FCC Measurement/Technical Report on

Telematic Unit
CONBOX-HIGH

FCC ID: T8GP114
IC: 6434A-P114

Test Report Reference: MDE_HARMAN_1736_FCCc_rev1

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle D-PL-12140-01-00

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1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization
Certification for an Intentional Radiator (Digital Device / Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-18 Edition) and 15 (10-1-18 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

Part 15, Subpart E – Unlicensed National Information Infrastructure Devices

§ 15.403 Definitions

§ 15.407 General technical requirements

Note:
The tests were selected and performed with reference to the FCC Public Notice "Guidelines for Compliance Testing of Unlicensed National Information
Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02 General U-NII Test Procedures New Rules v02r01, 2017-12-14".

ANSI C63.10-2013 is applied.

FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 ("new rules") is applied.

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for UNII / LE-LAN (e.g. WLAN 5 GHz) equipment from FCC and IC

UNII equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 5: 8.8
Occupied bandwidth	§ 15.403 (i) (26 dB) / § 15.407 (e) (6 dB)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1 (99%) RSS-247 Issue 2: 6.2.4.1 (6 dB)
Maximum conducted output power	§ 15.407 (a) (1),(2),(3),(4)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1
Maximum power spectral density	§ 15.407 (a) (1),(2),(3),(5)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1
Transmitter undesirable emissions; General Field Strength Limits, Restricted Bands	§ 15.407 (b) § 15.209 (a)	RSS-Gen Issue 5: 6.13/8.9/8.10; RSS-247 Issue 2: 3.3/6.2 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2
Frequency stability	§ 15.407 (g)	RSS-Gen Issue 5: 6.11/8.11
Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)	§ 15.407 (h)	RSS-247 Issue 2: 6.2.2.1, 6.2.3.1, 6.3
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 5: 8.3
Receiver spurious emissions	–	-

1.3 MEASUREMENT SUMMARY / SIGNATURES

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407 **FCC §15.31, §15.407 (e)**

6 dB Bandwidth

The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Radio Technology, Operating Frequency, Subband			
WLAN a, high, U-NII-3	S01_AB01	Passed	Passed
WLAN a, low, U-NII-3	S01_AB01	Passed	Passed
WLAN a, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407 **FCC §15.31, §15.407 (a)(1)**

Maximum Conducted Output Power

The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Radio Technology, Operating Frequency, Subband			
WLAN a, high, U-NII-1	S01_AB01	Passed	Passed
WLAN a, high, U-NII-3	S01_AB01	Passed	Passed
WLAN a, low, U-NII-1	S01_AB01	Passed	Passed
WLAN a, low, U-NII-3	S01_AB01	Passed	Passed
WLAN a, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN a, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407 **FCC §15.31, §15.407 (a)(1)**

Maximum Conducted Output Power
The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Radio Technology, Operating Frequency, Subband			
WLAN ac 40 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 80 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 80 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407 **FCC §15.31, §15.407 (a)(1),(5)**

Peak Power Spectral Density
The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Radio Technology, Operating Frequency, Subband			
WLAN a, high, U-NII-1	S01_AB01	Passed	Passed
WLAN a, high, U-NII-3	S01_AB01	Passed	Passed
WLAN a, low, U-NII-1	S01_AB01	Passed	Passed

Peak Power Spectral Density
The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Subband	**Setup**	**FCC**	**IC**
WLAN a, low, U-NII-3	S01_AB01	Passed	Passed
WLAN a, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN a, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 40 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 80 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 80 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz MIMO, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 20 MHz, mid, U-NII-1	S01_AB01	Passed	Passed
WLAN n 20 MHz, mid, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz MIMO, low, U-NII-1	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407	FCC §15.31, §15.407 (a) (1),(5)

Peak Power Spectral Density
The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	FCC	IC
WLAN n 40 MHz MIMO, low, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, high, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S01_AB01	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S01_AB01	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407	FCC §15.407 (b), (1),(2),(3),(4); FCC §15.205, §15.209, §15.407 (b) (5),(6)

Undesirable Emissions; General Field Strength Limits
The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Measurement range, Subband	Setup	FCC	IC
WLAN a, high, 1GHz - 26GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN a, mid, 9kHz - 30MHz, U-NII-1	S01_AE02	Passed	Passed
WLAN a, mid, 9kHz - 30MHz, U-NII-3	S01_AE02	Passed	Passed
WLAN ac 40 MHz MIMO, low, 1GHz - 26GHz, U-NII-1 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-1 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-3 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-1 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-3 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, mid, 1GHz - 26GHz, U-NII-1 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 20 MHz, mid, 1GHz - 26GHz, U-NII-3 Remark: 1- 18 GHz	S01_AE02	Passed	Passed
WLAN n 40 MHz, high, 1GHz - 26GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN n 40 MHz, high, 1GHz - 26GHz, U-NII-3	S01_AE02	Passed	Passed
WLAN n 40 MHz, low, 1GHz - 26GHz, U-NII-1	S01_AE02	Passed	Passed
WLAN n 40 MHz, low, 1GHz - 26GHz, U-NII-3	S01_AE02	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407	FCC §15.407 (b), (1),(2),(3),(4)

Band Edge

The measurement was performed according to ANSI C63.10 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	FCC	IC
WLAN a, high, U-NII-3	S01_AE02	Passed	Passed
WLAN a, low, U-NII-1	S01_AE02	Passed	Passed
WLAN a, low, U-NII-3	S01_AE02	Passed	Passed
WLAN ac 20 MHz MIMO, high, U-NII-3	S01_AE02	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-1	S01_AE02	Passed	Passed
WLAN ac 20 MHz MIMO, low, U-NII-3	S01_AE02	Passed	Passed
WLAN ac 40 MHz MIMO, low, U-NII-1	S01_AE02	Passed	Passed
WLAN ac 80 MHz, mid, U-NII-1	S01_AE02	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S01_AE02	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S01_AE02	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S01_AE02	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S01_AE02	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S01_AE02	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S01_AE02	Passed	Passed

N/A: Not applicable
N/P: Not performed

2 REVISION HISTORY

Report version control			
Version	**Release date**	**Change Description**	**Version validity**
initial	2019-04-16	--	valid
rev1	2019-05-14	Changed referenced version of 47 CFR Ch.1 Parts 2 and 15 edition to 2018	valid

COMMENT: The output power for Band U-NII-1 differs for FCC and IC. Except for the test case "Maximum Conducted Output Power " the Results given are the results when using the higher FCC output power.

(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik

(responsible for testing and report)
Dipl.-Ing. Daniel Gall

7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

3 ADMINISTRATIVE DATA

3.1 TESTING LABORATORY

Company Name:	7layers GmbH
Address:	Borsigstr. 11 40880 Ratingen Germany

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no:	DAkkS D-PL-12140-01-00
FCC Designation Number:	DE0015
FCC Test Firm Registration:	929146
ISED CAB Identifier	DE0007; ISED#: 3699A
Responsible for accreditation scope:	Dipl.-Ing. Marco Kullik
Report Template Version:	2019-02-12

3.2 PROJECT DATA

Responsible for testing and report:	Dipl.-Ing. Daniel Gall
Employees who performed the tests:	documented internally at 7Layers
Date of Report:	2019-05-14
Testing Period:	2018-12-03 to 2019-02-25

3.3 APPLICANT DATA

Company Name:	HARMAN BECKER Automotive Systems GmbH
Address:	Becker-Goering-Str. 16 76307 Karlsbad Germany
Contact Person:	Stefan Blaschek

3.4 MANUFACTURER DATA

Company Name:	HARMAN BECKER Automotive Systems GmbH
Address:	Becker-Goering-Str. 16 76307 Karlsbad Germany
Contact Person:	Stefan Blaschek

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Telematic system with wireless technologies
Product name	CONBOX-HIGH
Type	CONBOX-HIGH
Declared EUT data by the supplier	
Voltage Type	DC
Voltage Level	12 V
Tested Modulation Type	OFDM
Specific product description	The EUT has integrated Bluetooth, Bluetooth Low Energy and WLAN functionality. Relevant for this report is the WLAN transmitter supporting the U-NII sub bands 1 and 3. The supported WLAN modes are: a, n, ac in 20 MHz, n and ac in 40 MHz and ac 80 MHz bandwidth The antenna gain for 5 GHz band is: 2.4 dBi
Ports of the device	Enclosure Cable Harness incl. DC (unshielded) Antenna Port Cellular (4 Antennas, shielded) Antenna Port WLAN/BT/BT LE (3 Antennas, shielded) Antenna Port GNSS (1 Antenna, shielded)
Antenna 1	External / 2.4 dBi
Antenna 2	External / 2.4 dBi
Tested Datarates	A mode: 6 Mbps N / AC mode: MCS0
Special software used for testing	A script on the EUT is used by ADB shell to set the test modes.

The main components of the EUT are listed and described in chapter 3.2 EUT Main components.

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT ae02	DE1009043ae02	
Sample Parameter	**Value**	
Serial No.	A975J20JB000071	
HW Version	EC995	
SW Version	Y025	
Comment		

Sample Name	Sample Code	Description
EUT ab01	DE1009043ab01	
Sample Parameter	**Value**	
Serial No.	P114H00JB001124	
HW Version	EC983	
SW Version	Z025	
Comment		

NOTE:The short description is used to simplify the identification of the EUT in this test report.

