

Prüfbericht-Nr.: <i>Test report no.:</i>	DE26YPMS 001	Auftrags-Nr.: <i>Order no.:</i>	1200141 100	Seite 1 von 35 Page 1 of 35
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	665263	Auftragsdatum: <i>Order date:</i>	2025-09-10	
Auftraggeber: <i>Client:</i>	seepex GmbH, Scharnhölzstr. 344, 46240 Bottrop, Deutschland			
Prüfgegenstand: <i>Test item:</i>	Laboratory Equipment / Sensor Gateway			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	SGRIQB024DC0000001			
Auftrags-Inhalt: <i>Order content:</i>	Prüfung der Funkparameter nach FCC & ISCED Test of radio parameters acc. to FCC & ISCED			
Prüfgrundlage: <i>Test specification:</i>	Teilprüfung / Partial test Simultaneous test FCC CFR Part 15, 22, 24, 27 ISCED RSS 247, 130, 132, 139, 199			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2026-03-30	For reasons of confidentiality, no photos of the EUT are included in this report. For EUT and test setup photos please see the Photo Documentation to this report Number.		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A004236733-001 to 008			
Prüfzeitraum: <i>Testing period:</i>	2026-04-07 - 2026-04-22			
Ort der Prüfung: <i>Place of testing:</i>	Nürnberg Nuremberg			
Prüflaboratorium: <i>Testing laboratory:</i>	Wireless Labor Wireless Test Lab			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	10.07.2026 X 	genehmigt von: <i>authorized by:</i>	13.07.2026 X 	
Datum: <i>Date:</i>	Signiert von: Primoz Erzen	Ausstellungsdatum: <i>Issue date:</i>	Signiert von: Matthias Kraeutlein	
Stellung / Position:	Sachverständige(r)/Expert	Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / <i>Other:</i>	Product FCC ID: 2BV3O-SGRIQB024DC; Product IC: 35585-SGRIQB024DC			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	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 basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2023, 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. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2023, 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. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>
5	Wenn auf dem Bericht kein Akkreditierungshinweis aufgebracht ist, wurde der Bericht nicht im akkreditierten Bereich erstellt und ist folglich auch nicht vom EA MLA abgedeckt. Unabhängig davon wurde der Bericht auf Basis der allgemeinen Regeln der ISO/IEC 17000er Reihe erstellt. Mit "#" gekennzeichnete Prüfungen sind nicht Bestandteil der Akkreditierung D-PL-14169-03-00. <i>If there is no accreditation notice on the report, the report has not been produced in the accredited area and is consequently not covered by the EA MLA. Regardless of this, the report has been prepared based on the general rules of the ISO/IEC 17000 series. Tests marked with "#" are not covered by the accreditation D-PL-14169-03-00.</i>

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Produktbeschreibung
Product description

1	Test item	Laboratory Equipment / Sensor Gateway
2	Typ-No.	SGRIQB024DC0000001
3	Test sample obtaining	☒ Sampling by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	Provided Samples	A004236733-001 to 008
5	Radiated measurements sample	A004236733-003 (rad. sample)
6	Serial-No.	A004236733-003 (rad. Sample): SN1003
7	Supported radio technologies evaluated in this report	BLE; LTE Cat M1; LTE NB-IoT
8	Supported radio technologies not evaluated in this report	-
9	Description of EUT	Dry run protection with IoT monitoring capability
10	Software / Firmware (declared*)	V1.0 contains BLE: lq_base_nrf52_dtm (07.04.2026) LTE: lq_base_dualmode_rs485log_no_ble (07.04.2026) V2.2.1
11	Hardware (declared*)	V3.2
12	Companion Device used for radio connection with the EUT	CMW500
13	Auxiliary equipment used to set up the EUT	Laptop with USB to Serial adapter and NRF-Connect Software V5.2.1 (Direct Test Mode V. 2.5.3)
14	Accessory Devices used together with the EUT	Power Supply provided by TÜV Rheinland (ID 9077561)
15	Temperature Range	-20 to +60
16	Environment	Indoor and Outdoor

*declared by customer

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Absatz <i>Clause</i>	Anforderungen - Prüfungen / <i>Requirements - Tests</i>	Bemerkungen/ <i>Remarks</i>	Ergebnis <i>Result</i>
FCC §15.247 (d) ISED RSS-247 sec. 6.6	Unwanted Emissions		P ☒ F ☐ N/A ☐ N/T ☐
FCC §2.1051	Spurious emissions at antenna terminals	Test have been performed in radiated mode	P ☒ F ☐ N/A ☐ N/T ☐
FCC §2.1053	Field strength of spurious emissions (cabinet radiation with antenna ports terminated)	Not required when radiated measurements are performed to demonstrate compliance to the spurious emission limits at antenna terminals (KDB971168 D01 sect.7).	P ☐ F ☐ N/A ☒ N/T ☐
FCC §15.207 ISED RSS-Gen sec. 8.8	AC Power Conducted Emissions	-	P ☒ F ☐ N/A ☐ N/T ☐

Note :

All further tests described in the standards are not assessed as declared by customer.

The tested requirements and worst-case modes of operation for the tests are as declared by customer.

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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: DE0018EUT Classification

2 EUT Classification

2.1 Wireless technologies and frequencies supported by the EUT.

Technology	Applied Standard		Frequency range	Test report	Sup. by the EUT	Eval. in this report
	FCC CFR 47	ISED RSS-	TX [MHz]			
LTE Band 85	§27.5(c)	130	699-716		☒	☐
LTE Band 12	§27.5(c)	130	699-716		☒	☒
LTE Band 13	§27.5(b)	130	777-787		☒	☐
LTE Band 26	#Part 90 S	NA	814-824		☒	☐
	Part 22 H	132	824-849		☒	☐
LTE Band 5	Part 22 H	132	824-849		☒	☐
LTE Band 8	27.5(n)	NA	897.5-900.5		☒	☐
LTE Band 66	§27.5(d)	139	1710-1780		☒	☒
LTE Band 4	§27.5(d)	139	1710-1755		☒	☐
LTE Band 25	Part 24 E	133	1850-1915		☒	☐
LTE Band 2	Part 24 E	133	1850-1910		☒	☐
BLE	§15.247	247	2400-2483.5		☒	☐

The worst-case modes were declared by customer.

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2.2 Standard specific classification of the EUT

2.2.1 Applied standards

2.2.1.1 Part 22, 24, 27

FCC CFR 47 Part 22 Subpart H

FCC CFR 47 Part 24 Subpart E

FCC CFR 47 Part 27

ISED RSS-130 I2:02/2019

ISED RSS-132 I4:01/2023

ISED RSS-139 I4 incl. Amendment:10/2022

ISED RSS-199 I4:07/2023

2.2.1.2 Part 15

FCC CFR 47 Part 15 Subpart C- §15.247 Radiated Emission Limits and Additional Provisions for intentional Radiators operating in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (5725-5850 MHz only for FHSS devices according to §15.37(h)).

ISED RSS-247 I4:7/2025 Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt LAN Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands

2.2.2 Test Methods and Guidance Documents

2.2.2.1 General

KDB 662911 D01 v02r01:10/2011 Multiple Transmitter Output

KDB 996369 D04 v02:10/2020 Module Integration Guide

ISED RSS-Gen I5 incl. Amendment 2:2021 General Requirements for Compliance of Radio Apparatus

2.2.2.2 Part 22, 24, 27

ANSI C63.26:2015

FCC KDB 971168 D01 v03r01 Power Meas License Digital Systems

FCC KDB 971168 D02 v02r01 Misc Rev Approv License Devices

FCC KDB 412172 D01 v01r01 Determining ERP and EIRP

2.2.2.3 §15.247

FCC KDB 558074 D01 v05r02:04/19 DTS Measurement Guidance (ISED accepted alternate)

ANSI C63.10:2020 incl. Corrigendum 1:2023

ANSI C63.10a:2024 incl. Errata to C63.10a:2024, applied for ISED, only

Unless otherwise specified, in this documentation ANSI C63.10 refers to ANSI C63.10:2020 incl.

Corrigendum 1:2023 for FCC and ANSI C63.10a:2024 incl. Errata C63.10a:2024 for ISED. Any differences are stated where applicable.

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3 Test conditions and configurations

3.1 Normal environmental test conditions

Environmental condition	Parameter	Range during test
Temperature	°C	21 – 24
Relative humidity	%	20 – 60
Supply voltage EUT	V	24 DC
Accessory Device (power supply)*	V	120 AC 60Hz

*If not stated otherwise, the Accessory Device (power supply) was used to power the EUT. For radiated measurements the Accessory Device (power supply) was placed outside the chamber, and the cables were filtered at the point of feed-through.

3.2 Equipment modifications

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

3.3 Test Modes

Test case	Worst case Configuration
Radiated Spurious Emissions < 30 MHz	CatM1 Band12; NB-IoT Band 26; BLE 2400MHz 1Mbps
Radiated Spurious Emissions 30 MHz – 1 GHz	CatM1 Band12; NB-IoT Band 26; BLE 2400MHz 1Mbps
Radiated Spurious Emissions > 1 GHz	CatM1 Band12; NB-IoT Band 26; BLE 2400MHz 1Mbps

3.3.1 Test Modes Setup BLE

Mode description	Mode configuration
All Modes	For radiated TX measurements below 1GHz, no auxiliary equipment was connected to the EUT during test. The auxiliary equipment was only connected to the EUT before the tests for the mode configuration. For radiated TX measurements above 1GHz, the auxiliary equipment was connected to the EUT outside the chamber during the tests. The connection cables were grounded and filtered at the point of feed-through. For setting up the EUT, the Software NRF-Connect in direct Test Mode was used.
Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12	The EUT was set to TX-Mode with max Power (8dBm) and Modulation LE 1Mbps
Mode 2: BLE 2400MHz 1Mbps, NB-IoT Band 66	The EUT was set to TX-Mode with max Power (8dBm) and Modulation LE 1Mbps
Mode 3: N/A	
Mode 4: N/A	

The given modes were declared by the customer as worst case configurations.

