TEST REPORT OF A 5 GHZ LOW POWER WLAN CARDBUS CARD, BRAND INTERSIL, TYPE ISL37704C, IN CONFORMITY WITH 47 CFR PART 15 (2001-12-18).

FCC listed : 90828
Industry Canada : IC3501

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MEASUREMENT/TECHNICAL REPORT

Intersil Corporation

Model : ISL37704C

FCC ID: OSZ37704C

August 6, 2002

This report concerns:	Original grant/certification ~~Class 2 change~~ ~~Verification~~	
Equipment type:	Unlicensed U-NII Device	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii) ?	~~Yes~~	No
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 and the measurement procedures of ANSI C63.4-1992. TNO Electronic Products & Services (EPS) B.V. at Niekerk, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: August 6, 2002 Signature:

P. de Beer
TNO Electronic Products & Services (EPS) B.V.

Description of test item

Test item	:	5 GHz low power WLAN Cardbus card
Manufacturer	:	Intersil Corporation
Brand	:	Intersil
Type	:	ISL37704C
Serial numbers	:	0222 0084
Revision	:	C8
Receipt number	:	1
Receipt date	:	June 25, 2002

Applicant information

Applicant's representative	:	Mr. D. Sariredjo
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Test(s) performed

Location	:	Niekerk
Test(s) started	:	June 25, 2002
Test(s) completed	:	July 9, 2002
Purpose of test(s)	:	Type approval / certification
Test specification(s)	:	47 CFR Part 15 (2001-12-18)

Test engineer	:	O.H. Hoekstra
Report written by	:	P.A.J.M. Robben, B.Sc.E.E.
Project leader	:	O.H. Hoekstra

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The test results relate only to the item(s) tested.

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1 General information.

1.1 Product description.

The 5 GHz low power WLAN Cardbus card, brand Intersil, type ISL37704C, is designed to operate in the 5 GHz unlicensed U-NII devices frequency band (5150 MHz to 5350 MHz), as specified by the Federal Communications Commission in the USA.

The 5 GHz low power WLAN Cardbus card, brand Intersil, type ISL37704C, incorporates an integral antenna having a gain of less than +2 dBi.

1.2 Related submittal(s) and/or Grant(s).

Not applicable.

1.3 Tested system details.

Details and an overview of the system and all its components, as it has been tested, can be found in table 1 below. FCC ID's are stated in this overview where applicable. The EUT is listed in the first row of this table 1.

Description	Type number	Serial number	FCC ID	Cable descriptions
2.4 GHz low power WLAN Cardbus card	ISL37704C	0222 0084	OSZ37704C	None.
IBM Thinkpad computer	2626	55-0634L	n.a. (DoC)	-Unshielded DC power cord to AC/DC adapter -Shielded parallel cable to printer
IBM AC/DC power adapter 100-240 VAC/1.5 Amps to +18.5 VDC/2.7 Amps	2K06543	2M04T793A0Z	n.a. (DoC)	-Unshielded DC power cord to notebook computer -Unshielded power cord to AC mains
HP DeskJet 895Cxi	C6410A	ES8B42307H	n.a. (DoC)	-Unshielded DC power cord to AC/DC adapter -Shielded parallel cable to notebook computer
HP AC/DC power adapter 100-240 VAC/1 Amps to +18 VDC/1.1 Amps	C6409-60014	n.a.	n.a. (DoC)	-Unshielded DC power cord to printer -Unshielded power cord to AC mains

Table 1 - Tested system details overview.

1.4 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (2001-12-18), sections 15.107, 15.207, 15.109, 15.209, 15.205 and Subpart E (Unlicensed National Information Infrastructure Devices).

The test methods, which have been used, are based on ANSI C63.4: 1992.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters. Below 30 MHz the radiated emission tests were carried out at measurement distances of 3 and 10 meters. The test results regarding the radiated emission tests on frequencies below 30 MHz have been extrapolated in order to determine the field strength of the measured values at measurement distances of 30 and 300 meters (as required by 47 CFR Part 15).

The bandwidth of the receiver is switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

Radiated emission tests on frequencies above 1 GHz were performed with appropriate pre-amplifiers, antennas and a spectrum analyzer. At frequencies on which radiated emissions were found the level at the input of the pre-amplifier was reproduced by means of a RF signal generator. The output level of the signal generator was then increased with the antenna factor in order to obtain the actual field strength value for each individual frequency on which radiated emissions were found.

1.5 Test facility.

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at TNO Electronic Products & Services (EPS) B.V., located in Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 23, 2000.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at http://www.fcc.gov.

1.6 Product labeling.

In accordance with 47 CFR Part 15.19 (a)(3) the following text shall be placed on a label, which is attached to the EUT:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

In accordance with 47 CFR Part 2.925 (a)(1), the FCC ID shall be placed on a label, which is attached to the EUT.

For further details about the labeling requirements (size, legibility, etc.) as set by the Federal Communications Commission see 47 CFR Part 15.19 (a)(3), 47 CFR Part 15.19 (b)(2), 47 CFR Part 15.19 (b)(4), 47 CFR Part 2.925 and 47 CFR Part 2.926.

1.7 System test configuration.

1.7.1 Justification.

The system was configured for testing in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4: 1992.

Tests were performed at the operating frequencies channel 36 (5180 MHz), channel 48 (5240 MHz), channel 52 (5260 MHz) and channel 64 (5320 MHz). Further details may be found in table 2 below.

Channel	Operating frequencies (MHz)	Rated output power (dBm)	Test performed
36	5180	+16.0	***yes***
40	5200	+16.0	no
44	5220	+16.0	no
48	5240	+16.0	***yes***
52	5260	+16.0	***yes (partial testing)***
56	5280	+16.0	no
60	5300	+16.0	no
64	5320	+16.0	***yes***

Table 2 - Specification of channels and rated maximum output power (excluding an antenna gain of +2 dBi max.).

The EUT was tested when mounted in the cardbus slot of a notebook computer and while using the integral antenna (having a gain of +2 dBi max.) of the EUT.

1.7.2 EUT exercise software.

The EUT could be enabled to transmit or receive continuously on channels 36 (5180 MHz), 48 (5240 MHz), 52 (5260 MHz) and 64 (5320 MHz) by means of test software, which was supplied by the manufacturer of the EUT. Furthermore, the utilized test software also enables various transmission bit-rate settings in the range of 6 Mbit/s, 12 Mbit/s, 24 Mbit/s and 54 Mbit/s.

1.8 Special accessories.

No special accessories are used and/or needed to achieve compliance with the appropriate sections of 47 CFR Part 15.

1.9 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance with the appropriate sections of 47 CFR Part 15.

1.10 Configuration of the tested system.

Not applicable. See table 1 in section 1.3 of this test report.

1.11 Block diagram(s) of the EUT.

The block diagram is available as part of the documentation which is to be submitted to the FCC/TCB.

2 Radiated emission data.

2.1 Test results with EUT operating in receive mode on channel 36.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 36 (5180 MHz), are depicted in table 3.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.1	20.5	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.4	28.8	-	-	-	-	120	46.0	-	-
500.40	24.4	26.8	-	-	-	-	120	46.0	-	-
600.50	31.2	26.6	-	-	-	-	120	46.0	-	-
700.00	38.2	33.2	-	-	-	-	120	46.0	-	-
800.66	34.2	31.6	-	-	-	-	120	46.0	-	-
3992.0	-	-	n.t.	n.t.	36.0	<37.0	1000	-	54.0	74.0
4364.0	-	-	n.t.	n.t.	34.0	<37.0	1000	-	54.0	74.0
8756.0	-	-	n.t.	n.t.	39.0	<37.0	1000	-	54.0	74.0
13120.0	-	-	n.t.	n.t.	44.3	<40.0	1000	-	54.0	74.0
17456.0	-	-	n.t.	n.t.	<44.0	<44.0	1000	-	54.0	74.0
21850.0	-	-	n.t.	n.t.	39.6	38.2	1000	-	54.0	74.0
26241.0	-	-	n.t.	n.t.	<40.0	<40.0	1000	-	54.0	74.0

Table 3 - Test results with the EUT operating in receive mode on channel 36 (5180 MHz).

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 3 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

2.2 Test results with EUT operating in receive mode on channel 48.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 48 (5240 MHz), are depicted in table 4.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.1	20.5	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.4	28.8	-	-	-	-	120	46.0	-	-
500.40	24.4	26.8	-	-	-	-	120	46.0	-	-
600.50	31.2	26.6	-	-	-	-	120	46.0	-	-
700.00	38.2	33.2	-	-	-	-	120	46.0	-	-
800.66	34.2	31.6	-	-	-	-	120	46.0	-	-
3992.0	-	-	n.t.	n.t.	37.9	32.0	1000	-	54.0	74.0
4436.0	-	-	n.t.	n.t.	34.5	30.8	1000	-	54.0	74.0
8876.0	-	-	n.t.	n.t.	38.6	<37.0	1000	-	54.0	74.0
13300.0	-	-	n.t.	n.t.	43.2	<40.0	1000	-	54.0	74.0
17744.0	-	-	n.t.	n.t.	<44.0	<44.0	1000	-	54.0	74.0
22160.0	-	-	n.t.	n.t.	39.7	39.3	1000	-	54.0	74.0

Table 4 - Test results with the EUT operating in receive mode on channel 48 (5240 MHz).

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 4 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

2.3 Test results with EUT operating in receive mode on channel 64.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 64 (5320 MHz), are depicted in table 5.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.1	20.5	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.4	28.8	-	-	-	-	120	46.0	-	-
500.40	24.4	26.8	-	-	-	-	120	46.0	-	-
600.50	31.2	26.6	-	-	-	-	120	46.0	-	-
700.00	38.2	33.2	-	-	-	-	120	46.0	-	-
800.66	34.2	31.6	-	-	-	-	120	46.0	-	-
3992.0	-	-	n.t.	n.t.	33.8	30.3	1000	-	54.0	74.0
4508.0	-	-	n.t.	n.t.	34.8	31.4	1000	-	54.0	74.0
9020.0	-	-	n.t.	n.t.	40.8	36.8	1000	-	54.0	74.0
13520.0	-	-	n.t.	n.t.	41.8	<40.0	1000	-	54.0	74.0
18032.0	-	-	n.t.	n.t.	<44.0	<44.0	1000	-	54.0	74.0
22568.0	-	-	n.t.	n.t.	45.5	43.4	1000	-	54.0	74.0

Table 5 - Test results with the EUT operating in receive mode on channel 64 (5320 MHz).

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 5 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

2.4 Test results with EUT operating in transmit mode on channel 36.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 36 (5180 MHz), are depicted in table 6.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.5	22.1	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.7	30.5	-	-	-	-	120	46.0	-	-
600.50	31.6	26.6	-	-	-	-	120	46.0	-	-
700.00	36.0	33.0	-	-	-	-	120	46.0	-	-
800.66	32.8	31.6	-	-	-	-	120	46.0	-	-
10498.0	-	-	n.t.	n.t.	47.9	48.2	1000	-	54.0	74.0
15768.0	-	-	n.t.	44.6	53.7	54.6	1000	-	54.0	74.0

Table 6 - Test results with the EUT operating in transmit mode on channel 36 (5180 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (6 Mbit/s, 12 Mbit/s, 24 Mbit/s and 54 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 6.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 6 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

2.5 Test results with EUT operating in transmit mode on channel 48.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 48 (5240 MHz), are depicted in table 7.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.5	22.1	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.7	30.5	-	-	-	-	120	46.0	-	-
600.50	31.6	26.6	-	-	-	-	120	46.0	-	-
700.00	36.0	33.0	-	-	-	-	120	46.0	-	-
800.66	32.8	31.6	-	-	-	-	120	46.0	-	-
10371.0	-	-	n.t.	n.t.	48.5	45.0	1000	-	54.0	74.0
15577.0	-	-	44.1	45.1	55.1	55.4	1000	-	54.0	74.0

Table 7 - Test results with the EUT operating in transmit mode on channel 48 (5240 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (6 Mbit/s, 12 Mbit/s, 24 Mbit/s and 54 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 7.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 7 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

2.6 Test results with EUT operating in transmit mode on channel 64.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 64 (5320 MHz), are depicted in table 8.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
200.45	20.5	22.1	-	-	-	-	120	43.5	-	-
300.00	21.0	17.7	-	-	-	-	120	46.0	-	-
400.00	34.7	30.5	-	-	-	-	120	46.0	-	-
600.50	31.6	26.6	-	-	-	-	120	46.0	-	-
700.00	36.0	33.0	-	-	-	-	120	46.0	-	-
800.66	32.8	31.6	-	-	-	-	120	46.0	-	-
10647.0	-	-	n.t.	n.t.	50.9	51.5	1000	-	54.0	74.0
16002.0	-	-	43.0	n.t.	56.3	51.6	1000	-	54.0	74.0

Table 8 - Test results with the EUT operating in transmit mode on channel 64 (5320 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (6 Mbit/s, 12 Mbit/s, 24 Mbit/s and 54 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 8.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 8 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

3 Conducted emission data.

3.1 AC mains with EUT operating in transmit/receive mode.

The (worst-case) results of the conducted emission tests at the 110 Volts AC mains connection terminals of the notebook computer in which the EUT is mounted (cardbus slot), carried out in accordance with 47 CFR Part 15.107 and 47 CFR Part 15.207 with the EUT operating in transmit mode on channels 36 (5180 MHz), 48 (5240 MHz) and 64 (5320 MHz) while utilizing all possible transmission bit-rates (6 Mbit/s, 12 Mbit/s, 24 Mbit/s and 54 Mbit/s), are depicted in table 9.

Frequency (MHz)	Measurement results dB(µV) Neutral		Measurement results dB(µV) Line 1		Limits dB(µV)		Margin (dB) Neutral		Margin (dB) Line 1		Result
	QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
0.45	21.1	10.3	21.2	10.5	56.9	46.9	-35.8	-36.6	-35.7	-36.4	PASS
0.44	28.0	25.7	30.0	28.3	57.1	47.1	-29.1	-21.4	-27.1	-18.8	PASS
0.61	27.0	24.2	29.0	27.0	56.0	46.0	-29.0	-21.8	-27.0	-19.0	PASS
1.14	25.9	23.8	29.4	27.4	56.0	46.0	-30.1	-22.2	-26.6	-18.6	PASS
2.11	22.6	18.7	25.7	21.8	56.0	46.0	-33.4	-27.3	-30.3	-24.2	PASS
4.31	24.1	14.2	25.4	20.7	56.0	46.0	-31.9	-31.8	-30.6	-25.3	PASS
4.40	23.0	14.5	23.0	16.6	56.0	46.0	-33.0	-31.5	-33.0	-29.4	PASS
4.92	21.5	12.4	23.7	16.5	56.0	46.0	-34.5	-33.6	-32.3	-29.5	PASS
6.06	21.3	17.6	21.1	19.7	60.0	50.0	-38.7	-32.4	-38.9	-30.3	PASS

Table 9 - Test results with the EUT operating in transmit/receive mode.

Note: Disturbance voltage values of conducted emissions at frequencies not listed in table 9 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

4 Results of tests in conformity with 47 CFR Part 15, Subpart E.

4.1 Power limits.

4.1.1 Frequency band of 5150 MHz to 5250 MHz.

Tests have been carried out on the EUT, in accordance with 47 CFR Part 15.407 (a)(1), in order to determine the –26 dB emission bandwidth of the transmitter signal. It has been determined that the –26 dB emission bandwidth is 36.5 MHz.

The peak transmit power limit, based on the –26 dB emission bandwidth, in the frequency band of 5150 MHz to 5250 MHz can be calculated as follows:

+4 dBm + 10 log B, where B is the –26 dB emission bandwidth in MHz;

+4 dBm + 10 log 36.5 = +4 dBm + 15.6 = +19.6 dBm (91.2 mW).

In accordance with 47 CFR Part 15.407 (a)(1) the peak transmit power in the frequency band of 5150 MHz to 5250 MHz shall not exceed the lesser of 50 mW or +4 dBm + 10log B, where B is the –26 dB emission bandwidth in MHz. It has been determined that the peak transmit power limit, based on the –26 dB emission bandwidth, in the frequency band of 5150 MHz to 5250 MHz is 91.2 mW.

In accordance with 47 CFR Part 15.407 (a)(1), the peak transmit power limit, in the frequency band of 5150 MHz to 5250 MHz, has been set to +16.9 dBm (50 mW).

