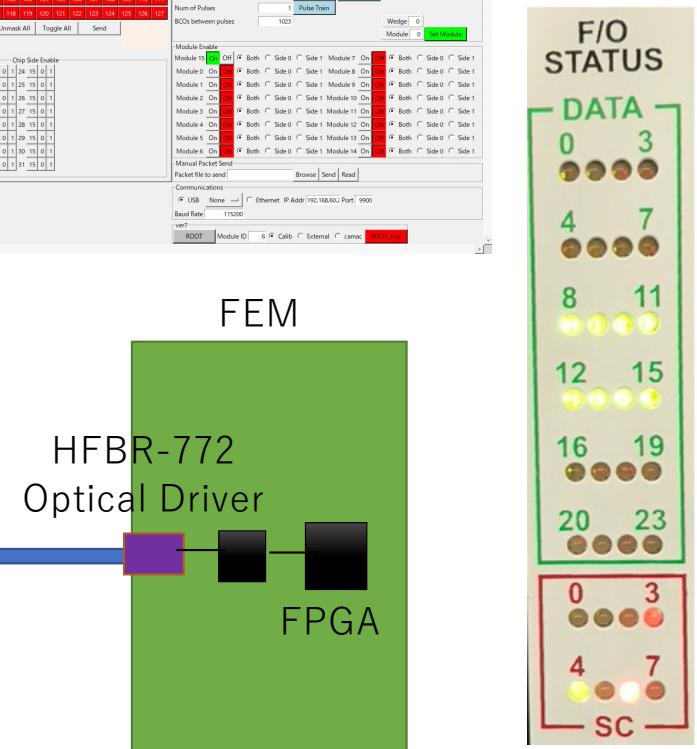
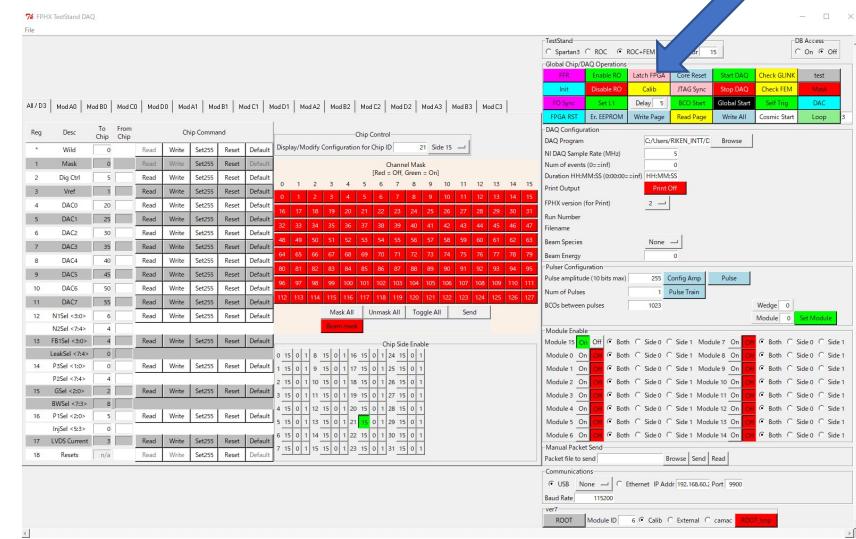
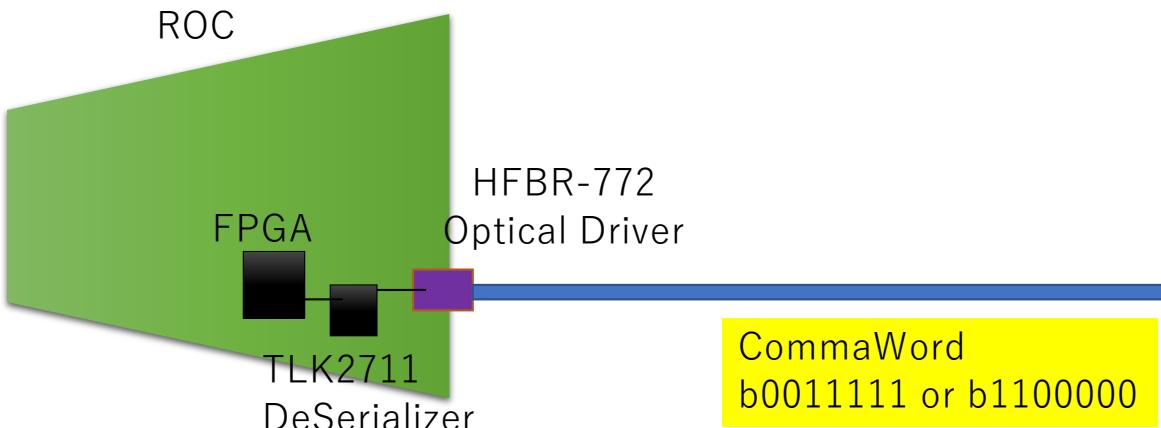


