W66 N220 Commerce Court ● Cedarburg, WI 53012
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www.lsr.com

RF Evaluation Exclusion Exhibit For:

ELO

Prepared by:

Coty Hammerer, EMC Engineer

9/27/17

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Contents

Product Description:

The Elo ECG Analysis System is intended to acquire, analyze, display, and record electrocardiographic information from adult, pediatric or neonatal populations. Basic system delivers 3, 6, 12, or 15 lead ECG's, interpretive analysis and vector loops. Transmission and reception of ECG data and other clinical data to and from a central clinical information system is supported.

The Elo ECG Analysis System is intended to be used under the direct supervision of a licensed healthcare practitioner, by trained operators in a hospital or medical professional's facility.

The following Radios are contained within the ELO, the Wilink8 and WB45NBT modules are leveraging certification while the RFID reader is being tested for a certification:

Radio: TI WL1837I, FCC ID: Z64-WL18DBMOD

Radio: Laird WB45NBT, FCC ID: SQG-WB45NBT

Note: EUT is considered a mobile device(s)

Statement of compliance:

The GE Healthcare ELO was evaluated against the requirements and limits of FCC Title 47 part 1.1310 and 2.1091, with the guidance of KDB 447498, the limits of RSS-102 and were found to be compliant.

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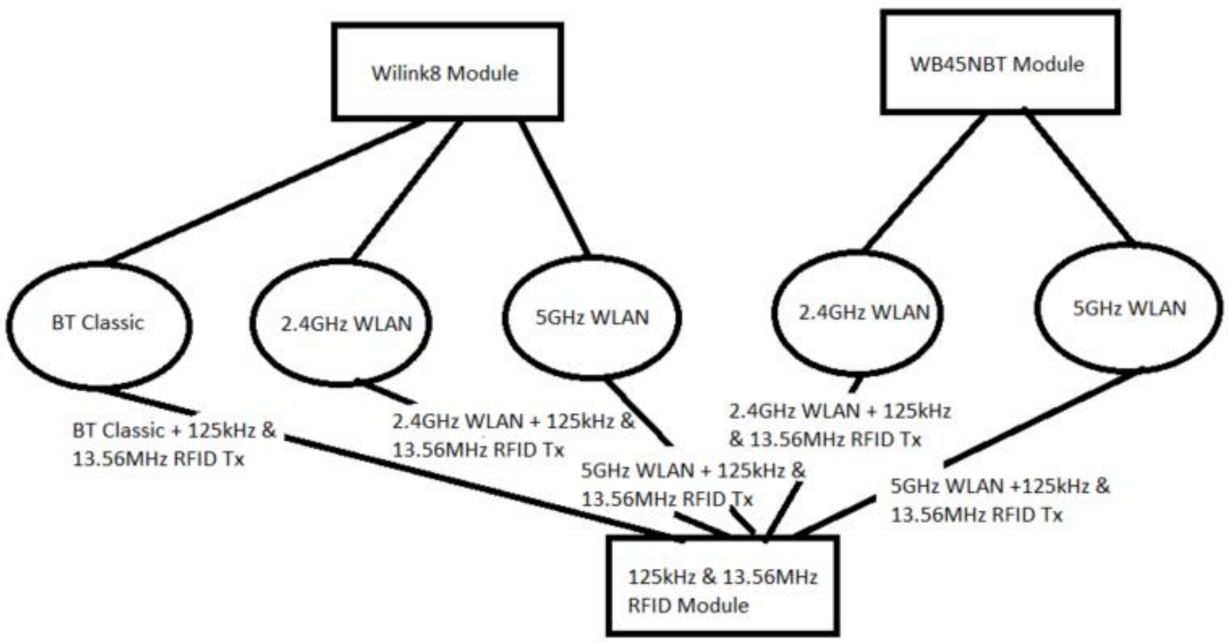
Simultaneous Transmission Flow Chart:



Note: BT/ BLE functionality disabled for WB45NBT module when used in the ELO.

