



CERTIFICATION TEST REPORT

FCC CFR47 PART 15 SUBPART C

Test Report File No.	14-IST-0151	☒ Basic	☐ Alternate
Date of Receipt	February 24, 2014	Begin of test date	March 12, 2014
Date of Issue	March 26, 2014	End of test date	March 18, 2014

Kind of Product	Control Unit
Basic Model(s)	S-10C
FCC ID	2AB26S-10C

Applicant	PLATO CO., LTD.
Address	5F Pyungchon IT Venture Center, 1113-1, Bisan-Dong, Dongan-Gu, Anyang-City, Gyeonggi-Do, Korea
Manufacturer	PLATO CO., LTD.
Address	5F Pyungchon IT Venture Center, 1113-1, Bisan-Dong, Dongan-Gu, Anyang-City, Gyeonggi-Do, Korea

Test Result

☒ Positive

☐ Negative

Tested By

Reviewed By

B.O.KO

S.J.CHO

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
- The test report is consists of 12 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST Co., Ltd.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4
I assume full responsibility for accuracy and completeness of these data.





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INFORMATION OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd.
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KOLAS Testing No. : KT118
RRA Designation No. : KR0018
FCC Registration No. : 400603
VCCI Member No. : 1739



Measurement Uncertainty

Conducted Emissions	$U = 2.98$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions (Antenna - Horizontal)	$U = 3.83$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions (Antenna - Verical)	$U = 4.50$ [dB] (Confidence level approximately 95 %, $k = 2$)



PRODUCT INFORMATION

Specification(Control Unit)

Part 15 Low Power Transmitter Below 1705KHz(DCD)

Power	DC 12V (Car Battery)
Dark Current	Max. 6uA
LF Frequency	134.2KHz (Tx)
LF Range	1m
RF Frequency	433.9 MHz (Rx)
RF Range	Max 30m
Dimension	72 x 102 x 24 mm
Operating Temp	-40 ~ 80°C
Weight	110g
Connector	16pin

**Note: All the testing were performed according to the procedures in
FCC CFR47 PART 15 SUBPART C**



SUMMARY

Applied Standard : FCC CRF Part 15 Subpart C

Standard Section	Description	result	remark
15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Pass	Meet the requirements
2.1049	20dB Bandwidth	Pass	Meet the requirements



Equipment Under Test

EUT Type :

- ☒ Table-Top. ☐ Floor-Standing.
☐ Table-Top and Floor-Standing (Combination).
☐ Hand held

Operation - mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

- ☐ Standby Mode
☒ Operational Condition : ☒ continue Transmit

Configuration of the equipment under test :

Following peripheral devices and interface cables were connected during the measurement :

Equipment	Manufacturer	Model	Serial No.
DC Power Supply	YOKOGAWA	PA7011	23HM5018

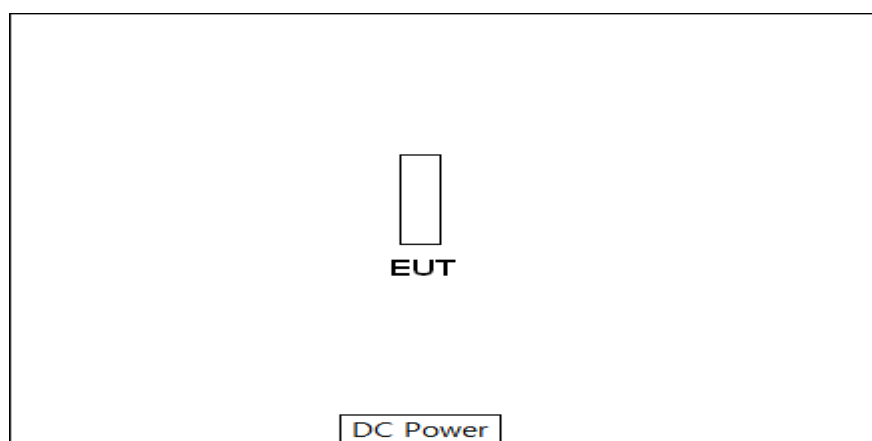
EUT exercise Software

To get a maximum radiated emission from the EUT, EUT was programed to transmit RF signal continuously.

To activate continuous transmission, software was changed as above for testing only.

To get a maximum emission levels from the EUT, the EUT was moved throughout the X, Y, and Z planes.