NE5 Fiber Latch Problem

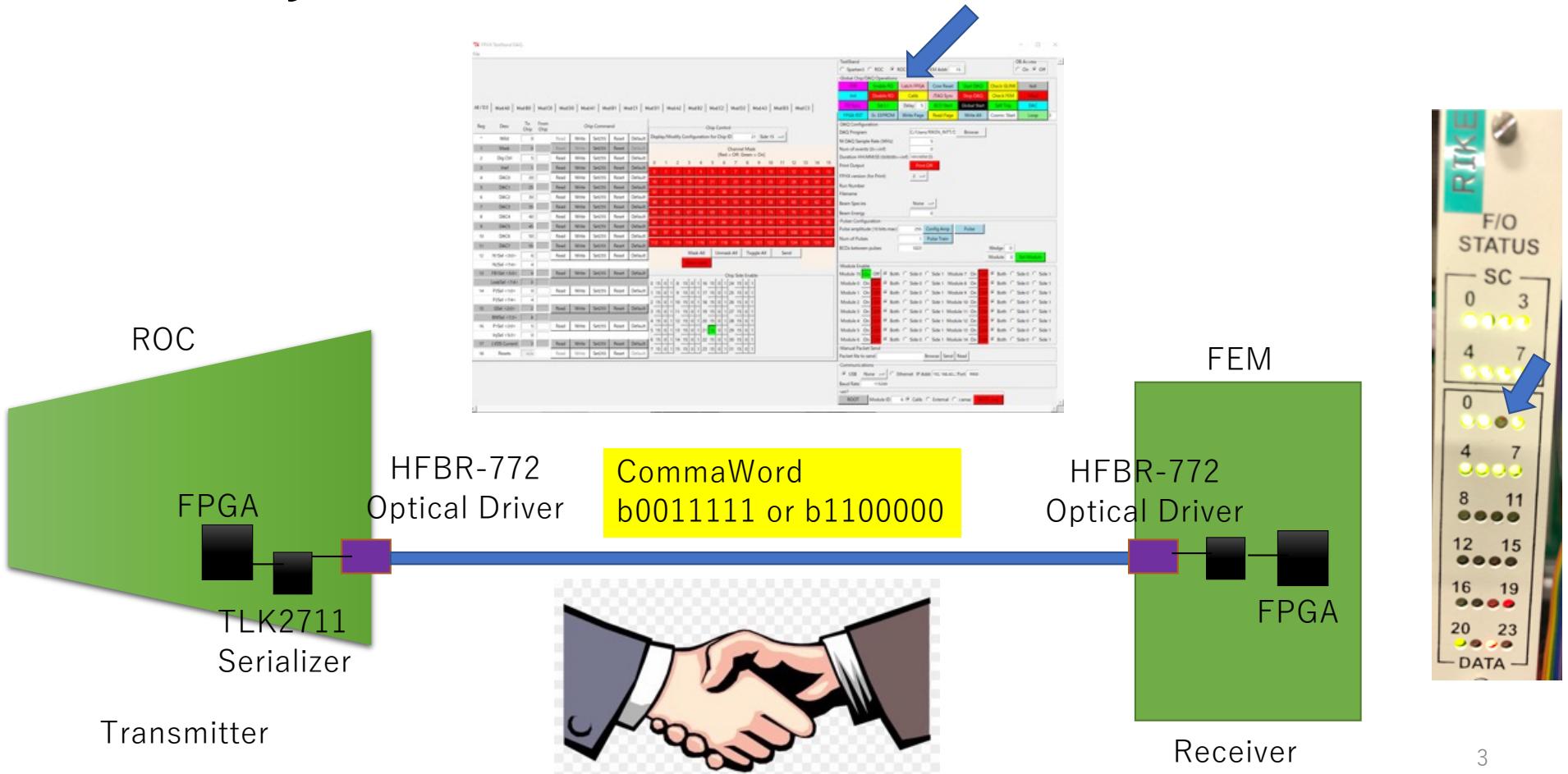
Itaru Nakagawa

RIKEN/RBRC

Fiber Synchronization



Fiber Synchronization Error



Fiber Sync Error Debugging with John K.

Bad port

$\times FFFF \times CSBC \times CSBC \times E3E3 \times SESE \times 7676$ } Reference (1)
 $\times FFFF \times CSBC \times CSBC \times E3E3 \times SESE \times 7676$

good port

$\times FFFF \times CSBC \times CSBC \times E3E3 \times SESE \times 7676$ } 3x(0000)