4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, OUT Code)	Description
-	-	-

4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless Auxiliary Equipment can influence the test results.

Device	**Details (Manufacturer, Type Model, HW, SW, S/N)**	**Description**
AUX1	4M0.035.507, 09/18, - , 00052/00056/00191/00037	4 external cellular antennas
AUX2	4N0 035 500, 47/17, -, -	3 external WLAN/BT antennas
AUX3	Hirschmann, -	External GNSS antenna

4.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	**Combination of EUTs**	**Description and Rationale**
S01_AE02	EUT ae02, AUX1, AUX2, AUX3	Radiated Setup
S01_AB01	EUT ab01,	Conducted Setup

4.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

4.6.1 TEST CHANNELS

U-NII-Subband 1 5150 - 5250 MHz			**U-NII-Subband 3 5725 - 5850 MHz**			**Nom. BW**
low	**mid**	**high**	**low**	**mid**	**high**	**20 MHz**
36	44	48	149	157	165	**Ch.-No.**
5180	5220	5240	5745	5785	5825	**MHz**

low	**mid**	**high**	**low**	**mid**	**high**	**40 MHz**
38	-	46	151	-	159	**Ch.-No.**
5190	-	5230	5755	-	5795	**MHz**
low	**mid**	**high**	**low**	**mid**	**high**	**80 MHz**
42	-		155	-	-	**Ch.-No.**
5210	-		5775	-	-	**MHz**

4.7 PRODUCT LABELLING

4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 6 DB BANDWIDTH

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.1.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.
The results recorded were measured with the modulation which produce the worst-case (smallest) emission bandwidth.

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Span: 40 / 80 / 160 MHz (for 20 / 40 / 80 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: 2000
- Sweeptime: Auto
- Detector: Peak

5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart E, §15.407 (e)
Within the 5.725-5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.1.3 TEST PROTOCOL

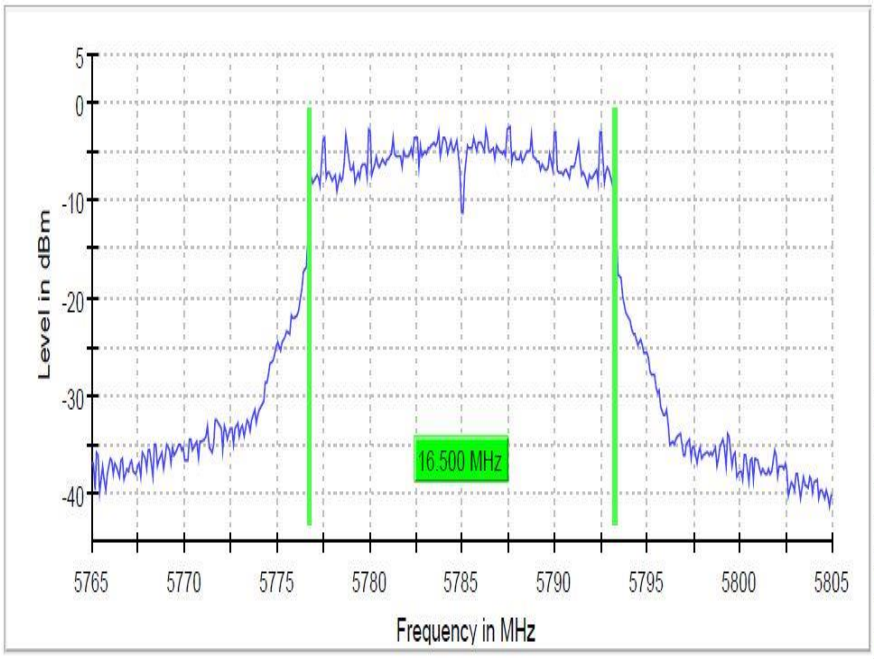
Ambient temperature: 25 °C
Air Pressure: 1010 hPa
Humidity: 40 %

Radio Technology	Operating Frequency	6 dB Bandwidth [MHz]	Limit [MHz]	Margin [MHz]	Min. 6 dB Frequency [MHz]	Max. 6 dB Frequency [MHz]
WLAN a	low	16.5	0.5	16.00	5736.75	5753.25
WLAN a	mid	16.5	0.5	16.00	5776.75	5793.25
WLAN a	high	16.5	0.5	16.00	5816.75	5833.25
WLAN n 20 MHz	low	17.7	0.5	17.20	5736.15	5753.85
WLAN n 20 MHz	mid	17.7	0.5	17.20	5776.15	5793.85
WLAN n 20 MHz	high	17.7	0.5	17.20	5816.15	5833.85
WLAN n 40 MHz	low	35.9	0.5	35.40	5737.15	5773.05
WLAN n 40 MHz	high	35.9	0.5	35.40	5777.05	5812.95
WLAN ac 20 MHz	low	17.7	0.5	17.20	5736.15	5753.85
WLAN ac 20 MHz	mid	17.7	0.5	17.20	5776.15	5793.85
WLAN ac 20 MHz	high	17.7	0.5	17.20	5816.15	5833.85
WLAN ac 40 MHz	low	36.2	0.5	35.70	5737.05	5773.25
WLAN ac 40 MHz	high	36.0	0.5	35.50	5777.05	5813.05
WLAN ac 80 MHz	mid	75.5	0.5	75.00	5737.35	5812.85

Remark: Please see next sub-clause for the measurement plot.

5.1.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Radio Technology = WLAN a, Operating Frequency = mid, Subband = U-NII-3 (S01_AB01)



Setting	Instrument Value
Start Frequency	5.76500 GHz
Stop Frequency	5.80500 GHz
Span	40.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	400
Sweeptime	56.886 µs
Reference Level	-10.000 dBm
Attenuation	10.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	19 / max. 150
Stable	5 / 5
Max Stable Difference	0.07 dB

5.1.5 TEST EQUIPMENT USED

- R&S TS8997

5.2 MAXIMUM CONDUCTED OUTPUT POWER

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.2.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. The reference level of the spectrum analyzer was set higher than the output power of the EUT.

The EUT was connected to a gated average reading power meter usinga short coax cable with a known loss.

5.2.2 TEST REQUIREMENTS / LIMITS

A) FCC
For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:
§15.407 (a) (1)
Limit: 50 mW (17 dBm) or 4 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.
FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 (“new rules”):
§15.407 (a) (1) (i): Outdoor access point:
Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.
The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
§15.407 (a) (1) (ii): Indoor access point:
Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.
§15.407 (a) (1) (iv): Mobile and portable client devices:
Limit: 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi.

For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:
§15.407 (a) (2)
Limit: 250 mW (24 dBm) or 11 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:
§15.407 (a) (3)
Limit: 1 W (30 dBm) or 17 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.
FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 (“new rules”):
§15.407 (a) (3):
Limit: 1 W (30 dBm).

§15.407 (a) (4):
The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

B) IC
Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, 6.2.1 (1), Band 5150-5250 MHz, indoor operation only:
Limit (e.i.r.p.): 200 mW (23 dBm) or 10 + 10 log10 B [dBm], whichever power is less.
B is the 99% emission bandwidth in MHz.

RSS-247, 6.2.2 (1), Band 5250-5350 MHz:
Limits:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

Note: For EUTs operating at a higher e.i.r.p. than 200 mW (23 dBm), compliance with the e.i.r.p. elevation mask is required.

RSS-247, 6.2.3 (1), Bands 5470-5600 MHz and 5650-5725 MHz:
Limits:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

RSS-247, 6.2.4 (1), Band 5725-5825 MHz:
Limits:
Maximum conducted Power: 1W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 4.0 W (36 dBm) or 23 + 10 log10 B [dBm], whichever power is less.

All frequency bands: B is the 99% emission bandwidth in MHz.

