EXHIBIT 2

Test Report List

Applicant: Northern Telecom Ltd.

For Certification on:

AB6UMTS1900IND

Exhibit 2A	Radio Test Report (Normal Environment) Radio Test Report (Extreme Environment)
Exhibit 2B	EMC Test Report EMC Lab Test Data

EXHIBIT 2A

Radio Test Report

Applicant: Northern Telecom Ltd.

For Certification on:

AB6UMTS1900IND

NORTEL NETWORKS™

Radio Test Report for UMTS 1900 Indoor 2 iBTS

Document number:	UMT/BTS/DJD/004972
Document issue:	V01.01/EN
Document status:	Standard
Date:	21/Oct/2002

RF Tests concerning FCC Part are performed
In Les Miroirs building – laboratory 006 – Nortel Networks, 38 Bd Paul Cézanne, 78280 Guyancourt – France

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Printed in France

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PUBLICATION HISTORY

21/10/2002 **S. BALE**

Document creation.

Issue V01.01 / EN Standard

CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the measurements results of tests performed on Nortel Networks UMTS 1900 Indoor 2 iBTS according to 3GPP TS 25.141 version 3.10.0 and FCC specifications.

1.2. SCOPE OF THIS DOCUMENT

This document applies to Nortel FDD

UMTS 1900 Indoor 2 iBTS

in the following configuration: STSR1 mode 30/45W.

1.3. AUDIENCE FOR THIS DOCUMENT

This document is to be used by any person needing a view on Nortel FDD UMTS 1900 Indoor 2 iBTS, Layer 1 RF performances (as described in 3GPP TS 25.141).

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

[A1]	UMT/BTS/APP/0022	Methodology of UMTS BTS validation under 25.141 specification
[A2]	UMT/BTS/DPL/4743	Radio test plan for UMTS 1900 iBTS

2.2. REFERENCE DOCUMENTS

[R1]	3GPP TS 25.141	3rd Generation Partnership Project ; Technical Specification Group Radio Access Networks ; Base station conformance testing (FDD) (Release 1999) Version 3.10.0
[R2]	47CFR Part 24	PERSONAL COMMUNICATIONS SERVICES January 2001
[R3]	47CFR Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS October 2001

3. TEST RESULTS

3.1. INTRODUCTION

The following information is submitted to introduce a Certification of the UMTS 1900 Indoor 2 iBTS for Northern Telecom, Inc:

- According to 47CFR Part 24, Subpart E
- According to 47CFR Part 2, Subpart J

of the FCC Rules and Regulations. The measurement procedures were in accordance with the requirements of Part 2.947.

3.2. MEASUREMENT RESULTS

Table 1 is a summary of the measurement results performed with 45W mode in this report.

Measurement Specification	Clause Number	Limit Specification	Description	Result
FCC 2.1046	-	24.232	Maximum Output Power	Complies
FCC 2.1049	-	-	Occupied Bandwidth	Complies
3GPP 25.141 Version 3.10	6.5.2.1	-	Spectrum Emission Mask	Complies
FCC 2.1051, 2.1057	-	24.238	Spurious Emission at Antenna Terminals	Complies
3GPP 25.141 Version 3.10	7.5	-	Blocking Characteristics	Complies

Table 1. Measurement Results performed with 45 W mode

Table 2 is a summary of the measurement results performed with 30W mode in this report.

Measurement Specification	Clause Number	Limit Specification	Description	Result
FCC 2.1046	-	24.232	Maximum Output Power	Complies

Table 2. Measurement Results performed with 30 W mode

3.3. MAXIMUM OUTPUT POWER

3.3.1 FCC REQUIREMENTS

(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT.See 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power. In no case may the peak output power of a base station transmitter exceed 100 watts.

(b) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

3.3.2 TEST RESULTS

The table 3 summarizes the maximum output power performed in 45W mode.

TEST CONDITIONS		Base Station Maximum Output Power (dBm)		
		Channel B 1932.6 MHz	Channel M 1960 MHz	Channel T 1987.4 MHz
		Sector 1	Sector 2	Sector 3
T_{nom}(25°C)	V_{nom}(48V)	44.7	45	44.7

Table 3. Measurements result for Maximum output power in 45W mode

3GPP requirements specifies that the maximum output power should be 45.1 dBm ±2.7 dB

For equivalent isotropically radiated power requirement, the sum of the antenna gain and the feeder losses should not be higher than 17.05dB. The reference for this calculation is the nominal output power of 45.1dBm.

This table 4 summarizes the maximum output power performed in 30W mode.

TEST CONDITIONS		Base Station Maximum Output Power (dBm)		
		Channel B 1932.6 MHz	Channel M 1960 MHz	Channel T 1987.4 MHz
		Sector 1	Sector 2	Sector 3
T_{nom}(25°C)	V_{nom}(48V)	42.9	43.2	42.9

Table 4. Measurements result for Maximum output power in 30W mode

3GPP requirements specifies that the maximum output power should be 43.3 dBm ±2.7 dB

3.3.3 TEST PROCEDURE

The equipment was configured as shown in Figure 1. A power meter has been used to performed the maximum output power test.

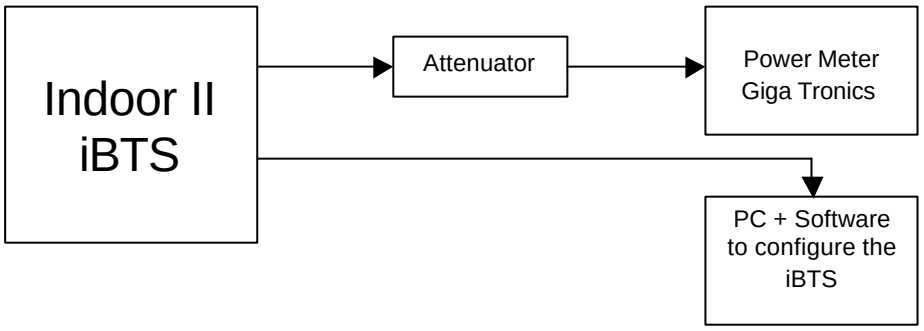


Figure 1. Test configuration to measure RF Output Power

The iBTS was configured to transmit at maximum power with 32 dedicated channels on the single carrier.

3.4. OCCUPIED BANDWIDTH

3.4.1 FCC REQUIREMENTS

The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated of at least 26 dB.

3.4.2 TEST RESULTS

The table 5 summarizes the Occupied bandwidth's test performed in 45W mode.

OBSERVED CHANNEL	Occupied bandwidth (MHz)		
	Channel B 1932.6 MHz	Channel M 1960 MHz	Channel T 1987.4 MHz
	Sector 1	Sector 2	Sector 3
Occupied bandwidth	4.6 MHz	4.6 MHz	4.6 MHz

Table 5. Measurements result for Occupied Bandwidth

3GPP requirements specifies that the maximum occupied bandwidth should be less than 5 MHz.

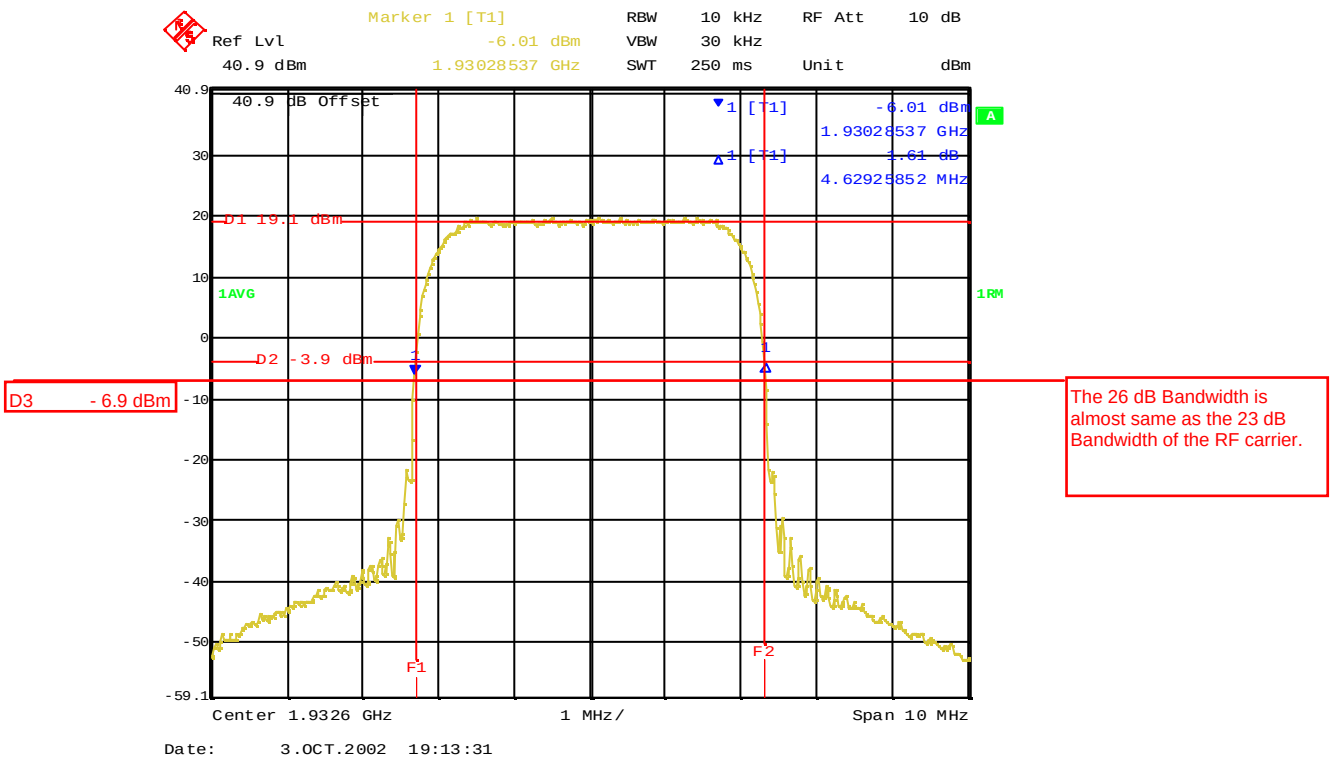


Figure 2. Sample plot for Occupied Bandwidth @ 1932.6 MHz

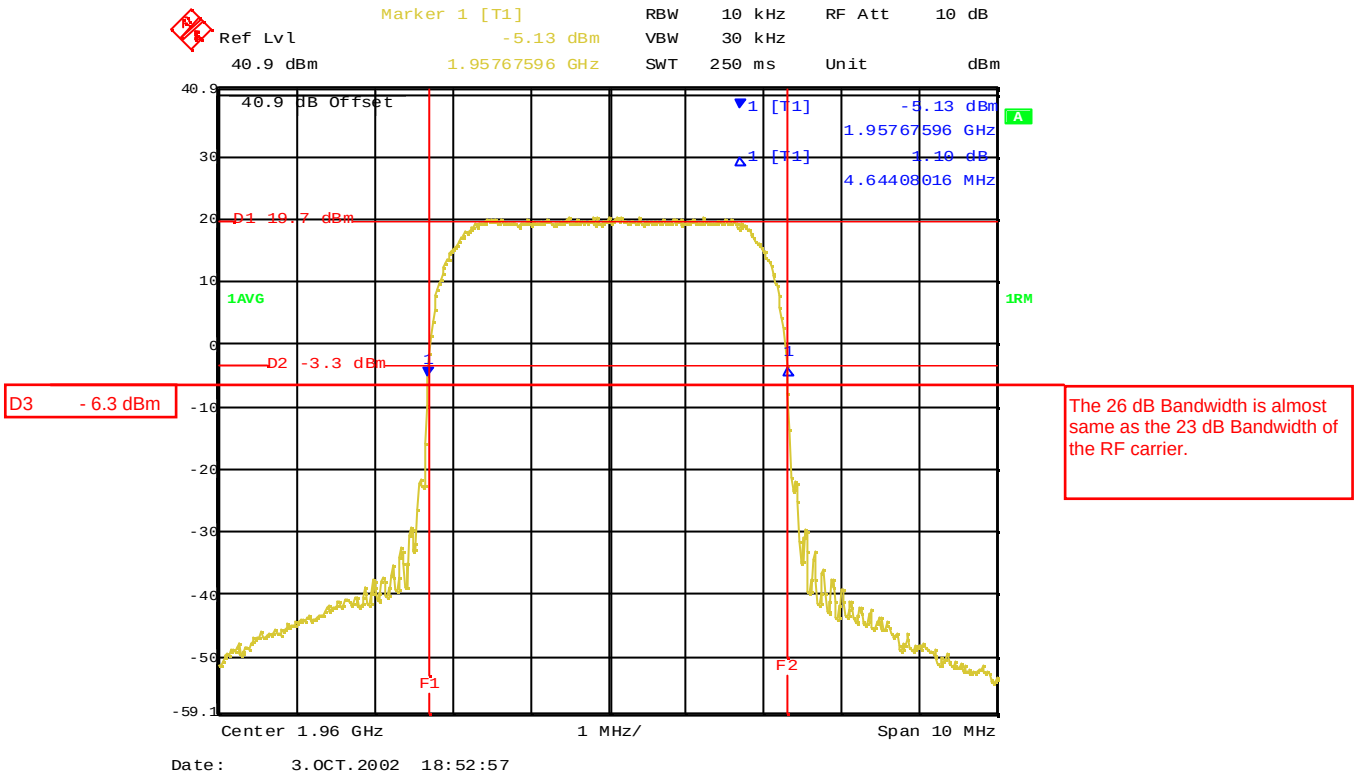


Figure 3. Sample plot for Occupied Bandwidth @ 1960 MHz

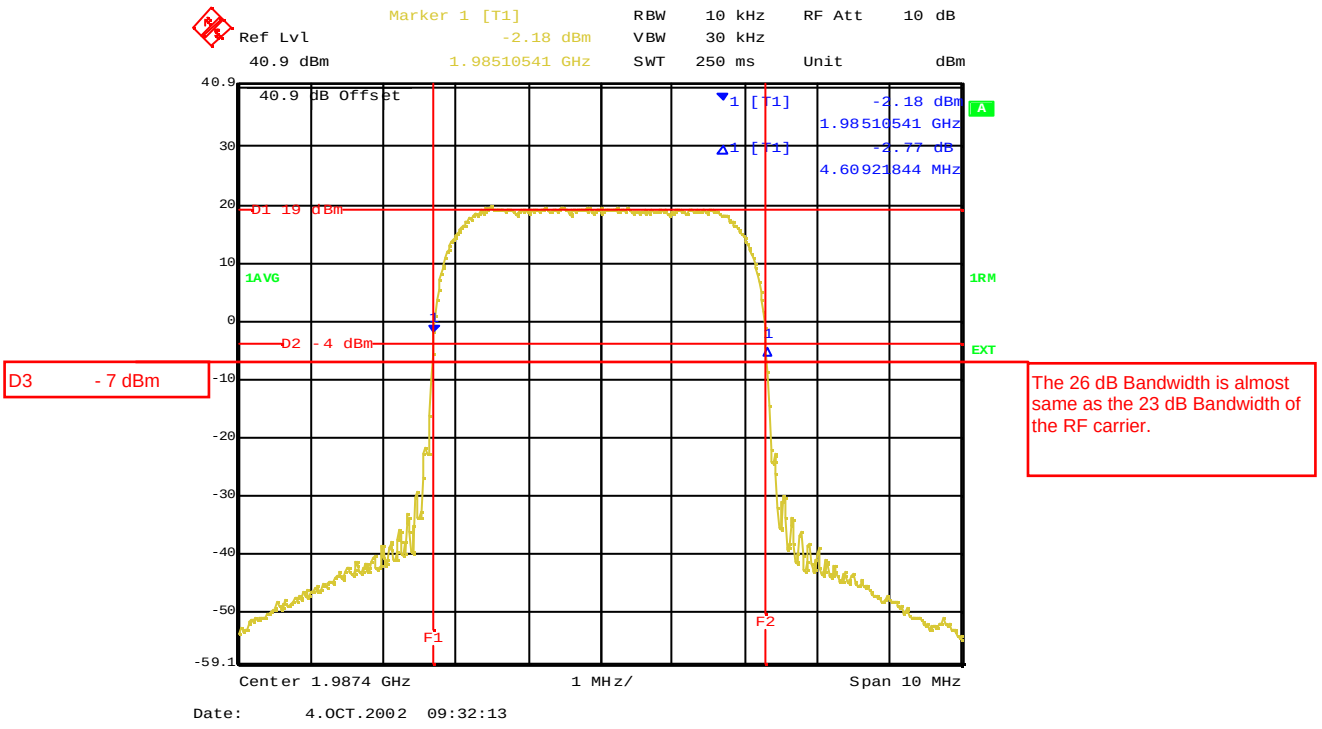


Figure 4. Sample plot for Occupied Bandwidth @ 1987.4 MHz

3.4.3 TEST PROCEDURE

The equipment was configured as shown in Figure 5.

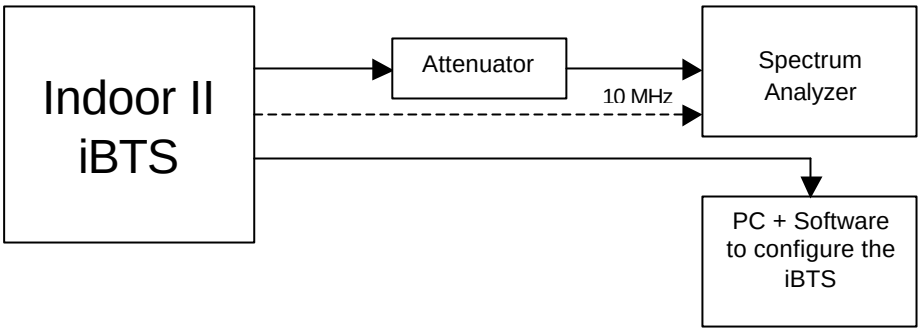


Figure 5. Test configuration for Occupied Bandwidth

The iBTS was configured to transmit at maximum power (45W). Measurements were performed at bottom, middle and top frequency of the transmit band on each sector.

