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Test report No: RF Exposure

TEST REPORT
Radio Spectrum Matters (RF)

Identification of item tested	Bluetooth & 2.4G WIFI communication Module
Trademark	N/A
Model and /or type reference	MWB-S-F13, MWB-S-F13A
FCC/IC ID	2ADQOMWB-S-F13
Features	5 Vdc, 0.5A
Applicant´s name / address	GD Midea Air-Conditioning Equipment Co.,Ltd. Lingang Road, Beijiao, Shunde , Foshan, Guangdong, PEOPLE'S REPUBLIC OF CHINA
Test method requested, standard	KDB 447498 D01V06 FCC Part 1.1310
Verdict Summary	COMPLIANCE
Tested by (name & signature)	Jazz Liang
Approved by (name & signature)	Tim Yan
Date of issue	2025-02-14
Report template No	TRF_EMC 2017-06- FCC_Exposure

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GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.
5. This report will not be used for social proof function in China market.

UNCERTAINTY

For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%
Atmospheric pressure	86 kPa – 106 kPa

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

☒ Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.				
☐ Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.				
Decimal separator used in this report	☒	Comma (,)	☐	Point (.)

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	:	Equipment Under Test
QP	:	Quasi-Peak
CAV	:	CISPR Average
AV	:	Average
CDN	:	Coupling Decoupling Network
SAC	:	Semi-Anechoic Chamber
OATS	:	Open Area Test Site
BW	:	Bandwidth
AM	:	Amplitude Modulation
PM	:	Pulse Modulation
HCP	:	Horizontal Coupling Plane
VCP	:	Vertical Coupling Plane
U_N	:	Nominal voltage
*T*x	:	Transmitter
*R*x	:	Receiver
N/A	:	Not Applicable
N/M	:	Not Measured

DOCUMENT HISTORY

Report nr.	Date	Description
RF Exposure	2025-02-14	First release.

REMARKS AND COMMENTS

The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Description of the item ..... :	Bluetooth & 2.4G WIFI communication Module
Trademark ..... :	N/A
Model / Type number ..... :	MWB-S-F13, MWB-S-F13A
FCC ID ..... :	2ADQOMWB-S-F13
Hardware ..... :	N/A
Software ..... :	N/A
Firmware ..... :	N/A
Ratings ..... :	5 Vdc, 0.5A
Manufacturer..... :	GD Midea Air-Conditioning Equipment Co.,Ltd. Lingang Road, Beijiao, Shunde , Foshan, Guangdong, PEOPLE'S REPUBLIC OF CHINA
Factory ..... :	GD Midea Air-Conditioning Equipment Co.,Ltd. Lingang Road, Beijiao, Shunde , Foshan, Guangdong, PEOPLE'S REPUBLIC OF CHINA

Based on customer description: Wireless module Characteristic

Operating frequency range(s) – Tx :	2412 – 2462 MHz for 2.4G WIFI 2402 – 2480 MHz for Bluetooth
Operating frequency range(s) – Rx :	2412 – 2462 MHz for 2.4G WIFI 2402 – 2480 MHz for Bluetooth
Type of Modulation ..... :	WLAN 2.4GHz : IEEE 802.11b: DSSS (CCK, QPSK, BPSK); IEEE 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM); IEEE 802.11n HT20: OFDM (BPSK, QPSK, 16QAM, 64QAM) Bluetooth LE:GFSK
Antenna type..... :	Integrate antenna
Antenna gain..... :	1.73 dBi
Operation temperature range	-20 – 85 ℃

Antenna List

Antenna Model No.	N/A					
Antenna Manufacturer	N/A					
Antenna Delivery	☒	1*TX+1*RX	☐	2*TX+2*RX	☐	3*TX+3*RX
Antenna Technology	☒	SISO				
	☐	MIMO	☐	Basic methodology		
			☐	Sectorized antenna systems		
			☐	Cross-polarized antennas		
			☐	Unequal antenna gains, with equal transmit powers		
			☐	Spatial Multiplexing		
			☐	Cyclic Delay Diversity (CDD)		
Antenna Type	Integrate antenna					
Antenna Gain						

Antenna Technology				Ant Gain(eth1) (dBi)
☒	SISO	☒	Ant1	1.73
		☐	Ant2	-

The radio module (Bluetooth) operating channels are:

