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On the Security of RC4 in TLS

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http://www.isg.rhul.ac.uk/tls/

UIC

TLS Record Protocol

CBC-mode
(AES, 3DES)

RC4

TLS Record Protocol

Information Security Group

CBC-mode
ES, 3DES)

BEAST attack

RC4

TLS Record Protocol

CBC-mode
ES, 3DES,

RC4

BEAST attack

Lucky 13

TLS Record Protocol

CBC-mode
ES, 3DES)

BEAST attack

Lucky 13

RC4

Switch to RC4?

TLS Record Protocol

Information Security Group

CBC-mode
AES, 3DES, ...

BEAST attack

Lucky 13

RC4

Switch to RC4?

Recommended!

Usage of RC4 in Practice

ICSI Certificate Notary

Recent survey of 16 billion TLS connections:
Approx. 50% protected via RC4 ciphersuites

Usage of RC4 in Practice

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How secure is TLS + RC4?

RC4 Keystream Distribution

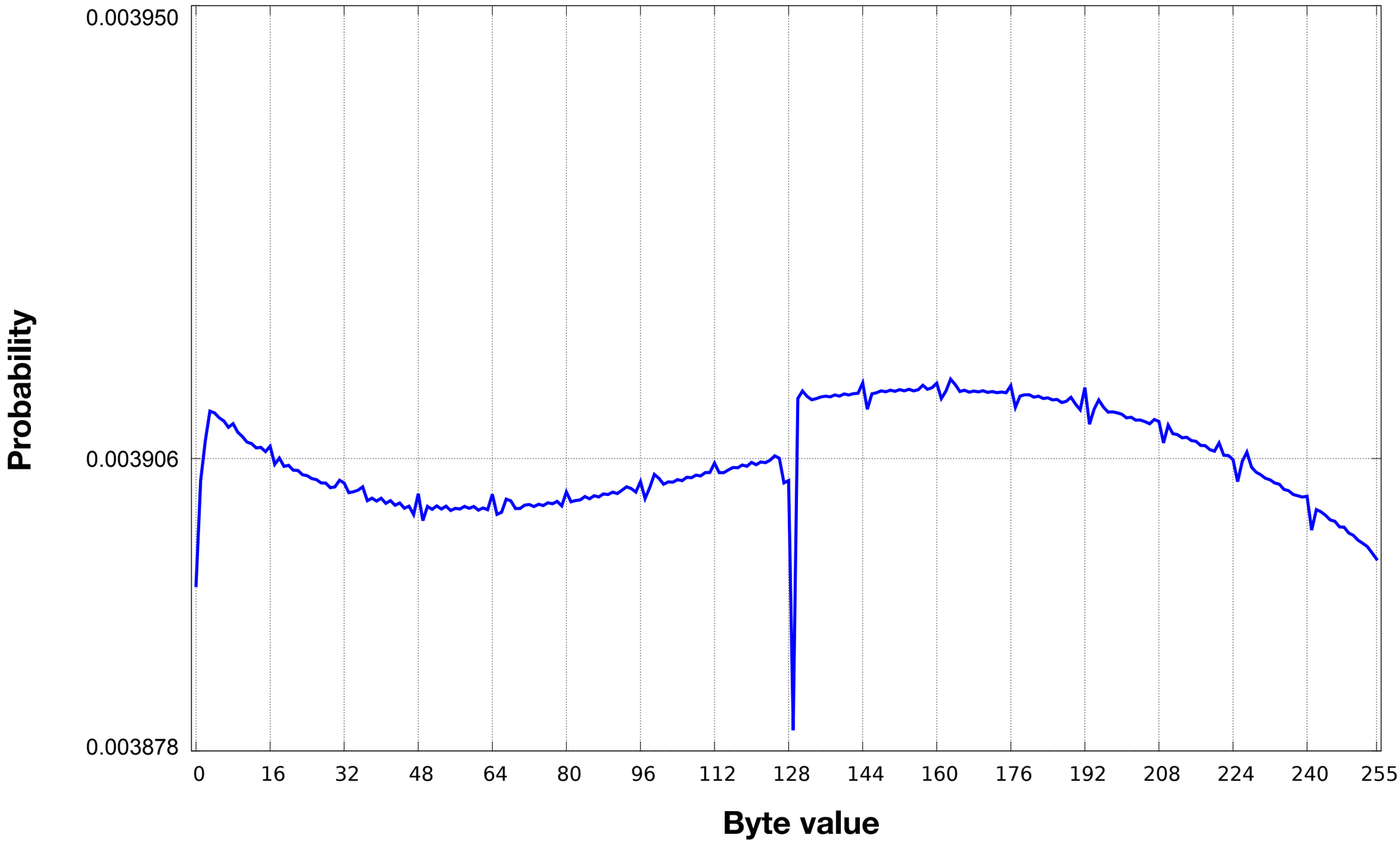
2^{45}

Random RC4 keys

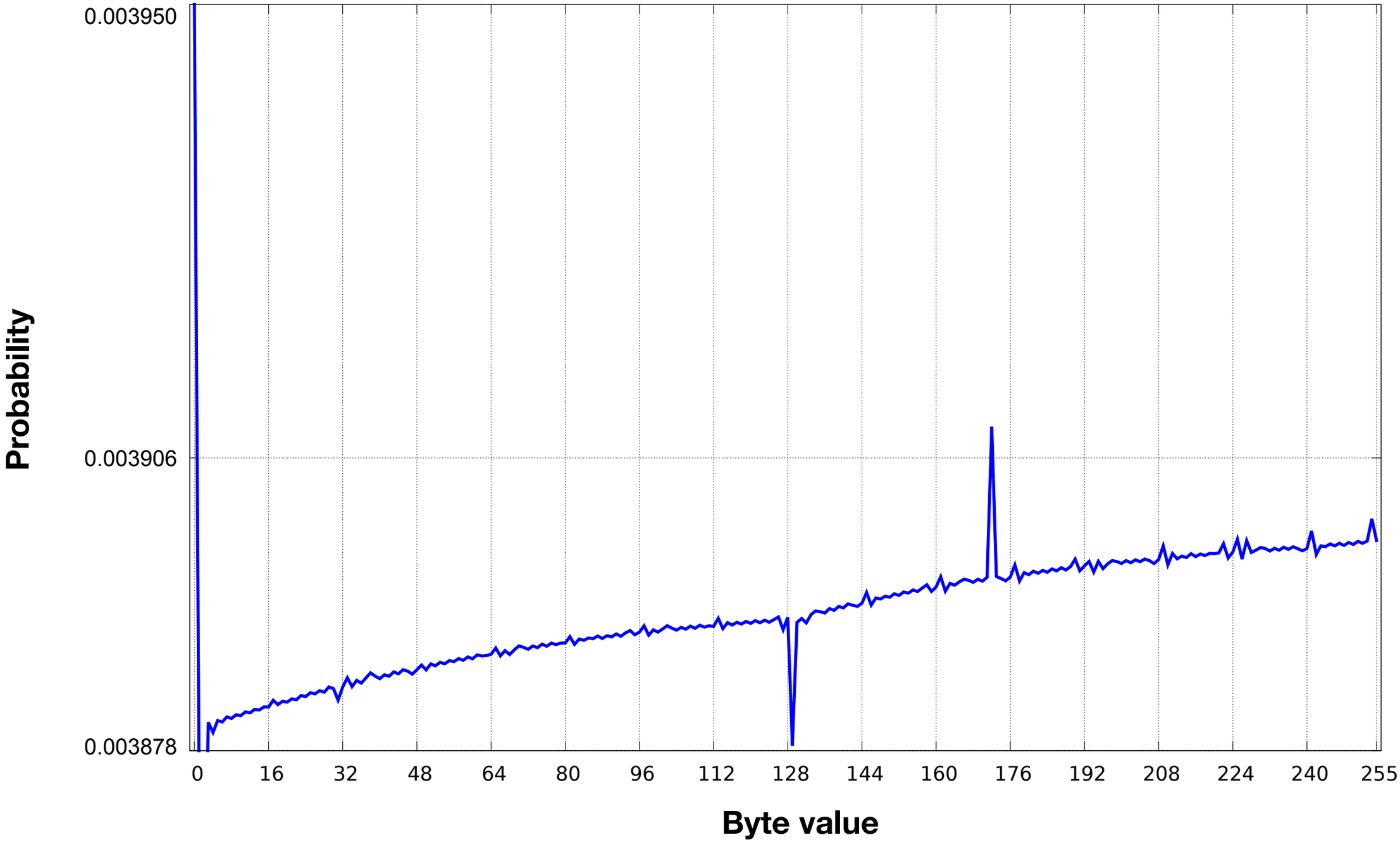
256

Keystream bytes

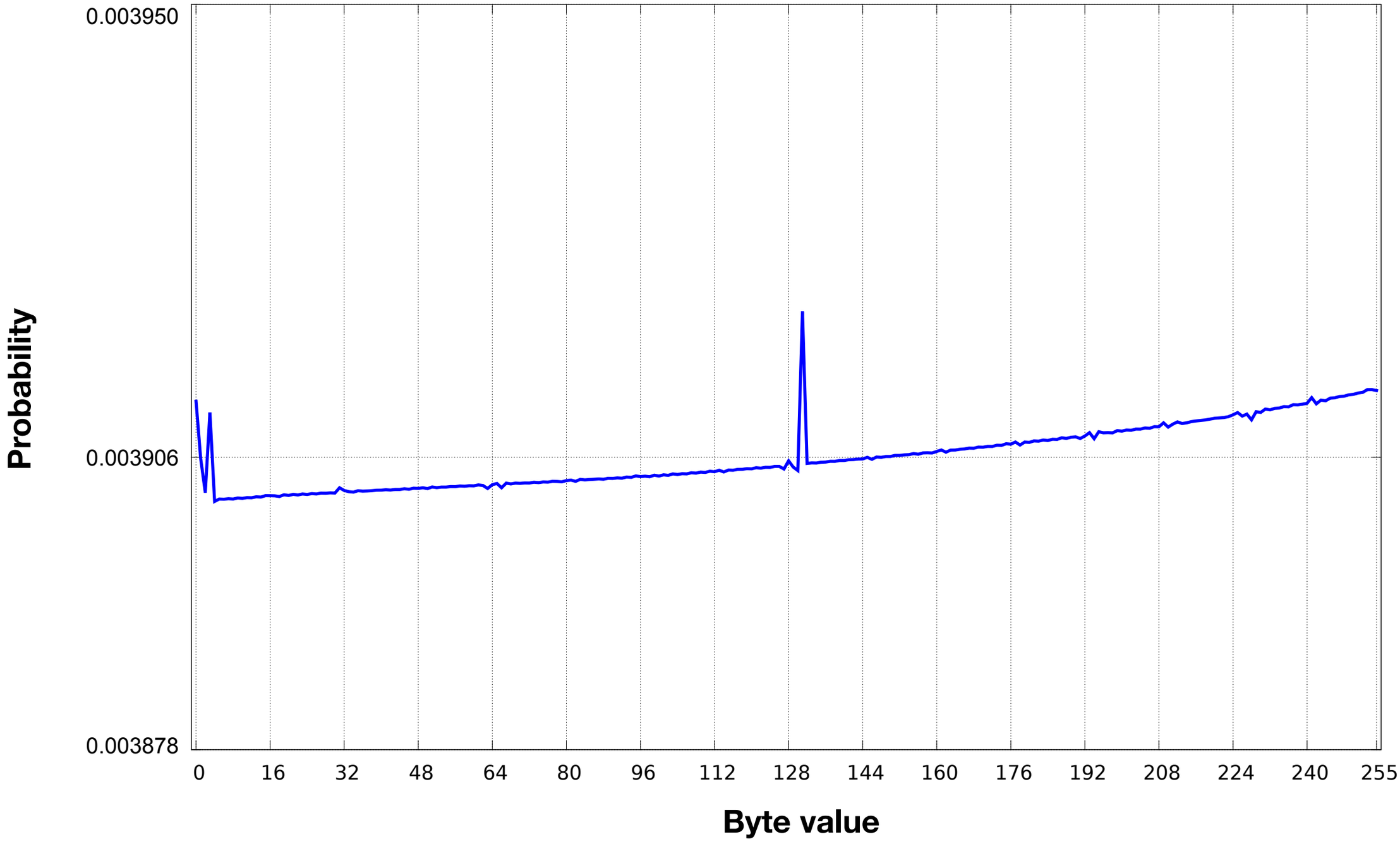
Keystream Distribution at Position 1



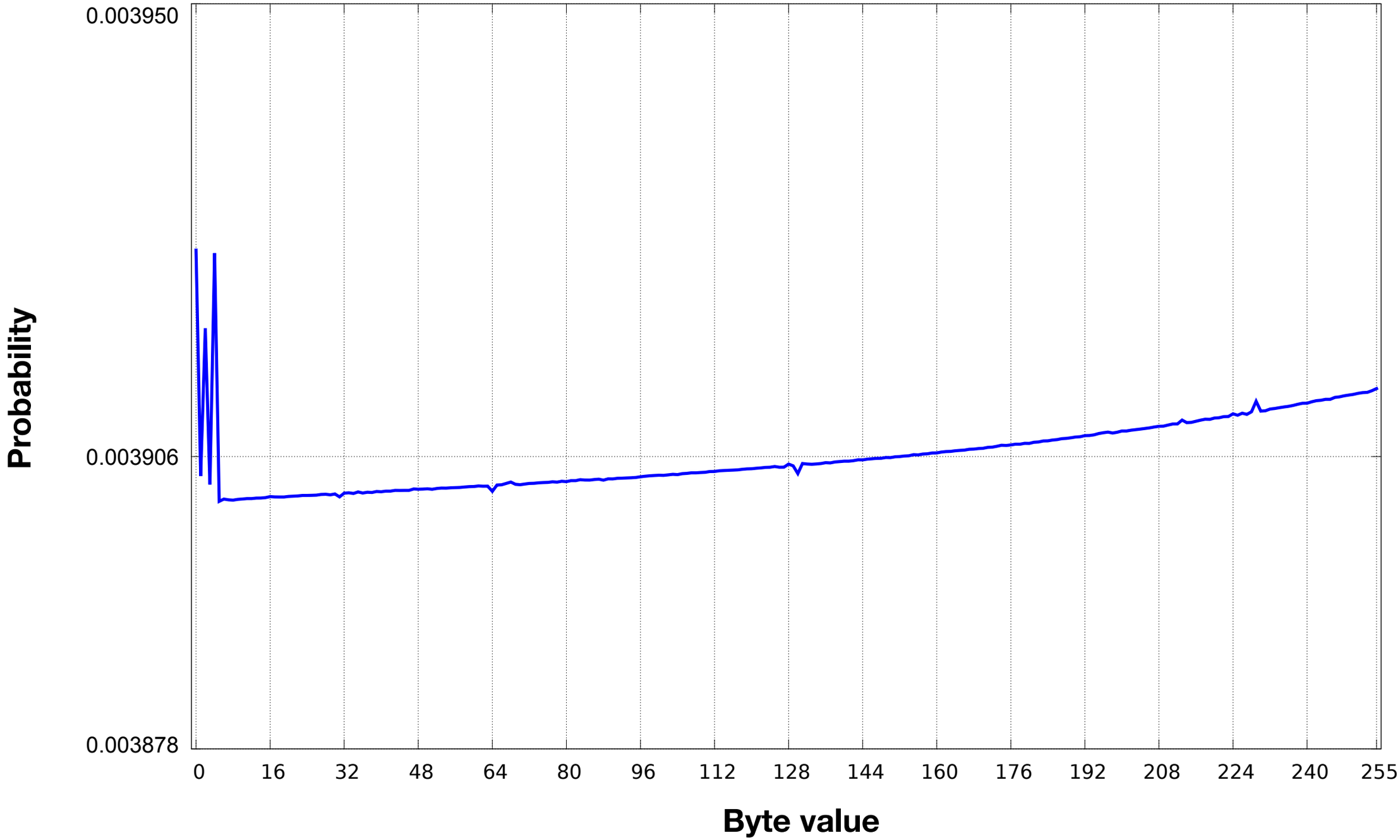