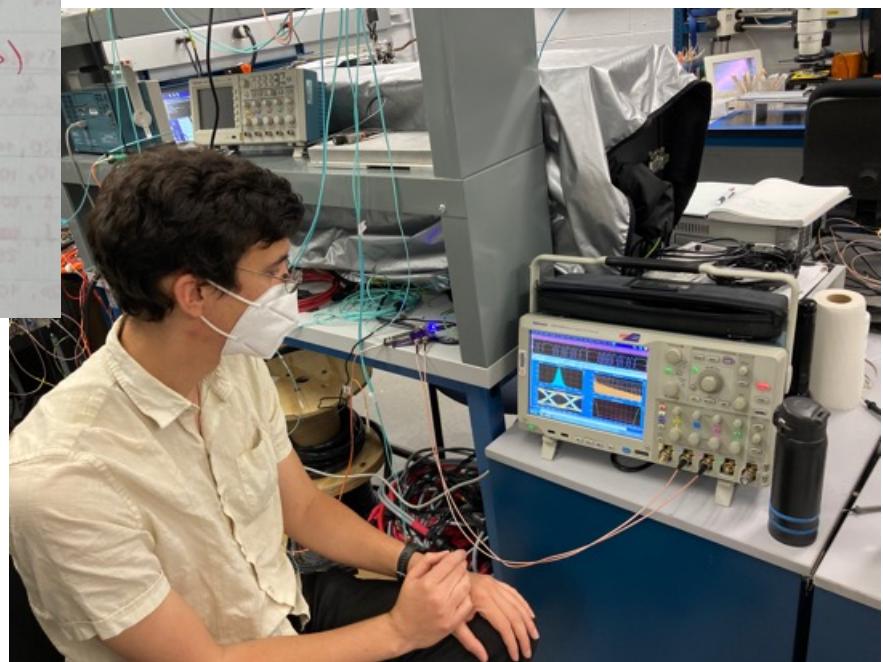
Bad port

After GTH Reset followed by latch

$\times DEFF \times 40BC \times CSBC \times C3E3 \times SESE \times 5676$ } 3x(0000)
 $\times FFFF \times CSBC \times CSBC \times E3E3 \times SESE \times 7676$ } 3x(0000)

good port

- We did observed collapsed comma words which is the smoking gun of the fiber sync error.
- However, the cause has not been identified. Signal shapes, reference clock jitters etc all look normal. This problem remain no solution yet.



May ~ September, 2022.

Pseudo-Random Bit Stream (PRBS)

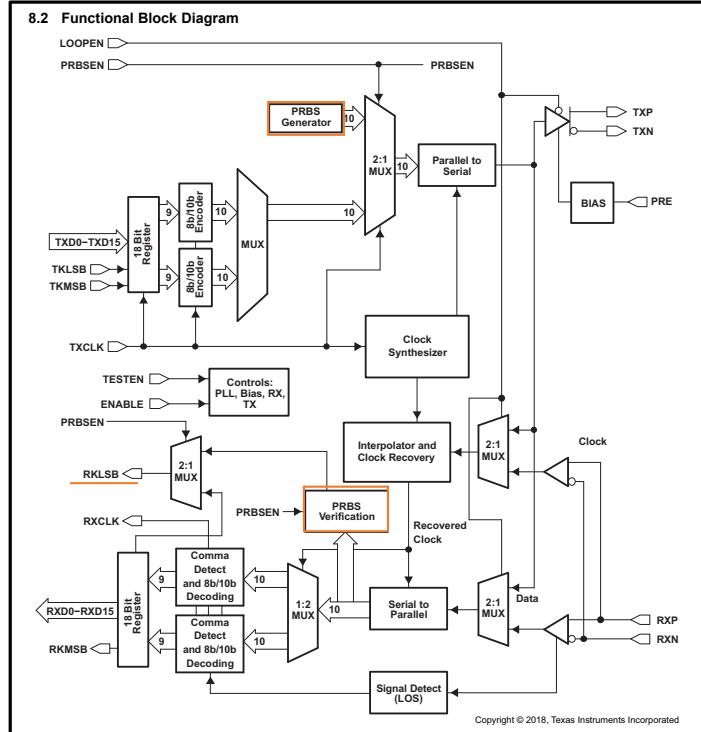
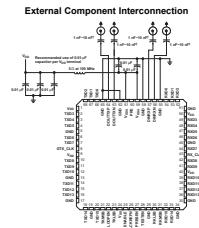
8.3.5 Pseudo-Random Bit Stream (PRBS) Generator

The TLK2711-SP has a built-in $2^7 - 1$ PRBS function. When the PRBSEN pin is forced high, the PRBS test is enabled. A PRBS is generated and fed into the 10-bit parallel-to-serial converter input register. Data from the normal input source is ignored during the PRBS mode. The PRBS pattern is then fed through the transmit circuitry as if it were normal data and sent out to the transmitter. The output can be sent to a bit error rate tester (BERT), the receiver of another TLK2711-SP, or looped back to the receive input. Because the PRBS is not really random, but a predetermined sequence of 1s and 0s, the data can be captured and checked for errors by a BERT.



8.3.14 PRBS Verification

The TLK2711-SP also has a built-in BERT function in the receiver side that is enabled by the PRBSEN. It can check for errors and report the errors by forcing the RKLSB pin low.

