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# TEST REPORT FOR GSM TESTING

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Report No.: SRTC2021-9004(F)-21082803(A)

Product Name: Smart Phone

Applicant: HMD global Oy

Manufacturer: HMD global Oy

Specification: FCC Part 24E, Part 22H, Part 2 (2020)

FCC ID: 2AJOTTA-1361

The State Radio\_monitoring\_center Testing Center (SRTC)  
15th Building, No.30 Shixing Street, Shijingshan District, Beijing, P.R.China  
Tel: 86-10-57996183 Fax: 86-10-57996388

## CONTENTS

<b>1. GENERAL INFORMATION .....</b>	<b>2</b>
1.1 Notes of the test report .....	2
1.2 Information about the testing laboratory .....	2
1.3 Applicant's details.....	2
1.4 Manufacturer's details.....	2
1.5 Test Environment .....	3
<b>2 DESCRIPTION OF THE DEVICE UNDER TEST .....</b>	<b>4</b>
2.1 Final Equipment Build Status.....	4
2.2 Support Equipment .....	5
2.3 Summary table.....	5
<b>3 REFERENCE SPECIFICATION .....</b>	<b>6</b>
<b>4 KEY TO NOTES AND RESULT CODES .....</b>	<b>6</b>
<b>5 RESULT SUMMARY .....</b>	<b>7</b>
<b>6 TEST RESULT.....</b>	<b>8</b>
6.1 RF Power Output.....	8
6.2 Effective Radiated Power and Effective Isotropic Radiated Power .....	9
6.3 Occupied Bandwidth .....	10
6.4 Emission Bandwidth- .....	11
6.5 Spurious Emissions at antenna terminal.....	12
6.6 Band Edges Compliance.....	13
6.7 Frequency Stability .....	14
6.8 Peak-Average Ratio.....	15
<b>7 MEASUREMENT UNCERTAINTIES .....</b>	<b>16</b>
<b>8 TEST EQUIPMENTS .....</b>	<b>17</b>
<b>APPENDIX A – TEST DATA OF CONDUCTED EMISSION .....</b>	<b>17</b>

## 1. GENERAL INFORMATION

### 1.1 Notes of the test report

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### 1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
City:	Beijing
Country or Region:	P.R.China
Contacted person:	Liu Jia
Tel:	+86 10 57996183
Fax:	+86 10 57996388
Email:	liujiaf@srtc.org.cn

### 1.3 Applicant's details

Company:	HMD global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo Finland
Contacted person:	Rosario Casillo
Tel:	+393 31 6272922
Email:	rosario.casillo@hmdglobal.com

### 1.4 Manufacturer's details

Company:	HMD global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo Finland

## 1.5 Test Environment

Date of Receipt of test sample at SRTC:	2021-08-22
Testing Start Date:	2021-08-25
Testing End Date:	2021-08-27

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient:	25	50
Maximum Extreme:	50	---
Minimum Extreme:	-10	---

Normal Supply Voltage (V d.c.):	3.85
Maximum Extreme Supply Voltage (V d.c.):	4.4
Minimum Extreme Supply Voltage (V d.c.):	3.4

## 2 DESCRIPTION OF THE DEVICE UNDER TEST

### 2.1 Final Equipment Build Status

Frequency Range:	GSM850: Tx:824~849MHz Rx:869~894MHz PCS1900: Tx:1850~1910MHz Rx:1930~1990MHz
Modulation Type:	GPRS:GMSK
Emission Designator:	300KGXW/300KG7W
Duplex Mode:	FDD
Duplex Spacing:	GSM850:45MHz PCS1900:80MHz
Antenna Type:	Integrated
Antenna Gain:	GSM850:-3.46dBi/PCS1900: -2.87dBi
Power Supply:	Battery or Charger
Hardware Version:	V1.0
Software Version:	000T_0_315
IMEI:	356271140001063

## 2.2 Support Equipment

The following support equipment was used to exercise the DUT during testing:

Equipment:	Battery
Manufacturer:	Guangdong Fenghua New Energy Co., Ltd.
Model Number:	P660

