CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6-10 . D-66117 Saarbrücken Telephon: +49 (0)681 598-0 Telefax: -9075

Recognized by the
Federal Communications Commission
FCC–Identification Number: 90462
TCB ID: DE 0001

Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 081/94-D0

Independent ETSI
compliance test house

Accredited Bluetooth™ Test Facility (BQTF)

Test Report No.: 2_3449-01-02/03
FCC Part 15.247 / CANADA RSS-210
RH-12
FCC ID: QTKRH-12
IC: 661AD-RH12

CETECOM – ICT Services GmbH
Untertürkheimerstr. 6-10
66117 Saarbrücken, Germany

Telephone: + 49 (0) 681 / 598-0
Fax: + 49 (0) 681 / 589-9075

Table of Contents

1 General Information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test Laboratory Manager:

2003-11-24	RSC8411	Berg M.	
Date	Section	Name	Signature

Technical Responsibility for Area of Testing:

2003-11-24	RSC8412	Hausknecht D.	
Date	Section	Name	Signature

1.2 Testing Laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany
Telephone : + 49 681 598 - 0
Telefax : + 49 681 598 - 9075
E-mail : info@ict.cetecom.de
Internet : www.cetecom-ict.de

Accredited testing laboratory
The Test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025.
DAR-registration number : **TTI-P-G 081/94-D0**
Accredited Bluetooth™ Test Facility (BQTF)

1.3 Details of Applicant

Name : NOKIA Corporation / TCC Nokia
Street : P.O. Box 86 (Joensuunkatu 7 E)
City : FIN-24101 Salo
Country : Finland
Telephone : +358 50 3687 123
Telefax : +358 7180 45220
Contact : Mr. Jarkko Luoma
Telephone : +358 50 3687 123
E-mail : Jarkko.Luoma@nokia.com

1.4 Application Details

Date of receipt of application : 2003-11-08
Date of receipt of test item : 2003-11-12
Date of test : 2003-11-13/14/17/18

1.5 Test Item

Type of equipment	:	**Triple Band GSM Mobile Phone with Bluetooth™**
Type designation	:	RH-12
Manufacturer	:	Nokia Corporation
Street	:	Keilalahdentie 4
City	:	02150 Espoo
Country	:	Finland
Serial number	:	IMEI : 004400.24.163637.0 (radiated tests); IMEI : 004400.26.162049.4 (conducted tests)
FCC – ID	:	QTKRH-12
IC	:	661AD-RH12
Hardware	:	0402 (for IMEI: 004400.26.162049.4) 0420 (for IMEI: 004400.24.163637.0)
Software	:	1.92
Additional information	**:**	
Frequency	:	2402 – 2480 MHz
Type of modulation	:	1M00FXD / 79M8FXD (FHSS)
Number of channels	:	79
Antenna	:	print antenna
Power supply	:	3.7V Li-ion Battery
Output power	:	EIRP: 0.889 mW (worst case); conducted : 1.47 mW
Field strength	:	max. 93.1 dBµV/m in 3m
Occupied bandwidth	:	931.864 kHz
Transmitter spurious	:	40.3 µV/m in 3m ; conducted : -.-
Receiver spurious	.	24.3 µV/m in 3
Temperature range	:	-30°C - +70°C

DECLARATION OF COMPLIANCE: I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Signature: _____

Date: 2003-05-09 Michael Berg ; Test management
NAME AND TITLE (Please print or type):

1.6 Test Specifications:

FCC Part 15 §15.247 (March 13. 2003)
CANADA RSS-210 (Issue 5)

2 Technical Test

2.1 Summary of Test Results

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-1992 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-1992 clause 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

All measurements are done in accordance with the Filing and Measurement Guidelimes for Frequency Hopping Spread Spectrum Systems DA 00-705 and Appendix A "BLUETOOTH APPROVALS"

The product fullfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

Final verdict : PASS

2.2 Test Report

TEST REPORT

Test Report No. : 2_3449-01-02/03

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Antenna Gain

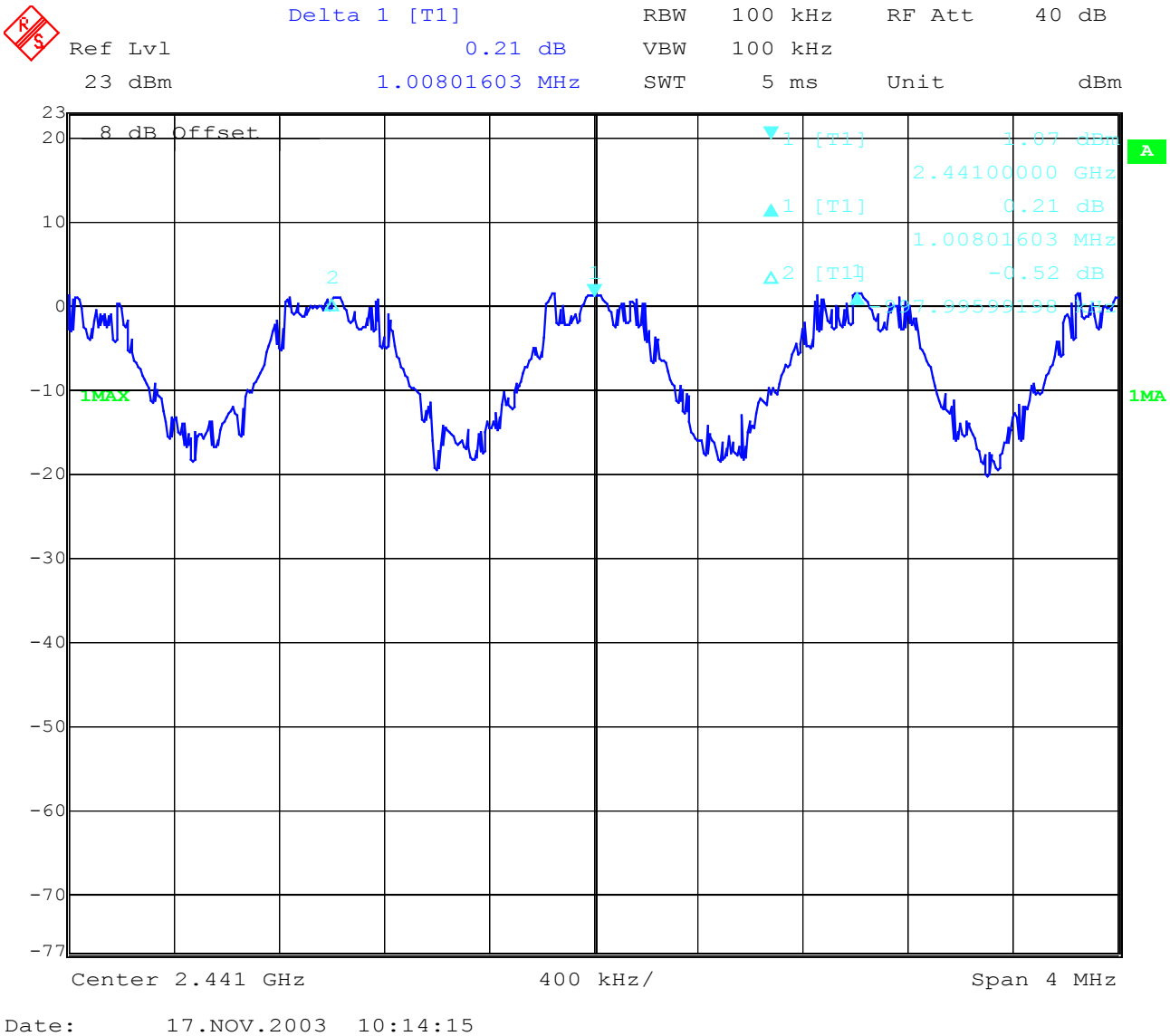
The antenna gain of the complete system is calculated by the difference of conducted power of the module and the radiated power in EIRP.

	low channel	mid channel	high channel
Conducted power	+0.50 dBm	+1.46 dBm	+1.67 dBm
Radiated power	-0.51dBm	-0.78 dBm	-1.11dBm
Gain	-1.01 dB	-2.24 dB	-2.78 dB

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Carrier frequency separation §15.247(a1)



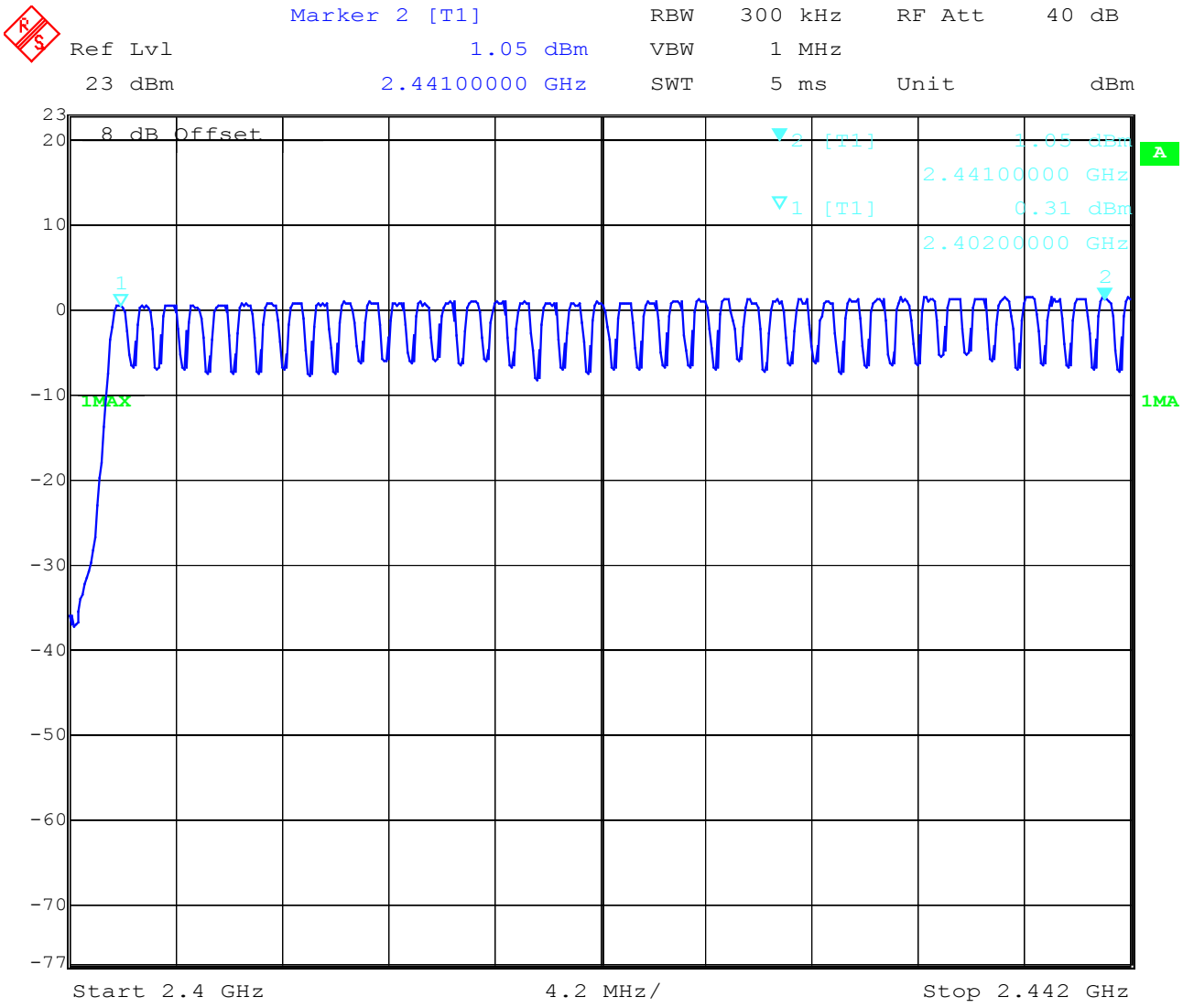
Channel separation is ~ 1 MHz

Limit: minimum 25 kHz or the 20 dB Bandwidth of the hopping system

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Number of hopping channels **§15.247(a1)**
Channel 1 - 40



Date: 17.NOV.2003 10:16:42

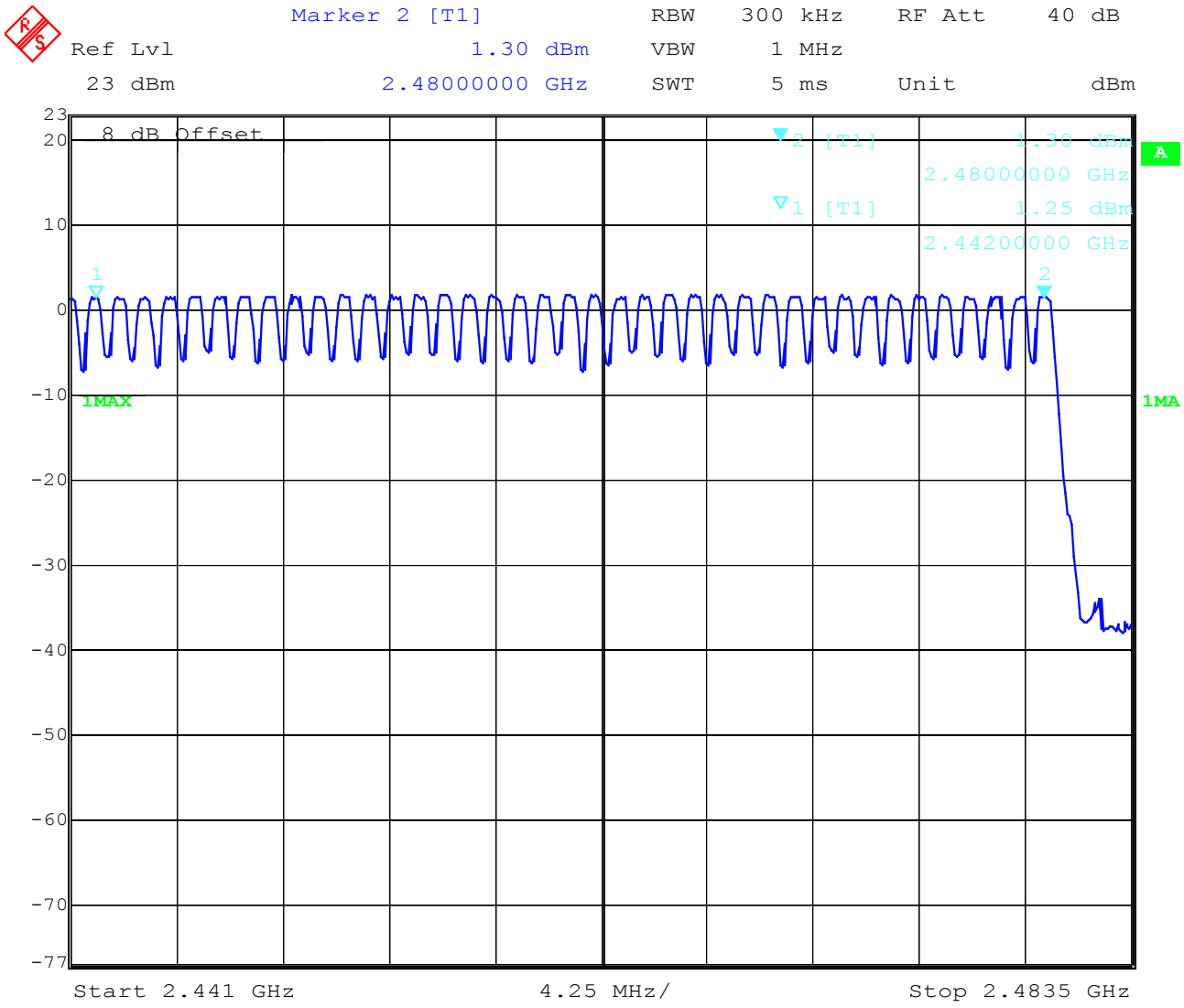
The number of hopping channels is 79.

Limit: at least 15 non-overlapping channels

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Number of hopping channels
Channel 41 - 79 **§15.247(a1)**



The number of hopping channels is 79.

Limit: at least 15 non-overlapping channels

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

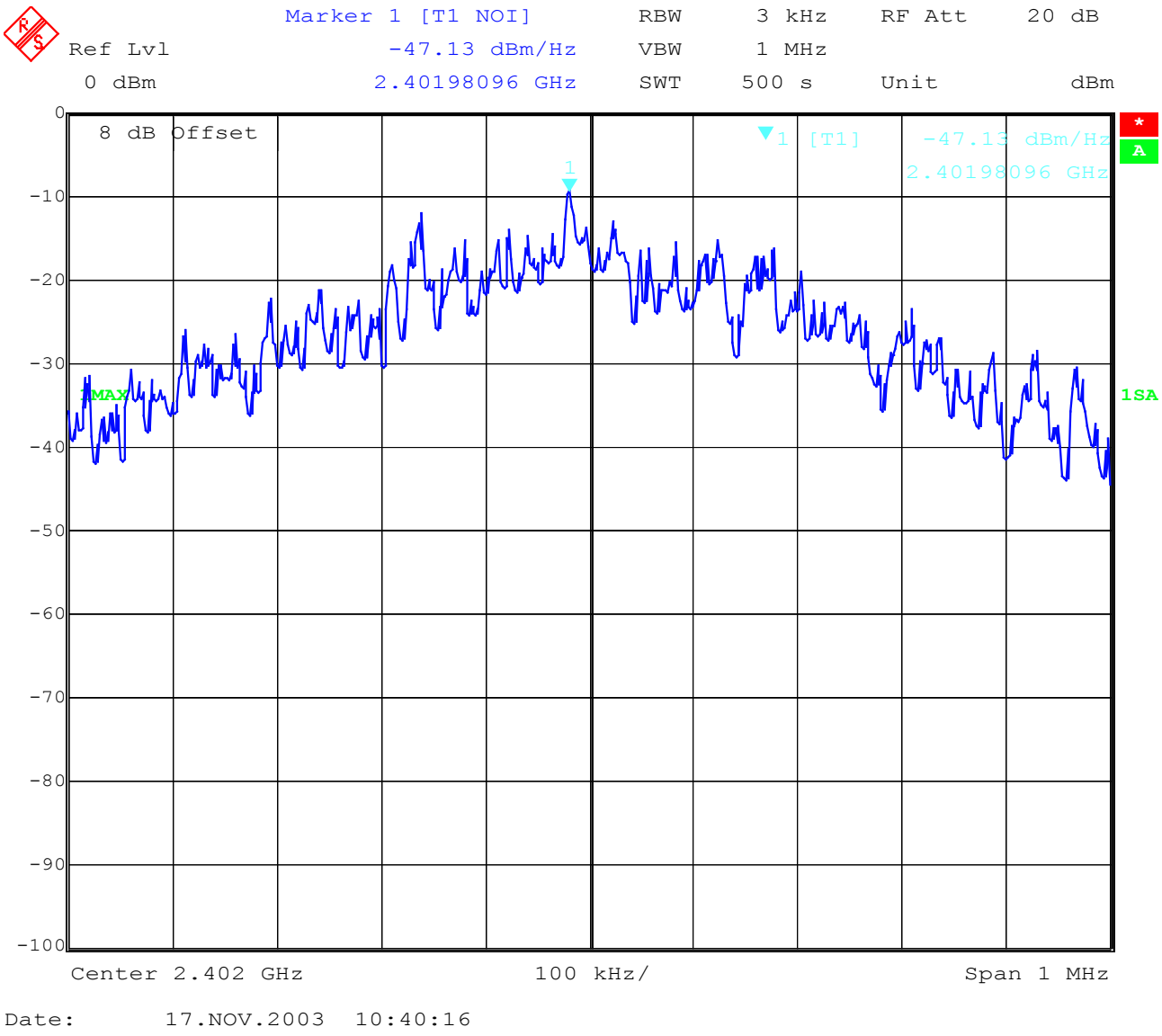
Time of occupancy (dwell time) §15.247(a1 iii)

For Bluetooth devives:

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:
Dwell time = time slot length * hop rate / number of hopping channels *30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)
For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)
This is according the Bluetooth Core Specification V 1.1 (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.
This was checked during the Bluetooth Qualification tests.
The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Power Spectral density (Hybrid system in Inquiry mode / Page scan) §15.247(d)
Low channel



