SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

FCC TEST REPORT PART 0

Application No.:	ZEWM2311001721RG
Applicant:	Xiaomi Communications Co., Ltd.
Manufacturer:	Xiaomi Communications Co., Ltd.
Product Name:	Mobile Phone
Model No.(EUT):	XIG05
Trade Mark:	Redmi
FCC ID:	2AFZZRA50J
Date of Receipt:	2023/11/14
Date of Test:	2023/12/08 to 2023/12/12
Date of Issue:	2023/12/25
Test conclusion:	**PASS**

Authorized Signature:

Keny Xu
Laboratory Manager

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China 518057 t (86-755) 26012053 www.sgsgroup.com.cn
中国・广东・深圳市南山区科技园中区M-10栋1号厂房 邮编: 518057 t (86-755) 26012053 sgs.china@sgs.com

REVISION HISTORY

Report Number	Revision	Description	Issue Date
ZEWM2311001721RG01	01	Original	2023/12/25

Prepared By	Vito Wang **Vito Wang**
Checked By	Roman Pan **Roman Pan**

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China 518057 t (86-755) 26012053 www.sgsgroup.com.cn
中国・广东・深圳市南山区科技园中区M-10栋1号厂房 邮编: 518057 t (86-755) 26012053 sgs.china@sgs.com

CONTENTS

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China 518057 t (86-755) 26012053 www.sgsgroup.com.cn
中国・广东・深圳市南山区科技园中区M-10栋1号厂房 邮编: 518057 t (86-755) 26012053 sgs.china@sgs.com

1 General Information

1.1 Details of Client

Applicant:	Xiaomi Communications Co., Ltd.
Address:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Vito Wang, Ethan Li

1.3 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

1.4 General Description of EUT

Device Type :	portable device		
Exposure Category:	uncontrolled environment / general population		
Product Name:	Mobile Phone		
Model No.(EUT):	XIG05		
FCC ID:	2AFZZRA50J		
Trade Mark:	Redmi		
Product Phase:	Identical Prototype		
IMEI:	864594070002941,864594070002909, 864594070002826,864594070003287		
Hardware Version:	13510N16		
Software Version:	Xiaomi HyperOS 1.0		
Device Operating Configurations :			
Modulation Mode:	**GSM:** GMSK, 8PSK; **WCDMA:** QPSK,16QAM; **LTE:** QPSK,16QAM,64QAM; **5G NR:** DFT-s-OFDM (PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM), CP-OFDM (QPSK, 16QAM, 64QAM, 256QAM) **WIFI:** DSSS, OFDM; **BT:** GFSK, π/4DQPSK,8DPSK		
Device Class:	B		
GPRS Multi-slots Class:	33	EGPRS Multi-slots Class:	33
HSDPA UE Category:	24	HSUPA UE Category	7
DC-HSDPA UE Category:	24		
Power Class	4,tested with power level 5(GSM850)		
	1,tested with power level 0(GSM1900)		
	3, tested with power control “all 1”(WCDMA Band)		
	3, tested with power control Max Power(LTE Band)		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	GSM850	824~849	869~894
	GSM1900	1850~1910	1930~1990
	WCDMA Band II	1850~1910	1930~1990
	WCDMA Band IV	1710~1755	2110~2155
	WCDMA Band V	824~849	869~894
	LTE Band 2	1850 ~1910	1930 ~1990
	LTE Band 4	1710~1755	2110~2155
	LTE Band 5	824~849	869-894
	LTE Band 7	2500~2570	2620~2690
	LTE Band 12	699~716	729~746
	LTE Band 13	777~787	746~756
	LTE Band 17	704~716	734~746
	LTE Band 26	814~849	859~894
	LTE Band 38	2570~2620	2570~2620
	LTE Band 41	2496~2690	2496~2690
	LTE Band 66	1710~1780	2110~2200
	NR Band n5	824~849	869~894

