STD-502-R / STD-503 Evaluation board
TB-STD503

Operation guide
Version 1.0 (Jan. 2015)

- This product requires the electrical and radio knowledge for setup and operation.
- To ensure proper and safe operation, please read this operation manual thoroughly prior to use.
- Please keep this manual.

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Contents

The TB-STD503 is an evaluation board for users of the STD-502-R and/or the STD-503 to evaluate the communication distance and quality in their actual environments.

1. Features

- Switching signal transmission test using the 4 transmit buttons and 4 receive LEDs to check communication links
  - One-way transmission
  - One-way transmission with ACK (LED)
  - Two-way communication
- Packet transmission test to evaluate the operation distance
  - One-way packet test
  - Two-way packet test (using ACK)
- Switching signal transmission test with channel stepping operation
- User direct access test where the user can directly access the terminals of the STD-502-R/STD-503.
- Switching signal transmission test using the external I/O port

2. Part names and functions

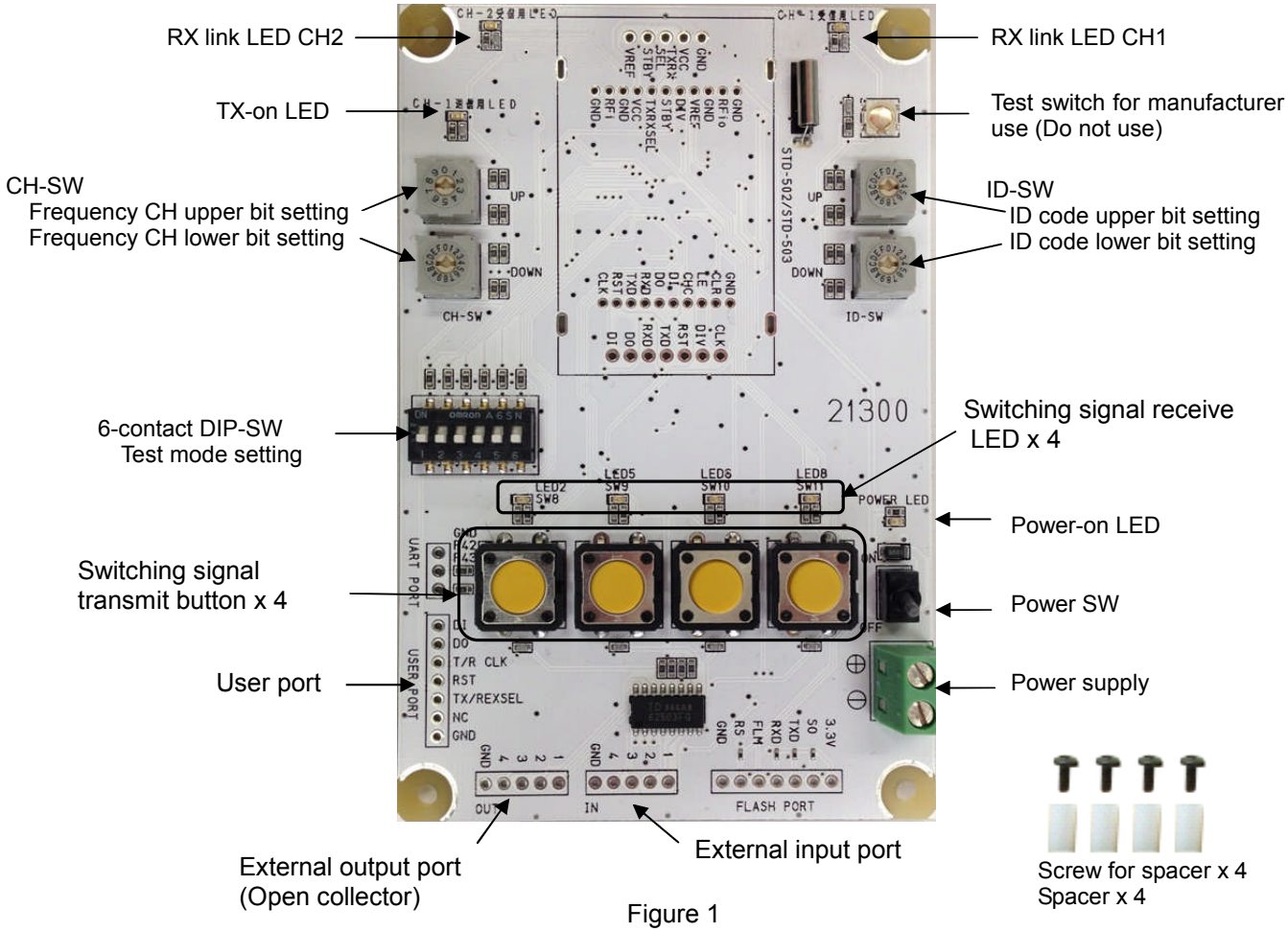


