FCC
RF Test Report

Product Name: Smart Phone

Model Number: MAR-LX2J

Report No.: SYBH(Z-RF)20190219010002-2001

FCC ID：QISMAR-LX2J

Authorized	APPROVED (Lab Manager)	PREPARED (Test Engineer)
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DATE	2019-03-26	2019-03-26

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1. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01
2. The laboratory has been recognized by the US Federal Communications Commission (FCC) to perform compliance testing subject to the Commission's Certification rules. The Designation Number is CN1173, and the Test Firm Registration Number is 294140.
3. The laboratory has been recognized by the Innovation, Science and Economic Development Canada (ISED) to test to Canadian radio equipment requirements. The CAB identifier is CN0003, an d the ISED# is 21741.
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MODIFICATION RECORD

No.	Report No	Modification Description
1	SYBH(Z-RF)20190219010002-2001	First release.

DECLARATION

Type	Description
Multiple Models Applications	☒ The present report applies to single model. ☐ The present report applies to several models. The practical measurements are performed with the model. The present report only presents the worst test case of all modes, see relevant test results for detailed.

1 Table of contents

2 General Information

2.1 Test standard/s

Applied Rules :	47 CFR FCC Part 02 47 CFR FCC Part 22 47 CFR FCC Part 24 47 CFR FCC Part 27 47 CFR FCC Part 90
Test Method :	FCC KDB 971168 D01 Power Meas License Digital Systems v03r01 ANSI C63.26

2.2 Test Environment

Temperature :	TN	15 to 30	°C during room temperature tests	
Ambient Relative Humidity:	40 to 55 %			
Atmospheric Pressure:	Not applicable			
Power supply :	VL	3.6	V	DC by Battery
	VN	3.8	V	
	VH	4.35	V	

NOTE: 1) VN= nominal voltage, VL= low extreme test voltage, VH= High extreme test voltage;

TN= normal temperature, TL= low extreme test temperature, TH= High extreme test temperature.

2.3 Test Laboratories

Test Location 1 :	RELIABILITY LABORATORY OF HUAWEI TECHNOLOGIES CO., LTD.
Address of Test Location 1 :	No.2, New City Avenue, Songshan Lake Sci. & Tech. Industry Park, Dongguan, 523808, P.R.C

2.4 Applicant and Manufacturer

Company Name :	HUAWEI TECHNOLOGIES CO., LTD
Address :	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

2.5 Application details

Date of Receipt Sample:	2019-02-24
Start of test:	2019-03-01
End of test:	2019-03-26

3 Test Summary

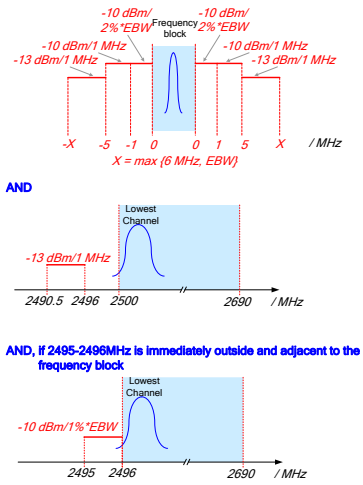
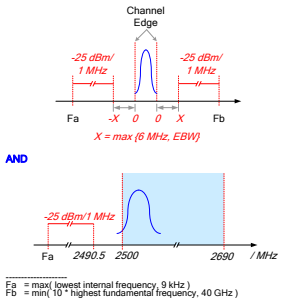
3.1 Cellular Band (824-849 MHz paired with 869-894 MHz)

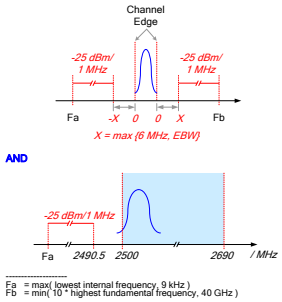
Test Item	FCC Rule No.	Requirements	Test Result	Verdict(Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913	FCC: ERP ≤ 7 W.	Appendix A	Pass
Peak-Average Ratio	---	Limit≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §22.917	FCC: ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. _____ Note 1): EBW is -26 dBc EBW.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §22.917	FCC: ≤ -13 dBm/RefBW, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz), after 1 MHz bands immediately outside and adjacent to the frequency block. (RefBW: ≥100 kHz for frequency below 1 GHz, and =1 MHz above 1 GHz)	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13 dBm/RefBW, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz), after 1 MHz bands immediately outside and adjacent to the frequency block. (RefBW: ≥100 kHz for frequency below 1 GHz, and =1 MHz above 1 GHz)	Appendix G	Pass
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm	Appendix H	Pass
NOTE: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

