5.5 PEAK POWER SPECTRAL DENSITY

Standard FCC Part 15 Subpart E

The test was performed according to:
ANSI C63.10, chapter 12.5 (SA-3)

5.5.1 TEST DESCRIPTION

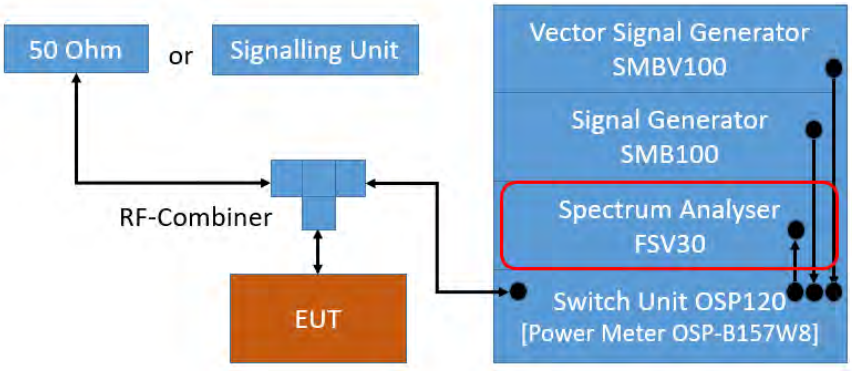
The Equipment Under Test (EUT) was set up in a shielded room to perform the Maximum Power Spectral Density measurements.
The results recorded were measured with the modulation which produces the worst-case (highest) output power.

For U-NII bands 1, 2A, 2C, 3:
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.

Analyzer settings:

- Resolution Bandwidth (RBW): 1 MHz (for subband 3: 500 kHz)
- Video Bandwidth (VBW): 3 MHz (for subband 3: 2 MHz)
- Trace: Max Hold
- Sweeps: till stable (at least 180, max. 900)
- Sweeptime: ≤ Number of sweep points x Min. Transmitter on time
- Detector: RMS
- Trigger: free run

Note:
The analyser settings are according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method SA-3.



TS8997; Maximum Power Spectral Density

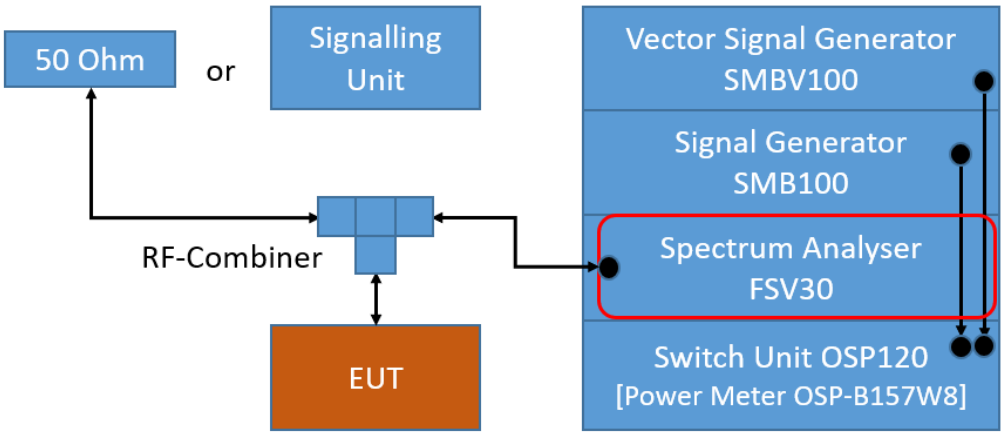
Attenuation of the measurement path

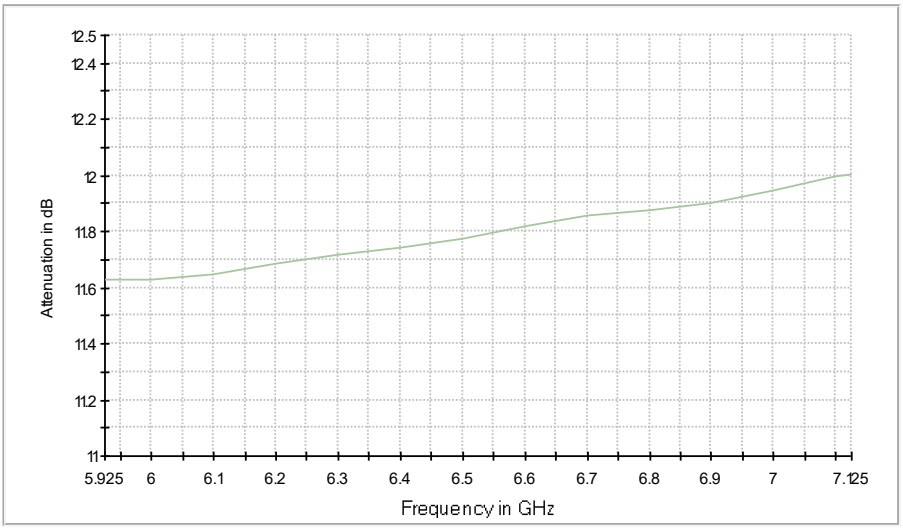
For U-NII bands 5, 6, 7, 8:
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Trace: Average, RMS power averaging mode
- Sweeps: at least 100
- Sweeptime: Auto
- Detector: RMS
- Trigger: free run (DC >98 %) or gated mode (DC< 98 %)

Note:
The analyser settings are according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method SA-1.





Attenuation of measurement path

5.5.2 TEST REQUIREMENTS / LIMITS

A) FCC

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

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

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

FCC Part 15, Subpart E, §15.407 (a) (4):
For a standard power access point and fixed client devices in the 5.925 − 6.425 GHz and 6.525 − 6.875 GHz bands:
Limit: 23 dBm/MHz e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (5):
For an indoor access point in the 5.925 − 7.125 GHz bands:
Limit: 5 dBm/MHz e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (6):
For a subordinate device operating under an indoor access point in the 5.925 − 7.125 GHz bands:
Limit: 5 dBm/MHz e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (7):
For a client device, except for fixed client devices, operating under standard power access point in the 5.925-6.425 GHz and 6.525-6.875 GHz bands:

Limit: 17 dBm/MHz e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (8):
For client devices operating under the control of an indoor access point in the 5.925 – 7.125 GHz bands:
Limit: -1 dBm/MHz e.i.r.p.

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

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

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

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

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

5.5.3 TEST PROTOCOL

Ambient temperature: 23-24 °C
Air Pressure: 998-1001 hPa
Humidity: 39-43 %

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

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5180	-3.7	-3.2	11.0	14.7	N/A	-	N/A	-
	5200	-3.3	-2.8	11.0	14.3	N/A	-	N/A	-
	5240	-3.4	-2.9	11.0	14.4	N/A	-	N/A	-
3	5745	-8.3	-8.3	30.0	38.3	30.0	38.3	N/A	-
	5785	-8.4	-8.4	30.0	38.4	30.0	38.4	N/A	-
	5825	-8.1	-8.1	30.0	38.1	30.0	38.1	N/A	-

WLAN n-Mode; 20 MHz; MCS 0; SISO

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5180	-4.1	-3.6	11.0	15.1	N/A	-	N/A	-
	5200	-3.7	-3.2	11.0	14.7	N/A	-	N/A	-
	5240	-3.8	-3.3	11.0	14.8	N/A	-	N/A	-
3	5745	-8.6	-8.6	30.0	38.6	30.0	38.6	N/A	-
	5785	-8.8	-8.8	30.0	38.8	30.0	38.8	N/A	-
	5825	-8.6	-8.6	30.0	38.6	30.0	38.6	N/A	-

WLAN n-Mode; 40 MHz; MCS 0; SISO

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5190	-4.8	-4.3	11.0	15.8	N/A	-	N/A	-
	5230	-4.7	-4.2	11.0	15.7	N/A	-	N/A	-
3	5755	-11.4	-11.4	30.0	41.4	30.0	41.4	N/A	-
	5795	-11.3	-11.3	30.0	41.3	30.0	41.3	N/A	-

