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Final

P22_0116-2_IOPT_CA-IF1043_report00
Date of Approval: 2022-Nov-15

Test Report

Device Under Test		**Customer**	
Device Family	CA-IF1043NF-Q1 CA-IF1043D-Q1	Order No.	P22_0116
Manufacturer	Chipanalog	Name	Shanghai Chipanalog Microelectronics Co.,LTD
DUT version	CA-IF1043NF-Q1	Address	2F, Block C,GaoJing Road,Qingpu District Shanghai, 201601 P.R. China
Sample marking	1043NF-Q1 27226.01 GJL02238E		

Number of Pages	20
Test Period	from ww43/2022 until ww44/2022
Test Method / Test Requirement	CAN IOPT Test for devices - with CAN FD up to 5 Mbit/s - with low power
Performed Tests and References	1 Interoperability test specification for high-speed CAN transceiver or equivalent devices IOPT.CAN v02 2 Static Tests based on: ISO 16845-2:2018, Road vehicles – Controller area network (CAN) conformance test plan – Part 2: High-speed medium access unit – Conformance test plan
Conformance Test Results	The Test Results refer to the delivered device.
1 Homogeneous Network with 16 Nodes / 8 Nodes	**Pass**
Heterogeneous Network with 16 Nodes – Mix of 6 8 Nodes – Mix of 5	**Pass**
2 Test type 1, static test cases	**Pass**

For detailed information see chapter Test List at the following pages.

Approved by

L. Kukla, Project Manager

Test performed by

K. Tadajan, M. Mohammad, Test Engineer

Table of Content

Revision History

Old revision	New revision	Amendment Description	Editor
–	00	Final version	LK

1 Device Under Test (detailed)

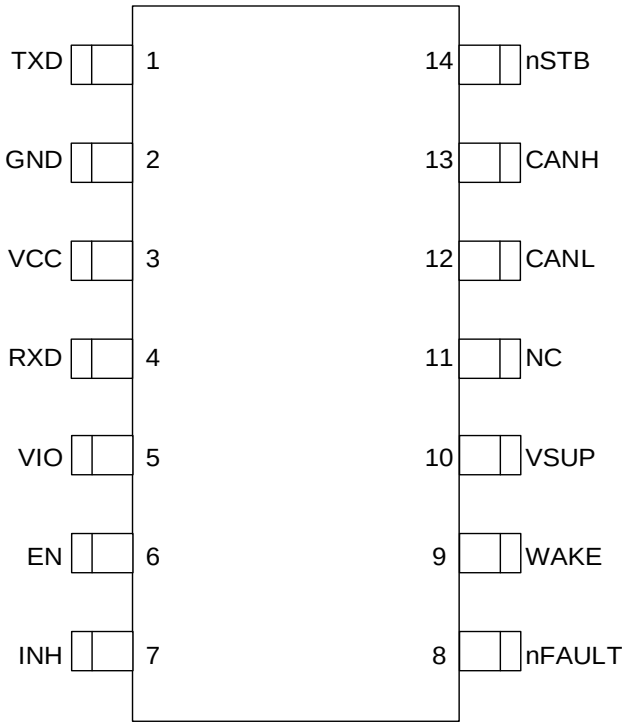
General	
Date of Sample Arrival	24.10.2022
Manufacturer	Chipanalog
Sample Marking	1043NF-Q1 27226.01 GJL02238E
Test performed with DUT no.	#01 to #16 // #01 to #08 (homogenous) #01 to #04 // #01 to #02 (mixed)

Device Specification	
Device Family	CA-IF1043NF-Q1 CA-IF1043D-Q1
DUT Version	CA-IF1043NF-Q1
Design step	-

Documentation	
User manual / datasheet	CA-IF1043_datasheet_version 0.8_en_20221110

Device Classification	
CAN FD Transceiver	Data rates up to 5 Mbit/s

2 Setup for Device Under Test



3 Test Equipment

The following test equipment and test system have been used.