5.2.3 TEST PROTOCOL

Ambient temperature: 25 °C
Air Pressure: 1010 hPa
Humidity: 40 %

Power values except U-NII-band 1 for IC:

WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	11.4	13.8	30.0	18.6	N/A				1)
	44	5220	12.4	14.8	30.0	17.6	N/A				1)
	48	5240	12.3	14.7	30.0	17.7	N/A				1)
3	149	5745	9.0	11.4	30.0	21.0	30.0	21.0	36.0	24.6	
	157	5785	9.5	11.9	30.0	20.5	30.0	20.5	36.0	24.1	
	165	5825	9.6	12.0	30.0	20.4	30.0	20.4	36.0	24.0	

WLAN n-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	12.3	14.7	30.0	17.7	N/A				1)
	44	5220	12.4	14.8	30.0	17.6	N/A				1)
	48	5240	12.4	14.8	30.0	17.6	N/A				1)
3	149	5745	8.8	11.2	30.0	21.2	30.0	21.2	36.0	24.8	
	157	5785	9.3	11.7	30.0	20.7	30.0	20.7	36.0	24.3	
	165	5825	9.5	11.9	30.0	20.5	30.0	20.5	36.0	24.1	

WLAN n-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	13.9	16.3	30.0	16.1	N/A				1)
	44	5220	13.8	16.2	30.0	16.2	N/A				1)
	48	5240	14.1	16.5	30.0	15.9	N/A				1)
3	149	5745	11.1	13.5	30.0	18.9	30.0	18.9	36.0	22.5	
	157	5785	11.1	13.5	30.0	18.9	30.0	18.9	36.0	22.5	
	165	5825	11.3	13.7	30.0	18.7	30.0	18.7	36.0	22.3	

WLAN n-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	10.6	13.0	30.0	19.4	N/A				1)
	46	5230	10.8	13.2	30.0	19.2	N/A				1)
3	151	5755	8.2	10.6	30.0	21.8	30.0	21.8	36.0	25.4	
	159	5795	8.9	11.3	30.0	21.1	30.0	21.1	36.0	24.7	

WLAN n-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	13.4	15.8	30.0	16.6	N/A				1)
	46	5230	13.0	15.4	30.0	17.0	N/A				1)
3	151	5755	10.9	13.3	30.0	19.1	30.0	30.0	36.0	22.7	
	159	5795	10.8	13.2	30.0	19.2	30.0	19.1	36.0	22.8	

WLAN ac-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	12.3	14.7	30.0	17.7	N/A				1)
	44	5220	12.4	14.8	30.0	17.6	N/A				1)
	48	5240	12.4	14.8	30.0	17.6	N/A				1)
3	149	5745	8.9	11.3	30.0	21.1	30.0	21.1	36.0	24.7	
	157	5785	9.3	11.7	30.0	20.7	30.0	20.7	36.0	24.3	
	165	5825	9.4	11.8	30.0	20.6	30.0	20.6	36.0	24.2	

WLAN ac-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	14.0	16.4	30.0	16.0	N/A				1)
	44	5220	14.6	17.0	30.0	15.4	N/A				1)
	48	5240	14.9	17.3	30.0	15.1	N/A				1)
3	149	5745	11.4	13.8	30.0	18.6	30.0	18.6	36.0	22.2	
	157	5785	11.4	13.8	30.0	18.6	30.0	18.6	36.0	22.2	
	165	5825	11.5	13.9	30.0	18.5	30.0	18.5	36.0	22.1	

WLAN ac-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	10.6	13.0	30.0	19.4	N/A				1)
	46	5230	10.8	13.2	30.0	19.2	N/A				1)
3	151	5755	8.5	10.9	30.0	21.5	30.0	21.5	36.0	25.1	
	159	5795	8.8	11.2	30.0	21.2	30.0	21.2	36.0	24.8	

WLAN ac-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	12.9	15.3	30.0	17.1	N/A				1)
	46	5230	13.1	15.5	30.0	16.9	N/A				1)
3	151	5755	11.2	13.6	30.0	18.8	30.0	30.0	36.0	22.4	
	159	5795	10.8	13.2	30.0	19.2	30.0	18.8	36.0	22.8	

WLAN ac-Mode; 80 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	42	5210	11.7	14.1	30.0	18.3	N/A				1)
3	155	5775	8.9	11.3	30.0	21.1	30.0	21.1	36.0	24.7	

WLAN ac-Mode; 80 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	42	5210	14.4	16.8	30.0	15.6	N/A				1)
3	155	5775	11.2	13.6	30.0	18.8	30.0	18.8	36.0	22.4	

Power values U-NII-band 1 for IC:

WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	10.6	13.0	14.0	1.0	1)
	44	5220	10.9	13.3	14.0	0.7	1)
	48	5240	11.0	13.4	14.0	0.6	1)

WLAN n-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	10.4	12.8	14.3	1.5	1)
	44	5220	10.7	13.1	14.3	1.2	1)
	48	5240	10.8	13.2	14.3	1.1	1)

WLAN n-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	11.9	14.3	14.3	0.0	1)
	44	5220	11.6	14.0	14.3	0.3	1)
	48	5240	11.5	13.9	14.3	0.4	1)

WLAN n-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	9.7	12.1	14.8	2.7	1)
	46	5230	10.2	12.6	14.8	2.2	1)

WLAN n-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	11.7	14.1	14.8	0.7	1)
	46	5230	11.8	14.2	14.8	0.6	1)

WLAN ac-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	10.5	12.9	14.3	1.4	1)
	44	5220	10.7	13.1	14.3	1.2	1)
	48	5240	10.9	13.3	14.3	1.0	1)

WLAN ac-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	36	5180	11.5	13.9	14.3	0.4	1)
	44	5220	11.7	14.1	14.3	0.2	1)
	48	5240	11.8	14.2	14.3	0.1	1)

WLAN ac-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	9.8	12.2	14.8	2.6	1)
	46	5230	10.1	12.5	14.8	2.3	1)

WLAN ac-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	38	5190	11.8	14.2	14.8	0.6	1)
	46	5230	11.8	14.2	14.8	0.6	1)

WLAN ac-Mode; 80 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	42	5210	10.7	13.1	14.8	1.7	1)

WLAN ac-Mode; 80 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	IC EIRP Limit [dBm]	Margin [dB]	
1	42	5210	11.5	13.9	14.8	0.9	1)

1) no additional limit applies related to the elevation.

Remark: Output Power Measurement with power meter, no plots provided.

5.2.4 TEST EQUIPMENT USED

- R&S TS8997

5.3 PEAK POWER SPECTRAL DENSITY

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.3.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up in a shielded room to perform the Maximum Power Spectral Density measurements.
The results recorded were measured with the modulation which produces the worst-case (highest) output power.

The EUT was connected to the spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:
- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Trace: RMS
- Sweeps: 100
- Sweeptime: 2 s (20 / 40 MHz BW), 3.2 s (80 MHz BW)
- Detector: RMS

5.3.2 TEST REQUIREMENTS / LIMITS

A) FCC
FCC Part 15, Subpart E, §15.407 (a) (1)
For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:
(i) and (ii), outdoor and indoor access points: Limit: 17 dBm/MHz.
(iv), mobile and portable client devices: Limit: 11 dBm/MHz.

FCC Part 15, Subpart E, §15.407 (a) (2)
For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:
Limit: 11 dBm/MHz.

FCC Part 15, Subpart E, §15.407 (a) (3)
For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:
Limit: 30 dBm/500 kHz.

Note: The limit will be also fulfilled when measuring at any bandwidth greater than 500 kHz. This applies to signals where the maximum conducted output power was measured at a bandwidth exceeding 500 kHz and which fulfil that limit of 30 dBm.

B) IC
Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, 6.2.1 (1), Band 5150-5250 MHz, indoor operation only:
Limit (e.i.r.p.): 10 dBm/MHz.

RSS-247, 6.2.2 (1), Band 5250-5350 MHz:
Limit: 11 dBm/MHz.

RSS-247, 6.2.3 (1), Bands 5470-5600 MHz and 5650-5725 MHz:
Limit: 11 dBm/MHz.

RSS-247, 6.2.4 (1), Band 5725-5850 MHz:
Limit: 30 dBm/500 kHz.

5.3.3 TEST PROTOCOL

Ambient temperature:	25 °C
Air Pressure:	1010 hPa
Humidity:	40 %

WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	36	5180	1.1	17.0	15.9	3.5	10.0	6.5
	44	5220	1.8	17.0	15.2	4.2	10.0	5.8
	48	5240	1.8	17.0	15.2	4.2	10.0	5.8
3	149	5745	-4.9	30.0	34.9		30.0	34.9
	157	5785	-4.0	30.0	34.0		30.0	34.0
	165	5825	-4.1	30.0	34.1		30.0	34.1

WLAN n-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	36	5180	1.4	17.0	15.6	3.7	10.0	6.3
	44	5220	1.4	17.0	15.6	3.7	10.0	6.3
	48	5240	1.4	17.0	15.6	3.8	10.0	6.2
3	149	5745	-5.3	30.0	35.3		30.0	35.3
	157	5785	-4.5	30.0	34.5		30.0	34.5
	165	5825	-4.4	30.0	34.4		30.0	34.4

WLAN n-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	36	5180	3.2	17.0	13.8	5.6	10.0	4.4
	44	5220	3.5	17.0	13.5	5.9	10.0	4.1
	48	5240	3.3	17.0	13.7	5.7	10.0	4.3
3	149	5745	-2.8	30.0	32.8		30.0	32.8
	157	5785	-2.3	30.0	32.3		30.0	32.3
	165	5825	-2.4	30.0	32.4		30.0	32.4

WLAN n-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	38	5190	-3.2	17.0	20.2	-0.8	10.0	10.8
	46	5230	-2.9	17.0	19.9	-0.6	10.0	10.6
3	151	5755	-8.6	30.0	38.6		30.0	38.6
	159	5795	-7.7	30.0	37.7		30.0	37.7

WLAN n-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	38	5190	-0.3	17.0	17.3	2.1	10.0	7.9
	46	5230	-0.6	17.0	17.6	1.8	10.0	8.2
3	151	5755	-6.1	30.0	36.1		30.0	36.1
	159	5795	-5.9	30.0	35.9		30.0	35.9

