

FCC Measurement/Technical Report on

Multimedia Equipment with WLAN and Bluetooth

BCI3L4PTR1(Star 3.5 / Star 3.0)

FCC ID: 2AUXS-BCI3L4PTR1

Test Report Reference: MDE_BOSCH_2511_FCC_08

Test Laboratory:

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Akkreditierungsstelle
D-PL-12140-01-00

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 (10-1-24 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 (only in case of direct or indirect connection to AC main)

§ 15.209 Radiated emission limits; general requirements

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

Note:

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 C63.10-2020 + Cor. 1-2023 + C63.10a-2024 + Errata to C63.10a-2024 is applied.

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 & AMD 1 & AMD 2: 8.8
Occupied bandwidth	§ 15.247 (a) (2)	RSS-247 Issue 3: 5.2 (a)
Peak conducted output power	§ 15.247 (b) (3), (4)	RSS-247 Issue 3: 5.4 (d)
Transmitter spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen Issue 5 & AMD 1 & AMD 2: 6.13 / 8.9/8.10; RSS-247 Issue 3: 5.5
Transmitter spurious radiated emissions	§ 15.247 (d); § 15.209 (a)	RSS-Gen Issue 5 & AMD 1 & AMD 2: 6.13 / 8.9/8.10; RSS-247 Issue 3: 5.5
Band edge compliance	§ 15.247 (d)	RSS-247 Issue 3: 5.5
Power density	§ 15.247 (e)	RSS-247 Issue 3: 5.2 (b)
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 5 & AMD 1 & AMD 2: 8.3
Receiver spurious emissions	–	–

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15

§ 15.247 (d)

Subpart C §15.247

Transmitter Spurious Emissions in Restricted Bands

The measurement was performed according to ANSI C63.10, chapter 6.4, 6.5, 6.6.5

Final Result

OP-Mode	Setup	Date	FCC	IC
Chip, Radio Technology, Operating Frequency, Measurement range				
Chip01, Bluetooth LE 2 Mbps, high, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-17	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, high, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-29	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, low, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-15	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, low, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-15	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, mid, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-15	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, mid, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-17	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, high, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-17	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, high, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-21	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, low, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-18	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, low, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, mid, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-08-18	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, mid, 1 G - 26 GHz	S01_BF03#S3.5	2025-08-18	Passed	Passed
Chip01, WLAN b, high, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-04-22	Passed	Passed
Chip01, WLAN b, low, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-05-02	Passed	Passed
Chip01, WLAN b, mid, 1 GHz - 26 GHz	S01_BF03#S3.5	2025-04-15	Passed	Passed
Chip01, WLAN b, mid, 30 MHz - 1 GHz	S01_BF03#S3.5	2025-04-22	Passed	Passed
Chip01, WLAN g, high, 1 GHz - 8 GHz	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN g, low, 1 GHz - 8 GHz	S01_BF03#S3.5	2025-04-16	Passed	Passed
Chip01, WLAN g, mid, 1 GHz - 8 GHz	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN b, mid, 9 kHz - 30 MHz	S01_BE03#S3.0	2025-08-13	Passed	Passed
Chip01, WLAN b, mid, 30 MHz - 1 GHz	S01_BE03#S3.0	2025-08-08	Passed	Passed
Chip01, WLAN b, high, 1 GHz - 26 GHz	S01_BE03#S3.0	2025-08-11	Passed	Passed
(Harmonic Only)				

47 CFR CHAPTER I FCC PART 15
§ 15.247 (d)
Subpart C §15.247

Band Edge Compliance Restricted Bands

The measurement was performed according to ANSI C63.10, chapter 6.6.5

Final Result
OP-Mode

 Chip, Radio Technology, Operating
 Frequency, Band Edge

Setup
Date
FCC
IC

Chip01, Bluetooth LE 2 Mbps, low, low	S01_BF03#S3.5	2025-08-15	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, low, low	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip01, WLAN g, low, low	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip01, Bluetooth LE 1 Mbps, high, high	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip01, Bluetooth LE 2 Mbps, high, high	S01_BF03#S3.5	2025-08-29	Passed	Passed
Chip02, Bluetooth LE 1 Mbps, high, high	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip02, Bluetooth LE 2 Mbps, high, high	S01_BF03#S3.5	2025-08-28	Passed	Passed
Chip01, WLAN ax 20 MHz (SU), high, high	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN ax 20 MHz (MU), high, high	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN b, high, high	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN g, high, high	S01_BF03#S3.5	2025-08-20	Passed	Passed
Chip01, WLAN n 20 MHz, high, high	S01_BF03#S3.5	2025-04-14	Passed	Passed
Chip01, WLAN ax 20 MHz (SU), high, high	S01_BE03#S3.0	2025-08-21	Passed	Passed
Chip01, WLAN ax 20 MHz (MU), high, high	S01_BE03#S3.0	2025-08-21	Passed	Passed
Chip01, WLAN b, high, high	S01_BE03#S3.0	2025-08-11	Passed	Passed

N/A: Not applicable

N/P: Not performed

2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2025-09-24	--	valid

COMMENT:

The hardware version of the equipment under test (EUT) has been updated from "**D05**" to "**D10**". The detailed differences between these two hardware versions can be found in document "BCI3L4PTR1--D10-HW-Changes--Release-Version-3.0".

Not all applicable tests were performed on the updated hardware version. The EUT with hardware version "D05" has been fully tested, as documented in Reference Test Report: "MDE_BOSCH_2411_FCC_08_rev02".

The focus of this test report is to demonstrate that the EUT with hardware version "D10" also fulfills the requirements of FCC 15.247. Therefore, only spot-checks have been performed on the updated hardware.



(responsible for accreditation scope)
Dipl.-Ing. Robert Machulec



(responsible for testing and report)
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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-12140-01-00
FCC Designation Number: DE0015
FCC Test Firm Registration: 929146
ISED CAB Identifier DE0007; ISED#: 3699A

Responsible for accreditation scope: Dipl.-Ing. Robert Machulec
Report Template Version: 2025-02-28

3.2 PROJECT DATA

Responsible for testing and report: BSc. Mhd Mouaz Saad
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2025-09-24
Testing Period: 2025-04-14 to 2025-08-29

3.3 APPLICANT DATA

Company Name: Robert Bosch GmbH
Address: Robert-Bosch-Platz 1, 70839 Gerlingen
Germany
Contact Person: Karin Silberhorn

3.4 MANUFACTURER DATA

Manufacturer 1

Company Name: Bosch Car Multimedia Portugal

Address: S.A. Rua Max Grundig
35-Lomar,
4705-820 Braga

Manufacturer 2

Company Name: Bosch Automotive Products (Suzhou) Co., Ltd.

Address: Changzhou Branch
No. 17, Long Men Road,
Wujin Hi-tech Industrial Zone
Changzhou, Jiangsu, P.R. China

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Central In-Vehicle Infotainment Computer		
Product name	Multimedia Device with WLAN and Bluetooth		
Model name	BCI3L4PTR1(Star 3.5 / Star 3.0)		
Declared EUT data by the supplier			
Voltage Type	DC		
Voltage Level	12 VDC		
Antenna / Gain	External		
	Antenna 2(Chip02 BT)	Antenna 3(Chip01 BT)	Antenna 4(WLAN 2.4)
	0.1 dB	0.1 dB	0.1 dB
Tested Modulation Type	BTLE: GFSK WLAN: WLAN b: DSSS, WLAN g/n: OFDM WLAN ax: OFDM and OFDMA		
General product description	Central In-Vehicle Infotainment Computer Gen20x.i3 infotainment system is the main unit in the vehicle, which combines the instrument cluster and infotainment functionality. It supports Bluetooth classic (BT), Bluetooth Low Energy (BTLE) and Wi-Fi (2.4GHz(SISO) and 5GHz(MIMO only)). Supported WLAN modes are b, g, n and ax with 20 MHz BW.		
Specific product description for the EUT	The EUT has the following modules for Bluetooth and WLAN:		
	ATC6QPL002(Chip02): Only BT and BTLE	ATC6QPL004(Chip01): BT, BTLE, Wi-Fi (2.4GHz and 5GHz).	
EUT ports (connected cables during testing):	Main Connector A(incl. DC Power) (unshielded, 1m)	GNSS antenna (shielded, 1.5m)	
	Main Connector B (unshielded, 1m)	BT/WLAN Antenna (shielded, 1.5m)	
	Ethernet (shielded, 1.5m)	HD-BaseT (shielded, 1.5m)	
	FM/AM/SDARS/Ref.-Antennas	USB 2.0 – TGS (shielded, 1.5m)	
	Video-Out Displays (shielded, 1.5m)	USB 2.0 - MM-Box (shielded, 1.5m)	
	CamsControl(shielded, 1.5m)	Video-in Cameras (shielded, 1.5m)	
	USB 3.0 High Speed Flashing/CAM Logging (shielded, 1.5m)		
Tested datarates	BTLE: 1Mbps, 2Mbps WLAN b: 1 Mbps, WLAN g: 6 Mbps, WLAN n and ax: MCS0		
Special software used for testing	ADB shell.exe / civic_wlan_rta_tool_v2_11.exe		
Connection to AC main is supported	No (no direct or indirect connection)		

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT A	DE1050027bf03	Radiated Sample
Sample Parameter	Value	
Serial No.	0020335	
HW Version	D10	
SW Version	E077.0	
Comment	BCI3L4PTR1 - Star 3.5	

Sample Name	Sample Code	Description
EUT B	DE1050028be03	Radiated Sample
Sample Parameter	Value	
Serial No.	0029012	
HW Version	D10	
SW Version	E230.1	
Comment	BCI3L4PTR1 - Star 3.0	

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
ANC 1	Continental, RKE223E1GNS, DE1050025/026AUX01	GNSS Antenna + Antenna Cable (1.5m)
ANC 2	Mercedes-Benz, A1779052902, DE1050025/026AUX45	4x WIFI/BT Antenna + 4x Antenna Cable (1.5m)

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
AUX A	Bosch, -, -, -, -	2x Cable Harness

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_BF03#S3.5	EUT A, ANC 1, ANC 2, AUX A	Radiated Setup
S01_BE03#S3.0	EUT B, ANC 1, ANC 2, AUX A	Radiated Setup

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

BT LE Test Channels:
Channel:
Frequency [MHz]

2.4 GHz ISM 2400 - 2483.5 MHz		
low	mid	high
0	19	39
2402	2440	2480

4.6.2 OPERATING MODES

The testing was conducted at the maximum output power setting specified by the manufacturer.

- BTLE mode: GFSK, Data Rate = 1 or 2 Mbps
- WLAN b-mode: 1 Mbit/s
- WLAN g-mode: 6 Mbit/s
- WLAN n-mode (20 MHz BW): MCS0
- WLAN ax-mode (20 MHz BW), support also the following modes:
 - o ax-mode **Single User (SU)** (not supported by all Test Channels)
 - o ax- mode **Multi User (MU)** (supported by all Test Channels)

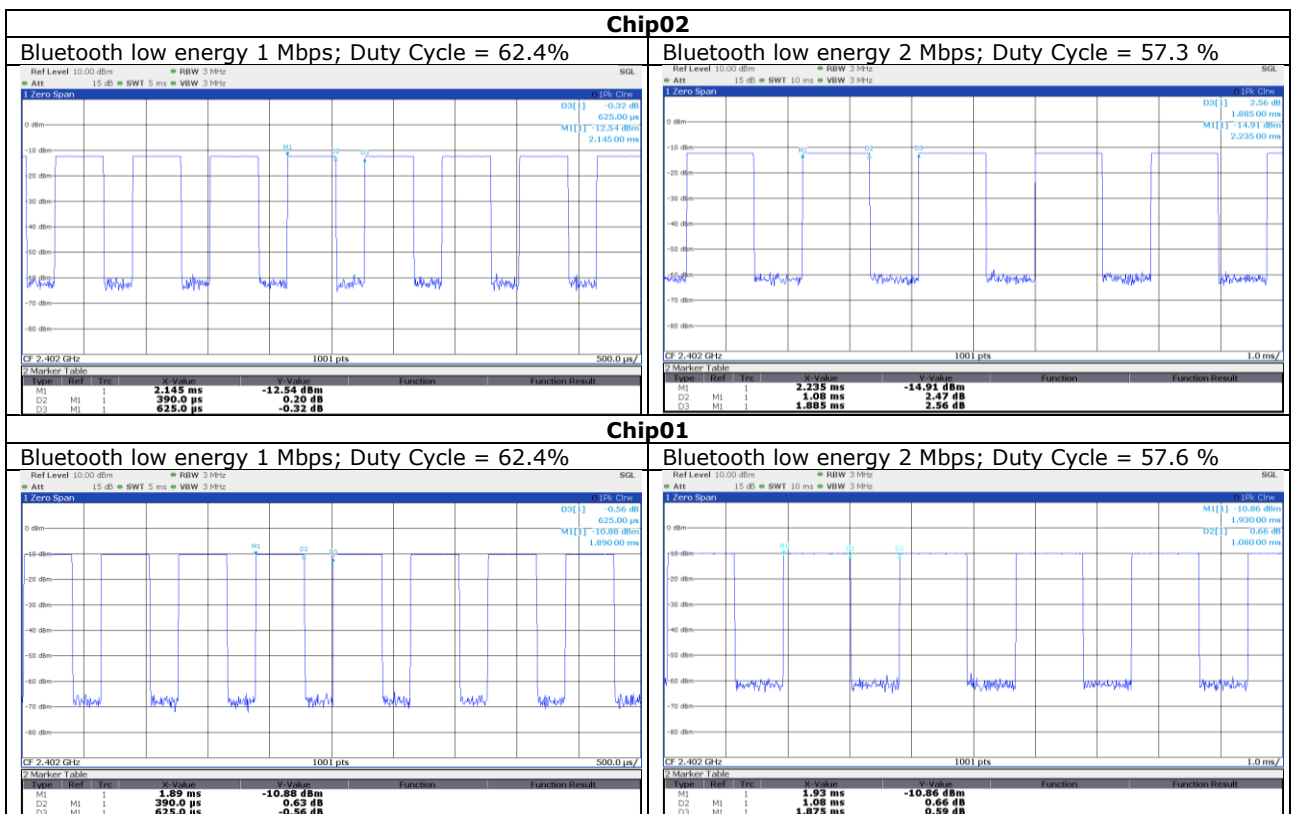
The test case RU26 represents the worst-case scenario for ax-mode MU, which is why MU mode was performed exclusively by RU26. (Please see the reference report: MDE_BOSCH_2411_FCC_08_rev02)

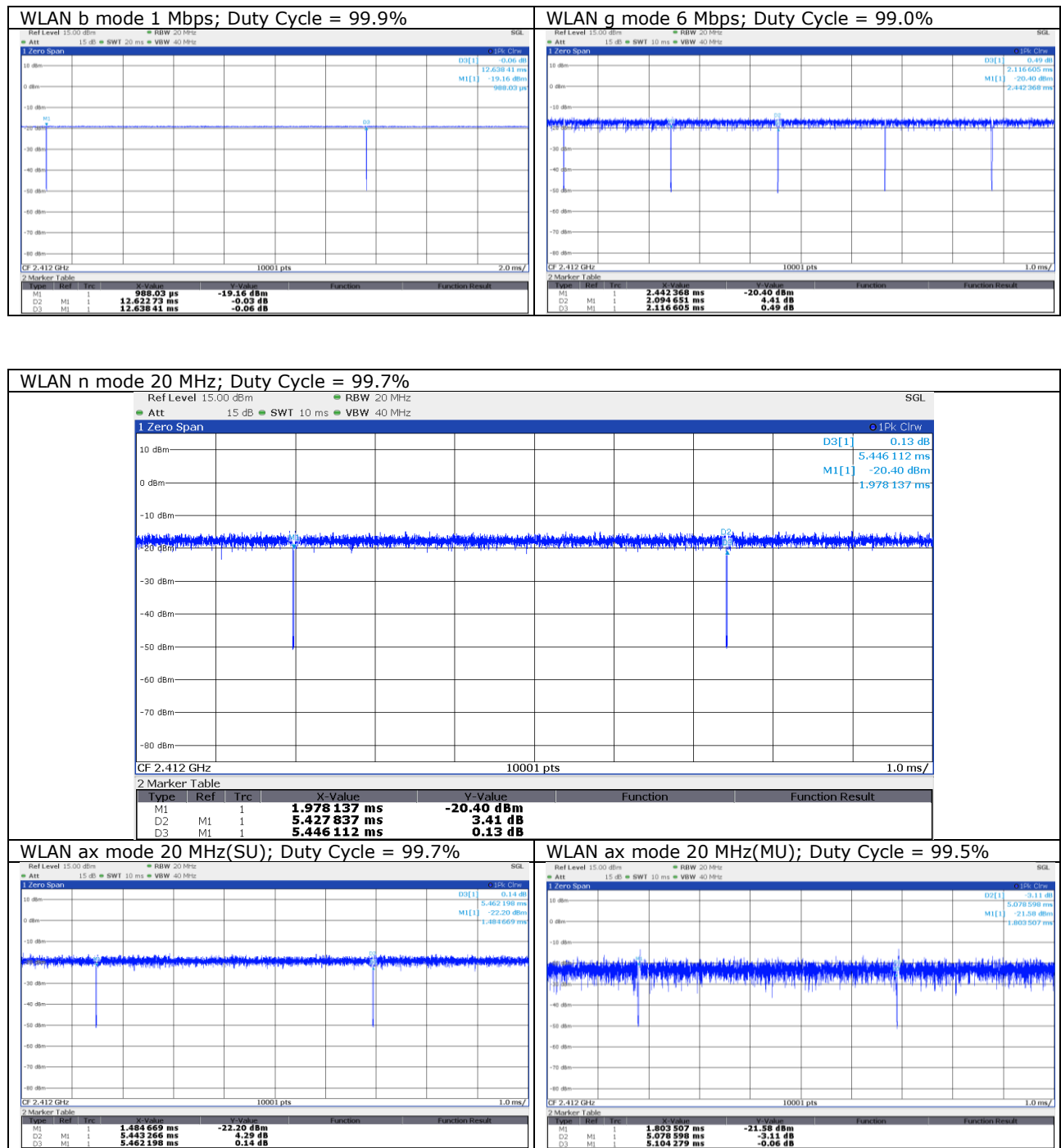
The supported test cases of the ax-mode MU by WLAN 2.4 GHz are in the following table:

BW 20					
2412 [MHz]		2437 [MHz]		2462 [MHz]	
SU/RU	RU offset	SU/RU	RU offset	SU/RU	RU offset
SU	-	-	-	SU	-
RU26	0	RU26	4	RU26	8
RU52	37	-	-	RU52	40
RU106	53	-	-	RU106	54
RU242	61	-	-	RU242	61

4.7 DUTY CYCLE

The test was performed according to:
ANSI C63.10, chapter 10.6





4.8 PRODUCT LABELLING

4.8.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.8.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 TRANSMITTER SPURIOUS EMISSIONS IN RESTRICTED BANDS

Standard **FCC Part 15 Subpart C**

The test was performed according to:

ANSI C63.10, chapter 6.4, 6.5, 6.6.5

5.1.1 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:

