

Test report No:
 NIE: 64502RAN.002

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091 ISED RSS-102 Issue 5:2015

(*) Identification of item under evaluation	WIFI BT combo module
(*) Trademark	Telit
(*) Model and /or type reference	WE866C6-P
Other identification of the product	HW version: 1.0 FCC ID: RI7WE866C6
(*) Features	WIFI 802.11 a/b/g/n/ac, BT/BTLE 5.0
Manufacturer	TELIT COMMUNICATIONS S.P.A Viale Stazione di Prosecco 5/B 34010 Sgonico, Trieste (Italy)
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) IEEE Std C95.3™ -2002 (R2008). IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager
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Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested", "General description of the device).
2. Maximum output power, maximum antenna gain and use distance information.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

TELIT COMMUNICATIONS S.P.A
Viale Stazione di Prosecco 5/B
34010 Sgonico, Trieste (Italy)

Document history

Report number	Date	Description
64502RAN.002	2020-06-17	First release

General description of the device under evaluation

The device under evaluation consists of a WIFI BT combo module.

As the equipment under evaluation is a module, a conservative evaluation distance of 20 cm has been used to perform the assessment.

The equipment specifications declared by the manufacturer for each supported technology and band are:

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Antenna peak gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	17.50	2.50	20.00	100.00
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	16.50	4.50	21.00	125.89
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	9.00	2.50	11.50	14.13

Table 1: Equipment specifications

RF Exposure Assessment result and verdict

FCC assessment:

Limits for Maximum Permissible Exposure (MPE) to comply with FCC 47 CFR § 2.1091 are defined in “§1.1310 Radiation Exposure limits, paragraph (e)”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (mW/cm ²)	FCC General Population Limit (mW/cm ²)	Verdict
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	20.00	0.02	1.00	Pass
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	20.00	0.03	1.00	Pass
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	20.00	0.003	1.00	Pass

Table 2: Assessment result and verdict

ISED assessment:

Limits for RF Field Strength to comply with RSS-102 Issue 5 are defined in “Health Canada’s RF exposure guideline, Safety code 6”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (W/m ²)	ISED General Public Limit (W/m ²)	Verdict
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	20.00	0.20	5.37	Pass
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	20.00	0.25	9.01	Pass
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	20.00	0.03	5.35	Pass

Table 3: Assessment result and verdict

Maximum Antenna Gain determination for RF Exposure compliance

Summary of maximum antenna gain values:

Maximum antenna gain for mobile operation to comply with MPE and EIRP limits (see Appendix A and B) shall not exceed the following values:

Technology / Mode	Band	Frequency (MHz)	Maximum Gain to comply with:				Maximum Gain (dBi)
			FCC MPE Limits (dBi)	ISED MPE Limits (dBi)	FCC conducted/ EIRP Limits (dBi)	ISED EIRP Limits (dBi)	
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	19.5	16.8	18.5	18.5	16.8
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	20.5	20.0	13.48	6.5	6.5
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	28.0	25.2	27.0	27.0	25.2

Table 4: Maximum Antenna Gain values

Maximum Gain to meet FCC Radiofrequency radiation exposure limits:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (mW/cm ²)	FCC General Population Limit (mW/cm ²)	Maximum Gain to meet FCC MPE Limits (dBi)
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	20.0	0.01	1.0	19.5
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	20.0	0.01	1.0	20.5
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	20.0	0.002	1.0	28.0

Table 5: Maximum Antenna Gain values based on FCC MPE limits

Maximum Gain to meet ISED Radiofrequency radiation exposure limits:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (W/m ²)	ISED General Public Limit (W/m ²)	Maximum Gain to meet ISED MPE Limits (dBi)
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	20.0	0.11	5.4	16.8
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	20.0	0.09	9.0	20.0
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	20.0	0.02	5.3	25.2

Table 6: Maximum Antenna Gain values based on ISED MPE limits

Maximum Gain to meet FCC Conducted Output Limit

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power RMS Burst (dBm)	Maximum FCC Conducted Output Limit (dBm)	Maximum Gain to meet FCC Conducted Output Limit (dBi)
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	17.5	17.5*	18.5*
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	16.5	16.5*	13.48*
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	9.0	9.0*	27.0*

