



FCC RF Test Report

Product Name: Smart Phone

Model Number: EVE-LX3

Report No.: SYBH(Z-RF)20221017002001-2004

FCC ID: 2ATEYEVE

Authorized	Name	Date
Prepared by:	Wang Xierobo	2022-10-19
Reviewed by:	Lin Jiekai	2022-10-19
Approved by:		2022-10-19

Reliability Laboratory of Huawei Technologies Co., Ltd.

No.2, New City Avenue, Songshan Lake Sci. & Tech. Industry Park, Dongguan, 523808, P.R.C Telephone: +86 769 23830808 Fax: +86 769 23837628



Notice

- 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, and the ISED# is 21741.
- 4. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named "Global Compliance and Testing Center of Huawei Technologies Co., Ltd", the both names have coexisted since 2009.
- 5. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- 6. The test report is invalid if there is any evidence of erasure and/or falsification.
- 7. The test report is only valid for the test samples.
- 8. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- 9. If any question about this report, please contact the laboratory (PublicGCTC@huawei.com).

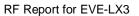


MODIFICATION RECORD

No.	Report No	Modification Description	
1	SYBH(Z-RF)20221017002001-2004	First release.	

DECLARATION

Туре	Description				
Multiple Models	☐ The present report applies to single model.				
Applications	☐ 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

1	Table o	of contents	4
2	Genera	al Information	5
	2.1	Test standard/s	5
	2.2	Test Environment	5
	2.3	Test Laboratories	5
	2.4	Applicant and Manufacturer	6
	2.5	Application details	6
3	Test S	ummary	7
4	Descrip	otion of the Equipment under Test (EUT)	8
	4.1	General Description	8
	4.2	EUT Identity	8
	4.3	Technical Description	9
5	Genera	al Test Conditions / Configurations	11
	5.1	Test Modes	11
	5.2	Description of tests	13
	5.3	Test Setups	15
	5.4	Test Conditions	18
6	Main T	est Instruments	19
	6.1	Current Test Project/Report	19
7	Measu	rement Uncertainty	20
8	Append	dixes	21



2 General Information

2.1 Test standard/s

Applied Rules :	47 CFR FCC Part 2, Subpart J		
Applied Nules :	47 CFR FCC Part 15, Subpart C		
	FCC KDB 558074 D01 DTS Meas Guidance v05r02		
Test Method :	ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless		
	Devices.		

2.2 Test Environment

Temperature :	TN	15 t	o 30 °	C du	ring room temperature tests
Ambient Relative Humidity:	25 to 75 %				
Atmospheric Pressure:	Not applicable				
Power supply :	VN	3.87		V	DC by Battery

NOTE 1: 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.

NOTE 2: The values used in the test report may be stringent than the declared.

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 Science & Technology Industry Park Dongguan, Guangdong, 523808, People's Republic of China	
Temperature of Test Location 1 :	25°C	
Relative humidity of Test Location 1 :	55 %	



2.4 Applicant and Manufacturer

Company Name :	Huawei Device Co., Ltd.		
Address :	No.2 of Xincheng Road, Songshan Lake Zone, Dongguan, Guangdong 523808, People's		
Address .	Republic of China		

2.5 Application details

2.5.1 Current Test Project/Report

Date of Receipt Sample:	2022-09-12
Start of test:	2022-09-13
End of test:	2022-10-19



3 Test Summary

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Testing location
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	Appendix A	Pass	Test Location 1
Occupied Bandwidth		No limit	Appendix B	Pass	Test Location 1
Duty Cycle	KDB 558074 D01(6.0)	No limit	Appendix C	Pass	Test Location 1
Maximum Average Output Power	15.247(b)(3)	FCC: For directional gain: Conducted < 30 dBm – (G[dBi] – 6 [dB]); Otherwise: Conducted < 30 dBm,	Appendix D	Pass	Test Location 1
Maximum Power Spectral Density Level	15.247(e)	Conducted < 8 dBm/3 kHz.	Appendix E	Pass	Test Location 1
Band Edges Compliance	45 247/4)	< -30 dBr/100 kHz if total	Appendix F	Pass	Test Location 1
Unwanted Emissions into Non-Restricted Frequency Bands	15.247(d)	average power ≤ power limit.	Appendix G	Pass	Test Location 1
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209 (NOTE 1)	FCC Part 15.209 field strength limit;	Appendix H	Pass	Test Location 1
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	Appendix I	Pass	Test Location 1

