

FCC PART 22H, PART 24E
TEST REPORT

For

Advanced Card Systems Ltd.

Units 2010-2013, 20th Floor, Chevalier Commercial Centre, 8 Wang Hoi Road,
Kowloon Bay, Hong Kong

FCC ID: V5MACR321

Report Type: Original Report	Product Type: Ticket Validator
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Report Number: RSZ131225007-00C	
Report Date: 2014-04-04	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Advanced Card Systems Ltd.*'s product, model number: *ACR321* (FCC ID: *V5MACR321*) or the "EUT" in this report was a *Ticket Validator*, which was measured approximately: 28.5 cm (L) x 16.5 cm (W) x 5.4 cm (H), rated with input voltage: DC10~36V with DC 3.7 V rechargeable Li-ion battery.

**All measurement and test data in this report was gathered from production sample serial number: 1312134 (Assigned by the applicant). The EUT supplied by the applicant was received on 2013-12-25.*

Objective

This test report is prepared on behalf of *Advanced Card Systems Ltd.* in accordance with Part 2-Subpart J, Part 22-Subpart H and Part 24-Subpart E of the Federal Communication Commissions rules.

The objective is to determine the compliance of the EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability and band edge.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS, Part 15.225 DXX and Part 15B JBP submissions with FCC ID: V5MACR321.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - Personal Communication Services

Applicable Standards: TIA/EIA 603-D, ANSI C63.4-2009.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp.(Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing according to TIA/EIA-603-D.
The final qualification test was performed with the EUT operating at normal mode.

Equipment Modifications

No modification was made to the EUT.

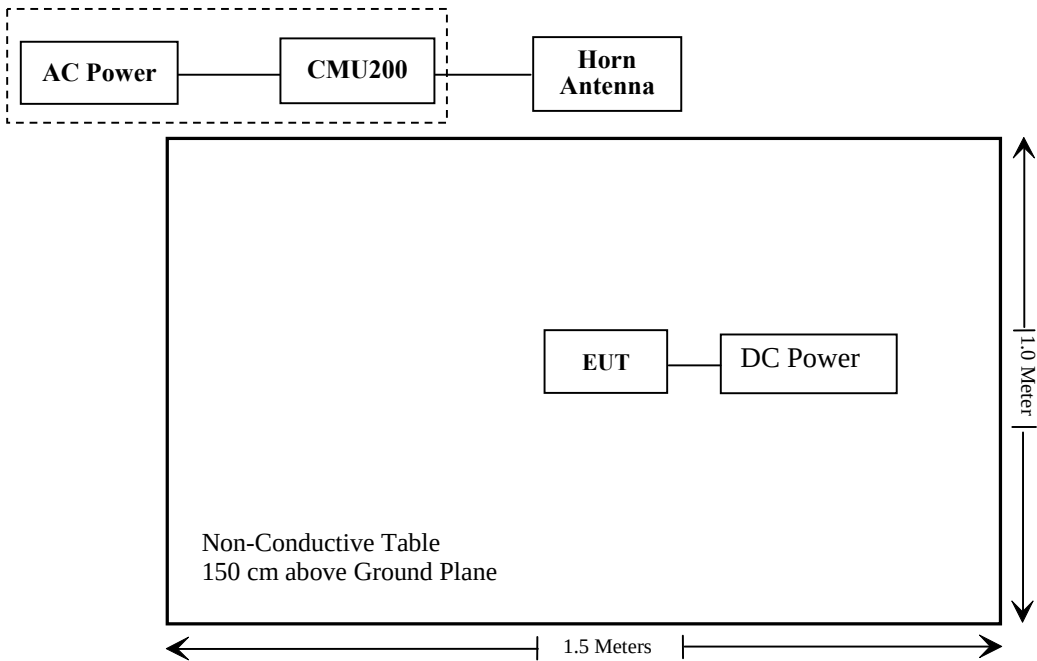
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	Quantity
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	106891	1
GW InsTEK	DC Power	GPS-3030DD	EM832096	1

External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielding Detachable Power Cable	1.5	EUT	DC Power Supply

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905 § 22.917; § 24.238	Bandwidth	Compliance*
§ 2.1051, § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053 § 22.917 (a); § 24.238 (a)	Field Strength of Spurious Radiation	Compliance
§ 22.917 (a); § 24.238 (a)	Out of band emission, Band Edge	Compliance*
§ 2.1055 § 22.355; § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliance*

Note: Compliance*: The RF module in this product was fully certified, which was tested in QuieTek Corporation with FCC ID: UDV-1009092010007 Report No.:109S016R-HP-US-P07V01 granted on 11/05/2010.