No.	Component	Manufacturer	Version / Type	Network
1	IOPT.CAN Tester T2	C&S	v1.1.0.232	Homogeneous Heterogeneous
2	UT software version	C&S	CA-IF1043	

4 Technical Correspondence

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5 Test List

5.1 Static Conformance Tests (ISO 16845-2:2018)

Used data sheet:
CA-IF1043_datasheet_version 0.8_en_20221110

“The motivation of static test cases is to check the availability and the boundaries in the data sheet of the IUT. For all integrated circuits every related parameter in Table 4 shall be part of the data sheet and fulfil the specified boundaries in terms of physical worst-case condition. Data sheet parameter names may deviate from the names in Table 4, but in this case a cross-reference list (data sheet versus Table 4) shall be provided for this test. Parameter conditions may deviate from the conditions in Table 4, if the data sheet conditions are according to the physical worst-case context in Table 4.”

HS-PMA types:
a - without low-power mode and partial network, **n/a**
b - with low-power mode, normal biasing and without partial network,
c - with low-power mode, automatic biasing and without partial network, **n/a**
d - with low-power mode, automatic biasing and partial network; **n/a**

No.	Parameter	Reference to ISO 11898-2:2016	Limits			Conditions[d]	Conformance test is passed if value		
			Min	Max	Unit	[d] Parameters within the conditions are aligned with Figure 4 p for test.	≤	≥	Rating
1	General maximum rating V_{CAN_H} and V_{CAN_L}	Table 15	-27,0	+40,0	V	-/-	min	Max	Pass 7.1 V_{BUS}
2	Extended maximum rating V_{CAN_H} and V_{CAN_L} (if supported)	Table 15	-58,0	+58,0	V	-/-	min	Max	Pass 7.1 V_{BUS}
3	Maximum rating V_{Diff}	Table 15	-5,0	+10,0	V	The maximum rating for V_{Diff} excludes that all combinations of V_{CAN_H} and V_{CAN_L} are compliant to this standard. $V_{Diff} = V_{CAN\_H} – V_{CAN\_L}$. This is required regardless whether general or extended maximum rating for V_{CAN_H} and V_{CAN_L} is fulfilled	min	Max	Pass 7.1 $V_{(DIFF)}$
4	Single ended recessive output voltage on CAN_H (V_{CAN_H}), bus biasing active	Table 5	+2,0	+3,0	V	All requirements in Table 5 apply concurrently. Therefore, not all combinations of V_{CAN_H} and V_{CAN_L} are compliant with the defined differential output voltage. See also ISO 11898-2:2016, Table 5.	max	min	Pass 7.5 $V_{O(REC)}$
5	Single ended recessive output voltage on CAN_L (V_{CAN_L}), bus biasing active	Table 5	+2,0	+3,0	V	All requirements in Table 5 apply concurrently. Therefore, not all combinations of V_{CAN_H} and V_{CAN_L} are compliant with the defined differential output voltage. See also ISO 11898-2:2016, Table 5.	max	min	Pass 7.5 $V_{O(REC)}$
6	Differential recessive output voltage (V_{Diff}), bus biasing active	Table 5	-0,5	+0,05	V	All requirements in Table 5 apply concurrently. Therefore, not all combinations of V_{CAN_H} and V_{CAN_L} are compliant with the defined differential output voltage. See also ISO 11898-2:2016, Table 5.	max	min	Pass 7.5 $V_{OD(REC)}$