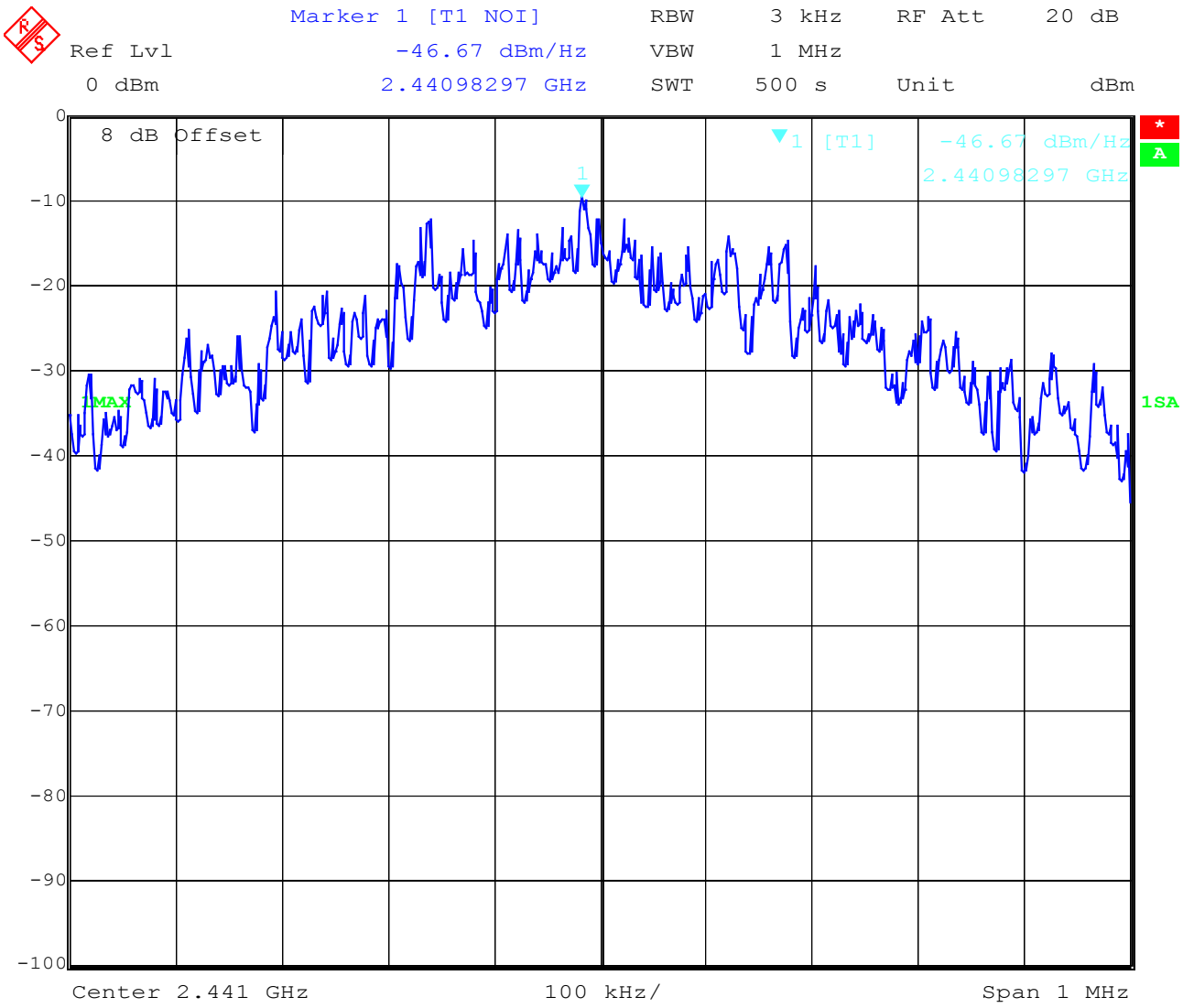
Power density : -47.13 dBm/Hz = -12.33 dBm / 3 KHz

Correction factor from dBm/Hz to dBm/3KHz is +34.8 dB

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Power Spectral density (Hybrid system in Inquiry mode / Page scan) §15.247(d)
Middle channel



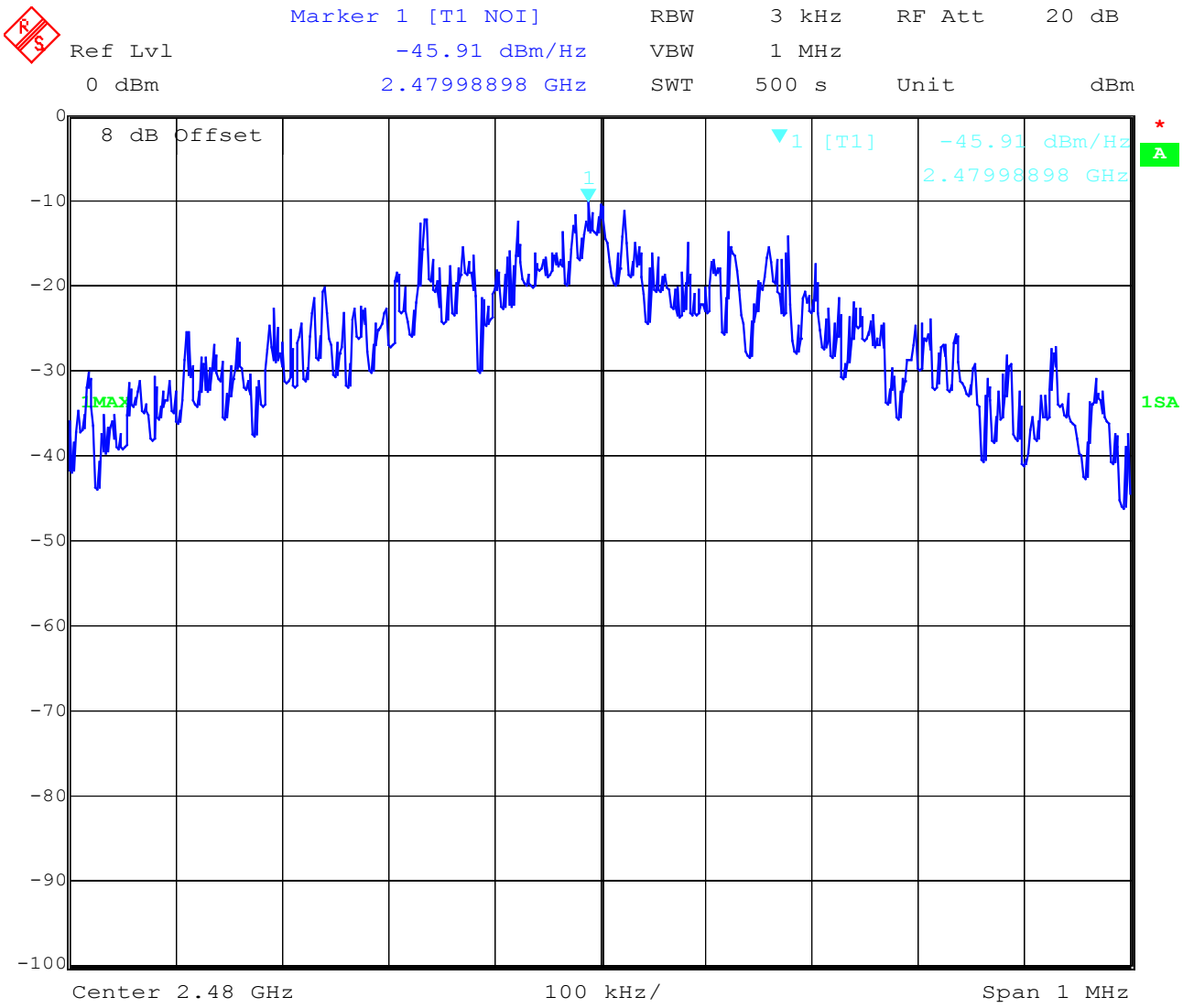
Power density : -46.67 dBm/Hz = -11.87 dBm / 3 KHz

Correction factor from dBm/Hz to dBm/3KHz is +34.8 dB

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Power Spectral density (Hybrid system in Inquiry mode / Page scan) §15.247(d)
High channel



Power density : -45.91 dBm/Hz = -11.11 dBm / 3 KHz

Correction factor from dBm/Hz to dBm/3KHz is +34.8 dB

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Spectrum Bandwidth of a FHSS System §15.247(a1)
20 dB bandwidth

TEST CONDITIONS		20 dB BANDWIDTH (kHz)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}(3.7)V	925.825	889.780	931.864
Measurement uncertainty		±1kHz		

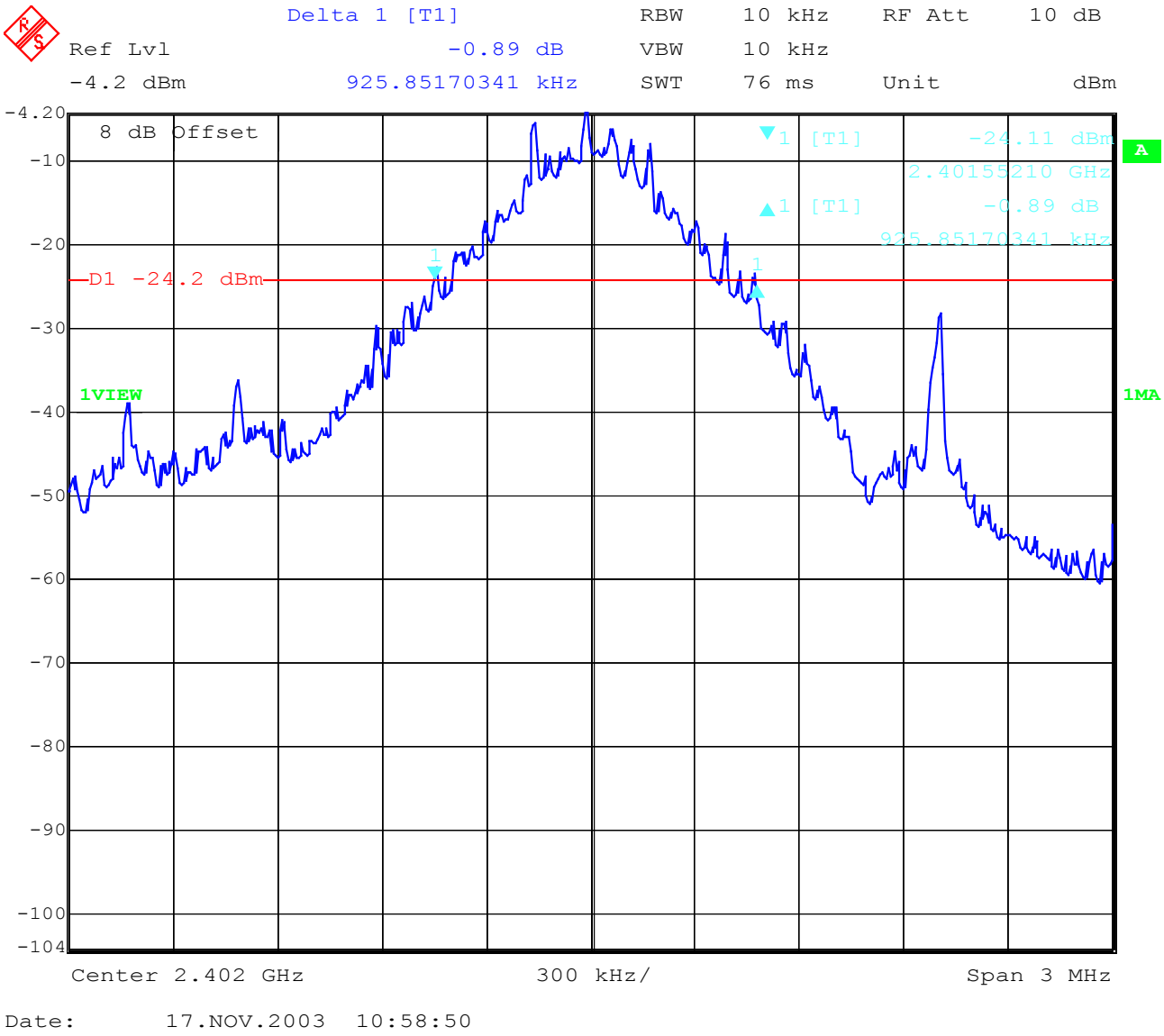
RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)
RBW: 10 kHz / VBW 10 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Spectrum Bandwith of a FHSS System **§15.247(a1)**
20 dB bandwidth

Low Channel

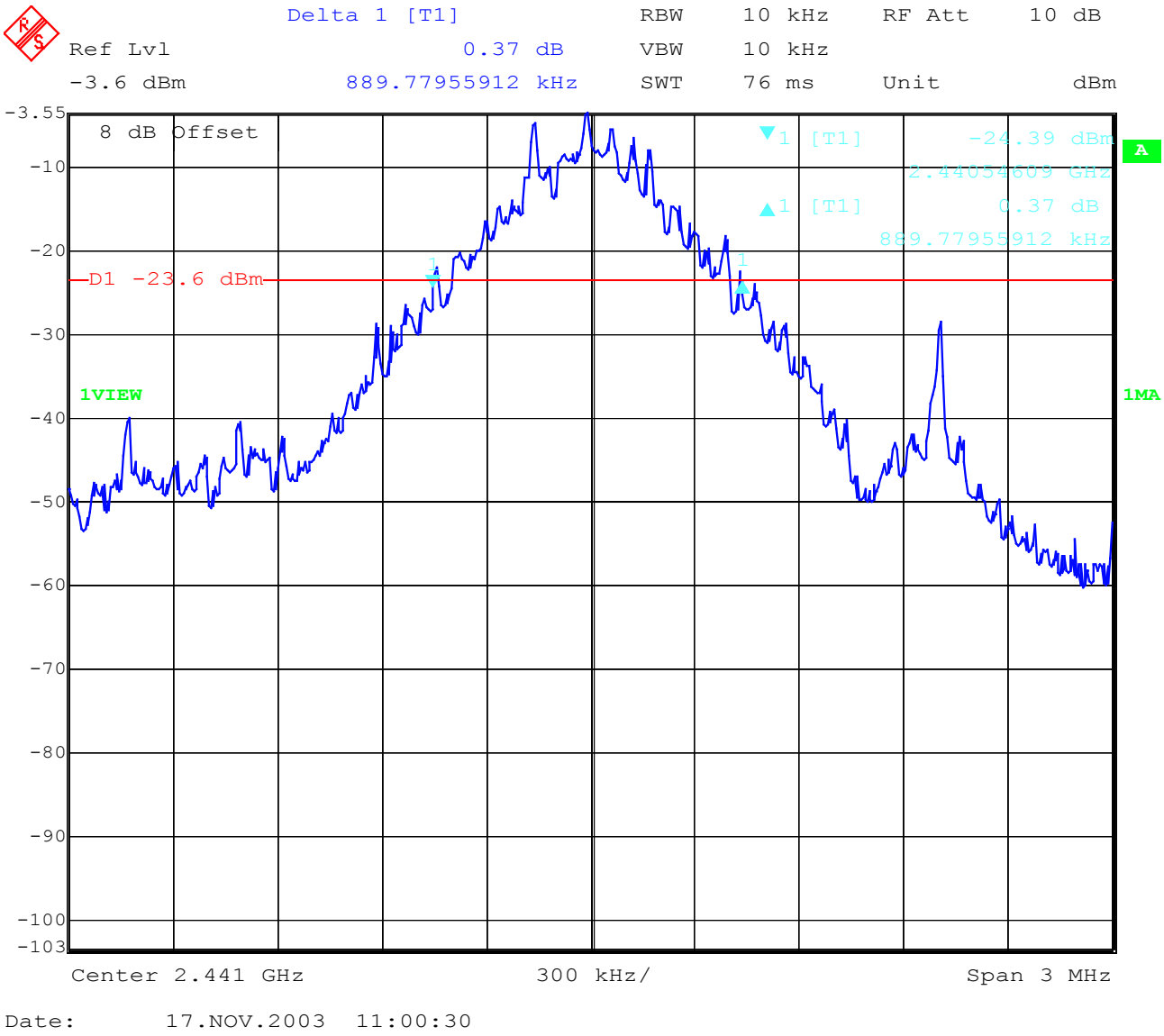


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Spectrum Bandwith of a FHSS System **§15.247(a1)**
20 dB bandwidth

Mid Channel

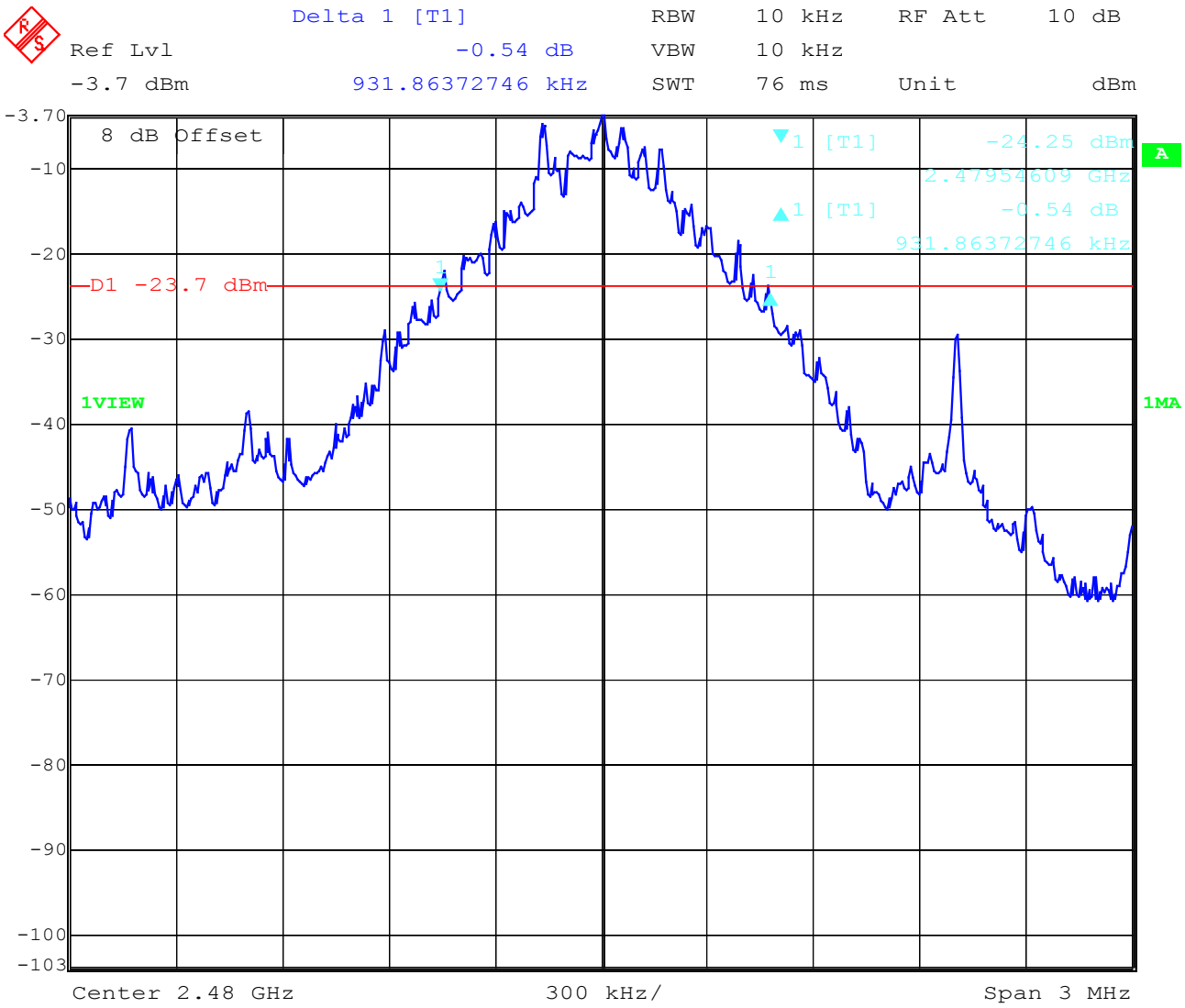


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Spectrum Bandwith of a FHSS System **§15.247(a1)**
20 dB bandwidth

High Channel



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

MAXIMUM PEAK OUTPUT POWER SUBCLAUSE § 15.247 (b) (1)
(conducted)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (mW)			
Frequency (MHz)			2402	2441	2480
T_{nom}(22.7)°C	V_{nom}(3.7)V	PK	1.122	1.409	1.469
De facto EIRP (Peak)			0.889 mW	0.836 mW	0.774 mW
(Antenna gain)			(-1.01 dB)	(-2.24 dB)	(-2.78 dB)
Measurement uncertainty			±3dB		

RBW / VBW : 3 MHz

LIMIT SUBCLAUSE § 15.247 (b) (1)

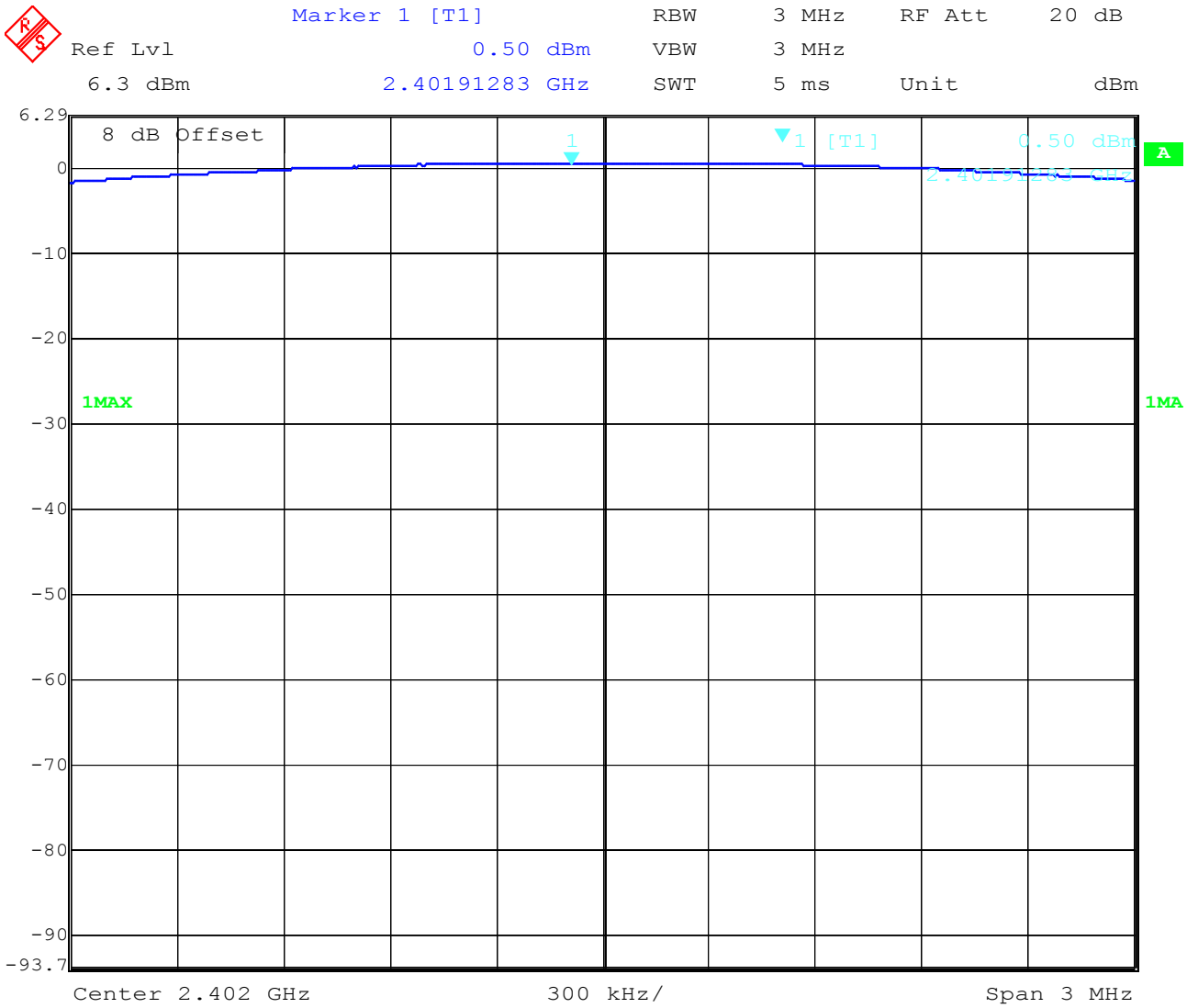
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