NOTE: The transmitter has an integral PCB loop antenna that is enclosed within the housing of the EUT and meets the requirements of FCC 15.203



4 Description of the Equipment under Test (EUT)

4.1 General Description

EVE-LX3 is subscriber equipment in the GSMWCDMA/LTE system. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/WCDMA and GSM protocol processing, voice, video MMS service, GPS, AGPS, Wi-Fi etc. Externally it provides earphone port (to provide voice service), and dual SIM/single SIM card interface.EVE-LX3 is dual/single SIM smart phone. 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 1: Only 2.4G WIFI 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	Description			
Product Name :	Smart Phone	Smart Phone			
Model name :	EVE-LX3				
SN:	Conducted 9STBB22824000052				
	Radiated 9STBB22824000091				
Software Version :	6.0.0.115(C603E2R2P1)				
Hardware Version :	HL1EVEM				



4.2.2 Sub-Assembly

Sub-Assembly							
Sub-Assembly Name	Model	Manufacturer	Description				
Adapter	HW-100225E00	Huawei Device Co., Ltd.	Input voltage: 100-240V ~50/60Hz, 0.75A				
Maptor	1100220200	Tradwor Bovico Go., Etc.	Output voltage: 5V/2A,9V/2A,10V/2.25A				
Adoptor	HW-100225B00	Huawei Device Co., Ltd.	Input voltage: 100-240V ~50/60Hz, 0.75A				
Adapter	HVV-100225B00	Huawei Device Co., Ltd.	Output voltage: 5V/2A,9V/2A,10V/2.25A				
Adoptor	HW-100225U00	Hugusi Davisa Ca. 14d	Input voltage: 100-240V ~50/60Hz, 0.75A				
Adapter	HVV-100225000	Huawei Device Co., Ltd.	Output voltage: 5V/2A,9V/2A,10V/2.25A				
Adoptor	UW 100225 100	Hugusi Davias Co. Ltd	Input voltage: 100-240V ~50/60Hz, 0.75A				
Adapter	HW-100225A00	Huawei Device Co., Ltd.	Output voltage: 5V/2A,9V/2A,10V/2.25A				
			Rated capacity: 4900mAh				
Battery	HB496590EFW-F	Huawei Device Co., Ltd.	Nominal Voltage: === +3.87V				
			Charging Voltage: +4.45V				

4.3 Technical Description

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

Characteristic	Description					
IEEE 802.11 WLAN Mode	⊠ 802.11b					
Supported	⊠ 802.11g					
	⊠ 802.11n		MHz			
		☐ HE SU	☐ 20 MHz, ☐ 40 MHz			
		☐ HE ERSU	☐ 20 MHz: 106-Tone/242-Tone			
	□ 802.11ax	П НЕ ТВ	☐ 20 MHz: 26-Tone/52-Tone/106-Tone/242-Tone			
	002.11ax		☐ 40 MHz:26-Tone/52-Tone/106-Tone/242-Tone/484-Tone			
		☐ HE MU	☐ 20 MHz: 26-Tone/52-Tone/106-Tone/242-Tone			
		☐ 40 MHz:26-Tone/52-Tone/106-Tone/242-Tone/484-Tor				
TX/RX Operating Range	2412-2462 MHz	2407 MHz + N * 5 MHz, N = 111 (for 802.11b/g/n HT20).				
TATIA Operating Range		2407 MHz + N * 5 MHz, N = 39 (for 802.11n HT40).				
Baseband Modulation	802.11b: DBPSK/DQPSK/CCK(DSSS)					
	802.11g : BPSK/C	PSK/16QAM/64QAM	M(OFDM)			
	802.11n : BPSK/C	PSK/16QAM/64QAM	M(OFDM)			
Emission Designator	8M06G7D (for 802	2.11b mode),				
	16M4G7D (for 80)	16M4G7D (for 802.11g mod),				
	17M6G7D (for 802.11n20 mode),					
	35M9G7D (for 802	35M9G7D (for 802.11n40 mode),				
TX Power Control	Supported, □	Supported, □ Not Supported				
Standby Mode	☐ Supported, ⊠	Not Supported				



