



Supplementary Notes to Horizon II *macro*

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INTRODUCTION:

- The Horizon II is the next generation of hardware to replace our existing BTS Hardware, at the same time supporting extra radio capacity within the same footprint.
- We can now have a 24 carrier BTS all within 2 stackable cabinets achieved by using the double density CTU II radio.
- Horizon II is an extremely high-powered base station (highest MOT ever done) and basically an enhancement to the GSM System.
- Software configurable to operate 2 channels at standard power, or 1 channel at double power.
- Incorporates an enhanced low-cost site controller board supporting Horizon 2, Horizon 1 and Mcell BTSs for backwards compatibility.
- Horizon II *macro* is fully interoperable and interchangeable with Horizon I systems. This coincides with the phasing out of the CTU.

Horizon II *macro* –v- Horizonmacro functionality

Comparing the functionality of the main components of the Horizon II *macro* with equivalent components of the previous generation Horizonmacro I.

Horizon II <i>macro</i> vs. Horizonmacro I		
Function	Horizon II <i>macro</i> component	Horizonmacro I equivalent
Input power conversion units (max fitted)	PSU (4)	PSM (3)
Power to transceivers and signal routing	Backplane	BPSM and backplane
Transceivers (max fitted)	CTU2 (6)	CTU (6)
Main processor module (Max fitted)	HIISC (2)	MCUF (2)
Processor module connection to transceivers in another cabinet	Internal XMUX in HIISC (1) and separate site expansion boards (1 or 2)	Internal FMUX in MCUF (2) or external FMUX (2)
Slave cabinet multiplexer	XMUX	FMUX
Rx components (Max fitted)	SURF2 (2)	SURF (1)
Transceiver to Rx components	SURF2 harness	SURF harness
TX blocks (Max fitted internally)	DUP, HCU and DHU (6)	DCF, TDF, DDF and HCU (3)
DC power supply for digital modules (Max fitted)	Integrated in HIISC supplied via backplane	BPSM (2)
Equipment protection/isolation	CBC	CBM
Links to terrestrial network (Max fitted)	Internal NIU in HIISC	NIU (4)
Alarm Handling E1/T1 links	Alarm Module *** CIM/T43 or BIM/BIB	Alarm Module CIM/T43 or BIM/BIB

NOTE : *** Alarm boards are not interchangeable
 CTU is not forward compatible with the HMII cabinet and is not supported.

CTU2

The new CTU2 provides the following functionality:

- Double density carrier support
- Backwards compatibility with current Horizonmacro platform (with some restrictions)
- Support of 900Mhz CTU2
- Support of 1800Mhz CTU2

The Double Density Capable CTU2 Hardware is capable of operating in Dual Carrier Mode or Single Carrier Mode under software control. There is a difference between the transmit power capabilities of a XCVR in SDM or DDM.



CTU2 RF Power Output

CTU 2 RF power output (installed in Horizon II <i>macro</i> cabinet)			
CTU2 configuration	Combining	Output power (+/- 2dB)	
		EGSM 900	DCS1800
Single density	No external combining	63 W	50 W
Double density	No external combining	20 W	16 W
2 x double density	1 internal + 1 external stage hybrid combining	9 W	7 W

CTU 2 RF power output (installed in Horizonmacro cabinet)			
CTU2 configuration	Combining	Output power (+/- 2dB)	
		EGSM 900	DCS1800
Single density	No external combining	40 W	32 W
Single density	1 external stage hybrid	20 W	16 W
Double density	No external combining	10 W	10 W
2 x double density	1 internal + 1 external stage hybrid combining	5 W	5 W

The CTU2 transceiver has the ability to support two logical carriers within a single transceiver unit.

The number of carriers to be supported by a CTU2 is determined from the database.

The CTU2 operates in single or dual carrier mode within a Horizonmacro or Horizon II *macro* cabinet. Therefore, it is possible that a single Horizonmacro or Horizon II *macro* cabinet can now support a maximum of 12 carriers, if all of the transceivers within the Horizonmacro/Horizon II *macro* cabinet are CTU2 operating in dual carrier mode.

However, when operating in dual carrier mode there are some restrictions on the operation in the Horizonmacro and Horizon II *macro* cabinet types.

