



Product Service

Choose certainty.
Add value.

2017-09-11

Page 1 of 103

Anhang zum Prüfbericht / ANNEX to Test Report

Nr. / No TR-33368-03325-03 (Edition 2)

Applicant: Häfele GmbH & Co. KG

Type of equipment:

Type designation: BLEBox

Order No.:

Test standards: BLE interface

Note:

The test data of this report is related only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1)
DL-InfoV (Germany) at
www.tuev-sued.com/imprint

Management:
Joachim Birnhalter (CEO)
Dr. Jens Butenandt (Managing Director)

Phone: +49 9421 55 22-0
Fax: +49 9421 55 22-99
www.tuev-sued.de
TÜV®

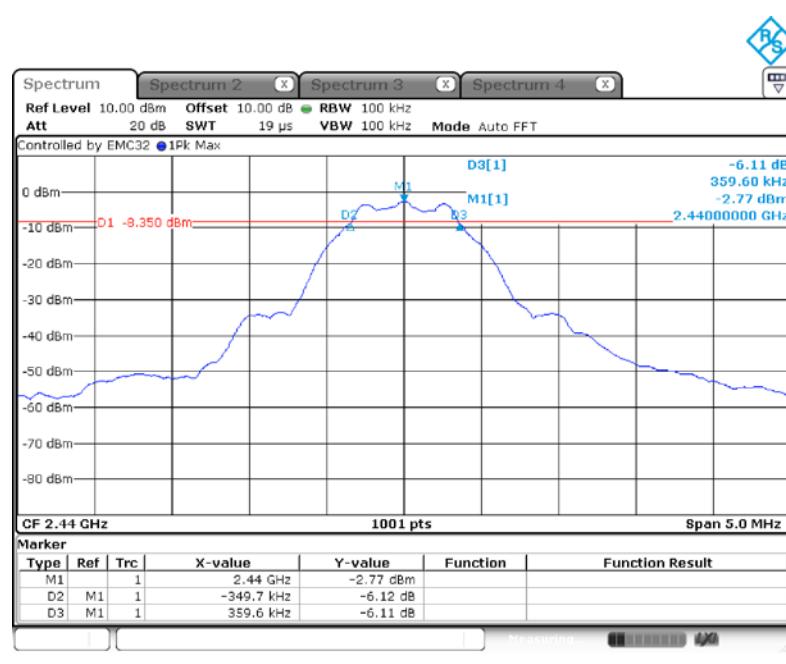
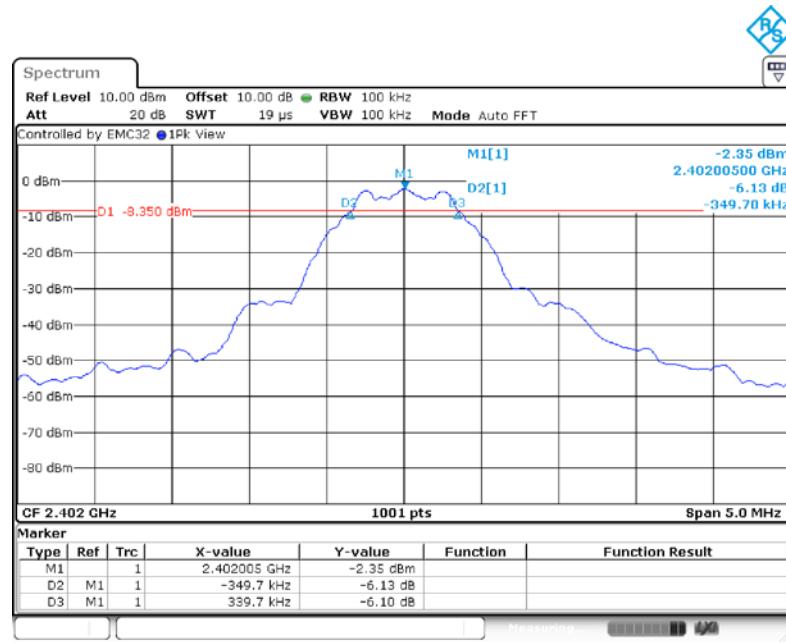
TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

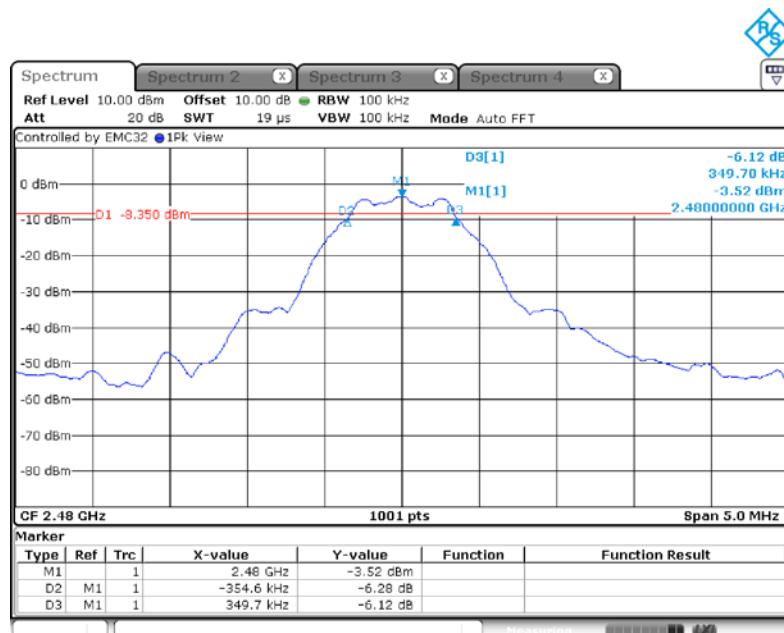
Table of Contents

1	Plots for 6 dB / DTS bandwidth	3
1.1	Test plots for Bluetooth Low Energy (BLE)	3
1.2	Test plots for Proprietary radio.....	5
2	Plots for Occupied Bandwidth (99 %).....	7
2.1	Test plots for Bluetooth Low Energy (BLE)	7
2.2	Test plots for Proprietary radio.....	9
3	Plots for Restricted Bands of Operation Requirement.....	11
3.1	Test plots for Bluetooth Low Energy (BLE)	11
3.2	Test plots for Proprietary Radio	16
4	Power Spectral Density	20
4.1	Test plots for Bluetooth Low Energy (BLE)	20
4.2	Test plots for Proprietary radio.....	21
5	Maximum Output Power.....	24
5.1	Test plots for Bluetooth Low Energy (BLE)	24
5.2	Test plots for Proprietary Radio	26
6	Conducted Powerline Emissions 150 kHz – 30 MHz.....	28
6.1	Test plots for 12 V power adapter.....	28
6.2	Test plots for 24 V power adapter.....	30
7	Plots for Conducted Emissions 30 MHz – 30 MHz.....	32
7.1	Test plots Bluetooth Low Energy (BLE)	32
7.2	Test plots for Proprietary Radio	34
8	Plots for Radiated Emissions 9 kHz – 30 MHz	36
8.1	Test plots for Bluetooth Low Energy (BLE)	36
8.2	Test plots for Proprietary Radio	42
9	Plots for Radiated Emissions 30 MHz – 25 GHz	48
9.1	Test plots for Bluetooth Low Energy (BLE)	48
9.2	Test plots for Proprietary radio.....	76
10	Revision History	103

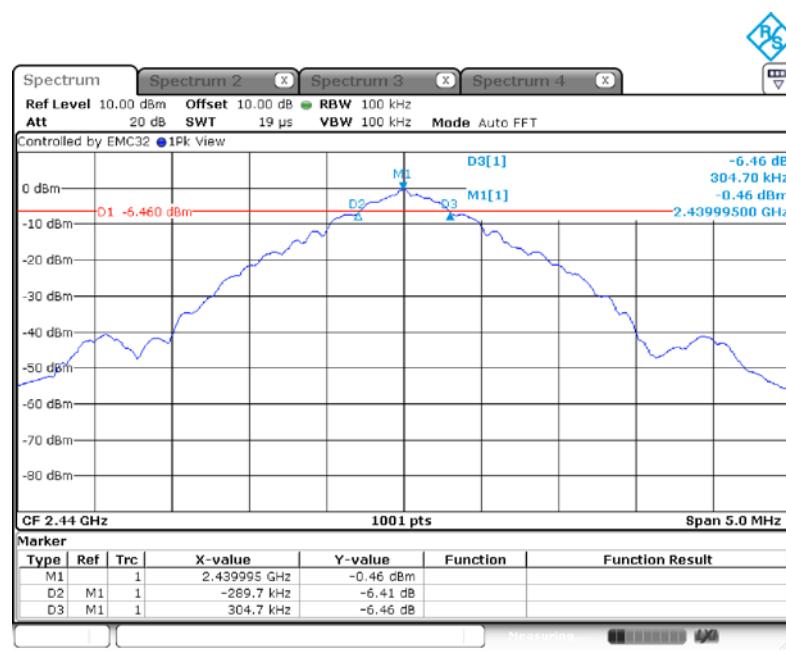
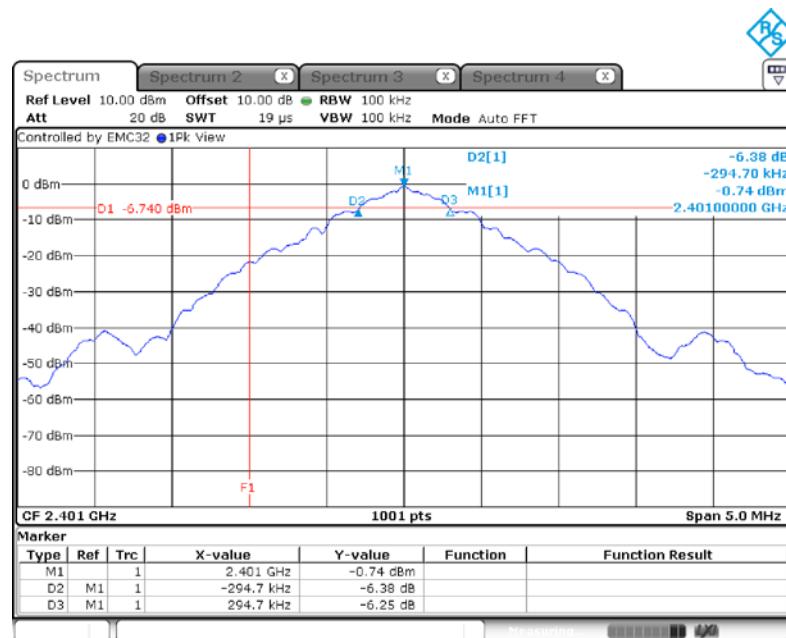
1 Plots for 6 dB / DTS bandwidth

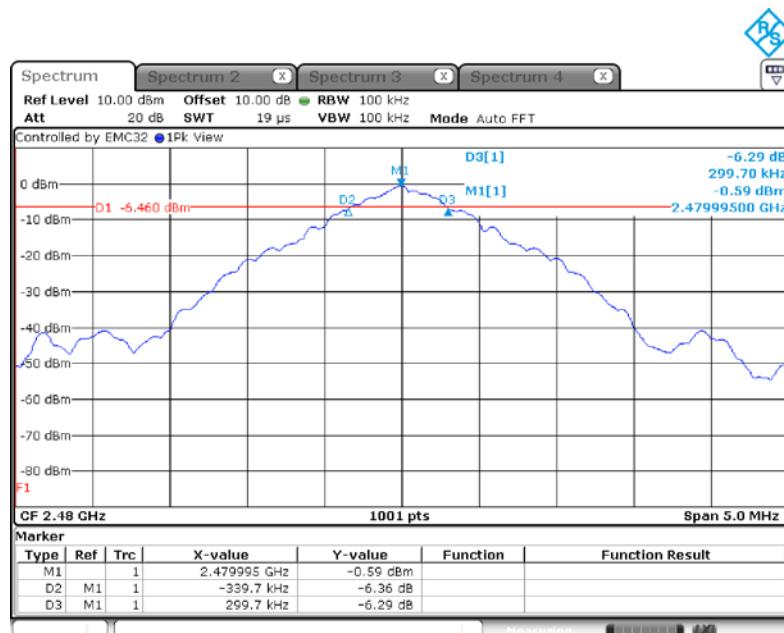
1.1 Test plots for Bluetooth Low Energy (BLE)





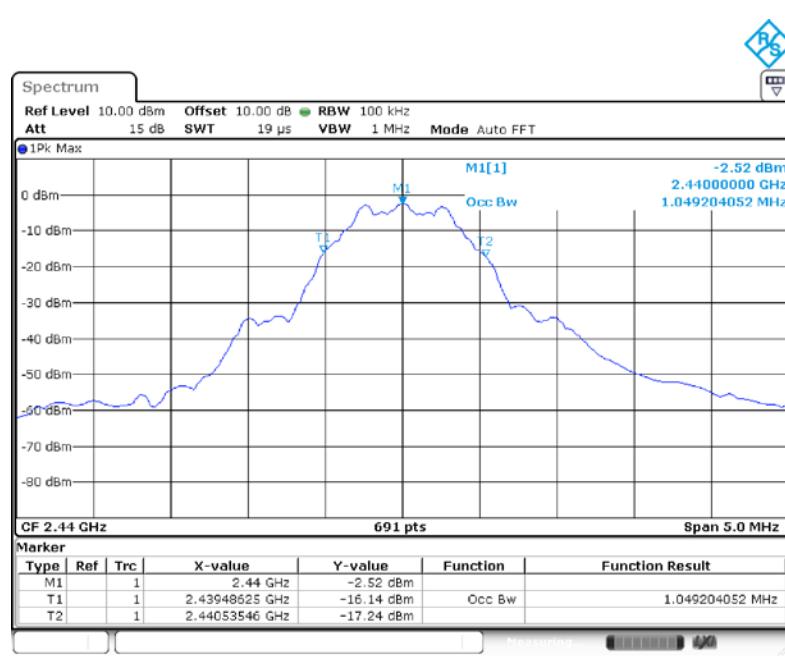
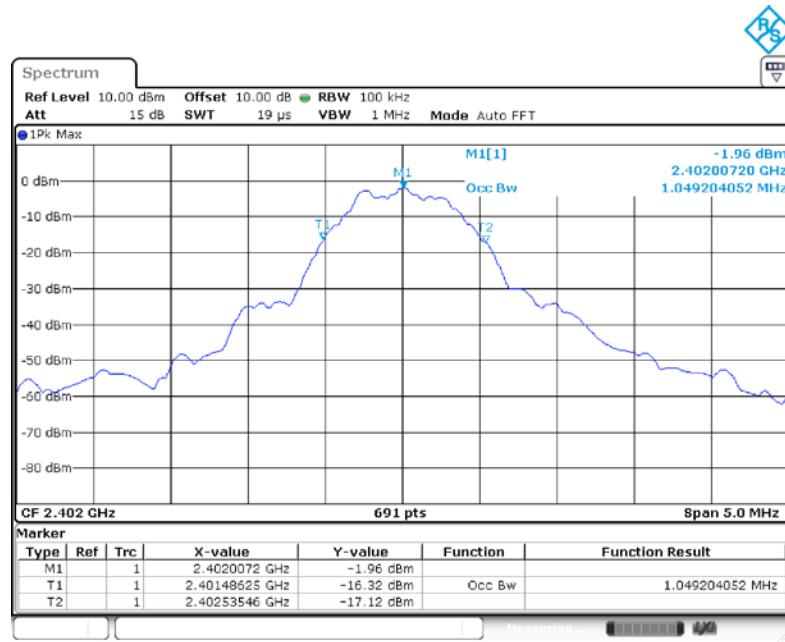
1.2 Test plots for Proprietary radio

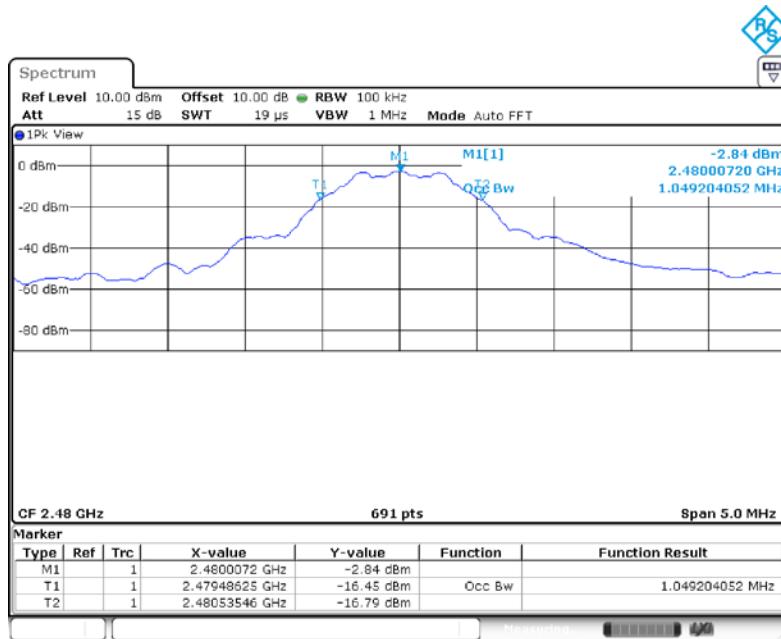




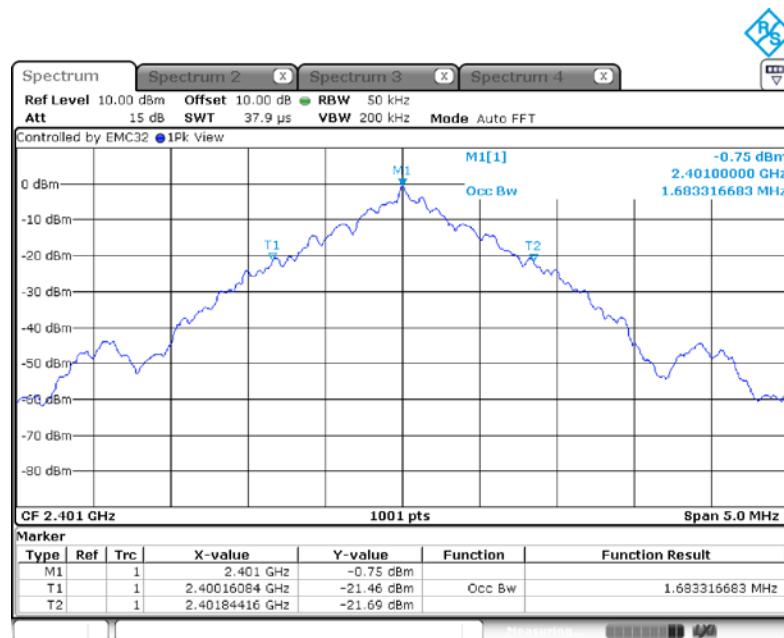
2 Plots for Occupied Bandwidth (99 %)

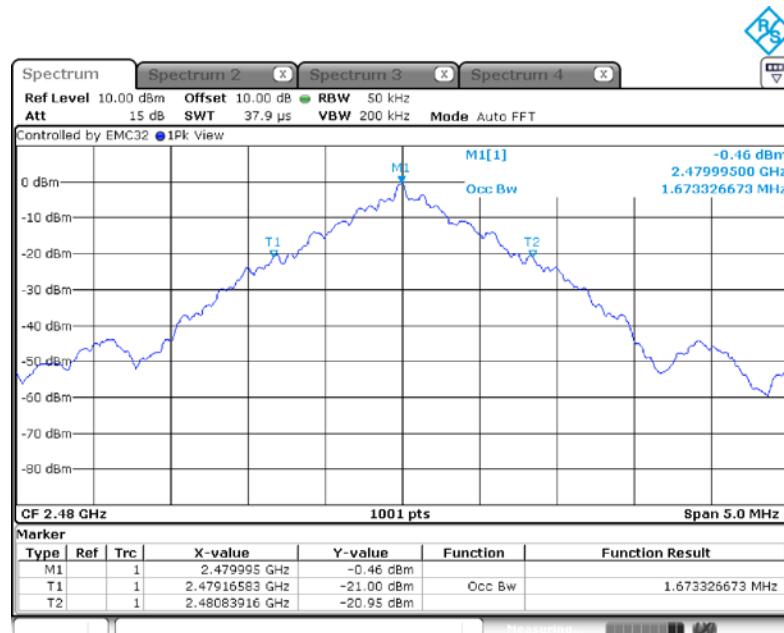
2.1 Test plots for Bluetooth Low Energy (BLE)





2.2 Test plots for Proprietary radio



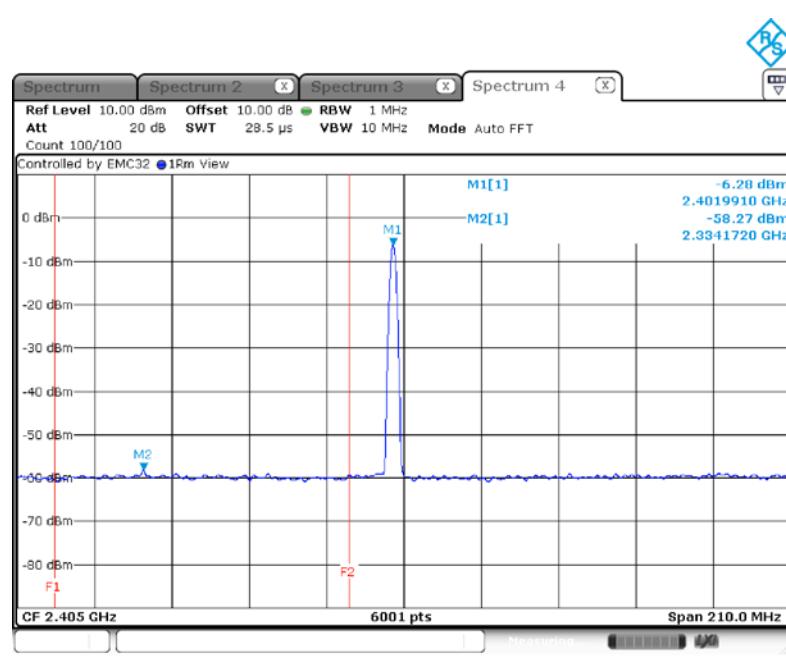
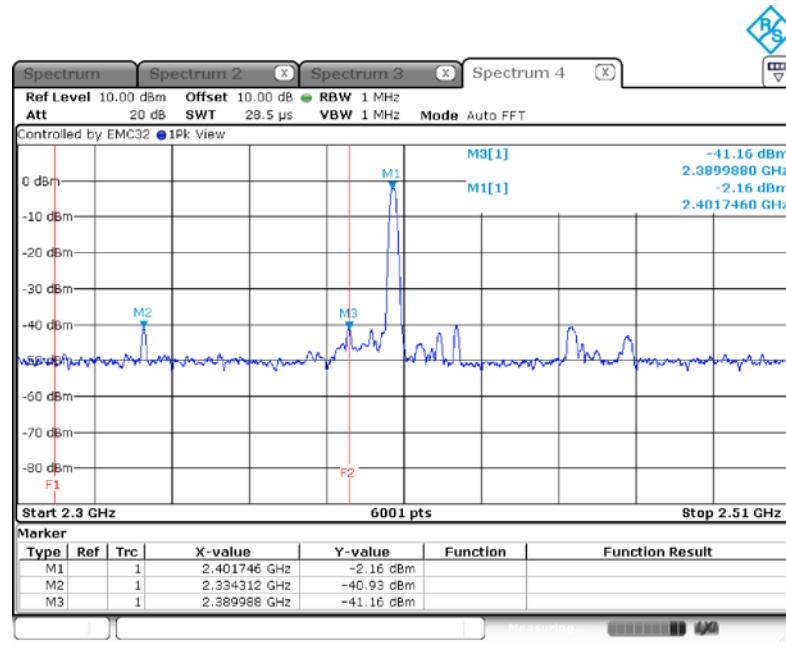


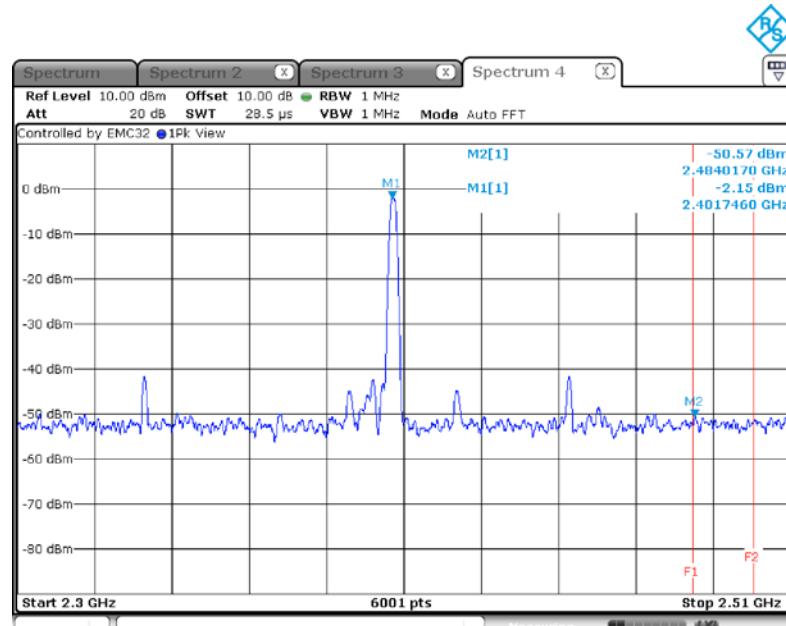
Date: 21.AUG.2017 14:58:51

3 Plots for Restricted Bands of Operation Requirement

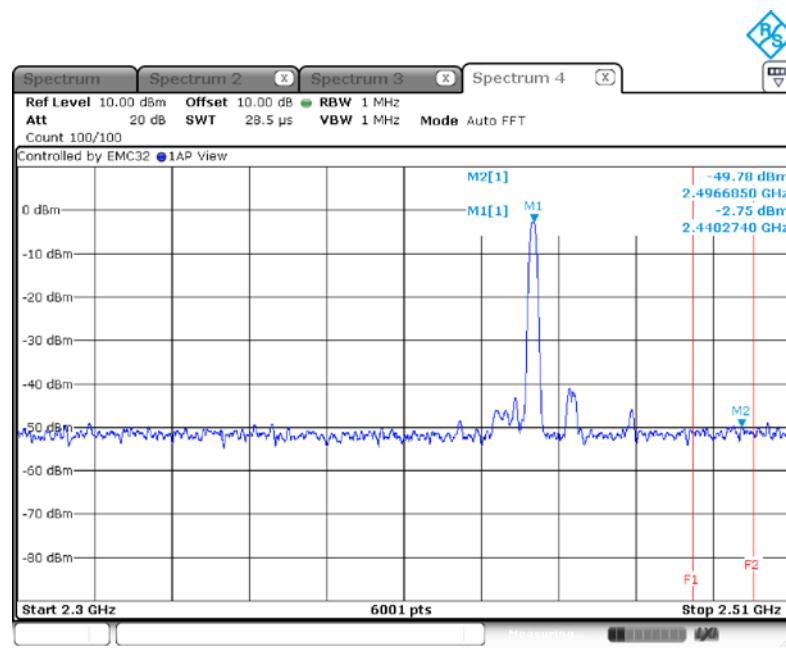
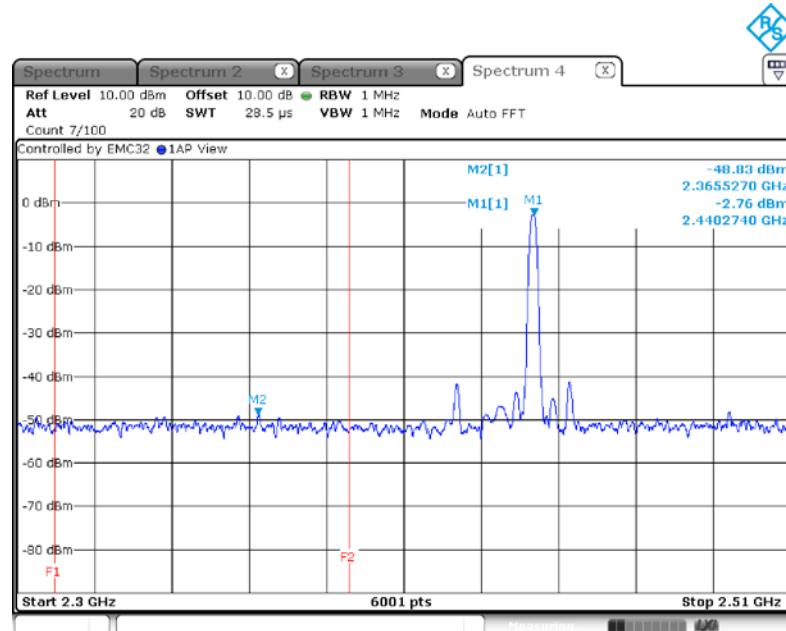
3.1 Test plots for Bluetooth Low Energy (BLE)

3.1.1 Lowest Channel

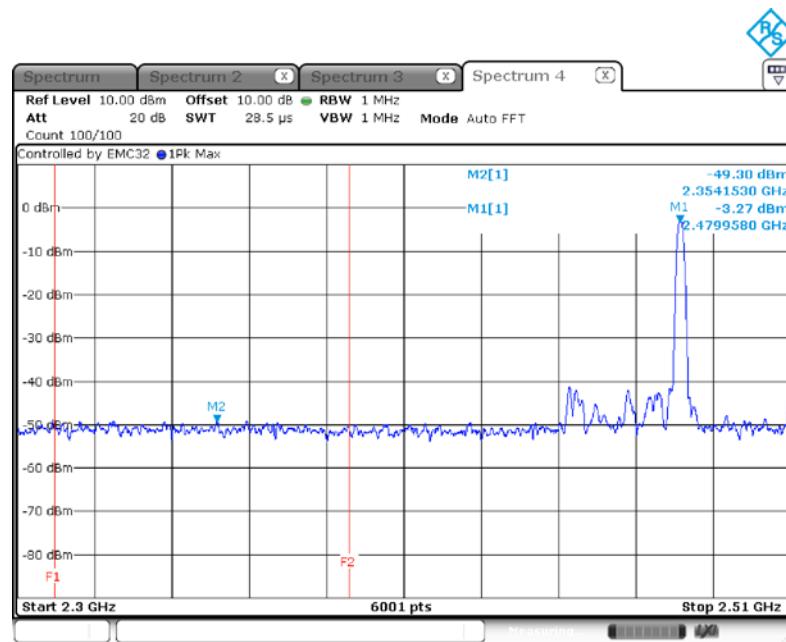




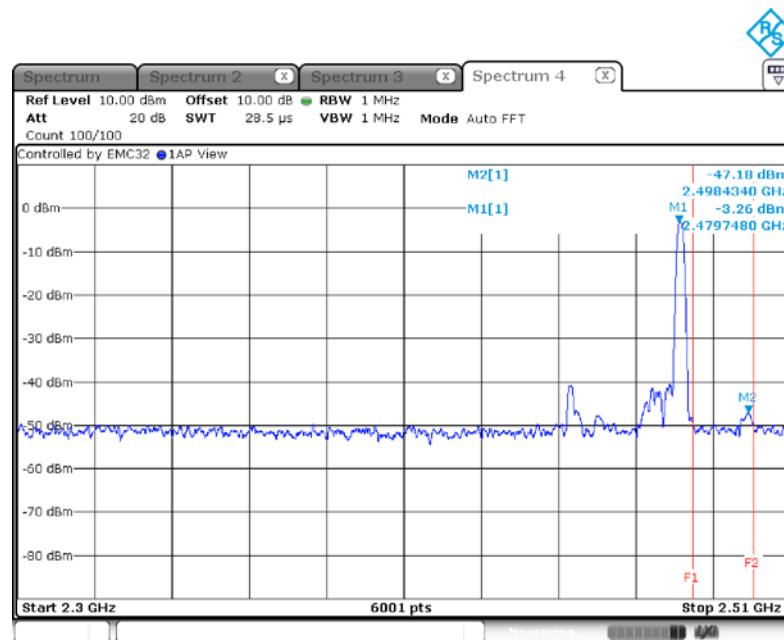
3.1.2 Middle Channel



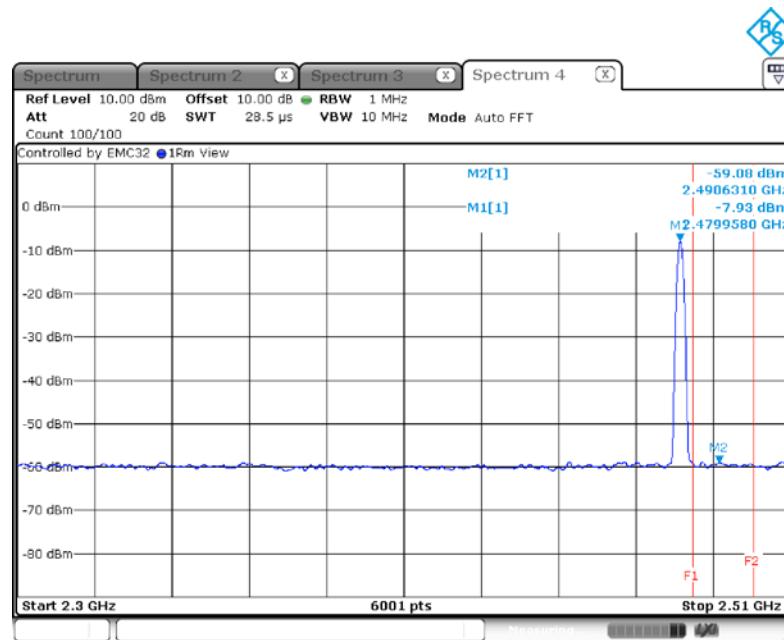
3.1.3 Highest Channel



Date: 20 JUL. 2017 16:37:13



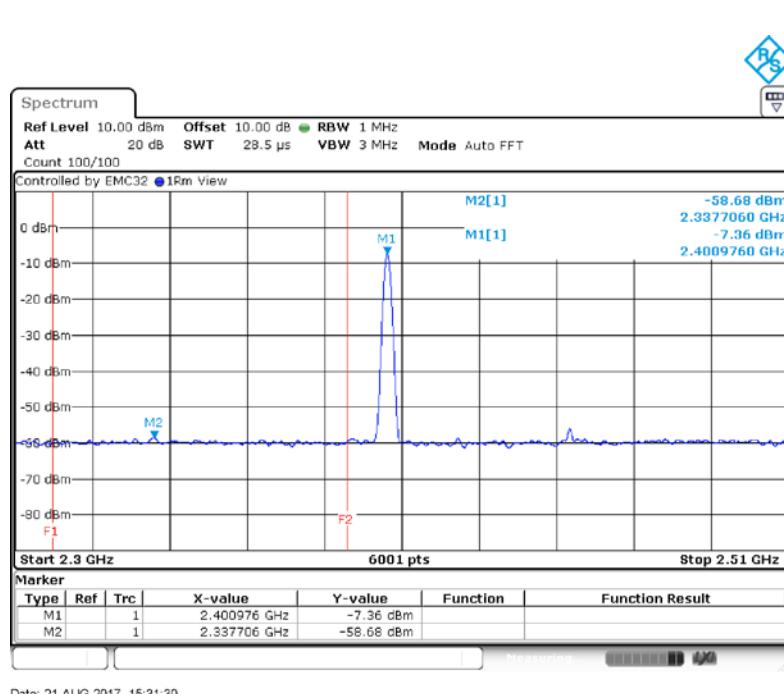
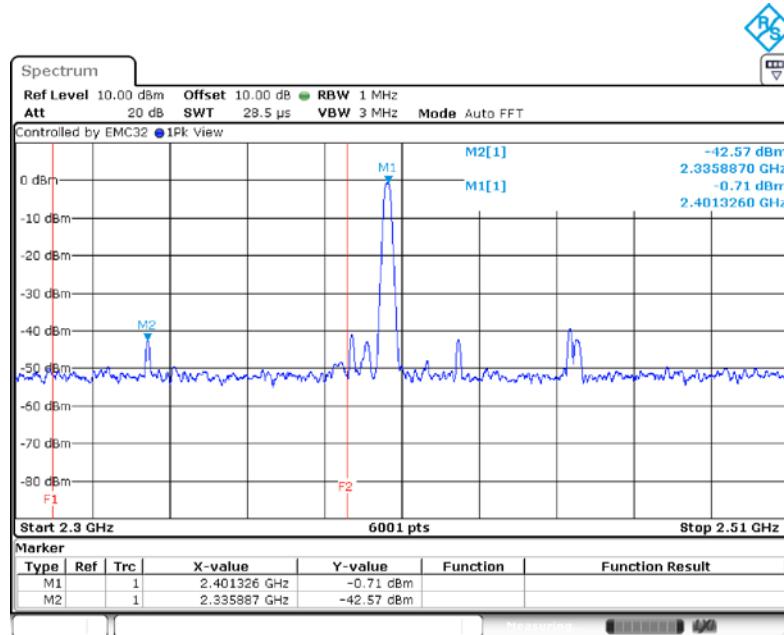
Date: 20 JUL 2017 16:32:25