Figure 1

3. Circuit diagram

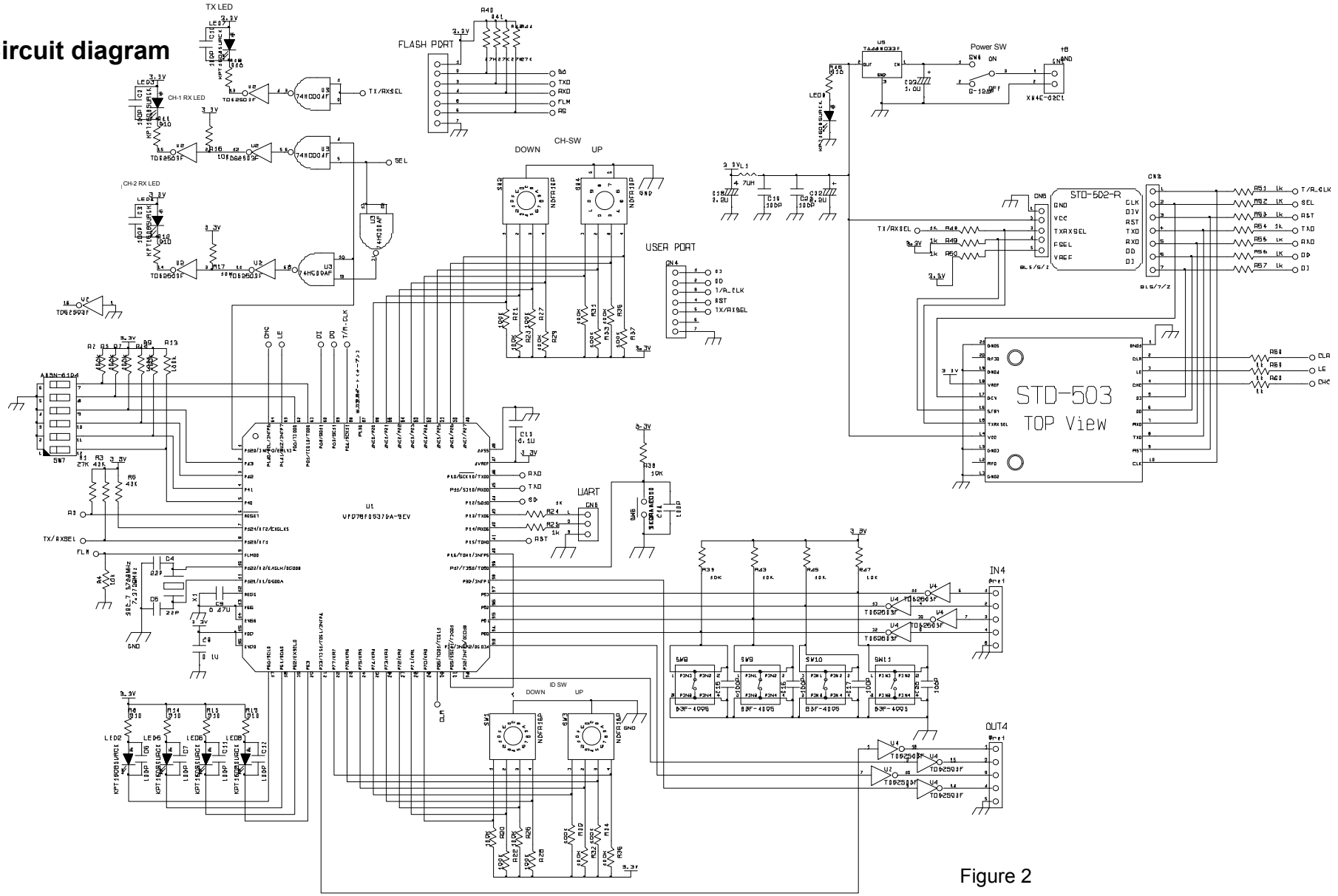


Figure 2

4. Operation range

Item	Min.	Typ.	Max.	Unit
Supply voltage	4.3	-	14	V
Supply current (TB-STD503 only)	-	8	-	mA
Supply current (TB-STD503 + STD-502-R)	-	75	-	mA
Supply current (TB-STD503 + STD-503)	-	65	-	mA
External input port voltage (Output on)	2.4	-	14	V
External input port voltage (Output off)	0		0.4	V
External output port voltage (Open collector)	2.4	-	14	V
External output port current (Open collector)	-	-	80	mA
User port input voltage (High-level) *1	2.2	-	3.3	V
User port input voltage (Low-level) *1	0	-	1.1	V

Table 1

*1: Use a totem-pole output for the user port. Open-collector/drain outputs should not be used.

5. Notice on the usage of the TB-STD503

The TB-STD503 is intended to be used for communication range tests of the STD-502-R/STD-503.
Do not use by installing in user's remote control equipment.

6. How to set up

Set the STD-502-R / STD-503 on the TB-STD503 as shown in Figure 3 and apply 4.3 V to 14 V to the power supply terminal. Make sure to set the test mode before turning the power switch on.
For details of the test mode, refer to the explanation of each mode.