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3.3.2 Test Modes Setup LTE Cat-M1, NB-IOT

Test Modes LTE Cat-M1	Mode configuration (achieved by using the CMW 500 as companion device)	
Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12	Connection state	Connection established / RRC State Connected
	Modulation	QPSK
	Power	Maximum Power
	BW=1.4MHz, Mid Range (UL=707.5MHz; DL=737.5MHz; all RBs used)	

The given modes were declared by the customer as worst case configurations.

Test Modes NB-IOT	Mode configuration (achieved by using the CMW 500 as companion device)	
Mode 2: BLE 2400MHz 1Mbps, NBIOT Band 66	Connection state	Connection Established / RRC State Connected
	Subcarrier Spacing	15 kHz
	# Subcarriers / Start SC	1 / 0
	MCS, TBS	0, BPSK
	Operation mode	Standalone
	Pattern	Continuous UL
	UL Frequency: 1745 MHz; DL Frequency: 2145 MHz	

The given modes were declared by the customer as worst case configurations.

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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 ETSI TR 100 028-1/-2 and ETSI TS 103 051 (radiated measurements) and is documented in the quality system acc. to ISO/IEC 17025:2017.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation.

The stated values are the expanded uncertainty values, the measured value lies within the assigned range of values with a probability of 95% ($k = 1.96$).

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 Conducted Spurious Emissions (RX/TX)	1.0	dB	9k-1GHz
	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	%	-

Measured value	Limit	Extended measurement uncertainty ($k=1.96$)	Confidence interval (95%)
19 dBm @ 2.48GHz	20 dBm	1.7 dB	17.3 dBm – 20.7 dBm

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4 Test results in detail

FCC Part 2, Subpart J, §2.947 (f):

A composite system is a system that incorporates different devices contained either in a single enclosure or in separate enclosures connected by wire or cable. If the individual devices in a composite system are subject to different technical standards, each such device must comply with its specific standards. In no event may the measured emissions of the composite system exceed the highest level permitted for an individual component. Testing for compliance with the different standards shall be performed with all of the devices in the system functioning. If the composite system incorporates more than one antenna or other radiating source and these radiating sources are designed to emit at the same time, measurements of conducted and radiated emissions shall be performed with all radiating sources that are to be employed emitting.

996369 D04 Module Integration Guide, 3.1:

The host manufacturer is responsible to ensure that when their product operates as intended it does not have any emissions present that are out of compliance that were not present when the transmitters were tested individually.

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4.1 Individual device for technologies according to FCC CFR 47 §15.247

4.1.1 Unwanted Emissions

4.1.1.1 Description

Unwanted Emissions are any emissions outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating

4.1.1.2 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d); RSS-247 sec. 6.6:

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.

Attenuation below the general limits specified in § 15.209(a) and RSS-Gen sec. 8.9 is not required.

Radiated emissions which fall in the restricted bands, as defined in § 15.205(a) and RSS-Gen sec.8.10, must comply with the radiated emission limits specified in § 15.209(a) and RSS-Gen sec. 8.9.

FCC Part 15, Subpart C, §15.209; RSS-Gen sec. 8.9; Radiated Emission Limits:

Frequency [MHz]	Measurement distance [m]	Limit [μA/m]	Limit [μV/m]	Limit [dBμV/m]	Limit @3m dBμV/m]	Detector
0.009 – 0.09	300	6.37/F*	2400/F*	48.5 ... 28.5	128.5 ... 108.5	AVG(Pk)
0.09 – 0.11	300	6.37/F*	2400/F*	28.5 ... 26.8	108.5 ... 106.8	QP
0.11 – 0.49	300	6.37/F*	2400/F*	26.8 ... 13.8	106.8 ... 93.8	AVG(Pk)
0.49 – 1.705	30	63.7/F*	24000/F*	33.8 ... 23.0	73.8 ... 63.0	QP
1.705 – 30	30	0.08	30	29.5	69.5	QP
30 – 88	3		100	40.0	40.0	QP
88 – 216	3		150	43.5	43.5	QP
216 – 960	3		200	46.0	46.0	QP
960 - 1000	3		500	54.0	54.0	QP
1000 - 40000	3		500	54.0	54.0	AVG(Pk)

*F in kHz

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency ranges 9–90kHz, 110–490kHz and above 1000MHz where the measurements are employing a linear average detector.

FCC Part 15, Subpart C, §15.35(b); RSS-Gen sec. 8.1:

..., 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....

FCC Part 15, Subpart A, §15.33 (a)(1); ANSI C63.10 clause 5.5; RSS-Gen sec. 6.13.2:

For an intentional radiator operating below 10 GHz, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

FCC Part 15, Subpart C, §15.31 (f); RSS-Gen sec. 6.5, 6.6:

When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 40 dB/decade for frequencies below 30MHz and 20 dB/decade for frequencies at or above 30MHz.

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For this documentation the distance extrapolation factor was added to the limit that was calculated using this formula:

$$Emission\ limit_{meas} \left(\frac{dB\mu V}{m} \right) = Emission\ limit + EF * \log \left(\frac{d_1}{d_2} \right)$$

Where

d_1 : standard distance (e. g. 30 m)
 d_2 : measurement distance (e. g. 3 m)
EF: extrapolation factor (20 or 40)

The field strength E is calculated using the following equation:

$$E = RawRec + Corr$$

While

$$Corr = AF + SigPathAtt + PreampAtt$$

Were

E: electric field value
RawRec: Receiver reading
AF: Antenna factor
SigPathAtt: Signalpath losses
PreampAtt: Preamplifier losses

For example, if a Receiver reading of 1dBμV was measured and the Antenna factor is 2 dB/m, the Signalpath losses are 3dB and the Preamplifier losses are -10dB, then the Correction is calculated to:
Corr = (2+3-10) dB= -5dB and the Final electric field strength E is calculated to:
E = (1 +(- 5)) dBμV/m = -4 dBμV/m

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4.2 Individual device for Technologies according to FCC CFR 47 Part 22/24/27

4.2.1 Radiated Spurious Emissions

4.2.1.1 Description

The primary necessity for radiated emissions testing is to demonstrate that any spurious emissions radiating from the EUT cabinet, control circuitry, power leads, or intermediate circuit elements, which would be missed in a totally dedicated conducted test, comply with the applicable limits. Such a test can only be performed in a radiated test configuration.

In addition, many contemporary portable transmitters utilize integral antennas, precluding access to an antenna output port from which to perform conducted compliance measurements. For these types of transmitters, all of the data necessary to demonstrate compliance must be measured in a radiated test configuration.

4.2.1.2 Requirements / Limits

Technology	Frequency range	Applied Standard		Limit conducted	RBW	OOB and Special limits		
	TX [MHz]	FCC CFR 47§	ISED RSS-	[dBm]		Offset from edge	Limit [dBm]	RBW
LTE Band 85	698-716	27.53(g)	130 sec. 4.7.1	-13	100k	+/-100kHz	-13	30kHz
LTE Band 12	699-716	27.53(g)	130 sec. 4.7.1	-13	100k	+/-100kHz	-13	30kHz
LTE Band 17	704-716	27.53(g)	130 sec. 4.7.1	-13	100k	+/-100kHz	-13	30kHz
LTE Band 13	777-787	27.53(c),(f)	130 sec. 4.7.1	-13	100k	+/-100kHz 1559-1610 MHz 763-775 MHz 793-806 MHz	-13 -70 /-80* -46dBm -35dBm	30kHz 100kHz 6.25 kHz 6.25 kHz
LTE Band 26	814-824	#90.691	NA	-13	100k	+/-37.5kHz	-20	1%OBW
	824-849	22.917(a),(b)	132 sec. 5.5	-13	100k/1M	+/-1MHz	-13	1%OBW
GSM850	824-849	22.917(a),(b)	132 sec. 5.5	-13	100k/1M	+/-1MHz	-13	1%OBW
LTE Band 5	824-849	22.917(a),(b)	132 sec. 5.5	-13	100k/1M	+/-1MHz	-13	1%OBW
LTE Band 8	897.5-900.5	27.1509	NA	-13	100k	+/-100kHz	-13	1%OBW
LTE Band 66	1710-1780	27.53(h)	139 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW
LTE Band 4	1710-1755	27.53(h)	139 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW
GSM1900	1850-1915	24.238(a),(b)	133 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW
LTE Band 2	1850-1910	24.238(a),(b)	133 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW
LTE Band 25	1850-1915	24.238(a),(b)	133 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW
LTE Band 41	2496-2690	27.53(m)(4),(6)	NA	-25	1M	0..+/-5MHz	-10	1MHz
						+/(5 .. X) MHz	-13	1MHz
LTE Band 41	2500-2690	NA	199 sec. 5.6	-13	1M	+/-1MHz	-13	1%OBW

X = max(6MHz, 26dB-OBW); OBW: FCC 26db-OBW; ISED: 99%-OBW

* emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

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KDB971168 D01 sect. 6.1: When no explicit signal characteristic specification is made (e.g., peak, average, power averaging (rms)), then it should be assumed that the unwanted emissions are to be measured in a manner consistent with how the power or PSD in the fundamental emission is measured

ANSI C63.26 sec. 5.2.3.1: Even when the RF output power or unwanted emissions limits are expressed in terms of average power or PSD, including ERP or EIRP, it is usually acceptable to demonstrate compliance with peak power measurement data under the presumption that the peak power level will always be greater than or equal to the average power level, regardless of RF signal type.

