

FCC Measurement/Technical Report on

6.5inchCluster

Connected Instrumentation Cluster for Motorcycle (in WLAN-Mode)

FCC ID: 2AUXS-6P5CLUSTER
IC: 25847-6P5CLUSTER

Test Report Reference: MDE_BOSCH_2004_FCC_01

Test Laboratory:

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Borsigstrasse 11
40880 Ratingen
Germany



Deutsche
Akkreditierungsstelle
D-PL-12140-01-01
D-PL-12140-01-02
D-PL-12140-01-03

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization

Certification for an Intentional Radiator.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-19 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

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz

Note 1:

The tests were selected and performed with reference to the FCC Public Notice “Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, 558074 D01 15.247 Meas Guidance v05r02, 2019-04-02”. ANSI C63.10–2013 is applied.

Note 2:

§ 15.207 Conducted limits are not applicable:

The device is not designed to be connected to the public utility (AC) power line.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for DTS (e.g. WLAN 2.4 GHz, BT LE) equipment from FCC and IC

DTS equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 5: 8.8
Occupied bandwidth	§ 15.247 (a) (2)	RSS-247 Issue 2: 5.2 (a)
Peak conducted output power	§ 15.247 (b) (3), (4)	RSS-247 Issue 2: 5.4 (d)
Transmitter spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen Issue 5: 6.13 / 8.9/8.10; RSS-247 Issue 2: 5.5
Transmitter spurious radiated emissions	§ 15.247 (d); § 15.209 (a)	RSS-Gen Issue 5: 6.13 / 8.9/8.10; RSS-247 Issue 2: 5.5
Band edge compliance	§ 15.247 (d)	RSS-247 Issue 2: 5.5
Power density	§ 15.247 (e)	RSS-247 Issue 2: 5.2 (b)
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 5: 8.3
Receiver spurious emissions	–	–

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15 Subpart C §15.247

§ 15.247 (a) (2)

Occupied Bandwidth (6 dB)

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency				
WLAN b, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart C §15.247

IC RSS-Gen & IC TRC-43; Ch. 6.7 & Ch. 8

Occupied Bandwidth (99%)

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency				
WLAN b, high	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN b, low	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN b, mid	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN g, high	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN g, low	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN g, mid	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN n 20 MHz, high	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN n 20 MHz, low	S01_ab01_WLAN	2020-07-29	N/A	Performed
WLAN n 20 MHz, mid	S01_ab01_WLAN	2020-07-29	N/A	Performed

47 CFR CHAPTER I FCC PART 15 Subpart C §15.247

§ 15.247 (b) (3)

Peak Power Output

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Measurement method				
WLAN b, high, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, low, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, mid, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, high, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, low, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, mid, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, high, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, low, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, mid, conducted	S01_ab01_WLAN	2020-07-29	Passed	Passed

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (d)

Spurious RF Conducted Emissions

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency				
WLAN b, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, mid	S01_ab01_WLAN	2020-07-29	Passed	Passed

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (d)

Transmitter Spurious Radiated Emissions

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Measurement range				
WLAN b, high, 1 GHz - 26 GHz	S01_aa01_WLAN	2020-08-12	Passed	Passed
WLAN b, high, 30 MHz - 1 GHz	S01_aa01_WLAN	2020-08-02	Passed	Passed
WLAN b, low, 1 GHz - 26 GHz	S01_aa01_WLAN	2020-08-12	Passed	Passed
WLAN b, low, 30 MHz - 1 GHz	S01_aa01_WLAN	2020-08-02	Passed	Passed
WLAN b, mid, 1 GHz - 26 GHz	S01_aa01_WLAN	2020-08-12	Passed	Passed
WLAN b, mid, 30 MHz - 1 GHz	S01_aa01_WLAN	2020-08-02	Passed	Passed
WLAN b, mid, 9 kHz - 30 MHz	S01_aa01_WLAN	2020-08-02	Passed	Passed
WLAN g, high, 1 GHz - 8 GHz	S01_aa01_WLAN	2020-08-12	Passed	Passed
WLAN g, low, 1 GHz - 8 GHz	S01_aa01_WLAN	2020-08-14	Passed	Passed
WLAN g, mid, 1 GHz - 8 GHz	S01_aa01_WLAN	2020-08-14	Passed	Passed
WLAN n 20 MHz, high, 1 GHz - 8 GHz	S01_aa01_WLAN	2020-08-16	Passed	Passed

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (d)

Band Edge Compliance Conducted

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Band Edge				
WLAN b, high, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN b, low, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, high, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN g, low, low	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, high, high	S01_ab01_WLAN	2020-07-29	Passed	Passed
WLAN n 20 MHz, low, low	S01_ab01_WLAN	2020-07-29	Passed	Passed

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (d)

Band Edge Compliance Radiated

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode

Radio Technology, Operating Frequency,
Band Edge

Setup

Date

FCC

IC

WLAN b, high, high

S01_aa01_WLAN

2020-08-12

Passed

Passed

WLAN g, high, high

S01_aa01_WLAN

2020-08-12

Passed

Passed

WLAN n 20 MHz, high, high

S01_aa01_WLAN

2020-08-16

Passed

Passed

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (e)

Power Density

The measurement was performed according to ANSI C63.10

Final Result

OP-Mode

Radio Technology, Operating Frequency

Setup

Date

FCC

IC

WLAN b, high

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN b, low

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN b, mid

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN g, high

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN g, low

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN g, mid

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN n 20 MHz, high

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN n 20 MHz, low

S01_ab01_WLAN

2020-07-29

Passed

Passed

WLAN n 20 MHz, mid

S01_ab01_WLAN

2020-07-29

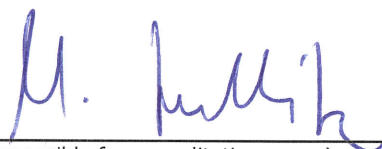
Passed

Passed

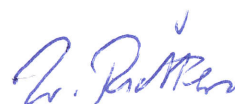
2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2020-09-21	--	valid
--	--	--	--

COMMENT: -



(responsible for accreditation scope)
Marco Kullik



(responsible for testing and report)
Wolfgang Richter



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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-12140-01-01| -02 | -03
FCC Designation Number: DE0015
FCC Test Firm Registration: 929146
ISED CAB Identifier DE0007; ISED#: 3699A
Responsible for accreditation scope: Marco Kullik
Report Template Version: 2020-06-15

3.2 PROJECT DATA

Responsible for testing and report: Wolfgang Richter
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2020-09-21
Testing Period: 2020-07-29 to 2020-09-17

3.3 APPLICANT DATA

Company Name: Robert Bosch GmbH
Address: Robert-Bosch-Straße 200
31139 Hildesheim
Germany
Contact Person: Thomas Dargel

3.4 MANUFACTURER DATA

Company Name:	Robert Bosch GmbH
Address:	Robert-Bosch-Straße 200 31139 Hildesheim Germany
Contact Person:	Thomas Dargel

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Declared EUT data by the supplier	
Kind of Device product description	The 6.5inchCluster is a motorcycle instrumentation cluster with integrated connectivity functions. It is only intended for usage on motorcycles. It performs speedometer and odometer functions, as well as infotainment. Key features: - 6.5" high-resolution color display - Connectivity (CAN, LIN, Bluetooth, Wi-Fi) - Smartphone integration - USB for charging functions - Housing IP6K9K
Product name	Connected Instrumentation Cluster for Motorcycle
Type	6.5inchCluster
General product description	-
Specific product description for the EUT	UGKZ7A2001A module for Wi-Fi & BT - Smartphone, UGXZEX304A module: BT - Headset
Special software used for testing	on Intel stick "RTA Test Profile"
Tested data rates	WLAN: b-mode, 20 MHz, 1 Mbit/s; WLAN g-mode, 20 MHz, 6 Mbit/s; WLAN n-mode, 20 MHz, MCS0
Tested Modulation Type	b-mode: DSSS/CCK; g-Mode: OFDM; n-mode: OFDM
The EUT provides the following ports:	Main Connector and Connectivity Connector
Voltage Level	13.5 V
Voltage Type	DC (from motorcycle)
Additional information	World Safe Mode: Channel number 12 – 13 / 2484 MHz not supported Bandwidth: 20 MHz
Integral Antenna	WLAN: SMD chip antenna, TDK, ANT162442DT-2001AM1, 2.1 dBi BT-Smartphone: SMD chip antenna, TDK, ANT162442ST-1000AM1, +1 dBi BT-Headset: SMD chip antenna, TDK, ANT162442ST-1000AM1, +3 dBi

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT A	DE1050021aa01	Sample with 3 integral antennas for WLAN, BT-Smartphone and BT-Headset
Sample Parameter	Value	
Serial No.	20040003521	
HW Version	007	
SW Version	10.02	
Comment	Variant #1 (0263763)	

Sample Name	Sample Code	Description
EUT B	DE1050021ab01	Sample with 3 temporary SMA antenna connectors for WLAN, BT-Smartphone and BT-Headset
Sample Parameter	Value	
Serial No.	20030003551	
HW Version	007	
SW Version	10.02	
Comment 1	Variant #1 (0263763)	
Comment 2	integral antennas not connected	

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
AC Adapter RE03 /W10	Fujitsu Ltd., SED110P2-19.0, -, -, 07813018A	AC Adapter for laptop RE03 /W10
AUX 01	Robert Bosch GmbH, iKombi Control Box, -, -, -	Control box
AUX 02	PEAK Systems, PCAN-USB, -, -, IPEH-002021	CAN adapter between control box and Intel stick
AUX 03	Intel, Intel Compute Stick, -, Yocto OS, STK1AW32SC	Intel stick
AUX 04	Asian Power Devices, AC Adapter, -, -, WA-15I05R	Power supply for Intel Stick
AUX 05	Lindy, USB 2.0 Fast Ethernet Converter, -, -, 42922	USB-Ethernet adapter between Intel stick and laptop
AUX 06	PONTIS EMC PRODUCTS, foCAN_B, V4.0, -, 4921607013	Fiber Optic Converter for CAN bus
AUX 07	PONTIS EMC PRODUCTS, foCAN_B, V4.0, -, 4921607014	Fiber Optic Converter for CAN bus
Laptop RE03 /W10	Fujitsu Ltd., Lifebook E-Series E781, -, W10, DSCK013809	Lifebook E-Series E781

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_ab01_WLAN	EUT B, AC Adapter RE03 /W10, Laptop RE03 /W10, AUX 01, AUX 03, AUX 05, AUX 04, AUX 02,	measurement on temporary WLAN antenna connector
S01_aa01_WLAN	EUT A, AC Adapter RE03 /W10, Laptop RE03 /W10, AUX 01, AUX 03, AUX 07, AUX 06, AUX 05, AUX 04, AUX 02,	used for radiated measurements in WLAN mode, EUT, AUX 01 and AUX 06 inside chamber

4.6 OPERATING MODES / TEST CHANNELS

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

4.6.1 TEST CHANNELS

WLAN
20 MHz Test Channels:
Channel:
Frequency [MHz]

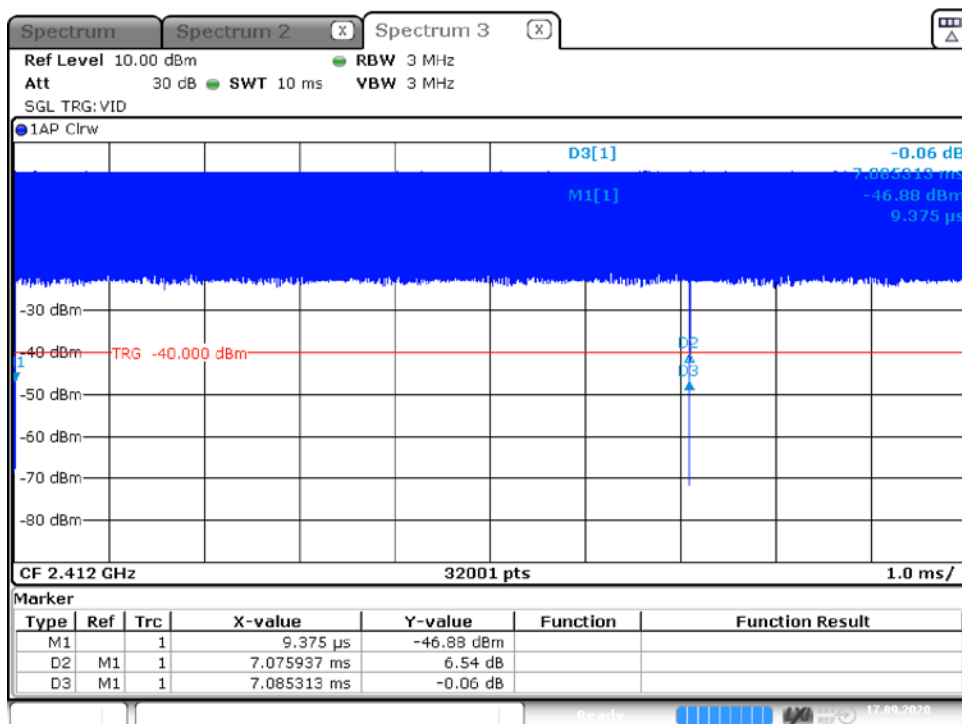
2.4 GHz ISM 2400 - 2483.5 MHz		
low	mid	high
1	6	11
2412	2437	2462

4.6.2 POWER SETTINGS

The power settings are not selectable by the operator.

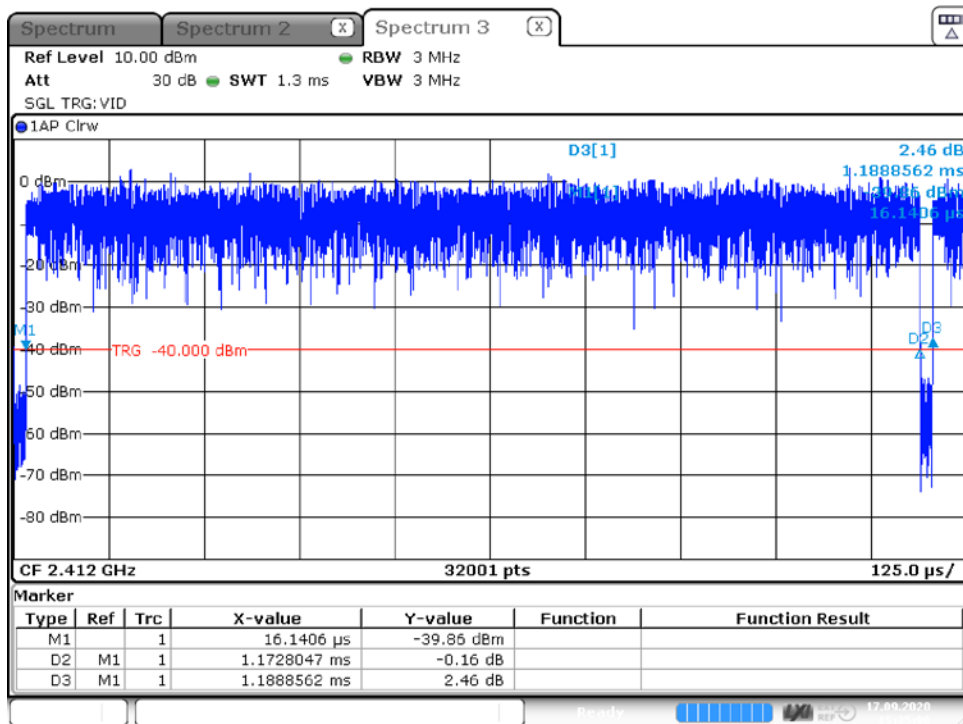
4.6.3 DUTY CYCLE

Mode	T _{on}	T _{Periode}	Duty Cycle
WLAN	ms	ms	%
b-mode	7.0759	7.0853	99.87%
g-mode	1.1728	1.1888	98.65%
n-mode	1.1008	1.1168	98.57%



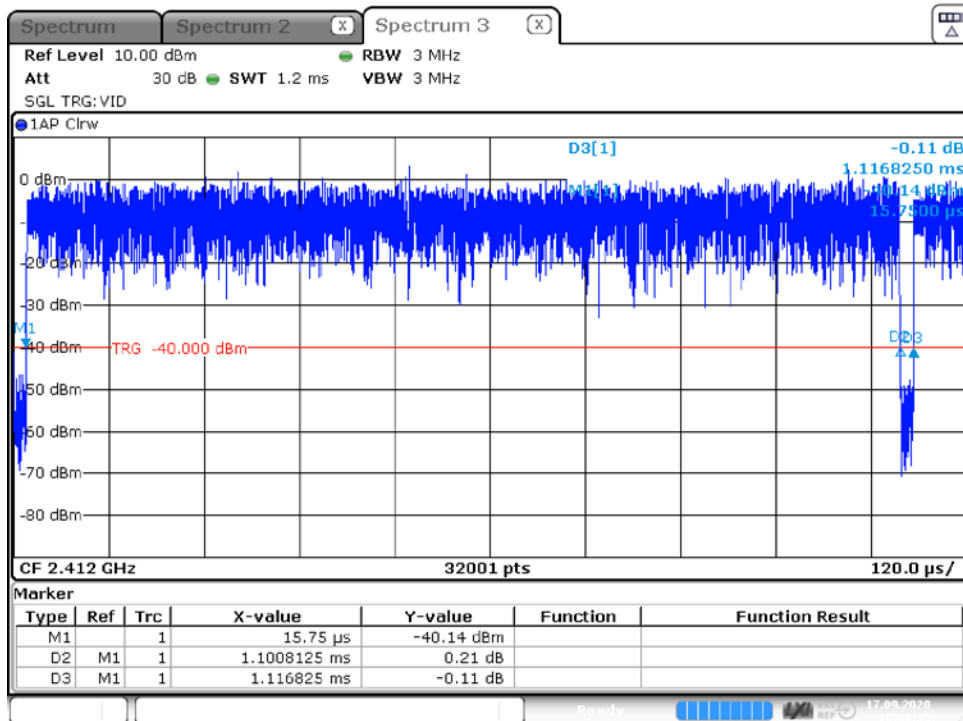
Date: 17.SEP.2020 15:21:32

b-mode



Date: 17.SEP.2020 15:35:06

g-mode



Date: 17.SEP.2020 15:30:36

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 OCCUPIED BANDWIDTH (6 DB)

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.1.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up to perform the occupied bandwidth measurements.