WLAN ac-Mode; 20 MHz; MCS 0; SISO

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5180	-4.1	-3.6	11.0	15.1	N/A	-	N/A	-
	5200	-3.6	-3.1	11.0	14.6	N/A	-	N/A	-
	5240	-3.6	-3.1	11.0	14.6	N/A	-	N/A	-
3	5745	-8.6	-8.6	30.0	38.6	30.0	38.6	N/A	-
	5785	-8.8	-8.8	30.0	38.8	30.0	38.8	N/A	-
	5825	-8.6	-8.6	30.0	38.6	30.0	38.6	N/A	-

WLAN ac-Mode; 40 MHz; MCS 0; SISO

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5190	-4.6	-4.1	11.0	15.6	N/A	-	N/A	-
	5230	-4.7	-4.2	11.0	15.7	N/A	-	N/A	-
3	5755	-11.9	-11.9	30.0	41.9	30.0	41.9	N/A	-
	5795	-12.1	-12.1	30.0	42.1	30.0	42.1	N/A	-

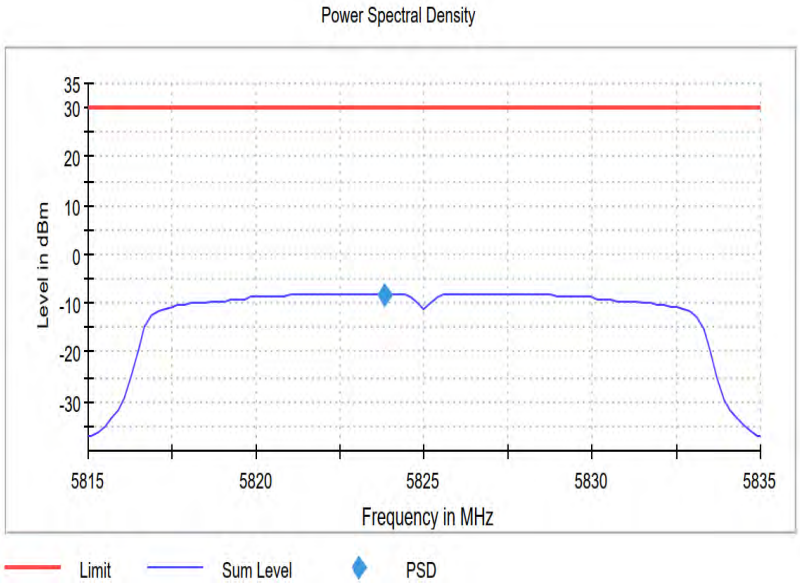
WLAN ac-Mode; 80 MHz; MCS 0; SISO

U-NII-Subband	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED Limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]	ISED E.I.R.P limit [dBm/MHz] or [dBm/500kHz] (U-NII-3)	Margin [dB]
1	5210	-7.5	-7.0	11.0	18.5	N/A	-	N/A	-
3	5775	-10.6	-10.6	30.0	40.6	30.0	40.6	N/A	-

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

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

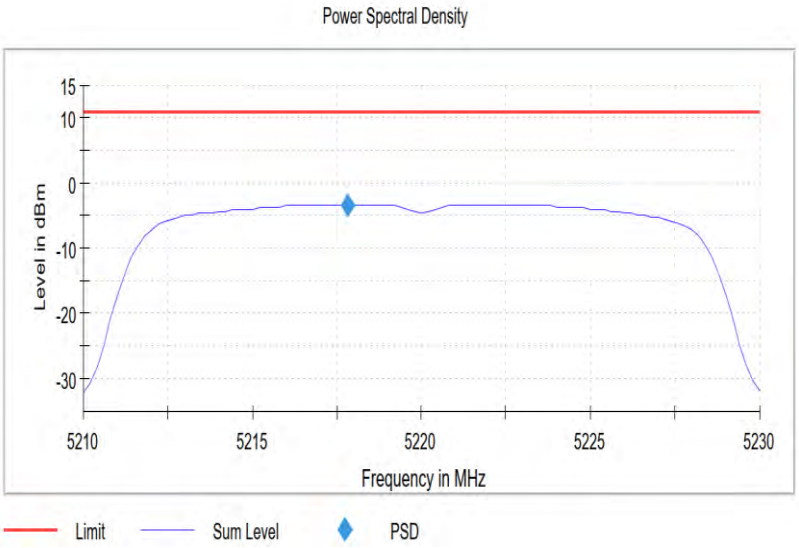
Radio Technology = WLAN a, Operating Frequency = high, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.81500 GHz	5.81500 GHz
Stop Frequency	5.83500 GHz	5.83500 GHz
Span	20.000 MHz	20.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	101	~ 80
Sweeptime	1.010 s	1.010 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	60	60
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.05 dB	0.30 dB

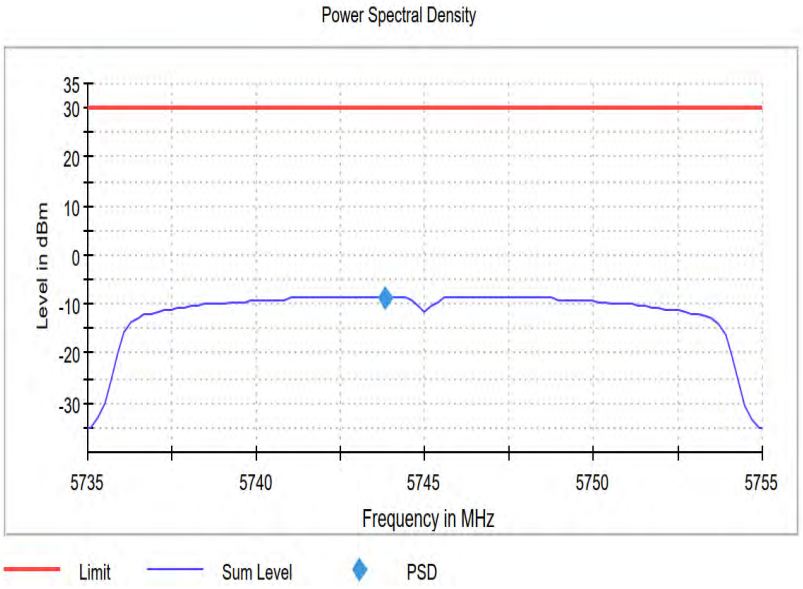
Radio Technology = WLAN a, Operating Frequency = mid, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.21000 GHz	5.21000 GHz
Stop Frequency	5.23000 GHz	5.23000 GHz
Span	20.000 MHz	20.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 40
Sweeptime	505.000 ms	505.000 ms
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	119	119
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.30 dB

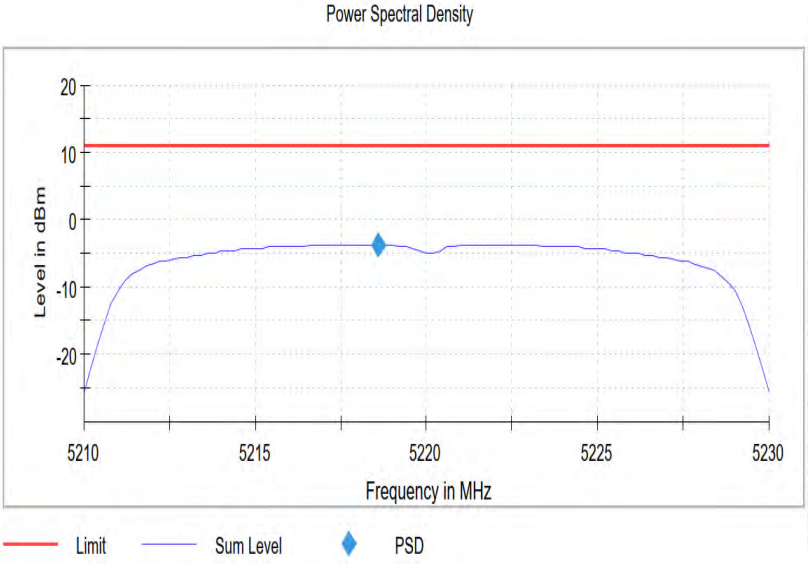
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.73500 GHz	5.73500 GHz
Stop Frequency	5.75500 GHz	5.75500 GHz
Span	20.000 MHz	20.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	101	~ 80
Sweeptime	1.010 s	1.010 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	60	60
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.05 dB	0.30 dB