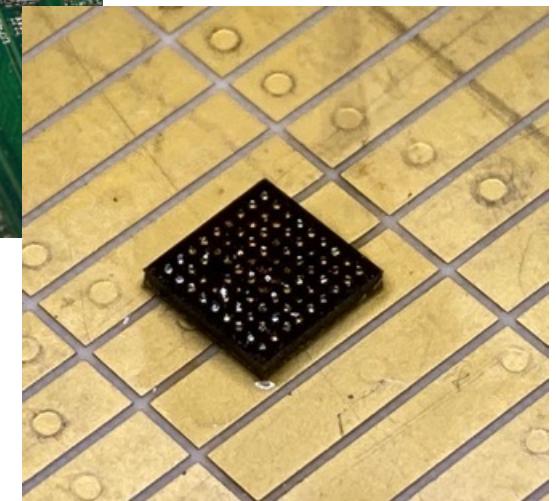
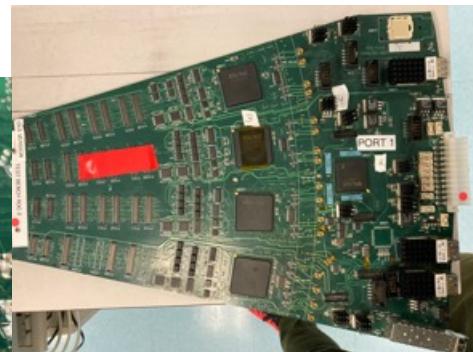
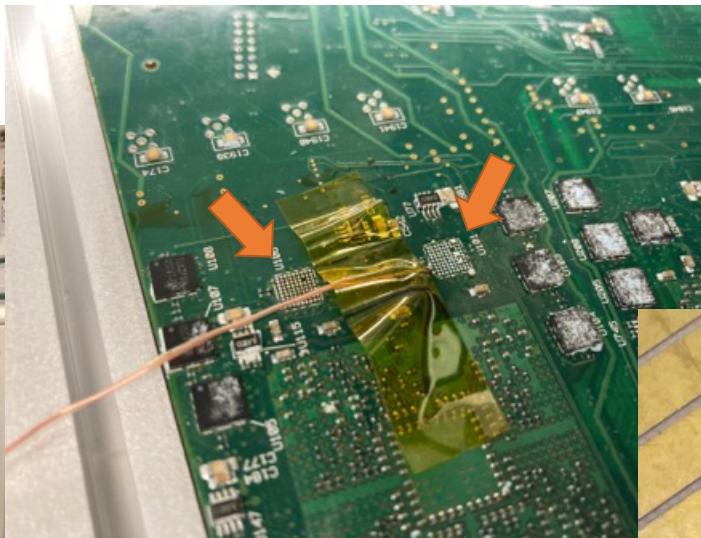
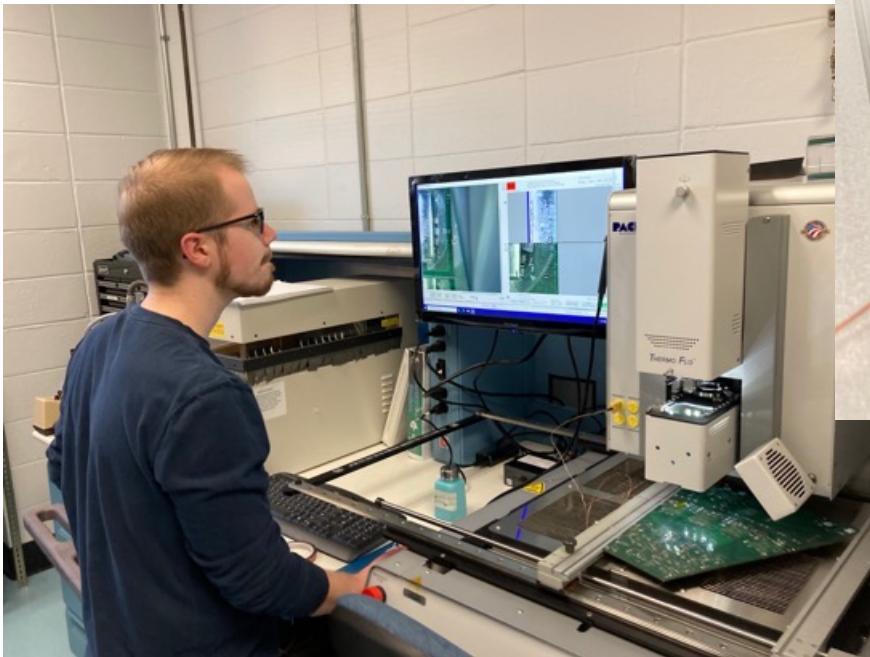


Next Step

- Honestly, we ran out of idea how to debug this problem further.
- We decided to replace TLK2711 without observing any direct evidence of the cause.
- TLK2711 is discontinued product and not available in the US market. We salvage “the old ROC”, a prototype version and take TLK2711 from it. There are 33 (8/column+SC) TLK2711 are implemented per ROC.
- Replacing TLK2711 is a certain risk since it is the ball soldering and non-negligible possibility of damaging soldering pads of both TLK2711 and ROC.
- The attempt is done in the instrumentation division.

