

Thermodynamics-based Cognitive Demodulation for 'THz Torch' Wireless Communications Links

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Supplementary Table

Supplementary Table S1. Band-pass filter specifications

	50% cut-off, λ_1 to λ_2 , bandwidth μm (THz)	Aperture size mm^2	Aperture blockage* %
ch#1	4.48 - 4.54 (65.95 - 66.88)	4.6×4.6	67
ch#2	4.74 - 4.79 (62.57 - 63.25)	4.9×4.9	63
ch#3	5.09 - 5.31 (56.44 - 58.83)	3.8×3.8	78
ch#4	7.01 - 7.11 (42.19 - 42.79)	5.6×5.6	51
ch#5	7.37 - 7.48 (40.08 - 40.67)	5.6×5.6	51
ch#6	8.22 - 8.62 (34.81 - 36.45)	3.8×3.8	78
ch#7	9.61 - 10.03 (29.92 - 31.23)	3.7×3.7	69
ch#8	10.09 - 10.54 (28.46 - 29.74)	4.7×4.7	65
Single	8.03 - 13.74 (21.83 - 37.33)	4.6×4.6	67

* With reference to an unblocked circular filter having diameter $\varnothing = 9$ mm

Supplementary Table S2. Implementation and performance summary comparisons of reported ‘THz Torch’ wireless links

	Sep. 2011 ¹	Dec. 2011 ²	Apr. 2013 ³	Jun. 2014 ⁴	May 2016 ⁵	This Work
Source Type	5×Eiko-8666 4.7 × 3.7 mm ²	5×Eiko-8666 4.7 × 3.7 mm ²	5×Eiko-8666 4.7 × 3.7 mm ²	5×Eiko-8666 4.7 × 3.7 mm ²	5×Eiko-8666 4.7 × 3.7 mm ²	INTX 17-0900 1.7 × 1.7 mm ²
Emitter DC Power (mW)	146	4×146 = 584	146	4×994 = 3,976	994	898 and 8×898 = 7,184
Number of Channels	1	4	1	4	1	1 and 8
3 dB Bandwidth (THz)	25	~4×15 = 60	25	~4×15 = 60	25	16 and ~8×2.5
Modulation Mechanism	Electronic	Chopper	Chopper	Chopper	Chopper	Electronic
Transmitted Data	Clock	Clock	Clock	Arbitrary	Clock	Arbitrary
Operation	Record and post-process	Record and post-process	Record and post-process	Record and post-process	Record and post-process	Fully asynchronous
Tx-Rx Lens Pair	None	None	None	None	KBr ∅1.5 cm	ZnSe ∅2.5 cm
min ⇒ max Range (cm)	0.5 ⇒ 2.5	1.0	1.0	3 ⇒ 4	12 ⇒ 15	100 ⇒ 200 and 50
PIR Sensor	Voltage mode IRA-E710ST1	Voltage mode IRA-E710ST1	Current mode LME-553	Current mode LME-553	Current mode LME-553	Current mode LME-335
Total NRZ Bit Rate (bps)	10.2 ⇒ 1	4×20.6 = 82	760	4×640 = 2,560	2,000	125 and 8×125 = 1,000
Figure of Merit (cm × bps)	5.1	82	760	10,240	30,000	25,000 and 50,000
Bit Error Rate (%)	0 qualitative	0 qualitative	0 qualitative	0.11 ⇒ 15 quantitative	0.0018 ⇒ 18 quantitative	see Figure quantitative

References

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