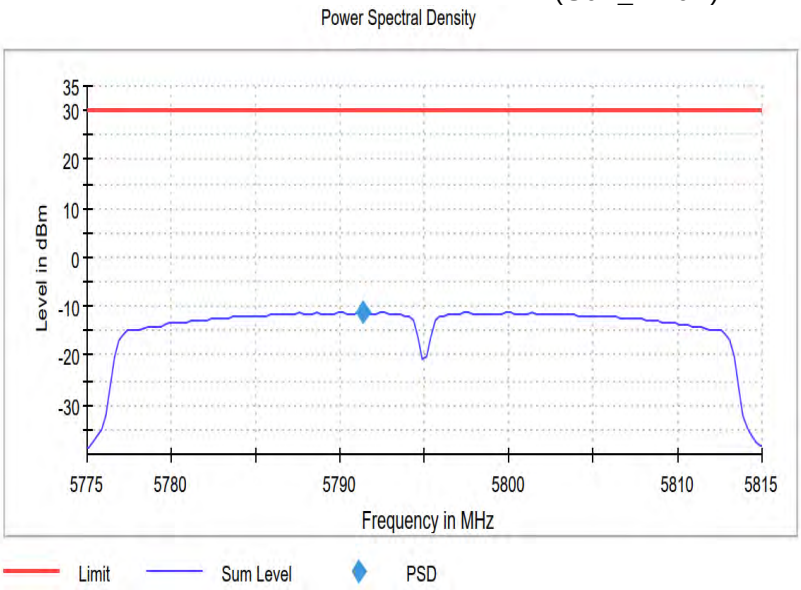
Radio Technology = WLAN n 20 MHz, Operating Frequency = mid, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.21000 GHz	5.21000 GHz
Stop Frequency	5.23000 GHz	5.23000 GHz
Span	20.000 MHz	20.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 40
Sweeptime	505.000 ms	505.000 ms
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	119	119
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.04 dB	0.30 dB

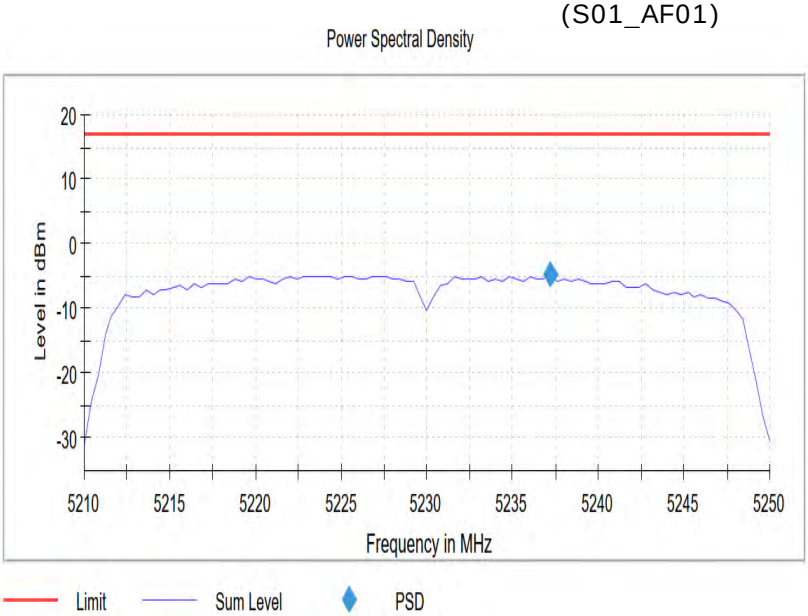
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.77500 GHz	5.77500 GHz
Stop Frequency	5.81500 GHz	5.81500 GHz
Span	40.000 MHz	40.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	160	~ 160
Sweeptime	1.600 s	1.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	38	38
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.10 dB	0.30 dB

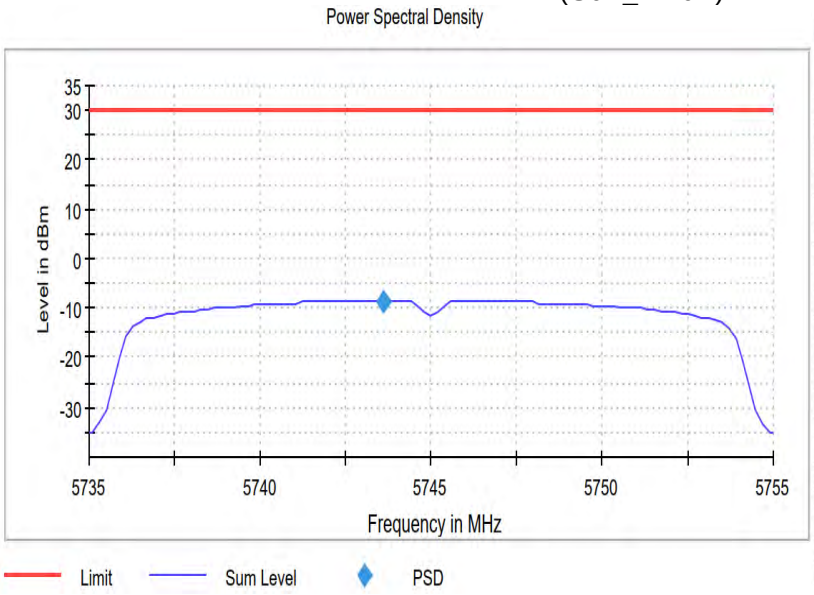
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.21000 GHz	5.21000 GHz
Stop Frequency	5.25000 GHz	5.25000 GHz
Span	40.000 MHz	40.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 80
Sweeptime	1.000 ms	10.100 µs
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	0	5940595
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	15 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.30 dB

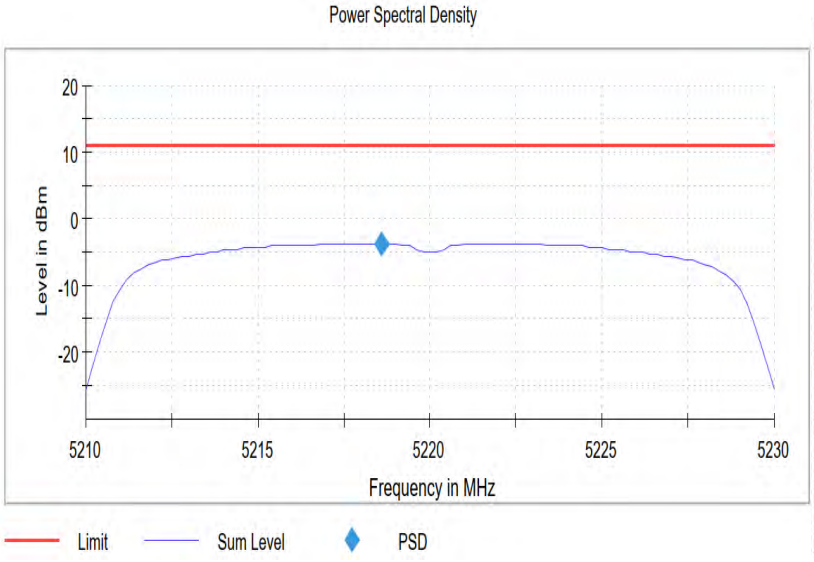
Radio Technology = WLAN ac 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.73500 GHz	5.73500 GHz
Stop Frequency	5.75500 GHz	5.75500 GHz
Span	20.000 MHz	20.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	101	~ 80
Sweeptime	1.010 s	1.010 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	60	60
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.05 dB	0.30 dB

