Recognized by the
Federal Communications Commission
Anechoic chamber registration no.: 90462 (FCC)
Anechoic chamber registration no.: 3463 (IC)
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.: 5-4907-01-13/04

FCC Part 15.407 / CANADA RSS-210
FCC ID:LYHIWPBV1
IC:267AB-IWPBV1

IWLAN/PB LINK PN IO

CETECOM – ICT Services GmbH
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Table of contents

1. ADMINISTRATIVE DATA 3

1.1. ADMINISTRATIVE DATA OF THE TEST FACILITY 3
1.1.1 Identification of the testing laboratory 3
1.1.2 Organizational items 3
1.1.3 Applicant´s details 4
1.2 ADMINISTRATIVE DATA OF MANUFACTURER / MEMBER 4
1.3 DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT) 5
1.3.1 EUT: Type, S/N etc. 5
1.3.2 If RF component testing only, description of additional used HW/SW 5
1.3.3 ADDITIONAL EUT INFORMATION 5
1.3.4 EUT operating modes 6
1.3.5 Extreme conditions testing values 6

2 TEST STANDARD & SUMMARY LIST OF ALL PERFORMED TEST CASES 7

3 RF MEASUREMENT TESTING 8

3.1 DESCRIPTION OF TEST SET-UP 8
3.1.1 Radiated measurements 8
3.1.2 Conducted measurements 8
3.1.3 AC-conducted measurements 8
3.2 REFERENCED DOCUMENTS 9
3.3 ADDITIONAL COMMENTS 9
3.4 ANTENNA GAIN 9
3.5 MAXIMUM CONDUCTED OUTPUT POWER §15.407A(3)+(4) 10
3.6 SPECTRAL DENSITY CONDUCTED §15.407(A5) 18
3.7 RATIO OF PEAK EXCURSION §15.407(A6) 22
3.8 UNDESIRABLE EMISSION LIMITS AT BAND EDGES 15.407 (B3) 26
3.9 SPURIOUS (CONDUCTED) 15.407 (B3) 28
3.10 MPE CALCULATION 37
3.11 MAX. PEAK OUTPUT POWER (RADIATED) §15.247 (B) (1) 39
3.12 SPURIOUS EMISSIONS - RADIATED (TRANSMITTER) §15.209 41
3.13 SPURIOUS EMISSIONS RADIATED (RX) 15.209 58
3.14 SPURIOUS EMISSIONS - RADIATED <30 MHZ (VALID FOR ALL ANTENNA TYPES) §15.109 62
3.15 CONDUCTED EMISSIONS <30 MHZ §15.107/207 63
3.16 MAXIMUM CONDUCTED OUTPUT POWER §15.407A(3)+(4) 64
3.17 SPECTRAL DENSITY CONDUCTED §15.407(A5) 72
3.18 RATIO OF PEAK EXCURSION §15.407(A6) 76
3.19 UNDESIRABLE EMISSION LIMITS AT BAND EDGES 15.407 (B3) 80
3.20 SPURIOUS (CONDUCTED) 15.407 (B3) 82
3.21 MPE CALCULATION 91
3.22 MAX. PEAK OUTPUT POWER (RADIATED) §15.247 (B) (1) 92
3.23 SPURIOUS EMISSIONS - RADIATED (TRANSMITTER) §15.209 93
3.24 SPURIOUS EMISSIONS RADIATED (RX) 15.209 110
3.25 SPURIOUS EMISSIONS - RADIATED <30 MHZ (VALID FOR ALL ANTENNA TYPES) §15.109 114
3.26 CONDUCTED EMISSIONS <30 MHZ §15.107/207 115

3 PHOTOGRAPHS 120

ANNEX 1: ANTENNA MEASUREMENTS

1. Administrative data

1.1. Administrative data of the test facility

1.1.1 Identification of the testing laboratory

Company name:	Cetecom ICT Services GmbH
Address:	Untertürkheimerstr. 6-10 D-66117 Saarbruecken Germany
Laboratory accreditation:	DAR-Registration No. TTI-P-G081/94-D0 Bluetooth Qualification Test Facility (BQTF)
Responsible for testing laboratory:	Harro Ames, Michael Berg Phone: +49 681 598 0 Fax: +49 681 598 9075 email: info@ict.cetecom.de

..... / .....
Responsible for testing laboratory
(Harro Ames, Michael Berg)

1.1.2 Organizational items

Reference No.:	5-4907-01-13/04
Order No.:	
Responsible for test report and project leader:	Harro Ames, Michael Berg
Receipt of EUT:	2004-11-28
Date(s) of test:	2004-11-28 to 2005-01-11
Date of report:	2005-03-07
Number of report pages:	140
Number of diagram pages (annex):	
Version of template:1.2	

..... / .....
Responsible for test report
(Harro Ames, Michael Berg)

Note:
The test results of this test report relate exclusively to the item tested as specified in this report. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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During the test no hardware and software changes are allowed to be performed at the EUT.

1.1.3 Applicant´s details

Applicant´s name:	Siemens AG A&D PT2
Address:	Gleiwitzer Strasse 555 D-90475 Nürnberg Germany
Contact person:	Mr. Dietmar Herian Phone: +49 (0)721 595 4406 Fax: +49 (0)721 595 4406 email:

1.2 Administrative data of manufacturer / member

Manufacturer´s name:	- applicant -
Address:	

1.3 Description of the Equipment under test (EUT)

1.3.1 EUT: Type, S/N etc.

Product name	Product ID	Description	S/N serial number	HW hardware status	SW software status
IWLAN/PB LINK PN IO		WLAN Client		1 (Serie)	
Frequency Band [GHz]	Type of Modulation	Number of channels	Antenna-connectors	Power Supply	Temperature Range
5.25 – 5.35 5.725 – 5.825	OFDM	4 / 4	1 external	24 V DC	0 …60 C

1.3.2 If RF component testing only, description of additional used HW/SW

	Product name	Product ID	Description	S/N serial number	HW hardware status	SW software status
1						
2						

1.3.3 Additional EUT information

The tested product runs as a wireless client in combination with a SPS-control unit.

The build-in WLAN card is able to use A, B and G-mode in 2.4 and 5 GHZ range.

The client can be used with 3 different antennas in this frequency range.

- the standard dual-band omnidirectional antenna ANT795-4MR, called “Antenna 1” in the report
- the high-gain dual-band omnidirectional antenna ANT795-6MR, called “Antenna 2” in the report
- the high-gain patch antenna ANT793-8DR, called “Antenna 3” in the report

Depending on the antenna gain it is necessary to use the loss of the coax cable to fulfil the requirements of the standard. In the annex of this report the antenna diagrams, the antenna gain and the necessary cable loss is described for each antenna.

The test was performed with this three different antennas.
The first antenna, here called antenna 1 is a dualband rod antenna for mounting directly on the housing.
The second antenna, here called antenna 2 is a „high gain“ dualband antenna tobe mounted separately from the client, connected with reverse sma connectors and a coax cable.
The third antenna is a high gain monoband antenna for Point to Point connections to be mounted separately from the client, connected with reverse sma connectors and a coax cable.

1.3.4 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions

*) EUT operating mode no. is used to simplify the test report.

1.3.5 Extreme conditions testing values

Description	Shortcut	Unit	Value
Nominal Temperature / humidity	T_{nom}	°C / %	22°C / 33%
Low Temperature	T_{low}	°C	0 C
High Temperature	T_{high}	°C	60 C
Nominal Power Source	V_{nom}	V	24
Low Power Source	V_{low}	V	20
High Power Source	V_{high}	V	28

Type of powersource: External DC power supply from our house

2 Test standard & summary list of all performed test cases

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC Part 15 §15.407 - CANADA RSS-210			

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
None	Antenna Gain	Yes			
Range:	5.725 to 5.825 GHz				
§15.407a(3)+(4)	Peak transmit power	Yes			
§15.407a(5)	Peak power spectral density conducted	Yes			
§ 15.407a (6)	Ratio of peak excursion	Yes			
§ 15.407b (3)	Undesirable emissions conducted	Yes			
§ 15.209	Spurious Emission -radiated (TX)	Yes			
§ 15.209	Spurious Emission -radiated (RX)	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	Yes			
Range:	5.25 to 5.35 GHz				
§15.407a(2)+(4)	Peak transmit power	Yes			
§15.407a(5)	Peak power spectral density conducted	Yes			
§ 15.407a (6)	Ratio of peak excursion	Yes			
§ 15.407b (2)	Undesirable emissions conducted	Yes			
§ 15.209	Spurious Emission -radiated (TX)	Yes			
§ 15.209	Spurious Emission -radiated (RX)	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	Yes			

3 RF measurement testing

3.1 Description of test set-up

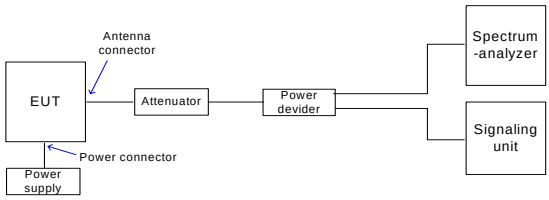
3.1.1 Radiated measurements

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 C63.4-2003 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 C63-4-2003 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 with lownoise preamp

3.1.2 Conducted measurements

The EUT´s RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is connected to the spectrum analyzer. The specific losses for signal pathsis first checked within a calibration. The measuerment readings on the spectrum analyzer is corrected by the specific test set-up loss. The attenuator, power divider, signaling unit and the spectrum analyzer are impedance matched on 50 Ohm.



3.1.3 AC-conducted measurements

As the product is sold without any power supply, we used a power supply from our company to show compliance with AC-conducted requirements.

3.2 Referenced Documents

none

3.3 Additional comments

Hardware / software changes during testing

Setup revision	Description of change	Change referenced to setup revision	Already perf. testcases influenced yes (reapeted) / no
1.0	Start setup	-	-

3.4 Antenna gain

The antenna gain for the three (see 1.3.3) used antennas was measured in a so called “compact range” in our house (see results on annex 1)

Antenna 1: (ANT795-4MR) (for direct connection at the housing)
-Max gain at 5.3 GHz = 4.0 dBi

Antenna 2: (ANT795-6MR) (always delivered with a 5 m coax cable with 6 dB loss)
-Max gain at 5.3 GHz = 7.9 dBi - 6 dB cable loss => 1,9 dBi

Antenna 3: (ANT793-8DR) (always delivered with a 5m coax cable with 6dB loss)

-Max gain at 5.75 GHz = 17.0 dBi - 6 dB cable loss => 11 dBi

Attention: Antenna 3 can only be used in the frequency range from 5725 to 5825 MHz for Point to Point connections.
The EIRP with this antenna is at maximum 36.2 dBm.

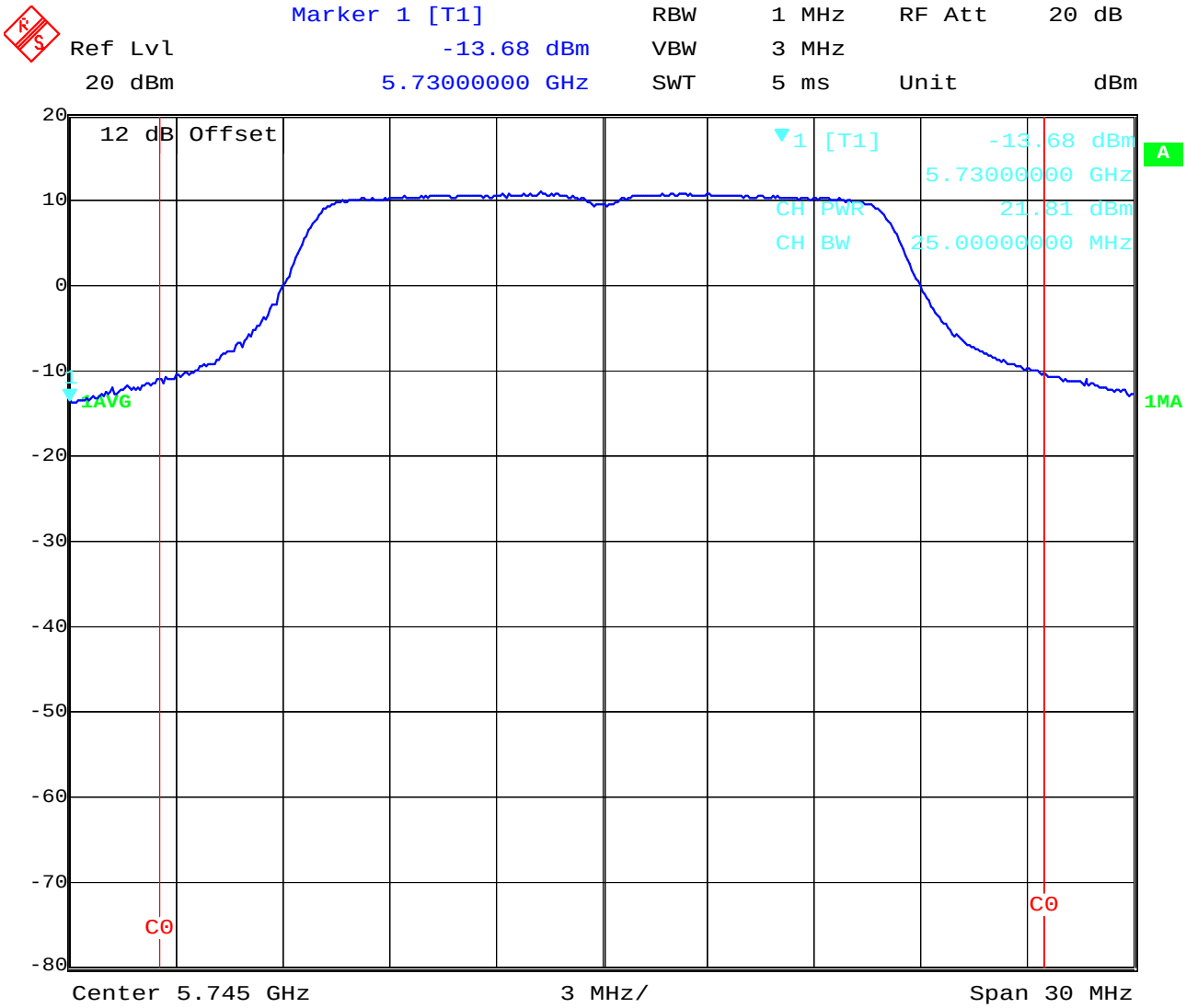
According to Part15.407 (a3) there is no need to reduce the power for point to point connections (Antenna gain < 23 dBi)

Frequency range of the sample : 5725 to 5825 MHz

3.5 Maximum Conducted Output Power §15.407a(3)+(4)

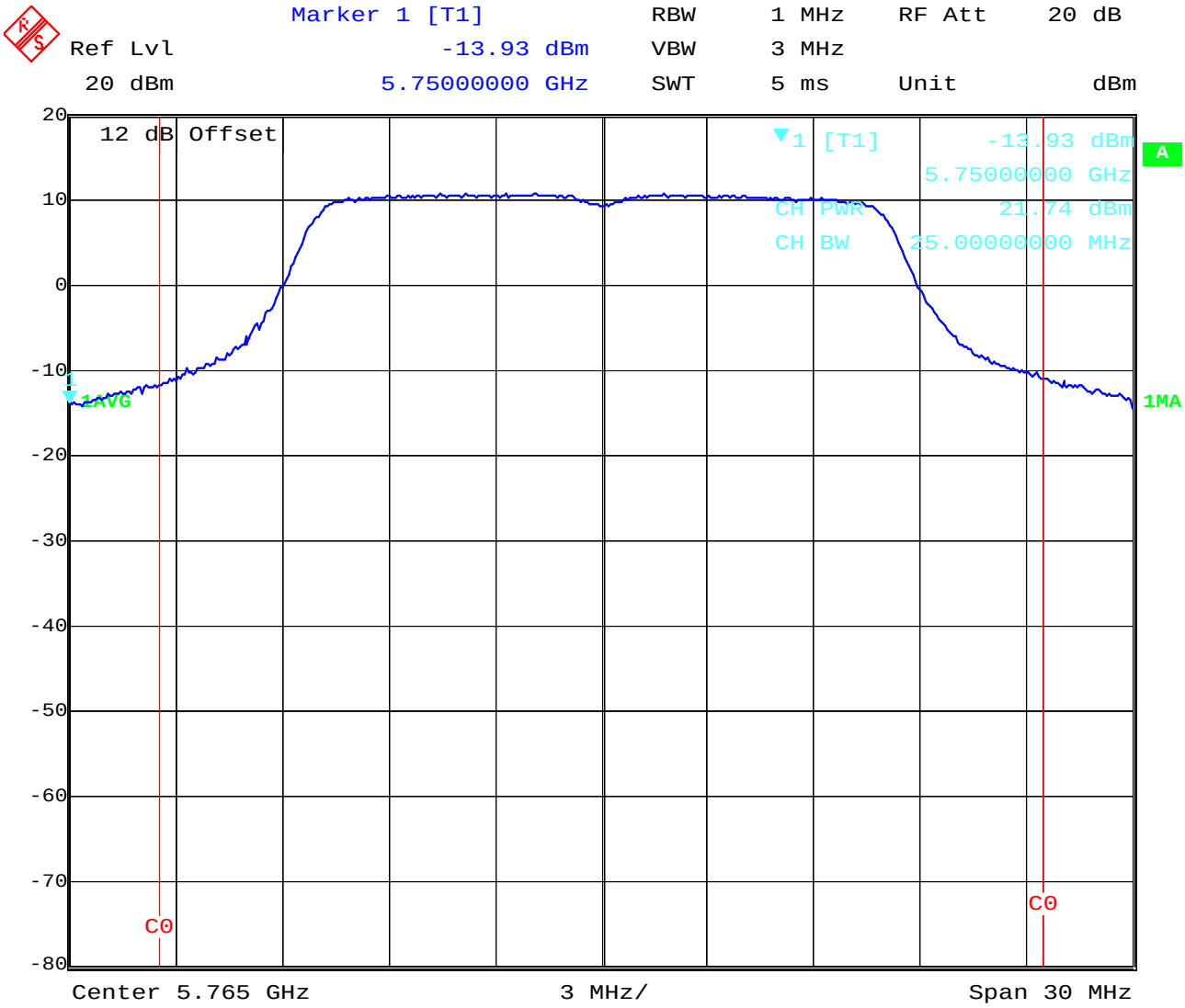
3.5.1 Power measured with the build-in function of the analyzer FSIQ26 according to the Guidelines DA-02-2138 A1 method 1

Plot 1: 5745 MHz



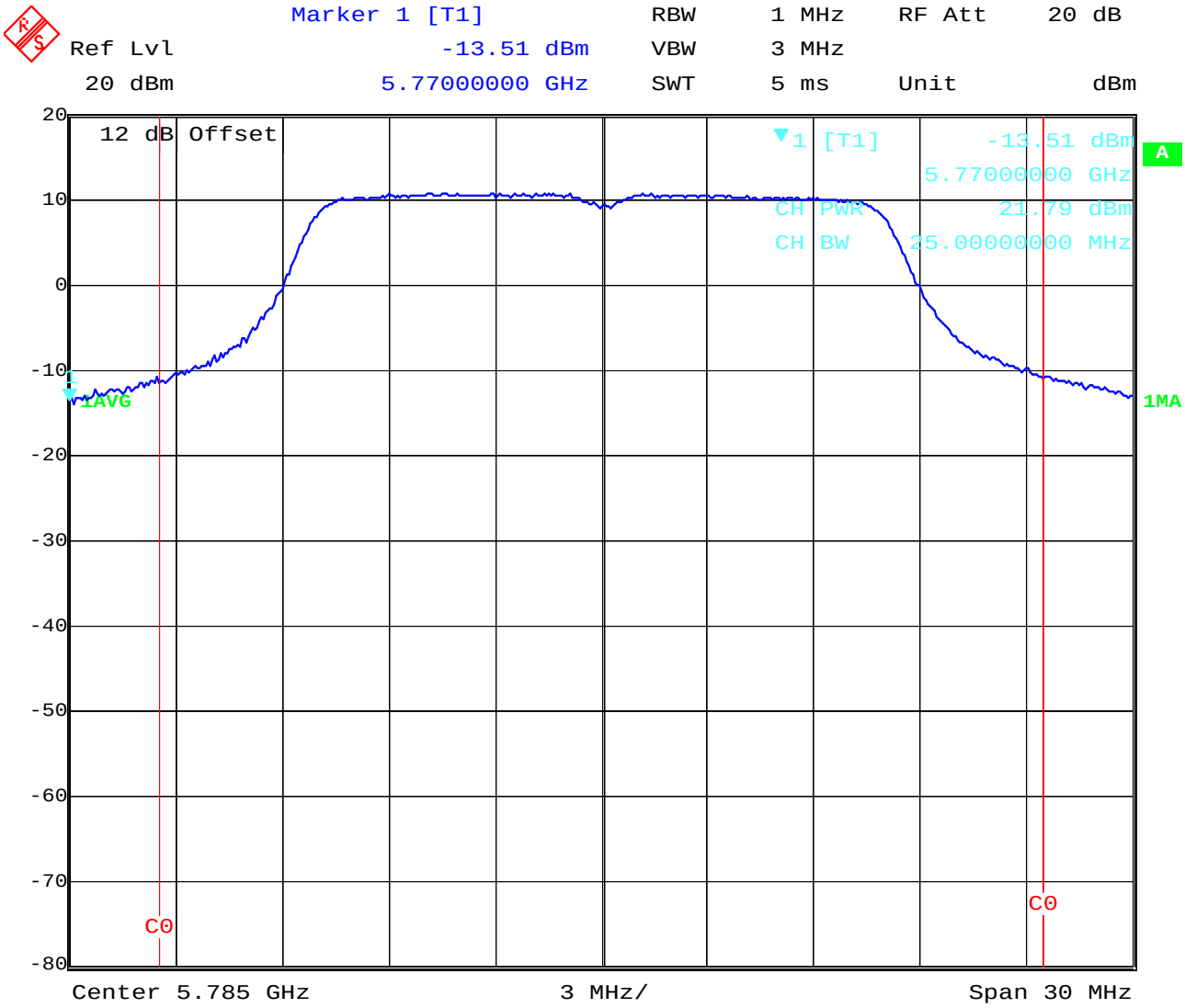
Date: 21.FEB.2005 12:51:14

Plot 2: 5765 Mhz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)



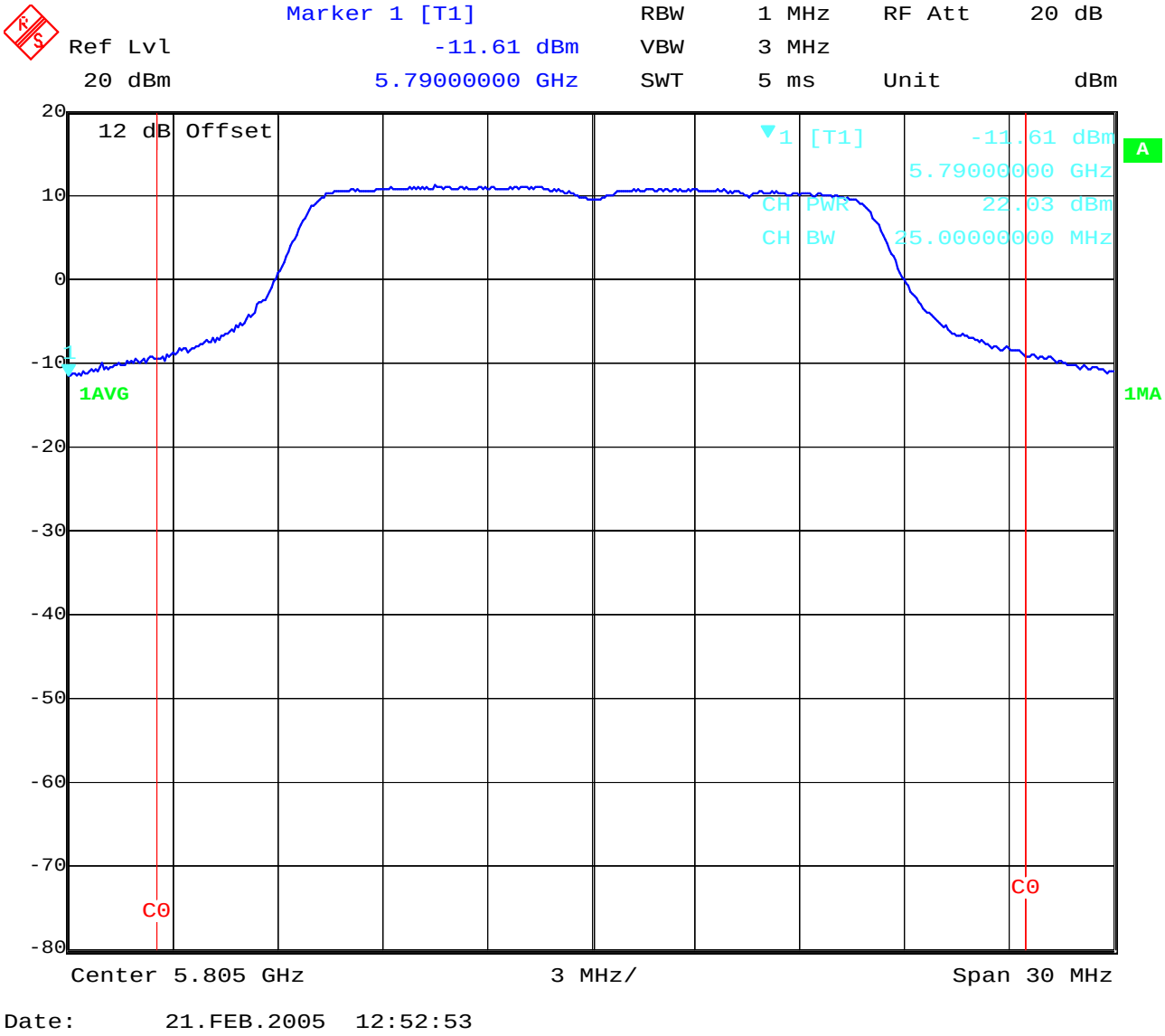
Date: 21.FEB.2005 12:51:49

Plot 3: 5785 MHz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)



Date: 21.FEB.2005 12:52:23

Plot 4: 5805 MHz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)

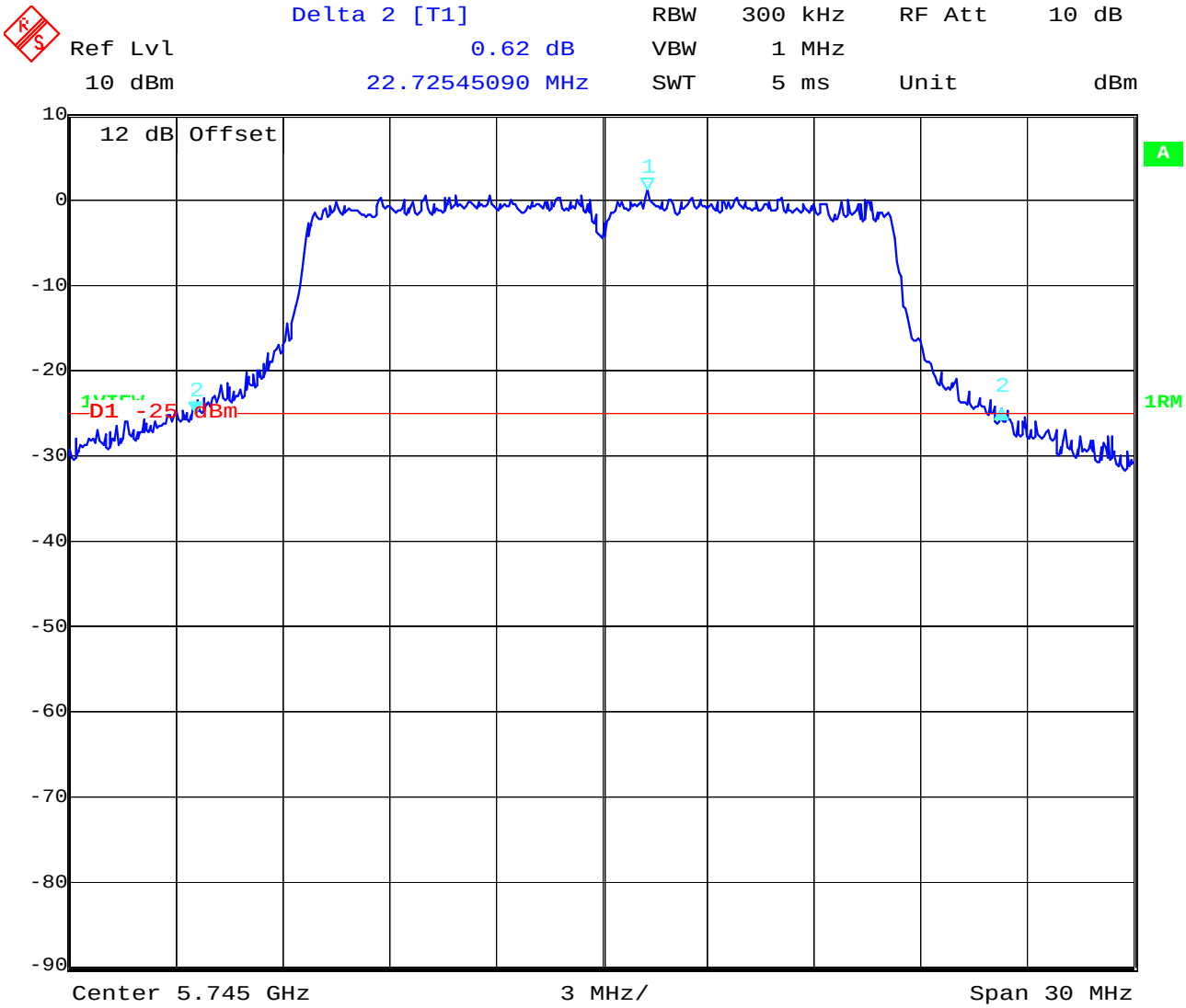


Results:

Plot 1: max output power with channel power: 21.81 dBm
Plot 2: max output power with channel power: 21.74 dBm
Plot 3: max output power with channel power: 21.79 dBm
Plot 4: max output power with channel power: 22.09 dBm

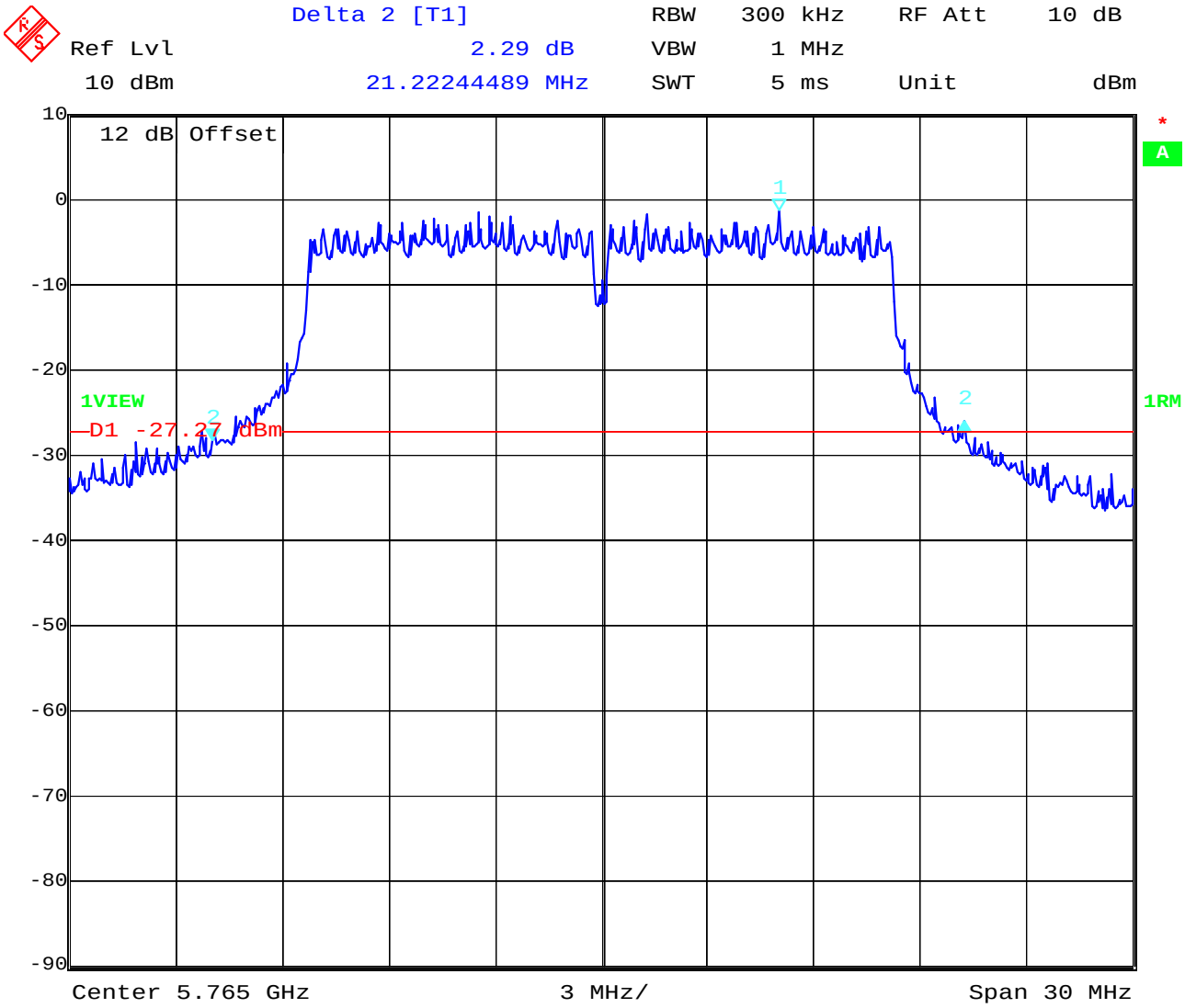
Emission Bandwidth

5745 MHz



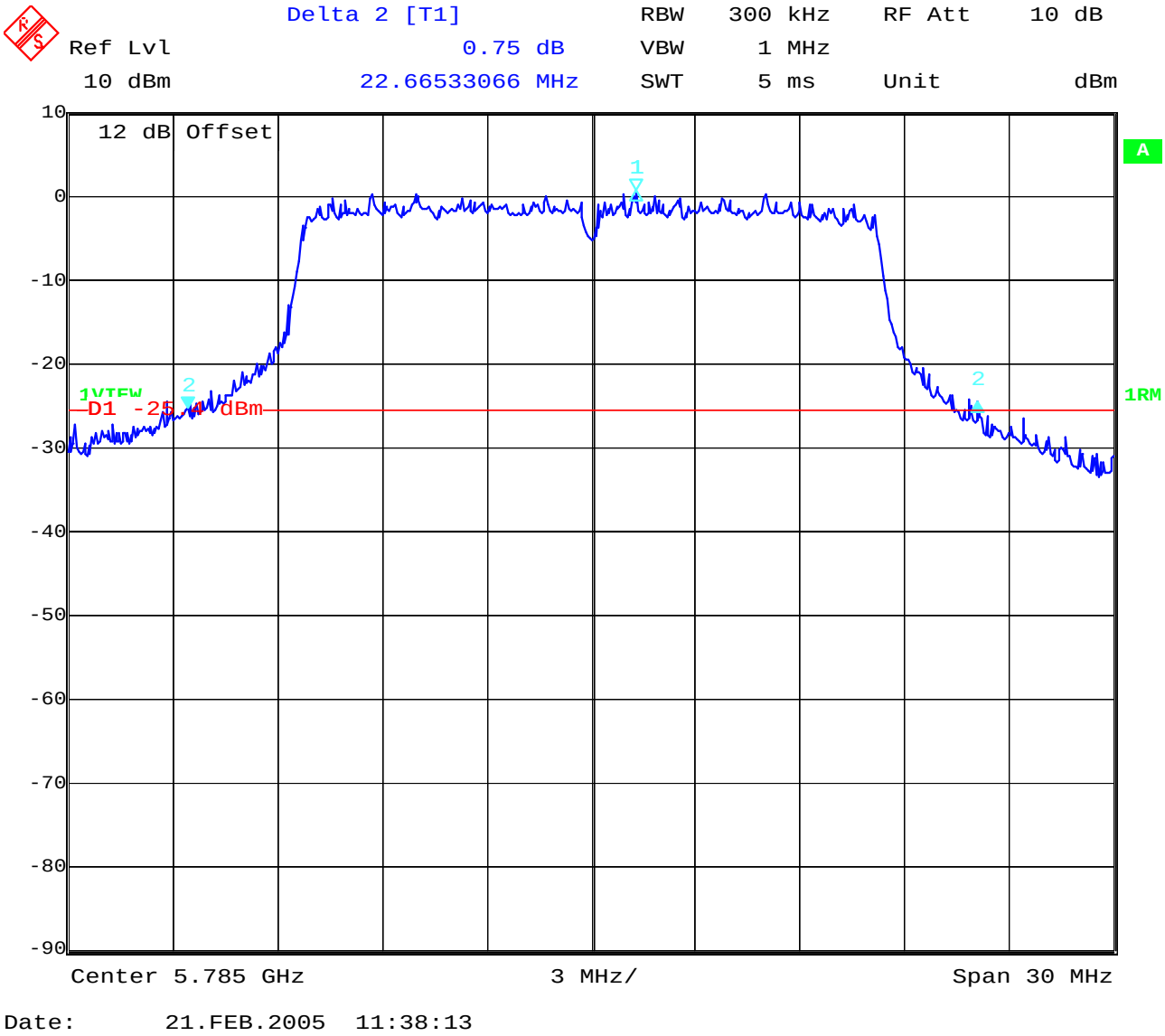
Date: 21.FEB.2005 11:36:57

5765 MHz

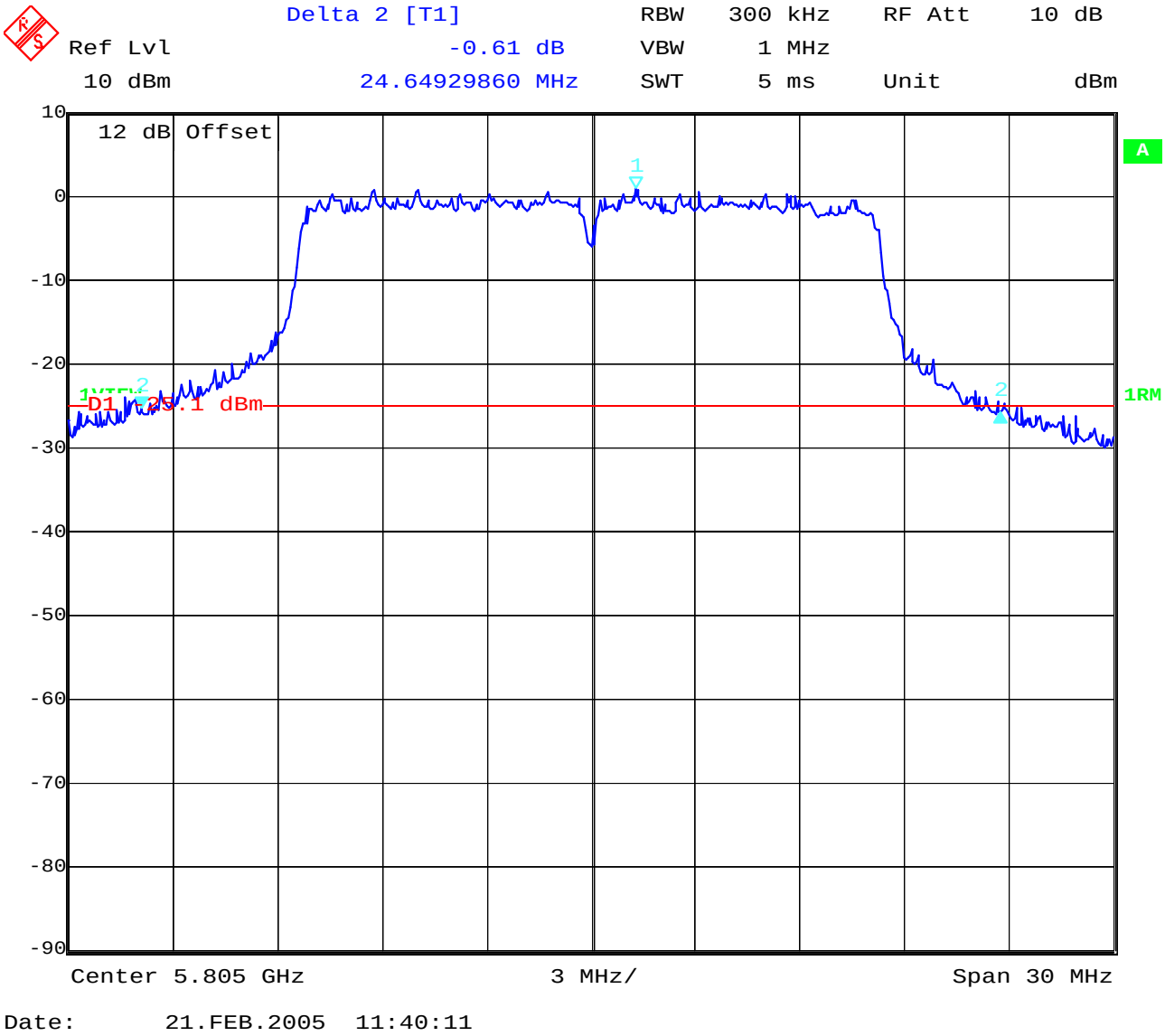


Date: 21.FEB.2005 11:35:43

5785 MHz


Delta 2 [T1]
0.75 dB
22.66533066 MHz
RBW 300 kHz
VBW 1 MHz
SWT 5 ms
RF Att 10 dB
Unit dBm
Ref Lvl
10 dBm
12 dB Offset
1VIEW
D1 -25.00 dBm
1RM
A
Center 5.785 GHz
3 MHz/
Span 30 MHz
Date: 21.FEB.2005 11:38:13

5805 MHz



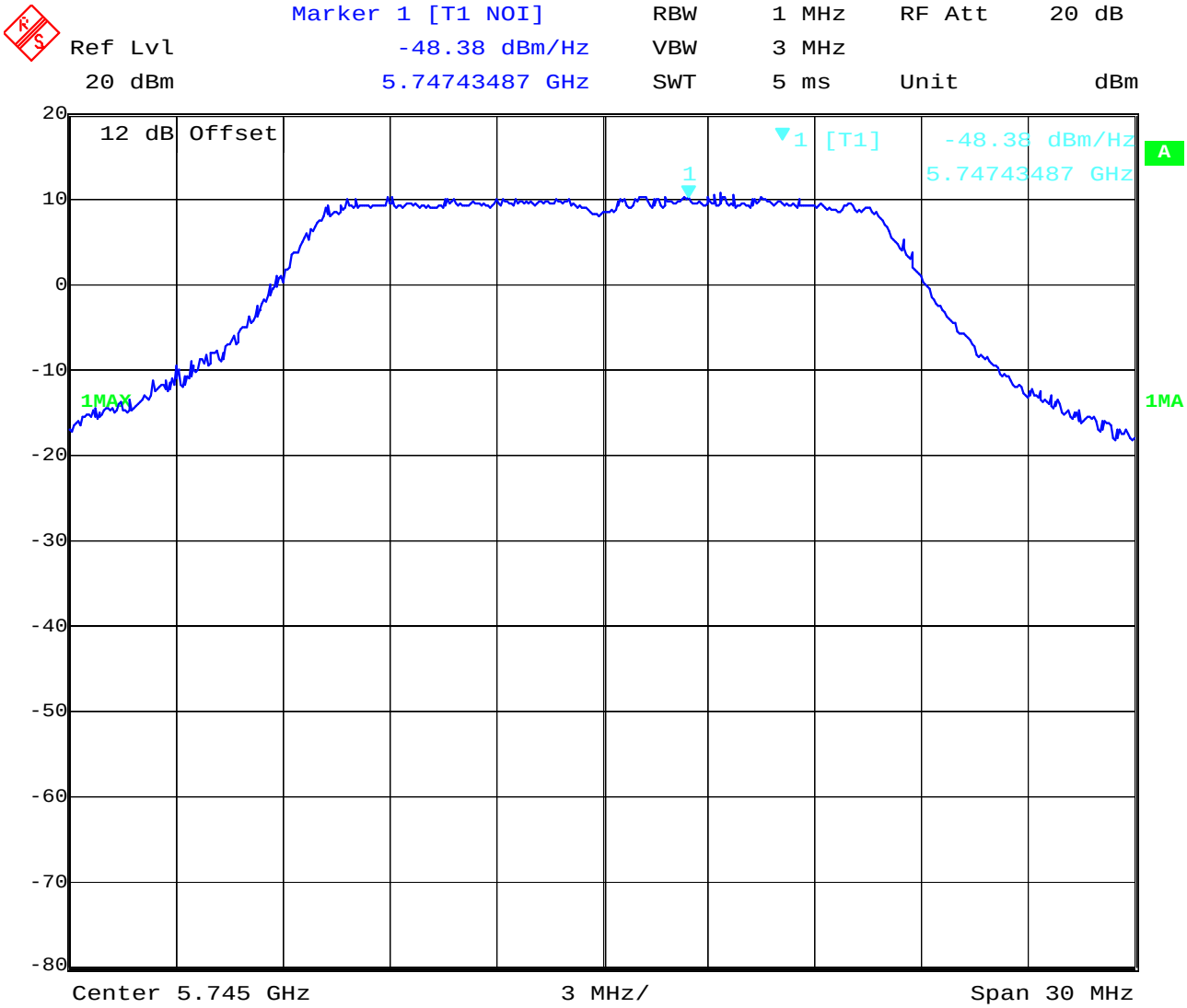
Results:

Plot 1: OBW at –26 dBc: 22.725 MHz
Plot 2: OBW at –26 dBc: 21.222 MHz
Plot 3: OBW at –26 dBc: 22.665 MHz
Plot 4: OBW at –26 dBc: 24.649 MHz

3.6 Spectral Density Conducted §15.407(a5)

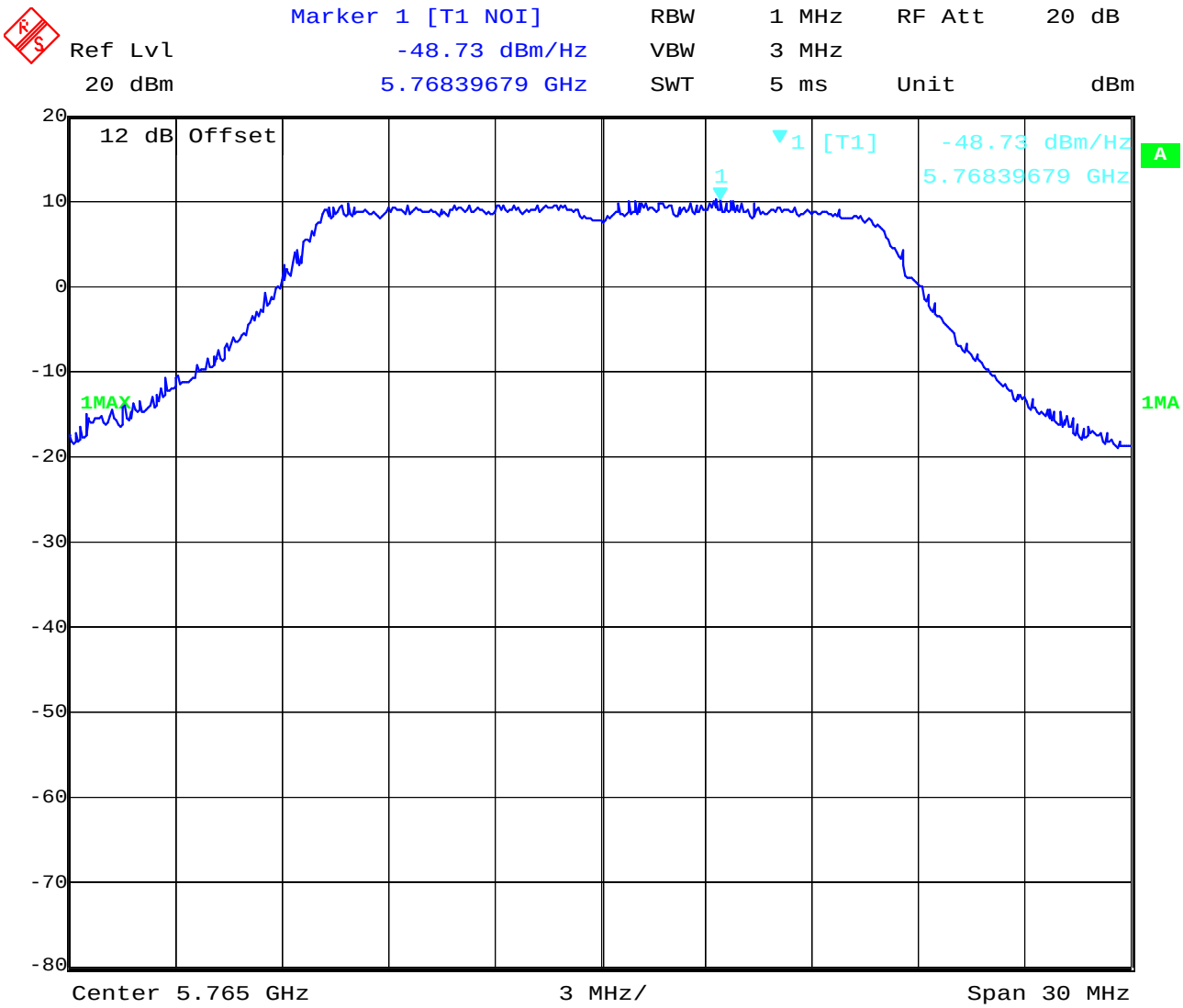
Plot 1 : 5745 MHz

Result is calculated to 1 Hz with the power density function of the analyzer FSIQ26. The get the result related to 1 MHz according to FCC you have to add 60 dB.



