

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: Talkpool AB
Address of applicant: Ostergatan 11, SE-434 30 Kungsbacka, Sweden

Manufacturer: Talkpool AB
Address of manufacturer: Ostergatan 11, SE-434 30 Kungsbacka, Sweden

General Description of EUT:

Product Name: CO2 meter
Trade Name: /
Model No.: OY1211
Adding Model(s): /
Rated Voltage: DC 3.6V
Battery Capacity: /
FCC ID: 2A6VH-OY1211
Equipment Type: Fixed device

Technical Characteristics of EUT:

LoRa (Hopping)

Frequency Range: 902.3MHz-914.9MHz
RF Output Power: 21.10mW (Conducted)
Modulation: LoRa
Quantity of Channels: 64
Channel Separation: 200kHz
Type of Antenna: PCB Antenna
Antenna Gain: -0.53dBi

LoRa (DTS)

Frequency Range: 903MHz-914.2MHz
RF Output Power: 0.0021mW (Conducted)
Modulation: LoRa
Quantity of Channels: 8
Channel Separation: 600kHz
Type of Antenna: PCB Antenna
Antenna Gain: -0.53dBi

1.2 RF Exposure Exemption

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:

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

Where

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

and

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

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 $\lambda/2\pi$, 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	$0.0128 R^2 f$
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	Min. Frequency	Max. Output Power	Max. Tune-Up Output Power	Antenna Gain	Duty Cycle	Tune-Up EIRP
	(MHz)	(dBm)	(dBm)	(dBi)	(%)	(dBm)
LoRa	902.3	13.25	14.00	-0.53	100	13.47

Frequency (MHz)	Option	Min. Distance	Tune-Up ERP		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
902.3	C	20.00	11.32	13.55	461.98	0.03	Pass

Note: 1. $ERP = EIRP - 2.15dB$; $EIRP = Output\ Power + Antenna\ gain$

2. Option A, B and C refers as clause 1.2.
3. For option B, $P_{th}(mW)$ convert to $Exposure\ Limit(mW)$; For option C, $ERP(W)$ convert to $Exposure\ Limit(mW)$.
4. 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