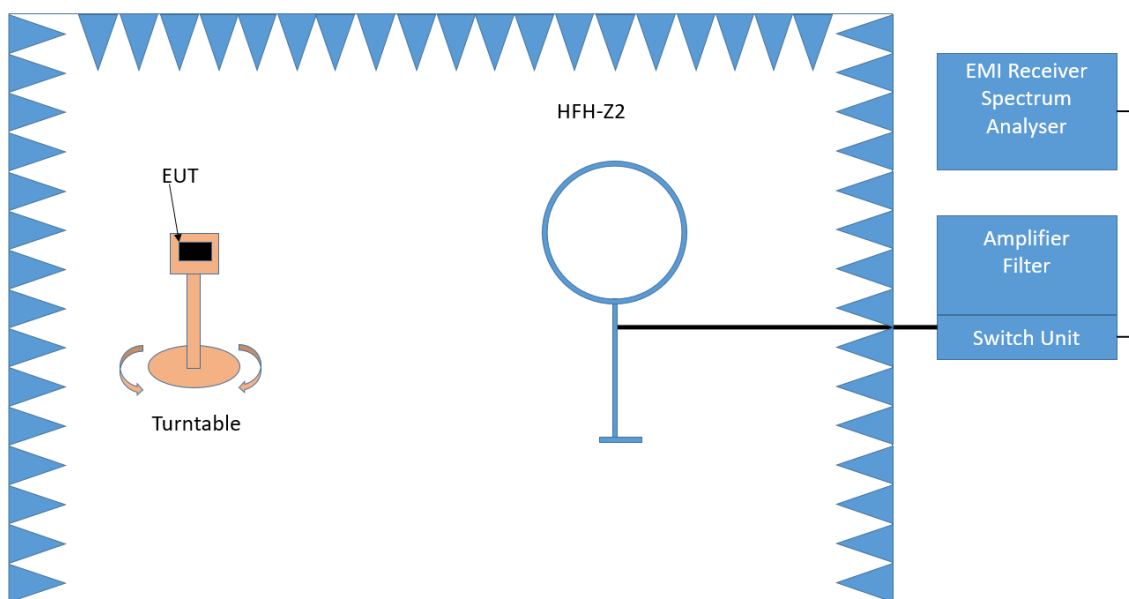
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

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)

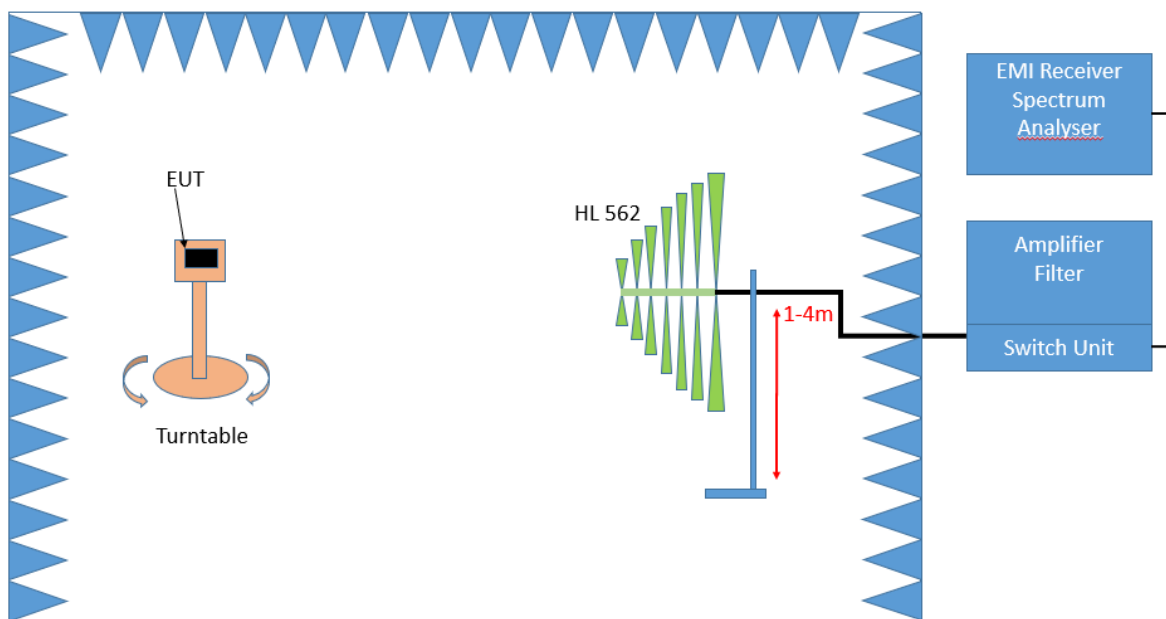
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

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 360° . 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 between 1 – 4 meter. 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

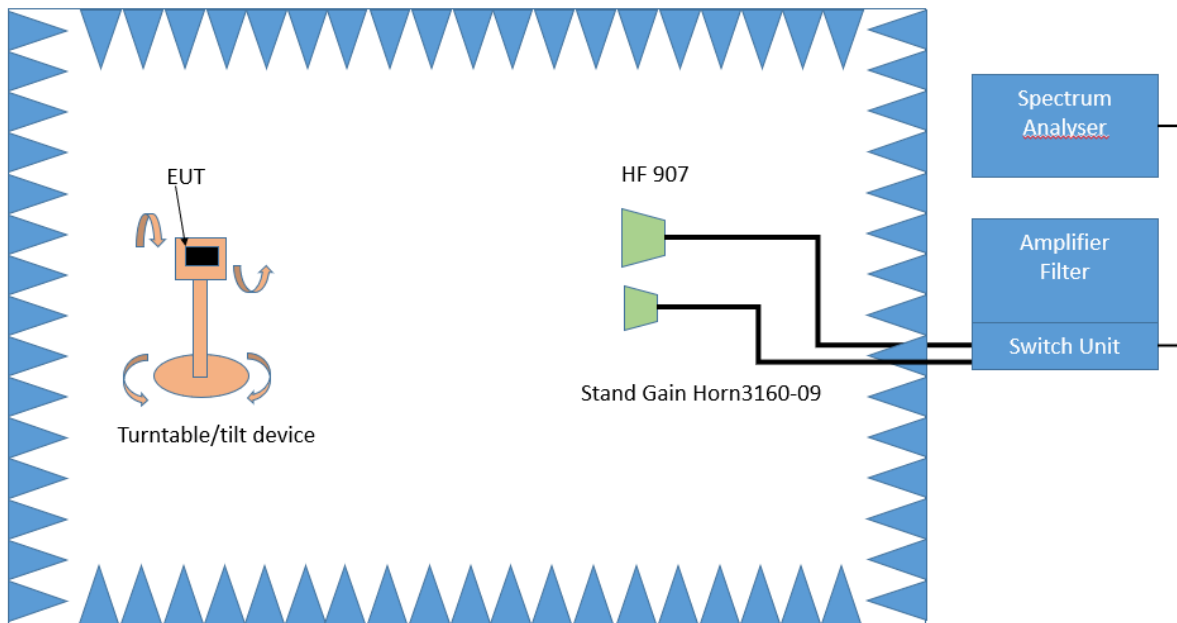
After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

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

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

5.1.3 TEST PROTOCOL

Ambient temperature: 20–22 °C
 Air Pressure: 999–1007 hPa
 Humidity: 33–41 %

Chip01(S01_BF03#S3.5)

BT LE 2 Mbit/s

Applied duty cycle correction (AV): 4.8 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
0	2402	119.9	18.3	QP	120	43.5	25.2	RB
0	2402	172.4	24.6	QP	120	43.5	18.9	RB
0	2402	334.6	28.6	QP	120	46.0	17.4	RB
0	2402	406.9	29.5	QP	120	46.0	16.5	RB
19	2440	165.2	23.3	QP	120	43.5	20.2	RB
19	2440	322.4	23.7	QP	120	46.0	22.3	RB
19	2440	402.8	22.5	QP	120	46.0	23.5	RB
39	2480	150.0	6.0	QP	120	43.5	37.5	RB
39	2480	165.0	10.0	QP	120	43.5	33.5	RB
39	2480	283.6	11.0	QP	120	46.0	35.0	RB

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

Applied duty cycle correction (AV): 0 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	150.0	29.8	QP	120	43.5	13.7	RB
1	2412	165.2	28.7	QP	120	43.5	14.8	RB
1	2412	334.8	24.7	QP	120	46.0	21.3	RB
1	2412	406.5	29.8	QP	120	46.0	16.2	RB
6	2437	150.0	26.3	QP	120	43.5	17.2	RB
6	2437	165.0	34.1	QP	120	43.5	9.4	RB
6	2437	405.0	33.0	QP	120	46.0	13.0	RB
11	2462	129.8	23.3	QP	120	43.5	20.2	RB
11	2462	150.0	24.1	QP	120	43.5	19.4	RB
11	2462	156.8	20.8	QP	120	43.5	22.7	RB
11	2462	167.1	33.4	QP	120	43.5	10.1	RB
11	2462	404.3	36.7	QP	120	46.0	9.3	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*	---	---	---	---	---	---	RB
6	2437*	---	---	---	---	---	---	RB
11	2462*	---	---	---	---	---	---	RB

Chip02(S01_BF03#S3.5)

BT LE 2 Mbit/s

Applied duty cycle correction (AV): 4.8 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
0	2402	165.2	14.1	QP	120	43.5	29.4	RB
0	2402	322.8	23.9	QP	120	46.0	22.1	RB
19	2440	165.2	13.2	QP	120	43.5	30.3	RB
19	2440	322.8	24.9	QP	120	46.0	21.1	RB
39	2480	113.4	5.9	QP	120	43.5	37.6	RB
39	2480	322.8	21.0	QP	120	46.0	25.0	RB

=====

Ambient temperature: 20–22 °C

Air Pressure: 999–1007 hPa

Humidity: 33–41 %

Chip01(S01_BE03#S3.0 / S01_BE03#S3.0)

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

Applied duty cycle correction (AV): 0 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
6	2437	407.3	28.1	QP	120	46.0	17.9	RB
11	2462*	- - -	- - -	- - -	- - -	- - -	- - -	RB

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

- The measurements have been performed only on worst-case modes" b-mode, g-mode and BT LE 2 Mbit/s ", which they had the highest spurious Emission in the Reference Report: "MDE_BOSCH_2411_FCC_08_rev02"

***) no peaks have been found for these operating channels / operating modes**

Comment:

- At least spurious emissions that exceed the limit values, that come within 20 dB below these values are listed in the table above.

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

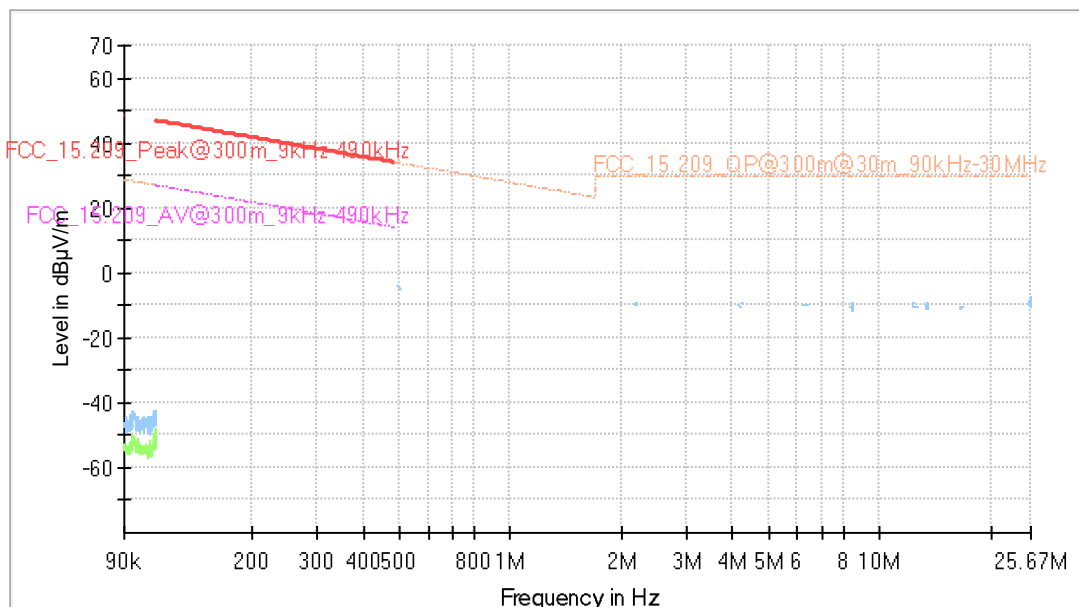
Trace:

blue = Peak (9 kHz - 40 GHz)
 green = AV (9 kHz - 30 MHz and 1 - 26 GHz), QP (30 MHz - 1 GHz)

Marker:

Star = critical frequency, Rhombus = final Results

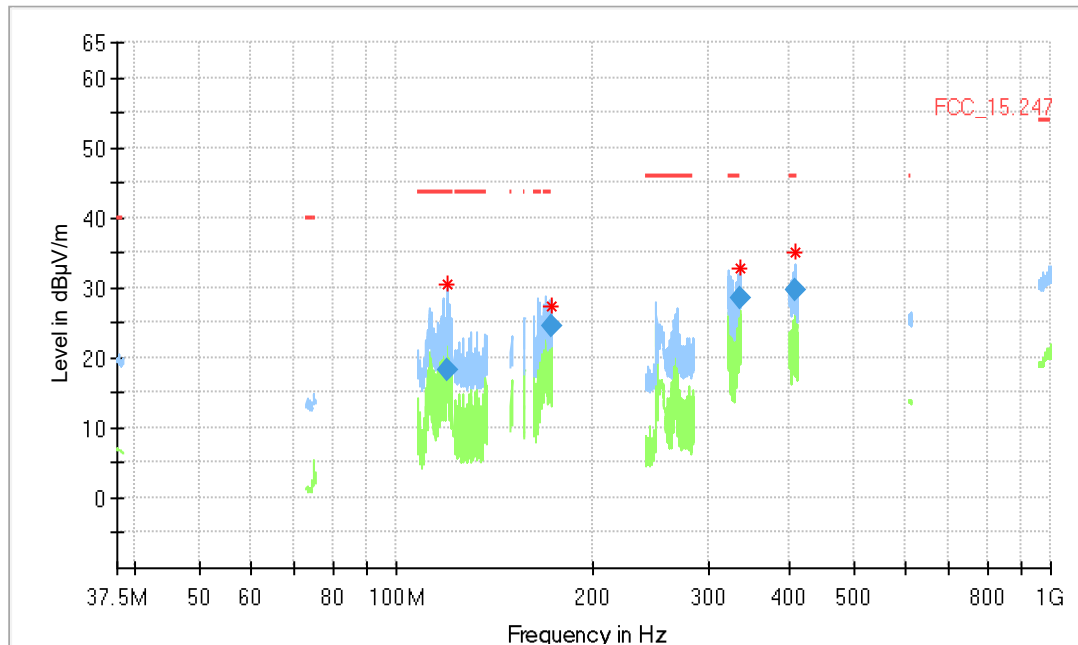
Chip01, Modulation= WLAN b, Operating Channel = mid,
 Measurement range = 9 kHz - 30 MHz
 (S01_BE03#S3.0)



Final Result

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

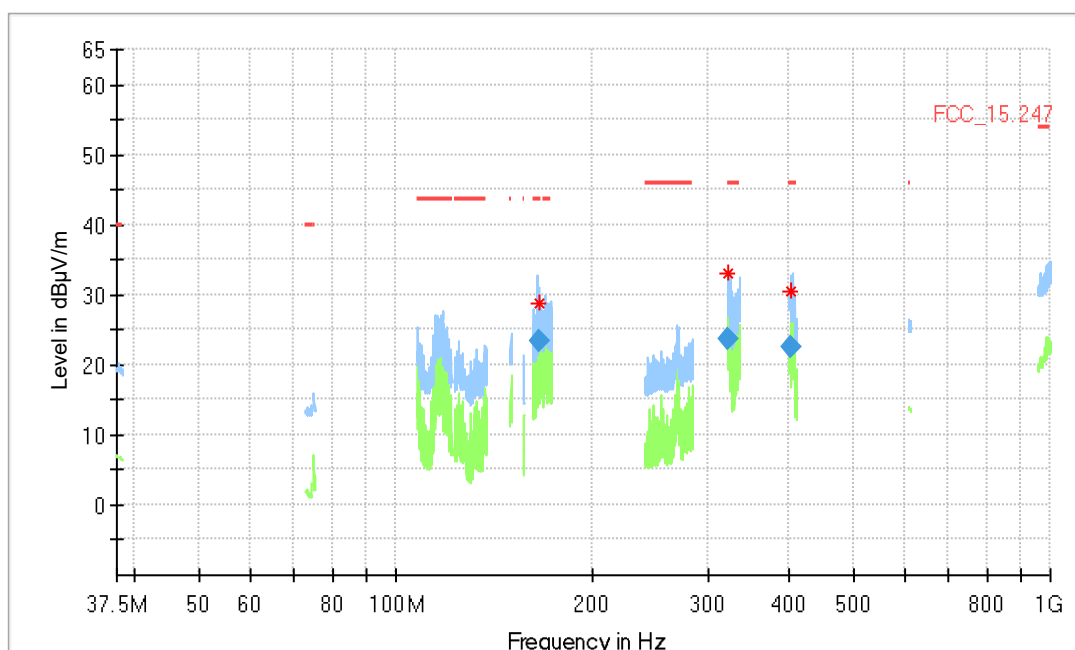
Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = low,
Measurement range = 30 MHz – 1 GHz
(S01_BF03#S3.5)



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)
119.910000	18.3	43.50	25.2	1000.0	120.000	110.0	V	12	11.5
172.430000	24.6	43.50	18.9	1000.0	120.000	100.0	V	84	9.9
334.600000	28.6	46.00	17.4	1000.0	120.000	104.0	H	30	14.9
406.920000	29.5	46.00	16.5	1000.0	120.000	124.0	V	326	17.1

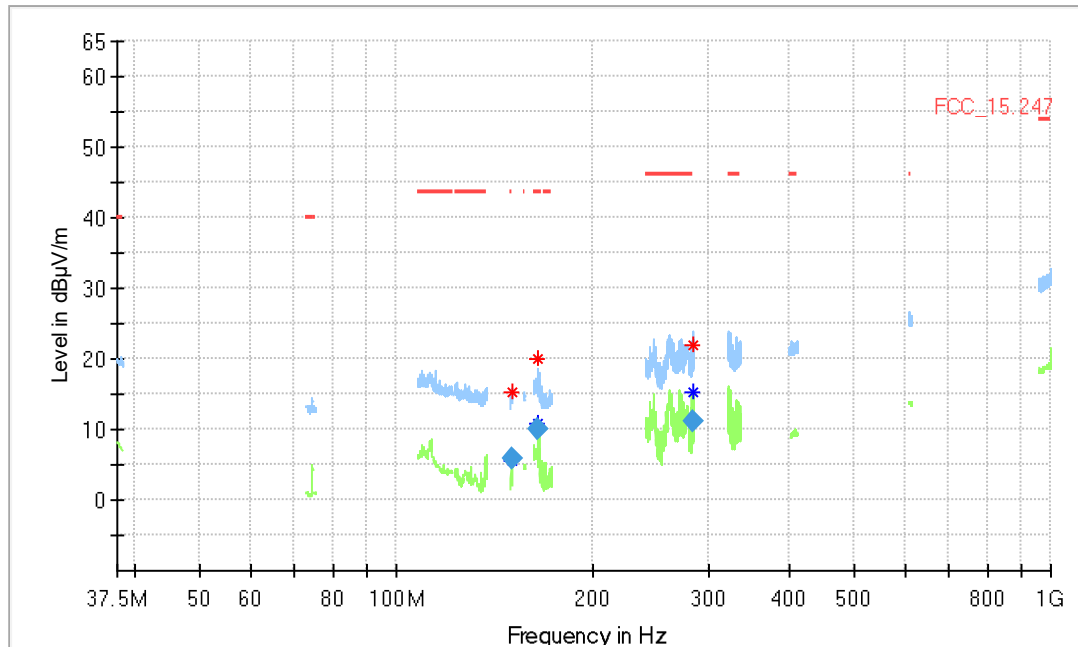
Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = mid,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
165.192500	23.3	43.50	20.2	1000.0	120.000	124.0	V	53	9.5
322.420000	23.7	46.00	22.3	1000.0	120.000	116.0	H	15	14.5
402.750000	22.5	46.00	23.5	1000.0	120.000	111.0	V	0	17.0

