

# Memotec Mobile DCME Systems

The Direct Line to Increase Profits  
DCME solution for Mobile Operators



3G Migration

Streamline Operating Costs

Increase Revenue Stream

Guaranty Service Integrity

## Memotec Mobile DCME

A solution for reducing costs, increasing capacity and migrating to 3G



Large capacity SDH optical fiber networks are common place in Mobile core networks. However, there are always locations for which fiber is not appropriate or feasible. For those cases, a Mobile Operator has to seek other alternatives – leased lines, microwave or satellite links- to connect equipments (BSCs and MSCs), for which the cost of bandwidth is high, and capacity is limited.

Another dilemma facing mobile operators is the migration of their core network infrastructure. 3G and converged fix/mobile core networks are based on packet (ATM, IP/MPLS) technology, while 2G/2.5G requires a TDM based transmission network. The migration process involves maintaining the co-existence of two transmission networks (TDM and packet), which results in additional cost overhead (network operation costs, transmission equipment like routers and switches). Also, the partition of the underlying transmission infrastructure between TDM and packet causes significant bandwidth inefficiencies.

Memotec's Mobile DCME solutions offer Mobile Operators a simple and easy way to reduce their costs and increase capacity of their non-fiber transmission assets. It also lowers 3G and convergence migration costs through transparently converging 2G core networks into a single packet based network, based on a layered architecture concept.

Using advanced voice compression technology combined with state of the art packet processing, Memotec's Mobile DCME offers a 3G core ready, highly scaleable carrier-grade solution tailored to Mobile Operators needs, delivering up to **16:1 bandwidth reduction on A & E voice trunks**, while preserving voice quality.

### Key Benefits

Best bandwidth efficiency:  
maximize OPEX savings

2G/2.5G/3G network consolidation:  
reduce OPEX/CAPEX

Superior voice quality

Improve network reliability

One stop voice & data transport solution

### Key Features

Up to 16:1 bandwidth compression

Up to 8:1 SS7 traffic optimization

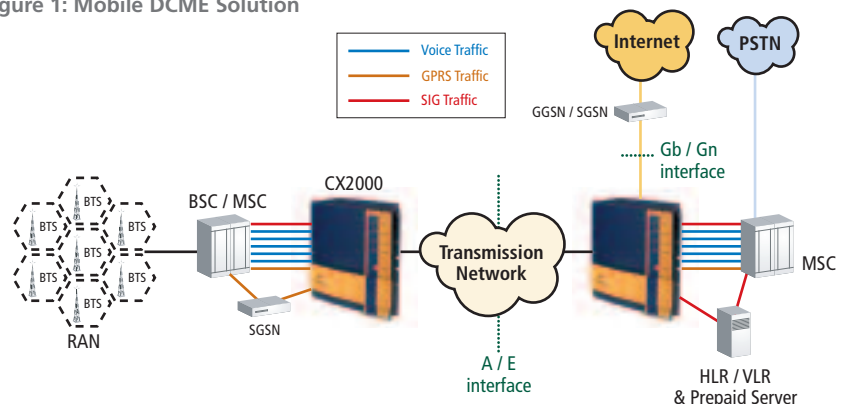
High quality mobile friendly codec

Voice and Data aggregation & compression

Protocol independent backbone

On-board traffic monitoring probe

Figure 1: Mobile DCME Solution



# Quality

## Catering to Mobile Operator's Needs

Cellular networks deserve a dedicated voice compression solution when it comes to optimize A and E trunks. That's because, unlike telephony networks, cellular networks already operate with compressed voice on the Radio Access Network –RAN– and carry a good proportion of data traffic (Signaling, SMS, GPRS/EDGE user traffic) in addition to voice traffic.

Being a key service differentiator, voice quality is a primary concern for Mobile Operators: adding a DCME system in an A or E link may result in severe voice quality degradation –delay, information loss–, if the solution is not engineered properly (for example, mobile to mobile communications needs voice to go through multiple compression-decompression cycles). This further deteriorates if the A/E links is going over satellite, due to the added delay of satellite transmission

Therefore Mobile Operators will require specific features not found in traditional telephony DCME products.

Memotec understands Mobile Operator's requirements and offers a dedicated Mobile DCME solution with a unique feature set that takes care of Mobile Operator's network specific issues and minimizes voice quality degradation. The result is enhanced quality of service, un-compromised flexibility and maximum cost efficiency.



