Assignment 8: Research on Cavli C10QM and Proposal of Custom AT Commands

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1. Objective

To research a suitable Cavli IoT communication module, understand its capabilities, and design three custom AT commands with appropriate use cases, syntax, expected responses, and manual interpretations.

2. Module Selected: Cavli C10QM

Overview

The Cavli C10QM is a compact LTE Cat M1/NB-IoT module designed for global IoT deployment. It supports a wide array of industrial and low-power applications such as smart metering, asset tracking, and remote monitoring.

Key Features

- **Cellular**: LTE Cat M1/NB-IoT (1 Mbps downlink/uplink)
- **GNSS**: GPS, GLONASS, BeiDou, Galileo (optional)
- **Interfaces**: UART, USB 2.0, GPIO, I2C, SPI
- **Power**: Ultra-low power consumption via PSM and eDRX
- **Coverage**: Global LTE bands including B1-B28

3. Proposed Custom AT Commands

3.1. 1. `AT+CQMGNSSINFO` – Enhanced GNSS Information Query

Purpose

To retrieve advanced GNSS data such as fix quality, number of satellites, horizontal dilution, and power usage—essential for power-optimized positioning in IoT deployments.

Syntax

AT+CQMGNSSINFO[=<mode>]

Parameter:

- `<mode>` (optional): 0 = Basic, 1 = Extended

Mock Response

```
+CQMGNSSINFO: 3,12.971598,77.594566,920.4,0.0,0.0,1.2,6,28,45.2
+CQMGNSSINFO: UTC=143022.00,DATE=180725,PDOP=2.1,ACCURACY=3.5
OK
```

Manual Interpretation

A 3D fix is achieved using 6 satellites. Accuracy is 3.5m, power consumption is 45.2 mW, indicating efficient GNSS acquisition with minimum battery drain—ideal for tracking and field sensors.

3.2. 2. AT+CQMRATCFG – RAT and Band Configuration

Purpose

To manually configure and prioritize network access technologies (Cat M1 or NB-IoT) and associated bands based on deployment location and operator preference.

Syntax

AT+CQMRATCFG[=<rat_preference>]
AT+CQMRATCFG="CATM1","B1,B3,B20"

Parameter:

- <rat_preference>:
  - 0 = Cat M1 only
  - 1 = NB-IoT only
  - 2 = Cat M1 preferred
  - 3 = NB-IoT preferred
  - 4 = Auto

Mock Response

+CQMRATCFG: CATM1,B1,B3,B20
+CQMRATCFG: NBIOT,B8,B20
+CQMRATCFG: PREFERENCE=2
OK

Manual Interpretation

The module is configured to prefer Cat M1 over NB-IoT, with priority on Bands 1, 3, and 20. This enhances connection speed and latency in regions with strong Cat M1 coverage.

3.3. 3. AT+CQMNETSTAT – Extended Network Status

Purpose

To provide deep network diagnostics and registration status for embedded systems with weak signal, including SNR, RSRP, and coverage class.

Syntax

AT+CQMNETSTAT[=<detail_level>]

Parameter:

- <detail_level>: 0 = Basic, 1 = Extended

Mock Response

```
+CQMNETSTAT: 1,8,20,-78,-108,-12,8,0,14,1280
+CQMNETSTAT: PLMN="26201",EARFCN=6300,PCI=245,TAC=AB12
+CQMNETSTAT: ECL=0,CE_LEVEL=0,REP_FACTOR=1,COVERAGE_CLASS=A
OK
```

3.3.1 Manual Interpretation

Device is registered on home network (PLMN 26201), operating on Band 20. Signal quality is good (RSRP -108 dBm, SNR 8 dB), and coverage is normal (CE level 0). DRX cycle = 1280 ms.

4. Error Codes

Common CME Errors for Custom Commands:

- `+CME ERROR: 3` – Operation not allowed
- `+CME ERROR: 102` – GNSS not enabled
- `+CME ERROR: 104` – RAT not supported
- `+CME ERROR: 106` – Power saving conflict

5. Conclusion

The Cavli C10QM provides robust, low-power, and globally compatible wireless connectivity for embedded IoT solutions. The custom AT commands proposed in this assignment target power efficiency, GNSS accuracy, and cellular optimization, crucial for scalable LPWAN deployments. With thoughtful syntax, power-aware design, and well-interpreted mock responses, these commands are ready for implementation, validation, or simulation testing.