

EXHIBIT 2B

EMC Test Report

Applicant: Northern Telecom Ltd.

For Certification on:

AB6S8000

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TEST REPORT

CFR 47 Part 15 and CFR 47 Part 24

S8000 outdoor equipped with HePA 1900MHz

N°149021DK

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FCC registration # 90469

Written by : D.RAUD

8 January 2003

Identification : 149021DK

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Identification : 149021DK

Applicant:

SANMINA SCI (Patrick GALOPIN) 46 Rue Pierre Curie PLAISIR 78376 FRANCE

Product description

Product: S8000 outdoor equipped with HePA 1900MHz

Manufacturer :

NORTEL NETWORKS 38, rue Paul Cézanne Guyancourt 78928 Yvelines

Responsible of the equipment:

(Patrick GALOPIN)

Product type: BTS S8000 OUTDOOR Prototype n° 192101 Power supply: 208V/60Hz , tested at 208 V 60 Hz. biphase

PRODUCT PICTURE:

Cabinet Front view





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cabinet rear view



PRODUCT COMPOSITION:

References E - DRX GSM1900
 NTQA88PA 03 NNTM7503EIPE
 NTQA88PA 03 NNTM7503EMOQ
 NTQA88PA 03 NNTM7503EIZ8
 NTQA88PA 03 NNTM7503EMOR
 NTQA88PA 03 NNTM7503EMN5
 NTQA88PA 03 NNTM7503EMN5

References HePA PCS 1900
 NTQA50RA D1 FORM01334273
 NTQA50RA D1 FORM01334279
 NTQA50RA D1 FORM01334281
 NTQA50RA D1 FORM01334277
 NTQA50RA D1 FORM01334278
 NTQA50RA D1 FORM01334274

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SPL PCS

NTQA10AA 03 NNTMES001QQA NTQA10AA 03 NNTMES001QR0 NTQA10AA 03 NNTMES001QR5 NTQA10AA 03 NNTMES001QR6

 References PCS COMBINER H2D NTQA51AA 01 NNTM6100JTUY NTQA51AA 01 NNTM6100LPDD NTQA51AA 07 MTECO223B115 NTQA51AA 03 FORM01295152

- References CPCMI T1 PCBA NTQA66AA 04 NNTM7501PJRU
- References CMCF PCBA PHASE 2 NTQA66CB 05 NNTMES00FZ1Y NTQA66CB 05 NNTMES00FZ27
- References RECAL PCBA NTQA66DA 02 NNTMES00GGJS
- References TYPE F PSU NTQA57AA 03 ADPL09002RGV NTQA57AA 03 ADPL09003P77
- References RECTIFIER SHELF 7 NTU47001 P1 SNMN750087C5

- References Rectifier NTQA91AA 01 PITS01150819

NTQA91AA 01 PITS01130819 NTQA91AA 03 PITS01Z04242 NTQA91AA 01 PITS01077037 NTQA91AA 01 PITS01077753 NTQA91AA 01 PITS1G78554



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UTILISATION:

Base Transceiver Station

General test conditions

AUXILIARY EQUIPMENT:

Attenuators and 50 ohms load

WORKING MODE FOR EMISSION TEST

Measurements are done in transmitter mode (all transmitters at maximum power, in BCCH mode without frequency hopping), and in receiver mode Channels configuration for the test:

DRX#	CHANNE	FREQUENCY
	L #	(MHz)
0	512	1930.2
1	560	1939.8
2	620	1951.8
3	690	1965.8
4	750	1977.8
5	810	1989.8

Software version:

- EDRX : load V14f1e03 (V14.3)
- CMCF : load V12a1e11 (V12.49)

Reference standards choice

The product is information technology equipment. The product standard CFR47 Part 15 has to be used for emission (class B because of residential, commercial and light industry use).

The product is a personal communication service equipment So, applicable standards are: CFR47 Part 15 class B (2002)

CFR47 part 24 "Subpart E" (2002)



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Interpretation and remarks:

This equipment conforms to limits standards for EMC measurements.