### CHOICE OF THE VOICE CODEC:

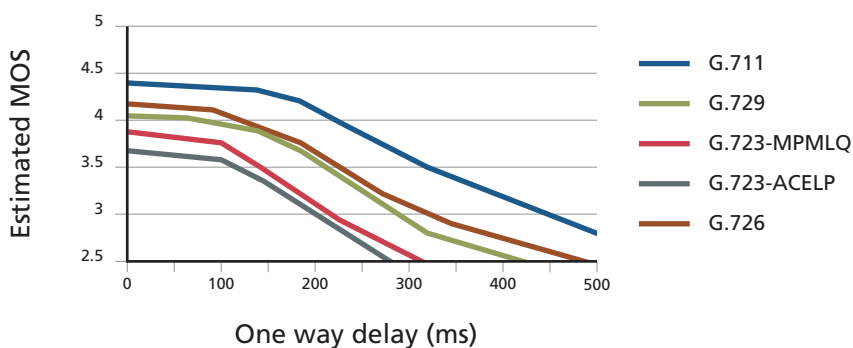
In Mobile networks, it is not all about the compression ratio performance. More important is the resulting quality (MOS score) of the DCME codec combined with the Mobile Radio Access Network (RAN) delays and codecs, which can be significantly different from the codec's nominal MOS score

Memotec's DCME toll-grade voice codec –G.729– delivers a better voice quality when used in tandem operation with GSM codecs and over long delay transmission lines (satellite links, mobile radio links). Starting with a native compression ratio of 8:1, Memotec improves then the compression ratio through silence suppression and pre-emptive bandwidth management techniques, resulting in an impressive 12:1 up to 16:1 bandwidth reduction factor, without further voice quality degradation.

### TRANSCODER FREE OPERATION [TFO]:

Memotec's proprietary voice trunking protocol delivers an end-to-end single voice compression/decompression cycle, whether the voice is carried over multiple satellite hops or a combination of satellite and terrestrial transmission links. This applies in particular to local calls and Mobile to Mobile communications. Memotec's TFO feature guarantees that the voice quality will not be further deteriorated by going through un-necessary additional compression cycles.

### Codec comparison – no packet loss



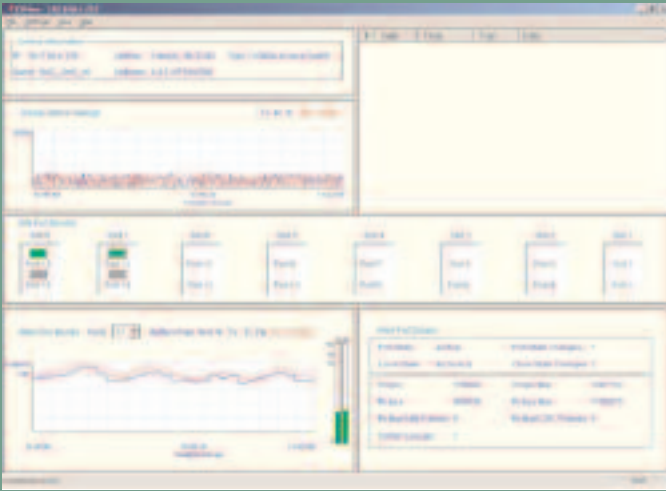


Figure 2: CXMON A/E interface monitoring tool

**ECHO CANCELLATION:**

The quality and performance of the echo canceller is instrumental to the overall voice quality end-user experience, even more when the link is going over long latency satellite links. Memotec has drawn upon its longstanding experience in providing voice compression solutions over satellite network, to implement a trusted, best of breed echo canceller, which has won multiple awards and praises from customers for its voice quality. It also provides up to 64ms echo tail, enough to match any network configuration and situation.

**DATA INTERFACES:**

Mobile communications are not just about voice. Data services play also a key role in the service offering (SMS, IN services, GPRS and EDGE user data services), which also needs to be carried between the BSC and the MSC, or between MSCs. Therefore, a Mobile DCME solution must also supports the various data services and interfaces present at the MSC or the BSC. This implies being able to aggregate, multiplex and compress SS7 traffic, GPRS/EDGE traffic at the Gb (BSC) or Gn (MSC) interface, and IP traffic.

Memotec’s DCME solution offers a wide range of Serial, Frame-Relay, Ethernet, IP and ATM interfaces handling the many types of physical interface, protocol and speeds found in Mobile networks. It also provides loss less line-rate hardware data compression, delivering up to 60% bandwidth reduction, together with a sophisticated SS7 traffic optimization algorithm delivering a 4:1 up to 8:1 bandwidth reduction on SS7 channels.

**REAL-TIME NETWORK MANAGEMENT:**

It is essential for the GSM Operator to know what is the traffic going through the A/E links and how the DCME system handles it, in order to maximize transmission resources efficiency and control quality of service.