Characteristic	Description					
Equipment Type	⊠ Stand-alone equipment, □ Plug-in radio device, □ Combined equipment					
Antenna	Description	Isotropic Antenna				
	Туре	☐ Integral (permanent fixed antenna, which may be built-in, designed as an				
		indispensable p	part of EUT)			
		☐ Dedicated ((removable antenna supplied with EUT, designed as an			
		indispensable p	part of EUT)			
	Ports		Ant 2, Ant 3			
	Smart System	⊠ 802.11b	⊠SISO, □2*2 CDD, □3*3 CDD, □4*4 CDD			
		⊠ 802.11g	⊠SISO, □2*2 CDD, □3*3 CDD, □4*4 CDD			
		⊠ 802.11n	⊠SISO, □2*2 MIMO, □3*3 MIMO, □4*4 MIMO			
		☐ 802.11ax	□SISO, □2*2 MIMO, □3*3 MIMO, □4*4 MIMO			
	Gain	-1.5 dBi				
	Remark	When the EUT is put into service, the practical maximum antenna gain should NC				
		exceed the value as described above.				
Power Supply	Type	☐ External DC mains,				
		□ Battery,				
		☐ AC/DC Adapter,				
		☐ Powered over Ethernet (PoE).				
		□ USB				
		☐ Other				



5 General Test Conditions / Configurations

5.1 Test Modes

5.1.1 Worst case Configurations

NOTE: Typical working modes for each IEEE 802.11 mode are selected to perform tests

Test Mode	Power Level Setting defined by Manufacturer	Test Modes Description		
	ANT1			
11b20SISO	17.00	IEEE 802.11b with data rate of 1 Mbps using SISO		
110203130	17.00	mode.		
11g20SISO	CH1/11: 10.50	IEEE 802.11g with data rate of 6 Mbps		
119203130	Others: 17.00			
11n20SISO	CH1/11: 11.50	IEEE 802.11n with data rate of MCS0 and bandwidth of		
1111203130	Others: 16.50	20 MHz, using SISO mode		
	CH3/9: 8.00			
11n40SISO	CH4: 9.50	IEEE 802.11n with data rate of MCS0 and bandwidth of		
	CH5/8: 12.5	40 MHz, using SISO mode		
	CH6/7: 13.00			

5.1.2 Frequencies under Test

Test Bandwidth	RF Channel				
Test Bandwidth	Lowest (L)	Middle (M)	Highest (H)		
20MHz	Ch No. 1 / 2412 MHz	Ch No. 6 / 2437 MHz	Ch No. 11 / 2462 MHz		
40MHz	Ch No. 3 / 2422 MHz	Ch No. 6 / 2437 MHz	Ch No. 9 / 2452 MHz		

Note: Due to the channel power levels are different, we have increased the proximity channel test in Appendix.



