TEST REPORT OF A 2.4 GHZ LOW POWER RLAN MINIPCI CARD, BRAND AGERE, TYPE MPCI3A-20/R, IN CONFORMITY WITH CFR 47 PART 15.247 (2001-5-24)

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MEASUREMENT/TECHNICAL REPORT

Agere Systems Nederland B.V.

Model : MPCI3A-20/R

FCC ID: IMRMPCIDE3

December 20, 2001

This report concerns (strike out one):	Original grant/certification ~~Class 2 change~~ ~~Verification~~	
Equipment type:	Direct Sequence Spread Spectrum Transceiver	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii) ?	~~Yes~~ No	
Report prepared by:	Name	: P.A.J.M. Robben, B.Sc.E.E.
	Company name	: TNO Certification EPS
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The data taken for this test and report herein was done in accordance with CFR 47 Part 15 and the measurement procedures of ANSI C63.4-1992. TNO Certification EPS 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: December 20, 2001 Signature:

P. de Beer
TNO Certification EPS

Description of test item

Test item	:	2.4 GHz low power RLAN MiniPCI card
Manufacturer	:	Agere Systems Nederland B.V.
Brand	:	Agere
Type	:	MPCI3A-20/R
Revision	:	8U354
Receipt number	:	2
Receipt date	:	December 12, 2001

Applicant information

Applicant's representative	:	Mr. W. Kerkhof
Company	:	Agere Systems Nederland B.V.
Address	:	Zadelstede 1-10
Postal code	:	3431 JZ
City	:	Nieuwegein
PO-box	:	755
Postal code	:	3430 AP
City	:	Nieuwegein
Country	:	The Netherlands
Telephone number	:	+31 30 609 7534
Telefax number	:	+31 30 609 7556

Test(s) performed

Location	:	Niekerk
Test(s) started	:	December 12, 2001
Test(s) completed	:	December 18, 2001
Purpose of test(s)	:	Type approval / certification
Test specification(s)	:	CFR 47 Part 15.247 (2001-5-24)

Test engineer : O.H. Hoekstra 

Report written by : P.A.J.M. Robben, B.Sc.E.E. 

Project leader : P. de Beer 

Table of contents

1 General information

1.1 Product description

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, is designed to operate in the 2.4 GHz ISM frequency band, channels 1 to 11 (2412 MHz to 2462 MHz), as specified by the Federal Communications Commission in the USA.

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, utilizes Direct Sequence Spread Spectrum (DSSS) technology.

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, is intended for use in notebooks with a factory installed integrated antenna. Only antennas, which have been certified by the Federal Communications Commission for use with this specific 2.4 GHz low power RLAN MiniPCI card, may be connected to the antenna connector of this device.

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 RLAN MiniPCI card	MPCI3A-20/R	-	-	Antenna cable connected to an external antenna, having a gain of 3 dBi
Notebook computer	Latitude C600	DS/N TW-0791UH-12800-0BR-0635 DP/N 0791UH C/O TW Rev A05	n.a. (DoC)	Unshielded DC power cord to AC/DC adapter Shielded parallel cable to printer
Dell AC/DC power adapter 100-240 VAC/1.5 Amps to +20 VDC/3.5 Amps	AA20031, PA-6 family	DS/N CN-09364U-12761-0C4-007R DP/N 09361U\C/O CN/Rev A00	n.a. (DoC)	Unshielded DC power cord to notebook computer Unshielded power cord to AC mains
External antenna for testing purposes and having a gain of 3 dBi	Range extender	n.a.	n.a.	Antenna cable connected to 2.4 GHz low power RLAN MiniPCI card
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 CFR 47 Part 15, section 15.247 (2001-5-24).

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 CFR 47 Part 15).

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 Certification EPS, located in Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, and has found these test facilities to be in compliance with the requirements of CFR 47 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. 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 CFR 47 Part 15.19 (a)(3) the following text shall be placed on a label, which is attached to the notebook computer (host-system), in which the EUT is built-in:

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.

The FCC ID of the EUT must be placed on a label, which is attached to the notebook computer (host-system), in which the EUT is built-in.

For further details about the labeling requirements (size, legibility, etc.) as set by the Federal Communications Commission see CFR 47 Part 15.19 (a)(3), CFR 47 Part 15.19 (b)(2), CFR 47 Part 15.19 (b)(4), CFR 47 Part 2.925 and CFR 47 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 lowest operating frequency (channel 1: 2412 MHz), the operating frequency in the middle of the specified frequency band (channel 6: 2437 MHz) and the highest operating frequency (channel 11: 2462 MHz). Further details may be found in table 2 below.

Channel	Operating frequencies (MHz)	Rated output power (dBm)	Test performed
1	2412	+15	***yes***
2	2417	+15	no
3	2422	+15	no
4	2427	+15	no
5	2432	+15	no
6	2437	+15	***yes***
7	2442	+15	no
8	2447	+15	no
9	2452	+15	no
10	2457	+15	no
11	2462	+15	***yes***

Table 2 - Specification of channels and rated maximum output power (excluding an antenna gain of 3 dBi).

The EUT was tested in a notebook computer with an external antenna, having a gain of 3 dBi, connected to the antenna port. The use of such an external antenna simulates the worst-case configuration, which may occur. The actual usage of internal antennas, which may have different antenna gain specifications, calls out for spurious emission measurements in each individual notebook configuration on a case-by-case basis in order to have these antennas certified for use with the EUT. The results of these measurements may be attached to this test report in order to prove full compliance with the appropriate sections of CFR 47 Part 15.

1.7.2 EUT exercise software

The EUT could be enabled to transmit or receive continuously on channels 1 (2412 MHz), 6 (2437 MHz) and 11 (2462 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 1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s.

1.8 Special accessories

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

1.9 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the appropriate sections of CFR 47 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 Test results of measurements in conformity with CFR 47 Part 15.247

2.1 Minimum 6 dB bandwidth

The results of tests on the EUT, carried out in accordance with CFR 47 Part 15.247 (a)(2), are depicted in table 3.

Transmission bitrate (Mbit/s)	Minimum 6 dB bandwidth (kHz)			Limit (kHz)
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	11180	12600	12600	>500
2	12750	10280	10130	>500
5.5	10430	10880	11930	>500
11	11480	11480	11480	>500

Table 3 - Minimum 6 dB bandwidth.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

2.2 Maximum peak output power

The results of tests on the EUT, carried out in accordance with CFR 47 Part 15.247 (b)(1), are depicted in table 4.

Transmission bitrate (Mbit/s)	Maximum peak output power (dBm)			Limit (dBm) Antenna gain < 6 dBi
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	18.8	18.9	19.1	30.0
2	18.8	18.9	19.1	30.0
5.5	18.2	18.5	18.5	30.0
11	18.7	18.8	18.9	30.0

Table 4 - Maximum peak output 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 4. 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 output power is required.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

2.3 Radiated emission data outside restricted bands

The results of tests on the EUT, carried out in accordance with CFR 47 Part 15.247 (c), are depicted in table 5.

Radiated emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band.

Frequency (MHz)	Level below working channel based on field strength (dB)	Limit (dB)
all frequencies	<40.0	< -20.0

Table 5 - Radiated emission data outside restricted bands.

Note: Worst case measurement values for transmissions with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) and channel (channel 1 (2412 MHz), channel 6 (2437 MHz) and channel 11 (2462 MHz)) combinations.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

2.4 Conducted emission data outside restricted bands

The results of tests on the EUT, carried out in accordance with CFR 47 Part 15.247 (c), are depicted in table 6.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band.

Frequency (MHz)	Level below working channel based on field strength (dB)	Limit (dB)
2398.60	-36.1	< -20.0
other frequencies	< -40.0	< -20.0

Table 6 - Conducted emission data outside restricted bands.

Note: Worst case measurement values for transmissions with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) and channel (channel 1 (2412 MHz), channel 6 (2437 MHz) and channel 11 (2462 MHz)) combinations.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

2.5 Peak power spectral density

The results of the tests on the EUT, carried out in accordance with CFR 47 Part 15.247 (d), are depicted in table 7.

