ENGINEERING TEST REPORT

Product / Model # PR34X-A
FCC ID: PQG-PR34X-A

Applicant:

Lyngsoe Systems Ltd.
101 Simona Dr., Unit 2
Bolton, Ontario L7E 4E8

Federal Communications Commission (FCC)
Maximum Permissible Exposure (MPE) Evaluation

UltraTech's File No.: 16LYI131_MPE

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: April 18, 2016	
Report Prepared by: Dharmajit Solanki Issued Date: April 18, 2016	Tested by: N/A Test Dates: N/A

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax: (905) 829-8050
Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com

TABLE OF CONTENTS

EXHIBIT 1. GENERAL INFORMATION

1.1. CLIENT INFORMATION

APPLICANT	
Name:	Lyngsoe Systems Ltd.
Address:	101 Simona Dr., Unit 2 Bolton, Ontario Canada L7E 4E8
Contact Person:	Donald Ferguson Phone #: 905-501-1533 Fax #: 905-501-1538 Email Address: dfe@lyngsoesystems.com

1.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information was supplied by the applicant.

Brand Name:	Lyngsoe Systems
Product Name:	PR34X-A
Model Name or Number:	PR34X-A
Type of Equipment:	LTE Radio Module (Licensed Non Broadcast Station Transmitter)
Co-located Transmitter 1:	2.4 GHz Wi-Fi DTS Module, FCC ID: QPU8000
Co-located Transmitter 2:	900 MHz RFID Module, FCC ID: QV5MERCURY6E-M
Primary User Functions of EUT:	Unit will be mounted on a belt loader and reads UHF passive tags going on and off the plane

EXHIBIT 2. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]

2.1. Limits

§ **1.1310:** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

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	*($900/f^2$)	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	*($180/f^2$)	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

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

2.2. Method of Measurements

Calculation Method of Power Density/RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where, P: power input to the antenna in mW
EIRP: equivalent (or effective) isotropically radiated power
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

2.3. RF Evaluation, Co-location with Wi-Fi & RFID Modules

Pursuant to KDB 447498 D01 General RF Exposure Guidance v06, Section 7.2:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density.

As per Manufacturer's C2PC declaration of PR34X-A, this model will be integrated in a host device consisting of the following 3 radio modules and their associated antennas. Power Densities are calculated as shown below at prediction distance of 32 cm.

1) **LTE Radio transmitter integrated in the PR34X-A:**

   (a) LTE 700 MHz: O/p Power: 228 mW, Max Gain: 9.74 dBi, Power Density S = 0.17 mW/cm^2

   (b) LTE 1700 MHz: O/p Power: 259 mW, Max Gain: 5.78 dBi, Power Density S = 0.076 mW/cm^2

   (a) LTE 800/850 MHz: O/p Power: 298 mW, Max Gain: 9.72 dBi, Power Density S = 0.217 mW/cm^2

   (b) LTE 1900 MHz: O/p Power: 355 mW, Max Gain: 7.51 dBi, Power Density S = 0.155 mW/cm^2

2) **Wi-Fi Transmitter integrated in the PR34X-A:**

   2.4 GHz Tx: O/p Power: 195 mW, Max Gain: 0.8 dBi, Power Density S = 0.018 mW/cm^2

3) **RFID Transmitter integrated in the PR34X-A:**

   900 MHz Tx: O/p Power: 933.25 mW, Max Gain: 6.0 dBi, Power Density S = 0.289 mW/cm^2

The following MPE evaluation of the PR34X-A is to find out that the MPE ratio is $\leq$ 1. The test data is the worst-case derived from MPE repots of integrated Wi-Fi & RFID modules from FCC site and this radio module.

MPE Ratio Calculation of all 3 Modules at an Evaluation Distance of 32 cm

Modules	Max. Power Density, S (mW/cm^2)	MPE Limit (mW/cm^2)	MPE Ratio
Radio Module LTE Band (700 MHz)*	0.170	0.518	0.328*
Radio Module LTE Band (1700 MHz)*	0.076	1.000	0.076*
Radio Module LTE Band (8/850MHz)*	**0.217**	**0.55**	**0.395***
Radio Module LTE Band (1900 MHz)*	0.155	1.000	0.155*
Wi-Fi Module (2.4GHz)	**0.018**	**1.000**	**0.018**
RFID Module (900 MHz)	**0.289**	**0.612**	**0.472**
Maximum MPE Ratio: (0.395 + 0.018 + 0.472)			**0.885 < 1**

*Out of 4 available AT&T LTE Cellular radio bands (700, 850, 1700 & 1900 MHz) only one & one channel can transmit at any given time as declared by the applicant and stated in the C2PC request letter, hence the highest MPE ratio of that band was chosen as shown above in bold text as the worst case to calculate the Maximum MPE of the device.

Conclusion:-
Based on the above computation, the maximum MPE ratio of the model PR34X-A is 0.885 and is < 1.0, hence is in compliance with FCC RF exposure requirements @ **32 cm**. and requires this as minimum MPE separation distance from General Populations/Equipment Operators when installed and shall be declared by the manufacturer under RF Exposure warning in the user manual. Co-location is permitted at this evaluation separation distance when operated and the exposure conditions of the host device when integrated with Wi-Fi and RFID modules.