3.2 PCS Band (1850-1910 MHz paired with 1930-1990 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict(Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP ≤ 2 W	Appendix A	Pass
Peak-Average Ratio	§2.1046, §24.232	Limit≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §24.238	FCC: ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. _____ Note 1): EBW is -26 dBc EBW.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238	FCC: ≤ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	FCC: ≤ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks	Appendix G	Pass
Frequency Stability	§2.1055, §24.235	FCC: Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

3.3 BRS&EBS Band (2500-2570 MHz paired with 2620-2690 MHz)

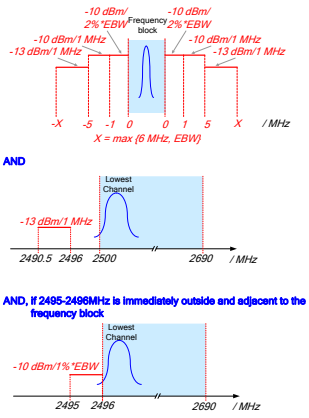
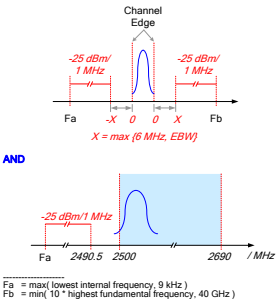
Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Appendix A	Pass
Peak-Average Ratio	§27.50(a)	Limit: ≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m4)	FCC:  Note 1): EBW is -26 dBc EBW.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)	FCC:  Note 1): EBW is -26 dBc EBW. Note 2): MeasFrom: max(lowest internal	Appendix F	Pass

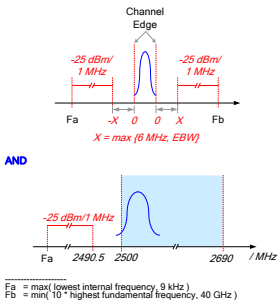
Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
		frequency, 9 kHz). Note 3): MeasTo: min(10 * highest fundamental frequency, 40 GHz).		
Field Strength of Spurious Radiation	§2.1053, §27.53(m)	FCC:  Note 1): EBW is -26 dBc EBW. Note 2): MeasFrom: max(lowest internal frequency, 9 kHz). Note 3): MeasTo: min(10 * highest fundamental frequency, 40 GHz).	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

3.4 Band (814-824 MHz paired with 859-869MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Transmitter Conducted Power Output	§2.1046, §90.635	< 100 W.	Appendix A	PASS
Peak-Average Ratio	---	---	Appendix B	N/T
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §90.691	< 50 + 10Log10(P[Watts]]) at Band Edge and for all out-of-band emissions wthin 37.5kHz of Block Edge	Appendix E	PASS
Spurious Emission at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log10(P[Watts]) for all out-of-band emissions	Appendix F	PASS
Field Strength of Spurious Radiation	§2.1053, §90.691	< 43 + 10Log10(P[Watts]) for all out-of-band emissions	Appendix G	PASS
Frequency Stability	§2.1055, §90.213	< ±2.5ppm.	Appendix H	PASS
NOTE: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

3.5 Band41 (2545-2655 MHz paired with 2545-2655 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Appendix A	Pass
Peak-Average Ratio	§27.50(a)	Limit≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m4)	 FCC: Note 1): EBW is -26 dBc EBW.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)	FCC:  Note 1): EBW is -26 dBc EBW. Note 2): MeasFrom: max(lowest internal frequency, 9 kHz). Note 3): MeasTo: min(10 * highest fundamental frequency, 40 GHz).	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)	FCC:	Appendix G	Pass

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
		 Note 1): EBW is -26 dBc EBW. Note 2): MeasFrom: max(lowest internal frequency, 9 kHz). Note 3): MeasTo: min(10 * highest fundamental frequency, 40 GHz).		
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

4 Description of the Equipment under Test (EUT)

4.1 General Description

MAR-LX2J is subscriber equipment in the GSM/WCDMA/LTE system. The GSM frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The UMTS frequency band is B1 and B2 and B5 and B6 and B8 and B19. The LTE frequency band is B1 and B3 and B5 and B7 and B8 and B18 and B19 and B26 and B28 and B41. The Mobile Phone implements such functions as RF signal receiving/transmitting, GSM/WCDMA/LTE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides one micro SD card interface (it can also used as SIM card interface), earphone port (to provide voice service) and one SIM card interface. MAR-LX2J are dual SIM and single SIM smart phones, Single SIM delete SIM only by software. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

Note: Only GSM850 and GSM1900,UMTS frequency B2 and B5,LTE frequency B5 and B7 and B26 and B41 bands test data included in this report.