The spectrum analyzer had the following setting:

Resolution Bandwidth	10 kHz
Video Bandwidth	30 kHz
Span	10 MHz
Sweep time	250 ms
Reference Level Offset	Corrected to take into account cables and attenuator losses

3.5. SPECTRUM EMISSION MASK

3.5.1 3GPP REQUIREMENTS

For regions where this clause applies, the requirement shall be met by a base station transmitting on a single RF carrier configured in accordance with the manufacturer's specification. Emissions shall not exceed the maximum level specified in table 6 in the frequency range from Δf =2.5 MHz to 3.5 MHz from the carrier frequency, where:

- Δf is the separation between the carrier frequency and the nominal –3dB point of the measuring filter closest to the carrier frequency.
- f_offset is the separation between the carrier frequency and the centre of the measurement filter;

Frequency offset of measurement filter –3dB point, Df	**Frequency offset of measurement filter centre frequency, f_offset**	**Requirements**	**Measurement bandwidth**
2.5 MHz ≤ Δf < 2.7 MHz	2.515MHz ≤ f_offset < 2.715MHz	-15dBm	30 kHz
2.7 MHz ≤ Δf < 3.5 MHz	2.715MHz ≤ f_offset < 3.515MHz	-15dBm	30 kHz

Table 6. Spectrum emission mask values

3.5.2 TEST RESULTS

The table 7 summarizes the results obtained during the Spectrum Emission Mask test.

Frequency offset (MHz)	**Spectrum Emission Mask (dBm)**					
	Channel B 1932.6 MHz		Channel M 1960 MHz		Channel T 1987.4 MHz	
	Sector 1		Sector 2		Sector 3	
	+	-	+	-	+	-
2.515 to 2.715	-24.7	-25.6	-24.2	-24	-25	-24.8
2.715 to 3.515	-29.9	-30.3	-30.2	-30.3	-29.8	-30

Table 7. Measurements result for Spectrum Emission Mask

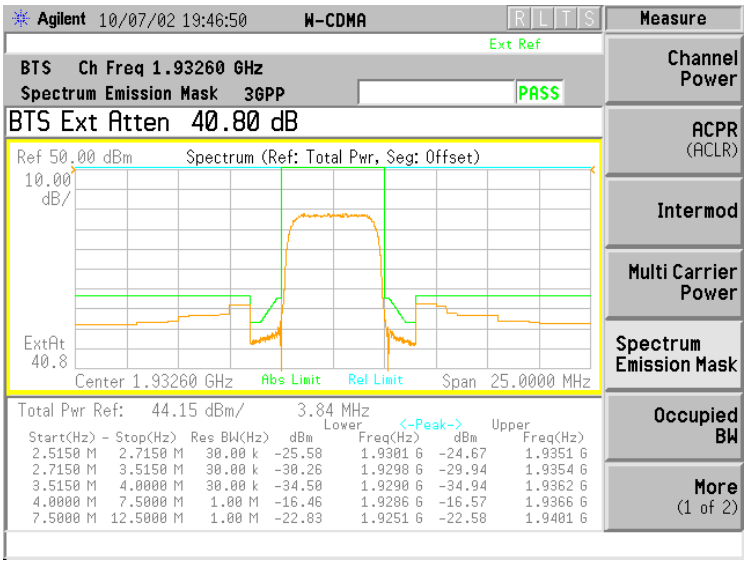


Figure 6. Spectrum Emission Mask @ 1932.6 MHz

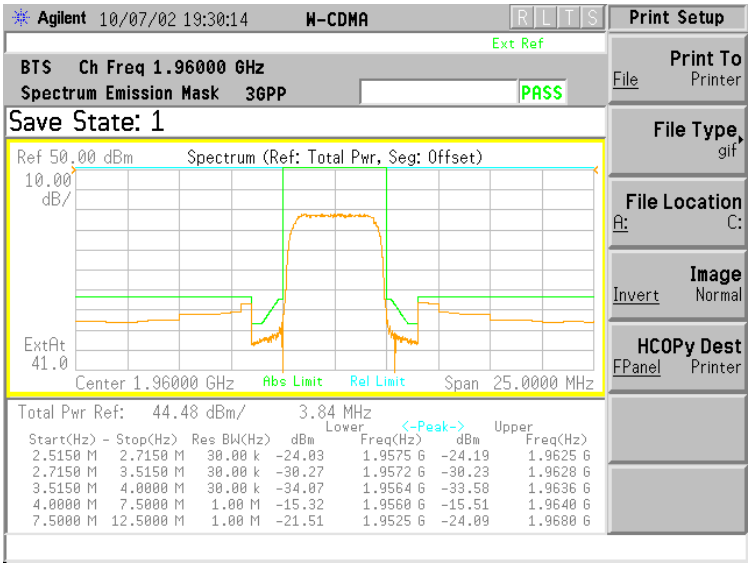


Figure 7. Spectrum Emission Mask @ 1960 MHz

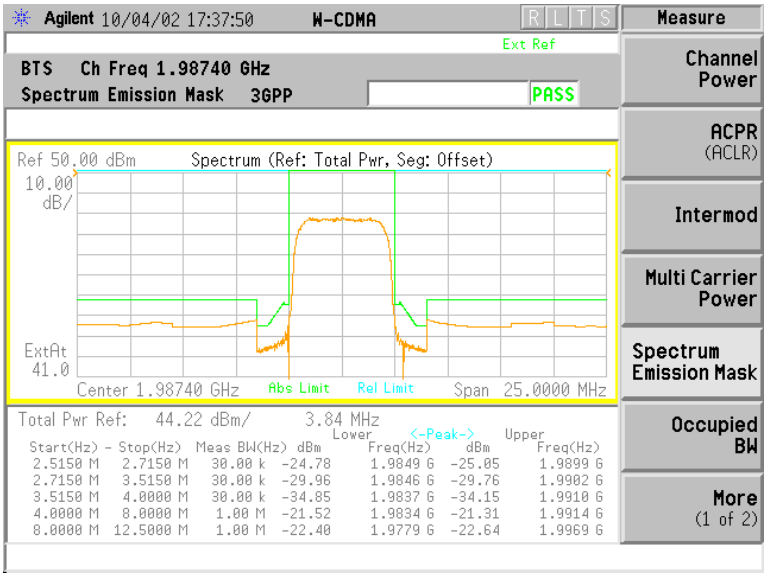


Figure 8. Spectrum Emission Mask @ 1987.4 MHz

3.5.3 TEST PROCEDURE

The equipment was configured as shown in Figure 9.

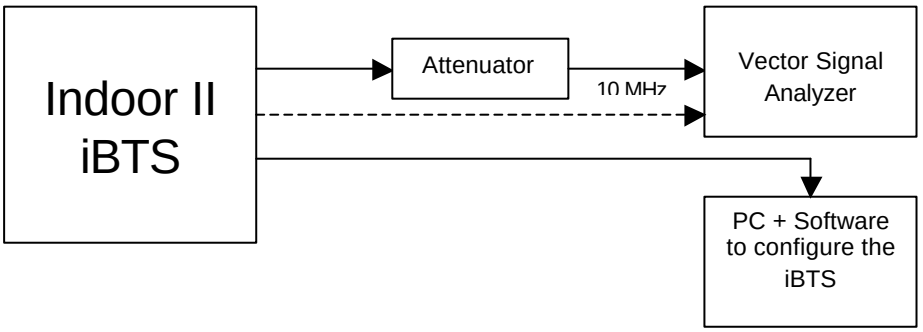


Figure 9. Test configuration for Spectrum Emission Mask

3.6. BLOCKING CHARACTERISTICS

3.6.1 3GPP REQUIREMENTS

The blocking characteristics is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the adjacent channels. The blocking performance requirement applies as specified in table 8.

Test Code	Center Frequency of Interfering Signal	Interfering Signal Level	Wanted Signal mean power	Minimum Offset of Interfering Signal	Type of Interfering Signal
A	1850 - 1910 MHz	-40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
B	1830 - 1850 MHz 1910 - 1930 MHz	-40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
C	1 MHz - 1830 MHz 1930 MHz - 12750 MHz	-15 dBm	-115 dBm	—	CW carrier
D	1930 – 1990 MHz	+16 dBm	-115 dBm	—	CW carrier

Table 8. Blocking Characteristics

3.6.2 TEST RESULTS

The tables 9 to 12 show the results for Blocking Characteristics in all bands declared in the table 8.

Test Code	BLOCKING RESPONSES (MHz) Out of Band CW carrier	BIT ERROR RATIO (%) Channel M 1880 MHz Sector 2
C	1 MHz to 925 MHz	0.0
	925 MHz to 960 MHz	0.0
	960 MHz to 1805 MHz	0.0
	1805 MHz to 1830 MHz	0.0
	1930 MHz to 4000 MHz	0.0
	4000 MHz to 12750 MHz	0.0

Table 9. Measurements result for Blocking Characteristics out of Band

Test Code	BLOCKING RESPONSES (MHz) In Tx Band CW carrier	BIT ERROR RATIO (%) Channel M 1880 MHz Sector 2
D	1930 MHz to 1990 MHz	0.0

Table 10.Measurements result for Blocking Characteristics in Tx Band

Test Code	BLOCKING RESPONSES (MHz) Out of Band WCDMA signal	BIT ERROR RATIO (%) Channel M 1880 MHz Sector 2
B	1830 MHz to 1850 MHz	0.0
	1910 MHz to 1930 MHz	0.0

Table 11. Measurements result for Blocking Characteristics out of Band

Test Code	BLOCKING RESPONSES (MHz) In Rx Band WCDMA signal	BIT ERROR RATIO (%)
		Channel M 1880 MHz
		Sector 2
A	1850 MHz to 1870 MHz	0.0
	1890 MHz to 1910 MHz	0.0

Table 12. Measurements result for Blocking Characteristics in Rx Band

REQUIREMENT CLAUSE 7.5

BER	< 0.1 %

3.6.3 TEST PROCEDURE

The equipment was configured as shown in Figure 10.

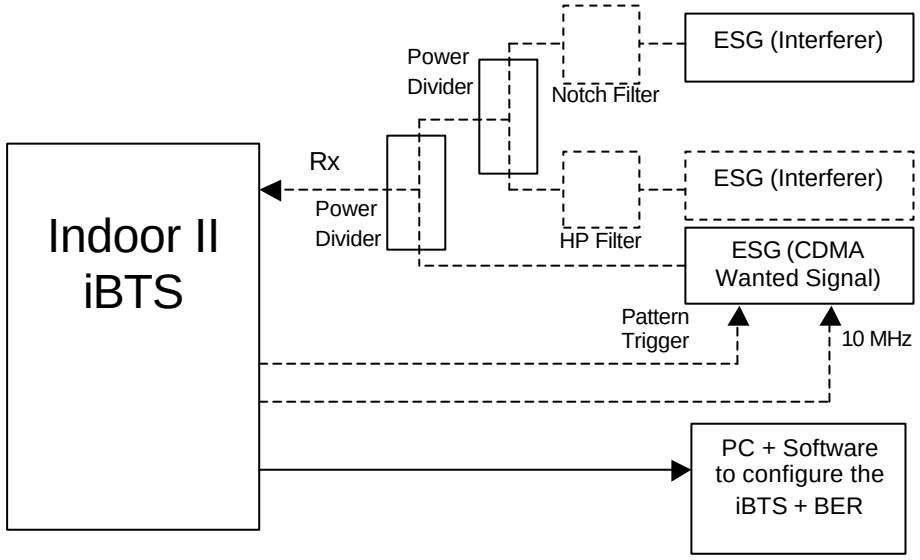


Figure 10. Test configuration for Blocking Characteristics

To perform this test, a notch filter and a high pass filter have been used to avoid the increasing noise floor in the Rx band.

For all the measurements, each BER is calculated from at least 50000 received data bits.

3.7. SPURIOUS EMISSIONS AT ANTENNA TERMINALS

3.7.1 FCC REQUIREMENTS

(a) At any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shallbe adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

3.7.2 TEST RESULTS

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (45 dBm => 31.6 W).

Therefore the spurious emissions must be attenuated by at least:

43 + 10*Log(31.6) = 58 dB

The measured output power was 45 dBm, therefore the limit is -13 dBm.

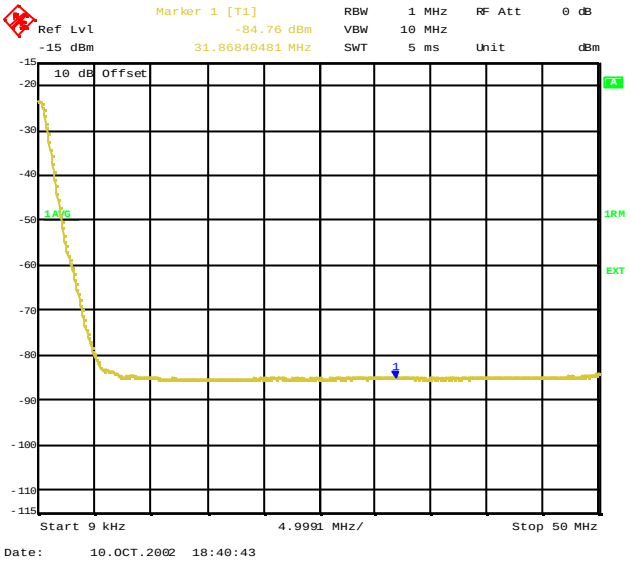
Tables 13 to 15 show the results for Spurious Emissions at Antenna Terminals.

Frequency band	SPURIOUS EMISSION LEVEL (dBm) Channel B 1932.6 MHz Sector 1	Margin (dB)	Limit (dBm)
9 kHz to 50 MHz	-84.8	71.8	-13
50 MHz to 500 MHz	-82.6	69.6	
500 MHz to 1 GHz	-79.2	66.2	
1 GHz to 1.8 GHz	-77.4	64.4	
1800 MHz to 1925 MHz	-31.7	18.7	
1925 MHz to 1927.025 MHz	-20.3	7.3	
1927.025 MHz to 1928.025 MHz	-21	8	
1928.025 MHzto 1929.025 MHz[1]	-18.5	5.5	
1929.025 MHz to 1929.975 MHz[2]	-16.3	3.3	
1935.025 MHz to 1935.975 MHz	-16.1	3.1	
1935.975 MHz to 1936.975 MHz	-20.6	7.6	
1936.975 MHz to 1937.975 MHz	-22.2	9.2	
1937.975 MHz to 1940 MHz	-15.3	2.3	
1940 MHz to 4 GHz	-28.2	15.2	
4 GHz to 12 GHz	-50.1	37.1	
12 GHz to 20 GHz	-36.7	23.7	

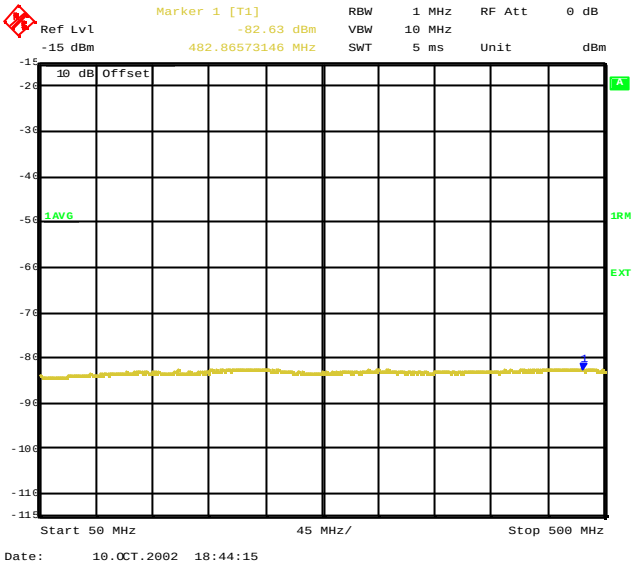
Table 13. Measurements result for Spurious Emission in B band

[1] For this frequency band, the carrier has been set at 1932.4MHz.
[2] For this frequency band, the carrier has been set at 1932.4MHz.

