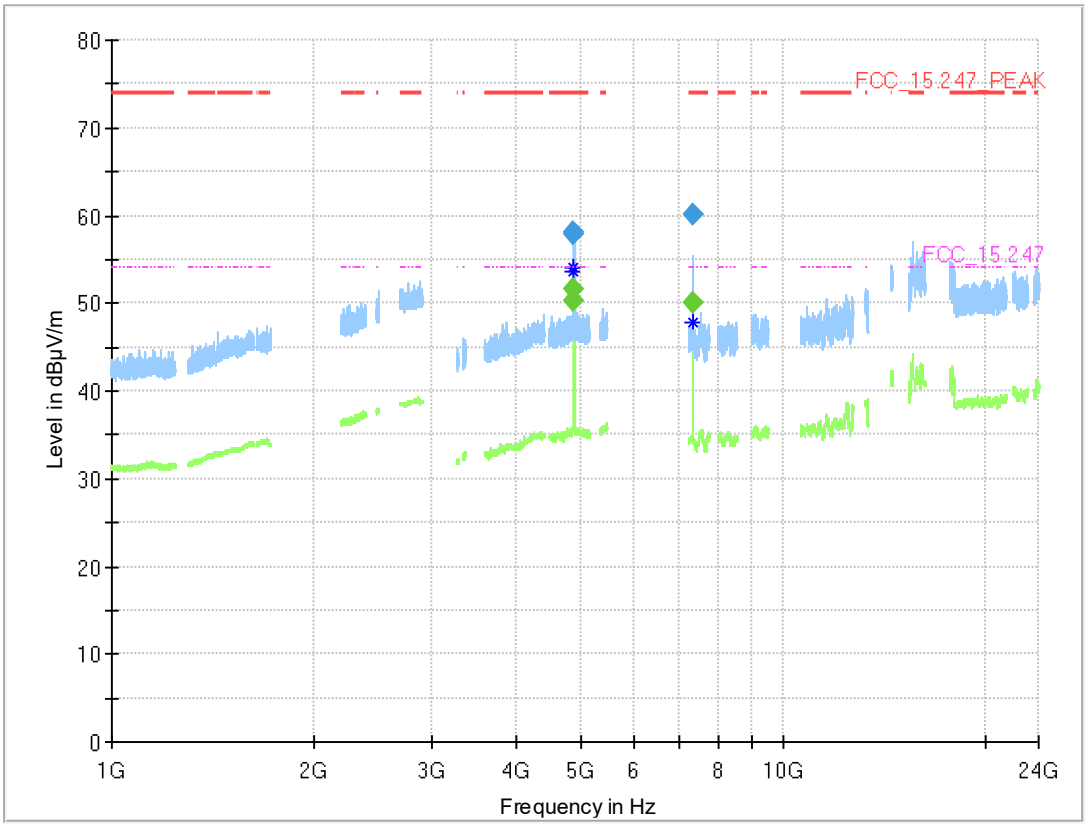
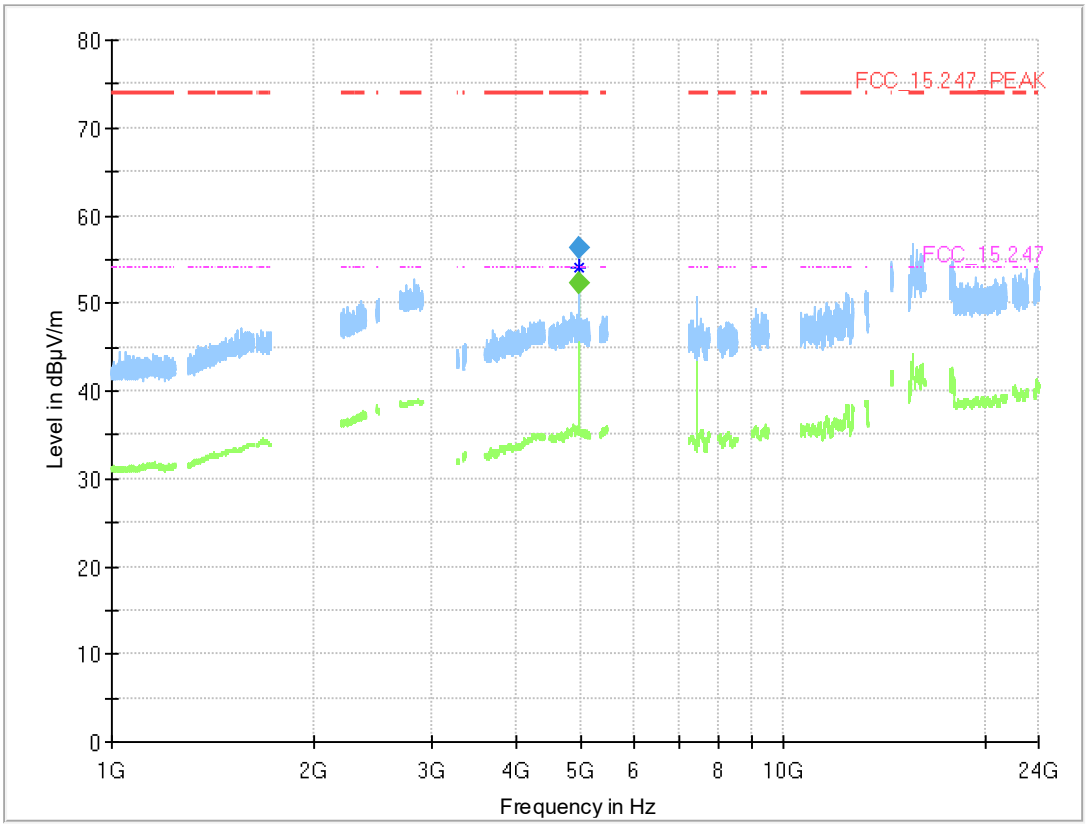
Radio Technology = Bluetooth BDR, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S02_166_AE01)



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)
4882.200	---	51.7	54.00	2.34	1000.0	1000.000	150.0	H	-60.0	82.0	4.5
4882.200	57.8	---	74.00	16.19	1000.0	1000.000	150.0	H	-60.0	82.0	4.5
4882.363	---	50.3	54.00	3.67	1000.0	1000.000	150.0	H	-60.0	92.0	4.5
4882.363	58.1	---	74.00	15.94	1000.0	1000.000	150.0	H	-60.0	92.0	4.5
7322.250	---	50.1	54.00	3.93	1000.0	1000.000	150.0	V	2.0	11.0	-13.2
7322.250	60.1	---	74.00	13.86	1000.0	1000.000	150.0	V	2.0	11.0	-13.2

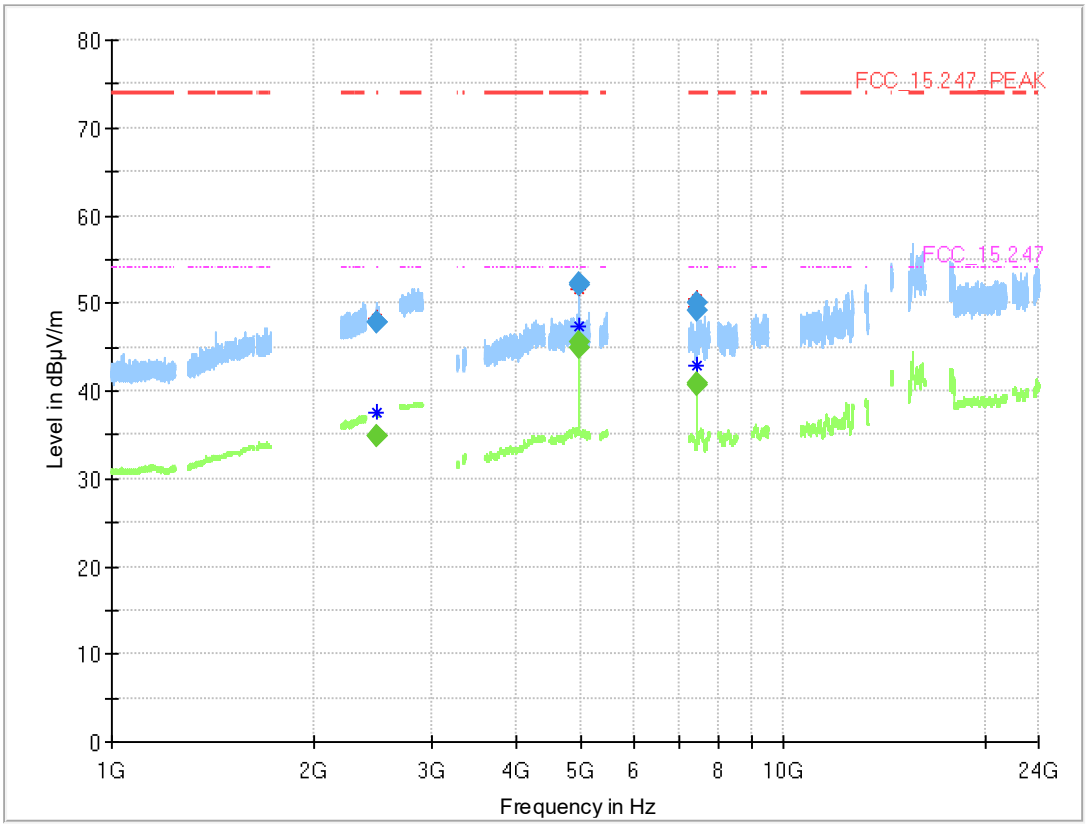
Radio Technology = Bluetooth BDR, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S02_166_AE01)



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)
4960.038	---	52.3	54.00	1.68	1000.0	1000.000	150.0	H	-58.0	44.0	4.4
4960.038	56.2	---	74.00	17.78	1000.0	1000.000	150.0	H	-58.0	44.0	4.4

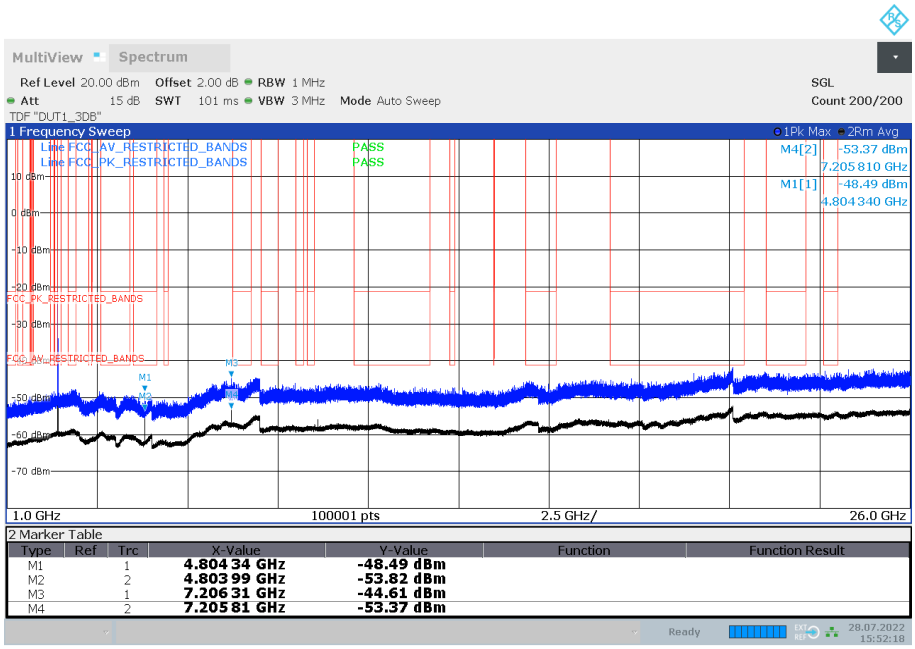
Radio Technology = Bluetooth BDR, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S02_166_AB01)



Final_Result

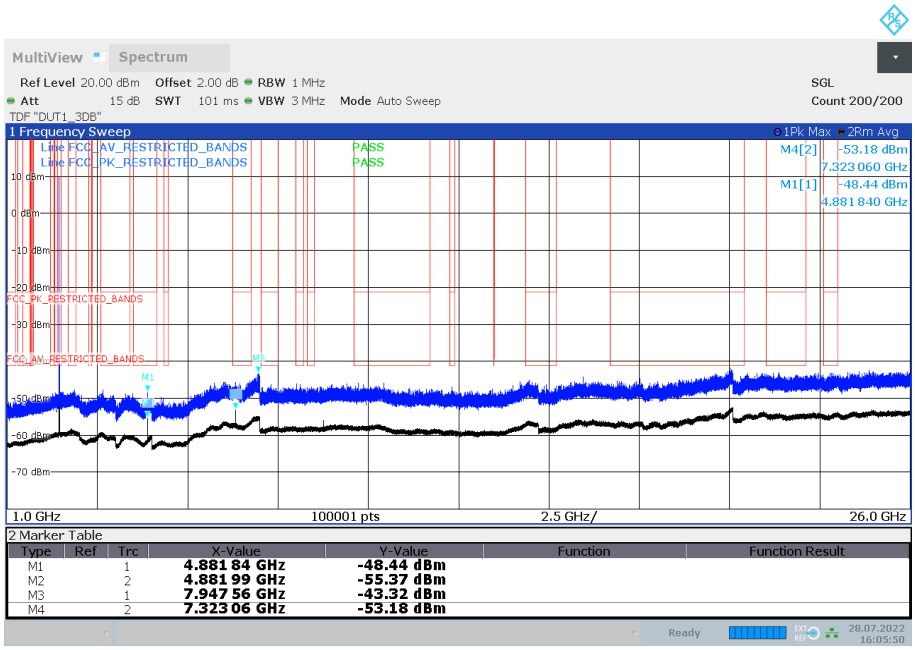
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2484.325	---	34.8	54.00	19.19	1000.0	1000.000	150.0	H	-52.0	4.0	5.3
2484.325	47.9	---	74.00	26.10	1000.0	1000.000	150.0	H	-52.0	4.0	5.3
2484.490	---	34.8	54.00	19.19	1000.0	1000.000	150.0	V	116.0	94.0	5.3
2484.490	47.8	---	74.00	26.23	1000.0	1000.000	150.0	V	116.0	94.0	5.3
4959.875	---	45.6	54.00	8.44	1000.0	1000.000	150.0	H	-36.0	-1.0	4.4
4959.875	52.2	---	74.00	21.81	1000.0	1000.000	150.0	H	-36.0	-1.0	4.4
4960.200	---	45.0	54.00	9.03	1000.0	1000.000	150.0	H	157.0	95.0	4.4
4960.200	52.2	---	74.00	21.84	1000.0	1000.000	150.0	H	157.0	95.0	4.4
7439.500	---	40.9	54.00	13.12	1000.0	1000.000	150.0	H	60.0	93.0	-13.3
7439.500	50.1	---	74.00	23.86	1000.0	1000.000	150.0	H	60.0	93.0	-13.3
7440.000	---	40.7	54.00	13.30	1000.0	1000.000	150.0	H	58.0	86.0	-13.2
7440.000	49.2	---	74.00	24.81	1000.0	1000.000	150.0	H	58.0	86.0	-13.2

Radio Technology = Bluetooth BDR, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



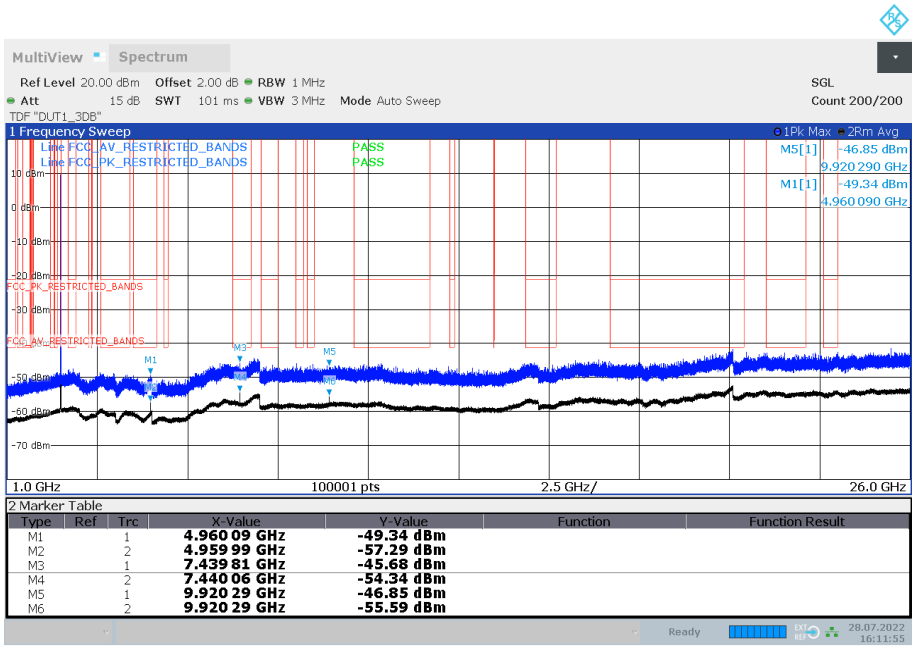
15:52:18 28.07.2022

Radio Technology = Bluetooth BDR, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



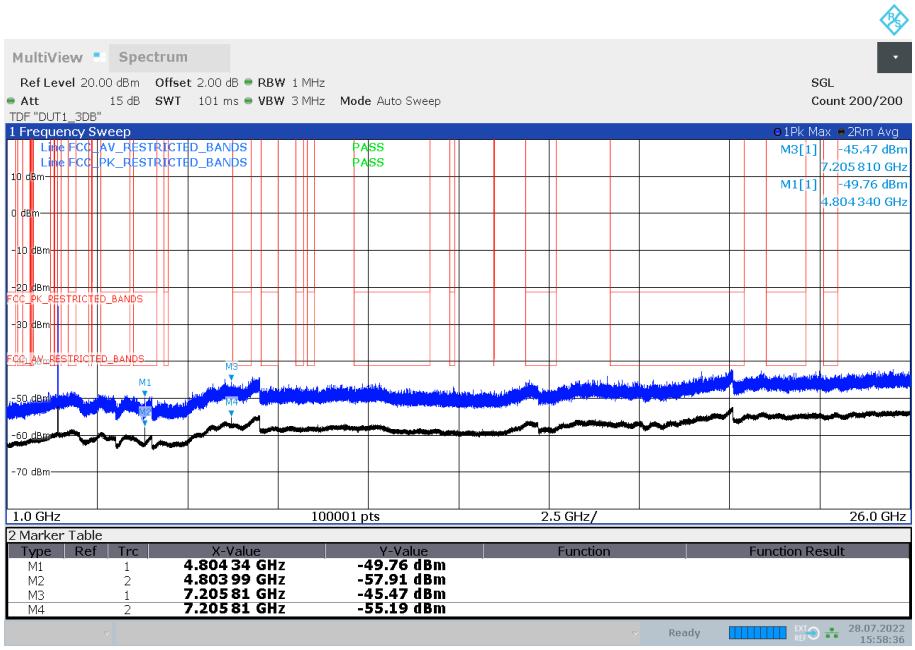
16:05:51 28.07.2022

Radio Technology = Bluetooth BDR, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



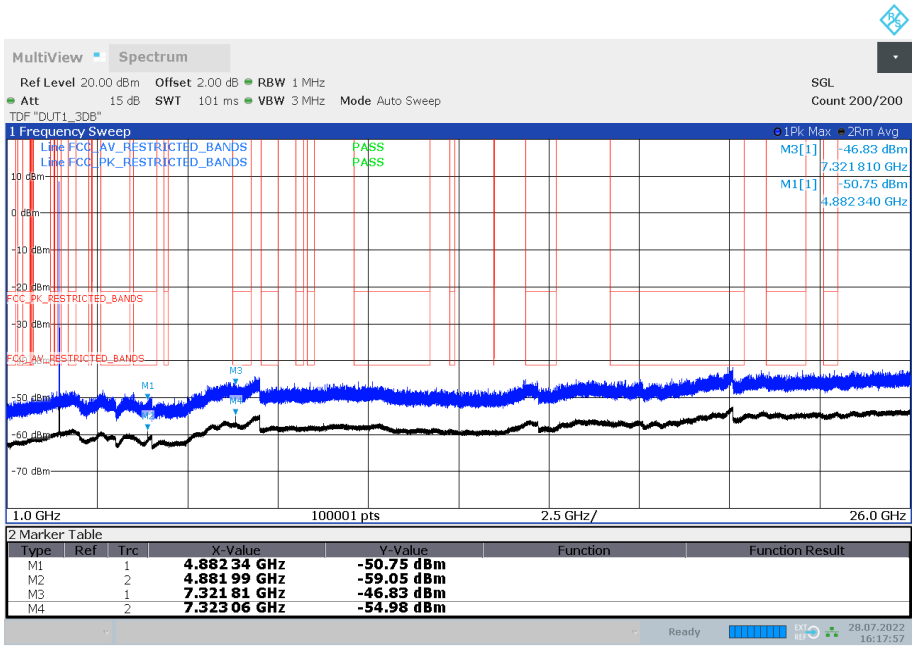
16:11:56 28.07.2022

Radio Technology = Bluetooth EDR 2, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



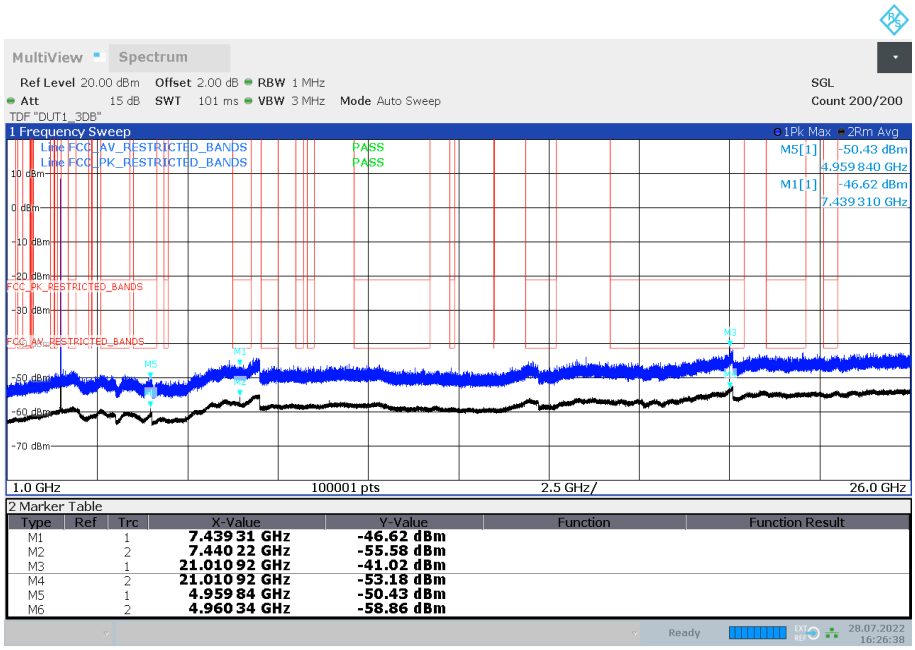
15:58:36 28.07.2022

Radio Technology = Bluetooth EDR 2, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



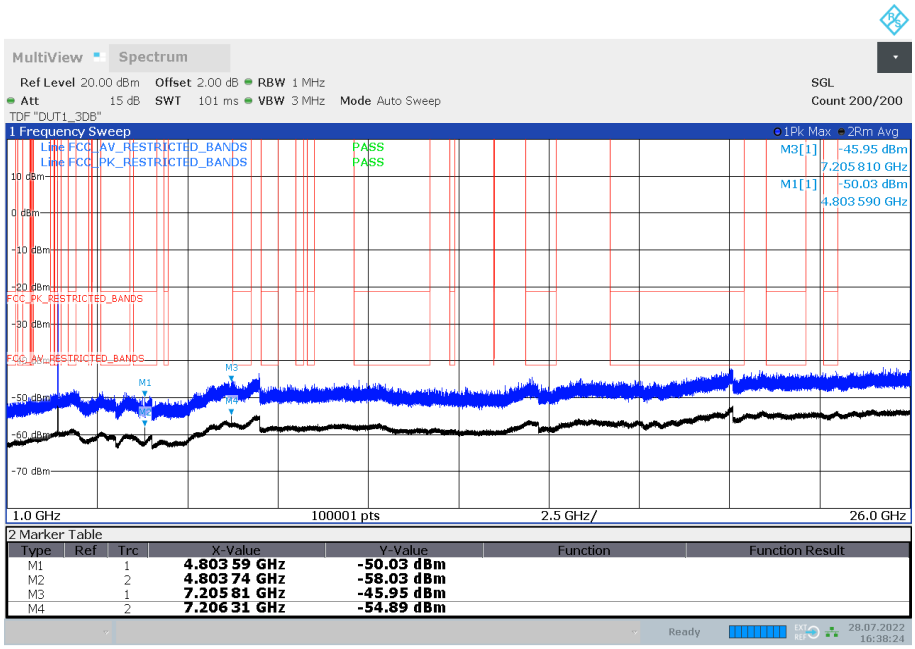
16:17:58 28.07.2022

Radio Technology = Bluetooth EDR 2, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