FCC §15.247 (i) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

MPE Calculation

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where:

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally **numeric** gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
848.8	0	1.00	32.55	1798.87	20	0.36	0.56
1909.8	-1	0.79	28.96	787.05	20	0.12	1.00

Note: To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

Result: Compliance

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

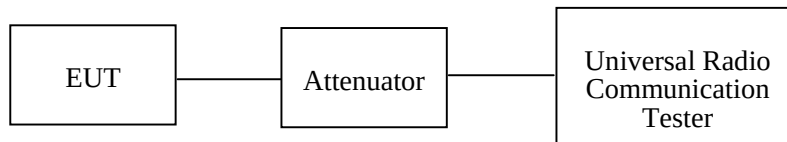
FCC § 2.1046, § 22.913 (a) & § 24.232 (c) - RF OUTPUT POWER**Applicable Standard**

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications..

Test Procedure*Conducted method:*

The RF output of the transmitter was connected to the wireless test set and the spectrum analyzer through sufficient attenuation.

*Radiated method:*

TIA 603-D section 2.2.17

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2014-11-30
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2013-09-17	2014-09-17
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
HP	Signal Generator	8341B	2624A00116	2013-05-09	2014-05-09
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	106891	2013-11-23	2014-11-23

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	21 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-02-22.

Conducted Power

Test data of Conducted Power is referred to FCC ID: UDV-1009092010007 granted on 11/05/2010, report No.: 109S016R-HP-US-P07V01, which was tested by QuieTek Corporation.

Radiated Power**ERP & EIRP****GPRS Mode:**

Frequency (MHz)	Receiver Reading (dBμV)	TurnTable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 22H/24E	
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
ERP for Cellular Band (Part 22H), High Channel										
836.6	95.13	157	2.6	H	27.6	0.74	0	26.86	38.45	11.59
836.6	99.22	236	2.1	V	31.7	0.74	0	30.96	38.45	7.49
EIRP for PCS Band (Part 24E), High Channel										
1880.0	87.65	89	1.7	H	15.4	1.03	9.40	23.77	33.01	9.24
1880.0	90.34	268	1.4	V	18.2	1.03	9.40	26.57	33.01	6.44

EDGE Mode:

Frequency (MHz)	Receiver Reading (dBμV)	TurnTable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 22H/24E	
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
ERP for Cellular Band (Part 22H), High Channel										
836.6	90.13	172	2.1	H	22.6	0.74	0.00	21.89	38.45	16.56
836.6	94.22	196	1.8	V	26.7	0.74	0.00	25.98	38.45	12.47
EIRP for PCS Band (Part 24E), High Channel										
1880.0	84.09	54	1.1	H	11.8	1.03	9.40	20.21	33.01	12.80
1880.0	86.96	132	1.2	V	14.9	1.03	9.40	23.22	33.01	9.79

WCDMA Mode:

Frequency (MHz)	Receiver Reading (dBμV)	TurnTable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 22H/24E	
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
ERP for Cellular Band (Part 22H), Middle Channel										
836.6	119.87	177	1.2	H	19.1	0.74	7.60	25.99	38.45	12.46
836.6	122.56	223	1.5	V	18.8	0.74	7.60	25.66	38.45	12.79
EIRP for PCS Band (Part 24E), Middle Channel										
1880.0	85.70	218	1.6	H	13.5	1.03	9.40	21.87	33.01	11.14
1880.0	87.16	11	1.9	V	15.1	1.03	9.40	23.47	33.01	9.54

Note: all above data were tested with no amplifier.

FCC §2.1049, §22.917, §22.905 & §24.238 - BANDWIDTH

Applicable Standard

FCC §2.1049, §22.917, §22.905 and §24.238.

Test Data

Test data is referred to FCC ID: UDV-1009092010007 granted on 11/05/2010, report No.: 109S016R-HP-US-P07V01, which was tested by QuieTek Corporation.

