

Report No.: XEWA2310000073RG02

Rev.: 01

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TEST REPORT

Application No.: XEWA2310000073RG
Applicant: Harman International Industries Incorporated
Address of Applicant: 30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer: Harman International Industries Incorporated
Address of Manufacturer: 30001, Cabot Drive, Novi, MI 48377, USA
EUT Description: Toyota La-DCM
Model No.: TYT25_LT_AA
Trade Mark: HARMAN
FCC ID: 2AHPN-TYT25-LT-AA
Standard(s): FCC 47 CFR Part 15, Subpart B
Date of Receipt: 2023/11/01
Date of Test: 2023/12/11 to 2023/12/15
Date of Issue: 2024/01/10

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Linus Chen
 Wireless Laboratory Manager





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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2024/01/10		Original

Prepared By	 <hr/> (Leah Chen) / Test Engineer
Checked By	 <hr/> (Andy Yao) /Reviewer



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Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at Mains Terminals (150kHz-30MHz)	FCC 47 CFR Part 15, Subpart B	ANSI C63.4:2014	Class B	Pass
Radiated Emissions (30MHz-1GHz)	FCC 47 CFR Part 15, Subpart B	ANSI C63.4:2014	Class B	Pass
Radiated Emissions (above 1GHz)	FCC 47 CFR Part 15, Subpart B	ANSI C63.4:2014	Class B	Pass

Internal Source	Upper Frequency
Below 1.705MHz	30MHz
1.705MHz to 108MHz	1GHz
108MHz to 500MHz	2GHz
500MHz to 1GHz	5GHz
Above 1GHz	5th harmonic of the highest frequency or 40GHz, whichever is lower



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1 General Information

EUT Description:	Toyota La-DCM		
Model No.:	TYT25_LT_AA		
Trade Mark:	HARMAN		
Hardware Version:	0.0.3		
Software Version:	TYTLLADCM_R04.5D		
IMEI:	356590670015866		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band II	1850~1910	1930~1990
	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
	Wi-Fi 2.4G	2412~2462	2412~2462
	Bluetooth	2402~2480	2402~2480
	Wi-Fi 5G	5150~5850	5150~5850
GNSS	/	1559~1610	
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.		

Accessory:

GPS Antenna No.	Model No.	Description	Manufacturer
1	481D	519 ± 10	Shenzhen VLG Wireless Technology Co., LTD
2	334D	750 + 20	
3	452D	850 + 20	
4	D90B	990 + 20	



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 中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 t (86-29) 6282 7885 sgs.china@sgs.com

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1.1 Description of Support Units

The EUT has been tested as an independent unit.

1.2 Test Location

All tests were performed at:

Company:	SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Address:	1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi' an, Shaanxi China
Post code:	710086
Test engineer:	Abbott Wang

1.3 Test Facility

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

<p>•A2LA (Certificate No. 4854.01) SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.</p> <p>• Innovation, Science and Economic Development Canada SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory. CAB identifier: CN0095. IC#: 25613.</p> <p>• FCC –Designation Number: CN1337 SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized as an accredited testing laboratory. Designation Number: CN1337. Test Firm Registration Number: 917410</p>

1.4 Deviation from Standards

None

1.5 Abnormalities from Standard Conditions

None



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2 Emission Test Results

2.1 Conducted Emissions at Mains Terminals (150kHz-30MHz)

Test Requirement:	47 CFR Part 15, Subpart B		
Test Method:	ANSI C63.4:2014		
Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency Range (MHz)	Limit(dBμV)	
		Quasi-peak	average
	0.15M-0.5MHz	66 ~ 56*	56 ~ 46*
	0.5M-5MHz	56	46
	5M-30MHz	60	50
*Decreases with the logarithm of the frequency Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz			

2.1.1 E.U.T. Operation

Operating Environment:

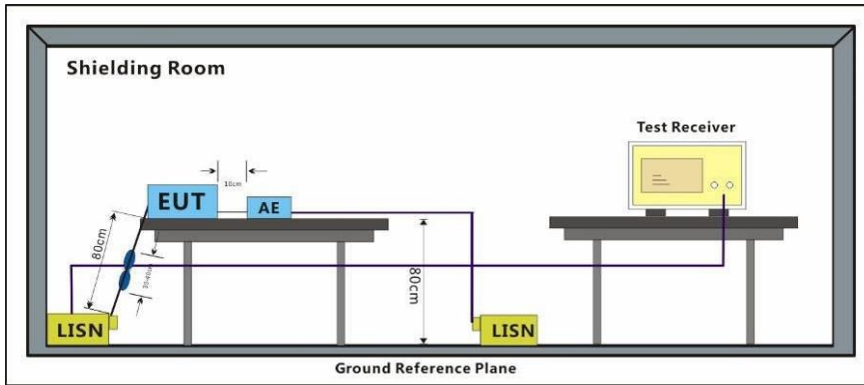
Temperature:	22~25°C
Humidity:	40~60%RH
Atmospheric Pressure:	96~98kPa
Pretest these modes to find the worst case:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle b: BT+5GWLAN+GNSS RX+LTE Band 5 Idle
The worst case for final test:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle



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2.1.2 Test Setup Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



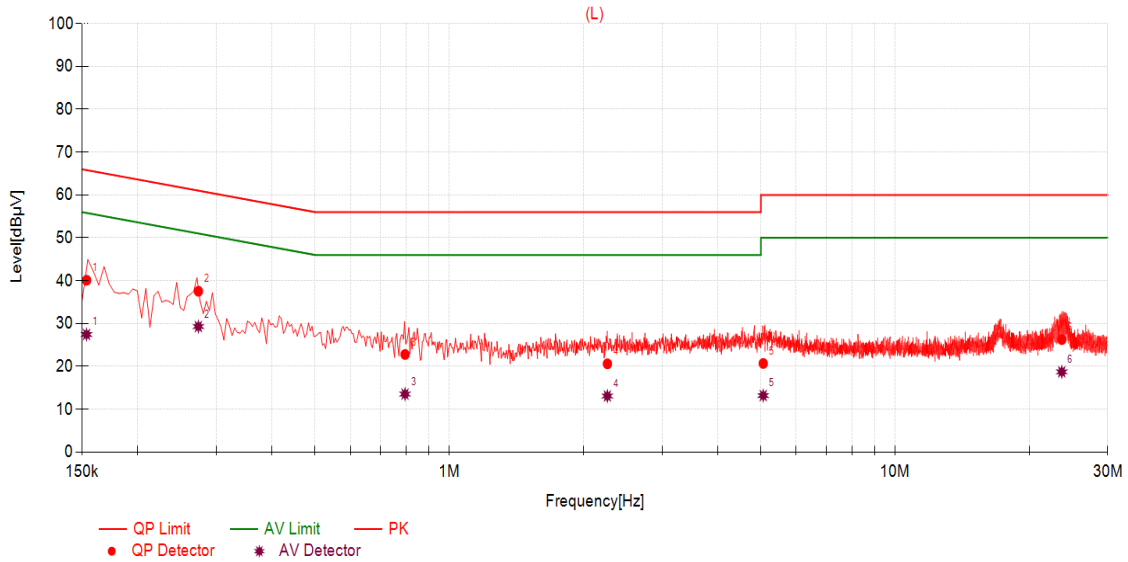
2.1.3 Measurement Data

An initial pre-scan was performed with peak detector. Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.



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Final Test Mode:	Mode a	Phase:	Line
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Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1535	9.86	30.25	40.11	65.81	25.70	17.59	27.45	55.81	28.36	PASS
2	0.2735	9.89	27.65	37.54	61.01	23.47	19.41	29.30	51.01	21.71	PASS
3	0.7954	9.92	12.87	22.79	56.00	33.21	3.62	13.54	46.00	32.46	PASS
4	2.2623	9.86	10.76	20.62	56.00	35.38	3.23	13.09	46.00	32.91	PASS
5	5.0617	9.88	10.82	20.70	60.00	39.30	3.32	13.20	50.00	36.80	PASS
6	23.6621	10.30	15.96	26.26	60.00	33.74	8.43	18.73	50.00	31.27	PASS

