COMLAB
Accredited Testing and Certification
EMC, Radio and Telecommunications

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Total no. of Pages : 40

Test report : 37317-6

Item tested : EXT 3241

Type of equipment : Frequency Hopping Transmitter

FCC ID : ELI324X

Client : RTX Telecom A/S

Tested according to :

FCC part 15, subpart C
Frequency Hopping Transmitters

RSS-210, Issue 5
Low Power Licence-Exempt Radiocommunication Devices

Date of issue : 18 FEBRUARY 2005

Authorised by :

Kjell G. Haga
Managing Director

Frode Sveinsen
Technical Supervisor

CONTENTS

1 GENERAL INFORMATION

1.1 Testhouse Info

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Managing Director:	Kjell G. Haga
FCC test firm registration # :	994405
IC OATS registration # :	4443

1.2 Client Information

Name :	RTX Telecom A/S
Address :	Stroemmen 6, 9400 Noerresundby, Denmark
Telephone :	+45 96 32 23 88
Fax :	+45 96 32 23 10

Contact:

Name :	Kent Messerschmidt
E-mail :	km@rtx.dk

1.3 Manufacturer

Name :	/
Address :	/
Telephone :	/
Fax :	/
E-mail :	/

2 Test Information

2.1 Tested Item

Name :	RTX Telecom
FCC ID :	ELI324X
Industry Canada ID :	
Model/version :	EXT 3241
Serial number :	005
Hardware identity and/or version:	V3
Software identity and/or version :	/
Frequency Range :	2401.920 - 2481.408 MHz
Tunable Bands :	1
Number of Channels :	47
Modulation :	GFSK
Emissions Designator :	1MF1D
User Frequency Adjustment :	None, Software controlled.
Rated Output Power :	80 mW

Theory of Operation

The RTX 3240 Extension Unit is one of the two extension units for the TLE II wireless telephone jack system, it connects over a wireless link to the BS 3240 Base Unit.

The RTX 3241 Extension Unit has two modes of operation, which is selected using the switch. If positioned in "C" mode (Computer) the device works as the RTX 3240 and if the switch is placed in "S" (Speech) the Extension Unit will be able to support Phones and Fax's. RTX3241 is capable of generating a ring-signal and also forward CLI information received from the PSTN network.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20 - 23 °C
Relative humidity:	20 - 30 %
Normal test voltage:	115 V AC

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2005-01-19

Test period : from 2005-01-19 to 2005-01-31

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: RTX Telecom AS

Model No.: EXT 3241

Serial No.: 005

All measurements are tracable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC Part 15, Subpart C, paragraph 15.247 for Frequency Hopping Spread Spectrum devices and Industry Canada RSS-210 Frequency Hopping Spread Spectrum.

Radiated tests were conducted in accordance with ANSI C63.4-2001. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10 metres.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-production Unit

DSS Equipment Code ☐ Family Listing

THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

COMLAB

NEMKO COMLAB REF: 37317-6

TESTED BY: Frode Sveinsen DATE: 4 FEBRUARY 2005

Frode Sveinsen, Test engineer

3.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 reference	Result
Powerline Conducted Emission	15.207(a)	7.4, 9	Complies
Channel Separation	15.247(a)(1)	6.2.2(o)(a1)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	6.2.2(o)(a1)	Complies
Time of Occupancy	15.247(a)(1)(iii)	Amendment, para I (ii)	Complies
Occupied Bandwidth	15.247(a)(1)	Amendment, para I (ii)	Complies
Peak Power Output	15.247(b)	6.2.2 (o)(a3)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	6.2.2 (o)(e1)	N/A[1]
Spurious Emissions (Radiated)	15.247(c)	6.2.2 (o)(e1)	Complies

[1] The tested equipment has integrated antennas only.

3.3 Description of modification for Modification Filing

Not Applicable.

3.4 Comments

The channels and antenna to operate on was selected with a PC connected to the EUT through a test-jig. The software and test-jig was supplied by the applicant. The PC was only used for selection of channel and antenna.

The measurements were done with the EUT powered by 115 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Powerline Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Tore Løvlien	**Date of Test: 27 January 2005**

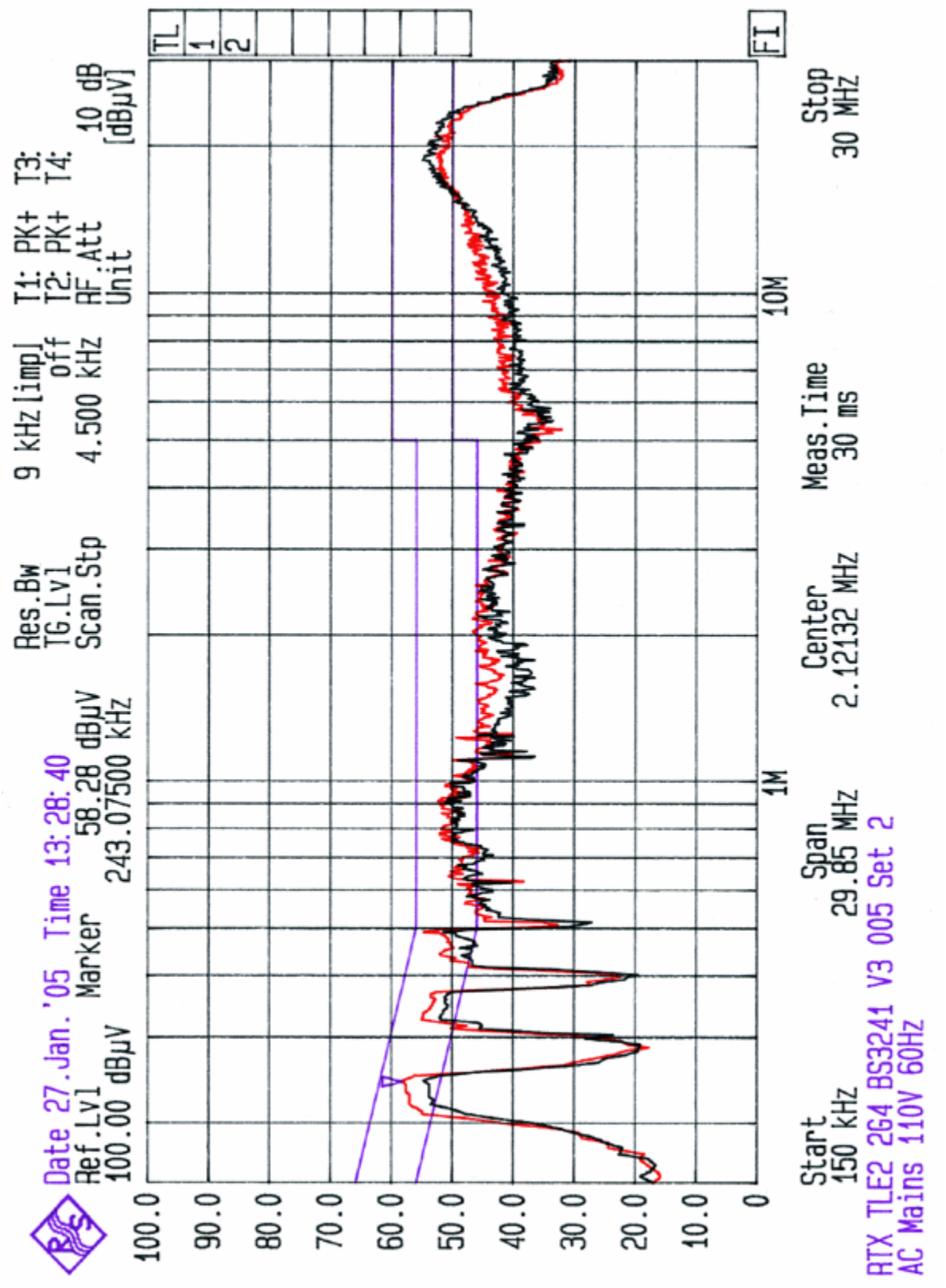
Measurement procedure: CISPR 22 1997 Clause 5.1 Class B ITE using 50 µH/50 ohms LISN.

Test Results: **Complies.**

Measurement Data: **See attached graph, (Peak detector).**

Highest measured value (N or L1):

Frequency	Detector	Measured value	Limit	Margin
KHz	Peak/QP/AV	dBµV	dBµV	dB
243.07	QP	56.2	62	5.8
	AV	42.0	52	10.0
342.0	QP	52.9	59	6.1
	AV	38.9	49	10.1
489.76	QP	50.9	56.5	5.6
	AV	35.7	46.5	10.8
914.11	QP	49.1	56	6.9
	AV	32.1	46	13.9
18 622	QP	48.0	60	12.0
	AV	41.8	50	8.2



AC Mains Peak Detector

4.2 Channel Separation

Para. No.: 15.247 (a)(1)

Test Performed By: Frode Sveinsen	**Date of Test: 21 January 2005**

Test Results: **Complies**

Measurement Data: Channel Separation: 6.894 MHz / 4 = 1.7235 MHz

20 dB Bandwidth of hopping channel: 1.2505 MHz

RF channel (0 to 46) has no influence on 20 dB bandwidth.

See attached graph

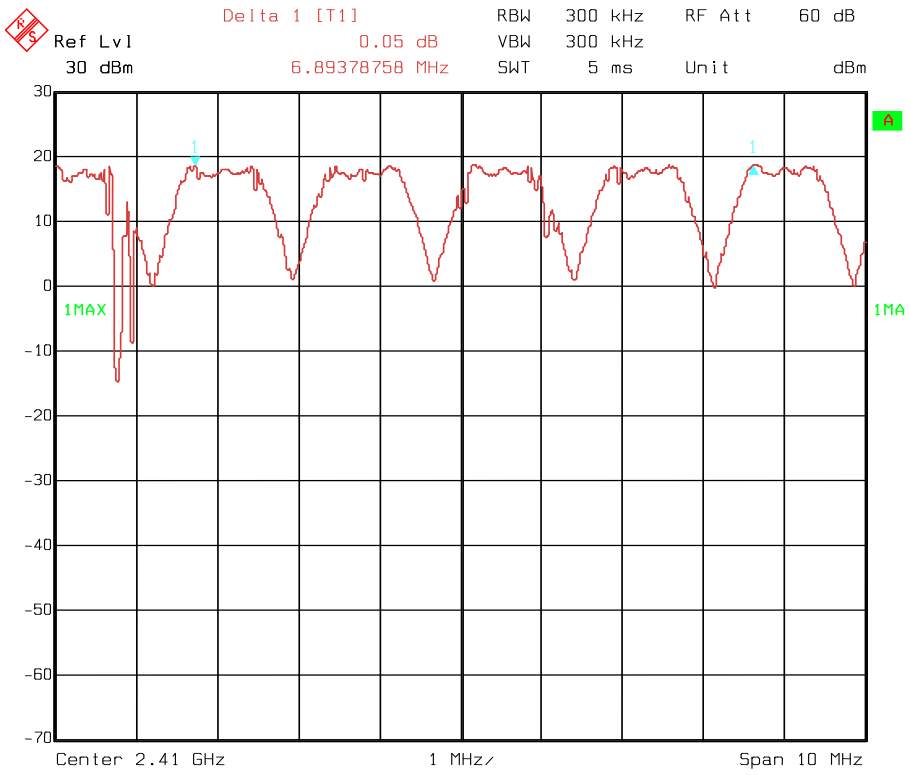
Channel Separation nominal value: 1.728 MHz.

Requirement:

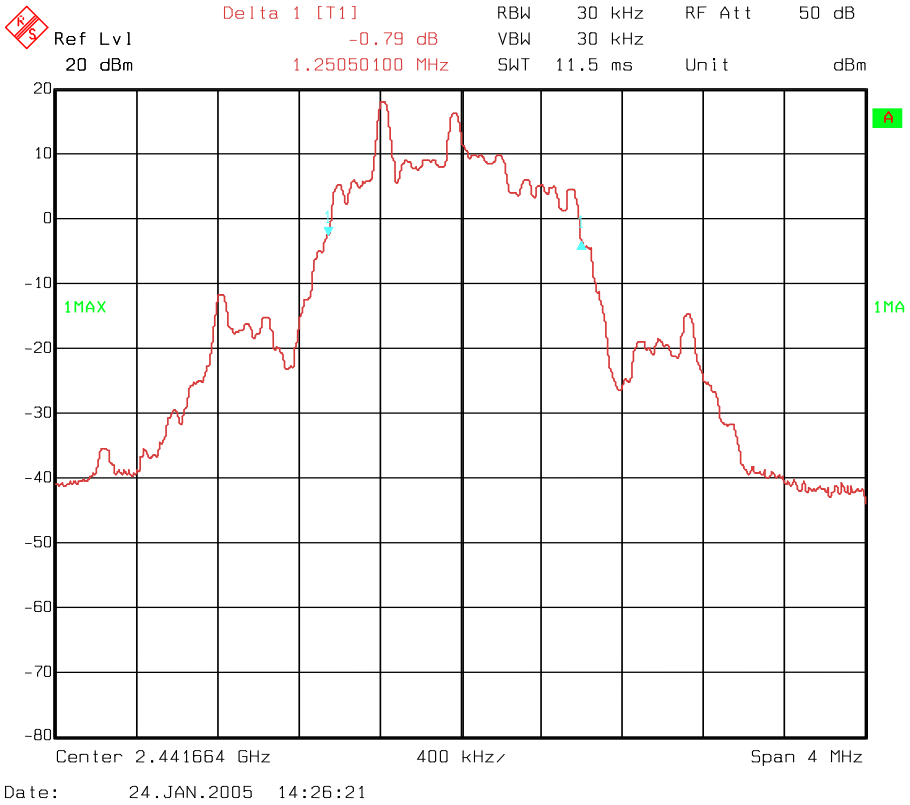
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

or:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.