Keystream Distribution at Position 2



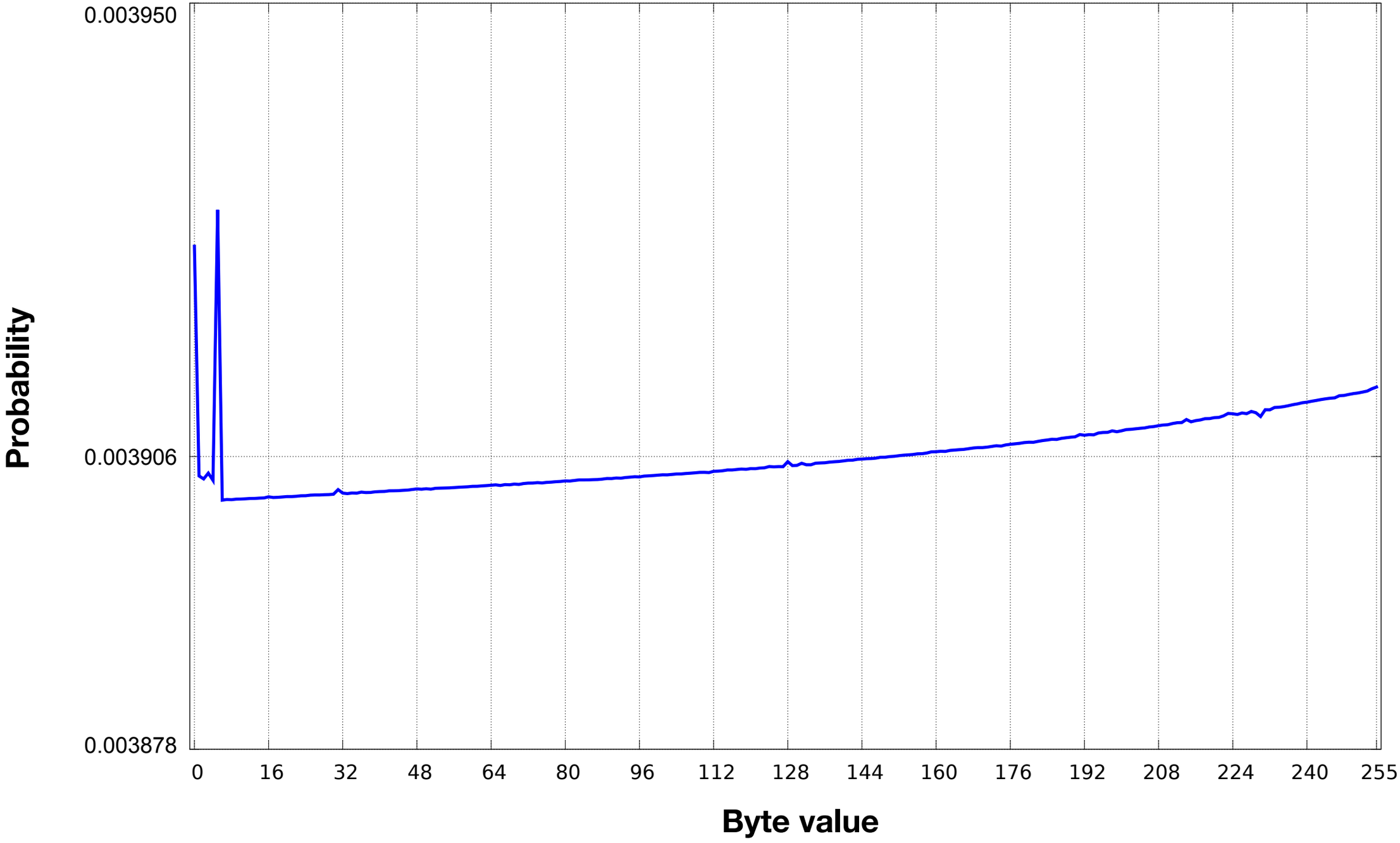
Keystream Distribution at Position 3



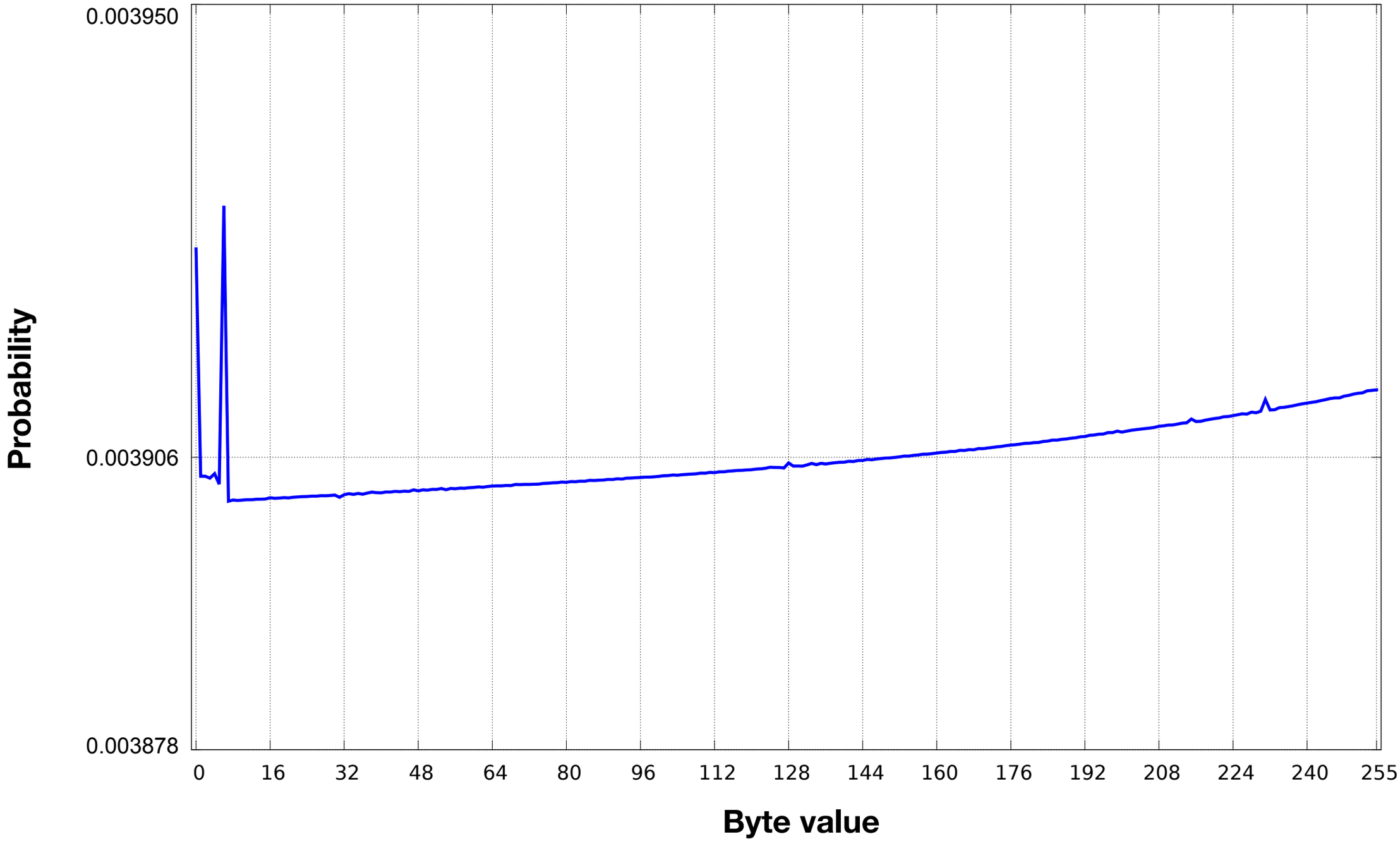
Keystream Distribution at Position 4



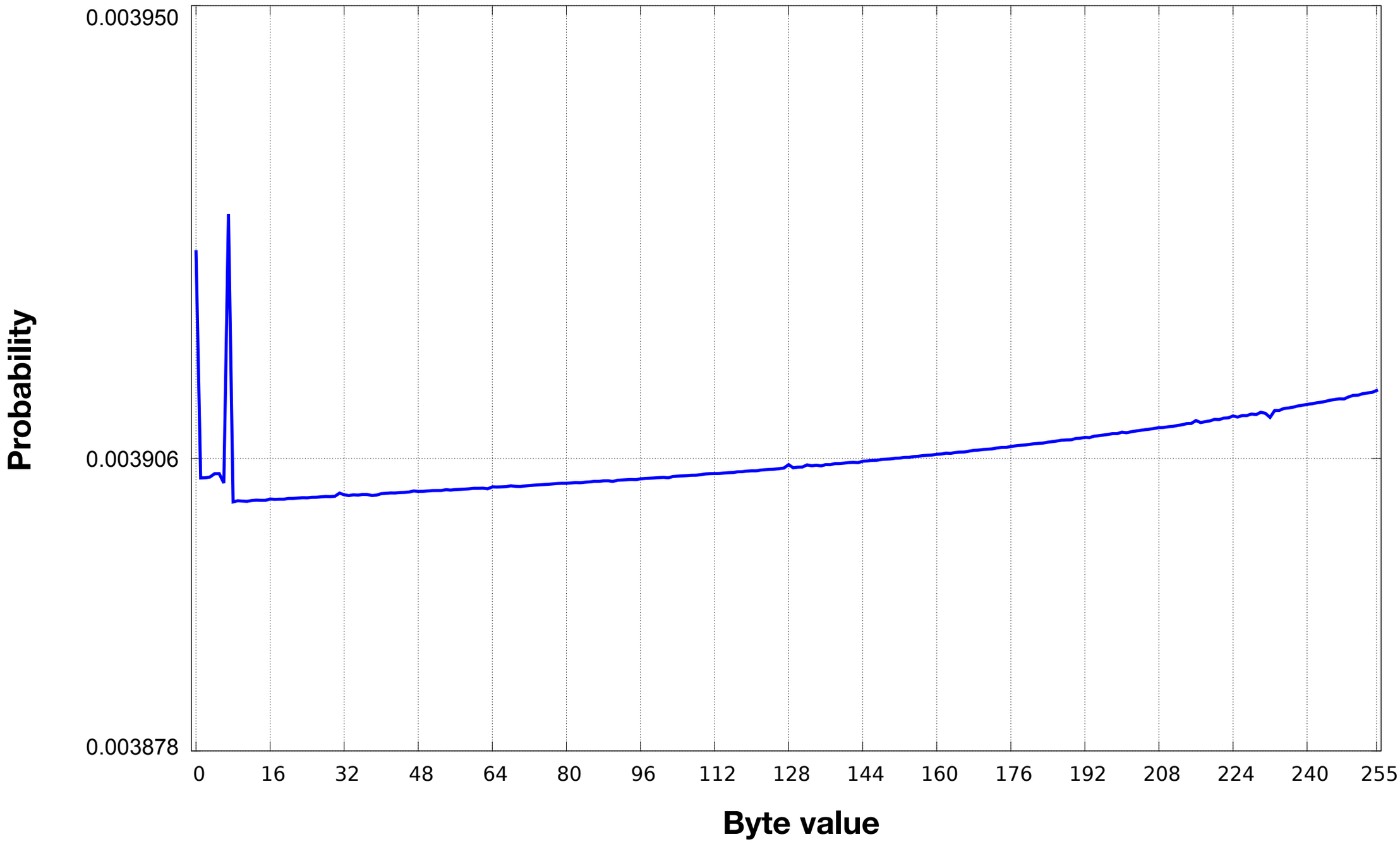
Keystream Distribution at Position 5



Keystream Distribution at Position 6



Keystream Distribution at Position 7



Keystream Distribution at Position 8

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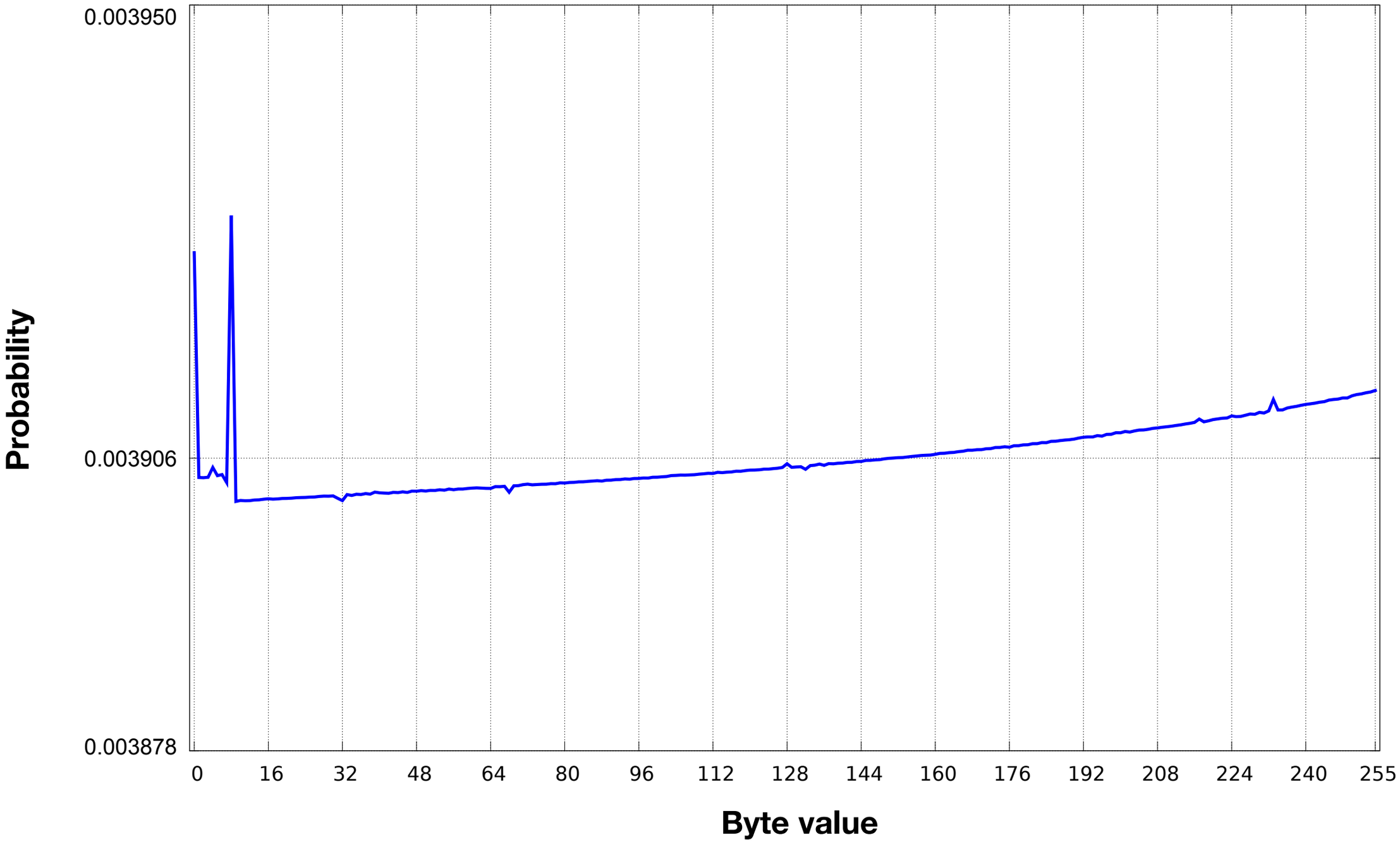
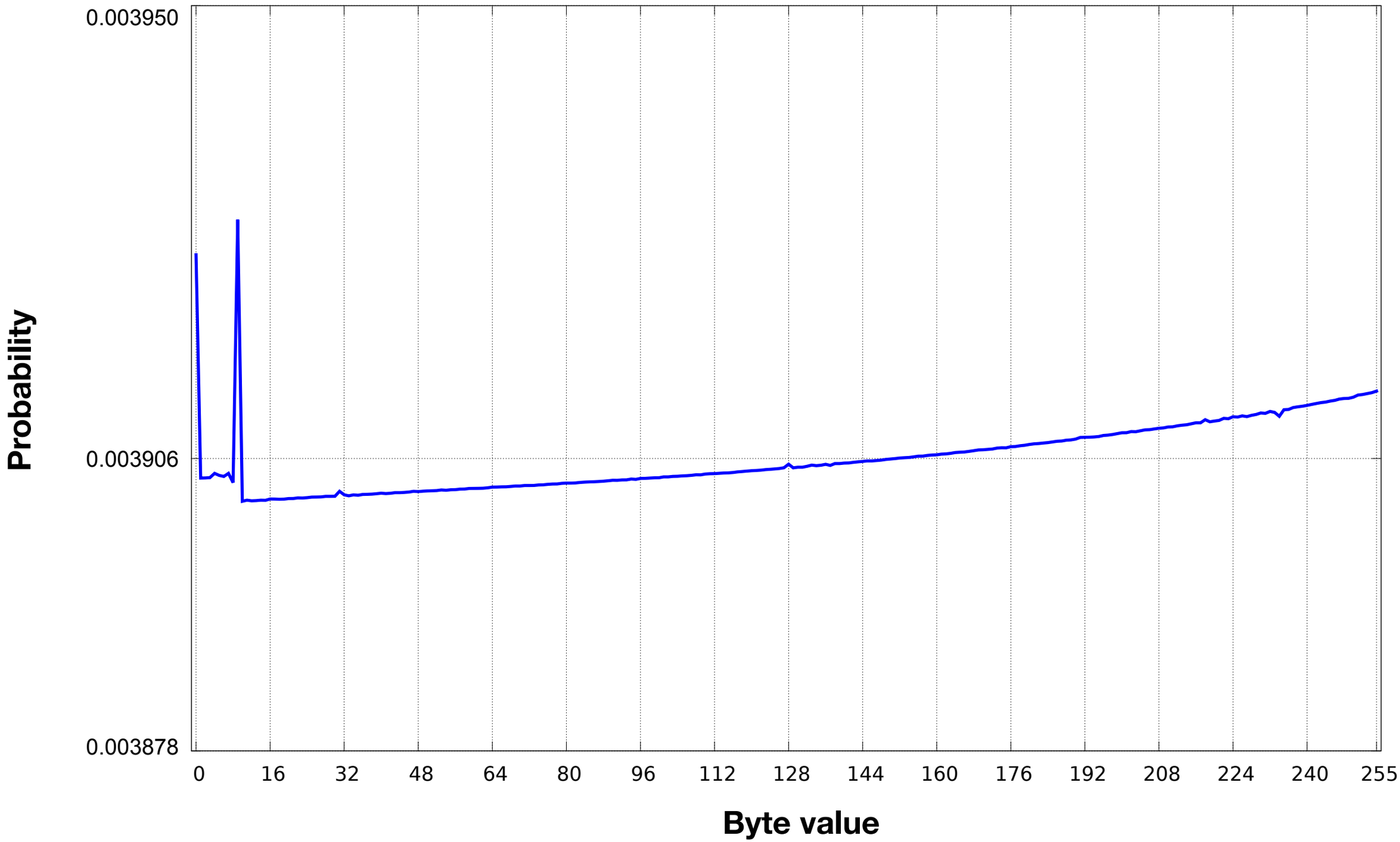
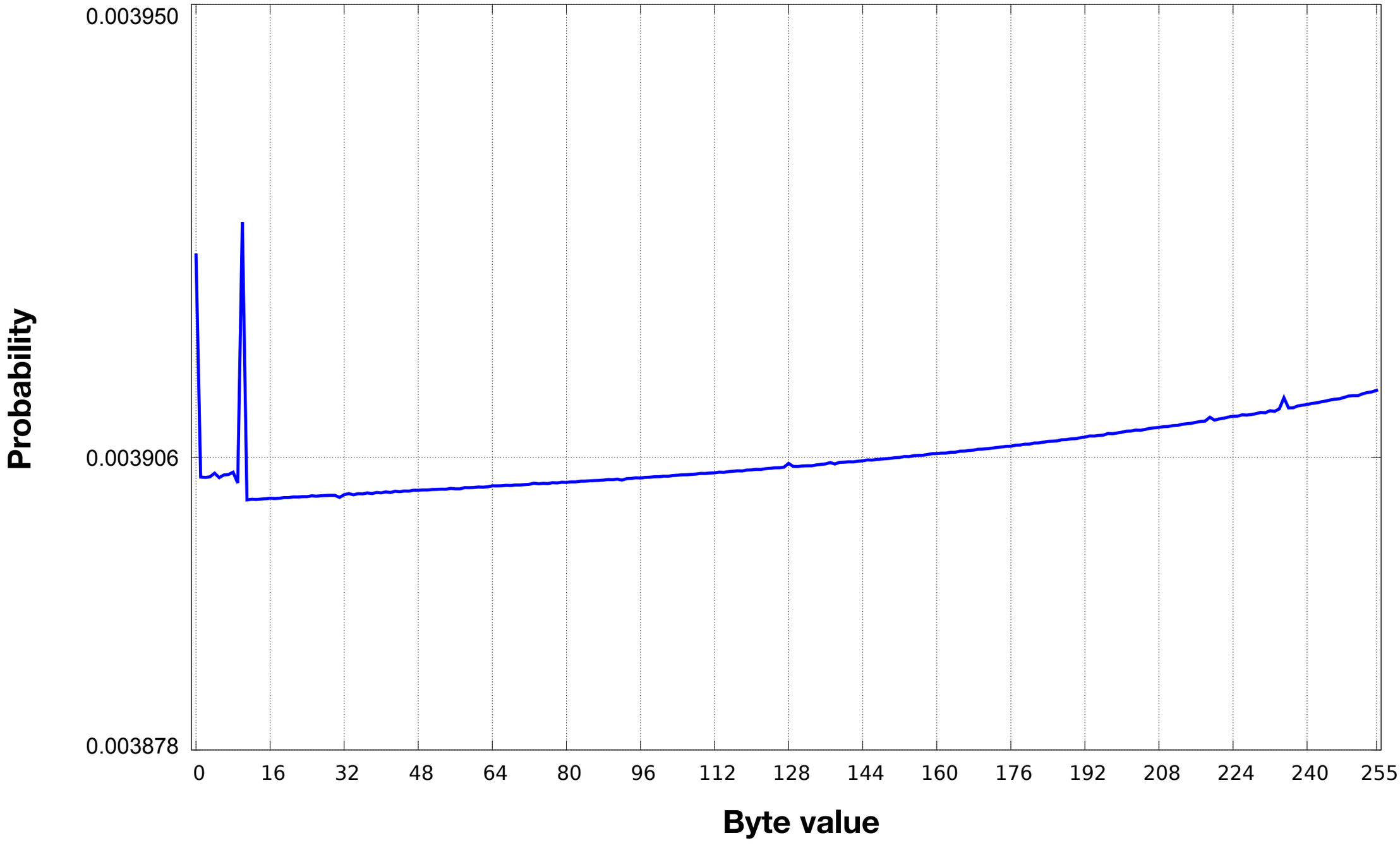