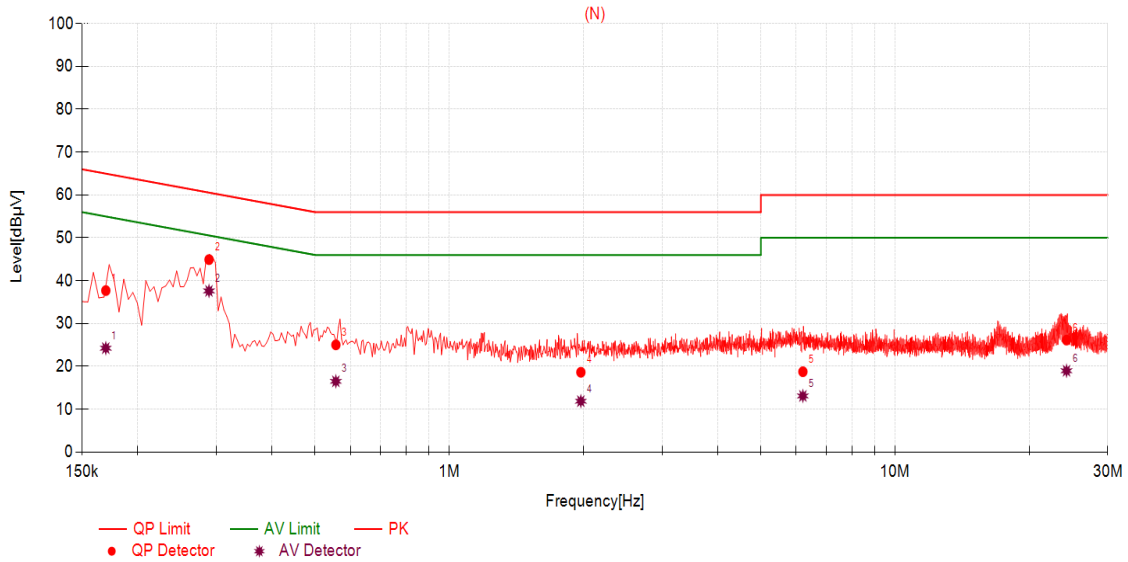
Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value = Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
3. Margin = Limit[dBµV] – Value[dBµV]



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Final Test Mode:	Mode a	Phase:	Neutral
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Data List											
NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1695	9.80	27.90	37.70	64.98	27.28	14.46	24.26	54.98	30.72	PASS
2	0.2889	9.79	35.14	44.93	60.56	15.63	27.83	37.62	50.56	12.94	PASS
3	0.5564	9.86	15.18	25.04	56.00	30.96	6.66	16.52	46.00	29.48	PASS
4	1.9727	9.85	8.79	18.64	56.00	37.36	2.04	11.89	46.00	34.11	PASS
5	6.2117	10.03	8.74	18.77	60.00	41.23	3.08	13.11	50.00	36.89	PASS
6	24.2524	10.29	15.86	26.15	60.00	33.85	8.69	18.98	50.00	31.02	PASS

Remark:

- The following Quasi-Peak and Average measurements were performed on the EUT:
- Value = Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
- Margin = Limit[dBµV] – Value[dBµV]



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2.2 Radiated Emissions (30MHz-1GHz)

Test Requirement:	47 CFR Part 15, Subpart B		
Test Method:	ANSI C63.4:2014		
Frequency Range:	30MHz to 1GHz		
Measurement Distance:	3m		
Limit:	Frequency Range (MHz)	Limit(dBμV/m)	Detector
	30MHz -88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
960MHz-1000MHz	54.0	Quasi-peak	
Detector:	Peak for pre-scan (120kHz resolution bandwidth) 30M to1000MHZ		

2.2.1 E.U.T. Operation

Temperature:	22~25°C
Humidity:	40~60%RH
Atmospheric Pressure:	96~98kPa
Pretest these modes to find the worst case:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle b: BT+5GWLAN+GNSS RX+LTE Band 5 Idle
The worst case for final test:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle

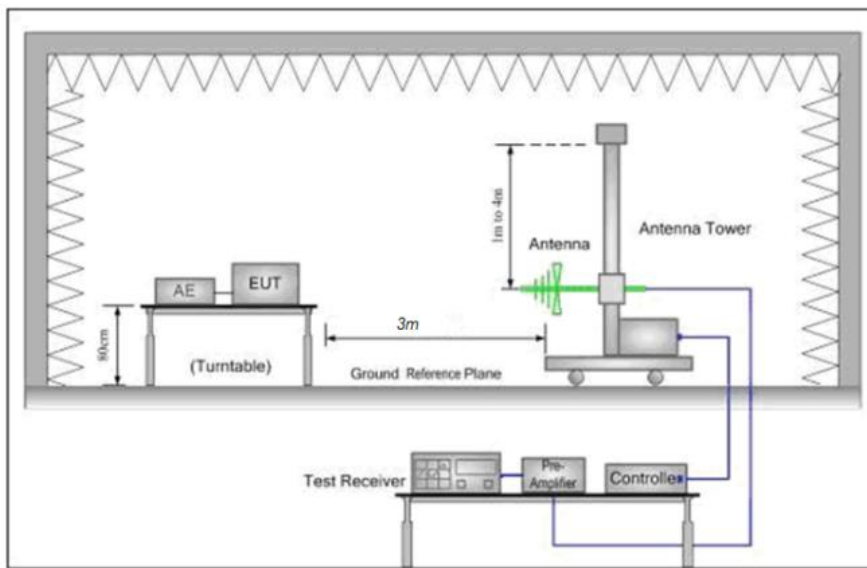


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2.2.2 Test Setup Procedures

1. The EUT was placed in a semi Anechoic Chamber as show below
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna height is adjusted between 1 to 4 meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function with specified bandwidth with Maximum Hold Mode, and the trace was allowed to stabilize.
7. If the emission level of the EUT in peak mode was 6 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.

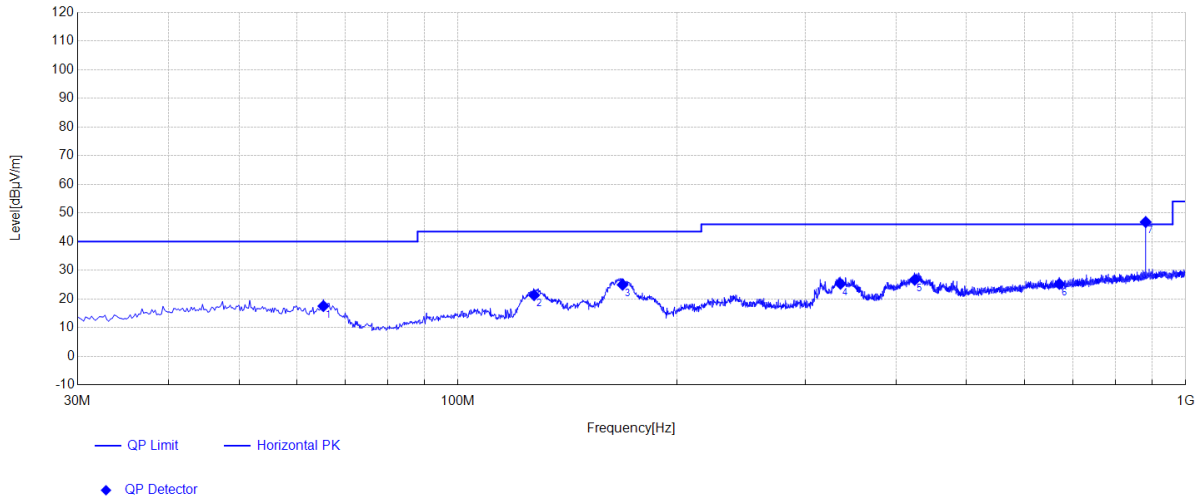


2.2.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities. The three polarities of X,Y,Z were measured by EUT, but only the worst data had been displayed.



Final Test Mode:	Mode a	Polarization:	Horizontal
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Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	65.3151	12.04	-27.01	32.47	17.50	40.00	22.50	Horizontal
2	127.2134	8.44	-26.59	39.44	21.29	43.50	22.21	Horizontal
3	168.3497	8.83	-26.22	42.32	24.93	43.50	18.57	Horizontal
4	335.4171	14.23	-25.47	36.49	25.25	46.00	20.75	Horizontal
5	424.2869	16.01	-24.85	35.5	26.66	46.00	19.34	Horizontal
6	670.5221	19.57	-23.77	29.42	25.22	46.00	20.78	Horizontal
7*	881.2482	21.75	-23.13	48.18	46.80	-	-	Horizontal

Remark:

1. The Quasi-Peak measurements were performed on the EUT.

2. Value = Reading + AF + Factor:

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier (dB)