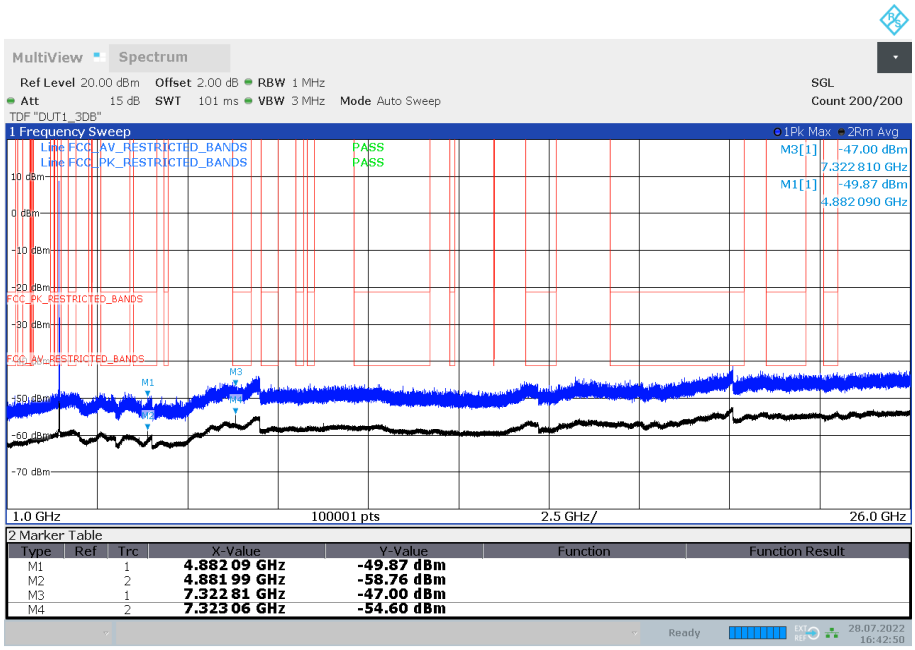
16:26:39 28.07.2022

Radio Technology = Bluetooth EDR 3, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



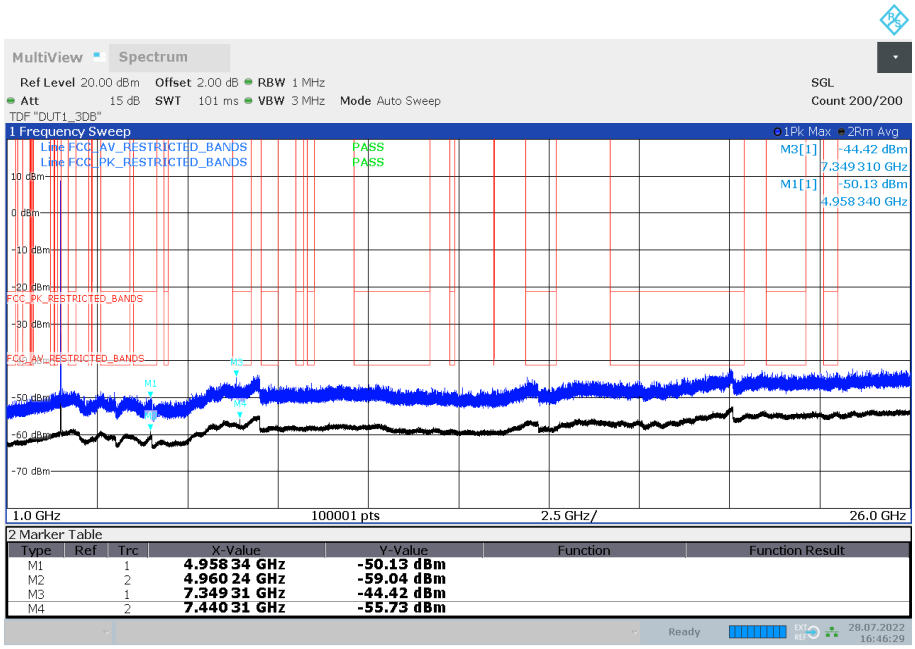
16:38:25 28.07.2022

Radio Technology = Bluetooth EDR 3, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



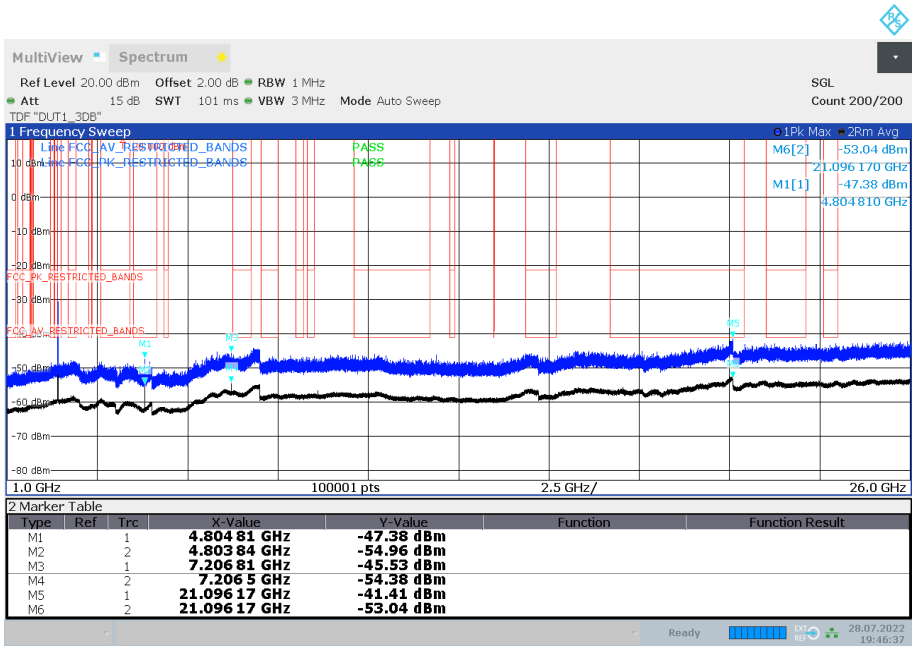
16:42:51 28.07.2022

Radio Technology = Bluetooth EDR 3, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



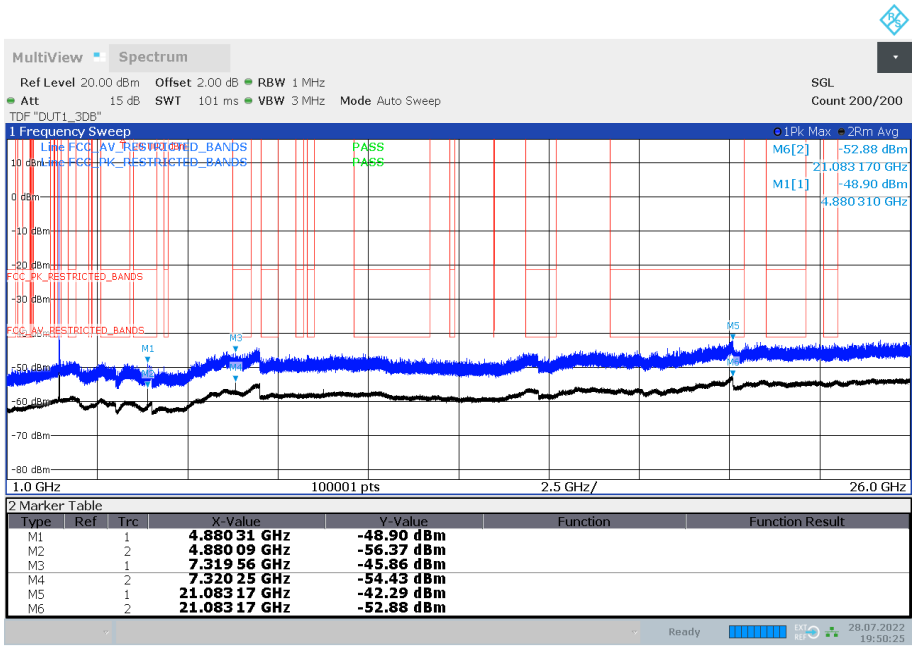
16:46:29 28.07.2022

Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



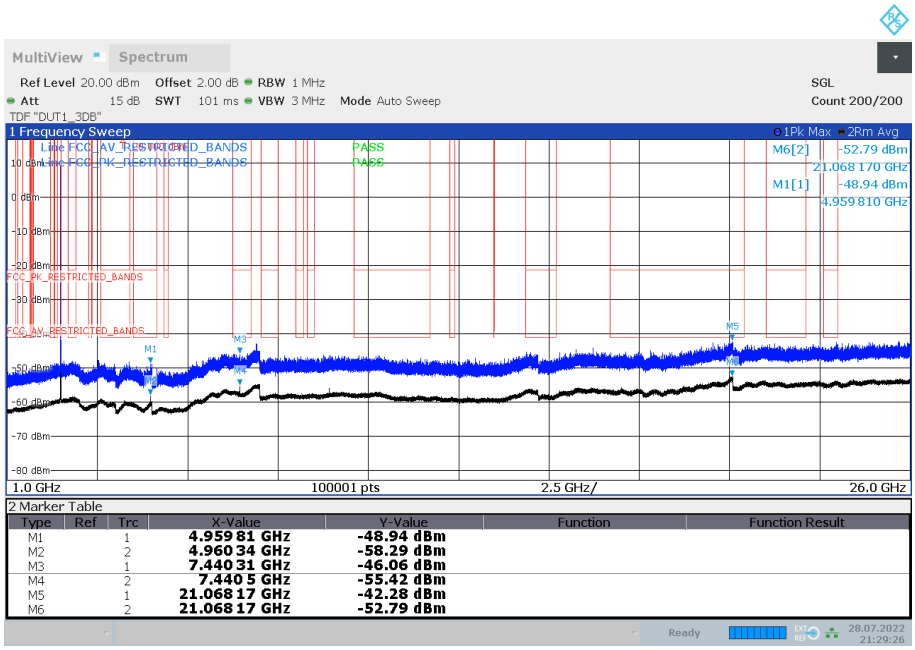
19:46:37 28.07.2022

Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



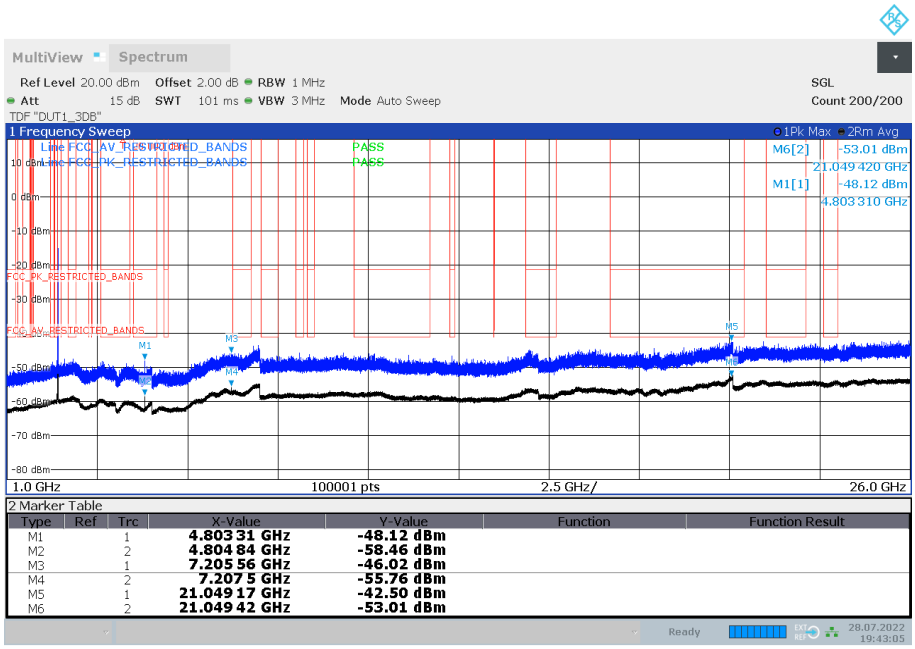
19:50:25 28.07.2022

Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



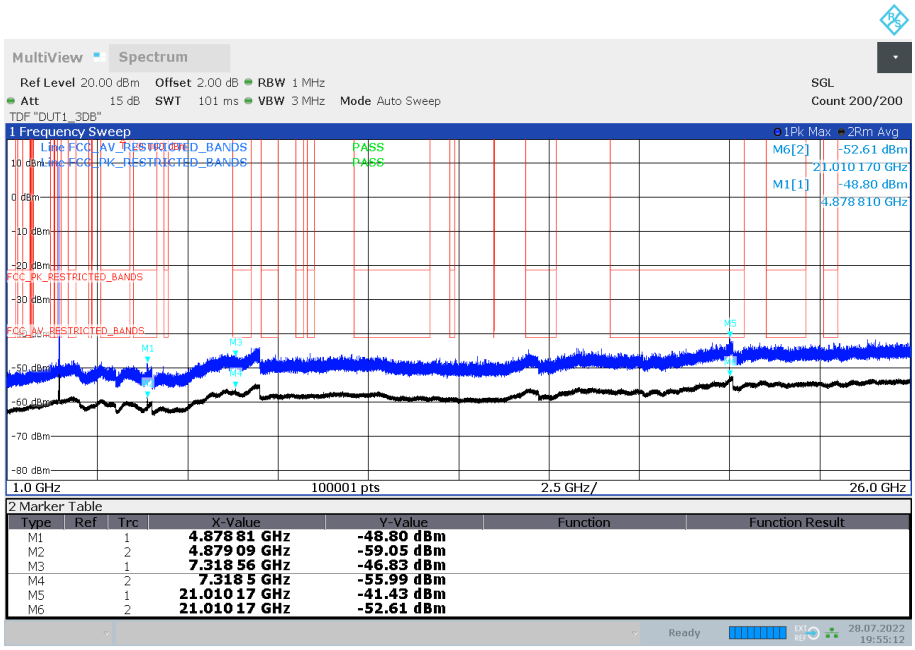
21:29:27 28.07.2022

Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



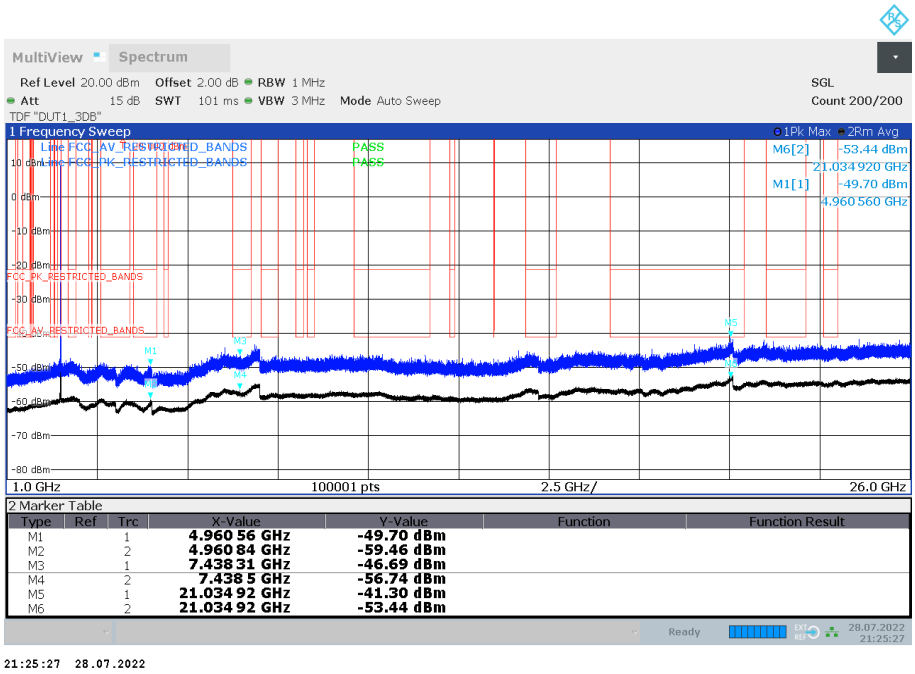
19:43:05 28.07.2022

Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)

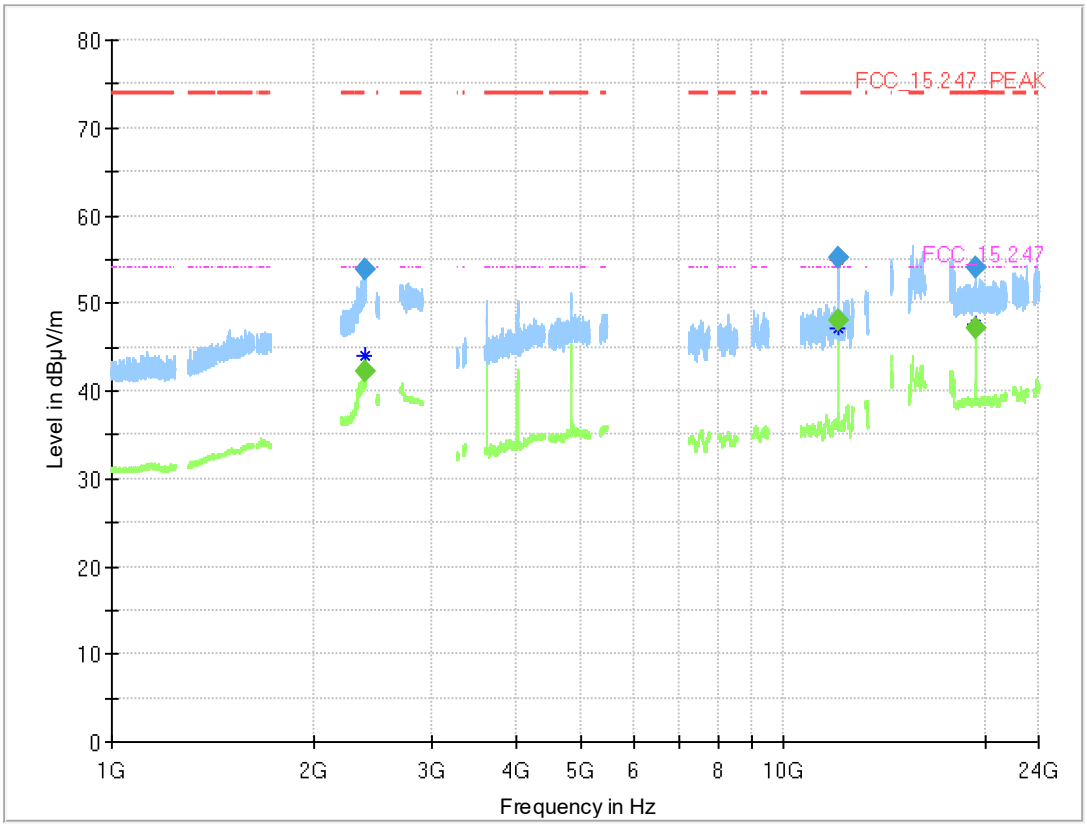


19:55:12 28.07.2022

Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



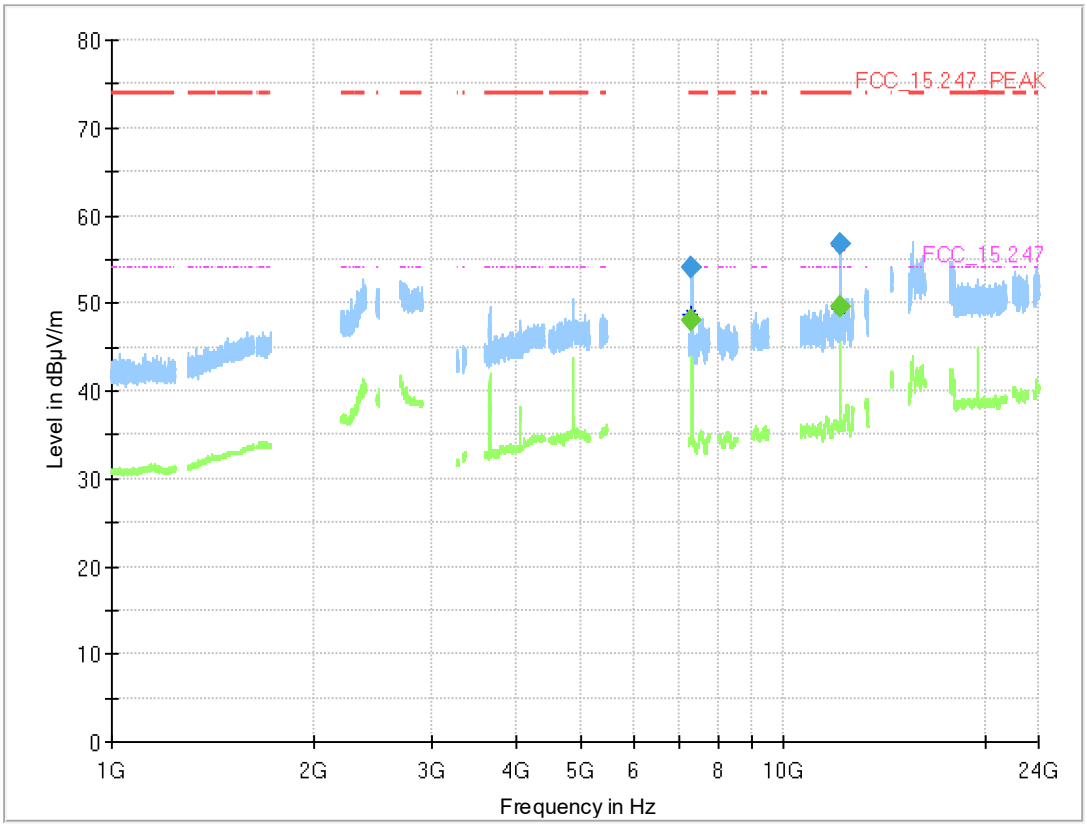
Radio Technology = WLAN b, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S02_166_AF01)



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)
2385.760	---	42.2	54.00	11.82	1000.0	1000.000	150.0	V	97.0	88.0	4.9
2385.760	53.9	---	74.00	20.13	1000.0	1000.000	150.0	V	97.0	88.0	4.9
12061.600	---	47.9	54.00	6.06	1000.0	1000.000	150.0	V	-173.0	-12.0	-7.6
12061.600	55.3	---	74.00	18.73	1000.0	1000.000	150.0	V	-173.0	-12.0	-7.6
19295.910	---	47.2	54.00	6.77	1000.0	1000.000	150.0	V	27.0	96.0	17.2
19295.910	54.2	---	74.00	19.81	1000.0	1000.000	150.0	V	27.0	96.0	17.2

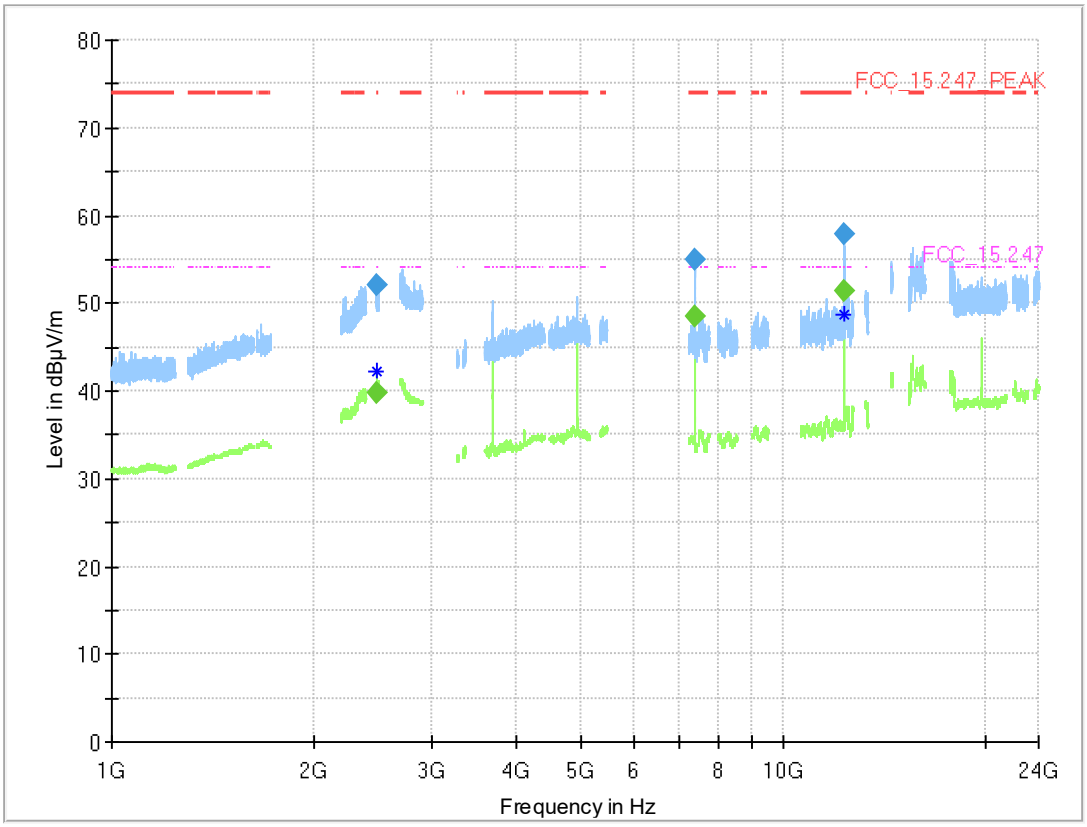
Radio Technology = WLAN b, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S02_166_AF01)



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)
7312.750	---	48.0	54.00	5.96	1000.0	1000.000	150.0	H	117.0	105.0	-13.0
7312.750	54.1	---	74.00	19.90	1000.0	1000.000	150.0	H	117.0	105.0	-13.0
12186.445	---	49.6	54.00	4.36	1000.0	1000.000	150.0	V	-180.0	-3.0	-7.9
12186.445	56.8	---	74.00	17.19	1000.0	1000.000	150.0	V	-180.0	-3.0	-7.9

