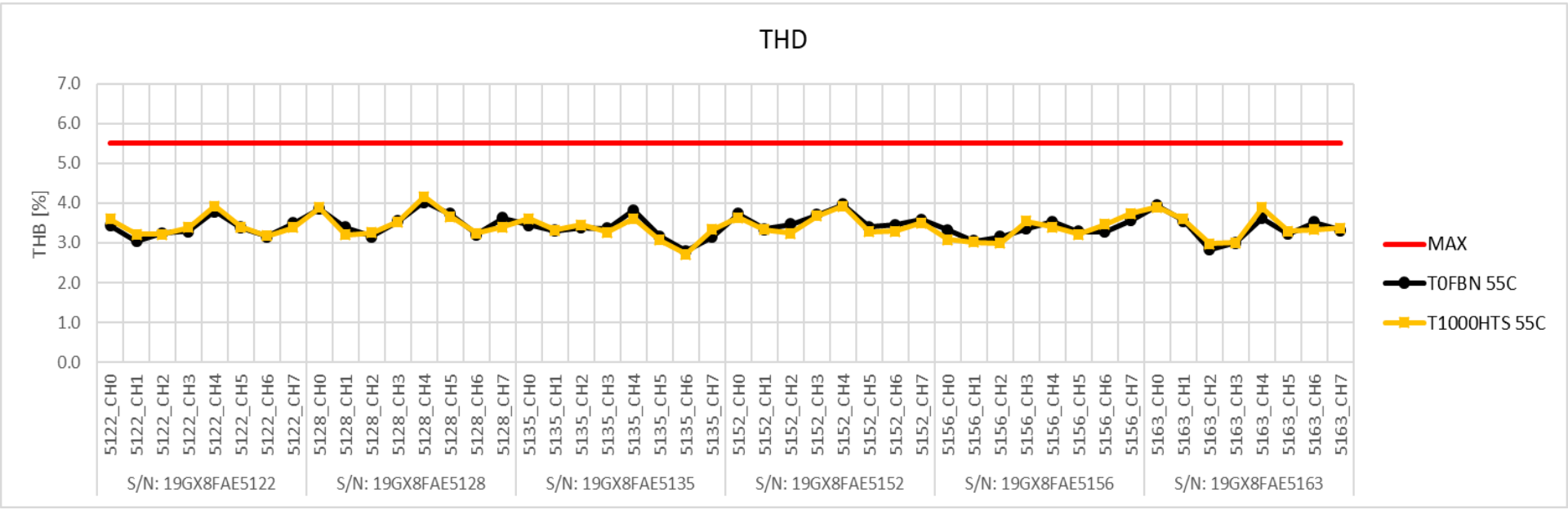


GX74870 Group 2C @55C

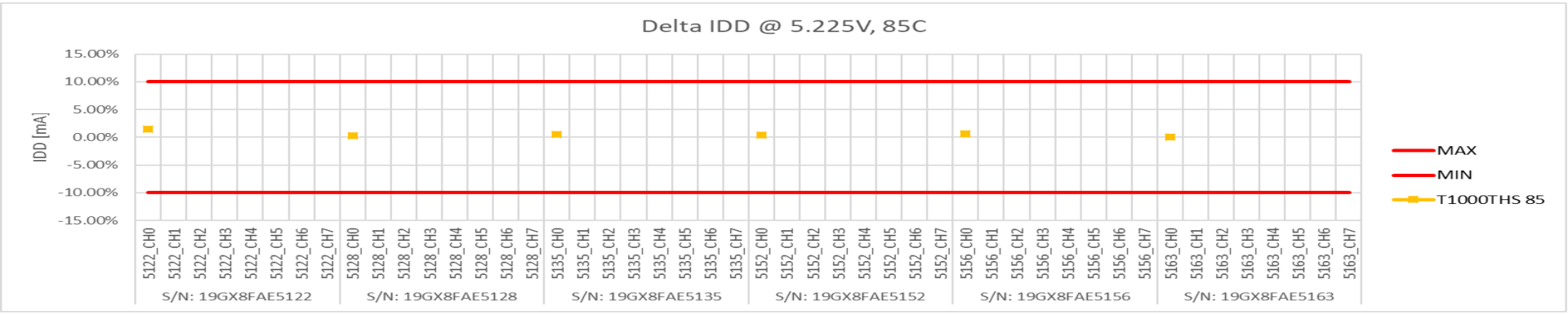


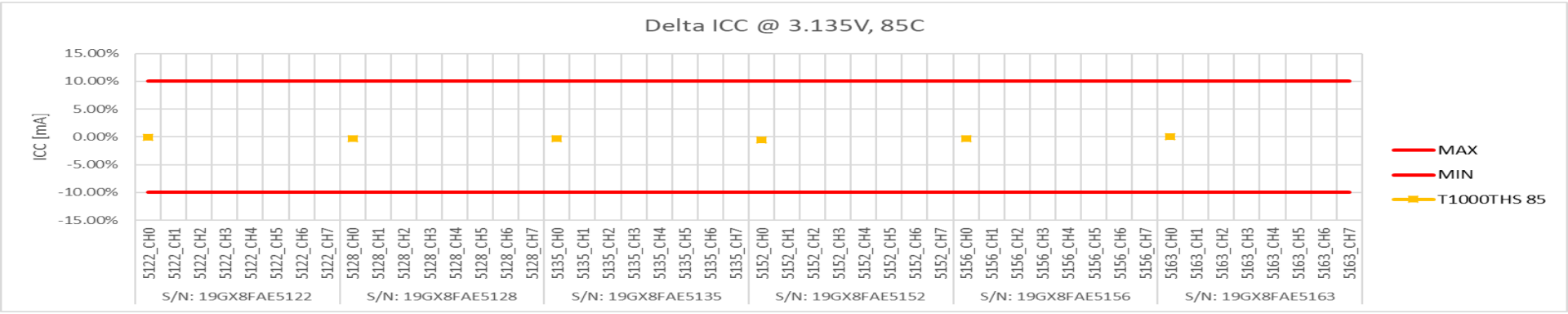


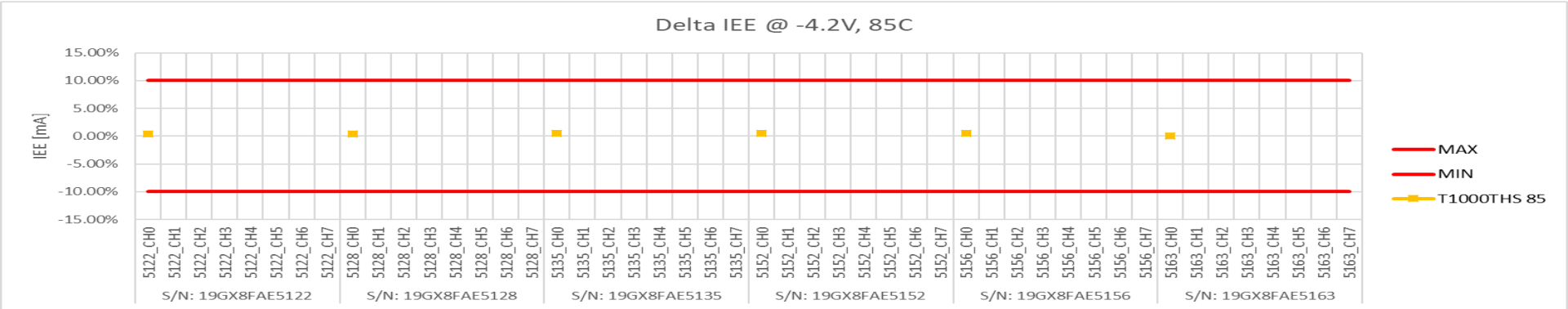
