TEST REPORT

Date of Issue: 19th February 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 : Motor Unit
Model Number : 7KX1
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

Yuma Kajishima

Test engineer: Yuma Kajishima

Table of Contents

1. REVISION HISTORY 3

2. GENERAL INFORMATION 4

2.1. Product Description 4
2.2. Engineering changes to the EUT 4

3. TEST SYSTEM 5

3.1. Test Procedure 5
3.2. Test Software List 5
3.3. Date of Test 5
3.4. Block Diagram of Test System 6
3.5. Test Location 6

4. ANTENNA GAIN 7

4.1. Test Results 7
4.2. Photographs of Test System 8

5. TEST EQUIPMENT 8

1. REVISION HISTORY

Report Version	Page	Revised Content	Reason for Revision	Date of Issue	Status
A	-	Initial issue of report	-	19th February 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

Antenna Number		7KX1_W	7KX1_B
Operating Temperature		-10 ℃ ~ 50 ℃	
Operation Voltage		8.3 V, 13.5V	
Antenna Material		PCB on board	
Antenna Type		Printed monopole antenna	
Antenna dimension		1 4	1 2
Wireless Circuit	Frequency Range	2478 MHz	2402 – 2480 MHz
	Output Power	<10 dBm	<4 dBm
	Modulation	GFSK	GFSK
	Antenna Gain	PCB antenna with -0.53 dBi gain	PCB antenna with 0.01 dBi gain

(2) Test Arrangement

Test Arrangement			
■ Table-top	☐ Floor-standing	☐ Combinations	☐ 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 3 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

Frequency range	: 2478±1 MHz (7KX1_W) 2442±1 MHz (7KX1_B)
Frequency span	: 300 kHz
Resolution bandwidth	: 120 kHz
Reference level	: 0 dBm
Sweep time	: Auto
Detector function	: Normal
Number of points	: 101

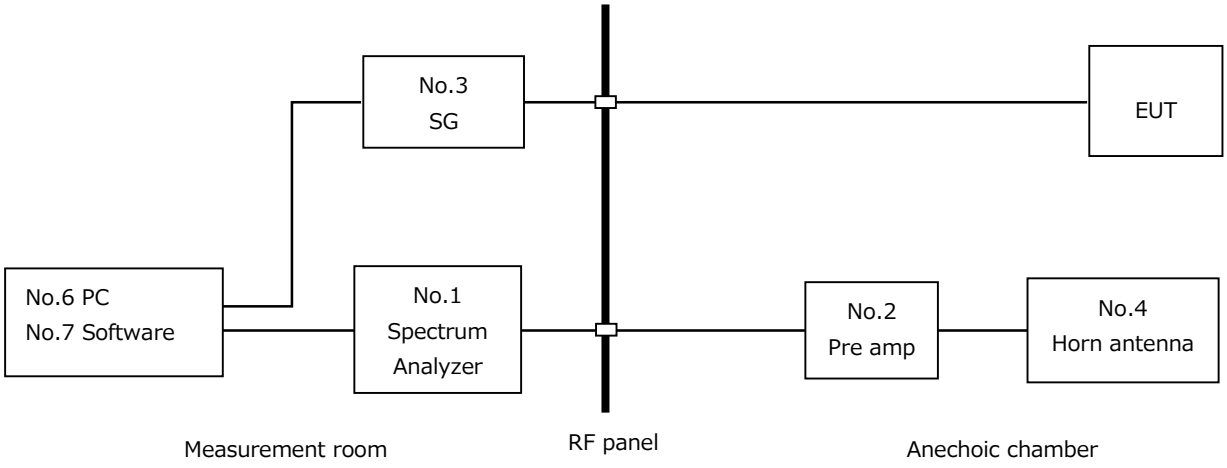
3.2. Test Software List

Software Name	Version	Manufacture
TDK Antenna-Lab	2.3.8299.25404	TDK

3.3. Date of Test

Receipt of Test Sample : 29th January 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 : 29th January 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