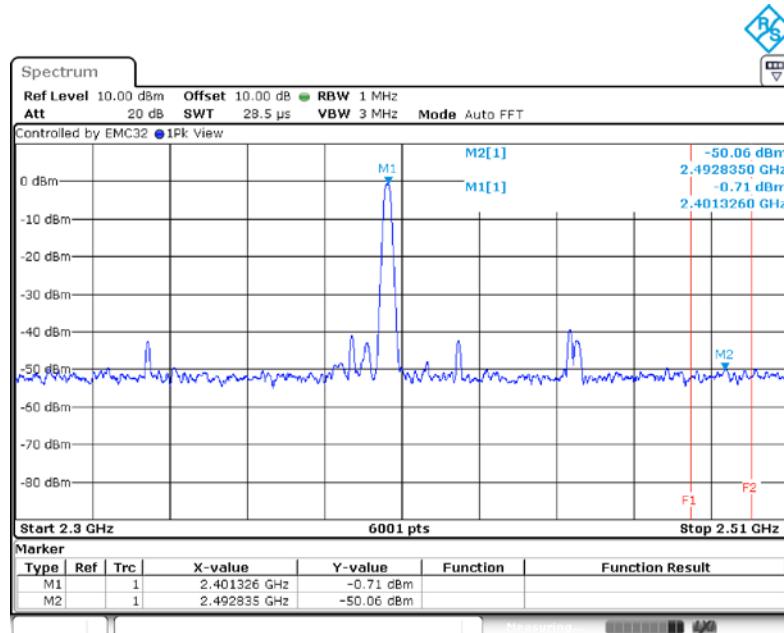


Date: 20 JUL 2017 16:36:20

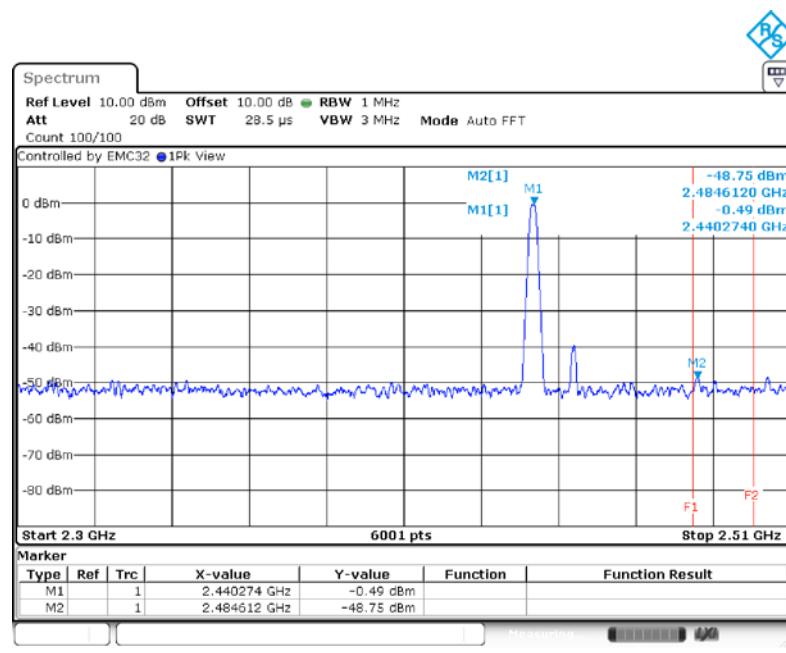
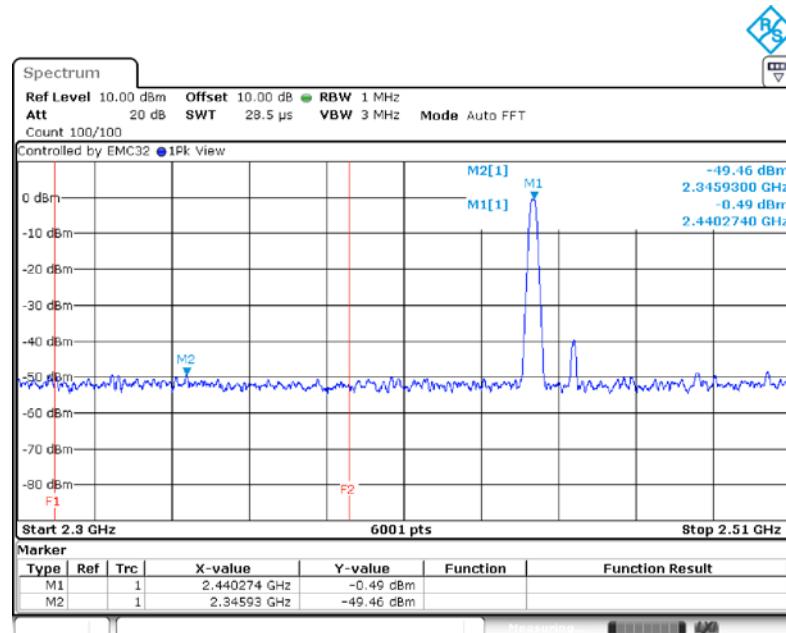
3.2 Test plots for Proprietary Radio

3.2.1 Lowest Channel

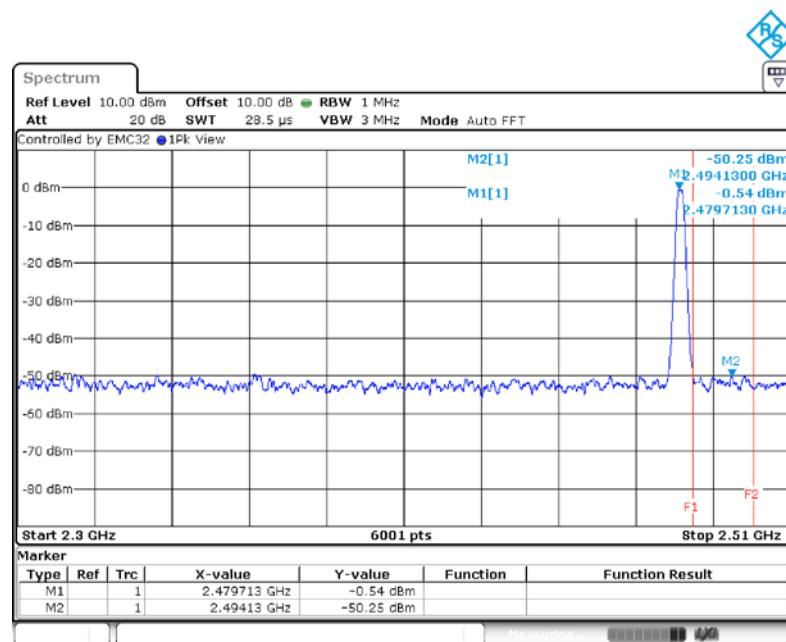
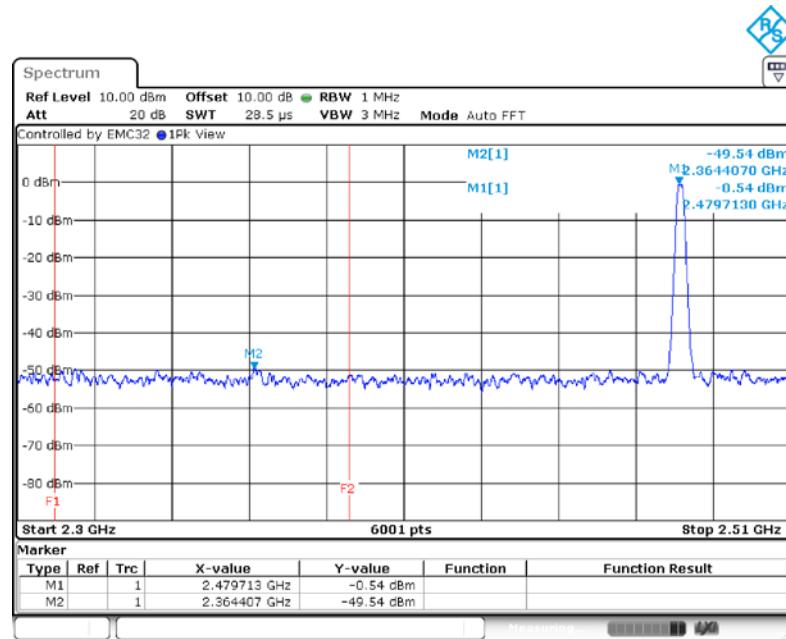




3.2.2 Middle Channel



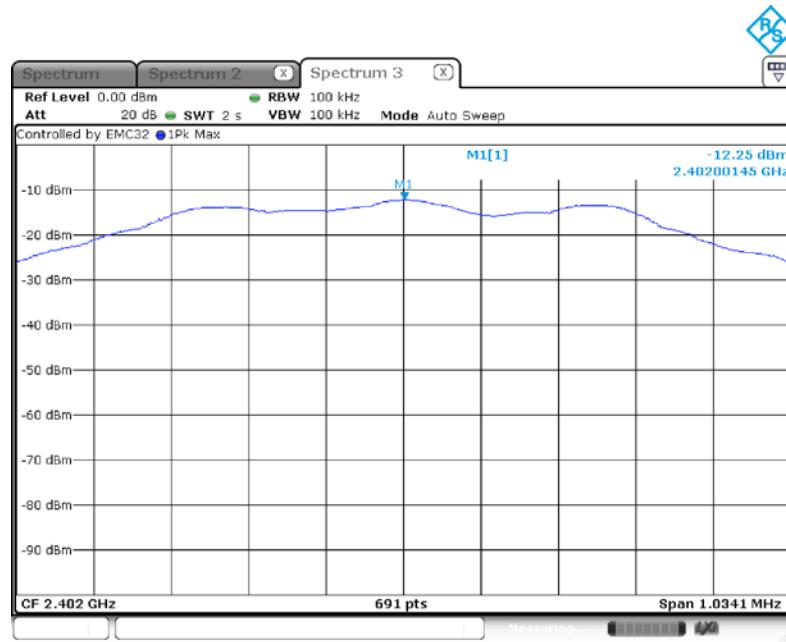
3.2.3 Highest Channel



4 Power Spectral Density

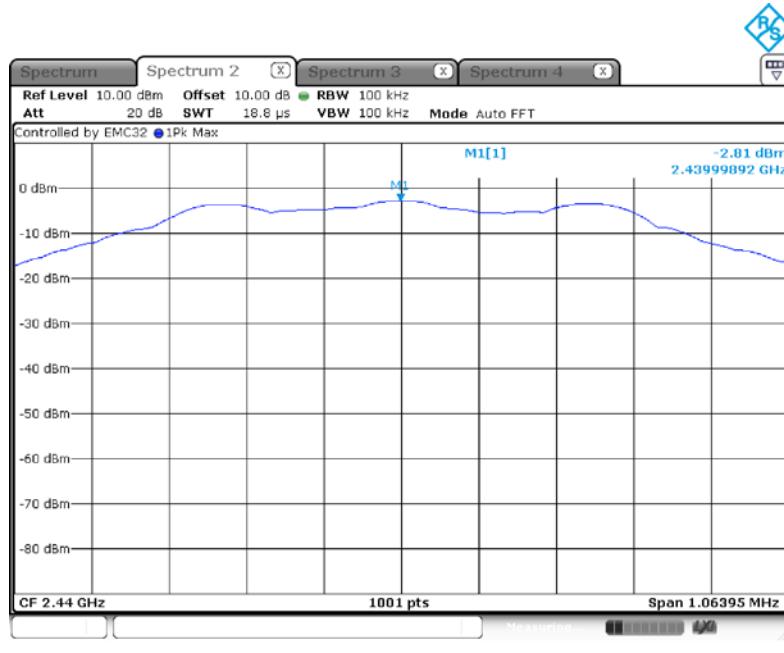
4.1 Test plots for Bluetooth Low Energy (BLE)

4.1.1 Lowest channel

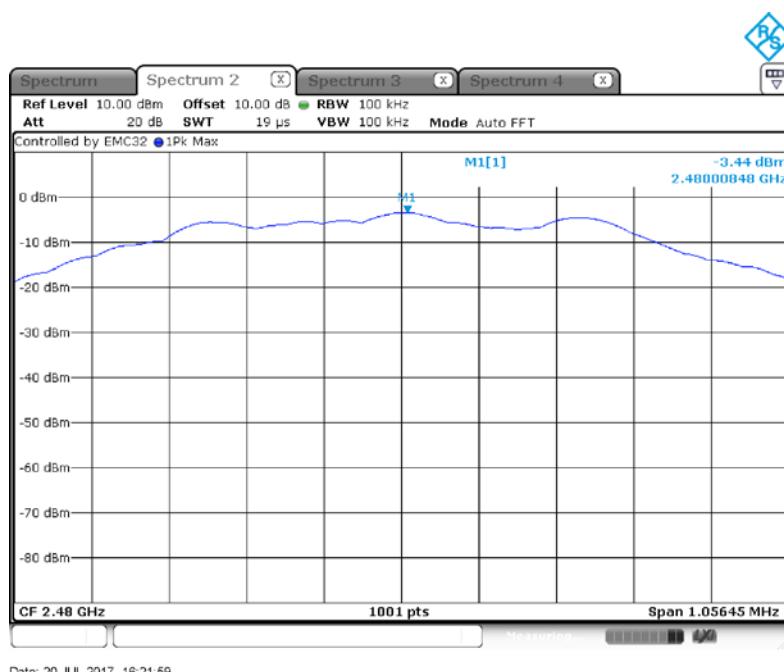


Note: Offset of 10 dB added to measurement value manually

4.1.2 Middle channel

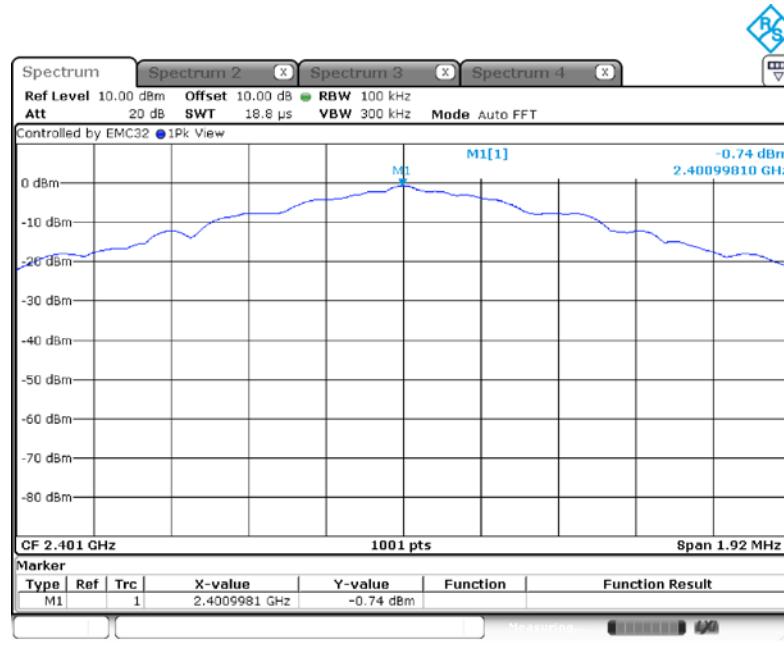


4.1.3 Highest channel

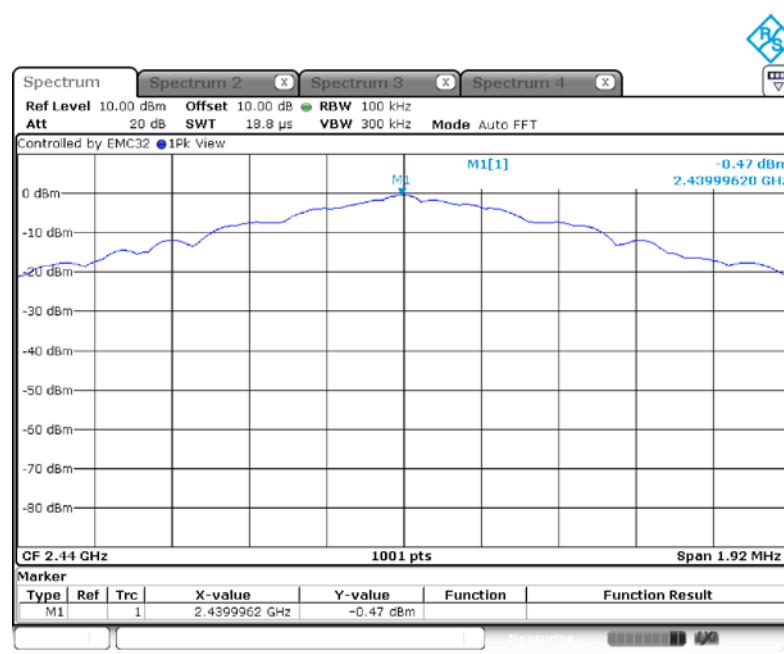


4.2 Test plots for Proprietary radio

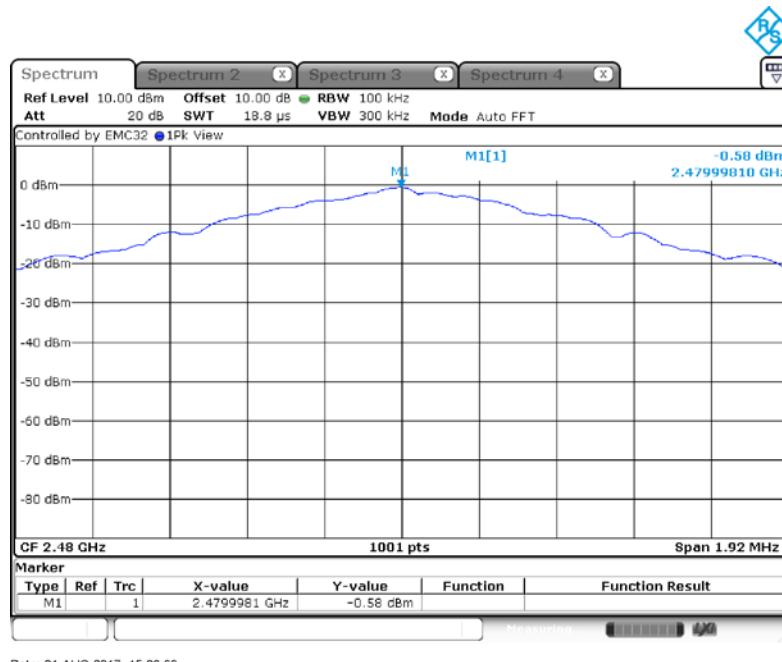
4.2.1 Lowest channel



4.2.2 Middle channel



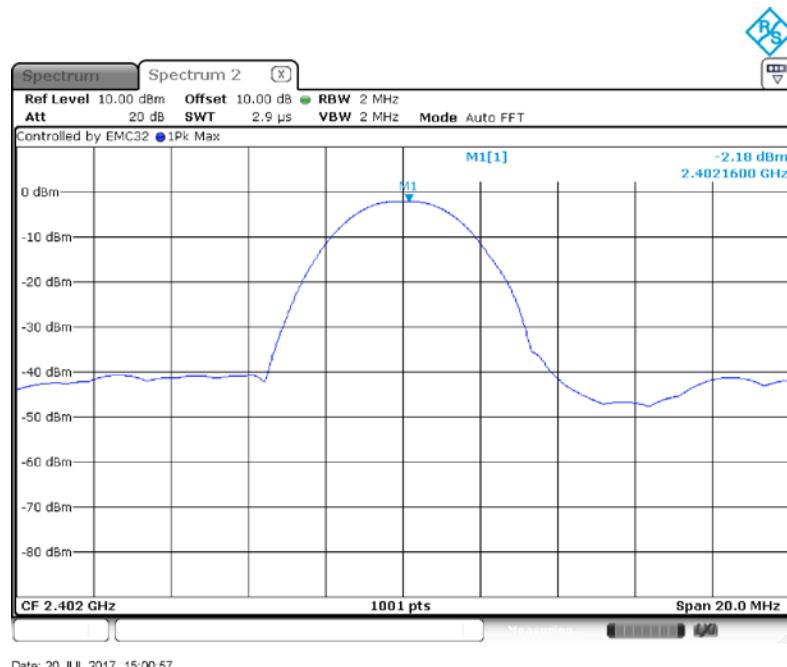
4.2.3 Highest channel



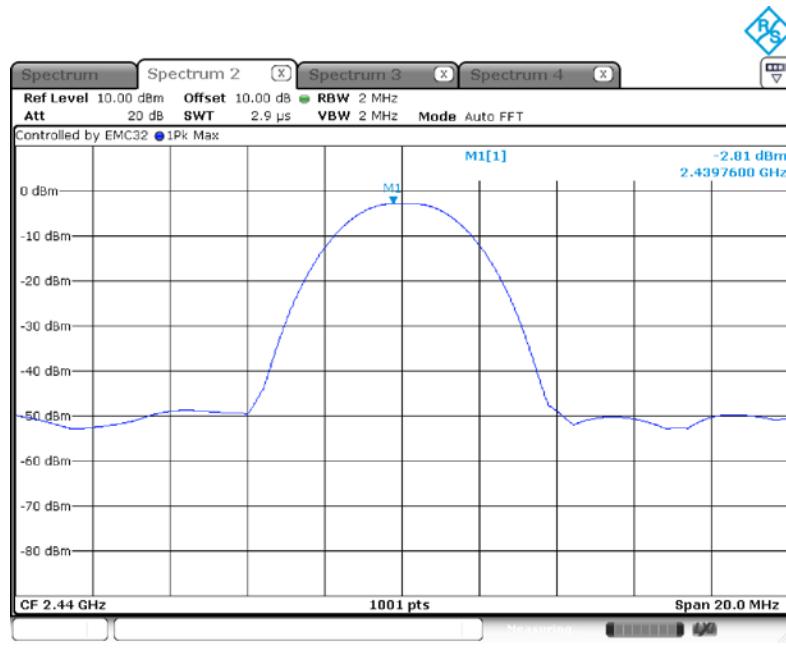
5 Maximum Output Power

5.1 Test plots for Bluetooth Low Energy (BLE)

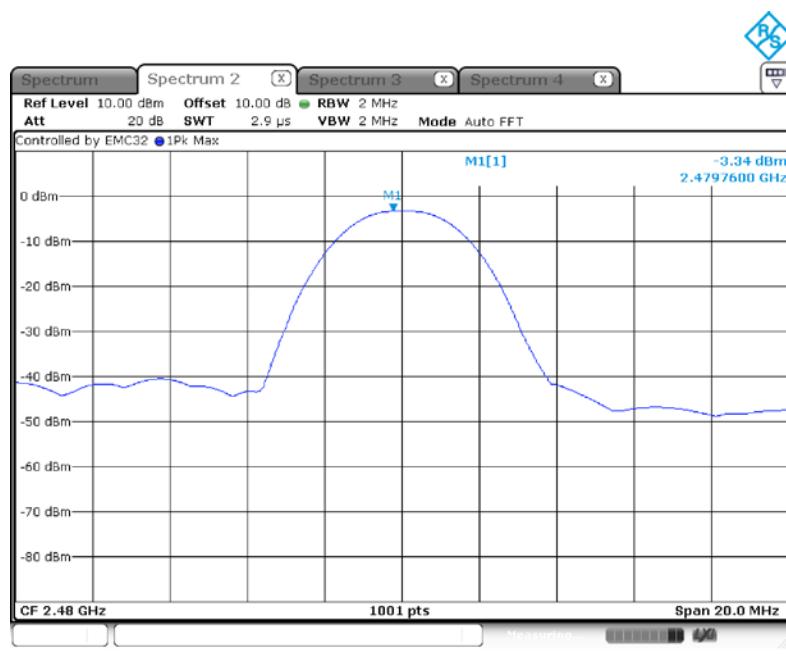
5.1.1 Lowest Channel



5.1.2 Middle Channel

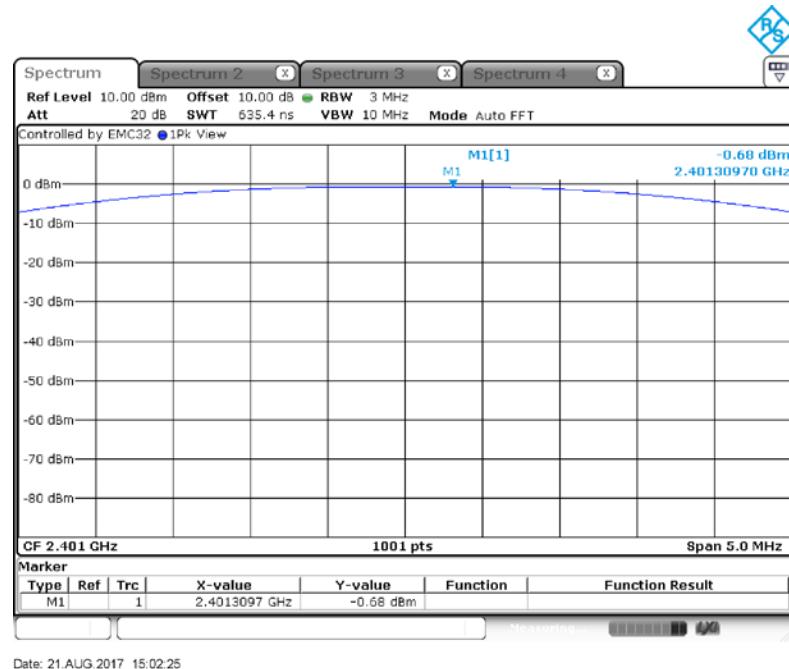


5.1.3 Highest Channel

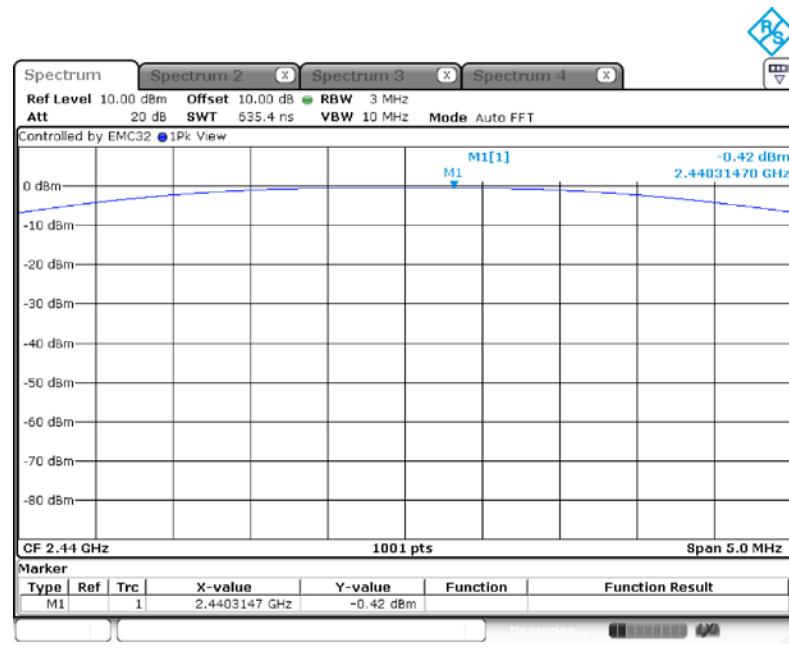


5.2 Test plots for Proprietary Radio

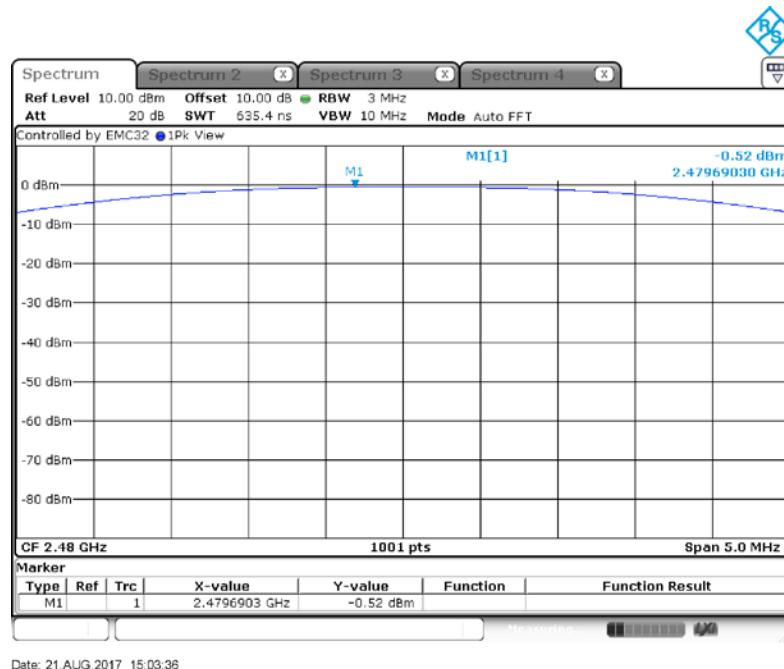
5.2.1 Lowest Channel



5.2.2 Middle Channel



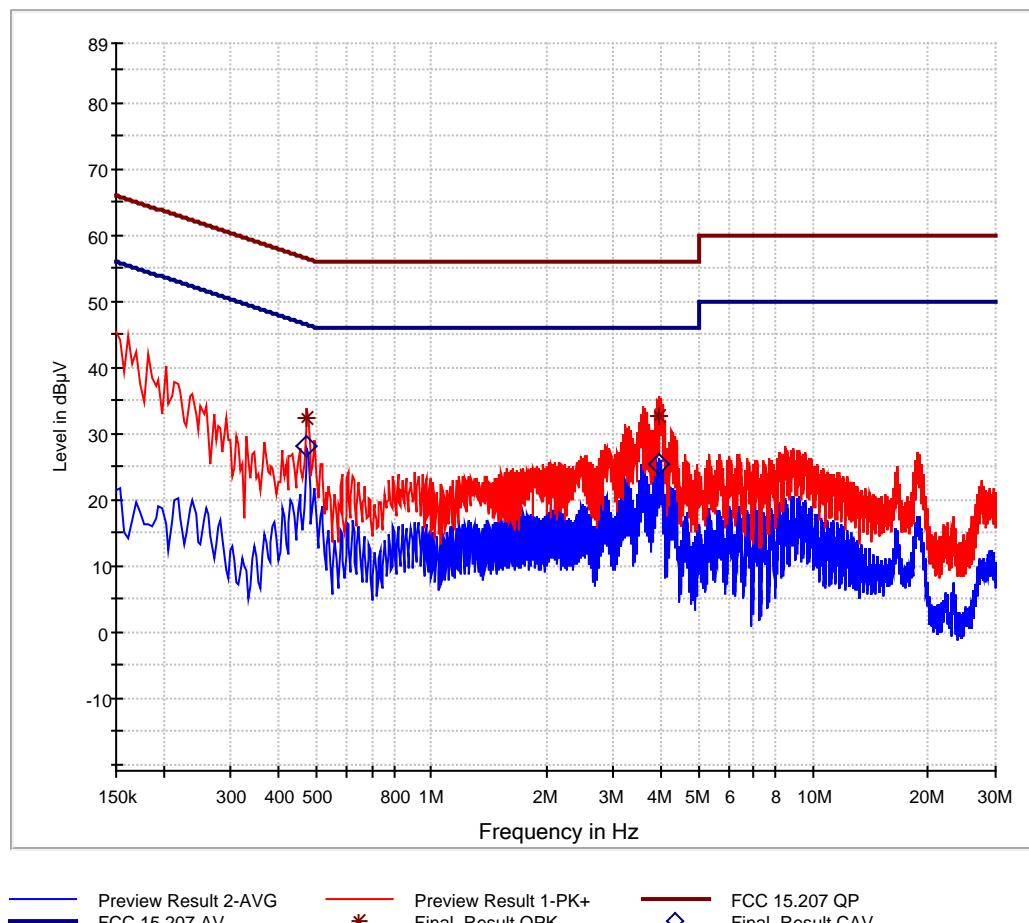
5.2.3 Highest Channel



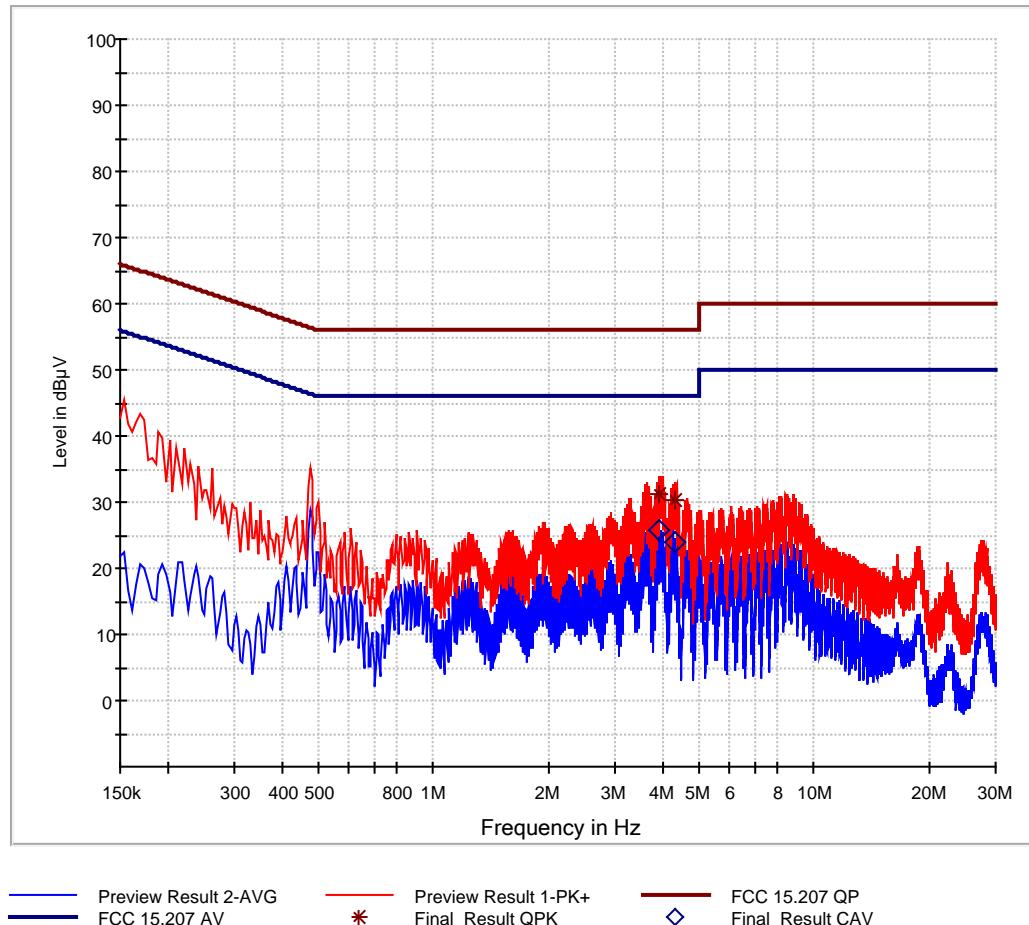
6 Conducted Powerline Emissions 150 kHz – 30 MHz