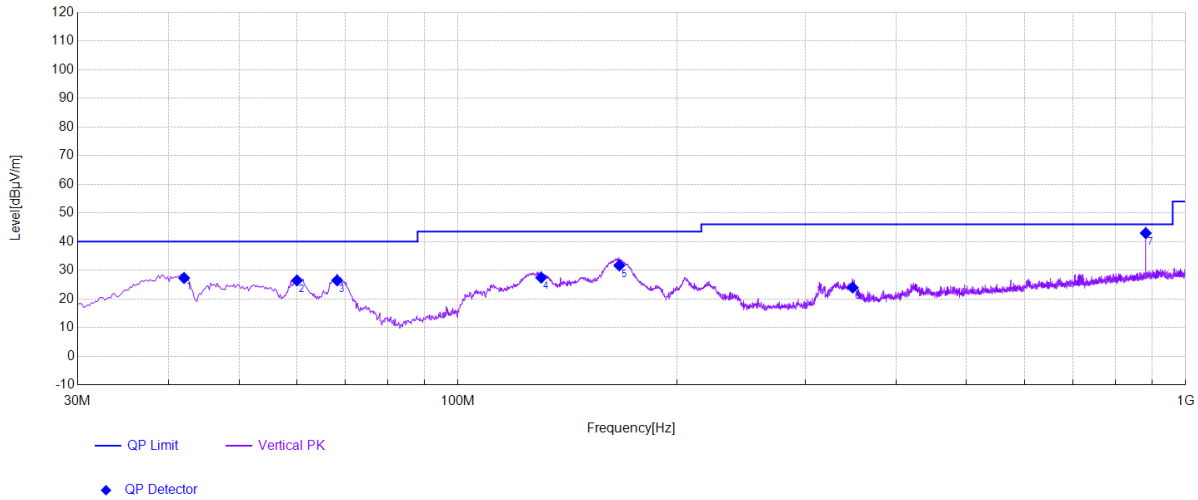
Margin = Limit[dBμV/m] - Value[dBμV/m]

Note*: #7 30M-1G: is system simulator signal which can be ignored.



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Final Test Mode:	Mode a	Polarization:	Vertical
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Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	42.0304	13.51	-27.64	41.41	27.28	40.00	12.72	Vertical
2	60.076	12.39	-27.25	41.28	26.42	40.00	13.58	Vertical
3	68.2256	10.41	-26.87	42.91	26.45	40.00	13.55	Vertical
4	130.124	8.16	-26.39	45.64	27.41	43.50	16.09	Vertical
5	166.6033	9.02	-26.24	48.88	31.66	43.50	11.84	Vertical
6	348.6117	14.93	-25.29	34.31	23.95	46.00	22.05	Vertical
7*	881.4423	21.76	-23.13	44.31	42.94	-	-	Vertical

Remark:

- The Quasi-Peak measurements were performed on the EUT.
- Value = Reading + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier (dB)
 Margin = Limit[dBμV/m] - Value[dBμV/m]

Note*: #7 30M-1G: is system simulator signal which can be ignored.



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2.3 Radiated Emissions (above 1GHz)

Test Requirement:	47 CFR Part 15, Subpart B		
Test Method:	ANSI C63.4:2014		
Frequency Range:	Above 1GHz		
Measurement Distance:	3m		
Limit:	Frequency (MHz)	Limit (dB μ V/m)	Detector
	Above 1GHz	74 54	Peak Average
Detector:	Peak for pre-scan (1000kHz resolution bandwidth) 5th harmonic of the highest frequency or 40GHz, whichever is lower.		

2.3.1 E.U.T. Operation

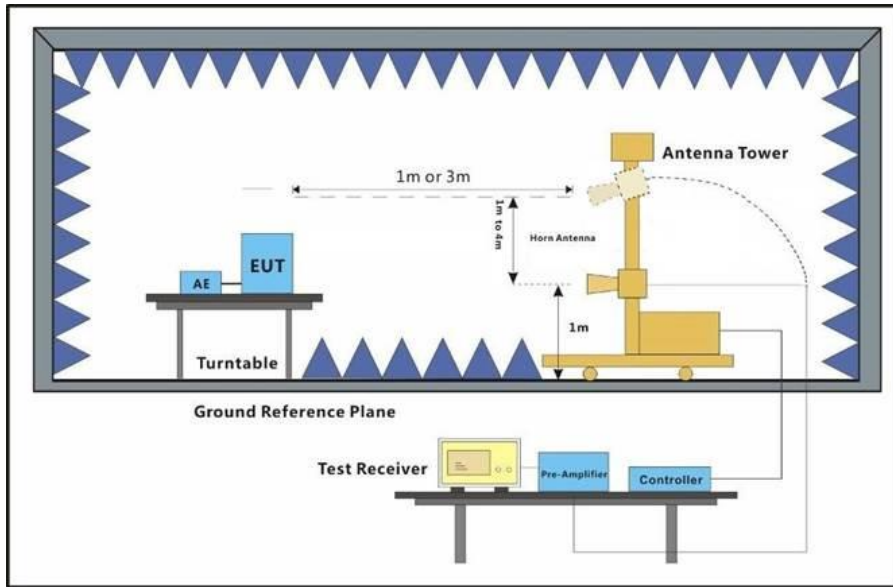
Temperature:	22~25°C
Humidity:	40~60%RH
Atmospheric Pressure:	96~98kPa
Pretest these modes to find the worst case:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle b: BT+5GWLAN+GNSS RX+LTE Band 5 Idle
The worst case for final test:	a: BT+2.4GWLAN+GNSS RX+ WCDMA Band V Idle



