TEST REPORT

CFR 47 Part 15
and CFR 47 Part 24

UMTS 1900 Indoor 2 iBTS 24V

N°149025DK

Technical control: O.ROY	**GYL technologies** Parc d'activités de Lanserre 21, rue de la Fuye 49610 Juigné sur Loire Tel. : 02.41.57.57.40 - Fax : 02.41.45.25.77	Quality Control: L.MONTIEL

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Summary

1 GENERAL INFORMATION

1.1 APPLICANT:

SANMINA SCI
46 Rue Pierre Curie
78376 PLAISIR - FRANCE

1.2 MANUFACTURER:

NORTEL NETWORKS
38, rue Paul Cézanne
78928 Guyancourt Yvelines – France

1.3 APPLICANT REPRESENTATIVE:

Marc CANCOUËT

1.4 TEST DATE:

July 2 to July 4 2003

1.5 TEST SITE:

GYL Technologies
Parc d'activités de Lanserre
49610 Juigné sur Loire – France
FCC registration Number : 90469

2 INTRODUCTION

The following test report for a Base Station Transmitter is written in accordance with Part 15, 22 and 24 of the Federal Communications Commissions. The Equipment Under Test (EUT) was the UMTS 1900 Indoor 2 iBTS 24V. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions of 2001. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurements were performed manually at GYL TECHNOLOGIES. The radiated emissions measurements required by the rules were performed on the three to ten meters, open field, test site maintained by GYL Technologies Parc d'activités de Lanserre, 49610 Juigné sur Loire , France. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission.

The power line conducted emission measurements were performed in a shielded enclosure also located at the Parc d'activités de Lanserre, 49610 Juigné sur Loire, France facility

3 MEASUREMENT EQUIPMENT LIST

PART TYPE	MANUFACTURER	MODEL	SERIAL NUMBER	CALIBRATION DATE
RECEIVERS				
Receiver	Rohde & Schwarz	ESI 7	M02020	Mar-03
Spectrum analyzer	Rohde & Schwarz	FSEM 30	M02021	Dec-02
ARTIFICIAL MAINS NETWORKS				
LISN (50µH / 5/50Ω)	Rohde & Schwarz	ESH2-Z5	M02034	Oct-02
ANTENNAS				
Bilog (30-2000MHz)	CHASE	CBL-6112	M02031	Nov-02
Horn (1 to 18GHz)	EMCO	3161-01	M01138	

4 TESTED SYSTEM DETAILS

The equipment tested is a **B**ase **T**ransceiver **S**tation for **C**ellular **R**adiotelephone **S**ervices also considered as an Information Technology Equipment. The equipment provides Personal Communications Services in the 1930 – 1990 MHz frequency band.

5 EQUIPMENT DESCRIPTION

5.1 PRODUCT TYPE:

UMTS 1900 Indoor 2 iBTS (STSR 3D Configuration):
The UMTS 1900 Indoor 2 iBTS 24V is a UMTS 1900 Indoor 2 iBTS 48V with a DC/DC converter +24V/-55V placed in top of the cabinet as shown by the pictures given in the next pages

5.1.1 Equipment Release Status:

TRM 1900 (all): P1
CCM: 14
CEM: E8 & G6
GPSAM: D7
MCPA 1900 (all): D2
DDM 1900 (all): D1
ICU: D5
MCA: D1
INTERCO: D1
DIGITAL SHELF: D2
LPPCM: P1
External Alarm kit: D2
TMA 1900: D1

5.2 AUXILIARY EQUIPMENT:

Power supply: 24V dc.
Attenuators and 50 ohms load

5.3 PRODUCT PICTURES:

Front view **Rear view**

24V to - 48 V converter front and rear views

5.4 PRODUCT COMPOSITION

The table given here under gives the features details of the equipment under test

ARTICLE	PEC code	Release	Serial number
TRM 1900	NTUM10EA	P1	NNTM7502DFQE
TRM 1900	NTUM10EA	P1	NNTM7502CZMJ
TRM 1900	NTUM10EA	P1	NNTM7502CZM8
CCM	NTGY25AA	14	NNTM5330KMGX
CEM	NTUM00AA	G6	NNTM7503KXUL
CEM	NTUM00AA	G6	NNTM7503L4ZR
CEM	NTUM00AA	E8	NNTM7503CBPH
CEM	NTUM00AA	G6	NNTM7503L502
GPSAM	NTUM24AA	D7	NNTM7503PHK7
MCPA 1900	NTUM30PA	D2	PWWT03D9DJV6 Firmware 1.12
MCPA 1900	NTUM30PA	D2	PWWT03D97J81 Firmware 1.12
MCPA 1900	NTUM30PA	D2	PWWT03D97J8D Firmware 1.12
MCPA 1900	NTUM30PA	D2	PWWT03D9L74Y Firmware 1.12
MCPA 1900	NTUM30PA	D2	PWWT03D9DJTN Firmware 1.12
MCPA 1900	NTUM30PA	D2	PWWT03D97J86 Firmware 1.12
DDM 1900	NTUM42AA	D1	FORM01426047
DDM 1900	NTUM42AA	D1	FORM01428020
DDM 1900	NTUM42AA	D1	FORM01426048
ICU	NTBY58AA	D5	SNMNGG0002G8
INTERCO	NTBY76AA	D1	SNMN7500AUF8
DIGITAL SHELF	NTBY72CA	D2	SNMN7500AS4G
MCA	NTBY90AA	D1	SNMN7500AOO6
LPPCM	NTBY14BA	P1	SNMN7500979P
External alarm kit	NTBY98AA	D2	SNMN75007DFG
Rack Delta			
Kit 24 V (+24V/-55V converter)	NTBY51AA	S0	EN032500003
Converters			
Converter 24/48	NTBY5101	S2	MG032500007
Converter 24/48	NTBY5101	S2	MG032500008
Converter 24/48	NTBY5101	S2	MG032500002
Converter 24/48	NTBY5101	S2	MG032500003
2 fillers converter	NTBY5102	S0	
TMA1900	NTUM35AA	D1	FORM01429980

6 EXERCISING TEST CONDITIONS

Measurements are done in transmitter mode (all transmitters at maximum power, in BCCH mode without frequency hopping), and in receiver mode
Installation diagram and cables list on appendix C10

6.1 CHANNELS TEST CONFIGURATION:

TRM	CHANNEL #	Definition
2	B	TRM 2 output on PA 1 and 6 transmitting at 1932.4 MHz and 46.5dBm
3	M	TRM 3 output on PA 2 and 3 transmitting at 1960 MHz and 46.5dBm
9	T	TRM 9 output on PA 4 and 5 transmitting at 1987.6 MHz and 46.5dBm

6.2 EUT EXERCISING SOFTWARE

The EUT was provided with the software to continuously transmit during testing. The carrier was also checked to verify that the information was being transmitted.