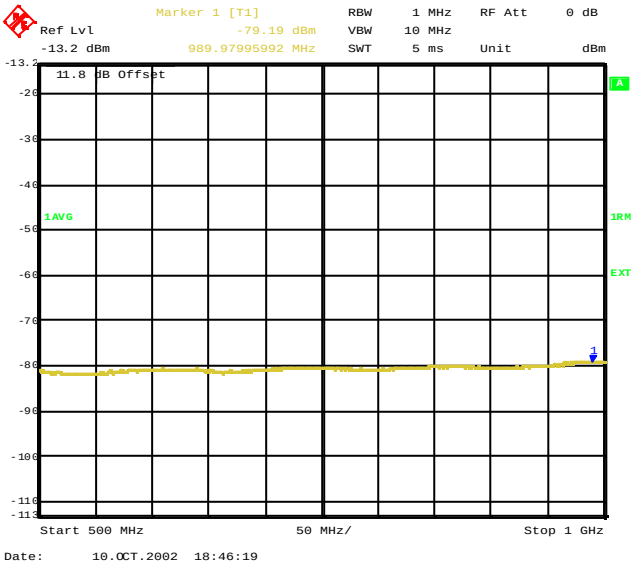
9 kHz-50 MHz[3]



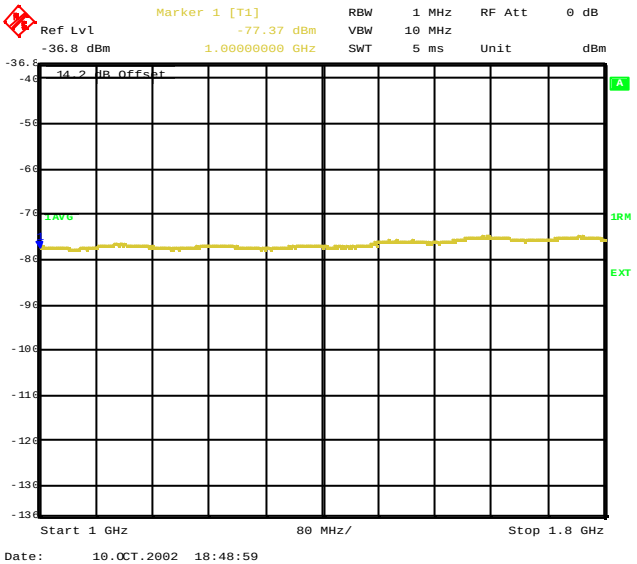
50 MHz-500 MHz



500 MHz-1 GHz

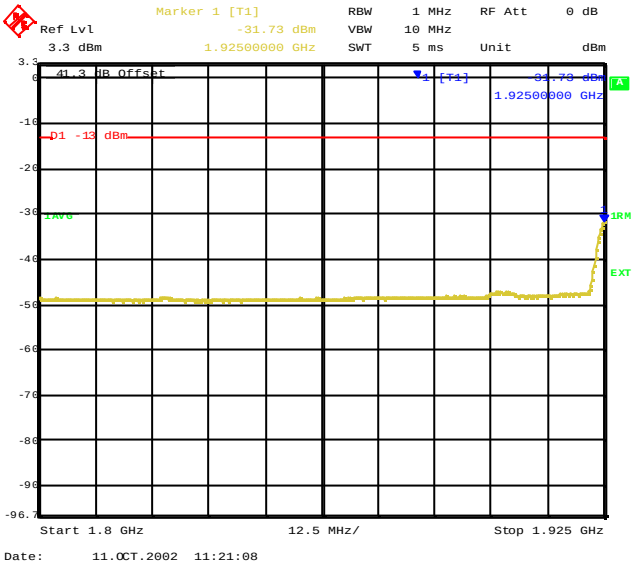


1 GHz-1.8 GHz



[3] Spectrum lines at 9 kHz are internal DC spectrum line of Analyzer

1800 MHz- 1925 MHz



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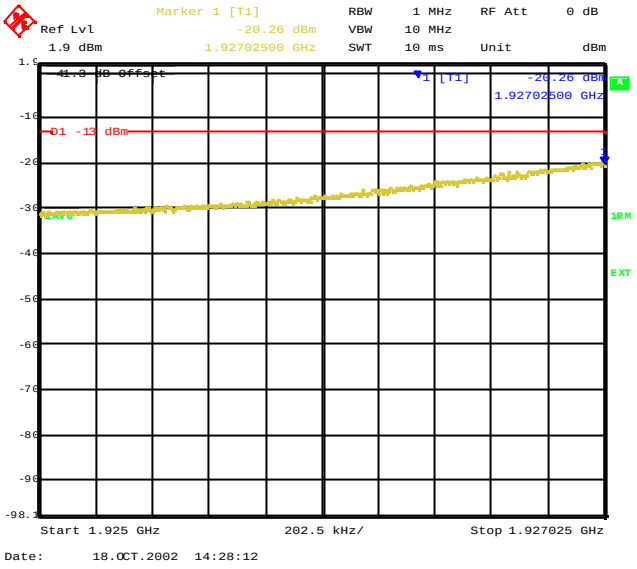
1925 MHz-1927.025 MHz



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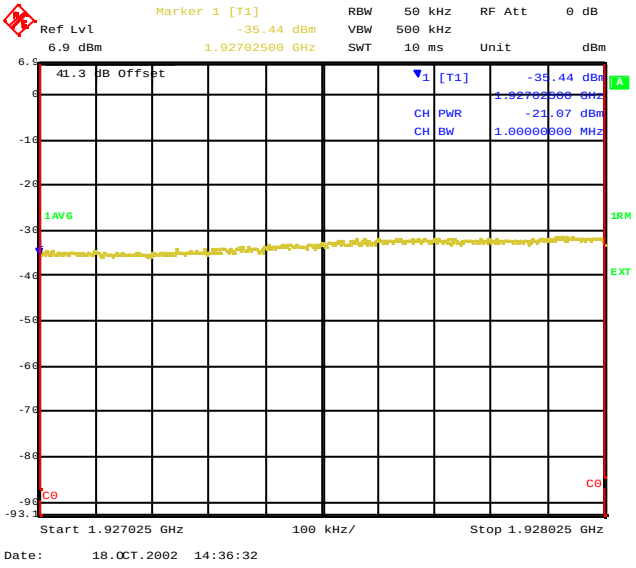
1927.025 MHz-1928.025 MHz



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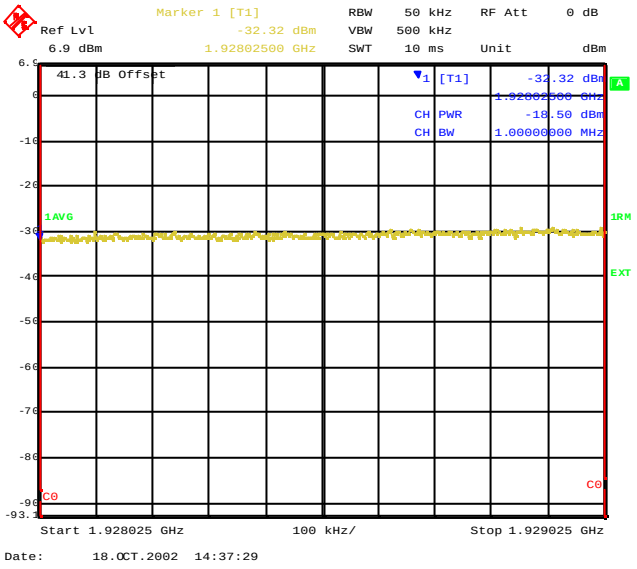
1928.025 MHz-1929.025 MHz



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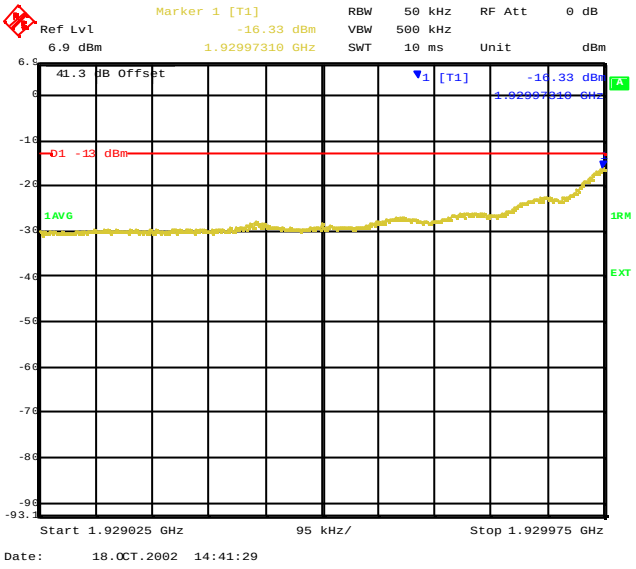
1929.025 MHz-1929.975 MHz



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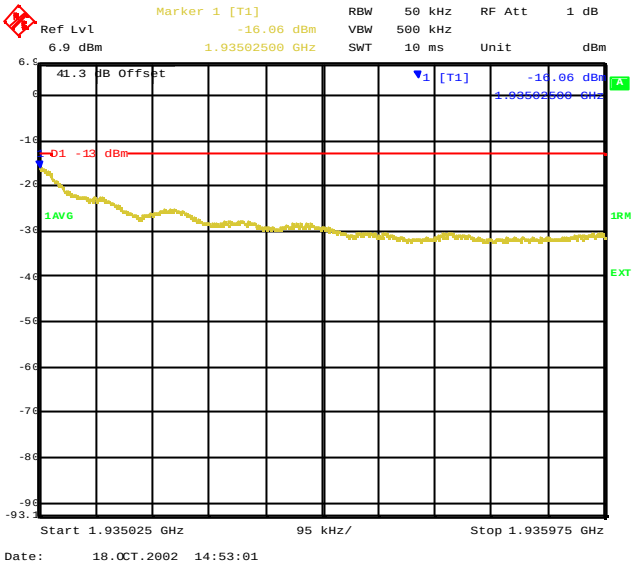
1935.025 MHz-1935.975 MHz



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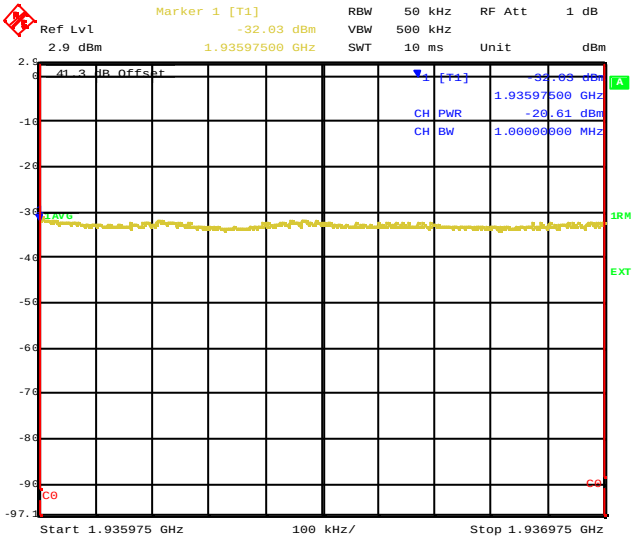
1935.975 MHz-1936.975 MHz



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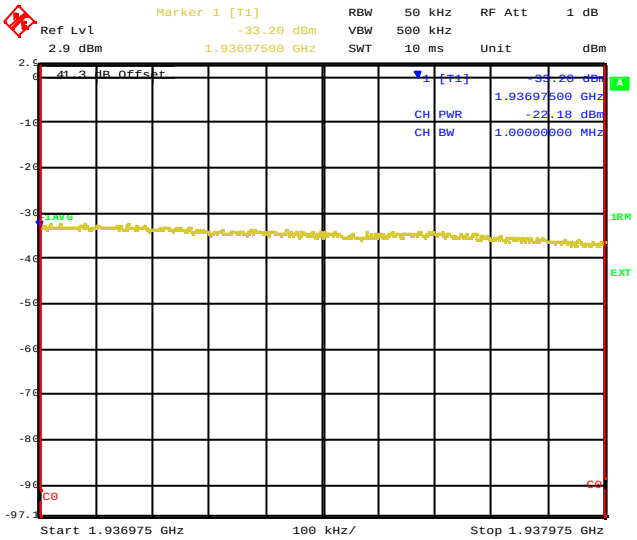
1936.975 MHz-1937.975 MHz



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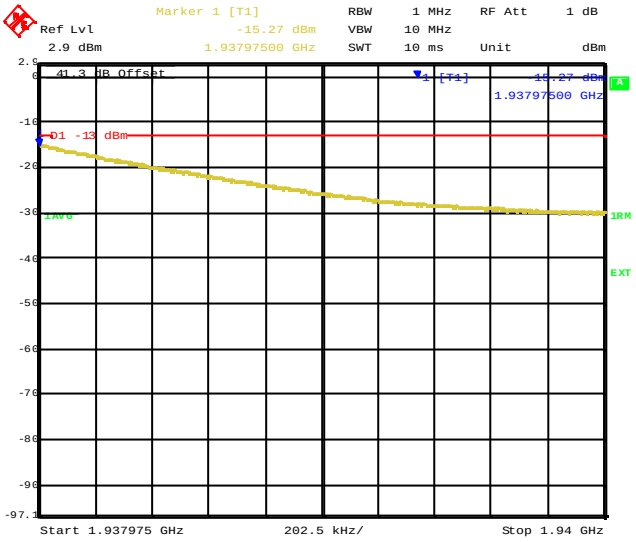
1937.975 MHz-1940 MHz



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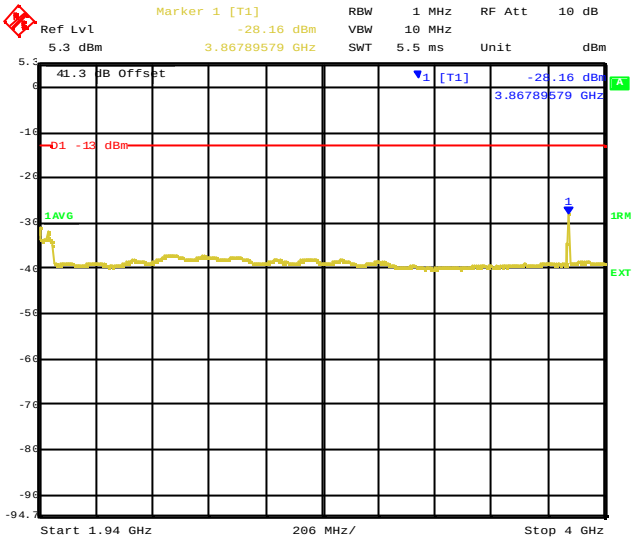
1940 MHz-4 GHz



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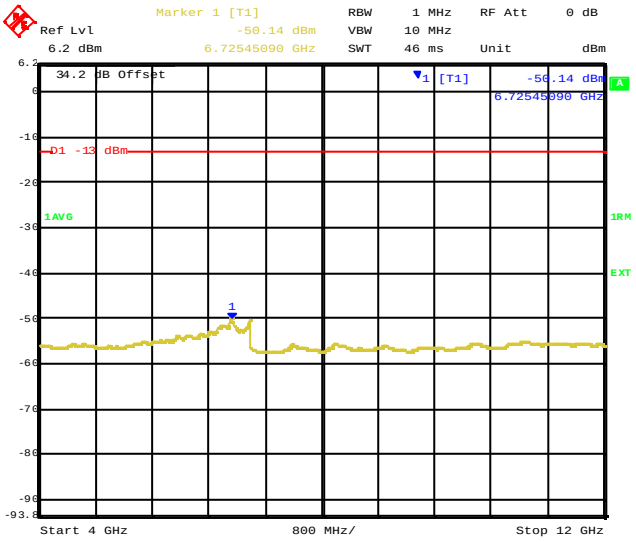
4 GHz-12 GHz



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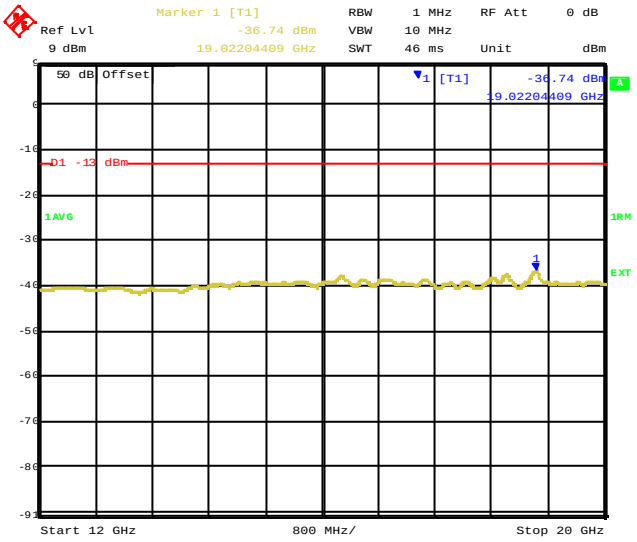
12 GHz-20 GHz



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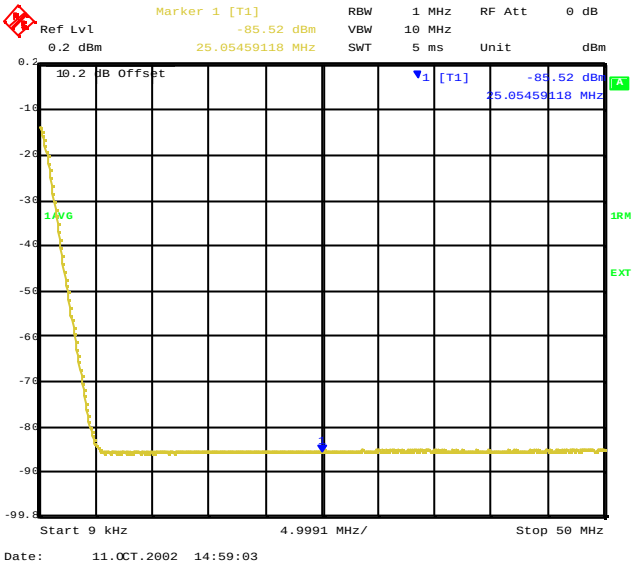
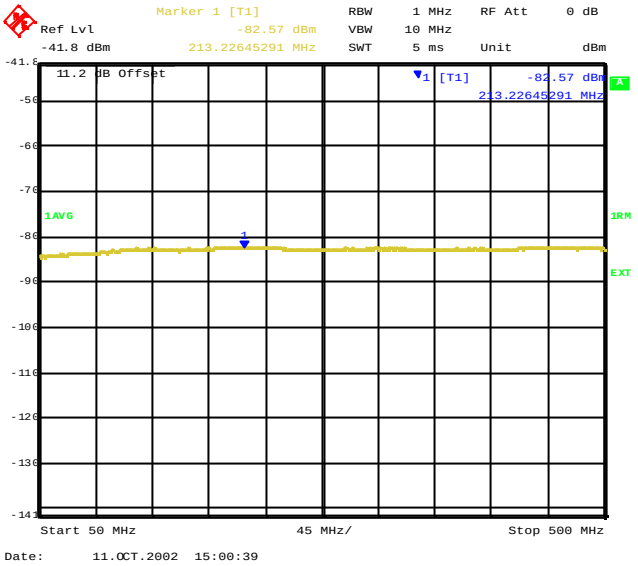
Frequency band	SPURIOUS EMISSION LEVEL (dBm) Channel M 1960 MHz Sector 2	Margin (dB)	Limit (dBm)
9 kHz to 50 MHz	-85.5	72.5	-13
50 MHz to 500 MHz	-82.6	69.6	
500 MHz to 1 GHz	-80.3	67.3	
1 GHz to 1.8 GHz	-76.5	63.5	
1800 MHz to 1954.525 MHz	-22.7	9.7	
1954.525 MHz to 1955.525 MHz	-18.9	5.9	
1955.525 MHzto 1956.525 MHz	-16.5	3.5	
1956.525 MHz to 1957.475 MHz	-22.3	9.3	
1962.525 MHz to 1963.475 MHz	-22.9	9.9	
1963.475 MHz to 1964.475 MHz	-22.4	9.4	
1964.475 MHz to 1965.475 MHz	-25.8	12.8	
1965.475 MHz to 1970 MHz	-17.2	4.2	
1970 MHz to 4 GHz	-23.4	10.4	
4 GHz to 12 GHz	-50.6	37.6	
12 GHz to 20 GHz	-36.7	23.7	