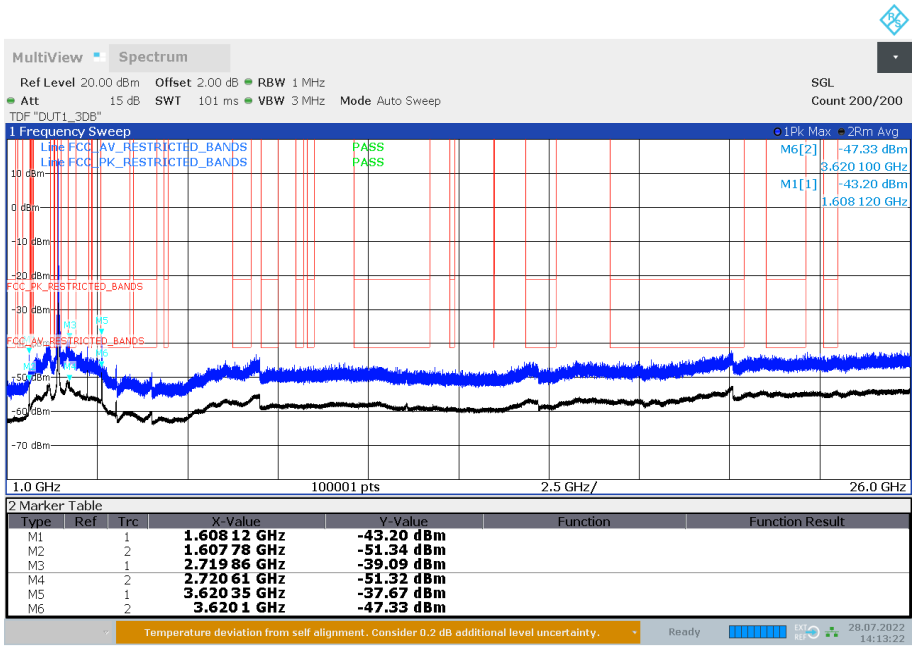
Radio Technology = WLAN b, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S02_166_AF01)



Final_Result

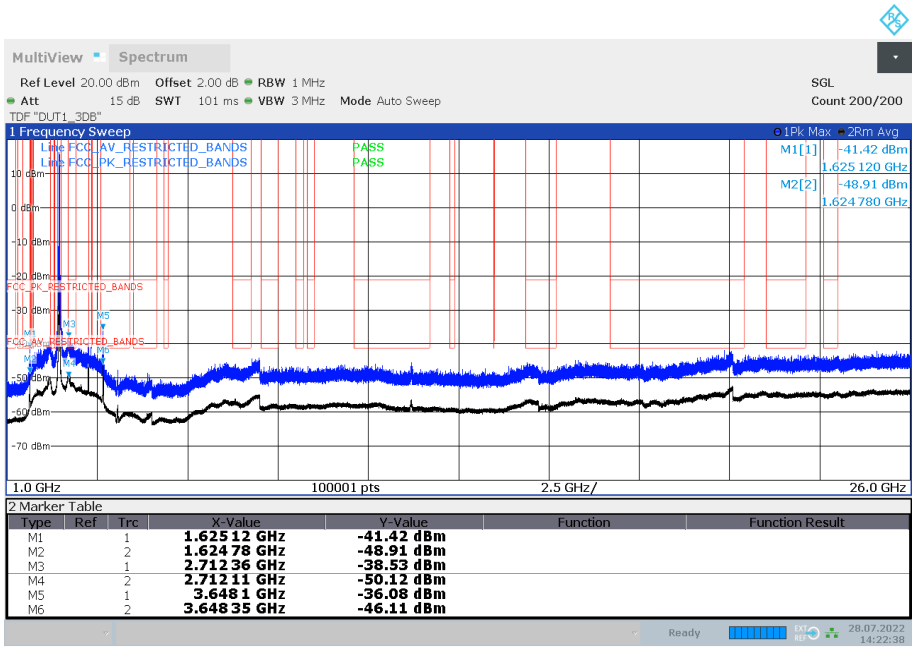
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2483.665	52.0	---	74.00	22.01	1000.0	1000.000	150.0	H	-161.0	8.0	5.3
2483.665	---	39.8	54.00	14.24	1000.0	1000.000	150.0	H	-161.0	8.0	5.3
7384.500	54.9	---	74.00	19.10	1000.0	1000.000	150.0	H	67.0	105.0	-14.2
7384.500	---	48.4	54.00	5.59	1000.0	1000.000	150.0	H	67.0	105.0	-14.2
12309.295	57.9	---	74.00	16.07	1000.0	1000.000	150.0	V	-179.0	-12.0	-7.0
12309.295	---	51.3	54.00	2.68	1000.0	1000.000	150.0	V	-179.0	-12.0	-7.0

Radio Technology = WLAN g, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



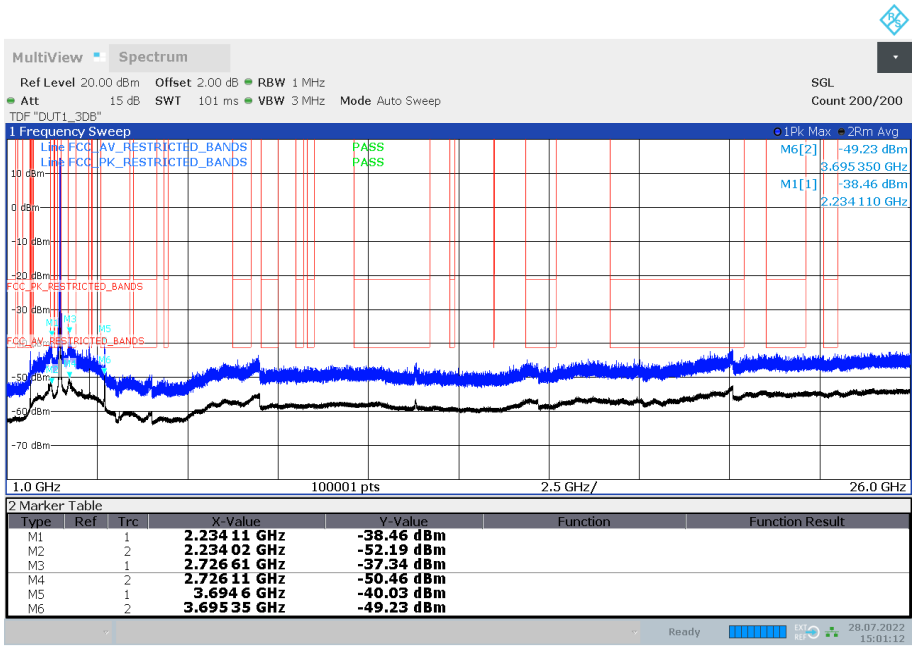
14:13:23 28.07.2022

Radio Technology = WLAN g, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



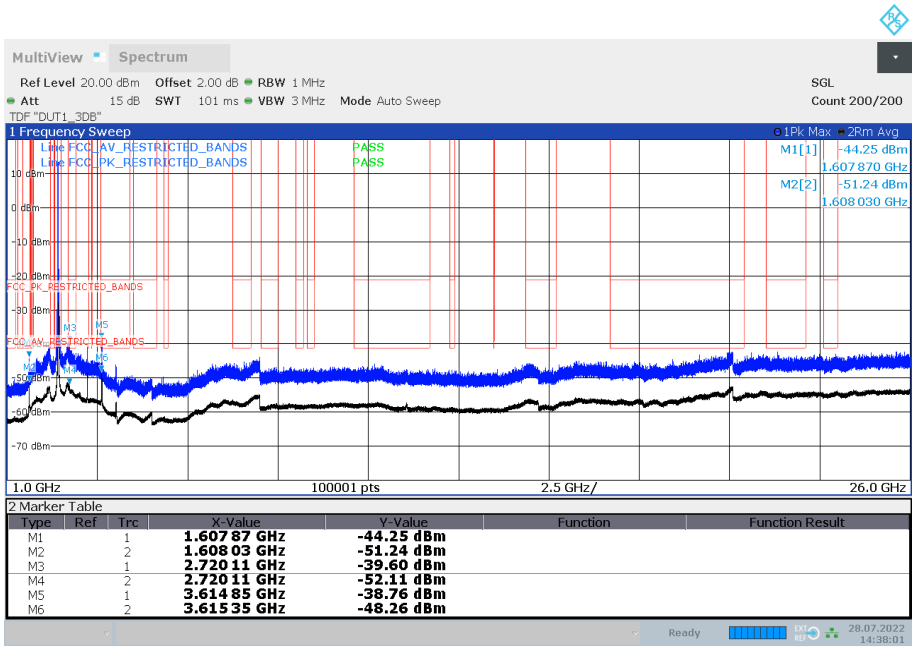
14:22:39 28.07.2022

Radio Technology = WLAN g, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



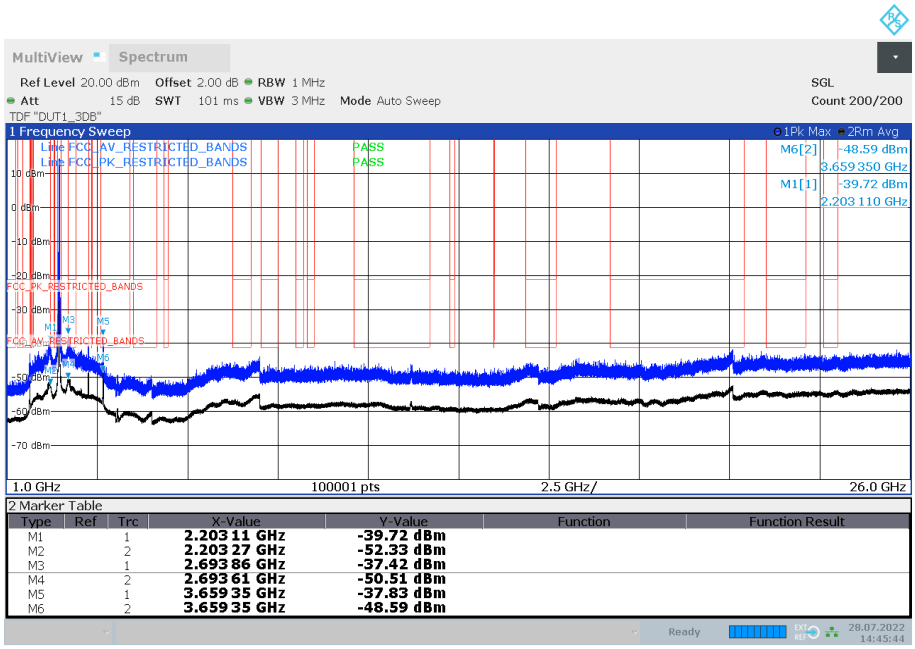
15:01:13 28.07.2022

Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



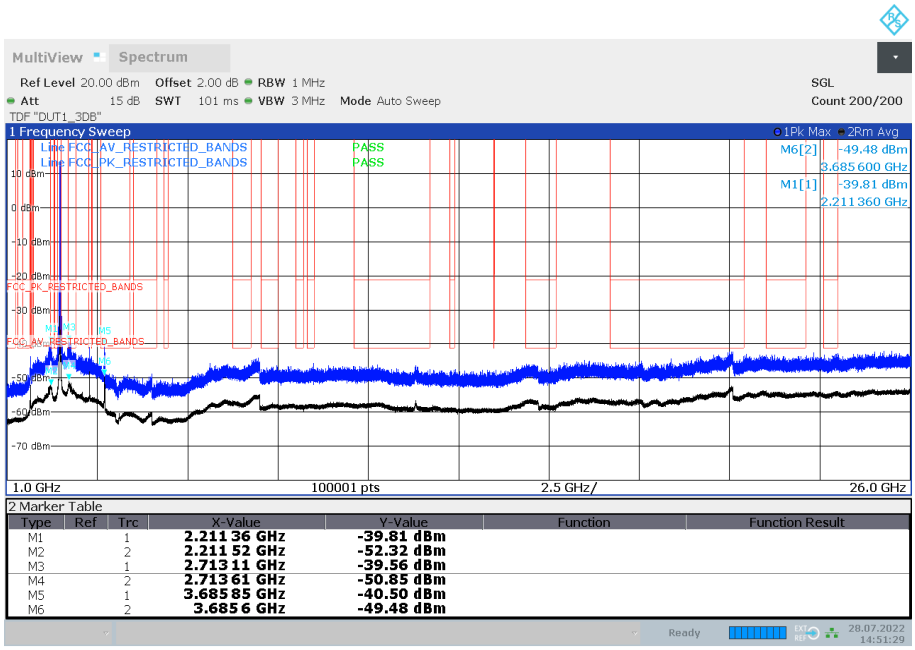
14:38:02 28.07.2022

Radio Technology = WLAN n 20 MHz, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



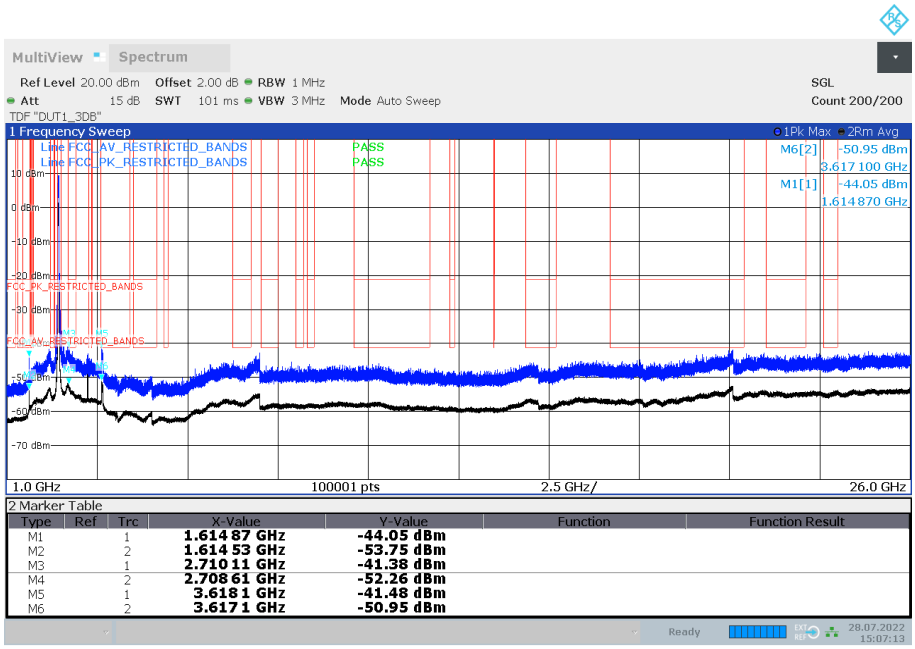
14:45:44 28.07.2022

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



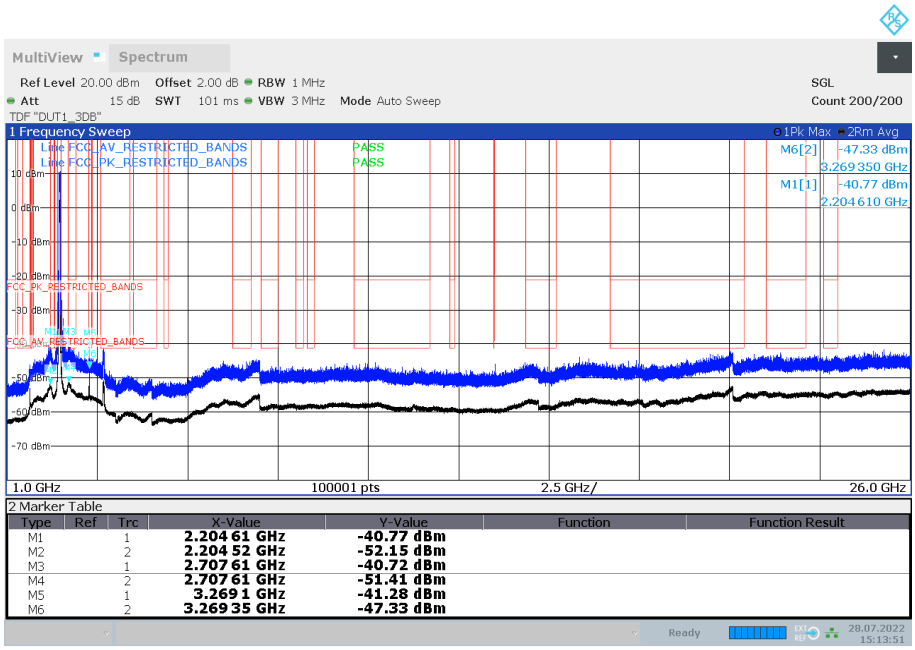
14:51:29 28.07.2022

Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



15:07:14 28.07.2022

Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S01_166_AB01)



15:13:51 28.07.2022

5.6.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 GHz FCC
- Radiated Emissions SAC H-Field
- Radiated Emissions SAC up to 1 GHz
- R&S TS8997

5.7 BAND EDGE COMPLIANCE CONDUCTED

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10 11.11

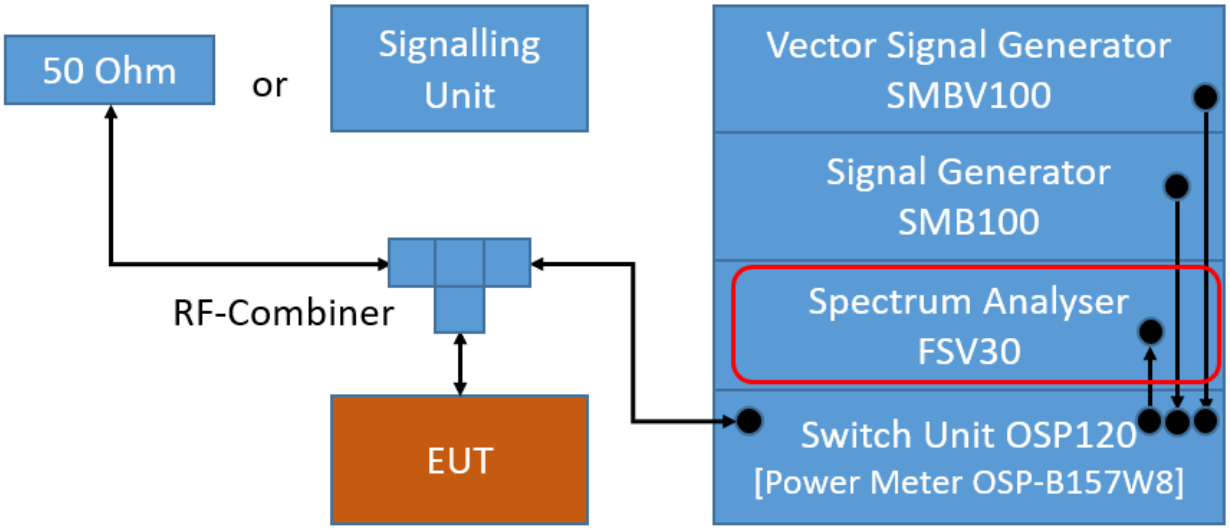
5.7.1 TEST DESCRIPTION

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".

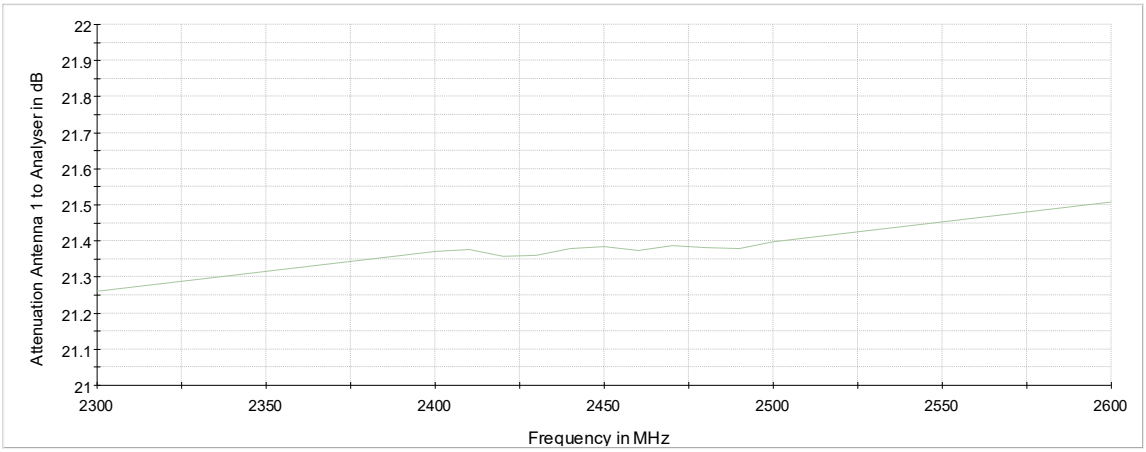
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

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
- Sweeptime: Auto
- Sweeps: Till stable (min. 300, max. 15000)
- Trace: Maxhold



TS8997; Band Edge Conducted



Attenuation of the measurement path

5.7.2 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..."

5.7.3 TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1006 hPa
Humidity: 53 %

BT GFSK

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]
0	2402	2400.0	-46.7	PEAK	100	7.9	-12.1	34.6
78	2480	2483.5	-45.9	PEAK	100	6.1	-13.9	32.0

BT π/4 DQPSK

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]
0	2402	2400.0	-47.0	PEAK	100	3.0	-17.0	30.0
78	2480	2483.5	-46.7	PEAK	100	3.5	-16.5	30.2

BT 8-DPSK

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]
0	2402	2400.0	-45.6	PEAK	100	3.8	-16.2	29.4
78	2480	2483.5	-45.2	PEAK	100	3.8	-16.2	29.0

BT LE 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]
0	2402	2400.0	-48.2	PEAK	100	8.0	-12.0	36.2
39	2480	2483.5	-51.3	PEAK	100	7.1	-12.9	38.4

BT LE 2 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]
0	2402	2400.0	-22.8	PEAK	100	7.1	-12.9	9.9
39	2480	2483.5	-48.5	PEAK	100	7.0	-13.0	35.5

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	-38.9	PEAK	100	7.9	-22.1	16.8
11	2462	2483.5	-47.3	PEAK	100	8.3	-21.7	25.6

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	-32.6	PEAK	100	3.9	-26.1	6.5
11	2462	2483.5	-41.0	PEAK	100	4.1	-25.9	15.1

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	-33.3	PEAK	100	2.9	-27.1	6.2
11	2462	2483.5	-43.5	PEAK	100	3.2	-26.8	16.7

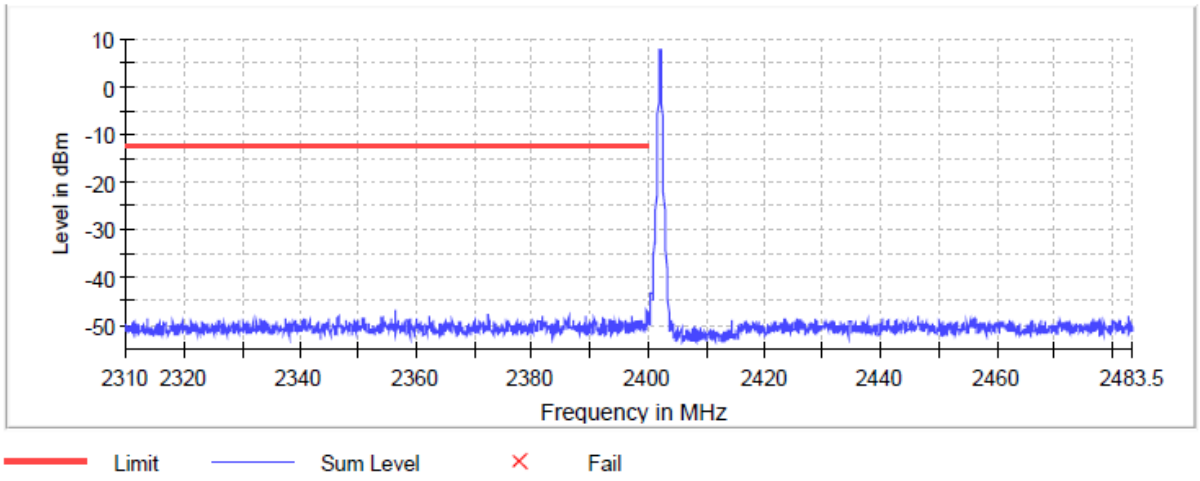
WLAN n-Mode; 40 MHz; MCS0

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]
3	2422	2400.0	-36.9	PEAK	100	-0.4	-30.4	6.5
9	2452	2483.5	-36.0	PEAK	100	0.6	-29.4	6.6

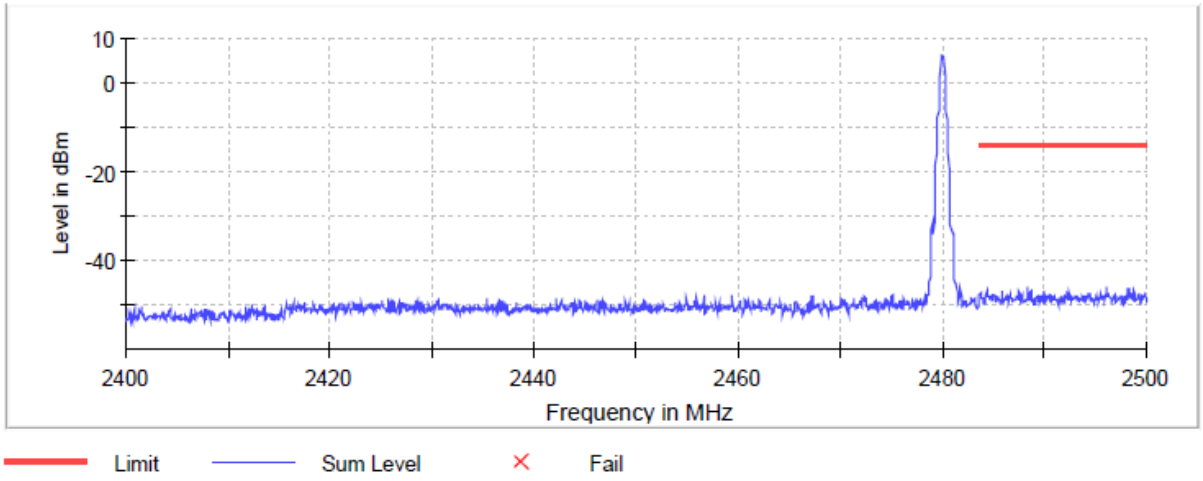
Remark: Please see next sub-clause for the measurement plot.