- The BSS in which the Horizonmacro cabinet resides must be running the current software release for Horizon II *macro* (1670.xx). If the BSS is running software release prior to the addition of support for the CTU2, the CTU2 will not be able to be brought into service. If this fault were to occur, the H2SC/CTU2 would have to be returned for repair.
- To prevent this unrecoverable fault occurring in the field, the H2SC and CTU2 contains self-preservation code, which will prevent a software release prior to 1670.xx being downloaded

Single Carrier Mode:

- In Single Carrier mode, the CTU2 is similar to those of a CTU. The CTU2 can be used as a replacement (FRU) for the CTU within a Horizonmacro cabinet.

```
MMI-RAM 0115 -> disp_eq 60 dri 1 0
```

```
DRI identifier: 1 0
DRI Density [dri_density]: SINGLE
Cabinet identifier: 0
Type of connection to the BTP: MASTER
Port to which the TCU is connected [tcu_port]: 1
RTF identifier [pref_rtf_id]:
GSM cell ID where the DRI appears: 123 99 4 62
Antenna select number for this cell [antenna_select]: 2
Tuneable combining used: No
The diversity flag for this DRI is [diversity_flag]: 0
The fm cell type is [fm_cell_type]: 0
```

```
MMI-RAM 0115 -> disp_eq 63 dri 2 0
```

```
DRI identifier: 2 0
DRI Density [dri_density]: DOUBLE
Associated DRI identifier: 2 1
Cabinet identifier: 0
Type of connection to the BTP: MASTER
Port to which the TCU is connected [tcu_port]: 4
RTF identifier [pref_rtf_id]:
GSM cell ID where the DRI appears: 123 99 4 72
Antenna select number for this cell [antenna_select]: 3
Tuneable combining used: No
The diversity flag for this DRI is [diversity_flag]: 1
The fm cell type is [fm_cell_type]: 4
```

Dual Carrier Mode:

CTU2 supports two carriers when operating in dual carrier mode. When the CTU2 is operating in dual carrier mode within a Horizonmacro cabinet the following restrictions apply;

- **Baseband Hopping** – Baseband hopping is not allowed in some scenarios. The baseband hopping restrictions on the CTU2 apply when the controlling cabinet within the BTS is a Horizonmacro or M-Cell cabinet. The table below shows Baseband Hopping support for CTU2.

	Controlling cabinet	M-Cell or Horizonmacro				Horizon II <i>macro</i>			
	Extension cabinet	None	M-Cell	Horizon macro	Horizon macro2	None	M-Cell	Horizon macro	Horizon macro2
XCVR Type									
CTU2 - SD		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CTU2 - DD		No	No	No	No	Yes	Yes	Yes	Yes

- **Output Power** - Maximum output power capabilities (at the cabinet antenna connector) are reduced when operating in Dual Carrier Mode. This is due to internal combining within the CTU2.
- **Remote Tune Combining** – The use of an RTC device with a Double Density XCVR in Dual Carrier Mode is not possible as the XCVR contains two carriers multiplexed onto a single RF output.
- **Cell Restrictions** – In Dual Carrier Mode, both of the carriers supported on the CTU2 must reside in the same cell because there is only a single RF output on the CTU2. In addition, as the CTU2 can only support a single frequency band, the carriers must also reside in the same zone in a Dual Band Cell.

Power Supply Unit (PSU):

The power consumption of a CTU2 is greater than that of a CTU. When using CTU2's in a Horizonmacro cabinet it is recommended to use 3 PSU's. The following rule of thumb applies:



The cabinet power requirements come in 3 variants:

<u>Horizon II <i>macro</i> cabinet power supply requirements</u>		
Nominal Voltage	Voltage supply range	Current supply maximum
+27 V dc (negative earth)	+19.5 to +30 V dc	64 A (at nominal voltage)
-48 V dc (positive earth)	-39 to -72 V dc	36 A (at nominal voltage)
120/240 V ac (50 to 60 Hz)	88 to 270 V	7.5 A (at nominal voltage)

There are five alarm conditions for each PSU:

- Output Overvoltage
- Output undervoltage
- Input undervoltage
- Overtemperature
- Fan failure

PSU Operation configuration	
Number of PSUs	Maximum load capability
2	Upto 3 CTUs
3	Upto 6 CTUs
4	Redundancy and power load sharing

