

Test Report No. 7191163393-EEC17/01
dated 14 Jun 2017



PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
47 CFR FCC Parts 2, 15, 22 and 24
OF AN
E-LOG AND FLEET MANAGEMENT DEVICE
[Model : DC200S]
[Contains FCC ID : A4C01005A & QIPX8]

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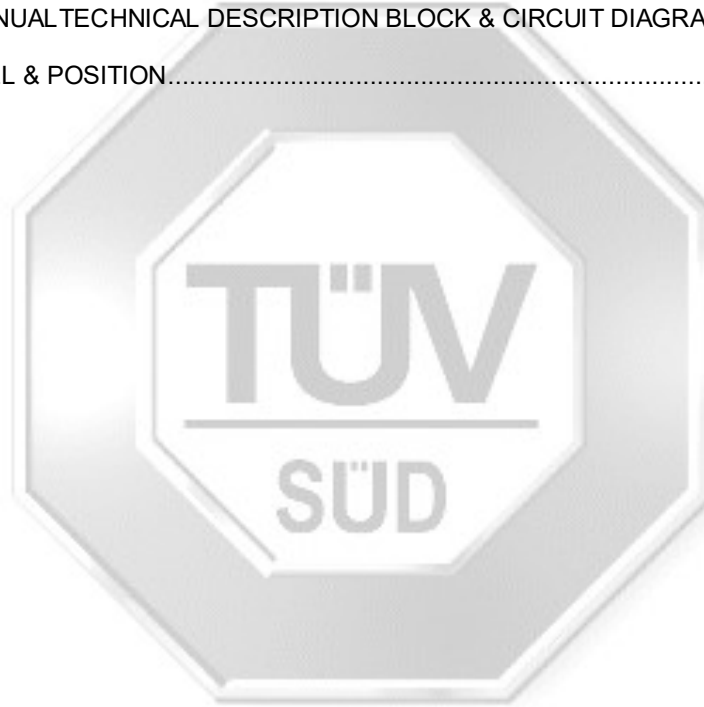
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TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail
47 CFR FCC Parts 2 and 22 (PCS 850)		
22.913(a)(2), 2.1046	RF Power Output	Not Tested *See Note 7
22.917(b), 2.1049	Occupied Bandwidth	Not Tested *See Note 7
22.917(a), 22.917(b), 2.1053	Band Edge Compliance (Radiated)	Not Tested *See Note 7
22.917(a), 22.917(b), 2.1051	Out of Band Emissions (Conducted)	Not Tested *See Note 7
22.917(a), 22.917(b), 2.1053	Out of Band Emissions (Radiated)	Not Tested *See Note 7
47 CFR FCC Parts 2 and 24 (PCS 1900)		
24.232(c), 2.1046	RF Power Output	Not Tested *See Note 7
24.238(b), 2.1049	Occupied Bandwidth	Not Tested *See Note 7
24.238(a), 24.238(b), 2.1053	Band Edge Compliance (Radiated)	Not Tested *See Note 7
24.238(a), 24.238(b), 2.1051	Out of Band Emissions (Conducted)	Not Tested *See Note 7
24.238(a), 24.238(b), 2.1053	Out of Band Emissions (Radiated)	Pass
47 CFR FCC Parts 1 and 15		
15.107	Conducted Emissions	Not Tested *See Note 7
15.109	Receiver Spurious Emissions	Pass
1.1310	Maximum Permissible Exposure	Not Tested *See Note 7

TEST SUMMARY

Notes

1. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) when it was configured to operate under PCS 850 and/or PCS 1900 operating conditions. For each channel, the EUT was configured to operate in the test mode.

PCS 850	
<u>Transmit Channel</u>	<u>Frequency (MHz)</u>
Channel 128	824.2
Channel 189	836.4
Channel 251	848.8
PCS 1900	
<u>Transmit Channel</u>	<u>Frequency (MHz)</u>
Channel 512	1850.2
Channel 661	1880.0
Channel 810	1909.8

2. The Equipment Under Test (EUT) supports PCS 850 / PCS 1900 only.
3. 47 CFR FCC Parts 22 and 24 measurement procedures are according to ANSI TIA-603-D : 2010 while 47 CFR FCC Part 15 measurement procedures are according to ANSI C63.4 : 2014.
4. The EUT is a Class B device when in non-transmitting and receiving states and meets the 47 CFR FCC Part15B Class B requirements.
5. The Equipment Under Test (EUT) is a battery operated device and contains no provision for public utility connections.
6. The EUT was tested using fully charged batteries with DC voltage of 12.2V.
7. The RF module of the Equipment Under Test (EUT) is a qualified RF module, which bears the FCC ID: QIPXS8. As such, only limited tests as mentioned above were evaluated.
8. The difference between this EUT, DC200S and DC200 (previously tested) is the cellular antenna was replaced to GA DC700S Main Antenna (Part number: GADC700S01) by Green Antenna Pte Ltd.

Below are the Antenna Gain differences.