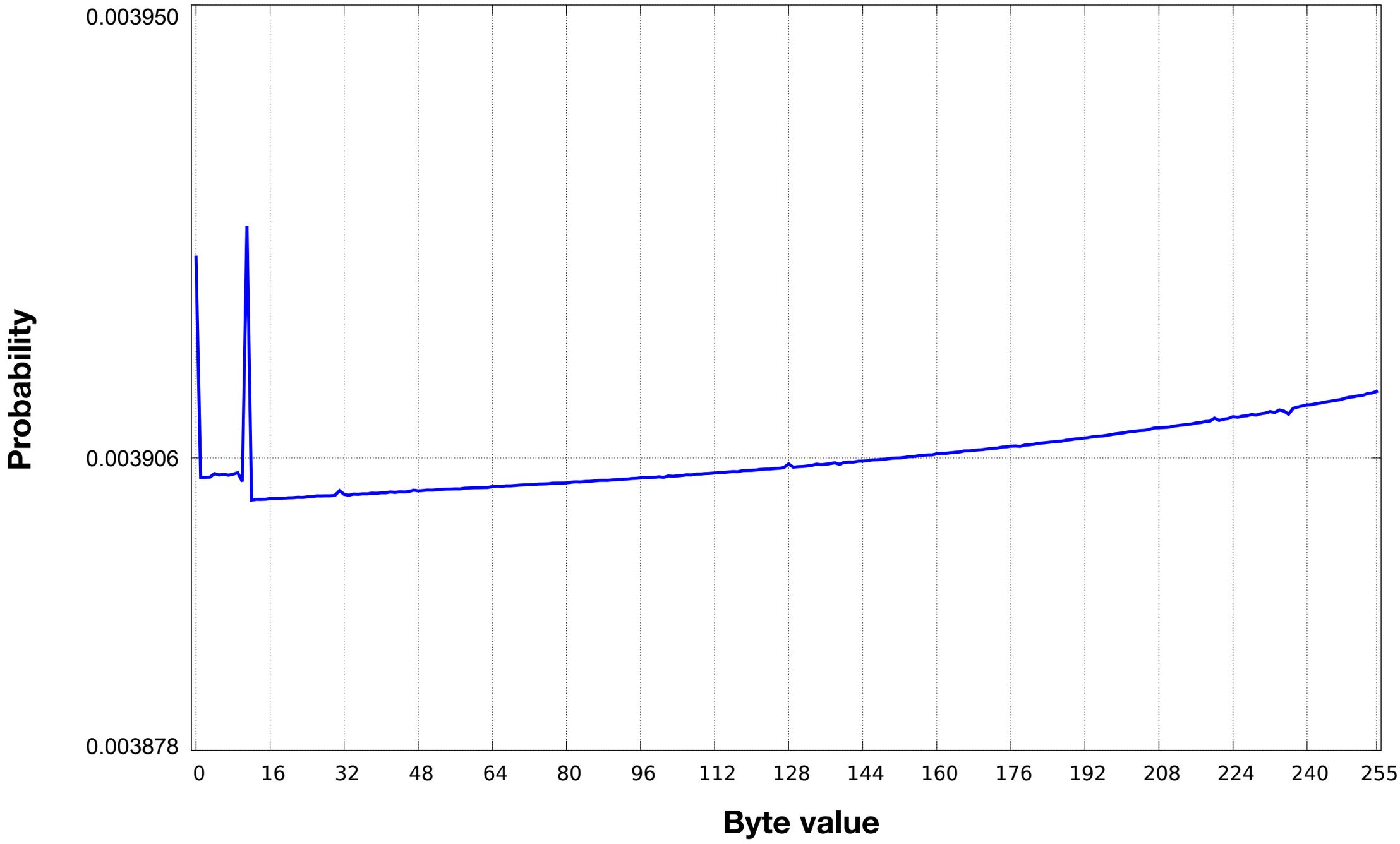
Keystream Distribution at Position 9



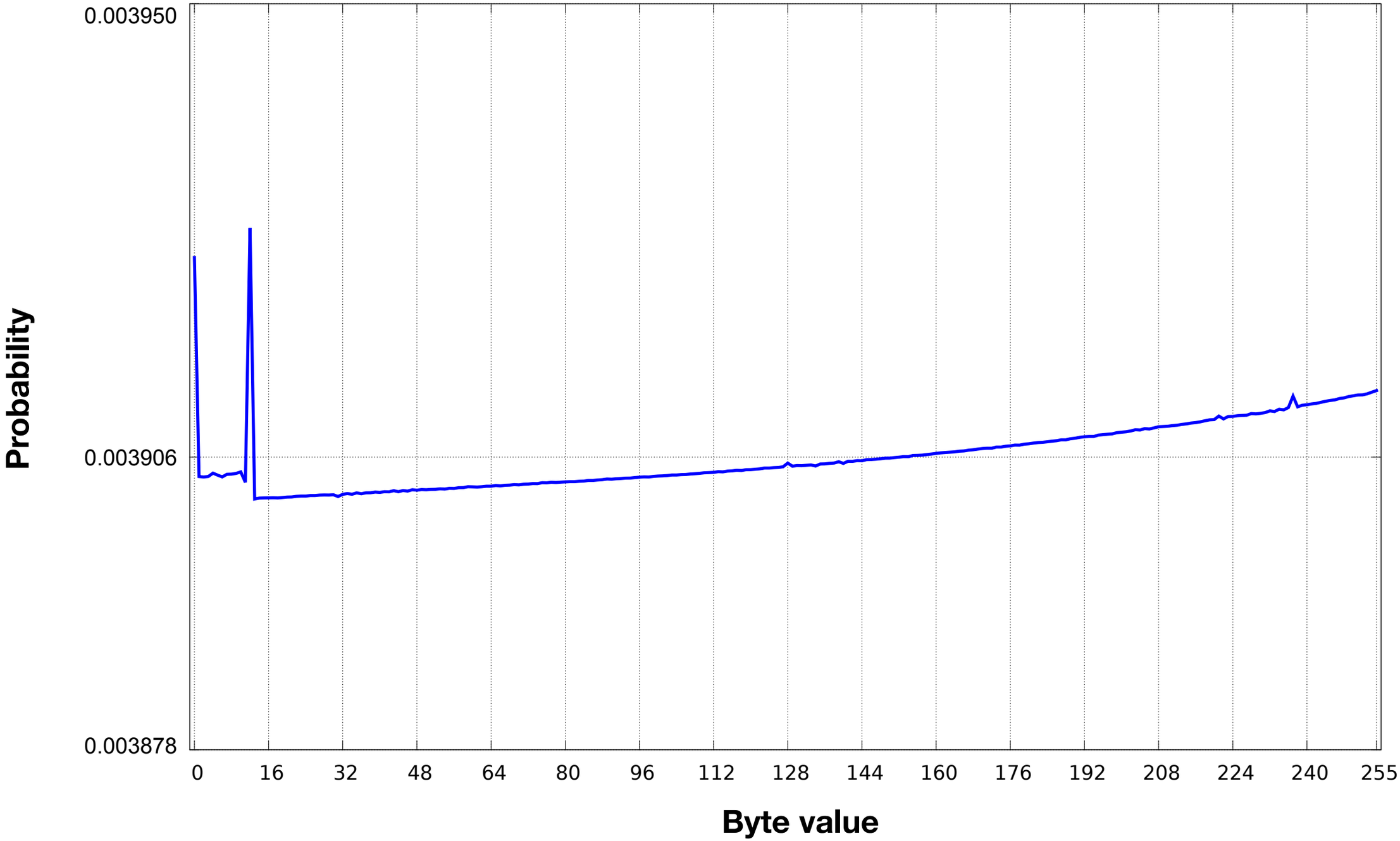
Keystream Distribution at Position 10



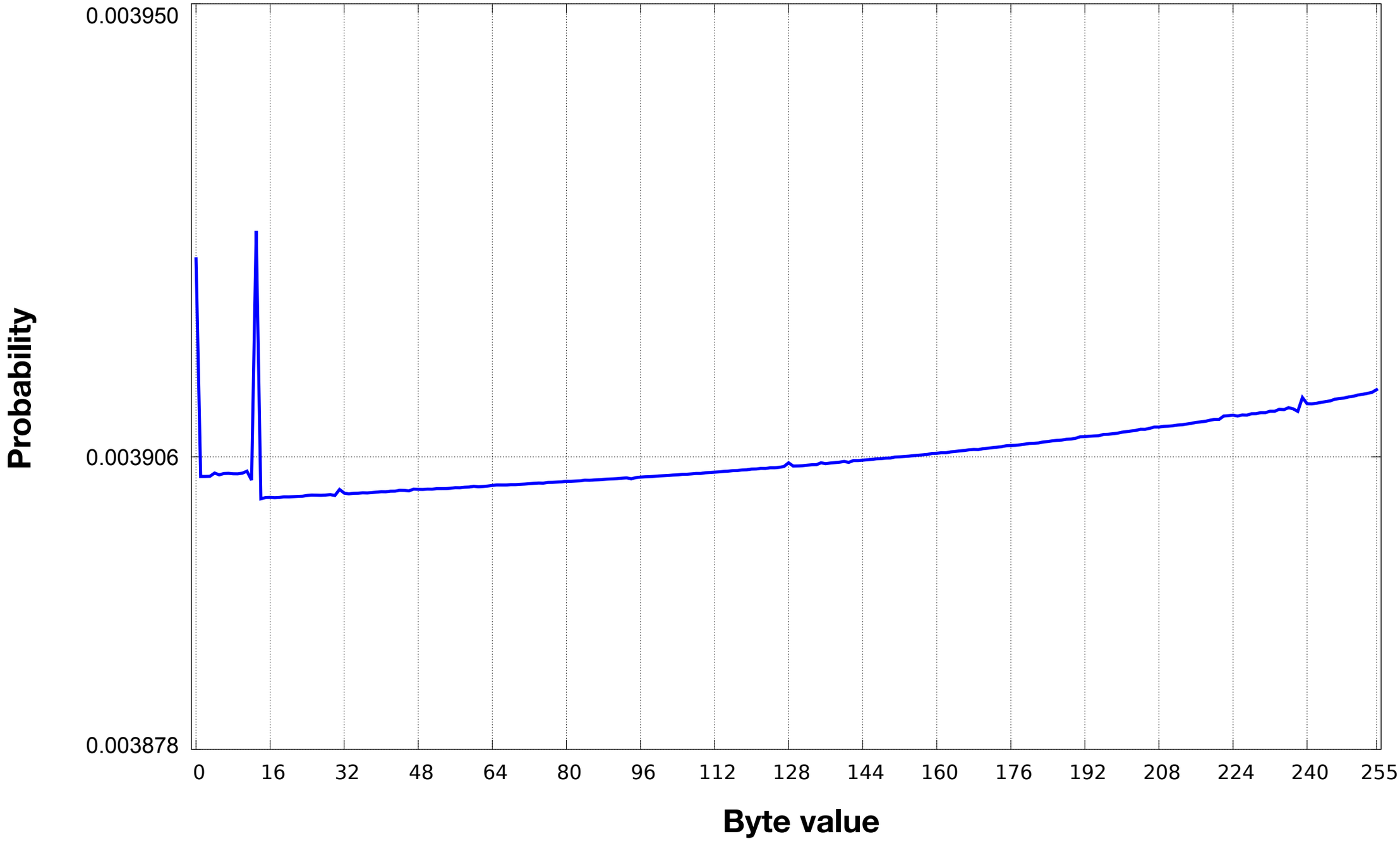
Keystream Distribution at Position 11



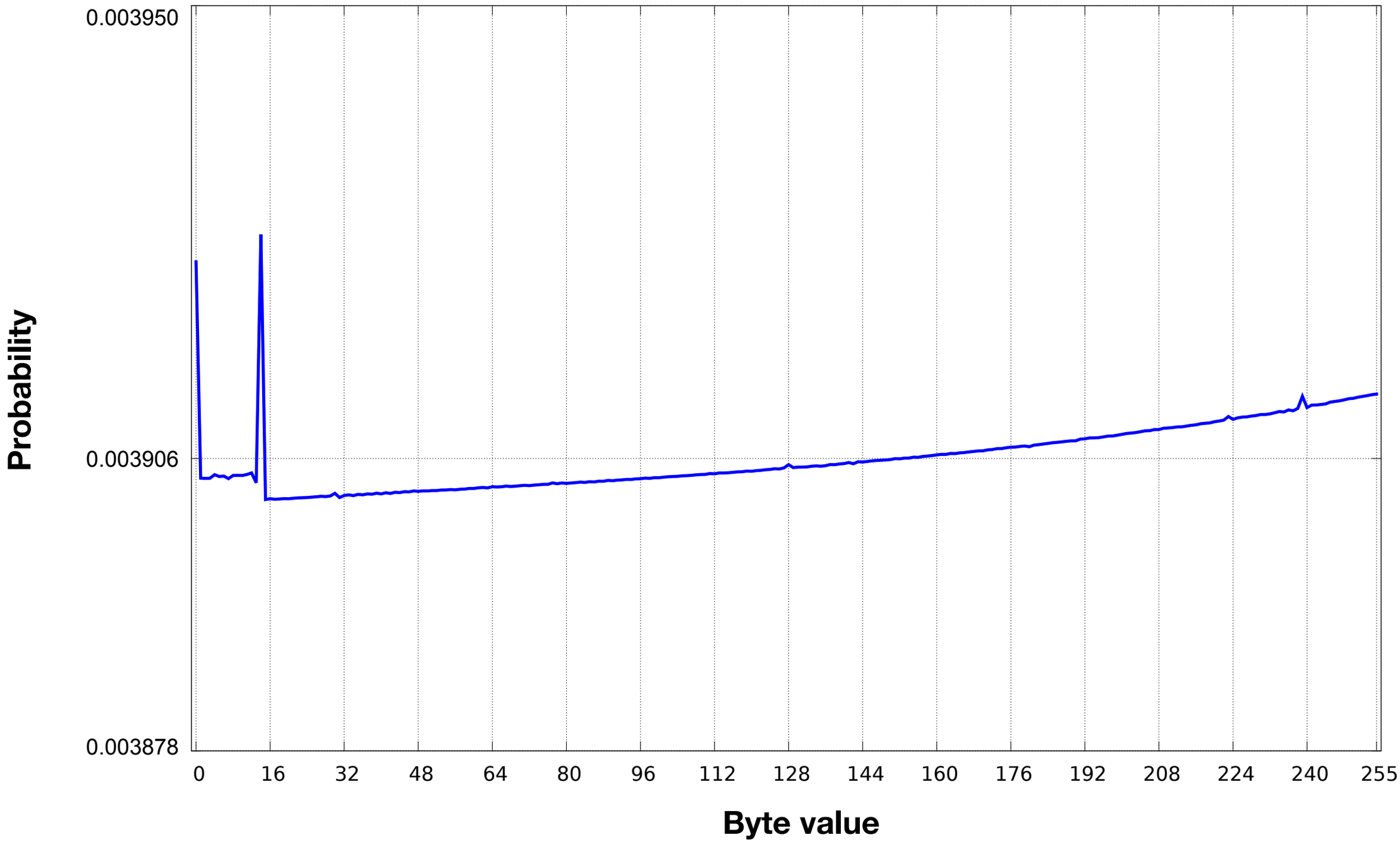
Keystream Distribution at Position 12



Keystream Distribution at Position 13



Keystream Distribution at Position 14



Keystream Distribution at Position 15