Modules software version: V03E2.1E05.6_2
PI bench: V03D304
Visual TRM: V305
Visual BBS for CEM: V03D3.0_E02

7 CONFORMANCE STATEMENT

7.1 STANDARDS REFERENCED FOR THIS REPORT

PART 2: 1999	Frequency allocations and Radio Treaty Matters General Rules and Regulations
PART 15: 2002	Radio frequency devices
ANSI C63.4-2001	Standard format measurements/technical report personal computer and peripherals
PART 24 Subpart E" (2000)	Broadband Personal communications services

7.2 JUSTIFICATION

As mentioned in paragraph 5 of this report, the equipment is an information technology equipment providing public mobiles services and Personal Communication Services and as it may be installed in residential commercial or light industry areas the following sub clause of the standard mentioned above are

- Part 15.107 and 15.109 (subpart B) for respectively conducted and radiated emission.
- Part 24.238 (subpart E) for broadband PCS emission limits

8 Interpretation and remarks:

This equipment complies with the rules of the FCC.

8.1 IMPORTANT REMARK:

Since no emissions were detected in the pre-scan measurement, substitution method was not performed on UMTS 1900 Indoor 2 iBTS 24V

The EUT Plot on pages 17 and 20 show measured noise floor levels detected while testing the UMTS 1900 Indoor 2 iBTS 24V

9 TEST ACCORDING TO CFR 47 Part 15 Class B

Tests performed by Daniel RAUD at GYL Technologies laboratories, in July 2 to 4, 2003.

9.1 REFERENCE DOCUMENTATION:

FCC part 15 (Sub part B) §15.109 of 2002

9.2 RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was pre-scanned in the semi anechoic at one meter distance. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained. As Part 24 radiated requirements was tested in conjunction with the Part 15 testing. The spectrum was searched to identify emissions. A complete scan of the applicable spectrum was completed (up to 10^{th} harmonic of fundamental). The transmitters were then turned off, with the rest of the equipment powered on. A complete scan of the spectrum was done and referred to as “ambient” without the transmitter keyed on. Emissions emanating from the transmitter were identified from comparing these two scans. The identified emissions (from the transmitter) were measured and the levels recorded with the transmitter keyed on at full rated power output.

Final radiated emissions measurements were made, as outlined in Section 8 of the ANSI C63.4 measurement standard, on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.1 meter above the ground plane. The iBTS was tested to the applicable limits of the FCC rules. The measurement distance between the center of the measurement antenna and the equipment under test is 3 meters (or less for frequencies above 1 GHz .At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Summary of settings

ESI 7 EMI TEST RECEIVER IN RECEIVER MODE	
Peak measurement time	5 ms
step size	40 KHz
Preamplifier	ON
Preselector	ON
Resolution, Band With	120 kHz
Final Quasi Peak measurement time	1 s minimum
Final average measurement time	1 second

All readings are quasi-peak unless stated otherwise.

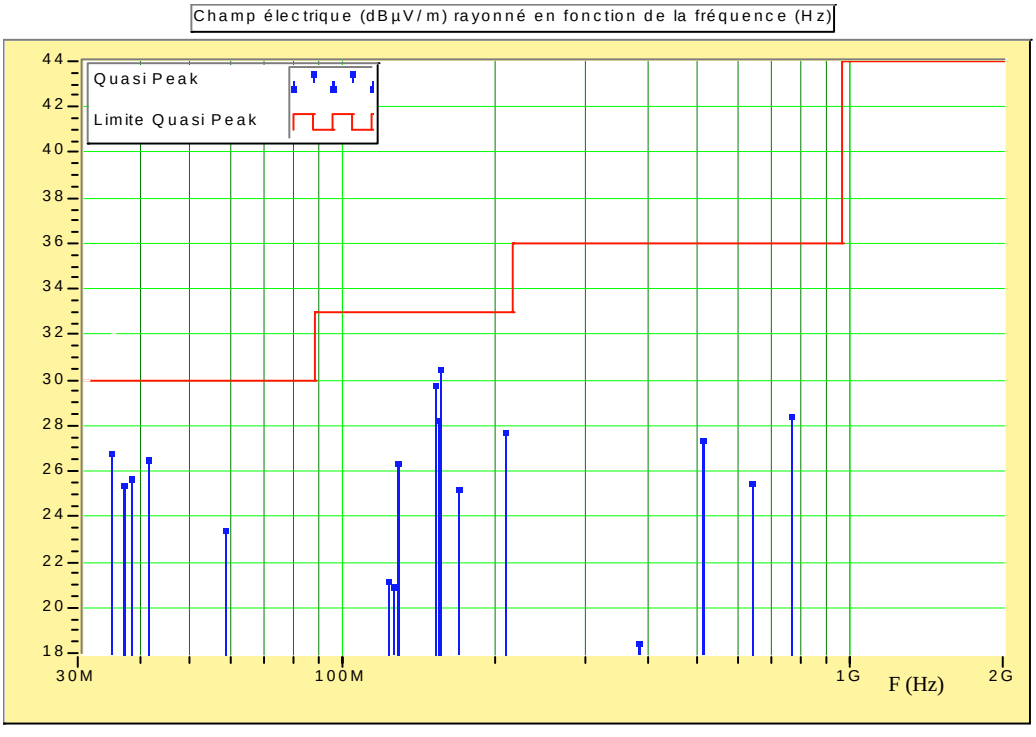
9.2.1 Test Set up

9.3 RESULTS (§ 15.109 class B):

The following data table lists the most significant emission frequencies, measured level, correction factor (includes cable and antenna corrections), corrected reading and the limit. The highest peaks are measured in quasi-peak detection mode at 3 meters distance, except for emissions radiated above 1 GHz where an average detector with 1 MHz resolution bandwidth was used.

