



# TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Ericsson AB.  
KRC 131 1005/2 dTRU-8 Edge Transceiver Unit

To: FCC Part 22: 2001

**Test Report Serial No:**  
RFI/MPTB1/RP44045JD01A

|                                                                                                                                                                                       |                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:</b><br> | <b>Checked By:</b><br> |
| <b>Tested By:</b><br><br>pp                                                                        | <b>Release Version No: PDF01</b>                                                                           |
| <b>Issue Date: 15 November 2002</b>                                                                                                                                                   | <b>Test Dates: 02 October 2002 to 04 October 2002</b>                                                      |

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**TEST REPORT**

**Conformance Testing Department**

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## **1. Client Information**

|                      |                                                  |
|----------------------|--------------------------------------------------|
| <b>Company Name:</b> | Ericsson AB                                      |
| <b>Address:</b>      | Torshamnsgatan 21-23<br>S-164 80 Kista<br>Sweden |
| <b>Contact Name:</b> | Mr Larry Lindstrom                               |

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## **2. Equipment Under Test (EUT)**

The following information has been supplied by the client:

### **2.1. Identification Of Equipment Under Test (EUT)**

| Unit        | Model Number   | Serial Number | Revision Number |
|-------------|----------------|---------------|-----------------|
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KFDQ    | R2A             |

**\*Note** The above unit was tested for all conducted measurements installed within the RBS 2206 (24 VDC) Cabinet.

| Unit        | Model Number   | Serial Number | Revision Number |
|-------------|----------------|---------------|-----------------|
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YF    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5Y9    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YQ    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KLCG    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KLQG    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KLCV    | R2A             |

**\*Note** The above units were tested for radiated spurious emissions within the RBS 2206 (24 VDC) Cabinet.

| Unit        | Model Number   | Serial Number | Revision Number |
|-------------|----------------|---------------|-----------------|
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KFDW    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000KFEB    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YJ    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YN    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YC    | R2A             |
| dTRU-8 Edge | KRC 131 1005/2 | AE5000K5YP    | R2A             |

**\*Note** The above units were tested for radiated spurious emissions within the RBS 2106 (208 VAC) Cabinet.

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**2.2. Description Of EUT**

The EUT is a GMSK/8PSK transceiver unit dTRU-8 Edge operating in the GSM 850 MHz Band.

**2.3. Modifications Incorporated In EUT**

The EUT has not been modified from what is described by the Model Name/Number and Unique Type Identification stated above.

**2.4. Additional Information Related To Testing**

|                             |                                                                                                                                                                                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Type of Unit:</b>        | GSM 850 Transceiver Unit dTRU-8 Edge                                                                                                                                                                                                                  |
| <b>Interface Ports:</b>     | Telecommunication line – E1 or T1 PCM<br>Alarm input – closing/opening inputs for alarms<br>TG Sync – synchronisation interface between base stations<br>DC output – DC supply for optional equipment<br>DC input/output – for battery back-up<br>GPS |
| <b>Transmit Frequency</b>   | 869 MHz to 894 MHz                                                                                                                                                                                                                                    |
| <b>Receive Frequency</b>    | 824 MHz to 849 MHz                                                                                                                                                                                                                                    |
| <b>Maximum Power Output</b> | 49dBm in TCC mode                                                                                                                                                                                                                                     |

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**2.5. Support Equipment**

The following support equipment was used to exercise the EUT during testing:

|                               |                      |
|-------------------------------|----------------------|
| <b>Description:</b>           | BSC Simulator        |
| <b>Brand Name:</b>            | RBS Master 2         |
| <b>Model Name or Number:</b>  | LPY 107 1007/1 R1F   |
| <b>Serial Number:</b>         | 00163                |
| <b>FCC ID Number:</b>         | Not applicable       |
| <b>Cable Length And Type:</b> | 5 m, 9 pin D type    |
| <b>Connected to Port:</b>     | TG Sync              |
| <b>Cable Length And Type:</b> | 3.5 m, 9 pin, D type |
| <b>Connected to Port:</b>     | G.703 ABIS           |
| <b>Cable Length And Type:</b> | 3 m, 9 pin, D type   |
| <b>Connected to Port:</b>     | RBS DVT              |
| <b>Cable Length And Type:</b> | 2 m, BNC             |
| <b>Connected to Port:</b>     | Ext Ref In           |

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**Support Equipment (continued)**

|                               |                      |
|-------------------------------|----------------------|
| <b>Description:</b>           | Computer             |
| <b>Brand Name:</b>            | Propac               |
| <b>Model Name or Number:</b>  | 19-003               |
| <b>Serial Number:</b>         | 620                  |
| <b>FCC ID Number:</b>         | Not applicable       |
| <b>Cable Length And Type:</b> | 1.5 m, 9 pin, D type |
| <b>Connected to Port:</b>     | PC out               |
| <b>Cable Length And Type:</b> | 2 m, 9 pin, D type   |
| <b>Connected to Port:</b>     | PC Ctrl              |

|                               |                       |
|-------------------------------|-----------------------|
| <b>Description:</b>           | PSU                   |
| <b>Brand Name:</b>            | Xantrex               |
| <b>Model Name or Number:</b>  | Powerbox PBXKW 55-55  |
| <b>Serial Number:</b>         | None stated by client |
| <b>FCC ID Number:</b>         | Not applicable        |
| <b>Cable Length And Type:</b> | 1 m, Mains cable      |
| <b>Connected to Port:</b>     | Not applicable        |

