FCC Test Report

FCC ID	:	**2ANR7-TPMS4**
Equipment	:	**Tire-pressure monitoring system (TPMS)**
Model No.	:	**TPMS4 ; SUN TPMX** **(Two models are for marketing purpose)**
Brand Name	:	**Snap-on**
Applicant	:	**ATEQ INSTRUMENTS (ASIA) PTE LTD.TAIWAN BRANCH (SINGAPORE)**
Address	:	**3 LANE223, SAN JIA DONG STREET, 40642, TAICHUNG**
Standard	:	**47 CFR FCC Part 15.209**
Received Date	:	**Oct. 30, 2017**
Tested Date	:	**Apr. 10 ~ Apr. 16, 2018**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: **Approved by:**

Along Chen / Assistant Manager **Gary Chang / Manager**

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
FR7O3001	Rev. 01	Initial issue	May 11, 2018

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV/m at 3m]: 0.168MHz 54.56 (Margin -10.52dB) - QP	Pass
15.209	Radiated Emissions	[dBuV/m at 3m]: 117.30MHz 42.45 (Margin -1.05dB) - QP	Pass

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (kHz)	**Modulation**	**Ch. Frequency (kHz)**	**Channel Number**	**Data Rate**
123 ~ 127	CW	125	1	10 kbps

1.1.2 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector	Remark
1	Wirebound	---	---	---

1.1.3 EUT Operational Condition

Supply Voltage	5Vdc from AC adapter 3.8Vdc from Lithium battery

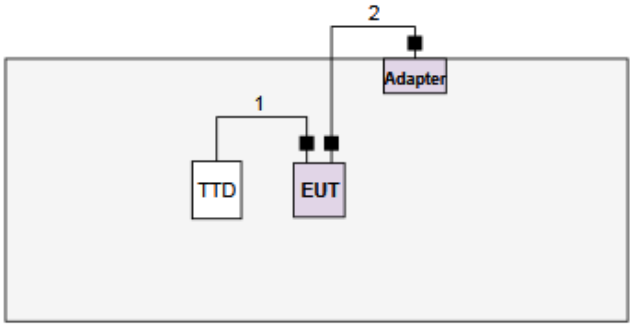
1.1.4 Accessories

No.	Equipment	Description
1	Battery	Brand: NEXcell Battery Co., Ltd. Model Name: NLI-N7100. Power Rating: 3.8Vdc, 3050mAh
2	Adapter	Brand: JS Model: FJ-SW1260502000UN I/P: 100-240Vac, 50/60Hz, 0.4A O/P: 5Vdc, 2000mA
3	USB cable	1.1m shielded with 2 cores
4	Tire Tread Depth	1.76m shielded with 1 core

Support Equipment List						
No.	Equipment	Brand	Model	S/N	FCC ID	Signal cable / Length (m)
1	Tire Tread Depth (TTD)	---	---	---	---	RJ45, 1.76m shielded with 1 core.

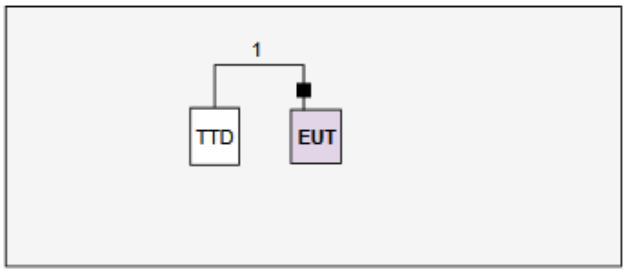
1.2 Test Setup Chart

Test Setup Diagram (Charger mode)



1. RJ45, 1.76m shielded with 1 core
2. USB, 1.1m shielded with 2 cores

Test Setup Diagram (TX mode)



