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2023-03-21

Reference

P118379-F15

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EMC tests on Ericsson Radio 4490HP 44B5 44B12A C

Product name: Radio 4490HP 44B5 44B12A C

Product number: KRC 161 981/3

RISE Research Institutes of Sweden AB Vehicles and Automation - EMC-IKT

Performed by



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Examined by



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Commission

The tests were performed to verify that the electromagnetic compatibility of the equipment under test (EUT), meets the requirements of listed standards.

Summary

Standard	Compliant	Remarks
FCC 47 CFR part 15 B / ICES-003 Issue 7	Yes	
15.107 / 6.1 Conducted emission Power lines, class B	Yes	-
15.109 / 6.2 Radiated emission, class B	Yes	-

Description of the test object

The test object is a Remote radio Unit (Radio 4490 44B5 44B12A C) designed to provide mobile users with a connection to a mobile network.

Test configuration

RF configuration A-D: One NR, LTE and NB IoT GB carrier in B5 (60 W) per port
 One NR, LTE and NB IoT GB carrier in B12A (60 W) per port
 OIL: Opto fibre, single mode, 25 Gbit/s
 Power configuration : -48 VDC

The test object was activated for maximum transmit power. Test model FR1-TM1.1 was used in cell 1 (DL) and reference measurement channel FR1-A1-1 was used in cell1 (UL) for NR, Test model E-TM1.1 was used in cell 1 (DL) and reference measurement channel A1-3 was used in cell1 (UL) for LTE and Test model N-TM27 was used in cell 1 (DL) and reference measurement channel A14-1 was used in cell1 (UL) for NB IoT GB as defined in 3GPP TS 38.141-2.

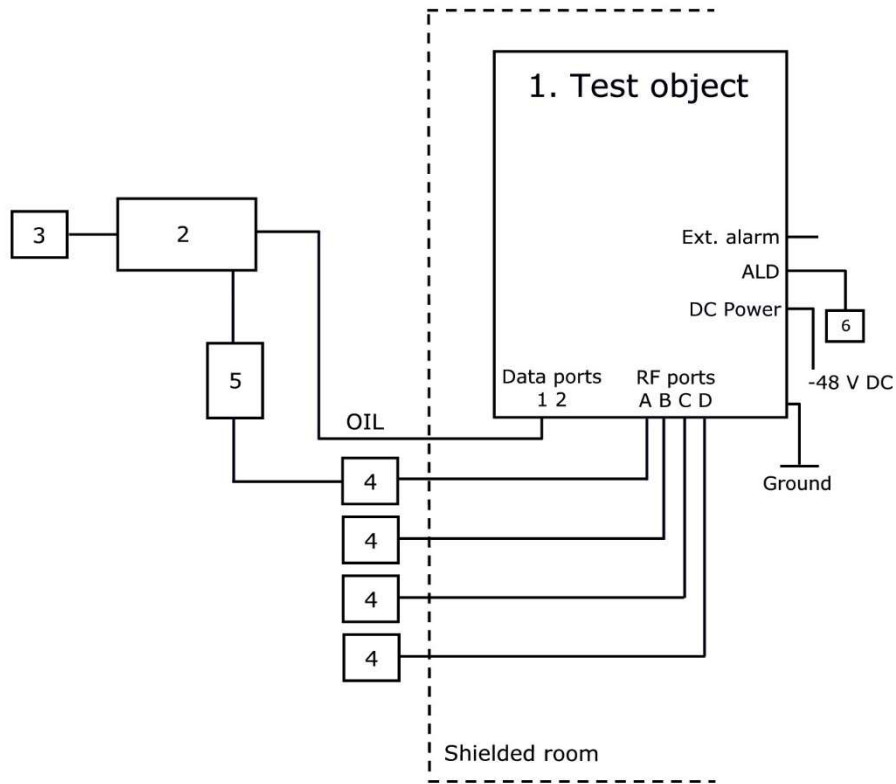
The test object was configured with all RF paths allocated to the following frequency:
 RF A-D:

NR		LTE		NB-IoT GB	
MHz	BW (MHz)	MHz	BW (MHz)	MHz	BW (MHz)
871.5	5	889	10	Top PRB of LTE	0.2
731.5	5	740	10	Top PRB of LTE	0.2

RX frequencies were configured 45 MHz below the corresponding TX frequency according to the applicable duplex offset for the operating band B5.

RX frequencies were configured 30 MHz below the corresponding TX frequency according to the applicable duplex offset for the operating band B12A.