FCC §2.1051, §22.917(a) & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

FCC §2.1051, §22.917(a) and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Data

Test data is referred to FCC ID: UDV-1009092010007 granted on 11/05/2010, report No.: 109S016R-HP-US-P07V01, which was tested by QuieTek Corporation.

FCC §2.1053, §22.917 & §24.238 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §22.917 and § 24.238.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg(\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{Log}_{10}(\text{power out in Watts})$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2014-11-30
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2013-09-25	2014-09-25
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2013-04-03	2014-04-03
HP	Amplifier	8447E	1937A01046	2013-09-30	2014-09-30
HP	Signal Generator	8341B	2624A00116	2013-05-09	2014-05-09
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
Electro-Mechanics	Horn Antenna	3116	9510-2270	2013-10-14	2016-10-13
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	106891	2013-11-23	2014-11-23

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	21 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-02-22.

EUT operation mode: Transmitting (worst case)

30 MHz ~ 10 GHz:

Cellular Band (Part 22H)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 22H	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
GPRS(Worst) Mode, Middle channel										
170.2	29.51	85	1.3	H	-67.5	0.28	0	-67.78	-13	54.78
170.2	30.29	160	1.4	V	-66.7	0.28	0	-66.98	-13	53.98
1673.2	56.01	218	2.5	H	-47.0	0.97	9.40	-38.57	-13	25.57
1673.2	52.37	34	1.5	V	-48.1	0.97	9.40	-39.67	-13	26.67
2509.8	36.41	325	2.0	H	-64.3	1.46	10.70	-55.06	-13	42.06
2509.8	35.92	338	2.3	V	-60.4	1.46	10.70	-51.16	-13	38.16
3346.4	35.72	149	1.3	H	-58.7	2.08	10.80	-49.98	-13	36.98
3346.4	35.81	31	1.8	V	-57.8	2.08	10.80	-49.08	-13	36.08
WCDMA Mode, Middle channel										
183.5	29.21	32	1.6	H	-67.8	0.29	0	-68.09	-13	55.09
183.5	29.50	305	1.4	V	-67.5	0.29	0	-67.79	-13	54.79
1673.2	57.89	303	2.1	H	-45.1	0.97	9.40	-36.67	-13	23.67
1673.2	55.38	103	1.7	V	-45.1	0.97	9.40	-36.67	-13	23.67
2509.8	36.77	241	2.5	H	-64.0	1.46	10.70	-54.76	-13	41.76
2509.8	36.89	110	1.0	V	-59.5	1.46	10.70	-50.26	-13	37.26
3346.4	35.48	100	1.7	H	-58.9	2.08	10.80	-50.18	-13	37.18
3346.4	35.27	329	1.3	V	-58.3	2.08	10.80	-49.58	-13	36.58

30 MHz ~ 20 GHz:

PCS Band (Part 24E)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 24E	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
GPRS(Worst) Mode, Middle channel										
170.2	32.15	16	1.7	H	-64.8	0.28	0	-65.08	-13	52.08
170.2	31.58	257	1.5	V	-65.4	0.28	0	-65.68	-13	52.68
3760.0	35.38	158	1.1	H	-60.7	2.96	10.40	-53.26	-13	40.26
3760.0	35.24	229	1.1	V	-59.5	2.96	10.40	-52.06	-13	39.06
WCDMA Mode, Middle channel										
183.5	30.17	58	1.7	H	-66.8	0.29	0	-67.09	-13	54.09
183.5	31.08	72	1.5	V	-65.9	0.29	0	-66.19	-13	53.19
3760.0	36.27	156	2.4	H	-59.8	2.96	10.40	-52.36	-13	39.36
3760.0	36.59	120	2.3	V	-58.1	2.96	10.40	-50.66	-13	37.66

Note:

1) Absolute Level = SG Level - Cable loss + Antenna Gain

2) Margin = Limit- Absolute Level

FCC §22.917(a) & §24.238(a) - BAND EDGES

Applicable Standard

According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Data

Test data is referred to FCC ID: UDV-1009092010007 granted on 11/05/2010, report No.: 109S016R-HP-US-P07V01, which was tested by QuieTek Corporation.

FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY**Applicable Standard**

FCC § 2.1055, §22.355, §24.235

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Data

Test data is referred to FCC ID: UDV-1009092010007 granted on 11/05/2010, report No.: 109S016R-HP-US-P07V01, which was tested by QuieTek Corporation.

******* END OF REPORT *******