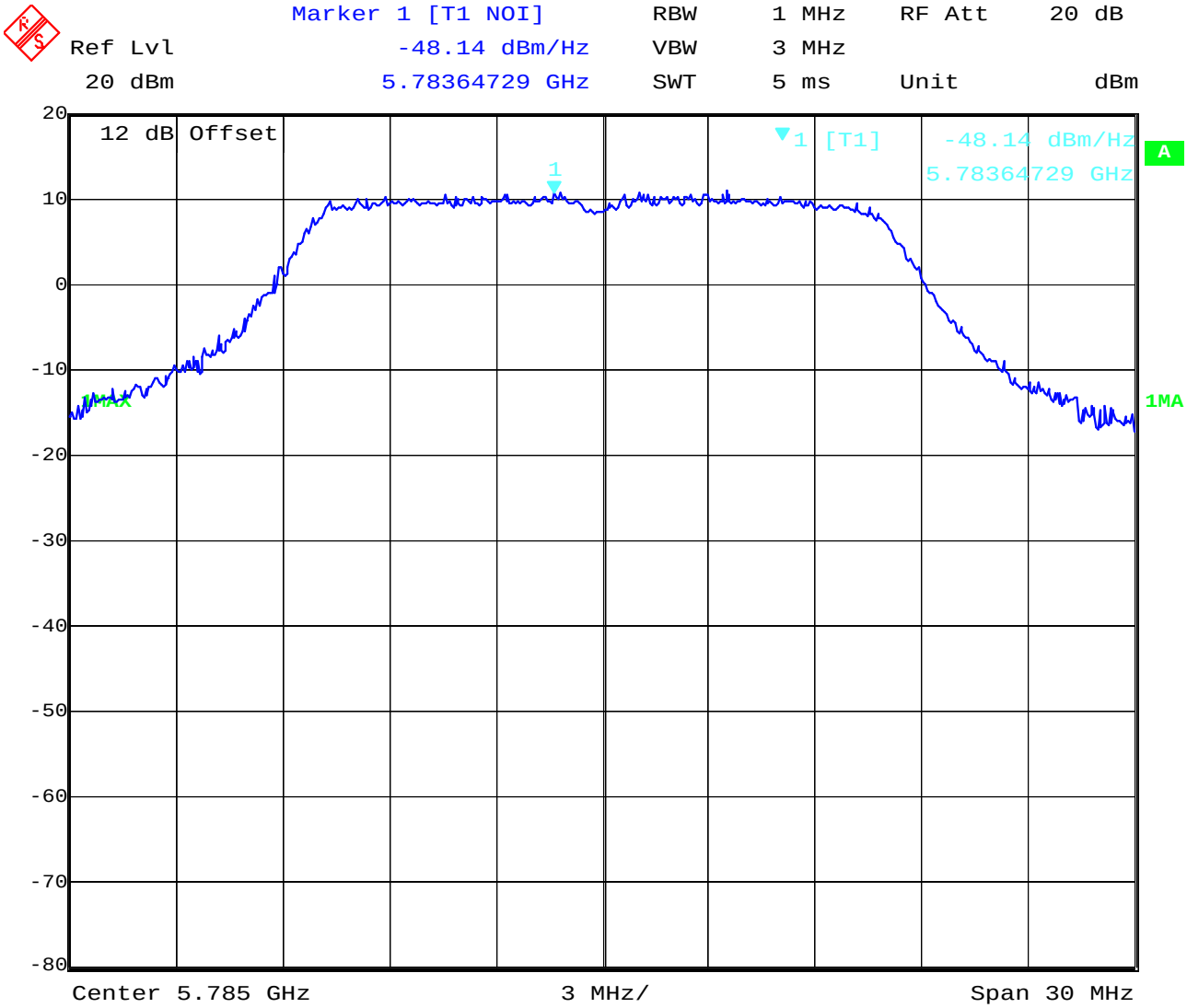
Date: 21.FEB.2005 12:58:19

Plot 2: 5765 MHz



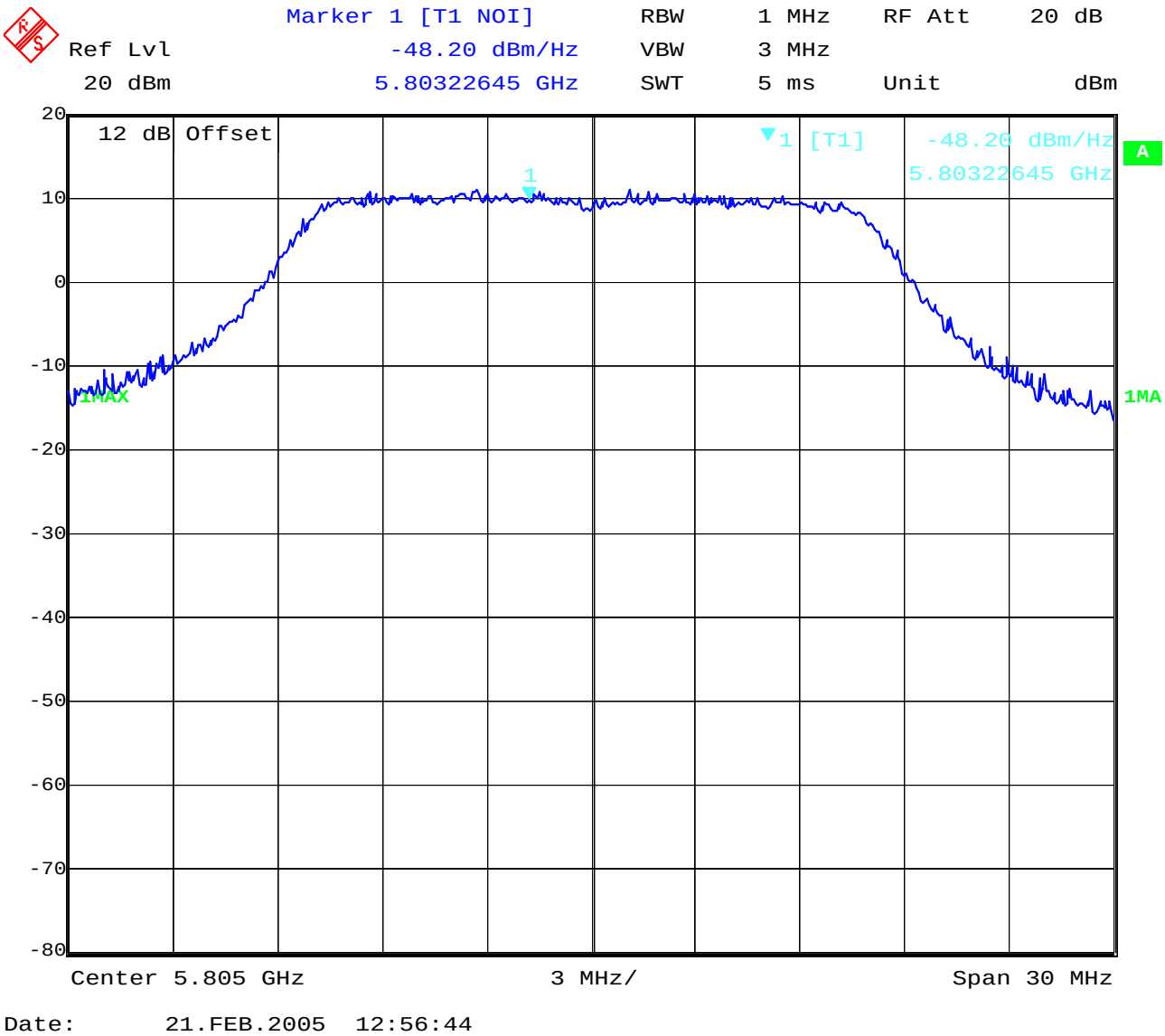
Date: 21.FEB.2005 12:57:49

Plot 3: 5785 MHz



Date: 21.FEB.2005 12:57:17

Plot 4: 5805 MHz

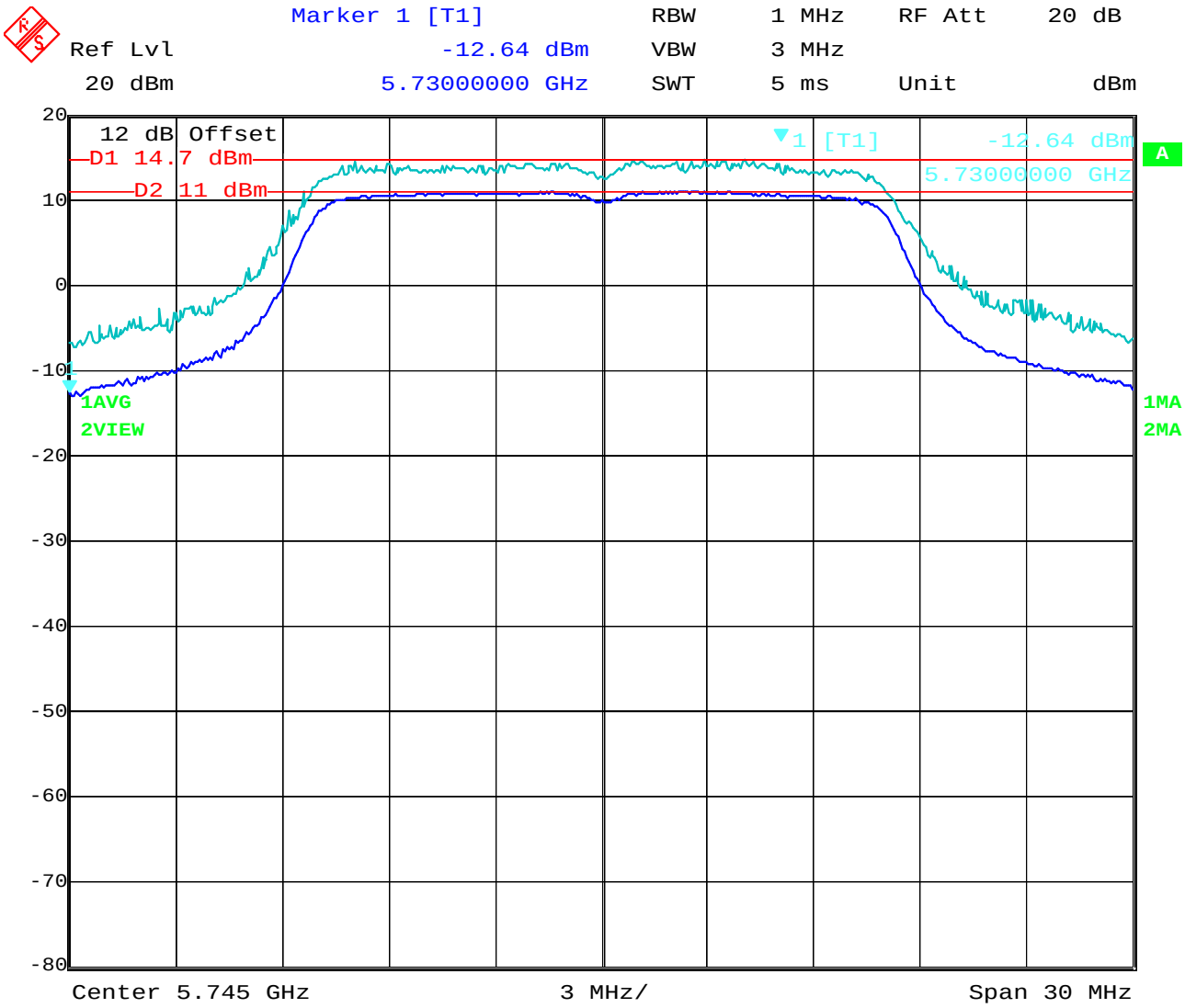


Results: with correction factors +60 dB regarding the BW-correction to 1 MHz RBW of the analyzer

Test conditions		Spectral density Including +60 dB correction factor		
Frequency [MHz]			Limit	
	5745 MHz	11.62 dBm	17 dBm	Pass
	5765 MHz	11.27 dBm	17 dBm	Pass
	5785 MHz	11.86 dBm	17 dBm	Pass
	5805 MHz	11.80dBm	17 dBm	Pass
Measurement uncertainity		±1dB		

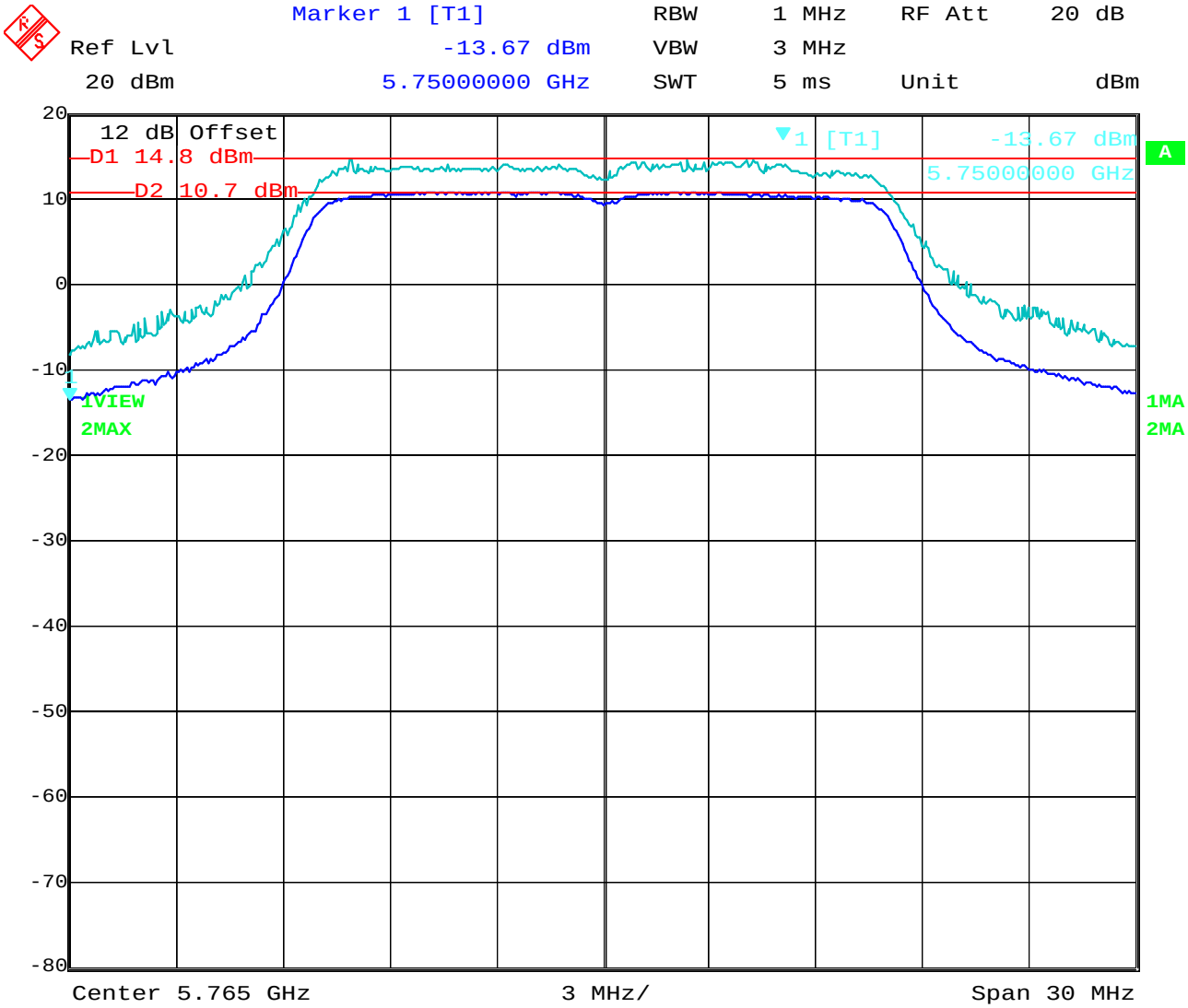
3.7 Ratio of Peak Excursion §15.407(a6)

Plot 1 : 5745 MHz



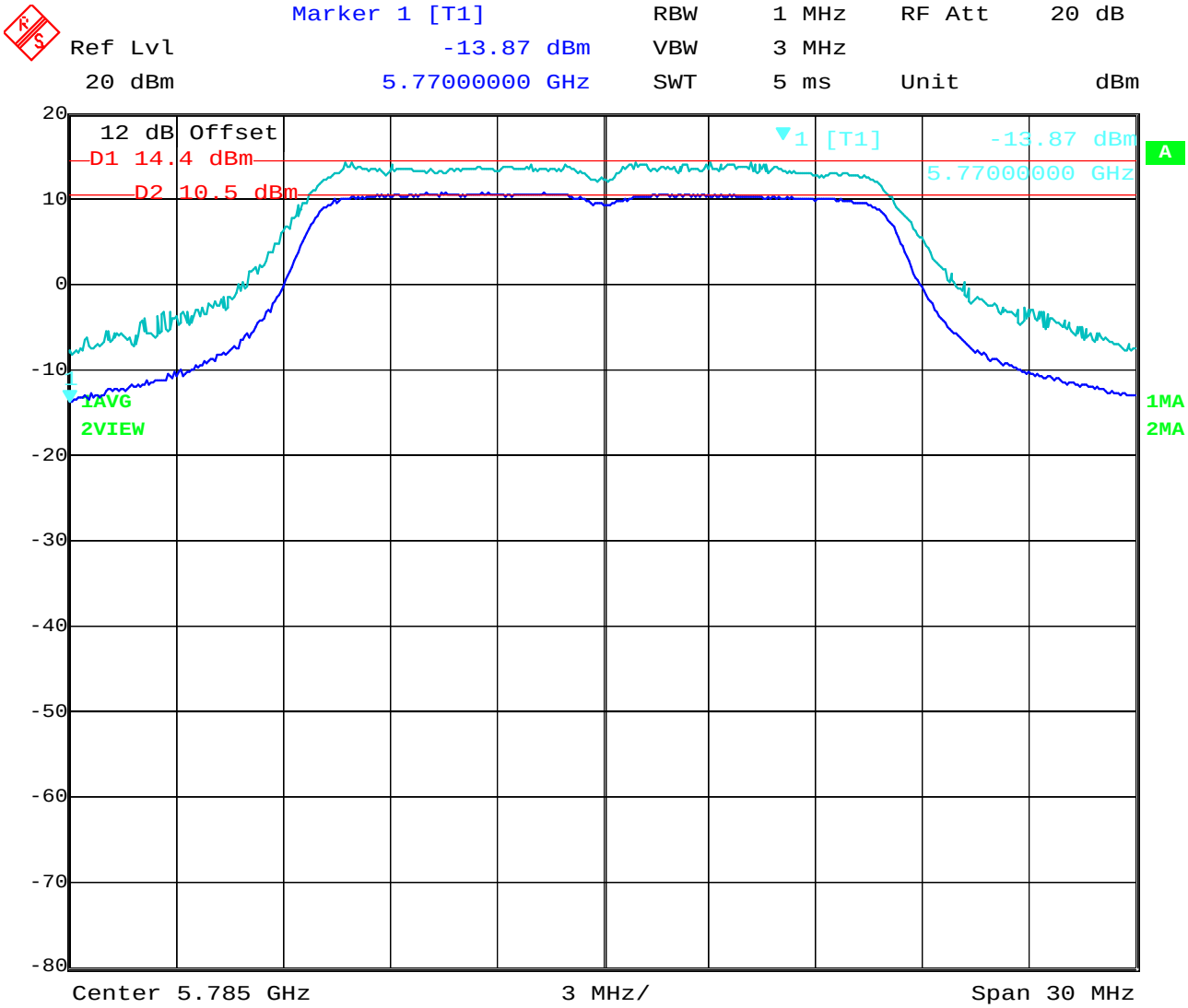
Date: 21.FEB.2005 13:27:07

Plot 2: 5765 MHz



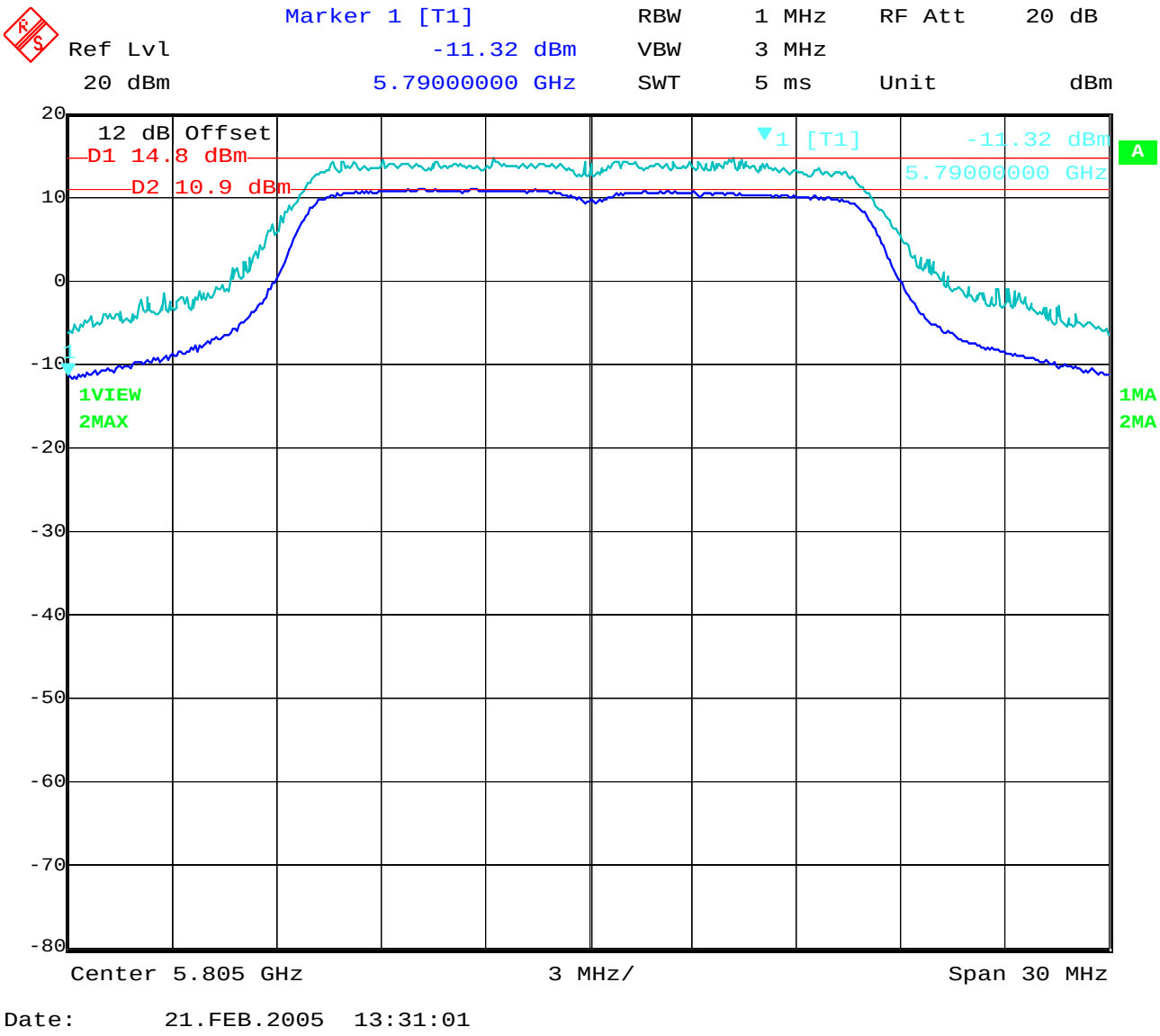
Date: 21.FEB.2005 13:28:31

Plot 3: 5785 MHz



Date: 21.FEB.2005 13:29:56

Plot 4: 5805 MHz



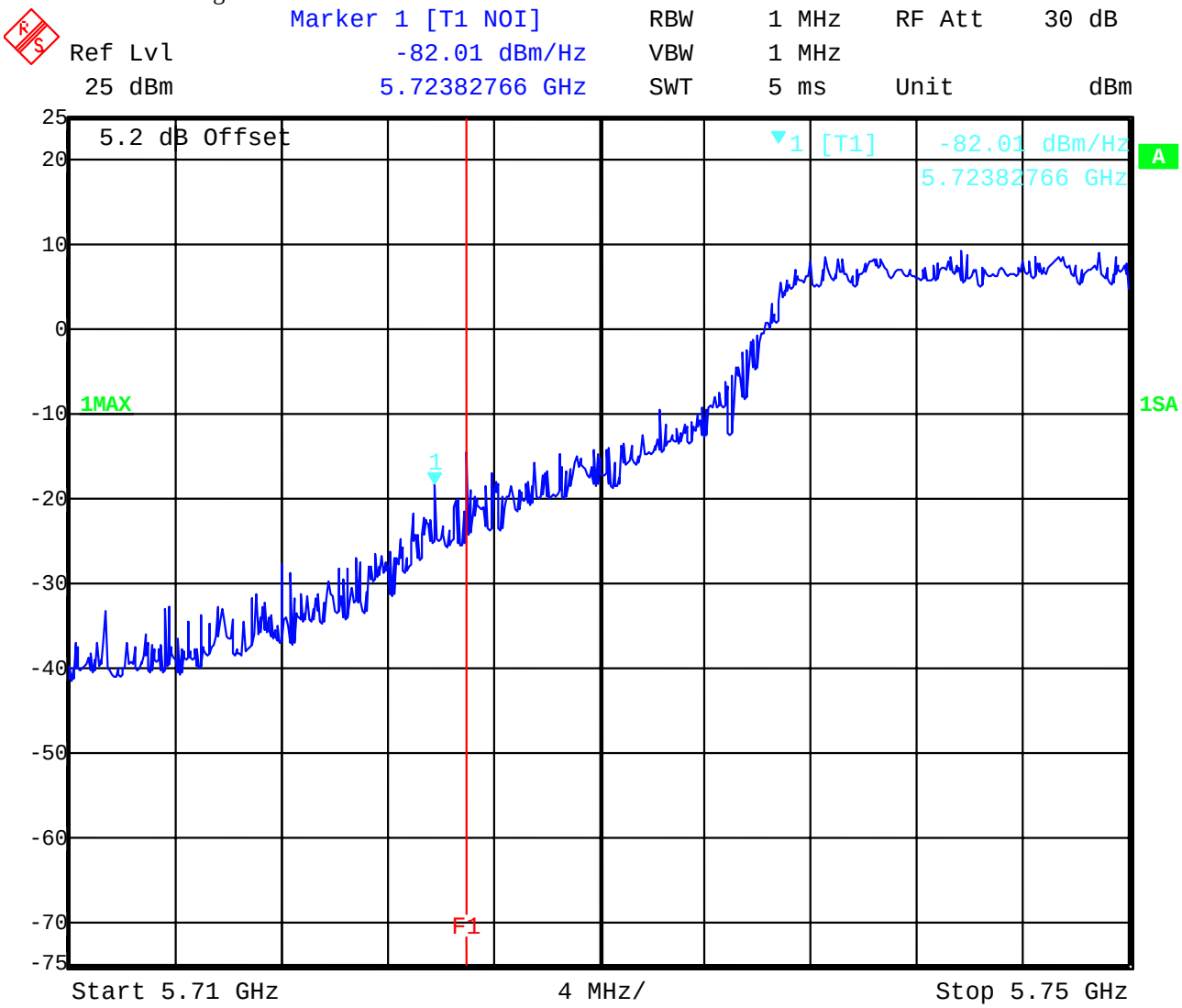
Date: 21.FEB.2005 13:31:01

Results

Test conditions		Ratio of peak excursion of the modulation envelope		
		Result	Limit	
5745 MHz		3.7 dB	13 dB	Pass
5765 MHz		4.1 dB	13 dB	Pass
5785 MHz		3.9 dB	13 dB	Pass
5805 MHz		3.9 dB	13 dB	Pass
Measurement uncertainity		±1dB		

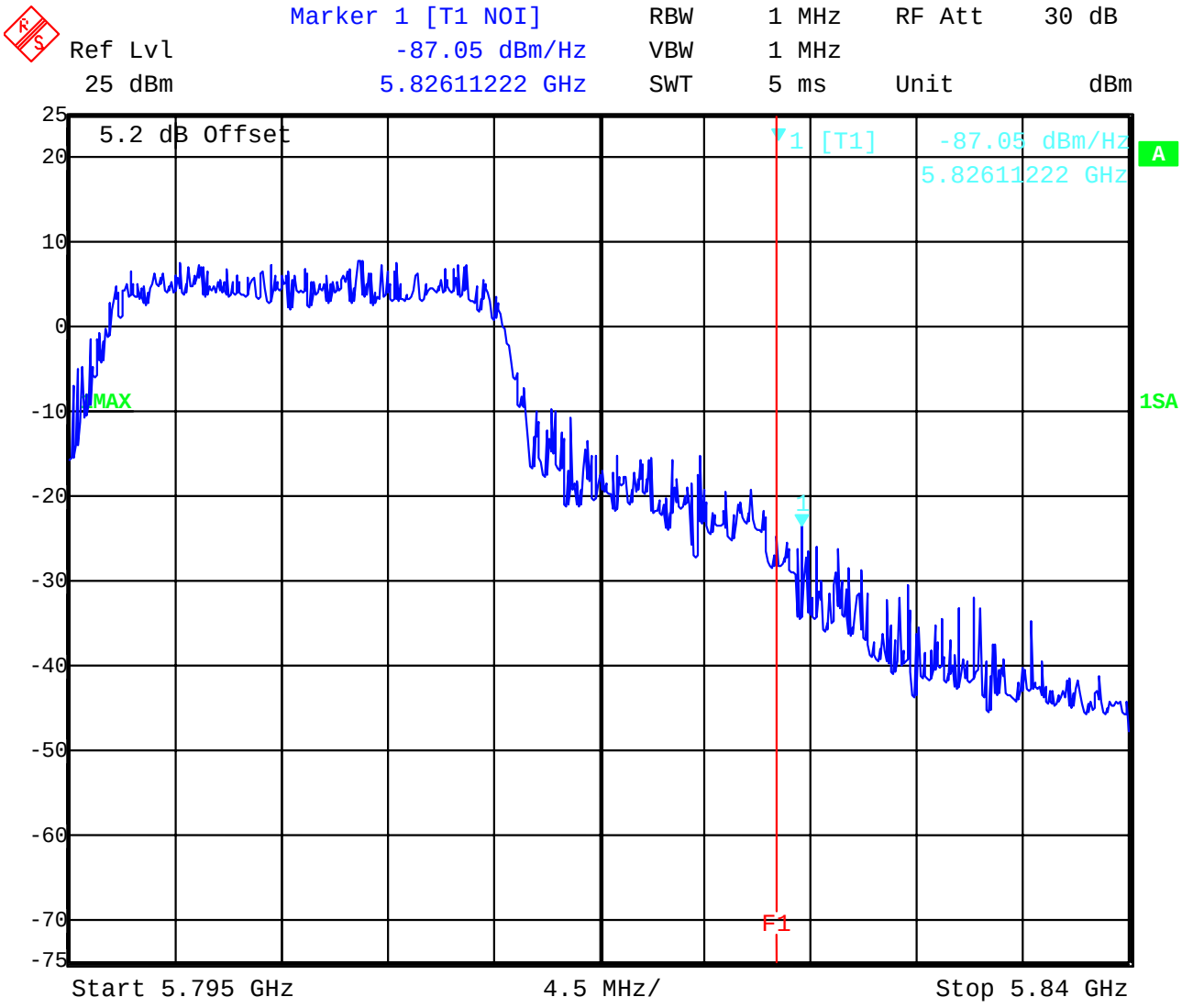
3.8 Undesirable emission limits at band edges 15.407 (b3)

Plot 1: lower band edge



RBW / VBW : 1 MHz

Plot 2: upper band edge



RBW / VBW : 10 MHz

Limits: - ± 10 Mhz above band edge -17 dBm/MHz

- more than 10 MHz above or below -27 dBm/MHz

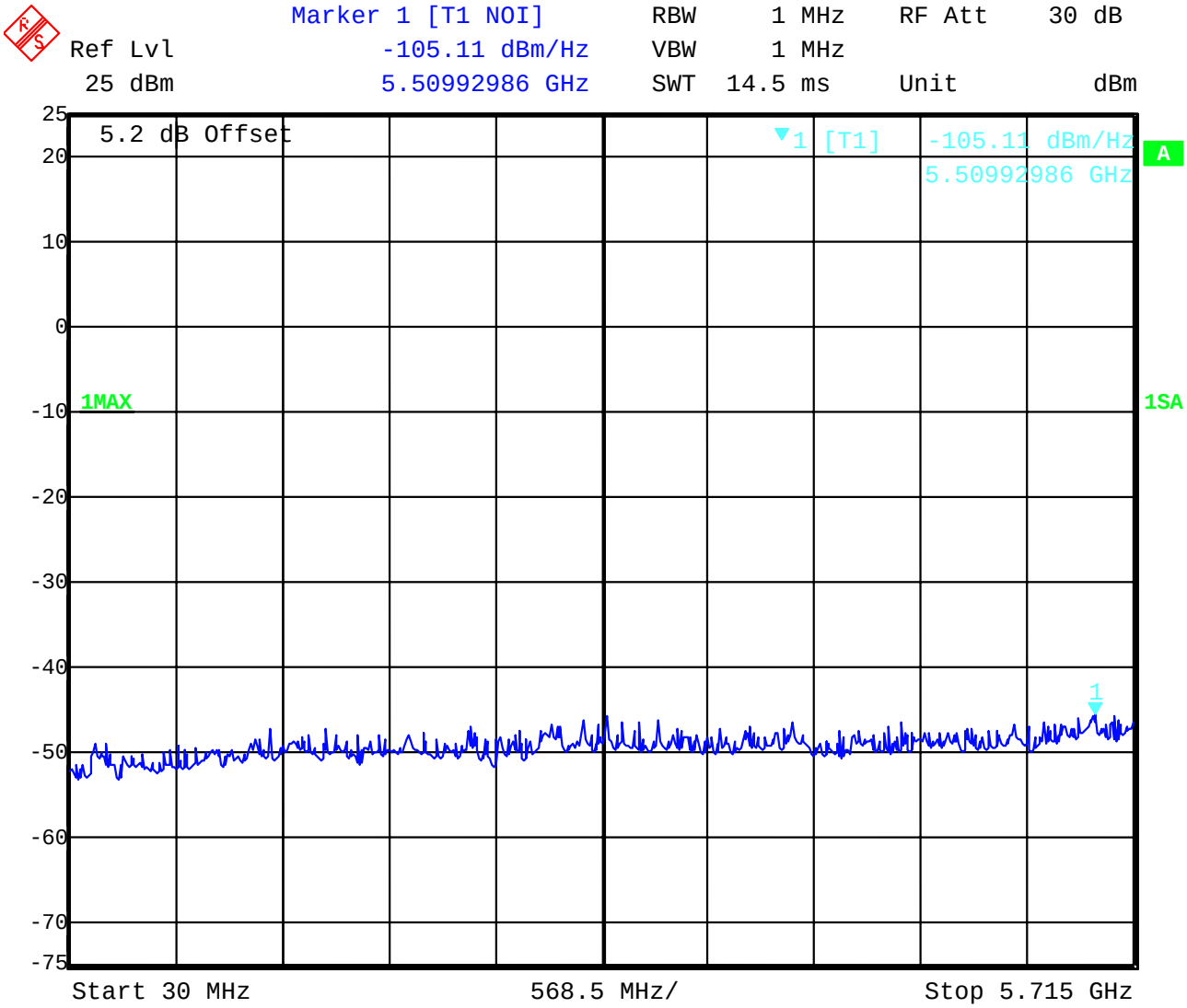
Result: - lower band edge - 10 MHz: -82.0 dBm/Hz + 60 dB = -22.0 dBm/MHz => pass
- upper band edge + 10 MHz: -87.1 dBm/Hz + 60 dB = -27.1 dBm/MHz => pass

-all frequencies more than 10 MHz above or below band edge < -30 dBm/MHz => pass

3.9 Spurious (conducted) 15.407 (b3)

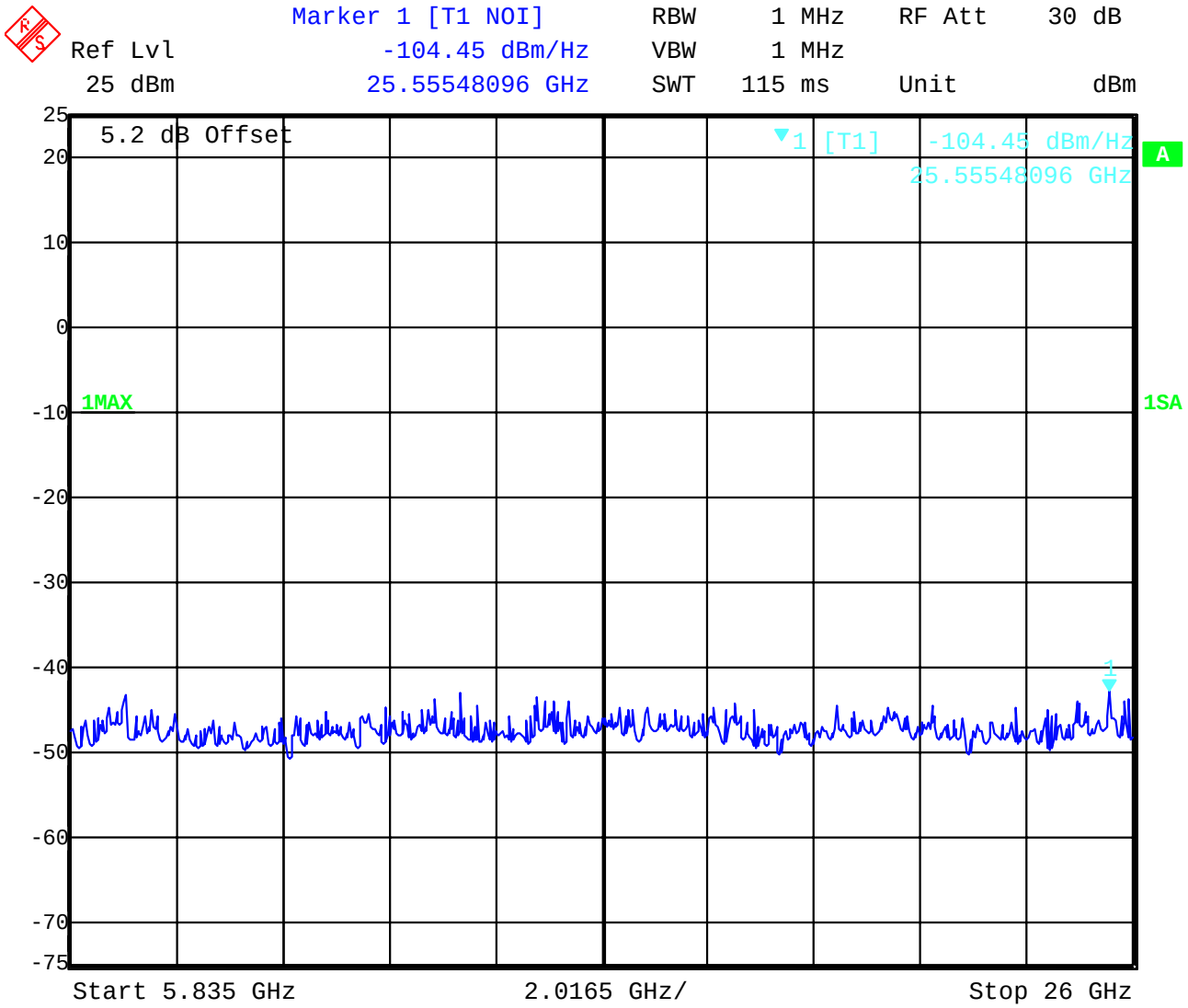
The measurement was performed up to 60 GHz with external mixers.
There were no peaks found.

Plot 1: 5745 MHz



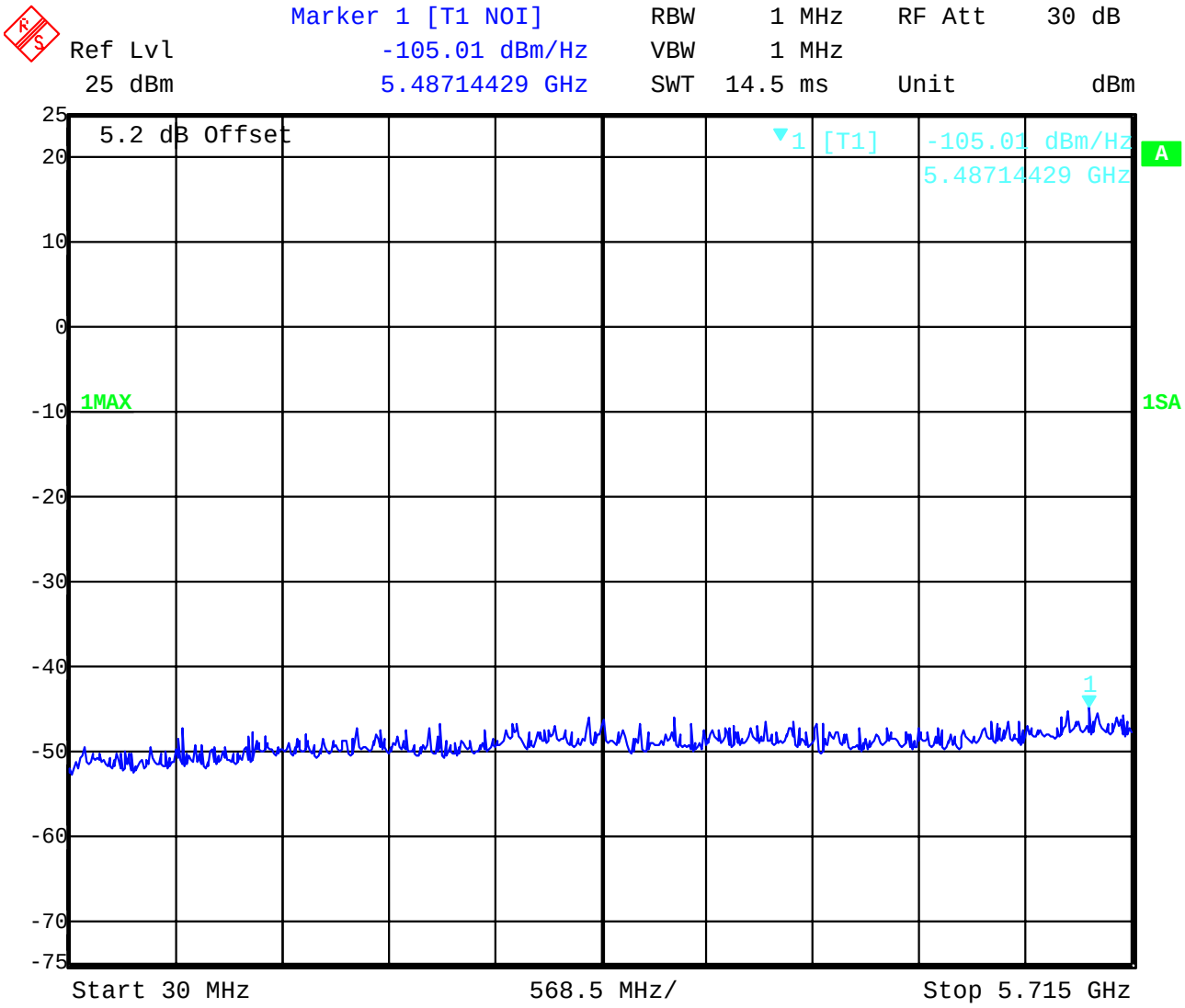
RBW / VBW : 1 MHz

Plot 2: 5745 MHz



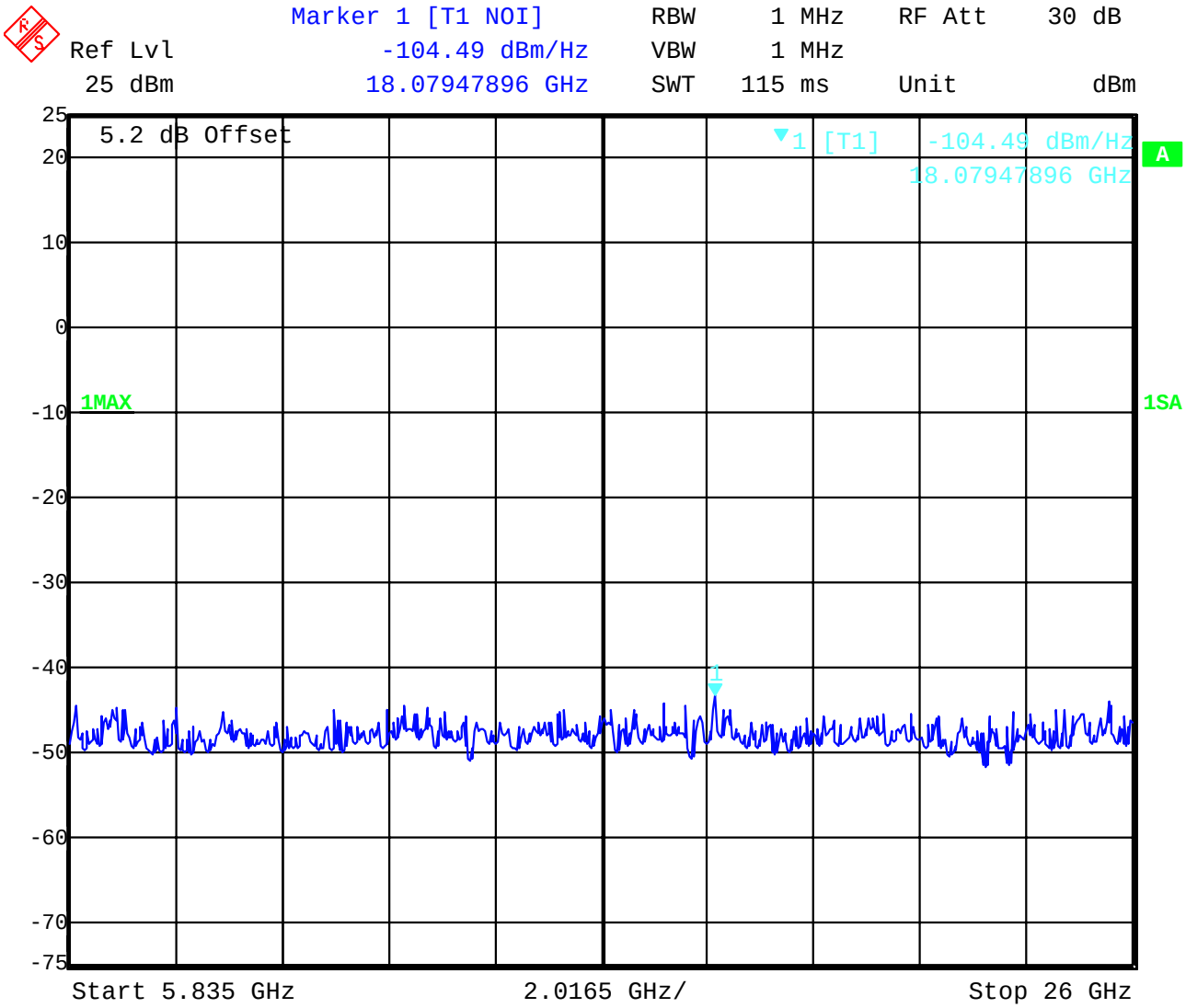
RBW / VBW : 1 MHz

Plot 3: 5765 MHz



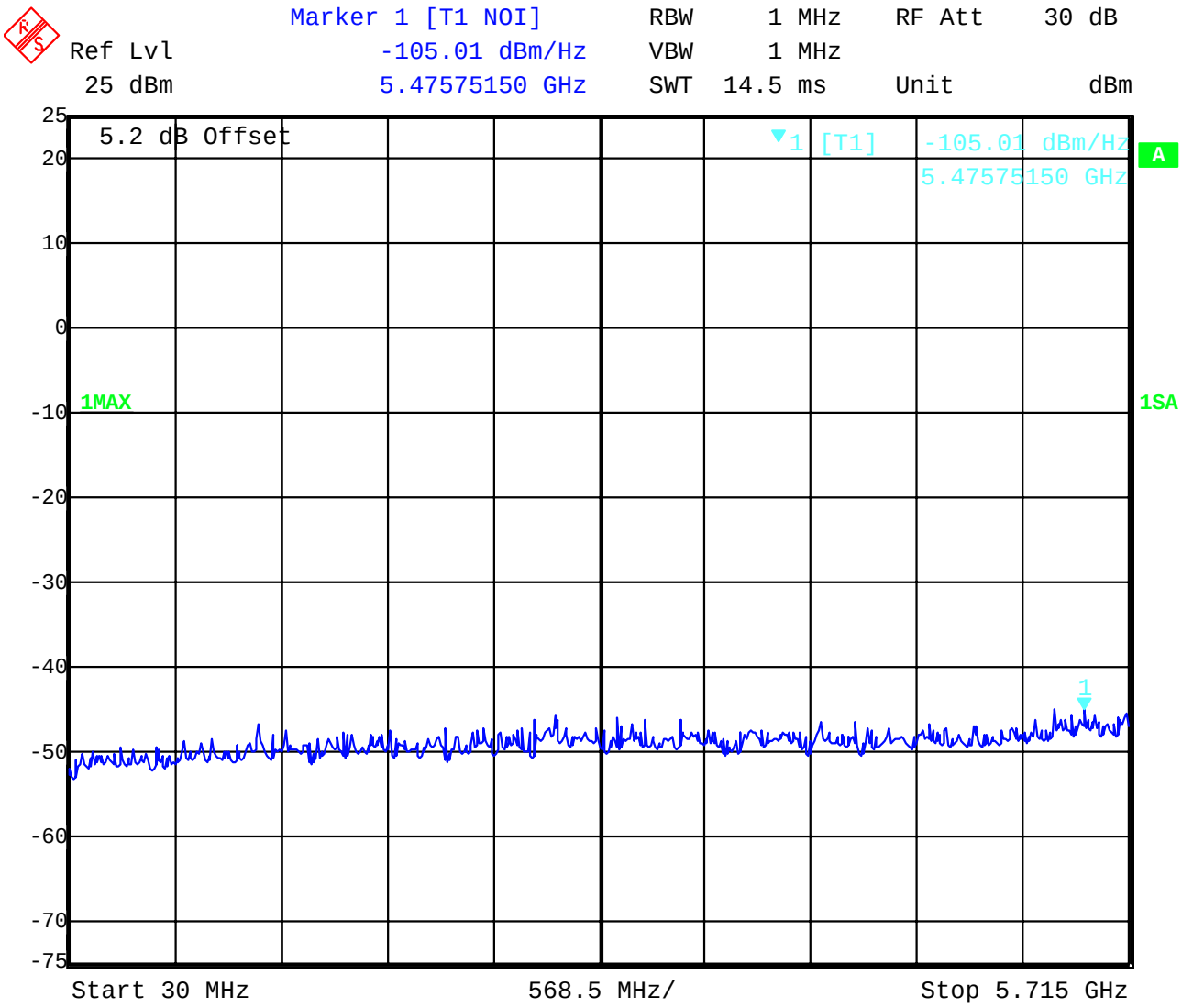
RBW / VBW : 1 MHz

Plot 4: 5765 MHz



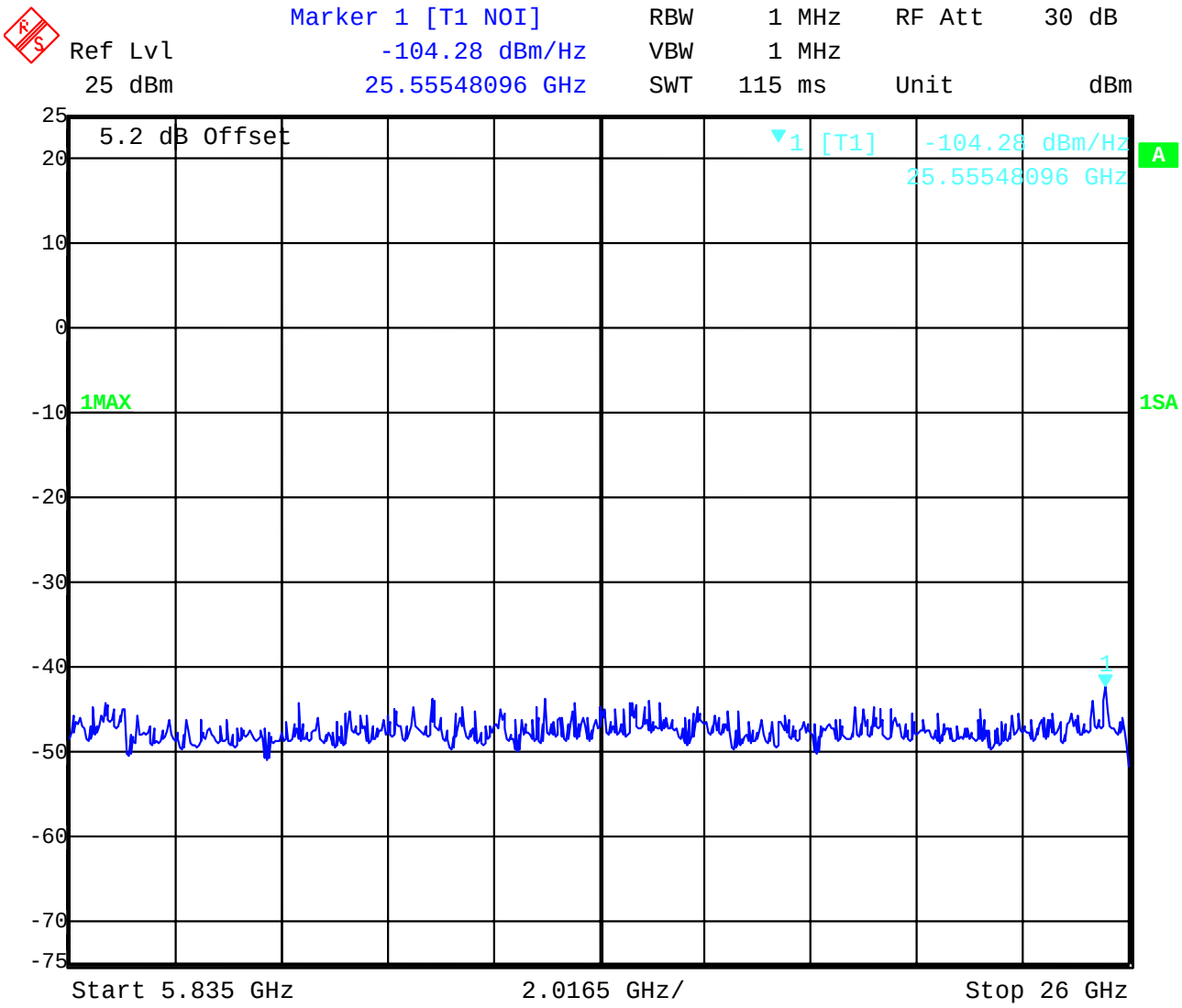
RBW / VBW : 1 MHz

Plot 5: 5785 MHz



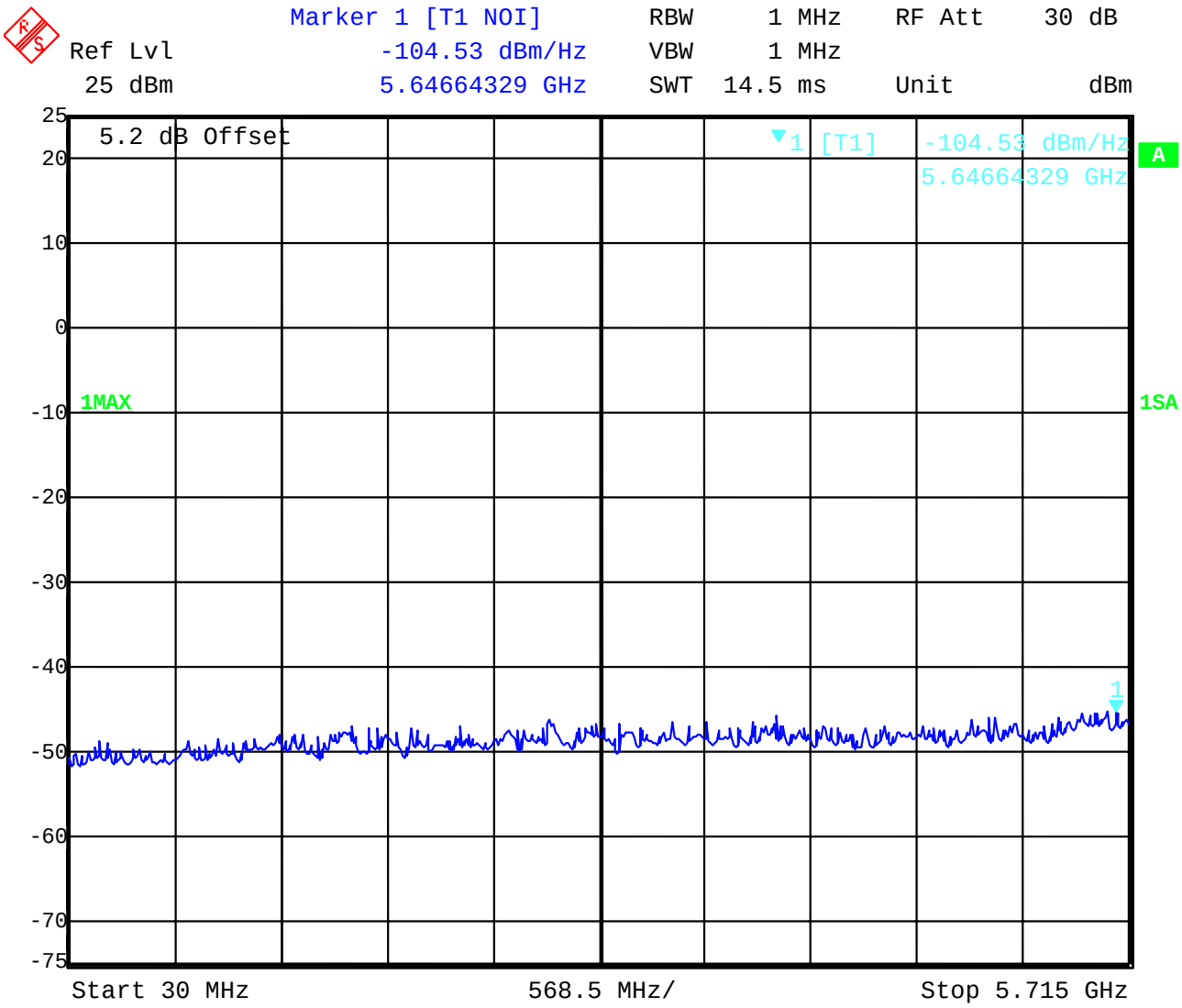
RBW / VBW : 1 MHz

Plot 6: 5785 MHz



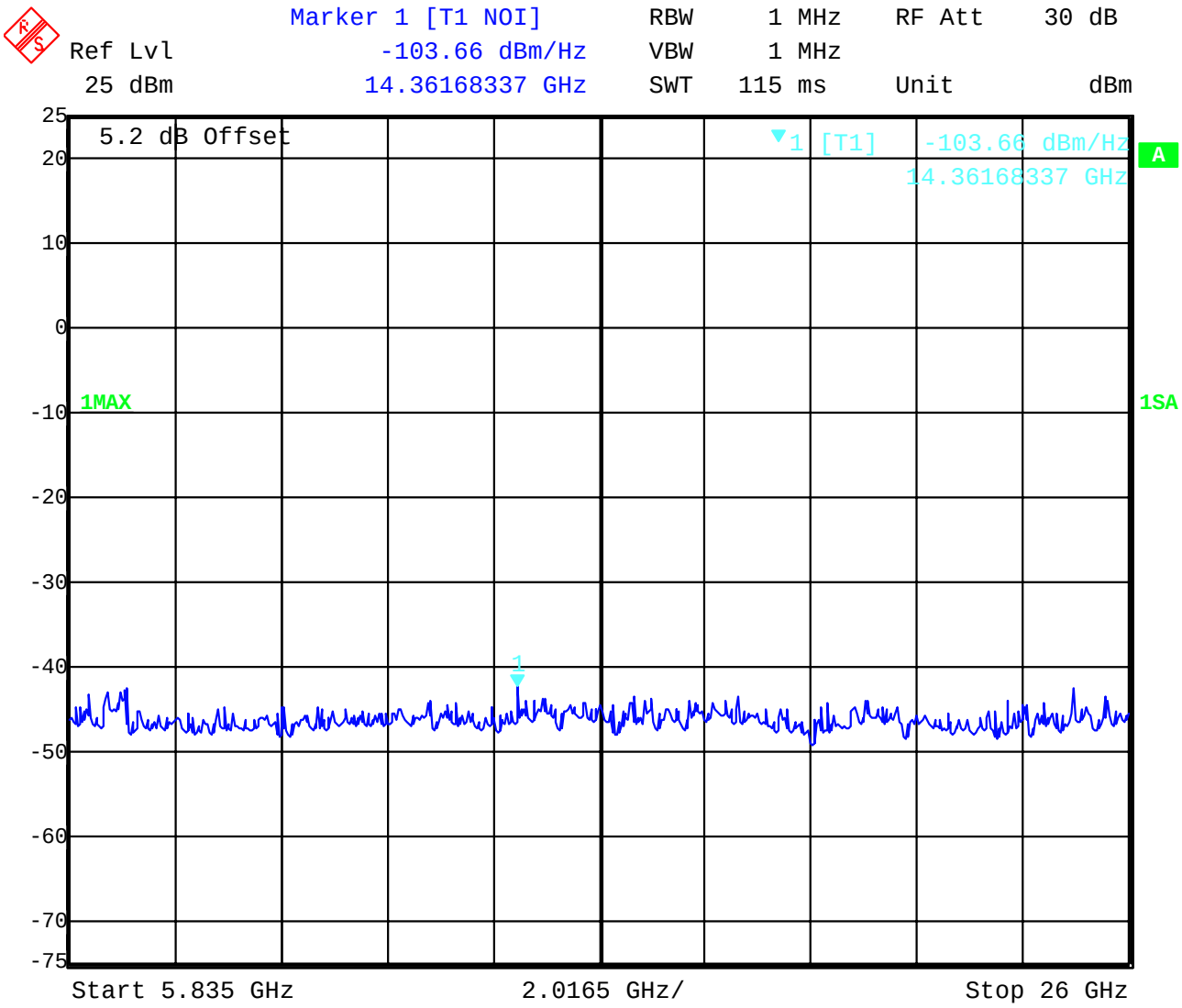
RBW / VBW : 1 MHz

Plot 7: 5805 MHz



RBW / VBW : 1 MHz

Plot 8: 5805 MHz



RBW / VBW : 1 MHz

Spurious emissions conducted

Result & Limits

Emission Limitations					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emmision power	actual attenuation below frequency of operation [dB]	results
5745			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5765			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5785			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5805			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
Measurement uncertainty		± 3dB			

RBW : 1 MHz VBW: 1 MHz

Under normal test conditions only	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)).

