MPE test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
EQUADOR STRADA

FCC ID: T2X-SDA-STRADAPAL

Company:
PARKEON

Distribution: Mr EPENOY **(Company: PARKEON)**

Number of pages: 12 with 2 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	28-Mar-18	Creation	T. LEDRESSEUR, Radio Technician	

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DESIGNATION OF PRODUCT:	**EQUADOR STRADA**
Serial number (S/N):	Refer appendix 4
Reference / model (P/N):	Strada PAL
Software version:	Refer appendix 4
MANUFACTURER:	**PARKEON**

COMPANY SUBMITTING THE PRODUCT:

Company:	PARKEON
Address:	6, RUE ISAAC NEWTON PARC LAFAYETTE 25075 BESANCON CEDEX 9 FRANCE
Responsible:	Mr EPENOY
DATE(S) OF TEST:	From 26-Oct-17 to 27-Oct-17
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	S. LOUIS ***VISA:***
WRITTEN BY:	S. LOUIS

CONTENTS

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **EQUADOR STRADA**, in accordance with normative reference.

The device under test integrates:

- RFID function not already certified.
- 2G/3G module already certified with FCCID: RI7HE910.

This radio test report concern only test realized for certification of RFID part. Measures for verification of the product (sub part 15B of CFR 47) are reported on report N°RR051-17-104577-2-A Ed. X

The host device of certified module shall be properly labeled to identify the modules within.
The report concern only the calcul of MPE

2. PRODUCT DESCRIPTION

RFID Module

Class:	B
Utilization:	Residential
Antenna type and gain:	Integral antenna (unknown gain)
Operating frequency range:	13.56MHz
Number of channels:	1
Channel spacing:	Not concerned
Modulation:	RFID
Power source:	12Vdc by rechargeable lead acid battery

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

2G-3G Module:

Class:	B
Utilization:	Residential
Antenna type and gain:	Integral antenna (unknown gain)
Operating frequency range:	From 824.2 MHz to 848.8 MHz (GSM-850 – uplink) From 869.2 MHz to 893.8 MHz (GSM-850– downlink) From 1850.2 MHz to 1909.8 MHz (PCS-1900 – uplink) From 1930.2 MHz to 1989.8 MHz (PCS-1900– downlink)

The two antennas (RFID and GSM/PCS) are separated by more than 20 cm as required by the GRANT of the GSM/PCS module.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 (2018)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment

4. RF EXPOSURE

Calculus for RFID in standalone

Maximum measured power = 48.3 dBµV/m = 0.000000867mW at 13.56 MHz
with $P = (E \times d)^2 / (30 \times Gp)$ *with d = 10 m and Gp = 1*

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

$$PSD = \frac{EIRP}{4 \times \pi \times R^2} = \frac{0.000000867}{4 \times \pi \times 20^2} = 0.00000000017243 \text{ mW/cm}^2 \text{ (limit = 0.98 mW/cm}^2\text{)}$$

The MPE ratio is then calculated for the simultaneous transmission.

$$MPE\ ratio(RFID) = \frac{PSD}{PSD\ lim} = \frac{0.00000000017243}{0.98} = 0.000000000175947$$

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

Calculus for RFID and GSM/PCS for simultaneous transmission

The worst case for GSM/PCS is used for each band, see RF exposure test report for this module (see appendix 1)
See appendix 2 for characteristics of the antenna used with GSM/PCS module (GC550 from Giga concept)

The maximum antenna gain used for the entire band is 0dBi

The Simultaneous transmission MPE test exclusion is determined with the sum of each MPE ratio

RFID and 850 MHz frequency band (GSM850 FCC V)

GSM 850 characteristics:

Conducted output power 32.2 dBm
Antenna gain: 0 dBi
Duty cycle 50%

MPE limits 0.55mW/cm^2

EIRP = 32.2 + 0 – 3 = 29.2dBm (831.76 mW)

$$PSD = \frac{EIRP}{4 \times \pi \times R^2} = \frac{831.76}{4 \times \pi \times 20^2} = 0.165 \text{ mW/cm}^2 \text{ (limit = 0.55 mW/cm}^2\text{)}$$

$$\text{MPE ratio(GSM 850)} = \frac{PSD}{PSD\ lim} = \frac{0.165}{0.55} = 0.3$$

$$\sum \text{ of MPE ratio} = \text{MPE ratio(GSM 850)} + \text{MPE ratio(RFID)} = 0.3 + 0.000000000175947 \leq 1.0$$