IMPORTANT REMARK :

Since no emissions were detected in the prescan measurement, substitution method was not performed on S8000 Outdoor

The EUT Plot on page 19 show measured noise floor levels detected while testing the BTS S8000.

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Test according to CFR 47 Part 15 Class B

Tests performed by Daniel RAUD at GYL Technologies laboratories, in December, 18 and 19 of 2002.

REFERENCE DOCUMENTATION:

FCC CFR 47 part 15, (2002) ANSI C63.4 (2001).

CONDUCTED DISTURBANCE AT INPUT POWER ACCESS :

General measurement conditions.

Conforms to ANSI C63.4. Measurement done in free field

Limit :

Class B of FCC standard regulation CFR 47 part 15 subpart B for conducted emission limit (§15.107 class B device).

Method of measurement.

Method of measurement and test installation according to Section 7 of the ANSI C63.4 measurement standard.



Test equipment used :

APPARATUS	MANUFACTURER	REFERENCE	Identification	Date of
				verification
EMI test receiver	Rohde & Schwarz	ESI 7	M02020	Dec-01
LISN (50µH / 5/50ohms)	Rohde & Schwarz	ESH2-Z5	M02034	Jun-02

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echnologies

Highest lines. (CYAN colour trace = Average; GREEN colour = Peak trace)

Live 1

Frequency (MHz)	Quasi-peak (dBµV)	QP margin (dB)
0.158	26.5	-39.1
0.194	34.4	-29.4
0.398	26.9	-31.0
0.498	25.1	-31.0
0.694	32.8	-23.2

Frequency (MHz)	Average (dBµV)	AV. margin (dB)
0.198	28.4	-25.3
0.694	21.4	-24.6
22.106	20.8	-29.2
22.382	21.9	-28.1





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Live 2

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AV. margin

(dB)

-25.6 -26.3 -29.1 -29.7 -28.8 -28.9 -29.5 -29.0

Frequency (MHz)	Quasi-peak (dBµV)	QP margin (dB)	Frequency (MHz)	Average (dBµV)
0.198	37.7	-26.0	0.198	28.1
0.298	30.4	-29.9	0.694	19.7
0.694	28.2	-27.8	3.486	16.9
4.090	17.4	-38.6	20.482	20.3
22.382	23.7	-36.3	24.118	21.2
23.906	24.8	-35.2	24.314	21.1
24.126	25.6	-34.4	24.414	20.5
24.622	24.8	-35.2	24.514	21.0
24.914	24.8	-35.2		



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INTERPRETATION AND REMARKS:



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RADIATED DISTURBANCE :

Limit :

Class B of FCC standard regulation CFR 47 part 15 subpart B for radiated emission limit (§15.109 class B device) for unintentional radiator

General measurement conditions.

Conforms to ANSI C63.4.

Diagram in 0° position, angles are positives in the reverse clock wise.

Equipment under test.

• Front view





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• Rear view



Method of measurement.

Method of measurement and test installation according to Section 8 of the ANSI C63.4 measurement standard.

Measurement are done at 10m in a free area.

We try to obtain a maximum at all frequencies by moving the product orientation and antenna polarisation. The height of the antenna can vary from 1 m to 4 m.

Test equipment used :

APPARATUS	MANUFACTURER	REFERENCE	Identification	Date of
				verification
Free field open area test si	ite			Jul-02
Receiver	Rohde & Schwarz	ESI 7	M02020	Dec-01
Bilog antenna	CHASE	CBL-6112	M02031	Nov-01



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Results :

Highest lines table (spurious signals):

