

Annex 4: Measurement diagrams
to TEST REPORT
No.: 6-0196/12-1-2b-C1

According to:
FCC Regulations
Part 15.109
Part 15.209 & Part 15.247
IC Regulations
RSS-Gen Issue 3 & RSS-210 Issue 8

for

Miele & Cie. KG

Communication unit for household appliances EI 7800
(ZigBee Wireless Technology)

FCC-ID: 2ACUWEI7800
IC: 5669C-EI7800







Laboratory Accreditation and Listings			
 Deutsche Akkreditierungsstelle D-PL-12047-01-01	 FEDERAL COMMUNICATIONS COMMISSION USA Reg. No.: 736496 MRA US-EU 0003	 Industry Canada Reg. No.: 3462D-1 3462D-2	 Reg. No.: R-2665, R-2666 C-2914, T-1967 G-301
 CTIA Authorized Test Lab LAB CODE 20011130-00	 WiFi ALLIANCE AUTHORIZED RF LABORATORY		
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CETECOM GmbH Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com			

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1. Measurement diagrams

1.1. Radiated field strength (§15.209)

1.1.1. Radiated magnetic field strength measurements (f < 30 MHz)

Diagram No. 2.01

Date: 10.08.2012	Page 1 of 1
Test description:	Magnetic Fieldstrength Measurement related to 300 m/ 30 m distance
Test site and distance:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance
Distance correction:	used
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Tas
Operating conditions:	TX (CW mode), low CH 11 = 2405 MHz
Power during tests:	5V DC
Comment 1:	S/N 2
Comment 2:	6-0196-12-1-2b
EUT Information	
EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Comment:	DC 5V, part no. 09368690

FCC15.209_magn hor+vert

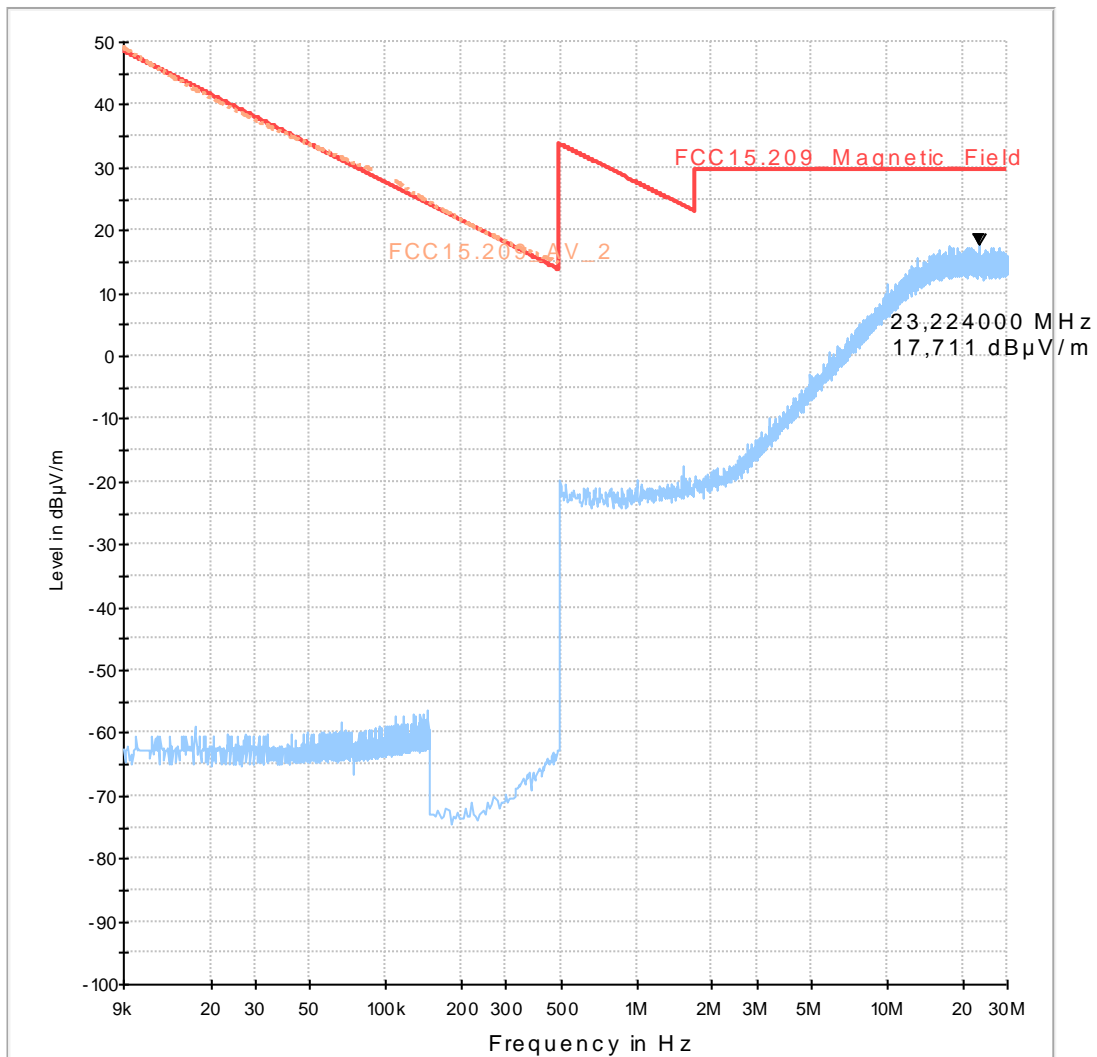


Diagram No. 2.02

Date:	10.08.2012	Page 1 of 1
Test description:	Magnetic Fieldstrength Measurement related to 300 m/ 30 m distance	
Test site and distance:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance used	
Distance correction:	used	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Tas	
Operating conditions:	TX (CW mode), middle CH 18 = 2440 MHz	
Power during tests:	5V DC	
Comment 1:	S/N 5	
Comment 2:	6-0196-12-1-2b	

EUT Information

EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Comment:	DC 5V, part no. 09368690

FCC15.209_magn hor+vert

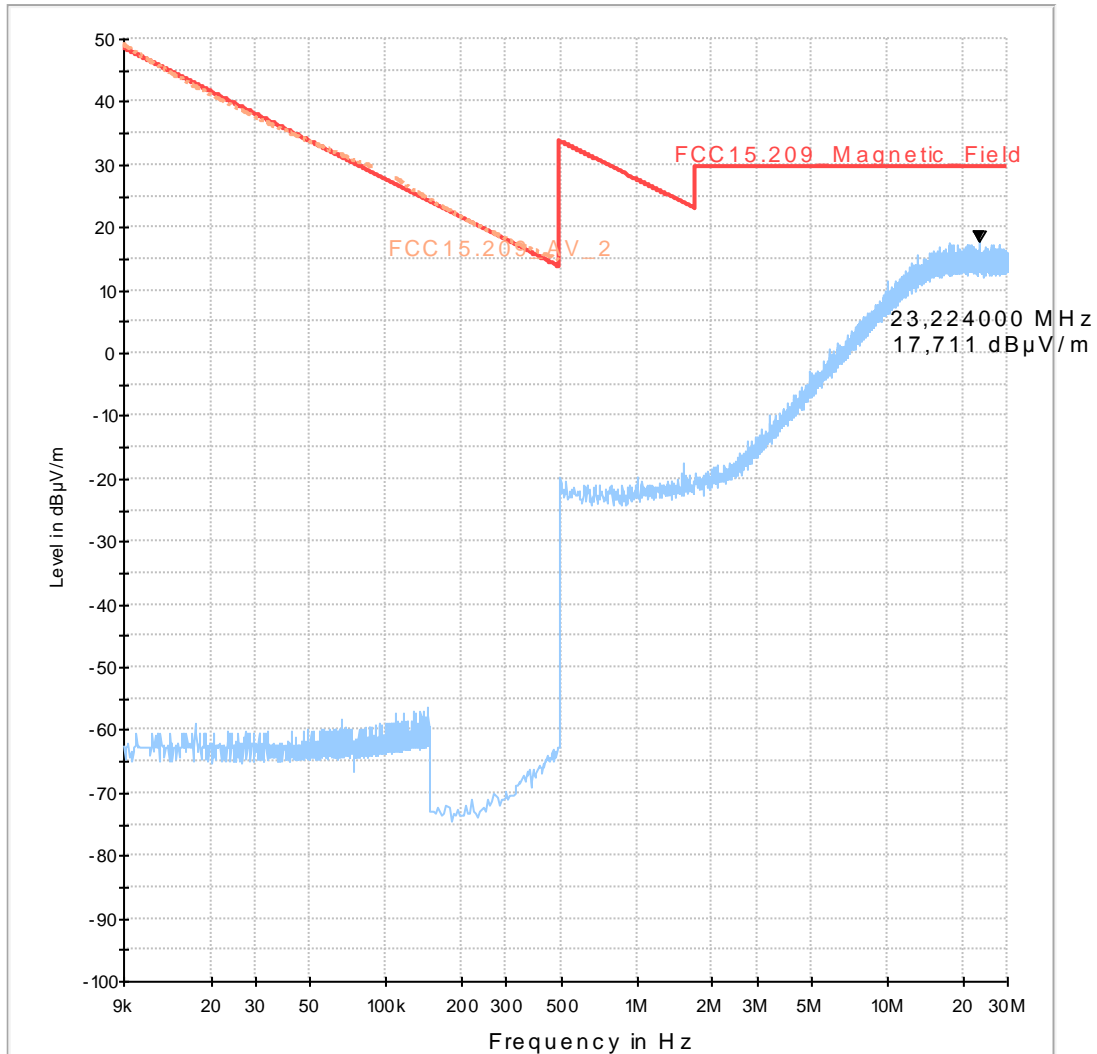


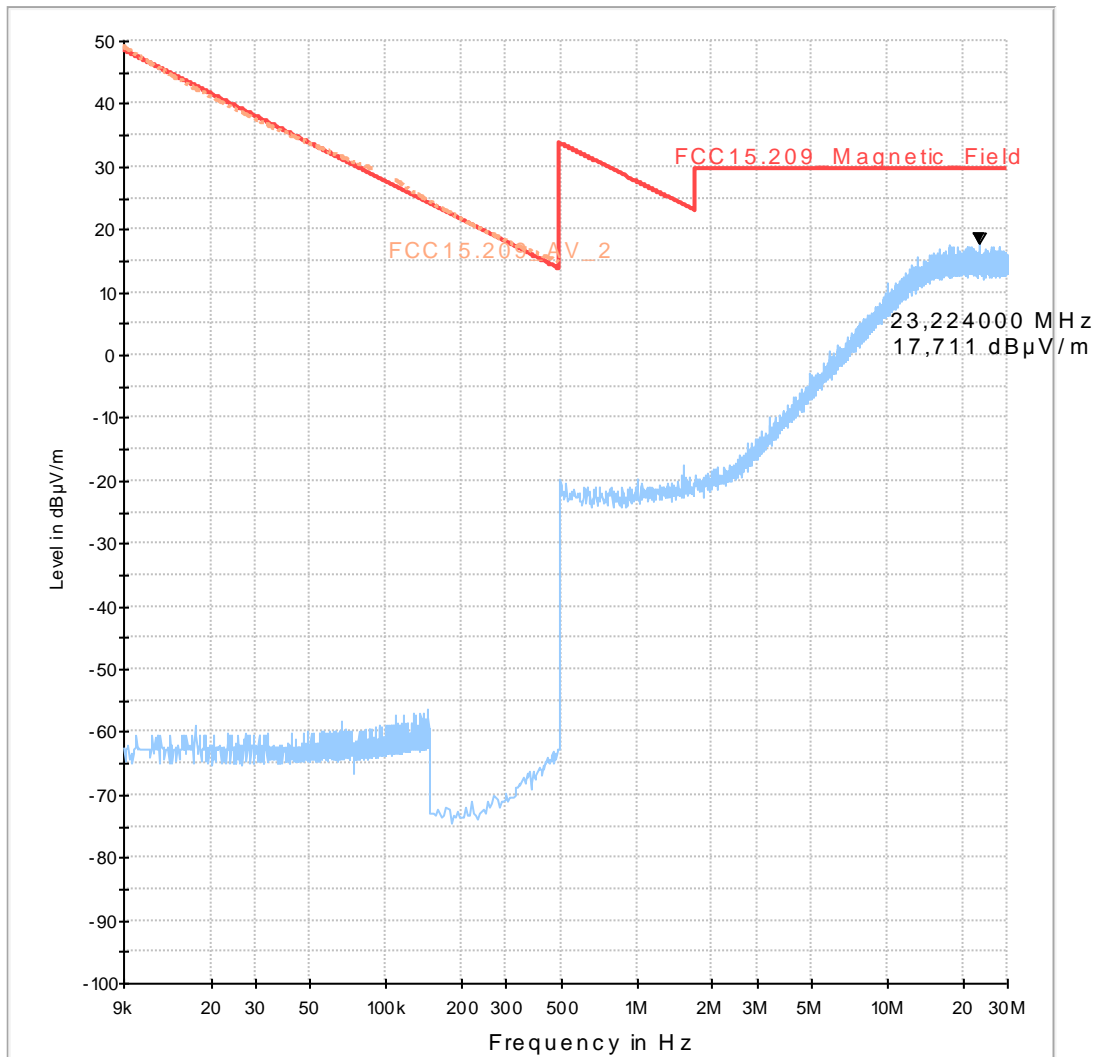
Diagram No. 2.03

Date: 10.08.2012	Page 1 of 1
Test description:	Magnetic Fieldstrength Measurement related to 300 m/ 30 m distance
Test site and distance:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance used
Distance correction:	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Tas
Operating conditions:	TX (CW mode), high CH 26 = 2480 MHz
Power during tests:	5V DC
Comment 1:	S/N 7
Comment 2:	6-0196-12-1-2b

EUT Information

EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Comment:	DC 5V, part no. 09368690

FCC 15.209_magn hor+vert



1.1.2. Radiated field strength (30 MHz < f < 1 GHz)

Diagram No. 3.01

Test description:	10.08.2012 Page 1 of 1
Test site and distance:	Electric Fieldstrength Measurement
Distance correction:	Semi Anechoic Room (SAR) with 3 m measurement distance
Used filter:	not used
Test specification.:	FCC 15.209 ; RSS-Gen: Issue 3
Operator:	Tas
Operating mode:	TX (CW mode), low CH 11 = 2405 MHz
Comments :	5V DC
	S/N 2
	6-0196-12-1-2b

EUT Information	
EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev.:	--
Comment:	DC 5V, part no. 09368690

01_FCC15.209_hor+vert_kipp

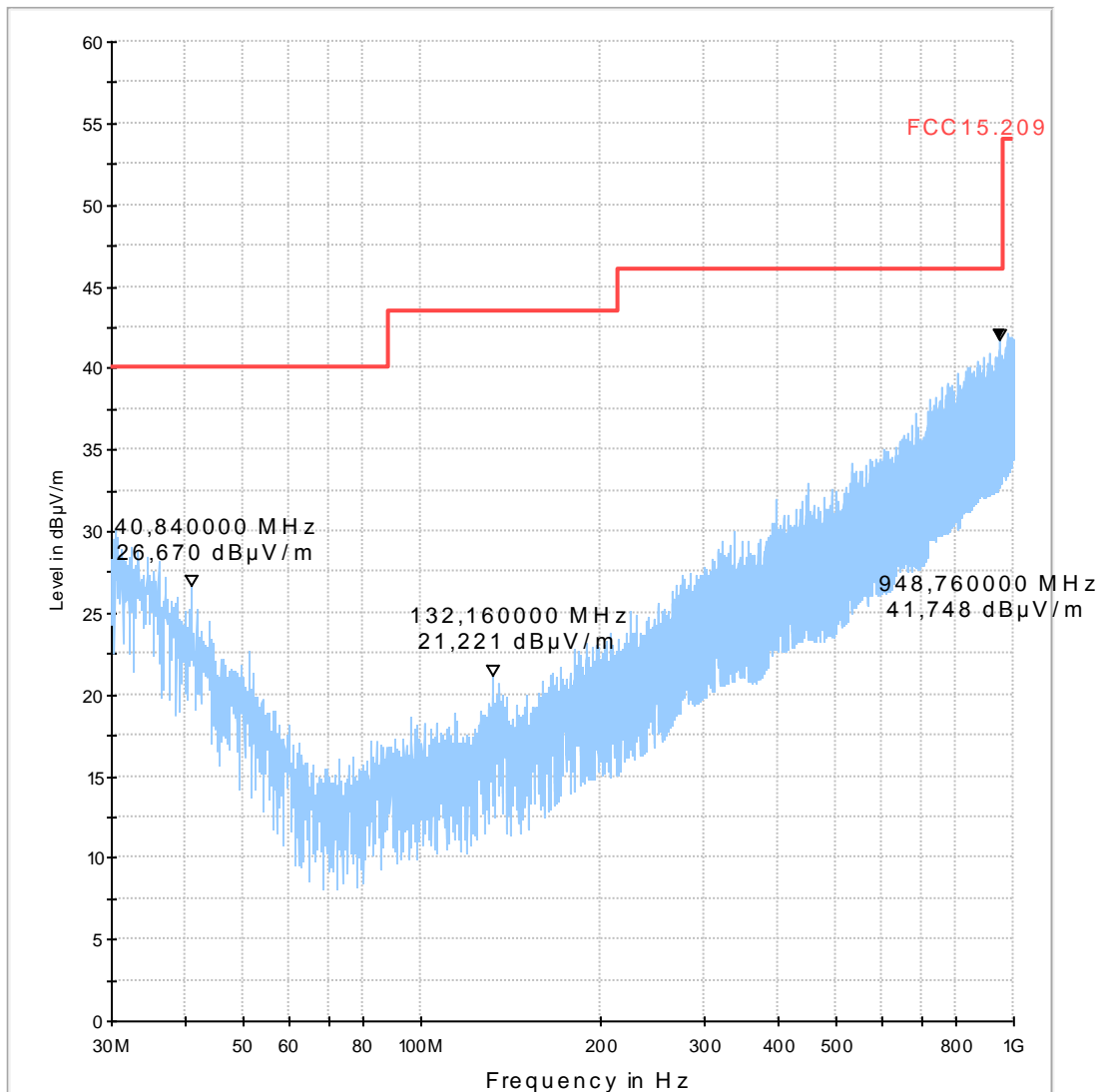


Diagram No. 3.02

10.08.2012 Page 1 of 1
 Electric Fieldstrength Measurement
 Semi Anechoic Room (SAR) with 3 m measurement distance
 Distance correction: not used
 Used filter: not used