1. RJ45, 1.76m shielded with 1 core

1.3 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2017	Dec. 03, 2018
Receiver	R&S	ESR3	101658	Nov. 20, 2017	Nov. 19, 2018
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 25, 2017	Jul. 24, 2018
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2017	Nov. 12, 2018
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 07, 2017	Dec. 06, 2018
Preamplifier	EMC	EMC02325	980225	Jul. 28, 2017	Jul. 27, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 07, 2017	Dec. 06, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 07, 2017	Dec. 06, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 07, 2017	Dec. 06, 2018
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 07, 2017	Dec. 06, 2018
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 07, 2017	Dec. 06, 2018
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 07, 2017	Dec. 06, 2018
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.4 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.209
ANSI C63.10-2013
FCC KDB 414788 D01 Radiated Test Site v01

1.5 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty	
Parameters	**Uncertainty**
AC conducted emission	±2.90 dB
Radiated emission	±3.66 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	22°C / 59%	Alex Tsai
Radiated Emissions	03CH01-WS	24°C / 61%	Akun Chung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (kHz)	Test Configuration
AC Conducted Emissions	---	---	Charger mode
Radiated Emissions	---	---	Charger mode
	CW	125	TX mode
NOTE: The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **X-plane** results were found as the worst case and were shown in this report			

3 Transmitter Test Results

3.1 Conducted Emissions

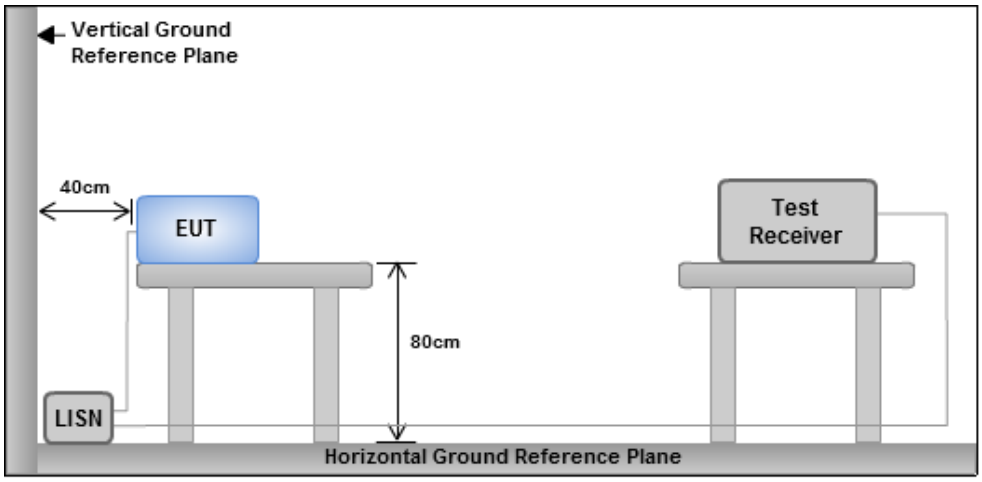
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V / 60Hz.