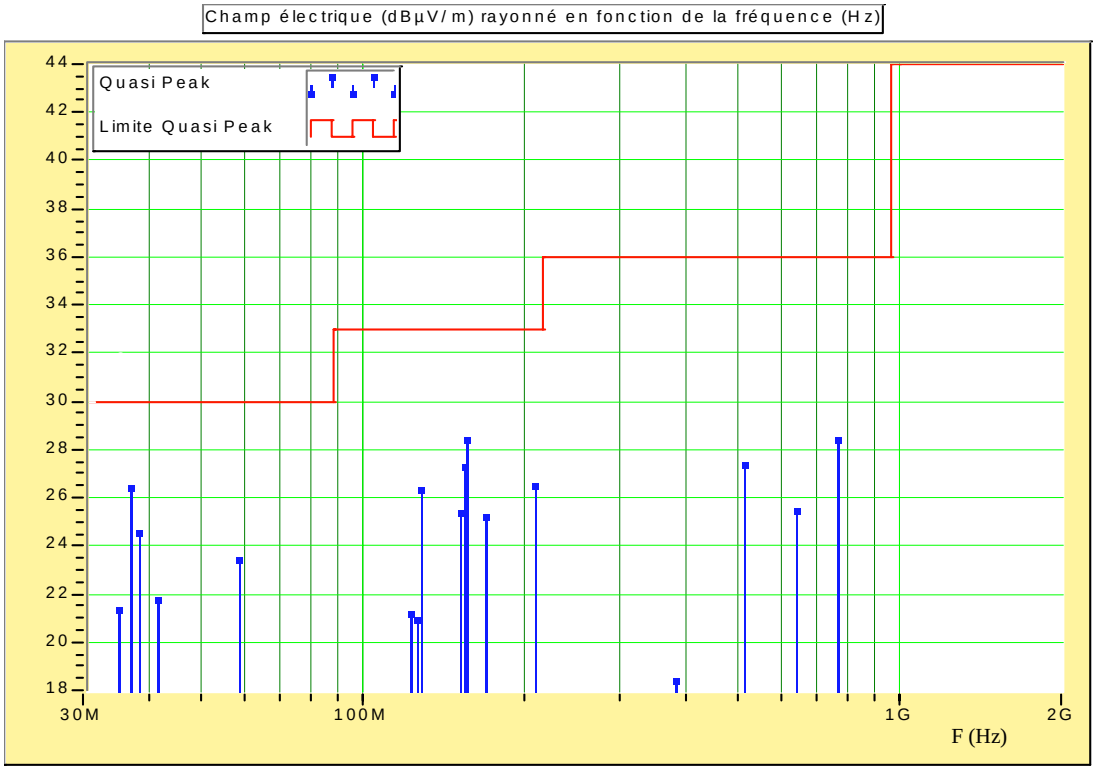
Results with the equipment having 4 rectifiers

F (MHz)	PK (dBµV/m)	QP (dBµV/m)	Margin (dB)	Pol	H (cm)	Angle (degrees)	Corr. Fact (dB)	RBW (kHz)	Comments
34,909	30,80	26,78	-3,22	V	196	345	15,78	120	
36,946	30,35	25,41	-4,59	V	194	323	15,08	120	
38,046	30,41	25,70	-4,30	V	104	323	14,70	120	
41,267	33,83	26,51	-3,49	V	103	1	13,39	120	
58,731	27,25	23,39	-6,61	V	103	323	5,92	120	
122,803	26,89	21,20	-11,80	V	103	323	12,96	120	
125,601	32,25	20,91	-12,09	V	98	74	12,99	120	
128,498	30,18	26,32	-6,68	V	108	351	12,87	120	
151,835	33,21	29,78	-3,22	V	106	345	11,44	120	
154,534	31,83	28,22	-4,78	V	109	344	11,47	120	
155,733	34,58	30,45	-2,55	V	110	329	11,48	120	
168,576	29,42	25,24	-7,76	V	105	5	11,27	120	
208,005	30,51	27,75	-5,25	V	351	345	11,52	120	
383,380	22,74	18,47	-17,53	V	201	32	17,75	120	
511,289	29,00	27,38	-8,62	H	283	337	20,62	120	
638,979	28,25	25,51	-10,49	V	261	19	21,41	120	
766,778	31,77	28,38	-7,62	H	158	39	22,47	120	



Results with the equipment having 3 rectifiers only

F (MHz)	PK (dBµV/m)	QP (dBµV/m)	Margin (dB)	Pol	H (cm)	Angle (degrees)	Corr. Fact (dB)	RBW (kHz)	Comments
34,908	26,74	21,37	-8,63	V	196	307	15,78	120	34,909
36,946	30,80	26,40	-3,60	V	196	307	15,08	120	36,946
38,047	29,23	24,52	-5,48	V	146	307	14,70	120	38,046
41,267	30,41	21,78	-8,22	V	146	310	13,39	120	41,267
58,731	27,25	23,39	-6,61	V	103	323	5,92	120	58,731
122,803	26,89	21,20	-11,80	V	103	323	12,96	120	122,803
125,601	32,25	20,91	-12,09	V	98	74	12,99	120	125,601
128,498	30,18	26,32	-6,68	V	108	351	12,87	120	128,498
151,835	28,69	25,43	-7,57	V	106	326	11,44	120	151,835
154,533	30,93	27,34	-5,66	V	106	326	11,47	120	154,534
155,733	32,61	28,46	-4,54	V	106	326	11,48	120	155,733
168,576	29,42	25,24	-7,76	V	105	5	11,27	120	168,576
208,004	30,11	26,51	-6,49	V	106	326	11,52	120	208,005
383,380	22,74	18,47	-17,53	V	201	32	17,75	120	383,380
511,289	29,00	27,38	-8,62	H	283	337	20,62	120	511,289
638,979	28,25	25,51	-10,49	V	261	19	21,41	120	638,979
766,778	31,77	28,38	-7,62	H	158	39	22,47	120	766,778



For indicative level

F (MHz)	PK (dBµV/m)	AV (dBµV/m)	Pol	H (cm)	A (degrees)	Corr. fact (dB)	RBW (kHz)	Comments
1926,941	58,07	53,71	V	103	1	32,87	1000	transmitter
1959,998	59,17	55,16	V	103	1	32,66	1000	transmitter
1986,707	78,82	74,18	H	246	330	32,49	1000	transmitter