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

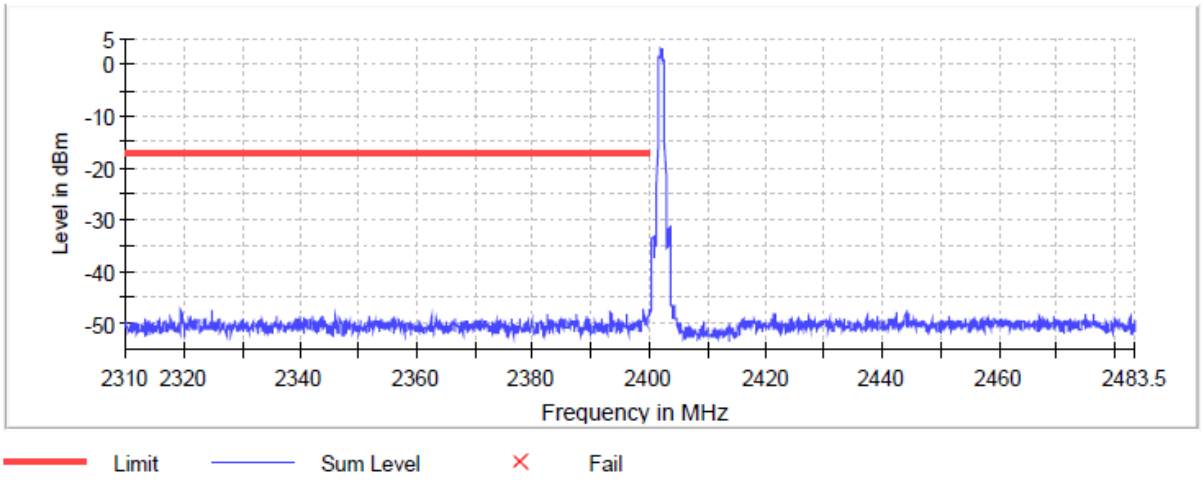
Radio Technology = Bluetooth BDR, Operating Frequency = low, Band Edge = low (S01_166_AB01)



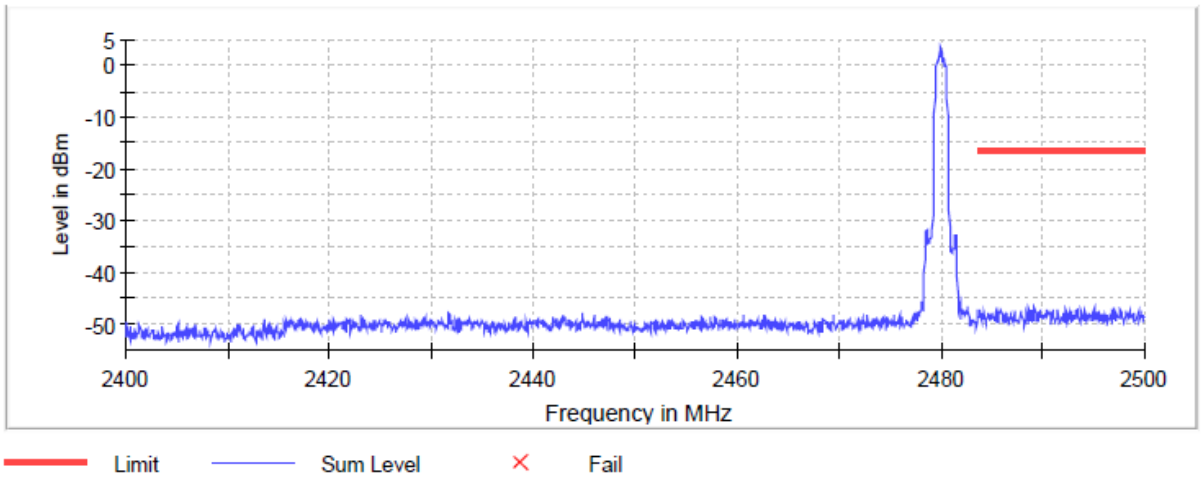
Radio Technology = Bluetooth BDR, Operating Frequency = high, Band Edge = high (S01_166_AB01)



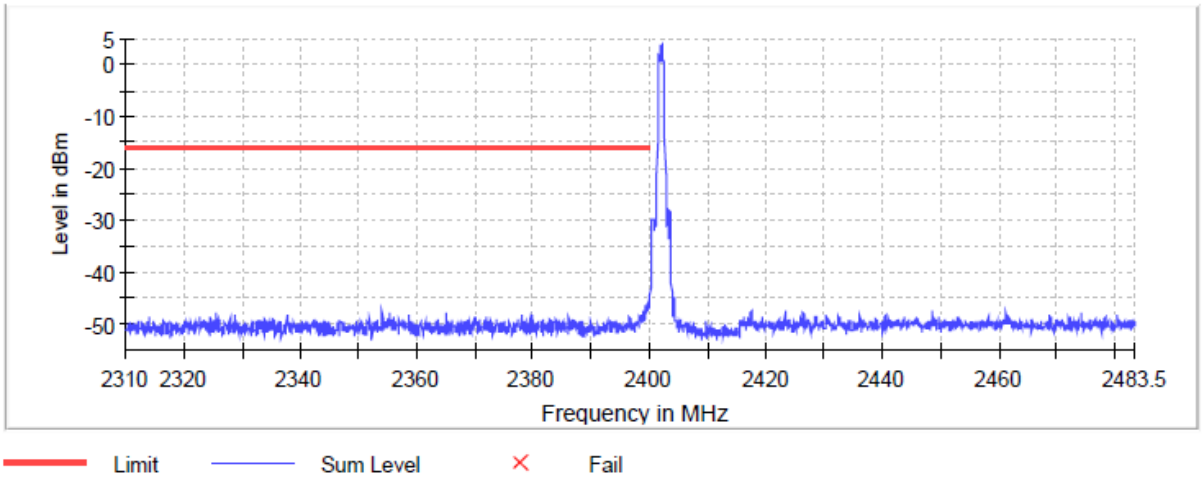
Radio Technology = Bluetooth EDR 2, Operating Frequency = low, Band Edge = low (S01_166_AB01)



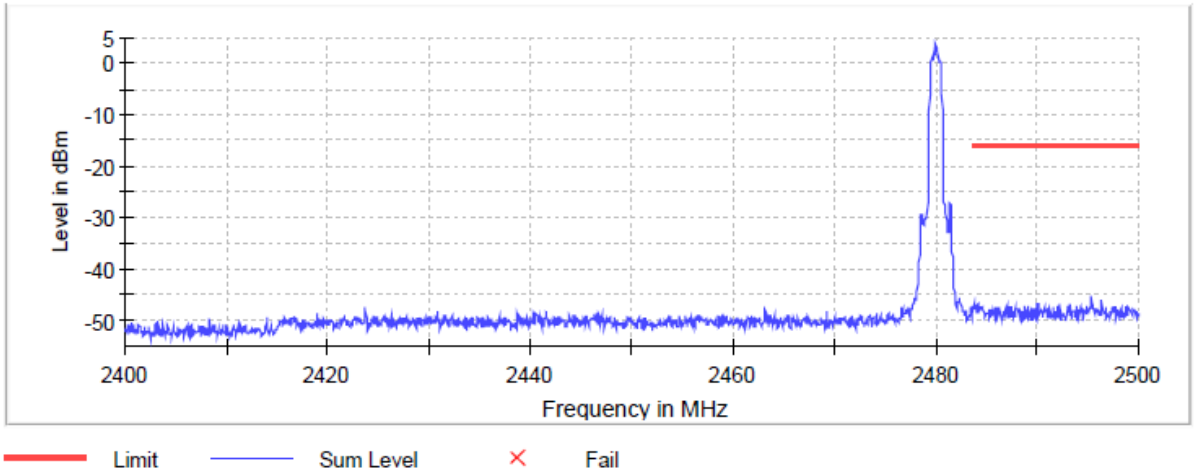
Radio Technology = Bluetooth EDR 2, Operating Frequency = high, Band Edge = high (S01_166_AB01)



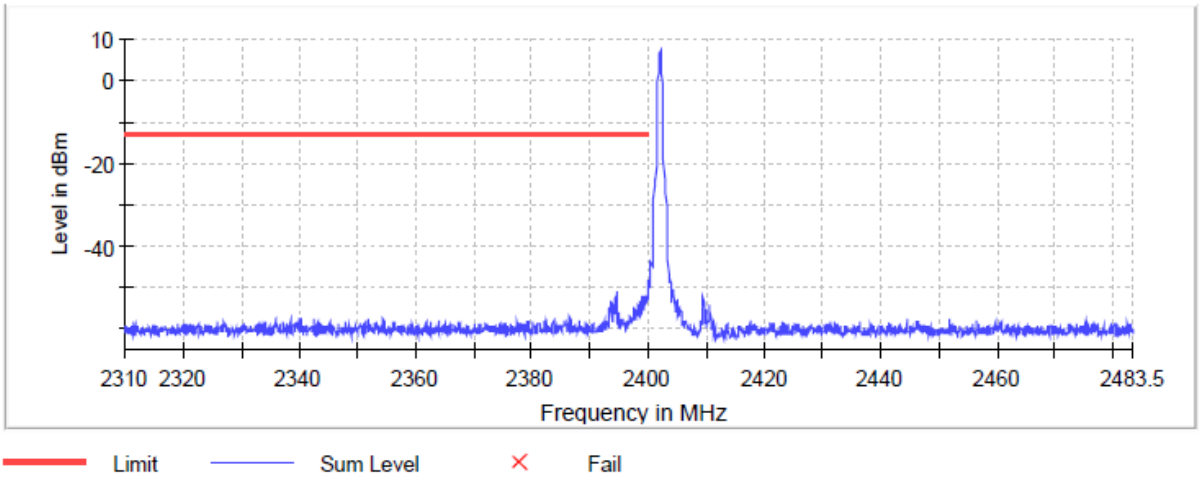
Radio Technology = Bluetooth EDR 3, Operating Frequency = low, Band Edge = low (S01_166_AB01)



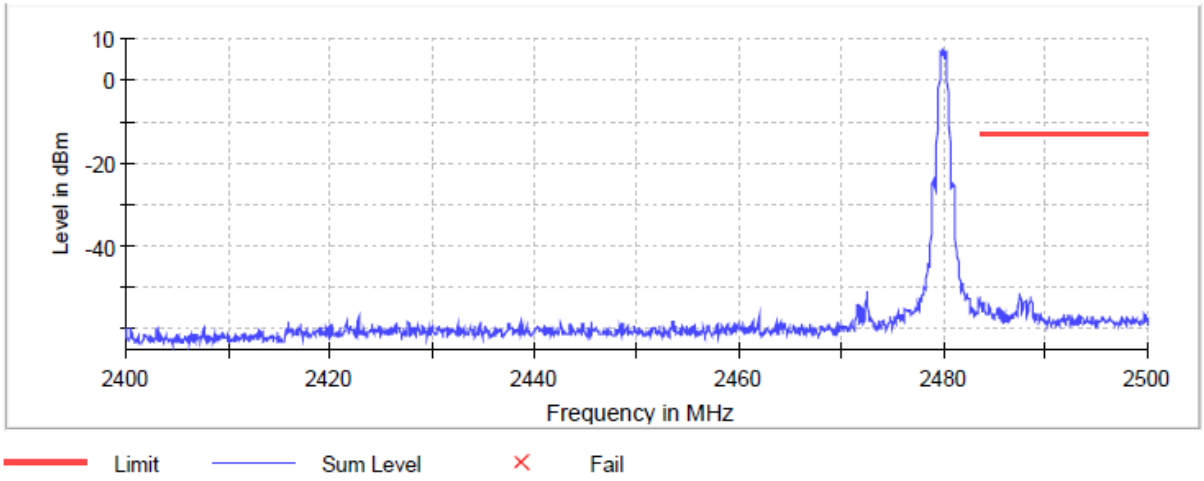
Radio Technology = Bluetooth EDR 3, Operating Frequency = high, Band Edge = high (S01_166_AB01)



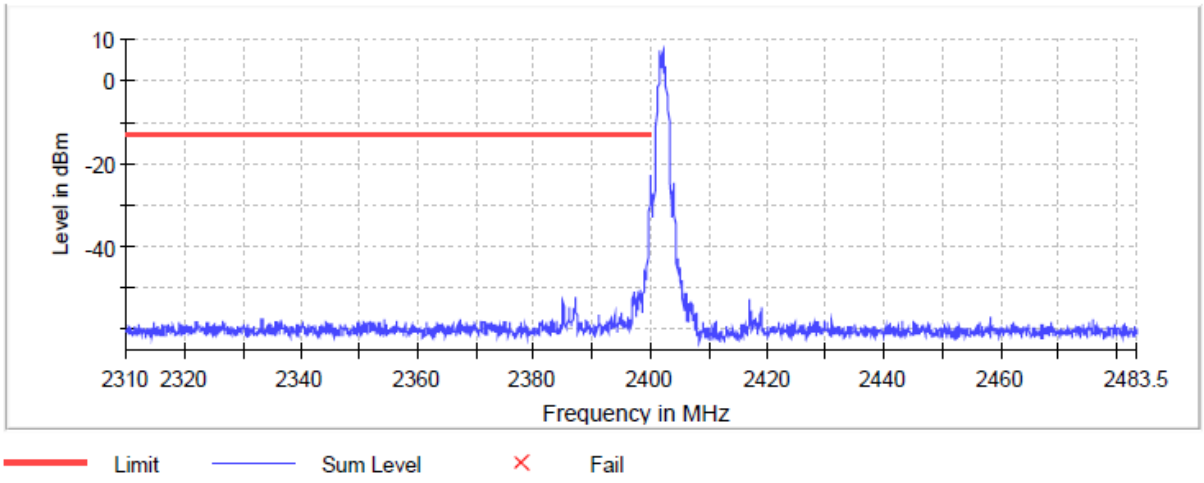
Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = low, Band Edge = low (S01_166_AB01)



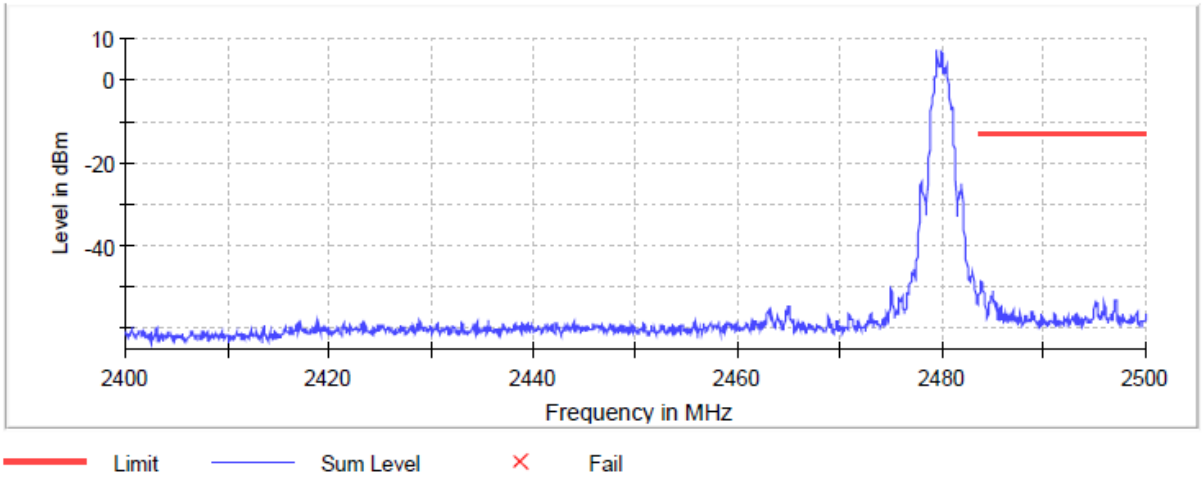
Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = high, Band Edge = high (S01_166_AB01)



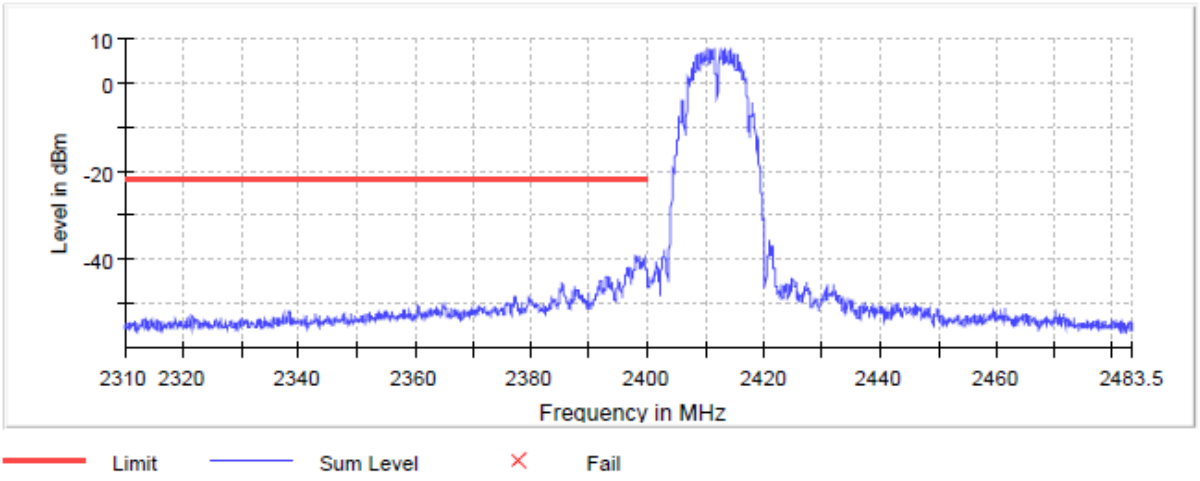
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = low, Band Edge = low (S01_166_AB01)



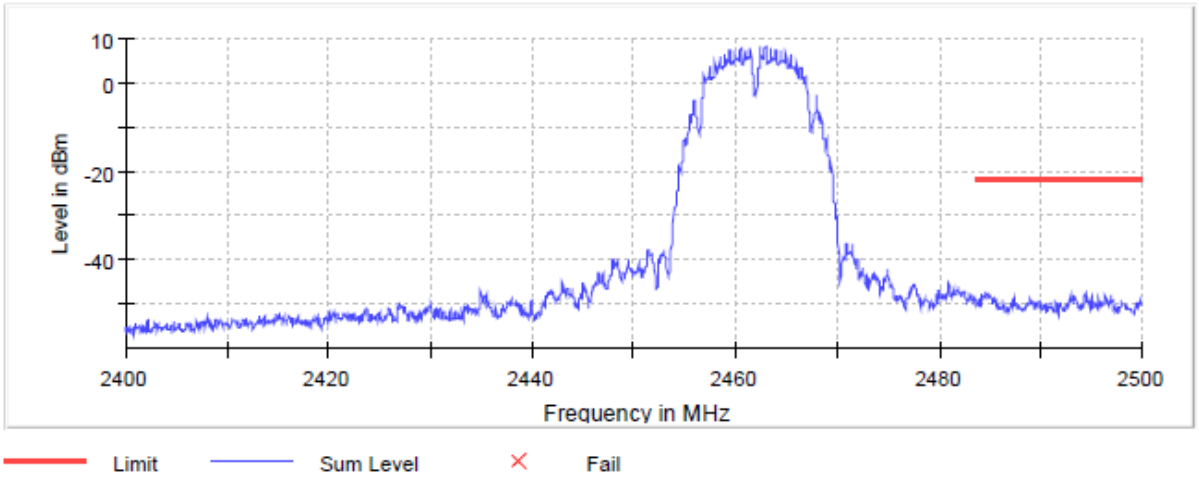
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Band Edge = high (S01_166_AB01)



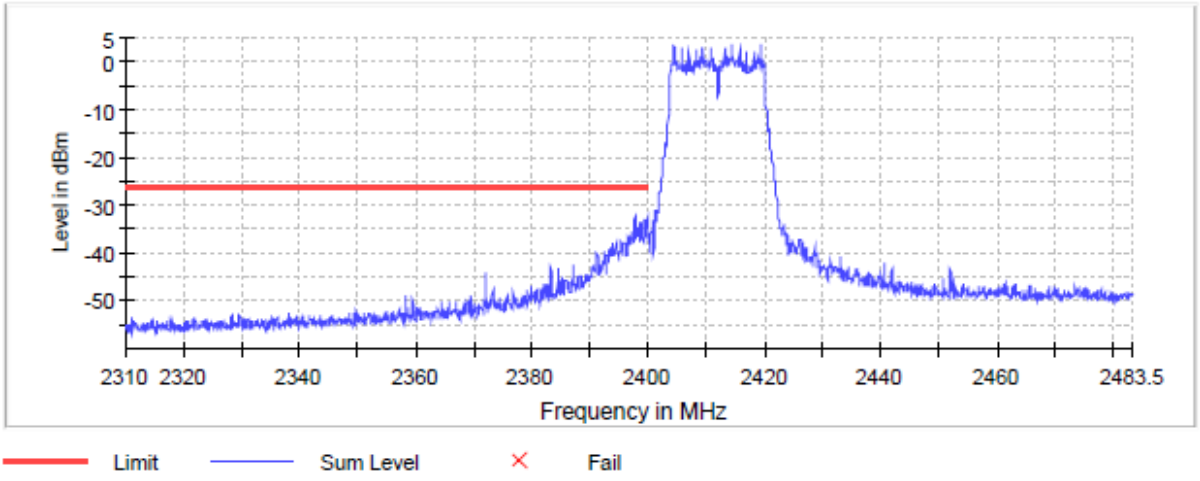
Radio Technology = WLAN b, Operating Frequency = low, Band Edge = low (S01_166_AB01)



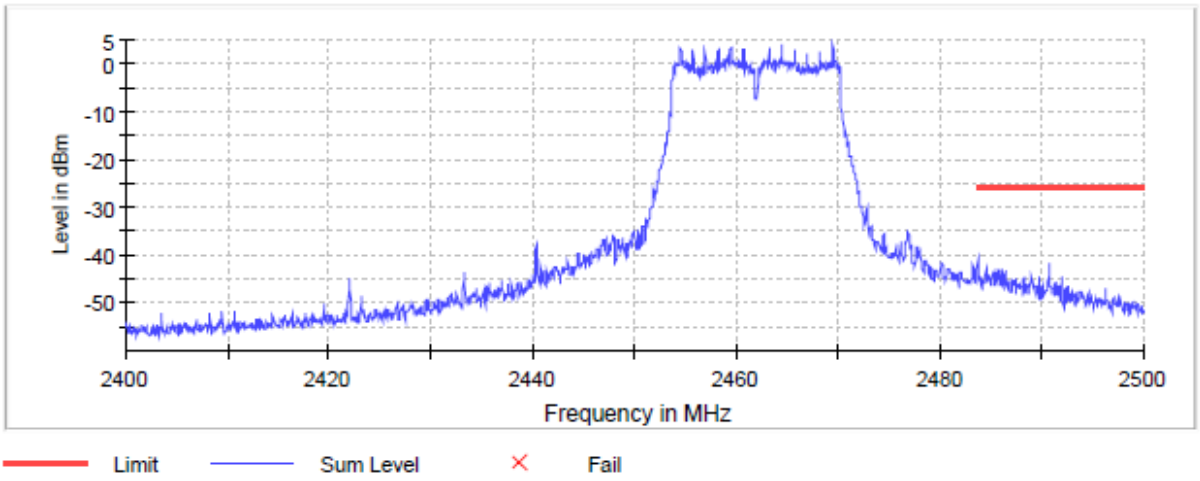
Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high (S01_166_AB01)



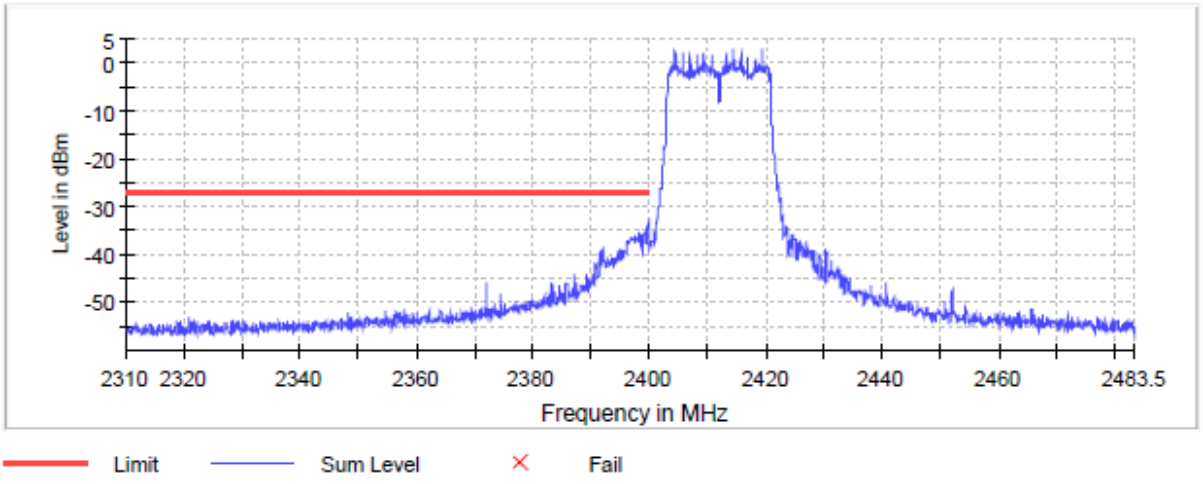
Radio Technology = WLAN g, Operating Frequency = low, Band Edge = low (S01_166_AB01)