4.1.2 Frequency band of 5250 MHz to 5350 MHz.

Tests have been carried out on the EUT, in accordance with 47 CFR Part 15.407 (a)(2), in order to determine the –26 dB emission bandwidth of the transmitter signal. It has been determined that the –26 dB emission bandwidth is 36.5 MHz.

The peak transmit power limit, based on the –26 dB emission bandwidth, in the frequency band of 5250 MHz to 5350 MHz can be calculated as follows:

+11 dBm + 10 log B, where B is the –26 dB emission bandwidth in MHz;

+11 dBm + 10 log 36.5 = +11 dBm + 15.6 = +26.6 dBm (457.1 mW).

In accordance with 47 CFR Part 15.407 (a)(2) the peak transmit power in the frequency band of 5250 MHz to 5350 MHz shall not exceed the lesser of 250 mW or +11 dBm + 10log B, where B is the –26 dB emission bandwidth in MHz. It has been determined that the peak transmit power limit, based on the –26 dB emission bandwidth, in the frequency band of 5250 MHz to 5350 MHz is 457.1 mW.

In accordance with 47 CFR Part 15.407 (a)(2), the peak transmit power limit, in the frequency band of 5250 MHz to 5350 MHz, has been set to +23.9 dBm (250 mW).

4.1.3 Frequency band of 5725 MHz to 5825 MHz.

47 CFR Part 15.407 (a)(3) is not applicable to the EUT.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

4.2 Maximum peak transmit power.

The results of tests on the EUT, carried out in accordance with 47 CFR Part 15.407 (a)(4), are depicted in table 10. The limits have been derived from 47 CFR Part 15.407 (a)(1) and 47 CFR Part 15.407 (a)(2), see also section 4.1 of this test report.

Transmission bitrate (Mbit/s)	Maximum peak transmit power (dBm)				Limit (dBm) Antenna gain < 6 dBi	
	Ch. 36 (5180 MHz)	Ch. 48 (5240 MHz)	Ch. 52 (5260 MHz)	Ch. 64 (5320 MHz)	5150-5250 MHz	5250-5350 MHz
6	+16.5	+16.3	+16.3	+16.4	+16.9	+23.9
12	+16.5	+16.3	+16.3	+16.4	+16.9	+23.9
24	+16.5	+16.3	+16.3	+16.4	+16.9	+23.9
54	+16.5	+16.3	+16.3	+16.4	+16.9	+23.9

Table 10 - Maximum peak transmit power.

Note: During the measurements, the AC mains supply voltage of the notebook PC in which the EUT was built-in was varied between 85% and 115% of the nominal value. The maximum measured values are depicted in table 10. No differences in measurement results, due to the AC mains voltage variations between 85% and 115% from the nominal value, have been observed. As the antenna gain does not exceed 6 dBi, no reduction of the maximum peak transmit power is required.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

4.3 Peak power spectral density.

The results of the tests on the EUT, carried out in accordance with 47 CFR Part 15.407 (a)(5), are depicted in table 11. The limits have been derived from 47 CFR Part 15.407 (a)(1) and 47 CFR Part 15.407 (a)(2).

It has been determined that the –26 dB emission bandwidth of the EUT is 36.5 MHz. Therefore, in accordance with 47 CFR Part 15.407 (a)(5), the measurements have been carried out over a bandwidth of 1 MHz.

The plots of the measurements regarding the peak power spectral density may be found in section 5.1 of this test report.

Transmission bitrate (Mbit/s)	Peak power spectral density (conducted) in any 1 MHz band (dBm)				Limit (dBm)	
	Ch. 36 (5180 MHz)	Ch. 48 (5240 MHz)	Ch. 52 (5260 MHz)	Ch. 64 (5320 MHz)	5150-5250 MHz	5250-5350 MHz
6	+2.6	+2.1	+2.1	+2.9	+4.0	+11.0
12	+2.8	+1.8	+1.9	+2.2	+4.0	+11.0
24	+2.8	+1.8	+2.0	+2.2	+4.0	+11.0
54	+2.6	+2.0	+2.2	+2.4	+4.0	+11.0

Table 11 - Peak power spectral density.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

4.4 Ratio of the peak excursion of the modulation envelope.

The results of the tests on the EUT, carried out in accordance with 47 CFR Part 15.407 (a)(6), are depicted in table 12.

The plots of the measurements may be found in section 5.2 of this test report. The upper trace represents the measurement while the spectrum analyzer was in peak hold mode with a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz. The lower trace represents the measurement while the spectrum analyzer was in peak hold mode with a resolution bandwidth of 1 MHz and a video bandwidth of 30 kHz.

Transmission bitrate (Mbit/s)	Ratio of the peak excursion of the modulation envelope (dB)			Limit (dB)
	Ch. 36 (5180 MHz)	Ch. 48 (5240 MHz)	Ch. 64 (5320 MHz)	
6	7.7	7.1	6.9	<13.0
12	8.8	8.5	8.1	<13.0
24	8.0	7.5	7.9	<13.0
54	7.9	7.8	7.9	<13.0

Table 12 – Ratio of the peak excursion of the modulation envelope.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

4.5 Peak emissions outside the frequency bands of operation.

4.5.1 Transmitters operating in the 5.15 – 5.25 GHz frequency band.

In accordance with 47 CFR Part 15.407 (b)(1) all emissions outside of the 5.15 – 5.35 GHz frequency band shall not exceed and EIRP of –27 dBm/MHz. The results of these measurements may be found in section 2 of this test report.

4.5.2 Transmitters operating in the 5.25 – 5.35 GHz frequency band.

In accordance with 47 CFR Part 15.407 (b)(2) all emissions outside of the 5.15 – 5.35 GHz frequency band shall not exceed and EIRP of –27 dBm/MHz. The results of these measurements may be found in section 2 of this test report.

4.5.3 Transmitters operating in the 5.725 – 5.825 GHz frequency band.

Not applicable.

4.5.4 Unwanted emissions below 1 GHz.

In accordance with 47 CFR Part 15.407 (b)(5) all unwanted emissions below 1 GHz must comply with the general field strength limits set forth in 47 CFR Part 15.209. The results of these measurements may be found in section 2 of this test report.

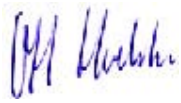
Any U-NII device using an AC power line are required to comply with the conducted limits set forth in 47 CFR Part 15.207. The results of these measurements may be found in section 3 of this test report.

4.5.5 Restricted bands of operation.

In accordance with 47 CFR Part 15.407 (b)(6) intentional radiators need to comply with the provisions of 47 CFR Part 15.205. The results of these measurements may be found in section 2 of this test report.

The plots of the (conducted) measurements regarding unwanted emissions in the 4.5 – 5.15 GHz and 5.35 – 5.46 GHz restricted bands of operation may be found in section 5.3 of this test report.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : August 6, 2002

4.6 Automatic discontinuation of transmissions.

The EUT shall automatically discontinue transmission in case of either absence of information to transmit or operational failure.

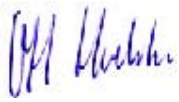
In accordance with 47 CFR Part 15.407 (c) applicants shall include in their application of how this requirement is met.

4.7 Transmitting antenna.

In accordance with 47 CFR Part 15.407 (d) any U-NII device that operates in the 5.15 – 5.25 GHz frequency band shall use a transmitting antenna that is an integral part of the device.

The EUT is fitted with a transmitting antenna that is an integral part of the device.

Test engineer

Signature : 

Name : Onno H. Hoekstra

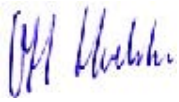
Date : August 6, 2002

4.8 Indoor operations.

In accordance with 47 CFR Part 15.407 (e) U-NII devices operating in 5.15 – 5.25 GHz frequency band are restricted to indoor operations only.

The applicant has declared that the EUT is intended for indoor operations only.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : August 6, 2002

4.9 Radio frequency radiation exposure.

In accordance with 47 CFR Part 15.407 (f) U-NII devices are subject to the radio frequency radiation exposure requirements specified in 47 CFR Part 1.1307 (b), 47 CFR Part 2.1091 and 47 CFR Part 2.1093, as appropriate. All equipment shall be considered to operate in a “general population/uncontrolled” environment.

In accordance with 47 CFR Part 15.407 (f) applicants shall include in their application of how this requirement is met.

4.10 Frequency stability.

In accordance with 47 CFR Part 15.407 (g) the frequency stability of U-NII devices must be such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

The results of tests on the EUT, carried out in order to determine the frequency stability under extreme temperature conditions combined with variations in the AC mains input voltage, are depicted in table 13.

Test conditions		Frequency (MHz)		
		Channel 36 (5180 MHz)	Channel 52 (5260 MHz)	Channel 64 (5320 MHz)
T = +21 °C	V = 110 VAC	5179.9852	5259.9835	5319.9829
T = 0 °C	V = 93.5 VAC	5179.9857	5259.9853	5319.9851
	V = 126.5 VAC	5179.9857	5259.9853	5319.9851
T = +35 °C	V = 93.5 VAC	5179.9908	5259.9869	5319.9863
	V = 126.5 VAC	5179.9908	5259.9870	5319.9864

Table 13 – Frequency stability

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : August 6, 2002

5 Plots of measurement data.

For reference purposes and visualization of spectrum analyzer settings during the measurements, a selection of plots of measurement data is included in this test report.

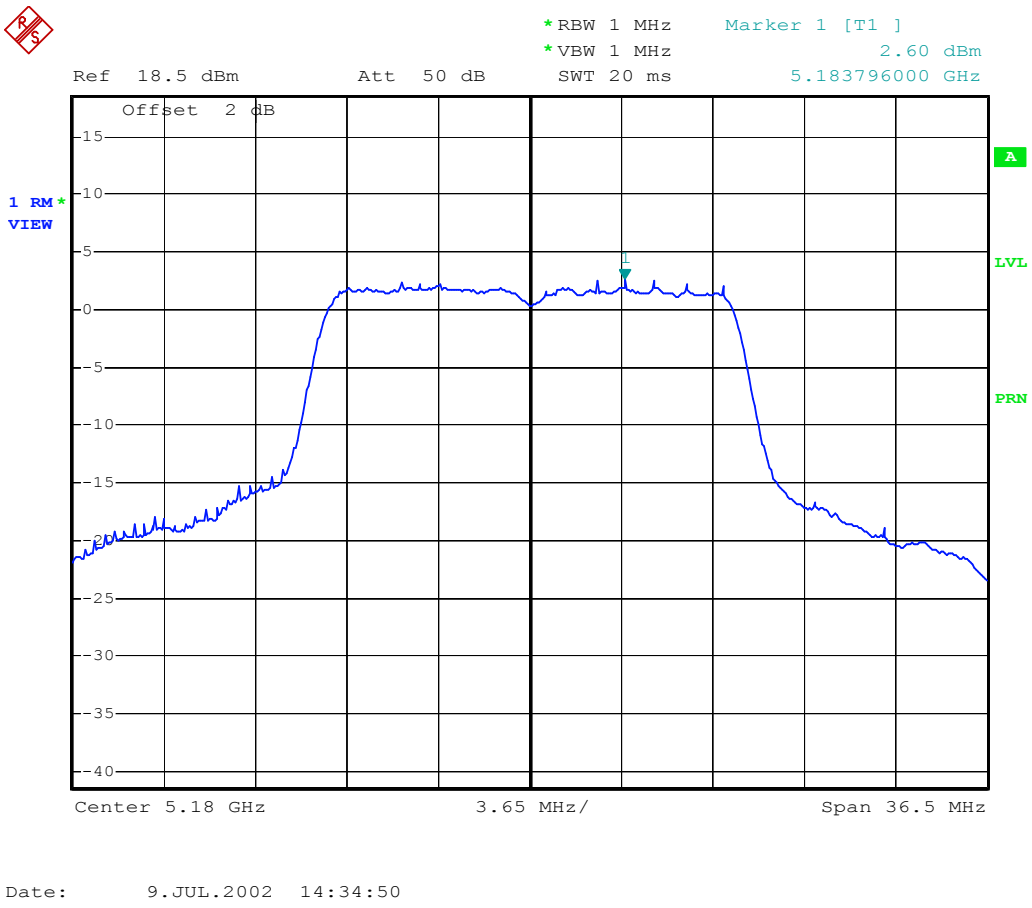
Test engineer

Signature :

Name : Onno H. Hoekstra

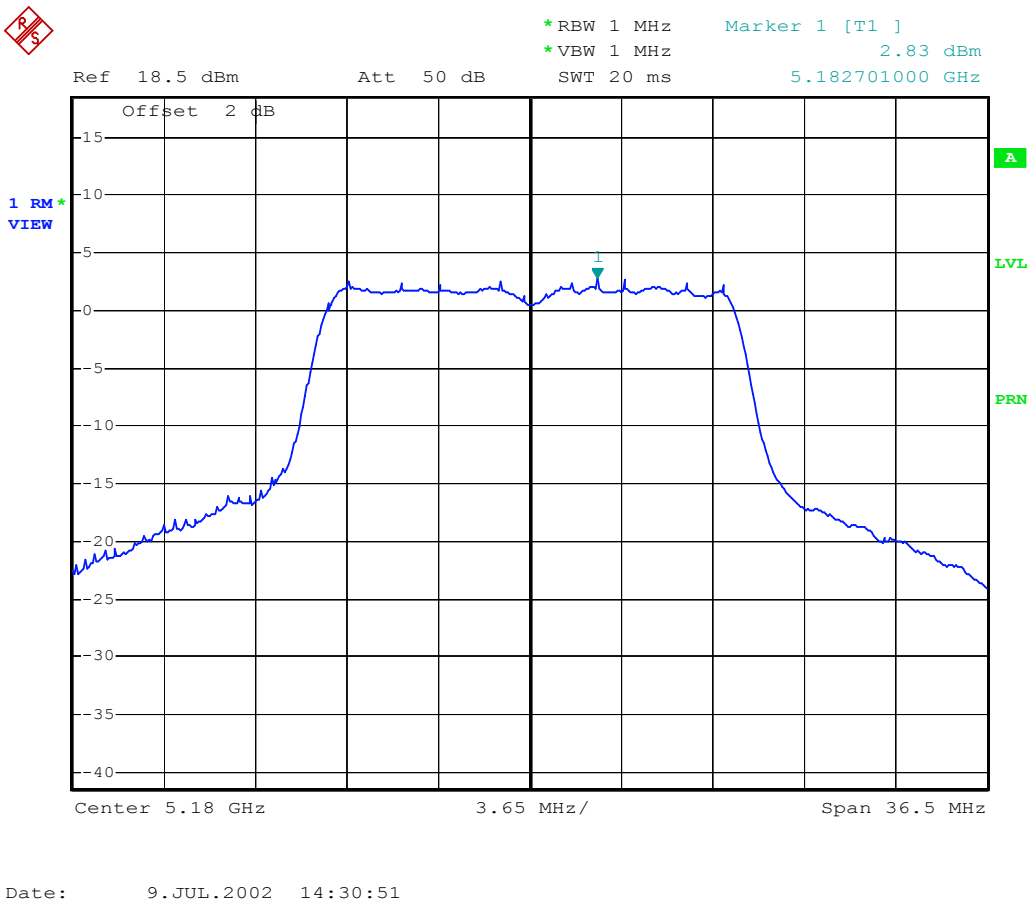
Date : August 6, 2002

5.1 Peak power spectral density, 47 CFR Part 15.407 (a)(5).



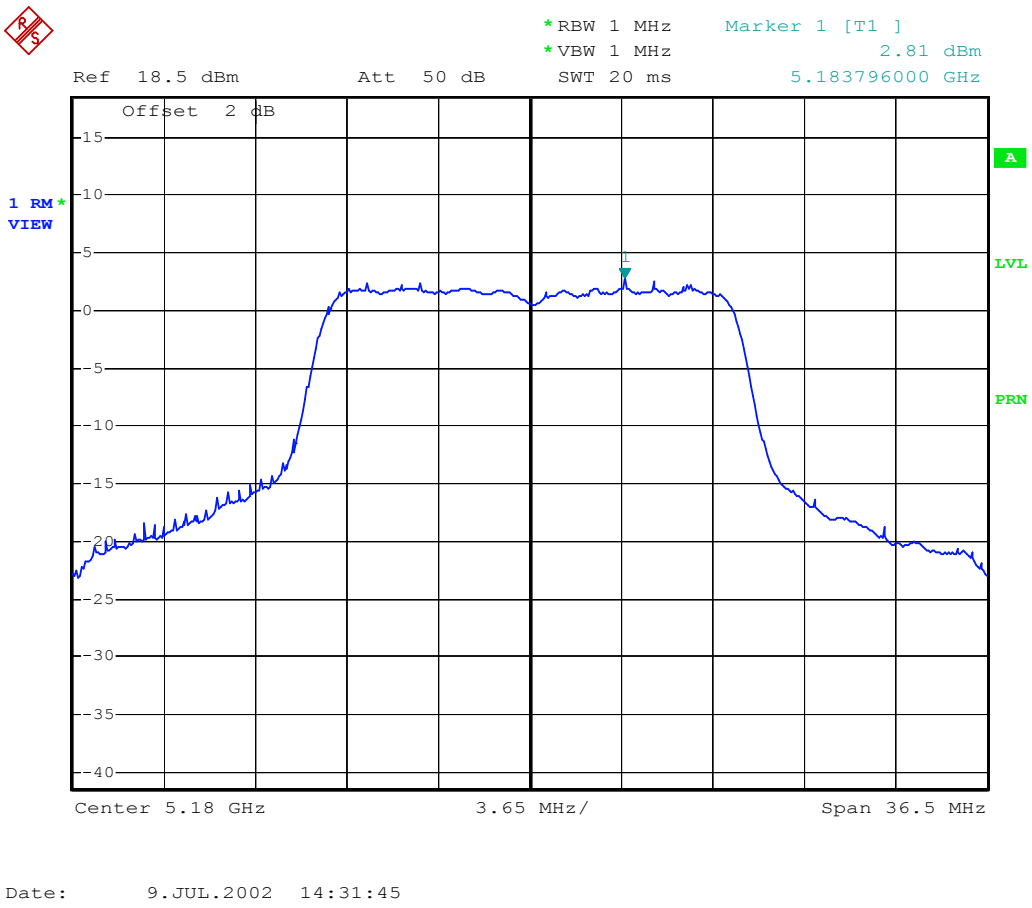
Plot 1 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 6 Mbit/s. Corrected (offset) for cable losses of +2 dB.



