

Prüfbericht-Nr.: Test report no.:	DE239P74 001	Auftrags-Nr.: Order no.:	1140809 191	Seite 1 von 59 Page 1 of 59	
Kunden-Referenz-Nr.: Client reference no.:	-	Auftragsdatum: Order date:	2023-05-23		
Auftraggeber: Client:	FIOR and GENTZ GmbH Dorette von Stern Strasse 5 Lueneburg 21337, Germany				
Prüfgegenstand: Test item:	Bluetooth Controller				
Bezeichnung / Typ-Nr.: Identification / Type no.:	ET3860				
Auftrags-Inhalt: Order content:	Prüfung der Funkparameter nach FCC & ISCED Test of radio parameters acc. to FCC & ISCED				
Prüfgrundlage: Test specification:	Vollprüfung / Complete test FCC CFR 47 Part 15 Subpart C- §15.247 ISCED RSS-247:2023 Issue 3				
Wareneingangsdatum: Date of sample receipt:	2023-11-27	Refer to EUT External Photos_ DE239P74 001			
Prüfmuster-Nr.: Test sample no.:	A003611168-003 to 004				
Prüfzeitraum: Testing period:	2023-12-02 - 2023-12-20				
Ort der Prüfung: Place of testing:	Nürnberg Nuremberg				
Prüflaboratorium: Testing laboratory:	Wireless Labor Wireless Test Lab				
Prüfergebnis*: Test result*:	Pass				
geprüft von: tested by:	 Signiert von: Matthias Kraeutlein		genehmigt von: authorized by:	 Signiert von: Patrick Reusch	
Datum: Date:	2024-09-25		Ausstellungsdatum: Issue date:	2024-09-27	
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / Other:	-				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged				
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
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Anmerkungen Remarks

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4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i>

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Produktbeschreibung
Product description

1	Test item	Bluetooth Controller
2	Typ-No.	ET3860
3	Test sample obtaining	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	Serial-No.	-
5	Description of EUT	Automatic ankle joint system NEURO HiSWING R+ has an automatic adjustment function of inclination angle. When a patient goes up/down the ramp, the joint adjusts its angle to compensate for the change inclination angle of the ramp. Using the App, automatic adjustment can be enabled or disabled. The angle of joint can also be manually unlocked by pressing a mechanical button in the joint, and after selecting proper angle, locked again. Joint angle could be changed by +/- 17°.
6	Supported radio technologies	BLE4.2
7	Max RF output power (declared)	3 dBm
8	Operating Frequency (declared)	2402MHz to 2480Hz
9	Data Rate & Channel Bandwidth (declared)	1Mbps & 2 MHz
10	Number of Channels	40
11	Modulation	GFSK
12	Rated Voltage / Frequency	4.2V DC
13	Radio Module / Antenna Type	☒ Radio module with antenna on module PCB ☐ Radio module with dedicated antenna ☐ Radio module with user accessible antenna connector
14	Antenna Name	PCB Antenna
15	Antenna Type	☒ Integral antenna ☐ Dedicated antenna ☐ Permanent antenna connector
16	Antenna amount of chains	1
17	Antenna Gain (declared)	0 dBi

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Product description

18	Software Version	5.1.5
19	Hardware Version	1.4.1
20	Used Samples	A003611168-003 Conducted Sample A003611168-004 Radiated Sample
21	Companion Device	Radio test firmware controlled by shell through UART
22	Accessory Devices	Power Supply FW8002.1MUSB/05
23	Data Cable	-
24	I/O Ports	-
25	Temperature Range	-10° to 40°
26	Environment	Indoor
27	Pictures of the EUT Refer to EUT External Photos_ DE239P74 001	
28	FCC ID: 2BH6Y-ET3860 & IC:32628-ET3860	

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Absatz Clause	Anforderungen – Prüfungen / Requirements - Tests	Bemerkungen / Remarks	Ergebnis Result
FCC 15.247 (a)(1) RSS-247 sec. 5.1	20 dB Bandwidth	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Number of Hopping Frequencies	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Time of Occupancy	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1) RSS-247 sec. 5.1	Carrier Frequency Separation	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (b) RSS-247 sec. 5.4	Maximum Output Power	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (e) RSS-247 sec. 5.2 (b)	Power Spectral Density	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (a)(2) RSS-247 sec. 5.2 (a)	6dB Bandwidth	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (d) RSS-247 sec. 5.5	Band Edge Measurement	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (d) RSS-247 sec. 5.5	Conducted Spurious Emission	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.205, 15.209 RSS-Gen sec. 8.9, 8.10	Radiated Spurious Emission	-	P ☒ F ☐ N/A ☐ N/T ☐

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Absatz Clause	Anforderungen – Prüfungen / Requirements - Tests	Bemerkungen / Remarks	Ergebnis Result
FCC 15.207 RSS-Gen sec. 8.8	AC Power Conducted Emissions	-	P ☒ F ☐ N/A ☐ N/T ☐

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1 EUT Classification

1.1 Wireless technologies and frequencies supported by the EUT

The named technologies are only those falling in the specification of the applied standard.

Technology	Frequency Range (TX)	TX Function	Supported by the EUT	Evaluated in this report
802.11b	2400 – 2483.5 MHz	SISO	☐	☐
802.11g	2400 – 2483.5 MHz	SISO	☐	☐
802.11n (20MHz)	2400 – 2483.5 MHz	SISO	☐	☐
802.11n (40MHz)	2400 – 2483.5 MHz	SISO	☐	☐
BLE4.2	2400 – 2483.5 MHz	SISO	☒	☒

1.2 Standard specific classification of the EUT

1.2.1 Applied standards

FCC CFR 47 Part 15 Subpart C - §15.247

ISED RSS-247:2017

1.2.2 Test Methods and Guidance Documents

ANSI C63.10:2013

KDB 558074 D01 DTS Measurement Guidance v05

1.2.3 System Type

☒	DTS (Digital Transmission System)
☐	FHSS (Frequency Hopping Spread Spectrum)

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2 General

2.1 Registration

The measurement facilities for conducted and radiated disturbance measurements of the TÜV Rheinland LGA Products have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission's Rules.

FCC Registration Number: 939976

Bundesnetzagentur Registration Number: BNetzA-CAB-17/21-16

The measurement facilities are also recognized by Innovation, Science and Economic Development (ISED) Canada to test to Canadian radio equipment requirements.

Company Number: 11235A

CAB Identifier: DE0018

2.2 Equipment modifications

No modifications were found to be necessary in order to perform the tests or to achieve compliance.

2.3 Test modes

Mode	Description	Mode configuration
All Modes		☐ No auxiliary equipment was connected to the EUT. ☐ The auxiliary equipment was connected to the EUT during the tests to keep the configured settings active. ☒ The auxiliary equipment laptop was only connected to the EUT before the tests for the mode configuration. During the test the auxiliary laptop equipment was disconnected from the EUT.
1	TX mode	Tx modulated with continuous transmission on Low Mid and High Channels, Freq 2402MHz, 2440MHz and 2480MHz, Bandwidth 2MHz, GFSK modulation.
2	TX mode & charging	Tx modulated with continuous transmission on Low Mid and High Channels, Freq 2402MHz, 2440MHz and 2480MHz, Bandwidth 2MHz, GFSK modulation. Power supply FW8002.1MUSB/05

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3 Test conditions

3.1 General

The DUT was tested standalone on the transmit test mode in normal test conditions.

3.2 Normal test conditions

Environmental condition	Parameter	Range
Temperature	°C	21-23
Relative humidity	%	20-23
Supply voltage	Volts DC	4.2

3.3 Antenna assemblies

Antenna connector is prepared so tests were done in conducted and radiated mode.

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3.4 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the quality system acc. to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation.

The manufacturer has the sole responsibility of continued compliance of the device.

Test	Value	Unit	Range
Frequency Error	2,7 *10 ⁻⁸	Hz	-
Frequency Stability under low voltage conditions			
Time	1,1*10 ⁻⁹	s	-
Conducted Carrier Power	1.0	dB	9k-1GHz
Conducted Spurious Emissions (RX/TX)	1.7	dB	1GHz-6GHz
	2.8	dB	6GHz-40GHz
Occupied Bandwidth (OBW)	0.1	%	-
TX Power Spectral Density	4.2	mW	9kHz - 6GHz
	1.6	dB	9kHz - 6GHz
Dwell Time	4,6 *10 ⁻⁷	Hz	-
Frequency Separation			-
Measurement of conducted emissions at the power supply connection to LISN	2.3	dB	9kHz – 150kHz
	2.2	dB	150kHz – 30MHz
Measurement of the field strength at distance 3m	1.6	dB	9k-150kHz
	4.5	dB	30-1000MHz
	5	dB	1-6GHz
	5.3	dB	6-40GHz
Temperature	0.8	K	-
Humidity	4	%	-
Voltage (AC/DC)	1.0	%	-

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4 Test results in detail

4.1 Maximum Output Power

4.1.1 Requirements / Limits

The maximum output power limit is expressed in terms of either maximum peak conducted output power or maximum conducted output power.

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the full signal bandwidth.

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

	Condition		Limit
☒	Systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands		<i>FCC Part 15, Subpart C, §15.247 (b) (3)</i> 1 watt = 30dBm. Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).
☐	Frequency hopping systems operating 2400-2483.5 MHz band.	Employing less than 75 non-overlapping hopping channels	<i>FCC Part 15, Subpart C, §15.247 (b) (1)</i> 0.125 watt = 21dBm.
☐		Employing at least 75 non-overlapping hopping channels	<i>FCC Part 15, Subpart C, §15.247 (b) (1)</i> 1 watt = 30dBm.
☐	Frequency hopping systems operating 5725-5850 MHz band.		<i>FCC Part 15, Subpart C, §15.247 (b) (1)</i> 1 watt = 30dBm.
☐	Frequency hopping systems operating 902-928 MHz band.	Employing less than 50 but at least 25 hopping channels	<i>FCC Part 15, Subpart C, §15.247 (b) (2)</i> 0.25 watt = 24dBm.
☐		Employing at least 50 hopping channels	<i>FCC Part 15, Subpart C, §15.247 (b) (2)</i> 1 watt = 30dBm
☐	Antenna gain greater than 6dBi		<i>FCC Part 15, Subpart C, §15.247 (b) (4)</i> The conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3), as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

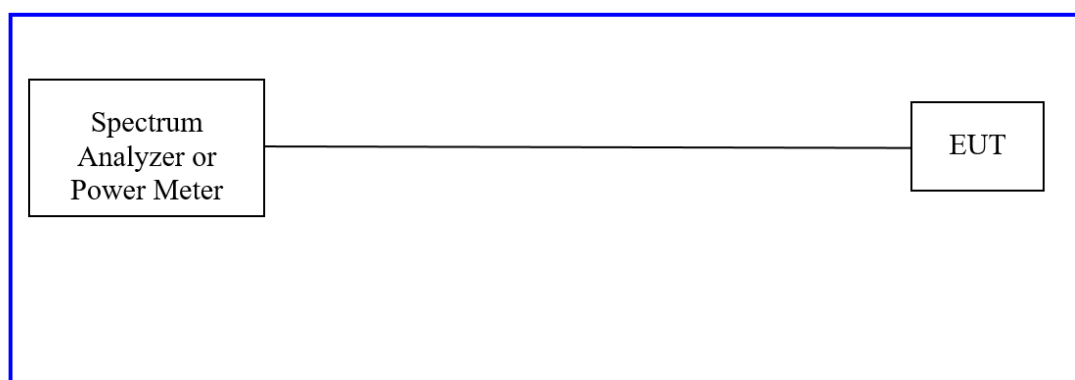
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4.1.2 Test Method

Conducted method was used to measure the maximum output power according to ANSI C63.10:2013 clause 11.9.1.1 peak power (RBW > DTS bandwidth). The EUT was connected to the spectrum analyzer via a coax cable with a known loss.



4.1.3 Test setup

EUT		A003611168-003
Test Condition		Normal conditions
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning		Distance: EUT height: Antenna height: ☐ 3m ☐ 1.5m ☐ 1.5m ☐ 10m ☐ 0.8m ☐ 1m to 4m – height scan ☒ N/A
Companion device		-
Operation mode		1
Spectrum Analyzer	Frequency	2402MHz, 2440MHz, 2480MHz
	Resolution Bandwidth	1 MHz
	Video Bandwidth	3 MHz
	Detector	Peak
Further parameters		-
Test engineer		Matthias Kräutlein

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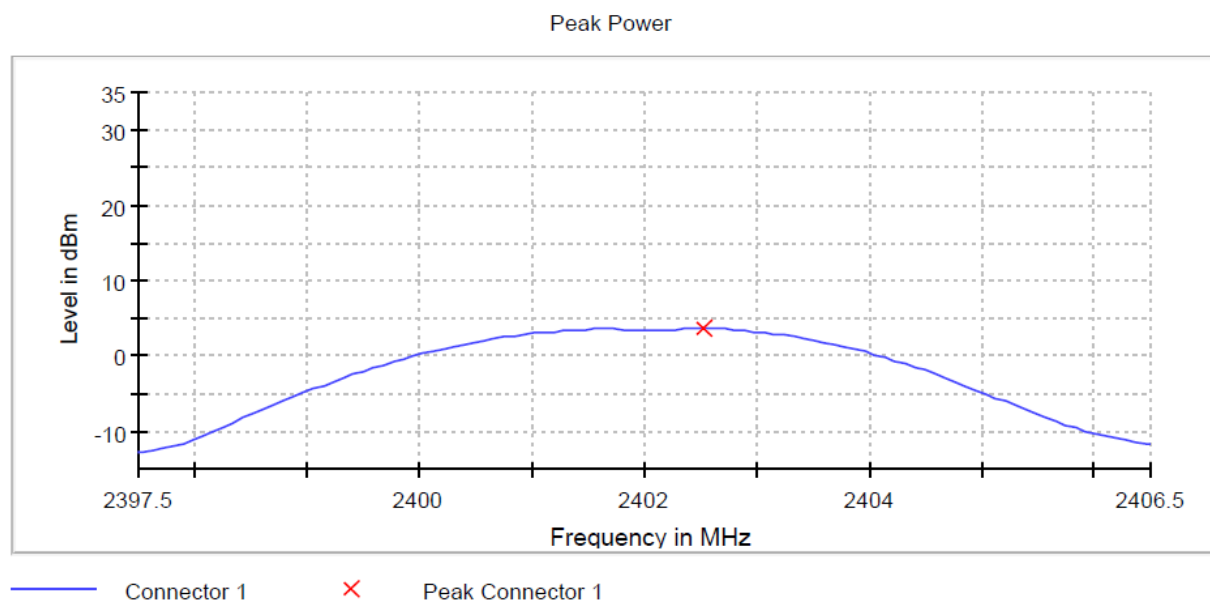
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4.1.4 Test results

Maximum Output power result:

- **Lowest Channel**

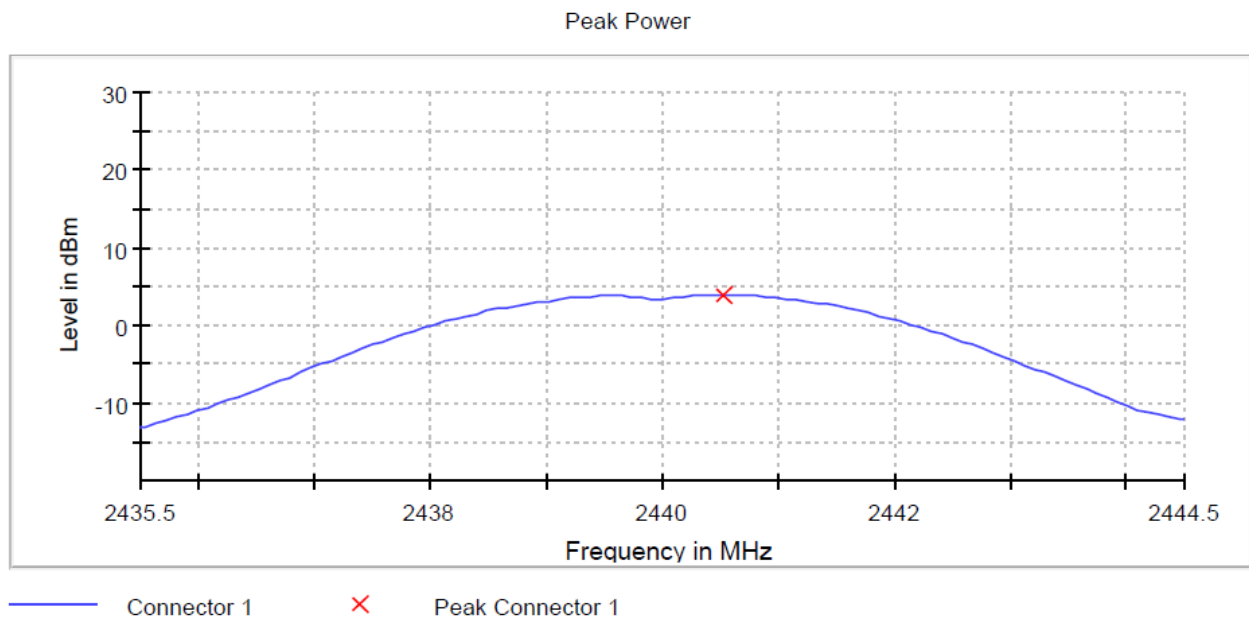


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- Middle Channel

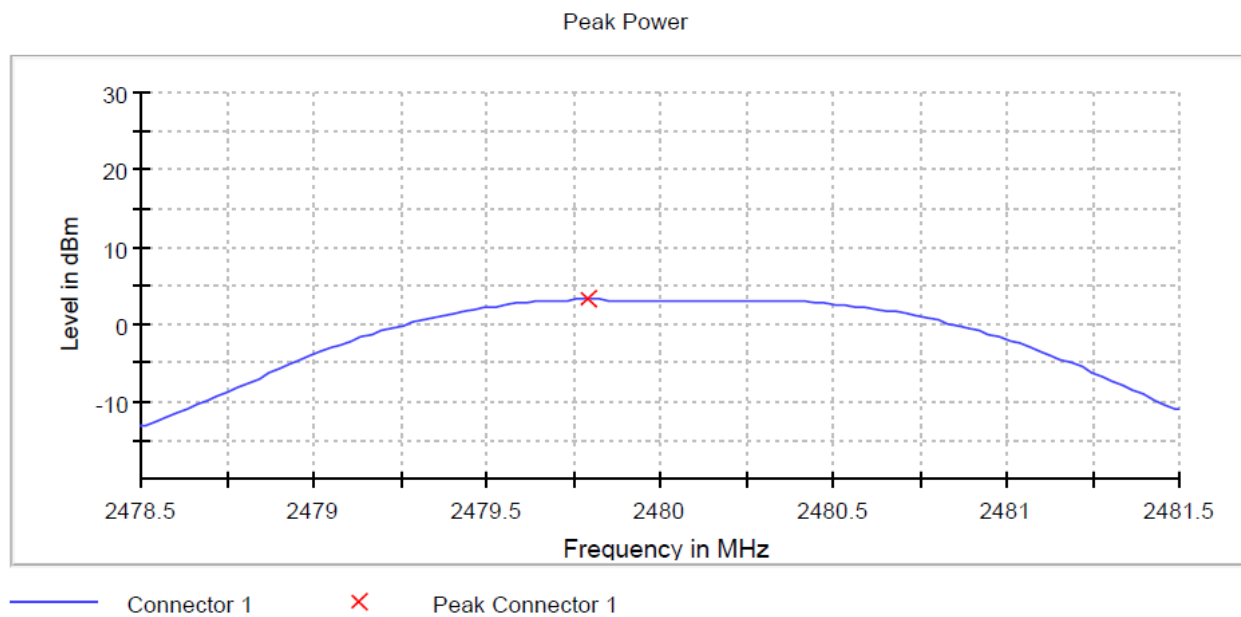


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- Highest Channel



Frequency	Peak conducted output power (dBm)	Limit (dBm)	Margin (dB)	Test Result
Lowest	3.7	30	26.3	Pass
Middle	4.0		26.0	Pass
Highest	3.2		26.8	Pass

Final test result	Pass
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4.2 Power Spectral Density

4.2.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.2.2 Test Method

The same method of determining the conducted output power shall be used to determine the power spectral density according to ANSI C63.10:2013 clause 11.10.2 peak PSD.

4.2.3 Test setup

EUT		A003611168-003
Test Condition		Normal conditions
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning		Distance: EUT height: Antenna height: ☐ 3m ☐ 1.5m ☐ 1.5m ☐ 10m ☐ 0.8m ☐ 1m to 4m – height scan
		☒ N/A
Companion device		-
Operation mode		1
Spectrum Analyzer	Centre Frequency	2402MHz, 2440MHz and 2480MHz
	Resolution Bandwidth	100k
	Video Bandwidth	1M
	Span	1.08
	Sweep time	Max Peak
Further parameters		-
Test engineer		Matthias Kräutlein

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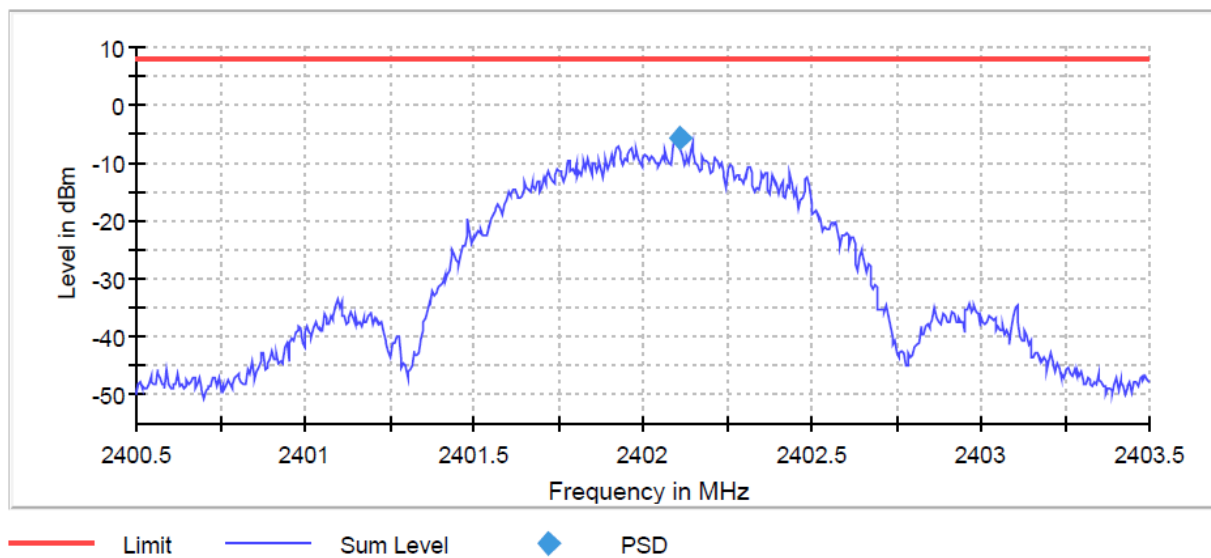
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4.2.4 Test results

- Lowest Channel

Power Spectral Density



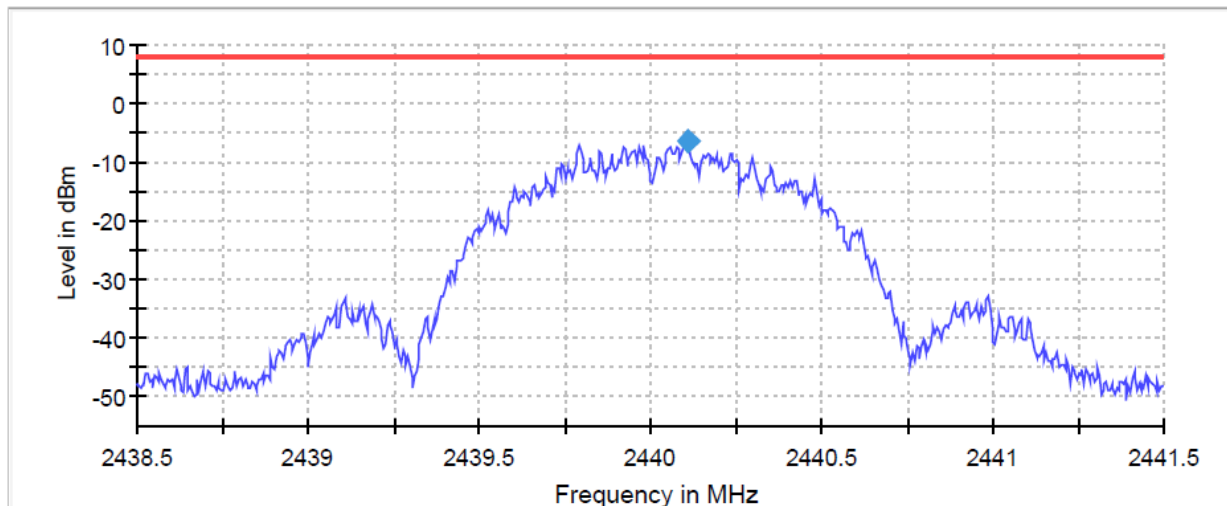
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- Middle Channel

Power Spectral Density



— Limit — Sum Level ◆ PSD

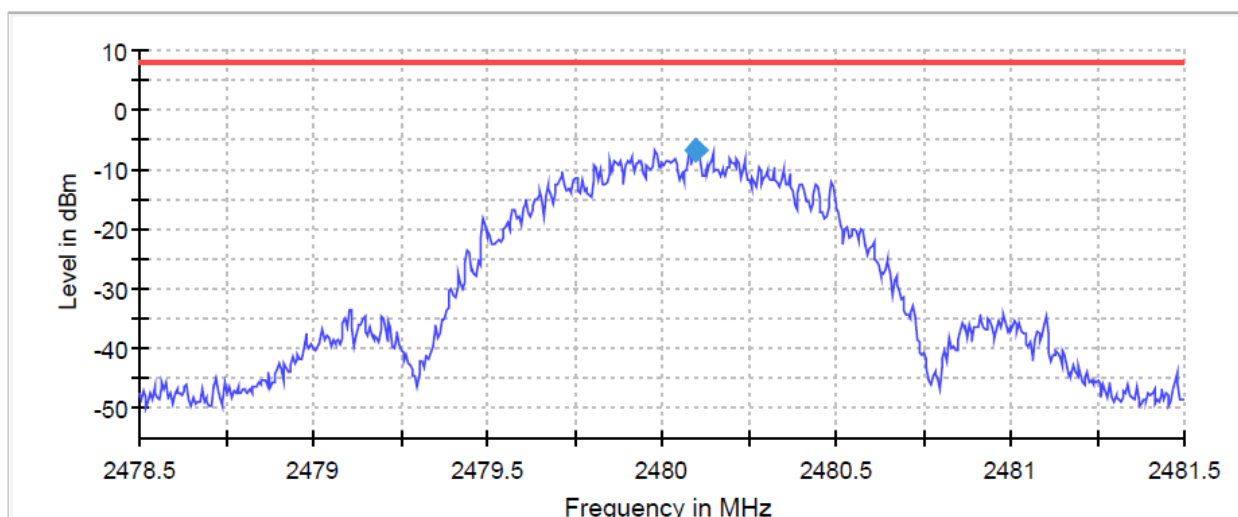
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- Highest Channel

Power Spectral Density



— Limit — Sum Level ◆ PSD

Frequency	Peak conducted power spectral density (dBm/MHz)	Limit (dBm)	Margin (dB)	Test Result
Lowest	-5.588	8	13.588	Pass
Middle	-6.353		14.353	Pass
Highest	-6.633		14.633	Pass

Final test result

Pass

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4.3 6 dB Bandwidth (DTS bandwidth) and 99% Bandwidth

4.3.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.3.2 Test Method

Conducted method was used to measure the 6 dB bandwidth according to ANSI C63.10:2013 clause 6.9.2. The EUT was connected to the spectrum analyzer via a coax cable with a known loss

4.3.3 Test setup

EUT		A003611168-003
Test Condition		Normal conditions
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning		Distance: EUT height: Antenna height: ☐ 3m ☐ 1.5m ☐ 1.5m ☐ 10m ☐ 0.8m ☐ 1m to 4m – height scan
		☒ N/A
Companion device		-
Operation mode		1
Spectrum Analyzer	Centre Frequency	2402MHz, 2400MHz and 2480MHz
	Resolution Bandwidth	100 kHz for 6 dB bandwidth 1 to 5% of OCB for 99% bandwidth (BW:1MHz so RBW is 10 KHz)
	Video Bandwidth	300 kHz for 6 dB bandwidth 30 KHz for 99% bandwidth
	Span	2 MHz
	Sweep time	Max Peak
Further parameters		-
Test engineer		Matthias Kräutlein

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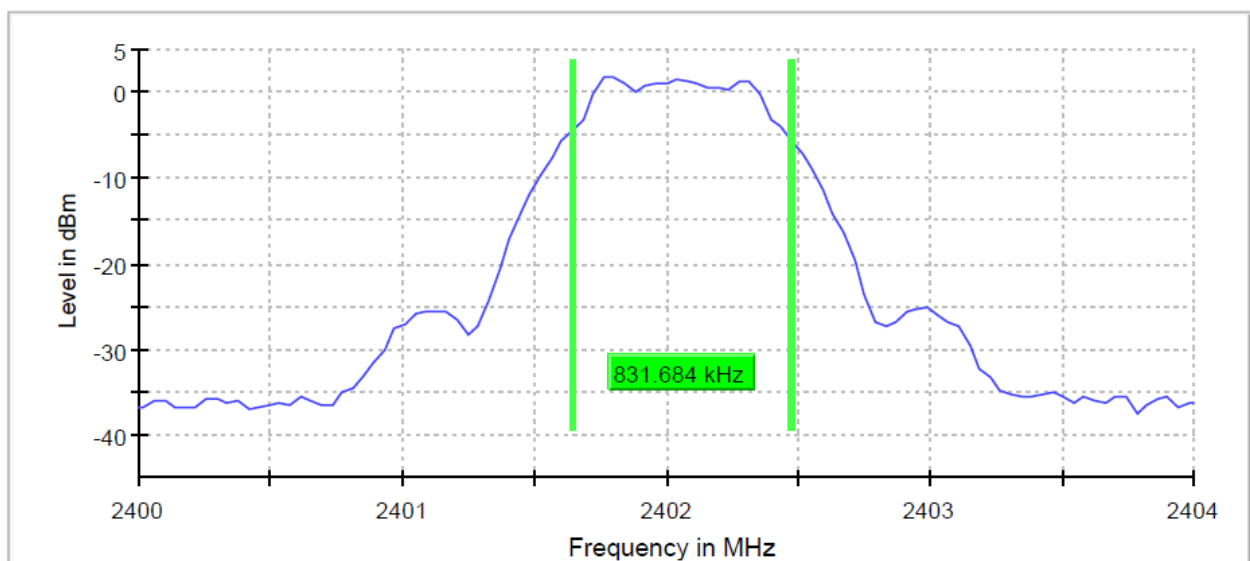
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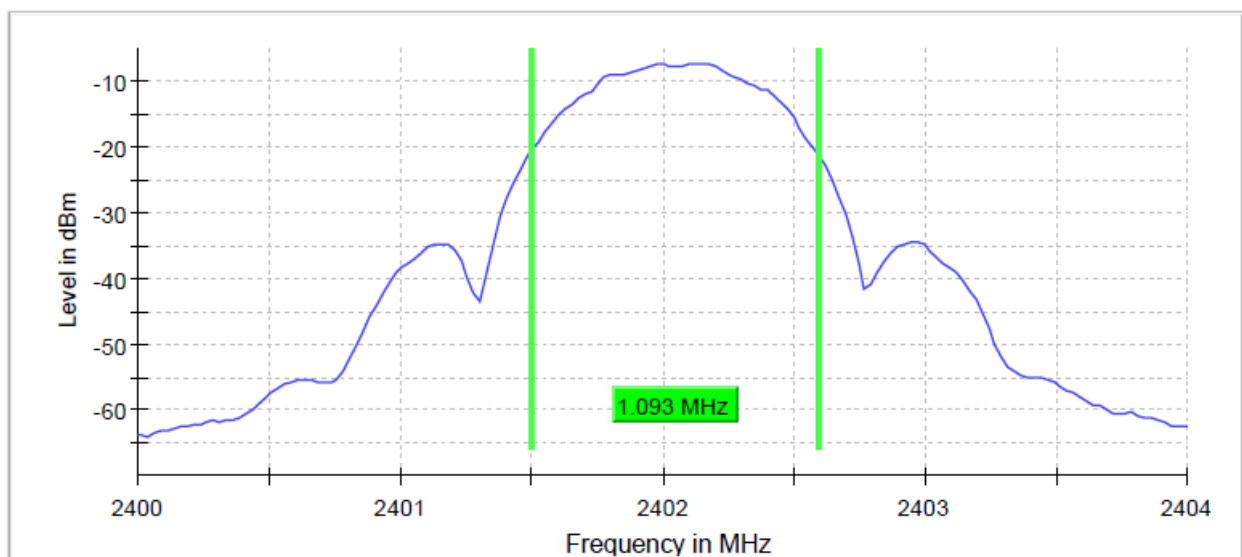
4.3.4 Test results