Frequency	Quasi-peak	Std limit	Margin	Polari-	hight	Angle	Corr	Comment
(MHz)	$(dB\mu V/m)$	$(dB\mu V/m)$	(dB)	sation	(cm)	(Deg.)	Fact.	
40.649	18.54	30	-11.46	V	114	215	14.72	
41.322	16.19	30	-13.81	V	101	201	14.48	
83.181	6.48	30	-23.52	V	100	41	8.35	
131.074	11.65	33	-21.35	V	133	94	12.76	
143.363	13.16	33	-19.84	V	131	28	12.06	
147.461	10.66	33	-22.34	V	120	176	11.66	
233.476	18.21	36	-17.79	V	100	48	12.92	
253.956	17.66	36	-18.34	H	356	272	15.65	
258.051	13.49	36	-22.51	V	197	156	13.98	
282.624	13.67	36	-22.33	Н	129	313	16.26	

No spurious signal found between 282.624 MHz and 10GHz

Champ électrique (dBµV/m) rayonné en fonction de la fréquence (Hz)



INTERPRETATION AND REMARKS:

Conform

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Measurement at transmitters frequencies (D=10m) for indicative level transmitters output connected to resistive 50 ohms loads .

F (MHz)	Peak Level	Antenna	F (MHz)	Peak Level	Antenna
	$(dB\mu V/m)$	polarity		$(dB\mu V/m)$	polarity
1930.271	79.01	Н	1965.873	77.09	Н
1939.869	70.45	Н	1977.871	70.97	Н
1951.871	77.01	Н	1989.869	75.17	Н

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Pre-Scan measurement to identify spurious emissions from EUT at D=1m:

F (MHz)	PK (dBµV/m)	Marge (dB)	Pol	H(cm)	A(°)	FC(dB)	Comments
40.621	25.15	-24.85	Н	100	0	13.71	
41.323	24.94	-25.06	V	100	270	13.36	
45.531	25.18	-24.82	Н	100	0	11.22	
45.752	33.87	-16.13	V	100	0	11.09	
45.932	28.66	-21.34	V	100	270	10.98	
49.399	28.4	-21.6	V	100	270	8.9	
49.719	26.7	-23.3	V	100	0	8.71	
50.173	25.56	-24.44	V	100	270	8.49	
78.357	8.5	-41.5	V	100	270	7.59	
83.19	26.53	-23.47	V	100	270	8.35	
83.479	29.17	-20.83	V	100	270	8.4	
131.101	8.97	-44.03	V	100	270	12.76	
135.174	6.2	-46.8	V	100	270	12.58	
143.375	18.05	-34.95	V	100	270	12.05	
147.463	6.25	-46.75	V	100	270	11.66	
192.549	12.68	-40.32	V	100	270	10.89	
213.018	12.09	-40.91	V	100	270	11.8	
233.507	13.28	-42.72	V	100	270	12.92	
253.948	17.63	-38.37	V	100	270	13.91	
258.036	18.38	-37.62	V	100	270	13.98	
282.685	18.7	-37.3	V	100	270	14.45	
1930.271	77.92	13.92	V	100	0	32.85	Transmitter 1
1939.869	101.3	37.3	Н	100	0	32.78	Transmitter 2
1951.871	87.77	23.77	Н	100	0	32.62	Transmitter 3
1965.873	86.42	22.42	Н	100	0	32.54	Transmitter 4
1977.871	73.24	9.24	V	100	0	32.46	Transmitter 5
1989.869	86.40	22.40	Н	100	0	32.43	Transmitter 6

Champ électrique (dBµV/m) rayonné en fonction de la fréquence (H z)





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Test according to CFR 47 Part 24

Tests performed by Daniel RAUD at GYL Technologies laboratories. in December. 19 of 2002.

REFERENCE DOCUMENTATION:

CFR47 part 24 "Subpart E" (2000) ANSI C63.4 (2001).

RADIATED DISTURBANCE :

General measurement conditions.

Conforms to Section 8 of the ANSI C63.4 measurement standard. Diagram in 0° position. angles are positives in the reverse clock wise.

RADIATED DISTURBANCE :

General measurement conditions.

Conforms to Section 8 of the ANSI C63.4 measurement standard. Equipment under test:



Method of measurement.

Method of measurement and test installation according ANSI C63.4. Measurement are done at 1m in a free area.