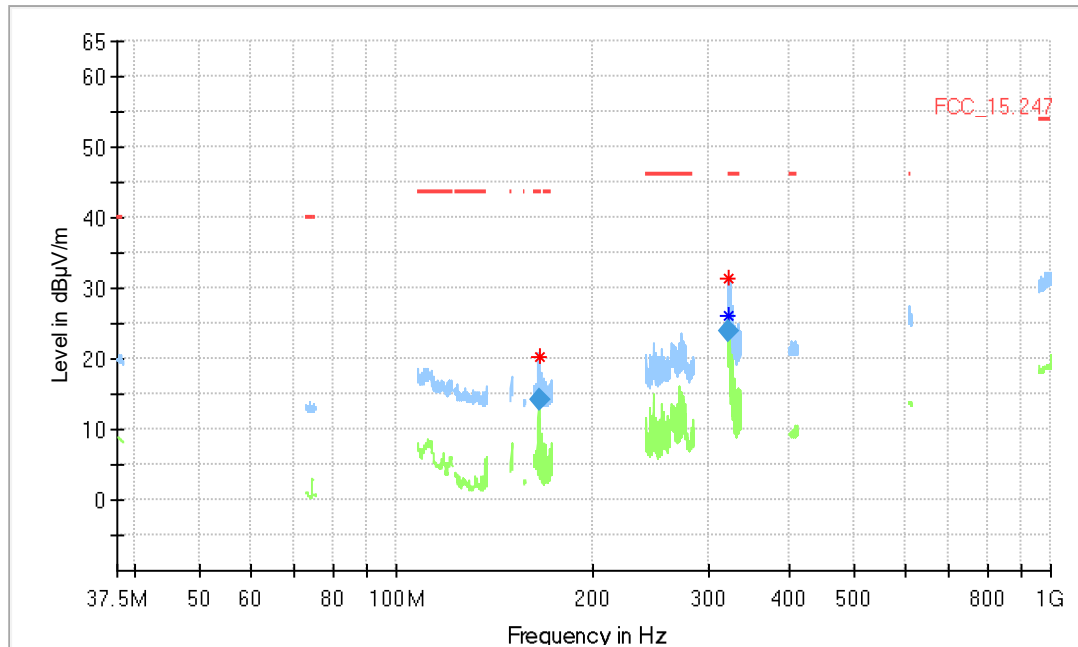
Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = high,
Measurement range = 30 MHz – 1 GHz
(S01_BF03#S3.5)



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)
149.960000	6.0	43.50	37.5	1000.0	120.000	121.0	V	123	9.5
165.042500	10.0	43.50	33.5	1000.0	120.000	105.0	V	349	9.5
283.590000	11.0	46.00	35.0	1000.0	120.000	140.0	H	31	13.2

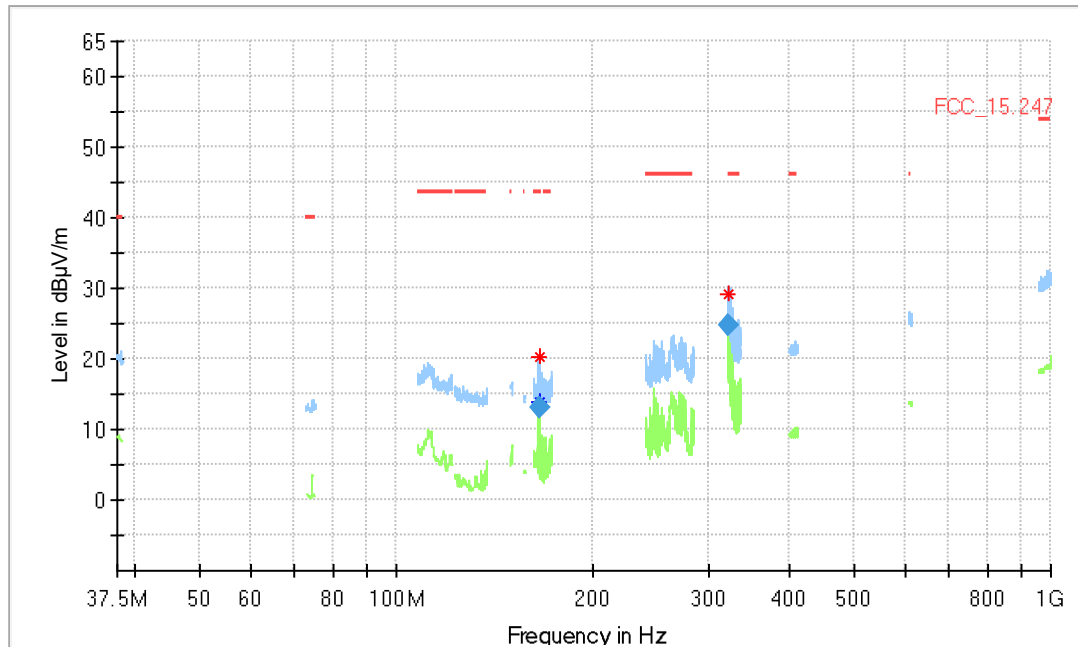
Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = low,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
165.192500	14.1	43.50	29.4	1000.0	120.000	112.0	V	247	9.5
322.780000	23.9	46.00	22.2	1000.0	120.000	104.0	H	104	14.5

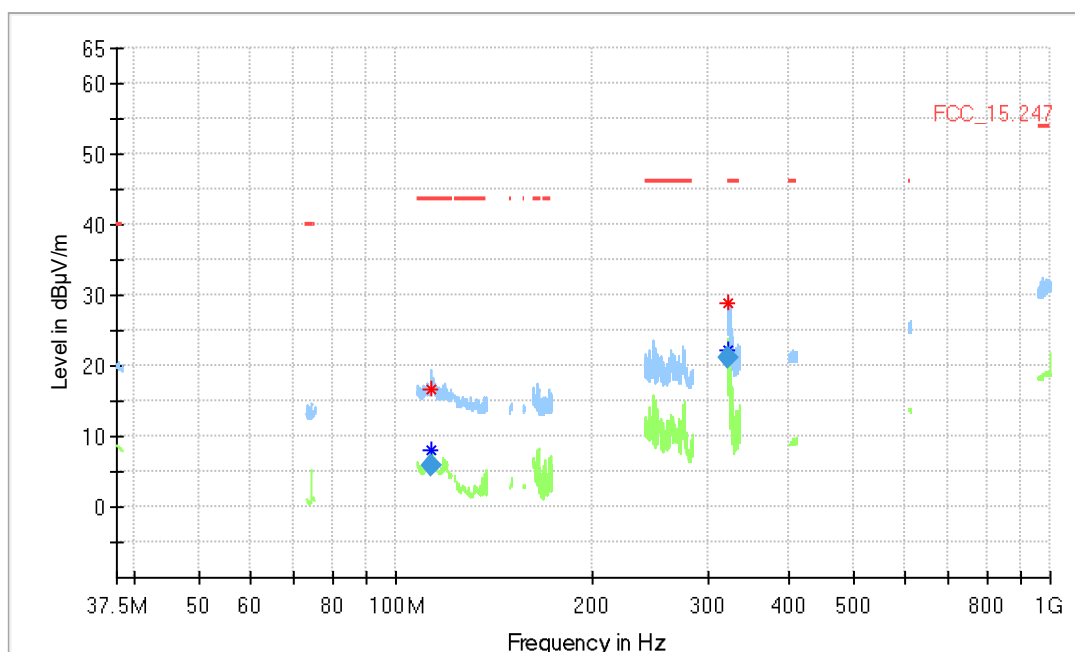
Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = mid,
Measurement range = 30 MHz – 1 GHz
(S01_BF03#S3.5)



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)
165.222500	13.2	43.50	30.3	1000.0	120.000	109.0	V	251	9.5
322.810000	24.9	46.00	21.2	1000.0	120.000	106.0	H	79	14.5

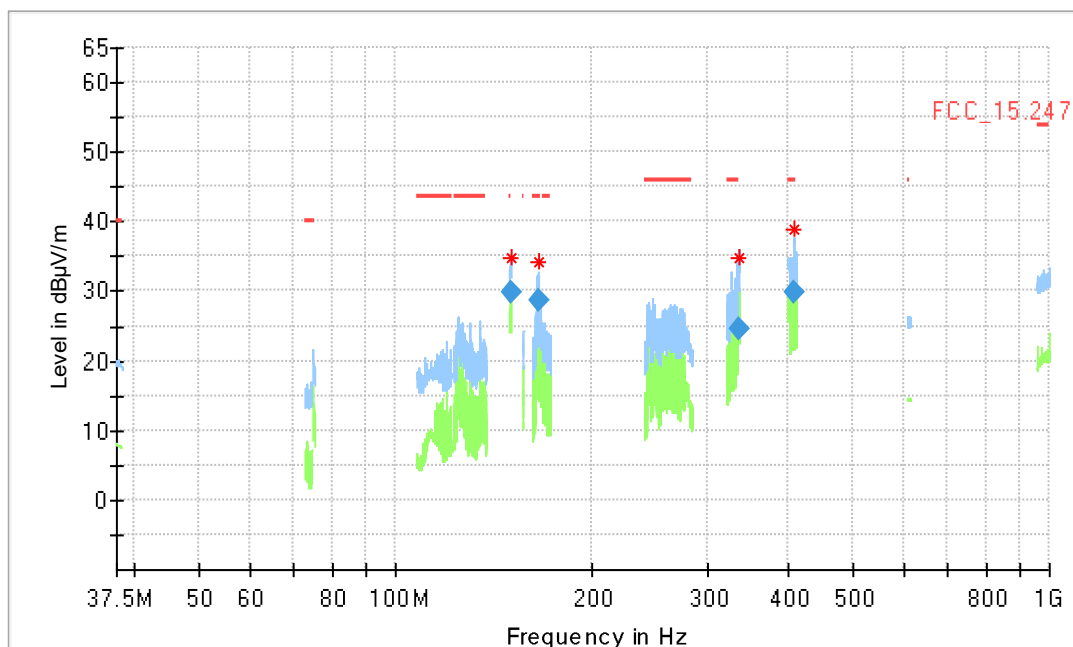
Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = high,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
113.430000	5.9	43.50	37.6	1000.0	120.000	142.0	V	6	11.6
322.840000	21.0	46.00	25.0	1000.0	120.000	100.0	H	98	14.5

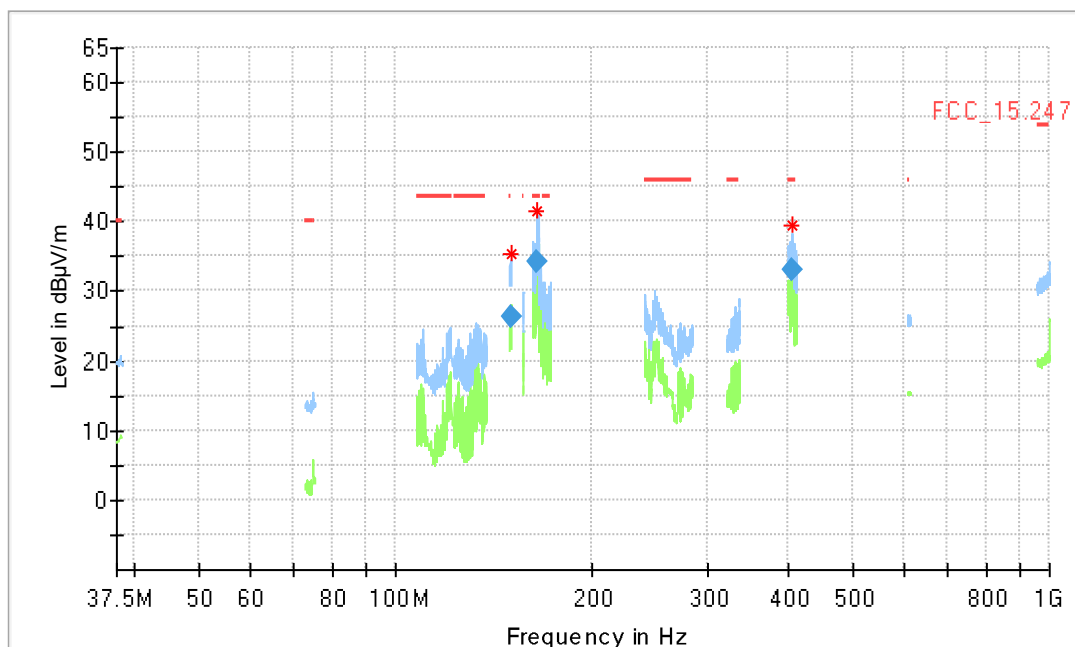
Chip01, Modulation= WLAN b, Operating Channel = low,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
149.990000	29.83	43.50	13.67	1000.0	120.000	104.0	V	314.0	9.5
165.192500	28.66	43.50	14.84	1000.0	120.000	100.0	V	141.0	9.5
334.810000	24.66	46.00	21.34	1000.0	120.000	100.0	V	303.0	14.9
406.530000	29.82	46.00	16.18	1000.0	120.000	100.0	H	0.0	17.1

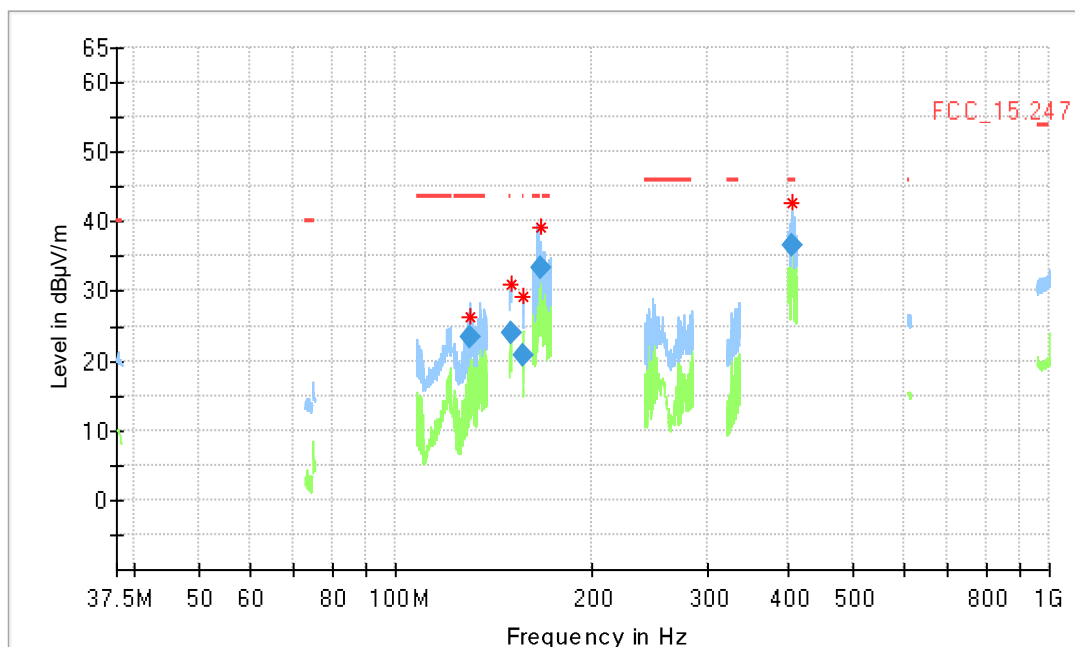
Chip01, Modulation= WLAN b, Operating Channel = mid,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
149.960000	26.29	43.50	17.21	1000.0	120.000	122.0	V	217.0	9.5
165.012500	34.10	43.50	9.40	1000.0	120.000	109.0	V	228.0	9.5
405.030000	33.04	46.00	12.96	1000.0	120.000	113.0	H	54.0	17.1

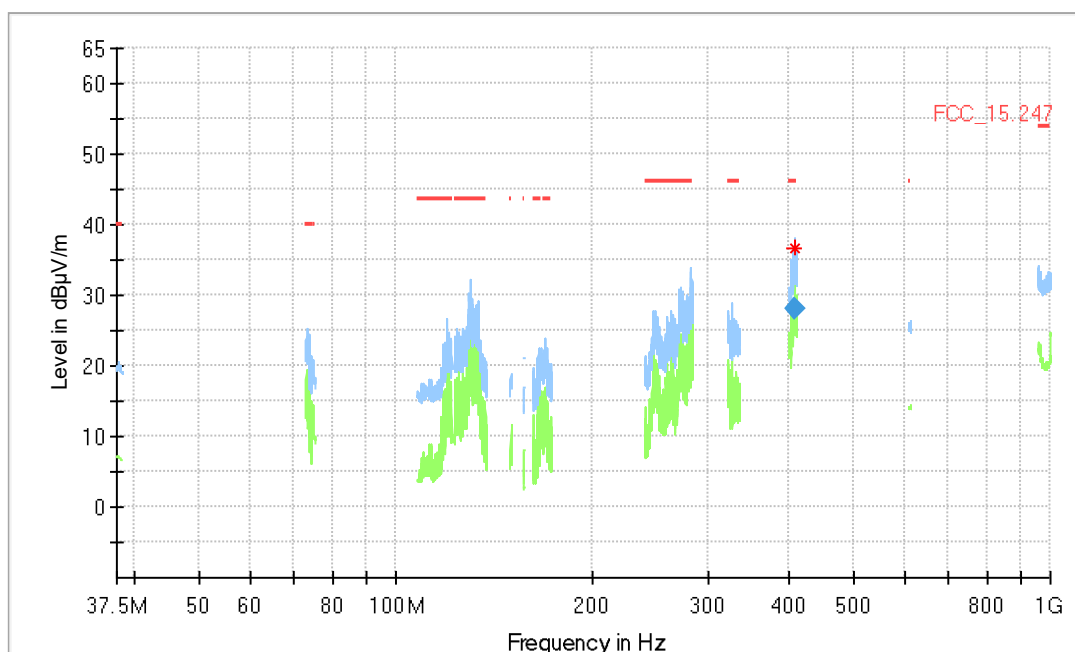
Chip01, Modulation= WLAN b, Operating Channel = high,
 Measurement range = 30 MHz – 1 GHz
 (S01_BF03#S3.5)



