Product Service

Choose certainty.
Add value.

October 20, 2017

Prüfbericht / *Test Report* Nr. / *No.* 381040-97413-05 (Edition 1)

Applicant:	Moticon GmbH
Type of equipment:	Left and Right Sensor Insole
Type designation:	SENSORINSOLE2
Order No.:	mot-po160353
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.249 Industry Canada Radio Standards Specifications RSS-GEN Issue 4, Sections 8.8 and 8.10 and RSS-210 Issue 9, Section B.10 (Category I Equipment)

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.

Bundesnetzagentur

BNetzA-CAB-16/21-15

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	SENSORINSOLE2
Parts[2]:	
Serial number(s):	2235; 2254
Manufacturer:	Moticon GmbH
Type of equipment:	Left and Right Sensor Insole
Version:	As received
FCC ID:	2AB3O-INSOLE2
Additional parts/accessories:	

Technical data of EUT		
Application frequency range:	2400.0 MHz - 2483.5 MHz	
Frequency range:	2403 MHz – 2480 MHz	
Operating frequency:	2403 MHz, 2440 MHz,2480 MHz	
Type of modulation:	GFSK	
Pulse train:	---	
Pulse width:	---	
Number of RF-channels:	77	
Channel spacing:	1 MHz	
Designation of emissions[3]:	860KF1D	
Type of antenna:	Integrated	
Size/length of antenna:	N/A	
Connection of antenna:	☐ detachable	☒ not detachable
Type of power supply:	Battery supply	
Specifications for power supply:	nominal voltage:	3.7 V

[1] Type designation of the system if EUT consists of more than one part.
[2] Type designations of the parts of the system, if applicable.
[3] Also known as "Class of Emission".

2 Administrative Data

Application details	
Applicant (full address):	Moticon GmbH Machtlfinger Straße 21 81379 München / Munich Germany
Contact person:	Mr. Dr.-Ing. Robert Vilzmann
Order number:	mot-po160353
Receipt of EUT:	2017-02-20
Date(s) of test:	2017-04-12 – 2017-10-19
Note(s):	

Report details	
Report number:	381040-97413-05
Edition:	1
Issue date:	2017-10-20

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	TÜV SÜD Product Service GmbH
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAkkS Registration No. D-PL-11321-11-01
Laboratory recognition:	Registration No. BNetzA-CAB-16/21-15
Industry Canada test site registration:	3050A-2
Contact person:	Mr. Markus Biberger Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

4 Summary

Summary of test results
The tested sample complies with the requirements set forth in the **Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.249** of the Federal Communication Commission (FCC) and the **Radio Standards Specifications** **RSS-GEN Issue 4, Sections 8.8 and 8.10 and** **RSS-210 Issue 9, Section B.10 (Category I Equipment)** of Industry Canada (IC).

Die Prüfergebnisse beziehen sich ausschließlich auf das zur Prüfung vorgestellte Prüfmuster. Ohne schriftliche Genehmigung des Prüflabors darf der Prüfbericht auszugsweise nicht vervielfältigt werden. *The test results relate only to the individual item which has been tested. Without the written approval of the test laboratory this report may not be reproduced in extracts.*

Datum / *Date*	Geprüft von / *Tested by*	Freigabe durch / *Checked by*
2017-10-20	Steindl Martin Martin Steindl Responsible for testing	Markus Biberger Reviewer

Prüfergebnis / *Test Result*

☒ **Erfüllt / *Passed***

☐ **Nicht erfüllt / *Not passed***

5 Operation Mode and Configuration of EUT

Operation Mode(s)
Transmitting on lowest, middle and highest frequency channel with test mode.

Configuration(s) of EUT
The EUT was configured in stand alone mode. All radiated emissions were performed in three orthogonal axis.

List of ports and cables				
Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*

List of devices connected to EUT				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*

List of support devices				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	ANT plus interface dongle			
2	Laptop PC			

[4] Ports shall be classified as ac power, dc power or signal/control port

6 Measurement Procedures

6.1 Bandwidth Measurements

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, section 15.215(c) IC RSS-Gen Issue 4, section 6.6 IC RSS-210 Issue 9, section A.1.3 ANSI C63.10, section 6.9.1
Guide:	ANSI C63.10 / IC RSS-Gen Issue 4, section 6.6
Measurement setup:	☐ Conducted: See below ☒ Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.3)

If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.

If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.

The analyzer settings are specified by the test description of the appropriate test record(s).

6.2 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.249(d) IC RSS-210 Issue 9, section B.10(b)
Guide:	ANSI C63.10

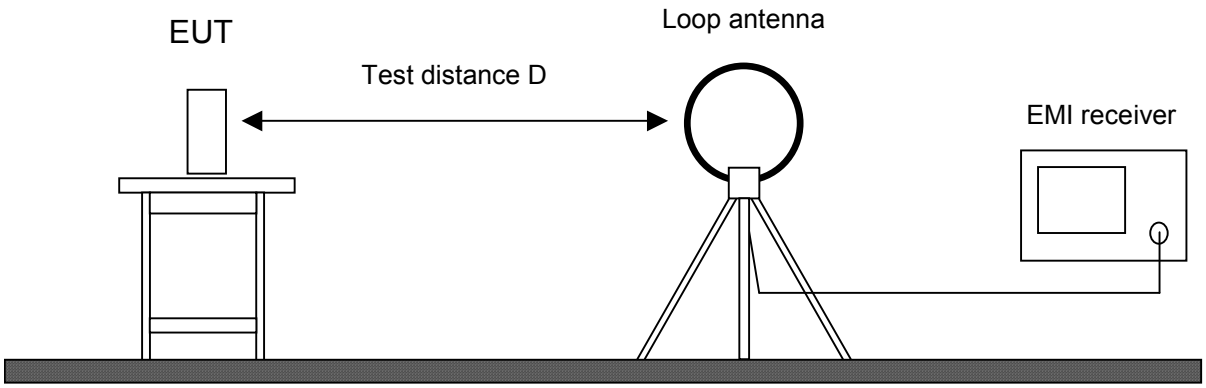
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.



TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☒	EMI test receiver	ESW26	28268	101315	Rohde & Schwarz
☐	EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
☒	Loop antenna	HFH2-Z2	1016	882964/1	Rohde & Schwarz
☐	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☒	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Semi anechoic room	No. 8	2057	---	Albatross
☒	Measurement Software	EMC32_K8 V10.20.01	1852	100016	Rohde & Schwarz

6.3 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.249 IC RSS-210 Issue 9, section B.10
Guide:	ANSI C63.10

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

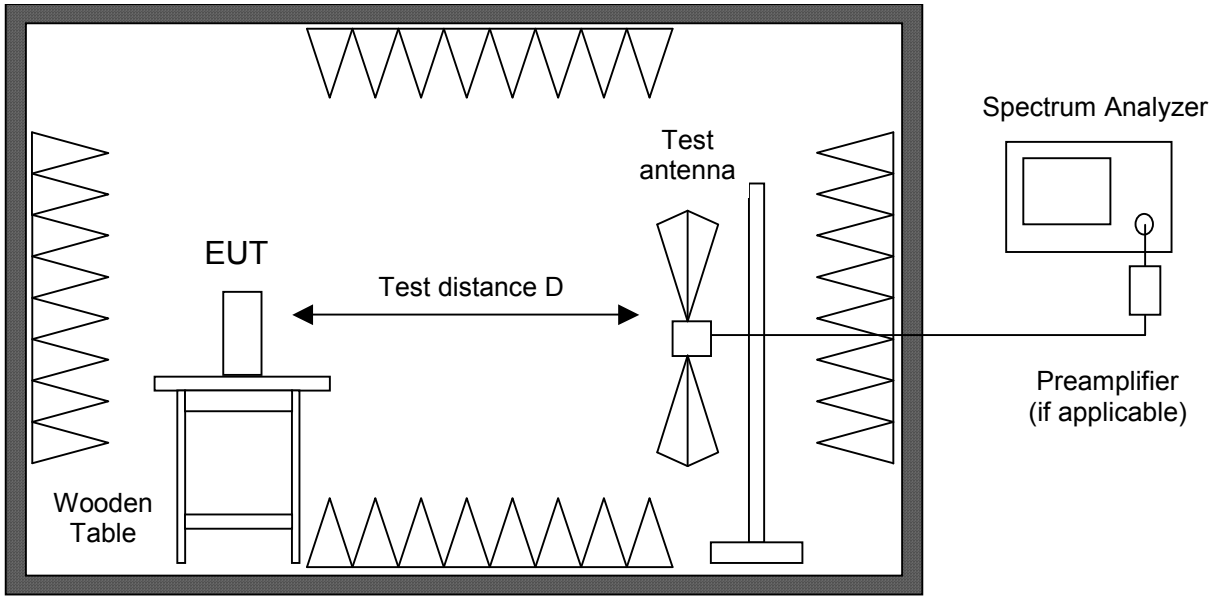
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites is used (see 6.4). If prescans are recorded in fully anechoic room they are indicated appropriately.



Fully or semi anechoic room

Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Spectrum analyzer		FSV40	2364	101448	Rohde & Schwarz
☒	EMI test receiver		ESW26	28268	101315	Rohde & Schwarz
☐	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Horn antenna		HF907	2073	100154	Rohde & Schwarz
☐	Horn antenna		3115	1516	9508-4553	EMCO
☐	Horn antenna		3160-03	1010	9112-1003	EMCO
☐	Horn antenna		3160-04	1011	9112-1001	EMCO
☐	Horn antenna		3160-05	1012	9112-1001	EMCO
☒	Horn antenna		3160-06	1013	9112-1001	EMCO
☒	Horn antenna		3160-07	1014	9112-1008	EMCO
☒	Horn antenna		3160-08	1015	9112-1002	EMCO
☒	Horn antenna		3160-09	1265	9403-1025	EMCO
☐	Horn antenna		3160-10	1575	399185	EMCO
☐	Microwave cable	Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable	Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☒	Microwave cable	Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☒	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable	Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☒	Microwave cable	Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Semi anechoic room		No. 8	2057	---	Albatross
☒	Measurement Software		EMC32_K8 V10.20.01	1852	100016	Rohde & Schwarz

6.4 Radiated Emission at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.249 IC RSS-210 Issue 9, section B.10
Guide:	ANSI C63.10

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

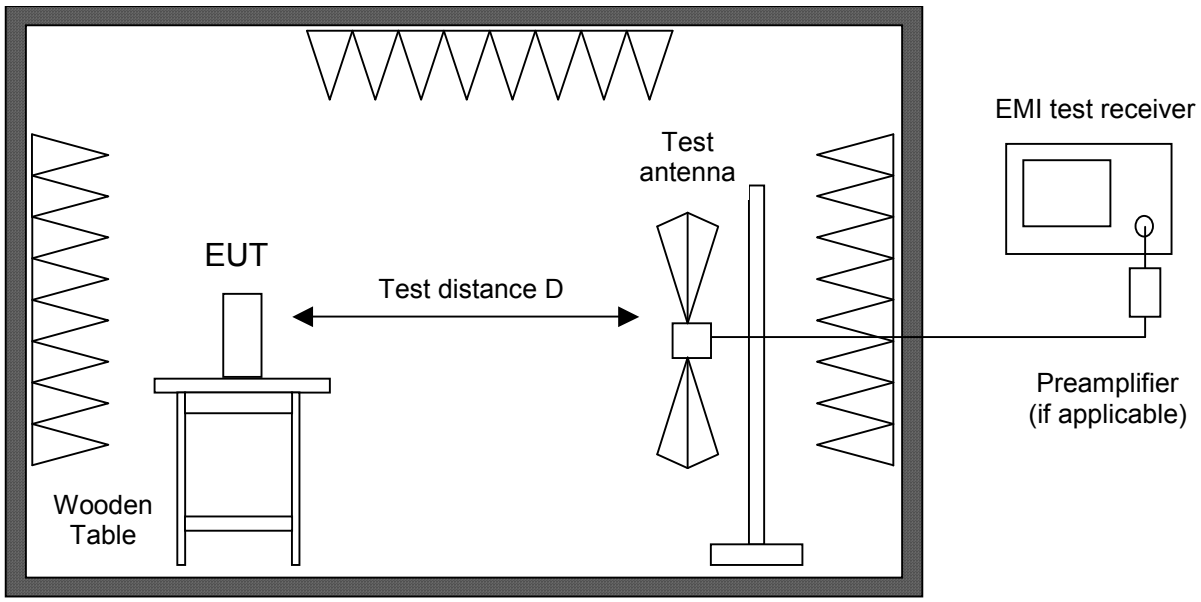
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is dircharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Alternate test site (semi anechoic room)

Test instruments used:

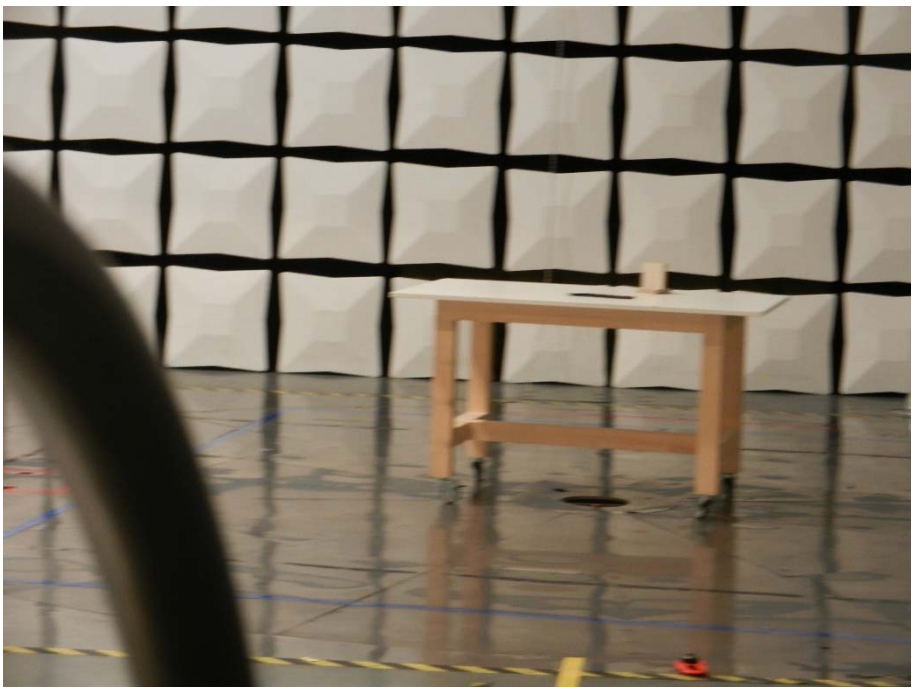
	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	EMI test receiver		ESW26	28268	101315	Rohde & Schwarz
☒	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Microwave cable	Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☒	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable	Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Microwave cable	Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☒	Semi anechoic room		No. 8	2057	---	Albatross
☒	Measurement Software		EMC32_K8 V10.20.01	1852	100016	Rohde & Schwarz

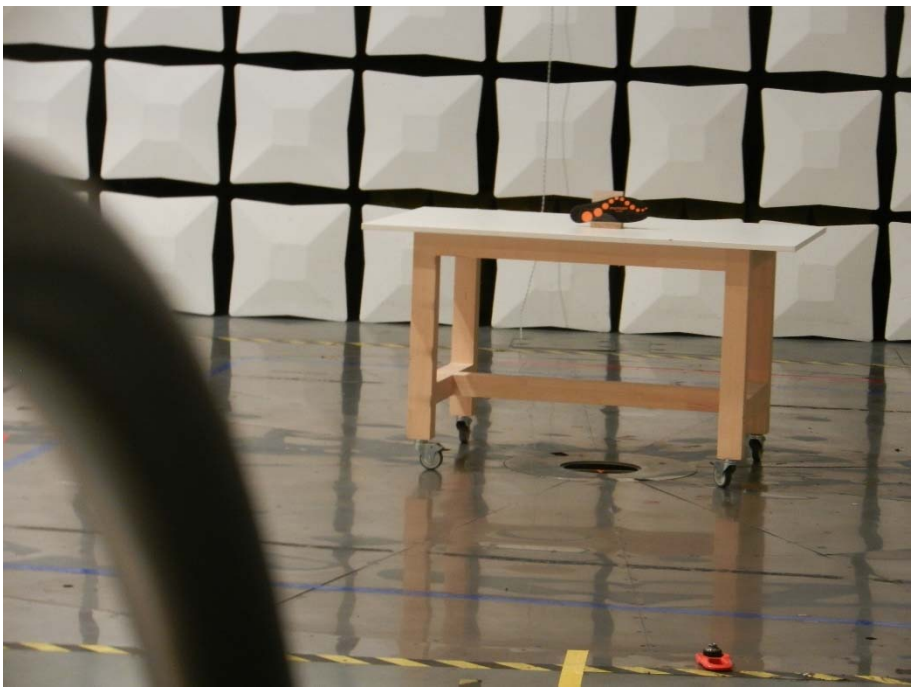
7 Photographs Taken During Testing

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for radiated emission measurement 9 kHz – 30 MHz





TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

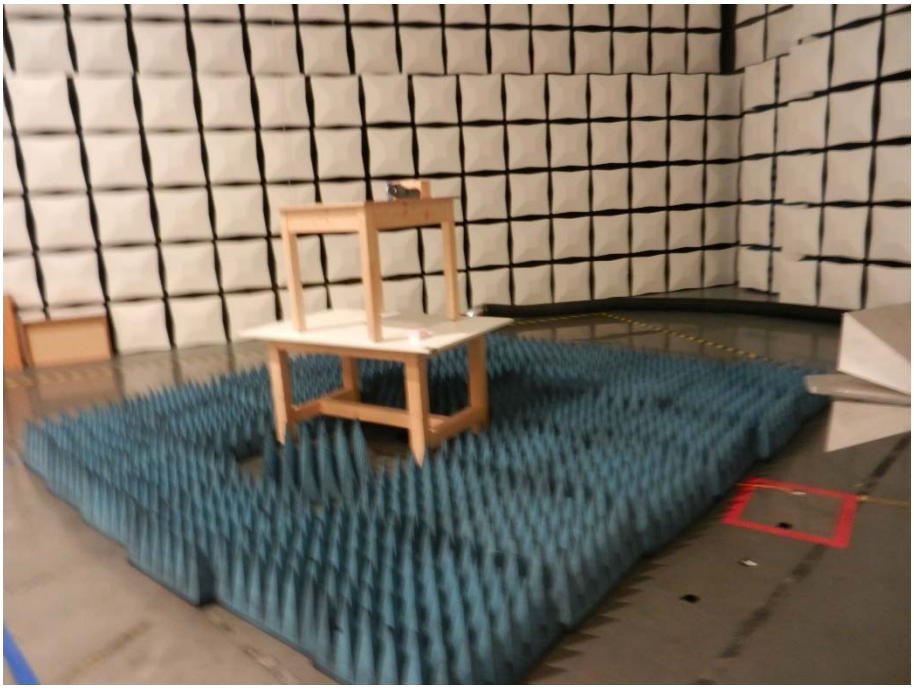
Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for radiated emission measurement 9 kHz – 30 MHz - continued -

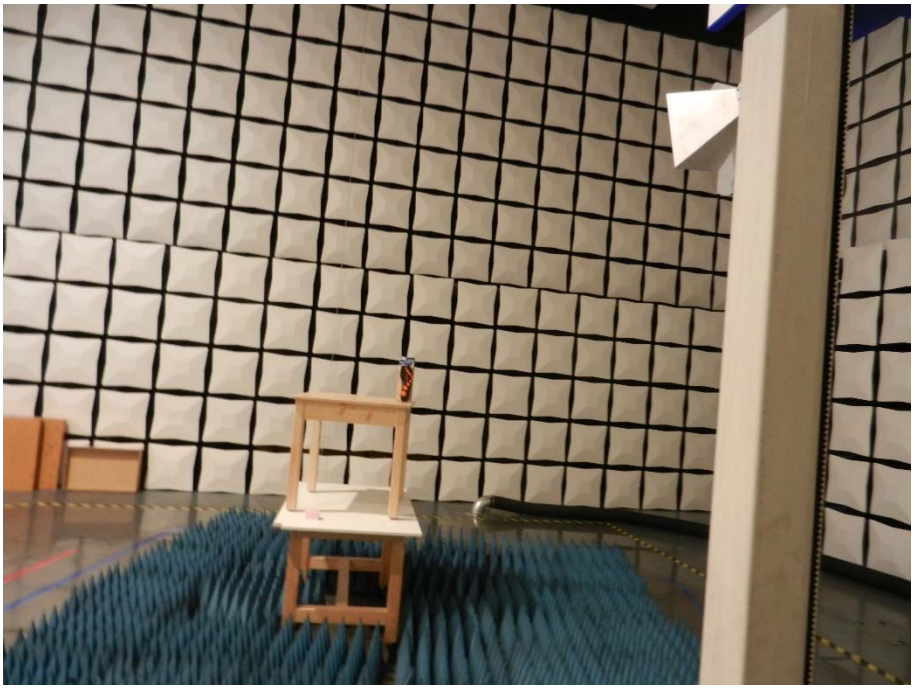
TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for radiated emission measurement (fully anechoic room)



Test setup for radiated emission measurement (fully anechoic room) - continued -



TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for radiated emission measurement (alternate test site)

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for radiated emission measurement (alternate test site) - continued -

8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	25	Recorded
15.215(c)	Bandwidth of the emission	33	Test passed
2.201, 2.202	Class of emission	37	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a)	Restricted bands of operation	38	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	---	Not applicable
15.205(b) 15.249	Radiated emission 9 kHz to 30 MHz	42	Test passed
15.205(b) 15.215(b) 15.249	Radiated emission 30 MHz to 25 GHz	49	Test passed

IC RSS-Gen Issue 4			
Section(s)	*Test*	*Page*	*Result*
6.12	Transmitter output power (conducted)	---	Not applicable
6.6	Occupied Bandwidth	25	Recorded
9	Designation of emissions	37	Calculated
6.10	Pulsed operation	---	Not applicable
8.8	Conducted AC powerline emission 150 kHz to 30 MHz	---	Not applicable
8.10	Restricted bands and unwanted emission frequencies	38	Test passed
6.4, 6.13, 8.9	Unwanted emissions 9 kHz to 30 MHz	42	Test passed
6.4, 6.13, 8.9	Unwanted emissions 30 MHz to 25 GHz	49	Test passed
3.2	Exposure of Humans to RF Fields	89	Exempted from SAR and RF evaluation