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**RBS 2206 (24 VDC) Hardware list (Conducted Measurements)**

| Unit      | Model Number   | Serial Number | Revision Number |
|-----------|----------------|---------------|-----------------|
| Cabinet   | SEB 112 1095/1 | S763367550    | R2A             |
| CDU Shelf | BFL 119 406/1  | S76           | R2A             |
| CDU_G8    | BFL 119 155/1  | A40003WQNB    | R2F             |
| CDU_G8    | BFL 119 155/1  | A40003WQNC    | R2F             |
| CDU_G8    | BFL 119 155/1  | A40003WQND    | R2F             |
| Dummy     | SXK 107 5031/2 | S76           | R1B             |
| Dummy     | SXK 107 5031/2 | S76           | R1B             |
| CXU-10    | KRY 101 1856/1 | A40003FQGF    | R3B             |
| TRU Shelf | BFL 119 407/1  | S76           | R2A             |
| IDM 01    | BMG 980 06/1   | T671028233    | R2A             |
| PSU_Shelf | BFL 119 408/1  | S76           | R2A             |
| PSU_AC    | BML 231 202/1  | A083322111    | R2G             |
| PSU_AC    | BML 231 202/1  | A083516276    | R2G             |
| PSU_AC    | BML 231 202/1  | A083535748    | R2G             |
| PSU_AC    | BML 231 202/1  | A083516236    | R2G             |
| DXU_21    | BOE 602 14/1   | A101688457    | R4G             |
| Dummy     | SXK 107 5029/1 | S76           | R1C             |
| Dummy     | SXK 107 5030/1 | S76           | R1B             |
| FCU_01    | BGM 1361001/2  | A082763346    | R2D             |
| DC Filter | KFE 101 1145/1 | TR2100915     | R1A/A           |
| ACCU_01   | BMG 980 07/1   | S792034233    | R1A             |

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**RBS 2206 (24 VDC) Hardware list (Radiated Measurements)**

| <b>Unit</b> | <b>Model Number</b> | <b>Serial Number</b> | <b>Revision Number</b> |
|-------------|---------------------|----------------------|------------------------|
| Cabinet     | SEB 112 1095/1      | S763429263           | -                      |
| CDU_G8      | BFL 119 155/1       | A40003WNBZ           | -                      |
| CDU_G8      | BFL 119 155/1       | A40003WNBW           | -                      |
| CDU_G8      | BFL 119 155/1       | A40003WNBX           | -                      |
| PSU-AC      | BML 231 202/1       | A083512425           | -                      |
| PSU-AC      | BML 231 202/1       | A083376369           | -                      |
| PSU-AC      | BML 231 202/1       | A083508576           | -                      |
| PSU-AC      | BML 231 202/1       | A083543464           | -                      |
| CXU         | KRY 101 1856/1      | S6900131KA           | -                      |
| FCU         | BGM 136 1001/2      | A083080495           | -                      |
| DXU 21      | BOE 602 14/1        | X510043459           | -                      |

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**RBS 2106 (208 VAC) Hardware list (Radiated Measurements)**

| Unit    | Model Number    | Serial Number | Revision Number |
|---------|-----------------|---------------|-----------------|
| Cabinet | SEB 112 1135/04 | S77TOR6559    | -               |
| CDU_G8  | BFL 119 155/1   | A40003WNC1    | -               |
| CDU_G8  | BFL 119 155/1   | A40003WTGD    | -               |
| CDU_G8  | BFL 119 155/1   | A40003WNBT    | -               |
| PSU-AC  | BML 231 202/1   | A083512361    | -               |
| PSU-AC  | BML 231 202/1   | A083535632    | -               |
| PSU-AC  | BML 231 202/1   | A08353617     | -               |
| PSU-AC  | BML 231 202/1   | A083331319    | -               |
| CXU     | KRY 101 1856/1  | A40003F40M    | -               |
| FCU     | BGM 136 1001/2  | A08350845     | -               |
| BFU-21  | BMG 980 13/1    | A082997612    | -               |
| CCU     | BPD10436/1      | S781129819    | -               |
| ACCU    | BMG98011/1      | A441354629    | -               |
| DXU-21  | BOE60214/1      | X510059039    | -               |
| ABM-01  | BMG98012/1      | T671042251    | -               |

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### **3. Test Specification, Methods And Procedures**

#### **3.1. Test Specifications**

|                         |                                                                                                                           |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>       | FCC Part 22: 2001 Sections 22.355, 22.913, 22.917                                                                         |
| <b>Title:</b>           | Code of Federal Regulations, Part 22 (47CFR)<br>Public Mobile Services.                                                   |
| <b>Comments:</b>        | None.                                                                                                                     |
| <b>Purpose of Test:</b> | To determine whether the equipment complied with the requirements of the specification for the purposes of certification. |

|                         |                                                                                                                              |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>       | FCC Part 2: 2001 Sections 2.1046 2.1047 2.1049 2.1051 2.1053<br>2.1055                                                       |
| <b>Title:</b>           | Code of Federal Regulations, Part 2 (47CFR)<br>Frequency allocations and radio treaty matters; General Rules and Regulations |
| <b>Comments:</b>        | None.                                                                                                                        |
| <b>Purpose of Test:</b> | To determine whether the equipment complied with the requirements of the specification for the purposes of certification.    |

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### **3.2. Methods And Procedures**

The methods and procedures used were as detailed in:

47CFR: Part 22 (2001)

Title: Federal Communications Commission: Code of Federal Regulations 47:  
Public Mobile Services.

47CFR: Part 2 (2001)

Title: Federal Communications Commission: Code of Federal Regulations 47:  
Telecommunication

ANSI C63.2 (1996)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1998)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1 (1999)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

### **3.3. Definition Of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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#### **4. Deviations From The Test Specification**

None.

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## **5. Operation Of The EUT During Testing**

### **5.1. Operating Conditions**

The EUT was tested in a normal laboratory environment.