Table 14. Measurements result for Spurious Emission in M band

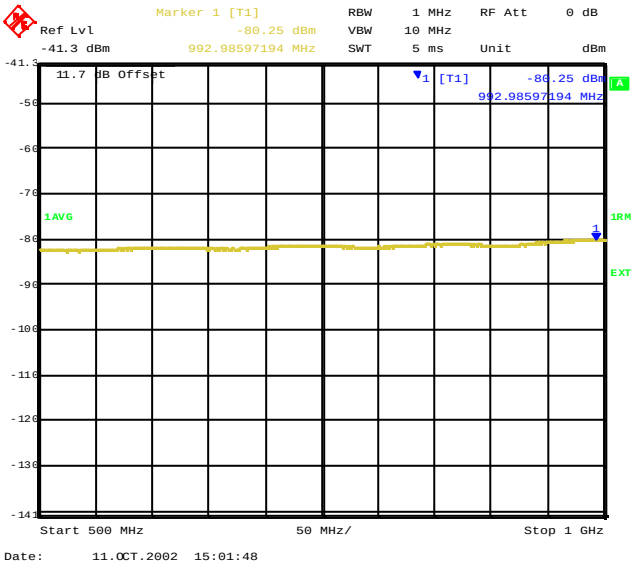
9 kHz-50 MHz[4]



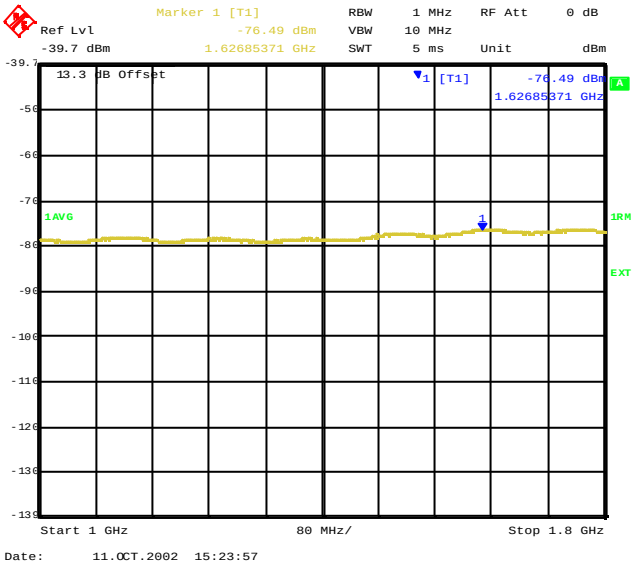
50 MHz-500 MHz



500 MHz-1 GHz

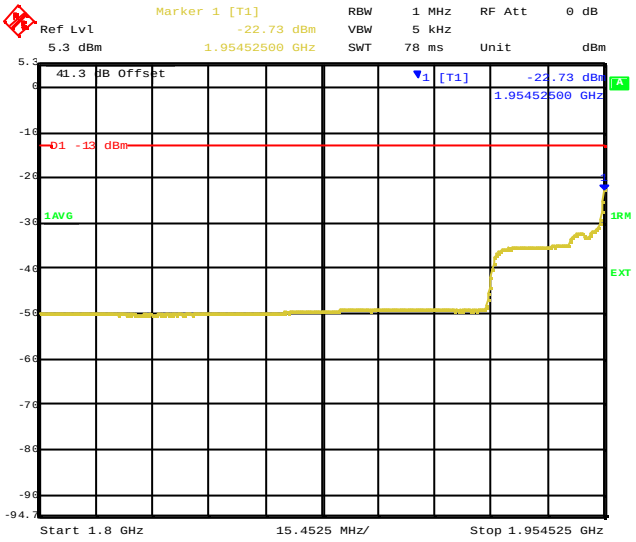


1 GHz-1.8 GHz



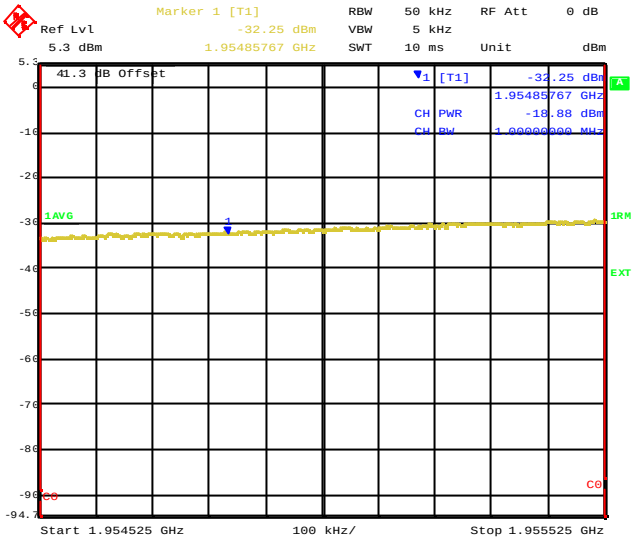
[4] Spectrum lines at 9 kHz are internal DC spectrum line of Analyzer

1800 MHz- 1954.525 MHz



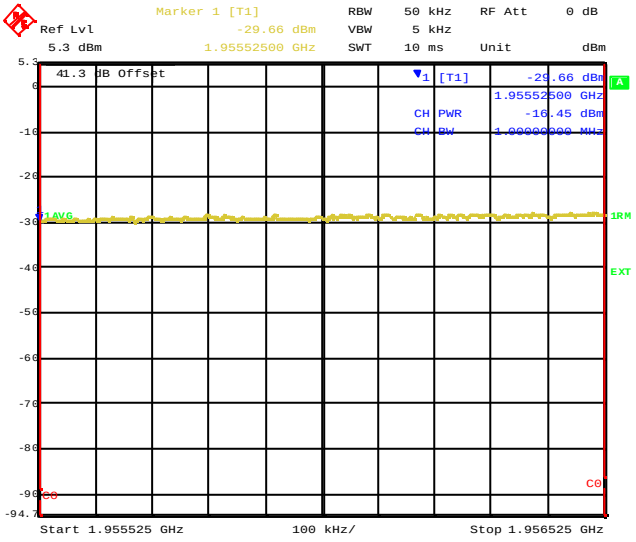
Date: 11.OCT.2002 16:22:09

1954.525 MHz-1955.525 MHz



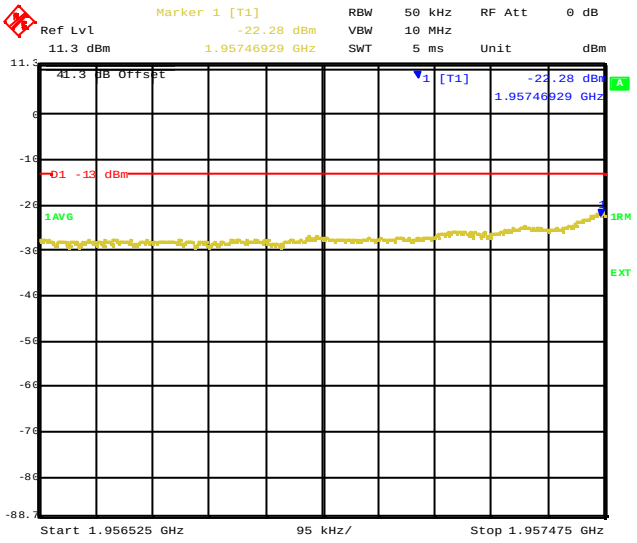
Date: 11.OCT.2002 16:25:25

1955.525 MHz-1956.525 MHz



Date: 11.OCT.2002 16:27:26

1956.525 MHz-1957.475 MHz



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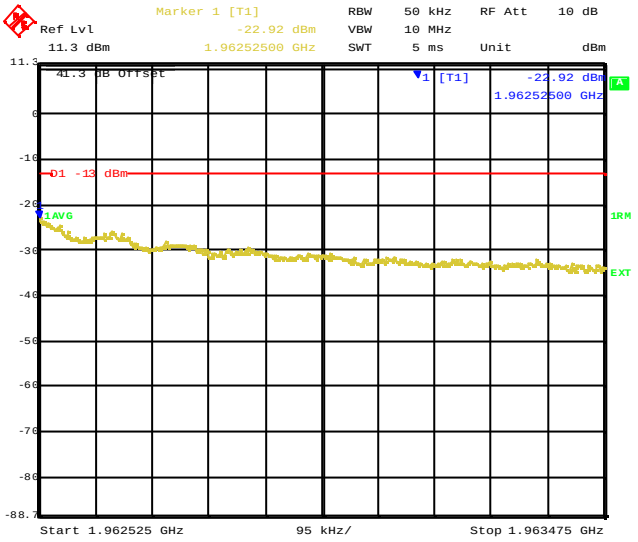
1962.525 MHz-1963.475 MHz



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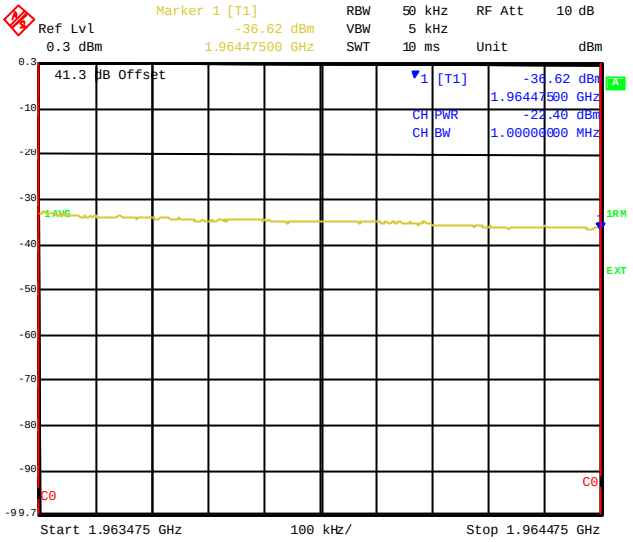
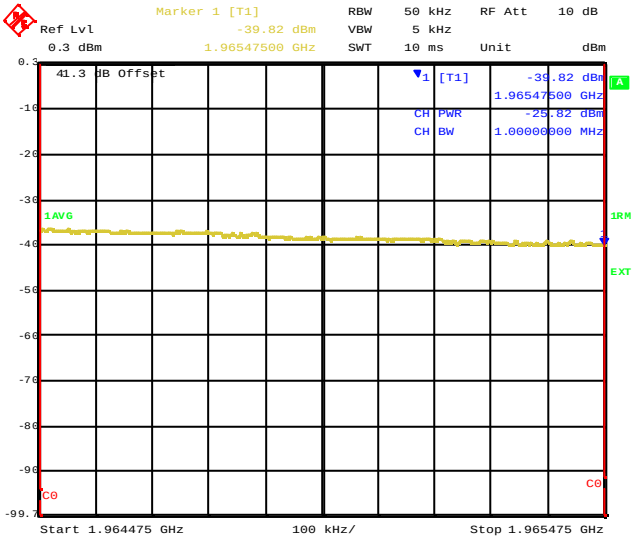
1963.475 MHz-1964.475 MHz



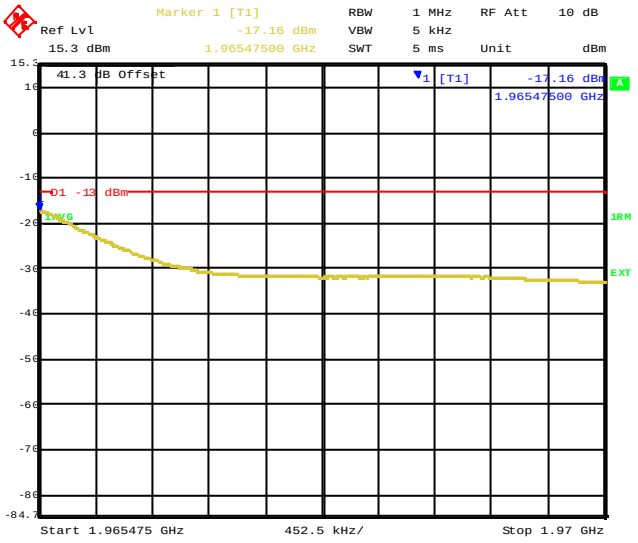
Date: 11.OCT.2002 16:35:02

1964.475 MHz-1965.475 MHz



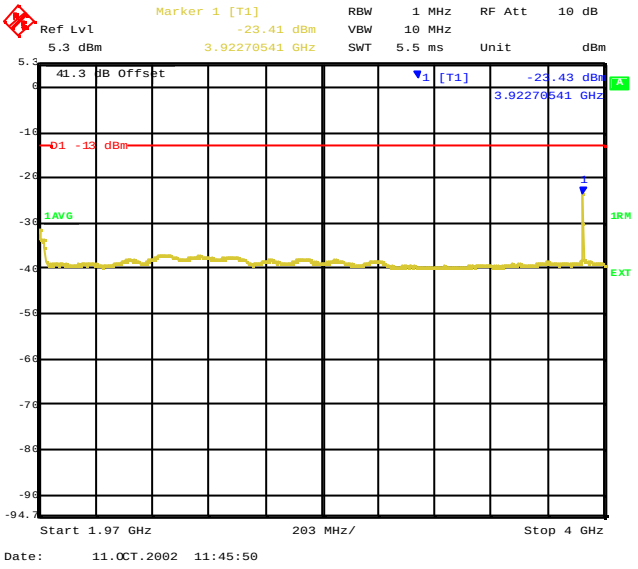
Date: 11.OCT.2002 16:33:15

1965.475 MHz-1970 MHz

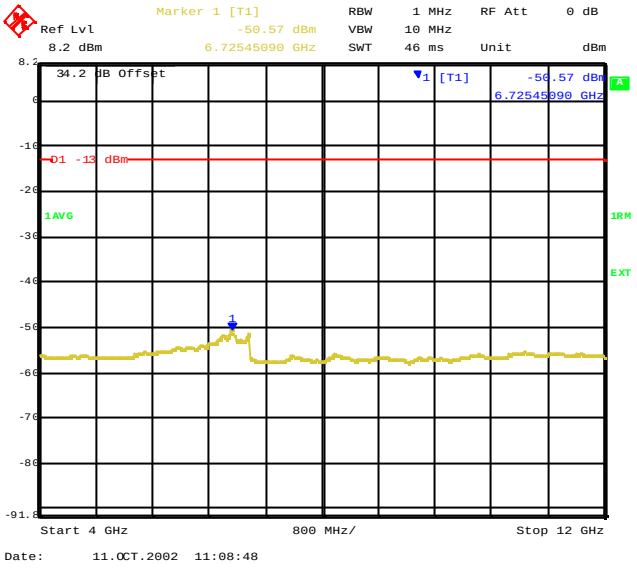


Date: 11.OCT.2002 16:30:34

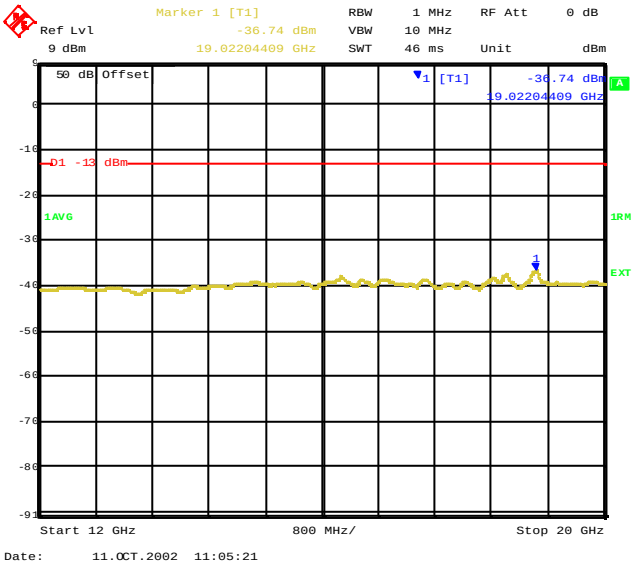
1970 MHz-4 GHz



4 GHz-12 GHz



12 GHz-20 GHz

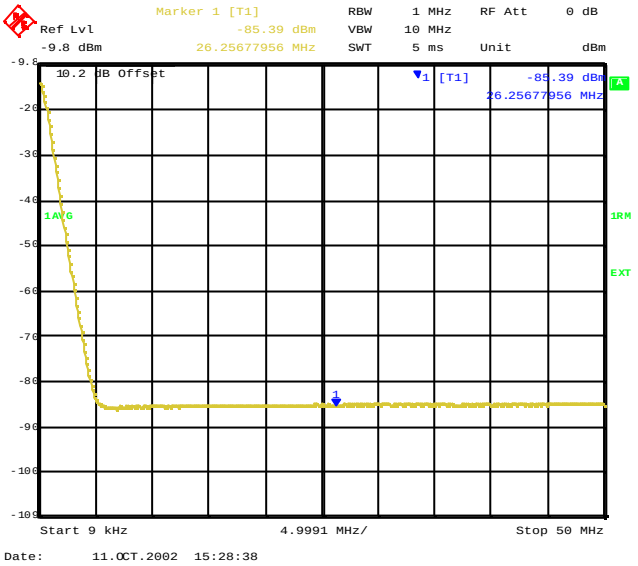


Frequency band	SPURIOUS EMISSION LEVEL (dBm) Channel T 1987.4 MHz Sector 3	Margin (dB)	Limit (dBm)
9 kHz to 50 MHz	-84.8	71.8	-13
50 MHz to 500 MHz	-82.6	69.6	
500 MHz to 1 GHz	-79.2	66.2	
1 GHz to 1.8 GHz	-77.4	64.4	
1800 MHz to 1980 MHz	-31.7	18.7	
1980 MHz to 1982.025 MHz	-18.8	5.8	
1982.025 MHz to 1983.025 MHz	-19.8	6.8	
1983.025 MHzto 1984.025 MHz	-17.5	4.5	
1984.025 MHz to 1984.975 MHz	-15.1	2.1	
1990.025 MHz to 1990.975 MHz[5]	-16.6	3.6	
1990.975 MHz to 1991.975 MHz[6]	-24.6	11.6	
1991.975 MHz to 1992.975 MHz	-27.1	14.1	
1992.975 MHz to 1995 MHz	-15.5	2.5	
1995 MHz to 4 GHz	-24	15.2	
4 GHz to 12 GHz	-50.7	37.1	
12 GHz to 20 GHz	-36.7	23.7	

Table 15. Measurements result for Spurious Emission in T band

[5] For this frequency band, the carrier has been set at 1987.6MHz.
[6] For this frequency band, the carrier has been set at 1987.6MHz.