WLAN ac-Mode; 20 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	36	5180	1.3	17.0	15.7	3.7	10.0	6.3
	44	5220	1.3	17.0	15.7	3.7	10.0	6.3
	48	5240	1.4	17.0	15.6	3.8	10.0	6.3
3	149	5745	-5.3	30.0	35.3		30.0	35.3
	157	5785	-4.5	30.0	34.5		30.0	34.5
	165	5825	-4.4	30.0	34.4		30.0	34.4

WLAN ac-Mode; 20 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	36	5180	4.5	17.0	12.5	6.9	10.0	3.1
	44	5220	4.4	17.0	12.6	6.8	10.0	3.2
	48	5240	4.3	17.0	12.7	6.7	10.0	3.3
3	149	5745	-2.2	30.0	32.2		30.0	32.2
	157	5785	-2.4	30.0	32.4		30.0	32.4
	165	5825	-2.1	30.0	32.1		30.0	32.1

WLAN ac-Mode; 40 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	38	5190	-3.2	17.0	20.2	-0.8	10.0	10.8
	46	5230	-3.0	17.0	20.0	-0.6	10.0	10.6
3	151	5755	-8.4	30.0	38.4		30.0	38.4
	159	5795	-7.9	30.0	37.9		30.0	37.9

WLAN ac-Mode; 40 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	38	5190	-0.7	17.0	17.7	1.7	10.0	8.3
	46	5230	-0.6	17.0	17.6	1.8	10.0	8.2
3	151	5755	-5.7	30.0	35.7		30.0	35.7
	159	5795	-6.0	30.0	36.0		30.0	36.0

WLAN ac-Mode; 80 MHz; MCS0; SISO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	42	5210	-5.0	17.0	22.0	-2.7	10.0	12.7
3	155	5775	-10.7	30.0	40.7		30.0	40.7

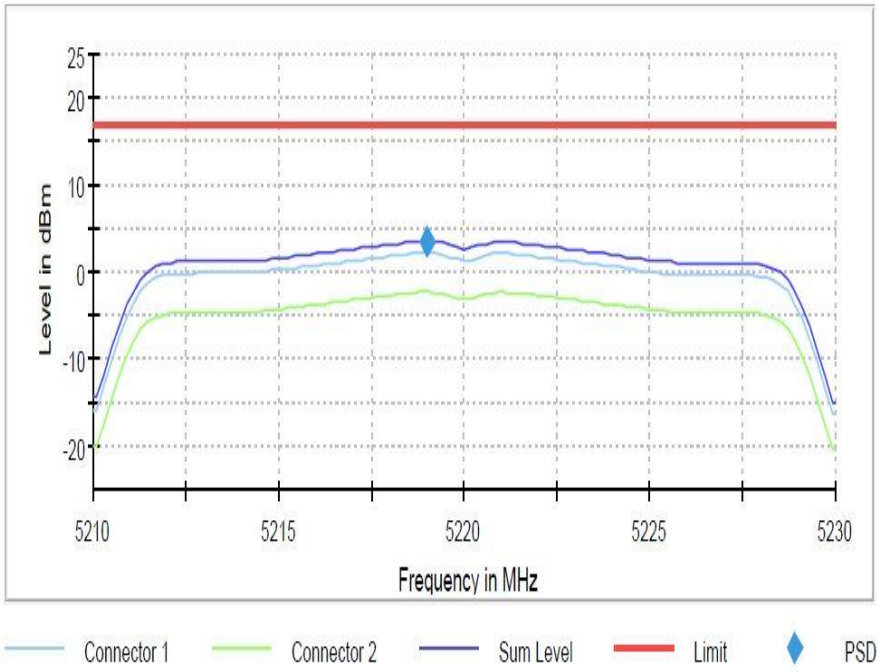
WLAN ac-Mode; 80 MHz; MCS0; MIMO

U-NII-Subband	Ch. No.	Freq. [MHz]	MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	IC EIRP MPSD [dBm/ MHz]	IC Limit [dBm/MHz]	Margin [dB]
1	42	5210	-2.0	17.0	19.0	0.4	10.0	9.6
3	155	5775	-8.1	30.0	38.1		30.0	38.1

Remark: Please see next sub-clause for the measurement plot.

5.3.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Radio Technology = WLAN n 20 MHz MIMO, Operating Frequency = mid, Subband = U-NII-1 (S01_AB01)



Setting	Instrument Value
Start Frequency	5.21000 GHz
Stop Frequency	5.23000 GHz
Span	20.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
Sweeptime	2.020 s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	RMS
SweepCount	3
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	4 / max. 15
Stable	3 / 3
Max Stable Difference	0.09 dB

5.3.5 TEST EQUIPMENT USED

- R&S TS8997

5.4 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.4.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered from a DC power source.

1. Measurement up to 30 MHz
The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement
- Anechoic chamber
- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 – 30 MHz
- Frequency steps: 0.05 kHz and 2.25 kHz
- IF–Bandwidth: 0.2 kHz and 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement
For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.
- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF–Bandwidth: 0.2 - 10 kHz
- Measuring time / Frequency step: 1 s

2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)
- Frequency range: 30 – 1000 MHz

- Frequency steps: 30 kHz
- IF–Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: –180° to 90°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by ± 45° around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 100 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: ± 45 ° around the determined value
- Height variation range: ± 100 cm around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector
With the settings determined in step 3, the final measurement will be performed:
EMI receiver settings for step 4:
- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz
The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
Step 1:
The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.
All steps were performed with one height (1.5 m) of the receiving antenna only.
The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.
The turn table step size (azimuth angle) for the preliminary measurement is 45 °.
Above 26 GHz the measurement distance is reduced to 1 m.
Step 2:

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.
The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
EMI receiver settings (for all steps):
- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Step 3:
Spectrum analyser settings for step 3:
- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

5.4.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15 Subpart E, §15.407 (b)(1)
For transmitters operating in the 5150–5250 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E, §15.407 (b)(2)
For transmitters operating in the 5250–5350 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E, §15.407 (b)(3)
For transmitters operating in the 5470–5725 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.

FCC Part 15 Subpart E, §15.407 (b)(4)
For transmitters operating in the 5725–5850 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5715–5860 MHz and additionally
Limit: –17 dBm/MHz EIRP within the frequency ranges 5715–5725 and 5850–5860 MHz.

B) IC
Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, 6.2.1 (2), Emissions outside the band 5150-5250 MHz, indoor operation only:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5250 MHz.

RSS-247, 6.2.2 (2), Emissions outside the band 5250-5350 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5250–5350 MHz.

RSS-247, 6.2.3 (2), Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.
Note: No operation is permitted for the frequency range 5600–5650 MHz.

RSS-247, 6.2.4 (2), Emissions outside the band 5725-5825 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5715–5835 MHz and additionally
Limit: –17 dBm/MHz EIRP within the frequency ranges 5715–5725 and 5825–5835 MHz.

C) FCC & IC

FCC Part 15 Subpart E, §15.405
The provisions of §§ 15.203 and 15.205 are included.

§15.407 (b)(6)
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.

§15.407 (b)(7)
The provisions of §15.205 apply to intentional radiators operating under this section

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

Frequency in 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 (2).

Frequency in 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 - 26000	500@3m	3	54.0@3m
26000 - 40000	500@3m	1	54.0@3m

The measured values above 26 GHz are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

§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:

- Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)
- Limit (dBµV/m) = EIRP [dBm] – 20 log (d [m]) + 104.8

Limit types (in result tables on next page):
RB – Emissions falls into a "Restricted Band" according FCC §§15.205 and 15.209 *)
UE – "Undesirable Emission Limit" according FCC §15.407
BE-RB – Band Edge Limit basing on "Restricted Band Limits"
BE-UE – Band Edge Limit basing on "Undesirable Emission Limit"
*) Below 1 GHz the limits of §15.209 are applied for all frequencies.

5.4.3 TEST PROTOCOL

Ambient temperature: 25 -27 °C
Air Pressure: 996 - 1026 hPa
Humidity: 30 - 45 %
WLAN a-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
36	5180	1249.9	51.3	PEAK	1000	68.2	16.9	UE
36	5180	10358.8	58.3	PEAK	1000	68.2	9.9	UE
44	5220	1249.9	51.7	PEAK	1000	68.2	16.5	UE
44	5220	10439.1	63.8	PEAK	1000	68.2	4.4	UE
48	5240	2492.8	49.6	PEAK	1000	74.0	24.4	RB
48	5240	2492.8	36.4	AV	1000	54.0	17.6	RB
48	5240	10479.1	65.0	PEAK	1000	68.2	3.2	UE
149	5745	1725.7	45.6	PEAK	1000	68.2	22.6	UE
149	5745	5722.8	68.5	PEAK	1000	78.0	9.5	BE
149	5745	11489.2	56.5	PEAK	1000	74.0	17.5	RB
149	5745	11489.2	44.4	AV	1000	54.0	9.6	RB
165	5825	11649.2	39.3	AV	1000	68.2	14.7	UE
165	5825	11649.2	61.9	PEAK	1000	74.0	12.1	RB