CXMON is a software based probe, embedded in the Memotec’s CX device which enables the operator to monitor precisely each voice trunk digital interface with real time graphic visualization of the different traffic being forwarded (signaling, voice, data), and analyze the compression performance of the DCME system.

As a result, CXMON allows the GSM operator to control the quality of service delivered over the backhaul network and fine tune the network efficiency for optimal cost effective utilization.

**3G Migration**

An important issue with any capital investment in Mobile Telecommunications is: can the equipment adapt itself to the next generation, and how will it help migrate my network? Namely, for Mobile Networks DCME solutions:

- Can my system handle the increasing importance of data traffic in my network?
- How my DCME solution will adapt to a packet based (ATM or IP/MPLS) core network, with the introduction of 3G?

Unlike traditional [telephony] DCME solutions which are designed to run on TDM backbone infrastructure, Memotec’s DCME solution can operate on any data network infrastructure. Therefore, Mobile Operators can further reduce costs by running 2G A&E voice trunks on top of the data backbone (overlay mode), be it a 3G or a 2.5G data network

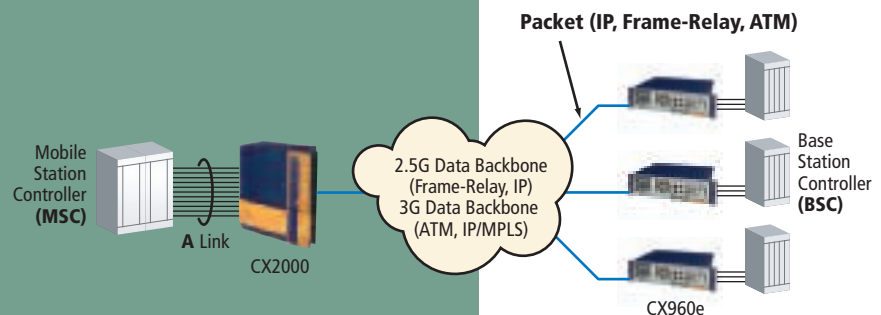
**ADDITIONAL COST SAVINGS INCLUDE:**

- one single network to manage (OPEX savings);
- reduced bandwidth requirements thanks to the benefits of voice and data traffic statistical multiplexing (up to an additional 2:1 factor);
- a better utilization of the network equipment infrastructure (CAPEX savings).

Memotec’s DCME solution includes specific features to manage and guaranty the voice quality when carrying voice trunks over the data network:

- QoS policy management,
- Traffic Prioritization,
- Packet Loss Concealment [PLC],
- Rate adaptative jitter buffer (to compensate the variable jitter introduced by packet networks)
- Improved echo canceller
- Delay resilient codec

Figure 3: 3G Migration - Layered architecture



# Applications:

## 1. Satellite (or leased line) A or E Link Cost Reduction

Many mobile operators who have deployed satellite A or E links, are still carrying voice as plain PCM [G.711] 64 kbit/s channels or ADPCM [G.726] 32 Kbit/s channels. The main reason being the fear of degrading voice quality by using more aggressive voice codecs. However the cost of those links is a heavy burden to the Mobile operator OPEX.

Memotec brings the solution: thanks to Memotec's Mobile DCME unique features, Mobile Operators can now enjoy **12:1 and more** bandwidth reduction on their A/E voice trunks while preserving voice quality.

For example, let's consider an A link of 8 E1s, carrying 240 voice channels and 8 SS7 signaling channels. Assuming a conservative 40% silence ratio, Memotec's DCME solution will reduce the bandwidth required on the satellite link down to **1,300 kbit/s**.

If the Mobile Operator was previously using an ADPCM solution, introducing Memotec's DCME will translate into a **saving of \$25,000 / month (\$300,000 / year)\***, yielding a payback period of a few months.

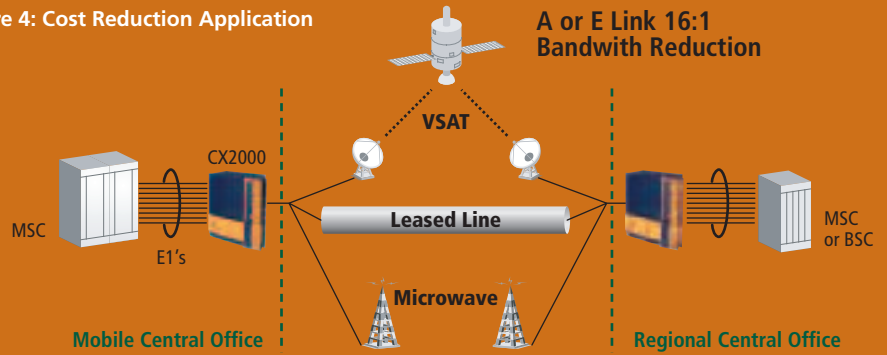
Note that a similar business case could be made for leased line backhaul or congested PDH (E3) microwave links: the same example would reduce the backhaul capacity from 8 E1s (or one E3) to a single E1.