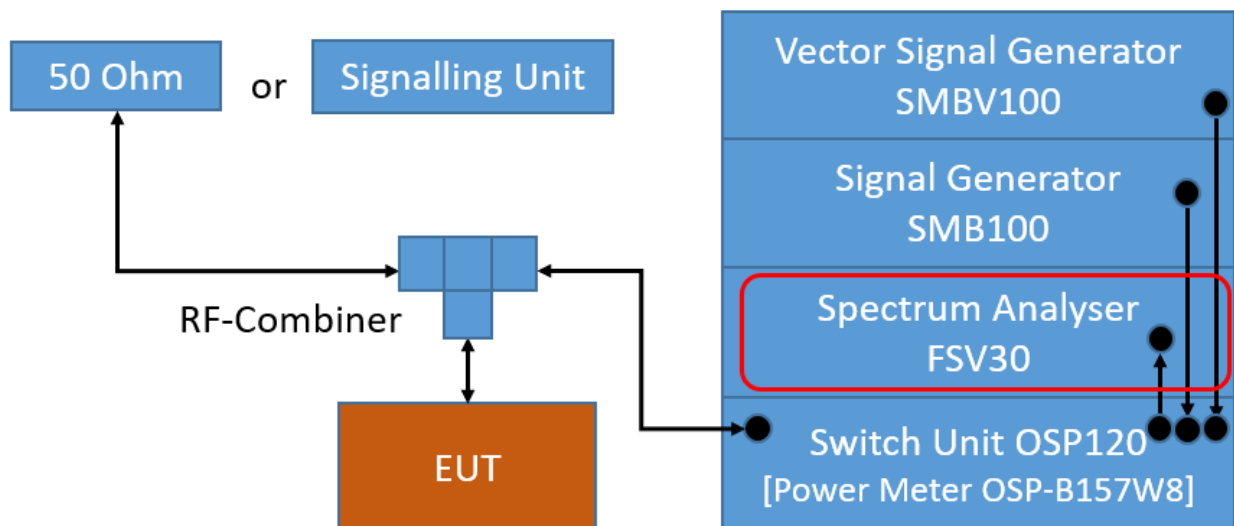
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produce the worst-case (smallest) emission bandwidth.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyser settings:

- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Span: Two times nominal bandwidth
- Trace: Maxhold
- Sweeps: Till stable (min. 500, max. 15000)
- Sweep Time: Auto
- Detector: Peak



TS8997; Channel Bandwidth

5.1.2 TEST REQUIREMENTS / LIMITS

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

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

5.1.3 TEST PROTOCOL

Ambient temperature: 23 °C
 Air Pressure: 1009 hPa
 Humidity: 51 %
 WLAN b-Mode; 20 MHz; 1 Mbit/s

Band	Channel No.	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Margin to Limit [MHz]
2.4 GHz ISM	1	2412	10.2	0.5	9.7
	6	2437	10.2	0.5	9.7
	11	2462	10.2	0.5	9.7

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

Band	Channel No.	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Margin to Limit [MHz]
2.4 GHz ISM	1	2412	16.4	0.5	15.9
	6	2437	16.4	0.5	15.9
	11	2462	16.4	0.5	15.9

WLAN n-Mode; 20 MHz; MCS0

Band	Channel No.	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Margin to Limit [MHz]
2.4 GHz ISM	1	2412	17.2	0.5	16.7
	6	2437	17.4	0.5	16.9
	11	2462	17.2	0.5	16.7

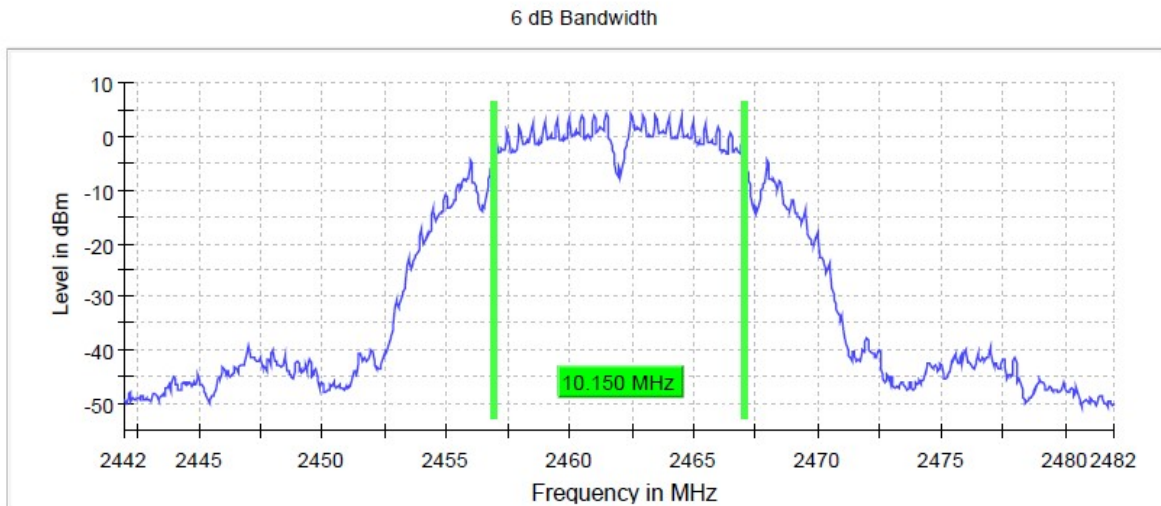
Remark: Please see next sub-clause for the measurement plot.

5.1.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN b, Operating Frequency = mid
(S01_ab01_WLAN)

6 dB Bandwidth

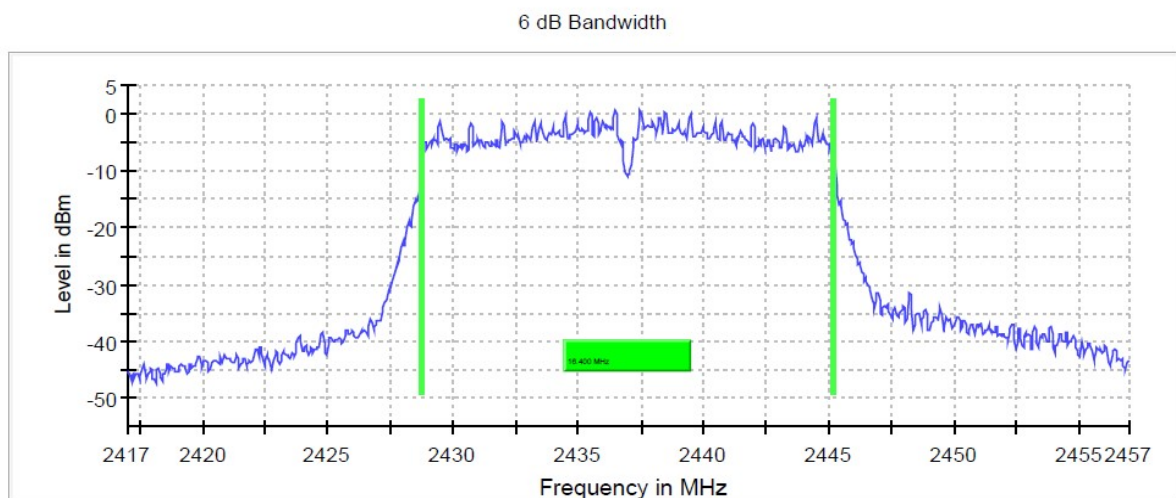
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2462.000000	10.150000	0.500000	---	2456.925000	2467.075000	4.3	PASS



Radio Technology = WLAN g, Operating Frequency = mid
(S01_ab01_WLAN)

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2437.000000	16.400000	0.500000	---	2428.775000	2445.175000	0.6	PASS

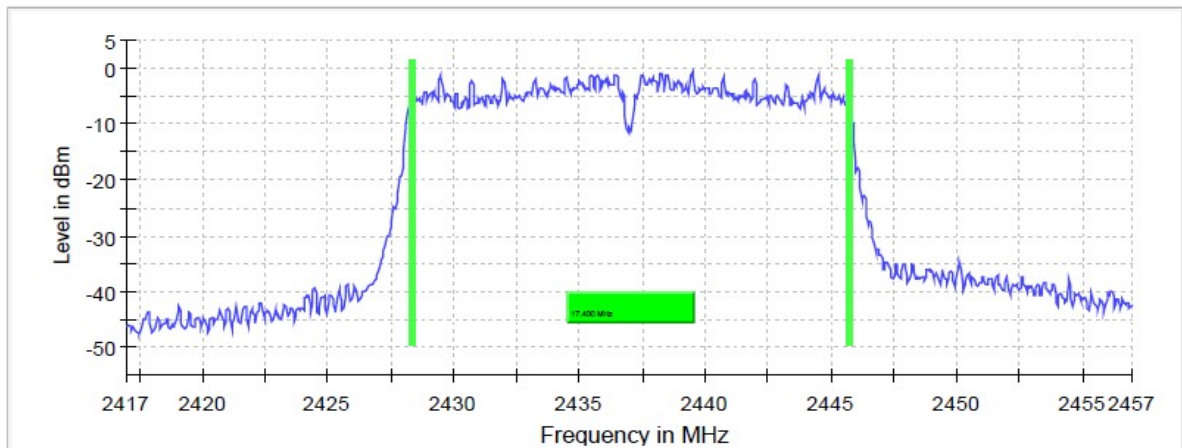


Radio Technology = WLAN n 20 MHz, Operating Frequency = mid
(S01_ab01_WLAN)

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2437.000000	17.400000	0.500000	---	2428.375000	2445.775000	-0.5	PASS

6 dB Bandwidth



5.1.5 TEST EQUIPMENT USED

- R&S TS8997

5.2 OCCUPIED BANDWIDTH (99%)

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.2.1 TEST DESCRIPTION

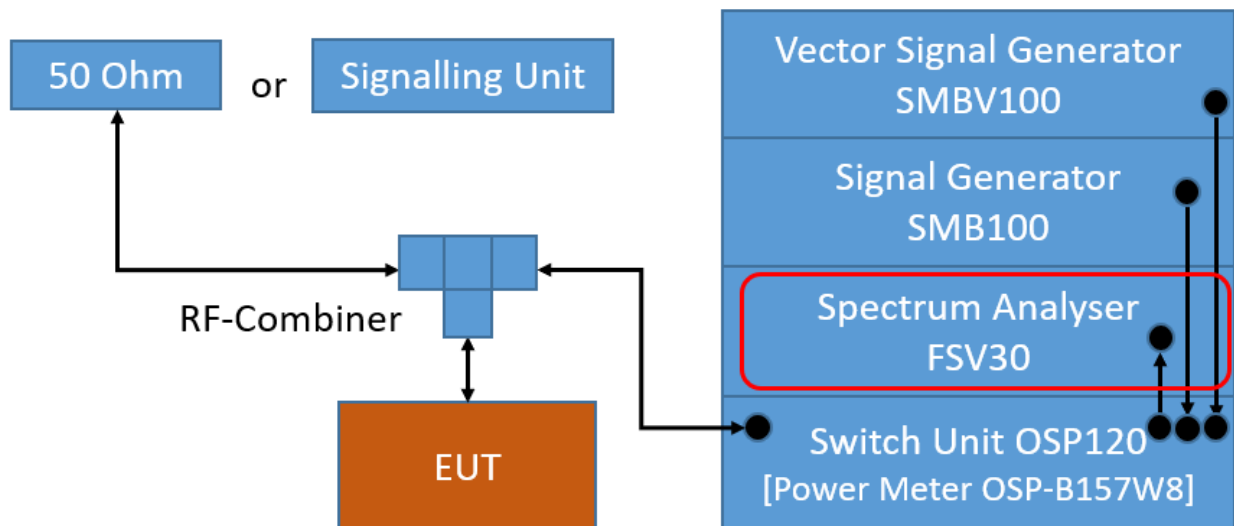
The Equipment Under Test (EUT) was set up to perform the occupied bandwidth measurements.

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 EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyser settings:

- Resolution Bandwidth (RBW): 1 to 5 % of the OBW
- Video Bandwidth (VBW): ≥ 3 times the RBW
- Span: 1.5 to 5 times the OBW
- Trace: Maxhold
- Sweeps: Till stable (min. 500, max. 75000)
- Sweep Time: Auto
- Detector: Peak



TS8997; Channel Bandwidth

5.2.2 TEST REQUIREMENTS / LIMITS

No applicable limit:

5.2.3 TEST PROTOCOL

Ambient temperature: 23 °C
 Air Pressure: 1009 hPa
 Humidity: 51 %
 WLAN b-Mode; 20 MHz; 1 Mbit/s

Band	Channel No.	Frequency [MHz]	99 % Bandwidth [MHz]
2.4 GHz ISM	1	2412	13.2
	6	2437	13.2
	11	2462	13.2

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

Band	Channel No.	Frequency [MHz]	99 % Bandwidth [MHz]
2.4 GHz ISM	1	2412	16.6
	6	2437	16.5
	11	2462	16.5

WLAN n-Mode; 20 MHz; MCS0

Band	Channel No.	Frequency [MHz]	99 % Bandwidth [MHz]
2.4 GHz ISM	1	2412	17.5
	6	2437	17.5
	11	2462	17.5

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

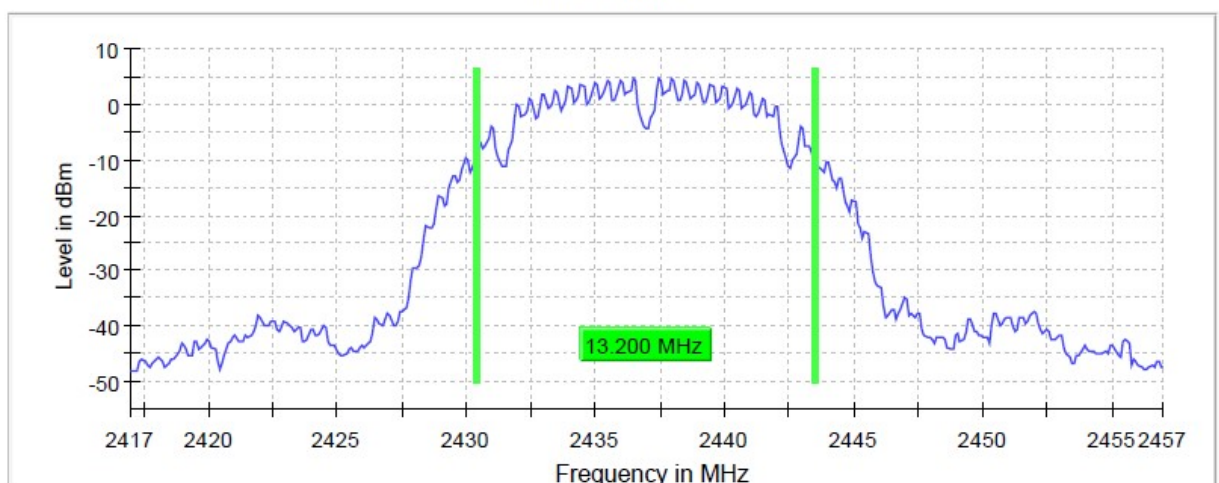
5.2.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN b, Operating Frequency = mid
 (S01_ab01_WLAN)

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2437.000000	13.200000	---	---	2430.350000	2443.550000	PASS

99 % Bandwidth

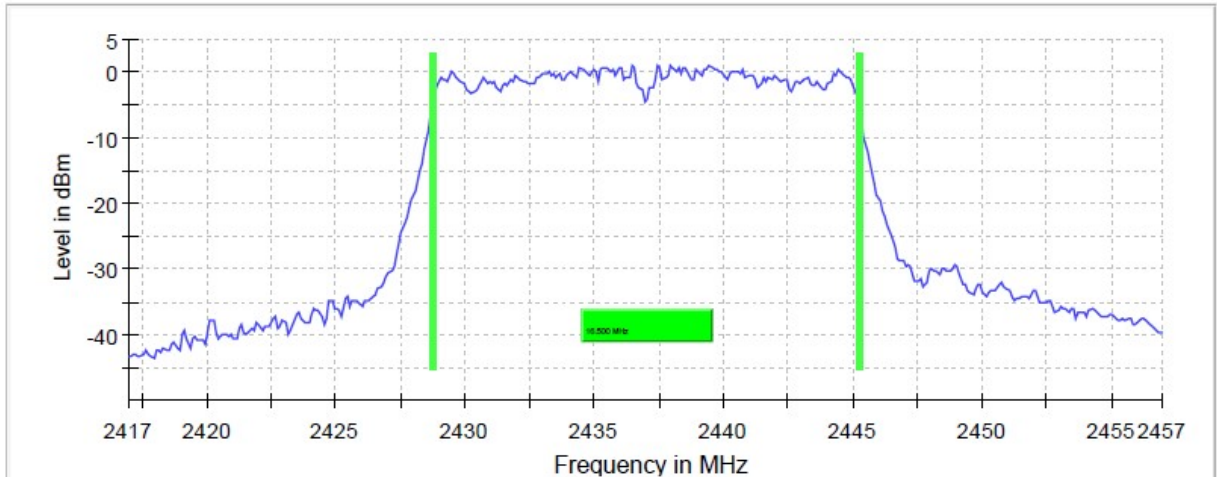


Radio Technology = WLAN g, Operating Frequency = mid
(S01_ab01_WLAN)

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2437.000000	16.500000	---	---	2428.750000	2445.250000	PASS

99 % Bandwidth

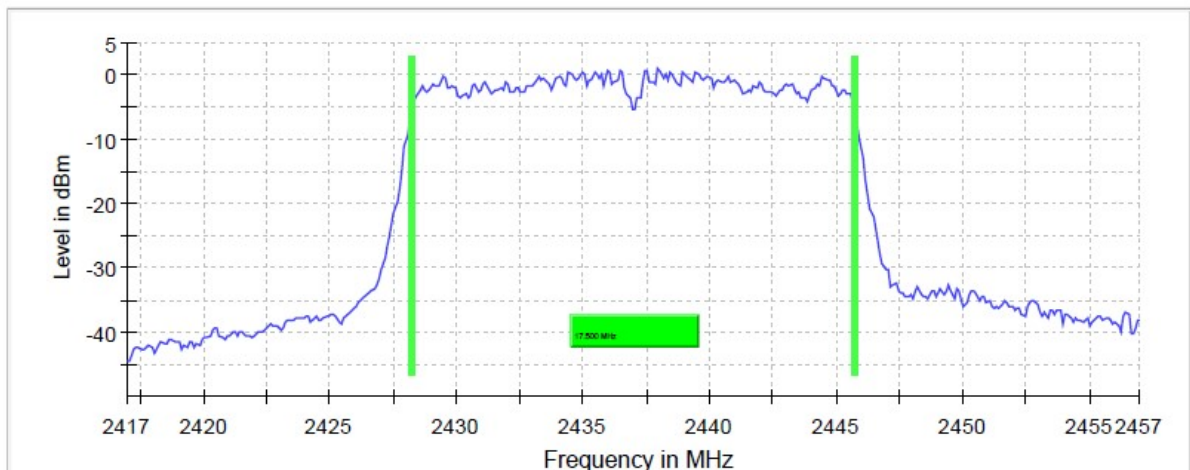


Radio Technology = WLAN n 20 MHz, Operating Frequency = mid
(S01_ab01_WLAN)

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2437.000000	17.500000	---	---	2428.250000	2445.750000	PASS

99 % Bandwidth



5.2.5 TEST EQUIPMENT USED

- R&S TS8997

5.3 PEAK POWER OUTPUT

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.3.1 TEST DESCRIPTION

DTS EQUIPMENT:

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.