We try to obtain a maximum at all frequencies by moving the product orientation and antenna polarisation. The height of the antenna can vary from 1 m to 4 m.

Measurements done in transmitter mode (all transmitters at maximum power 60 W. in BCCH mode without frequency hopping) and in receiver mode.



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Test equipment used :

APPARATUS	MANUFACTURER	REFERENCE	Identification	Date of
				verification
Free field open area test site				Jul-02
Horn antenna	EMCO	9504 - 4496	M02045	Apr-01
Spectrum analyzer(20Hz- 26.5GHz)	Rohde & Schwarz	FSEM30	M02021	Dec-01

Results :

<u>1</u> - Measurement at transmitters frequencies **for indicative level** transmitters output connected to resistive 50 ohms loads.

FREQUENCY	Measure	AF	Loss cable	Correc.Factor	Level	Limit	Margin
(GHz)	$(dB\mu V)$	(A)	(B)	(A)+(B)	$(dB\mu V/m)$	$(dB\mu V/m)$	(dB)
1						93.9	
1.9302	57.3	27.9	2	29.9	87.2	93.9	-6.7
1.9390	59.8	27.9	2	29.9	89.7	93.9	-4.2
1.9518	59.7	27.9	2	29.9	89.6	93.9	-4.3
1.9658	61.9	27.9	2	29.9	91.8	93.9	-2.1
1.9778	62.2	27.9	2	29.9	92.1	93.9	-1.8
1.9898	58.6	27.9	2	29.9	88.5	93.9	-5.4
20						93.9	



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2 - Spurious emissions measurement.

No spurious emission found which level upper to noise level in 100KHz bandwidth (No harmonics of the transmitter's carrier frequencies were detected above the noise level)..

INTERPRETATION AND REMARKS:

Conform





EMC TEST PLAN for HePA OD 1900 MHz in the S8000 products.

Reference:	Nortel - STP - 00482
Version:	01 - en
Status:	Approved
Date:	29/Nov/2002
Product Name:	S8000 Indoor / Outdoor
Frequency:	PCS
Discipline:	EMC
Author:	P. GALOPIN
Verified by:	T. LUCHINI
Approved by:	C. CHANSARD

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01 - en	29/11/02	P. GALOPIN	Creation of the document	

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1. INTRODUCTION

1.1. OBJECT

This document presents the tests foreseen for the introduction of the HePA accepting a power until 60 W.

In order to qualify HePA, EMC test must be performed. These new modules can be integrated in GSM 19000 BTS products \$8000 Indoor and \$8000 Outdoor BTS.

Then, the base stations systems equipped with HePA must comply with the following standard :

- CRF 47 FCC part 15 Section 15.107 August 2002, Section 15.209 August 2002
- CFR 47 FCC part 24 Section 24.238 2000

For covering in the totality the standard FCC part 15, we will realized the tests in the outdoor product.

The reason is that the outdoor products are powered in alternative current, and that the conducted emissions are applicable exclusively on the AC equipment, specific at outdoor products.

1.2. APPLICABLITY

Product	Applicability	Comment
S8000 Outdoor	FCC part 15 § 15.107 & 15.209 FCC part 24 § 24.238	Will be performed
S8000 Indoor	FCC part 15 & 15.209 FCC part 24 § 24.238	Will not be performed. No requirements for the conducted emissions . Conformity covered with tests performed on S8000 outdoor

2. RELATED DOCUMENTS

2.1. APPLICABLES DOCUMENTS

[A1] CFR 47 Part 24
 [A2] CFR 47 Part 2
 [A2] CFR 47 Part 2
 [A2] CFR 47 Part 2
 [A3] CFR-47-Part15
 [A3] CFR-47-Part15
 Code of Federal Regulations - Part 2 + PERSONAL COMMUNICATIONS SERVICES. Date : June 1996.
 [A3] CFR-47-Part15
 Code of Federal Regulatory. Radio Frequency devices.