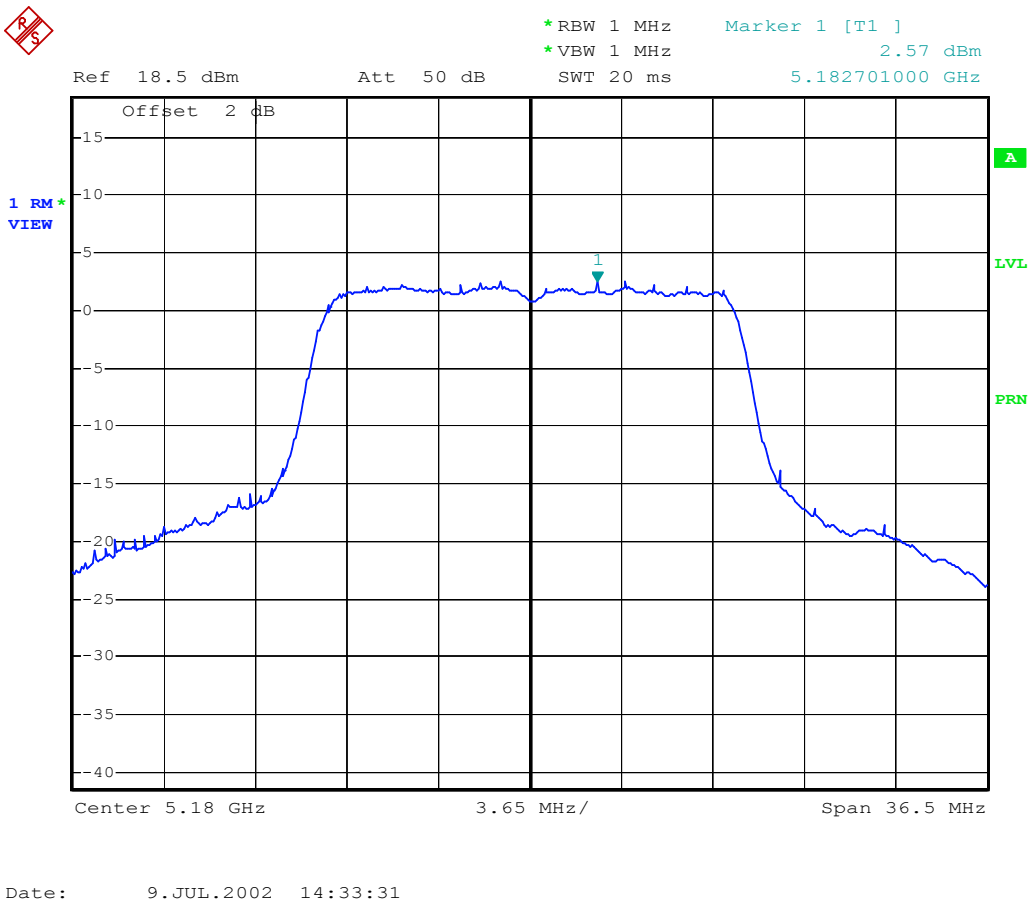
Plot 2 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 12 Mbit/s. Corrected (offset) for cable losses of +2 dB.



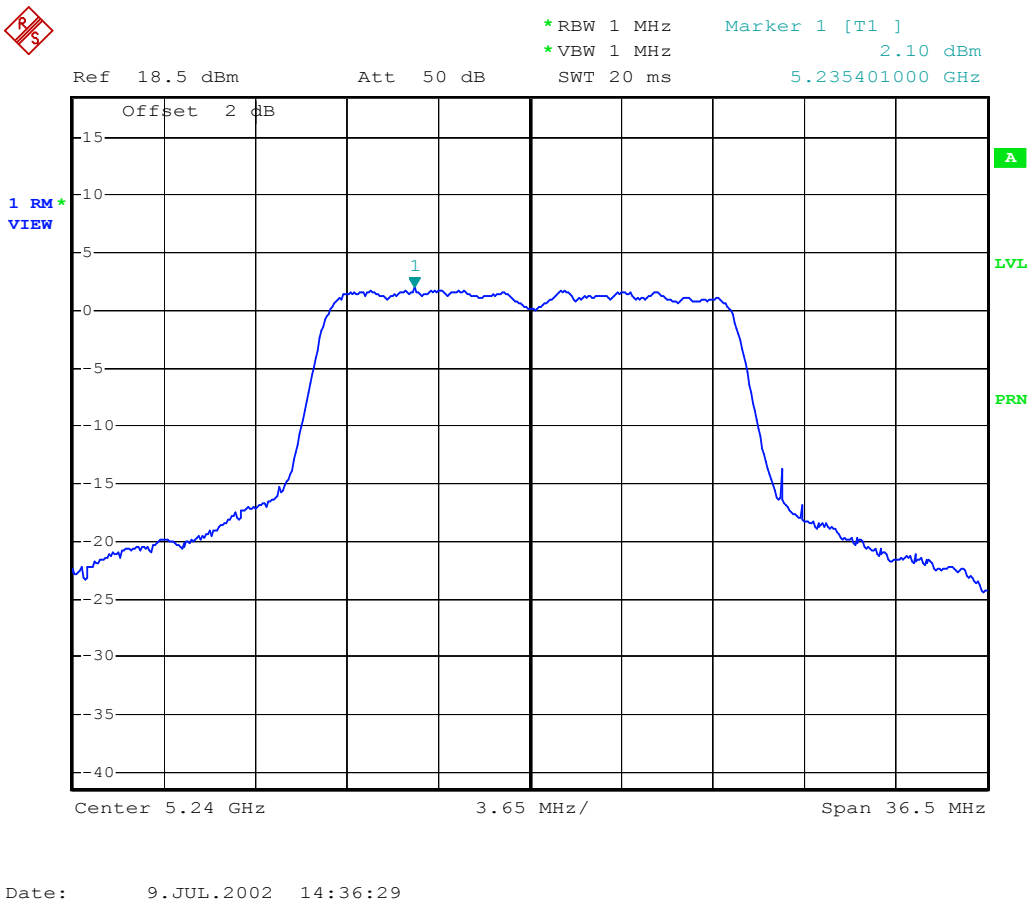
Plot 3 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 24 Mbit/s. Corrected (offset) for cable losses of +2 dB.



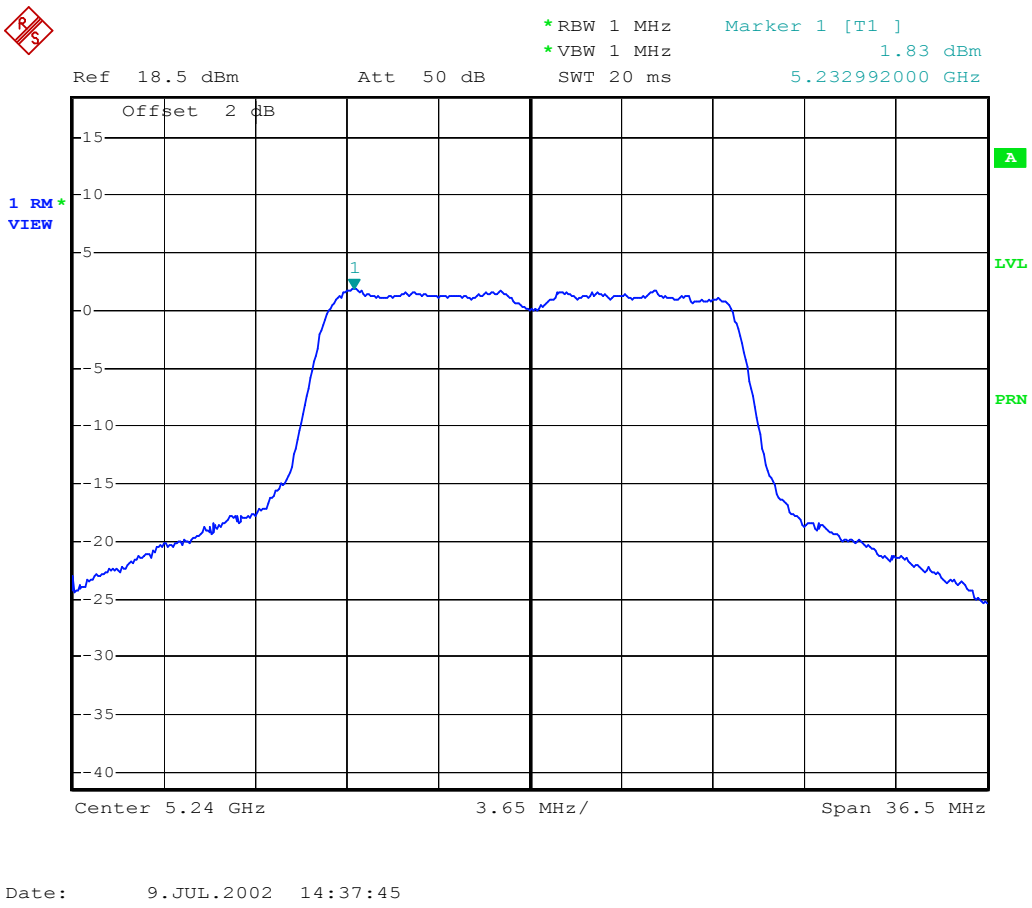
Plot 4 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 54 Mbit/s. Corrected (offset) for cable losses of +2 dB.



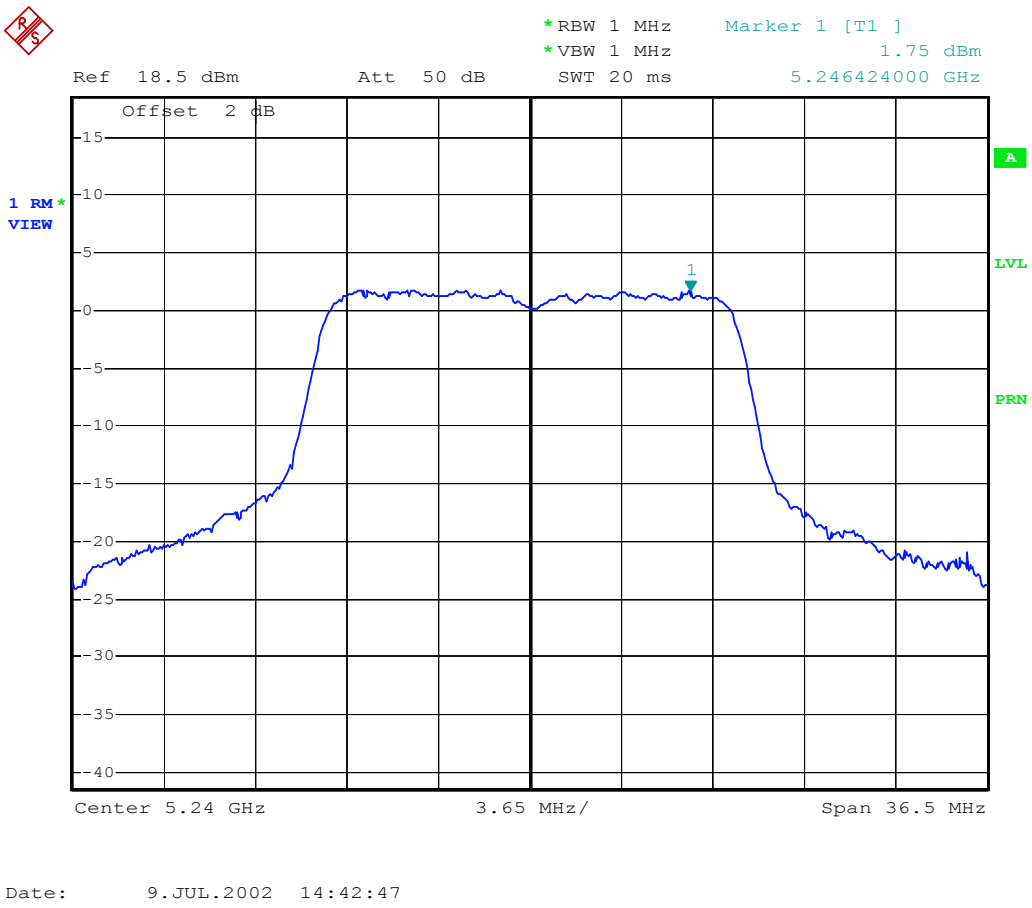
Plot 5 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 6 Mbit/s. Corrected (offset) for cable losses of +2 dB.



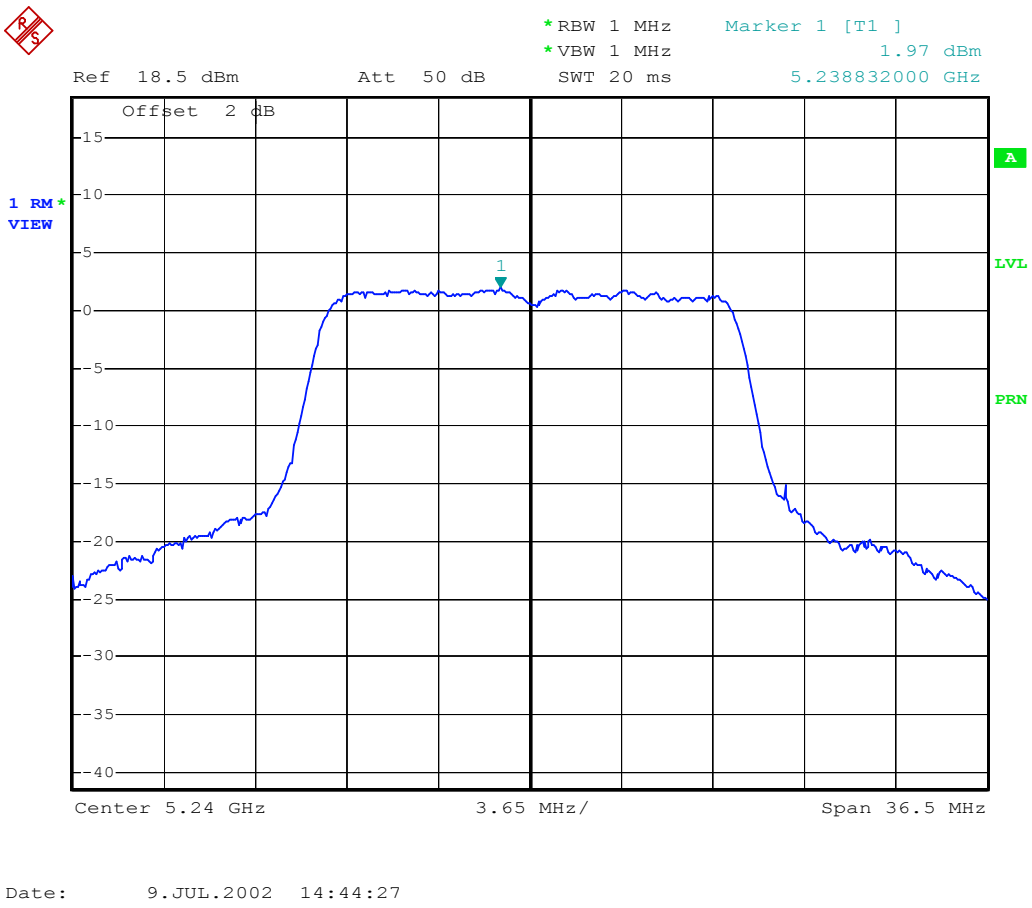
Plot 6 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 12 Mbit/s. Corrected (offset) for cable losses of +2 dB.



