Prüfbericht-Nr.: *Test report no.:*	**60432905-002**	**Auftrags-Nr.:** *Order no.:*	3343627_220	Seite 1 von 44 *Page 1 of 44*
Kunden-Referenz-Nr.: *Client reference No.:*	N/A	**Auftragsdatum:** *Order date:*	19.11.2020	
Auftraggeber: *Client:*	Designa Verkehrsleittechnik GmbH Faluner Weg 3, D-24109 KIEL			
Prüfgegenstand: *Test item:*	DESIGNA Smart Move			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	SM1			
Auftrags-Inhalt: *Order content:*	Prüfung der Funkparameter nach FCC *Test of radio parameters acc. to FCC*			
Prüfgrundlage: *Test specification:*	Teilprüfung / Partial test FCC CFR 47 Part 15 Subpart C- §15.247			
Wareneingangsdatum: *Date of sample receipt:*	10.12.2020			
Prüfmuster-Nr.: *Test sample no.:*	A002966615-001/003/005/007			
Prüfzeitraum: *Testing period:*	16.12.2020 – 21.12.2020			
Ort der Prüfung: *Place of testing:*	Nürnberg *Nuremberg*			
Prüflaboratorium: *Testing laboratory:*	Wireless Labor *Wireless Test Lab*			
Prüfergebnis*: *Test result*:*	*Pass*			

geprüft von: *tested by*:		**genehmigt von:** *authorized by*:	
Datum: *Date:* 24.02.2021	M. Sc. Alaa Bustati	**Datum:** *Issue date:* 24.02.2021	Dipl. -Ing. Melanie Bense
Stellung / *Position*	Sachverständige(r)/Expert	**Stellung /** *Position*	Team Leader Wireless

Sonstiges / *Other*:

Dieser Prüfbericht 60432905-002 ersetzt den Prüfbericht 60432905-001 (siehe Änderungsverzeichnis) / The test report 60432905-002 replaces the test report 60432905-001 (see change history).

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:*	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* Legende:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.

Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.
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Anmerkungen
Remarks

4	Die Messunsicherheit der in diesem Prüfbericht aufgeführten Messverfahren wird nicht unmittelbar in die Bewertung zur Einhaltung der jeweiligen Grenzwerte mit einbezogen. Es gelten die Anforderungen der Spezifikationen TS 103 051 und TS 100 028-1/-2 in aktueller Form, deren Grundlage der „shared risk“ Ansatz ist. Dieser beschreibt für die jeweilige Norm die maximalen zulässigen Unsicherheitsbeträge unter denen der Messwert als „wahr“ angesehen werden kann. Eine zusätzliche Betrachtung der Messunsicherheit bezüglich des gemessenen Wertes findet bei Unterschreitung der maximalen Unsicherheitsbeträge gemäß den Spezifikationen nicht statt. *The measurement uncertainty of the measurement methods listed in this test report is not directly included in the assessment of compliance with the respective limit values. The requirements of the specifications TS 103 051 and TS 100 028-1/-2 apply in their current form, based on the "shared risk" approach. For the respective standard, this describes the maximum acceptable uncertainty below which the measured value can be regarded as "true". An additional consideration of the measurement uncertainty with regard to the measured value does not take place if the maximum acceptable uncertainties according to the specifications are not reached.*
5	Die Aussage zur Konformität des in diesem Prüfbericht geprüften Produktes wird auf Kundenwunsch nach den Kriterien und Anforderungen der angewendeten Normen durchgeführt. Abweichende Bewertungsbedingungen durch den Kunden werden in den jeweiligen Kapiteln gesondert dokumentiert. Grundsätzlich wird eine Konformitätsbewertung auf Basis der angewendeten Normen durchgeführt, sofern mit dem Kunden keine abweichende Regelung getroffen wurde. *The statement of conformity of the product tested in this test report is carried out according to the criteria and requirements of the applied standards on customer request. Deviating assessment conditions by the customer are documented separately in the respective chapters. In principle, the assessment of conformity is made on the basis of the standards applied, unless otherwise agreed with the customer.*

Produktbeschreibung
Product description

1	**Test item**	DESIGNA Smart Move
2	**Typ-No.**	SM1
3	**Test sample obtaining**	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	**Contain FCC-ID**	2AYEQSM1
5	**Operating Frequency**	2402 – 2480 MHz
6	**Channel Bandwidth**	1 MHz
7	**Number of Channels**	40
8	**Rated Voltage / Frequency**	Primary device: 5V / DC (USB) Secondary device: 3V / DC (2xLR20 batteries)
9	**Antenna Type**	☐ Integral antenna ☒ Permanent antenna connector
10	**Antenna amount of chains**	1
11	**Antenna Gain**	9 dBi
12	**Software**	1.3.1
13	**Firmware**	28.10.7.2
14	**Used Samples**	A002966615-001 → Primary device radiated sample A002966615-003 → Secondary device radiated sample A002966615-005 → Primary device conducted sample A002966615-007 → Secondary device conducted sample
15	**Data Cable**	RJ11 to RS232 (Primary device)
16	**I/O Ports**	Primary device: USB (Output), RJ11 (Output) Secondary device: No input or output ports
17	**Environment**	Indoor and Outdoor
18	**Pictures of the EUT**	Photos see Appendix to this report (Appendix to 60432905-002)

Absatz *Clause*	**Anforderungen – Prüfungen /** *Requirements - Tests*	**Bemerkungen /** *Remarks*	**Ergebnis** *Result*
FCC 15.247 (a)(1)	20 dB Bandwidth	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1)	Number of Hopping Frequencies	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1)	Time of Occupancy	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (a)(1)	Carrier Frequency Separation	Does not apply for DTS equipment	P ☐ F ☐ N/A ☒ N/T ☐
FCC 15.247 (b)	Maximum Output Power	It verified that conducted signal test is electrically identical with original certificate, items re-tested are only for technical reference	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (e)	Power Spectral Density	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (a)(2)	6dB Bandwidth	-	P ☐ F ☐ N/A ☐ N/T ☒
FCC 15.247 (d)	Band Edge Measurement	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.247 (d)	Conducted Spurious Emission	-	P ☐ F ☐ N/A ☐ N/T ☒
FCC 15.205, 15.209	Radiated Spurious Emission	-	P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**Anforderungen – Prüfungen /** *Requirements - Tests*	**Bemerkungen /** *Remarks*	**Ergebnis** *Result*
FCC 15.207	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)	Supported by the EUT	Evaluated in this report
BLE 4.2	2402 – 2480 MHz	☒	☒

1.2 Standard specific classification of the EUT

1.2.1 Applied standards

FCC CFR 47 Part 15 Subpart C - §15.247

1.2.2 Test Methods and Guidance Documents

ANSI C63.10:2013

KDB 558074 D01 DTS Measurement Guidance v05

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 996369 D04 Module Integration Guide v01

1.2.3 System Type

DTS (Digital Transmission System)

1.2.4 Type of equipment

Equipment that can be used in multiple orientations

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

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
1	TX modulated with continuous transmission	Both devices were prepared with direct test mode and serial to usb cable. The transmit mode was configured using nRFgo studio software

2.4 Worst case Test Modes

The DUT radiated spurious emission was tested in the worst case configuration as stated in the test report of the radio module BL652-SC.

Test Report Reference: FR662202-06AE,

Date of report: 28.05.2018,

FCC-ID: SQGBL652.

Following configurations were used for the test cases:

Test case	Worst case Configuration
Radiated Spurious Emissions < 30 MHz	Lowest Channel
Radiated Spurious Emissions 30 MHz – 1 GHz	Lowest Channel
Radiated Spurious Emissions > 1 GHz	Lowest Channel

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	%	28-32
Supply voltage Primary device	Volts AC	Input AC/DC adapter: 120V / 60Hz Input DUT: 5V DC
Supply voltage Secondary device	Volts DC	3V (2xLR20 batteries)

3.3 Antenna assemblies

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

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	%	-

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.

DTS devices:

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt. Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

FCC Part 15, Subpart C, §15.247 (b) (4)

if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

Frequency Hopping Systems:

FCC Part 15, Subpart C, §15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

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

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

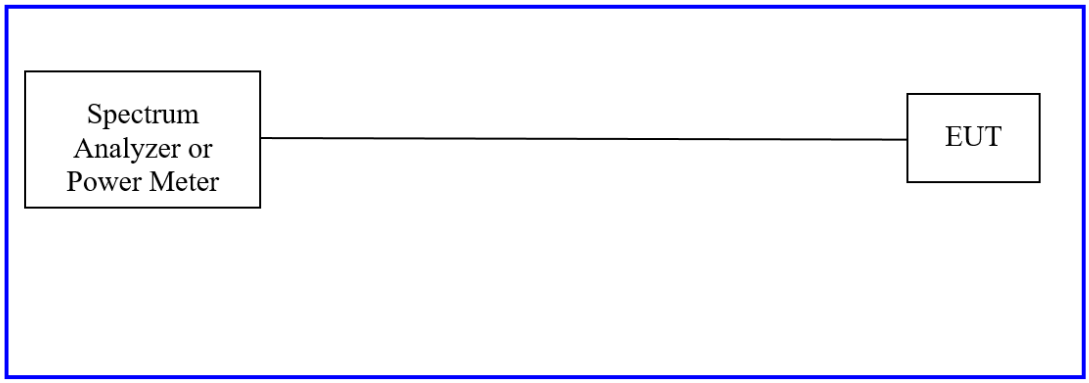
Devices with antenna gain greater than 6 dBi:

FCC Part 15, Subpart C, §15.247 (b) (4)

If transmitting antennas of directional gain greater than 6 dBi are used, 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

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.



the applicable output power limit shall be calculated as follows:

$$P_{Out} = P_{Limit} - (G_{Tx} - 6)$$

where:

P_{Out} is the maximum conducted output power in dBm,

P_{Limit} is the output power limit in dBm,

G_{Tx} is the maximum transmitting antenna directional gain in dBi

The Applicable limit for conducted output power is 27 dBm

4.1.3 Test setup

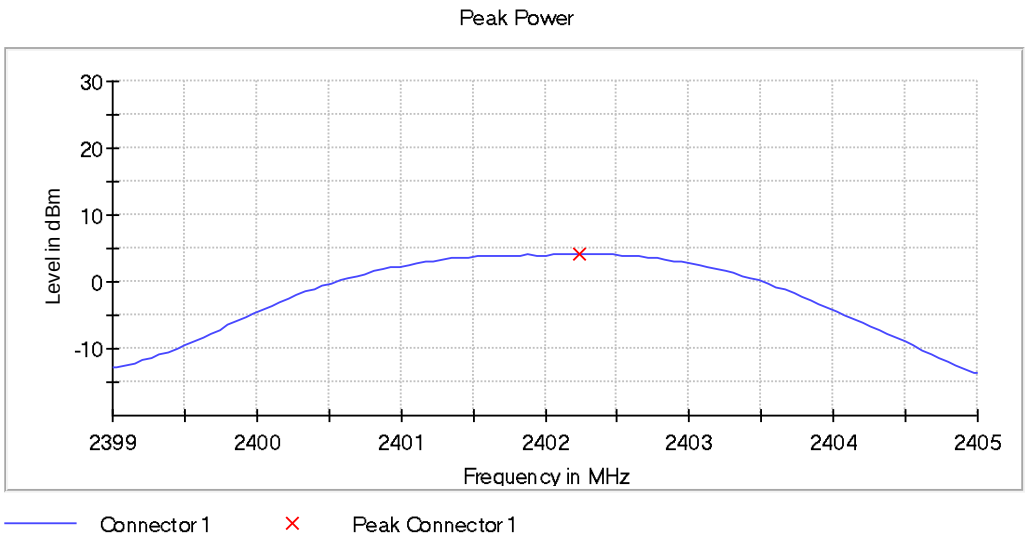
EUT	A002966615-005 → Primary device A002966615-007 → Secondary device		
Test Condition	Normal conditions		
Chamber details	☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room		
Measurement positioning	Distance: ☐ 3m ☐ 10m	EUT height: ☐ 1.5m ☐ 0.8m	Antenna height: ☐ 1.5m ☐ 1m to 4m – height scan
	☒ N/A		
Companion device	-		
Operation mode	Mode 1: TX modulated with continuous transmission		