Test specification.: FCC 15.209 ; RSS-Gen: Issue 3

Operator: Tas
 Operating mode: TX (CW mode), middle CH 18 = 2440 MHz
 Comments : 5V DC
 S/N 5
 6-0196-12-1-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Comment: DC 5V, part no. 09368690

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
952.750000	30.7	1000.0	120.000	187.0	H	356.0	90.0	27.0	15.30	46.00

01_FCC15.209_hor+vert_kipp

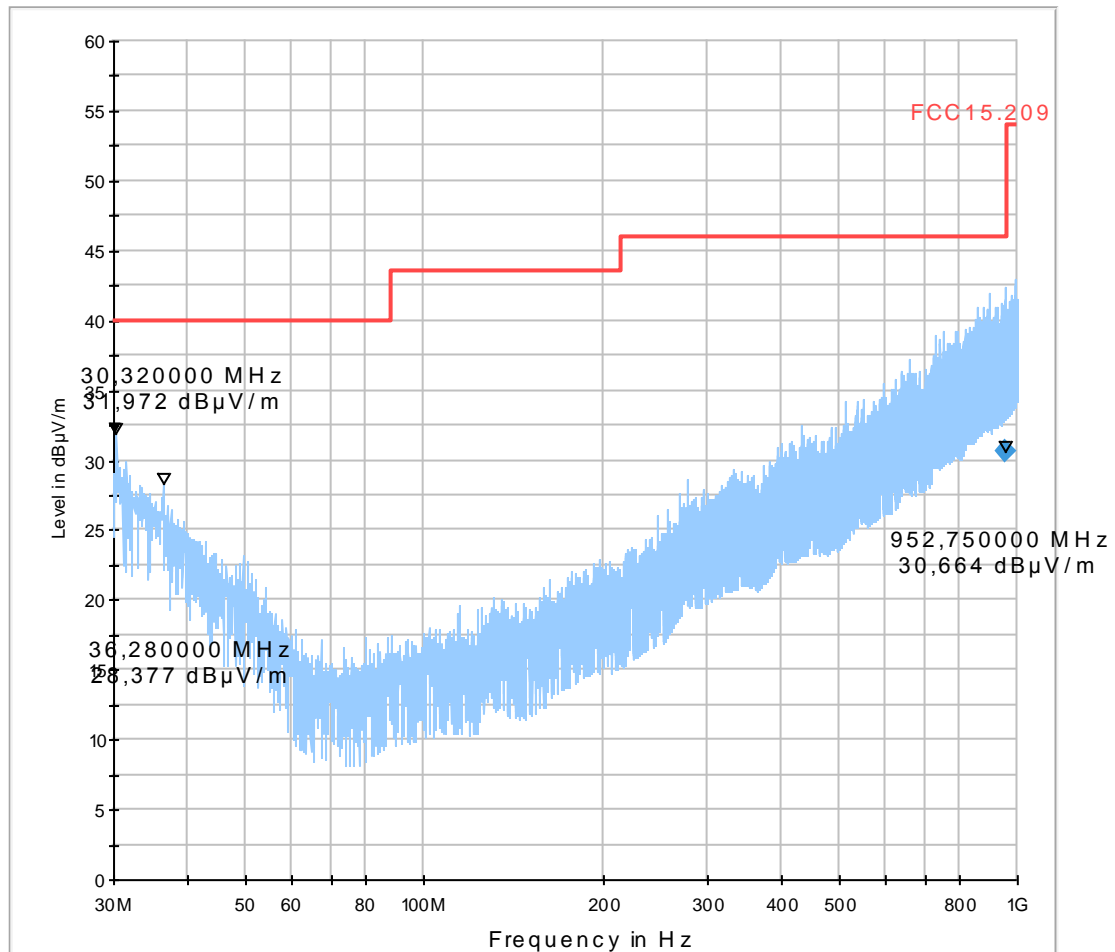


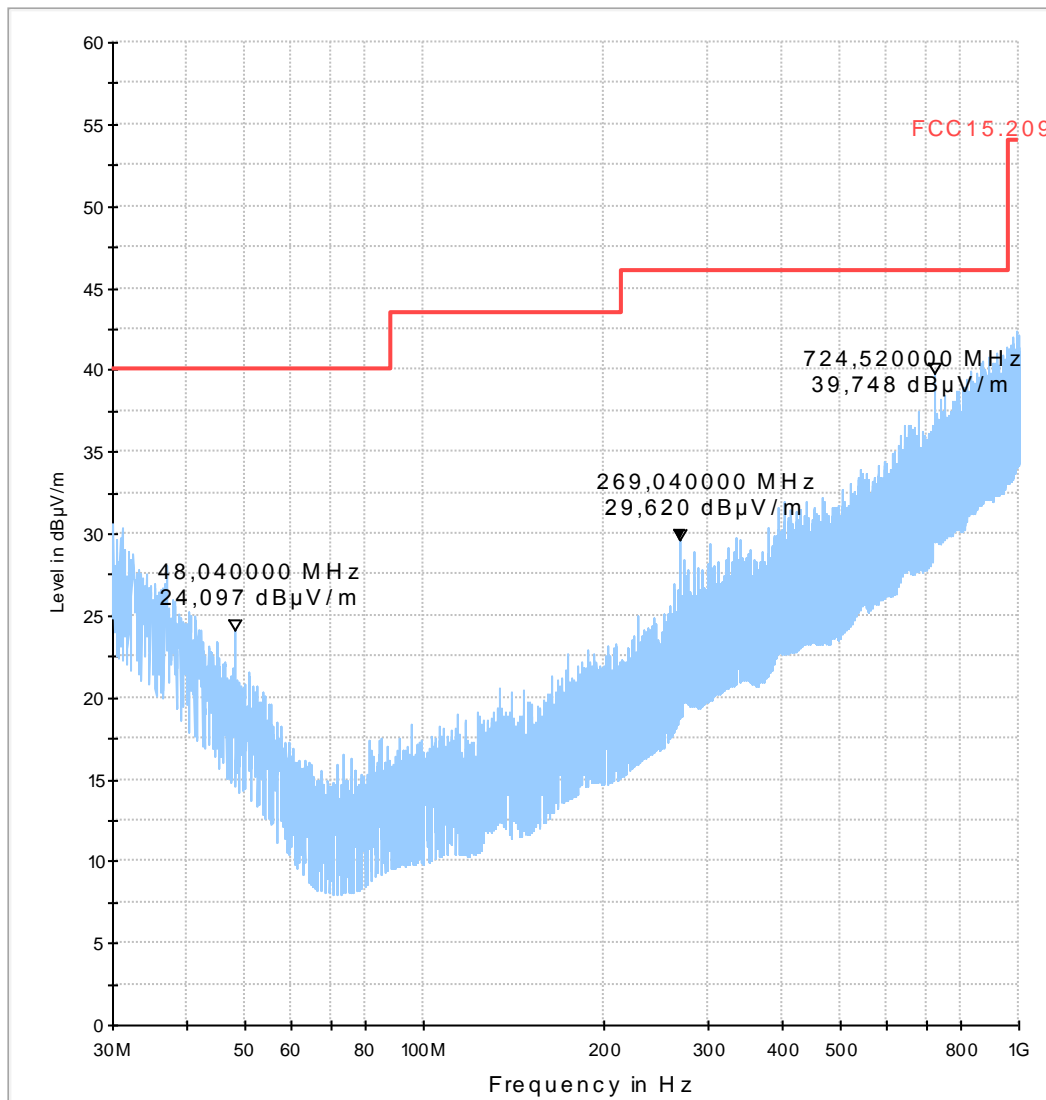
Diagram No. 3.03

Test description:	10.08.2012 Page 1 of 1
Test site and distance:	Electric Field strength Measurement
Distance correction:	Semi Anechoic Room (SAR) with 3 m measurement distance
Used filter:	not used
Test specification:	not used
	FCC 15.209 Class B; RSS-Gen: Issue 3
Operator:	Tas
Operating mode:	TX (CW mode), high CH 26 = 2480 MHz
Comments :	5V DC
	S/N 7
	6-0196-12-1-2b

EUT Information

EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Comment:	DC 5V, part no. 09368690

01_FCC 15.209_hor+vert_kipp



1.1.3. Radiated field strength (1 GHz < f < 18 GHz)

Diagram No.: 4.01

Common Information

Test Description: Radiated field strength emission accord. §15.247 in 3m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: §15.205 &15.209 Intentional Radiator
 Antenna polarisation: horizontal/vertical

Operator Name: Tas/YZH
 Comment: S/N 2, 5 VDC
 Op. Mode: TX, low channel11 = 2405 MHz
 Projekt: 6-0196-12-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Power during test: 5V DC

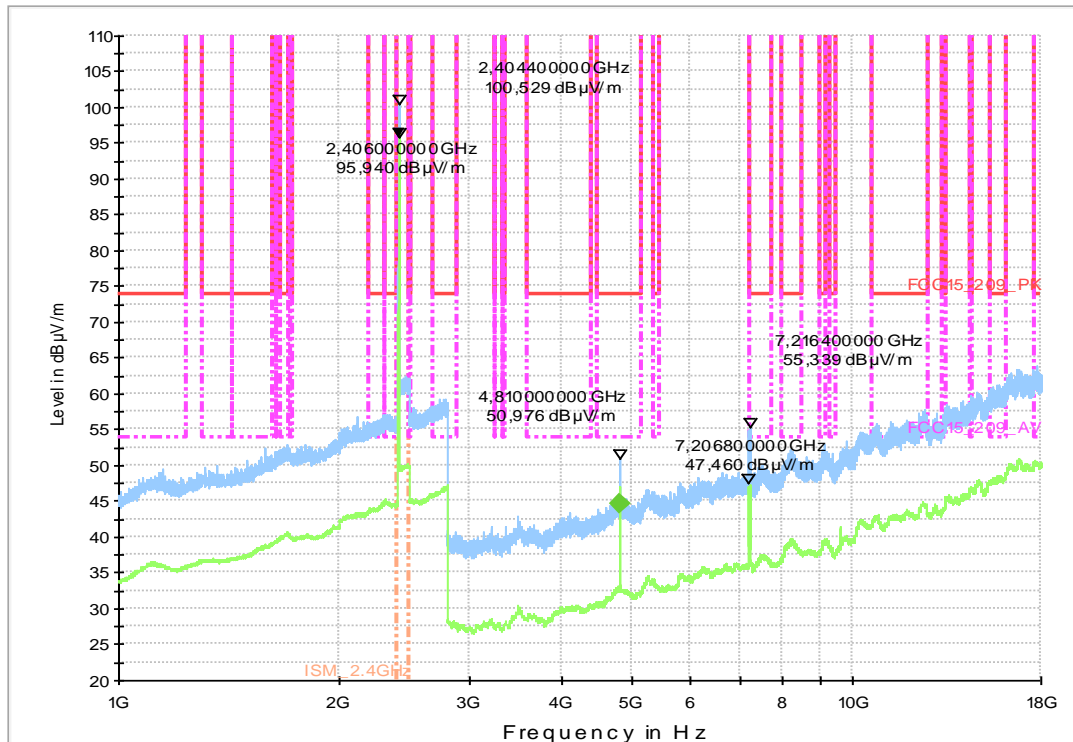
Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)
4810.100000	44.7	100.0	1000.000	155.0	H	20.0	0.0	4.9	9.3

(continuation of the "Final Result 2" table from column 10 ...)

Frequency (MHz)	Limit (dBµV/m)	Comment
4810.100000	54.0	

00431_SM1_KP1_WLAN_500us



EMI Auto Test Template: 00431_SM1_KP1_WLAN_500us

Diagram No.: 4.02

Common Information

Test Description: Radiated field strength emission accord. §15.247 in 3m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: §15.205 & 15.209 Intentional Radiator
 Antenna polarisation: horizontal/vertical

 Operator Name: YZH
 Comment: S/N 5, 5VDC
 Op. Mode: TX, Middle channel18 = 2440 MHz
 Projekt: 6-0196-12-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Power during test: 5V DC

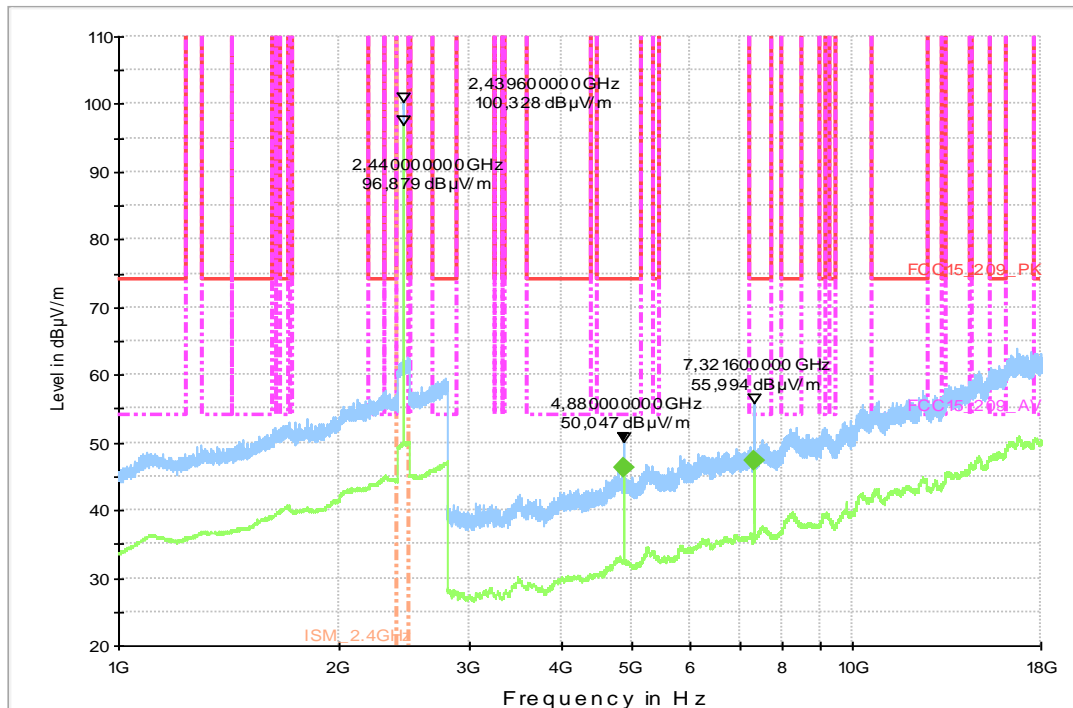
Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)
4880.100000	46.3	100.0	1000.000	155.0	H	82.0	0.0	4.6	7.7
7321.300000	47.3	100.0	1000.000	155.0	H	86.0	90.0	10.2	6.7

(continuation of the "Final Result 2" table from column 10 ...)