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

3.10 MPE calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a "worst case" prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation: (Antenna 1)

(Calculated for max. EIRP)

EIRP: 28.0 dBm = 631.0 mW

calculated at distance of 20 cm:

power density = $631.0 / 4\pi 20^2$ = 0.126 mW/cm^2

Calculation: (Antenna 2)

EIRP: 28.3 dBm = 676.1 mW

power density = $676.1/4\pi 20^2$ = 0.135 mW/cm^2

Limit:

1mW/cm^2 is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

RF EXPOSURE INFO for high gain antenna

Environmental evaluation measurements of Maximum Permissible Exposure (MPE) to radio frequency (RF) radiation from transmitting devices for compliance with the technical rules and regulations of the U.S. Federal Communications Commission and Industry Canada.

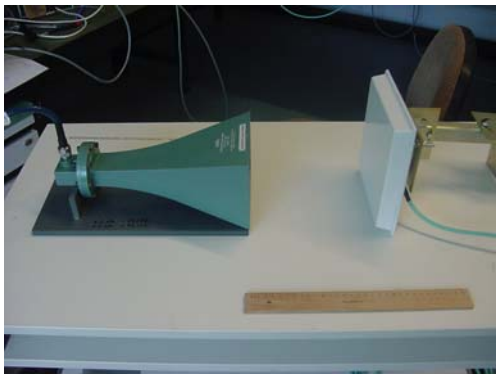
Description of EUT

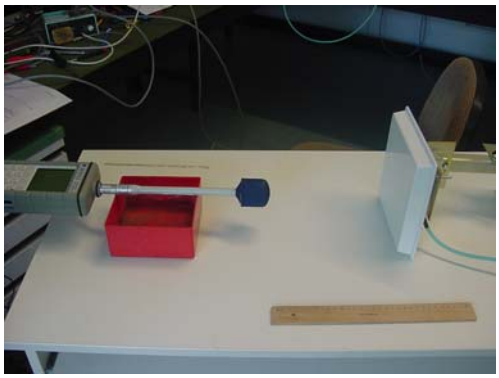
Siemens AG Model: wireless Client with antenna type ANT793-8DR including 3m coax cable.

1) The probe was positioned on a table at a separation distance of 20 cm from the radiating antenna and at a starting height of 5 cm to the center of the probe.
2) The table was positioned so that the initial start angle was 0 degrees.
3) The EUT was powered on and allowed sufficient time to stabilize. The EUT was operated at full power on a desired frequency.
4) The analyzer and the field probe was set for maximum hold, and set on the appropriate power range.
5) The table was rotated 360 degrees and the maximum reading was obtained for that elevation.
6) The antennas were lifted and lowered at maximum value in the horizontal plane to find the maximum in vertical position.

Result:
The max measured MPE value on a distance of 20 cm is: **0.44 mW/cm^2** by measurement with the analyzer
0.42 mW/cm^2 by measurement with the field probe

MPE System Specification:
- Electromagnetic Radiation Field probe, PMM Model 8053
  Frequency Range: 1 MHz to 40 GHz
  Calibration date: 05/2005
- Signal analyzer FSIQ26 from R&S
  Frequency range: 10 Hz to 26.5 GHz
  Calibration date: 07/2004





Limit:

1mW/ cm^2 is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

3.11 Max. peak output power (radiated) §15.247 (b) (1)

Results:

Test conditions **Antenna 1** (gain 4.0 dBi) Frequency [MHz]		Max. peak output power EIRP [dBm]		
		5745 MHz	5765 MHz	5785 MHz
T_{nom}	V_{nom}	27.1 rad	28.0 rad	27.1 rad
Frequency [MHz]		5805 MHz		
T_{nom}	V_{nom}	26.5 rad		
Measurement uncertainty		±3dB		

Test conditions **Antenna 2** (gain 7.9 dBi –3.6 dB cable loss => 4.3 dBi) Frequency [MHz]		Max. peak output power EIRP [dBm]		
		5745 MHz	5765 MHz	5785 MHz
T_{nom}	V_{nom}	27.4 rad	28.3 rad	27.4 rad
Frequency [MHz]		5805 MHz		
T_{nom}	V_{nom}	26.9 rad		
Measurement uncertainty		±3dB		

This combination is only for point to point connections.

Test conditions **Antenna 3** (gain 17.0 dBi) Frequency [MHz]		Max. peak output power EIRP [dBm]		
		5745 MHz	5765 MHz	5785 MHz
T_{nom}	V_{nom}	40.1 rad	41.0 rad	35.3 rad
Frequency [MHz]		5805 MHz		
T_{nom}	V_{nom}	34.7 rad		
Measurement uncertainty		±3dB		

Limits:

Under normal test conditions	Max. 1.0 Watt / 30 dBm
For point to point	If the antenna gain < 23 dBi No changes to output power necessary

3.12 Spurious Emissions - radiated (Transmitter) §15.209

There were no significant differences between the antennas.

We found no spurious in any channel up to 60 GHz.

The spurious below 1 GHz are radiated from the housing and identical at each antenna.

On the next page you find a list of restricted bands and the results of the spurious measurements of this three antennas up to 40 GHz.

There was only one frequency within the restricted bands with more than 100µV below limit.

The plots on the next pages show the behaviour of antenna 1 as an example.

Results:

Spurious Emissisons level [µV/m]								
f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]
38.7	QP	35.3						
42.0	QP	38.4						
90.1	QP	38.6						
142.3	QP	34.8						
528.7	QP	41.8						
Measurement uncertainty			±3 dB					

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

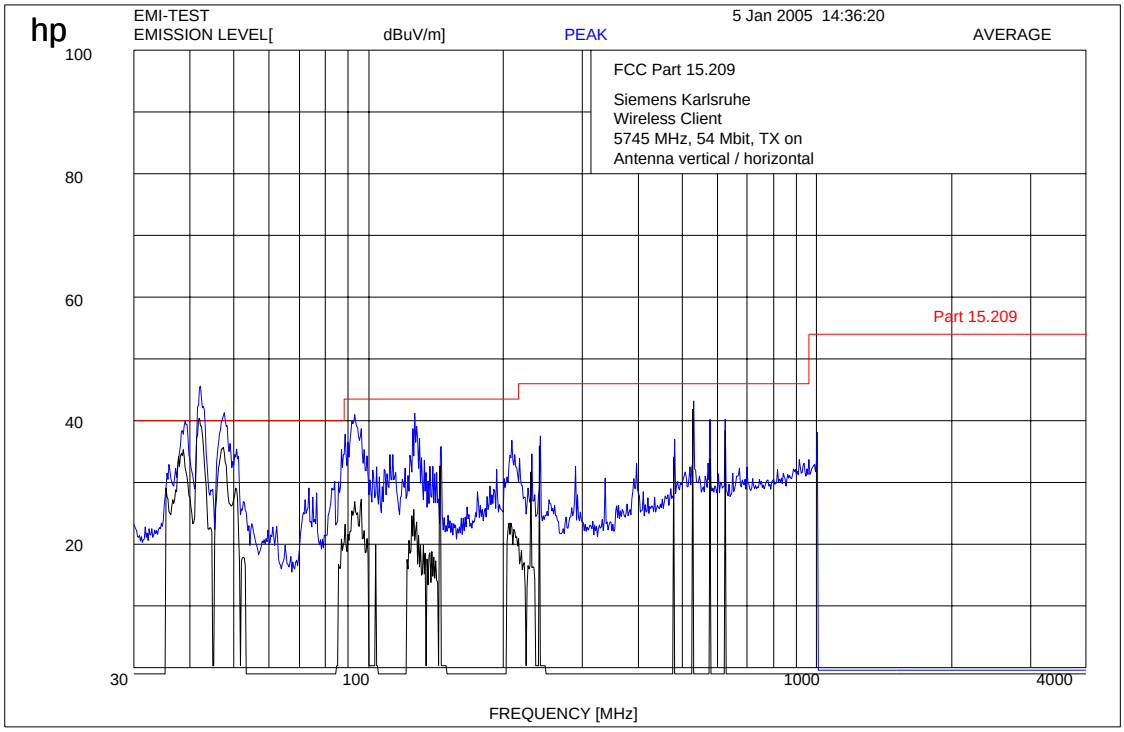
Measurement distance see table

Limits : § 15.109 / 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

Frequencies (MHz)	Limit	Antenna 1	Antenna 2	Antenna 3
37.5 – 38.25	100µV/m at 3m	-	-	-
73 – 74.6	100µV/m at 3m	-	-	-
74.8 – 75.2	100µV/m at 3m	-	-	-
108 – 121.94	150µV/m at 3m	-	-	-
123 – 138	150µV/m at 3m	-	-	-
149.9 – 150.05	150µV/m at 3m	-	-	-
156.52475-156.52525	150µV/m at 3m	-	-	-
156.7 – 156.9	150µV/m at 3m	-	-	-
162.0125 – 167.17	150µV/m at 3m	-	-	-
167.72 – 173.2	150µV/m at 3m	-	-	-
240 – 285	200µV/m at 3m	240.7MHz, 88µV/m	240.7MHz, 88µV/m	240.7MHz, 88µV/m
322 – 335.4	200µV/m at 3m	-	-	-
399.9 – 410	200µV/m at 3m	-	-	-
608 – 614	200µV/m at 3m	-	-	-
960 – 1240	500µV/m at 3m	-	-	-
1300 – 1427	500µV/m at 3m	-	-	-
1435 – 1626.5	500µV/m at 3m	-	-	-
1645.5 – 1646.5	500µV/m at 3m	-	-	-
1660 – 1710	500µV/m at 3m	-	-	-
1718.8 – 1722.2	500µV/m at 3m	-	-	-
2200 – 2300	500µV/m at 3m	-	-	-
2310 - 2390	500µV/m at 3m	-	-	-
2483.5 – 2500	500µV/m at 3m	-	-	-
2655 – 2900	500µV/m at 3m	-	-	-
3260 – 3267	500µV/m at 3m	-	-	-
3332 – 3339	500µV/m at 3m	-	-	-
3345.8 – 3358	500µV/m at 3m	-	-	-
3600 – 4400	500µV/m at 3m	-	-	-
4500 – 5150	500µV/m at 3m	-	-	-
5350 – 5460	500µV/m at 3m	-	-	-
7250 – 7750	500µV/m at 3m	-	-	-
8025 – 8500	500µV/m at 3m	-	-	-
9000 – 9200	500µV/m at 3m	-	-	-
9300 – 9500	500µV/m at 3m	-	-	-
10600 – 12700	500µV/m at 3m	-	-	-
13250 – 13400	500µV/m at 3m	-	-	-
14470 – 14500	500µV/m at 3m	-	-	-
15350 – 16200	500µV/m at 3m	-	-	-
17700 – 21400	500µV/m at 3m	-	-	-
22010 – 23120	500µV/m at 3m	-	-	-
23600 – 24000	500µV/m at 3m	-	-	-
31200 – 31800	500µV/m at 3m	-	-	-
36430 – 36500	500µV/m at 3m	-	-	-
>38600	500µV/m at 3m	-	-	-

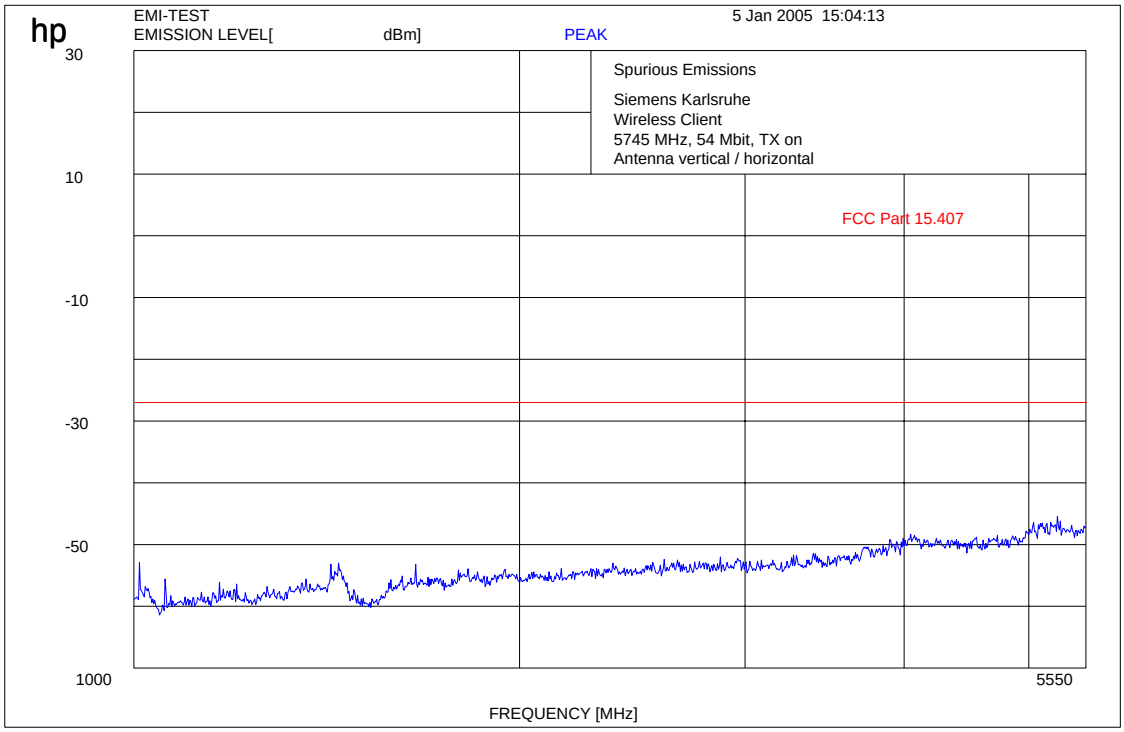
Plot 1: 0.03 - 1 GHz vertical (lowest channel) (worst case)



The yellow line shows the QP values. They are in all cases > 6 dB below limit.

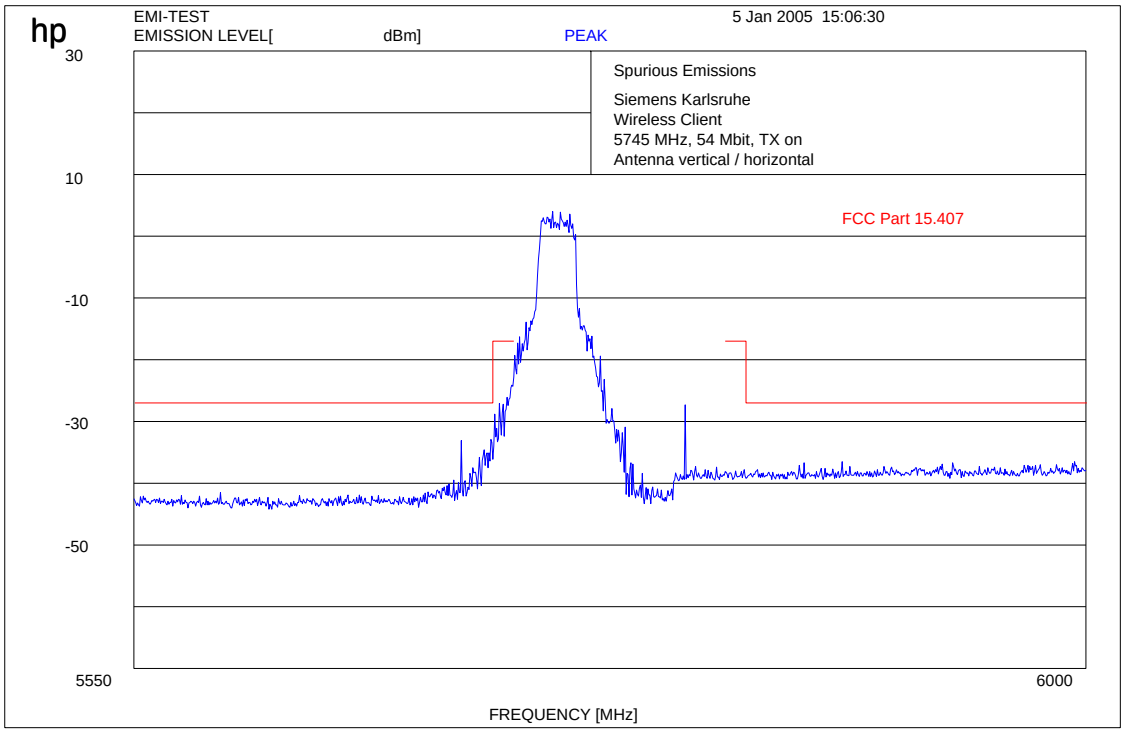
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 2: 1 GHz – 5.55 GHz vertical (lowest channel) (worst case)



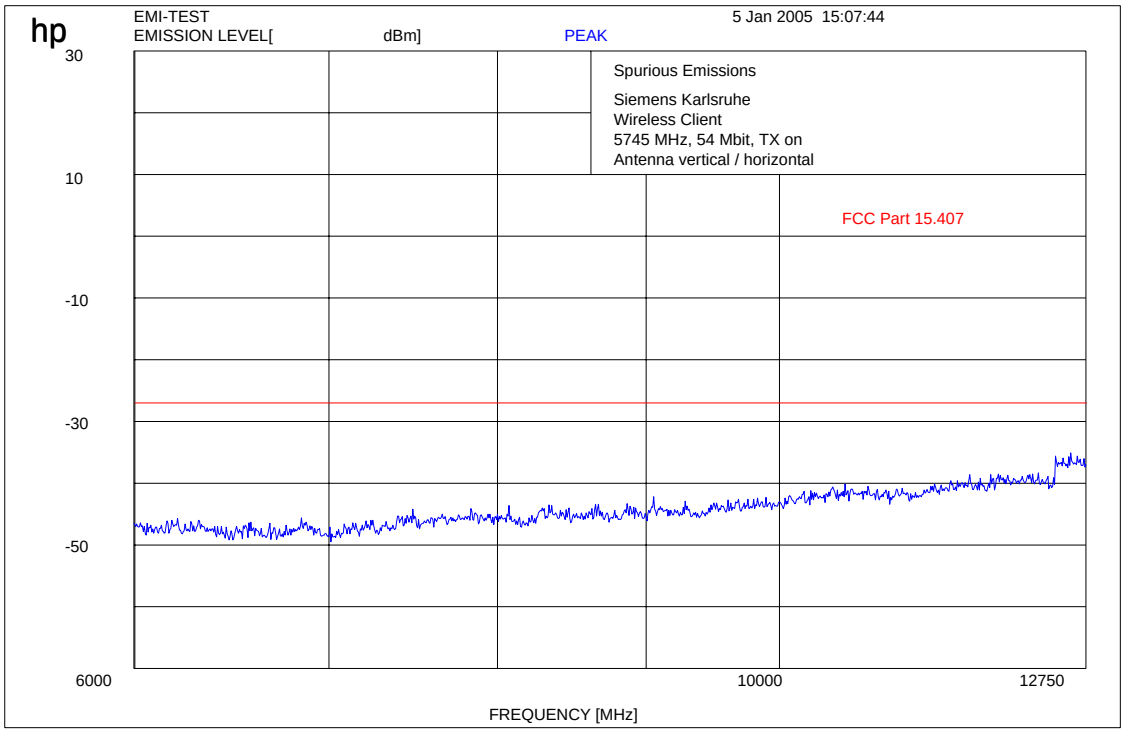
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 3: 5.55 GHz - 6 GHz vertical (lowest channel) (worst case)



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

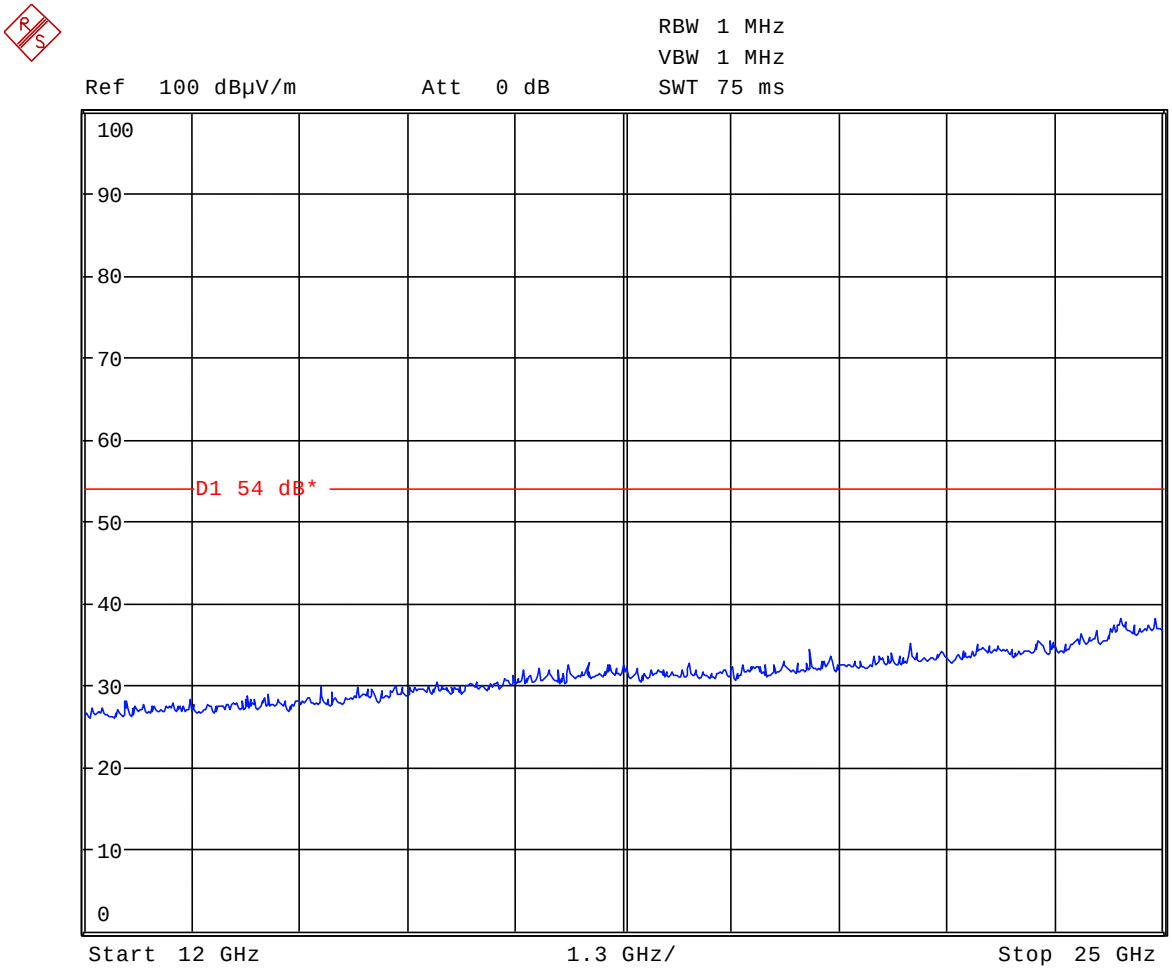
Plot 4: 6 GHz - 12.75 GHz vertical (lowest channel) (worst case)



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

Plot 5: -25 GHz vertical (lowest channel) (worst case)

Valid for all three measured channels.

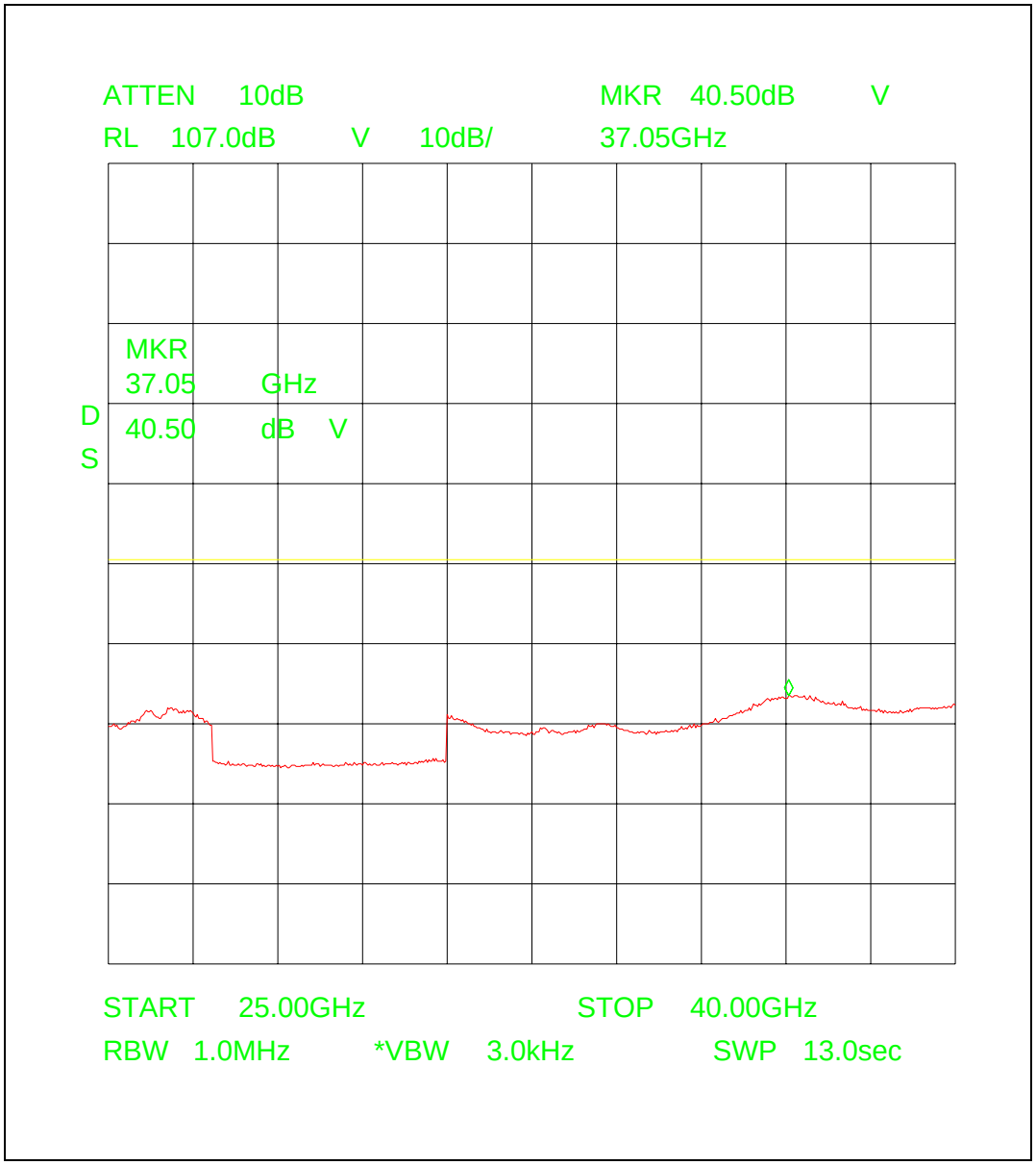


f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

We also measured with external mixers up to 60 GHz.

The plots are valid for all three channels. There were no peaks found.

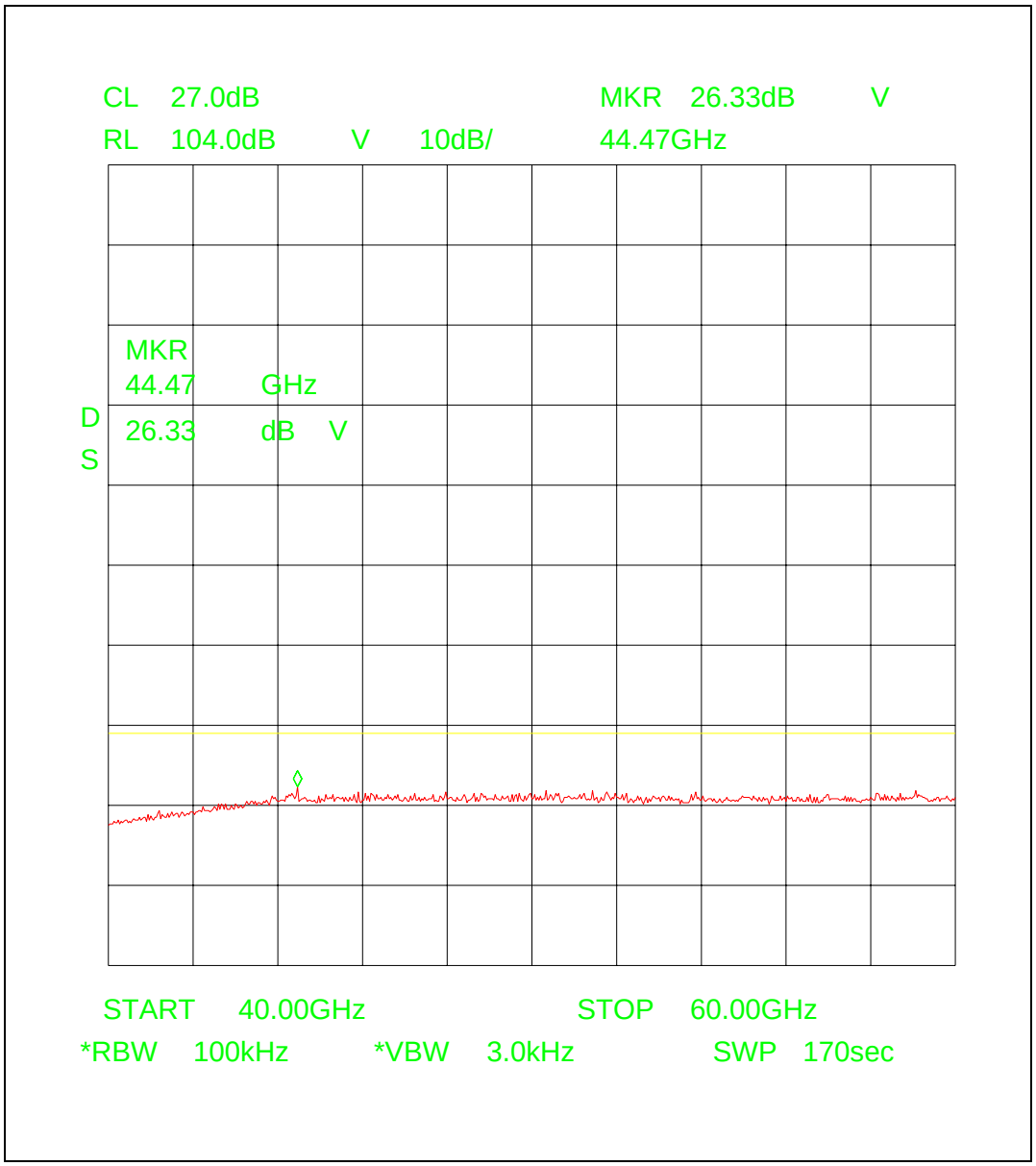
Plot 6: 25 – 40 GHz



Measured under following conditions.

Distance 0.5 Meter - 15.56 dB,
Antenna k-factor 37.5 dB (1/m),
Amplifier 30 dB,
Cabel loss 3.5 dB

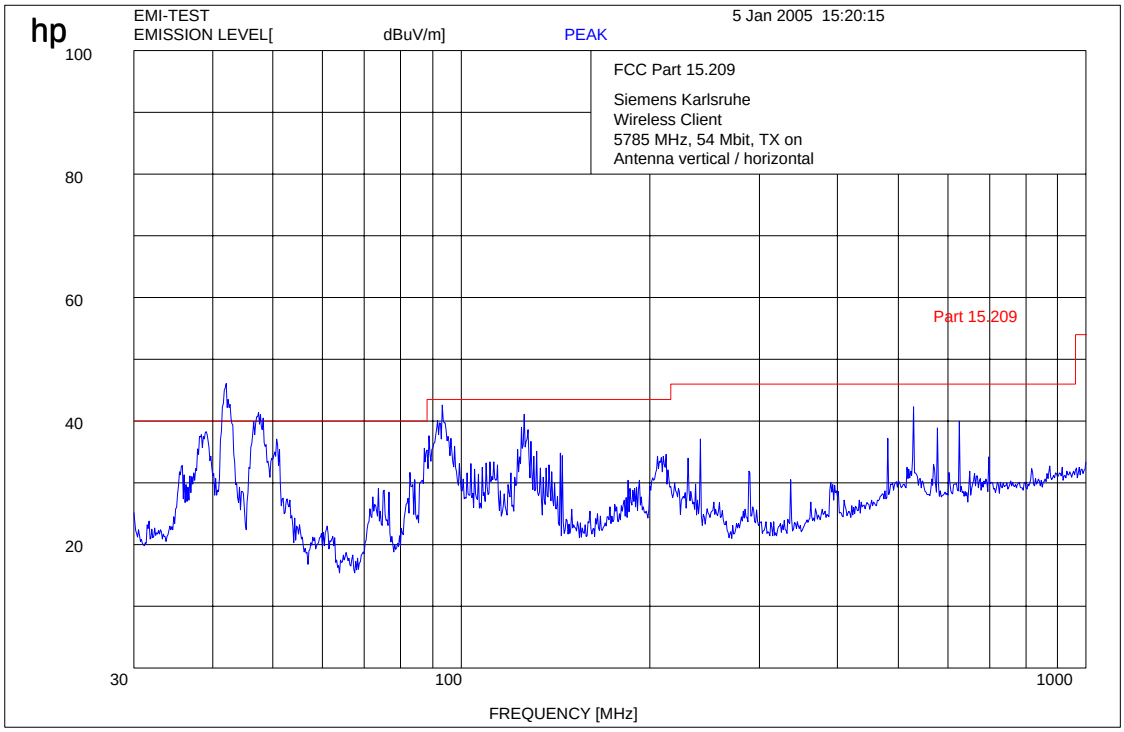
Plot 7: 40 to 60 GHz



Measured under the following conditions.

Distance 0.25 Meter - 21.58 dB,
Antenna k-factor 43.9 dB (1/m),

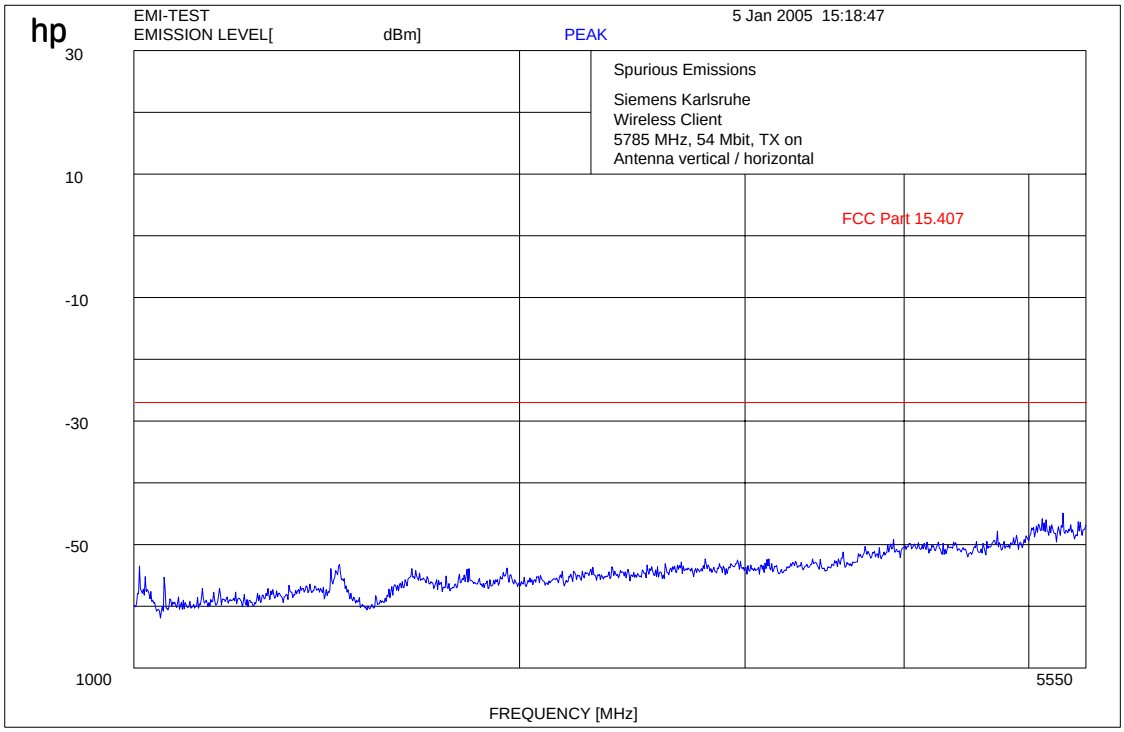
Plot 8: 30 MHz to 1 GHz (middle channel)



The yellow line shows the QP values. They are in all cases > 6 dB below limit.

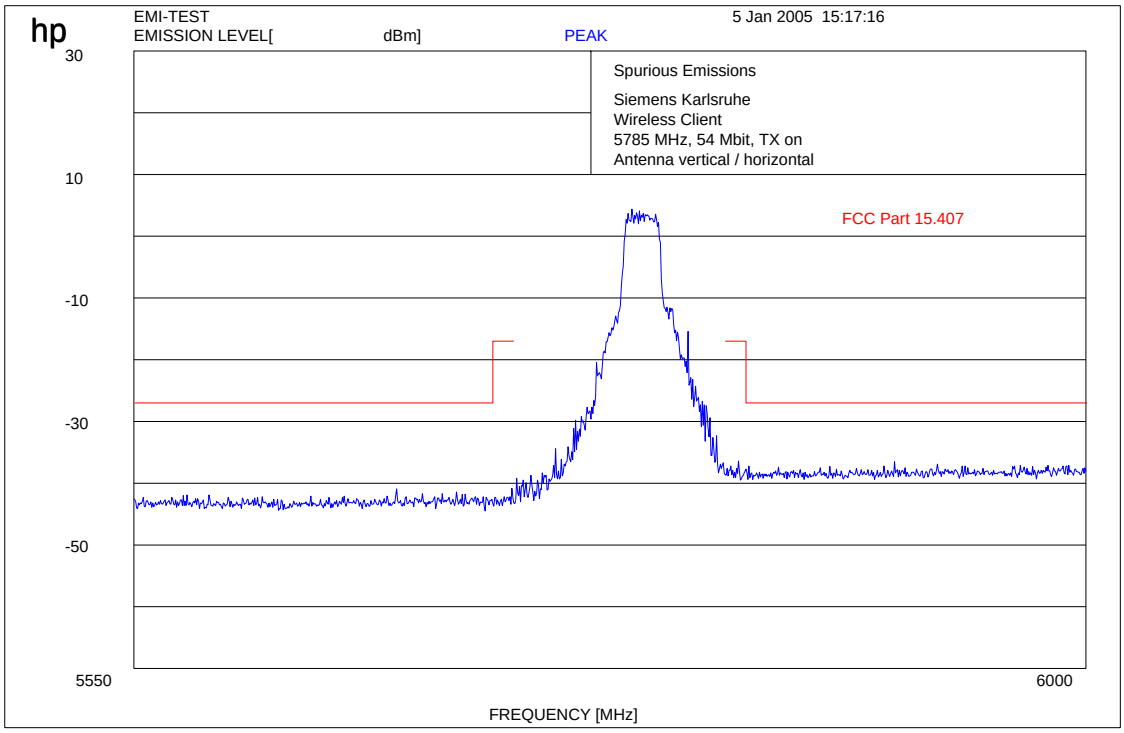
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 9: 1 GHz to 5.55 GHz (middle channel)



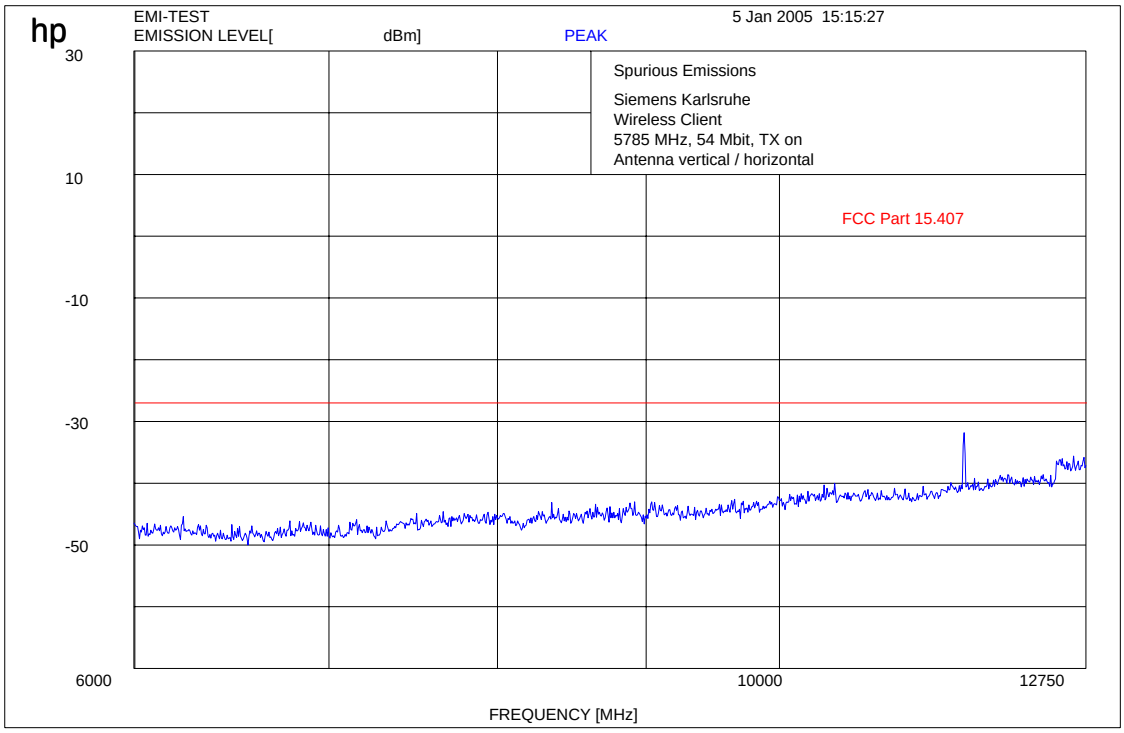
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 10: 5.55 GHz to 6GHz vertical / horizontal (middle channel)



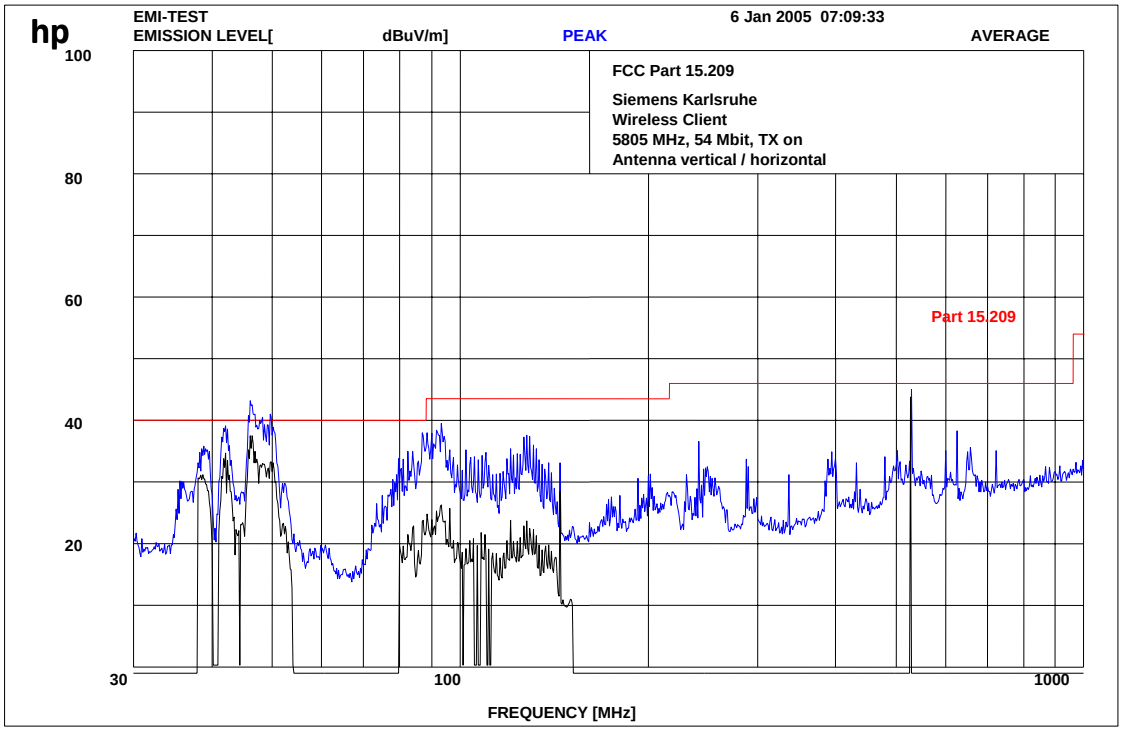
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 11: 6- 12.75 GHz (middle channel)



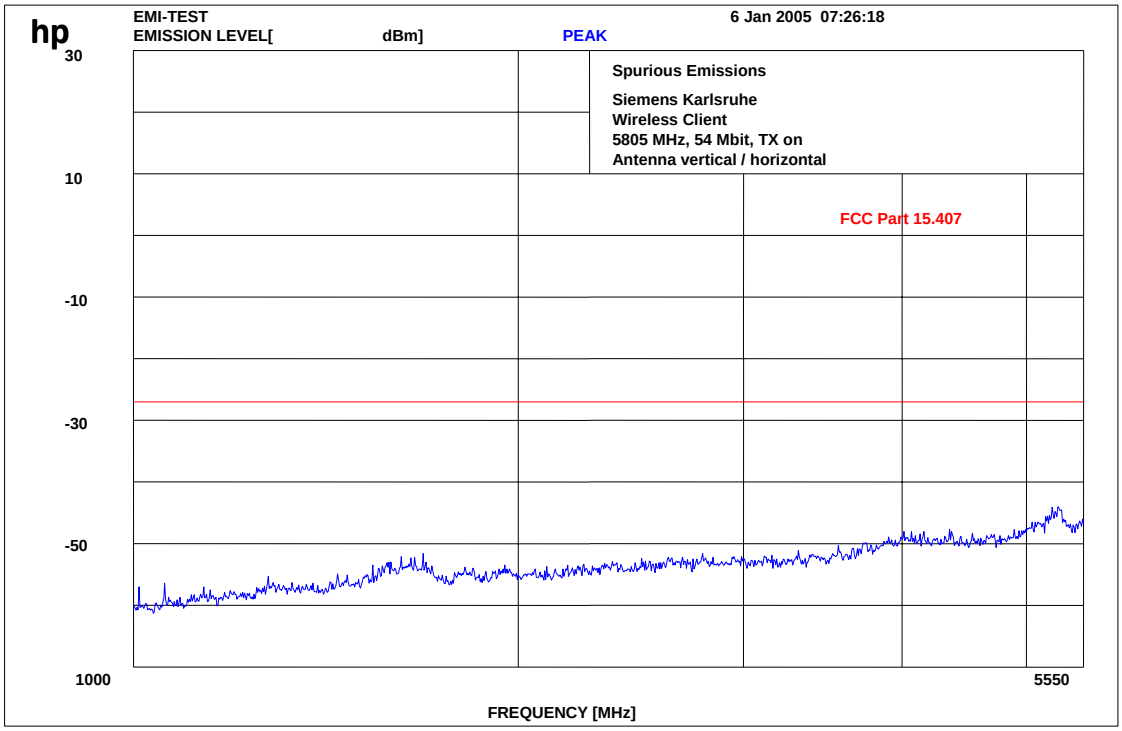
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 8: 30 MHz to 1 GHz (highest channel)



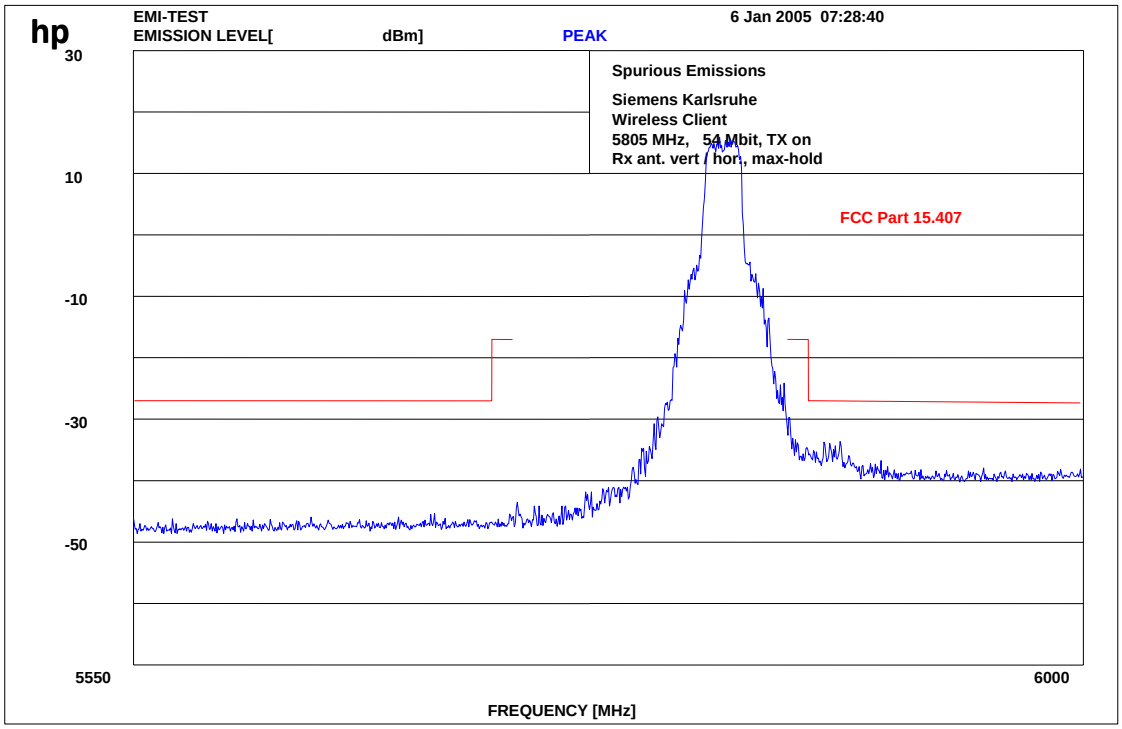
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 9: 1 GHz to 5.55 GHz (highest channel)



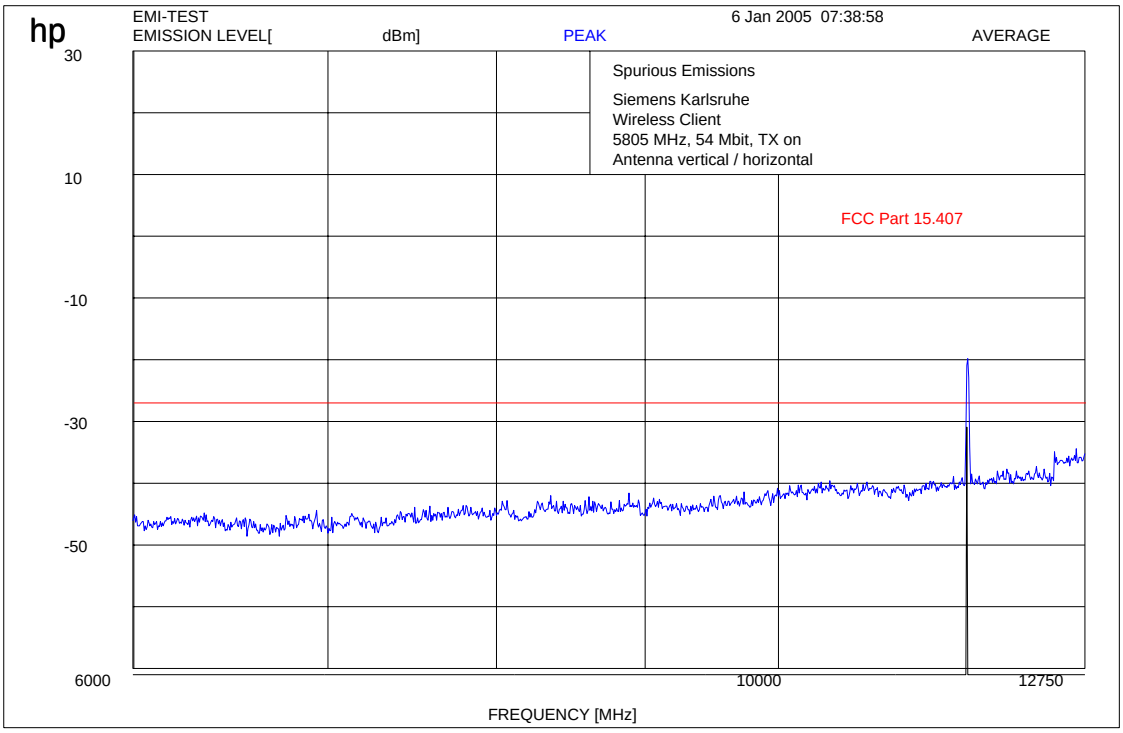
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 10: 5.55 GHz to 6GHz vertical / horizontal (highest channel)



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

Plot 11: 6- 12.75 GHz (highest channel)



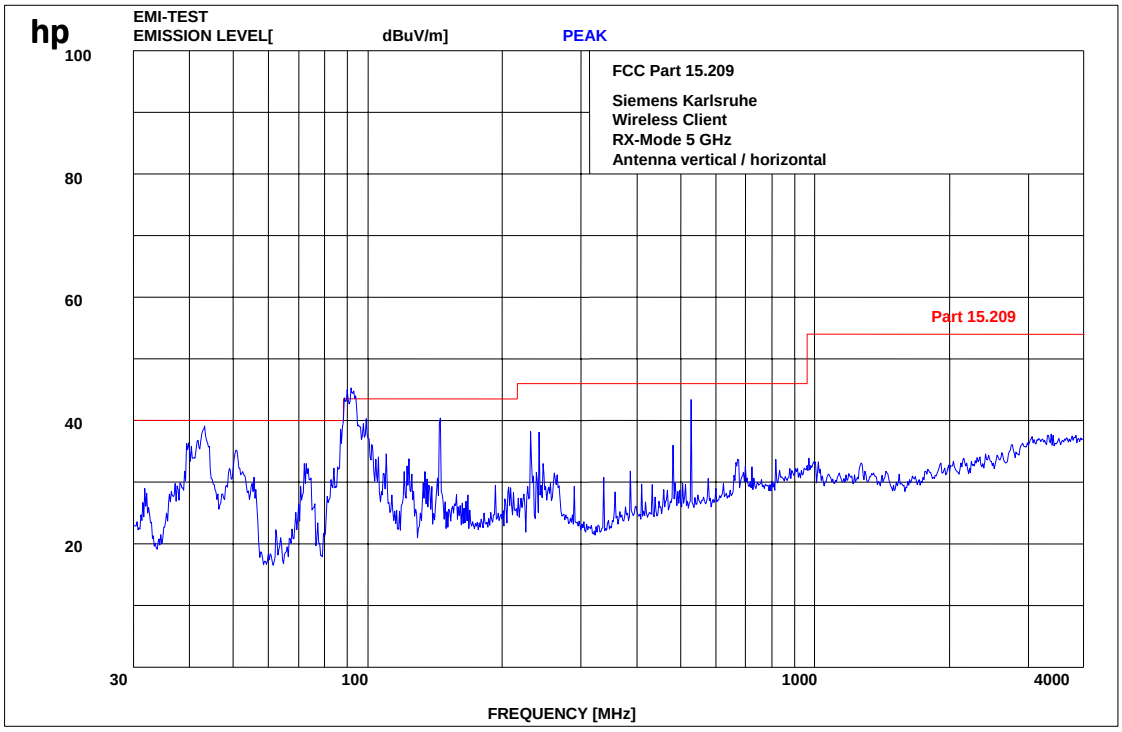
The spurious measured at 11.61 GHz is average –30.9 dBm.