Channel separation



20 dB Bandwidth

4.3 Pseudorandom Hopping Algorithm

Para. No.: 15.247 (a)(1)

Test Performed By: Frode Sveinsen	**Date of Test: 27 January 2005**

Test Results: Complies

Measurement Data: /

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

Base Table Hopping Sequence

The hopping sequence is described in the document FCC Description TLE II.

4.4 Occupancy Time

Para. No.: 15.247 (a)(1)(iii)

Test Performed By: Frode Sveinsen	**Date of Test: 31 January 2005**

Test Results: Complies

Measurement Data: Number of RF channel: 47

RF burst pr channel: 10 x 819.6µs = 8.20 ms*

Time between each RF burst on same RF channel: 470 ms

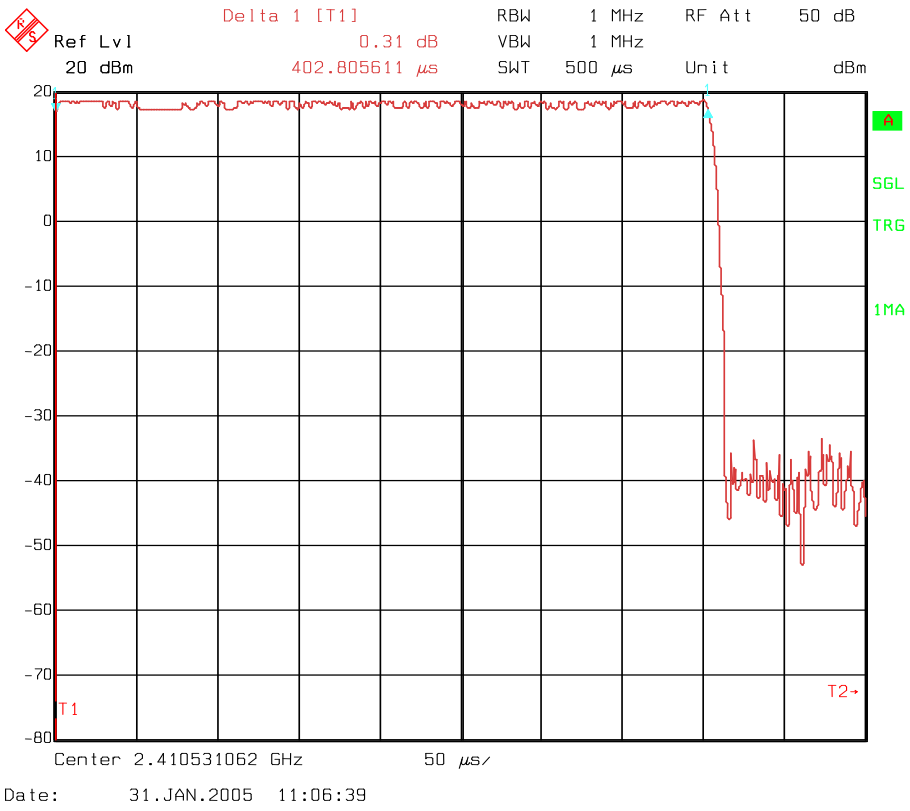
Time of occupancy: (8.20 ms / 470 ms) * 0,4s *47 = 0.328 s

*Maximum theoretical number of RF bursts pr. channel is 10 double slots pr. 470 ms.

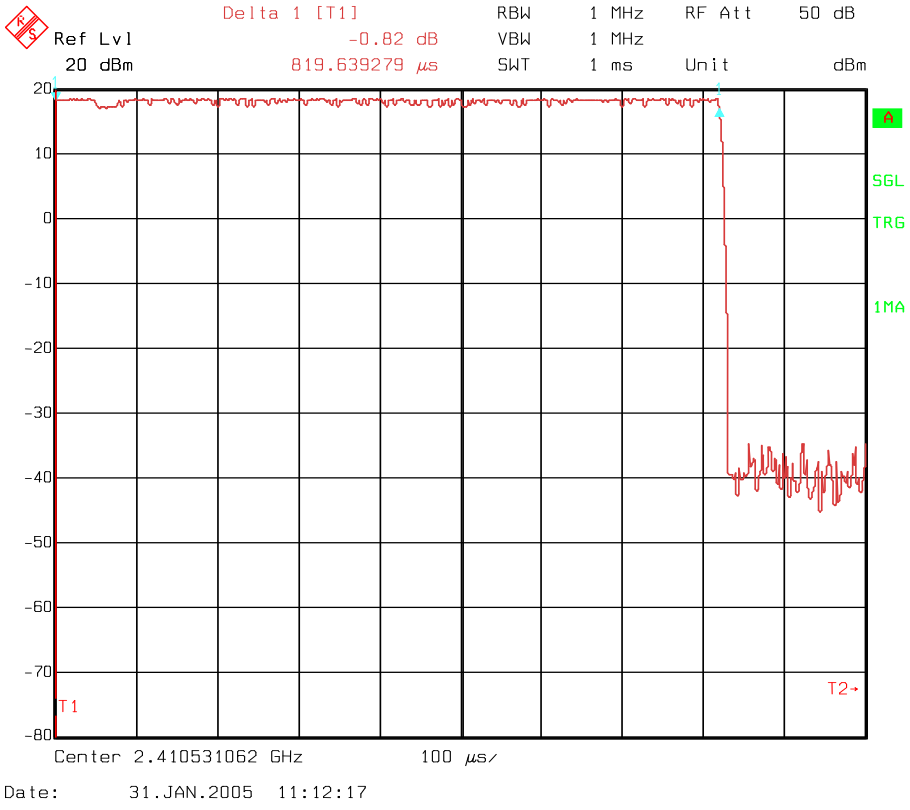
See attached graph.

Requirements:

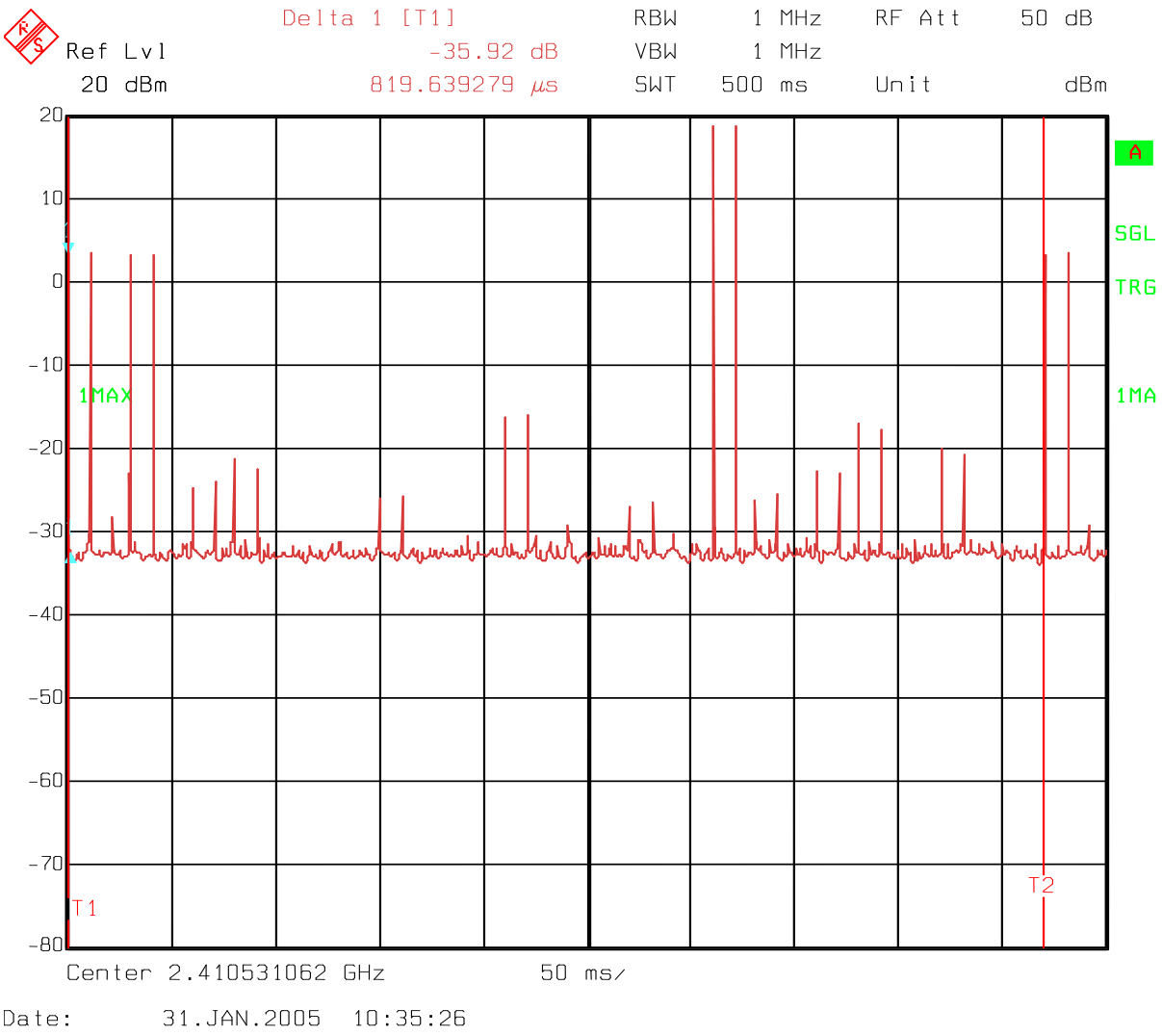
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



RF burst single slot



RF burst double slot



RF burst ch 23, 3 slots

4.5 Occupied Bandwidth

Para. No.: 15.247 (a)(1)(iii)

Test Performed By: Frode Sveinsen	**Date of Test: 21 January 2005**

Test Results: Complies

Measurement Data: 47 RF channels in use

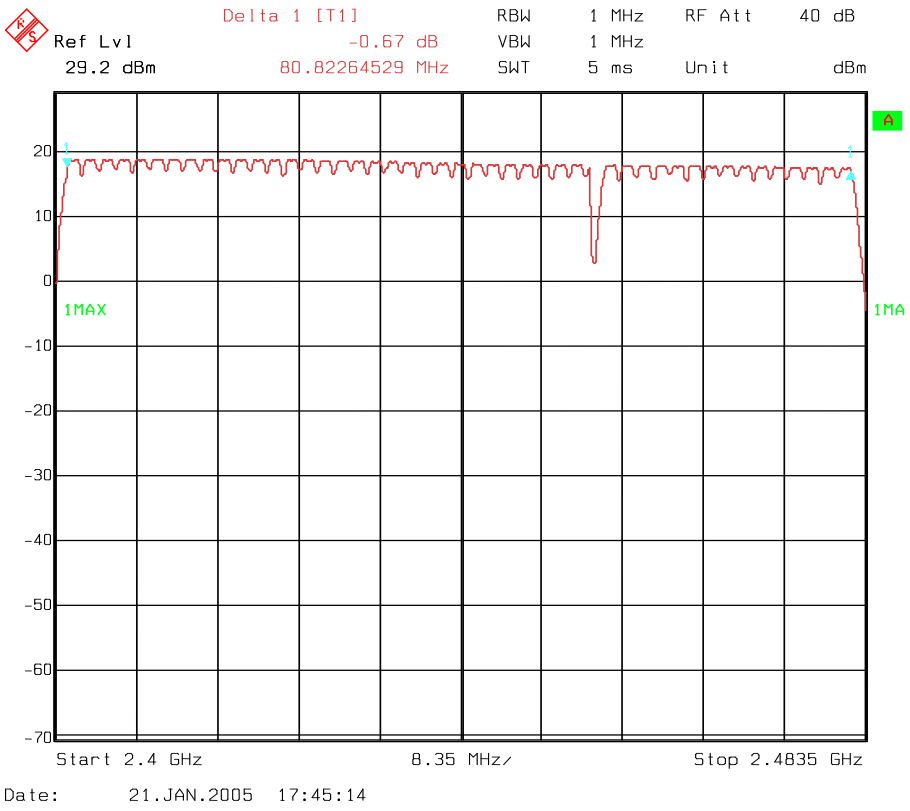
See attached graph.

Requirements:

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

Channel Centre Frequencies

The 47 channel centre frequencies are listed in the FCC Description TLE II.



RF channel in use

4.6 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: Frode Sveinsen	**Date of Test: 21 January 2005**

Test Results: Complies

Measurement Data:

Maximum Conducted Peak Output Power, Watts

RF channel	0	23	46
Measured value	0.090	0.080	0.065

Maximum EIRP, Watts

RF channel	0	23	46
Calculated EIRP	0.201	0.206	0.137
Antenna gain dBi	3.5	4.1	3.2

Antenna gain = 10*log(EIRP/Conducted power) dBi

The EIRP is calculated from measured field strength by the formula in DA00-705.