No spurious signal found between 1 GHz and 20 GHz

9.4 INTERPRETATION AND REMARKS:

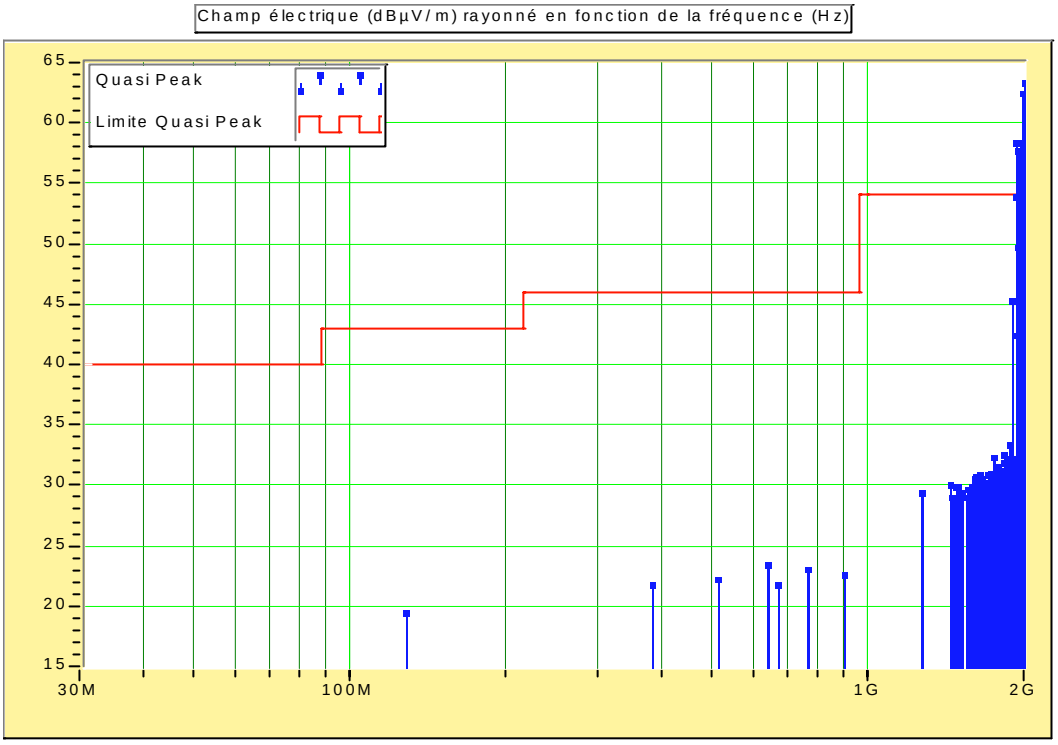
The equipment complies with the §15.109 requirements

9.5 PRE-SCAN MEASUREMENT TO IDENTIFY SPURIOUS EMISSIONS FROM EUT

at D = 1m:

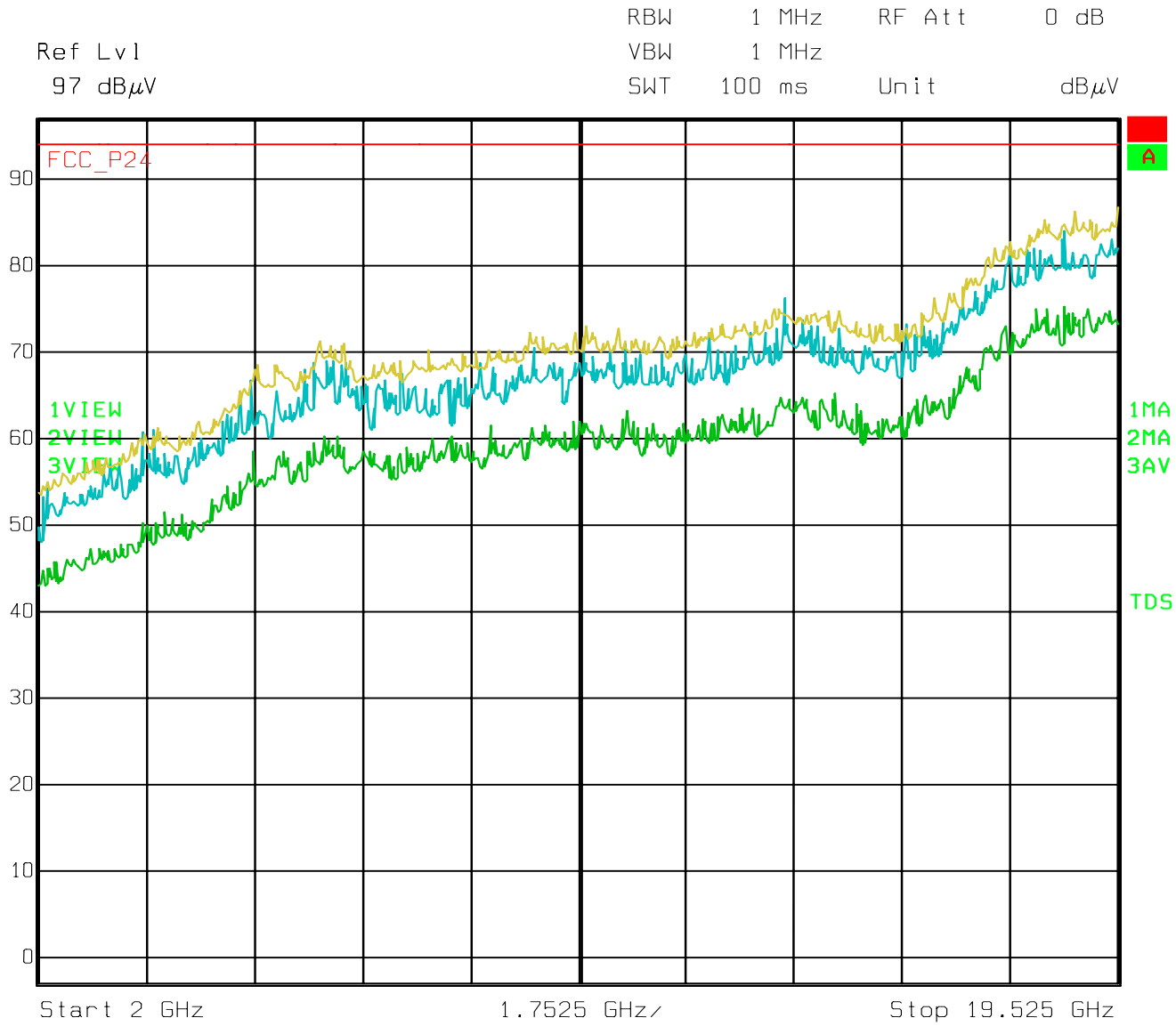
F (MHz)	PK (dBµV/m)	Margin (dB)	Pol	H (cm)	Angle (degrees)	Corr. Fact. (dB)	Comments
127,848	19,55	-23,45	H	100	0	12,89	
383,412	21,84	-24,16	H	100	0	17,75	
511,194	22,23	-23,77	H	100	0	20,62	
894,589	22,59	-23,41	H	100	0	22,16	
1266,441	29,34	-24,66	H	100	0	27,76	
1486,774	29,87	-24,13	H	100	0	29,91	
1496,768	29,93	-24,07	H	100	0	29,98	
1505,514	29,39	-24,61	H	100	0	30,04	
1516,258	29,46	-24,54	H	100	0	30,11	
1599,214	30,61	-23,39	H	100	0	30,65	
1601,462	30,03	-23,97	H	100	0	30,67	
1608,858	30,69	-23,31	H	100	0	30,74	
1612,856	30,12	-23,88	H	100	0	30,77	
1625,150	30,23	-23,77	H	100	0	30,88	
1638,992	29,01	-24,99	H	100	0	31,00	
1640,342	30,96	-23,04	H	100	0	31,01	
1642,490	29,74	-24,26	H	100	0	31,03	
1644,689	30,40	-23,60	H	100	0	31,04	
1656,983	30,51	-23,49	H	100	0	31,15	
1665,128	29,94	-24,06	H	100	0	31,22	
1701,359	29,55	-24,45	H	100	0	31,53	
1705,207	30,92	-23,08	H	100	0	31,56	
1710,154	30,95	-23,05	H	100	0	31,60	
1711,704	30,97	-23,03	H	100	0	31,61	
1717,001	31,01	-22,99	H	100	0	31,65	
1735,141	31,14	-22,86	H	100	0	31,79	
1753,881	32,45	-21,55	H	100	0	31,93	
1760,028	31,33	-22,67	H	100	0	31,98	
1790,362	30,92	-23,08	H	100	0	32,21	
1888,659	45,37	-8,62	H	100	0	32,95	Ambient
1916,195	31,75	-22,25	H	100	0	32,94	transmitters
1925,190	42,51	-11,49	H	100	0	32,88	
1926,239	58,45	4,45	H	100	0	32,87	
1930,637	53,88	-0,12	H	100	0	32,84	
1939,132	49,73	-4,27	H	100	0	32,79	
1953,325	57,77	3,77	H	100	0	32,70	
1958,922	53,24	-0,76	H	100	0	32,66	
1966,668	58,39	4,39	H	100	0	32,61	