2.2. REFERENCE DOCUMENTS

[R1] PCS/BTS/DD/0101 Technical specification for S8000 45W Edge / 60 W GSMK Power Amplifier.

3. TEST PLAN SUMMARY

.

Test	Required	Test specification	Reference Method
Radiated emissions	\boxtimes	FCC part 15 sub Part 15 B Class B	section 15.109 (30 MHz to 10 GHz) H5
Conducted emissions on AC port AC – 60 Hz – 208 V	\boxtimes	FCC part 15	Class B
Radiated emissions	\boxtimes	FCC part 24 sub Part E	Section 24.238

4. TEST PLAN

4.1. RADIATED EMISSIONS TESTS

Standard Coverage : FCC Part 15.109 & FCC Part 24.238

Intend :

- (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonics and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of 2.989, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open filed measurements (e.g., a broadcast transmitter installed in a building) measurements will be acceptable of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.
- (b) The measurements specified in paragraph (a) of this section shall be made for the following equipment :
 - (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz.
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedure :

Radiated emission measurement procedures shall be performed as outlined in Section 8 of the ANSI C63.4 measurement standard. The BTS will be tested to the applicable limits of the FCC rules. For radiated emission measurements the measurement distance between the center of the measurement antenna and the equipment under test shall be 3 meters (or less for frequencies above 1 GHz). In order to maximize all emission levels from the equipment, the emissions will be searched with the receive antenna at varied height levels. The equipment shall also be rotated a full 360 degrees on the turntable with the receive antenna at varying height levels (1 to 4 meters). Tests shall be made with the antenna positioned in both the horizontal and vertical planes of polarization. The BTS shall be placed on the turntable as per ANSI C63.4 measurement procedures. Please see the Part 15 test plan as Part 22 & 24 radiated requirements will be tested in conjunction with the Part 15 testing. The spectrum shall be searched to identify emissions. A complete scan of the applicable spectrum shall be completed (up to 10th harmonic of fundamental). The transmitter shall then be turned off, with the rest of the equipment powered on. A complete scan of the spectrum shall be done and referred to as "ambient" without the transmitter keyed on. Emissions emanating from the transmitter shall be identified from comparing these two scans. The identified emissions (from the transmitter) shall be measured and the levels recorded with the transmitter keyed on at full rated power output.

Important remark :

Substitution measurements must be made on all detected emissions given that the limits for the FCC are given in power measurements. If no emissions are detected, measurements should be made et the noise floor levels for each of the transmitter harmonic frequencies and a statement should be placed in the test report indicating that no emissions were detected.





Figure 7 : Test configuration for Radiated Spurious emissions

The BTS was configured to transmit at maximum power (static level 0).

Measurements were made according to the procedures outline in ANSI C63.4

The emissions were investigated up to the tenth harmonic of the fundamental emission (20 GHz).

The measured level of the emissions was recorded and compared to the limit.

The reference level for spurious radiation was taken with reference to an ideal dipole antenna excited by the rated output power according to the following relationship :

$$E(V/m) = \frac{1}{R(m)} * \sqrt{30 * Pt * G}$$

Where,

E = Field Strength in Volts/meter,

R = Measurement distance in meters,

 P_t = Transmitter Rated Power in Watts (30 Watts),

G = Gain of ideal Dipole (linear)

Therefore :

$$E(V/m) = \sqrt{30*60*1.64}$$

 $E = 54.33 \text{ V/m} = 154.70 \text{ dB}\mu\text{V/m}$

The spurious emissions must be attenuated by at least 43 + 10*Log(60) = 60.78 dB. Therefore the field strength limit at 1 meters is : E = $154.70 \text{ dB}\mu\text{V/m} - 60.78 \text{ dB} = 93.9 \text{ dB}\mu\text{V/m}$