## 2.3 Summary table.

FCC Rule Part	Mode	Frequency Range (MHz)	ERP/ EIRP (dBm)	ERP/ EIRP (W)	Frequency Tolerance (ppm)	Emission Designator
22H	GSM850	824.2-848.8	27.20	0.525	0.018444	244KGXW
24E	GSM1900	1850.2-1909.8	26.61	0.458	0.014253	244KGXW

### **3 REFERENCE SPECIFICATION**

Specification	Version	Title
FCC Part2	2020	Frequency allocations and radio treaty matters; general rules and regulations
FCC Part22	2020	Public mobile services
FCC Part24	2020	Personal communications services
ANSI C63.26	2020	American national standard for compliance testing of transmitters used in licensed radio services
KDB 971168 D01	April 9, 2018	Measurement guidance for certification of licensed digital transmitters
TIA-603-E-2016	March 2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards




### **4 KEY TO NOTES AND RESULT CODES**

The following are the definition of the test result.

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
NT	Normal Temperature
NV	Nominal voltage
HV	High voltage
LV	Low voltage

## 5 RESULT SUMMARY

No.	Test case	FCC reference	Verdict
1	RF Power Output	2.1046	Pass
2	Effective Radiated Power and Effective Isotropic Radiated Power	22.913(a)(5)/24.232(c)	Pass
3	Occupied Bandwidth	2.1049	Pass
4	Emission Bandwidth	2.1049	Pass
5	Spurious Emissions at antenna terminals	2.1051/22.917(a)/24.238(a)	Pass
6	Band Edges Compliance	2.1051/22.917(a)/24.238(a)	Pass
7	Frequency Stability	2.1055/22.355/24.235	Pass
8	Radiated Spurious Emissions	2.1053/22.917(a)/24.238(a)	Pass
9	Peak-Average Ratio	24.232(d)	Pass

This Test Report Is Issued by: Mr. Peng Zhen 	Checked by: Ms. Liu Jia 
Tested by: Mr. Li Bin 	Issued date:  20210906

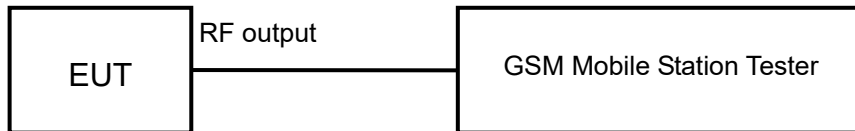


## **6 TEST RESULT**

### **6.1 RF Power Output**

Rule Part(s)  
FCC Part 2.1046

Test Setup:



Test procedure:

After a radio link has been established between EUT and Tester, the output power of the cell signal of the testing equipment will be decreased until the output power of the EUT reach a maximum value. Then the test data can be read at the tester screen. The loss between RF output port of the EUT and the input port of the tester will be taken into consideration. The measurement will be conducted at three channels (Low, Middle and High channels)

Limits: No specific conduct power requirements in part 2.1046.

Test result:

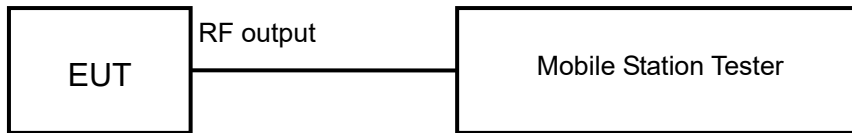
The test results are shown in Appendix A.

## 6.2 Effective Radiated Power and Effective Isotropic Radiated Power

Rule Part(s)

FCC Part 22.913(a)(5)/Part 24.232(c)

Test setup:



Test procedure:

KDB 971168 D01 v03r01 – Section 5.6

Test Settings

Subclause 5.2.5.5 of ANSI C63.26-2015 is applicable, along with the following provisions. For personal/portable radios utilizing an integral antenna, the factor LC is typically negligible. However, in a fixed station transmit system that utilizes a long cable run between the transmitter and the transmitting antenna, this factor can be significant. The minimum cable loss should be used in this equation.