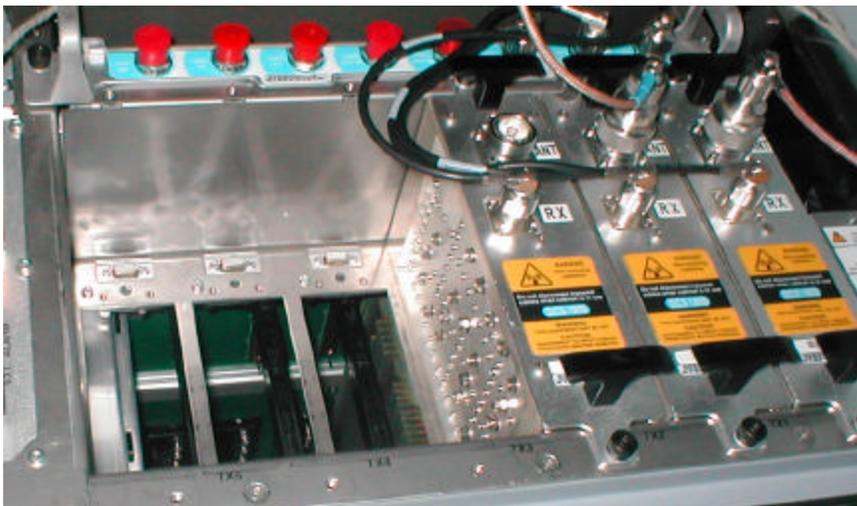
FAN Unit

Three fan units located beneath the CTUs and digital modules provide cooling for the cabinet. Each unit contains two fans and provides cooling for the whole cabinet, except for the PSUs and SURFs.

If one fan fails, the other two compensate for the loss. Three cabinet Temperature sensors are located above the transceiver unit. One sensor to trigger at 70 deg C (Overtemperature Alarm) and a further two sensors to trigger at 85 deg C. (Shutdown Alarm) It requires both sensors to alarm at 85 deg C before shutdown procedures happen. The Alarm Board and Site Controller process the alarm.

Tx Blocks

Up to 6 Tx blocks can be located in the Tx block basket on top of the cabinet.



There are 3 types of internal Tx blocks.

DUP –	Duplexer (one Antenna serves one CTU2 for both Tx and Rx)
HCU –	Hybrid Combiner Unit (Combines two CTU2s Tx outputs for input to DUP. Upto 4 carriers (DDX) combine into one antenna.
DHU –	Dual Hybrid Combiner Unit. Basically two HCUs. 3 Tx inputs from CTU2 (6 carriers) combined onto one antenna.

Battery Backup Hold-up unit: (not yet available)

Fitted into Slot 0 of the PSU rack of AC cabinet only. Can give upto 2 to 3 seconds of power backup in the case of AC mains failure on full load.

HORIZONMACRO II CABINET

The New Horizon II *macro* BTS hardware will provide the following functionality,

- **Support of 6 double density CTU2**
- **Support of 900MHz only cabinet**
- **Support of 1800MHz only cabinet**
- **Support of MCUF replacement – H2SC**
 - **Integrated NIU**
 - **Integrated FMUX**
 - **E1 support**
 - **Enhanced E1 Redundancy**
 - **Increased removable flash media**
- **XMUX**
- **Site I/O Panel**
- **Increased RSL functionality**
- **Interoperability with current M-Cell and Horizonmacro products,**
- **Compact Digital Module**
- **H2-SURF**
- **RTC**
-

Horizon II *macro* Site Controller (H2SC)

The **Horizon II *macro* Site Controller (H2SC)** acts as the main processor card within the Horizon II *macro* cabinet. It performs all of the functionality as the MCUF does when it resides in a Horizonmacro cabinet. The H2SC also supports a number of enhancements/limitations:

- **Backwards compatibility with MCU/MCUF**

The H2SC is not backwards compatible with the MCUF/MCU. Placement of a H2SC within a Horizonmacro/M-Cell cabinet is not supported. Also, placement of a MCU/MCUF within a Horizon II *macro* cabinet is not supported.

- **Integrated NIU**

The H2SC provides the NIU functionality integrated onto the H2SC card, removing the need for the multiple NIUs. The integrated NIU device supports E1 spans only.

- **Integrated FMUX**

The H2SC will support three integrated FMUX devices. This will mean that to expand a single Horizon II *macro* cabinet site into a four cabinet site will require the addition of no further hardware devices in the controlling cabinet.

- **E1 support**

The integrated NIU on each H2SC will support six E1 connections, without utilizing the redundant NIU functionality on the redundant H2SC (if present).

- **Enhanced E1 Redundancy**

The six E1 terminations are routed (via Site I/O panel) to either the primary or redundant NIU device on the respective H2SC, dependant on which H2SC is the master controlling processor. This effectively provides a greater degree of isolation between the primary and redundant elements within the Horizon II *macro* cabinet, as the primary and redundant H2SC do not have to share the NIU resources when configured to their maximum capability.

- **Increased removable flash media capacity**

The removable Compactflash media device associated with the H2SC has an increased capacity of 32Mb, compared to the old linear *flash* 20Mb.

Because of differences (size and format) the H2SC removable flash media device is not backwards compatible with the MCUF/MCU. In addition, the MCUF/MCU removable flash media device is not forward compatible with the H2SC.