Transmission bitrate (Mbit/s)	Peak power spectral density (conducted) in any 3 kHz band (dBm)			Limit (dBm)
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	-9.1	-9.0	-8.9	<8.0
2	-9.3	-9.1	-8.8	<8.0
5.5	-8.3	-8.2	-8.3	<8.0
11	-6.8	-6.7	-6.5	<8.0

Table 7 - Peak power spectral density.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

2.6 Processing gain

The results of the processing gain tests, carried out in accordance with CFR 47 Part 15.247 (e), are available in a separate test report with reference number 02012802.r00b, dated December 20, 2001, issued by TNO Certification EPS.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

3 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.

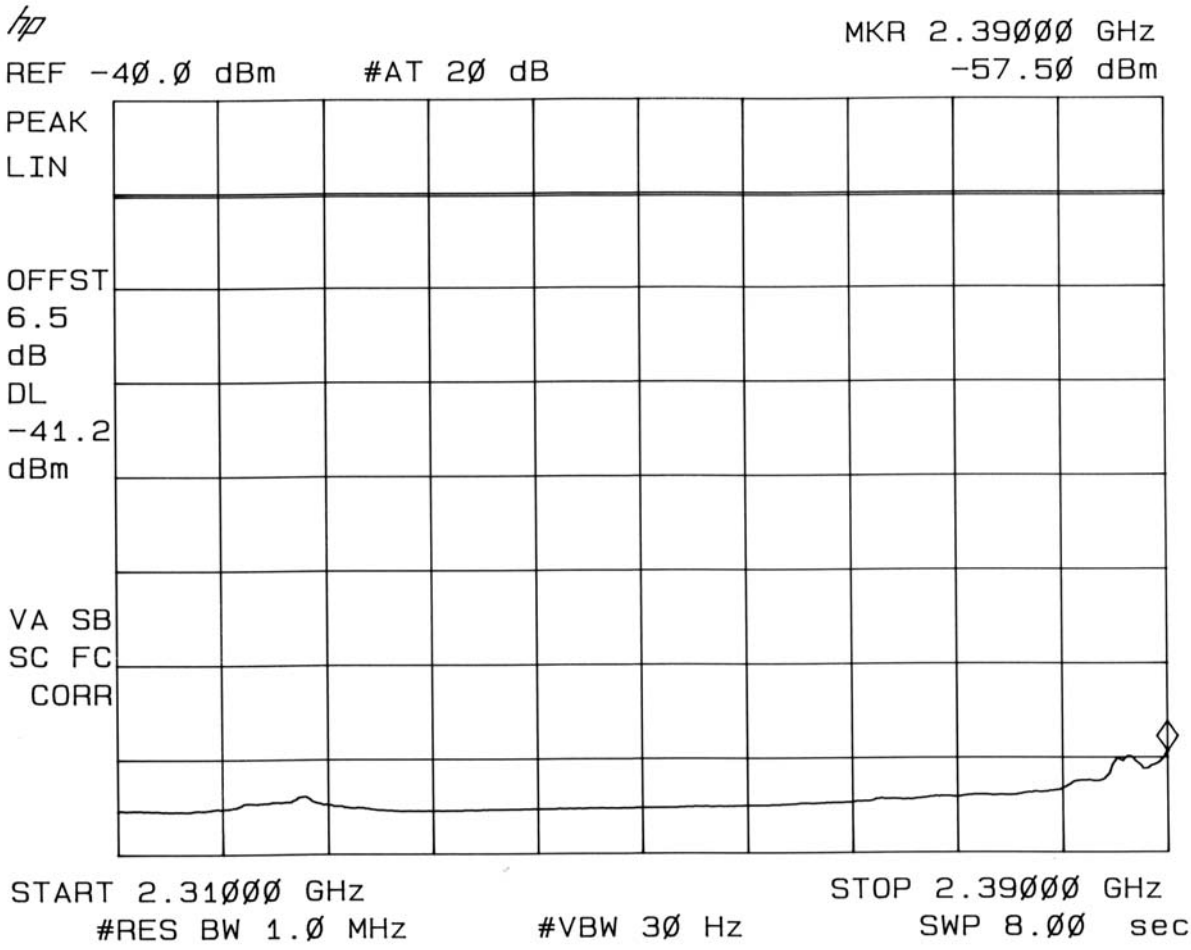
Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : December 20, 2001

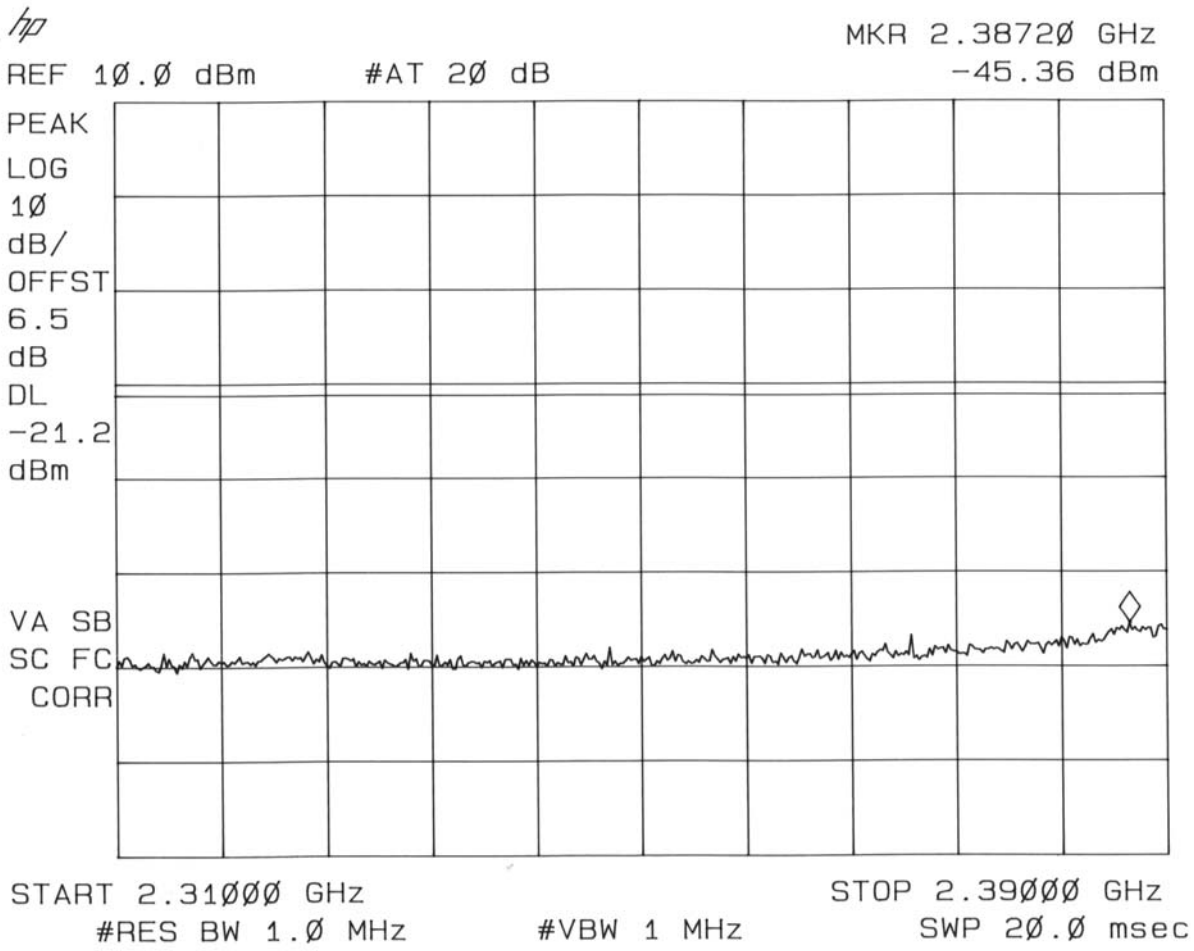
3.1 Emission in restricted bands nearest to the band 2400 - 2483.5 MHz



Plot 1 - Average measurement values in restricted band 2310 - 2390 MHz.

