

TEST REPORT

Date of Issue : 13 June 2024

The laboratory doesn't take part in the sampling and this test report applies only to the samples tested.

Without the laboratory approval by the documents, this report should not be copied in part.

1.Applicant

Company Name : SHIMANO INC.
Mailing Address : 3-77 Oimatsu-cho, Sakai-ku, Sakai City,
Osaka 590-8577, Japan

2.Identification of Tested Device

Type of Device : Digital Device
Device Name : Shift Switch
Model Number : OT21
Trade Name : SHIMANO
Type of Test : ☐Production ☐Pre-production ☒Prototype

3.Test Items

Antenna Gains

Shimano Inc.
3-77 Oimatsu-cho, Sakai-ku, Sakai City, Osaka, 590-8577, Japan

Test engineer: Takaya Masuda

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1. REVISION HISTORY

Report Version	Page	Revised Content	Reason for Revision	Date of Issue	Status
A	-	Initial issue of report	-	13 June 2024	Original

2. GENERAL INFORMATION

The information provided from the customer is as follows;

-Applicant, Type of EUT, Model Number of EUT on the cover and other relevant pages.

-2.1. : Product Description

*The laboratory is exempted from liability of any test results affected from the above information.

2.1. Product Description

(1) Technical Specifications

OT21

- Operating temperature : -10 °C ~ 50 °C
- Operation voltage : 6.0 V
- Antenna Material : PCB on board
- Antenna Type : Printed monopole antenna
- Antenna Dimension: : 12.7×1.0mm (Length×Width)
- Wireless circuit : Frequency range : 2478 MHz
Output power(max) : 7.23dBm
Modulation : GFSK
Antenna gain : PCB antenna with 1.27 dBi gain

(2) Test Arrangement

Test Arrangement			
<input checked="" type="checkbox"/> Table-top	<input type="checkbox"/> Floor-standing	<input type="checkbox"/> Combinations	<input type="checkbox"/> Other (Install on bicycle)

[Attention]

All above information in this chapter was declared by the applicant.

2.2. Engineering changes to the EUT

■ without changes, □ with changes (details are found inside of this report)

3. TEST SYSTEM

3.1. Test Procedure

- (1) Set the reference antenna which has the known antenna gain in the anechoic chamber at the center of the rotation table in the condition of horizontal or vertical polarization.
See also the block diagram and the photographs of EUT System configuration in this report.
Also, the EUT is placed about 1.5 m high from the vertical reference ground plane.
- (2) Feed the antenna with signal generator at the specific power and receive it with another antenna at the 2 m distance and the same height.
- (3) Rotate the table 360 degrees and get the maximum value of the received power as the reference with the spectrum analyzer (*1).
- (4) Change from the reference antenna to the EUT antenna and measure the received power with the same manner of (1) to (3).
- (5) Calculate the antenna gain using the measured value and the reference value and plot it in the polar chart.

[Note]

(*1) Spectrum Analyzer Set Up Conditions

F	Frequency span	: 300 kHz
r	Resolution bandwidth	: 120 kHz
e	Reference level	: 10 dBm
q	Sweep time	: Auto
u	Detector function	: Normal
e	Number of points	: 101
n		