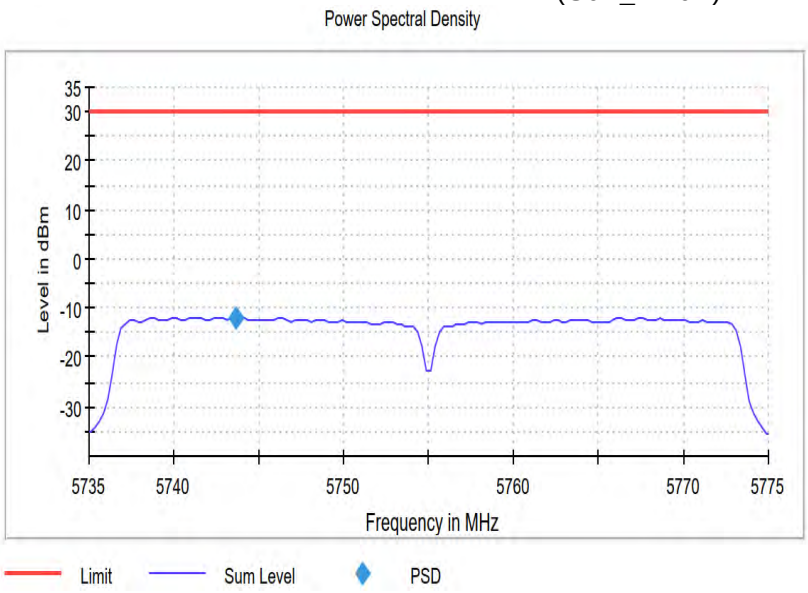
Radio Technology = WLAN ac 20 MHz, Operating Frequency = mid, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.21000 GHz	5.21000 GHz
Stop Frequency	5.23000 GHz	5.23000 GHz
Span	20.000 MHz	20.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 40
Sweeptime	505.000 ms	505.000 ms
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	119	119
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.06 dB	0.30 dB

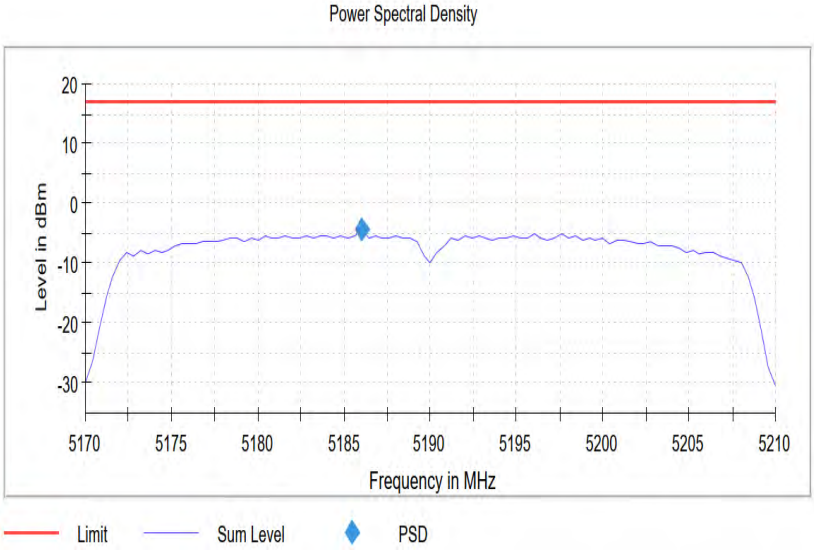
Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.73500 GHz	5.73500 GHz
Stop Frequency	5.77500 GHz	5.77500 GHz
Span	40.000 MHz	40.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	160	~ 160
Sweeptime	1.600 s	1.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	38	38
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.08 dB	0.30 dB

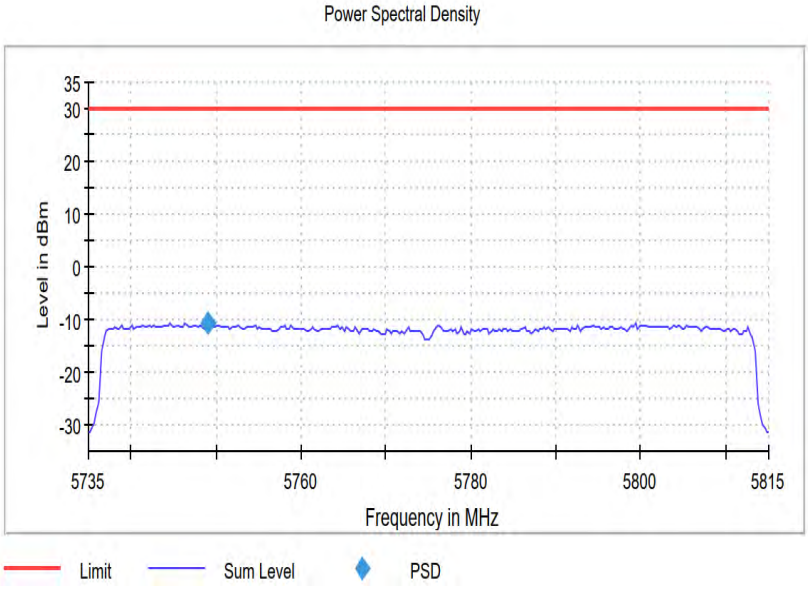
Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.17000 GHz	5.17000 GHz
Stop Frequency	5.21000 GHz	5.21000 GHz
Span	40.000 MHz	40.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 80
Sweeptime	1.000 ms	10.100 µs
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	0	5940595
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	15 / max. 15	max. 15
Stable	2 / 3	3
Max Stable Difference	0.00 dB	0.30 dB

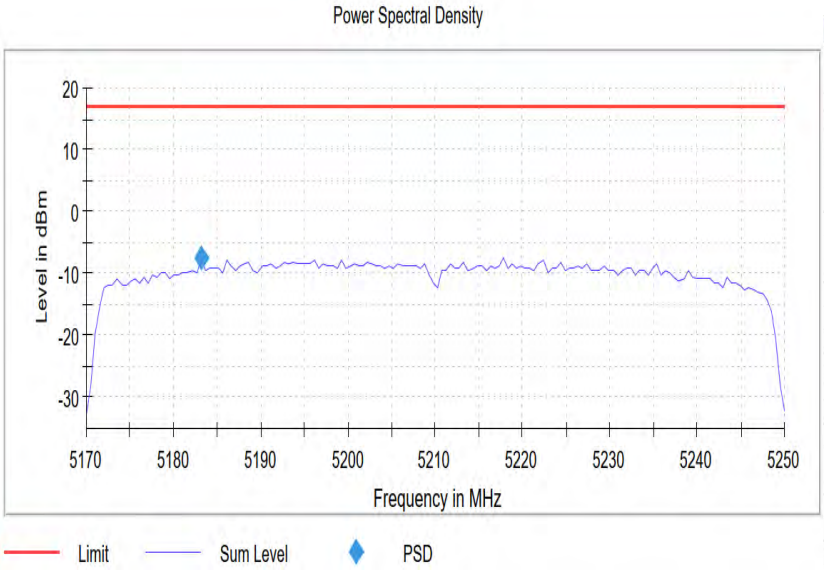
Radio Technology = WLAN ac 80 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AM01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.73500 GHz	5.73500 GHz
Stop Frequency	5.81500 GHz	5.81500 GHz
Span	80.000 MHz	80.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	320	~ 320
Sweeptime	6.400 ms	6.400 ms
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	RMS	RMS
SweepCount	9376	9376
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	8 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.24 dB	0.30 dB

Radio Technology = WLAN ac 80 MHz, Operating Frequency = mid, Subband = U-NII-1 (S01_AF01)



Measurement

Setting	Instrument Value	Target Value
Start Frequency	5.17000 GHz	5.17000 GHz
Stop Frequency	5.25000 GHz	5.25000 GHz
Span	80.000 MHz	80.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	160	~ 160
Sweeptime	1.000 ms	16.000 µs
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	0	3750001
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	15 / max. 15	max. 15
Stable	1 / 3	3
Max Stable Difference	0.00 dB	0.30 dB