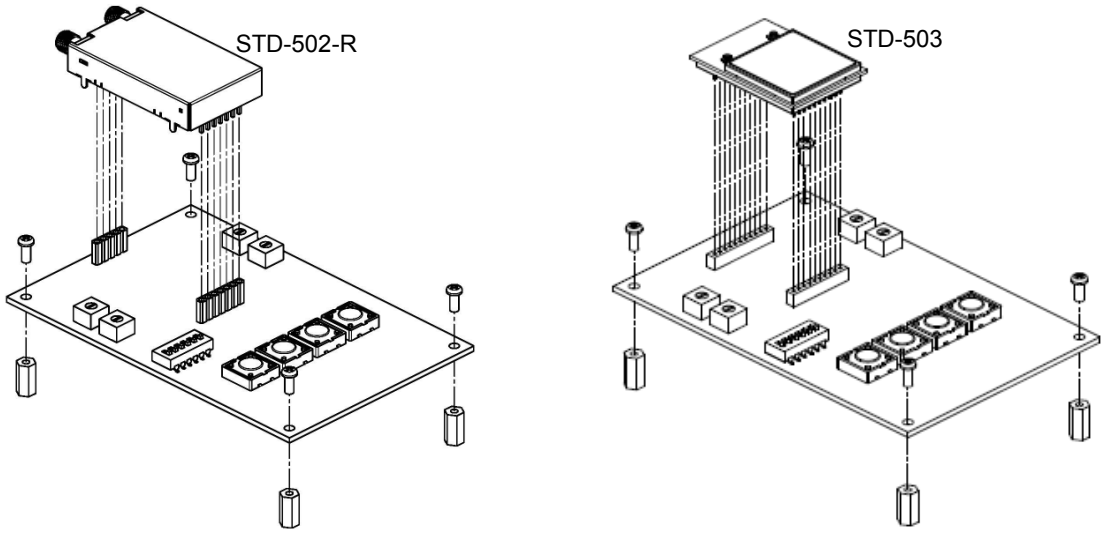


Figure 3

7. Frequency setting

The operation frequency can be set with the CH-SW as shown in Table 2.

CH No.	CH-SW		Frequency [MHz]	CH No.	CH-SW		Frequency[MHz]
	UP	Down			UP	Down	
0	0	0	2402.5	39	2	7	2441.5
1	0	1	2403.5	40	2	8	2442.5
2	0	2	2404.5	41	2	9	2443.5
3	0	3	2405.5	42	2	A	2444.5
4	0	4	2406.5	43	2	B	2445.5
5	0	5	2407.5	44	2	C	2446.5
6	0	6	2408.5	45	2	D	2447.5
7	0	7	2409.5	46	2	E	2448.5
8	0	8	2410.5	47	2	F	2449.5
9	0	9	2411.5	48	3	0	2450.5
10	0	A	2412.5	49	3	1	2451.5
11	0	B	2413.5	50	3	2	2452.5
12	0	C	2414.5	51	3	3	2453.5
13	0	D	2415.5	52	3	4	2454.5
14	0	E	2416.5	53	3	5	2455.5
15	0	F	2417.5	54	3	6	2456.5
16	1	0	2418.5	55	3	7	2457.5
17	1	1	2419.5	56	3	8	2458.5
18	1	2	2420.5	57	3	9	2459.5
19	1	3	2421.5	58	3	A	2460.5
20	1	4	2422.5	59	3	B	2461.5
21	1	5	2423.5	60	3	C	2462.5
22	1	6	2424.5	61	3	D	2463.5
23	1	7	2425.5	62	3	E	2464.5
24	1	8	2426.5	63	3	F	2465.5
25	1	9	2427.5	64	4	0	2466.5
26	1	A	2428.5	65	4	1	2467.5
27	1	B	2429.5	66	4	2	2468.5
28	1	C	2430.5	67	4	3	2469.5
29	1	D	2431.5	68	4	4	2470.5
30	1	E	2432.5	69	4	5	2471.5
31	1	F	2433.5	70	4	6	2472.5
32	2	0	2434.5	71	4	7	2473.5
33	2	1	2435.5	72	4	8	2474.5
34	2	2	2436.5	73	4	9	2475.5
35	2	3	2437.5	74	4	A	2476.5
36	2	4	2438.5	75	4	B	2477.5
37	2	5	2439.5	76	4	C	2478.5
38	2	6	2440.5				

Table 2

8. Channel stepping pattern

With the TB-STD503, it is possible to perform communication test with channel stepping operation added, in which the TB-STD503 hops over pre-defined 10 channels. The stepping pattern can be set with the CH-SW for lower bit setting as shown in Table 3.