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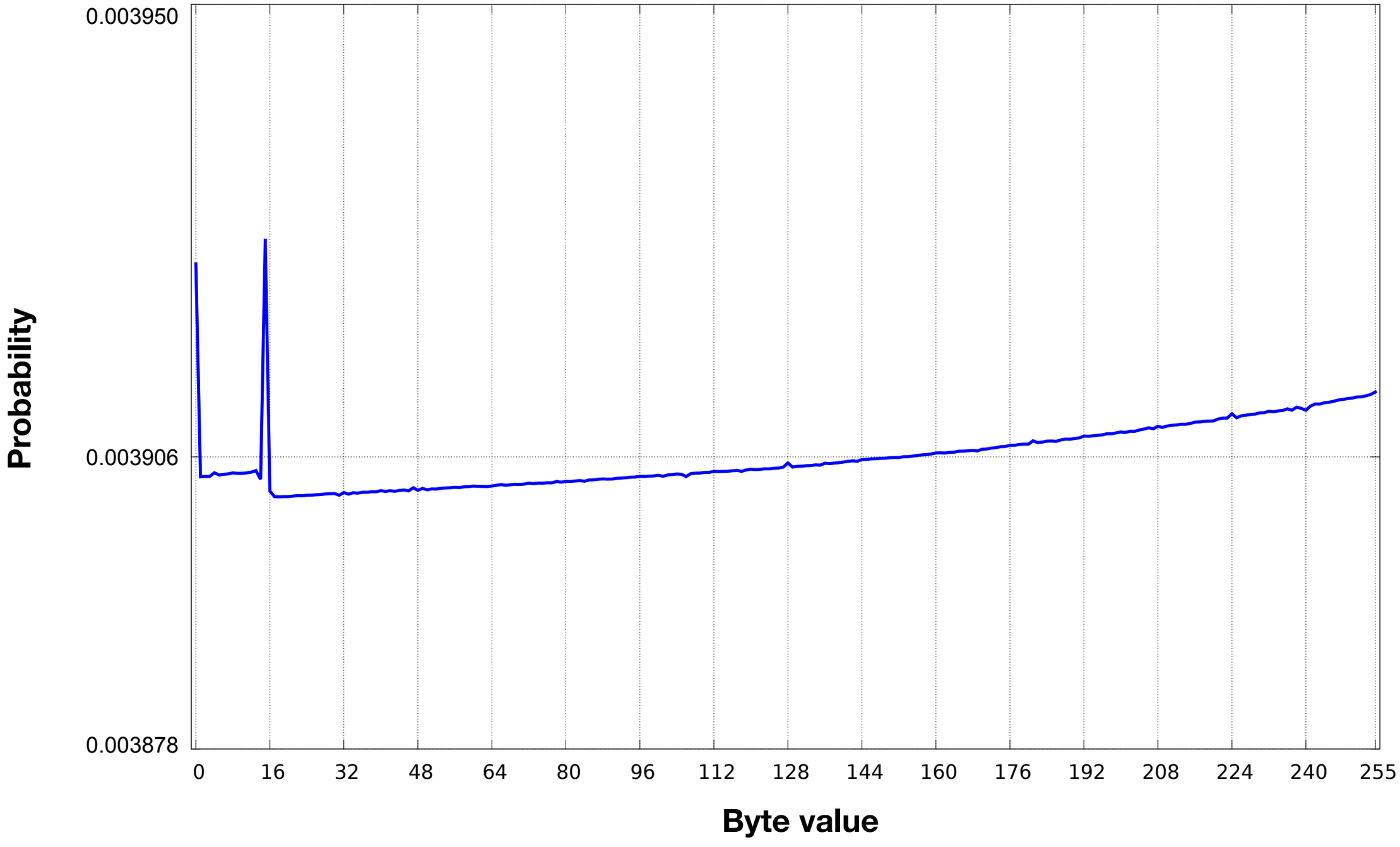
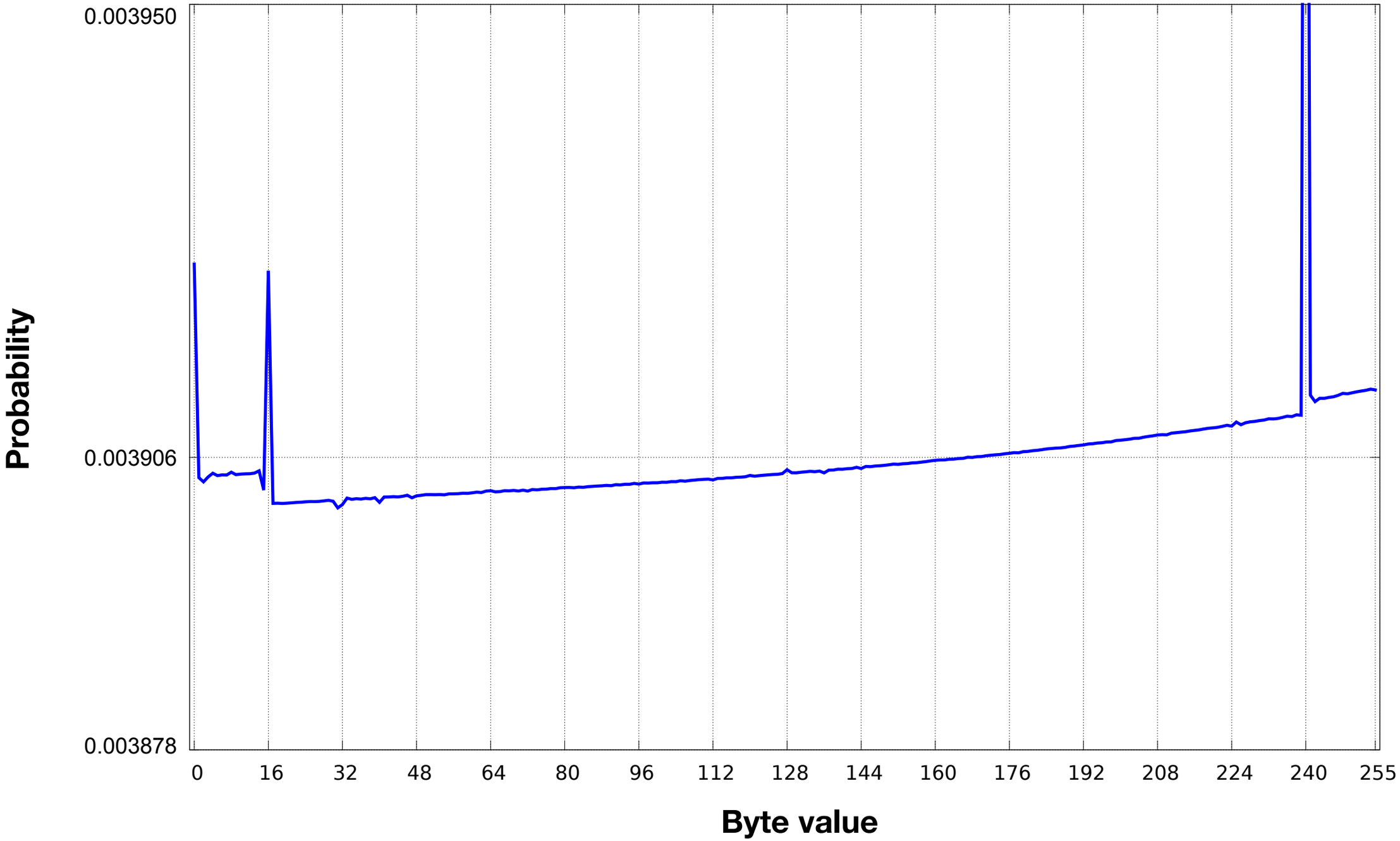
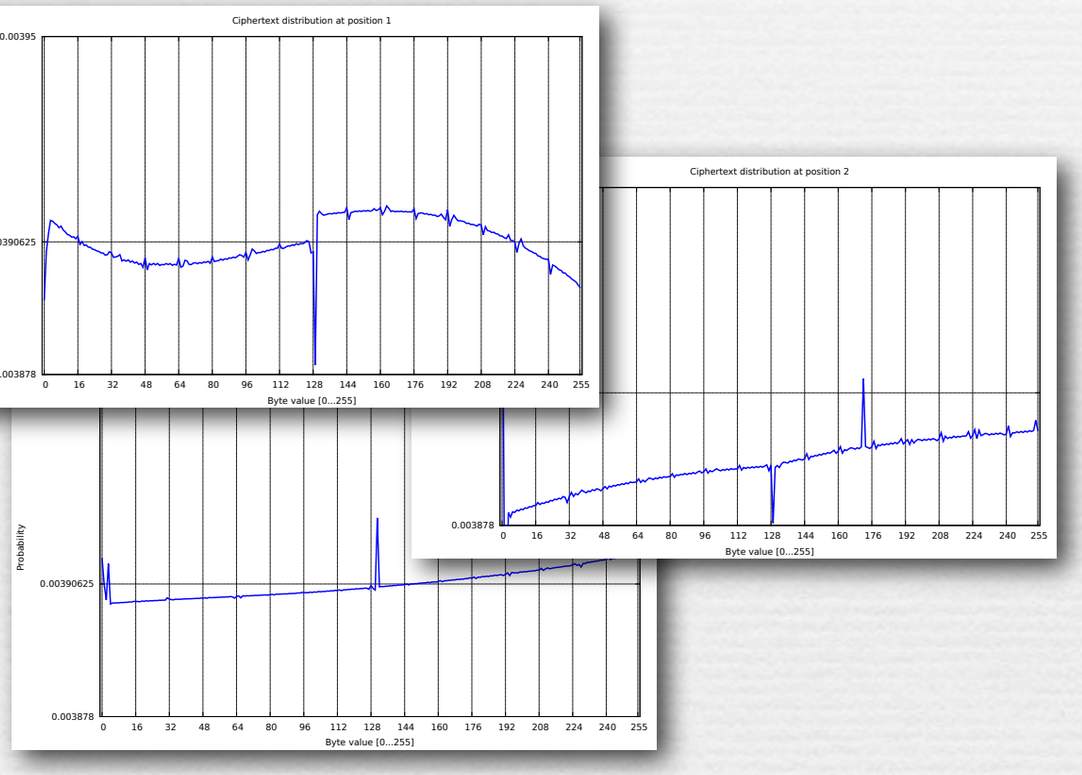


Keystream Distribution at Position 16



Plaintext Recovery Attack



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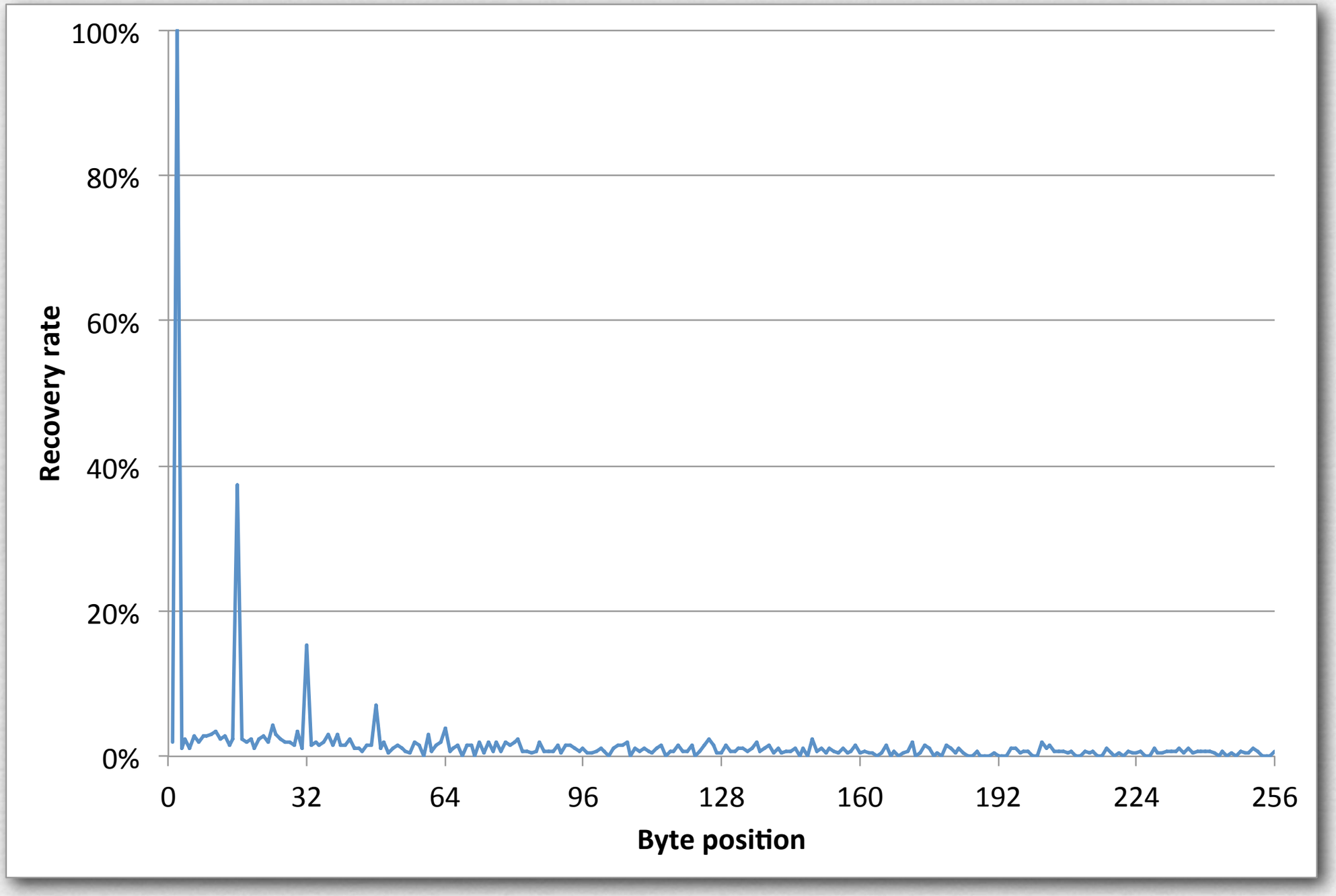
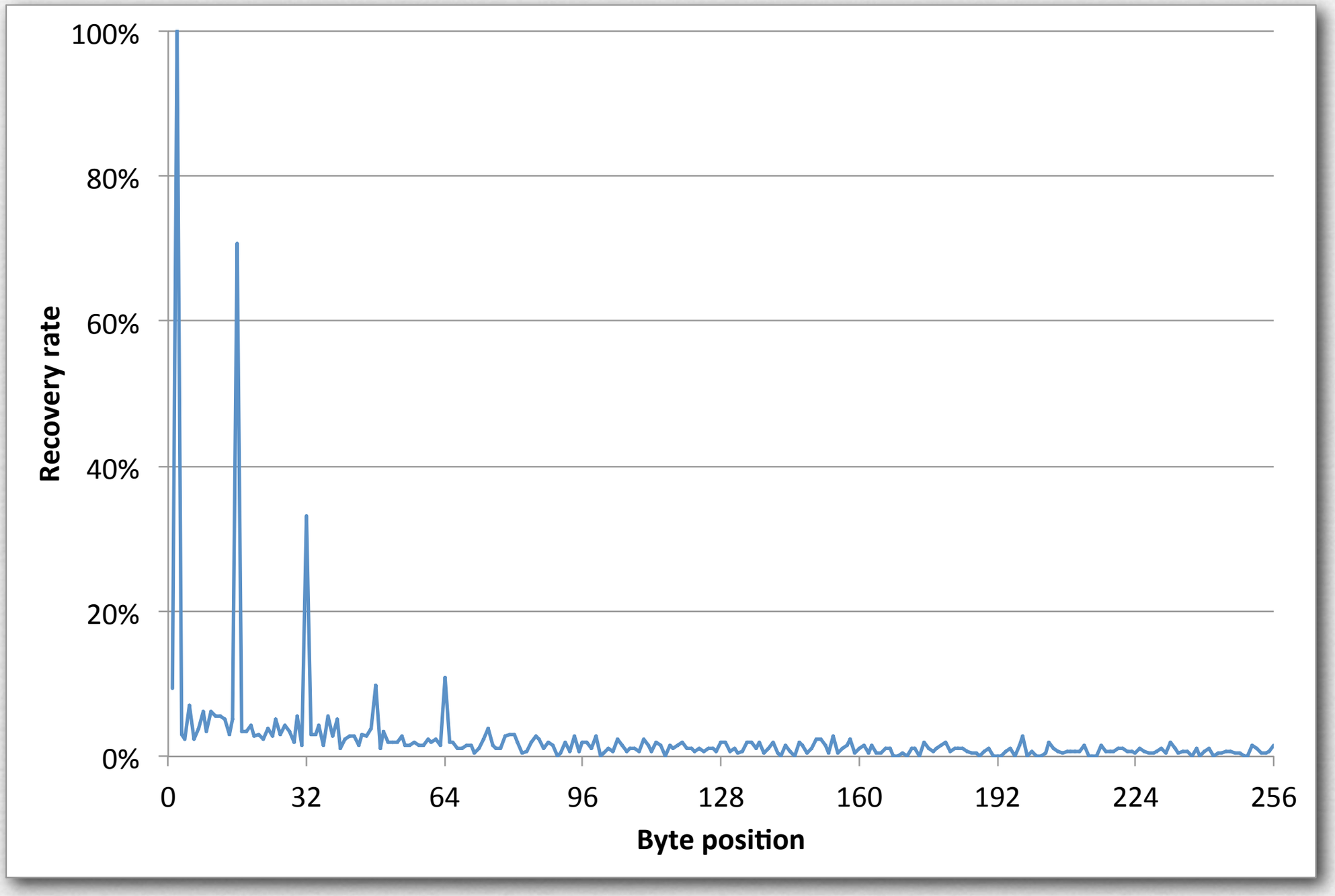
TLS plaintext recovery
(initial bytes)