See attached graph.

Detachable antenna? ☐ Yes ☒ No

If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

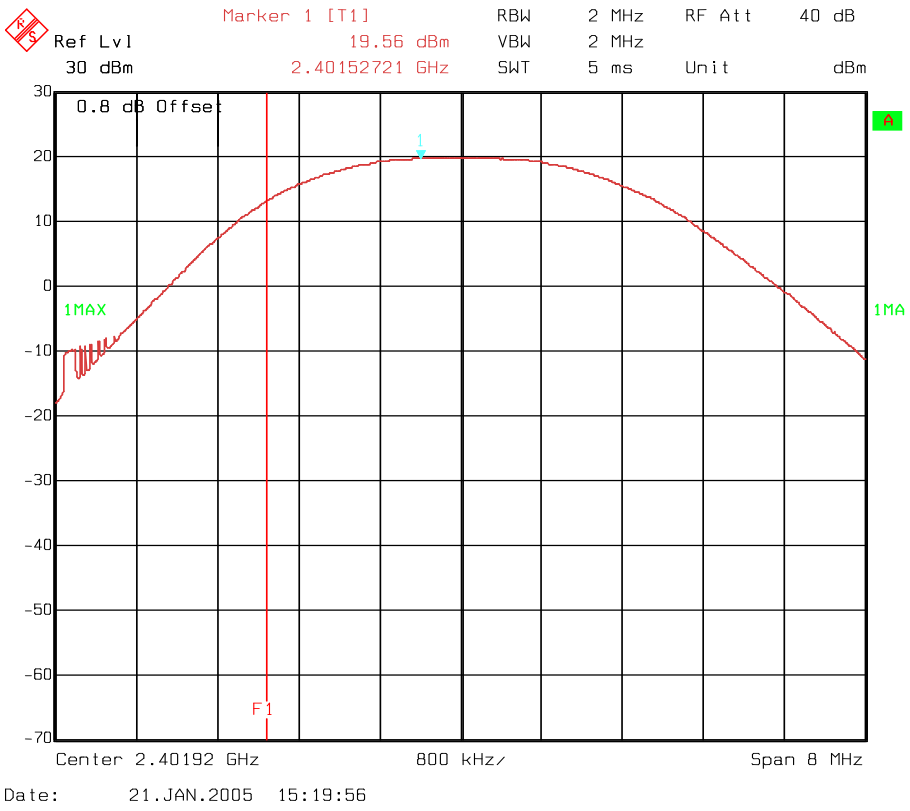
Requirements:

The maximum peak output power for frequency hopping systems shall not exceed the following limits:

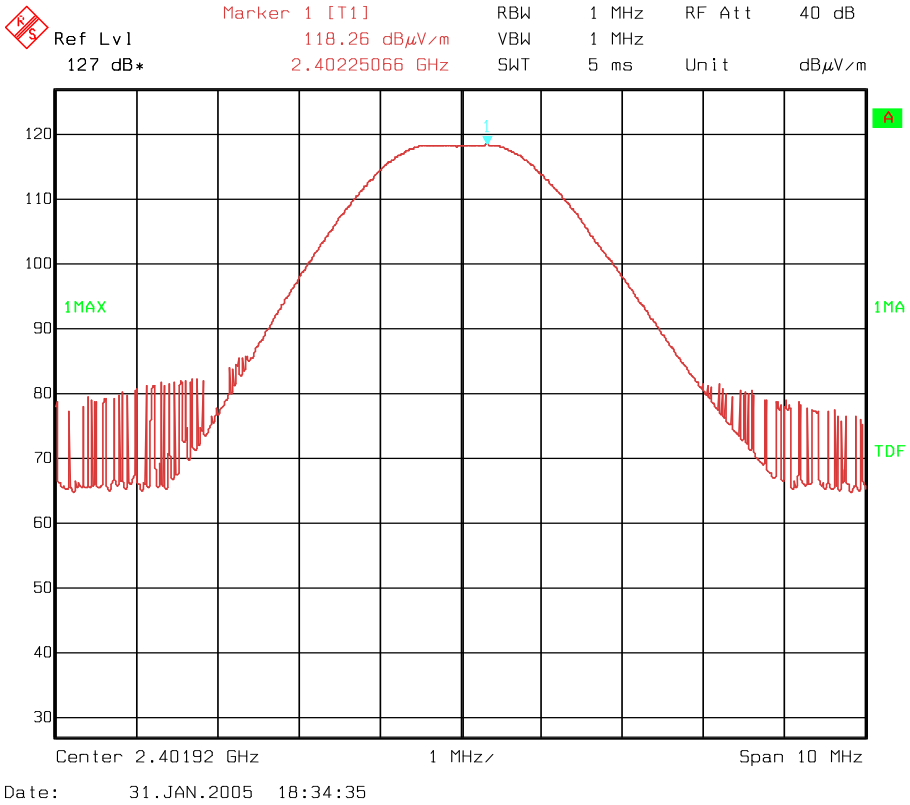
For systems employing at least 75 hopping channels: 1 watt

For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 watts

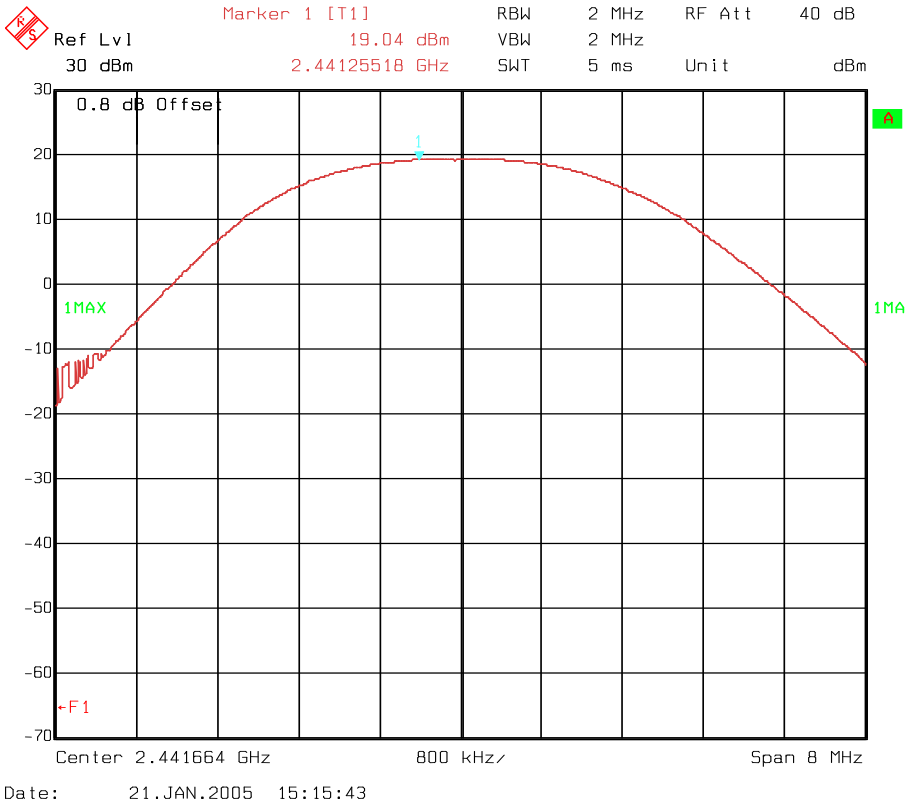
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



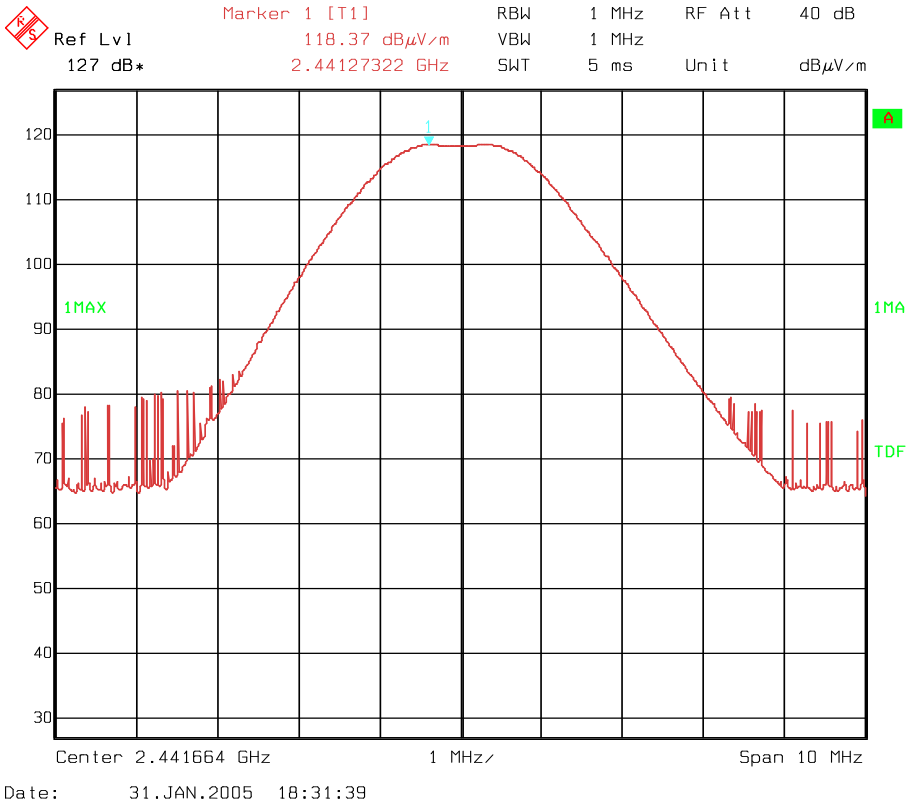
RF conducted channel 0



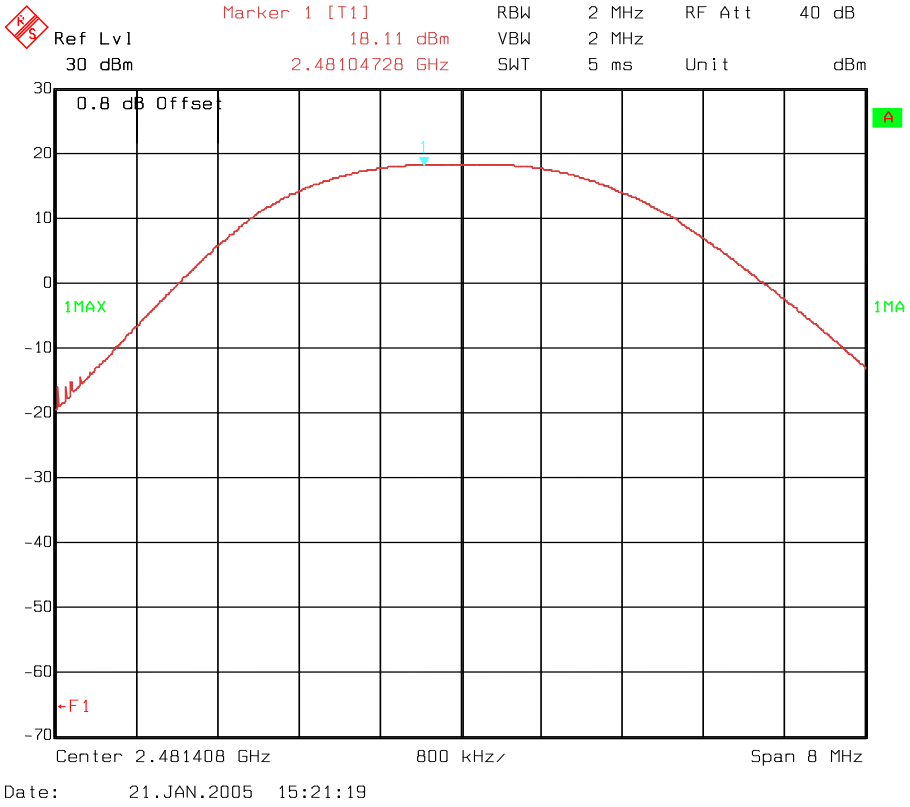
RF radiated channel 0



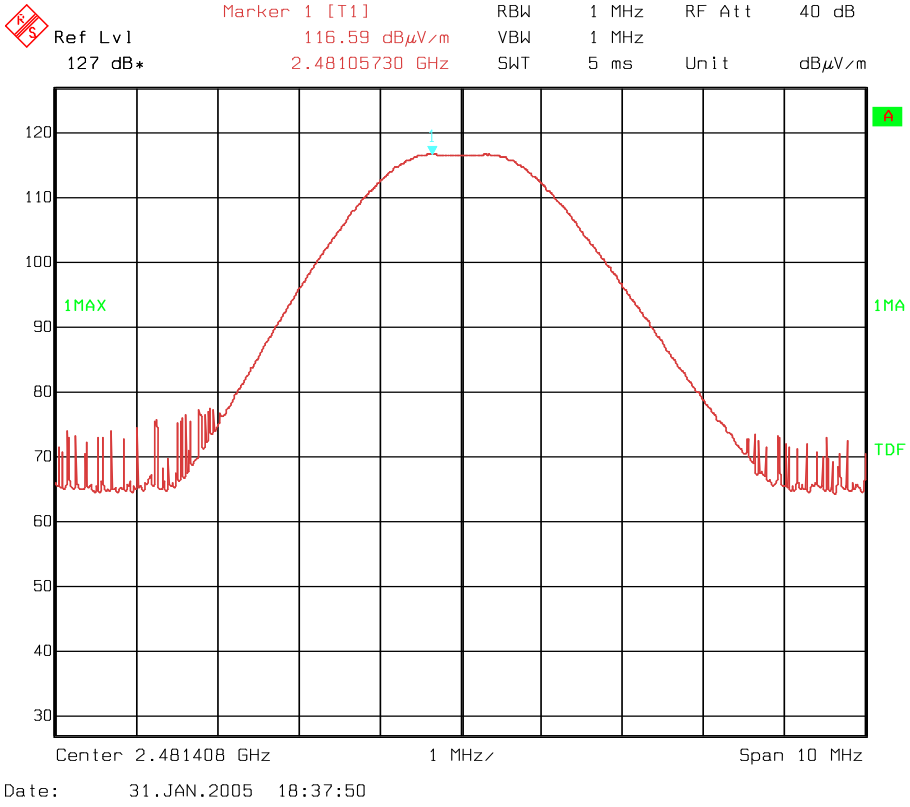
RF conducted channel 23



RF radiated channel 23



RF conducted channel 46



RF radiated channel 46

4.7 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen	**Date of Test: 25 to 31 January 2005**

Test Results: Complies

Measurement Data:

Band-edge conducted power.