3.1.3 Test Setup

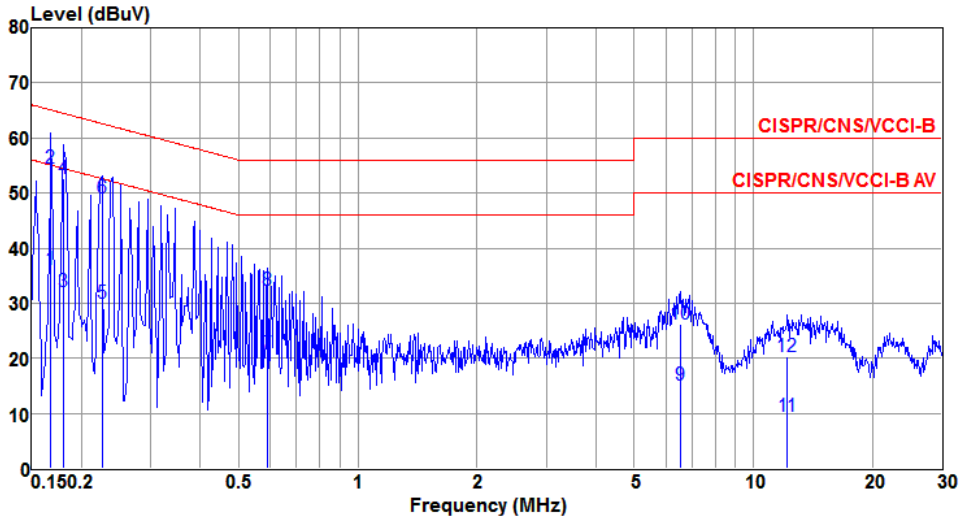


Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Charger mode

3.1.4 Test Result of Conducted Emissions

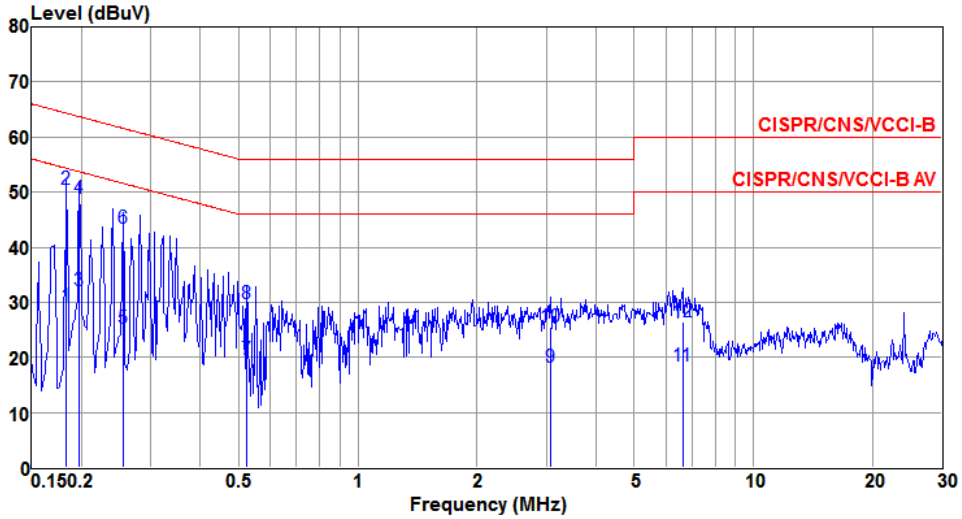
Power Phase	Line	Test Freq. (kHz)	125



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.168	36.12	55.08	-18.96	35.82	0.28	0.02	Average
2@	0.168	54.56	65.08	-10.52	54.26	0.28	0.02	QP
3	0.180	32.11	54.50	-22.39	31.81	0.28	0.02	Average
4	0.180	52.70	64.50	-11.80	52.40	0.28	0.02	QP
5	0.226	30.00	52.61	-22.61	29.67	0.30	0.03	Average
6	0.226	48.99	62.61	-13.62	48.66	0.30	0.03	QP
7	0.592	20.72	46.00	-25.28	20.34	0.36	0.02	Average
8	0.592	32.38	56.00	-23.62	32.00	0.36	0.02	QP
9	6.557	15.07	50.00	-34.93	14.28	0.52	0.27	Average
10	6.557	26.15	60.00	-33.85	25.36	0.52	0.27	QP
11	12.188	9.41	50.00	-40.59	8.46	0.63	0.32	Average
12	12.188	20.24	60.00	-39.76	19.29	0.63	0.32	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Power Phase	Neutral	Test Freq. (kHz)	125