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)
129.810000	23.27	43.50	20.23	1000.0	120.000	126.0	V	127.0	11.0
149.990000	24.07	43.50	19.43	1000.0	120.000	223.0	V	277.0	9.5
156.820000	20.80	43.50	22.70	1000.0	120.000	105.0	V	86.0	9.4
167.112500	33.43	43.50	10.07	1000.0	120.000	104.0	V	228.0	9.6
404.250000	36.67	46.00	9.33	1000.0	120.000	104.0	H	11.0	17.1

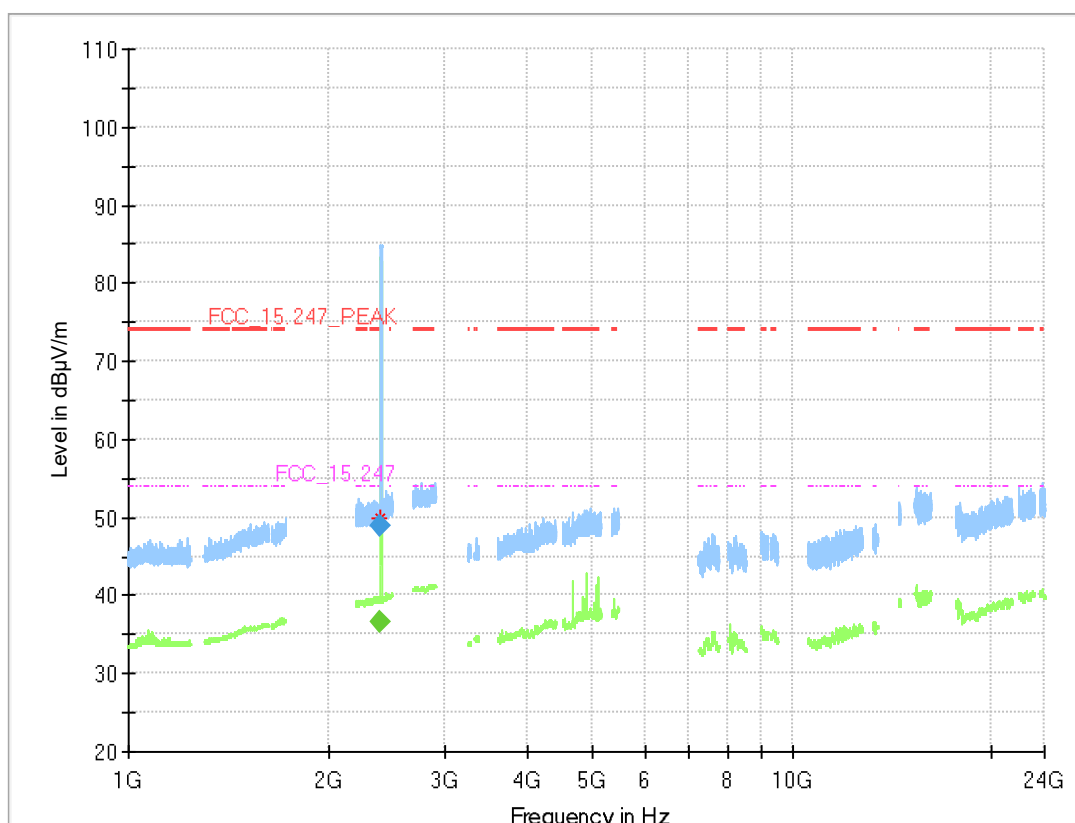
Chip01, Modulation= WLAN b, Operating Channel = mid,
 Measurement range = 30 MHz – 1 GHz
 (S01_BE03#S3.0)



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)
407.280000	28.1	46.00	17.9	1000.0	120.000	104.0	H	96	17.1

Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = low,
 Measurement range = 1 GHz - 24 GHz
 (S01_BF03#S3.5)

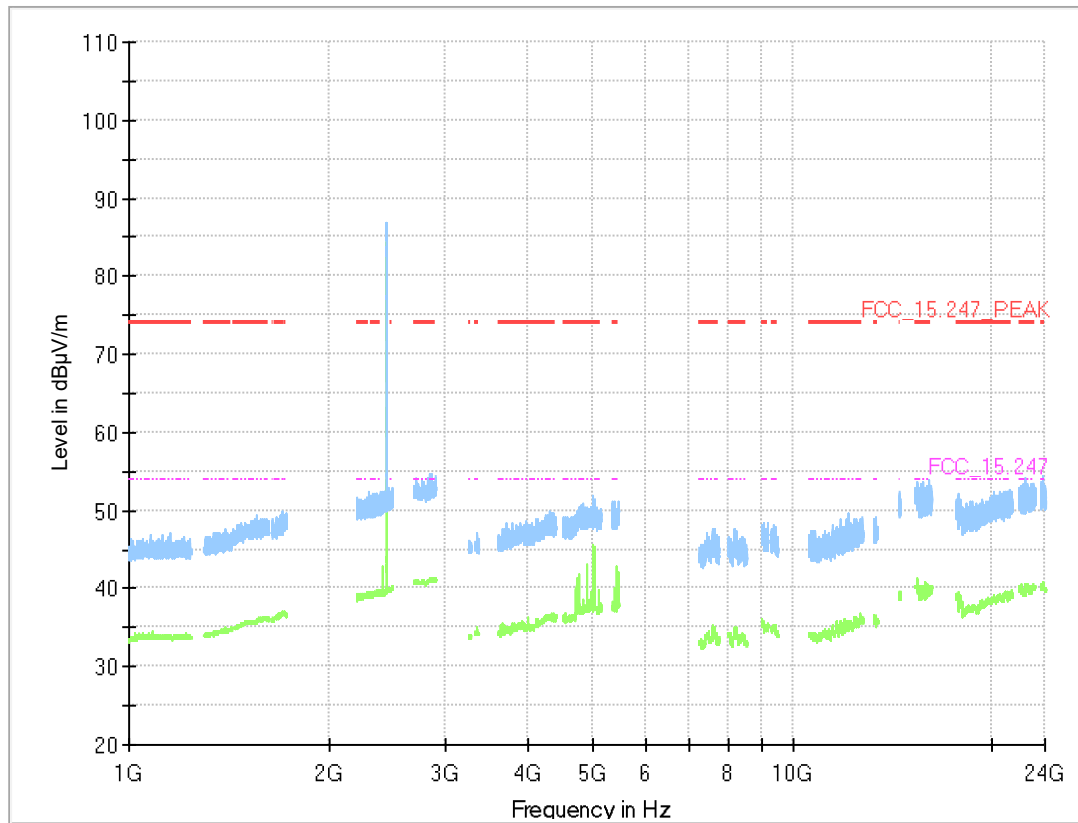


Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Marg in (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2389.920	49.0	---	74.00	25.00	1000.0	1000.000	150.0	H	-180.0	-4.0	7.0
2389.920	---	36.7	54.00	17.28	1000.0	1000.000	150.0	H	-180.0	-4.0	7.0

(Note: the peak at 2402 MHz is the wanted signal)

Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = mid,
 Measurement range = 1 GHz - 24 GHz
 (S01_BF03#S3.5)

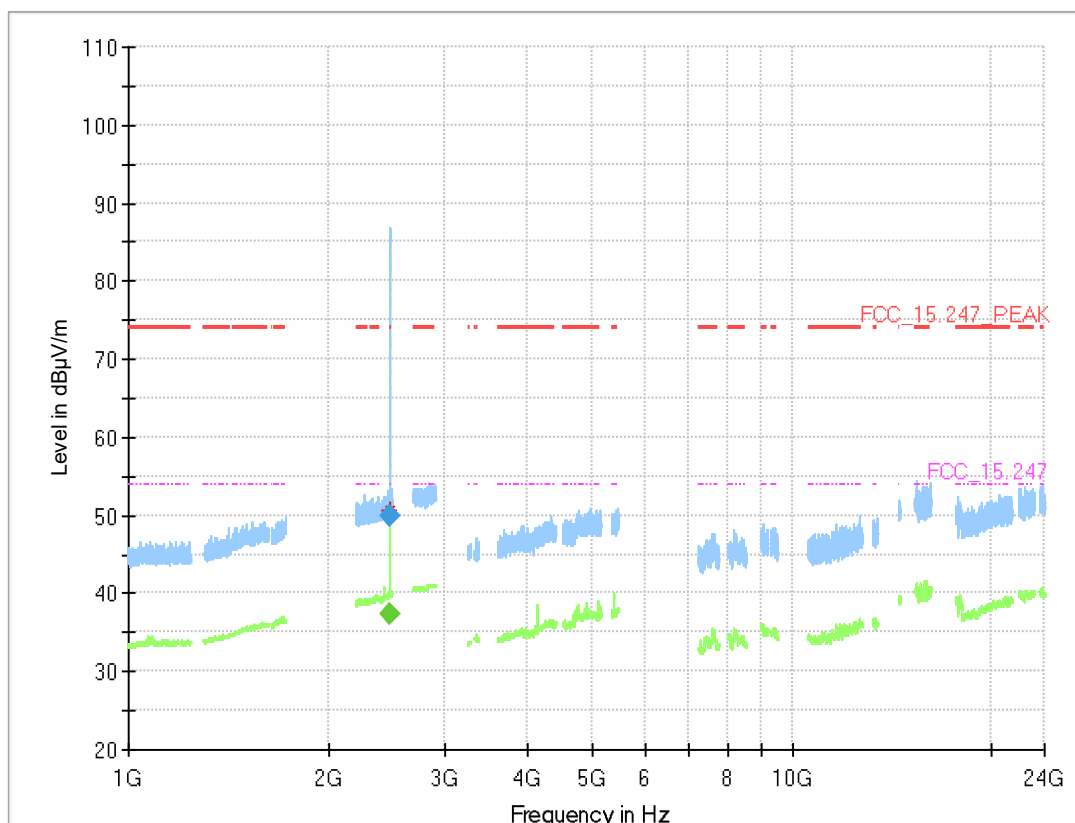


Final_Result

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)
---	---	---	---	---	---	---	---	---	---	---	---

(Note: the peak at 2440 MHz is the wanted signal)

Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = high,
Measurement range = 1 GHz - 24 GHz
(S01_BF03#S3.5)

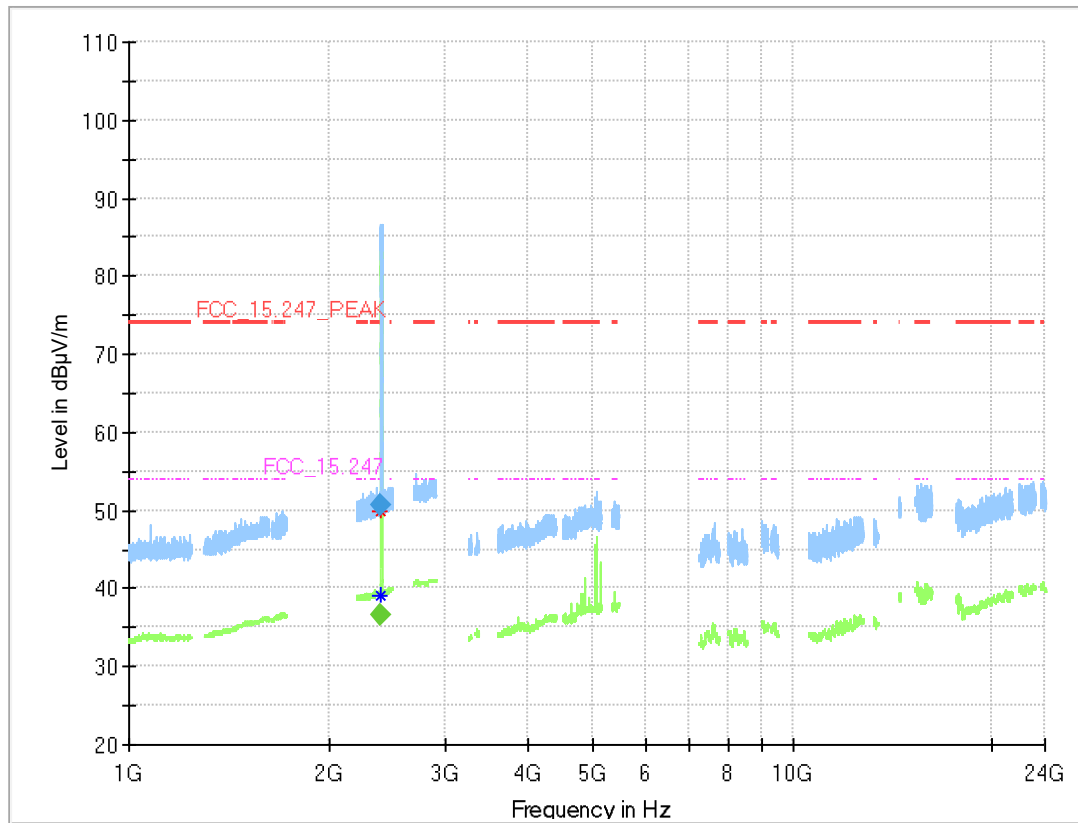


Final Result

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)
2483.500	---	37.2	54.00	16.77	1000.0	1000.000	150.0	H	126.0	15.0	7.6
2483.500	49.8	---	74.00	24.17	1000.0	1000.000	150.0	H	126.0	15.0	7.6

(Note: the peak at 2480 MHz is the wanted signal)

Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = low,
 Measurement range = 1 GHz - 24 GHz
 (S01_BF03#S3.5)

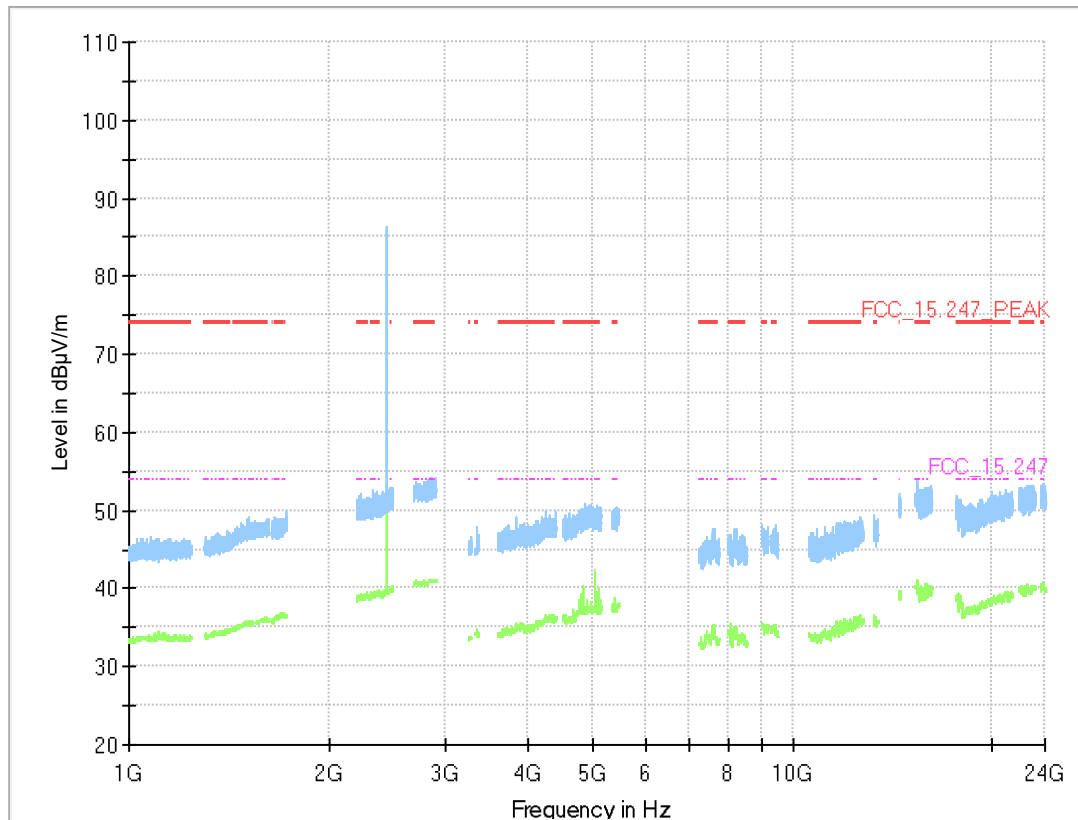


Final Result

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)
2389.920	50.7	---	74.00	23.35	1000.0	1000.000	150.0	H	-5.0	105.0	7.0
2389.920	---	36.7	54.00	17.31	1000.0	1000.000	150.0	H	-5.0	105.0	7.0

(Note: the peak at 2402 MHz is the wanted signal)

Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = mid,
 Measurement range = 1 GHz - 24 GHz
 (S01_BF03#S3.5)

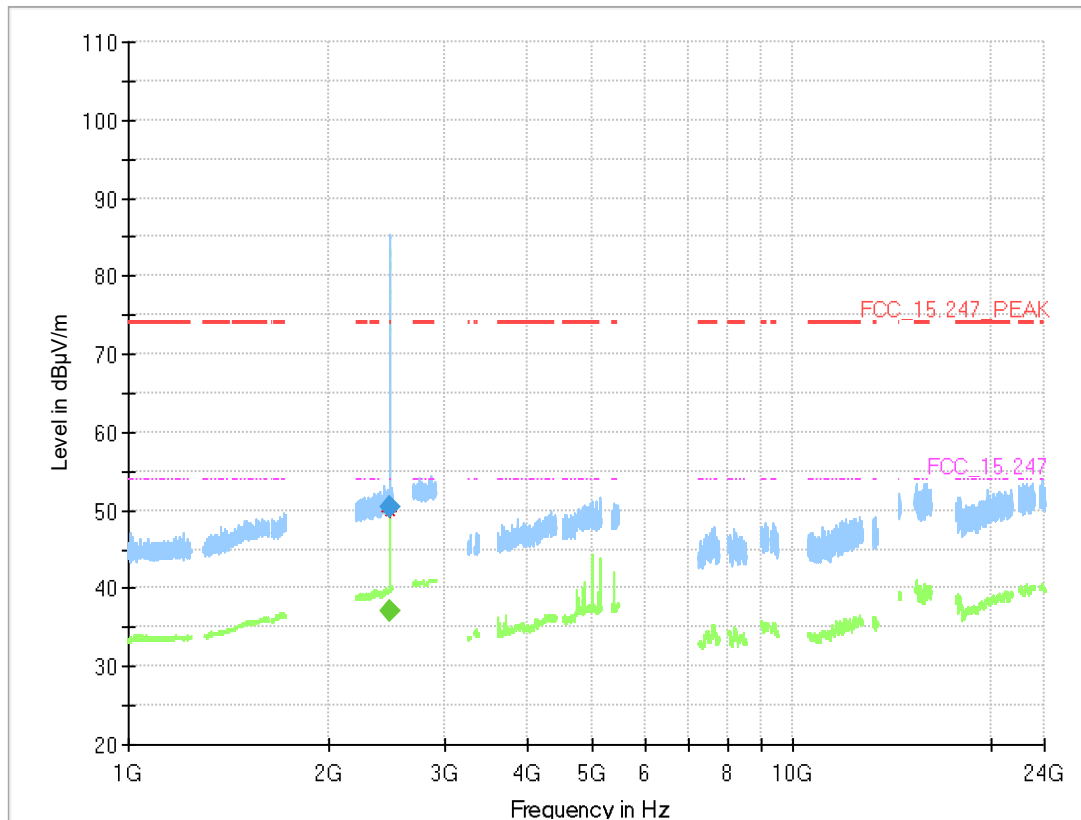


Final Result

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)
---	---	---	---	---	---	---	---	---	---	---	---