Spectrum Analyzer	**Frequency**	2402 MHz, 2440 MHz, 2480 MHz
	Resolution Bandwidth	2 MHz
	Video Bandwidth	10 MHz
Further parameters		-
Test engineer		M. Sc. Alaa Bustati

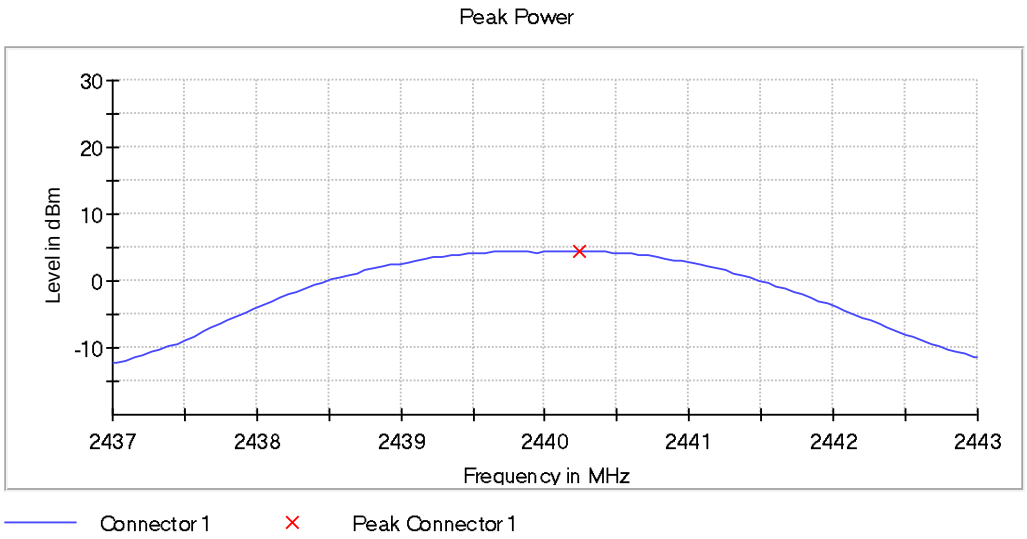
4.1.4 Test results

4.1.4.1 Primary Device

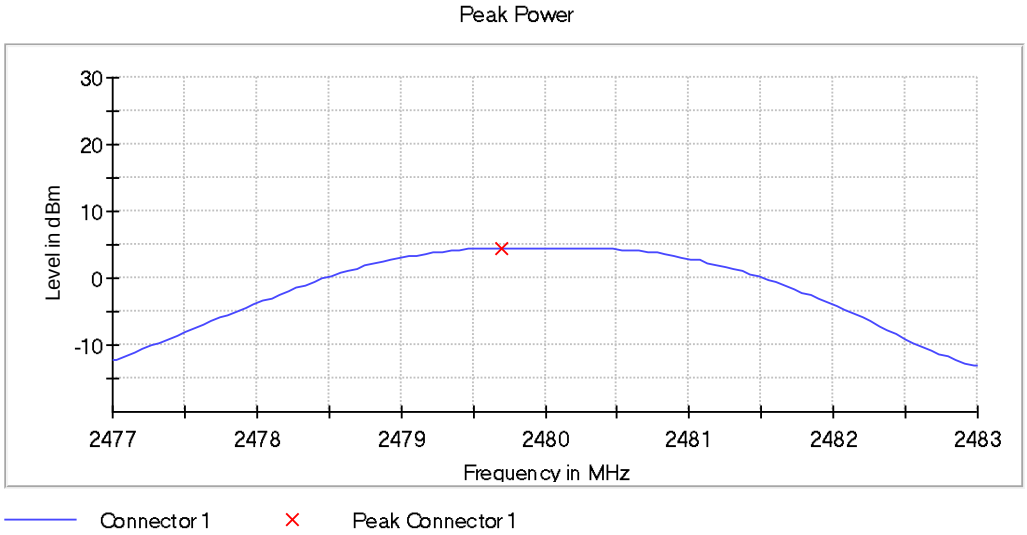
- **Lowest Channel**



- **Middle Channel**



- **Highest Channel**

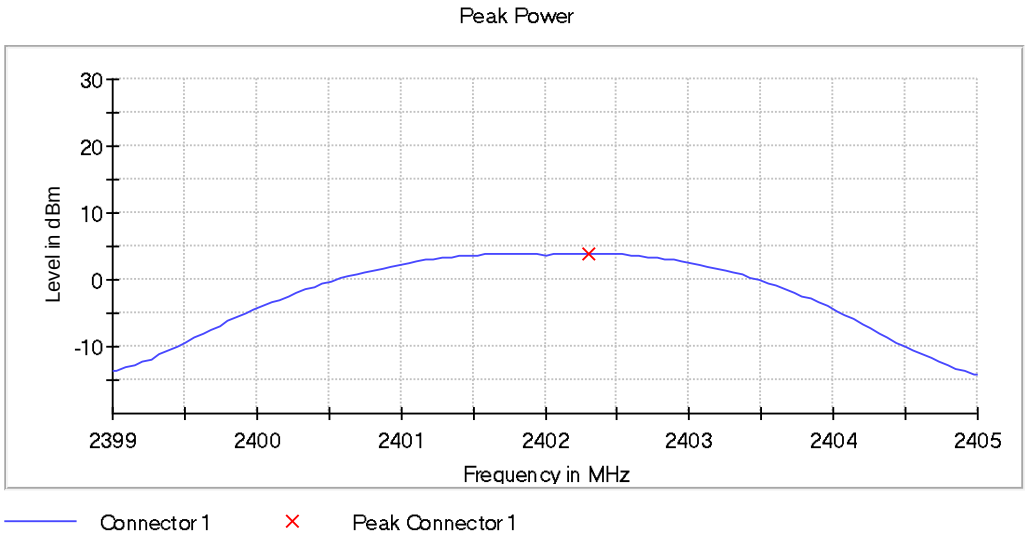


-

Frequency (MHz)	Peak conducted output power (dBm)	Limit (dBm)	Margin (dB)	Test Result
2402	4.2	27	22.8	Pass
2440	4.4		22.6	Pass
2480	4.5		22.5	Pass

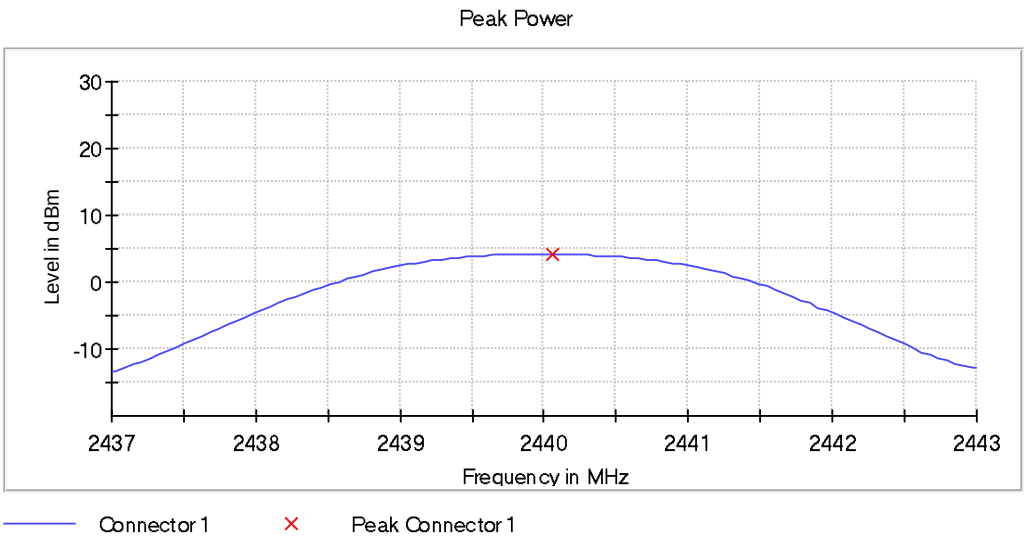
4.1.4.2 Secondary Device

- **Lowest Channel**

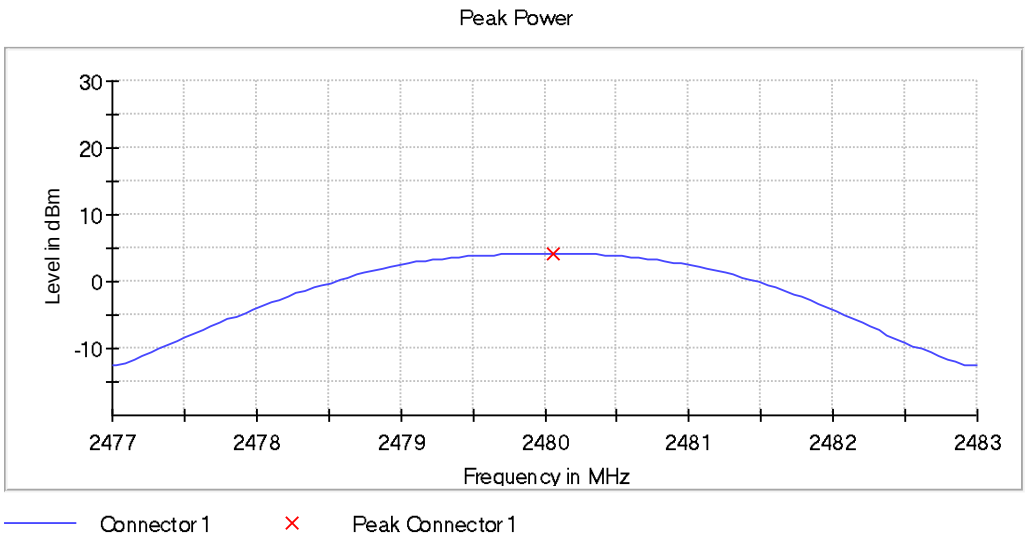


Prüfdokumentation
Test documentation

- **Middle Channel**



- **Highest Channel**



Frequency	Peak conducted output power (dBm)	Limit (dBm)	Margin (dB)	Test Result
Lowest	3.9	27	23.1	Pass
Middle	4.2		22.8	Pass
Highest	4.2		22.8	Pass

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.

