RADIO TEST REPORT

Test Report No.: 31FE0078-SH-01-A-R1

Applicant	:	**SUMITOMO PRECISION PRODUCTS CO., LTD.**
Type of Equipment	:	**2.4GHz/10mW TRANSCEIVER MODULE**
Model No.	:	**WM-Z2200**
FCC ID	:	**WWGZ2200**
Test regulation	:	**FCC Part15 Subpart C: 2010**
Test result	:	**Complied**

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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 31FE0078-SH-01-A. 31FE0078-SH-01-A is replaced with this report.

Date of test: June 28 - July 28, 2011

Representative test engineer:

H. Shirasawa

Hikaru Shirasawa
Engineer of WiSE Japan,
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Approved by :

I. Isozaki

Ichiro Isozaki
Leader of WiSE Japan,
UL Verification Service

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

JAB Testing RTL02610

Contents

SECTION 1: Customer information

Company Name	:	SUMITOMO PRECISION PRODUCTS CO., LTD.
Brand or Trade name	:	SPP
Address	:	1-10, Fuso-cho, Amagasaki, Hyogo, 660-0891 Japan
Telephone Number	:	+81-6-6489-8264
Facsimile Number	:	+81-6-6489-5910
Contact Person	:	Junya Tada

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	2.4GHz/10mW TRANSCEIVER MODULE
Model Number	:	WM-Z2200
Serial Number	:	1105500002
Rating	:	DC5V
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	:	March 1, 2011
Modification of EUT	:	No modification by the test lab.

2.2 Product description

Model: WM-Z2200 (referred to as the EUT in this report) is a 2.4GHz/10mW TRANSCEIVER MODULE.

Clock frequency(ies) in the system : 7.3728MHz

Equipment type	:	Transceiver
Frequency of operation	:	2405-2475MHz
Bandwidth & channel spacing	:	5MHz & 5MHz
Type of modulation	:	Offset- QPSK
Antenna type	:	Dipole Antenna
Antenna gain	:	2.0dBi(W1030), 2.1dBi(ANTB18-135A0), 1.8dBi(ANTB18-143A0C0), 1.8dBi(ANTB18-143B0C0), 1.8dBi (ANTB18-152A0) *1)
Antenna connector type	:	I-PEX(U.FL)
ITU code	:	G1D
Operation temperature range	:	-10 to 70 deg.C.

*1) The antennas W1030 and ANTB18-135A0 were tested as representatives. ANTB18-135A0 was selected since it has the highest antenna gain in 4 antennas (ANTB18-**).

FCC Part15.31 (e)
The Sumitomo Precision Products CO., LTD. product provides stable voltage (DC5V) constantly to the EUT regardless of input voltage.
Therefore, the EUT complies with the requirement.

FCC Part15.203
The EUT has a unique coupling/antenna connector (U.FL). Therefore the equipment complies with the requirement of 15.203.

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2010, final revised on December 6, 2010 and effective January 5, 2011

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

The EUT complies with FCC Part 15 Subpart B: 2010 although the test has been performed on the host device. Refer to the test report: 31FE0078-SH-01-B.

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	11.3dB Freq.: 0.31310MHz Phase: N Detection: Average Mode: Tx 11ch 2405MHz and Freq.: 0.30295MHz Phase: N Detection: Average Mode: Tx 18ch 2440MHz (Antenna:ANTB18-135A0)	Complied
6dB bandwidth	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (a)(2) & 15.209	Conducted	N/A	See data	Complied
Maximum peak output power	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (b)(3) & 15.209	Conducted	N/A		Complied
Spurious emission & Restricted band edges	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	3.1dB Freq.: 2549.164 MHz Polarization: Horizontal Detection: Average Mode: Tx 11ch 2405MHz (Antenna:ANTB18-135A0)	Complied
Power density	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (e)	Conducted	N/A	See data	Complied
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422						

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2003 13. Measurement of intentional radiators, RSS-Gen 4.6.1	RSS-Gen 4.6.1	Conducted	-	-
Note: UL Japan's Work Procedures No.13-EM-W0420 and 13-EM-W0422					

* Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC*1/SR*2 (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.0 dB	2.7 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.3 dB	2.7 dB	3.4 dB
	30MHz-300MHz	4.7 dB	4.5 dB	4.7 dB
	300MHz-1GHz	4.5 dB	4.6 dB	4.6 dB
	1GHz-13GHz	3.9 dB	3.9 dB	4.0 dB
Radiated emission (Measurement distance: 1m)	13GHz-18GHz	4.8 dB	4.8 dB	4.8 dB
	18GHz-40GHz	4.4 dB	4.2 dB	4.2 dB

*1: SAC=Semi-Anechoic Chamber
*2: SR= Shielded Room is applied besides radiated emission

Conducted emission test

The data listed in this test report has enough margin, more than site margin.