6.1 Test plots for 12 V power adapter

6.1.1.1 Phase L1

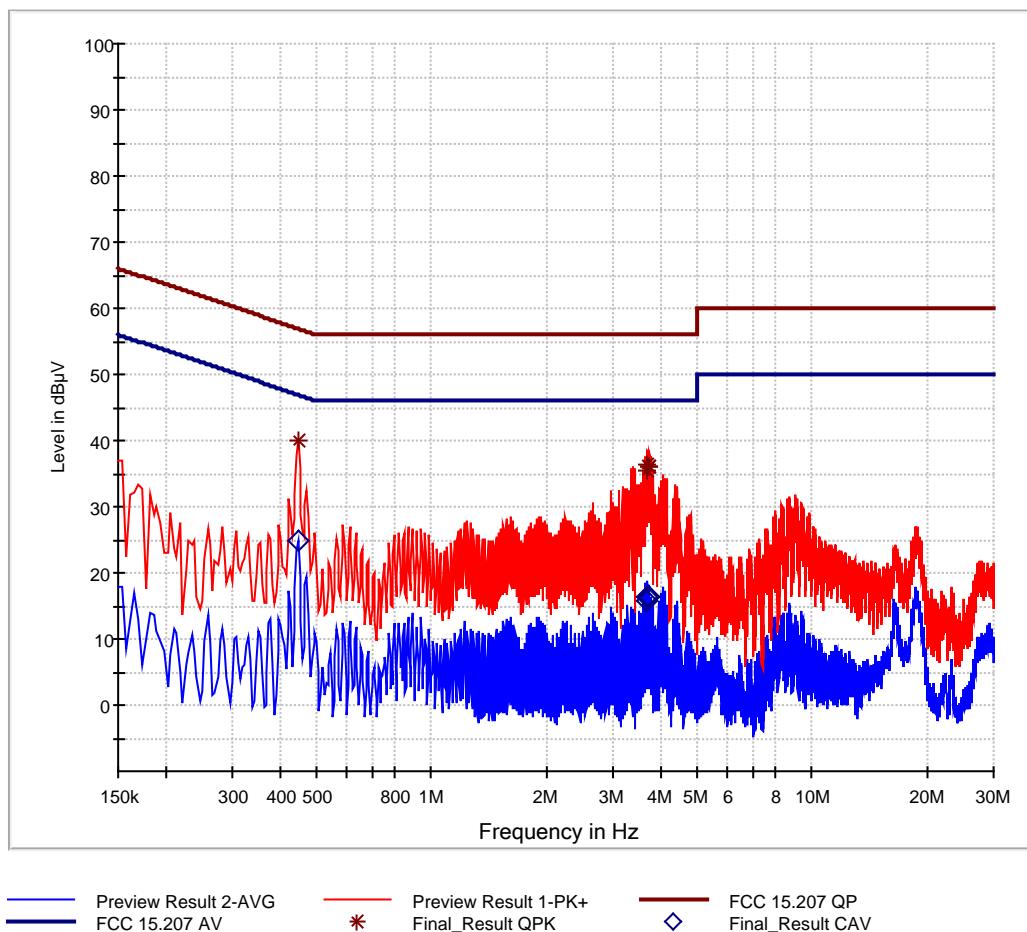


6.1.1.2 Phase N

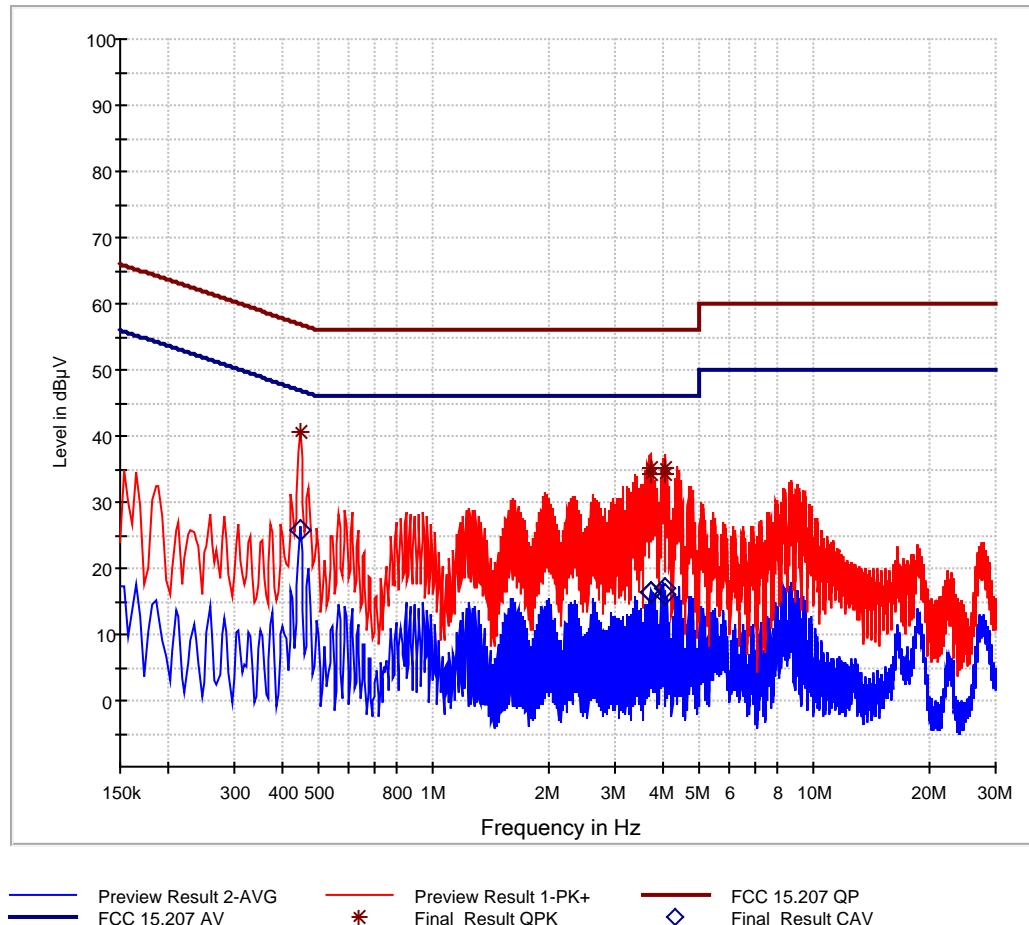


6.2 Test plots for 24 V power adapter

6.2.1.1 Phase L1



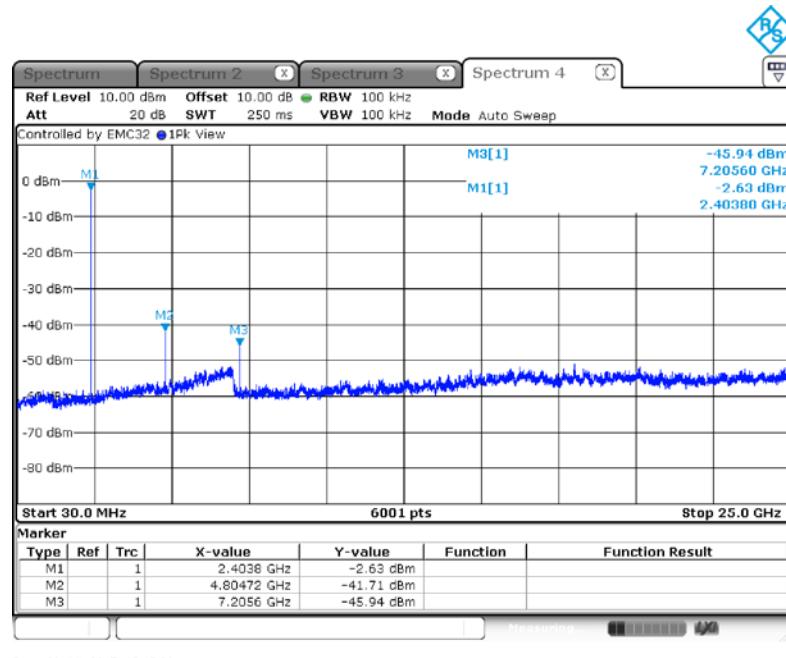
6.2.1.2 Phase N



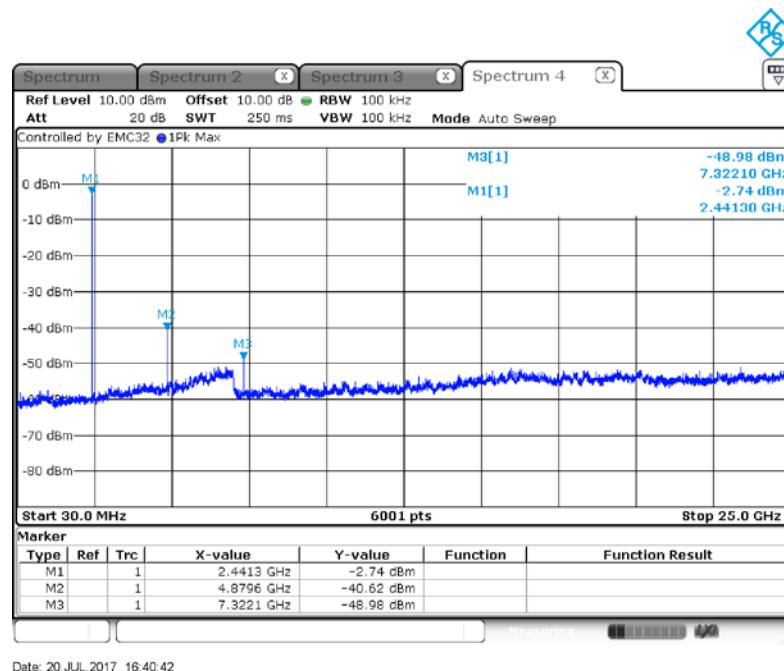
7 Plots for Conducted Emissions 30 MHz – 30 MHz

7.1 Test plots Bluetooth Low Energy (BLE)

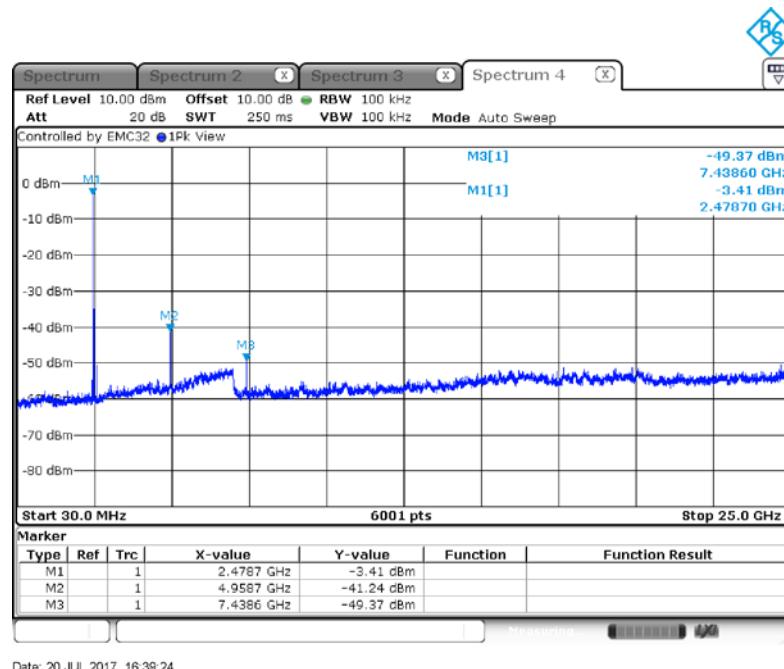
7.1.1 Lowest Channel



7.1.2 Middle Channel

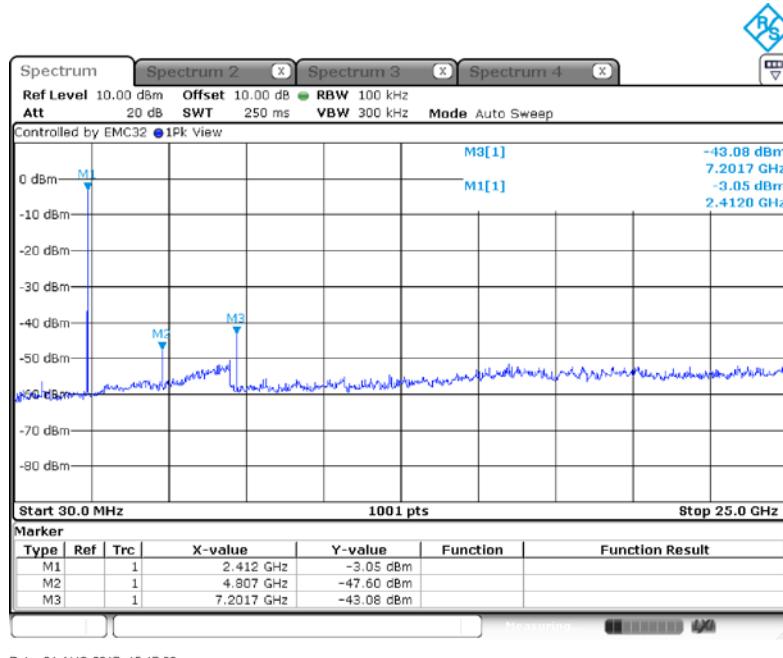


7.1.3 Highest Channel

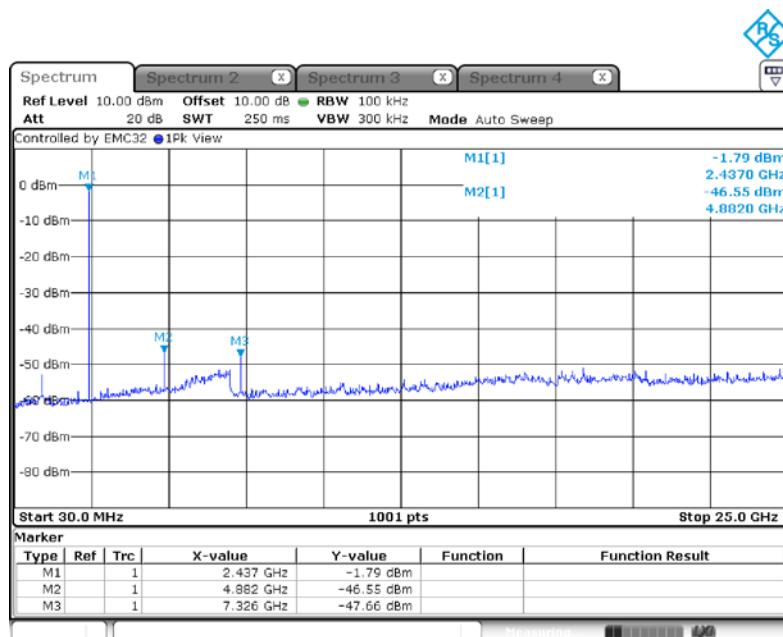


7.2 Test plots for Proprietary Radio

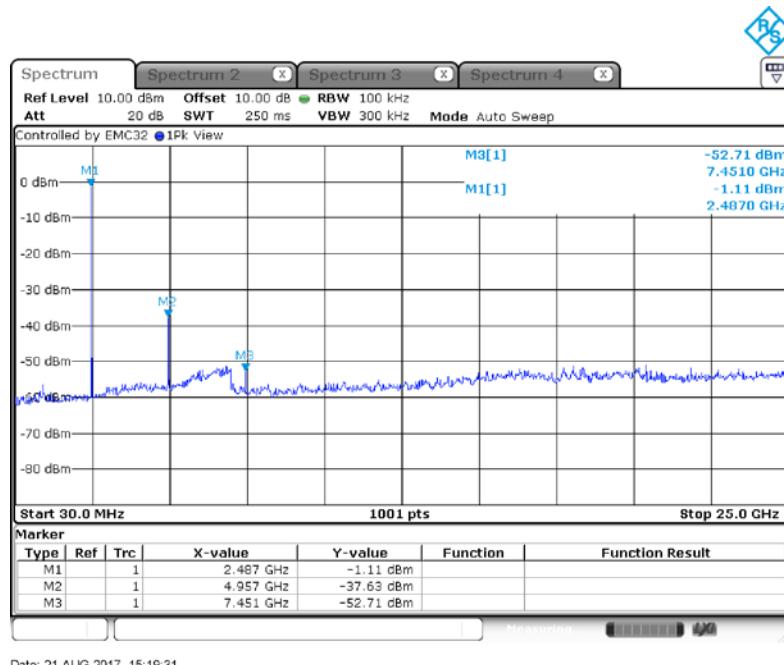
7.2.1 Lowest Channel



7.2.2 Middle Channel



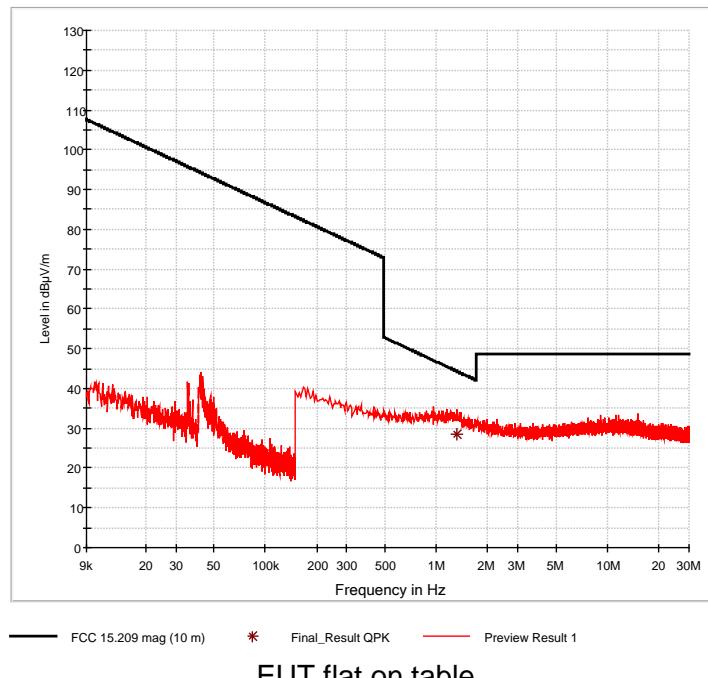
7.2.3 Highest Channel

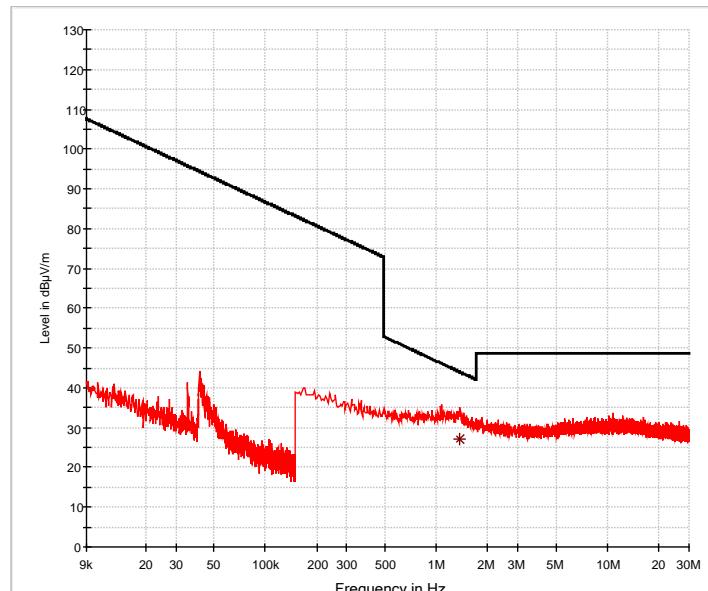


8 Plots for Radiated Emissions 9 kHz – 30 MHz

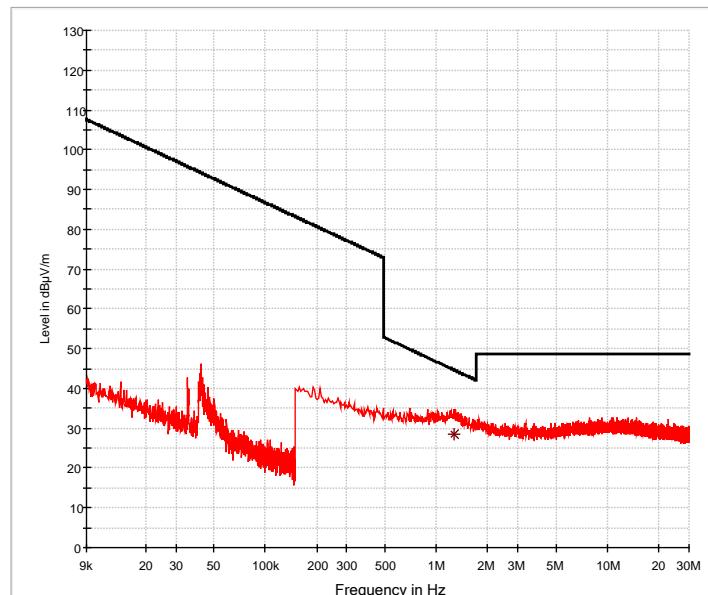
8.1 Test plots for Bluetooth Low Energy (BLE)

8.1.1 Lowest Channel



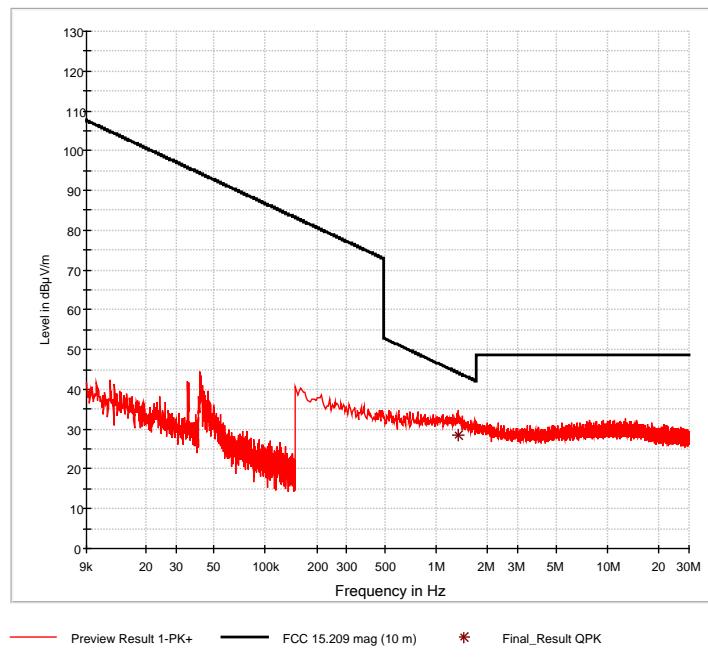


EUT on long side

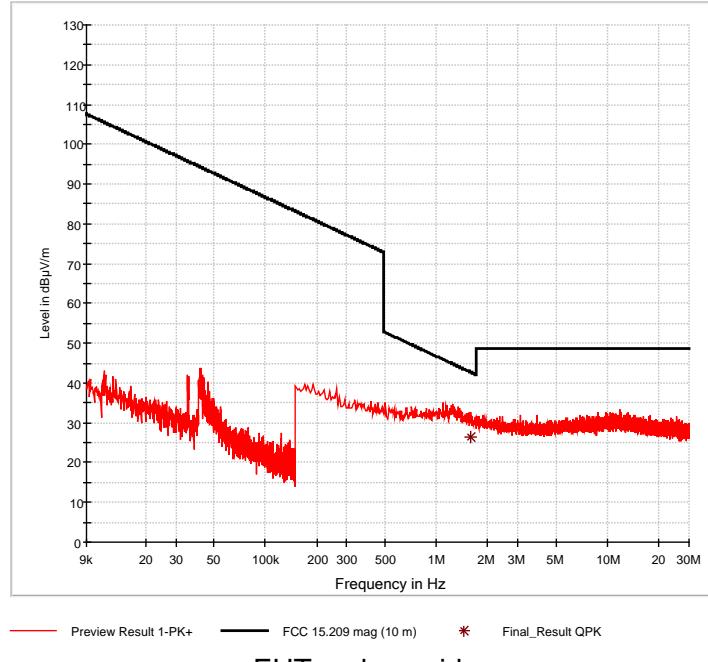


EUT in upright position

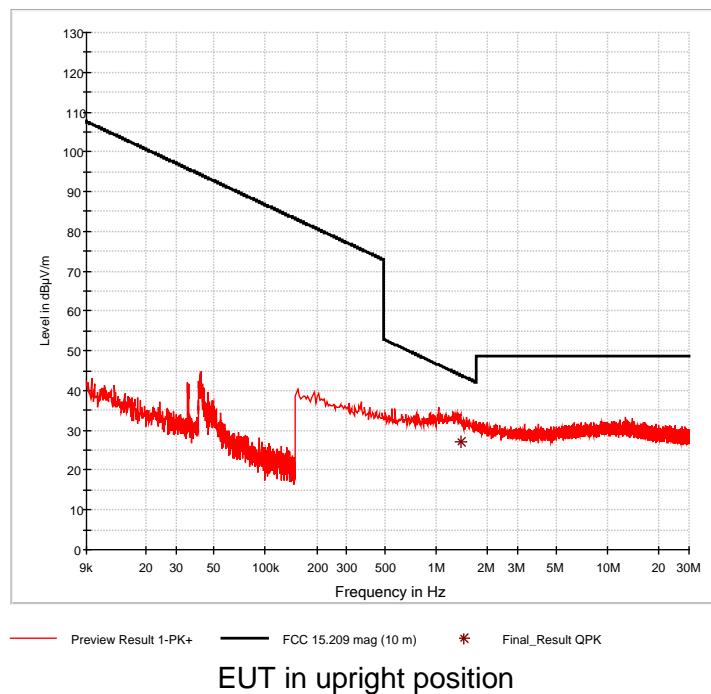
8.1.2 Middle channel



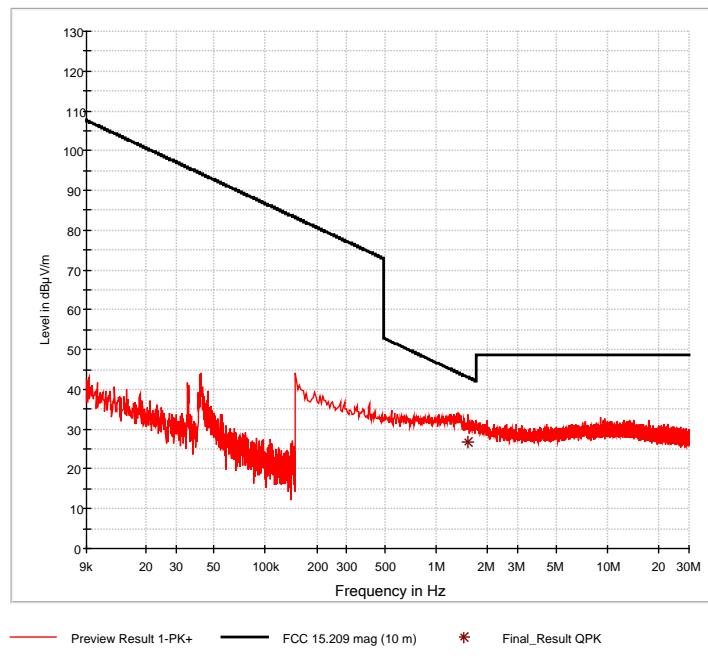
EUT flat on table



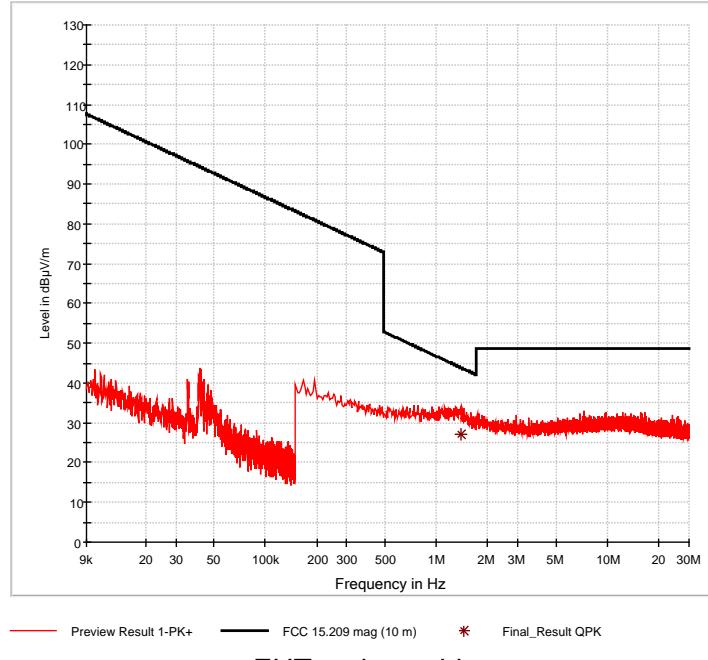
EUT on long side



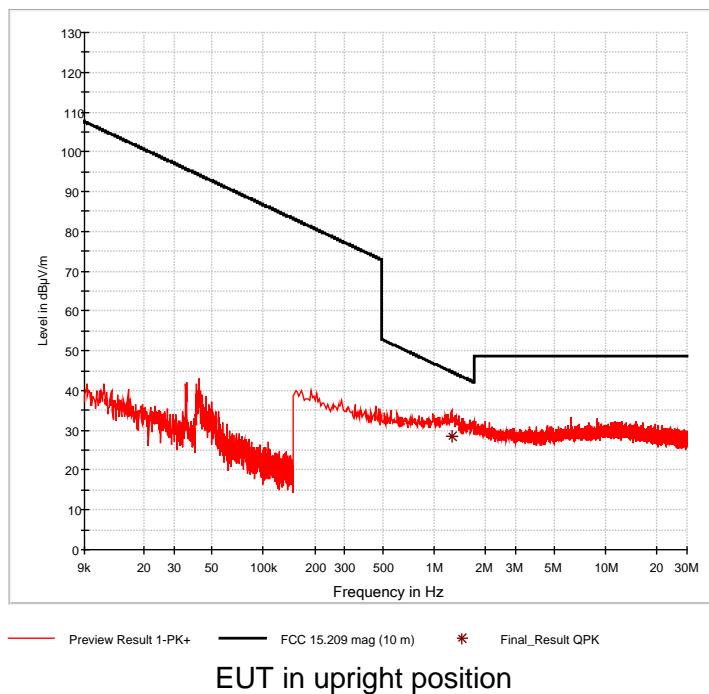
8.1.3 Highest channel



EUT flat on table

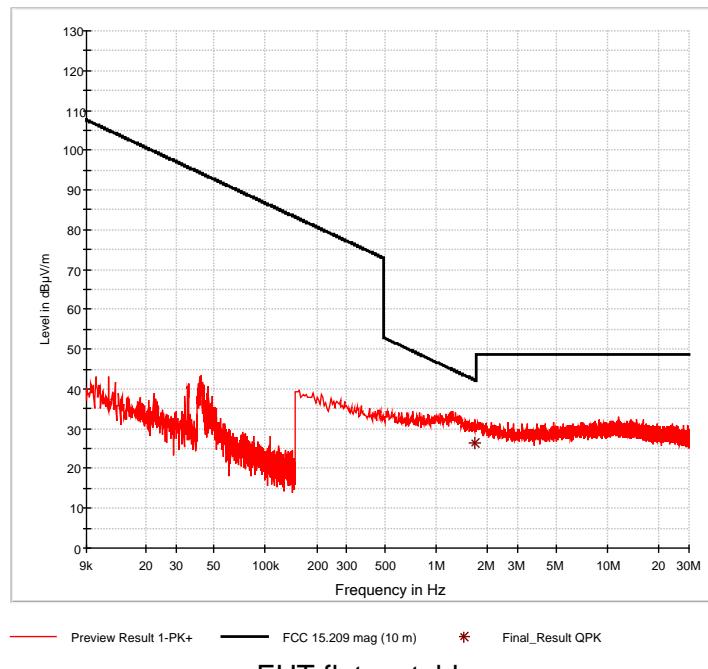


EUT on long side

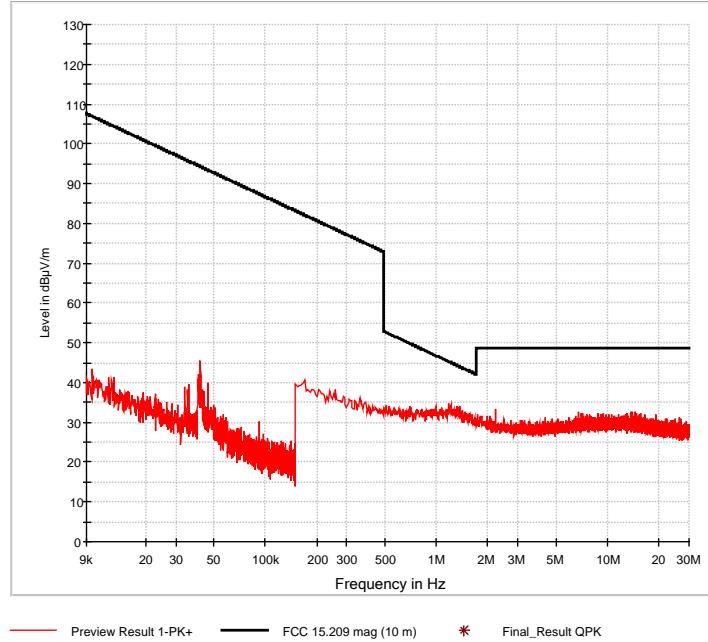


8.2 Test plots for Proprietary Radio

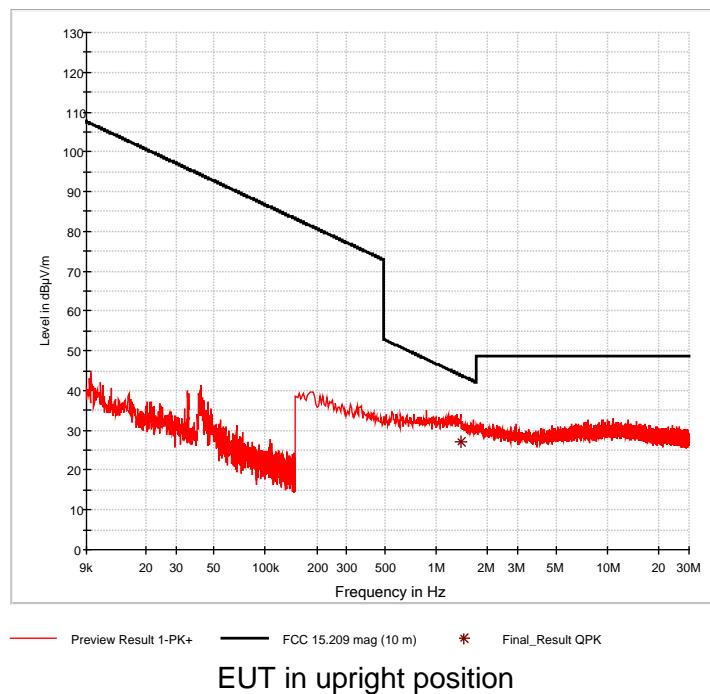
8.2.1 Lowest Channel



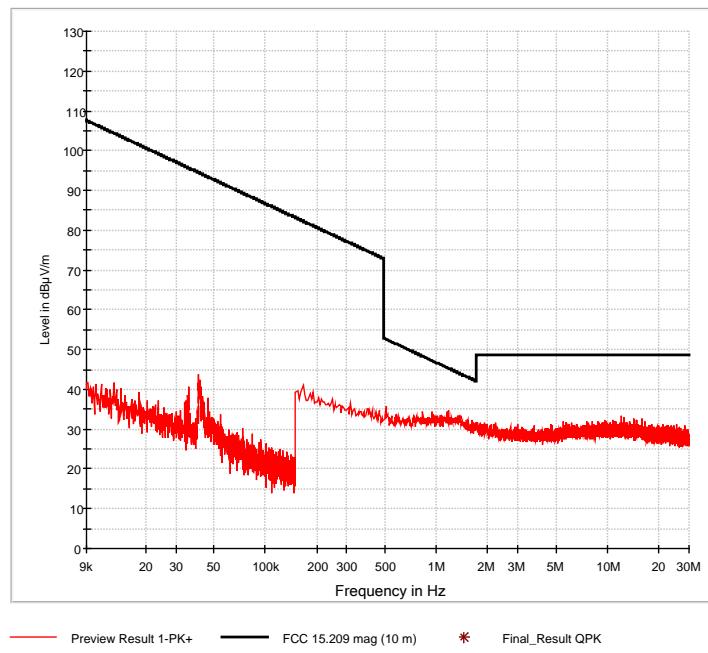
EUT flat on table



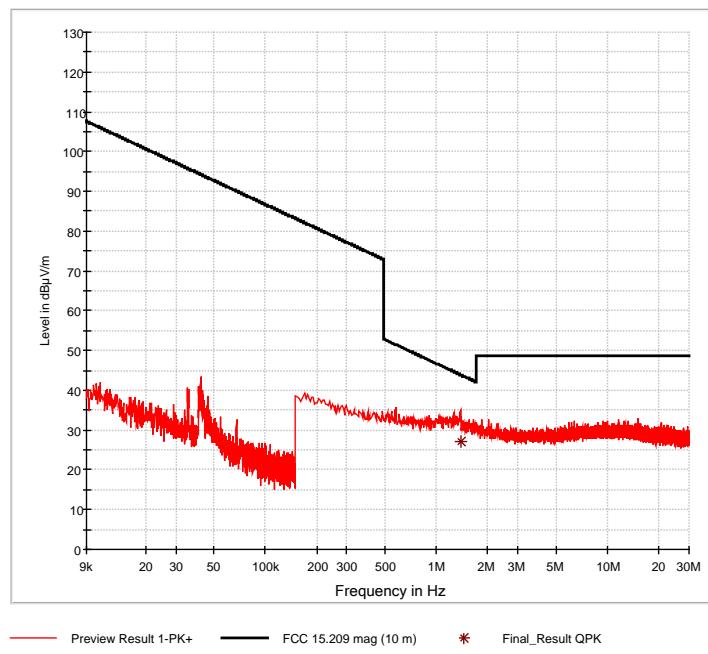
EUT on long side



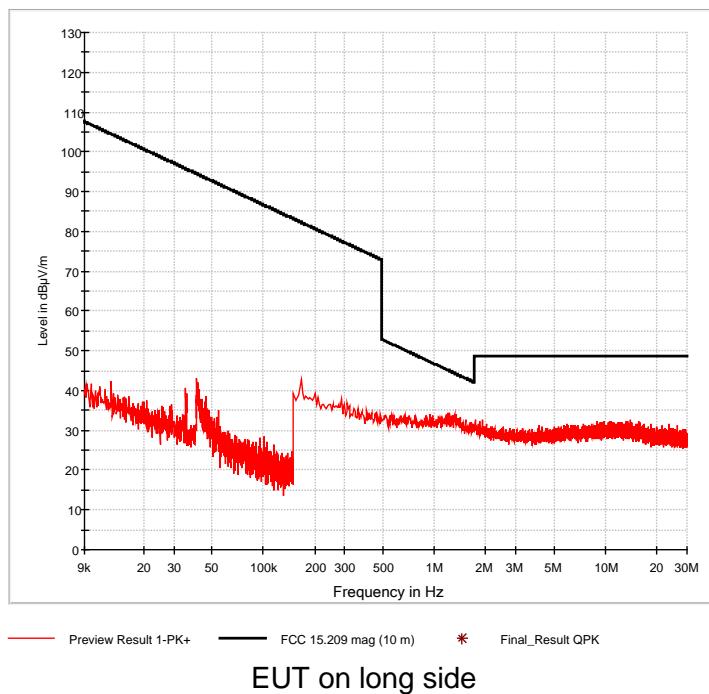
8.2.2 Middle Channel



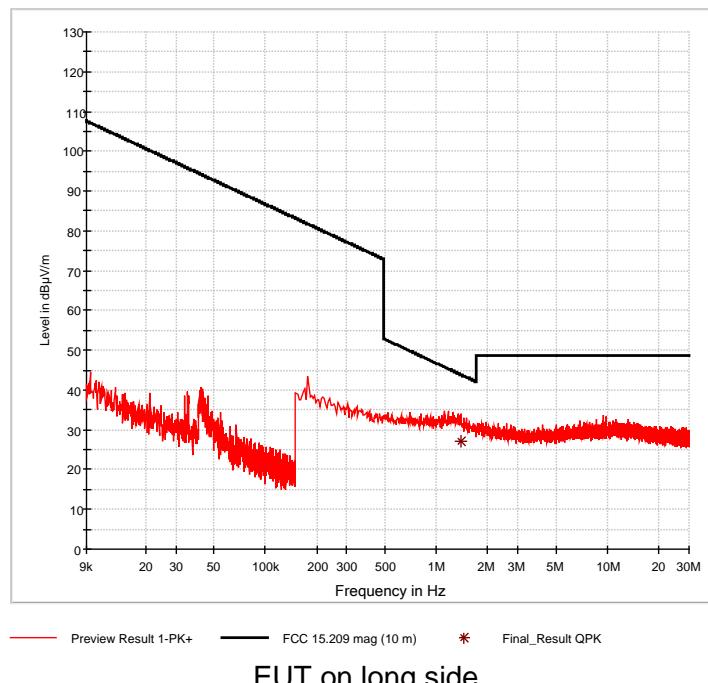
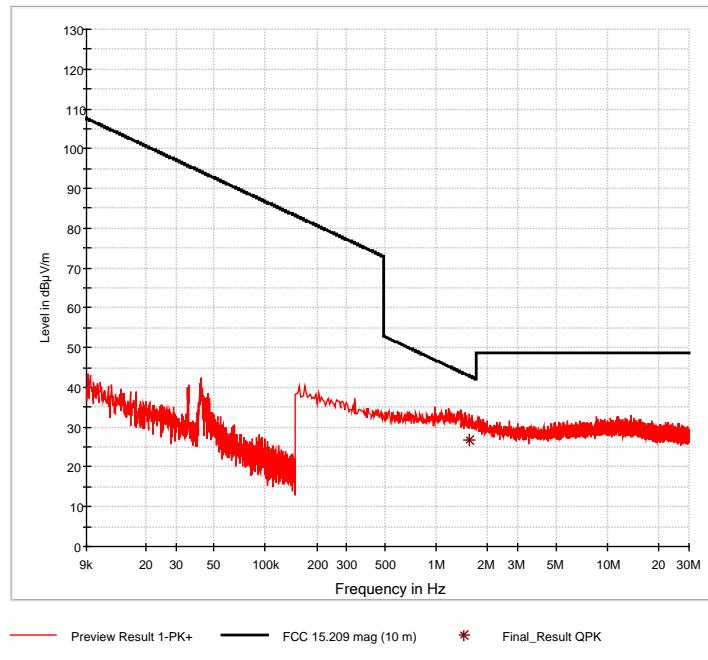
EUT flat on table