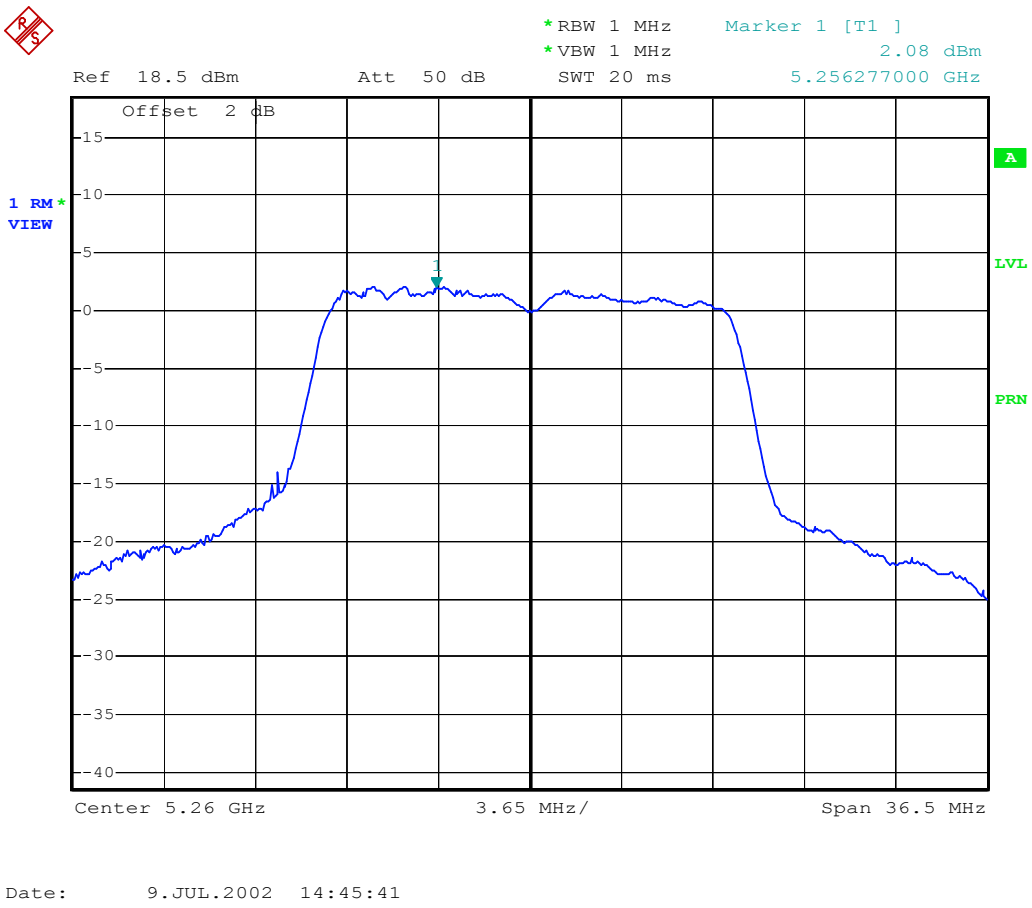
Plot 7 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 24 Mbit/s. Corrected (offset) for cable losses of +2 dB.



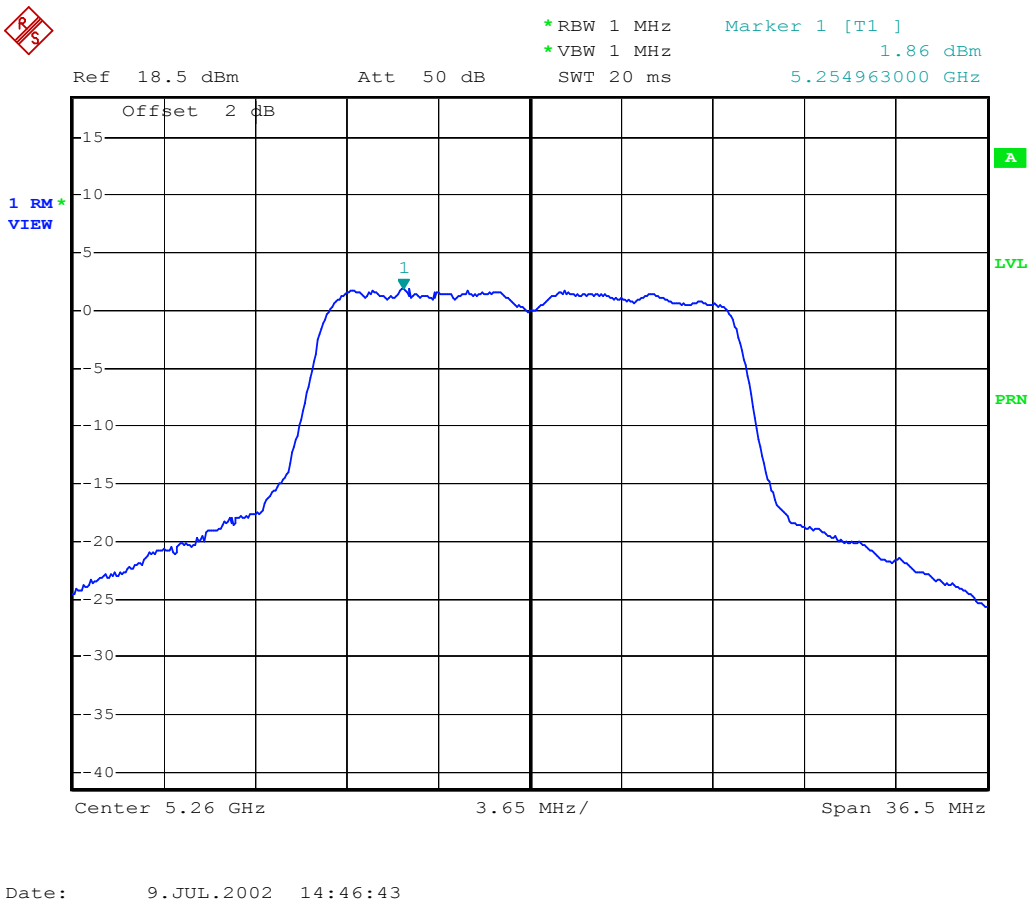
Plot 8 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 54 Mbit/s. Corrected (offset) for cable losses of +2 dB.



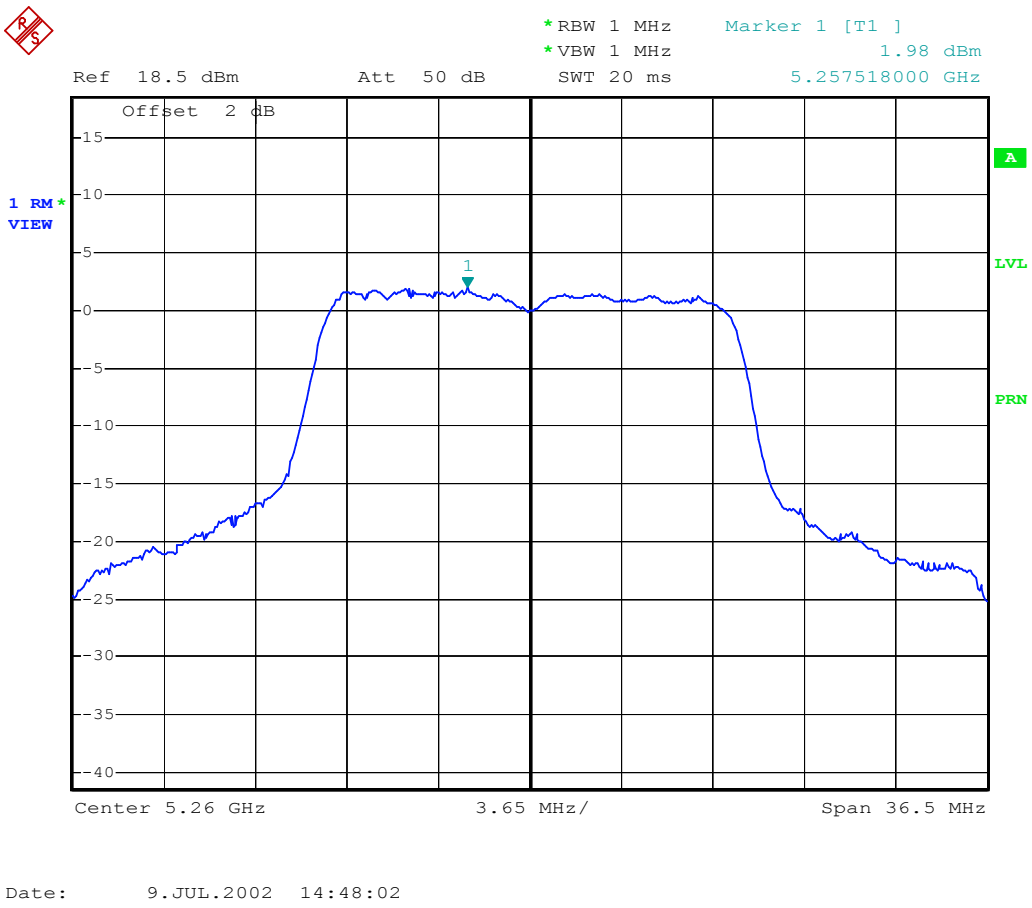
Plot 9 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 52 (5260 MHz) at a transmission bit-rate of 6 Mbit/s. Corrected (offset) for cable losses of +2 dB.



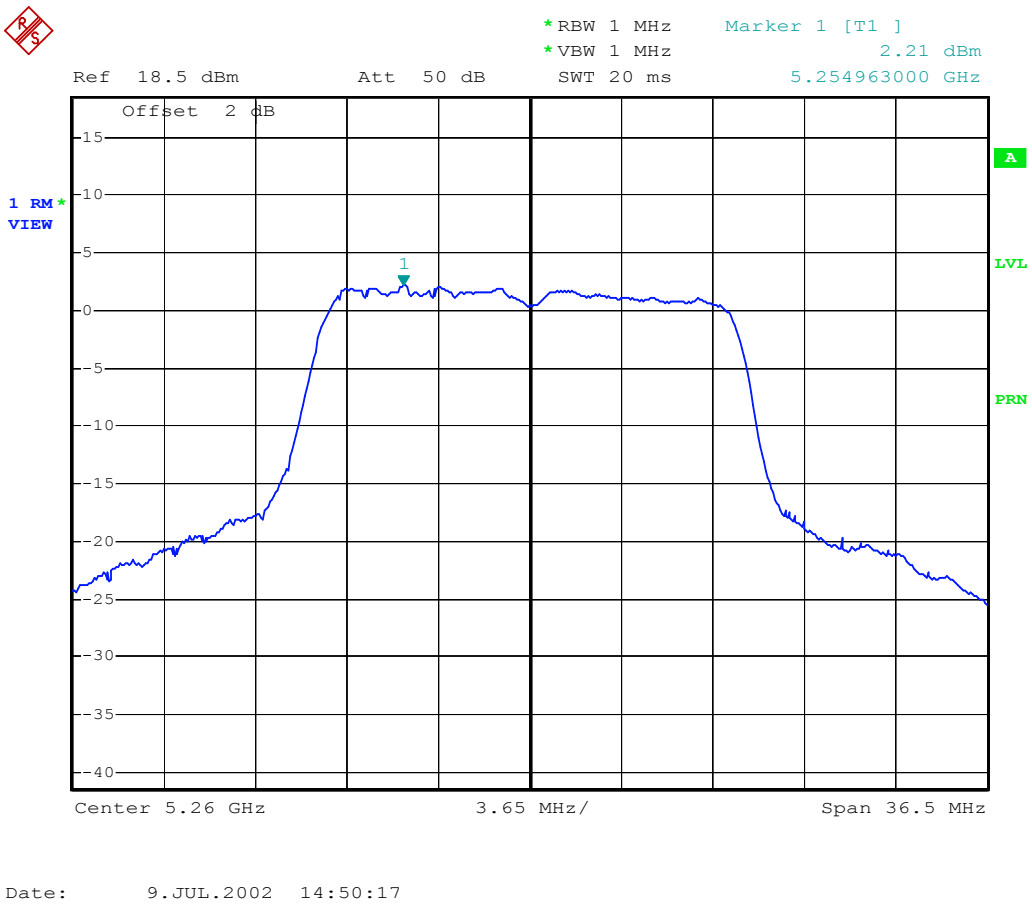
Plot 10 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 52 (5260 MHz) at a transmission bit-rate of 12 Mbit/s. Corrected (offset) for cable losses of +2 dB.



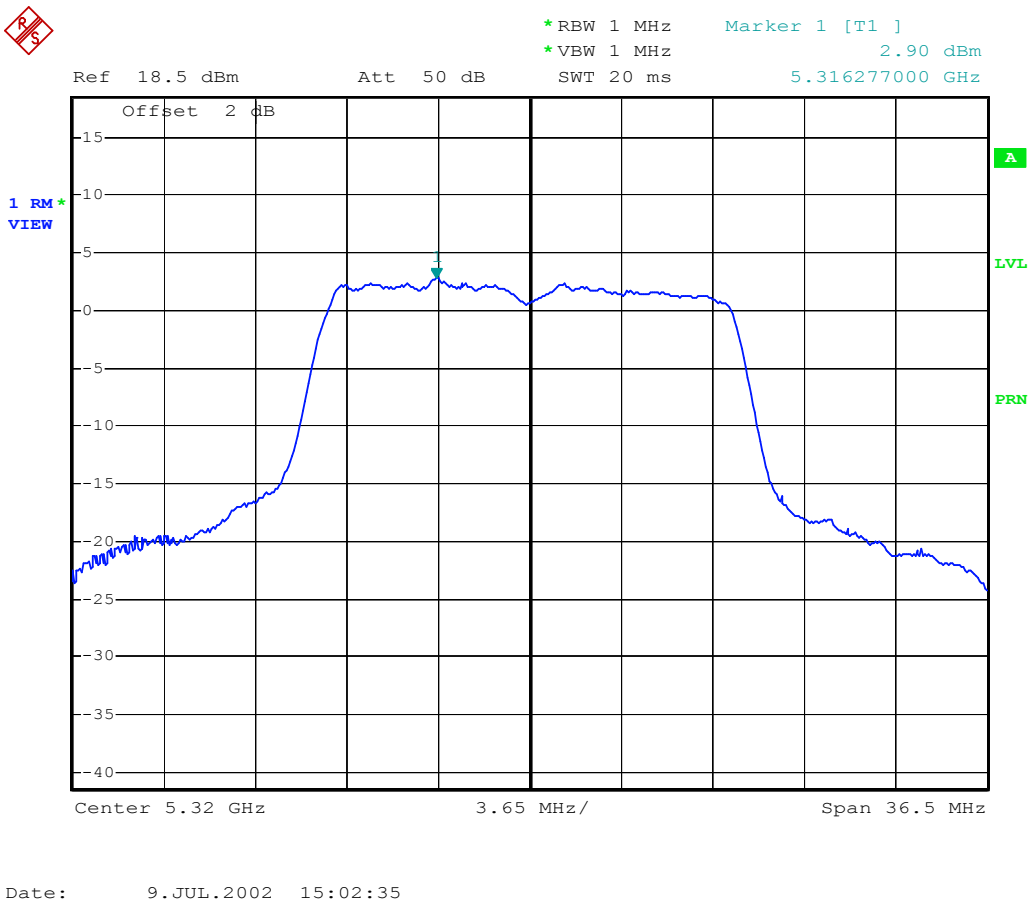
Plot 11 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 52 (5260 MHz) at a transmission bit-rate of 24 Mbit/s. Corrected (offset) for cable losses of +2 dB.