CH-SW (DOWN)	Stepping pattern (10-channel stepping)									
	CH No.	Frequency [MHz]	CH No.	Frequency [MHz]	CH No.	Frequency [MHz]	CH No.	Frequency [MHz]	CH No.	Frequency [MHz]
0	64	2466.5	48	2450.5	26	2428.5	39	2441.5	24	2426.5
	30	2432.5	75	2477.5	56	2458.5	7	2409.5	1	2403.5
1	59	2461.5	49	2451.5	73	2475.5	0	2402.5	70	2472.5
	14	2416.5	50	2452.5	19	2421.5	33	2435.5	74	2476.5
2	66	2468.5	40	2442.5	61	2463.5	23	2425.5	20	2422.5
	15	2417.5	18	2420.5	62	2464.5	11	2413.5	38	2440.5
3	36	2438.5	76	2478.5	52	2454.50	71	2473.5	45	2447.5
	32	2434.5	4	2406.5	13	2415.5	6	2408.5	10	2412.5
4	51	2453.5	69	2471.5	41	2443.5	44	2446.5	43	2445.5
	42	2444.5	12	2414.5	31	2433.5	54	2456.5	53	2455.5
5	29	2431.5	2	2404.5	9	2411.5	3	2405.5	25	2427.5
	63	2465.5	5	2407.5	16	2418.5	35	2437.5	46	2448.5
6	72	2474.5	22	2424.5	34	2436.5	28	2430.5	58	2460.5
	67	2469.5	60	2462.5	27	2429.5	8	2410.5	21	2423.5
7	68	2470.5	37	2439.5	55	2457.5	65	2467.5	17	2419.5
	57	2459.5	47	2449.5	25	2427.5	69	2471.5	29	2431.5
8	16	2418.5	30	2432.5	45	2447.5	42	2444.5	27	2429.5
	19	2421.5	24	2426.5	48	2450.5	2	2404.5	71	2473.5
9	26	2428.5	49	2451.5	51	2453.5	33	2435.5	7	2409.5
	72	2474.5	55	2457.5	57	2459.5	47	2449.5	58	2460.5
A	70	2472.5	9	2411.5	12	2414.5	37	2439.5	15	2417.5
	28	2430.5	56	2458.5	1	2403.5	76	2478.5	3	2405.5
B	18	2420.5	50	2452.5	13	2415.5	75	2477.5	36	2438.5
	61	2463.5	65	2467.5	53	2455.5	15	2417.5	74	2476.5
C	63	2465.5	67	2469.5	64	2466.5	41	2443.5	22	2424.5
	21	2423.5	60	2462.5	40	2442.5	23	2425.5	6	2408.5
D	8	2410.5	34	2436.5	20	2422.5	73	2475.5	4	2406.5
	43	2445.5	14	2416.5	11	2413.5	32	2434.5	35	2437.5
E	5	2407.5	0	2402.5	39	2441.5	54	2456.5	17	2419.5
	62	2464.5	66	2468.5	10	2412.5	59	2461.5	52	2454.5
F	53	2455.5	28	2430.5	26	2428.5	43	2445.5	59	2461.5
	32	2434.5	27	2429.5	54	2456.5	39	2441.5	4	2406.5

Table 3

The channel stepping operation of the TB-STD503 is performed by using the channel stepping function controlled via CHC pin.
For details, refer to the STD-503 Operation Guide.

The STD-502-R does not have the CHC pin. When the STD-502-R is used, the channel stepping operation is performed by using the channel change command.

9. Test mode setting

The user can perform the following evaluation tests using the TB-STD503:

- Switching signal transmission test (see *12.2 Switching signal transmission test*)
- Packet transmission test (see *12.3 Packet transmission test*)
- User direct access test (see *12.4 User direct access test*)
- Switching signal transmission test with channel stepping operation (see *13 Switching signal transmission test with channel stepping operation)*
- Switching signal transmission test using the external port (see *14 Switching signal transmission test using the external port*)

To perform the switching signal transmission test, packet test and user direct access test, set the TB-STD503 used as a master board to each test mode. The test mode can be set with the #1 to 3 pins of the 6-contact DIP switch as shown in Table 4.

CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C Refer to Table 2	ON	OFF	OFF	For setting of the test using the external port	For bit rate setting *Both pins should be set to OFF when STD-503 is used.		Switching signal transmission test – One way transmission mode
	OFF	ON	OFF				Switching signal transmission test – Transmission with ACK mode
	ON	ON	OFF				Switching signal transmission test – Two way master mode
	OFF	OFF	ON				Packet transmission test mode
	ON	OFF	ON				User direct access test (Frame detection function OFF)
	OFF	ON	ON				User direct access test (Frame detection function ON)

Table 4

To perform the switching signal transmission test with channel stepping operation, set the TB-STD503 used as a master board to each test mode. The test mode can be set with the CH-SW and the #1 to 3 pins of the 6-contact DIP switch as shown in Table 5.

CH-SW		DIP-SW						Test mode
Up	Down	1	2	3	4	5	6	
8	0 | F Refer to Table 3	ON	OFF	OFF	For setting of the test using the external port	For bit rate setting *Both pins should be set to OFF when STD-503 is used.		Switching signal transmission test **with channel stepping operation** – One way transmission mode
		OFF	ON	OFF				Switching signal transmission test **with channel stepping operation** – Transmission with ACK mode
		ON	ON	OFF				Switching signal transmission test **with channel stepping operation** – Two way master mode

Table 5

For the switching signal transmission test using the external port, the operation setting can be done with the #4 pin of the 6-contact DIP switch. For more detail, refer to *14. Switching signal transmission test using the external ports.*

10. ID code setting

The ID code can be set from 00 to FF with the ID-SW. A communication link is only established if the master board and slave board have the same ID.