Frequency	Power below nearest channel, dB		Limit	Margin
GHz	RF ch 0/46	Frequency hopping	dB	dB
2.4	-48,5	-39.5	-20	28.5 / 19.5
2.4835	-58.6	-50.6	-20	38.6 / 30.6

See attached graph

Band-edge field strength 2.4835 GHz.

Max field strength upper channel (46), 1 MHz BW: 113.4 dBµV/m
Delta marker 100 kHz BW: –56.2 dB
Field strength at 2,4835 GHz Peak: 113.4 dBµV/m - 56.2 dB = 57.2 dBµV/m
Margin: 74 – 57.2 = 16.8 dB.
Field strength at 2,4835 GHz Average: 57.2 - 20 = 37.2 dBµV/m.
See attatched plots.

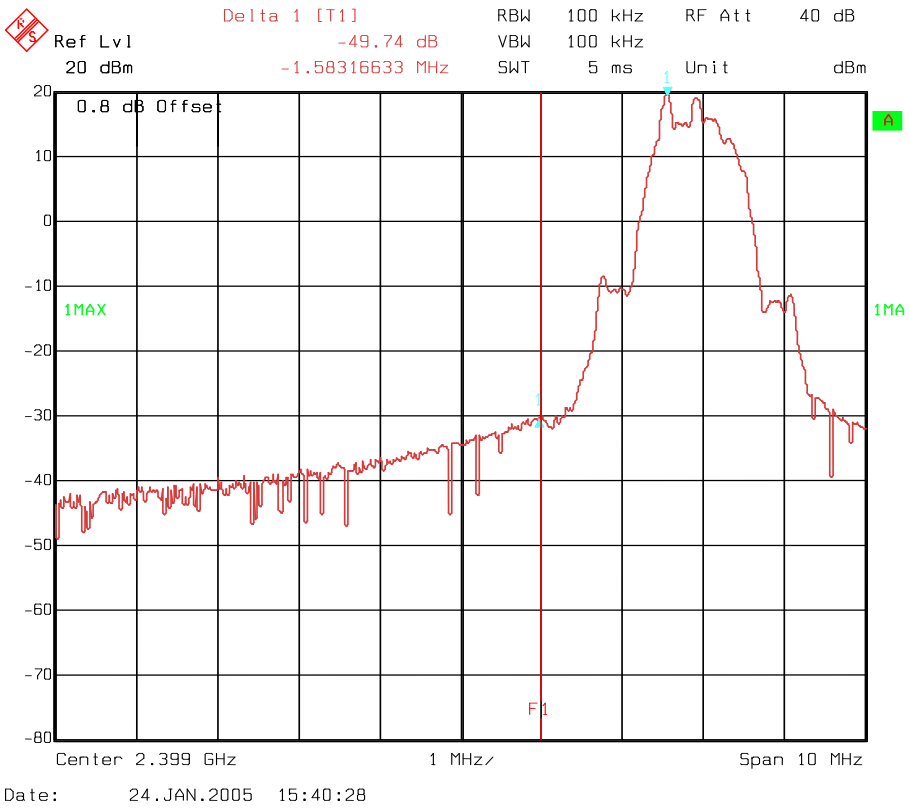
RF conducted power to 25 GHz see attached graph.
Maximum RF level outside operating band:
RF ch 0: -57,1 dB/C, margin 37,3 dB
RF ch 23: -55,5 dB/C, margin 35,5 dB
RF ch 46: -53,6 dB7C, margin 33,6 dB

Radiated Emissions, 1-25 GHz

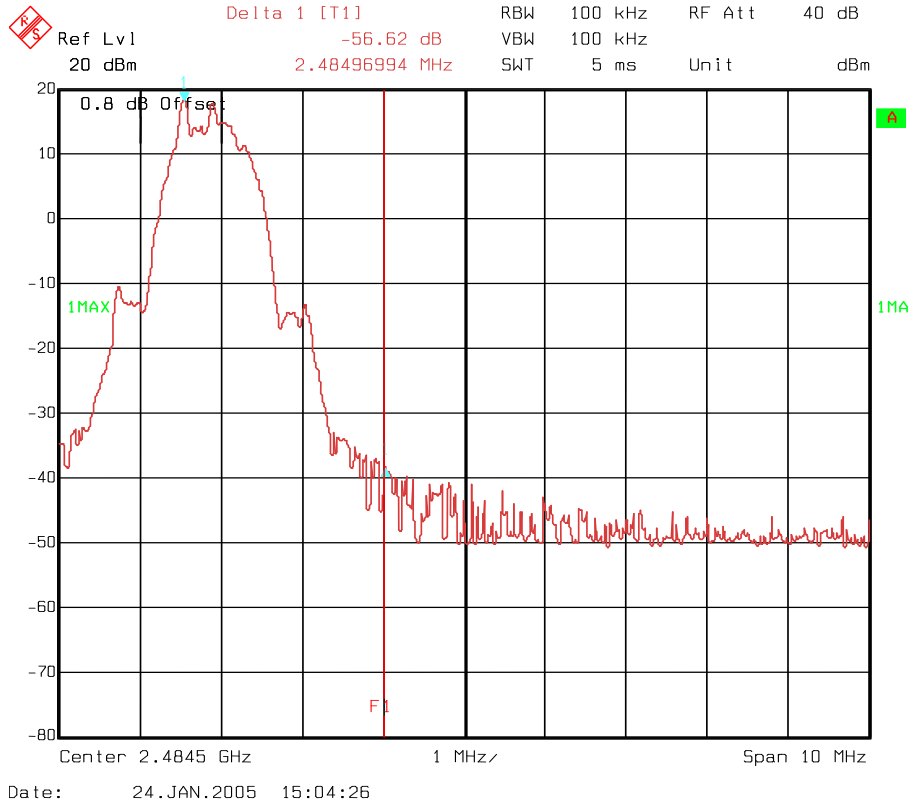
1-18 GHz measured at a distance of 3m, 18-25 GHz measured at 1m.

No spurious emissions were detected in any of the restricted bands. See attached graphs.

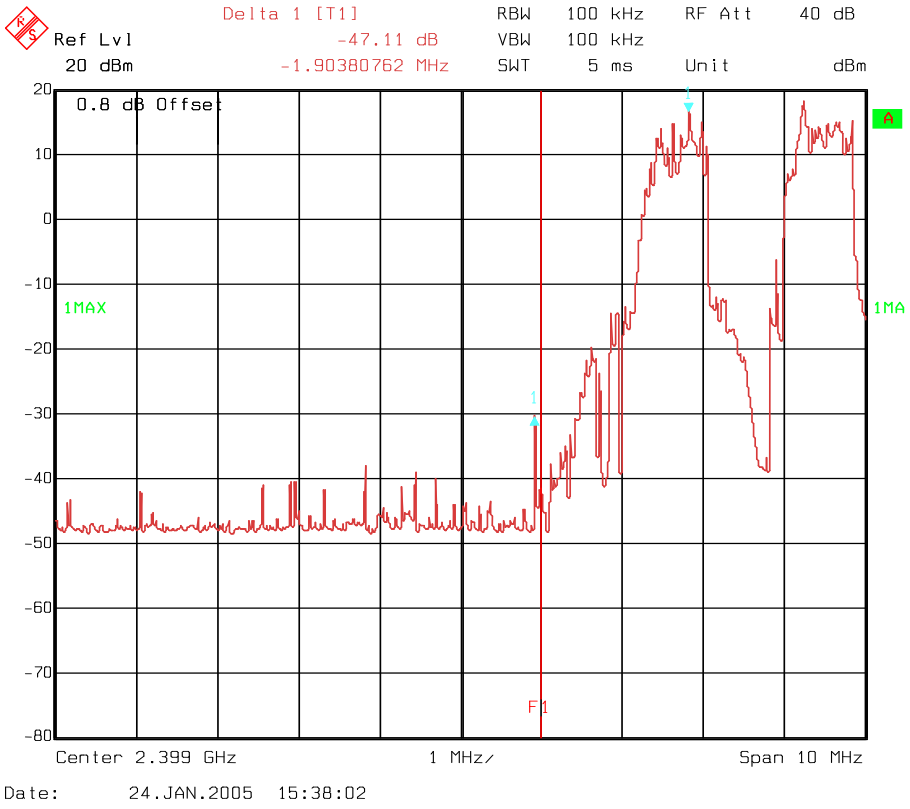
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".



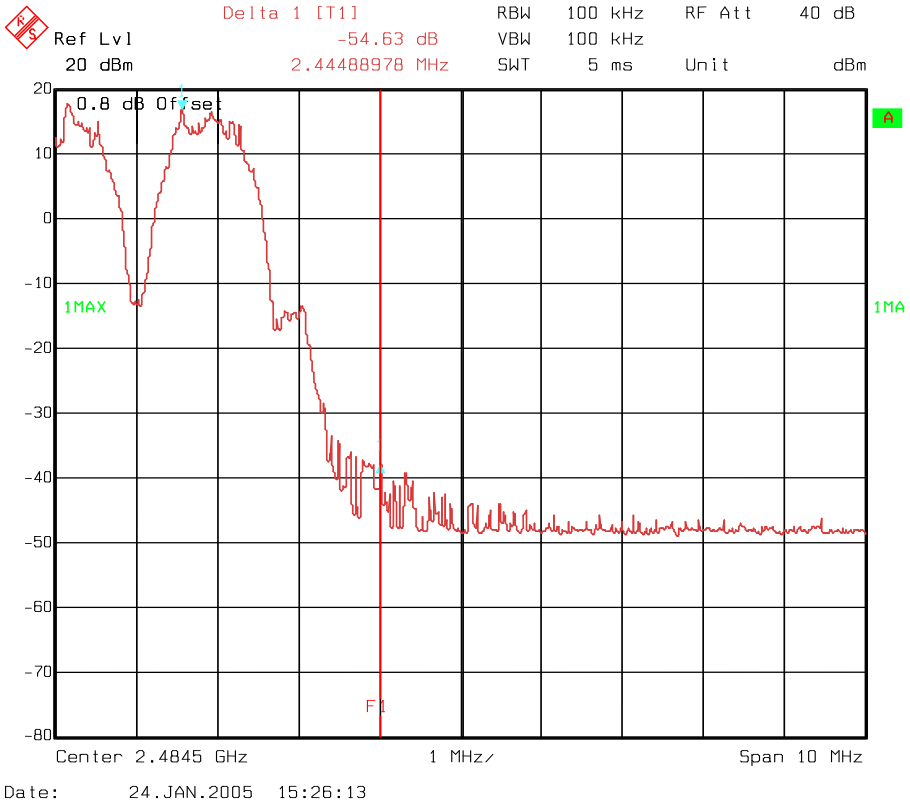
Band-edge conducted power ch 0, lower end



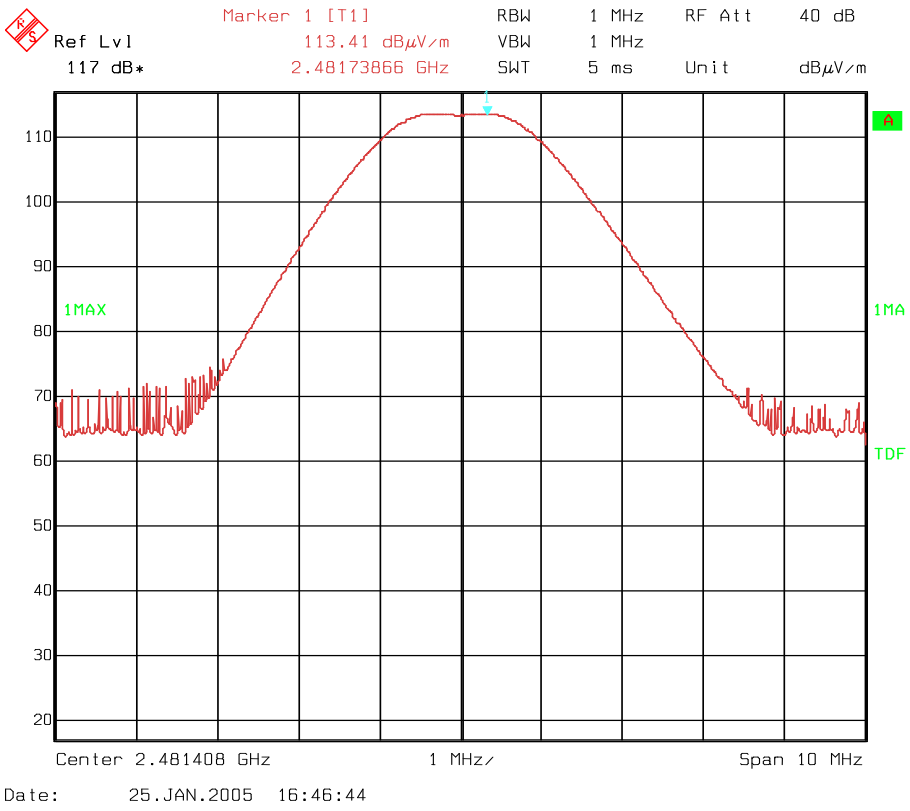
Band-edge conducted power ch 46, upper end



