1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	ST Engineering Urban Solutions Ltd.
Address of applicant:	100 Jurong East Street 21. Singapore 609602
Manufacturer:	ZHEJIANG FONDA TECHNOLOGY CO.,LTD
Address of manufacturer:	9TH FLOOR SHUYU BUILDING, NO.98 WENYI WEST ROAD, XIHU DISTRICT, HANGZHOU, ZHEJIANG, CHINA

General Description of EUT:

Product Name:	Remote Street Lighting Controller
Trade Name:	AGIL
Model No.:	AGIL LCU 302
Adding Model(s):	AGIL LCU 302-1
Rated Voltage:	AC100-240V
Battery:	/
Adapter Model:	/
FCC ID:	2BEVP-AGILLCU302
Equipment Type:	Mobile device

Technical Characteristics of EUT:	
4G	
Support Networks:	FDD-LTE
Support Band:	FDD-LTE Band 2, 4, 5, 12, 13, 25, 66
Uplink Frequency:	FDD-LTE Band 2: Tx: 1850-1910MHz, FDD-LTE Band 4: Tx: 1710-1755MHz, FDD-LTE Band 5: Tx: 824-849MHz, FDD-LTE Band 12: Tx: 699-716MHz, FDD-LTE Band 13: Tx: 777-787MHz, FDD-LTE Band 25: Tx: 1850-1915MHz FDD-LTE Band 66:Tx: 1710-1780MHz
Downlink Frequency:	FDD-LTE Band 2: Rx: 1930-1990MHz, FDD-LTE Band 4: Rx: 2110-2155MHz, FDD-LTE Band 5: Rx: 869-894MHz, FDD-LTE Band 12: Rx: 729-746MHz, FDD-LTE Band 13: Rx: 746-756MHz, FDD-LTE Band 25: Rx: 1930-1995MHz FDD-LTE Band 66: Rx: 2110-2200MHz
RF Output Power:	FDD-LTE Band 2: 21.13dBm, FDD-LTE Band 4: 21.87dBm, FDD-LTE Band 5: 20.97dBm,

	FDD-LTE Band 12: 21.21dBm, FDD-LTE Band 13: 21.46dBm, FDD-LTE Band 25: 21.10dBm, FDD-LTE Band 66: 21.86dBm
Type of Emission:	FDD-LTE Band 2: 185KG7D FDD-LTE Band 4: 185KG7D FDD-LTE Band 5: 250KG7D FDD-LTE Band12: 237KG7D FDD-LTE Band13: 250KG7D FDD-LTE Band 25: 185KG7D FDD-LTE Band 66: 185KG7D
Type of Modulation:	BPSK, QPSK
Antenna Type:	PCB Antenna
Antenna Gain:	FDD-LTE Band 2: 0.49dBi, FDD-LTE Band 4: 0.13dBi, FDD-LTE Band 5: -0.8dBi, FDD-LTE Band 12: -0.96dBi, FDD-LTE Band 13: -0.11dBi, FDD-LTE Band 25: 0.48dBi FDD-LTE Band 66: 0.49dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A):The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. R must be at least λ/2π, where λ is the free-space operating wavelength in meters.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2/f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2f
1,500-100,000	19.2R^2

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).

(B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

1.3 Calculated Result

Radio Access Technology	Prediction Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Tune-Up Time-Averaged Power (dBm)	ERP (dBm)
LTE Band 2	1850	21.13	0.49	100	23.0	21.34
LTE Band 4	1710	21.87	0.13	100	23.0	20.98
LTE Band 5	824	20.97	-0.8	100	23.0	20.05
LTE Band 12	699	21.21	-0.96	100	23.0	19.89
LTE Band 13	777	21.46	-0.11	100	23.0	20.74
LTE Band 25	1850	21.10	0.48	100	23.0	21.33
LTE Band 66	1710	21.86	0.49	100	23.0	21.34

Radio Access Technology	Option	Min. Distance (cm)	Max. Power (dBm)	Max. Power (mW)	Exposure Limit (mW)	Ratio	Result Pass/Fail
LTE Band 2	C	20.00	21.34	136.14	768.00	0.18	Pass
LTE Band 4	C	20.00	20.98	125.31	768.00	0.16	Pass
LTE Band 5	C	20.00	20.05	101.16	421.89	0.24	Pass
LTE Band 12	C	20.00	19.89	97.50	357.89	0.27	Pass
LTE Band 13	C	20.00	20.74	118.58	397.82	0.30	Pass
LTE Band 25	C	20.00	21.33	135.83	768.00	0.18	Pass
LTE Band 66	C	20.00	21.34	136.14	768.00	0.18	Pass

*Note: 1. Time-Averaged Power=Output Power * Duty Cycle; ERP= Time-Averaged Power + Antenna gain-2.15dB*

2. Option A, B and C refers as clause 1.2.

3. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;

4. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).

5. Ratio= Tune-up ERP (mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result
					Pass/Fail
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Result: Pass