This configuration meet the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498

RFID and 1900 MHz frequency band (PCS1900 FCC II)

PCS 1900 characteristics:

Conducted output power 29.2 dBm
Antenna gain: 0 dBi
Duty cycle 50%

MPE limits 0.55mW/cm^2

EIRP = 29.2 + 0 – 3 = 26.2dBm (416.87 mW)

$$PSD = \frac{EIRP}{4 \times \pi \times R^2} = \frac{416.87}{4 \times \pi \times 20^2} = 0.083 \text{ mW/cm}^2 \text{ (limit = 0.55 mW/cm}^2\text{)}$$

$$\text{MPE ratio(GSM 850)} = \frac{PSD}{PSD\ lim} = \frac{0.083}{0.55} = 0.151$$

$$\sum \text{ of MPE ratio} = \text{MPE ratio(GSM 850)} + \text{MPE ratio(RFID)} = 0.151 + 0.000000000175947 \leq 1.0$$

This configuration meet the requirement for Simultaneous transmission MPE test exclusion (§7.2 of KDB 447498)

APPENDIX 1: Extract of RF exposure test report of GSM/PCS module

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850 MHz frequency band (GSM 850, FDD V)

			RF Output Power				Calculations to meet ERP limits				Calculations to meet MPE limits				
			Burst Average Power		Peak Power		ERP limit	EIRP limit	Antenna gain to meet ERP limits		MPE limits according to §1.1310	Duty cycle	Evaluation distance	Antenna gain to meet MPE limits	
Bands	Sub-Test	Frequency (MHz)	(dBm)	(W)	(dBm)	(W)	(W)	(W)	Numerical	(dBi)	(mW/cm^2)	(%)	(cm)	Numerical	(dBi)
GSM 850	-----	824.2	32.50	1.778	32.70	1.862	7	11.48	6.17	7.89	0.55	12.50%	20	12.43	10.94
		836.4	32.40	1.738	32.60	1.820	7	11.48	6.31	7.99	0.56	12.50%	20	12.90	11.10
		848.8	32.40	1.738	32.60	1.820	7	11.48	6.31	7.99	0.57	12.50%	20	13.09	11.17
GPRS 850	4Down1Up	824.2	32.80	1.905	33.00	1.995	7	11.48	5.75	7.59	0.55	12.50%	20	11.60	10.64
		836.4	32.70	1.862	32.90	1.950	7	11.48	5.89	7.69	0.56	12.50%	20	12.04	10.80
		848.8	32.70	1.862	32.90	1.950	7	11.48	5.89	7.69	0.57	12.50%	20	12.22	10.87
	3Down2Up	824.2	32.20	1.660	32.40	1.738	7	11.48	6.61	8.19	0.55	50.00%	20	3.33	5.22
		836.4	32.20	1.660	32.40	1.738	7	11.48	6.61	8.19	0.56	50.00%	20	3.38	5.28
		848.8	32.30	1.698	32.40	1.738	7	11.48	6.61	8.19	0.57	50.00%	20	3.35	5.25
	2Down3Up	824.2	31.70	1.479	31.90	1.549	7	11.48	7.41	8.69	0.55	37.50%	20	4.98	6.97
		836.4	31.70	1.479	31.80	1.514	7	11.48	7.58	8.79	0.56	37.50%	20	5.05	7.03
		848.8	31.70	1.479	31.90	1.549	7	11.48	7.41	8.69	0.57	37.50%	20	5.13	7.09
	1Down4Up	824.2	30.60	1.148	30.80	1.202	7	11.48	9.55	9.80	0.55	50.00%	20	4.81	6.82
		836.4	30.60	1.148	30.70	1.175	7	11.48	9.77	9.89	0.56	50.00%	20	4.88	6.88
		848.8	30.60	1.148	30.80	1.202	7	11.48	9.55	9.80	0.57	50.00%	20	4.96	6.95
EGPRS 850	4Down1Up	824.2	27.40	0.550	29.90	0.977	7	11.48	11.75	10.70	0.55	12.50%	20	40.17	16.03
		836.4	27.20	0.525	29.80	0.955	7	11.48	12.02	10.79	0.56	12.50%	20	42.71	16.30
		848.8	27.20	0.525	29.80	0.955	7	11.48	12.02	10.79	0.57	12.50%	20	43.34	16.36
	3Down2Up	824.2	26.90	0.490	29.50	0.891	7	11.48	12.88	11.10	0.55	25.00%	20	22.55	13.53
		836.4	26.90	0.490	29.70	0.933	7	11.48	12.30	10.90	0.56	25.00%	20	22.88	13.59
		848.8	26.90	0.490	29.70	0.933	7	11.48	12.30	10.90	0.57	25.00%	20	23.22	13.65
	2Down3Up	824.2	26.00	0.398	28.90	0.776	7	11.48	14.79	11.70	0.55	37.50%	20	18.51	12.67
		836.4	26.10	0.407	28.90	0.776	7	11.48	14.79	11.70	0.56	37.50%	20	18.36	12.63
		848.8	26.20	0.417	29.00	0.794	7	11.48	14.46	11.60	0.57	37.50%	20	18.19	12.59
	1Down4Up	824.2	25.40	0.347	28.40	0.692	7	11.48	16.59	12.19	0.55	50.00%	20	15.92	12.01
		836.4	25.40	0.347	28.40	0.692	7	11.48	16.59	12.19	0.56	50.00%	20	16.15	12.08
		848.8	25.50	0.355	28.50	0.708	7	11.48	16.21	12.09	0.57	50.00%	20	16.02	12.04
WCDMA Band V	-----	826.4	23.82	0.241	26.63	0.460	7	11.48	24.96	13.97	0.55	100.00%	20	11.49	10.60
		836.4	23.70	0.234	26.43	0.440	7	11.48	26.09	14.16	0.56	100.00%	20	11.98	10.78
		846.4	23.61	0.230	26.47	0.444	7	11.48	25.86	14.12	0.56	100.00%	20	12.33	10.91