F (MHz)	PK (dBµV/m)	Margin (dB)	Pol	H (cm)	Angle (degrees)	Corr. Fact. (dB)	Comments
1984,408	58,39	4,39	H	100	0	32,50	
1988,956	62,45	8,45	H	100	0	32,47	
1992,854	63,28	9,28	H	100	0	32,45	



Spectrum of noise level from 1GHz to 20GHz including loss cable and antenna factors

Legend:
Yellow curve represents the peak measurement in max hold mode
Blue curve represents the peak measurement in sweeping mode
Green curve represents the average measurements



10 TEST ACCORDING TO CFR 47 Part 24 subpart E

Tests performed by Daniel RAUD at GYL Technologies laboratories, in July 2 to 4, 2003.

10.1 REFERENCE DOCUMENTATION:

CFR 47 part 24 subpart E (§ 24.238) of 2000

10.2 RADIATED DISTURBANCE:

10.2.1 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.

10.2.2 General measurement conditions.

Equipment under test:

.

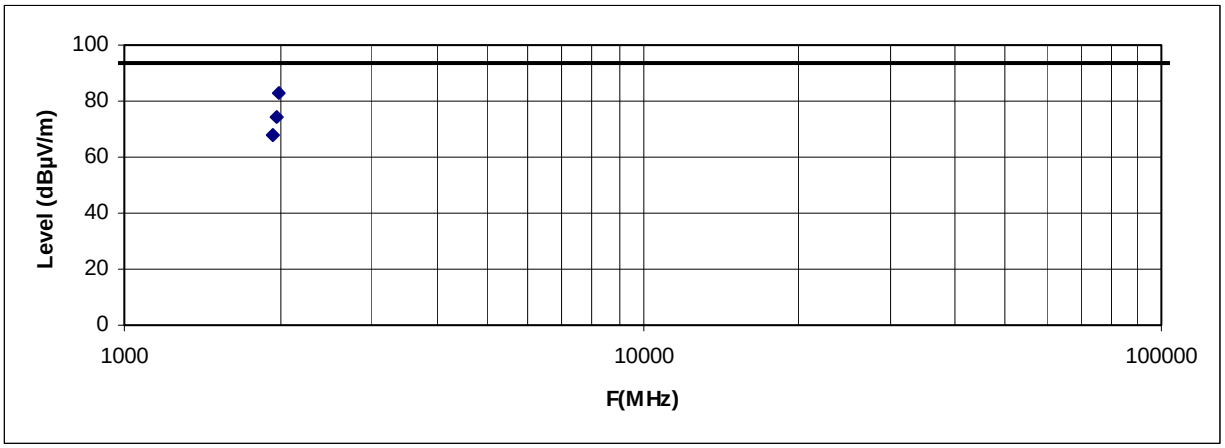
10.2.3 Method of measurement.

Measurements are done at 10m in an open area test site and maximum at all frequencies is analyzed by moving the product orientation and antenna polarization. The height of the antenna can vary from 1 m to 4 m Since no emission were detected above 1 GHZ a less than 30 cm scan was performed
Measurements are done in transmitter mode (all transmitters at maximum power 45Watts)

10.2.4 RESULTS (§24.238):

Measurement at transmitters' frequencies **for indicative level**
Transmitters output connected to resistive 50 ohms loads

FREQUENCY (MHz)	Measure (dBµV)	AF A	Loss cable B	Correc. Factor A+B	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1 932.4	**38.1**	**27.9**	**2**	**29.9**	**68**	**93.9**	**-25.9**
1 960.0	**44.1**	**27.9**	**2**	**29.9**	**74**	**93.9**	**-19.9**
1 987.6	**53.1**	**27.9**	**2**	**29.9**	**83**	**93.9**	**-10.9**