MAXIMUM PEAK OUTPUT POWER (conducted) SUBCLAUSE § 15.247 (b) (1)

Low Channel



LIMIT SUBCLAUSE § 15.247 (b) (1)

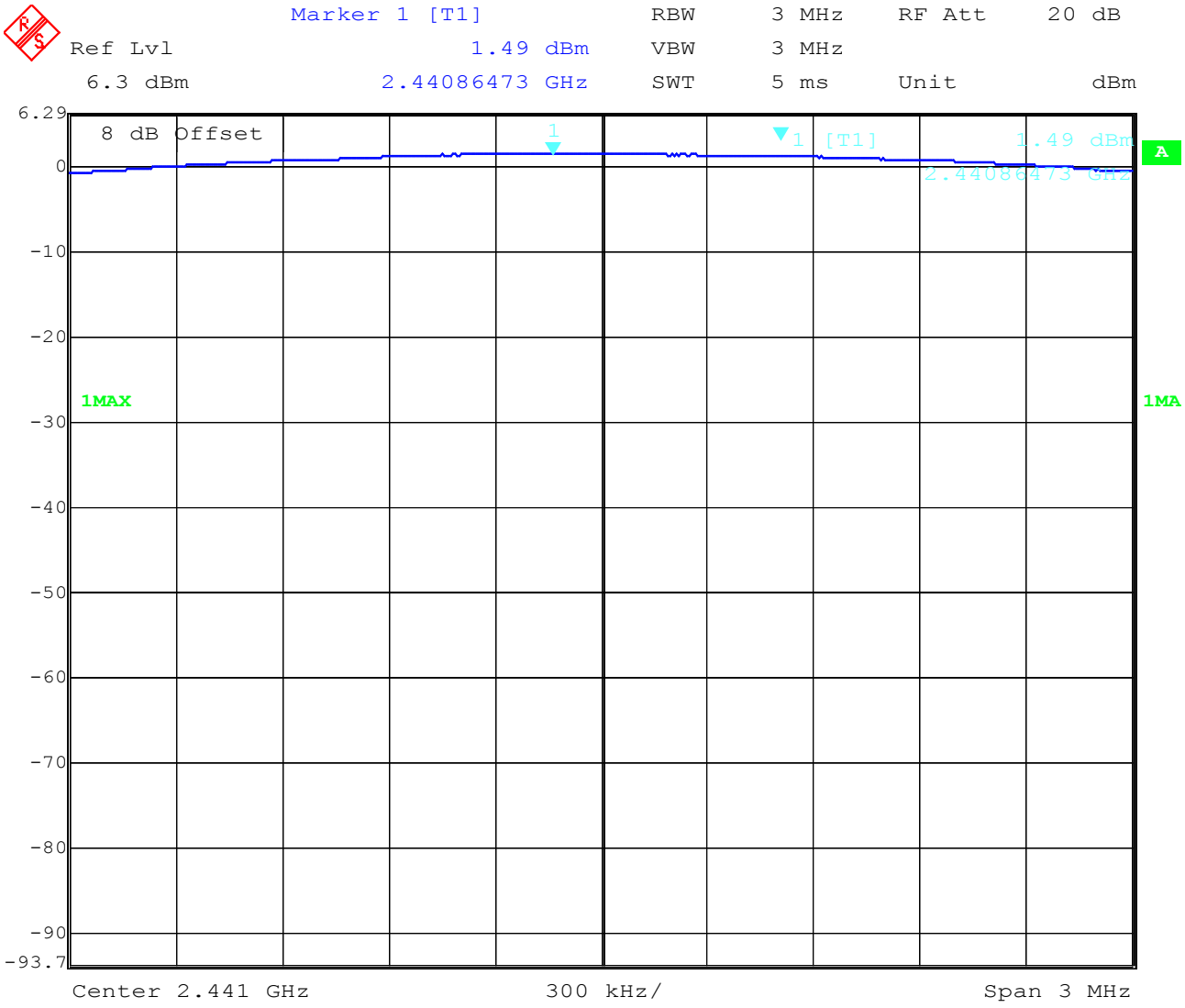
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

MAXIMUM PEAK OUTPUT POWER (conducted) SUBCLAUSE § 15.247 (b) (1)

Mid Channel



LIMIT SUBCLAUSE § 15.247 (b) (1)

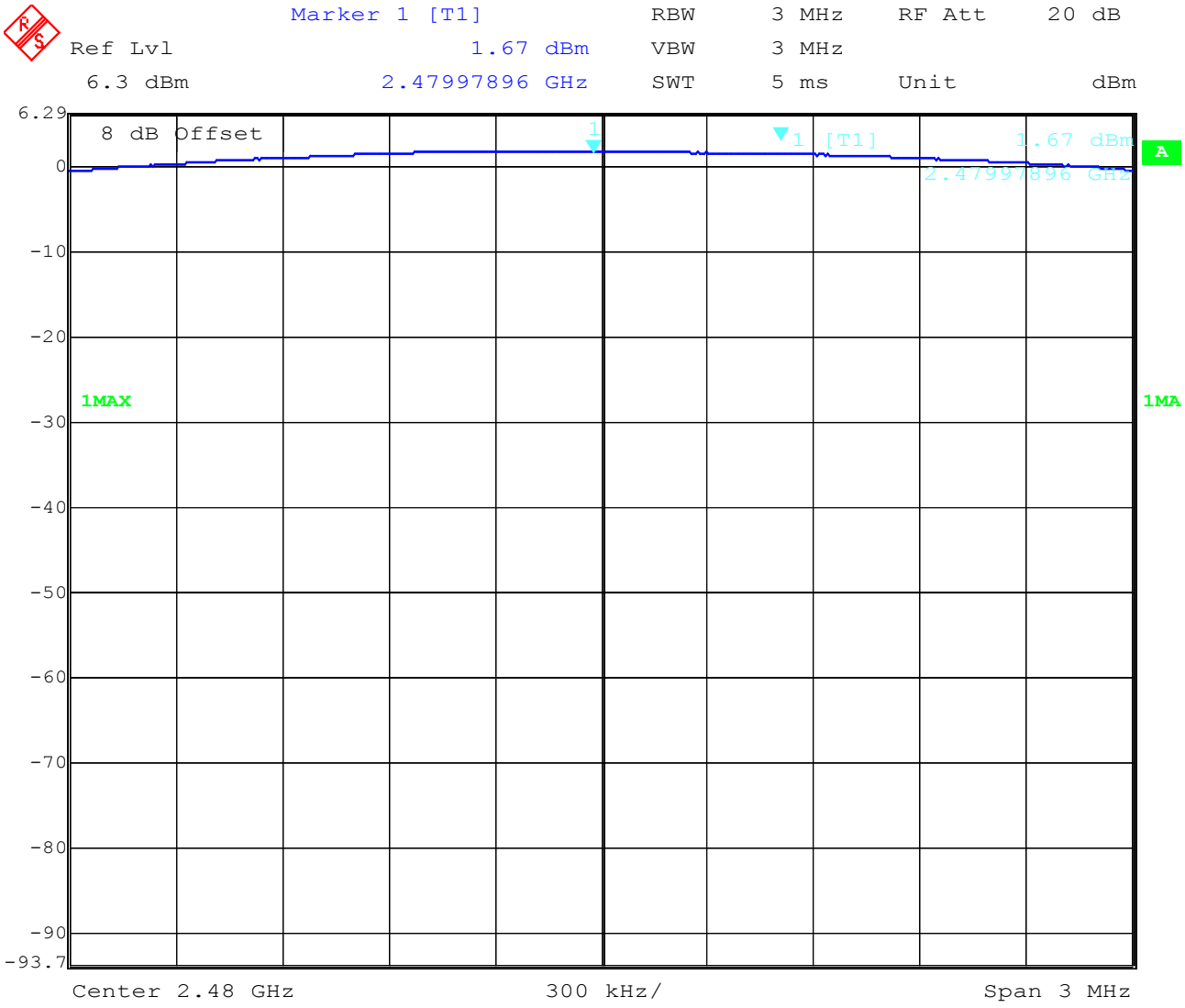
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

MAXIMUM PEAK OUTPUT POWER (conducted) SUBCLAUSE § 15.247 (b) (1)

High Channel



LIMIT SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

MAXIMUM PEAK OUTPUT POWER SUBCLAUSE § 15.247 (b) (1)
(RADIATED)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER EIRP (mW)		
Frequency (MHz)		2402	2441	2480
T_{nom}(22.7)°C	V_{nom}(3.7)V	0.889 mW	0.836 mW	0.774 mW
Measurement uncertainty		±3dB		

RBW/VBW : 3 MHz

Measured at a distance of 3m

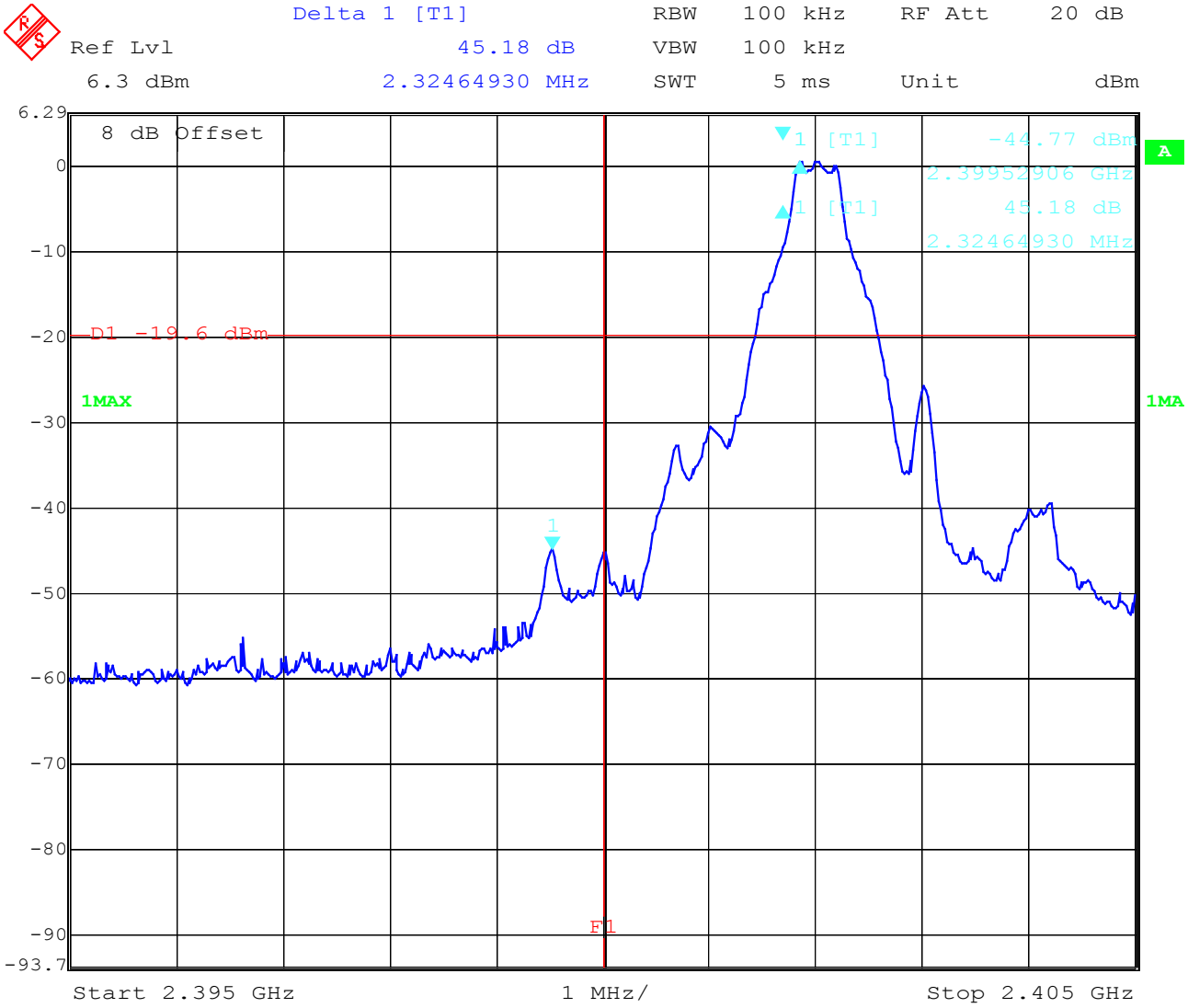
LIMIT SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance of conducted emissions **§15.247 (c)**



Low frequency section (hopping off)

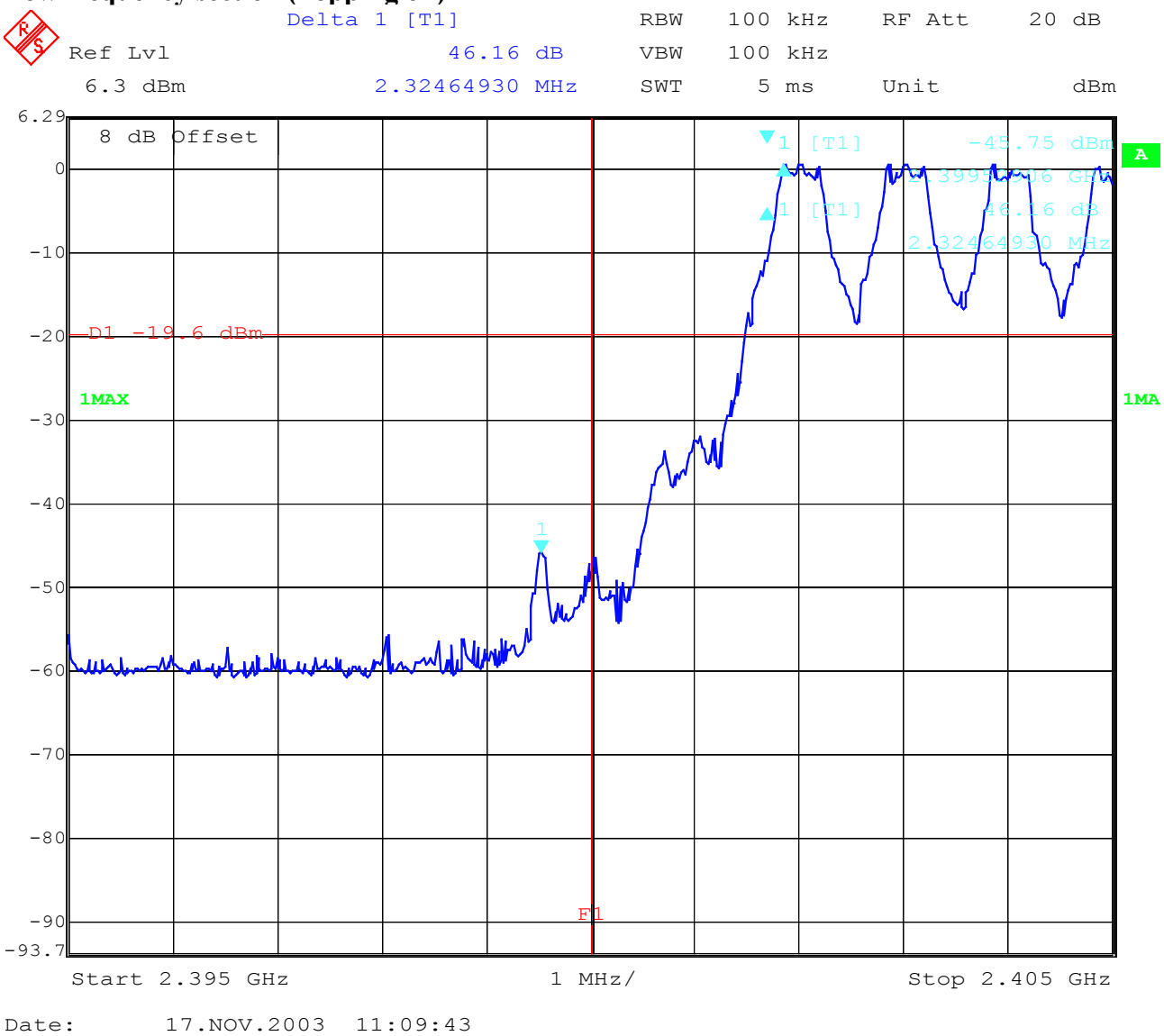
Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance of conducted emissions §15.247 (c)

Low frequency section (hopping on)



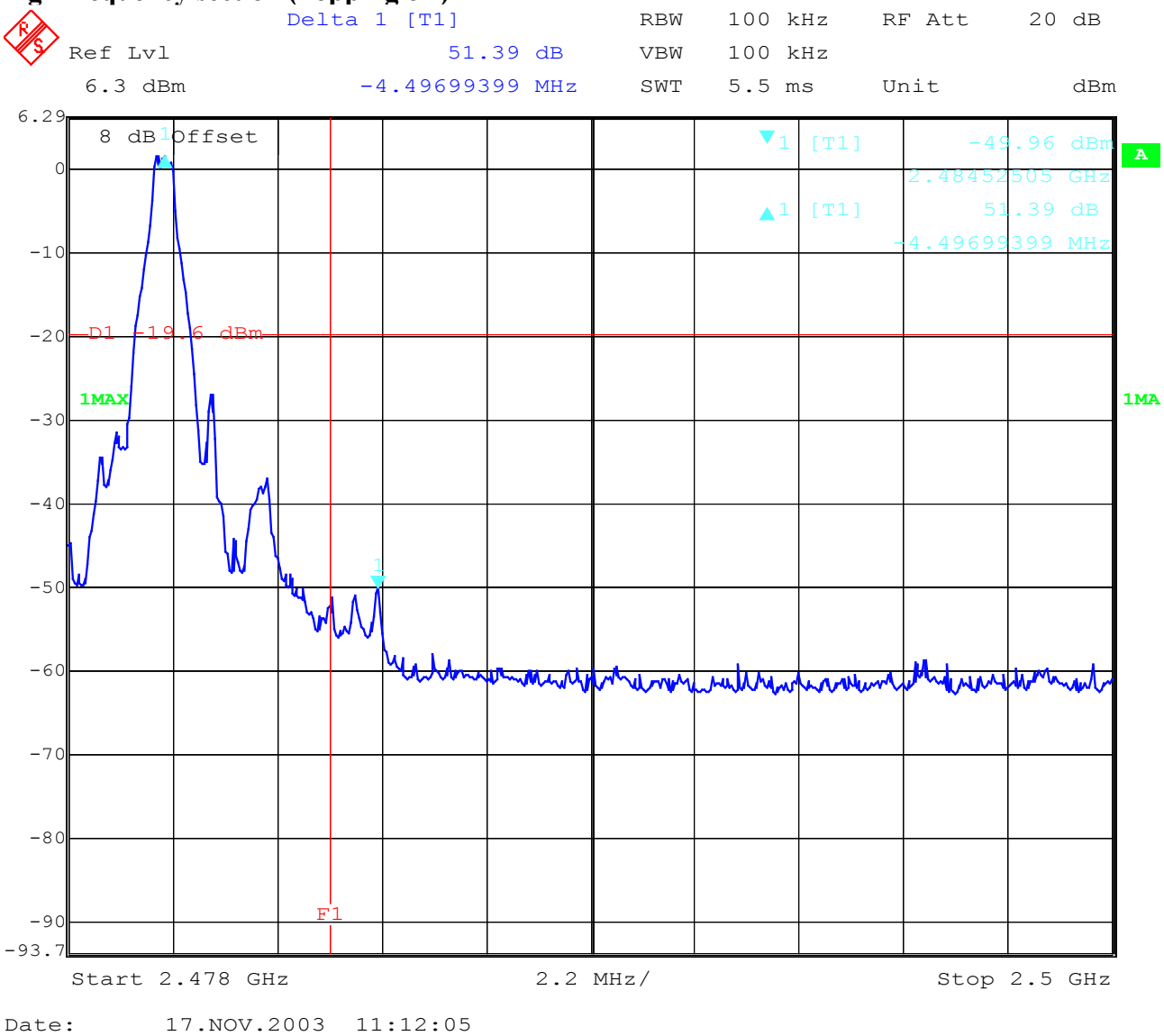
Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance of conducted emissions §15.247 (c)

high frequency section (hopping off)