XMUX

To allow the Horizon II *macro* cabinet to be used as an extension cabinet it must provide multiplexing of the data to and from the controlling cabinet. A new XMUX card was introduced to provide the multiplexing functionality. The XMUX card slots into the H2SC slot in the digital card cage. The XMUX interfaces with the controlling cabinet at the BTS site, whether it is a Horizon II *macro*/Horizonmacro/M-Cell cabinet.

The XMUX is not backwards compatible with the FMUX and placement within a Horizonmacro/M-Cell cabinet is not supported. Similarly, placement of the FMUX card within the Horizon II *macro* cabinet shall not be supported.

Site I/O Panel

Within the Horizon II *macro* cabinet, the fibre connectors are consolidated onto the Site I/O panel. All fibre connections are terminated on the Site I/O panel and routed (via the backplane) to the associated device (H2SC or XMUX).

The Site I/O panel is also responsible for termination of the E1 span connections.

Redundancy

Redundancy is determined by the complement of HIISCs in the master cabinet. If the cabinet contains two HIISCs (1 + 1 redundant), two XMUXs must be installed in each Horizon II *macro* slave cabinet and two site expansion boards are also required in the master and each slave cabinet.

Enhanced RSL capabilities

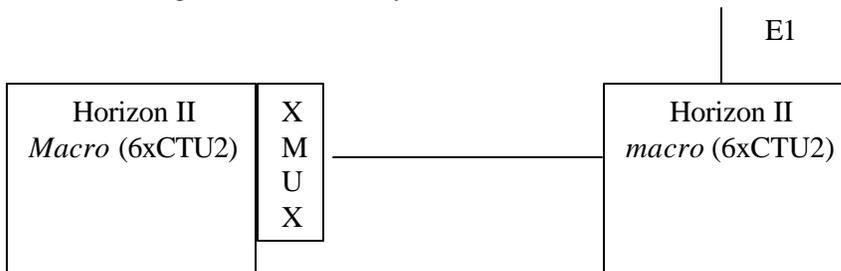
The integrated NIU on the H2SC supports upto a maximum of six E1 spans. The operator can equip up to a maximum of six RSL on the six E1 spans, with a maximum of four RSL devices per span.

The RSL devices can either be provisioned on 16kbps or 64kbps channels.

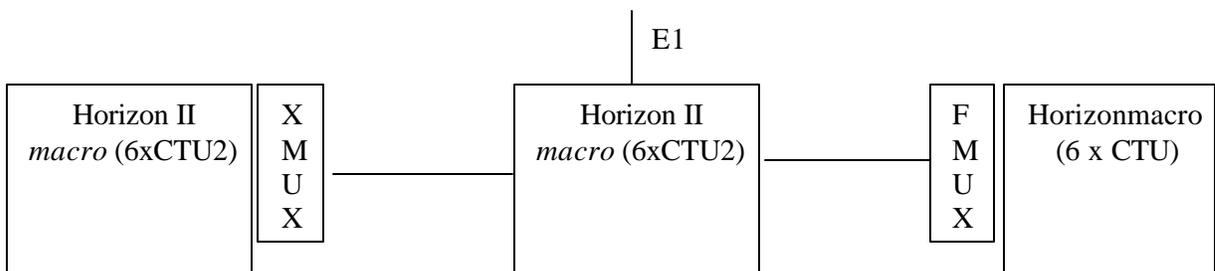
Interoperability with current M-Cell and Horizonmacro products

The Horizon II *macro* BTS platform can be used as a controlling and extension cabinet within sites with a mixture of M-Cell and Horizonmacro equipment. There are no restrictions on the mixture of cabinets allowed in a site. However the maximum number of carriers supported within a BTS site is still limited at 24 carriers.

Therefore, a 24-carrier site can be implemented with two Horizon II *macro* cabinets containing 12 double density transceivers.



Two Horizon II *macro*'s expanded.



Horizon II *macro*, expanded to a Horizon II *macro* and a Horizonmacro.

Digital Module Layout

The consolidation of functionality onto the H2SC within the Horizon II *macro* cabinet allows the reduction of the size of the Digital Module due to the removal of slots required for a number of FRUs (NIU/FMUX).



Alarm Board

The Alarm Module is situated in the Digital Module Layout next to the Site Controller. It provides External alarm monitoring from the cabinet via the backplane.