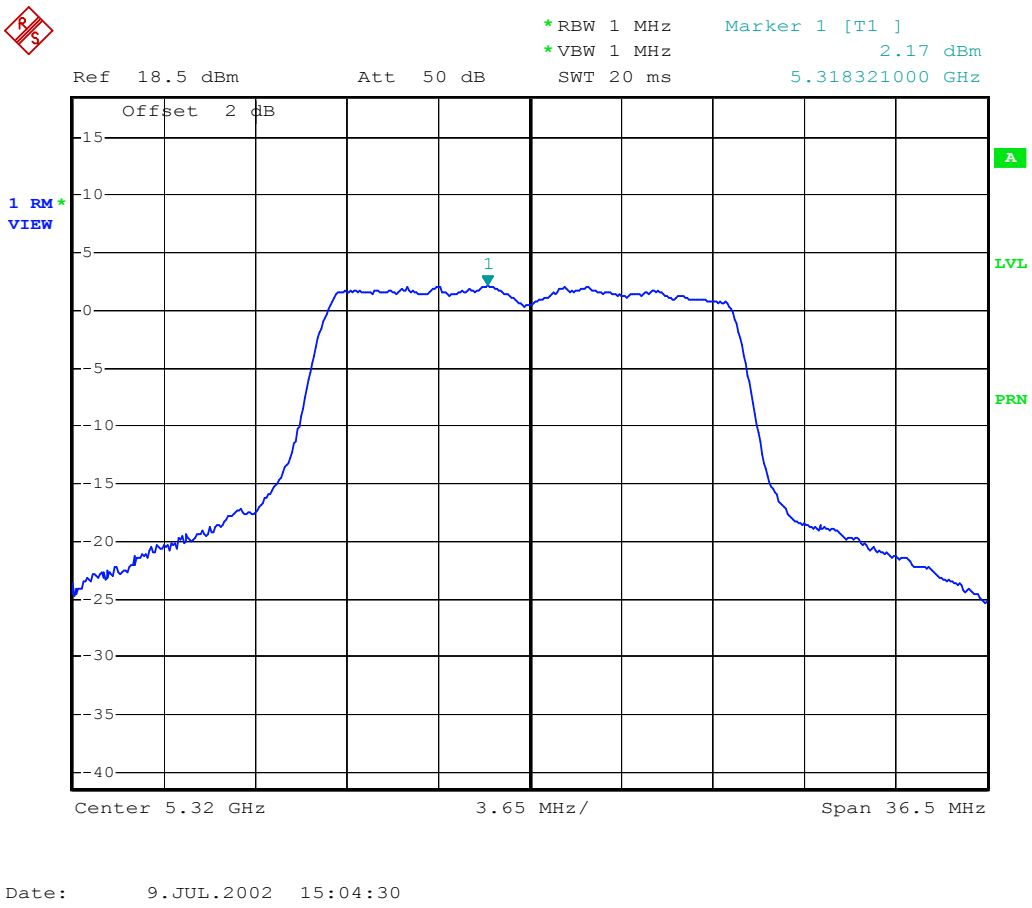
Plot 12 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 52 (5260 MHz) at a transmission bit-rate of 54 Mbit/s. Corrected (offset) for cable losses of +2 dB.



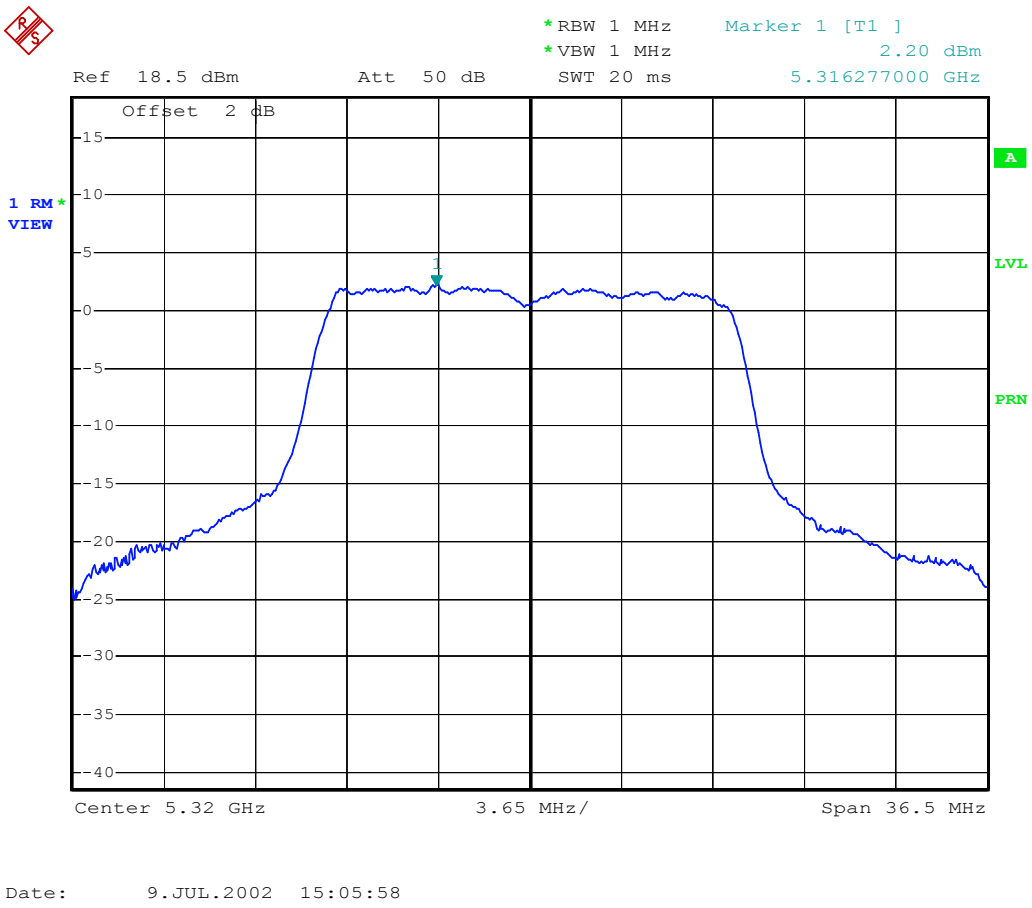
Plot 13 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 6 Mbit/s. Corrected (offset) for cable losses of +2 dB.



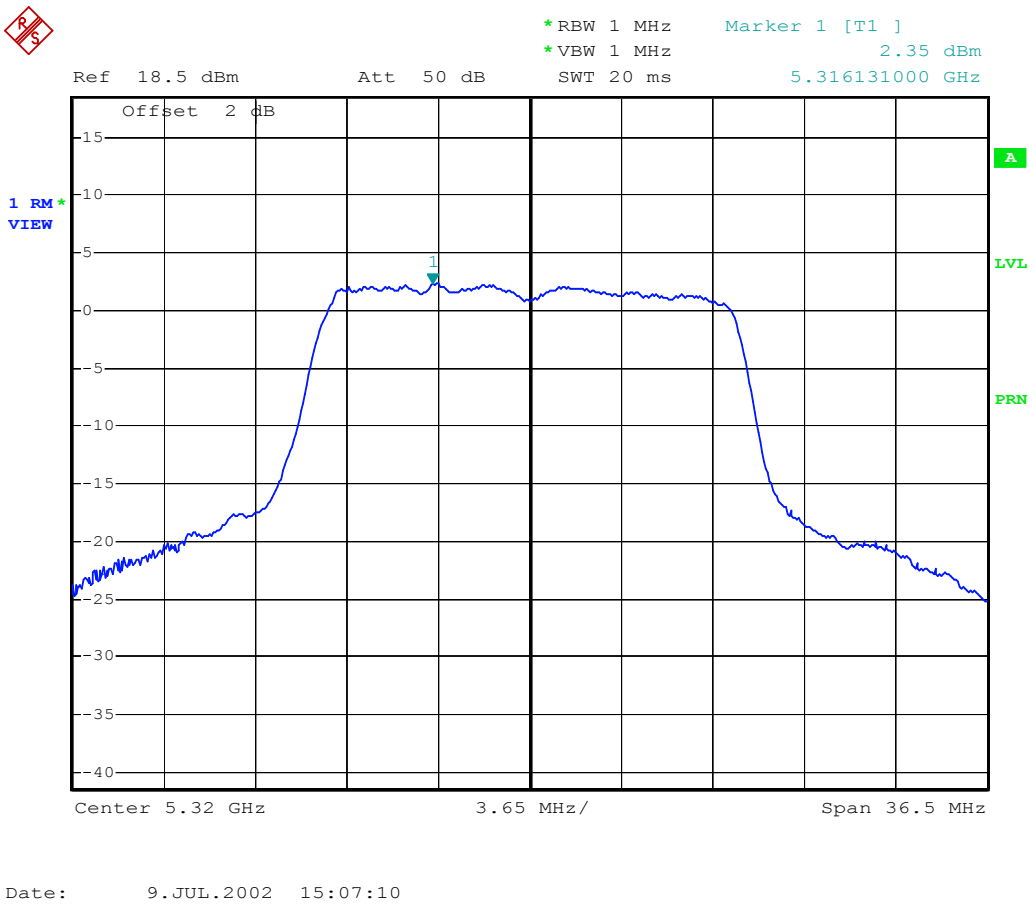
Plot 14 - Peak power spectral density (conducted) in any 1 MHz band.

Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 12 Mbit/s. Corrected (offset) for cable losses of +2 dB.



Plot 15 - Peak power spectral density (conducted) in any 1 MHz band.

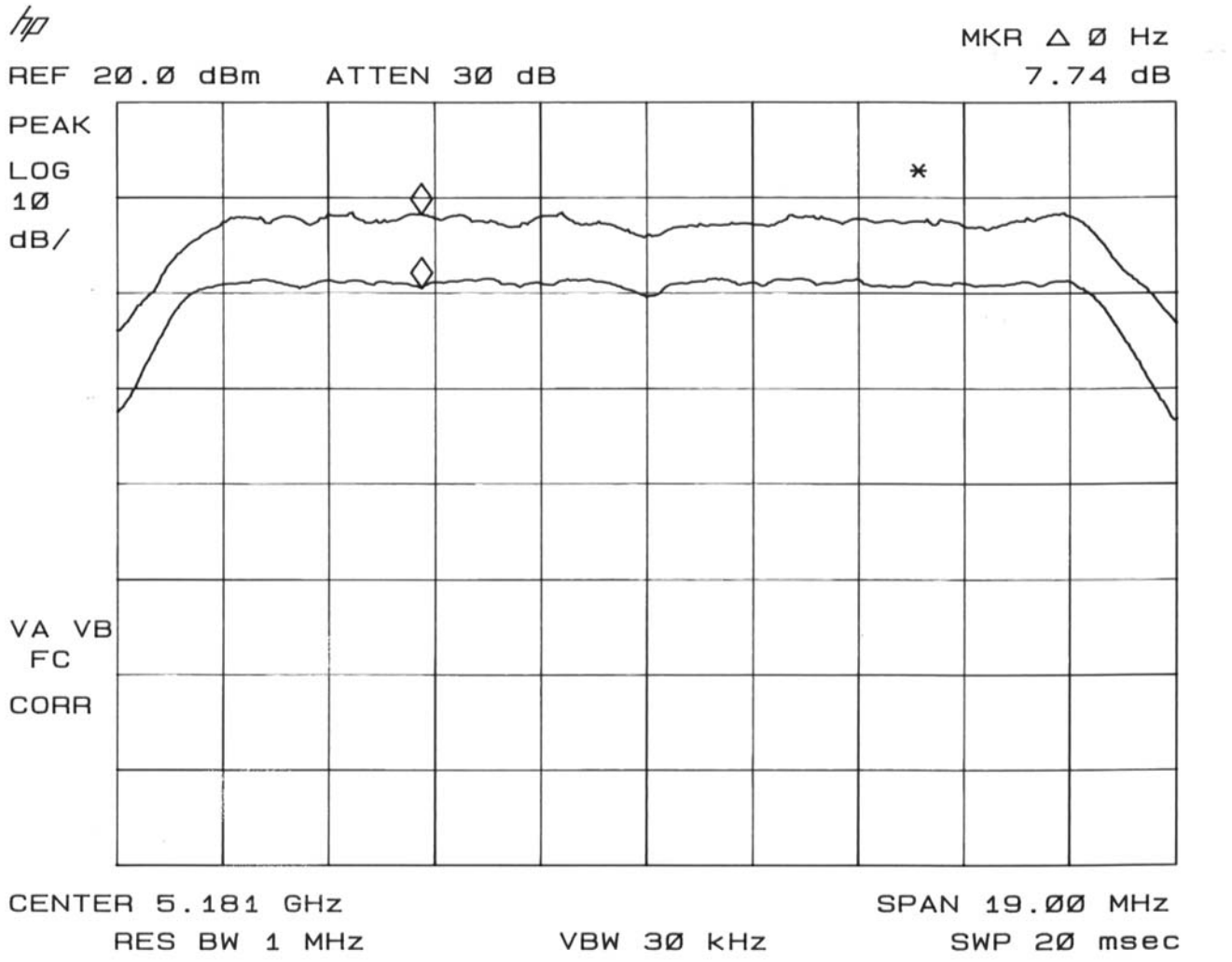
Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 24 Mbit/s. Corrected (offset) for cable losses of +2 dB.



Plot 16 - Peak power spectral density (conducted) in any 1 MHz band.

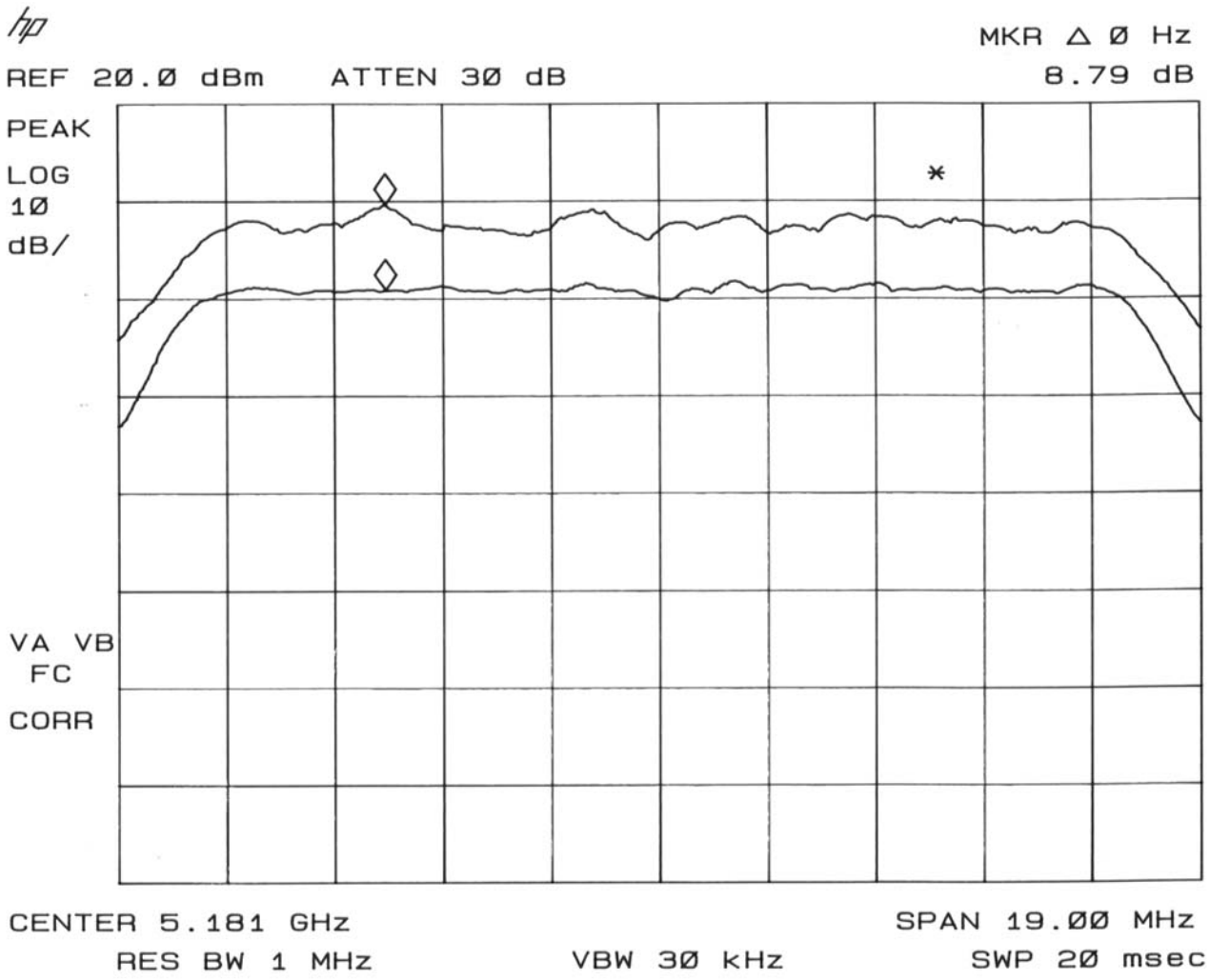
Peak power spectral density (conducted) in any 1 MHz band with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 54 Mbit/s. Corrected (offset) for cable losses of +2 dB.

