FCC TEST REPORT

Test report
On Behalf of
Smart Eye AB (Paul)
For
Driver Monitoring System
Model No.: AIS

FCC ID: 2BADP-AIS

Prepared for :	**Smart Eye AB (Paul)** Forsta Langgatan 28B,413 27 Goteborg, Sweden
Prepared By :	**Shenzhen Tongzhou Testing Co.,Ltd** **1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China**
Date of Test:	**2023/3/4 ~ 2023/3/28**
Date of Report:	**2023/3/29**
Report Number:	**TZ230204021-E1**

The test report apply only to the specific sample(s) tested under stated test conditions
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

TEST RESULT CERTIFICATION

Applicant's name ..... :	**Smart Eye AB (Paul)**
Address ..... :	Forsta Langgatan 28B,413 27 Goteborg, Sweden
Manufacture's Name ..... :	**Tung Thih Electron(Xiamen) Co., Ltd.**
Address ..... :	1-17, ZhaoGang Road, Xiangbei Industrial Zone, Xiang'an District, Xiamen,China

Product description

Trade Mark ..... :	N/A
Product name ..... :	Driver Monitoring System
Model and/or type reference . :	AIS
Standards ..... :	FCC Rules and Regulations Part 22 & Part 24 ANSI C63.26:2015

Date of Test ..... :	
Date (s) of performance of tests..... :	**2023/3/4 ~ 2023/3/28**
Date of Issue ..... :	**2023/3/29**
Test Result..... :	**Pass**

Testing Engineer : Anna Hu

(Anna Hu)

Technical Manager : Hugo Chen

(Hugo Chen)

Authorized Signatory : Andy Zhang

(Andy Zhang)

Revision History

Revision	Issue Date	Revisions	Revised By
000	2023/3/29	Initial Issue	Andy Zhang

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

FCC Part 22 Subpart H: PRIVATE LAND MOBILE RADIO SERVICES.

FCC Part 24 Subpart E: PUBLIC MOBILE SERVICES

ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

ANSI C63.26-2015: IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

FCCKDB971168D01 Power Meas License Digital Systems

2 SUMMARY

2.1 Product Description

Product Name	:	Driver Monitoring System
Model Number	:	AIS
Model Difference Declaration	:	N/A
Test Model	:	AIS
Power Supply	:	DC 24V
Hardware version	:	v2.3.1
Software version	:	v1.1.2
Sample ID	:	TZ230204021–1#&TZ230204021–2#
GSM		
GSM FCC Operation Frequency	:	GSM850(UL: 824 – 849 MHz/DL: 869 – 894 MHz) GSM1900(UL: 1850 –1910 MHz/DL: 1930 – 1990 MHz)
Channel Separation	:	0.2MHz
Modulation Technology	:	GMSK,8PSK
Antenna Type And Gain	:	GSM850:5.0 dBi GSM1900:4.9 dBi
E-UTRA		
E-UTRA FCC Operation Frequency	:	FDD Band 2 (UL: 1850 – 1910 MHz/DL: 1930 – 1990 MHz) FDD Band 4 (UL: 1710 – 1755 MHz/DL: 2110 – 2155 MHz) FDD Band 5 (UL: 824 – 849 MHz/DL: 869 – 894 MHz) FDD Band 12(UL: 699 – 716 MHz/DL: 729 – 746 MHz) FDD Band 26 (UL: 814 – 849 MHz/DL: 859 – 894 MHz)
Channel Separation	:	0.1 MHz
Modulation Technology	:	OFDM (BPSK,16QAM, QPSK)
Antenna Type And Gain	:	Internal Antenna FDD Band 2:4.9 dBi FDD Band 4:4.9 dBi FDD Band 5:5.0 dBi FDD Band 12:4.7 dBi FDD Band 26:4.7 dBi

Note 1: Antenna position refer to EUT Photos.
Note 2: the above information was supplied by the applicant.