Limits:

A. Mobile (MPE)

OET Bulletin 65 limits for General population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
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

RSS 102 limits for General population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Per RSS 102 issue 5 section 2.5.2, RF exposure evaluation is required if separation distance between the user and/or bystander and the device's radiating element is greater than 20cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

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Data and calculations:

Antenna Information (Original Filing Antenna's):

Wilink8 Module:

Antenna Type	Brand	2.4GHz~2.5GHz	4.9GHz~5.8GHz
PCB	Ethertronics	-0.6	4.5
Dipole	LSR	2	2
PCB	Laird	2	4
Chip	Pulse	3.2	4.2
PIFA	LSR	2	3
Chip	TDK	2.4	3.96

Note: Only the Laird PCB antenna is used for the Wilink8 Module of the ELO.

WB45NBT Module:

Mode	Frequency Range (MHz)	Maximum Conducted Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
BT EDR	2402~2480	7.98	2.79	20	0.002	1
BT LE	2402~2480	8.30	2.79	20	0.003	1
Wi-Fi	2412~2462	18.58	2.79	20	0.027	1
Wi-Fi	5180~5240	19.09	3.9	20	0.040	1
Wi-Fi	5260~5320	16.91	3.9	20	0.024	1
Wi-Fi	5500~5700	16.73	4	20	0.024	1
Wi-Fi	5745~5825	17.89	4	20	0.031	1

Note: Only a Laird PCB antenna is used for the WB45NBT Module of the ELO. The BT/ BLE functionality disabled for WB45NBT module when used in the ELO.

Note: Worst case Antenna Gain for each band per each modules antenna is used in the below calculations to show worse case possible values.

A. MPE Calculation – 2.4 GHz WLAN Wilink 8

The following MPE calculations are based on a measured conducted RF power of +17.50 dBm as presented to the antenna and a peak antenna gain of +3.20 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	17.50	(dBm)
Maximum peak output power at antenna input terminal:	56.234	(mW)
Antenna gain(typical):	3.2	(dBi)
Maximum antenna gain:	2.089	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.023374	(mW/cm^2)

RSS 102 Issue 5 Power density limit at 2412 MHz:

$0.02619*(2412)^{(0.6834)}$ = **5.37 W/m²**

Power density for EUT = 0.0234 mW/cm^2 = **0.234 W/m²**

Conclusion:

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Since **0.23 W/m²** < **5.37 W/m²**, the EUT complies with RSS 102 Issue 5. Since **0.023 mW/cm² < 1 mW/cm²,** the EUT complies with OET Bulletin 65.

B. MPE Calculation – 5 GHz WLAN Wilink 8

The following MPE calculations are based on a measured conducted RF power of +19.50 dBm as presented to the antenna and a peak antenna gain of +4.50 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	19.50	(dBm)
Maximum peak output power at antenna input terminal:	89.125	(mW)
Antenna gain(typical):	4.5	(dBi)
Maximum antenna gain:	2.818	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.049972	(mW/cm^2)

RSS 102 Issue 5 Power density limit at 5180 MHz:

$0.02619*(5180)^{(0.6834)}$ = **9.05 W/m²**

Power density for EUT = 0.050 mW/cm² = **0.50 W/m²**

Conclusion:

Since **0.50 W/m²** < **9.05 W/m²**, the EUT complies with RSS 102 Issue 5. Since **0.050 mW/cm² < 1 mW/cm²,** the EUT complies with OET Bulletin 65.

C. MPE Calculation – BT Classic Wilink 8

The following MPE calculations are based on a measured conducted RF power of +12.50 dBm as presented to the antenna and a peak antenna gain of +3.20 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.50	(dBm)
Maximum peak output power at antenna input terminal:	17.783	(mW)
Antenna gain(typical):	3.2	(dBi)
Maximum antenna gain:	2.089	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2402	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.007391	(mW/cm^2)

RSS 102 Issue 5 Power density limit at 2402 MHz:

0.02619*(2402)$^{(0.6834)}$ = **5.35 W/m^2**

Power density for EUT = 0.0074 mW/cm^2 = **0.074 W/m^2**

Conclusion:

Since **0.074 W/m^2** < **5.35 W/m^2**, the EUT complies with RSS 102 Issue 5. Since **0.0074 mW/cm^2 < 1 mW/cm^2,** the EUT complies with OET Bulletin 65.