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Receiver Setting	Pre-Scan (to identify spurious emissions from EUT)	Final Measurements
Detector Type	Peak	Quasi-Peak (CISPR)
Mode	Max Hold	Not Applicable
Bandwidth	100 kHz or 1 MHz (for > 1GHz)	120 kHz*
Amplitude Range	60 dB	20 dB
Measurement Time	Not Applicable	> 1s
Observation Time	Not Applicable	> 15s
Step size	Continuous sweep	Not Applicable
Sweep Time	Coupled	Not Applicable
Measuring Distance	3m for 30 MHz - 1GHz	10m for 30 MHz - 1GHz
	1m for 1GHz - 20GHz	1m for 1GHz - 20GHz

Spectrum Analyzer setting during measurements shall be as following :

Pass / Fail criteria :

- For 30 MHz to 1 GHz : Measurement distance : 10 m

 Limit :
 [30 MHz-88 MHz]
 30 dBμV/m

 [88 MHz-216 MHz]
 33.5 dBμV/m

 [216 MHz-960 MHz]
 36 dBμV/m

 Above 960 MHz
 43.5 dBμV/m
- For 1 GHz to 20 GHz : Measurement distance : 1 m Limit : 93.9 dBµV/m

S/W Configuration – Traffic data flow :

All transmitters in the EUT should be transmitting at full power.

The transmitters' operating frequencies should be selected by setting the Absolute Radio Frequency Channel Numbers (ARFCN) equally distributed over the BSS operating band, subject to any restrictions of the configuration of the EUT.

Transmit Power : All TX at 60 W

5. CONDUCTED EMISSIONS TESTS

Test case name : Conducted emissions AC

Standard Coverage : FCC Part 15.107 (0.150 MHz – 30 MHz)

Intend :

Measurement shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications.

Test procedure :

A measuring receiver shall be connected to each RSIL measurement port in turn and the conducted emission levels recorded. The RSIL measurement ports not being used for measurement shall be terminated with a 50 Ω (50 μ H) load.

Pass / Fail Criteria :

Limits for conducted emissions AC mode FCC Part 15 Subpart B (0.150 MHz – 30 MHz)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

S/W Configuration – Traffic data flow :

All transmitters in the EUT should be transmitting at full power. The transmitters' operating frequencies should be selected by setting the Absolute Radio Frequency Channel Numbers (ARFCN) equally distributed over the BSS operating band, subject to any restrictions of the configuration of the EUT.

6. **DOCUMENTATION DELIVERABLES**

The report need to contain the minimum following information :

- all the information contained in this document, in order to identity precisely the configuration under test,
- photographs of the equipment under test (as many as different tests, showing open field test site...),
- any deviation from the test methods defined in the relevant standards,
- all calculation formula used during testing (for example, conversion for a test distance of 10m instead of field measurements),
- description of any modifications made to the EUT during testing which are required to acquire compliance,
- instrumentation and antennas calibration dates,
- for radiated and conducted emissions, a table giving the maximum emission levels in absolute and with respect to the limit (margin). Graphical presentation of the results (such as spectrum analyser plots) has to be incorporated.

6.1. INSTALLATION DIAGRAM

The drawing gives a representation of functional test bench.



7. ABBREVIATIONS

- BTS : Base Transceiver Station
- DC : Direct Current
- DCS : Digital Cellular System
- EMC : Electromagnetic Compatibility
- EN : European Norm
- ETS : ETSI Standard
- EUT : Equipment Under Test
- GSM : Global System Mobile
- IT : Information Technology
- N/A : Not Applicable
- RF: Radio Frequency TRX: Transmitter/receiver

8. **DEFINITIONS**

FCC Part 2 - This part contains the Table of Frequency Allocations and special requirements in international regulations, recommendations, agreements, and treaties. This part also contains standards and procedures concerning the marketing and importation of radio frequency devices, and for obtaining equipment authorization.

FCC Part 15 - This part contains rules setting out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

FCC Part 24 - This part states the conditions under which portions of the radio spectrum are made available and licensed for PCS.

Effective Radiated Power (e.r.p.) (in a given direction) - The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

Equivalent Isotropically Radiated Power (e.i.r.p.) - The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

Mean power (of a radio transmitter) - The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

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