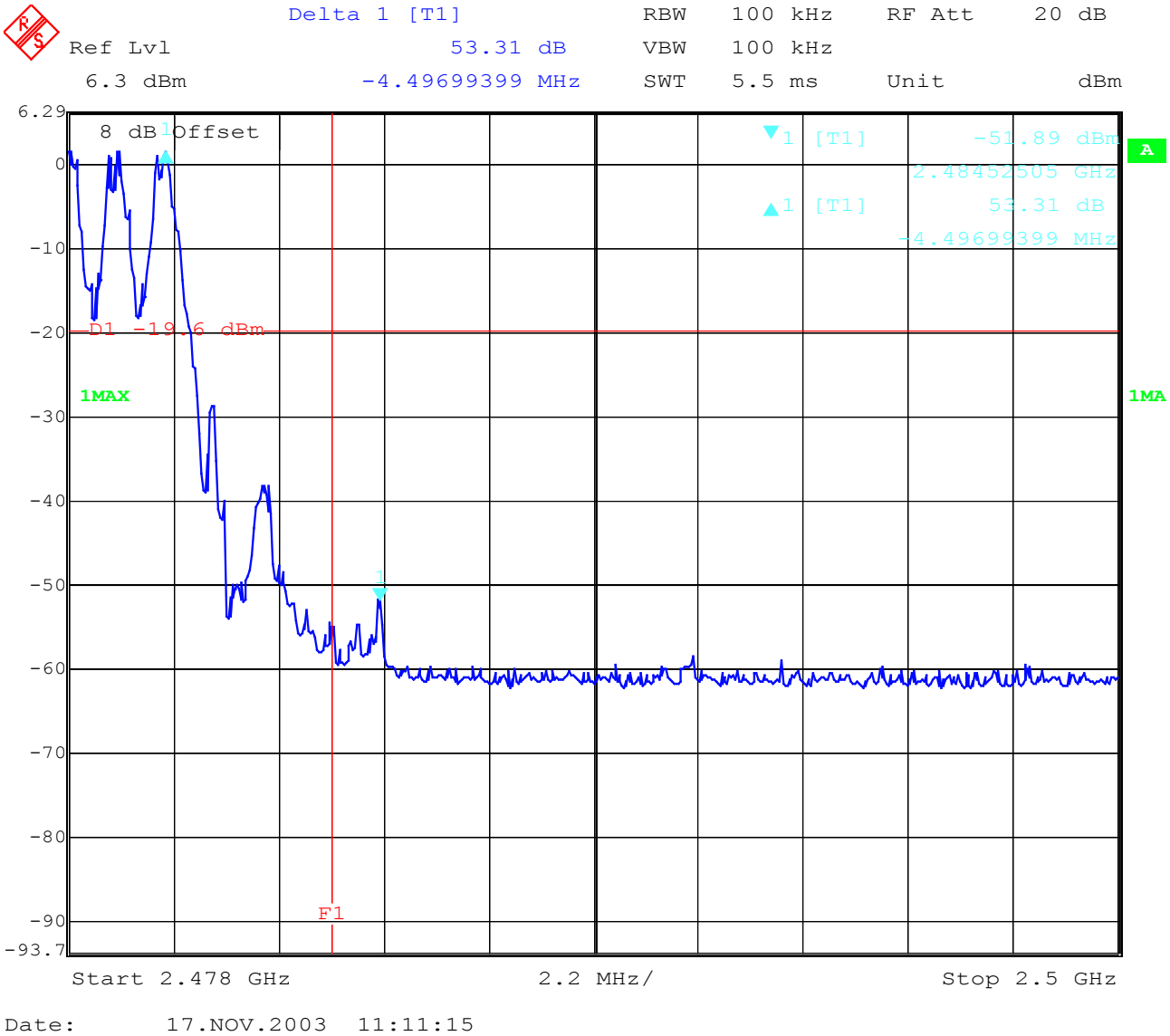
Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance of conducted emissions §15.247 (c)

high frequency section (hopping on)

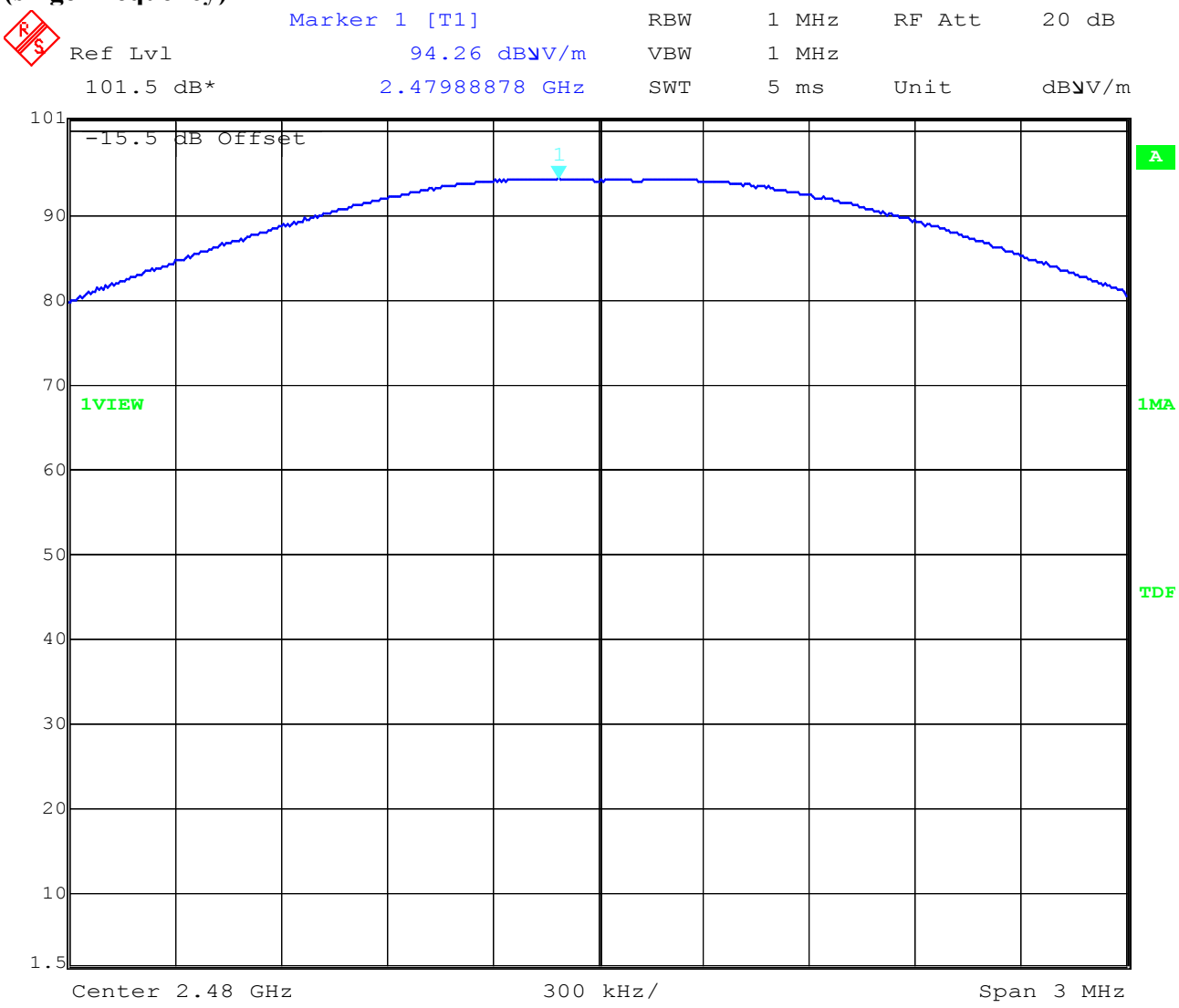


Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance radiated
Max field strength in 3m distance
(singel frequency)

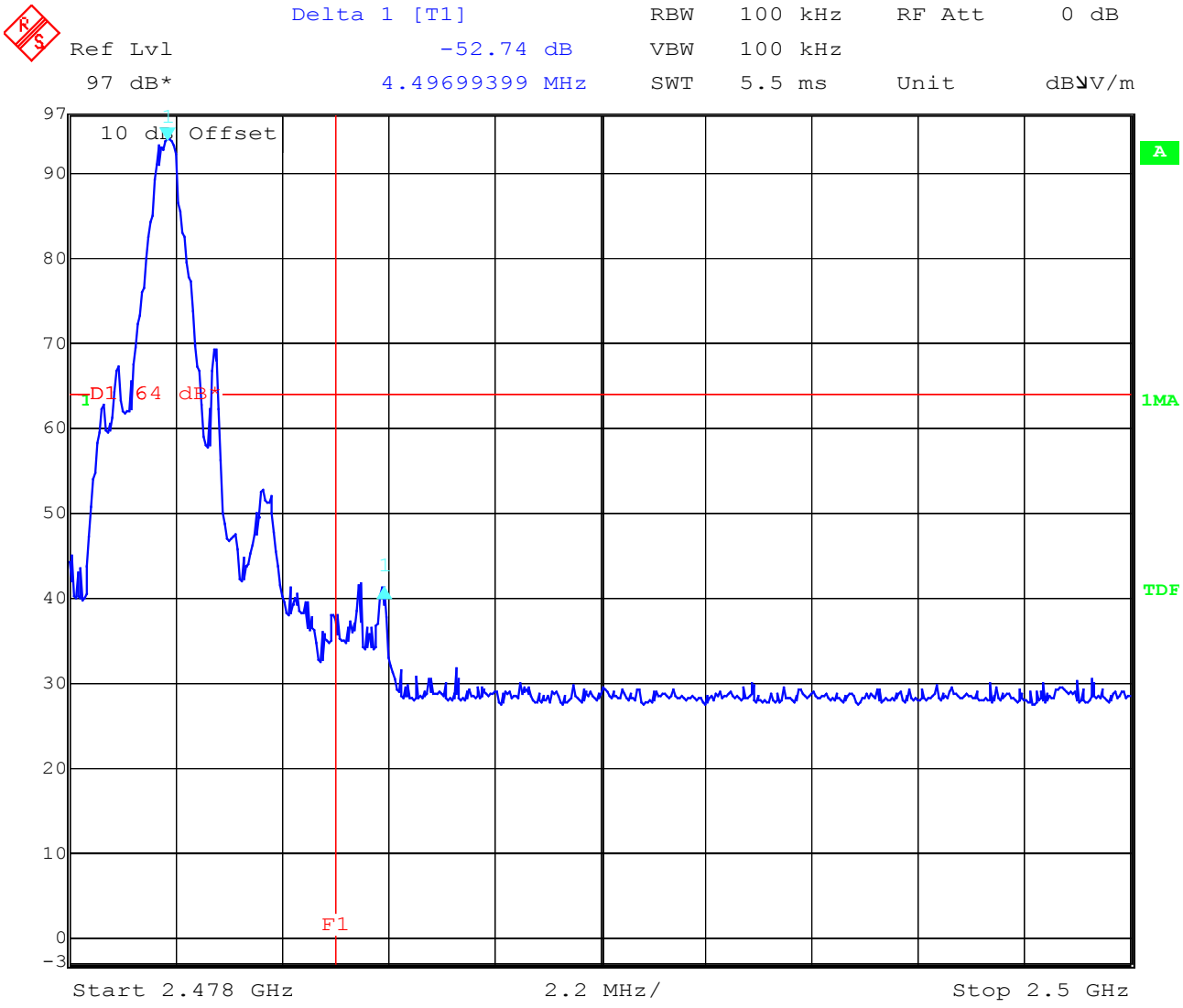


Frequency	Meter reading	Cable loss	Antenna factor	Results
2480 MHz	99.26	1.3	-6.3	94.26 dBµV/m
		correcting factor in plot implemented		

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance radiated
Marker-Delta Method (single carrier)



Date: 17.NOV.2003 08:49:44

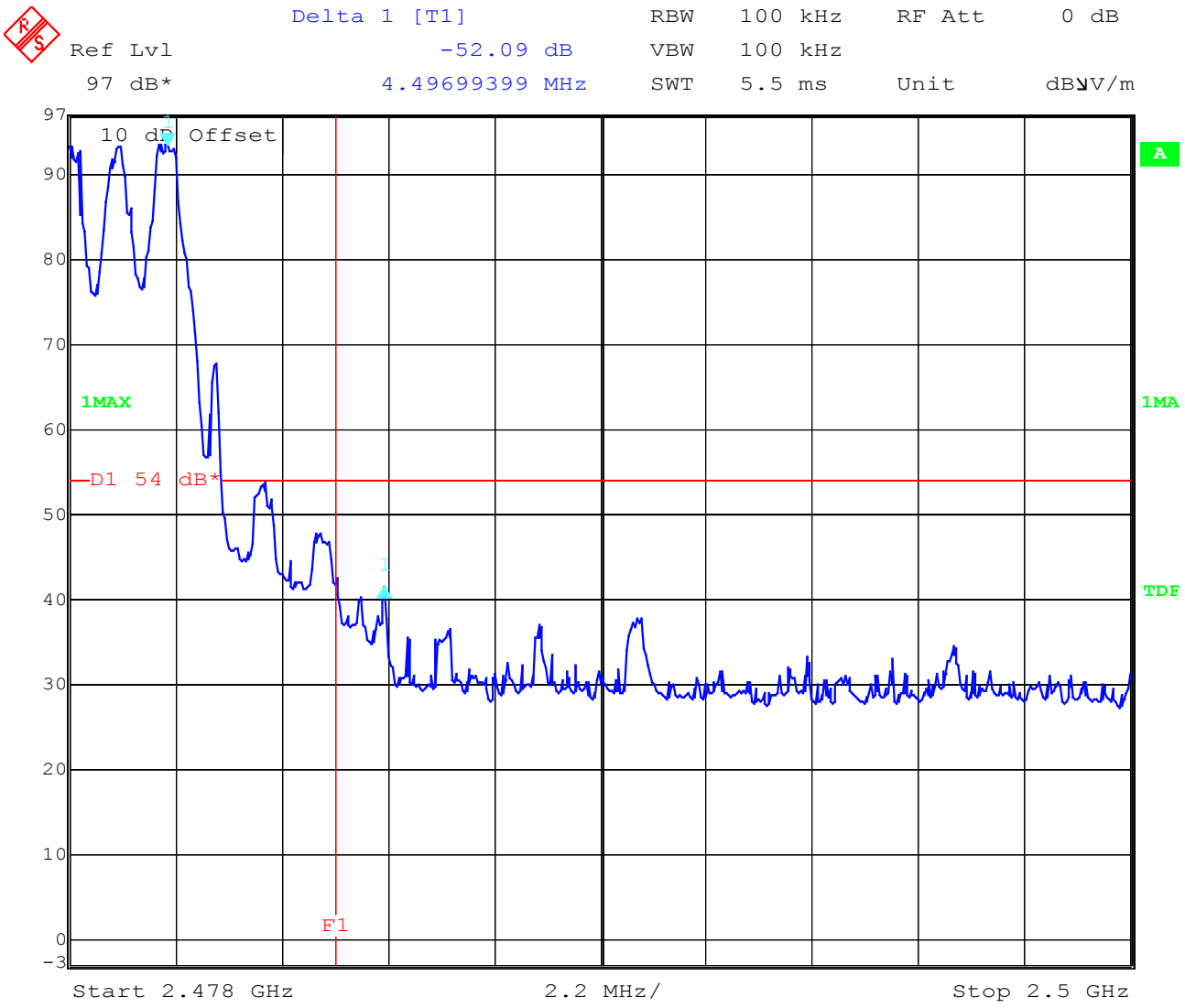
Marker-Delta-Value : 52.74 dB
This measurement was made to show that the behavior of the system is conform to

FCC 15.205 (restricted bands)

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance radiated
Marker-Delta Method (hopping mode)



Date: 17.NOV.2003 08:57:39

Marker-Delta-Value : 52.09 dB

This measurement was made to show that the behavior of the system is conform to FCC 15.205 (restricted bands)

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance of radiated emissions §15.205

Radiated field strength

The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

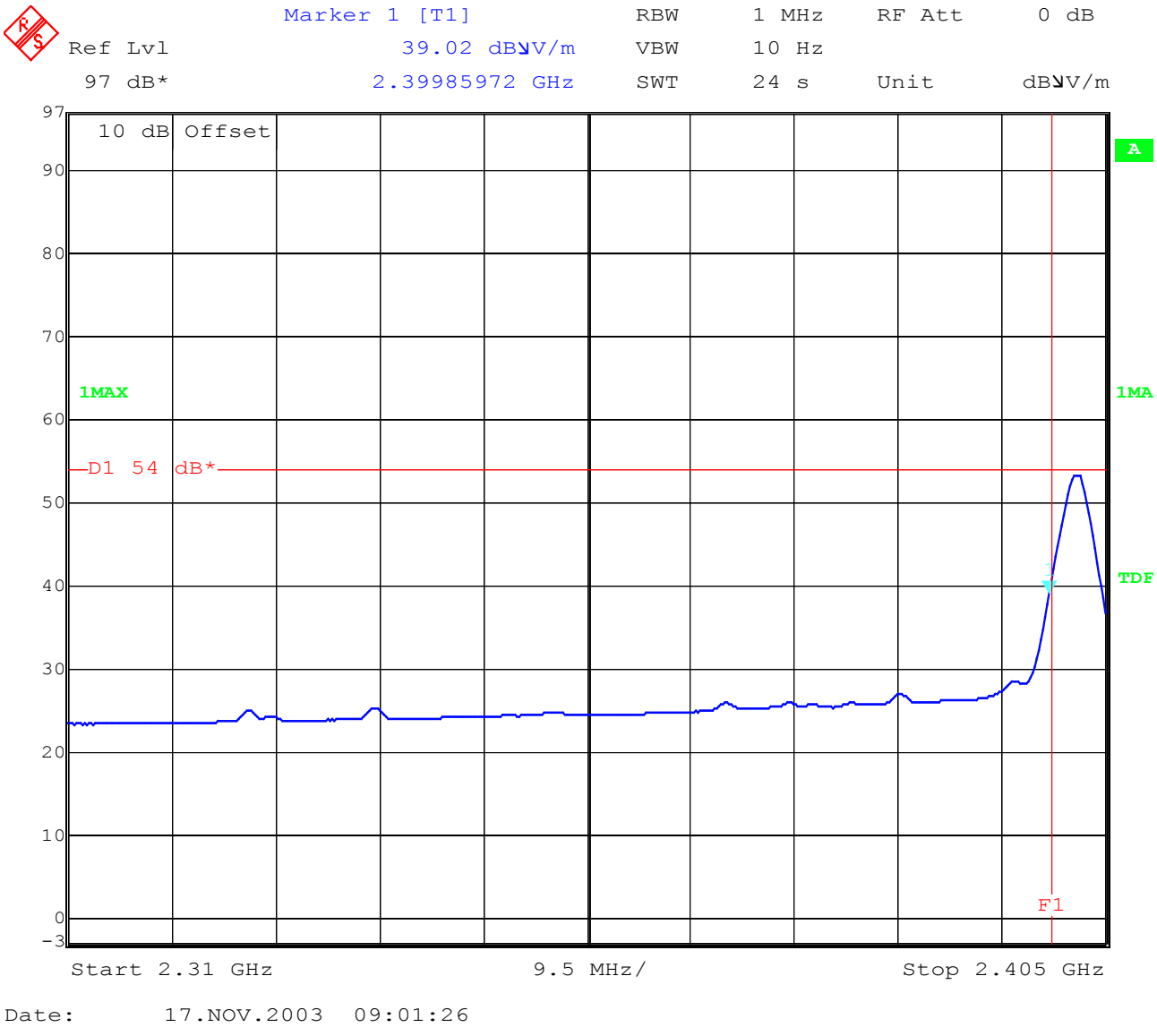
high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	99.26 dBµV/m Peak	-5.0	94.26 dBµV/m
Max. average value	Calculated with duty cycle correction factor	94.26 dBµV/m peak	-3.32 dB duty cycle correction factor (DH5)	90.94 dBµV/m
Delta value	Peak min. 30 kHz RBW/VBW	52.74 dB (single carrier) 52.09 dB (hopping mode)	-	-
Value at band edge	limit 54 dBµV/m			38.2 dBµV/m (single carrier) 38.85 dBµV/m (hopping mode)
Statement:				Complies

The product complies with the limit of the restricted bands.