Maximum peak conducted output power (e.g. Bluetooth Low Energy):

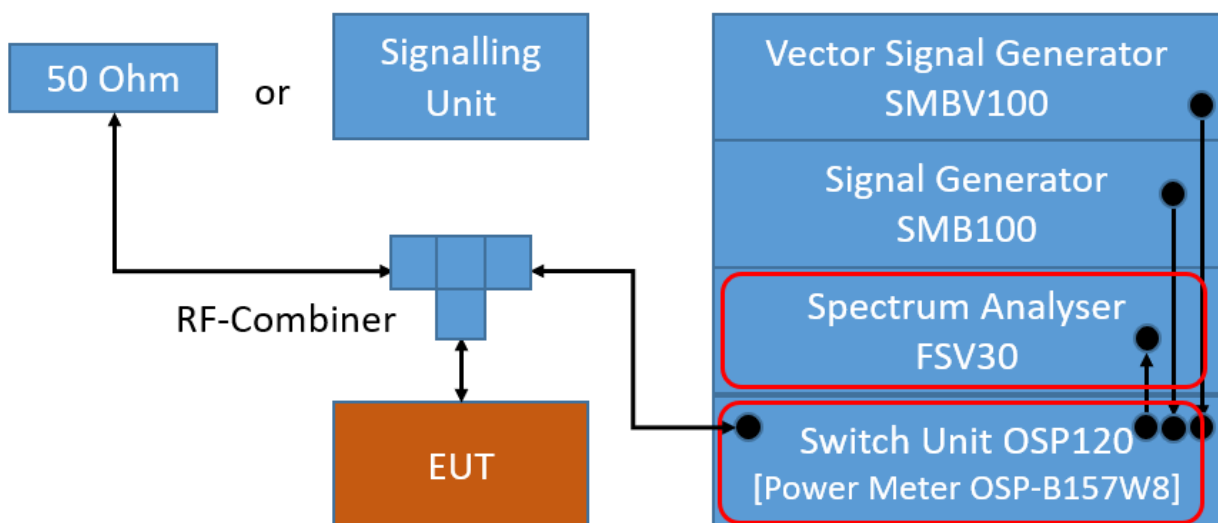
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered. The reference level of the spectrum analyser was set higher than the output power of the EUT.

Analyser settings:

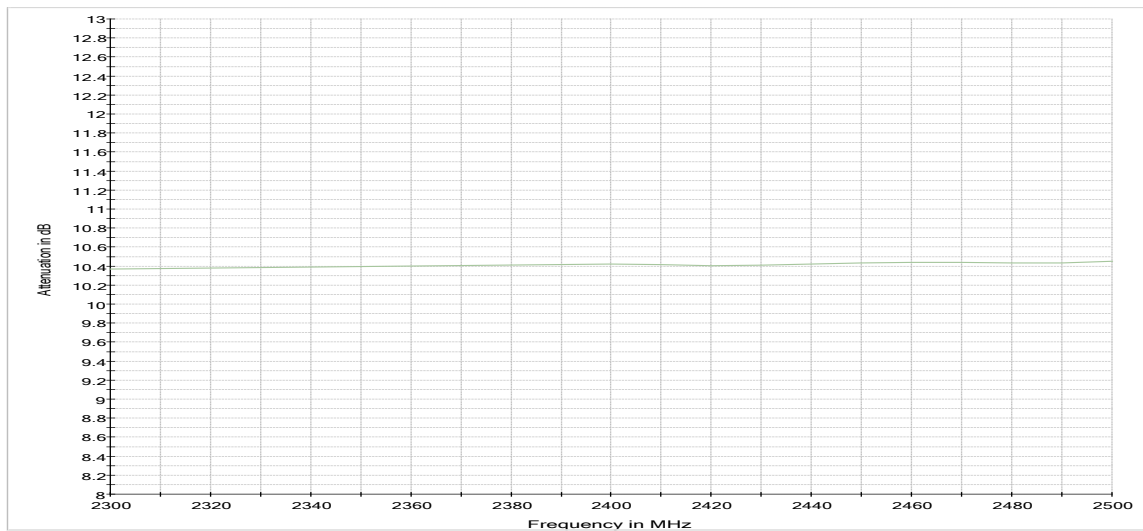
- Resolution Bandwidth (RBW): $\geq$ DTS bandwidth
- Video Bandwidth (VBW): $\geq$ 3 times RBW or maximum of analyzer
- Span: $\geq$ 3 times RBW
- Trace: Maxhold
- Sweeps: Till stable (min. 300, max. 15000)
- Sweep time: Auto
- Detector: Peak

Maximum conducted average output power (e.g. WLAN):

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered. Measurement is performed using the gated RF average power meter integrated in the OSP 120 module OSP-B157W8 with signal bandwidth >300 MHz.



TS8997; Output Power



Attenuation of the measurement path

5.3.2 TEST REQUIREMENTS / LIMITS

DTS devices:

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

For systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt.

=> Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Frequency Hopping Systems:

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

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

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

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

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)

5.3.3 TEST PROTOCOL

Ambient temperature: 23 °C
 Air Pressure: 1009 hPa
 Humidity: 51 %
 WLAN b-Mode; 20 MHz; 1 Mbit/s

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	1	2412	13.1	30.0	16.9	15.2
	6	2437	13.5	30.0	16.5	15.6
	11	2462	13.2	30.0	16.8	15.3

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

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	1	2412	10.6	30.0	19.4	12.7
	6	2437	10.5	30.0	19.5	12.6
	11	2462	10.7	30.0	19.3	12.8

WLAN n-Mode; 20 MHz; MCS0

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	1	2412	10.8	30.0	19.2	12.9
	6	2437	10.7	30.0	19.3	12.8
	11	2462	10.8	30.0	19.2	12.9

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

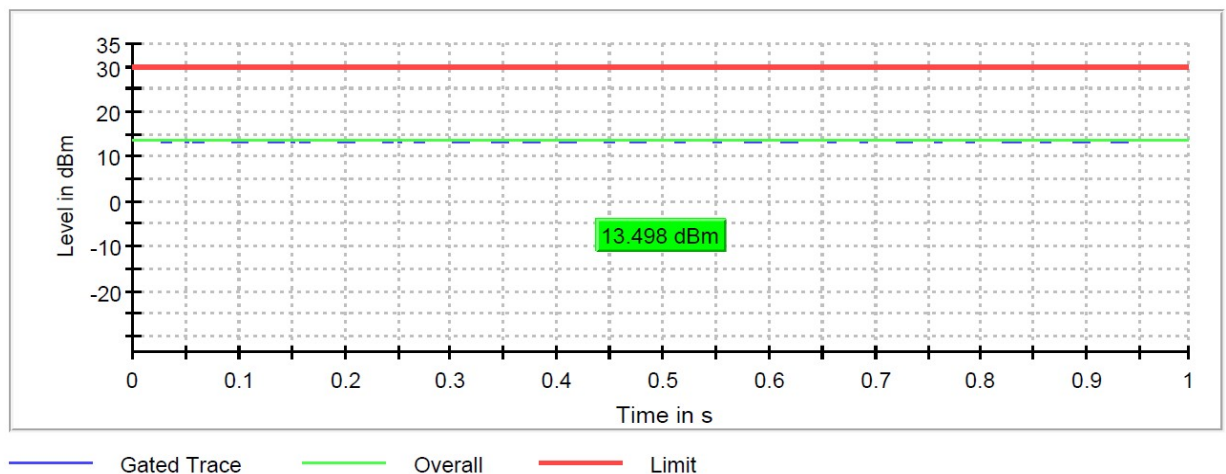
5.3.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN b, Operating Frequency = mid, Measurement method = conducted (S01_ab01_WLAN)

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2437.000000	13.5	30.0	16.5	99.850	PASS

Gated Trace



5.3.5 TEST EQUIPMENT USED

- R&S TS8997

5.4 SPURIOUS RF CONDUCTED EMISSIONS

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.4.1 TEST DESCRIPTION

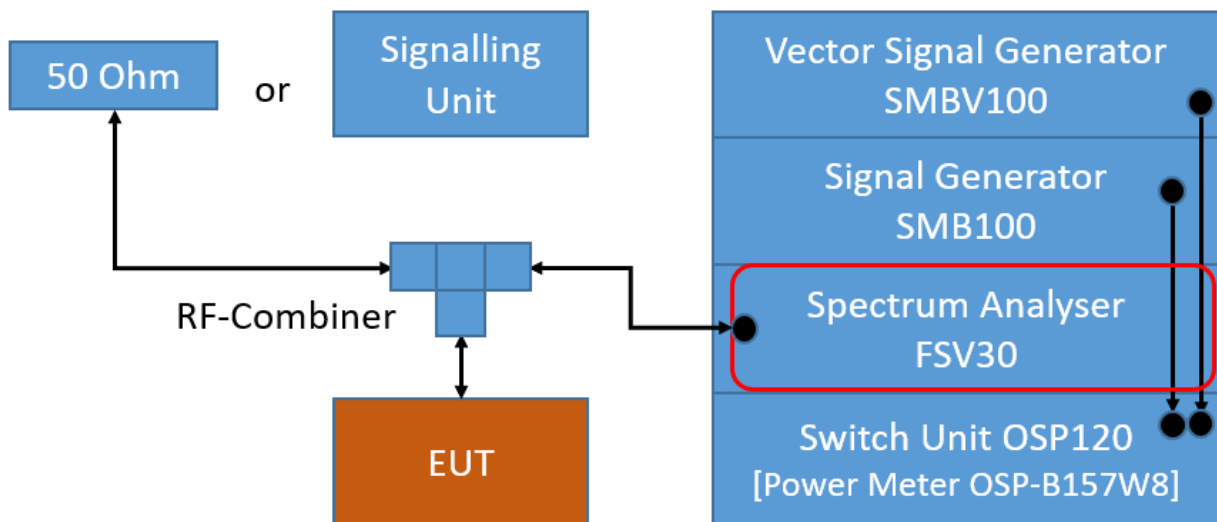
The Equipment Under Test (EUT) was set up to perform the spurious emissions measurements.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyser settings:

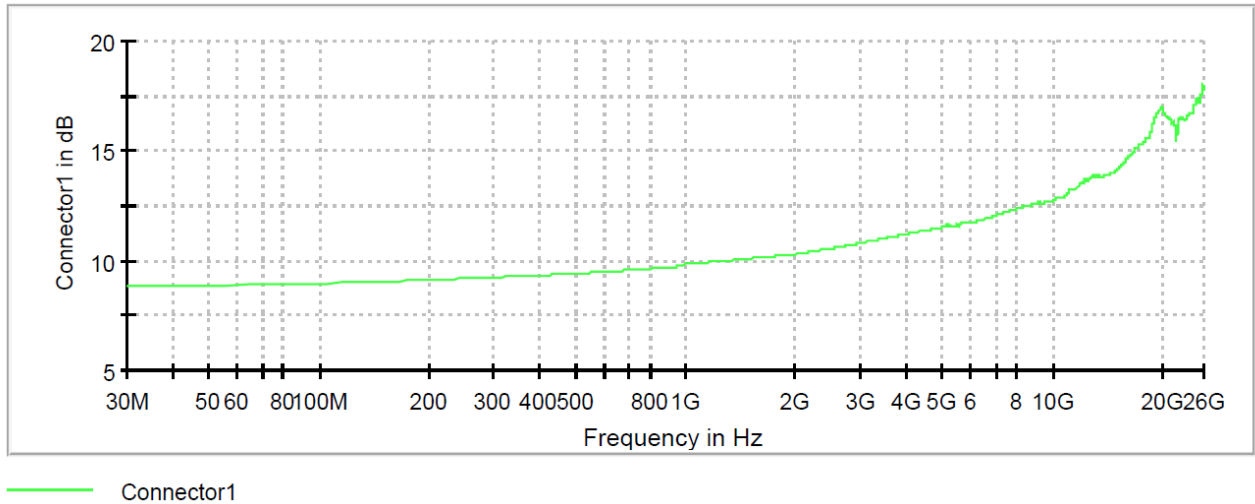
- Frequency range: 30 – 26000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Trace: Maxhold
- Sweeps: Till Stable (max. 120)
- Sweep Time: Auto
- Detector: Peak

The reference value for the measurement of the spurious RF conducted emissions is determined during the test “band edge compliance conducted”. This value is used to calculate the 20 dBc or 30 dBc limit.



TS8997; Spurious RF Conducted Emissions

Attenuation



5.4.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.247 (c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.4.3 TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1009 hPa
Humidity: 51 %
WLAN b-Mode; 20 MHz; 1 Mbit/s

Channel No	Channel Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2395.0	-41.1	PEAK	100	4.5	-25.5	15.6
6	2437	4877.1	-47.1	PEAK	100	4.6	-25.4	21.7
11	2462	4937.1	-45.9	PEAK	100	3.7	-26.3	19.6

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

Channel No	Channel Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2395.0	-38.7	PEAK	100	-0.1	-30.1	8.6
6	2437	15421.1	-46.7	PEAK	100	0.6	-29.4	17.3
11	2462	25795.1	-46.8	PEAK	100	-0.3	-30.3	16.5

WLAN n-Mode; 20 MHz; MCS0

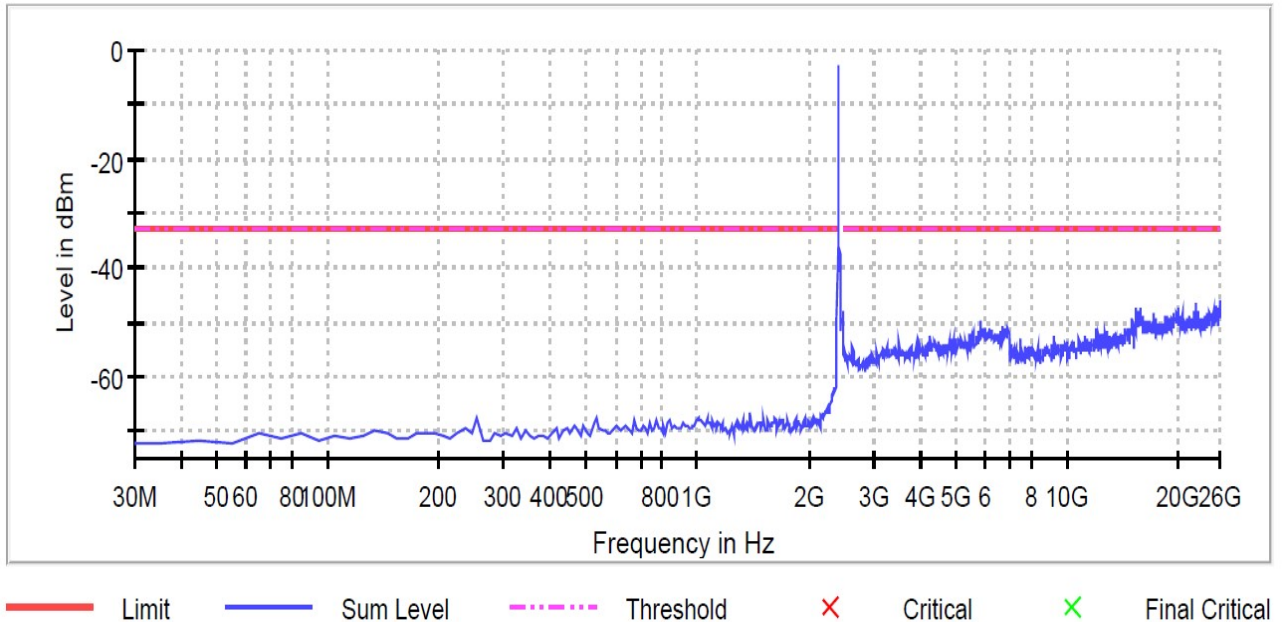
Channel No	Channel Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2395.0	-35.9	PEAK	100	1.0	-29.0	6.9
6	2437	19828.5	-46.5	PEAK	100	-0.5	-30.5	16.0
11	2462	2488.5	-45.8	PEAK	100	0.1	-29.9	15.9

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

5.4.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = low
(S01_ab01_WLAN)

Spurious



5.4.5 TEST EQUIPMENT USED

- R&S TS8997

5.5 TRANSMITTER SPURIOUS RADIATED EMISSIONS

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.5.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapters of ANSI C63.10:

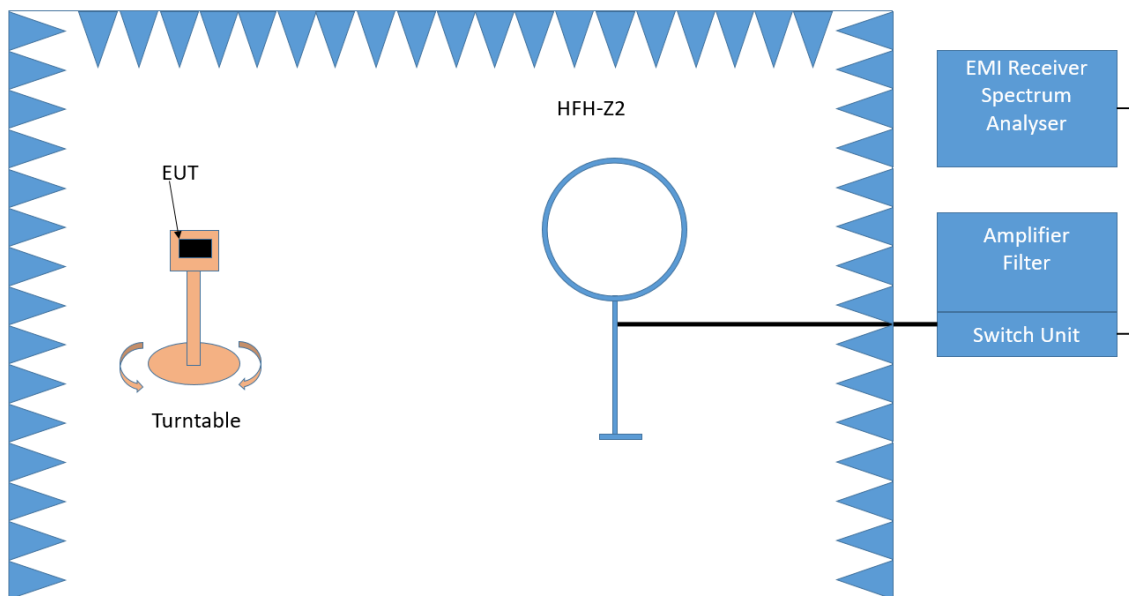
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

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.