	<u>DC200 Antenna Gain</u>	<u>DC200S Antenna Gain</u>
PCS 850	0.97dBi	0.54 dBi
PCS 1900	1.78dBi	2.09 dBi

Modifications

No modifications were made.

PRODUCT DESCRIPTION

Description	: The Equipment Under Test (EUT) is an E-Log And Fleet Management Device .
Applicant	: A4C-RM Acquisition LLC 855 Woods Drive Skokie IL 60077 USA
Manufacturer	: PCI Limited 35 Pioneer Road North Singapore 628475
Factory (ies)	: Pt PCI Elektronik Internasional Panbil Industrial Estate Factory C Lot 2-3 Jalan Ahmad Yani Muka Kuning, Batam 29433 Indonesia
Model Number	: DC200S
FCC ID	: A4C01005A & QIPXS8
Serial Number	: Nil
Microprocessor	: STMicroelectronics STM32F746ZGT6 & IC ARM CORTEX M7 STM32 32-Bit LQFP144
Operating / Transmitting Frequency	: 824MHz – 849MHz (uplink) and 869MHz – 894MHz (downlink) (PCS 850) 1850MHz – 1910MHz (uplink) and 1930MHz – 1990MHz (downlink) (PCS 1900)
Clock / Oscillator Frequency	: 16MHz
Modulation / Emissions Designator	: 300KGXW (PCS 850) 300KGXW (PCS 1900)
Antenna Gain	: 0.54dBi (PCS 850) 2.09dBi (PCS 1900)
Port / Connectors	: Refer to manufacturer's user manual / operating manual
Rated Input Power	: 12Vdc & 24Vdc
Accessories	: Nil



SUPPORTING EQUIPMENT DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Rohde & Schwarz Universal Radio Communication Tester	M/N: CMU200 S/N: 112123 FCC ID: Nil	2.00m unshielded power cable





EUT OPERATING CONDITIONS

47 CFR FCC Part 15

1. Out of Band Emissions (Radiated)
2. Receiver Spurious Emissions

The EUT was exercised by operating in continuous loopback mode with the reception level is above the receiver minimum sensitivity at lower, middle and upper channels one at a time. The R&S CMU200 was used as a simulated PCS 850 and PCS 1900 base station.



OUT OF BAND EMISSIONS (RADIATED) TEST

47 CFR FCC Parts 24.238(a), 24.238(b) and 2.1053 Out of Band Emissions (Radiated) Limits

The EUT shows compliance to the requirements of this section, which states:

- (a) The power of any emission outside the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.
- (b) Compliance with these rules is based on the use of measurement instrumentation employing resolution bandwidth of 1MHz or greater. In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attempted at least 26dB below the transmitter power.

47 CFR FCC Parts 24.238(a), 24.238(b) and 2.1053 Out of Band Emissions (Radiated) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz)	E7405A	US40240195	20 Mar 2018
HP Preamplifier (100kHz-1.3GHz) – PA2	8447D	2944A08173	16 May 2018
Schaffner Bilog Antenna – BL3 (Ref)	CBL6112D	2549	11 Feb 2017
TDK-RF Horn Antenna	HRN-0118	130256	18 Oct 2017
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	10 Mar 2018
Micro-Tronics Bandstop Filter (2.4-2.5 GHz)	BRM50701	17	27 Nov 2017
K&L Microwave Tunable Band Reject Filter	3TNF-1000/2000-N/N	436	07 Nov 2017

OUT OF BAND EMISSIONS (RADIATED) TEST

47 CFR FCC Parts 24.238(a), 24.238(b) and 2.1053 Out of Band Emissions (Radiated) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant antenna was set at the required test distance away from the EUT and supporting equipment boundary.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 1MHz.
5. All other supporting equipment were powered separately from another filtered mains.

47 CFR FCC Parts 24.238(a), 24.238(b) and 2.1053 Out of Band Emissions (Radiated) Test Method

1. The EUT was set to transmit at the maximum power at the lower channel with the modulation on at normal test condition.
2. The receiving antenna (test antenna) was set at vertical polarization with the height of 1m.
3. With the spectrum analyser was set to max hold enabled the emissions outside the operating frequency range (spurious emissions) were searched and recorded. For EUT which is a portable device, the spurious emission search was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces worst emissions.
4. For each spurious emission found, the test antenna was raised or lowered through the specified range of heights (1m – 4m) until a maximum signal level was detected on the test receiver.
5. The EUT was then rotated through 360° in the horizontal plane until the maximum signal was received. The maximum received signal level was recorded.
6. The steps 2 to 5 were repeated with the receiving antenna was set to horizontal polarization.
7. Comparison was made on both measured spurious emission results with vertical and horizontal polarizations. The highest value out of vertical and horizontal polarizations was recorded as A dBm.
8. A known reference path loss was then added to the A (measured level in step 7) to obtain the measured spurious emission power.
9. The steps 2 to 8 were repeated until all the spurious emissions (up to 10th harmonics of the carrier frequency) were measured.
10. The steps 2 to 9 were repeated with the EUT was set to operate at the middle and upper channels respectively.