4.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

4.2.1 Board

Board		
Description	Software Version	Hardware Version
Main Board	9.0.1.120(SP1C900E120R1P16)	HL2MARLM

4.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
Adapter	HW-090200EH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200BH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200JH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200UH0	Huawei Technologies	Input voltage: 100-240V ~50/60Hz 0.5A

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
		Co., Ltd.	Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-059200EHQ	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Battery	HB356687ECW	Huawei Technologies Co., Ltd.	Rated capacity: 3240mAh Nominal Voltage: ⎓ +3.82V Charging Voltage: ⎓ +4.40V

4.3 Technical Specification

NOTE: For the detailed technical descriptions, see the applicant/manufacturer's specifications or user manual.

4.3.1 General

Characteristics	Description	
Radio System Type	☒ GSM ☒ UMTS ☒ LTE	
Supported Frequency Range	GSM850/ WCDMA850	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	PCS1900/ WCDMA1900	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	LTE BAND5	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	LTE BAND7	Transmission (TX): 2500 to 2570 MHz
		Receiving (RX): 2620 to 2690 MHz
	LTE band 26(814 to 824 MHz) only apply for FCC.	Transmission (TX): 814 to 824MHz
		Receiving (RX): 859 to 869 MHz
	LTE band 26 (824 to 849 MHz)	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	LTE Band 41(2545 to 2655 MHz)	Transmission (TX): 2545 to 2655 MHz
		Receiving (RX): 2545 to 2655 MHz
Antenna	Description	Isotropic Antenna
	Type	☒ Integral ☐ External ☐ Dedicated
	TX and RX Antenna Ports(one band)	TX & RX port: 1 TX-only port: 0 RX-only port: 1
	Smart Antenna(for uplink)	☐ MIMO ☒ Non MIMO
	Gain	GSM850: -7.2 dBi (per antenna port, max) PCS1900: -1.8 dBi (per antenna port, max) WCDMA 850: -7.2 dBi (per antenna port, max) WCDMA 1900: -1.8 dBi (per antenna port, max) LTE Band 5: -7.2 dBi (per antenna port, max) LTE Band 7: 0.5 dBi (per antenna port, max) LTE Band 26: -7.2 dBi (per antenna port, max) LTE Band 41: 0.5 dBi (per antenna port, max)

Characteristics	Description	
	Remark	When the EUT is put into service, the practical maximum antenna gain should NOT exceed the value as described above.
Target TX Output Power	GSM850: 32.1 dBm GSM1900 30.3 dBm UMTS850 24.0 dBm UMTS1900: 23.5 dBm LTE Band 5: 23.5 dBm LTE Band 7: 23.0 dBm LTE Band 26: 24.0 dBm LTE Band 41: 23.0 dBm	
Supported Channel Bandwidth	GSM system:	☒ 200 kHz
	UMTS system:	☒ 5 MHz
	LTE band 5	☒1.4MHz, ☒3MHz, ☒5MHz, ☒10MHz
	LTE band 7	☒5MHz, ☒10MHz ,☒15MHz ,☒20MHz
	LTE band 26(814-824MHz)	☒1.4MHz, ☒3MHz, ☒5MHz, ☒10MHz
	LTE band 26(824-849MHz)	☒1.4MHz, ☒3MHz, ☒5MHz, ☒10MHz ,☒ 15MHz
	LTE band 41(2545-2655MHz)	☒5MHz, ☒10MHz ,☒15MHz ,☒20MHz
Type of Modulation for uplink	GSM	☒ GMSK ☒ 8PSK
	WCDMA	☒ QPSK ☐ 16QAM(only for HSPA+) ☐ 64QAM
	LTE	☒ QPSK ☒ 16QAM ☒ 64QAM
Designation of Emissions (Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.)	GSM850:	245KGXW, 254KG7W
	GSM1900:	250KGXW, 255KG7W
	UMTS850:	4M18F9W
	UMTS1900:	4M18F9W
	LTE BAND5:	1M09G7D (1.4 MHz QPSK modulation), 1M10W7D (1.4 MHz 16QAM modulation) 2M71G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 9M02G7D (10 MHz QPSK modulation), 9M04W7D (10 MHz 16QAM modulation)
	LTE BAND7:	4M51G7D (5 MHz QPSK modulation),

Characteristics	Description	
		4M52W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation)
	LTE BAND26(814-824MHz):	1M10G7D (1.4 MHz QPSK modulation), 1M10W7D (1.4 MHz 16QAM modulation) 2M71G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
	LTE BAND26(824-849MHz):	1M10G7D (1.4 MHz QPSK modulation), 1M10W7D (1.4 MHz 16QAM modulation) 2M71G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M52G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 9M02G7D (10 MHz QPSK modulation), 9M04W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation)
	LTE BAND41(2545-2655MHz):	4M52G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M04W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation)

5 General Test Conditions / Configurations

5.1 Test Modes

NOTE1: The test mode(s) are selected according to relevant radio technology specifications.
NOTE2: The modulation for WCDMA, HSUPA, HSDPA, DC-HSDPA is the same, which is QPSK, and the WCDMA is the worst, so we test the WCDMA only.
NOTE3: The power of LTE system 64QAM modulation is lower than that of 16QAM, so we did not test 64QAM modulation.