### **5.2. Operating Modes**

The EUT was tested in the following operating modes:

#### **5.2.1. Radiated Emissions – GMSK Mode**

Three configurations tested together: With internal combiner plus TCC, with internal combiner and without internal combiner.

| <b><u>Channel No.</u></b> | <b><u>Frequency</u></b> | <b><u>Description</u></b>            |
|---------------------------|-------------------------|--------------------------------------|
| 128                       | 869.2 MHz               | dTRU with internal combiner plus TCC |
| 251                       | 893.8 MHz               | dTRU with internal combiner plus TCC |
| 128                       | 869.2 MHz               | dTRU with internal combiner          |
| 153                       | 874.2 MHz               | dTRU with internal combiner          |
| 226                       | 888.8 MHz               | dTRU with internal combiner          |
| 251                       | 893.8 MHz               | dTRU with internal combiner          |
| 128                       | 869.2 MHz               | dTRU without internal combiner       |
| 251                       | 893.8 MHz               | dTRU without internal combiner       |
| 129                       | 869.4 MHz               | dTRU with internal combiner plus TCC |
| 250                       | 893.6 MHz               | dTRU with internal combiner plus TCC |
| 129                       | 869.4 MHz               | dTRU with internal combiner          |
| 154                       | 874.4 MHz               | dTRU with internal combiner          |
| 225                       | 888.6 MHz               | dTRU with internal combiner          |
| 250                       | 893.6 MHz               | dTRU with internal combiner          |
| 129                       | 869.4 MHz               | dTRU without internal combiner       |
| 250                       | 893.6 MHz               | dTRU without internal combiner       |

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**5.2.2. Radiated Emissions – EDGE Mode**

Three modes tested together: With internal combiner plus TCC, with internal combiner and without internal combiner.

| <b><u>Channel No.</u></b> | <b><u>Frequency</u></b> | <b><u>Description</u></b>            |
|---------------------------|-------------------------|--------------------------------------|
| 129                       | 869.4 MHz               | dTRU with internal combiner plus TCC |
| 250                       | 893.6 MHz               | dTRU with internal combiner plus TCC |
| 129                       | 869.4 MHz               | dTRU with internal combiner          |
| 154                       | 874.4 MHz               | dTRU with internal combiner          |
| 225                       | 888.6 MHz               | dTRU with internal combiner          |
| 250                       | 893.6 MHz               | dTRU with internal combiner          |
| 129                       | 869.4 MHz               | dTRU without internal combiner       |
| 250                       | 893.6 MHz               | dTRU without internal combiner       |

**5.2.3. Conducted Emissions**

One configuration and modulation type was tested at a time: With internal combiner plus TCC, with internal combiner and without internal combiner.

| <b><u>GMSK Mode</u></b>   |                         | <b><u>EDGE Mode</u></b>   |                         |
|---------------------------|-------------------------|---------------------------|-------------------------|
| <b><u>Channel No.</u></b> | <b><u>Frequency</u></b> | <b><u>Channel No.</u></b> | <b><u>Frequency</u></b> |
| 128                       | 869.2 MHz               |                           |                         |
| 129                       | 869.4 MHz               | 129                       | 869.4 MHz               |
| 189                       | 881.4 MHz               | 189                       | 881.4 MHz               |
| 250                       | 893.6 MHz               | 250                       | 893.6 MHz               |
| 251                       | 893.8 MHz               |                           |                         |

**5.3. Configuration and Peripherals**

The EUT was tested in the following configuration:

The EUTs were tested installed within a RBS 2206 and a RBS 2106 Base Transceiver Station (BTS).

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## **6. Summary Of Test Results**

### **6.1. Transmit Mode**

| <b>Range Of Measurements</b>                                     | <b>Specification Reference</b>                 | <b>Mode of Operation</b> | <b>Port Type</b>  | <b>Compliance Status</b> |
|------------------------------------------------------------------|------------------------------------------------|--------------------------|-------------------|--------------------------|
| Conducted RF Output Power (GSM 850 Mode)                         | Part 2 of CFR 47: 2001, Section 2.1046(a)      | Transmit                 | Antenna Terminals | Complied                 |
| Modulation Characteristics                                       | Part 22 of CFR 47: 2001, Section 2.1047(a)     | Transmit                 | Antenna Terminals | Complied                 |
| Frequency Stability (Temperature & Voltage Variation)            | Part 22 of CFR 47: 2001, Section 2.1055/22.355 | Transmit                 | Antenna Terminals | Complied                 |
| Occupied Bandwidth                                               | Part 22 of CFR 47: 2001, Section 2.1049        | Transmit                 | Antenna Terminals | Complied                 |
| Conducted Out of Band Emissions (9 kHz to 10.0 GHz)              | Part 22 of CFR 47: 2001, Section 2.1051/22.917 | Transmit                 | Antenna Terminals | Complied                 |
| Electric Field Strength, Spurious Emissions (30 MHz to 10.0 GHz) | Part 2 of CFR 47: 2001, Section 2.1053/22.917  | Transmit                 | Antenna           | Complied                 |

### **6.2. Location Of Tests**

All the measurements described in this report were performed at the premises of Ericsson AB, Bergfotsgatan 2, Mölndal, SE-431 84, Sweden and Radio Frequency Investigation Ltd., Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ

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## **7. Measurements, Examinations And Derived Results**

### **7.1. General Comments**

7.1.1. This section contains test results only.

7.1.2. Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 8 for details of measurement uncertainties.

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**7.2. Conducted RF Output Power: GSM 850 Mode: Section 2.1046 (a)**

7.2.1. The EUT and spectrum analyser were configured as for conducted antenna port measurements.

7.2.2. Tests were performed to identify the maximum transmit power in accordance with FCC Part 2.1046(a) for conducted power, with reference to TIA\_EIA\_603A.

7.2.3. Measurements were made at the CDU\_G8 output connectors.

7.2.4. The output was connected to a spectrum analyser via cables, a 50 Ohm attenuator and an RF box containing further attenuators and a GSM 850 Tx band notch filter.