Test Set-Up



Radiated Emissions



Radiated Emissions Test, 9 kHz to 30 MHz(Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f) (2) .
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.
5. The result was 20dB lower than the limit line 15.31(o) was not reported.

Radiated Emissions:

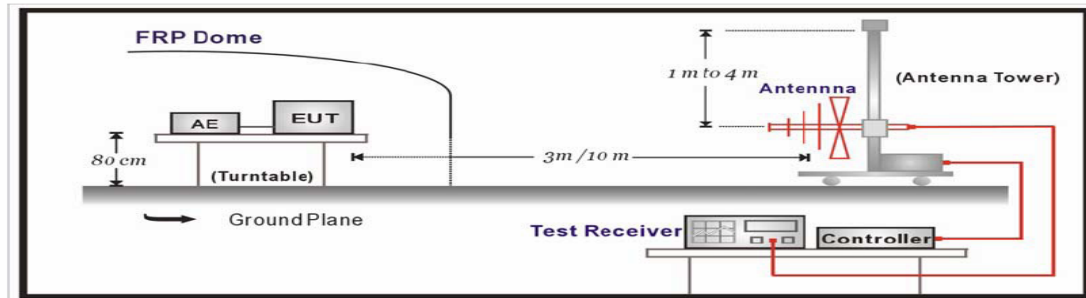
The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120kHz.

Procedure of Test

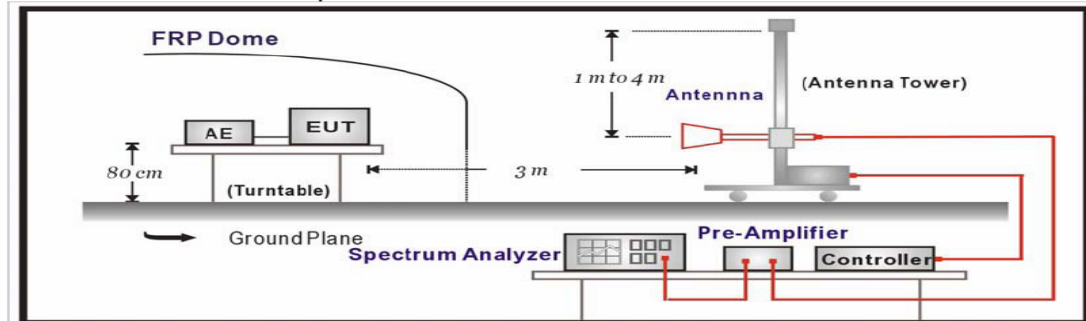
Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.(The bandwidth below 1GHz setting on the field strength meter is 120KHz and above 1GHz is 1MHz.)



Under 1GHz Test Setup:



Above 1GHz Test Setup:



Limits

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field Strength levels specified in the following table :

FCC Part 15 Subpart C Section 15.209 Limits		
Frequency (MHz)	$\mu\text{V}/\text{meter}$	$\text{dB}\mu\text{V}/\text{meter (3m)}$
0.009-0.490	$2400/F(\text{KHz})$ at 300 m	$20\log 2400/F(\text{KHz})+80$
0.490-1.705	$24000/F(\text{KHz})$ at 30m	$20\log 24000/F(\text{KHz})+40$
1.705-30	30 at 30 m	49.5
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

Remarks : Except as provided in paragraph(g), fundamental emissions from an intentional radiators operating under this section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz or 470-806MHz.

However, operation within these frequency bands is permitted under other sections of this part, e.g., Section 15.231 and 15.241.



Radiated Emissions Results

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Due for Cal	Serial Number
EMI Receiver	ESCS30	Rohde & Schwarz	May 10, 2014	100171
EMI Receiver	ESCI7	Rohde & Schwarz	Jul. 16, 2014	100872
SPECTRUM ANALYZER	R3273	ADVANTEST	Oct. 07, 2014	95090431
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 26, 2014	8620771017
Log-bicon Antenna	VULB9160	Schwarz beck	Jun. 03, 2015	3071
HORN-Antenna	3115	EMCO	Dec. 04, 2015	9012-3602
HORN-Antenna	HF906	Rohde & Schwarz	Oct. 25, 2015	100530
PRE AMPLIFIER	8449B OPT H02	HP	Oct. 08, 2014	3008A0530

*Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.
2. The calibration interval of horn ant. and loop ant. is 24 months*

◆ Test Conditions

Temperature (22.5 ± 0.2) °C
Humidity (37.8 ± 0.2) % R.H.
Atmosphere (1010) mbar

◆ Test Area Full-Anechoic Room (3m)

◆ Test Date March 14, 2014

Note :

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

Where Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)



Field strength of fundamental

Fundamental Emissions Test (Below 30MHz) :

☒ Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, packet types and antenna ports (if EUT with antenna diversity architecture), and X, Y, Z Axis.