Table 7: Maximum Antenna Gain values based on FCC conducted output limits

* Note: See appendix A, FCC conducted output limits section

Maximum Gain to meet ISED EIRP limits

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power RMS Burst ((dBm)	EIRP Limits (dBm)	Maximum Gain to meet EIRP Limits (dBi)
WLAN (802.11b/g/n)	2.4 GHz	2412 - 2472	17.5	36.0	18.5
WLAN (802.11a/n/ac)	5 GHz	5150 - 5825	16.5	23.0	6.5
Bluetooth BR / BTLE 5.0	2.4 GHz	2400 - 2483.5	9.0	36.0	27.0

Table 8: Maximum Antenna Gain values based on ISED EIRP limits

Appendix A: FCC RF Exposure information

FCC RF Exposure evaluation

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—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 Exposure				
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
300–1,500	.....	.....	f/300	6
1,500–100,000	.....	.....	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
300–1,500	.....	.....	f/1500	30
1,500–100,000	.....	.....	1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

FCC MPE Evaluation

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction:

$$\text{Power density: } S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$$\text{Maximum gain to meet the MPE limit: } G_{\max}[dBi] = (10 * \log[S[mW/cm^2] * 4\pi R[cm]^2] - P_{\max}[dBm])$$

S = power density

P_{\max} = power input to the antenna

R = distance to the center of radiation of the antenna (evaluation distance)

G_{\max} = power gain of the antenna in the direction of interest relative to an isotropic radiator

FCC Conducted Output Limits

Maximum FCC conducted output limits are stated into FCC 47 CFR §15.247 (b) (4) standard. The limit depends on the antenna value as follows, for antenna gains with 6dBi:

Standard	Band (MHz)	Conducted output limit (W)	Maximum EIRP (dBm)
FCC 47 CFR §15.247 (b)	2400-2483.5	1.0	36.0

For antenna gains exceeding 6dBi, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Maximum FCC EIRP limits for 5GHz bands are stated into FCC 47 CFR §15.407 standard. The limit depends on the antenna value as follows, for antenna gains with 6dBi:

Standard	Band (MHz)	Conducted output limit (W)	Maximum EIRP (dBm)
FCC 47 CFR §15.407	5150-5250	1.0	36.0
	5250-5725	0.25	30.0
	5725-5850	1.0	36.0

For antenna gains exceeding 6dBi, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Appendix B: ISED RF Exposure information

ISED RF Exposure evaluation for mobile devices

According to RSS-102 Issue 5, Paragraph “4. Exposure Limits”, Industry of Canada has adopted the RF field strength limits established in Health Canada’s RF exposure guideline, Safety code 6:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²³	170	180	-	Instantaneous*
0.1-10	-	1.6/ <i>f</i>	-	6**
1.29-10	193/ <i>f</i> ^{0.5}	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ <i>f</i> ^{0.25}	0.3444/ <i>f</i> ^{0.25}	44.72/ <i>f</i> ^{0.5}	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 <i>f</i> ^{0.25}	0.04138 <i>f</i> ^{0.25}	0.6455 <i>f</i> ^{0.5}	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ <i>f</i> ^{1.2}
150000-300000	0.354 <i>f</i> ^{0.5}	9.40 x 10 ⁻⁴ <i>f</i> ^{0.5}	3.33 x 10 ⁻⁴ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

ISED MPE Evaluation

Each supported transmission technology will be evaluated to determine if it is in compliance with RSS-102 Issue 5, RF Field Strength Limits for devices used by the General Public.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction:

$$\text{Power density: } S[W / m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$$\text{Maximum gain to meet Field Strength limits: } G_{\max} [dBi] = (10 * \log[S[W / m^2] * 4\pi R[m]^2]) + 30 - P_{\max} [dBm]$$

S = power density

P_{\max} = power input to the antenna

R = distance to the center of radiation of the antenna (evaluation distance)

G_{\max} = power gain of the antenna in the direction of interest relative to an isotropic radiator

ISED EIRP Limits

Maximum ISED EIRP limits are stated into RSS-247 Issue 2 standard:

Standard	Band (MHz)	EIRP limit (dBm)	EIRP limit (W)
RSS-247 Issue 2, section 5.4	2400-2483.5	36.0	4.0
RSS-247 Issue 2, section 6.2.1.1	5150-5250	23.0	0.20
RSS-247 Issue 2, section 6.2.2.1	5250-5350	30.0	1.0
RSS-247 Issue 2, section 6.2.3.1	5470-5725	30.0	1.0

For equipment operating in the band 5725-5850 MHz bands with antenna gain lower than 6dBi:

Standard	Band (MHz)	Conducted output limit (dBm)	Conducted output limit (W)
RSS-247 Issue 2, section 6.2.4.1	5725-5850	30.0	1.0

For antenna gains exceeding 6dBi, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.