No.	Parameter	Reference to ISO 11898-2:2016	Limits			Conditions[d] [d] Parameters within the conditions are aligned with Figure 4 p for test.	Conformance test is passed if value		
			Min	Max	Unit		≤	≥	Rating
7	Single ended recessive output voltage on CAN_H (V_{CAN_H}), bus biasing inactive	Table 6	-0,1	+0,1	V	See ISO 11898-2:2016, 5.10 to determine when bias shall be inactive. See also ISO 11898-2:2016, Table 6.	max	min	Pass 7.5 $V_{O(STB)}$
8	Single ended recessive output voltage on CAN_L (V_{CAN_L}), bus biasing inactive	Table 6	-0,1	+0,1	V	See ISO 11898-2:2016, 5.10 and Table 6.	max	min	Pass 7.5 $V_{O(STB)}$
9	Differential recessive output voltage (V_{Diff}), bus biasing inactive	Table 6	-0,2	+0,2	V	See ISO 11898-2:2016, 5.10 and Table 6.	max	min	Pass 7.5 $V_{O(STB)}$
10	Single ended voltage on CAN_H, dominant output (V_{CAN_H})	Table 2	+2,75	+4,50	V	R_L = 50 Ω … 65 Ω	max	min	Pass 7.5 $V_{O(DOM)}$
11	Single ended voltage on CAN_L, dominant output (V_{CAN_L})	Table 2	+0,5	+2,25	V	R_L = 50 Ω … 65 Ω	max	min	Pass 7.5 $V_{O(DOM)}$
12	Differential voltage on normal bus load, dominant output (V_{Dfiff})	Table 2	+1,5	+3,0	V	R_L = 50 Ω … 65 Ω	max	min	Pass 7.5 $V_{OD(DOM)}$
13	Differential voltage on effective resistance during arbitration, dominant output (V_{Diff})	Table 2	+1,5	+5,0	V	R_L = 2240 Ω	max	min	Pass 7.5 $V_{OD(DOM)}$
14	Differential voltage on extended bus load, dominant output (V_{Diff}) (if supported)	Table 2	+1,4	+3,3	V	R_L = 45 Ω … 70 Ω	max	min	Pass 7.5 $V_{OD(DOM)}$
15	Driver symmetry (V_{SYM}), with a frequency that corresponds to the highest bit rate for which the HS-PMA implementation is intended, however, at most 1 MHz (2 MBit/s)	Table 3	+0,9	+1,1	-/-	R_L = 60 Ω; C_1 = 4,7 nF	max	min	Pass 7.5 V_{SYM}
16	Absolute current on CAN_H (I_{CAN_H}), Maximum driver output current	Table 4	-/-	+115	mA	-3,0 V ≤ V_{CAN_H} ≤ +18,0 V See also ISO 11898-2:2016, Table 4.	max	-/-	Pass 7.5 $I_{OS(SS\_DOM)}$

No.	Parameter	Reference to ISO 11898-2:2016	Limits			Conditions[d] [d] Parameters within the conditions are aligned with Figure 4 p for test.	Conformance test is passed if value		
			Min	Max	Unit		≤	≥	Rating
17	Absolute current on CAN_L (I_{CAN_L}), Maximum driver output current	Table 4	-/-	+115	mA	-3,0 V ≤ V_{CAN_L} ≤ +18,0 V See also ISO 11898-2:2016, Table 4.	max	-/-	Pass 7.5 $I_{OS(SS\_DOM)}$
18	Transmit dominant time out (t_{dom}), (if supported) *b) The minimum value of 0,3 ms is accepted for legacy implementations.*	Table 7	+0,8[b]	+10,0	ms	-/-	max	min	Pass 7.6 t_{DOM}
19	Receiver recessive state differential input voltage range, bus biasing active (V_{Diff})	Table 8	-3,0	+0,5	V	-12,0 V ≤ V_{CAN_L} ≤ +12,0 V -12,0 V ≤ V_{CAN_H} ≤ +12,0 V	min	max	Pass 7.5 V_{DIFF_R}
20	Receiver dominant state differential input voltage range, bus biasing active (V_{Diff})	Table 8	+0,9	+8,0	V	-12,0 V ≤ V_{CAN_L} ≤ +12,0 V -12,0 V ≤ V_{CAN_H} ≤ +12,0 V	min	Max	Pass 7.5 V_{DTFF_D}
21	Receiver recessive state differential input voltage range, bus biasing inactive (V_{Diff}), (if supported)	Table 9	-3,0	+0,4	V	-12,0 V ≤ V_{CAN_L} ≤ +12,0 V -12,0 V ≤ V_{CAN_H} ≤ +12,0 V	min	Max	Pass 7.5 $V_{DIFF\_R(STB)}$
22	Receiver dominant state differential input voltage range, bus biasing inactive (V_{Diff}), (if supported)	Table 9	+1,15	+8,0	V	-12,0 V ≤ V_{CAN_L} ≤ +12,0 V -12,0 V ≤ V_{CAN_H} ≤ +12,0 V	min	max	Pass 7.5 $V_{DTFF\_D(STB)}$
23	Differential internal resistance, receiver input resistance (R_{Diff})	Table 10	12	100	kΩ	-2,0 V ≤ V_{CAN_H} ≤ +7,0 V -2,0 V ≤ V_{CAN_L} ≤ +7,0 V	max	min	Pass 7.5 R_{DIFF}
24	Single ended internal resistance, receiver input resistance (R_{CAN_H}, R_{CAN_L})	Table 10	6	50	kΩ	-2,0 V ≤ V_{CAN_H} ≤ +7,0 V -2,0 V ≤ V_{CAN_L} ≤ +7,0 V	max	min	Pass 7.5 R_{IN}
25	Matching of receiver internal resistance (m_R)	Table 11	-0,03	+0,03	-/-	V_{CAN_H} = +5,0 V V_{CAN_L} = +5,0 V	max	min	Pass 7.5 $R_{DIFF(M)}$
26	Loop delay (t_{Loop})	Table 12	-/-	255	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	-/-	Pass 7.6 t_{loop1}, t_{loop2}