Test setup:



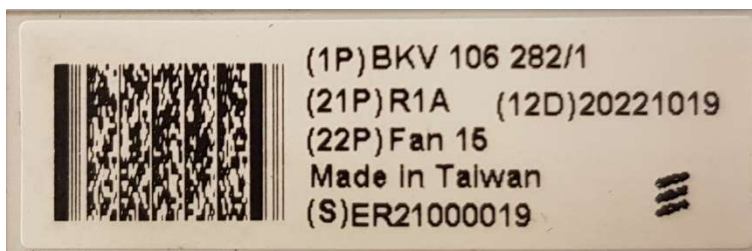
Test object:

1.	Radio 4490HP 44B5 44B12A C, KRC 161 981/3, rev. R1C, s/n: E23E486629 with radio software: CXP 2021 113/1, rev. R25A316
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Fan unit:

Product name	Product number	R-state	Serial number
Fan 15	BKV 106 282/1	R1A	ER21000019



Functional test equipment:

2.	Computer, Apple Mac mini, BAMS – 1001964632 Synbox, LPC 107 043/1, rev: R2A, s/n: A402704700, BAMS – 1001670135 Netgear switch Model GS724T, BAMS – 1001530576 RAN processor 6651, KDU 137 0093/1, rev: R2A, s/n: E23D856792 with RBS software: CXP 202 0666/1, rev. R67A281 PXIe-1085, BAMS – 1001843639 National Instruments NI PXIe-8301 National Instruments NI PXIe-5840 National Instruments NI PXIe-5840 National Instruments NI PXIe-5840 National Instruments NI PXIe-5840 National Instruments NI PXIe-5646 National Instruments NI PXIe-5646
3.	GPS Active Antenna, KRE 101 2082/1
4.	Attenuation/ Termination
5.	7x 2-way power splitters, Microlab D2-49FN
6.	RET, Andrew ATM200-A20, s/n: CN10151085133

SFP module connected to interface Data 1:

Product number	Manufacturer	Product number of Manufacturer	Serial number
RDH 102 75/3	Ericsson	25GBASE-LR I-Temp SFP28	EA61XL17BF



Interfaces:

DC power port: -48 VDC, shielded 2-wire (RPM 155 53) or 3-wire (RPM 155 54) ^{Note}	DC
RF A-D, 4.3-10 connector, combined TX/RX	Antenna
Data 1, Optical Interface Link, single mode opto fibre	Signal
Data 2, Optical Interface Link, single mode opto fibre, not used in this configuration	Signal
ALD control, shielded multi-wire	Signal
EXT alarm, shielded multi-wire	Signal
Ground wire	Ground

Note: Tests were performed with shielded 2-wire if nothing else stated in the report

Test facility

The used semi-anechoic chamber is compliant with ANSI C63.4. RISE is an ISO 17025 accredited test facility for Electromagnetic Compatibility (EMC) and Radio testing. RISE is Recognized Lab under FCC (Designation number: SE0001) and ISED (CAB identifier: SE0002).

References

Measurements were done according to relevant parts of the following standards:

ANSI C63.4-2014
ANSI C63.4a-2017
CFR 47 part 15 B, Mars, 2023
ICES-003 Issue 7
ICES-Gen Issue 1

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "RISE – 3936". The uncertainties are calculated with a coverage factor $k=2$ (95% level of confidence).

The measurement uncertainties are shown in the table below:

Standard	Method	Uncertainty \pm
ANSI C63.4	Conducted emission 150k-30 MHz, AMN (LISN)	3.1 dB
ANSI C63.4	Radiated emission 30-1000 MHz	5.9 dB
	Radiated emission 1-6 GHz	5.2 dB
	Radiated emission 6-40 GHz	5.6 dB

Note 1: The calibration results are within the specified limits of the standard.

Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered: 2023-03-14.

Test engineer

Tomas Isbring and Andreas Björnqvist, RISE.

Test participant

None.

Conducted emission

Date	Temperature	Humidity
2023-03-16	22 °C ± 3 °C	16 % ± 5 %

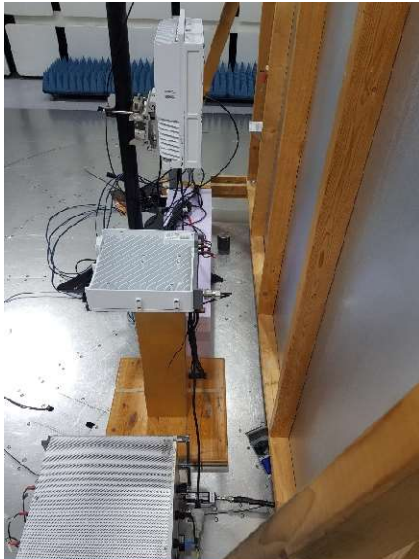
The measurements were performed according to ANSI C63.4-2014.

Test setup and procedure

The measurements on AC ports were performed with a 50 µH/50 ohm LISN.
 The measurements were performed on the AC side of the typical AC/DC power supply powered with 2-phase 208 VAC/ 60 Hz.
 The test object was standing 40 cm from the vertical ground plane during the measurements.

AC/DC power supply details (placed on the table in picture above):
 Power 6302, BML 901 367/1, rev. R1A, s/n: BR84766379.