Delta marker plots see above pages

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance radiated (average)
Restricted band 2310 – 2390 MHz

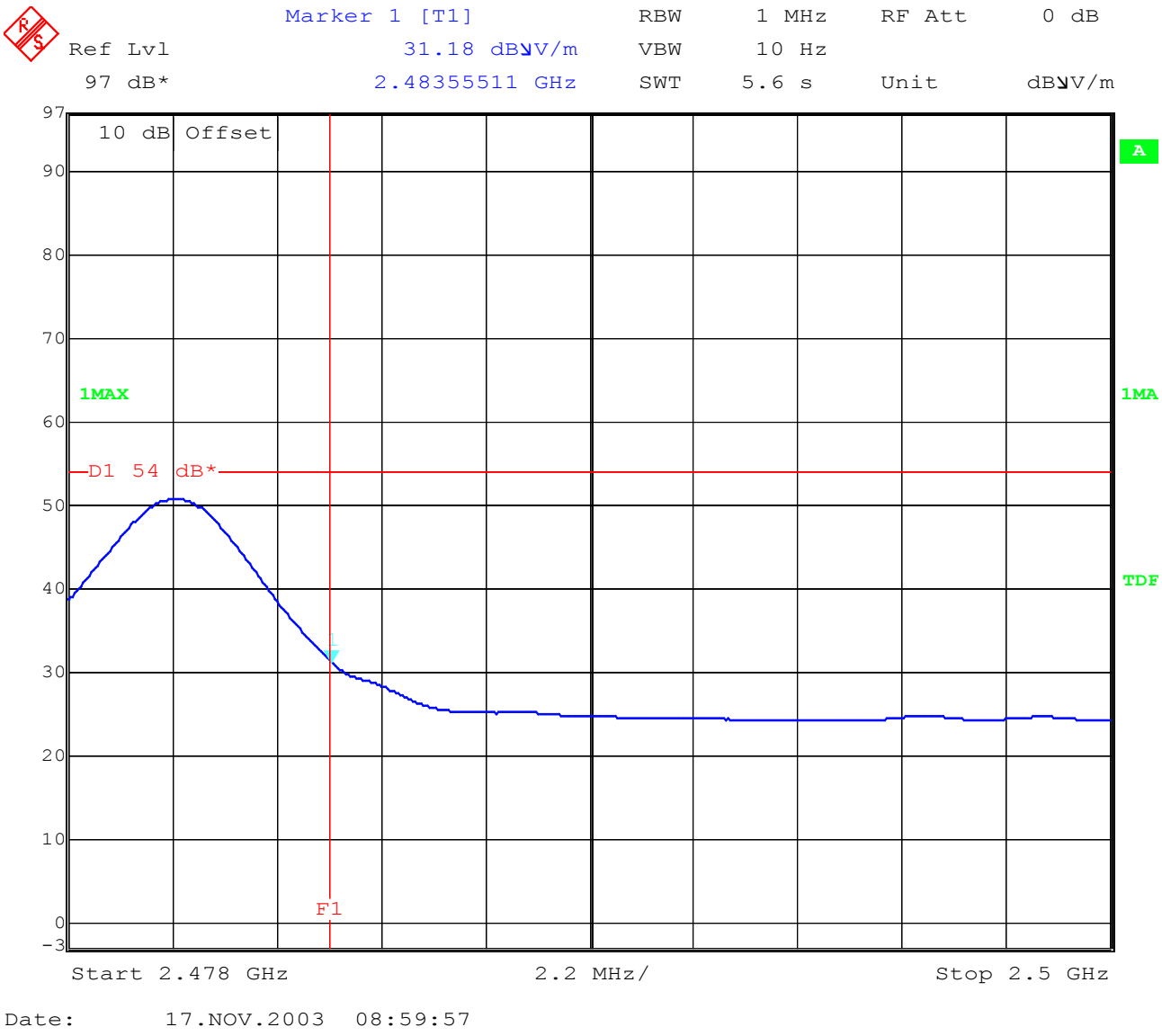


Date: 17.NOV.2003 09:01:26

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

Band-edge compliance radiated (average)
Restricted band 2483.5 - 2500 MHz



Date: 17.NOV.2003 08:59:57

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS- Conducted (Transmitter) § 15.247 (c) (1)

EMISSION LIMITATIONS					
f (MHz)		amplitude of emission (dBm)	limit max. allowed emmision power	actual attenuation below frequency of operation (dB)	results
2402		+0.50	30 dBm	-	Operating frequency
no peak found			-20 dBc (-19.50 dBm)		complies
2441		+1.49	30 dBm	-	Operating frequency
no peak found			-20 dBc (-18.51 dBm)		complies
2480		+1.67	30 dBm		Operating frequency
			-20 dBc (-18.33 dBm)		
9168.3		-54.93		56.6	complies
Measurement uncertainty	± 3dB				

RBW : 100 kHz VBW: 100 MHz
For emissions that fall into restricted bands you find the radiated emissions later in the report.

LIMITS SUBCLAUSE § 15.247 (c)

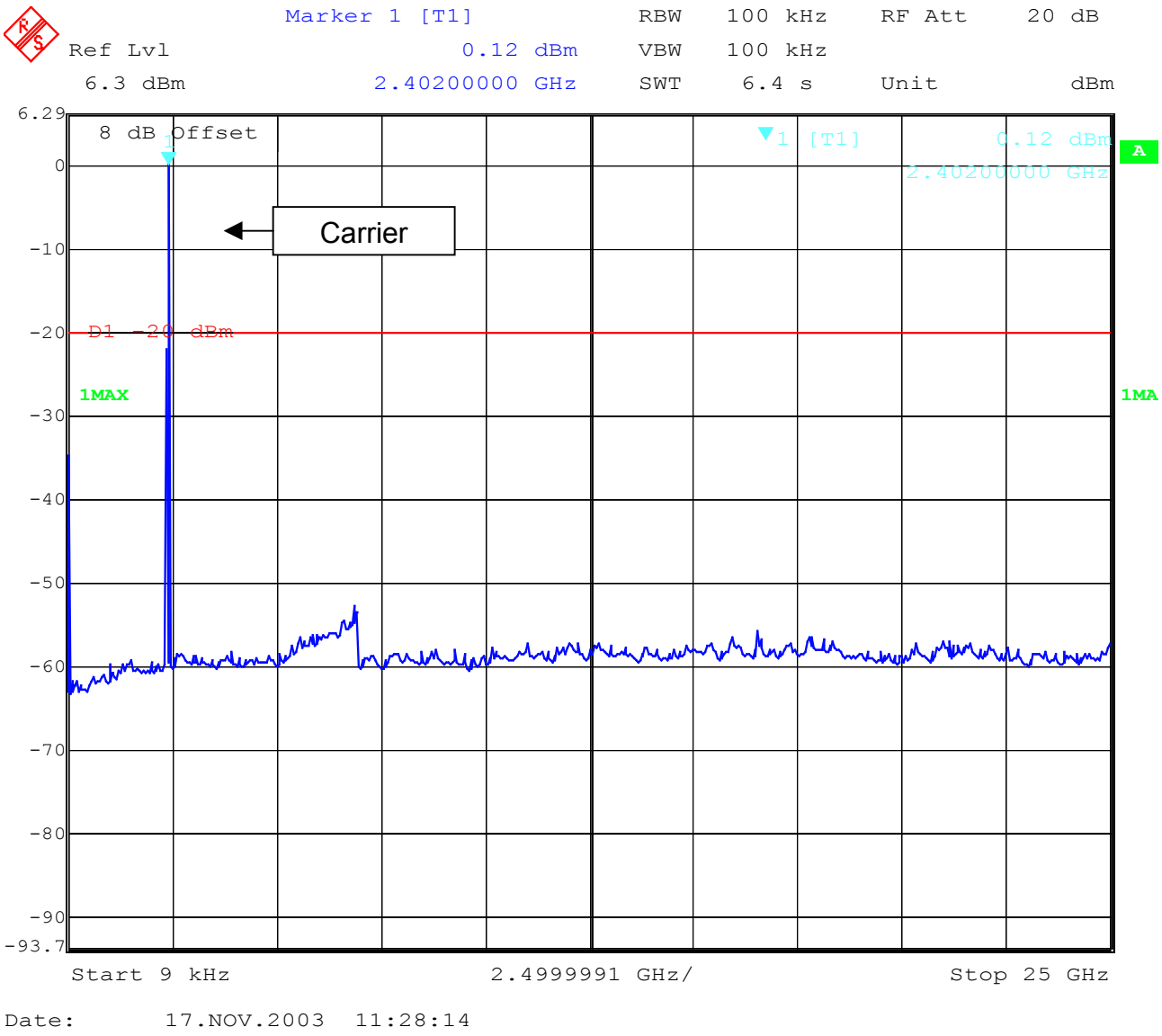
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS- Conducted (Transmitter) § 15.247 (c) (1)

Low Channel : 9 kHz - 25 GHz

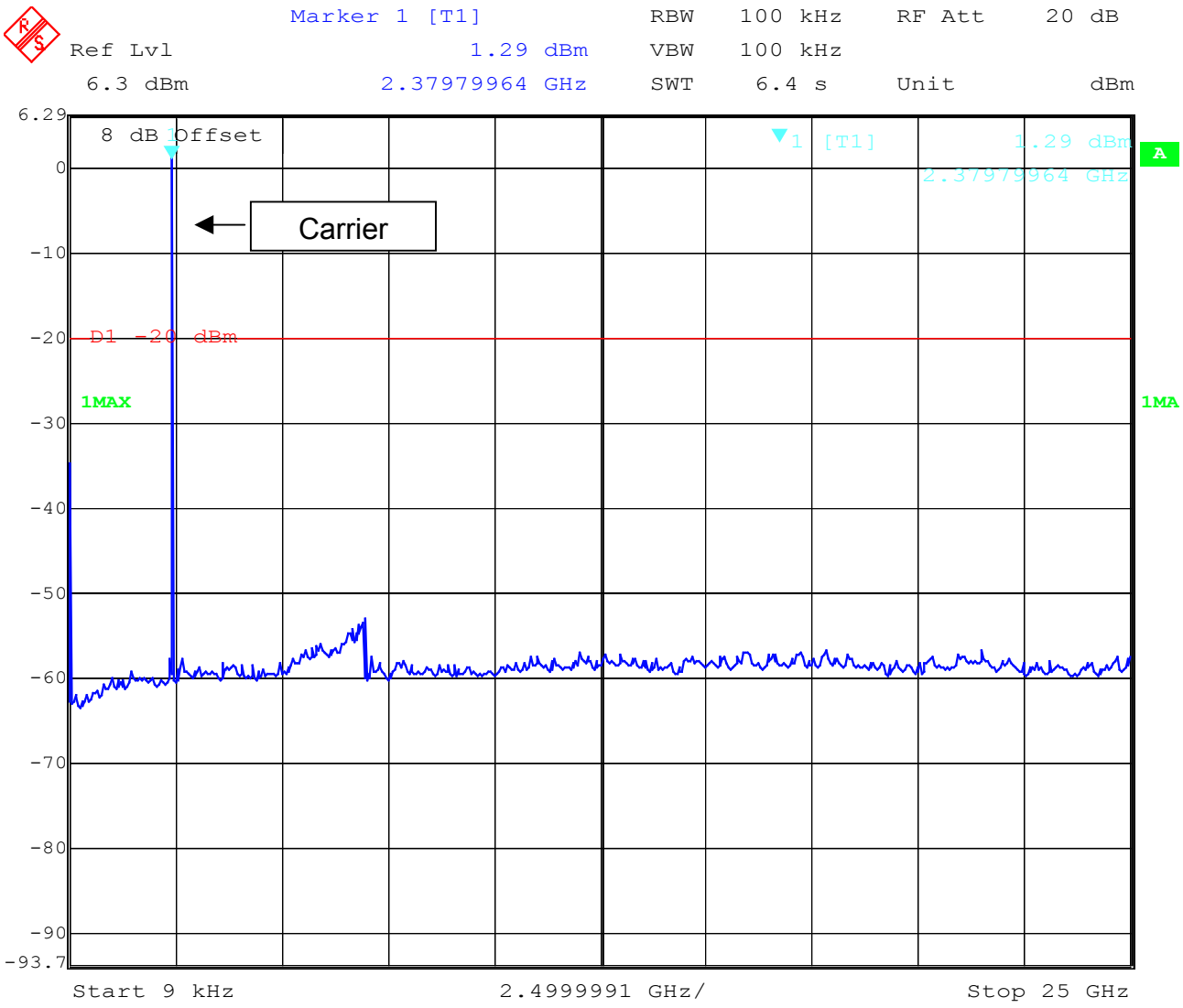


RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS- Conducted (Transmitter) **§ 15.247 (c) (1)**
Mid Channel : 9 kHz – 25 GHz



Date: 17.NOV.2003 11:24:25

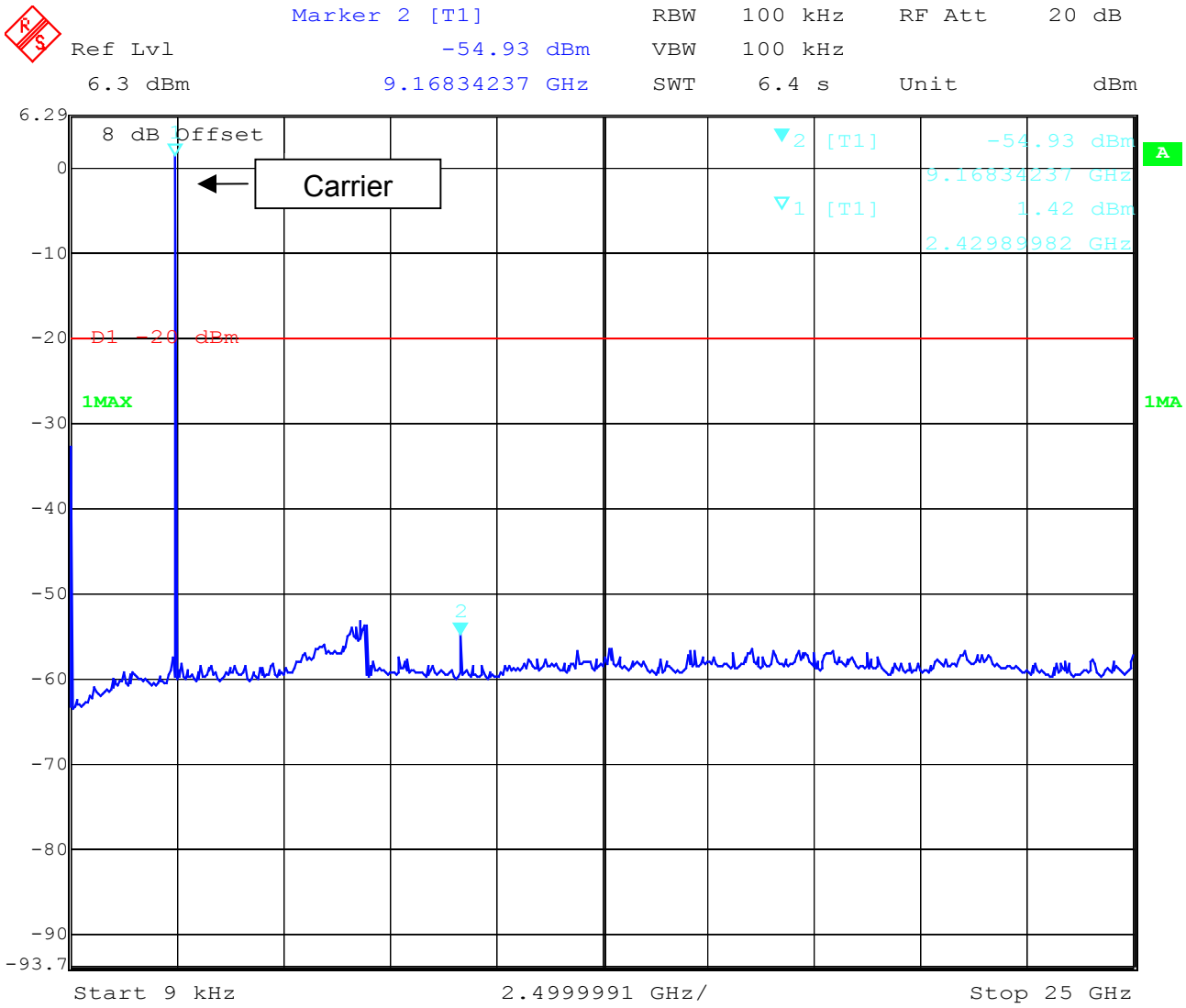
RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS- Conducted (Transmitter) § 15.247 (c) (1)

High Channel : 9kHz – 25 GHz



Date: 17.NOV.2003 11:20:02

RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24, 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

SPURIOUS RADIATED EMISSION § 15.247 (c) (1)

SPURIOUS EMISSIONS LEVEL (µV/m)								
2402 MHz			2441 MHz			2480 MHz		
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
31.5	PK	38.5	31.66	PK	39.8	31.5	PK	40.27
12 to 25 GHz no traceable signal found								
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limits SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

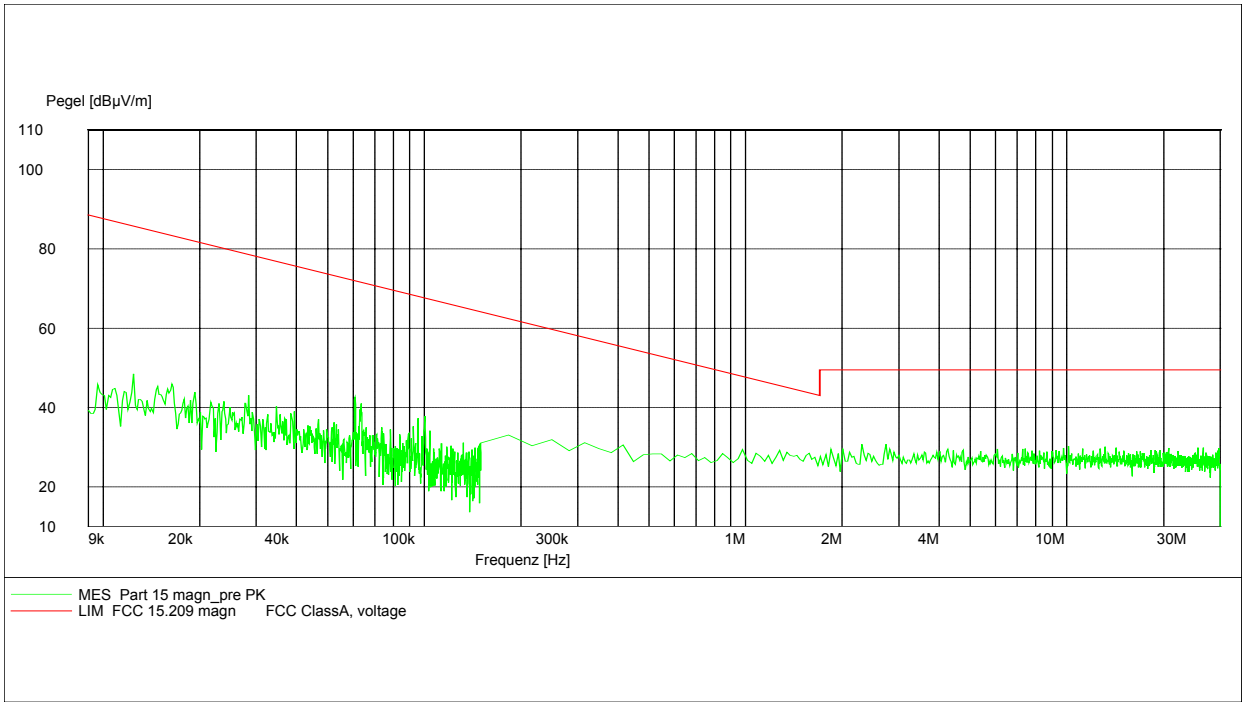
Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS (valid for all channels)

SUBCLAUSE § 15.247 (c) (1)

9 kHz –30 MHz

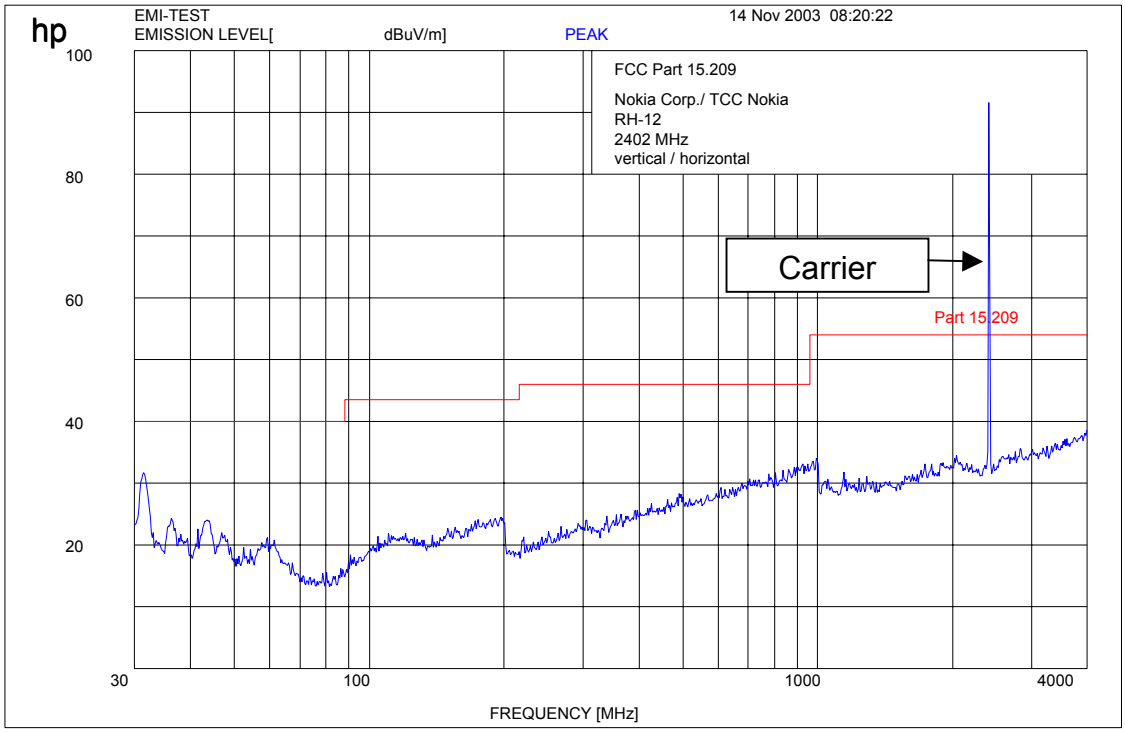
```
EUT:                  RH-12 with Charger ACP-12E
Manufacturer:         Nokia Corp. / TCC Nokia
Operating Condition:  Bluetooth Tx mode
Test Site:            Cetecom, Room 6
Operator:             Berg M.
Test Specification:   15.209
Comment:              115 V / 60 Hz
Start of Test:        14.11.03 / 13:16:49
```



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2402 MHz - 4 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