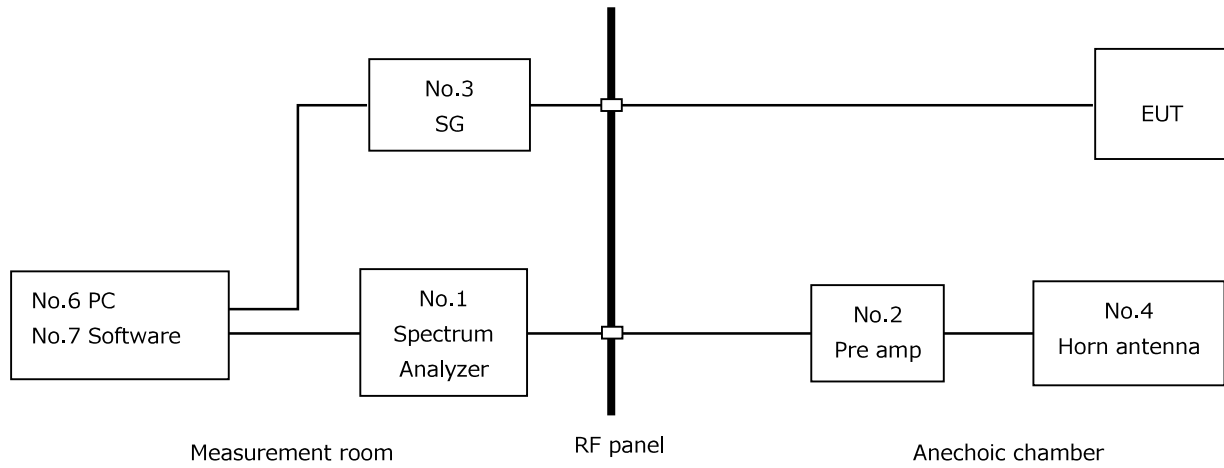
3.2. Test Software List

Software Name	Version	Manufacture
TDK Antenna-Lab	2.3.8299.25404	TDK

3.3. Date of Test

- Receipt of Test Sample : 5 June 2024
- Condition of Test Sample : ☒ Damage is not found on the set.
 ☐ Damage is found on the set. (Details are described in this report)
- Test Completed on : 5 June 2024
- Condition of Test Sample : ☒ Damage is not found on the set.
 ☐ Damage is found on the set. (Details are described in this report)

3.4. Block Diagram of Test System



3.5. Test Location

Shimano Inc. EMC Test Laboratory
 3-77 Oimatsu-cho, Sakai-ku, Sakai City, Osaka, 590-8577, Japan

4. ANTENNA Gain

4.1. Test Results

Measured Frequency (MHz)	Plane	Polarization	Meter Reading (dBm)	Reference Value (dBm)	Reference Antenna Gain (dBi)	EUT Antenna Gain (dBi)
2478	XY	Horizontal	3.68	4.51	2.1	1.27
		Vertical	-4.06	4.46	2.1	-6.42
	YZ	Horizontal	-0.12	4.51	2.1	-2.53
		Vertical	1.97	4.46	2.1	-0.39
	XZ	Horizontal	0.15	4.51	2.1	-2.26
		Vertical	-0.15	4.46	2.1	-2.51

[Note]

(1) The reference value is the maximum value of the reference antenna which is positioned at the same manner with the EUT.

[Calculation Method]

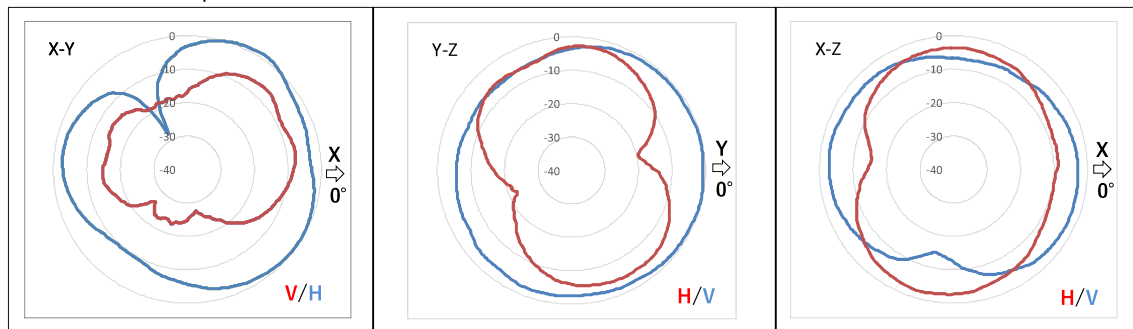
EUT Antenna Gain (dBi)

= *Meter Reading (maximum level of all directions) (dBm) – Reference value (dBm)*
+ *Reference Antenna Gain (dBi)*

For example: at 2478 MHz XY Plane Horizontal value,

$EUT\ Antenna\ Gain\ (dBi) = (3.68)\ (dBm) - (4.51)\ (dBm) + (2.1)\ (dBi) = 1.27$

Test Results in Graph



4.2. Photographs of Test System

Refer to a separate test setup photo.

5. TEST EQUIPMENT

No.	Equipment	Manufacturer	Model No.	Calibration Date
1	Spectrum Analyzer	Keysight Technology	N9010B	June 6, 2023
2	RF Pre-Amplifier (500 MHz ~ 8 GHz)	R&K	LA1020-RS	June 6, 2023
3	Signal Generator	Keysight Technology	N5171B	June 7, 2023
4	Broadband Horn Antenna	TDK	HRN-0118	September 29, 2023
5	Dipole Antenna	Anritsu	MA5612 B4	August 29, 2023
6	Personal Computer (Control measurement)	HP	ELITEDESK 800 G4 TW/CT	N/A
7	Antenna Measurement Software	TDK	TDK Antenna- Lab	N/A

Note : Shimano Inc. EMC Test Laboratory checked the performance, before using this device.

The overall program of calibration and verification of equipment is designed and operated so as to ensure that measurement made by Shimano Inc.

End of Report.