	NR Band n7	2500~2570	2620~2690
	NR Band n38	2570~2620	2570~2620
	NR Band n41	2496~2690	2496~2690
	NR Band n66	1710~1780	2110~2200
	NR Band n77	3450~3550	3450~3550
		3700~3980	3700~3980
	NR Band n78	3450~3550	3450~3550
		3700~3800	3700~3800
	Bluetooth	2400~2483.5	2400~2483.5
	Wi-Fi 2.4G	2402~2462	2402~2462
	Wi-Fi 5G	5150~5250	5150~5250
		5250~5350	5250~5350
		5470~5725	5470~5725
		5725~5850	5725~5850
NFC	Wireless Technology and Frequency Range		13.56MHz
	mode		ASK
RF Cable:	☒ Provided by the applicant ☐ Provided by the laboratory		
Battery Information:	Model:	BM5V	
	Normal Voltage:	+3.91V	
	Typical capacity:	5020mAh	
	Manufacturer:	NVT	

Note: *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

Remark:
As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

1.5 Time-Averaging for SAR

The equipment under test (EUT) is a portable handset, it contains the Qualcomm modem supporting 2G/3G/4G/5G NR/BT/WLAN/NFC bands. But only 2G/3G/4G/5G NR are enabled with Qualcomm Smart Transmit feature to control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is in compliance with the FCC requirement. GSM/WCDMA are configured for peak exposure mode. For device using Smart Transmit force peak mode or peak mode, we verification the time-window switch test in part2 follows the Qualcomm user guide, but LTE Standalone/NR SA/NSA/Inter band UL CA are not peak mode, we verification the applicable cases in part2.

The compliance test under the static transmission scenario and simultaneous transmission analysis are reported in Part 1 report. The validation of the time-averaging algorithm and compliance under the dynamic (time- varying) transmission scenario for WWAN technologies are reported in Part 2 report.

Nomenclature for Part 0 Report:

Technology	Term	Description
WWAN	P_{limit}	Power level that corresponds to the exposure design target (*SAR_design_target)* after accounting for all device design related uncertainties
	P_{max}	Maximum tune up output power
	SAR_design_target	Target SAR level < FCC SAR limit after accounting for all device design related uncertainties
	SAR Char	Table containing *Plimit* for all technologies and bands

2 SAR CHARACTERIZATION

2.1 DSI and SAR Determination

This device uses different Device State Index (DSI) to configure different time averaged power levels based on certain exposure scenarios. Depending on the detection scheme implemented in the smartphone, the worst-case SAR was determined by measurements for the relevant exposure conditions for that DSI. Detailed descriptions of the detection mechanisms are included in the operational description.

When 1g SAR and 10g SAR exposure comparison is needed, the worst-case was determined from SAR normalized to 1g or 10g SAR limit.

The device state index (DSI) conditions used in Table 1 represent different exposure scenarios.

Scenario	Description	SAR Test Cases
Head (DSI = 1)	▪ Device positioned next to head ▪ Receiver Active	*Head SAR per KDB Publication 648474 D04*
Body-worn (DSI = 4)	▪ Device being used with a body-worn accessory	*Body-worn SAR per KDB Publication 648474 D04*
Hotspot mode (DSI = 5)	▪ Device transmits in hotspot mode near body ▪ Hotspot Mode Active	*Hotspot SAR per KDB Publication 941225 D06*

Table 1： DSI and Corresponding Exposure Scenarios

2.2 SAR Design Target And Uncertainty

SAR_design_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer.

$$SAR\_design\_target < SAR_{regulatory\_limit} \times 10^{\frac{-\text{total uncertainty}}{10}}$$

Band	Antenna	Uncertainty	SAR_design_target Head&Body Worn&Hotspot	SAR_design_target Limbs
GSM 850	0#	1.0	0.87	2.07
	1#	1.0	0.87	2.07
GSM 1900	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
WCDMA_B2	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
WCDMA_B4	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
WCDMA_B5	0#	1.0	0.87	2.07
	1#	1.0	0.87	2.07
LTE_B2	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
LTE_B4	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
LTE_B5	0#	1.0	0.87	2.07
	1#	0.7	0.94	2.21
LTE_B7	2#	1.5	0.78	1.84
	3#	1.0	0.87	2.07
	4#	1.5	0.78	1.84
	5#	1.5	0.78	1.84
LTE_B12	0#	1.0	0.87	2.07
	1#	1.0	0.87	2.07
LTE_B13	0#	1.0	0.87	2.07
	1#	1.0	0.87	2.07
LTE_B17	0#	1.0	0.87	2.07
	1#	1.0	0.87	2.07
LTE_B26	0#	1.0	0.87	2.07
	1#	0.7	0.94	2.21
LTE_B66	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
LTE_B38	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07