Test Mode	Test Modes Description
GSM/TM1	GSM system, GSM/GPRS, GMSK modulation
GSM/TM2	GSM system, EDGE, 8PSK modulation
UMTS/TM1	WCDMA system, QPSK modulation
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

5.2 Test Frequency

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
GSM850	TX	Channel 128	Channel 190	Channel 251
		824.2MHz	836.6MHz	848.8MHz
	RX	Channel 128	Channel 190	Channel 251
		869.2MHz	881.6MHz	893.8MHz
WCDMA850	TX	Channel 4132	Channel 4182	Channel 4233
		826.4MHz	836.4MHz	846.6MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4MHz	881.4MHz	891.6MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
GSM1900	TX	Channel 512	Channel 661	Channel 810
		1850.2MHz	1880.0MHz	1909.8MHz
	RX	Channel 512	Channel 661	Channel 810
		1930.2 MHz	1960.0 MHz	1989.8 MHz
WCDMA1900	TX	Channel 9262	Channel9400	Channel9538
		1852.4MHz	1880.0MHz	1907.6MHz
	RX	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 5	TX(1.4M)	Channel 20407	Channel 20525	Channel 20643

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
		824.7 MHz	836.5 MHz	848.3 MHz
	TX(3M)	Channel 20415	Channel 20525	Channel 20635
		825.5 MHz	836.5 MHz	847.5 MHz
	TX(5M)	Channel 20425	Channel 20525	Channel 20625
		826.5 MHz	836.5 MHz	846.5 MHz
	TX(10M)	Channel 20450	Channel 20525	Channel 20600
		829 MHz	836.5 MHz	844 MHz
	RX(1.4M)	Channel 2407	Channel 2525	Channel 2643
		869.7 MHz	881.5 MHz	893.3 MHz
	RX (3M)	Channel 2415	Channel 2525	Channel 2635
		870.5 MHz	881.5 MHz	892.5 MHz
	RX(5M)	Channel 2425	Channel 2525	Channel 2625
		871.5 MHz	881.5 MHz	891.5 MHz
	RX (10M)	Channel 2450	Channel 2525	Channel 2600
		874 MHz	881.5 MHz	889 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 7	TX (5M)	Channel 20775	Channel 21100	Channel 21425
		2502.5 MHz	2535 MHz	2567.5 MHz
	TX (10M)	Channel 20800	Channel 21100	Channel 21400
		2505 MHz	2535 MHz	2565 MHz
	TX (15M)	Channel 20825	Channel 21100	Channel 21375
		2507.5 MHz	2535 MHz	2562.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
	TX (20M)	Channel 20850	Channel 21100	Channel 21350
		2510 MHz	2535 MHz	2560 MHz
	RX (5M)	Channel 2775	Channel 3100	Channel 3425
		2622.5 MHz	2655 MHz	2687.5 MHz
	RX (10M)	Channel 2800	Channel 3100	Channel 3400
		2625 MHz	2655 MHz	2685 MHz
	RX (15M)	Channel 2825	Channel 3100	Channel 3375
		2627.5 MHz	2655 MHz	2682.5 MHz
	RX (20M)	Channel 2850	Channel 3100	Channel 3350
		2630 MHz	2655 MHz	2680 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE Band 26 (814 to 824 MHz)	TX (1.4M)	Channel 26697	Channel 26740	Channel 26783
		814.7 MHz	819 MHz	823.3 MHz
	TX (3M)	Channel 26705	Channel 26740	Channel 26775
		815.5 MHz	819 MHz	822.5 MHz
	TX (5M)	Channel 26715	Channel 26740	Channel 26765
		816.5 MHz	819 MHz	821.5 MHz
	TX (10M)	Channel 26740	Channel 26740	Channel 26740
		819 MHz	819 MHz	819 MHz
	RX (1.4M)	Channel 8697	Channel 8740	Channel 8783
		859.7 MHz	864 MHz	868.3 MHz
	RX (3M)	Channel 8705	Channel 8740	Channel 8765

