

EXHIBIT 1. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]

§ 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.

1.1. 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 (effective) isotropic radiated power.

S: power density mW/cm²

G: numeric gain of antenna relative to isotropic radiator

r: distance to centre of radiation in cm

1.2. RF Evaluation

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.

The EUT is subject to co-location MPE evaluation, below table are the possible options:

Source Option	Lyngsoe Systems Ltd. WiFi and Bluetooth Module (FCC ID: PQG-XREADER)	JADAK, a business unit of Novanta Corporation RFID Reader Module (FCC ID: QV5MERCURY6E-M)	Telit Communications S.p.A. Data Terminal Module (FCC ID: RI7LE910CXWWX))
1	X		X
2	X	X	X

Co-location evaluation is evaluated at a separation distance of 55 cm. The table below is the calculation for all the possible options and the sum of the MPE ratios from all sources.

Source Option	Maximum MPE Ratio			Sum of MPE ratios from all sources
	Lyngsoe Systems Ltd. WiFi and Bluetooth Module (FCC ID: PQG-XREADER)	JADAK, a business unit of Novanta Corporation RFID Reader Module (FCC ID: QV5MERCURY6E-M)	Telit Communications S.p.A. Data Terminal Module (FCC ID: RI7LE910CXWWX)	
1	0.008	--	0.133	0.141
2	0.008	0.168	0.133	0.309

The sum of the MPE ratios from all sources is < 1 . Thus, in compliant with general public (uncontrolled environment) MPE limit.

For detailed MPE ratios calculation, refer to the following tables.

Calculated MPE Ratio for Lyngsoe Systems WiFi and Bluetooth Module									
Band	Frequency (MHz)	² Antenna Gain (dBi)	¹ Maximum Power (dBm)	¹ Maximum EIRP (dBm)	¹ Maximum EIRP (W)	¹ Average EIRP (mW)	Power Density at 55cm (mW/cm ²)	MPE Limit (mW/cm ²)	MPE Ratio
Bluetooth	2402	3.2	12.5	15.7	0.037	37.154	0.001	1.000	0.001
2.4GHz WLAN	2412	3.2	17.5	20.7	0.117	117.49	0.003	1.000	0.003
5GHz WLAN	5180	4.5	19.5	24	0.251	251.189	0.007	1.000	0.007
Sum of MPE Ratios from Bluetooth and 5GHz WLAN:									0.008
¹ Data derived from Texas Instruments WiFi and Bluetooth Module MPE test report, Test Report No. FA741330.									
² Maximum permitted antenna gain.									

Calculated MPE Ratio for JADAK, a business unit of Novanta Corporation RFID Reader Module									
Operating Band (MHz)	Frequency (MHz)	^{1,3} Conducted Power Include Cable Loss (dBm)	^{2,3} Antenna Gain (dBi)	³ Tune-Up Tolerance (dB)	EIRP (dBm)	Distance (cm)	MPE (mW/cm ²)	MPE Limit (mW/cm ²)	MPE Ratio
902-928	902.75	28.86	6.5	± 0.5	35.86	55	0.101	0.602	0.168
¹ Cable loss of 1.14 dB applied to output power of 30 dBm ² Maximum permitted antenna gain. ³ Data derived from JADAK, a business unit of Novanta Corporation, RFID Reader test report, Test Report No. FCC_IC_RF_SL20061501-JAD-006									

Calculated MPE Ratio for Telit Communications S.p.A. Data Terminal Module							
Band / Mode	Frequency (MHz)	¹ Max Power (dBm)	¹ Maximum Permissive Antenna Gain (dBi)	Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	MPE Ratio
GSM/GPRS Cell	824.2 - 848.8	27.5	6.91	55	0.073	0.549	0.133
EDGE Cell	824.2 - 848.9	22	12.41	55	0.073	0.549	0.133
GSM/GPRS PCS	1850.2 - 1909.8	24.5	8.51	55	0.053	1.000	0.053
EDGE PCS	1850.2 - 1909.8	21	12.01	55	0.053	1.000	0.053
WCDMA Cell	826.4 - 846.6	24.5	9.92	55	0.073	0.551	0.132
WCDMA AWS	1712.4 - 1752.6	24.5	5.50	55	0.026	1.000	0.026
WCDMA PCS	1852.4 - 1907.6	24.5	8.51	55	0.053	1.000	0.053
LTE BAND25/2	1850.7 - 1914.3	24	9.01	55	0.053	1.000	0.053
LTE BAND4	1710.7 - 1754.3	24	6.00	55	0.026	1.000	0.026
LTE BAND26/5	824.7 - 848.3	24	10.41	55	0.073	0.550	0.133
LTE BAND7	2502.5 - 2567.5	24	9.01	55	0.053	1.000	0.053
LTE BAND8	898.2 - 899.8	24	10.79	55	0.079	0.599	0.132
LTE BAND12	699.7 - 715.3	24	9.70	55	0.062	0.466	0.133
LTE BAND13	779.5 - 784.5	24	10.17	55	0.069	0.520	0.133
LTE BAND14	790.5 - 795.5	24	10.23	55	0.070	0.527	0.133
LTE Band26(Part.90)	814.7 - 823.3	24	10.36	55	0.072	0.543	0.133
¹ Data derived from Telit Data Terminal Module MPE test report, Test Report No. 1M2106040065-03.R17.							

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 23LYI212_FCCMPE

May 11, 2023

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)