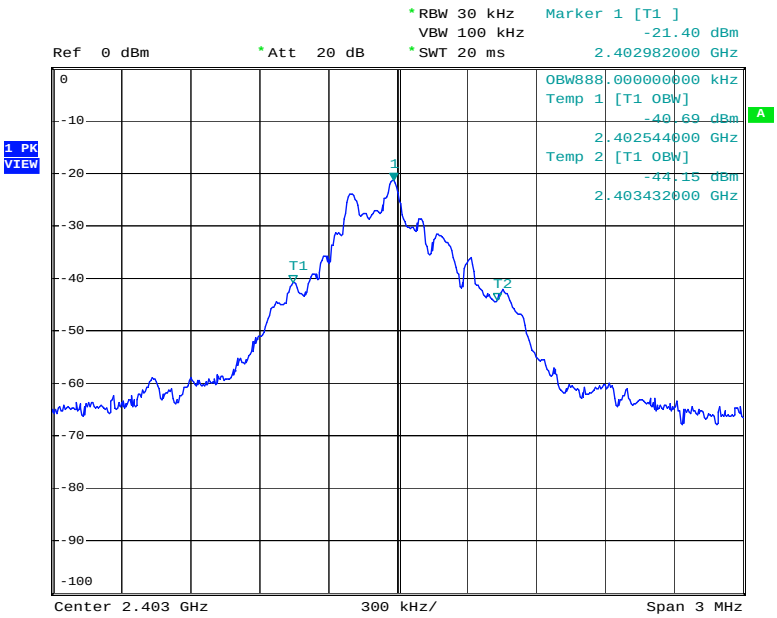
IC RSS-210 Issue 9			
Section(s)	*Test*	*Page*	*Result*
B.10	Unwanted emissions 9 kHz to 30 MHz	42	Test passed
B.10	Unwanted emissions 30 MHz to 25 GHz	49	Test passed

8.1 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.10, section 6.9.1
Guide:	ANSI C63.10
Description:	The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission. The occupied bandwidth according to ANSI C63.10, section 6.9.1; is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier. The span range of the spectrum analysator display shall be between two times and five times of the occupied bandwidth. The resolution bandwidth of the spectrum analyzer should be approximately 1 % to 5 % of the occupied bandwidth, unless otherwise specified, depending on the applicable requirement. The video bandwidth shall be at least three times greater than the resolution bandwidth. The dynamic range of the spectrum analyzator at the selected resolution bandwidth shall be more than 10 dB below the target “dB down” (attenuation) requirement.
Measurement procedure:	Bandwidth Measurements (6.1)

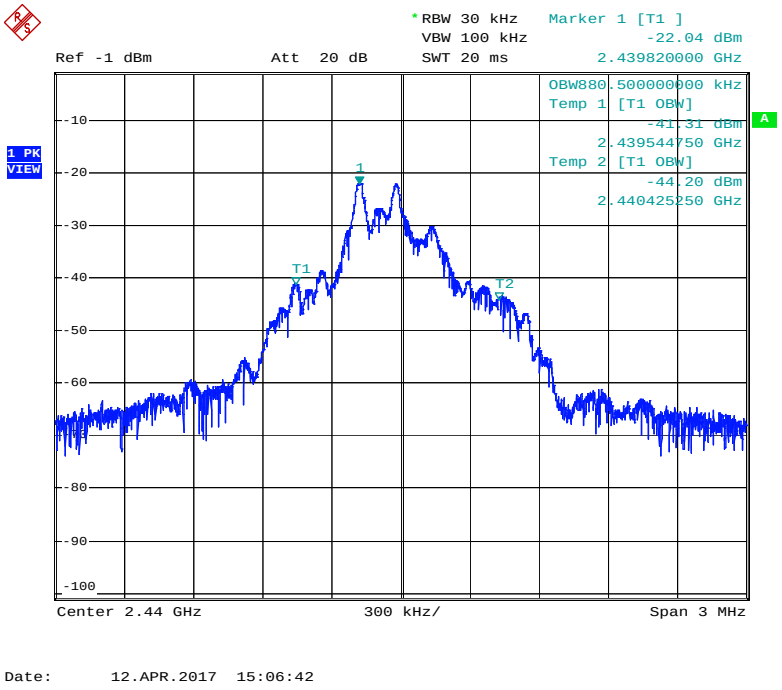
Comment:	
Date of test:	2017-04-12 / 2017-10-19
Test site:	Fully anechoic room

Occupied Bandwidth (99 %):



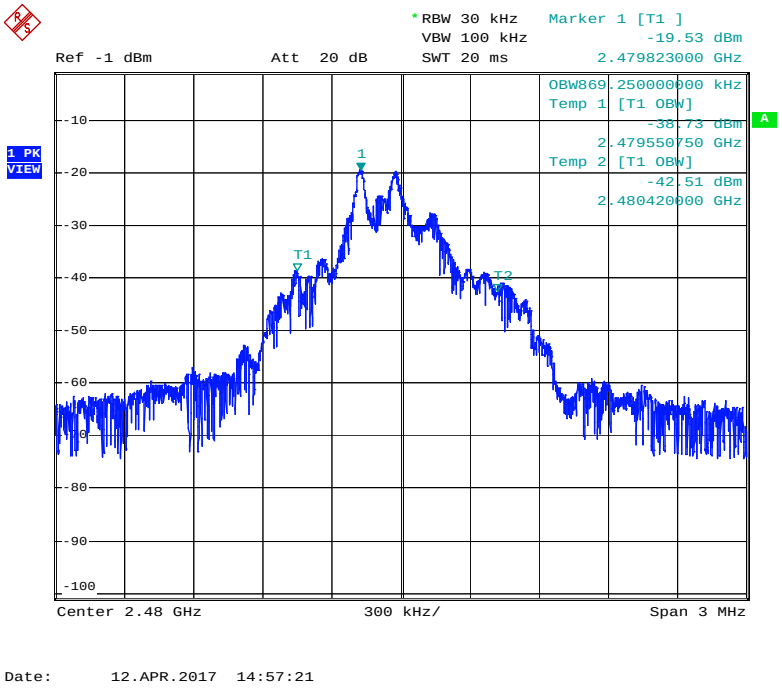
Occupied Bandwidth (99 %):	**888.0 kHz**

Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**880.50 kHz**

Occupied Bandwidth (99 %):



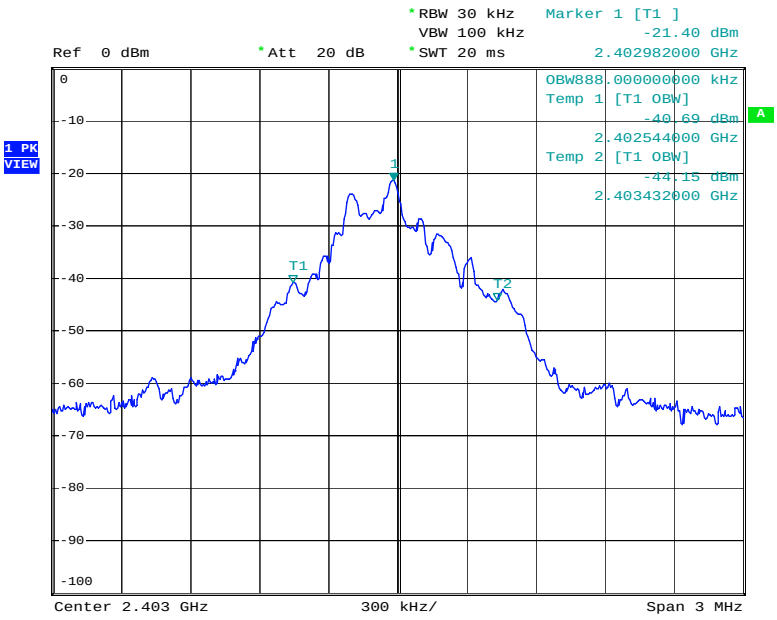
Occupied Bandwidth (99 %):	**869.25 kHz**

Occupied Bandwidth (continued)

Rules and specifications:	IC RSS-Gen Issue 4, section 6.6
Guide:	IC RSS-Gen Issue 4, section 6.6
Description:	If not specified in the applicable RSS the occupied bandwidth is measuredas the 99% emission bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.
Measurement procedure:	Bandwidth Measurements (6.1)

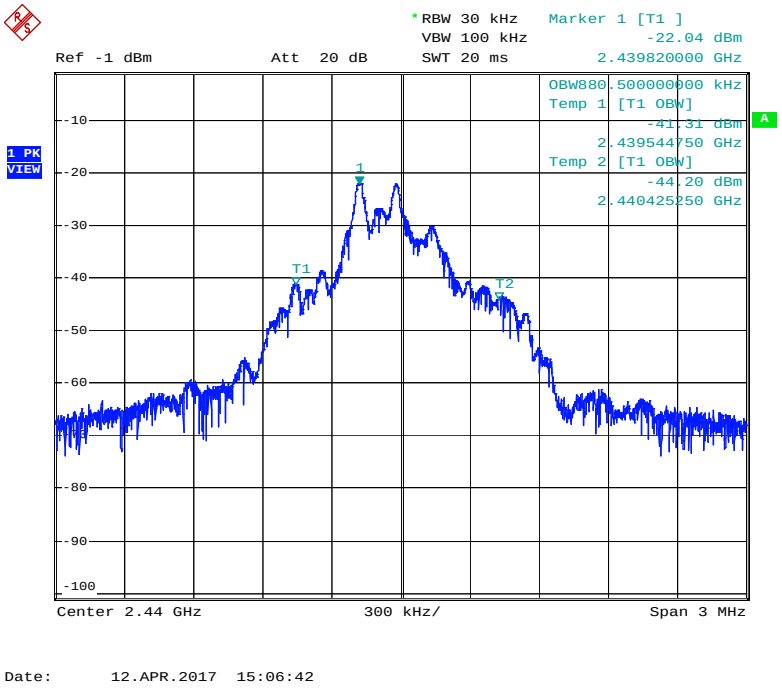
Comment:	
Date of test:	2017-04-12 / 2017-10-19
Test site:	Fully anechoic room

Occupied Bandwidth (99 %):



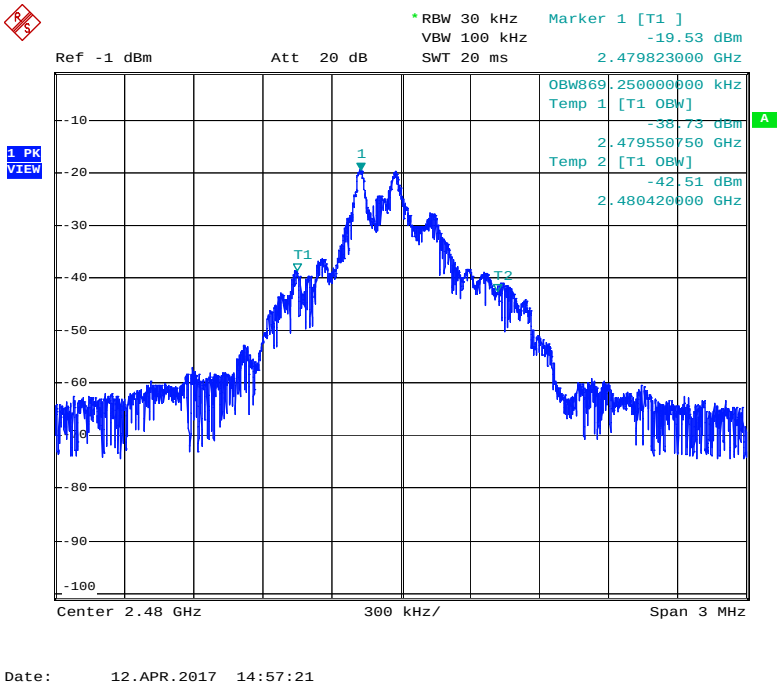
Occupied Bandwidth (99 %):	**888.0 kHz**

Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**880.50 kHz**

Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**869.25 kHz**

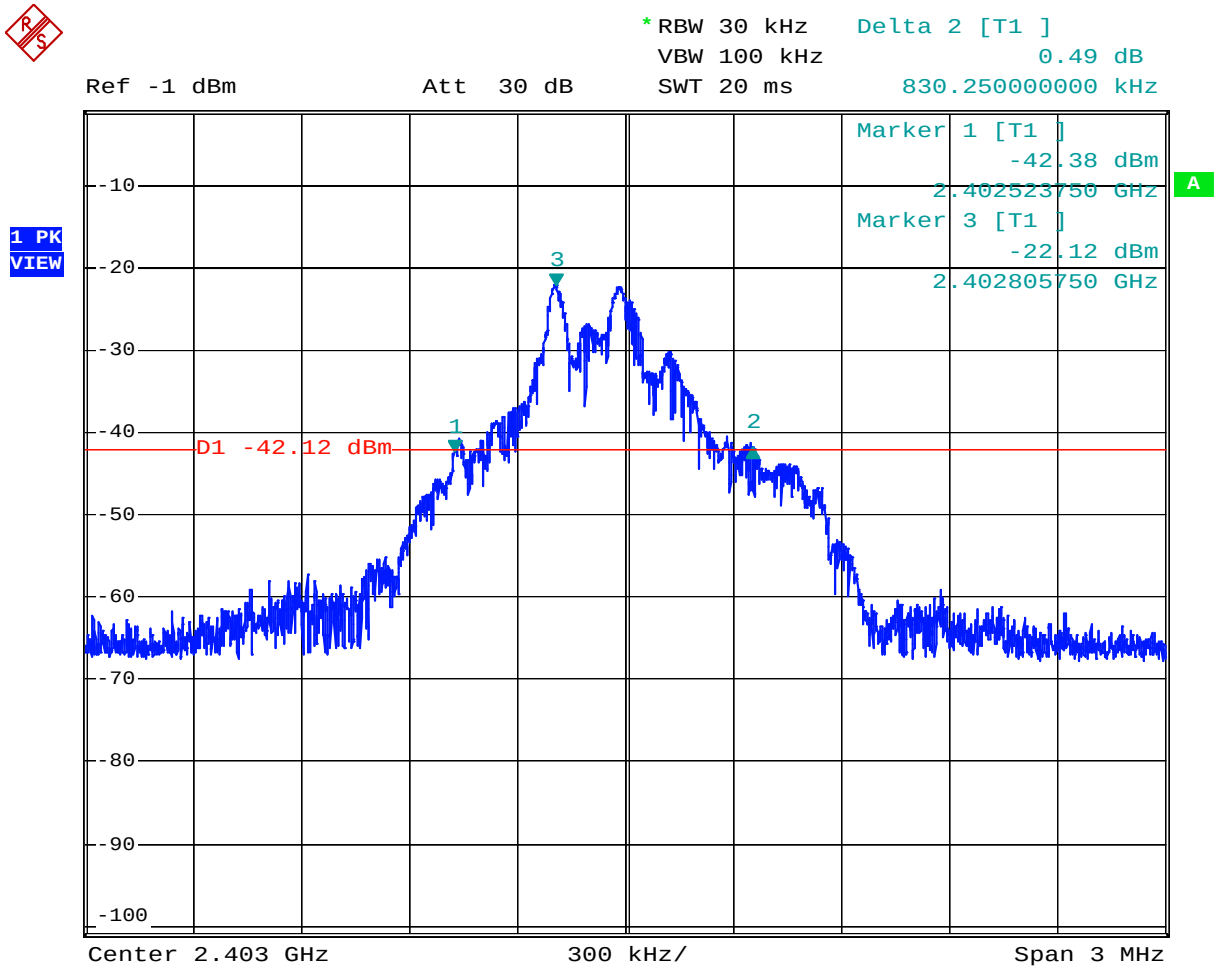
8.2 Bandwidth of the Emission

Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.10
Description:	The 20 dB bandwidth of the emission is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier. For intentional radiators operating under the alternative provisions to the general emission limits the requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. The span range of the spectrum analysator display shall be between two times and five times of the occupied bandwidth. The resolution bandwidth of the spectrum analyzer should be approximately 1 % to 5 % of the occupied bandwidth, unless otherwise specified, depending on the applicable requirement. The video bandwidth shall be at least three times greater than the resolution bandwidth. The dynamic range of the spectrum analyzator at the selected resolution bandwidth shall be more than 10 dB below the target “dB down” (attenuation) requirement.
	The video bandwidth shall be at least three times greater than the resolution bandwidth.
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	2017-04-12
Test site:	Fully anechoic room

Test Result:	Test passed

Emission Bandwidth (-20 dBc):

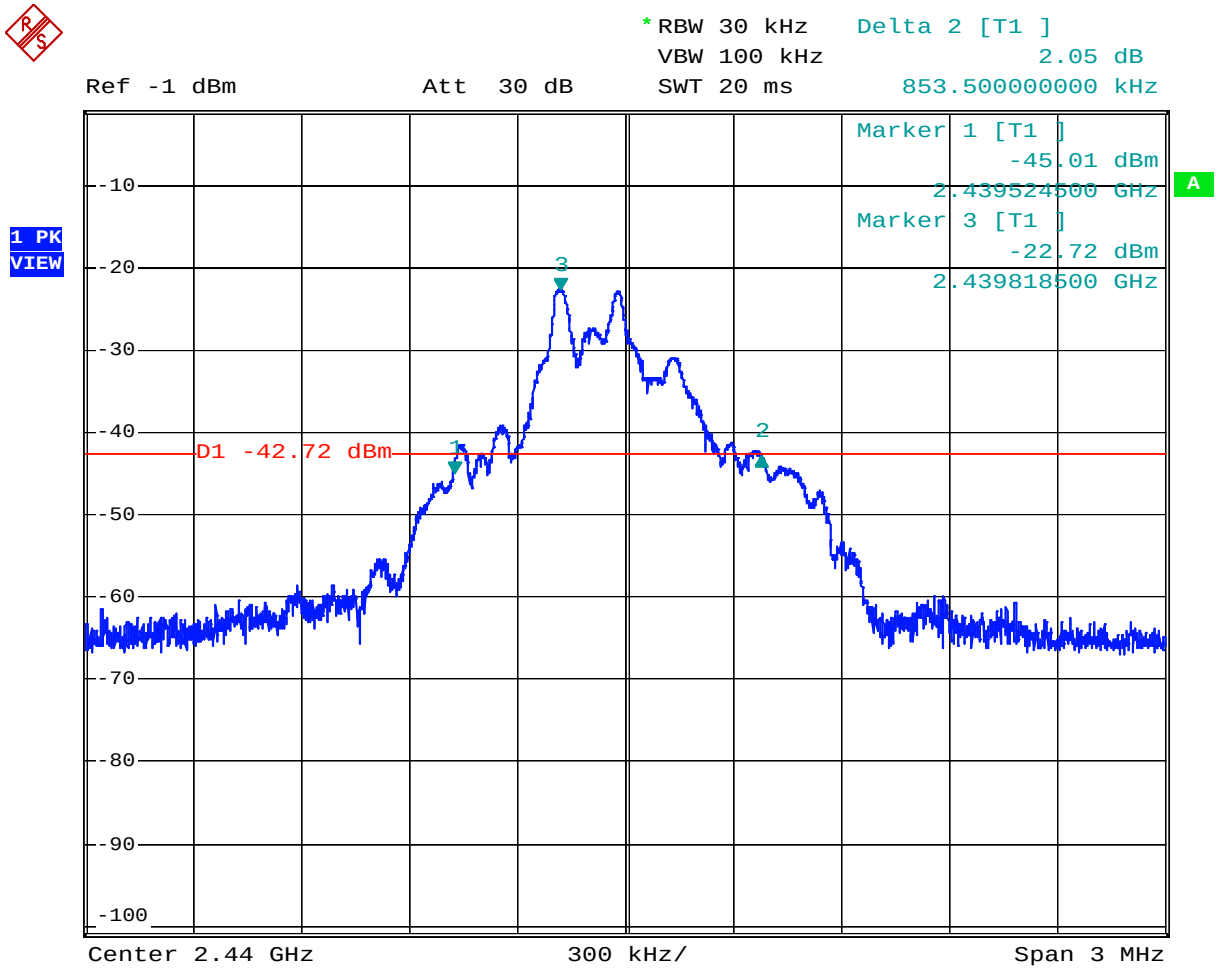


Permitted frequency band:	**2400.0 MHz - 2483.5 MHz**	
20 dB bandwidth:	**830.25 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☐ **specified** **---**	☒ **not specified**
Bandwidth of the emission:	**830.25 kHz**	**within permitted frequency band[5]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[5] If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Emission Bandwidth (-20 dBc):

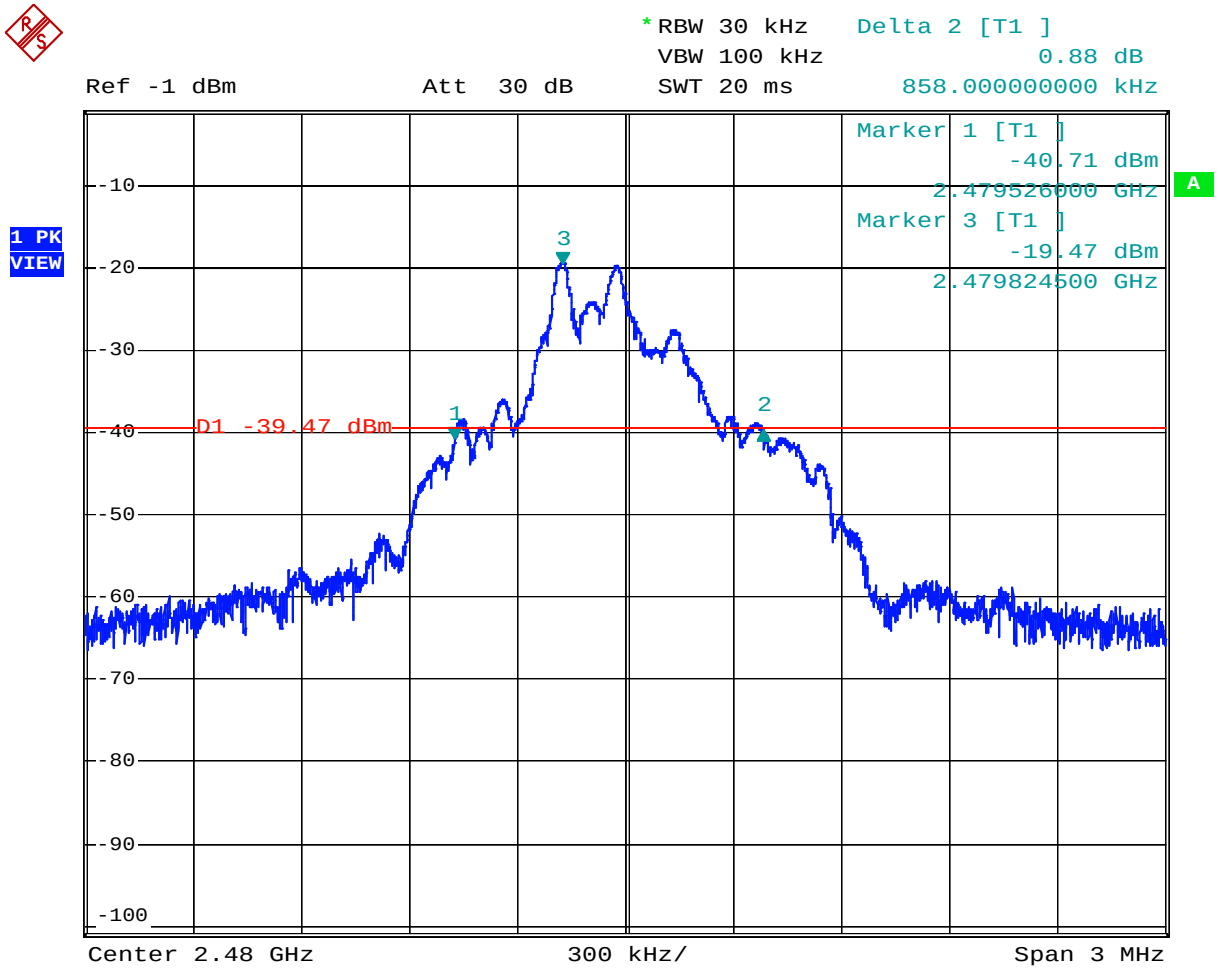


Permitted frequency band:	**2400.0 MHz - 2483.5 MHz**	
20 dB bandwidth:	**853.50 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☐ **specified** **---**	☒ **not specified**
Bandwidth of the emission:	**853.50 kHz**	**within permitted frequency band[6]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[6] If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Emission Bandwidth (-20 dBc):