7.2.5. The path loss was entered into the spectrum analyser as a reference level offset.

7.2.6. Results are shown for the EUT set to Bottom, Middle and Top channels using a 24 V DC supply.

7.2.7. dTRU serial number AE5000KFDQ was used during the test.

**Results****Configuration Mode: GMSK - dTRU: Output 1+2, TCC Mode**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 48.65       |
| Middle  | 881.4           | 48.86       |
| Top     | 893.8           | 48.74       |

**Configuration Mode: GMSK - dTRU. Output 1 with internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 42.68       |
| Middle  | 881.4           | 42.74       |
| Top     | 893.8           | 42.68       |

**Configuration Mode: GMSK - dTRU, Output 2 with internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 42.87       |
| Middle  | 881.4           | 43.01       |
| Top     | 893.8           | 42.94       |

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**Conducted RF Output Power: GSM 850 Mode: Section 2.1046 (a) (continued)****Configuration: Mode GMSK - dTRU, Output 1 without internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 46.13       |
| Middle  | 881.4           | 46.30       |
| Top     | 893.8           | 46.20       |

**Configuration: Mode GMSK - dTRU, Output 2 without internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 46.05       |
| Middle  | 881.4           | 46.37       |
| Top     | 893.8           | 46.18       |

**Configuration: Mode 8PSK - dTRU, Output 1 without internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 45.95       |
| Middle  | 881.4           | 46.21       |
| Top     | 893.8           | 46.18       |

**Configuration: Mode 8PSK - dTRU, Output 2 without internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 45.95       |
| Middle  | 881.4           | 46.29       |
| Top     | 893.8           | 46.13       |

**Configuration: Mode 8PSK (edge) - dTRU, Output 1 with internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 42.53       |
| Middle  | 881.4           | 42.76       |
| Top     | 893.8           | 42.71       |

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**Carrier Output Power: GSM 850 Mode: Section 2.1046 (a) (continued)****Configuration: Mode 8PSK (edge) - dTRU, Output 2 with internal combiner**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 42.80       |
| Middle  | 881.4           | 42.87       |
| Top     | 893.8           | 42.85       |

**Configuration: Mode 8PSK (edge) - dTRU, Output 1+2, TCC Mode**

| Channel | Frequency (MHz) | Level (dBm) |
|---------|-----------------|-------------|
| Bottom  | 869.2           | 48.65       |
| Middle  | 881.4           | 48.86       |
| Top     | 893.8           | 48.77       |

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**7.3. Modulation Characteristics: Section 2.1047**

7.3.1. The EUT and spectrum analyser were configured as for conducted antenna port measurements.

7.3.2. Tests were performed to identify the modulation characteristics in accordance with FCC Part 2.1047, with reference to TIA\_EIA\_603A and TR45 SP-4027-280C for Limits.

7.3.3. Measurements were made at the CDU\_G8 output connectors.

7.3.4. The output was connected to a spectrum analyser, which was used in GSM BTS analyser mode, via cables and with 40 dB of attenuation in the path.

7.3.5. Testing was performed on the middle channel only.

7.3.6. **GMSK** mode– The tolerance of the maximum output phase error, shall not be greater than 5 degrees.

7.3.7. **EDGE** mode– The error vector magnitude, (EVM) shall be less than 12.5% RMS. The origin offset in any burst shall be less than –30 dBc

**. Configuration: Mode GMSK - dTRU, Output1 and 2 without internal combiner**

| GMSK        | Phase Error (°) |               |
|-------------|-----------------|---------------|
|             | dTRU Output 1   | dTRU Output 2 |
| Phase Error | 2.51            | 2.45          |
| Max         | 2.51            |               |

| EDGE    | EVM (% RMS)   |               |
|---------|---------------|---------------|
|         | dTRU Output 1 | dTRU Output 2 |
| EVM     | 1.59          | 1.47          |
| Max EVM | 1.59          |               |

|               | Origin Offset (dB) |               |
|---------------|--------------------|---------------|
|               | dTRU Output 1      | dTRU Output 2 |
| Origin Offset | -51.75             | -47.69        |
| Max 00        | -47.69             |               |

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**7.4. Frequency Stability Measurements: GSM 850 Mode:  
(Temperature and Voltage Variation): Sections 22.355**

7.4.1. The EUT and spectrum analyser were configured for conducted antenna port measurements.

7.4.2. Measurements were performed to determine the frequency stability of the fundamental emission from the EUT, when subjected to variation of ambient temperature and variation of supply voltage.

7.4.3. Measurements were made at the CDU\_G8 output connectors.

7.4.4. The output was connected to a spectrum analyser which was used in GSM BTS analyser mode, via cables and with 30 dB of attenuation in the path.

7.4.5. The path loss was entered into the spectrum analyser as a reference level offset.

7.4.6. Testing was performed on the middle channel only.

7.4.7. The ambient temperature was varied from -30°C to +50°C in 10°C steps. During the test the fundamental frequency of the EUT shall stay within 1.5 ppm of the fundamental frequency.