No.	Parameter	Reference to ISO 11898-2:2016	Limits			Conditions[d]	Conformance test is passed if value		
			Min	Max	Unit	[d] Parameters within the conditions are aligned with Figure 4 p for test.	≤	≥	Rating
27	Transmitted recessive bit width @ 2 Mbit/s ($t_{Bit(Bus)}$), (if supported)	Table 13	435	530	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 $t_{bit(bus)}$
28	Received recessive bit width @ 2 Mbit/s ($t_{Bit(RXD)}$), (if supported)	Table 13	400	550	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 $t_{bit(rxd)}$
29	Receiver timing symmetry @ 2 Mbit/s (Δt_{Rec}), (if supported)	Table 13	-65	+40	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 t_{rec}
30	Transmitted recessive bit width @ 5 Mbit/s ($t_{Bit(Bus)}$), (if supported)	Table 14	155	210	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 $t_{bit(bus)}$
31	Received recessive bit width @ 5 Mbit/s ($t_{Bit(RXD)}$), (if supported)	Table 14	120	220	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 $t_{bit(rxd)}$
32	Receiver timing symmetry @ 5 Mbit/s (Δt_{Rec}), (if supported)	Table 14	-45	+15	ns	R_L = 60 Ω, C_2 = 100 pF, C_{RXD} = 15 pF	max	min	Pass 7.6 t_{rec}
33	Leakage current on CAN_H, CAN_L (I_{CAN_H}, I_{CAN_L}), maximum leakage currents, unpowered	Table 16	-10	+10	µA	V_{CAN_H} = 5 V, V_{CAN_L} = 5 V, All supply inputs connected to GND.	max	min	Pass 7.5 I_{LKG}
34	CAN activity filter time, long (t_{Filter}), (if supported)	Table 20	0,5	5,0	µs	-/-	max	min	Pass 7.6 T_{wk_FILTER}
35	CAN activity filter time, short (t_{Filter}), (if supported)	Table 20	0,15	1,8	µs	-/-	max	min	Pass 7.6 T_{wk_FILTER}
36	Wake-up timeout (t_{Wake}), (if supported) *c) For legacy implementations a minimum value of 350 µs is acceptable.*	Table 20	800,0[c]	10000,0	µs	-/-	max	min	Pass 7.6 $T_{WK\_TIMEOUT}$ *legacy implementation*