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

3.13 Spurious emissions radiated (RX) 15.209

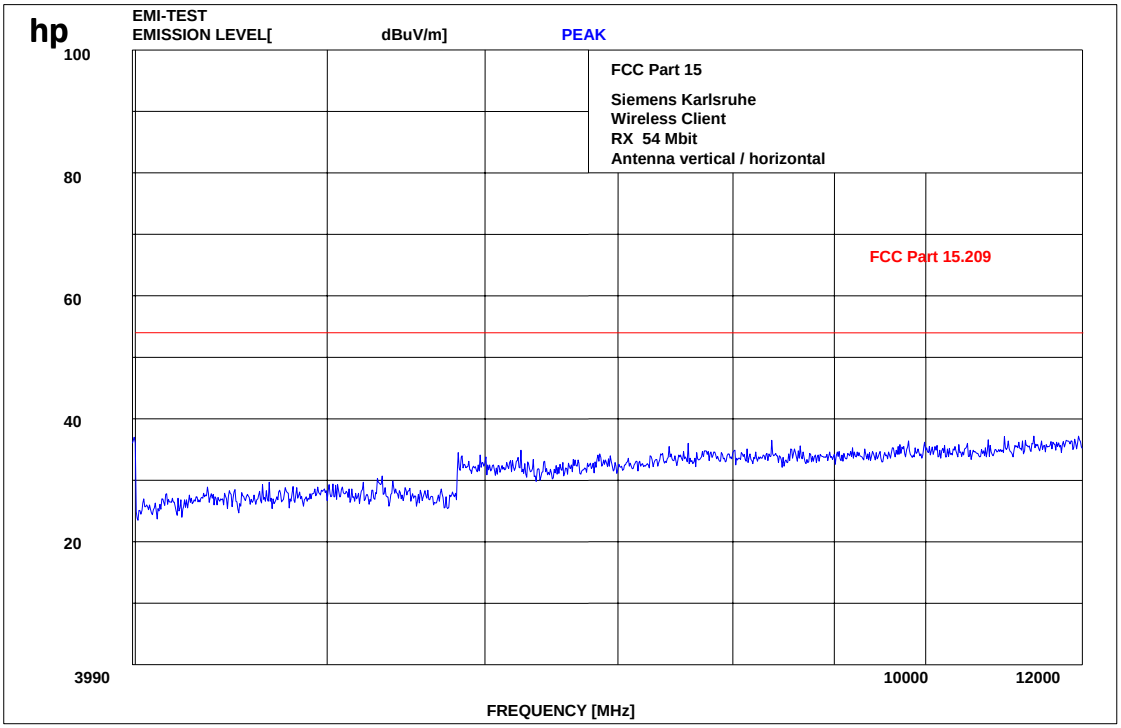
Valid for all three antennas

Plot 1: 30 to 4000 MHz



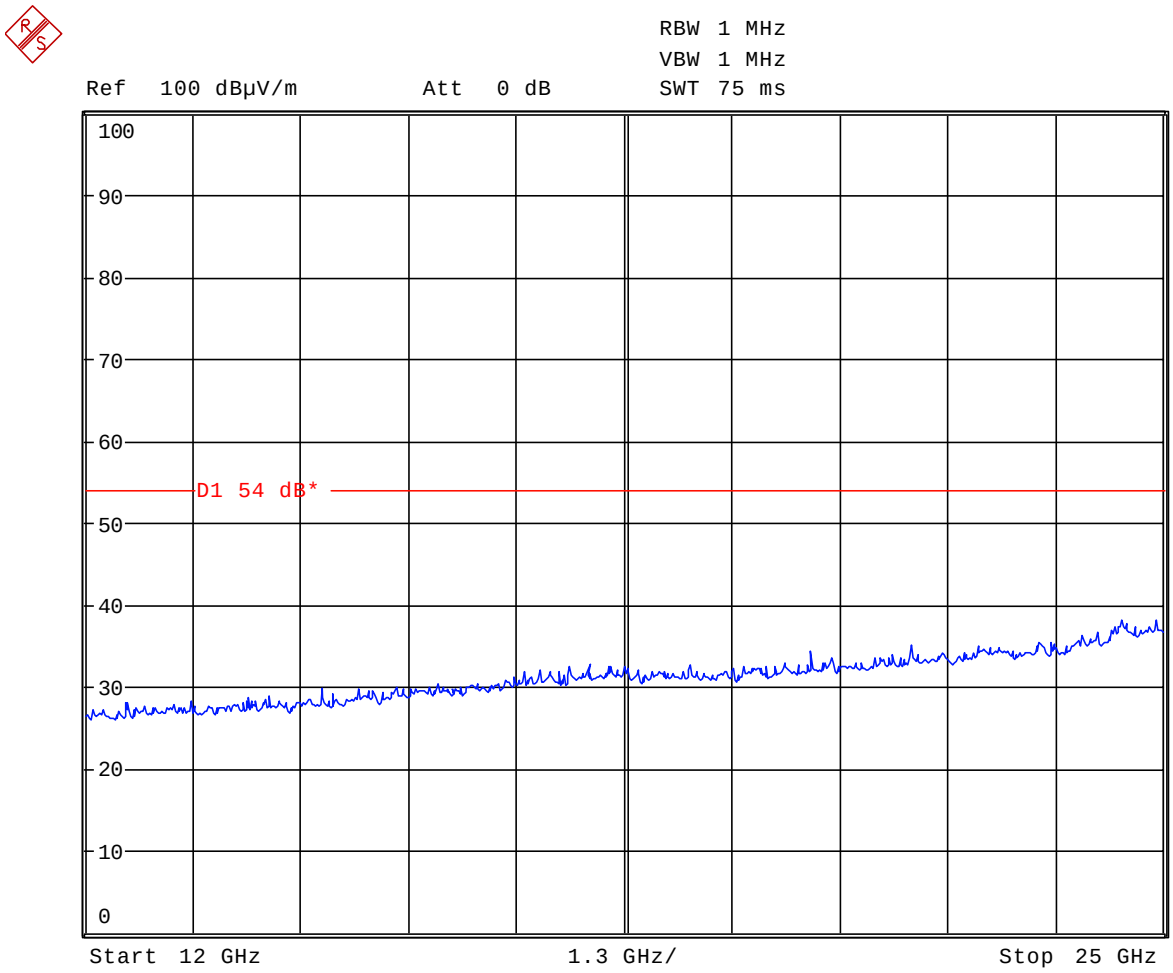
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 2: 4 GHz to 12 GHz



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

Plot 3: - 25 GHz



The measurements were performed up to 60 GHz. There were no peaks found.

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

Limits: § 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

Results:

Spurious Emissisons level [µV/m]								
f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]
38.7	QP	34.2						
42.0	QP	36.4						
90.1	QP	39.6						
142.3	QP	34.8						
528.7	QP	40.8						
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 : § 15.109 / 209

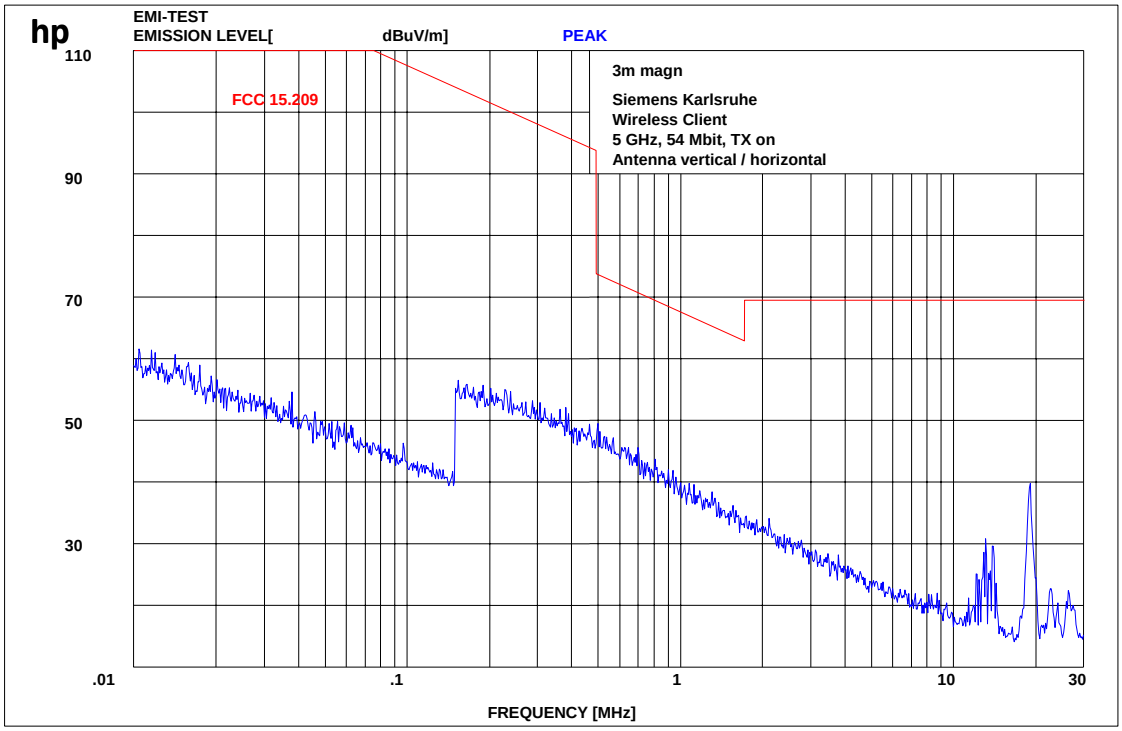
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

3.14 Spurious Emissions - radiated <30 MHz (valid for all antenna types)§15.109

(measured with a 110V AC power supply from our house as the product is delivered without any power supply.)

Measured at 3 m distance.
Values recalculated with 40 dB/decade according to FCC rules.

Plot 1:



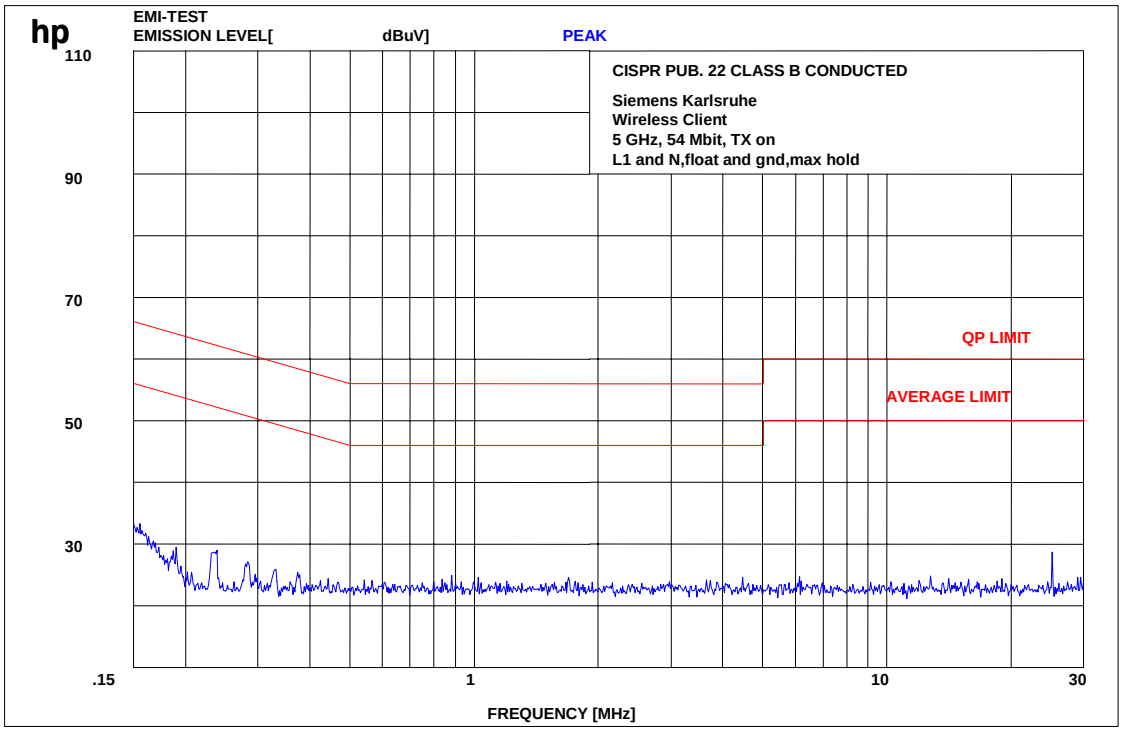
Limits:

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dBµV/m	30
30 - 88	100 / 40 dBµV/m	3
88 - 216	150 / 43.5 dBµV/m	3
216 - 960	200 / 46 dBµV/m	3
above 960	54 dBµV/m	3

3.15 Conducted Emissions <30 MHz §15.107/207

(measured with a 110V AC power supply from our house as the product is delivered without any power supply.)

Plot 1: CISPR 22



We measured in TX and RX mode, L1 and N floating and grounded, max value was hold.

Limits :

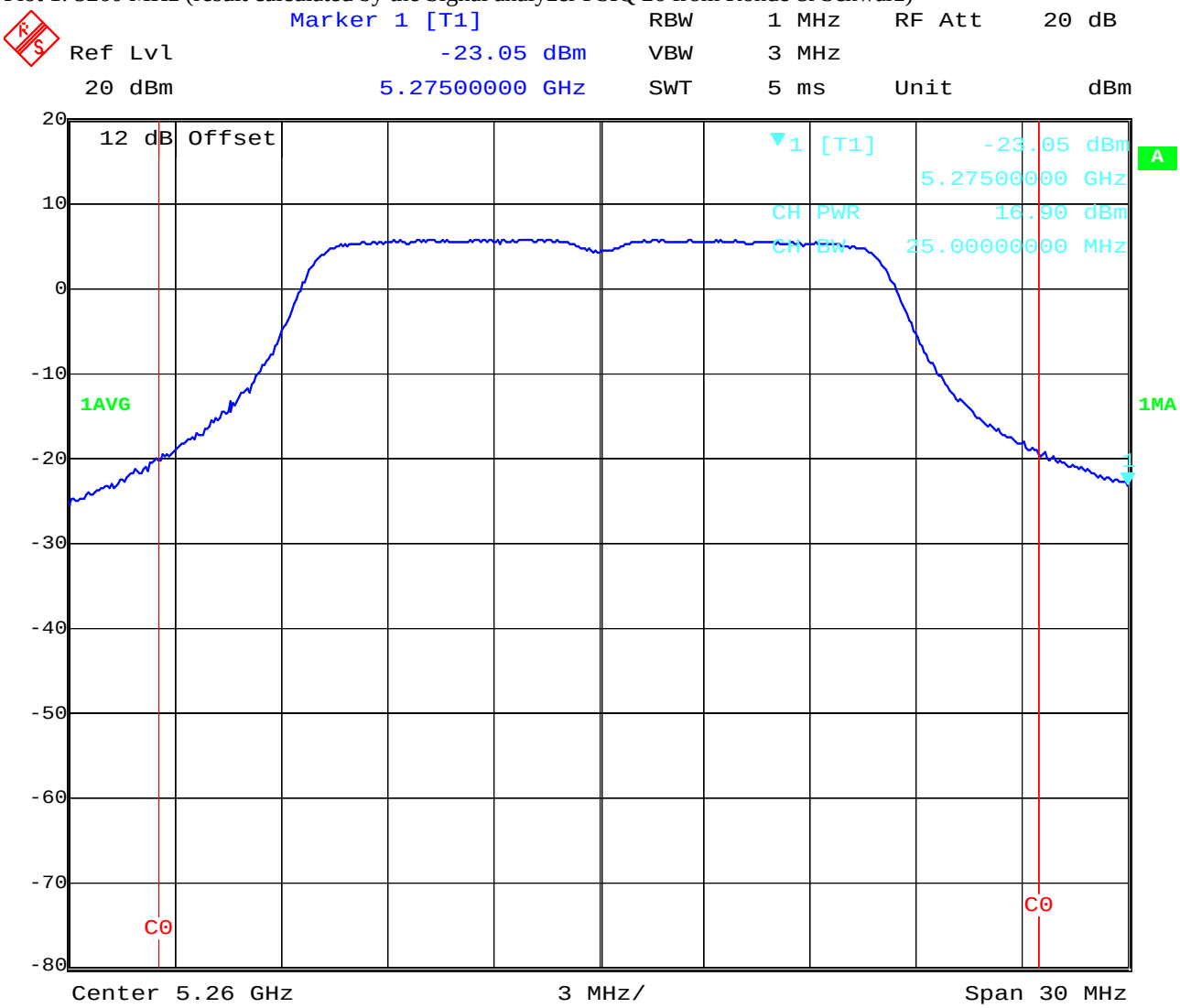
Under normal test conditions only	See plots

Frequency range of the sample : 5250 to 5350 MHz

3.16 Maximum Conducted Output Power §15.407a(3)+(4)

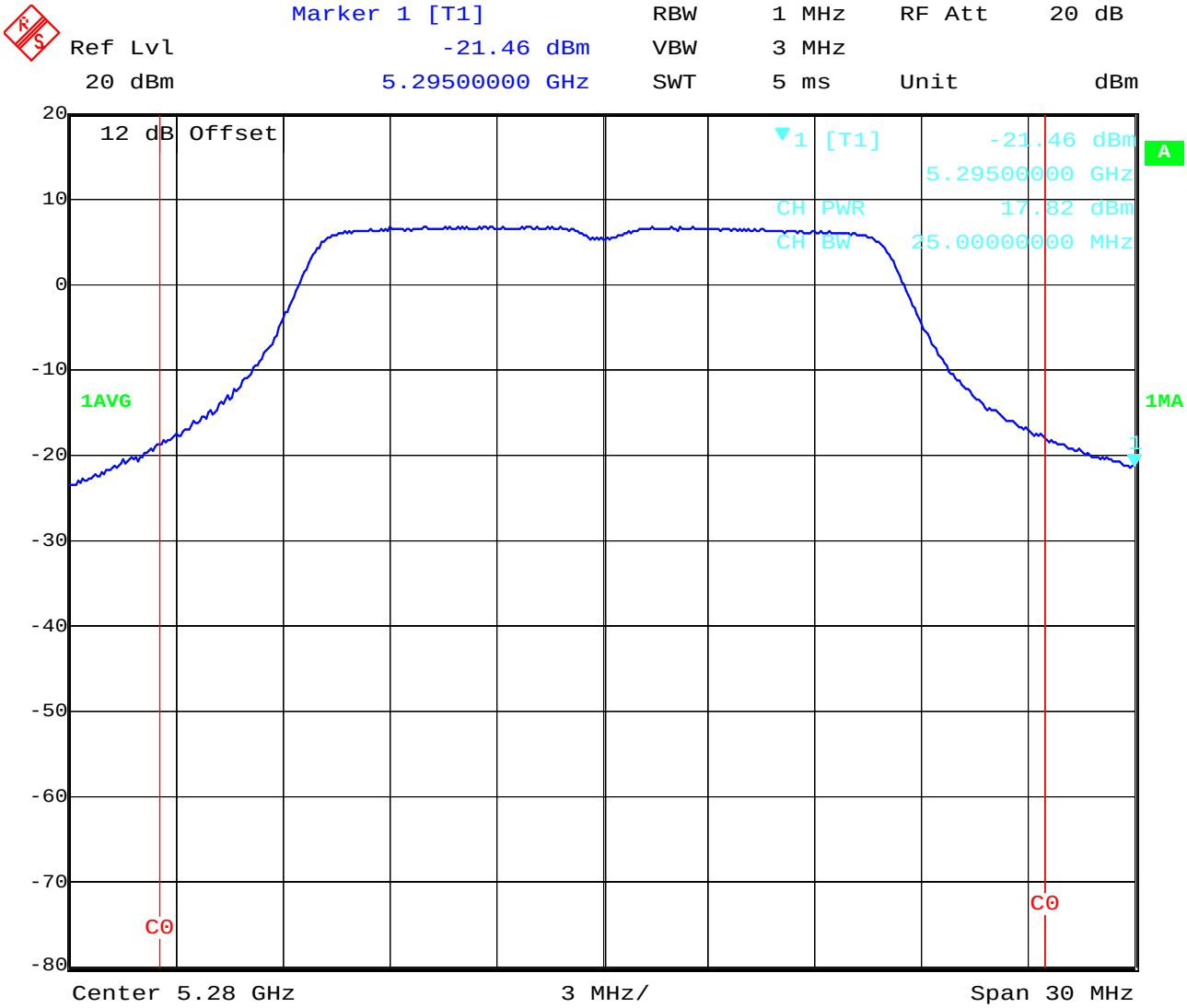
Power measured with the build-in function of the analyzer FSIQ26 according to the Guidelines DA-02-2138 A1 method 1

Plot 1: 5260 MHz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)



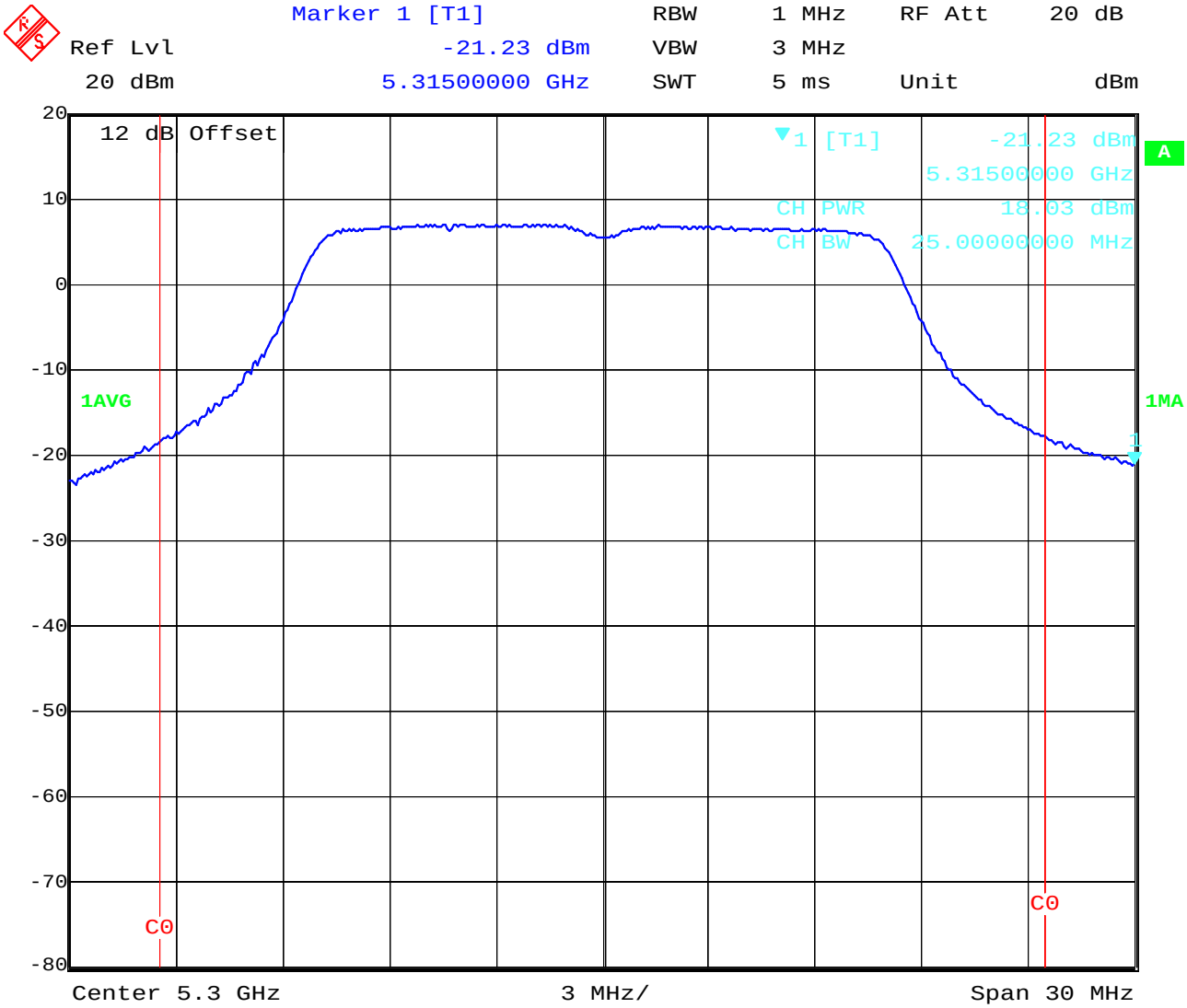
Date: 21.FEB.2005 12:48:50

Plot 2: 5280 Mhz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)



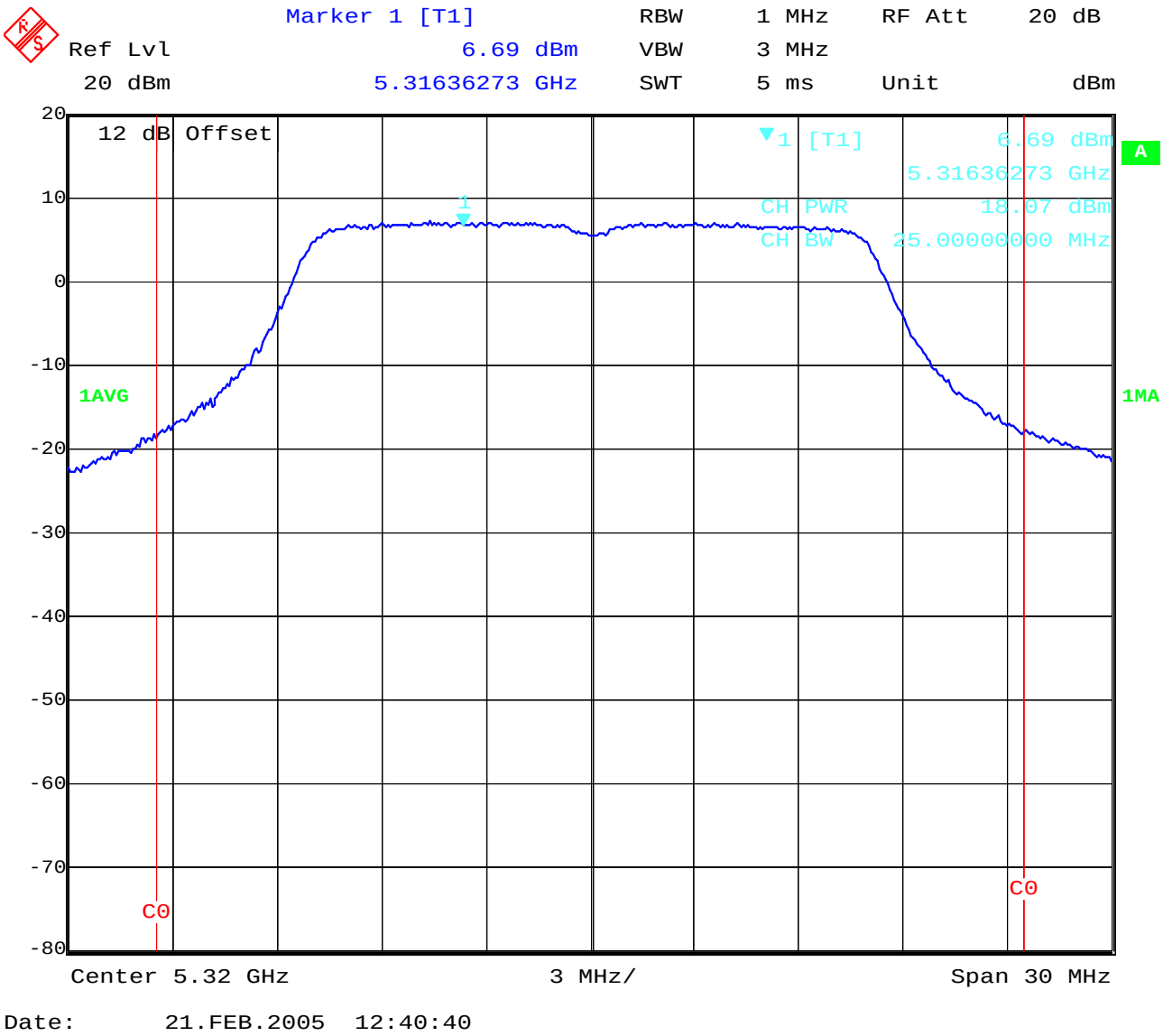
Date: 21.FEB.2005 12:48:22

Plot 3: 5300 MHz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)



Date: 21.FEB.2005 12:47:40

Plot 4: 5320 MHz (result calculated by the Signal analyzer FSIQ 26 from Rohde & Schwarz)

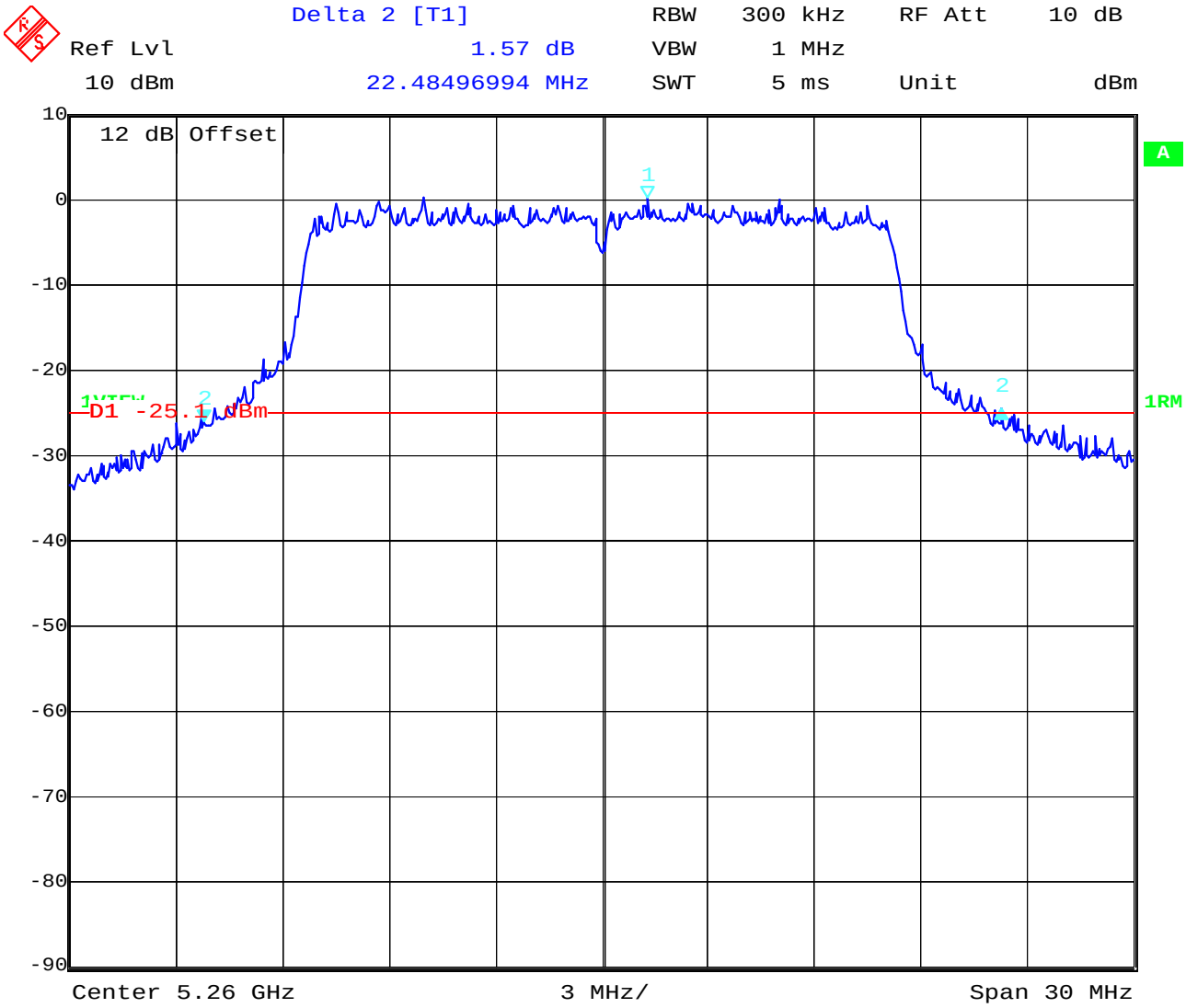


Results:

Plot 1: Max output power with true RMS filter : 16.90 dBm
Plot 2: Max output power with true RMS filter : 17.83 dBm
Plot 3: Max output power with true RMS filter : 18.00 dBm
Plot 4: Max output power with true RMS filter : 18.01 dBm

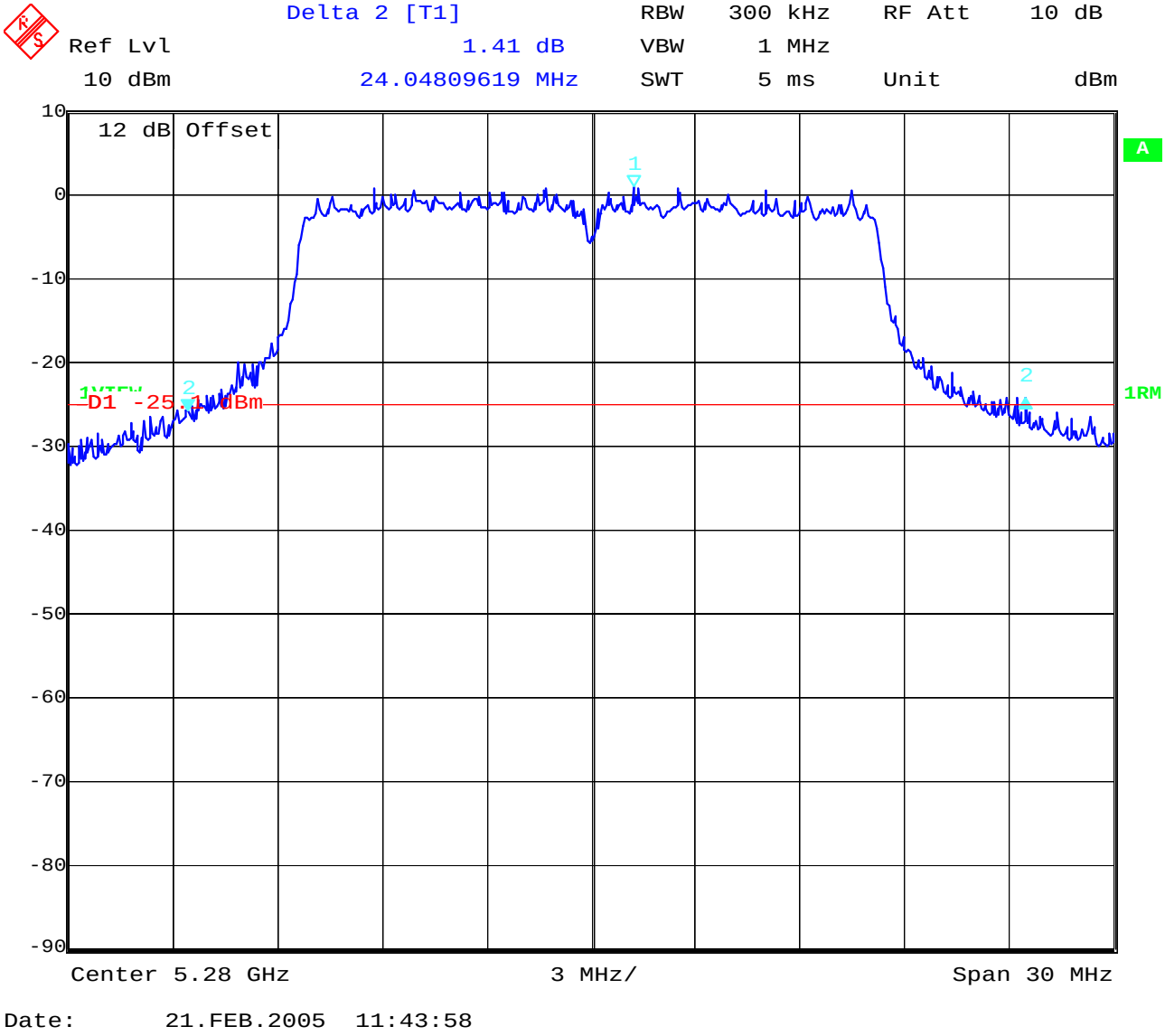
Emission Bandwidth

5260 MHz

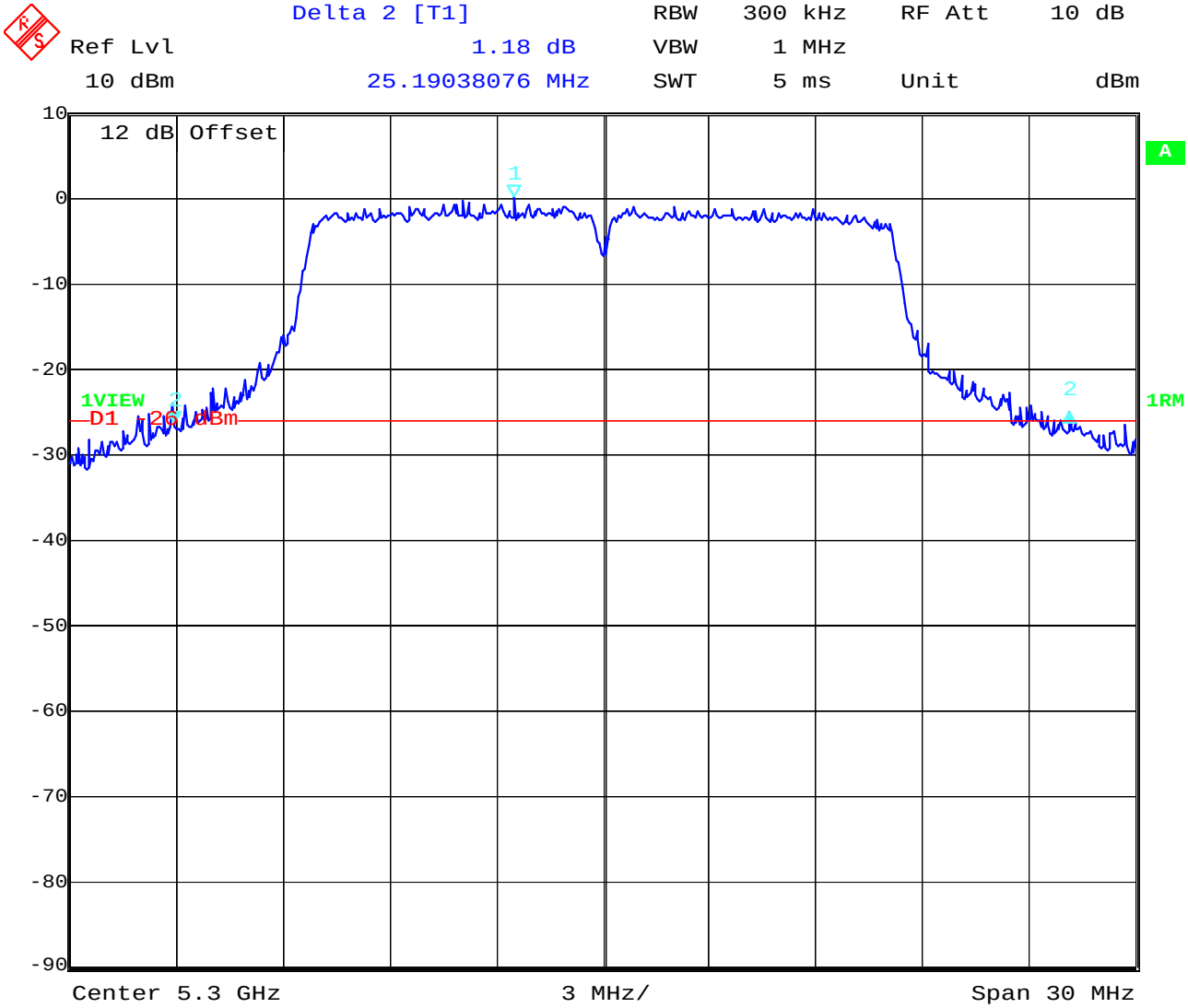


Date: 21.FEB.2005 11:42:19

5280 MHz

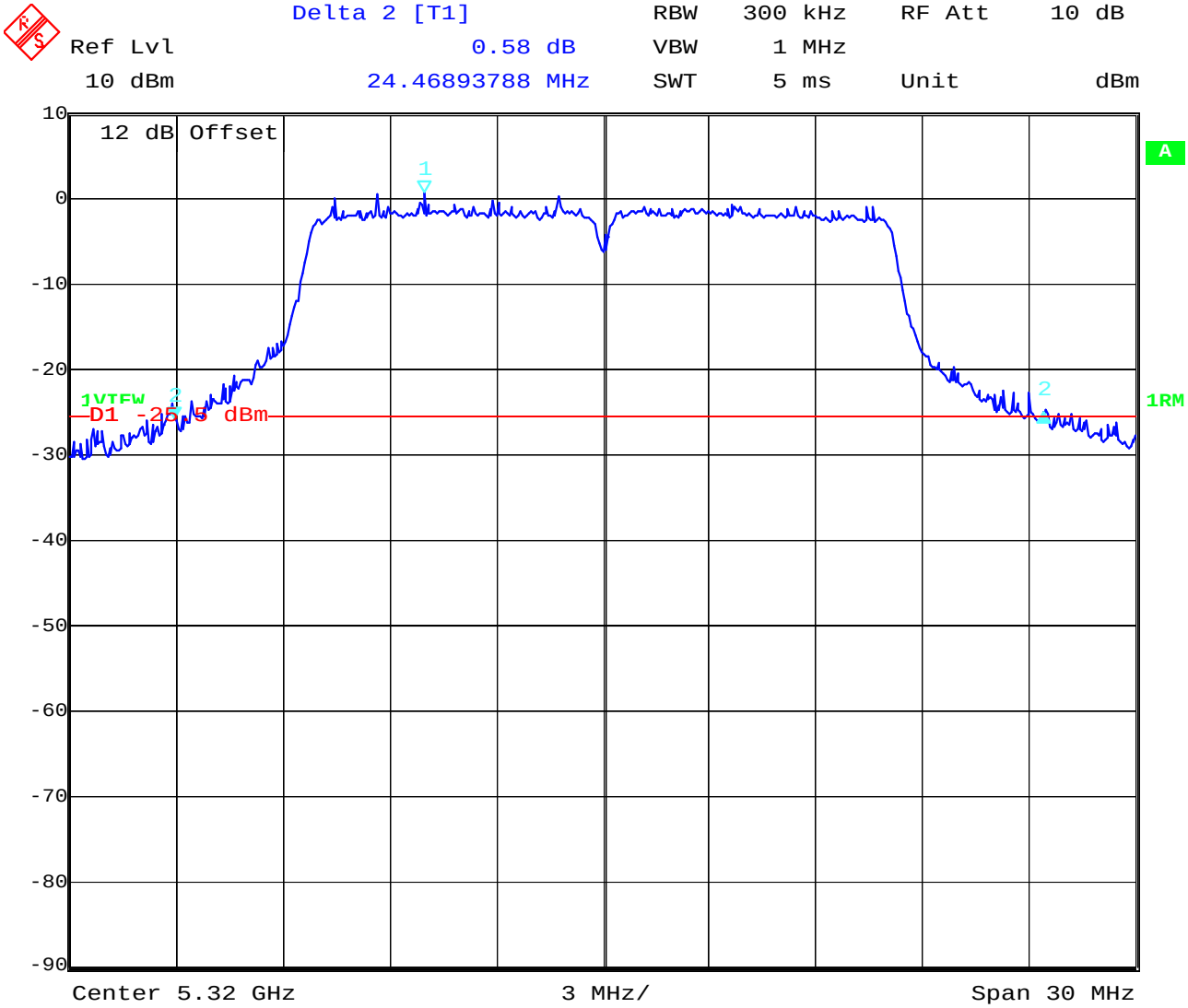

Delta 2 [T1]
1.41 dB
24.04809619 MHz
RBW 300 kHz
VBW 1 MHz
SWT 5 ms
RF Att 10 dB
Unit dBm
Ref Lvl
10 dBm
12 dB Offset
D1 -25.11 dBm
A
1RM
Center 5.28 GHz
3 MHz/
Span 30 MHz
Date: 21.FEB.2005 11:43:58

5300 MHz



Date: 21.FEB.2005 11:46:16

5320 MHz



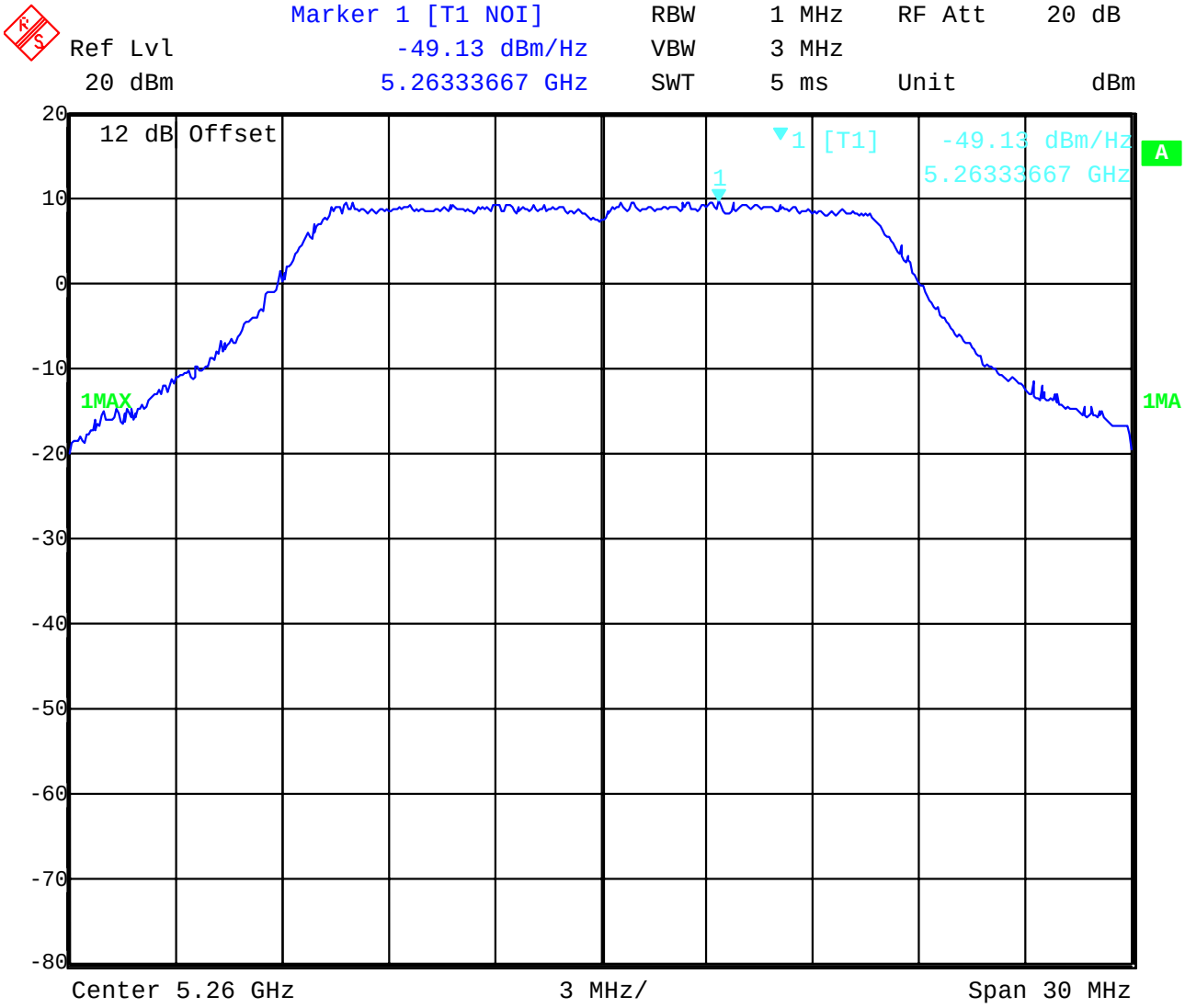
Results:

Plot 1: OBW at –26 dBc: 22.485 MHz
Plot 2: OBW at –26 dBc: 24.048 MHz
Plot 3: OBW at –26 dBc: 25.190 MHz
Plot 4: OBW at –26 dBc: 24.469 MHz

3.17 Spectral Density Conducted §15.407(a5)

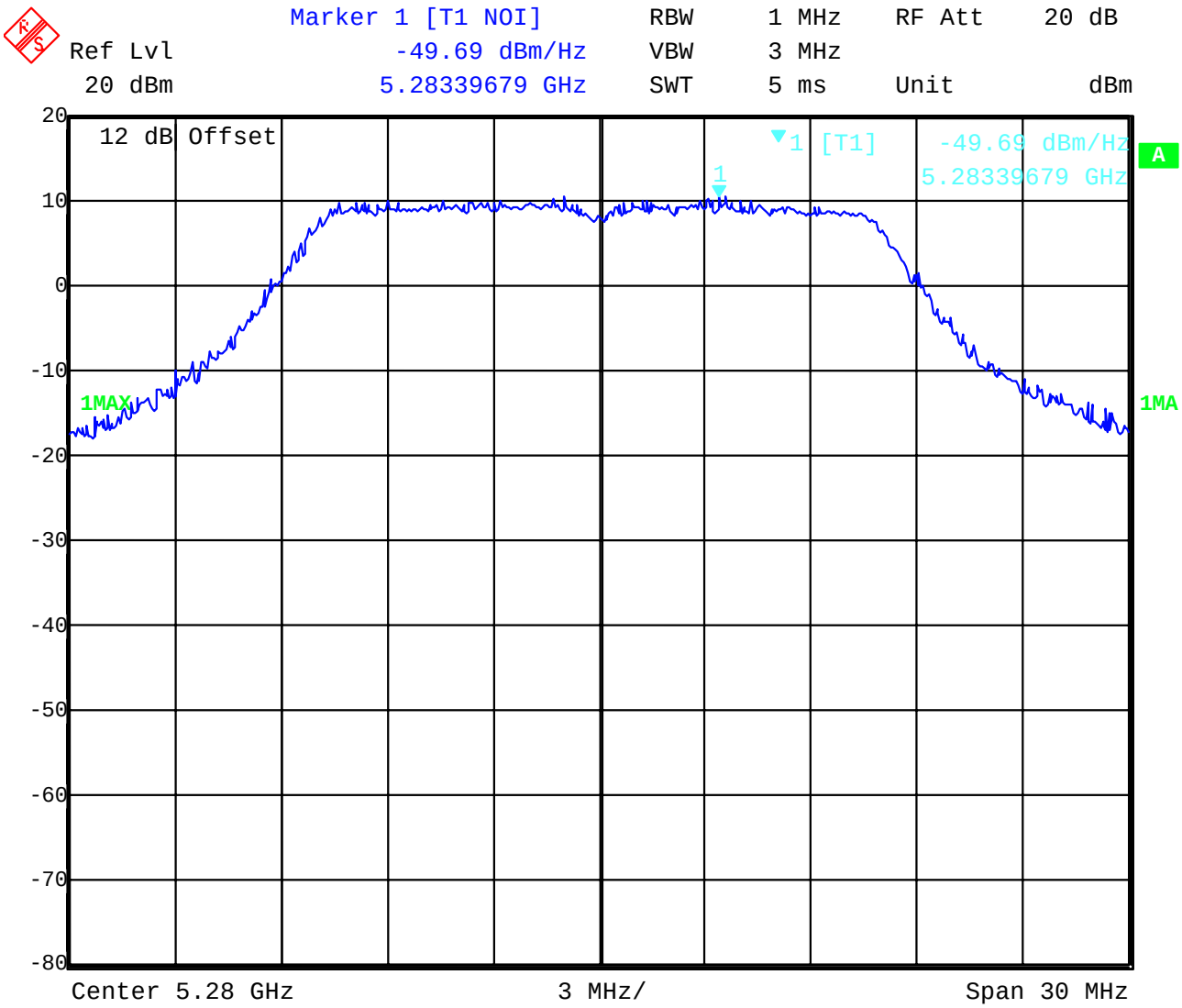
Plot 1 : 5260 MHz

Result is calculated to 1 Hz with the power density function of the analyzer FSIQ26. The get the result related to 1 MHz according to FCC you have to add 60 dB.