5.1.3 The typical and worst case operational mode for each of the following tests

Test Item	Mode	Antenna	Bandwidth	Tone for 11ax	RU for 11ax
DTS (6 dB) Bandwidth	All	SISO	All	N/A	N/A
Occupied Bandwidth	All	SISO	All	N/A	N/A
Duty Cycle	All	SISO	All	N/A	N/A
Maximum Average Output Power	All	SISO	All	N/A	N/A
Maximum Power Spectral Density Level	All	SISO	20MHz	N/A	N/A
Band Edges Compliance	All	SISO	All	N/A	N/A
Unwanted Emissions into Non-Restricted Frequency Bands	All	SISO	All	N/A	N/A
Unwanted Emissions into Restricted Frequency Bands (Radiated)	All	SISO	All	N/A	N/A
AC Power Line Conducted Emissions	11n	SISO	20MHz	N/A	N/A



5.2 Description of tests

5.2.1 Bandwidth measurement

- (a) Connect EUT test port to spectrum analyzer.
- (b) Set the EUT to transmit maximum output power at 2.4GHz, then set the measured frequency number and test the bandwidth with spectrum analyzer.

5.2.2 Average output power

- (a) Connect EUT test port to spectrum analyzer.
- (b) Set the EUT to transmit maximum output power at 2.4GHz.
- (c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted output power separately.

5.2.3 Band edge spurious emission

- (a) Connect EUT test port to spectrum analyzer
- (b) Set the EUT to transmit maximum output power at 2.4GHz.
- (c) Then set the EUT to transmit at high, low frequency and measure the conducted band edge spurious separately.

5.2.4 Conducted RF spurious

- (a) Connect EUT test port to spectrum analyzer
- (b) Set the EUT to transmit maximum output power at 2.4GHz.
- (c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted spurious separately.

5.2.5 Power spectral density

- (a) Connect EUT test port to spectrum analyzer
- (b) Set the EUT to transmit maximum output power at 2.4GHz.
- (c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted power spectral density.

5.2.6 Radiated spurious emission & spurious in restricted band

For frequency below 1GHz, the test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). The EUT was set-up on insulator 80cm above the Ground Plane. For frequency above 1GHz, the test site full-anechoic chamber has met the requirement of ANSI C63.10 (2013). The EUT was set-up on insulator 150cm above the Ground Plane.

The set-up and test methods were according to ANSI C63.10:2013. The Radiated Disturbance measurements were made using a Rohde and Schwarz Test Receiver and control software.

A preliminary scan and a final scan of the emissions were made by using test script of software; the emissions were measured using a Quasi-Peak Detector below 1GHz, Peak Detector and AV Detector above 1GHz. The maximal emission value was acquired by



adjusting the antenna height, polarisation and turntable azimuth in accordance with the software setup. Normally, the height range of antenna was 1m to 4m, and the azimuth range of turntable was 0°to 360°. The receive antenna has two polarizations V and H.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other nonmetallic 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.

The EUT communicates with the BTS simulator through Air interface. The EUT operated on the typical channel.

Measurement bandwidth: 30 MHz - 1000 MHz: 120 kHz

Measurement bandwidth: 1000 MHz – 10th Carrier Frequency: 1 MHz

5.2.7 Conducted Emission at Power Port

The Table-top EUT was placed upon a non-metallic table 0.8 m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

Conducted Disturbance at AC Port measurements were undertaken on the L and N Lines. The emissions were measured using a Quasi-Peak Detector and Average Detector.

The EUT communicates with the BTS simulator through Air interface, the BTS simulator controls the Wireless Modem to transmitter the maximum power which defined in specification of product. The Wireless Modem operated on the typical channel.

Measurement bandwidth (RBW) for 150kHz to 30 MHz: 9 kHz;