KDB971168 D01 sect. 5.7.2(g): The measurement of emissions immediately outside the block/band/channel shall account for the width of the window that the instrument uses to perform the measurement. If the measurement is performed with the RBW centered exactly at the band edge frequency, then one-half of the measurement bandwidth RBW will capture power contained within the block/band/channel and thus bias the measurement. For this reason, the frequency range that must be examined begins at an offset of RBW/2 relative to both the upper and lower band edge frequencies

KDB 971168 D01: Normally, the applicable rule part specifies the reference bandwidth for measuring unwanted emission levels (typically, 100 kHz if the authorized frequency band/block is at or below 1 GHz and 1 MHz if the authorized frequency band/block is above 1 GHz), effectively depicting the unwanted emission limit in terms of a power spectral density. In those cases where no reference bandwidth is explicitly specified, the values in the preceding sentence should be used.

Typically, a measurement (resolution) bandwidth smaller than the reference bandwidth is allowed for measurements within a specified frequency range at the edge of the authorized frequency block/band (e.g., within the first Y MHz outside of the authorized frequency band/block, where the value of Y is specified in the relevant rule part). Some FCC out-of-band emission rules permit the use of a narrower RBW (typically limited to a minimum RBW of 1 % of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

ANSI C63.26-2015 - Section 4.4.3: Below 30 MHz, substitution method testing is not required. Rather, the magnetic field strength is measured using a loop antenna and the result is converted to EIRP, ERP, or radiated field strength as specified by the applicable requirements. By convention, magnetic field strength is converted to an electric field strength based on the free space impedance [$1 \mu\text{V/m} = (377 \Omega) \times 1 \mu\text{A/m}$], then electric field strength is converted to radiated power using the equation $\text{EIRP (dBm)} = \text{E (dB}\mu\text{V/m)} + 20\log(\text{D}) - 104.8$; where D is the measurement distance (in the far field region) in m. ($\text{ERP} = \text{EIRP} - 2.15$),

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4.2.1.3 Test Method

For integration measurements, the transmit frequency, including fundamental components of modulation are not tested, as these emissions are assumed not to be affected by the integration.

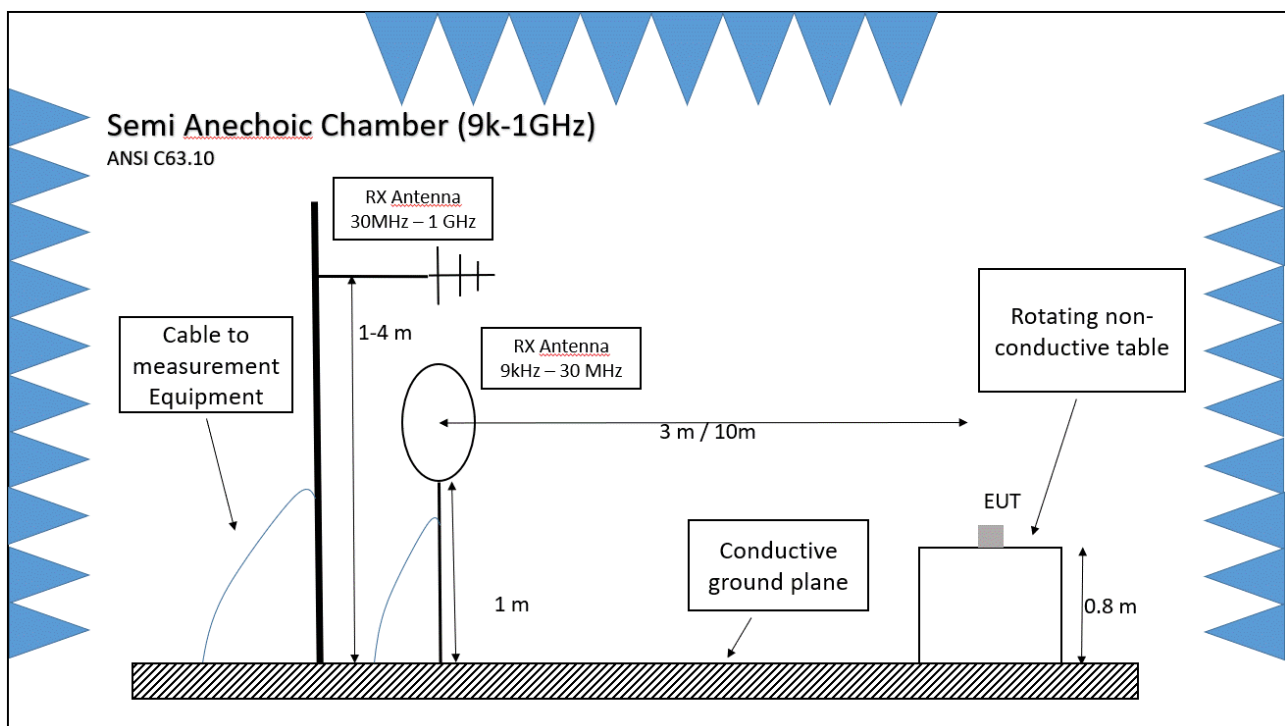
A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. Preliminary emission testing was performed inside the anechoic chamber. The measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. The different measurement setups for each frequency range are shown below.

For the final testing, 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.

4.2.1.4 EUT positioning (Radiated Spurious Emissions)

4.2.1.4.1 EUT positioning below 1GHz

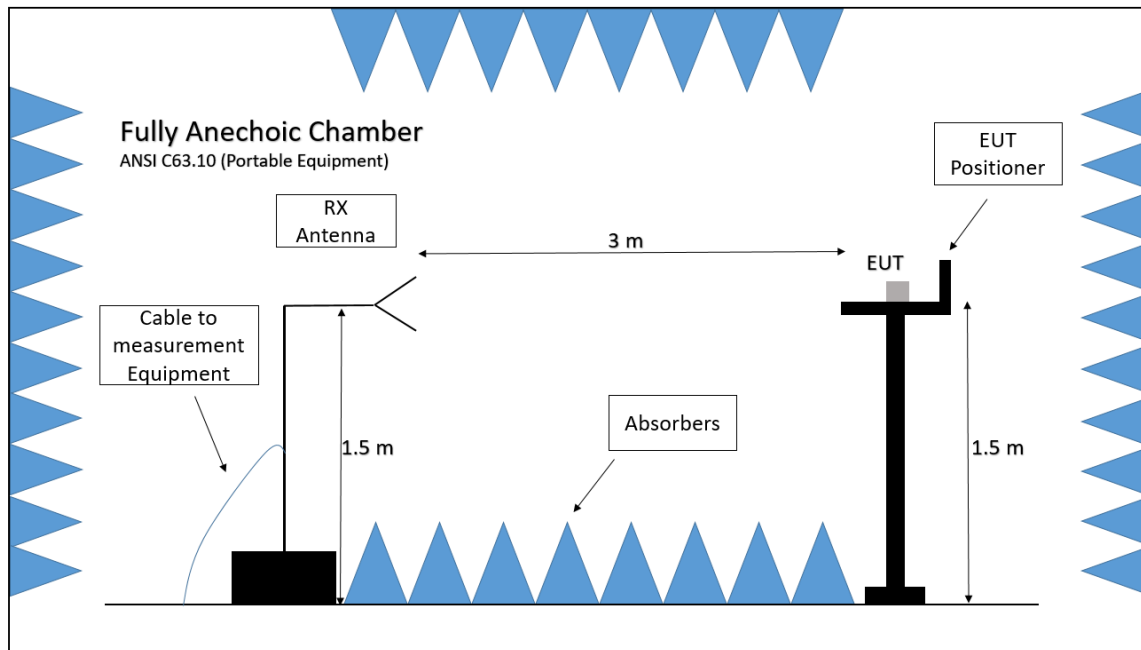


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4.2.1.4.2 EUT positioning above 1GHz



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4.2.1.5 Measurement Setup

4.2.1.5.1 Measurement Setup 9kHz - 30MHz

Test Site	SAC (Semi Anechoic Chamber)
Receiving Antenna	Loop antenna (HFH 2)
Receiving Antenna Height	1m (lowest height of Loop antenna)
Receiving Antenna Polarization	Parallel and perpendicular to the EUT
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	22.5° during exploratory tests Linear during maximizations for final measurements
Receiver Configurations	Average and peak detectors Quasi Peak detector
	RBW: 200Hz (9 - 150kHz) and 9 kHz (150kHz – 30MHz)
	Step Size: 50Hz (9-150kHz) and 2.25kHz (150k-30MHz)
	Sweep Time: 100ms (FFT) during exploratory tests Sweep Time: 1s for final measurements