Photo of the test setup:



Measurement equipment

Item	Name	Inv.no	Cal.due date
Semi Anechoic Chamber	Tesla	503881	
Spectrum analyzer	Rohde & Schwarz	901385	2023-07-20
RF Cable	Huber & Suhner	BX91490	2023-06-30
RF Cable	Rosenberger	503508	2023-09-08
RF Cable	Rosenberger	503509	2023-09-08
LISN, 100 A, 3P	Schwarzbeck	502112	2023-12-02
Transient Limiter	Electro-Metrics	BX42882	2023-10-03
Decoupling clamp	Lüthi	KWP01116	2024-03-04
Thermohygrometer	Testo	504188	2023-06-30

Limits

AC power port, Class B

Frequency range [MHz]	Quasi-peak [dBµV]	Average [dBµV]
0.15 to 0.5	66 to 56	56 to 46
> 0.5 to 5	56	46
> 5 to 31	60	50

NOTE: The limits decrease linearly with the logarithm of the frequency in the range 0.15 to 0.5 MHz.

Remarks

EUT Emission level (dBuV) = SA reading (dBuV) + (CableLosses (dB) + LimiterLoss (dB) + InsertionLoss_{AMN (LISN)} (dB))

The correction factors are stored in R&S EMC 32 software as separate files and activated as applicable in the Hardware setup, for each measurement configuration.

Result

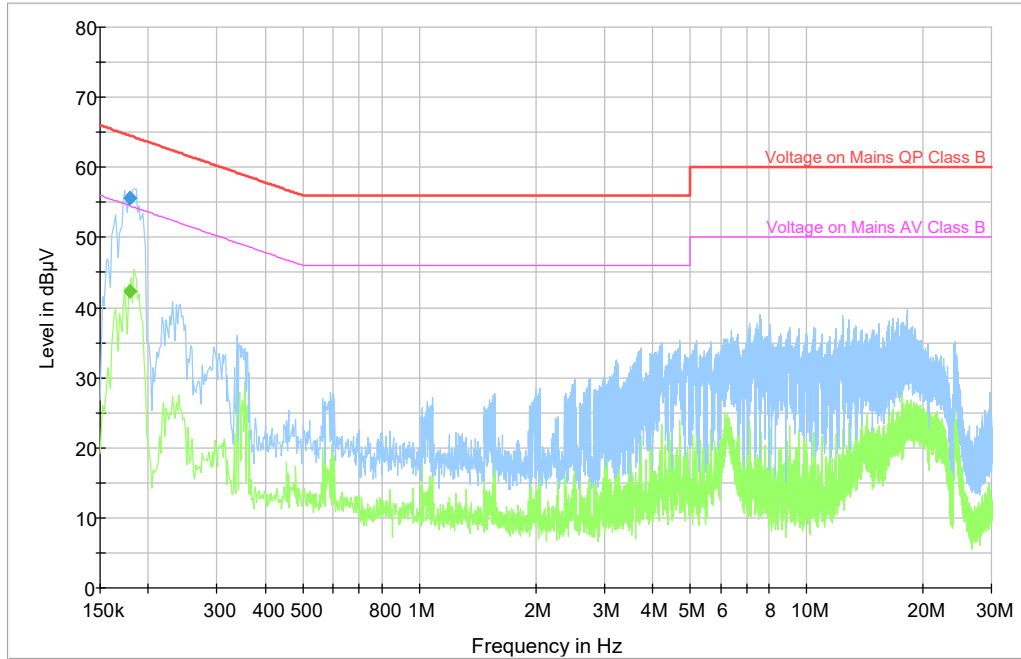
The conducted emission spectra are shown on the following pages.

Diagram 1: AC mains power port, L1 conductor

Diagram 2: AC mains power port, L2 conductor

Emission below limit?	Yes
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Diagram 1: AC mains power port, L1 conductor