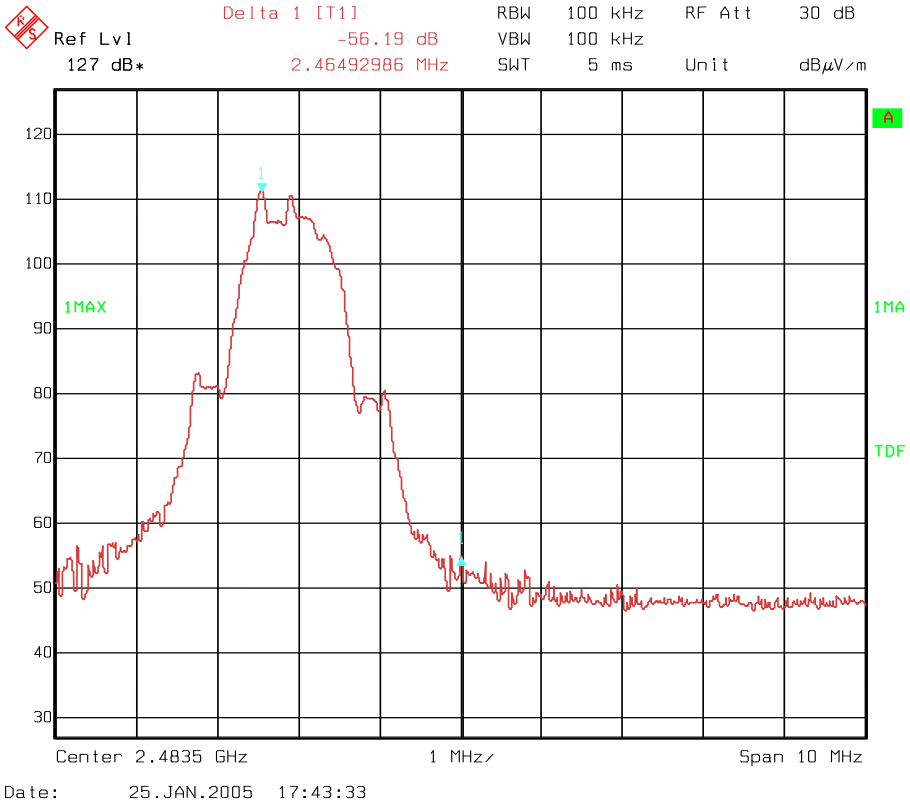
Band-edge conducted power, frequency hopping, lower end.



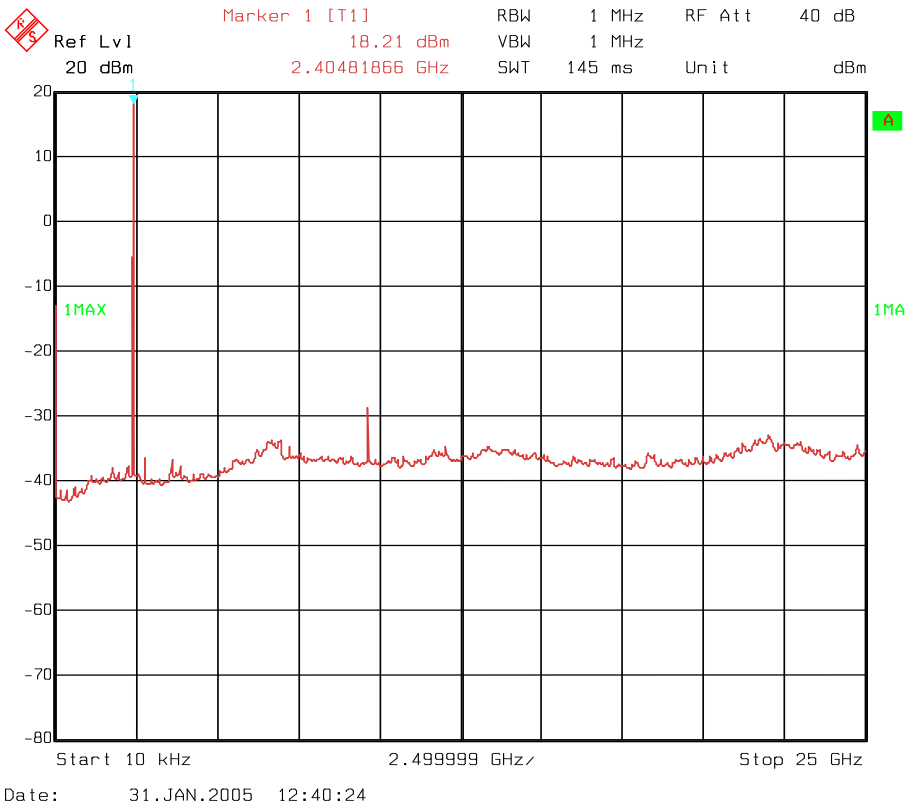
Band-edge conducted power frequency hopping, upper end.



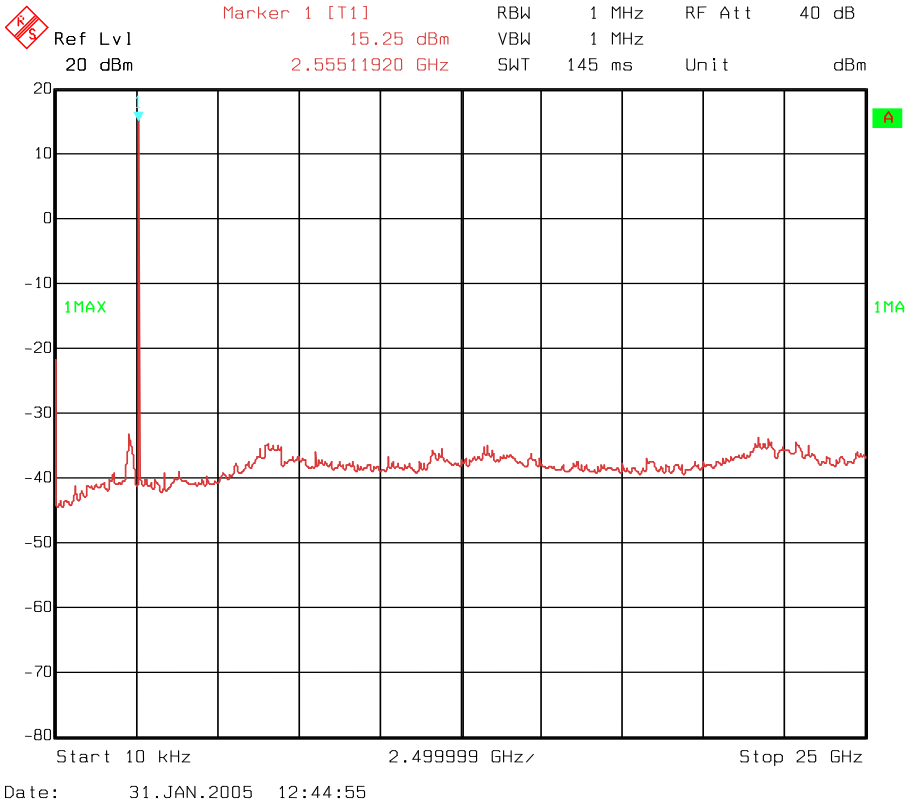
Max field strength ch 46.