- Lowest Channel

6 dB Bandwidth



99 % Bandwidth



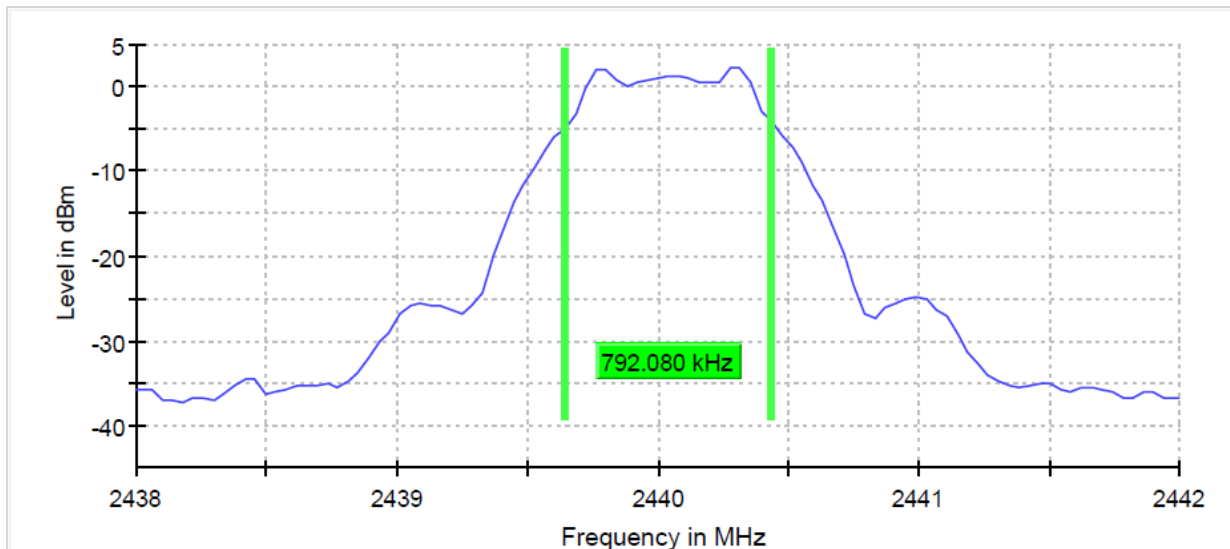
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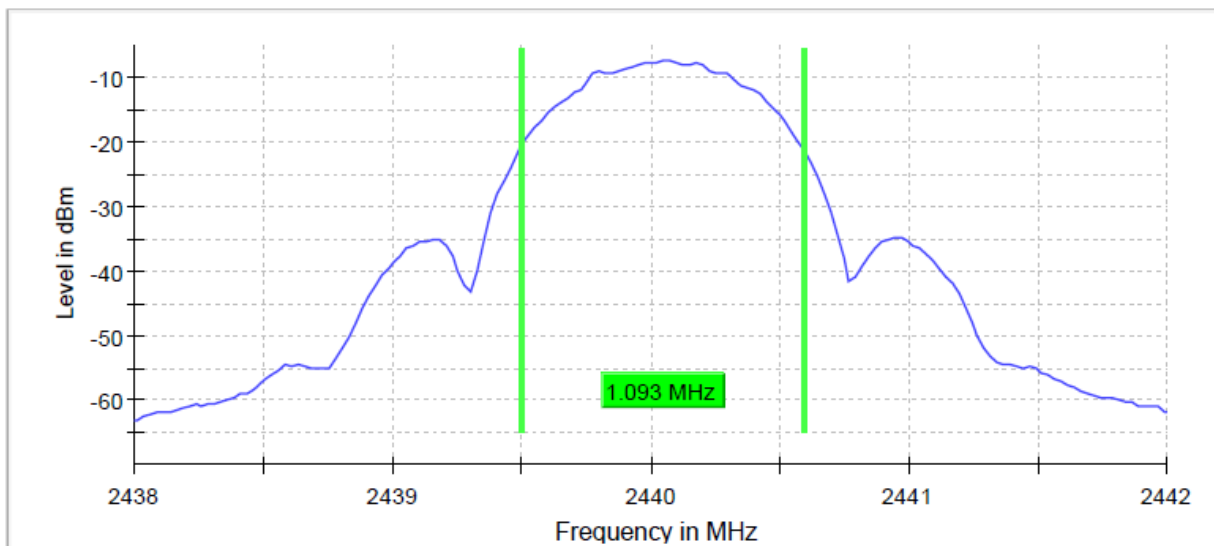
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- Middle Channel

6 dB Bandwidth



99 % Bandwidth



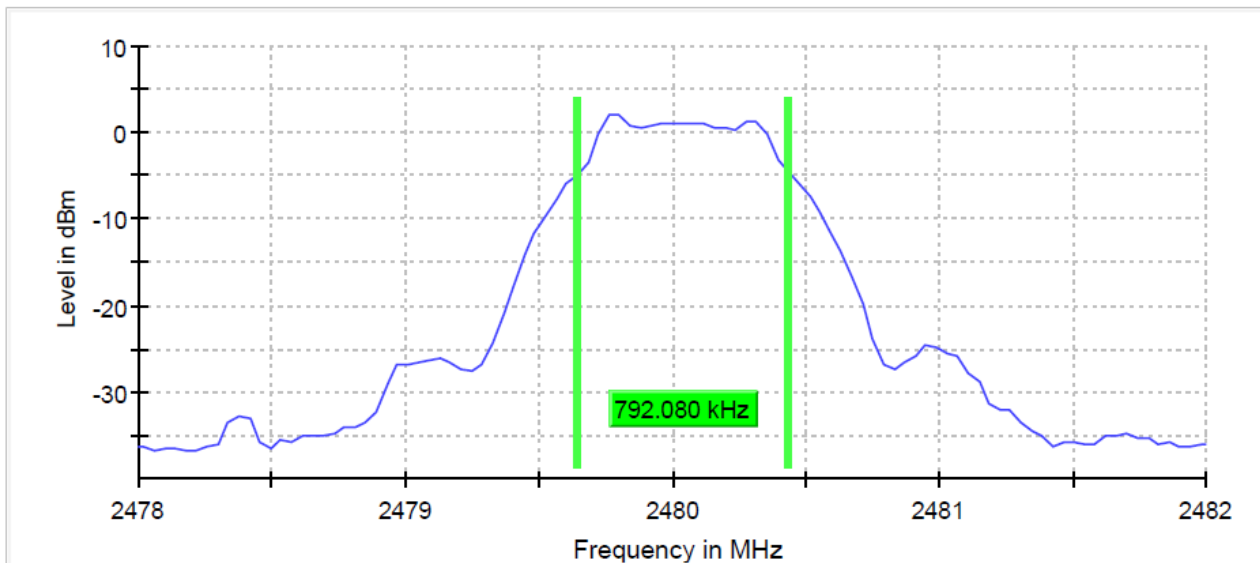
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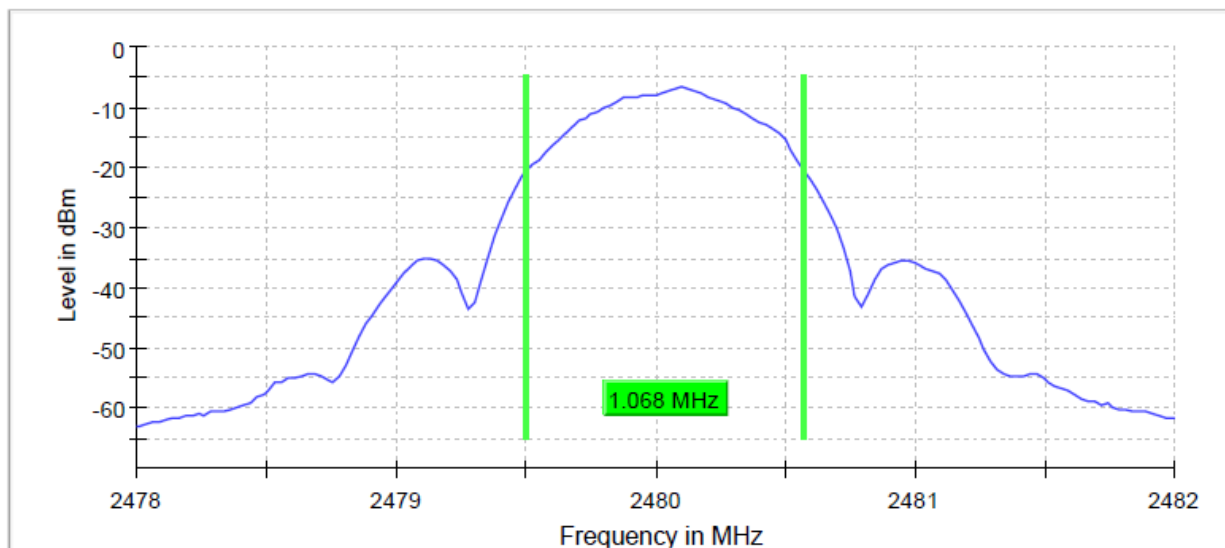
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- Highest Channel

6 dB Bandwidth



99 % Bandwidth



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Frequency	6 dB Bandwidth (kHz)	99% Bandwidth (MHz)	Minimum bandwidth (kHz)	Test Result
Lowest	831.684	1.093	500	Pass
Middle	792.080	1.093		Pass
Highest	792.080	1.068		Pass

Final test result	Pass
-------------------	------

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4.4 Conducted Spurious Emissions

4.4.1 Requirements / Limits

☒	<i>FCC Part 15, Subpart C, §15.247 (d)</i> In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provide the transmitter demonstrates compliance with the peak conducted power limits.
☐	<i>FCC Part 15, Subpart C, §15.247 (d)</i> If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this test shall be 30 dB instead of 20 dB.

4.4.2 Test Method

Conducted method was used to measure the conducted spurious emissions in frequency range (30 MHz to 26 GHz) according to ANSI C63.10:2013 clause 11.11.3. The EUT was connected to the spectrum analyzer via a coax cable with a known loss.

4.4.3 Test Setup

EUT	A003611168-003		
Test Condition	Normal conditions		
Chamber details	☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room		
Measurement positioning	Distance:	EUT height:	Antenna height:
	☐ 3m ☐ 10m	☐ 1.5m ☐ 0.8m	☐ 1.5m ☐ 1m to 4m – height scan
	☒ N/A		
Companion device	-		
Operation mode	1		
Further parameters	-		
Test engineer	Matthias Kräutlein		

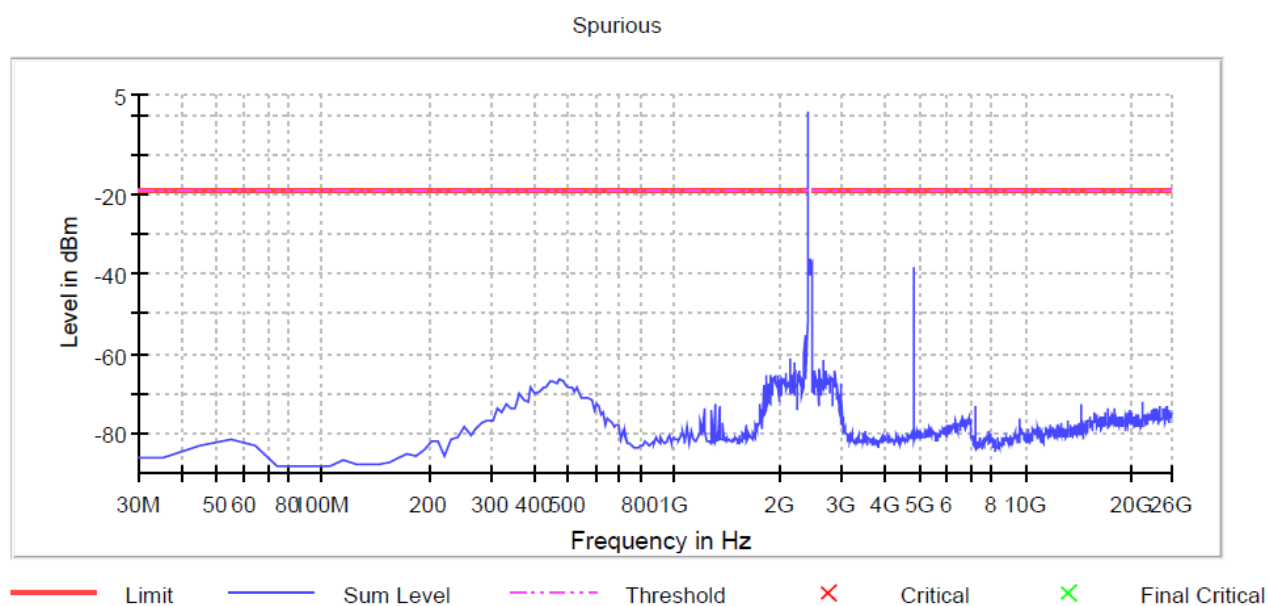
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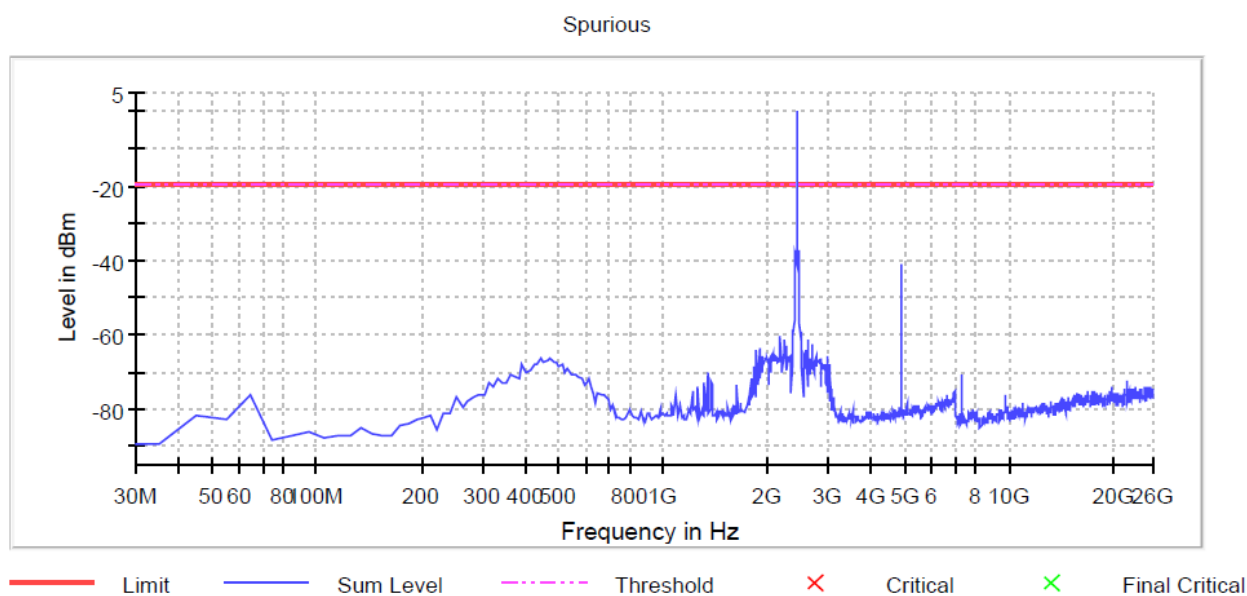
Prüfdokumentation Test documentation