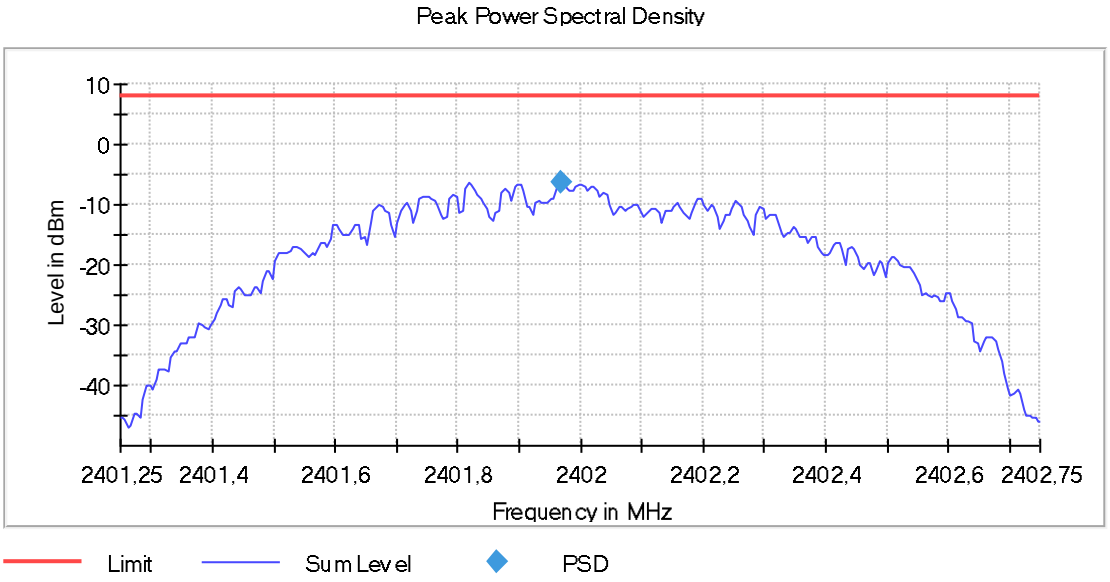
4.2.3 Test setup

EUT		A002966615-005 → Primary device A002966615-007 → Secondary device		
Test Condition		Normal conditions		
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room		
Measurement positioning		Distance: ☐ 3m ☐ 10m	EUT height: ☐ 1.5m ☐ 0.8m	Antenna height: ☐ 1.5m ☐ 1m to 4m – height scan
		☒ N/A		
Companion device		-		
Operation mode		Mode 1: TX modulated with continuous transmission		
Spectrum Analyzer	**Centre Frequency**	2402 MHz, 2440 MHz, 2480 MHz		
	Resolution Bandwidth	10 kHz		
	Video Bandwidth	30 kHz		
	Span	1.5 MHz		
	Sweep time	1.5 ms		
Further parameters		-		
Test engineer		M. Sc. Alaa Bustati		

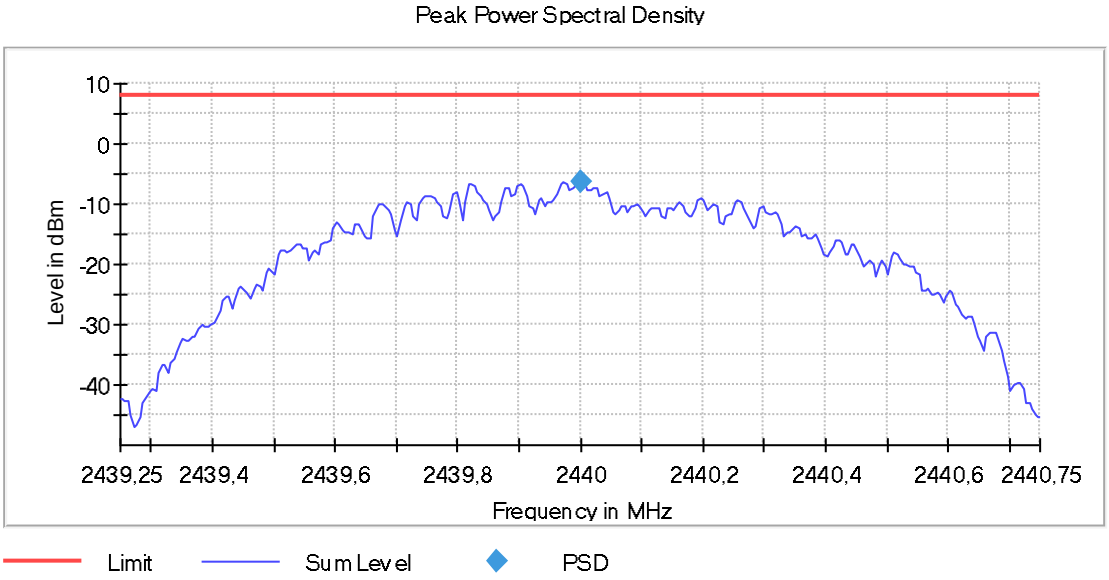
4.2.4 Test results

4.2.4.1 Primary Device

- **Lowest Channel**

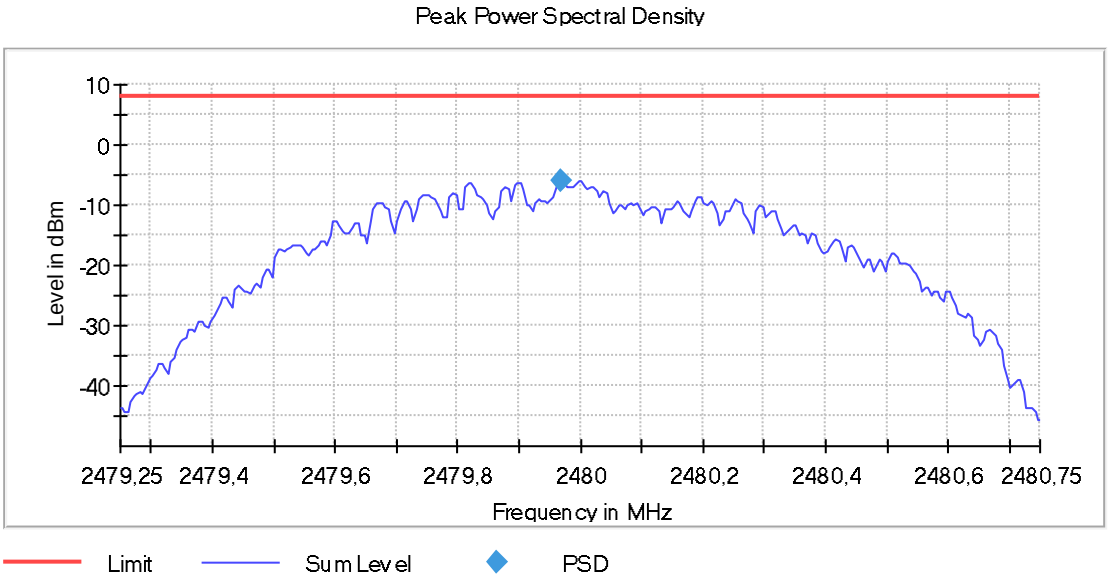


- **Middle Channel**



Prüfdokumentation
Test documentation

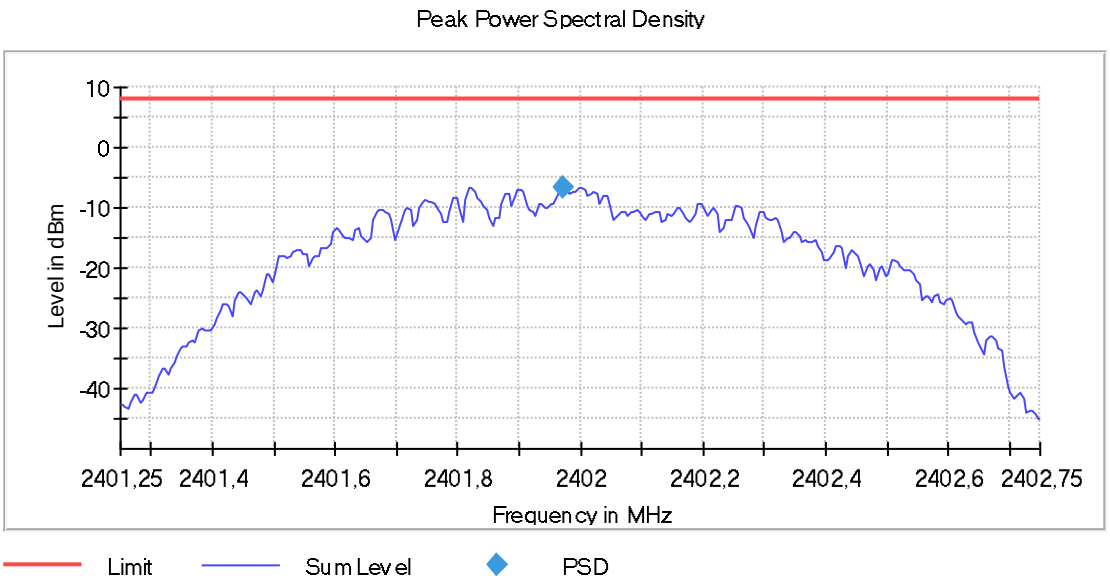
- **Highest Channel**



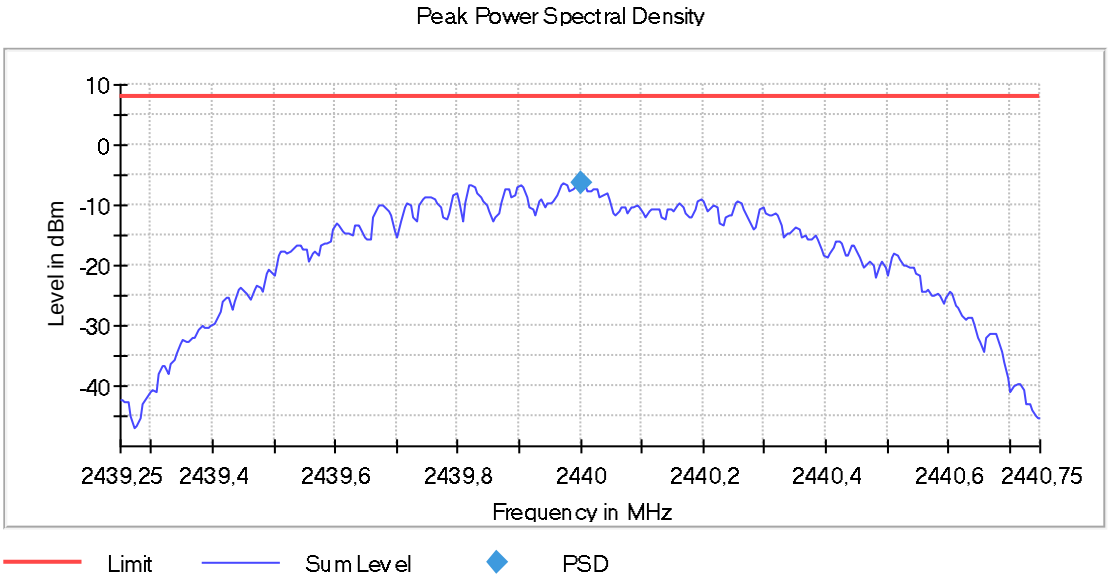
Frequency (MHz)	Peak conducted power spectral density (dBm/MHz)	Limit (dBm)	Margin (dB)	Test Result
2401.9675	-6.314	8	14.314	Pass
2439.9675	-6.009		14.009	Pass
2479.9675	-6.070		14.07	Pass

4.2.4.2 Secondary Device

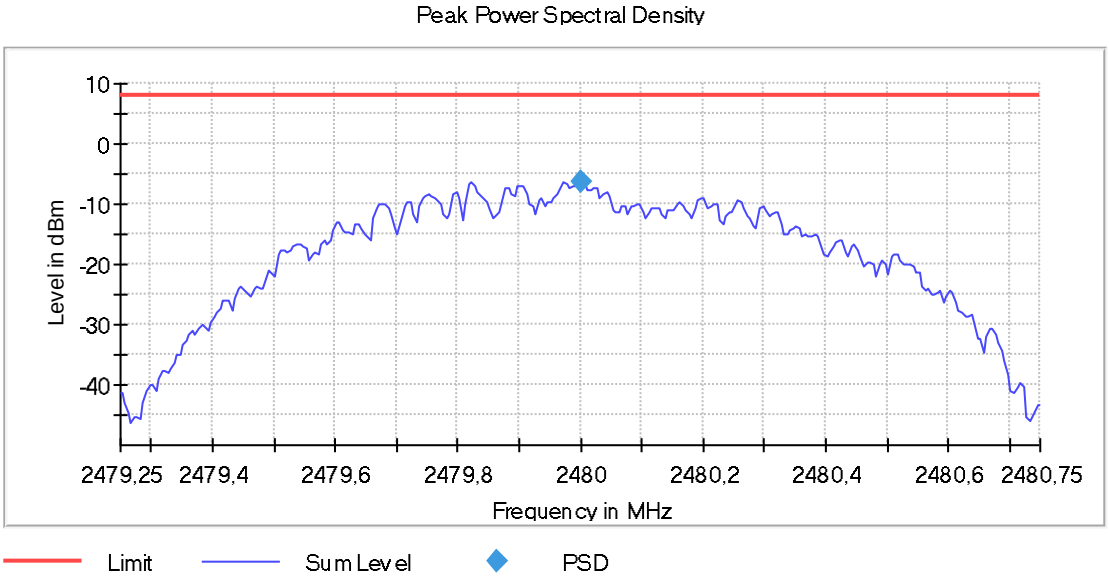
- **Lowest Channel**



- **Middle Channel**



- **Highest Channel**



Frequency (MHz)	Peak conducted power spectral density (dBm/MHz)	Limit (dBm)	Margin (dB)	Test Result
2401.9675	-6.690	8	14.690	Pass
2440.0025	-6.389		14.389	Pass
2480.0025	-6.446		14.446	Pass

4.3 Band Edge Measurement

4.3.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

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. 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.