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
		860.5 MHz	864 MHz	867.5 MHz
	RX (5M)	Channel 8715	Channel 8740	Channel 8765
		861.5 MHz	864 MHz	866.5 MHz
	RX (10M)	Channel 8740	Channel 8740	Channel 8740
		864 MHz	864 MHz	864 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE Band 26 (824 to 849 MHz)	TX (1.4M)	Channel 26797	Channel 26915	Channel 27033
		824.7 MHz	836.5 MHz	848.3 MHz
	TX (3M)	Channel 26805	Channel 26915	Channel 27025
		825.5 MHz	836.5 MHz	847.5 MHz
	TX (5M)	Channel 26815	Channel 26915	Channel 27015
		826.5 MHz	836.5 MHz	846.5 MHz
	TX (10M)	Channel 26840	Channel 26915	Channel 26990
		829 MHz	836.5 MHz	844 MHz
	TX (15M)	Channel 26865	Channel 26915	Channel 26965
		831.5 MHz	836.5 MHz	841.5 MHz
	RX (1.4M)	Channel 8697	Channel 8915	Channel 9033
		859.7 MHz	881.5 MHz	893.3 MHz
	RX (3M)	Channel 8805	Channel 8915	Channel 9025
		860.5 MHz	881.5 MHz	892.5 MHz
	RX (5M)	Channel 8815	Channel 8915	Channel 9015
		871.5 MHz	881.5 MHz	891.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
	RX (10M)	Channel 8840	Channel 8915	Channel 8990
		874 MHz	881.5 MHz	889 MHz
	RX (15M)	Channel 8865	Channel 8915	Channel 8965
		876.5 MHz	881.5 MHz	886.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 41(2545-2655)	TX(5M)	Channel 40165	Channel 40690	Channel 41215
		2547.5 MHz	2600 MHz	2652.5 MHz
	TX(10M)	Channel 40190	Channel 40690	Channel 41190
		2550 MHz	2600 MHz	2650 MHz
	TX(15M)	Channel 40215	Channel 40690	Channel 41165
		2552.5 MHz	2600 MHz	2647.5 MHz
	TX(20M)	Channel 40240	Channel 40690	Channel 41140
		2555 MHz	2600 MHz	2645 MHz
	RX(5M)	Channel 40165	Channel 40690	Channel 41215
		2547.5 MHz	2600 MHz	2652.5 MHz
	RX(10M)	Channel 40190	Channel 40690	Channel 41190
		2550 MHz	2600 MHz	2650 MHz
	RX(15M)	Channel 40215	Channel 40690	Channel 41165
		2552.5 MHz	2600 MHz	2647.5 MHz
	RX(20M)	Channel 40240	Channel 40690	Channel 41140
		2555 MHz	2600 MHz	2645 MHz

5.3 DESCRIPTION OF TESTS

5.3.1 Radiated Power and Radiated Spurious Emissions

Radiated spurious emissions are investigated indoors in a full-anechoic chamber to determine the frequencies producing the worst case emissions. Final measurements for radiated power and radiated spurious emissions are performed on the 3 meter OATS per the guidelines of ANSI/TIA-603-E-2016. The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 150cm above the ground plane and 3 meters from the receive antenna. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Emissions are also investigated with the receive antenna horizontally and vertically polarized.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other non-metallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z) axis positions such that emissions from the EUT are maximized. Measure the EUT maximum RF power and record the result.

A half-wave dipole is then substituted in place of the EUT. For emissions above 3GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT.

The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to Pg [dBm] – cable loss [dB].

The calculated Pd levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of $43 + 10\log_{10}(\text{Power}_{[\text{Watts}]})$.

Test Procedures Used

KDB 971168 D01 v03-Section 5

ANSI/TIA-603-E-2016-Section 2.2.17 / ANSI/TIA-603-E-2016-Section 2.2.12

Note: Reference test setup 3

5.3.2 Peak-Average Ratio

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth.

Test Procedures Used

KDB 971168 D01 v03-Section 5.7.2

Test Settings

1、The signal analyzer's CCDF measurement profile enabled

2、Frequency= carrier center frequency

3、Measurement BW > EBW of signal

4、for continuous transmissions, set to 1ms

5、Record the maximum PAPR level associated with a probability of 0.1%.

Note: Reference test setup 1

5.3.3 Occupied Bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

Test Procedures Used

KDB 971168 D01 v03-Section 4.3

Test Settings

1、SET RBW=1-5% of OBW

2、SET VBW ≥ 3*RBW

3、Detector: Peak

4、Trace mode= max hold.

5、Sweep= auto couple

6、Steps 1-5 were repeated after it is stable

Note: Reference test setup 1.

5.3.4 Band Edge Compliance

The test complies with the requirements in clause 2 of the present report according to test procedures in KDB 971168 D01 v03-Section 6 with corresponding test settings.