Permitted frequency band:	**2400.0 MHz - 2483.5 MHz**	
20 dB bandwidth:	**858.00 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☐ **specified** **---**	☒ **not specified**
Bandwidth of the emission:	**858.000 kHz**	**within permitted frequency band[7]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[7] If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 4, section 9
Guide:	ANSI C63.10 / TRC-43

Type of modulation:	Frequency Shift Keying (FSK)

B_n = Necessary Bandwidth	$B_n = 2DK + B$
D = Peak deviation	D = 200 kHz
K = Overall numerical factor	K = 1
B = Modulation rate	B = 460 kHz
Calculation:	$B_n = 2 \cdot (200\ kHz) \cdot 1 + (460\ kHz) = 860\ kHz$

Designation of Emissions:	**860KF1D**

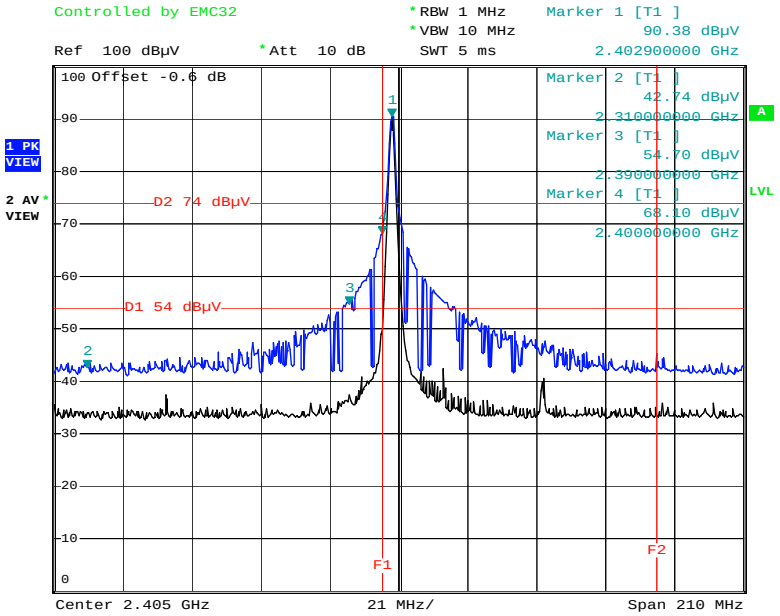
8.4 Restricted Bands of Operation

Rules and specifications:	CFR 47 Part 15, section 15.205(a) IC RSS-GEN Issue 4, section 8.10
Guide:	ANSI C63.10
Limit:	Only spurious emissions are permitted in any of the frequency bands listed in CFR 47 Part 15, section 15.205(a) or IC RSS-GEN Issue 4, section 8.10.
Measurement procedure:	Radiated Emission in Fully or Semi Anechoic Room (6.3)

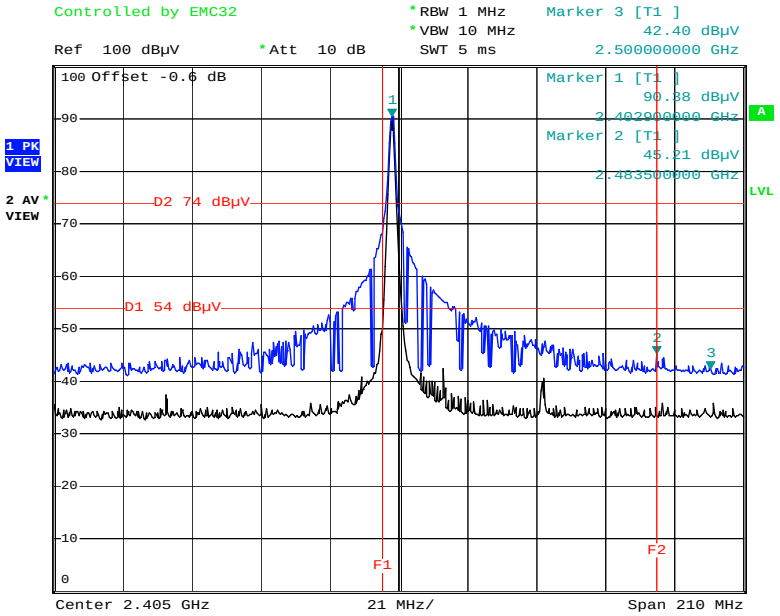
Comment:	
Date of test:	2017-10-19
Test site:	Fully anechoic room
Test distance:	3 meters

Test Result:	Test passed

Restricted Bands of Operation – Lowest Channel:



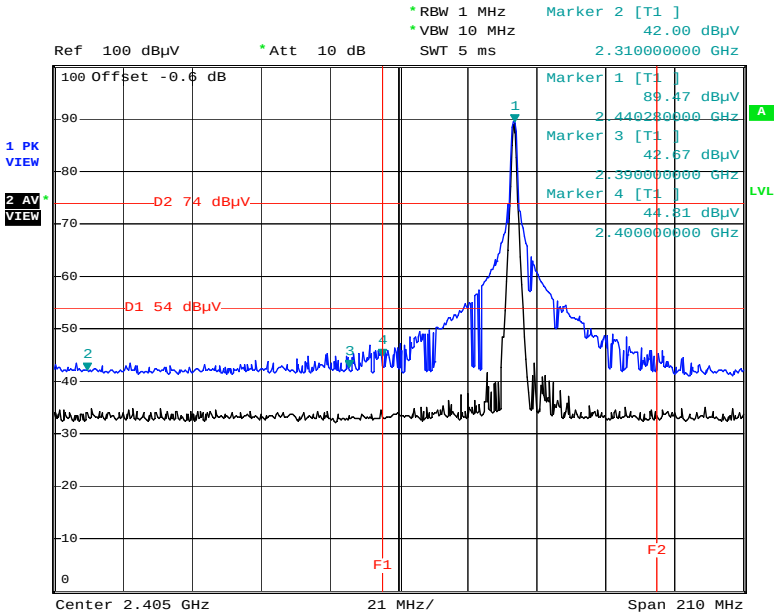
Date: 19.OCT.2017 09:49:26

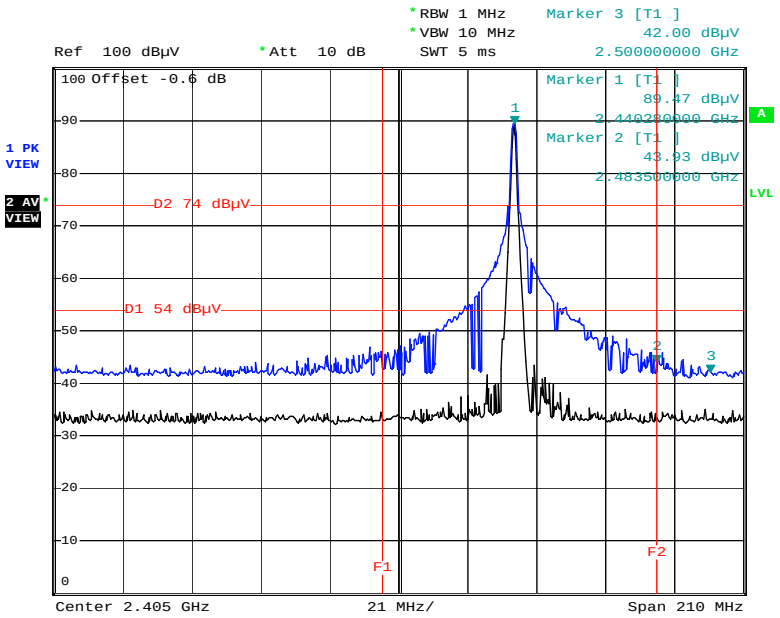


Date: 19.OCT.2017 09:50:19

Test Result:	Test passed

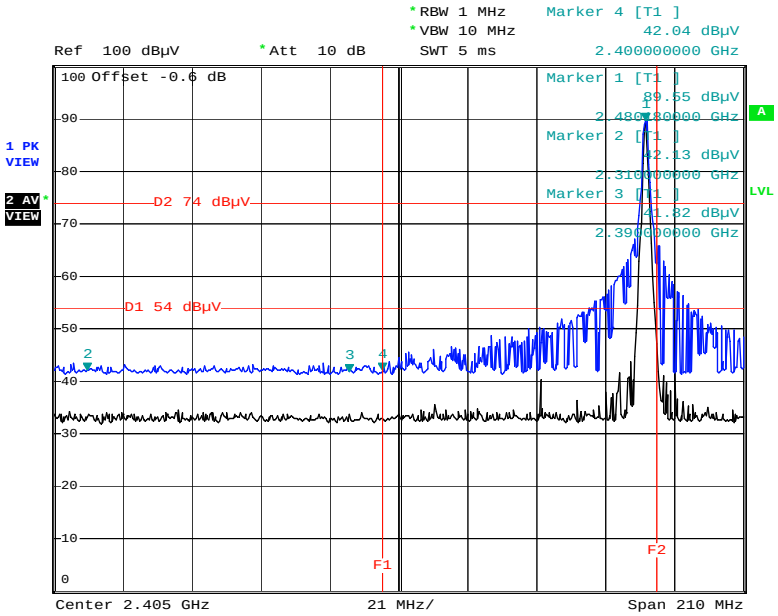
Restricted Bands of Operation – Middle Channel:



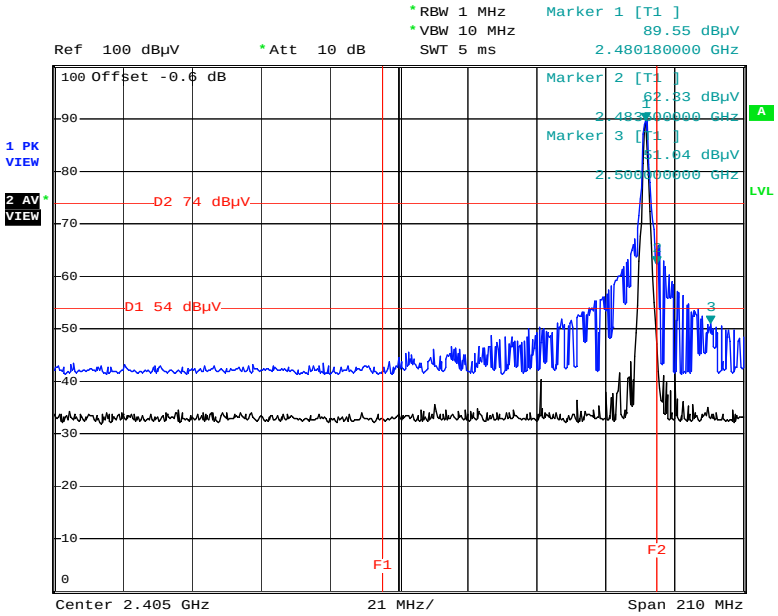


Test Result:	Test passed

Restricted Bands of Operation – Hightest Channel:



Date: 19.OCT.2017 11:44:09



Date: 19.OCT.2017 11:43:39

Test Result:	Test passed

8.5 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.249(d) IC RSS-210 Issue 9, section B.10(b)			
Guide:	ANSI C63.10			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
	0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
	1.705 - 30.000	30	29.5	30
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.2)			

Comment:	
Date of test:	2017-10-04
Test site:	Open field test site

Test Result:	Test passed

Sample calculation of final values:

Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

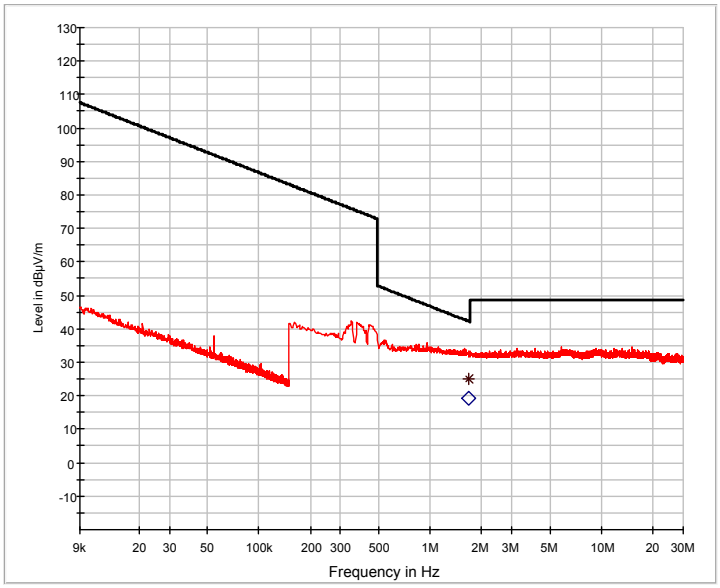
Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

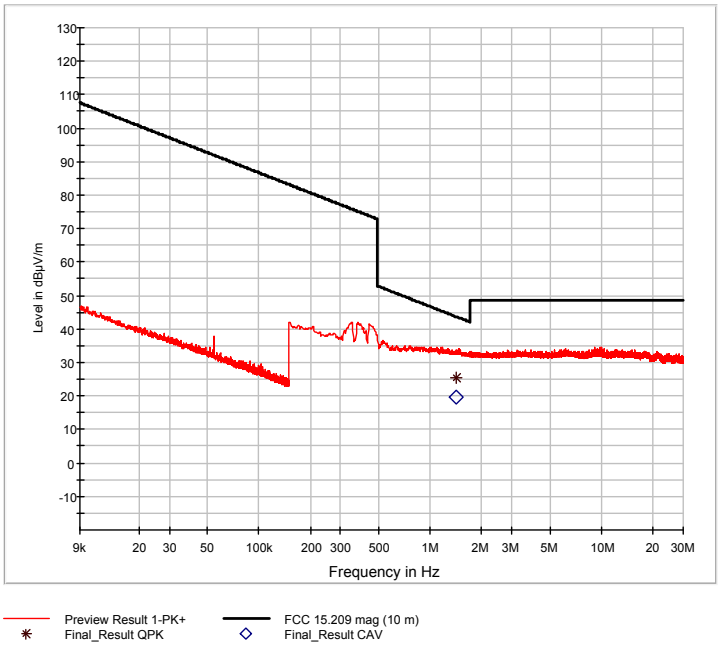
Comment:	Transmitting on lowest frequency; EUT in three orthogonal axis
Date of test:	2017-10-04
Test site:	Open field test site

Extrapolation factor: -40 dB/decade

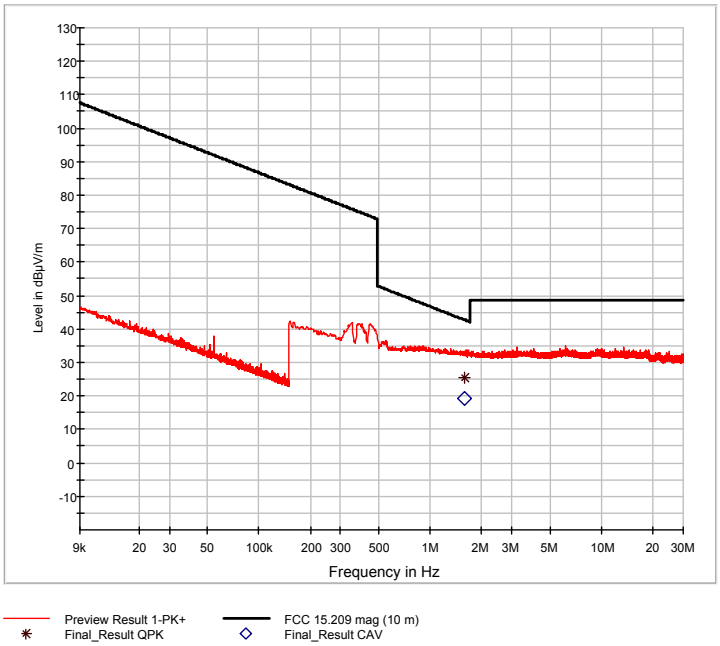
Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1.41450	Quasi-Peak	10	30	5.6	20.0	-19.1		6.5	24.6	18.1
1.59000	Quasi-Peak	10	30	5.3	20.0	-19.1		6.3	23.6	17.3
1.67325	Quasi-Peak	10	30	5.2	20.0	-19.1		6.1	23.1	**17.0**



EUT flat on table



EUT on long side

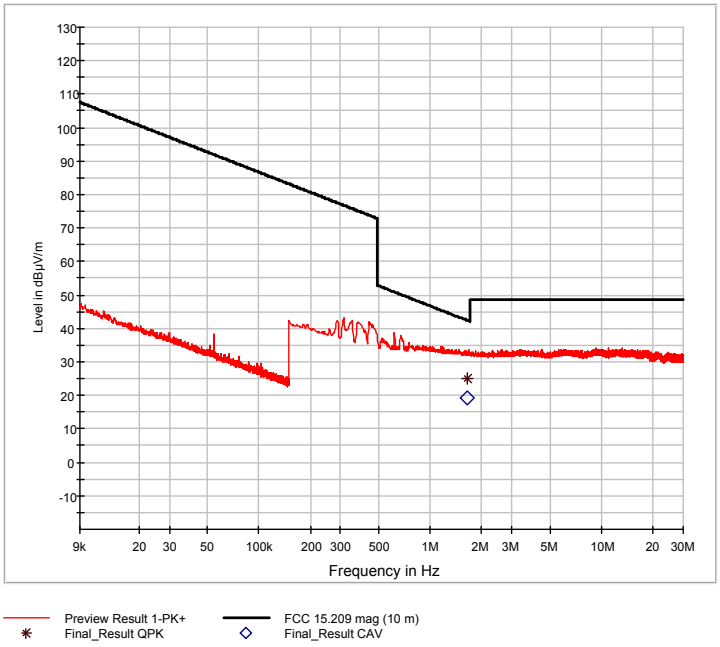


EUT in upright position

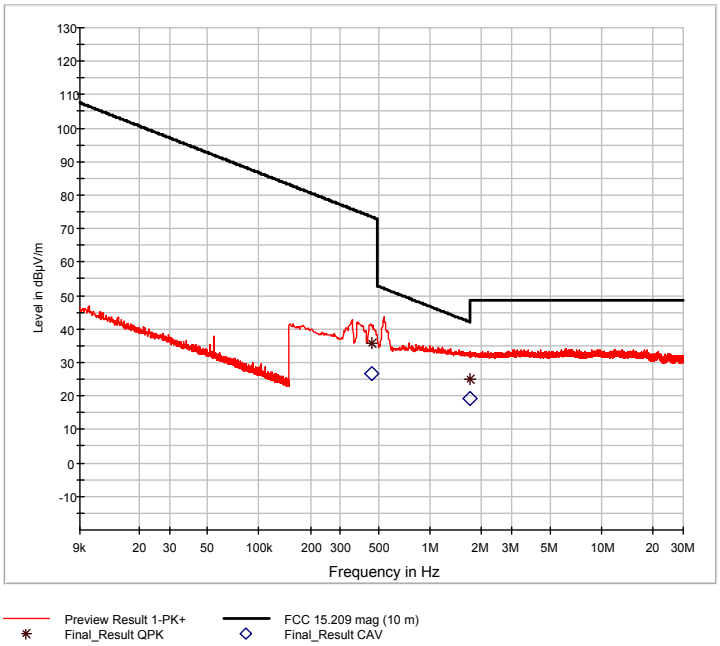
Comment:	Transmitting on middle frequency; EUT in three orthogonal axis
Date of test:	2017-10-04
Test site:	Open field test site

Extrapolation factor: -40 dB/decade

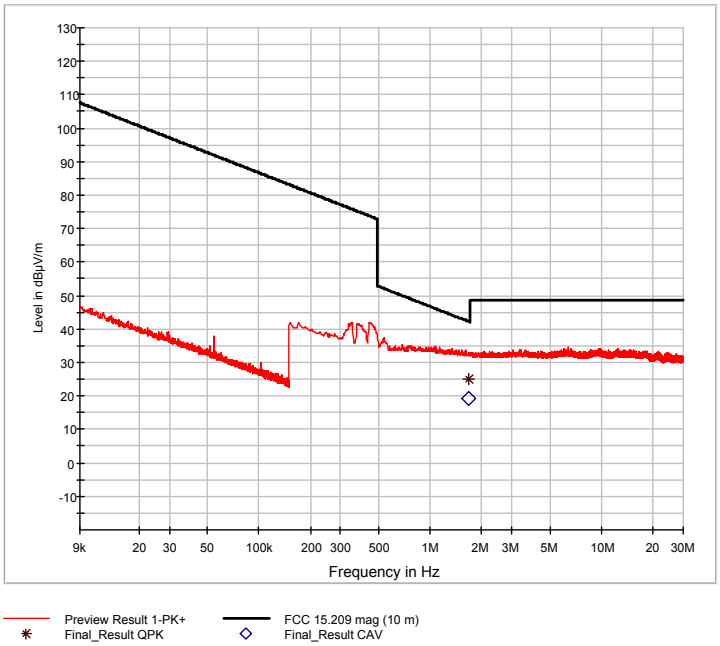
Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
0.45375	Average	10	300	6.9	20.0	-59.1		-32.2	14.5	46.7
1.65975	Quasi-Peak	10	30	5.2	20.0	-19.1		6.1	23.2	17.1
1.67100	Quasi-Peak	10	30	5.2	20.0	-19.1		6.1	23.1	17.1
1.70025	Quasi-Peak	10	30	5.2	20.0	-19.1		6.1	23.0	**16.9**