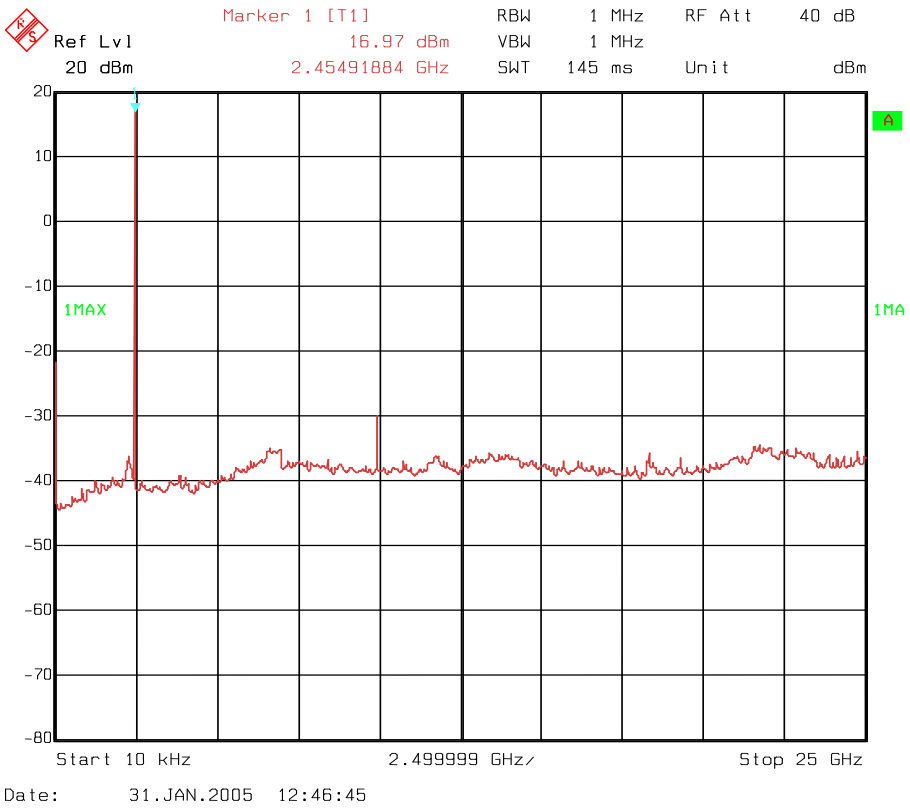
Marker Delta ch 46



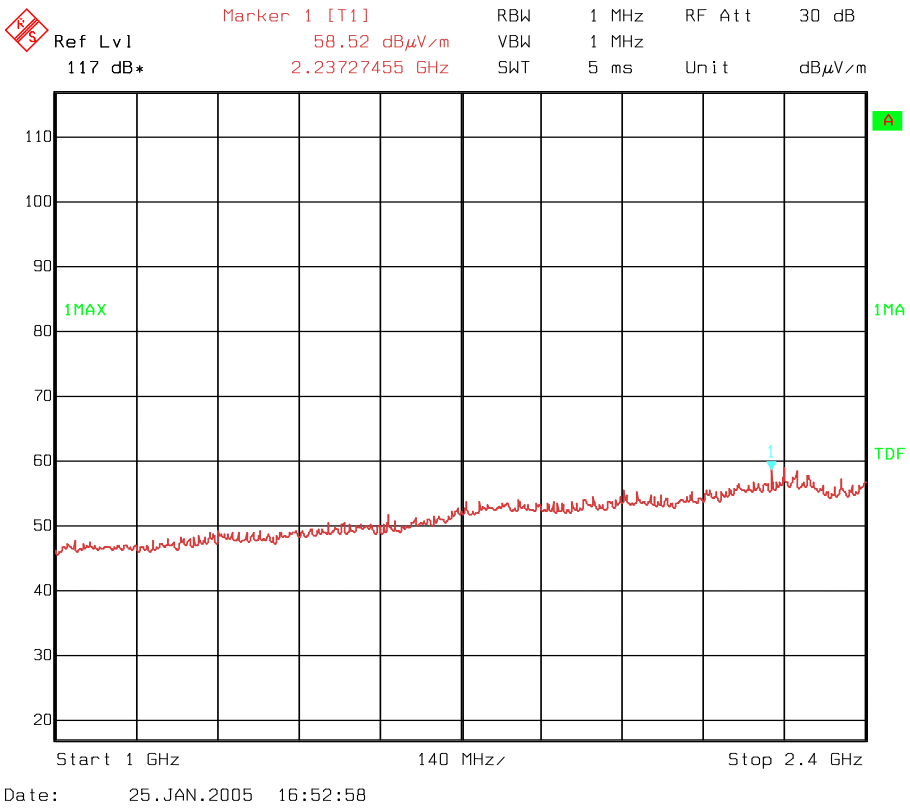
RF conducted emissions, ch 0



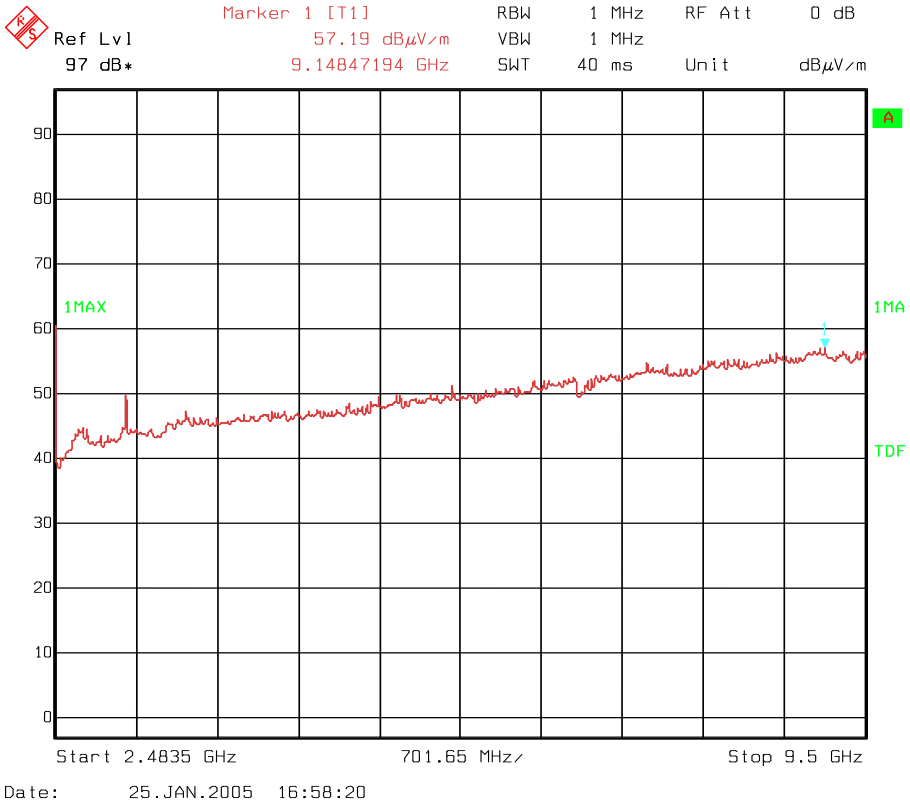
Rf conducted emissions, ch 23



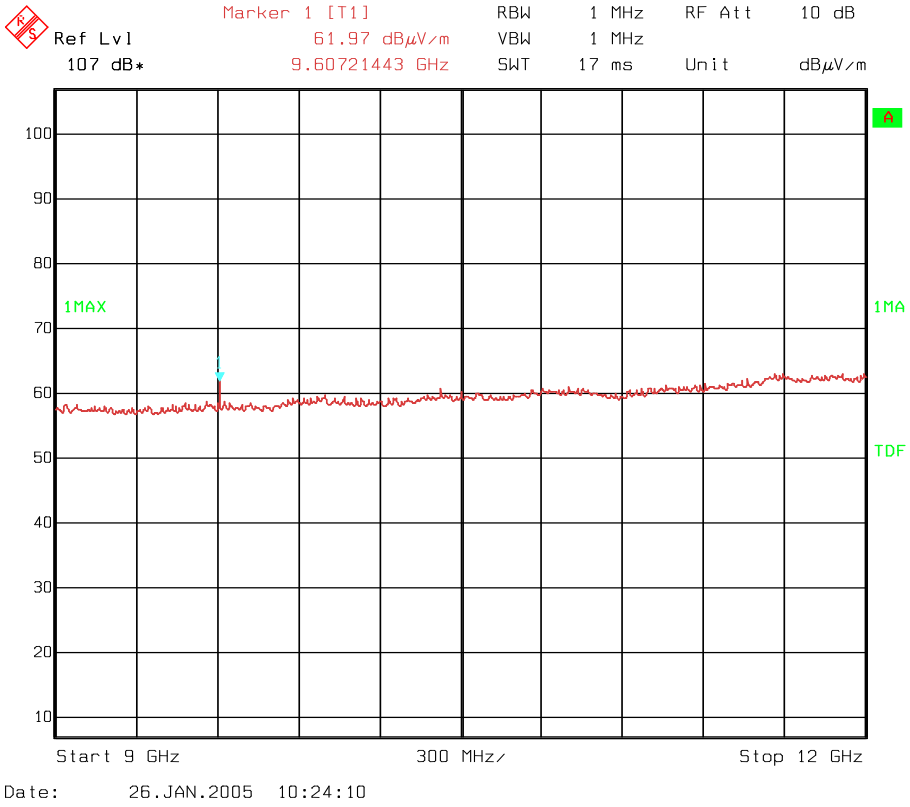
RF conducted emissions ch 46



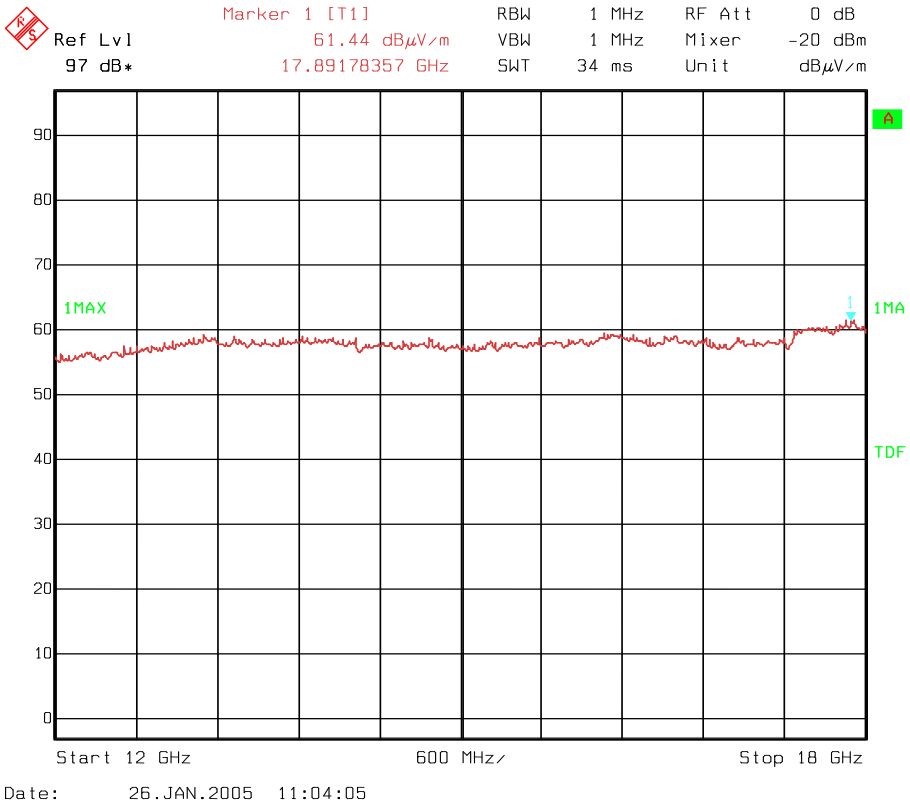
RF radiated emissions 1-2.4 GHz channel 0



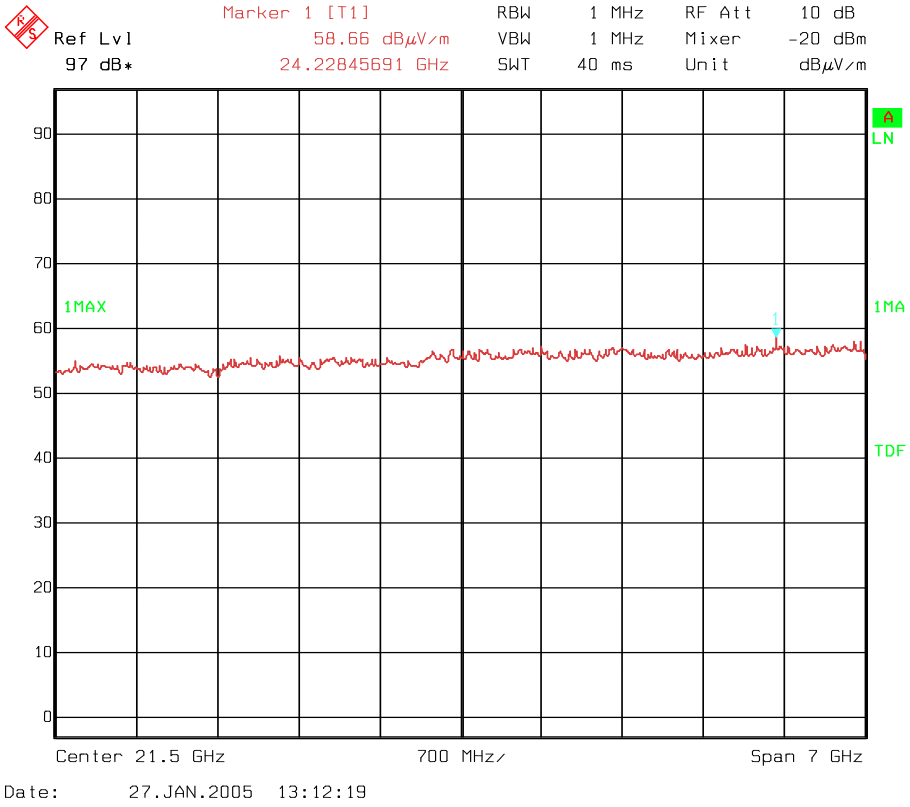
RF radiated emissions 2.4835-9.5 GHz channel 46



RF radiated emissions 9-12 GHz channel 46



RF radiated emissions 12-18 GHz channel 0



RF radiated emissions 18-25 GHz channel 0

Duty Cycle Calculation:

See also Para 4.4 Occupancy Time.

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

20*log((5x820) µsec / 0.1 sec) = - 27.7 dB

Maximum duty cycle according to Para 15.35 (b): -20 dB

This value is used when measuring average field strength above 1 GHz with Peak Detector function employed on spectrum analyzer.

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 10 m according to CISPR 22.

Tested in speech mode with active connection.

Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	metres	dBµV/m	dB
31	TX on	< 30	3	40.0	>10
33.2	TX on	< 30	3	40.0	>10
74.2	TX on	< 30	3	40.5	>10

See attached graphs.

Radiated emission 10 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).

Nemko Comlab AS

26. Jan 05 17:33

Peak

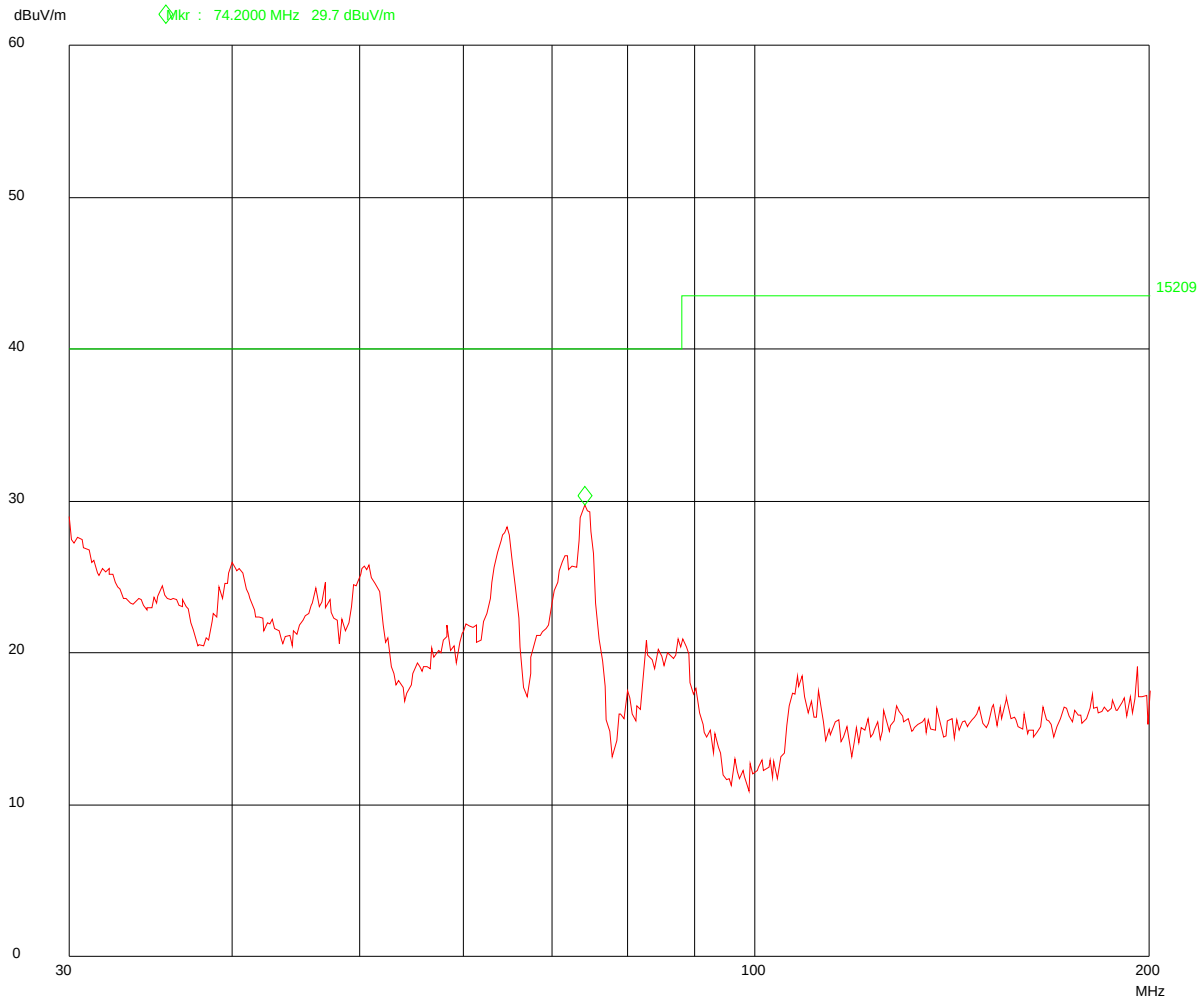
EUT:	RTX TLEII BS3240/EXT3241
Manuf:	RTX Telecom
Op Cond:	VP 1m
Operator:	FS
Test Spec:	FCC 15.209, 3m
Comment:	2.4GHz DCT Normal Mode