4.3.2 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.

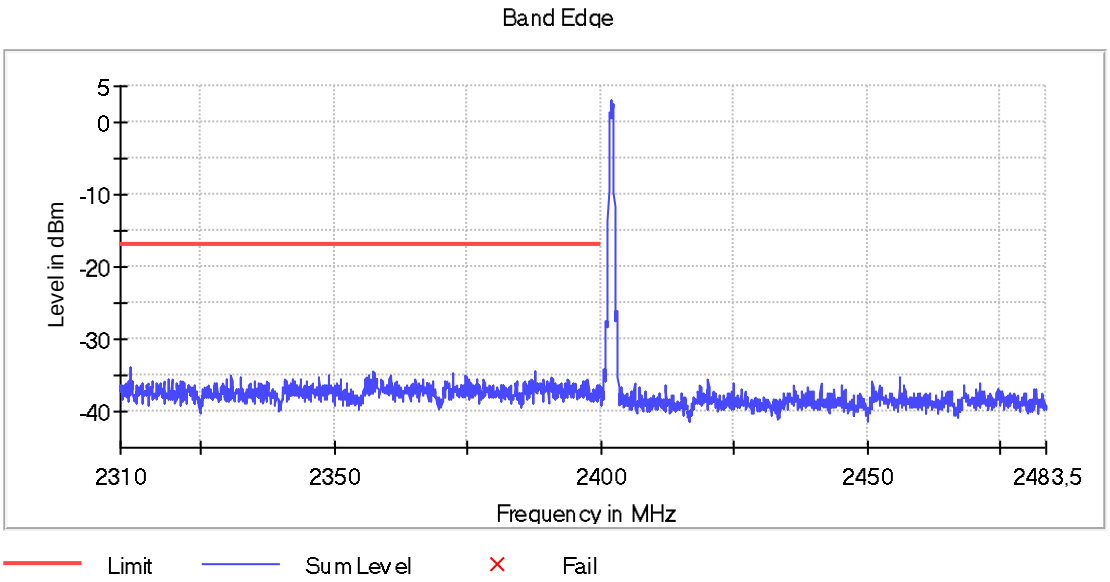
4.3.3 Test Setup

EUT		A002966615-005 → Primary device A002966615-007 → Secondary device
Test Condition		Normal conditions
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning		Distance: ☐ 3m ☐ 10m EUT height: ☐ 1.5m ☐ 0.8m Antenna height: ☐ 1.5m ☐ 1m to 4m – height scan
		☒ N/A
Companion device		-
Operation mode		Mode 1: TX modulated with continuous transmission
Spectrum Analyzer	**Resolution Bandwidth**	100 kHz
	Video Bandwidth	300 kHz
Further parameters		-
Test engineer		M. Sc. Alaa Bustati

4.3.4 Test results

4.3.4.1 Primary Device

- **Lowest Channel**



Inband Peak

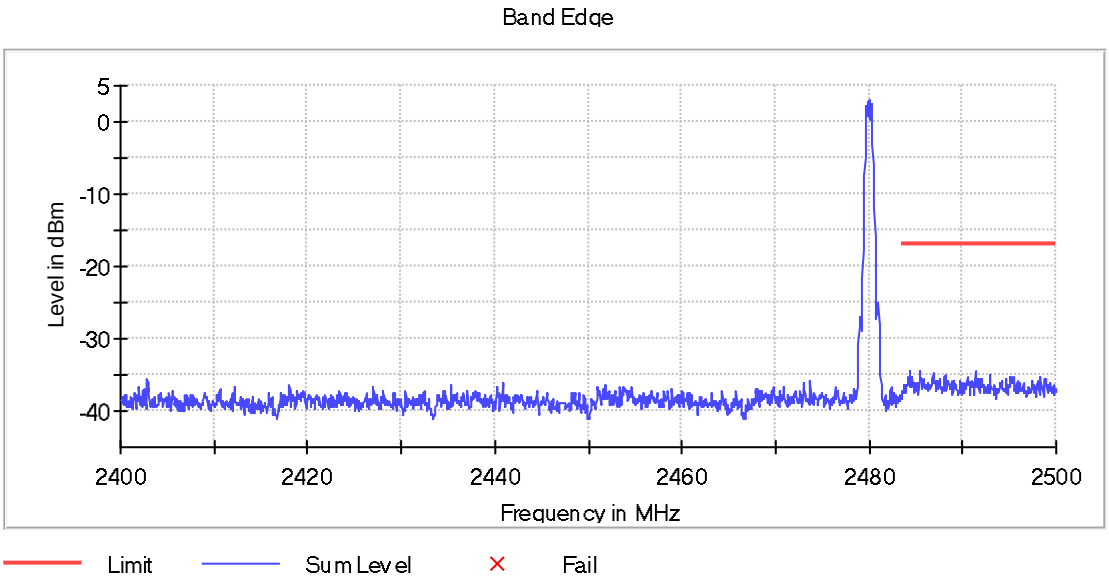
Frequency [MHz]	Level [dBm]
2402.025000	3.1

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2311.925000	-33.9	17.0	-16.9	PASS
2311.975000	-34.3	17.3	-16.9	PASS
2357.475000	-34.4	17.5	-16.9	PASS
2387.675000	-34.5	17.6	-16.9	PASS
2357.525000	-34.7	17.8	-16.9	PASS
2372.425000	-34.7	17.8	-16.9	PASS
2372.475000	-34.9	17.9	-16.9	PASS
2387.725000	-34.9	18.0	-16.9	PASS
2349.125000	-35.0	18.1	-16.9	PASS
2356.475000	-35.0	18.1	-16.9	PASS
2330.775000	-35.0	18.1	-16.9	PASS
2330.825000	-35.1	18.1	-16.9	PASS
2374.775000	-35.1	18.1	-16.9	PASS
2349.175000	-35.1	18.1	-16.9	PASS
2356.525000	-35.1	18.2	-16.9	PASS

Prüfdokumentation
Test documentation

- **Highest Channel**



Inband Peak

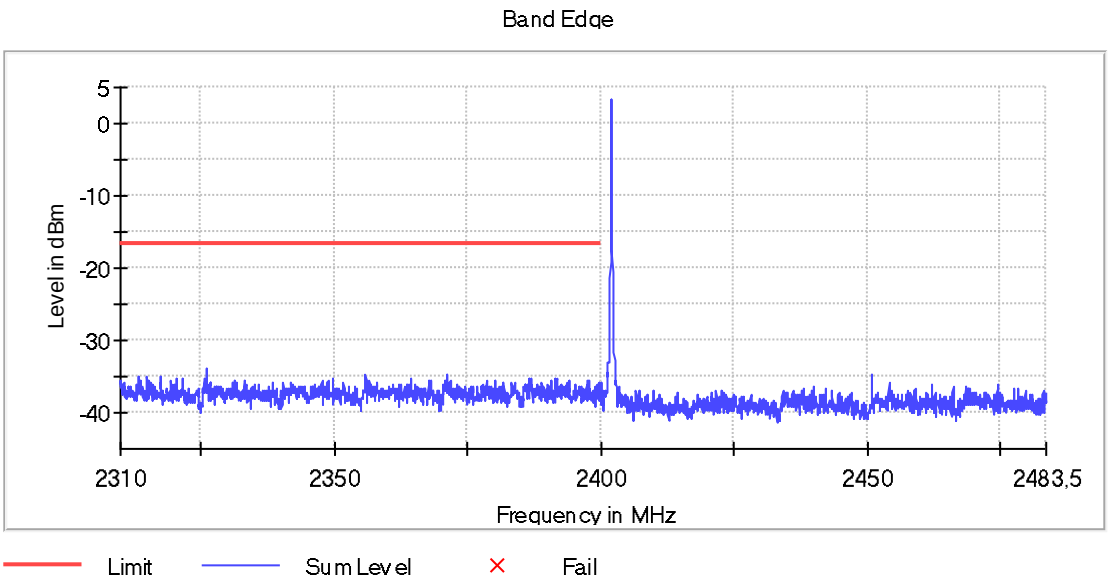
Frequency [MHz]	Level [dBm]
2480.025000	3.1

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2485.475000	-34.5	17.6	-16.9	PASS
2484.375000	-34.5	17.6	-16.9	PASS
2491.375000	-34.5	17.6	-16.9	PASS
2485.425000	-34.5	17.7	-16.9	PASS
2484.325000	-34.7	17.8	-16.9	PASS
2491.425000	-34.7	17.8	-16.9	PASS
2486.875000	-34.7	17.8	-16.9	PASS
2486.925000	-34.7	17.9	-16.9	PASS
2492.975000	-34.9	18.0	-16.9	PASS
2488.125000	-35.0	18.1	-16.9	PASS
2492.925000	-35.0	18.1	-16.9	PASS
2490.575000	-35.1	18.3	-16.9	PASS
2495.075000	-35.2	18.3	-16.9	PASS
2490.475000	-35.3	18.4	-16.9	PASS
2488.075000	-35.3	18.4	-16.9	PASS