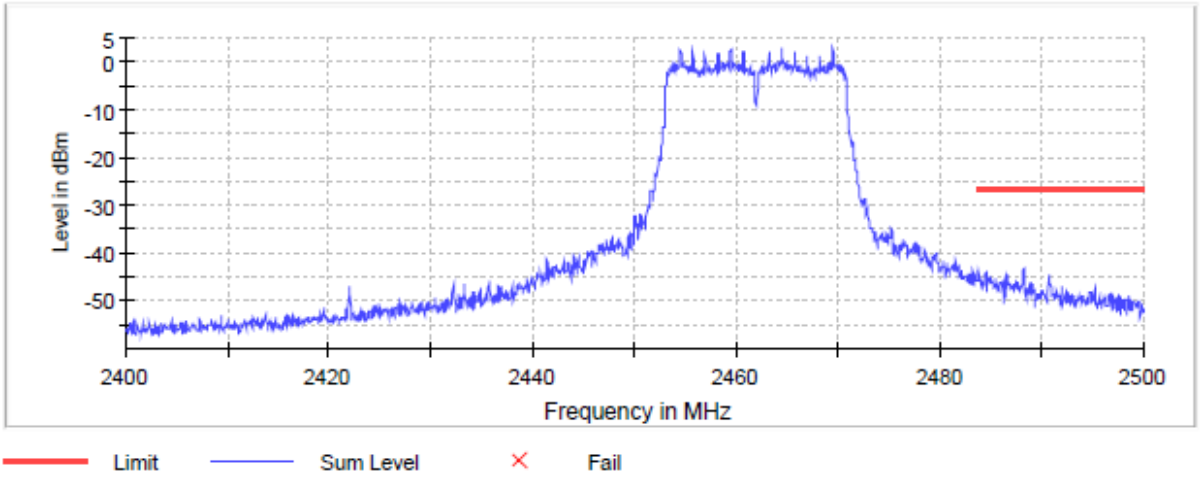
Radio Technology = WLAN g, Operating Frequency = high, Band Edge = high
(S01_166_AB01)



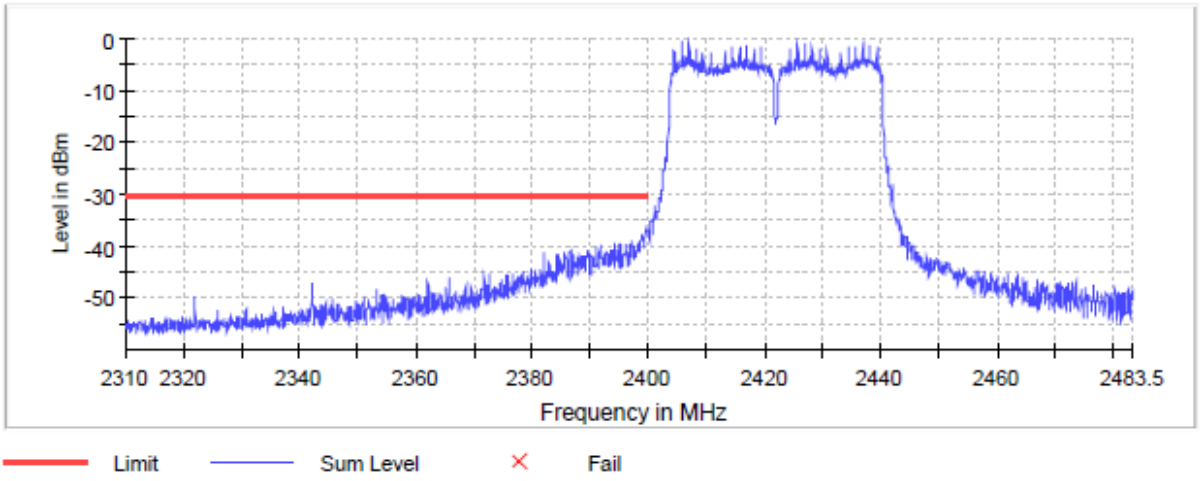
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Band Edge = low
(S01_166_AB01)



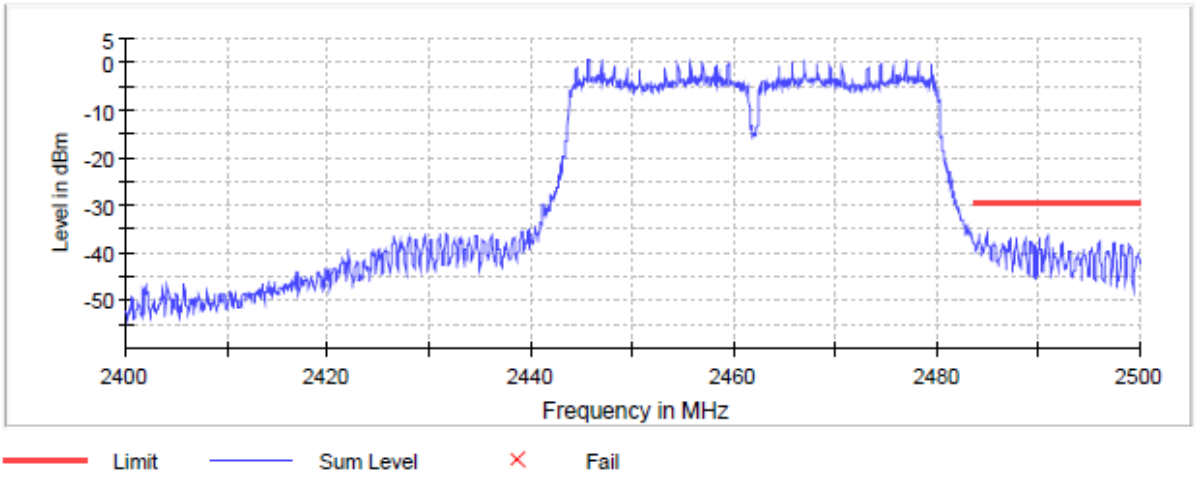
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Band Edge = high (S01_166_AB01)



Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Band Edge = low (S01_166_AB01)



Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Band Edge = high (S01_166_AB01)



5.7.5 TEST EQUIPMENT USED

- R&S TS8997

5.8 BAND EDGE COMPLIANCE RADIATED

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10

5.8.1 TEST DESCRIPTION

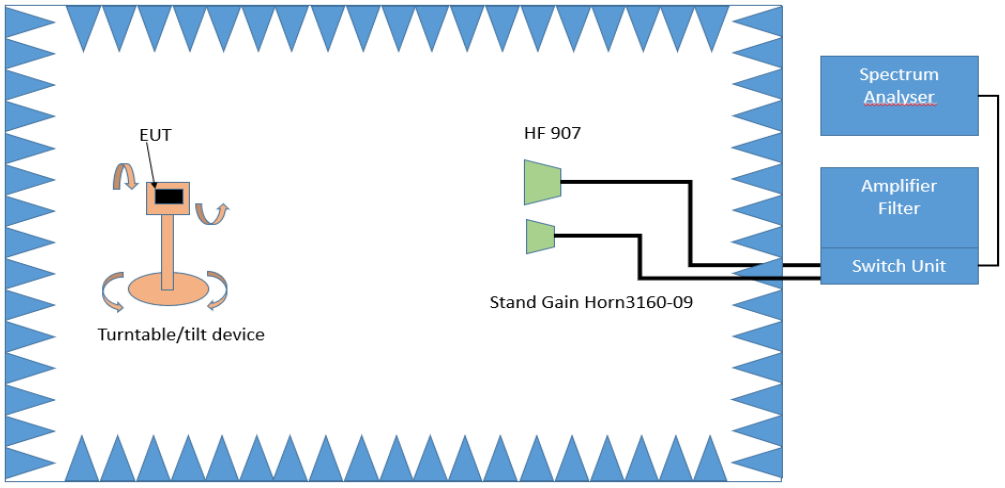
Radiated Measurement with integral antenna or 50 Ohm termination at antenna port

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

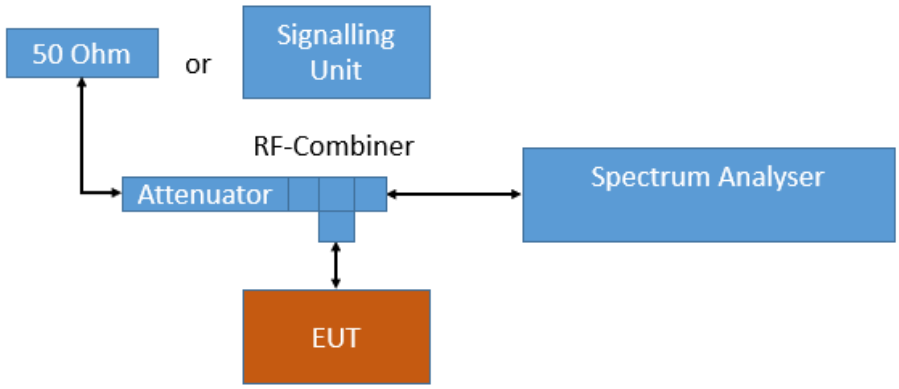
Step 2:
The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
Spectrum analyser settings:
- Detector: Peak

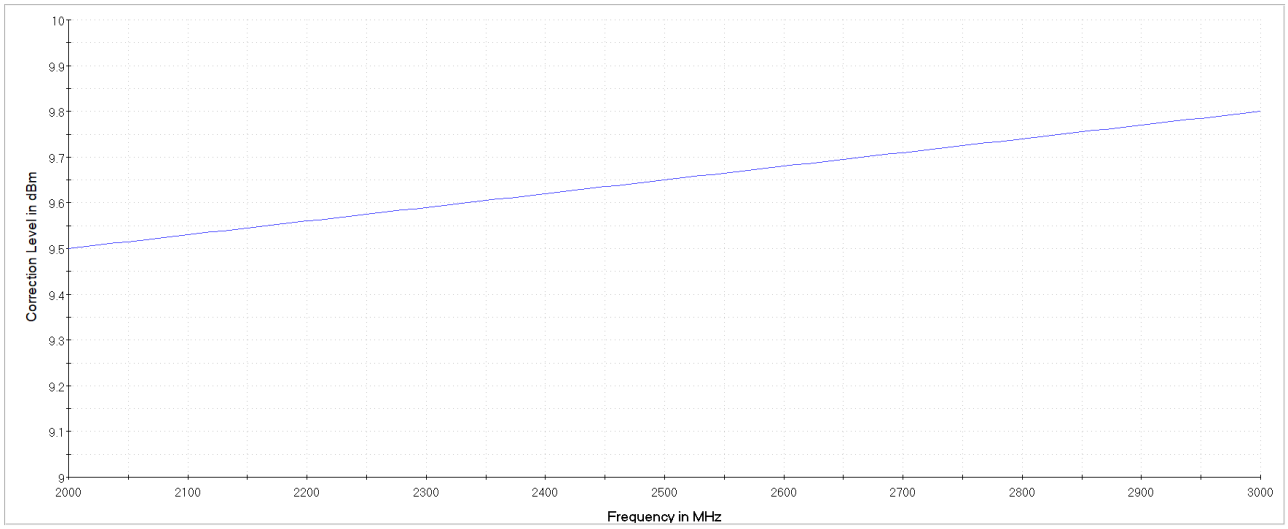
Step 3:
Spectrum analyser settings for step 3:
- Detector: Peak / CISPR Average
- Measured frequencies: in step 1 determined frequencies
- RBW = 1 MHz
- VBW = 3 MHz
- Measuring time: 1 s

Conducted Measurements at antenna ports

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: 2350 – 2500 MHz
- Resolution Bandwidth (RBW): 1000 kHz
- Video Bandwidth (VBW): 3000 kHz
- Trace: Maxhold, Average Power
- Sweeps: 10000
- Sweep Time: coupled
- Detector: Peak, RMS

For the conducted emissions in restricted bands the Value is measured in dBm and then converted to dBµV/m as given in KDB 558074:

1. Measure the conducted output power in dBm.
2. Add the maximum antenna gain in dBi. (Included in measurement result by offset)
3. Add the appropriate ground reflection factor (0 for measured range)
   6 dB for frequencies ≤ 30 MHz;
   4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive; and
   0 dB for frequencies > 1000 MHz).
4. Convert the resultant EIRP level to an equivalent electric field strength level using the following relationship:
   E = EIRP – 20 log D + 104.8
   Where E is the electric field strength in dBµV/m,
   EIRP is the equivalent isotropically radiated power in dBm
   D is the specified measurement distance in m

Value [dBµV/m] = Measured value [dBm] (including gain and ground reflection factor) – 20 log D + 104.8

5.8.2 TEST REQUIREMENTS / LIMITS

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

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

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
0.009 – 0.49	2400/F(kHz)@300m	3	(48.5 – 13.8)@300m
0.49 – 1.705	24000/F(kHz)@30m	3	(33.8 – 23.0)@30m
1.705 – 30	30@30m	3	29.5@30m

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (2).

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 - 26000	500@3m	3	54.0@3m
26000 - 40000	500@3m	1	54.0@3m

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

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

5.8.3 TEST PROTOCOL

Ambient temperature: 24-30 °C
Air Pressure: 990–1020 hPa
Humidity: 30–40 %
BT GFSK
Applied duty cycle correction (AV): 0.1 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2480	2483.5	63.0	PEAK	1000	74.0	11.0
Radiated Integral Antenna	2480	2483.5	36.7	AV	1000	54.0	17.3
Radiated 50 Ohm Termination	2480	2483.5	47.9	PEAK	1000	74.0	26.1
Radiated 50 Ohm Termination	2480	2483.5	34.9	AV	1000	54.0	19.1
Conducted	2402	2390.0	45.5	PEAK	1000	74.0	28.5
Conducted	2402	2390.0	34.2	AV	1000	54.0	19.8
Conducted	2480	2483.5	52.2	PEAK	1000	74.0	21.8
Conducted	2480	2483.5	41.7	AV	1000	54.0	12.3
Conducted	2402	2390.0	45.5	PEAK	1000	74.0	28.5
Conducted	2402	2390.0	34.2	AV	1000	54.0	19.8
Conducted	2480	2483.5	52.2	PEAK	1000	74.0	21.8
Conducted	2480	2483.5	41.7	AV	1000	54.0	12.3

BT π/4 DQPSK (2-DH1)
Applied duty cycle correction (AV): 0.2 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2480	2483.5	57.5	PEAK	1000	74.0	16.5
Radiated Integral Antenna	2480	2483.5	36.0	AV	1000	54.0	18.0
Radiated Integral Antenna	2480	2483.5	57.5	PEAK	1000	74.0	16.5
Radiated Integral Antenna	2480	2483.5	36.0	AV	1000	54.0	18.0
Conducted	2402	2390.0	45.6	PEAK	1000	74.0	28.4
Conducted	2402	2390.0	34.4	AV	1000	54.0	19.6
Conducted	2480	2483.5	57.3	PEAK	1000	74.0	16.7
Conducted	2480	2483.5	41.0	AV	1000	54.0	13.0

BT 8-DPSK (3-DH1)
Applied duty cycle correction (AV): 0.3 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2480	2483.5	55.4	PEAK	1000	74.0	18.6
Radiated Integral Antenna	2480	2483.5	37.2	AV	1000	54.0	16.8
Conducted	2402	2390.0	49.3	PEAK	1000	74.0	24.7
Conducted	2402	2390.0	34.3	AV	1000	54.0	19.7
Conducted	2480	2483.5	57.9	PEAK	1000	74.0	16.1
Conducted	2480	2483.5	42.9	AV	1000	54.0	11.1

BT LE 1 Mbit/s
Applied duty cycle correction (AV): 1.4 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Conducted	2402	2390.0	47.1	PEAK	1000	74.0	26.9
Conducted	2402	2390.0	35.9	AV	1000	54.0	18.1
Conducted	2480	2483.5	58.7	PEAK	1000	74.0	15.3
Conducted	2480	2483.5	43.3	AV	1000	54.0	10.7

BT LE 2 Mbit/s
Applied duty cycle correction (AV): 7.4 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2480	2483.5	52.6	PEAK	1000	74.0	21.4
Radiated Integral Antenna	2480	2483.5	43.2	AV	1000	54.0	10.8
Conducted	2402	2390.0	49.4	PEAK	1000	74.0	24.6
Conducted	2402	2390.0	44.9	AV	1000	54.0	9.1
Conducted	2480	2483.5	64.8	PEAK	1000	74.0	9.2
Conducted	2480	2483.5	52.9	AV	1000	54.0	1.1

WLAN b-Mode; 20 MHz; 1 Mbit/s
Applied duty cycle correction (AV): 0 dB

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2462	2483.5	52.0	PEAK	1000	74.0	22.0
Radiated Integral Antenna	2462	2483.5	39.8	AV	1000	54.0	14.2
Radiated 50 Ohm Termination	2462	2483.5	48.2	PEAK	1000	74.0	25.8
Radiated 50 Ohm Termination	2462	2483.5	35.0	AV	1000	54.0	19.0
Conducted	2412	2390.0	58.1	PEAK	1000	74.0	16.0
Conducted	2412	2390.0	49.1	AV	1000	54.0	4.9
Conducted	2462	2483.5	58.2	PEAK	1000	74.0	15.8
Conducted	2462	2483.5	48.9	AV	1000	54.0	5.1

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

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2462	2483.5	62.0	PEAK	1000	74.0	12.0
Radiated Integral Antenna	2462	2483.5	42.5	AV	1000	54.0	11.5
Conducted	2412	2390.0	71.4	PEAK	1000	74.0	2.6
Conducted	2412	2390.0	50.0	AV	1000	54.0	4.0
Conducted	2417	2390.0	72.8	PEAK	1000	74.0	1.2
Conducted	2417	2390.0	52.2	AV	1000	54.0	1.8
Conducted	2452	2483.5	72.8	PEAK	1000	74.0	1.2
Conducted	2452	2483.5	51.4	AV	1000	54.0	2.6
Conducted	2457	2483.5	72.6	PEAK	1000	74.0	1.4
Conducted	2457	2483.5	49.6	AV	1000	54.0	4.4
Conducted	2462	2483.5	72.1	PEAK	1000	74.0	1.9
Conducted	2462	2483.5	49.7	AV	1000	54.0	4.3

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

Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2462	2483.5	60.8	PEAK	1000	74.0	13.2
Radiated Integral Antenna	2462	2483.5	42.8	AV	1000	54.0	11.2
Conducted	2412	2390.0	71.1	PEAK	1000	74.0	2.9
Conducted	2412	2390.0	49.2	AV	1000	54.0	4.8
Conducted	2417	2390.0	66.3	PEAK	1000	74.0	7.7
Conducted	2417	2390.0	47.9	AV	1000	54.0	6.1
Conducted	2457	2483.5	68.9	PEAK	1000	74.0	5.1
Conducted	2457	2483.5	48.5	AV	1000	54.0	5.5
Conducted	2462	2483.5	73.0	PEAK	1000	74.0	1.0
Conducted	2462	2483.5	48.9	AV	1000	54.0	5.1

WLAN n-Mode; 40 MHz; MCS0
Applied duty cycle correction (AV): 0.2 dB

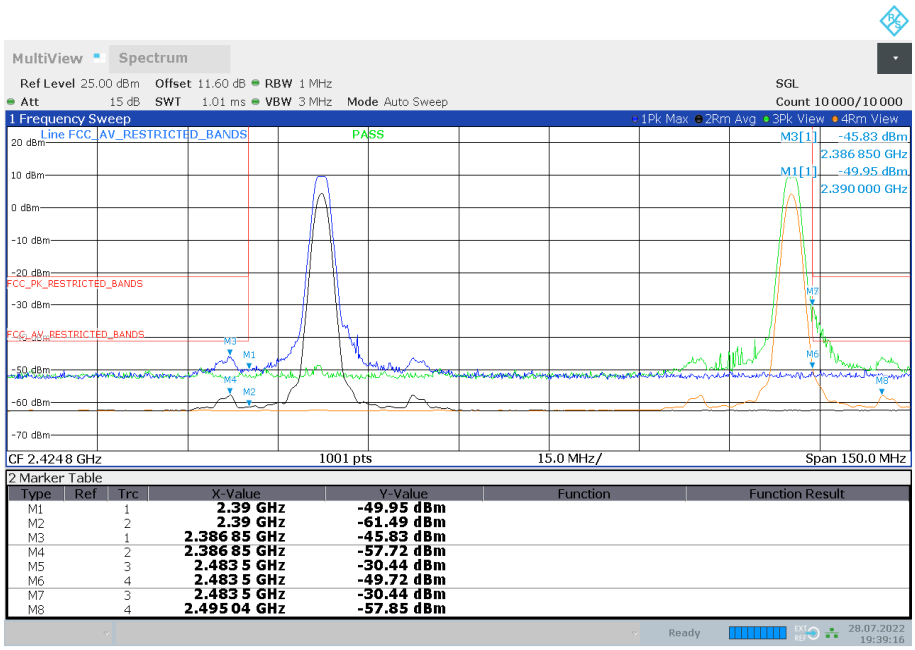
Measurement Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
Radiated Integral Antenna	2452	2483.5	63.9	PEAK	1000	74.0	10.1
Radiated Integral Antenna	2452	2483.5	43.7	AV	1000	54.0	10.3
Conducted	2422	2390.0	71.4	PEAK	1000	74.0	2.6
Conducted	2422	2390.0	51.1	AV	1000	54.0	2.9
Conducted	2432	2390.0	70.8	PEAK	1000	74.0	3.2
Conducted	2432	2390.0	50.4	AV	1000	54.0	3.6
Conducted	2437	2483.5	72.4	PEAK	1000	74.0	1.6
Conducted	2437	2483.5	49.7	AV	1000	54.0	4.3
Conducted	2452	2483.5	73.5	PEAK	1000	74.0	0.5
Conducted	2452	2483.5	51.8	AV	1000	54.0	2.2

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

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

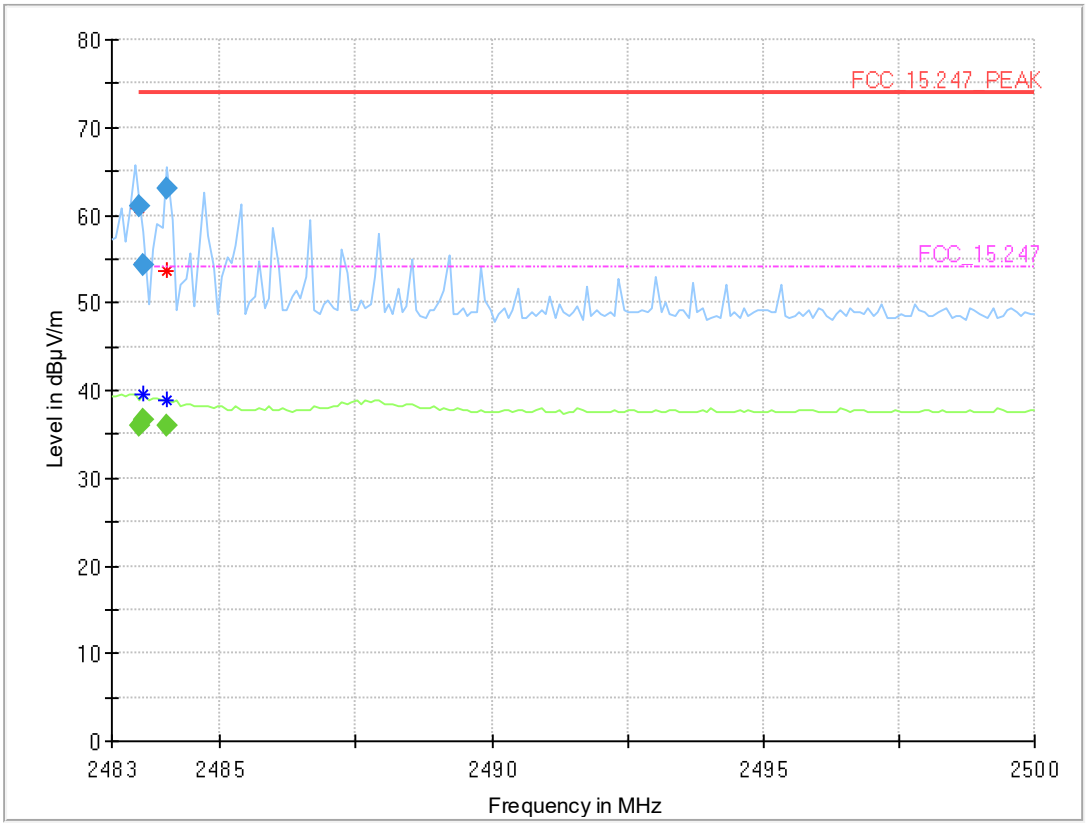
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = low + high, Band Edge = low + high

(S01_166_AB01)