4.4.4 Test results

- Lowest Channel



- Middle Channel



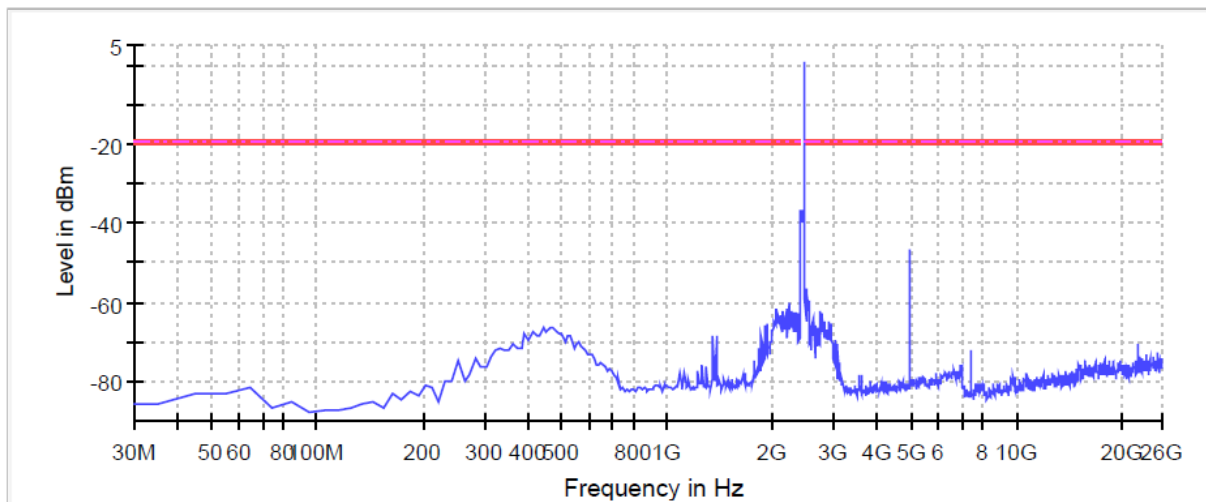
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- Highest Channel

Spurious



— Limit — Sum Level - - - Threshold × Critical × Final Critical

Final test result

Pass

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4.5 Band Edge Measurement

4.5.1 Requirements / Limits

☒	<i>FCC Part 15, Subpart C, §15.247 (d)</i> In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provide the transmitter demonstrates compliance with the peak conducted power limits.
☐	<i>FCC Part 15, Subpart C, §15.247 (d)</i> If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this test shall be 30 dB instead of 20 dB.

4.5.2 Test Method

Conducted method was used to perform the band edge measurements according to ANSI C63.10:2013 clause 11.13.3.2 Peak detection. The EUT was connected to the spectrum analyzer via a coax cable with a known loss. The measurements are done when DUT is configured to the lowest and highest channels.

4.5.3 Test Setup

EUT		A003611168-003
Test Condition		Normal conditions
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning		Distance: EUT height: Antenna height: ☐ 3m ☐ 1.5m ☐ 1.5m ☐ 10m ☐ 0.8m ☐ 1m to 4m – height scan ☒ N/A
Operation mode		1
Spectrum Analyzer	Centre Frequency	2402MHz and 2480MHz
	Resolution Bandwidth	100KHz
	Video Bandwidth	300KHz
	Span	25
	Detector	Peak
Further parameters		-
Test engineer		Matthias Kräutlein

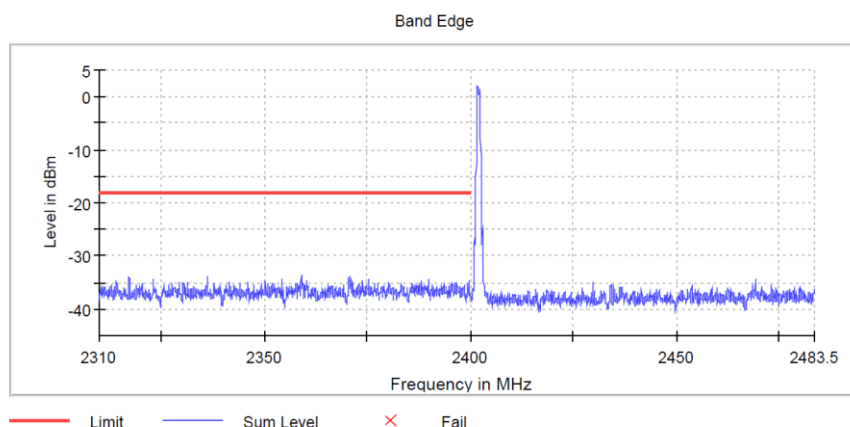
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4.5.4 Test results

- Lowest Channel



Inband Peak

Frequency [MHz]	Level [dBm]
2401.775000	1.9

Measurements

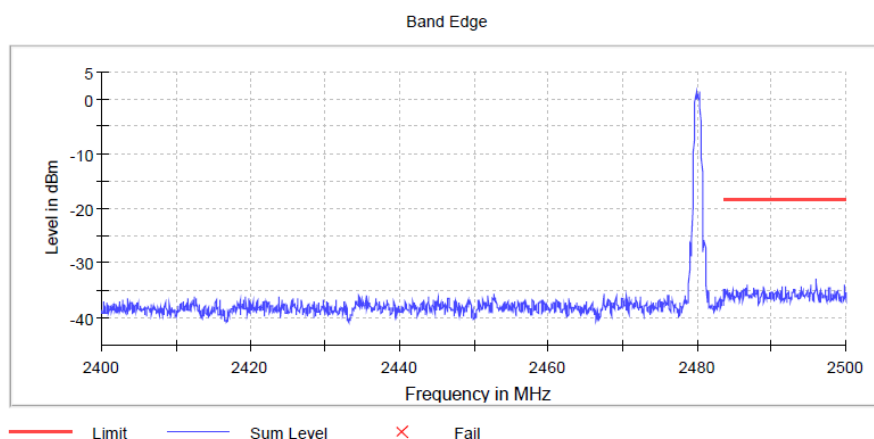
Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2359.075	-33.3	15.2	-18.1	Pass
2359.025	-33.7	15.7	-18.1	Pass
2370.975	-33.8	15.7	-18.1	Pass
2370.925	-33.8	15.8	-18.1	Pass
2336.225	-33.9	15.8	-18.1	Pass
2317.275	-33.9	15.8	-18.1	Pass
2336.175	-34	15.9	-18.1	Pass
2370.475	-34	15.9	-18.1	Pass
2359.125	-34.1	16	-18.1	Pass
2370.425	-34.1	16.1	-18.1	Pass
2375.375	-34.2	16.1	-18.1	Pass
2389.925	-34.3	16.2	-18.1	Pass
2317.325	-34.3	16.3	-18.1	Pass
2354.325	-34.4	16.3	-18.1	Pass
2375.325	-34.4	16.3	-18.1	Pass

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- Highest Channel



Inband Peak

Frequency [MHz]	Level [dBm]
2480.275000	1.5

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2495.975	-32.9	14.4	-18.5	Pass
2496.025	-33.5	15.1	-18.5	Pass
2495.925	-33.7	15.2	-18.5	Pass
2499.825	-34.1	15.6	-18.5	Pass
2495.275	-34.1	15.6	-18.5	Pass
2486.675	-34.1	15.7	-18.5	Pass
2499.775	-34.1	15.7	-18.5	Pass
2491.875	-34.2	15.7	-18.5	Pass
2486.725	-34.2	15.8	-18.5	Pass
2491.825	-34.3	15.8	-18.5	Pass
2488.825	-34.3	15.9	-18.5	Pass
2491.425	-34.4	15.9	-18.5	Pass
2495.225	-34.4	15.9	-18.5	Pass
2493.975	-34.4	15.9	-18.5	Pass
2495.875	-34.5	16	-18.5	Pass

Final test result	Pass
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4.6 Radiated Spurious Emissions

4.6.1 Requirements / Limits

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode. The emissions shall not exceed the values in FCC Part 15, Subpart C §15.205, §15.209, §15.247(d).

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency [MHz]	Limit [$\mu\text{V/m}$]	Measurement distance [m]	Limits [$\text{dB}\mu\text{V/m}$]
0.009 – 0.49	2400/F(kHz)@300m	3	(48.5 – 13.8)@300m
0.49 – 1.705	24000/F(kHz)@30m	3	(33.8 – 23.0)@30m
1.705 – 30	30@30m	3	29.5@30m

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (f)(2).

Frequency [MHz]	Limit [$\mu\text{V/m}$]	Measurement distance [m]	Limits [$\text{dB}\mu\text{V/m}$]
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 - 40000	500@3m	3	54.0@3m

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:

$$\text{Limit [dB}\mu\text{V/m]} = 20 \log (\text{Limit } [\mu\text{V/m}] / 1\mu\text{V/m})$$

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4.6.2 Test Method

4.6.2.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. Preliminary emission profile testing was performed inside the anechoic chamber. The receiving antenna was placed at a distance of 3m for all measurements. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. The different measurement setup for each frequency range are shown below.

9 kHz - 30 MHz

Following Measurement Setup is used:

Test Site	Semi-anechoic chamber
Receiving Antenna	Loop antenna (HFH 2)
Receiving Antenna Height	1 m
Receiving Antenna Polarization	Parallel – Perpendicular
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	22.5°
Receiver Configurations	Average and peak detectors
	RBW: 200Hz (9 - 150 kHz) and 9 kHz (150 kHz – 30 MHz)
	Step Size: 50Hz (9-150kHz) and 2.25kHz (150k-30MHz)
	Sweep Time: 100ms (FFT)

30 MHz - 1 GHz

Following Measurement Setup is used:

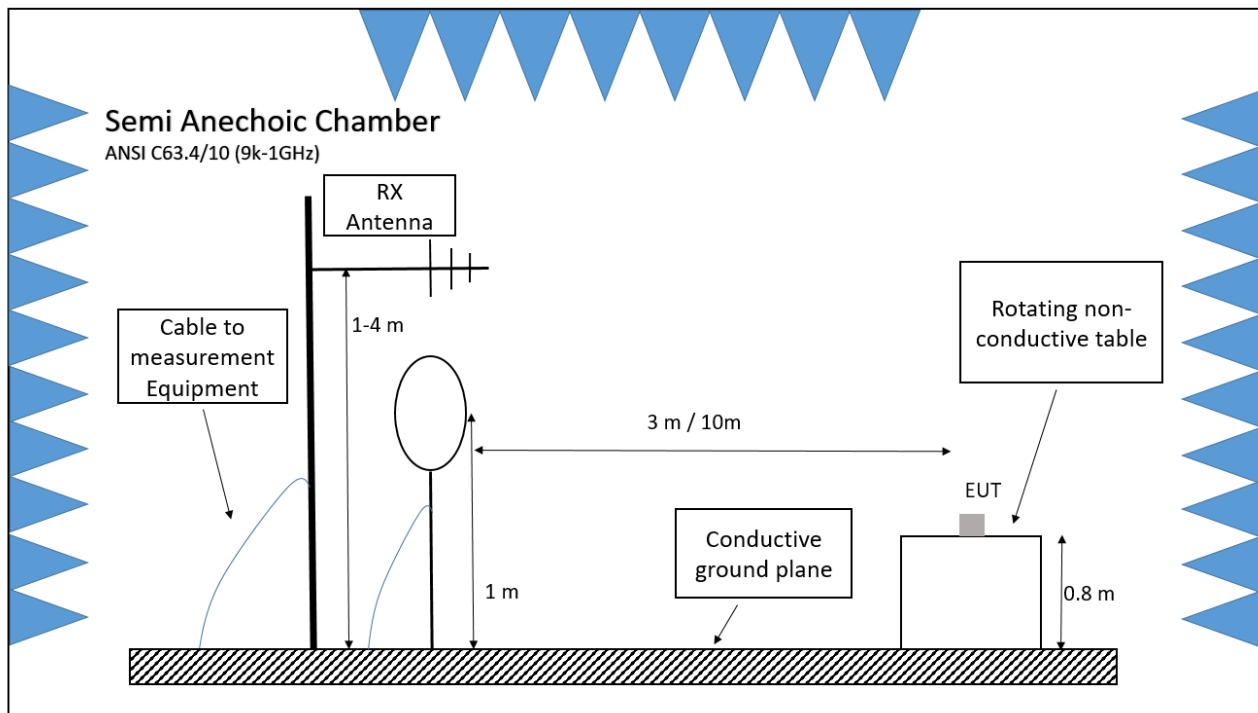
Test Site	Semi-anechoic chamber
Receiving Antenna	Hybrid Antenna VULB 9168
Receiving Antenna height	Varied (1m to 4 m, step size 1m)
Receiving Antenna Polarization	Horizontal– Vertical
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	45°
Receiver Configurations	Peak detector
	RBW :120 kHz
	Step Size: 30kHz (30-1000MHz)
	Sweep Time : 100 ms (FFT)

For Measurements below 1 GHz, the EUT was positioned as shown in the setup photograph:

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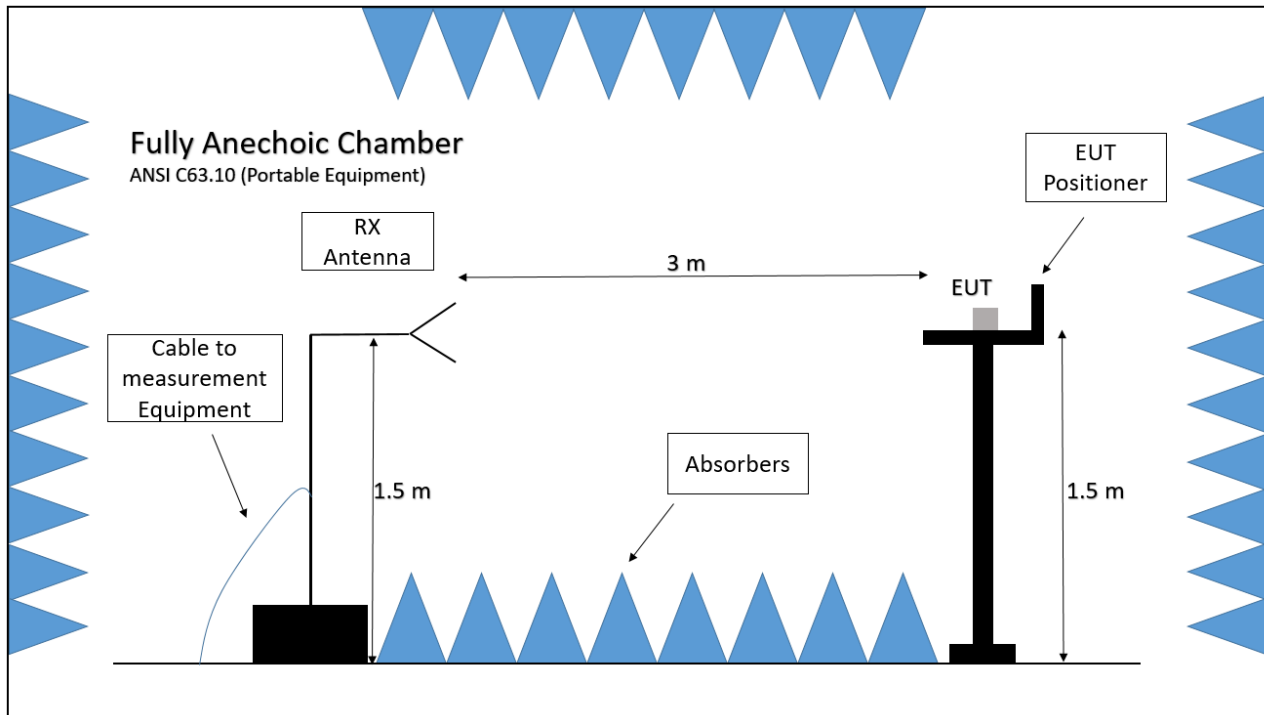
1 GHz - 26 GHz

Following Measurement Setup is used:

Test Site	Fully-anechoic chamber
Receiving Antenna	Horn Antenna HF907 (1-18 GHz), 3116C-PA (18-26 GHz)
Receiving Antenna Height	1.5 m
Receiving Antenna Polarization	Horizontal– Vertical
EUT Positioner	40 cm x 60 cm non-conductive positioner 1.5 m above the floor / Step size,elevation angle 45°
EUT Turn Table Step Size	45°
Spectrum Analyzer	Average and peak detectors
	RBW: 1 MHz
	Sweep Time : 100 ms

For Measurements over 1 GHz, the EUT was positioned as shown in the setup photograph:

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Test documentation



4.6.2.2 Final Test

The placement of EUT and cables were the same as for preliminary testing. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, then the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. For the measurements in the frequency range 30 MHz to 1 GHz for each measured frequency the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. For measurement above 1 GHz the turntable and positioner step sizes were set to a range of 22° and the antenna height is fixed.