5.5.5 TEST EQUIPMENT USED

- R&S TS8997

5.6 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Standard FCC Part 15 Subpart E

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

5.6.1 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:

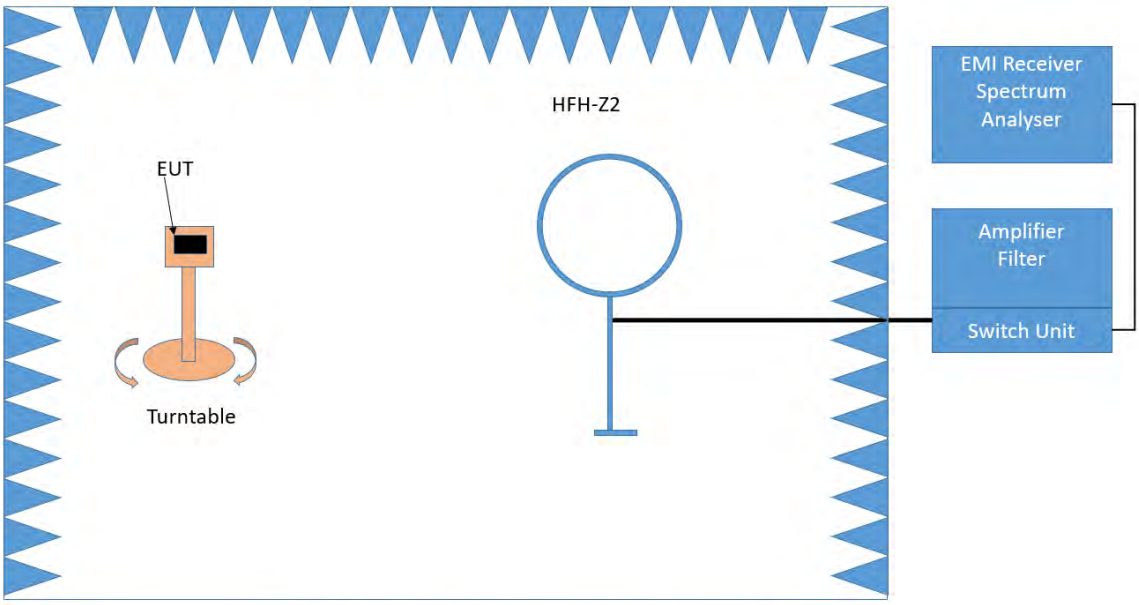
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHZ: Chapter 6.6 (procedure according 6.6.5 used)

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
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 – 30 MHz
- Frequency steps: 0.05 kHz and 2.25 kHz
- IF–Bandwidth: 0.2 kHz and 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)

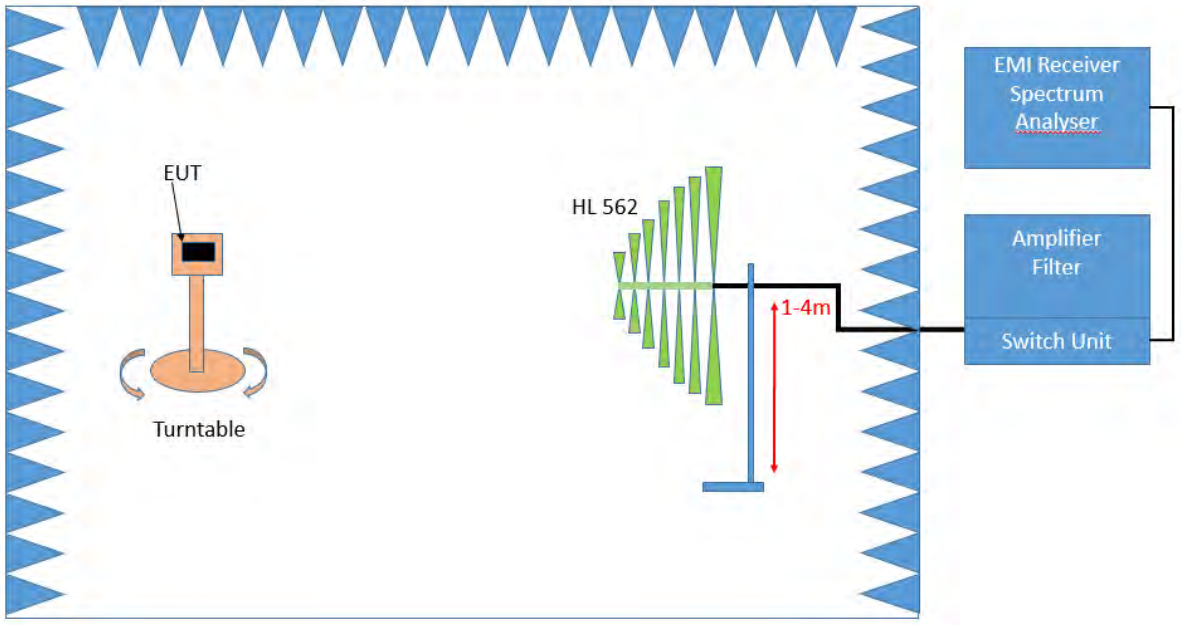
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF–Bandwidth: 0.2 - 10 kHz
- Measuring time / Frequency step: 1 s

2. Measurement above 30 MHz and up to 1 GHz



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 by 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

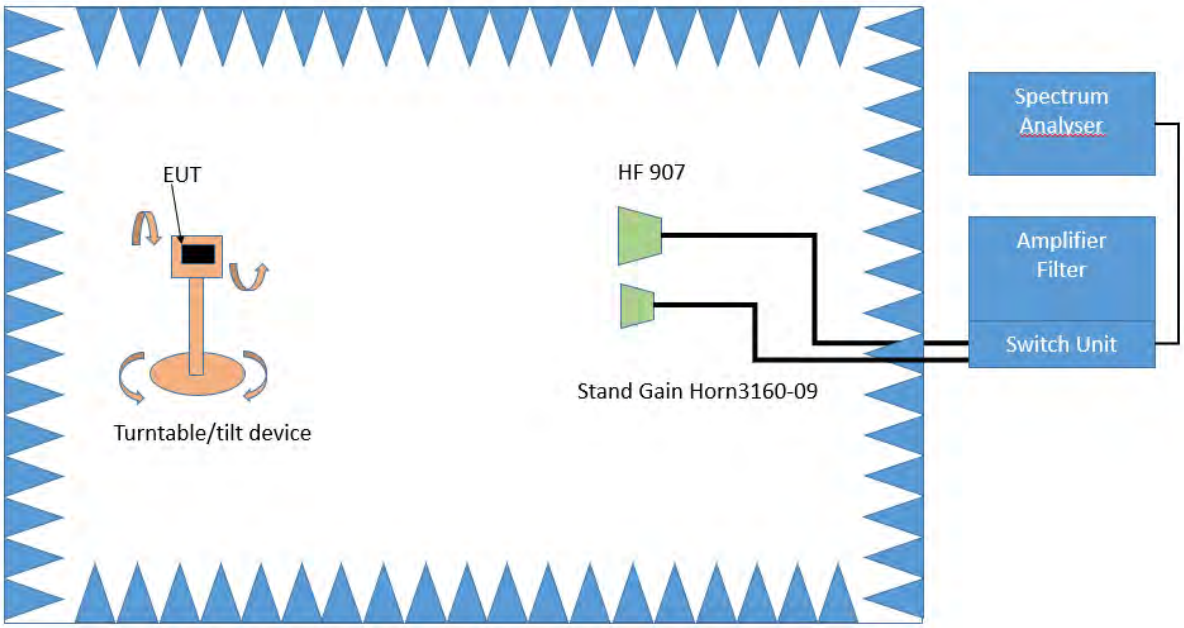
Step 3: Final measurement with QP detector
With the settings determined in step 2, the final measurement will be performed:
EMI receiver settings for step 3:
- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

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 1 GHz up to 26.5 GHz



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

Step 1:
The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.
All steps were performed with one height (1.5 m) of the receiving antenna only.
The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.
The turn table step size (azimuth angle) for the preliminary measurement is 45 °.