(Note: the peak at 2440 MHz is the wanted signal)

Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = high,
Measurement range = 1 GHz - 24 GHz
(S01_BF03#S3.5)

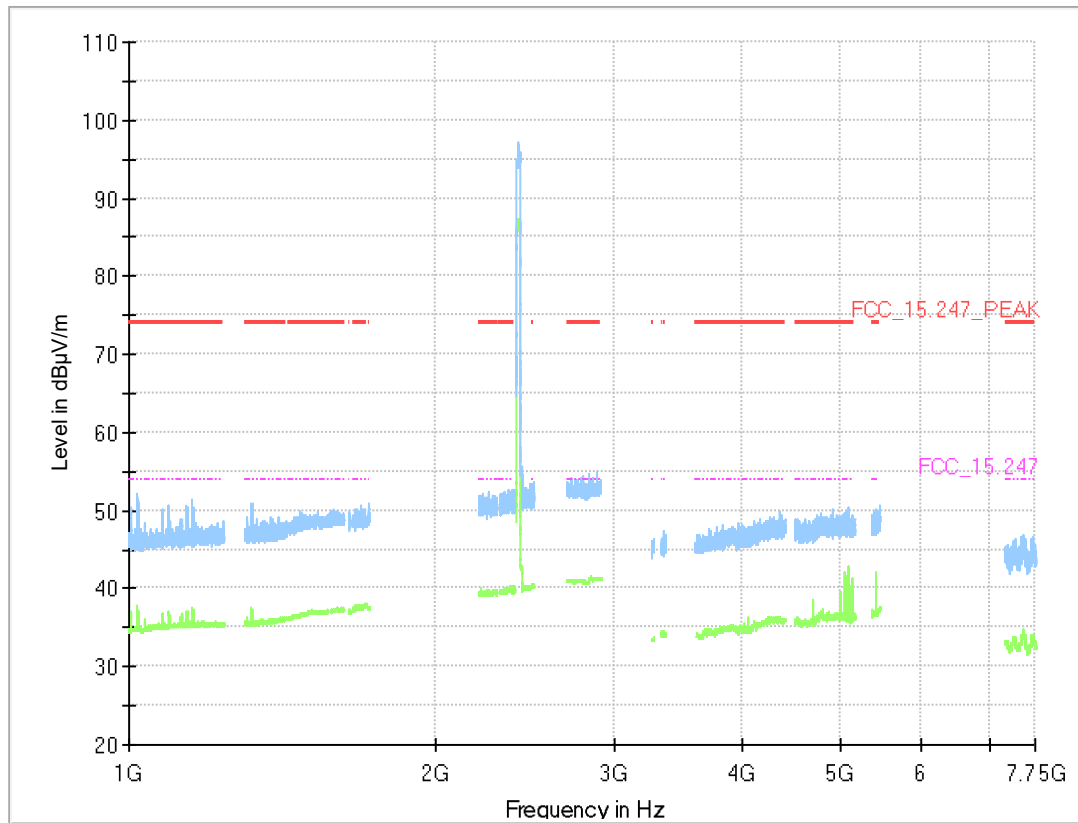


Final Result

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)
2483.500	---	37.2	54.00	16.79	1000.0	1000.000	150.0	V	-83.0	105.0	7.6
2483.500	50.4	---	74.00	23.63	1000.0	1000.000	150.0	V	-83.0	105.0	7.6

(Note: the peak at 2480 MHz is the wanted signal)

Chip01, Modulation= WLAN g, Operating Channel = low,
Measurement range = 1 GHz – 7.75 GHz
(S01_BF03#S3.5)

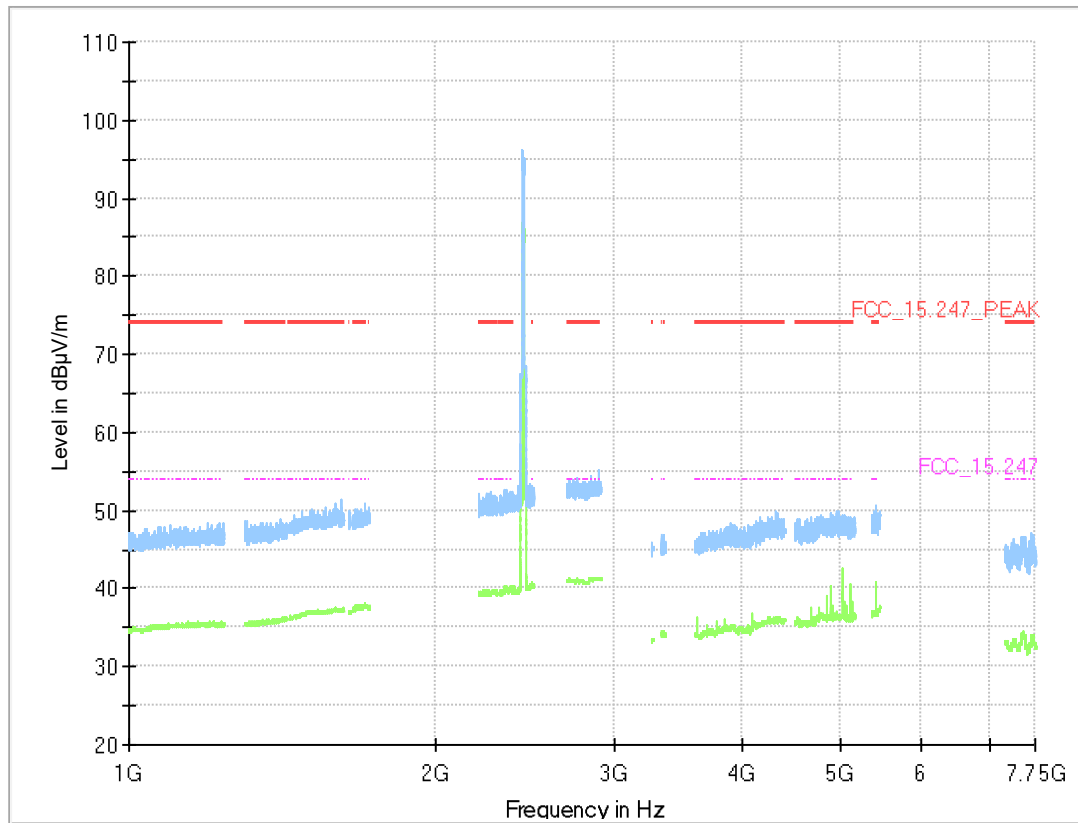


Final_Result

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)
---	---	---	---	---	---	---	---		---	---	---

(Note: the peak at 2412 MHz is the wanted signal)

Chip01, Modulation= WLAN g, Operating Channel = mid,
Measurement range = 1 GHz - 7.75 GHz
(S01_BF03#S3.5)

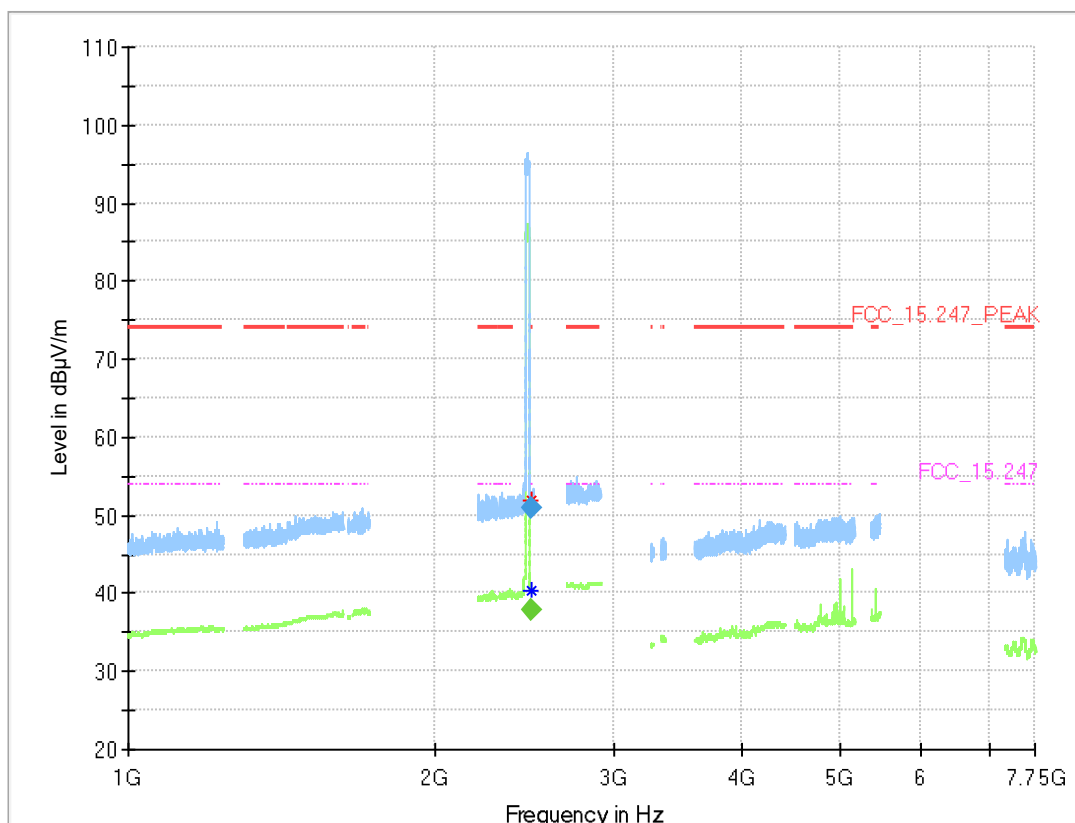


Final Result

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)
---	---	---	---	---	---	---	---	---	---	---	---

(Note: the peak at 2437 MHz is the wanted signal)

Chip01, Modulation= WLAN g, Operating Channel = high,
Measurement range = 1 GHz – 7.75 GHz
(S01_BF03#S3.5)

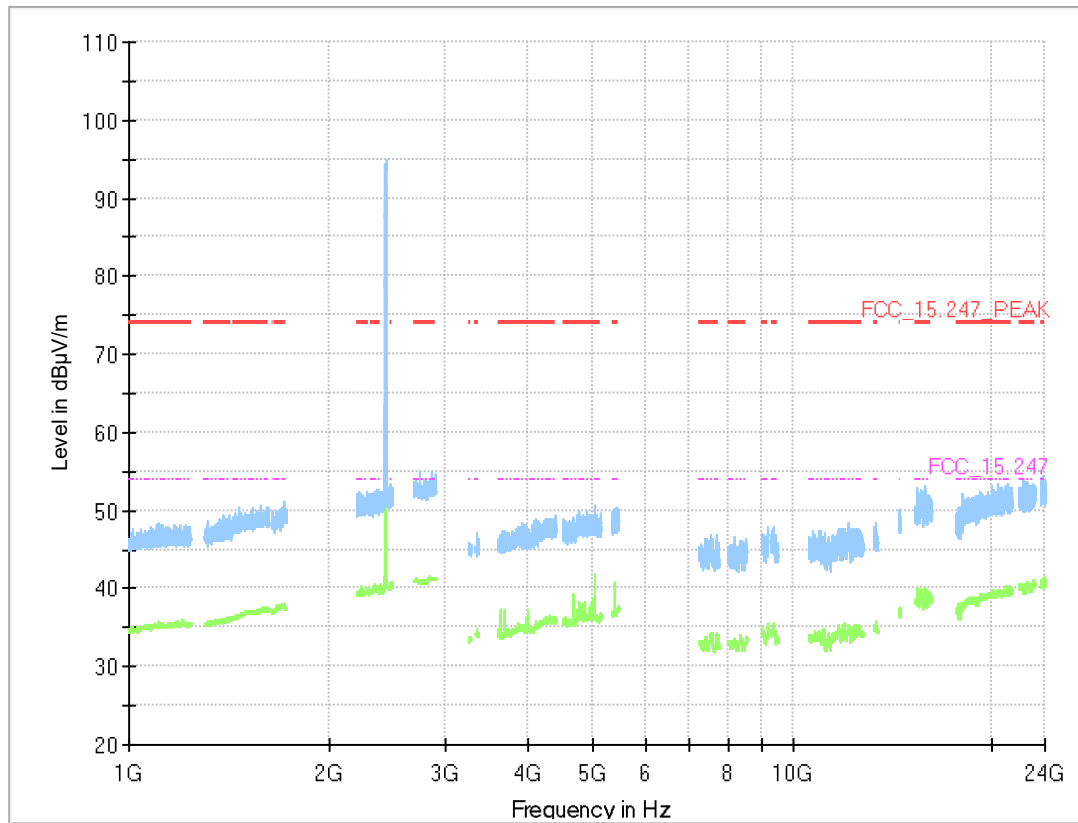


Final Result

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)
2483.875	---	37.7	54.00	16.26	1000.0	1000.000	150.0	V	150.0	61.0	8.0
2483.875	50.9	---	74.00	23.08	1000.0	1000.000	150.0	V	150.0	61.0	8.0

(Note: the peak at 2463 MHz is the wanted signal)

Chip01, Modulation= WLAN b, Operating Channel = mid,
Measurement range = 1 GHz - 24 GHz
(S01_BF03#S3.5)

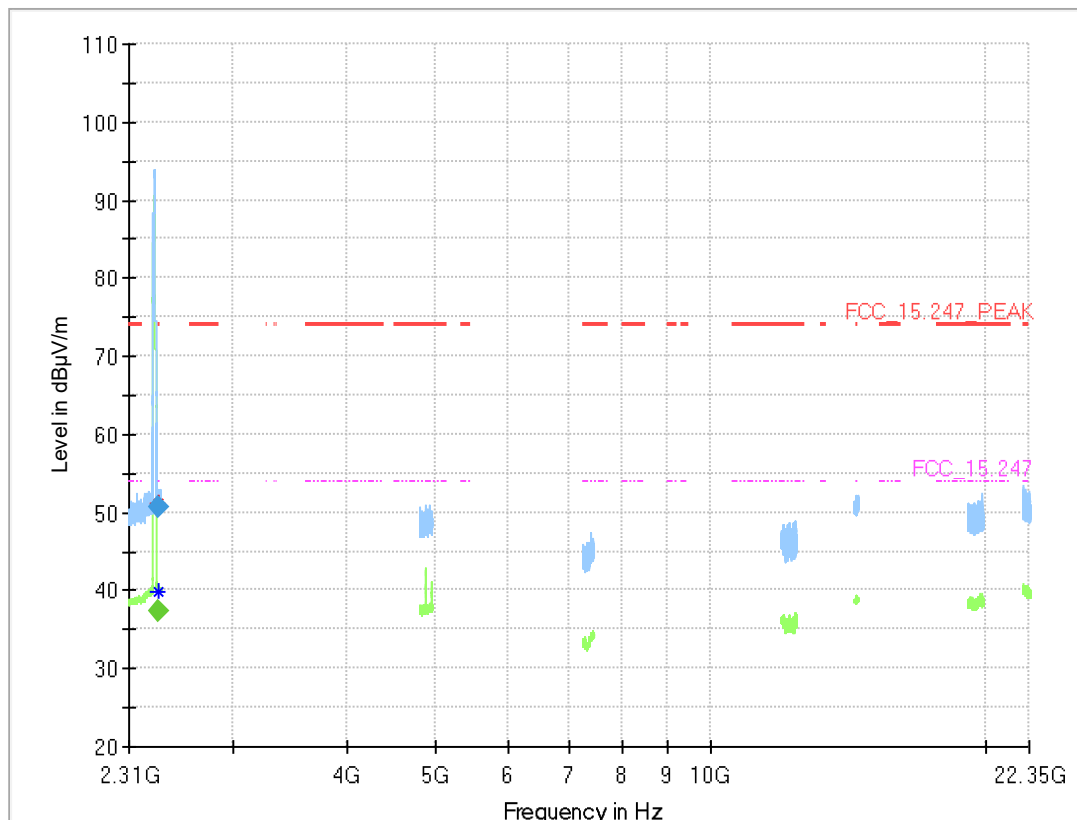


Final Result

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)
---	---	---	---	---	---	---	---	---	---	---	---

(Note: the peak at 2437 MHz is the wanted signal)

Chip01, Modulation= WLAN b, Operating Channel = high,
Measurement range = 2.31 GHz – 22.35 GHz (only Harmonics)
(S01_BE03#S3.0)



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)	Corr. (dB/m)
2483.500	---	37.4	54.00	16.60	1000.0	1000.000	150.0	V	101.0	79.0	7.6
2483.500	50.6	---	74.00	23.43	1000.0	1000.000	150.0	V	101.0	79.0	7.6

(Note: the peak at 2480 MHz is the wanted signal)

5.1.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 GHz FCC
- Radiated Emissions SAC H-Field
- Radiated Emissions SAC up to 1 GHz

5.2 BAND EDGE SPURIOUS EMISSIONS IN RESTRICTED BANDS

Standard **FCC Part 15 Subpart C**

The test was performed according to:

ANSI C63.10, chapter 6.6.5

5.2.1 TEST DESCRIPTION

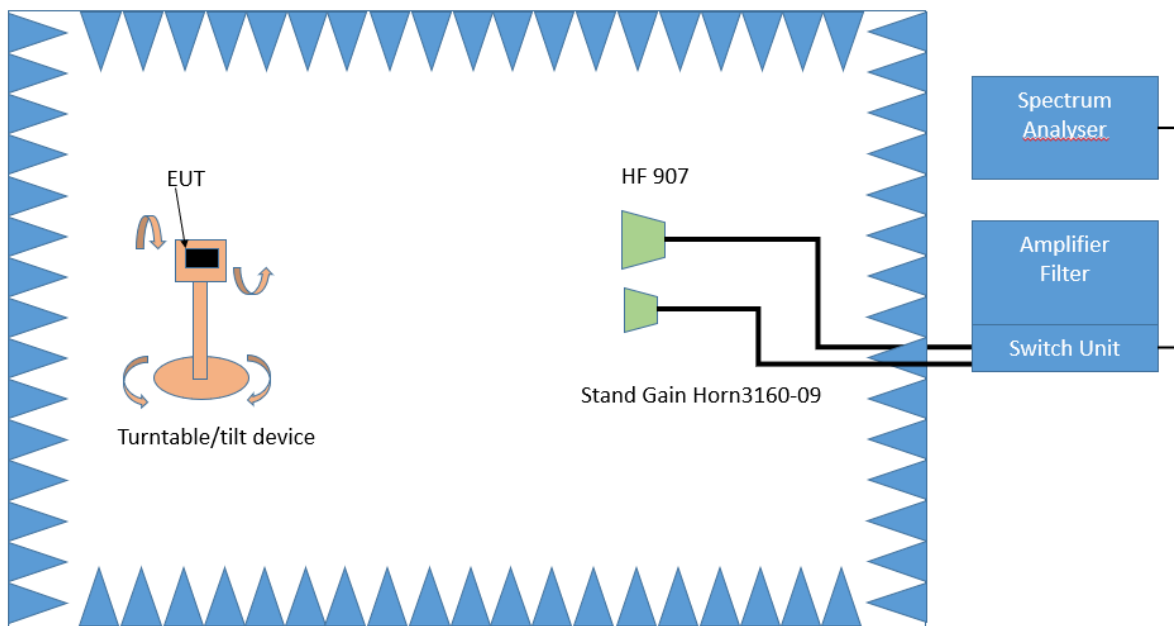
The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapter of ANSI C63.10:

- 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

5.2.2 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 ($\mu\text{V}/\text{m}$)	Measurement distance (m)	Limits ($\text{dB}\mu\text{V}/\text{m}$)
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 ($\mu\text{V}/\text{m}$)	Measurement distance (m)	Limits ($\text{dB}\mu\text{V}/\text{m}$)
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: $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

5.2.3 TEST PROTOCOL

(S01 BF03#S3.5):

Ambient temperature: 20–22 °C
 Air Pressure: 999–1007 hPa
 Humidity: 33–41 %

Chip01(S01_BF03#S3.5)

BT LE 1 Mbit/s

Applied duty cycle correction (AV): 4.1 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]
39	2480	2483.5	51.6	PEAK	1000	74.0	22.4
39	2480	2483.5	43.2	AV	1000	54.0	10.8

BT LE 2 Mbit/s

Applied duty cycle correction (AV): 4.8 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]
0	2402	2390.0	49.0	PEAK	1000	74.0	25.0
0	2402	2390.0	41.5	AV	1000	54.0	12.5
39	2480	2483.5	49.8	PEAK	1000	74.0	24.2
39	2480	2483.5	42.0	AV	1000	54.0	12.0

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

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	52.2	PEAK	1000	74.0	21.8
11	2462	2483.5	39.6	AV	1000	54.0	14.4

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]
1	2412	2390.0	50.6	PEAK	1000	74.0	23.4
1	2412	2390.0	36.8	AV	1000	54.0	17.2
11	2462	2483.5	50.9	PEAK	1000	74.0	23.1
11	2462	2483.5	37.8	AV	1000	54.0	16.2

WLAN n-Mode; 20 MHz; MCS0

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	50.5	PEAK	1000	74.0	23.5
11	2462	2483.5	37.7	AV	1000	54.0	16.3

WLAN ax-Mode; 20 MHz (**SU**); MCS0

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	52.2	PEAK	1000	74.0	21.8
11	2462	2483.5	39.6	AV	1000	54.0	14.4

WLAN ax-Mode; 20 MHz (**MU**); MCS0

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	52.8	PEAK	1000	74.0	21.2
11	2462	2483.5	39.7	AV	1000	54.0	14.3

Chip02(S01_BF03#S3.5)

BT LE 1 Mbit/s

Applied duty cycle correction (AV): 4.1 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]
39	2480	2483.5	52.4	PEAK	1000	74.0	21.6
39	2480	2483.5	43.2	AV	1000	54.0	10.8

BT LE 2 Mbit/s

Applied duty cycle correction (AV): 4.8 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]
0	2402	2483.5	50.7	PEAK	1000	74.0	23.3
0	2402	2483.5	41.5	AV	1000	54.0	12.5
39	2480	2483.5	50.4	PEAK	1000	74.0	23.6
39	2480	2483.5	42.0	AV	1000	54.0	12.0

=====

(S01 BE03#S3.0):

Ambient temperature: 20–22 °C
 Air Pressure: 999–1007 hPa
 Humidity: 33–41 %

Chip01(S01_BE03#S3.0)

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

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	50.6	PEAK	1000	74.0	23.4
11	2462	2483.5	37.4	AV	1000	54.0	16.6

WLAN ax-Mode; 20 MHz (**SU**); MCS0

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	51.9	PEAK	1000	74.0	22.1
11	2462	2483.5	39.1	AV	1000	54.0	14.9

WLAN ax-Mode; 20 MHz (**MU**); MCS0

Applied duty cycle correction (AV): 0 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]
11	2462	2483.5	52.0	PEAK	1000	74.0	22.0
11	2462	2483.5	39.2	AV	1000	54.0	14.8

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

- The measurements have been performed only on worst-case modes, which they had the highest spurious Emission in the Reference Report: "MDE_BOSCH_2411_FCC_08_rev02"

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

Trace:

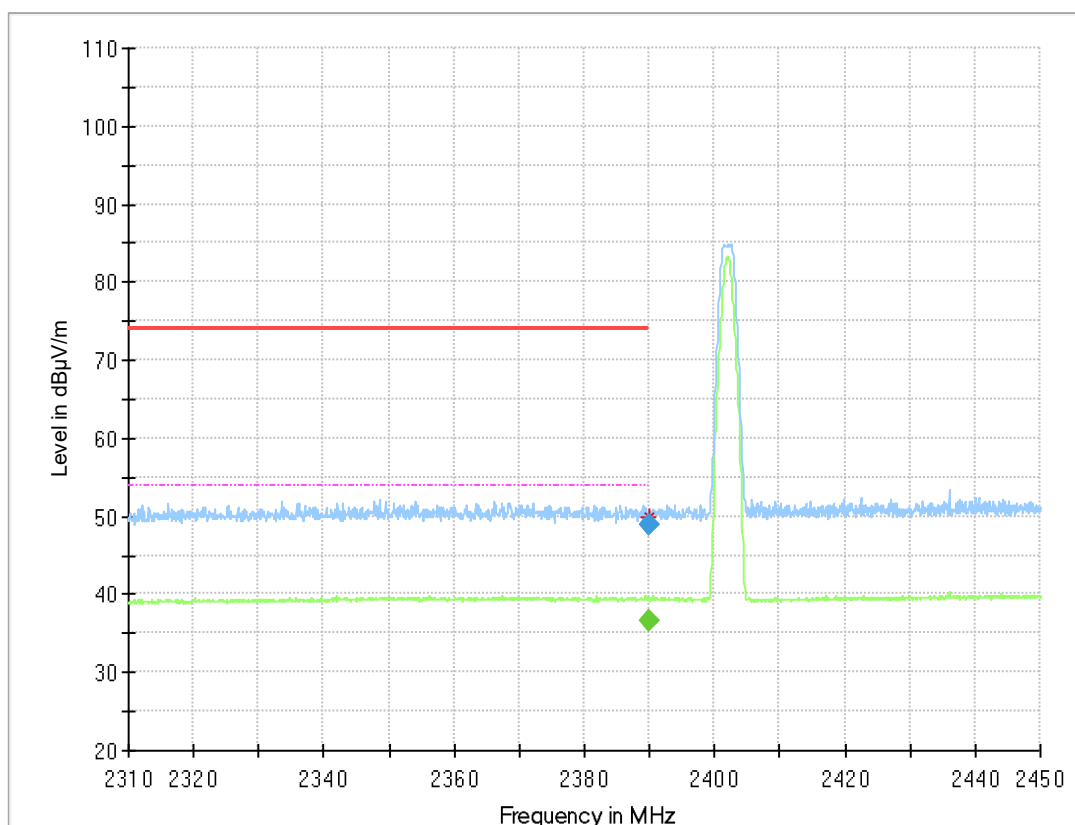
blue = Peak

green = AV

Marker:

Star = critical frequency, Rhombus = final Results

Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = low, Band Edge = low
(S01_BF03#S3.5)

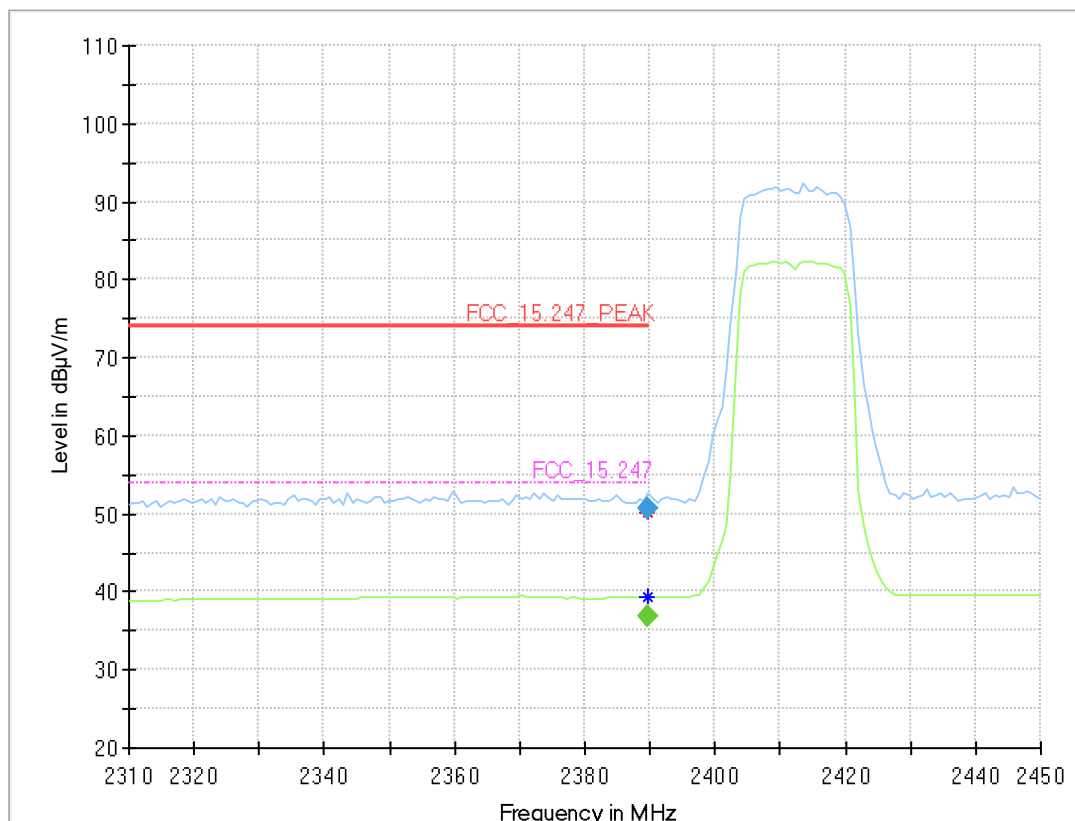


Final Result

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)
2389.920	49.0	---	74.00	25.00	1000.0	1000.000	150.0	H	-180.0	-4.0	7.0
2389.920	---	36.7	54.00	17.28	1000.0	1000.000	150.0	H	-180.0	-4.0	7.0

(Note: The peak at 2368 MHz is not related to the fundamental transmitter)

Chip01, Modulation= WLAN g, Operating Channel = low, Band Edge = low
(S01_BF03#S3.5)

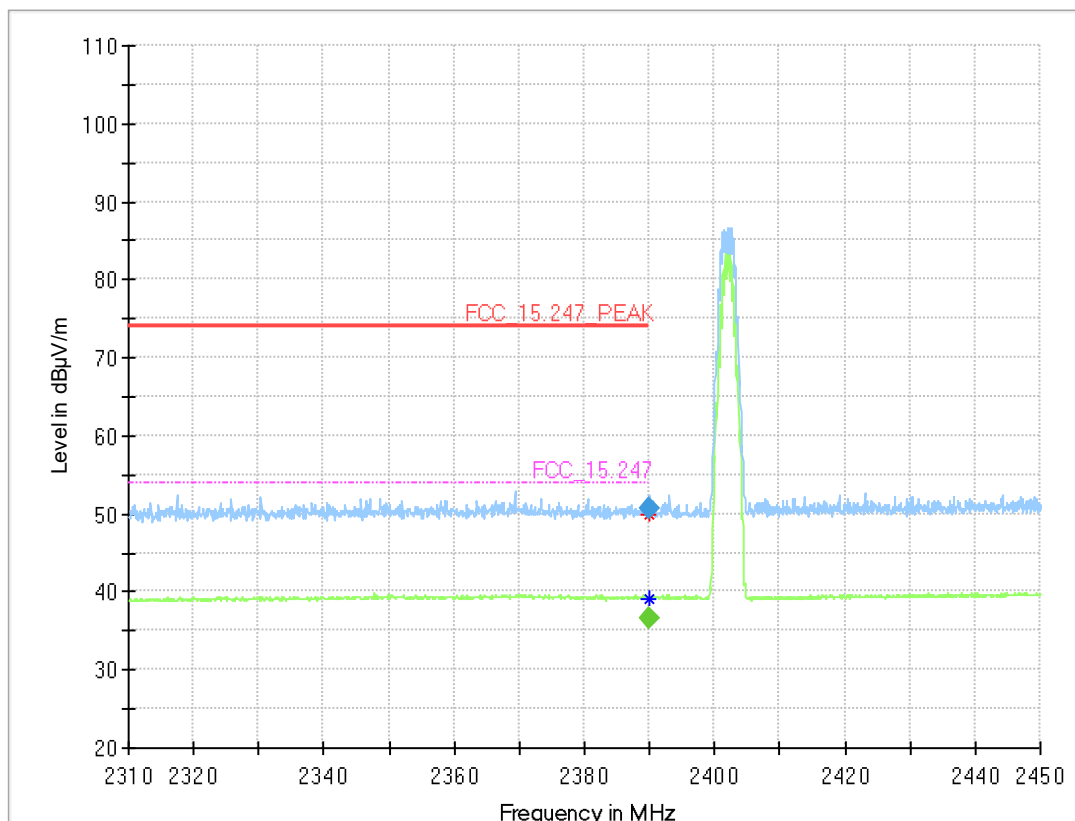


Final_Result

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)
2389.800	---	36.7	54.00	17.27	1000.0	1000.000	150.0	V	81.0	-1.0	7.0
2389.800	50.6	---	74.00	23.42	1000.0	1000.000	150.0	V	81.0	-1.0	7.0

(Note: The peak at 2365 MHz is not related to the fundamental transmitter)

Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = low, Band Edge = low
(S01_BF03#S3.5)

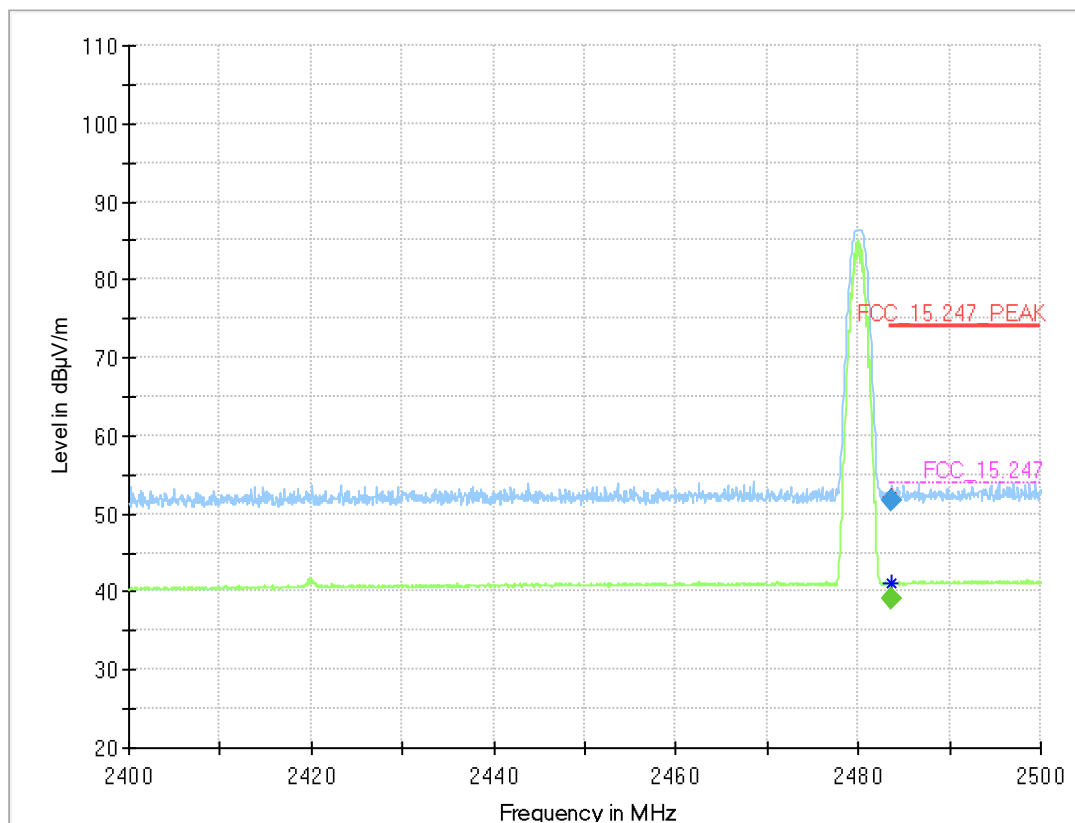


Final_Result

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)
2389.920	50.7	---	74.00	23.35	1000.0	1000.000	150.0	H	-5.0	105.0	7.0
2389.920	---	36.7	54.00	17.31	1000.0	1000.000	150.0	H	-5.0	105.0	7.0

(Note: The peak at 2368 MHz is not related to the fundamental transmitter)

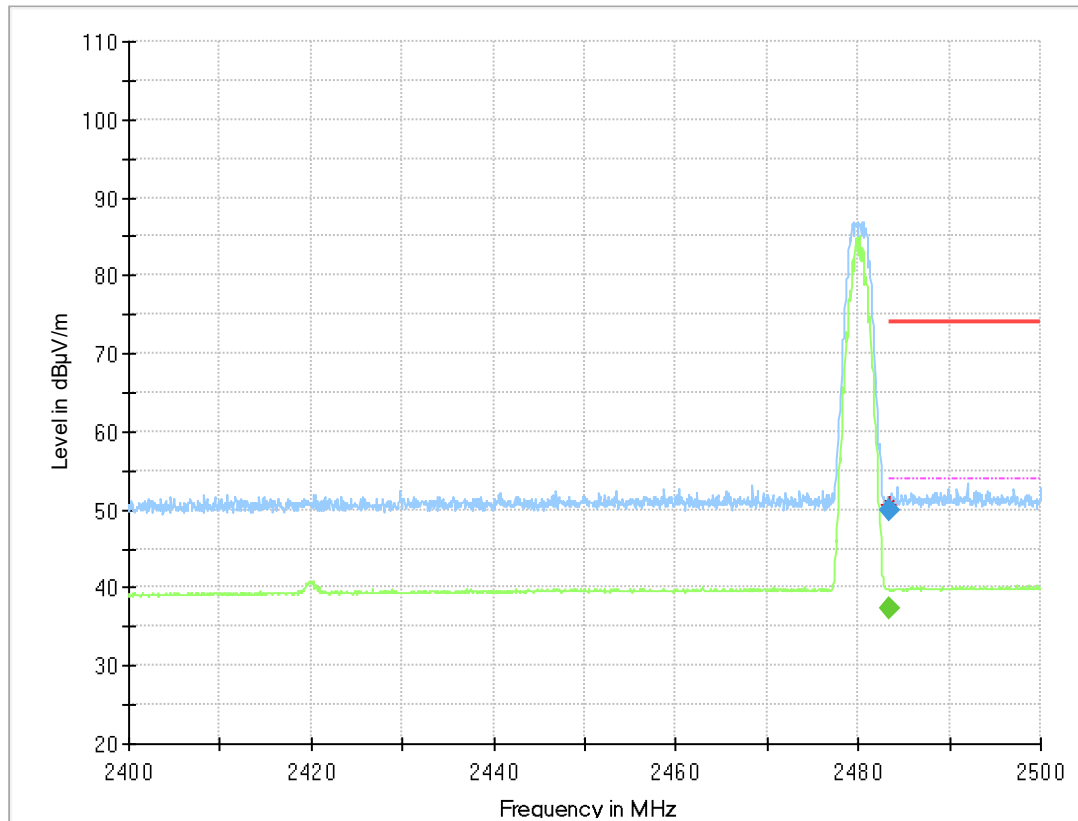
Chip01, Modulation= BT LE 1 Mbit/s, Operating Channel = high, Band Edge = high
 (S01_BF03#S3.5)