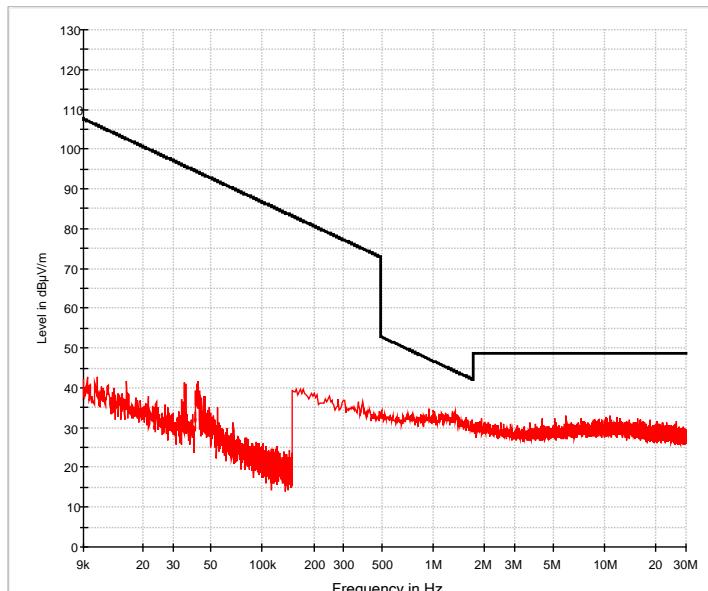


EUT on long side



8.2.3 Highest channel





— Preview Result 1-PK+ — FCC 15.209 mag (10 m) * Final_Result QPK

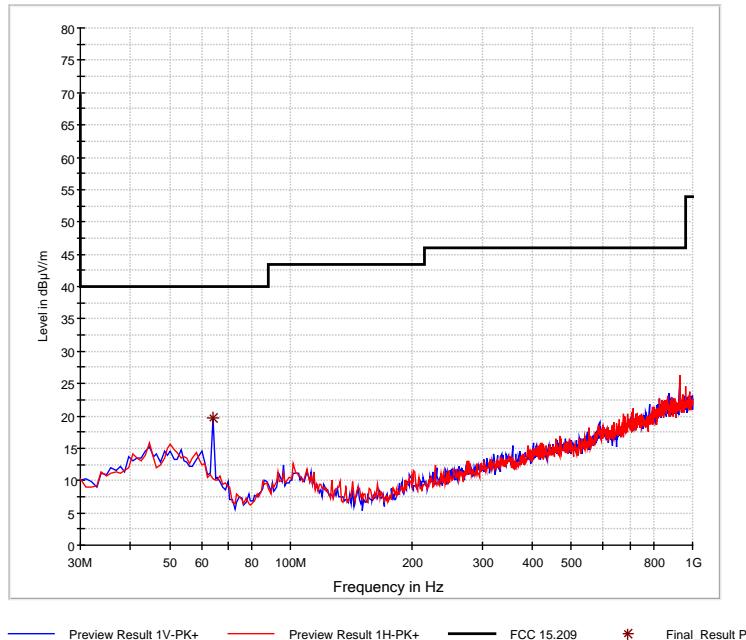
EUT in upright position

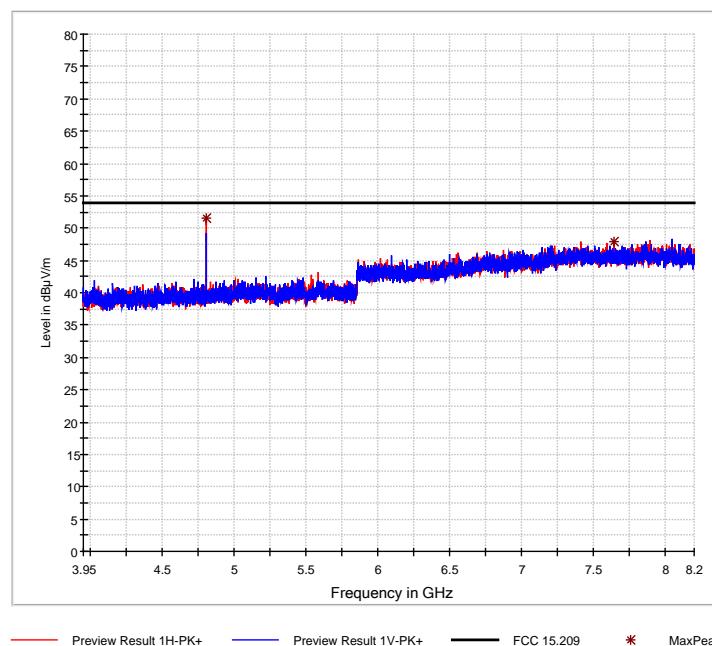
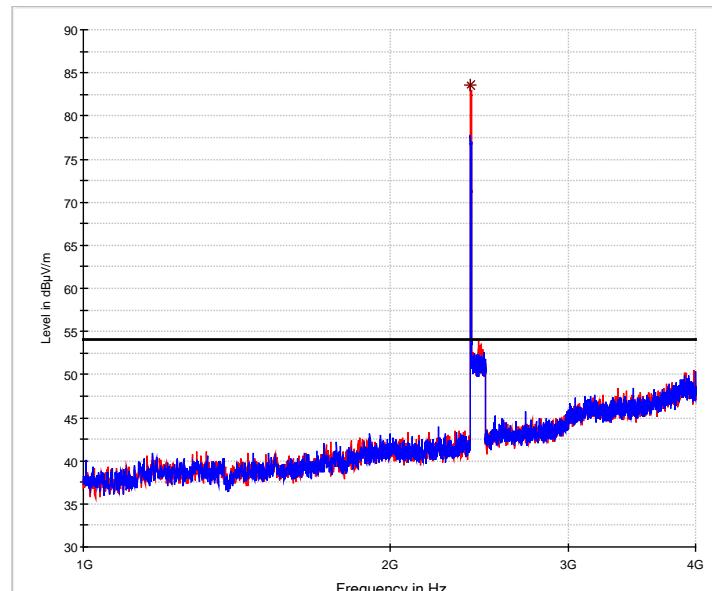
9 Plots for Radiated Emissions 30 MHz – 25 GHz

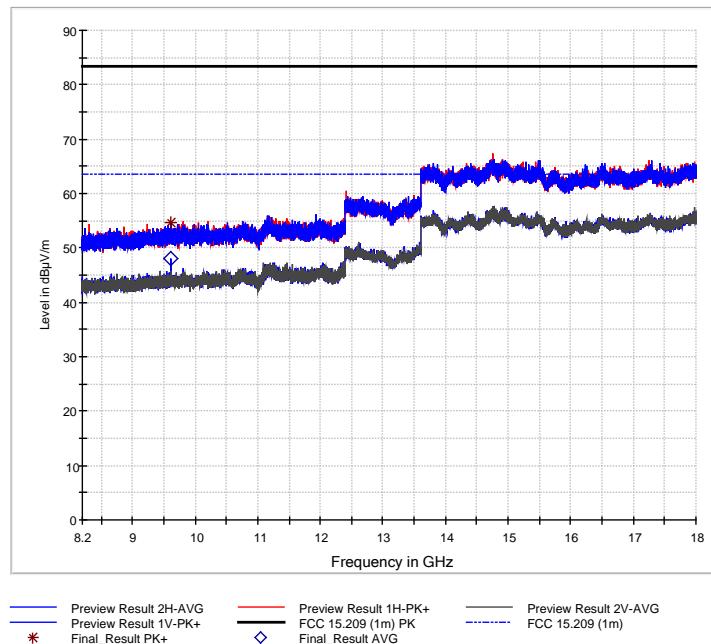
9.1 Test plots for Bluetooth Low Energy (BLE)

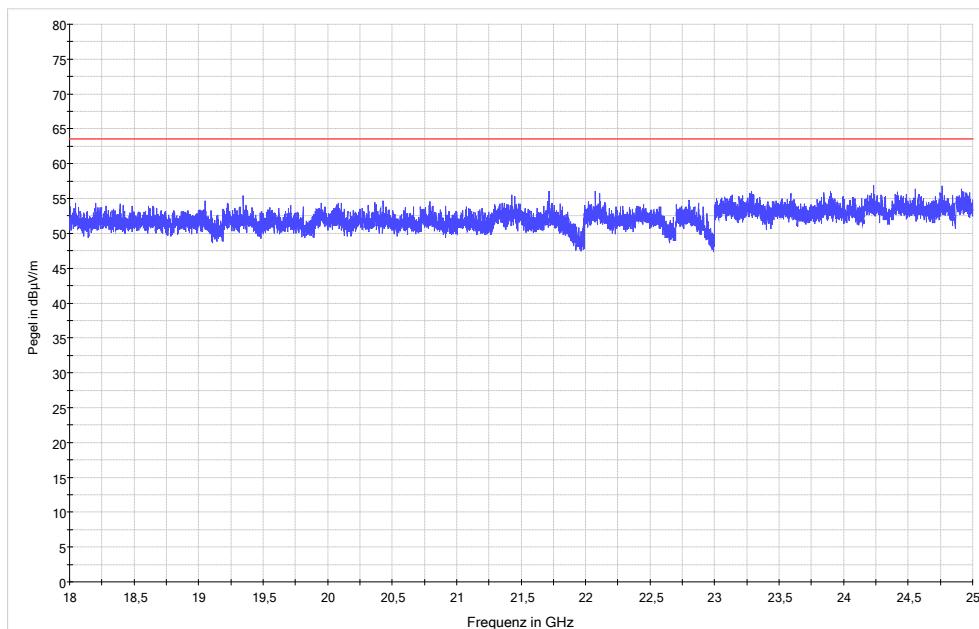
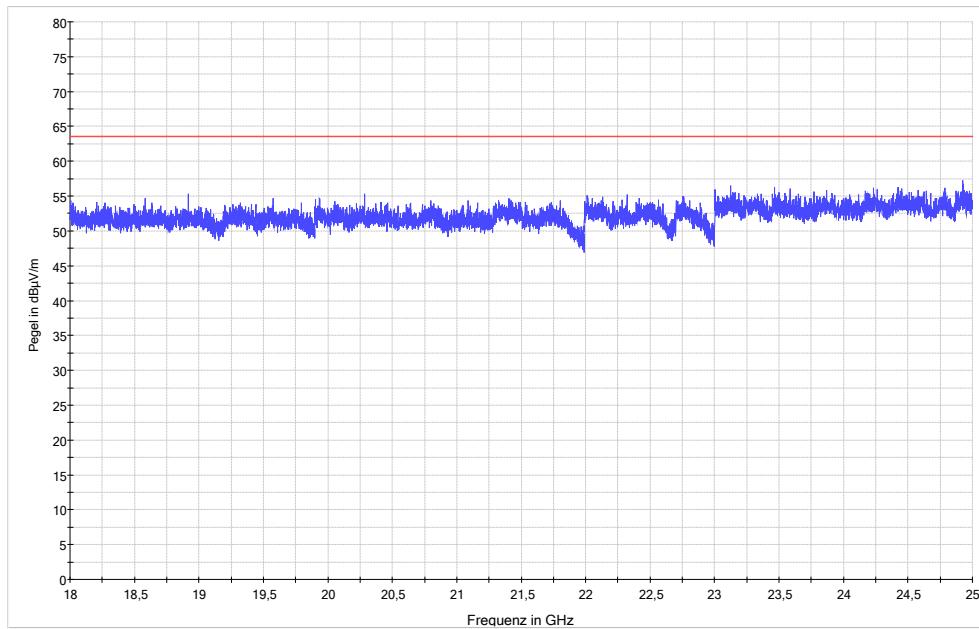
9.1.1 Lowest Channel

9.1.1.1 EUT flat on table

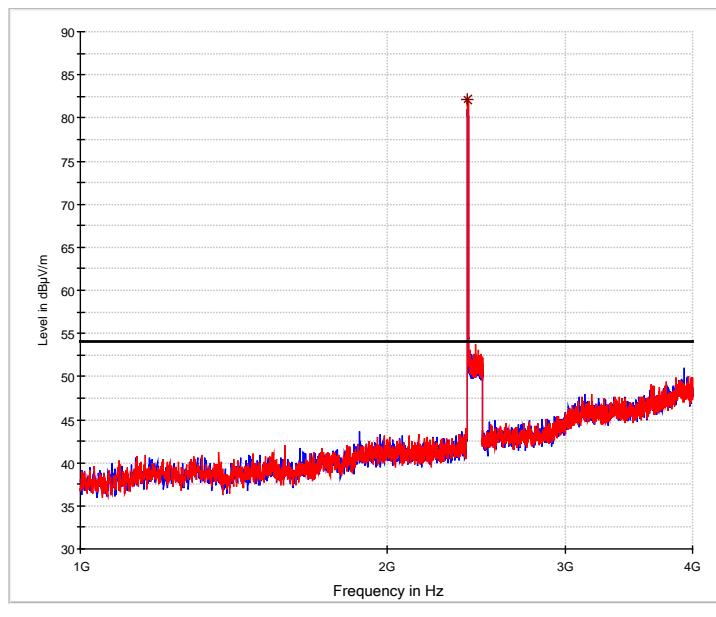
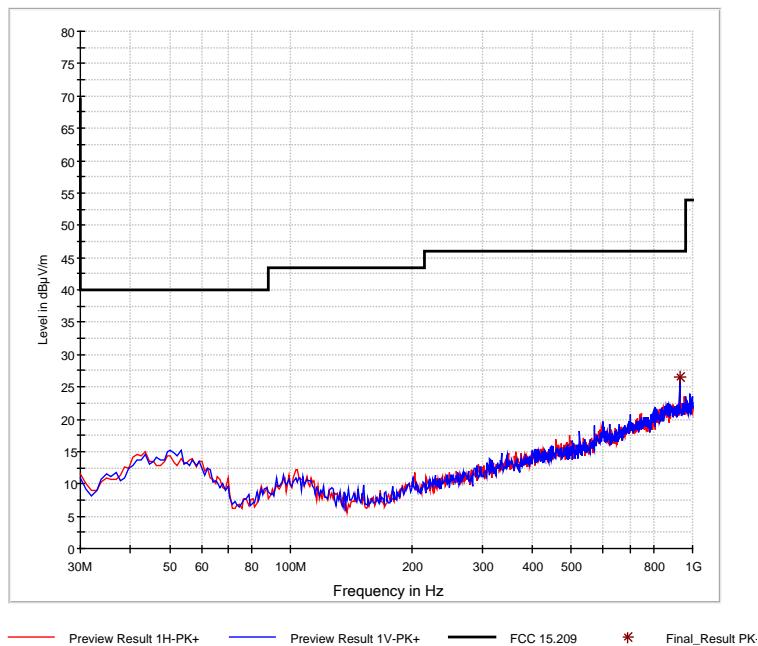


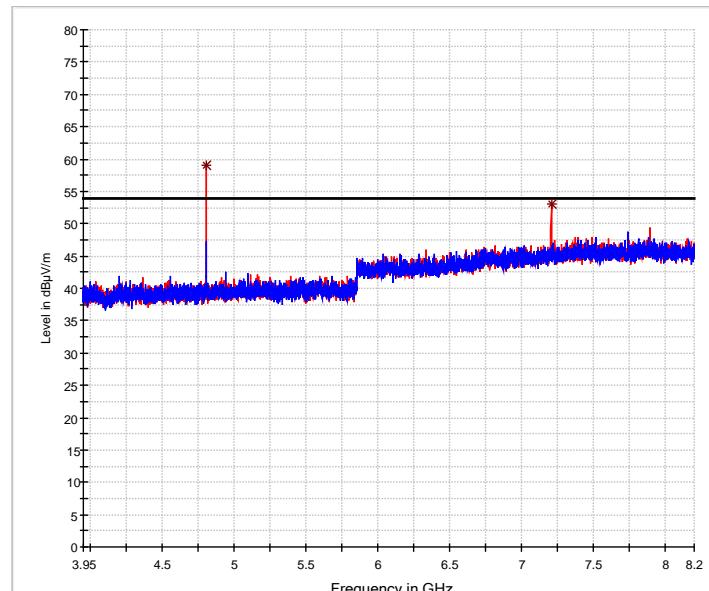




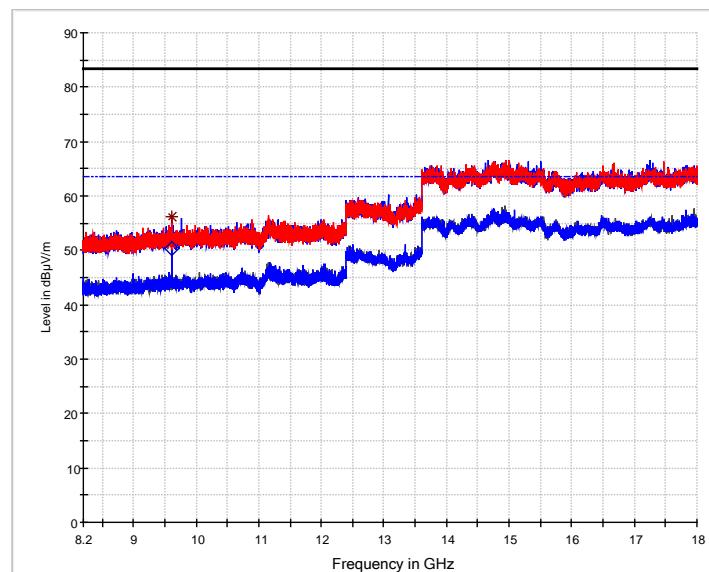


9.1.1.2 EUT on long side:

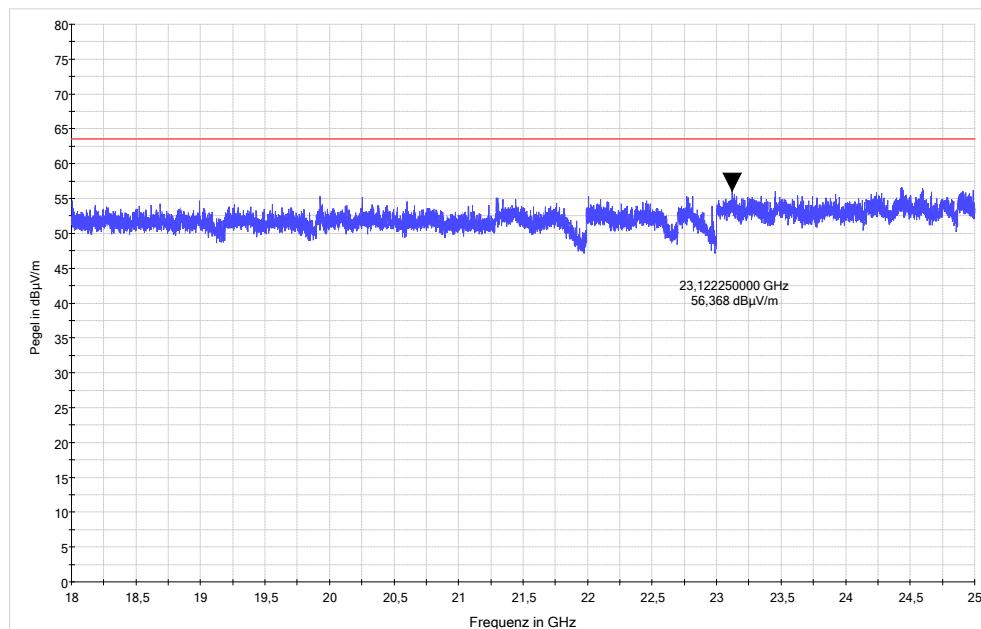
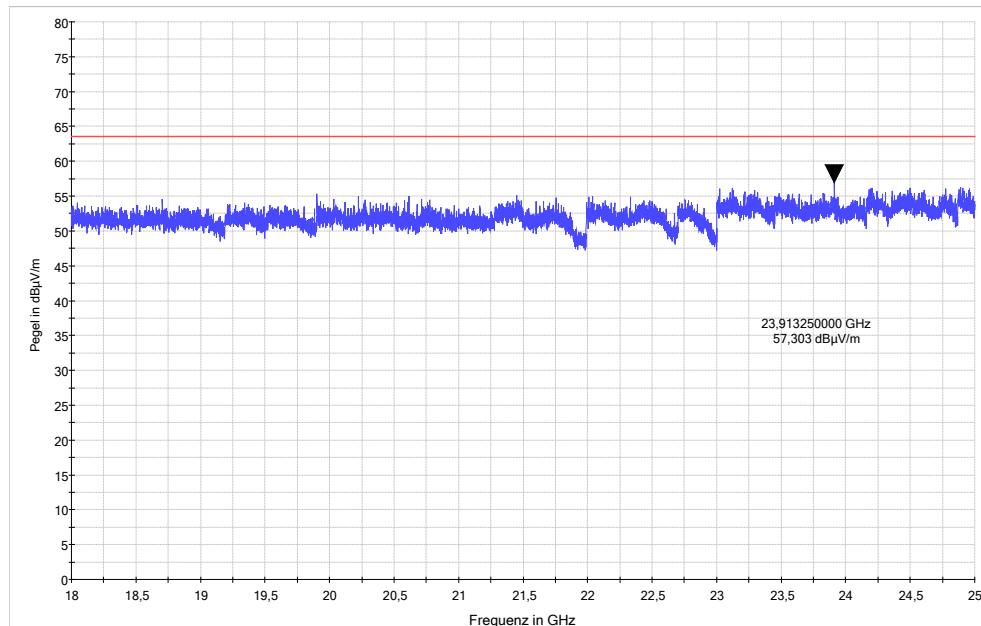




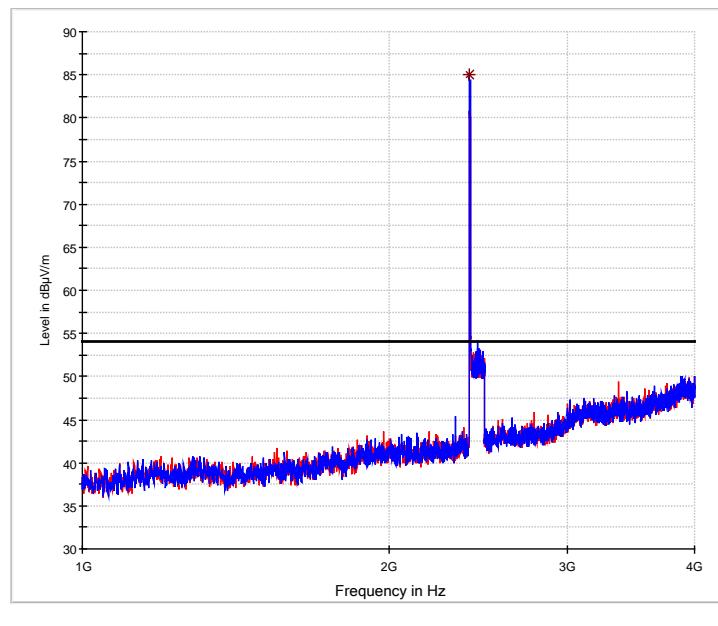
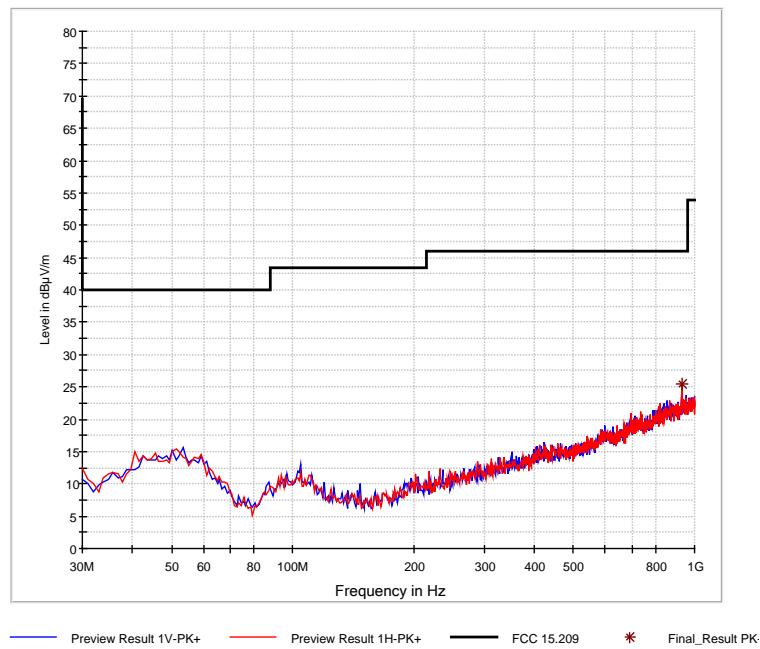
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * MaxPeak

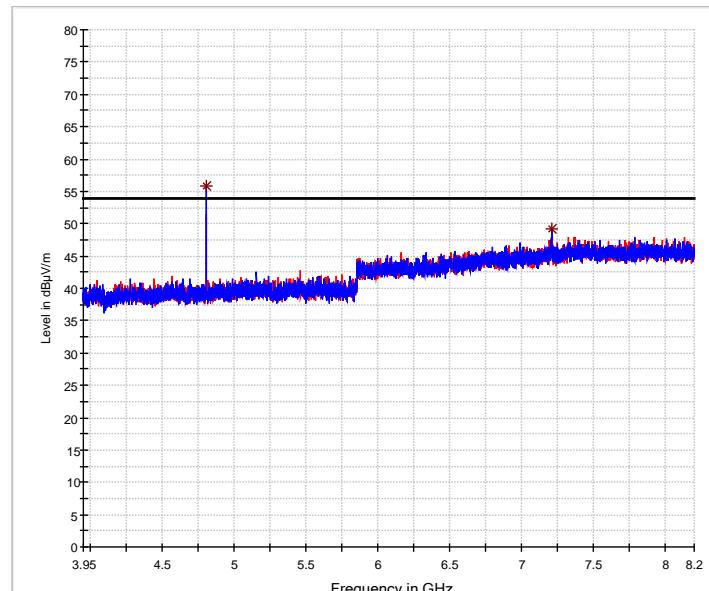


— Preview Result 2V-AVG
— Preview Result 1H-PK+
— Final_Result PK+ — Preview Result 1V-PK+
— FCC 15.209 (1m) PK — Final_Result AVG
* FCC 15.209 (1m)

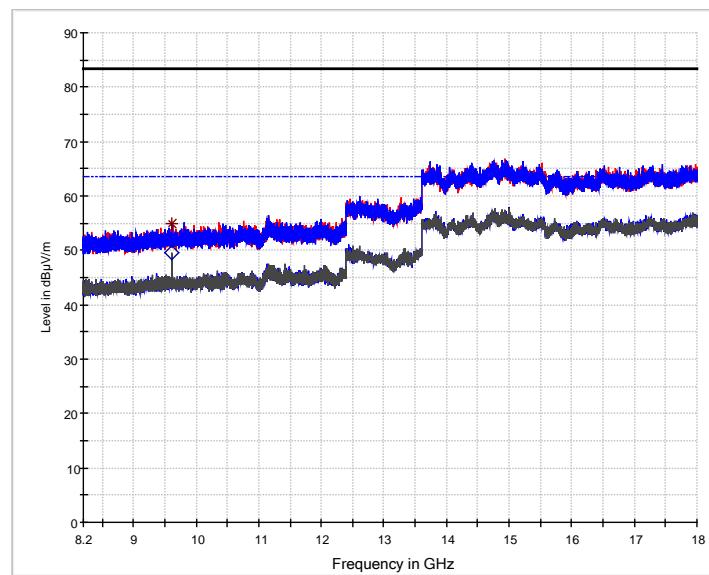


9.1.1.3 EUT in upright position:

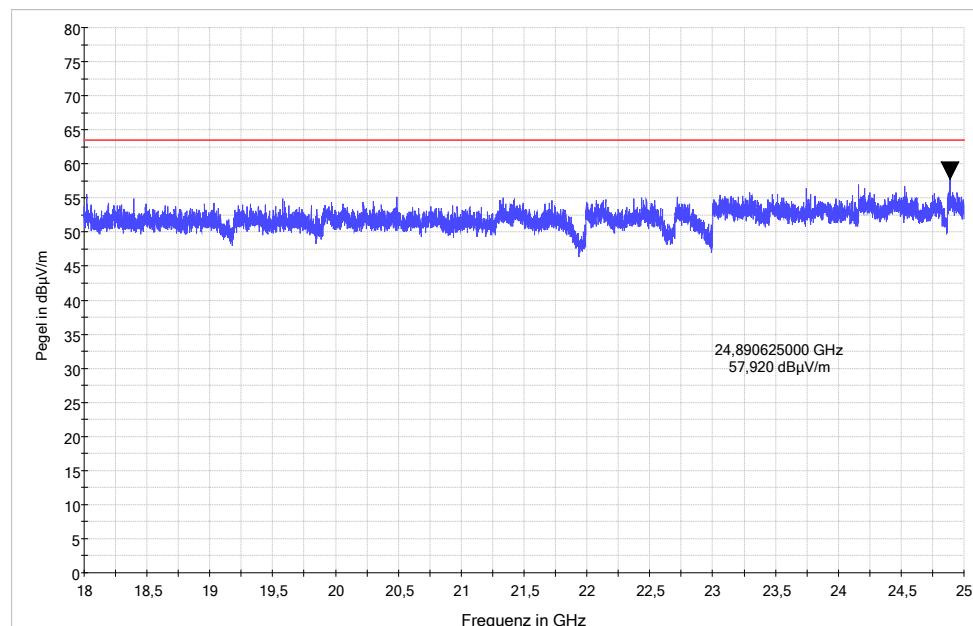
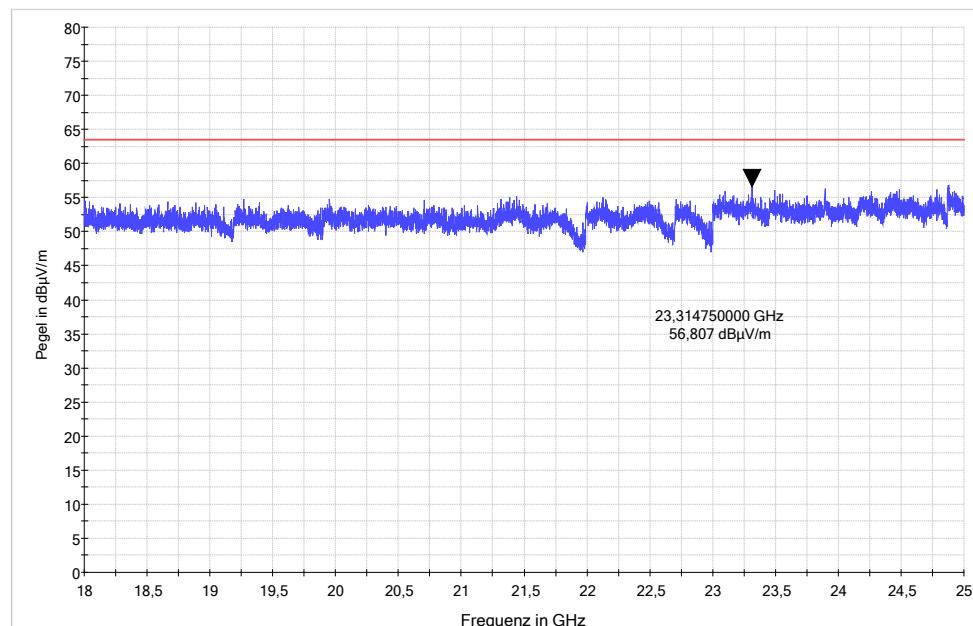




— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

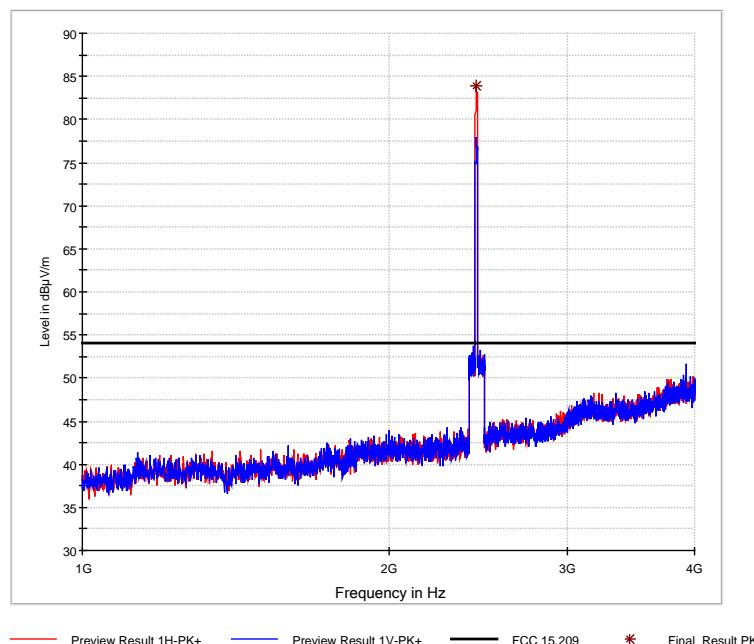
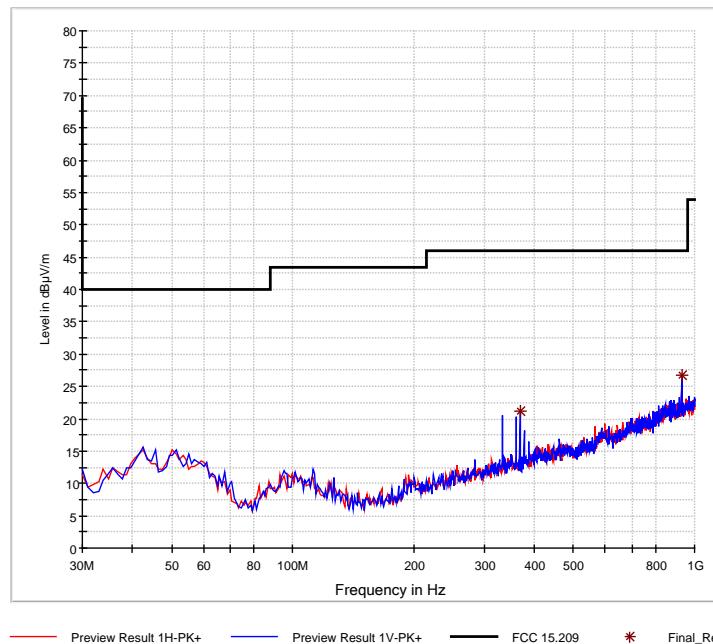