10.2.5 Spurious emissions measurement.

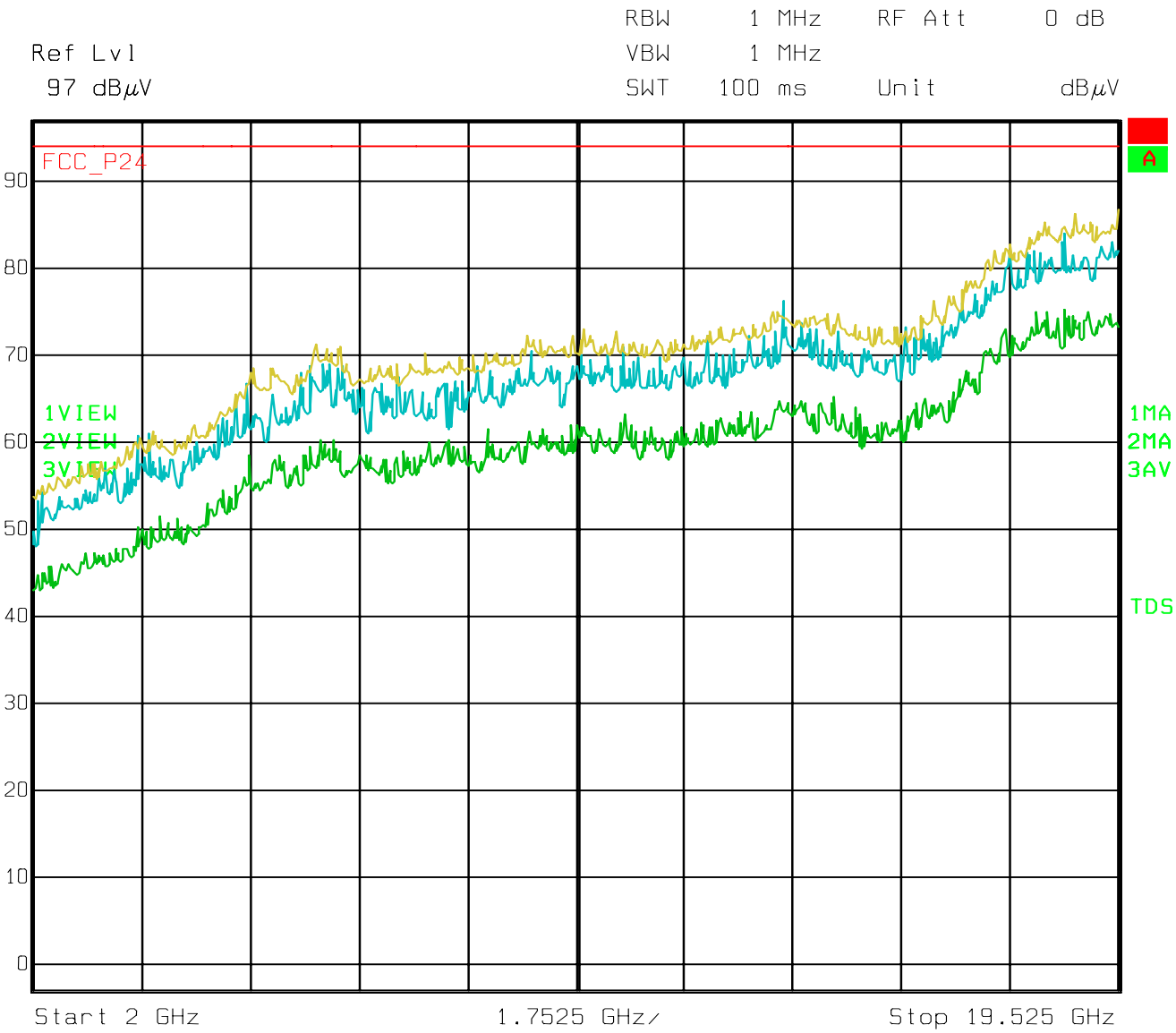
No spurious emission found which level upper to noise level in 1 MHz bandwidth (harmonics transmitters' frequencies under noise level)

10.3 INTERPRETATION AND REMARKS:

The equipment complies with the §24.238 requirements

Spectrum of noise level from 1GHz to 20GHz including loss cable and antenna factors

Legend:
Yellow curve represents the peak measurement in max hold mode
Blue curve represents the peak measurement in sweeping mode
Green curve represents the average measurements



SANMINA-SCI

UMTS 1900 Indoor 2 iBTS 24V: EMC test plan

Reference:	**PLN-T-030351-6G1**
Version:	**B**
Status:	**Approved**
Date:	**01/07/2003**

Product Name:	**UMTS 1900 Indoor 2 iBTS 24V**
Frequency:	**UMTS-1900**
Discipline:	**EMC**

Author:	**Marc CANCOUËT**
Verified by:	**Patrick GALOPIN**
Approved by:	**Christian CHANSARD**

PUBLICATION HISTORY

VERSION	DATE	AUTHOR	MODIFICATION
A	03/06/2003	M. CANCOUËT	Creation of the document
B	01/07/2003	M. CANCOUËT	Correction of the document

CONTENTS

1. INTRODUCTION

The purpose of this document is to present the plan for the EMC qualification of the UMTS 1900 Indoor 2 iBTS 24V used for the US Market. The conformity with the test program presented below will be used to demonstrate the compliance of the UMTS 1900 Indoor 2 iBTS 24V with the Electromagnetic Compatibility applicable standard.

The UMTS 1900 Indoor 2 iBTS 24V is a UMTS 1900 Indoor 2 iBTS 48V with a DC/DC converter +24V/-55V placed in top of the cabinet.

The UMTS 1900 Indoor 2 iBTS has been qualified in STSR1 configuration (without converter 24V/- 48V option) in October 2002 in GYL Technologies laboratory. Details on the qualification status of this configuration have been available in the document referenced [R6].

For North America, applicable standard for EMC Base stations are the FCC part 15 Class B and the FCC Part 24.

This document applies to:

Product:	UMTS 1900 Indoor 2 iBTS 24V
Manufacturer:	NORTEL NETWORKS
Frequencies:	1930 – 1990 MHz
Configuration:	STSR3D
Option:	PCM lightening protection kit External alarm module Kit 24V

2. RELATED DOCUMENTS

2.1. APPLICABLES DOCUMENTS

[A1]	47CFR Part 2	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations - Frequency allocations and radio treaty matters; general rules and regulations - dated 10/1/01
[A2]	47 CFR Part 15 08/20/02	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations – Radio frequency devices – dated 08/20/02
[A3]	47 CFR Part 24	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations - Personal communications services - dated 10/1/01

2.2. REFERENCE DOCUMENTS

[R1]	UMT/BTS/DD/390	Requirements specification for a phase II 600 mm UMTS indoor cabinet.
[R2]	UMT/BTS/DD/389	Requirements specification: DC electrical distribution system for a phase II 600 mm UMTS Indoor cabinet.
[R3]	UMT/BTS/DD/388	Requirements specification: Indoor iBTS 600 phase II indoor cooling unit.
[R4]	PLN-V-030355-6G1	1900 MHz UMTS PI Qualification Plan
[R5]	UMT/BTS/DD/458	Technical requirement for +24/-48V DC Power converter solution to supply our Indoor UMTS BTS (draft)
[R6]	NORTEL-STR-00443	IBTS UMTS Indoor 2 1900 MHz

3. REQUIREMENTS BEFORE EMC ASSESSMENT

3.1. HARDWARE TECHNICAL STATUS

Details on the technical status of the system will be available in the document, supplied by Nortel Networks during the commissioning & acceptance phase form for UMTS 1900 Indoor 2 iBTS 24V.

The following table presents the hardware status of the Nortel Networks UMTS 1900 Indoor 2 iBTS 24V during the qualification phase.