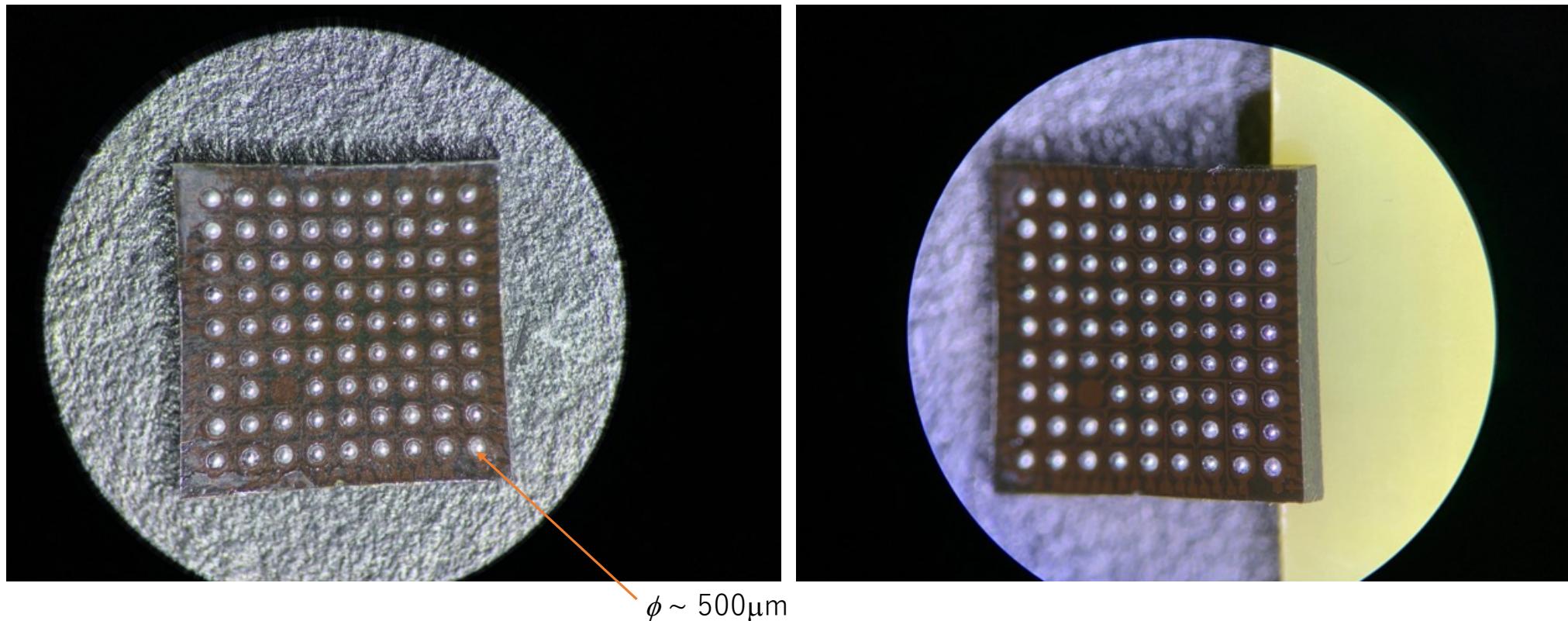
Removal of TLK2711 from “Old ROC”

By Joseph Pinz @ Instrument Div.



TLK2711 removal from “the old ROC” the version BCO cable input is incompatible with production version

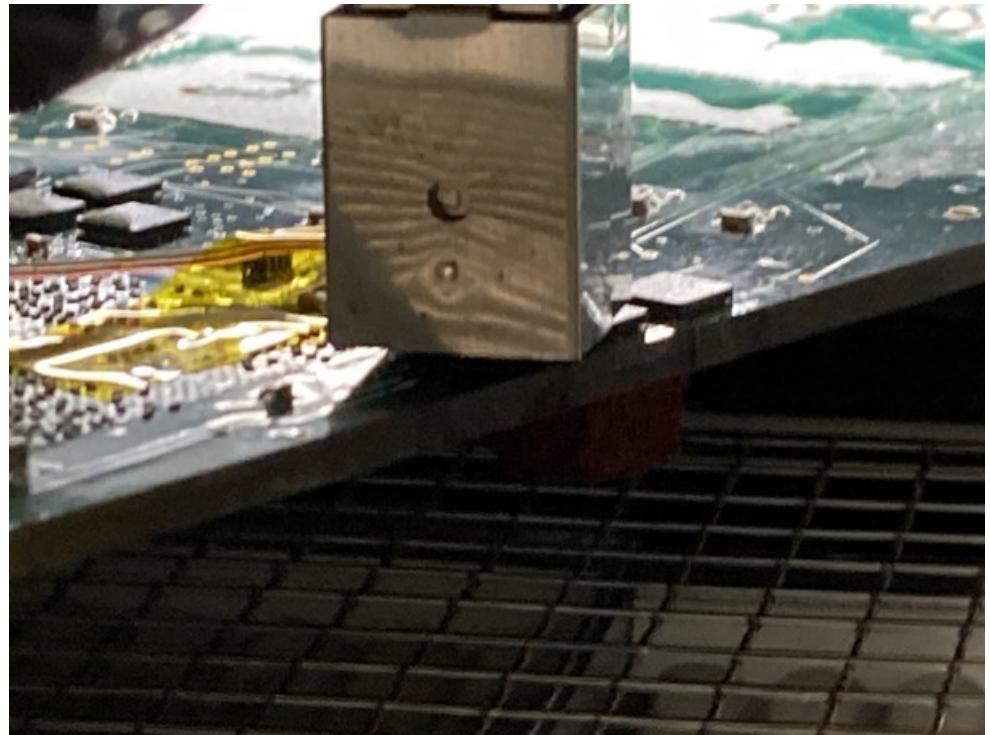
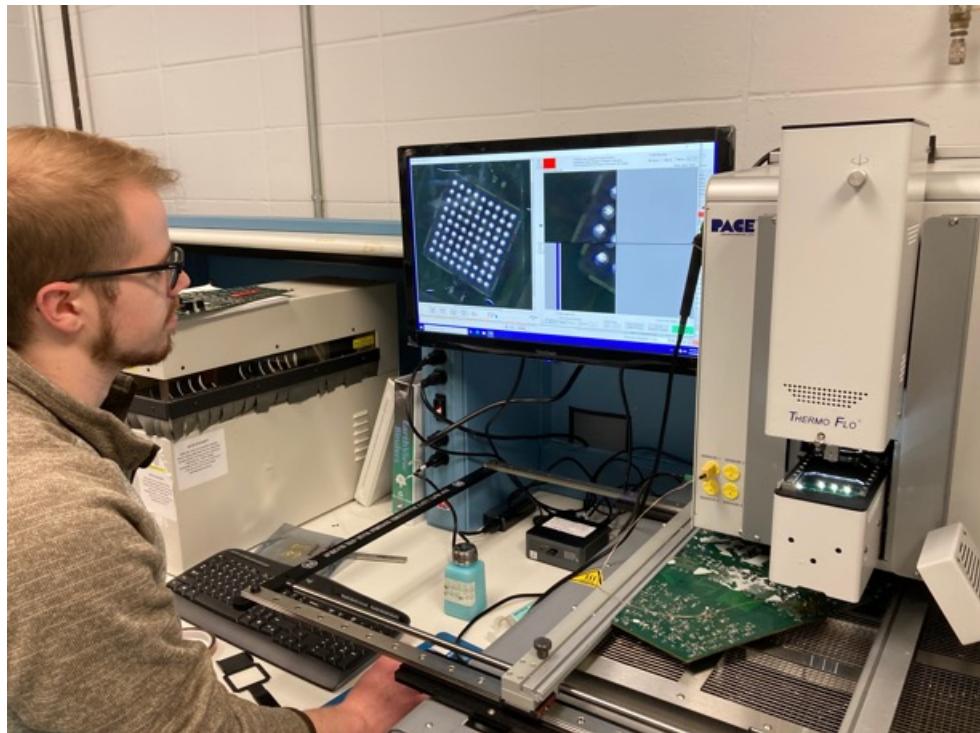
Re-balling solder on the TLK2711