D. MPE Calculation – 13.56 MHz RFID

The following MPE calculations are based on radiated measurements.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-40.03	(dBm)
Maximum peak output power at antenna input terminal:	0.000	(mW)
Antenna gain(typical):		(dBi)
Maximum antenna gain:		(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	13.56	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.98	(mW/cm^2)
Power density at prediction frequency:	0.000000	(mW/cm^2)

Highest 3m measurement at 13.56 MHz = 55.2 dBuV/m (Average Detector), So 55.20 dBuV/m – 95.23 (Conversion for dBuV/m to dBm) = -40.03 dBm

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RSS 102 Issue 5 Power density limit at 13.56 MHz:

$2.00\ W/m^2$

Power density for EUT = $0.000\ mW/cm^2$ = **$0.00\ W/m^2$**

Conclusion:

Since **$0.00\ W/m^2$** < **$2.00\ W/m^2$**, the EUT complies with RSS 102 Issue 5. Since **$0.00\ mW/cm^2$ < $0.98\ mW/cm^2$,** the EUT complies with OET Bulletin 65.

E. MPE Calculation – 125 kHz RFID

The following MPE calculations are based on radiated measurements.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-31.03	(dBm)
Maximum peak output power at antenna input terminal:	0.001	(mW)
Antenna gain(typical):		(dBi)
Maximum antenna gain:		(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	0.125	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	100	(mW/cm^2)
Power density at prediction frequency:	0.000000	(mW/cm^2)

Note: The 100 mW/cm^2 MPE limit has been extended down from the 300 kHz limit which has been allowed by the FCC in the past for low TX's and will be evaluated for acceptability by the FCC during their PAG process.

Highest 3m measurement at 125 kHz = 64.20 dBuV/m (Average Detector), So 64.20 dBuV/m – 95.23 (Conversion for dBuV/m to dBm) = -31.03 dBm

RSS 102 Issue 5 Magnetic Field limit at 0.125 MHz:

= **0.73/ [f (in MHz)], so 0.73/0.125 = 5.84 A/m rms**

E-Field strength at 20 cm:

First, 40*log(3m/0.2m) = 47.04

Then, 64.20 dBuV/m + 47.04 = 111.24 dBuV/m at 20cm distance

Converting from dBuV/m to V/m:

= $10^{\frac{dBuV/m}{20}}\ x\ 1(10)^{-6}$ = $10^{\frac{111.24}{20}}\ x\ 1(10)^{-6}$ = 0.36 V/m

Converting to dBuA/m:

dBuA/m = dBuV/m – 51.5, where $20Log_{10}[120\pi]$ = 51.5 (characteristic impedance of free space), so 111.24 dBuV/m at 20 cm distance – 51.5= 59.74 dBuA/m

Converting to A/m:

A/m = $10^{\frac{(dBuA/m-120)}{20}}$ = $10^{\frac{59.74\ dBuA/m-120}{20}}$ = 9.71x10^-4 or 0.000971 A/m rms

Conclusion:

Since **9.71x10^-4 A/m < 5.84 A/m**, the EUT complies with RSS 102 Issue 5. Since **0.00 mW/cm^2 < 100 mW/cm^2,** the EUT complies with OET Bulletin 65.

F. MPE Calculation – 2.4 GHz WB45NBT

The following MPE calculations are based on a measured conducted RF power of +23.01dBm as presented to the antenna and a peak antenna gain of +2.79 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	23.01	(dBm)
Maximum peak output power at antenna input terminal:	199.986	(mW)
Antenna gain(typical):	2.79	(dBi)
Maximum antenna gain:	1.901	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.075636	(mW/cm^2)

RSS 102 Issue 5 Power density limit at 2437 MHz:

$0.02619*(2437)^{(0.6834)}$ = **5.41 W/m²**

Power density for EUT = 0.076 mW/cm² = **0.76 W/m²**

Conclusion:

Since **0.76 W/m²** < **5.41 W/m²**, the EUT complies with RSS 102 Issue 5. Since **0.076 mW/cm² < 1 mW/cm²**, the EUT complies with OET Bulletin 65.