OUT OF BAND EMISSIONS (RADIATED) TEST

47 CFR FCC Parts 24.238(a), 24.238(b) and 2.1053 Out of Band Emissions (Radiated) Results

Operating Mode	PCS 1900 Transmit & Receive (Worst) + Bluetooth 2440MHz @ DM1 Packet Type + WiFi 802.11g 2412MHz @ 9Mbps	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	60%
Test Distance	3m	Atmospheric Pressure	10300mbar
Antenna Gain	2.09 dBi	Tested By	Chang Wai Kit

LOWER CHANNEL (CHANNEL 512)

Frequency (MHz)	Amplitude (dBm)	Limit (dBm)
6479.5370	-40.0	-13.0
9807.5370	-48.1	-13.0
11463.570	-47.5	-13.0
11740.3000	-46.7	-13.0
12196.6800	-47.1	-13.0
12353.1600	-46.5	-13.0

MIDDLE CHANNEL (CHANNEL 661)

Frequency (MHz)	Amplitude (dBm)	Limit (dBm)
6472.2930	-41.2	-13.0
8791.8960	-48.7	-13.0
9580.0680	-47.7	-13.0
10582.6700	-47.6	-13.0
11263.6270	-46.9	-13.0
11737.4000	-46.2	-13.0

UPPER CHANNEL (CHANNEL 810)

Frequency (MHz)	Amplitude (dBm)	Limit (dBm)
6499.8210	-40.8	-13.0
6759.1640	-48.8	-13.0
8790.4460	-48.0	-13.0
10190.0320	-47.9	-13.0
11260.7300	-47.3	-13.0
11999.6410	-47.6	-13.0

Notes

- The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators.
- Out of band (Radiated) Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ± 4.0 dB.

RECEIVER SPURIOUS EMISSIONS TEST

47 CFR FCC Part 15.109 Receiver Spurious Emissions Limits (Class B)

Frequency Range (MHz)	Quasi-Peak Limit Values (dBμV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*

* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

47 CFR FCC Part 15.109 Receiver Spurious Emissions Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI1	ESI40	100010	11 Oct 2017
Schaffner Bilog Antenna –(30MHz-2GHz) BL4	CBL6112B	2593	18 Jan 2018
Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441056	22 Jul 2017
TDK-RF Horn Antenna	HRN-0118	130256	18 Oct 2017
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	10 Mar 2018
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	12 Oct 2017
ETS Horn Antenna(18GHz-40GHz) (Ref)	3116	0004-2474	18 Oct 2017
Micro-Tronics Bandstop Filter (2.4-2.5 GHz)	BRM50701	17	27 Nov 2017
K&L Microwave Tunable Band Reject Filter	3TNF-1000/2000-N/N	436	07 Nov 2017

RECEIVER SPURIOUS EMISSIONS TEST

47 CFR FCC Part 15.109 Receiver Spurious Emissions Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

47 CFR FCC Part 15.109 Receiver Spurious Emissions Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 5th harmonic of the highest frequency used or generated by the EUT, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

Sample Calculation Example

At 300 MHz	Q-P limit = 37.0 dB μ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 31.0 dB μ V/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 37.0 - 31.0 = 6.0	i.e. 6.0 dB below Q-P limit

RECEIVER SPURIOUS EMISSIONS TEST

47 CFR FCC Part 15.109 Receiver Spurious Emissions Results

Operating Mode	PCS 1900 Transmit & Receive (Worst) + Bluetooth 2440MHz @ DM1 Packet Type + WiFi 802.11g 2412MHz @ 9Mbps	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	60%
Test Distance	3m	Atmospheric Pressure	10300mbar
Class	B	Tested By	Nazrulhizat

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel (Worst)
332.1740	41.9	46.0	4.1	151	161	H	661
332.1740	38.6	46.0	7.4	225	114	V	661
464.9780	36.5	46.0	9.5	135	43	H	661
624.0070	37.0	46.0	9.0	115	192	H	661
800.0070	27.8	46.0	18.2	202	300	V	661
805.1290	31.0	46.0	15.0	118	191	H	661

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch (Worst)
5.0570	49.8	74.0	24.2	36.6	54.0	17.4	199	218	V	661
5.2752	51.0	74.0	23.0	38.0	54.0	16.0	102	103	H	661
5.5313	51.1	74.0	22.9	37.8	54.0	16.2	102	149	V	661
5.8875	49.3	74.0	24.7	36.6	54.0	17.4	198	282	H	661
14.6664	45.5	74.0	28.5	32.2	54.0	21.8	100	198	V	661
17.7570	49.4	74.0	24.6	35.3	54.0	18.7	100	148	H	661

Notes

- All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
- A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
RBW: 120kHz VBW: 1MHz
>1GHz
RBW: 1MHz VBW: 3MHz
- Receiver Spurious Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25.0GHz is ±4.0dB.

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July 2011