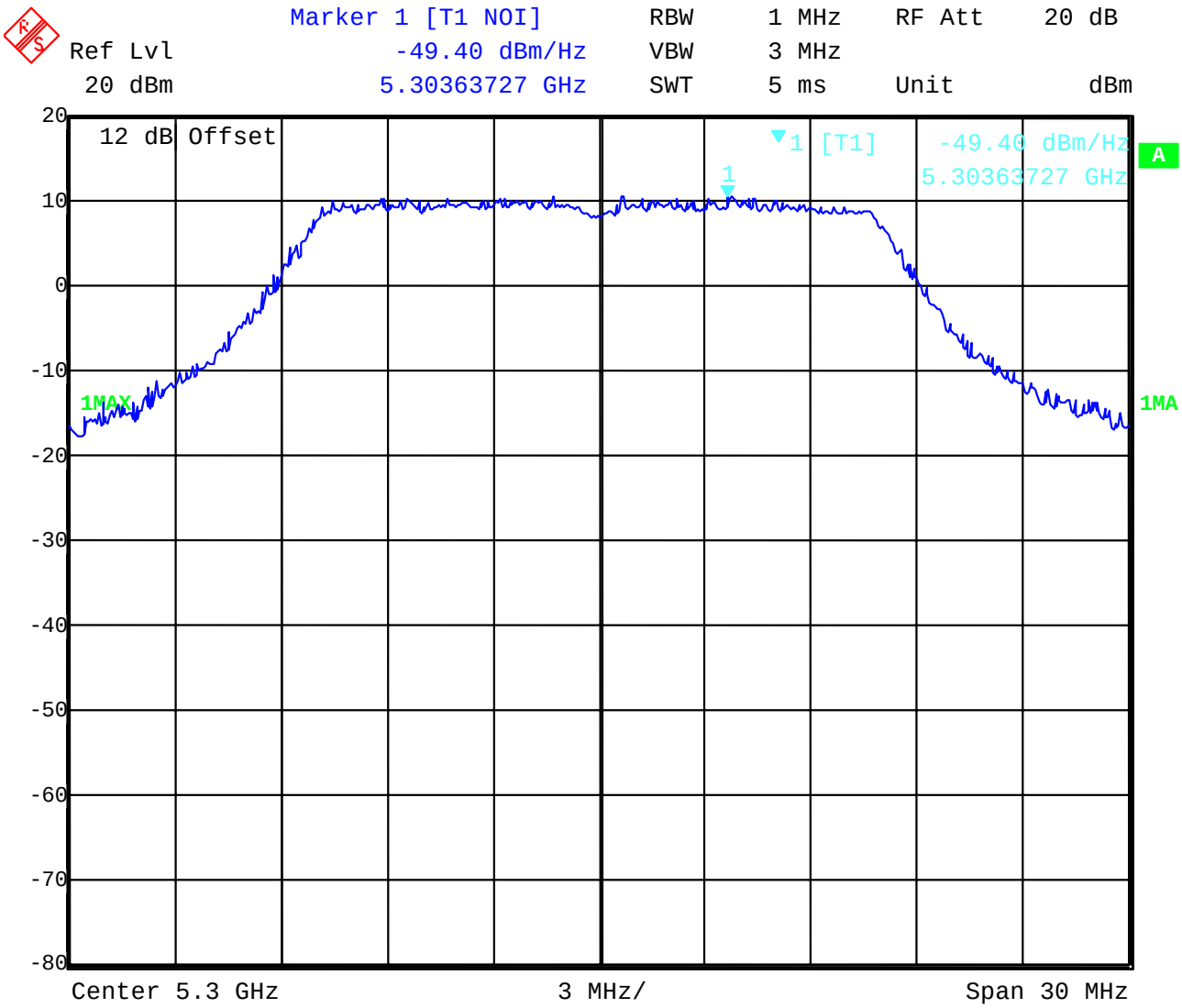
Date: 21.FEB.2005 13:02:22

Plot 2: 5280 MHz



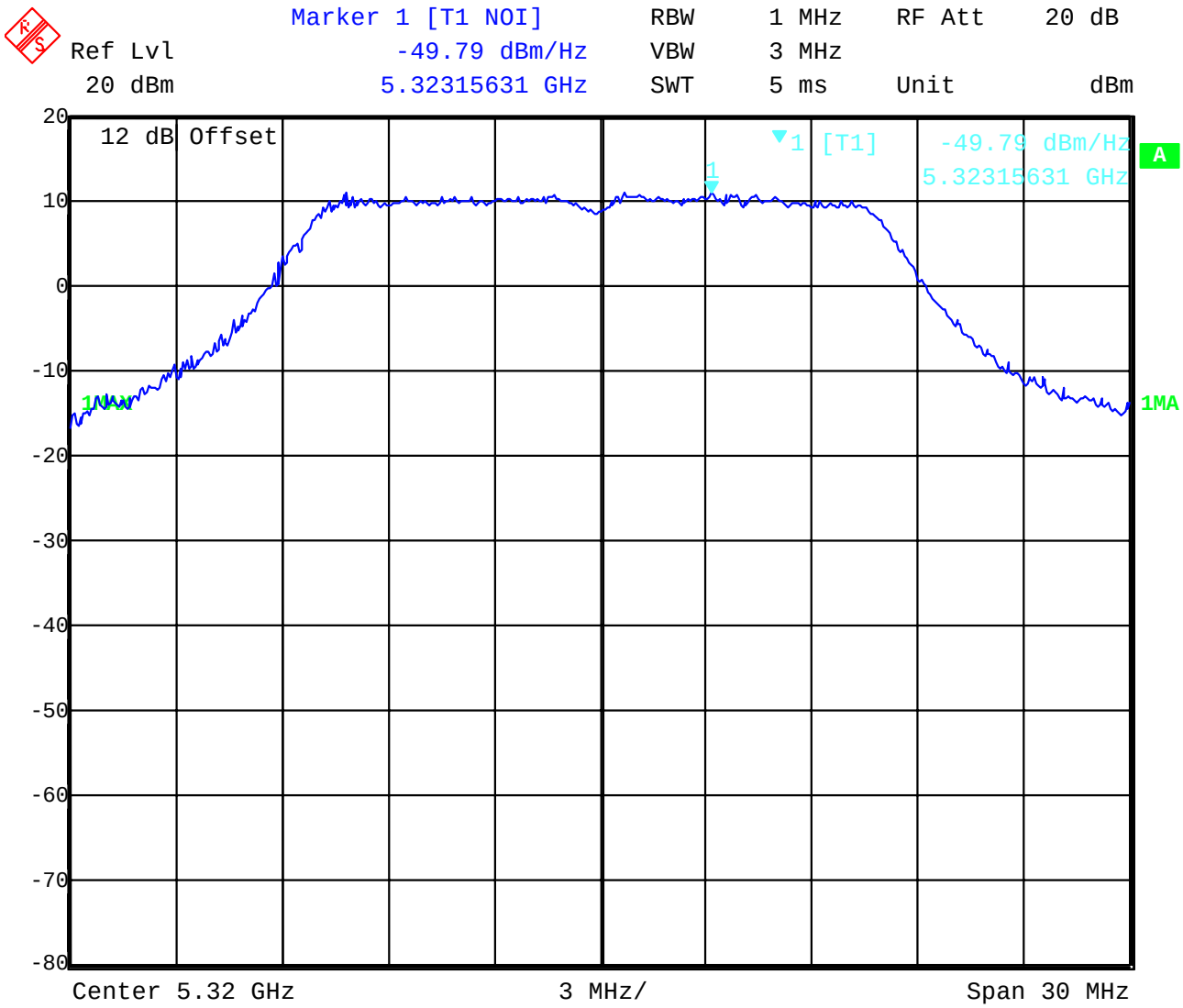
Date: 21.FEB.2005 13:01:42

Plot 3: 5300 MHz



Date: 21.FEB.2005 13:01:12

Plot 4: 5320 MHz



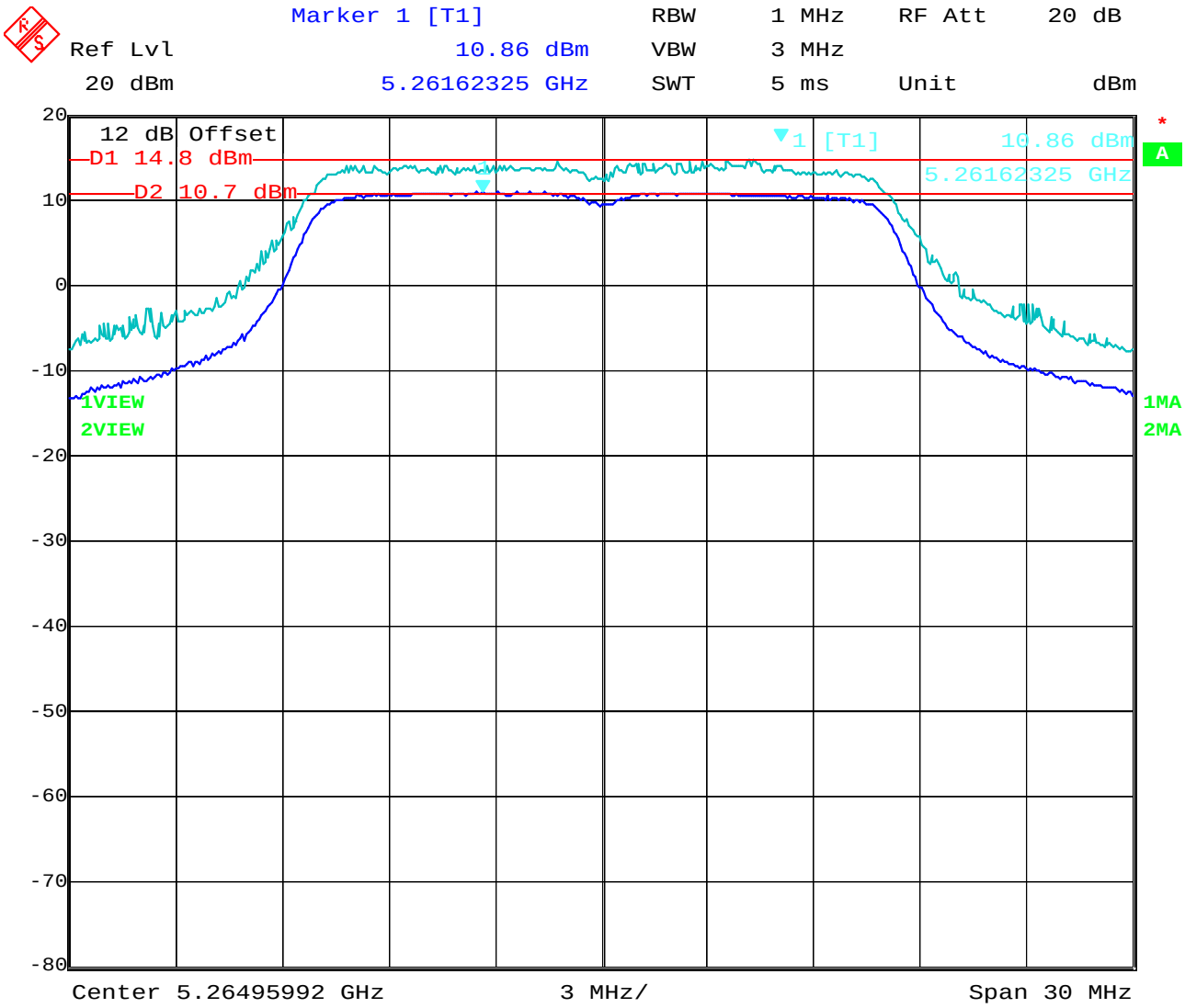
Date: 21.FEB.2005 13:00:29

Results: with correction factors +60 dB regarding the BW of 1 MHz .

Test conditions Frequency [MHz]		Spectral density Including +60 dB correction factor		
			Limit	
	5260 MHz	10.87	11 dBm	Pass
	5280 MHz	10.31	11 dBm	Pass
	5300 MHz	10.60	11 dBm	Pass
	5320 MHz	10.21	11 dBm	Pass
Measurement uncertainity		±1dB		

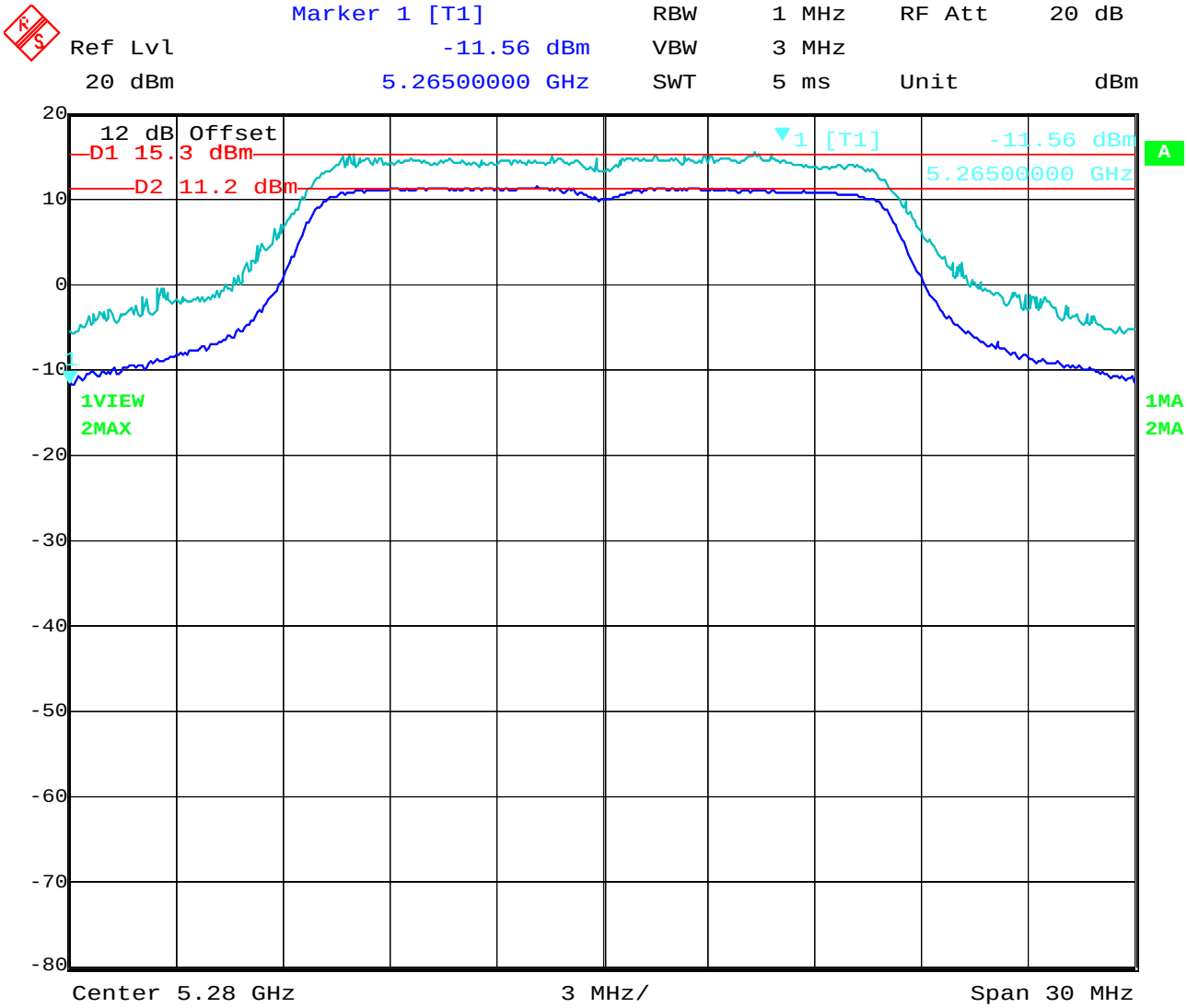
3.18 Ratio of Peak Excursion §15.407(a6)

Plot 1 : 5260 MHz



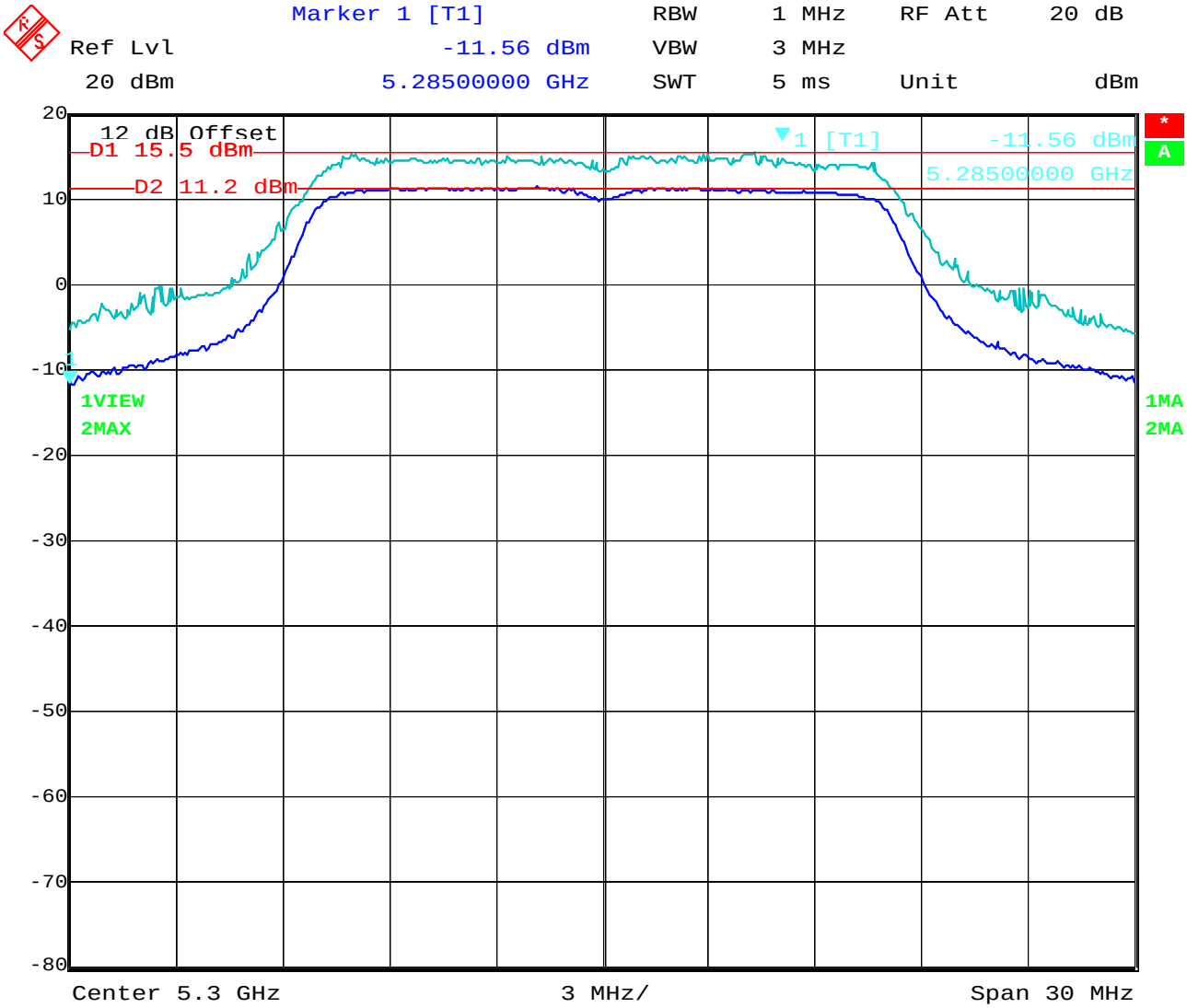
Date: 21.FEB.2005 13:22:00

Plot 2: 5280 MHz



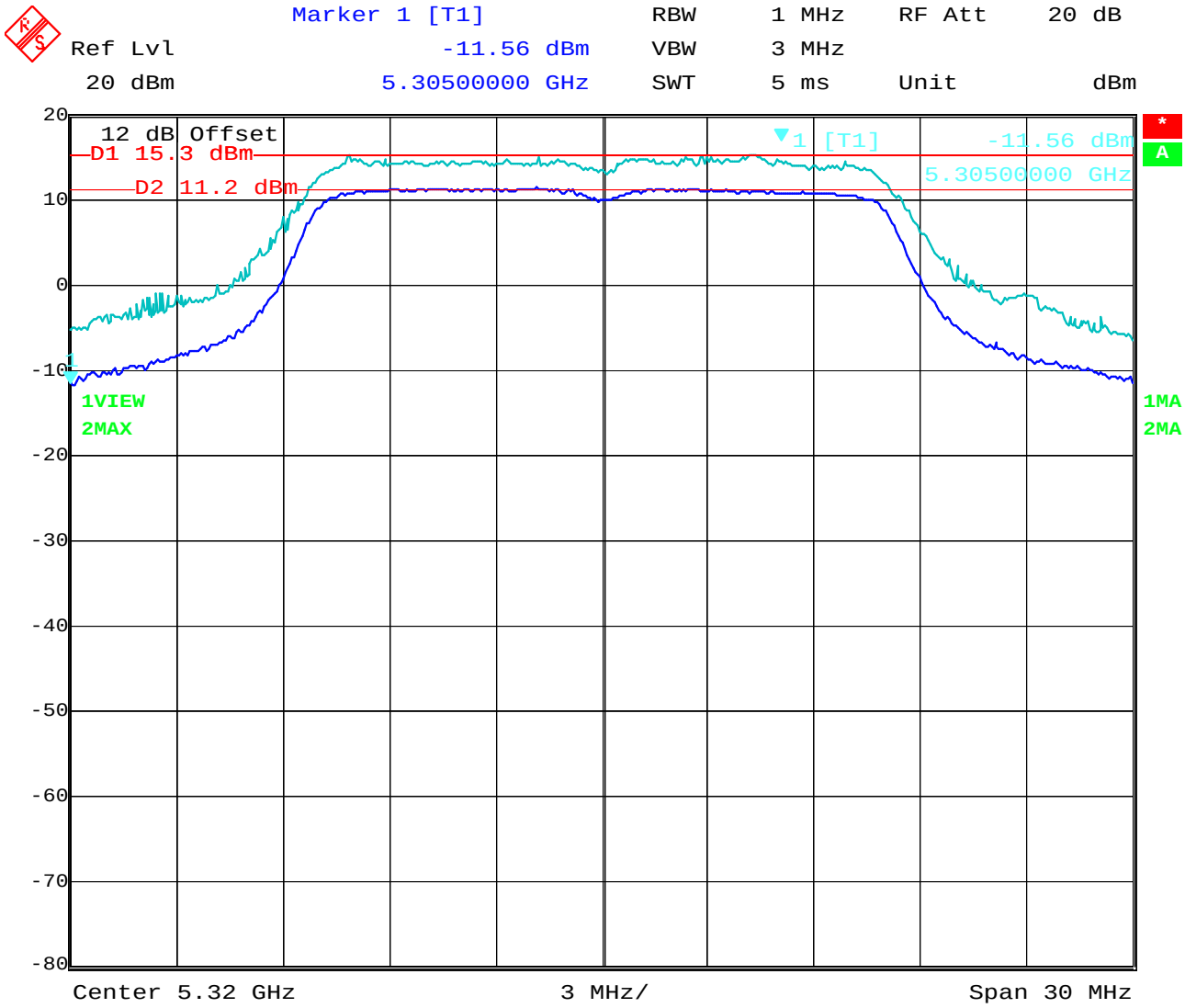
Date: 21.FEB.2005 13:24:03

Plot 3: 5300 MHz



Date: 21.FEB.2005 13:24:44

Plot 4: 5320 MHz



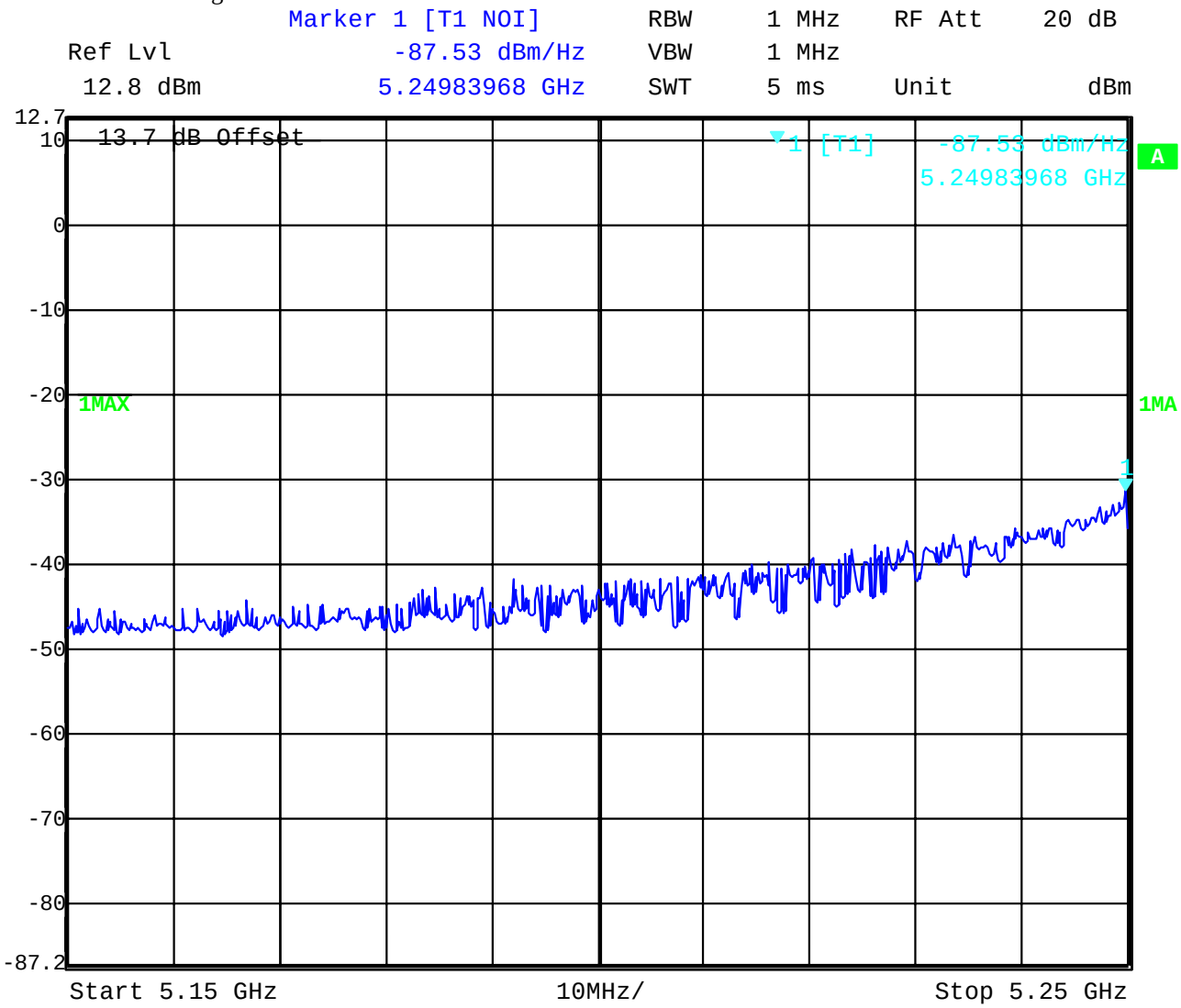
Date: 21.FEB.2005 13:25:35

Results

Test conditions		Ratio of peak excursion of the modulation envelope		
		Result	Limit	
5745 MHz		4.1 dB	13 dB	Pass
5765 MHz		4.1 dB	13 dB	Pass
5785 MHz		4.3 dB	13 dB	Pass
5805 MHz		4.1 dB	13 dB	Pass
Measurement uncertainity		±1dB		

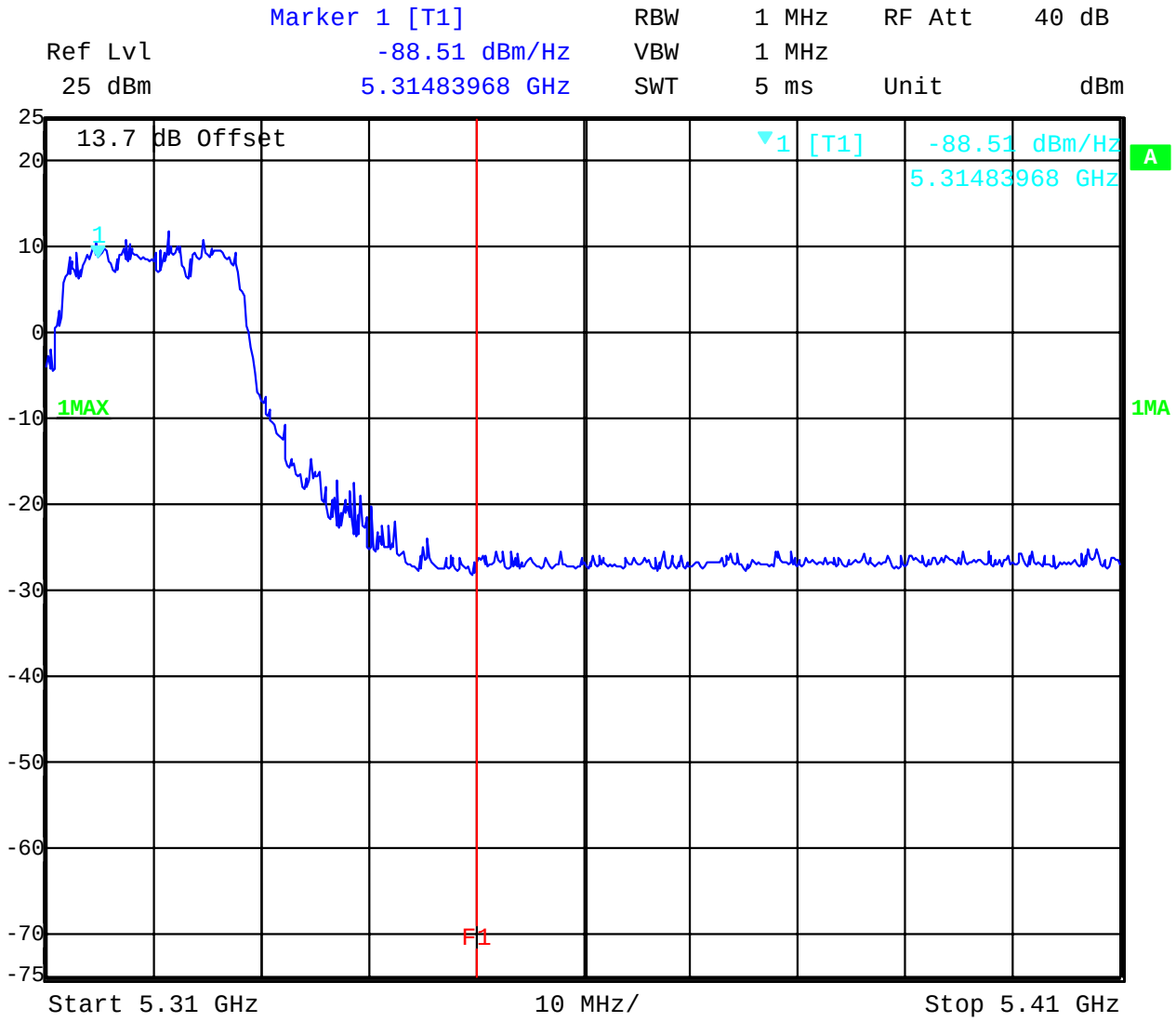
3.19 Undesirable emission limits at band edges 15.407 (b3)

Plot 1: lower band edge



RBW / VBW : 1 MHz

Plot 2: upper band edge



RBW / VBW : 1 MHz

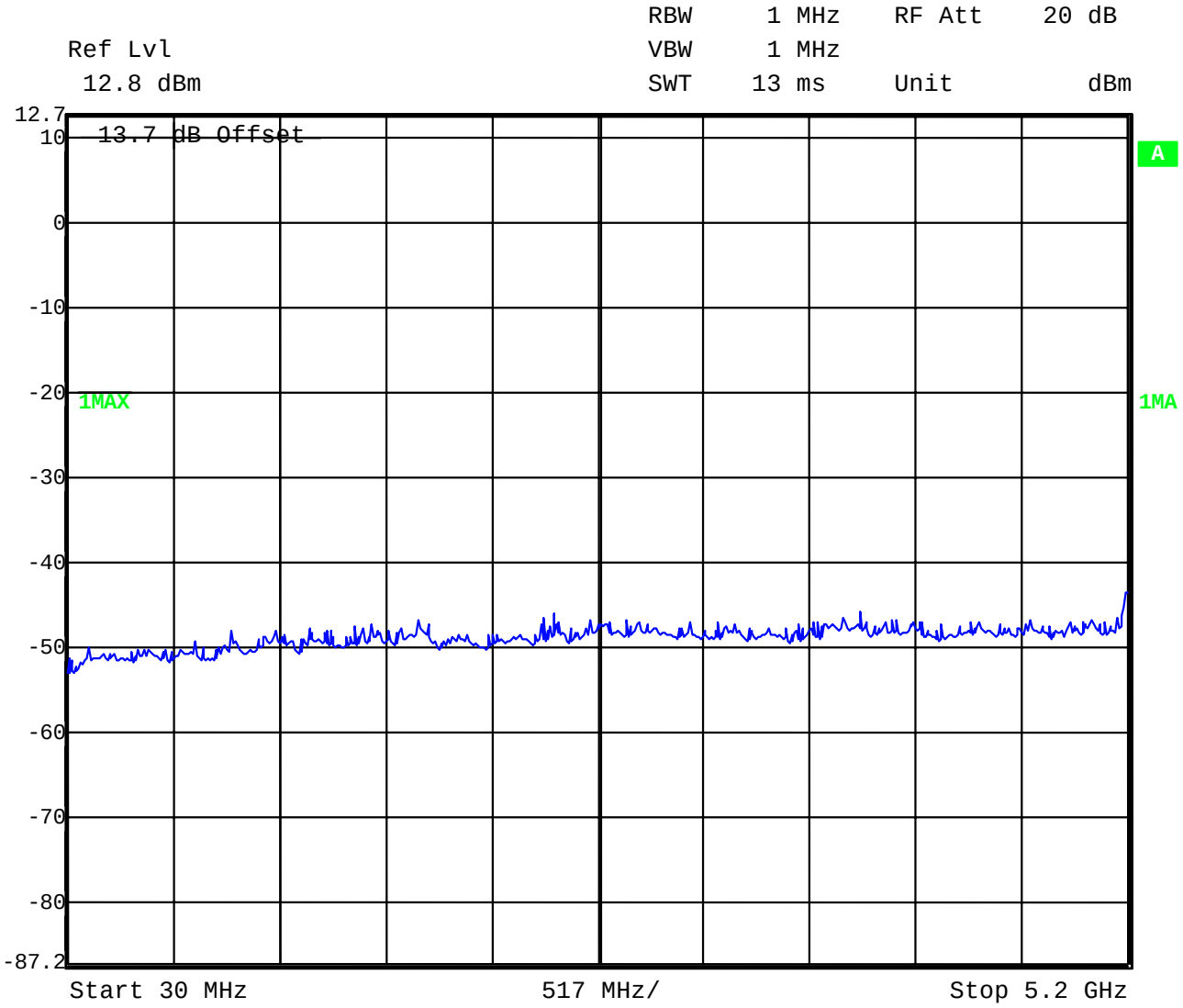
Limits:
- + 10 Mhz above band edge -17 dBm/MHz
- + 10 Mhz belowband edge -27 dBm/MHz
- more than 10 MHz above or below -27 dBm/MHz

Result:
- lower band edge - 10 MHz: -87.5 dBm/Hz + 60 dB = -31.5 dBm/MHz => pass
- upper band edge + 10 MHz: -88.5 dBm/Hz + 60 dB = -28.5 dBm/MHz => pass

-all frequencies more than 10 MHz above or below band edge < -30 dBm/MHz => pass

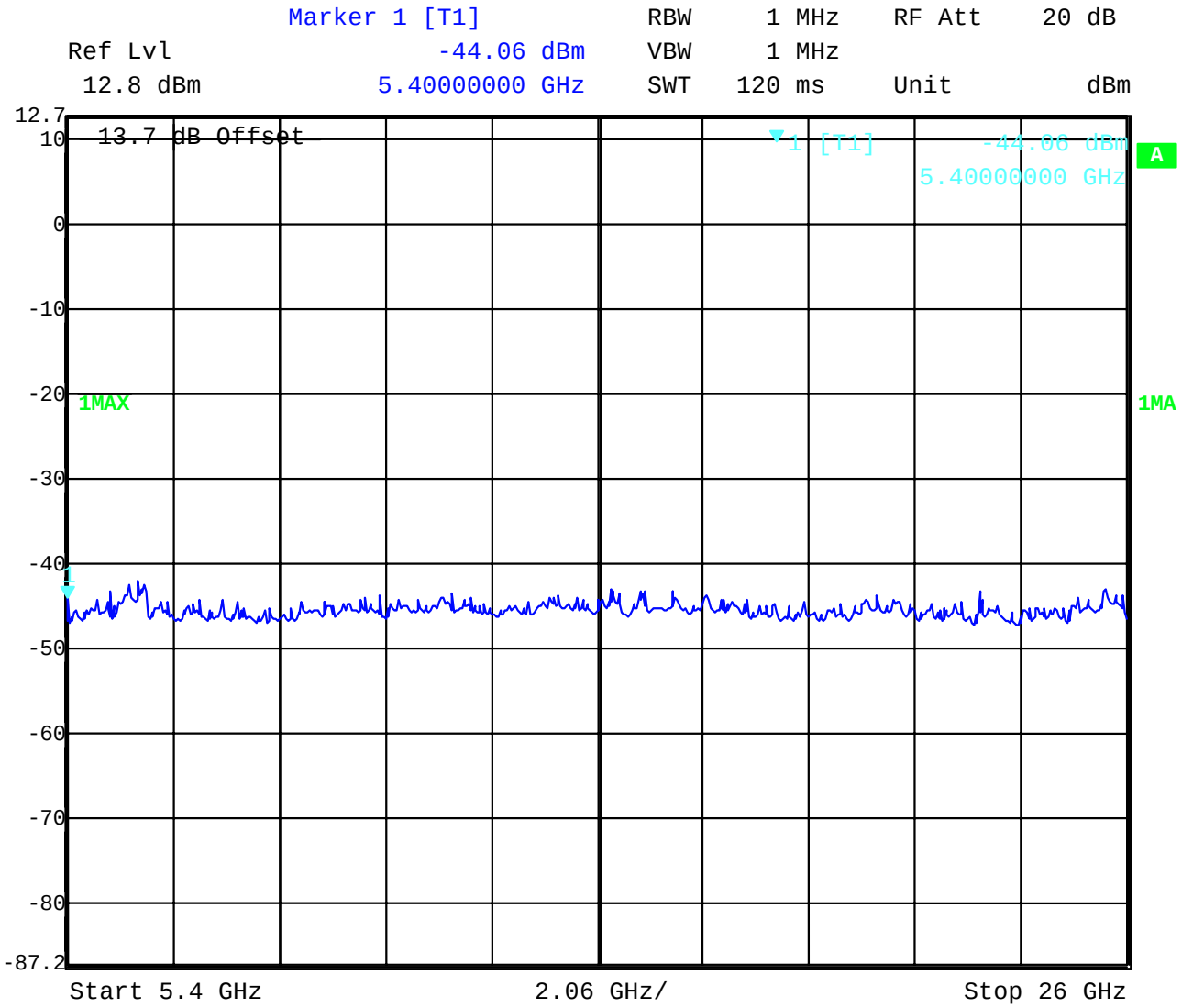
3.20 Spurious (conducted) 15.407 (b3)