7.4.8. The ppm frequency error is calculated using the following formula taken from the TIA\_EIA\_603A document.

$$\text{ppm error} = \left( \frac{MCF_{\text{MHz}}}{ACF_{\text{MHz}}} - 1 \right) * 10^6$$

where  $MCF_{\text{MHz}}$  is the measured carrier frequency in MHz  
 $ACF_{\text{MHz}}$  is the assigned carrier frequency in MHz

7.4.9. The client has stated that the authorised frequency block is:-

|                  |         |
|------------------|---------|
| Lower Block Edge | 869 MHz |
| Upper Block Edge | 894 MHz |

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**Frequency Stability Measurements (continued)**

Results: Mode GMSK - dTRU output 1 without hybrid combiner  
Channel 189 (881.4 MHz)

| Temperature (°C) | DC Input Voltage (Volts) | Peak Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|------------------|--------------------------|---------------------------|-----------------------|-------------|--------------|----------|
| -30              | 20.4                     | 5.36                      | 0.00608               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | 6.01                      | 0.00682               | 1.500       | 1.493        | Complied |
| -20              | 20.4                     | -7.17                     | 0.00813               | 1.500       | 1.492        | Complied |
|                  | 27.6                     | 4.58                      | 0.00520               | 1.500       | 1.495        | Complied |
| -10              | 20.4                     | 5.42                      | 0.00615               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | 4.78                      | 0.00542               | 1.500       | 1.495        | Complied |
| +0               | 20.4                     | 4.58                      | 0.00520               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | -3.75                     | 0.00425               | 1.500       | 1.496        | Complied |
| +10              | 20.4                     | -4.91                     | 0.00557               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | -6.39                     | 0.00725               | 1.500       | 1.493        | Complied |
| +20              | 20.4                     | -6.46                     | 0.00733               | 1.500       | 1.493        | Complied |
|                  | 27.6                     | -5.10                     | 0.00579               | 1.500       | 1.494        | Complied |
| +30              | 20.4                     | -6.01                     | 0.00682               | 1.500       | 1.493        | Complied |
|                  | 27.6                     | -6.39                     | 0.00725               | 1.500       | 1.493        | Complied |
| +40              | 20.4                     | -6.30                     | 0.00715               | 1.500       | 1.493        | Complied |
|                  | 27.6                     | -7.17                     | 0.00813               | 1.500       | 1.492        | Complied |
| +50              | 20.4                     | -4.97                     | 0.00564               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | -7.23                     | 0.00820               | 1.500       | 1.492        | Complied |

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**Frequency Stability Measurements (continued)**

Results: Mode GMSK - dTRU output 2 without hybrid combiner  
Channel 189 (881.4 MHz)

| Temperature (°C) | DC Input Voltage (Volts) | Peak Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|------------------|--------------------------|---------------------------|-----------------------|-------------|--------------|----------|
| -30              | 20.4                     | 4.84                      | 0.00549               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | 3.29                      | 0.00373               | 1.500       | 1.496        | Complied |
| -20              | 20.4                     | -6.26                     | 0.00710               | 1.500       | 1.493        | Complied |
|                  | 27.6                     | 3.03                      | 0.00344               | 1.500       | 1.497        | Complied |
| -10              | 20.4                     | 3.75                      | 0.00425               | 1.500       | 1.496        | Complied |
|                  | 27.6                     | 8.20                      | 0.00930               | 1.500       | 1.491        | Complied |
| +0               | 20.4                     | 3.55                      | 0.00403               | 1.500       | 1.496        | Complied |
|                  | 27.6                     | -4.46                     | 0.00506               | 1.500       | 1.495        | Complied |
| +10              | 20.4                     | -4.65                     | 0.00528               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | -3.03                     | 0.00344               | 1.500       | 1.497        | Complied |
| +20              | 20.4                     | 2.58                      | 0.00293               | 1.500       | 1.497        | Complied |
|                  | 27.6                     | 4.33                      | 0.0491                | 1.500       | 1.495        | Complied |
| +30              | 20.4                     | -4.07                     | 0.00462               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | -5.55                     | 0.00630               | 1.500       | 1.494        | Complied |
| +40              | 20.4                     | -5.62                     | 0.00638               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | -5.75                     | 0.00652               | 1.500       | 1.493        | Complied |
| +50              | 20.4                     | -5.55                     | 0.00630               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | -5.17                     | 0.00587               | 1.500       | 1.494        | Complied |

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**Frequency Stability Measurements (continued)**

Results: Mode EDGE - dTRU output 1 without hybrid combiner  
Channel 189 (881.4 MHz)

| Temperature (°C) | DC Input Voltage (Volts) | Absolute Peak Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|------------------|--------------------------|------------------------------------|-----------------------|-------------|--------------|----------|
| -30              | 20.4                     | -8.20                              | 0.00930               | 1.500       | 1.491        | Complied |
|                  | 27.6                     | 5.55                               | 0.00630               | 1.500       | 1.494        | Complied |
| -20              | 20.4                     | -7.94                              | 0.00901               | 1.500       | 1.491        | Complied |
|                  | 27.6                     | 6.26                               | 0.00710               | 1.500       | 1.493        | Complied |
| -10              | 20.4                     | 7.81                               | 0.00886               | 1.500       | 1.491        | Complied |
|                  | 27.6                     | 7.10                               | 0.00806               | 1.500       | 1.492        | Complied |
| +0               | 20.4                     | -4.39                              | 0.00498               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | 3.68                               | 0.00418               | 1.500       | 1.496        | Complied |
| +10              | 20.4                     | -4.58                              | 0.00520               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | -6.91                              | 0.00784               | 1.500       | 1.492        | Complied |
| +20              | 20.4                     | -4.78                              | 0.00542               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | 4.26                               | 0.00483               | 1.500       | 1.495        | Complied |
| +30              | 20.4                     | -7.10                              | 0.00806               | 1.500       | 1.492        | Complied |
|                  | 27.6                     | -9.36                              | 0.01062               | 1.500       | 1.489        | Complied |
| +40              | 20.4                     | -7.68                              | 0.00871               | 1.500       | 1.491        | Complied |
|                  | 27.6                     | 7.10                               | 0.00806               | 1.500       | 1.492        | Complied |
| +50              | 20.4                     | -6.65                              | 0.00754               | 1.500       | 1.492        | Complied |
|                  | 27.6                     | -5.29                              | 0.00600               | 1.500       | 1.494        | Complied |