Modules Designation		***Supplier***
Indoor wired CABINET	NTBY06AA	SANMINA
Digital Shelf	NTBY72CA	
Interco Panel	NTBY76AA	
CEM module	NTUM00AA	NORTEL
TRM module	NTUM10EA	NORTEL
CCM module	NTGY25AA	NORTEL
GPSAM module	NTUM24AA	NORTEL
MCPA	NTUM30PA	POWERWAVE
DDM	NTUM42AA	FOREM
PCM external cable 100 Ω	NTBY60TA	
EA Cable	NTBY6102	
MCA	NTBY90AA	
ICU	NTBY58AA	SANMINA
LPPCM	NTBY14BA	
EAM lightning protection	NTBY98AA	
TMA Kits	NTUM35AA	
Kit 24 V (+24V/-55V converter)	NTBY51AA	DELTA

3.2. LIST OF KITS & CABLES

3.2.1 LIST OF KITS

In fact, protections modules are optional but can be used to protect the PCM links & the Alarms links. These modules are made only with passive components and then are not critical modules for the system.
Kits are the following :

Kits: PCM lightning protection (NTBY61QA)
EAM lightning protection (NTBY98AA)

The TMA Kit (NTUM35AA) as ancillary equipments already comply with FCC standard, and is under the responsibility of the OEM supplier.

3.2.2 LIST OF CABLES

The following ports of the UMTS 1900 Indoor 2 iBTS 24V were available and connected :

- Iub port (telecom port) : cable referenced NTBY60TA 25 meters 100Ω. This cable has been looped in order to transmit TX signals on RX ones.
- Alarms externs ports: cable referenced NTBY6102 25 meters. 1 cable has been looped and the other cable has been connected to the 24 V / - 48 V DC/DC converter.
- Radio port (signal port) : 6 RF cables RADIALL SHF9TD – DC-2GHz – Insertion loss < 5.5 dB at 2 GHz (15 meters). Attenuators and loads have also been used on RF links.
- DC port : Lab cable (about 10 meters).

3.3. SOFTWARE NEEDS FOR UMTS 1900 INDOOR 2 IBTS

As the objective is to perform the FCC marking on the UMTS 1900 Indoor 2 iBTS 24V STSR3D, we need to use performance criteria as defined in the EMC applicable standard for UMTS project.
Consequently, for emissions, we have to configure the equipment with the power amplifiers set at their maximum rated level, and looped back the Iub link in order to generate activity inside this cable.

If one of the above functionality is not available for the testing phase, we will not be able to perform the FCC marking based on the tests realized.

4. TEST PLAN SUMMARY

4.1. TESTS MATRIX FOR QUALIFICATION

The following table lists the tests to be done, the severity level to apply, the configuration to test and comment when necessary.

	Test case	Application	Standard	Test requirement	Performance criteria	Comment
	Emission tests					
1	Radiated emissions	Enclosure of iBTS Indoor	FCC Part 15 § 15.109	30MHz – 18 GHz	Class B	**This EMC test is realized with the normal configuration.**
2	Radiated emissions	Enclosure of iBTS Indoor	FCC Part 24 § 24.238	30 MHz – 20GHz	The spurious emissions must be attenuated by at least 43 + 10 Log(P) P = Transmitter rated Power in Watts	**This EMC test is realized with the normal configuration.**

4.2. TEST DESCRIPTION OF THE RADIATED EMISSION

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 iBTS 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 iBTS shall be placed on the turntable as per ANSI C63.4 measurement procedures. Please see the Part 15 test plan as Part 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 10^{th} 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.

The equipment was configured as shown in the next figure.

UMTS 1900 Indoor 2 iBTS 24V: EMC test plan

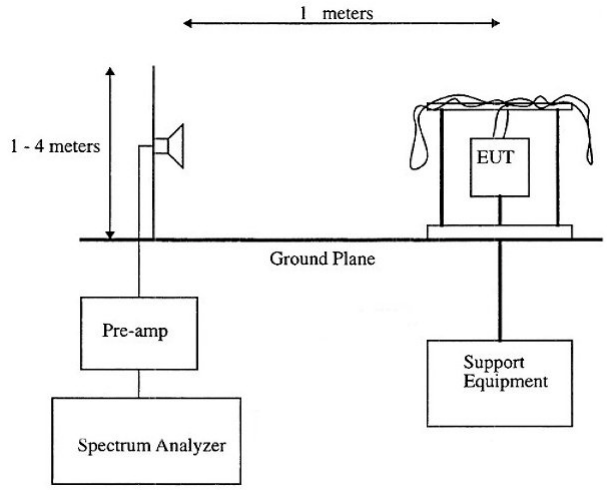


Figure 7 : Test configuration for Radiated Spurious emissions

Limits for radiated emissions from FCC Part 24.

Frequency range	**Minimum requirement (e.r.p.)/Reference Bandwidth**
30 MHz≤ f <20 GHz	The spurious emissions must be attenuated by at least 43 + 10 Log(P) P = Transmitter rated Power in Watts

Limits for radiated emissions (FCC Part 15 class B)

Frequency range MHz	Distance m	Electrics fields	
		µV/m	dBµV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
>960	3	500	54

UMTS 1900 Indoor 2 iBTS 24V: EMC test plan

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 (45 Watts),
G = Gain of ideal Dipole (linear)

Therefore :

$$\mathbf{E(V/m) = \sqrt{30 * 45 * 1.64}}$$

E = 47V/m = 153.44 dBµV/m
The spurious emissions must be attenuated by at least 43 + 10*Log(45) = 59.5dB.
Therefore the field strength limit at 1 meters is :
E = 153.44 dBµV/m – 59.5 dB = 93.9 dBµV/m

Spectrum Analyzer setting during measurements shall be as following :

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 1m for 1GHz - 20GHz	10m for 30 MHz - 1GHz 1m for 1GHz - 20GHz

UMTS 1900 Indoor 2 iBTS 24V: EMC test plan

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**

Limits for radiated emissions from FCC Part 24.

Frequency range	**Minimum requirement (e.r.p.)/Reference Bandwidth**
30 MHz≤ f <20 GHz	The spurious emissions must be attenuated by at least 43 + 10 Log(P) P = Transmitter rated Power in Watts

Limits for radiated emissions (FCC Part 15 class B)

Frequency range MHz	Distance m	Electrics fields	
		µV/m	dBµV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
>960	3	500	54

4.3. IBTS EMISSION TESTS CONFIGURATIONS

The iBTS will be configured with the maximum hardware activation in order to simulate the worst case. The hardware configuration will then be equivalent to a STSR3D.
We will have the following number of modules:
- 4 CEM
- 3 TRM
- 2 CCM
- 1 GPSAM
- 6 MCPA
- 3 DDM
- DC converter +24V/-55V

For a functional point of view, the test configuration shall be as close to the normal intended use and the base station shall transmit with the maximum power declared by Nortel with all the transmitters active. So the 6 MCPA have to transmit a UMTS radio signal at the maximum power for this configuration (45 W). The UMTS Indoor 2 iBTS will be configured to transmit a radio signal on all the MCPA with three carriers test model.
Following the software, we can activate the RF links as follow:

- TRM 2 output on PA 1 and 6 transmitting at 1932.4 MHz and 46.5 dBm
- TRM 3 output on PA 2 and 3 transmitting at 1960 MHz and 46.5 dBm
- TRM 9 output on PA 4 and 5 transmitting at 1987.6 MHz and 46.5 dBm

In the same time, some data are looped back on the Iub link (external cable with TX and RX looped back together).

