



FCC PART 22H, PART 24E
MEASUREMENT AND TEST REPORT

For

Advanced Card Systems Ltd.

Units 2010-2013, 20/F, Chevalier Commercial Centre, Kowloon, Hong Kong

FCC ID: V5MACR320

Report Type: Original Report	Product Type: Ticket Validator
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Report Number: RSZ120528001-00C	
Report Date: 2012-07-03	
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* This report contains data that are not covered by the NVLAP accreditation and are marked with an asterisk "★" (Rev.2)

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Advanced Card Systems Ltd.*'s product, model number: *ACR320 (FCC ID:V5MACR320)* or the "EUT" as referred to in this report is a *Ticket Validator*, which measures approximately: 28.0 cm (L) x 16.5 cm (W) x 5.0 cm (H), rated input voltage: DC 10 ~36 V from vehicular.

** All measurement and test data in this report was gathered from production sample serial number: 1205074 (Assigned by BACL, Shenzhen). The EUT was received on 2012-05-28.*

Objective

This type approval 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 compliance with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, band edge and radiated margin.

Related Submittal(s)/Grant(s)

FCC Part 15.225 DXX, Part 15.247 DTS and Part 15B JBP submissions with FCC ID: V5MACR320.

The GPRS/EDGE/WCDMA RF module was test in QuieTek Corporation, SuZhou EMC Laboratory with FCC ID: UDV-1009092010007.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part 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.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(Shenzhen) to collect test data is located in 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.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>

SYSTEM TEST CONFIGURATION

Justification

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.

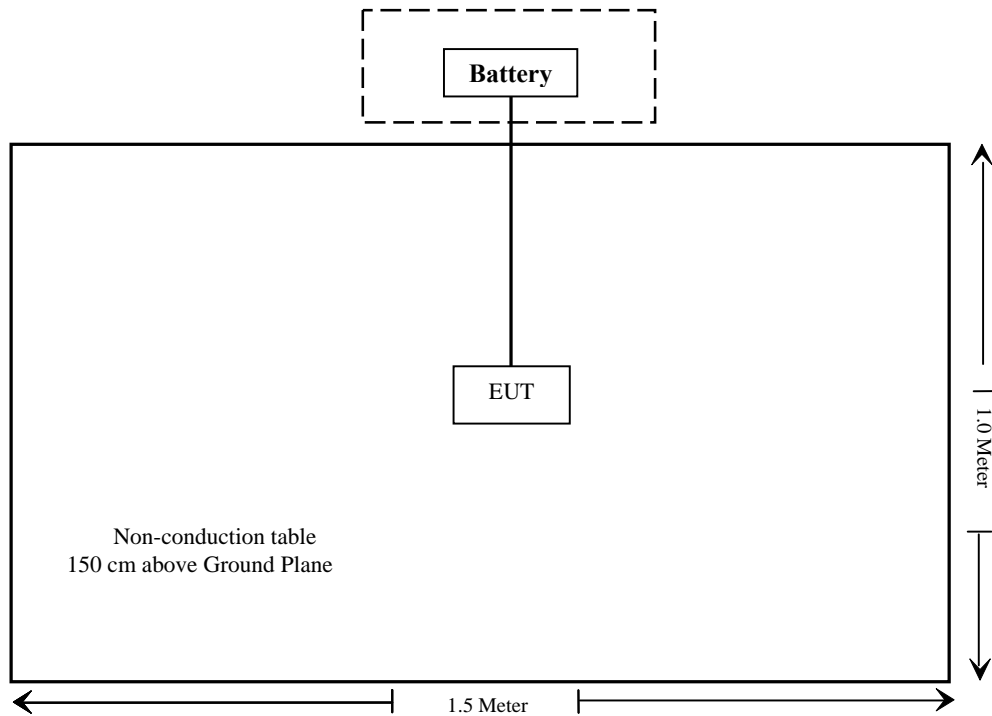
Equipment Modifications

No modifications were made to the EUT.

External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded Detachable DC Power Cable	3.0	EUT	Battery

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b)(1), §2.1091	Maximum Permissible exposure (MPE)	Compliance
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	N/A
§ 2.1049; § 22.905 § 22.917; § 24.238	Occupied 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 GPRS/EDGE/WCDMA RF module was test in QuieTek Corporation, SuZhou EMC Laboratory with FCC ID: UDV-1009092010007 granted on 2010-11-05.