	5#	1.0	0.87	2.07
LTE_B41	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
NR5G_N5	0#	1.0	0.87	2.07
	1#	0.7	0.94	2.21
NR5G_N7	2#	1.5	0.78	1.84
	3#	1.0	0.87	2.07
	4#	1.5	0.78	1.84
	5#	1.5	0.78	1.84
NR5G_N38	2#	1.5	0.78	1.84
	3#	1.0	0.87	2.07
	4#	1.5	0.78	1.84
	5#	1.5	0.78	1.84
NR5G_N41	2#	1.5	0.78	1.84
	3#	1.0	0.87	2.07
	4#	1.5	0.78	1.84
	5#	1.5	0.78	1.84
NR5G_N66	2#	1.0	0.87	2.07
	3#	1.0	0.87	2.07
	4#	1.0	0.87	2.07
	5#	1.0	0.87	2.07
NR5G_N77 PC2 50%	1#	1.5	0.78	1.84
	6#	1.0	0.87	2.07
	7#	1.5	0.78	1.84
	8#	1.5	0.78	1.84
NR5G_N77 PC3 100%	1#	1.5	0.78	1.84
	6#	0.7	0.94	2.21
	7#	1.5	0.78	1.84
	8#	1.5	0.78	1.84
NR5G_N78 PC2 50%	1#	1.5	0.78	1.84
	6#	1.0	0.87	2.07
	7#	1.5	0.78	1.84
	8#	1.5	0.78	1.84
NR5G_N78 PC3 100%	1#	1.5	0.78	1.84
	6#	0.7	0.94	2.21
	7#	1.5	0.78	1.84
	8#	1.5	0.78	1.84

2.3 SAR Char

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of SAR_design_target, below the predefined time-averaged power limit, for each characterized technology and band. Smart Transmit allows the device to transmit at higher power instantaneously, as high as P_{max}, when needed, but enforces power limiting to maintain time-averaged transmit power to P_{limit}. Below table shows P_{limit} EFS settings and maximum tune up output power P_{max} configured for this EUT for various transmit conditions (DSI: Device State Index).

P_{limit} for supported technologies and bands (actual EFS settings)

Band	Mode	Antenna	P_{max}*	P_{limit} (average)		
				Head	Body worn&Limbs	Hotspot
				DSI 1	DSI 4	DSI 5
GSM 850	GPRS 4TS	0#	23.5	23.5	23.5	23.5
	GPRS 4TS	1#	23.8	20.8	23.8	20.8
GSM 1900	GPRS 4TS	3#	20.5	19.5	20.5	19.5
	GPRS 4TS	4#	20.0	20.0	20.0	20.0
WCDMA_B2	RMC	3#	24.0	18.0	24.0	18.0
	RMC	4#	23.6	23.6	23.6	20.1
WCDMA_B4	RMC	2#	19.7	19.7	19.7	19.7
	RMC	3#	24.0	17.5	24.0	17.5
	RMC	4#	23.6	23.6	23.6	22.1
	RMC	5#	22.1	19.6	19.6	19.6
WCDMA_B5	RMC	0#	24.0	24.0	24.0	24.0
	RMC	1#	24.5	21.0	22.0	21.0
LTE_B2	QPSK	3#	24.5	19.0	24.5	19.0
	QPSK	4#	24.0	24.0	24.0	21.0
	QPSK	5#	23.0	16.5	20.5	16.5
LTE_B4	QPSK	2#	20.8	19.8	20.8	19.8
	QPSK	3#	24.5	18.0	23.5	14.5
	QPSK	4#	23.7	23.7	23.7	22.2
	QPSK	5#	22.9	19.4	20.4	19.4
LTE_B5	QPSK	0#	24.5	24.5	24.5	24.5
	QPSK	1#	25.0	21.5	22.0	21.5
LTE_B7	QPSK	2#	20.2	16.2	17.2	16.2
	QPSK	3#	24.5	18.0	24.5	18.0
	QPSK	4#	24.2	24.2	24.2	19.7
	QPSK	5#	22.7	15.7	18.2	15.7
LTE_B12	QPSK	0#	24.0	24.0	24.0	24.0
	QPSK	1#	24.4	24.4	24.4	24.4
LTE_B13	QPSK	0#	24.5	24.5	24.5	24.5
	QPSK	1#	24.7	22.7	24.7	21.7
LTE_B17	QPSK	0#	24.0	24.0	24.0	24.0
	QPSK	1#	24.4	24.4	24.4	24.4
LTE_B26	QPSK	0#	24.5	24.5	24.5	24.5
	QPSK	1#	25.0	22.0	22.0	22.0
LTE_B66	QPSK	2#	19.7	18.7	19.7	18.7
	QPSK	3#	23.5	18.0	23.5	18.0
	QPSK	4#	23.0	23.0	23.0	22.0
	QPSK	5#	21.7	18.2	18.2	18.2
LTE_B38	QPSK	2#	18.4	15.4	16.9	15.4
	QPSK	3#	22.5	17.5	22.5	17.5
	QPSK	4#	22.2	22.2	22.2	19.7