Below 1 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

1. Measurement up to 30 MHz



Test Setup; Spurious Emission Radiated (SAC), 9 kHz – 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre-measurement

- Anechoic chamber
- Antenna distance: 3 m
- Antenna height: 1 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)

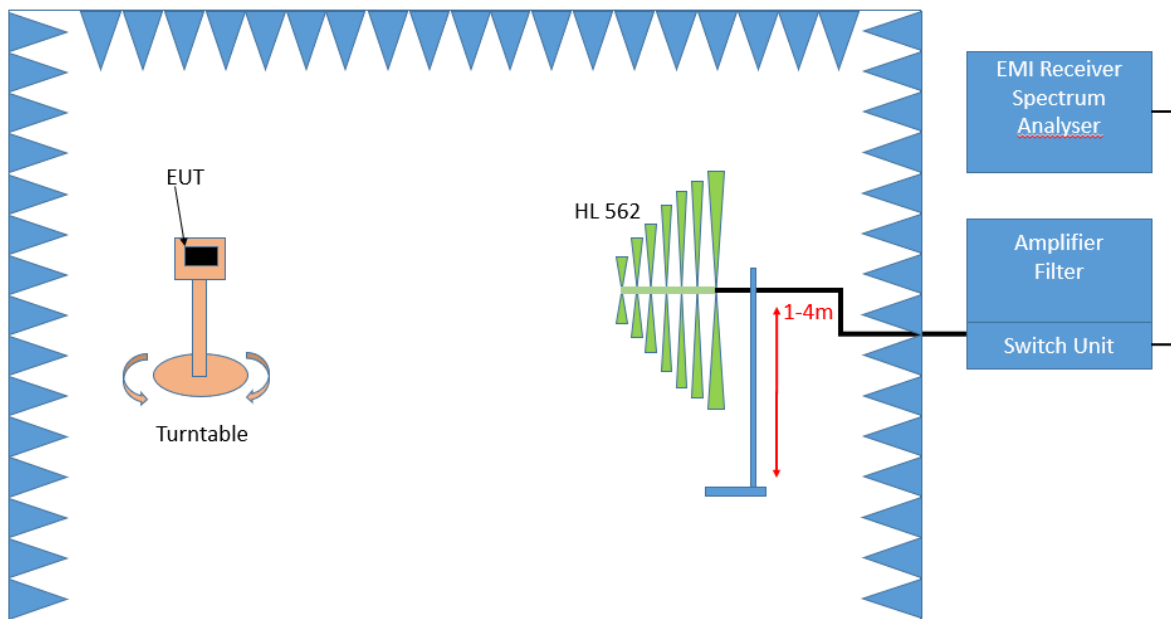
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

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.

- Detector: Quasi-Peak (9 kHz – 150 kHz, Peak / Average 150 kHz- 30 MHz)
- 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



Test Setup; Spurious Emission Radiated (SAC), 30 MHz- 1GHz

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 – 4 m
- Height variation step size: 1.5 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 $\pm 45^{\circ}$ 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: 360°
- Height variation range: 1 – 4 m
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector

With the settings determined in step 2, the final measurement will be performed:

EMI receiver settings for step 3:

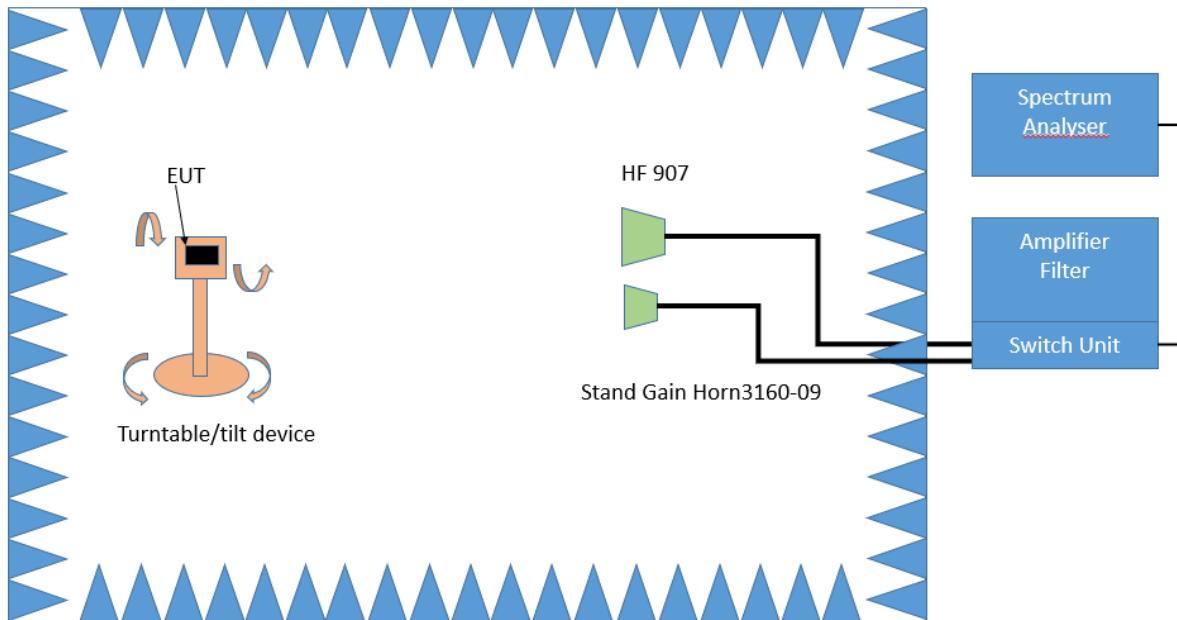
- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

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.

Above 1 GHz:

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.

3. Measurement above 1 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

Step 1:

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 °.

Spectrum analyser settings:

- Detector: Peak, Average
- RBW = 1 MHz
- VBW = 3 MHz

Step 2:

The turn table azimuth will slowly vary by $\pm 22.5^\circ$.

The elevation angle will slowly vary by $\pm 45^\circ$

Spectrum analyser settings:

- Detector: Peak

Step 3:

Spectrum analyser settings for step 3:

- Detector: Peak / CISPR Average
- Measured frequencies: in step 1 determined frequencies
- RBW = 1 MHz
- VBW = 3 MHz
- Measuring time: 1 s

5.5.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.247 (d)

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

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

Frequency 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: $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

5.5.3 TEST PROTOCOL

Ambient temperature: 27-29 °C
 Air Pressure: 1007-1010 hPa
 Humidity: 33-39 %
 WLAN b-Mode; 20 MHz; 1 Mbit/s
 Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
1	2412	128.4	35.9	QP	120	43.5	7.6	RB
1	2412	249.1	32.6	QP	120	46.0	13.4	RB
1	2412	990.4	33.6	QP	120	54.0	20.4	RB
6	2437	128.8	35.5	QP	120	43.5	8.0	RB
6	2437	249.0	34.2	QP	120	46.0	11.8	RB
6	2437	981.8	35.9	QP	120	54.0	18.1	RB
11	2462	75.1	31.9	QP	120	40.0	8.1	RB
11	2462	124.5	27.7	QP	120	43.5	15.8	RB
11	2462	171.8	28.0	QP	120	43.5	15.5	RB
11	2462	249.0	42.0	QP	120	46.0	4.0	RB
1	2412	1720.3	60.2	PEAK	1000	74.0	13.8	RB
1	2412	4823.9	40.9	AV	1000	54.0	13.1	RB
6	2437	1695.3	60.6	PEAK	1000	74.0	13.4	RB
6	2437	1696.3	35.2	AV	1000	54.0	18.8	RB
6	2437	1709.8	35.4	AV	1000	54.0	18.6	RB
6	2437	1709.8	61.7	PEAK	1000	74.0	12.3	RB
6	2437	1718.8	34.5	AV	1000	54.0	19.5	RB
6	2437	1718.8	59.3	PEAK	1000	74.0	14.7	RB
6	2437	1720.9	59.2	PEAK	1000	74.0	14.8	RB
6	2437	1721.2	34.9	AV	1000	54.0	19.1	RB
6	2437	2491.3	56.5	PEAK	1000	74.0	17.5	RB
6	2437	2491.3	36.6	AV	1000	54.0	17.4	RB
6	2437	2711.0	58.3	PEAK	1000	74.0	15.7	RB
6	2437	2711.0	37.5	AV	1000	54.0	16.5	RB
6	2437	2753.2	58.8	PEAK	1000	74.0	15.2	RB
6	2437	2753.2	37.7	AV	1000	54.0	16.3	RB
6	2437	15612.4	56.3	PEAK	1000	74.0	17.7	RB
6	2437	15612.4	41.4	AV	1000	54.0	12.6	RB
6	2437	17826.5	45.2	AV	1000	54.0	8.8	RB
6	2437	17826.5	59.4	PEAK	1000	74.0	14.6	RB
11	2462	1705.4	62.0	PEAK	1000	74.0	12.0	RB
11	2462	1705.4	35.1	AV	1000	54.0	18.9	RB
11	2462	1720.1	59.6	PEAK	1000	74.0	14.4	RB
11	2462	1720.7	35.2	AV	1000	54.0	18.8	RB
11	2462	2484.1	36.8	AV	1000	54.0	17.2	RB
11	2462	2484.1	53.7	PEAK	1000	74.0	20.3	RB
11	2462	2498.4	54.4	PEAK	1000	74.0	19.6	RB
11	2462	2498.4	36.9	AV	1000	54.0	17.1	RB
11	2462	2703.2	57.8	PEAK	1000	74.0	16.2	RB
11	2462	2703.2	37.7	AV	1000	54.0	16.3	RB
11	2462	2770.2	37.8	AV	1000	54.0	16.2	RB
11	2462	2770.2	62.3	PEAK	1000	74.0	11.7	RB
11	2462	15611.5	56.2	PEAK	1000	74.0	17.8	RB
11	2462	15611.5	41.5	AV	1000	54.0	12.5	RB
11	2462	17805.6	59.5	PEAK	1000	74.0	14.5	RB
11	2462	17805.6	45.4	AV	1000	54.0	8.6	RB

WLAN g-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
1	2412	1721.1	34.9	AV	1000	54.0	19.1	RB
1	2412	1721.8	60.7	PEAK	1000	74.0	13.3	RB
1	2412	2389.2	65.1	PEAK	1000	74.0	8.9	RB
1	2412	2389.9	42.2	AV	1000	54.0	11.8	RB
1	2412	2497.0	36.9	AV	1000	54.0	17.1	RB
1	2412	2497.4	57.5	PEAK	1000	74.0	16.5	RB
1	2412	2761.6	37.9	AV	1000	54.0	16.1	RB
1	2412	2761.6	62.5	PEAK	1000	74.0	11.5	RB
6	2437	1670.3	33.8	AV	1000	54.0	20.2	RB
6	2437	1671.9	54.7	PEAK	1000	74.0	19.3	RB
6	2437	1721.2	61.3	PEAK	1000	74.0	12.7	RB
6	2437	1721.5	35.2	AV	1000	54.0	18.8	RB
6	2437	2491.0	37.0	AV	1000	54.0	17.0	RB
6	2437	2491.8	56.5	PEAK	1000	74.0	17.5	RB
6	2437	2729.3	60.0	PEAK	1000	74.0	14.0	RB
6	2437	2729.5	37.9	AV	1000	54.0	16.1	RB
6	2437	7303.1	56.1	PEAK	1000	74.0	17.9	RB
6	2437	7307.4	36.9	AV	1000	54.0	17.1	RB
11	2462	1685.8	34.3	AV	1000	54.0	19.7	RB
11	2462	1685.8	55.6	PEAK	1000	74.0	18.4	RB
11	2462	1703.5	61.2	PEAK	1000	74.0	12.8	RB
11	2462	1703.5	35.2	AV	1000	54.0	18.8	RB
11	2462	1720.3	35.1	AV	1000	54.0	18.9	RB
11	2462	1721.0	60.4	PEAK	1000	74.0	13.6	RB
11	2462	2696.5	59.9	PEAK	1000	74.0	14.1	RB
11	2462	2696.5	37.5	AV	1000	54.0	16.5	RB
11	2462	2727.2	59.8	PEAK	1000	74.0	14.2	RB
11	2462	2727.2	37.6	AV	1000	54.0	16.4	RB

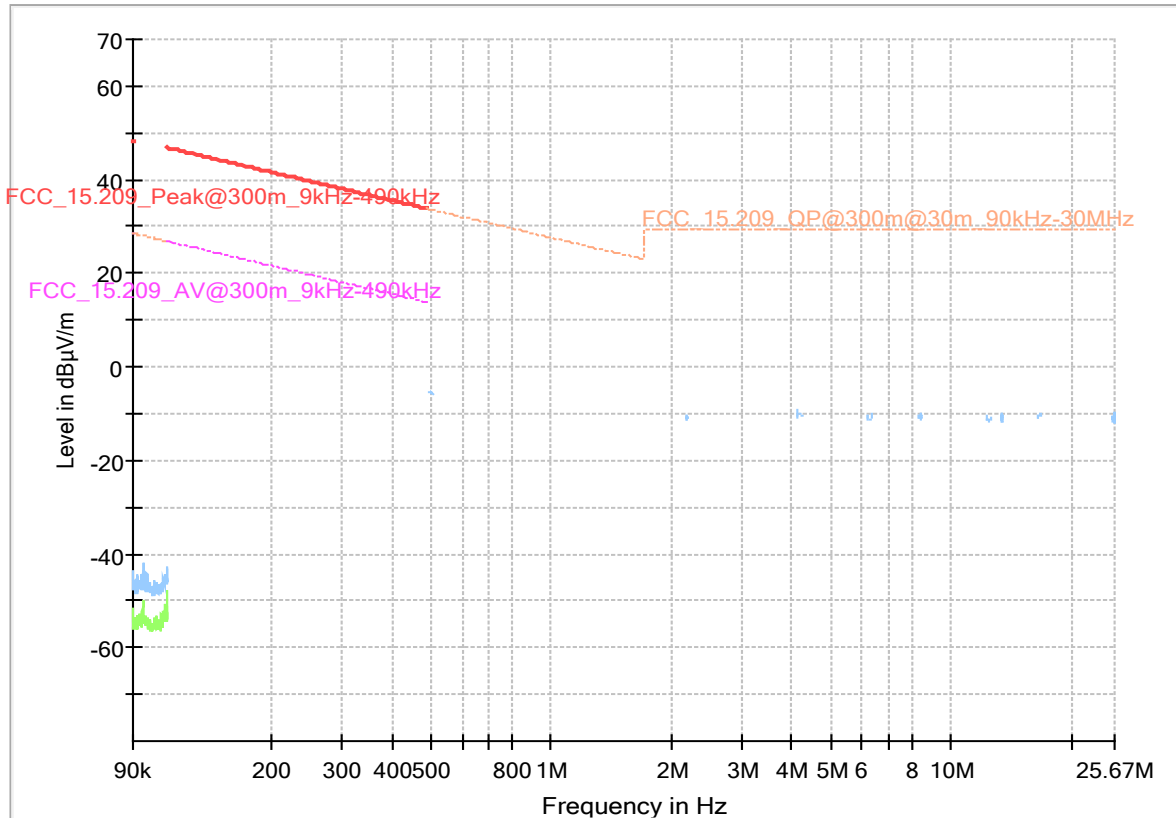
WLAN n-Mode; 20 MHz; MCS0
Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
11	2462	2485.2	42.4	AV	1000	54.0	11.6	RB
11	2462	2485.5	68.4	PEAK	1000	74.0	5.6	RB

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

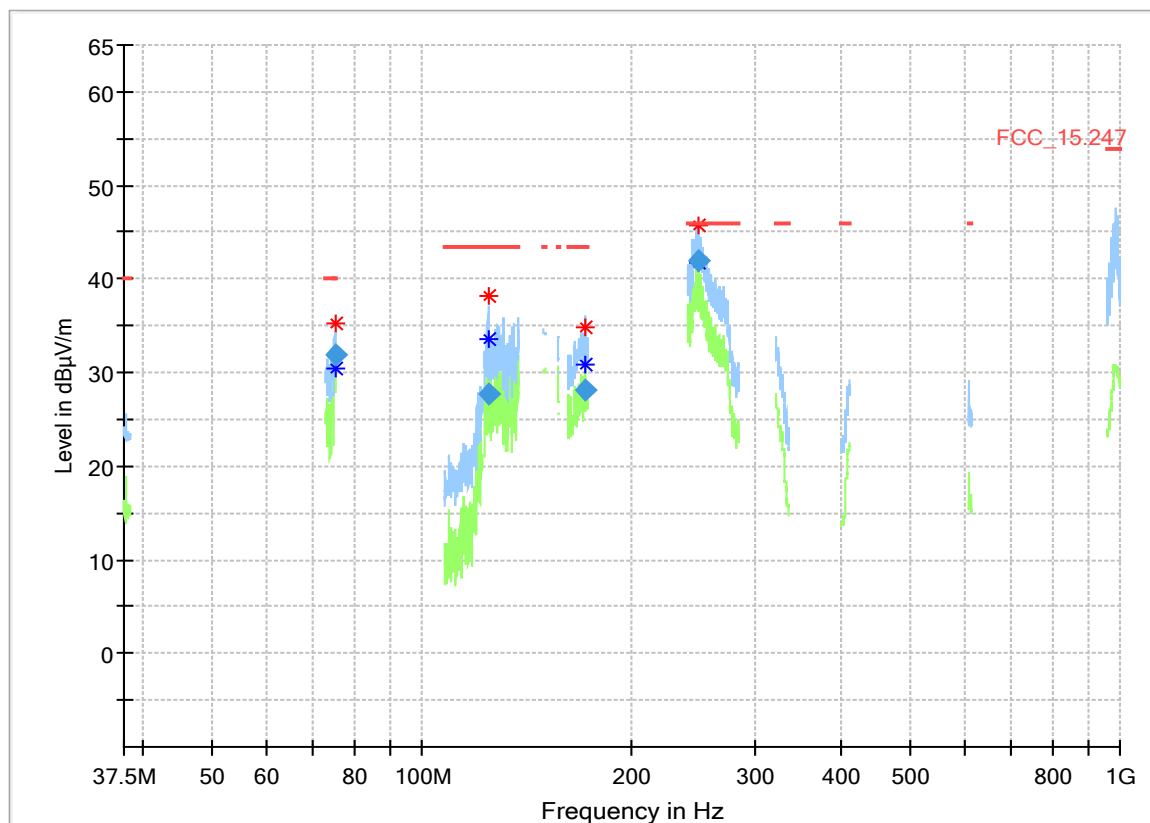
5.5.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN b, Operating Frequency = mid,
Measurement range = 9 kHz - 30 MHz
(S01_aa01_WLAN)



Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final QP, green = final AV

Radio Technology = WLAN b, Operating Frequency = high,
Measurement range = 30 MHz - 1 GHz
(S01_aa01_WLAN)

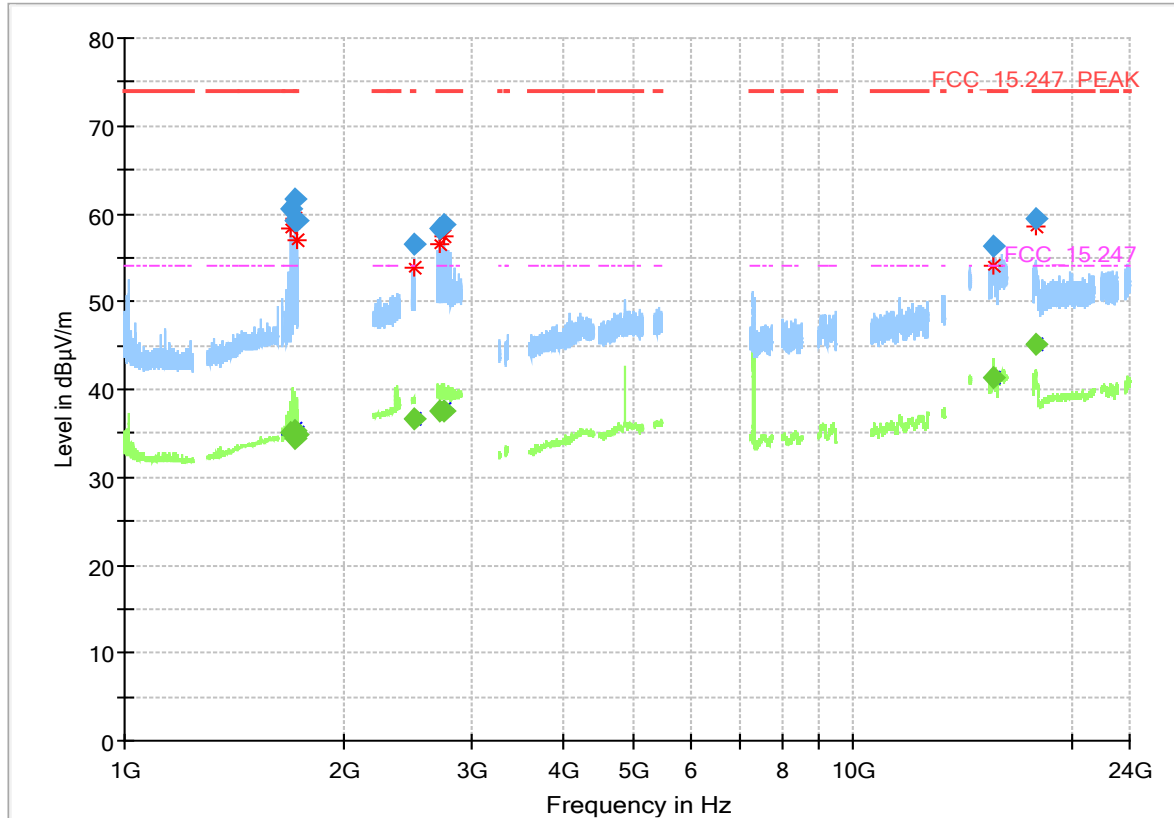


Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final QP

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
75.130000	31.86	40.00	8.14	1000.0	120.000	120.0	V	-200.0	9.5	
124.500000	27.68	43.50	15.82	1000.0	120.000	102.0	V	96.0	10.9	
171.770000	28.03	43.50	15.47	1000.0	120.000	107.0	V	85.0	8.9	
249.000000	41.96	46.00	4.04	1000.0	120.000	102.0	V	43.0	11.2	

Radio Technology = WLAN b, Operating Frequency = mid,
Measurement range = 1 GHz - 26 GHz
(S01_aa01_WLAN)

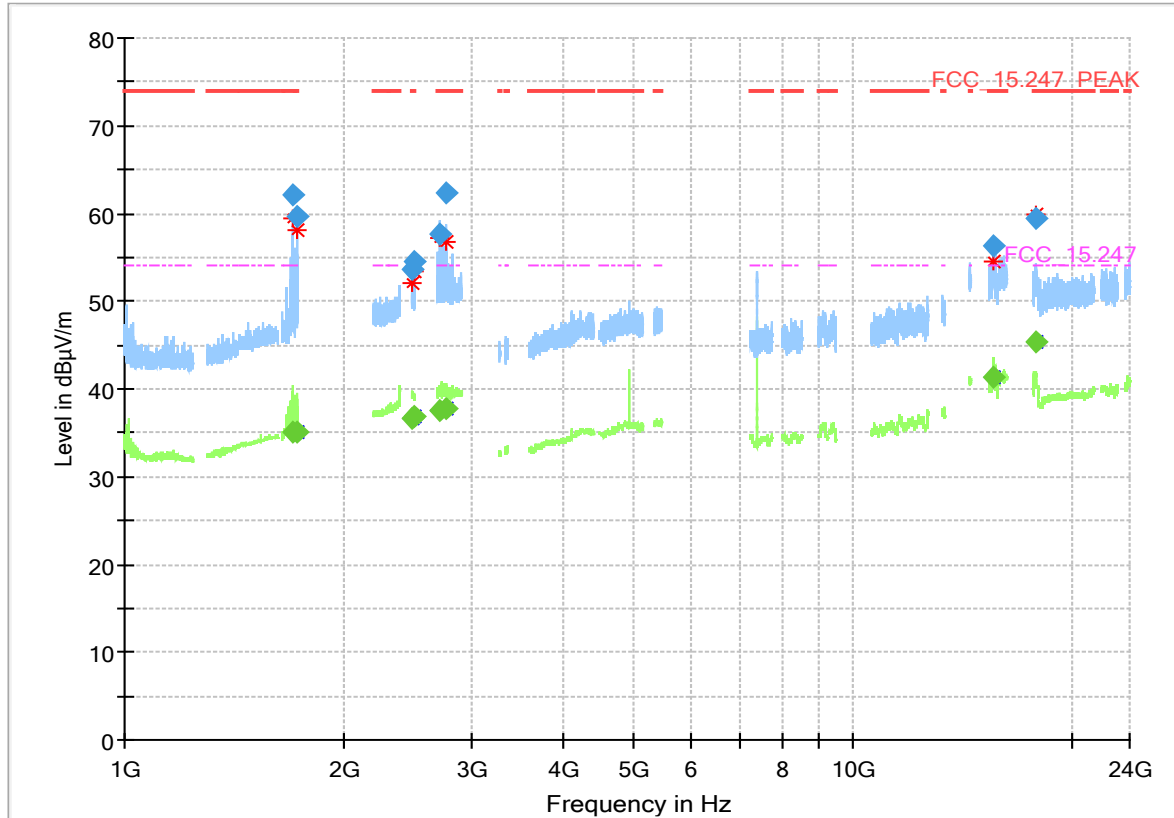


Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
1695.250	60.6	---	74.00	13.43	1000.0	1000.000	150.0	H	159.0	105.0	1.7
1696.250	---	35.1	54.00	18.85	1000.0	1000.000	150.0	H	-182.0	105.0	1.7
1709.750	---	35.3	54.00	18.75	1000.0	1000.000	150.0	H	-180.0	105.0	1.8
1709.750	61.7	---	74.00	12.27	1000.0	1000.000	150.0	H	-179.0	105.0	1.8
1718.800	---	34.4	54.00	19.56	1000.0	1000.000	150.0	H	-169.0	78.0	1.9
1718.800	59.3	---	74.00	14.73	1000.0	1000.000	150.0	H	-184.0	83.0	1.9
1720.908	59.2	---	74.00	14.80	1000.0	1000.000	150.0	H	157.0	105.0	1.9
1721.248	---	34.8	54.00	19.20	1000.0	1000.000	150.0	H	-176.0	87.0	1.9
2491.255	56.5	---	74.00	17.48	1000.0	1000.000	150.0	V	-179.0	105.0	5.4
2491.255	---	36.5	54.00	17.45	1000.0	1000.000	150.0	H	-144.0	105.0	5.4
2711.000	58.3	---	74.00	15.69	1000.0	1000.000	150.0	V	158.0	92.0	6.3
2711.000	---	37.4	54.00	16.57	1000.0	1000.000	150.0	V	161.0	87.0	6.3
2753.210	58.8	---	74.00	15.19	1000.0	1000.000	150.0	V	-179.0	105.0	6.2
2753.210	---	37.6	54.00	16.36	1000.0	1000.000	150.0	V	-186.0	103.0	6.2
15612.367	56.3	---	74.00	17.71	1000.0	1000.000	150.0	H	120.0	15.0	-1.8
15612.367	---	41.3	54.00	12.73	1000.0	1000.000	150.0	H	86.0	13.0	-1.8
17826.450	---	45.1	54.00	8.87	1000.0	1000.000	150.0	V	-11.0	-3.0	1.3
17826.450	59.4	---	74.00	14.57	1000.0	1000.000	150.0	H	-139.0	15.0	1.3

Radio Technology = WLAN b, Operating Frequency = high,
Measurement range = 1 GHz - 26 GHz
(S01_aa01_WLAN)

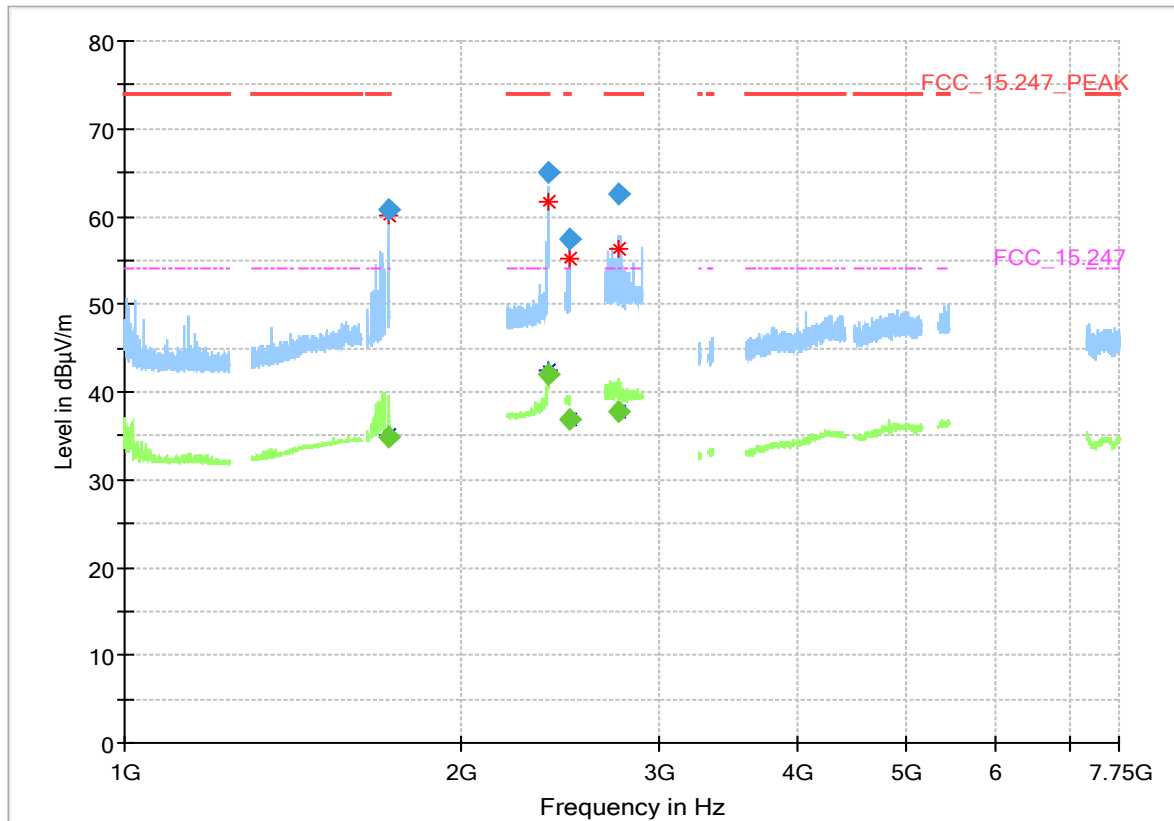


Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
1705.375	62.0	---	74.00	11.99	1000.0	1000.000	150.0	H	-177.0	97.0	1.8
1705.375	---	35.0	54.00	18.98	1000.0	1000.000	150.0	H	-184.0	105.0	1.8
1720.092	59.6	---	74.00	14.41	1000.0	1000.000	150.0	H	-158.0	105.0	1.9
1720.738	---	35.1	54.00	18.93	1000.0	1000.000	150.0	H	-178.0	95.0	1.9
2484.078	---	36.7	54.00	17.35	1000.0	1000.000	150.0	V	-150.0	-15.0	5.4
2484.078	53.7	---	74.00	20.29	1000.0	1000.000	150.0	V	-150.0	-5.0	5.4
2498.433	54.4	---	74.00	19.57	1000.0	1000.000	150.0	V	-171.0	105.0	5.5
2498.433	---	36.8	54.00	17.22	1000.0	1000.000	150.0	V	-38.0	87.0	5.5
2703.230	57.8	---	74.00	16.24	1000.0	1000.000	150.0	V	-184.0	97.0	6.2
2703.230	---	37.6	54.00	16.42	1000.0	1000.000	150.0	V	-188.0	103.0	6.2
2770.220	---	37.7	54.00	16.28	1000.0	1000.000	150.0	V	-186.0	87.0	6.3
2770.220	62.3	---	74.00	11.69	1000.0	1000.000	150.0	V	-169.0	105.0	6.3
15611.517	56.2	---	74.00	17.77	1000.0	1000.000	150.0	H	54.0	99.0	-1.8
15611.517	---	41.4	54.00	12.61	1000.0	1000.000	150.0	V	-41.0	13.0	-1.8
17805.600	59.5	---	74.00	14.54	1000.0	1000.000	150.0	H	-8.0	100.0	1.2
17805.600	---	45.3	54.00	8.68	1000.0	1000.000	150.0	H	-36.0	75.0	1.2

Radio Technology = WLAN g, Operating Frequency = low,
Measurement range = 1 GHz - 8 GHz
(S01_aa01_WLAN)

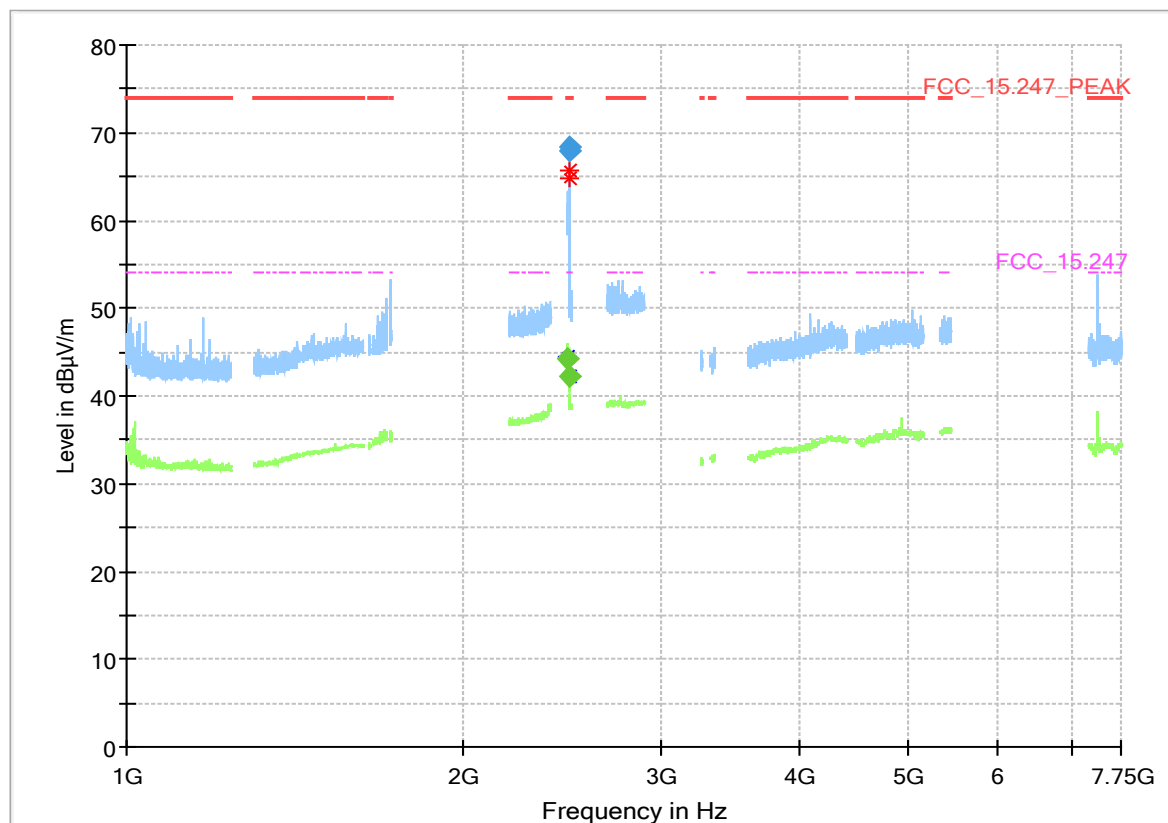


Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
1721.112	---	34.8	54.00	19.23	1000.0	1000.000	150.0	H	-184.0	87.0	1.9
1721.826	60.7	---	74.00	13.33	1000.0	1000.000	150.0	H	-184.0	110.0	1.9
2389.200	65.1	---	74.00	8.90	1000.0	1000.000	150.0	H	41.0	-6.0	4.9
2389.920	---	42.1	54.00	11.90	1000.0	1000.000	150.0	H	40.0	-16.0	4.9
2497.030	---	36.8	54.00	17.22	1000.0	1000.000	150.0	V	-182.0	101.0	5.5
2497.360	57.5	---	74.00	16.49	1000.0	1000.000	150.0	V	-169.0	98.0	5.5
2761.610	---	37.8	54.00	16.22	1000.0	1000.000	150.0	V	-186.0	93.0	6.2
2761.610	62.5	---	74.00	11.49	1000.0	1000.000	150.0	V	-178.0	105.0	6.2