4.2.1.5.2 Measurement Setup 30MHz - 1GHz

Test Site	Semi-anechoic chamber
Receiving Antenna	Hybrid Antenna VULB 9168
Receiving Antenna height	Varied (1m to 4m, step size 1m) during exploratory tests Linear during maximizations for final measurements
Receiving Antenna Polarization	Horizontal and Vertical
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	45° during exploratory tests Linear during maximizations for final measurements
Receiver Configurations	Average and peak detector
	RBW :120 kHz
	Step Size: 30kHz (30-1000MHz)
	Sweep Time: 20ms (FFT) during exploratory tests Sweep Time: 1s for final measurements

4.2.1.5.3 Measurement Setup above 1GHz

Test Site	Fully-anechoic chamber
Receiving Antenna	Horn Antenna HF907 (1-18GHz), 3116C-PA (18-40GHz)
Receiving Antenna Height	1.5m
Receiving Antenna Polarization	Horizontal – Vertical
EUT Positioner	40cm x 60cm non-conductive positioner 1.5m 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: 60s during exploratory tests Sweep Time: 10s for final measurements

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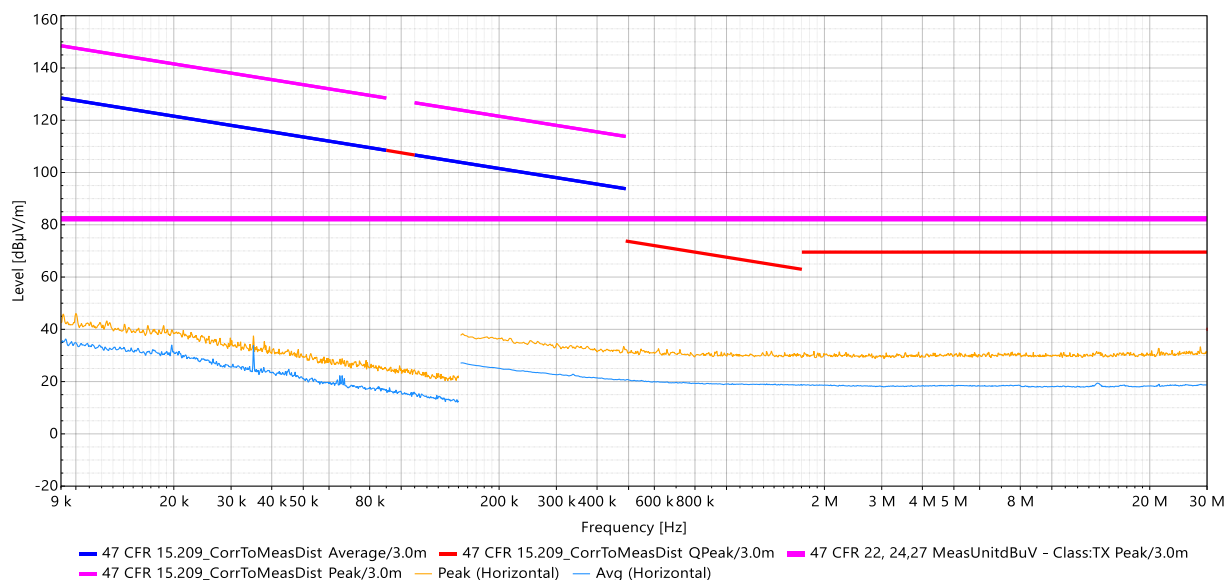
4.2.1.6 Test Setup (Radiated Spurious Emissions)

EUT	A004236733-003 (rad. sample)	
Companion device	CMW500	
Operation mode	☒ 1: BLE 2400MHz 1Mbps, CatM1 Band12 ☐ 3: N/A	☒ 2: BLE 2400MHz 1Mbps, NB-IOT Band 66 ☐ 4: N/A
Further parameters	-	
Test engineer	Primož Erzen	

4.2.1.7 Test results

4.2.1.7.1 9 kHz to 30 MHz, Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12

4.2.1.7.1.1 Perpendicular Polarization

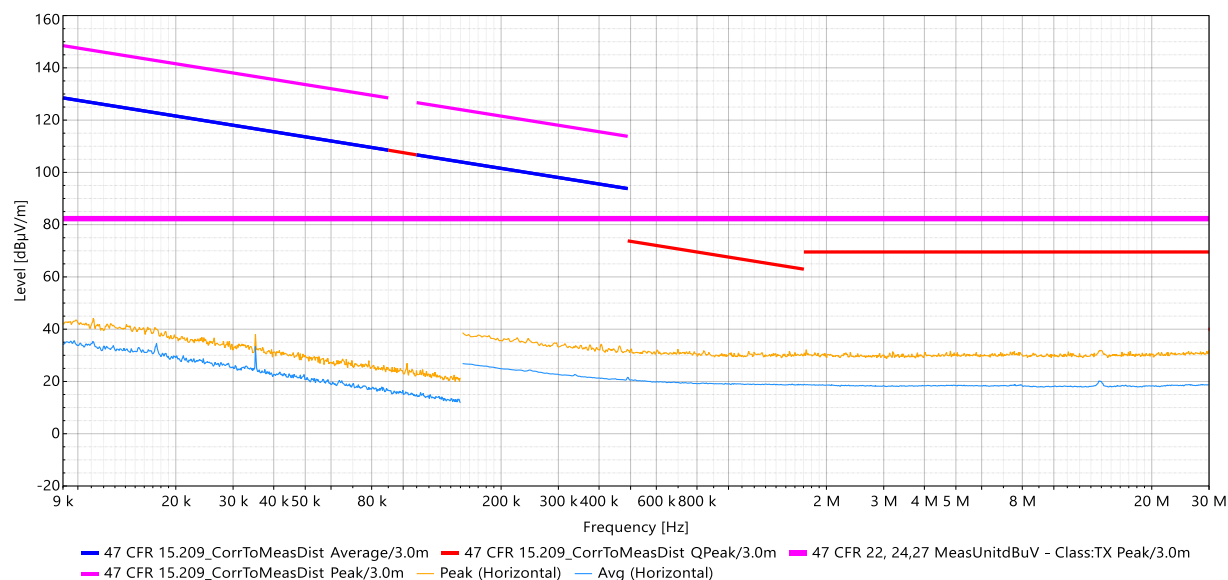


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4.2.1.7.1.2 Parallel Polarization



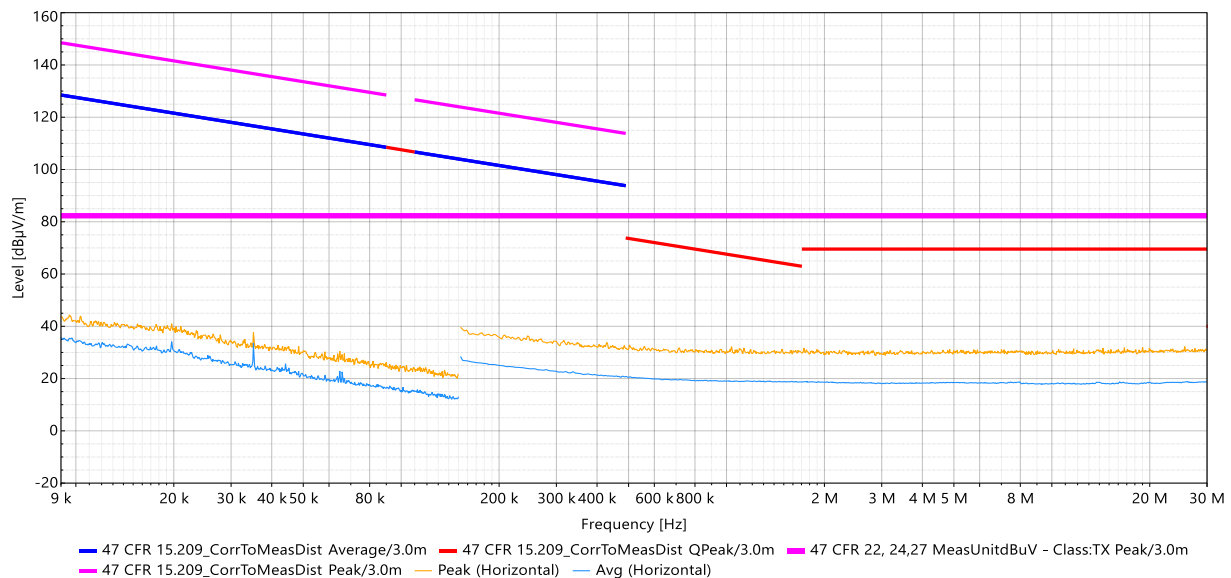
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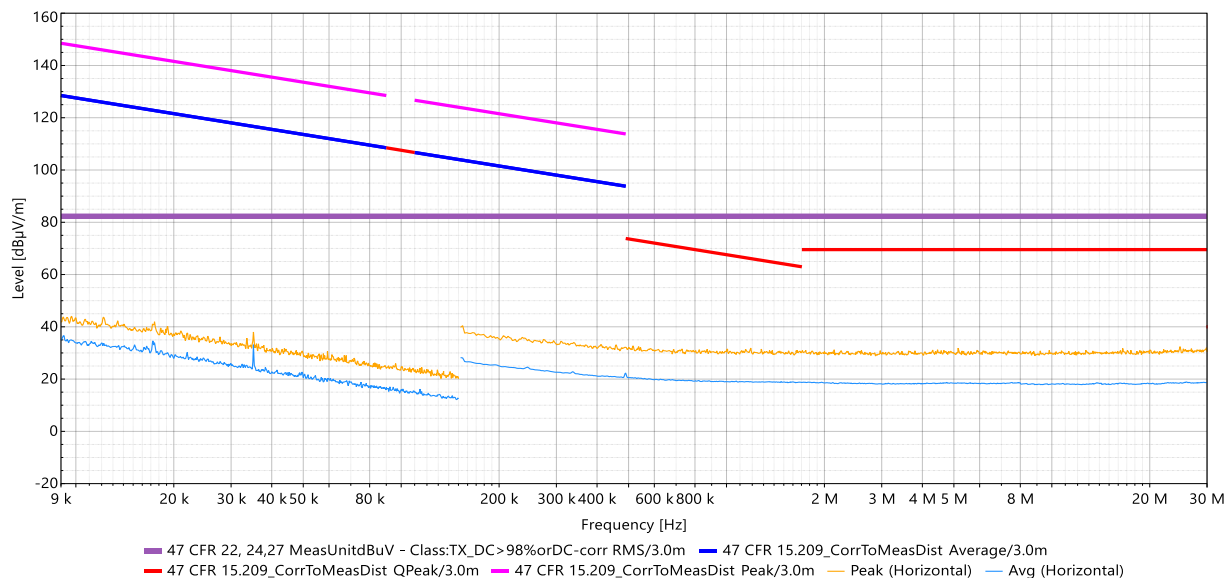
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4.2.1.7.2 9 kHz to 30 MHz, Mode 2: BLE 2400MHz 1Mbps, NB-IOT Band 66