EUT flat on table



EUT on long side

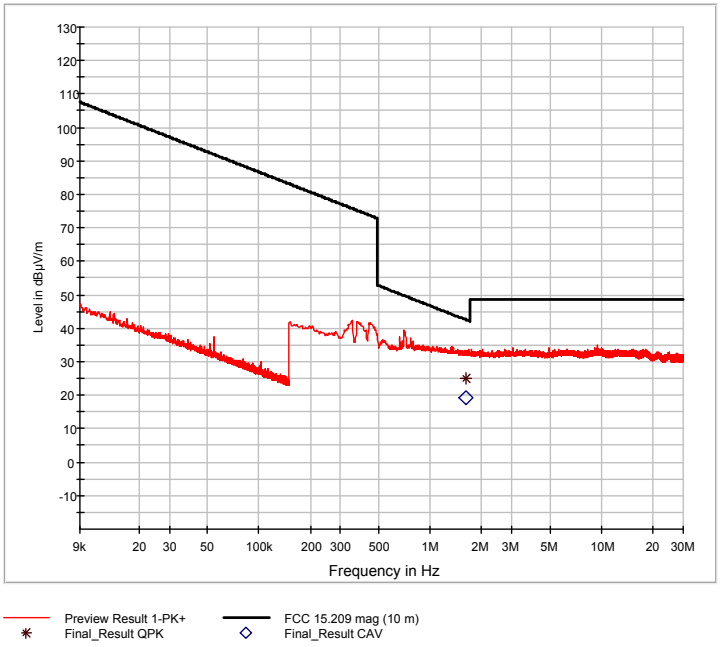


EUT in upright position

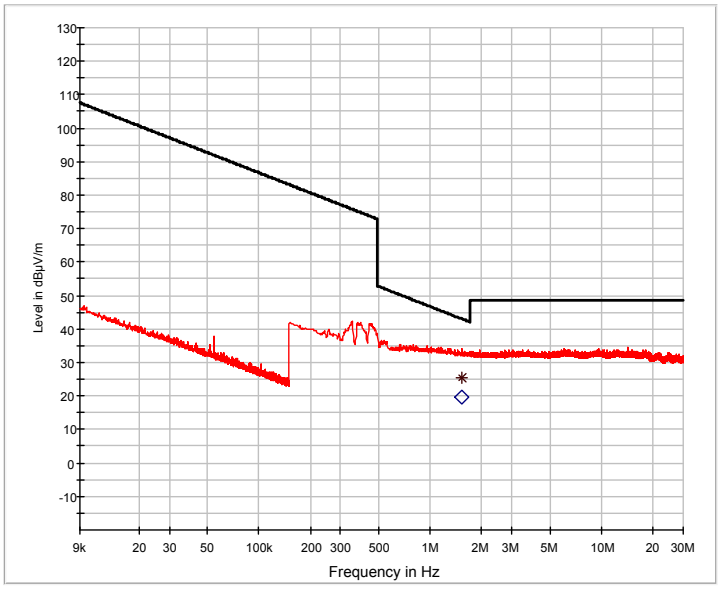
Comment:	Transmitting on highest frequency; EUT in three orthogonal axis
Date of test:	2017-10-04
Test site:	Open field test site

Extrapolation factor: -40 dB/decade

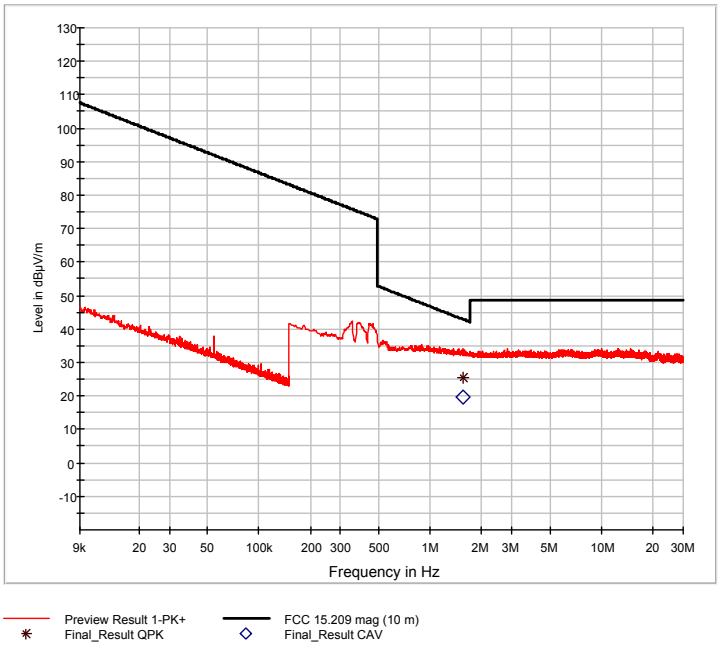
Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1.53600	Quasi-Peak	10	30	5.5	20.0	-19.1		6.4	23.9	17.5
1.55300	Quasi-Peak	10	30	5.4	20.0	-19.1		6.3	23.8	17.5
1.60575	Quasi-Peak	10	30	5.2	20.0	-19.1		6.2	23.5	**17.3**



EUT flat on table



EUT on long side



EUT in upright position

8.6 Radiated Emission Measurement 30 MHz to 25 GHz

Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.249 IC RSS-210 Issue 9, section B.10		
Guide:	ANSI C63.10		
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	Above 960	500	54.0
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.3) Radiated Emission at Alternative Test Site (6.4)		

Comment:	
Date of test:	
Test site:	Semi-anechoic room, cabin no. 8
Test distance:	Frequencies ≤ 6 GHz: 3 meters Frequencies > 6 GHz: 1 meter

Test Result:	Test passed

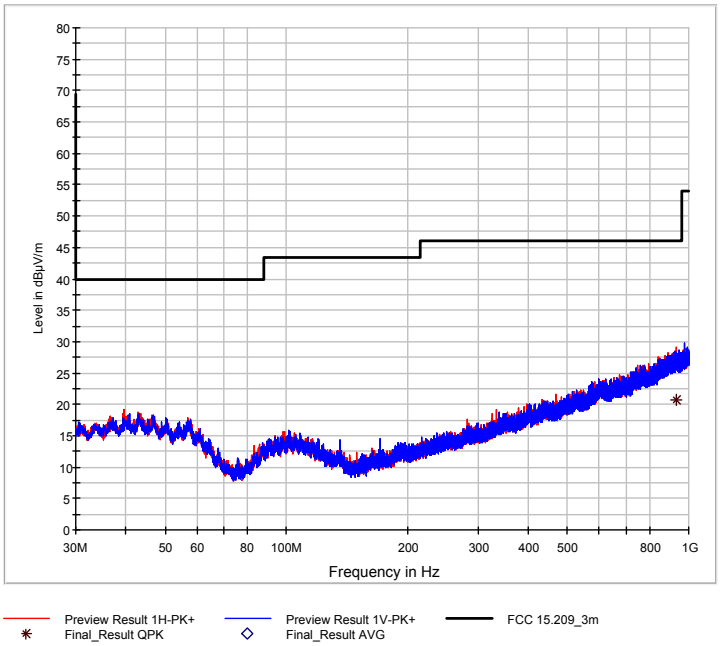
Sample calculation of final values:

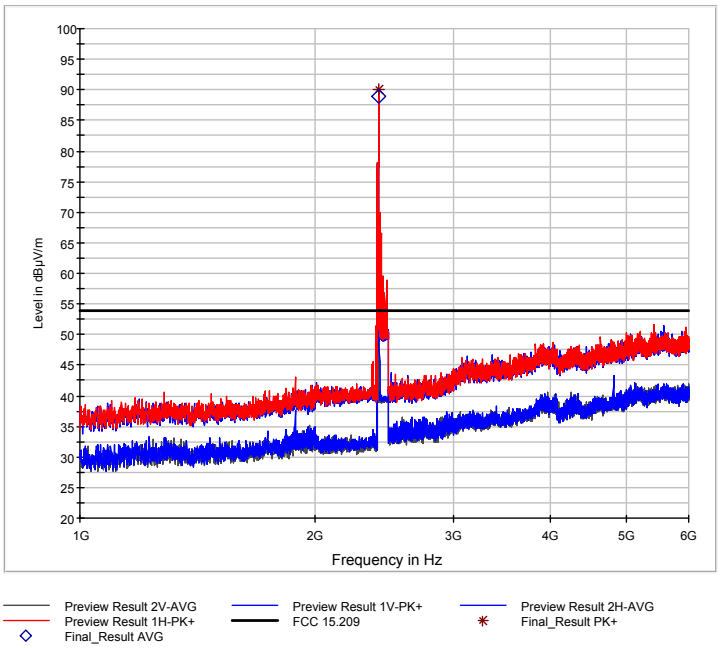
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

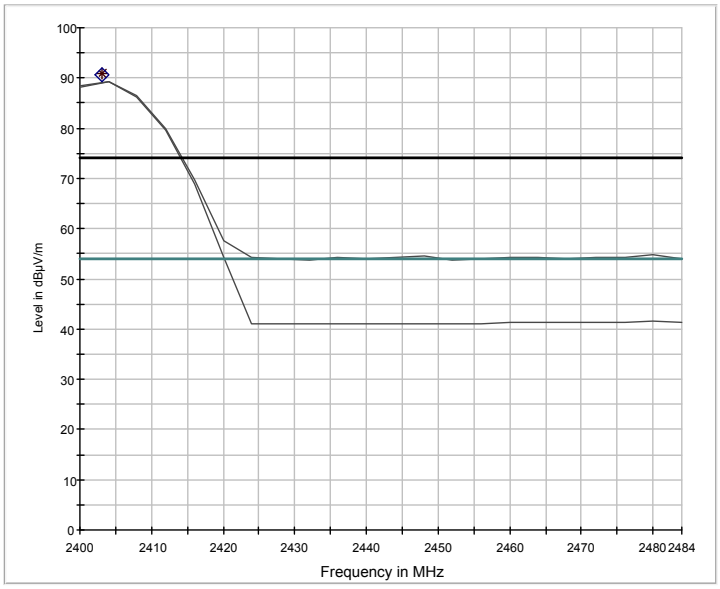
Comment:	Transmitting on lowest frequency; EUT in three orthogonal axis
Date of test:	
Test site:	Semi-anechoic room, cabin no. 8
Test distance:	Frequencies ≤ 8.2 GHz: 3 meters Frequencies > 8.2 GHz: 1 meter

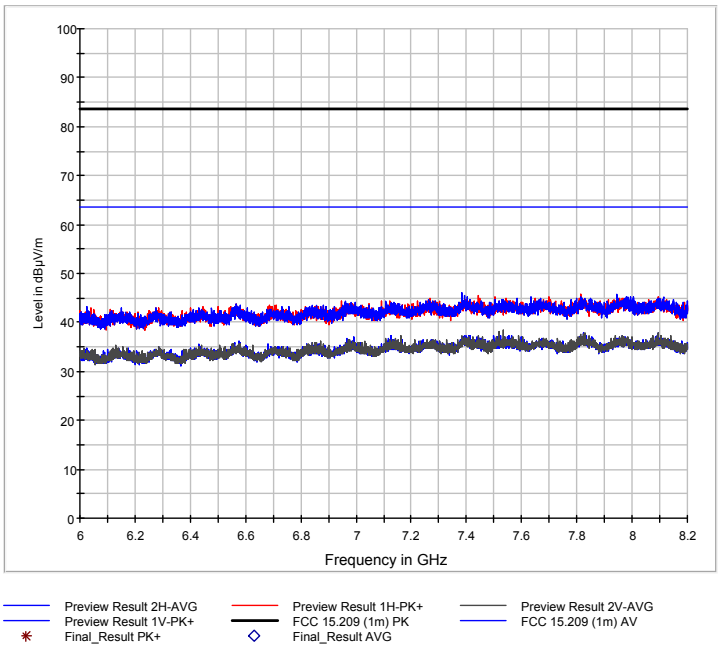
Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2403.000	vertical	Peak	57.3	34.2		91.5	94.0	**2.5**

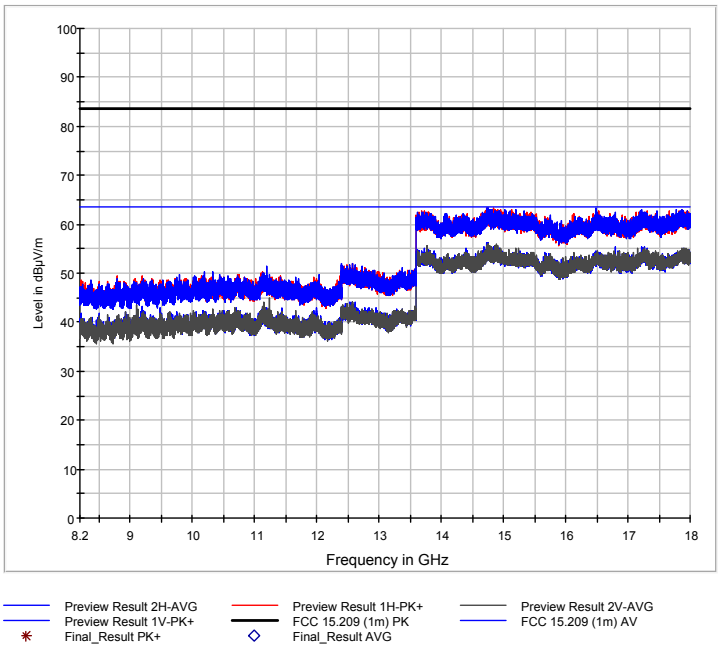
EUT flat on table:

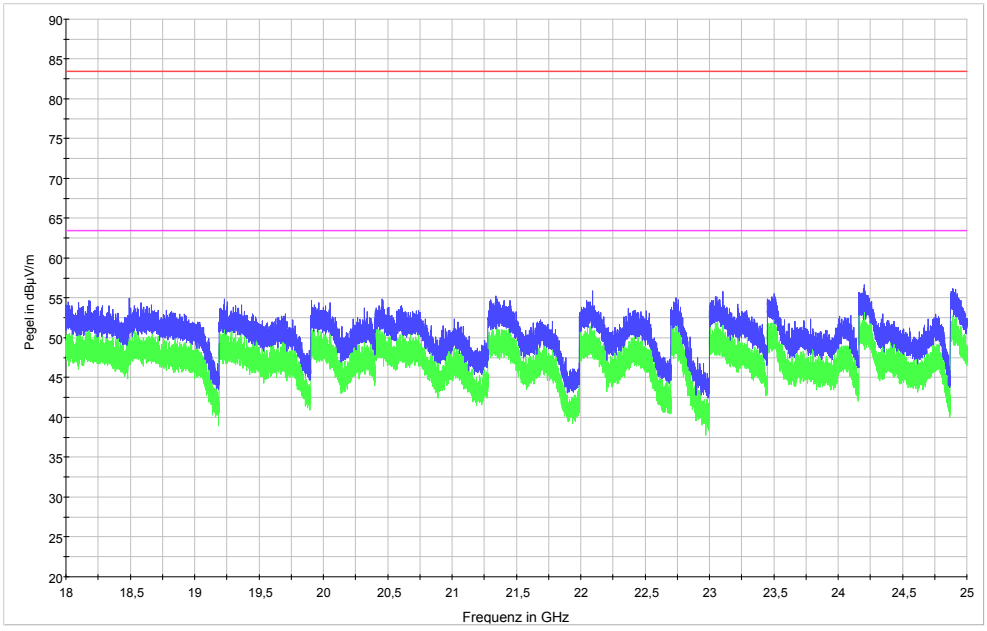


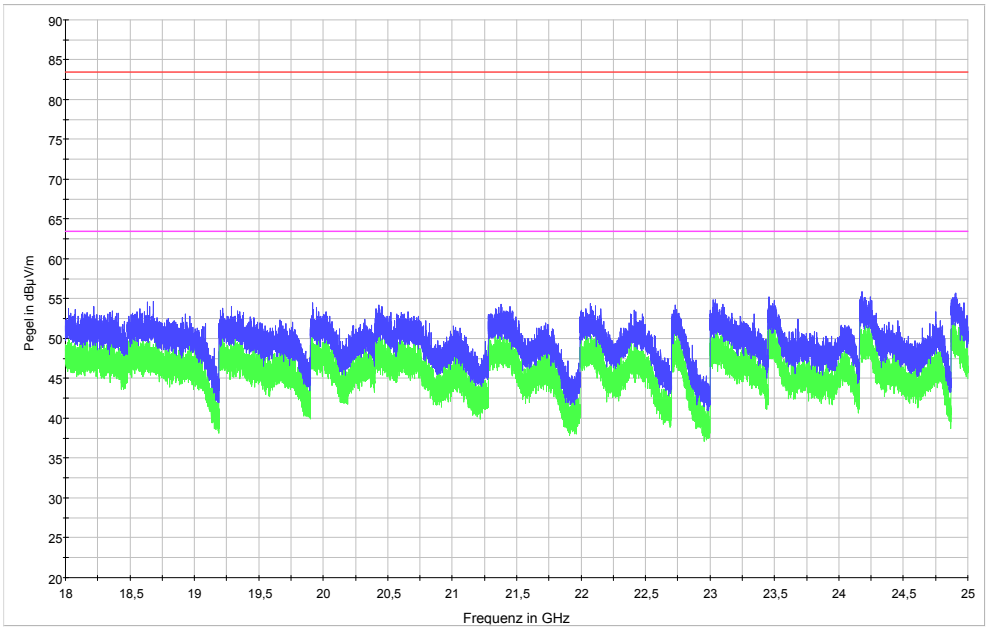



Level in dBµV/m
Frequency in MHz
Existing (2)-AVG
FCC 15.249 3 m AV
Existing (1)-PK+
Final_Result PK+
FCC 15.249 3 m PK
Final_Result CAV

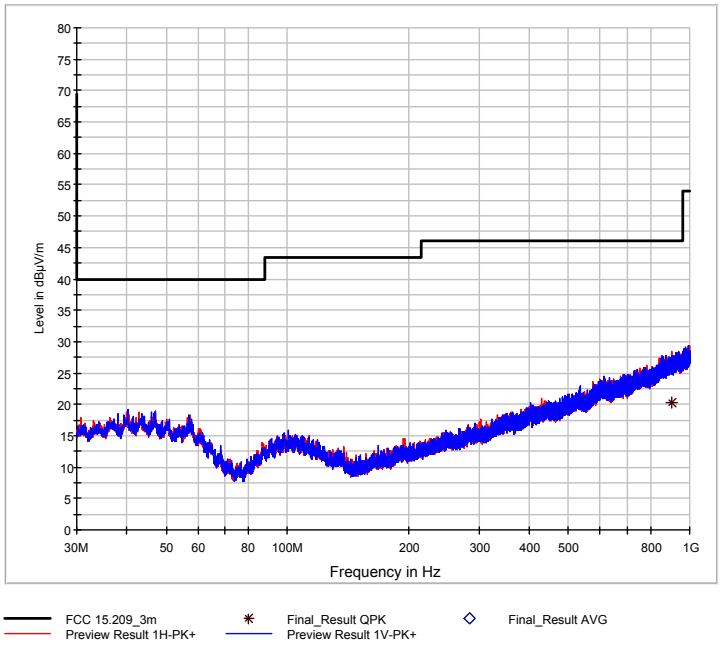

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

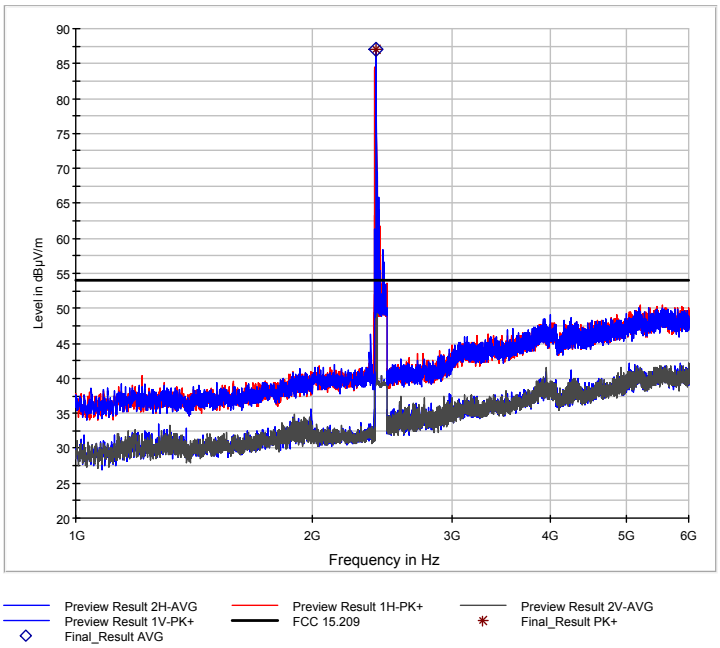

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.209 (1m) PK
FCC 15.209 (1m) AV
Final_Result PK+
Final_Result AVG

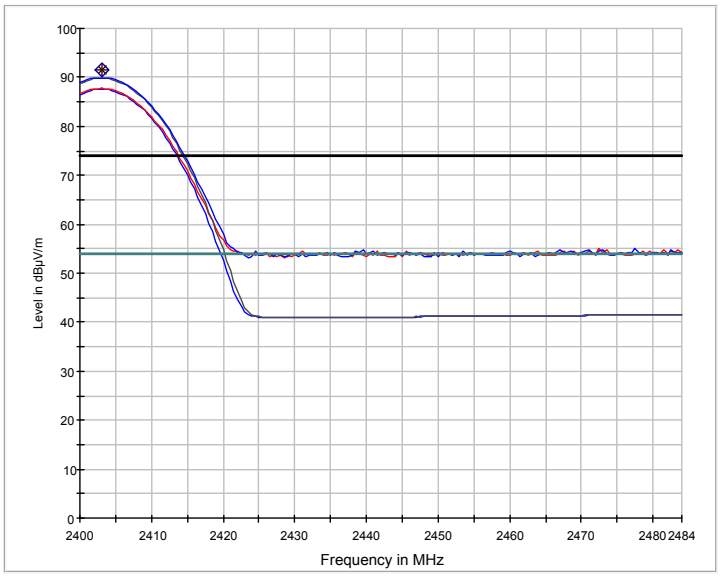

Pegel in dBµV/m
Frequenz in GHz

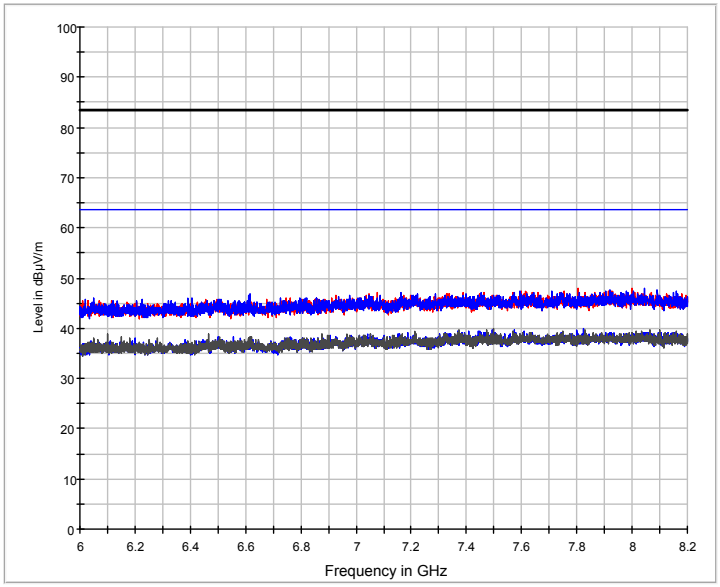

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

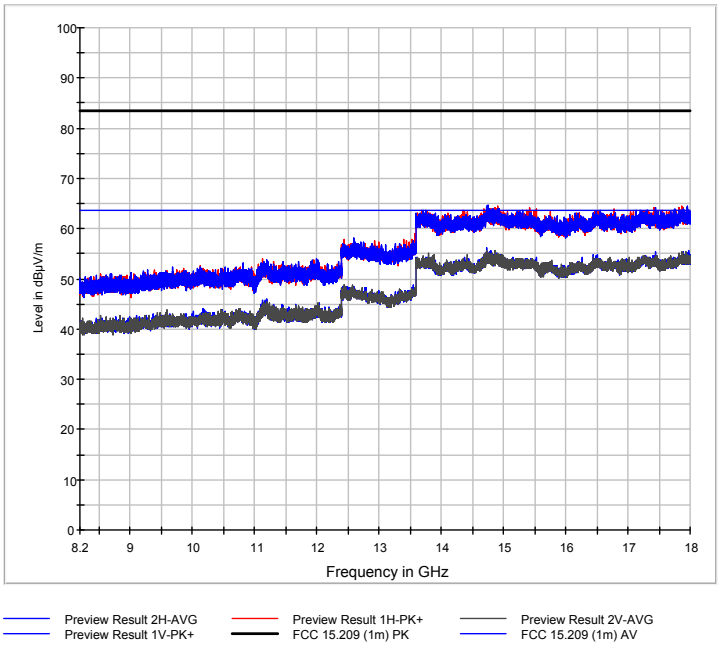
EUT on long side:

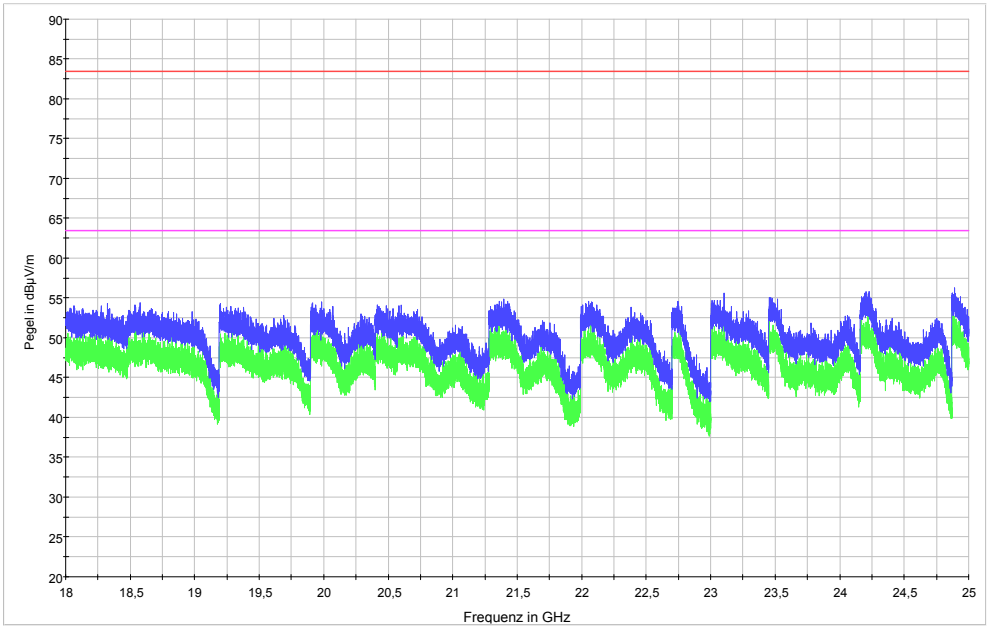


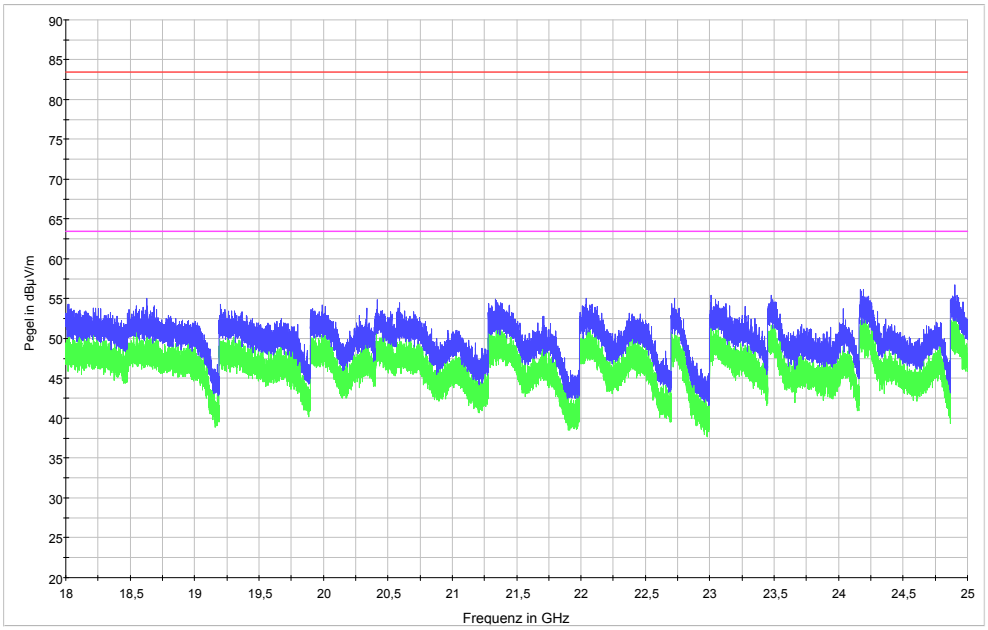



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV

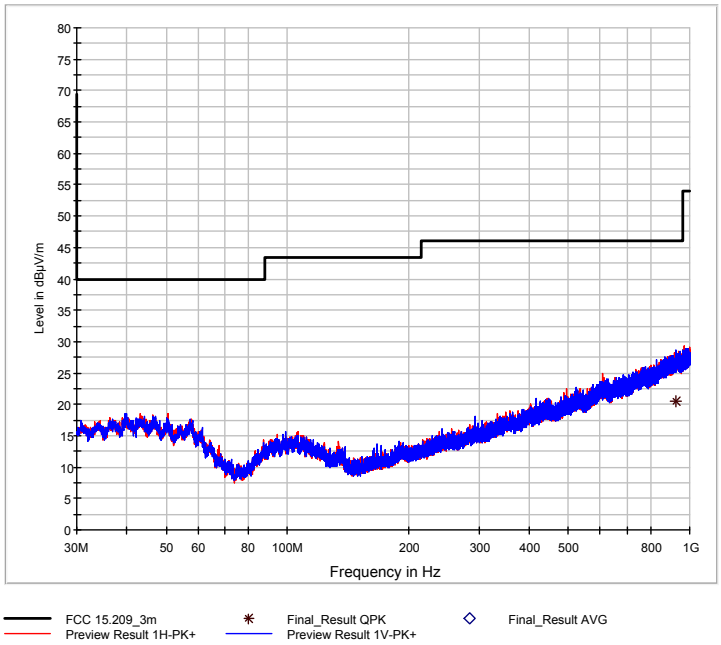

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

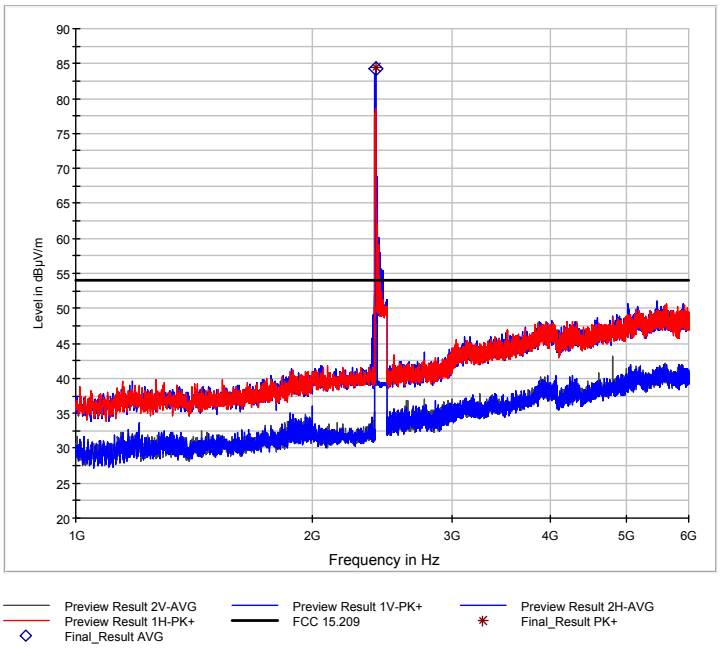

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

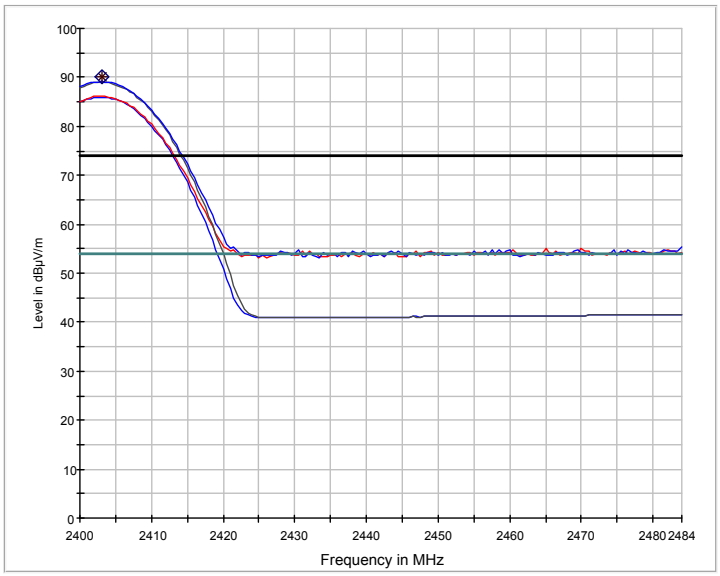

Pegel in dBµV/m
Frequenz in GHz

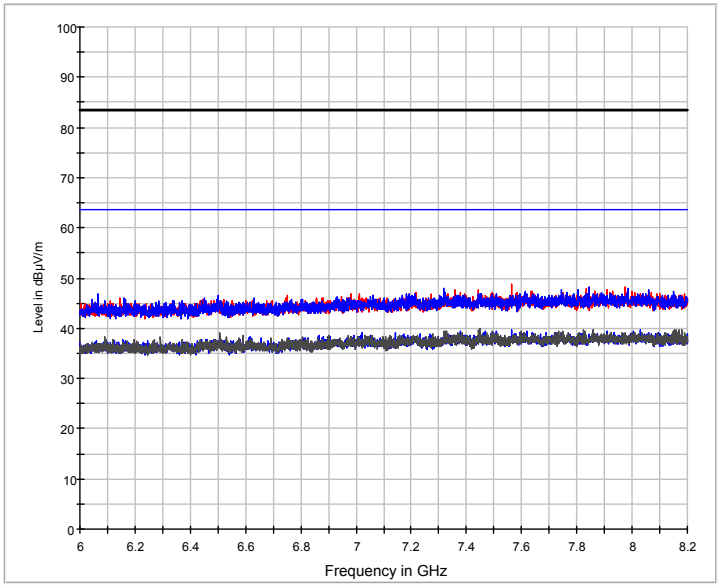

Pegel in dBµV/m
Frequenz in GHz
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25

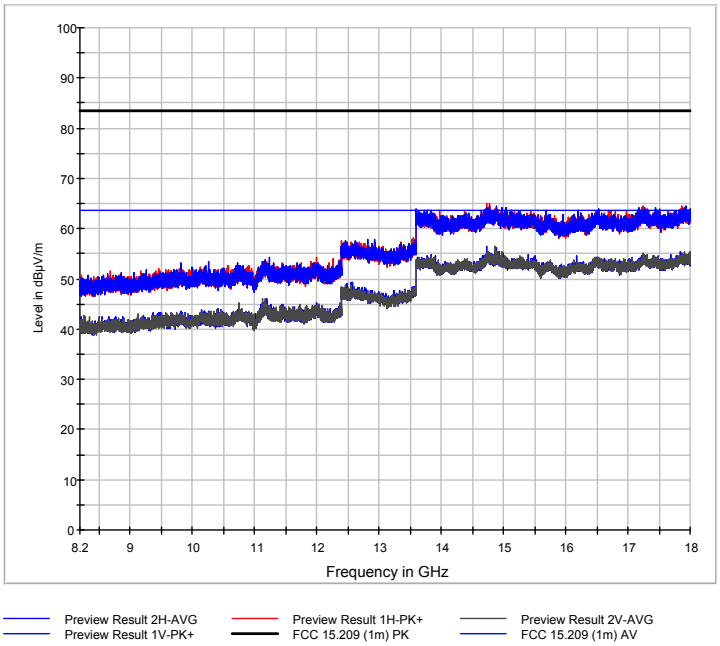
EUT in upright position:

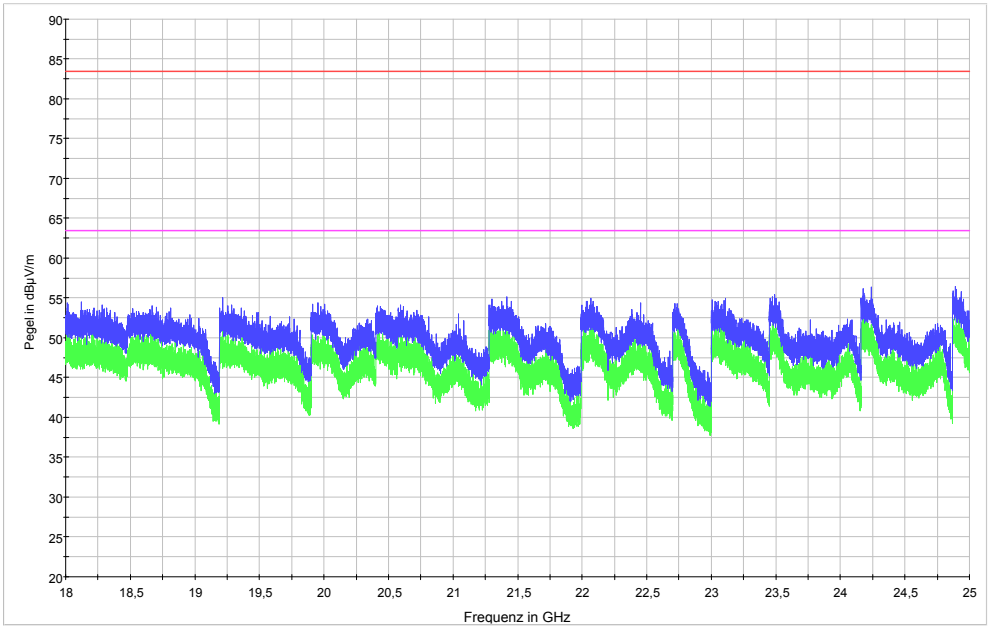


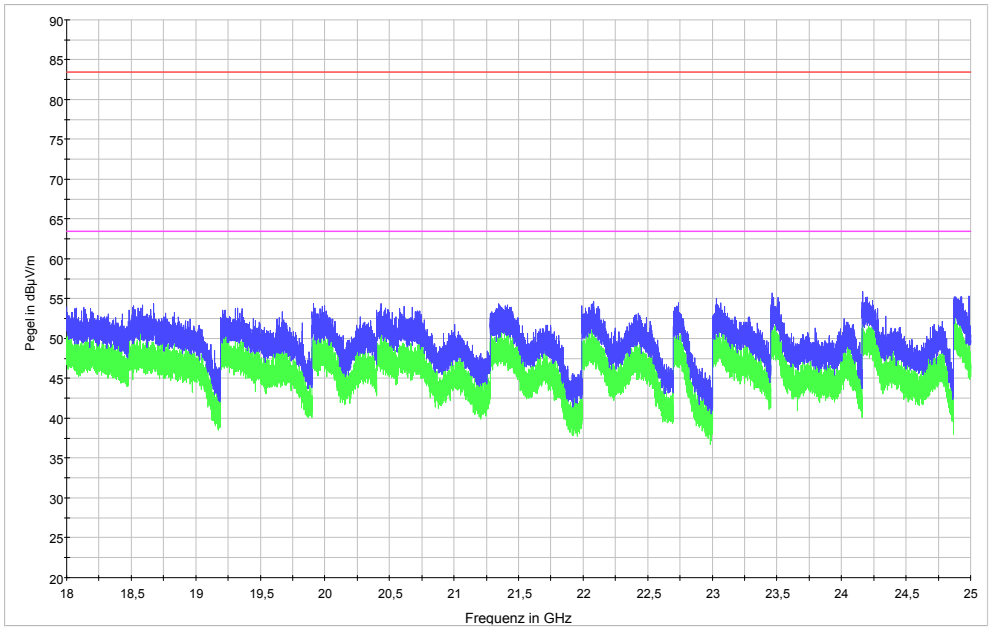



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

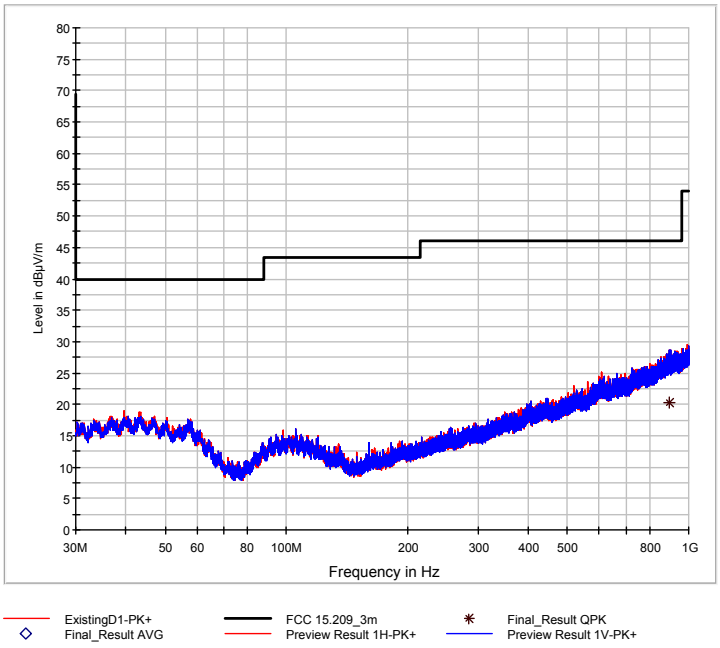

Pegel in dBµV/m
Frequenz in GHz

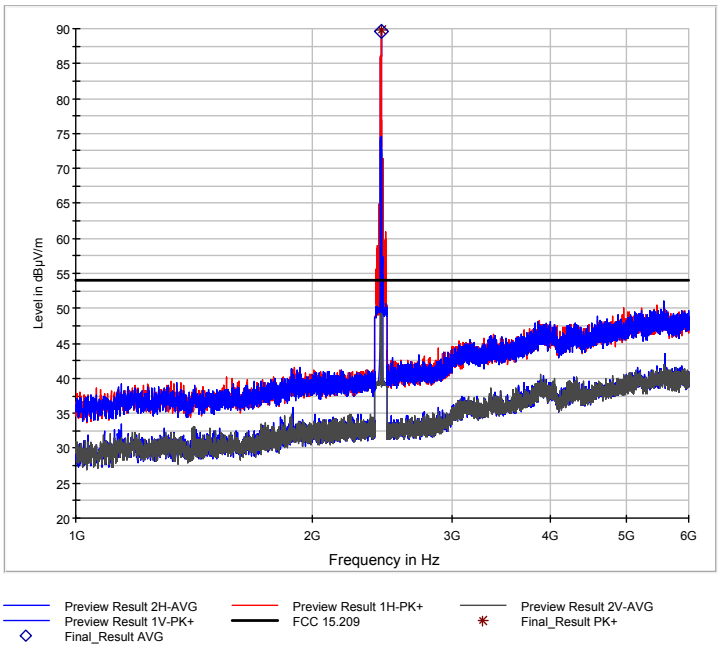

Pegel in dBµV/m
Frequenz in GHz
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25

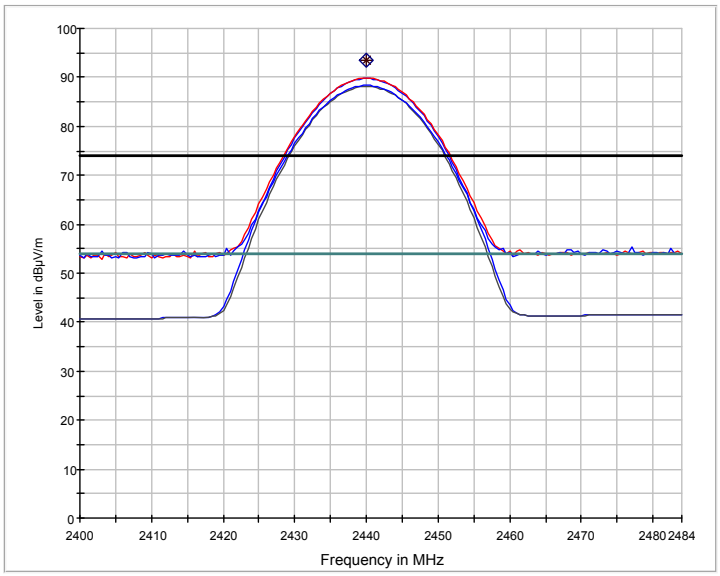
Comment:	Transmitting on middle frequency; EUT in three orthogonal axis
Date of test:	
Test site:	Semi-anechoic room, cabin no. 8
Test distance:	Frequencies ≤ 8.2 GHz: 3 meters Frequencies > 8.2 GHz: 1 meter

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2440.000	horizontal	Peak	59.2	34.4		93.6	94.0	**0.4**