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)
2483.688	---	39.1	54.00	14.89	1000.0	1000.000	150.0	V	63.0	15.0	7.7
2483.688	51.6	---	74.00	22.44	1000.0	1000.000	150.0	V	63.0	15.0	7.7

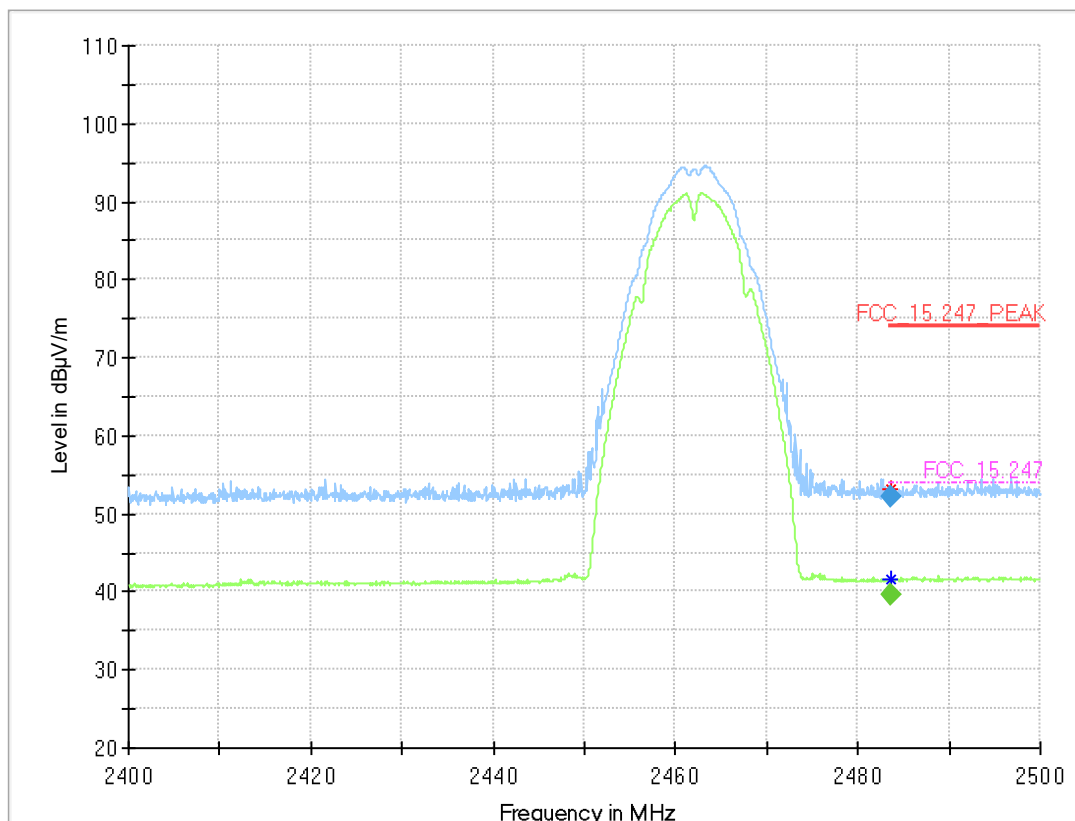
Chip01, Modulation= BT LE 2 Mbit/s, Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2483.500	---	37.2	54.00	16.77	1000.0	1000.000	150.0	H	126.0	15.0	7.6
2483.500	49.8	---	74.00	24.17	1000.0	1000.000	150.0	H	126.0	15.0	7.6

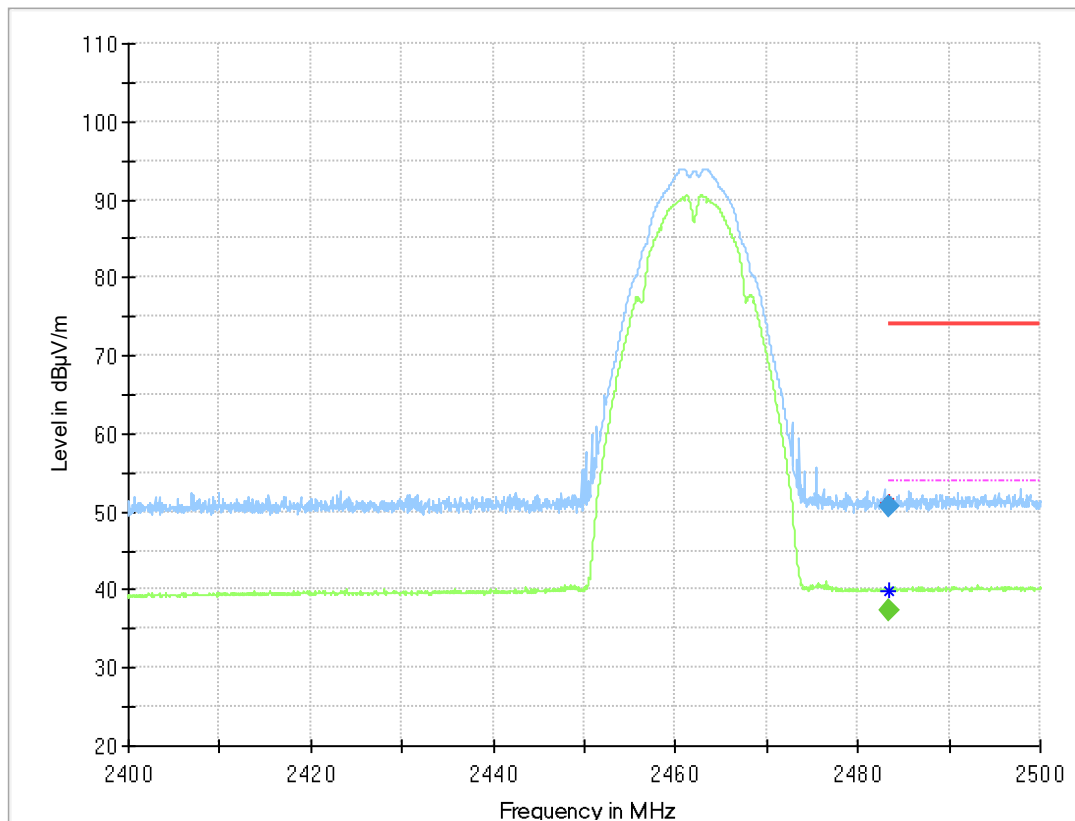
Chip01, Modulation= WLAN b, Operating Channel = high, Band Edge = high
 (S01_BF03#S3.5)



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)
2483.688	---	39.6	54.00	14.42	1000.0	1000.000	150.0	H	-156.0	84.0	8.0
2483.688	52.2	---	74.00	21.82	1000.0	1000.000	150.0	H	-156.0	84.0	8.0

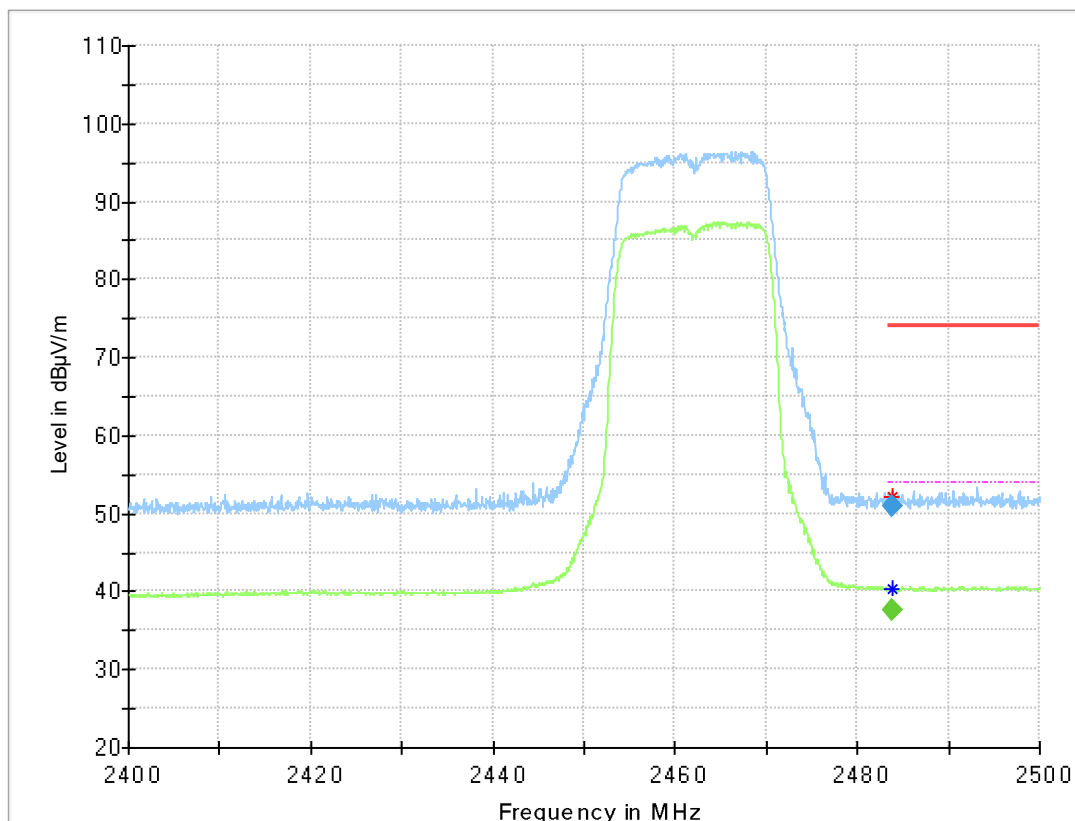
Chip01, Modulation= WLAN b, Operating Channel = high, Band Edge = high
 (S01_BE03#S3.0)



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)	Corr. (dB/m)
2483.500	50.6	---	74.00	23.43	1000.0	1000.000	150.0	V	101.0	79.0	7.6
2483.500	---	37.4	54.00	16.60	1000.0	1000.000	150.0	V	101.0	79.0	7.6

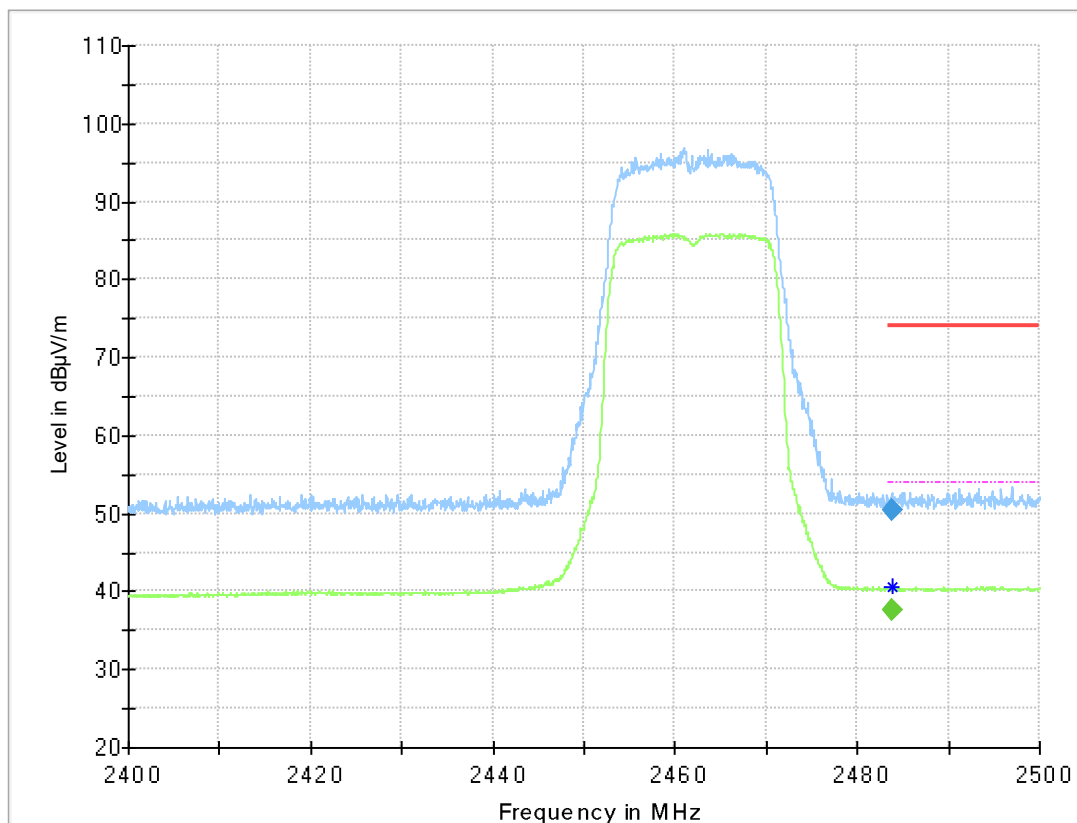
Chip01, Modulation= WLAN g, Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2483.875	50.9	---	74.00	23.08	1000.0	1000.000	150.0	V	150.0	61.0	8.0
2483.875	---	37.7	54.00	16.26	1000.0	1000.000	150.0	V	150.0	61.0	8.0

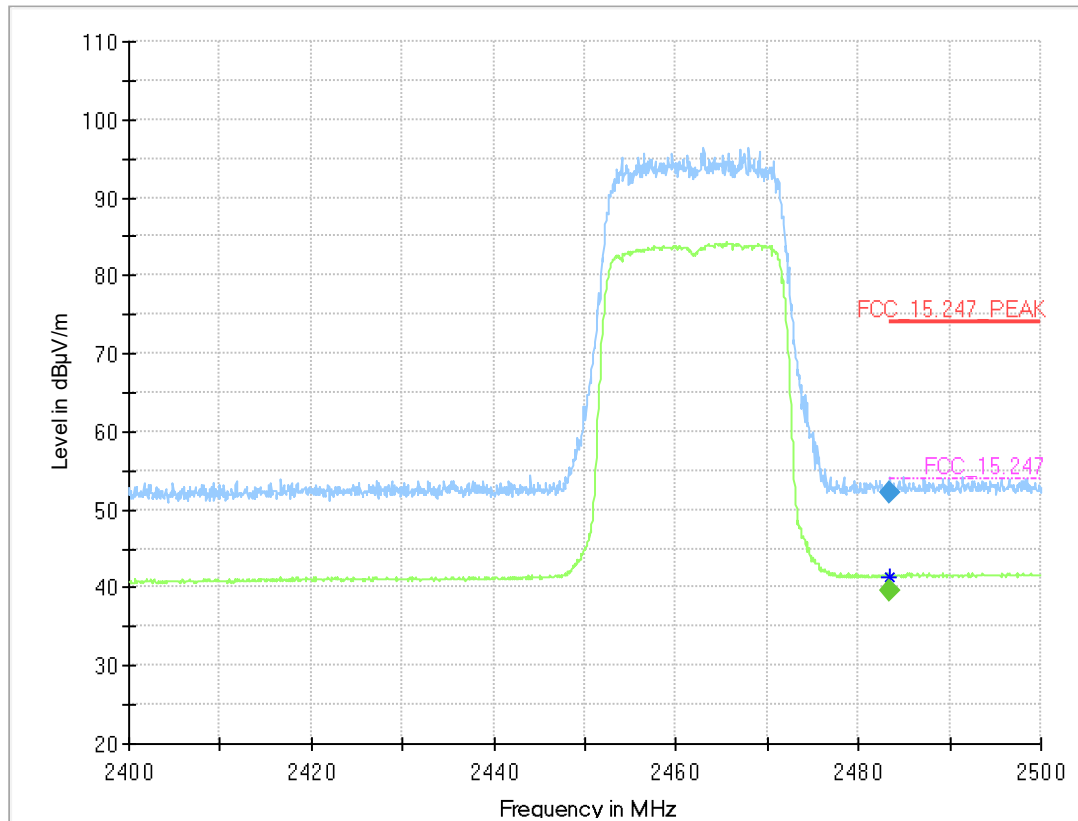
Chip01, Modulation= WLAN n 20 MHz, Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2483.750	50.5	---	74.00	23.45	1000.0	1000.000	150.0	H	-170.0	14.0	8.0
2483.750	---	37.7	54.00	16.32	1000.0	1000.000	150.0	H	-170.0	14.0	8.0

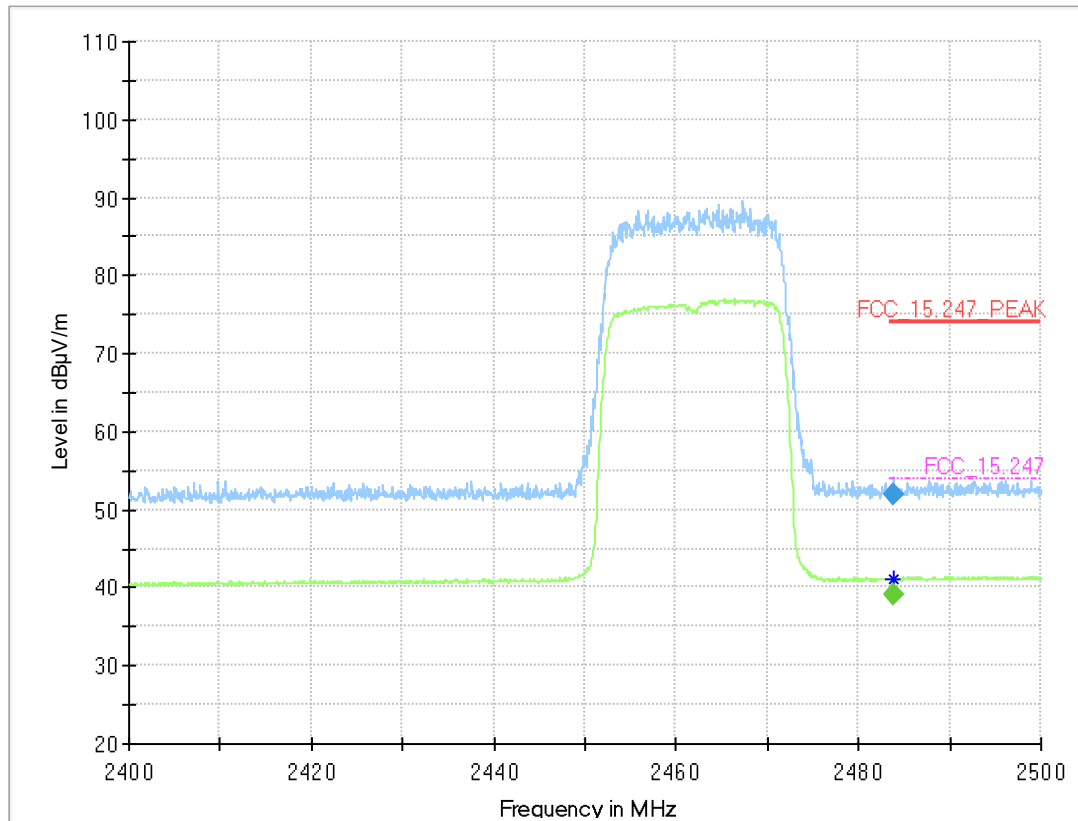
Chip01, Modulation= WLAN ax 20 MHz (SU), Operating Channel = high, Band Edge = high
 (S01_BF03#S3.5)