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.183	29.30	54.33	-25.03	29.13	0.15	0.02	Average
2@	0.183	50.48	64.33	-13.85	50.31	0.15	0.02	QP
3	0.198	32.09	53.71	-21.62	31.91	0.15	0.03	Average
4	0.198	48.93	63.71	-14.78	48.75	0.15	0.03	QP
5	0.255	25.28	51.60	-26.32	25.09	0.16	0.03	Average
6	0.255	43.33	61.60	-18.27	43.14	0.16	0.03	QP
7	0.524	19.61	46.00	-26.39	19.38	0.21	0.02	Average
8	0.524	29.72	56.00	-26.28	29.49	0.21	0.02	QP
9	3.074	18.13	46.00	-27.87	17.63	0.33	0.17	Average
10	3.074	25.49	56.00	-30.51	24.99	0.33	0.17	QP
11	6.627	18.34	50.00	-31.66	17.66	0.41	0.27	Average
12	6.627	26.52	60.00	-33.48	25.84	0.41	0.27	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.2 Radiated Emissions

3.2.1 Limit of Radiated Emissions

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29.54	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit
Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.2.2 Test Procedures

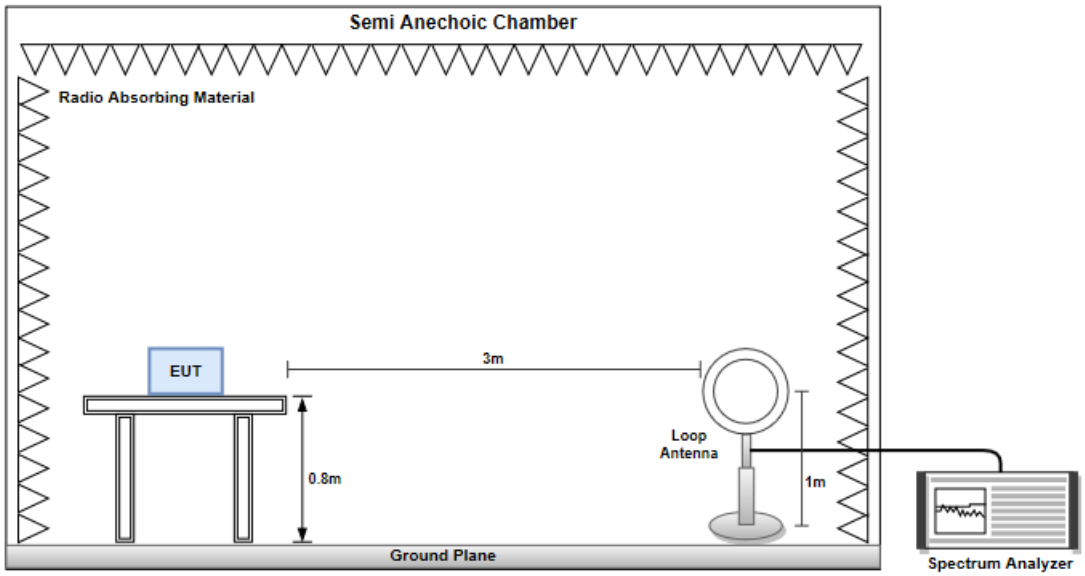
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at a height of 0.8 m test table above the ground plane.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

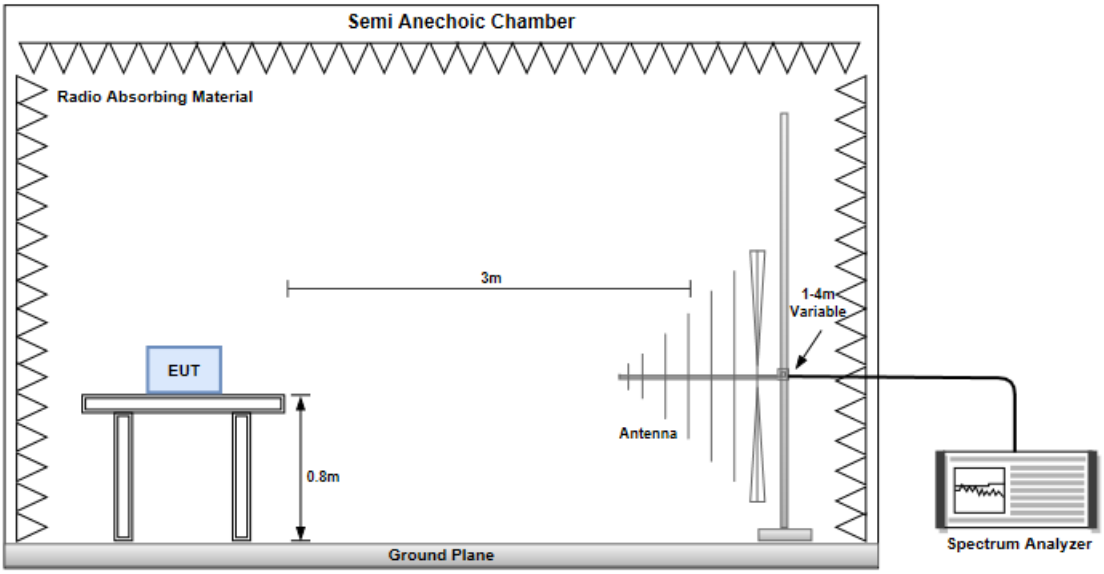
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. Correction values between measurement form the semi-anechoic chamber and open-field test site have been confirmed and added to the factor.

