RF Exposure Evaluation Report

APPLICANT	:	ALPS ELECTRIC CO., LTD.
EQUIPMENT	:	LTE Data Module
BRAND NAME	:	ALPS
MODEL NAME	:	UMDZ1
MARKETING NAME	:	UMDZ1
FCC ID	:	2ADOH-ALPSUMDZ1EVB1
STANDARD	:	47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA531022	Rev. 01	Initial issue of report	Apr. 15, 2015

1. Administration Data

1.1. Testing Laboratory

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	ALPS ELECTRIC CO., LTD.
Address	6-3-36, Furukawanakazato, Osaki City, Miyagi Prefecture 989-6181

Manufacturer	
Company Name	ALPS ELECTRIC CO., LTD.
Address	6-3-36, Furukawanakazato, Osaki City, Miyagi Prefecture 989-6181

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	LTE Data Module
Brand Name	ALPS
Model Name	UMDZ1
FCC ID	2ADOH-ALPSUMDZ1EVB1
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz
Mode	• GPRS/EGPRS • RMC 12.2Kbps • HSDPA • HSUPA • DC-HSDPA • LTE: QPSK, 16QAM
Antenna Type	Fixed External Antenna
HW Version	ES2.0
SW Version	V15.2
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

3. Maximum RF average output power among production units

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GPRS/EDGE (GMSK, 1 Tx slot)	33.00	30.00
GPRS/EDGE (GMSK, 2 Tx slots)	31.00	29.00
GPRS/EDGE (GMSK, 3 Tx slots)	29.00	27.00
GPRS/EDGE (GMSK, 4 Tx slots)	28.00	26.00
EDGE (8PSK, 1 Tx slot)	27.00	27.00
EDGE (8PSK, 2 Tx slots)	25.00	27.00
EDGE (8PSK, 3 Tx slots)	23.00	27.00
EDGE (8PSK, 4 Tx slots)	22.00	26.00

Mode		Average Power (dBm)
WCDMA	Band V	24.00
	Band IV	24.00
	Band II	24.00
LTE	Band 17	23.00
	Band 5	23.00
	Band 4	23.00
	Band 2	23.00

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum ERP (dBm)	Maximum ERP (W)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
GPRS 850 (1 Tx slot)	824	7.50	33.00	38.350	6.855	40.500	11.220	7.000	1412.538	0.281	0.549
GPRS 850 (2 Tx slots)	824	7.50	31.00	36.360	4.325	38.500	7.079	7.000	1769.864	0.352	0.549
GPRS 850 (3 Tx slots)	824	7.50	29.00	34.350	2.729	36.500	2.723	7.000	1674.943	0.333	0.549
GPRS 850 (4 Tx slots)	824	7.50	28.00	33.350	2.168	35.500	2.163	7.000	1778.279	0.354	0.549
EGPRS 850 (1 Tx slot)	824	7.50	27.00	32.350	1.722	34.500	1.722	7.000	354.813	0.071	0.549
EGPRS 850 (2 Tx slots)	824	7.50	25.00	30.360	1.086	32.500	1.778	7.000	444.570	0.088	0.549
EGPRS 850 (3 Tx slots)	824	7.50	23.00	28.360	0.685	30.500	1.122	7.000	420.757	0.084	0.549
EGPRS 850 (4 Tx slots)	824	7.50	22.00	27.360	0.545	29.500	0.891	7.000	445.625	0.089	0.549
GPRS 1900 (1 Tx slot)	1850	3.00	30.00	30.860	1.219	33.000	1.995	2.000	251.189	0.050	1.000
GPRS 1900 (2 Tx slots)	1850	3.00	29.00	29.860	0.968	32.000	1.585	2.000	396.223	0.079	1.000
GPRS 1900 (3 Tx slots)	1850	3.00	27.00	27.860	0.611	30.000	1.000	2.000	374.973	0.075	1.000
GPRS 1900 (4 Tx slots)	1850	3.00	26.00	26.860	0.485	29.000	0.794	2.000	398.107	0.079	1.000
EGPRS 1900 (1 Tx slot)	1850	3.00	27.00	27.860	0.611	30.000	1.000	2.000	125.893	0.025	1.000
EGPRS 1900 (2 Tx slots)	1850	3.00	27.00	27.860	0.611	30.000	1.000	2.000	250.000	0.050	1.000
EGPRS 1900 (3 Tx slots)	1850	3.00	27.00	27.860	0.611	30.000	1.000	2.000	375.000	0.075	1.000
EGPRS 1900 (4 Tx slots)	1850	3.00	26.00	26.860	0.485	29.000	0.794	2.000	397.164	0.079	1.000
WCDMA Band 5	804	7.50	24.00	29.360	0.863	31.500	1.413	7.000	1412.538	0.281	0.536
WCDMA Band 4	1710	6.00	24.00	27.860	0.611	30.000	1.000	1.000	1000.000	0.199	1.000
WCDMA Band 2	1850	3.00	24.00	24.860	0.306	27.000	0.501	2.000	501.187	0.100	1.000
LTE Band 17	704	10.50	23.00	31.360	1.368	33.500	2.239	3.000	2238.721	0.446	0.469
LTE Band 5	824	7.50	23.00	28.360	0.685	30.500	1.122	7.000	1122.018	0.223	0.549
LTE Band 4	1710	6.00	23.00	26.860	0.485	29.000	0.794	1.000	794.328	0.158	1.000
LTE Band 2	1850	3.00	23.00	23.860	0.243	26.000	0.398	2.000	398.107	0.079	1.000

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band

5.2. Collocated Power Density Calculation

Note:

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN/WiMax is less than or equal to 29dBm and for Bluetooth is less than or equal to 15dBm.
2. A maximum antenna gain of 5 dBi for WLAN/WiMAX/BT has been assumed for all collocated antennas.