4.3.4.2 Secondary Device

- **Lowest Channel**



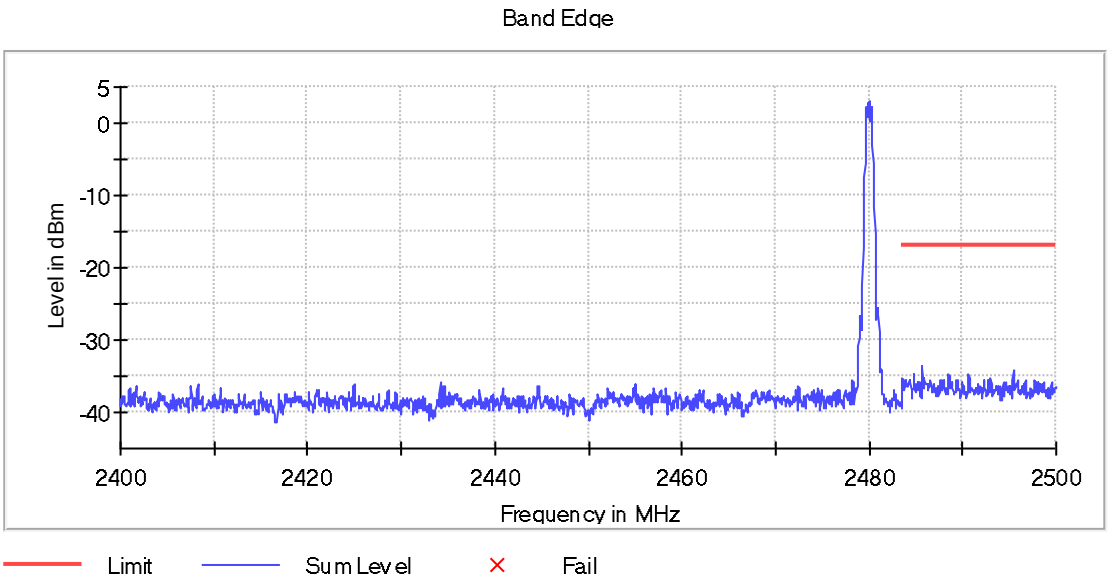
Inband Peak

Frequency [MHz]	Level [dBm]
2402.025000	3.4

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2326.225000	-33.8	17.1	-16.6	PASS
2326.175000	-34.4	17.7	-16.6	PASS
2326.275000	-34.5	17.8	-16.6	PASS
2371.175000	-34.6	18.0	-16.6	PASS
2355.975000	-34.7	18.1	-16.6	PASS
2371.125000	-34.8	18.1	-16.6	PASS
2317.475000	-34.9	18.2	-16.6	PASS
2313.425000	-34.9	18.3	-16.6	PASS
2314.975000	-34.9	18.3	-16.6	PASS
2313.475000	-34.9	18.3	-16.6	PASS
2317.425000	-35.0	18.4	-16.6	PASS
2315.025000	-35.1	18.4	-16.6	PASS
2355.925000	-35.1	18.5	-16.6	PASS
2325.675000	-35.2	18.6	-16.6	PASS
2321.525000	-35.2	18.6	-16.6	PASS

- **Highest Channel**



Inband Peak

Frequency [MHz]	Level [dBm]
2480.025000	3.0

Measurements

Frequency [MHz]	Level [dBm]	Margin [dB]	Limit [dBm]	Result
2485.675000	-33.6	16.6	-17.0	PASS
2485.725000	-33.9	16.9	-17.0	PASS
2495.475000	-34.2	17.1	-17.0	PASS
2495.425000	-34.2	17.2	-17.0	PASS
2485.625000	-34.5	17.5	-17.0	PASS
2490.675000	-34.6	17.6	-17.0	PASS
2484.775000	-34.8	17.7	-17.0	PASS
2488.525000	-34.8	17.8	-17.0	PASS
2484.825000	-34.8	17.8	-17.0	PASS
2488.575000	-35.0	17.9	-17.0	PASS
2490.725000	-35.2	18.1	-17.0	PASS
2485.875000	-35.2	18.1	-17.0	PASS
2483.575000	-35.2	18.1	-17.0	PASS
2490.625000	-35.2	18.1	-17.0	PASS
2493.025000	-35.2	18.2	-17.0	PASS

Final test result	Pass

4.4 Radiated Spurious Emissions

4.4.1 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 [µV/m]	Measurement distance [m]	Limits [dBµV/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 [µV/m]	Measurement distance [m]	Limits [dBµV/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:

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

4.4.2 Test Method

4.4.2.1 Perliminary 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 Polarisation	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)

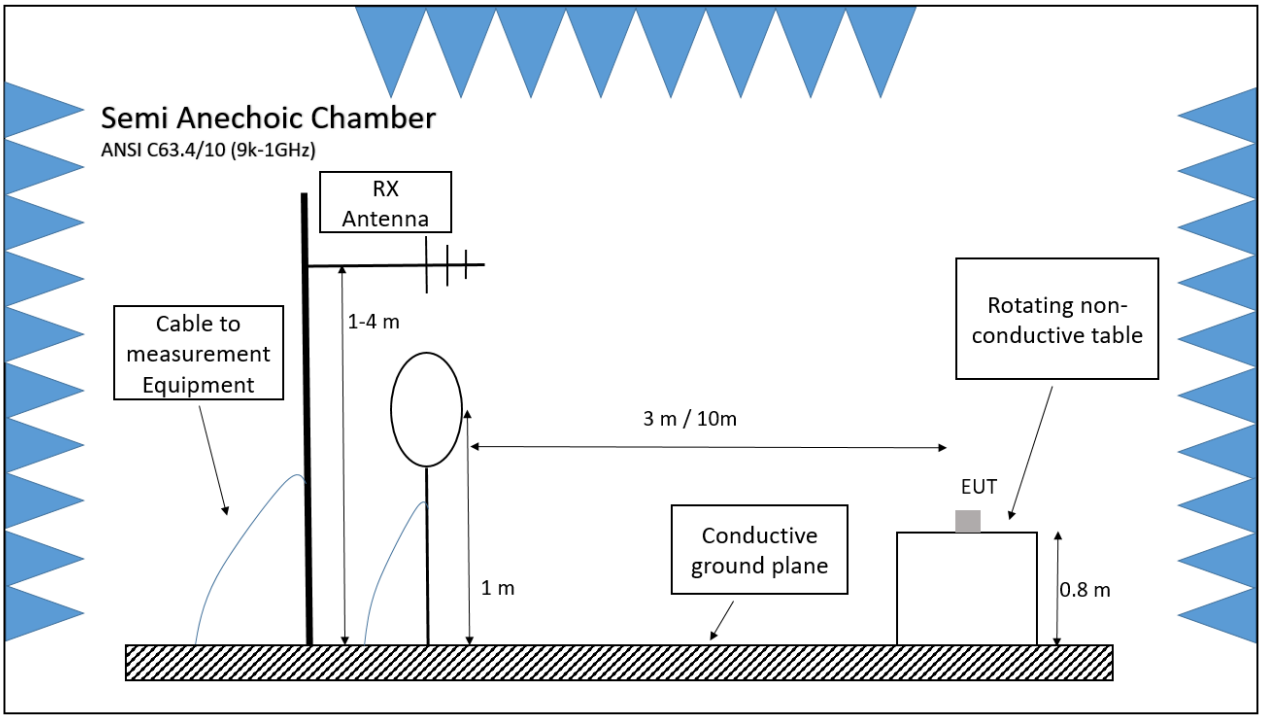
30 MHz - 1 GHz

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 Polarisation	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)

Prüfdokumentation
Test documentation

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

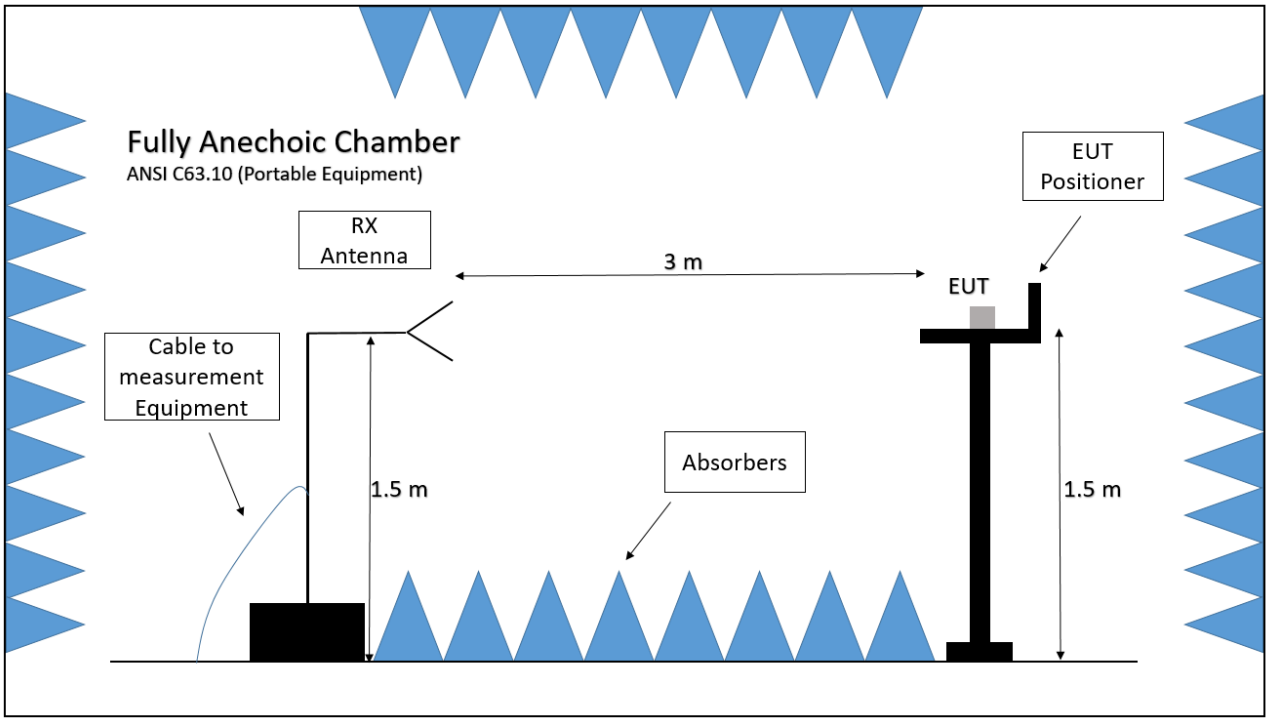


1 GHz - 25 GHz

Following Measurement Setup is used:

Test Site	Fully-anechoic chamber
Receiving Antenna	Horn Antenna HF907 (1-18 GHz), 3116C-PA (18-25 GHz)
Receiving Antenna Height	1.5 m
Receiving Antenna Polarisation	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 Analyser	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:



4.4.2.2 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, than 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 measurments 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 measurments 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

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

4.4.3 Test Setup

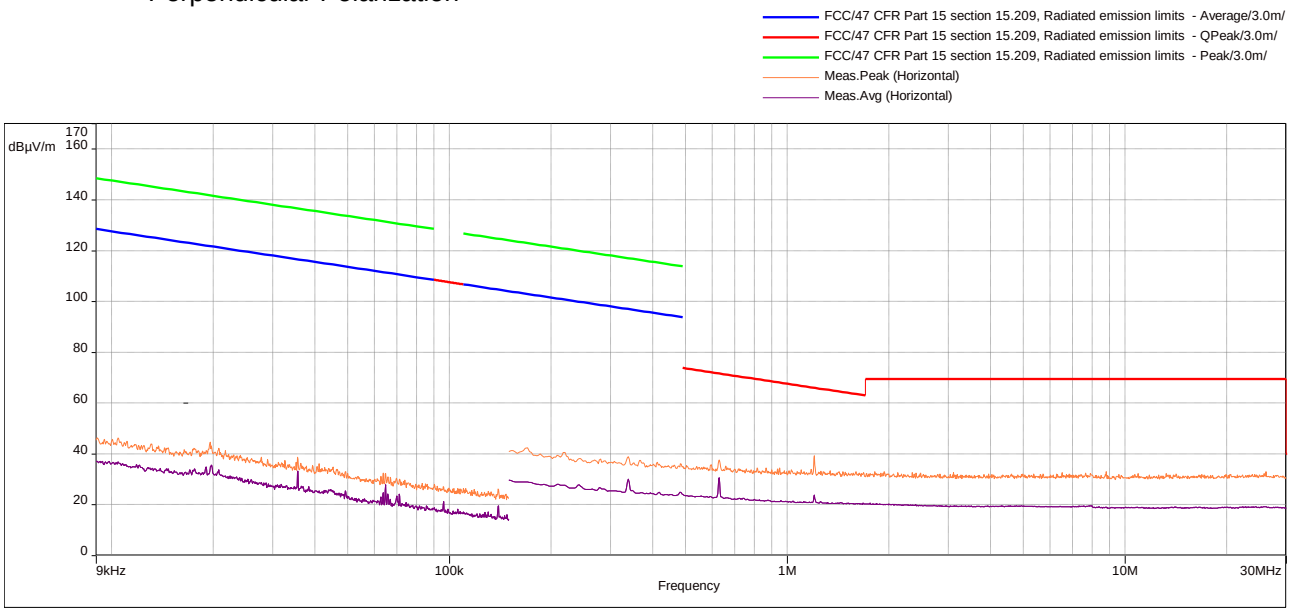
EUT	A002966615-001 → Primary device A002966615-003 → Secondary device
Test Condition	Normal conditions
Companion device	-
Operation mode	Mode 1: TX modulated with continuous transmission
Further parameters	-
Test engineer	M. Sc. Alaa Bustati