Success Probability
2^{20} Sessions

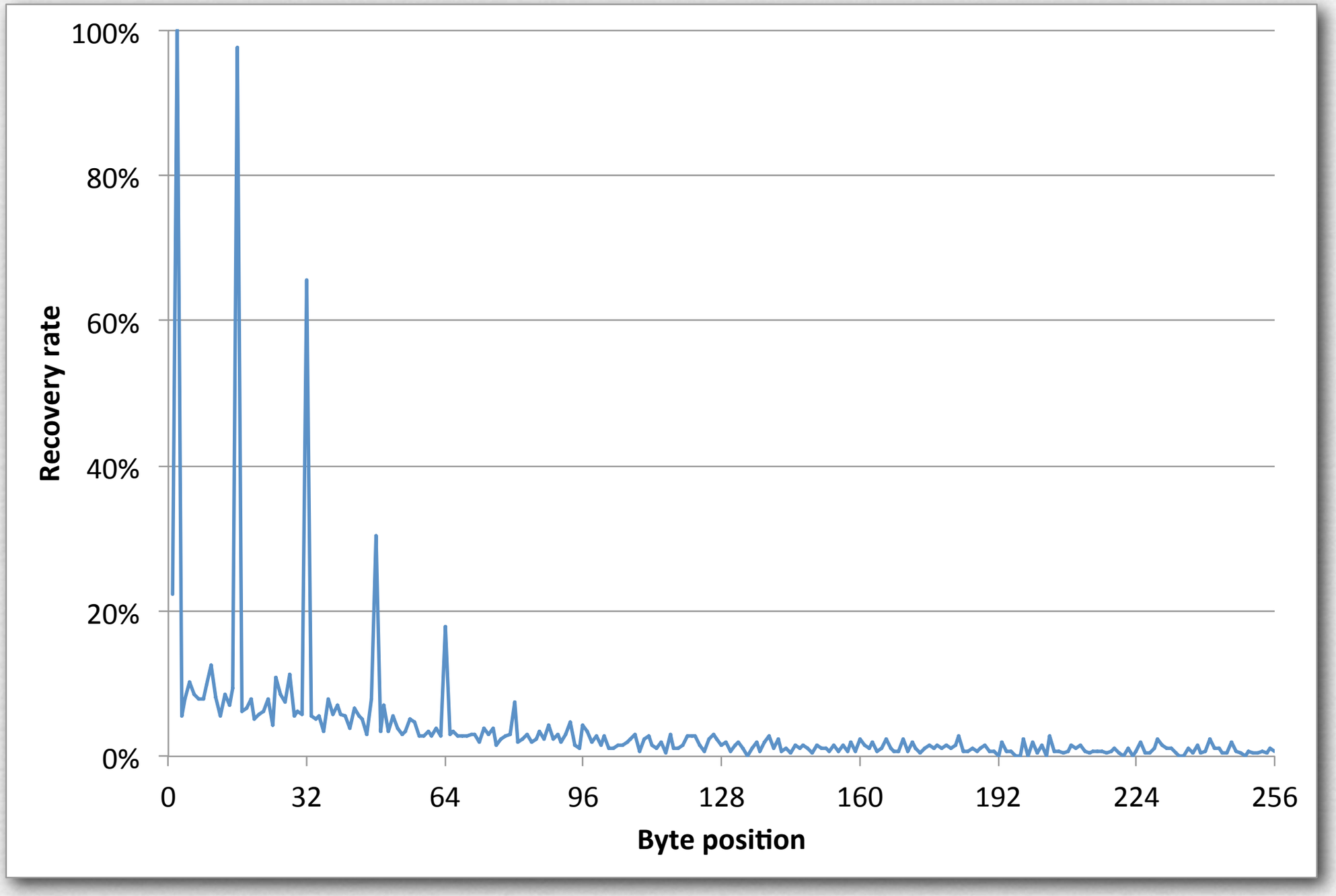


Success Probability
2^{21} Sessions

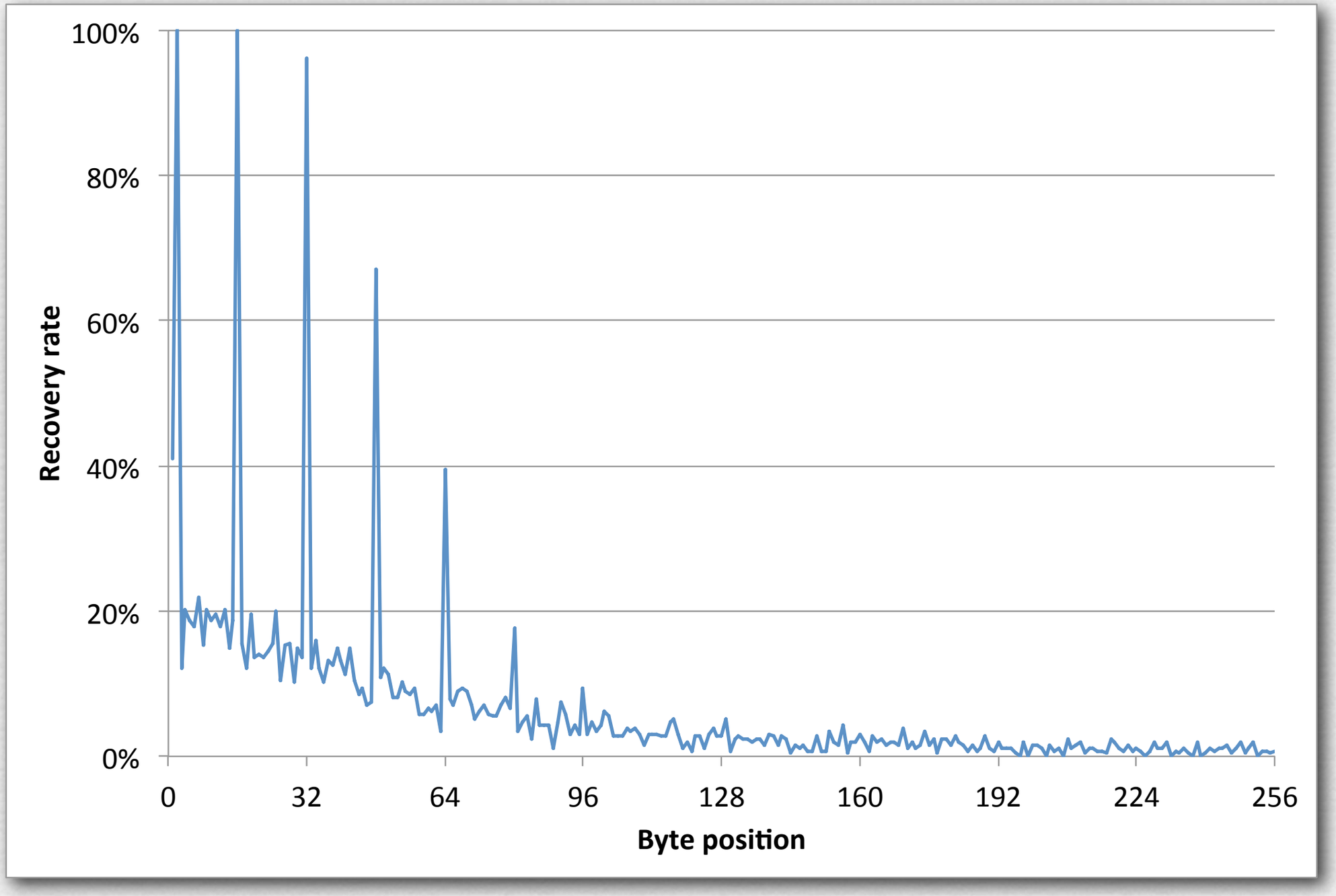


Success Probability
2^{22} Sessions

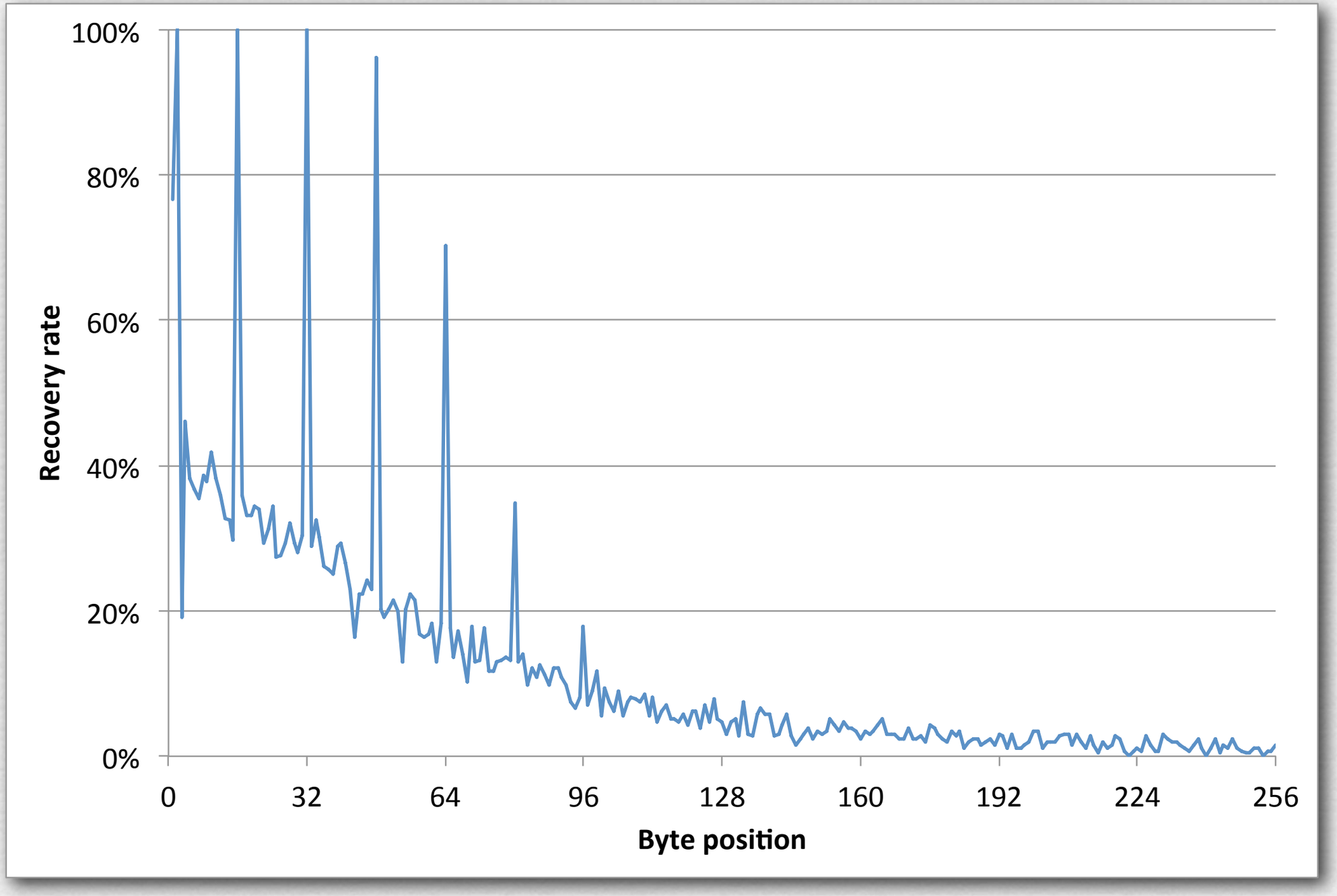
Information Security Group



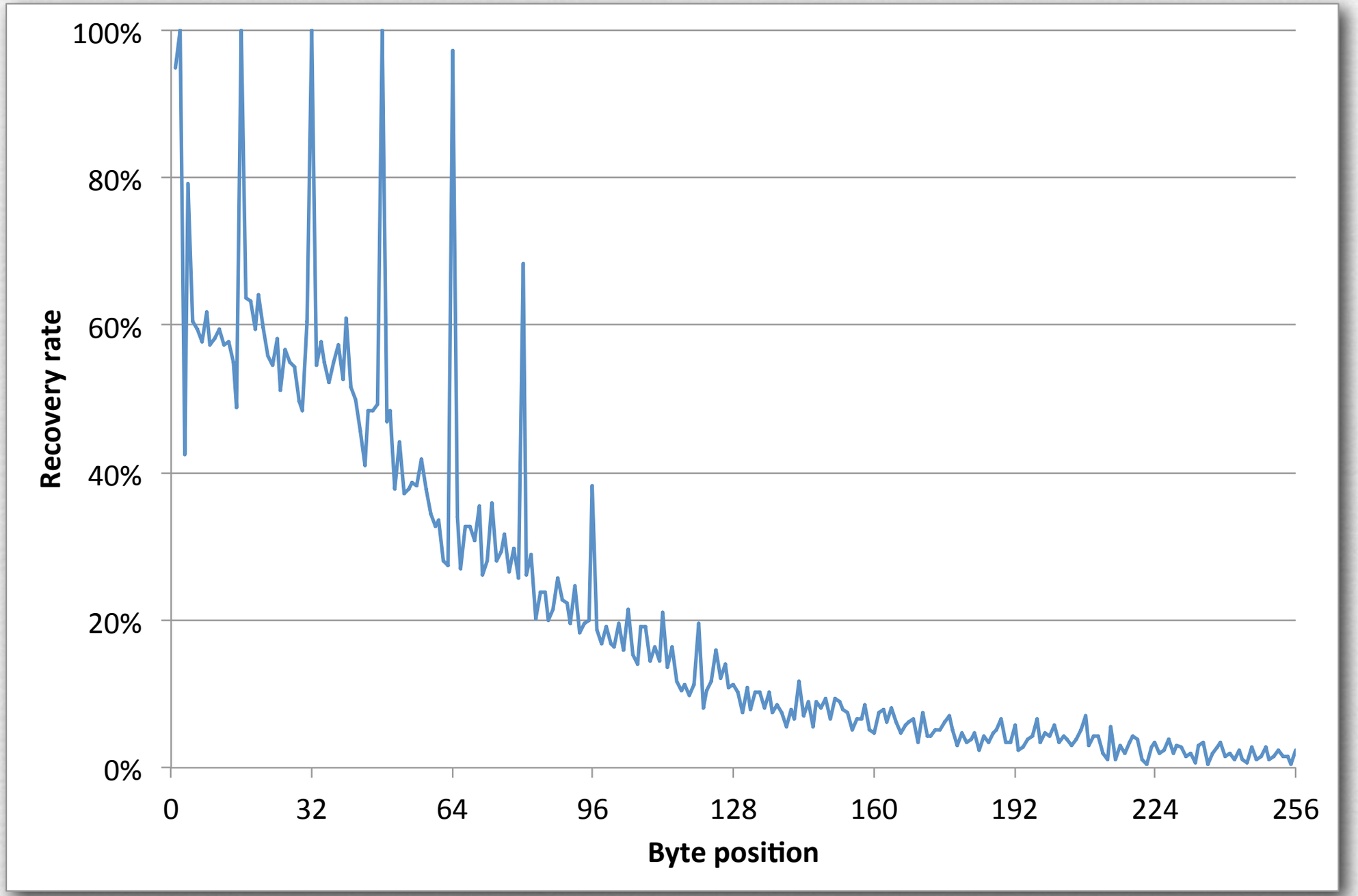
Success Probability
2^{23} Sessions



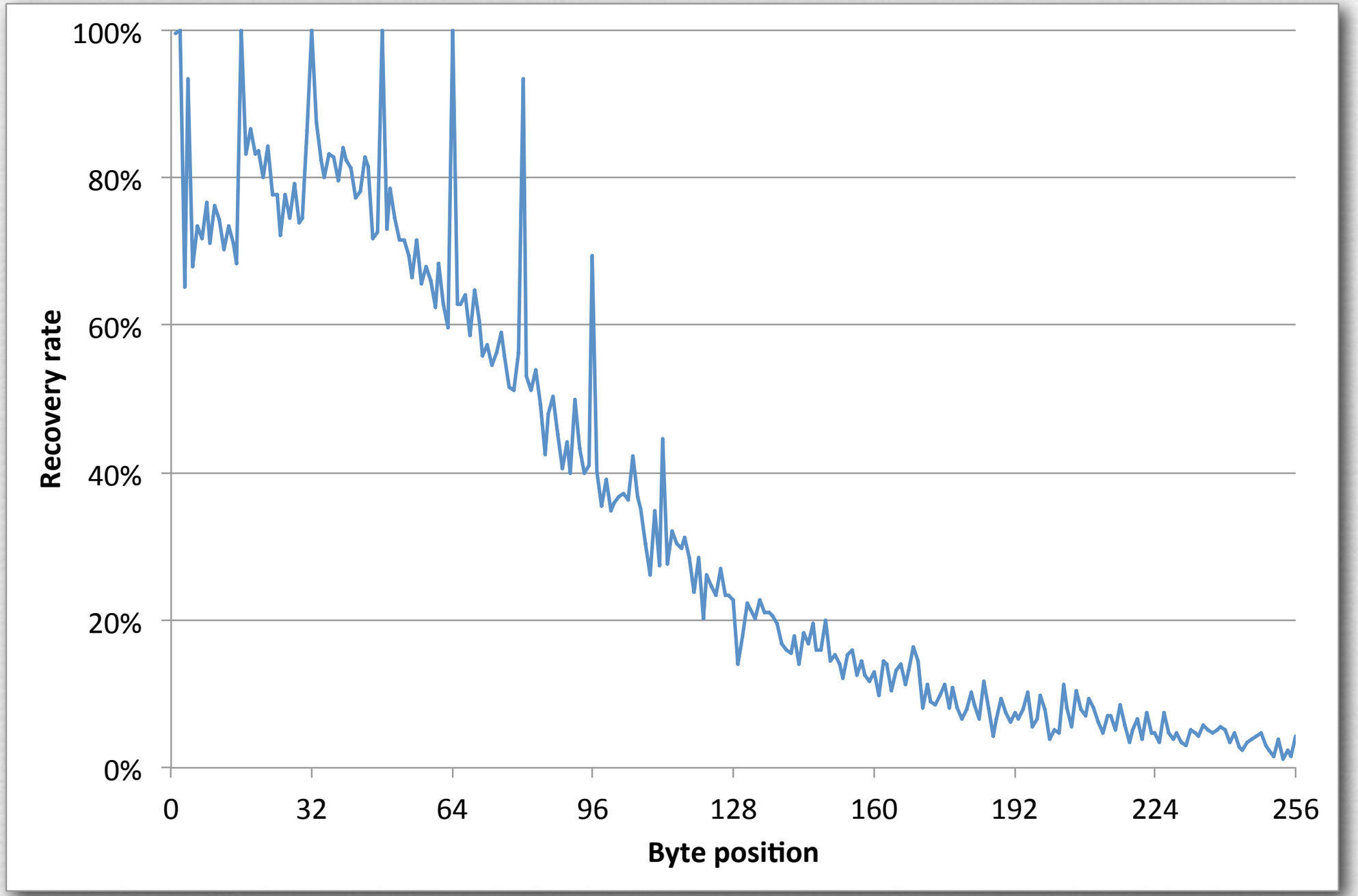
Success Probability
2^{24} Sessions



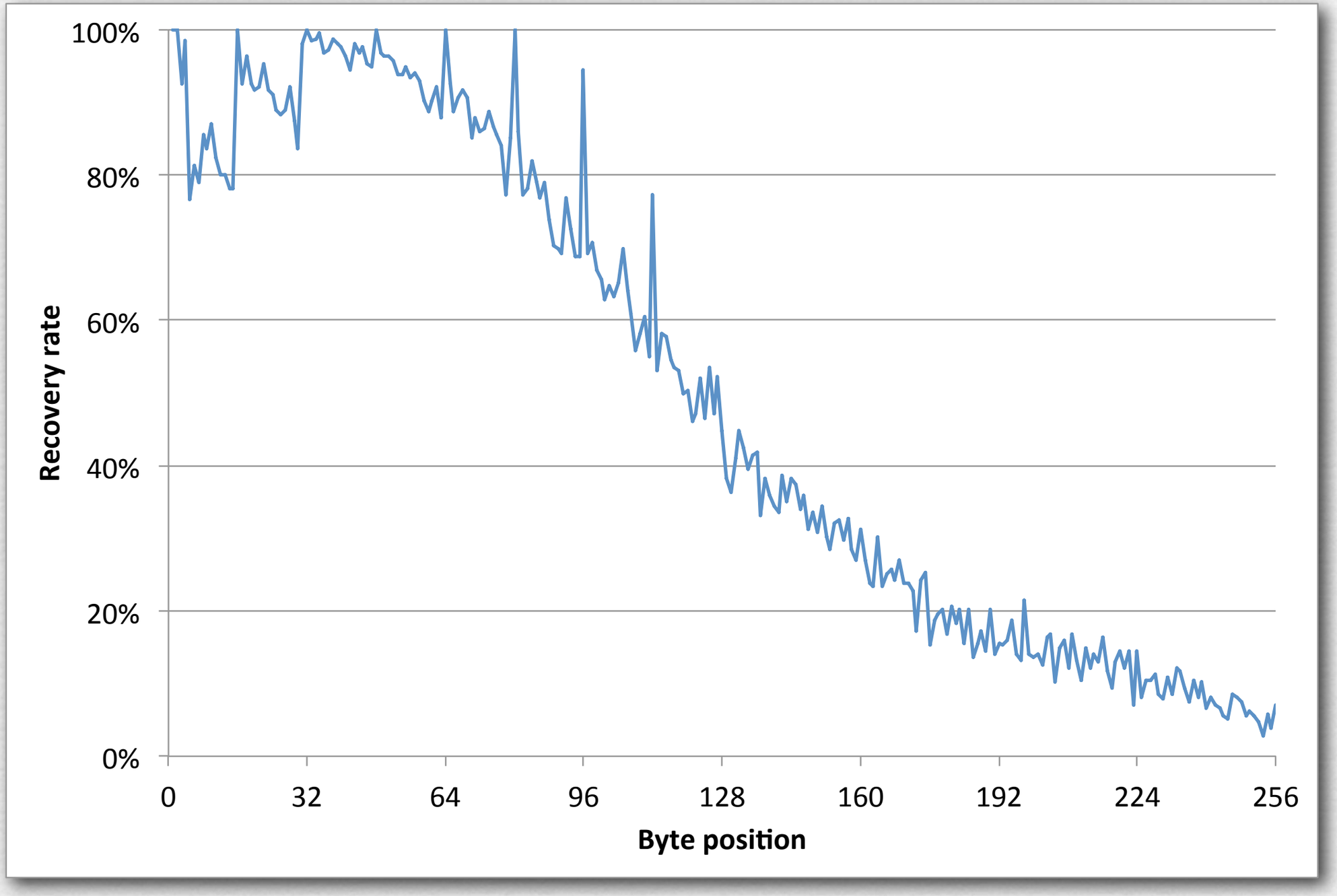
Success Probability
2^{25} Sessions



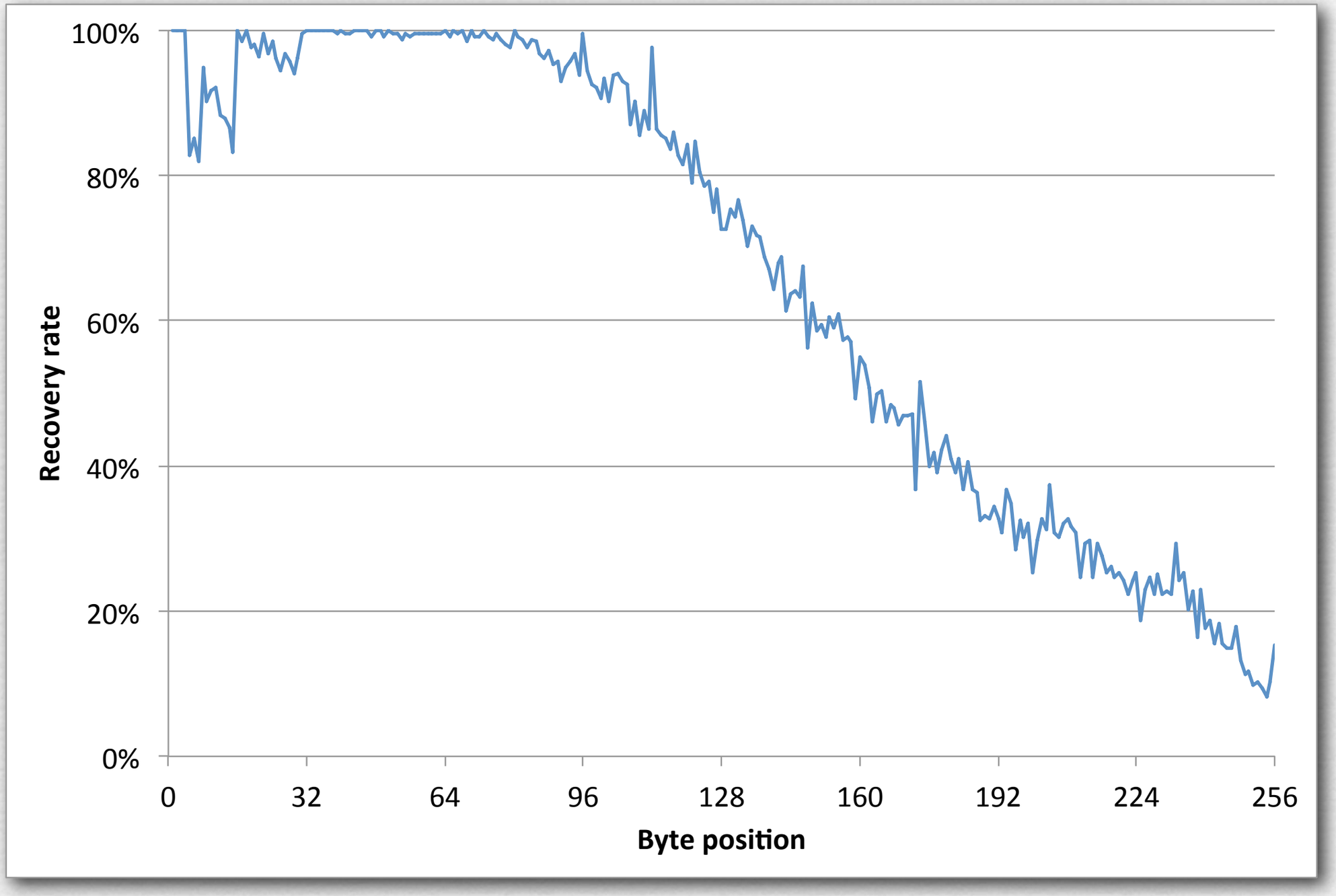