WLAN n-Mode; 20 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
36	5180	5148.5	67.9	PEAK	1000	74.0	6.1	RB
36	5180	5148.1	46.7	AV	1000	54.0	7.3	RB
36	5180	10354.7	63.8	PEAK	1000	68.2	4.4	UE
44	5220	1249.9	52.1	PEAK	1000	74.0	21.9	RB
44	5220	10441.6	63.4	PEAK	1000	74.0	10.6	RB
48	5240	10477.1	59.5	PEAK	1000	74.0	14.5	RB
149	5745	11490.2	47.7	AV	1000	54.0	6.3	RB
149	5745	11490.2	62.5	PEAK	1000	74.0	11.5	RB
157	5785	11570.0	42.5	AV	1000	54.0	11.5	RB
157	5785	11572.0	63.3	PEAK	1000	74.0	10.7	RB
165	5825	11657.7	62.4	PEAK	1000	74.0	11.6	RB
165	5825	11648.5	47.8	AV	1000	54.0	6.2	RB

WLAN n-Mode; 40 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
38	5190	5149.8	72.9	PEAK	1000	74.0	1.1	RB
38	5190	5149.4	47.1	AV	1000	54.0	6.9	RB
38	5190	10376.7	62.0	PEAK	1000	68.2	6.2	UE
46	5230	10457.7	61.2	PEAK	1000	68.2	7.0	UE
151	5755	5219.1	54.5	PEAK	1000	68.2	13.7	UE
151	5755	5721.5	65.7	PEAK	1000	68.2	2.5	UE
151	5755	11516.8	41.2	AV	1000	54.0	12.8	RB
151	5755	11516.9	58.3	PEAK	1000	74.0	15.7	RB
159	5795	11580.2	37.9	AV	1000	54.0	16.1	RB

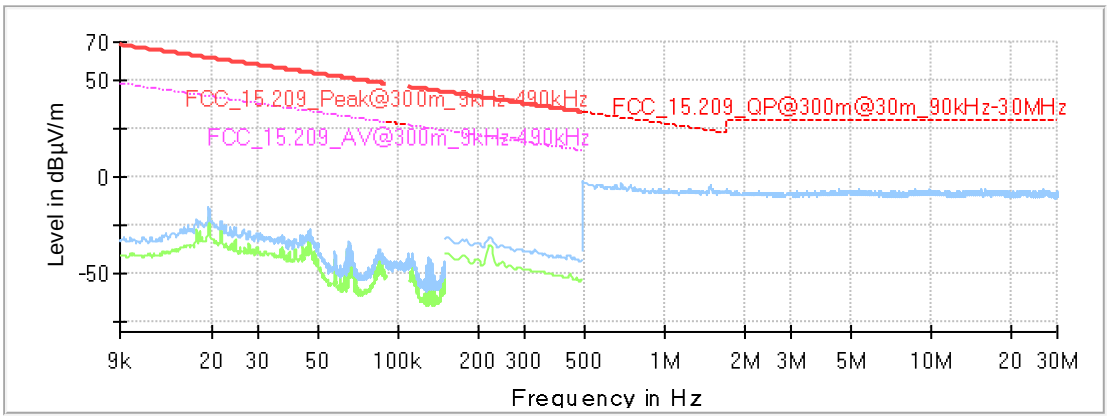
WLAN ac-Mode; 40 MHz; MCS0; MIMO
Applied duty cycle correction (AV): 0 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
38	5190	5149.2	61.3	PEAK	1000	74.0	12.7	RB
38	5190	5149.2	44.5	AV	1000	54.0	9.5	RB
38	5190	10380.6	59.4	PEAK	1000	68.2	8.8	UE

Remark: Please see next sub-clause for the measurement plot.

5.4.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Radio Technology = WLAN a, Operating Frequency = mid, Subband = U-NII-1 (S01_AE02)



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
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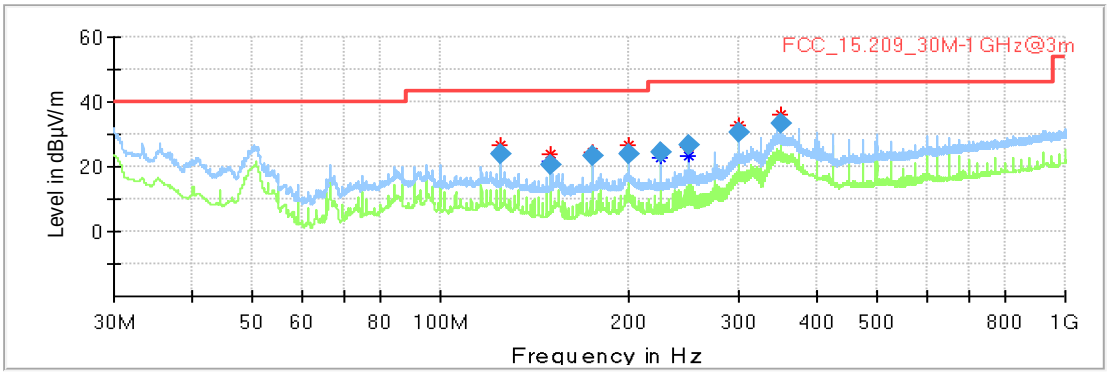
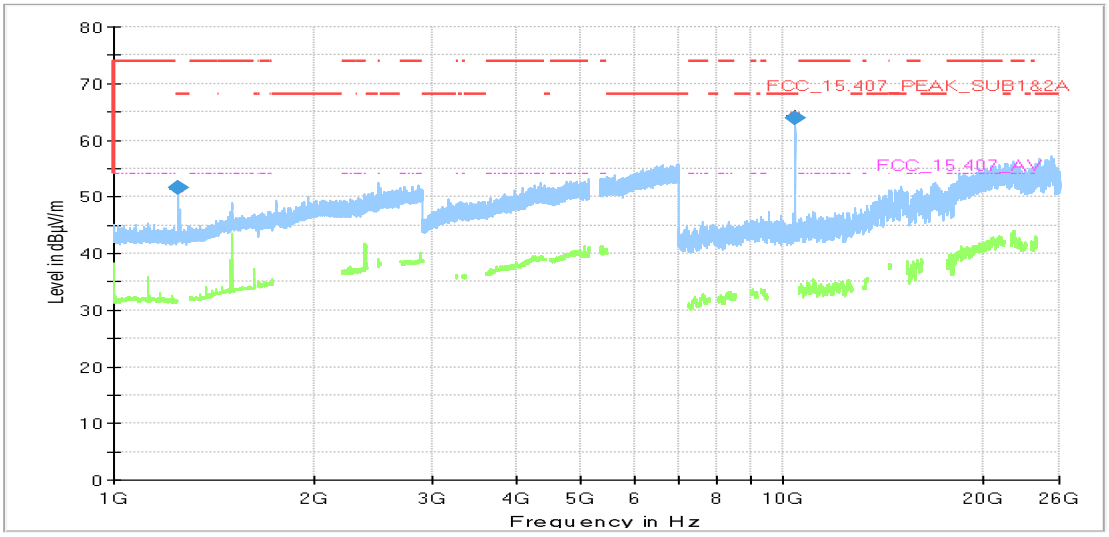


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
125.010000	23.67	43.50	19.83	1000.0	120.000	119.0	V	83.0	11.0	
150.000000	20.35	43.50	23.15	1000.0	120.000	235.0	H	-195.0	9.3	
174.990000	23.60	43.50	19.90	1000.0	120.000	102.0	V	97.0	9.1	
199.980000	24.02	43.50	19.48	1000.0	120.000	106.0	V	-63.0	9.3	
225.000000	24.17	46.00	21.83	1000.0	120.000	100.0	V	-35.0	9.8	
249.990000	26.61	46.00	19.39	1000.0	120.000	128.0	H	-46.0	11.4	
300.000000	30.58	46.00	15.42	1000.0	120.000	111.0	H	-71.0	13.1	
349.980000	33.39	46.00	12.61	1000.0	120.000	100.0	H	-52.0	14.7	