FCC §1.1307 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to §1.1307 (b)(1) and §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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	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;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

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

Calculated Data:

Radio	Freq. (MHz)	MPE Limit (mW/cm ²)	Output Power (mW)	Duty Cycle	Ant. Gain (dBi)	Ant. Gain (numeric)	Power Density at 20cm	% of MPE at 20cm
Wi-Fi	2412	1.000	31.12	100%	2.0	1.58	0.0010	0.10
GPRS 8	824	1.000	1798.87	12.5%	0	1.00	0.0358	3.58
	1850	0.549	787.05	12.5%	-1.0	0.79	0.0124	2.26
GPRS 10	824	1.000	1188.05	25%	0	1.00	0.0236	2.36
	1850	0.549	717.79	25%	-1.0	0.79	0.0113	2.06
GPRS 12	824	1.000	632.41	50%	0	1.00	0.0126	1.26
	1850	0.549	624.52	50%	-1.0	0.79	0.0098	1.79
WCDMA (Band V)	824	1.000	225.94	100%	0	1.00	0.0045	0.45
WCDMA (Band II)	1850	0.549	188.36	100%	-1.0	0.79	0.0030	0.55

The MPE calculations in the spreadsheet above demonstrates that the combination of the GPRS/WCDMA with the Wi-Fi radio defined meets the MPE requirements stated in FCC Part 1.1310 at the 20 cm distance required for mobile exposure conditions

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

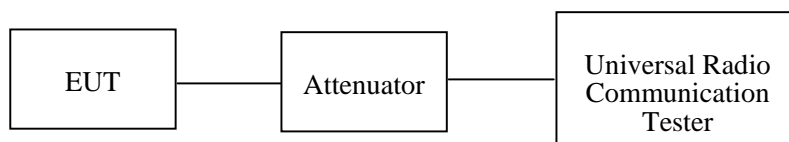
According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

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-C 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	2012-11-30
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2011-11-24	2012-11-23
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2012-03-17	2013-03-16
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20
HP	Synthesized Sweeper	8341B	2624A00116	2012-04-11	2013-04-10
COM POWER	Dipole Antenna	AD-100	041000	2011-09-25	2012-09-25
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2013-02-10
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	109038	2012-04-11	2013-04-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

The testing was performed by Eric Lee on 2012-06-28.

Conducted Power:

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

Radiated Power

ERP & EIRP (worse case)

ERP for Cellular Band (Part 22H)

Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBd)	Cable Loss (dB)	Absolute Level (dBm)	Part 22H Limit (dBm)
Frequency (MHz)	S.A. Reading (dBµV)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Ant. Polar (H/V)				
GPRS(GMSK), High Channel											
848.8	97.75	185	2.0	H	848.8	31.3	H	0	0.9	30.4	38.45
848.8	92.71	182	1.8	V	848.8	27.2	V	0	0.9	26.3	38.45
EDGE(8PSK), High Channel											
848.8	92.64	153	1.6	H	848.8	26.2	H	0	0.9	25.3	38.45
848.8	87.75	140	1.5	V	848.8	25.3	V	0	0.9	24.4	38.45
WCDMA Band V, Low Channel											
826.4	87.15	178	1.9	H	826.4	20.7	H	0	0.9	19.8	38.45
826.4	81.87	188	1.7	V	826.4	16.3	V	0	0.9	15.4	38.45

EIRP for PCS Band (Part 24E)

Indicated		Table Angle Degree	Test Antenna		Substituted			Antenna Gain Correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Part 24E Limit (dBm)
Frequency (MHz)	S.A. Reading (dBµV)		Height (m)	Polar (H/V)	Frequency (MHz)	S.G. Level (dBm)	Ant. Polar (H/V)				
GPRS(GMSK), High Channel											
1909.8	94.25	185	1.8	H	1909.8	19.7	H	9.4	1.0	28.1	33
1909.8	87.04	180	1.6	V	1909.8	17.6	V	9.4	1.0	26.0	33
EDGE(8PSK), Low Channel											
1850.2	88.91	125	1.5	H	1850.2	14.7	H	9.4	1.0	23.1	33
1850.2	81.85	153	1.5	V	1850.2	12.5	V	9.4	1.0	20.9	33
WCDMA Band II, Low Channel											
1852.4	86.36	174	1.9	H	1852.4	11.8	H	9.4	1.03	20.17	33
1852.4	75.24	168	2.0	V	1852.4	5.8	V	9.4	1.03	14.17	33

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

Applicable Standard

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

Test Result: Compliant

Please refer to FCC ID: UDV-1009092010007 granted on 2010-11-05, report No.: 109S016R-HP-US-P07V01, which was tested in Quietek Corporation, SuZhou EMC Laboratory.