Average measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 3 dBi antenna gain (including antenna cable losses) and 3.5 dB cable losses (measurement cable)

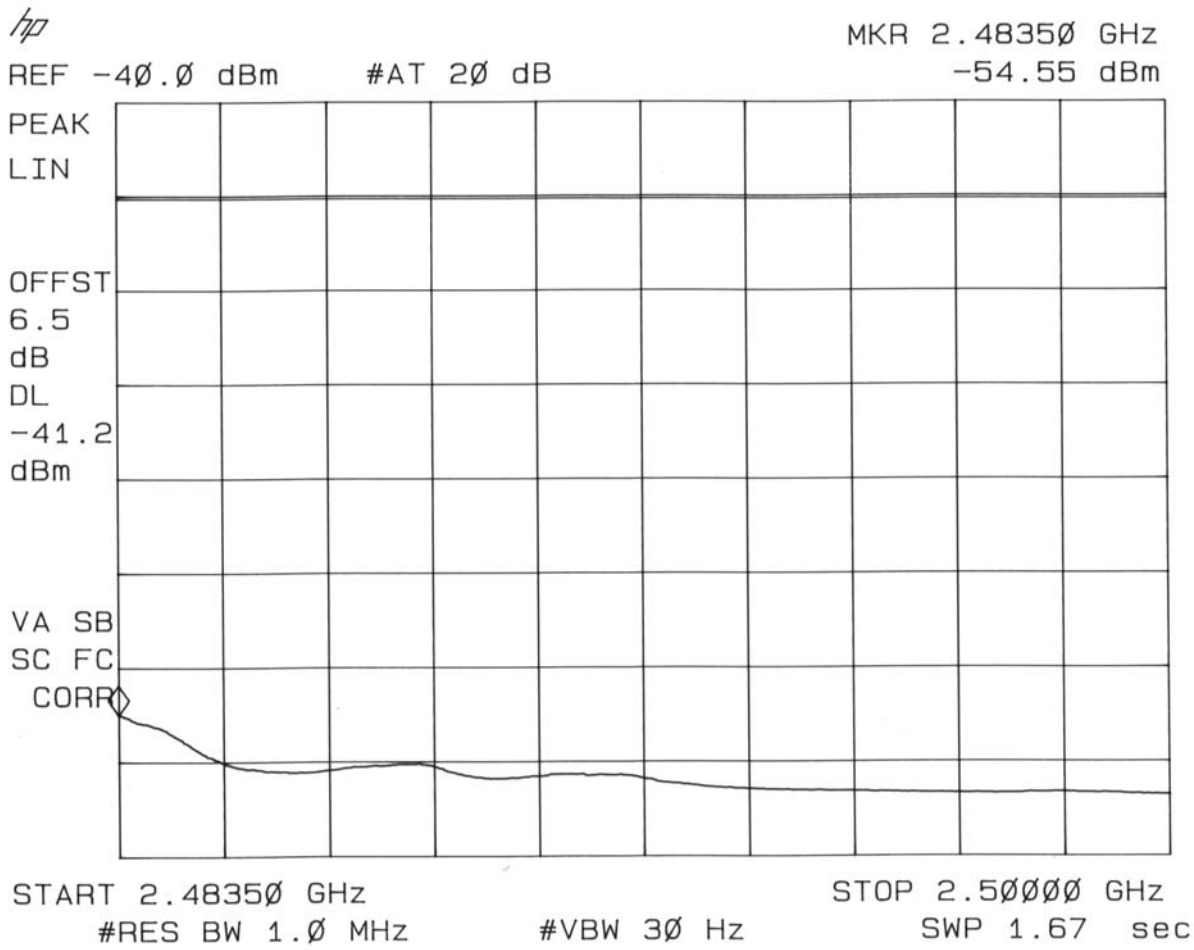
Note: 54 dBµV/m :: -41.2 dBm display line setting.



Plot 2 - Peak measurement values in restricted band 2310 - 2390 MHz.

Peak measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 3 dBi antenna gain (including antenna cable losses) and 3.5 dB cable losses (measurement cable).

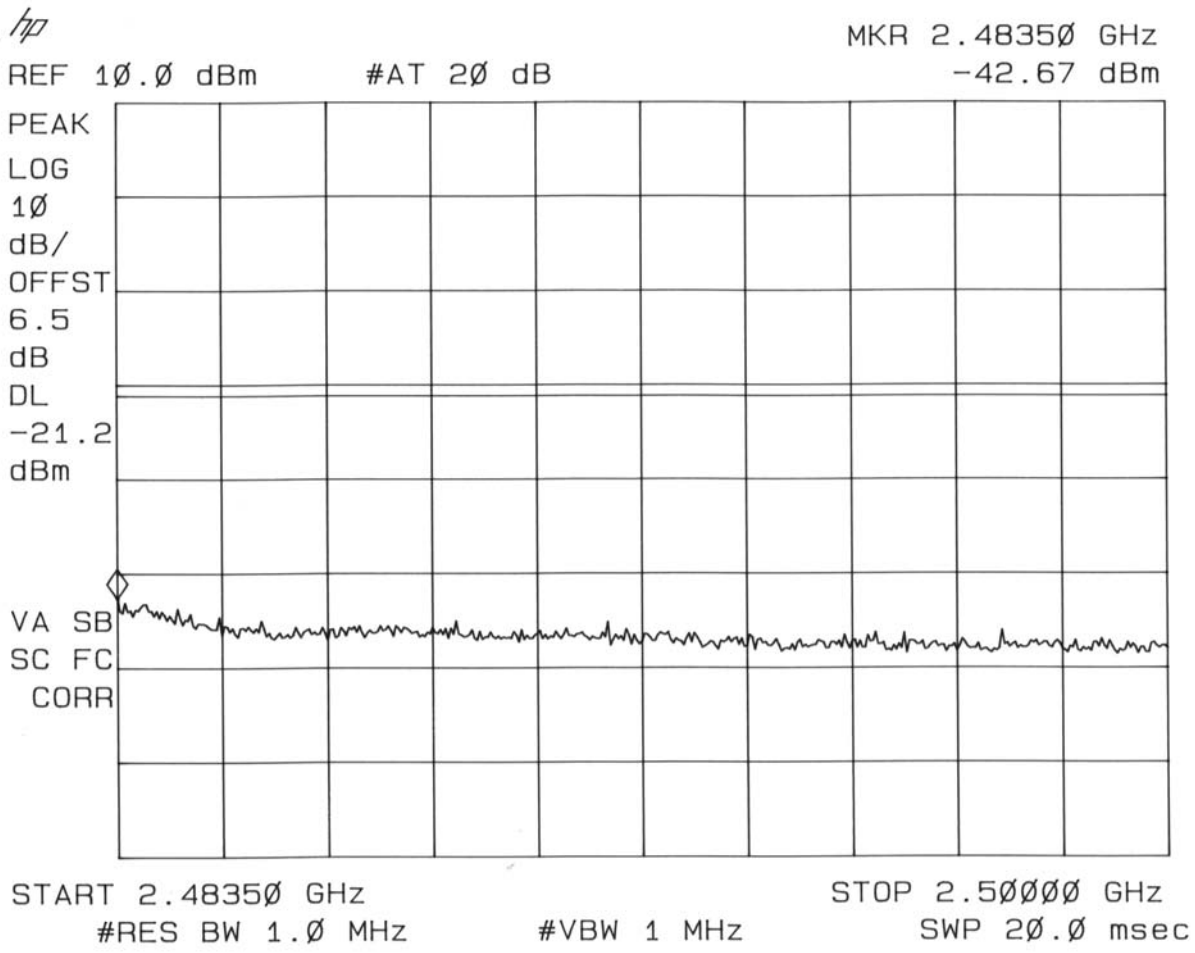
Note: 74 dBµV/m :: -21.2 dBm display line setting.



Plot 3 - Average measurement values in restricted band 2483.5 - 2500 MHz.

Average measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 3 dBi antenna gain (including antenna cable losses) and 3.5 dB cable losses (measurement cable).

Note: 54 dBµV/m :: -41.2 dBm display line setting.