GSM Card Slot :

	Maximum ERP/EIRP (dBm)
GSM850	**27.30**
GPRS850	**26.71**
EGPRS850	**20.73**
GSM1900	**25.64**
GPRS1900	**24.82**
EGPRS1900	**19.59**

2.2 Short description of the Equipment under Test (EUT)

EUT is subscriber equipment in the GSM/LTE system. Frequency bands Shows in section 2.1.

2.3 Normal Accessory setting

Fully charged battery was used during the test.

2.4 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- ● supplied by the manufacturer
- ○ - supplied by the lab

○	/	Model:	/
		Input:	/
		Output:	/
		Lab. Code:	/

2.5 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2BADP-AIS** filing to comply with FCC Part 22 and FCC Part 24 Rules.

2.6 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Test Facility

FCC
Designation Number: CN1275
Test Firm Registration Number: 167722
Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA
Certificate Number: 5463.01
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC
ISED#: 22033
CAB identifier: CN0099
Shenzhen Tongzhou Testing Co.,Ltd has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

3.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.3 Test Description

PCS 1900:

Test Item	FCC Rule No.	Requirements	Judgement	Sample ID
Effective (Isotropic) Radiated Power	2.1046, 24.232(c)	EIRP ≤ 2W(33dBm)	Pass	TZ230204021-2#
Bandwidth	2.1049 24.238(a)	OBW: No limit. EBW: No limit.	Pass	Note1
Band Edges	2.1051, 24.238(a)	-13dBm	Pass	Note1
Spurious Emission at Antenna Terminals	2.1051, 24.238(a)	-13dBm	Pass	Note1
Field Strength of Spurious Radiation	2.1053, 24.238(a)	-13dBm	Pass	TZ230204021-2#
Frequency Stability	2.1055, 24.235	the fundamental emission stays within the authorized frequency block.	Pass	Note1
Peak to average ratio	24.232(d)	<13dB	Pass	Note1

GSM850:

Test Item	FCC Rule No.	Requirements	Judgement	Sample ID
Effective (Isotropic) Radiated Power	2.1046, 22.913(a)	ERP ≤ 7W(38.5dBm)	Pass	TZ230204021-2#
Occupied Bandwidth	2.1049	OBW: No limit.	Pass	Note1
Emission Bandwidth	22.917(b)	EBW: No limit.	Pass	Note1
Band Edges Compliance	2.1051, 22.917(a)(b)	-13dBm	Pass	Note1
Spurious Emission at Antenna Terminals	2.1051, 22.917	-13dBm	Pass	Note1
Field Strength of Spurious Radiation	2.1053, 22.917	-13dBm	Pass	TZ230204021-2#
Frequency Stability	2.1055, 22.355	the fundamental emissions stay within the authorized bands of operation. (2.5ppm)	Pass	Note1
Peak to average ratio	2.1046, 22.913(a)	<13dB	Pass	Note1

Remark: The measurement uncertainty is not included in the test result.

Note1: the LTE module in this product has already finished the certification(FCC ID: XMR201910BG95M3), Reference the results in the original test report

3.4 Equipment Used during the Test

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2022/12/28	2023/12/27
2	Power Sensor	Agilent	U2021XA	MY5365004	2022/12/28	2023/12/27
3	Loop Antenna	schwarzbeck	FMZB1519B	00023	2022/11/13	2025/11/12
4	Wideband Antenna	schwarzbeck	VULB 9163	958	2022/11/13	2025/11/12
5	Horn Antenna	schwarzbeck	BBHA 9120D	01989	2022/11/13	2025/11/12
6	EMI Test Receiver	R&S	ESCI	100849/003	2022/12/28	2023/12/27
7	Controller	MF	MF7802	N/A	N/A	N/A
8	Amplifier	schwarzbeck	BBV 9743	209	2022/12/28	2023/12/27
9	Amplifier	Tonscend	TSAMP-0518SE	--	2022/12/28	2023/12/27
10	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2022/12/28	2023/12/27
11	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2022/12/28	2023/12/27
12	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
12	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A
14	Horn Antenna	A-INFO	LB-180400-KF	J211020657	2022/12/28	2023/12/27
15	Amplifier	CDSA	PAP-1840	17021	2022/12/28	2023/12/27
16	Spectrum Analyzer	R&S	FSP40	100550	2023/1/10	2024/1/9
17	UNIVERSAL RADIO COMMUNICATION	R&S	CMW500	101855	2022/12/28	2023/12/27
18	Signal Generator	Keysight	N5182A	MY4620709	2022/12/28	2023/12/27