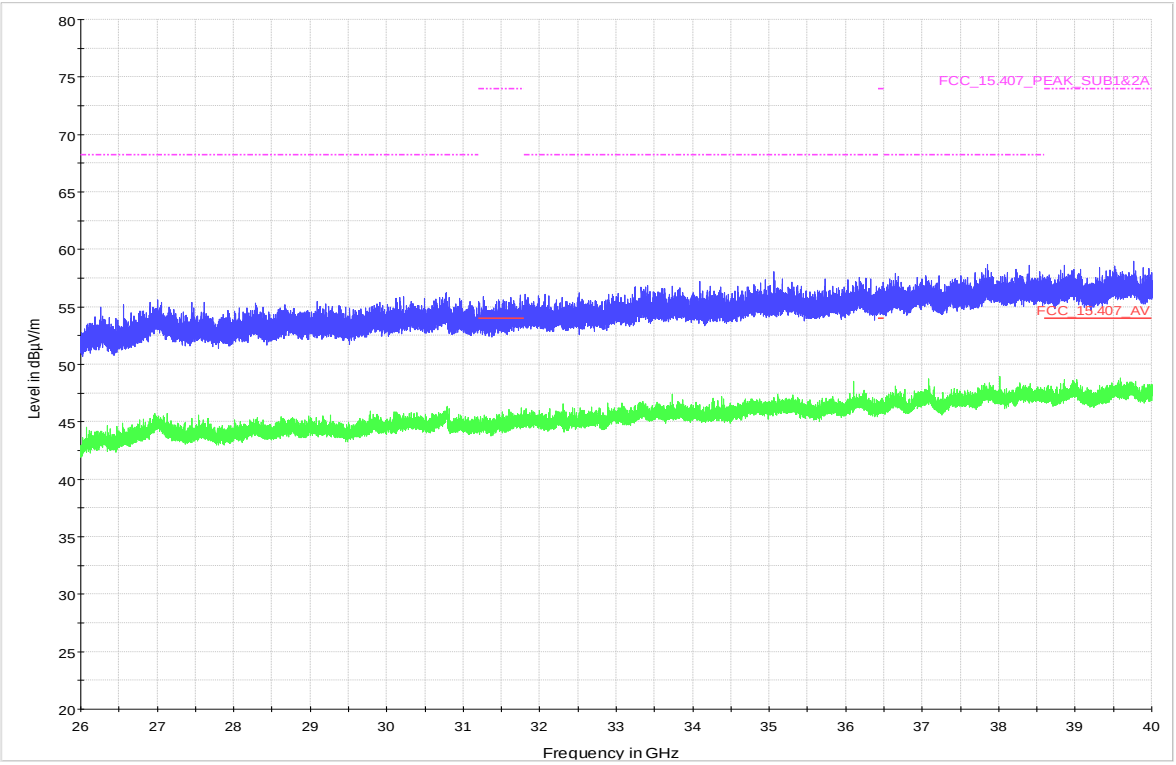


Critical_Freqs

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)
1249.900	51.4	---	68.20	16.78	---	---	150.0	H	-87.0	78.0
10439.125	64.4	---	68.20	3.85	---	---	150.0	H	129.0	88.0

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)
1249.900	51.7	---	68.20	16.50	1000.0	1000.000	150.0	H	-87.0	78.0
10439.125	63.8	---	68.20	4.38	1000.0	1000.000	150.0	H	129.0	88.0



5.4.5 TEST EQUIPMENT USED

- Radiated Emissions

5.5 BAND EDGE

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.5.1 TEST DESCRIPTION

Please see test description for the test case "Spurious Radiated Emissions"

5.5.2 TEST REQUIREMENTS / LIMITS

For band edges connected to a restricted band, the limits are specified in Section 15.209(a)

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

Frequency in 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 (2).

Frequency in 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 - 26000	500@3m	3	54.0@3m
26000 - 40000	500@3m	1	54.0@3m

The measured values above 26 GHz are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

§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: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

5.5.3 TEST PROTOCOL

Ambient temperature: 25 -27 °C
Air Pressure: 996 - 1026 hPa
Humidity: 30 - 45 %
WLAN a-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	36	5180	5150.0	55.2	PEAK	1000	74.0	18.8	BE-RB	FCC&IC
	36	5180	5150.0	42.6	AV	1000	54.0	11.4	BE-RB	FCC&IC
3	149	5745	5725.0	67.9	PEAK	1000	122.2	54.3	BE-UE	FCC&IC
	165	5825	5850.0	64.7	PEAK	1000	122.0	57.3	BE-UE	FCC&IC

WLAN n-Mode; 20 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	36	5180	5150.0	68.7	PEAK	1000	74.0	5.3	BE-RB	FCC&IC
	36	5180	5150.0	46.3	AV	1000	54.0	7.7	BE-RB	FCC&IC
3	149	5745	5725.0	69.6	PEAK	1000	121.1	51.5	BE-UE	FCC&IC
	165	5825	5850.0	65.9	PEAK	1000	121.7	55.8	BE-UE	FCC&IC

WLAN n-Mode; 40 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	38	5190	5150.0	66.3	PEAK	1000	74.0	7.7	BE-RB	FCC&IC
	38	5190	5150.0	44.1	AV	1000	54.0	6.9	BE-RB	FCC&IC
3	151	5755	5725.0	68.1	PEAK	1000	114.2	46.1	BE-UE	FCC&IC
	159	5795	5850.0	57.5	PEAK	1000	113.8	56.3	BE-UE	FCC&IC

WLAN ac-Mode; 80 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	42	5210	5150.0	69.9	PEAK	1000	74.0	4.1	BE-RB	FCC&IC
	42	5210	5150.0	52.0	AV	1000	54.0	2.0	BE-RB	FCC&IC

WLAN ac-Mode; 20 MHz; MCS0; MIMO
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	36	5180	5150.0	73.6	PEAK	1000	74.0	0.4	BE-RB	FCC&IC
	36	5180	5150.0	53.0	AV	1000	54.0	1.0	BE-RB	FCC&IC
3	149	5745	5725.0	75.0	PEAK	1000	121.3	46.3	BE-UE	FCC&IC
	165	5825	5850.0	67.8	PEAK	1000	120.8	53.0	BE-UE	FCC&IC

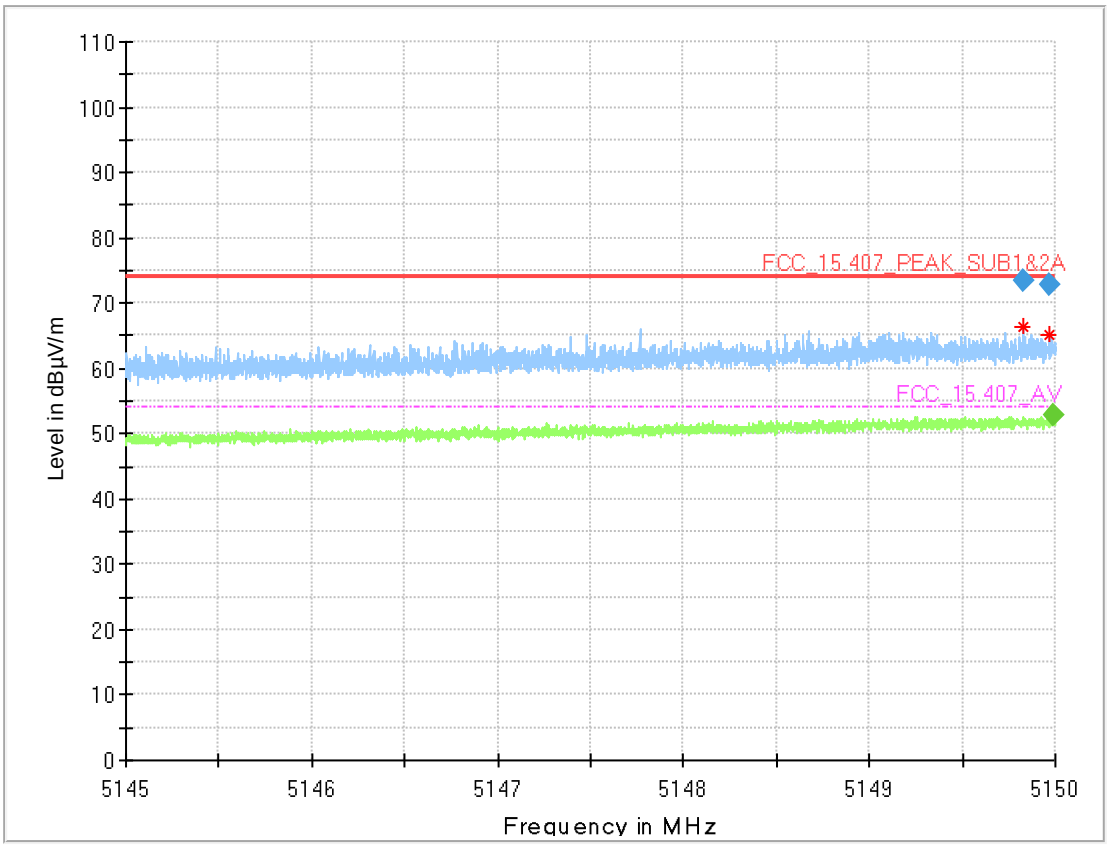
WLAN ac-Mode; 40 MHz; MCS0; MIMO
Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
1	38	5190	5150.0	61.3	PEAK	1000	74.0	12.7	BE-RB	FCC&IC
	38	5190	5150.0	44.5	AV	1000	54.0	9.5	BE-RB	FCC&IC

Remark: SISO mode is worst case for Band Edge. The worst results for SISO were repeated with a revised script. Please see next sub-clause for the measurement plot.