Radio Technology = WLAN n 20 MHz, Operating Frequency = high,
Measurement range = 1 GHz - 8 GHz
(S01_aa01_WLAN)



Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
2483.748	---	44.3	54.00	9.69	1000.0	1000.000	150.0	H	19.0	-12.0	5.4
2483.995	67.9	---	74.00	6.12	1000.0	1000.000	150.0	H	-11.0	1.0	5.4
2485.233	---	42.3	54.00	11.71	1000.0	1000.000	150.0	H	19.0	-12.0	5.4
2485.480	68.4	---	74.00	5.56	1000.0	1000.000	150.0	H	19.0	-10.0	5.4

5.5.5 TEST EQUIPMENT USED

- Radiated Emissions

5.6 BAND EDGE COMPLIANCE CONDUCTED

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

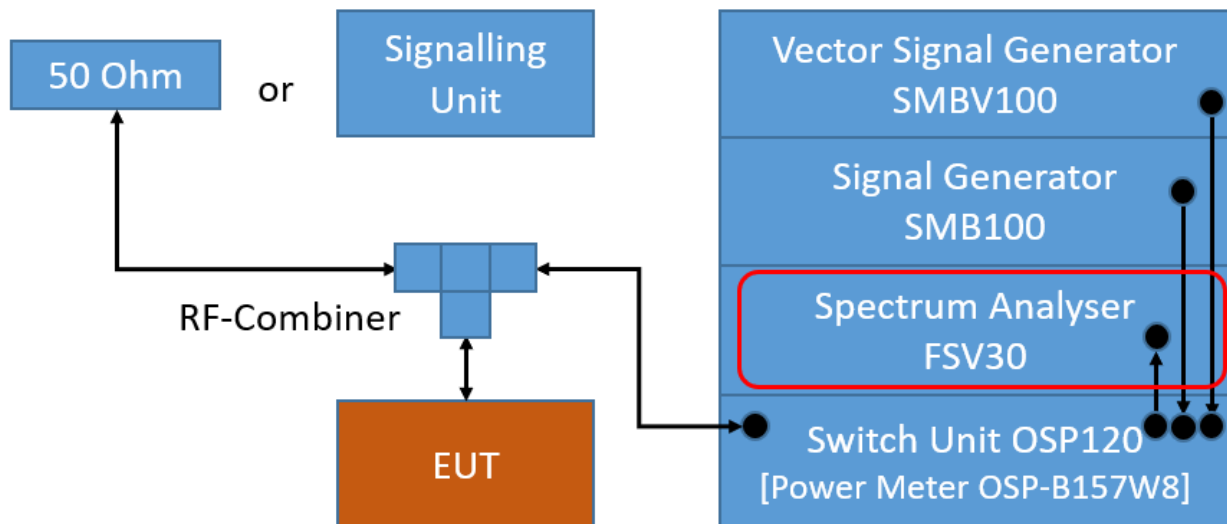
5.6.1 TEST DESCRIPTION

For the conducted measurement, the Equipment Under Test (EUT) is placed in a shielded room. The reference power was measured in the test case "Spurious RF Conducted Emissions".

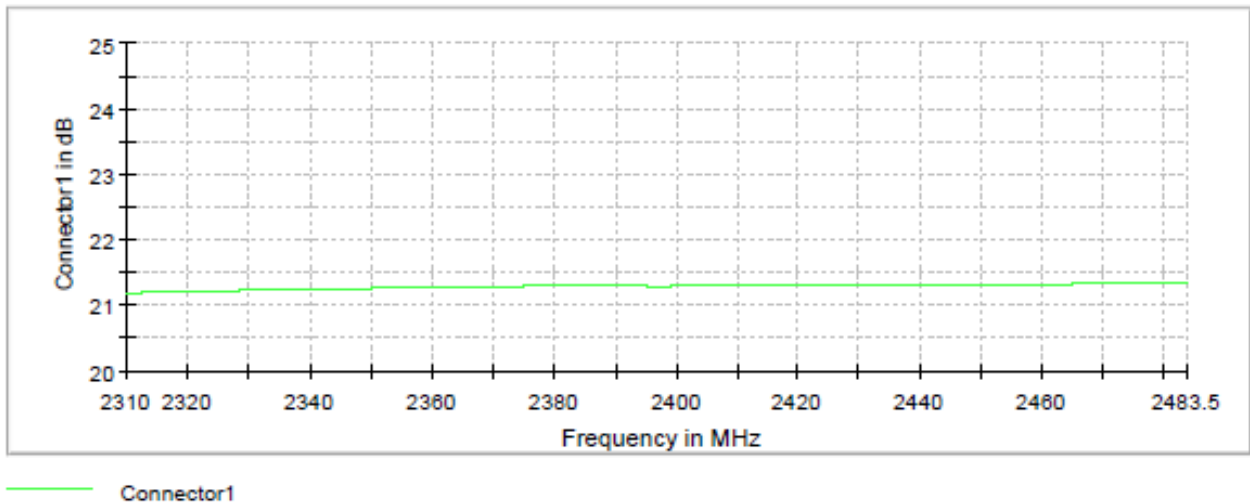
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyser settings:

- Lower Band Edge:
Measured range: 2310.0 MHz to 2483.5 MHz
Upper Band Edge
Measured range: 2400.0 MHz to 2500 MHz
- Detector: Peak
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep time: Auto
- Sweeps: Till stable (min. 300, max. 15000)
- Trace: Maxhold



TS8997; Band Edge Conducted



Attenuation of the measurement path

5.6.2 TEST REQUIREMENTS / LIMITS

FCC Part 15.247 (d)

"In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. ...

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c))."

For the conducted measurement the RF power at the band edge 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..."

5.6.3 TEST PROTOCOL

WLAN b-Mode; 20 MHz; 1 Mbit/s

Channel No.	Channel Center Frequency [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2400.0	-39.6	PEAK	100	4.5	-25.5	14.1
11	2462	2483.5	-45.7	PEAK	100	3.7	-26.3	19.4

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

Channel No.	Channel Center Frequency [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2400.0	-37.9	PEAK	100	-0.1	-30.1	7.8
11	2462	2483.5	-44.3	PEAK	100	-0.3	-30.3	14.0

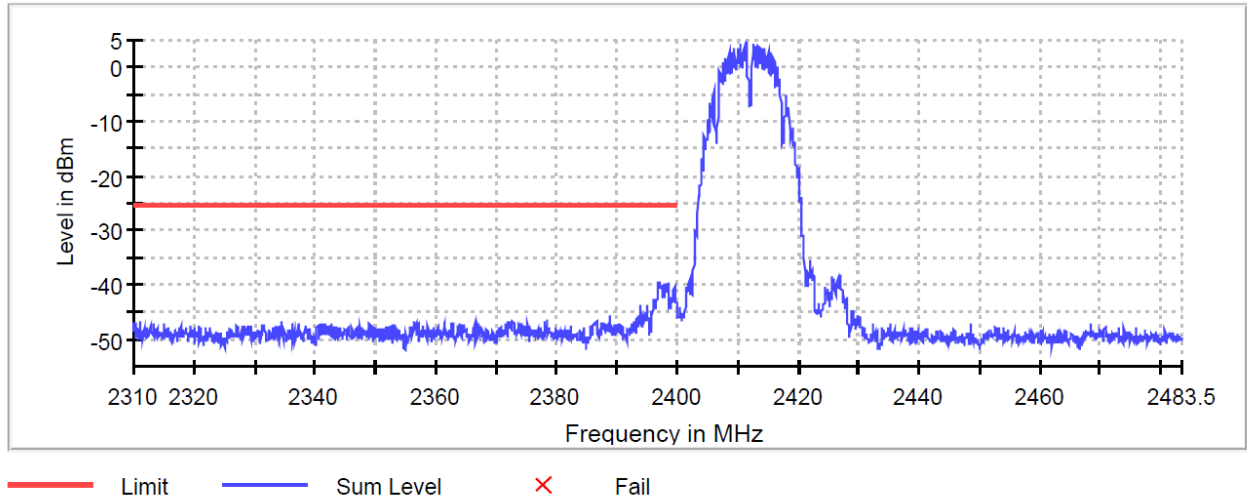
WLAN n-Mode; 20 MHz; MCS0

Channel No.	Channel Center Frequency [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBm]	Margin to Limit [dB]
1	2412	2400.0	-36.9	PEAK	100	1.0	-29.0	7.9
11	2462	2483.5	-43.0	PEAK	100	0.1	-29.9	13.1

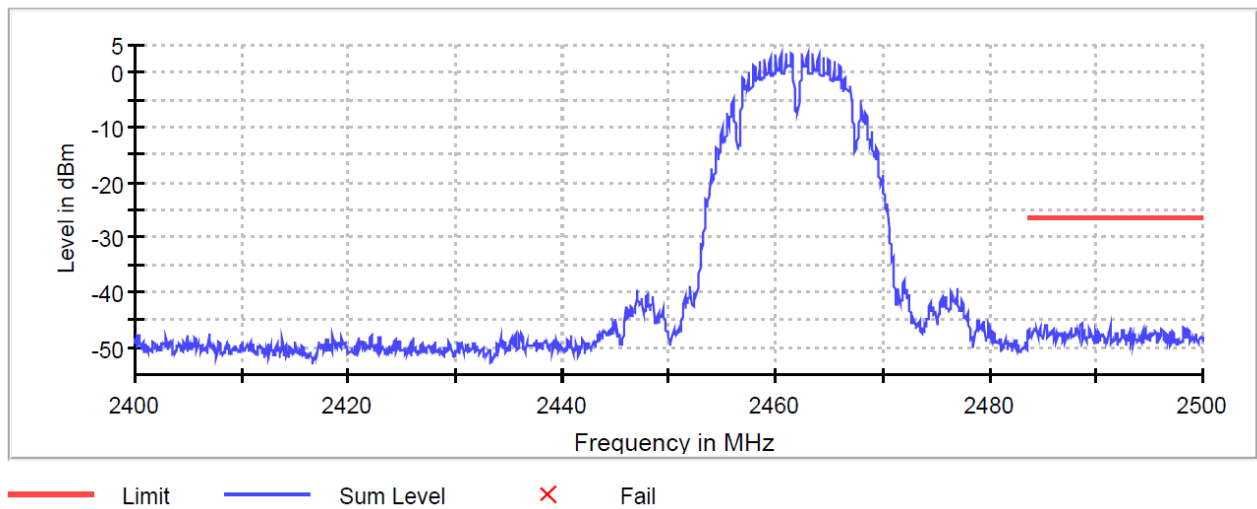
Remark: Please see next sub-clause for the measurement plot.

5.6.4 MEASUREMENT PLOT

Radio Technology = WLAN b, Operating Frequency = low, Band Edge = low
(S01_ab01_WLAN)
Band Edge

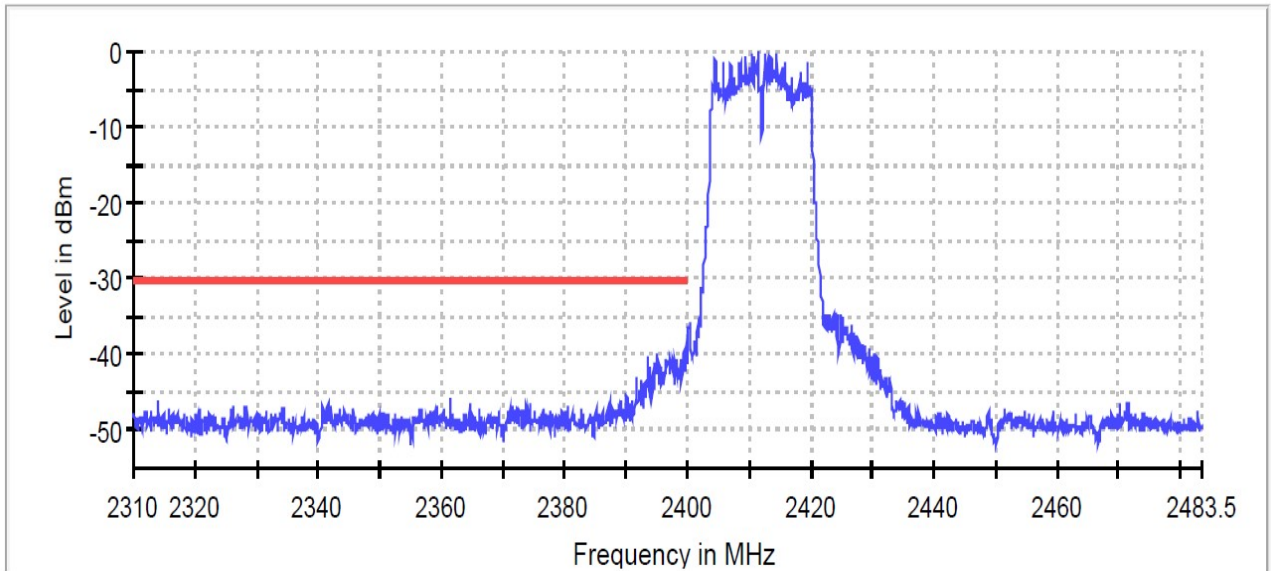


Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high
(S01_ab01_WLAN)
Band Edge



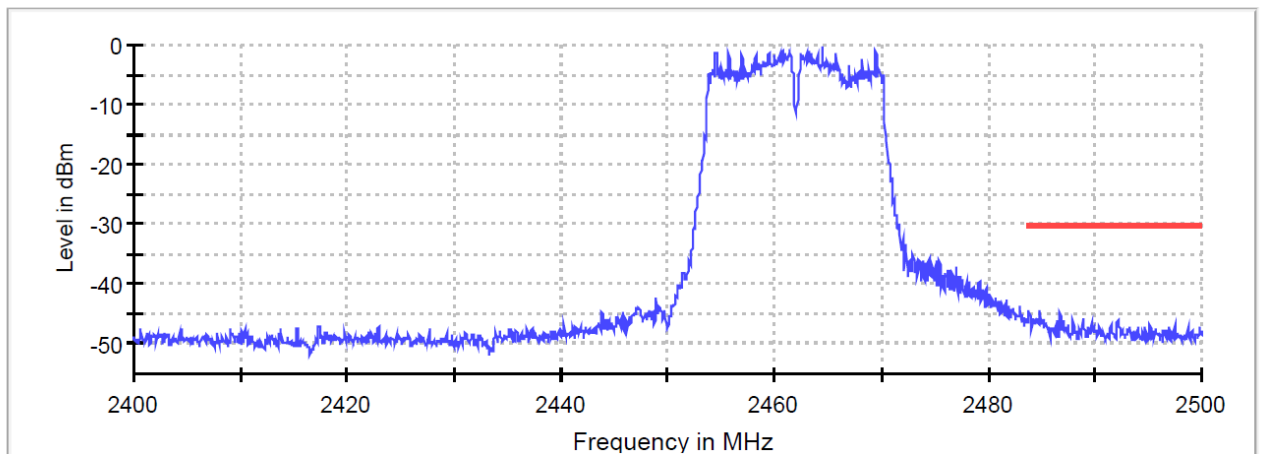
Radio Technology = WLAN g, Operating Frequency = low, Band Edge = low
(S01_ab01_WLAN)

Band Edge



— Limit — Sum Level × Fail

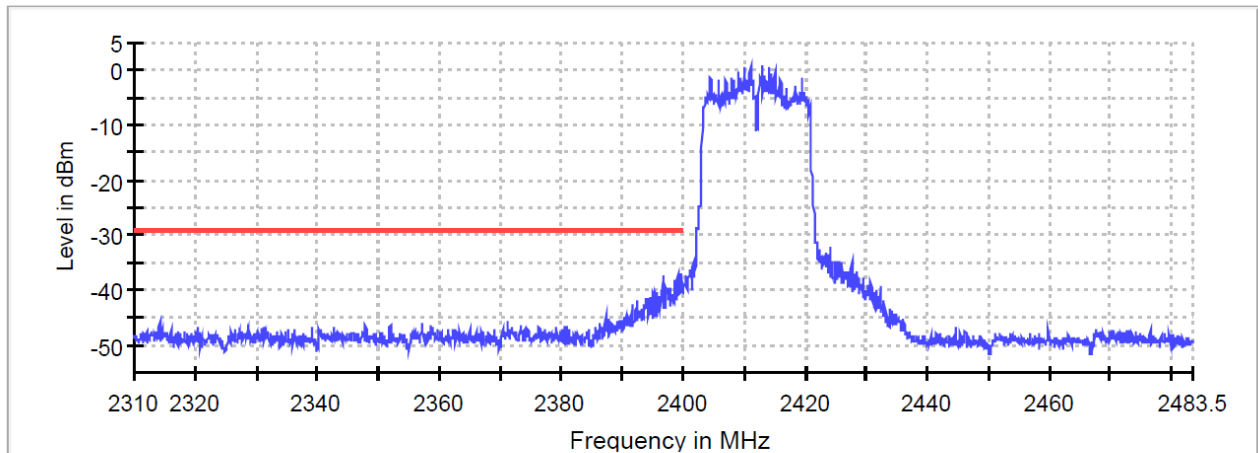
Radio Technology = WLAN g, Operating Frequency = high, Band Edge = high
(S01_ab01_WLAN)
Band Edge



— Limit — Sum Level × Fail

Radio Technology = WLAN n, Operating Frequency = low, Band Edge = low
(S01_ab01_WLAN)