3.5 Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to ETSI TR 100 028 " Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics" and is documented in the Shenzhen Tongzhou Testing Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Tongzhou Testing Co.,Ltd is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.10 dB	(1)
Radiated Emission	1~18GHz	3.70 dB	(1)
Radiated Emission	18-40GHz	3.90 dB	(1)
Conducted Disturbance	0.15~30MHz	1.63 dB	(1)
Conducted Power	9KHz~18GHz	0.61 dB	(1)
Spurious RF Conducted Emission	9KHz~40GHz	1.22 dB	(1)
Band Edge Compliance of RF Emission	9KHz~40GHz	1.22 dB	(1)
Occuiped Bandwidth	9KHz~40GHz	-	(1)
Frequency Error	9KHz~40GHz	1×10^{-7}	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4 DESCRIPTION OF TEST MODES

During the testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication Tester (CMU 200)to ensure max power transmission and proper modulation. Three channels (The top channel, the middle channel and the bottom channel) were chosen for testing on both WCDMA frequency band.

*****Note:** WCDMA/HSPA band II, WCDMA/HSPA band IV,WCDMA/HSPA band V mode have been tested during the test.

The worst condition was recorded in the test report if no other modes test data.

5 TEST CONDITIONS AND RESULTS

5.1 OUTPUT POWER

5.1.1 RADIATED OUTPUT POWER

5.1.1.1 MEASUREMENT METHOD

The measurements procedures specified in ANSI/TIA-603-E-2016 were applied.

1. Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signal operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT operating at its maximum duty cycle, at maximum power, and at the approximate frequencies.
2. In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (Pin) is applied to the input of the dipole, and the power received (Pr) at the chamber's probe antenna is recorded.
3. The substitution method is used. Substitution values at each frequency are measured before and saved to the test software. A "reference path loss" is established as ARpl=Pin + 2.15 - Pr. TheARpl is the attenuation of “reference path loss”, and including the gain of receive antenna, the cable loss and the air loss. The measurement results are obtained as described below: Power=PMea+ARpl
4. The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.
5. From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.
6. The EUT is then put into continuously transmitting mode at its maximum power level.
7. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.
8. This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power (Pin).
9. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi...

5.1.1.2 PROVISIONS APPLICABLE

Mode	FCC Part Section(s)	Nominal Peak Power
GSM/GPRS/EGPRS 850	22.913(a)(2)	<=38.45dBm (7W). ERP
GSM/GPRS/EGPRS 1900	24.232(c)	<=33dBm (2W). EIRP

5.1.1.3 MEASUREMENT RESULT

Pass

Temperature	24.1℃	Humidity	58%
Test Engineer	Anna Hu		

Radiated Power (ERP) for GPRS/EGPRS 850				
Mode	Frequency	Result		Conclusion
		Max. Peak ERP (dBm)	Polarization Of Max. E.R.P	
GSM	824.2	**27.30**	Horizontal	Pass
	836.6	26.06	Horizontal	Pass
	848.8	27.29	Horizontal	Pass
	824.2	22.11	Vertical	Pass
	836.6	22.25	Vertical	Pass
	848.8	21.35	Vertical	Pass
GPRS	824.2	**26.71**	Horizontal	Pass
	836.6	26.51	Horizontal	Pass
	848.8	24.99	Horizontal	Pass
	824.2	21.15	Vertical	Pass
	836.6	21.28	Vertical	Pass
	848.8	20.04	Vertical	Pass
EGPRS	824.2	20.15	Horizontal	Pass
	836.6	19.94	Horizontal	Pass
	848.8	**20.73**	Horizontal	Pass
	824.2	15.88	Vertical	Pass
	836.6	15.56	Vertical	Pass
	848.8	15.98	Vertical	Pass