It also receives inputs from:

- Cabinet PSUs
- Environmental control devices. (Overtemperature)
- Customer defined alarms (EAS)
- Antenna VSWR monitoring. (Via Tx Blocks)

H2-SURF (Sectorized Unified Receiver Front-end)

The H2-SURF within a Horizon II *macro* cabinet provides the same functionality as the SURF within a Horizonmacro cabinet. There are two versions of the H2-SURF, 900Mhz and 1800Mhz. There are four RF connections from the CTU2, Ports A, B, C and D. Ports A and B for a single Surf and C and D connected to a second surf for 4 branch diversity. The H2SURF also includes a number of hardware enhancements to support extra functionality, such as, 4 branch receive diversity.

The VSWR functionality within the SURF is not supported by the H2SURF. A monitor circuit within the duplexer now performs the VSWR functionality, which monitors the reflected power generated by the CTU2.

The RF Loopback functionality provided by the SURF has also been removed from the H2-SURF. The RF loopback functionality is now contained within the CTU2 under software control. Software instructions activate the test hardware, causing a loopback signal to be injected internally into the Rx input of the CTU2 to test its receive section.

The H2-SURF is not backwards compatible with the current SURF. The current SURF is not forwards compatible with the H2-SURF.

Bay Level Calibration

The Bay Level Calibration procedure has been altered with the introduction of the Horizon2 feature. The alterations will affect existing platforms as well as the new Horizon II *macro* cabinet. One of the main changes is that the radio to be calibrated has to be “*in-service*” during calibration. All the other radios in the sector are to be “*locked*”.

- Data Storage Format

The way the Bay Level Calibration is stored is altered to allow a larger dynamic range of adjustment. Alteration of the storage format will mean that conversion from current to new and new to current formats is supported for backwards compatibility. The increase in dynamic range will mean that there will be more memory space required for storage.

For a DD-DCM XCVR the Bay Level Calibration data for both carriers shall be identical. Hence, it is required to only calibrate a single XCVR; the data will then be applied to both XCVR devices.

- Data Storage Location

Currently the Bay Level Calibration data is stored on DSP flash memory within the XCVR and uploaded to the BSS DB when connection to the XCVR is made. DSP flash memory has been removed. The Bay Level Calibration data is stored on BSS software flash memory on the CTU2 (now controlled by RSS) for backwards compatibility purposes. It is also stored on the HIISC card and in CM at the BSC.

```

MMI-RAM 1015 -> disp_cal_data 25 dri 1 0 0

DRI ID: 1 0 0
Data read from transceiver
Store Calibration Data: disabled
Calibration Data (All values in Hex):
Transmit Power Offsets = 0
Receiver System Data:
Antenna Number      1      2      3      4      5      6
-----
c66, c66, c66, b00, b00, b00,
c00, c00, c00, b1a, b1a, b1a,
bcd, bcd, bcd, b4d, b4d, b4d,
bb3, bb3, bb3, b4d, b4d, b4d,
be6, be6, be6, b80, b80, b80,
b9a, b9a, b9a, b80, b80, b80,
acd, acd, acd, b4d, b4d, b4d,
a4d, a4d, a4d, b00, b00, b00,
a80, a80, a80, a80, a80, a80,
a80, a80, a80, a00, a00, a00,
a66, a66, a66, 9b3, 9b3, 9b3,
a1a, a1a, a1a, 966, 966, 966,
9e6, 9e6, 9e6, 900, 900, 900,
99a, 99a, 99a, 880, 880, 880,
980, 980, 980, 800, 800, 800,
94d, 94d, 94d, 780, 780, 780,
b80, b80, b80, 900, 900, 900,
c00, c00, c00, a00, a00, a00,
cb3, cb3, cb3, a80, a80, a80,
d00, d00, d00, ab3, ab3, ab3,
d1a, d1a, d1a, acd, acd, acd,
ccd, ccd, ccd, b00, b00, b00,

```

The CTU2 introduced higher precision CAL Data, which are UWORDS instead of UBYTES. The old radios were calibrated using UBYTES and the new CTU2 radios use UWORDS. Because the CTU can be replaced by a CTU2, we need to store the data in the DB in a common format. We therefore store this in the UWORD format, because otherwise we would loose the added precision.

When the radio is unlocked, and the `disp_cal_data` command is used, we will display the data as stored on the radio, i.e. UWORDS for CTU2, UBYTES for all other. When the radio is locked, we can't access the data on the radio, or determine what type the radio is. Therefore we display the data from the DB in UWORDS, i.e. as it is stored in the DB.