Setting the ID of the master board to 00 enables a broadcasting function where a master board sends data to all slave boards regardless of their ID.
When the ID of the slave board is set to 00, the slave board receives any master IDs.

11. Data bit rate setting (when using STD-502-R)

When the STD-502-R is mounted on the TB-STD503, the data bit rate can be set with the # 5 and 6 pins of the 6-contact DIP switch as shown in Table 6.

DIP-SW						Bit rate
1	2	3	4	5	6	
-	-	-	-	OFF	OFF	9.6 kbps
-	-	-	-	ON	OFF	19.2 kbps

Table 6

* The data rate available with the STD-503 is 19.2 kbps only. When using the STD-503, set both the #5 and #6 pins to OFF.

12. Explanation of each test mode

12.1 Set as slave board

CH-SW	DIP-SW						Slave board setting
	1	2	3	4	5	6	
00 | 4C	OFF	OFF	OFF	-	-	-	

Table 7

Set the TB-STD503 as the slave board for the switching signal transmission test and packet test.

Before turning on the power SW of the board, match the frequency channel and ID code with those of the master board.
When a link is established, the CH1 link LED or CH2 link LED is turned on. At the same time, the receive LED(s) corresponding to the transmit button(s) pressed on the master board lights up.
The receiving output retains the latest valid state for approx. 300 ms when reception errors occur.

Note: The CH1/CH2 link LED uses the DIV signal from the STD-502-R/STD-503. The DIV signal shows which antenna is used in diversity reception and switches Bit by Bit according to the received signal. However, with the TB-STD503, the CH1/CH2 link LED lights up on frame basis. This means the CH1/CH2 link LED may not precisely reflect the DIV signal. Please use the CH1/CH2 link LED only as a rough guide.

12.2 Switching signal transmission test

a) One-way transmission mode

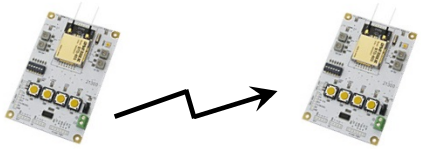
CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C	ON	OFF	OFF	-	-	-	Switching signal transmission test One-way transmission mode

Table 8

This mode is used when performing the switching signal transmission test in one-way communication.

Set the TB-STD503 used as a master board to the one-way transmission mode (Table 8) and set the opposite board as the slave board (Table 7).

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board.



Master board
One-way transmission mode

Slave board

When a link is established, the receive LED(s) on the slave board corresponding to the transmit button(s) pressed on the master board lights up.
The switching signal data is updated every 6 ms (19200 bps) or 12 ms (9600 bps).

b) Transmission with ACK mode

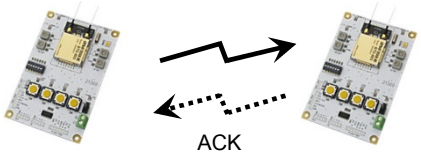
CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C	OFF	ON	OFF	-	-	-	Switching signal transmission test Transmission with ACK mode

Table 9

This mode is used when performing the switching signal transmission test using an ACK.

Set the TB-STD503 used as the master board to the transmission with ACK mode (Table 9) and the opposite board as the slave board (Table 7).

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board.



Master board
Transmission with ACK mode

Slave board

When a link is established, the receive LED(s) on the slave board corresponding to the transmit button(s) pressed on the master board lights up. Then the slave board sends the same switching data back to the master board and the corresponding LED(s) on the master board is turned on.

The switching signal data is updated every 26 ms (19200 bps) or 40 ms (9600 bps).

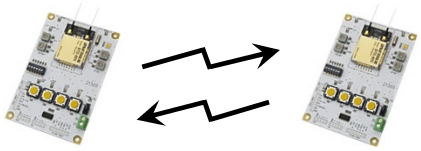
c) Two-way master mode

CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C	ON	ON	OFF	-	-	-	Switching signal transmission test Two-way master mode

Table 10

This mode is used when performing the switching signal transmission test in two-way communication.

Set the TB-STD503 used as a master board to the two-way master mode (Table 10) and the opposite board as the slave board (Table 7).



Master board
Two-way master mode

Slave board

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board. The switching signal transmission is possible from both boards.

When a link is established, the receive LED(s) on one board corresponding to the transmit button(s) pressed on the other board lights up.

The switching signal data is updated every 26 ms (19200 bps) or 40 ms (9600 bps).

12.3 Packet transmission test

To perform the packet transmission test, set the TB-STD503 used as a master board to the packet transmission mode as shown in the Table 11. The opposite board should be set as the slave board (Table 7).

CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C	OFF	OFF	ON	-	-	-	Packet transmission test mode

There are two packet test modes: One-way transmission and Two-way transmission with ACK. These can be started by pressing the transmission button on the master board (See Figure 4).