	QPSK	5#	20.8	13.8	16.8	13.8
LTE_B41	QPSK	2#	18.3	15.8	17.3	15.8
	QPSK	3#	22.5	17.5	22.5	17.5
	QPSK	4#	22.3	22.3	22.3	20.3
	QPSK	5#	20.8	13.8	16.3	13.8
NR5G_N5	QPSK	0#	24.5	24.5	24.5	24.5
	QPSK	1#	25.0	22.0	22.0	22.0
NR5G_N7	QPSK	2#	20.5	17.5	18.5	17.5
	QPSK	3#	24.5	18.0	24.5	18.0
	QPSK	4#	24.2	24.2	24.2	19.2
	QPSK	5#	22.7	16.2	19.2	16.2
NR5G_N38	QPSK	2#	20.5	17.5	18.5	17.5
	QPSK	3#	24.5	16.5	24.5	16.5
	QPSK	4#	24.2	24.2	24.2	18.7
	QPSK	5#	22.8	16.3	19.3	16.3
NR5G_N41	QPSK	2#	20.5	18.0	18.5	18.0
	QPSK	3#	24.5	16.5	24.5	16.5
	QPSK	4#	24.2	24.2	24.2	19.2
	QPSK	5#	22.8	16.8	19.8	16.8
NR5G_N66	QPSK	2#	19.5	19.5	19.5	19.5
	QPSK	3#	23.5	18.0	23.5	18.0
	QPSK	4#	22.8	22.8	22.8	22.3
	QPSK	5#	21.7	19.7	20.2	19.7
NR5G_N77 PC2 50%	QPSK	1#	22.6	/	/	/
	QPSK	6#	24.0	/	/	/
	QPSK	7#	20.8	/	20.8	/
	QPSK	8#	18.6	/	/	/
NR5G_N77 PC3 100%	QPSK	1#	23.6	19.1	16.6	16.6
	QPSK	6#	25.0	14.5	14.5	14.5
	QPSK	7#	21.8	15.3	21.8	14.8
	QPSK	8#	19.6	16.1	18.1	16.1
NR5G_N78 PC2 50%	QPSK	1#	22.6	/	/	/
	QPSK	6#	24.0	/	/	/
	QPSK	7#	20.8	/	20.8	/
	QPSK	8#	18.6	/	/	/
NR5G_N78 PC3 100%	QPSK	1#	23.6	19.1	16.6	16.6
	QPSK	6#	25.0	14.0	14.0	14.0
	QPSK	7#	21.8	14.8	21.8	14.8
	QPSK	8#	19.6	15.6	17.1	15.6

Note:
1) *P_{max} is used for RF tune up procedure. The maximum allowed output power is equal to P_{max} + Total uncertainty.
2) The max allowed output power is the P_{limit} + Total uncertainty, and if P_{limit} is higher than P_{max}, the device output power will be P_{max} instead.
3) Note that WLAN operations are not enabled with Smart Transmit.

---END---