GX74870 Group 2C @55C



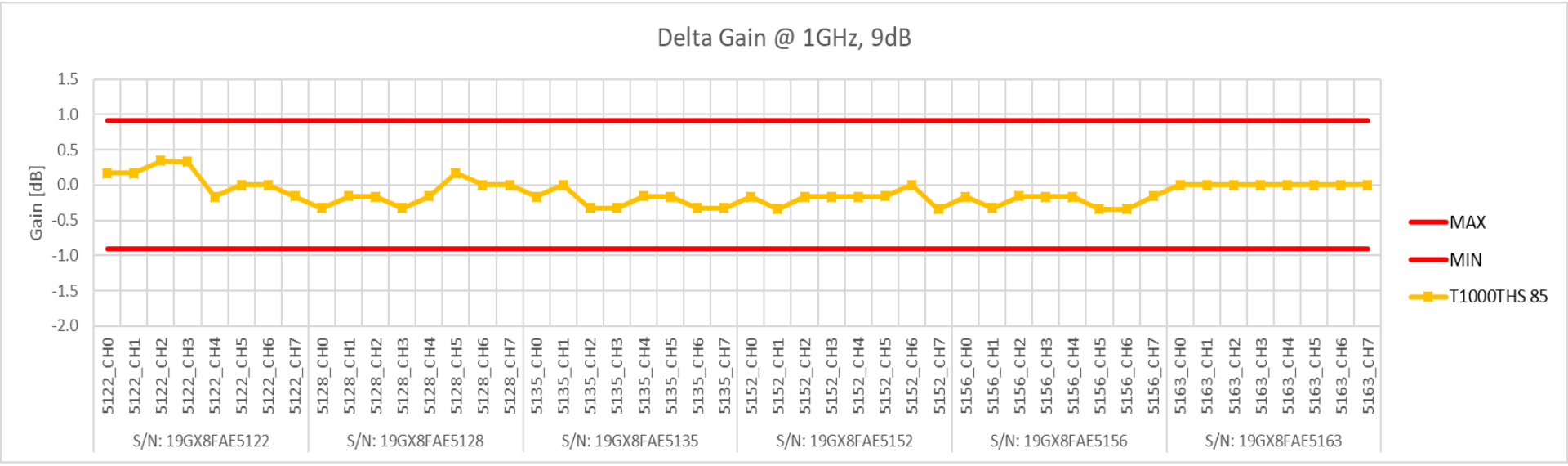
GX74870 Group 2C @85C

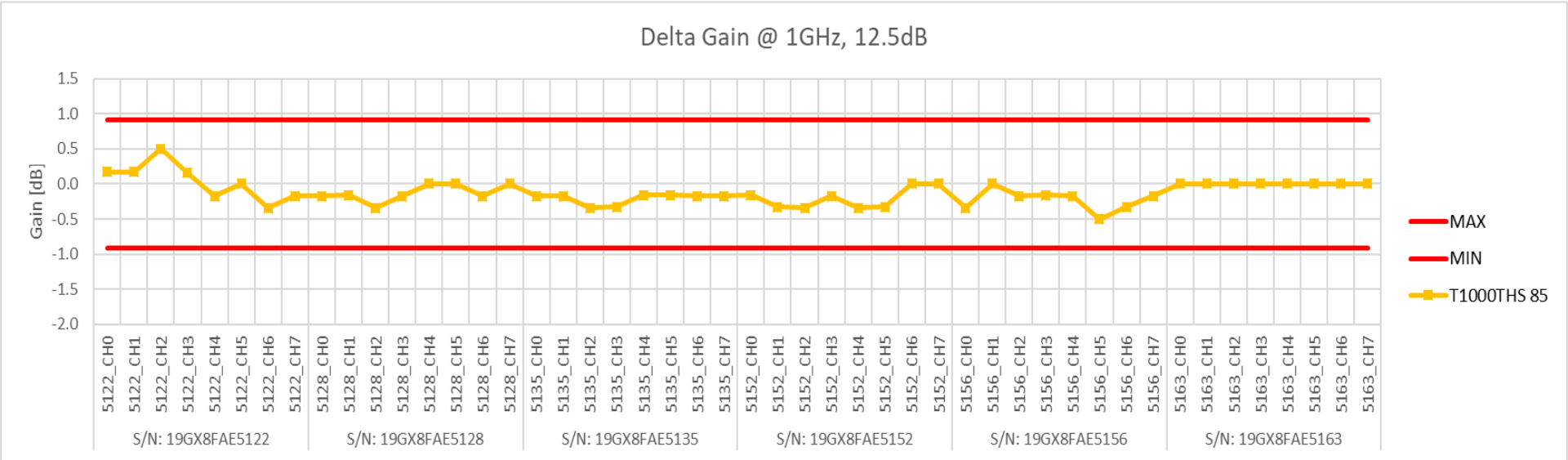




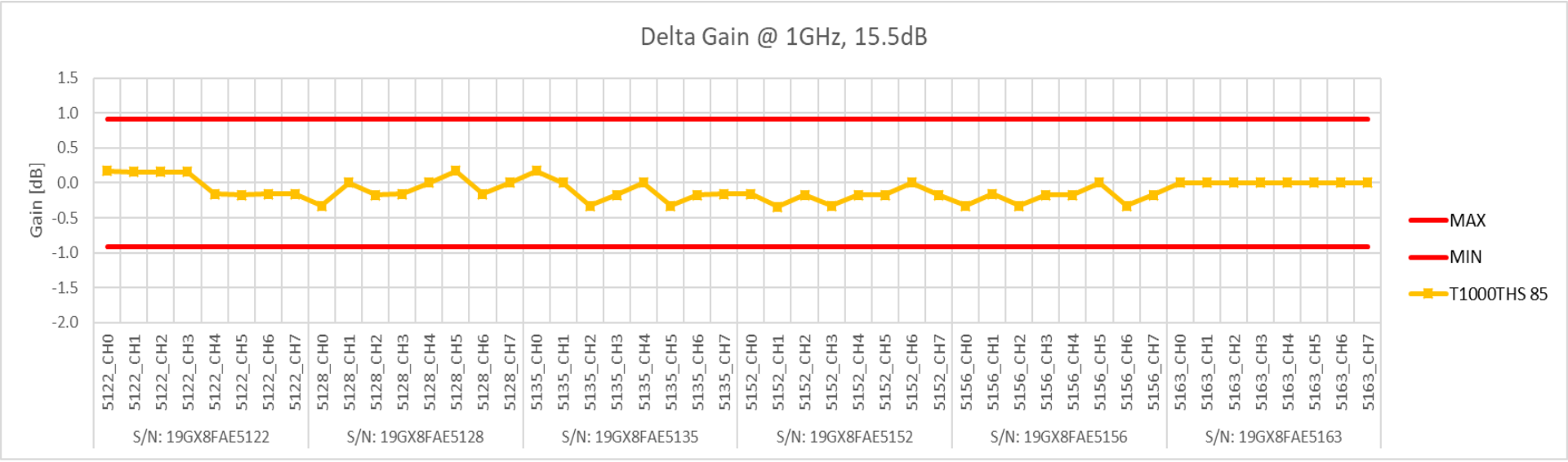


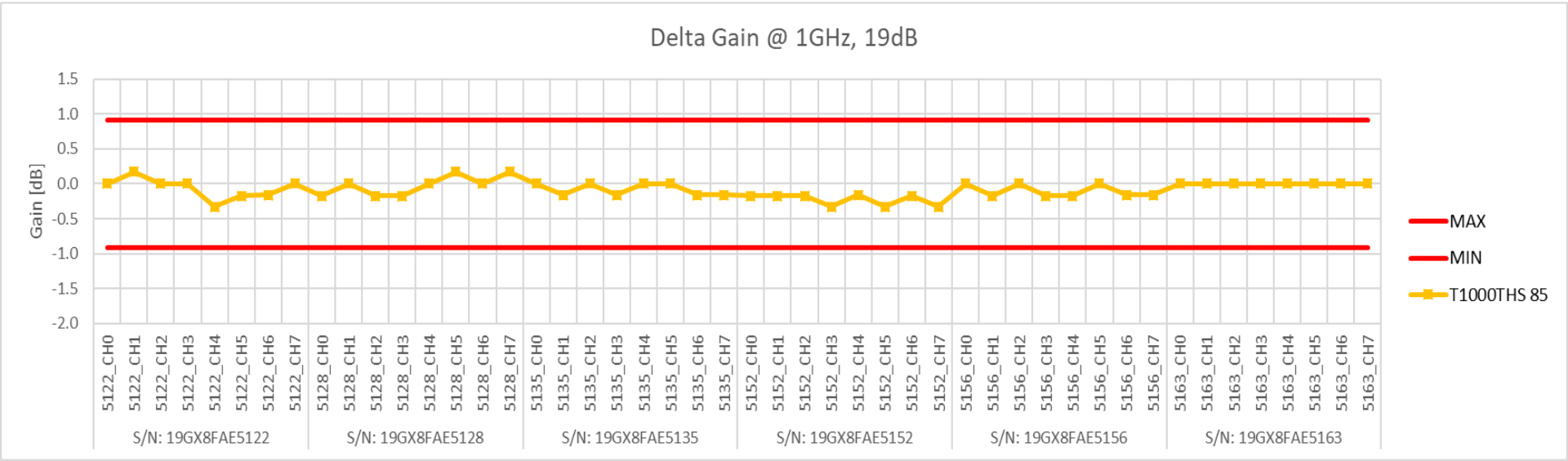