4.4.4 Test results

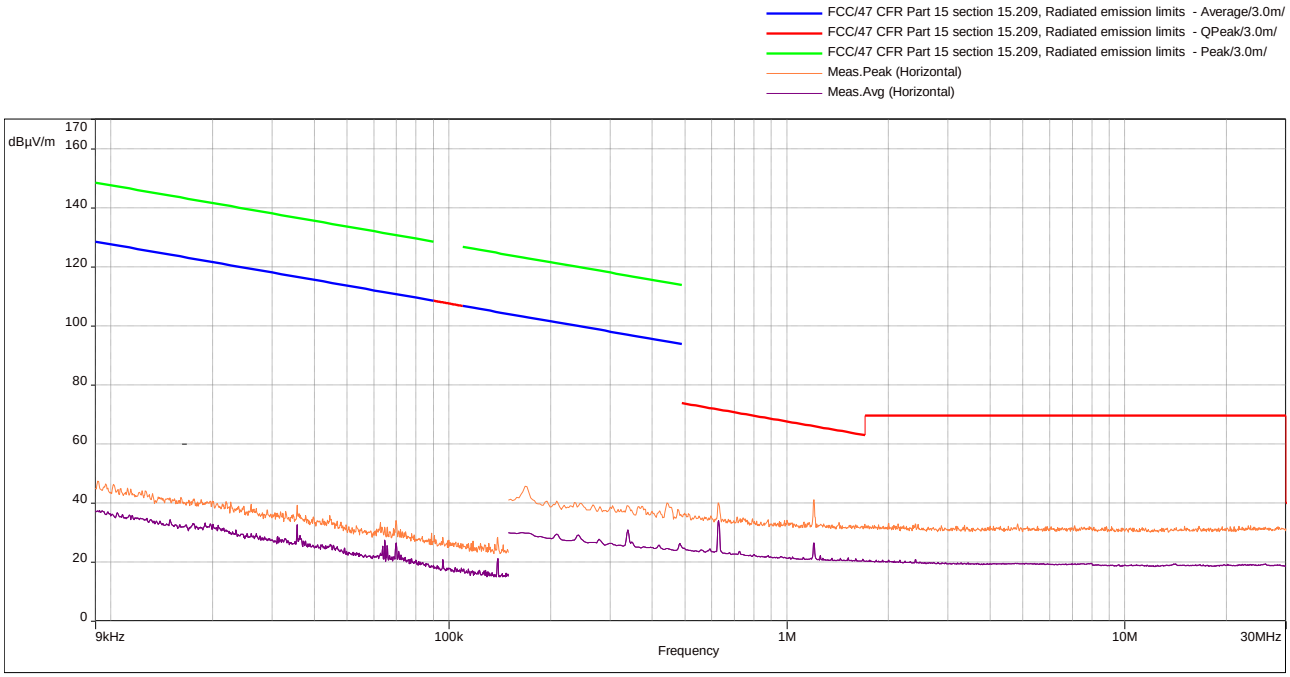
4.4.4.1 Primary Device

- **9kHz to 30 MHz, lowest channel (worst case configuration)**

  - Perpendicular Polarization



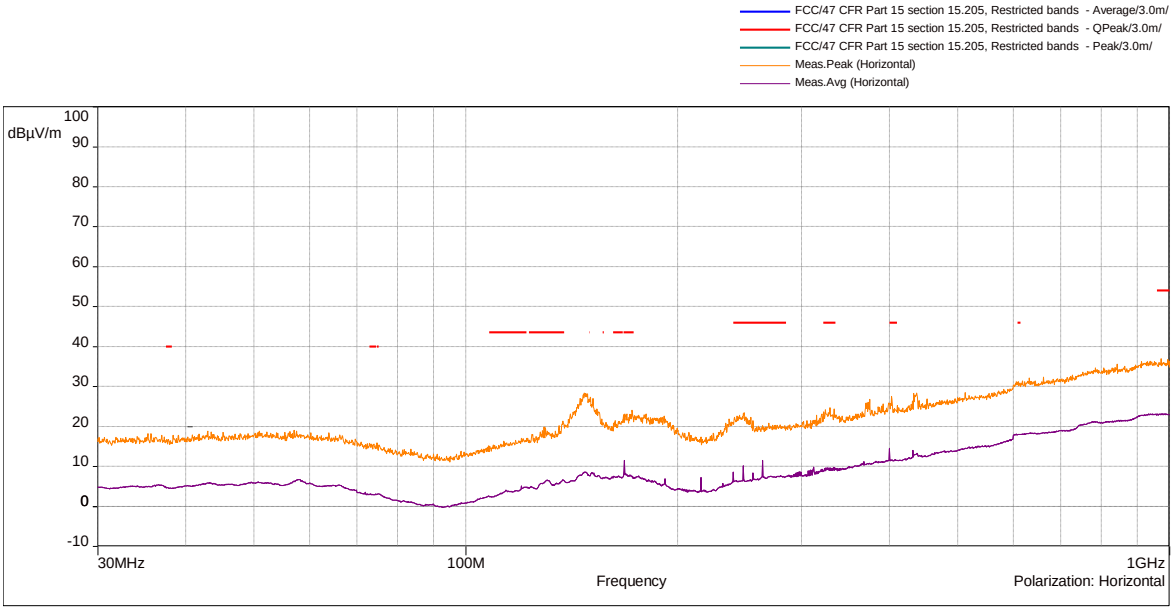
  - Parallel Polarization



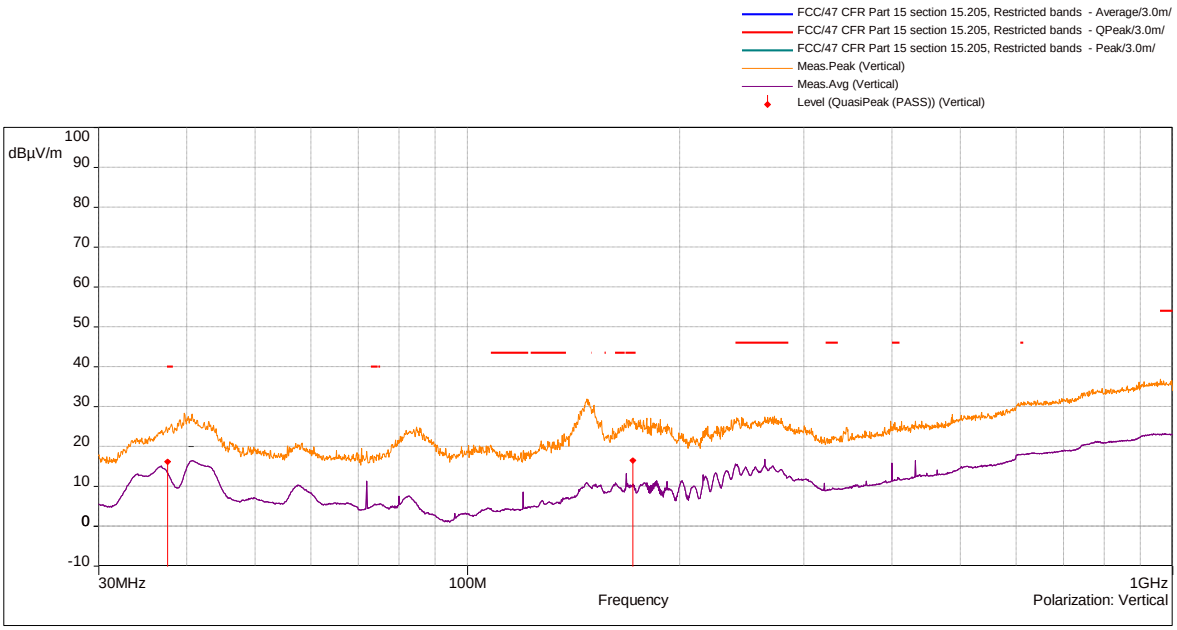
Prüfdokumentation
Test documentation

- **30 MHz – 1 GHz, lowest channel (worst case configuration)**

  - Horizontal Polarization



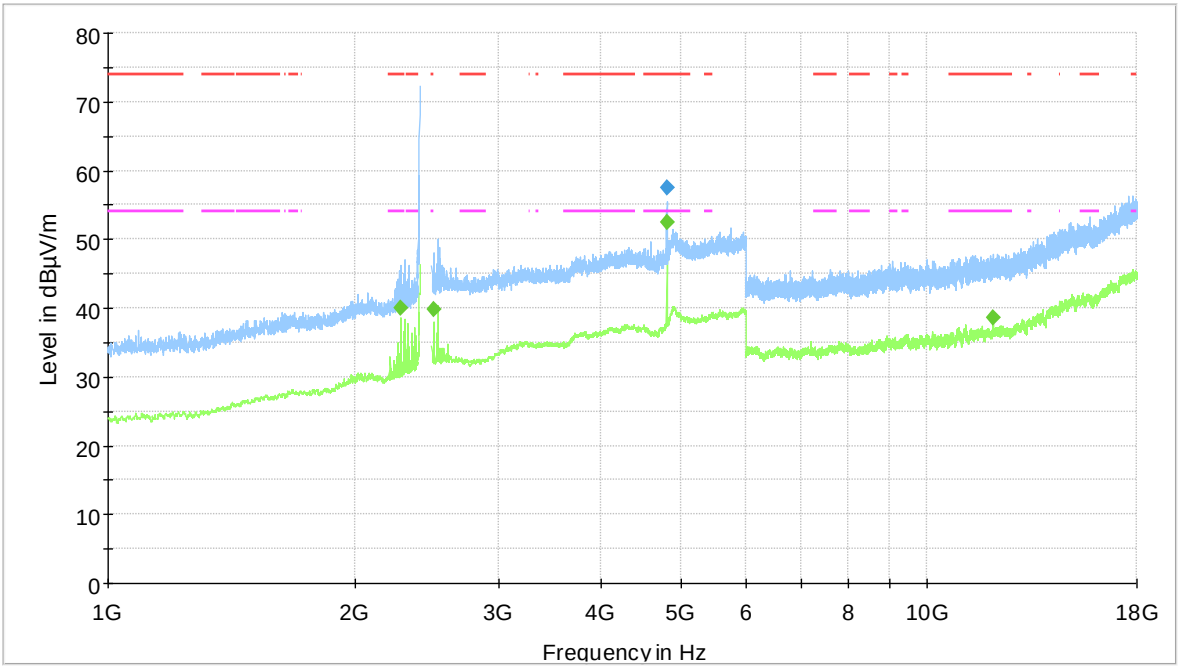
  - Vertical Polarization



Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
37.56	2	16.23	40.00	-23.77	22.80	1.00	Vertical	1.00	13.58
171.54	2	16.50	43.50	-27.00	161.30	1.00	Vertical	1.00	14.33