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)
2483.500	---	39.6	54.00	14.41	1000.0	1000.000	150.0	H	109.0	14.0	8.0
2483.500	52.2	---	74.00	21.79	1000.0	1000.000	150.0	H	109.0	14.0	8.0

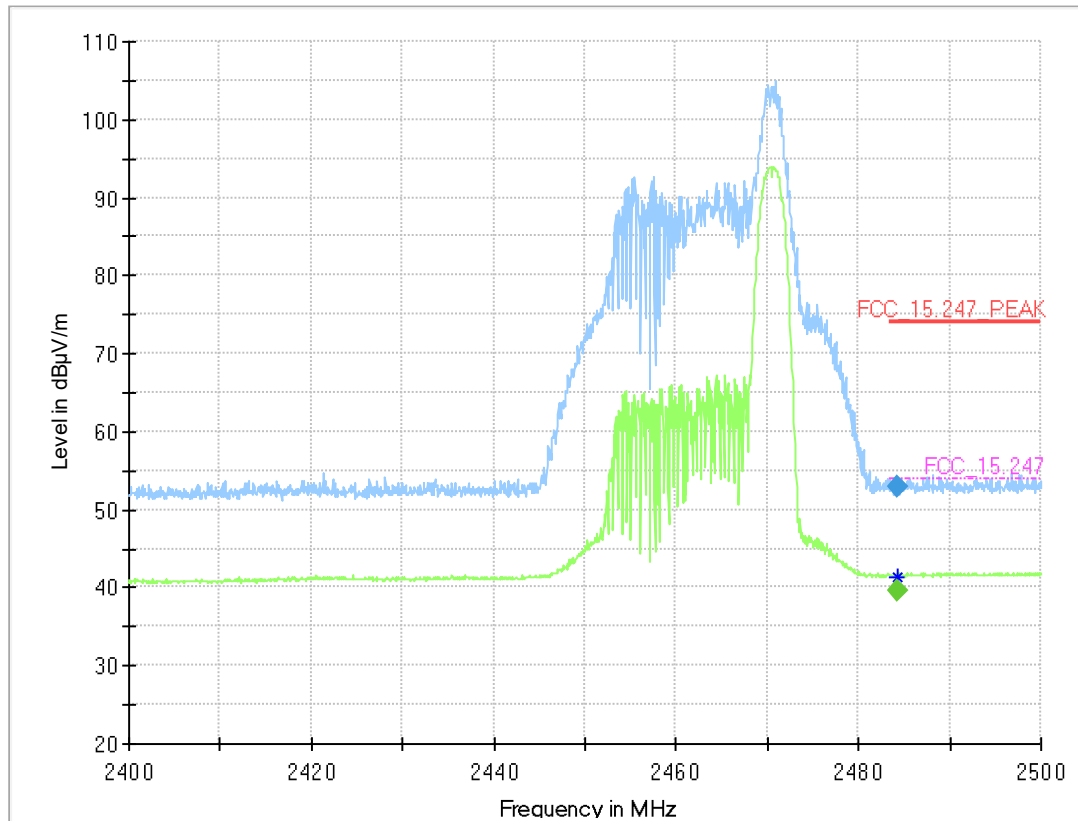
Chip01, Modulation= WLAN ax 20 MHz (SU), Operating Channel = high, Band Edge = high
 (S01_BE03#S3.0)



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)	Corr. (dB/m)
2483.813	---	39.1	54.00	14.86	1000.0	1000.000	150.0	V	-126.0	0.0	7.7
2483.813	51.9	---	74.00	22.06	1000.0	1000.000	150.0	V	-126.0	0.0	7.7

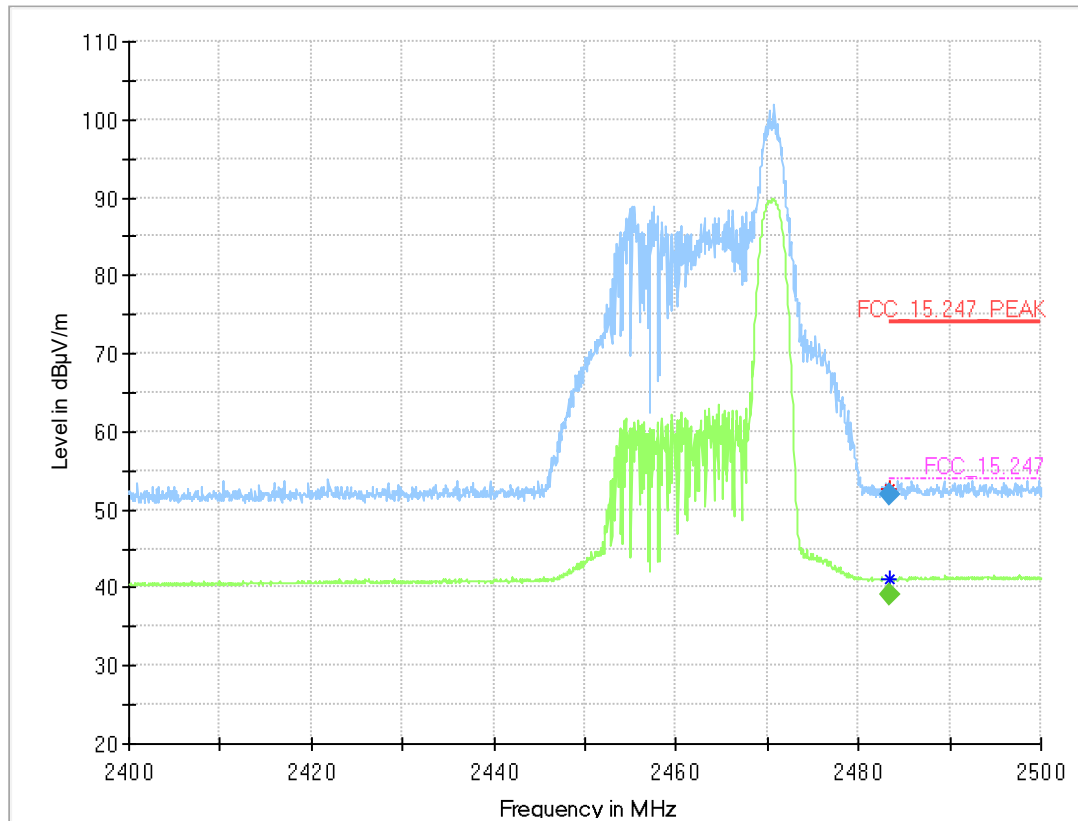
Chip01, Modulation= WLAN ax 20 MHz (MU), Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2484.250	---	39.7	54.00	14.33	1000.0	1000.000	150.0	V	-158.0	98.0	8.0
2484.250	52.8	---	74.00	21.18	1000.0	1000.000	150.0	V	-158.0	98.0	8.0

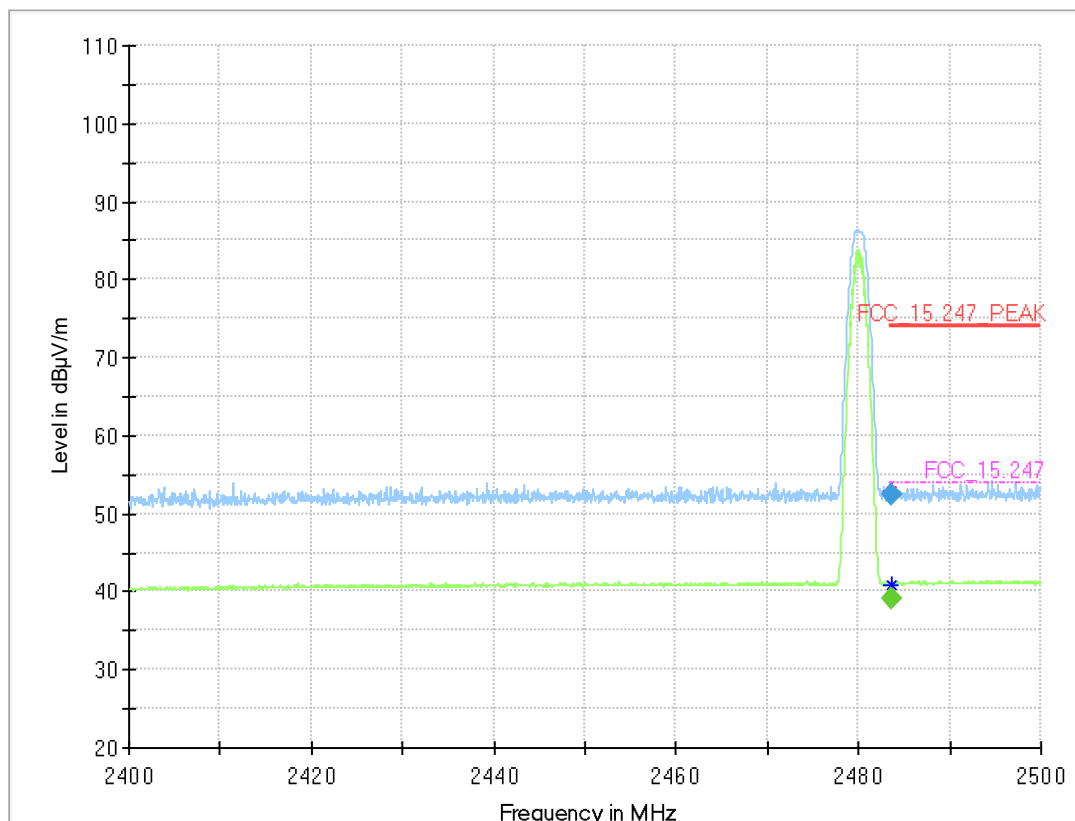
Chip01, Modulation= WLAN ax 20 MHz (MU), Operating Channel = high, Band Edge = high
(S01_BE03#S3.0)



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)	Corr. (dB/m)
2483.500	52.0	---	74.00	21.98	1000.0	1000.000	150.0	V	91.0	12.0	7.6
2483.500	---	39.2	54.00	14.83	1000.0	1000.000	150.0	V	91.0	12.0	7.6

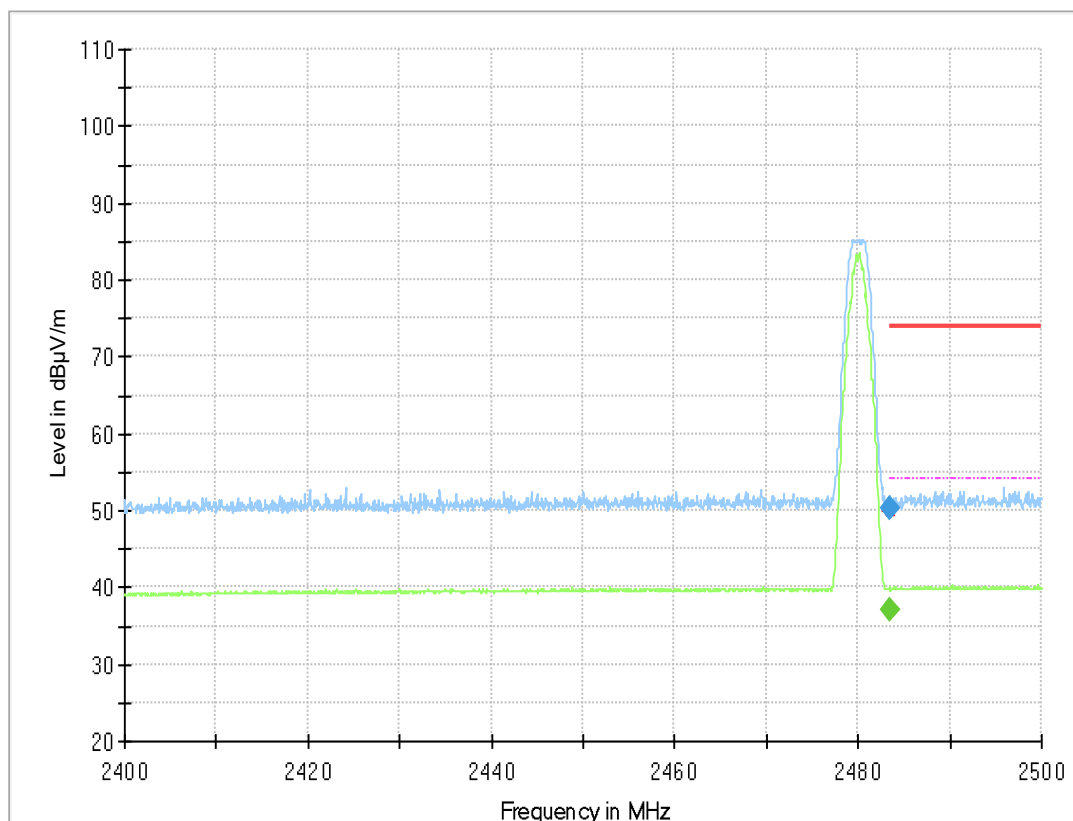
Chip02, Modulation= BT LE 1 Mbit/s, Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2483.563	---	39.1	54.00	14.88	1000.0	1000.000	150.0	V	127.0	84.0	7.6
2483.563	52.4	---	74.00	21.60	1000.0	1000.000	150.0	V	127.0	84.0	7.6

Chip02, Modulation= BT LE 2 Mbit/s, Operating Channel = high, Band Edge = high
(S01_BF03#S3.5)



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)
2483.500	50.4	---	74.00	23.63	1000.0	1000.000	150.0	V	-83.0	105.0	7.6
2483.500	---	37.2	54.00	16.79	1000.0	1000.000	150.0	V	-83.0	105.0	7.6

5.2.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 GHz FCC

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

- 1 Radiated Emissions FAR 2.4 GHz FCC
Radiated emission tests for 2.4 GHz ISM devices in a fully anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.2	Innco Systems CO3000	Controller for bore sight mast FAC	innco systems GmbH	CO3000/1460/54740522/P	N/A	N/A
1.3	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A	N/A
1.4	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	N/A	N/A
1.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
1.6	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A	N/A
1.7	FSW43	Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	103779	2024-12	2026-12
1.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
1.9	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
1.10	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
1.11	MA3000/0800-XP-ET-compact	Bore Sight Antenna Mast	innco systems GmbH	9210522	N/A	N/A
1.12	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
1.13	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008	N/A	N/A
1.14	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2023-08	2025-08
1.15	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
1.16	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
1.17	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2024-10	2027-10

2 Radiated Emissions SAC H-Field
Radiated emission tests in the H-Field in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
2.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufth Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
2.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
2.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
2.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
2.6	Opus10 THI (8152.00)	T/H Logger 10	Lufth Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
2.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
2.8	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
2.9	HFH2-Z2	Loop Antenna + 3 Axis Tripod	Rohde & Schwarz GmbH & Co. KG	829324/006	2024-04	2027-04
2.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10

3 Radiated Emissions SAC up to 1 GHz
 Radiated emission tests up to 1 GHz in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
3.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
3.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
3.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
3.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
3.5	HL 562 ULTRALOG	Biconical-log-per antenna (30 MHz - 3 GHz) with HL 562E biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003		
3.6	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
3.7	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
3.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
3.9	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
3.10	HL562E ULTRALOG	Biconical-log-per Antenna (30 MHz - 6 GHz)	Rohde & Schwarz GmbH & Co. KG	102299	2024-07	2027-07
3.11	Chase CBL6111C + INMET 64671 18N-6dB	Hybrid Antenna with 6dB Attenuator		2624 Kartei-Nr E-003226/K1026	2023-03	2026-03
3.12	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10
3.13	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/1192 0513	N/A	N/A

The calibration interval is the time interval between "Last Calibration" and "Calibration Due"

6.2 TEST EQUIPMENT SOFTWARE

Semi-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
INNCO Mast Controller	1.02.62
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
MATURO Controller	1.24
MATURO Mast	12.19
MATURO Turn-Table	30.10
Fully-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
MATURO Controller	1.30
MATURO Turn-Unit	11.10
MATURO Mast	12.10
MATURO Turntable	12.11
INNCO Controller	1.03.02
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
TS 8997	
WMS32 Measurement Software	11.60.00 (till 2024-03-19), 11.70.00 + Hotfix 01
Conducted AC Emissions:	
Software	Version
EMC32 Measurement Software	10.60.20

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 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 = $-40 \cdot \log(d_{\text{Limit}}/d_{\text{used}})$

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

Table shows an extract of values

7.2 ANTENNA R&S HL562 (30 MHz – 1 GHz)

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

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

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

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

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

7.3 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.

7.4 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)

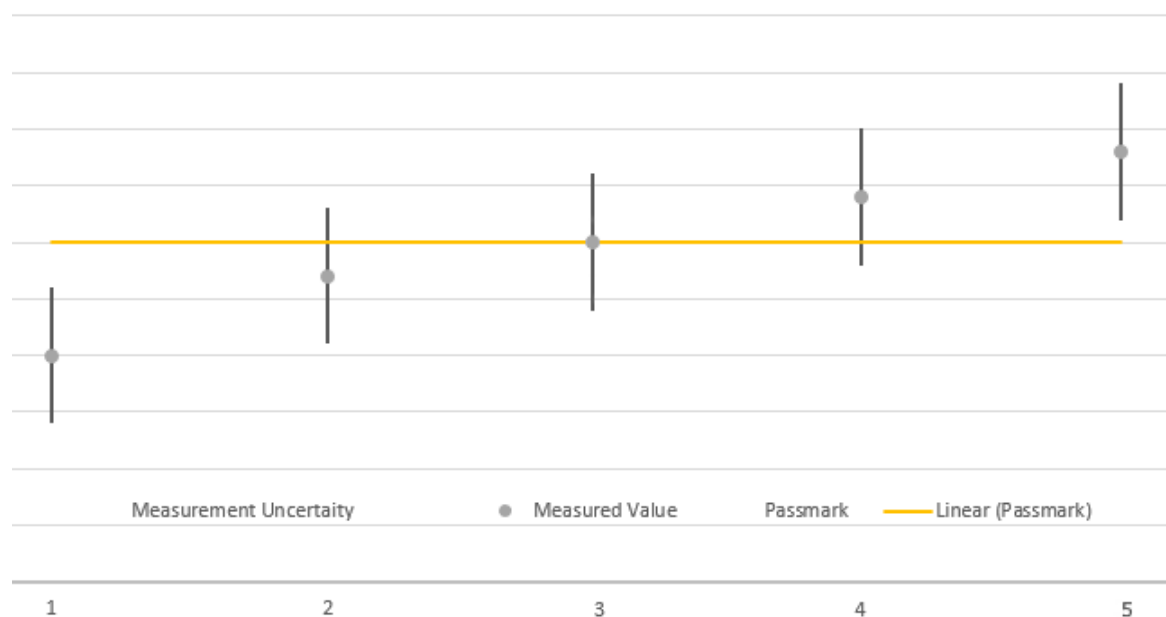
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

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	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	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.

*****END OF TEST REPORT*****