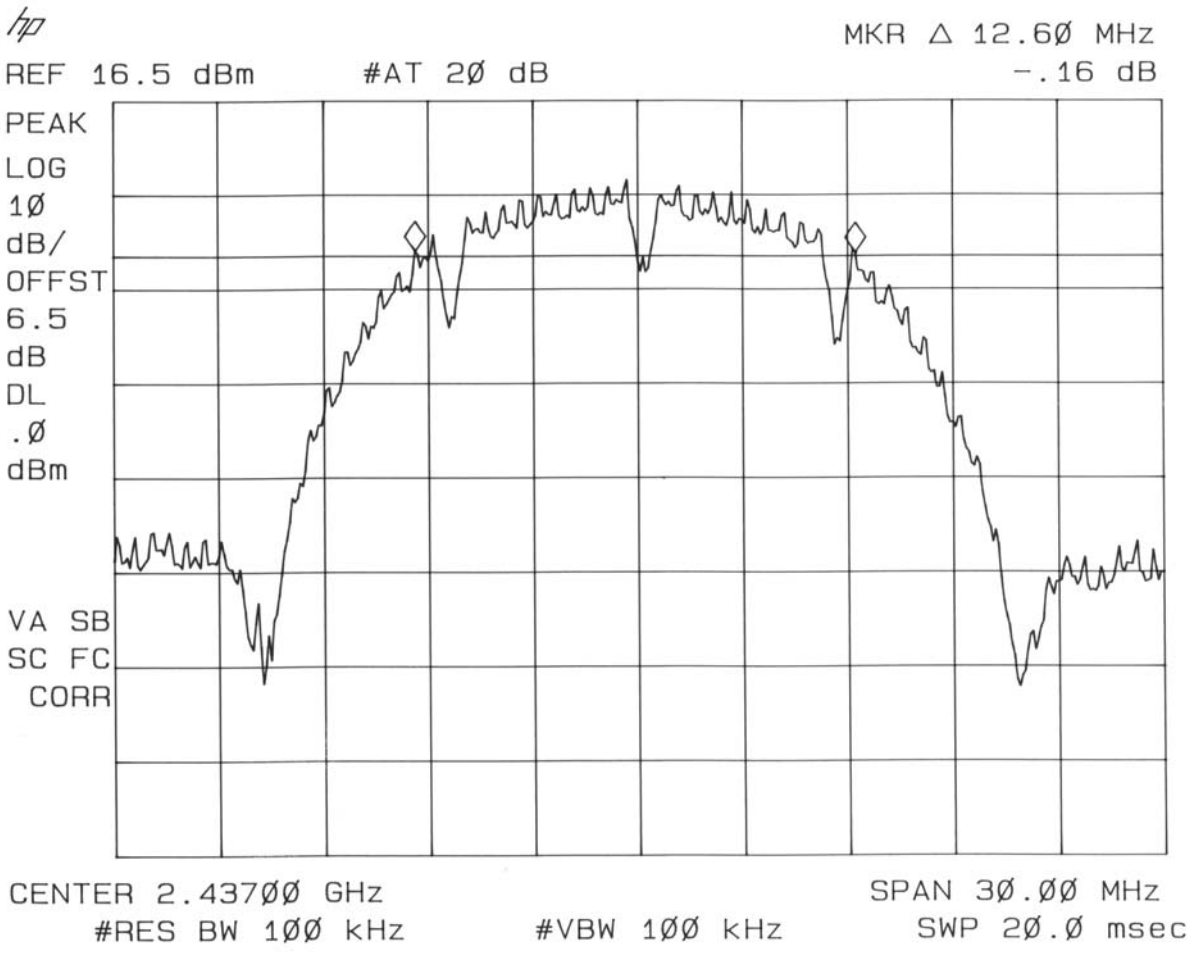


Plot 4 - Peak measurement values in restricted band 2483.5 - 2500 MHz.

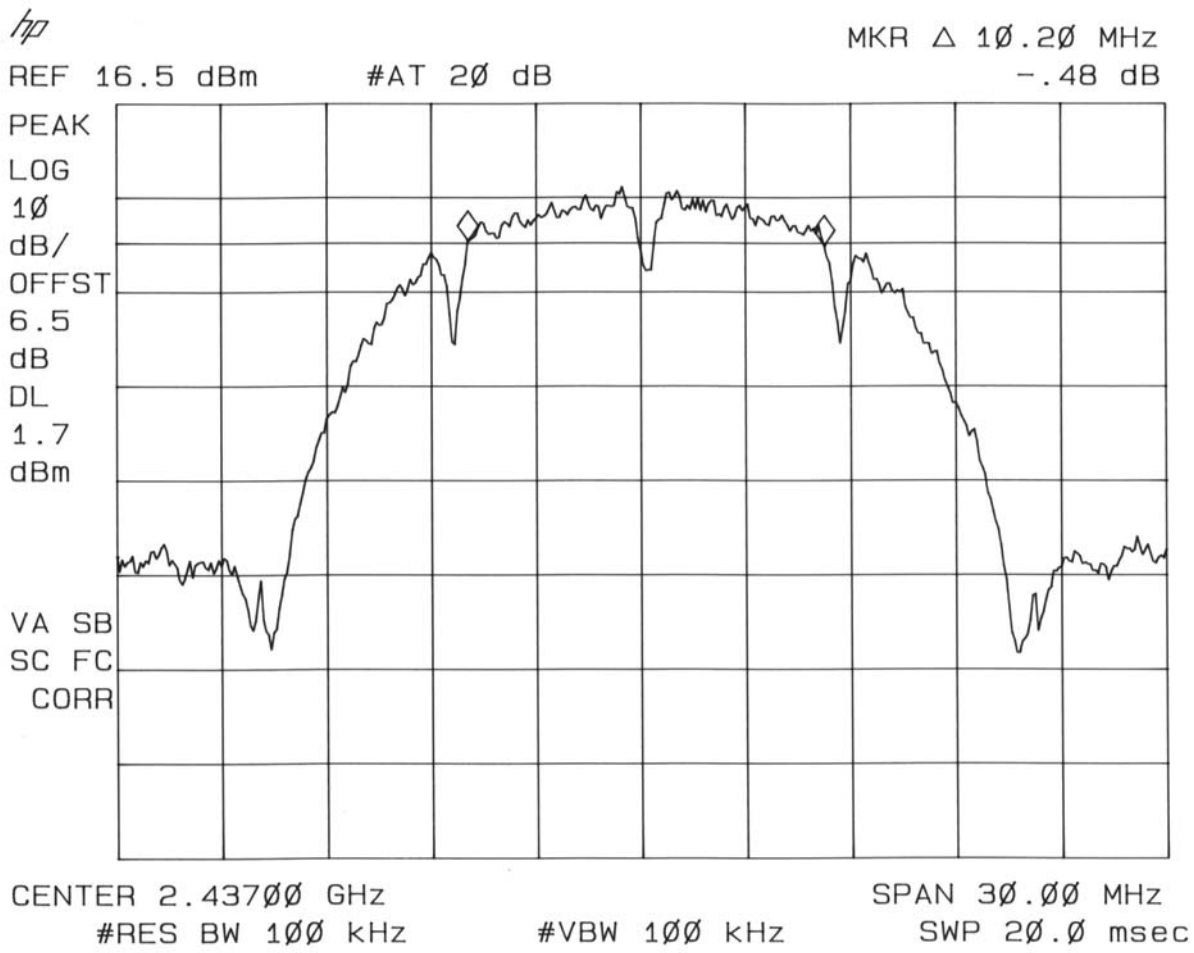
Peak measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 3 dBi antenna gain (including antenna cable losses) and 3.5 dB cable losses (measurement cable).

Note: 74 dBµV/m :: -21.2 dBm display line setting.