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
GPRS 850 (1 Tx slot)	824	6.00	33.00	39.0	7.94	1000.00	0.199	0.549	0.362
GPRS 850 (2 Tx slots)	824	6.00	31.00	37.0	5.01	1252.97	0.249	0.549	0.454
GPRS 850 (3 Tx slots)	824	6.00	29.00	35.0	3.16	1185.77	0.236	0.549	0.430
GPRS 850 (4 Tx slots)	824	6.00	28.00	34.0	2.51	1258.93	0.251	0.549	0.456
EGPRS 850 (1 Tx slot)	824	6.00	27.00	33.0	2.00	251.19	0.050	0.549	0.091
EGPRS 850 (2 Tx slots)	824	6.00	25.00	31.0	1.26	314.73	0.063	0.549	0.114
EGPRS 850 (3 Tx slots)	824	6.00	23.00	29.0	0.79	297.87	0.059	0.549	0.108
EGPRS 850 (4 Tx slots)	824	6.00	22.00	28.0	0.63	315.48	0.063	0.549	0.114
GPRS 1900 (1 Tx slot)	1850	3.00	30.00	33.0	2.00	251.19	0.050	1.000	0.050
GPRS 1900 (2 Tx slots)	1850	3.00	29.00	32.0	1.58	396.22	0.079	1.000	0.079
GPRS 1900 (3 Tx slots)	1850	3.00	27.00	30.0	1.00	374.97	0.075	1.000	0.075
GPRS 1900 (4 Tx slots)	1850	3.00	26.00	29.0	0.79	398.11	0.079	1.000	0.079
EGPRS 1900 (1 Tx slot)	1850	3.00	27.00	30.0	1.00	125.89	0.025	1.000	0.025
EGPRS 1900 (2 Tx slots)	1850	3.00	27.00	30.0	1.00	250.00	0.050	1.000	0.050
EGPRS 1900 (3 Tx slots)	1850	3.00	27.00	30.0	1.00	375.00	0.075	1.000	0.075
EGPRS 1900 (4 Tx slots)	1850	3.00	26.00	29.0	0.79	397.16	0.079	1.000	0.079
WCDMA Band 5	804	6.00	24.00	30.0	1.00	1000.00	0.199	0.536	0.371
WCDMA Band 4	1710	6.00	24.00	30.0	1.00	1000.00	0.199	1.000	0.199
WCDMA Band 2	1850	3.00	24.00	27.0	0.50	501.19	0.100	1.000	0.100
LTE Band 17	704	7.50	23.00	30.5	1.12	1122.02	0.223	0.469	0.476
LTE Band 5	824	6.00	23.00	29.0	0.79	794.33	0.158	0.549	0.288
LTE Band 4	1710	6.00	23.00	29.0	0.79	794.33	0.158	1.000	0.158
LTE Band 2	1850	3.00	23.00	26.0	0.40	398.11	0.079	1.000	0.079
WLNA2.4GHz Band	2412	5.00	29.00	34.0	2.51	2511.89	0.500	1.000	0.500
WLNA5GHz Band	5180	5.00	29.00	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax2.6GHz	2500	5.00	29.00	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax3.5GHz	3400	5.00	29.00	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax3.7GHz	3600	5.00	29.00	34.0	2.51	2511.89	0.500	1.000	0.500
Bluetooth	2402	5.00	15.00	20.0	0.10	100.00	0.020	1.000	0.020

<Collocated analysis>

Note:

1. For colocation analysis, LTE Band 17 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. ∑(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + WLAN + Bluetooth and WWAN + WiMax + Bluetooth.
3. Considering the WWAN module collocation with the other transmitters of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant.

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	∑(Power Density / Limit) of WWAN + WLAN + Bluetooth
0.500	0.020	0.476	0.996

Max WiMax Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	∑(Power Density / Limit) of WWAN + WiMax + Bluetooth
0.500	0.020	0.476	0.966

Conclusion:

Based on FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, the analysis concludes that this product when transmitting in standalone within a host device, is complant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

Technology	Band	Maximum Conducted Power (dBm)	Maximum Standalone Antenna Gain (dBi)	Maximum Collocated Antenna Gain (dBi)
GSM	GSM850	33.00	7.50	6.00
	GSM1900	30.00	3.00	3.00
UMTS	Band 5	24.00	7.50	6.00
	Band 4	24.00	6.00	6.00
	Band 2	24.00	3.00	3.00
LTE	Band 17	23.00	10.50	7.50
	Band 5	23.00	7.50	6.00
	Band 4	23.00	6.00	6.00
	Band 2	23.00	3.00	3.00