Radiated Power (E.I.R.P) for GPRS/EGPRS 1900				
Mode	**Frequency**	**Result**		**Conclusion**
		Max. Peak ERP (dBm)	**Polarization Of Max. E.I.R.P**	
GSM	1850.2	**25.64**	Horizontal	Pass
	1880.0	25.43	Horizontal	Pass
	1909.8	25.26	Horizontal	Pass
	1850.2	20.31	Vertical	Pass
	1880.0	22.04	Vertical	Pass
	1909.8	21.23	Vertical	Pass
GPRS	1850.2	24.24	Horizontal	Pass
	1880.0	**24.82**	Horizontal	Pass
	1909.8	22.81	Horizontal	Pass
	1850.2	20.67	Vertical	Pass
	1880.0	21.39	Vertical	Pass
	1909.8	21.23	Vertical	Pass
EGPRS	1850.2	**19.59**	Horizontal	Pass
	1880.0	19.36	Horizontal	Pass
	1909.8	18.90	Horizontal	Pass
	1850.2	14.04	Vertical	Pass
	1880.0	13.97	Vertical	Pass
	1909.8	25.64	Vertical	Pass

Note: Above is the worst mode data.

5.2 SPURIOUS EMISSION

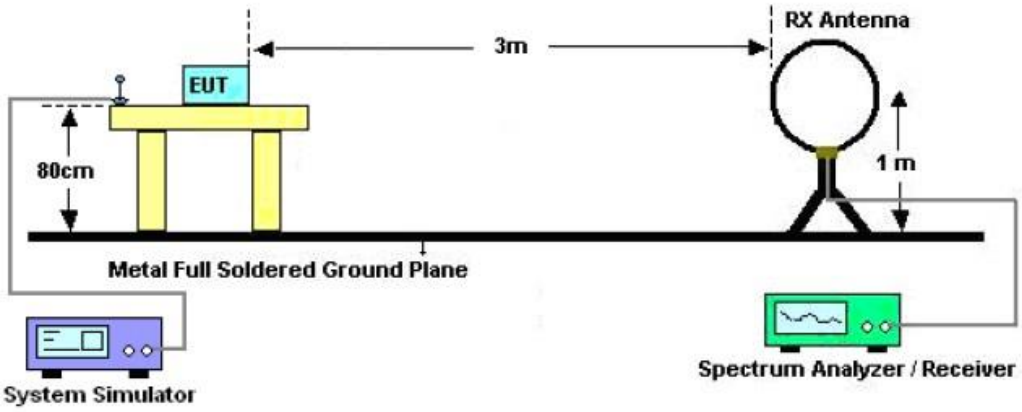
5.2.1 RADIATED SPURIOUS EMISSION

5.2.1.1 MEASUREMENT METHOD

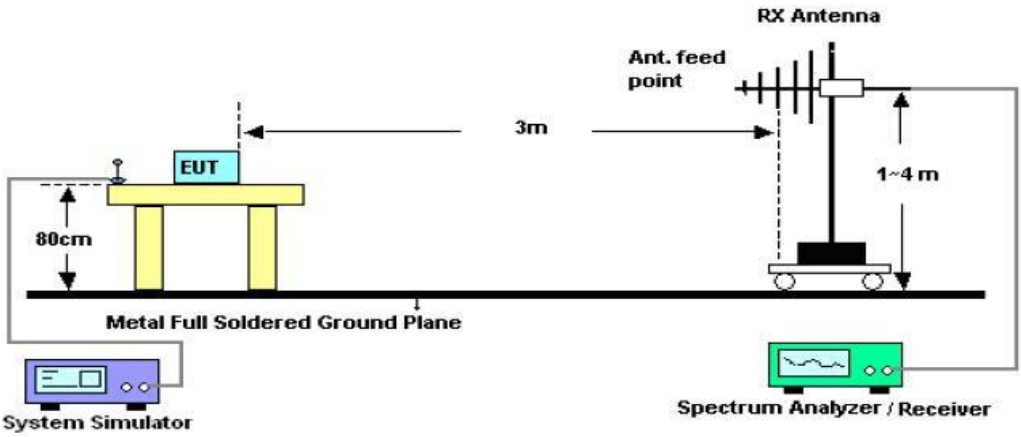
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

5.2.1.2 TEST SETUP

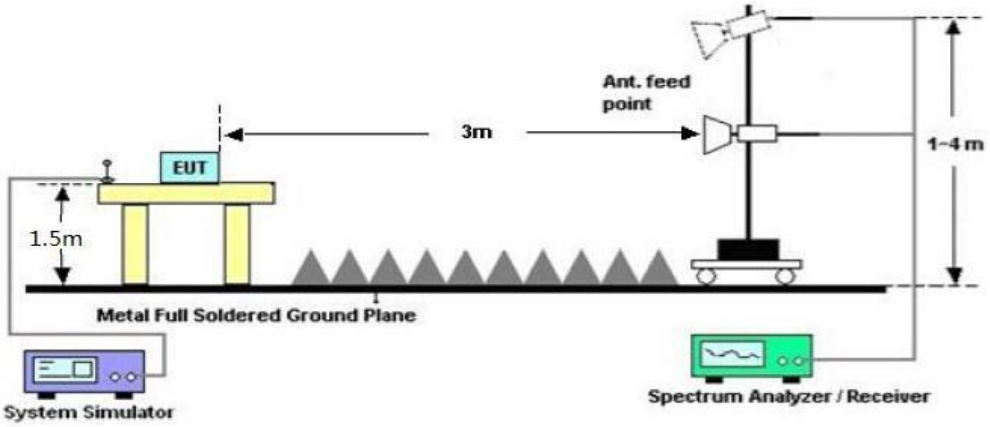
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



5.2.1.3 PROVISIONS APPLICABLE

(a) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at