All the input/output ports will be connected to representative cables and load. The nominal external cables shall be supplied to Sanmina EMC team before the tests.

For DC power, we used converter Kit 24 V (NTBY51AA), this optional module is used for some configuration for US market.

Internal protection module is optional but can be used to protect the Alarm links. This module is made only with passive components and then are not critical modules for the system. Nevertheless, this optional module will be used in the system for the emissions tests.

External protection module is optional but can be used to protect the PCM links. This module is made only with passive components and then are not critical modules for the system. Nevertheless, this optional module will be used in the system for the emission tests.

5. CONCLUSION

The tests presented in this document, if compliant with the EMC standard, will allow determining the compliance of the UMTS 1900 Indoor 2 iBTS 24V with the FCC standards.

6. ABBREVIATIONS AND DEFINITIONS

6.1. ABBREVIATIONS

The following abbreviations are relevant to this document.

Abbreviation	Explanation
3GPP	Third Generation Partnership Project
3-ϕ	Three Phase
A	Ampere
AC	Alternating Current
AMN	Artificial Mains Network
ATM	Asynchronous Transfer Mode
BIP	Breaker Interface Panel
BLER	Block Error Ratio
BS	Base Station
BTS	Base station Transceiver System
CB	Circuit Breaker
CCM	Core Control Module
CE	Compliance Europe
CEM	Channel Element Module
CPICH	Common Pilot Channel
CPC	Common Product Code
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
dB	Decibel
dBm	Power unit (in Decibels) referenced to 1 mW
dBµV	Voltage unit (in Decibels) referenced to 1 µV
dBµV/m	Field Strength unit (in Decibels) referenced to 1 µV/m.
DC	Direct Current
DDM	Dual Duplexer Module
DPCH	Dedicated Physical Channel
EFT	Electrical Fast Transients
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Norms
ESD	Electrostatic Discharge
EUT	Equipment Under Test
f	Frequency
fc	Chip frequency in IS-95 standard. fc = 1.2288MHz
FCC	Federal Communications Commission
FDD	Frequency Division Duplexing
GHz	Gigahertz
GPS	Global Positioning System
GPSAM	Global Positioning System Alarm Module
HSSL	High Speed Serial Links

HW	Hardware (also H/W)
Hz	Hertz
iaw	In Accordance With
iBTS	Internet Base station Transceiver System
IEC	International Electrotechnical Commission
I/O	Input/Output
ITU	International Telecommunications Union
kHz	Kilohertz
kV	Kilovolt
LISN	Line Impedance Stabilization Network
m	Meter
MCPA	Multichannel Power Amplifier (also PA).
MHz	Megahertz
mm	Millimeter
mW	Milliwatt
N/A	Not Applicable
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PCB	Printed Circuit Board
PCCPCH	Primary Common Control Physical Channel
PEC	Procurement Engineering Code
PFM	Power Filter Module
PI	Product Integrity
PICH	Page Indication Channel
PP and G	Power Protection and Ground
RF	Radio Frequency
R&TTE	Radio and Telecommunications Equipment
SF	Spreading Factor
STSR	Sector Transmit Sector Receive
TBT	Test Bench Tools
TDD	Time Division Duplexing
TMA	Tower Masthead Antenna
TRM	Transmit Receive Module
ULC	Unlimited Liability Corporation
UMTS	Universal Mobile Telecommunications System
µV	Microvolts
V	Volts
VAC	Volts AC
VDC	Volts DC
W	Watt

6.2. DEFINITIONS

The following are definitions of terms used throughout this test plan.

Ancillary Equipment - Equipment (apparatus), used in connection with a receiver, transmitter or transceiver is considered as an ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver to provide additional operational and/or control features to the radio equipment, (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver, transmitter or transceiver; and
- the receiver, transmitter or transceiver to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

Base Station Equipment - Radio and/or ancillary equipment intended for operation at a fixed location and powered directly or indirectly (e.g. via an AC/DC converter or power supply) by AC mains network, or an extended local DC mains network.

BLER - BLER is block error ratio. The BLER calculation shall be based on evaluating the CRC on each transport block.

Continuous phenomena (continuous disturbance) **-** Electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects (IEC 60050-161).

Radio communications equipment **-** Telecommunications equipment , which includes one or more transmitters and/or receivers and/or parts thereof for use in a fixed, mobile or portable application. It can be operated with ancillary equipment but if so, is not dependent on it for basic functionality.

Port **-** A particular interface, of the specified equipment (apparatus), with the electromagnetic environment. For example, any connection point on equipment intended for connection of cables to or from that equipment is considered as a port (see Figure 2-1).

Signal and control **-** Port which carries information or control signals, excluding antenna ports.

Spurious Emission – Emissions on a frequency, or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of band emissions.

Effective Radiated Power (ERP) – 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 tile sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

Telecommunication port **-** Ports, which are intended to be connected to telecommunication networks (e.g. public switched telecommunication networks, integrated services digital networks), local area networks (e.g. Ethernet, Token Ring) and similar networks.

Transient phenomena **-** Pertaining to or designating a phenomena or a quantity, which varies between two consecutive steady states during a time interval short, compared with the time-scale of interest (IEC 60050-161).

fc -Chip frequency in IS-95 standard. fc = 1.2288MHz

NodeB - A logical node responsible for radio transmission/reception in one or more cells to/from the User Equipment.
Iub - Interface between a Node B and an RNC.

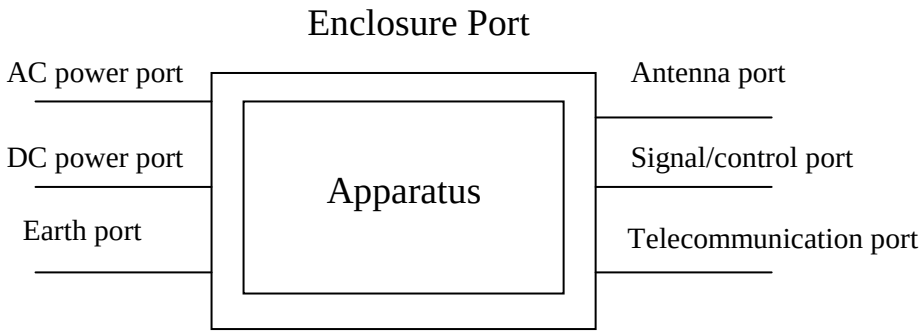


Figure 1: Examples of Ports.

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