No.	Parameter	Reference to ISO 11898-2:2016	Limits			Conditions[d]	Conformance test is passed if value		
			Min	Max	Unit	[d] Parameters within the conditions are aligned with Figure 4 p for test.	≤	≥	Rating
37	Timeout for bus inactivity (t_{Silece})	Table 20	$0,6*10^6$	$1,2*10^6$	µs	-/-	max	min	n/a
38	Bus Bias reaction time (t_{Bais})	Table 20	-/-	250,0	µs	-/-	max	-/-	n/a
39	Number of recessive bits before a new SOF shall be accepted (n_{Bits_idle}) (if supported)	Table 18	6	10	-/-	-/-	max	min	n/a
40	CAN FD data phase glitch filter (slow) ($pGlitch_{Slow}$) (if supported)	Table 19	5,00	17,50	% of arbit-ration bit time	-/-	min	max	n/a
41	CAN FD data phase glitch filter (fast) ($pGlitch_{Fast}$) (if supported)	Table 19	2,50	8,75	% of arbit-ration bit time	-/-	min	max	n/a

5.2 Dynamic Tests (CAN IOPT v02)

Following test case numeration relates on the corresponding test specification.

IOPT 5.4 –Tests in Homogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus for “5 Mbit/s Devices”

No.	Tests in Homogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus	Result	Comment
5.4.1	**Test Flow 1** Op. mode variation after recovery at normal mode, failure application on startup		*Performed in 8-node-network with 5 Mbit/s*
5.4.1.1.x	GND Shift = 0V	n/a	
5.4.1.2.x	GND Shift = +1V	n/a	
5.4.1.3.x	GND Shift = -1V	n/a	
5.4.2	**Test Flow 2** Op. mode variation after recovery at normal mode, failure application in normal mode		4224 Test cases
5.4.2.1.x	GND Shift = 0V	E/Pass	
5.4.2.2.x	GND Shift = +1V	E/Pass	
5.4.2.3.x	GND Shift = -1V	E/Pass	
5.4.3	**Test Flow 3** Op. mode variation before recovery at normal Mode, failure application in normal mode		4224 test cases
5.4.3.1.x	GND Shift = 0V	E/Pass	
5.4.3.2.x	GND Shift = +1V	E/Pass	
5.4.3.3.x	GND Shift = -1V	E/Pass	
5.4.4	**Test Flow 4** Op. mode variation with failure before recovery at normal mode, failure application on startup		264 Test cases
5.4.4.1.x	GND Shift = 0V	E/Pass	
5.4.4.2.x	GND Shift = +1V	E/Pass	
5.4.4.3.x	GND Shift = -1V	E/Pass	

No.	Tests in Homogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus	Result	Comment
5.4.5	**Test Flow 5** Op. mode variation with failure before recovery at low-power mode, failure application in normal mode		4224 Test cases
5.4.5.1.x	GND Shift = 0V	E/Pass	
5.4.5.2.x	GND Shift = +1V	E/Pass	
5.4.5.3.x	GND Shift = -1V	E/Pass	
5.4.6	**Test Flow 6** Op. mode variation with failure before recovery at low-power mode, failure application in low-power mode		4224 Test cases
5.4.6.1.x	GND Shift = 0V	E/Pass	
5.4.6.2.x	GND Shift = +1V	E/Pass	
5.4.6.3.x	GND Shift = -1V	E/Pass	
5.4.7	**Test Flow 7** Op. mode variation with failure before recovery at normal mode, failure application in low-power mode		264 Test cases
5.4.7.1.x	GND Shift = 0V	E/Pass	
5.4.7.2.x	GND Shift = +1V	E/Pass	
5.4.7.3.x	GND Shift = -1V	E/Pass	

Signs and symbols

E executed

IOPT 5.4 –Tests in Homogeneous Network with 8 Nodes – 5 Mbit/s with wake-up via bus

No.	Tests in Homogeneous Network with 8 Nodes – 5 Mbit/s with wake-up via bus	Result	Comment
5.4.1	**Test Flow 1** Op. mode variation after recovery at normal mode, failure application on startup		1088 Test cases
5.4.1.1.x	GND Shift = 0V	E/Pass	
5.4.1.2.x	GND Shift = +1V	E/Pass	
5.4.1.3.x	GND Shift = -1V	E/Pass	

Signs and symbols

E executed

IOPT 6.4 –Tests in Heterogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus for “5 Mbit/s Devices”