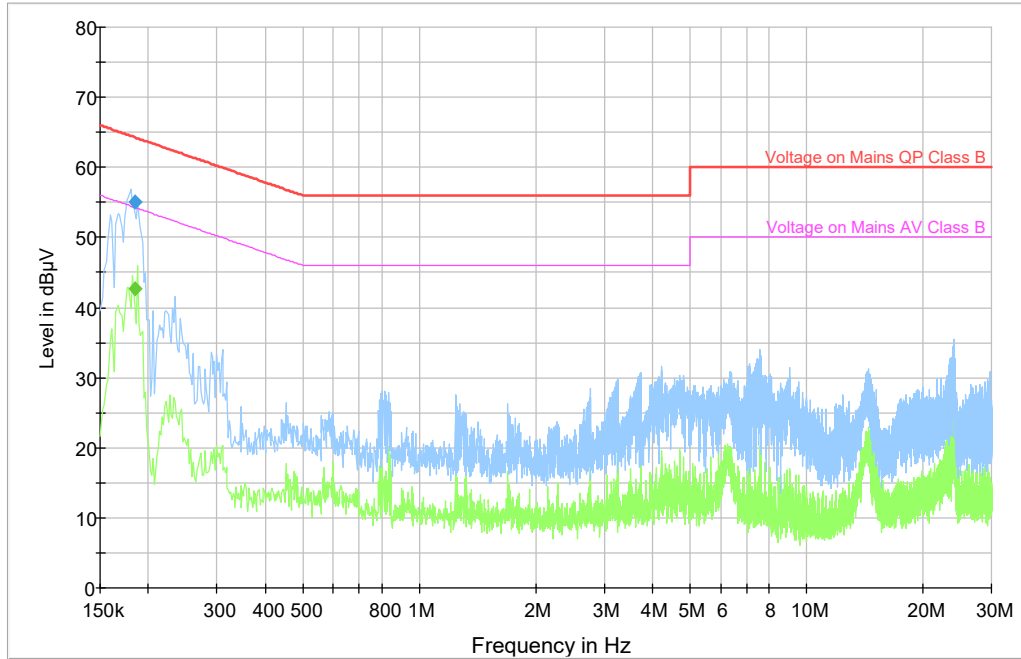


— Preview Result 2-AVG — Preview Result 1-PK+ — Voltage on Mains QP Class B
— Voltage on Mains AV Class B ◆ Final_Result QPK ◆ Final_Result CAV

Final result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.179297	55.60	---	64.52	8.92	15000.0	9.000	L1	9.9
0.179297	---	42.23	54.52	12.29	15000.0	9.000	L1	9.9

Diagram 2: AC mains power port, L2 conductor



— Preview Result 2-AVG
 — Preview Result 1-PK+
 — Voltage on Mains QP Class B
— Voltage on Mains AV Class B
 ◆ Final_Result QPK
 ◆ Final_Result CAV

Final result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.184089	55.13	---	64.30	9.17	15000.0	9.000	L2	9.8
0.184089	---	42.65	54.30	11.65	15000.0	9.000	L2	9.8

Radiated emission

Date 2023-03-15	Temperature 22 °C ± 3 °C	Humidity 18 % ± 5 %
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The measurements were performed according to ANSI C63.4 2014, ANSI C63.4a-2017.

Test setup and procedure

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1 m in the frequency range 18 – 40 GHz. The measurement procedure is as the following:

1. A pre-measurement is performed with peak and average detector. For measurement < 1 GHz the test object is measured in eight directions with the antenna at two heights, 1.0 m, and 2.5 m with elevation angle. For measurements > 1 GHz the test object is measured in seventeen directions with the antenna at two heights, 1.0 m and 2.5 m with elevation angle.
2. For measurements in the frequency range 1 – 18 GHz, RF absorbers were covering a floor area to comply with site validation requirements according to CISPR 16-1-4.
3. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m (30 MHz -18 GHz), 1 to 2 m (18 GHz – 40 GHz) with elevation angle for maximum response. Then the emission is measured with quasi-peak detector on frequencies below 1 GHz and with peak and average detector above 1 GHz.

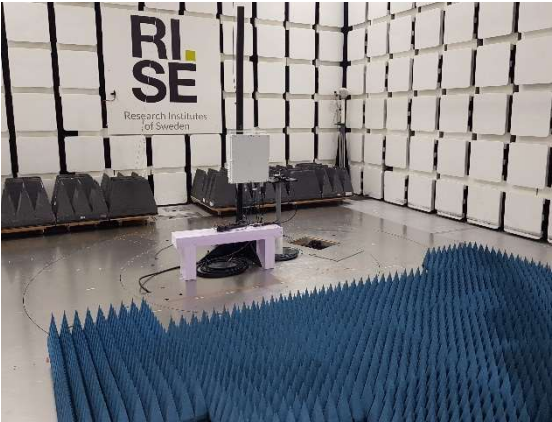
Measurement equipment

Item	Name	Inv.no	Cal. due date
Semi Anechoic Chamber	TDK	503881	-
	NSA	BX90699	2025-11-04
	SVSWR	BX90702	2024-09-20
Spectrum Analyzer	Rohde & Schwarz ESU40	901385	2023-07-20
Software	Rohde & Schwarz EMC32	BX62351	-
RF cable	Huber & Suhner Eacon 4C	BX91490	2023-06-30
RF Cable	Rosenberger UFB311A	503508	2023-09-08
RF Cable	Rosenberger UFB311A	503509	2023-09-08
Antenna, Bilog	Teseq CBL6143A	BX92331	2025-09-16
Preamplifier	MicroComp Nordic MCN-JS42-00101800-28-10P	901545	2024-01-25
HP filter	Wainwright WHKX1.0/18G-10SS	901373	2023-07-08
Antenna, Horn	Emco 3115	502175	2024-07-02
Antenna, Std.gain Horn	Flann 16240-25	503939	2024-01-25
Antenna, Std.gain Horn	Flann 18240-25	503900	2024-01-25
RF Cable	Teledyne Reynolds	900226	2023-09-12
Preamplifier	Miteq JS4-18004000-30-5A	503278	2024-01-23
Antenna, Std.gain horn	Flann 20240-20	BX92412	2024-01-12
Antenna, Std.gain horn	Flann 22240-20	BX92413	2024-01-12
Thermohygrometer	Testo 625	504188	2023-06-30