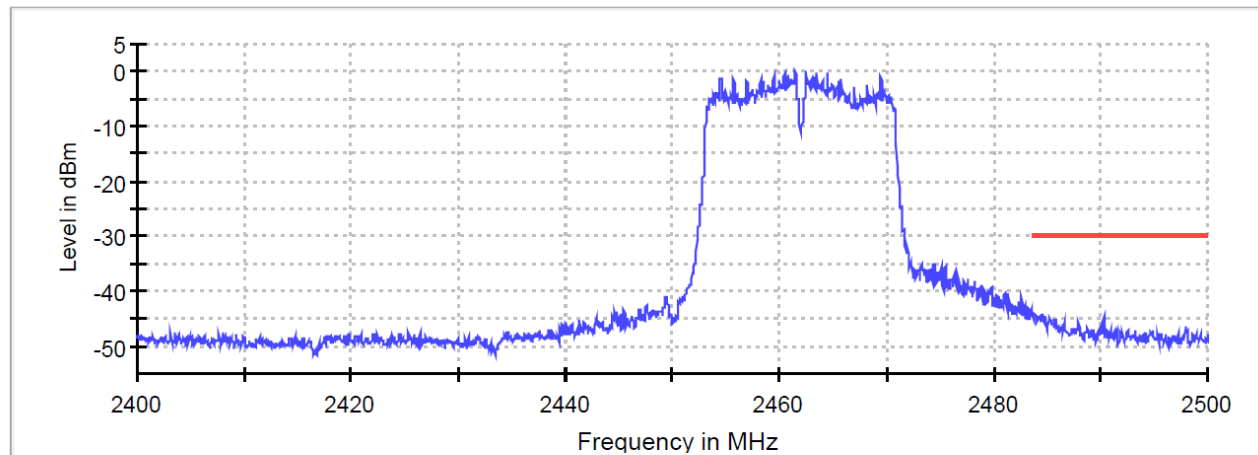
Band Edge



— Limit — Sum Level × Fail

Radio Technology = WLAN n, Operating Frequency = high, Band Edge = high
(S01_ab01_WLAN)

Band Edge



— Limit — Sum Level × Fail

5.6.5 TEST EQUIPMENT USED

- R&S TS8997

5.7 BAND EDGE COMPLIANCE RADIATED

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.7.1 TEST DESCRIPTION

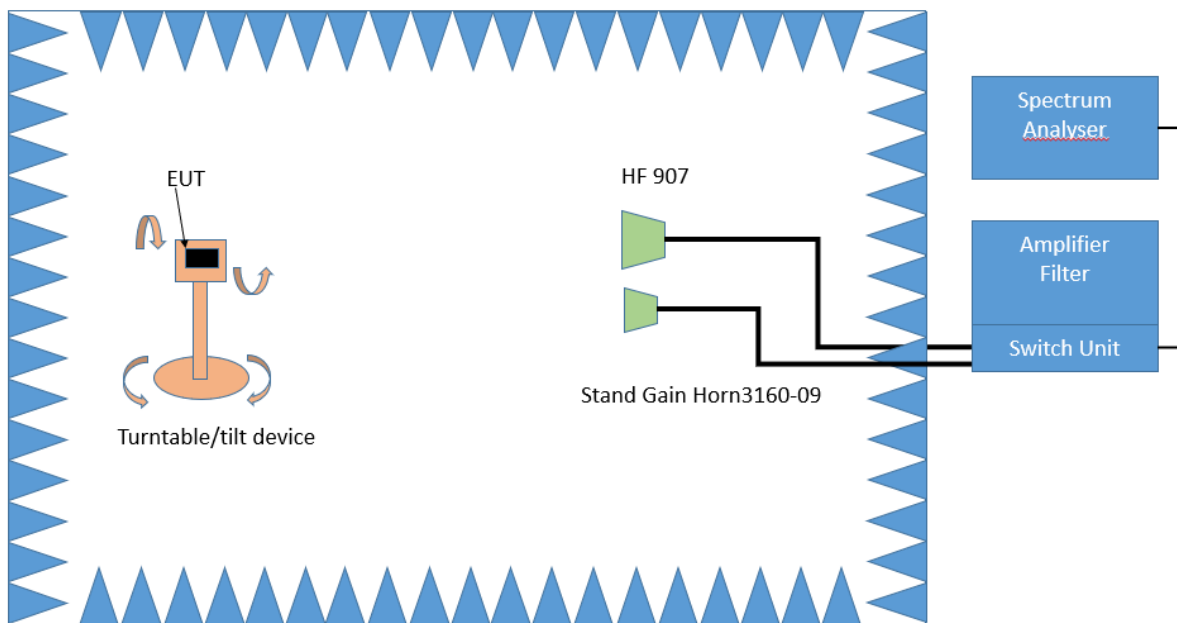
The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapter of ANSI C63.10:

- Chapter 6.10.5

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 (procedure according ANSI C63.10, chapter 6.6.5).

3. Measurement above 1 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

Step 1:

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 °.

Spectrum analyser settings:

- Detector: Peak, Average
- RBW = 1 MHz
- VBW = 3 MHz

Step 2:

The turn table azimuth will slowly vary by $\pm 22.5^\circ$.

The elevation angle will slowly vary by $\pm 45^\circ$

Spectrum analyser settings:

- Detector: Peak

Step 3:

Spectrum analyser settings for step 3:

- Detector: Peak / CISPR Average
- Measured frequencies: in step 1 determined frequencies
- RBW = 1 MHz
- VBW = 3 MHz
- Measuring time: 1 s

5.7.2 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: $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

5.7.3 TEST PROTOCOL

WLAN b-Mode; 20 MHz; 1 Mbit/s

Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
11	2462	2483.5	53.7	PEAK	1000	74.0	20.3	BE
11	2462	2483.5	39.8	AV	1000	54.0	14.2	BE

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

Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
11	2462	2483.5	40.3	AV	1000	54.0	13.7	BE
11	2462	2483.5	62.8	PEAK	1000	74.0	11.2	BE

WLAN n-Mode; 20 MHz; MCS0

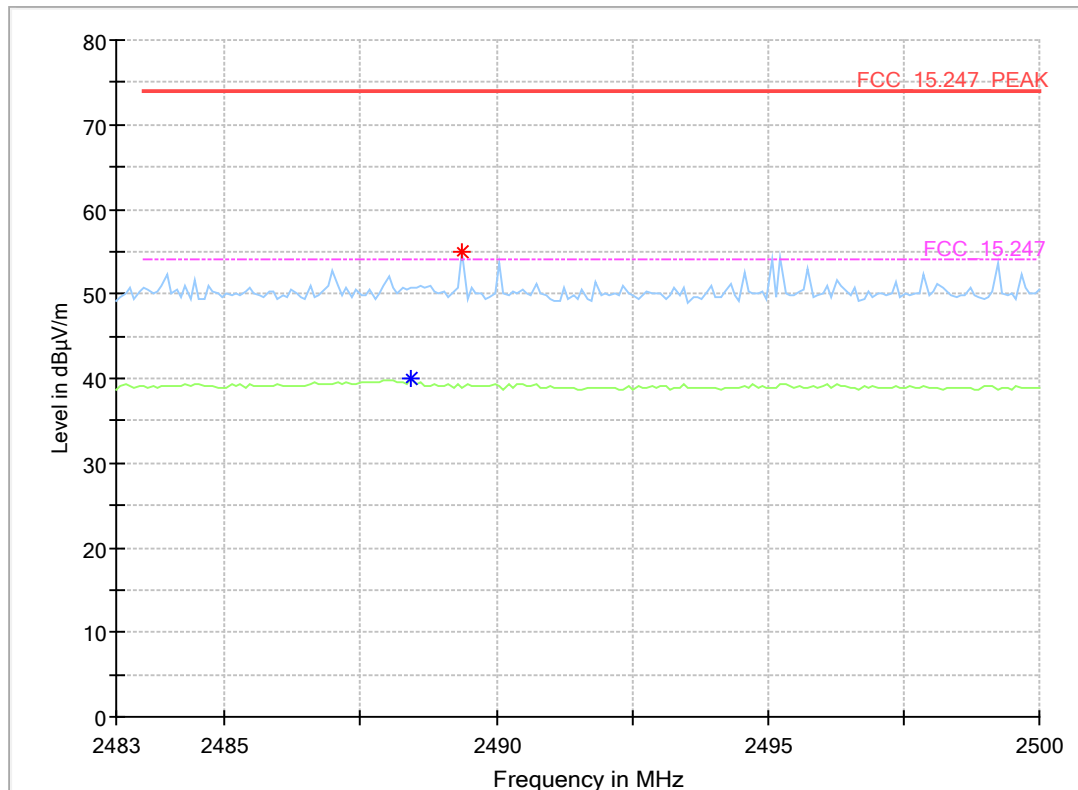
Applied duty cycle correction (AV): 0.1 dB

Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
11	2462	2483.5	68.4	PEAK	1000	74.0	5.6	BE
11	2462	2483.5	44.4	AV	1000	54.0	9.6	BE

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

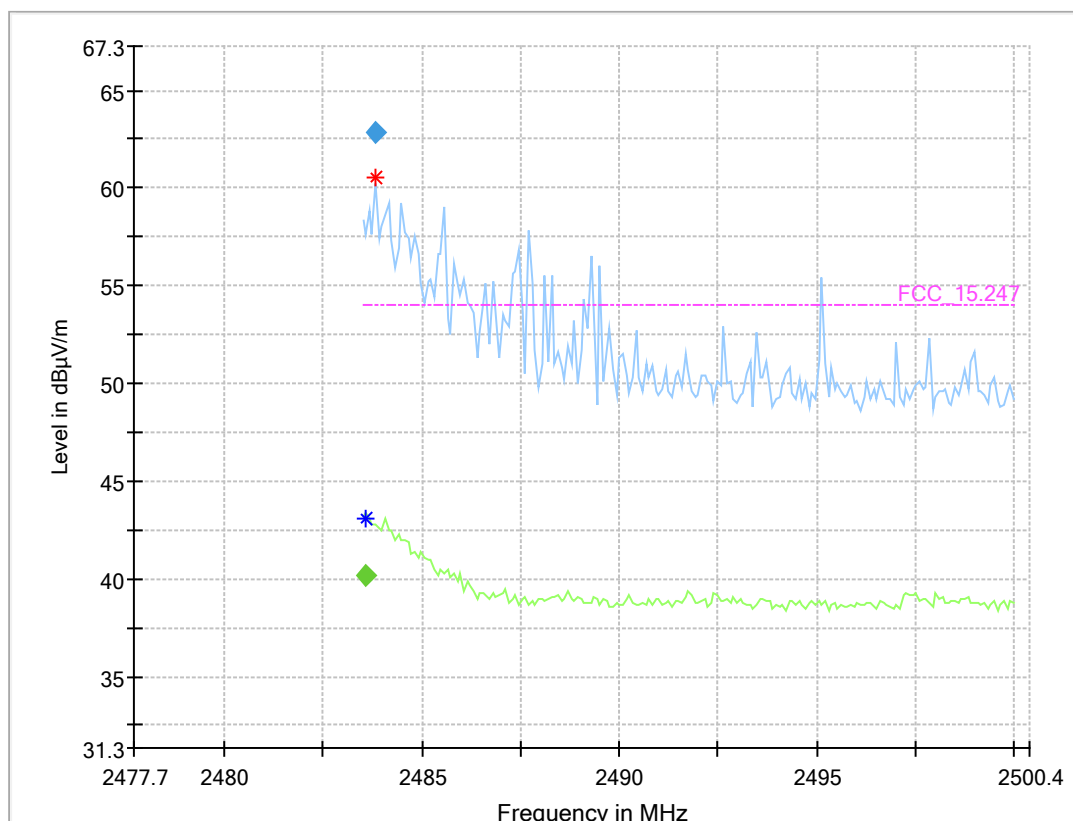
5.7.4 MEASUREMENT PLOT

Radio Technology = WLAN b 20 MHz, Operating Frequency = high, Band Edge = high
(S01_aa01_WLAN)



Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

Radio Technology = WLAN g 20 MHz, Operating Frequency = high, Band Edge = high
(S01_aa01_WLAN)

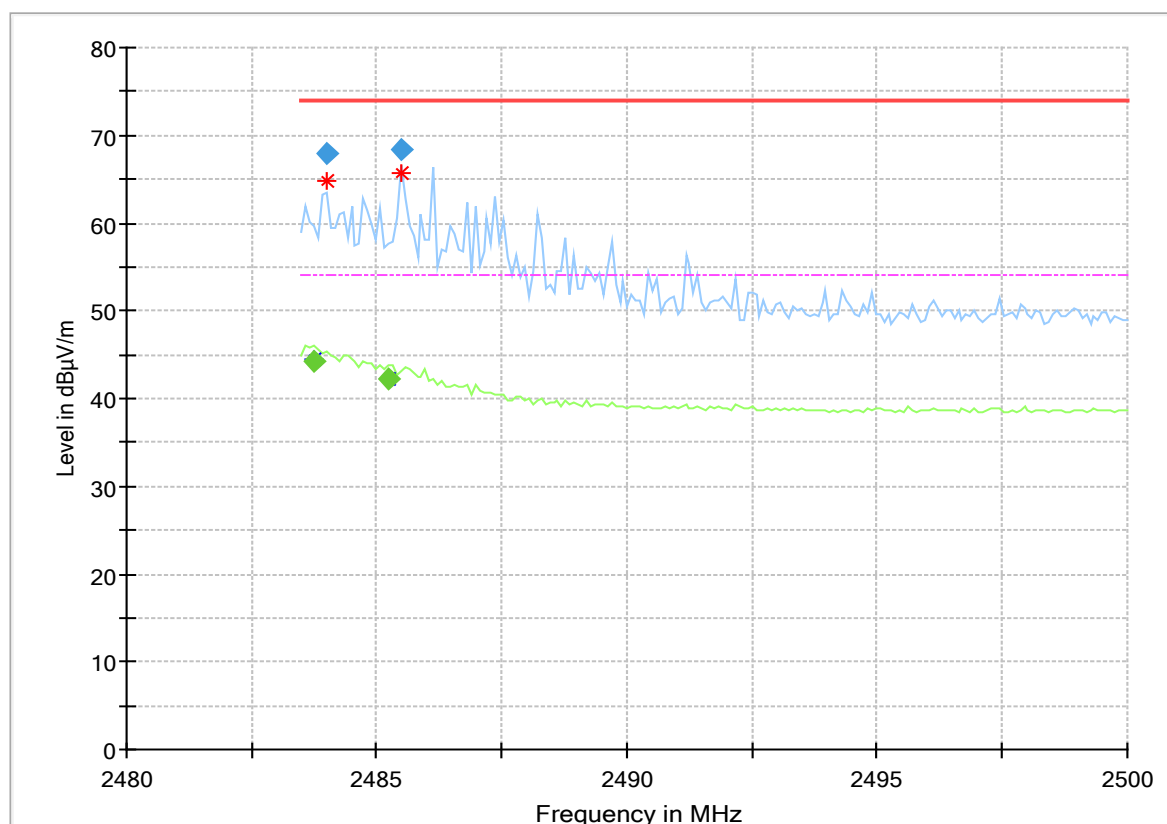


Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
2483.583	---	40.2	54.00	13.78	1000.0	1000.000	150.0	H	19.0	-4.0	5.4
2483.830	62.8	---	74.00	11.18	1000.0	1000.000	150.0	H	-11.0	15.0	5.4

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Band Edge = high
(S01_aa01_WLAN)



Legend: Trace: blue = Peak, green = AV, Star = critical frequency, Rhombus: blue = final Peak, green = final AV

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)	Corr. (dB/m)
2483.748	---	44.3	54.00	9.69	1000.0	1000.000	150.0	H	19.0	-12.0	5.4
2483.995	67.9	---	74.00	6.12	1000.0	1000.000	150.0	H	-11.0	1.0	5.4
2485.233	---	42.3	54.00	11.71	1000.0	1000.000	150.0	H	19.0	-12.0	5.4
2485.480	68.4	---	74.00	5.56	1000.0	1000.000	150.0	H	19.0	-10.0	5.4

5.7.5 TEST EQUIPMENT USED

- Radiated Emissions

5.8 POWER DENSITY

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.8.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up in a shielded room to perform the Power Density measurements.

The results recorded were measured with the modulation which produces the worst-case (highest) power density.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Maximum Peak Power Spectral Density (e.g. Bluetooth low energy):

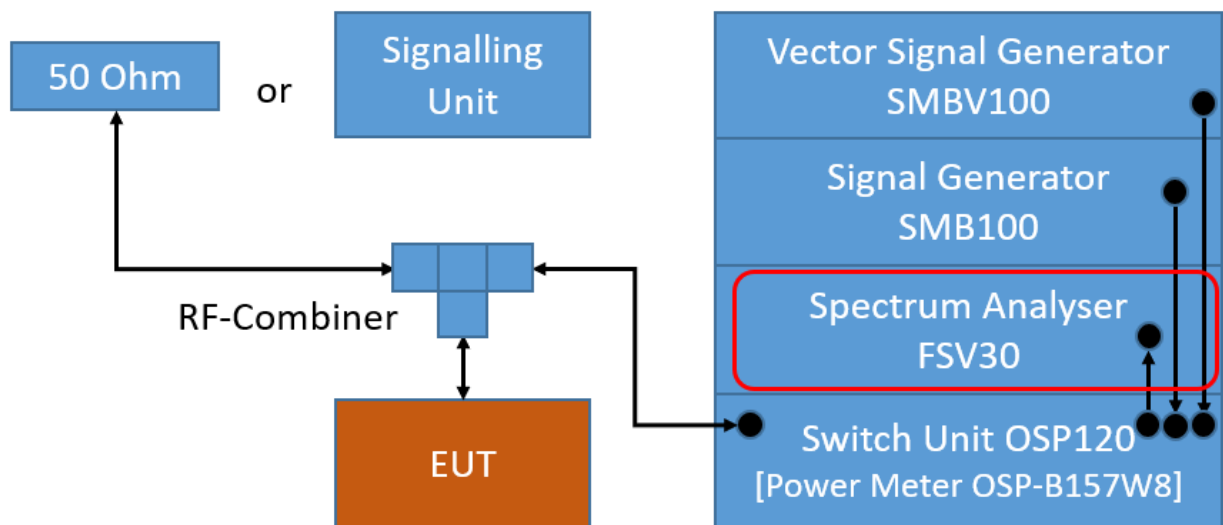
Analyser settings:

- Resolution Bandwidth (RBW): 100 kHz, 10 kHz or 3 kHz
- Video Bandwidth (VBW): ≥ 3 times RBW
- Trace: Maxhold
- Sweeps: Till stable (min. 200, max. 15000)
- Sweep time: Auto
- Detector: Peak

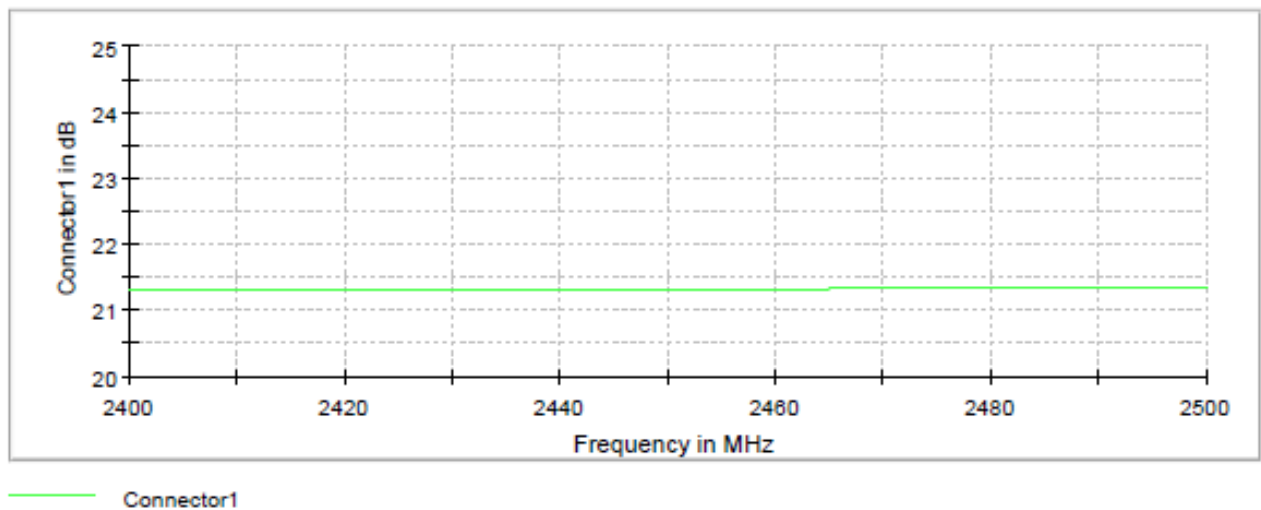
Maximum Average Power Spectral Density (e.g. WLAN):

Analyser settings:

- Resolution Bandwidth (RBW): 100 kHz, 10 kHz or 3 kHz
- Video Bandwidth (VBW): ≥ 3 times RBW
- Sweep Points: ≥ 2 times span / RBW
- Trace: Maxhold
- Sweeps: Till stable (max. 150)
- Sweep time: $\leq$ Number of Sweep Points x minimum transmission duration
- Detector: RMS



TS8997; Power Spectral Density



Attenuation of the measurement path

5.8.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.247 (e)

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

...