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**Frequency Stability Measurements (continued)****Results: Mode EDGE - dTRU output 2 without hybrid combiner  
Channel 189 (881.4 MHz)**

| Temperature (°C) | DC Input Voltage (Volts) | Peak Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|------------------|--------------------------|---------------------------|-----------------------|-------------|--------------|----------|
| -30              | 20.4                     | 7.10                      | 0.00806               | 1.500       | 1.492        | Complied |
|                  | 27.6                     | 10.91                     | 0.01238               | 1.500       | 1.488        | Complied |
| -20              | 20.4                     | -10.14                    | 0.01150               | 1.500       | 1.488        | Complied |
|                  | 27.6                     | -5.88                     | 0.00667               | 1.500       | 1.493        | Complied |
| -10              | 20.4                     | 15.05                     | 0.01708               | 1.500       | 1.483        | Complied |
|                  | 27.6                     | 12.72                     | 0.01443               | 1.500       | 1.486        | Complied |
| +0               | 20.4                     | -4.26                     | 0.00483               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | 4.97                      | 0.00564               | 1.500       | 1.494        | Complied |
| +10              | 20.4                     | -5.49                     | 0.00623               | 1.500       | 1.494        | Complied |
|                  | 27.6                     | -7.17                     | 0.00813               | 1.500       | 1.492        | Complied |
| +20              | 20.4                     | -4.78                     | 0.00542               | 1.500       | 1.495        | Complied |
|                  | 27.6                     | 5.42                      | 0.00615               | 1.500       | 1.494        | Complied |
| +30              | 20.4                     | -5.88                     | 0.00667               | 1.500       | 1.493        | Complied |
|                  | 27.6                     | -5.04                     | 0.00572               | 1.500       | 1.494        | Complied |
| +40              | 20.4                     | -9.04                     | 0.01026               | 1.500       | 1.490        | Complied |
|                  | 27.6                     | -4.52                     | 0.00129               | 1.500       | 1.495        | Complied |
| +50              | 20.4                     | -8.20                     | 0.00930               | 1.500       | 1.491        | Complied |
|                  | 27.6                     | -5.68                     | 0.00644               | 1.500       | 1.494        | Complied |

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### **7.5. Transmitter Conducted Measurements: GSM 850 Mode (Occupied Bandwidth): Sections 2.1049**

7.5.1. The EUT and spectrum analyser were configured for conducted antenna port measurements.

7.5.2. Tests were performed to identify the Occupied Bandwidth in accordance with FCC Part 2.1049 with reference to TIA\_EIA\_603A.

7.5.3. Measurements were made at the CDU\_G8 output connectors.

7.5.4. The output was connected to a spectrum analyser via cables and with 40 dB of attenuation in the path,

7.5.5. The path loss was entered into the spectrum analyser as a reference level offset.

7.5.6. In GMSK mode this unit must use a reduced transmit power by 16 dB to 30 dBm for the channels adjacent to each frequency block edge in order to show compliance.

7.5.7. In Edge mode it was not possible to reduce the transmit power enough for the channels adjacent to each frequency block edge to fulfil the requirements, thus these channels must be excluded in order to comply.

7.5.8. The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB.

7.5.9. Please refer to Appendix 4 for graphical results.

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**7.6. Transmitter Conducted Measurements: (Out of Band Emissions - Spurious and Intermodulation Responses): Section 2.1051/22.917(e)**

7.6.1. The EUT and spectrum analyser were configured as for conducted antenna port measurements.

7.6.2. Tests were performed to identify out of band emissions in accordance with FCC Part 2.1051 and 22.917(e) with reference to TIA\_EIA\_603A.

7.6.3. Tests were also performed to identify the level of any Intermodulation responses present.

7.6.4. Measurements were made at the CDU\_G8 output connectors

7.6.5. The output was connected to a spectrum analyser via cables, attenuation and an RF box containing various filters.

7.6.6. The path loss was entered into the spectrum analyser as a reference level offset.

7.6.7. FCC Part 22.917(e) states that emissions shall be attenuated by at least  $43 + 10 \log(P)$  dB below the transmitter power, where (P) is the power measured at the EUT antenna terminals.

7.6.8. The worse case emission was at least 9 dB below the limit. Please refer to Appendix 4 for graphical results.

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## **7.7. Transmitter Radiated Emissions: Section 2.1053/22.917 (e)**

### **Electric Field Strength Measurements of Spurious Emissions and Intermodulation Products: 30 MHz to 10 GHz**

7.7.1. Tests were performed to identify the field strength of spurious emissions as per ANSI/TIA\_EIA\_603A.

7.7.2. Tests were also performed to identify the field strength of any Intermodulation responses present.

7.7.3. Measurements were performed at 3 m test distance with 1.5 m antenna height in a anechoic lined screened room in the frequency range of 30 MHz to 10 GHz.

7.7.4. The power of any emission outside the frequency band shall be attenuated below the transmitter power (p) by at least  $43 + 10 \log (P)$  dB.

7.7.5. The limit line was determined by radiating -13dBm from a dipole located in place of the EUT and measuring the equivalent field strength at the 3 meters.

7.7.6. Worse case emissions can be noted on graphs 44045JD01A/001 @ 16 dB below the limit and 44045JD01A/016 @ 17 dB below the limit.

