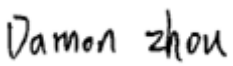
1 Cover Page

RF Exposure Evaluation Report

Application No.:	KSCR2311002052AT
FCC ID:	2APJ4-SNM500
IC:	23860-SNM500
Applicant:	MeiG Smart Technology Co., Ltd
Address of Applicant:	2nd Floor,Office Building,No.5 Lingxia Road,Fenghuang,Fuyong Street,Bao'an District,Shenzhen City.
Manufacturer:	MeiG Smart Technology Co., Ltd
Address of Manufacturer:	2nd Floor,Office Building,No.5 Lingxia Road,Fenghuang,Fuyong Street,Bao'an District,Shenzhen City.
Equipment Under Test (EUT):	
EUT Name:	Wireless communication module
Model No.:	SNM500
Trade Mark:	MEIGLink
Standard(s) :	FCC Rules 47 CFR §2.1091 KDB 447498 D04 interim General RF Exposure Guidance v01 RSS-102 Issue 5 Amendment 1 (February 2, 2021)
Date of Receipt:	2023-11-16
Date of Test:	2024-03-19 to 2024-03-20
Date of Issue:	2024-03-20
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Revision Record			
Version	**Description**	***Date***	***Remark***
00	Original	2024-03-20	/

Authorized for issue by:				
Tested By		 **Damon_Zhou/Project Engineer**		
Approved By		 **Terry Hou /Reviewer**		

2 Contents

3 General Information

3.1 General Description of E.U.T.

	Power supply:	DC 3.8V
	S/N:	M500Q16CYD071300051
	Firmware Version:	SLM500Q_EQ000_2774.5CA7F6A.7315A21_231104_100_V01_T13

3.2 Details of E.U.T.

2.4G

	Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz; 802.11n(HT40): 2422MHz to 2452MHz
	Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK); 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
	Number of Channels:	802.11b/g/n(HT20):11;802.11n(HT40):7
	Channel Spacing:	5MHz
	Antenna Type:	Dipole Antenna
	Antenna Gain:	1dBi (Provided by the manufacturer)

BT

	Operation Frequency:	2402MHz to 2480MHz
	Bluetooth Version:	V4.2 Dual mode
	Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
	Number of Channels:	79
	Channel Spacing:	1MHz
	Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
	Antenna Type:	Dipole Antenna
	Antenna Gain:	1dBi (Provided by the manufacturer)

BLE

	Operation Frequency:	2402MHz to 2480MHz
	Bluetooth Version:	V4.2 Dual mode
	Modulation Type:	GFSK
	Number of Channels:	40
	Channel Spacing:	2MHz
	Antenna Type:	Dipole Antenna
	Antenna Gain:	1dBi (Provided by the manufacturer)

5G

Operation Frequency/Number of channels (20MHz):	U-NII-I: 5180-5240MHz (4 Channels); U-NII-2A: 5260-5320MHz (4 Channels); U-NII-2C: 5500-5700MHz (11 Channels); U-NII-3: 5745-5825MHz (5 Channels)
Operation Frequency/Number of channels/(40MHz):	U-NII-I: 5190-5230MHz (2 Channels); U-NII-2A: 5270-5310MHz (2 Channels); U-NII-2C: 5510-5670MHz (5 Channels); U-NII-3: 5755-5795MHz (2 Channels)
Operation Frequency/Number of channels (80MHz):	U-NII-I: 5210MHz (1 Channel); U-NII-2A: 5290MHz (1 Channels); U-NII-2C: 5530-5610MHz (2 Channels); U-NII-3: 5775MHz (1 Channel)
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK); 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM); 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing:	802.11a/n/ac20: 20MHz; 802.11n/ac40: 40MHz; 802.11ac80: 80MHz
DFS Function:	Slave without Radar detection
Antenna Type:	Dipole Antenna
Antenna Gain:	1dBi (Provided by the manufacturer)

3.3 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

Note:

1.SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).

2.SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).

3. Sample source: sent by customer.

3.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC**

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

- **ISED**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 2324E

- **VCCI**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600, C-11707, T-11499, G-10216 respectively.

4 FCC Radiofrequency radiation exposure limits

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

4.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. From §1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least λ/2π. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

$$P_{\text{th}}\ (\text{mW}) = ERP_{20\ \text{cm}}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \qquad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only 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.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

Limit calculation			
Frequency range	Frequency(MHz)	R(λ/2π)(m)	Threshold ERP(W)
300~1500MHz	**915**	0.0522	0.032
1500~100000MHz	**2462**	0.0194	0.007

4.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of §1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{\text{th}}\ (\text{mW}) = \begin{cases} ERP_{20\ \text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ \text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \qquad (\text{B.2})$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ \text{cm}}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1).

Example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance(mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

For 2.4G WiFi

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.462**	1.903	**20**	**3060.000**

For 5G WiFi

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**5.825**	2.090	**20**	**3060.000**

For BT

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.48**	1.905	**20**	**3060.000**

For BLE

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.48**	1.905	**20**	**3060.000**

5 IC Radiofrequency radiation exposure limits:

According to RSS-102 section 2.5.2, RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

For 2.4G device, the limit of worse case is 2.68 W

For 5G device,the limit of worse case is 4.53W

6 Measurement and Calculation

6.1 Maximum transmit power

The Power Data is based on the RF Test Report KSCR231100205201, KSCR231100205202, KSCR231100205203, KSCR231100205204.