BLE:

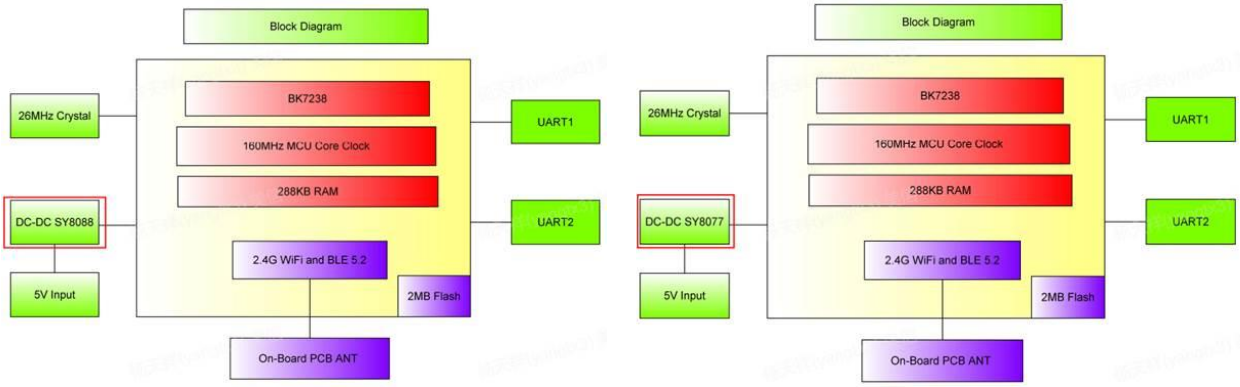
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454	-	-
13	2428	27	2456	-	-

The WIFI mode operating channels are:

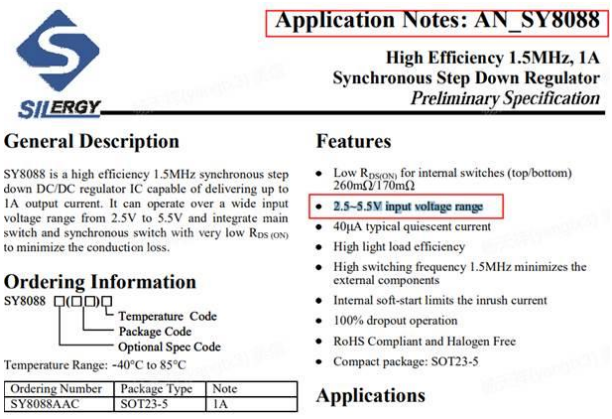
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	-	-
6	2437	-	-
7	2442	-	-

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 5 V					
	☐	Battery:					
Mounting position.....:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Installed on the circuit board					

Intended use of the Equipment Under Test (EUT)
The apparatus as supplied for the test is Wireless module. According to customer description, models MWB-S-F13, MWB-S-F13A are identical in Appearance, color, schematic and structure, only the DC-DC component is different for all the models, Details as below： MWB-S-F13 DC-DC model is 8088，MWB-S-F13A DC-DC model is 8077.



The function of both 8077 and 8088 in the circuit is to convert a 5V voltage to a 3.3V voltage. The only difference between the 8077 and 8088 is that the input voltage range is not the same.



Application Notes: AN_SY8088

High Efficiency 1.5MHz, 1A Synchronous Step Down Regulator
Preliminary Specification

General Description

SY8088 is a high efficiency 1.5MHz synchronous step down DC/DC regulator IC capable of delivering up to 1A output current. It can operate over a wide input voltage range from 2.5V to 5.5V and integrate main switch and synchronous switch with very low $R_{DS(ON)}$ to minimize the conduction loss.