5.5.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Radio Technology = WLAN ac 20 MHz MIMO, Operating Frequency = low, Subband = U-NII-1 (S01_AE02)



Critical_Freqs

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)
5149.825	66.2	---	74.00	7.76	---	---	150.0	V	-179.0	82.0
5149.968	65.1	---	74.00	8.86	---	---	150.0	V	-11.0	75.0
5149.991	---	52.7	54.00	1.28	---	---	150.0	V	-8.0	85.0

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)
5149.825	73.6	---	74.00	0.43	1000.0	1000.000	150.0	V	-179.0	82.0
5149.968	72.7	---	74.00	1.29	1000.0	1000.000	150.0	V	-11.0	75.0
5149.991	---	53.0	54.00	1.04	1000.0	1000.000	150.0	V	-8.0	85.0

5.5.5 TEST EQUIPMENT USED

- Radiated Emissions

6 TEST EQUIPMENT

1 R&S TS8997
EN300328/301893 Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	107695	2017-07	2020-07
1.2	MFS	Rubidium Frequency Standard	Datum-Beverly	5489/001	2018-07	2019-07
1.3	1515 / 93459	Broadband Power Divider SMA (Aux)	Weinschel Associates	LN673		
1.4	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2018-04	2020-04
1.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2018-04	2020-04
1.6	VHF-3100+	High Pass Filter		-		
1.7	VT 4002	Temperature Chamber	Vötsch	58566002150010	2018-04	2020-04
1.8	A8455-4	4 Way Power Divider (SMA)		-		
1.9	Opus10 THI (8152.00)	ThermoHygro Datalogger 03 (Environ)	Lufft Mess- und Regeltechnik GmbH	7482	2017-03	2019-03
1.10	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2016-10	2019-10
1.11	OSP120	Switching Unit with integrated power meter	Rohde & Schwarz	101158	2018-05	2021-05

2 Radiated Emissions
Lab to perform radiated emission tests

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	NRV-Z1	Sensor Head A	Rohde & Schwarz GmbH & Co. KG	827753/005	2018-07	2019-07
2.2	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2018-10	2020-10
2.3	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13 (Environ)	Lufft Mess- und Regeltechnik GmbH	13936	2017-04	2019-04
2.4	ESW44	EMI Test Receiver	Rohde & Schwarz GmbH & Co. KG	101603	2018-05	2019-05
2.5	Anechoic Chamber	10.58 x 6.38 x 6.00 m³	Frankonia	none	2018-06	2020-06
2.6	FS-Z60	Harmonic Mixer 40 - 60 GHz	Rohde & Schwarz Messgerätebau GmbH	100178	2016-12	2019-12

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.7	FS-Z220	Harmonic Mixer 140 - 220 GHz	Rohde & Schwarz Messgerätebau GmbH	101005	2017-03	2020-03
2.8	SGH-05	Standard Gain / Pyramidal Horn Antenna (140 - 220 GHz)	RPG-Radiometer Physics GmbH	075		
2.9	HL 562	Ultralog new biconicals	Rohde & Schwarz	830547/003	2018-07	2021-07
2.10	5HC2700/12750 -1.5-KK	High Pass Filter	Trilithic	9942012		
2.11	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-		
2.12	Fully Anechoic Room	8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	2018-06	2020-06
2.13	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2018-04	2020-04
2.14	NRVD	Power Meter	Rohde & Schwarz GmbH & Co. KG	828110/016	2018-07	2019-07
2.15	HF 906	Double-ridged horn	Rohde & Schwarz	357357/002	2018-09	2021-09
2.16	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785		
2.17	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2019-02	2021-02
2.18	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069		
2.19	SGH-19	Standard Gain / Pyramidal Horn Antenna (40 - 60 GHz)	RPG-Radiometer Physics GmbH	093		
2.20	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright	09		
2.21	4HC1600/12750 -1.5-KK	High Pass Filter	Trilithic	9942011		
2.22	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304		
2.23	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368		
2.24	TT 1.5 WI	Turn Table	Maturo GmbH	-		
2.25	HL 562 Ultralog	Log.-per. Antenna	Rohde & Schwarz	100609	2016-04	2019-04
2.26	HF 906	Double-ridged horn	Rohde & Schwarz	357357/001	2018-03	2021-03
2.27	FS-Z325	Harmonic Mixer 220 - 325 GHz	Rohde & Schwarz Messgerätebau GmbH	101006	2017-03	2020-03

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.28	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronic GmbH	00086675		
2.29	SGH-08	Standard Gain / Pyramidal Horn Antenna (90 - 140 GHz)	RPG-Radiometer Physics GmbH	064		
2.30	SGH-12	Standard Gain / Pyramidal HornAntenna (60 - 90 GHz)	RPG-Radiometer Physics GmbH	326		
2.31	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
2.32	FS-Z140	Harmonic Mixer 90 -140 GHz	Rohde & Schwarz Messgerätebau GmbH	101007	2017-02	2020-02
2.33	HFH2-Z2	Loop Antenna	Rohde & Schwarz	829324/006	2018-01	2021-01
2.34	Opus10 THI (8152.00)	ThermoHygro Datalogger 12 (Environ)	Lufft Mess- und Regeltechnik GmbH	12482	2017-03	2019-03
2.35	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2019-01	2020-01
2.36	JS4-00101800-35-5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037		
2.37	AS 620 P	Antenna mast	HD GmbH	620/37		
2.38	Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	Maturo GmbH	TD1.5-10kg/024/3790709		
2.39	SGH-03	Standard Gain / Pyramidal Horn Antenna (220 - 325 GHz)	RPG-Radiometer Physics GmbH	060		
2.40	FS-Z90	Harmonic Mixer 60 - 90 GHz	Rohde & Schwarz Messgerätebau GmbH	101686	2017-03	2020-03
2.41	ESIB 26	Spectrum Analyzer	Rohde & Schwarz	830482/004	2018-01	2020-01
2.42	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
2.43	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324		
2.44	AM 4.0	Antenna mast	Maturo GmbH	AM4.0/180/11920513		
2.45	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2018-07	2021-07

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

7.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

Frequency		Corr.	LISN insertion loss ESH3-Z5	cable loss (incl. 10 dB atten-uator)
MHz		dB	dB	dB
0.15		10.1	0.1	10.0
5		10.3	0.1	10.2
7		10.5	0.2	10.3
10		10.5	0.2	10.3
12		10.7	0.3	10.4
14		10.7	0.3	10.4
16		10.8	0.4	10.4
18		10.9	0.4	10.5
20		10.9	0.4	10.5
22		11.1	0.5	10.6
24		11.1	0.5	10.6
26		11.2	0.5	10.7
28		11.2	0.5	10.7
30		11.3	0.5	10.8

Sample calculation

U_{LISN} (dB µV) = U (dB µV) + Corr. (dB)
U = Receiver reading
LISN Insertion loss = Voltage Division Factor of LISN
Corr. = sum of single correction factors of used LISN, cables, switch units (if used)
Linear interpolation will be used for frequencies in between the values in the table.

7.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency	AF HFH-Z2)	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-40 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
0.009	20.50	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.01	20.45	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.015	20.37	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.02	20.36	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.025	20.38	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.03	20.32	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.05	20.35	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.08	20.30	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.1	20.20	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.2	20.17	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.3	20.14	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.49	20.12	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.490001	20.12	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.5	20.11	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.8	20.10	-39.6	0.1	0.1	0.1	0.1	-40	30	3
1	20.09	-39.6	0.1	0.1	0.1	0.1	-40	30	3
2	20.08	-39.6	0.1	0.1	0.1	0.1	-40	30	3
3	20.06	-39.6	0.1	0.1	0.1	0.1	-40	30	3
4	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
5	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
6	20.02	-39.5	0.2	0.1	0.1	0.1	-40	30	3
8	19.95	-39.5	0.2	0.1	0.1	0.1	-40	30	3
10	19.83	-39.4	0.2	0.1	0.2	0.1	-40	30	3
12	19.71	-39.4	0.2	0.1	0.2	0.1	-40	30	3
14	19.54	-39.4	0.2	0.1	0.2	0.1	-40	30	3
16	19.53	-39.3	0.3	0.1	0.2	0.1	-40	30	3
18	19.50	-39.3	0.3	0.1	0.2	0.1	-40	30	3
20	19.57	-39.3	0.3	0.1	0.2	0.1	-40	30	3
22	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
24	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
26	19.54	-39.3	0.3	0.1	0.2	0.1	-40	30	3
28	19.46	-39.2	0.3	0.1	0.3	0.1	-40	30	3
30	19.73	-39.1	0.4	0.1	0.3	0.1	-40	30	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -40 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values

7.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

(d_{Limit} = 3 m)

Frequency	AF R&S HL562	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
30	18.6	0.6	0.29	0.04	0.23	0.02	0.0	3	3
50	6.0	0.9	0.39	0.09	0.32	0.08	0.0	3	3
100	9.7	1.2	0.56	0.14	0.47	0.08	0.0	3	3
150	7.9	1.6	0.73	0.20	0.59	0.12	0.0	3	3
200	7.6	1.9	0.84	0.21	0.70	0.11	0.0	3	3
250	9.5	2.1	0.98	0.24	0.80	0.13	0.0	3	3
300	11.0	2.3	1.04	0.26	0.89	0.15	0.0	3	3
350	12.4	2.6	1.18	0.31	0.96	0.13	0.0	3	3
400	13.6	2.9	1.28	0.35	1.03	0.19	0.0	3	3
450	14.7	3.1	1.39	0.38	1.11	0.22	0.0	3	3
500	15.6	3.2	1.44	0.39	1.20	0.19	0.0	3	3
550	16.3	3.5	1.55	0.46	1.24	0.23	0.0	3	3
600	17.2	3.5	1.59	0.43	1.29	0.23	0.0	3	3
650	18.1	3.6	1.67	0.34	1.35	0.22	0.0	3	3
700	18.5	3.6	1.67	0.42	1.41	0.15	0.0	3	3
750	19.1	4.1	1.87	0.54	1.46	0.25	0.0	3	3
800	19.6	4.1	1.90	0.46	1.51	0.25	0.0	3	3
850	20.1	4.4	1.99	0.60	1.56	0.27	0.0	3	3
900	20.8	4.7	2.14	0.60	1.63	0.29	0.0	3	3
950	21.1	4.8	2.22	0.60	1.66	0.33	0.0	3	3
1000	21.6	4.9	2.23	0.61	1.71	0.30	0.0	3	3

