RF Exposure Calculation

Voxter® Elite+
Version: 1.00

Contents

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1   Description of the product:

The product is a voice terminal. It includes a pre certified WiFi module (FCC ID: O2FWIBEAR11N) and a pre certified Bluetooth module (FCC ID: SQGBT800). The product is intended to be used in storages by trained personal only. The product is battery supplied.

2 RF exposure calculation WiFi

The values of the transmit power are taken from the Datasheet of the original certification file
FCC ID: PV7-WIBEAR11N-DF2. The manufacturer defines test distance as 17,6mm; please refer to
document "Test distance definition".

Maximum transmit power levels taken from Datasheet of PV7-WIBEAR11N-DF2:

Operation mode	Data Rate [Mbps]	Transmit Power [dBm]	[mW]	Tolerance [dBm]
802.11b	1	18	63	±1
	11	18	63	±1
802.11g	6	15	32	±1
	54	15	32	±1
802.11a	6	15	32	±1
	54	15	32	±1

Used formula according to KDB447498 sub clause 4.3.1 a).
The Voxter® Elite+ is a body worn product. Therefore a threshold of 3 is used.

$$\frac{Power\ of\ channel\ [mW]}{Test\ distance\ [mm]} \times \sqrt{f\ [GHz]} \leq 3$$

2.1 Calculation of Effective Power:

Operation Mode	Data Rate [Mbps]	Transmit Power [dBm]	Tolerance [dBm]	Antenna Gain [dBi]	Max Power [dBm]	Duty Cycle [%]	Effective Power [mW]
802.11b	1	18	1	2,5	21,5	1%	1,41
	11	18	1	2,5	21,5	1%	1,41
802.11g	6	15	1	2,5	18,5	1%	0,71
	54	15	1	2,5	18,5	1%	0,71
802.11a	6	15	1	5	21	1%	1,26
	54	15	1	5	21	1%	1,26

2.2 SAR Calculation:

Operation Mode	Data Rate [Mbps]	Frequency [GHz]	Effective Power [mW]	Test Distance [mm]	Result	Limit	Pass / Fail
802.11b	1	2,4	1,41	17,6	**0,12**	3	Pass
	11	2,4	1,41	17,6	**0,12**	3	Pass
802.11g	6	2,4	0,71	17,6	**0,06**	3	Pass
	54	2,4	0,71	17,6	**0,06**	3	Pass
802.11a	6	5	1,26	17,6	**0,16**	3	Pass
	54	5	1,26	17,6	**0,16**	3	Pass

3 RF exposure calculation Bluetooth

The values of the transmit power are taken from the RF exposure calculation of the original certification file FCC ID: SQGBT800. The manufacturer defines test distance as 8mm; please refer to document "Test distance definition".

Transmit power levels taken from RF exposure calculation of SQGBT800:

Operation mode	Frequency		Power	
		[MHz]	[dBm]	[mW]
BT800-SA	EDR	2402-2480	7,91	6,18
	LE	2402-2480	7,58	5,73

Used formula according to KDB447498 sub clause 4.3.1 a):
The Voxter® Elite+ is a body worn product. Therefore a threshold of 3 is used.

$$\frac{Power\ of\ channel\ [mW]}{Test\ distance\ [mm]} \times \sqrt{f\ [GHz]} \leq 3$$

Calculation:

Operation mode	Frequency [GHz]	Power [mW]	Test distance [mm]	Result	Limit	Pass / Fail
BT800-SA (BT EDR)	2,4	6,18	8	**1,20**	3	Pass
BT800-SA (BT LE)	2,4	5,73	8	**1,11**	3	Pass

4 Simultaneous transmission of WiFi and Bluetooth

To show compliance the worst case of WiFi transmission is taken (802.11a), Bluetooth transmission is taken (BT-EDR). This should symbolize the absolute worst case.

| Operation mode	Frequency [GHz]	Power [mW]	Test distance [mm]	Result	Limit	Pass / Fail
802.11a	5	1,26	17,6	0,16	3	Pass
BT800-SA (BT EDR)	2,4	6,18	8	1,20	3	Pass
			Total:	**1,36**	**3**	Pass

5   Duty Cycle Calculation

Voxter® Elite+ was developed specifically for Lydia® voice applications. Voice recognition and voice output via the headset are controlled locally and the device is directly connected to the higher-level system via Wi-Fi. After voice recognition the result package is send to a server (up to 2048 Byte). The server will send back the next task to the Voxter® Elite+ depending on the recognition result (up to 2048 Byte).

The voice recognition also as the voice generation is done on the Voxter® Elite+. Therefore no voice is transmitted over Wi-Fi.