2.4G WiFi

Test Mode	Test Channel	Ant	Power [dBm]	Power [mW]
11B SISO	2412	Ant1	17.74	59.43
11B SISO	2437	Ant1	17.91	61.80
11B SISO	2462	Ant1	17.45	55.59
11G SISO	2412	Ant1	18.48	**70.47**
11G SISO	2437	Ant1	17.62	57.81
11G SISO	2462	Ant1	17.23	52.84
11N20 SISO	2412	Ant1	17.71	59.02
11N20 SISO	2437	Ant1	17.72	59.16
11N20 SISO	2462	Ant1	17.43	55.34
11N40 SISO	2422	Ant1	17.63	57.94
11N40 SISO	2437	Ant1	17.67	58.48
11N40 SISO	2452	Ant1	17.84	60.81

BLE

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
1M	2402	3.49	2.23
	2440	3.67	**2.33**
	2480	2.83	1.92

BT

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
GFSK	2402	12.66	18.45
	2441	12.74	18.79
	2480	12.04	16.00
π/4DQPSK	2402	12.71	18.66
	2441	12.77	18.92
	2480	12.07	16.11
8DPSK	2402	12.89	19.45
	2441	12.97	**19.82**
	2480	12.27	16.87

5G WiFi

Test Mode	Test Frequency (MHz)	Ant	Antenna Power (dBm)	Antenna Power (mW)
802.11a SISO	5180	Ant1	14.06	25.47
	5200	Ant1	14.19	26.24
	5240	Ant1	13.97	24.95
	5260	Ant1	14.84	30.48
	5300	Ant1	13.88	24.43
	5320	Ant1	14.64	29.11
	5500	Ant1	14.97	31.41
	5580	Ant1	15.08	**32.21**
	5700	Ant1	13.31	21.43
	5745	Ant1	13.78	23.88
	5785	Ant1	14.52	28.31
	5825	Ant1	13.72	23.55
802.11n (HT20) SISO	5180	Ant1	14.16	26.06
	5200	Ant1	13.72	23.55
	5240	Ant1	14.15	26.00
	5260	Ant1	14.36	27.29
	5300	Ant1	13.34	21.58
	5320	Ant1	14.12	25.82
	5500	Ant1	14.78	30.06
	5580	Ant1	14.92	31.05
	5700	Ant1	13.64	23.12
	5745	Ant1	14.49	28.12
	5785	Ant1	14.19	26.24
	5825	Ant1	13.73	23.60
802.11n (HT40) SISO	5190	Ant1	13.86	24.32
	5230	Ant1	13.46	22.18
	5270	Ant1	14.69	29.44
	5310	Ant1	14.04	25.35
	5510	Ant1	14.95	31.26
	5550	Ant1	14.32	27.04
	5670	Ant1	14.92	31.05
	5755	Ant1	13.51	22.44
	5795	Ant1	14.09	25.64
802.11ac (VHT80) SISO	5210	Ant1	13.90	24.55
	5290	Ant1	13.82	24.10
	5530	Ant1	13.69	23.39
	5610	Ant1	13.59	22.86
	5775	Ant1	13.56	22.70

6.2 RF Exposure Calculation

For FCC:

2.4G WiFi

The Max Conducted Peak Output Power is 70.47mW. The best case gain of the antenna is 1.0dBi.
1.0dBi logarithmic terms convert to numeric result is nearly 1.26.
According to the formula. calculate the EIRP test result:
EIRP= P x G = 70.47 mW x 1.26 = 88.79mW < 3060mW

BT:

The Max Conducted Peak Output Power is 19.82mW. The best case gain of the antenna is 1.0dBi.
1.0dBi logarithmic terms convert to numeric result is nearly 1.26.
According to the formula. calculate the EIRP test result:
EIRP= P x G = 19.82 mW x 1.26 = 24.973mW < 3060mW

BLE:

The Max Conducted Peak Output Power is 2.33mW. The best case gain of the antenna is 1.0dBi.
1.0dBi logarithmic terms convert to numeric result is nearly 1.26.
According to the formula. calculate the EIRP test result:
EIRP= P x G = 2.33 mW x 1.26 = 2.936mW < 3060mW

5G WiFi

The Max Conducted Peak Output Power is 32.21mW. The best case gain of the antenna is 1.0dBi.
1.0dBi logarithmic terms convert to numeric result is nearly 1.26.
According to the formula. calculate the EIRP test result:
EIRP= P x G = 32.21mW x 1.26 = 40.585mW < 3060mW

Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

	Evaluation method	Exempt Limit(mW)	Verdict
☐	Blanket 1 mW Blanket Exemption	1mW	N/A
☐	MPE-based Exemption(ERP)	7mW(ERP) (2.4GHz Band)	N/A
☒	SAR-based Exemption(P_{th})	3060mW(ERP) (1.5GHz~6GHz)	Yes

The Bluetooth,2.4G and 5G WiFi can simultaneously transmit, and the maximum rate of MPE is 24.973/3060+88.79/3060+40.585/3060=0.051<=1. So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report

For IC:

For 2.4G WiFi:
E.I.R.P.= P*G= 0.07047W×1.26=0.089W＜2.68W
For BT:
E.I.R.P.= P*G= 0.01982W×1.26=0.02W<2.68W
For BLE:
EIRP= P x G = 0.00233W x1.26=0.003W<2.68W
For 5GHz WiFi mode:
E.I.R.P.= P*G= 0.03221W×1.26=0.04W<4.53W
The Bluetooth,2.4G and 5G WiFi can simultaneously transmit, and the maximum rate of MPE is 0.02/2.68+0.089/2.68+0.04/2.68=0.05<=1. So the device is exclusion from SAR test

--End of the Report--