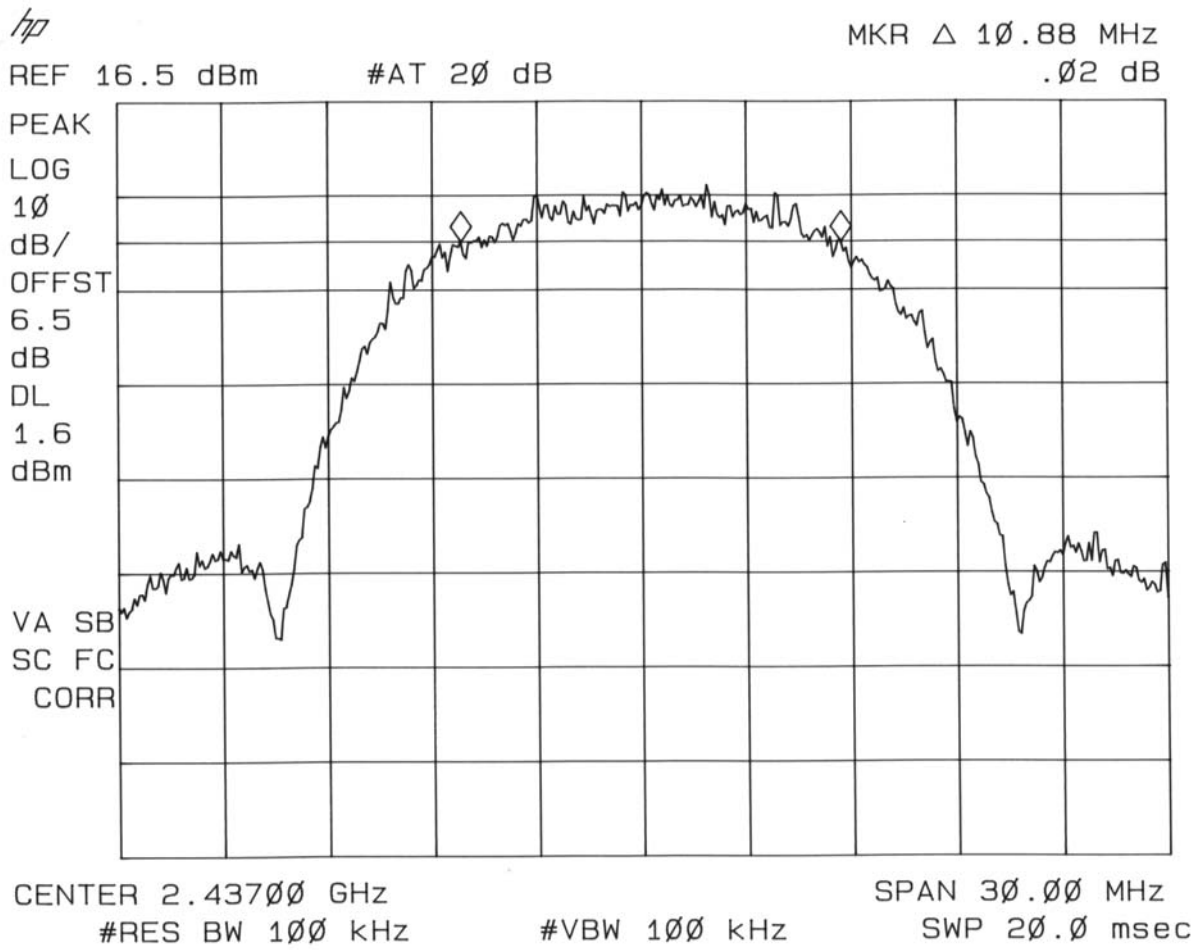
3.2 Minimum 6 dB bandwidth



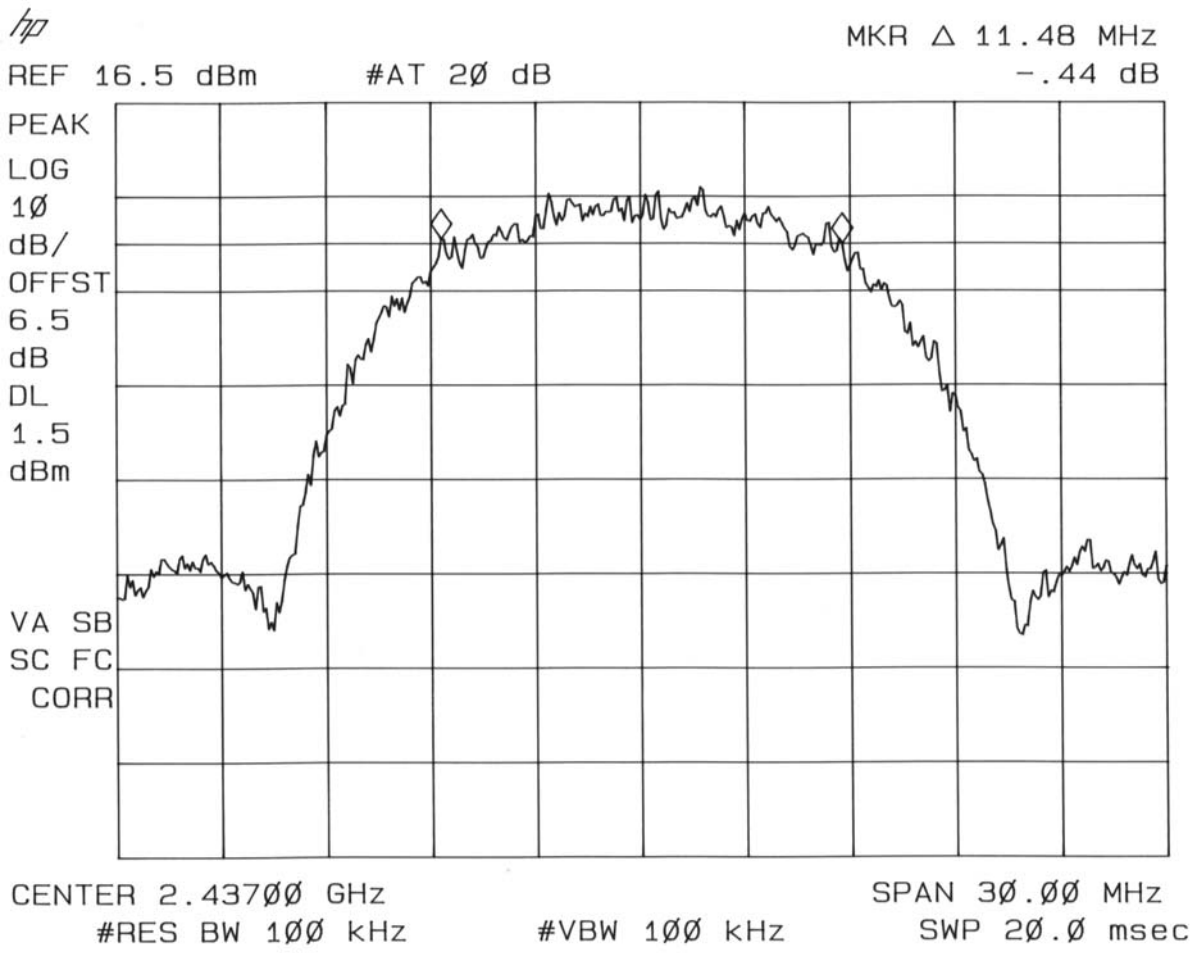
Plot 5 - Minimum 6 dB bandwidth at a transmission bit-rate of 1 Mbit/s.



Plot 6 - Minimum 6 dB bandwidth at a transmission bit-rate of 2 Mbit/s.