Prüfdokumentation
Test documentation

- **1-18 GHz, lowest channel (worst case configuration)**

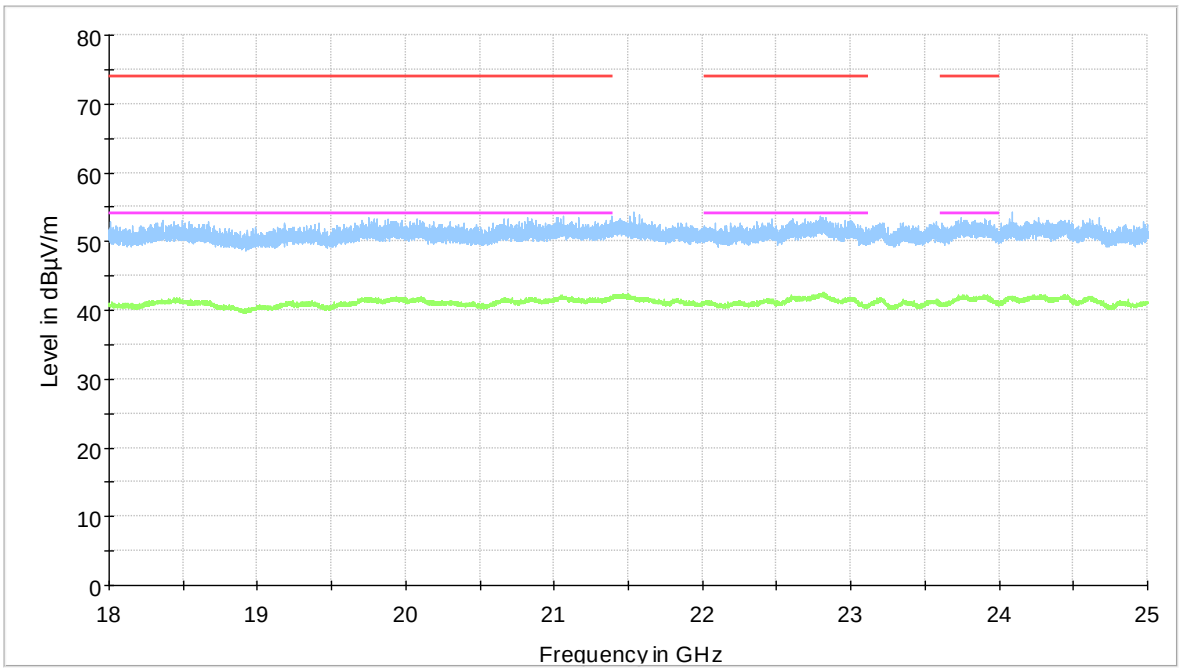


Preview Result 2-AVG
FCC_15C_15.209_Radiated_Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated_Emissions_Avg
Final_Result AVG

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)
2274.044643	---	40.02	54.00	13.98	100.0	1000.000	150.0	V	252.0	90.0	-0.9
2498.025834	---	39.79	54.00	14.21	100.0	1000.000	150.0	V	263.0	87.0	0.7
4803.588750	57.52	---	74.00	16.48	100.0	1000.000	150.0	V	123.0	360.0	7.7
4803.901250	---	52.39	54.00	1.61	100.0	1000.000	150.0	V	122.0	326.0	7.7
12009.126667	---	38.61	54.00	15.39	100.0	1000.000	150.0	H	10.0	360.0	1.7

Prüfdokumentation
Test documentation

- **18-25 GHz, lowest channel (worst case configuration)**

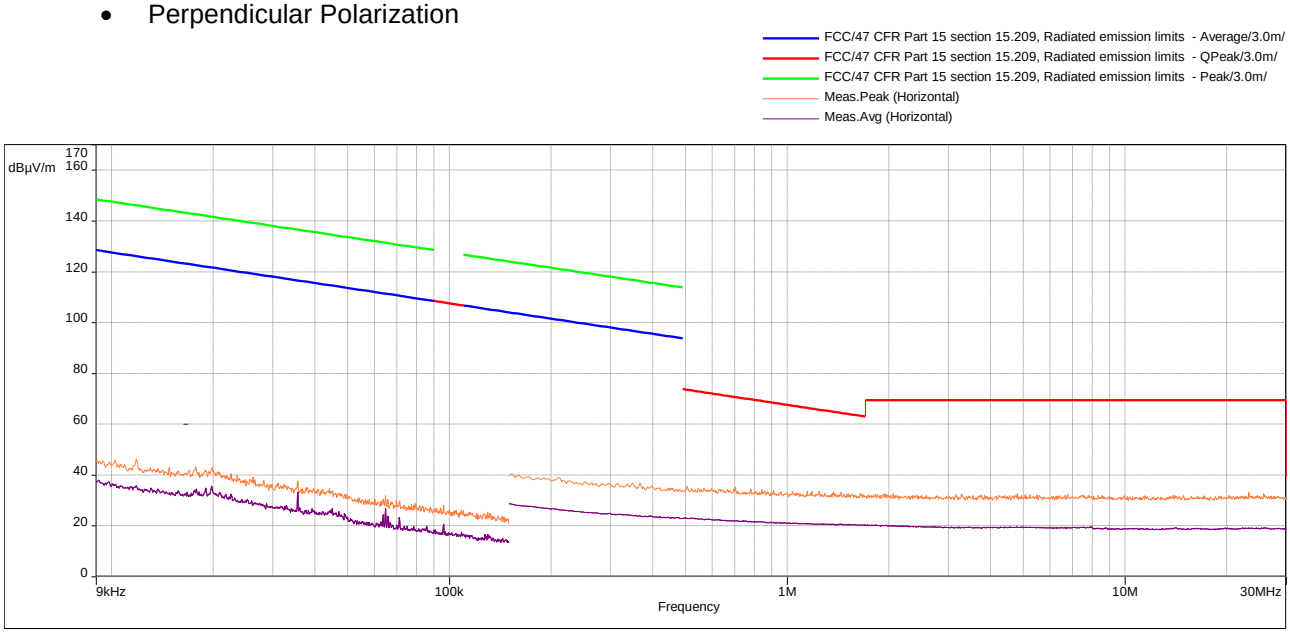


Preview Result 2-AVG
Preview Result 1-PK+
FCC_15C_15.209_Radiated_Emissions_Peak
FCC_15C_15.209_Radiated_Emissions_Avg
Final_Result PK+
Final_Result AVG