Note: Reference test setup 1.

5.3.5 Spurious and Harmonic Emissions at Antenna Terminal

The test complies with the requirements in clause 2 of the present report according to test procedures in KDB 971168 D01 v03-Section 6 with corresponding test settings.

Note: Reference test setup 1.

5.3.6 Frequency Stability / Temperature Variation

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

Time Period and Procedure:

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. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

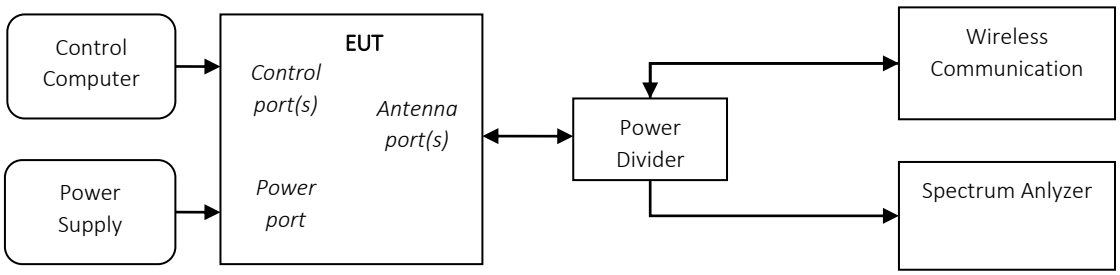
Test Procedures Used

ANSI/TIA-603-E-2016

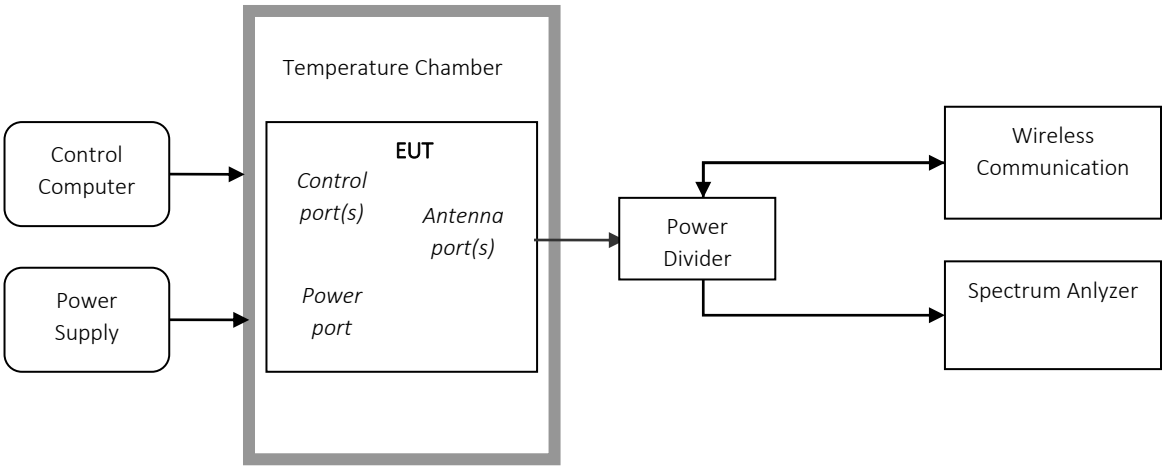
Note: Reference test setup 2.