Frequency (MHz)	Limit (dBµV/m)	Comment
4880.100000	54.0	
7321.300000	54.0	

00431_SM1_KP1_WLAN_500us



EMI Auto Test Template: 00431_SM1_KP1_WLAN_500us

Diagram No.: 4.03

Common Information

Test Description: Radiated field strength emission accord. §15.247 in 3m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: §15.205 & 15.209 Intentional Radiator
 Antenna polarisation: horizontal/vertical

 Operator Name: Tas
 Comment: S/N 18, 5 VDC
 Op. Mode: TX, high channel 26 = 2480 MHz
 6-0196-12-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Power during test: 5V DC

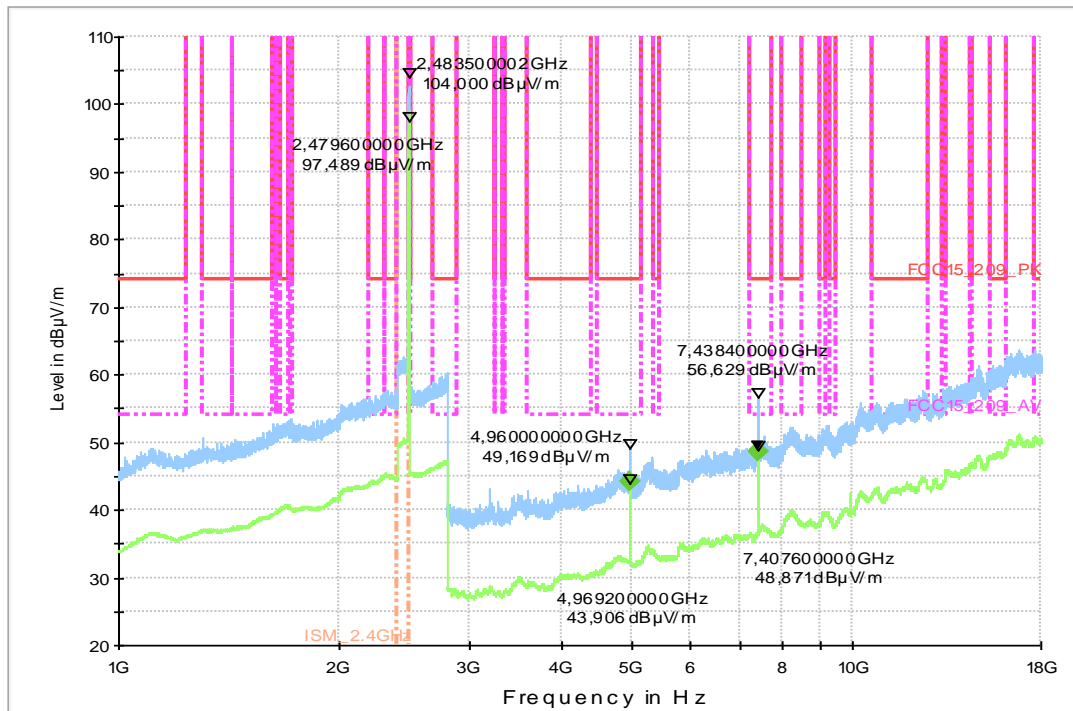
Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Marginal (dB)
4960.100000	44.2	100.0	1000.000	155.0	H	155.0	90.0	4.3	9.8
7438.500000	48.7	100.0	1000.000	155.0	H	68.0	90.0	11.3	5.3

(continuation of the "Final Result 2" table from column 10 ...)

Frequency (MHz)	Limit (dBµV/m)	Comment
4960.100000	54.0	
7438.500000	54.0	

00431_SM1_KP1_WLAN_500us



EMI Auto Test Template: 00431_SM1_KP1_WLAN_500us

1.1.4. Carrier radiated field strength in 3 m and band-edge compliance acc. FCC §15.247 & §15.209

Diagram No.: 4.01_EIRP

Common Information

Test Description: EIRP - ZigBee 2.4GHz ISM band
 Test Site: CETECOM GmbH Essen
 Test Standard: FCC §15.247
 Antenna polarisation: horizontal/vertical

 Operator Name: Tas
 Comment: S/N 2
 Op. Mode: TX, low channel 11 = 2405 MHz
 6-0196-12-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Power during test: 5V DC

Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Comment
2405.500000	102.3	100.0	1000.000	155.0	H	199.0	0.0	35.5	

Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Comment
2405.000000	97.3	100.0	1000.000	155.0	H	195.0	0.0	35.5	

Carrier_measurement_SM1_PA0_KP1_WLAN

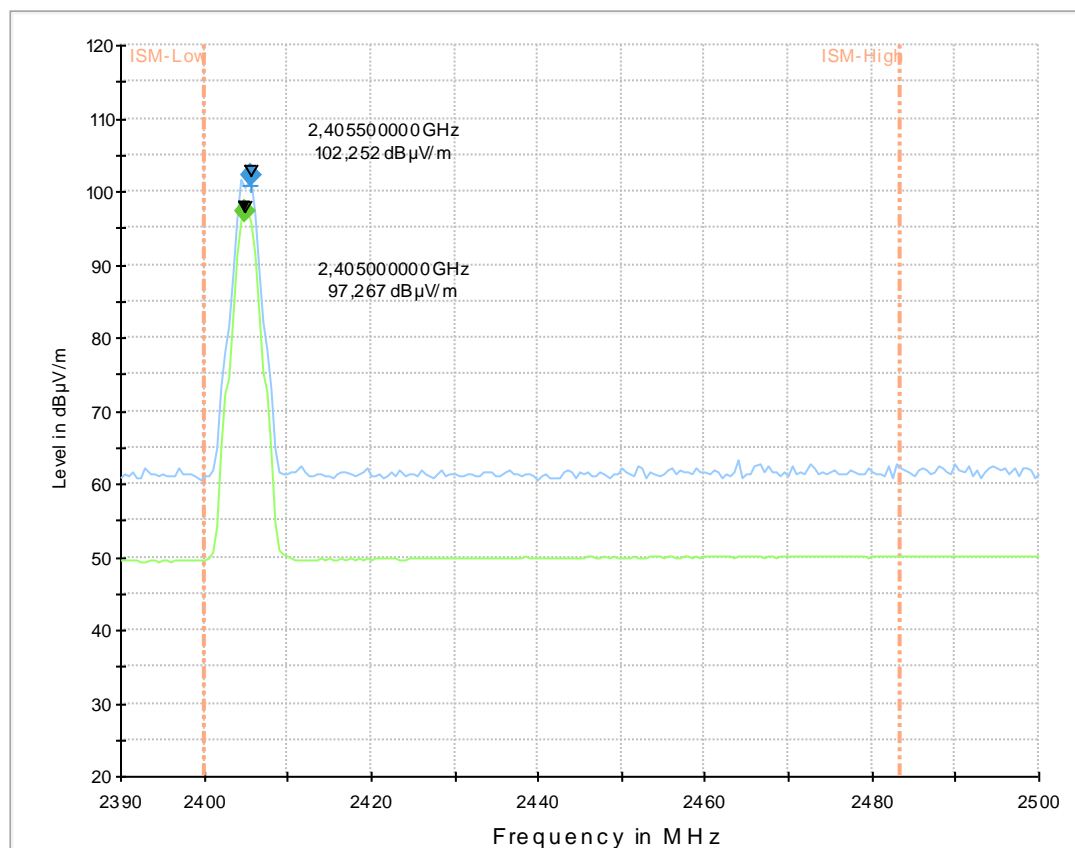


Diagram No.: 4.01_BE

Common Information

Test Description:	Band Edge Radiated - ZigBee 2.4GHz ISM band
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC §15.247
Antenna polarisation:	horizontal/vertical
Operator Name:	Tas
Comment:	S/N 2
Op. Mode:	TX, low channel 11 = 2405 MHz 6-0196-12-2b

EUT Information

EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Power during test:	5V DC

08_ESU_2.4GHz_Low_Band_Edge_PA0

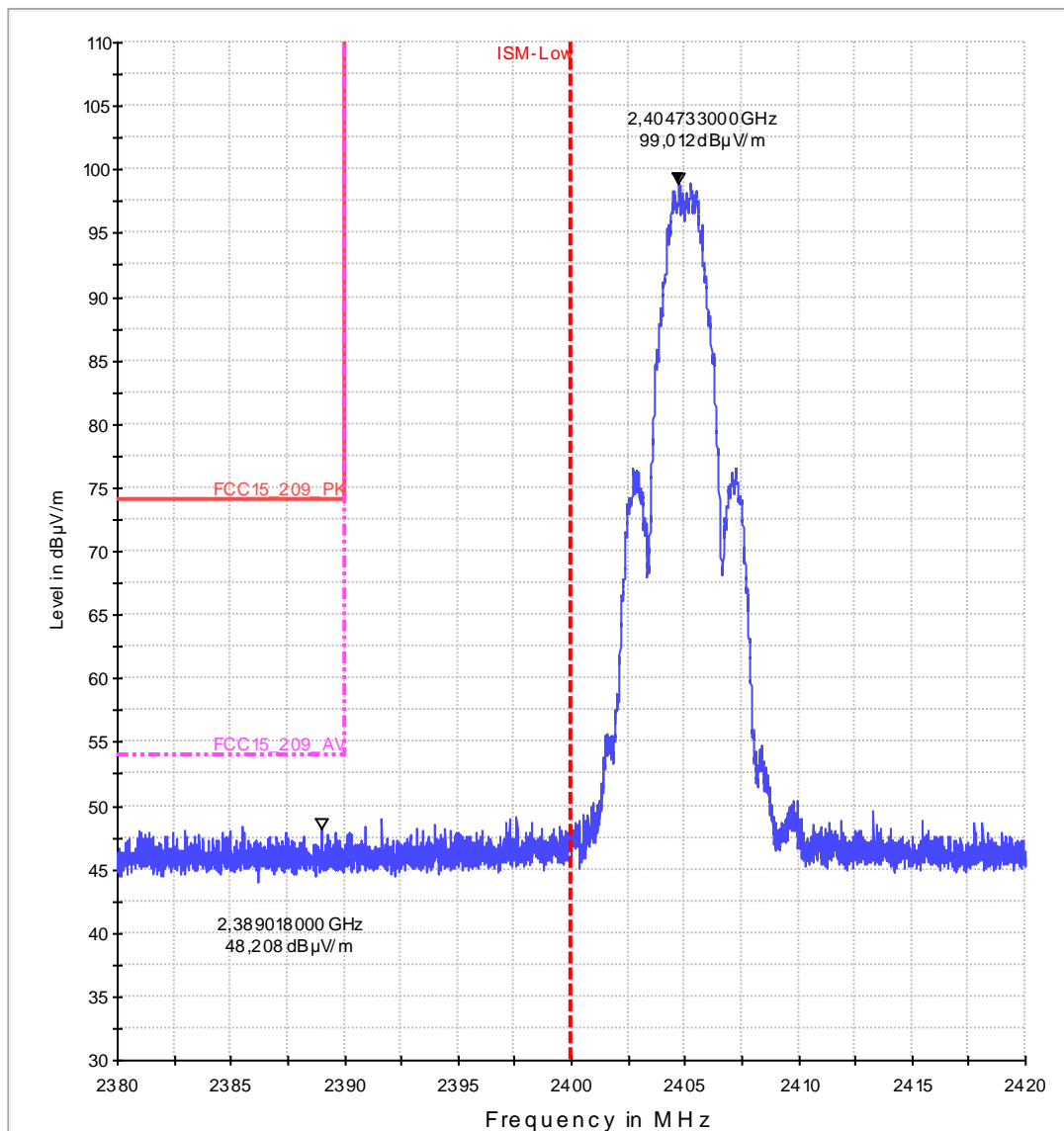


Diagram No.: 4.02_EIRP

Common Information

Test Description: Radiated field strength emission accord. in 3 m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: FCC §15.247
 Antenna polarisation: horizontal/vertical

 Operator Name: Tas
 Comment: Humidity: 47%rH; Temperature: 20°C
 Op. Mode: Channel no. 18= 2440 MHz_middle
 EUT: S/N 9
 6-0196-12-1-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Serial Number:
 Hardware Rev: --
 Power during test: 5V DC
 Comment: Adapter board 111269 B

Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Elevation (deg)	Corr. (dB)
2440.500000	101.0	100.0	1000.000	155.0	H	179.0	90.0	35.6

Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Elevation (deg)	Corr. (dB)
2440.000000	97.2	100.0	1000.000	155.0	H	179.0	90.0	35.6

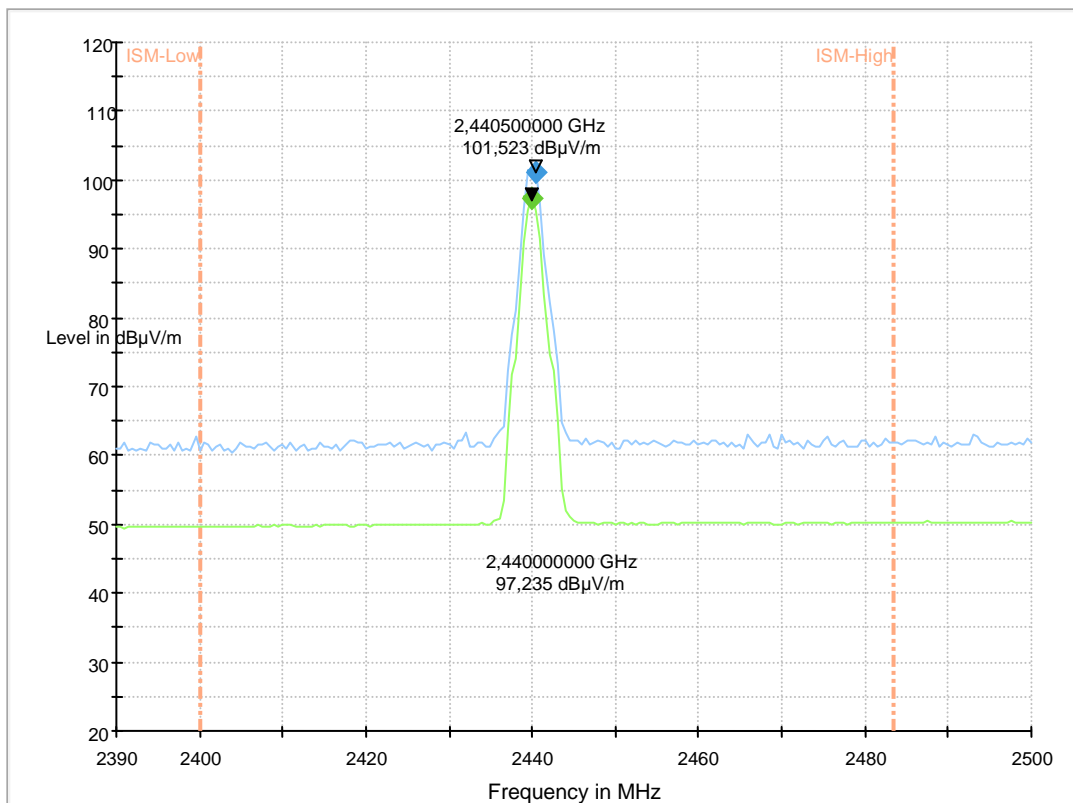


Diagram No.: 4.03_EIRP

Common Information

Test Description: EIRP – Radiated field strength in 3 m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: FCC §15.247
 Antenna polarisation: horizontal/vertical

 Operator Name: Tas
 Comment: Humidity: 47%rH; Temperature: 20°C
 Op. Mode: Channel no. 26= 2480 MHz_high
 EUT: S/N 15
 6-0196-12-1-2b

EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Serial Number:
 Hardware Rev: --
 Power during test: 5V DC
 Comment: Adapter board 111269 B

Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Comment
2479.500000	92.8	100.0	1000.000	155.0	H	174.0	0.0	35.7	

Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Comment
2480.000000	89.3	100.0	1000.000	155.0	H	175.0	0.0	35.7	