4.2.1.7.2.1 Perpendicular Polarization



4.2.1.7.2.2 Parallel Polarization



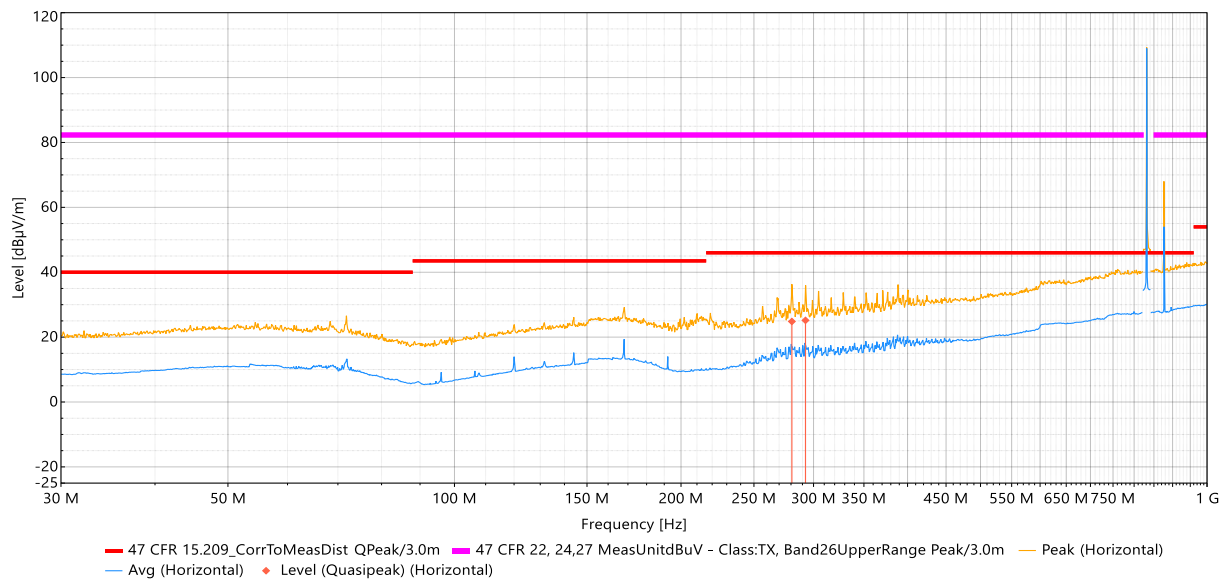
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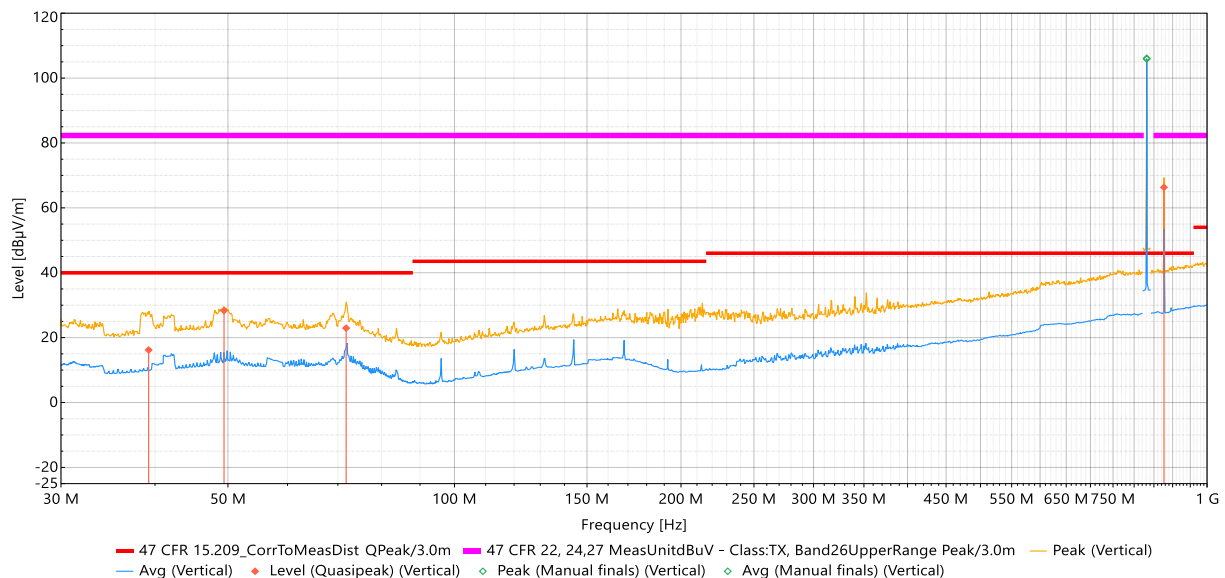
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4.2.1.7.3 30 MHz to 1 GHz, Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12

4.2.1.7.3.1 Horizontal Polarization



4.2.1.7.3.2 Vertical Polarization



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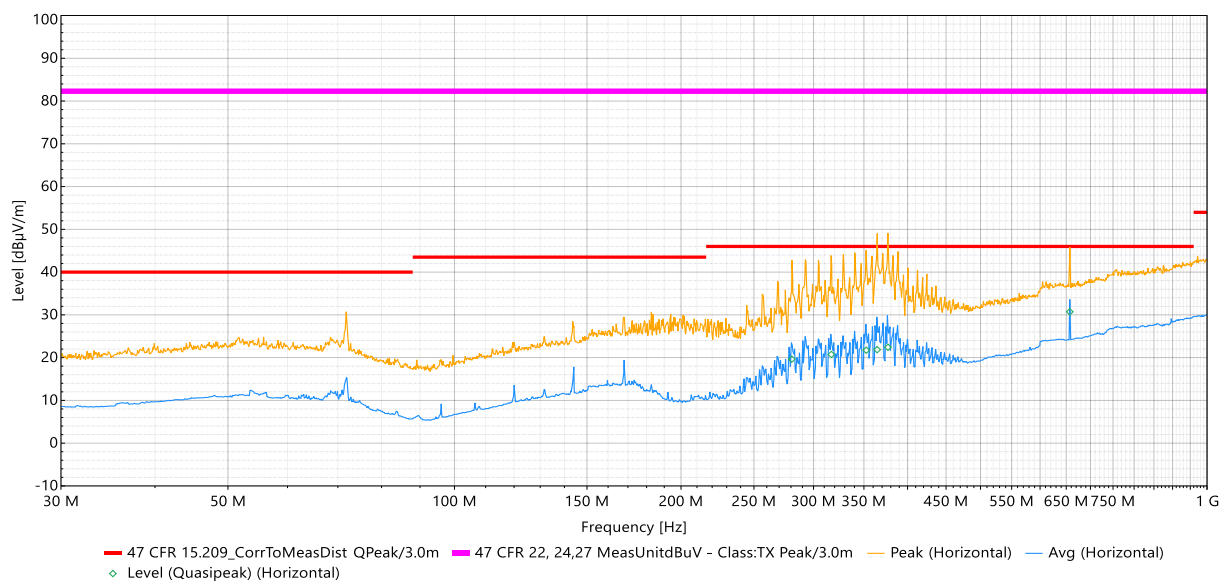
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4.2.1.7.3.3 Summary

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Pol	Azimuth (deg)	Height (m)	Corr. (dB)
39.231 M	16.2	40.0	-23.8	V	213.5	1.18	19.6
49.406 M	28.3	40.0	-11.7	V	260.8	1.80	20.7
71.791 M	22.9	40.0	-17.1	V	161.5	1.00	18.4
280.762 M	24.8	46.0	-21.2	H	123.9	1.12	21.3
292.703 M	25.2	46.0	-20.8	H	104.4	1.06	21.7
876.507 M	Wanted Signal Companion Device			V	175.0	1.25	33.2
831.41 M	Wanted Signal EUT			V	300.0	1.00	33.0