(\*The calculation above assumes a transponder cost of \$3,000/MHz/month, and a 1.6 bit/Hz efficiency (3/4 TPC 8PSK modem with 1.4 spacing).

## 2. Ater to A Link Migration

In an Ater link configuration, the TRAU (Transcoding Unit) is located at the MSC, and voice information is carried between the BSC and the MSC in a compressed format (usually 16kbit/s per voice channel). But as traffic increases, it might become necessary to locate the TRAU at the BSC, thus migrating the Ater link to an A link. Voice being uncompressed in an A link, it occupies a full 64 kbit/s circuit as opposed to 16 or 8 kbit/s in an Ater link: an A link will require at least **4 times more** transmission capacity than an Ater link, thus significantly increasing network OPEX.

Figure 4: Cost Reduction Application



Memotec's MobileDCME brings the solution. Delivering from a 12:1 up to 16:1 voice compression ratio, an A link equipped with Memotec will then require about **3:1 to 4:1 less** transmission bandwidth than the Ater link, thus allowing for significant network OPEX savings, or additional backhaul capacity for future growth and new services.

## 3. A/E Link Backup (disaster recovery)

Transmission infrastructure supporting A/E links shall guarantee the maximum availability and offer protection schemes against network outages. For example, a PDH E3 [34 Mb/s] outage, carrying 480 voice channels, will cost an Operator near \$3,000/hour of revenue loss (at 10c/mn).

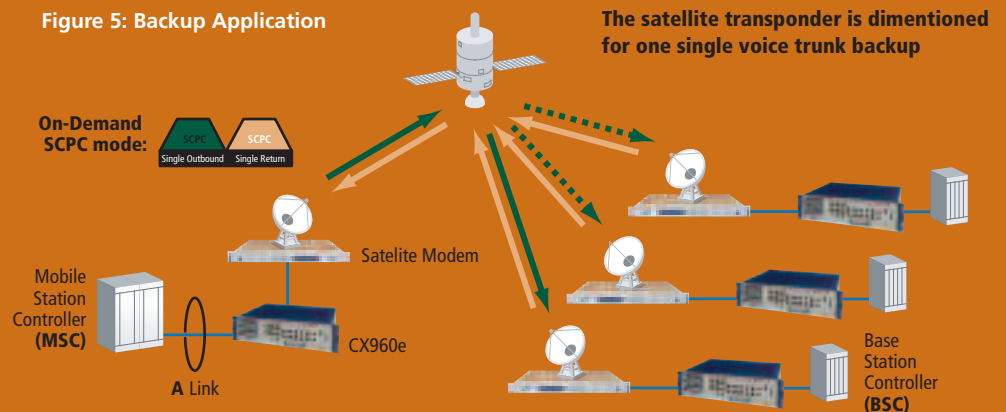
Network outages are particularly sensitive for Mobile operators using 3rd party leased lines networks, or unprotected fiber links (fiber cuts). Those can account for 30% up to 50% of all network faults, and amount to hundred of thousand of dollars of revenue loss for the Mobile Operator. The availability issue is further emphasized as Mobile services are more and more as being a critical public service, adding pressure to increase the network reliability and provision solutions for disaster recovery.

Unfortunately, cost and feasibility of link protection to ensure proper network reliability is often an issue for Mobile Operators.

Memotec's DCME solution addresses this problem: it offers an inexpensive A/E link backup solution based on On-Demand satellite backhaul. The Memotec's solution provides a global backup service for all the Mobile Operator critical A/E links, at a minimum operating cost. Opex is limited to the satellite bandwidth required by only one or a few A/E links after compression, and setup on demand at the location where the link outage happens.

The Memotec's DCME backup solution is best implemented using Comtech's Vipersat satellite modems (www.vipersat.com), which delivers the highest transponder bandwidth efficiency for bandwidth on-demand satellite applications. VMS – Vipersat's NMS system – in conjunction with Memotec's bandwidth management capabilities, also offers superior real-time monitoring functionalities, which enable the operator to accurately and timely tailor satellite resources where they need to be deployed.