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2.3.2 Test Setup Procedures

1. The EUT was placed in a full Anechoic Chamber as show below
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation
(Distance from antenna to EUT is 1m for measurements >18GHz).
4. The antenna height is adjusted between 1 to 4 meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak and AV Detect Function with specified bandwidth with Maximum Hold Mode, and the trace was allowed to stabilize.
7. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.



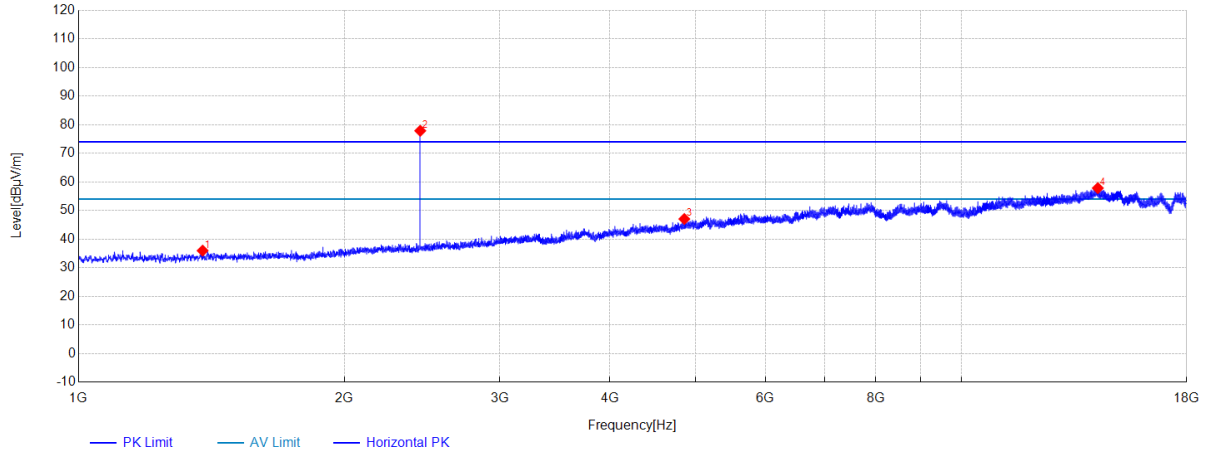
2.3.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Average measurements were conducted based on the peak sweep graph. The EUT was measured by Horn antenna with 2 orthogonal polarities.

The three polarities of X, Y, Z were measured by EUT, but only the worst data had been displayed. Scan from 5th harmonic of the highest frequency or 40GHz, whichever is lower, the disturbance above 18GHz was very low. The points marked on below plots are the highest emissions could be found when testing, so only below points had been displayed.



Final Test Mode:	Mode a	Polarization:	Horizontal
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Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	1382.1753	64.77	25.84	-54.65	35.96	74.00	38.04	Horizontal
2*	2438.2575	102.59	27.88	-52.64	77.83	-	-	Horizontal
3	4855.7542	62.12	32.83	-47.93	47.02	74.00	26.98	Horizontal
4	14278.2111	56.62	40.72	-39.54	57.80	74.00	16.20	Horizontal

Remark:

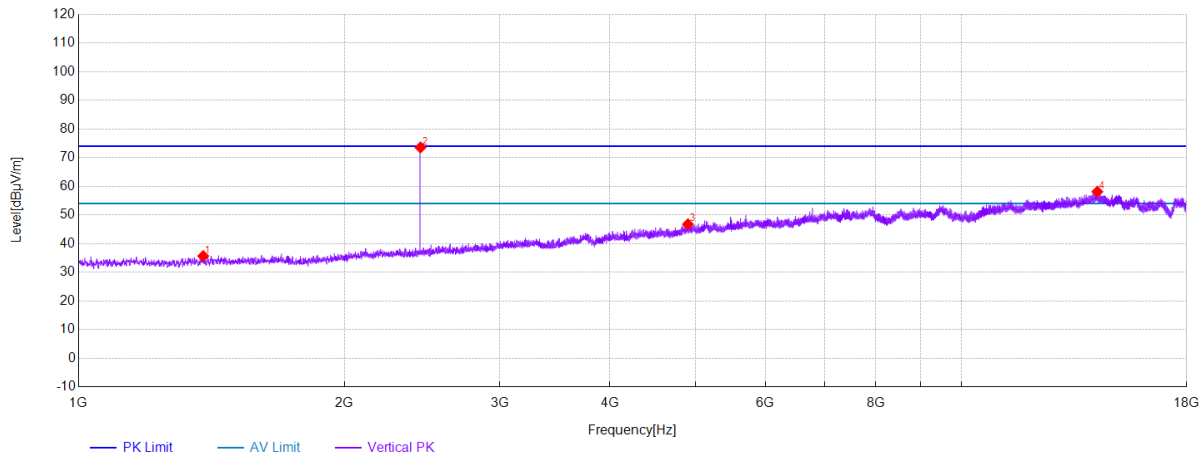
- The Peak and Average measurements were performed on the EUT.
- Level = Reading Level + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier gain(dB)
 Margin = Limit[dBµV/m] – Level[dBµV/m]

Note*: #2 1G-18G: is RF signal which come from Wi-Fi access point used to connect the EUT, and which can be ignored.



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Final Test Mode:	Mode a	Polarization:	Vertical
------------------	--------	---------------	----------



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	1384.2154	64.45	25.83	-54.64	35.64	74.00	38.36	Vertical
2*	2439.6176	98.28	27.88	-52.63	73.53	-	-	Vertical
3	4901.3161	61.50	33.10	-47.87	46.73	74.00	27.27	Vertical
4	14259.8504	56.78	40.74	-39.44	58.08	74.00	15.92	Vertical

Remark:

- The Peak and Average measurements were performed on the EUT.
- Level = Reading Level + AF + Factor:
 AF = Antenna Factor(dB/m)
 Factor = Cable Factor(dB) - Preamplifier gain(dB)
 Margin = Limit[dBμV/m] – Level[dBμV/m]

Note*: #2 1G-18G: is RF signal which come from Wi-Fi access point used to connect the EUT, and which can be ignored.



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3 Equipment List

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	XAW04-03-01	N/A	N/A
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2023/06/30	2024/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-07-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2023/02/16	2024/02/15
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2023/06/30	2024/06/29

Remark: NCR=No Calibration Requirement



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RE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/d d)	Cal.Due date (yyyy/mm/d d)
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2021/09/09	2024/09/08
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2023/02/16	2024/02/15
Spectrum Analyzer	ROHDE&SCHWARZ	FSV3044	XAW01-13-05	2023/05/15	2024/05/14
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2022/07/28	2024/07/27
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2022/07/28	2024/07/27
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2022/07/23	2024/07/22
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP9K3G32	XAW01-41-01	2023/05/15	2024/05/14
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2023/08/30	2024/08/29
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2023/08/30	2024/08/29
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2023/08/30	2024/08/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/09/04	2024/09/03
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2023/02/16	2024/02/15
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-05-01	NCR	NCR

Remark: NCR=No Calibration Requirement



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SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Wireless Laboratory

11/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

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4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Conduction Emission	± 3.0dB (150kHz to 30MHz)
2	Radiated Emission	± 4.9dB (30MHz to 1GHz)
		± 4.9dB (1GHz to 6GHz)
		± 4.7dB (6GHz to 18GHz)
		± 5.26dB (Above 18GHz)
<p>Remark:</p> <p>The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/ETSI Uncertainty), so the test results</p> <ul style="list-style-type: none"> – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit. 		



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5 Photographs

5.1 Test Setup

Refer to Appendix A.1 15B Setup Photos.

---End of Report---