5.4 Test Setups

5.4.1 Test Setup 1



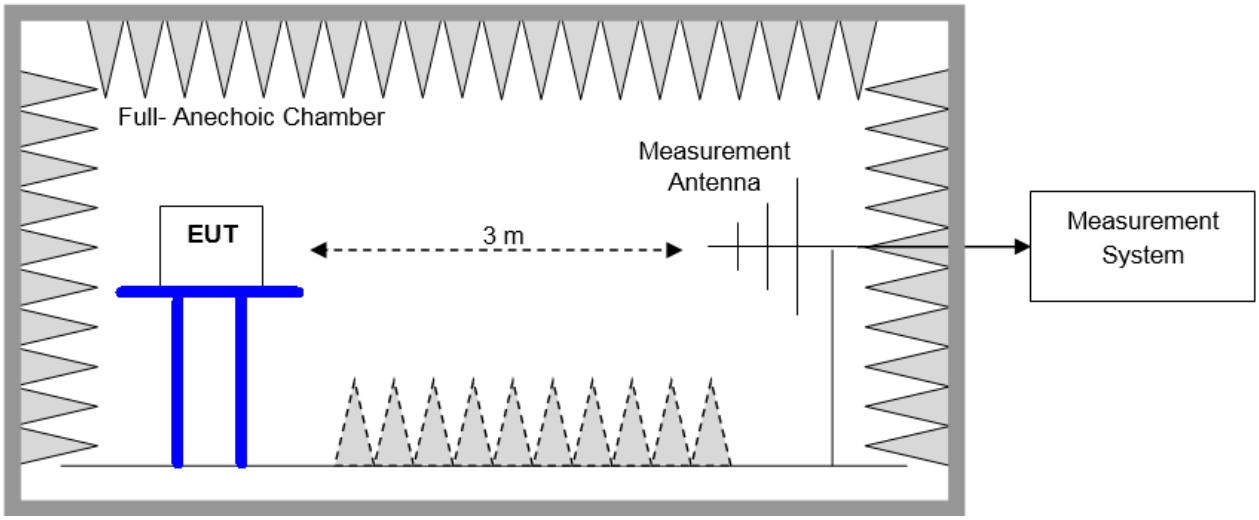
5.4.2 Test Setup 2



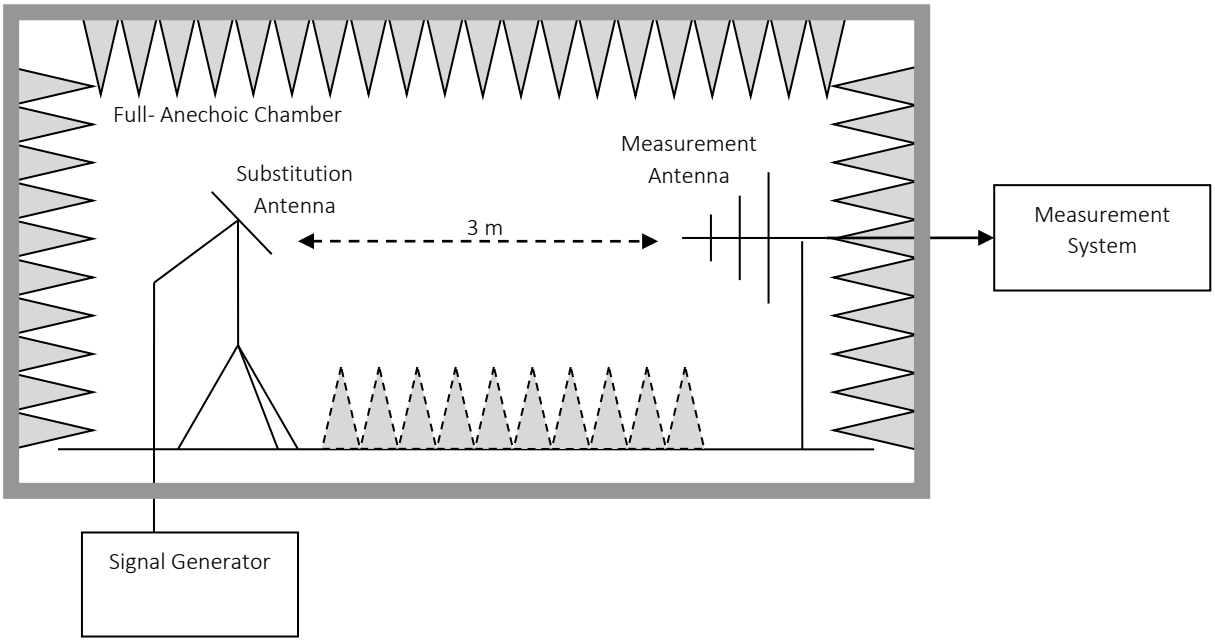
5.4.3 Test Setup 3

NOTE: Effective radiated power (ERP) and Equivalent Isotropic Radiated Power(EIRP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

5.4.3.1 Step 1: Pre-test



5.4.3.2 Step 2: Substitution method to verify the maximum ERP/EIRP



5.5 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
	Average Power, Spectral Density (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Peak-to-Average Ratio (if required)		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Modulation Characteristics		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
	Emission Bandwidth (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)

Test Case	Test Conditions	
	Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 3
	Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1/TM2/TM3,LTE/TM1,LTE/TM2 NOTE: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Frequency Stability	Test Env.	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) VL, VN and VH of Rated Voltage at Ambient Climate.
	Test Setup	Test Setup 2
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2

6 Main Test Instruments

This table gives a complete overview of the RF measurement equipment.
Devices used during the test described are marked ☒

6.1 Current Test Project/Report

Main Test Equipments(GSM/WCDMA/LTE test system)					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Temperature Chamber	WEISS	WKL64	56246002940010	2018/10/24	2019/10/24
Universal Radio Communication Tester	R&S	CMW500	159302	2018/07/23	2019/07/23
Spectrum Analyzer	Agilent	N9030A	MY49431698	2018/07/23	2019/07/23
Spectrum Analyzer	Keysight	N9040B	MY57212529	2018/06/28	2019/06/28
Signal generator	Agilent	E8257D	MY51500314	2018/04/27	2019/04/27