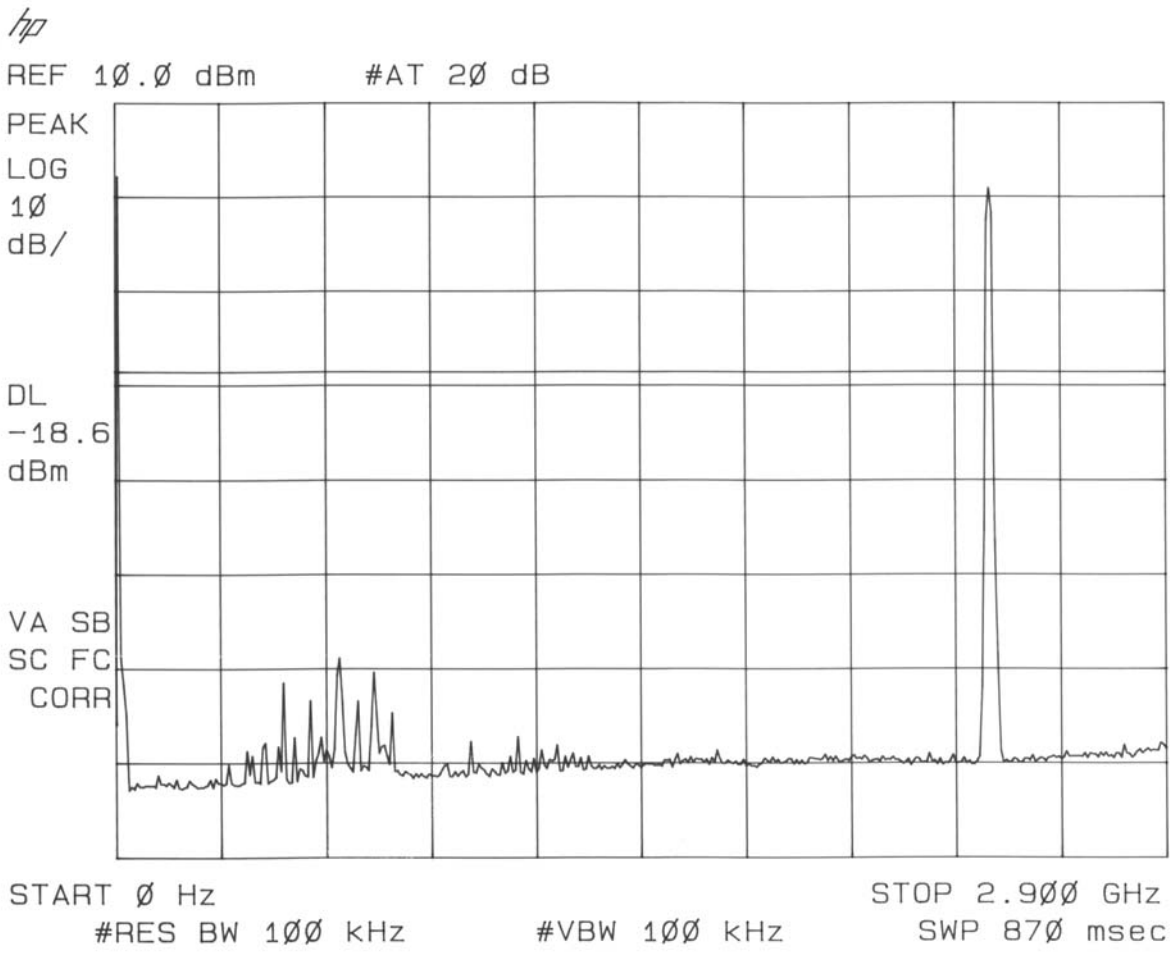


Plot 7 - Minimum 6 dB bandwidth at a transmission bit-rate of 5.5 Mbit/s.



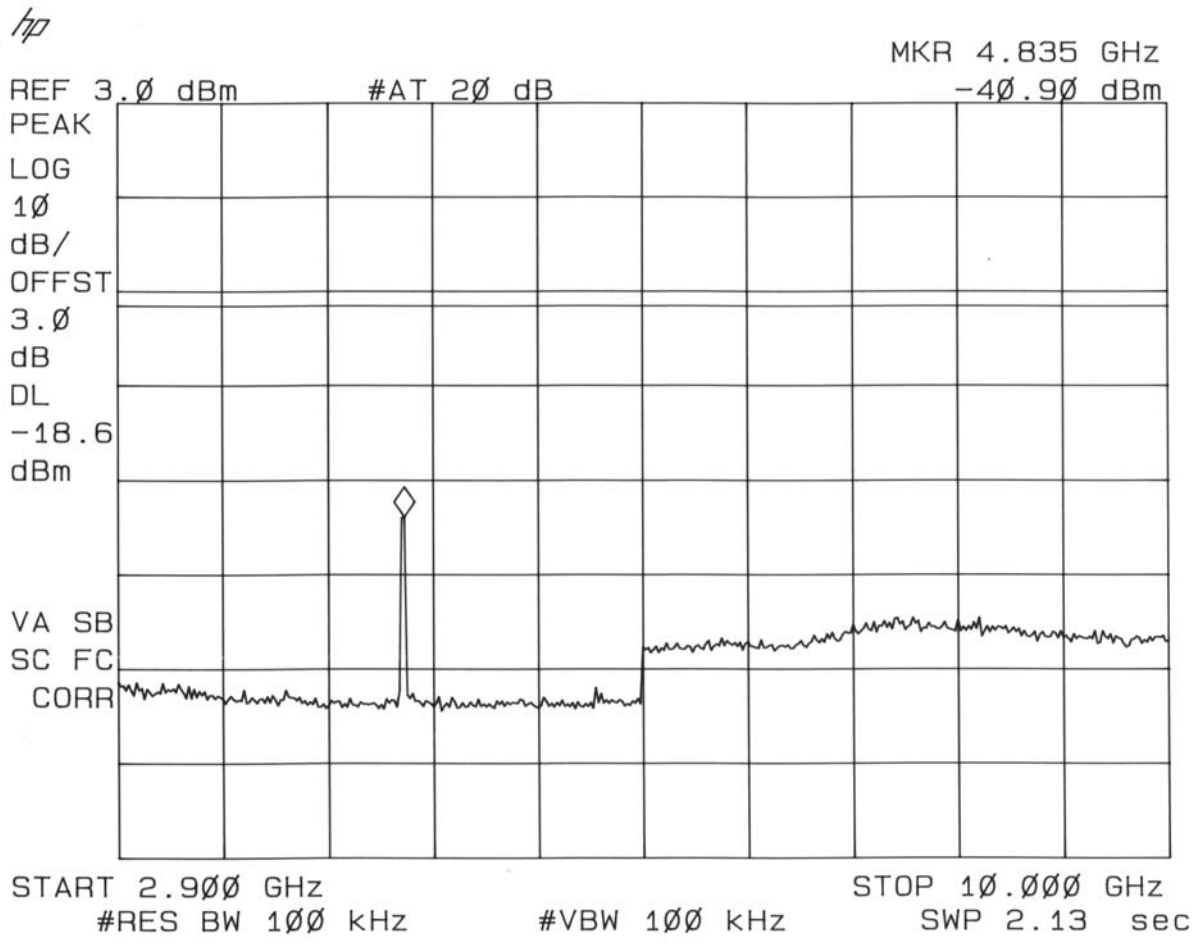
Plot 8 - Minimum 6 dB bandwidth at a transmission bit-rate of 11 Mbit/s.

3.3 Conducted emission data outside restricted bands



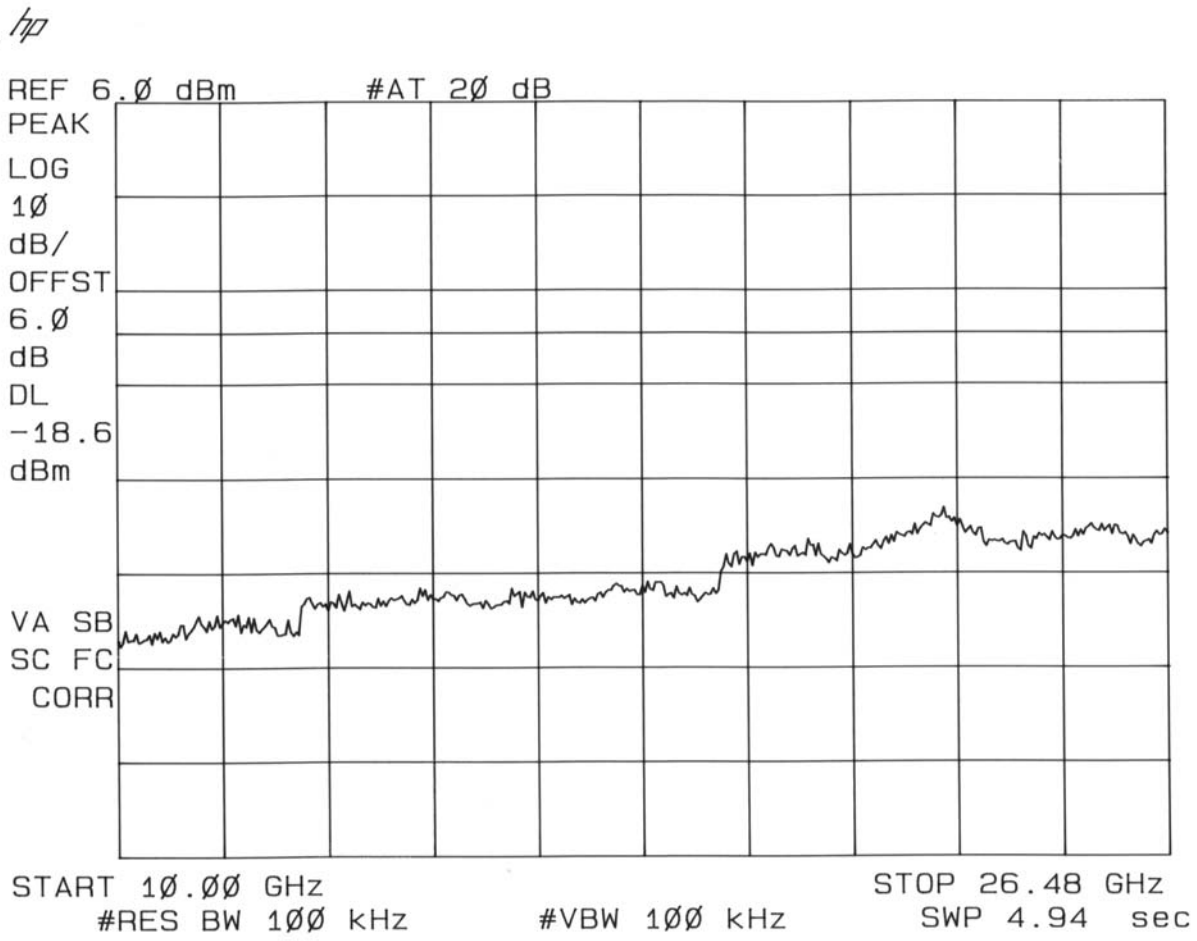
Plot 9 - Conducted emission outside restricted bands.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Plot 10 - Conducted emission outside restricted band.