5.2 Ratio of the peak excursion of the modulation envelope, 47 CFR Part 15.407 (a)(6).



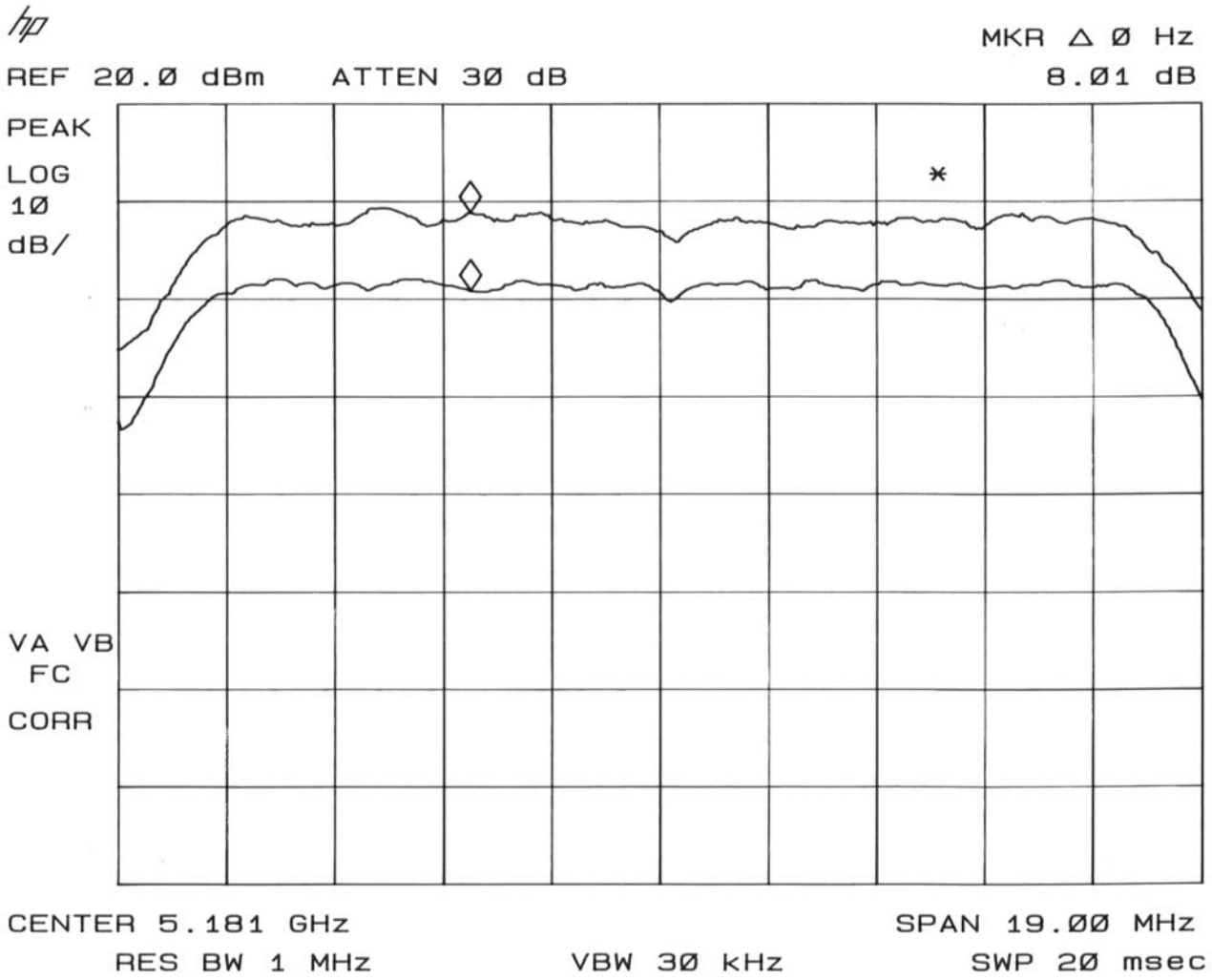
Plot 17 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 6 Mbit/s.



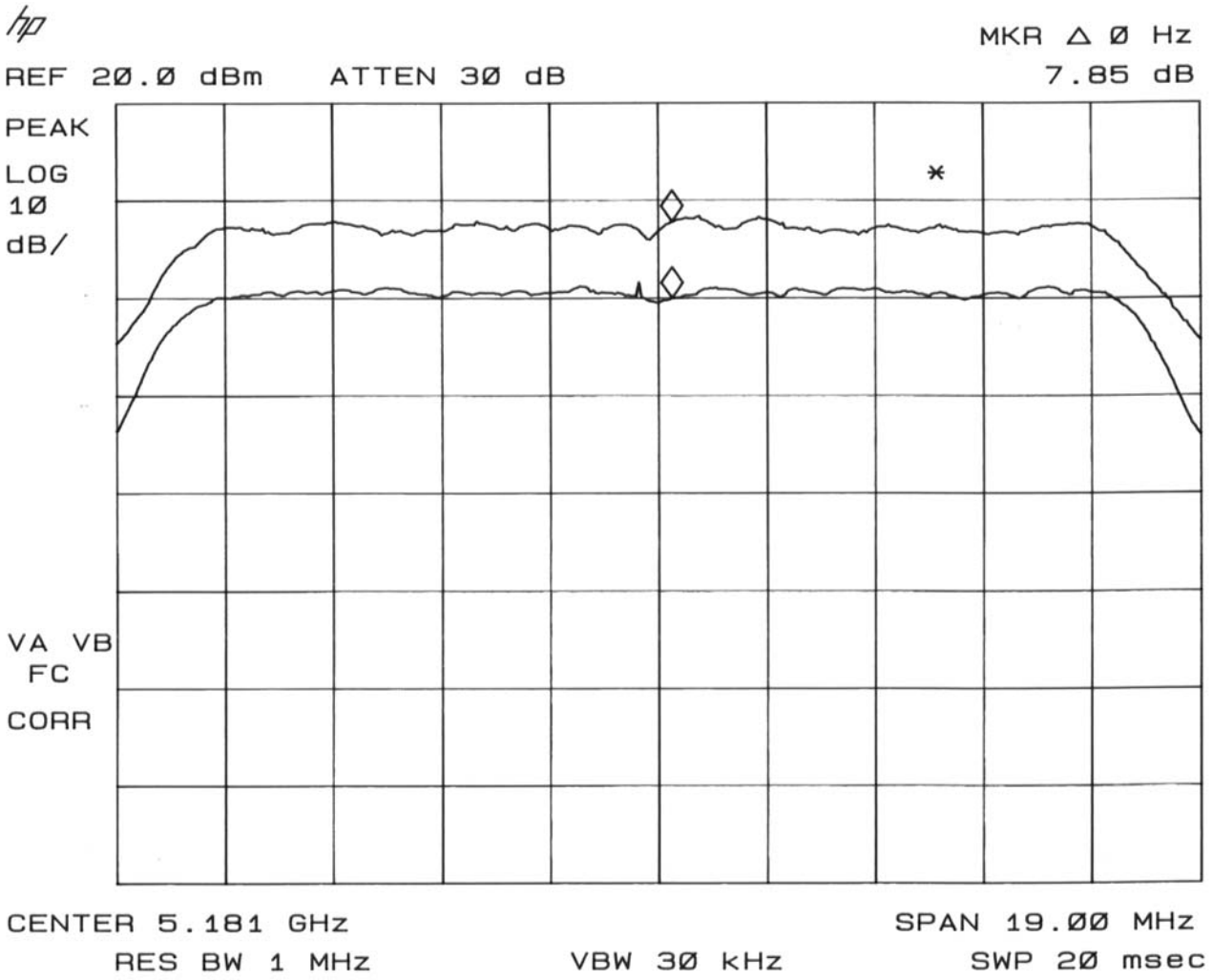
Plot 18 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 12 Mbit/s.



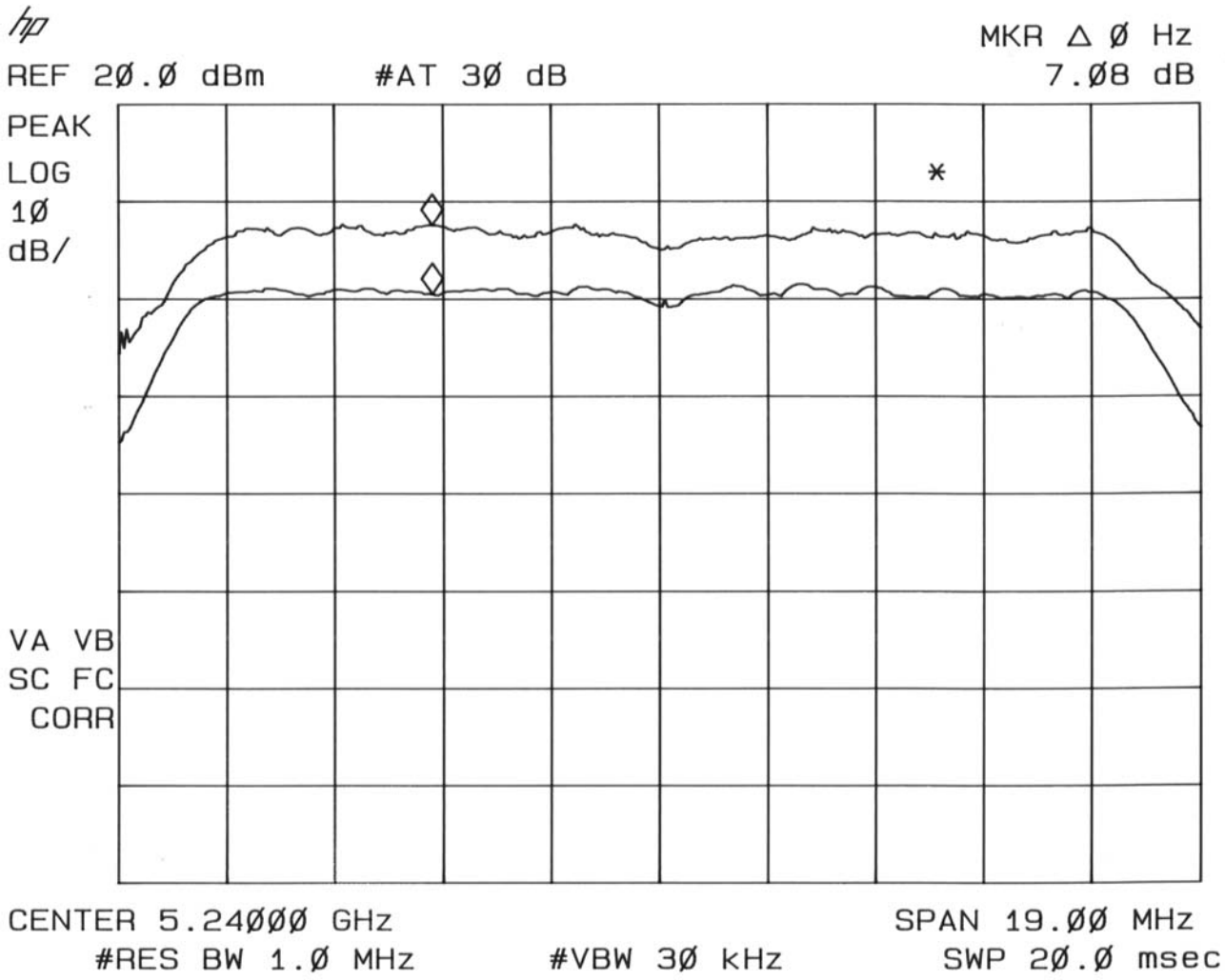
Plot 19 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 24 Mbit/s.



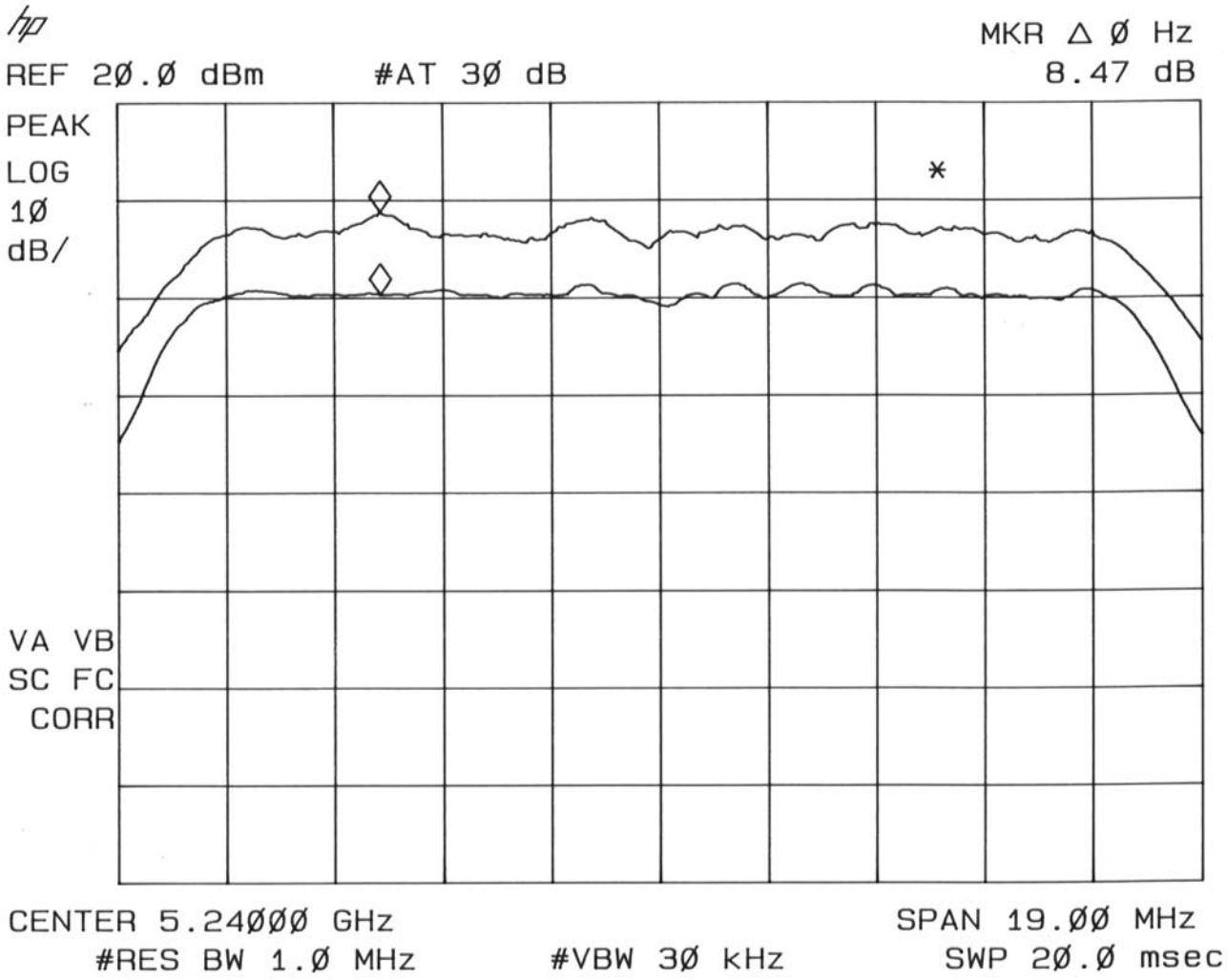
Plot 20 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 36 (5180 MHz) at a transmission bit-rate of 54 Mbit/s.