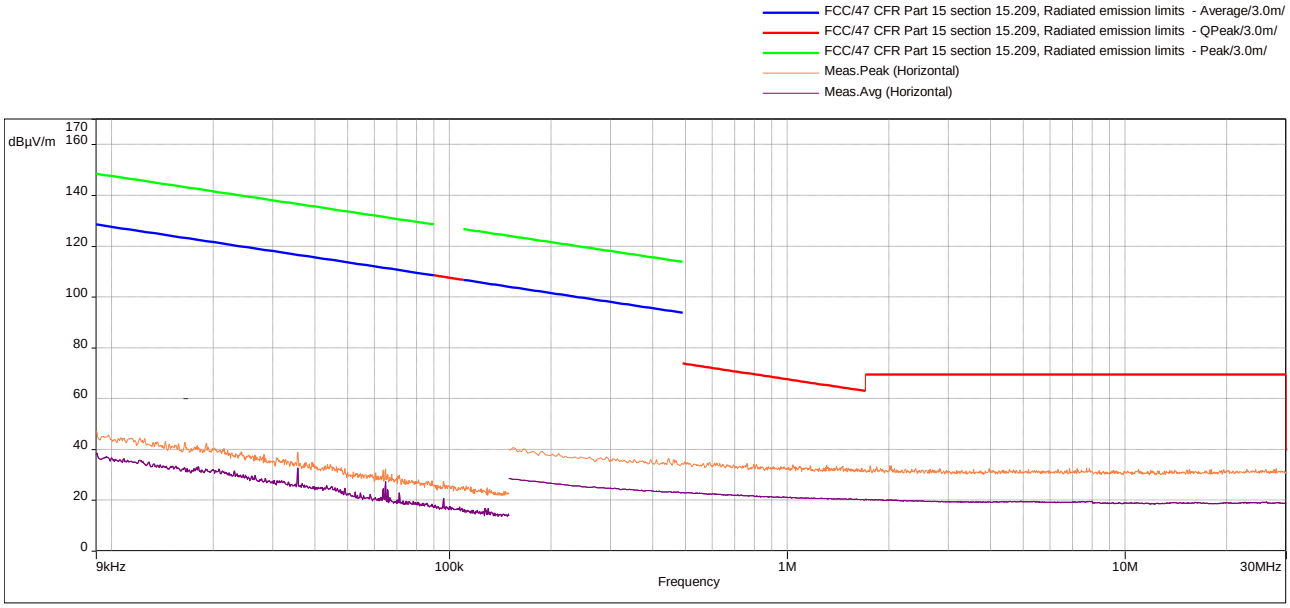
4.4.4.2 Secondary Device

- **9kHz to 30 MHz, lowest channel (worst case configuration)**

  - Perpendicular Polarization



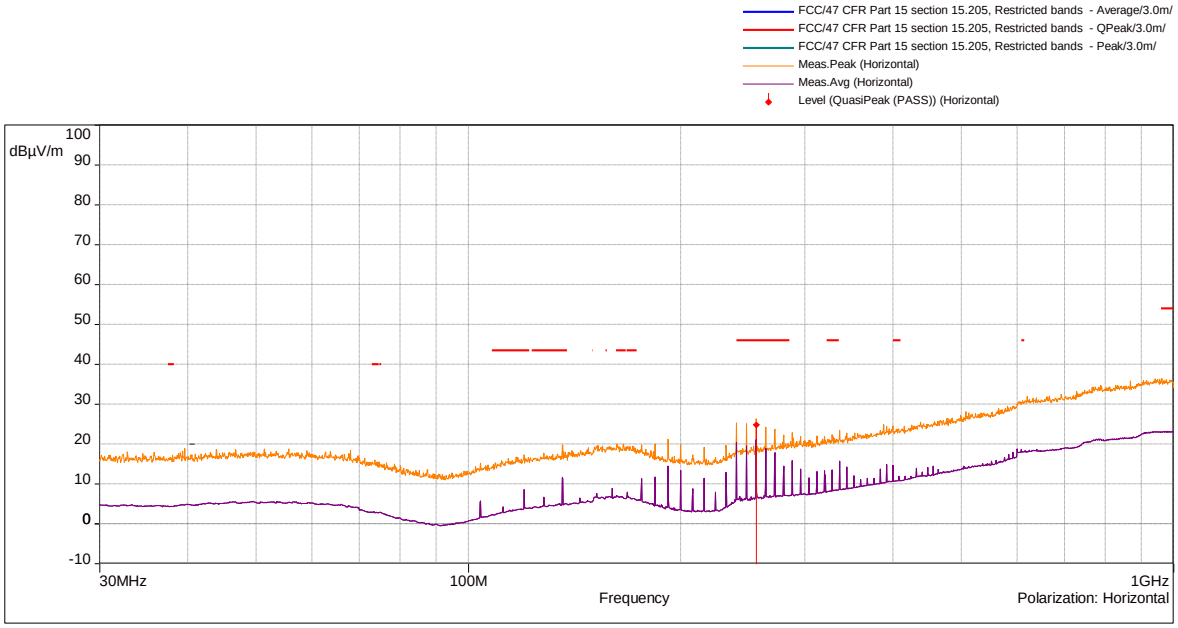
  - Parallel Polarization



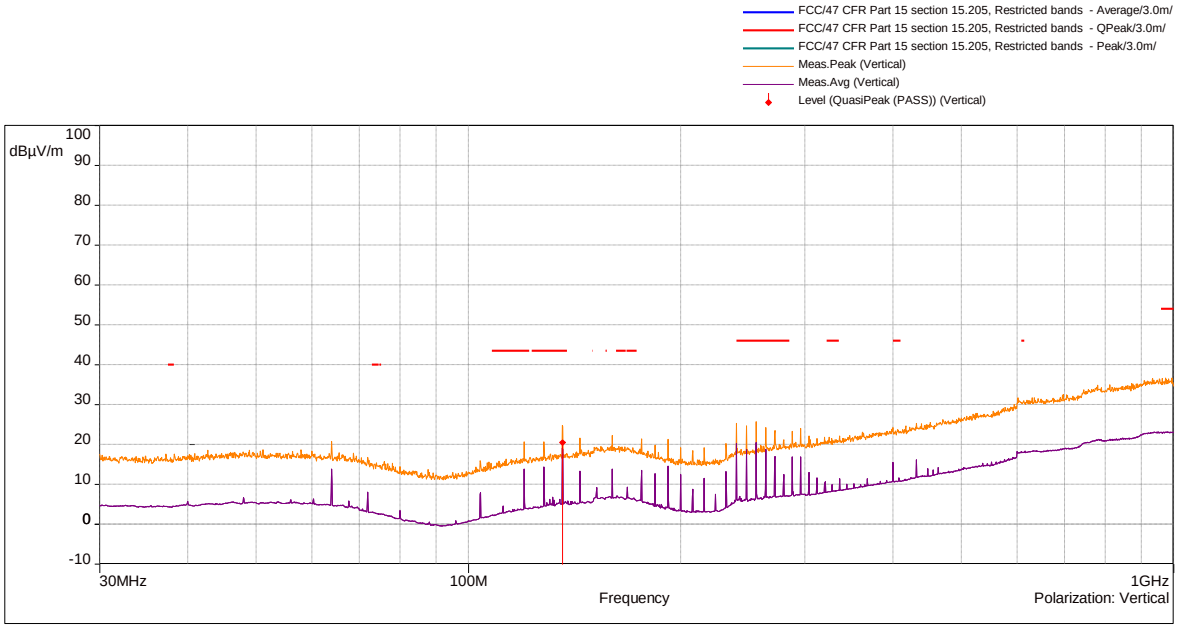
Prüfdokumentation
Test documentation

- **30 MHz – 1 GHz, lowest channel (worst case configuration)**

  - Horizontal Polarization



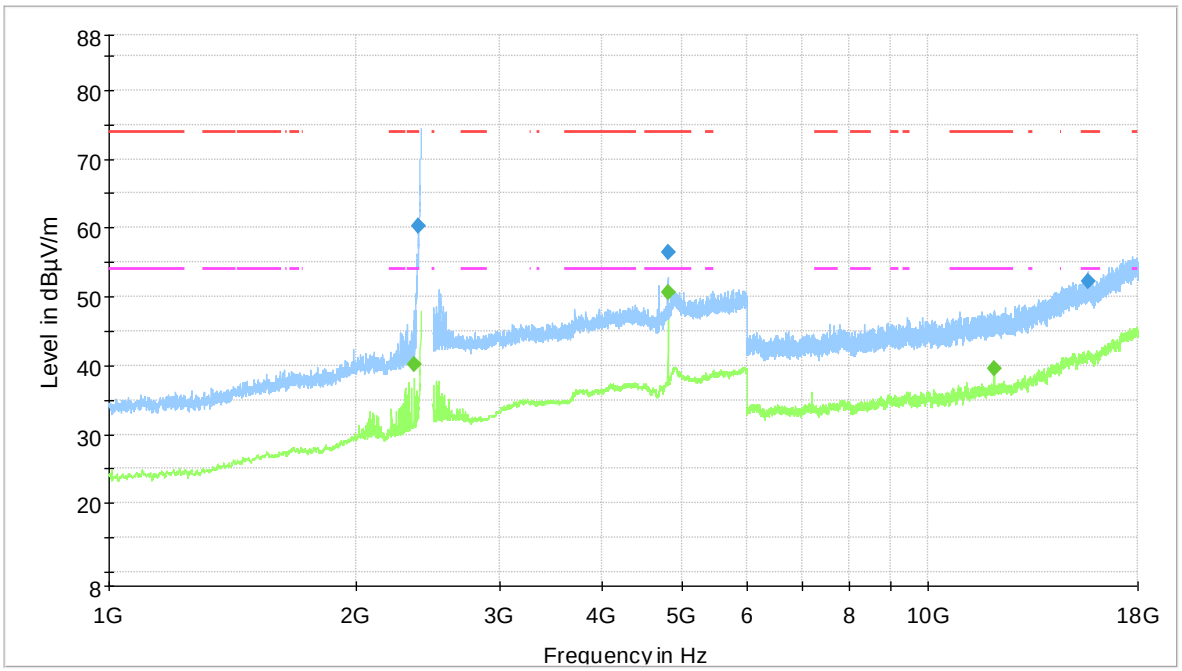
  - Vertical Polarization



Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
255.99	1	24.87	46.00	-21.13	266.80	1.12	Horizontal	1.00	13.80
135.99	2	20.55	43.50	-22.95	146.70	1.01	Vertical	1.00	13.75

Prüfdokumentation
Test documentation

- **1-18 GHz, lowest channel (worst case configuration)**

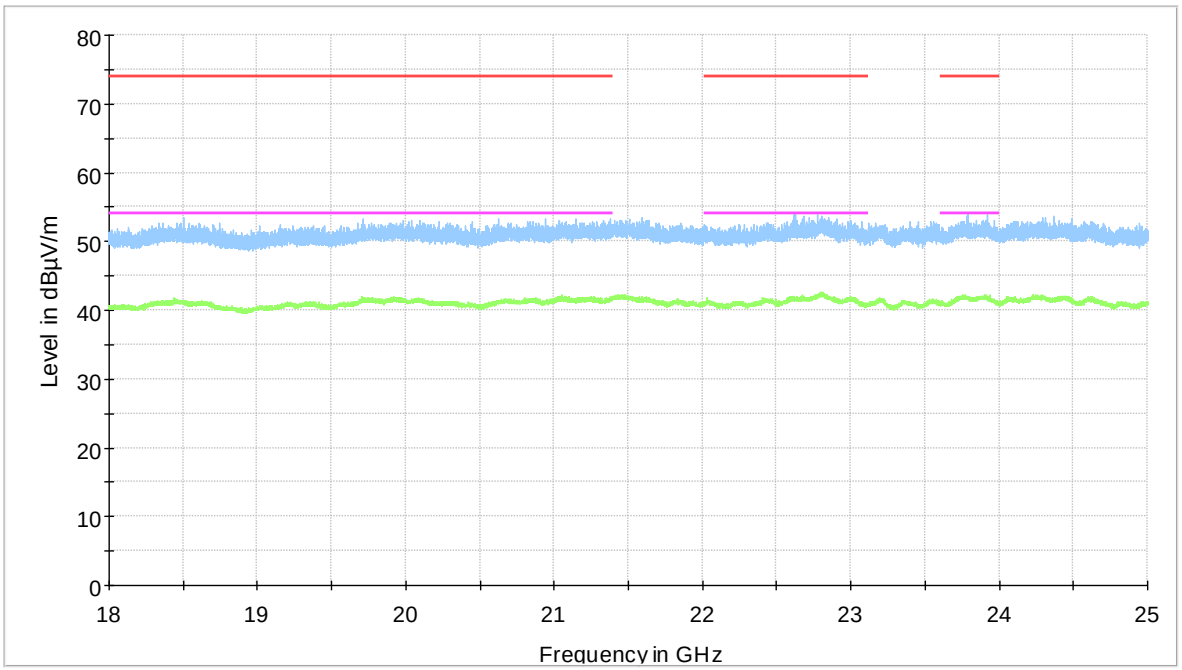


Preview Result 2-AVG
FCC_15C_15.209_Radiated_Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated_Emissions_Avg
Final_Result AVG

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)
2354.042857	---	40.08	54.00	13.92	100.0	1000.000	150.0	V	97.0	89.0	-0.4
2382.498214	60.28	---	74.00	13.72	100.0	1000.000	150.0	V	82.0	86.0	0.8
4803.991250	56.47	---	74.00	17.53	100.0	1000.000	150.0	H	82.0	342.0	7.7
4804.068750	---	50.52	54.00	3.48	100.0	1000.000	150.0	H	82.0	352.0	7.7
12008.691458	---	39.50	54.00	14.50	100.0	1000.000	150.0	H	11.0	27.0	1.7
15629.431250	52.23	---	74.00	21.77	100.0	1000.000	150.0	H	73.0	75.0	6.7

Prüfdokumentation
Test documentation

- **18-25 GHz, lowest channel (worst case configuration)**



Preview Result 2-AVG
FCC_15C_15.209_Radiated_Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
FCC_15C_15.209_Radiated_Emissions_Avg
Final_Result AVG

Final test result	Pass

Fotodokumentation
Photo documentation

5 Test Setup Photo

Photos see Appendix to this report (Appendix to 60432905-002)

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*
Test System TS8997: Power Meter: OSP-B157 Spectrum Analyzer: FSV-30 Signal Generator: SMB100A Vector Signal Generator: SMBV100A	Rohde & Schwarz	2728871	07.2019	07.2021
Fully Anechoic Room	Albatross Projects GmbH	2959749	10.2018	10.2021
RSE-Filtersystem	Rohde & Schwarz	9002802	12.2020	12.2021
Signal Analyser UXA N9041B	Keysight	2971644	02.2020	02.2021
Antenna HF907	Rohde & Schwarz	2856263	08.2018	08.2021
Antenna, Double Ridged Horn Antenna 3116C-PA	ETS LINDGREN	2900393	10.2020	10.2022
Antenna HFH 2	Rohde & Schwarz	2728893	06.2018	06.2021
Semi-Anechoic Chamber 30-1000 MHz	Siemens	2729645	06.2020	06.2022
Antenna VULB 9168	Schwarzbeck	2728787	09.2019	09.2022
Receiver ESU 26	Rohde & Schwarz	2728898	08.2020	08.2021

6.2 Software

Test Software	**Developer**	**Version**
EMC32	Rohde & Schwarz	10.60.10
BAT-EMC	NEXIO	3.19.1.25

Änderungsverzeichnis
Change history

7 Change History

<table>
<tr><th>Revision Number</th><th>List of revisions</th><th>Date of issue</th></tr>
<tr><td>60432905-001</td><td>Initial Release</td><td>25.01.2021</td></tr>
<tr><td>60432905-002</td><td>
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<tr><td>4</td><td>26</td><td>Inserted</td><td>Photos see Appendix to this report (Appendix to 60432905-002)</td><td>Alaa Bustati</td><td>2021-02-24</td></tr>
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<tr><td>6</td><td>17</td><td>Inserted</td><td>It verified that conducted signal test is electrically identical with original certificate, items re-tested are only for technical reference</td><td>Alaa Bustati</td><td>2021-02-24</td></tr>
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Test Setup: Radiated Measurements (9 kHz - 30 MHz)
/
Test Setup: Radiated Measurements (30 MHz - 1 GHz)
/
Test Setup: Radiated Measurements (1 GHz to 25 GHz)
/
Test Setup: Conducted Measurements</td><td>Alaa Bustati</td><td>2021-02-24</td></tr>
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</td><td>24.02.2021</td></tr>
<tr><td colspan="3">Note: Latest revision report will replace all previous reports.</td></tr>
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Änderungsverzeichnis
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Ende des Prüfberichts
End of Test Report