3.2.3 Test Setup

Radiated Emissions below 30MHz



Radiated Emissions below 1 GHz



TX mode

3.2.4 Transmitter Radiated Unwanted Emissions (9kHz ~ 1.705MHz)

Polarization		Loop Open					
Frequency (MHz)		**Emission Level dBuV/m**	**Limit (dBuV/m)**	**Margin (dB)**	**SA Reading (dBuV/m)**	**Factor**	**Remark**
1	0.125	77.17	105.67	-28.50	54.20	22.97	Average
2	0.125	77.25	125.67	-48.42	54.20	22.97	Peak
3	0.250	60.90	99.65	-38.75	37.50	22.59	Average
4	0.250	61.49	119.65	-58.16	38.90	22.59	Peak
5	0.375	57.70	96.12	-38.42	35.40	22.30	Average
6	0.375	58.40	116.12	-57.72	36.10	22.30	Peak

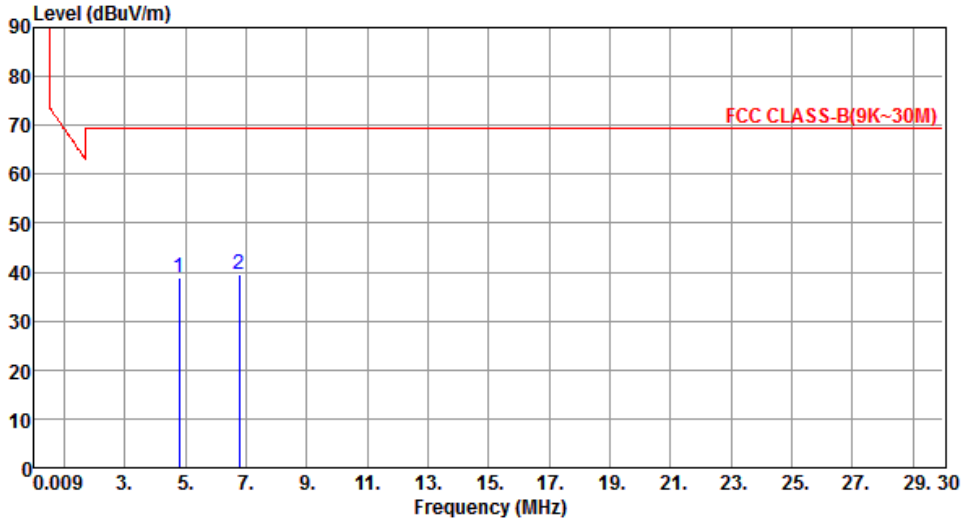
Polarization		Loop Close					
Frequency (MHz)		**Emission Level dBuV/m**	**Limit (dBuV/m)**	**Margin (dB)**	**SA Reading (dBuV/m)**	**Factor**	**Remark**
1	0.125	72.27	105.67	-33.40	49.30	22.97	Average
2	0.125	72.35	125.67	-53.32	49.30	22.97	Peak
3	0.250	55.19	99.65	-44.46	32.60	22.59	Average
4	0.250	56.29	119.65	-63.36	33.70	22.59	Peak
5	0.375	55.10	96.12	-41.02	32.80	22.30	Average
6	0.375	56.40	116.12	-59.72	34.10	22.30	Peak