4.2.1.7.4 30 MHz to 1 GHz, Mode 2: BLE 2400MHz 1Mbps, NB-IOT Band 66

4.2.1.7.4.1 Horizontal Polarization

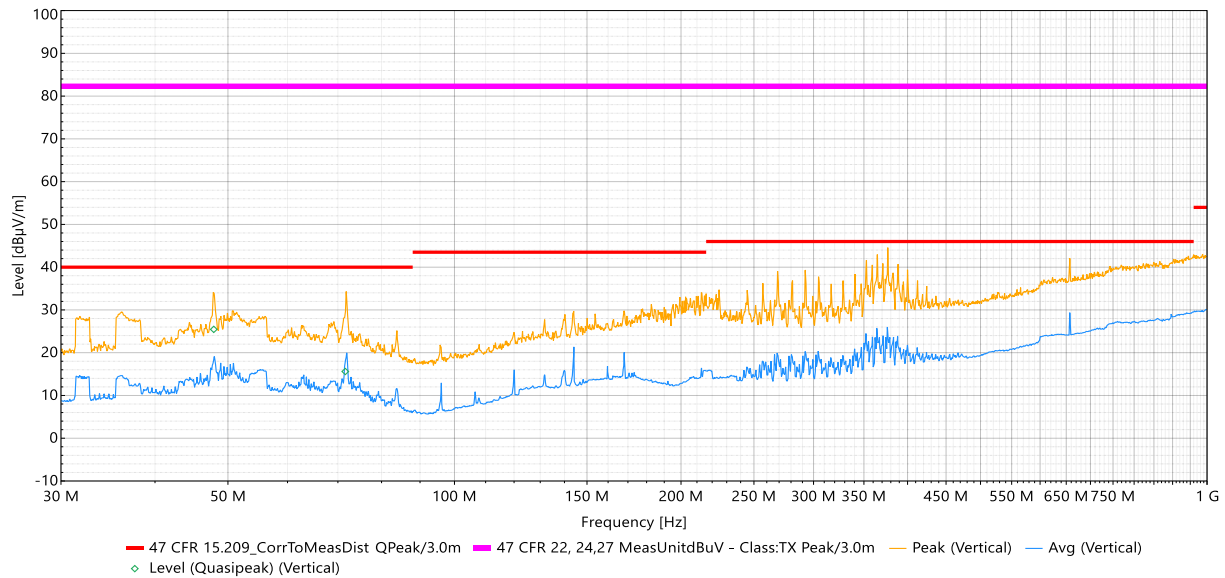


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4.2.1.7.4.2 Vertical Polarization



4.2.1.7.4.3 Summary

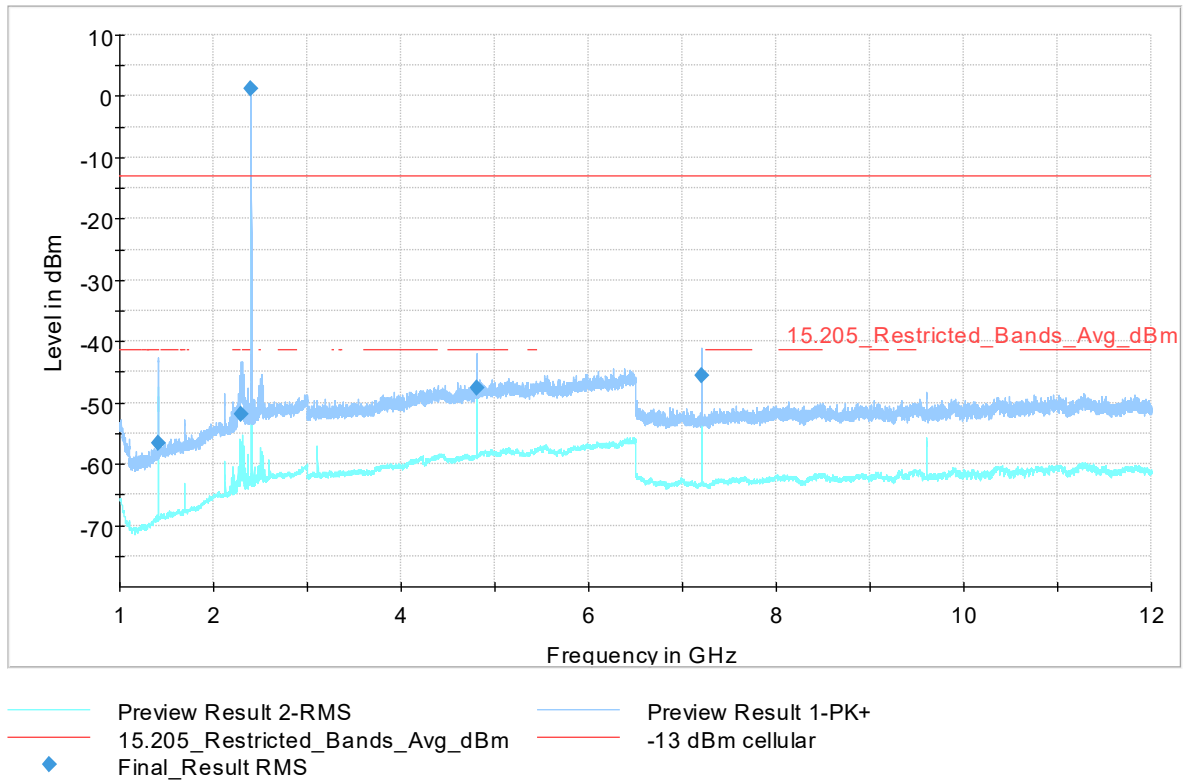
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Pol	Azimuth (deg)	Height (m)	Corr. (dB)
47.88 M	25.5	40.0	-14.5	V	216.0	1.50	20.7
71.6 M	15.6	40.0	-24.4	V	114.3	3.56	18.4
280.678 M	19.6	46.0	-26.4	H	101.8	1.61	21.3
316.803 M	20.7	46.0	-25.3	H	160.4	3.98	22.3
352.526 M	21.7	46.0	-24.3	H	286.8	2.81	23.2
364.486 M	21.9	46.0	-24.1	H	119.9	3.24	23.3
376.718 M	22.4	46.0	-23.6	H	111.7	2.75	23.8
657.076 M	30.7	46.0	-15.3	H	225.5	3.08	30.0

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4.2.1.7.5 1 to 12GHz, Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12



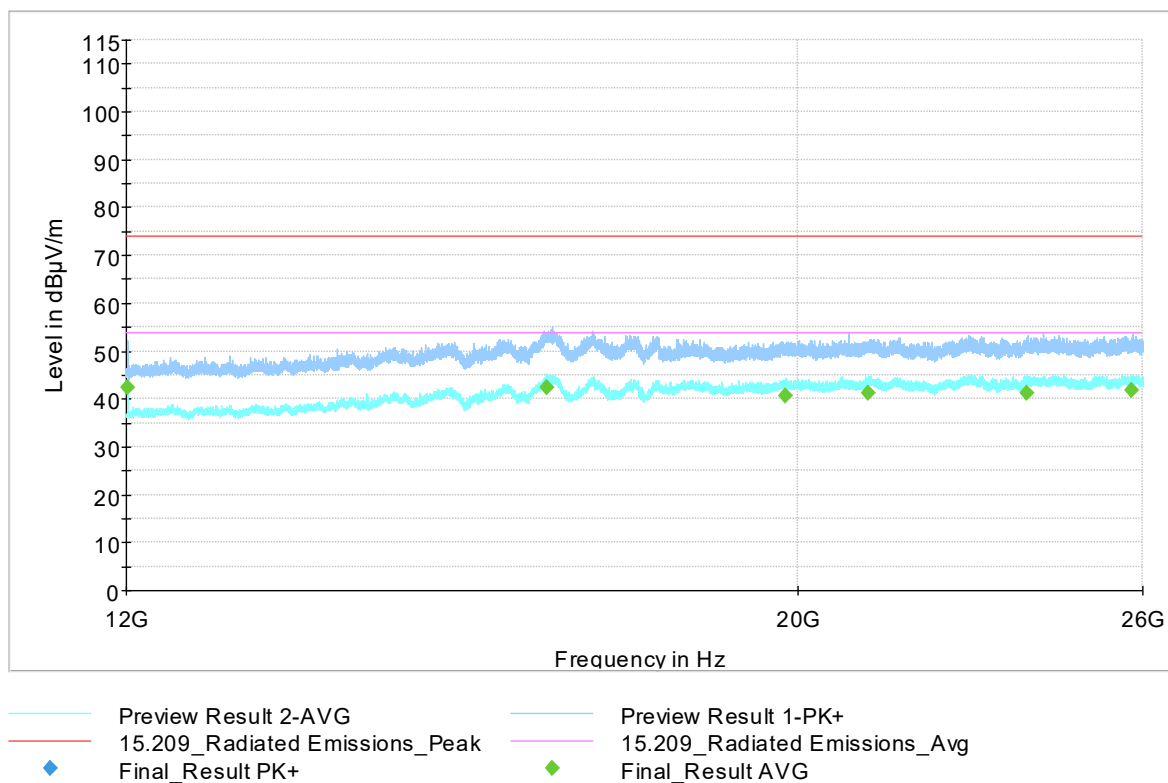
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1415.935065	-56.50	-13.00	43.50	10.0	1000.0	150.0	V	345.0	52.0	-91.5
2289.571429	-51.87	-13.00	38.87	10.0	1000.0	150.0	H	210.0	31.0	-87.5
2402.090909	Wanted emission BLE			10.0	1000.0	150.0	H	209.0	13.0	-86.6
4803.707792	-47.50	-13.00	34.50	10.0	1000.0	150.0	H	69.0	96.0	-89.1
7205.181818	-45.62	-13.00	32.62	10.0	1000.0	150.0	H	326.0	40.0	-102.4