For the measurements in the frequency ranges (90-110kHz, 490 kHz-1 GHz) quasi-peak detector is used, while average and peak detectors are used in other ranges.

Final testing was performed on an SVSWR compliant test site.

The final average electric field value (E_{final}) is calculated in the final measurement table using the following equation:

$$E_{final} = \text{RawRec} + \text{Corr.}$$

While

$$\text{Corr.} = \text{Trd. Corr.} + \text{Sig Path} + \text{Preamp}$$

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4.6.3 Test Setup

EUT	A003611168-004
Test Condition	Normal conditions
Companion device	-
Operation mode	1,2
Further parameters	-
Test engineer	Matthias Kräutlein

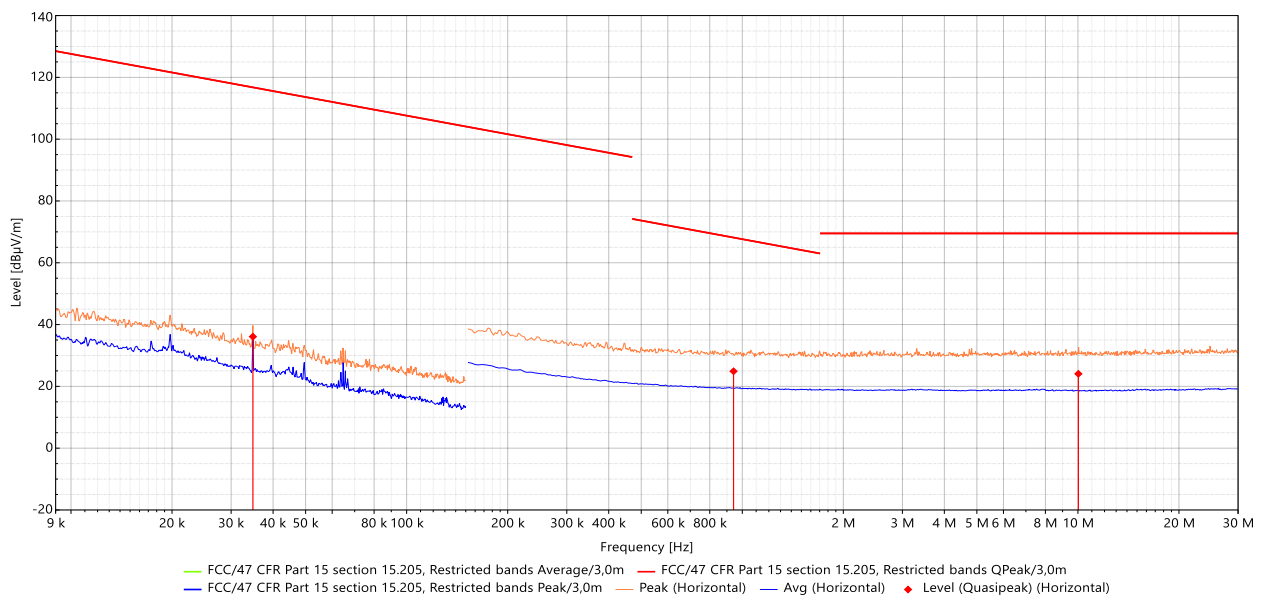
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Test documentation

4.6.4 Test results

4.6.4.1 9 kHz to 30 MHz, Lowest Channel

Mode 1

Perpendicular Polarization



Frequency (Hz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.832 k	36.1	116.8	-80.7	H	277.8	1.50	20.1	200	1.0	Pass
10.032 M	24.1	69.5	-45.4	H	14.7	1.50	20.4	9 k	1.0	Pass
941.875 k	24.9	68.2	-43.3	H	30.9	1.50	20.0	9 k	1.0	Pass

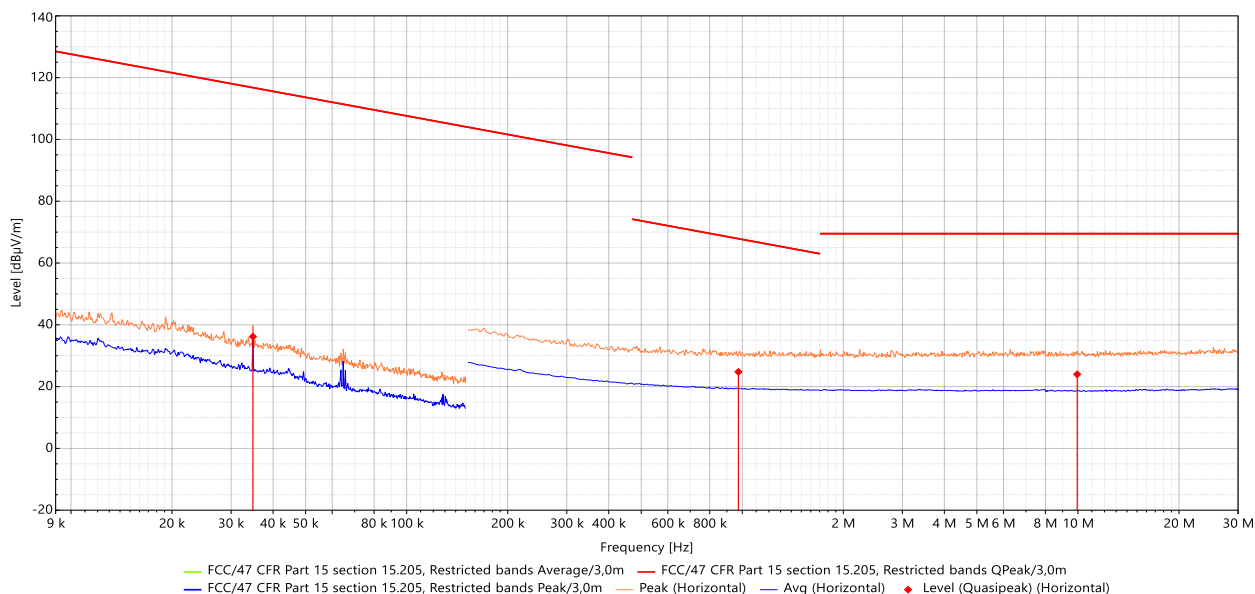
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Parallel Polarization

#41(9 kHz-30 MHz), Horizontal



Frequency (Hz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.829 k	36.2	116.8	-80.6	H	97.4	1.50	20.1	200	1.0	Pass
9.95 M	24.0	69.5	-45.5	H	322.2	1.50	20.4	9 k	1.0	Pass
973.74 k	24.8	67.9	-43.1	H	249.8	1.50	20.0	9 k	1.0	Pass

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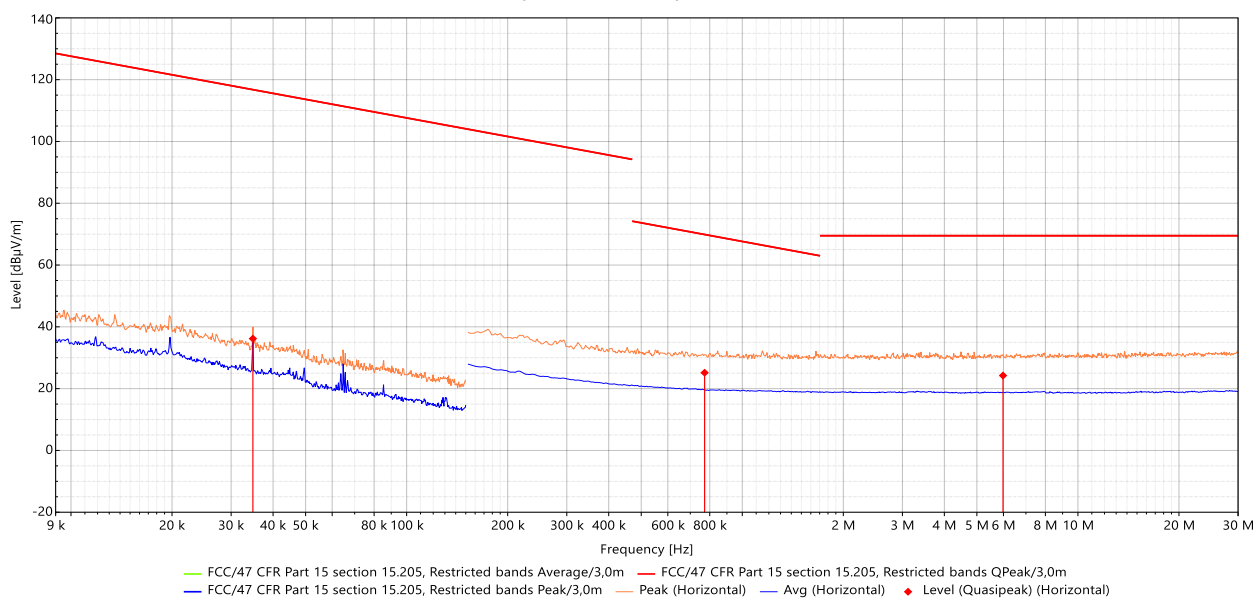
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Mode 2

Perpendicular Polarization

#39(9 kHz-30 MHz), Horizontal



Frequency (Hz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.831 k	36.2	116.8	-80.6	H	79.4	1.50	20.1	200	1.0	Pass
5.982 M	24.2	69.5	-45.3	H	84.9	1.50	20.2	9 k	1.0	Pass
772.208 k	25.1	69.9	-44.7	H	0.7	1.50	20.0	9 k	1.0	Pass

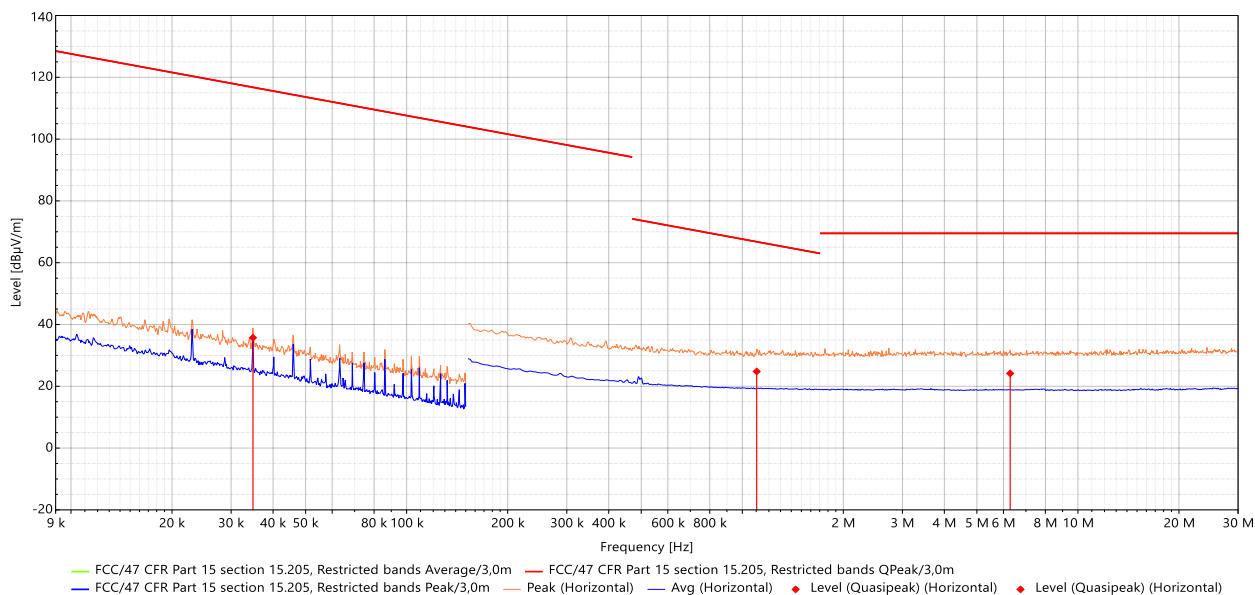
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Parallel Polarization

#37(9 kHz-30 MHz), Horizontal



Frequency (Hz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.85 k	35.7	116.8	-81.0	H	63	1.00	20.1	200	1.0	Pass
6.284 M	24.2	69.5	-45.3	H	44.7	1.00	20.3	9 k	1.0	Pass
1.104 M	24.8	66.8	-42.0	H	0.1	1.00	20.0	9 k	1.0	Pass

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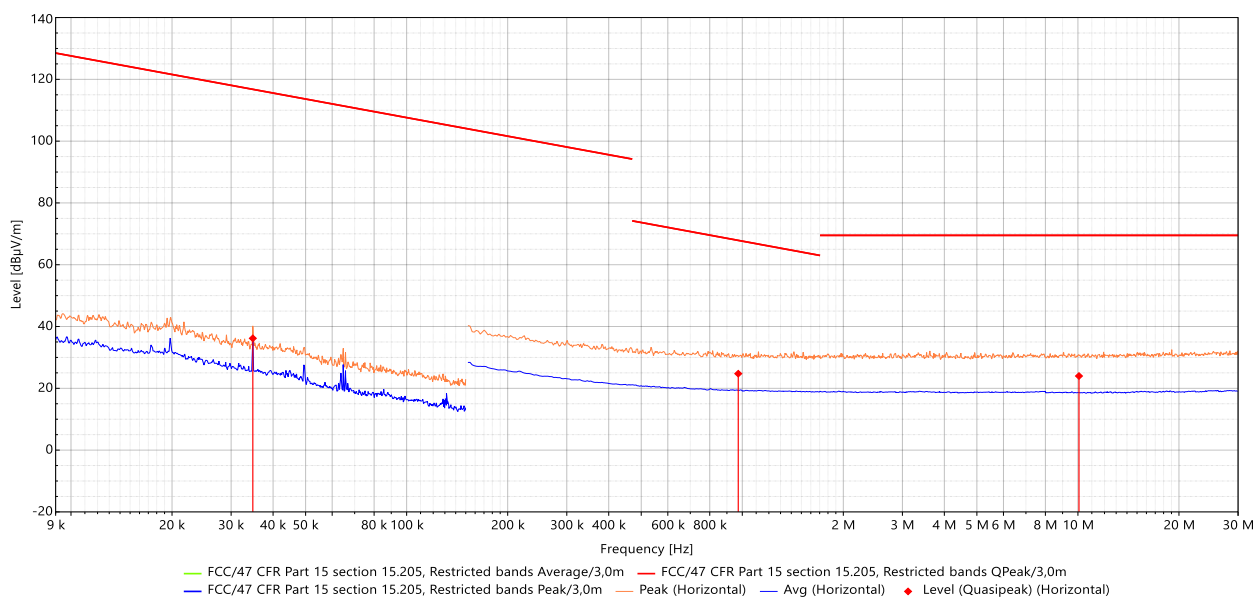
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4.6.4.2 9 kHz to 30 MHz, Highest Channel