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB).
*Factor includes antenna factor and cable loss.
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

TX mode

3.2.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

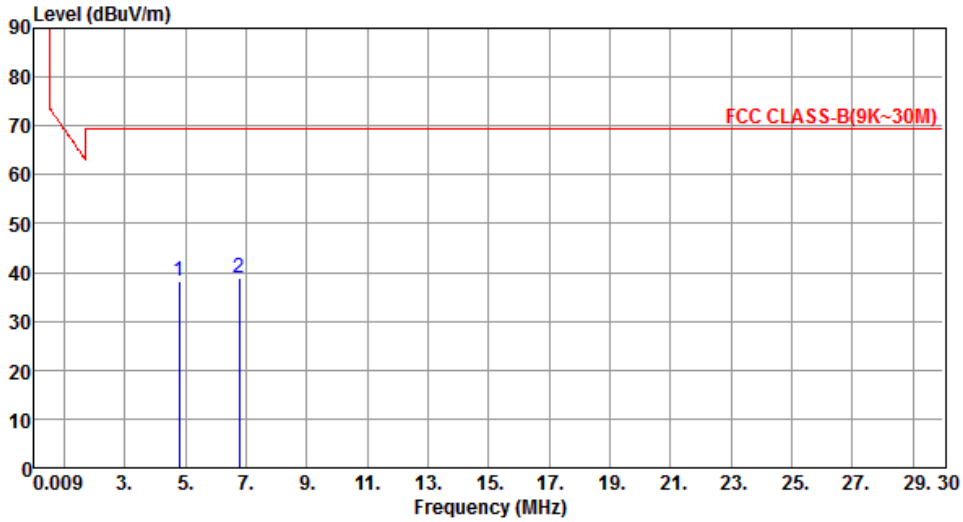
Polarization	Loop Open	**Test Freq. (kHz)**	125



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	4.78	39.01	69.54	-30.53	17.45	21.56	QP	---	---
2	6.76	39.65	69.54	-29.89	17.32	22.33	QP	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

Polarization	Loop Close	Test Freq. (kHz)	125



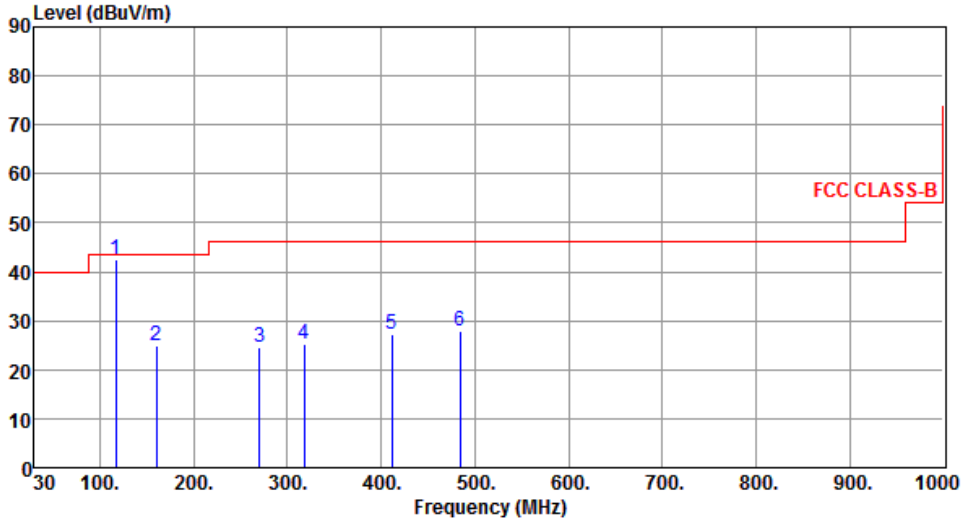
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	4.78	38.04	69.54	-31.50	16.48	21.56	QP	---	---
2	6.76	38.87	69.54	-30.67	16.54	22.33	QP	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