Radiated emission test

The data listed in this test report has enough margin, more than site margin.

Antenna port conducted test

Power Measurement uncertainty above 1GHz for this test was: (±) 1.3dB
Spurious emission (Conducted), Power density Measurement (below 1GHz) uncertainty for this test was: (±) 1.9dB
Spurious emission (Conducted), Power density Measurement (1G-3GHz) uncertainty for this test was: (±) 2.5dB
Spurious emission (Conducted), Power density Measurement (3G-18GHz) uncertainty for this test was: (±) 3.8dB
Spurious emission (Conducted), Power density Measurement (18G-26.5GHz) uncertainty for this test was: (±) 4.1dB
Bandwidth Measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐ No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 Full-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☒ No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☒ No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

3.6 Test setup, Data of test & Test instruments

Refer to Appendix 1 to 3.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

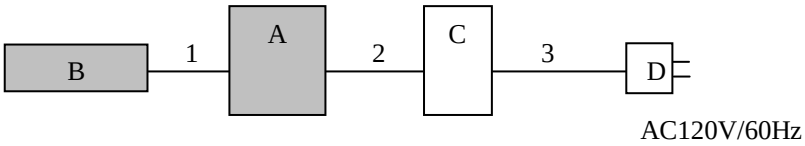
The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test item	Mode	Tested frequency	Power setting *1)	Worst data rate *2)
All items	Transmitting	2405MHz, 2440MHz, 2475MHz	10dBm	250kbps
*1) Software: FCC_HighPowerRF_AllCh_201102.exe *2) The worst condition was determined based on the test result of Maximum Peak Output Power (Middle Channel)				

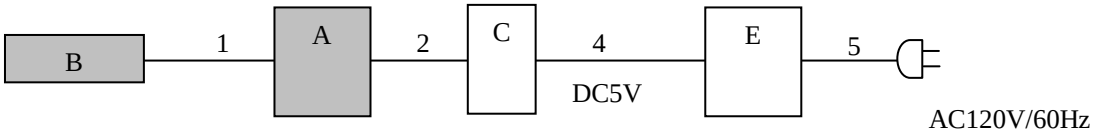
Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals

Conducted emission



Radiated emission



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	2.4GHz/10mW TRANSCEIVER MODULE	WM-Z2200	1105500002	SUMITOMO PRECISION PRODUCTS	EUT
B	Dipole Antenna	W1030, ANTB18-135A0	-	Pulse	EUT
C	Jig	-	-	SUMITOMO PRECISION PRODUCTS	-
D	AC Adapter	APS305-0510	1102-00432	Anthin	-
E	DC Power Supply	PAN35-10A	NA000955	Kikusui	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna	0.06	Unshielded	Unshielded	-
2	Power	0.05	Unshielded	Unshielded	-
3	DC	1.8	Shielded	Unshielded	-
4	DC	2.28	Unshielded	Unshielded	-
5	AC	1.8	Unshielded	Unshielded	-

SECTION 5: Conducted emission

5.1 Operating environment

The test was carried out in No.2 shielded room.

Temperature : Refer to test data (APPENDIX 2)
Humidity : Refer to test data (APPENDIX 2)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and was flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN and excess AC cable was bundled in center.
Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a screened room. The EUT was connected to a Line Impedance Stabilization Network (LISN).
An overview sweep with peak detection has been performed.
The measurements had been performed with a quasi-peak detector and if required, an average detector.
The conducted emission measurements were made with the following detector of the test receiver.

Detector Type : Quasi-Peak/ Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass
Refer to APPENDIX 2

SECTION 6: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure
The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 7: Maximum peak output power

Test procedure
The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 8: Spurious emission (Antenna port conducted)

Test procedure
The spurious emission was measured with a spectrum analyzer connected to the antenna port.
In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.
In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass
Refer to APPENDIX 2

SECTION 9: Radiated emission

9.1 Operating environment

The test was carried out in No.2 Semi-Anechoic Chamber.

Temperature : Refer to test data (APPENDIX 2)
Humidity : Refer to test data (APPENDIX 2)

9.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of EUT, including its peripherals was aligned and flushed with rear of tabletop.
Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
Photographs of the set up are shown in Appendix 1.

9.3 Test conditions

Frequency range : 30MHz to 26.5GHz
EUT position : Table top

9.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 13GHz) / 1m (above 13GHz). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.
The radiated emission measurements were made with the following detection of the test receiver and Spectrum Analyzer.