Perpendicular Polarization

#43(9 kHz-30 MHz), Horizontal



Frequency (Hz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.813 k	36.2	116.8	-80.6	H	42.3	1.50	20.1	200	1.0	Pass
10.073 M	24.0	69.5	-45.5	H	66.3	1.50	20.4	9 k	1.0	Pass
972.776 k	24.7	67.9	-43.1	H	253.5	1.50	20.0	9 k	1.0	Pass

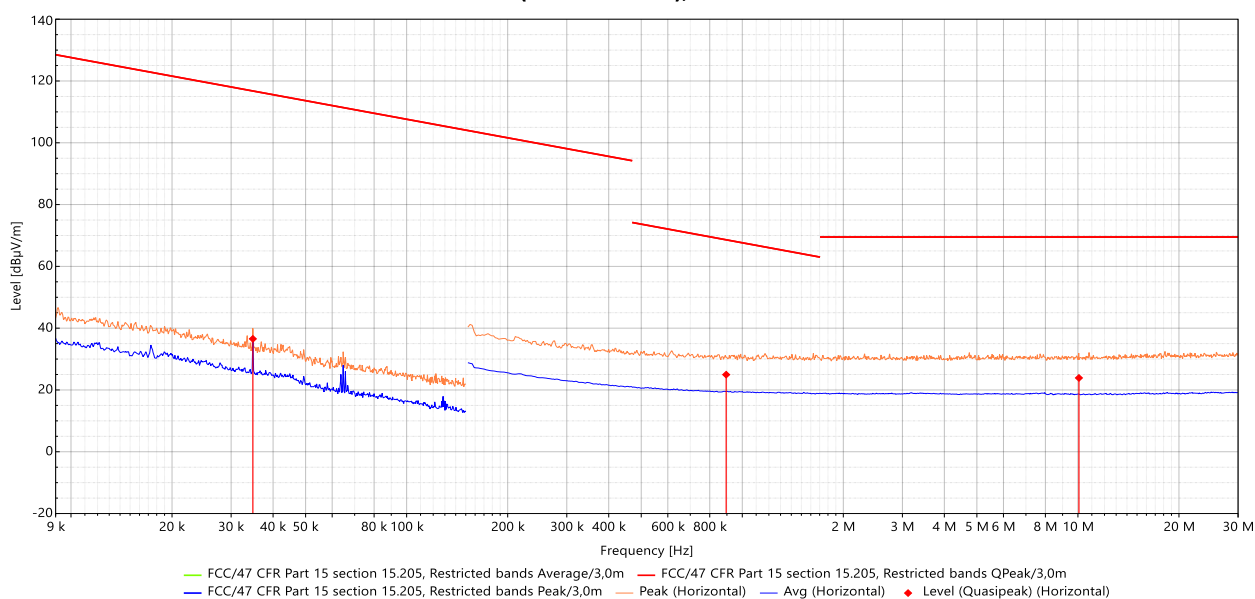
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Parallel Polarization

#42(9 kHz-30 MHz), Horizontal



Frequency (Hz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pos	Azimuth (°)	Height (m)	Correction (dB)	RBW (Hz)	M. time (s)	Comments
34.822 k	36.5	116.8	-80.2	H	276.2	1.50	20.1	200	1.0	Pass
10.07 M	23.9	69.5	-45.6	H	329.8	1.50	20.4	9 k	1.0	Pass
895.458 k	24.9	68.6	-43.7	H	109.7	1.50	20.0	9 k	1.0	Pass

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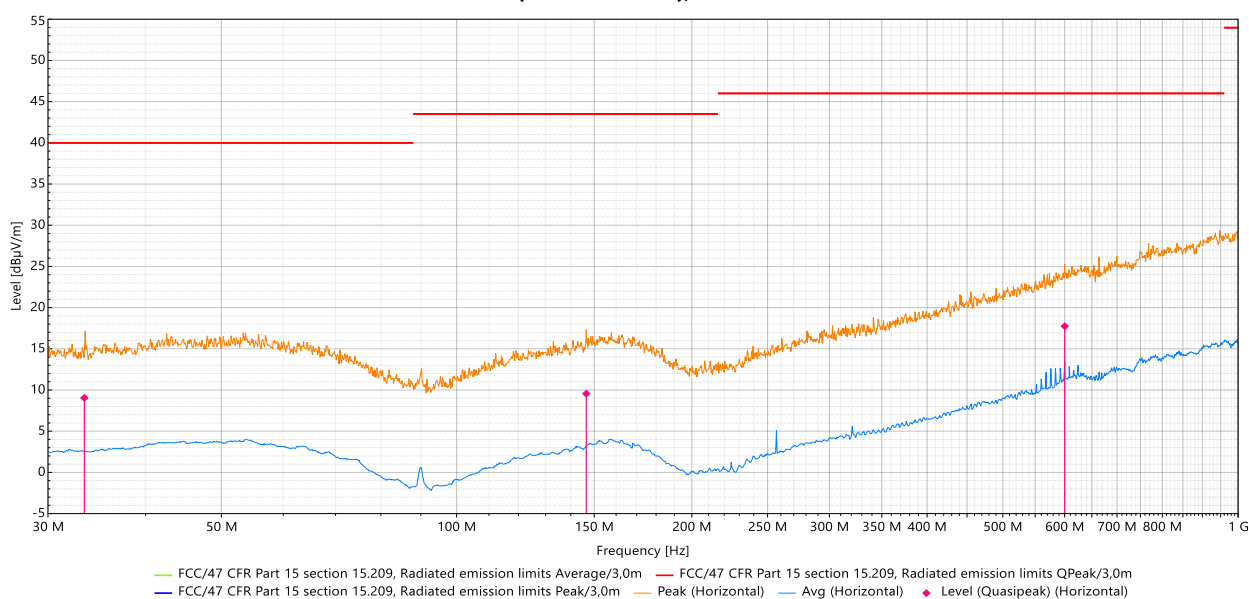
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4.6.4.3 30 MHz to 1 GHz, Lowest Channel

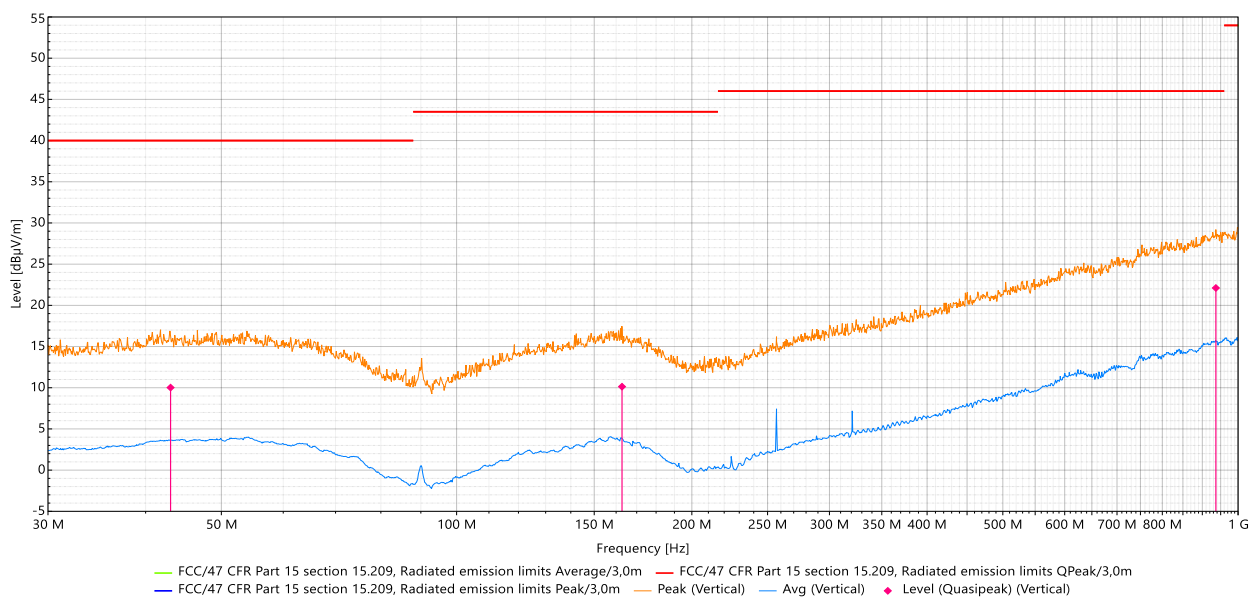
Mode 1
Horizontal Polarization

#36(30 MHz-1 GHz), Horizontal



Vertical Polarization

#36(30 MHz-1 GHz), Vertical



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Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
146.526	9.6	43.5	-33.9	81.9	1.90	H	1.0	-10.6
162.806	10.1	43.5	-33.4	66.5	1.49	V	1.0	-10.1
33.39	9.1	40.0	-30.9	64.8	1.32	H	1.0	-11.8
43.051	10.0	40.0	-30.0	316.0	2.98	V	1.0	-10.7
600.063	17.7	46.0	-28.3	256.9	2.44	H	1.0	-2.8
936.719	22.1	46.0	-23.9	0.2	4.00	V	1.0	2.0

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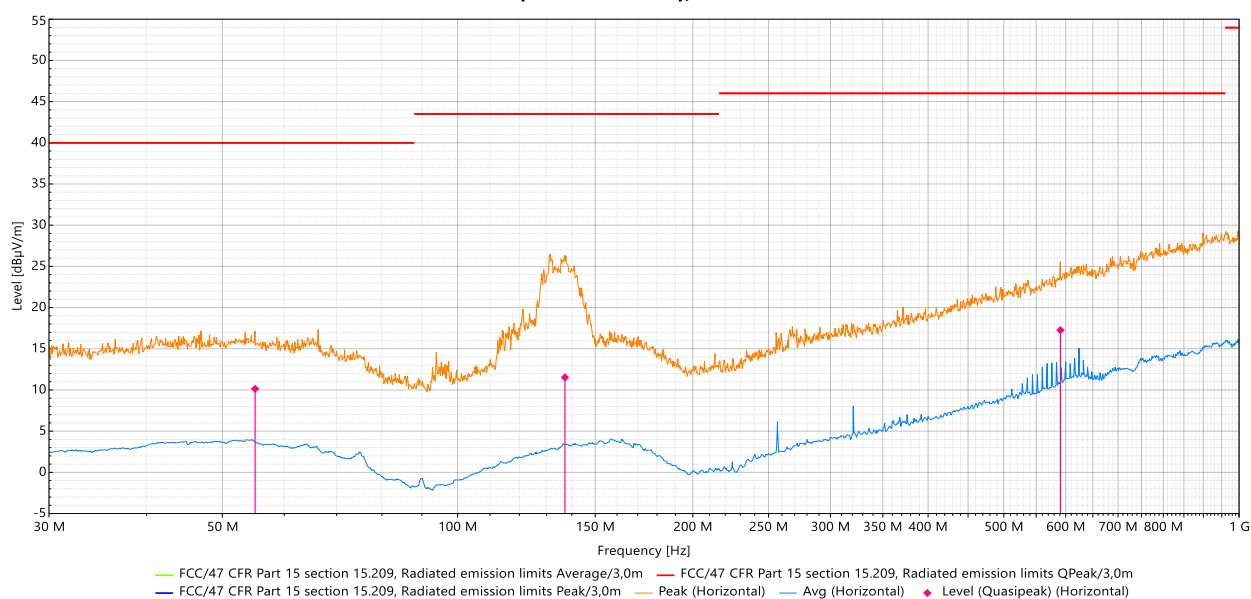
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Mode 2

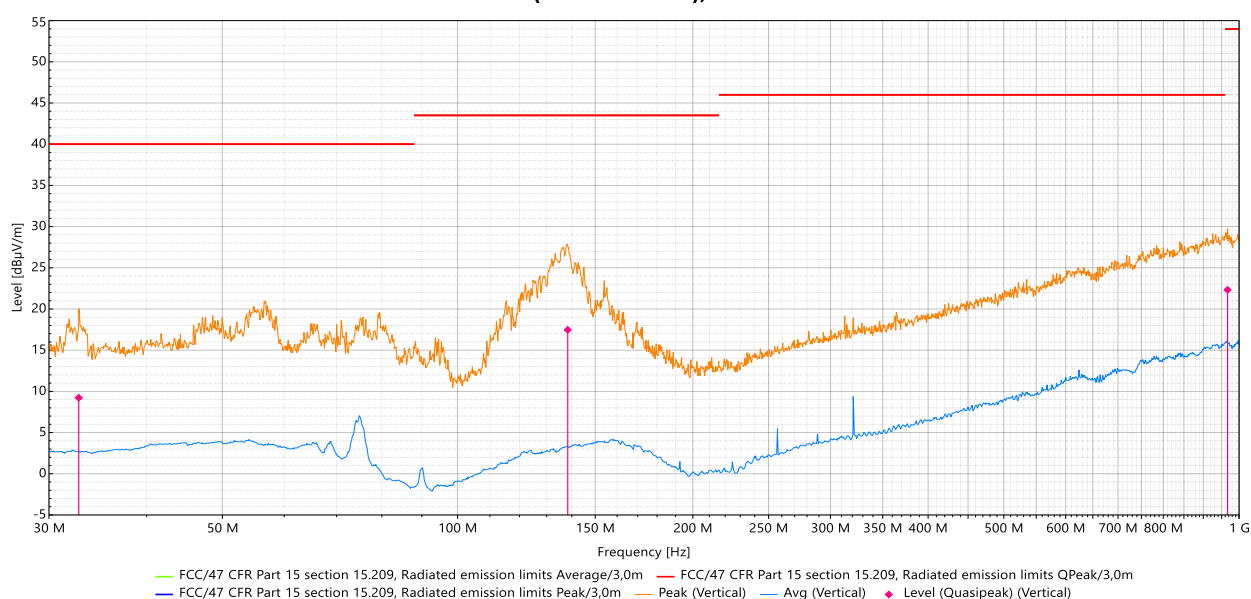
Horizontal Polarization

#28(30 MHz-1 GHz), Horizontal



Vertical Polarization

#28(30 MHz-1 GHz), Vertical



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Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
137.211 M	11.5	43.5	-32.0	262.8	3.46	H	1.0	-11.1
966.644 M	22.3	54.0	-31.7	227.0	2.04	V	1.0	2.4
32.748 M	9.2	40.0	-30.8	71.1	1.08	V	1.0	-11.8
55.067 M	10.1	40.0	-29.9	140.5	3.55	H	1.0	-10.5
590.755 M	17.3	46.0	-28.7	64.9	1.52	H	1.0	-3.1
138.337 M	17.5	43.5	-26.0	14.0	1.12	V	1.0	-11.1