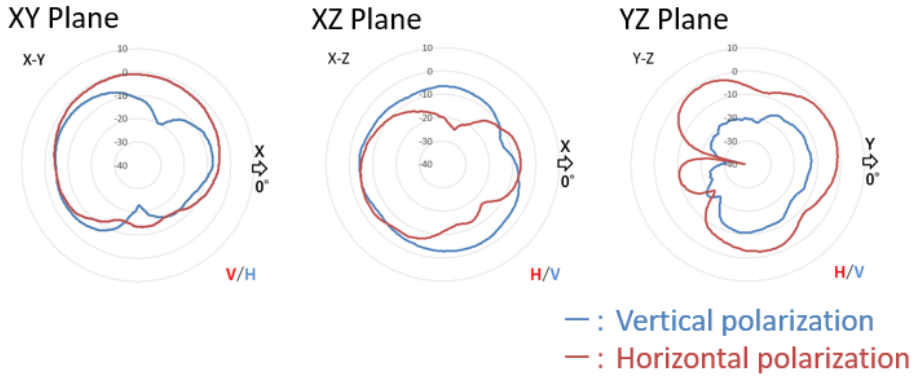
4. ANTENNA GAIN

4.1. Test Results

7KX1_W

Measured Frequency (MHz)	Plane	Polarization	Meter Reading (dBm)	Reference Value (dBm)	Reference Antenna Gain (dBi)	EUT Antenna Gain (dBi)
2478	XY	Horizontal	-3.66	2.14	2.10	-3.70
		Vertical	-0.64	2.27	2.10	-0.68
	XZ	Horizontal	-3.73	2.14	2.10	-3.78
		Vertical	-2.35	2.27	2.10	-2.39
	YZ	Horizontal	-0.49	2.14	2.10	-0.53
		Vertical	-10.66	2.27	2.10	-10.70

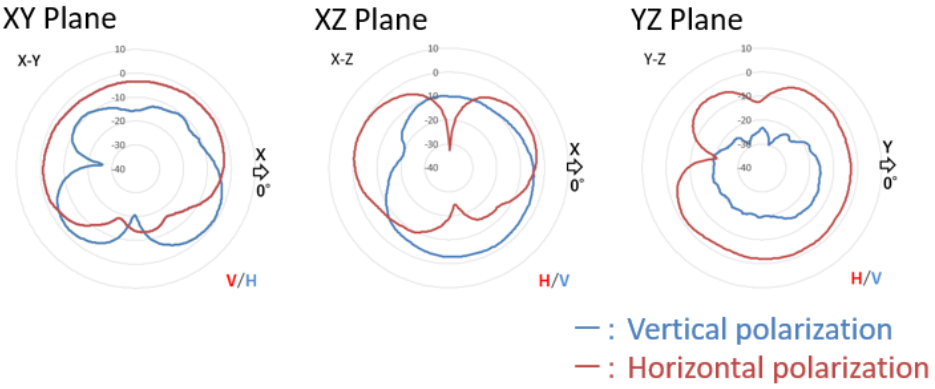
Test Results in Graph



7KX1_B

Measured Frequency (MHz)	Plane	Polarization	Meter Reading (dBm)	Reference Value (dBm)	Reference Antenna Gain (dBi)	EUT Antenna Gain (dBi)
2442	XY	Horizontal	-1.05	1.93	2.10	-0.88
		Vertical	-1.35	2.13	2.10	-1.18
	XZ	Horizontal	-0.17	1.93	2.10	0.01
		Vertical	-2.04	2.13	2.10	-2.06
	YZ	Horizontal	-1.58	1.93	2.10	-1.41
		Vertical	-14.63	2.13	2.10	-14.45

Test Results in Graph



[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) = (-3.66) (dBm) – (2.14) (dBm) + (2.10) (dBi) = -3.70

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 (1 GHz ～ 6 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. EMC Test Laboratory are traceable to the national standards of measurement or equivalent abroad.

End of Report.