APPENDIX 6
DATA UPLINK & MODULATION

Seismic Data Link (BOX Remote Unit to BOX Base Station)

The uplink data transmission rate is 60,000 bits/s, this comprising:

Seismic Data Rate: 48000 bits/s and
Overhead (packet framing and error detection): 12,000 bits/s

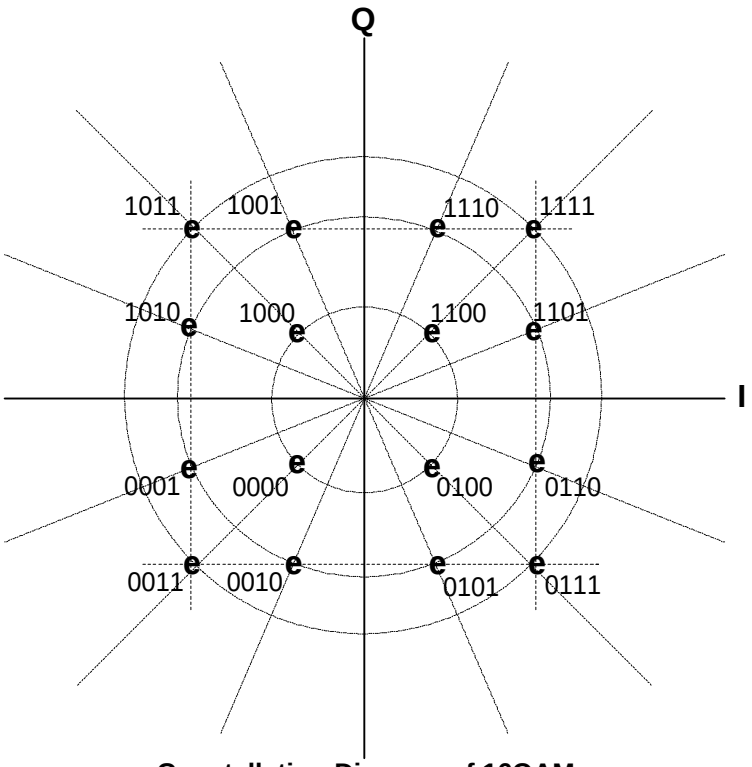
Parameters of the seismic data uplink are summarised below:

Access method:	Frequency Division Multiple Access (FDMA)
Data format	16QAM in each of two sub-bands with feed forward signal regeneration from pilot tones
Design Error rate	10^{-6} BER
Pulse shaping:	Root-raised cosine at transmit and receive locations
Channel raw data rate:	60,000 bits/s
Sustained message throughput:	48,000 bits/s
Symbol rate:	7,500 symbols/s on each channel sub-band
Error detection method:	Parity of 8 bit blocks
Error detection:	Odd number of bit errors in 8-bit block
Error correction:	None
Data bandwidth:	19200 Hz [$(1+\alpha) \times$ data Nyquist limit]
Lower sub-band center	-5172 Hz, relative to channel center
Upper sub-band center	+5172 Hz, relative to channel center

Modulation

The modulation format used for uplink transmission is 16QAM. A constellation diagram of this format is shown in figure 7 overleaf.

The bit mapping of each constellation point is so chosen that any two adjacent points differ in only one bit. Since a symbol received in error is most likely to be received as an adjacent symbol, this choice of symbol mapping serves to minimise error rate.



Constellation Diagram of 16QAM showing 4-bit combinations
Figure 7