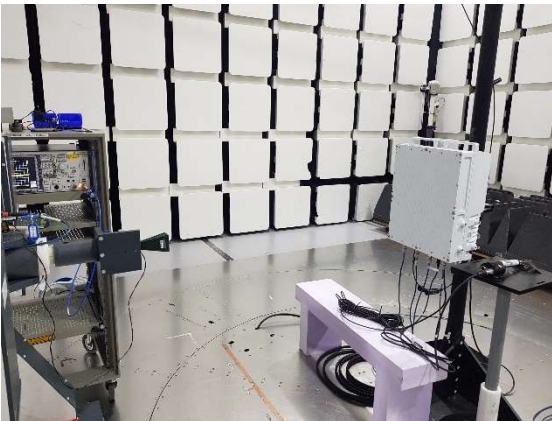
Test setup 30-1000 MHz:



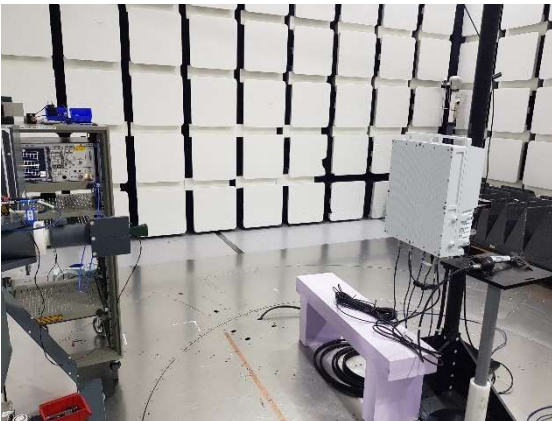
Test setup 1-18 GHz:



Test setup 18-26.5 GHz:



Test setup 26.5-40 GHz:



Limits

Frequency range (MHz)	Limit (dBµV) Quasipeak	Limit (dBµV) Average	Limit (dBµV) Peak
30 - 88	40	-	-
88 - 216	43.5	-	-
216 - 960	46	-	-
960 - 1000	54	-	-
1000 - 18000	-	54	74
18000 - up to 5th harmonic of the highest frequency or 40 GHz, whichever is lower.	-	64 ^{Note}	84 ^{Note}

Note: The limit is adjusted due to the measurement antenna distance 1 m >18 GHz.

The requirement limit according to FCC part 15 is used for the measurements, which is stricter than ICES-003.

EUT Emission level (dBuV/m) = SA reading (dBuV) + (CableLosses (dB) + Antenna factor (dB/m) + FilterLoss (dB) – LNAGAIN (dB))

The correction factors are stored in R&S EMC 32 software as separate files and activated as applicable in the Hardware setup, for each measurement configuration.

Result

The emission spectra are shown on the following pages.

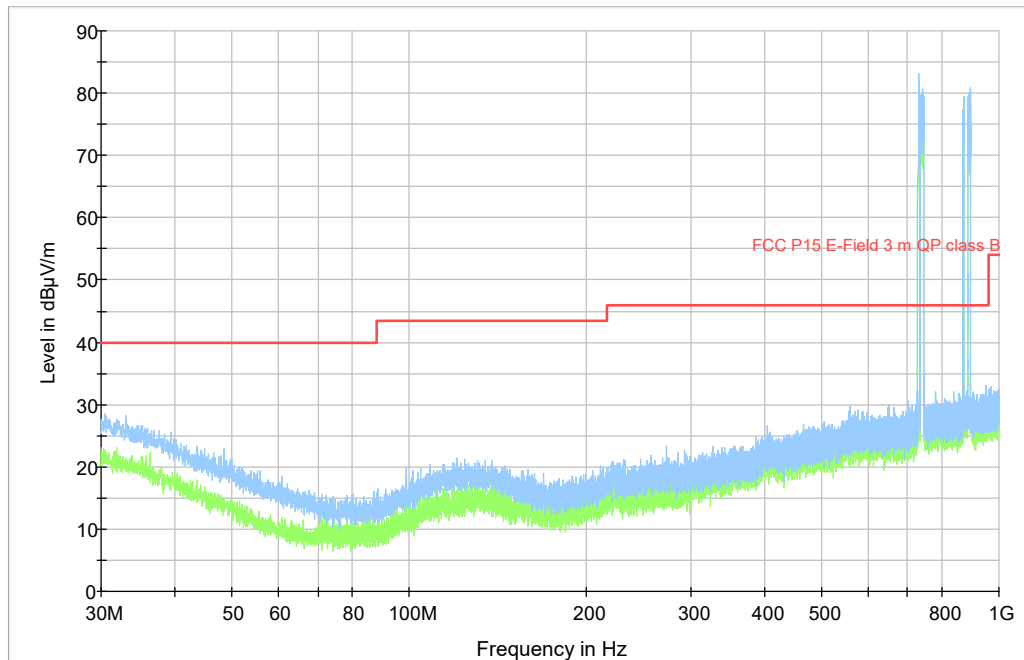
- Diagram: Pre-test with peak and average detector, vertical and horizontal polarization
- 1: 30-1000 MHz
- 2: 1-8.2 GHz
- 3: 8.2-12.75 GHz
- 4: 12.75-18 GHz
- 5: 18-26.5 GHz
- 6: 26.5-40 GHz