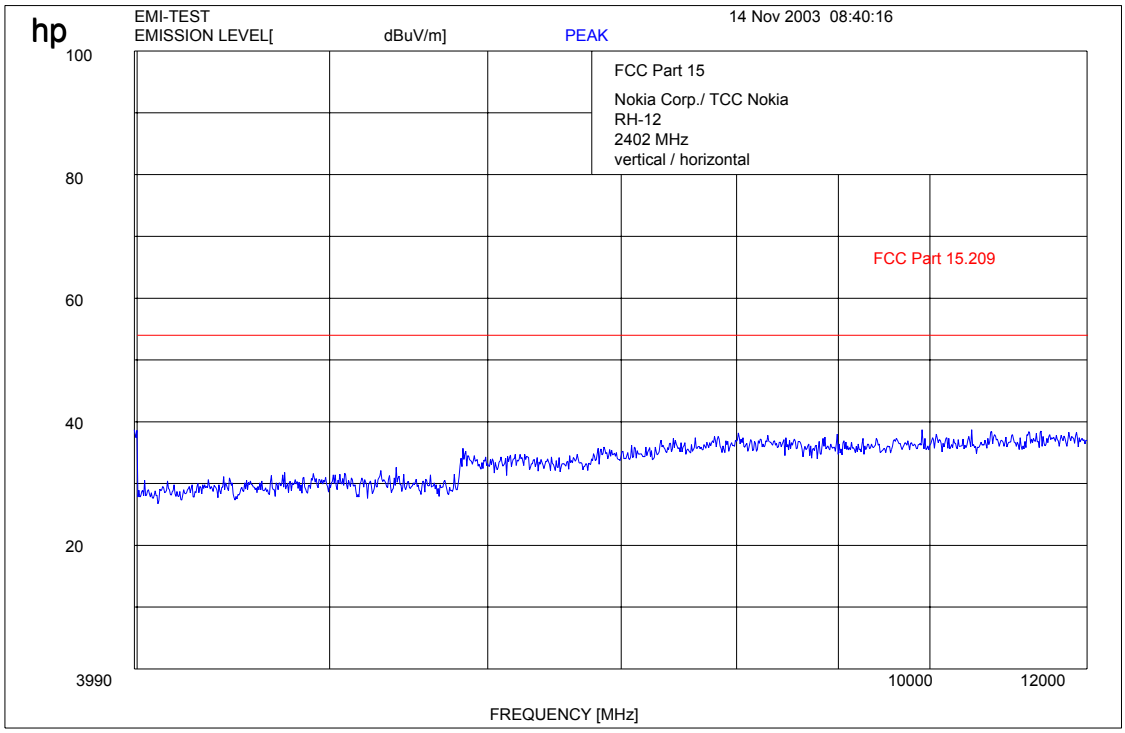
LIMITS **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2402 MHz - 12 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

LIMITS **SUBCLAUSE § 15.247 (c)**

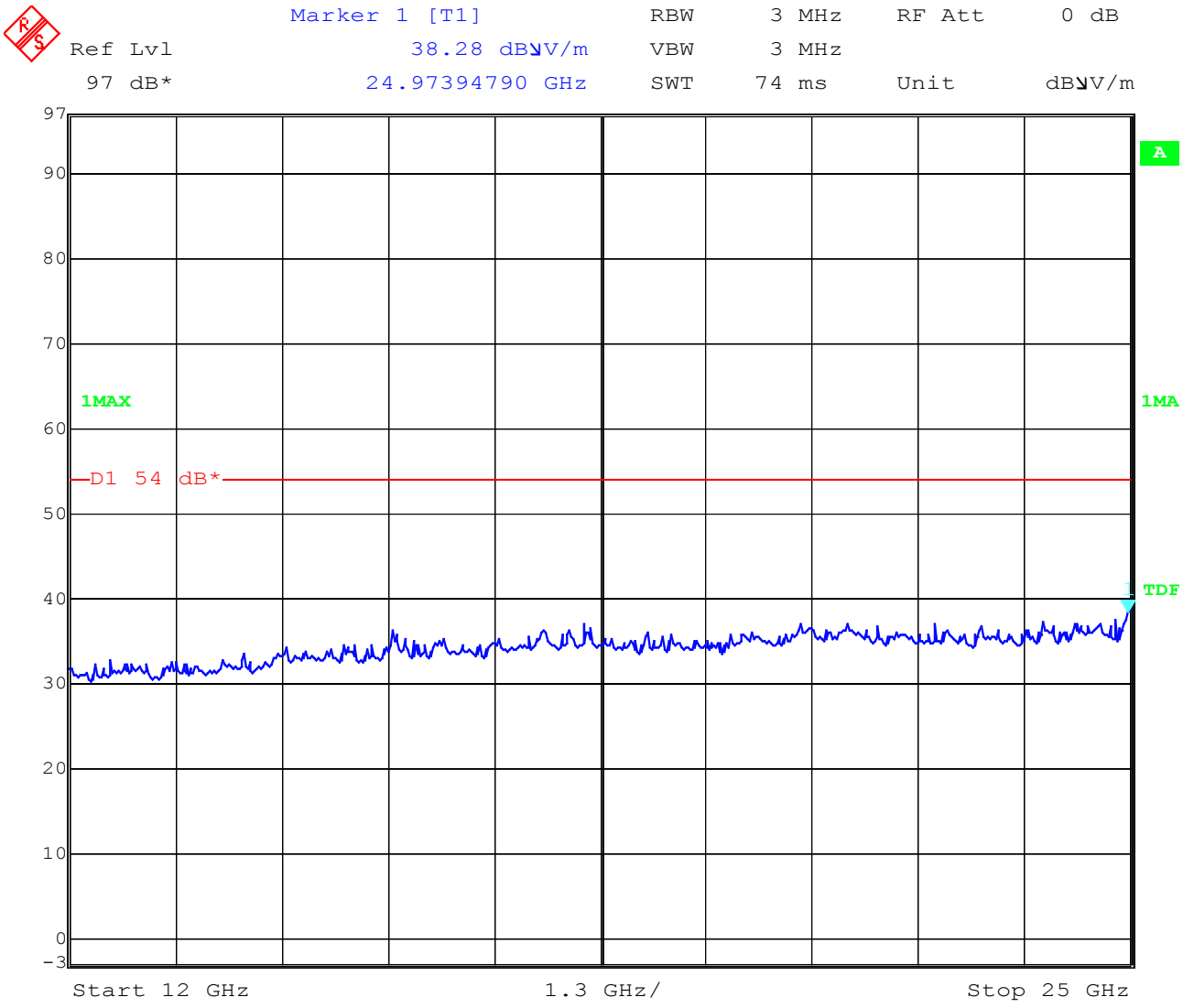
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**

2402 MHz – 25 GHz



Date: 17.NOV.2003 08:05:18

f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

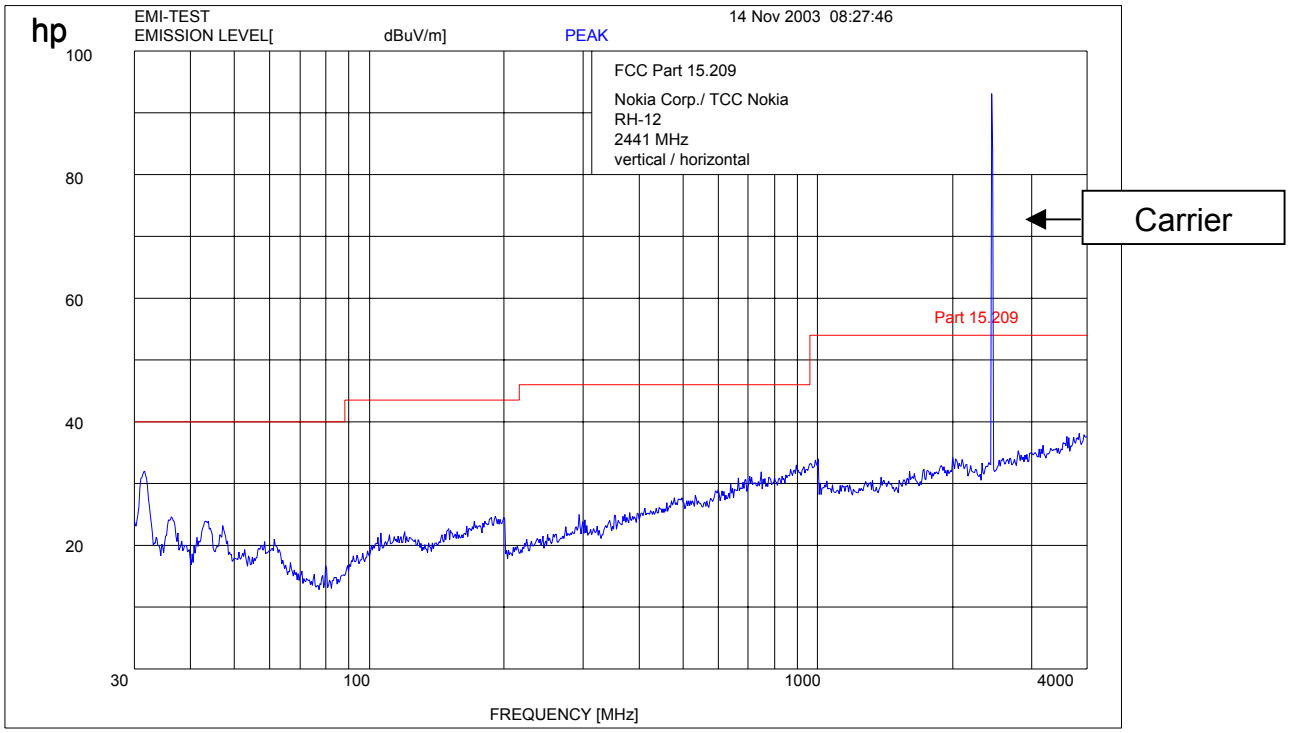
LIMITS **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2441 MHz -4 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

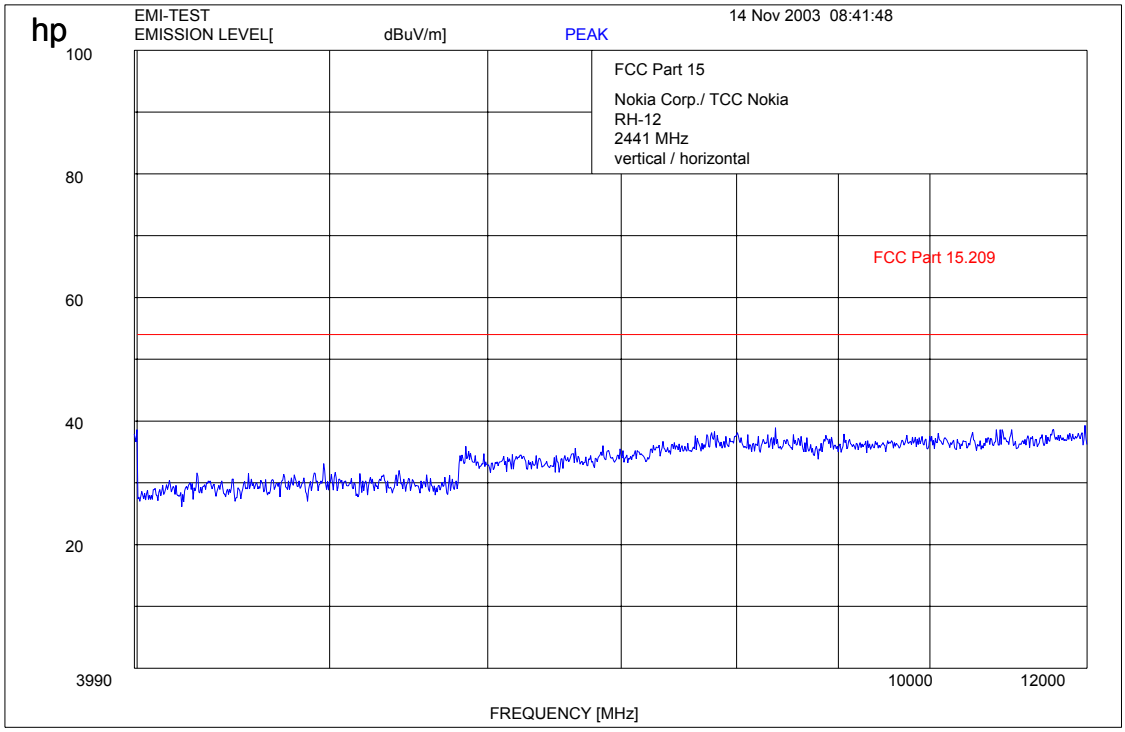
LIMITS **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2441 MHz - 12 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

LIMITS **SUBCLAUSE § 15.247 (c)**

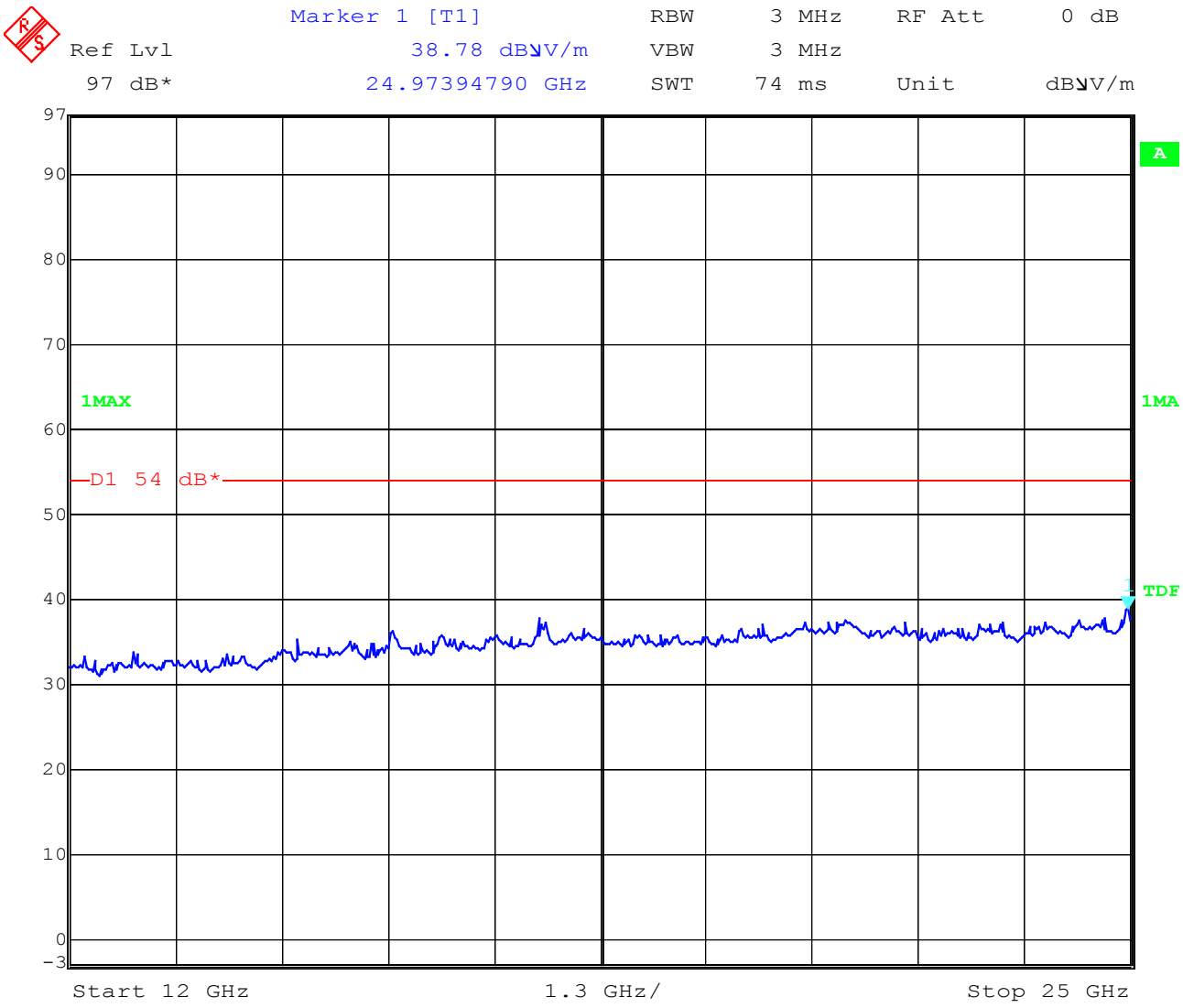
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS SUBCLAUSE § 15.247 (c) (1)

2441 MHz - 25 GHz



Date: 17.NOV.2003 08:04:59

f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

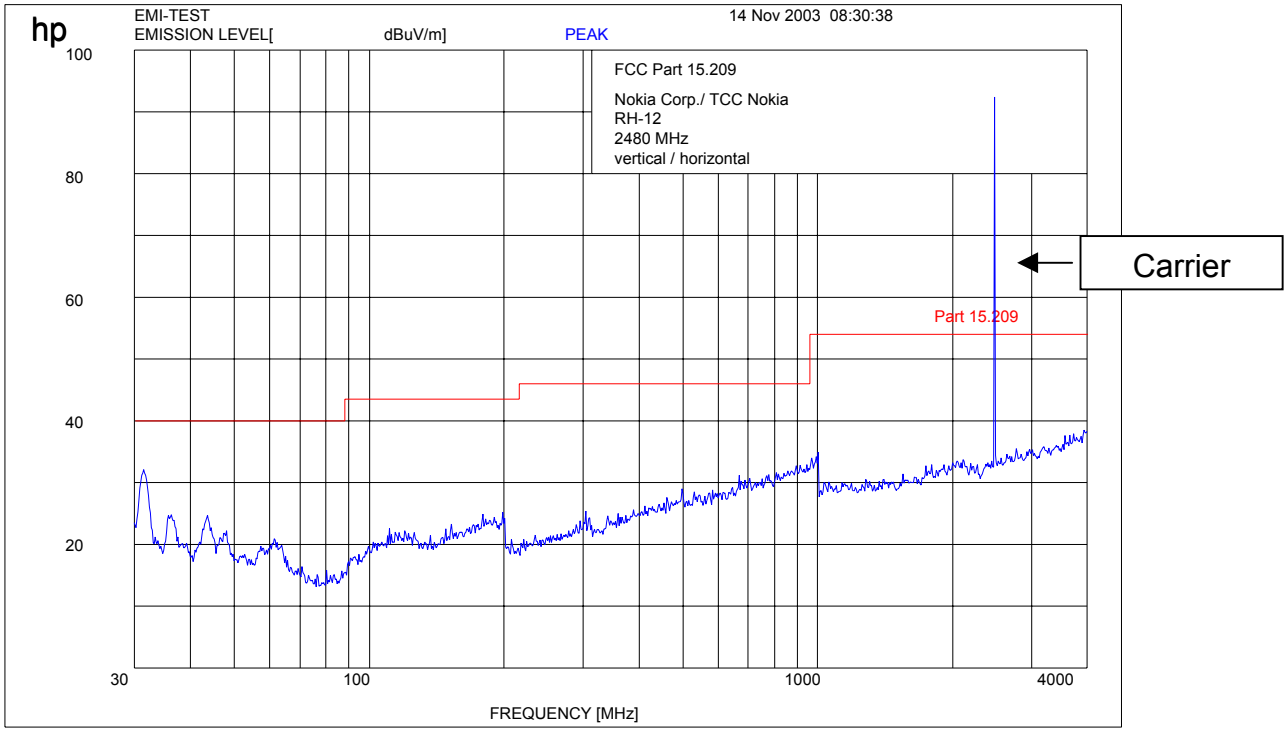
LIMITS SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2480 MHz – 4 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

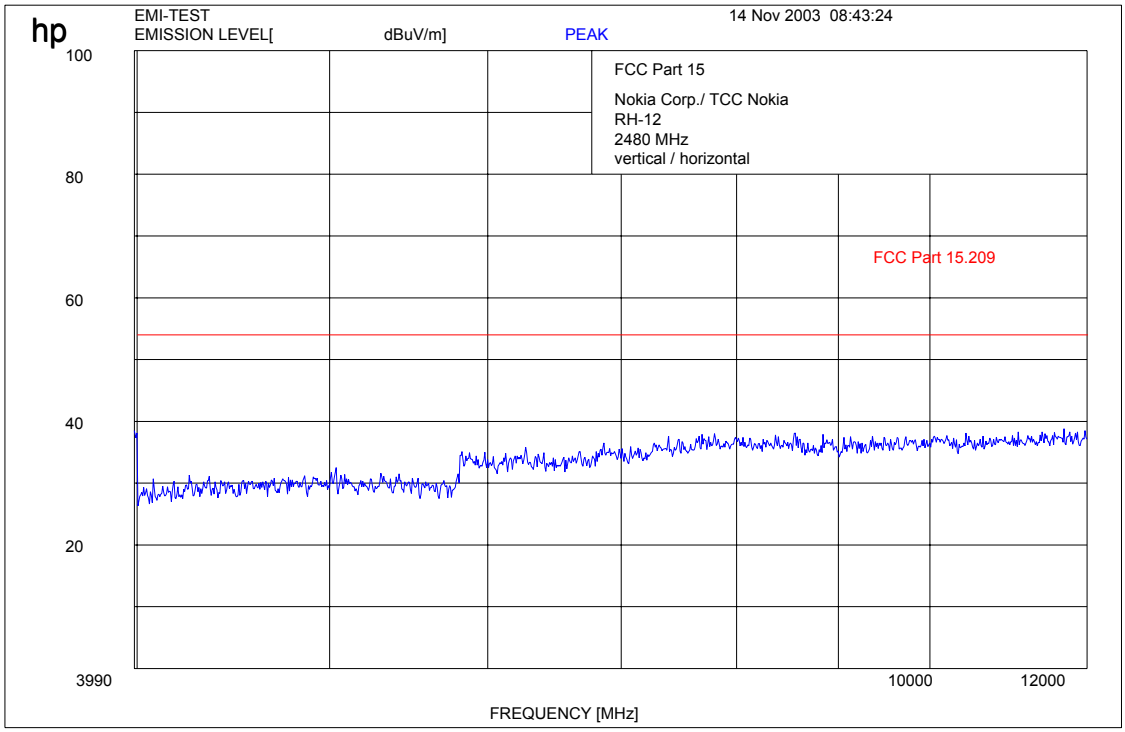
LIMITS **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2480 MHz – 12 GHz