2022/11/4

10

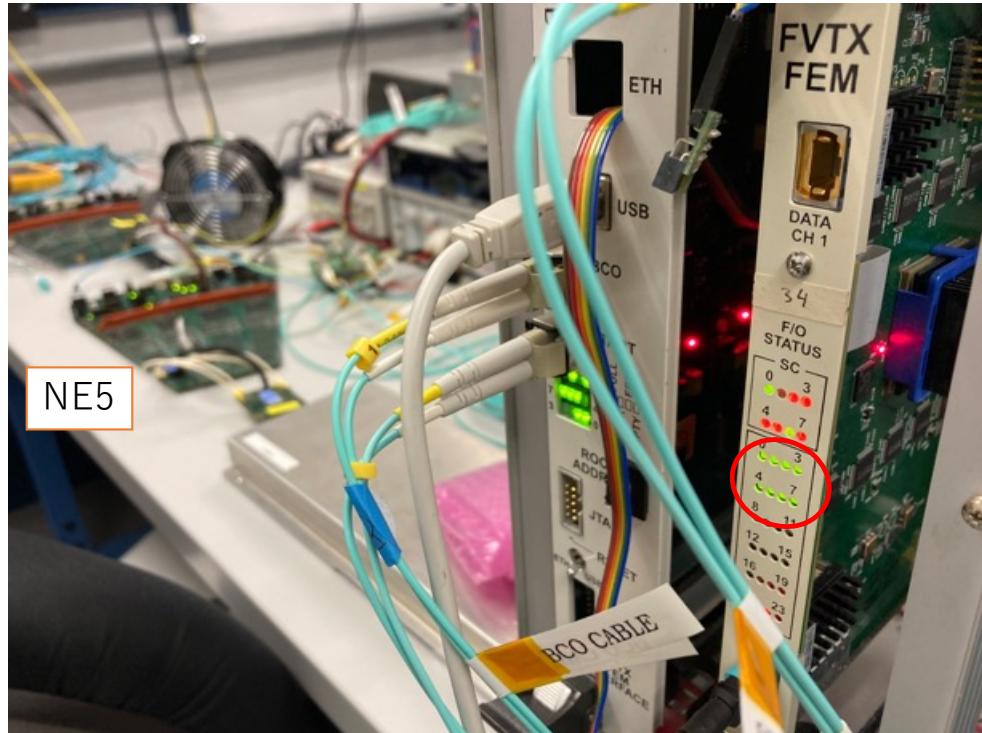
Implementation of TLK2711 on NE5



After removal of bad TLK2711s from NE5, implement TLK2711 took out from the “old ROC”.