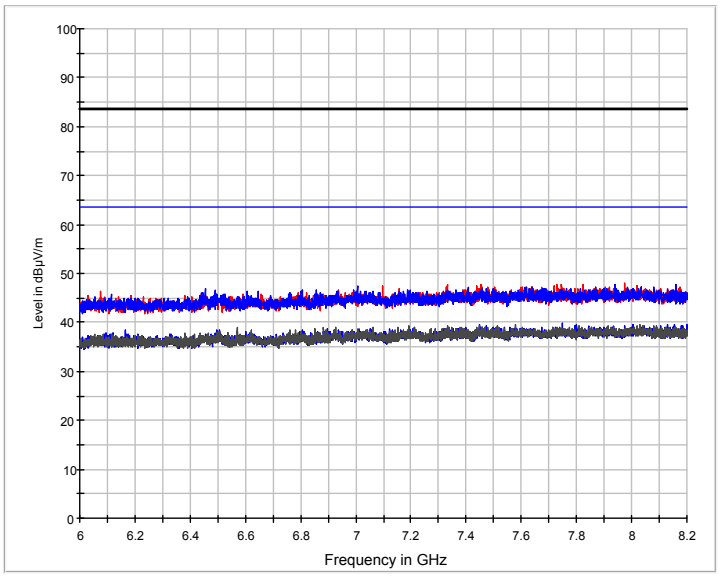
EUT flat on table:



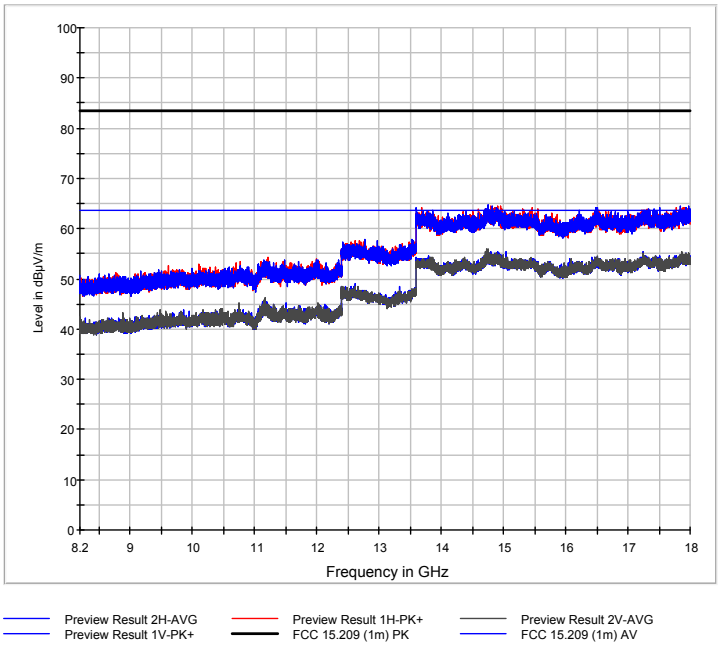


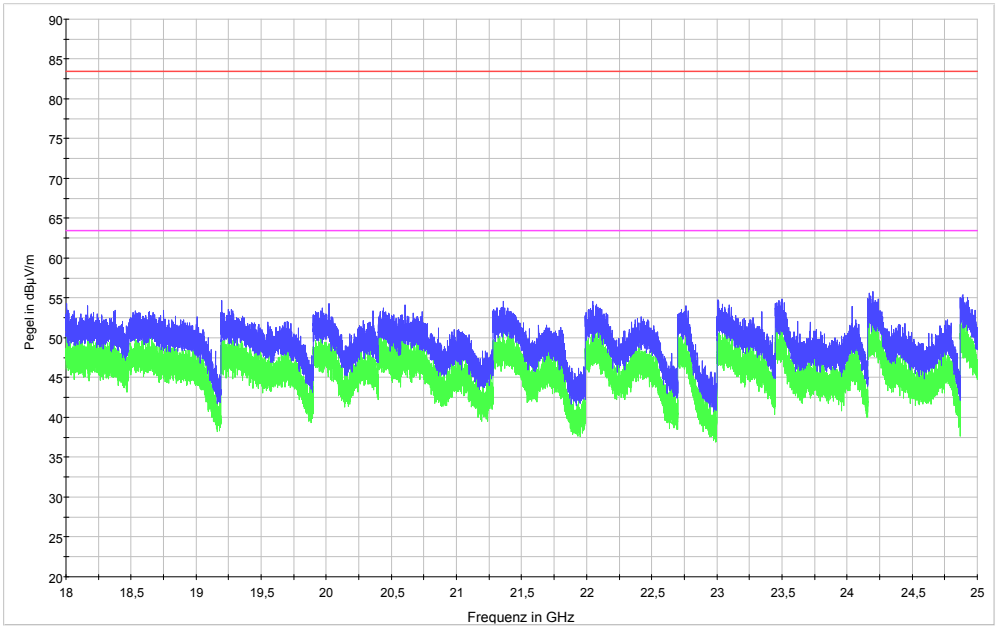


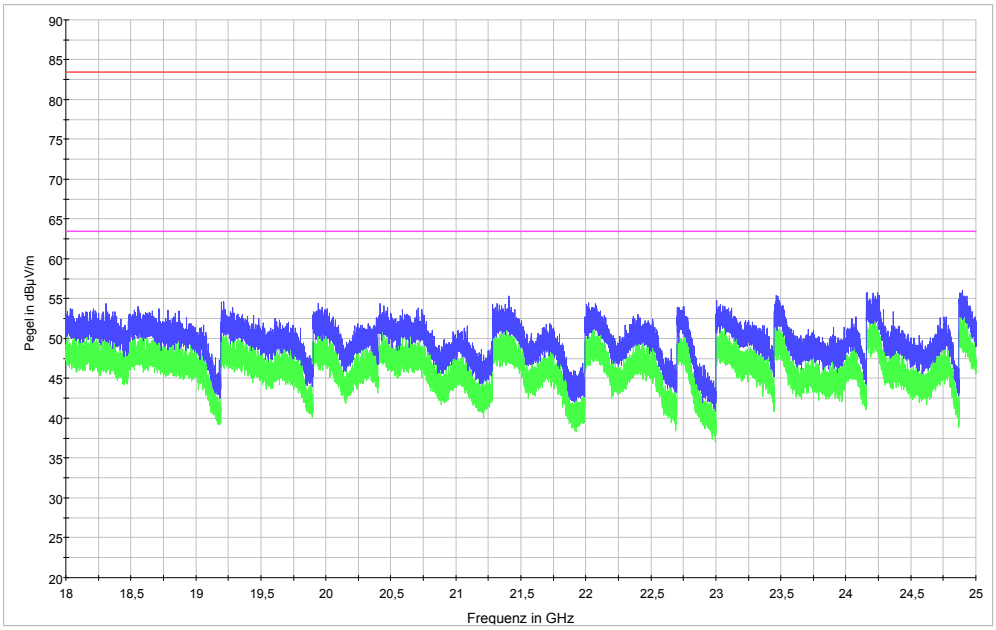
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV



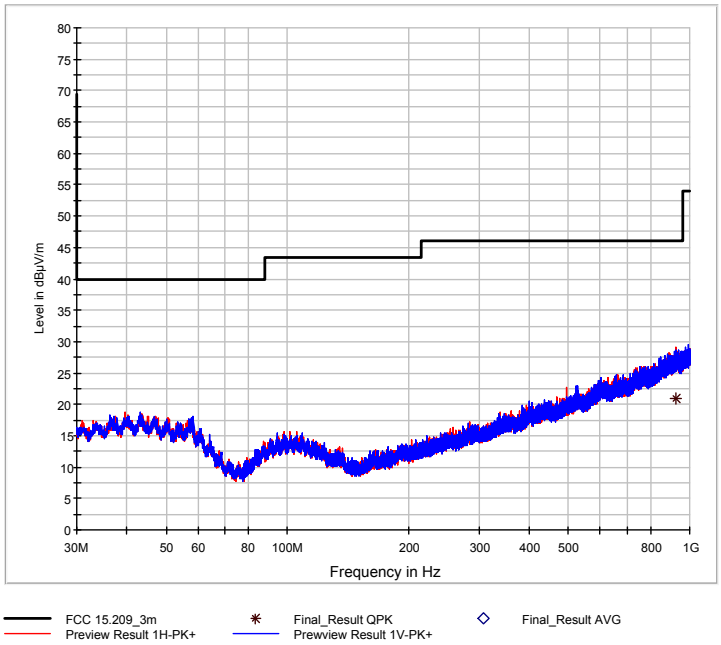
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

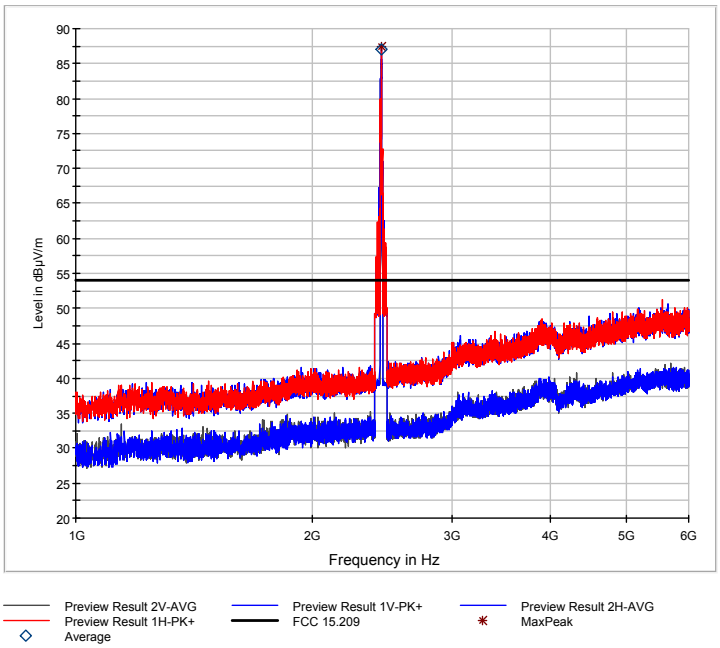

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

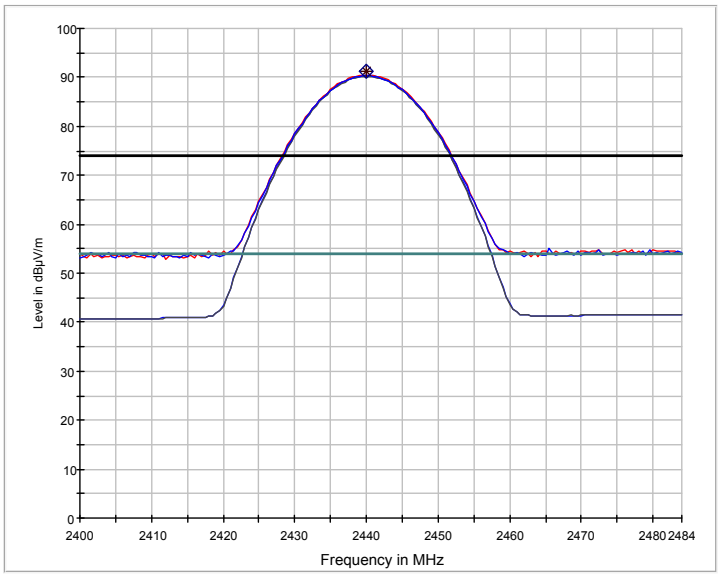

Pegel in dBµV/m
Frequenz in GHz

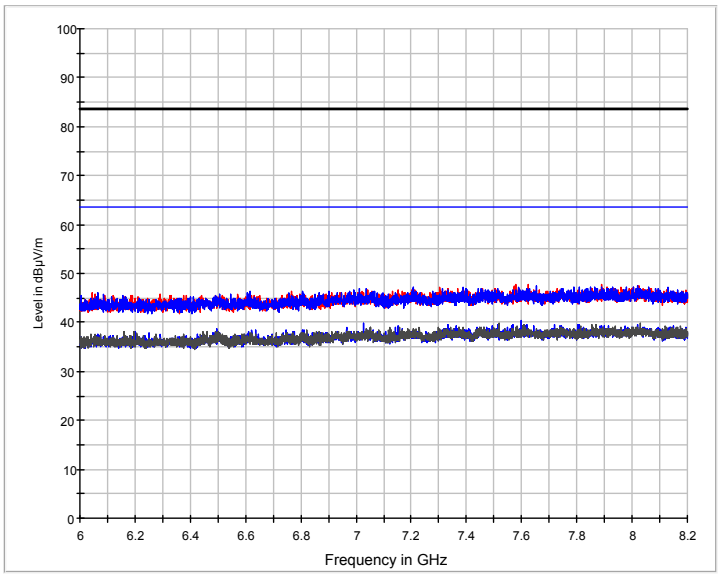

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

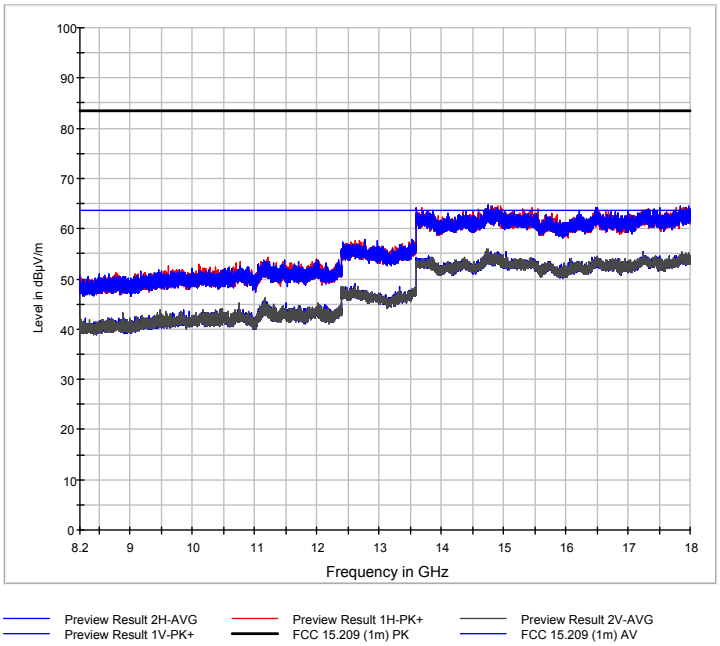
EUT on long side:

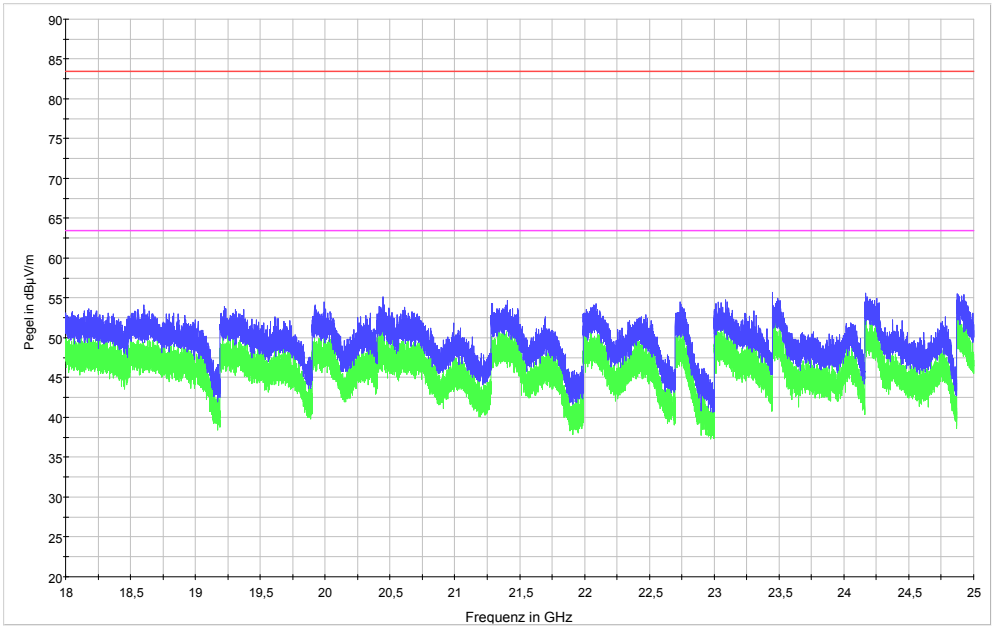


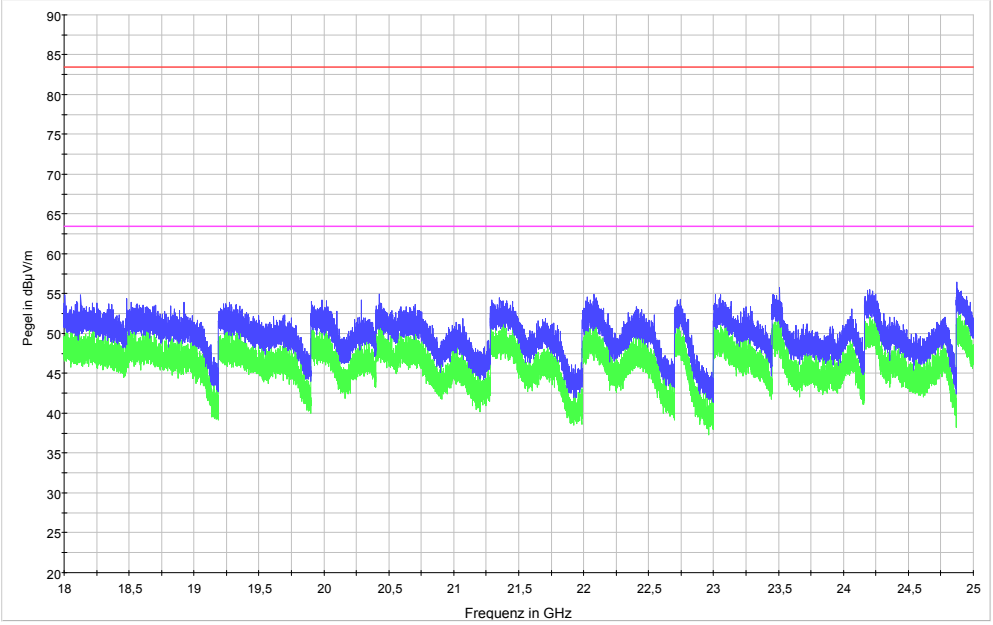



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV

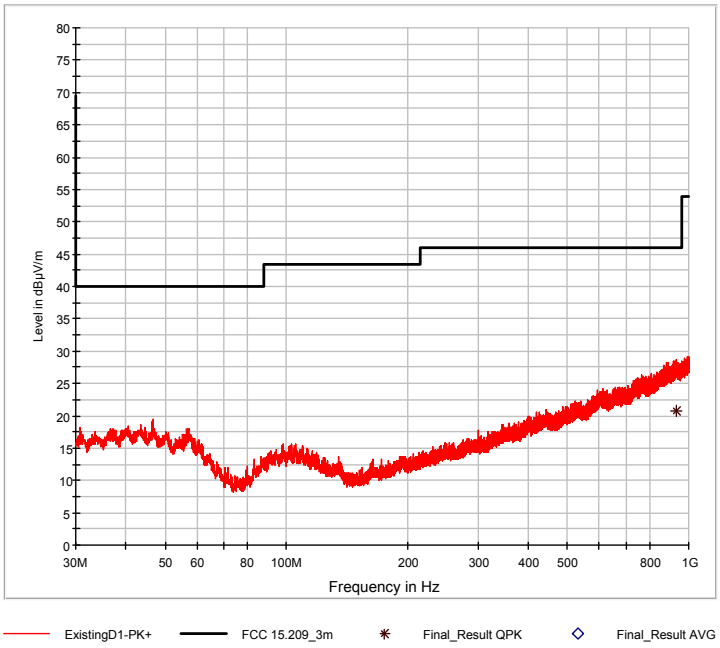

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

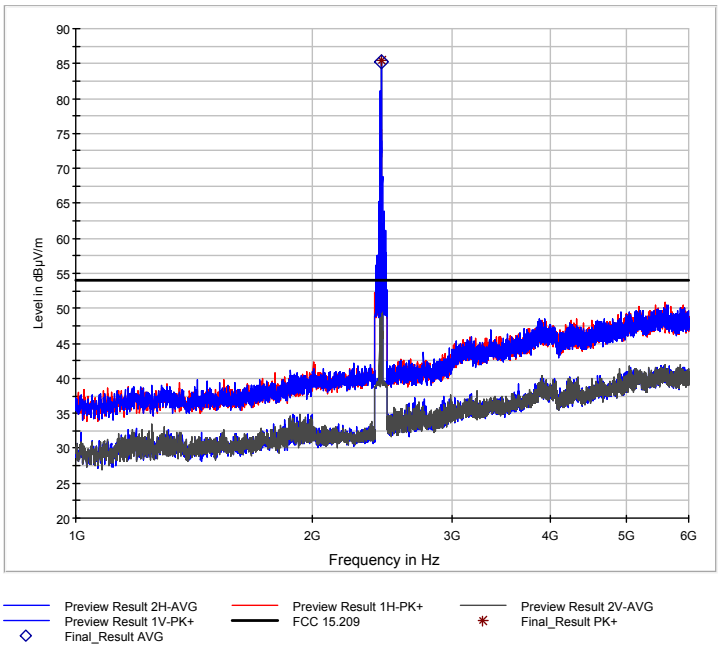

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

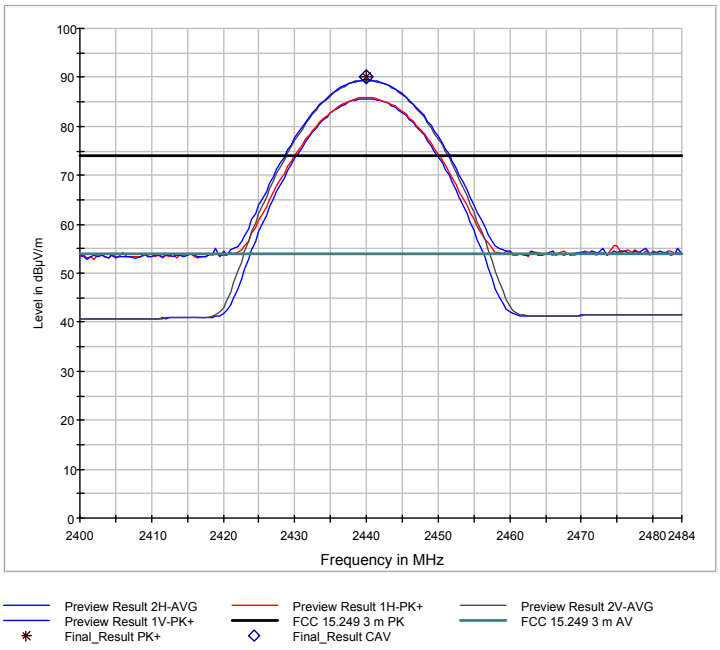

Pegel in dBµV/m
Frequenz in GHz

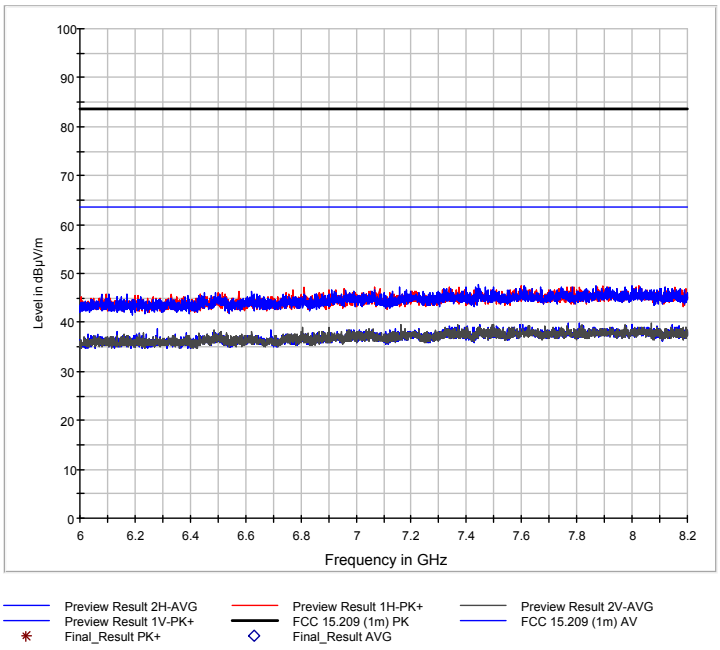

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

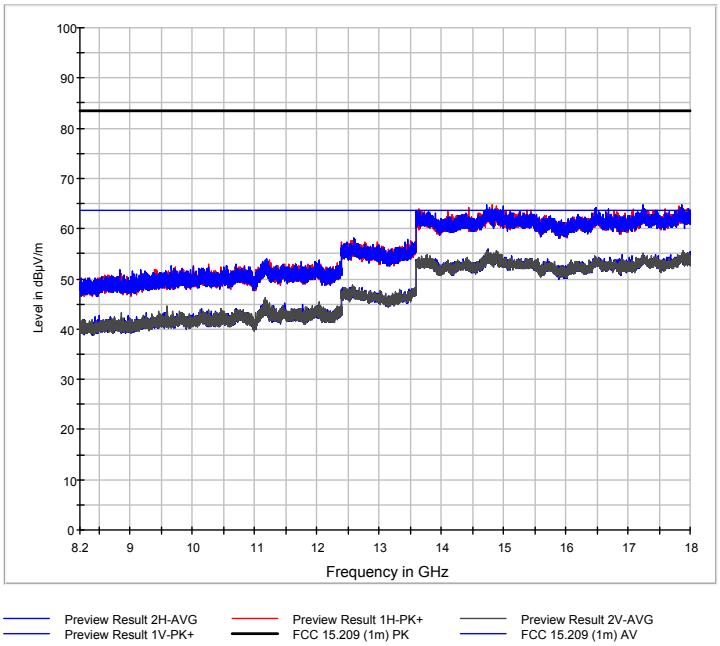
EUT in upright position:

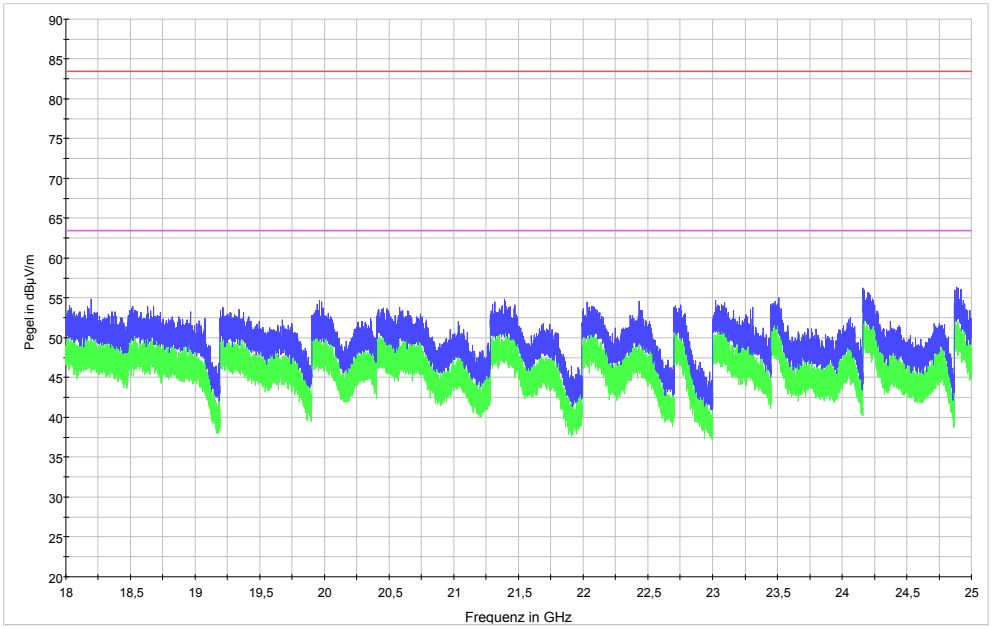


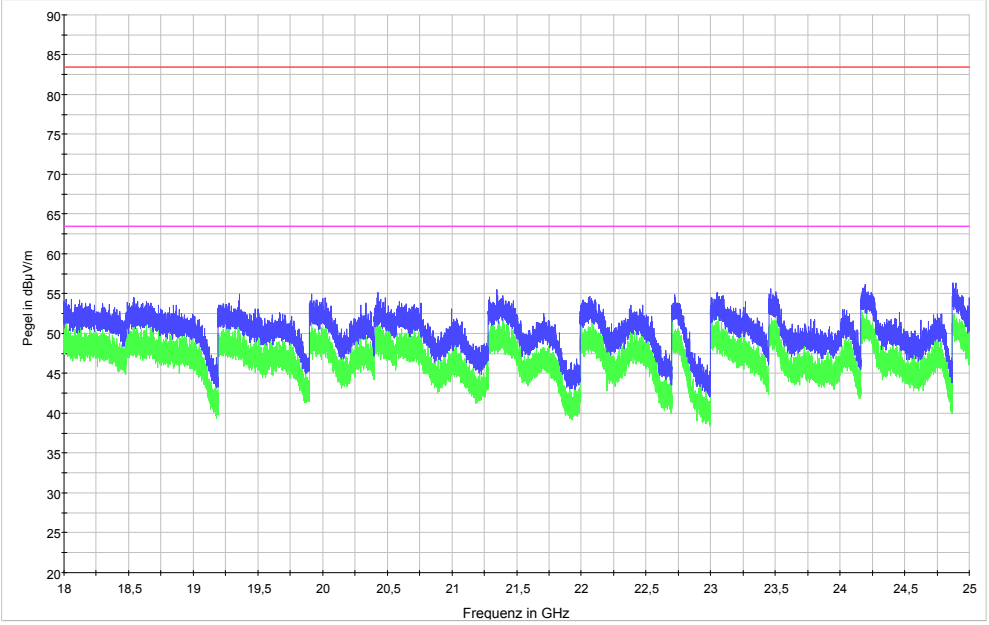



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

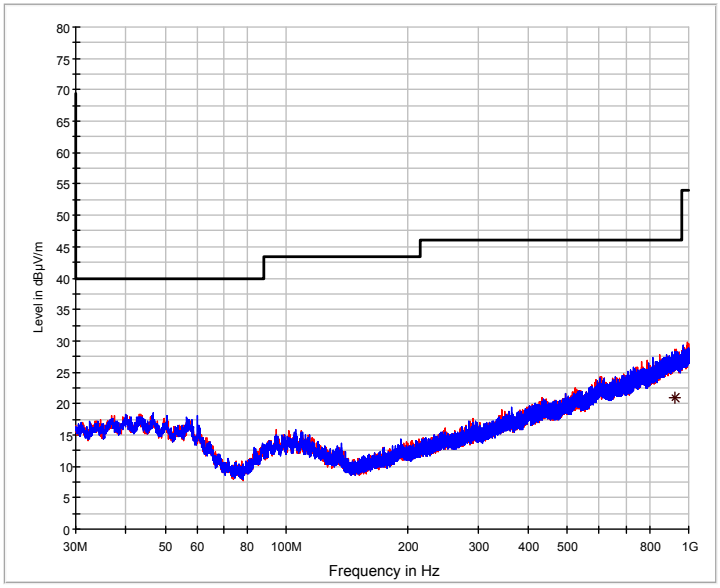

Pegel in dBµV/m
Frequenz in GHz

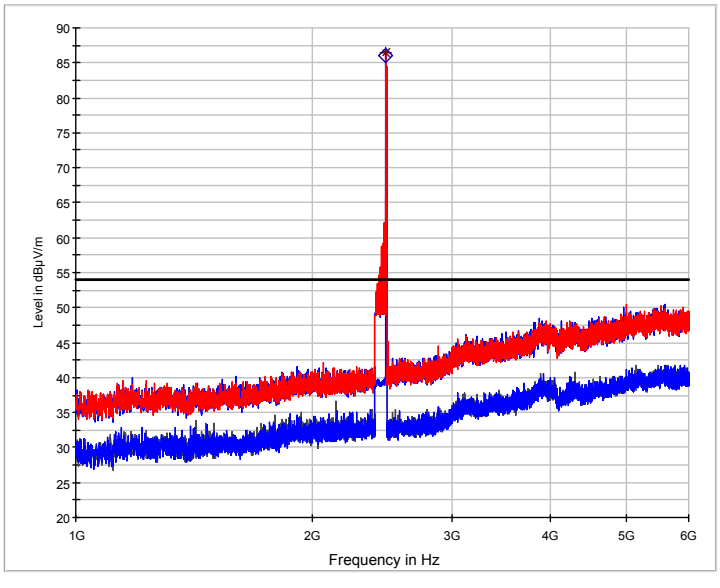

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

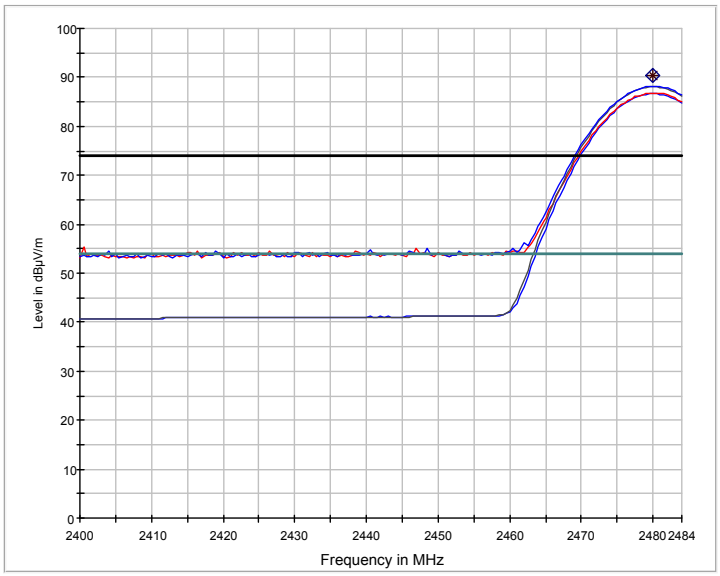
Comment:	Transmitting on highest frequency; EUT in three orthogonal axis
Date of test:	
Test site:	Semi-anechoic room, cabin no. 8
Test distance:	Frequencies ≤ 8.2 GHz: 3 meters Frequencies > 8.2 GHz: 1 meter

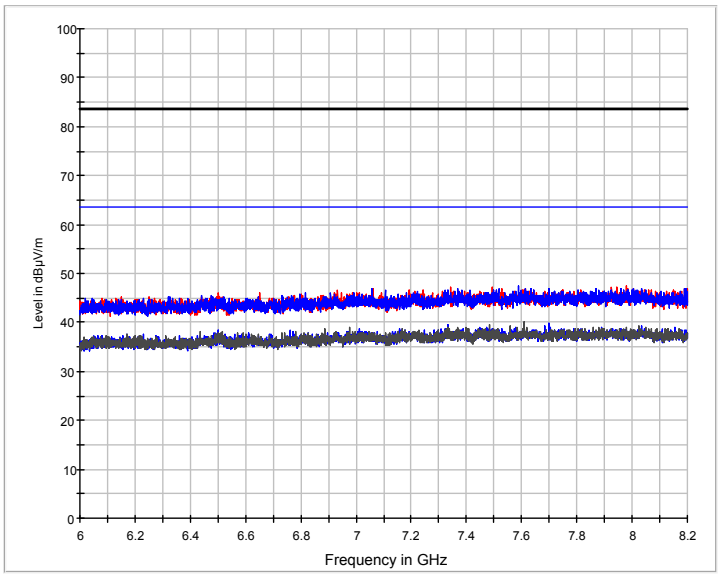
Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2480.000	vertical	Peak	55.7	34.7		90.4	94.0	**3.7**

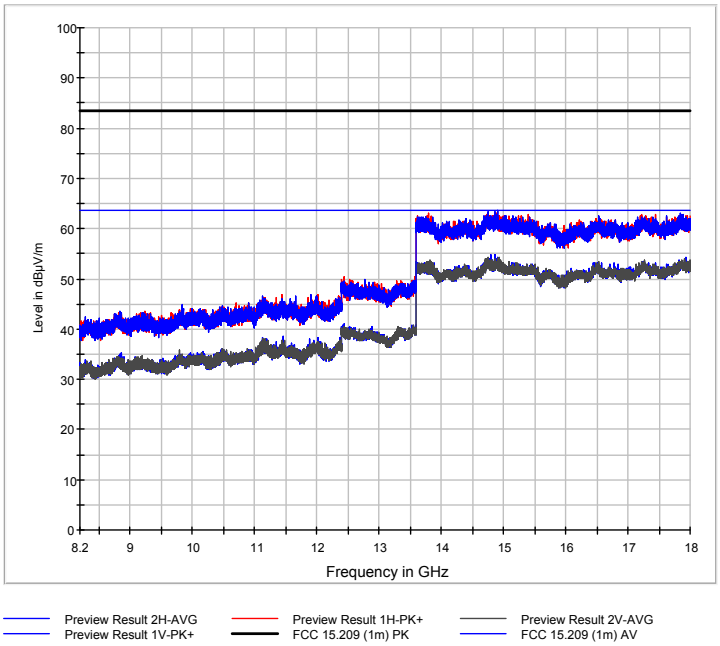
EUT flat on table:

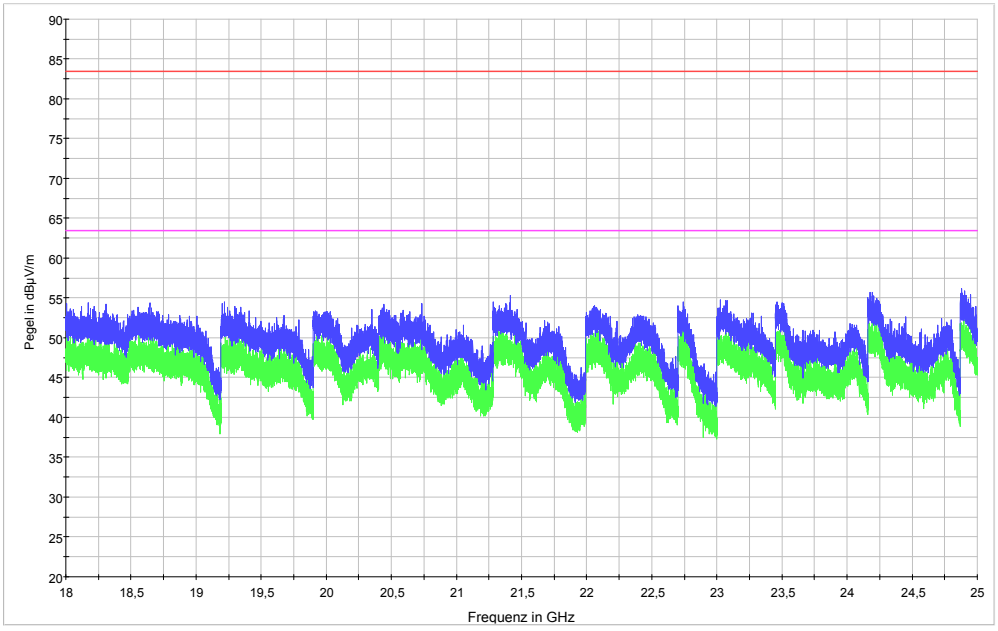


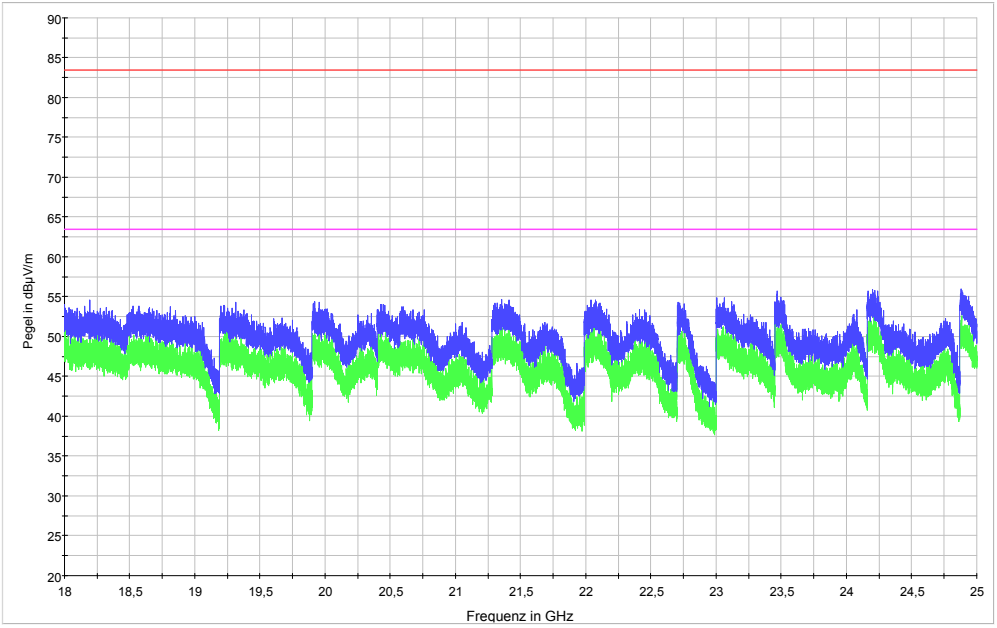



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV

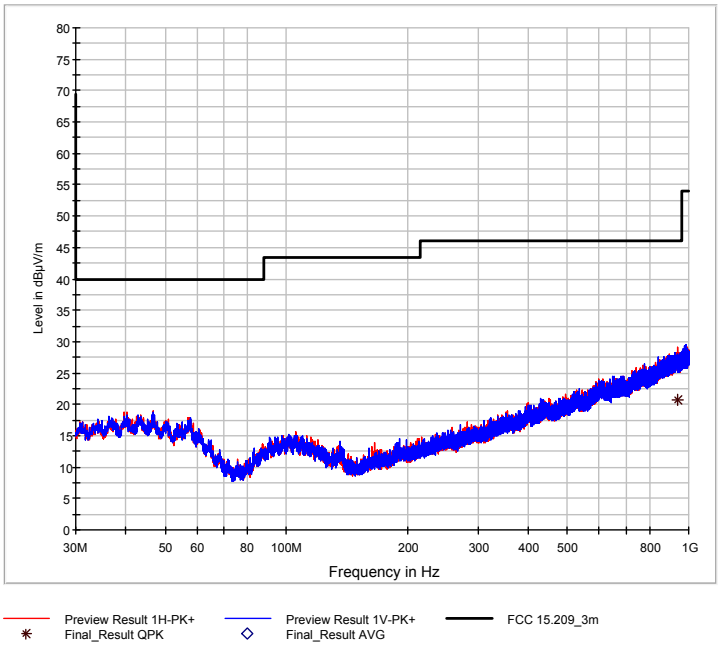

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

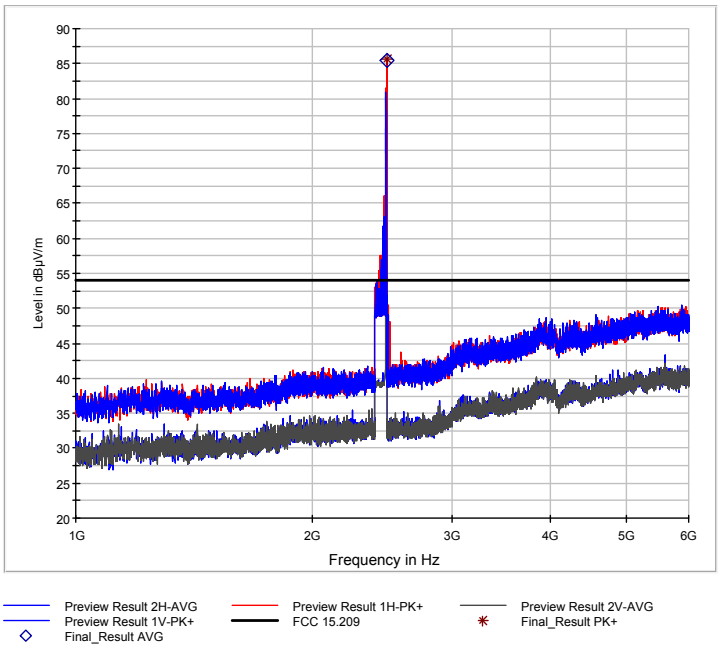

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

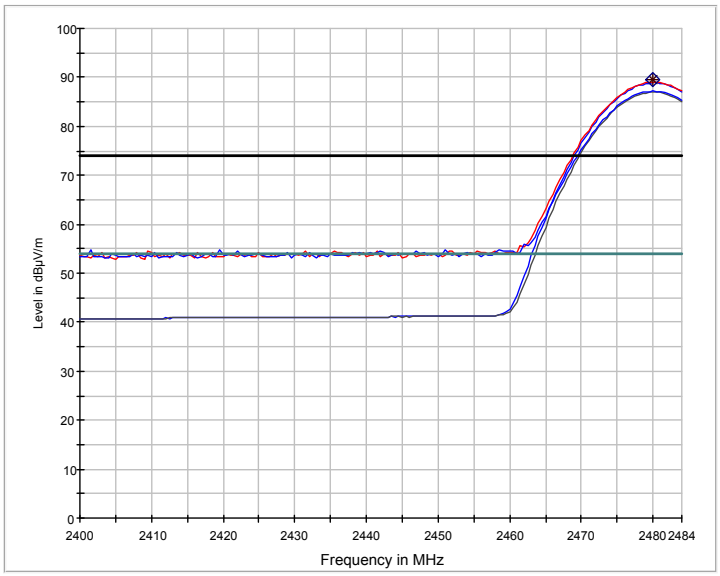

Pegel in dBµV/m
Frequenz in GHz

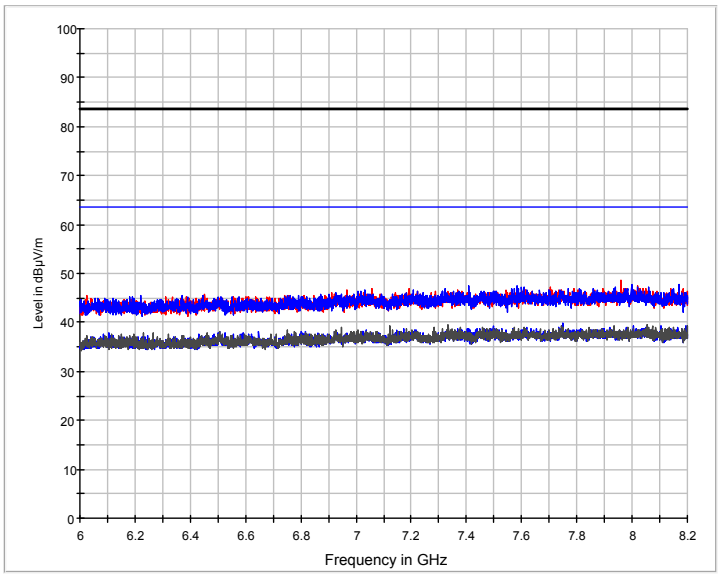

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

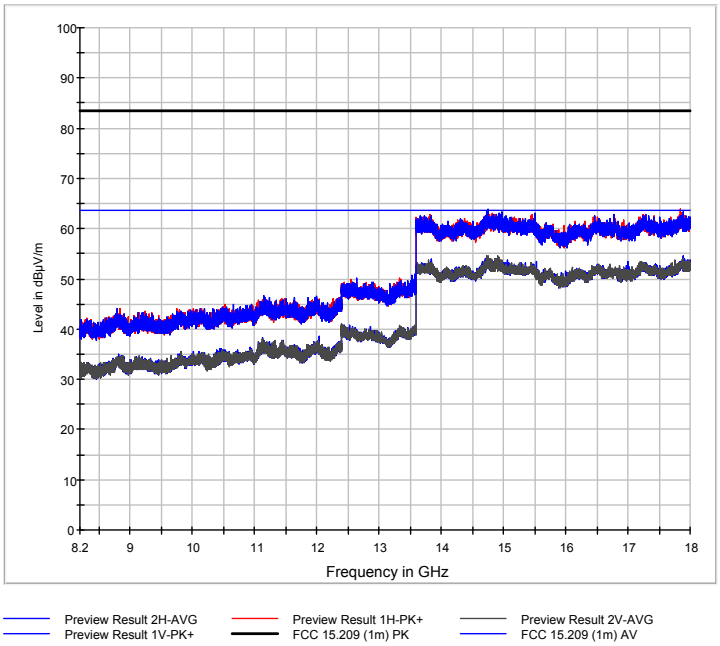
EUT on long side:

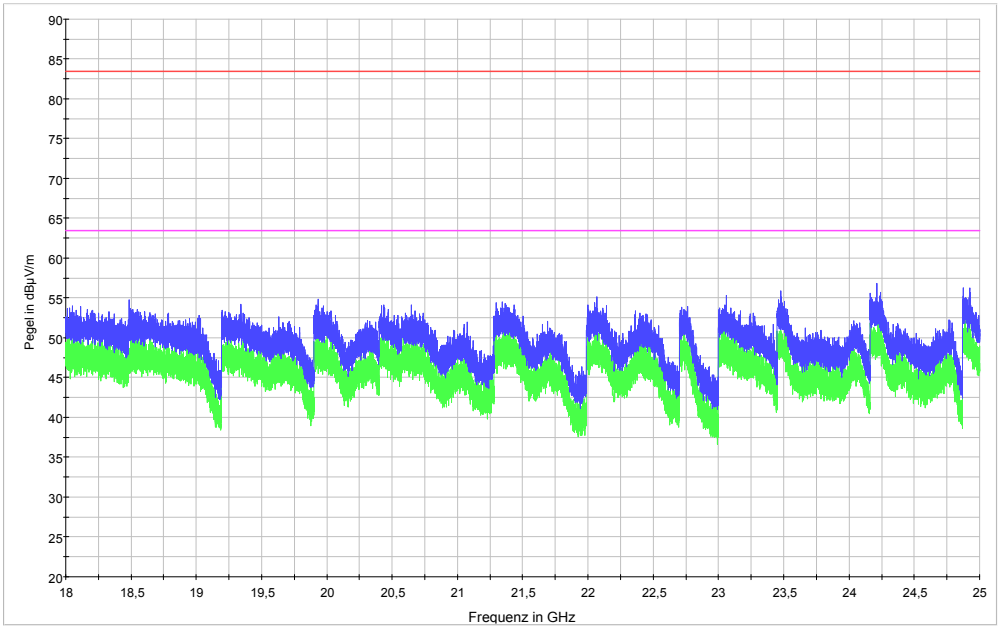


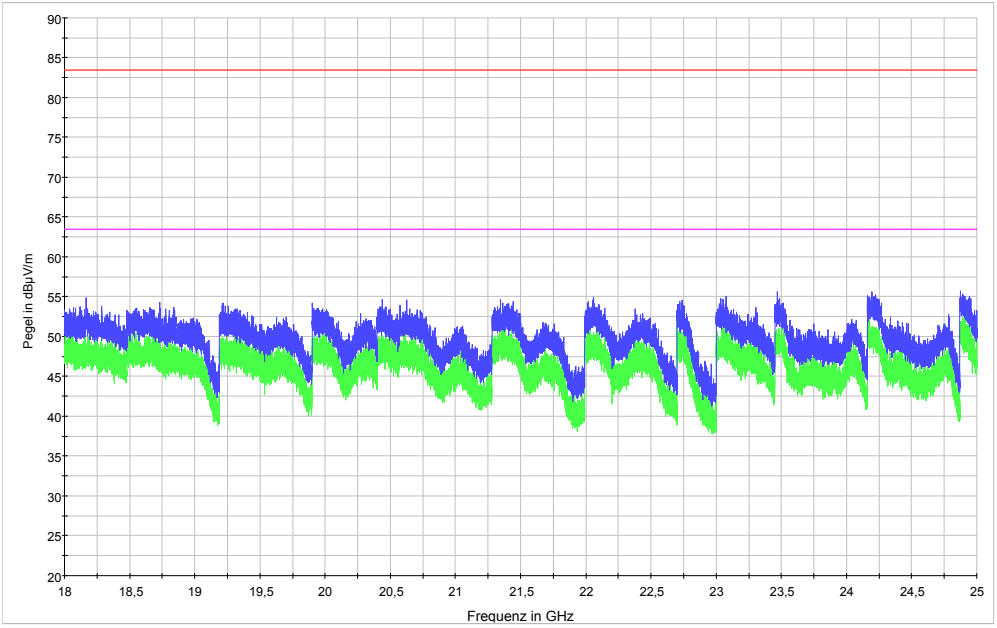



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.249 3 m PK
FCC 15.249 3 m AV
Final_Result PK+
Final_Result CAV

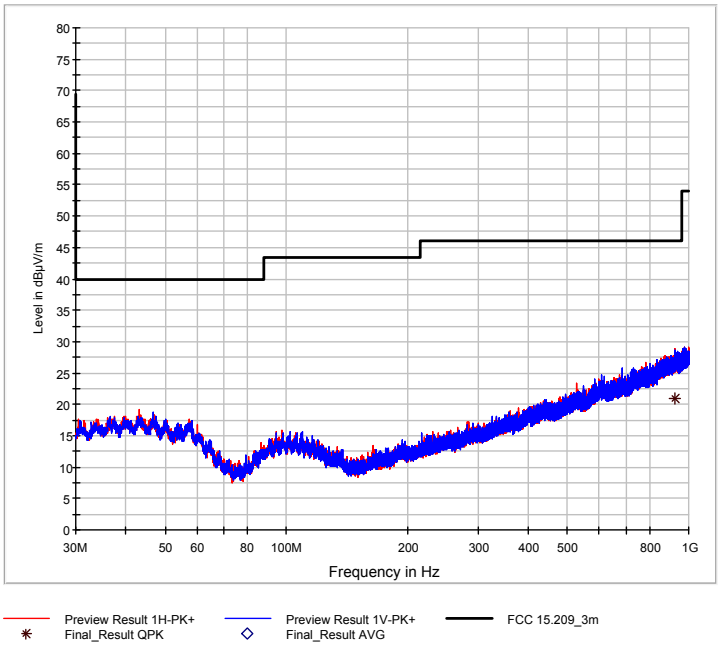

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.209 (1m) PK
FCC 15.209 (1m) AV
Final_Result PK+
Final_Result AVG

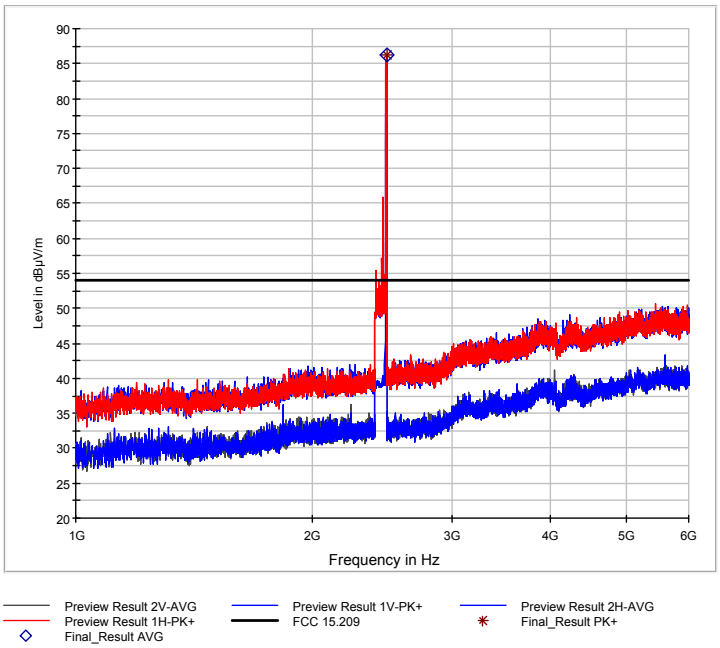

Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV

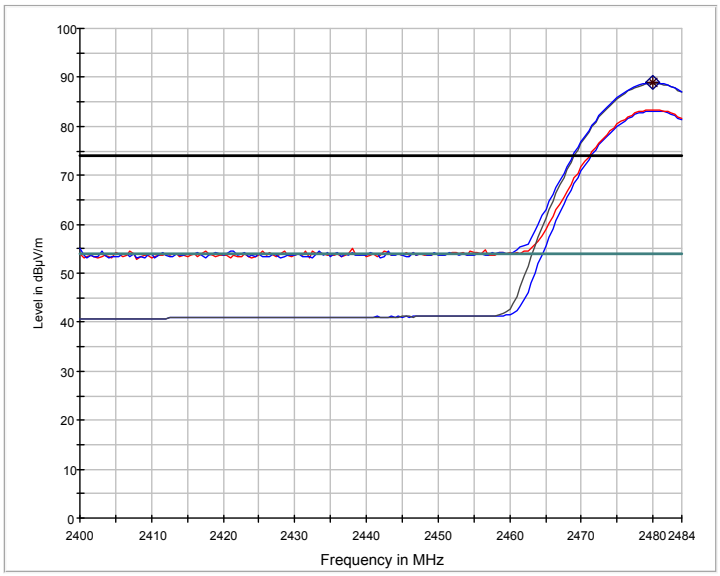

Pegel in dBµV/m
Frequenz in GHz

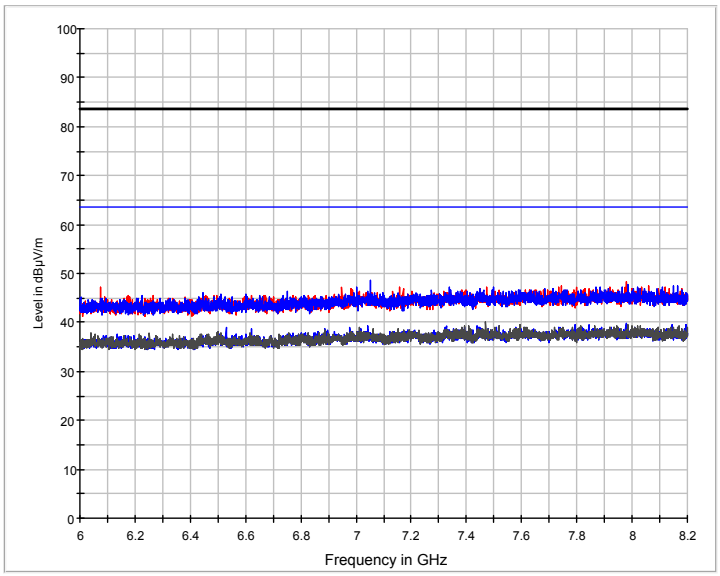

Pegel in dBµV/m
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25
Frequenz in GHz

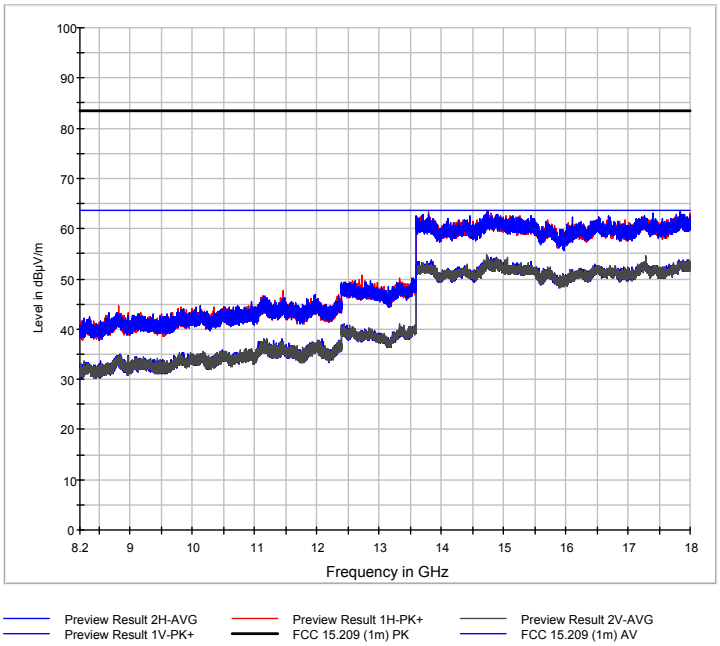
EUT in upright position:

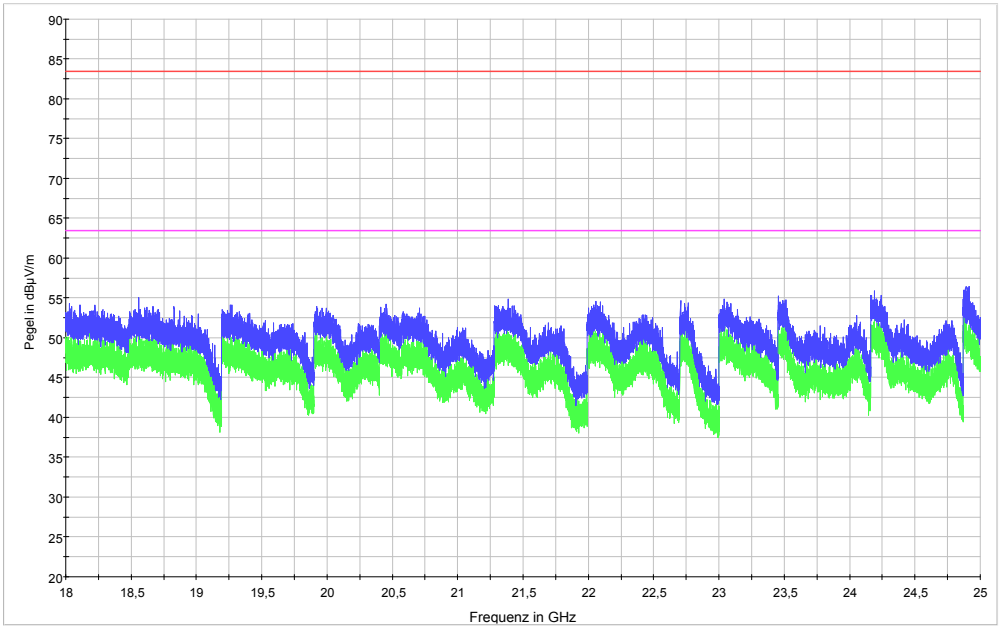


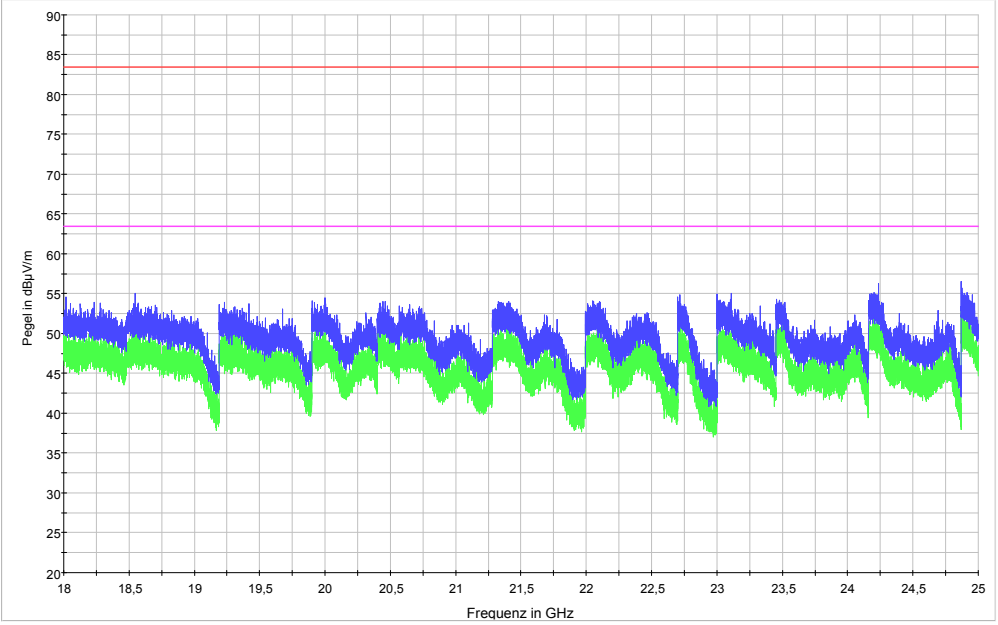



Level in dBµV/m
Frequency in MHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.249 3 m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.249 3 m AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Level in dBµV/m
Frequency in GHz
Preview Result 2H-AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Pegel in dBµV/m
Frequenz in GHz


Pegel in dBµV/m
Frequenz in GHz
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
18,5
19
19,5
20
20,5
21
21,5
22
22,5
23
23,5
24
24,5
25

8.7 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 4, section 3.2
Guide:	IC RSS-102 Issue 5, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W**			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = **.....**		☐		
$EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W**				
☐ the field strength[8] in V/m: FS = **..... V/m**			☐	
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W**				
with:				
Distance between the antennas in m: D = **..... m**			☐	
☐ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by8:				
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **687.3 µW**				
with:				
Field strength in V/m: FS = **47.86 mV/m**			☒	
Distance between the two antennas in m: D = **3 m**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **687.3 µW**				

[8] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
☒ less than or equal to 20 cm	☐ greater than 20 cm		☒		
Transmitting device is					
☐ in the vicinity of the human head	☒ body-worn		☒		

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				

Frequency (MHz)	Exemption limits (mW)[9] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 [10]	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	**2440.0 MHz**
Distance:	d	=	**5 mm**
Transmitter output power:	TP	=	**687.3 µW**
Limit:	TP_{limit}	=	**4000.0 µW** ☒

☐ SAR evaluation is documented in test report no. .....

[9] The excemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

[10] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows: ☐ below 20 MHz[11] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance). ☐ between 3 kHz and 10 MHz exposure limits apply as following: ☐ In a uncontrolled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than $2.7 \cdot 10\text{-}4\ f$ V/m_{rms} at any part of the body where *f* is in Hz. The instantaneous RF field strength is equal or less than 83 V/m_{rms} and equal or less than 90 A/m_{rms}. ☐ In a controlled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than $1.35 \cdot 10\text{-}4\ f$ V/m_{rms} at any part of the body where *f* is in Hz. The instantaneous RF field strength is equal or less than 170 V/m_{rms} and equal or less than 180 A/m_{rms}. ☐ at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4{,}49/f^{0.5}$ W (adjusted for tune-up tolerance, where *f* is in MHz. ☐ at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance). ☐ at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \cdot 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where *f* is in MHz. ☐ at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance). In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.				
Carrier frequency: f = **..... MHz** Transmitter output power: TP = **..... mW** Limit: TP_{limit} = **..... mW**				☐
☐ RF exposure evaluation is documented in test report no.				

[11] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demostrate compilance tot he instanteneous limits in IC RSS-102, issue 5, section 4.

9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 1, 2016
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2016
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 13, 2014 (published on June 20, 2014)
☒	ANSI C63.10	American national Standard of Procedures for Compilance Testing of Unlicensed Wireless Devices	June 27, 2013 (published on September 13, 2013)
☒	RSS-Gen	Radio Standards Specification RSS-Gen Issue 4 containing General Requirements for Compilance of Radio Apparatus, published by Industry Canada	November 2014
☒	RSS-210	Radio Standards Specification RSS-210 Issue 9 for Licence-Exempt Radio Apparatus: Category I Equipment, published by Industry Canada	August 2016
☐	RSS-310	Radio Standards Specification RSS-310 Issue 3 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	December 2010
☒	RSS-102	Radio Standards Specification RSS-102 Issue 5: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada	March 2015
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 6: Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement, published by Industry Canada	January 2016
☒	CISPR 22	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, “Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement”	1997
☐	CAN/CSA CISPR 22-10	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2010

☒	TRC-43	Designation of Emissions, Class of Station and Nature of Service, published by Industry Canada	November 2012

10 Test Equipment List with Calibration Data

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Last Calibration*	*Next Calibration*
EMI test receiver	28268	ESW26	101315	Rohde & Schwarz	Rohde & Schwarz	2017/06	2018/06
Spectrum analyser	2364	FSV40	101448	Rohde & Schwarz	Rohde & Schwarz	2016/11	2017/11
Double ridged horn antenna	2073	HF907	100154	Rohde & Schwarz	Rohde & Schwarz	2017/06	2018/06
Horn antenna	1013	3160-06	9112-1001	EMCO Elektronik		see note 1	
Horn antenna	1014	3160-07	9112-1008	EMCO Elektronik		see note 1	
Horn antenna	1015	3160-08	9112-1002	EMCO Elektronik		see note 1	
Horn antenna	1265	3160-09	9403-1025 (931941-010)	EMCO Elektronik		see note 1	
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	2016/07	2018/07
TRILOG Broadband Antenna	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	2016/07	2018/07

Note 1: No calibration required.
Note 2: Not calibrated separately but with the whole test system when recording calibration data.
Note 3: No calibration required. Devices are checked before use.
Note 4: No calibration required. Devices are checked by calibrated equipment during test.

11 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	2017-10-20	M. Steindl	First Edition