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4.2.1.7.6 12 to 26GHz, Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12



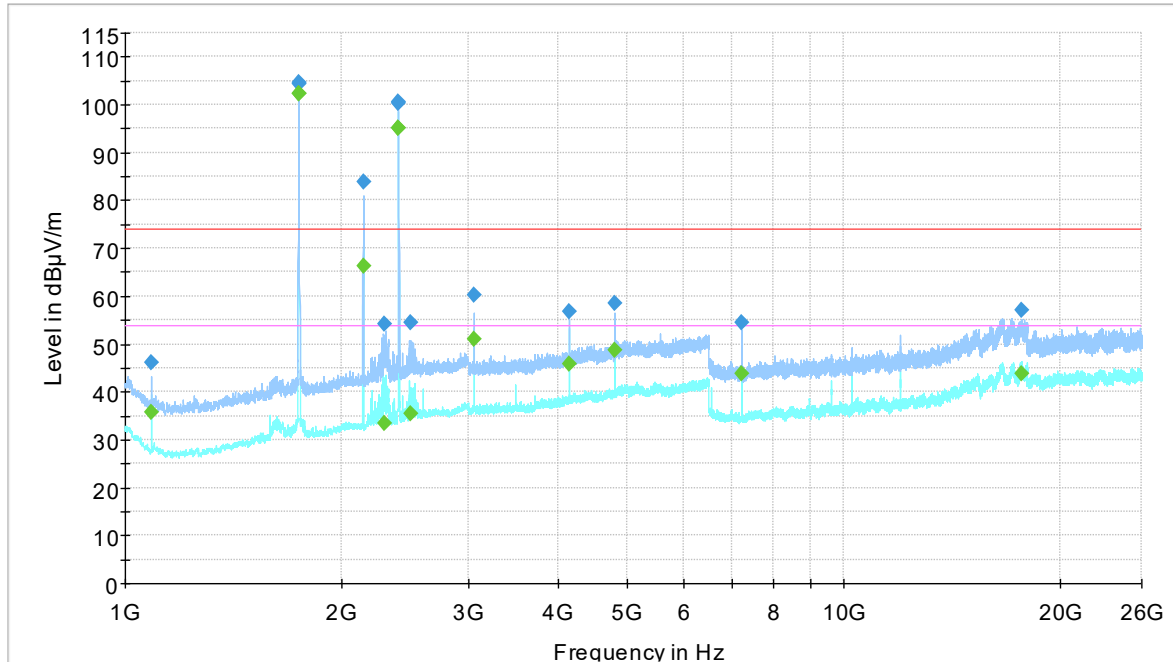
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
12008.82	42.47	54.00	11.53	1000	1000.00	150.0	V	106.0	86.0	-0.2
16518.94	42.32	54.00	11.68	1000	1000.00	150.0	V	221.0	-1.0	8.8
19818.54	40.63	54.00	13.37	1000	1000.00	150.0	V	102.0	70.0	19.8
21103.40	41.11	54.00	12.89	1000	1000.00	150.0	H	101.0	30.0	20.0
23815.60	41.31	54.00	12.69	1000	1000.00	150.0	H	13.0	30.0	22.8
25795.30	41.68	54.00	12.32	1000	1000.00	150.0	H	21.0	26.0	23.2

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4.2.1.7.7 1 to 26GHz, Mode 2: BLE 2400MHz 1Mbps, NB-IOT Band 66



Preview Result 2-AVG
15.209_Radiated Emissions_Peak
Final_Result PK+
Preview Result 1-PK+
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)
1087.66	46.03	---	74.00	27.97	1000	1000.00	150.0	V	180.0	86.0	4.9
1087.66	---	35.88	54.00	18.12	1000	1000.00	150.0	V	180.0	86.0	4.9
1744.88	Wanted emission Band 66				1000	1000.00	150.0	H	189.0	35.0	7.7
2145.10	Wanted emission companion device				1000	1000.00	150.0	V	284.0	72.0	9.7
2296.26	---	33.55	54.00	20.45	1000	1000.00	150.0	V	205.0	90.0	9.9
2296.26	54.21	---	74.00	19.79	1000	1000.00	150.0	V	205.0	90.0	9.9
2401.93	Wanted emission BLE				1000	1000.00	150.0	H	179.0	-6.0	10.7
2498.18	54.42	---	74.00	19.58	1000	1000.00	150.0	H	207.0	15.0	11.5
2498.18	---	35.53	54.00	18.47	1000	1000.00	150.0	H	207.0	15.0	11.5
3059.16	---	50.91	54.00	3.09	1000	1000.00	150.0	H	220.0	5.0	3.2
3059.16	60.14	---	74.00	13.86	1000	1000.00	150.0	H	220.0	5.0	3.2
4146.31	---	45.72	54.00	8.28	1000	1000.00	150.0	V	35.0	100.0	5.9
4146.31	56.64	---	74.00	17.36	1000	1000.00	150.0	V	35.0	100.0	5.9
4804.33	58.48	---	74.00	15.52	1000	1000.00	150.0	H	235.0	47.0	8.3
4804.33	---	48.84	54.00	5.16	1000	1000.00	150.0	H	235.0	47.0	8.3
7205.29	---	43.83	54.00	10.17	1000	1000.00	150.0	V	257.0	35.0	-5.0
7205.29	54.53	---	74.00	19.47	1000	1000.00	150.0	V	257.0	35.0	-5.0
17701.8	---	43.79	54.00	10.21	1000	1000.00	150.0	V	22.0	18.0	11.3
17701.8	57.15	---	74.00	16.85	1000	1000.00	150.0	V	22.0	18.0	11.3

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4.3 AC Power Conducted Emission

4.3.1 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)

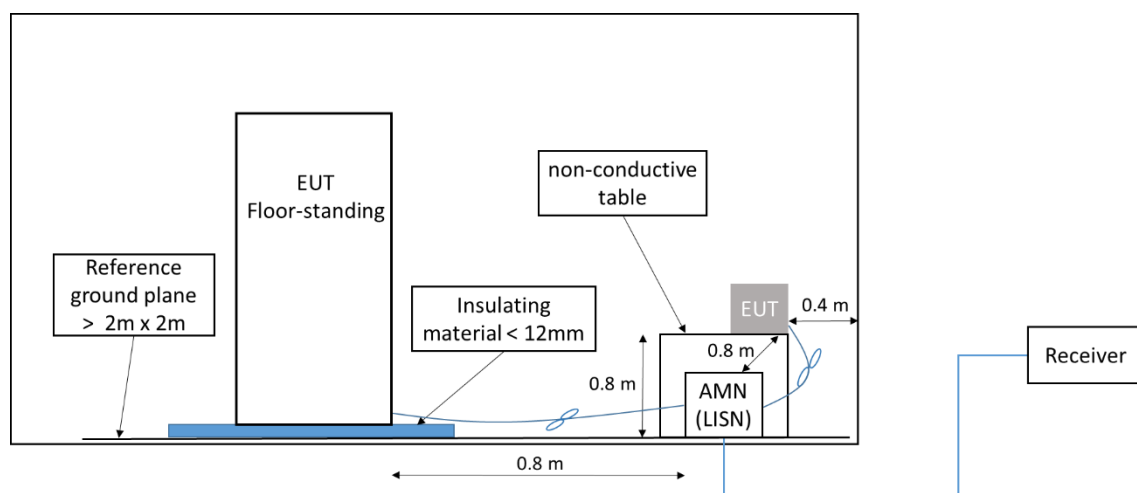
... Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested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

KDB174176 D01 Line Conducted FAQ v01r01:

For a device operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna within the transmitter's fundamental emission band.