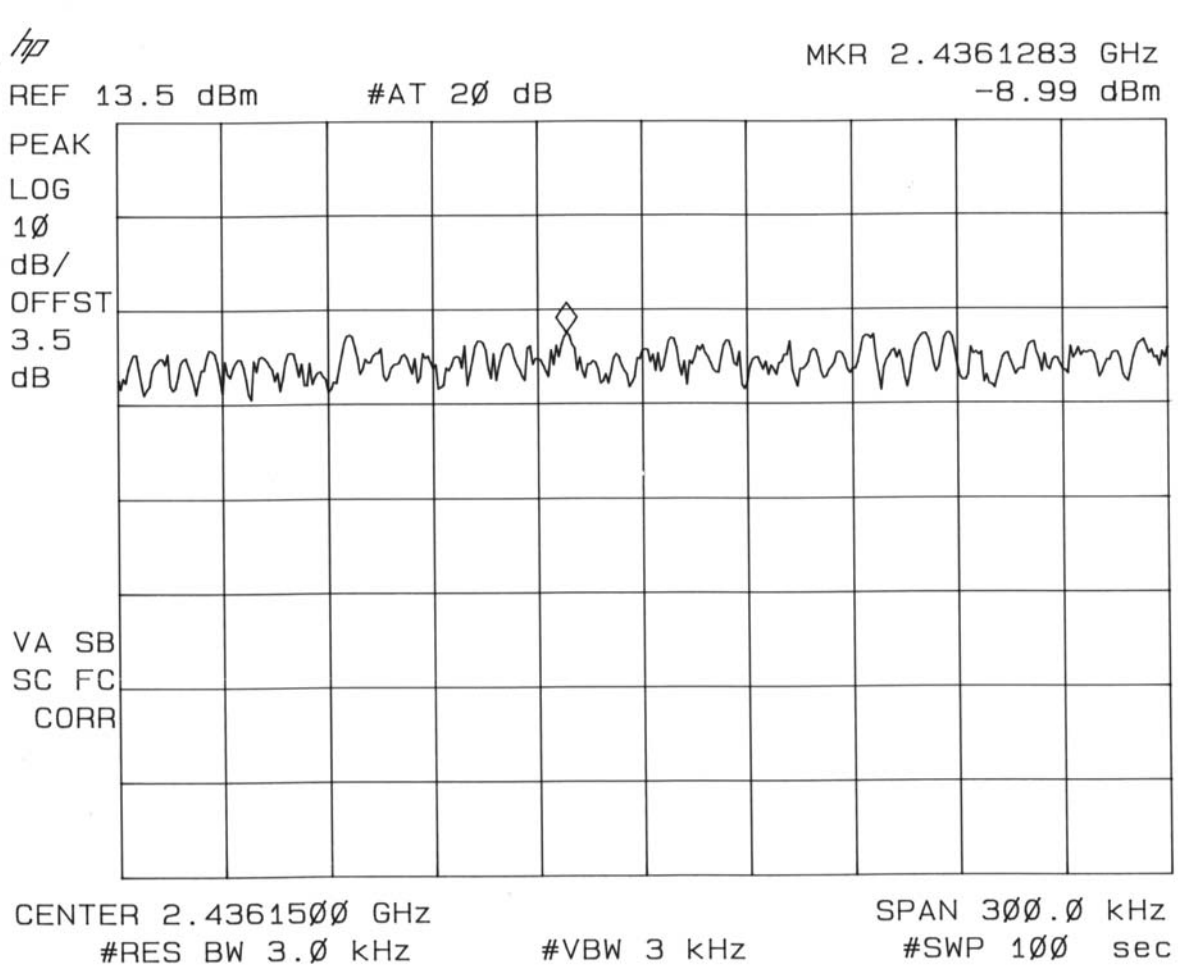
Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Plot 11 - Conducted emission outside restricted band.

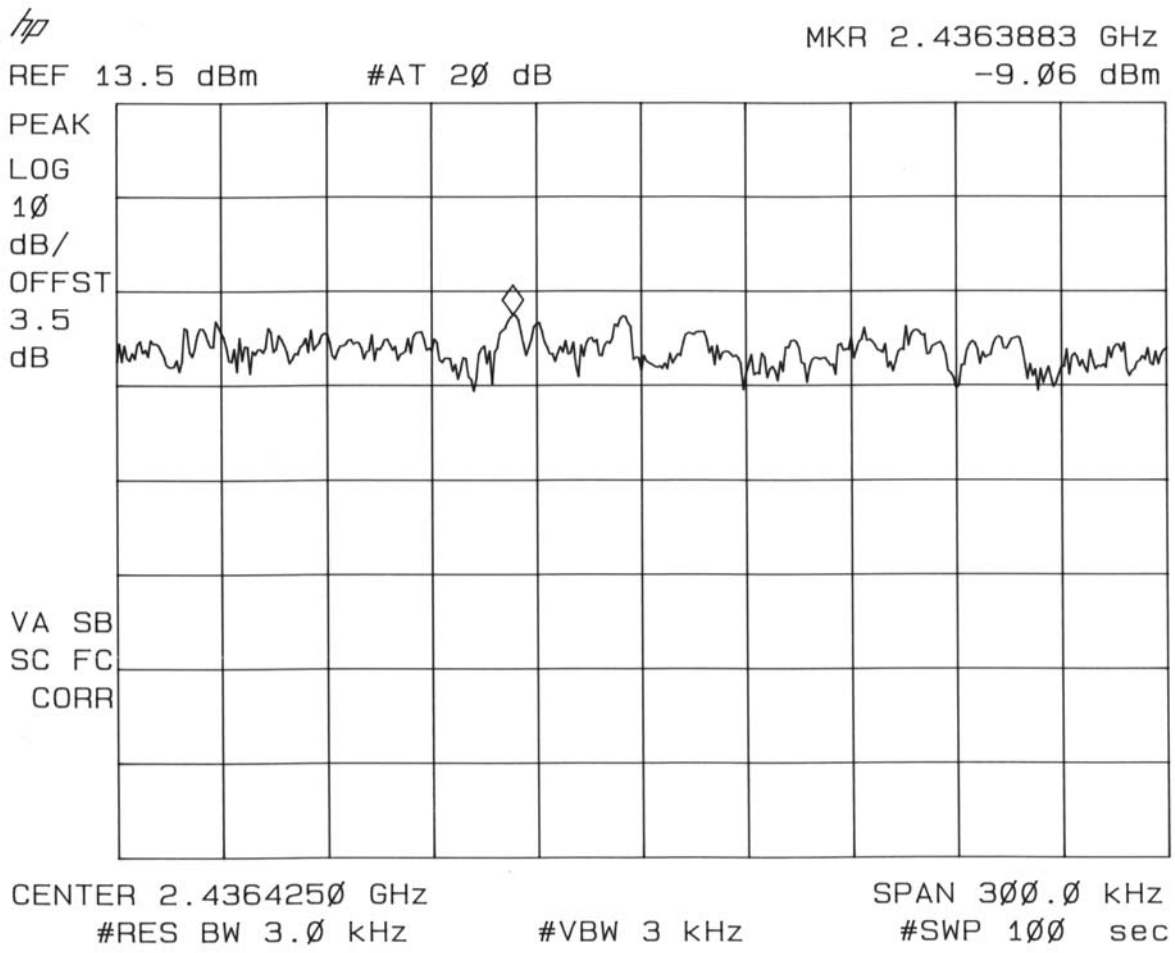
Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.