The same method of determining the conducted output power shall be used to determine the power spectral density.

FCC Part 15, Subpart C, §15.247 (f)

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques.

...

The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

5.8.3 TEST PROTOCOL

BT LE 2 Mbit/s

Band	Channel No.	Frequency [MHz]	Power Density [dBm / 10kHz]	Limit [dBm / 3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-4.0	8.0	12.0
	6	2437	-3.9	8.0	11.9
	11	2462	-4.2	8.0	12.2

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

Band	Channel No.	Frequency [MHz]	Power Density [dBm / 100kHz]	Limit [dBm / 3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-7.6	8.0	15.6
	6	2437	-7.5	8.0	15.5
	11	2462	-6.5	8.0	14.5

WLAN n-Mode; 20 MHz; MCS0

Band	Channel No.	Frequency [MHz]	Power Density [dBm / 100kHz]	Limit [dBm / 3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-7.7	8.0	15.7
	6	2437	-7.1	8.0	15.1
	11	2462	-7.6	8.0	15.6

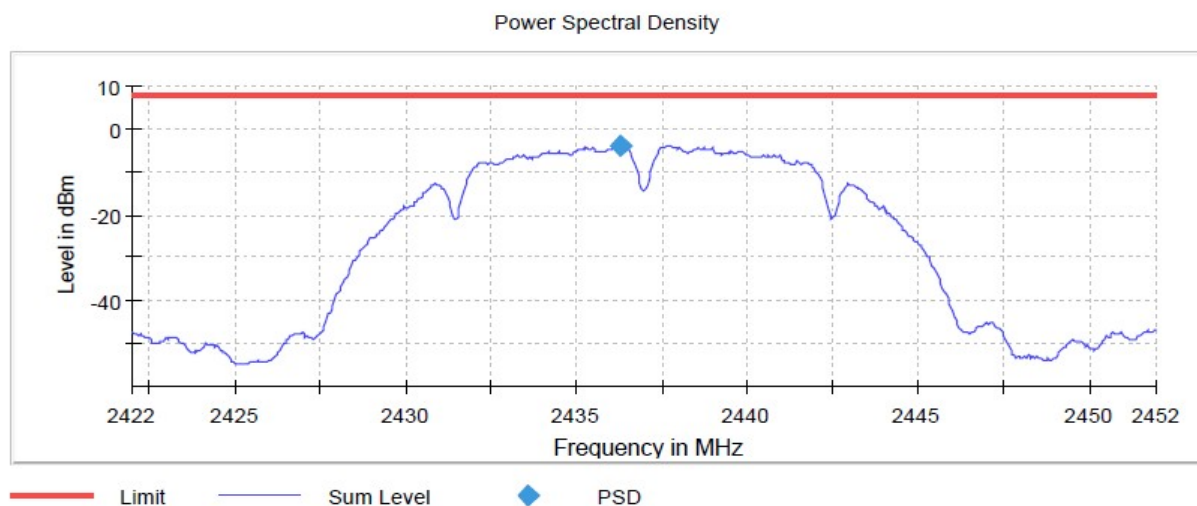
Remark: Please see next sub-clause for the measurement plot.

5.8.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN b, Operating Frequency = mid
(S01_ab01_WLAN)

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2436.275000	-3.923	8.0	PASS



5.8.5 TEST EQUIPMENT USED

- R&S TS8997

6 TEST EQUIPMENT

- 1 R&S TS8997
2.4 and 5 GHz Bands Conducted 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		
1.2	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2020-05	2022-05
1.3	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2020-04	2022-04
1.4	NGSM 32/10	Power Supply	Rohde & Schwarz GmbH & Co. KG	3456	2020-01	2022-01
1.5	SMBV100A	Enhanced GNSS	Rohde & Schwarz GmbH & Co. KG	262682-eP	2018-01	2021-01
1.6	Opus10 THI (8152.00)	T/H Logger 03	Lufft Mess- und Regeltechnik GmbH	7482	2019-06	2021-06
1.7	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2019-11	2022-11
1.8	OSP120	Contains Power Meter and Switching Unit OSP-B157W8	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	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2019-10	2020-10
2.2	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515		
2.3	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2019-05	2021-05
2.4	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2019-12	2021-12
2.5	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia	none		
2.6	HL 562 ULTRALOG	Biconical-log-per antenna (30 MHz - 3 GHz) with HL 562E biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003	2018-07	2021-07
2.7	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq			
2.8	5HC2700/12750-1.5-KK	High Pass Filter	Trilithic	9942012		

Ref. No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.9	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-		
2.10	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB		
2.11	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2020-04	2022-04
2.12	WRD1920/1980-5/22-5EESD	Tunable Band Reject Filter	Wainwright Instruments GmbH	11		
2.13	Opus10 THI (8152.00)	T/H Logger 10	Lufth Mess- und Regeltechnik GmbH	12488	2019-06	2021-06
2.14	PONTIS Con4101	PONTIS Camera Controller		6061510370		
2.15	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785		
2.16	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2019-02	2021-02
2.17	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069		
2.18	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09		
2.19	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99		
2.20	4HC1600/12750-1.5-KK	High Pass Filter	Trilithic	9942011		
2.21	SMB100A	Signal Generator 100 kHz - 40 GHz	Rohde & Schwarz Vertriebs-GmbH	181486	2019-11	2021-11
2.22	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368		
2.23	TT 1.5 WI	Turn Table	Maturo GmbH	-		
2.24	HL 562 ULTRALOG	Biconical-log-per Antenna (30 MHz - 3 GHz)	Rohde & Schwarz GmbH & Co. KG	100609	2019-05	2022-05
2.25	foCAN (v 4.0)	Fibre optic link CAN	Audivo GmbH (PONTIS EMC)	492 1607 014		
2.26	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675		
2.27	MA4985-XP-ET	Bore Sight Antenna Mast	innco systems GmbH	none		
2.28	JUN-AIR Mod. 6-15	Air Compressor	JUN-AIR Deutschland GmbH	612582		
2.29	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
2.30	HFH2-Z2	Loop Antenna	Rohde & Schwarz	829324/006	2018-01	2021-01
2.31	SB4-100.OLD20-3T/10 Airwin 2 x 1.5 kW	Air compressor (oil-free)	airWin Kompressoren UG	901/00503		

Ref. No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.32	UNI-T UT195E	True RMS Digital Multimeter	UNI-T UNI-TREND TECHNOLOGY (CHINA) CO., LTD.	C190729561		
2.33	JS4-00101800-35-5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037		
2.34	AS 620 P	Antenna Mast (pneumatic polarisation)	HD GmbH	620/37		
2.35	6005D (30 V / 5 A)	Laboratory Power Supply 120 V 60 Hz	PeakTech	81062045		
2.36	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709		
2.37	Innco Systems CO3000	Controller for bore sight mast SAC	innco systems GmbH	CO3000/967/39371016/L		
2.38	HF 907-2	Double-ridged horn	Rohde & Schwarz	102817	2019-04	2022-04
2.39	foCAN (v 4.0)	Fibre optic link CAN	Audivo GmbH (PONTIS EMC)	492 1607 013		
2.40	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
2.41	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324		
2.42	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/11920513		
2.43	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 attenuator)
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

$$U_{\text{LISN}} (\text{dB } \mu\text{V}) = U (\text{dB } \mu\text{V}) + \text{Corr. (dB)}$$

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 MHz	AF HFH-Z2) dB (1/m)	Corr. dB	cable loss 1 (inside chamber) dB	cable loss 2 (outside chamber) dB	cable loss 3 (switch unit) dB	cable loss 4 (to receiver) dB	distance corr. (-40 dB/ decade) dB	d _{Limit} (meas. distance (limit) m	d _{used} (meas. distance (used) 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

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)

($d_{Limit} = 3 \text{ m}$)

Frequency	AF R&S HL562	Corr.
MHz	dB (1/m)	dB
30	18.6	0.6
50	6.0	0.9
100	9.7	1.2
150	7.9	1.6
200	7.6	1.9
250	9.5	2.1
300	11.0	2.3
350	12.4	2.6
400	13.6	2.9
450	14.7	3.1
500	15.6	3.2
550	16.3	3.5
600	17.2	3.5
650	18.1	3.6
700	18.5	3.6
750	19.1	4.1
800	19.6	4.1
850	20.1	4.4
900	20.8	4.7
950	21.1	4.8
1000	21.6	4.9

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)
dB	dB	dB	dB	dB	m	m
0.29	0.04	0.23	0.02	0.0	3	3
0.39	0.09	0.32	0.08	0.0	3	3
0.56	0.14	0.47	0.08	0.0	3	3
0.73	0.20	0.59	0.12	0.0	3	3
0.84	0.21	0.70	0.11	0.0	3	3
0.98	0.24	0.80	0.13	0.0	3	3
1.04	0.26	0.89	0.15	0.0	3	3
1.18	0.31	0.96	0.13	0.0	3	3
1.28	0.35	1.03	0.19	0.0	3	3
1.39	0.38	1.11	0.22	0.0	3	3
1.44	0.39	1.20	0.19	0.0	3	3
1.55	0.46	1.24	0.23	0.0	3	3
1.59	0.43	1.29	0.23	0.0	3	3
1.67	0.34	1.35	0.22	0.0	3	3
1.67	0.42	1.41	0.15	0.0	3	3
1.87	0.54	1.46	0.25	0.0	3	3
1.90	0.46	1.51	0.25	0.0	3	3
1.99	0.60	1.56	0.27	0.0	3	3
2.14	0.60	1.63	0.29	0.0	3	3
2.22	0.60	1.66	0.33	0.0	3	3
2.23	0.61	1.71	0.30	0.0	3	3

($d_{Limit} = 10 \text{ m}$)

30	18.6	-9.9
50	6.0	-9.6
100	9.7	-9.2
150	7.9	-8.8
200	7.6	-8.6
250	9.5	-8.3
300	11.0	-8.1
350	12.4	-7.9
400	13.6	-7.6
450	14.7	-7.4
500	15.6	-7.2
550	16.3	-7.0
600	17.2	-6.9
650	18.1	-6.9
700	18.5	-6.8
750	19.1	-6.3
800	19.6	-6.3
850	20.1	-6.0
900	20.8	-5.8
950	21.1	-5.6
1000	21.6	-5.6

0.29	0.04	0.23	0.02	-10.5	10	3
0.39	0.09	0.32	0.08	-10.5	10	3
0.56	0.14	0.47	0.08	-10.5	10	3
0.73	0.20	0.59	0.12	-10.5	10	3
0.84	0.21	0.70	0.11	-10.5	10	3
0.98	0.24	0.80	0.13	-10.5	10	3
1.04	0.26	0.89	0.15	-10.5	10	3
1.18	0.31	0.96	0.13	-10.5	10	3
1.28	0.35	1.03	0.19	-10.5	10	3
1.39	0.38	1.11	0.22	-10.5	10	3
1.44	0.39	1.20	0.19	-10.5	10	3
1.55	0.46	1.24	0.23	-10.5	10	3
1.59	0.43	1.29	0.23	-10.5	10	3
1.67	0.34	1.35	0.22	-10.5	10	3
1.67	0.42	1.41	0.15	-10.5	10	3
1.87	0.54	1.46	0.25	-10.5	10	3
1.90	0.46	1.51	0.25	-10.5	10	3
1.99	0.60	1.56	0.27	-10.5	10	3
2.14	0.60	1.63	0.29	-10.5	10	3
2.22	0.60	1.66	0.33	-10.5	10	3
2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-20 * \text{LOG} (d_{Limit} / d_{used})$

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.
MHz	dB (1/m)	dB
1000	24.4	-19.4
2000	28.5	-17.4
3000	31.0	-16.1
4000	33.1	-14.7
5000	34.4	-13.7
6000	34.7	-12.7
7000	35.6	-11.0

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)		
dB	dB	dB	dB		
0.99	0.31	-21.51	0.79		
1.44	0.44	-20.63	1.38		
1.87	0.53	-19.85	1.33		
2.41	0.67	-19.13	1.31		
2.78	0.86	-18.71	1.40		
2.74	0.90	-17.83	1.47		
2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
3000	31.0	-23.4
4000	33.1	-23.3
5000	34.4	-21.7
6000	34.7	-21.2
7000	35.6	-19.8

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
dB	dB	dB	dB	dB	
0.47	1.87	0.53	-27.58	1.33	
0.56	2.41	0.67	-28.23	1.31	
0.61	2.78	0.86	-27.35	1.40	
0.58	2.74	0.90	-26.89	1.47	
0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
7000	35.6	-57.3
8000	36.3	-56.3
9000	37.1	-55.3
10000	37.5	-56.2
11000	37.5	-55.3
12000	37.6	-53.7
13000	38.2	-53.5
14000	39.9	-56.3
15000	40.9	-54.1
16000	41.3	-54.1
17000	42.8	-54.4
18000	44.2	-54.7

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)
dB	dB	dB	dB	dB	dB
0.56	1.28	-62.72	2.66	0.94	1.46
0.69	0.71	-61.49	2.84	1.00	1.53
0.68	0.65	-60.80	3.06	1.09	1.60
0.70	0.54	-61.91	3.28	1.20	1.67
0.80	0.61	-61.40	3.43	1.27	1.70
0.84	0.42	-59.70	3.53	1.26	1.73
0.83	0.44	-59.81	3.75	1.32	1.83
0.91	0.53	-63.03	3.91	1.40	1.77
0.98	0.54	-61.05	4.02	1.44	1.83
1.23	0.49	-61.51	4.17	1.51	1.85
1.36	0.76	-62.36	4.34	1.53	2.00
1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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 = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

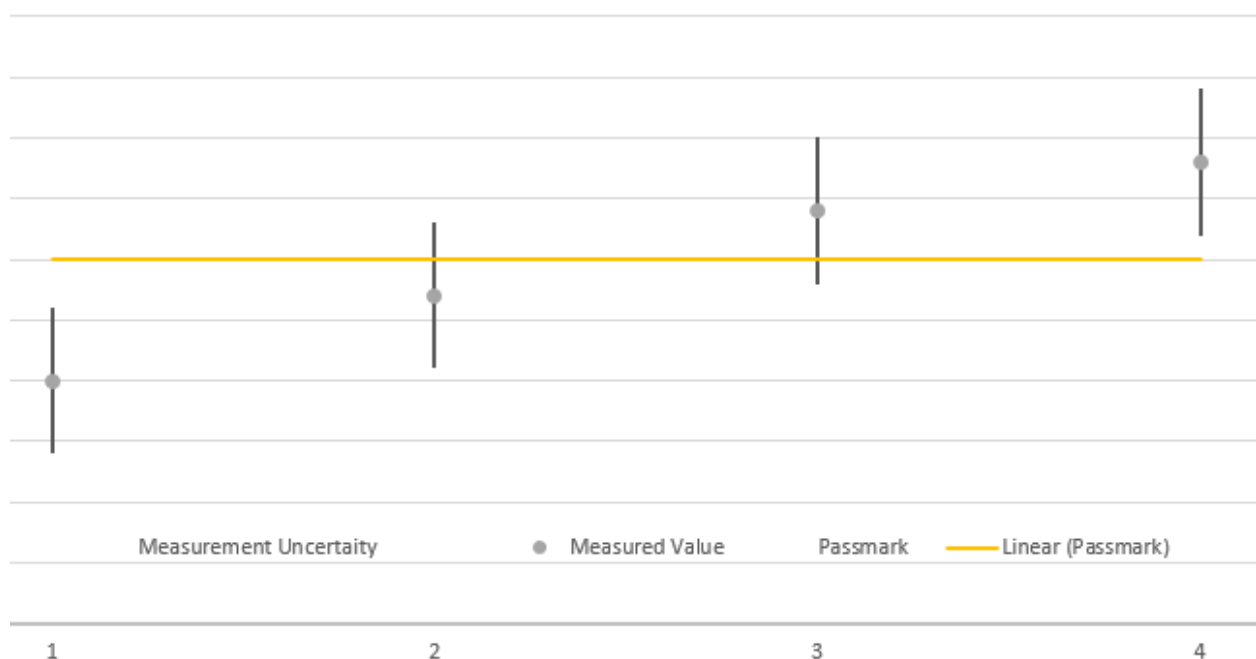
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

8 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

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	above pass mark	within pass mark	Failed
4	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.

9 PHOTO REPORT

Please see separate photo report.