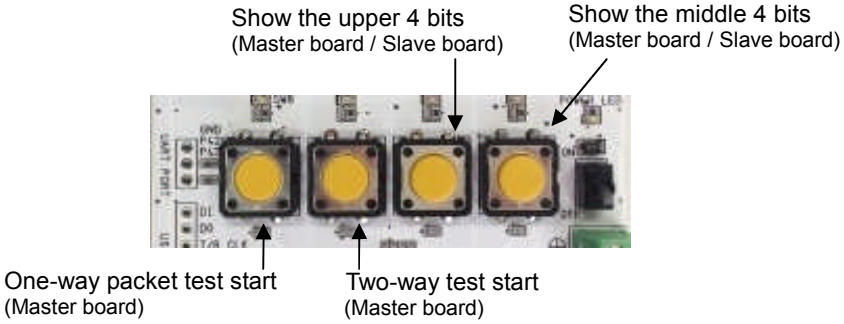


Figure 4: Function of each transmit button in packet transmission test

The packet data length and the number of packets can be set with the ID-SW as shown in the table 12 and 13.

Packet data length (bytes)	ID-SW (lower bit)
10	1
20	2
30	3
50	4
100	5
200	6

Table 12

Number of packets	ID-SW (upper bit)
100	1
200	2
300	3
500	4
1000	5
1	6
10	7

Table 13

a) One-way packet transmission test

The master board sends information about the set number of packets to the slave board multiple times and then sends the packet data as many times equal to the set number of packets.

On the master board, set the packet data length and the number of packets using the ID-SW (Table 12 and 13). The ID-SW on the slave board can be set to any values.

After setting the same frequency channel to the master and slave boards, turn on the power SW of the both boards.

By pressing the one-way packet test start button on the master board (see Figure 4) , a one-way packet test starts and the receive LEDs on the master and slave boards blink.
When the LEDs stop blinking, the packet test finishes.

The number of error packets is shown in 12-bit binary form using the LEDs on the slave board. When the packet test finishes, the lower 4 bits are shown on the LED with the lowest bit on the rightmost LED. The LED on and off represent the binary digits 1 and 0, respectively.

In the same way, the middle 4 bits and upper 4 bits are shown by pressing the transmit buttons as instructed in Figure 4. All-LED off means no packet error.

The data for the number of packet error is retained until the packet test start button is pressed again on the master board and communication is re-established.

b) Two-way packet transmission test

The master board sends the packet data to the slave board and the slave board returns an ACK to the master board. The data is repeatedly sent equal to the number of times set for the number of packets.

On the master board, set the packet data length and the number of packets using the ID-SW (Table 12 and 13). The ID-SW on the slave board can be set to any values.

After setting the same frequency channel for the master and the slave boards, turn on the power SW of the both boards.

By pressing the packet test start button on the master board, a packet test starts and the receive LEDs on the master and slave boards blink. When the LEDs stop blinking, the packet test finishes.

The number of error packets is shown in 12-bit binary form using the LEDs on the master board. When the packet test finishes, the lower 4 bits are shown on the LED with the lowest bit on the rightmost LED. The LED on and off represent the binary digits 1 and 0, respectively.

In the same way, the middle 4 bits and upper 4 bits are shown by pressing the buttons as instructed in Figure 4. All-LED off means no packet error.

The data for the number of packet errors is retained until the two-way packet test start button is pressed a

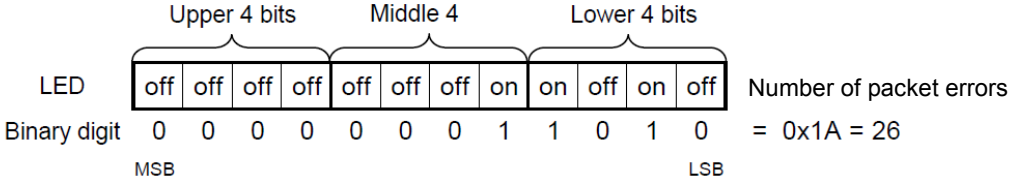


Figure 5: Example of how the number of error packets is shown

12.4 User direct access test

CH-SW	DIP-SW						Test mode
	1	2	3	4	5	6	
00 | 4C	ON	OFF	ON	-	-	-	User direct access test mode (Frame detection function OFF)
	OFF	ON	ON	-	-	-	User direct access test mode (Frame detection function ON)

Table 14

In this mode, the user can directly access the terminals of the STD-502-R/STD-503 mounted on the TB-STD503. The accessible terminals are shown in Table 15. Frequency channel and frame detection should be set on the TB-STD503.

There is no overvoltage protection in the internal circuit of the TB-STD503 which is connected to each terminal of the user port. Please exercise due care when using this port:
* The input signal level should be 3.3V.
* A totem-pole output should be connected to this port. Do not use open collector or open drain output.

STD-502-R / STD-503 signal	Function	Status of the internal CPU ports
DI	Transmission data input	High impedance
DO	Reception data output	High impedance
CLK	Sync clock for TX/RX data	High impedance
RST	Initialization of Frame detection function	High impedance
TXRXSEL	TX/RX switching	High impedance

Table 15

For the detail of the signals used on the STD-502-R/STD-503, refer to the Operation Guide of each module.