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

$$\text{ERP/EIRP} = \text{PMeas} - \text{LC} + \text{GT}$$

Where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

Limits for GSM850:

Operation Mode	Power Step	E.R.P. (dBm)
GSM	5	≤38.45
GPRS	3	≤38.45
EDGE	6	≤38.45

Limits for PCS1900:

Operation Mode	Power Step	E.I.R.P. (dBm)
GSM	0	≤33
GPRS	3	≤33
EDGE	5	≤33

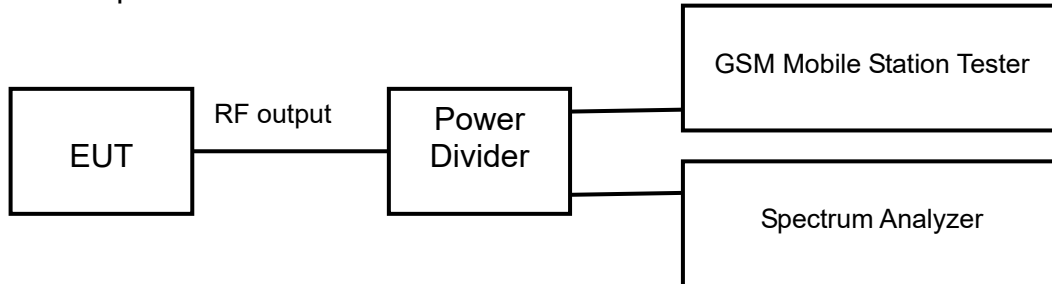
Test result:

The test results are shown in Appendix A.

### 6.3 Occupied Bandwidth

Rule Part(s)  
Part 2.1049

Test Setup:



Test procedure:  
KDB 971168 D01 v03r01 – Section 4.2

#### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq$  3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Limits: No specific occupied bandwidth requirements in part 2.1049

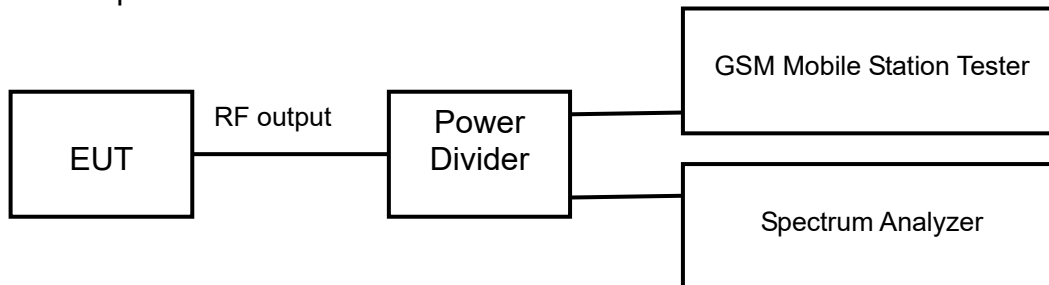
Test result:

The test results are shown in Appendix A.

## 6.4 Emission Bandwidth-

Rule Part(s)  
Part 2.1049

Test Setup:



Test procedure:  
KDB 971168 D01 v03r01 – Section 4.2

### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 26dB occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq$  3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the emission bandwidth observed in Step 7

Limits: No specific occupied bandwidth requirements in part 2.1049

Test result:

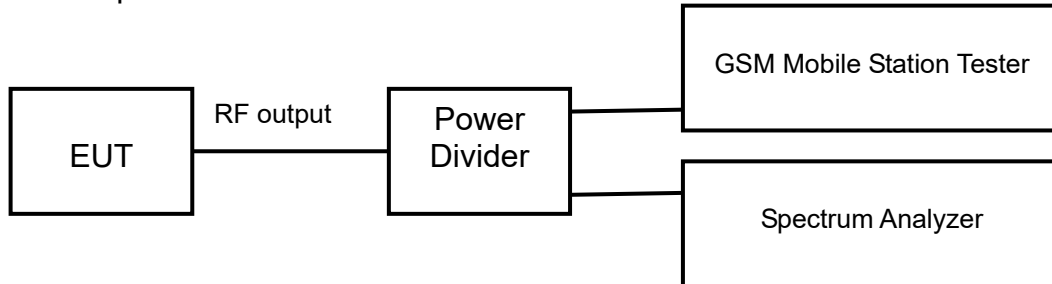
The test results are shown in Appendix A.