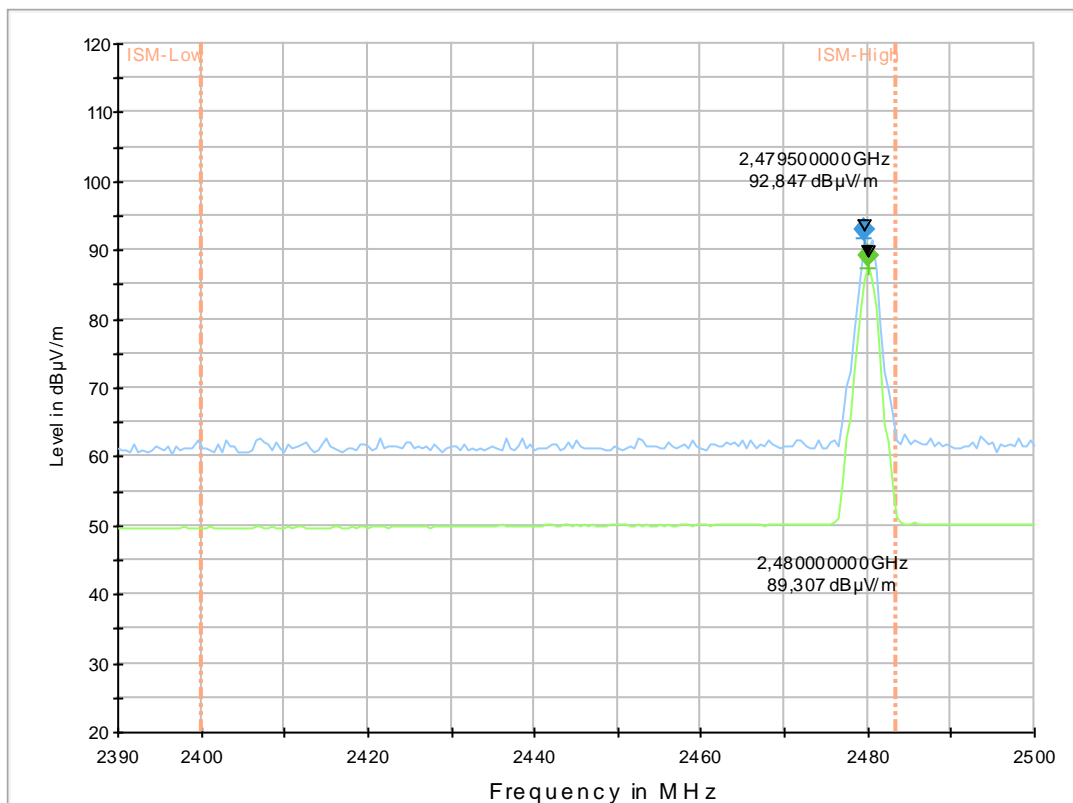


Diagram No.: 4.03_BE

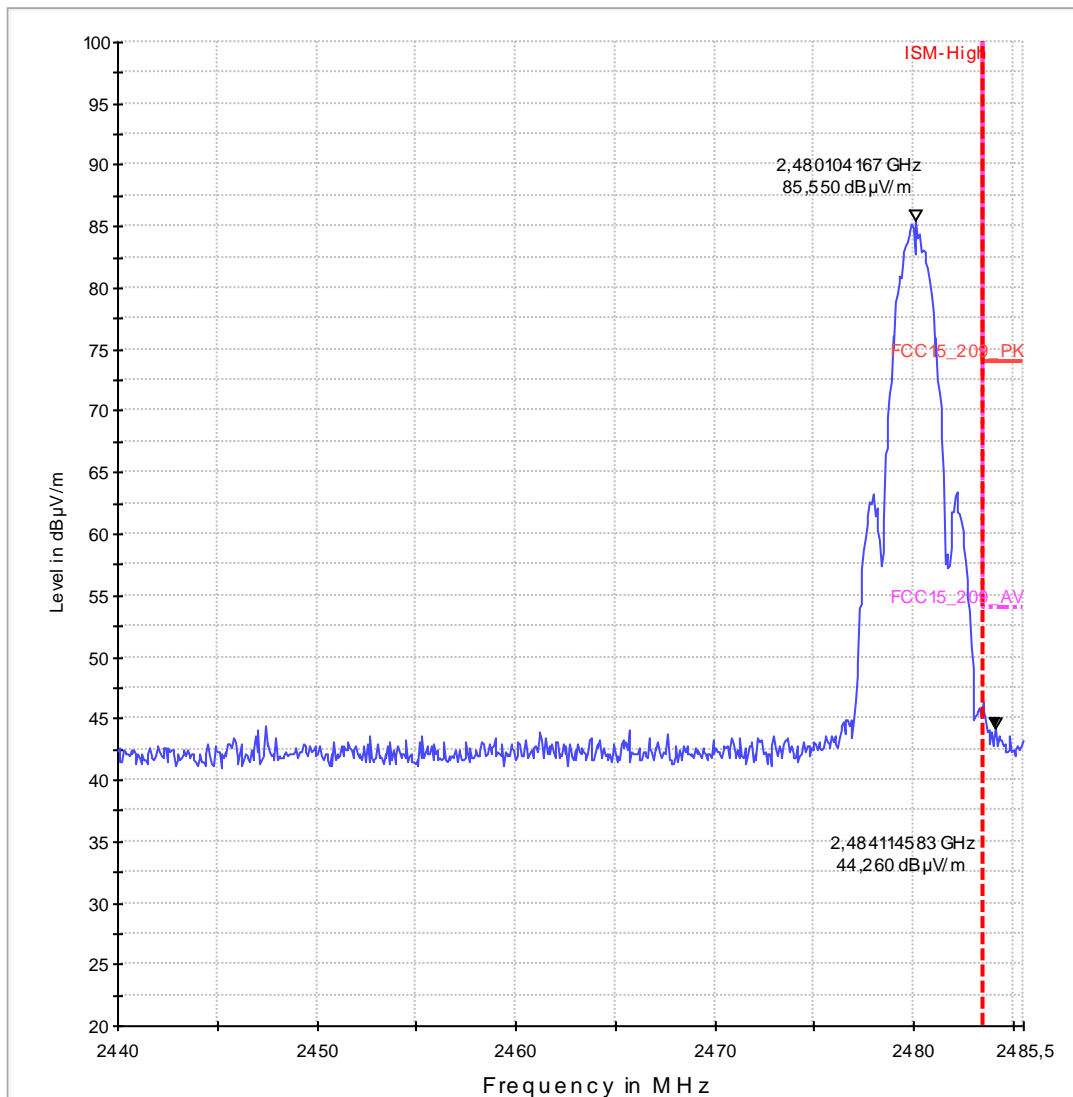
Common Information

Test Description: Band-Edge Radiated field strength emission in 3 m distance
 Test Site: CETECOM GmbH Essen
 Test Standard: FCC §15.205, 15.209 & 15.247
 Antenna polarisation: horizontal/vertical

Operator Name: Tas
 Comment: Humidity: 47%rH; Temperature: 20°C
 Op. Mode: Channel no. 26= 2480 MHz_high
 S/N 15
 6-0196-12-1-2b

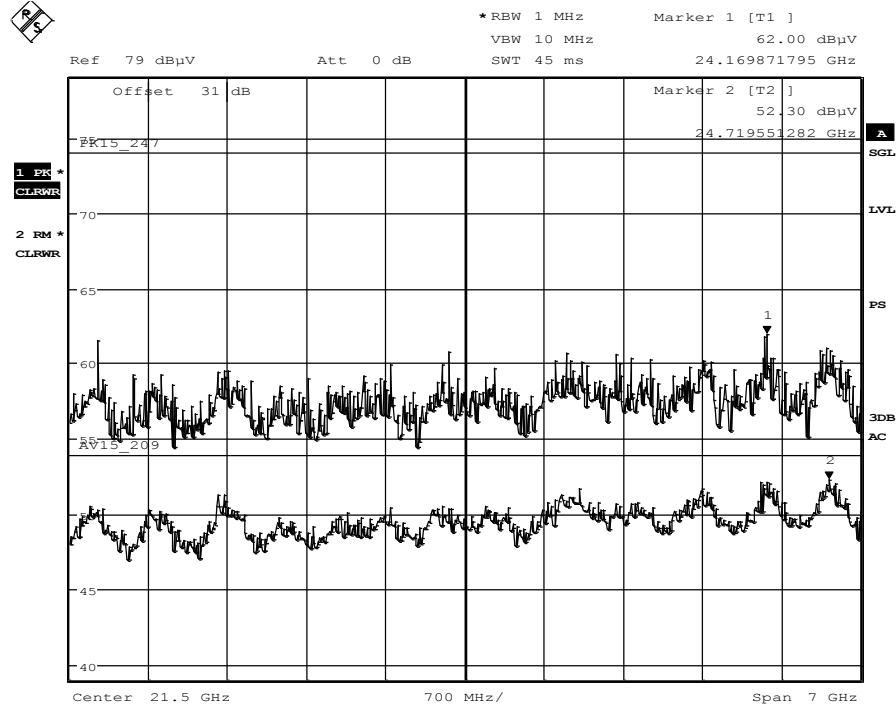
EUT Information

EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Serial Number:
 Hardware Rev: --
 Power during test: 5V DC
 Comment: Adapter board 111269 B



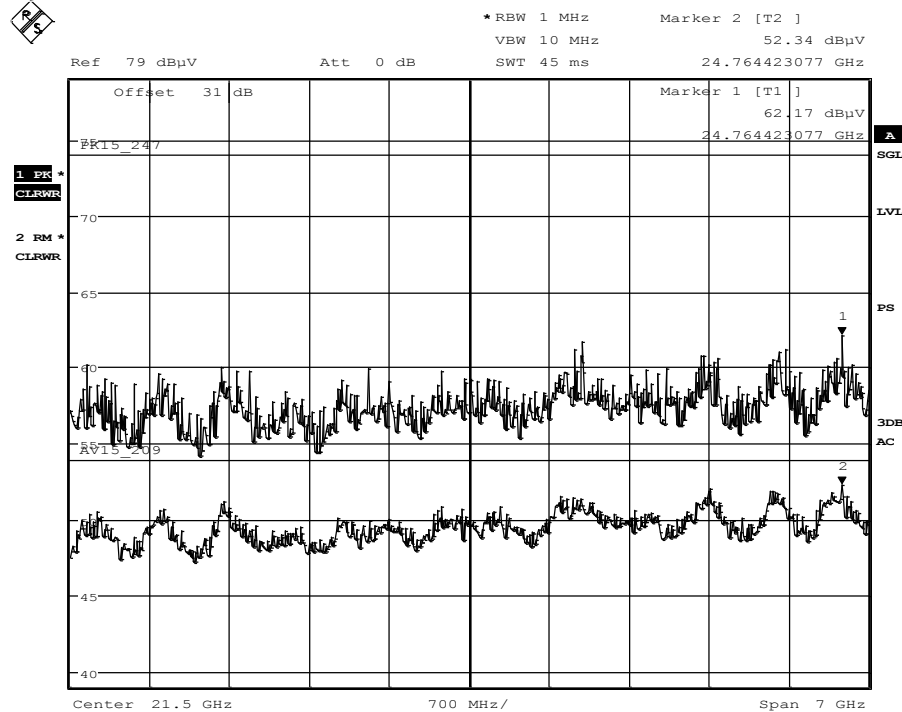
1.2. Radiated emissions in the frequency range above 18 GHz

4.04 channel low:



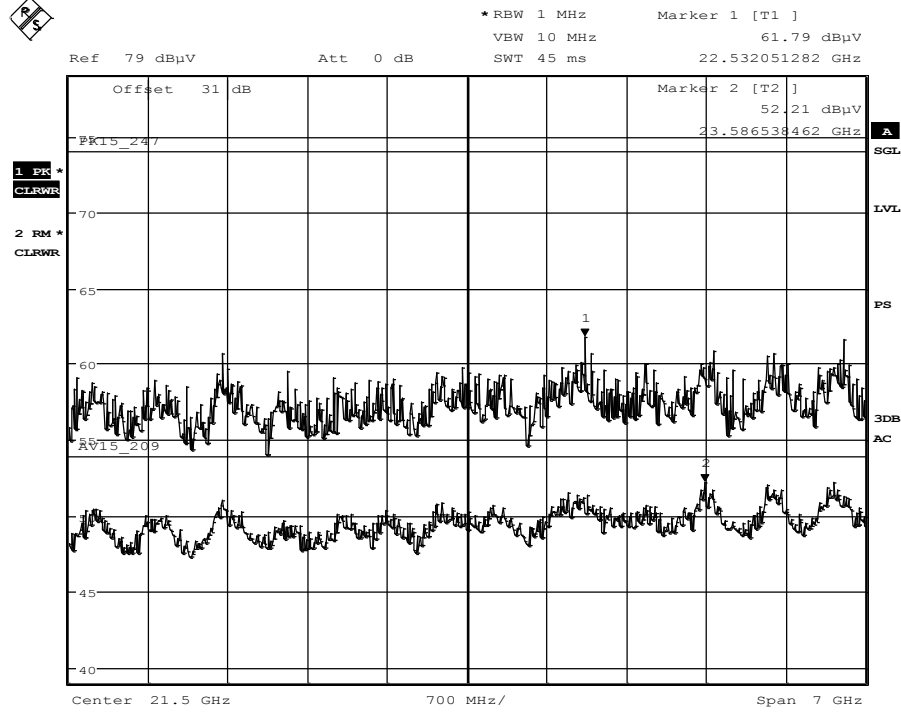
Date: 21.SEP.2012 11:47:52

4.05 channel middle:



Date: 21.SEP.2012 11:46:26

4.06 channel high:



Date: 21.SEP.2012 11:45:29

1.3. Radiated field strength (§15.109, Class B)

1.3.1. Radiated field strength (30 MHz < f < 1 GHz)

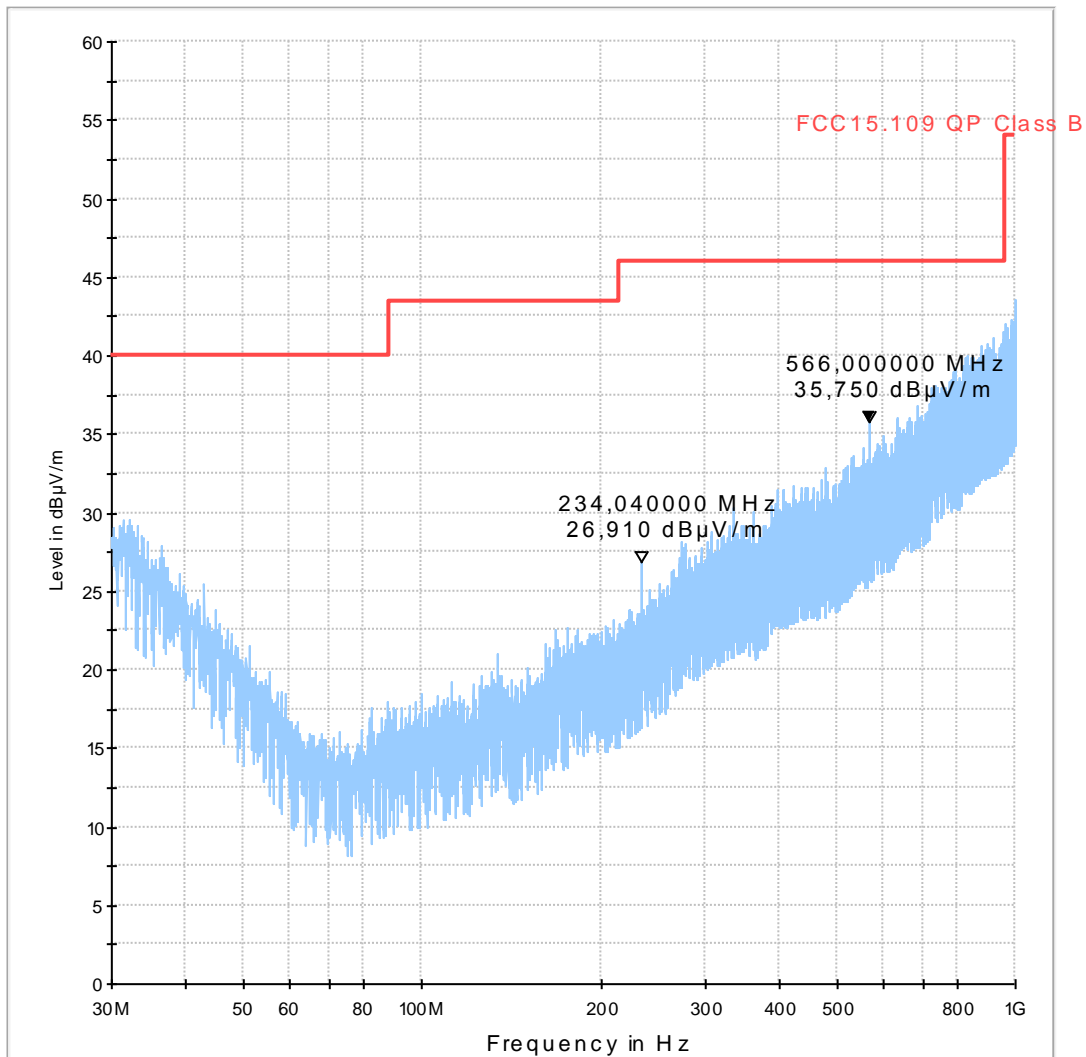
Diagram No. 3.04_RX

Date:	10.08.2012	Page 1 of 1
Test description:	Electric Fieldstrength Measurement	
Test site and distance:	Semi Anechoic Room (SAR) with 3m measurement distance	
Distance correction:	not used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Used filter:	not used	
Test specification:	FCC15.109, class B; RSS-Gen.: Issue 3	
Operator:	Tas	
Operating conditions:	RX , CH 15 = 2425 MHz	
Measured sides of EUT:	front, right, rear, left	
Power during tests:	5V DC	
Comments:	S/N 11 6-0196-12-1-2b	

EUT Information

EUT Name:	EI 7800 with shielding
Manufacturer:	Miele
Hardware Rev:	--
Comment:	DC 5V, part no. 09368690