Frequency	:	30-1000MHz	1000-26500MHz	
Detection Type	:	Quasi-Peak	Peak	* Average
IF Bandwidth	:	120kHz	RBW: 1MHz/VBW: 3MHz	RBW: 1MHz/VBW: 10Hz

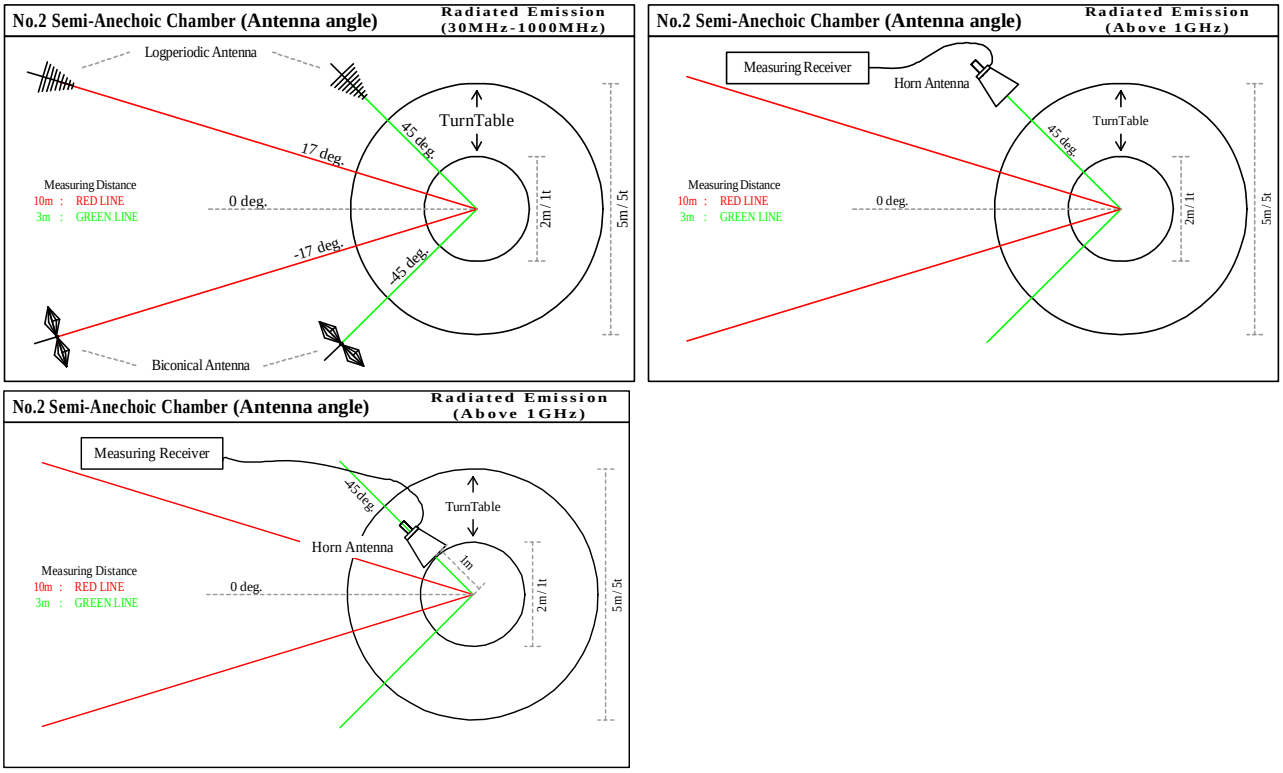
* When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.
* The VBW was based on the inverse of the duty cycle (Refer to Appendix 2).

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT and its antenna to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst position:

	Frequency / Test / Antenna	Carrier	Spurious			
			30M-1GHz	1-13GHz	13-18GHz	18-26.5GHz
EUT Antenna	Horizontal	X	X	X	X	X
	Vertical	Y	Y	Y	Y	Y
Module	Horizontal	Y	Y	Z	Z	Z
	Vertical	Z	Y	Z	Z	Z

Figure 1. Antenna angle



11.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Band edge level at 2390MHz and 2483.5MHz are below the limits of FCC 15.209. Refer to the data of Radiated emission.

11.6 Results

Summary of the test results : Pass *No noise was detected above the 5th order harmonics.
Refer to APPENDIX 2

SECTION 10: Peak Power density

Test procedure
The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer *1)
RBW / VBW : 3kHz / 10kHz

*1) PSD Option 1 of " Measurement of Digital Transmission Systems Operating under Section 15.247".

Summary of the test results: Pass
Refer to APPENDIX 2

Contents of appendixes

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Conducted emission
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Pre-check of the worst position

APPENDIX 2: Test data

Conducted emission
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APPENDIX 3: Test instruments

Test instruments