There are conversion formulas to convert the value to/from UWORDS/UBYTEs. These are as follows.

$$\text{BLC16} = (44800 + 256 * \text{BLC8}) / 10;$$

$$\text{BLC8} = (\text{BLC16} * 10 - 44800) / 256$$

These two formulas convert from either CTU or CTU2 format into a gain value:

$$FEG = 2's_complim_ent_16_bit_value / 256$$

$$FEG = 17.5 + (2's_complim_ent_8_bit_value / 10)$$

These two formulas convert from a gain value into either CTU or CTU2 format:

$$2's_complim_ent_16_bit_value = round(FEG * 256)$$

$$2's_complim_ent_8_bit_value = round((FEG - 17.5) * 10)$$

Data Format:

Legacy Format:

8-bit format: 2's compliment, 1/10th dB precision as an offset from 17.5 dB

Range: {4.7 dB to 30.2 dB}

Hex	Decimal	Actual dB
80	128	4.7
81	129	4.8
...
fe	254	17.3
ff	255	17.4
0	0	17.5
1	1	17.6
...
7f	127	30.2

Proposed Format:

16-bit format: 2's compliment, 1/256th dB precision.

Range: {-128.000 dB to 127.9961dB}

Hex	Decimal	1/256 Precision
8000	32768	-128
8001	32769	-127.9960938
...
fffe	65534	-0.0078125
ffff	65535	-0.00390625
0	0	0
1	1	0.00390625
...
7fff	32767	127.9960938

APPENDIX A

Horizon II Rx Cabinet Calibration (Bay Level Calibration)

Proceed as follows:

- 1) Connect the 9-way to 9-way HIISC cable from a PC serial port to the HIISC TTY port.
- 2) On the PC, start the terminal emulator program.
- 3) Lock all DRIs in the sector. At the HIISC TTY, change to Level 3 and at the MMI-RAM> prompt type the following for **each** of the DRIs in the site:

```
MMI-RAM 0115 -> lock_device # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

- 4) If a Tx antenna is not connected to the radio under test, connect a 50 ohm 50 W dummy load to the Tx port.
- 5) Unlock the CTU2 to be calibrated. Change to Level 3 and at the MMI-RAM> prompt type:

```
MMI-RAM 0115 -> ins_device # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

Note: in the case of a double-density radio Rx cabinet calibration only needs to be performed on one of the two DRIs. The other DRI must remain locked.

- 6) Connect a serial port on the PC to the TTY Interface port on the CTU2 to be calibrated using the 9-way to 9-way DSP MMI/RSS cable.
- 7) If necessary, switch the 9-way to 9-way DSP MMI/RSS cable from providing RSS connectivity to providing DSP connectivity.
- 8) At the DSP MMI prompt type:

```
CTU2.carA.ts_0>chglev
```

Then enter the following password:

```
pizza
```

- 9) Enter Calibration Test Mode

```
CTU2.carA.ts_0>cal_test_mode on
Asking SW to acknowledge Cal test mode (8 second
timeout)...PASS
Now entering calibration test mode.
Type 'cal_test_mode off' to exit test mode.
CTU2.carA.ts_0>
```

- 10) Disable all alarms by entering the following:

```
CTU2.carA.ts_0>fm test_mode on
CTU2.carA.ts_0>fm_test block none none 0xff
```

- 11) Turn the radio's transmitters off by typing the following at the DSP MMI prompt:

```
CTU2.carA.ts_0>set_carrier cara
CTU2.carA.ts_0>ts a txp 0xff
CTU2.carA.ts_0>set_carrier carb
CTU2.carB.ts_0>ts a txp 0xff
CTU2.carB.ts_0>set_carrier cara
CTU2.carA.ts_0>
```

- 12) Configure which Rx antennas shall be calibrated with the following command.

```
CTU2.carA.ts_0> cal_config rx_cab_antennas <antenna>
<antenna> <antenna> <antenna> <antenna> <antenna>
```

Where <antenna> is one of the following:

- All** – all antennas.
- 0A** – antenna 0a.
- 1A** – antenna 1a.
- 2A** – antenna 2a.
- 0B** – antenna 0b.
- 1B** – antenna 1b.
- 2B** – antenna 2b.

One to six antenna options can be specified, separated by spaces. The option “all” is equivalent to “0A 1A 2A 0B 1B 2B”. For example, to calibrate antennas 0A and 0B, the following would be entered:

```
CTU2.carA.ts_0>cal_config rx_cab_antennas 0a 0b

Setting RX Cabinet Calibration antennas to: 0A 0B

CTU2.carA.ts_0>
```

In the following example, all antennas are selected to be calibrated:

```
CTU2.carA.ts_0>cal_config rx_cab_antennas all

Setting RX Cabinet Calibration antennas to: ALL

CTU2.carA.ts_0>
```

- 13) Start the Rx cabinet calibration procedure by typing the following at the DSP MMI prompt:

```
CTU2.carA.ts_0> cal_cabinet rx_cab
```

- 14) The following will be displayed on the screen. Included is the SURF2 antenna connector to which the signal generator should be connected –this is highlighted in the sample output below.

```

CTU2.carA.ts_0>cal_cabinet rx_cab
Enabling receive
[c A, b 0] Setting RX diversity switch to double density
(inject carrier A into carrier B)
Enabling transmit
Number of frequency groups = 47

Please connect the signal generator to branch 0A
Press return when the signal generator is connected.