TX mode

3.2.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)

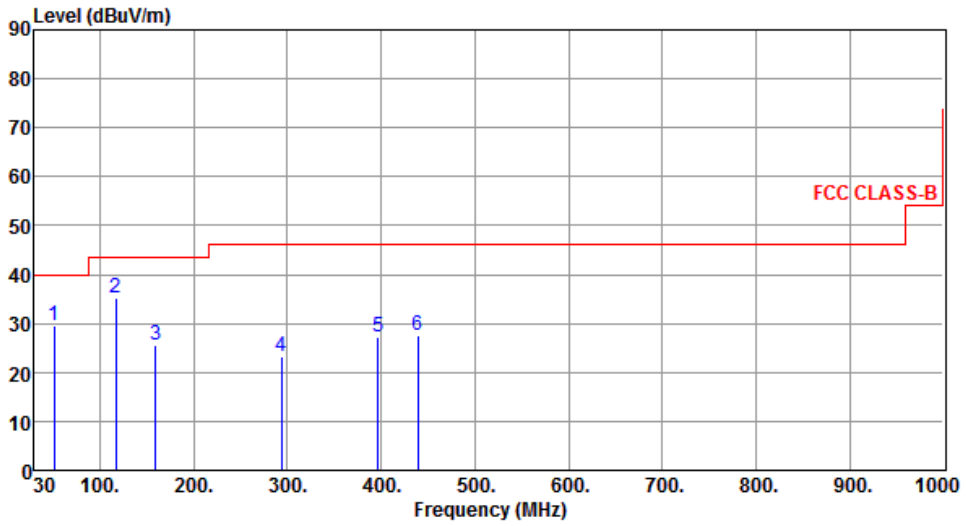
Polarization	Horizontal	**Test Freq. (kHz)**	125



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	117.30	42.42	43.50	-1.08	53.27	-10.85	Peak	---	---
2	159.98	25.00	43.50	-18.50	33.20	-8.20	Peak	---	---
3	270.56	24.58	46.00	-21.42	33.06	-8.48	Peak	---	---
4	318.09	25.29	46.00	-20.71	32.48	-7.19	Peak	---	---
5	411.21	27.15	46.00	-18.85	31.84	-4.69	Peak	---	---
6	483.96	27.82	46.00	-18.18	30.96	-3.14	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

Polarization	Vertical	Test Freq. (kHz)	125



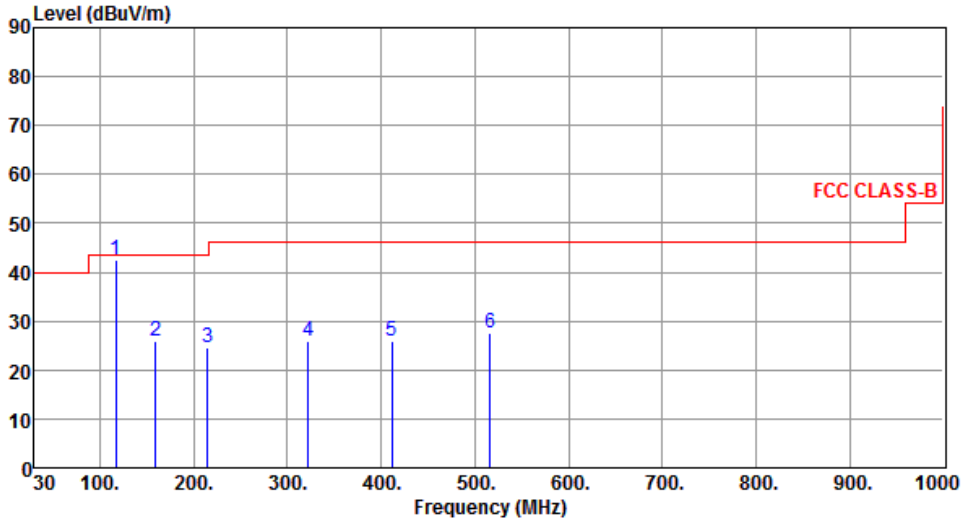
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	51.34	29.72	40.00	-10.28	37.49	-7.77	Peak	---	---
2	117.30	35.18	43.50	-8.32	46.03	-10.85	Peak	---	---
3	159.01	25.68	43.50	-17.82	33.89	-8.21	Peak	---	---
4	293.84	23.25	46.00	-22.75	31.02	-7.77	Peak	---	---
5	396.66	27.38	46.00	-18.62	32.42	-5.04	Peak	---	---
6	439.34	27.56	46.00	-18.44	31.60	-4.04	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