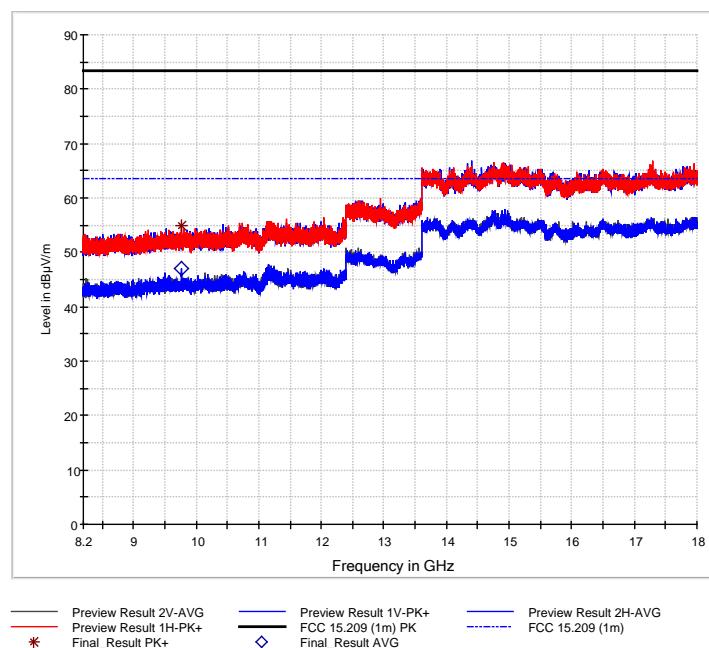
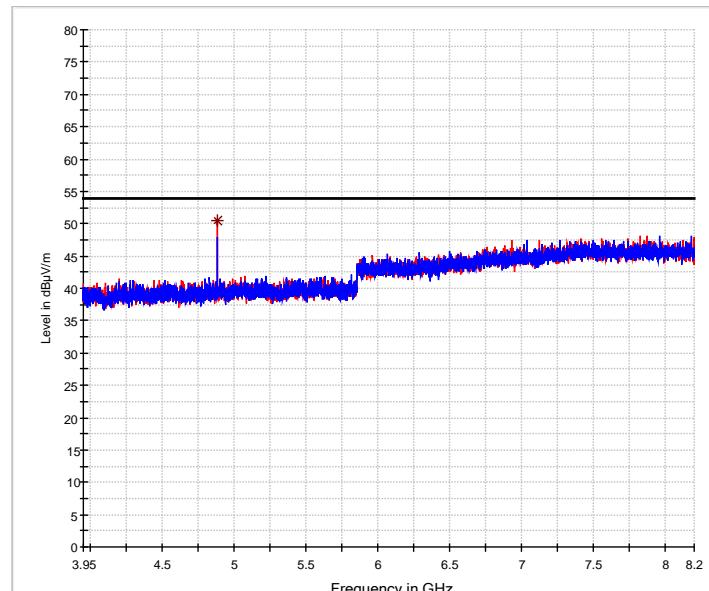
— Preview Result 2H-AVG
— Preview Result 1V-PK+ — Preview Result 1H-PK+
— Final_Result PK — FCC 15.209 (1m) PK — Preview Result 2V-AVG
* ◇ Final_Result AVG

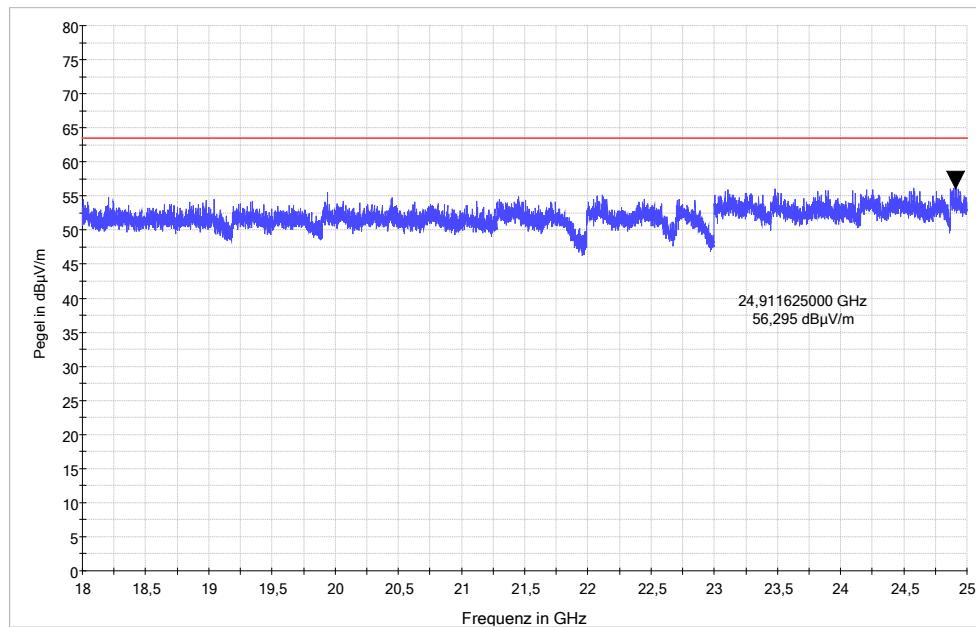
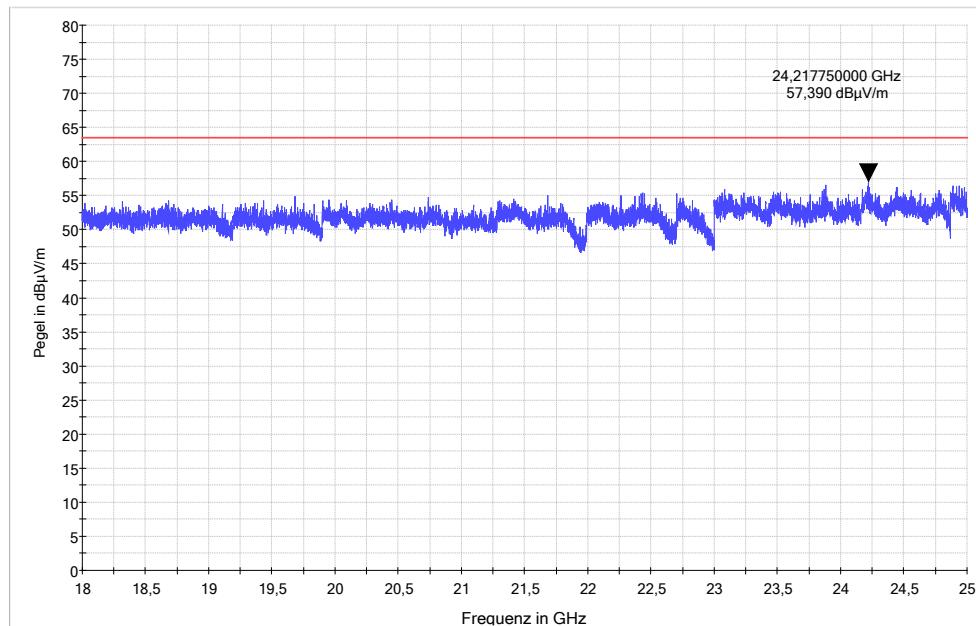


9.1.2 Middle channel

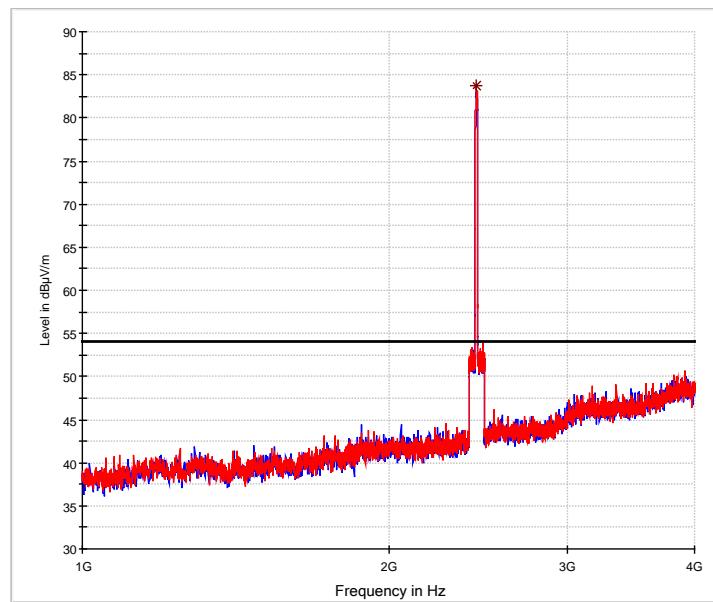
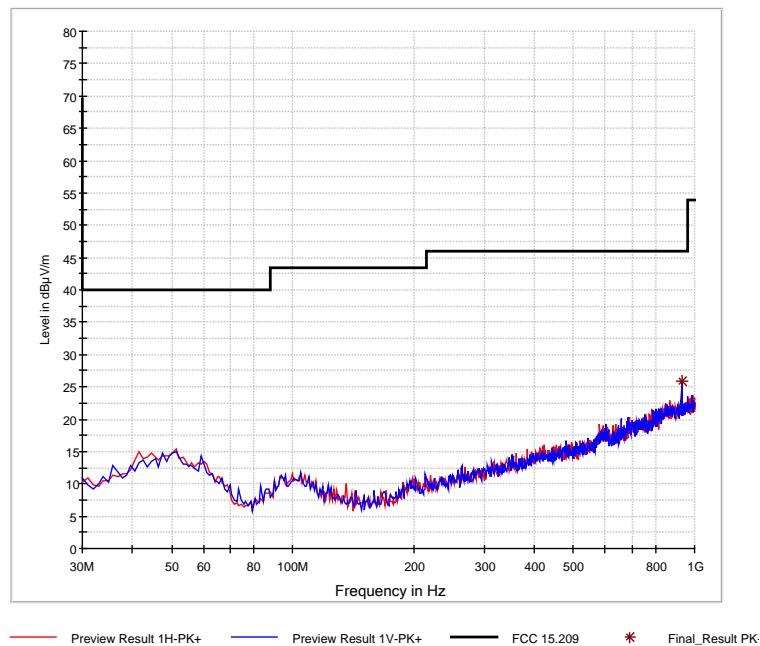
9.1.2.1 EUT flat on table

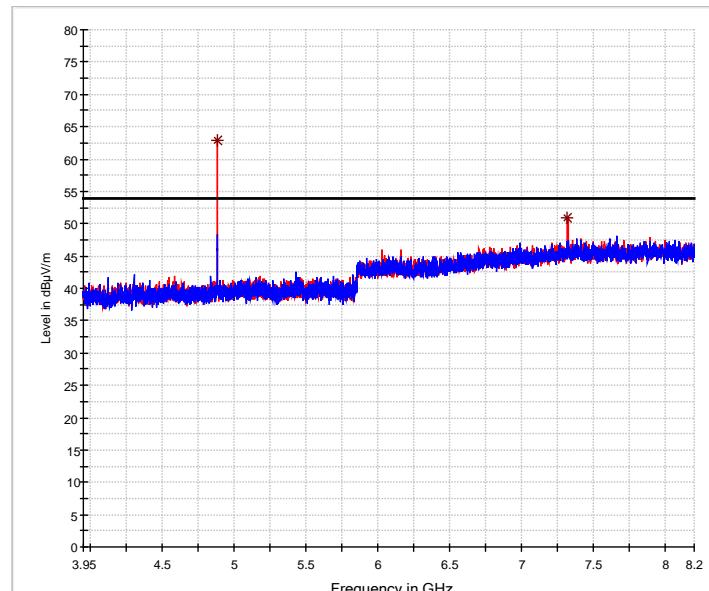




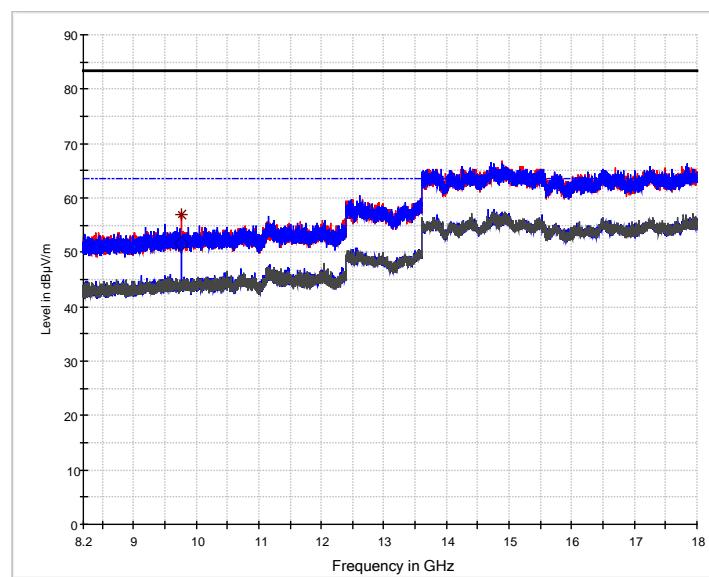


9.1.2.2 EUT on long side

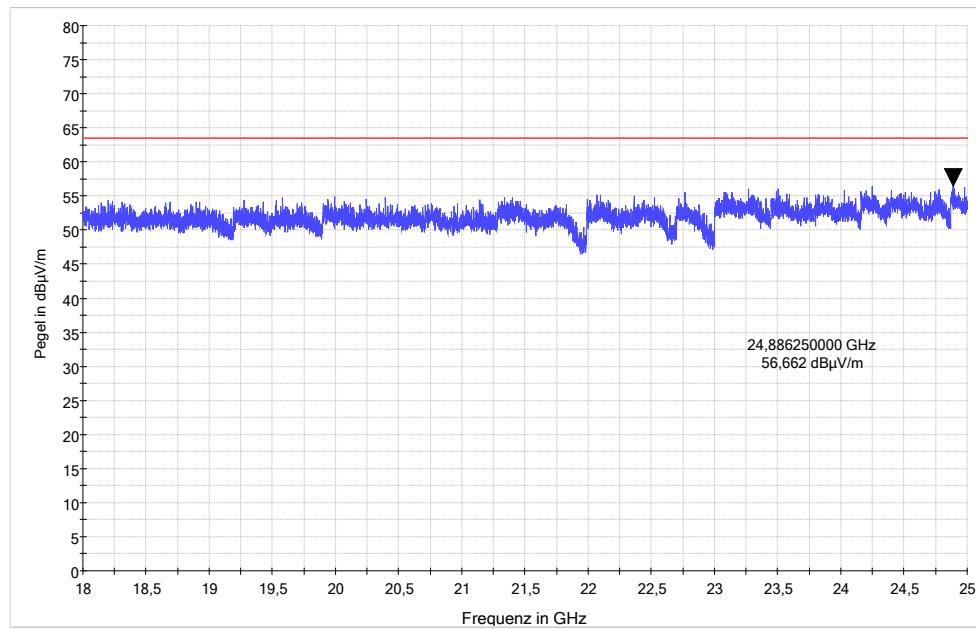
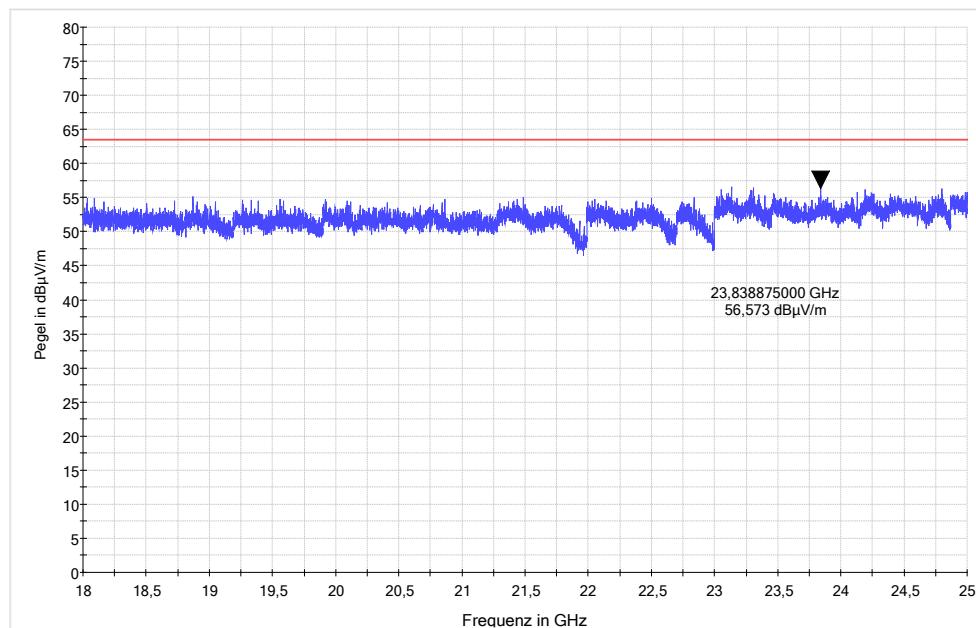




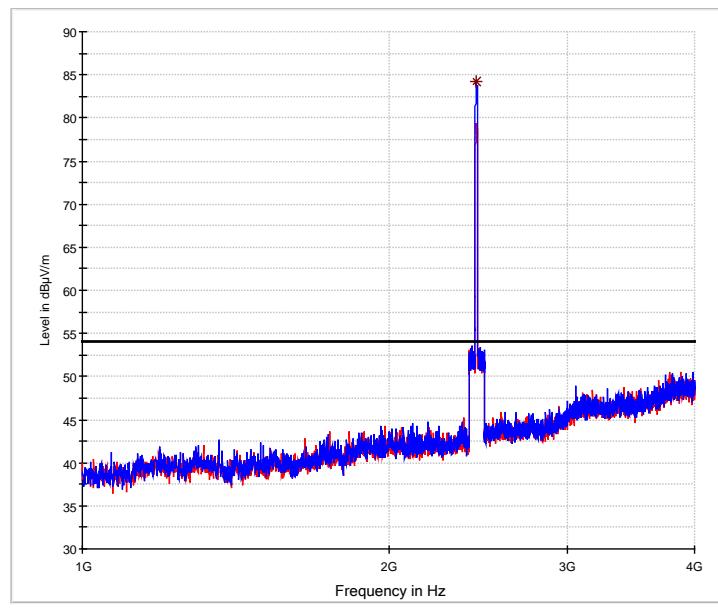
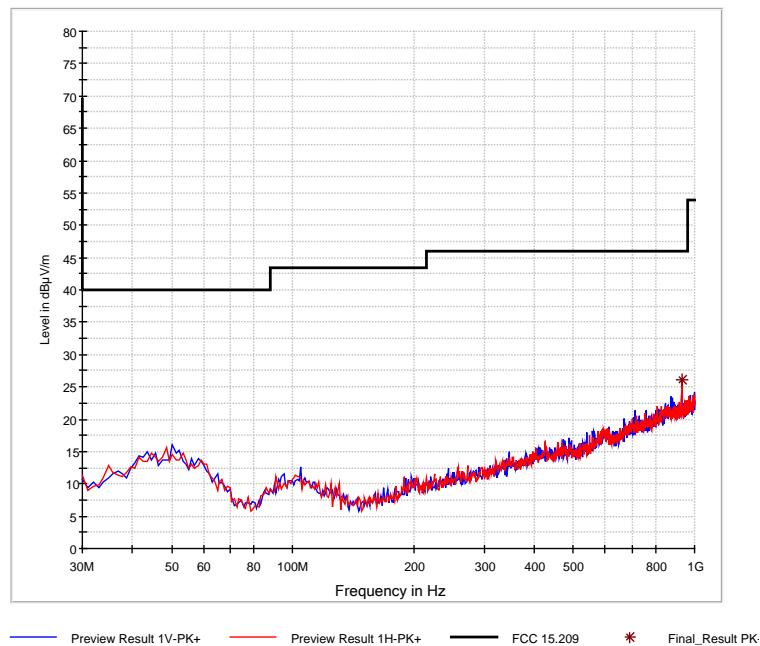
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

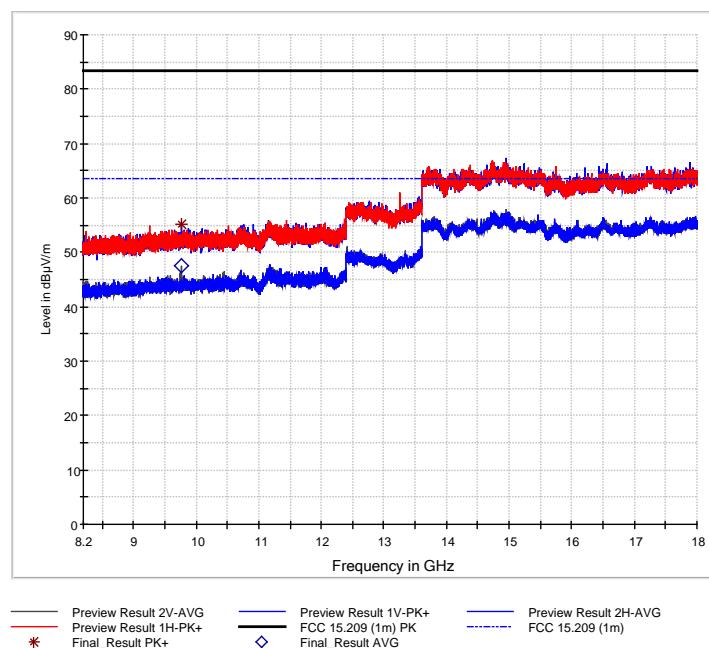
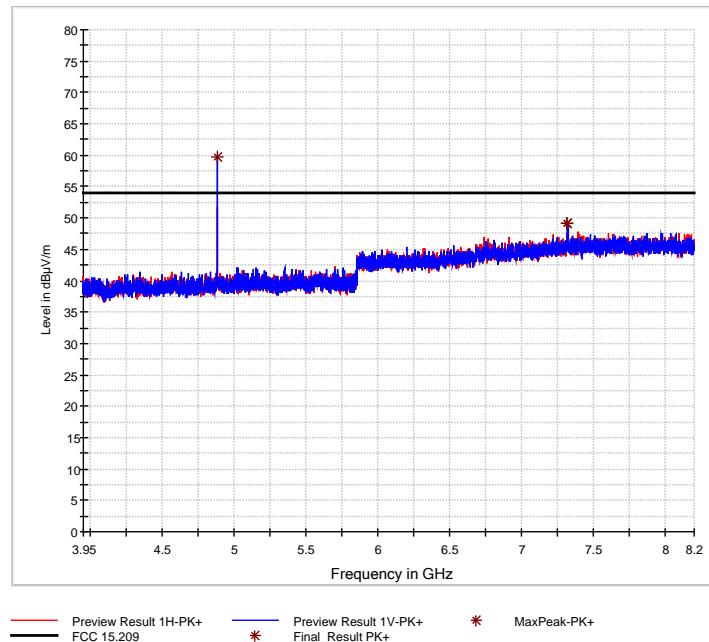


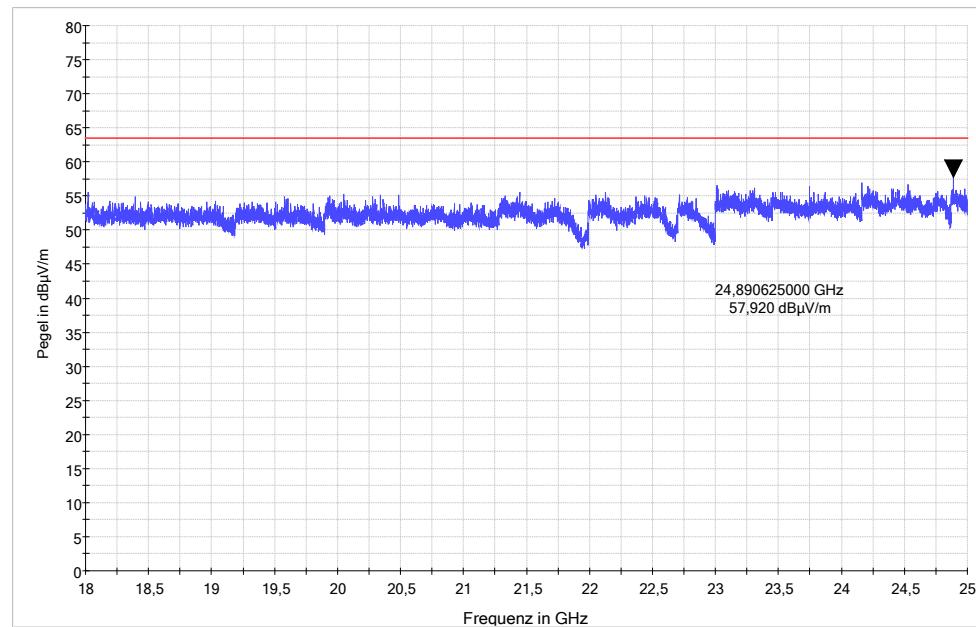
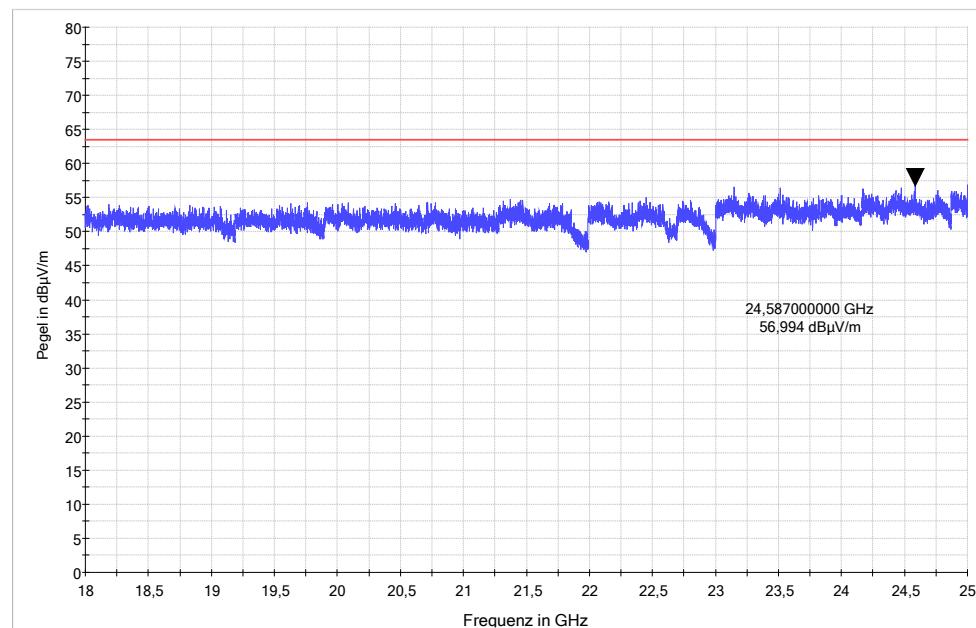
— Preview Result 2H-AVG — Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 (1m) PK — FCC 15.209 (1m) AVG
* ◇ Final_Result PK



9.1.2.3 EUT in upright position

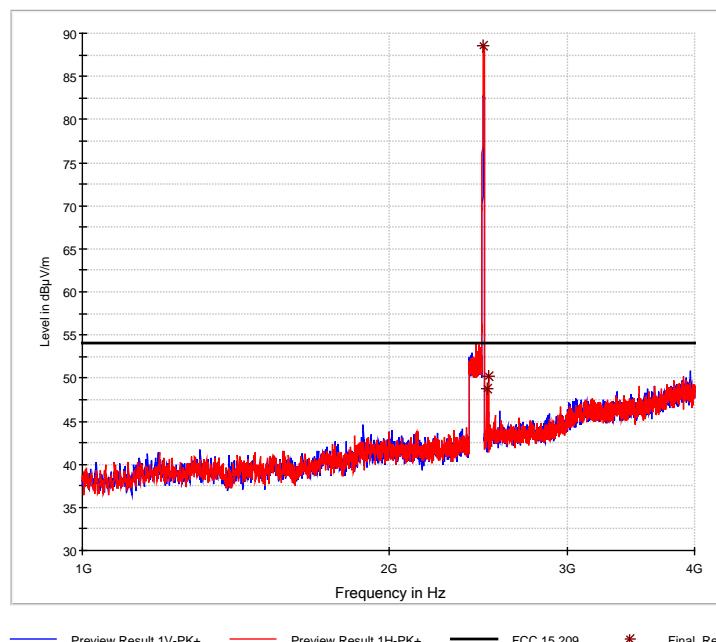
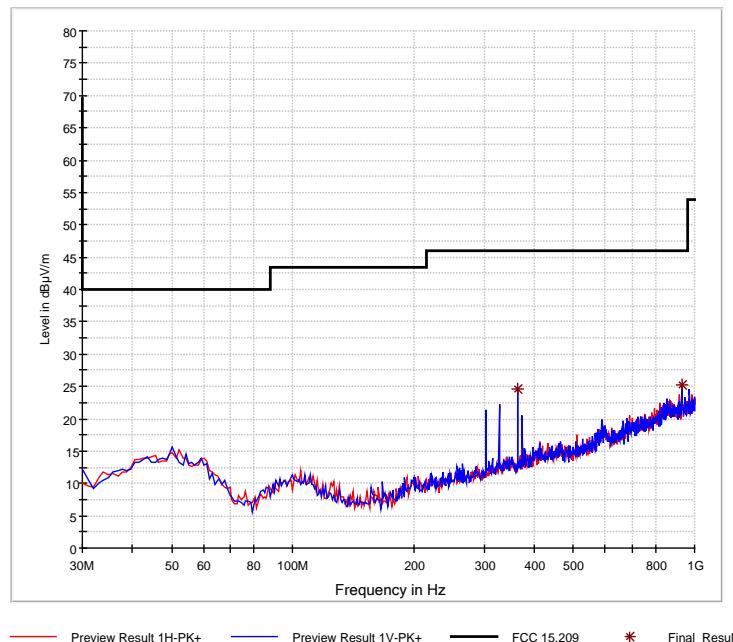


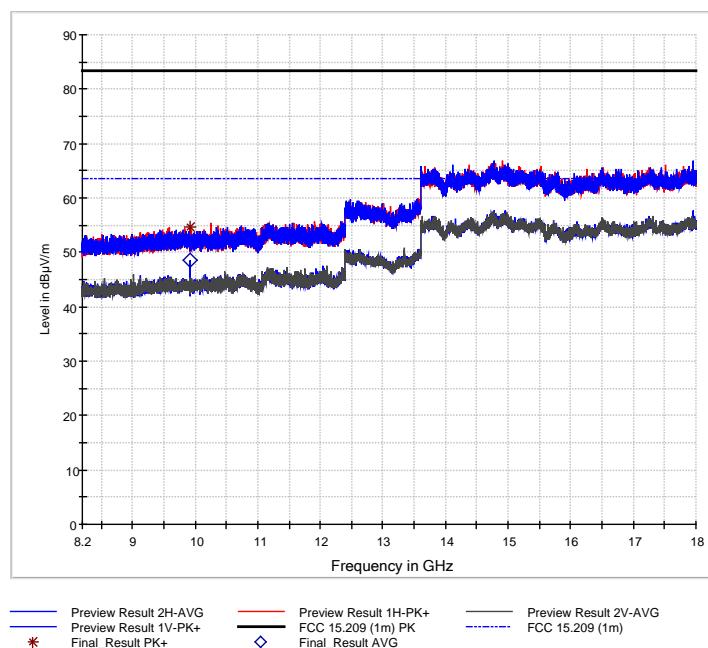
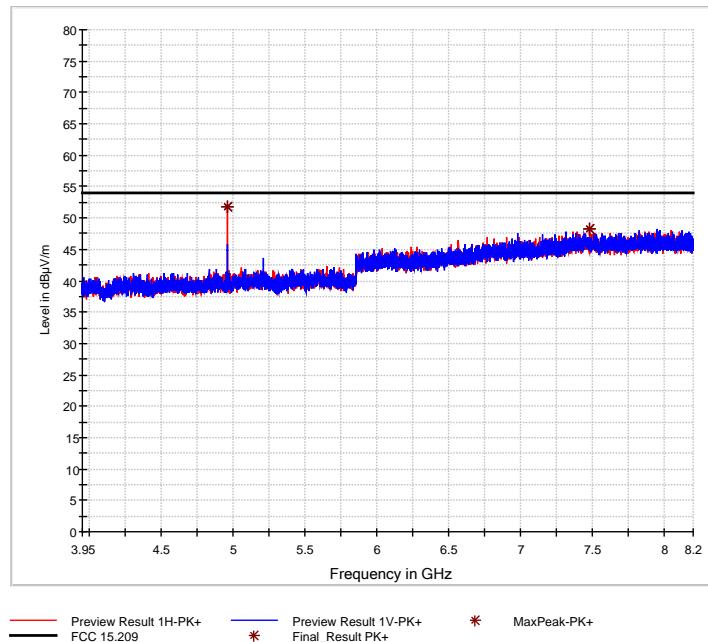


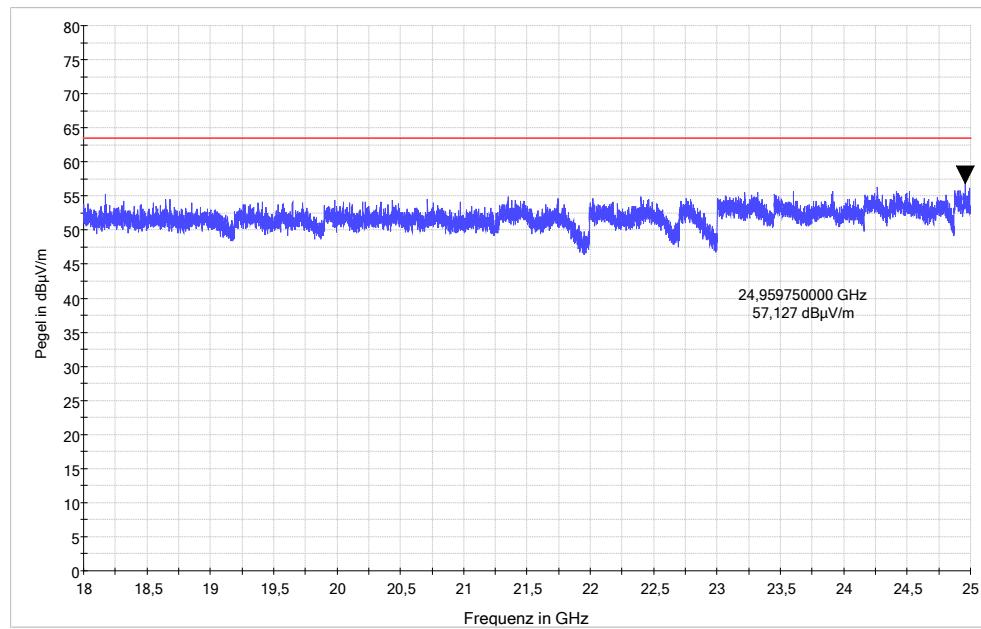
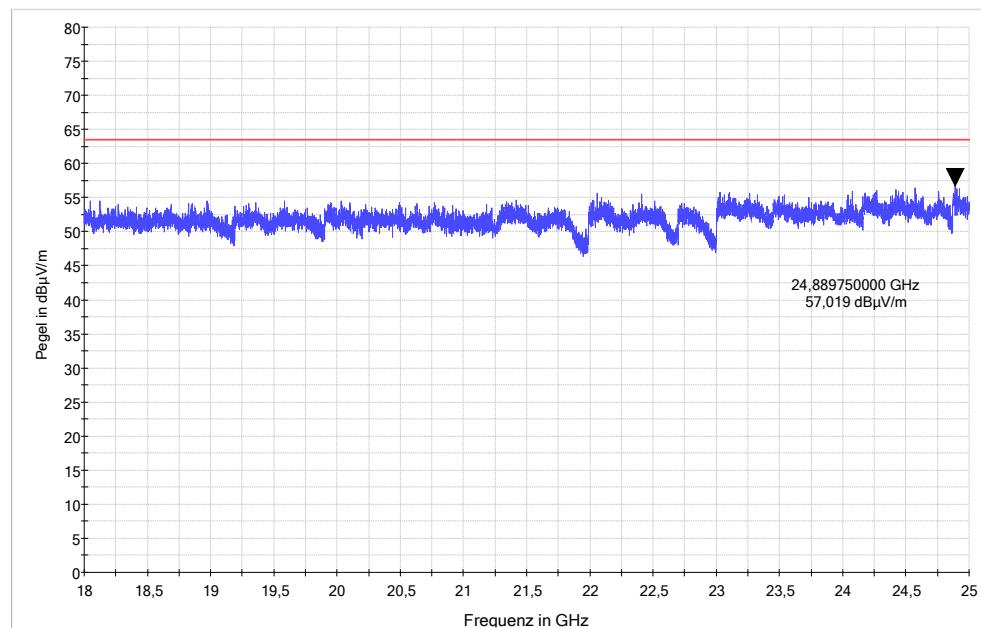