Plot 1: 5260 MHz



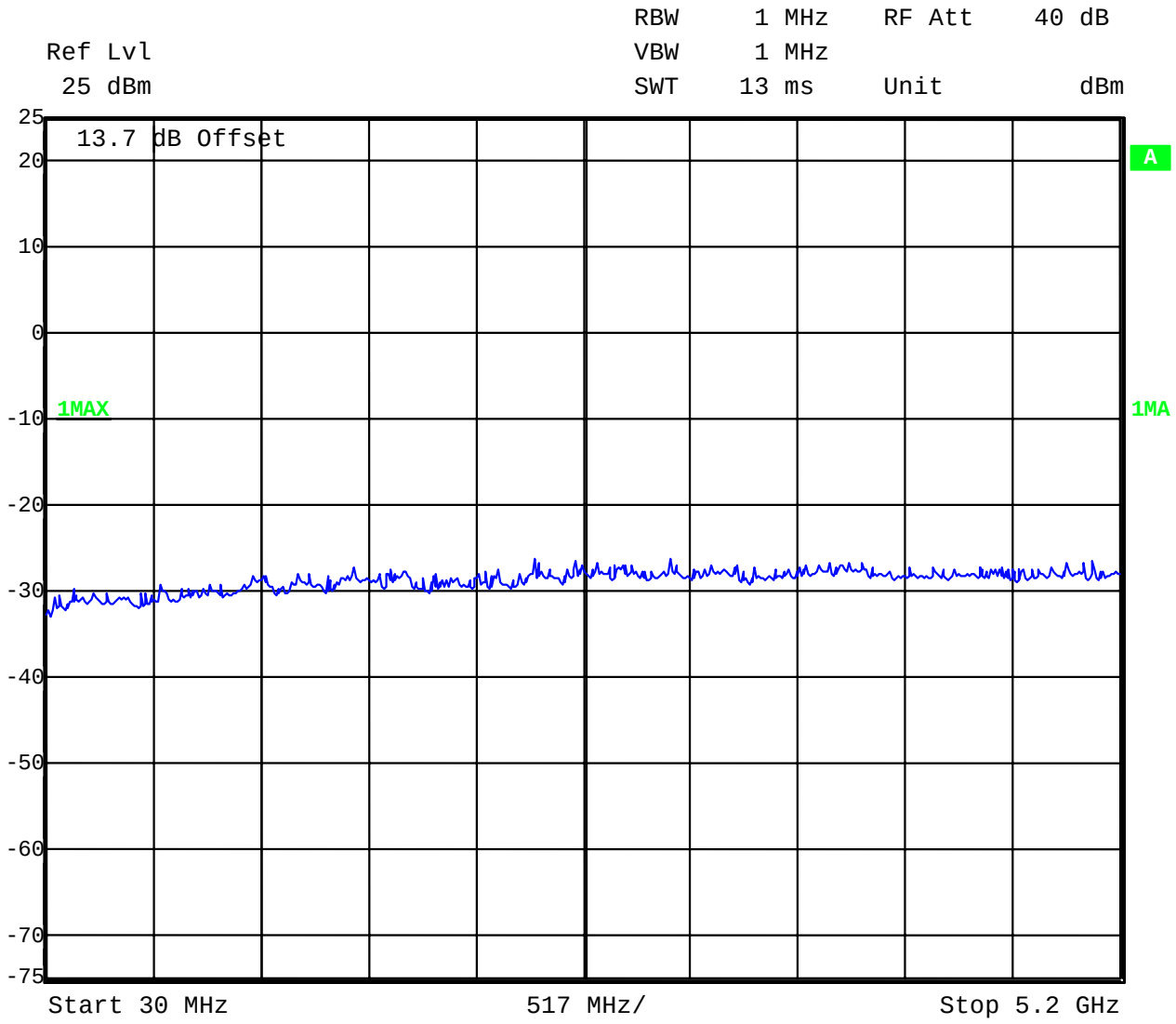
RBW / VBW : 1 MHz

Plot 2: 5260 MHz



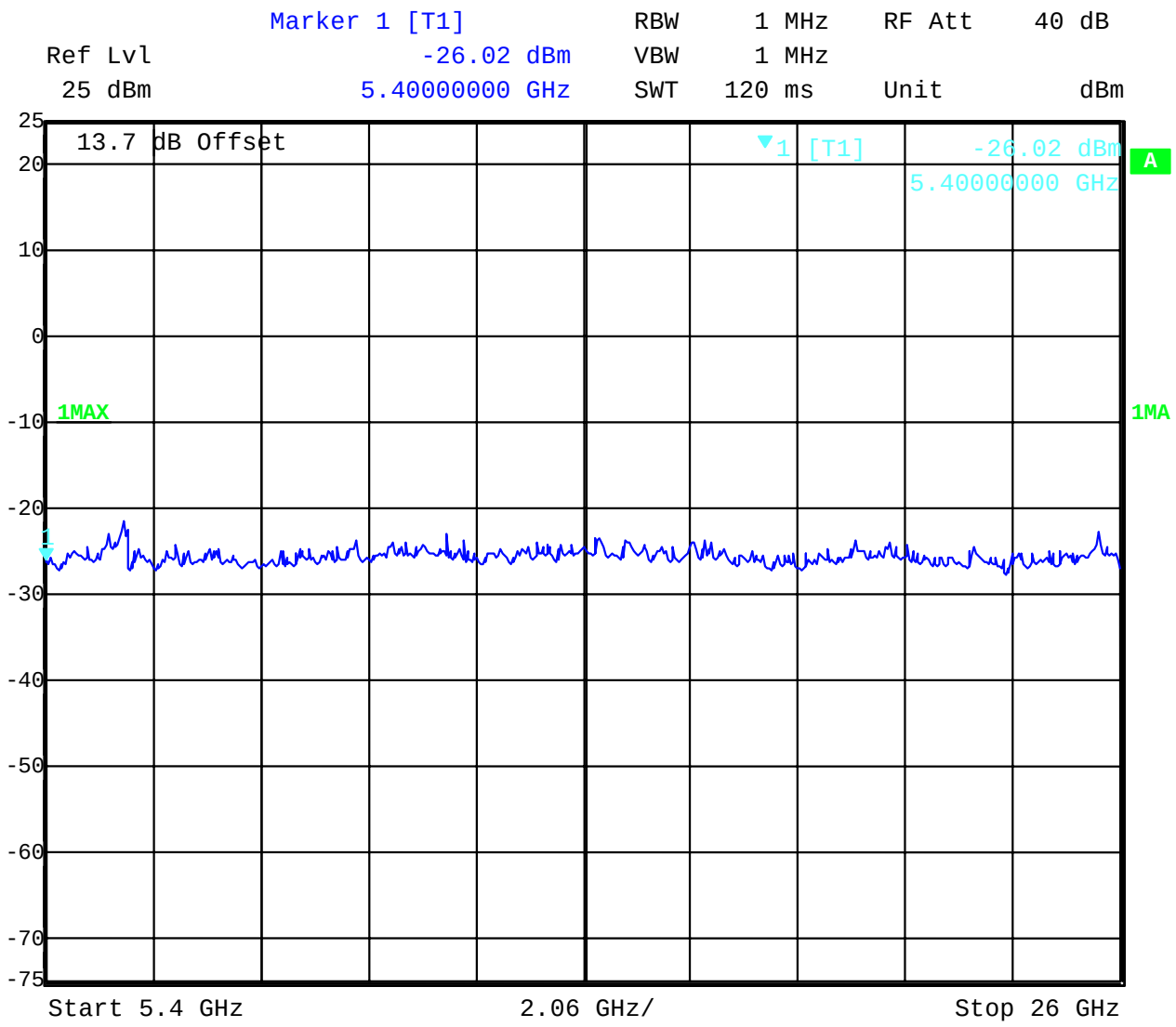
RBW / VBW : 1 MHz

Plot 3: 5280 MHz



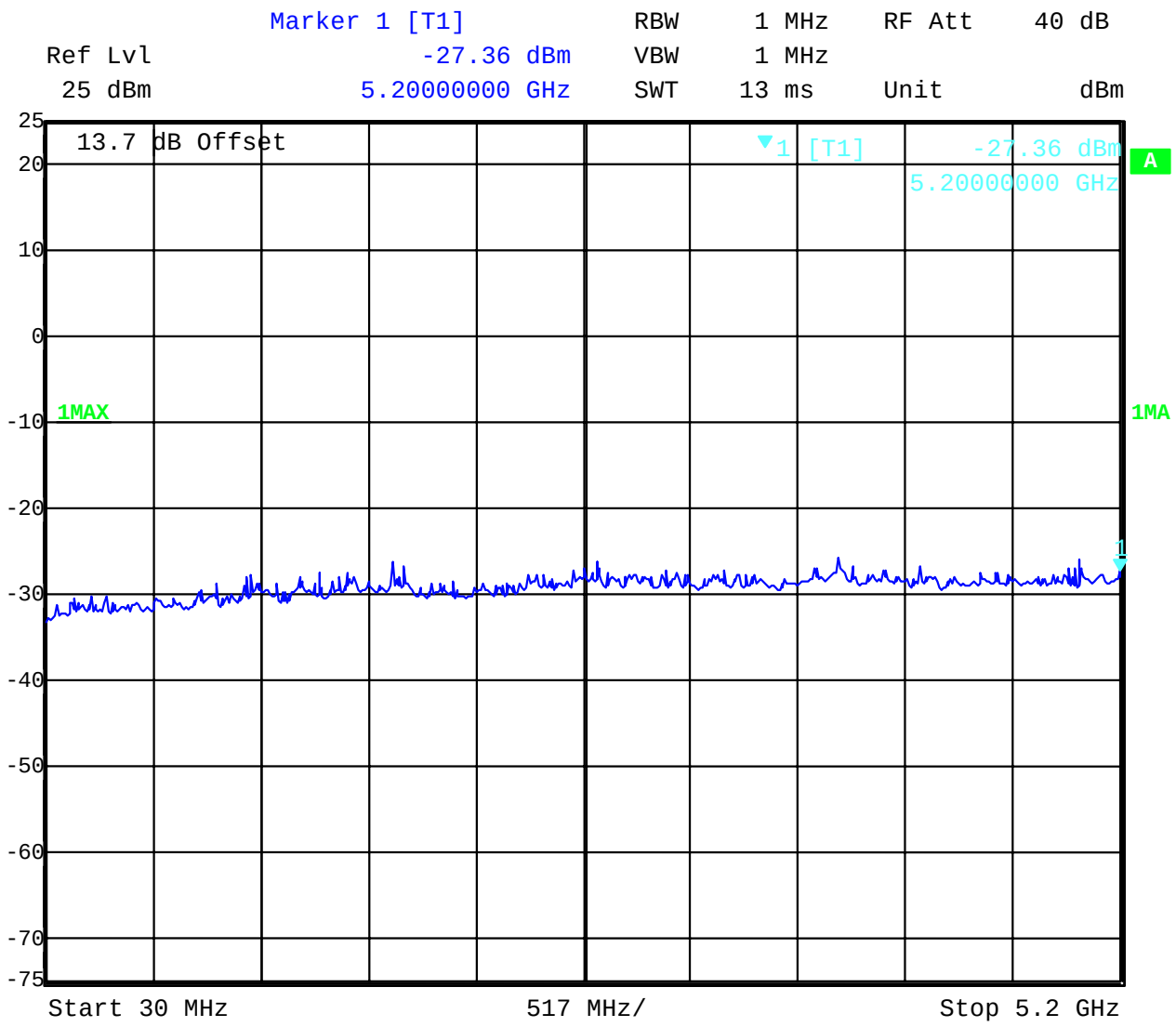
RBW / VBW : 1 MHz

Plot 4: 5280 MHz



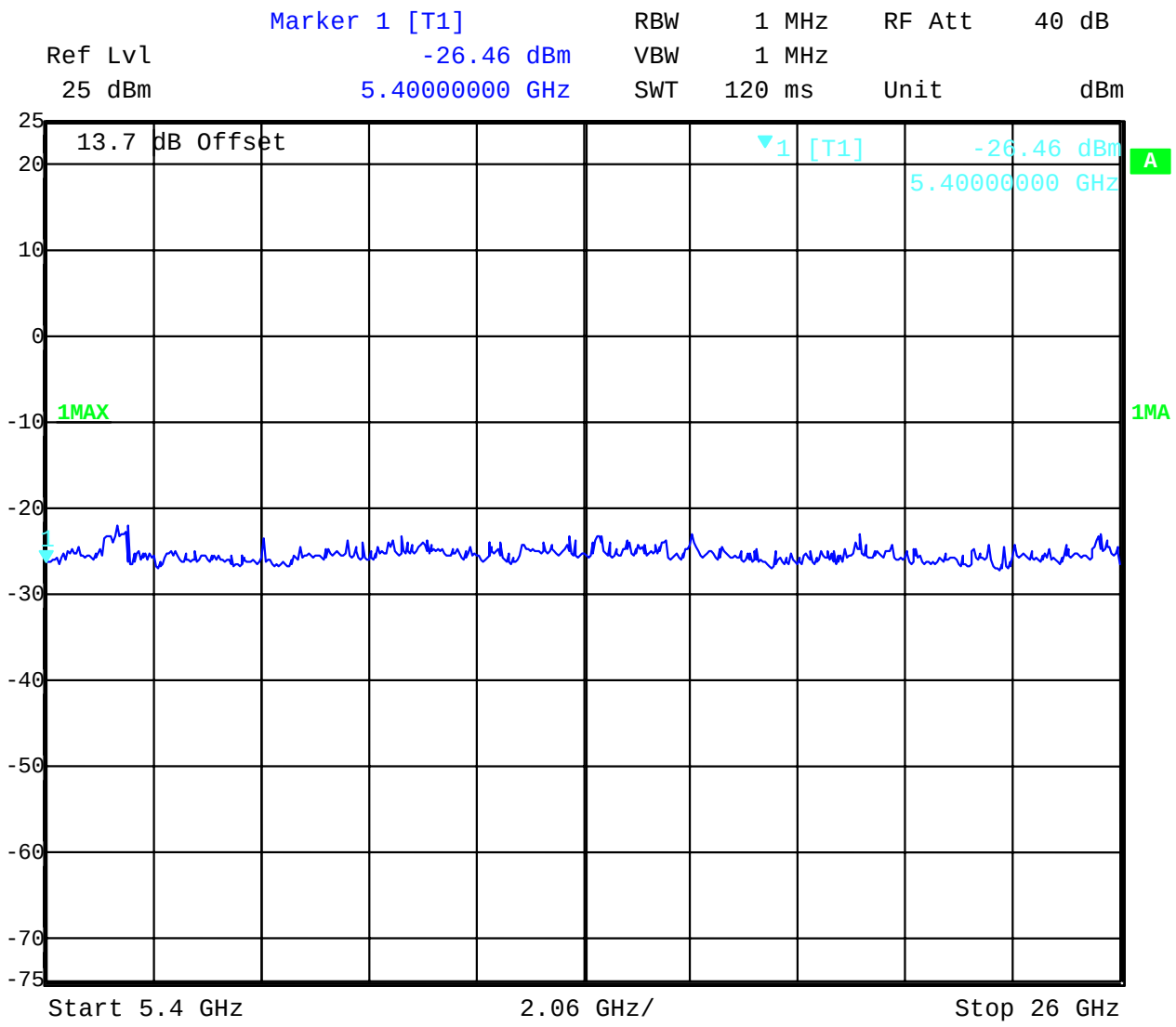
RBW / VBW : 1 MHz

Plot 5: 5300 MHz



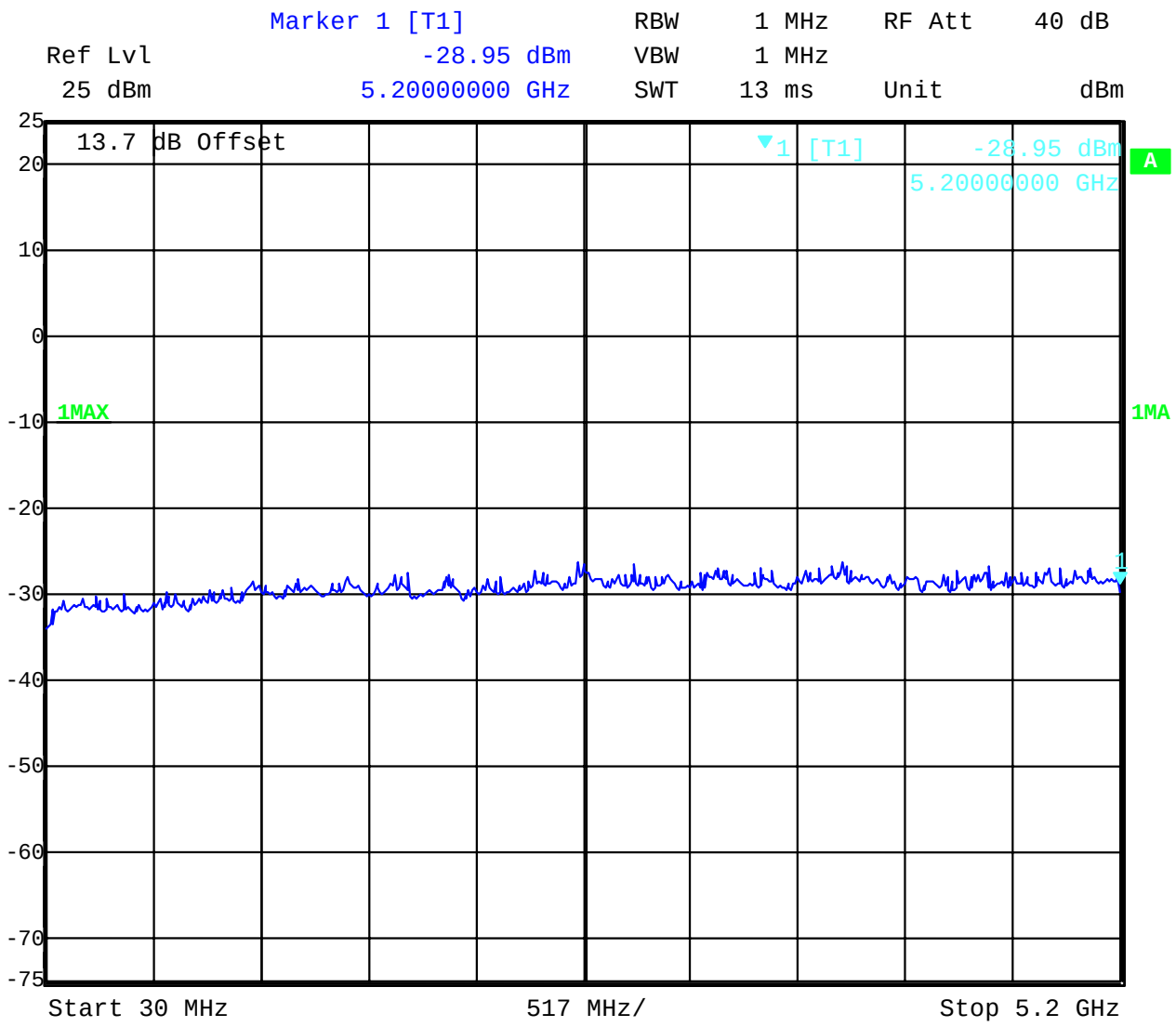
RBW / VBW : 1 MHz

Plot 6: 5320 MHz



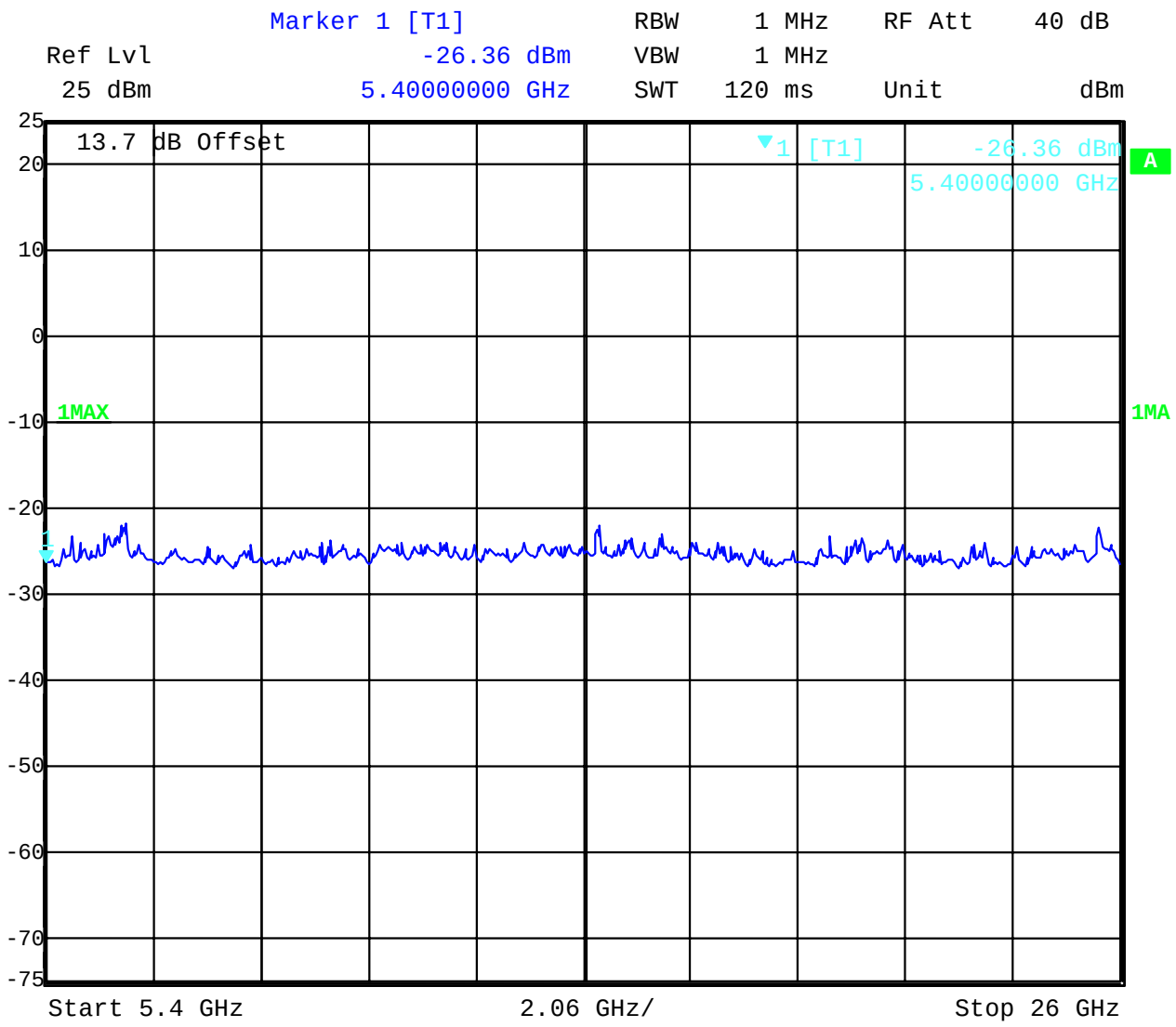
RBW / VBW : 1 MHz

Plot 7: 5320 MHz



RBW / VBW : 1 MHz

Plot 8: 5320 MHz



RBW / VBW : 1 MHz

Spurious emissions conducted

Result & Limits

Emission Limitations					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emmision power	actual attenuation below frequency of operation [dB]	results
5260			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5280			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5300			30 dBm	-	Operating frequency
no	peaks	found		< 20 dB below	limit
5320			30 dBm	-	Operating frequency
Measurement uncertainty		± 3dB			

RBW : 1 MHz VBW: 1 MHz

Under normal test conditions only	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)).

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

3.21 MPE Calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a "worst case" prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation: (Antenna 1)

(Calculated for max. EIRP)

EIRP: 28.3 dBm = 676.1 mW

calculated at distance of 20 cm:

power density = $676.1 / 4\pi 20^2$ = 0.135 mW/cm^2

Calculation: (Antenna 2)

EIRP: 28.6 dBm = 724.4 mW

power density = $724.4/4\pi 20^2$ = 0.144 mW/cm^2

Limit:

1mW/cm^2 is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

3.22 Max. peak output power (radiated) §15.247 (b) (1)

Results:

Test conditions **Antenna 1** (gain 4.0 dBi) Frequency [MHz]		Max. peak output power EIRP [dBm]		
		5260 MHz	5280 MHz	5300 MHz
T_{nom}	V_{nom}	28.3 rad	28.2 rad	25.6 rad
Frequency [MHz]		5320 MHz		
T_{nom}	V_{nom}	27.2 rad		
Measurement uncertainty		±3dB		

Test conditions **Antenna 2** (gain 7.9 dBi –3.6 dB loss => 4.3 dBi) Frequency [MHz]		Max. peak output power EIRP [dBm]		
		5260 MHz	5280 MHz	5300 MHz
T_{nom}	V_{nom}	28.6 rad	28.5 rad	25.9 rad
Frequency [MHz]		5320 MHz	5320 MHz	
T_{nom}	V_{nom}	27.5 rad		
Measurement uncertainty		±3dB		

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt / 30 dBm

3.23 Spurious Emissions - radiated (Transmitter) §15.209

There were no significant differences between the antennas.

We found no spurious in any channel up to 60 GHz.

The spurious below 1 GHz are radiated from the housing and the same with each antenna.

On the next page you find a list of restricted bands and the results of the spurious measurements of this three antennas up to 40 GHz.

There was only one frequency within the restricted bands with more than 100µV below limit.

The plots on the next pages show the behaviour of antenna 1 as an example.

Results:

Spurious Emissisons level [µV/m]								
f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]
38.7	QP	35.3						
42.0	QP	38.4						
90.1	QP	38.6						
142.3	QP	34.8						
528.7	QP	41.8						
Measurement uncertainty			±3 dB					

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

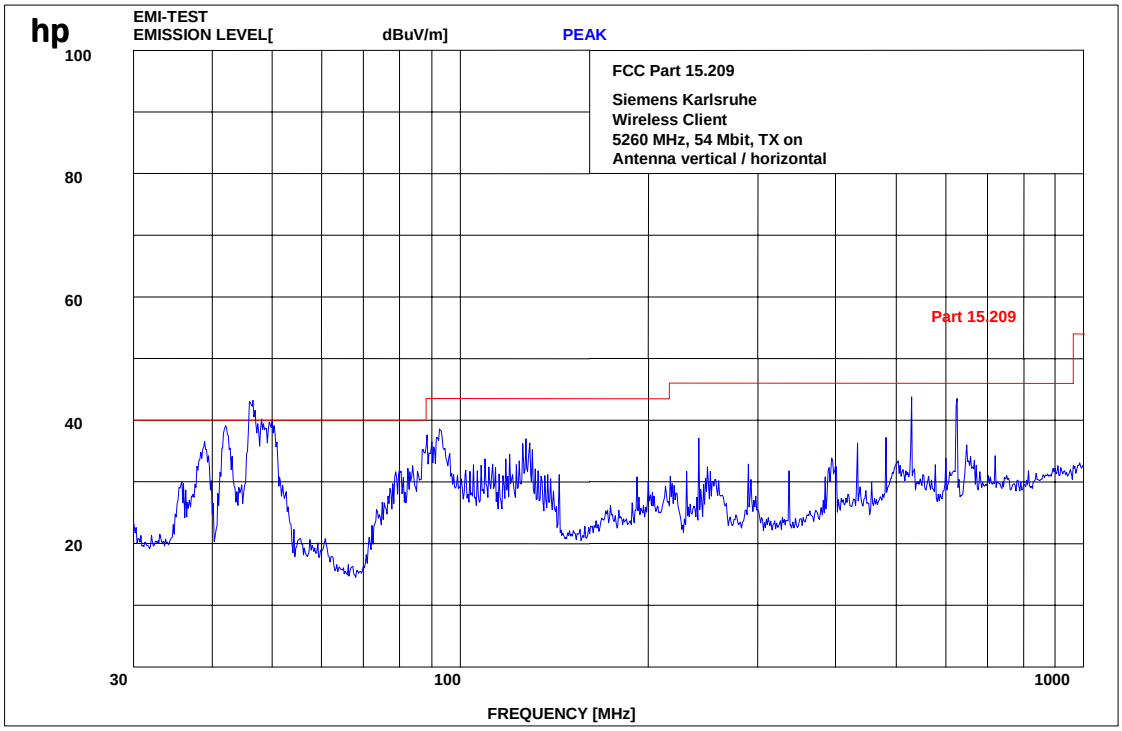
Measurement distance see table

Limits : § 15.109 / 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

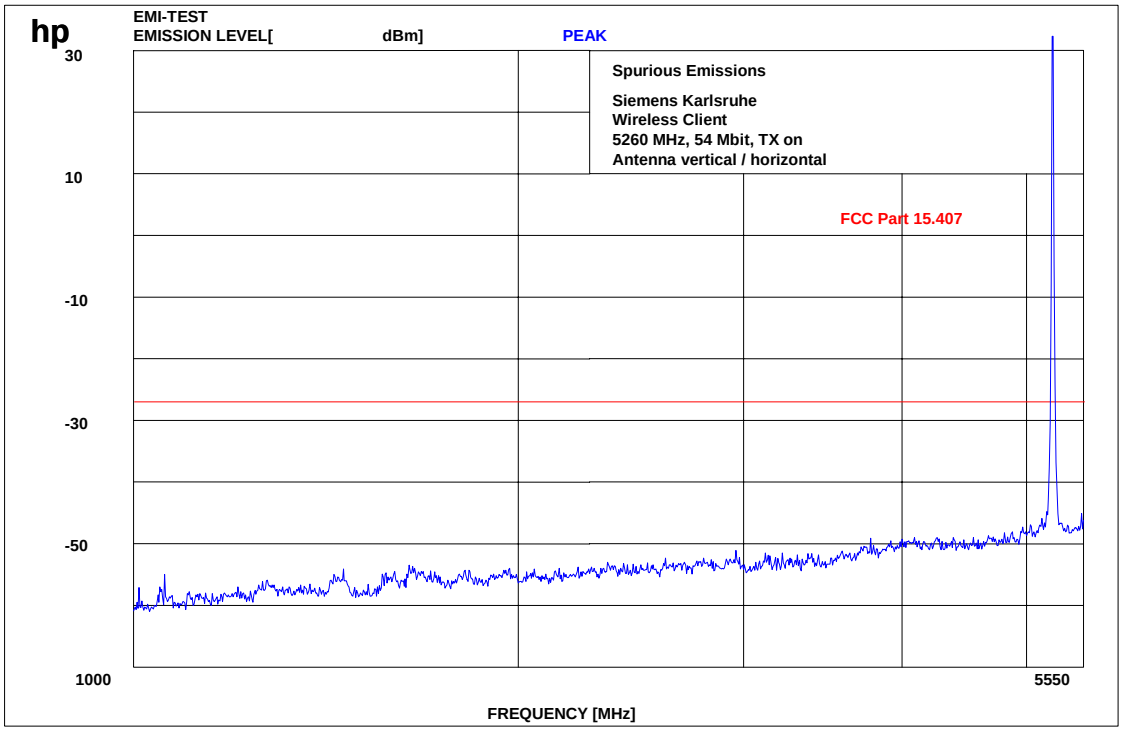
Frequencies (MHz)	Limit	Antenna 1	Antenna 2	Antenna 3
37.5 – 38.25	100µV/m at 3m	-	-	-
73 – 74.6	100µV/m at 3m	-	-	-
74.8 – 75.2	100µV/m at 3m	-	-	-
108 – 121.94	150µV/m at 3m	-	-	-
123 – 138	150µV/m at 3m	-	-	-
149.9 – 150.05	150µV/m at 3m	-	-	-
156.52475-156.52525	150µV/m at 3m	-	-	-
156.7 – 156.9	150µV/m at 3m	-	-	-
162.0125 – 167.17	150µV/m at 3m	-	-	-
167.72 – 173.2	150µV/m at 3m	-	-	-
240 – 285	200µV/m at 3m	240.7MHz, 88µV/m	240.7MHz, 88µV/m	240.7MHz, 88µV/m
322 – 335.4	200µV/m at 3m	-	-	-
399.9 – 410	200µV/m at 3m	-	-	-
608 – 614	200µV/m at 3m	-	-	-
960 – 1240	500µV/m at 3m	-	-	-
1300 – 1427	500µV/m at 3m	-	-	-
1435 – 1626.5	500µV/m at 3m	-	-	-
1645.5 – 1646.5	500µV/m at 3m	-	-	-
1660 – 1710	500µV/m at 3m	-	-	-
1718.8 – 1722.2	500µV/m at 3m	-	-	-
2200 – 2300	500µV/m at 3m	-	-	-
2310 - 2390	500µV/m at 3m	-	-	-
2483.5 – 2500	500µV/m at 3m	-	-	-
2655 – 2900	500µV/m at 3m	-	-	-
3260 – 3267	500µV/m at 3m	-	-	-
3332 – 3339	500µV/m at 3m	-	-	-
3345.8 – 3358	500µV/m at 3m	-	-	-
3600 – 4400	500µV/m at 3m	-	-	-
4500 – 5150	500µV/m at 3m	-	-	-
5350 – 5460	500µV/m at 3m	-	-	-
7250 – 7750	500µV/m at 3m	-	-	-
8025 – 8500	500µV/m at 3m	-	-	-
9000 – 9200	500µV/m at 3m	-	-	-
9300 – 9500	500µV/m at 3m	-	-	-
10600 – 12700	500µV/m at 3m	-	-	-
13250 – 13400	500µV/m at 3m	-	-	-
14470 – 14500	500µV/m at 3m	-	-	-
15350 – 16200	500µV/m at 3m	-	-	-
17700 – 21400	500µV/m at 3m	-	-	-
22010 – 23120	500µV/m at 3m	-	-	-
23600 – 24000	500µV/m at 3m	-	-	-
31200 – 31800	500µV/m at 3m	-	-	-
36430 – 36500	500µV/m at 3m	-	-	-
>38600	500µV/m at 3m	-	-	-

Plot 1: 0.03 – 1 GHz vertical (lowest channel)



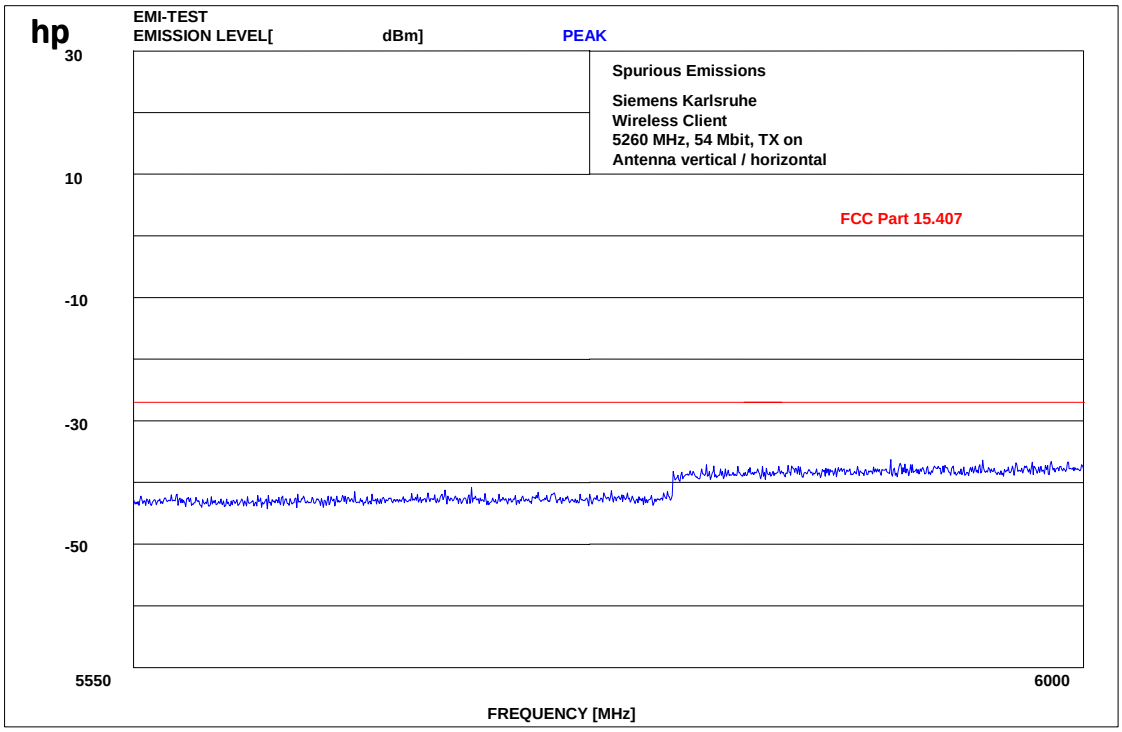
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 2: 1 GHz – 5.5 GHz vertical (lowest channel)



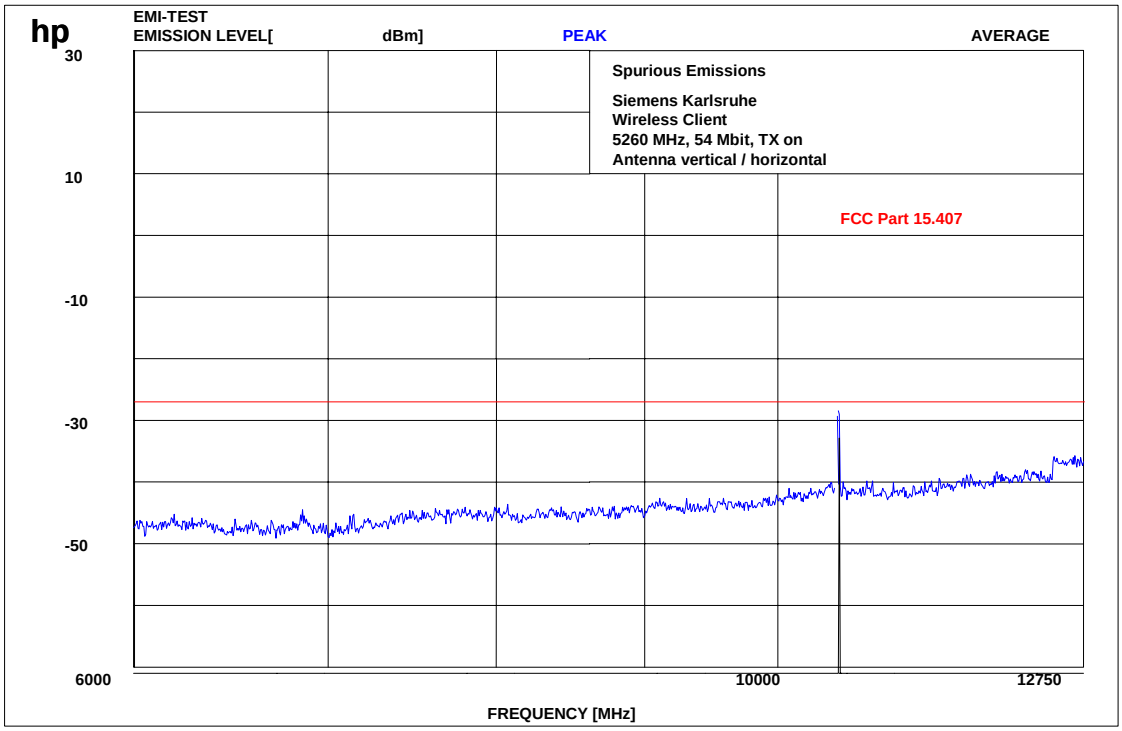
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 3: 5.5 to 6 GHz, vertical (lowest channel)



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

Plot 4: 6 to 12 GHz, vertical (lowest channel)

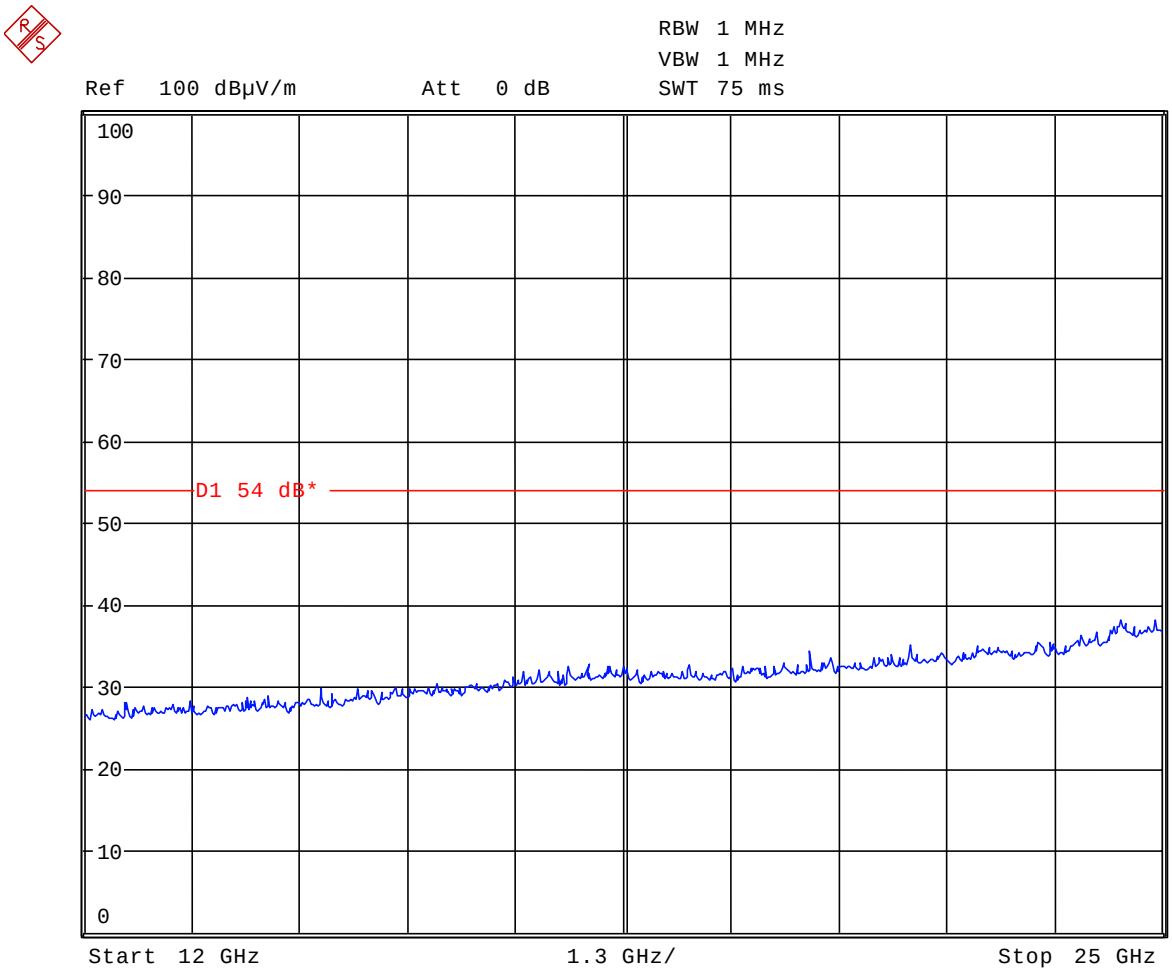


The signal at 10520 MHz is –33.4 dBm Average

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

Plot 5: -25 GHz vertical (lowest channel) (worst case)

Valid for all three measured channels.

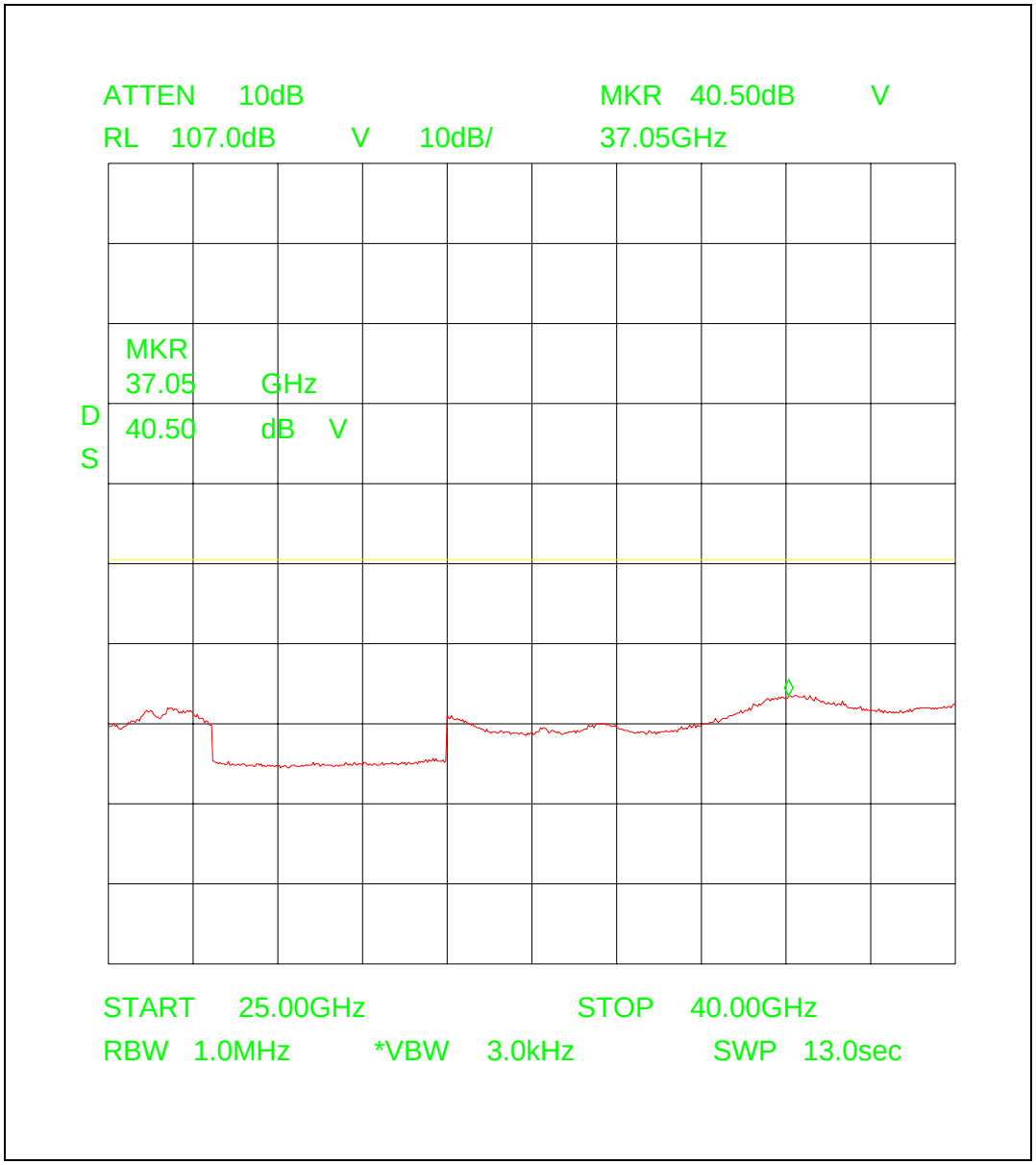


f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

We also measured with external mixers up to 60 GHz.

The plots are valid for all three channels. There were no peaks found.

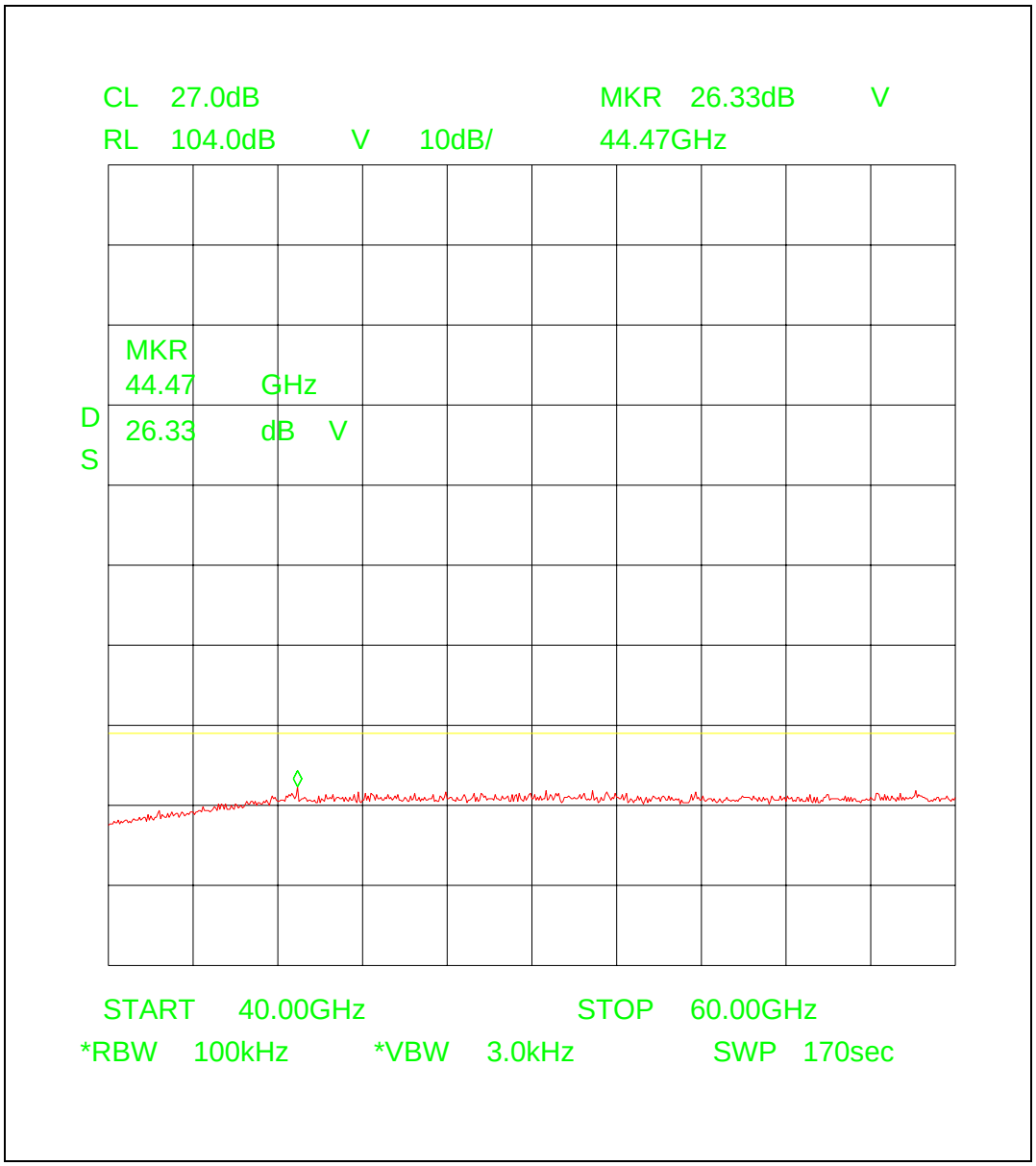
Plot 6: 25 – 40 GHz



Measured under following conditions.

Distance 0.5 Meter - 15.56 dB,
Antenna k-factor 37.5 dB (1/m),
Amplifier 30 dB,
Cabel loss 3.5 dB

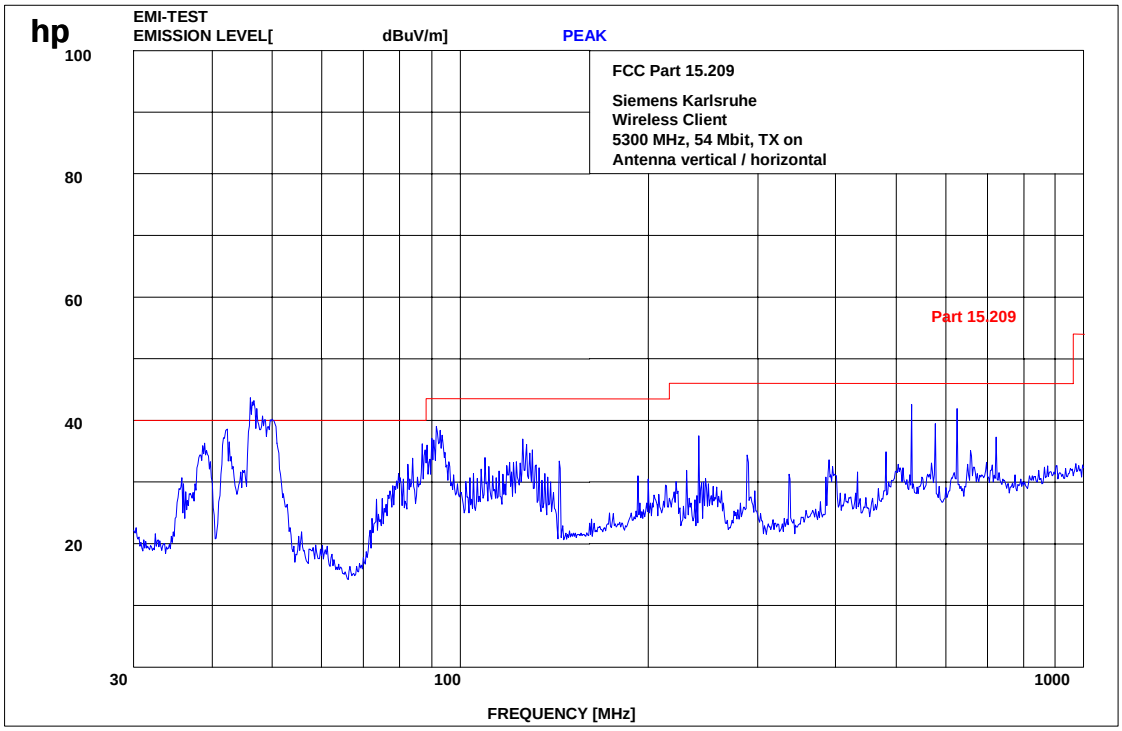
Plot 7: 40 to 60 GHz



Measured under the following conditions.

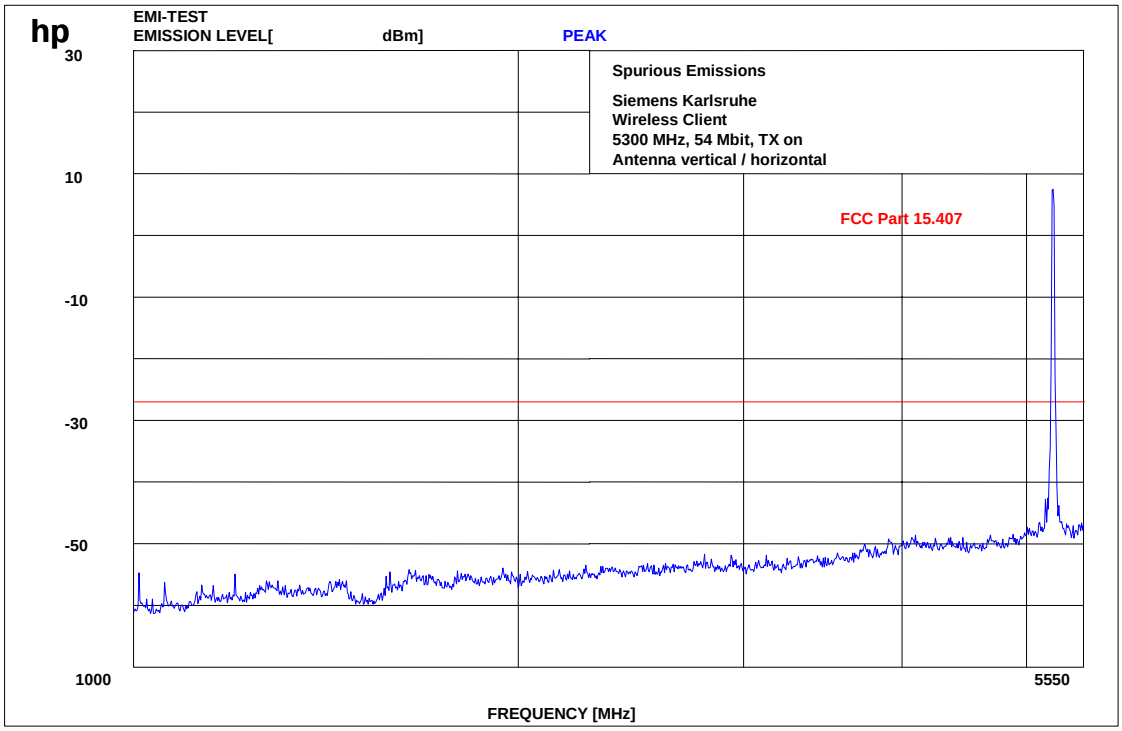
Distance 0.25 Meter - 21.58 dB,
Antenna k-factor 43.9 dB (1/m),

Plot 8: 30 MHz to 1 GHz (middle channel)



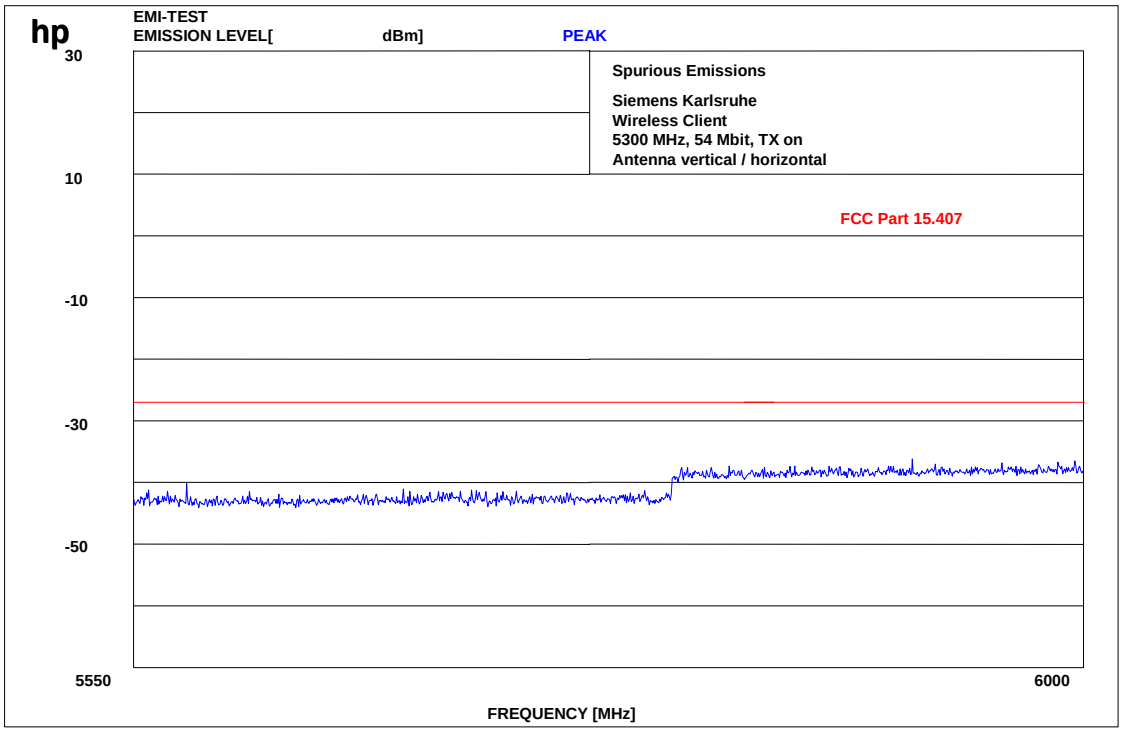
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 9: 1 GHz to 5.5 GHz (middle channel)



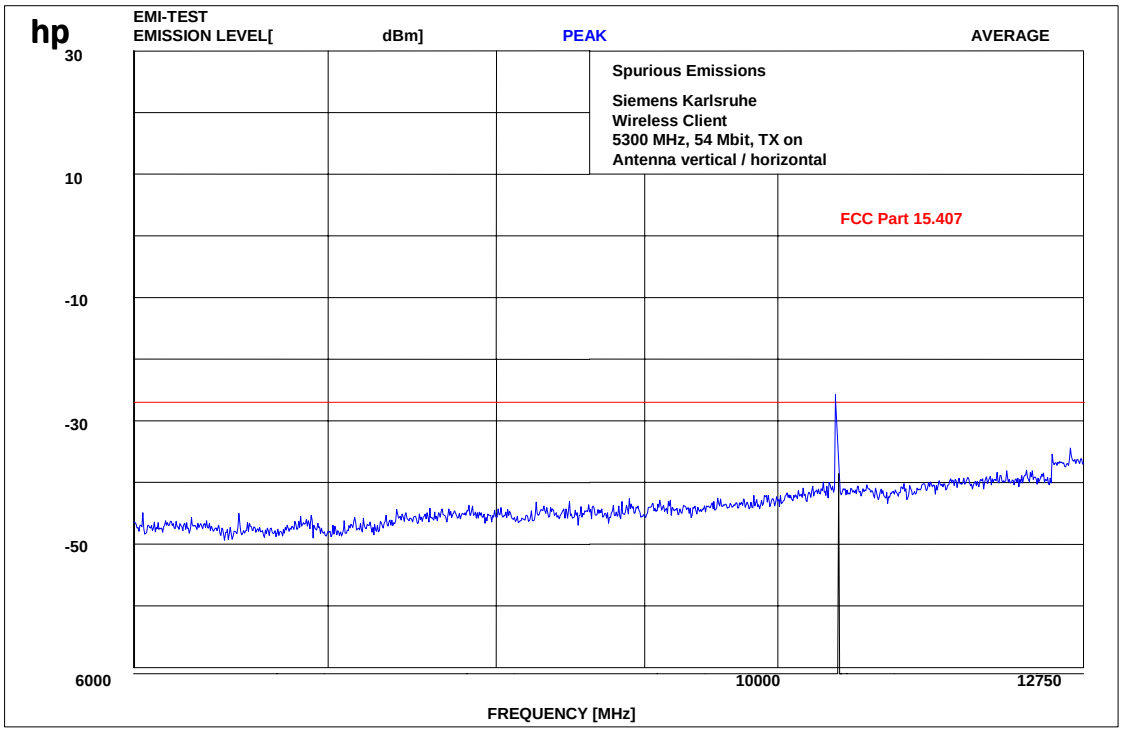
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 10: 5.5 GHz to 6 GHz (middle channel)



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

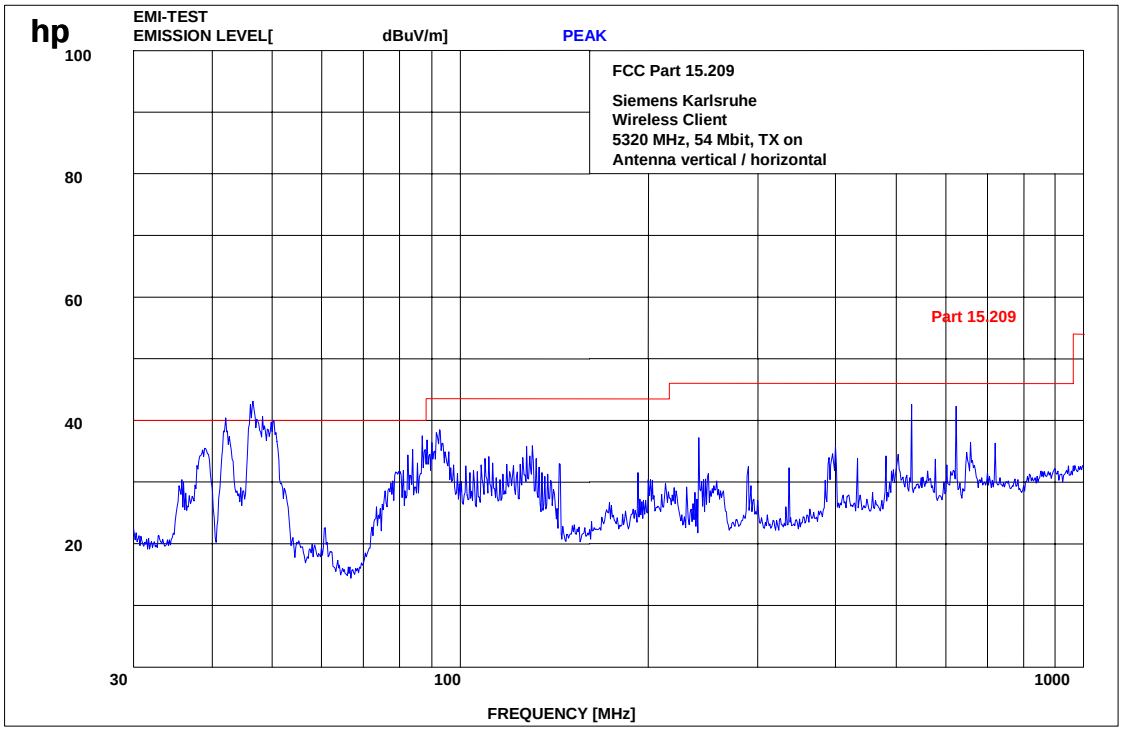
Plot 11: 6 GHz to 12 GHz (middle channel)