9 kHz-50 MHz[7]



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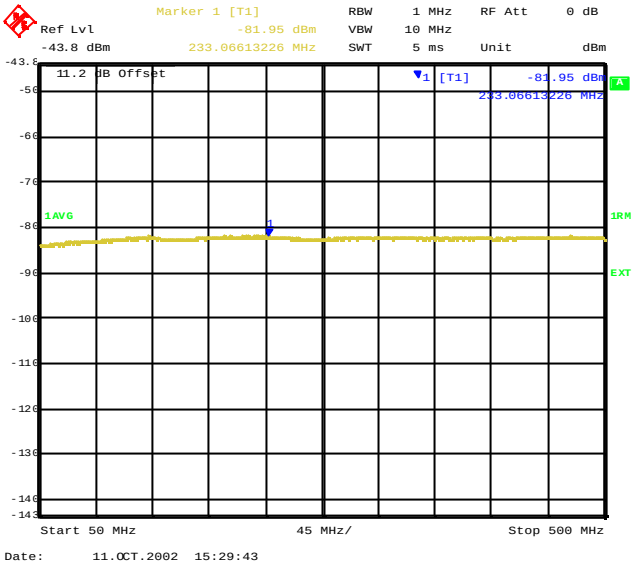
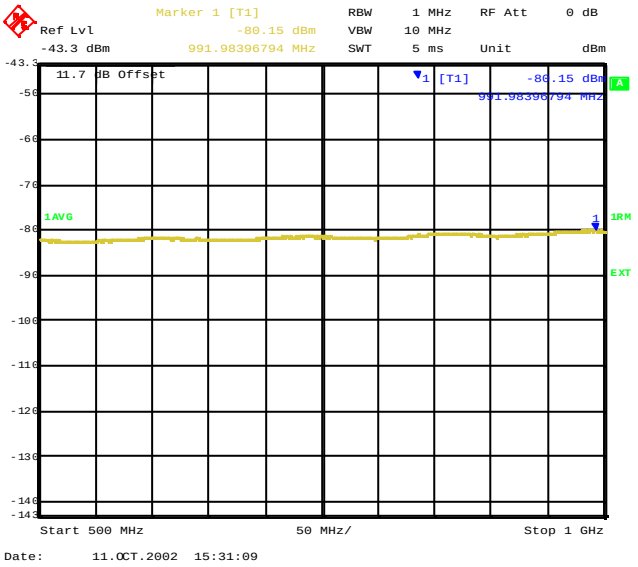
50 MHz-500 MHz



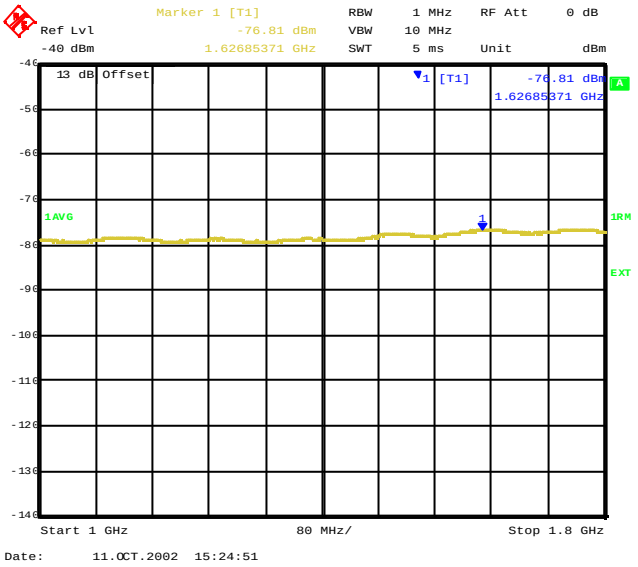
Date: 11.OCT.2002 15:29:43

500 MHz-1 GHz



Date: 11.OCT.2002 15:31:09

1 GHz-1.8 GHz



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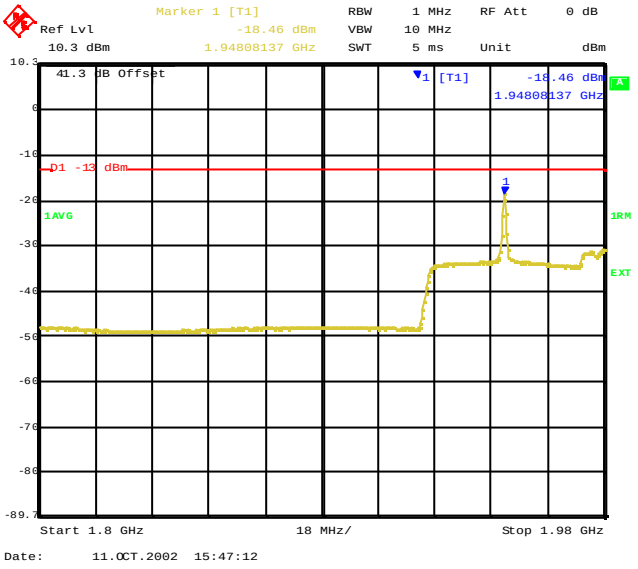
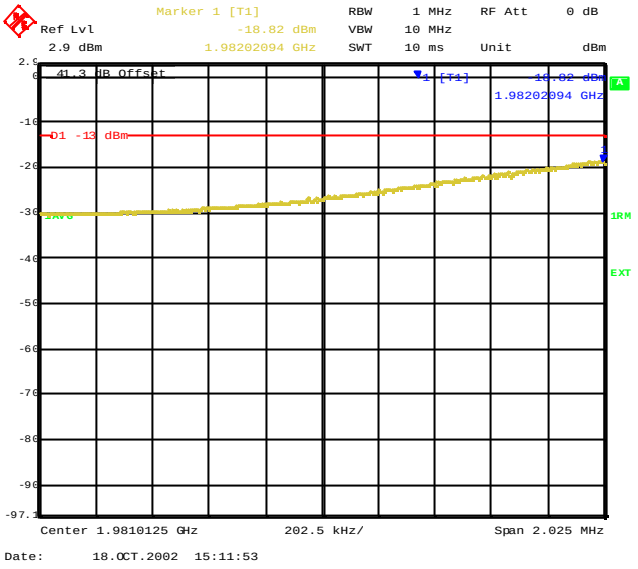
[7] Spectrum lines at 9 kHz are internal DC spectrum line of Analyzer

1800 MHz- 1980 MHz



Date: 11.OCT.2002 15:47:12

1980 MHz-1982.025 MHz



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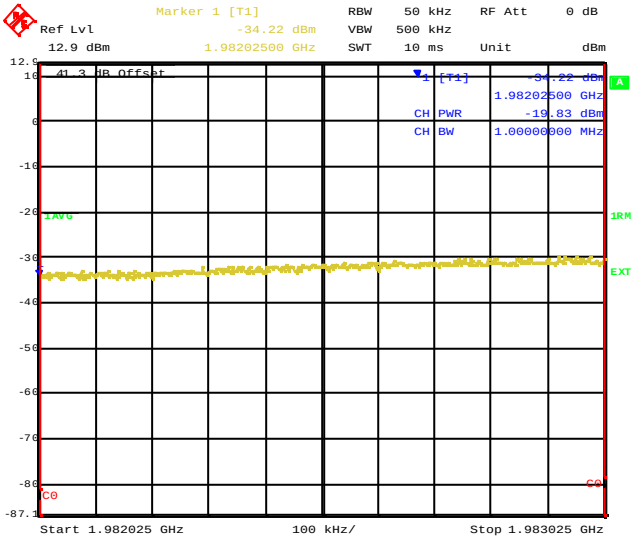
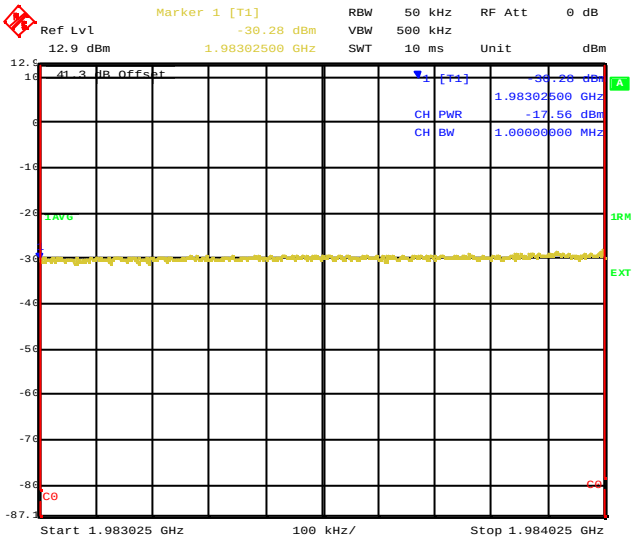
1982.025 MHz-1983.025 MHz



Date: 18.OCT.2002 15:13:38

1983.025 MHz-1984.025 MHz



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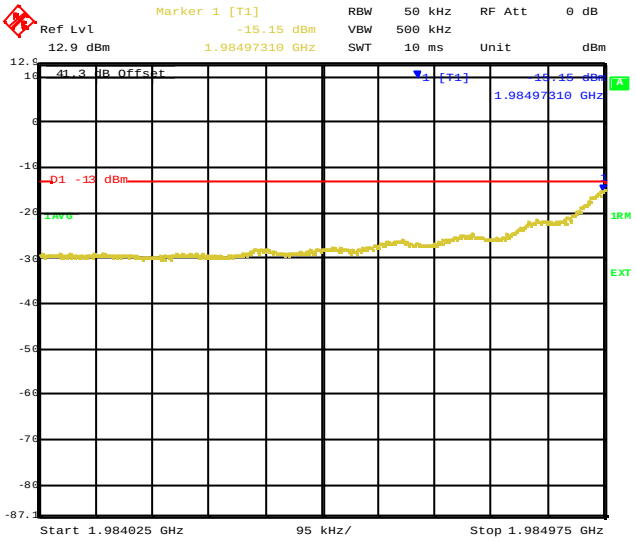
1984.025 MHz-1984.975 MHz



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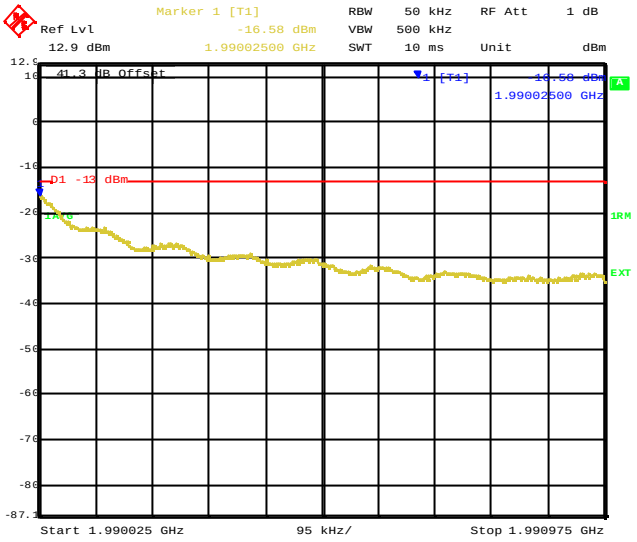
1990.025 MHz-1990.975 MHz



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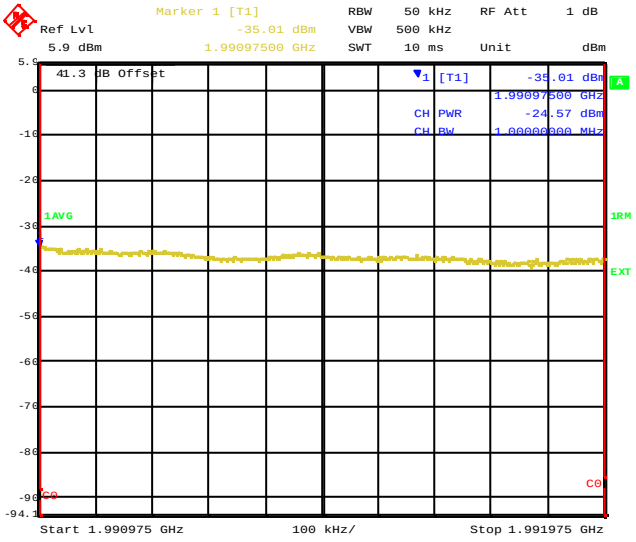
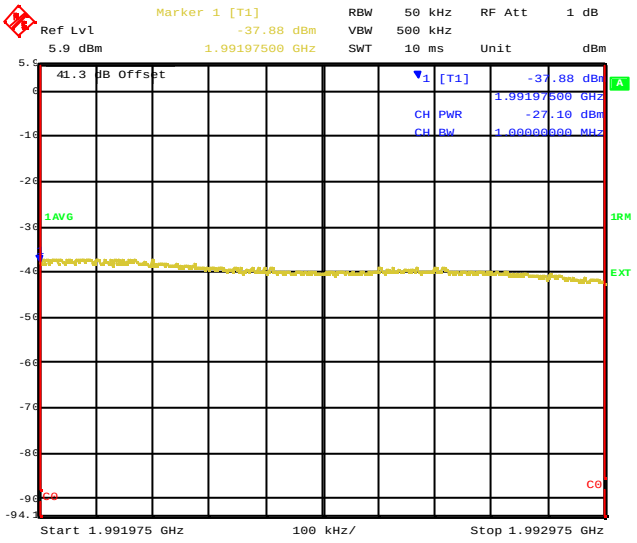
1990.975 MHz-1991.975 MHz



Date: 18.OCT.2002 15:29:13

1991.975 MHz-1992.975 MHz



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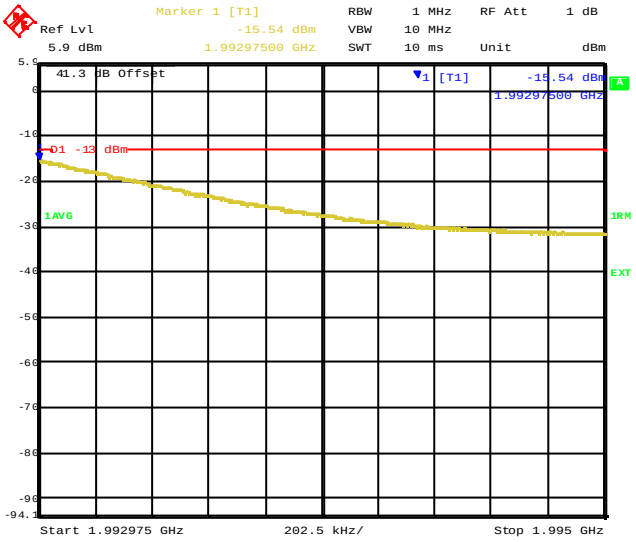
1992.975 MHz-1995 MHz



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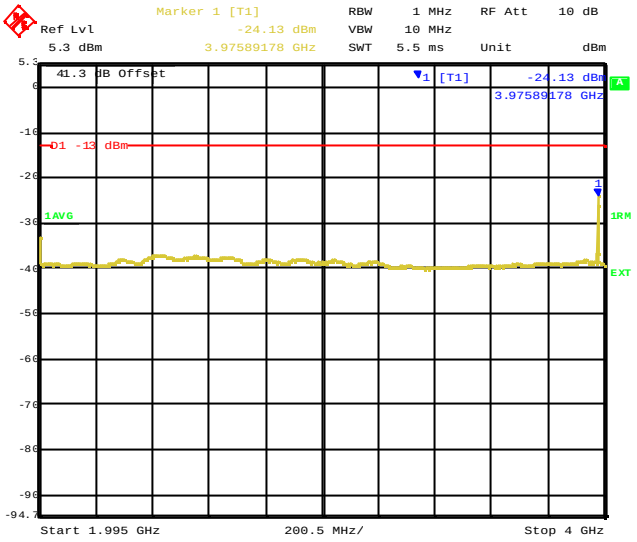
1995 MHz-4 GHz



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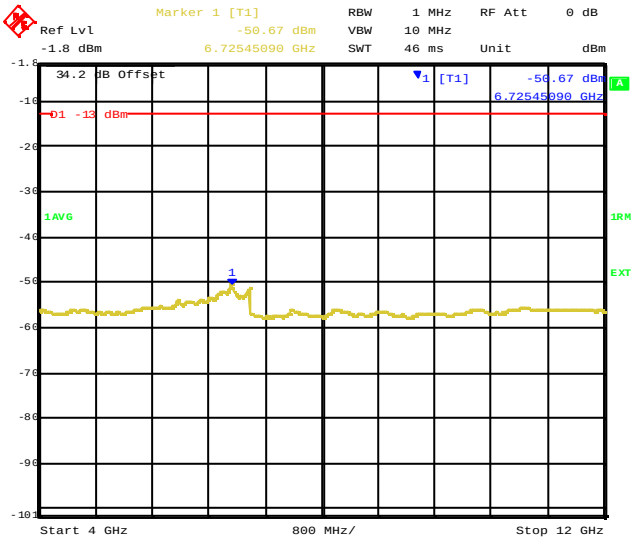
4 GHz-12 GHz



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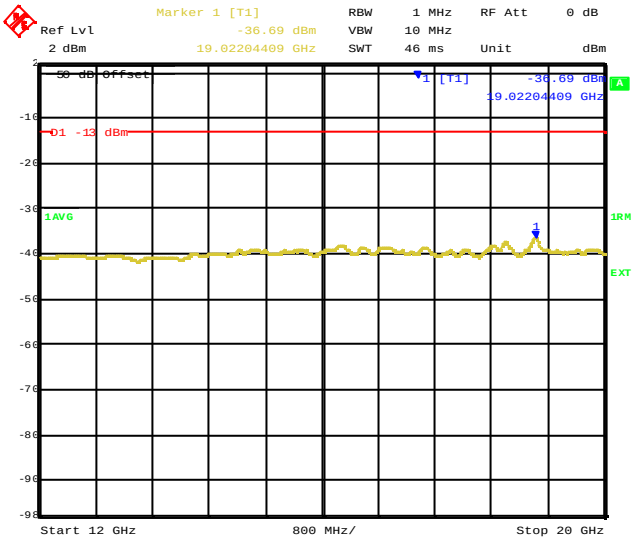
12 GHz-20 GHz



Date: 11.OCT.2002 14:04:02

3.7.3 TEST PROCEDURE

The equipment was configured as shown in Figure 11.