9.1.3 Highest channel

9.1.3.1 EUT flat on table

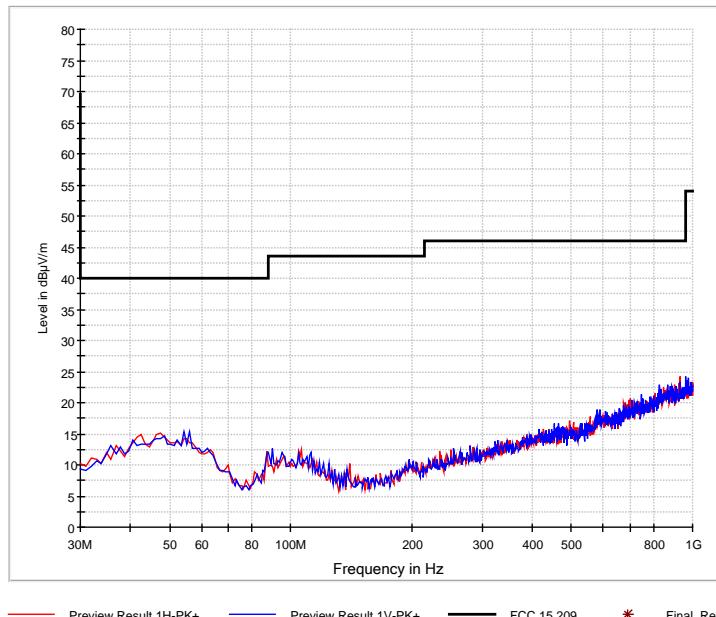




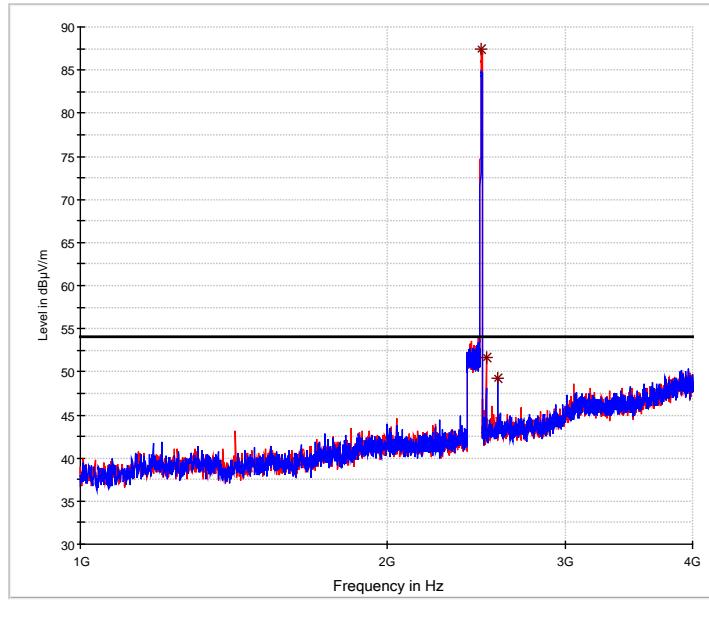


9.1.3.2 EUT on long side:

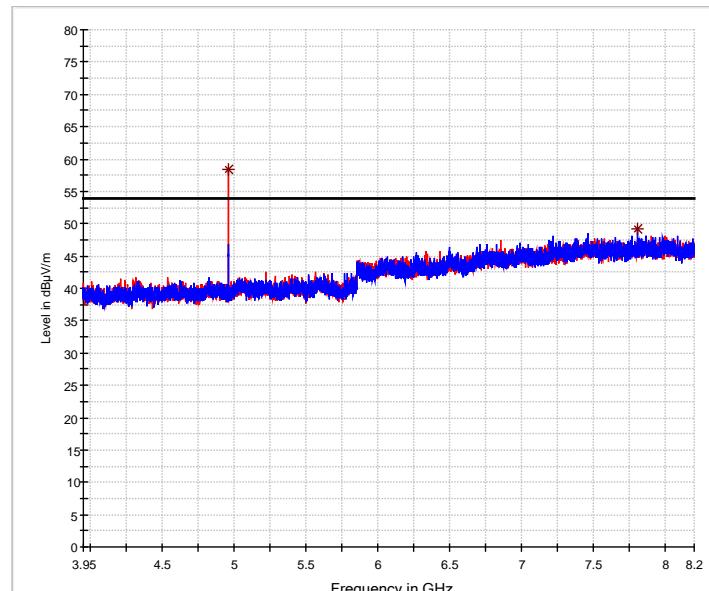
Full Spectrum



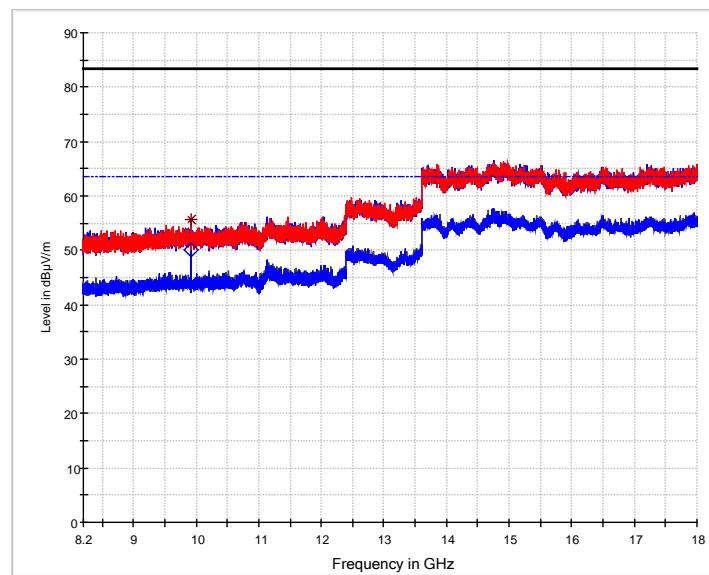
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK



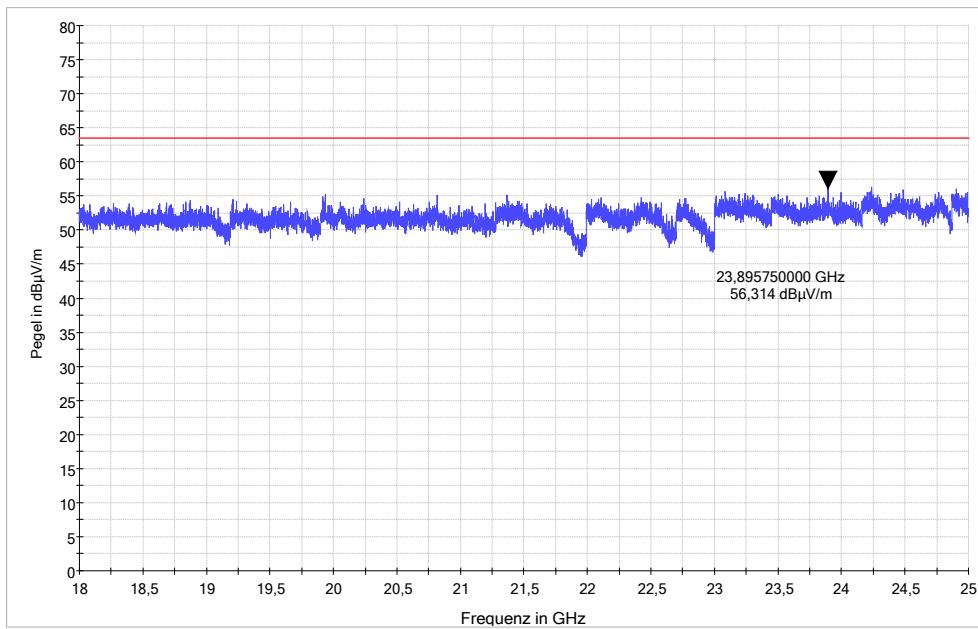
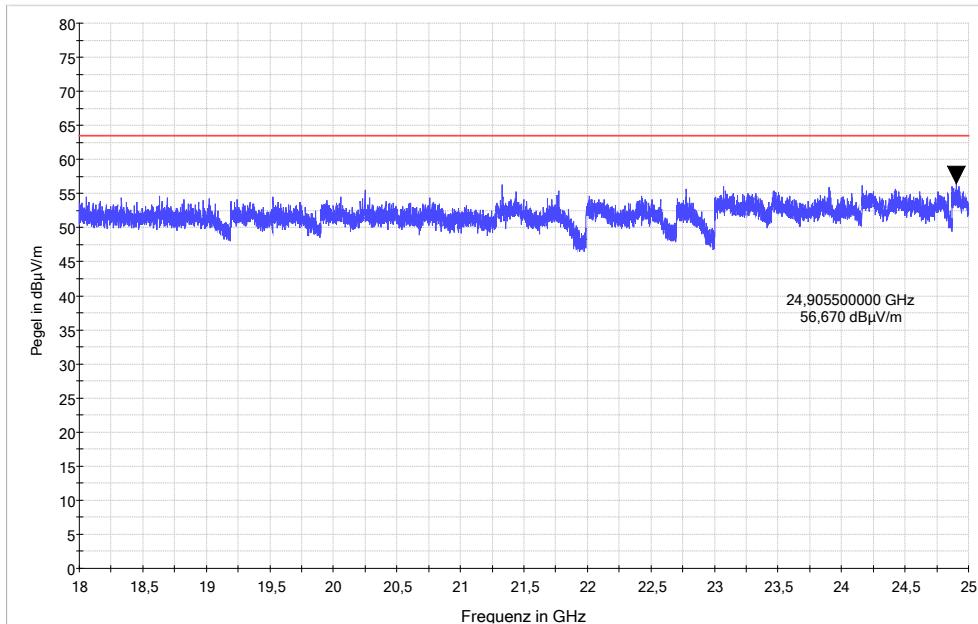
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK



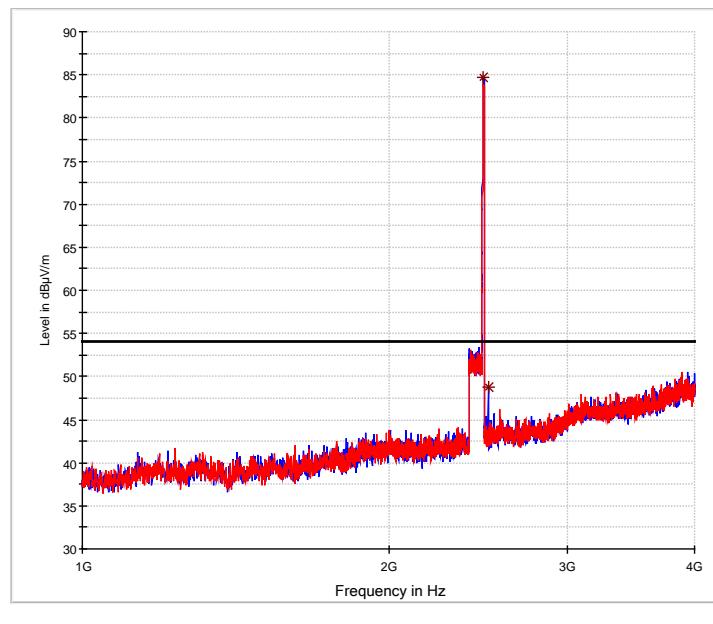
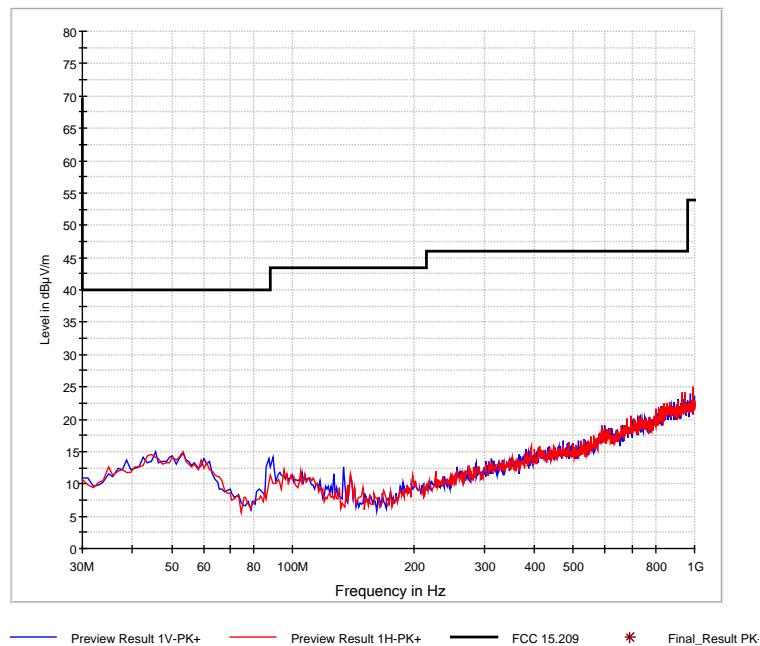
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

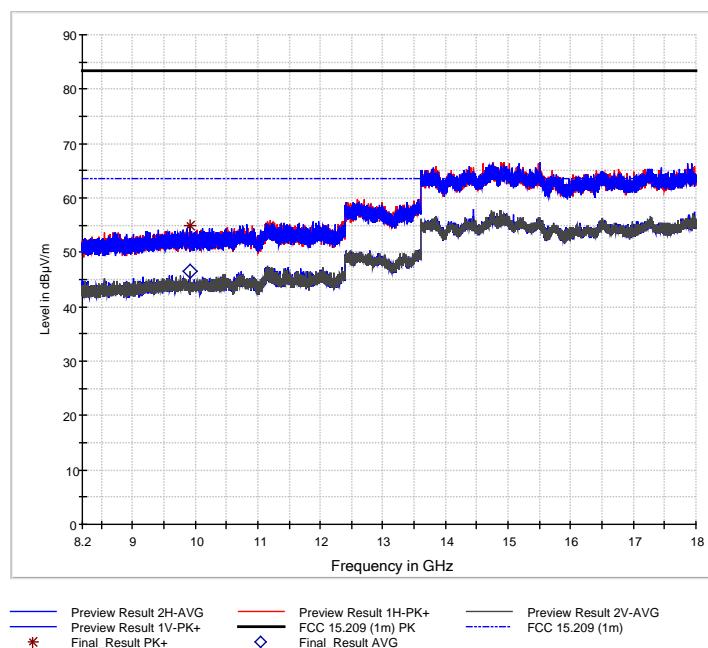
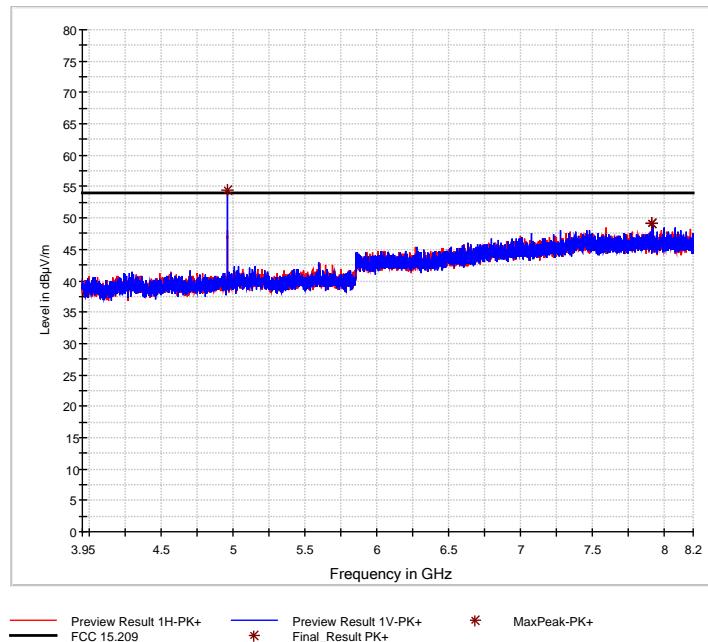


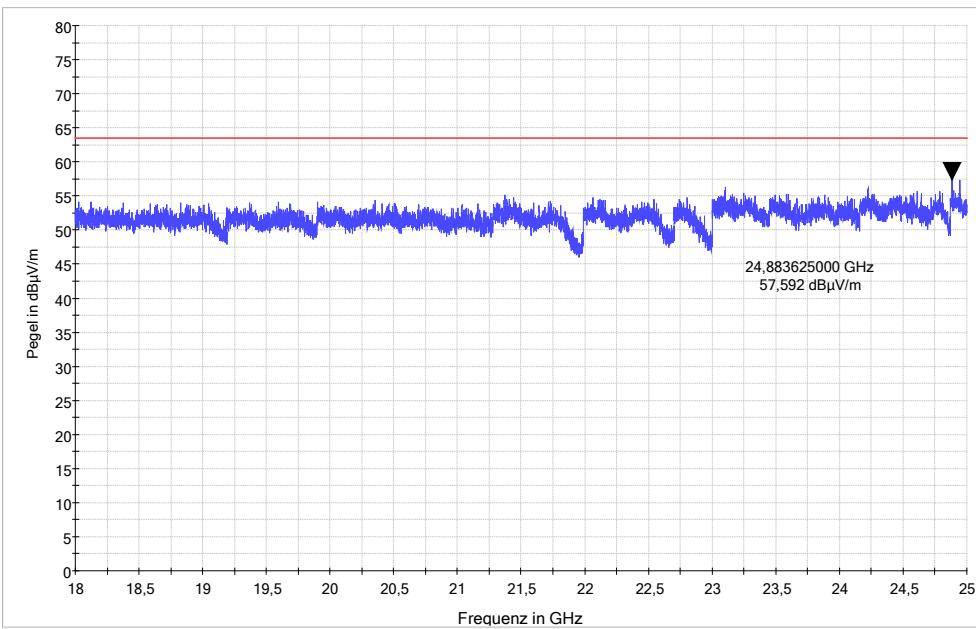
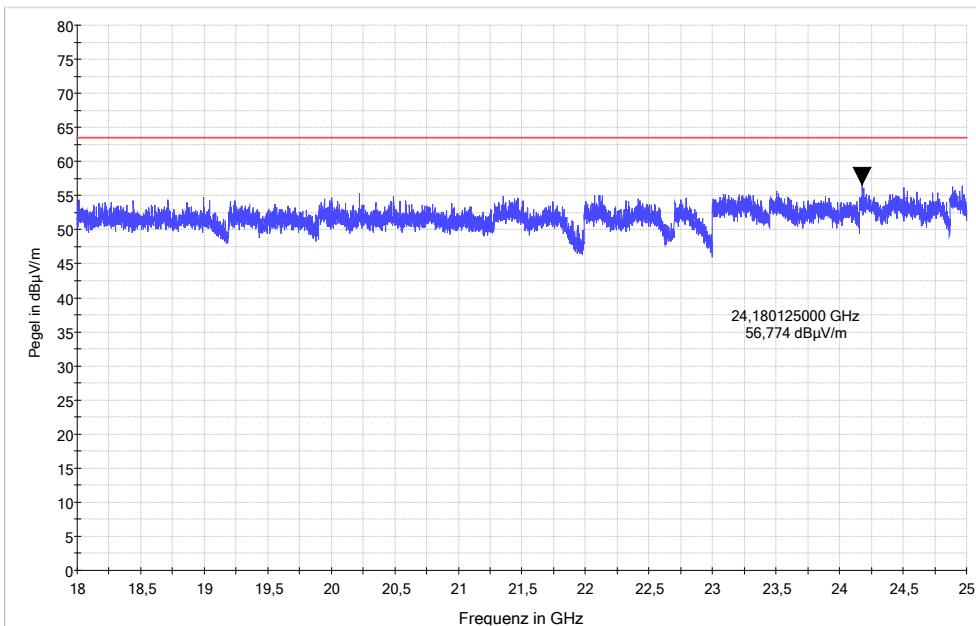
— Preview Result 2V-AVG — Preview Result 1H-PK+ — FCC 15.209 (1m) PK — FCC 15.209 (1m) AVG
* Final_Result PK ◇ Final_Result AVG



9.1.3.3 EUT in upright position:



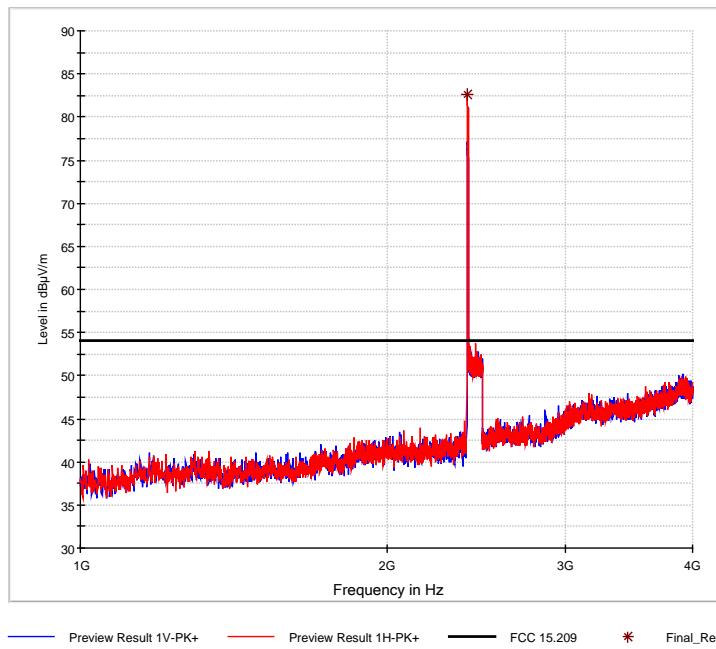
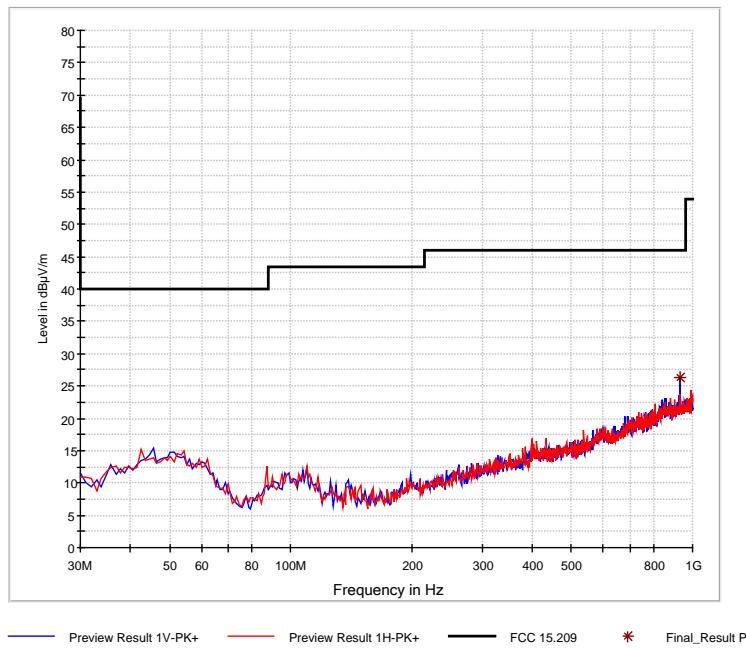


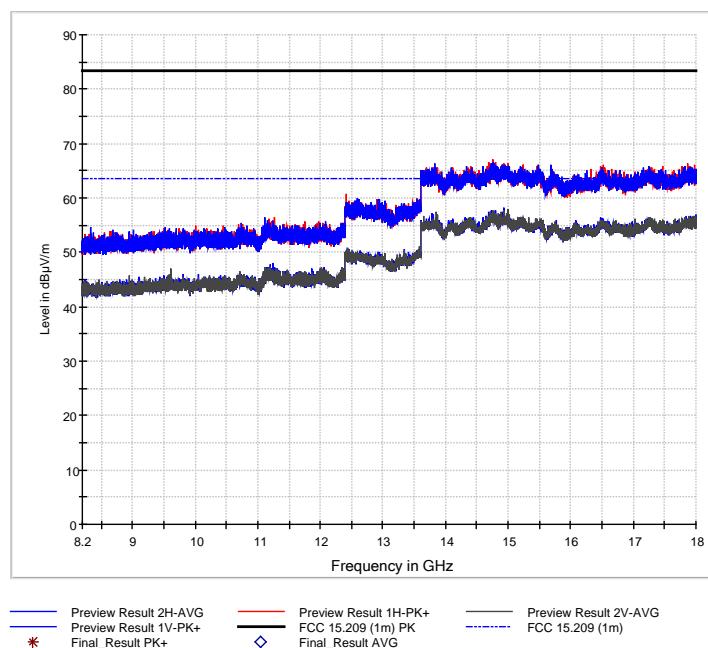
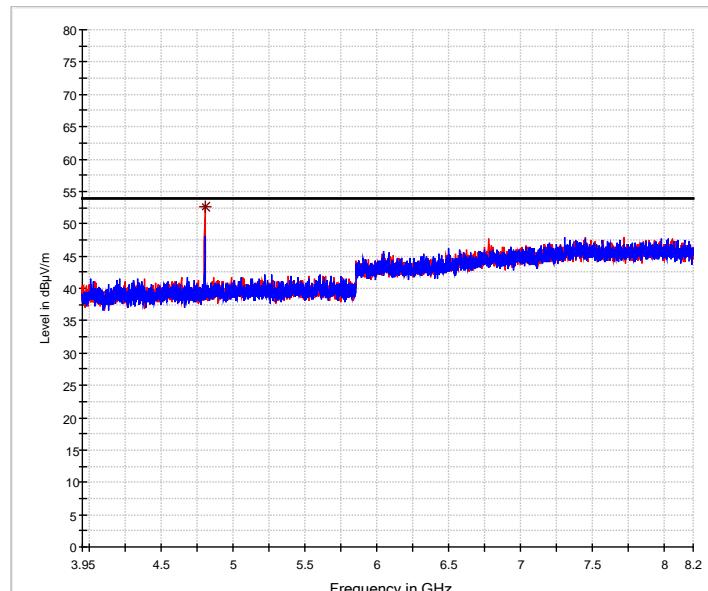


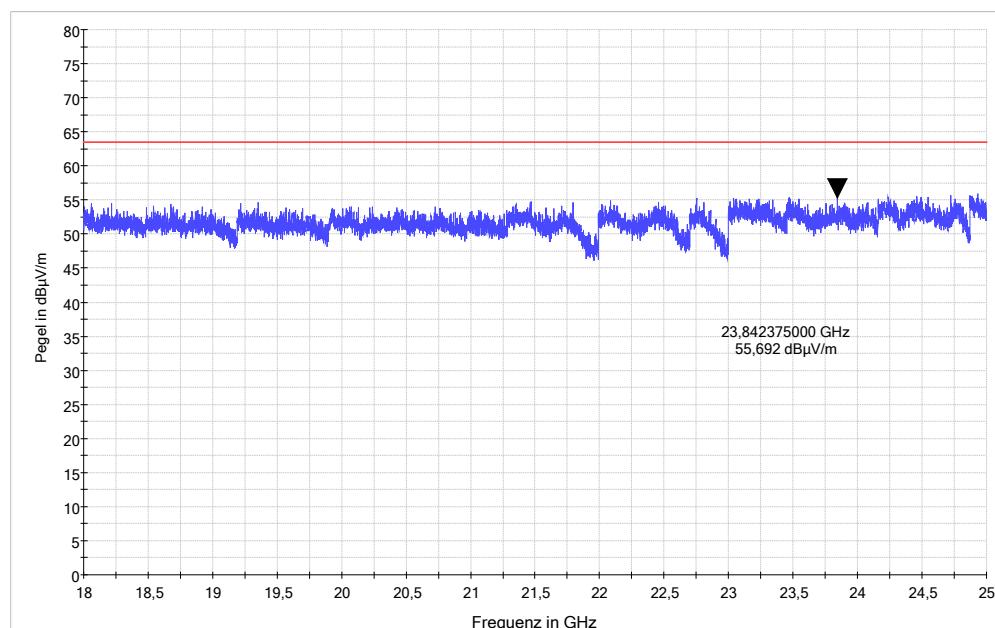
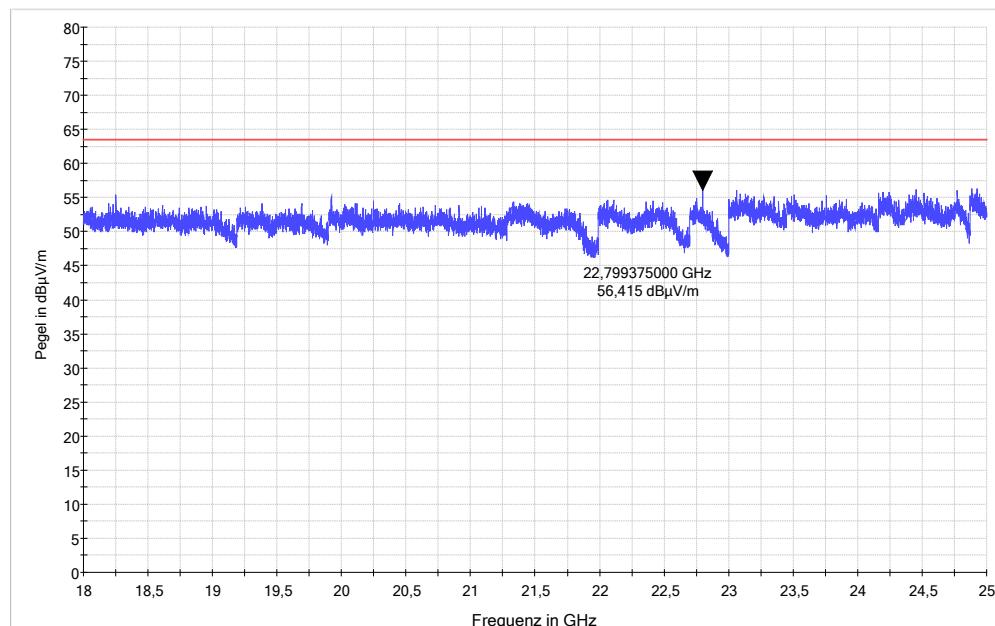
9.2 Test plots for Proprietary radio

9.2.1 Lowest channel

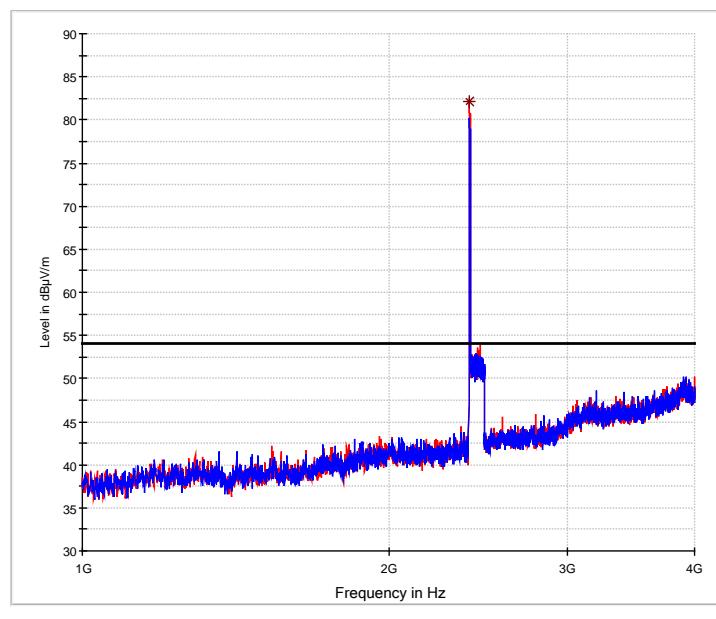
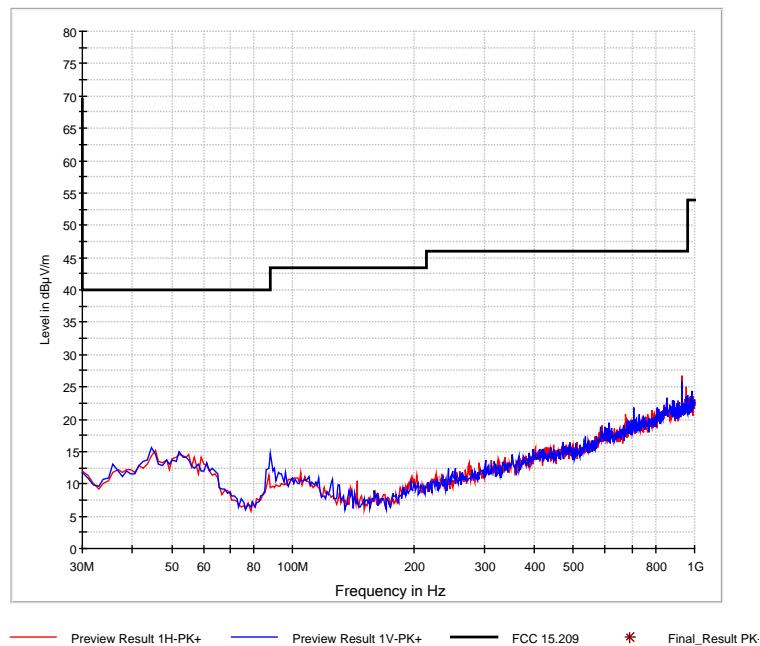
9.2.1.1 EUT flat on table

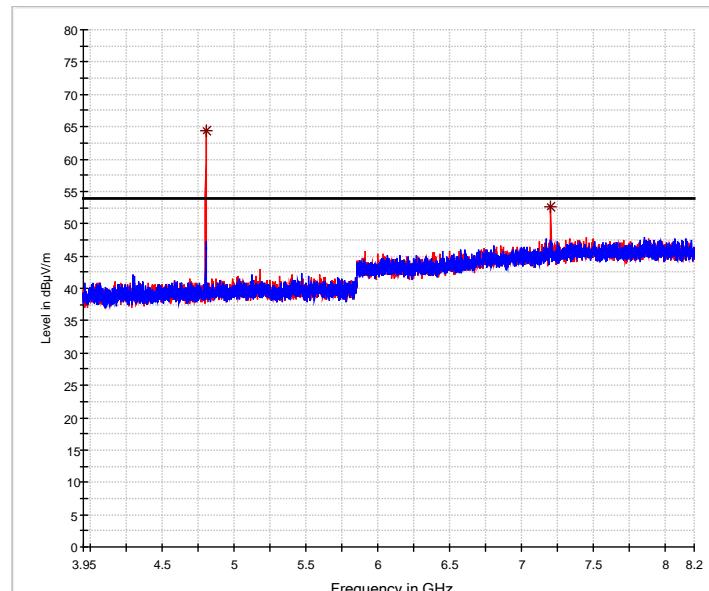




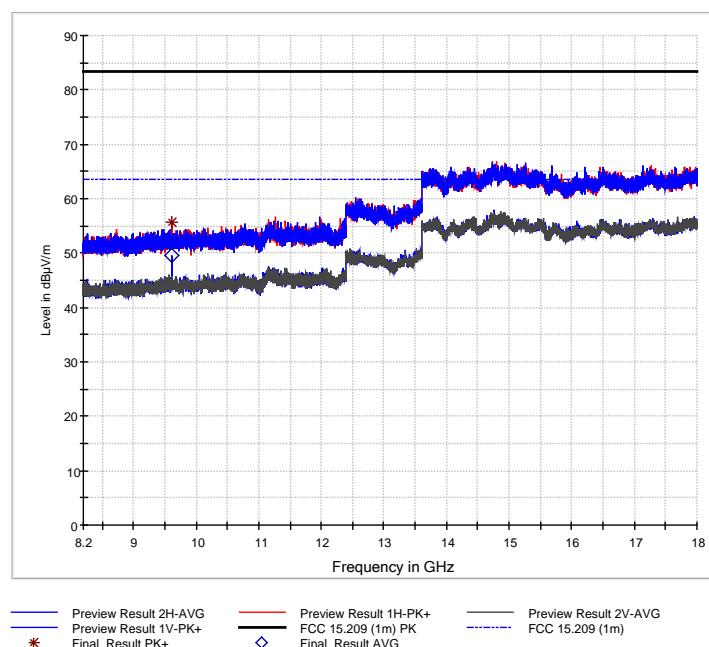


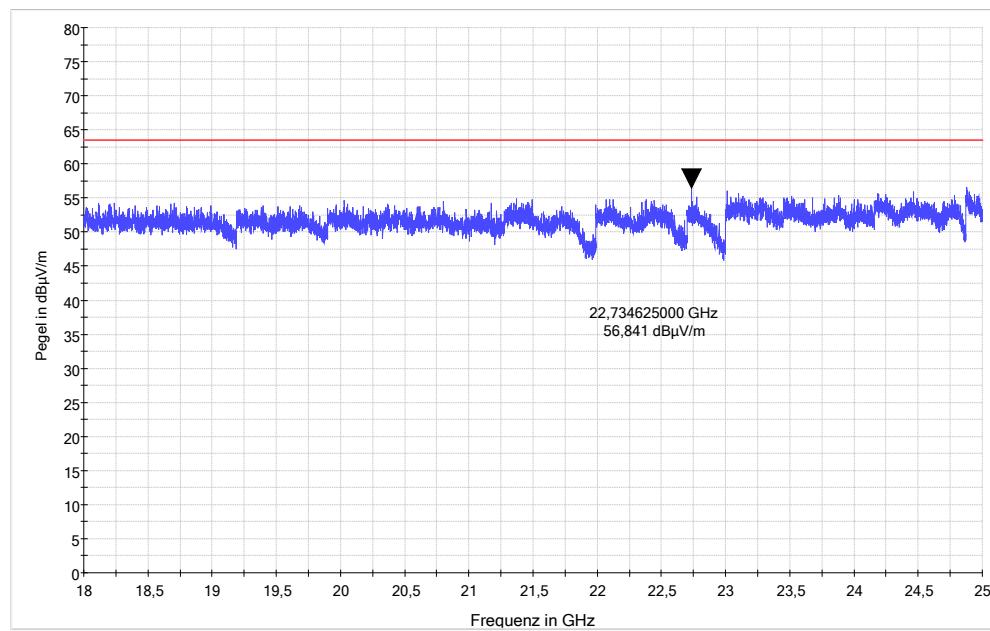
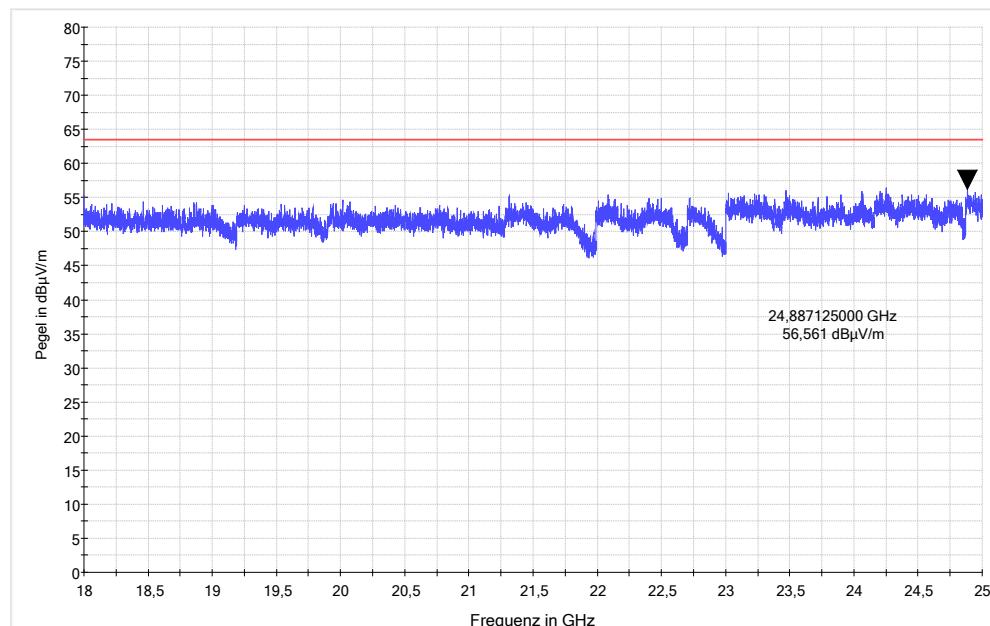
9.2.1.2 EUT on long side