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

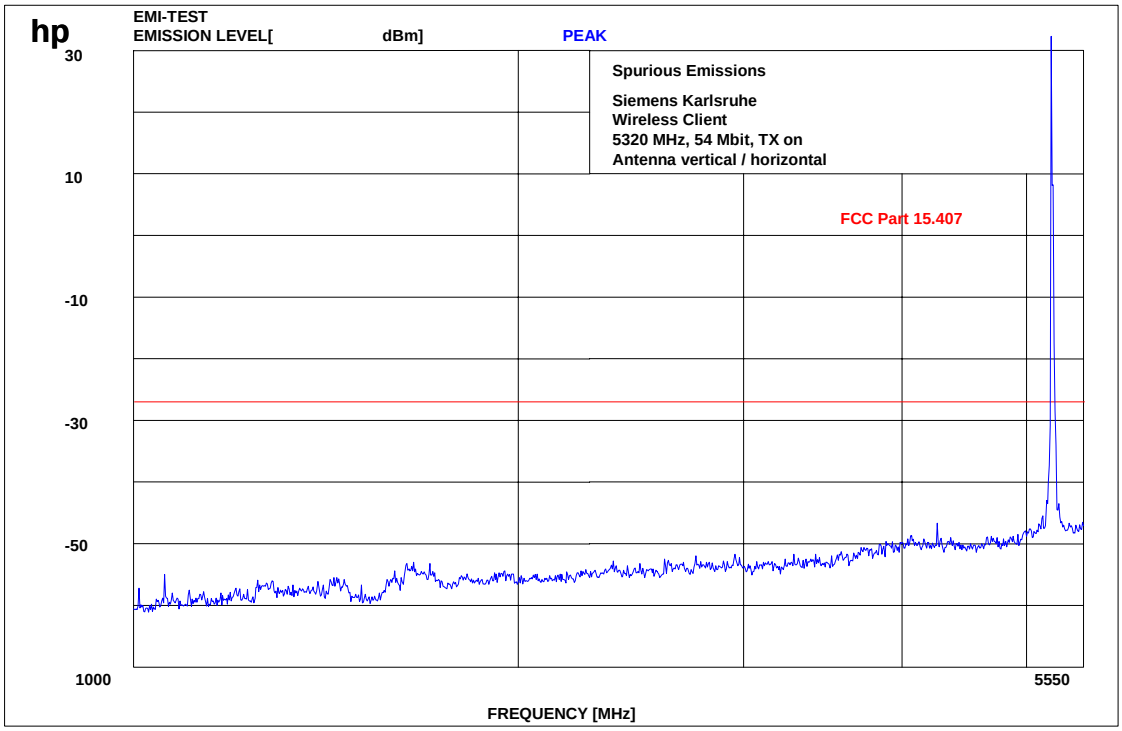
The signal at 10600 MHz is –34.7 dBm Average

Plot 12: 30 MHz to 1 GHz (highest channel)



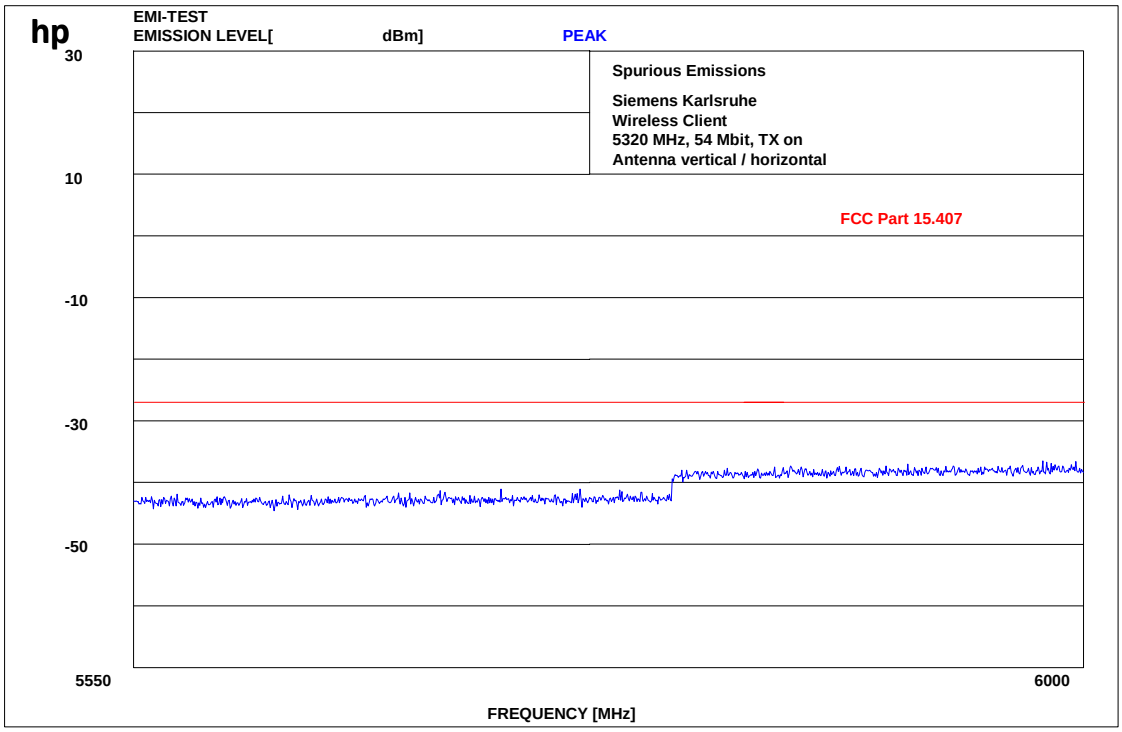
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 13: 1 GHz to 5.5 GHz (highest channel)



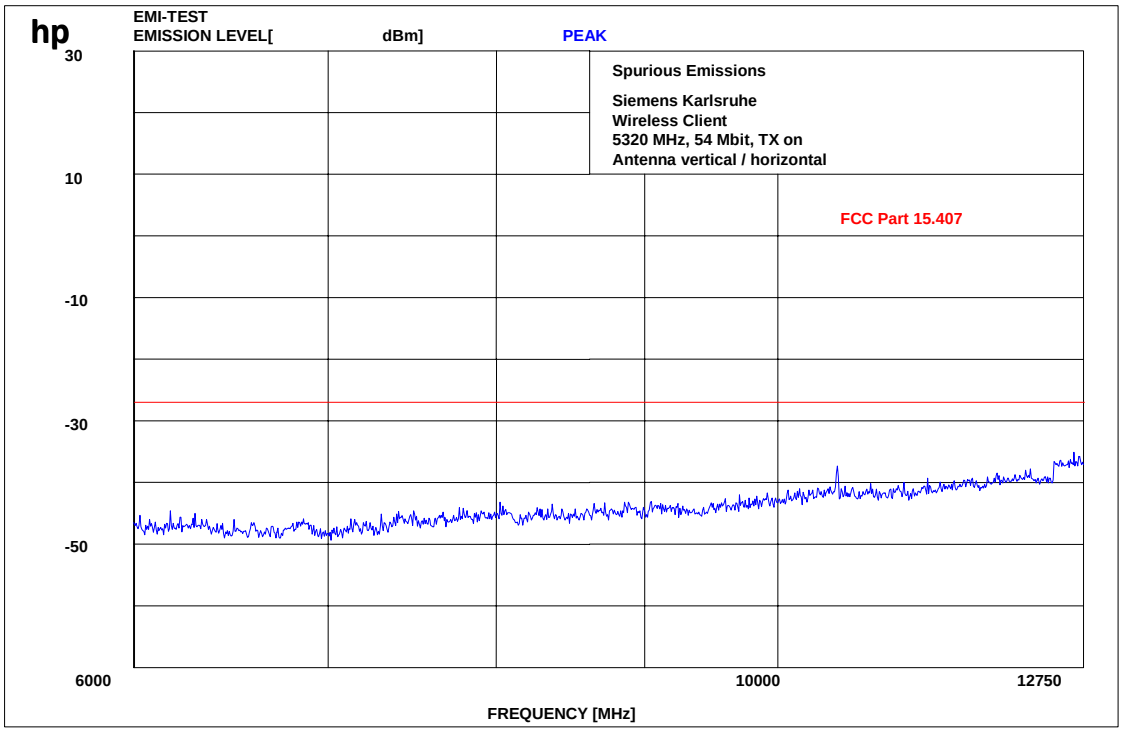
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 14: 5.5 GHz to 6 GHz (highest channel)



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

Plot 15: 6 GHz to 12 GHz (highest channel)

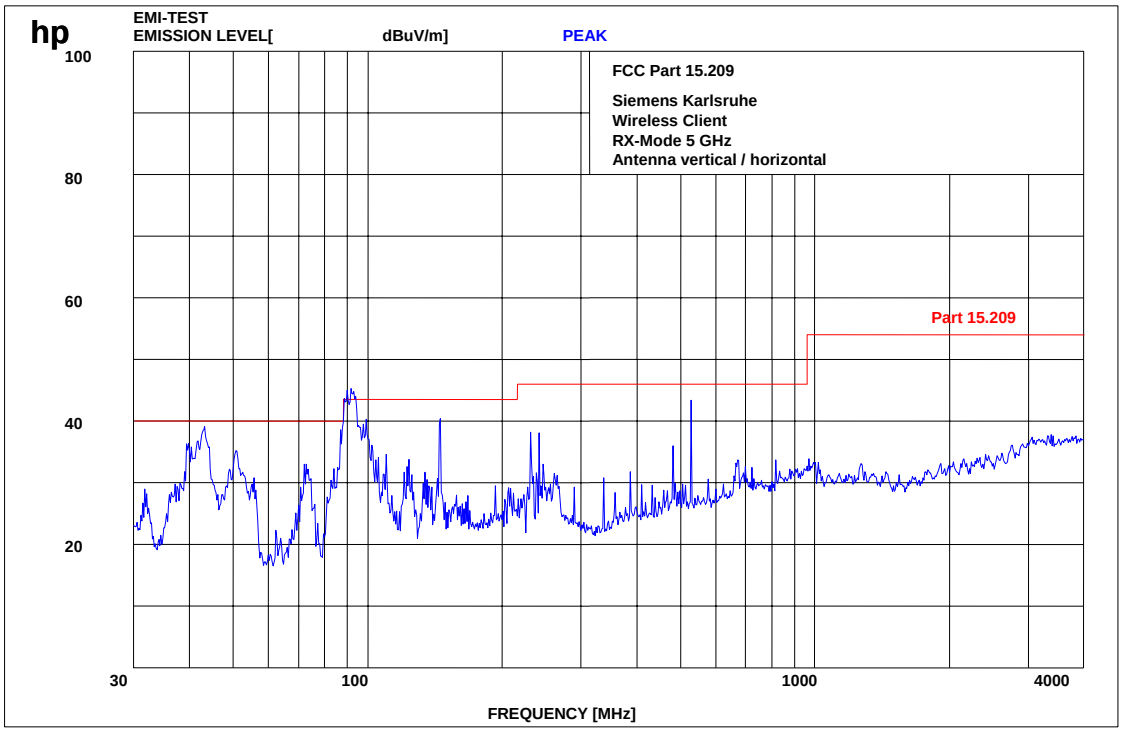


f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

3.24 Spurious emissions radiated (RX) 15.209

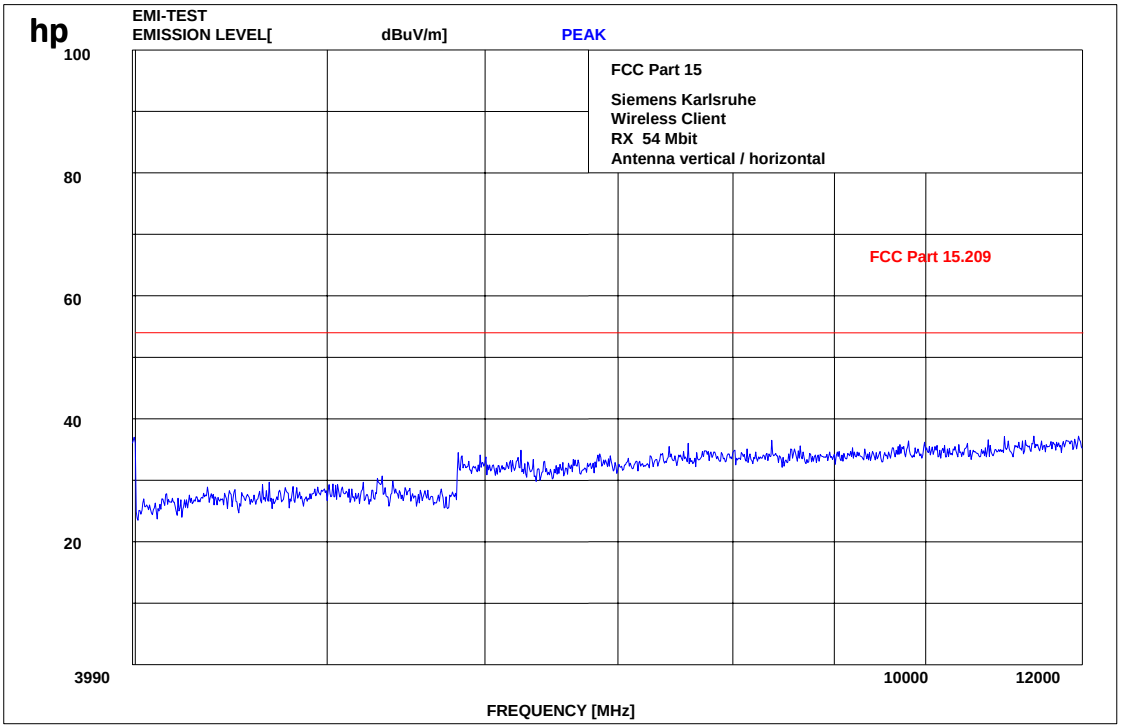
Valid for all three antennas

Plot 1: 30 to 4000 MHz



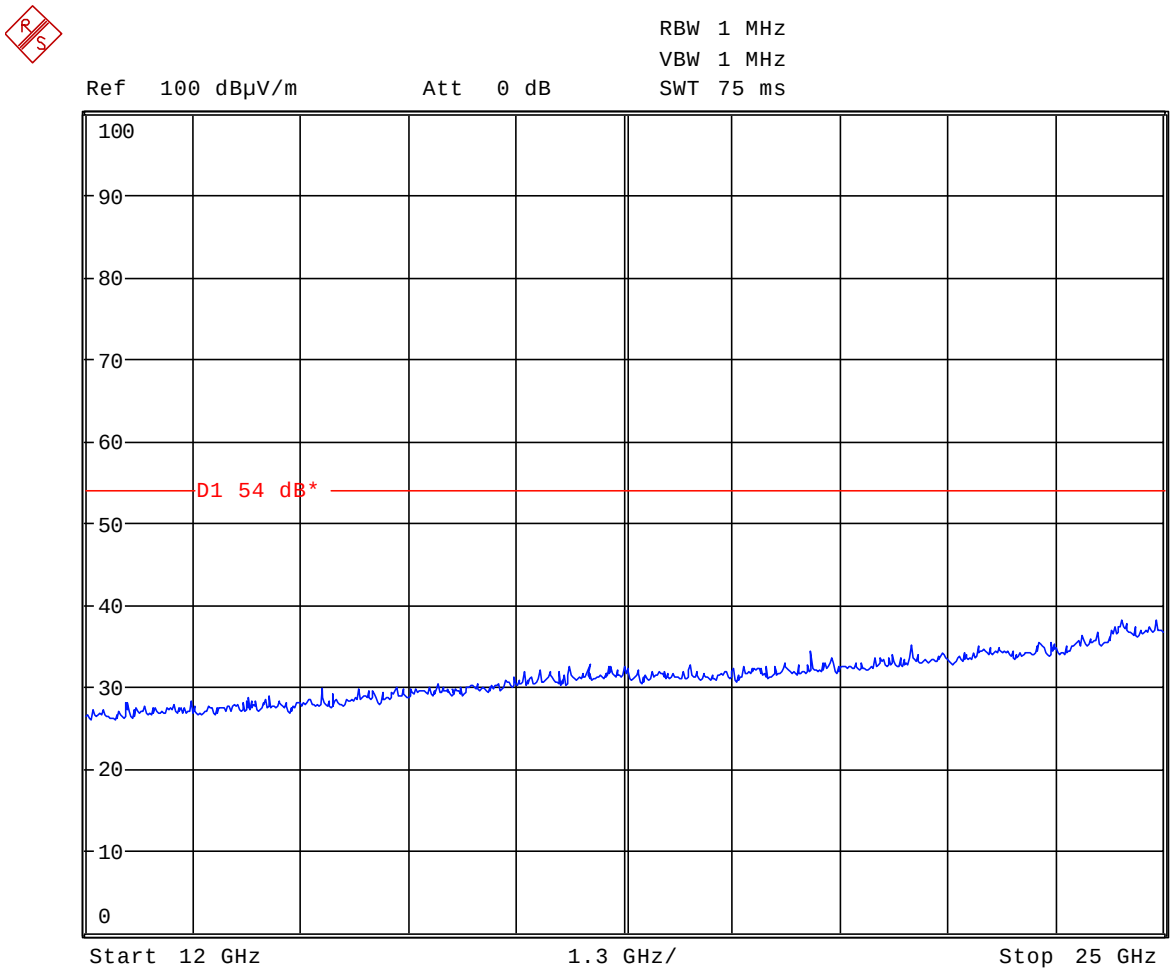
f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 2: 4 GHz to 12 GHz



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

Plot 3: - 25 GHz



The measurements were performed up to 60 GHz. There were no peaks found.

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

Limits: § 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

Results:

Spurious Emissisons level [µV/m]								
f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]	f[MHz]	Detector	Level [µV/m]
38.7	QP	35.3						
42.0	QP	38.4						
90.1	QP	38.6						
142.3	QP	34.8						
528.7	QP	41.8						
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 : § 15.109 / 209

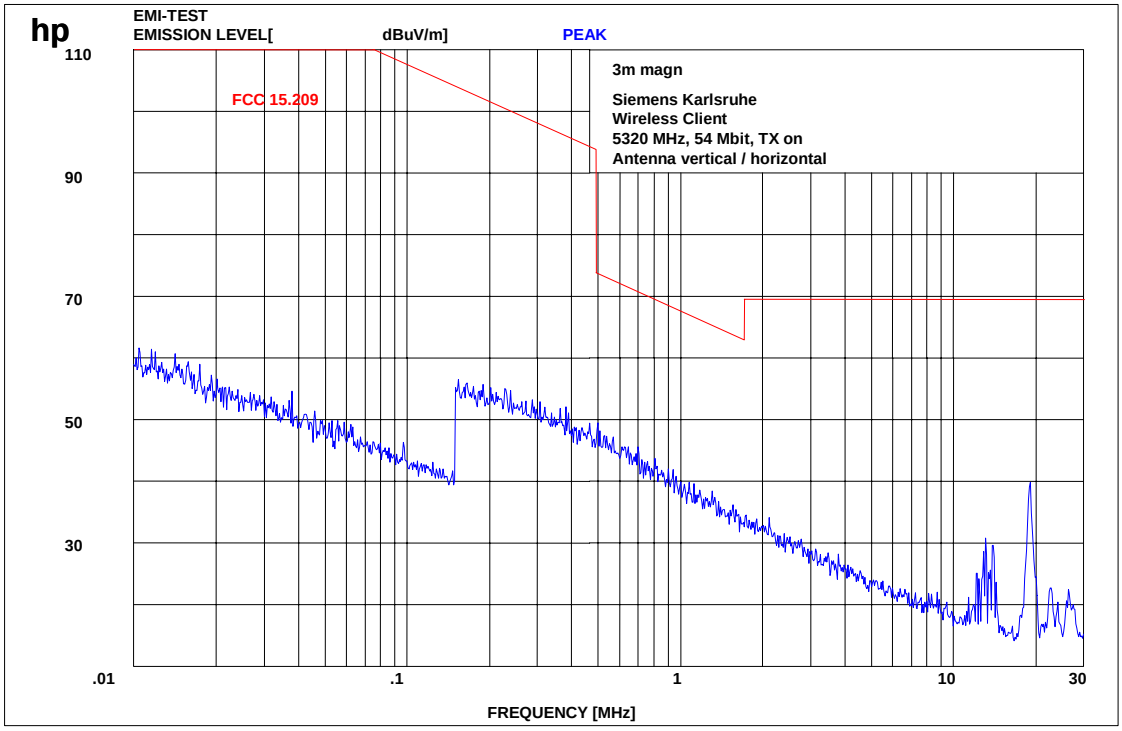
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

3.25 Spurious Emissions - radiated <30 MHz (valid for all antenna types)§15.109

(measured with a 110V AC power supply from our house as the product is delivered without any power supply.)

Measured at 3 m distance.
Values recalculated with 40 dB/decade according to FCC rules.

Plot 1:



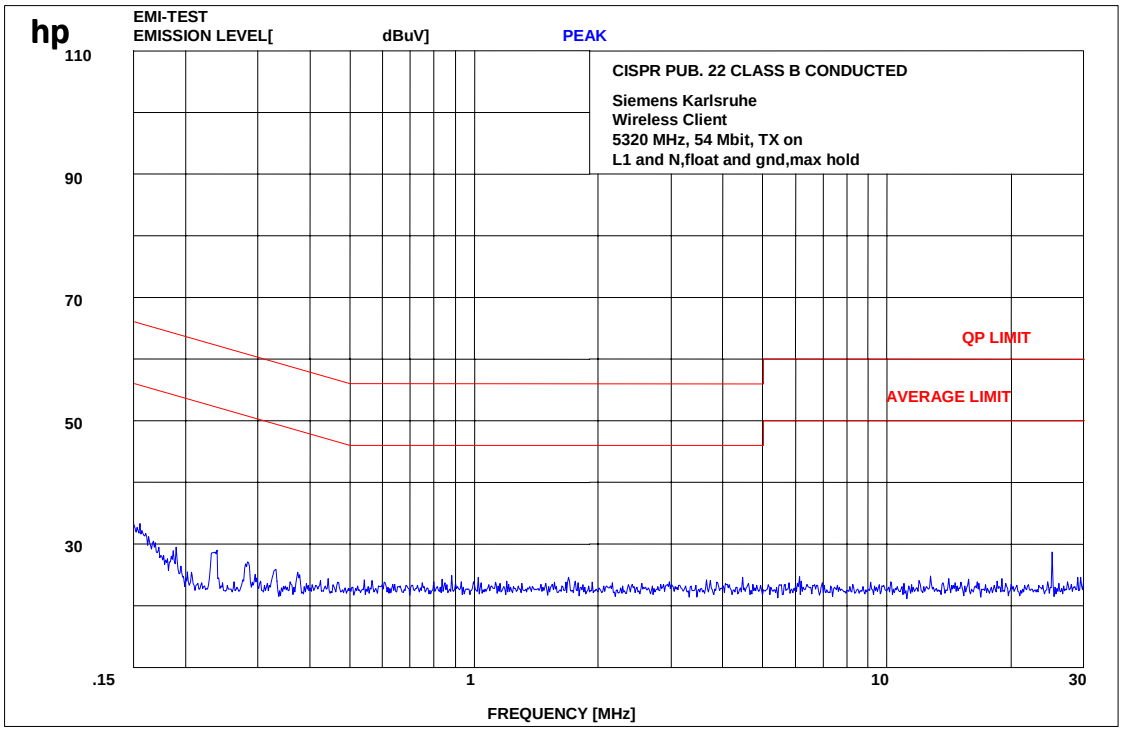
Limits:

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dBµV/m	30
30 - 88	100 / 40 dBµV/m	3
88 - 216	150 / 43.5 dBµV/m	3
216 - 960	200 / 46 dBµV/m	3
above 960	54 dBµV/m	3

3.26 Conducted Emissions <30 MHz §15.107/207

(measured with a 110V AC power supply from our house as the product is delivered without any power supply.)

Plot 1: CISPR 22



We measured in TX and RX mode, L1 and N floating and grounded, max value was hold.

Limits :

Under normal test conditions only	See plots

3.27 Used Testequipment

Anechoic chamber C:

Device	Manufacturer	Type	S/N Number	Inv. No. Cetecom
Spectrum Analyzer	HP	8566B	2747A05306	300001000
Spectrum Analyzer Display	HP	85662A	2816A16541	300002297
Quasi-Peak-Adapter	HP	85650A	2811A01131	300000999
Power Supply	HP	6032A	2818A03450	300001040
Power Attenuator	Byrd	8325	1530	300001595
Biconical Antenna	EMCO	3104	3758	300001602
Log. Period. Antenna	EMCO	3146	2130	300001603
Double Ridged Antenna	EMCO	HP 3115P	3088	300001032
Active Loop Antenna	EMCO	6502	2210	300001015
Antenna VDE/FCC		HP11965B		300002298
SRM-Drive	HP	9144A	2823e46556	300001044
Software	HP	EMI		300000983
Busisolator	Kontron			300001056
Absorberhalle	MWB		87400/02	300000996
Salzsäule	Kontron			300001055
Antenna	R&S	HMO20	832211/003	300002243
Indukt.Tast Antenna	R&S	HFH 2 Z4	881468/026	300001464
System-Rack	HP I.V.	85900	*	300000222
Spectrum Analyzer	HP	8566B	2747A05275	300000219
Quasi-Peak-Adapter	HP	85650A	2811A01135	300000216
RF-Preselector	HP	85685A	2837A00779	300000218
Rahmen Antenne	R&S	HFH2-Z2	891847-35	300001169
Leitungsteiler	HP	11850C		300000997
Breitband-Hornantenne EMI	HP	35155P		300002300
PC	HP	Vectra VL		300001688
VHF Meßantenne	Schwarzbeck	VHA 9103		300001778
Spectrum Analyzer Display	HP	85662A	2816A16497	300001690
VHF Meßantenna	Schwarzbeck	VHA 9103		300001780
Biconical Antenna	EMCO	3104 C	9909-4868	300002590

SRD Laboratory:

Device	300001207	Type	S/N Number	Inv. No. Cetecom
Spectrum Analyzer	300001208	494AP	B010241	300000863
Spectrum Analyzer	HP	71210A (70000)	2731A02347	300000321
Spectrum Analyzer Display	HP	70206A	2840A01553	300002017
Reference Frequency	HP	70310A	2736A00707	300002018
Local Oscillator	HP	70900A	2842A02221	300002019
ZF-Modul 10Hz-300 kHz	HP	70902A	2840A02145	300002020
ZF-Modul 100 kHz-3 MHz	HP	70903A	2835A01069	300002021
HF-Teil für 71210A 100Hz- 22GHz	HP	70908A		300002022
Spectrum Analyzer 2	HP	85660B	3138A07614	
Spectrum Analyzer Display 2	HP	85662A	3144A20627	

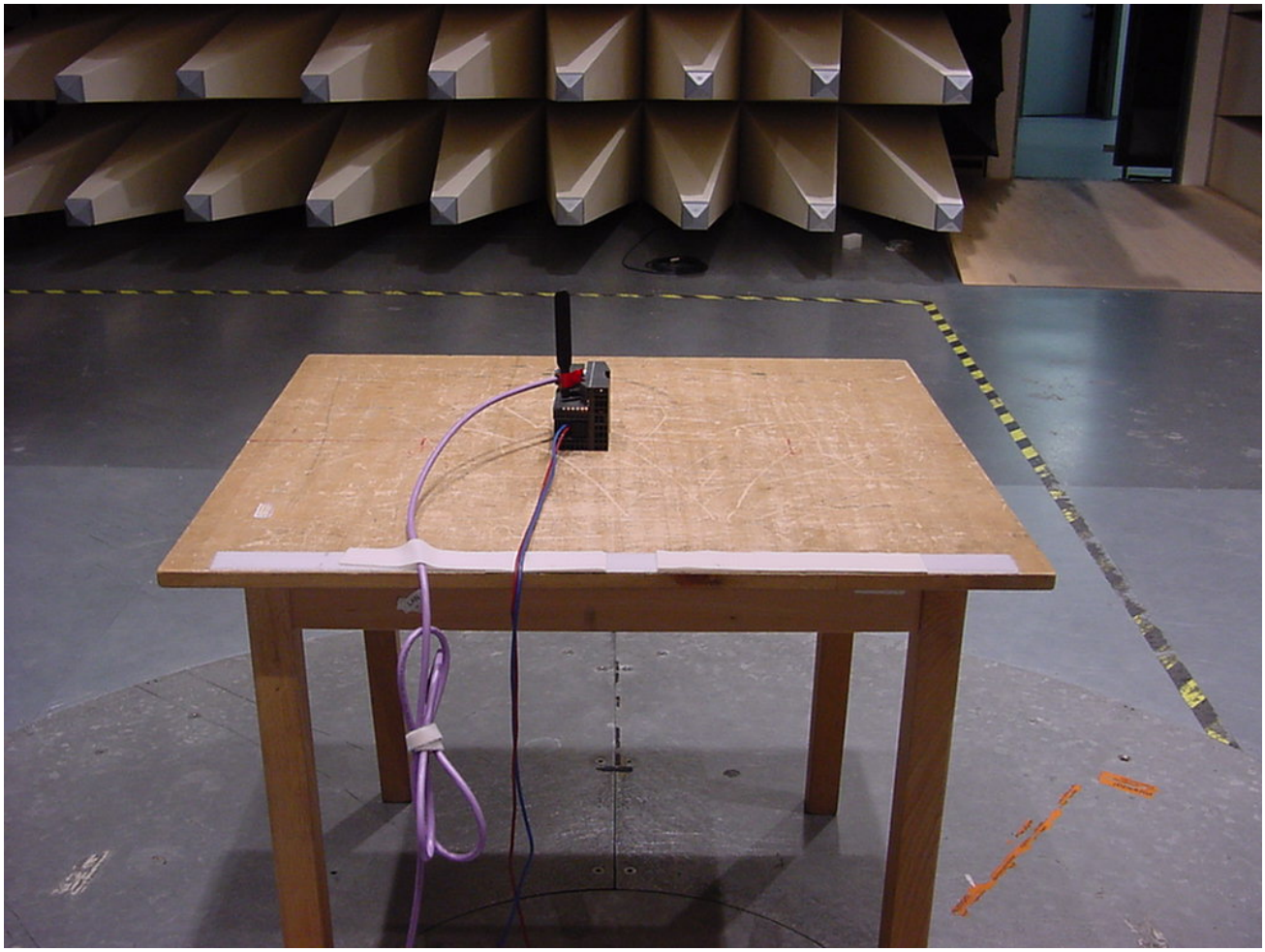
Signal Generator DC-600 KHz	HP	8904A	2822A01213	300001157
Signal Generator DC-600 KHz	HP	8904A	2822A01214	300001158
Powersupply	HP	6038A	3122A11097	300001204
Netznachbildung	R&S	ESH3-Z5	828576/020	300001210
Amplituden Controller	R&S	SMDU-Z2	871829/051	300002309
Trenntrafo	Erfi	913501		300001205
Trenntrafo	Grundig	RT5A	9242	300001627
Relais Matrix	HP	3488A	2719A15013	300001156
Multimeter	Siemens	Multizet		300001102
Peak Power Calibrator	HP	8900B		300001084
Schallgeber	Schomandl	SG 1	10159	300001209
Schallgeber	Schomandl	SG 2	10176	300002473
Filter	FSY Microwave			300001206
Attenuatorer	Pro Nova			300002476
Klimaschrank	Heraeus Voetsch	VUK04/500		300001012
Spectrum Analyzer 3	HP	8566A	1925A00257	300001098
Spectrum Analyzer Display 3	HP	85662	1925A00860	300002306
Oszilloscope	Tektronix	2432	110261	300001165
Radiocom. Analyzer	R&S	CMTA 54	894043/010	300001175
Powersupply	HP	6038A	2848A07027	300001174
Signal Generator 0.01-1280 MHz	HP	8662A	2224A01012	300001110
Signal Generator (Funktions)	R&S	AFGU	862490/032	300001201
Trenntrafo	Erfi	MPL	91350	300001155
Relais Matrix	R&S	PSU	893285/020	300001173
Power Meter	HP	436A	2101A12378	300001136
Powersensor	HP	8484A	2237A10156	300001140
Powersensor	HP	8482A	2237A06016	300001139
Relais Matrix	R&S	PSU	282628/004	300001214
Powersupply	Zentro		2007	300001109
Oszilloscope	Tektronix	7633		300001111
Klimaschrank	Heraeus Voetsch	VUK04/500	32926	300001500
Quasi-Peak Adapter	HP	85650A	2811A01204	300002308
Radiocom. Analyzer	R&S	CMTA 84	894199/012	300001176
Oszilloscope	HP	54510A	3022A02062	300001202
Funkmeßplatz	Schomandl	FD1000	34982	300001115
Signal Generator	R&S	SMPC	882416/019	300001162
Frequency counter	HP	5340A	2116A08138	300001104
Power Meter	HP	436A	2031U01461	300001105
Powersensor	HP	8482A		300001106
Powersensor	HP	8484A		300001107
Powersensor	HP	8485A		300001108
Powersupply	HP	6038A	2752A04866	300001161
Reflectionsmeter	R&S	NAP	879191	300001132
Signal Generator NF	R&S	SPN	880139/068	300001142
Trenntrafo	Erfi	MPL	91350	300001151
Attenuator	JFW	30 db	1350h/104	300001703
Attenuator	JFW	10 db	1350h/103	300001704
Attenuator	JFW	20 db	1350h/106	300001705
Attenuator	JFW	20 db	1350h/105	300001766
Filter	Spinner	153755		300001791

Powersensor	HP	8484A	2237A10494	300001666
Powersupply	HP	6038A	3122A11097	300001204
Netznachbildung	R&S	ESH3-Z5	828576/020	300001210
Amplituden Controller	R&S	SMDU-Z2	871829/051	300002309
Trenntrafo	Erfi	913501		300001205
Trenntrafo	Grundig	RT5A	9242	300001627
Relais Matrix	HP	3488A	2719A15013	300001156
Multimeter	Siemens	Multizet		300001102
Peak Power Calibrator	HP	8900B		300001084
Schallgeber	Schomandl	SG 1	10159	300001209
Schallgeber	Schomandl	SG 2	10176	300002473
Filter	FSY Microwave			300001206
Attenuatorer	Pro Nova			300002476
Klimaschrank	Heraeus Voetsch	VUK04/500		300001012
Spectrum Analyzer 3	HP	8566A	1925A00257	300001098
Spectrum Analyzer Display 3	HP	85662	1925A00860	300002306
Oszilloscope	Tektronix	2432	110261	300001165
Radiocom. Analyzer	R&S	CMTA 54	894043/010	300001175
Powersupply	HP	6038A	2848A07027	300001174
Signal Generator 0.01-1280 MHz	HP	8662A	2224A01012	300001110
Signal Generator (Funktions)	R&S	AFGU	862490/032	300001201
Trenntrafo	Erfi	MPL	91350	300001155
Relais Matrix	R&S	PSU	893285/020	300001173
Power Meter	HP	436A	2101A12378	300001136
Powersensor	HP	8484A	2237A10156	300001140
Powersensor	HP	8482A	2237A06016	300001139
Relais Matrix	R&S	PSU	282628/004	300001214
Powersupply	Zentro		2007	300001109
Oszilloscope	Tektronix	7633		300001111
Klimaschrank	Heraeus Voetsch	VUK04/500	32926	300001500
Quasi-Peak Adapter	HP	85650A	2811A01204	300002308
Radiocom. Analyzer	R&S	CMTA 84	894199/012	300001176
Oszilloscope	HP	54510A	3022A02062	300001202
Funkmeßplatz	Schomandl	FD1000	34982	300001115
Signal Generator	R&S	SMPC	882416/019	300001162
Frequency counter	HP	5340A	2116A08138	300001104
Power Meter	HP	436A	2031U01461	300001105
Powersensor	HP	8482A		300001106
Powersensor	HP	8484A		300001107
Powersensor	HP	8485A		300001108
Powersupply	HP	6038A	2752A04866	300001161
Reflectionsmeter	R&S	NAP	879191	300001132
Signal Generator NF	R&S	SPN	880139/068	300001142
Trenntrafo	Erfi	MPL	91350	300001151
Attenuator	JFW	30 db	1350h/104	300001703
Attenuator	JFW	10 db	1350h/103	300001704
Attenuator	JFW	20 db	1350h/106	300001705
Attenuator	JFW	20 db	1350h/105	300001766
Filter	Spinner	153755		300001791
Powersensor	HP	8484A	2237A10494	300001666

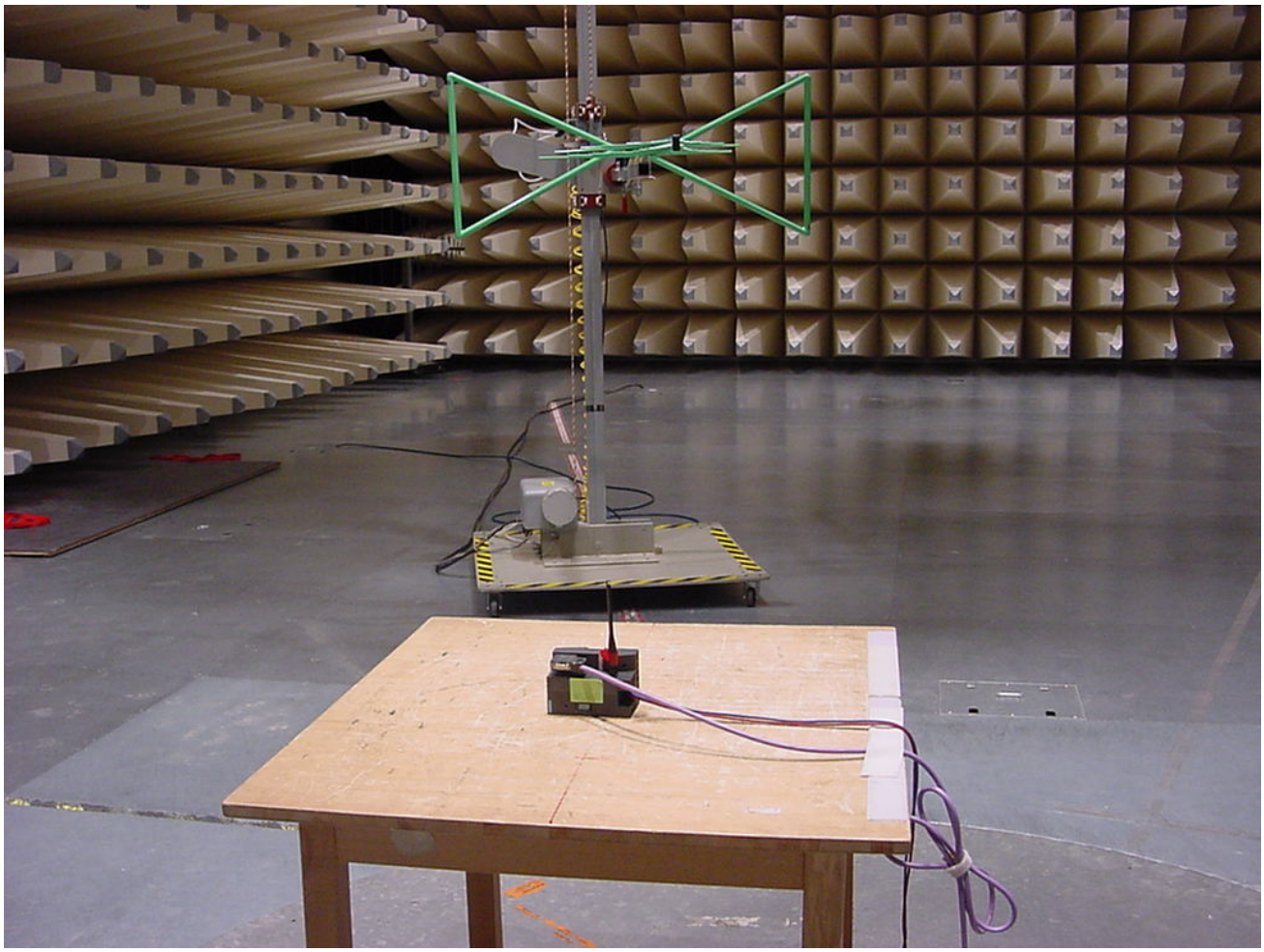
Powersensor	HP	8485A	2238A00849	300001668
Bandfilter	Telonic	TTF7255EE	20293-11	300001300
Bandfilter	Telonic	TTF12555EE	20292-6	300001302
Bandfilter	Telonic	TTF25055EE	20291-8	300001304
Bandfilter	Telonic	TTF50055EE	20290-7	300001305
Bandfilter	Telonic	TTF100055EE	20289-7	300001307
Bandfilter	Telonic	TTA300055EESN	20370-2	300001312
Bandstop	Telonic	TTR3753EE1	30013-1	300001314
Bandstop	Telonic	TTR723EE	20417-2	300001316
Bandstop	Telonic	TTR95-3EE	20372-4	300001318
Bandstop	Telonic	TTR1903EE	30036-4	300001320
Bandstop	Telonic	TTR3753EE	20369-5	300001321
Bandstop	Telonic	TTR750-3EE1	90177-1	300002387
Highpass	Pro Nova	HDP120-6GG	ohne	300001348
Highpass	Pro Nova	HMC500-6AA	HJ67-01?	300001350
Highpass	Narda	NHP 9000	0004	300001362
Highpass	Narda	HDP16-6GH	JV70-01	300001364
Highpass	RSD	HDP50-6GH, HDP200-6GG		300001371
Highpass	RSD	2099-02-01		300000370
Signal Generator 0.1-2060 MHz	HP	8657A	2838U00736	300001009
Radio Code Analyzer	Schlumberger	SL4922		300001038
Signal Analyzer	B&K	2033		300001047
Frequency counter	HP	5386A	2704A01243	300000998
Laufzeitelement	WR-Elektronik			300001036
Powersupply Stromversorgung	Systron	M5P 40/15A	828233	300001291
Powersupply	Heiden	1108-32	1701	300001392
Powersupply	Heiden	1108-32	1802	300001383
Powersupply	Heiden	1108-32	003202	300001187
Powersupply	Zentro	LA 2x30/5GB1	2011	300001276
Powersupply	Zentro	LA 2x30/5GB2	2012	300001275
Powersupply	Zentro	LA 30/5GA	2041,2042	300001287
Trenntrafo	Grundig	RT5A	8781	300001277
Trenntrafo	Grundig	RT5A	9242	300001263
Multimeter	Goerz Elektro	Unigor 6e P	911 355	300001625
Multimeter	Goerz Elektro	Unigor 6e P	911 391	300001281
Climatic Box	Heraeus Voetsch	VUK04/500	32679	300000299
Powersensor + Att.	HP	8482B	2703A02586	300001492
Attenuator 30 dB	HP	8498A	1801A02445	300001475
Signal Generator NF	HP		2822A01203	300001004
Attenuator	Spinner	BN 534171 D	51881	300001516
Attenuator coaxial	Bird	8325	2429	300001513
Impulsbegrenzer	R&S	ESH 3 Z2		300001460
4Port Box	R&S	4Port Box	860457/005	300001472
Signal Generator 0.1-4200 MHz	HP	8665A	2833A0011	300002299
NF-Spektrumanalyzer	B&K	2033A		300002301
Swissphone Freifeld-Messbox	Swissphone Schweiz			300002302
Trenntrafo regelbar	Grundig	RT5H	9242	300001628
Signal Generator	HP	8111A	2215G00867	300001117