Charger mode

3.2.7 Transmitter Radiated Unwanted Emissions (Above 30MHz)

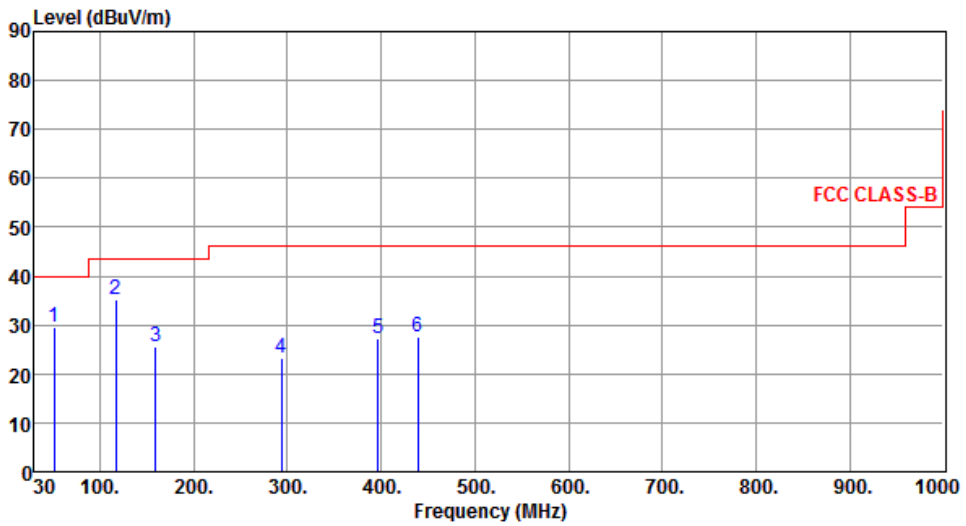
Polarization	Horizontal	**Test Freq. (kHz)**	125



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	117.30	42.45	43.50	-1.05	53.30	-10.85	QP	149	262
2	159.01	25.88	43.50	-17.62	34.09	-8.21	Peak	---	---
3	215.27	24.74	43.50	-18.76	35.52	-10.78	Peak	---	---
4	321.97	26.01	46.00	-19.99	33.11	-7.10	Peak	---	---
5	411.21	25.97	46.00	-20.03	30.66	-4.69	Peak	---	---
6	515.97	27.42	46.00	-18.58	29.90	-2.48	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

Polarization	Vertical	Test Freq. (kHz)	125



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	51.34	29.72	40.00	-10.28	37.49	-7.77	Peak	---	---
2	117.30	35.18	43.50	-8.32	46.03	-10.85	Peak	---	---
3	159.01	25.68	43.50	-17.82	33.89	-8.21	Peak	---	---
4	293.84	23.25	46.00	-22.75	31.02	-7.77	Peak	---	---
5	396.66	27.38	46.00	-18.62	32.42	-5.04	Peak	---	---
6	439.34	27.56	46.00	-18.44	31.60	-4.04	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m)

4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

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