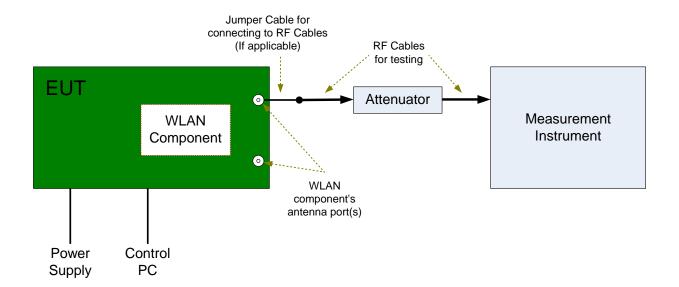
5.3 Test Setups

5.3.1 General Test Setup Configurations

Configuration	Description
Test Antenna Ports	Until otherwise specified,
	- All TX tests are performed at all TX antenna ports of the EUT, and
	- All RX tests are performed at all RX antenna ports of the EUT.
Multiple RF Sources	Other than the tested RF source of the EUT, other RF source(s) are disabled or shutdown during
	measurements.
Sensors and Antenna	Sensors and Antenna optimization function should be disabled during testing by software method to
	get the stable maximum power and avoid the influence of uncertain conditions

5.3.2 Test Setup 1

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.

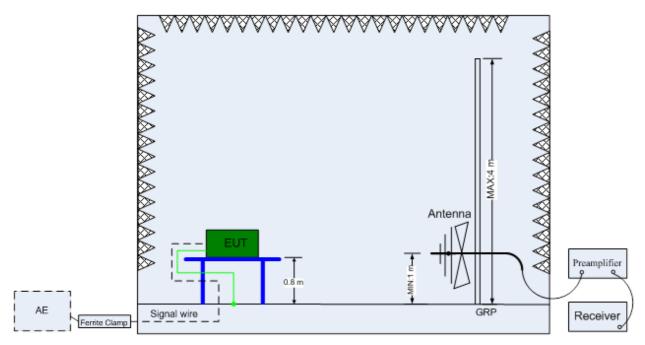


5.3.3 Test Setup 2

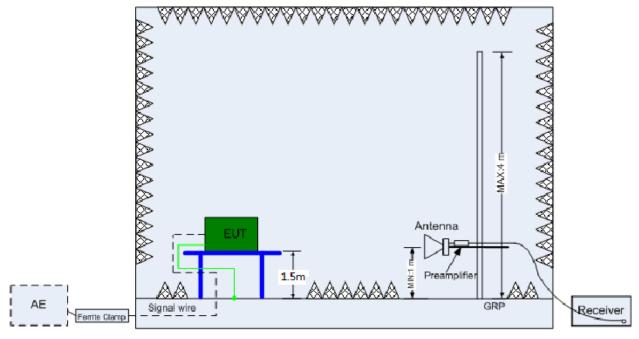
The semi-anechoic chamber and full-anechoic chamber has met the requirement of ANSI C63.4. The test distance is 3m.The setup is according to ANSI C63.4 and CAN/CSA-CEI/IEC CISPR 22.

The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).





(Below 1 GHz)



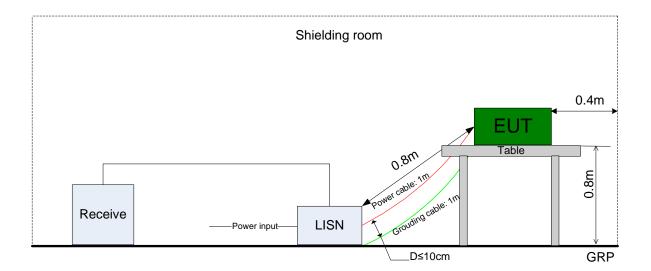
(Above 1 GHz)



5.3.4 Test Setup 3

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.