Remark

The highest internal frequency declared by the client was 25 GHz.

Emission below limit?	Yes
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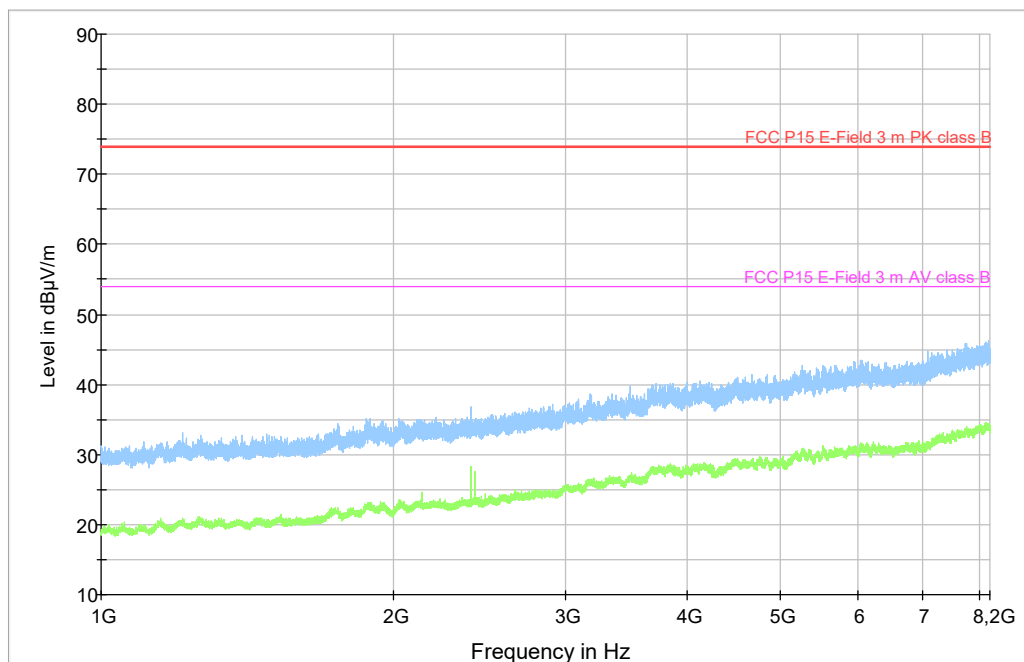
Diagram 1: 30-1000 MHz



— Preview Result 2-AVG Final_Result QPK
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 3 m QP class B

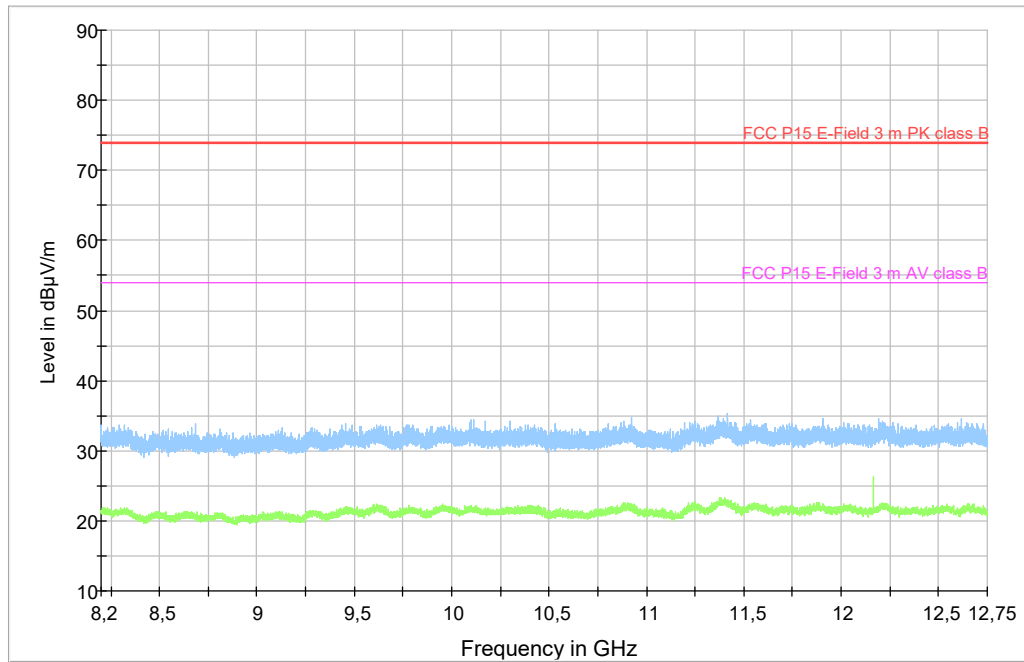
Note: The emissions in frequency band B5 869-894 MHz and B12A 729-745 MHz are the carrier frequencies and shall be ignored in the context.