Scan Settings (1 Range)

|-------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
20	30M	200M	HK116



30-200 MHz vertical polarized, measuring distance 3 m

Nemko Comlab AS

26. Jan 05 17:39

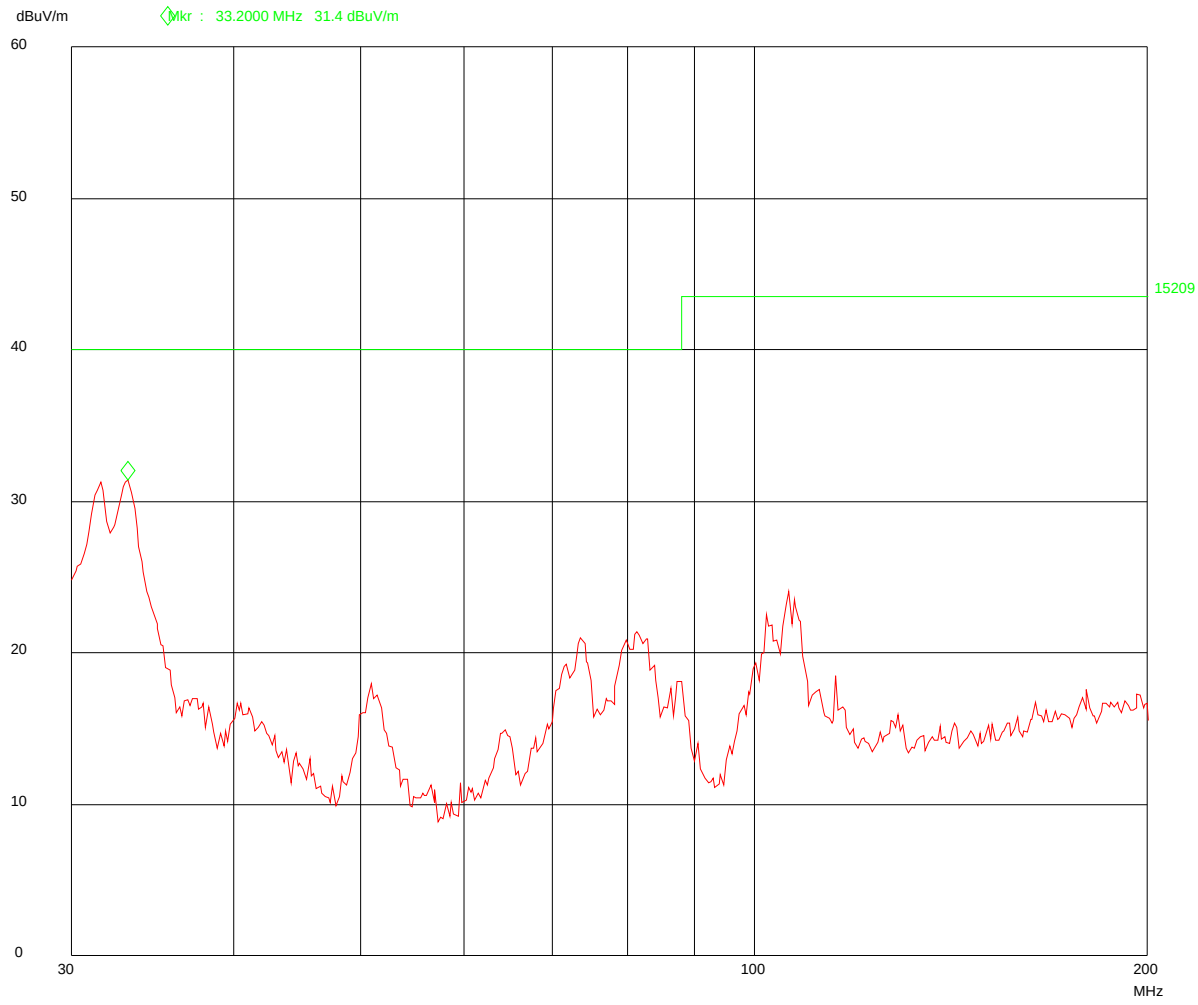
Peak

EUT: RTX TLEII BS3240/EXT3241
Manuf: RTX Telecom
Op Cond: HP 4m
Operator: FS
Test Spec: FCC 15.209, 3m
Comment: 2.4GHz DCT Normal Mode

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
20	30M	200M	HK116



30-200 MHz, horizontal polarization, measuring distance 3 m

Nemko Comlab AS

26. Jan 05 16:35

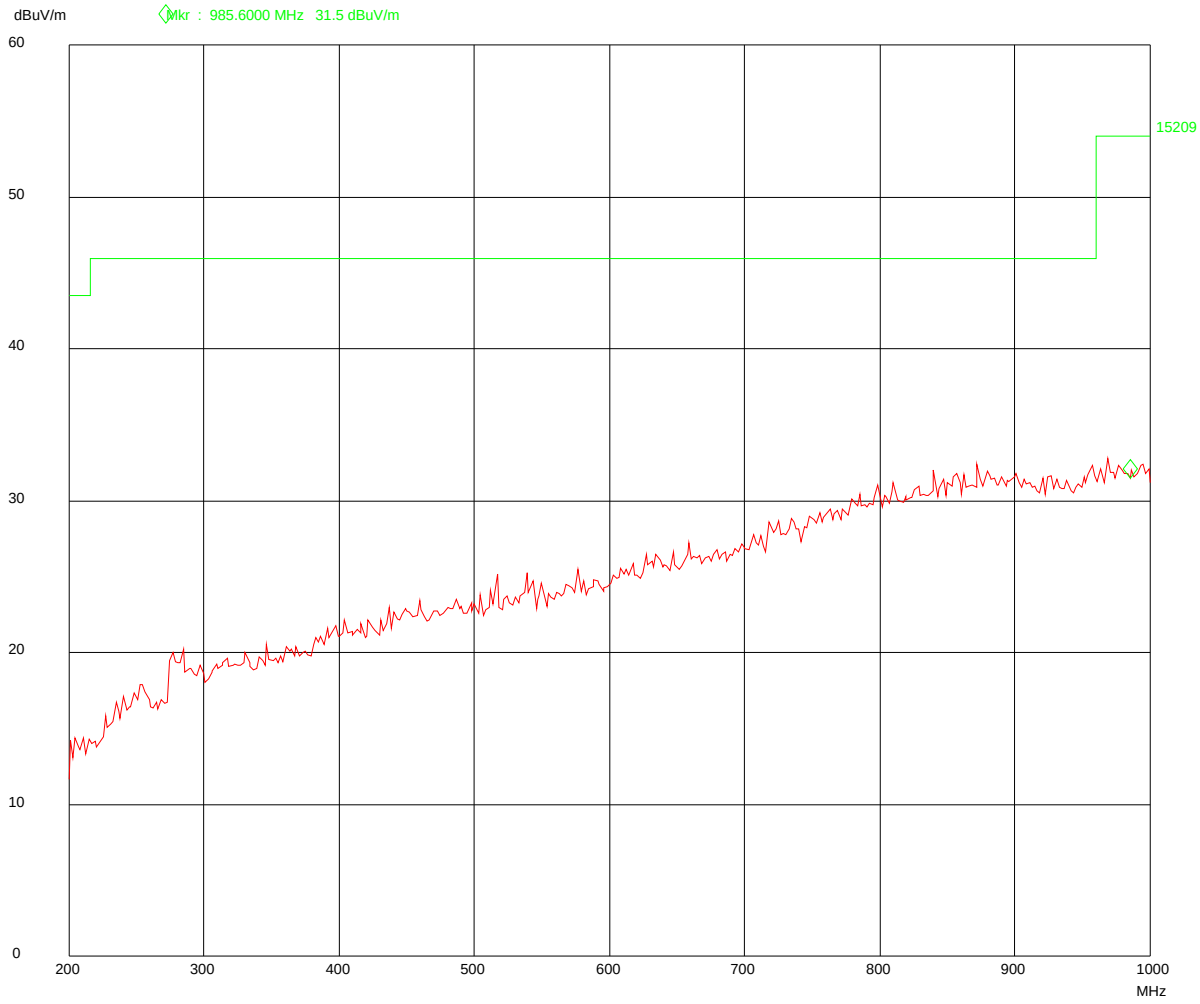
Peak

EUT: RTX TLEII BS3240/EXT3241
Manuf: RTX Telecom
Op Cond: VP 1m
Operator: FS
Test Spec: FCC 15.209, 3m
Comment: 2.4GHz DCT Normal Mode

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223



200-1000 MHz, vertical polarization, measuring distance 3 m

Nemko Comlab AS

26. Jan 05 16:54

Peak

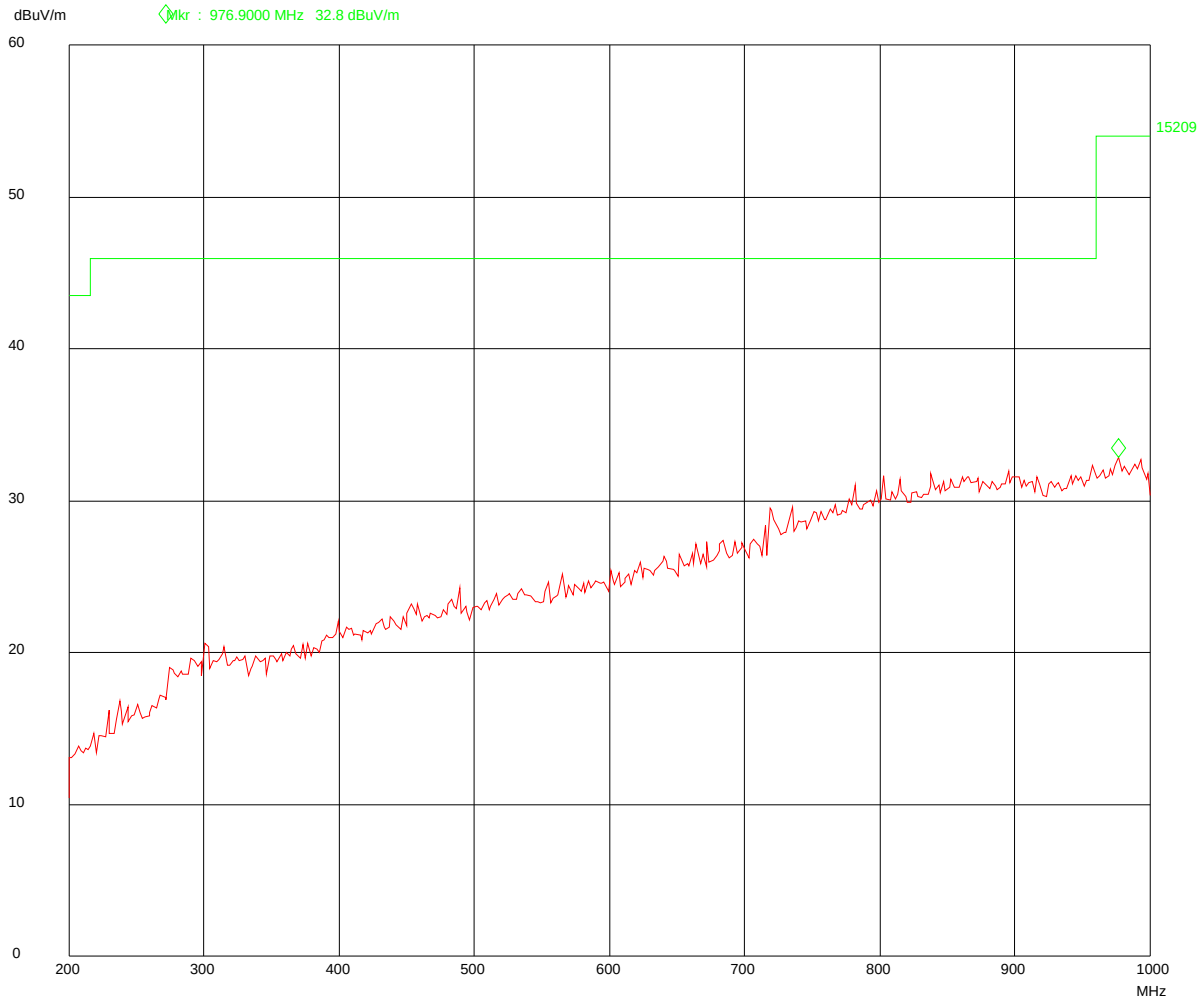
EUT:	RTX TLEII BS3240/EXT3241
Manuf:	RTX Telecom
Op Cond:	HP 4m
Operator:	FS
Test Spec:	FCC 15.209, 3m
Comment:	2.4GHz DCT Normal Mode