Ordering Information

SY8088 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

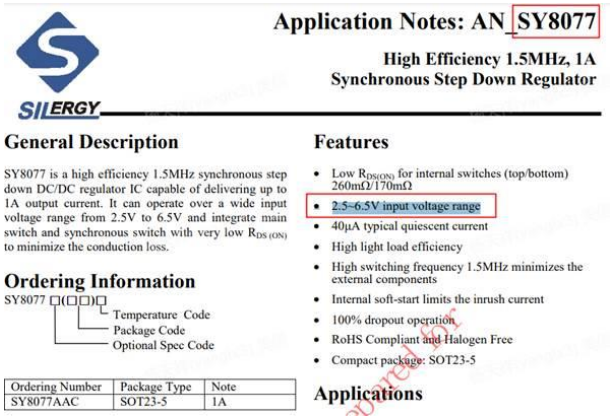
Temperature Range: -40°C to 85°C

Ordering Number	Package Type	Note
SY8088AAC	SOT23-5	1A

Features

- Low $R_{DS(ON)}$ for internal switches (top/bottom) 260mΩ/170mΩ
- 2.5~5.5V input voltage range
- 40μA typical quiescent current
- High light load efficiency
- High switching frequency 1.5MHz minimizes the external components
- Internal soft-start limits the inrush current
- 100% dropout operation
- RoHS Compliant and Halogen Free
- Compact package: SOT23-5

Applications



Application Notes: AN_SY8077

High Efficiency 1.5MHz, 1A Synchronous Step Down Regulator

General Description

SY8077 is a high efficiency 1.5MHz synchronous step down DC/DC regulator IC capable of delivering up to 1A output current. It can operate over a wide input voltage range from 2.5V to 6.5V and integrate main switch and synchronous switch with very low $R_{DS(ON)}$ to minimize the conduction loss.

Ordering Information

SY8077 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package Type	Note
SY8077AAC	SOT23-5	1A

Features

- Low $R_{DS(ON)}$ for internal switches (top/bottom) 260mΩ/170mΩ
- 2.5~6.5V input voltage range
- 40μA typical quiescent current
- High light load efficiency
- High switching frequency 1.5MHz minimizes the external components
- Internal soft-start limits the inrush current
- 100% dropout operation
- RoHS Compliant and Halogen Free
- Compact package: SOT23-5

Applications

Hence,model MWB-S-F13 were chosen for full test.

Copy of marking plate:
Refer to document label.

1.2 Test data

Test Location	DEKRA Testing and Certification (Shanghai) Ltd. Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China FCC Designation Number: CN1324;
Date of receipt of test item	2024-12-25
Date (s) of performance of tests	2024-12-25 to 2025-02-08
Test sample	Normal sample: MWB-S-F13(Lab no.4931349-1), RF conducted sample: MWB-S-F13(Lab no.4931349-2), RF radiated sample: MWB-S-F13(Lab no.4931349-1)

1.3 The environment(s) in which the EUT is intended to be used

The equipment under test (EUT) is intended to be used in the following environment(s):

☒	Residential (domestic) environment.
☒	Commercial and light-industrial environment.
☐	Industrial environment.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Operating mode	Operating mode description	Used for methos	
		Conducted	Radiated
1	Transmitting at BLE mode	☒	☐
2	Transmitting at WIFI mode	☒	☐
3		☐	☐
Supplemental information: ---			

2.2 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
Laptop	Latitude 5488	DELL	DEKRA
Serial port tool	-	-	Client
Wifi_Test_Tool	V1.9.0m	-	Client
Supplemental information: ---			

2.3 Test Configuration / Block diagram used for tests

Refer to Annex 3.

3 RF EXPOSURE EVALUATION

3.1 Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)
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 Exposures				
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
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	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
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula
Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$
Power Density: $Pd(W/m^2)=E^2/377$

Where
Pd = power density in mW/cm2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm
E=Electric Field (V/m)

Pd is the limit of MPE, 1 mW/cm2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

3.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

The temperature and related humidity: 18℃and 78％ RH.

3.3 Test Result

Test Mode	Frequency Band (MHz)	Conducted RF Power Output (dBm)	Maximum Power (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit of Power Density S(mW/cm^2)
BLE	2402 ~ 2480	4.6	2.9	0.00058	1
2.4GWIFI	2412 ~ 2462	15.5	35.5	0.007	1

Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

For example,: EIRP=Pout*G= 2.9 mW

$E=2.9/(4*pi*20^2)=0.00058\ mW/cm^2$

The formula of calculate the simultaneously transmission is

$\sum$(All mode Power Desity)/Limit $\leqslant 1$

Calculated:

$0.00058/1+0.007/1=0.019 \leqslant 1$

--- END ---