```

- 15) When the signal generator is connected and configured, press ENTER at the DSP MMI prompt.
- 16) The on-screen instructions will inform you of the new signal generator settings, shown highlighted in the sample output below. Be sure to accommodate for any loss in the cables connecting the signal generator to the antenna connector – for example, if the cables have a loss of 1.5dB and you are asked to provide -65.2dBm, you should set the signal generator to -63.7dBm. Make the appropriate adjustments then press ENTER.

```

Please set the signal generator to
POWER -65.2000 dBm
FREQ 1710.8052 MHz

Press any key to continue

```

- 17) The readings for each test frequency will look like this:

```

IQ average reading C0B0: 2565696, 0x00272640
IQ average reading C1B0: 2762909, 0x002a289d
Measured gain: 14.76 (0x0ec2)
Measured gain: 15.69 (0x0fb0)

Frequency group 2 of 47

Please set the signal generator to
POWER -65.2000 dBm
FREQ 1712.4052 MHz

```

Repeat step 16) until all appropriate test frequencies (47 for DCS1800) have been calibrated. The routine will then move to the next antenna to be calibrated, asking you to move the signal generator connection. At this point return to step 14 in these instructions.

- 18) When the procedure is complete, type the following at the DSP MMI prompt:

```
CTU2.carA.ts_0> cal_store_1
```

After a delay of up to sixteen seconds result of the data storage will be printed to the screen.

```
CTU2.carA.ts_0>cal_store_1
PASS

CTU2.carA.ts_0>
```

- 19) To perform TX Cabinet Calibration on the same radio, without resetting the radio proceed to step 11) in section 22).
- 20) After the data is stored, connect the 9-way to 9-way HIISC cable from the PC serial A port to the HIISC TTY and enter the following to lock the CTU2 that was just calibrated.

```
MMI-RAM 0115 -> lock_device # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

- 21) Execute the `clear_cal_data` command at the BSC prompt, which will clear the *previous* TX and RX cabinet calibration data from the BSC, for the newly calibrated radio. In the case of a double-density radio, clear the TX **and** RX cabinet calibration data for **both** DRIs on the radio. Type:

```
MMI-RAM 0115 -> clear_cal_data # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

After executing this command, the BSC will copy the new calibration data from the radio.

- 22) You may now move the 9-way to 9-way DSP MMI/RSS cable to the CTU2 TTY port of the **next** CTU2 to be calibrated then return to step 4) above to bring that radio into service.

Horizon II TX Cabinet Calibration (Bay Level Calibration)

The following procedure is used to calibrate CTU2 transmit output power:

- 1) Connect the 9-way to 9-way HIISC cable from the PC serial A port to the HIISC TTY port.
- 2) At the PC start the terminal emulator program.
- 3) Lock all DRIs in the sector. At the HIISC TTY, Change to Level 3 and at the MMI-RAM> prompt type the following for **each** of the DRIs in the site:

```
MMI-RAM 1015-> lock_device # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

- 4) Disconnect the antenna. Connect a dummy load to the power meter ensuring the meter is fitted with a 50 W element and connect the meter to the Tx output.
- 5) Change to Level 3 and at the MMI-RAM> prompt type

```
MMI-RAM 1015-> ins_device # dri A * 0
```

Where:

#	is the number of the site logged into.
A	is the antenna/relative cell number (0 to 5).
*	is the DRI number of the radio.

- 6) Connect a serial port on the PC to the TTY Interface port on the CTU2 to be calibrated using the 9-way to 9-way DSP MMI/RSS cable. If necessary, switch the 9-way to 9-way DSP MMI/RSS cable from providing RSS connectivity to providing DSP connectivity.
- 7) At the DSP MMI prompt type:

```
CTU2.carA.ts_0>chglev
```

Then enter the following password:

```
pizza
```

- 8) Enter Calibration Test Mode

```
CTU2.carA.ts_0>cal_test_mode on
```

- 9) Disable all alarms by entering the following:

```
CTU2.carA.ts_0>fm test_mode on
FM Test Mode is: ON
```

```
CTU2.carA.ts_0>fm_test block none none 0xff
The following alarm has been: [BLOCK]
Car : 00
TS : 00
FC : 00ff
DFZ : FM
```