Main Test Equipments(RSE test system)					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Universal Radio Communication Tester	R&S	CMU200	117385	2018/05/08	2019/05/07
Universal Radio Communication Tester	R&S	MT8821C	6261760791	2018/04/02	2019/04/01
Spectrum analyzer	R&S	FSU3	200474	2019/01/15	2020/01/14
Spectrum analyzer	R&S	FSU43	100144	2019/01/15	2020/01/14
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-521	2018/04/09	2020/04/08
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100304	2017/05/27	2019/05/26
double ridged horn antenna（0.8G-18GHz)	R&S	HF907	100391	2017/7/20	2019/07/19
Pyramidal Horn Antenna(18GHz-26.5GHz)	ETS-Lindgren	3160-09	5140299	2017/07/20	2019/07/19
Pyramidal Horn Antenna(26.5GHz-40GHz)	ETS-Lindgren	3160-10	00205695	2018/04/20	2020/04/19
Pyramidal Horn Antenna(26.5GHz-40GHz)	ETS-Lindgren	3160-10	LM5947	2017/07/20	2019/07/19
Software Information					
Test Item	Software Name	Manufacturer	Version		
RSE	EMC32	R&S	V8.40.0		

Main Test Equipments(RE test system)

Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Test receiver	R&S	ESU26	100387	2019/01/15	2020/01/14
Test receiver	R&S	ESU26	100387	2019/01/15	2020/01/14
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100262	2017/04/25	2019/04/25
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100263	2017/04/25	2019/04/25
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-357	2017/04/21	2019/04/20
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-520	2017/3/29	2019/03/28
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-491	2017/3/29	2019/03/28
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-356	2018/4/9	2020/04/08

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EMC32	R&S	V9.25.0

7 Measurement Uncertainty

For a 95% confidence level (k = 2), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Test Item		Extended Uncertainty
Transmit Output Power Conducted	Power [dBm]	U = 0.64 dB
RF Power Density, Conducted	Power [dBm]	U = 0.64 dB
Bandwidth	Magnitude [kHz]	200kHz: U＝9.06kHz 1.4MHz: U＝9.48kHz 3MHz: U＝10.86kHz 5MHz: U=13.84kHz 10MHz: U=22.32kHz 15MHz: U=31.9kHz 20MHz: U=41.78kHz
Band Edge Compliance	Disturbance Power [dBm]	U = 0.9 dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	20MHz~3.6GHz：U＝0.88dB 3.6GHz~8.4GHz：U＝1.08dB 8.4GHz~13.6GHz：U＝1.24dB 13.6GHz~22GHz：U＝1.34dB 22GHz~26.5GHz：U＝1.36dB
Field Strength of Spurious Radiation	ERP/EIRP [dBm]	For 3 m Chamber: U = 5.94 dB (30 MHz to 3GHz) U = 5.54 dB (3GHz to 18GHz) U = 4.94 dB (18GHz to 26.5GHz)
Frequency Stability	Frequency Accuracy [Hz]	800MHz: U＝24.08Hz 900MHz: U＝24.54Hz 1900MHz: U＝34.7Hz 2100MHz: U=36.96Hz 2300MHz: U=39.24Hz 2500MHz: U=41.58Hz 2600MHz: U=42.74Hz

8 Appendixes

Appendix No.	Description
SYBH(Z-RF)20190219010002-2001-A	Appendix_for_GSM
SYBH(Z-RF)20190219010002-2001-B	Appendix_for_WCDMA
SYBH(Z-RF)20190219010002-2001-C	Appendix_for_LTE_Band_5
SYBH(Z-RF)20190219010002-2001-D	Appendix_for_LTE_Band_7
SYBH(Z-RF)20190219010002-2001-E	Appendix_for_LTE_Band_26(814-824)
SYBH(Z-RF)20190219010002-2001-F	Appendix_for_LTE_Band_26(824-849)
SYBH(Z-RF)20190219010002-2001-G	Appendix_for_LTE_Band_41(2545-2655)

Appendix	Description
Appendix A	Effective (Isotropic) Radiated Power Output Data
Appendix B	Peak-Average Ratio
Appendix C	Modulation Characteristics
Appendix D	Bandwidth
Appendix E	Band Edges Compliance
Appendix F	Spurious Emission at Antenna Terminals
Appendix G	Field Strength of Spurious Radiation
Appendix H	Frequency Stability

Note: For the RSE data we tested ant1&ant2, the data presented is all the antenna mode; the other items we tested all antenna modes, but the data presented is the worst antenna mode.

END