19:39:17 28.07.2022

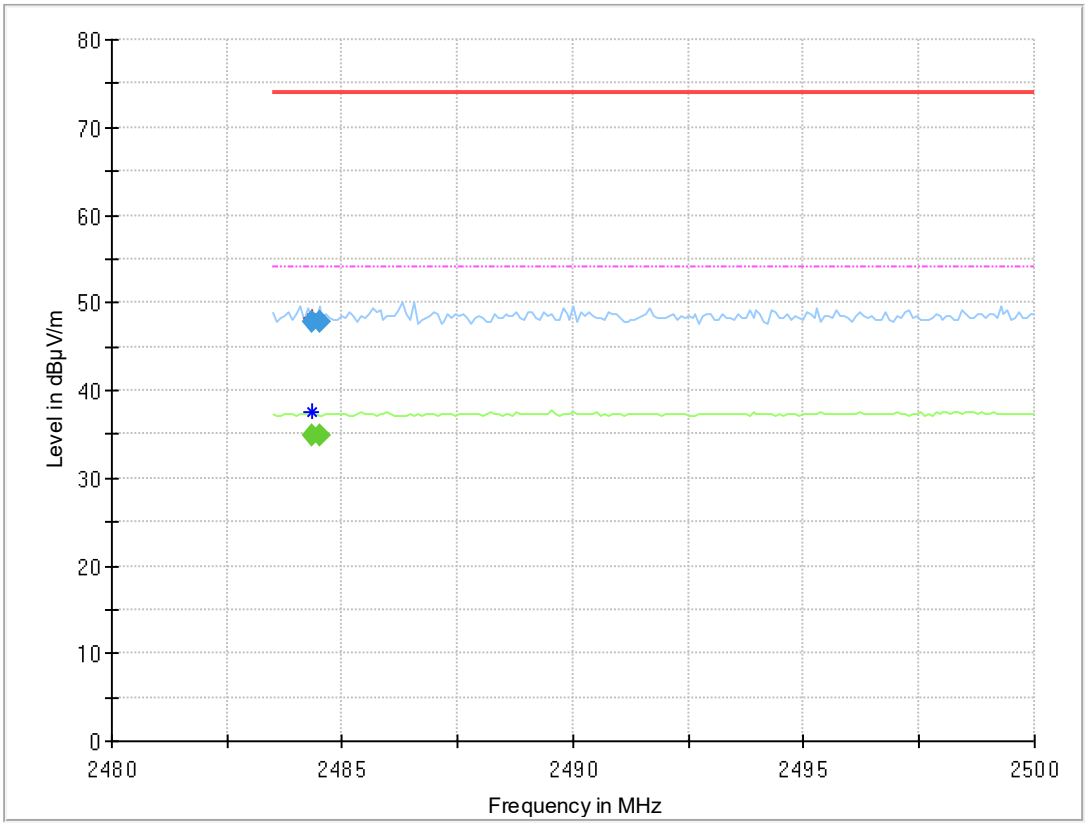
Radio Technology = Bluetooth BDR, Operating Frequency = high, Band Edge = high (S02_166_AE01)



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)
2483.510	---	35.9	54.00	18.07	1000.0	1000.000	150.0	H	-122.0	79.0	5.3
2483.510	61.0	---	74.00	13.00	1000.0	1000.000	150.0	H	-122.0	79.0	5.3
2483.595	---	36.6	54.00	17.35	1000.0	1000.000	150.0	H	-173.0	0.0	5.3
2483.595	54.3	---	74.00	19.67	1000.0	1000.000	150.0	H	-173.0	0.0	5.3
2484.020	---	36.1	54.00	17.92	1000.0	1000.000	150.0	H	-169.0	-7.0	5.3
2484.020	63.0	---	74.00	10.96	1000.0	1000.000	150.0	H	-60.0	98.0	5.3

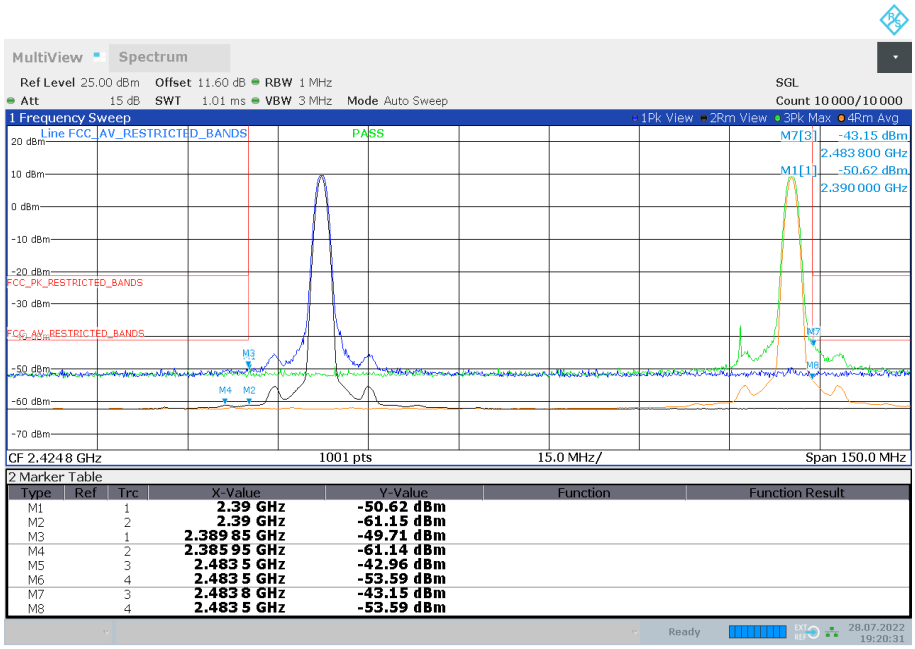
Radio Technology = Bluetooth BDR, Operating Frequency = high, Band Edge = high (S02_166_AB01)



Final_Result

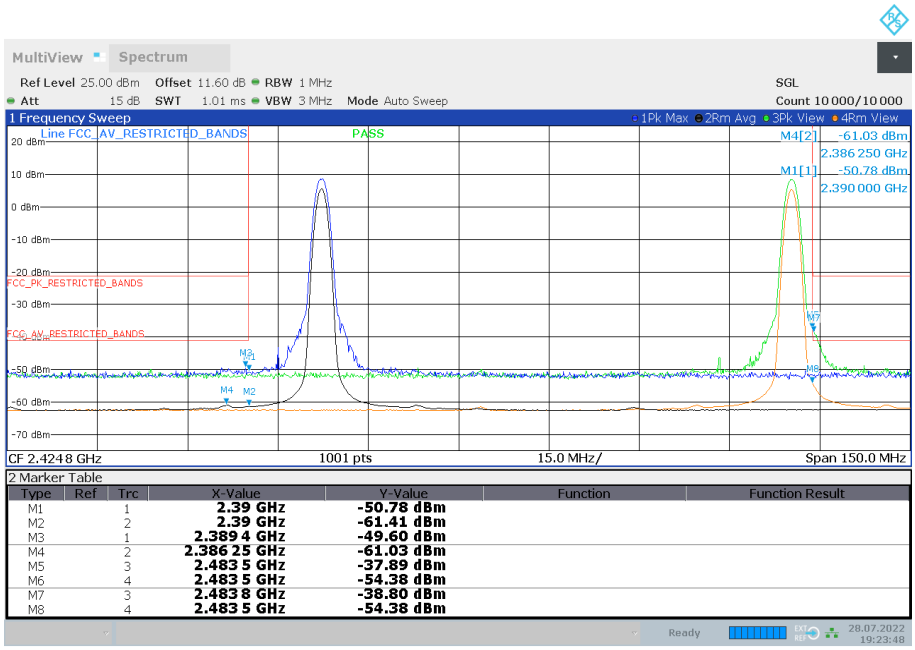
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2484.325	---	34.8	54.00	19.19	1000.0	1000.000	150.0	H	-52.0	4.0	5.3
2484.325	47.9	---	74.00	26.10	1000.0	1000.000	150.0	H	-52.0	4.0	5.3
2484.490	---	34.8	54.00	19.19	1000.0	1000.000	150.0	V	116.0	94.0	5.3
2484.490	47.8	---	74.00	26.23	1000.0	1000.000	150.0	V	116.0	94.0	5.3

Radio Technology = Bluetooth BDR, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



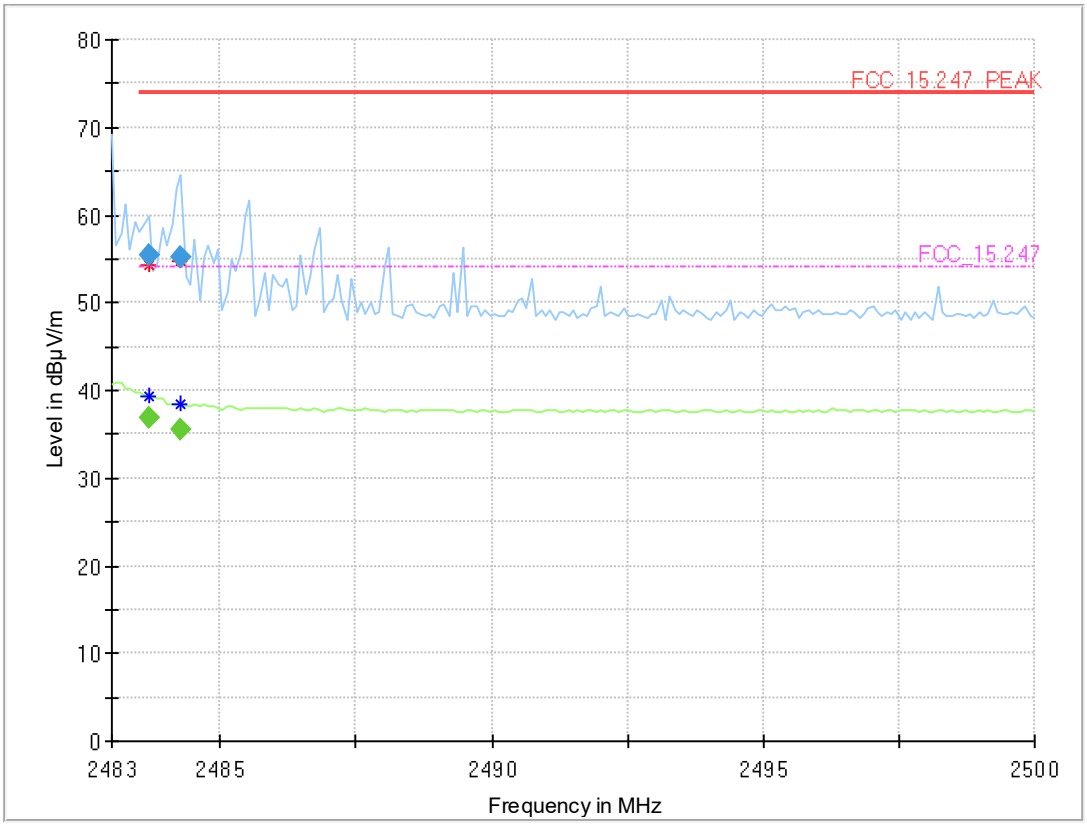
19:20:32 28.07.2022

Radio Technology = Bluetooth EDR 2, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



19:23:49 28.07.2022

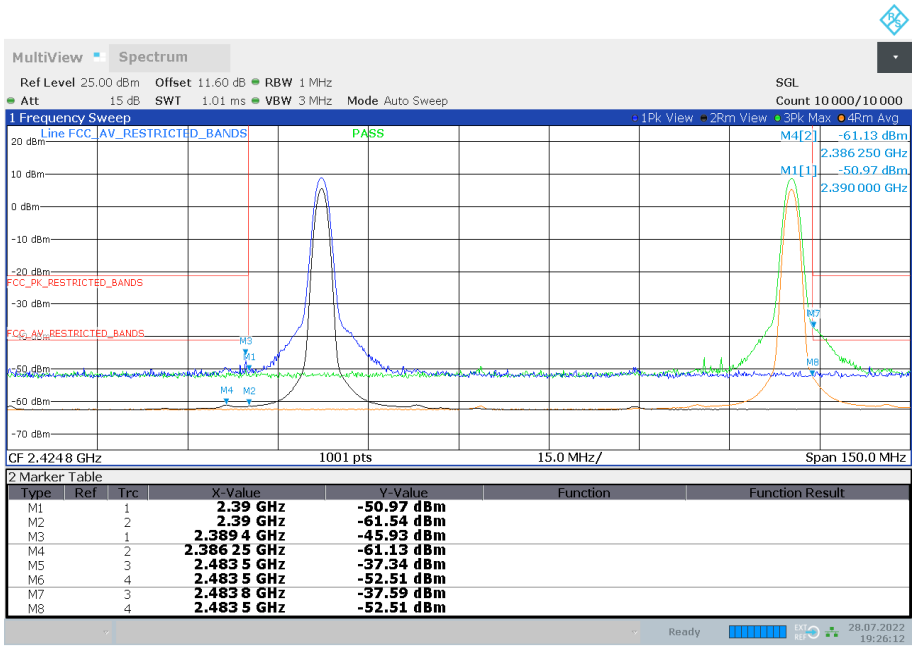
Radio Technology = Bluetooth EDR 3, Operating Frequency = high, Band Edge = high (S02_166_AE01)



Final_Result

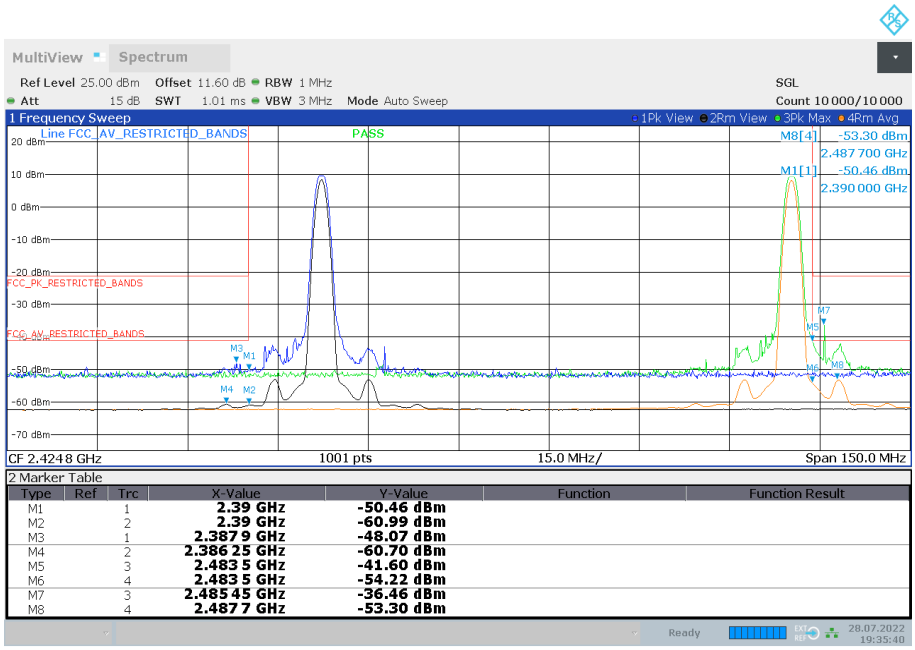
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2483.680	---	36.9	54.00	17.13	1000.0	1000.000	150.0	H	-173.0	2.0	5.3
2483.680	55.4	---	74.00	18.63	1000.0	1000.000	150.0	H	-173.0	2.0	5.3
2484.275	---	35.6	54.00	18.37	1000.0	1000.000	150.0	H	-139.0	84.0	5.3
2484.275	55.2	---	74.00	18.80	1000.0	1000.000	150.0	H	-139.0	84.0	5.3

Radio Technology = Bluetooth EDR 3, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



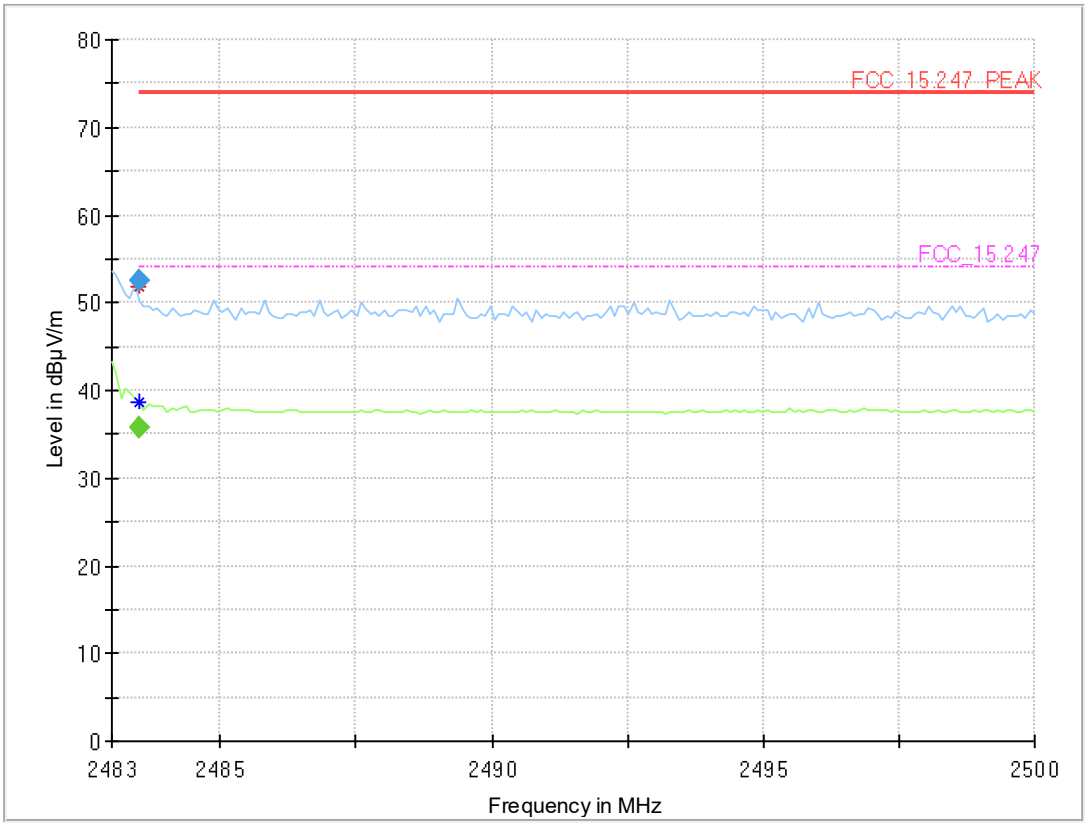
19:26:12 28.07.2022

Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



19:35:40 28.07.2022

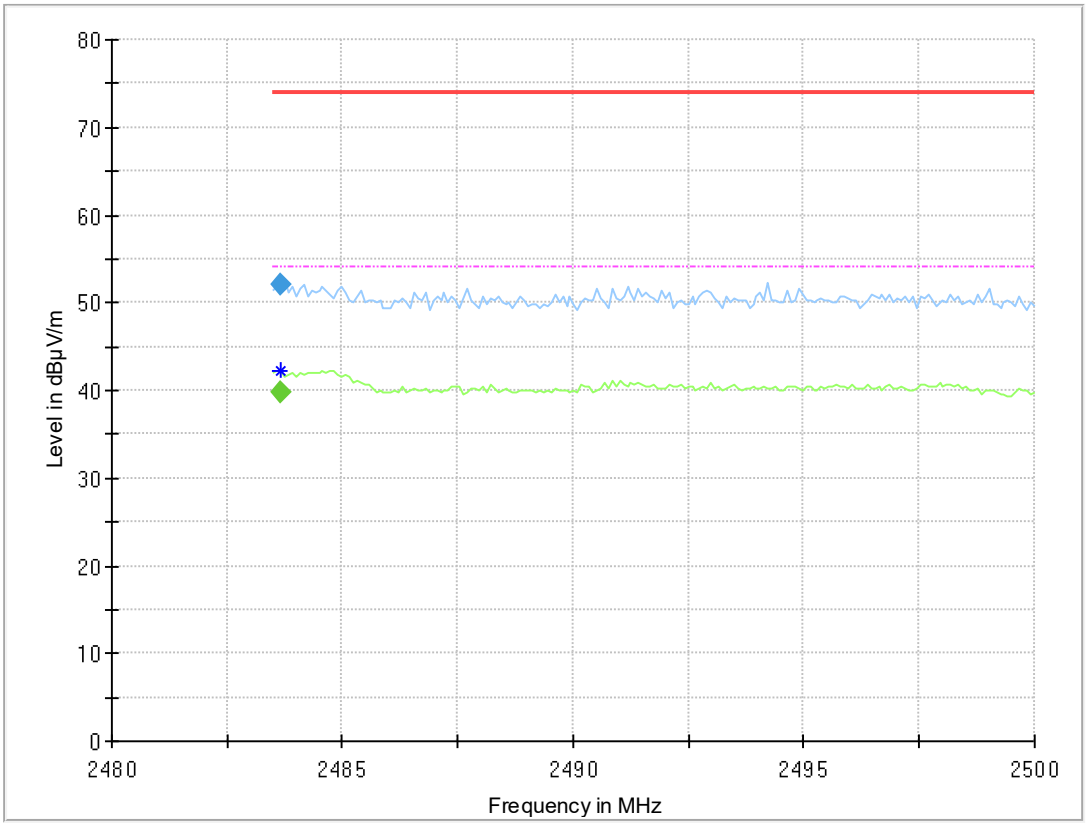
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Band Edge = high (S02_166_AE01)



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)
2483.510	---	35.8	54.00	18.24	1000.0	1000.000	150.0	H	-159.0	8.0	5.3
2483.510	52.6	---	74.00	21.45	1000.0	1000.000	150.0	H	-159.0	8.0	5.3

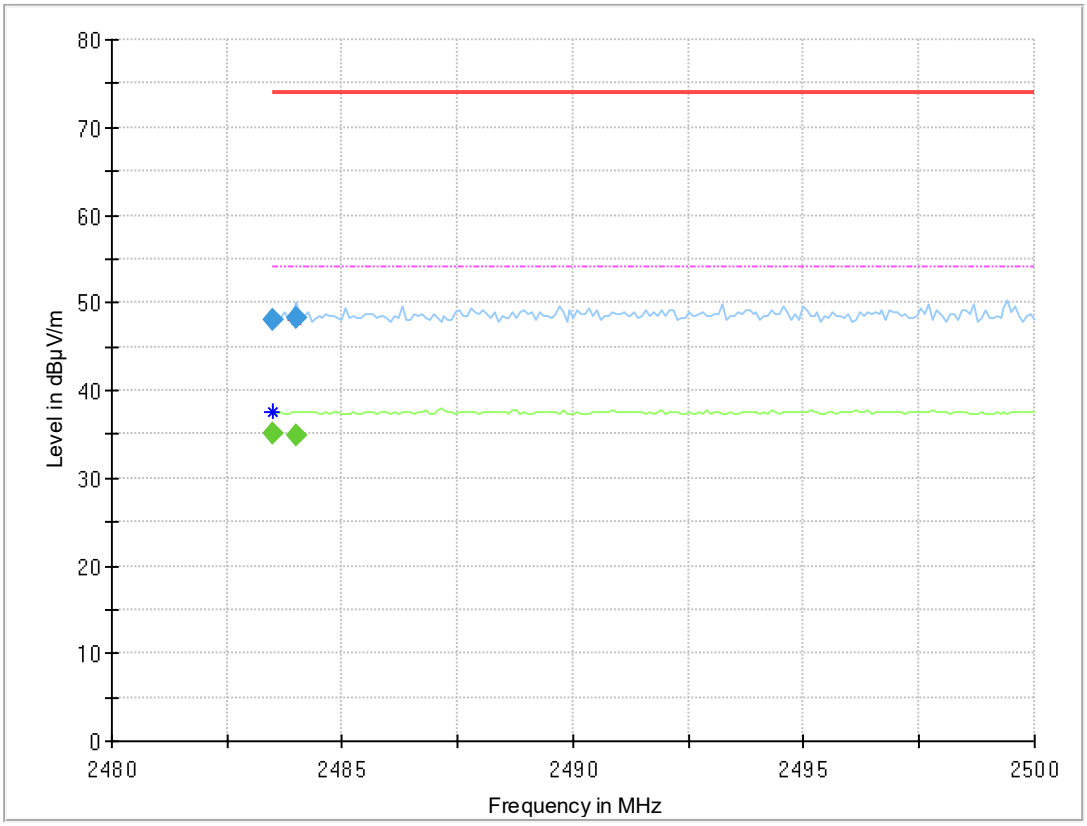
Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high
(S02_166_AE01)



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)
2483.665	---	39.8	54.00	14.24	1000.0	1000.000	150.0	H	-161.0	8.0	5.3
2483.665	52.0	---	74.00	22.01	1000.0	1000.000	150.0	H	-161.0	8.0	5.3

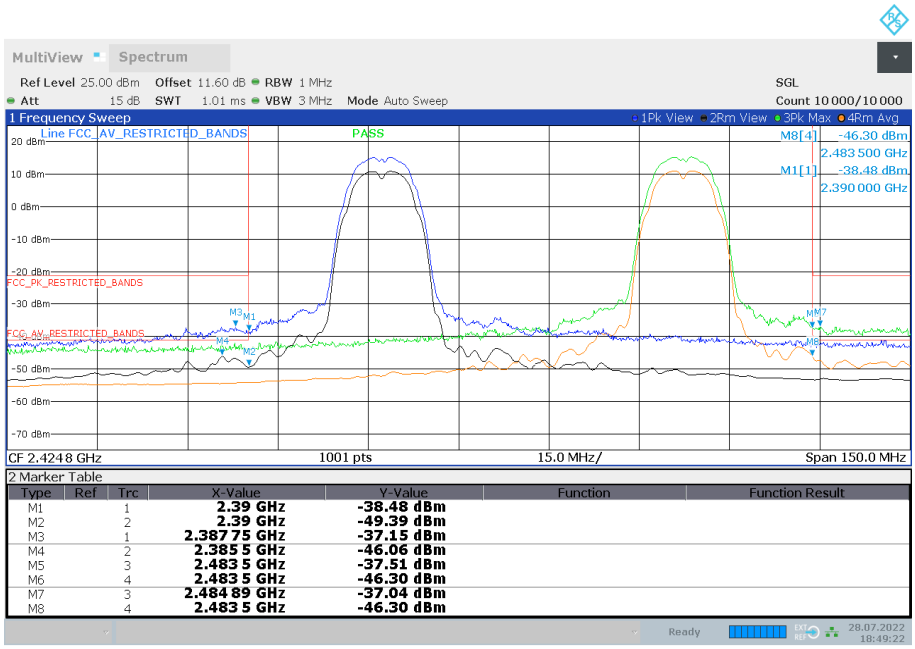
Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high
(S02_166_AB01)