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

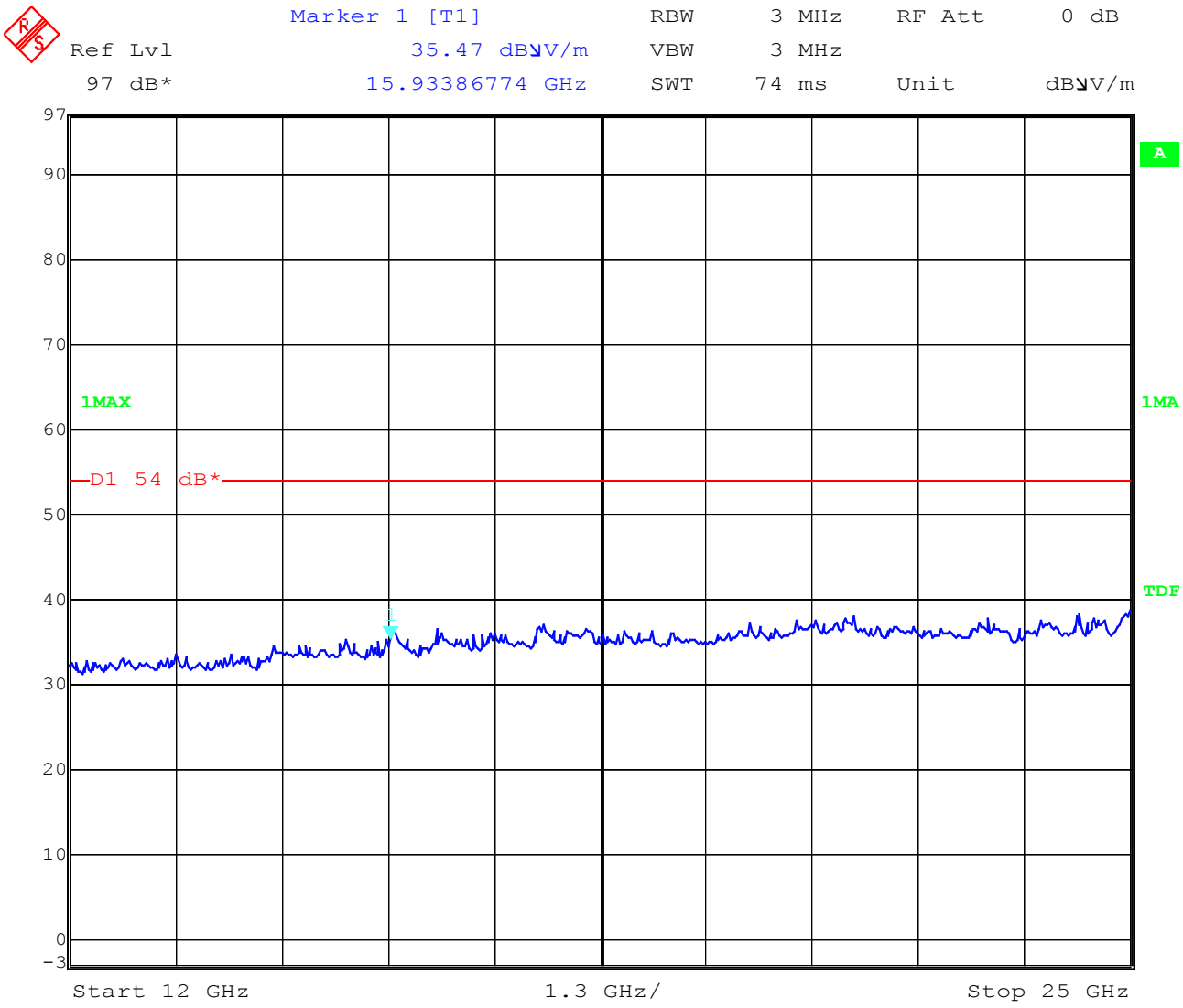
LIMITS **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS **SUBCLAUSE § 15.247 (c) (1)**
2480 MHz –25 GHz



Date: 17.NOV.2003 08:04:01

f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

LIMITS **SUBCLAUSE § 15.247 (c)**

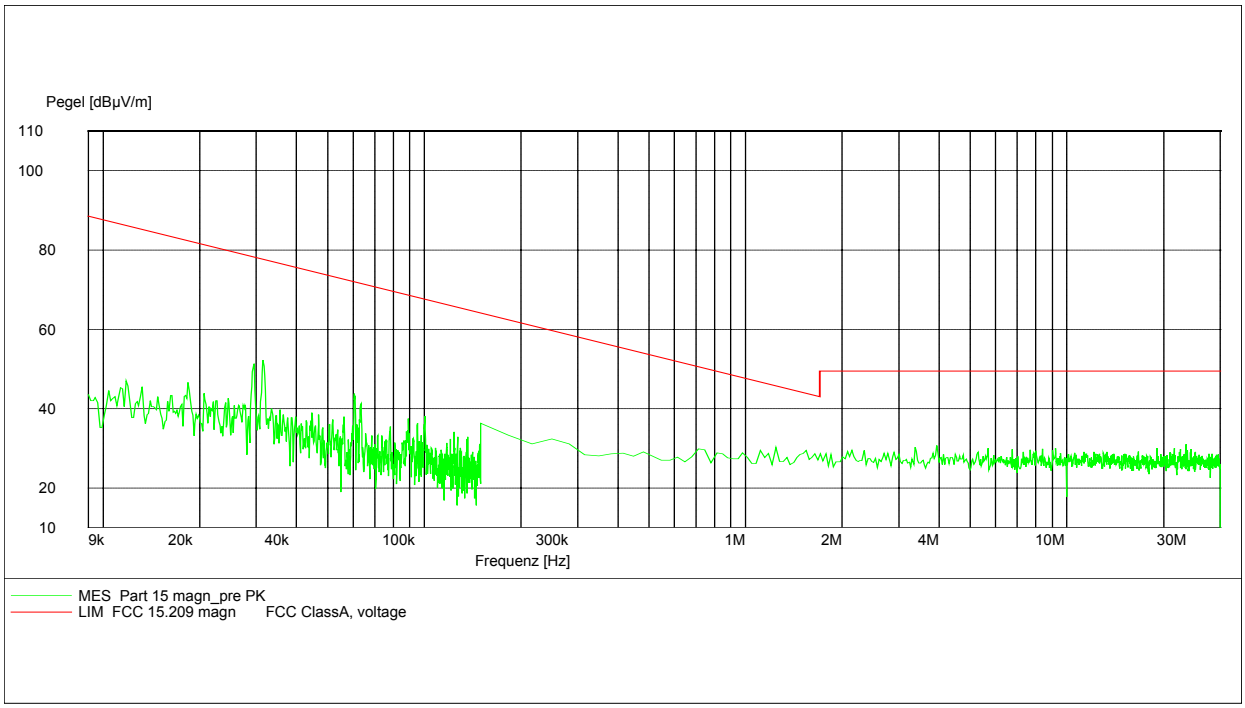
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109
9 kHz –30 MHz

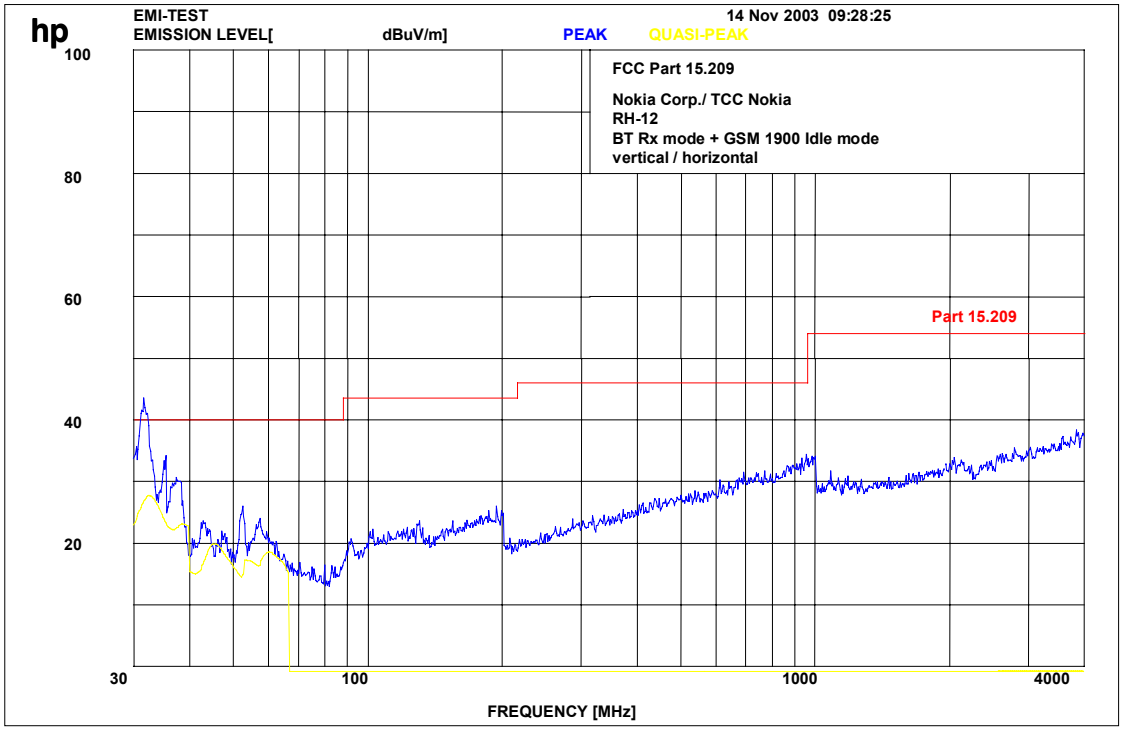
```
EUT:                  RH-12 with Charger ACP-12E
Manufacturer:         Nokia Corp. / TCC Nokia
Operating Condition:  Rx mode
Test Site:            Cetecom, Room 6
Operator:             Berg M.
Test Specification:   15.109
Comment:              115 V / 60 Hz
Start of Test:        14.11.03 / 13:12:18
```



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

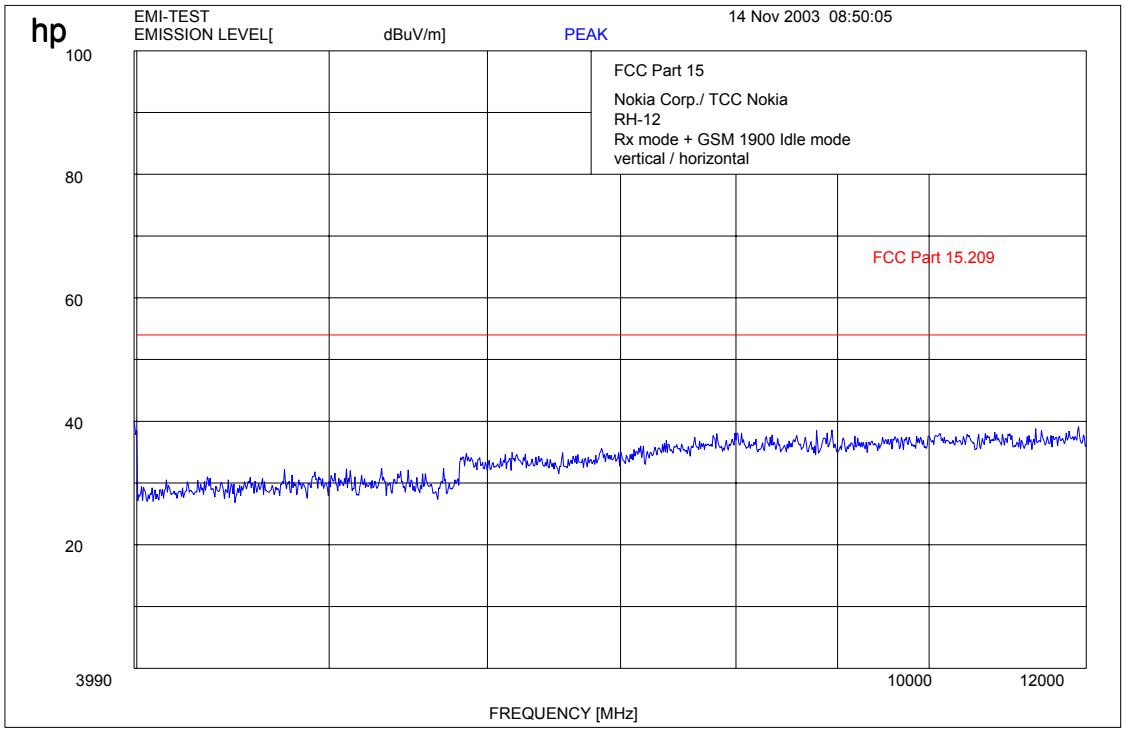
Limits **SUBCLAUSE § 15.109**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

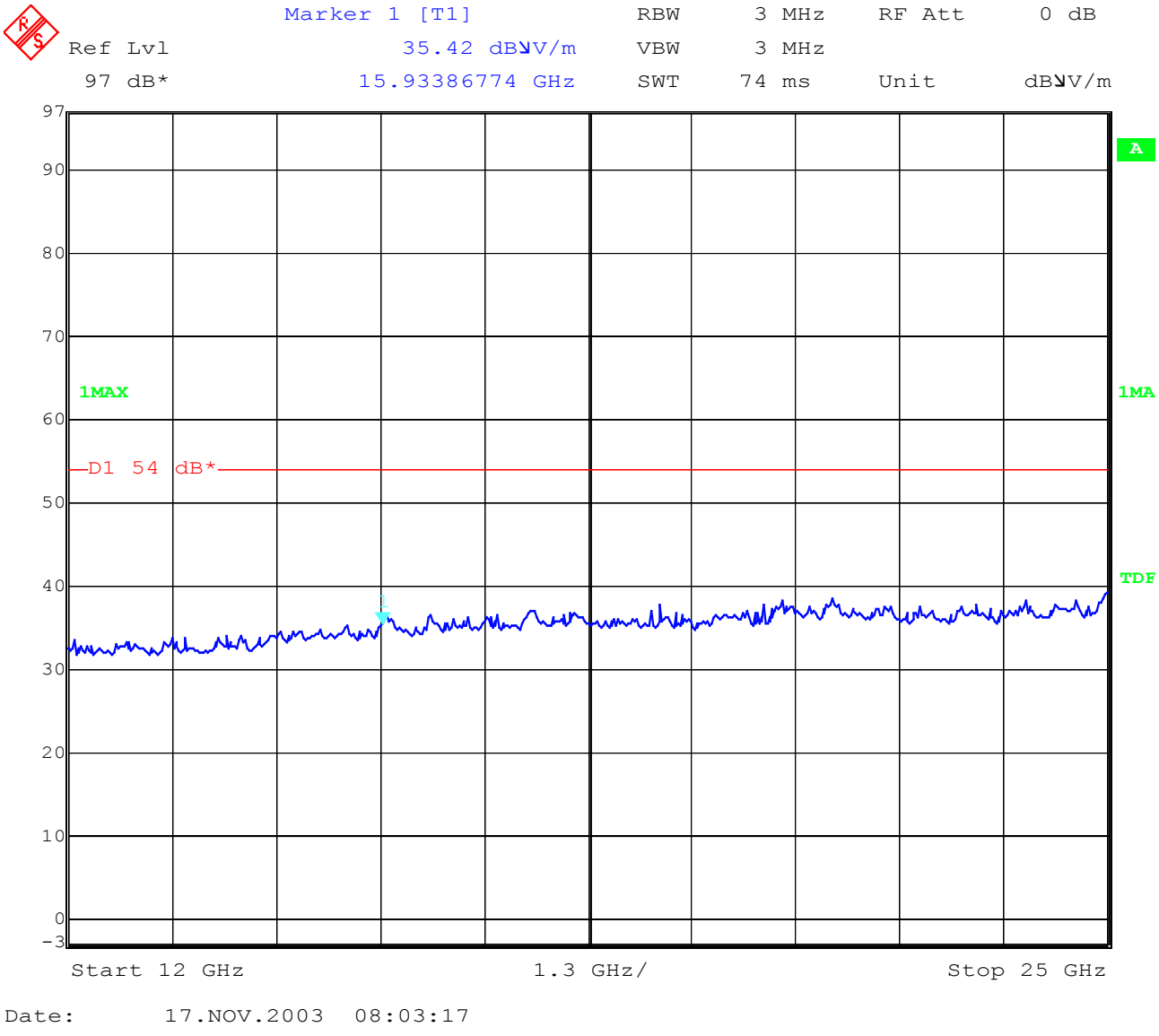
Limits **SUBCLAUSE § 15.109**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



Date: 17.NOV.2003 08:03:17

f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**

Limits **SUBCLAUSE § 15.109**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

RECEIVER SPURIOUS RADIATION **§ 15.109**
Radiated

SPURIOUS EMISSIONS LEVEL (µV/m)								
CH 1 / 2 / 3								
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
32.44	QP	24.3						
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**
see above plots

Measurement distance see table

Limits **SUBCLAUSE § 15.109**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 – 24; 64

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

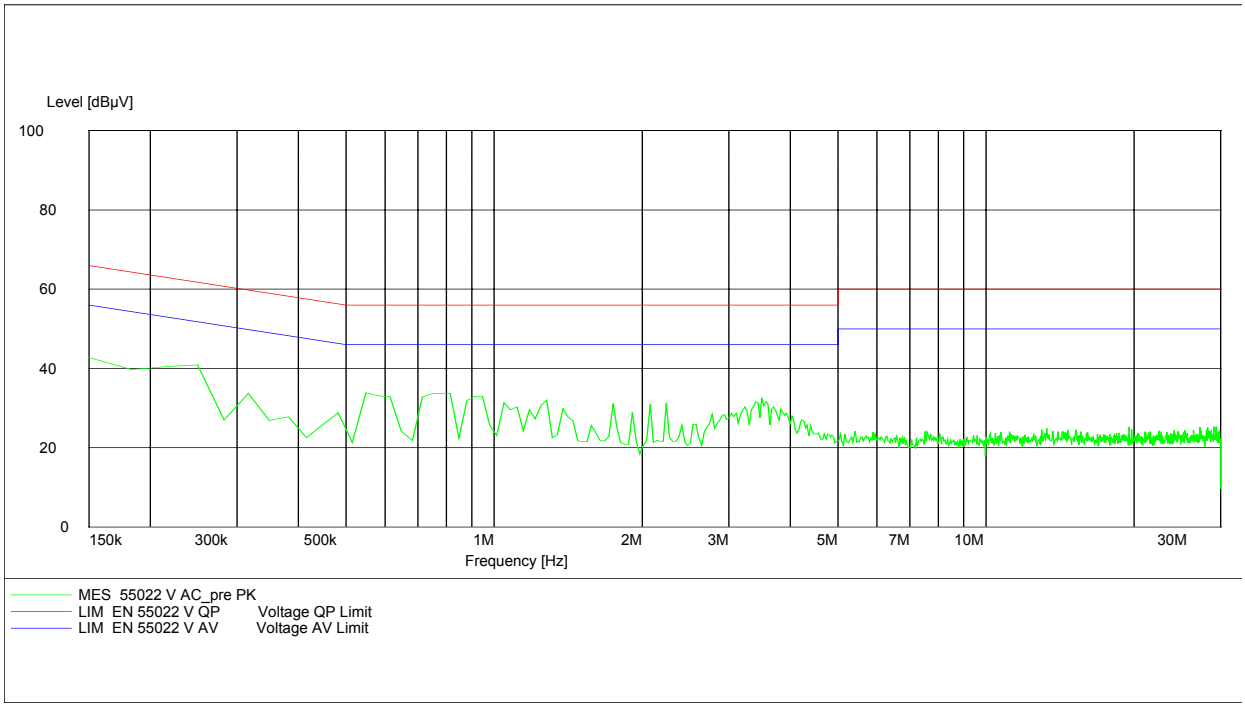
Conducted emissions § 15.107/207

EN 55022 / CISPR 22

```
EUT:                    RH-12
Manufacturer:           Nokia Corp. / TCC Nokia
Operating Condition:    Tx mode with charger ACP-12E
Test Site:              Room 006
Operator:               Berg M.
Test Specification:     EN 55022
Comment:                115 V / 60 Hz
Start of Test:          14.11.03 / 13:23:18
```

SCAN TABLE: "EN 55022 V"

```
  Short Description:              Voltage Mains 1.60
  Start      Stop       Step      Detector  Meas.     IF      Transducer
  Frequency  Frequency  Width               Time      Bandw.
  150.0 kHz  30.0 MHz   7.5 kHz   MaxPeak   100.0 ms  10 kHz  ESH3-Z5 L1 1458
```



Limit § 15.207

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

* **Decreases with the logarithm of the frequency.**

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

Equipment under test : RH-12
Ambient temperature : 22.7°C
Relative humidity : 38%