least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Note: only result the worst condition of each test mode:

5.2.1.4 MEASUREMENT RESULT

Pass

Temperature	24.1℃	Humidity	58%
Test Engineer	Anna Hu		

GSM 850:

The Worst Test Results for Channel 128/824.2 MHz				
Frequency	Emission Level	Limits	Margin	Comment
(MHz)	(dBm)	(dBm)	(dB)	
1648.20	-55.98	-13	42.98	Horizontal
3296.62	-38.90	-13	25.90	Horizontal
4945.07	-54.22	-13	41.22	Horizontal
1648.28	-40.83	-13	27.83	Vertical
3296.67	-49.10	-13	36.10	Vertical
4945.09	-47.39	-13	34.39	Vertical

PCS 1900:

The Worst Test Results for Channel 512/1850.2 MHz				
Frequency	Emission Level	Limits	Margin	Comment
(MHz)	(dBm)	(dBm)	(dB)	
3700.22	-60.28	-13	47.28	Horizontal
7400.65	-38.05	-13	25.05	Horizontal
11101.08	-55.58	-13	42.58	Horizontal
3700.25	-41.42	-13	28.42	Vertical
7400.60	-53.14	-13	40.14	Vertical
11101.06	-46.05	-13	33.05	Vertical

RESULT: PASS

Note:

11. Margin = Limit - Emission Level
12. Below 30MHZ no Spurious found and Above is the worst mode data.

6 Test Set up Photos of the E UT

Please refer to separated files for Test Setup Photos of the EUT.

7 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

8 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

**********End of Report **********