Success Probability
2^{26} Sessions



Success Probability
2^{27} Sessions



Success Probability
2^{28} Sessions



Success Probability
2^{29} Sessions

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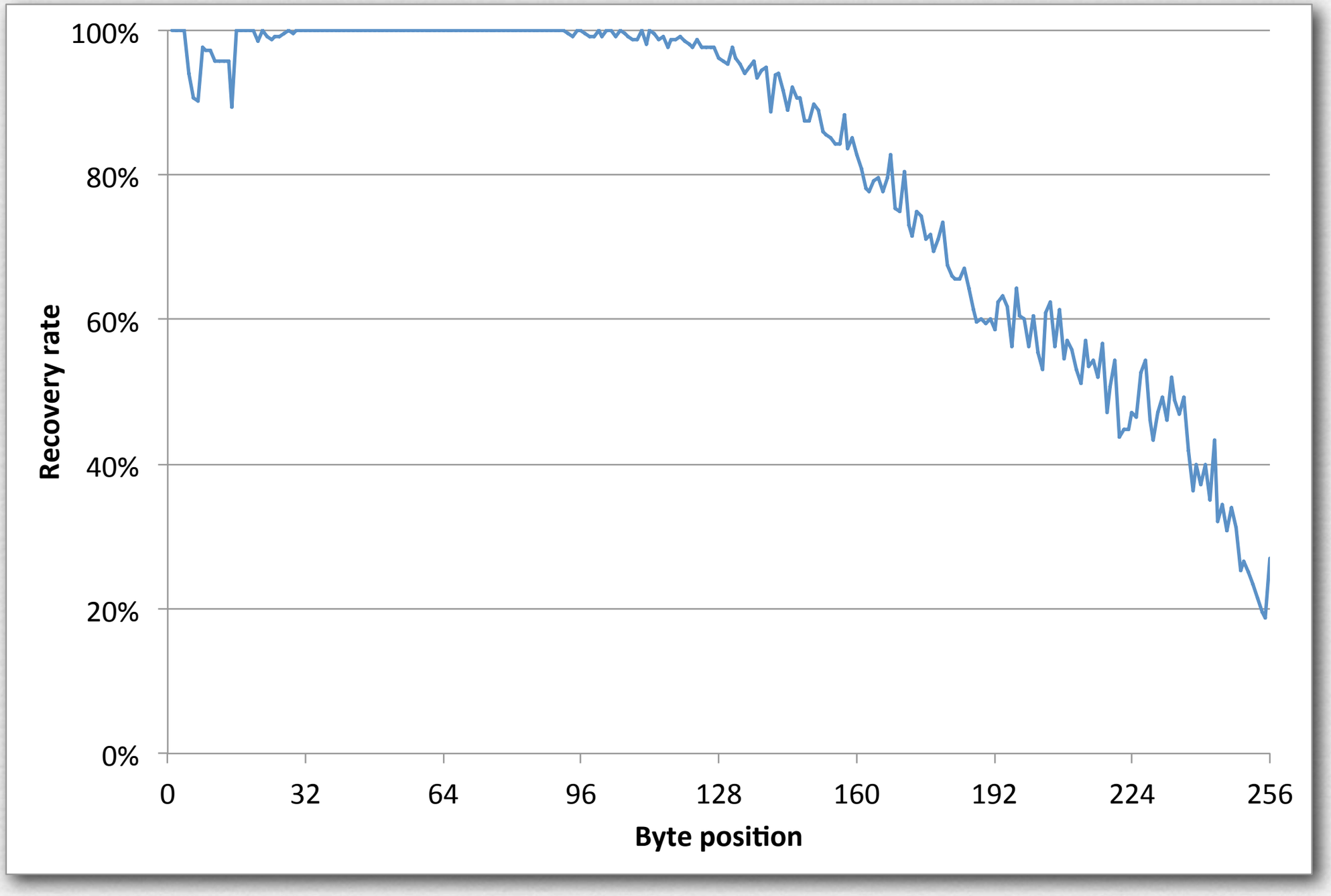
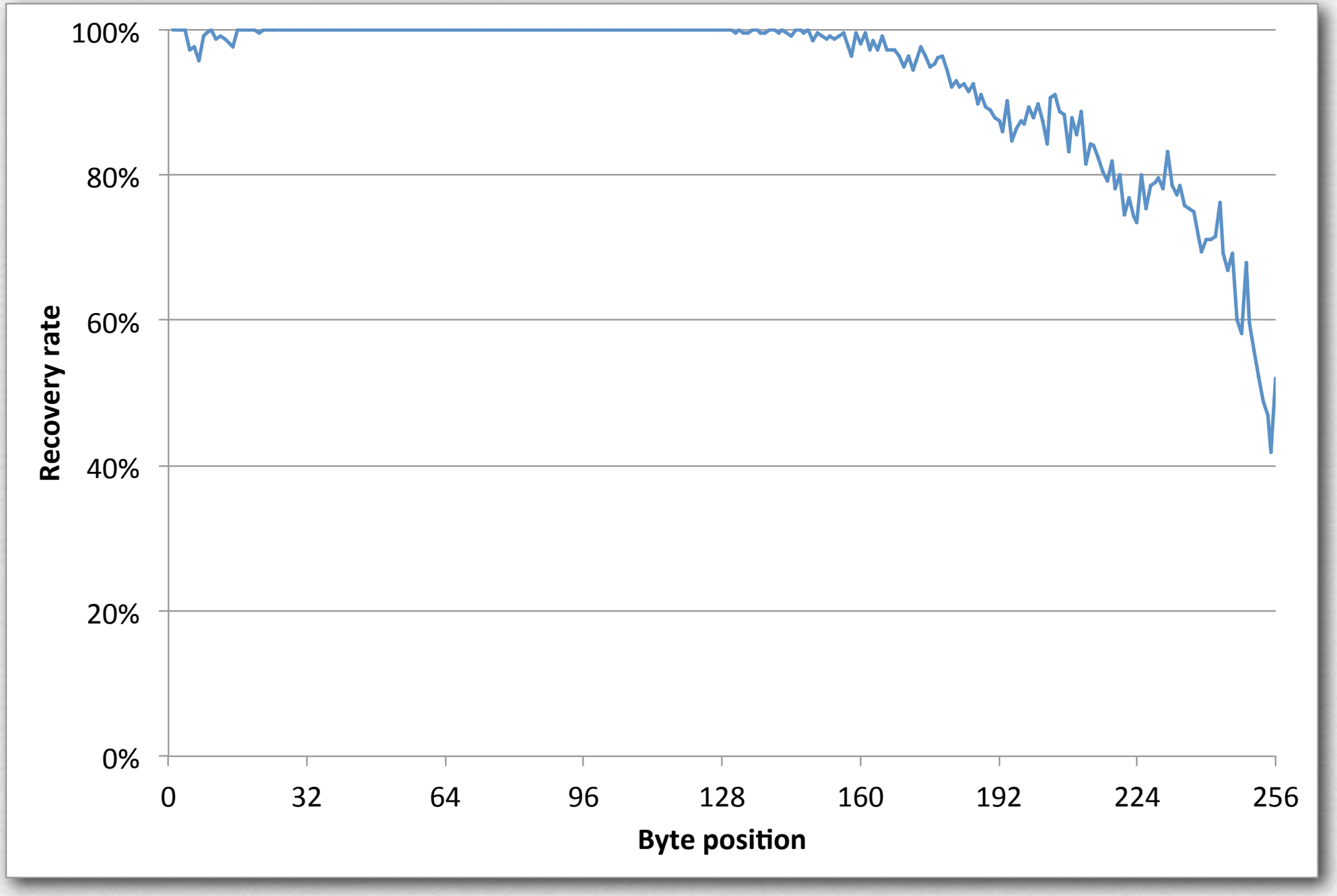
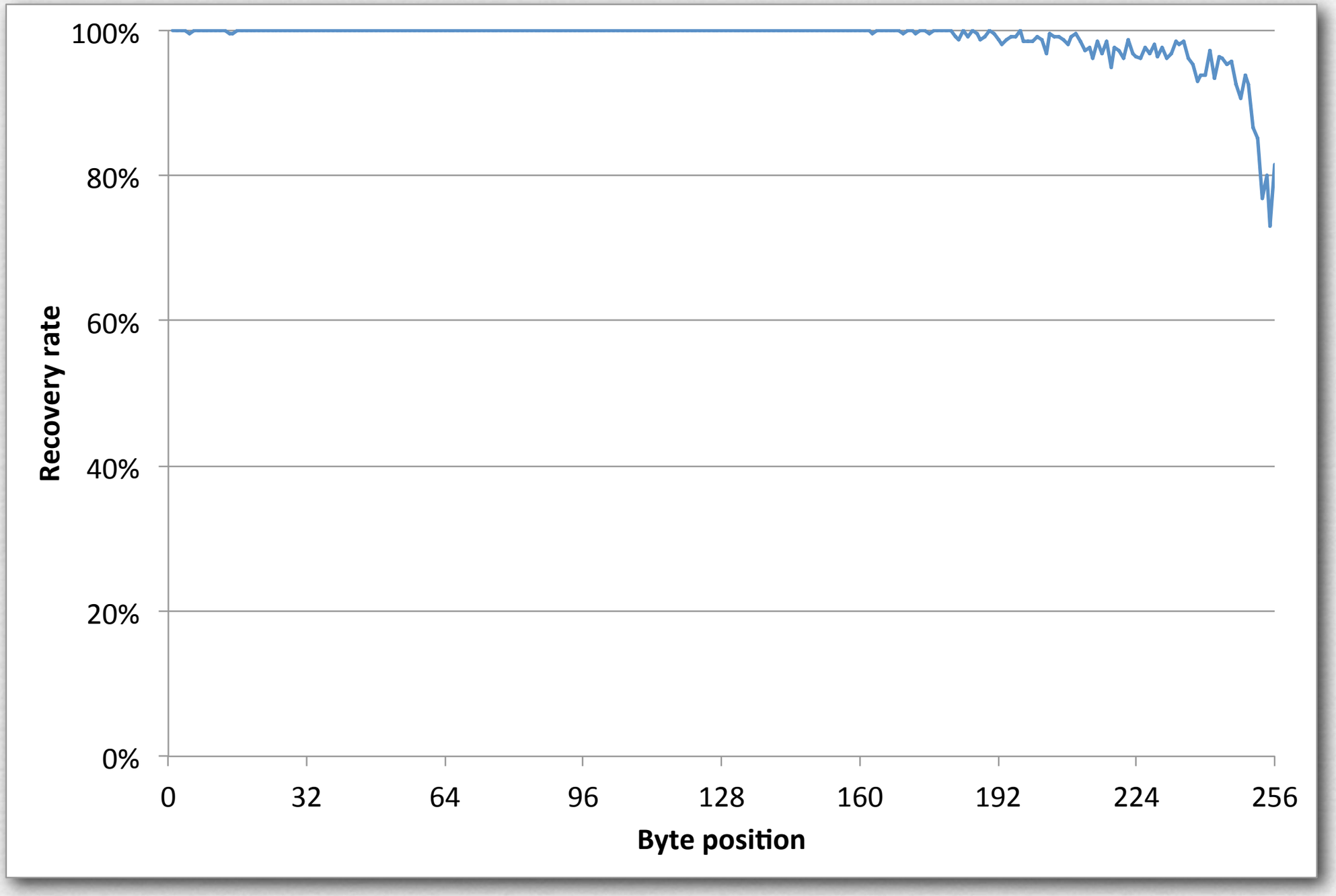


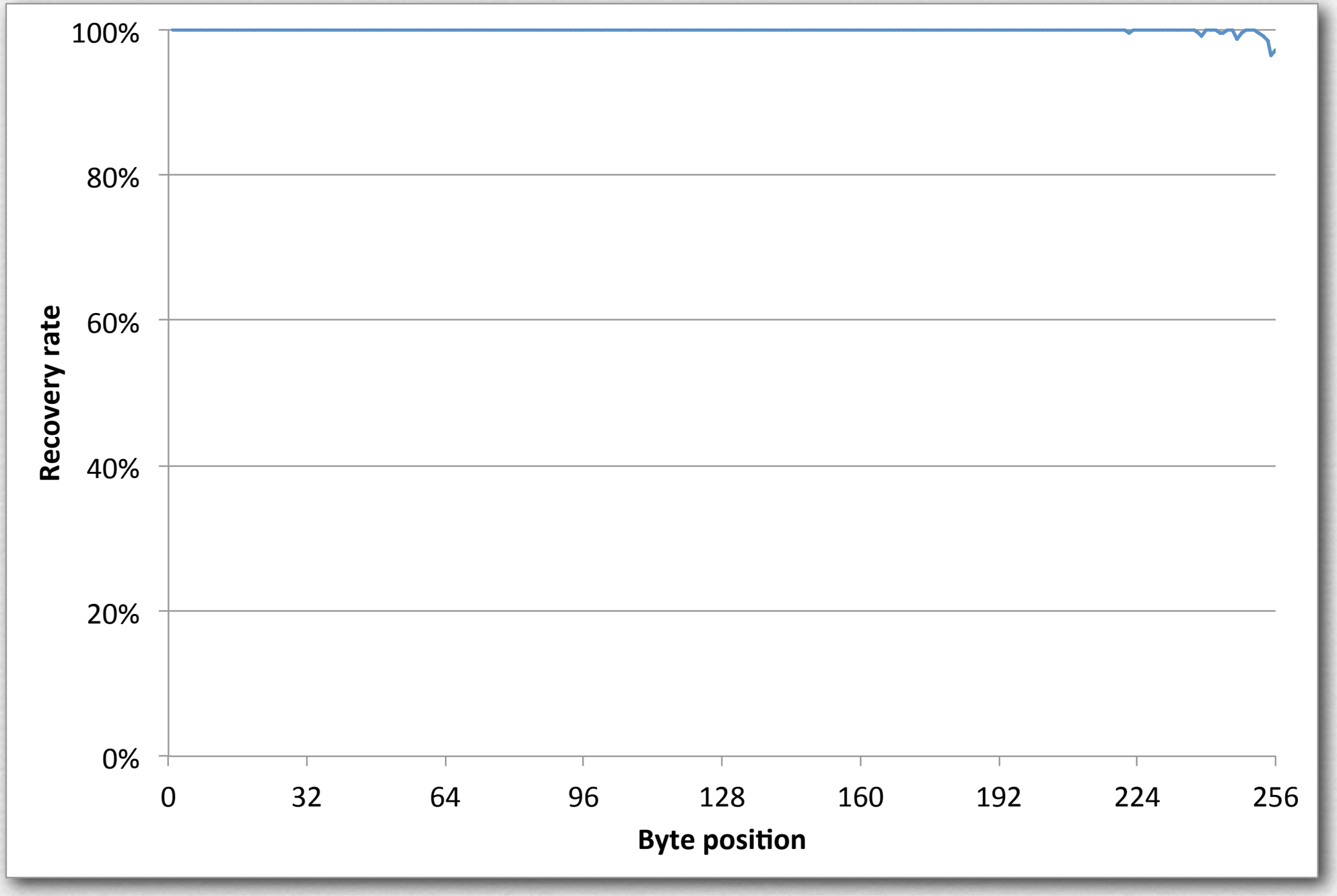
Success Probability
2^{30} Sessions



Success Probability
2^{31} Sessions



Success Probability
2^{32} Sessions



Second Attack

Double-byte
“long term” biases

+

⇒

TLS plaintext
recovery
(any bytes)

Second Attack

- Beyond byte position 256?

Double-byte "long term" biases +  ⇒ TLS plaintext recovery (any bytes)

Second Attack

- Beyond byte position 256?

Double-byte "long term" biases + 

⇒ TLS plaintext recovery (any bytes)

- Interested?

http://isg.rhul.ac.uk/tls/ Google TLS + RHUL

Second Attack

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Double-byte "long term" biases +  ⇒ TLS plaintext recovery (any bytes)

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Thank You!