The following figures shows the communication to the server and back to the Voxter® Elite+ with a data package of 2048 Byte in both directions and a data rate of 1 Mbps (worst case).

For the duty cycle calculation we assume that the communication to the server will happen every five seconds. This is a worst case assumption for a practical use case.
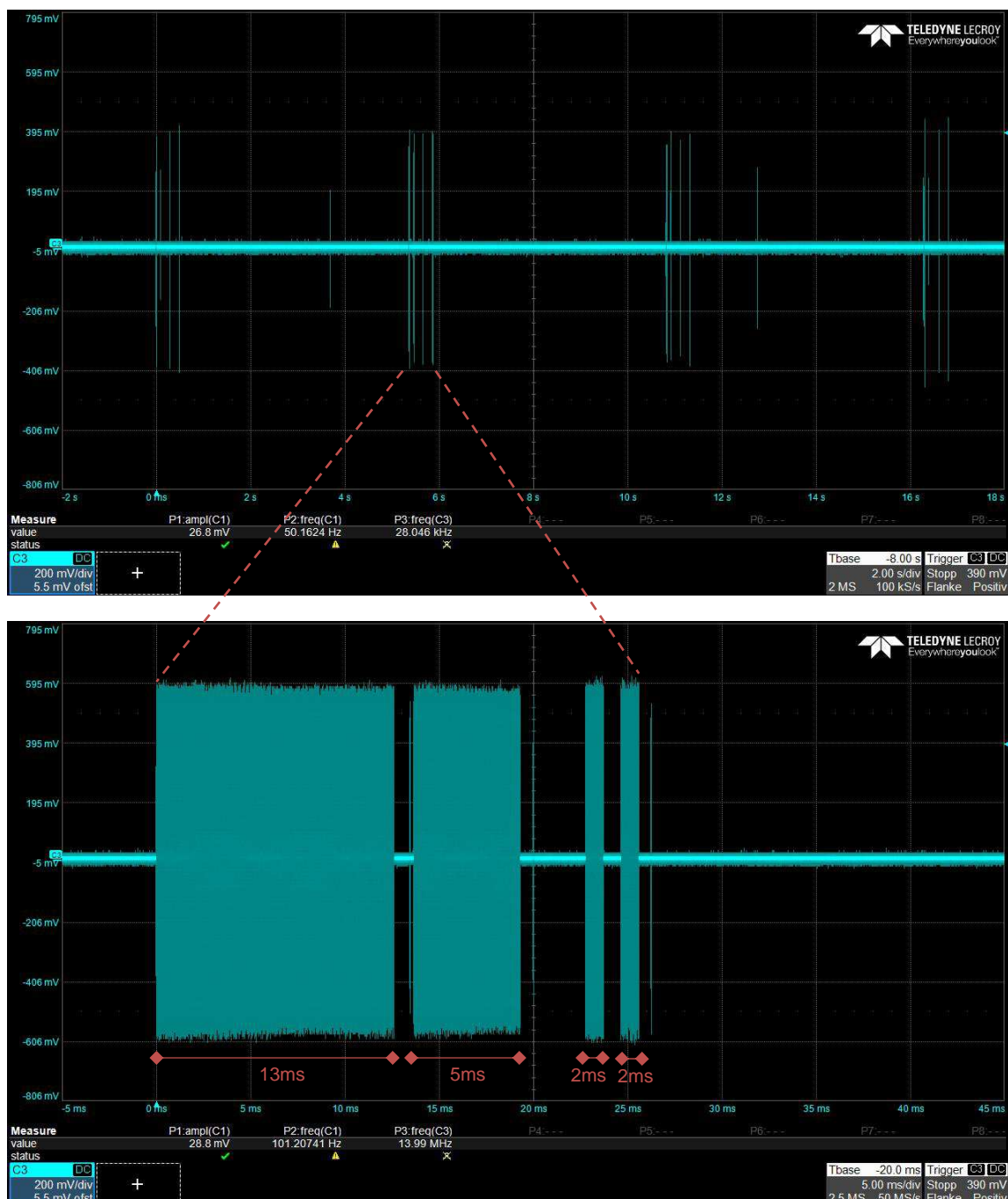
The duty cycle is calculated as the following:

	Calculation	Result
Transmit summary duration (of one block)	s. figure above	22ms (13ms + 5 ms + 2 ms + 2 ms)
Blocks per minute (every five seconds)	60s / 5s	12
Transmit summary duration (in one minute)	12 x 22ms	264ms
Duty Cycle	100% / 60000ms x 264ms	**0,44%**

As there are also some Wi-Fi protocol packages we are calculating with a Duty Cycle of **1%**