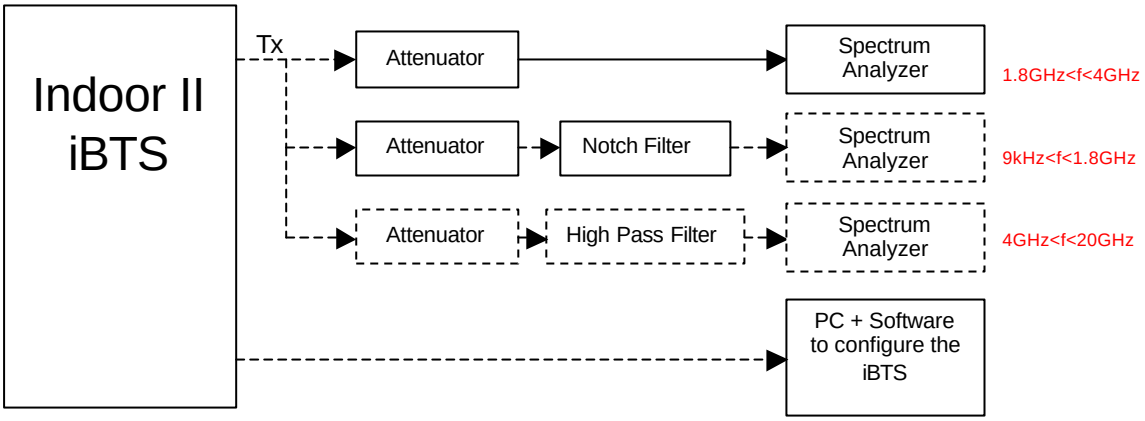


Figure 11. Test configuration for Spurious Emission

For these measurements, three benches have been used.

The bench 1 is used to measure spurious near the Tx band.

The bench 2 and 3 use respectively a stop band filter and a high pass filter in order to filter out the TX band of the iBTS and only measure the spurious created inside the iBTS.

The spectrum analyzer has the following setting in the 1 MHz bands immediately outside and adjacent to the frequency block:

Resolution Bandwidth	50 kHz
Video Bandwidth	5 / 500 kHz
Reference Level Offset	Corrected to take into account cables and attenuator losses

As regards the other bands, the following setting is applied:

Resolution Bandwidth	1 MHz
Video Bandwidth	10 MHz
Reference Level Offset	Corrected to take into account cables and attenuator losses

Just beside the 1 MHz bands immediately adjacent to the frequency block, the measure has been performed with 50kHz resolution bandwidth instead of 1 MHz. With this resolution bandwidth, **integrated over 1 MHz,** a better estimation of spurious power has been achieved (in the case of RBW 1MHz influence from the carrier power on the measurement has been observed)

The IUB link simulated with a RNC Simulator can't support a channel raster of 100 kHz but of 200 kHz. Therefore, channel B has been set to 1932.6MHz and channel T to 1987.4MHz instead of 1932.5MHz and 1987.5MHz.

However, to consider the worst case for the measurements, a carrier frequency of 1932.4MHz has been used but only on the first-left 2MHz from the frequency block [1930; 1935 MHz].

For measurements on channel T, a carrier frequency of 1987.6MHz has been used but only on the first-right 2MHz from the frequency block [1985; 1990 MHz].

3.8. CONCLUSION

FCC part 24 and 3GPP 25.141 test have been performed. Test results comply with all the requirements.

3.9. MEASUREMENT EQUIPMENT LIST

Table 16 is a list of the measurement equipments used in these tests.

Equipment Description	Manufacturer	Model	Serial Number	Calibration
Spectrum Analyzer	Rohde & Schwarz	FSIQ 26	524071	25/01/02
Vector Signal Analyzer	Agilent	E4406A	US40062091	08/03/02
Power Meter	Gigatronics	8542C	511322	27/11/01
Signal Generator	Agilent	E4433B	523076	25/06/00
Signal Generator	Agilent	E4433B	524529	13/07/02
Signal Generator	Hewlett Packard	33120A	524395	18/12/02
Signal Generator	Hewlett Packard	8657B	505084	31/05/01
Signal Generator	Rohde & Schwarz	SMP 02	522314	02/11/01
Power Supply	Lambda	LLS5008	509079	14/03/00
Network Analyzer	Hewlett Packard	8719D	521768	03/12/01
Network Analyzer	Rohde & Schwarz	ZVRE	500701	08/08/01
Calibration Kit	Hewlett Packard	85032B	-	21/05/01
High Pass Filter	Trilithic	4HC2800/13 G-3-KK 9745041	23042	N/A
Notch Filter	TEMEX	CRL 21304006A	-	N/A
20 dB Coupler	UMCC	BC-C101-20N	D80017	N/A
3 dB Coupler	Mini-Circuits	ZAPD21	-	N/A
40dB attenuator	BIRD	50-A-MFN-40	-	N/A
10dB attenuator	Radiall	R417010128	-	N/A
30dB attenuator HF	Hewlett Packard	8498A	519473	N/A
Catapult	SUN Microsystems	ULTRA 10	530797	N/A

Table 16. Measurement equipment list

4. TECHNICAL STATUS OF THE MODULES CONSTITUTING THE TESTED EQUIPMENT

Designation	Hardware code / ***Software version***	Release	Manufacturer	Serial number
Indoor 2 iBTS	*NTBY06AA* / **v02.0C.02e02**	D2	Nortel Networks	SNMN750082LI
iCU	*NTBY90AA*	D3	SANMINA	SNMN750071ZY
TRM (digital shelf slot 2)	NTUM10EA	P1	Nortel Networks	NNTM7502DFME
CCM (digital shelf slot 4)	NTGY25AA	O5	Nortel Networks	NNTM533GPC81
CEM (digital shelf slot 6)	NTUM00AA	G4	Nortel Networks	NNTM7503KOYN
GPSAM (digital shelf slot 10)	NTUM24AA	D4	Nortel Networks	NNTM7503C8K1
MCPA UMTS (slot 1)	NTUM30PA	D1	PowerWave	PWWT030050RL
MCPA UMTS (slot 3)	NTUM30PA	D1	PowerWave	PWWT030050EL
MCPA UMTS (slot 5)	NTUM30PA	D1	PowerWave	PWWT030050VL
DDM 1	NTUM42AA	P1	Foreim	FORM01332176
DDM 2	NTUM42AA	P1	Foreim	FORM01332170
DDM 3	NTUM42AA	P1	Foreim	FORM01332174

5. ABBREVIATIONS AND DEFINITIONS

5.1. ABBREVIATIONS

ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
ARFCN	Absolute Radio Frequency Channel Number
BER	Bit Error Ratio
BLER	Block Error Ratio
BTS	Base Transceiving Station
CDMA	Code Division Multiple Access
CW	Carrier Wave
DCH	Dedicated Channel
DPCH	Dedicated Physical Channel
EUT	Equipment Under Test
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
N/A	Not Applicable
OTSR	Omni Transmit, Sectored Receive
PHS	Portable Handset System
SA	Spectrum Analyzer
sanf	Spectrum analyzer noise floor
SG	Signal Generator
SSDT	Site Selection Diversity Transmission
STSR	Sectored Transmit, Sectored Receive
SUT	System Under Test
UARFCN	UTRA ARFCN
UMTS	Universal Mobile Telecommunication System
VSA	Vector Signal Analyzer
WCDMA	Wide-band CDMA

5.2. DEFINITIONS

Frequency Band

	B	M	T
Tx (MHz)	1932.5	1960	1987.5
Rx (MHz)	1852.5	1880	1907.5

☙ END OF DOCUMENT ❧

SANMINA-SCI

iBTS Indoor 2 1900 MHz Radio Tests Report in extreme environment

Reference:	**Nortel-str-00440**
Version:	**01-en**
Status:	**Approved**
Date:	**25/09/2002**

Product Name:	**IBTS Indoor 2**
Frequency:	**1900 MHz**
Discipline:	**Radio**

Author:	**L.BUGUET**
Verified by:	**T.LUCHINI**
Approved by:	**C.CHANSARD**

PUBLICATION HISTORY

VERSION	DATE	AUTHOR	MODIFICATION
01-en	25/09/2002	L.BUGUET	Document Creation

CONTENTS

1. INTRODUCTION

1.1. OBJECTIVE OF THE DOCUMENT

This report presents the radio tests in extreme environment realized in order to introduce the Indoor 2 1900 MHz iBTS cabinet.
They took place in the Sanmina 14 m^3 climatic chamber during the weeks 39 and 40 of 2002.

1.2. SCOPE OF THIS DOCUMENT

This document applies to the iBTS Indoor 2 cabinet, with the following global description :

Product : iBTS Indoor 2

Manufacturer : Nortel

Type : 1900 MHz

Configuration : STSR1

Ancillary equipment : none

1.3. AUDIENCE FOR THIS DOCUMENT

This document is addressed to Nortel Networks and Sanmina-SCI R&D department involved in the development of the iBTS Indoor 2.

2. RELATED DOCUMENTS

2.1. APPLICABLE STANDARDS

[A1]	3GPP TS 25.141	3GPP; Technical Specification Group Radio Access Networks; Base station conformance testing (FDD) – v3.10.0 – July 2002
[A2]	47 CFR Part 24	FCC rules for Radio Frequency Devices, Title 47 of the code of federal regulations – Personal communications services – January 2001

2.2. REFERENCE DOCUMENTS

[R1]	UMT/BTS/DD/0390	Requirements specification for a phase II 600 mm UMTS Indoor cabinet
[R2]	UMT/BTS/DD/0388	Requirement specification : iBTS Indoor 600 phase II cooling unit
[R3]	UMT/BTS/DD/00474	IBTS UMTS Indoor 2 Modular Structure
[R4]	Nortel-sqp-00405	IBTS UMTS Indoor 2 1900 MHz STSR1:project qualification plan
[R5]	Nortel-stp-00414	IBTS Indoor Phase II 1900 MHz STSR1:thermal tests plan
[R6]	UMT/BTS/DJD/122	Hardware delivery form for iBTS UMTS 1900 cabinet – 13 sept 2002

3. PRESENTATION OF EQUIPMENT UNDER TEST

3.1. LIFE PROFILE

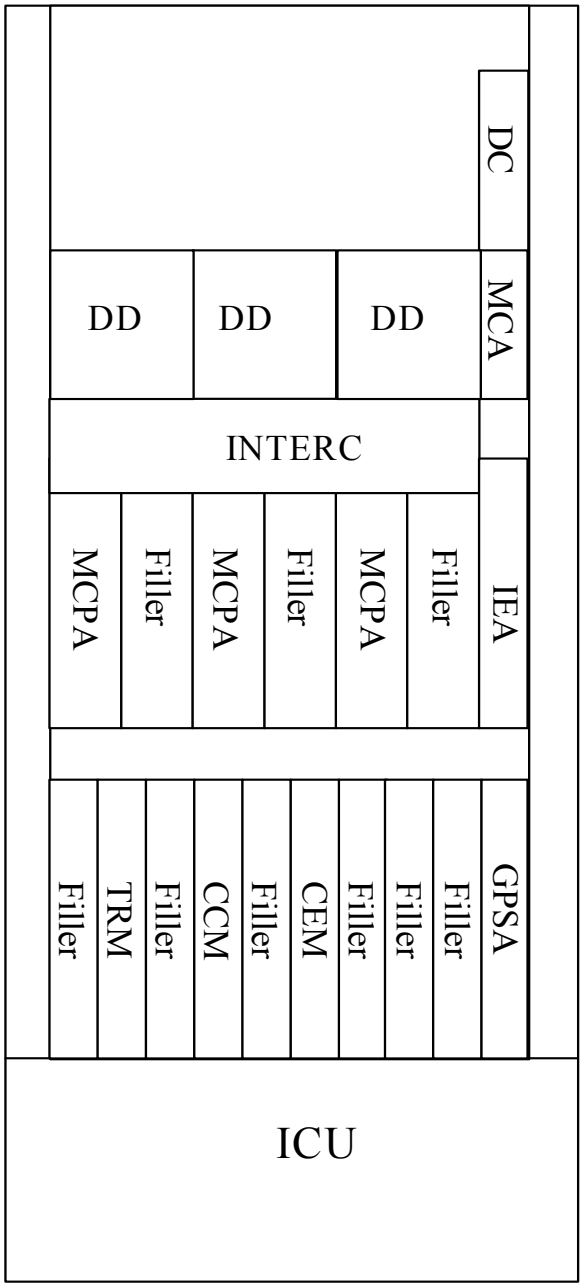
The tested equipment shall be installed in Indoor locations under operating conditions detailed in [R1] document.

3.2. HARDWARE CONFIGURATION

The equipment under test was a iBTS Indoor 2 product in STSR1 configuration.

- For BTS maximum output power tests ([A1] test case 6.2.1) : the 3 power amplifiers are configured to dissipate their maximum output power (i.e. 46.5 dBm, test model 1).
- For frequency error tests ([A2], §24.135) : the 3 power amplifiers are configured to dissipate their maximum output power – 3dB (i.e. 43.5 dBm, test model 4).

SUB-UNIT	Hardware Code	Technical status	Serial number	Supplier
Pre-cabled cabinet	NTBY06AA	D2	SNMN75007WZU	Sanmina
ICU	NTBY58AA	D3	SNMN75008NSC	Sanmina
TRM slot 2	NTUM10EA	P1	NNTM7502DFQE	Nortel
CCM slot 4	NTGY25AA	11	NNTM535V6FWN	Nortel
CEM slot 6	NTUM00AA	G2	NNTM7503F60W	Nortel
GPSAM slot 10	NTUM24AA	D4	NNTM7503KX8J	Nortel
PA 1	NTUM30PA	D1	PWWT030050ML	Powerwave
PA 3	NTUM30PA	D1	PWWT030050FL	Powerwave
PA 5	NTUM30PA	D1	PWWT030050JL	Powerwave
DDM 1.1	NTUM42AA	P1	FORM01332157	Nortel
DDM 1.2	NTUM42AA	P1	FORM01332159	Nortel
DDM 1.3	NTUM42AA	P1	FORM01332160	Nortel



STSR1

3.3. SOFTWARE CONFIGURATION

The software configuration used was chosen to perform radio tests during functional tests :

- Transmission tests: Maximum BTS output power ([A1] test case 6.2.1)
  Frequency stability ([A2], §24.135)

The test bench used to control the radio performances of the BTS is detailed in appendix A.

The softwares used were :

Server :

- Server Executable : Version V3D – Build V03D0204 (last compiled : 15/11/2001)
- Server's DLL : Version V03D0304 (last compiled 17/04/2002)

Sequencer :

- Generic Sequencer Application – Version V03D0304
- Specific : SEQ_IBTS_PI – Version V03D0203
- Bench conf : CONF_IBTS_PI.DLL – Version V03D0109

Visual BBS (for TRM module) : V02.1A01_E03

3.4. TEST APPARATUS

To realize these tests, the following equipments were used :

item	Designation	Identification number	Last calibration date
1	ESG 4433B, Agilent	Nortel, 525121	-
2	VSA E4406A, Agilent	Nortel, 525148	-
3	Powermeter 8542C, Gigatronics	Sanmina, 57220022	24/4/02
4	Power Sensor 80401A, Gigatronics	Sanmina, 57220023	29/4/02
5	ANT-20, Wandel&Goltermann	Sanmina, 57220001	12/06/02
6	Universal Counter, Racal System	Sanmina, 57220007	19/03/02
7	Signal Generator 8657B, HP	Sanmina, 57220056	18/03/02
9	Power supply, Electronics Measurements Inc	Sanmina, 57220045	22/02/02
10	Climatic chamber	Secasi, SV625496	9/02

4. TESTS CHRONOLOGY

To test the iBTS Indoor 2, the following sequence was applied :

Radio tests			
Test number	Test case name	Standard coverage	Product configuration
1	Maximum BTS output power	3GPP TS25.141	STSR1
2	Frequency stability	FCC part 24	STSR1

5. RF OUTPUT POWER

5.1. TESTS REQUIREMENTS

According to [A1], the RF maximum output power of the BTS shall be measured at extreme temperatures and extreme supply voltages for three different emission frequencies :
B = 1932.4MHz, M = 1960 MHz, T = 1987.6 MHz.
The BTS output power shall be in the range 45.1 dBm +/-3.2dB.