Diagram 2: 1-8.2 GHz



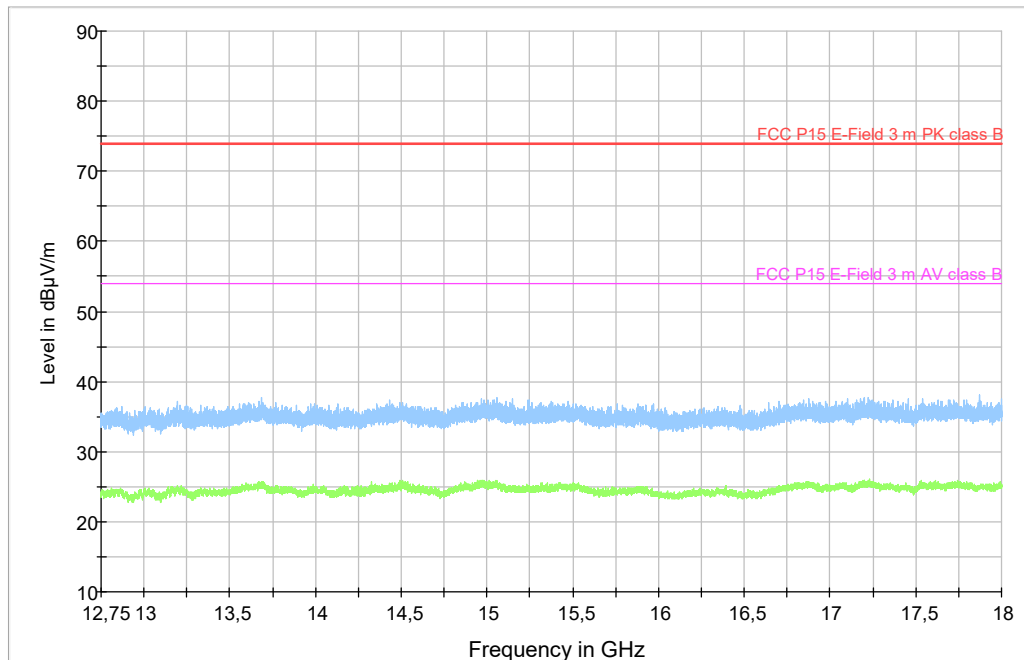
— Preview Result 2-AVG
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 3 m PK class B Final_Result CAV
— FCC P15 E-Field 3 m AV class B

Diagram 3:



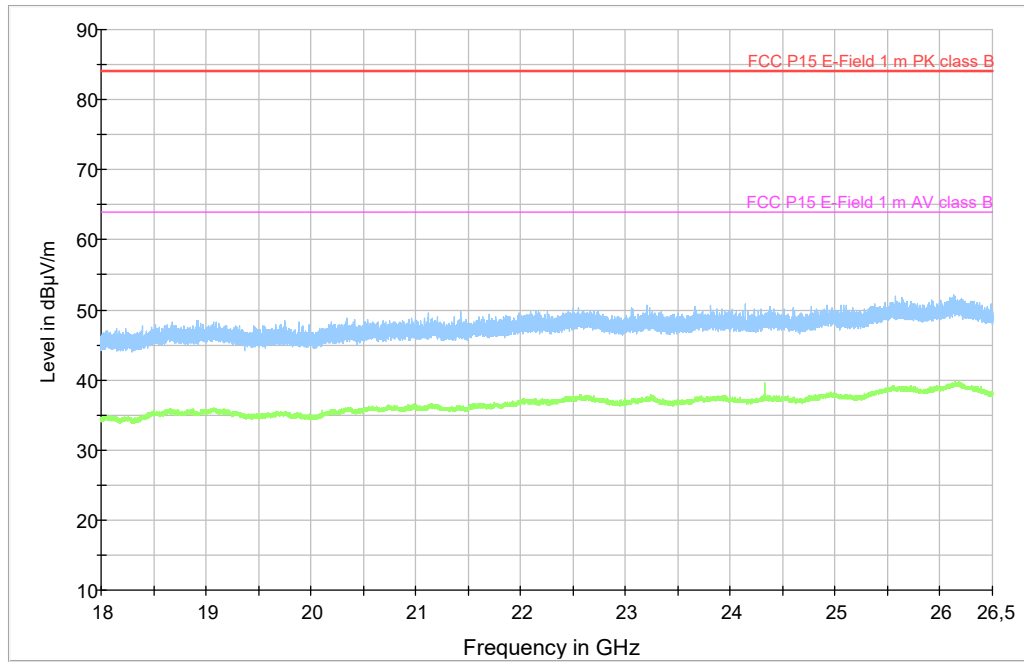
— Preview Result 2-AVG
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 3 m PK class B Final_Result CAV
— FCC P15 E-Field 3 m AV class B
 ◆