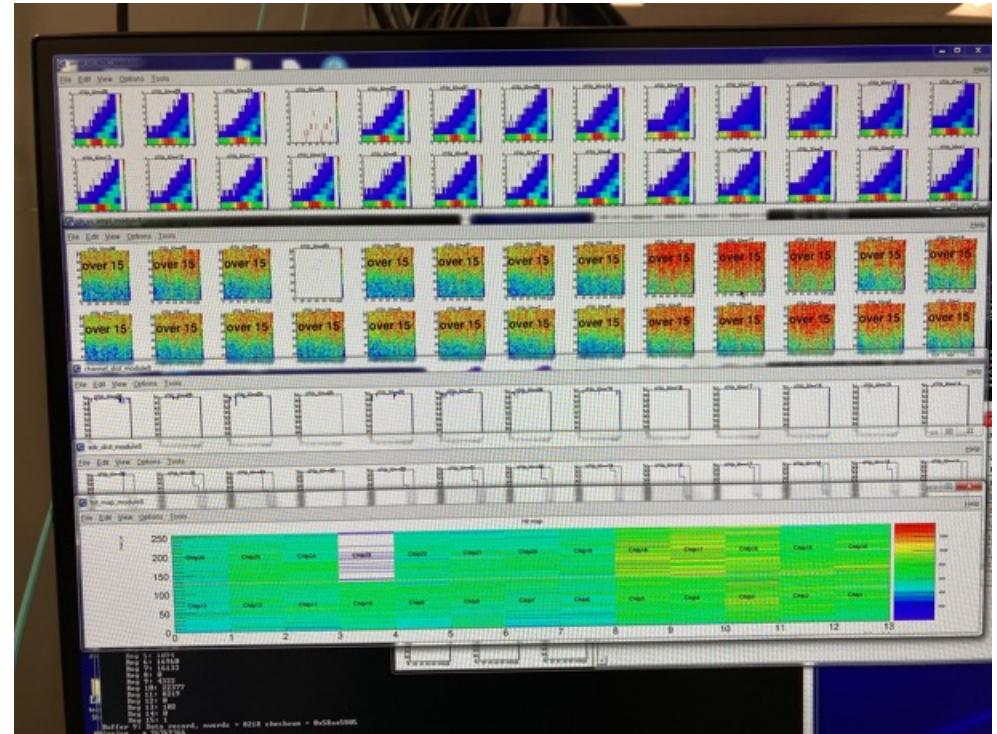
2022/11/8

Calibration Results



Now the data fiber latches successfully.

2022/11/8



Resulting calibration data. Need to debug further besides the fiber issue, but now we have ways to investigate.

ROC Status

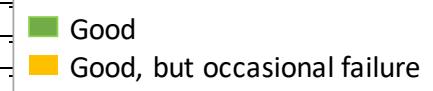
Index	ROC #	FVTX	Regulator Upgrade	Location	Class	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	Issue	Status
1	6	NW2	✓	BNL	1														
2	13	NE4	✓	BNL	1														
3	18	NE1	✓	BNL	1														
4	26	SE3	✓	BNL	1														
5	28	SE0	✓	BNL	1														
6	29	-	✓	BNL	1														
7	20	SW5	✓	BNL	1														
8	22	SE2	✓	BNL	1														
9	23	SE1	✓	BNL	1														
10	31	NW1	✓	BNL	1	R	R	R											
11	32	NE2	✓	BNL	1						R	R	R						
12	9	-	✓	BNL	1			R											
13	10	-	✓	BNL	1				R		R								
14	27	SE5	✓	BNL	1						R			R	R	R		L12 Replaced at Column-D	
15	19	NE5	✓	BNL	3										F			Fiber Sync	TLK2711 Replaced
16	24	SE4	✓	BNL	2			F							F			Fiber Sync	
17	16	NE3	✓	BNL	3				C	C	C							Calib Pulse	Waiting for SC-FPGA download
18	15	NE0	✓	RIKEN	2	R									F	F		Fiber Sync	
18	2	NW4	✓	RIKEN	3					R		R			F	R		Fiber Sync	
19	7	-	✓	RIKEN	3		R	R			R				R			Replaced all DF18	
20	21	-	✓	REPIC	3	R			R		R		R	F	R			Fiber Sync	
21	17	NW3	✓	RIKEN	3				F						R			Fiber Sync	
22	3	NW5	✓	RIKEN	3	R		R								R	F	Fiber Sync	
24	14	NE1	✓	REPIC	3					R		C	R	R	P	P	P	Calib Pulse	L12 to be replaced at Column-D

 Good
 Good, but occasional failure
 No data at all
C : Problem in Calibration pulse
F : Problem in data Fiber sync
P : Problem in Power supply
R : Recovered