5.2. TESTS RESULTS

- Ambient temperature : -5°C :

Emission frequency	Sector	Input voltage (V)	BTS max output power(dB)	Result
M = 1960 MHz	2	-57	46,0	PASS
M = 1960 MHz	2	-40,5	46,0	PASS
B = 1932.4 MHz	1	-57	45,8	PASS
B = 1932.4 MHz	1	-40,5	45,8	PASS
T = 1987.6 MHz	3	-57	46,0	PASS
T = 1987.6 MHz	3	-40,5	46,0	PASS

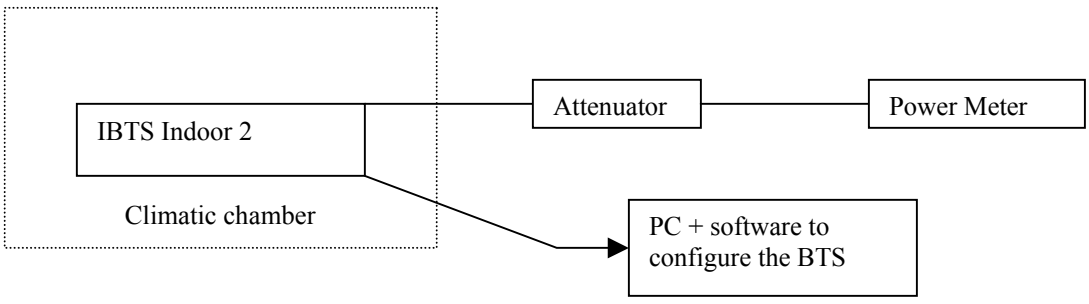
- Ambient temperature : 45°C :

Emission frequency	Sector	Input voltage (V)	BTS max output power(dB)	Result
M = 1960 MHz	2	-57	45,8	PASS
M = 1960 MHz	2	-40,5	45,8	PASS
B = 1932.4 MHz	1	-57	45,5	PASS
B = 1932.4 MHz	1	-40,5	45,5	PASS
T = 1987.6 MHz	3	-57	45,9	PASS
T = 1987.6 MHz	3	-40,5	45,9	PASS

The iBTS Indoor 2 complies with the requirement.

5.3. TEST PROCEDURE

To realize these tests, the equipment was placed in the climatic chamber during sufficient time to obtain good temperature stabilization at –5 °C and 45°C ambient temperature. The PA were configured at maximum RF output power (Test model 1) and this value was controlled during all tests.
The measurements were performed with a Power Meter, as described on the figure below :



6. FREQUENCY STABILITY

6.1. TESTS REQUIREMENTS

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10°C through the range.

6.2. TESTS RESULTS

- Ambient temperature : 45°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	-10,1	PASS
M = 1960 MHz	2	-57	15,6	PASS
M = 1960 MHz	2	-40,5	17,7	PASS
B = 1932.4 MHz	1	-48	-29,5	PASS
B = 1932.4 MHz	1	-57	-22,0	PASS
B = 1932.4 MHz	1	-40,5	15,7	PASS
T = 1987.6 MHz	3	-48	14,0	PASS
T = 1987.6 MHz	3	-57	24,9	PASS
T = 1987.6 MHz	3	-40,5	-16,1	PASS

- Ambient temperature : 35°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	-16,7	PASS
M = 1960 MHz	2	-57	10,1	PASS
M = 1960 MHz	2	-40,5	-19,1	PASS
B = 1932.4 MHz	1	-48	-13,0	PASS
B = 1932.4 MHz	1	-57	-16,1	PASS
B = 1932.4 MHz	1	-40,5	-19,4	PASS
T = 1987.6 MHz	3	-48	18,7	PASS
T = 1987.6 MHz	3	-57	8,5	PASS
T = 1987.6 MHz	3	-40,5	-14,4	PASS

- Ambient temperature : 25°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	-8,7	PASS
M = 1960 MHz	2	-57	-12,9	PASS
M = 1960 MHz	2	-40,5	10,1	PASS
B = 1932.4 MHz	1	-48	12,0	PASS
B = 1932.4 MHz	1	-57	24,4	PASS
B = 1932.4 MHz	1	-40,5	-22,1	PASS
T = 1987.6 MHz	3	-48	-21,8	PASS
T = 1987.6 MHz	3	-57	14,9	PASS
T = 1987.6 MHz	3	-40,5	14,6	PASS

- Ambient temperature : 15°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	26,6	PASS
M = 1960 MHz	2	-57	20,2	PASS
M = 1960 MHz	2	-40,5	18,5	PASS
B = 1932.4 MHz	1	-48	-23,0	PASS
B = 1932.4 MHz	1	-57	-10,5	PASS
B = 1932.4 MHz	1	-40,5	-14,8	PASS
T = 1987.6 MHz	3	-48	-10,4	PASS
T = 1987.6 MHz	3	-57	-27,3	PASS
T = 1987.6 MHz	3	-40,5	-12,1	PASS

- Ambient temperature : 5°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	22,9	PASS
M = 1960 MHz	2	-57	-13,7	PASS
M = 1960 MHz	2	-40,5	12,7	PASS
B = 1932.4 MHz	1	-48	19,0	PASS
B = 1932.4 MHz	1	-57	-20,4	PASS
B = 1932.4 MHz	1	-40,5	13,5	PASS
T = 1987.6 MHz	3	-48	-16,8	PASS
T = 1987.6 MHz	3	-57	21,7	PASS
T = 1987.6 MHz	3	-40,5	-19,7	PASS

- Ambient temperature : -5°C :

Emission frequency	Sector	Input voltage (V)	Frequency error (Hz)	Result
M = 1960 MHz	2	-48	-13,2	PASS
M = 1960 MHz	2	-57	-14,4	PASS
M = 1960 MHz	2	-40,5	-20,8	PASS
B = 1932.4 MHz	1	-48	20,0	PASS
B = 1932.4 MHz	1	-57	14,2	PASS
B = 1932.4 MHz	1	-40,5	-9,2	PASS
T = 1987.6 MHz	3	-48	9,4	PASS
T = 1987.6 MHz	3	-57	-20,0	PASS
T = 1987.6 MHz	3	-40,5	20,3	PASS

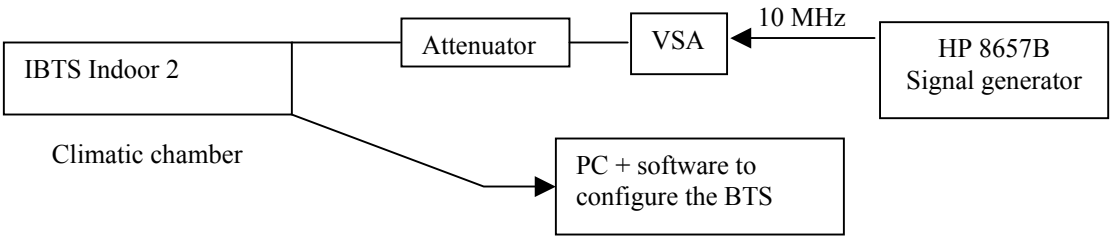
According to [A2], the frequency deviation was measured over a variation in a primary supply voltage of 85 % to 115 % of the nominal voltage and for three different emission frequencies.
The maximum frequency deviation allowed is 90 Hz.

The maximum deviation measured (29.5 Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The iBTS Indoor 2 1900 MHz complies with the requirement.

6.3. TEST PROCEDURE

To realize these tests, the equipment was placed in the climatic chamber during sufficient time to obtain good temperature stabilization at several ambient temperatures. The PA were configured at maximum RF output power –3dB (Test model 4) and this value was controlled during all tests.
The measurements were performed with a VSA, as described on the figure below :



A period of at least one hour was allowed prior to measurement to ensure that all the components of the oscillator circuit were stabilized at each temperature.

7. CONCLUSION

Radio tests			
Test number	Test case name	Standard coverage	Status
1	Maximum BTS output power	3GPP TS25.141	PASS
2	Frequency stability	47 CFR Part 24	PASS

The iBTS Indoor 2 STSR1 1900 MHz is compliant with RF requirements of 3GPP 25.141 version 3.10.0 for extreme conditions and with requirements for FCC approval according to CFR47 part 24.

8. ABBREVIATIONS AND DEFINITIONS

8.1. ABBREVIATIONS

ETS : European Telecommunication Standard
BTS : Base Transceiver Station
UMTS : Universal Mobile Telecommunication System
PA : Power Amplifier
CEM : Channel element module
CCM : Core Control Module
TRM : Transmitter receiver module
GPSAM : Global position system alarm module
MCA : Manufacturing Commissioning Alarm Module
STSR : Sector Transmit Sector Receive
EUT : Equipment Under Test
BS : Base Station
VSA : Vector Signal Analyzer
3GPP : 3rd Generation Partnership Project
Tx : Transmit

8.2. DEFINITIONS

NA

END OF DOCUMENT

EXHIBIT 2B

EMC Test Report

Applicant: Northern Telecom Ltd.

For Certification on:

AB6UMTS1900IND

SANMINA-SCI

iBTS UMTS Indoor 2 1900 MHz: EMC test report

Reference:	**Nortel-STR-00443**
Version:	**01**
Status:	**Approved**
Date:	**03/10/2002**

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

Author:	**Marc CANCOUËT**
Verified by:	**Thomas LUCHINI**
Approved by:	**Christian CHANSARD**

PUBLICATION HISTORY

VERSION	DATE	AUTHOR	MODIFICATION
01	03/10/2002	M.CANCOUËT	Creation of the document

CONTENTS

1. INTRODUCTION

The purpose of this document is to present the tests report of the EMC testing on the iBTS Indoor 2 UMTS 1900 MHz STSR1 used for the US Trial. The qualification phase on the BTS has been done according to the FCC Part 15 subpart B (Class B) and the FCC Part 24 Subpart E as defined by Nortel Networks.

This document applies to :

- Product : iBTS Indoor 1900 MHz
- Manufacturer : Nortel Networks
- Frequencies : 1930 – 1990 MHz
- Configuration : STSR 1
- Ancillary : No
- Options : No

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	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations - Radio frequency devices - dated 10/1/01
[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
[A4]	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

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]	UMT/SQP/00405	IBTS UMTS Indoor 1900 MHz: Project Qualification Plan
[R5]	Nortel-STP-00415	iBTS UMTS Indoor 2 1900 MHz: EMC test plan
[R6]	149018DK	External report from GYL Technologies

3. TESTS RESULTS

3.1. EMISSION TESTS CONFIGURATIONS

The iBTS is configured in order to simulate the real case used for the US Trial. The hardware configuration is equivalent to a STSR1.
We have the following number of modules:
- 1 CEM
- 1 TRM
- 1 CCM
- 1 GPSAM
- 3 MCPA
- 3 DDM

For a functional point of view, the test configuration is as close to the normal intended use and the base station transmit with the maximum power declared by Nortel with all the transmitters active. So the 3 MCPA transmit a UMTS radio signal at the maximum power (45W). The iBTS UMTS Indoor 1900 MHz is configured to transmit a radio signal corresponding to test model 2 (according to the 3 GPP standard) on all the MCPA. One carrier per MCPA is used.
Following the software, we can activate the RF links as follow:

- TRM 2 output on PA 1 ; PA 3 and 5 transmitting at 1960 MHz and 46.5dBm

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 are connected to representative cables and load. The tests allow us to validate a T1 IUB cable with 100 Ω impedance.

Internal protection module is optional but can be used to protect the Alarm links. This module is made only with passive components and then is not a critical module for the system.
This optional module is not used in the system for the 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 is not a critical module for the system.
This optional module is not used in the system for the emission tests.

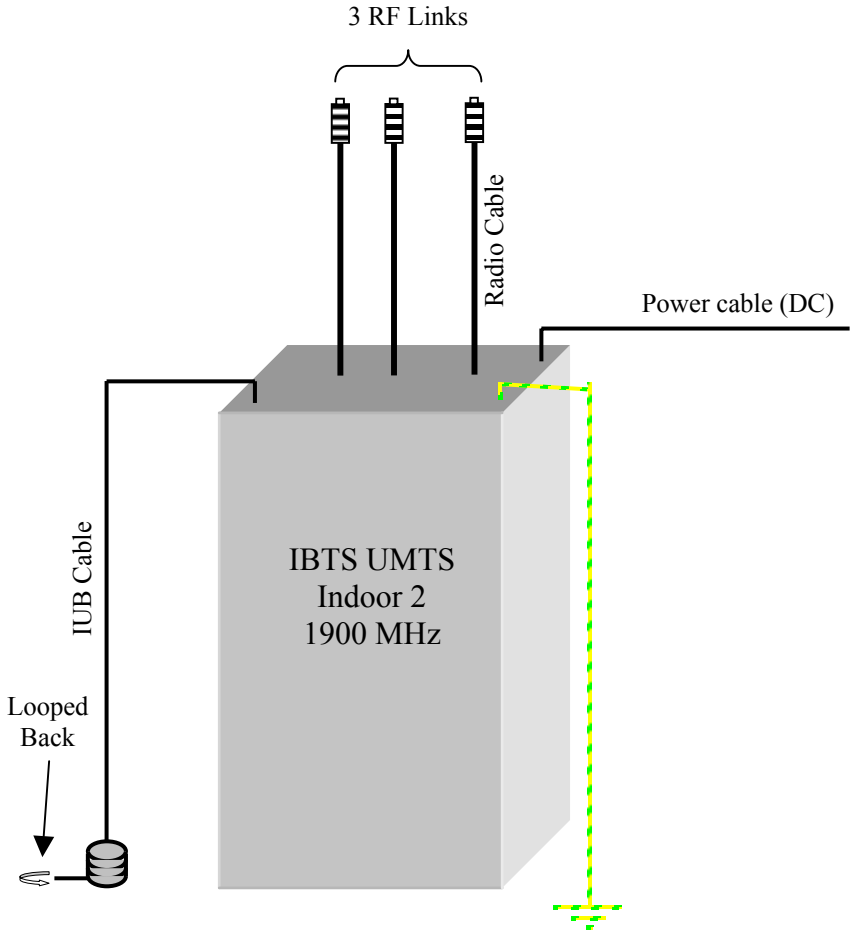
3.2. ICU TEST CONFIGURATION

The EMC tests and qualification of the iBTS Indoor 2 1900 MHz have been done with a cooling system in this technical status:

ICU 600 Ref: XSA 109 01/1 Release R2A
Step-Up Converter Ref: XSA 109 20/1 Release B2
Control Board Ref: XSA 110/01 Release R2A/A

3.3. INSTALLATION DIAGRAM

The drawing gives a representation of functional test bench.



See Annex 2 for the Hardware Technical Status.

The following ports of the iBTS Indoor 2 1900 MHz UMTS 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.
- Radio port (signal port) : 3 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 with ground connection (about 10 meters).

3.4. TEST CONFIGURATION

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 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 at the noise floor levels for each of the transmitter harmonics frequencies and a statements should be placed in the test report indicating that no emissions were detected.

The equipment was configured as shown in the next figure.

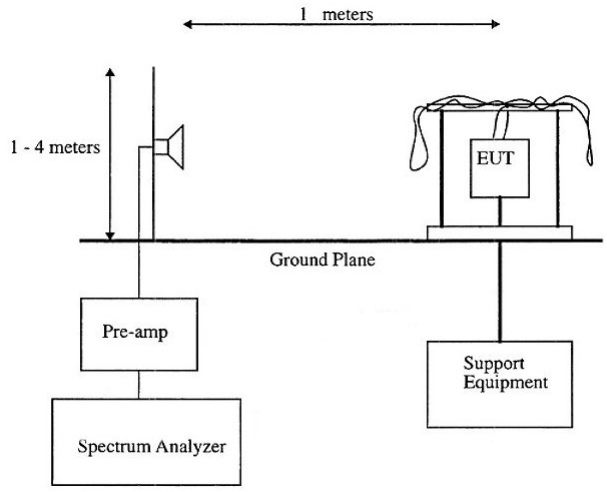


Figure 7 : Test configuration for Radiated Spurious emissions

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

Therefore :

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

E = 47.05 V/m = 153.45 dBμV/m
The spurious emissions must be attenuated by at least 43 + 10*Log(45) = 59.53 dB.
Therefore the field strength limit at 1 meters is :
E = 153.45 dBμV/m – 59.53 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

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**

3.5. MATRIX RESULTS

Configuration of the EUT	Test	Reference Method	Compliance	Comments
IBTS UMTS Indoor 2 1900 MHz	Radiated Emissions FCC Part 15 subpart B (Class B) (30 MHz to 10 GHz)	Section 15.109	**PASS**	Pass with +10 dB margin minimum in worst case.
	Radiated Emissions FCC Part 24 Subpart E (1GHz to 20 GHz)	Section 24.238	**PASS**	No frequencies between 1 and 20 GHz (except 1 transmit frequency).

No radiated spurious emissions were detected during testing and thus substitution measurements were not preformed.

The results of the EMC tests are also presented in the external report from GYL Technologies COFRAC laboratory [R6].

For the DC Power, we will test a new supplier of filters.
We have tested, 2 Filters EPCOS 100 nF (**B85121A2104B101**) instead of 2 Filters Schaffner 100 nF (FN 7561-100/M8).

4. CONCLUSION

The iBTS UMTS Indoor 2 1900 MHz comply with the EMC applicable requirements for US market, according to the FCC Part 15 subpart B (Class B) “Section 15.109” and the FCC Part 24 Subpart E “Section 24.238”.
The iBTS UMTS Indoor 2 is then qualified with 3 possible types of filters; Schaffner
Arcotronics
Epcos

5. ABBREVIATIONS AND DEFINITIONS

5.1. 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

5.2. DEFINITIONS

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).