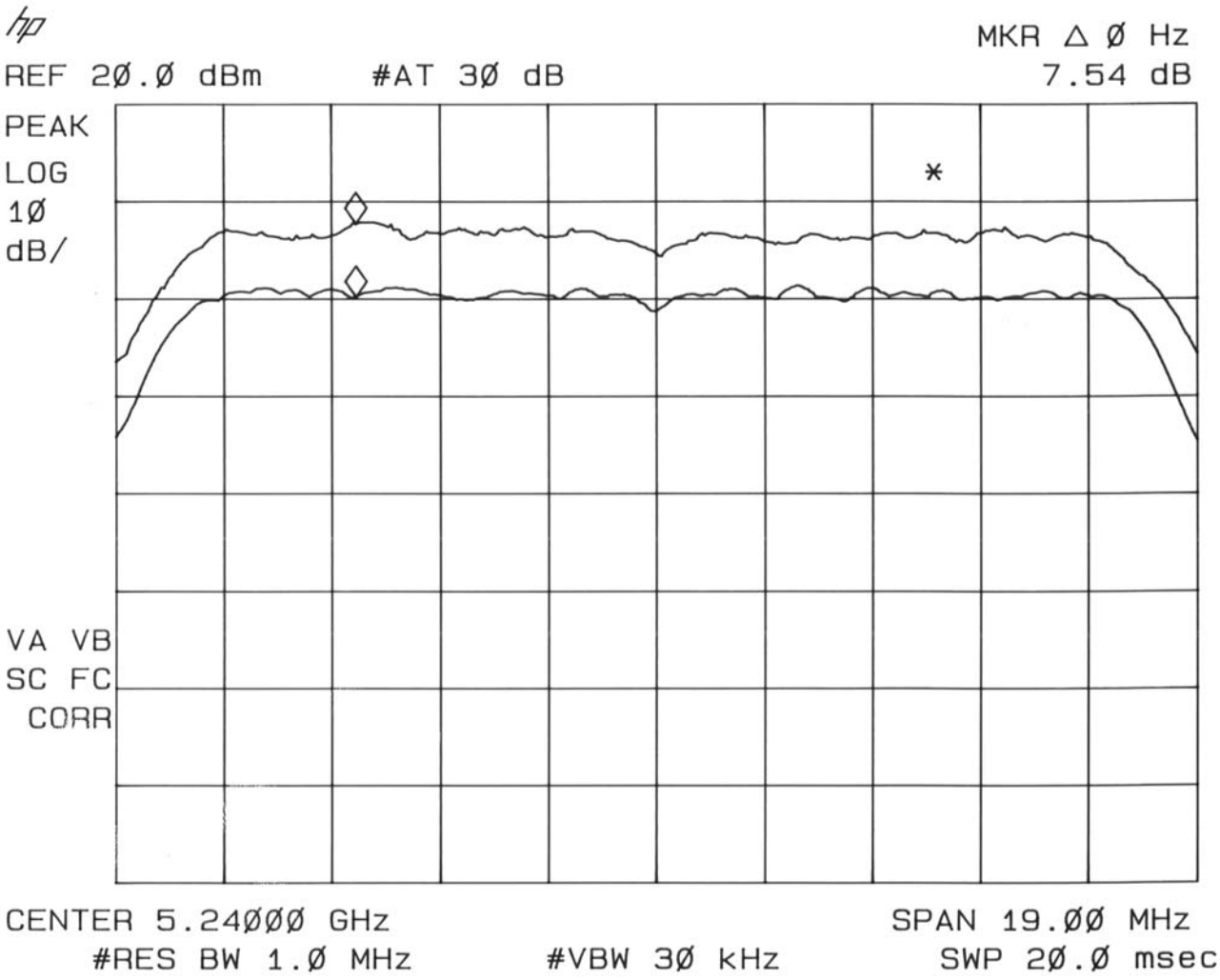
Plot 21 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 6 Mbit/s.



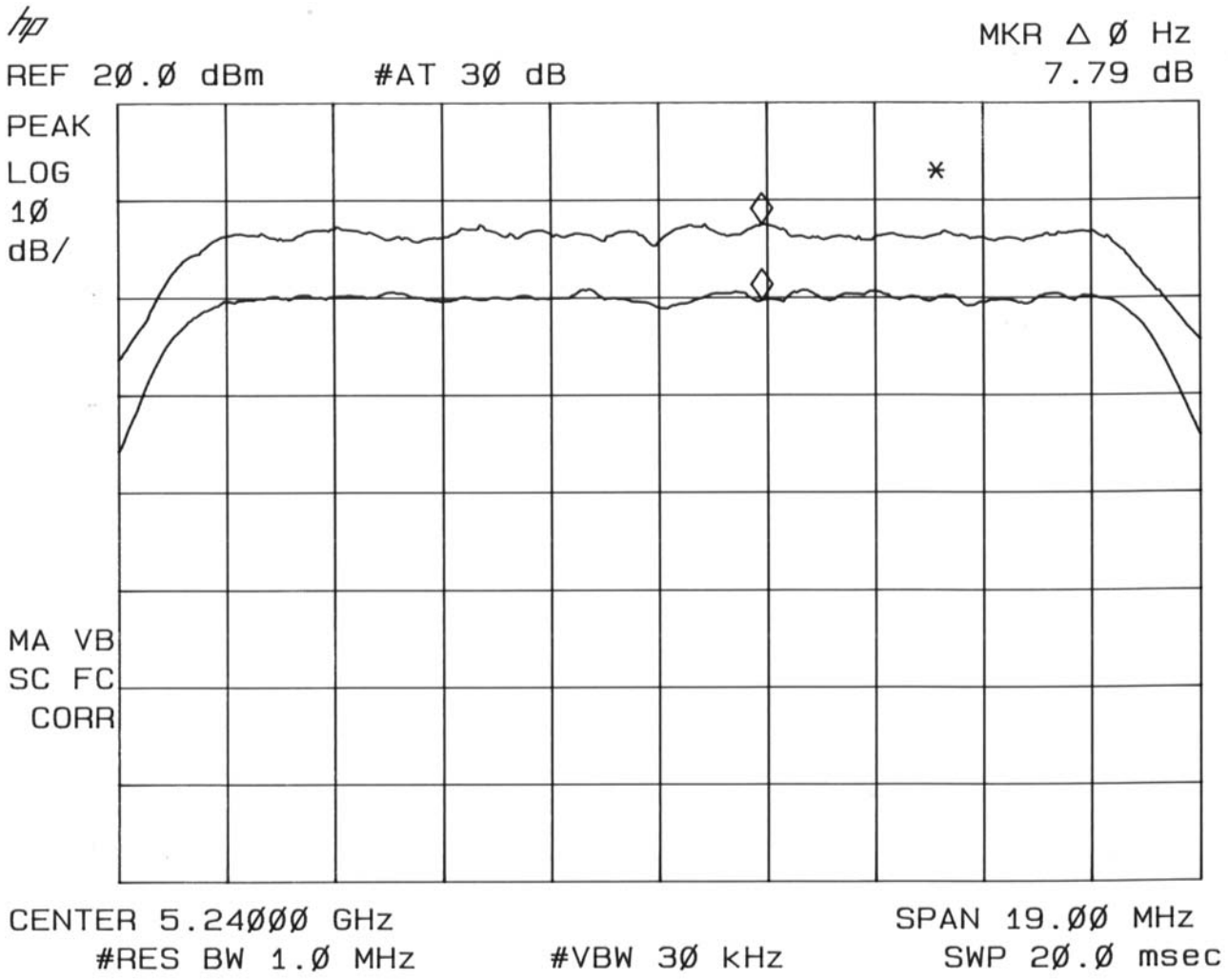
Plot 22 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 12 Mbit/s.



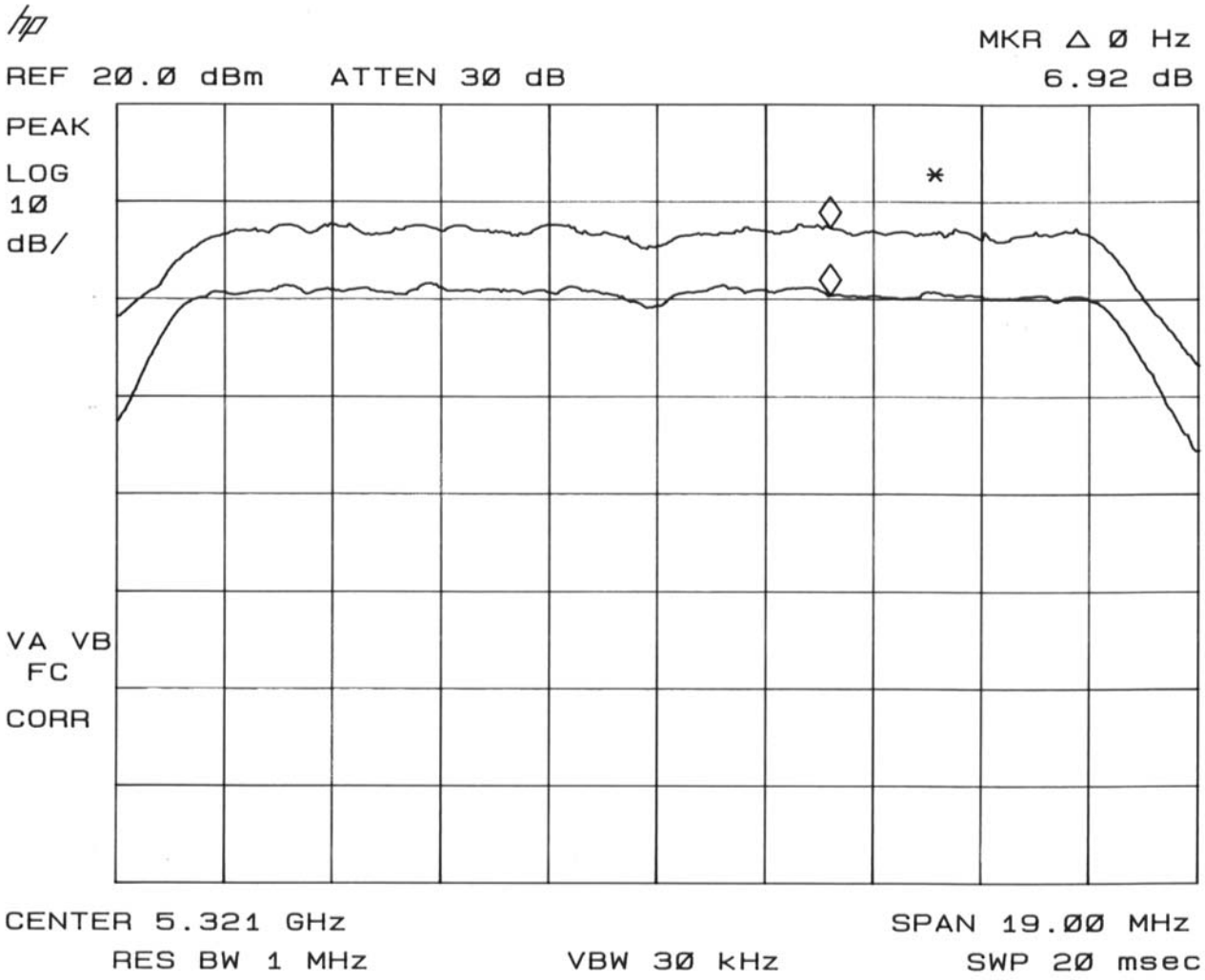
Plot 23 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 24 Mbit/s.



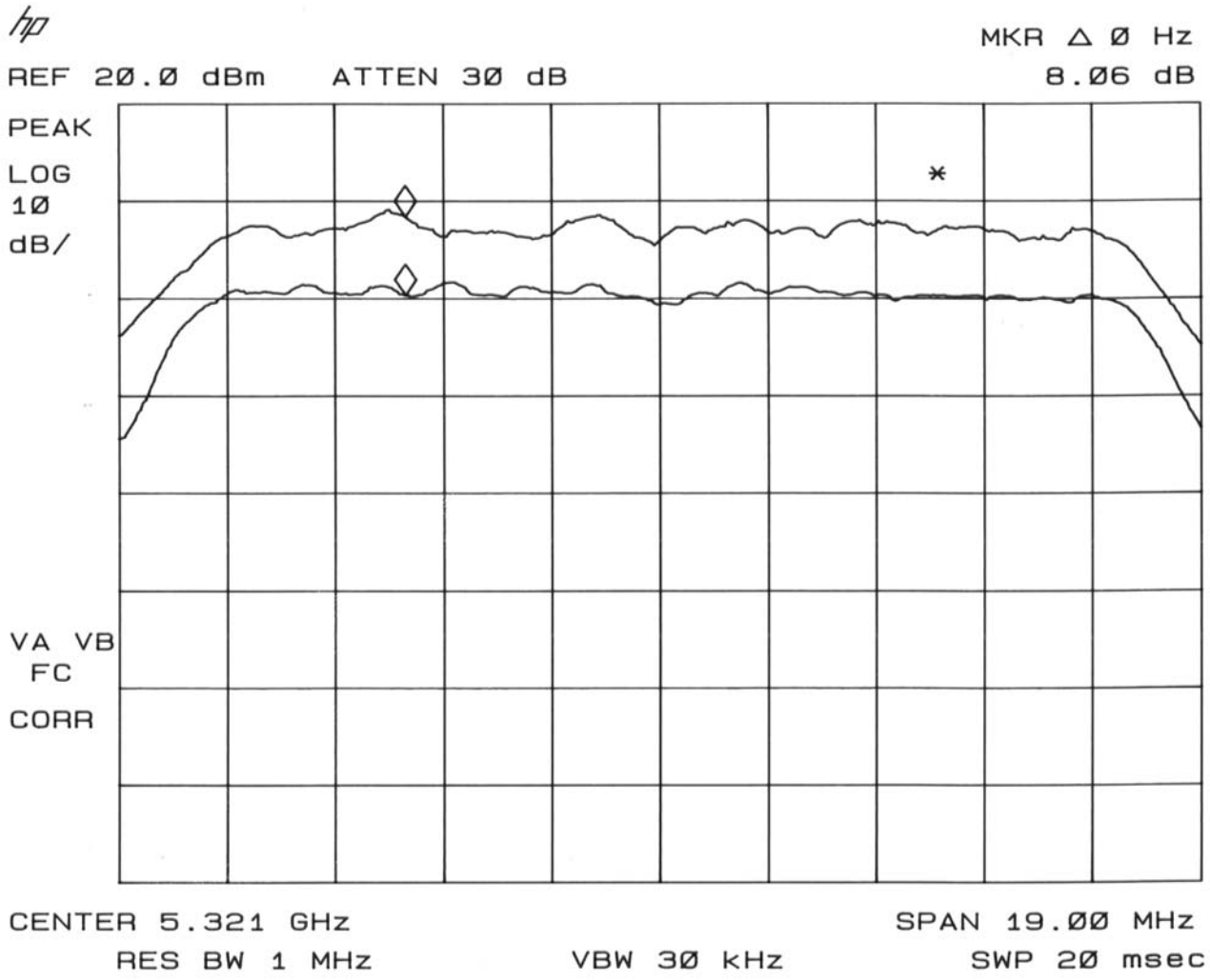
Plot 24 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 48 (5240 MHz) at a transmission bit-rate of 54 Mbit/s.