13. Transmission test with channel stepping operation

13.1 Setting of slave board for the switching signal transmission test with channel stepping operation

CH-SW		DIP-SW						
Up	Down	1	2	3	4	5	6	Switching signal transmission test with channel stepping operation Slave board setting
8	0 | F	OFF	OFF	OFF	-	-	-	

Table 16

Set the TB-STD503 as the slave board for the switching signal transmission test with channel stepping operation.

Before turning on the power SW of the board, match the frequency channel and ID code with those of the master board.
When a link is established, the CH1 link LED or CH2 link LED is turned on. At the same time, the receive LED(s) corresponding to the transmit button(s) pressed on the master board lights up.
The receiving output retains the latest valid state for approx. 300 ms when reception errors occur.

Note: The CH1/CH2 link LED uses the DIV signal from the STD-502-R/STD-503. The DIV signal shows which antenna is used in diversity reception and switches Bit by Bit according to the received signal. However, with the TB-STD503, the CH1/CH2 link LED lights up on frame basis. This means the CH1/CH2 link LED may not precisely reflect the DIV signal. Please use the CH1/CH2 link LED only as a rough guide.

13.2 Switching signal transmission test with channel stepping operation

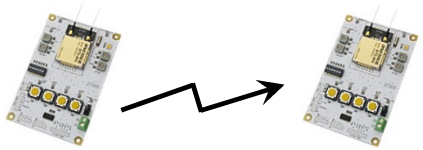
a) One-way transmission mode

CH-SW		DIP-SW						Test mode
Up	Down	1	2	3	4	5	6	
8	0 | F	ON	OFF	OFF	-	-	-	Switching signal transmission test with channel stepping operation One-way transmission mode

Table 17

This mode is used when performing the switching signal transmission test with channel stepping operation in one-way communication.

Set the TB-STD503 used as a master board to the one-way transmission mode (Table 17) and set the opposite board as the slave board (Table 16).



Master board
One-way transmission mode

Slave board

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board.

When a link is established, the receive LED(s) on the slave board corresponding to the transmit button(s) pressed on the master board lights up.
The switching signal data is updated every 6 ms (19200 bps) or 12 ms (9600 bps).

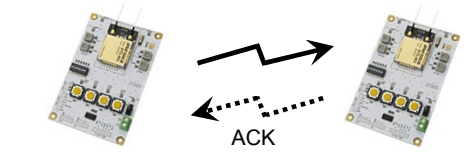
b) Transmission with ACK mode

CH-SW		DIP-SW						Test mode
Up	Down	1	2	3	4	5	6	
8	0 | F	OFF	ON	OFF	-	-	-	Switching signal transmission test with channel stepping operation Transmission with ACK mode

Table 18

This mode is used when performing the switching signal transmission test with channel stepping operation using an ACK.

Set the TB-STD503 used as a master board to the transmission with ACK mode (Table 18) and the opposite board as the slave board (Table 16).



Master board
Transmission with ACK mode

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board.

When a link is established, the receive LED(s) on the slave board corresponding to the transmit button(s) pressed on the master board lights up. Then the slave board sends the same switching data back to the master board and the corresponding LED(s) on the master board is turned on.

The switching signal data is updated every 26 ms (19200 bps) or 40 ms (9600 bps).

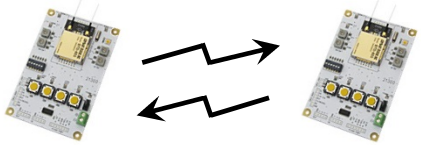
c) Two-way master mode

CH-SW		DIP-SW						Test mode
Up	Down	1	2	3	4	5	6	
8	0 | F	ON	ON	OFF	-	-	-	Switching signal transmission test with channel stepping operation Two-way master mode

Table 19

This mode is used when performing the switching signal transmission test with channel stepping operation in two-way communication.

Set the TB-STD503 used as a master board to the two-way master mode (Table 19) and the opposite board to the slave board (Table 16).



Master board
Two-way master mode

Slave board

Before turning on the power SW of the master board, match the frequency channel and ID code with those of the slave board. The switching signal transmission is possible from the both boards.

When a link is established, the receive LED(s) on one board corresponding to the transmit button(s) pressed on the other board lights up.

The switching signal data is updated every 26 ms (19200 bps) or 40 ms (9600 bps)

14. Switching signal transmission test using the external ports

You can perform a switching signal transmission test using the external ports consisting of 4 inputs and 4 outputs. A connection example is shown in Figure 6.