EUT	S-10C	PROBE	0.009~30 MHz(Y Plane)H/V
POWER	DC 12 V(Car Battery)	NOTE	0.1342MHz

Frequency MHz	Reading [dBuV]	Detector Mode	P (H,V)	Ant. Factor [dB/m]	Cable Loss dB	Distance Factor	Total [dBuV/m]	Average Limit [dBuV/m]	Margin dB
0.1342	64.5	PK	H	19.5	0.6	80	4.6	25.05	19.95
0.4026	40.0	PK	H	20.2	0.6	80	-19.2	25.05	44.25
27.60	27.6	PK	V	23.6	0.6	40	11.8	29.54	17.74

Note :

1. EUT was in continuous transmission mode and peak field strength meets AV limit.
2. No other spurious and harmonic emissions were reported greater than listed emissions above table
3. Total = reading level + Ant Factor + Cable Loss – Distance Factor

spurious emissions(30~1000MHz)

EUT	S-10C	PROBE	30~1000 MHz(Y Plane)H/V
POWER	DC 12 V(Car Battery)	NOTE	0.1342MHz

Frequency MHz	Reading [dBuV]	Detector Mode	P (H,V)	Correction factors [dB/m]	Total [dBuV/m]	QP Limit [dBuV/m]	Margin dB
34.850	22.90	QP	V	12.07	34.97	40.00	5.03
69.770	22.40	QP	V	10.94	33.34	40.00	6.66
118.270	23.30	QP	V	12.28	35.58	43.50	7.92
176.470	21.40	QP	H	13.49	34.89	43.50	8.61

Note :

1. EUT was in continuous transmission mode and peak field strength meets AV limit.
2. No other spurious and harmonic emissions were reported greater than listed emissions above table.
3. Correction factor = Ant Factor + Cable Loss

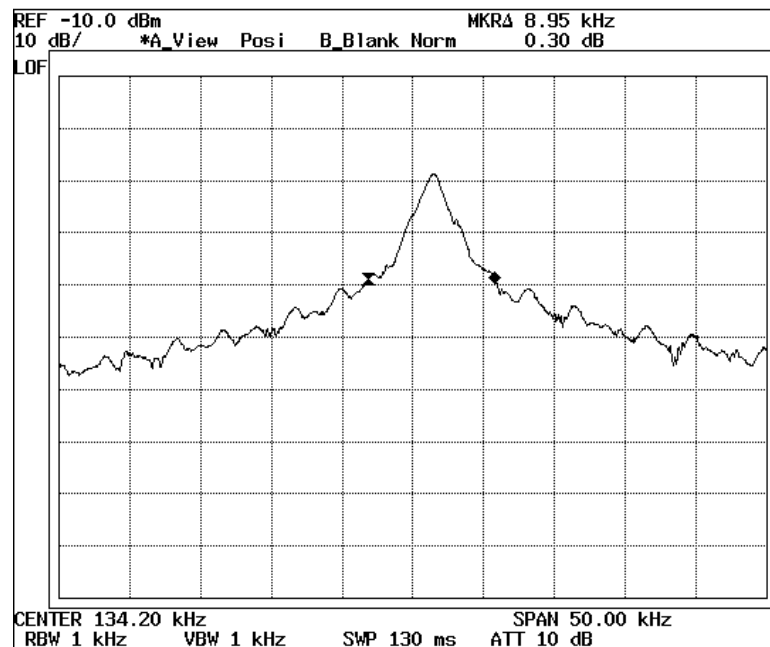


20dB Bandwidth Measurement

The 20dB Bandwidth is measured with a spectrum analyzer connected via a receiving antenna placed near the EUT while the EUT is operating.

The bandwidth of the Result

Tested Frequency (MHz)	Test Results
0.1342	8.95KHz





Appendix A. The Photos of Test Setup



Radiated Emissions 0.009~30MHz - Y View



Radiated Emissions 30~1000MHz - Y View

Appendix A. The Photos of Test Setup