Final_Result

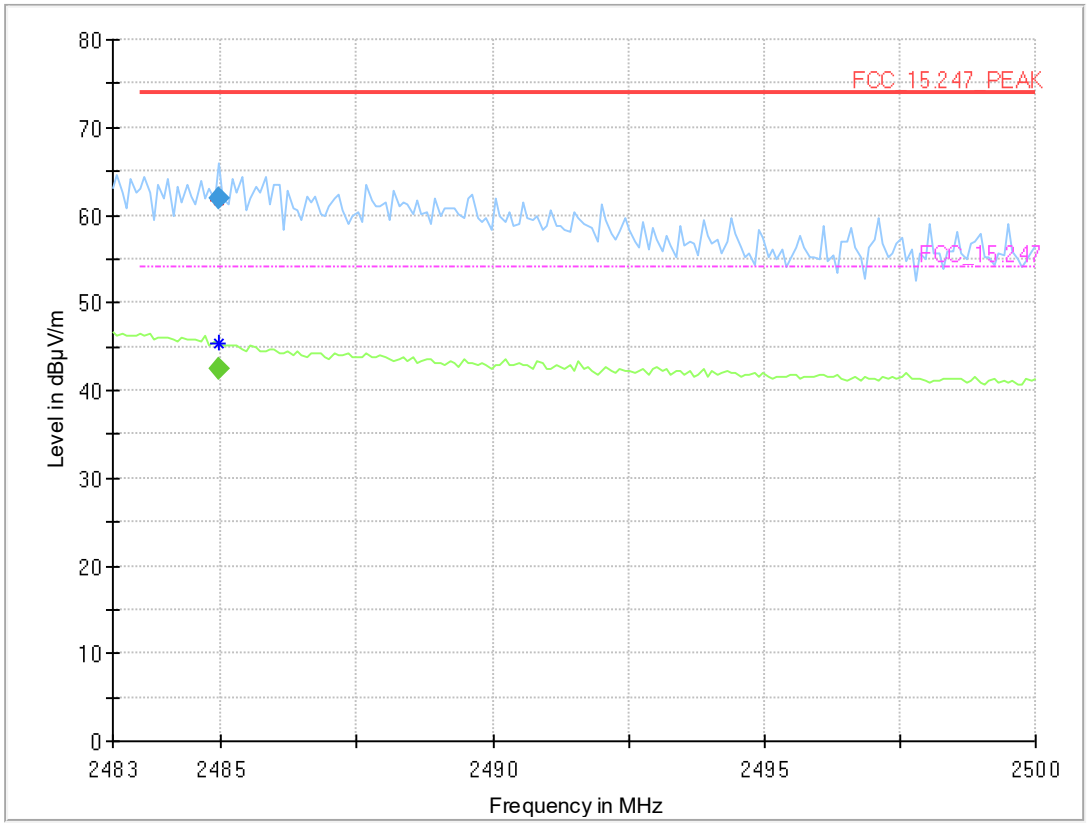
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2483.500	48.1	---	74.00	25.93	1000.0	1000.000	150.0	H	64.0	105.0	5.3
2483.500	---	35.0	54.00	18.96	1000.0	1000.000	150.0	H	64.0	105.0	5.3
2483.995	48.2	---	74.00	25.78	1000.0	1000.000	150.0	V	-66.0	91.0	5.3
2483.995	---	35.0	54.00	19.04	1000.0	1000.000	150.0	V	-66.0	91.0	5.3

Radio Technology = WLAN b, Operating Frequency = low + high, Band Edge = low + high (S01_166_AB01)



18:49:22 28.07.2022

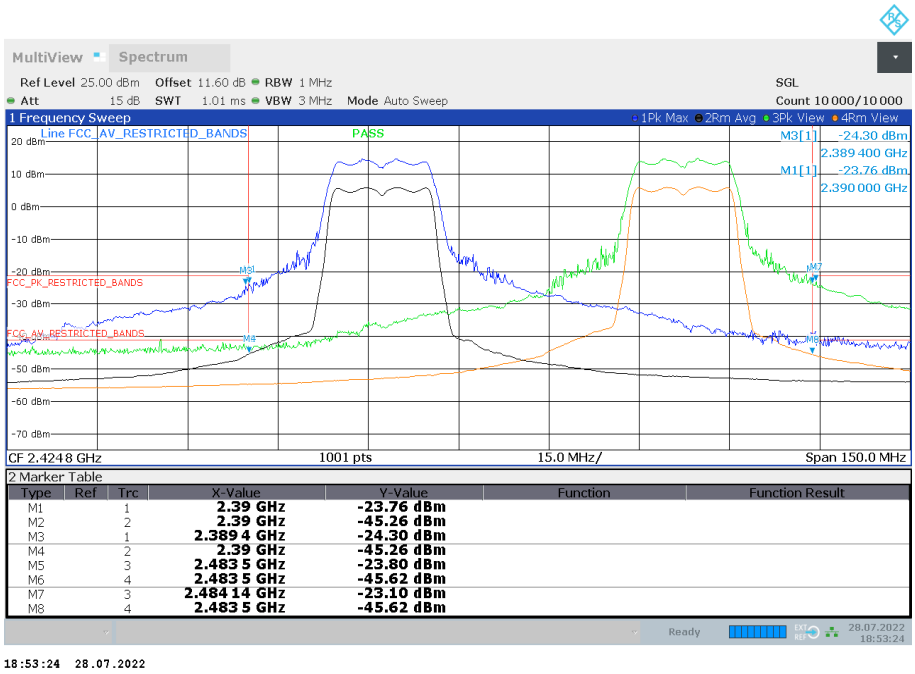
Radio Technology = WLAN g, Operating Frequency = high, Band Edge = high (S02_166_AG01)



Final_Result

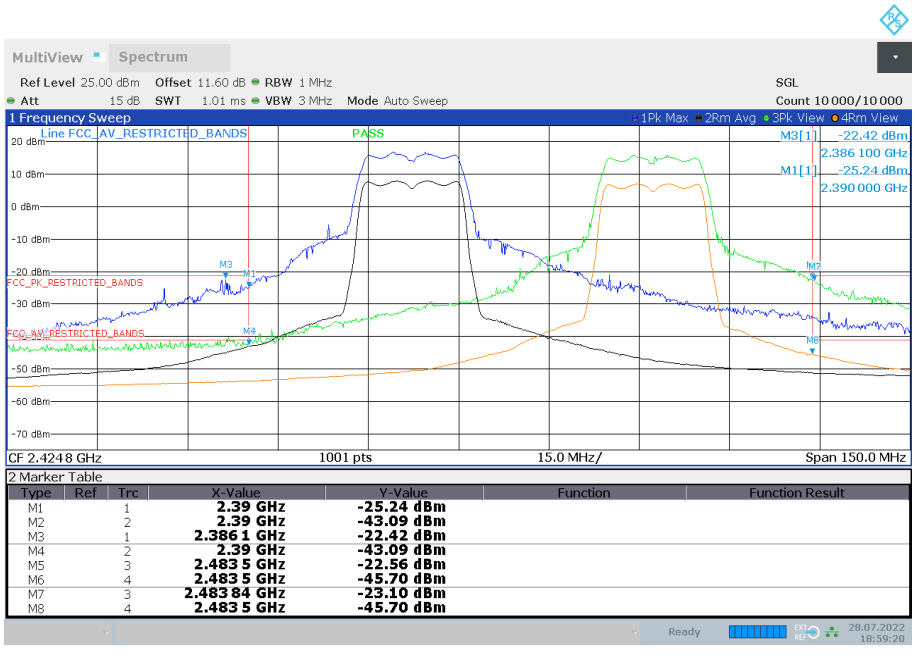
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2484.955	---	42.4	54.00	11.57	1000.0	1000.000	150.0	H	-191.0	6.0	5.3
2484.955	62.0	---	74.00	12.01	1000.0	1000.000	150.0	H	-191.0	6.0	5.3

Radio Technology = WLAN g, Operating Frequency = low + high, Band Edge = low + high (S01_166_AB01)



18:53:24 28.07.2022

TX on 2412 and 2462 MHz



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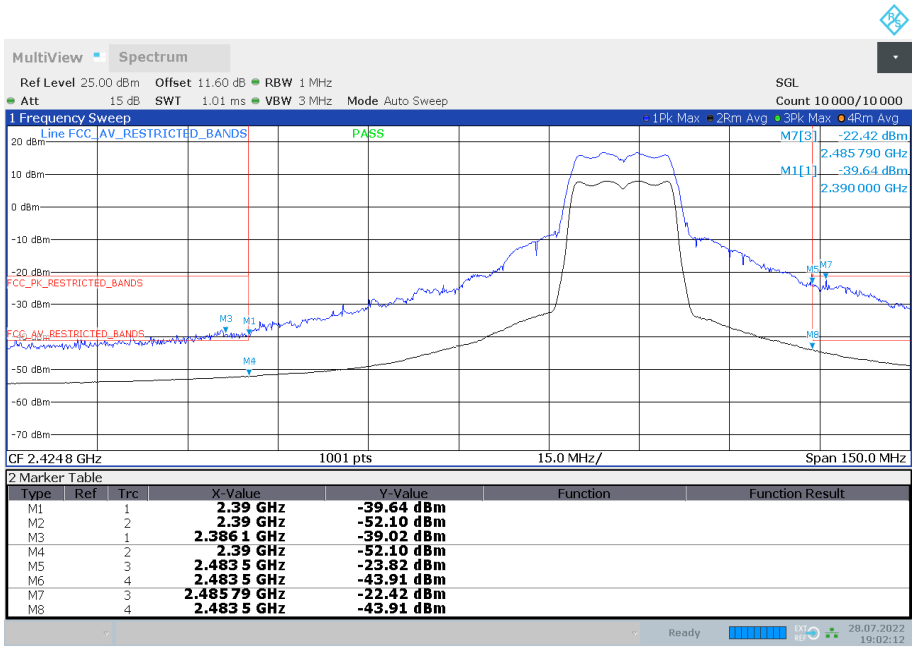
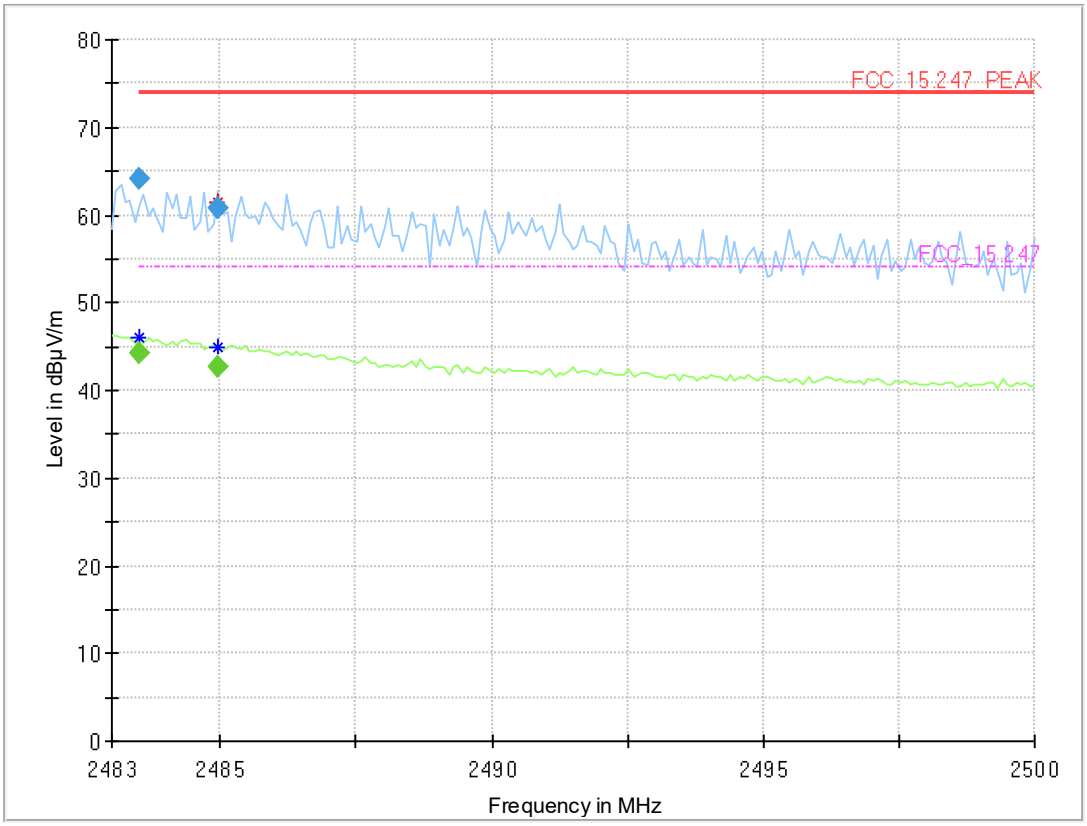
TX on 2417 and 2457 MHz



TX on 2452 MHz

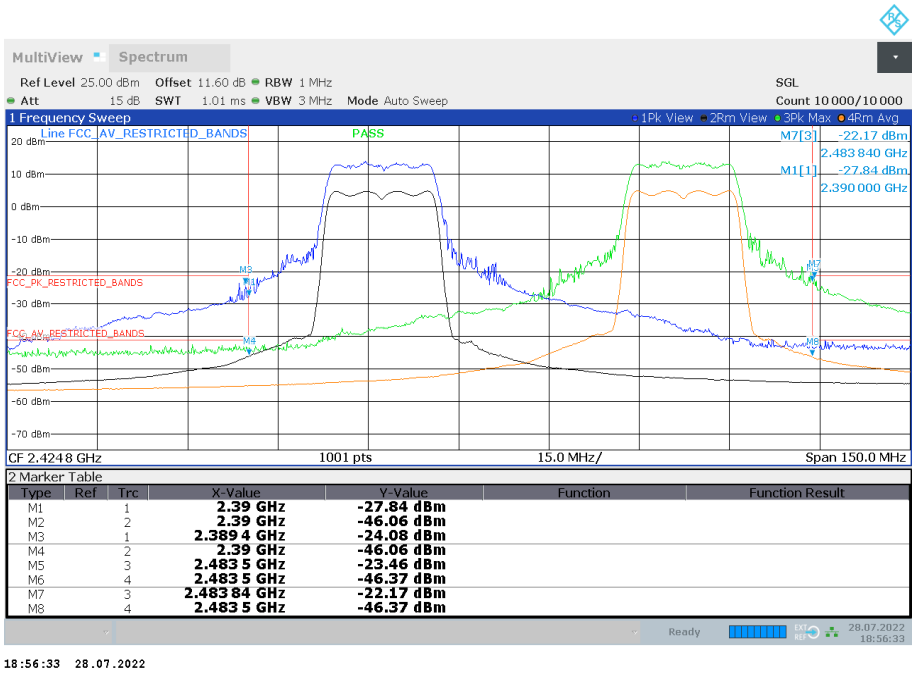
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Band Edge = high (S02_166_AG01)



Final_Result

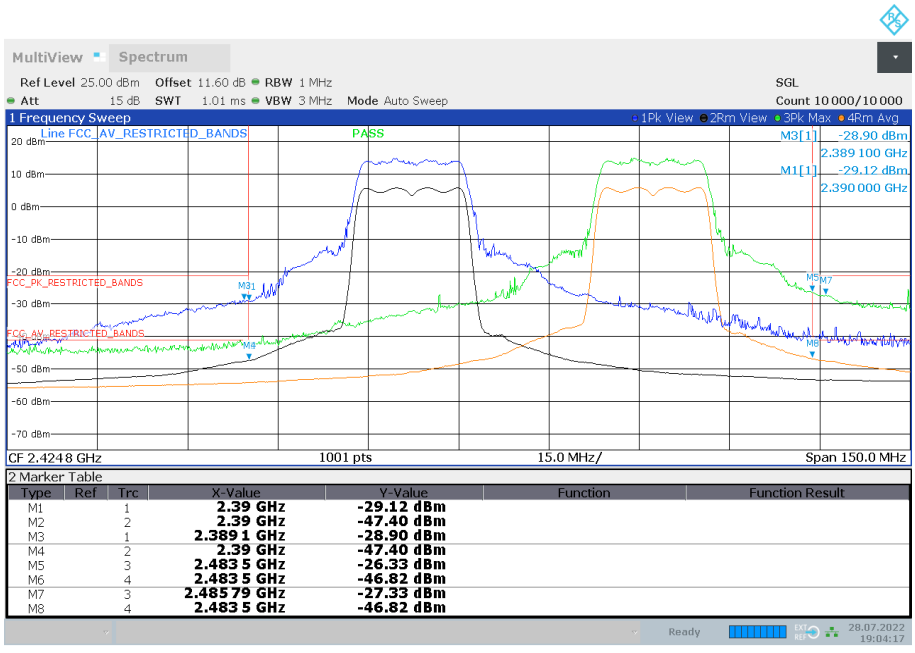
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2483.510	---	44.3	54.00	9.71	1000.0	1000.000	150.0	H	-161.0	15.0	5.3
2483.510	64.0	---	74.00	9.97	1000.0	1000.000	150.0	H	-161.0	15.0	5.3
2484.955	---	42.7	54.00	11.32	1000.0	1000.000	150.0	H	-191.0	6.0	5.3
2484.955	60.8	---	74.00	13.18	1000.0	1000.000	150.0	H	-191.0	6.0	5.3

Radio Technology = WLAN n 20 MHz, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



18:56:33 28.07.2022

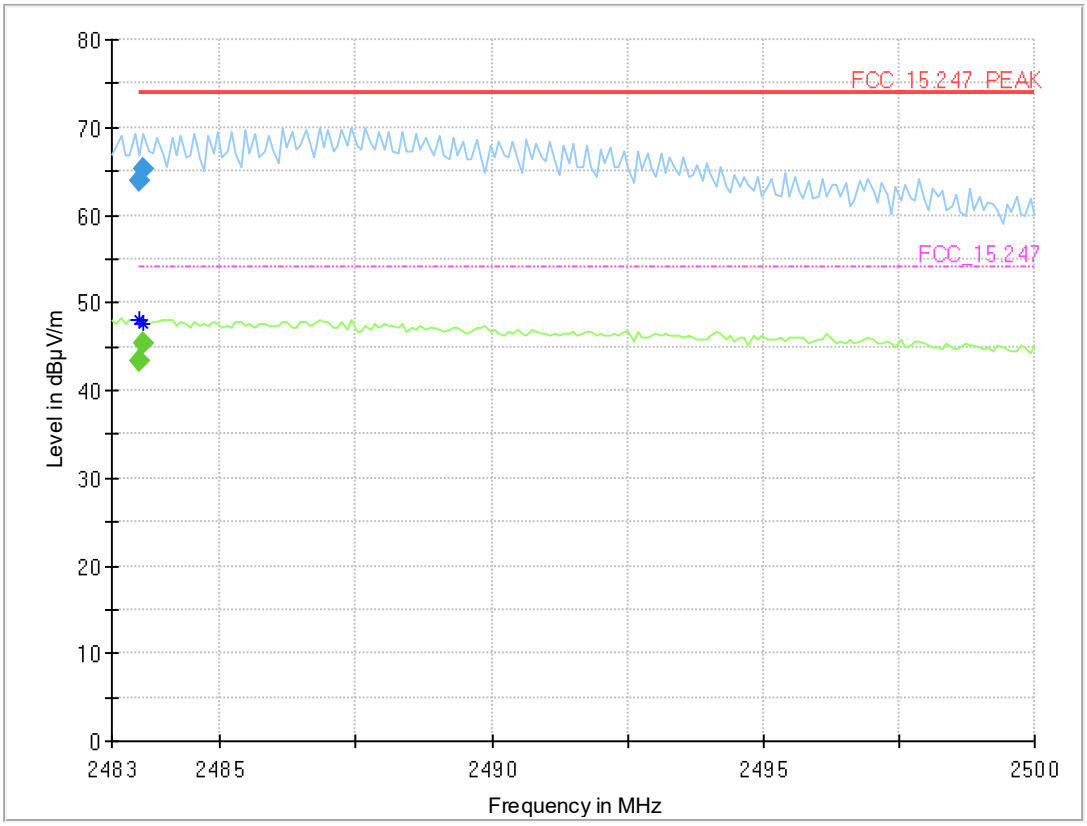
TX on 2412 MHz and 2462 MHz



19:04:18 28.07.2022

TX on 2417 and 2457 MHz

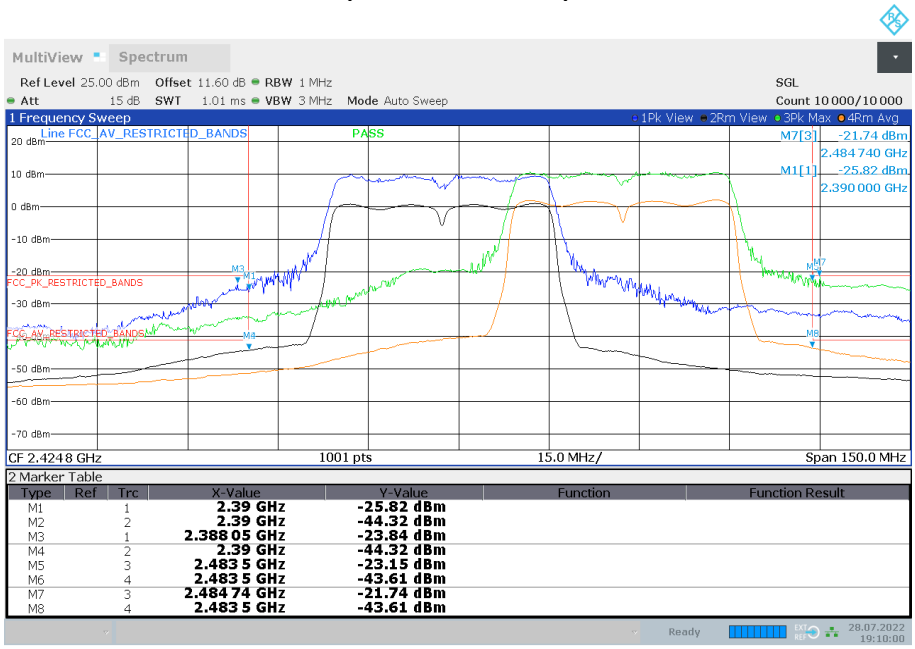
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Band Edge = high (S02_166_AG01)



Final_Result

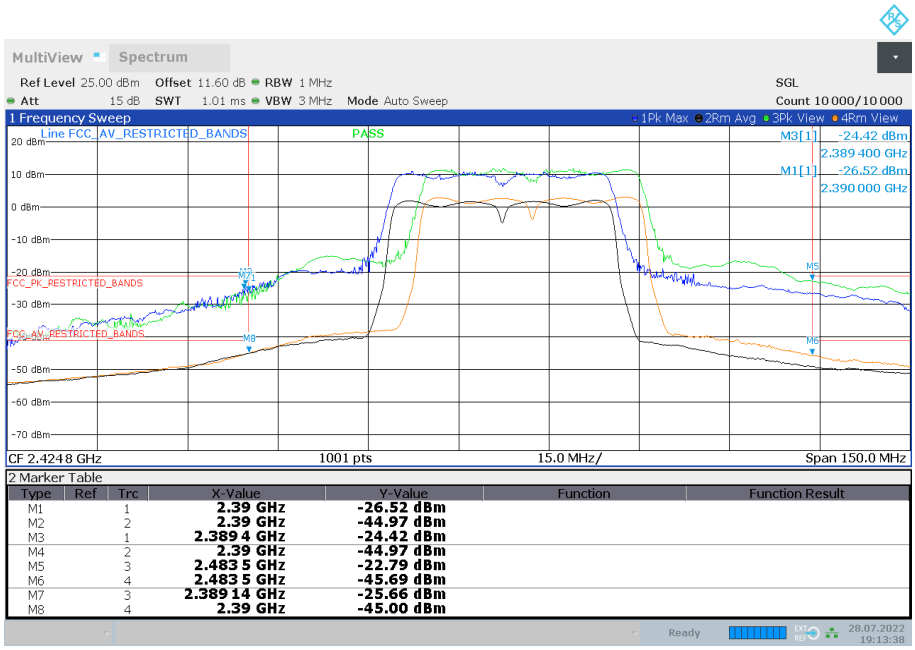
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
2483.510	---	43.5	54.00	10.54	1000.0	1000.000	150.0	V	109.0	96.0	5.3
2483.510	63.9	---	74.00	10.14	1000.0	1000.000	150.0	V	109.0	96.0	5.3
2483.595	---	45.4	54.00	8.59	1000.0	1000.000	150.0	H	-191.0	0.0	5.3
2483.595	65.3	---	74.00	8.72	1000.0	1000.000	150.0	H	-191.0	0.0	5.3

Radio Technology = WLAN n 40 MHz, Operating Frequency = low + high, Band Edge = low + high
(S01_166_AB01)



19:10:01 28.07.2022

TX on 2422 and 2452 MHz



19:13:38 28.07.2022

TX on 2432 and 2437 MHz

5.8.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 GHz FCC
- R&S TS8997

5.9 POWER DENSITY

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10 11.10.2, 11.10.7

5.9.1 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.