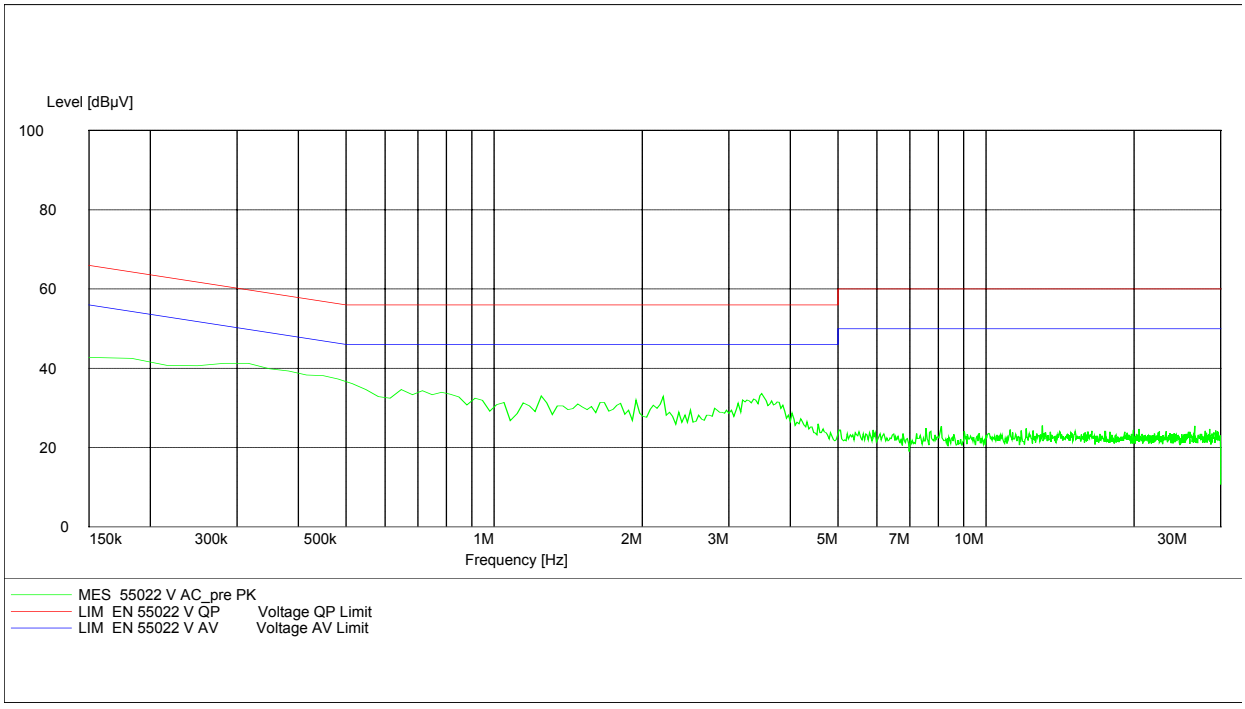
Conducted emissions § 15.107/207

EN 55022 / CISPR 22

```
EUT:                    RH-12
Manufacturer:           Nokia
Operating Condition:    With charging unit ACP-12E, idle mode
Test Site:              Room 006
Operator:               Berg M.
Test Specification:     EN 55022
Comment:                115 V / 60 Hz
Start of Test:          14.11.03 / 13:08:19
```

SCAN TABLE: "EN 55022 V"

```
  Short Description:              Voltage Mains 1.60
  Start      Stop       Step      Detector  Meas.     IF      Transducer
  Frequency  Frequency  Width               Time      Bandw.
  150.0 kHz  30.0 MHz   7.5 kHz   MaxPeak   100.0 ms  10 kHz  ESH3-Z5 L1 1458
```



Limit § 15.207

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

* Decreases with the logarithm of the frequency.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

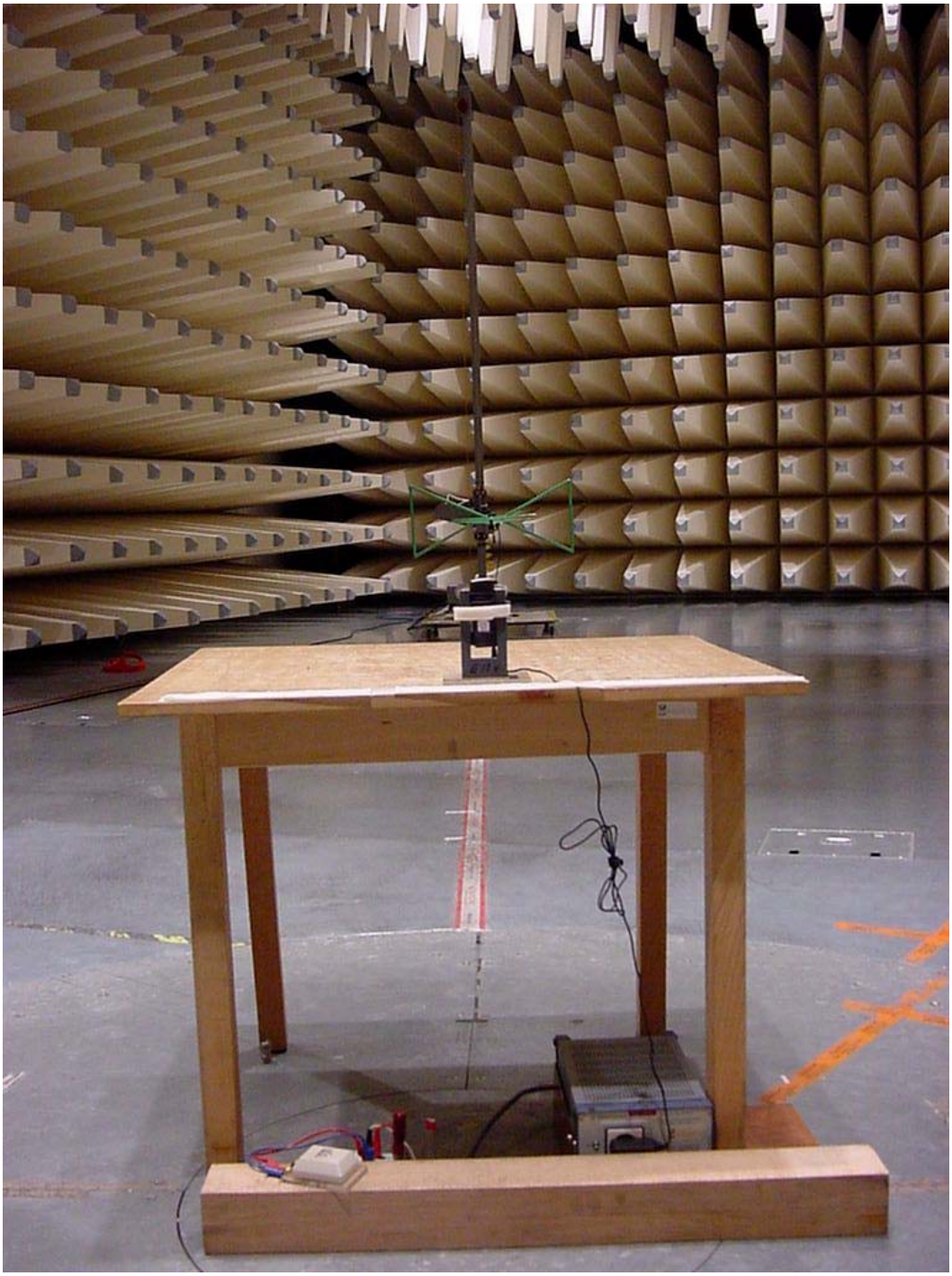
No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Calibrated
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257	Yes
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860	Yes
03	Oscilloscope	7633	Tektronix	230054	Yes
04	Radio Communication Analyzer	CMTA 54	Rohde & Schwarz	894 043/010	Yes
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027	Yes
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867	Yes
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012	Yes
08	Function Generator	AFGU	Rohde & Schwarz	862 480/032	Yes
09	Regulating Transformer	MPL	Erfi	91350	n.a.
10	LISN	NNLA 8120	Schwarzbeck	8120331	Yes
11	Relay-Matrix	PSU	Rohde & Schwarz	893 285/020	Yes
12	Power-Meter	436 A	Hewlett-Packard	2101A12378	Yes
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156	Yes
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616	Yes
15	Modulation Meter	9008	Racal-Dana	2647	Yes
16	Frequency Counter	5340 A	Hewlett-Packard	1532A03899	Yes
17	Anechoic Chamber	---	MWB	87400/002	Yes
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306	Yes
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541	Yes
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131	Yes
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768	Yes
22	Biconical Antenna	3104	Emco	3758	Yes
23	Log. Per. Antenna	3146	Emco	2130	Yes
24	Double Ridged Horn	3115	Emco	3088	Yes
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013	Yes
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008	Yes
27	Biconical Antenna	HK 116	Rohde & Schwarz	888 945/013	Yes
28	Log. Per. Antenna	HL 223	Rohde & Schwarz	825 584/002	Yes
29	Relay-Switch-Unit	RSU	Rohde & Schwarz	375 339/002	Yes
30	Highpass	HM985955	FSY Microwave	001	n.a.
31	Amplifier	P42-GA29	Tron-Tech	B 23602	Yes
32	Anechoic Chamber		Frankonia		Yes
33	Control Computer	PSM 7	Rohde & Schwarz	834 621/004	Yes
34	EMI Test Receiver	ESMI	Rohde & Schwarz	827 063/010	Yes
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010	Yes

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Calibrated
36	Control Computer	HD 100	Deisel	100/322/93	n.a.
37	Relay Matrix	PSN	Rohde & Schwarz	829 065/003	Yes
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008	Yes
39	Relay Switch Unit	RSU	Rohde & Schwarz	316 790/001	Yes
40	Power Supply	6032A	Hewlett Packard	2846A04063	Yes
41	Spectrum Monitor	EZM	Rohde & Schwarz	883 720/006	n.a.
42	Measuring Receiver	ESH 3	Rohde & Schwarz	890 174/002	Yes
43	Measuring Receiver	ESVP	Rohde & Schwarz	891 752/005	Yes
44	Bicon Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011	Yes
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010	Yes
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461	Yes
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002	Yes
48	Polarisation Network	HL 024 Z1	Rohde & Schwarz	341 570/002	Yes
49	Double Ridged Horn Antenna 1-26.5 GHz	3115	EMCO	9107-3696	Yes
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105	Yes
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04	Yes
52	Controler	PSM 7	Rohde & Schwarz	883 086/026	Yes
53	DC V-Network	ESH3-Z6	Rohde & Schwarz	861 406/005	Yes
54	DC V-Network	ESH3-Z6	Rohde & Schwarz	893 689/012	Yes
55	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	861 189/014	Yes
56	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	894 981/019	Yes
57	AC-3 Phase V-Network	ESH2-Z5	Rohde & Schwarz	882 394/007	Yes
58	Power Supply	6032A	Rohde & Schwarz	2933A05441	Yes
59	RF-Test Receiver	ESVP.52	Rohde & Schwarz	881 487/021	Yes
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026	n.a.
61	RF-Test Receiver	ESH3	Rohde & Schwarz	881 515/002	Yes
62	Relay Matrix	PSU	Rohde & Schwarz	882 943/029	Yes
63	Relay Matrix	PSU	Rohde & Schwarz	828 628/007	Yes
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27	Yes
65	Spectrum Analyzer	HP 8565E	Hewlett Packard	3473A00773	Yes
68					

Test setup
Radiated Emissions



Test setup

conducted emissions

PHOTOGRAPH OF THE EQUIPMENT

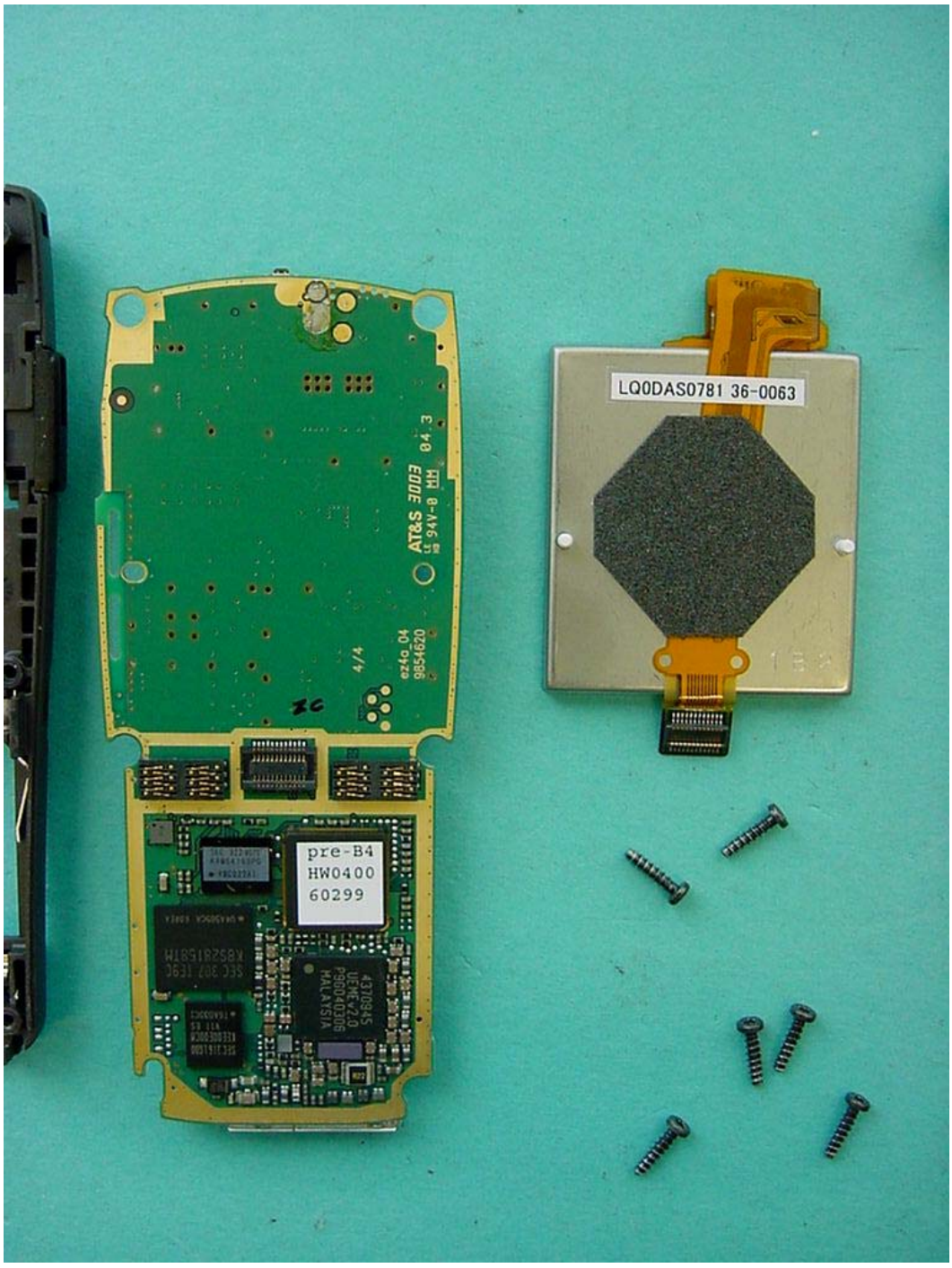
PHOTOGRAPH OF THE EQUIPMENT

PHOTOGRAPH OF THE EQUIPMENT

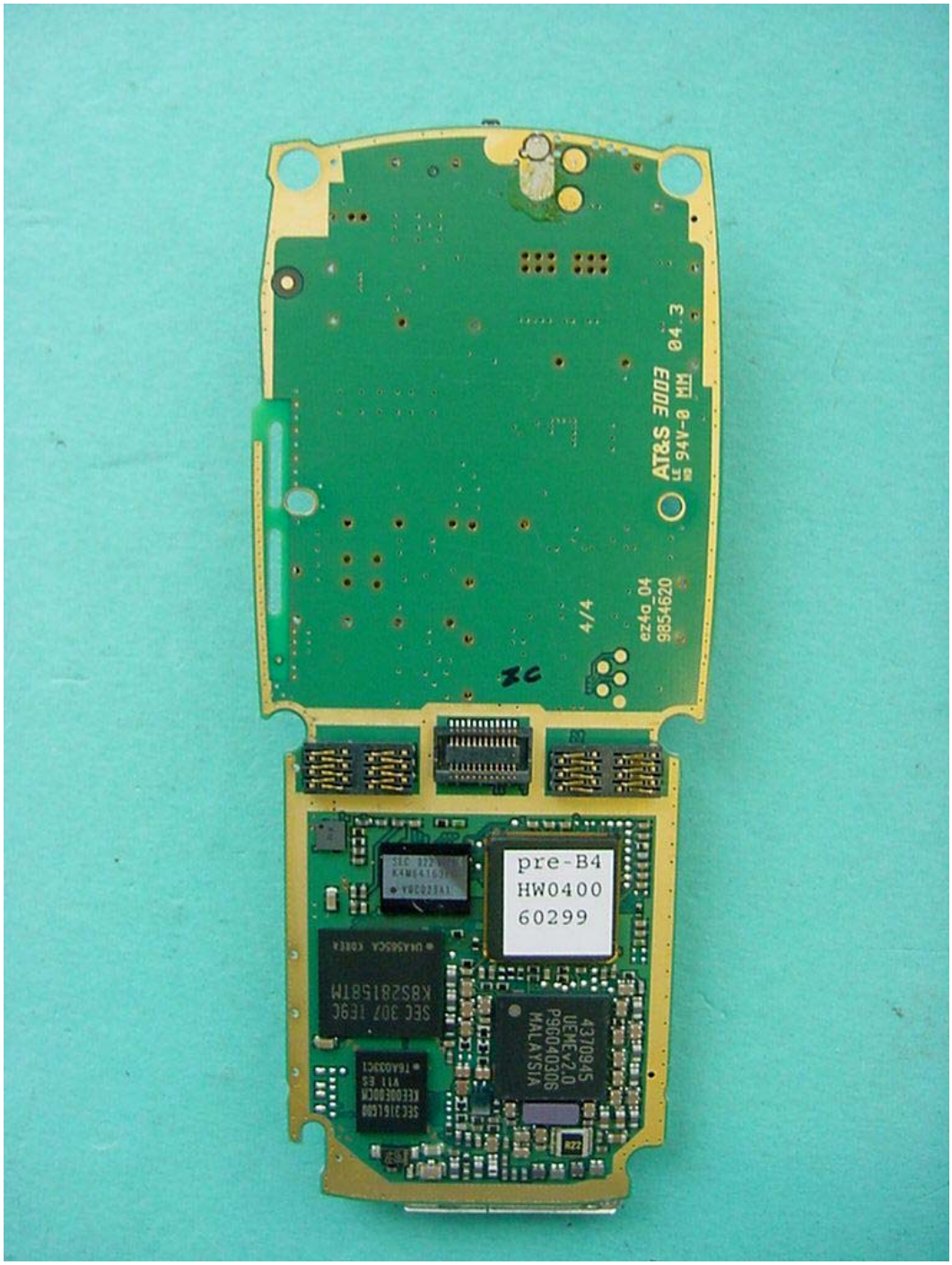
PHOTOGRAPH OF THE EQUIPMENT

PHOTOGRAPH OF THE EQUIPMENT

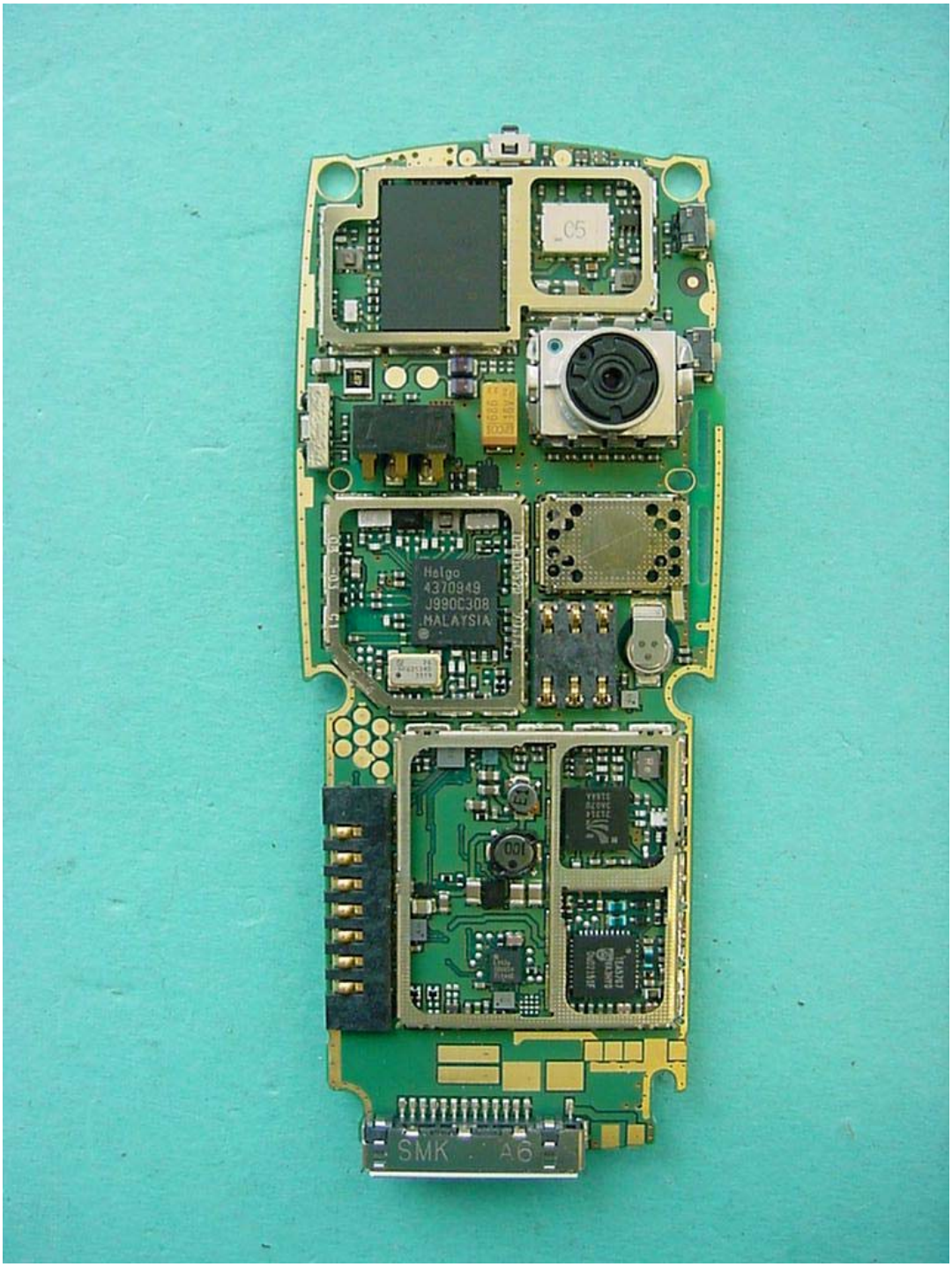
PHOTOGRAPH OF THE EQUIPMENT



PHOTOGRAPH OF THE EQUIPMENT



PHOTOGRAPH OF THE EQUIPMENT



PHOTOGRAPH OF THE EQUIPMENT