Diagram 4:



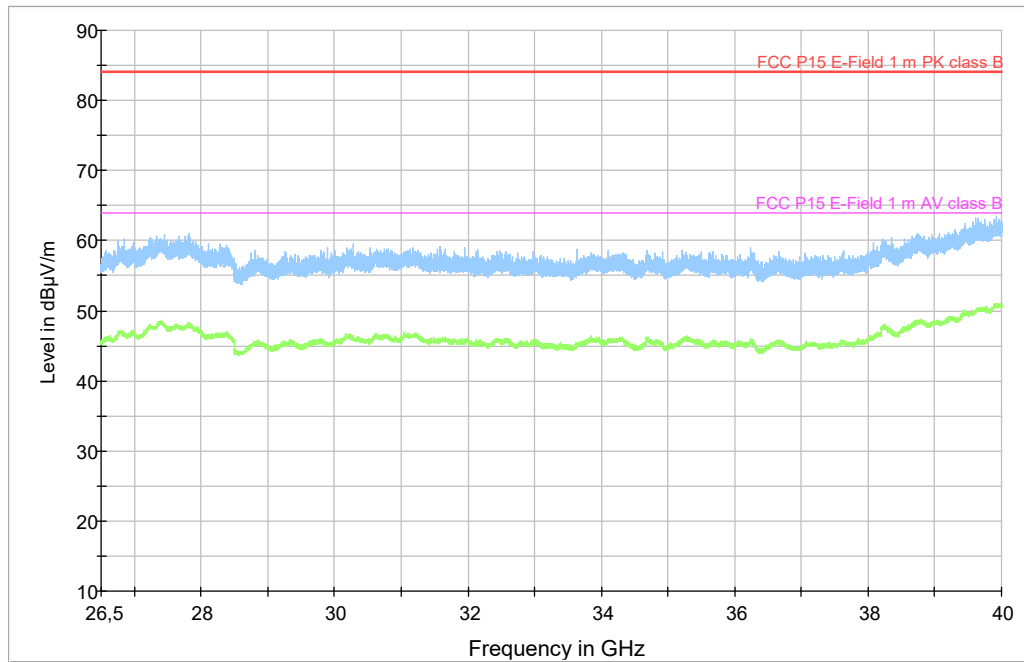
— Preview Result 2-AVG
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 3 m PK class B Final_Result CAV
— FCC P15 E-Field 3 m AV class B
 ◆

Diagram 5:



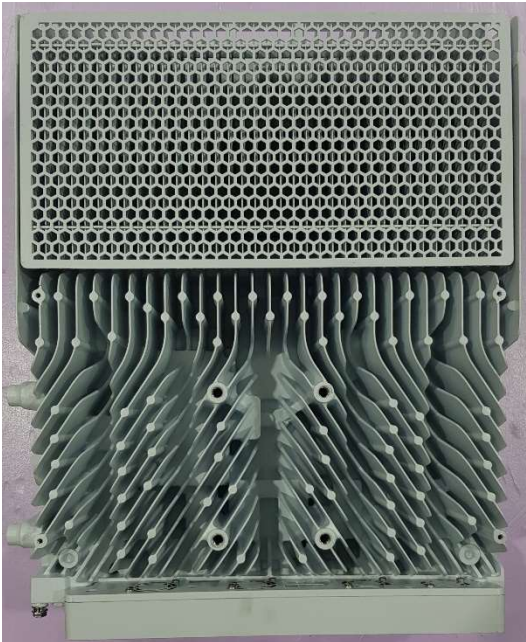
— Preview Result 2-AVG
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 1 m PK class B
— FCC P15 E-Field 1 m AV class B
 ◆
 ◆ Final_Result CAV

Diagram 6:



— Preview Result 2-AVG
 — Preview Result 1-PK+ Final_Result PK+
 — FCC P15 E-Field 1 m PK class B
— FCC P15 E-Field 1 m AV class B
 ◆
 ◆ Final_Result CAV

Photo of the test object:



End of report.

Verification

Transaction 09222115557490463131

Document

P118379-F15

Main document

18 pages

Initiated on 2023-04-06 14:11:54 CEST (+0200) by Tomas Isbring (TI)

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