3.4 Peak power spectral density



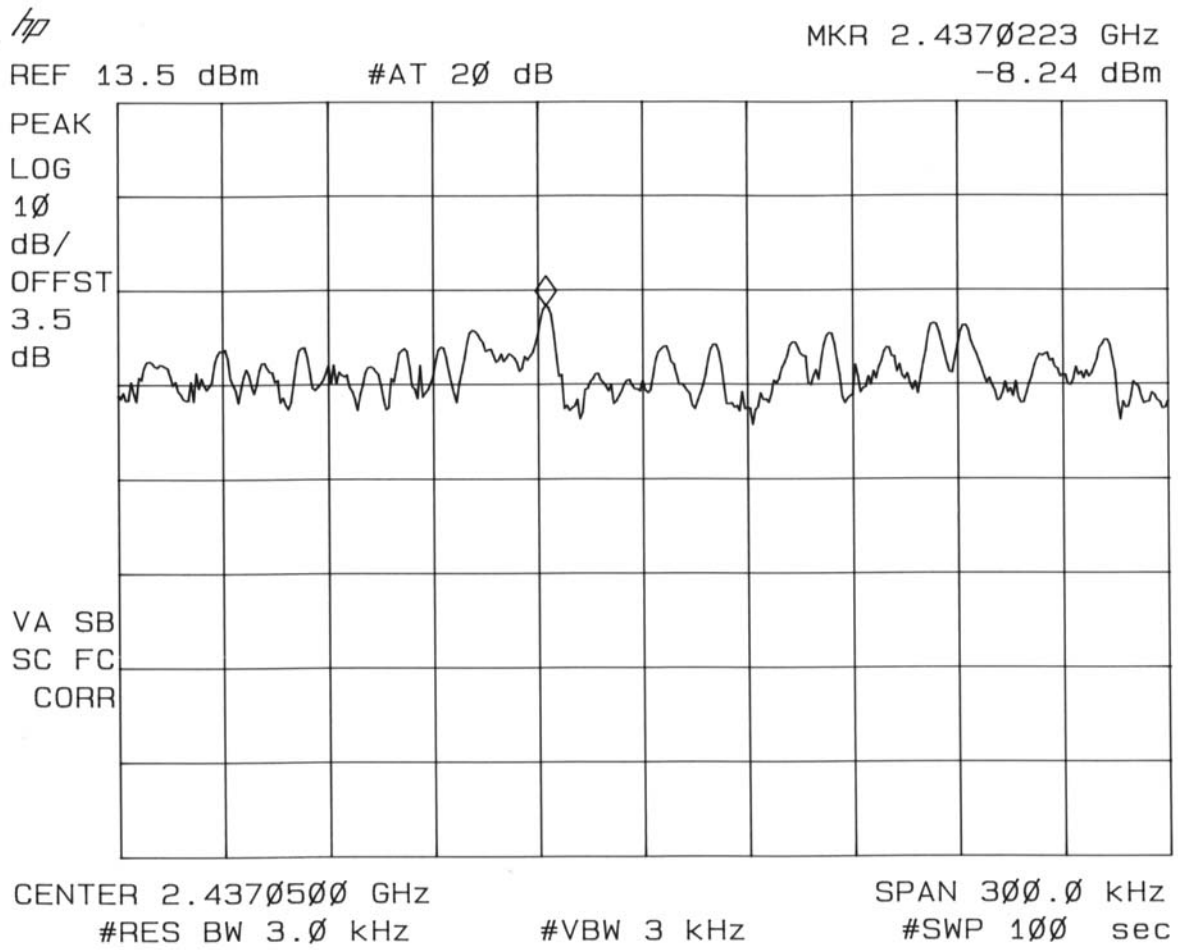
Plot 12 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 1 Mbit/s. Corrected (offset) for cable losses.



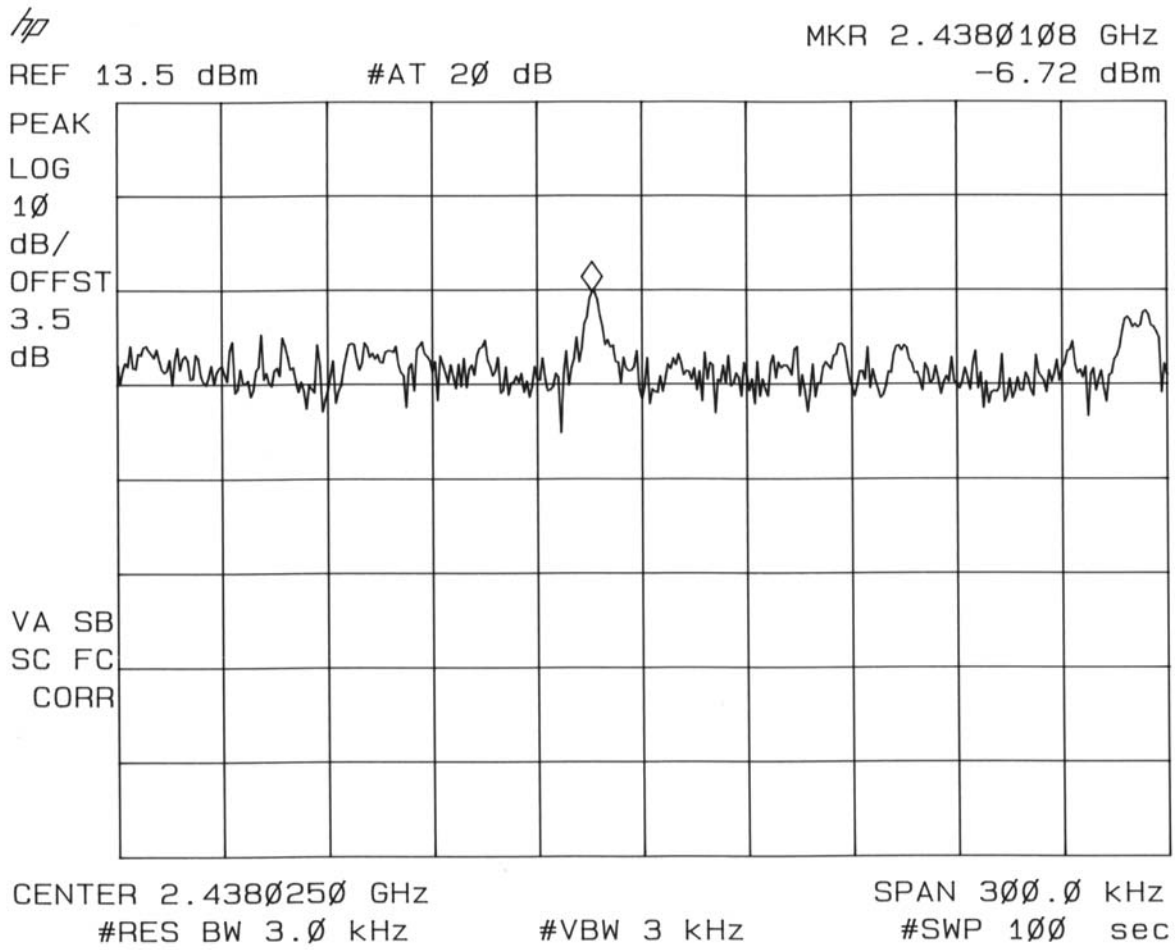
Plot 13 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 2 Mbit/s. Corrected (offset) for cable losses.



Plot 14 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 5.5 Mbit/s. Corrected (offset) for cable losses.



Plot 15 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 11 Mbit/s. Corrected (offset) for cable losses.

4 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