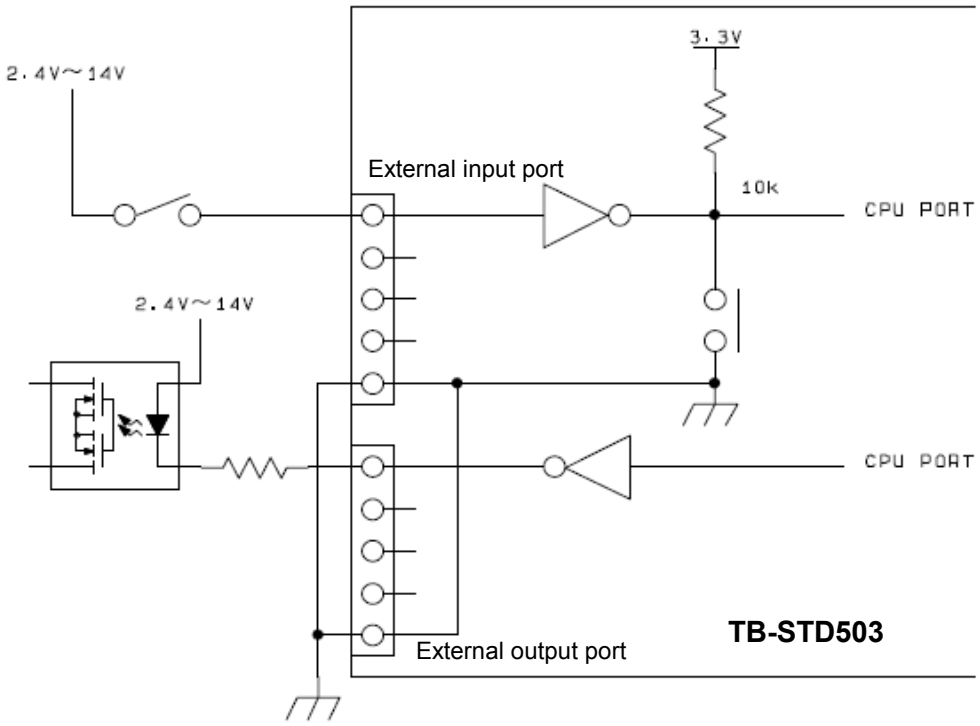


Figure 6

The input signal from the external circuit is connected in parallel with the transmit buttons of the TB-STD503 via an inverter (open collector) and then input into the internal CPU to be transmitted as switching data.

The available operation modes are one-way transmission, transmission with ACK and two-way communication. Also this test can be performed in the one-way transmission mode with channel stepping operation.

For output signal, the switching data output from the internal CPU is output via the inverter (open collector).

The input/output signal level is 2.4 V to 14 V and the output current is maximum 80 mA.

The logic level between the transmission input and the reception output can be set as shown in Table 20.

DIP-SW						Logic level
1	2	3	4	5	6	
-	-	-	OFF	-	-	External input H -> output L
-	-	-	ON			External input H -> output H

Table 20

15. Communication format (Reference information)

Switching signal transmission test - One-way transmission

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	1 byte
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 00	ID code (ID-SW)	SW data 00-0F	Checksum	CRC (CCITT)	Dummy data FF

Switching signal transmission test - Transmission with ACK

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 02	ID code (ID-SW)	SW data 00-0F	Checksum	CRC (CCITT)	Dummy data FFFF

Switching signal transmission test - Two-way master

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 01	ID code (ID-SW)	SW data 00-0F	Checksum	CRC (CCITT)	Dummy data FFFF

Switching signal transmission test - Data returned from the receiver/slave board

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 03	ID code (ID-SW)	SW data 00-0F	Checksum	CRC (CCITT)	Dummy data FFFF

Packet transmission test - Two-way communication

2 bytes	4 bytes	1 byte	1 byte		2 bytes	2 bytes	2 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 04	Packet data length	Packet data 10 - 200 bytes	Checksum	CRC (CCITT)	Dummy data FFFF

Packet transmission test - Code returned from the slave board

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 05	Invalid data	Invalid data	Checksum	CRC (CCITT)	Dummy data FFFF

Packet transmission test - Header code used for one-way transmission (transmission of the number of packets)

2 bytes	4 bytes	1 byte	1 byte	1 byte	2 bytes	2 bytes	3 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 06	Number of packets Lower byte	Number of packets Upper byte	Checksum	CRC (CCITT)	Dummy data FFFFFF

Note: In the one-way communication mode of the packet test, this code is repeatedly sent 30 times and then transmission data is sent as many times equal to number of packets set.

Packet transmission test Transmission data for one-way communication

2 bytes	4 bytes	1 byte	1 byte		2 bytes	2 bytes	3 bytes
Preamble FFFF	Frame detection code 167C6EA1	Operation mode 07	Packet data length	Packet data 10 - 200 bytes	Checksum	CRC (CCITT)	Dummy data FFFFFF

Important notice

- Customers are advised to consult with Circuit Design sales representatives before ordering. Circuit Design believes the provided information is accurate and reliable. However, Circuit Design reserves the right to make changes to this product without notice.
- Circuit Design products are neither designed nor intended for use in life support applications where malfunction can reasonably be expected to result in significant personal injury to the user. Any use of Circuit Design products in such safety-critical applications is understood to be fully at the risk of the customer and the customer must fully indemnify Circuit Design, Inc for any damages resulting from any improper use.
- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.

Cautions

- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with soot or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a great effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The GND for the radio module will also affect communication performance. If possible, ensure that the case GND and the circuit GND are connected to a large GND pattern.

Warnings

- Do not take apart or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.

REVISION HISTORY

Version	Date	Description	Remark
0.9	Dec. 2014	Preliminary	
1.0	Jan. 2015		