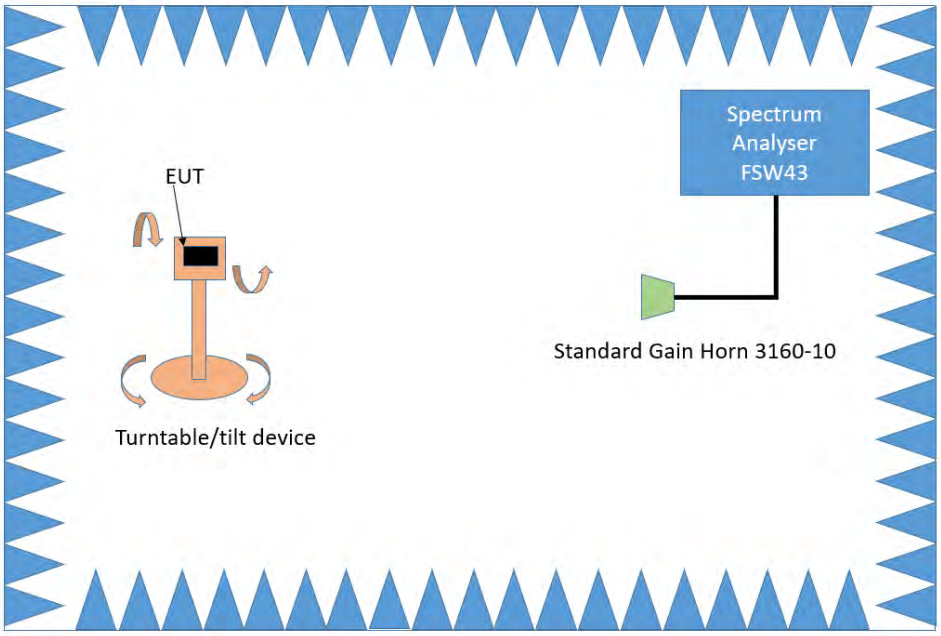
Step 2:
Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.
The turn table azimuth will slowly vary by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

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

4. Measurement above 26.5 GHz up to 40 GHz

The following modifications, compared to the frequency range 1 GHz – 26.5 GHz, apply to the measurement procedure for the frequency range above 26.5 GHz:

- Measurement distance: 1m



Test Setup; Spurious Emission Radiated (FAC), 26.5 – 40 GHz

5.6.2 TEST REQUIREMENTS / LIMITS

A) FCC

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

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

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

FCC Part 15 Subpart E, §15.407 (b)(4)
For transmitters operating in the 5725–5850 MHz band:
Limit: –27 dBm/MHz at 75 MHz or more above or below the band edge
increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge
increasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edge
increasing linearly to 27 dBm/MHz at the band edge.

FCC Part 15 Subpart E, §15.407 (b) (5)
For transmitters operating within the 5.925-7.125 GHz band:
Limit: −27 dBm/MHz EIRP outside of the band 5.925-7.125 GHz.

FCC Part 15 Subpart E, §15.407 (b) (6)
For transmitters operating within the 5.925-7.125 GHz bands:
Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

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

RSS-247, 6.2.1.2, Emissions outside the band 5150-5250 MHz, indoor operation only:
Limit: −27 dBm/MHz EIRP outside of the band 5150−5250 MHz.

RSS-247, 6.2.2.2, Emissions outside the band 5250-5350 MHz:
Limit: −27 dBm/MHz EIRP outside of the band 5250−5350 MHz.

RSS-247, 6.2.3.2, Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:
Limit: −27 dBm/MHz EIRP outside of the band 5470−5725 MHz.
However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p.at 5850 MHz instead of 5725 MHz.
Note: No operation is permitted for the frequency range 5600−5650 MHz.

RSS-247, 6.2.4.2, Emissions outside the band 5725-5850 MHz:

a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 Bm/MHz at 5 MHz above or below the band edges;
b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

C) FCC & IC

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

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

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

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

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

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

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

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

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

Used conversion factor:

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

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

5.6.3 TEST PROTOCOL

Ambient temperature: 22 °C
Air Pressure: 1008 hPa
Humidity: 40 %
WLAN a-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0.7 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
36	5180	1741.2	48.4	PEAK	1000	68.2	19.8	UE
36	5180	5148.4	57.8	PEAK	1000	74.0	16.2	RB
36	5180	5148.4	45.1	AV	1000	54.0	8.9	RB
36	5180	6631.2	59.4	PEAK	1000	68.2	8.8	UE
40	5200	33.1	27.2	QP	120	40.0	12.8	RB
40	5200	53.3	33.6	QP	120	40.0	6.5	RB
40	5200	66.5	33.1	QP	120	40.0	6.9	RB
40	5200	105.0	32.9	QP	120	43.5	10.6	RB
40	5200	127.1	32.7	QP	120	43.5	10.8	RB
40	5200	195.0	34.1	QP	120	43.5	9.5	RB
40	5200	345.0	32.9	QP	120	46.0	13.1	RB
40	5200	480.0	38.6	QP	120	46.0	7.5	RB
40	5200	615.0	36.0	QP	120	46.0	10.0	RB
40	5200	630.0	41.6	QP	120	46.0	4.4	RB
40	5200	645.0	39.1	QP	120	46.0	6.9	RB
40	5200	720.0	36.1	QP	120	46.0	9.9	RB
40	5200	780.0	36.9	QP	120	46.0	9.1	RB
48	5240	-	-	-	-	-	-	-
149	5745	-	-	-	-	-	-	-
157	5785	33.3	26.2	QP	120	40.0	13.8	RB
157	5785	53.5	36.2	QP	120	40.0	3.8	RB
157	5785	70.1	31.7	QP	120	40.0	8.3	RB
157	5785	112.6	31.3	QP	120	43.5	12.2	RB
157	5785	128.3	32.7	QP	120	43.5	10.8	RB
157	5785	210.0	34.7	QP	120	43.5	8.8	RB
157	5785	330.0	35.4	QP	120	46.0	10.6	RB
157	5785	480.0	39.3	QP	120	46.0	6.7	RB
157	5785	555.0	36.7	QP	120	46.0	9.3	RB
157	5785	615.0	35.1	QP	120	46.0	10.9	RB
157	5785	630.0	41.8	QP	120	46.0	4.2	RB
157	5785	645.0	40.1	QP	120	46.0	5.9	RB
157	5785	720.0	35.7	QP	120	46.0	10.4	RB
157	5785	930.0	34.2	QP	120	46.0	11.8	RB
157	5785	2480.0	54.9	PEAK	1000	68.2	13.3	UE
157	5785	2840.8	39.4	AV	1000	74.0	34.6	RB
157	5785	2840.8	51.5	PEAK	1000	54.0	2.5	RB
157	5785	4957.1	45.0	AV	1000	54.0	9.0	RB
157	5785	4957.1	57.2	PEAK	1000	74.0	16.8	RB
165	5825	2438.5	52.8	PEAK	1000	68.2	15.4	UE
165	5825	5406.7	45.4	AV	1000	54.0	8.6	RB