Maximum antenna gain for 850 MHz frequency band: 5.22 dBi

1900 MHz frequency band (PCS 1900, FDD II)

			RF Output Power				Calculations to meet EIRP limits			Calculations to meet MPE limits				
			Burst Average Power		Peak Power		EIRP limit	Antenna gain to meet ERP limits		MPE limits according to §1.1310	Duty cycle	Evaluation distance	Antenna gain to meet MPE limits	
Bands	Sub-Test	Frequency (MHz)	(dBm)	(W)	(dBm)	(W)	(W)	Numerical	(dBi)	(mW/cm^2)	(%)	(cm)	Numerical	(dBi)
GSM 1900	-----	1850.20	29.50	0.891	29.70	0.933	2	2.24	3.51	1.00	12.50%	20	45.13	16.54
		1880.00	29.40	0.871	29.60	0.912	2	2.30	3.61	1.00	12.50%	20	46.17	16.64
		1909.80	29.20	0.832	29.30	0.851	2	2.40	3.80	1.00	12.50%	20	48.33	16.84
GPRS 1900	4Down1Up	1850.20	29.70	0.933	29.90	0.977	2	2.14	3.31	1.00	12.50%	20	43.10	16.34
		1880.00	29.60	0.912	29.80	0.955	2	2.19	3.41	1.00	12.50%	20	44.09	16.44
		1909.80	29.30	0.851	29.50	0.891	2	2.35	3.71	1.00	12.50%	20	47.25	16.74
	3Down2Up	1850.20	29.20	0.832	29.40	0.871	2	2.40	3.80	1.00	50.00%	20	12.08	10.82
		1880.00	29.20	0.832	29.40	0.871	2	2.40	3.80	1.00	50.00%	20	12.08	10.82
		1909.80	29.00	0.794	29.20	0.832	2	2.52	4.01	1.00	50.00%	20	12.66	11.02
	2Down3Up	1850.20	28.80	0.759	29.00	0.794	2	2.64	4.20	1.00	37.50%	20	17.66	12.46
		1880.00	28.60	0.724	28.80	0.759	2	2.76	4.41	1.00	37.50%	20	18.51	12.67
		1909.80	28.40	0.692	28.60	0.724	2	2.89	4.60	1.00	37.50%	20	19.37	12.87
	1Down4Up	1850.20	27.70	0.589	27.80	0.603	2	3.40	5.30	1.00	50.00%	20	17.07	12.32
		1880.00	27.40	0.550	27.50	0.562	2	3.64	5.60	1.00	50.00%	20	18.28	12.61
		1909.80	27.20	0.525	27.30	0.537	2	3.81	5.80	1.00	50.00%	20	19.15	12.82
EGPRS 1900	4Down1Up	1850.20	25.80	0.380	28.60	0.724	2	5.26	7.21	1.00	12.50%	20	105.82	20.24
		1880.00	25.60	0.363	28.40	0.692	2	5.51	7.41	1.00	12.50%	20	110.78	20.44
		1909.80	25.40	0.347	28.30	0.676	2	5.76	7.60	1.00	12.50%	20	115.89	20.64
	3Down2Up	1850.20	25.60	0.363	28.40	0.692	2	5.51	7.41	1.00	25.00%	20	55.39	17.43
		1880.00	25.40	0.347	28.10	0.646	2	5.76	7.60	1.00	25.00%	20	57.94	17.63
		1909.80	25.20	0.331	28.10	0.646	2	6.04	7.81	1.00	25.00%	20	60.74	17.83
	2Down3Up	1850.20	25.00	0.316	27.50	0.562	2	6.33	8.01	1.00	37.50%	20	42.42	16.27
		1880.00	24.70	0.295	27.40	0.550	2	6.78	8.31	1.00	37.50%	20	45.44	16.57
		1909.80	24.50	0.282	27.20	0.525	2	7.09	8.50	1.00	37.50%	20	47.53	16.76
	1Down4Up	1850.20	24.40	0.275	27.20	0.525	2	7.27	8.61	1.00	50.00%	20	36.56	15.62
		1880.00	24.30	0.269	27.00	0.501	2	7.43	8.71	1.00	50.00%	20	37.37	15.72
		1909.80	24.10	0.257	27.00	0.501	2	7.78	8.91	1.00	50.00%	20	39.12	15.92
WCDMA Band II	-----	1852.40	23.85	0.243	26.39	0.436	2	8.23	9.15	1.00	100.00%	20	20.69	13.15
		1880.00	23.57	0.228	25.93	0.392	2	8.77	9.43	1.00	100.00%	20	22.05	13.43
		1907.60	23.49	0.223	25.59	0.362	2	8.97	9.52	1.00	100.00%	20	22.54	13.52