3 Photographs

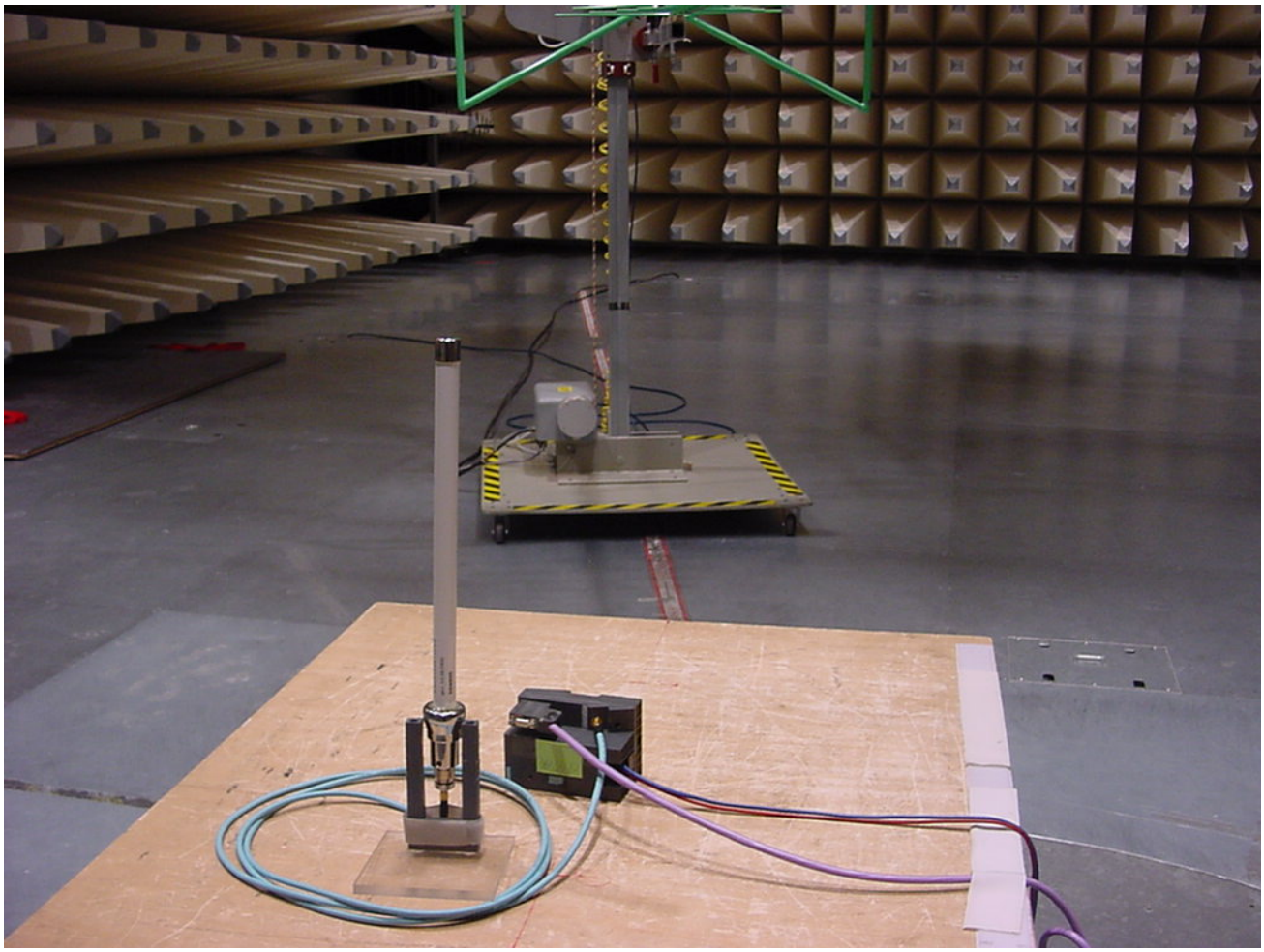
Test site: Antenna 1



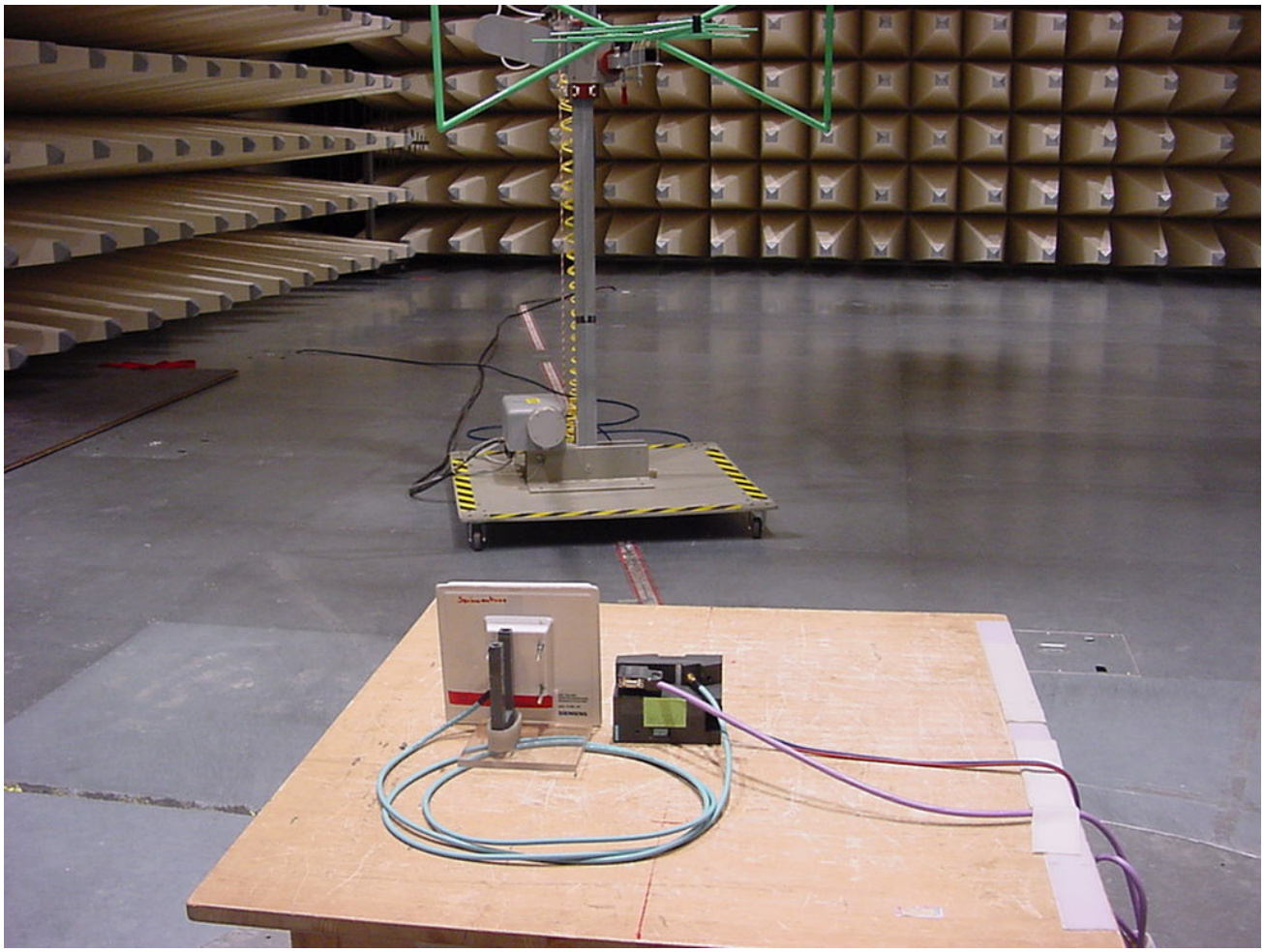
Test site: Antenna 1



Test site: Antenna 2

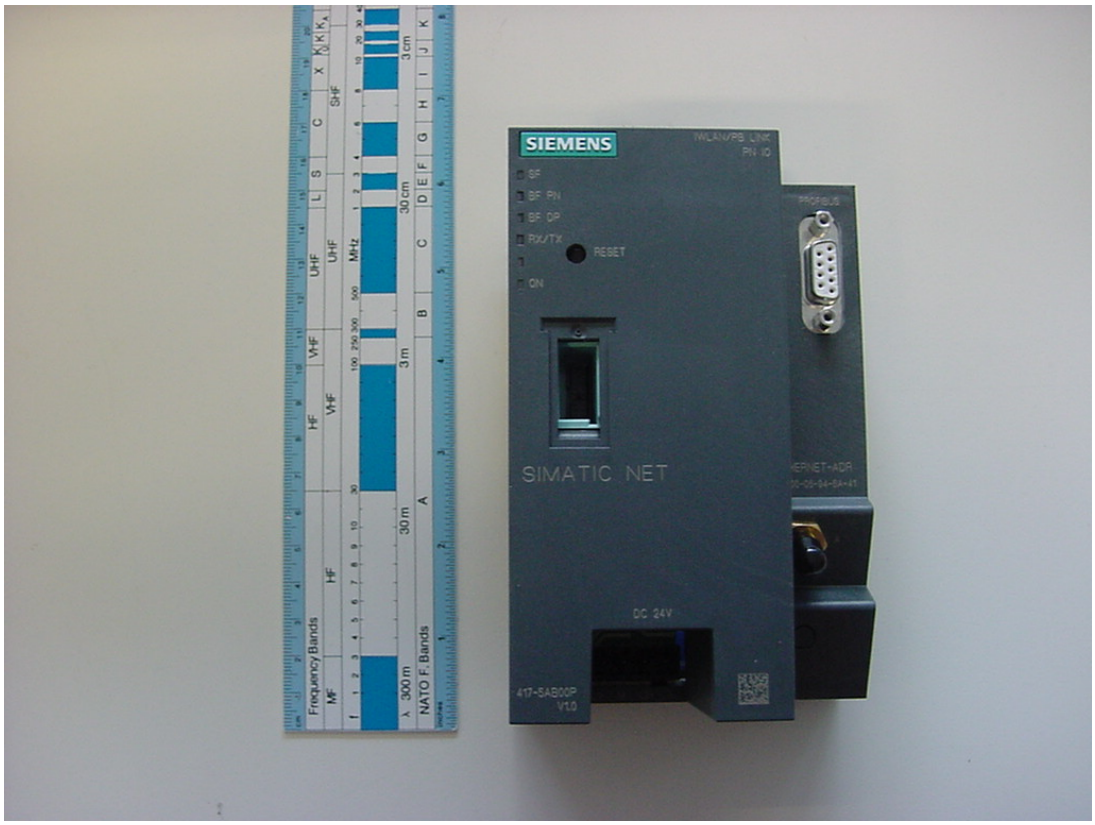


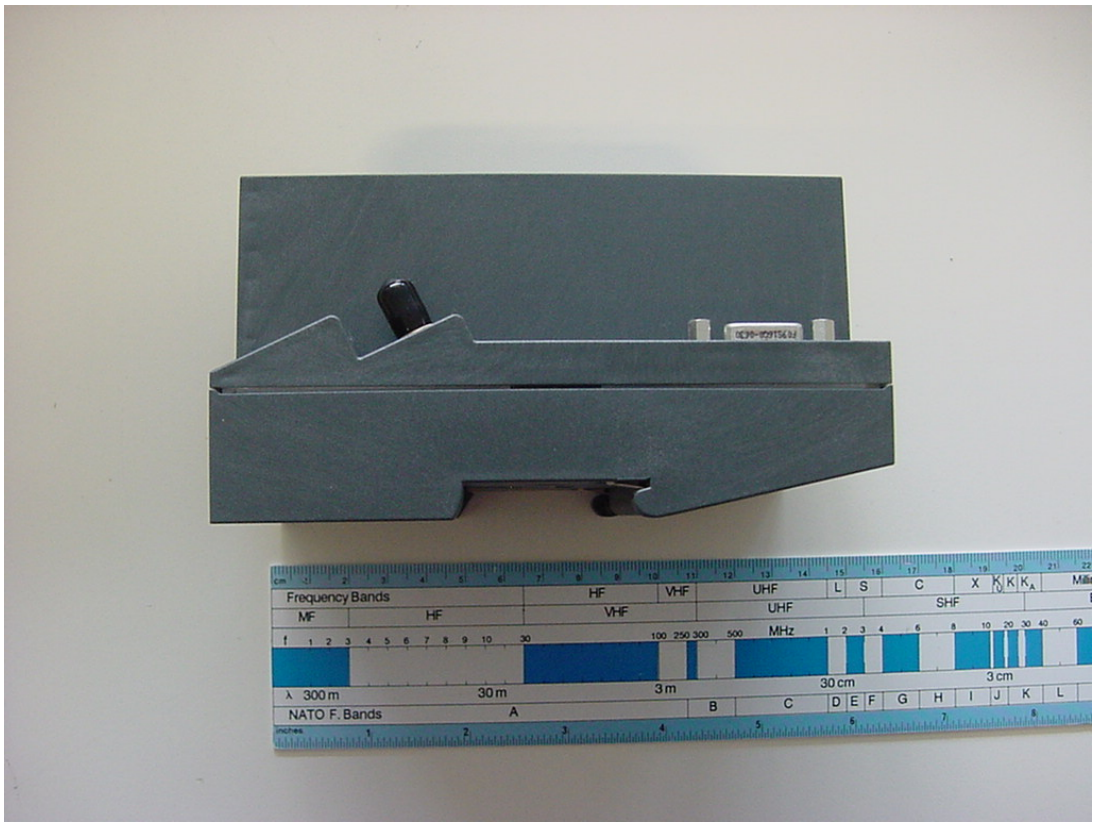
Test site: Antenna 3

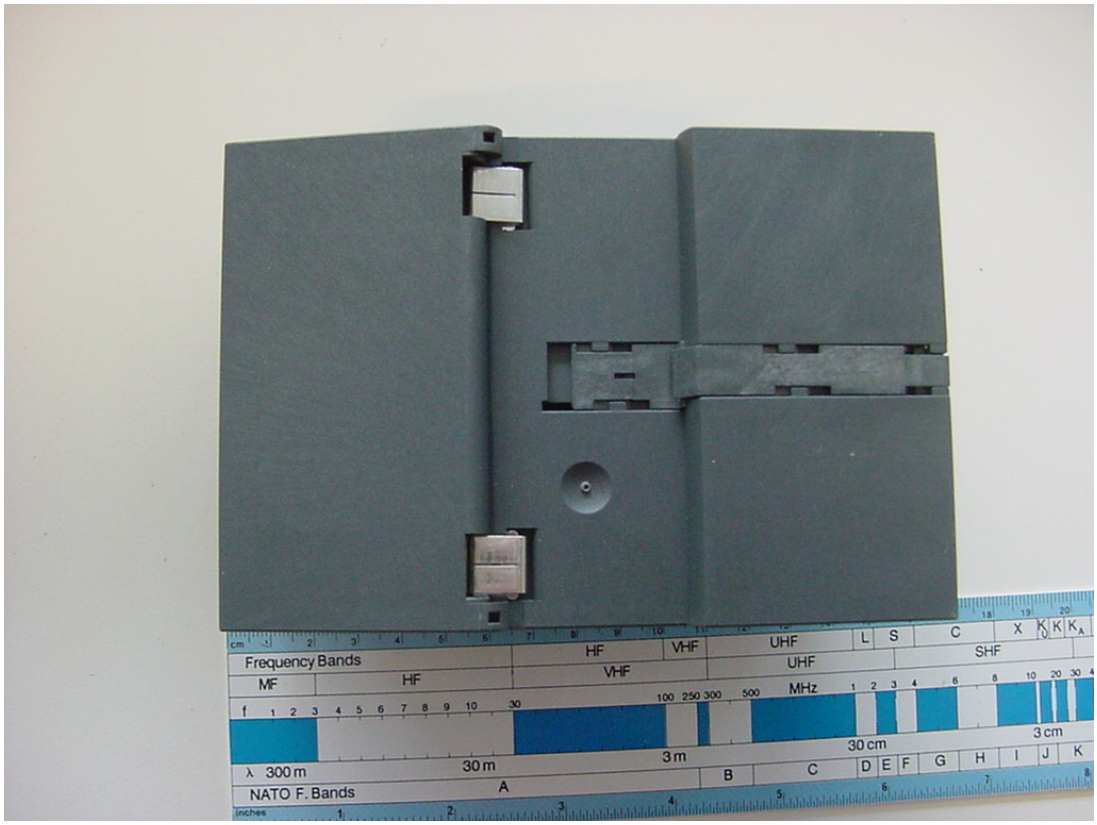


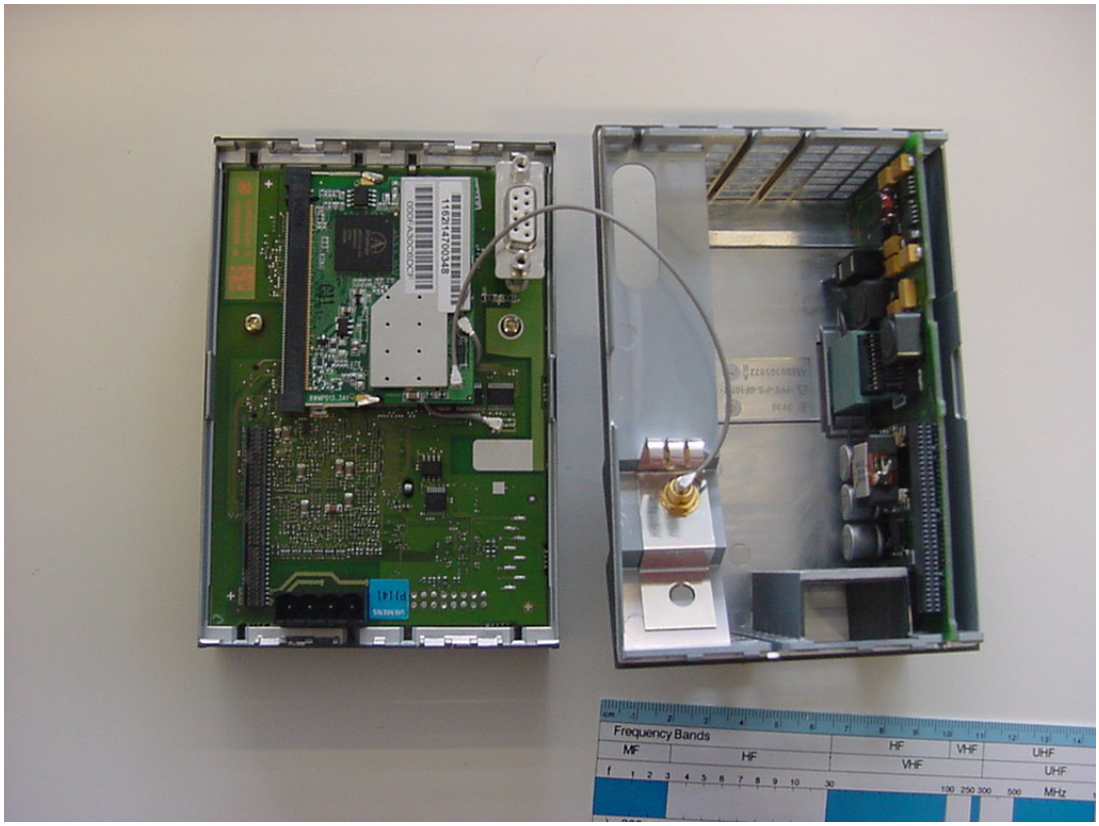
AC-conducted:

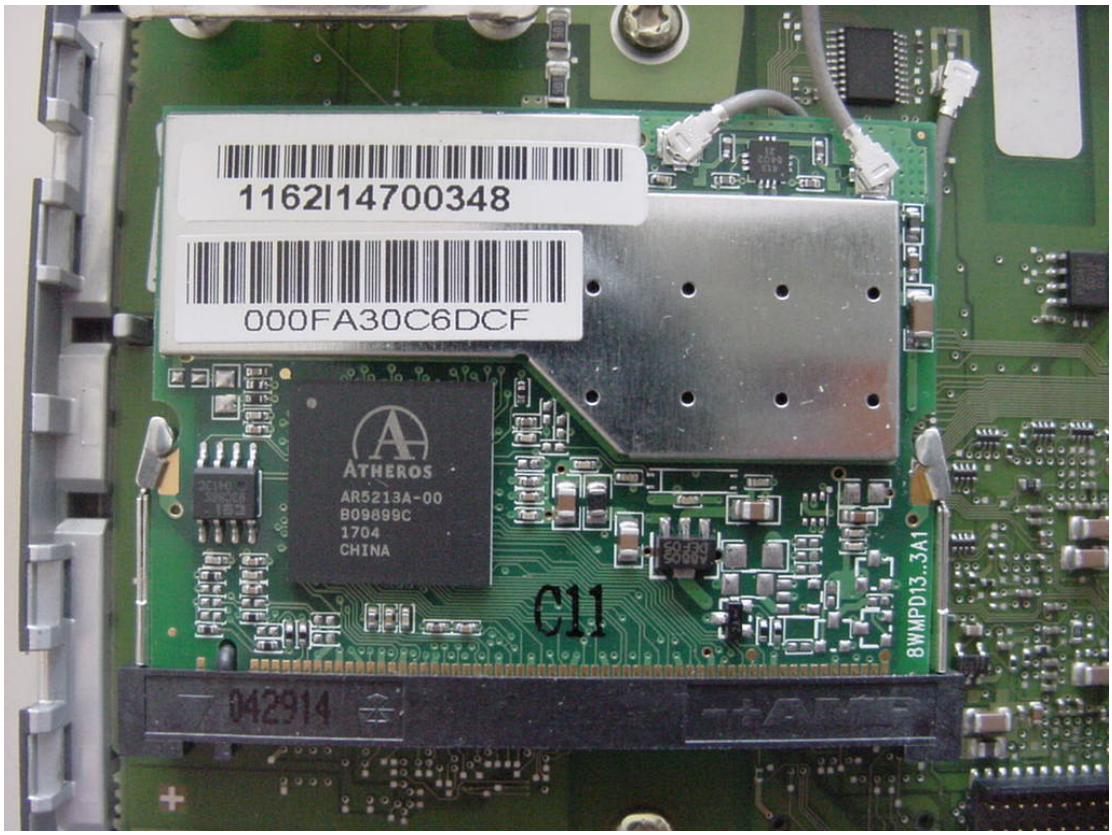
Test sample:


SIEMENS
SIMATIC NET
RESET
DC 24V
Frequency Bands
NATO F. Bands


Frequency Bands
NATO F. Bands


Frequency Bands
MF
HF
VHF
UHF
SHF
MHz
300 m
30 m
3 m
30 cm
3 cm
NATO F. Bands


Frequency Bands
MF
HF
VHF
UHF
MHz


1162I14700348
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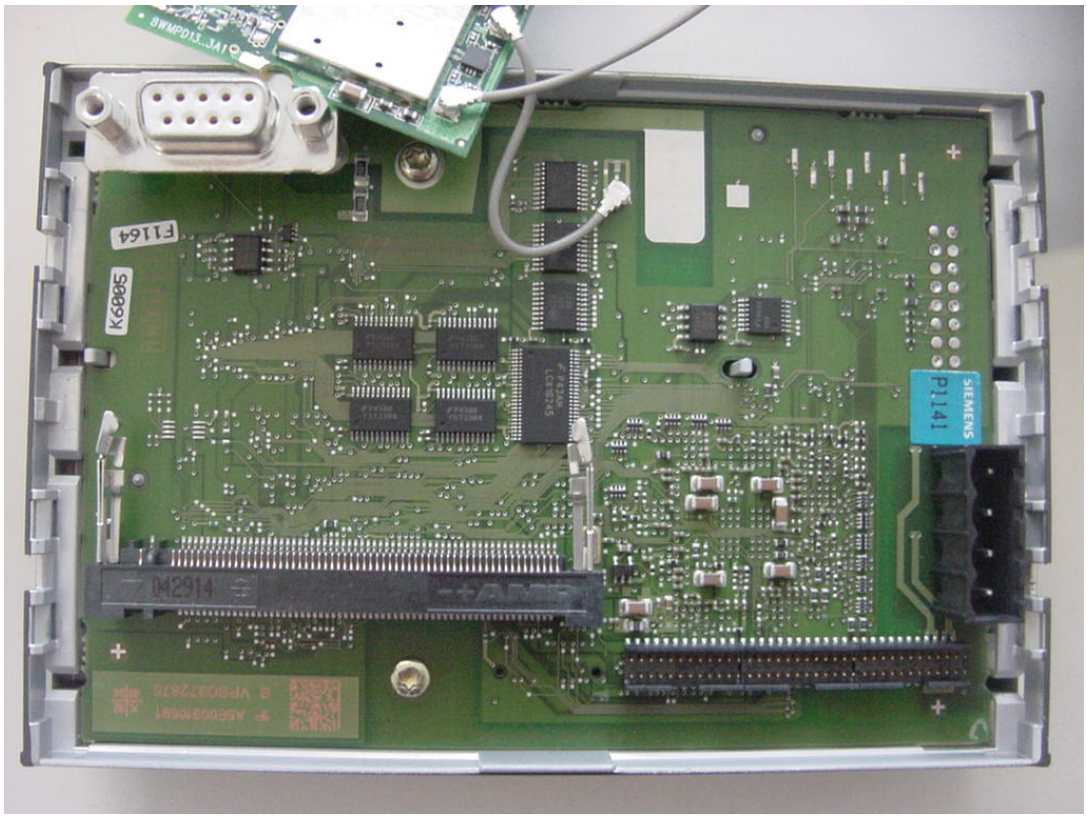
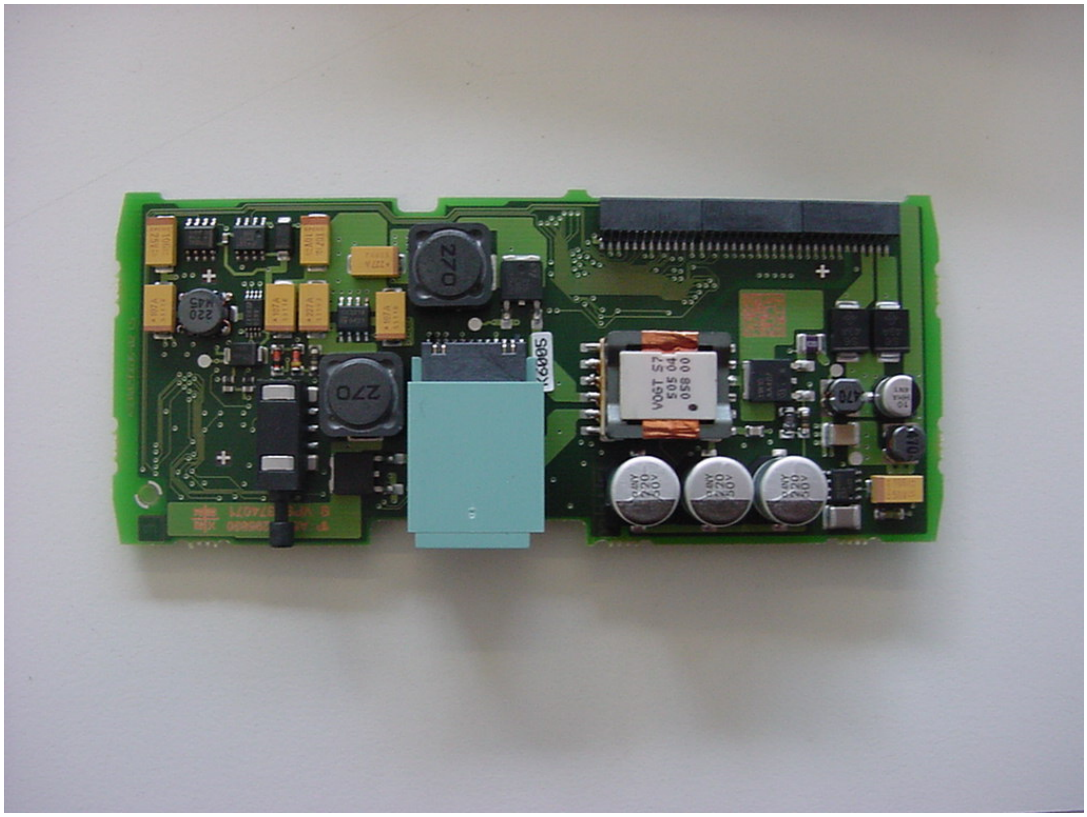
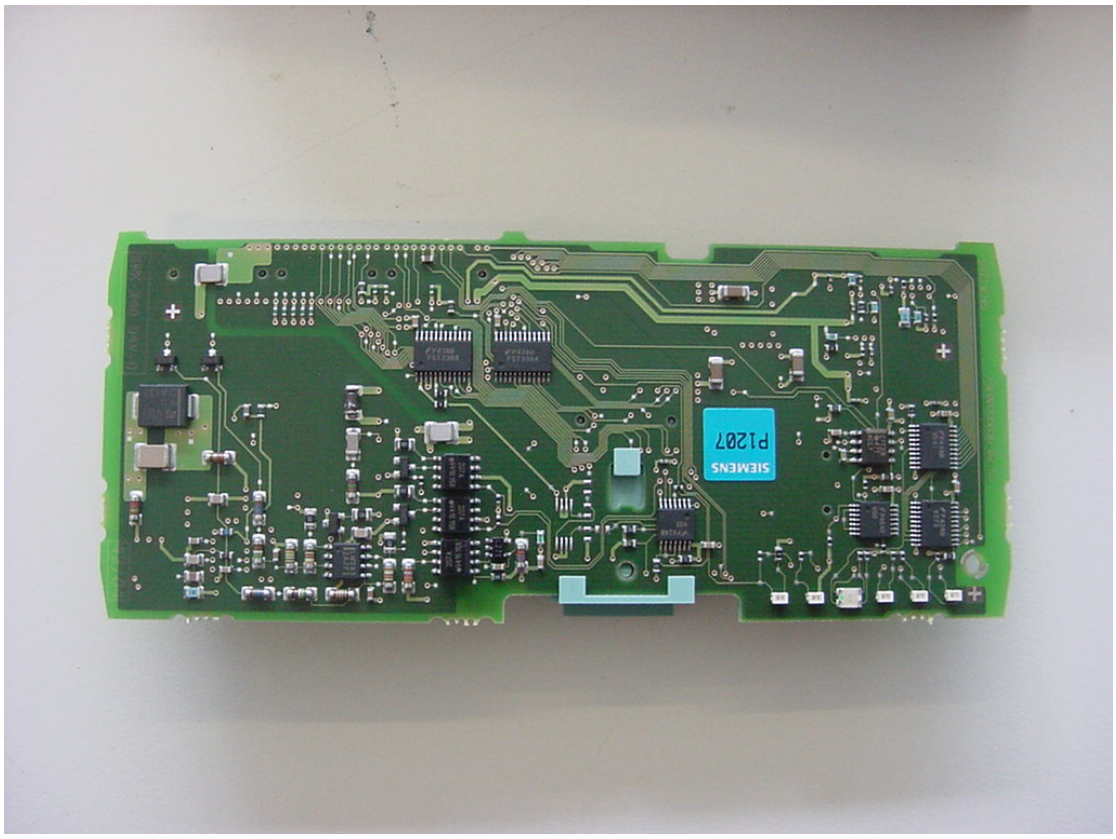
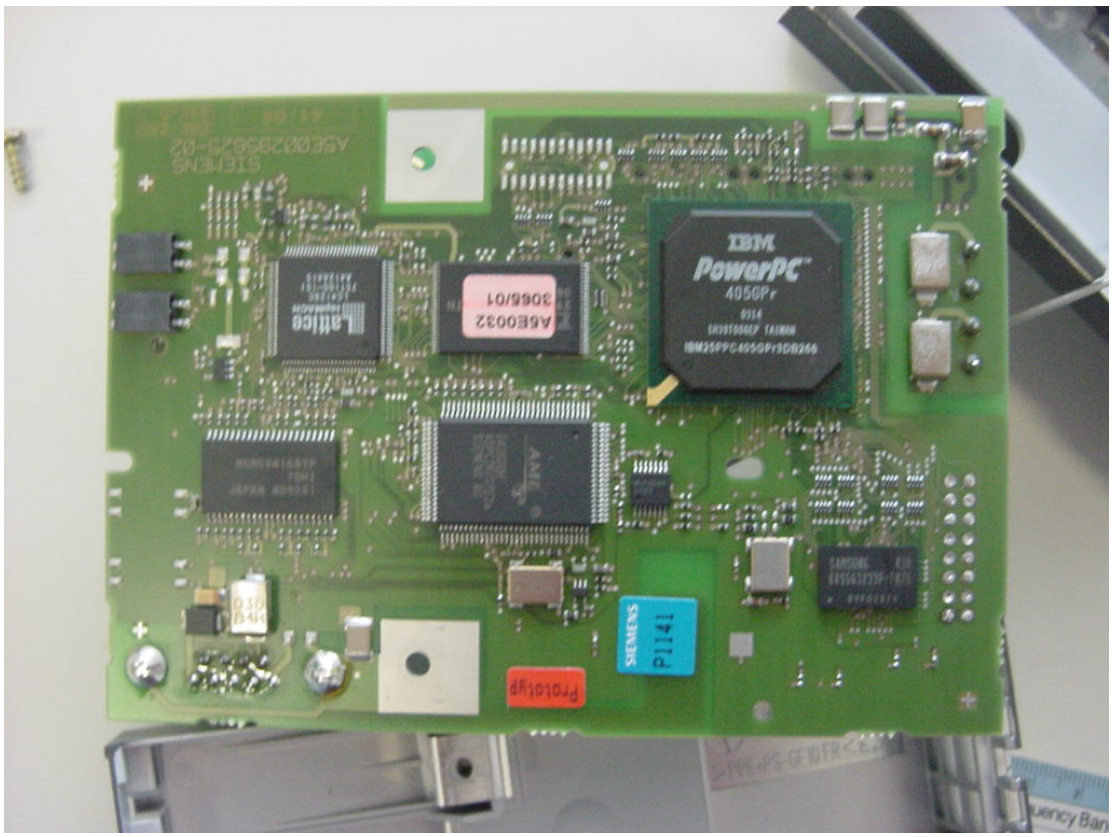
AR5213A-00
B09899C
1704
CHINA
C11
8WMPD13..3A1
042914

E117098
0427
94V-0
MADE IN TAIWAN
G29
P07802120


F1164
K60005
SIEMENS
P1141

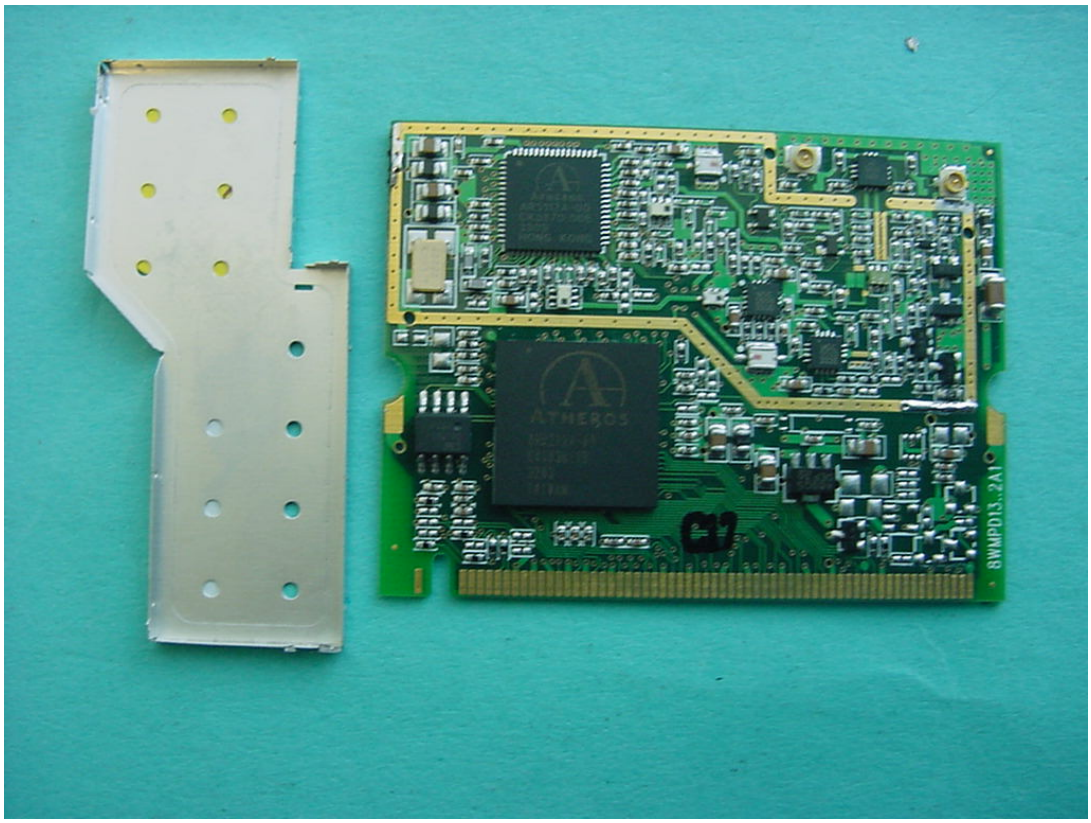

270
270
K60005


SIEMENS
P1207

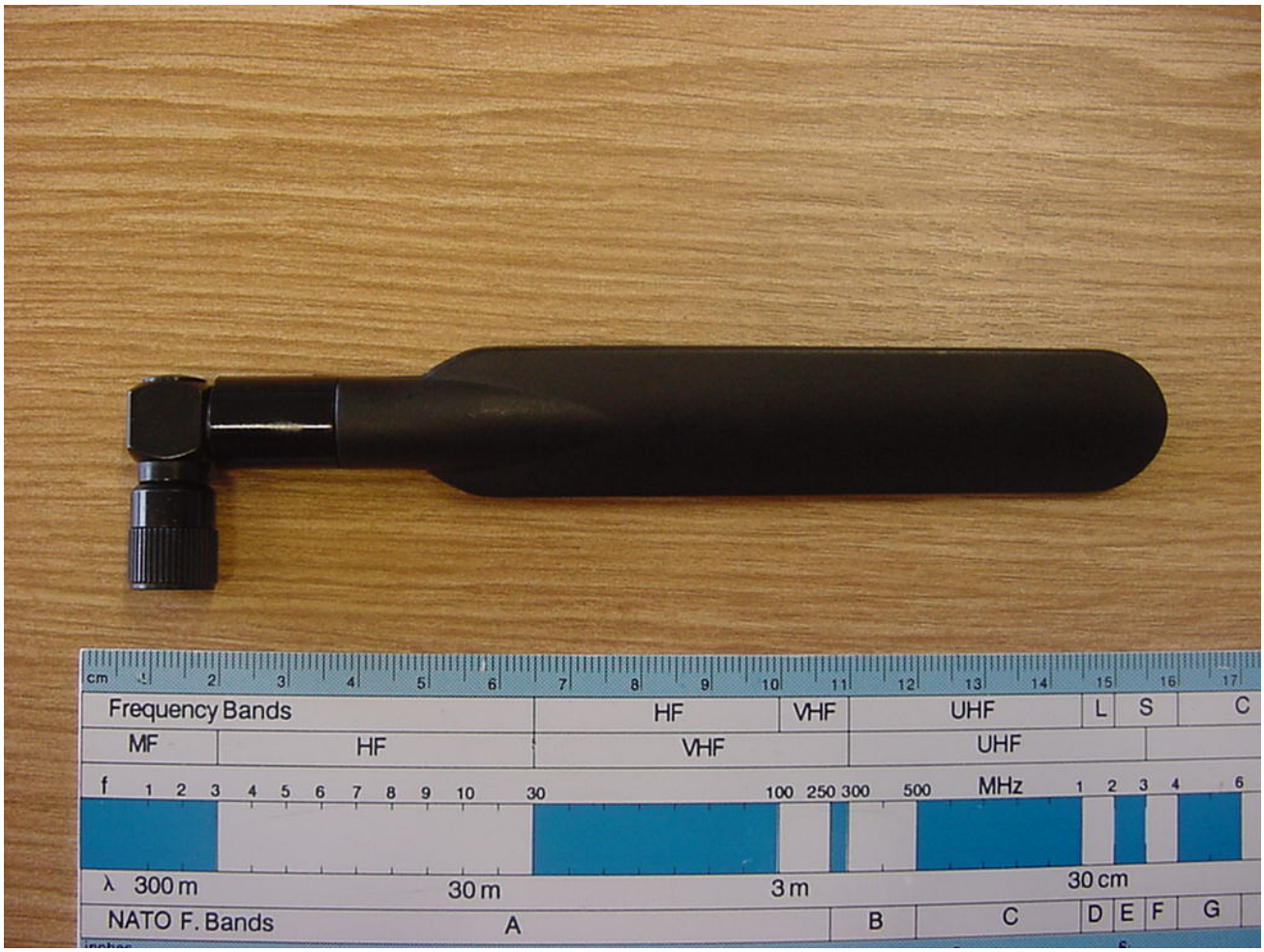

IBM
PowerPC
405GPr
Lattice
SIEMENS
P1141

000D88563355
27
17.03.04
ATHEROS
8WMPD13..2A1

1WMPA13...A1
1WMPD13...A2
1WMPG02...A3
PLOTECH 4 94V-0
3305-6996
E169497
MADE IN TAIWAN
P05491832
G36


ATHEROS
8WMPD13..2A1

Antenna 1:


cm
Frequency Bands
HF
VHF
UHF
L
S
C
MF
HF
VHF
UHF
f
MHz
λ 300 m
30 m
3 m
30 cm
NATO F. Bands
A
B
C
D
E
F
G

Antenna 2:

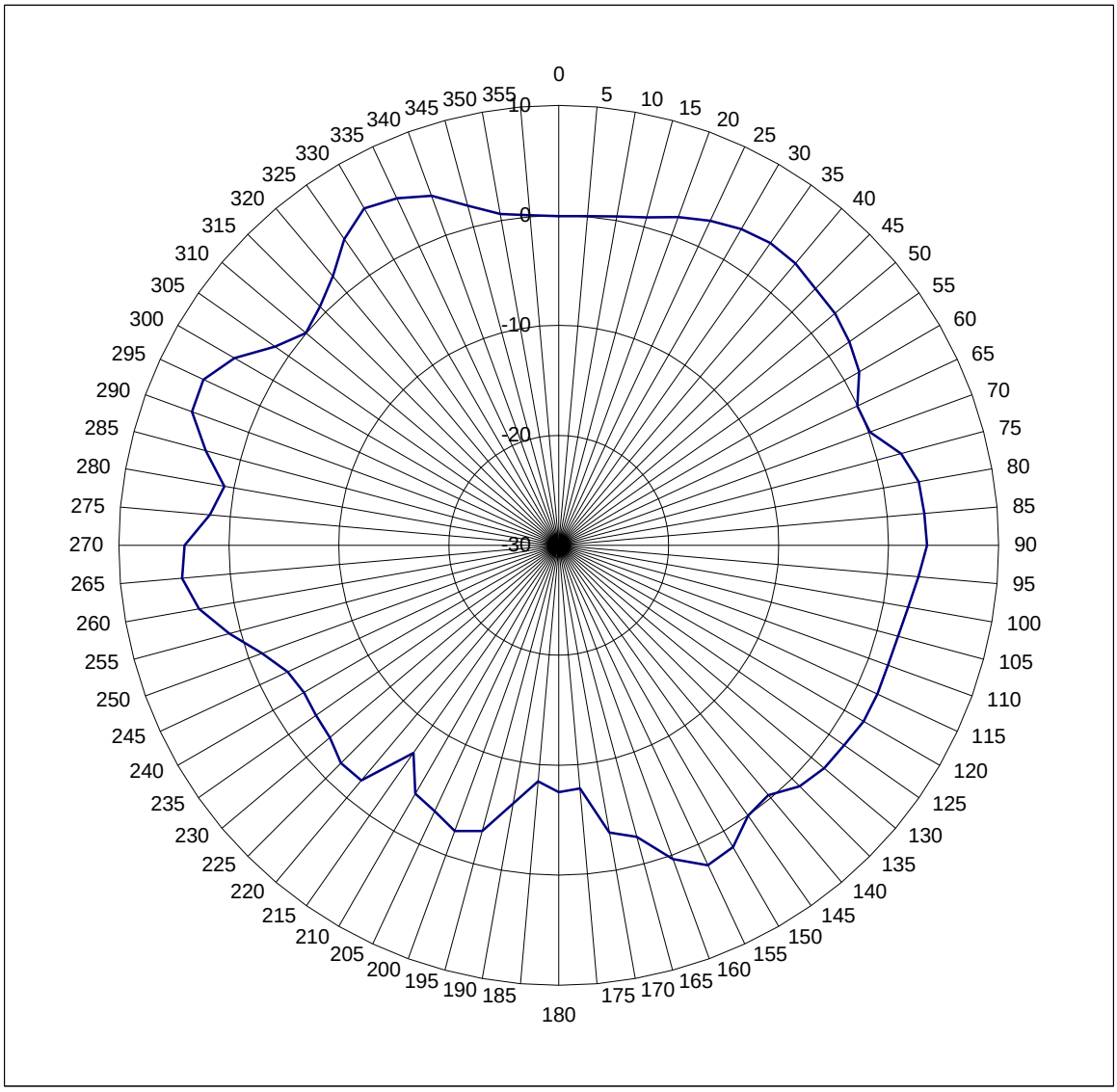
Antenna 3:

ANT.792-8R
Antenna 2.4 GHz
for WLAN 802.11b/g
gain: 13 dBi 30°
www.wistec.ch
wistec
wireless power from Switzerland

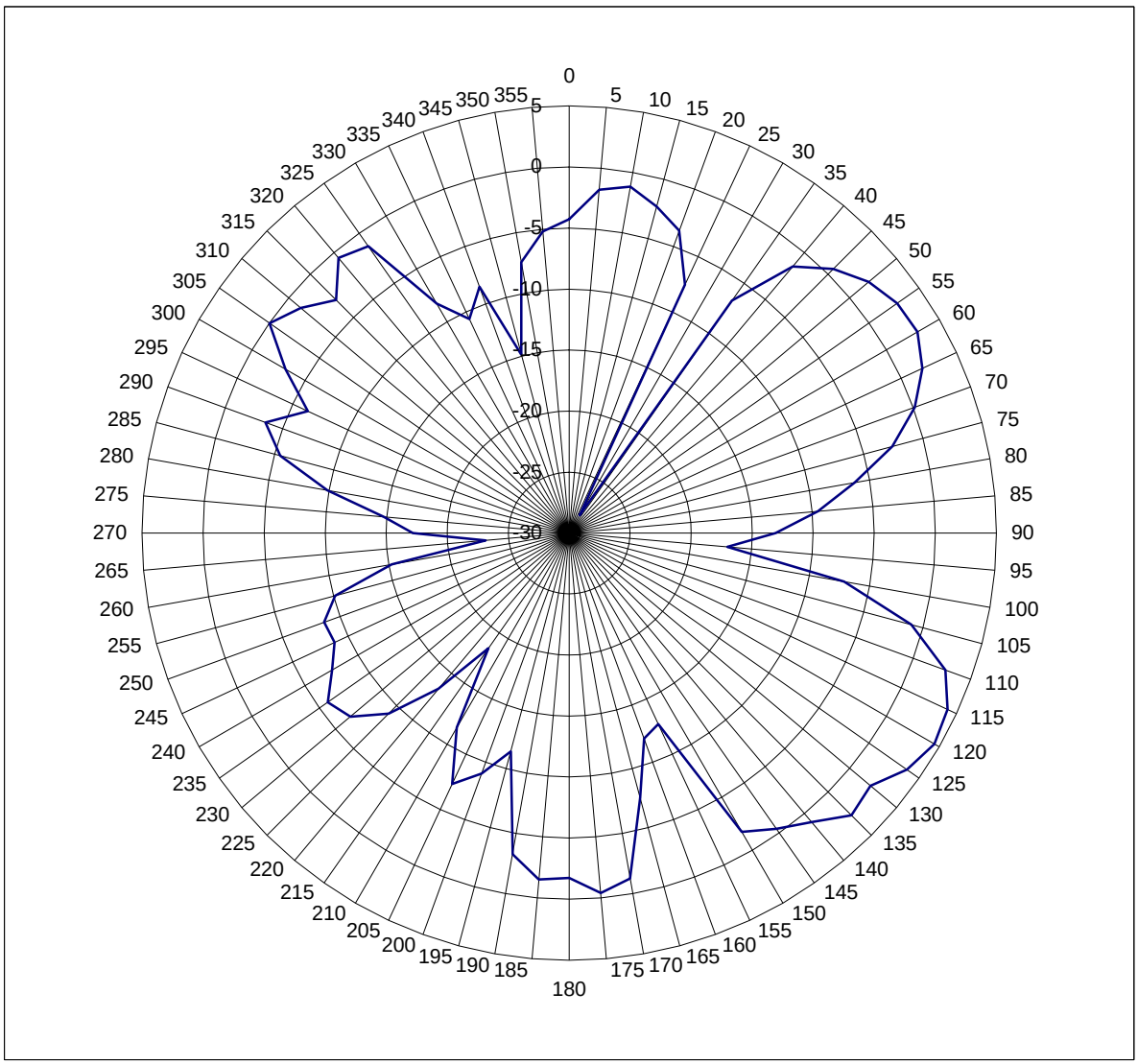
Annex 1:

Antenna gain: Antenna 1, max gain 4,0 dBi at 5.3 GHz

azimuth



elevation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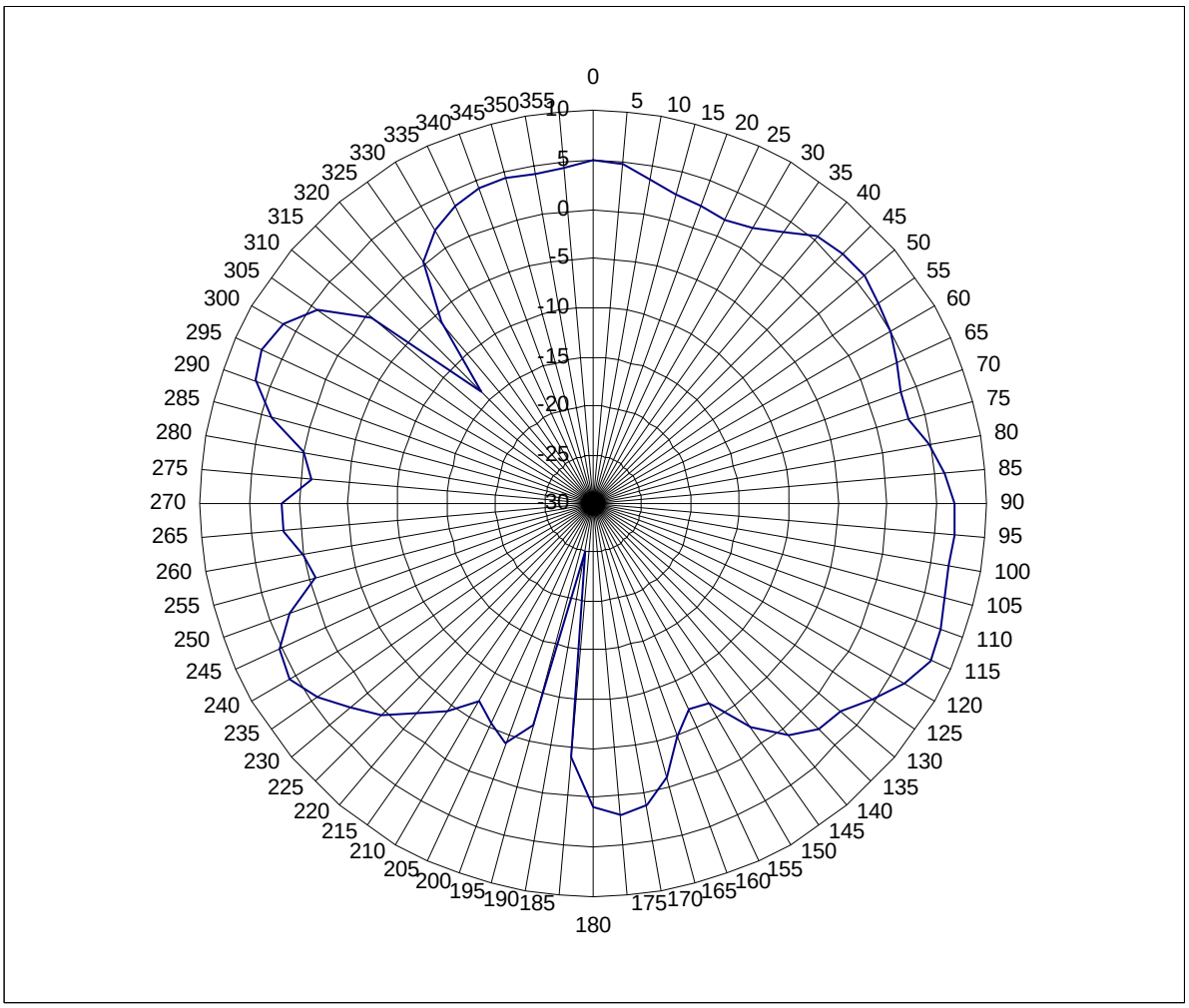
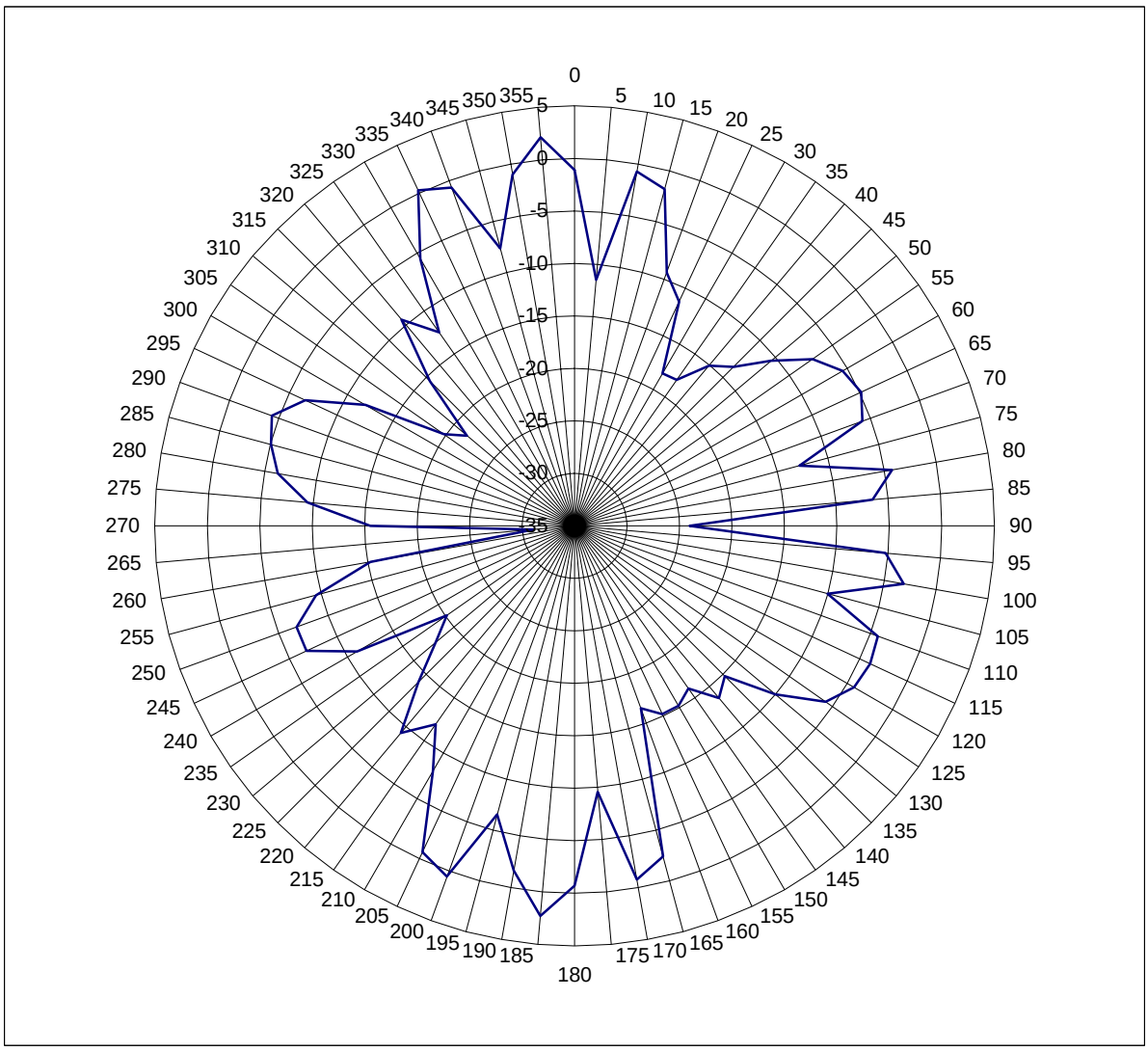
-30

Antenna 2 max gain 7,9 dBi at 5.2 GHz

azimuth



elevation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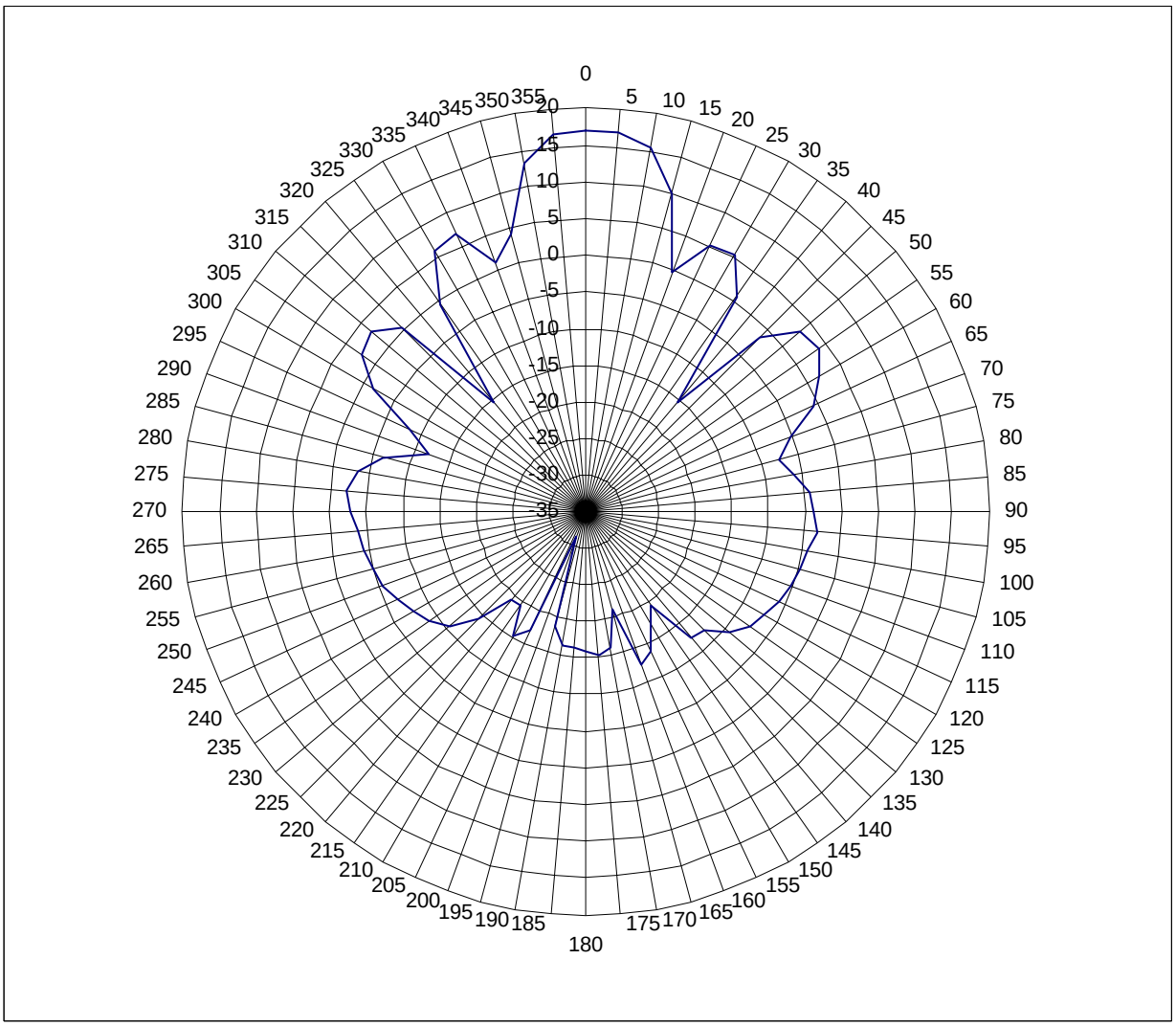
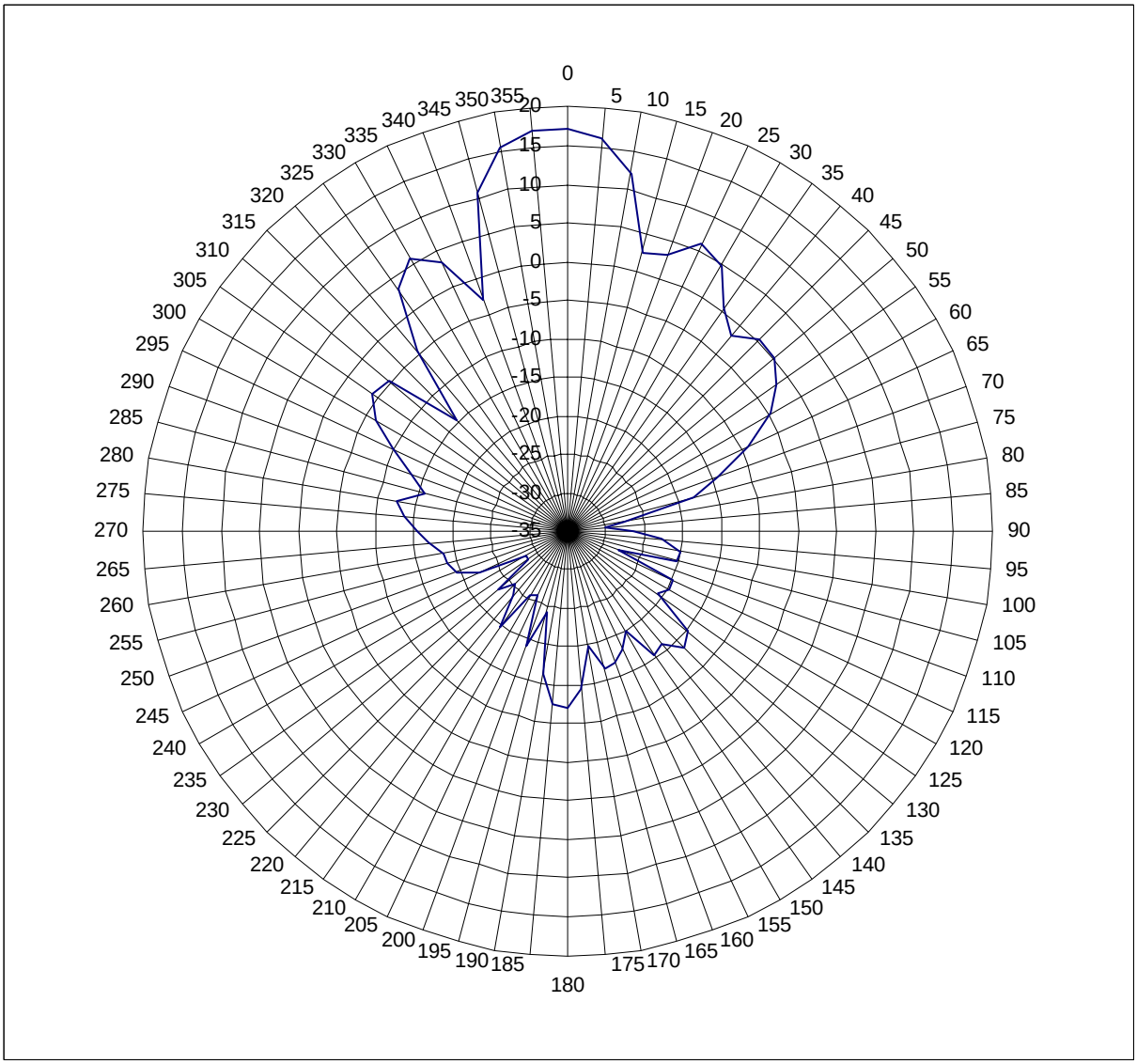
Antenna 3, max gain 17,0 dBi at 5.2 GHz

azimuth



elevation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