165	5825	5406.7	57.9	PEAK	1000	74.0	16.1	RB

WLAN n-Mode; 20 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.7 dB

Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
36	5180	2401.7	50.2	PEAK	1000	68.2	18.0	UE
36	5180	2632.6	51.6	PEAK	1000	68.2	16.6	UE
36	5180	4955.7	57.2	PEAK	1000	74.0	16.8	RB
36	5180	4955.7	45.1	AV	1000	54.0	8.9	RB
36	5180	5148.7	56.8	PEAK	1000	74.0	17.2	RB
36	5180	5148.7	44.8	AV	1000	54.0	9.2	RB
36	5180	5150.0	57.3	PEAK	1000	74.0	16.7	RB
36	5180	5150.0	44.7	AV	1000	54.0	9.3	RB
40	5200	2836.6	51.7	PEAK	1000	74.0	22.3	RB
40	5200	2836.6	39.6	AV	1000	54.0	14.4	RB
40	5200	15614.6	54.4	PEAK	1000	74.0	19.6	RB
40	5200	15614.6	42.4	AV	1000	54.0	11.6	RB
48	5240	2050.0	50.0	PEAK	1000	68.2	18.2	UE
48	5240	2659.8	51.1	PEAK	1000	68.2	17.1	UE
48	5240	2825.7	52.0	PEAK	1000	74.0	22.0	RB
48	5240	2825.7	39.4	AV	1000	54.0	14.6	RB
48	5240	4377.8	57.2	PEAK	1000	74.0	16.8	RB
48	5240	4377.8	44.7	AV	1000	54.0	9.3	RB
149	5745	2425.7	53.5	PEAK	1000	68.2	14.7	UE
149	5745	4250.8	44.4	AV	1000	54.0	9.6	RB
149	5745	4250.8	56.7	PEAK	1000	74.0	17.3	RB
149	5745	5043.4	44.7	AV	1000	54.0	9.3	RB
149	5745	5043.4	57.1	PEAK	1000	74.0	16.9	RB
157	5785	1775.7	48.0	PEAK	1000	68.2	20.2	UE
157	5785	2402.1	51.3	PEAK	1000	68.2	16.9	UE
157	5785	2472.2	51.7	PEAK	1000	68.2	16.5	UE
157	5785	2619.9	51.3	PEAK	1000	68.2	16.9	UE
157	5785	6951.2	59.8	PEAK	1000	68.2	8.4	UE
157	5785	17626.8	58.1	PEAK	1000	68.2	10.1	UE
165	5825	4939.7	57.8	PEAK	1000	74.0	16.2	RB
165	5825	4939.7	45.0	AV	1000	54.0	9.0	RB
165	5825	6573.0	58.8	PEAK	1000	68.2	9.4	UE
165	5825	15161.7	53.7	PEAK	1000	68.2	14.5	UE

WLAN n-Mode; 40 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 1.4 dB

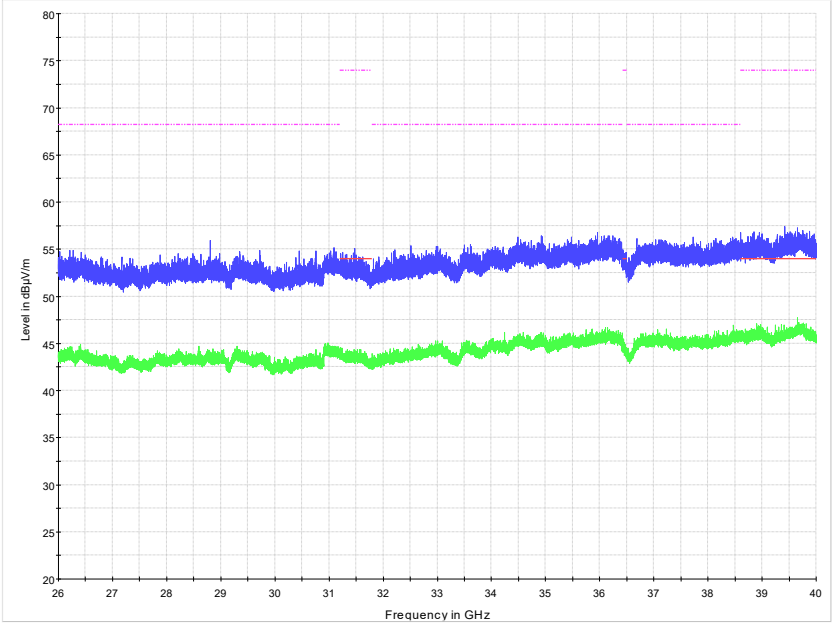
Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
38	5190	33.9	26.8	QP	120	40.0	13.2	RB
38	5190	46.7	33.7	QP	120	40.0	6.3	RB
38	5190	67.7	32.8	QP	120	40.0	7.2	RB
38	5190	90.0	33.7	QP	120	43.5	9.8	RB
38	5190	120.0	35.3	QP	120	43.5	8.2	RB
38	5190	131.1	32.8	QP	120	43.5	10.7	RB
38	5190	240.0	31.2	QP	120	46.0	14.8	RB
38	5190	270.0	35.1	QP	120	46.0	10.9	RB
38	5190	330.0	37.1	QP	120	46.0	8.9	RB
38	5190	375.0	32.7	QP	120	46.0	13.3	RB
38	5190	510.0	33.3	QP	120	46.0	12.7	RB
38	5190	570.0	33.8	QP	120	46.0	12.2	RB
38	5190	630.0	35.3	QP	120	46.0	10.7	RB
38	5190	780.0	34.0	QP	120	46.0	12.0	RB
38	5190	5145.3	57.0	PEAK	1000	74.0	17.0	RB
38	5190	5145.3	45.6	AV	1000	54.0	8.4	RB
46	5230	-	-	-	-	-	-	-
151	5755	1757.6	47.8	PEAK	1000	68.2	20.4	UE
159	5795	30.0	26.7	QP	9	29.5	2.8	RB
159	5795	58.1	30.9	QP	120	40.0	9.1	RB
159	5795	63.0	40.0	QP	120	40.0	0.0	RB
159	5795	67.2	36.5	QP	120	40.0	3.5	RB
159	5795	75.0	29.0	QP	120	40.0	11.0	RB
159	5795	84.7	28.2	QP	120	40.0	11.9	RB
159	5795	105.0	36.4	QP	120	43.5	7.1	RB
159	5795	114.2	34.3	QP	120	43.5	9.2	RB
159	5795	120.0	34.7	QP	120	43.5	8.8	RB
159	5795	135.1	30.4	QP	120	43.5	13.1	RB
159	5795	240.0	33.0	QP	120	46.0	13.0	RB
159	5795	330.0	35.4	QP	120	46.0	10.6	RB
159	5795	375.0	34.0	QP	120	46.0	12.0	RB
159	5795	555.0	34.8	QP	120	46.0	11.2	RB
159	5795	675.0	35.2	QP	120	46.0	10.8	RB
159	5795	705.0	36.6	QP	120	46.0	9.4	RB
159	5795	930.0	32.2	QP	120	46.0	13.8	RB
159	5795	1976.9	50.9	PEAK	1000	68.2	17.3	UE
159	5795	3550.0	54.6	PEAK	1000	68.2	13.6	UE

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

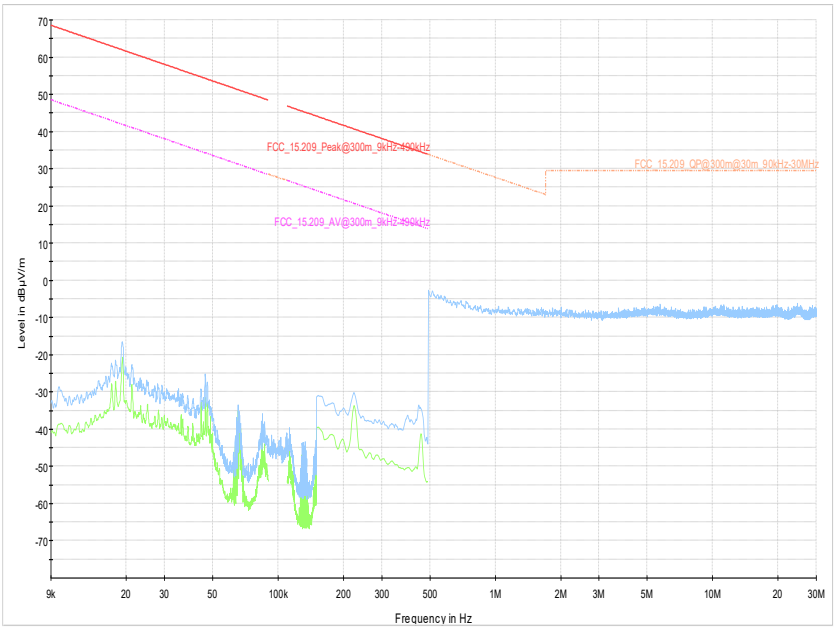
5.6.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-1 (S01_AB01)