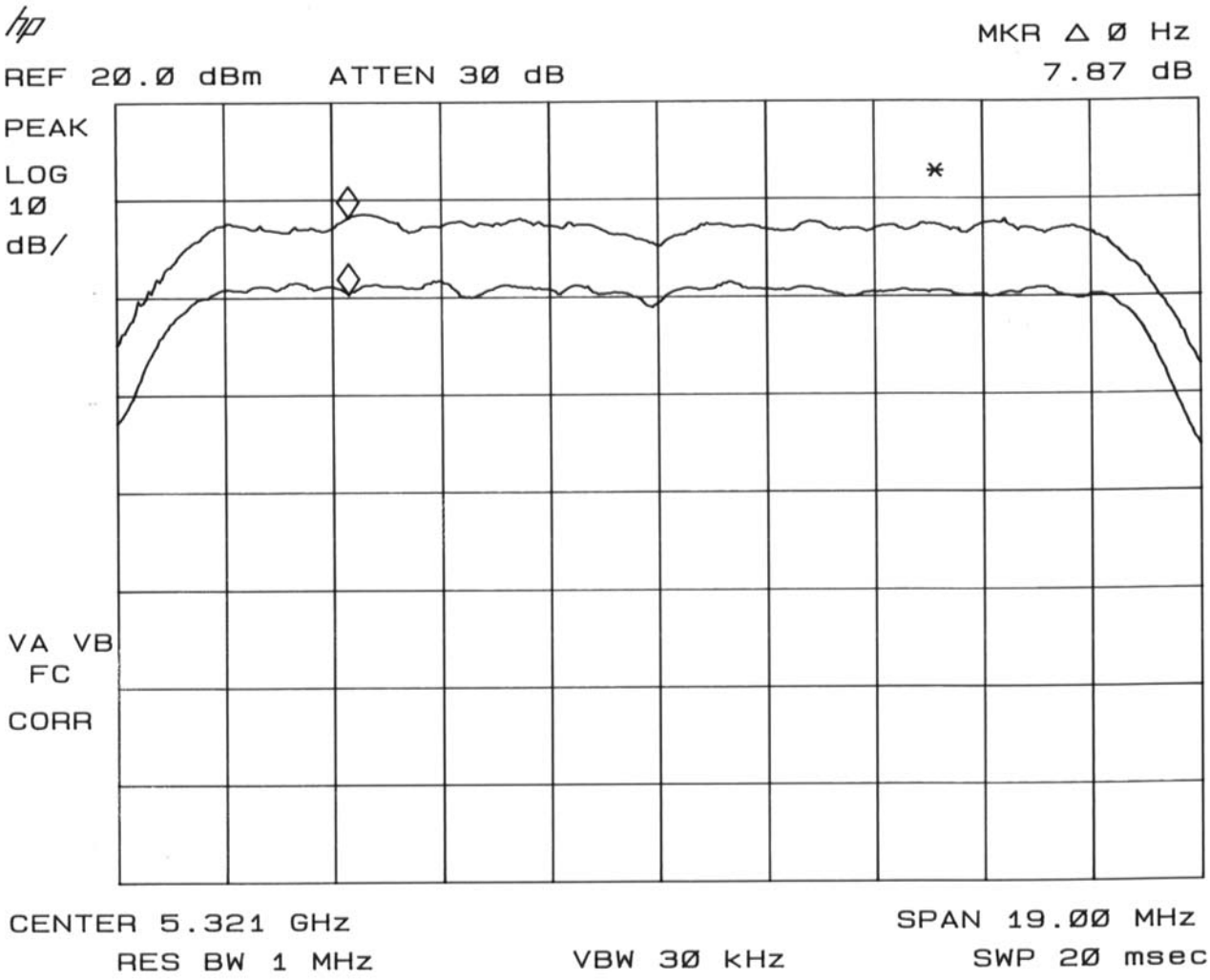
Plot 25 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 6 Mbit/s.



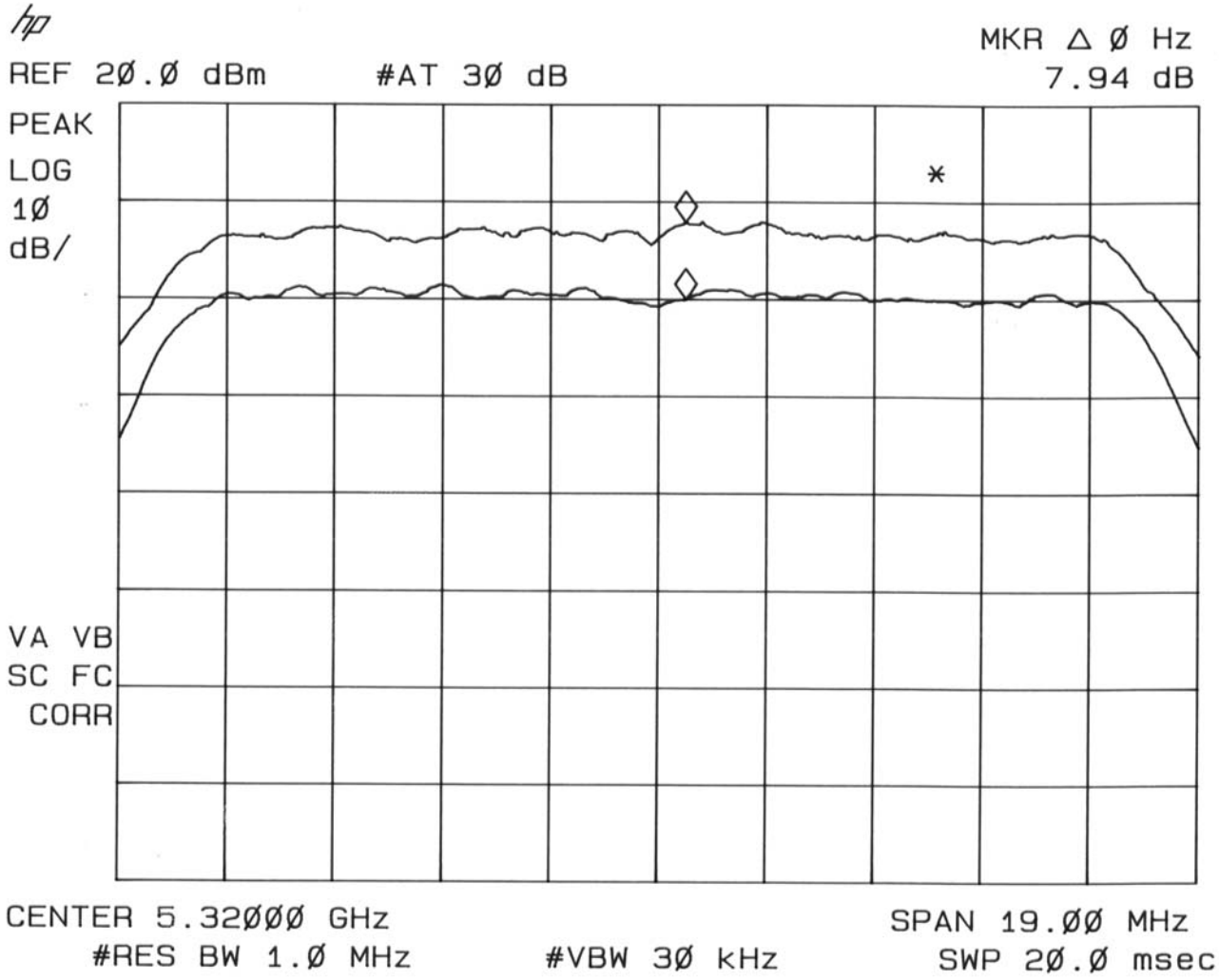
Plot 26 – Ratio of the peak excursion of the modulation envelope.

Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 12 Mbit/s.



Plot 27 – Ratio of the peak excursion of the modulation envelope.

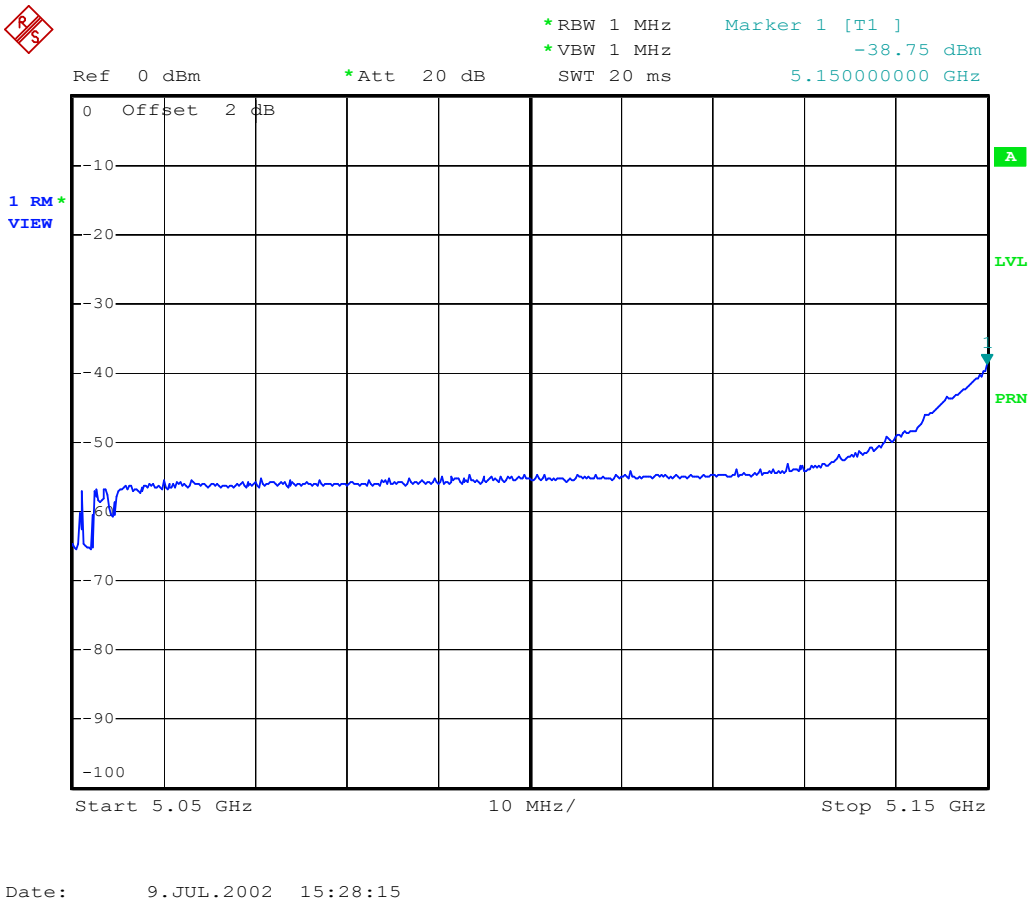
Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 24 Mbit/s.



Plot 28 – Ratio of the peak excursion of the modulation envelope.

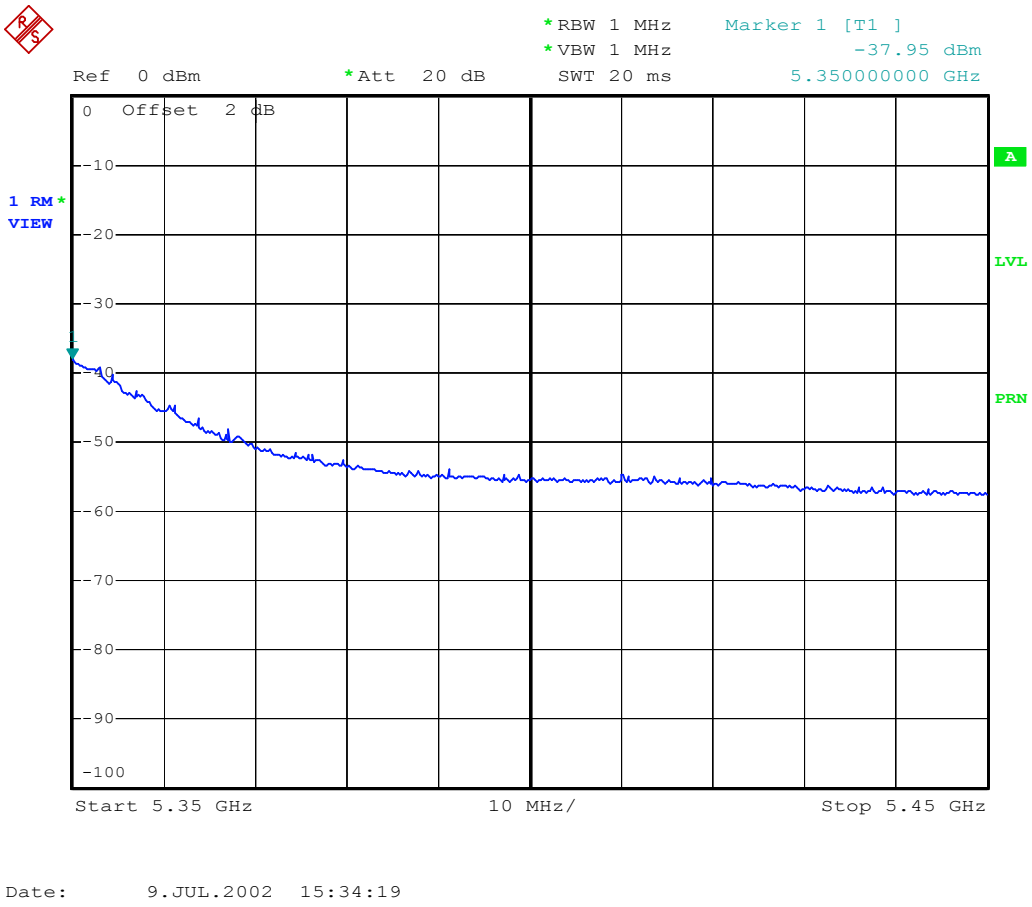
Ratio of the peak excursion of the modulation envelope with the EUT operating on channel 64 (5320 MHz) at a transmission bit-rate of 54 Mbit/s.

5.3 Restricted bands of operation, 47 CFR Part 15.407 (b)(6).



Plot 29 – Emissions in the 4.5 – 5.15 GHz restricted band of operation

Corrected (offset) for cable losses of +2 dB and +2 dB antenna gain.



Plot 30 – Emissions in the 5.35 – 5.46 GHz restricted band of operation

Corrected (offset) for cable losses of +2 dB and +2 dB antenna gain.

6 List of utilized test equipment.

Inventory number	Description	Brand	Type
12471	Biconical antenna 20MHz-200MHz	EATON	94455-1
12473	Log-per antenna 200-1000MHz	EATON	96005
12476	Antenna mast	EMCO	TR3
12477	Antenna mast 1-4 mtr	Poelstra	--
12482	Loop antenna	EMCO	6507
12483	Guidehorn	EMCO	3115
12484	Guidehorn	EMCO	3115
12488	Guidehorn 18 - 26.5 GHz	EMCO	RA42-K-F-4B-C
12533	Signalgenerator	MARCONI	2032
12559	Digital storage oscilloscope	Le Croy	9310M
12561	DC Power Supply 20A/70V	DELTA	SM7020D
12567	Plotter	HP	7440A
12605	calibrated dipole 28MHz-1GHz	Emco	3121c
12608	HF milliwattmeter	Hewlett Packard	HP435a
12609	Power sensor 10MHz-18GHz	Hewlett Packard	HP8481A
12636	Polyester chamber	Polyforce	--
12640	Temperature chamber	Heraeus	VEM03/500
13664	Spectrum analyzer	HP	HP8593E
13078	Preamplifier 0.1 GHz - 12 GHz	Miteq	AMF-3D-001120-35-14p
13452	Digital multi meter	HP	34401A
13526	Signalgenerator 20 GHz	Hewlett & Packard	83620A
13594	Preamplifier 10 GHz - 25 GHz	Miteq	AMF-6D-100250-10p
13886	Open Area testsite	Comtest	--
14051	Anechoic room	Comtest	--
14450	2.4 GHz bandrejectfilter	BSC	XN-1783
15633	Biconilog Testantenna	Chase	CBL 6111B
15667	Measuring receiver	R&S	ESCS 30
99045	DC Power Supply 3A/30V	DELTA	E030/3
99055	Non-conducting support	NMi	--
99061	Non-conducting support 150cm	NMi	--
99068	Detector N-F/BNC-F	Radiall	R451576000
99069	Cable 5m RG214	NMi	--
99071	Cable 10m RG214	NMi	--
99076	Bandpassfilter 4 - 10 GHz	Reactel	7AS-7G-6G-511
99077	Regulating trafo	RFT	LTS006
99112	Tripod	Chase	--
99136	Bandpassfilter 10 - 26.5 GHz	Reactel	9HS-10G/26.5G-S11