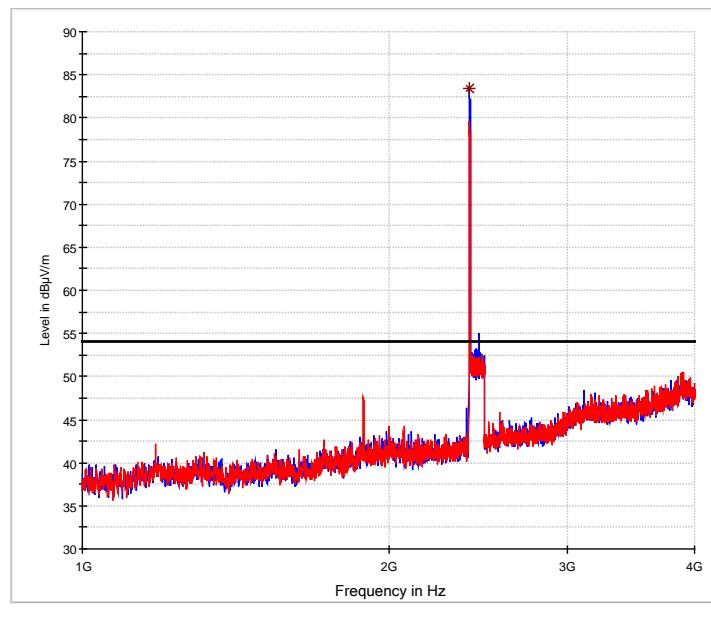
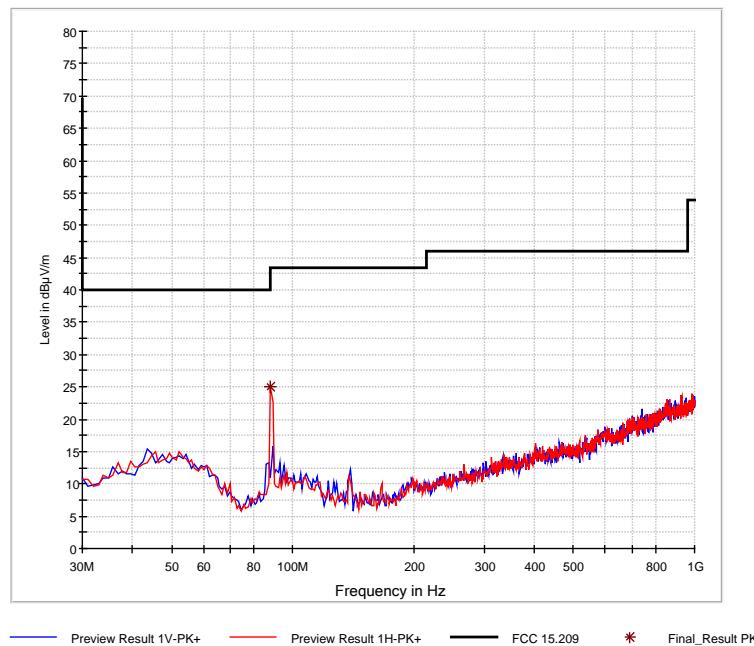


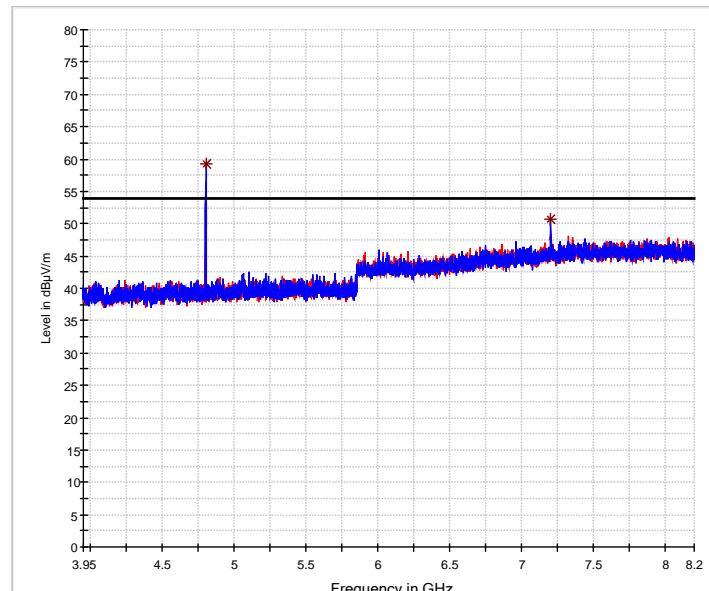
Nachmessen1!!



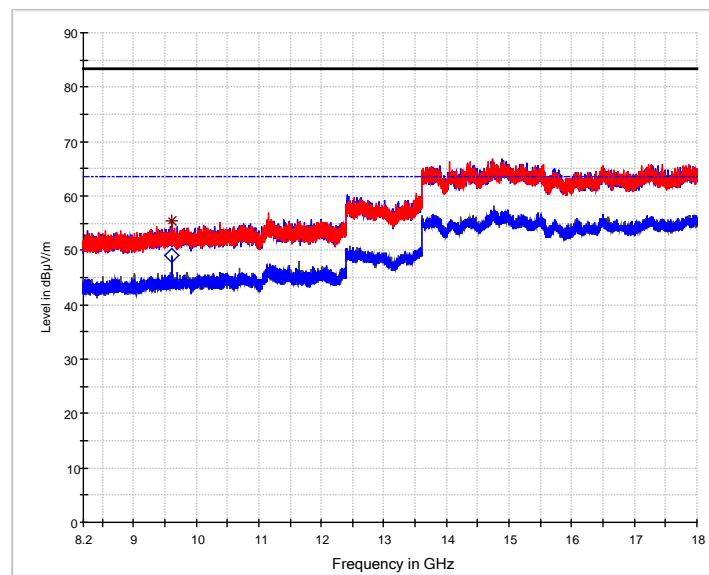


9.2.1.3 EUT in upright position:

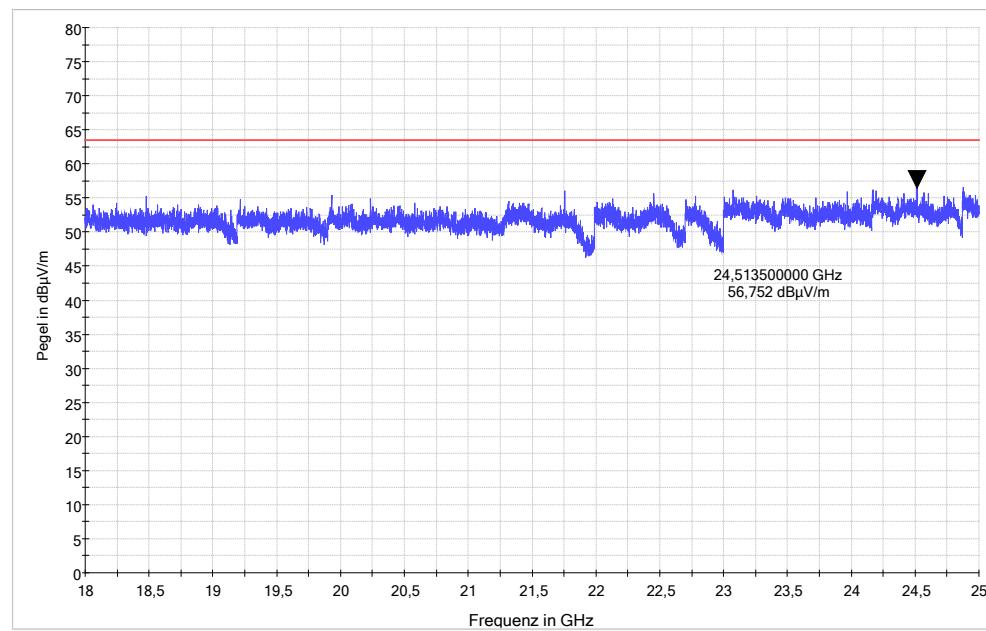
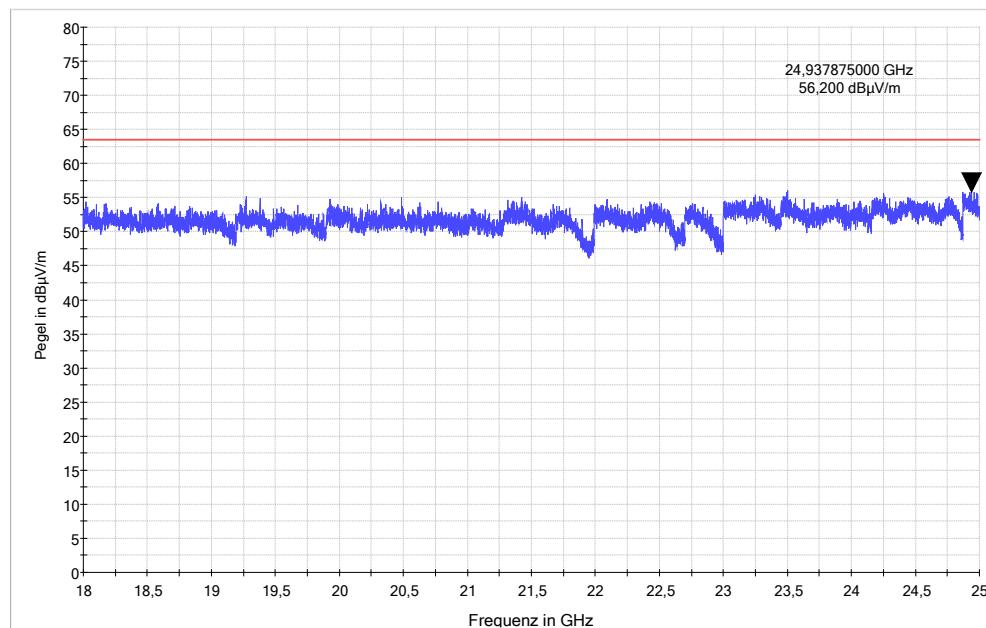




— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

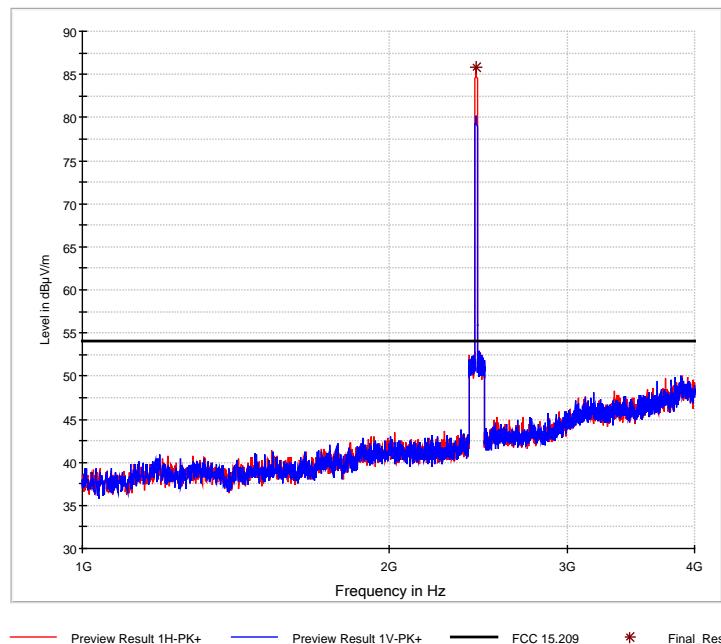
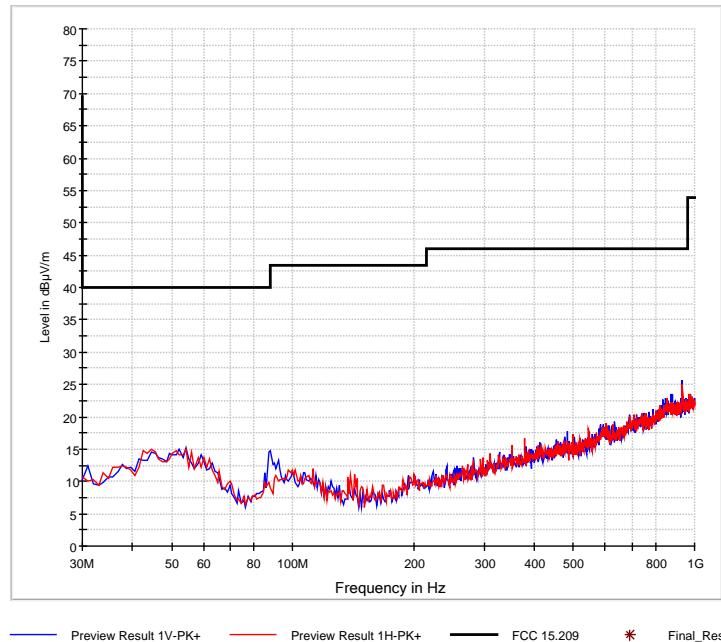


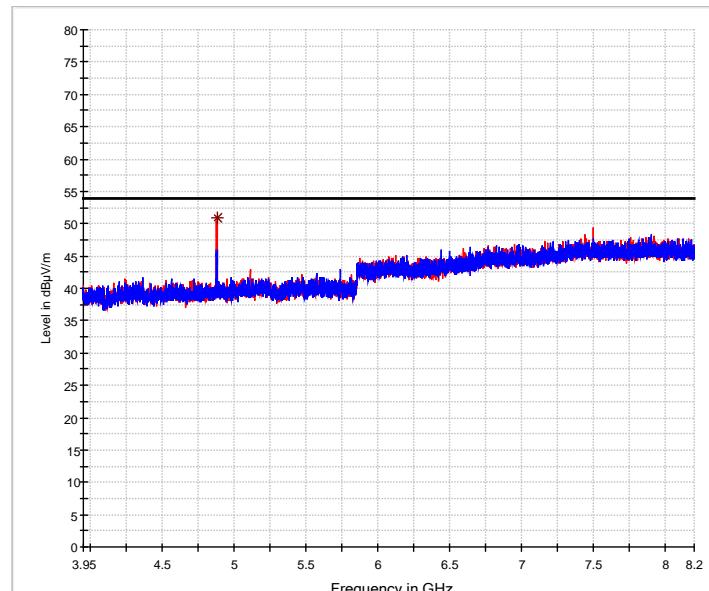
— Preview Result 2V-AVG
— Preview Result 1H-PK+
— Final_Result PK
— Preview Result 1V-PK+
— FCC 15.209 (1m) PK
— FCC 15.209 (1m) AVG
* Final_Result AVG



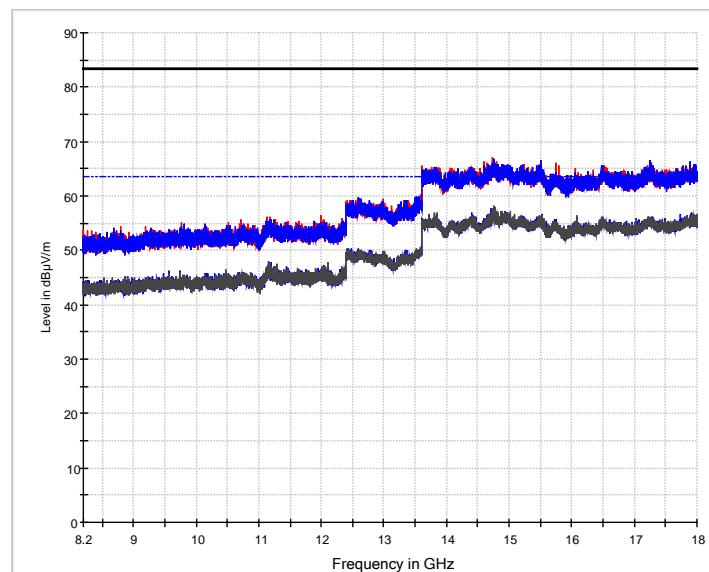
9.2.2 Middle channel

9.2.2.1 EUT flat on table:

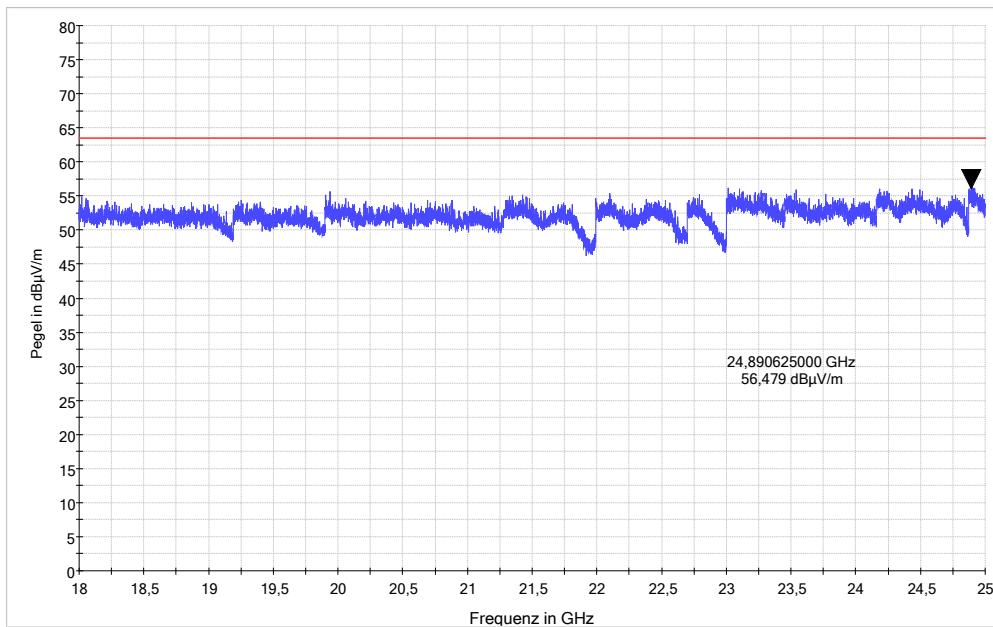
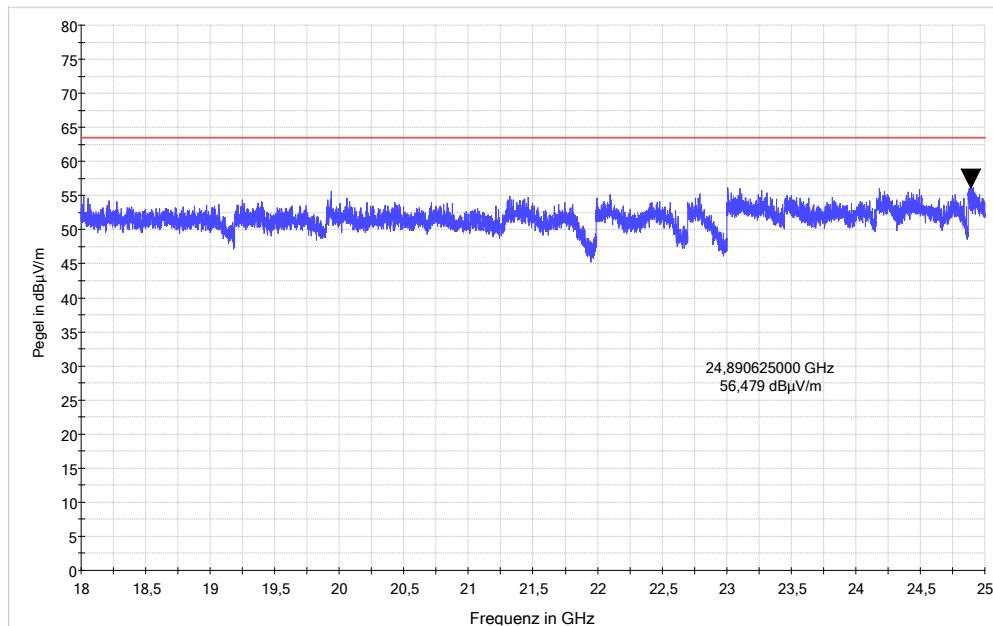




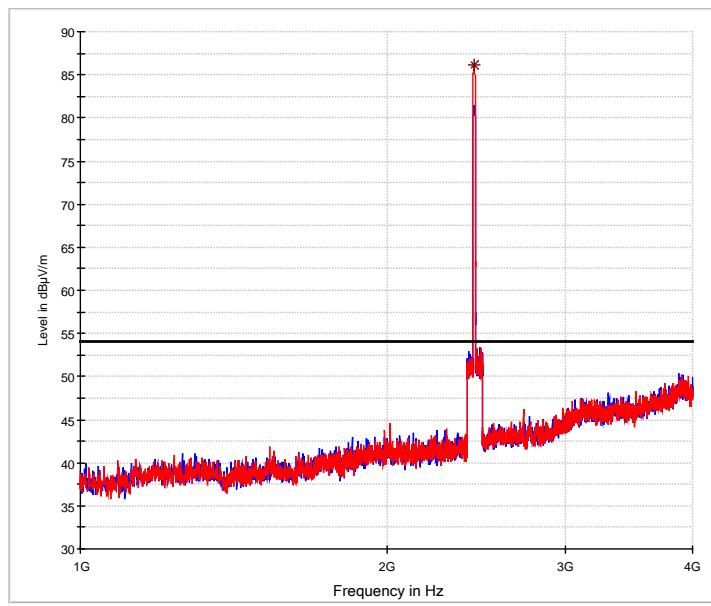
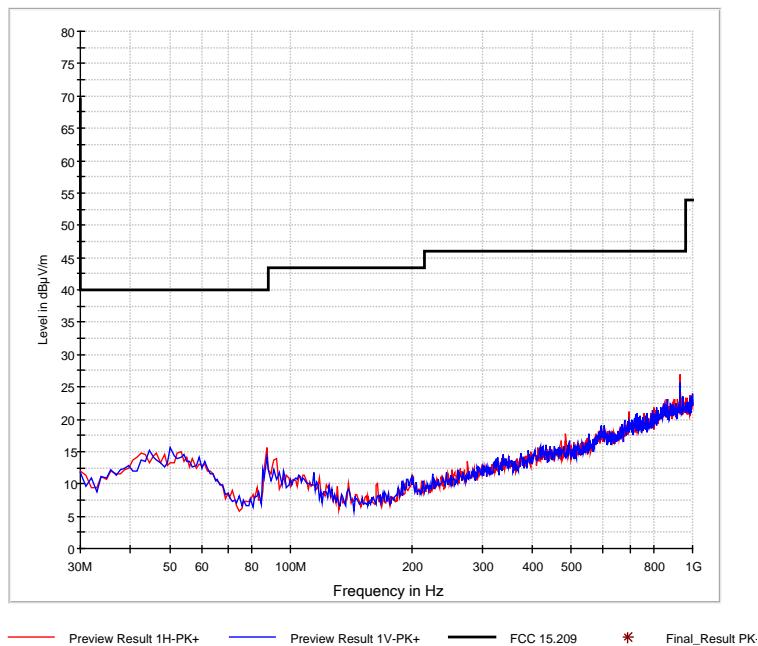
— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

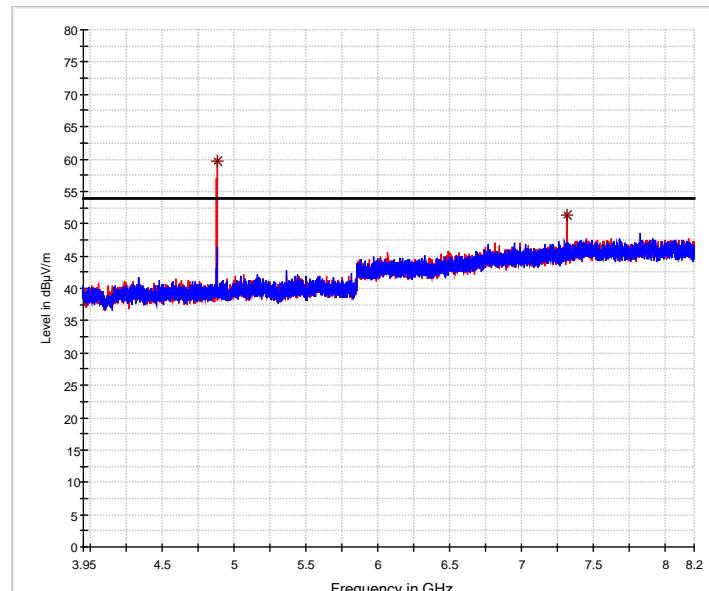


— Preview Result 2H-AVG
— Preview Result 1V-PK+ — Preview Result 1H-PK+ — Preview Result 2V-AVG
* — FCC 15.209 (1m) PK — FCC 15.209 (1m) AVG
◊ Final_Result PK Final_Result AVG

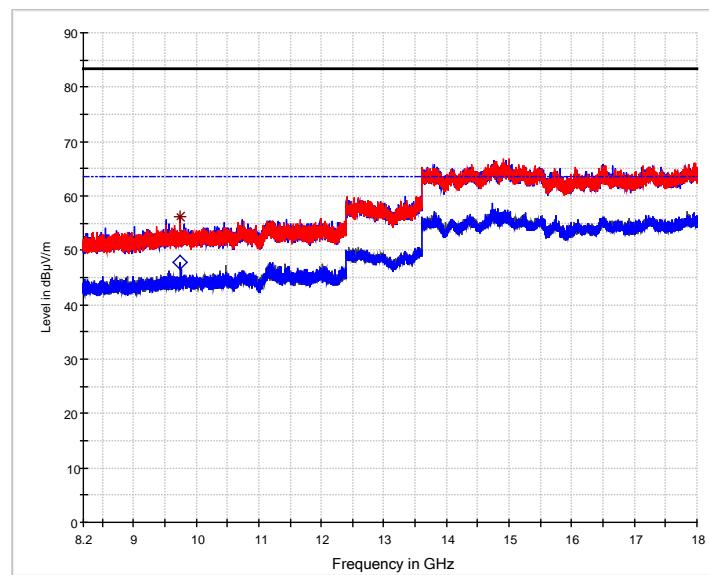


9.2.2.2 EUT on long side:

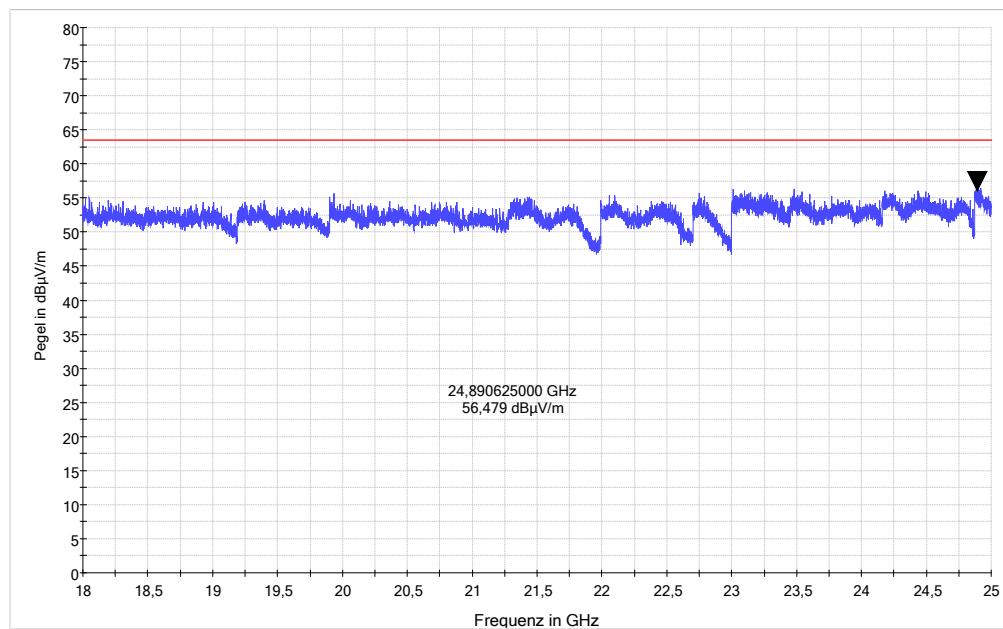
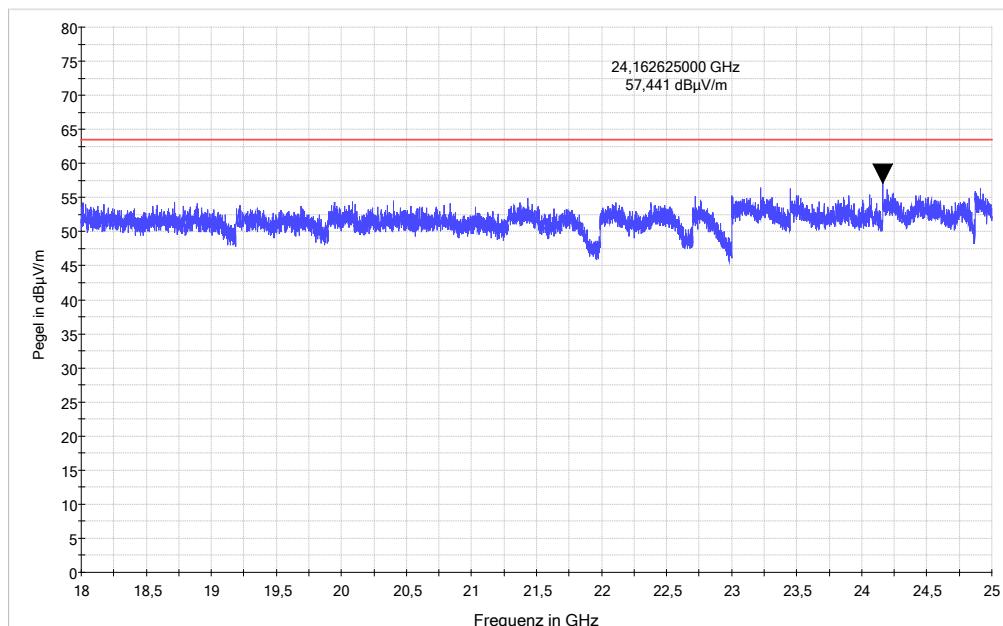




— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK

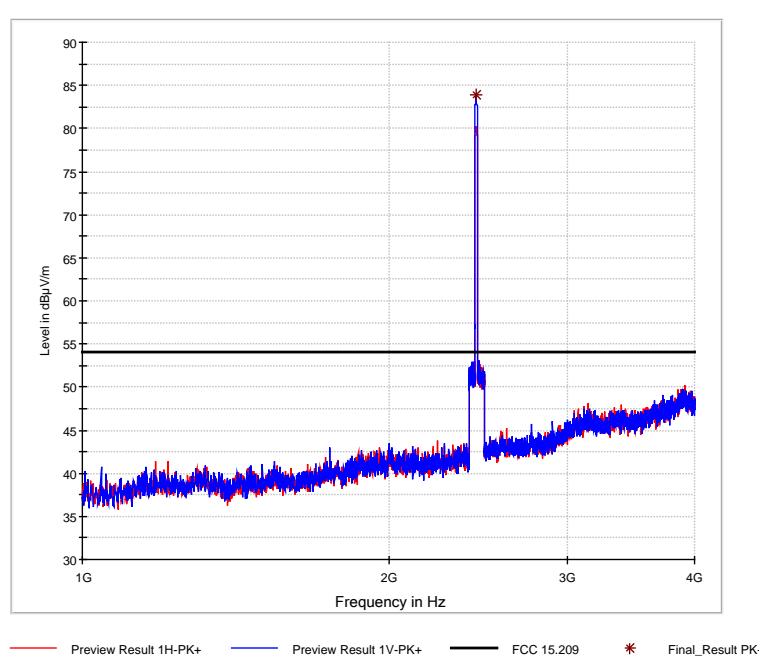
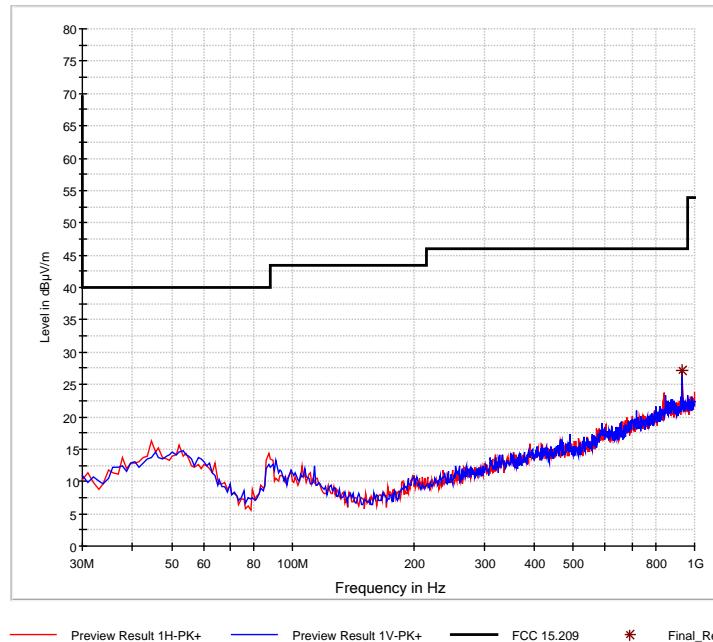