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 Result: Compliant

Please refer to FCC ID: UDV-1009092010007 granted on 2010-11-05, report No.: 109S016R-HP-US-P07V01, which was tested in QuieTek Corporation, SuZhou EMC Laboratory.

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

Applicable Standards

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 (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log₁₀ (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	2012-11-30
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2012-03-17	2013-03-16
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2011-11-24	2012-11-23
Mini-Circuits	Amplifier	ZVA-213+	T-E27H	2012-03-08	2013-03-07
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20
HP	Amplifier	HP8447D	2944A09795	2011-11-24	2012-11-23
HP	Synthesized Sweeper	8341B	2624A00116	2012-04-11	2013-04-10
COM POWER	Dipole Antenna	AD-100	041000	2011-09-25	2012-09-25
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2013-02-10
Electro-Mechanics	Horn antenna	3116	9510-2270	2011-10-14	2012-11-13
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	109038	2012-04-11	2013-04-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

The testing was performed by Eric Lee on 2012-06-28.

Test mode: Transmitting (worse case)

Cellular Band (Part 22H)

30MHz - 10GHz:

GPRS mode:

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBμV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
High Channel											
1697.6	47.27	186	1.8	V	1697.6	-54.8	8.8	0.95	-46.95	-13	33.95
1697.6	46.16	133	1.7	H	1697.6	-57.4	8.8	0.95	-49.55	-13	36.55
3395.2	35.52	172	1.7	V	3395.2	-60.4	11.5	2.22	-51.12	-13	38.12
2546.4	35.78	150	1.2	V	2546.4	-60.6	10.2	1.46	-51.86	-13	38.86
3395.2	33.15	188	1.8	H	3395.2	-63.7	11.5	2.22	-54.42	-13	41.42
2546.4	35.19	166	1.0	H	2546.4	-65.5	10.2	1.46	-56.76	-13	43.76

WCDMA mode:

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBμV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
Low Channel											
1652.8	41.55	191	1.8	V	1652.8	-58.9	9.0	0.97	-50.87	-13	37.87
1652.8	42.72	186	1.9	H	1652.8	-60.3	9.0	0.97	-52.27	-13	39.27

PCS Band (Part 24E)

30MHz -20GHz:

GPRS mode:

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBµV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
High Channel											
3819.6	41.66	161	1.6	H	3819.6	-55.6	12.0	2.59	-46.19	-13	33.19
3819.6	38.93	182	1.7	V	3819.6	-57.6	12.0	2.59	-48.19	-13	35.19
5729.4	34.28	163	1.4	V	5729.4	-56.9	12.4	3.94	-48.44	-13	35.44
5729.4	34.71	185	1.5	H	5729.4	-57.7	12.4	3.94	-49.24	-13	36.24

WCDMA mode:

Indicated		Table Angle Degree	Test Antenna		Substituted				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Reading (dBµV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain (dB)	Cable Loss (dB)			
Low Channel											
3704.8	38.52	180	1.8	H	3704.8	-58.7	12.0	2.59	-49.29	-13	36.29
3704.8	36.49	183	1.8	V	3704.8	-60.1	12.0	2.59	-50.69	-13	37.69

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 Result: Compliant

Please refer to FCC ID: UDV-1009092010007 granted on 2010-11-05, report No.: 109S016R-HP-US-P07V01, which was tested in QuieTek Corporation, SuZhou EMC Laboratory.

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

FCC § 2.1055 (a), § 2.1055 (d), §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 Result: Compliant

Please refer to FCC ID: UDV-1009092010007 granted on 2010-11-05, report No.: 109S016R-HP-US-P07V01, which was tested in QuieTek Corporation, SuZhou EMC Laboratory.

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