05_FCC15.109_hor+vert_kipp



1.3.2. Radiated field strength (1 GHz < f < 10 GHz)

4.07_RX

Common Information

Test Description: Radiated field strength emission accord. §15.109 in 3 m distance
 Test Site Location: CETECOM GmbH Essen
 Test Site: Fully Anechoic Room (FAR)
 Test Standard: FCC Part 15.109

Operating Mode: RX Mode - ZigBee, CH15 (2425 MHz)
 Equipment Class: Class B
 Environmental Conditions: Humidity: 49%rH; Temperature: 23°C
 Operator: Tas
 6-0196-12-1-2b, SN14

EUT Information

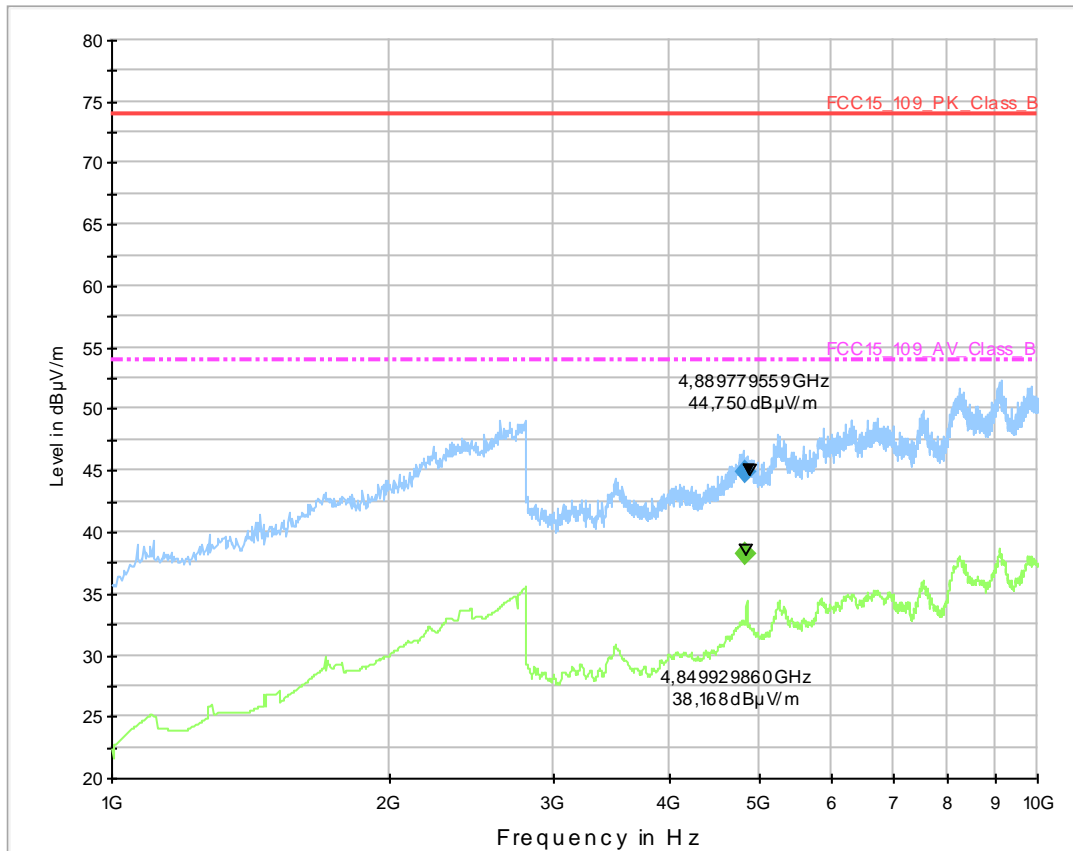
EUT Name: EI 7800 with shielding
 Manufacturer: Miele
 Hardware Rev: --
 Power during test: 5V DC

Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4847.585171	44.9	100.0	1000.000	H	11.0	90.0	4.8	29.1	74.0

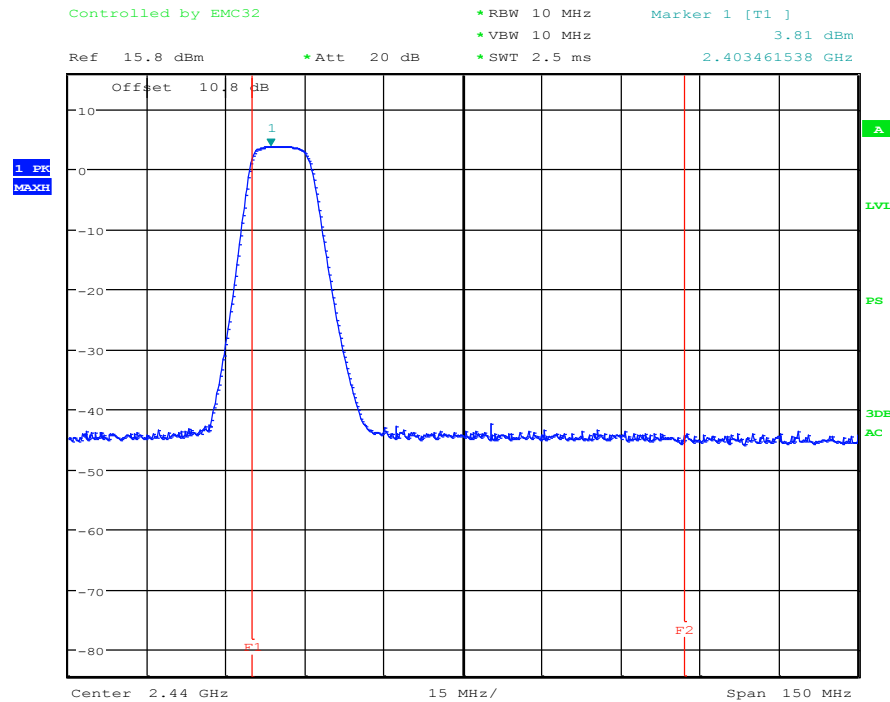
Final Result 2

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4849.929860	38.2	100.0	1000.000	H	89.0	0.0	4.7	15.8	54.0



1.4. Maximum peak conducted power

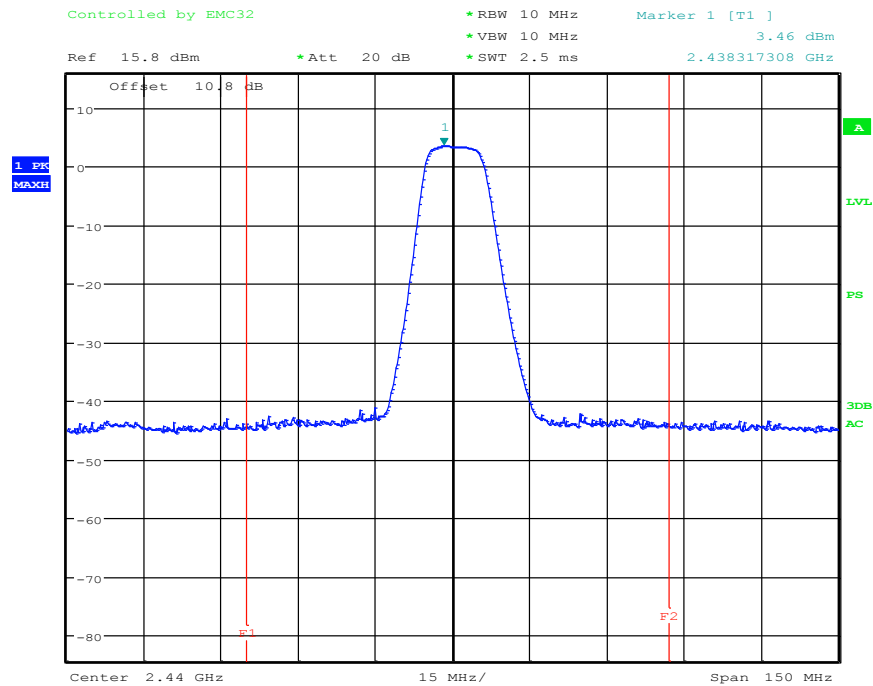
10.01 low channel:



Date: 30.AUG.2012 11:31:59

Channel 11, SN 12-> absolute maximum value of three channels

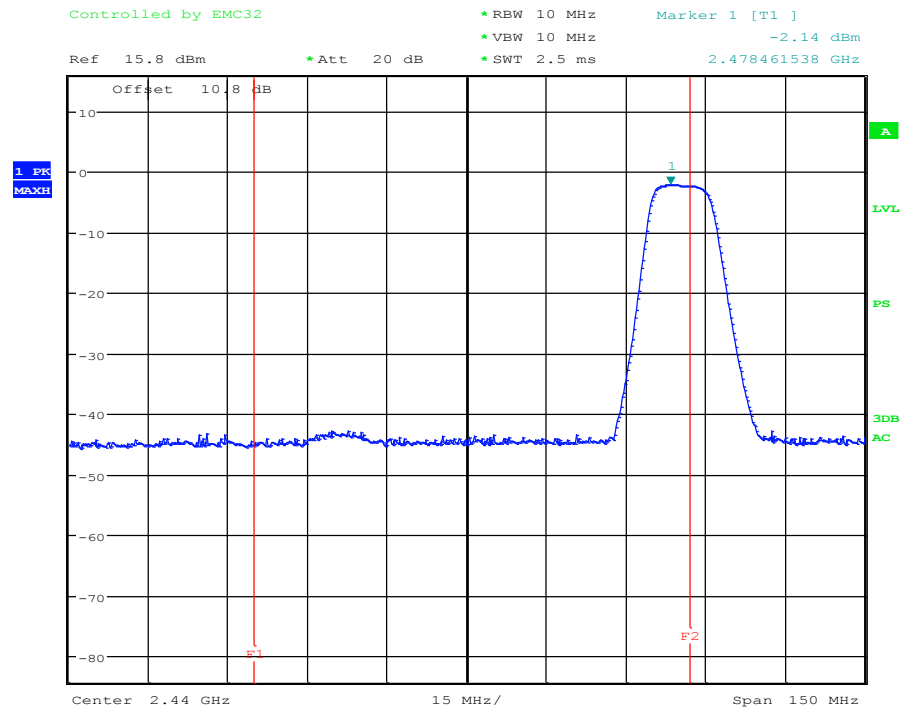
10.02 middle channel:



Date: 30.AUG.2012 11:27:03

Channel 18, SN 14

10.03 high channel:

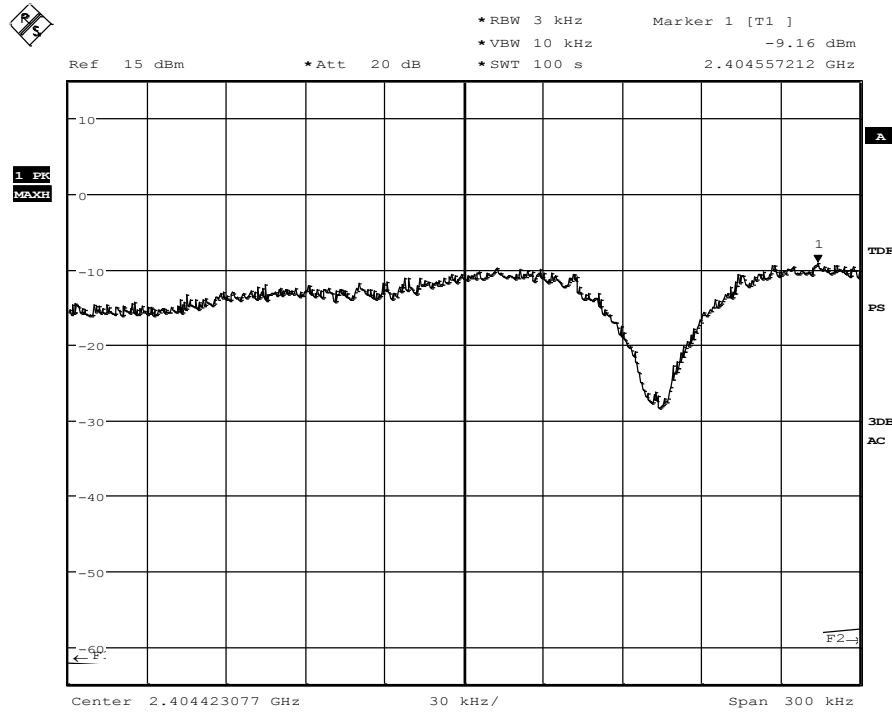


Date: 30.AUG.2012 11:05:52

Channel 26, SN 17

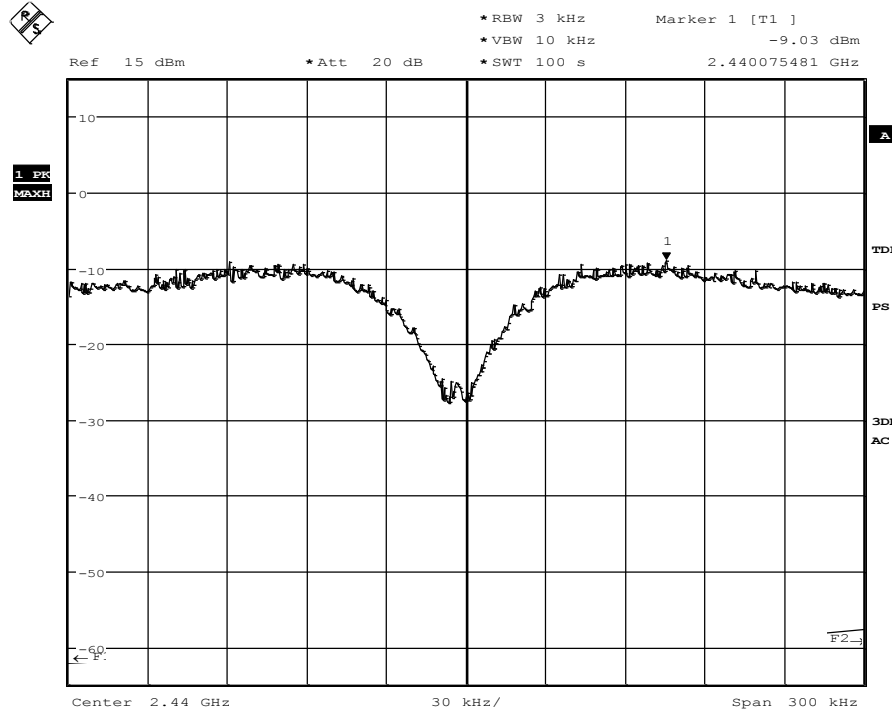
1.5. Power spectral density

11.01 low channel:



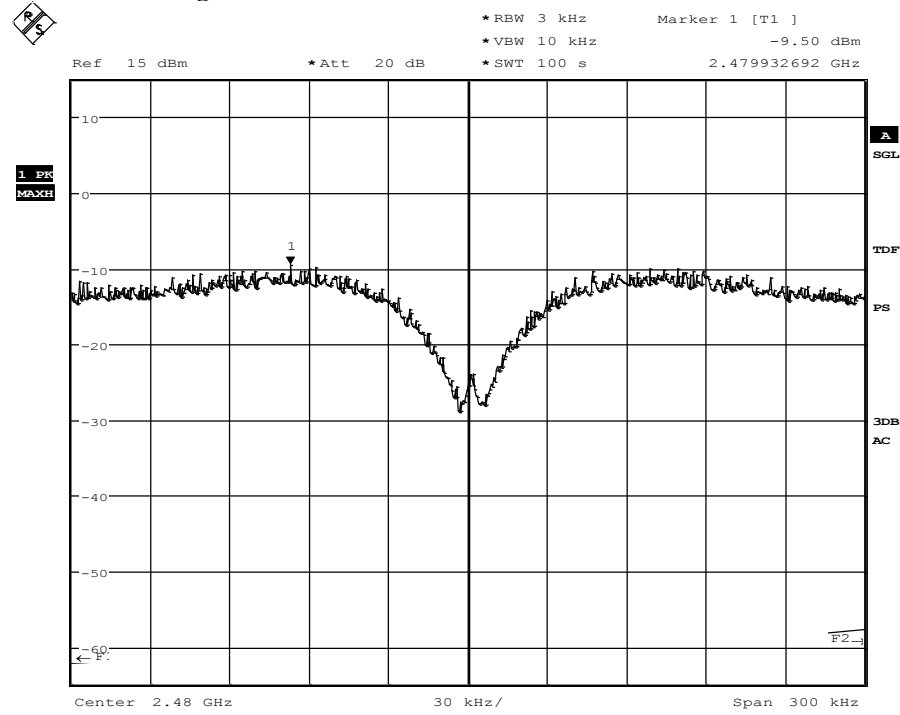
Date: 18.APR.2012 12:38:53

11.02 channel middle:



Date: 18.APR.2012 14:16:10

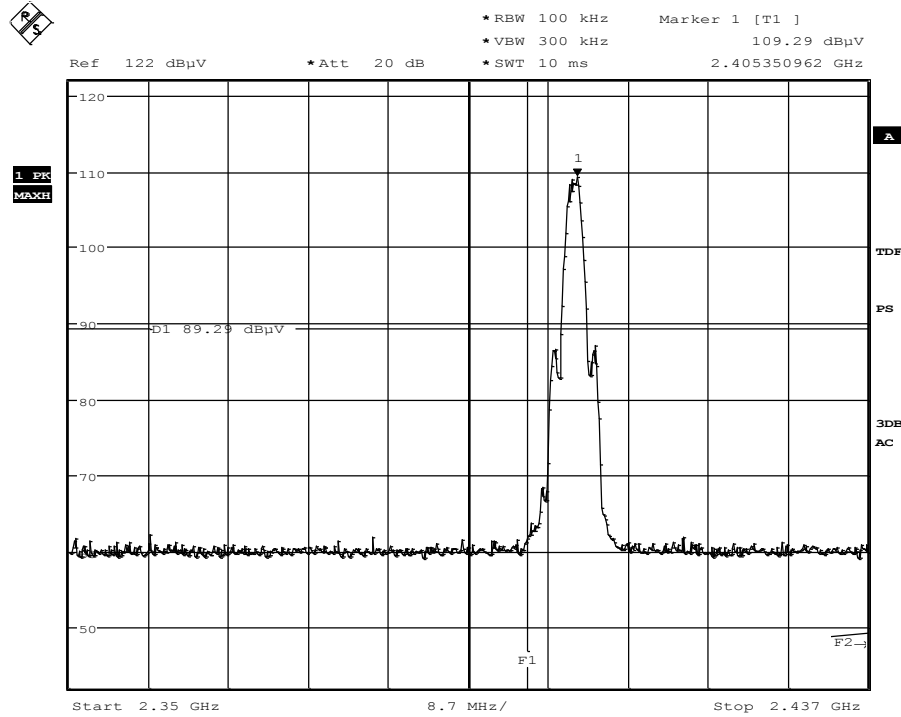
11.03 channel high:



Date: 18.APR.2012 16:08:06

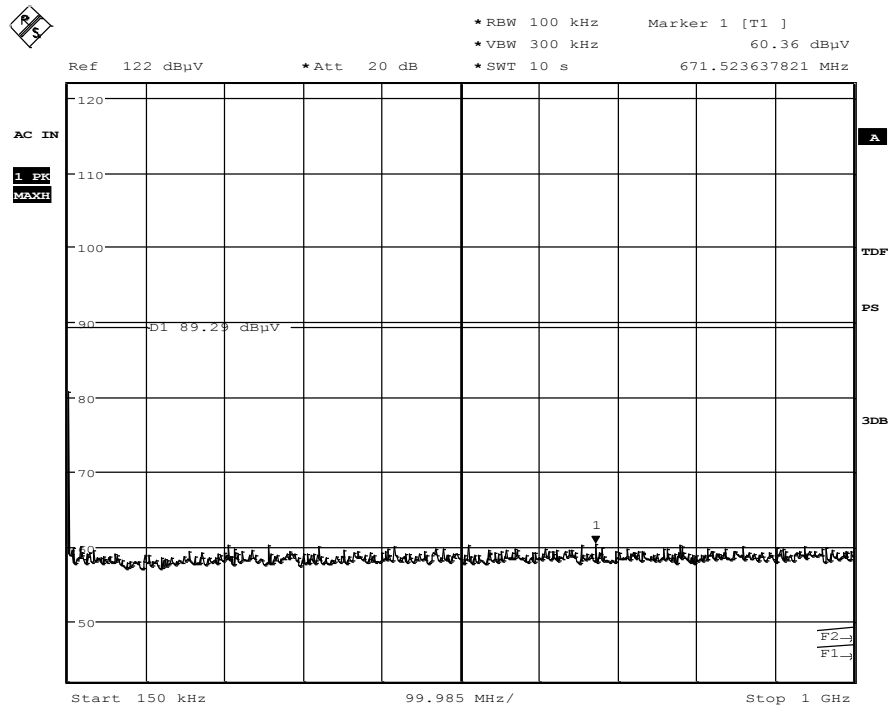
1.6. 20 dBc conducted emissions

12.01 low channel:



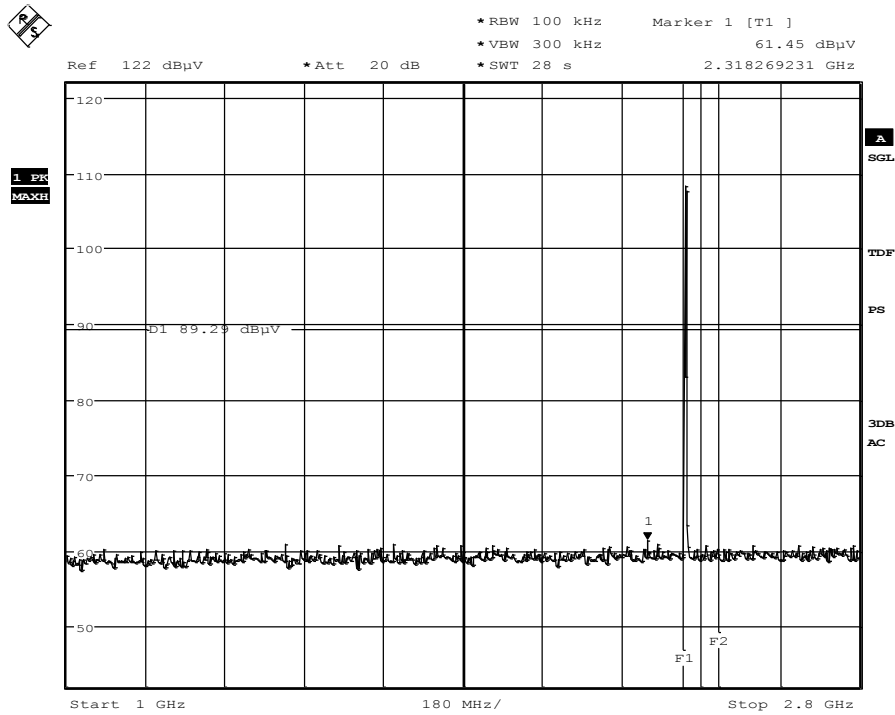
Date: 18.APR.2012 12:53:56

Reference value for low channel



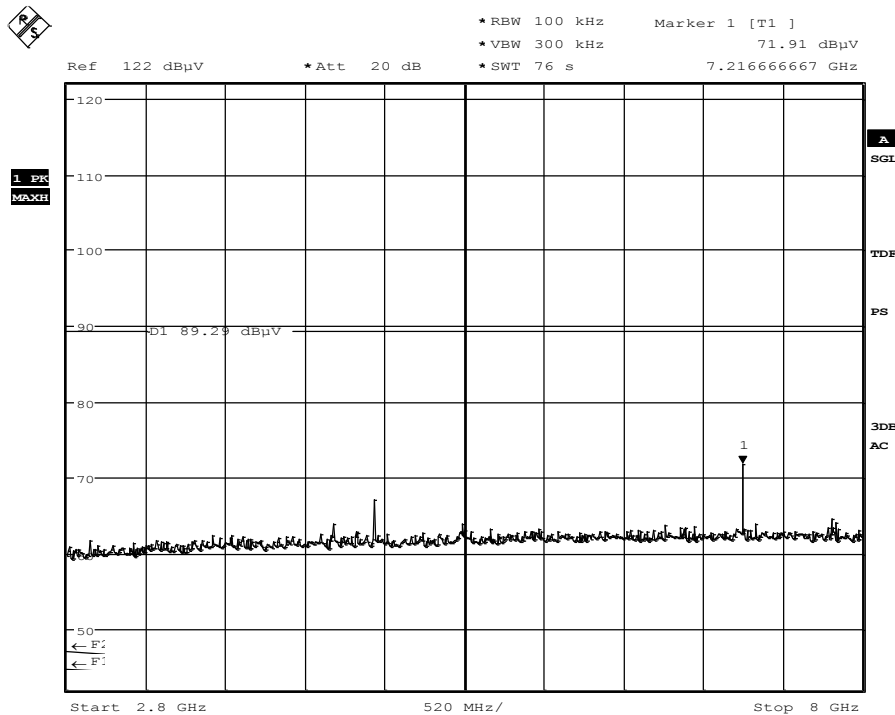
Date: 18.APR.2012 12:58:32

Sweep 1



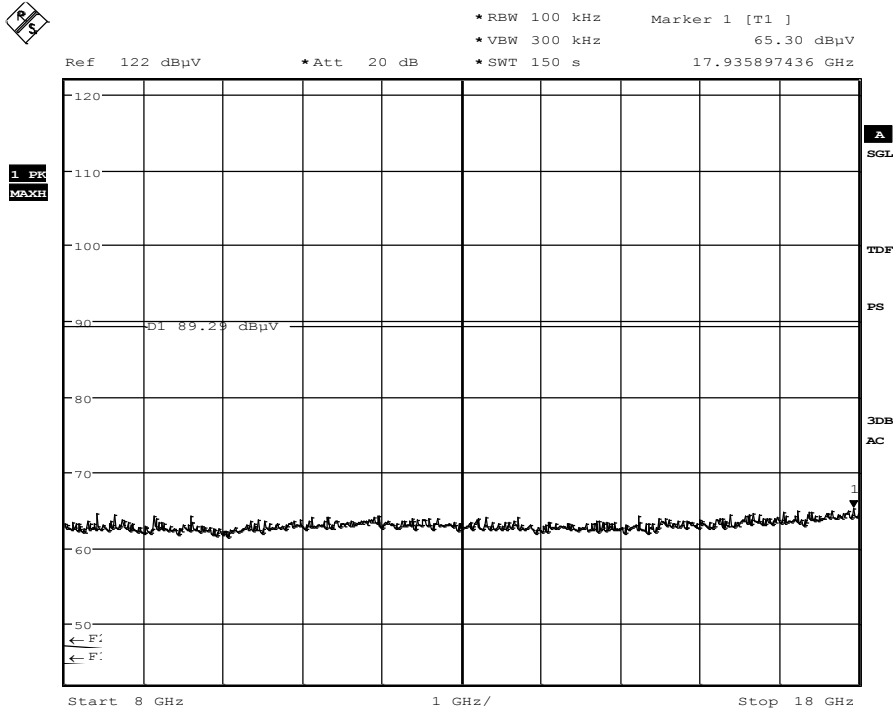
Date: 18.APR.2012 13:01:44

Sweep 2



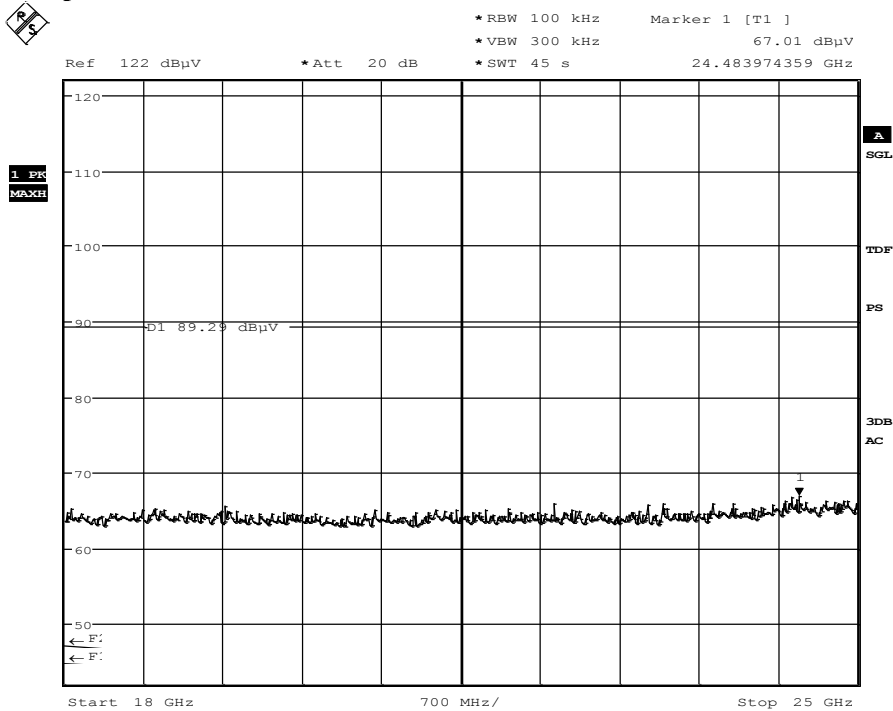
Date: 18.APR.2012 13:09:37

Sweep 3



Date: 18.APR.2012 13:14:13

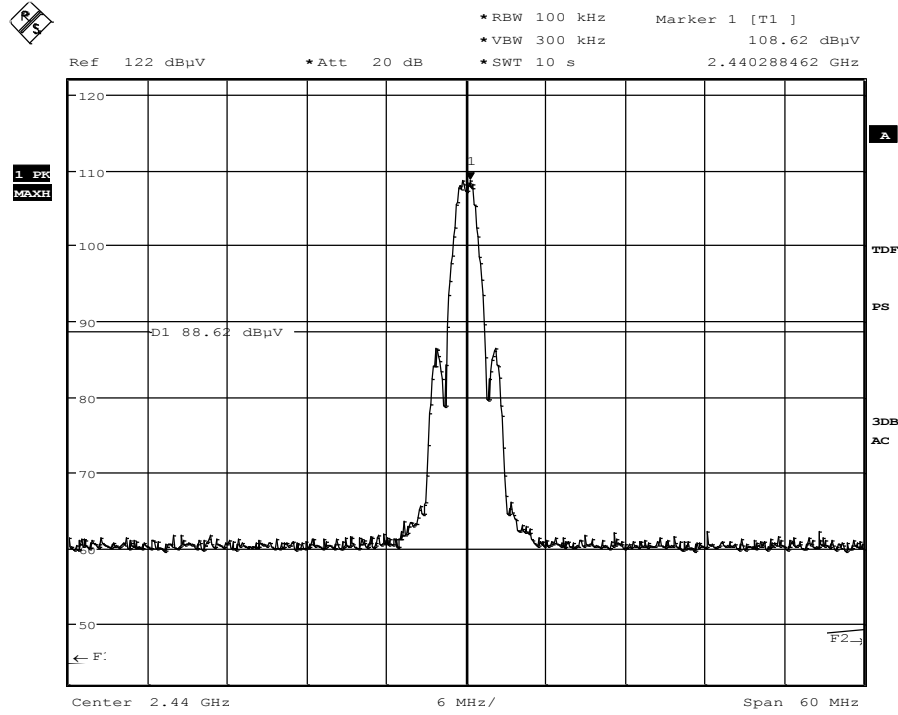
Sweep 4



Date: 18.APR.2012 13:16:35

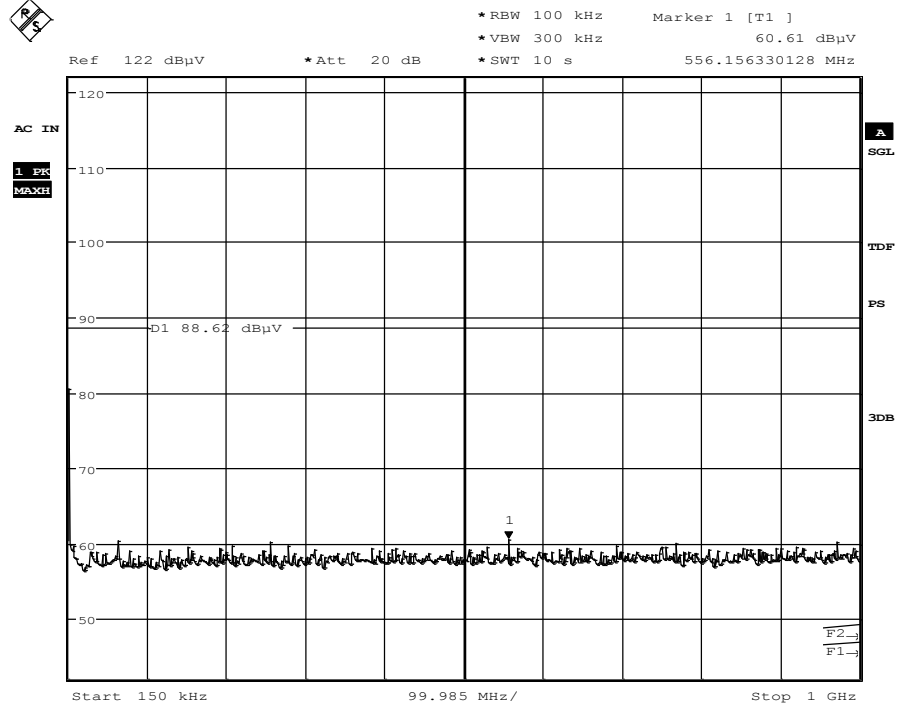
Sweep 5

12.02 middle channel:



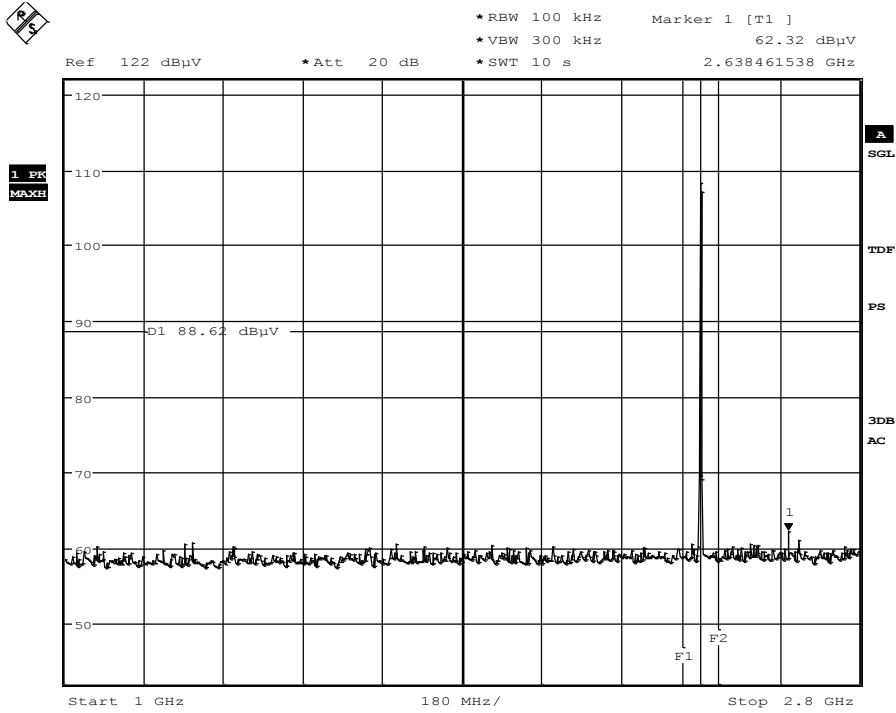
Date: 18.APR.2012 14:27:40

Reference value for middle channel



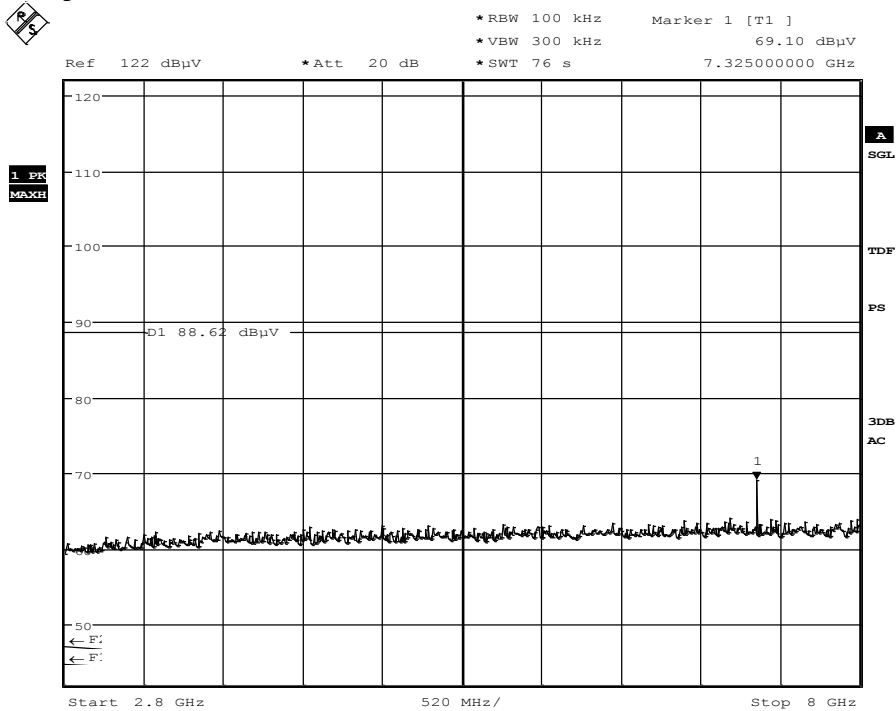
Date: 18.APR.2012 14:30:08

Sweep 1



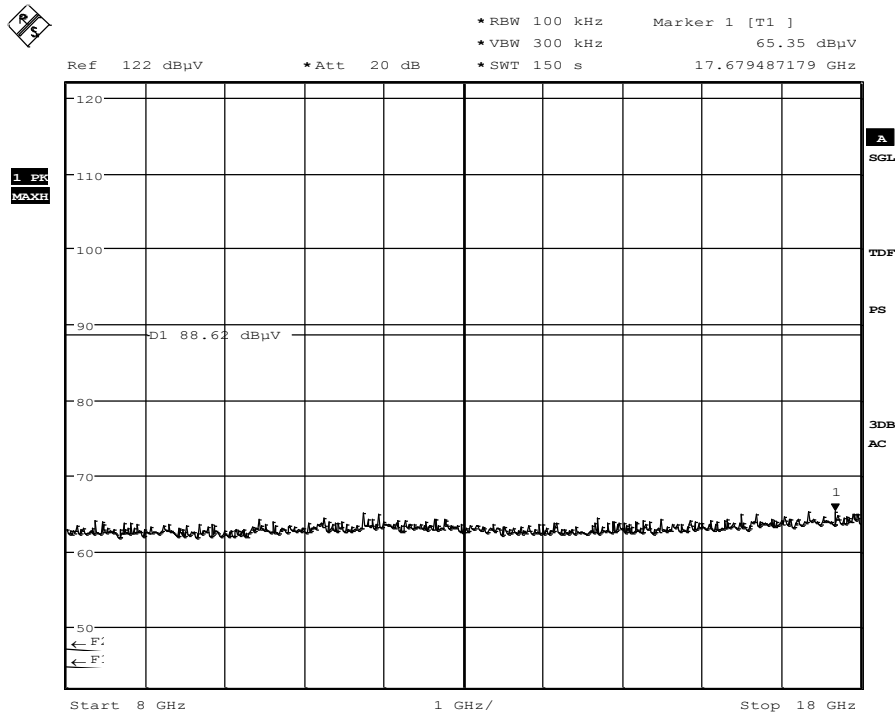
Date: 18.APR.2012 14:36:18

Sweep 2



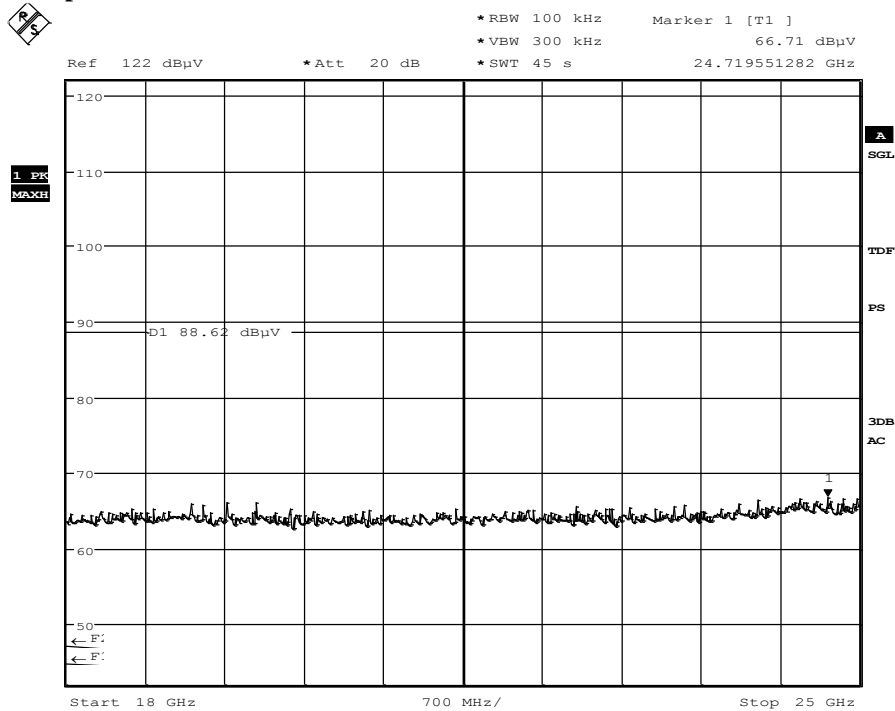
Date: 18.APR.2012 14:40:02

Sweep 3



Date: 18.APR.2012 14:44:39

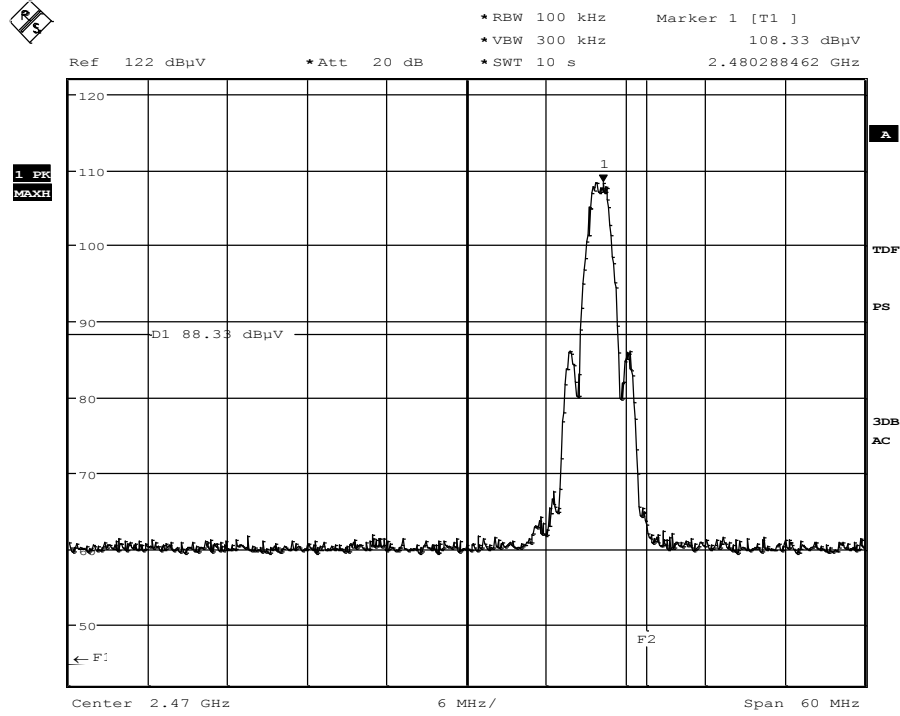
Sweep 4



Date: 18.APR.2012 14:47:48

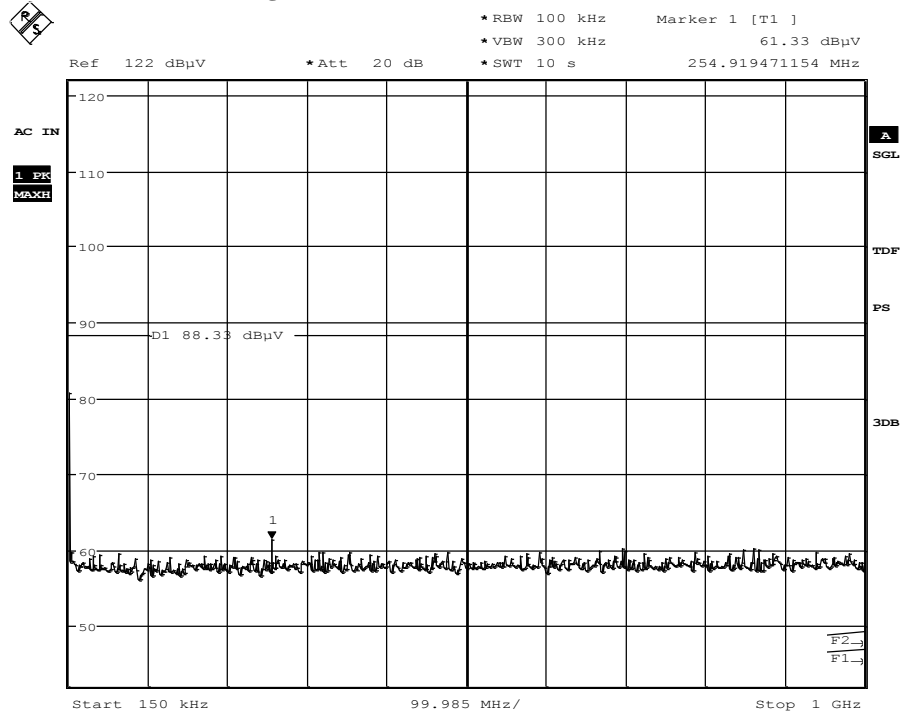
Sweep 5

12.03 high channel:



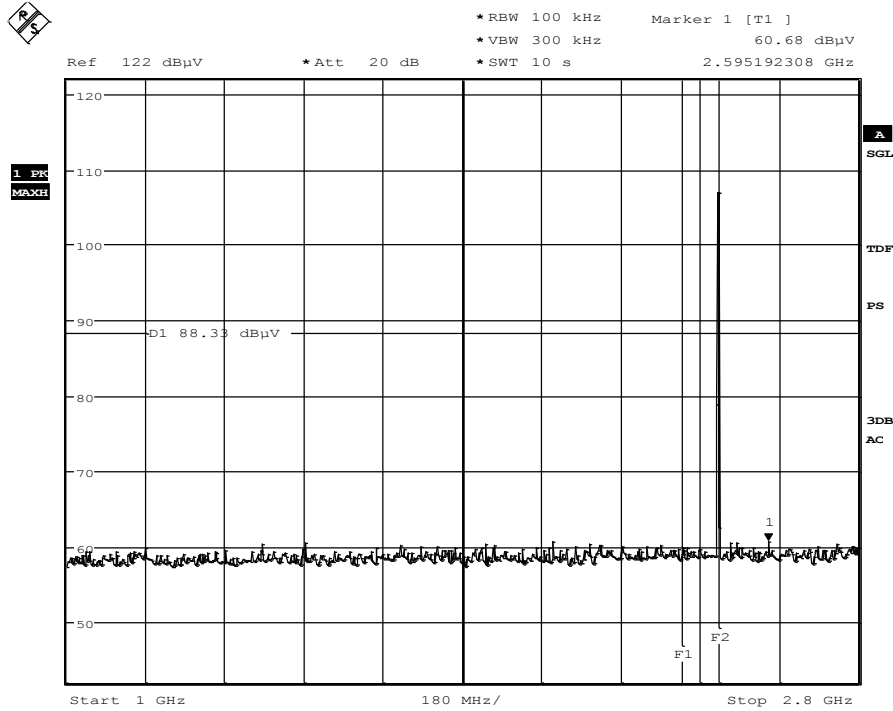
Date: 18.APR.2012 15:03:12

Reference value for High channel



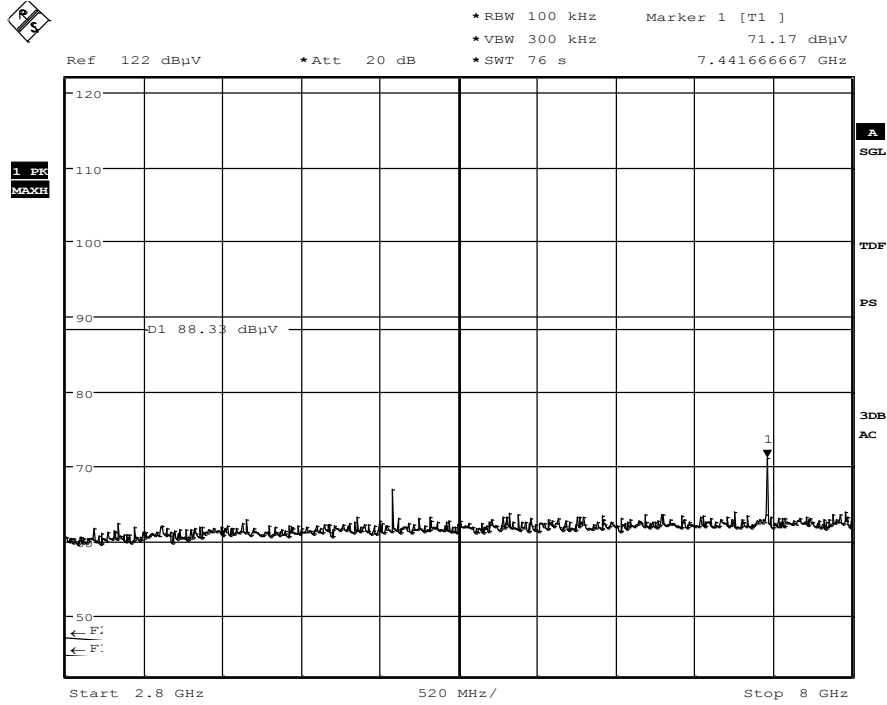
Date: 18.APR.2012 15:05:50

Sweep 1



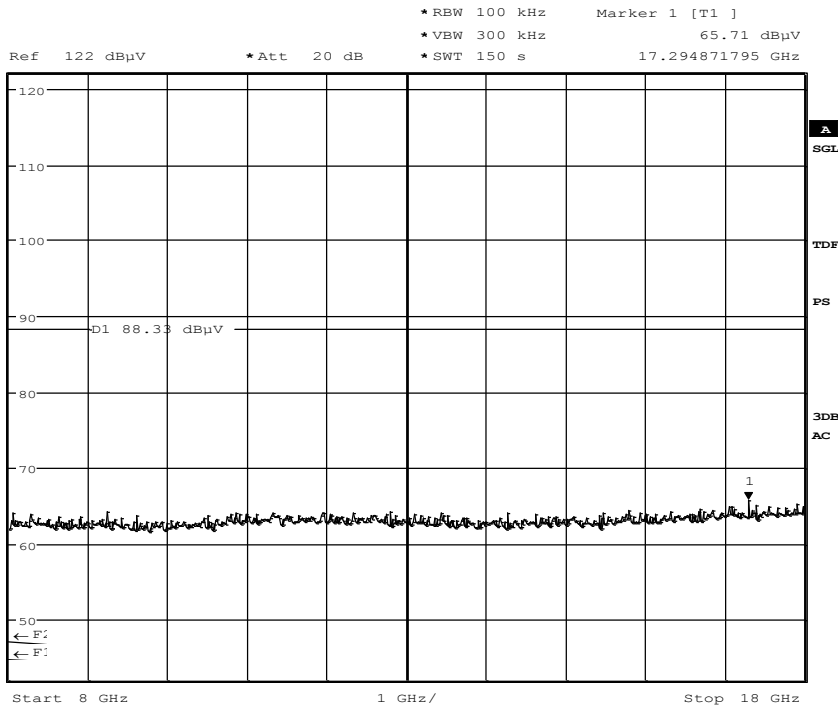
Date: 18.APR.2012 15:08:51

Sweep 2



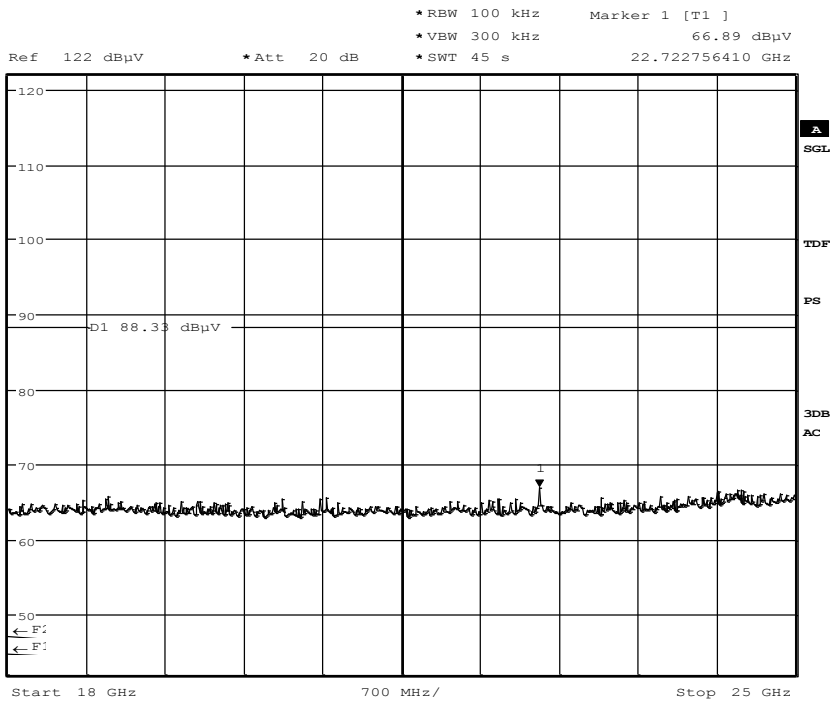
Date: 18.APR.2012 15:11:29

Sweep 3



Date: 18.APR.2012 15:15:05

Sweep 4

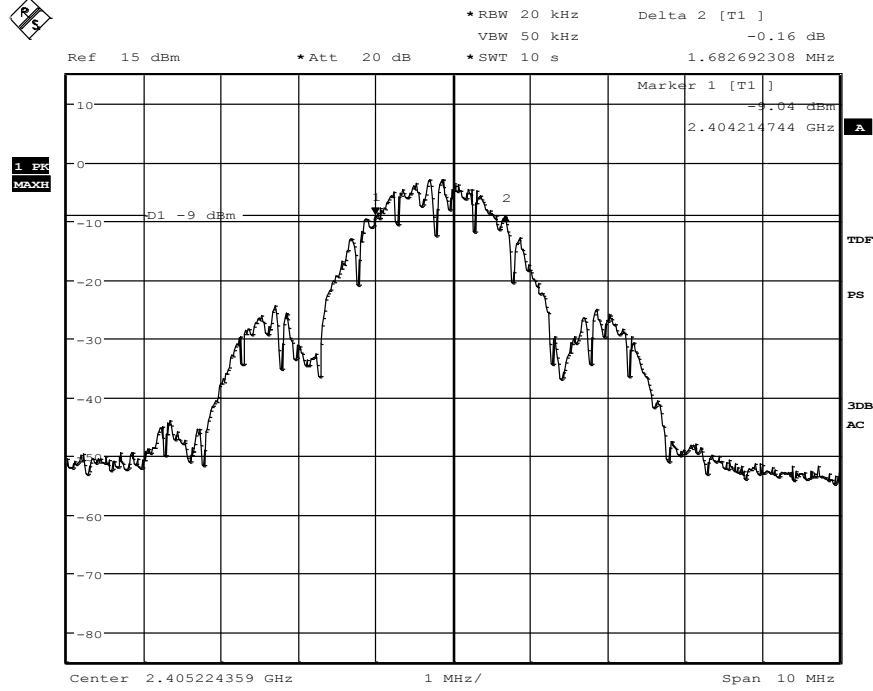


Date: 18.APR.2012 15:17:18

Sweep 5

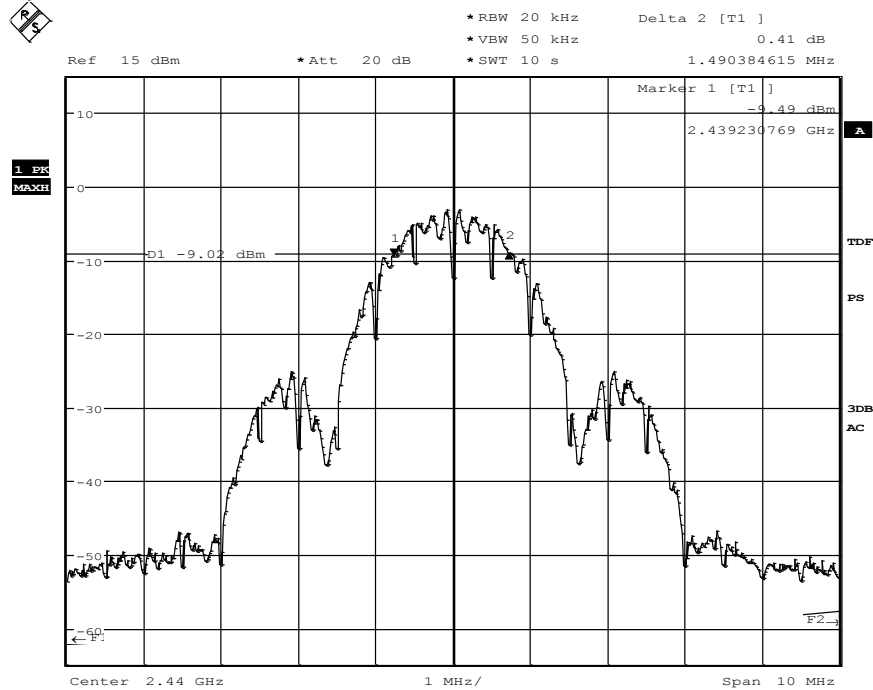
1.7. 6 dB bandwidth

13.01 low channel:



Date: 18.APR.2012 12:07:26

13.02 middle channel:



Date: 18.APR.2012 13:59:30

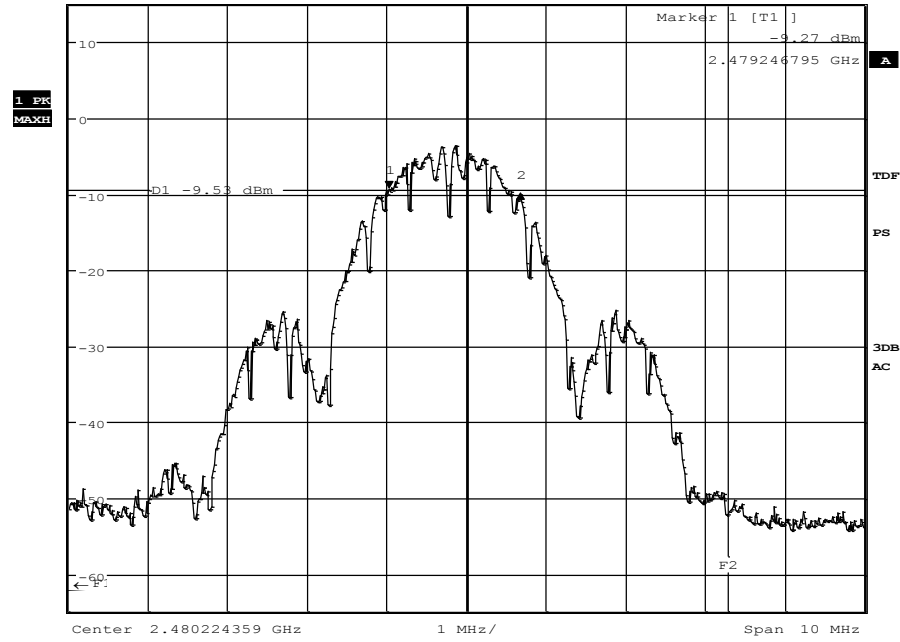
13.03 high channel:



*RBW 20 kHz Delta 2 [T1]
 *VBW 50 kHz -0.77 dB
 *SWT 10 s 1.650641026 MHz

Ref 15 dBm

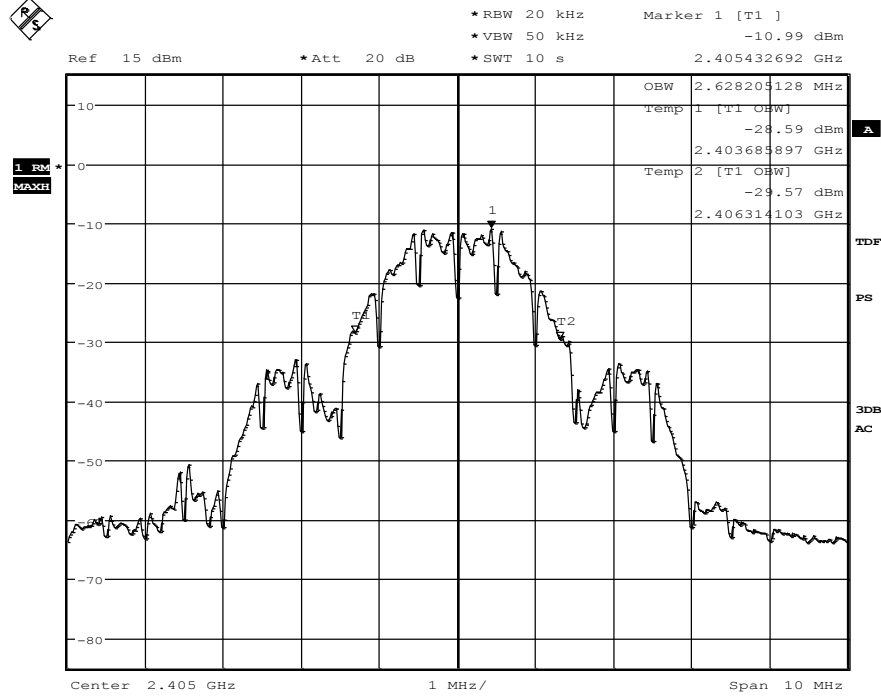
*Att 20 dB



Date: 18.APR.2012 15:58:37

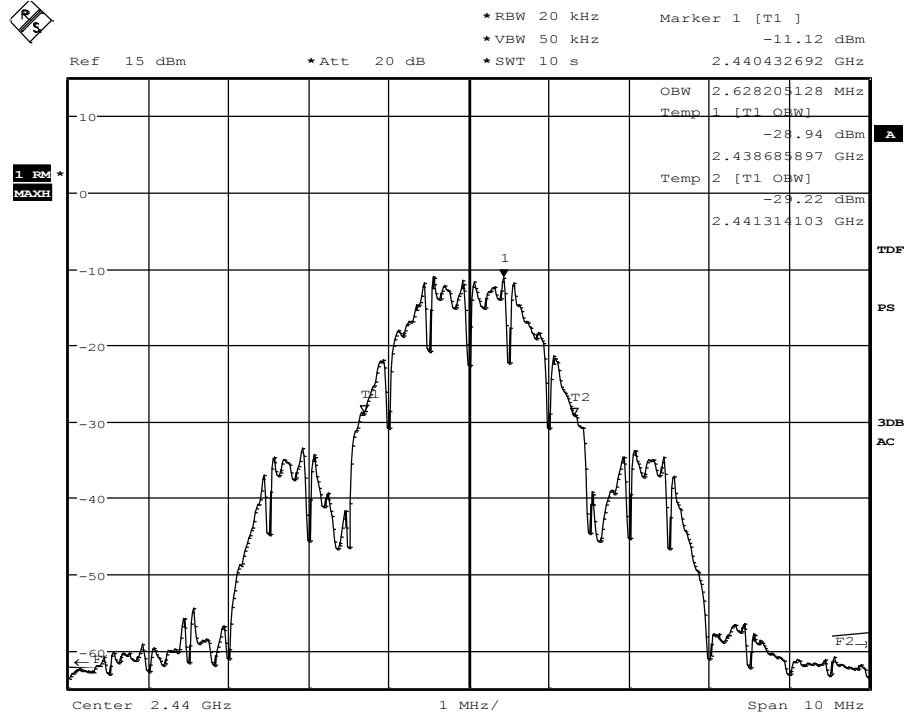
1.8. 99% Occupied bandwidth

14.01 low channel:



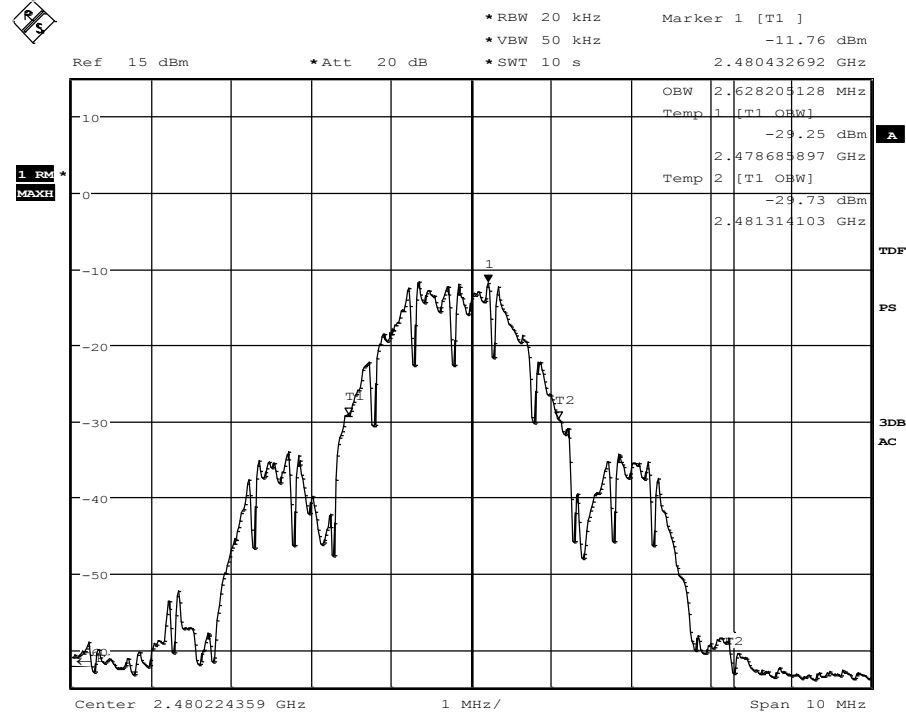
Date: 18.APR.2012 12:17:34

14.02 middle channel:



Date: 18.APR.2012 14:03:23

14.03 high channel:



Date: 18.APR.2012 16:00:12