14 Class-1 ROCs
out of 16 needed

ROC Status Updated

Index	ROC #	FVTX	Regulator Upgrade	Location	Class	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	Issue	Status	
1	6	NW2	✓	BNL	1															
2	13	NE4	✓	BNL	1															
3	18	NE1	✓	BNL	1															
4	26	SE3	✓	BNL	1															
5	28	SE0	✓	BNL	1															
6	29	-	✓	BNL	1															
7	20	SW5	✓	BNL	1															
8	22	SE2	✓	BNL	1															
9	23	SE1	✓	BNL	1															
10	31	NW1	✓	BNL	1	R	R	R												
11	32	NE2	✓	BNL	1							R	R	R						
12	9	-	✓	BNL	1			R												
13	10	-	✓	BNL	1				R		R									
14	27	SE5	✓	BNL	1						R			R	R	R		L12 Replaced at Column-D		
15	19	NE5	✓	BNL	3														TLK2711 Replaced	
16	24	SE4	✓	BNL	2			F											Fiber Sync	
17	16	NE3	✓	BNL	3				C	C	C								Calib Pulse	Waiting for SC-FPGA download
18	15	NE0	✓	RIKEN	2	R													Fiber Sync	
18	2	NW4	✓	RIKEN	3				R		R								Fiber Sync	
19	7	-	✓	RIKEN	3		R	R			R					R			Replaced all DF18	
20	21	-	✓	REPIC	3	R			R		R		R	F	R				Fiber Sync	
21	17	NW3	✓	RIKEN	3				F								R		Fiber Sync	
22	3	NW5	✓	RIKEN	3	R	R										R	F	Fiber Sync	
24	14	NE1	✓	REPIC	3					R		C	R	R	P	P	P	Calib Pulse	L12 to be replaced at Column-D	



 C : Problem in Calibration pulse

 F : Problem in data Fiber sync

 P : Problem in Power supply

 R : Recovered

There are still 6 more ROC boards (8 ports) beside NE5 which are suffered from the fiber latch issue.

Plan

- Will replace TLK2711 chips for column-A and D of SE4 at instrumental division to confirm the fiber latch issues are resolved by TLK2711 replacements. (November)
- In the meantime, Itaru look for a company who can do the ball soldering replacement in Japan as well as any TLK2711 stocks in the market. (November)
- If both columns of SE4 also be recovered from the fiber latch issue after the replacement, we'll try to replace the rest of ROCs. (December)

Why quite a few ROCs are suffered from the fiber latch issue?

Product Folder Order Now Technical Documents Tools & Software Support & Community

TEXAS INSTRUMENTS

TLK2711-SP
SGLS307P – JULY 2006 – REVISED FEBRUARY 2018

TLK2711-SP 1.6-Gbps to 2.5-Gbps Class V Transceiver

1 Features

- 1.6 to 2.5 Gbps (Gigabits Per Second) Serializer/Deserializer
- Hot-Plug Protection
- High-Performance 68-Pin Ceramic Quad Flat Pack Package (HFG)
- Low-Power Operation
- Programmable Preemphasis Levels on Serial Output
- Interfaces to Backplane, Copper Cables, or Optical Converters
- On-Chip 8-Bit/10-Bit Encoding/Decoding, Comma Detect
- On-Chip PLL Provides Clock Synthesis From Low-Speed Reference
- Low Power: < 500 mW
- 3-V Tolerance on Parallel Data Input Signals
- 16-Bit Parallel TTL-Compatible Data Interface
- Ideal for High-Speed Backplane Interconnect and Point-to-Point Data Link
- Military Temperature Range (-55°C to 125°C T_{case})
- Loss of Signal (LOS) Detection
- Integrated 50- Ω Termination Resistors on RX
- Engineering Evaluation (EM) Samples are Available ⁽¹⁾

2 Applications

- Point-to-Point High-Speed I/O
- Data Acquisition
- Data Processing

(1) These units are intended for engineering evaluation only. They are processed to a non-compliant flow (for example, no burn-in, and so forth) and are tested to temperature rating of 25°C only. These units are not suitable for qualification, production, radiation testing, or flight use. Parts are not warranted for performance on full MIL specified temperature range of -55°C to 125°C or operating life.

3 Description

The TLK2711-SP is a member of the WizardLink transceiver family of multigigabit transceivers, intended for use in ultra-high-speed bidirectional point-to-point data transmission systems. The TLK2711-SP supports an effective serial interface speed of 1.6 Gbps to 2.5 Gbps, providing up to 2 Gbps of data bandwidth.

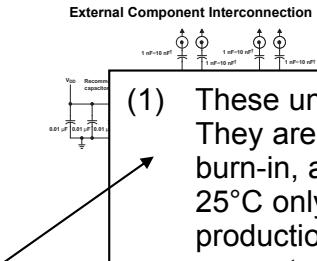
The primary application of the TLK2711-SP is to provide high-speed I/O data channels for point-to-point baseband data transmission over controlled impedance media of approximately $50\ \Omega$. The transmission media can be printed circuit board, copper cables, or fiber-optic cable. The maximum rate and distance of data transfer is dependent upon the attenuation characteristics of the media and the noise coupling to the environment.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TLK2711-SP	CFP (68)	13.97 mm x 13.97 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

External Component Interconnection



(1) These units are intended for engineering evaluation only. They are processed to a non-compliant flow (for example, no burn-in, and so forth) and are tested to temperature rating of 25°C only. These units are not suitable for qualification, production, radiation testing, or flight use. Parts are not warranted for performance on full MIL specified temperature range of -55°C to 125°C or operating life.

- Radiation damage?
- If so, we have higher chances to be suffered new cases during the beam operation than FVTX since we start from already accumulated dose during FVTX operation.
- We better be prepared.