Figure 5: Backup Application



MODEL	CAPACITY		
	T1/E1	Voice Channels	I/O module slots
CX900s	1 to 4	60	6
CX960e	1 to 16	240	8
CX2000	4 to 64	960	32

<b>CODECS SUPPORTED</b>	G.711, G.726, G.729
<b>WAN UPLINK</b>	E3 G.703 ATM* T1 or E1 framed/unframed Serial (up to 8 Mb/s) 10/100 Mb/s Ethernet
<b>WAN PROTOCOL</b>	TDM, IP, Frame-Relay, ATM
<b>OPTIMIZATION RATIO</b>	Up to 16:1
<b>A/E LINK SYNCHRONIZATION</b>	Loopback; Through clocking; Optional Stratum2-GPS clock synchronization
<b>A/E DIGITAL VOICE</b>	T1: - Line type: ANSI T1.403 (PRI), AT&T TR62411 (D4), and TR 54016 (ESF) - Encoding: JBZS (AT&T), AMI, B8ZS, ZBTISI, NRZ, NRZI E1: - Line type: CEPT (PRI), G.703/G.704 with or without CRC4 & MF - Encoding: HDB3, AMI, NRZ, NRZi, 75 or 120 Ohms AIS, RAI and NFAS bits relay
<b>DATA &amp; SIGNALING INTERFACES</b>	IP (Ethernet or Serial), ATM, Frame-Relay
<b>SS7 CHANNEL PROCESSING</b>	SS7 channels drop & insert multiplexing; Transparent transport over IP, HDLC frame or TDM with optional FISU and PCR mode MSU spoofing
<b>GPRS/EDGE BSC (Gb) AND SGSN/GGSN (Gn) INTERFACES</b>	Interface: T1/E1, Serial, Ethernet Protocol: Frame-Relay, IP, ATM (AAL5)
<b>OPTIONAL INTERFACE</b>	TDM channelized T1/E1 with Drop&Insert; Serial Synchronous (up to 8 Mb/s); 10/100 Mb/s Ethernet; Analog voice (order wire); Abis/Ater with up to 3:1 bandwidth optimization
<b>POWER SUPPLY</b>	85-264 VAC at 50-60 Hz, or DC -48V with optional 1+1 redundancy
<b>SIZE</b>	3U, 19" rack mount chassis (except CX2000: 12U)
<b>SYSTEM REDUNDANCY</b>	1+1* (power supply, fan, fabric, CPU)
<b>ENVIRONMENTAL</b>	Operating Temperature: 0° to 45° Celsius; Storage Temperature: -40° to +80° Celsius; Operating Humidity: 0 to 95%, non-condensing
<b>TELECOM CERTIFICATIONS</b>	USA FCC Part 68, IC, Canada CS03, CTR 2, 3, 4, 12, 13 and 21, TS 002, 003, 016, 031 and 038
<b>EMC CERTIFICATIONS</b>	FCC Part 15 Class A, EN55022 Class A, AS3548 Class A, EN55082-1
<b>SAFETY CERTIFICATIONS</b>	IEC950, UL1950, CSA, EN60950, TS001, UL, TUV, TUV GS

\*available on CX960e and CX2000 only

## Memotec Mobile DCME Systems: The direct line to increase profit

New services, technology migration, traffic growth, decreasing ARPU, inflating network infrastructure costs, improving operating margins: these are the multiple challenges facing Mobile Operators today. Memotec's Mobile DCME solution can help address those challenges and deliver solutions to Mobile Operator's current network issues, with a quick payback period. Whether you are using terrestrial landline, microwave transmissions or satellite links, be a traditional Mobile Operator or a MVNO, we do have the optimal network solution for your network, which will directly reduce costs and generate immediate profits.

Please contact the Memotec dedicated support team (COE@memotec.com) or call our local representative (www.memotec.com) to find out more on how Memotec Mobile DCME systems can increase your profits.

## About Memotec

Memotec is the pioneering supplier of cellular network satellite backhaul and GSM network optimization solutions. Memotec's flagship product, the CX Gateway, enables GSM operators to reduce dramatically network operating expenses by cutting transmission costs, both at the access (BTS/Abis interface) and network core (MSC-BSC A/E interfaces).

Leveraging the satellite modem expertise of parent company, Comtech EF Data, Memotec's CX Gateway offers GSM operators a new solution paradigm for deploying profitable voice & data services in rural, low density or geographically challenged areas.

Memotec is headquartered in Montreal, Canada, with offices around the world, and is a wholly owned subsidiary of Comtech EF Data Corp., and its parent company Comtech Telecommunications Corp (NASDAQ: CMTL).

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