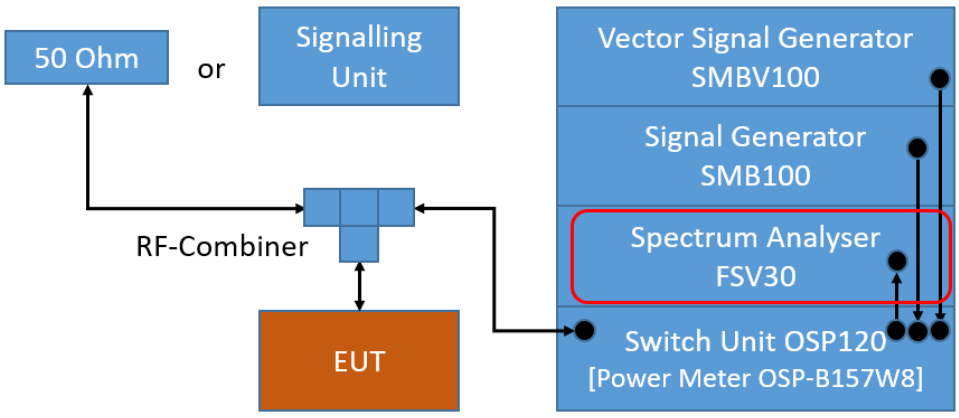
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

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

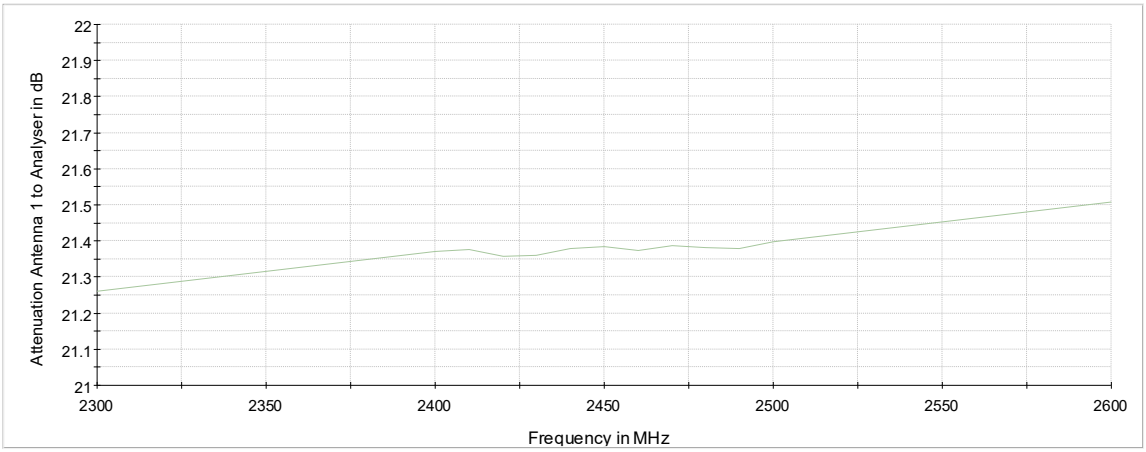
Analyser settings:
- Resolution Bandwidth (RBW): 100 kHz, 10 kHz or 3 kHz
- Video Bandwidth (VBW): ≥ 3 times RBW
- Trace: Maxhold
- Sweeps: Till stable (min. 200, max. 15000)
- Sweeptime: Auto
- Detector: Peak

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)
- Sweeptime: ≤ Number of Sweep Points x minimum transmission duration
- Detector: RMS



TS8997; Power Spectral Density



Attenuation of the measurement path

5.9.2 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

5.9.3 TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1006 hPa
Humidity: 53 %

BT GFSK

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	0	2402	2.2	10.0	8.0	5.8
	39	2441	2.0	10.0	8.0	6.0
	78	2480	1.8	10.0	8.0	6.2

BT π/4 DQPSK

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	0	2402	-0.8	10.0	8.0	8.8
	39	2441	-1.1	10.0	8.0	9.1
	78	2480	-1.1	10.0	8.0	9.1

BT 8-DPSK

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	0	2402	-0.9	10.0	8.0	8.9
	39	2441	-0.9	10.0	8.0	8.9
	78	2480	-1.1	10.0	8.0	9.1

BT LE 1 Mbit/s

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	0	2402	-2.2	10.0	8.0	10.2
	19	2440	-2.2	10.0	8.0	10.2
	39	2480	-2.4	10.0	8.0	10.4

BT LE 2 Mbit/s

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	0	2402	-5.6	10.0	8.0	13.6
	19	2440	-5.8	10.0	8.0	13.8
	39	2480	-5.9	10.0	8.0	13.9

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

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-0.2	100.0	8.0	8.2
	6	2437	0.3	100.0	8.0	7.7
	11	2462	0.4	100.0	8.0	7.6

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

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-4.8	100.0	8.0	12.8
	6	2437	-2.6	100.0	8.0	10.6
	11	2462	-4.7	100.0	8.0	12.7

WLAN n-Mode; 20 MHz; MCS0

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	-5.9	100.0	8.0	13.9
	6	2437	-4.6	100.0	8.0	12.6
	11	2462	-5.3	100.0	8.0	13.3

WLAN n-Mode; 40 MHz; MCS0

Band	Channel No.	Frequency [MHz]	Power Density [dBm / RBW]	RBW [kHz]	Limit [dBm/3kHz]	Margin to Limit [dB]
2.4 GHz ISM	3	2422	-9.5	100.0	8.0	17.5
	6	2437	-7.2	100.0	8.0	15.2
	9	2452	-8.0	100.0	8.0	16.0

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

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

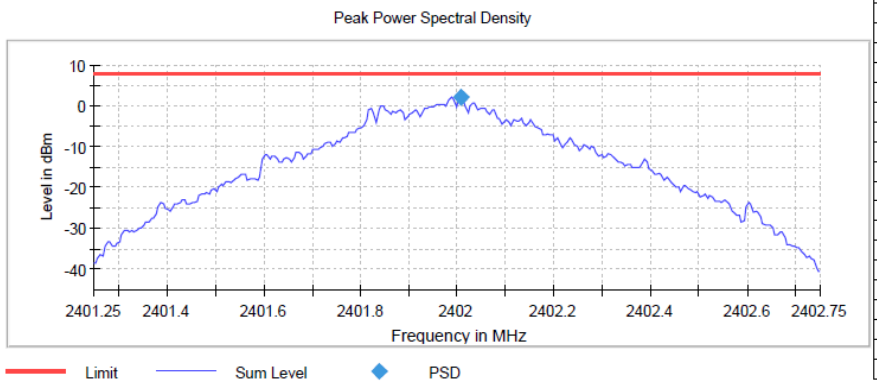
Radio Technology = BT Classic GFSK, Operating Frequency = mid
(S01_166_AB01)

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2402.007500	2.166	8.0	PASS

Ports

Port	State
1	used



Setting	Instrument Value
Start Frequency	2.40125 GHz
Stop Frequency	2.40275 GHz
Span	1.500 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	300
Sweeptime	1.500 ms
Reference Level	10.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	6 / max. 150
Stable	2 / 2
Max Stable Difference	0.23 dB

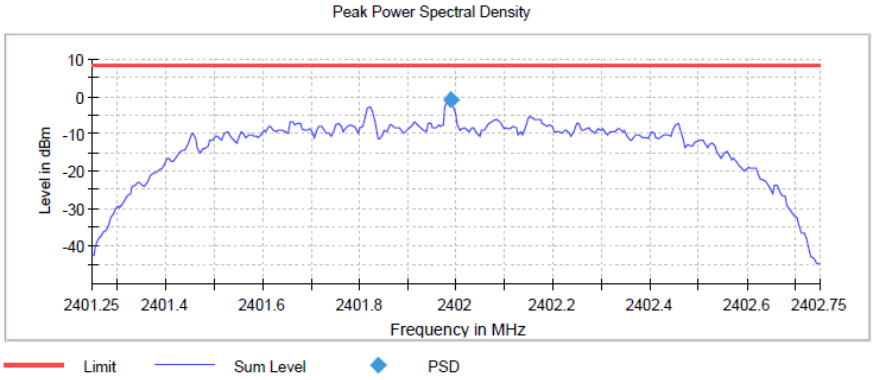
Radio Technology = BT Classic Pi/4 DQPSK, Operating Frequency = mid
(S01_166_AB01)

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.987500	-0.802	8.0	PASS

Ports

Port	State
1	used



Setting	Instrument Value
Start Frequency	2.40125 GHz
Stop Frequency	2.40275 GHz
Span	1.500 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	300
Sweeptime	1.500 ms
Reference Level	10.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	13 / max. 150
Stable	2 / 2
Max Stable Difference	0.10 dB

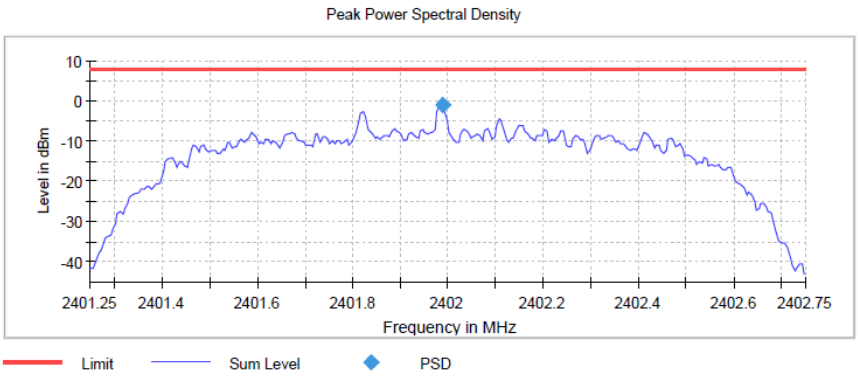
Radio Technology = BT Classic 8DPSK, Operating Frequency = mid
(S01_166_AB01)

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.987500	-0.893	8.0	PASS

Ports

Port	State
1	used



Setting	Instrument Value
Start Frequency	2.40125 GHz
Stop Frequency	2.40275 GHz
Span	1.500 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	300
Sweeptime	1.500 ms
Reference Level	10.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	5 / max. 150
Stable	2 / 2
Max Stable Difference	0.26 dB

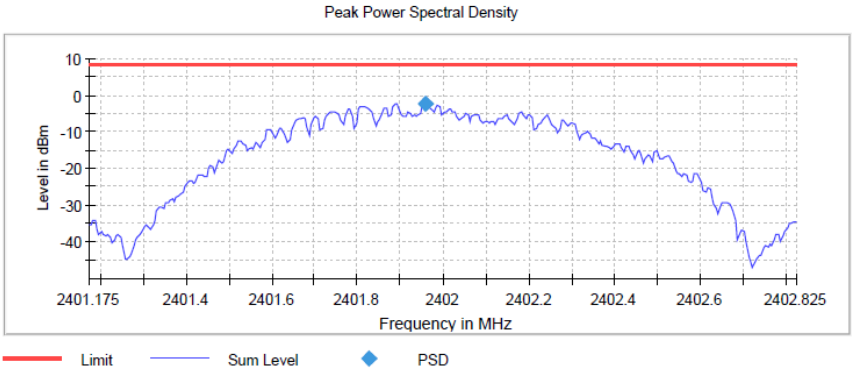
Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = low
(S01_166_AB01)

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.957500	-2.201	8.0	PASS

Ports

Port	State
1	used



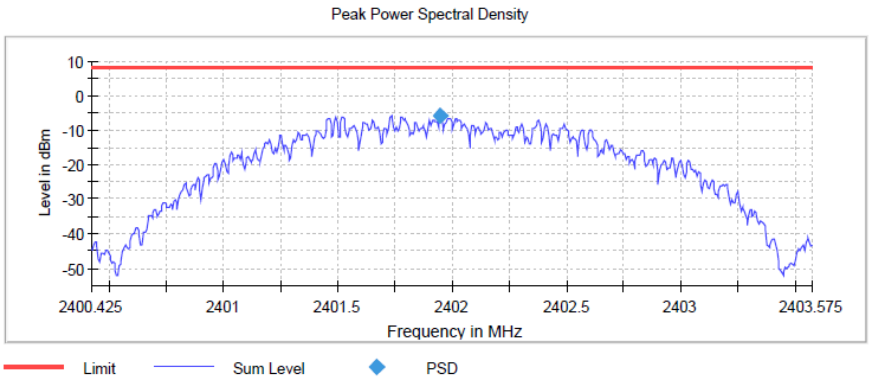
Setting	Instrument Value
Start Frequency	2.40118 GHz
Stop Frequency	2.40283 GHz
Span	1.650 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	330
Sweeptime	1.650 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	4 / max. 150
Stable	2 / 2
Max Stable Difference	0.13 dB

Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = low
(S01_166_AB01)

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.947500	-5.675	8.0	PASS

Ports

Port	State
1	used



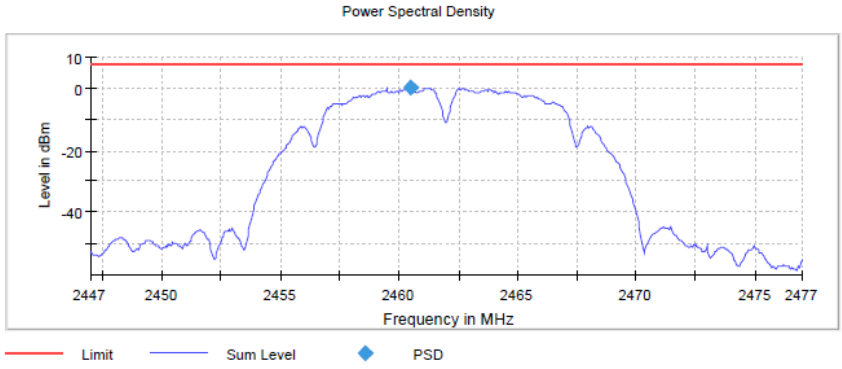
Setting	Instrument Value
Start Frequency	2.40043 GHz
Stop Frequency	2.40358 GHz
Span	3.150 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	630
Sweeptime	3.150 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	5 / max. 150
Stable	2 / 2
Max Stable Difference	0.20 dB

Radio Technology = WLAN b, Operating Frequency = high
(S01_166_AB01)

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2462.000000	2460.475000	0.379	8.0	PASS

Ports

Port	State
1	used



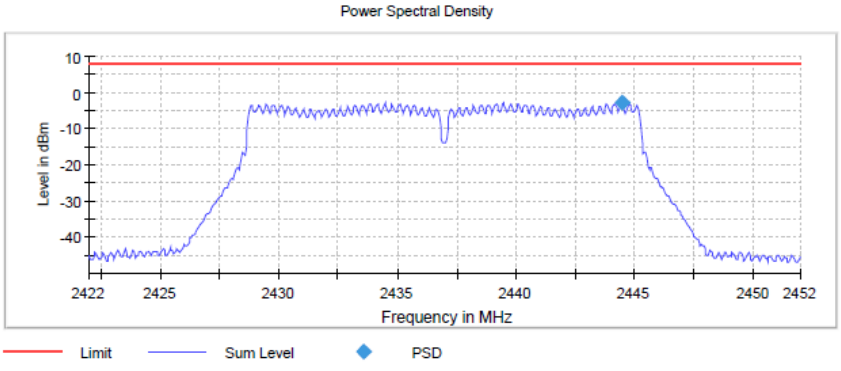
Setting	Instrument Value
Start Frequency	2.44700 GHz
Stop Frequency	2.47700 GHz
Span	30.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	600
Sweeptime	600.000 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	RMS
SweepCount	1
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	19 / max. 150
Stable	3 / 3
Max Stable Difference	0.16 dB

Radio Technology = WLAN g, Operating Frequency = mid
(S01_166_AB01)

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2444.475000	-2.575	8.0	PASS

Ports

Port	State
1	used



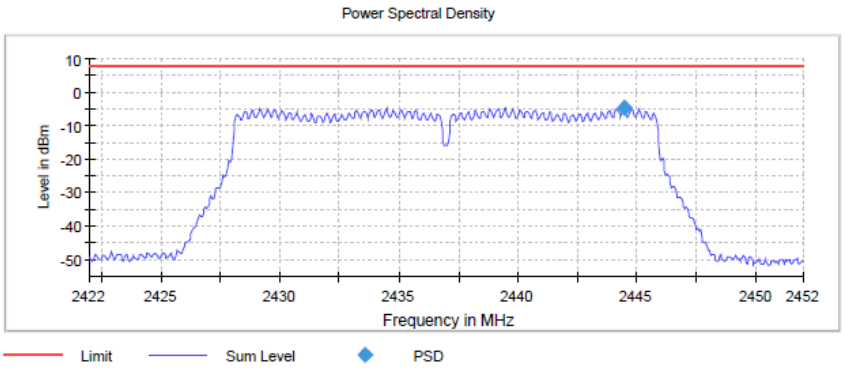
Setting	Instrument Value
Start Frequency	2.42200 GHz
Stop Frequency	2.45200 GHz
Span	30.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	600
Sweeptime	600.000 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	RMS
SweepCount	1
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	12 / max. 150
Stable	3 / 3
Max Stable Difference	0.18 dB

Radio Technology = WLAN n 20 MHz, Operating Frequency = mid
(S01_166_AB01)

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2444.475000	-4.644	8.0	PASS

Ports

Port	State
1	used



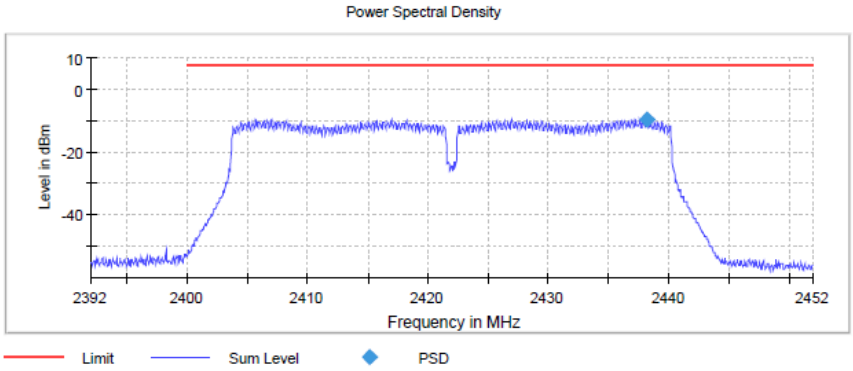
Setting	Instrument Value
Start Frequency	2.42200 GHz
Stop Frequency	2.45200 GHz
Span	30.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	600
Sweeptime	600.000 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	RMS
SweepCount	1
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	16 / max. 150
Stable	3 / 3
Max Stable Difference	0.35 dB

Radio Technology = WLAN n 40 MHz, Operating Frequency = mid
(S01_166_AB01)

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2422.000000	2438.225000	-9.473	8.0	PASS

Ports

Port	State
1	used



Setting	Instrument Value
Start Frequency	2.39200 GHz
Stop Frequency	2.45200 GHz
Span	60.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	1200
Sweeptime	1.200 s
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	RMS
SweepCount	1
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	13 / max. 150
Stable	3 / 3
Max Stable Difference	0.47 dB

5.9.5 TEST EQUIPMENT USED

- R&S TS8997

6 TEST EQUIPMENT

1 Conducted Emissions FCC

Conducted Emissions AC Mains for FCC standards

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2021-11	2022-11
1.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2021-10	2023-10
1.3	SMBV100A	Vector Signal Generator 9 kHz - 3.2 GHz (GNSS / Broadcast Signalling Unit)	Rohde & Schwarz GmbH & Co. KG	260001	2021-02	2024-02
1.4	ESH3-Z5	Two-Line V-Network (AUX)	Rohde & Schwarz GmbH & Co. KG	828304/029	2021-08	2023-08
1.5	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278		
1.6	CMU 200	"CMU2" Universal Radio Communication Tester	Rohde & Schwarz	837983/052	2021-11	2024-11
1.7	Chroma 6404	AC Source	Chroma ATE INC.	64040001304		
1.8	CMW500	Callbox OIL-RE, SUW	Rohde & Schwarz GmbH & Co. KG	155999-Ei	2019-09	2022-09
1.9	CMU 200	"CMU1" Universal Radio Communication Tester	Rohde & Schwarz GmbH & Co. KG	102366	2021-02	2024-02
1.10	CBT	Bluetooth Tester "CBT-02" incl. BLE-Option	Rohde & Schwarz	100302	2021-05	2024-05
1.11	CMW500	Callbox OIL-RE, SUA	Rohde & Schwarz GmbH & Co. KG	163529-bw	2020-07	2023-07
1.12	Shielded Room 02	Shielded Room 4m x 3m	Frankonia Germany EMC Solution GmbH	-		
1.13	CMW500	Callbox OIL-RE, SUA-160 MHz	Rohde & Schwarz GmbH & Co. KG	168927-cv	2020-05	2023-05
1.14	CMD 55	Digital Radio Communication Tester	Rohde & Schwarz	831050/020		
1.15	ESH3-Z5	Two-Line V-Network (EUT)	Rohde & Schwarz GmbH & Co. KG	829996/002	2021-08	2023-08
1.16	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2021-01	2023-01

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.17	CMW500	Callbox OIL-RE, SUA-160 MHz	Rohde & Schwarz GmbH & Co. KG	167766-By	2022-05	2025-05
1.18	Opus10 THI (8152.00)	T/H Logger 02	Lufft Mess- und Regeltechnik GmbH	7489	2021-10	2023-10
1.19	SMU 200A	Vector Signal Generator 100 kHz - 3 GHz (GPS Signalling Unit)	Rohde & Schwarz GmbH & Co. KG	100912		
1.20	CMW 500	Wideband Radio communication Tester	Rohde & Schwarz	107500		
1.21	CBT	Bluetooth Tester "CBT-01"	Rohde & Schwarz GmbH & Co. KG	100589	2021-09	2024-09

2 R&S TS8997
2.4 and 5 GHz Bands Conducted Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2021-11	2022-11
2.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2021-10	2023-10
2.3	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	107695	2021-06	2024-06
2.4	EX520	Digital Multimeter 12	Extech Instruments Corp	05157876	2022-06	2024-06
2.5	NGSM 32/10	Power Supply	Rohde & Schwarz GmbH & Co. KG	3456	2022-01	2024-01
2.6	Temperature Chamber KWP 120/70	Temperature Chamber Weiss 01	Weiss	59226012190010	2022-05	2024-05
2.7	Temperature Chamber VT 4002	Temperature Chamber Vötsch 03	Vötsch	58566002150010	2022-05	2024-05
2.8	FSW43	Signal analyser	Rohde & Schwarz GmbH & Co. KG	102013	2021-06	2023-06
2.9	Opus10 THI (8152.00)	T/H Logger 14	Lufft Mess- und Regeltechnik GmbH	13993	2021-08	2023-08
2.10	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2019-11	2022-11
2.11	OSP120	Contains Power Meter and Switching Unit OSP-B157W8	Rohde & Schwarz	101158	2021-08	2024-08

3 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
3.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2021-10	2023-10
3.2	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq			
3.3	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	2021-04	2023-04
3.4	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2022-06	2024-06
3.5	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785		
3.6	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2021-06	2023-06
3.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278		
3.8	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069		
3.9	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09		
3.10	TT 1.5 WI	Turn Table	Maturo GmbH	-		
3.11	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
3.12	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2020-10	2022-10
3.13	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709		
3.14	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
3.15	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324		
3.16	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2021-09	2024-09

4 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
4.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2021-10	2023-10
4.2	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2022-01	2024-01

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
4.3	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia	none		
4.4	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2021-08	2023-08
4.5	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278		
4.6	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99		
4.7	HFH2-Z2	Loop Antenna + 3 Axis Tripod	Rohde & Schwarz GmbH & Co. KG	829324/006	2021-01	2024-01

5 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
5.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2021-10	2023-10
5.2	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2022-01	2024-01
5.3	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia	none		
5.4	HL 562 ULTRALOG	Biconical-log-per antenna (30 MHz - 3 GHz) with HL 562E biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003	2021-09	2024-09
5.5	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2021-08	2023-08
5.6	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278		
5.7	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99		
5.8	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/1192 0513		

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

7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

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

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

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

Sample calculation

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

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

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

Sample calculation

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

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

(d_{Limit} = 3 m)

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

(d_{Limit} = 10 m)

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

Sample calculation

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

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

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

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

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

Sample calculation

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

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

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

Sample calculation

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

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

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

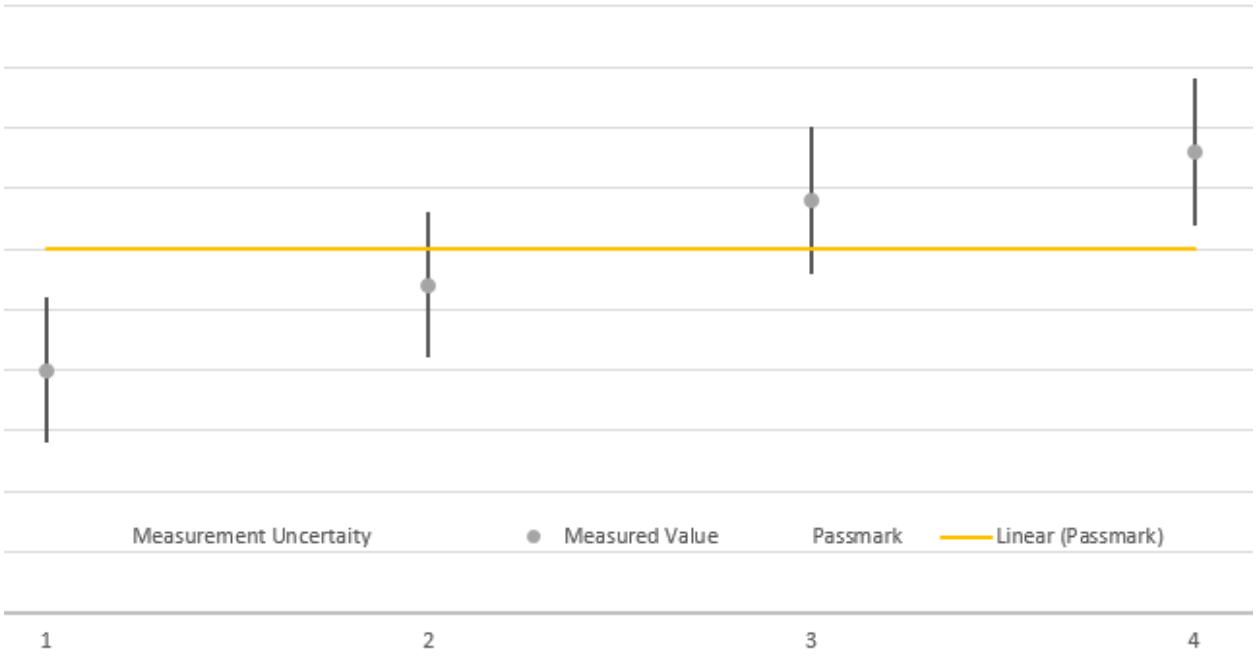
Sample calculation

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

8 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.