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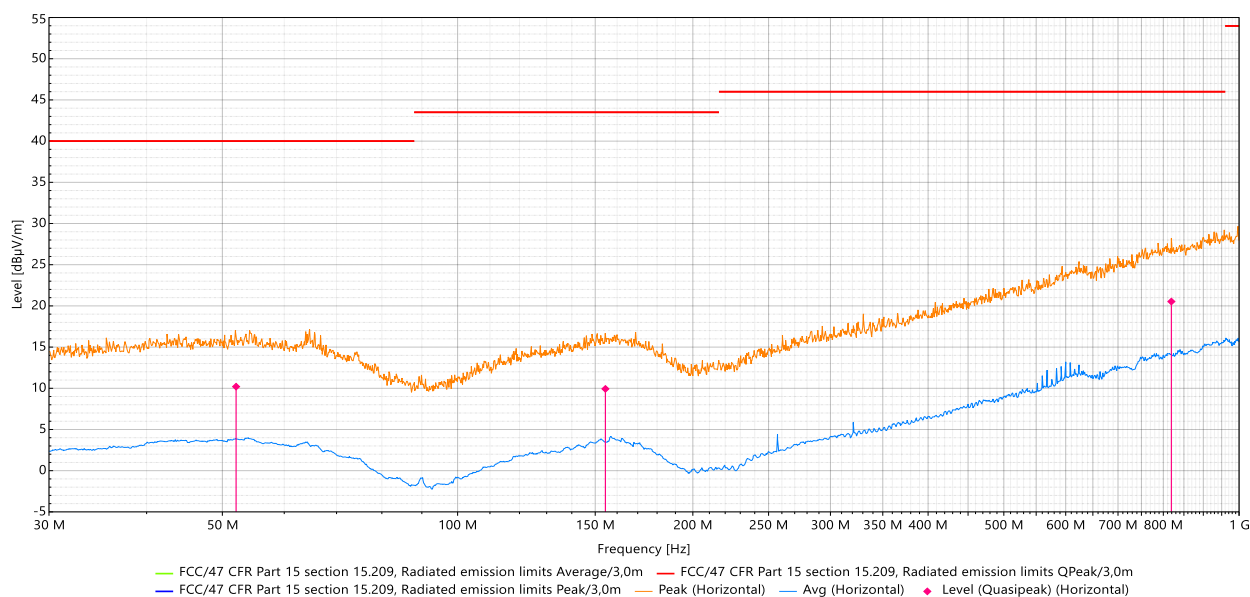
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4.6.4.4 30 MHz to 1 GHz, Highest Channel

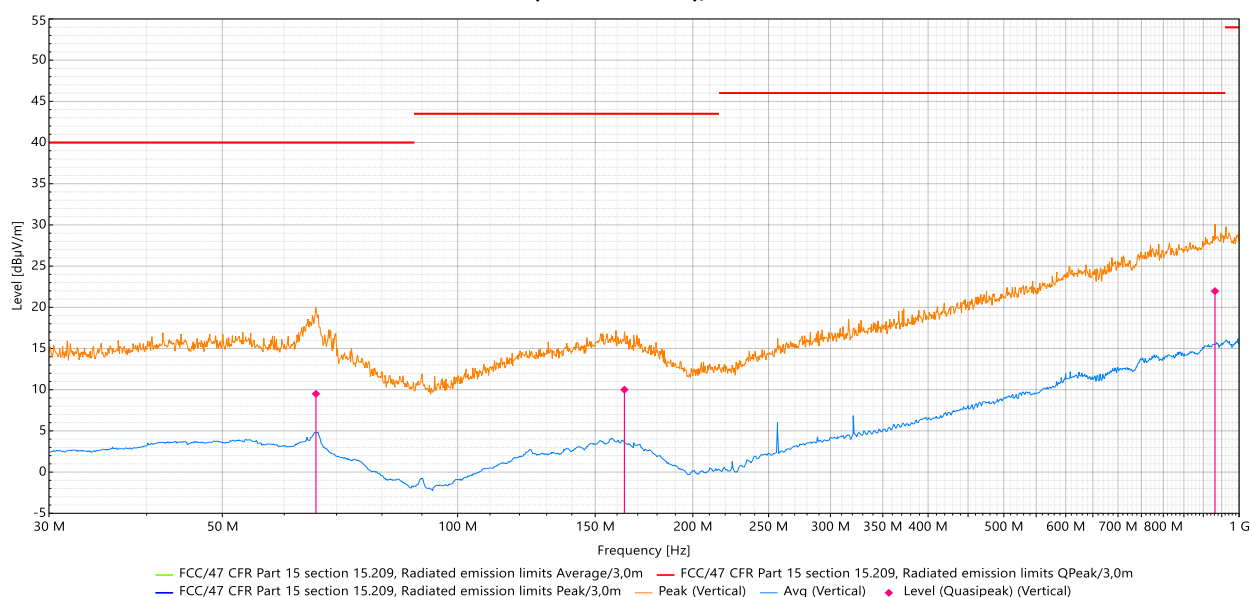
Horizontal Polarization

#38(30 MHz-1 GHz), Horizontal



Vertical Polarization

#38(30 MHz-1 GHz), Vertical



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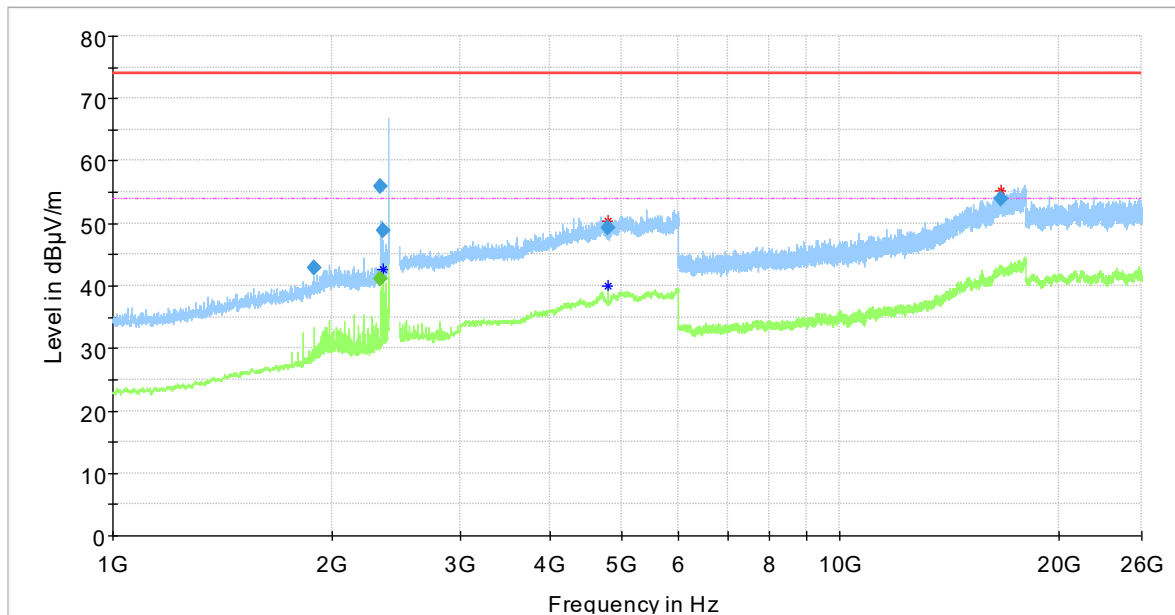
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
154.577 M	9.9	43.5	-33.6	247.8	4.00	H	1.0	-10.2
163.484 M	10.0	43.5	-33.5	247.9	4.00	V	1.0	-10.1
65.878 M	9.5	40.0	-30.5	238.5	1.93	V	1.0	-11.5
52.065 M	10.2	40.0	-29.8	86.3	1.76	H	1.0	-10.3
819.18 M	20.5	46.0	-25.5	149.3	1.02	H	1.0	0.4
931.479 M	22.0	46.0	-24.0	318.8	4.00	V	1.0	1.9

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4.6.4.5 1 to 26 GHz, Lowest Channel



- Preview Result 2-AVG
- * Critical_Freqs AVG
- FCC_15C_15.209_Radiated Emissions_Peak
- ◆ Final_Result PK+
- × MaxPeak-PK+ (Single)
- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC_15C_15.209_Radiated Emissions_Avg
- ◆ Final_Result AVG
- + Average-AVG (Single)

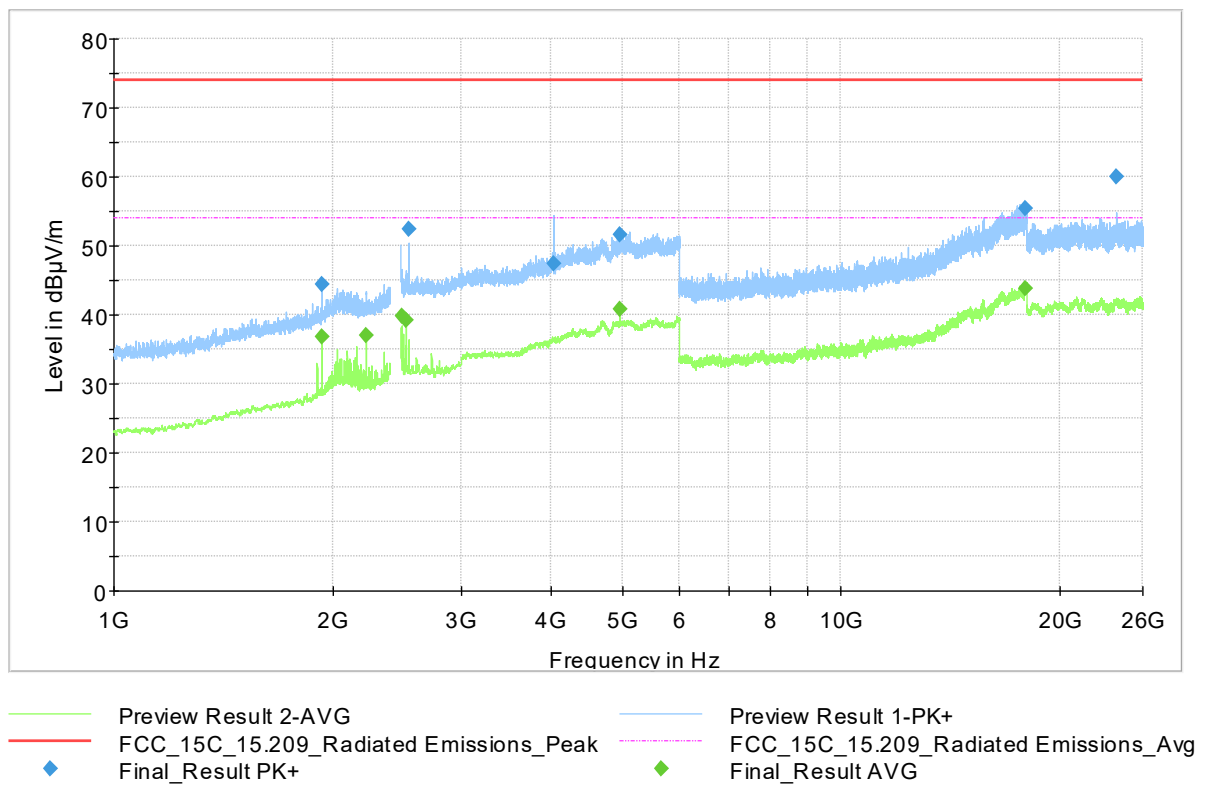
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
1889.908929	42.87	---	74.00	31.13	100.0	1000.000	150.0	H	130.0	180.0	-2.9
2338.062500	---	41.13	54.00	12.87	100.0	1000.000	150.0	H	257.0	360.0	-0.6
2338.317857	55.82	---	74.00	18.18	100.0	1000.000	150.0	H	262.0	0.0	-0.6
2354.046429	48.80	---	74.00	25.20	100.0	1000.000	150.0	H	239.0	360.0	-0.5
4803.835000	49.24	---	74.00	24.76	100.0	1000.000	150.0	H	173.0	255.0	8.7
16653.877917	53.94	---	74.00	20.06	100.0	1000.000	150.0	H	112.0	72.0	9.8

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4.6.4.6 1 to 26 GHz, Highest Channel



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
1935.987500	44.34	---	74.00	29.66	100.0	1000.000	150.0	V	179.0	65.0	-2.6
1936.062500	---	36.78	54.00	17.22	100.0	1000.000	150.0	V	185.0	76.0	-2.5
2224.057143	---	36.98	54.00	17.02	100.0	1000.000	150.0	H	350.0	360.0	-1.5
2488.141667	---	39.74	54.00	14.26	100.0	1000.000	150.0	H	185.0	9.0	0.7
2528.082917	---	39.16	54.00	14.84	100.0	1000.000	150.0	V	0.0	76.0	0.9
2544.084583	52.35	---	74.00	21.65	100.0	1000.000	150.0	H	336.0	360.0	1.1
4026.076250	47.34	---	74.00	26.66	100.0	1000.000	150.0	H	145.0	352.0	6.1
4960.166250	---	40.86	54.00	13.14	100.0	1000.000	150.0	V	298.0	8.0	10.0
4960.906250	51.65	---	74.00	22.35	100.0	1000.000	150.0	V	293.0	128.0	10.0
17966.644375	55.38	---	74.00	18.62	100.0	1000.000	150.0	H	110.0	358.0	12.1
17973.348333	---	43.82	54.00	10.18	100.0	1000.000	150.0	V	62.0	0.0	12.2
23932.047917	60.06	---	74.00	13.94	100.0	1000.000	150.0	H	331.0	165.0	22.9

Final test result

Pass

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4.7 AC Power Conducted Emission

4.7.1 Requirements / Limits

AC power-line conducted emission measurements shall be made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz, to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

FCC Part 15, Subpart C, §15.207 (a)

... for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

FCC Part 15, Subpart C, §15.207, Conducted Emission Limits

Frequency [MHz]	Conducted Limit [dB μ V]	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

*Decreases with logarithm of the frequency

FCC Part 15, Subpart C, §15.207 (c)

... Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

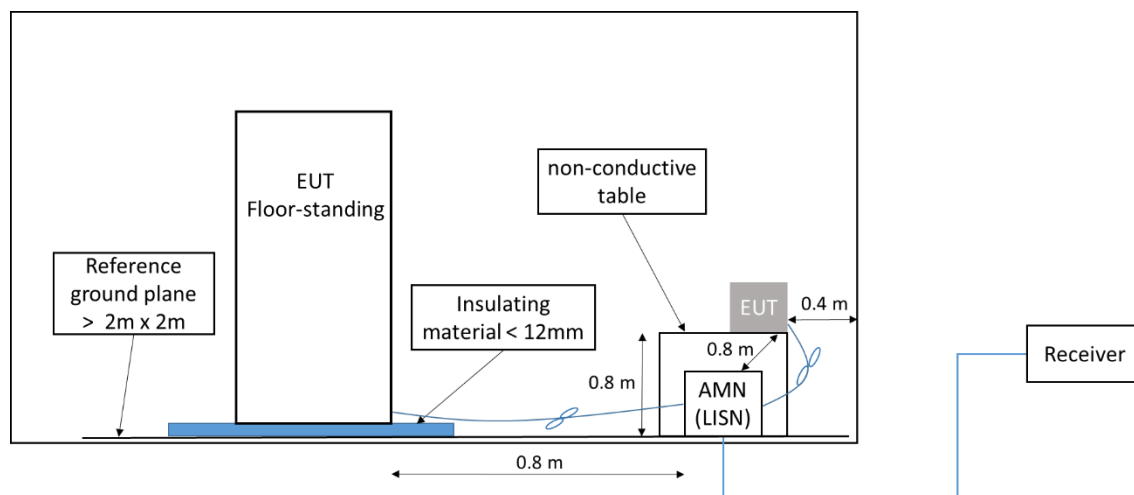
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4.7.2 Test Method

The test setup was made according to ANSI C63.10:2013 clauses 6.2.2 & 6.2.3 as shown in the photograph



The EUT was configured to transmit on the lowest channel since it has the highest output power.