5.4 Test Conditions

Test Case	Test Conditions		
	Configuration	Description	
DTS (6 dB)	Measurement Method	FCC KDB 558074 D01 §8.2 Option 1.	
Bandwidth	Test Environment	TN/VN	
	Test Setup	Test Setup 1	
	EUT Configuration	See §5.1	
Occupied	Measurement Method	ANSI C63.10 Section 6.9.3	
Bandwidth	Test Environment	TN/VN	
	Test Setup	Test Setup 1	
	EUT Configuration	See §5.1	
Maximum	Measurement Method	FCC KDB 558074 D01 §8.3.2.3	
Conducted Average	Test Environment	TN/VN	
Output Power	Test Setup	Test Setup 1	
	EUT Configuration	See §5.1	
Maximum Power	Measurement Method	FCC KDB 558074 D01 §8.4	
Spectral Density	Test Environment	TN/VN	
Level	Test Setup	Test Setup 1	
	EUT Configuration	See §5.1	
Band Edges	Measurement Method	FCC KDB 558074 D01 §8.7	
Compliance	Test Environment	TN/VN	
	Test Setup	Test Setup 1	
	EUT Configuration	See §5.1	
Unwanted	Measurement Method	FCC KDB 558074 D01 §8.5	
Emissions into	Test Environment	TN/VN	
Non-Restricted	Test Setup	Test Setup 1	
Frequency Bands	EUT Configuration	See §5.1	
Unwanted	Measurement Method	ANSI C63.10; FCC KDB 558074 D01 §8.6, Radiated	
Emissions into	Test Environment	TN/VN	
Restricted	Test Setup	Test Setup 2	
Frequency Bands	EUT Placement	☐ Flatwise, ☐ Upright, ☐ Hung	
(Radiated)	EUT Configuration	See §5.1	
AC Power Line	Measurement Method	AC mains conducted.	
Conducted	Test Environment	TN/VN	
Emissions	Test Setup	Test Setup 3	
	EUT Configuration	See §5.1	



6 Main Test Instruments

6.1 Current Test Project/Report

Main Test Equipments(BT/WIFI test system)					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Power Sensor	R&S	NRX	102976/102832	2022/07/04	2023/07/03
Signal Analyzer	R&S	FSW26	101585	2022/07/04	2023/07/03

Main Test Equipments(RE test system)					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Test receiver	R&S	ESW44	101878	2021/11/13	2022/11/12
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100262	2021/07/11	2023/07/10
Trilog Broadband Antenna (30M~3GHz)	SCHWARZB ECK	VULB 9163	01327	2021/05/28	2023/05/27
Trilog Broadband Antenna (1GHz~18GHz)	SCHWARZB ECK	HF907	100305	2021/05/08	2023/05/07
Trilog Broadband Antenna (18GHz~40GHz)	SCHWARZB ECK	BBHA 9170	BBHA9170647	2021/09/14	2023/09/13
Software Information					
Test Item	Software Nam	Software Name		Manufacturer	
RE	EMC32	EMC32		R&S	

Main Test Equipments(CE test system)					
Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal-Due
Test receiver	R&S	ESU26	100150	2021/11/13	2022/11/12
Line Impedance Stabilization	R&S	ENV216	101176	2022/07/04	2023/07/03
Network					
Software Information					
Test Item	Software Nam	e	Manufacturer		Version
CE	EMC32		R&S		V9.25.0



7 Measurement Uncertainty

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

Test Item		Extended Uncertainty
Transmit Output Power Data	Power [dBm]	U = 0.39 dB
RF Power Density, Conducted	Power [dBm]	U = 0.66 dB
Bandwidth	Magnitude [kHz]	20MHz: U=41.78kHz
		40MHz: U=82.12kHz
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 = 3.868 dB (9 kHz to 150 kHz)
		U = 3.782 dB (150 kHz to 30 MHz)
		U = 5.24 dB (30 MHz-1 GHz)
		U = 4.84 dB (1 GHz-18 GHz)
		U = 4.62 dB (18 GHz-26.5 GHz)
AC Power Line Conducted Emissions	Disturbance Voltage[dBµV]	U=2.3 dB
Duty Cycle	Duty Cycle [%]	U=±2.06 %



8 Appendixes

Appendix No.	Description
SYBH(Z-RF)20221017002001-2004-A	Appendix for 2.4G WLAN(Conducted)
SYBH(Z-RF)20221017002001-2004-B	Appendix for 2.4G WLAN(Radiated)

Note: We tested all modes & antennas, and the data presented in the appendix is the worst case.

END