```
SFZ : 0x20
Add1: 0x00000000
```

- 10) Turn the radio's transmitters off by typing the following at the DSP MMI prompt:

```
CTU2.carA.ts_0>set_carrier cara
CTU2.carA.ts_0>ts a txp 0xff
CTU2.carA.ts_0>set_carrier carb
CTU2.carA.ts_0>ts a txp 0xff
CTU2.carA.ts_0>set_carrier cara
```

After issuing these commands, the DSP MMI prompt should read "CTU2.carA.ts_0>".

- 11) Configure Tx Cabinet Calibration for the correct combining mode in which it will be used in final installation.

If the radio will be configured as a single density radio:

```
CTU2.carA.ts_0> cal_config tx_cab_mode single
```

If the radio will be configured as a double density radio:

```
CTU2.carA.ts_0> cal_config tx_cab_mode double
```

- 12) To start the Tx bay level calibration procedure, type the following at the DSP MMI prompt:

```
CTU2.carA.ts_0> cal_cabinet tx_cab
```

The following warning will be printed:

```
CTU2.carA.ts_0> cal_cabinet tx_cab

WARNING! All attenuation is about to be removed.
Please ensure that appropriate attenuation
is attached to the CTU2 TX output.

Press any key to continue
```

Check the connections to the antenna output then press ENTER.

- 13) The following information and instructions will be printed.

```
High Power Mode is currently DISABLED (max_tx_bts is >= 0).

High Power Mode will only be used if max_tx_bts database
parameter is set to -1.

If the current site database is accurate, you should run
TX cabinet calibration in the same mode as the database.

Press "H" to calibrate in High Power Mode,
or press "N" to calibrate in Normal Power Mode:
```

DISABLED will be replaced with **ENABLED** if the site is configured for High Power Mode.

If the site is configured for High Power Mode it is recommended that you run TX cabinet calibration in High Power Mode. Press **H** to continue.

If the site is not configured for High Power Mode it is recommended that you run TX cabinet calibration in Normal Power Mode. Press **N** to continue.

14) The following instructions will be displayed:

```
Press U to increase power, D to decrease power
until the target output power is reached.
Then press "Q" when finished.
```

Press **U** to increase the output power or **D** to decrease the output power until the power meter reading matches the target maximum power for the sector.

As the output power is adjusted, a message such as this will be displayed:

```
Setting offset to = 0x13
```

When the desired power has been reached, press **Q**.

15) Store the new TX cabinet calibration with the following DSP MMI command:

```
CTU2.carA.ts_0> cal_store_1
```

After a delay of up to sixteen seconds result of the data storage will be printed to the screen.

```
CTU2.carA.ts_0> cal_store_1
PASS

CTU2.carA.ts_0>
```

16) After the data is stored, connect the 9-way to 9-way HIISC cable from the PC serial A port to the HIISC TTY and enter the following to lock the CTU2 that was just calibrated.

```
MMI-RAM 1015-> lock_device # dri A * 0
```

Where: # **is:** the number of the site logged into.
 A the antenna/relative cell number (0 to 5).
 * DRI number of the radio.

17) Execute the `clear_cal_data` command at the BSC prompt, which will clear the *previous* TX and RX cabinet calibration data from the BSC, for the newly calibrated radio. In the case of a double-density radio, clear the TX **and** RX cabinet calibration data for **both** DRIs on the radio. Type:

```
MMI-RAM 0115 -> clear_cal_data # dri A * 0
```

Where: # is the number of the site logged into.

A is the antenna/relative cell number (0 to 5).
 * is the DRI number of the radio.

After executing this command, the BSC will copy the new calibration data from the radio.

- 18) You may now move the 9-way to 9-way DSP MMI/RSS cable to the CTU2 TTY port of the **next** CTU2 to be calibrated.

If RX calibration is to be performed on the next radio, then return to step 4) of the RX section above to bring that radio into service.

If TX calibration *only* is to be performed on the next radio, then return to step 4) of the TX section.

If all calibration is complete, proceed to the next step.

- 19) Remove the power meter and reconnect the antenna.
 20) If necessary, return the site to service by unlocking all of the radios.

TX Cabinet Calibration Channel Numbers and Frequencies:

Table Maint. 2-5 EGSM900 test frequencies			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
978	880.8052	43	898.4052
986	882.4052	51	900.0052
994	884.0052	59	901.6052
1002	885.6052	67	903.2052
1010	887.2052	75	904.8052
1018	888.8052	83	906.4052
03	890.4052	91	908.0052
11	892.0052	99	909.6052
19	893.6052	107	911.2052
27	895.2052	115	912.8052
35	896.8052	123	914.4052