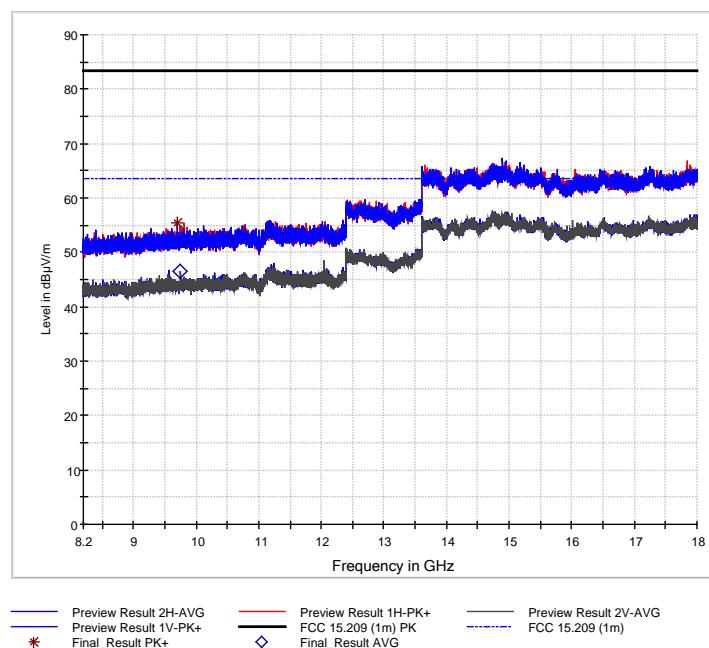
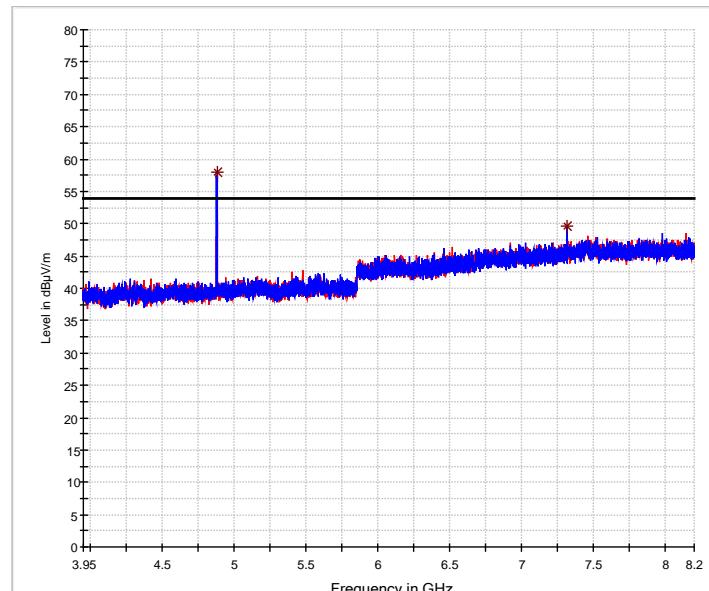
— Preview Result 2V-AVG
— Preview Result 1H-PK+
— Preview Result 1V-PK+
* Final_Result PK
— FCC 15.209 (1m) PK
◊ Final_Result AVG
— Preview Result 2H-AVG
— FCC 15.209 (1m) AVG

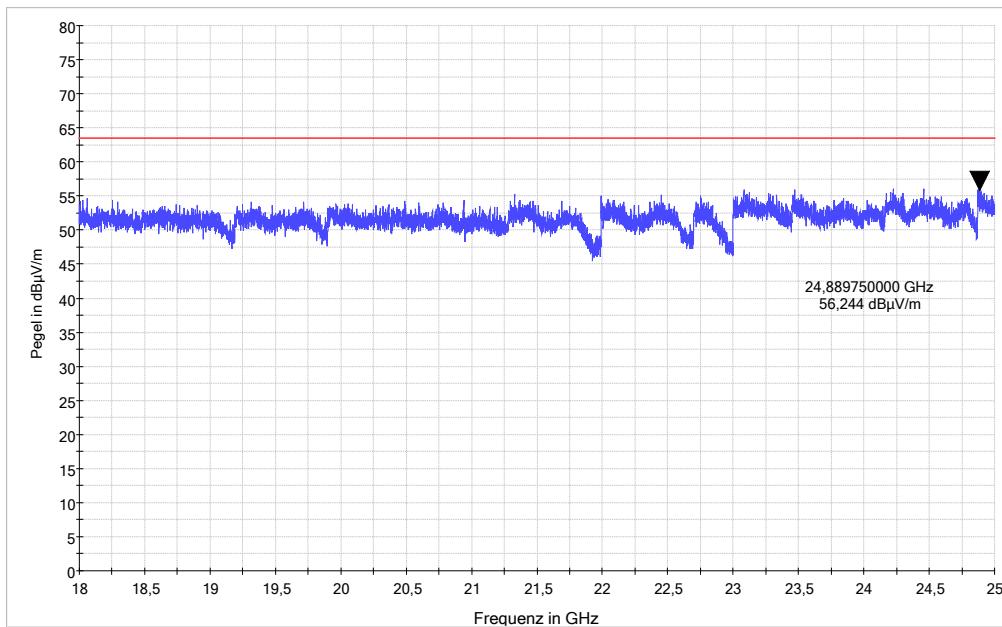
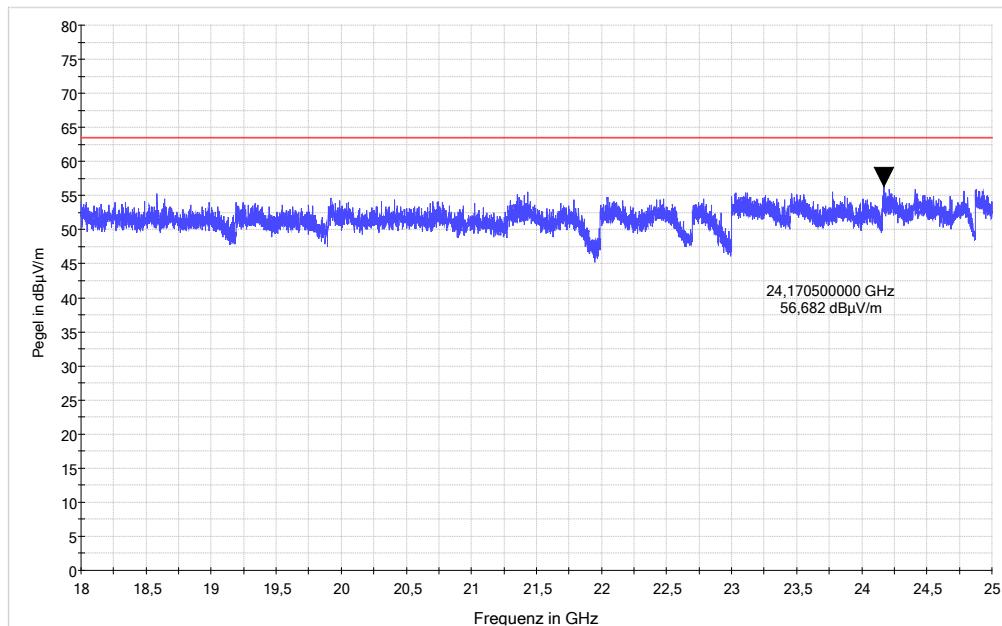


9.2.3 Middle channel

9.2.3.1 EUT in upright position

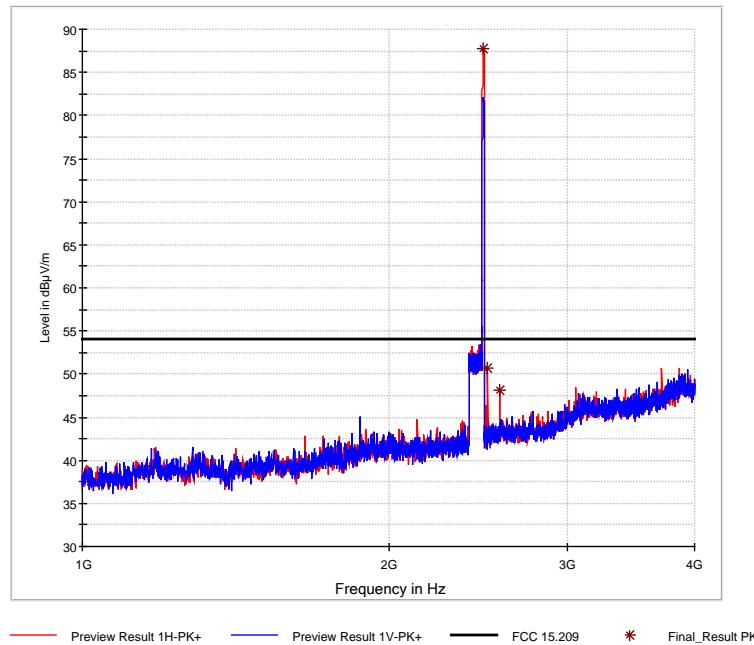
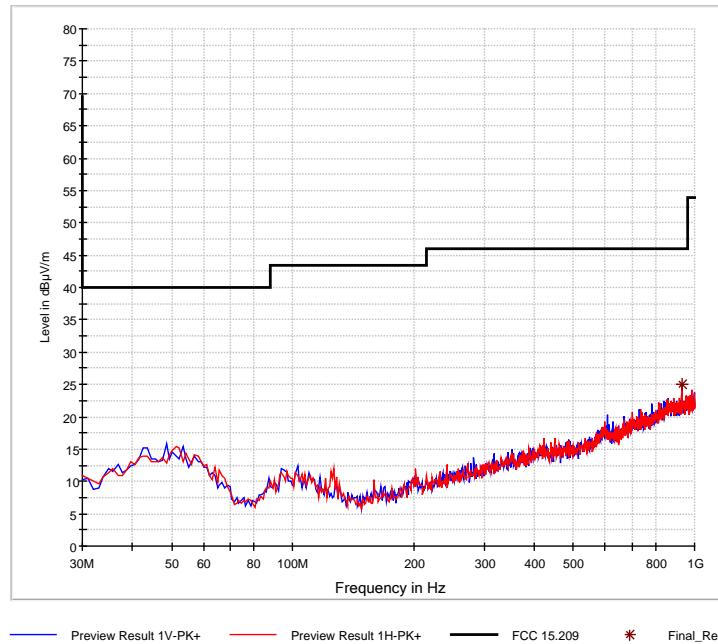


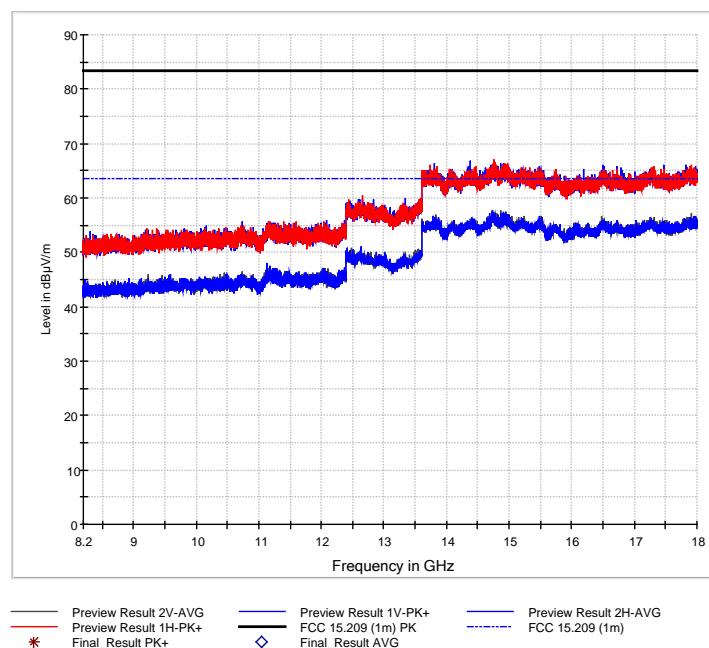
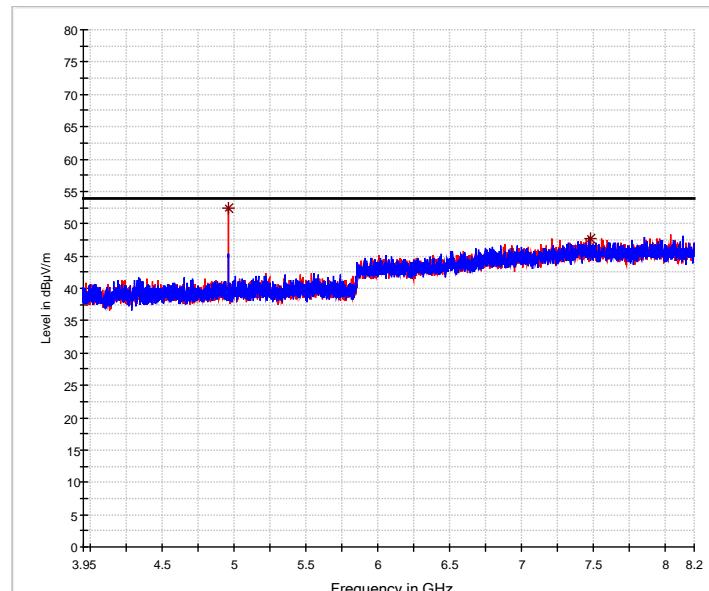


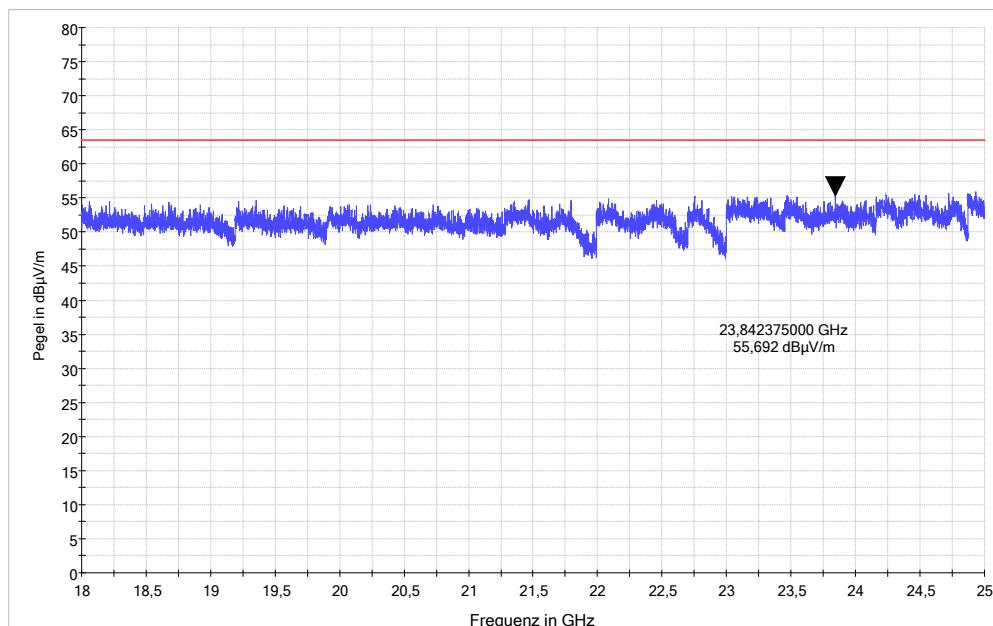
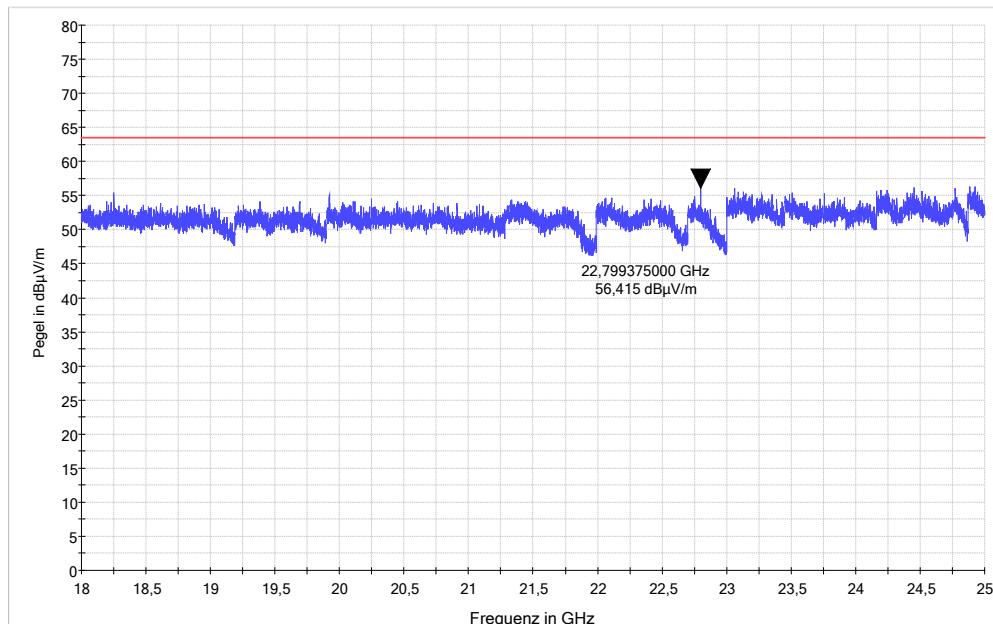


9.2.4 Highest channel

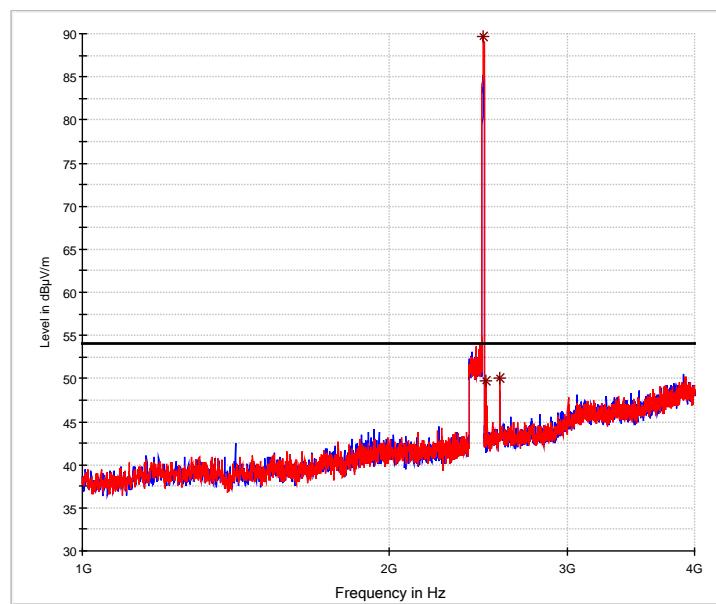
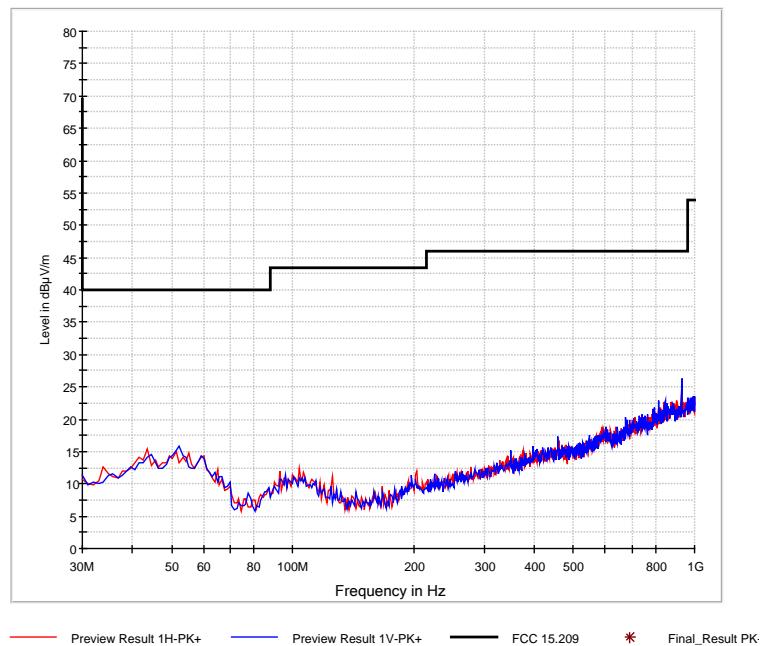
9.2.4.1 EUT flat on table

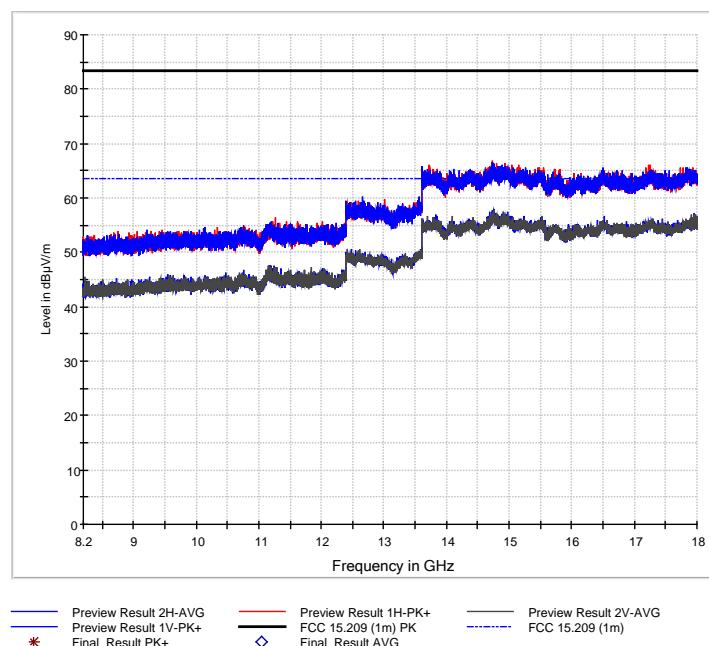
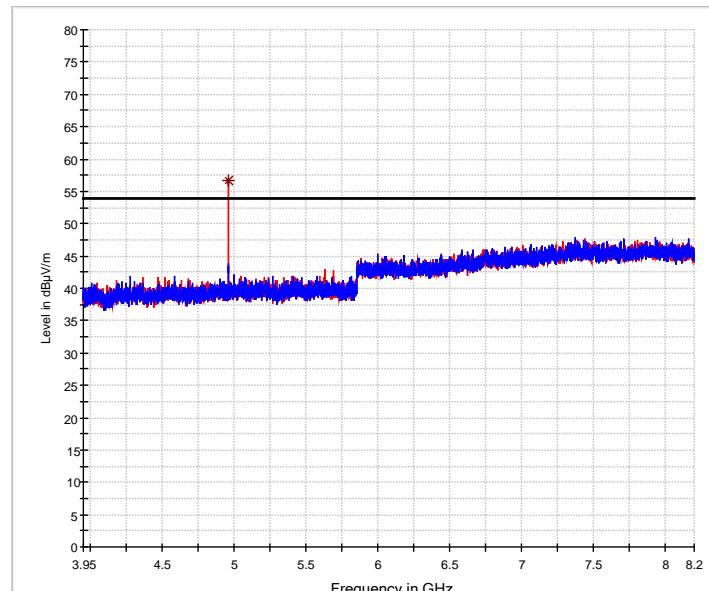


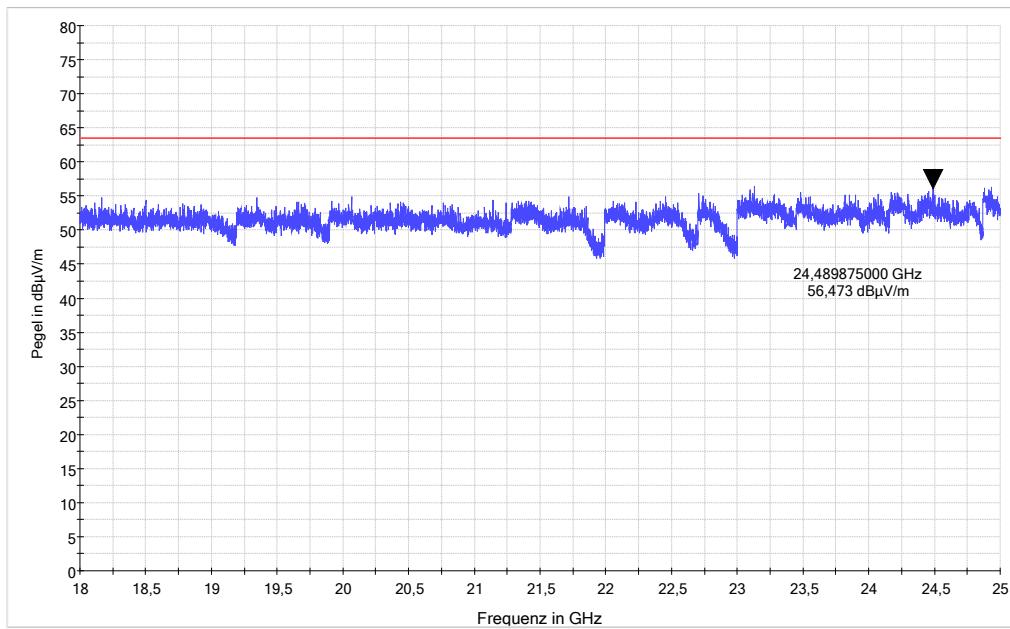
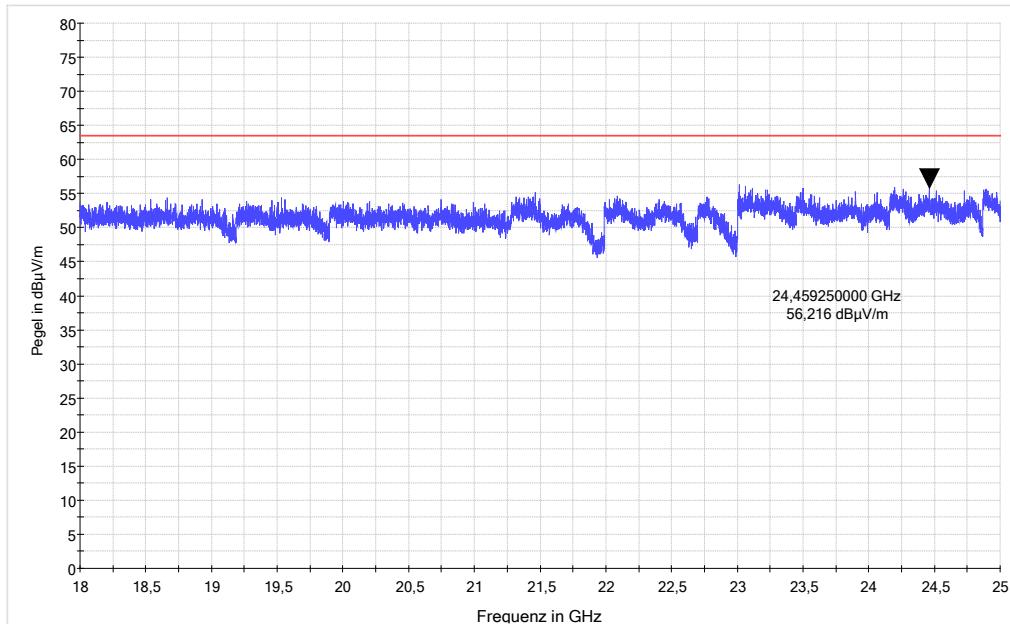




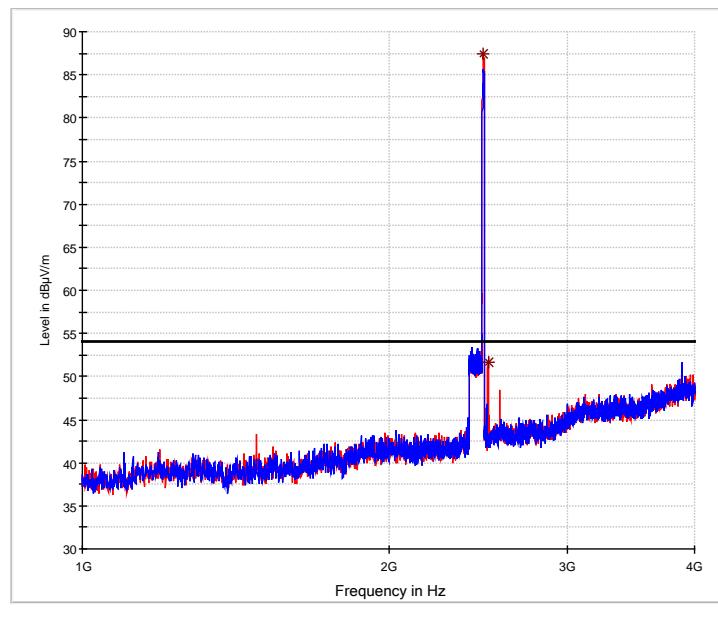
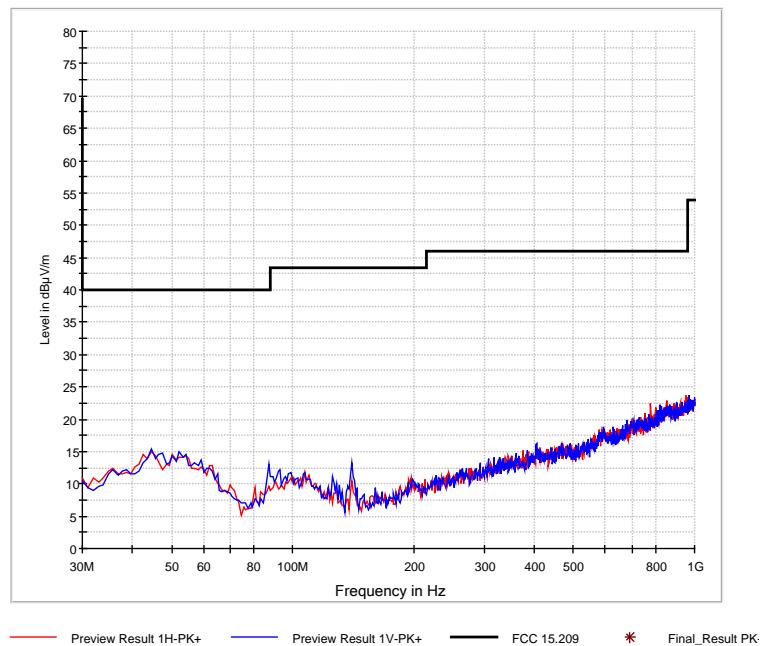
9.2.4.2 EUT on long side:

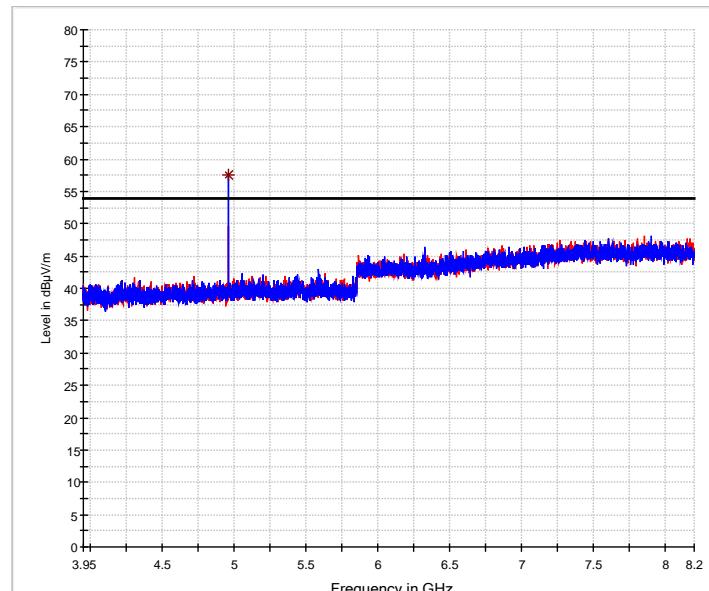




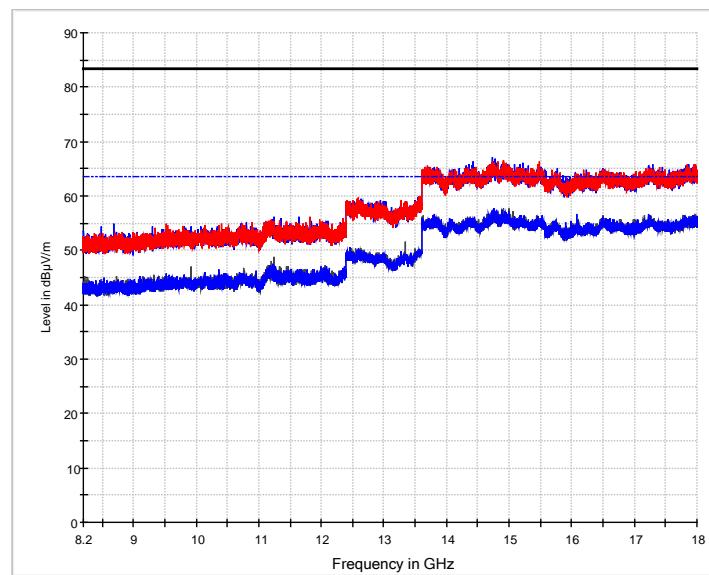


9.2.4.3 EUT in upright position

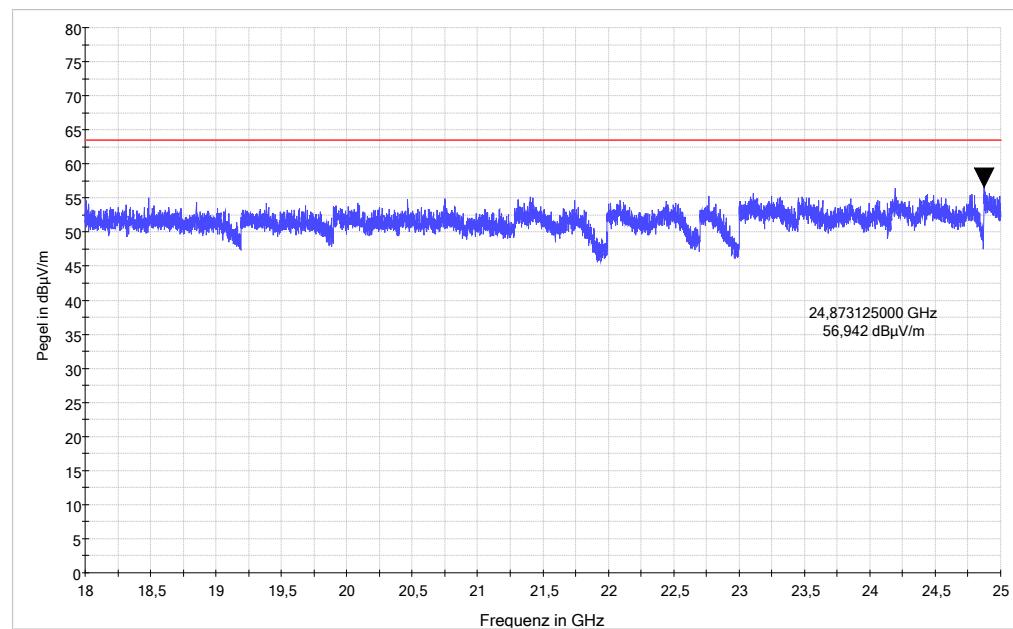
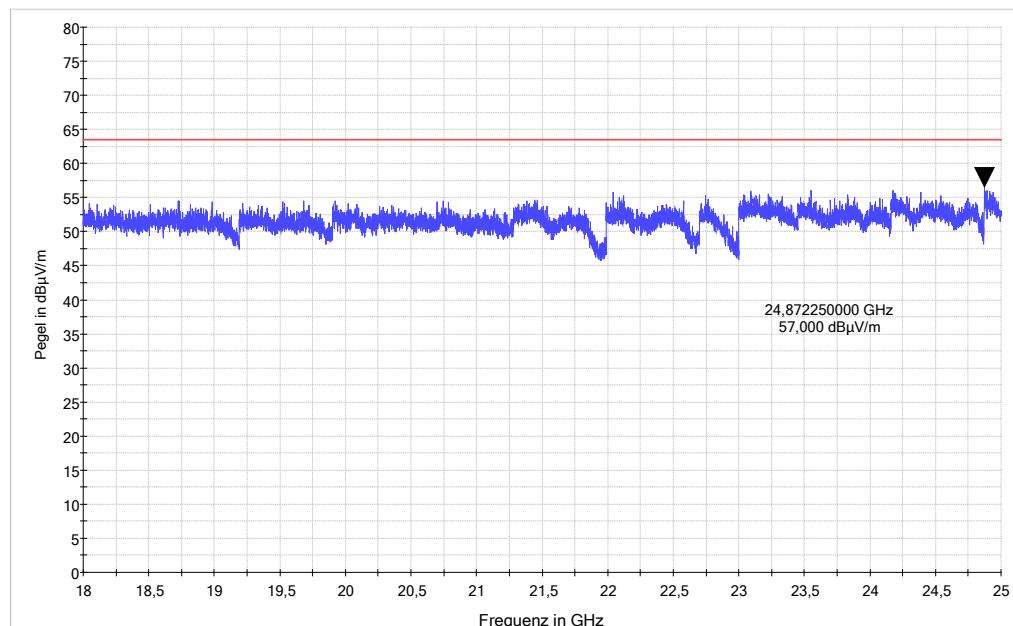




— Preview Result 1H-PK+ — Preview Result 1V-PK+ — FCC 15.209 * Final_Result PK



— Preview Result 2V-AVG
— Preview Result 1H-PK+
— Final_Result PK
— Preview Result 1V-PK+
— FCC 15.209 (1m) PK
— Final_Result AVG
* — Preview Result 2H-AVG
— FCC 15.209 (1m)
— Final_Result PK



10 Revision History

Revision History			
<i>Edition</i>	<i>Date</i>	<i>Issued by</i>	<i>Modifications</i>
1	2017-08-28	M. Steindl	First Edition
2	2017-09-11	M. Steindl (lc)	Correction of type designation