G. MPE Calculation – 5 GHz WB45NBT

The following MPE calculations are based on a measured conducted RF power of +18.69 dBm as presented to the antenna and a peak antenna gain of +4.00 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	18.69	(dBm)
Maximum peak output power at antenna input terminal:	73.961	(mW)
Antenna gain(typical):	4	(dBi)
Maximum antenna gain:	2.512	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5700	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.036960	(mW/cm^2)
Maximum allowable antenna gain:	18.3	(dBi)
Margin of Compliance at 20 cm =	14.3	dB

RSS 102 Issue 5 Power density limit at 5700 MHz:

$0.02619*(5700)^{(0.6834)}$ = **9.66 W/m^2**

Power density for EUT = 0.03696 mW/cm^2 = **0.37 W/m^2**

Conclusion:

Since **0.37 W/m^2** < **9.66 W/m^2**, the EUT complies with RSS 102 Issue 5. Since **0.037 mW/cm^2 < 1 mW/cm^2,** the EUT complies with OET Bulletin 65.

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Condition	E-Field (V/m)	H-Field (A/m)
Conversion of field strength of 125 kHz transmitter	0.36	9.71(10)^-4
RSS 102 Limit (Gen. Pop. Uncontrolled)	-	5.84
(Value/ Limit)²	-	2.76(10)^-8

Transmitter	Power Density (mW/cm²)	Limit (mW/cm²)
Wilink8 2.4 GHz WLAN	2.34(10)^-2	1
Wilink8 2.4 GHz BT	7.39(10)^-3	1
Wilink8 5 GHz WLAN	5.0(10)^-2	1
WB45NBT 2.4 GHz WLAN	7.56(10)^-2	1
WB45NBT 5 GHz WLAN	3.7(10)^-2	1
13.56 MHZ RFID	0.00	0.98

Note: Since there is no E-Field limit associated with 125 kHz, only the H-Field component is added to the summation for Simultaneous Transmissions that include a 125 kHz Tx.

Simultaneous Transmission with 2.4 GHz WLAN (Wlink8) + 13.56 MHz RFID + 0.125 MHz RFID

FCC MPE Ratio = $\frac{0.023\ mW/cm^2}{1\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{0.98\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{100\ mW/cm^2}$ = 0.023 < 1.0

ISED Ratio = 2.34(10)^-2 + 0.00 + $(\frac{9.71(10)^{-4} A/m}{5.84\ A/m})^2$ or 2.76(10)^-8 = 2.34(10)^-2 < 1

Simultaneous Transmission with 5 GHz WLAN (Wlink8) + 13.56 MHz RFID + 0.125 MHz RFID

FCC MPE Ratio = $\frac{0.047\ mW/cm^2}{1\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{0.98\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{100\ mW/cm^2}$ = 0.047 < 1.0

ISED Ratio = = 5.0(10)^-2 + 0.00 + 2.76(10)^-8 = 5.0(10)^-2 < 1

Simultaneous Transmission with BT Classic (Wlink8) + 13.56 MHz RFID + 0.125 MHz RFID

FCC MPE Ratio = $\frac{0.0074\ mW/cm^2}{1\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{0.98\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{100\ mW/cm^2}$ = 0.0074 < 1.0

ISED Ratio = 7.39(10)^-3 + 0.00 + 2.76(10)^-8 = 7.39(10)^-3 < 1

Simultaneous Transmission with 2.4 GHz WLAN (WB45NBT) + 13.56 MHz RFID + 0.125 MHz RFID

FCC MPE Ratio = $\frac{0.076\ mW/cm^2}{1\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{0.98\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{100\ mW/cm^2}$ = 0.076 < 1.0

ISED Ratio = 7.56(10)^-2 + 0.00 + 2.76(10)^-8 = 7.56(10)^-2 < 1

Simultaneous Transmission with 5 GHz WLAN (WB45NBT) + 13.56 MHz RFID + 0.125 MHz RFID

FCC MPE Ratio = $\frac{0.037\ mW/cm^2}{1\ mW/cm^2} + \frac{0.0000\ mW/cm^2}{0.98\ mW/cm^2}\ or\ \frac{0.0000\ mW/cm^2}{100\ mW/cm^2}$ = 0.037 < 1.0

ISED Ratio = 3.70(10)^-2 + 0.00 + 2.76(10)^-8 = 3.70(10)^-2 < 1

Therefore, the Ratios calculated for Simultaneous transmission in these cases meet the requirement of RSS-102 and OET Bulletin 65 using the methods of KDB 447498.