RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

Communication Module

Model Name.: Type2FJ

Prepared for:

Murata Manufacturing Co., Ltd.
10-1, Higashikotari 1-chome, Nagaokakyo-shi,
Kyoto 617-8555 Japan

Prepared by

Compliance Certification Services Inc.
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Issue Date: September 29, 2022

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	September 21, 2022	Initial Issue	ALL	Allison Chen
01	September 28, 2022	See the following Note Rev.(01)	P.12	Allison Chen
02	September 29, 2022	See the following Note Rev.(02)	P.1	Allison Chen

Note:
Rev.(01)
1. Remove exposure evaluation test data.
Rev.(02)
1. Modify applicant information.

Table of Contents

1 Attestation of Test Results

Applicant Name	Murata Manufacturing Co., Ltd.
Model Name	Type2FJ
Applicable Standards	FCC 47 CFR § 2.1091 KDB 447498 D04 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	March 9, 2022

Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainy.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved & Released By:

Sky Zhou
Asst. Section Manager
Compliance Certification Services Inc.

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1091, the following FCC Published RF exposure KDB procedures:

- o 447498 D04 Interim General RF Exposure Guidance v01
- o 865664 D02 RF Exposure Reporting v01r02

3 Device Under Test (DUT) Information

3.1 DUT Description

Product	Communication Module
Trade Name	muRata
Model No.	Type2FJ
Model Discrepancy	N/A
Hardware Version	1
Software Version	CYW43439A2_Runtime-26MHz.btp
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	☒ Bluetooth: 2402MHz ~ 2480MHz ☐ 802.11b/g/n HT20: 2412 MHz ~ 2462 MHz ☐ 802.11n HT40: 2422 MHz ~ 2452MHz ☐ 802.11a/n HT20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz ☐ 802.11n HT40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz ☐ 802.11ac VHT80: 5210MHz / 5775MHz ☐ 13.56MHz ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2 for 1500-100000MHz)
Antenna Specification	Monopole antenna / Gain: 1.33 dBi BT&BLE Gain : 1.33 dBi (Numeric gain: 1.36) Worst
Maximum Meaurement Average Power include tune up power	<table><tr><td>BT</td><td>8.65 dBm</td><td>(7.328 mW)</td></tr><tr><td>BLE</td><td>8.65 dBm</td><td>(7.328 mW)</td></tr></table>

Notes:
1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. The tune up power referred the average power of the test report TMWK2203000958KR and TMWK2203000959KR for RF Exposure assessment purpose.

Report No.: TMWK2203000960KR

4 Maximum Permissible Exposure

4.1 Limits for Maximum Permissible Exposure (MPE)

Table 1 - Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	* 100	6
3.0-30	1842/f	4.89/f	* 900/f^2	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* 100	30
1.34-30	824/f	2.19/f	* 180/f^2	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

4.2 MPE Calculation Method

Calculation

Given $E = \dfrac{\sqrt{30 \times P \times G}}{d}$ & $S = \dfrac{E^2}{377}$

Where E = Field strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ **Equation 1**

Where d = Distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm²

If, Substituting the MPE safe distance using d = 20 cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Calculation(continued)

Given R = R₃ + 40 log(3 / 0.2) or R = R₃ + 40 log(3 / 0.15)

E = 10^((R-12-)/20)

Where E = E field Strength

R₃ = Result Power on 3m

R = Result Power on 0.2m or 0.15m

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4.3 MPE EXEMPTION

(A) The available maximum time-averaged power is no more than 1 mW

(B) The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). *Pth* is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20\,cm}(d/20\text{ cm})^x & d \leq 20\text{ cm} \\ ERP_{20\,cm} & 20\text{ cm} < d \leq 40\text{ cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\,cm} \text{ (mW)} = \begin{cases} 2040f & 0.3\text{ GHz} \leq f < 1.5\text{ GHz} \\ 3060 & 1.5\text{ GHz} \leq f \leq 6\text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C) Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1{,}920\,R^2$.
1.34-30	$3{,}450\,R^2/f^2$.
30-300	$3.83\,R^2$.
300-1,500	$0.0128\,R^2f$.
1,500-100,000	$19.2R^2$.
Note: R is in meters, f is in MHz.	

4.4 Multiple RF sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^{a} \frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

5 MPE Exemption Option B

Bluetooth

MPE Exemption	Mode	Frequency (MHz)	R (m)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)
Option B	BT	2480.00	0.2	9.98	7.83	6.06736	3060
Option B	BLE	2480.00	0.2	9.98	7.83	6.06736	3060

6 Facilities

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)

END OF REPORT