7.7.7. Please refer to Appendix 4 for all other graphical results.

7.7.8. All other indicated spurious and intermodulation responses were at least 20 dB below the relevant limit.

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## **8. Measurement Uncertainty**

8.1. No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

8.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

8.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

8.4. The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| <b>Measurement Type</b>          | <b>Range</b>        | <b>Confidence Level</b> | <b>Calculated Uncertainty</b> |
|----------------------------------|---------------------|-------------------------|-------------------------------|
| Carrier Output Power             | Not applicable      | 95%                     | +/- 1.3 dB                    |
| Conducted Emissions (AC)         | 0.15 MHz to 30 MHz  | 95%                     | +/- 3.25 dB                   |
| Conducted Emissions Antenna Port | 0.009 kHz to 26 GHz | 95%                     | +/- 1.3 dB                    |
| Radiated Emissions at 3.0 metres | 30 MHz to 1000 MHz  | 95%                     | +/- 5.26 dB                   |
| Radiated Emissions at 3.0 metres | 1 GHz to 26 GHz     | 95%                     | +/- 1.78 dB                   |
| Frequency Stability              | Not applicable      | 95%                     | +/- 11.7 Hz                   |
| Occupied Bandwidth               | 869 to 894 MHz      | 95%                     | +/- 11.7 Hz                   |
| Emissions at Band Edges          | 869 to 894 MHz      | 95%                     | +/- 1.3 dB                    |

8.5. The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

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## **Appendix 1. Test Equipment Used**

### **Test equipment used for testing at Ericsson AB**

| <b>Description</b>  | <b>Manufacturer</b> | <b>Model Number</b>                | <b>Serial Number</b> |
|---------------------|---------------------|------------------------------------|----------------------|
| Signal Analyser     | Rohde & Schwarz     | FS1Q26                             | 836600/010           |
| RF Box              | Ericsson            | LYP 107 614                        | 1                    |
| Attenuator          | Weinschel Corp.     | 48-20-34                           | BC2571               |
| Cable 1             | Harbour Industries  | 2.5 M N-Type to N-Type 27478 LL142 | N/A                  |
| Cable 2             | Harbour Industries  | 2.5 M N-Type to N-Type 27478 LL142 | N/A                  |
| Cable 3             | Suhner Sucoflex     | 0.25 M N-Type to N-Type 104E       | N/A                  |
| Cable 4             | Suhner Sucoflex     | 0.25 M N-Type to N-Type 104E       | N/A                  |
| Cable 5             | Suhner Sucoflex     | 0.25 M N-Type to N-Type 104E       | N/A                  |
| Network Analyser    | Hewlett Packard     | HP8720D                            | US36140166           |
| Multimeter          | Fluke               | 76 True RMS                        | 68720337             |
| Temperature Chamber | Vötsch              | VCS 7250/5                         | 58566031900030       |

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**Test equipment used for testing at Radio Frequency Investigation Ltd.**

| <b>Instrument</b>                   | <b>Manufacturer</b> | <b>Model</b>          | <b>RFI No.</b> |
|-------------------------------------|---------------------|-----------------------|----------------|
| Horn Antenna                        | Eaton               | 9188-2                | A027           |
| 2 to 4 GHz Eaton Horn Antenna       | Eaton               | 91889-2               | A031           |
| Coaxial Termination                 | RS Components       | 612-192               | A1024          |
| Coaxial Termination                 | RS Components       | 612-192               | A1025          |
| Bilog Antenna                       | Chase               | CBL6111               | A259           |
| WG 14 horn                          | Flann               | 14240-20              | A427           |
| WG 12 horn                          | Flann               | 12240-20              | A428           |
| WG 16 horn                          | Flann               | 16240-20              | A429           |
| Rosenberger cable                   | Rosenberger         | FB311A1050M5050       | C1069          |
| Cable                               | Rosenberger         | UFA 210A-1-0787-50x50 | C304           |
| ESMI Spectrum Analyser / Receiver   | Rohde & Schwarz     | ESMI                  | M069           |
| Receiver / Spectrum Analyser System | Rohde & Schwarz     | ESBI                  | M088           |
| Temperature/Humidity/Pressure Meter | RS Components       | None                  | M134           |
| Site 5                              | RFI                 | 5                     | S205           |

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## **Appendix 2. Measurement Methods**

### **A2.1 Conducted Antenna Port Measurements: FCC Part 2**

A2.1.1 Spurious measurements at the Antenna port were performed from the lower frequency of the allocated frequency block and from the top frequency of the allocated frequency block to 10 times the highest EUT generated frequency.

A2.1.2 A measuring receiver was connected to the antenna port of the EUT via a suitable cable, RF Attenuator and filters. The total loss of the cable, attenuator and filters were measured and entered as a reference level offset into the measuring receiver to correct for the losses.

A2.1.3 The specified frequency bands were investigated with the transmitter operating at full power on the appropriate channels as described in section 5.2.

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**A2.2 FCC Part 2.1055: Frequency Stability**

A2.2.1 The EUT was situated within an environmental test chamber and connected to test equipment via an access port.

A2.2.1 Measurements were performed with the EUT operating under extremes of temperature in 10 degree increments within the range –30 to 50 deg C.

A2.2.1 Measurements were also performed at voltage extremes.

A2.2.1 The requirement was to determine the frequency stability of the device under specified environmental operating conditions.

A2.2.2 Measurements were made on the middle channel.

A2.2.3 The EUT was switched off for a minimum of 30 minutes between each stage of testing while the environmental chamber stabilised at the next temperature within the stated temperature range.

A2.2.4 The frequency error measured was converted to an error in ppm using the following formula as defined by TIA\_EIA\_603A:-

$$\text{ppm error} = \left( \frac{MCF_{MHz}}{ACF_{MHz}} - 1 \right) * 10^6$$

where  $MCF_{MHz}$  is the measured carrier frequency in MHz  
 $ACF_{MHz}$  is the assigned carrier frequency in MHz

A2.2.5 The measured ppm had to be less then the relevant limits in order to comply.

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### **A2.3 FCC Part 2.1049 (i): Occupied Bandwidth**

A2.3.1 The EUT was connected to a spectrum analyser via its antenna port.

A2.3.1 Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured from the fundamental emission at the bottom and top channels.