(d_{Limit} = 10 m)

30	18.6	-9.9	0.29	0.04	0.23	0.02	-10.5	10	3
50	6.0	-9.6	0.39	0.09	0.32	0.08	-10.5	10	3
100	9.7	-9.2	0.56	0.14	0.47	0.08	-10.5	10	3
150	7.9	-8.8	0.73	0.20	0.59	0.12	-10.5	10	3
200	7.6	-8.6	0.84	0.21	0.70	0.11	-10.5	10	3
250	9.5	-8.3	0.98	0.24	0.80	0.13	-10.5	10	3
300	11.0	-8.1	1.04	0.26	0.89	0.15	-10.5	10	3
350	12.4	-7.9	1.18	0.31	0.96	0.13	-10.5	10	3
400	13.6	-7.6	1.28	0.35	1.03	0.19	-10.5	10	3
450	14.7	-7.4	1.39	0.38	1.11	0.22	-10.5	10	3
500	15.6	-7.2	1.44	0.39	1.20	0.19	-10.5	10	3
550	16.3	-7.0	1.55	0.46	1.24	0.23	-10.5	10	3
600	17.2	-6.9	1.59	0.43	1.29	0.23	-10.5	10	3
650	18.1	-6.9	1.67	0.34	1.35	0.22	-10.5	10	3
700	18.5	-6.8	1.67	0.42	1.41	0.15	-10.5	10	3
750	19.1	-6.3	1.87	0.54	1.46	0.25	-10.5	10	3
800	19.6	-6.3	1.90	0.46	1.51	0.25	-10.5	10	3
850	20.1	-6.0	1.99	0.60	1.56	0.27	-10.5	10	3
900	20.8	-5.8	2.14	0.60	1.63	0.29	-10.5	10	3
950	21.1	-5.6	2.22	0.60	1.66	0.33	-10.5	10	3
1000	21.6	-5.6	2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

7.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay + cable inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit, atten-uator & pre-amp)	cable loss 4 (to receiver)		
MHz	dB (1/m)	dB	dB	dB	dB	dB		
1000	24.4	-19.4	0.99	0.31	-21.51	0.79		
2000	28.5	-17.4	1.44	0.44	-20.63	1.38		
3000	31.0	-16.1	1.87	0.53	-19.85	1.33		
4000	33.1	-14.7	2.41	0.67	-19.13	1.31		
5000	34.4	-13.7	2.78	0.86	-18.71	1.40		
6000	34.7	-12.7	2.74	0.90	-17.83	1.47		
7000	35.6	-11.0	2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (inside chamber)	cable loss 3 (outside chamber)	cable loss 4 (switch unit, atten-uator & pre-amp)	cable loss 5 (to receiver)	used for FCC 15.247
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	
3000	31.0	-23.4	0.47	1.87	0.53	-27.58	1.33	
4000	33.1	-23.3	0.56	2.41	0.67	-28.23	1.31	
5000	34.4	-21.7	0.61	2.78	0.86	-27.35	1.40	
6000	34.7	-21.2	0.58	2.74	0.90	-26.89	1.47	
7000	35.6	-19.8	0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (High Pass)	cable loss 3 (pre-amp)	cable loss 4 (inside chamber)	cable loss 5 (outside chamber)	cable loss 6 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	dB
7000	35.6	-57.3	0.56	1.28	-62.72	2.66	0.94	1.46
8000	36.3	-56.3	0.69	0.71	-61.49	2.84	1.00	1.53
9000	37.1	-55.3	0.68	0.65	-60.80	3.06	1.09	1.60
10000	37.5	-56.2	0.70	0.54	-61.91	3.28	1.20	1.67
11000	37.5	-55.3	0.80	0.61	-61.40	3.43	1.27	1.70
12000	37.6	-53.7	0.84	0.42	-59.70	3.53	1.26	1.73
13000	38.2	-53.5	0.83	0.44	-59.81	3.75	1.32	1.83
14000	39.9	-56.3	0.91	0.53	-63.03	3.91	1.40	1.77
15000	40.9	-54.1	0.98	0.54	-61.05	4.02	1.44	1.83
16000	41.3	-54.1	1.23	0.49	-61.51	4.17	1.51	1.85
17000	42.8	-54.4	1.36	0.76	-62.36	4.34	1.53	2.00
18000	44.2	-54.7	1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

7.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

Frequency	AF EMCO 3160-09	Corr.	cable loss 1 (inside chamber)	cable loss 2 (pre-amp)	cable loss 3 (inside chamber)	cable loss 4 (switch unit)	cable loss 5 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB
18000	40.2	-23.5	0.72	-35.85	6.20	2.81	2.65
18500	40.2	-23.2	0.69	-35.71	6.46	2.76	2.59
19000	40.2	-22.0	0.76	-35.44	6.69	3.15	2.79
19500	40.3	-21.3	0.74	-35.07	7.04	3.11	2.91
20000	40.3	-20.3	0.72	-34.49	7.30	3.07	3.05
20500	40.3	-19.9	0.78	-34.46	7.48	3.12	3.15
21000	40.3	-19.1	0.87	-34.07	7.61	3.20	3.33
21500	40.3	-19.1	0.90	-33.96	7.47	3.28	3.19
22000	40.3	-18.7	0.89	-33.57	7.34	3.35	3.28
22500	40.4	-19.0	0.87	-33.66	7.06	3.75	2.94
23000	40.4	-19.5	0.88	-33.75	6.92	3.77	2.70
23500	40.4	-19.3	0.90	-33.35	6.99	3.52	2.66
24000	40.4	-19.8	0.88	-33.99	6.88	3.88	2.58
24500	40.4	-19.5	0.91	-33.89	7.01	3.93	2.51
25000	40.4	-19.3	0.88	-33.00	6.72	3.96	2.14
25500	40.5	-20.4	0.89	-34.07	6.90	3.66	2.22
26000	40.5	-21.3	0.86	-35.11	7.02	3.69	2.28
26500	40.5	-21.1	0.90	-35.20	7.15	3.91	2.36

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

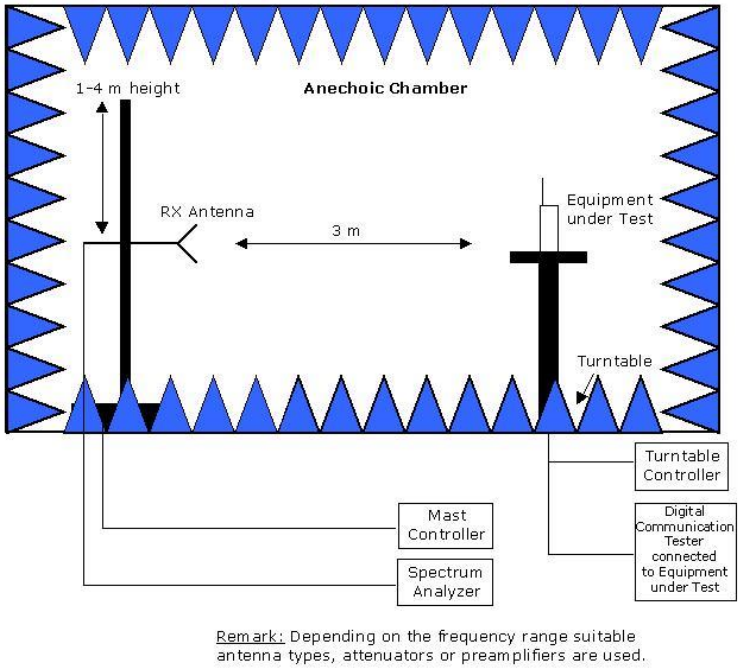
7.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

Frequency	AF EMCO 3160-10	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
GHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
26.5	43.4	-11.2	4.4				-9.5	3	1.0
27.0	43.4	-11.2	4.4				-9.5	3	1.0
28.0	43.4	-11.1	4.5				-9.5	3	1.0
29.0	43.5	-11.0	4.6				-9.5	3	1.0
30.0	43.5	-10.9	4.7				-9.5	3	1.0
31.0	43.5	-10.8	4.7				-9.5	3	1.0
32.0	43.5	-10.7	4.8				-9.5	3	1.0
33.0	43.6	-10.7	4.9				-9.5	3	1.0
34.0	43.6	-10.6	5.0				-9.5	3	1.0
35.0	43.6	-10.5	5.1				-9.5	3	1.0
36.0	43.6	-10.4	5.1				-9.5	3	1.0
37.0	43.7	-10.3	5.2				-9.5	3	1.0
38.0	43.7	-10.2	5.3				-9.5	3	1.0
39.0	43.7	-10.2	5.4				-9.5	3	1.0
40.0	43.8	-10.1	5.5				-9.5	3	1.0

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

8 SETUP DRAWINGS



Drawing 1: Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting groundplane.

9 MEASUREMENT UNCERTAINTIES

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

10 PHOTO REPORT

Please see separate photo report.