GX74870 Group 2C @85C



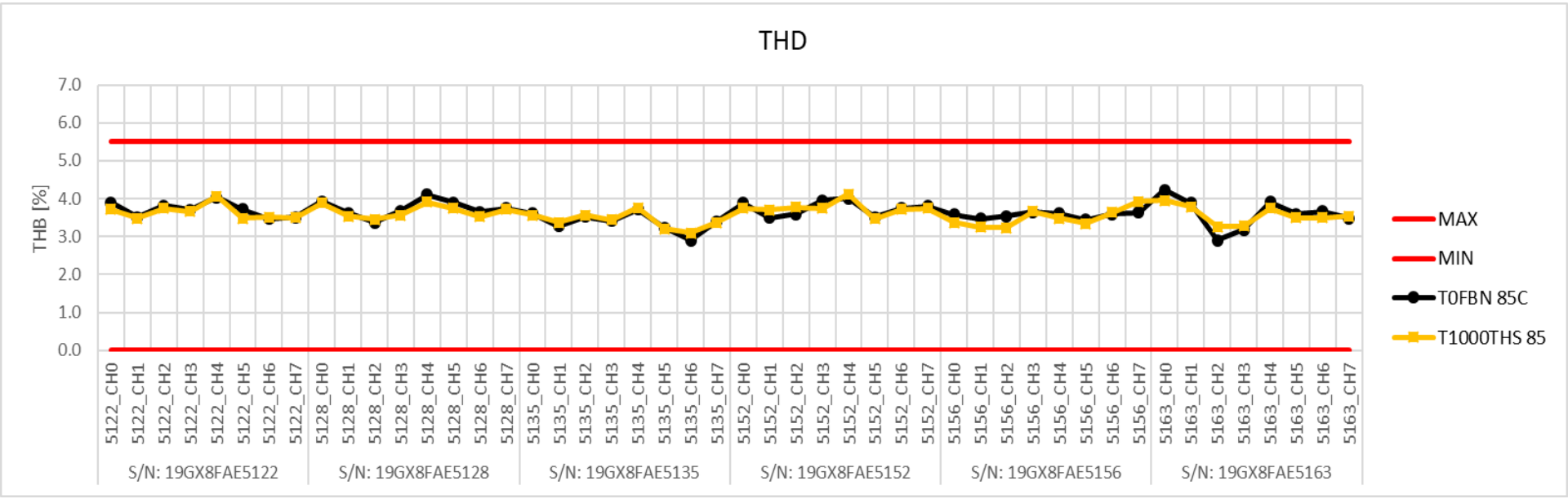


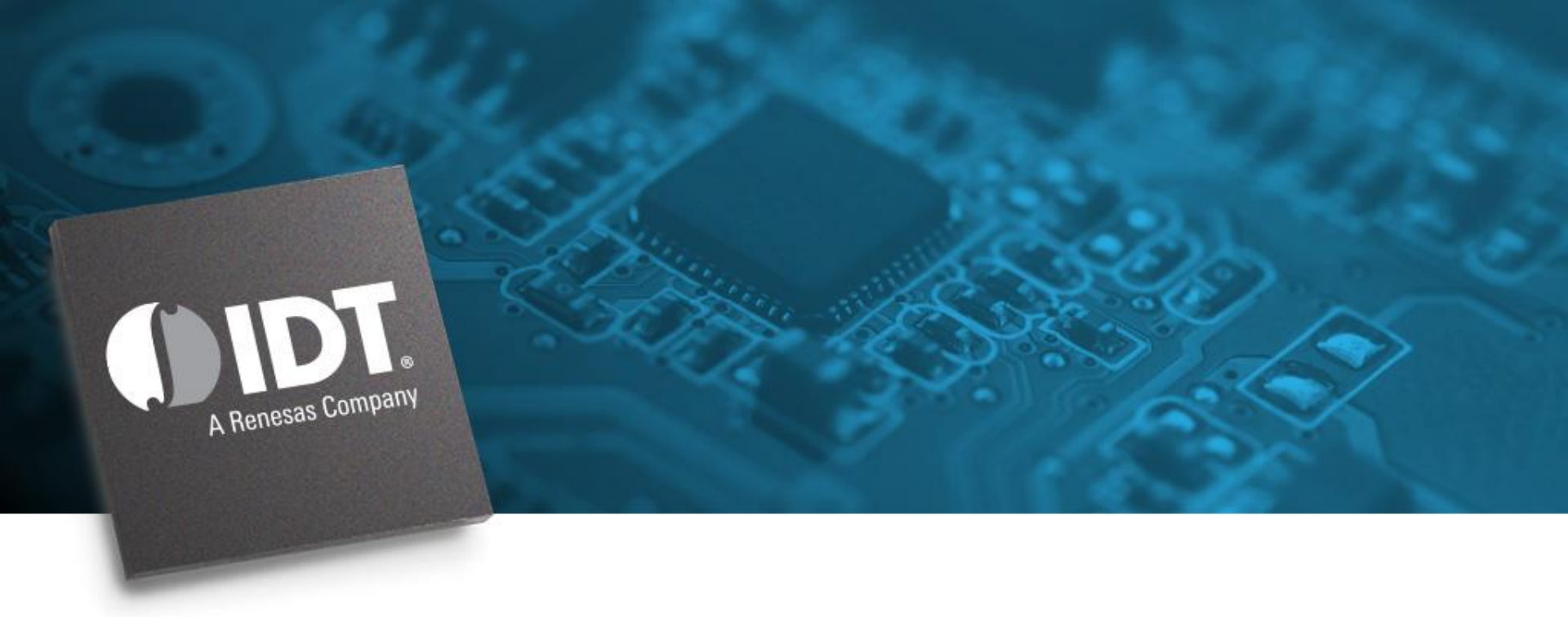
GX74870 Group 2C @85C





GX74870 Group 2C @85C





Additional Support Information

Process Change Impacts

- Nokia has inquired if the changing from SJ to FBN used epoxies may cause any gain control issues
  - In May of 2016 GigPeak performed an epoxy experiment comparing epoxies used in SJ with those used at FBN
    - H35 epoxy substituted by 84-1
    - H54 epoxy substituted by 84-3
  - HTOL was performed on hermetic sealed packages
    - After 500 hours gain drift was observed similar to units using H35 and H54 epoxy
    - Upon puncturing of a hole in the lid of the experiment units, the gain control recovered similar to units using H35 and H54 epoxy