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 marking 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 international, 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 (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.

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.

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.

6. ANNEX 1 : HARDWARE TECHNICAL STATUS

6.1. IBTS INDOOR 2 1900 MHZ

AVLM SANMINA	Date of delivery : 13/09/2002
Product : Indoor 2 UMTS i-BTS	
Article delivered : STSR1 1900 UMTS Indoor 2 i-BTS	Article code : NTBY06AA
Section transmitting : 4884	Designer name : ERPELDING.N
Prototype Serial Number (optional) : FRAME n° SNMN75007WZU	

Documents related to the Hardware Design Specifications

Documents dealing with specifications :

- UMT/BTS/DD/000017 V03.01/EN 'E-MOBILITY iBTS PLATFORM/UMTS PRODUCT SPECIFICATION'

Issues fixed on the cabinet :

- Radio transmitting with power level not compliant to the instruction (transmitting at level - 9 dB). Due to parameters stored in RTRX EEPROM in a wrong format. The RTRX EEPROM was modified during hardware integration.

Missing Equipment :.

- LPPCM
- ICU

Equipment Release Status:

TRM 1900 : P1
CCM : 11
CEM : G2

GPSAM : D4

MCPA 1900 (all) : D1

DDM 1900 (all) : P1

MCA : D1

INTERCO : P2

Digital backplane : D1

100 Ω PCM installation cable : NTBY60TA V01.01

Software compatibility :
Modules software version : ISS V02.0DE1E03
PI bench : V03D203
Visual TRM : V03D201

ARTICLE	**Article number**	**Release**	**Serial number**	ETHERNET ADDRESS
TRM 1900	NTUM10EA	P1	NNTM7502DFQE	136.147.43.95
CCM	NTGY25AA	11	NNTM535V6FWN	136.147.43.98
CEM	NTUM00AA	G2	NNTM7503F60W	136.147.43.102
GPSAM	NTUM24AA	D4	NNTM7503KX8J	
MCPA 1900	NTUM30PA	D1	PWWT030050ML	
MCPA 1900	NTUM30PA	D1	PWWT030050FL	
MCPA 1900	NTUM30PA	D1	PWWT030050JL	
DDM 1900	NTUM42AA	P1	FORM01332157	
DDM 1900	NTUM42AA	P1	FORM01332159	
DDM 1900	NTUM42AA	P1	FORM01332160	
MCA	NTBY90AA	D1	SNMN750086RA	
INTERCO PANEL	NTBY76AA	P2	SNMN27001C4Q	
DIGITAL SHELF	NTBY72CA	D1	SNMN75007ZXC	
Digital fillers (6)	NTUM20MC			
PA fillers (3)	NTUM31AA			

Functional limits :

The following features have been tested :

- Cabling.
- Power supply distribution.
- Inventory, Alarm, Commissioning.
- Functional tests on internal digital busses (TRM-PA and TRM-DDM).
- STSR1 radio transmitting in UMTS mode 30W (Output power, ACLR, spectrum mask, EVM, frequency error).
- STSR1 radio transmitting in UMTS mode 45W (Output power, ACLR, spectrum mask, EVM, frequency error).
- Radio receiving in UMTS mode (B, M, T) on all RX path.
- PCM (T1 ESF) loopback in Timeswitch.
- Long term alarm (Dallas + PA + DDM) scan and inventory (Dallas) scan.
- Long term temperature & transmit power PA scan.
- Long term radio EVM on transmitting in mode 45W.
- Long term radio receiving UMTS BER.

The functional limits are :

- Be careful to RF modules handling : no marking of specific 1900 spectrum band on the faceplate apart the PEC code.
- Mechanical & vibration tests limitation : the D-Sub connector of the 1900 DDMs not rigid enough.
- Wrong programming of DDM 1900 EEPROM : First byte incorrect (no software impact) and fields RU App / Type / Subtype stored with DDM 2100 parameters instead of DDM 1900.
- IC1 stored in DS2433 of MCA has its *PCM type* recorded in E1. No functional impact with PI software : the PCM type is configured by the user and not by reading the MCA.
- EVM test at Pmax –18 dB level is not supported.

Documents related to the Hardware Test Specifications

Reference of the test specifications documents :

- UMT/BTS/DJD/120 V01.02/EN Hardware integration test specification for iBTS UMTS 1900

Documents related to the Hardware Test Report

UMT/BTS/DJD/121 V01.01/EN Hardware integration test report for iBTS UMTS 1900

END OF DOCUMENT

Technologies

TEST REPORT

CFR 47 Part 15
and
CFR 47 Part 24

iBTS Indoor 2 1900 MHz

N°149018DK

Technical control: O. ROY	**GYL technologies** ANGERS TECHNOPOLE 1, rue Fleming 49066 ANGERS Tel. : 02.41.36.22.33 Fax : 02.41.36.22.23	Quality Control: L. MONTIEL

Summary

Appendixes C1 to C15

Applicant:

SANMINA
Design Center
46 rue Pierre CURIE
ZI les Gâtines
78376 PLAISIR
FRANCE

Product description

Product: iBTS Indoor 2 1900 MHz

Manufacturer :

NORTEL NETWORKS
38, rue Paul Cézanne
Guyancourt
78928 Yvelines

Responsible of the equipment: Marc CANCOUËT

Product type: iBTS UMTS INDOOR 2 1930-1990 MHz
Ref.:NTBY060AA . Serial: SNMN75007WZU.

Manual: none
Power supply: 0/-48Vdc , tested at : 0/-48Vdc

PRODUCT PICTURES:

Front side

Rear side

PRODUCT COMPOSITION:

Composition: appendixes C6 to C8

Interconnection and cables type: appendix C7

UTILISATION:

Internet **B**ase station **T**ransceiver **S**ystem

General test conditions

AUXILIARY EQUIPMENT:

AC/DC power supply; mark SORENSON; model DHP60-220M1
S/N: 0214A9018

WORKING MODE DURING TEST

Measurements are done in transmitter mode all transmitters at maximum power, and in receiver mode

Channels configuration for the test:

TRM 2 output on PA 1 ; PA 3 and 5 transmitting at 1960 MHz and 46.5dBm

(details on appendix C8)

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 1900MHz
So, applicable standards are:

CFR47 Part 15 Subpart B class B (2001)
CFR47 part 24, Subpart E (2000)

Interpretation and remarks:

This equipment complies with limits standards for EMC measurements.

IMPORTANT REMARK :
No emissions were detected during pre-scan as shown page 10,.therefore signal substitution was not performed on the EUT, noise floor plots are provided on page 14

Test according to CFR 47 Part 15 Class B

Tests performed by Daniel RAUD at GYL Technologies laboratories in September, 17 and 18 of 2002 .

REFERENCE DOCUMENTATION:

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

CONDUCTED DISTURBANCE AT INPUT POWER ACCESS :

Not applicable: powered by -48Vdc

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.

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 :

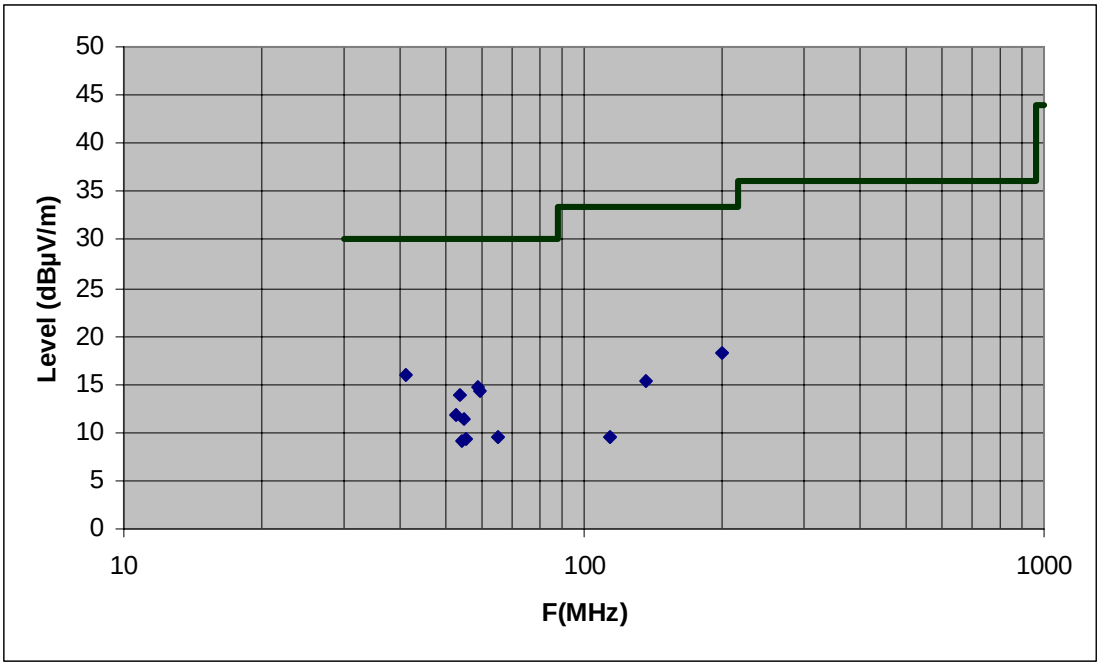
APPARATUS	MANUFACTURER	REFERENCE	SERIAL NUMBER	Date of verification
Free field open area test site				Jul-02
Receiver	Rohde & Schwarz	ESI 7	834638/007	Dec-01
ANTENNAS Bilog	CHASE	CBL-6112	2434	Nov-01

Results :

Highest lines table (spurious signals):

Frequency (MHz)	Quasi-peak (dBµV/m)	Std limit (dBµV/m)	Margin dB	Angle (Deg.)	Site (cm)	Polar.	Correct. Factor (dB)	Comment
41.039	16.06	30	-13,94	361	155	V	13,50	Broadband
52.439	11.76	30	-18,24	178	155	V	7,81	
53.715	13.89	30	-16,11	151	101	V	7,43	
54.168	9.12	30	-20,88	151	101	V	7,29	
54.972	11.35	30	-18,65	151	101	V	7,05	
55.408	9.3	30	-20,70	151	101	V	6,92	
59.034	14.77	30	-15,23	151	101	V	5,83	
59.45	14.25	30	-15,75	151	101	V	5,71	
64.803	9.59	33.5	-20,41	151	101	V	5,84	
113.852	9.64	33.5	-23,36	151	188	V	12,32	
136.091	15.25	33.5	-17,75	151	101	V	12,54	
200.023	18.16	36	-14,84	228	109	H	11,08	

No spurious signal found over 200,023 MHz

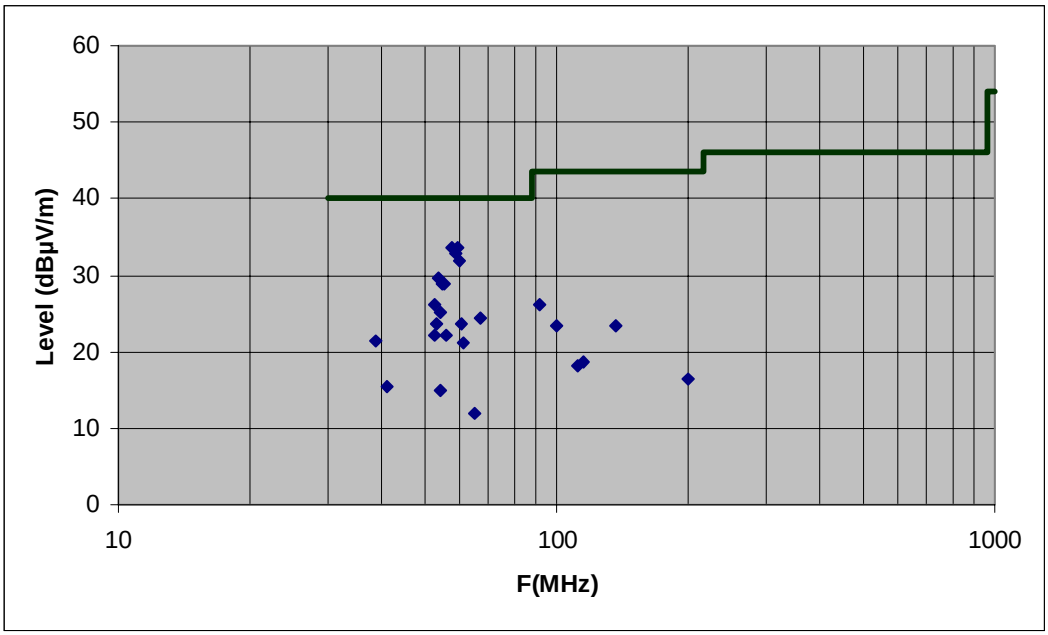


INTERPRETATION AND REMARKS:

Conform

Pre-Scan measurement to identify spurious emissions from EUT at D=3m :

F(MHz)	PK	Limit	Marge	Pol	H(cm)	A(°)	FC(dB)	Comments
38.68	21.51	40	-18.5	V	100	0	14.48	
41.04	15.36	40	-24.6	V	100	0	13.5	
52.52	26.21	40	-13.8	V	100	0	7.78	
52.88	22.04	40	-18.0	V	100	0	7.68	
53.32	23.75	40	-16.3	V	100	0	7.54	
53.72	29.65	40	-10.4	V	100	0	7.42	
54.16	25.17	40	-14.8	H	100	0	7.29	
54.56	14.91	40	-25.1	V	100	0	7.17	
54.96	28.79	40	-11.2	H	100	0	7.05	
55.4	28.85	40	-11.2	V	100	0	6.92	
56.2	22.21	40	-17.8	V	100	0	6.68	
57.84	33.64	40	-6.4	V	100	0	6.19	
58.64	32.95	40	-7.1	V	100	0	5.95	
59.48	33.63	40	-6.4	V	100	0	5.7	
59.88	31.81	40	-8.2	H	100	0	5.58	
60.72	23.77	40	-16.2	V	100	0	5.59	
61.12	21.11	40	-18.9	V	100	0	5.61	
64.84	12.05	40	-28.0	V	100	0	5.84	
67.28	24.5	40	-15.5	V	100	0	6	
91.04	26.23	43	-16.8	V	100	0	9.55	
100.014	23.44	43	-19.6	V	100	0	11.02	
112.04	18.06	43	-24.9	V	100	0	12.15	
114.68	18.56	43	-24.4	V	100	0	12.4	
136.08	23.33	43	-19.7	V	100	0	12.55	
200	16.5	43	-26.5	V	100	0	11.08	
1959.16	75.45	54	21.5	V	100	0	32.66	Transmitter



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

F (MHz)	QP Level (dBµV/m)	Antenna polarity
From 1.9592 GHz to 1.962 GHz	76.31	H

Test according to CFR 47 Part 24

Subpart E: § 24.238
Tests performed by Daniel RAUD at GYL Technologies laboratories in September, 18 of 2002.

REFERENCE DOCUMENTATION:

Part 24 subpart E
ANSI C63.4 (2001).

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 45 W) and in receiver mode.

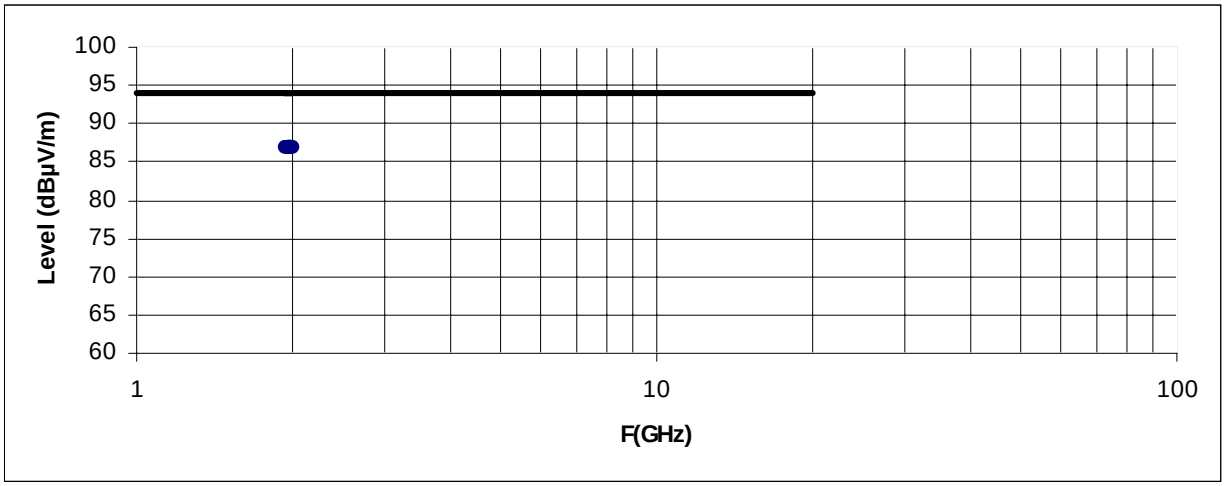
Test equipment used :

APPARATUS	MANUFACTURER	REFERENCE	SERIAL NUMBER	Date of verification
Free field open area test site				Jul-02
Horn antenna	EMCO	9504 - 4496	3115	Apr-00
Spectrum analyzer(20Hz-26.5GHz)	Rohde & Schwarz	FSEM30	107 985 00.30	Apr-01

Results :

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

FREQUENCY (GHz)	Measure (dBµV)	AF (A)	Loss cable (B)	Correct.Factor (A)+(B)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
From 1.9592 GHz to 1.962 GHz	57.1	27.9	2	29.9	87	93.9	-6.9



2 - **Spurious emissions measurement**.

No spurious emission found which level upper to noise level in 100KHz bandwidth (harmonics transmitters frequencies under noise level).

INTERPRETATION AND REMARKS:

Conform

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