4.3.2 Test Method

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



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4.3.3 Test Setup (AC Power Conducted Emission)

EUT	A004236733-003 (rad. sample)	
Companion device	CMW500	
Operation mode	☐ 1: BLE 2400MHz 1Mbps, CatM1 Band12	☒ 2: BLE 2400MHz 1Mbps, NB-IOT Band 66
	☐ 3: N/A	☐ 4: N/A
Further parameters	-	
Test engineer	Primož Erzen	

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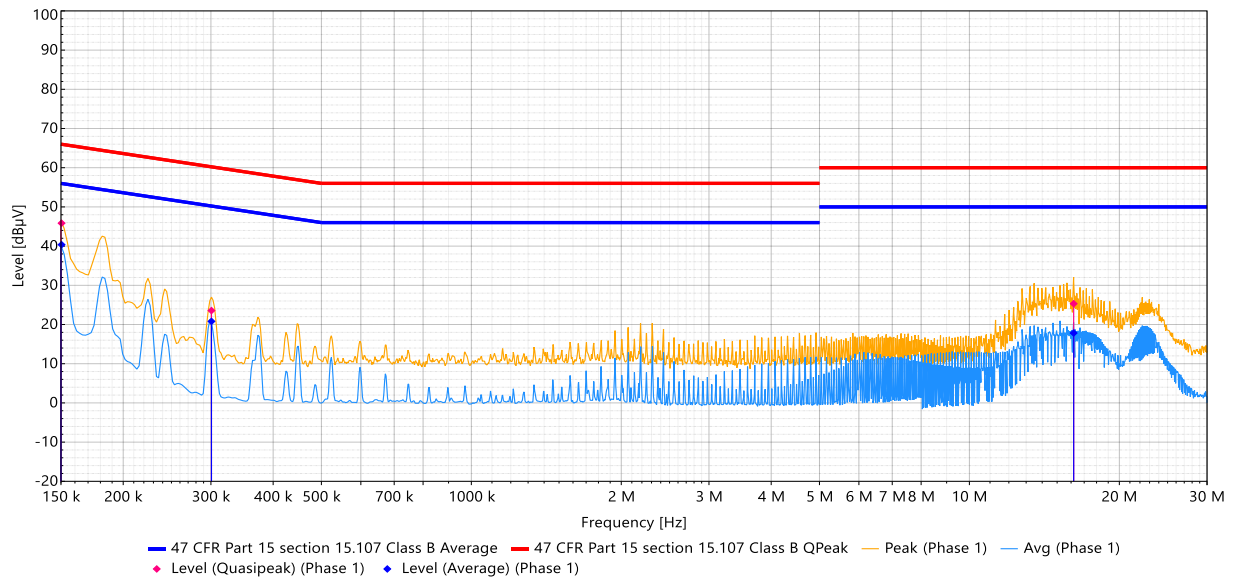
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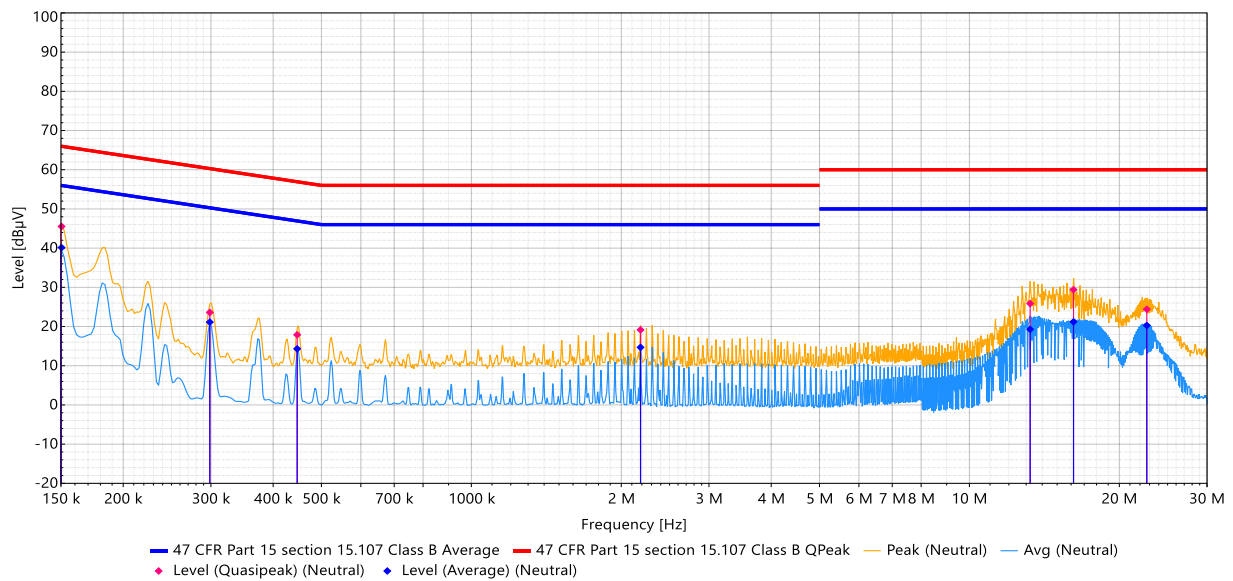
4.3.4 Test results (AC Power Conducted Emission)

4.3.4.1.1 Mode 1: BLE 2400MHz 1Mbps, CatM1 Band12

4.3.4.1.2 Line: Phase 1



4.3.4.1.3 Line: Neutral



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4.3.4.1.4 Summary

QuasiPeak

Frequency (Hz)	SR #	Level (dBµV)	Limit (dBµV)	Margin (dB)	Pos	Correction (dB)	M. time (s)	Comments
150 k	2	45.5	66.0	-20.5	Neutral	10.0	1.0	Pass
150 k	1	45.8	66.0	-20.2	Phase 1	10.0	1.0	Pass
298.5 k	2	23.6	60.3	-36.7	Neutral	10.0	1.0	Pass
300.75 k	1	23.6	60.2	-36.7	Phase 1	10.0	1.0	Pass
447 k	2	17.9	56.9	-39.0	Neutral	10.0	1.0	Pass
2.186 M	2	19.1	56.0	-36.9	Neutral	10.0	1.0	Pass
13.243 M	2	25.9	60.0	-34.1	Neutral	10.4	1.0	Pass
16.184 M	2	29.4	60.0	-30.6	Neutral	10.4	1.0	Pass
16.195 M	1	25.3	60.0	-34.7	Phase 1	10.3	1.0	Pass
22.709 M	2	24.4	60.0	-35.6	Neutral	10.5	1.0	Pass

Average

Frequency (Hz)	SR #	Level (dBµV)	Limit (dBµV)	Margin (dB)	Pos	Correction (dB)	M. time (s)	Comments
150 k	2	40.1	56.0	-15.9	Neutral	10.0	1.0	Pass
150 k	1	40.4	56.0	-15.6	Phase 1	10.0	1.0	Pass
298.5 k	2	21.1	50.3	-29.2	Neutral	10.0	1.0	Pass
300.75 k	1	20.8	50.2	-29.4	Phase 1	10.0	1.0	Pass
447 k	2	14.3	46.9	-32.6	Neutral	10.0	1.0	Pass
2.186 M	2	14.7	46.0	-31.3	Neutral	10.0	1.0	Pass
13.243 M	2	19.3	50.0	-30.7	Neutral	10.4	1.0	Pass
16.184 M	2	21.2	50.0	-28.8	Neutral	10.4	1.0	Pass
16.195 M	1	17.8	50.0	-32.2	Phase 1	10.3	1.0	Pass
22.709 M	2	20.3	50.0	-29.7	Neutral	10.5	1.0	Pass

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Fotodokumentation
Photo documentation

5 Test Setup Photo

For reasons of confidentiality, no photos of the EUT are included in this report.
For EUT and test setup photos please see the Photo Documentation to this report Number.

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Zusatzdokumentation
Additional documentation

6 Application form

The following information was provided by the customer and form the basis for the execution of the tests and the assessment of conformity. The given information can affect the results of both.

No application form was provided.

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Liste der verwendeten Prüfmittel
List of used test equipment

7 Equipment List

Prüfmittel Test equipment				Kalibrierung Calibration	
			ID	Letzte Last	Nächste Next
E-FAR 3	Fully Anechoic Room Test software: R&S EMC32 V10.60.20	Albatross Projects	2959749	31.03.2026 *	31.03.2027
	FSU 26 Spectrum Analyzer	Rohde & Schwarz	2844118	20.08.2025	20.08.2027
	UXA N9041B Signal Analyzer	Keysight	2971644	24.06.2024	24.06.2026
	RSE-Filtersystem	Rohde & Schwarz	9002802	23.02.2026 *	23.02.2027
	HF907 Antenna 1-18GHz	Rohde & Schwarz	2856263	10.09.2024	10.09.2027
	3116C-PA Horn Antenna 18-40GHz	ETS LINDGREN	2900393	30.01.2026	30.01.2029
	FHAD46-C2L05 Temperature & Humidity Logger	Ahlborn	9074526	30.09.2025	30.09.2026
E-SAC 10	Semi Anechoic Chamber Test Software: NEXIO BAT-EMC V2022.0.19.0	Siemens	9049495	03.09.2025	03.09.2027
	ESU 26 Receiver	Rohde & Schwarz	2723865	22.10.2025	22.10.2026
	HFH 2 Loop Antenna 9kHz-30MHz	Rohde & Schwarz	2728893	05.08.2024	05.08.2027
	VULB 9168 Antenna 30MHz – 1GHz	Schwarzbeck	2728136	05.10.2023	05.10.2026
	FHAD46-C2 Temperature & Humidity Logger	Ahlborn	9074528	30.09.2025	30.09.2026
C-SC -CE	Shielded Chamber Test Software: NEXIO BAT-EMC V2022.0.19.0	-	2728833	-	-
	ESU 8 Receiver	Rohde & Schwarz	2728844	19.08.2025	19.08.2027
	ESH2-Z5 Line Impedanz Stabilization Network	Rohde & Schwarz	2731908	16.07.2024	16.07.2027
	ESH3-Z2 Limiter	Rohde & Schwarz	9017596	05.09.2024	05.09.2026
	FHAD46-C2 Temperature & Humidity Logger	Ahlborn	9074531	30.09.2025	30.09.2026
DC Power Supply		Manson	9077561	11.02.2026 *	11.02.2028

*Equipment only verified and not calibrated

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Änderungsverzeichnis
Change history

8 Change history

Revision Number	List of revisions
001	Initial Release
Note: Latest revision report will replace all previous reports.	

Ende des Prüfberichts
End of Test Report