Scan Settings (1 Range)

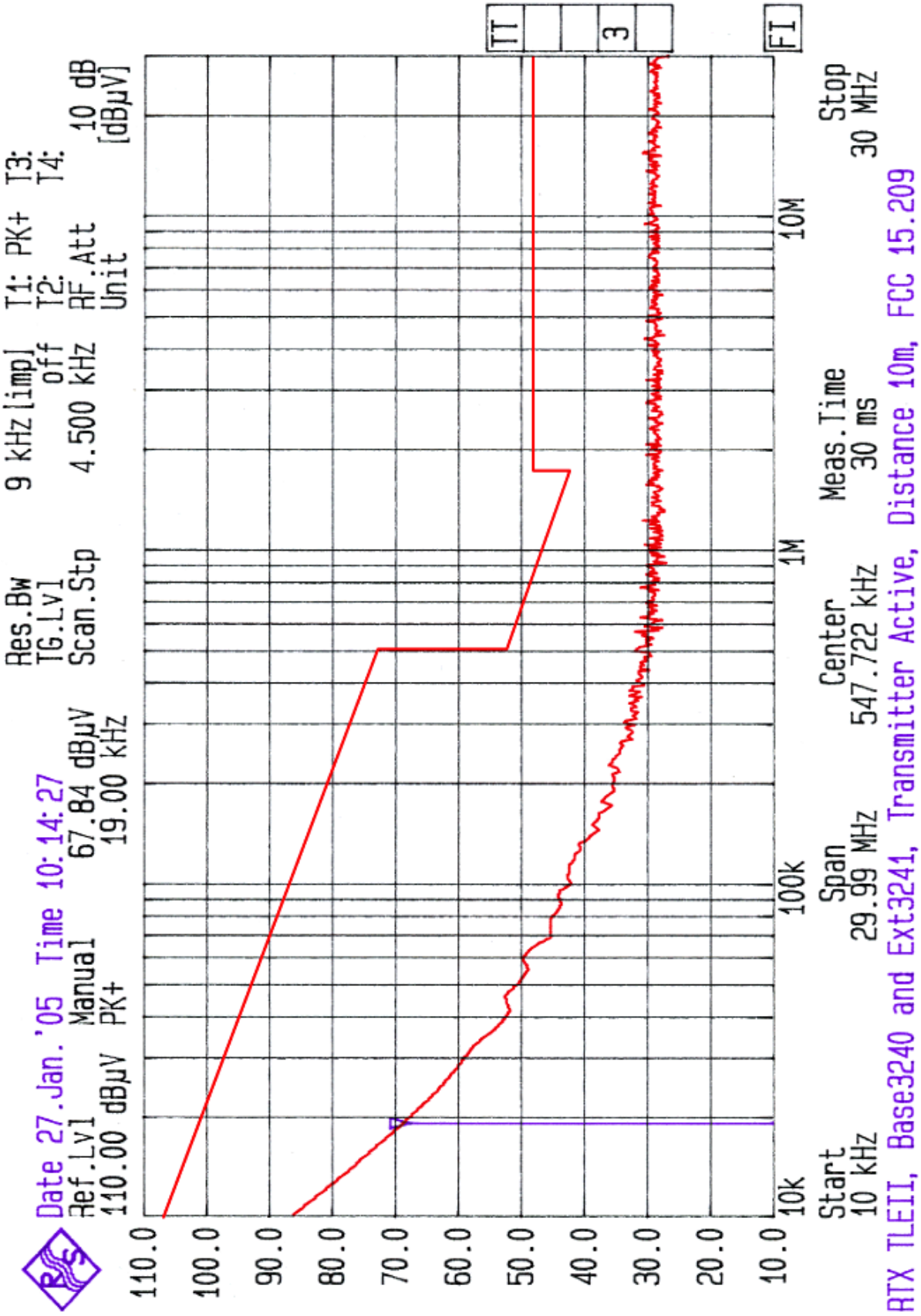
|-------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223



200-1000 MHz, horizontal polarization, measuring distance 3 m



Radiated 10 kHz-30 MHz, measuring distance 10 m

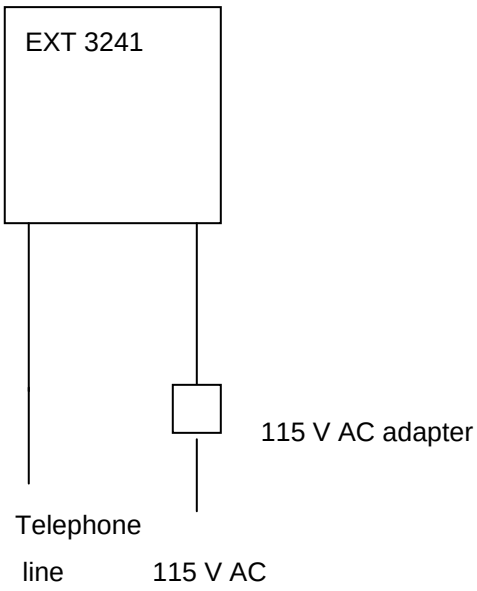
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

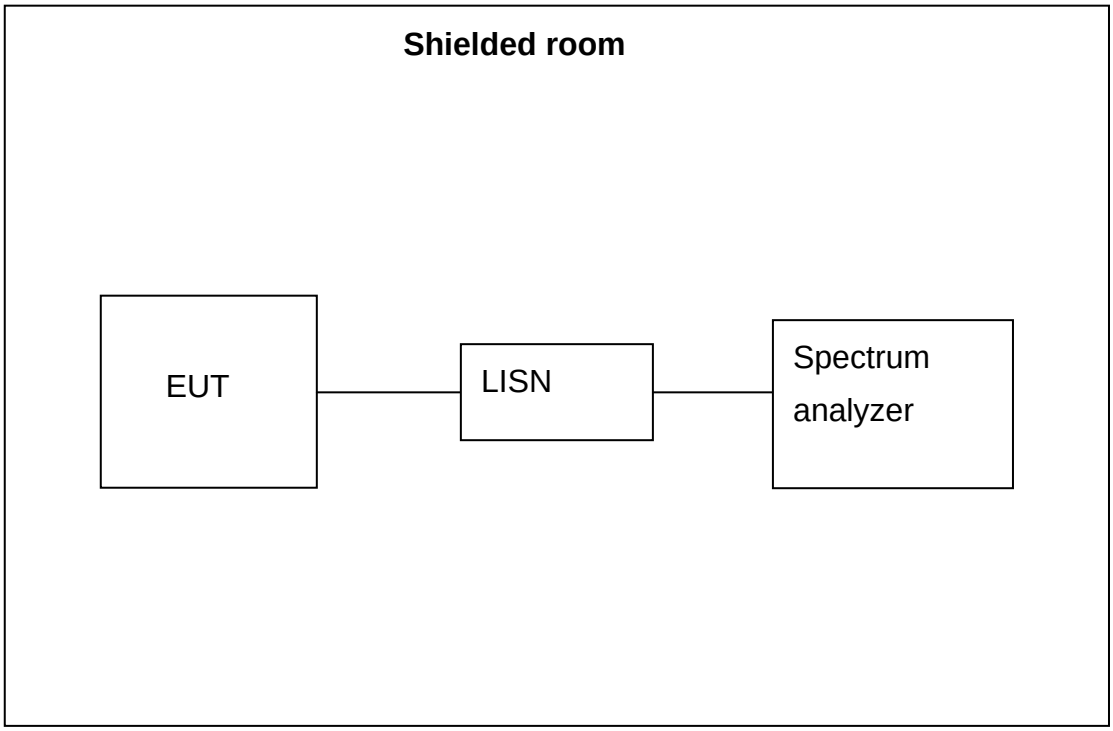
No.	Instrument/ancillary	Type of instrument/ancillary	Manufacturer	Ref. no.
1	FSEK	Spectrum Analyzer	Rohde & Schwarz	LR 1337
2	ESAI	Spectrum Analyzer	Rohde & Schwarz	LR 1090
3	3115	Antenna horn	EMCO	LR 1330
4	643	Antenna horn	Narda	LR 093
5	642	Antenna horn	Narda	LR 220
6	PM7320X	Antenna horn	Siverts lab	LR 103
7	DBF-520-20	Antenna horn	Systron Donner	LR 101
8	638	Antenna horn	Narda	LR 098
9	5VF1000/2000	BP filter	Trilithic	LR 1174
10	5VF2000/4000	BP filter	Texscan	LR 42
11	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076
12	8449B	Amplifier	Hewlett Packard	LR 1322
13	959C	Printer	Hewlett Packard	LR 1414
14	HFH2-Z2	Antenna loop	Rohde and Schwarz	LR 285
15	10855A	Amplifier	Hewlett Packard	LR 1445
16	HL223	Antenna log.per	Rohde & Schwarz	LR 1261
17	HK116	Antenna biconic	Rohde & Schwarz	LR 1260
18	ESVS 30	Test Receiver	Rohde & Schwarz	LR 1101

6 BLOCK DIAGRAM

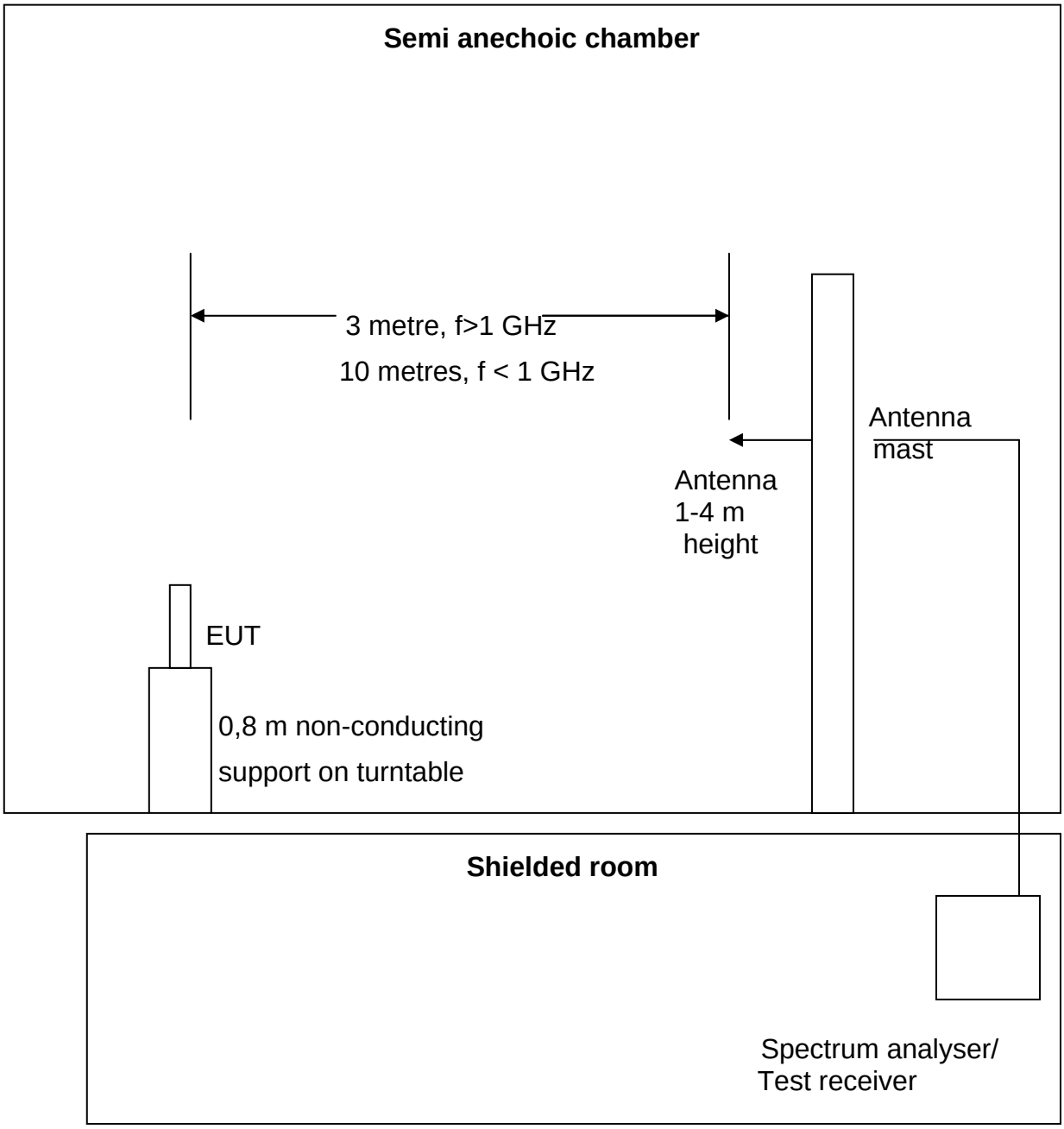
6.1 System set up



6.2 Powerline Conducted Emission



6.3 Test Site Radiated Emission



6.4 Peak Power Output