## 6.5 Spurious Emissions at antenna terminal

Rule Part(s)

FCC Part 2.1053/22.917 (a)/ 24.238(a)

Test Setup:



Test procedure:

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz for Cell, 20GHz for PCS
2. RBW=100 kHz (For below 1GHz), 1MHz (For above 1GHz)
3. VBW  $\geq 3 \times$  RBW
4. Detector = RMS
5. Trace mode = trace average for continuous emissions, max hold for pulse emissions
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Limits:

The minimum permissible attenuation level of any spurious emission is  $43 + \log_{10}(P_{[Watts]})$ , where P is the transmitter power in Watts.

Test result:

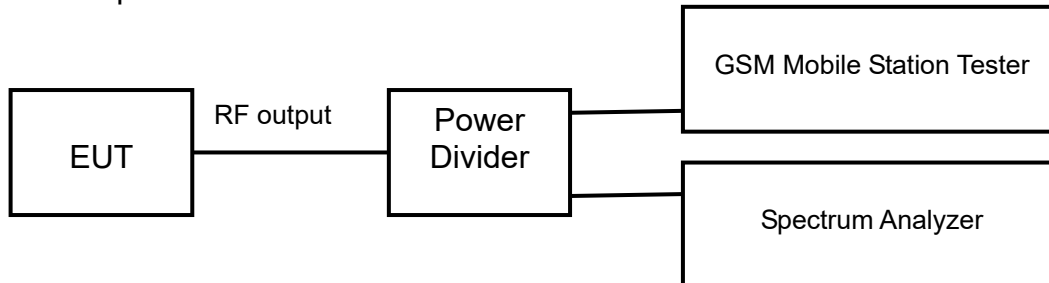
The test results are shown in Appendix A.

## 6.6 Band Edges Compliance

Rule Part (s)

FCC Part 2.1051/ 22.917(a) /Part 24.238(a)

Test Setup:



Test procedure:

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span=2MHz
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq 2 \times \text{Span}/\text{RBW}$
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Limit: The minimum permissible attenuation level of any spurious emission is  $43 + \log_{10}(P_{\text{[Watts]}})$ , where P is the transmitter power in Watts.

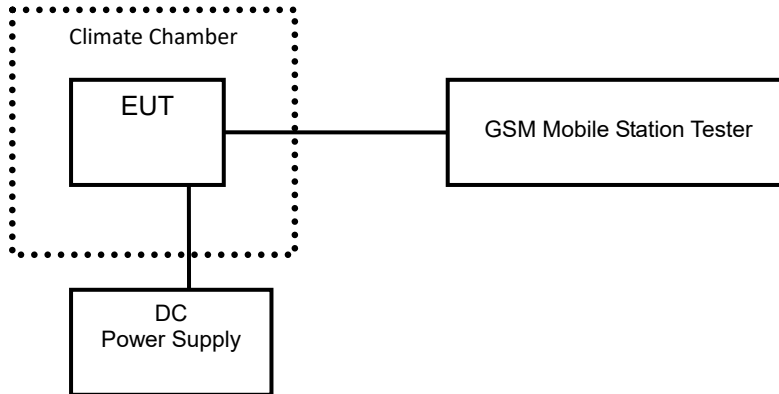
Test result:

The test results are shown in Appendix A.

## 6.7 Frequency Stability

Rule Part(s)  
FCC Part 2.1055/22.355 /Part 24.235

Test setup:



Test Procedure:  
ANSI/TIA-603-E-2016

### Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C (The temperature range can be declared by the manufacturer). A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