Maximum antenna gain for 1900 MHz frequency band: 3.31 dBi

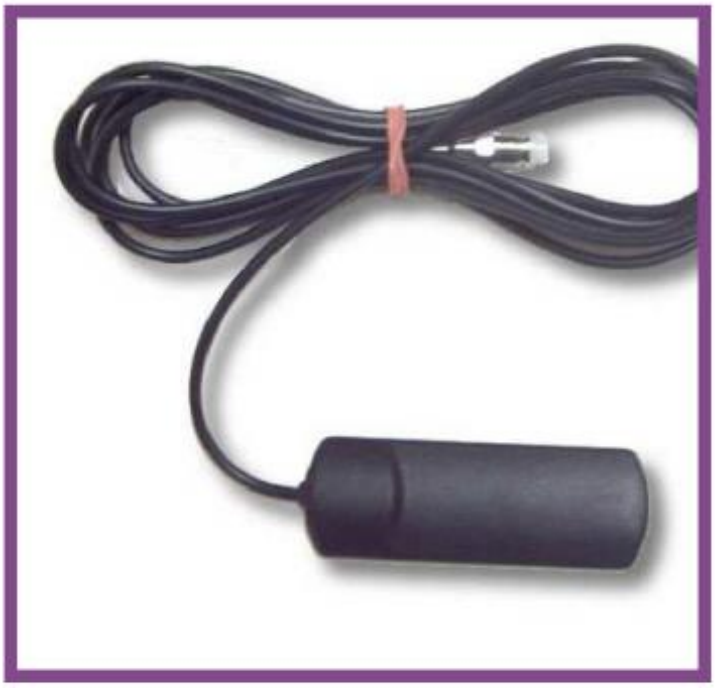
APPENDIX 2: GSM/PCS antenna characteristics

Giga-concept
Electronic components

GC550-PKN06

RoHS

PARKEON GPRS ANTENNAS



GSM
GPRS
UMTS
WIFI
Bluetooth

Code article Parkeon	CAT1000018053
Mounting position	On Glass
Impedance	50 ohms
Frequency	AMPS 824~894 MHz / GSM 900, 1800 MHz / PCN 1,9GHz / UMTS 2,1GHz Wifi & Bluetooth 2,4GHz
Polarization	Vertical
Gain MHz : dBi	0 dBi
VSWR	<2,5:1
Cable Type	120 cm RG174
Connector	MCX Male Right Angle
Housing	72mm x 25mm
Working temperature	-40℃ to + 85℃
Installation	Sticky pad