No.	Tests in Heterogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus – Mix of 6*: 2xA / 3xB / 2xC / 2xD / 3xE / 4xIUT	Result	Comment
6.4.1	**Test Flow 1** Op. mode variation after recovery at normal mode, failure application on startup		*Performed in 8-node-network with 5 Mbit/s*
6.4.1.1.x	GND Shift = 0V	n/a	
6.4.1.2.x	GND Shift = +1V	n/a	
6.4.1.3.x	GND Shift = -1V	n/a	
6.4.2	**Test Flow 2** Op. mode variation after recovery at normal mode, failure application in normal mode		4224 Test cases
6.4.2.1.x	GND Shift = 0V	E/Pass	
6.4.2.2.x	GND Shift = +1V	E/Pass	
6.4.2.3.x	GND Shift = -1V	E/Pass	
6.4.3	**Test Flow 3** Op. mode variation before recovery at normal Mode, failure application in normal mode		4224 Test cases
6.4.3.1.x	GND Shift = 0V	E/Pass	
6.4.3.2.x	GND Shift = +1V	E/Pass	
6.4.3.3.x	GND Shift = -1V	E/Pass	
6.4.4	**Test Flow 4** Op. mode variation with failure before recovery at normal mode, failure application on startup		264 Test cases
6.4.4.1.x	GND Shift = 0V	E/Pass	
6.4.4.2.x	GND Shift = +1V	E/Pass	
6.4.4.3.x	GND Shift = -1V	E/Pass	

No.	Tests in Heterogeneous Network with 16 Nodes – 2 Mbit/s with wake-up via bus – Mix of 6*: 2xA / 3xB / 2xC / 2xD / 3xE / 4xIUT	Result	Comment
6.4.5	**Test Flow 5** Op. mode variation with failure before recovery at low-power mode, failure application in normal mode		4224 Test cases
6.4.5.1.x	GND Shift = 0V	E/Pass	
6.4.5.2.x	GND Shift = +1V	E/Pass	
6.4.5.3.x	GND Shift = -1V	E/Pass	
6.4.6	**Test Flow 6** Op. mode variation with failure before recovery at low-power mode, failure application in low-power mode		4224 Test cases
6.4.6.1.x	GND Shift = 0V	E/Pass	
6.4.6.2.x	GND Shift = +1V	E/Pass	
6.4.6.3.x	GND Shift = -1V	E/Pass	
6.4.7	**Test Flow 7** Op. mode variation with failure before recovery at normal mode, failure application in low-power mode		264 Test cases
6.4.7.1.x	GND Shift = 0V	E/Pass	
6.4.7.2.x	GND Shift = +1V	E/Pass	
6.4.7.3.x	GND Shift = -1V	E/Pass	

Signs and symbols

E executed

Abbreviations to identify components:

- 2 x A TJA1044GT
- 3 x B TJA1043T
- 2 x C TLE9252
- 2 x D TLE9255WSK
- 3 x E TLE9251
- 4 x IUT Implementation Under Test

Positions of the reference devices in 500 kbit/s and 2 Mbit/s reference environments:

Node:	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16
TRX:	B	A	IUT	C	E	D	IUT	B	E	A	IUT	B	C	D	IUT	E

IOPT 6.4 –Tests in Heterogeneous Network with 8 Nodes – 5 Mbit/s with wake-up via bus

No.	Tests in Heterogeneous Network with 8 Nodes – 5 Mbit/s with wake-up via bus – Mix of 5*: 1xA / 2xB / 1xC / 2xD / 2xIUT	Result	Comment
6.4.1	**Test Flow 1** Op. mode variation after recovery at normal mode, failure application on startup		1088 Test cases
6.4.1.1.x	GND Shift = 0V	E/Pass	
6.4.1.2.x	GND Shift = +1V	E/Pass	
6.4.1.3.x	GND Shift = -1V	E/Pass	

Signs and symbols

E executed

Abbreviations to identify components:

- 1 x A TJA1044GT
- 2 x B TJA1043T
- 1 x C TLE9252
- 2 x D TLE9251
- 2 x IUT Implementation Under Test

Positions of the reference devices in 5 Mbit/s reference environments:

Node:	#1	#2	#3	#4	#5	#6	#7	#8
TRX:	A	B	IUT	C	B	D	IUT	D