4.7.3 Test Setup

EUT	A003611168-004
Test Condition	Normal conditions
Companion device	-
Operation mode	2
Further parameters	-
Test engineer	Matthias Kräutlein

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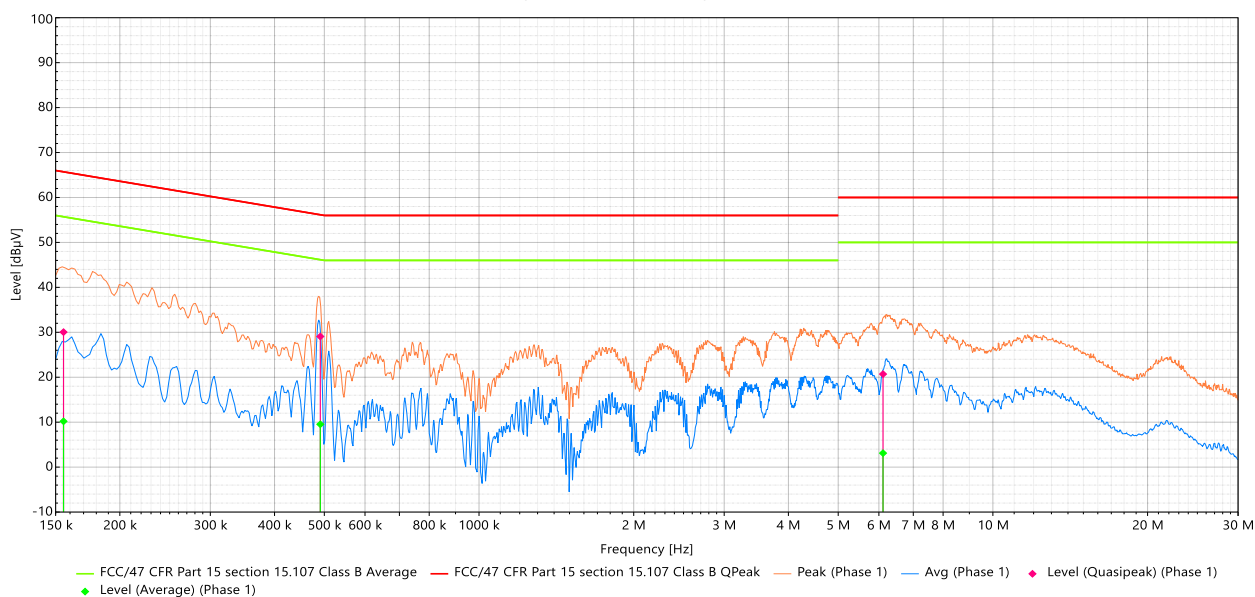
Prüfdokumentation Test documentation

4.7.4 Test results

120V 60Hz

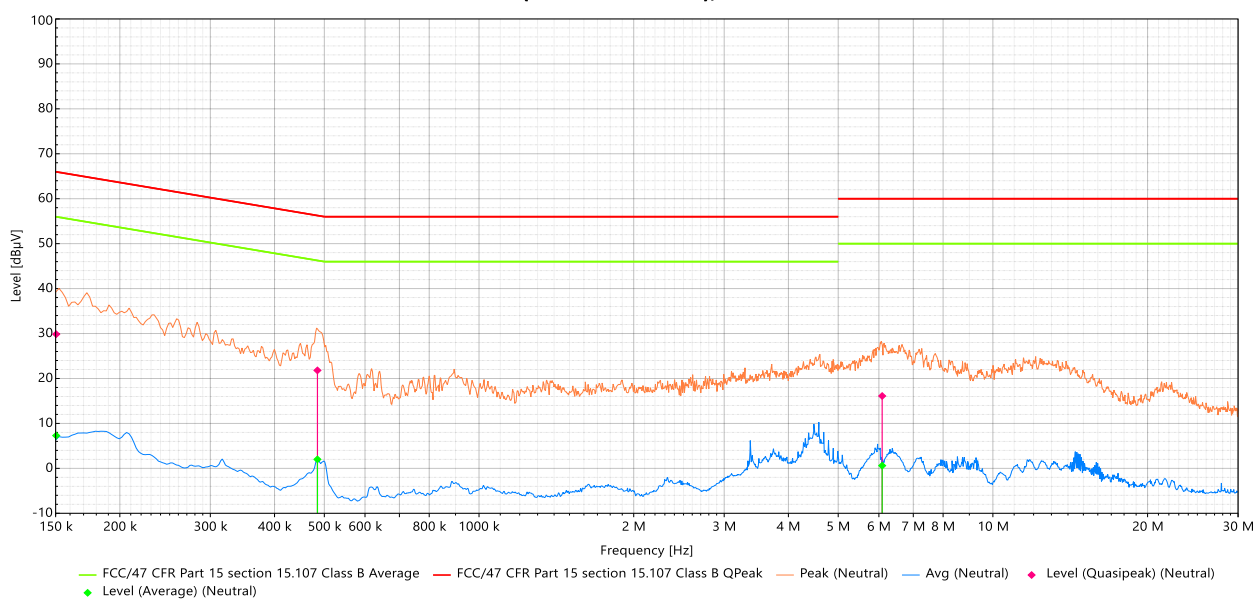
– Line: Phase 1

#31(150 kHz-30 MHz), Phase 1



– Line: Neutral

#31(150 kHz-30 MHz), Neutral



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QuasiPeak

Frequency (Hz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Correction (dB)	RBW (Hz)	M. time (s)	Comments
6.089 M	16.1	60.0	-43.9	Neutral	10.2	9 k	1.0	Pass
6.113 M	20.7	60.0	-39.3	Phase 1	10.2	9 k	1.0	Pass
150 k	29.9	66.0	-36.1	Neutral	10.0	9 k	1.0	Pass
155.4 k	30.0	65.8	-35.7	Phase 1	10.0	9 k	1.0	Pass
484.8 k	21.8	56.2	-34.5	Neutral	10.0	9 k	1.0	Pass
491.1 k	29.1	56.1	-27.1	Phase 1	10.0	9 k	1.0	Pass

Average

Frequency (Hz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Correction (dB)	RBW (Hz)	M. time (s)	Comments
6.089 M	0.6	50.0	-49.4	Neutral	10.2	9 k	1.0	Pass
150 k	7.3	56.0	-48.7	Neutral	10.0	9 k	1.0	Pass
6.113 M	3.1	50.0	-46.9	Phase 1	10.2	9 k	1.0	Pass
155.4 k	10.2	55.8	-45.6	Phase 1	10.0	9 k	1.0	Pass
484.8 k	2.0	46.2	-44.3	Neutral	10.0	9 k	1.0	Pass
491.1 k	9.5	46.1	-36.6	Phase 1	10.0	9 k	1.0	Pass

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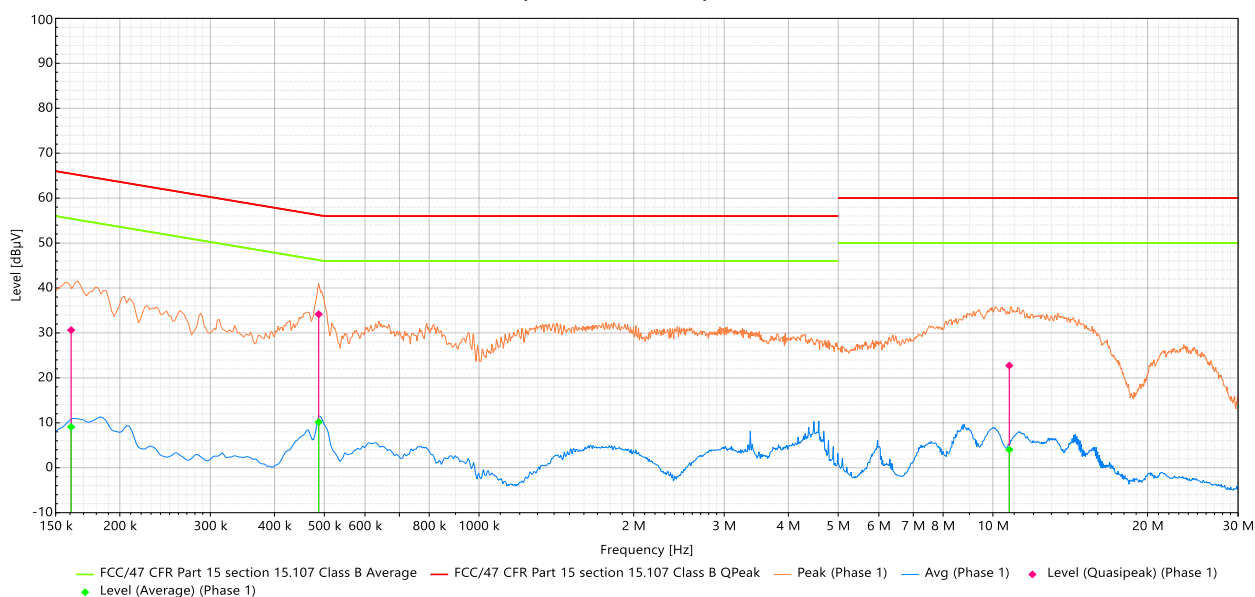
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240V 60Hz

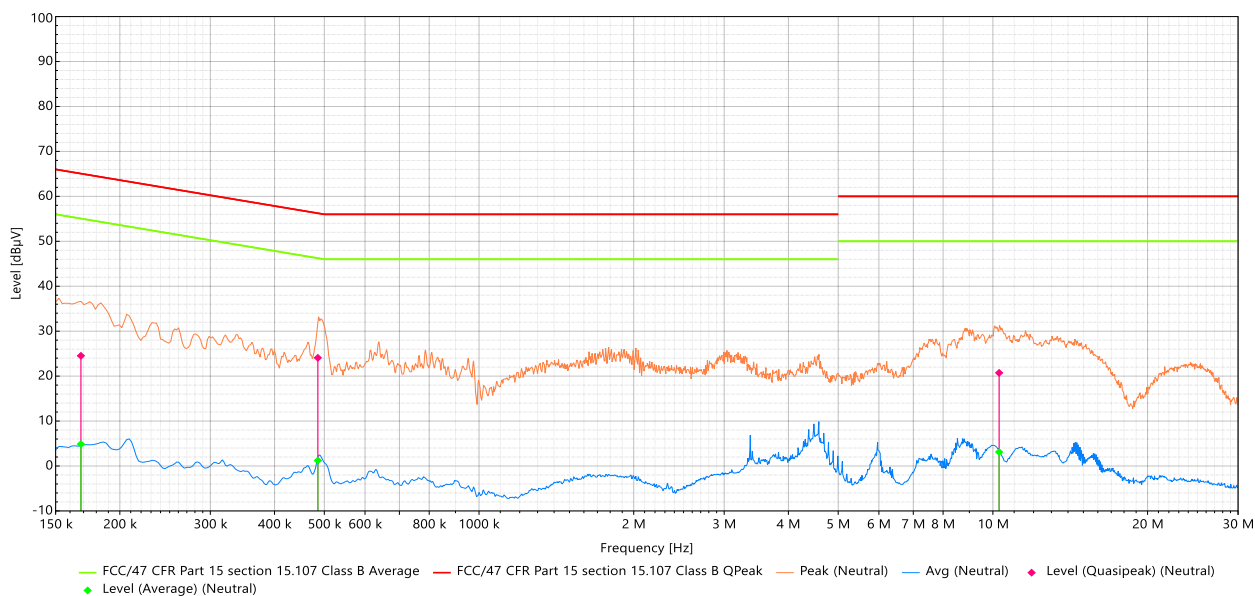
— Line: Phase 1

#32(150 kHz-30 MHz), Phase 1



— Line: Neutral

#32(150 kHz-30 MHz), Neutral



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QuasiPeak

Frequency (Hz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Correction (dB)	RBW (Hz)	M. time (s)	Comments
168 k	24.5	65.1	-40.5	Neutral	10.0	9 k	1.0	Pass
10.284 M	20.7	60.0	-39.3	Neutral	10.3	9 k	1.0	Pass
10.764 M	22.7	60.0	-37.3	Phase 1	10.3	9 k	1.0	Pass
160.8 k	30.6	65.4	-34.8	Phase 1	10.0	9 k	1.0	Pass
485.7 k	24.1	56.2	-32.2	Neutral	10.0	9 k	1.0	Pass
487.5 k	34.2	56.2	-22.1	Phase 1	10.0	9 k	1.0	Pass

Average

Frequency (Hz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Correction (dB)	RBW (Hz)	M. time (s)	Comments
168 k	4.9	55.1	-50.2	Neutral	10.0	9 k	1.0	Pass
10.284 M	3.1	50.0	-46.9	Neutral	10.3	9 k	1.0	Pass
160.8 k	9.1	55.4	-46.3	Phase 1	10.0	9 k	1.0	Pass
10.764 M	4.0	50.0	-46.0	Phase 1	10.3	9 k	1.0	Pass
485.7 k	1.2	46.2	-45.0	Neutral	10.0	9 k	1.0	Pass
487.5 k	10.2	46.2	-36.0	Phase 1	10.0	9 k	1.0	Pass

Final test result

Pass

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Fotodokumentation
Photo documentation

5 Test Setup Photo

Refer to EUT Test Setup Photos_ DE239P74 001

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Liste der verwendeten Prüfmittel
List of used test equipment

6 Equipment List

6.1 Hardware

Prüfmittel Test equipment			Prüfmittel-Nr. / ID- Nr. Equipment-No. / ID- No.	Letzte Kalibrierung Last calibration	Nächste Kalibrierung Next calibration
TS8997	OSP-B157 WX. (with integrated power meter)	Rohde & Schwarz	9000266	08.09.2022	08.09.2024
	OSP-B157W8	Rohde & Schwarz	9000267	07.09.2022	07.09.2024
	Spectrum Analyzer: FSV-30	Rohde & Schwarz	9000268	16.07.2021	16.07.2023
	Signal Generator: SMB100A	Rohde & Schwarz	9000269		11.02.2023
	Vector Sig Gen: SMBV100A	Rohde & Schwarz	9000270		11.02.2023
	Humidity / Baro / Temp. Data Recorder	PCE Instruments	9000207		08.08.2024
	Temperature & Humidity Chamber: PL-3-KPH	Espec	2731999		03.02.2025
Fully Anechoic Room		Albatross Projects GmbH	2959749	08.10.2021	* 08.10.2024
Signal Analyzer FSU 26		Rohde & Schwarz	2844118	04.08.2023	04.08.2025
Signal Analyzer UXA N9041B		Keysight	2971644	06.04.2022	06.04.2023
RSE-Filtersystem		Rohde & Schwarz	9002802	06.02.2024	* 06.02.2025
Antenna HF907 1-18GHz		Rohde & Schwarz	2856263	01.09.2021	01.09.2024
Horn Antenna 3116C-PA 18-40GHz		ETS LINDGREN	2900393	19.12.2022	19.12.2025
Semi-Anechoic Chamber 30-1000 MHz		Siemens	2729645	15.06.2022	15.06.2025
Receiver ESU 8		Rohde & Schwarz	2728844	23.02.2024	23.02.2025
Antenna HFH 2 (Loop) 9kHz-30MHz		Rohde & Schwarz	2728893	09.07.2021	09.07.2024
Antenna VULB 9168 30MHz – 1GHz		Schwarzbeck	2728136	05.10.2023	05.10.2026

6.2 Software

Test Software	Developer	Version
EMC32	Rohde & Schwarz	10.60.20
BAT-EMC	NEXIO	2022.0.8.0

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Änderungsverzeichnis
Change history

7 Change History

Revision Number	List of revisions	Date of issue
DE239P74 001	Initial Release	2024-09-27
Note: Latest revision report will replace all previous reports.		

Ende des Prüfberichts

End of Test Report