Gain Control Drift Root Cause

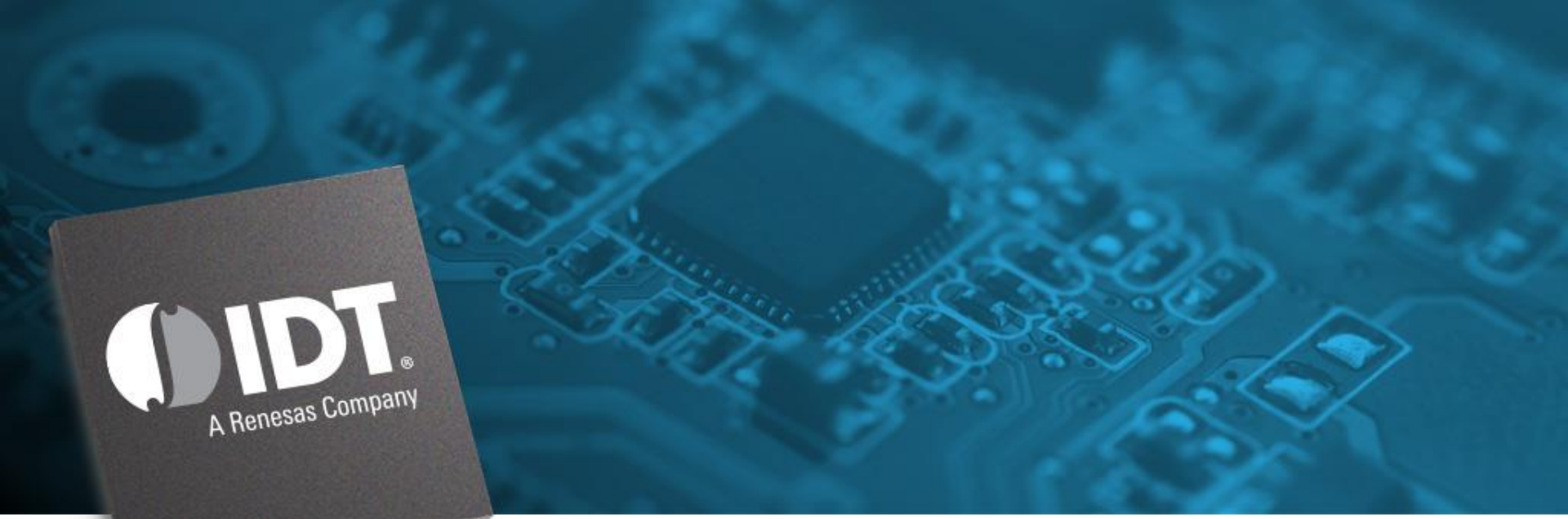
- From May through August 2016 GigPeak performed an experiment which proved that the failure pertains to the GCS pre-driver die (used also in other devices)
  - The study focuses on identifying the die failure mode using a systematic approach
  - Presentation provided to Nokia Quality and Engineering August 16th 2016 called “Gain Drift Failure Analysis”
  - Internal circuit nodes were systematically isolated and monitored (through consecutive cuts done with FIB)
  - From the results collected in the experiment, R10 variation (higher value after stress) is the root cause of the gain drift. The cause for the change in R10 is due to via from M1 to backside of die resistance changing
    - Note: a modified layout of the chip where all the resistors have been connected to M1 through a double post with larger dimension and TFR extension has been implemented
  - <u>This experiment clearly shows the failure mechanism is mechanical based, not from outgassing</u>

Other Hermetic Products using GCS

- As indicated on the previous slide, GigPeak in 2015/2016 had other hermetic products using GCS pre-drivers with a similar control circuit
  - GX72452B, GX72452B
  - Both of these products were assembled and tested at FBN
  - Both products exhibited a similar control shift during HTOL aging
  - For both products the gain control failure would recover by small puncture in the lid as seen on the GX74870
  - These results show the failure mechanism is the same whether built at San Jose or FBN

GX74470 – FNB Qualification Testing (For Reference)

Test Description	Conditions
High Temperature Operating Life - DC	JESD22-108D 125ºC, VCC max 5V, (168,500,1000, 2000hrs)
High Temperature Operating Life - RF	JESD22-108D, 125ºC, VCC max (5V), (500,1000,2000hrs)
IR Characterization	To determine maximum operating junction temperature and calculate thermal resistance (Rth)
Temp-Humidity Bias (THB)	JESD-22-A101B 85°C, 85% RH Low power bias condition
Temp. Cycling (MSL3 pre-condition)	JESD47 10°C/min, 3 min dwell times -40°C to 85°C: 10 cycles -25°C to 100°C: 500 cycles
High Temp. Storage (HTS)	JESD22-A103 150°C (un-bias)
Low Temp. Storage (LTS)	JESD-47 -40°C, 100 hrs.
Moisture Resistance Test	MIL-STD-750 Method 1021.4
MFG	Nokia Guidelines Condition A (Outdoor conditions)
Mechanical Shock	JESD22-B104 Cond. B
Vibration	JESD22-B103 Cond. A
Solderability	MIL-STD-883, 2003.11
Wire (Bond) Pull Test	JESD22-115A 30 bonds, 1 Lot
Die Shear	MIL-STD-883, 2019.9 6 pre-drivers & 6 output amps
Label Marking	MIL-STD-883, Method 2015



Thank You

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