A2.3.2 The Occupied Bandwidth was measured with the EUT output connected to a spectrum analyser via cables and with 40 dB of attenuation in the path, the path loss was entered into the spectrum analyser as a reference level offset. Tests were performed to identify the Occupied Bandwidth in accordance with FCC Part 2.1049 with reference to TIA\_EIA\_603A.

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**A2.4 Radiated Emissions: FCC Part 22**

A2.4.1 Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.4.2 Initial pre-scans covering the entire measurement band from the lowest generated frequency up to the highest specified frequency were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT with required further attention. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

A2.4.3 The radiated scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m with the EUT arranged and rotated on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

A2.4.4 The test equipment settings for radiated emissions measurements were as follows:

| <b>Receiver Function</b> | <b>Radiated Scan</b>              |
|--------------------------|-----------------------------------|
| Detector Type:           | Peak                              |
| Mode:                    | Max Hold                          |
| Bandwidth:               | (100 kHz < 1GHz)<br>(1MHz > 1GHz) |
| Amplitude Range:         | 60 dB                             |
| Measurement Time:        | Not applicable                    |
| Observation Time:        | Not applicable                    |
| Step Size:               | Continuous sweep                  |
| Sweep Time:              | Coupled                           |

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### **Appendix 3. Test Configuration Drawings**

This appendix contains the following drawings:

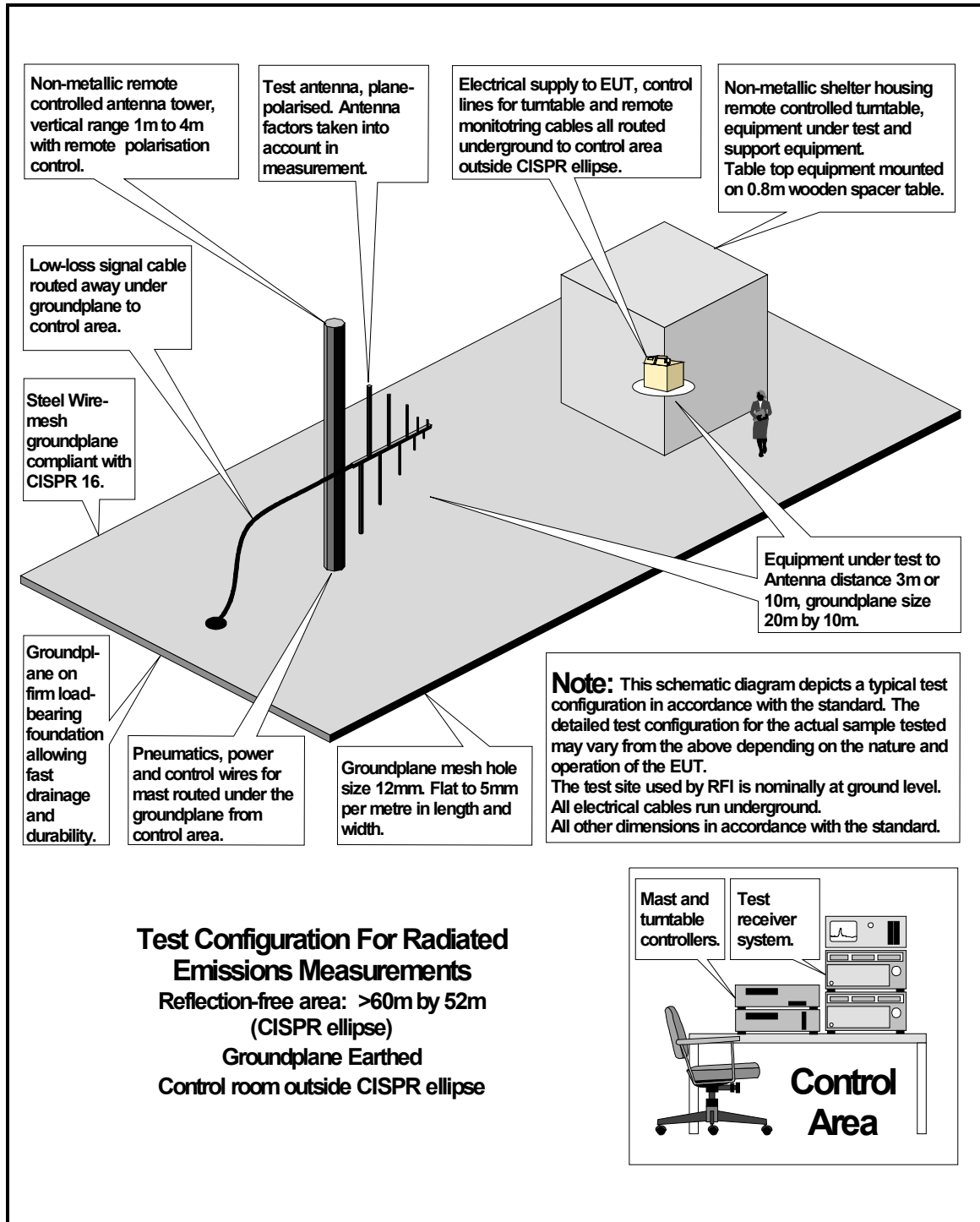
| <b>Drawing Reference Number</b> | <b>Title</b>                                                                                                    |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|
| DRG\44045JD01\EMIRAD            | Test configuration for measurement of radiated emissions                                                        |
| DRG\44045JD01\001               | Schematic diagram of the EUT, support equipment and interconnecting cables used for the radiated emissions test |

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KRC 131 1005/2 dTRU-8 Edge Transceiver Unit

To: FCC Part 22: 2001

DRG\44045JD01\EMIRAD



Test Of: Ericsson AB.

KRC 131 1005/2 dTRU-8 Edge Transceiver Unit

To: FCC Part 22: 2001

DRG\44045JD01\001

**Configuration of EUT and Local Support Equipment**