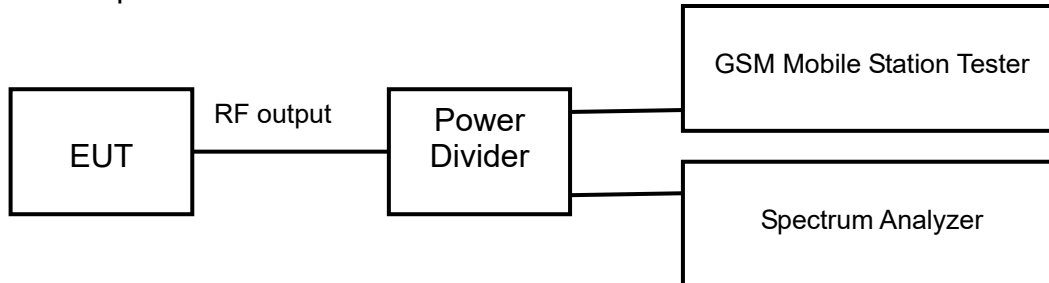
Limits: For Part 22, the frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency. For Part 24, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test result:  
The test results are shown in Appendix A.

## 6.8 Peak-Average Ratio

Rule Part(s)  
FCC Part 24.232(d)

Test Setup:



Test procedure:  
KDB 971168 D01 v03r01 – Section 5.7.1

Test settings:

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Limits: the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Test result:

The test results are shown in Appendix A



## 7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty	
RF Power Output	0.6 dB	
Effective Radiated Power and Effective Isotropic Radiated Power	0.6 dB	
Occupied Bandwidth	3kHz	
Emission Bandwidth	3kHz	
Peak-Average Ratio	0.8dB	
Frequency Stability	48Hz	
Band Edges Compliance	1.2dB	
Spurious Emissions at antenna terminal	9kHz~2GHz	1.2dB
	2G~3.6GHz	1.4dB
	3.6G~8GHz	2.2dB
	8G~12.75GHz	2.7dB

## **8 TEST EQUIPMENTS**

No.	Name/Model	Manufacturer	S/N	Calibration Date	Calibration Due Date
1	Mobile Station Tester / MT8820C	Anritsu	6201300660	2021.06.21	2022.06.20
2	Radio Communication Station / CMW500	R&S	161702	2021.06.21	2022.06.20
3	Radio Communication Station / SP9500	StarPoint	20334	2021.4.12	2022.4.11
4	Spectrum Analyzer / FSV40	R&S	101065	2021.06.21	2022.06.20
5	Spectrum Analyzer / FSW	R&S	101581	2021.02.19	2022.02.18
6	Spectrum Analyzer / N9020A	Agilent	MY48010771	2021.05.18	2022.05.17
7	Power Divider / 11667A	HP	19632	2021.06.21	2022.06.20
8	DC Power Supply / E3645A	Agilent	MY40000741	2021.04.22	2022.04.21
9	Temperature chamber / SH241	ESPEC	92013758	2021.06.21	2022.06.20
10	Fully-Anechoic Chamber / 12.65m×8.03m×7.50m	FRANKONIA	----	----	----
11	Semi-Anechoic/Chamber / 23.18m×16.88m×9.60m	FRANKONIA	---	----	----
12	Turn table Diameter:1m	FRANKONIA	----	----	----
13	Turn table Diameter:5m	FRANKONIA	----	----	----
14	Antenna master FAC(MA4.0)	MATURO	----	----	----
15	Antenna master SAC(MA4.0)	MATURO	----	----	----
16	Shielding room / 9.080m×5.255m×3.525m	FRANKONIA	----	----	----
17	Double-Ridged Waveguide Horn Antenna / HF 907	R&S	100512	2021.06.21	2022.06.20
18	Double-Ridged Waveguide Horn Antenna / HF 907	R&S	100513	2021.06.21	2022.06.20
19	Ultra log antenna / HL562	R&S	100016	2021.06.21	2022.06.20
20	Receive antenna /3160-09	SCHWARZ-BECK	002058-002	2021.06.21	2022.06.20
21	EMI test receiver / ESI 40	R&S	100015	2021.06.21	2022.06.20
22	EMI test receiver / ESCS30	R&S	100029	2021.06.21	2022.06.20
23	Receive antenna / HL562	R&S	100167	2021.06.21	2022.06.20
24	AMN / ENV216	R&S	3560.6550.12	2021.06.21	2022.06.20

## **APPENDIX A – TEST DATA OF CONDUCTED EMISSION**

Please refer to the attachment.