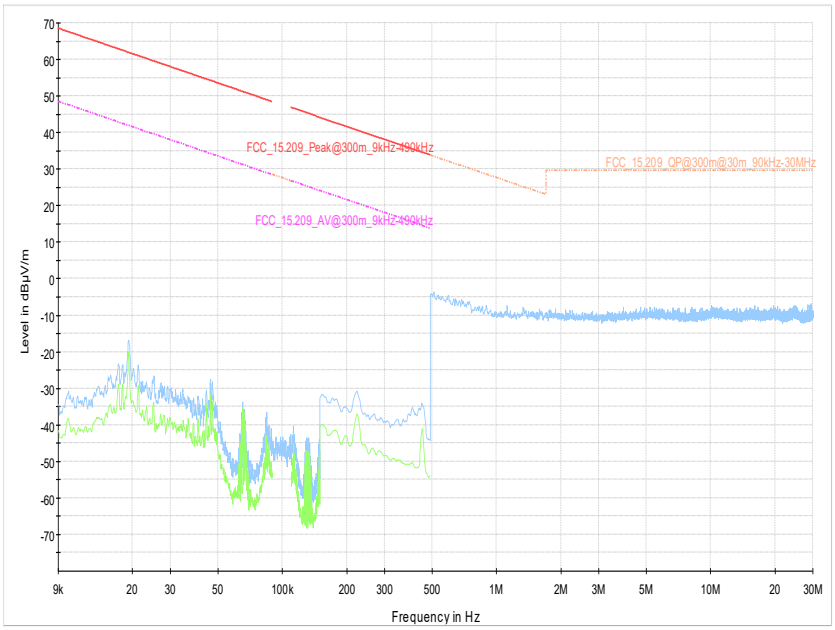
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-3 (S01_AB01)



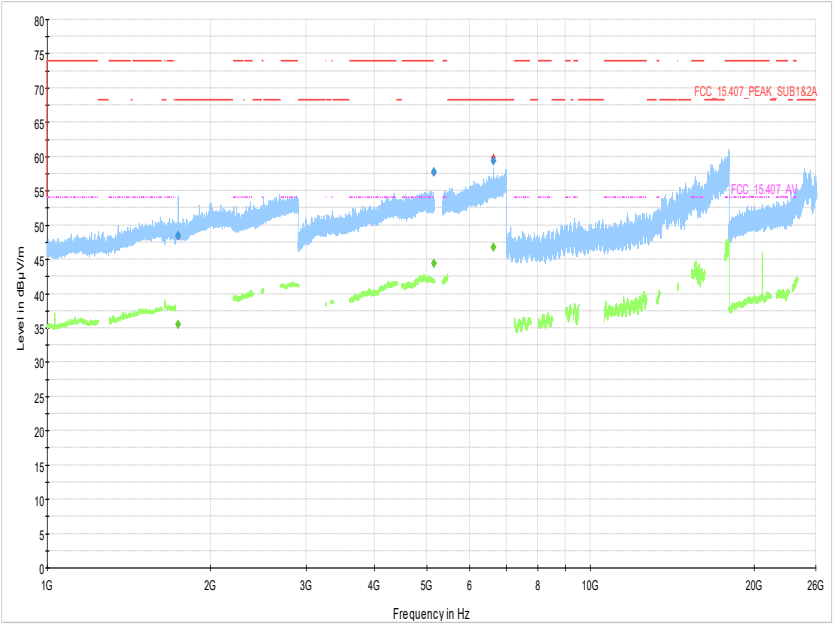
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 9kHz - 30MHz, Subband = U-NII-1 (S01_AB01)



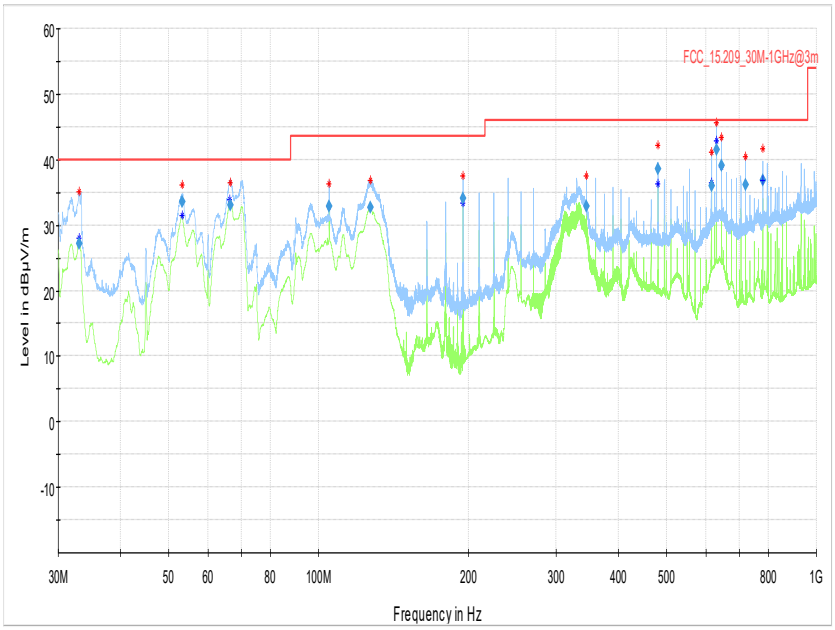
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Measurement range = 9kHz - 30MHz, Subband = U-NII-1 (S01_AB01)



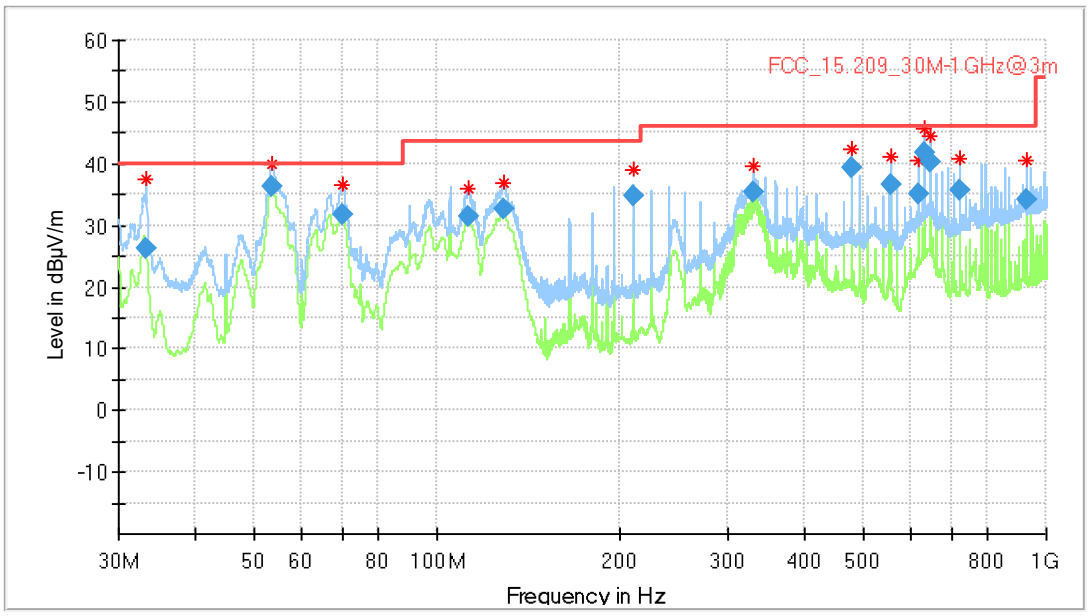
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-1 (S01_AB01)



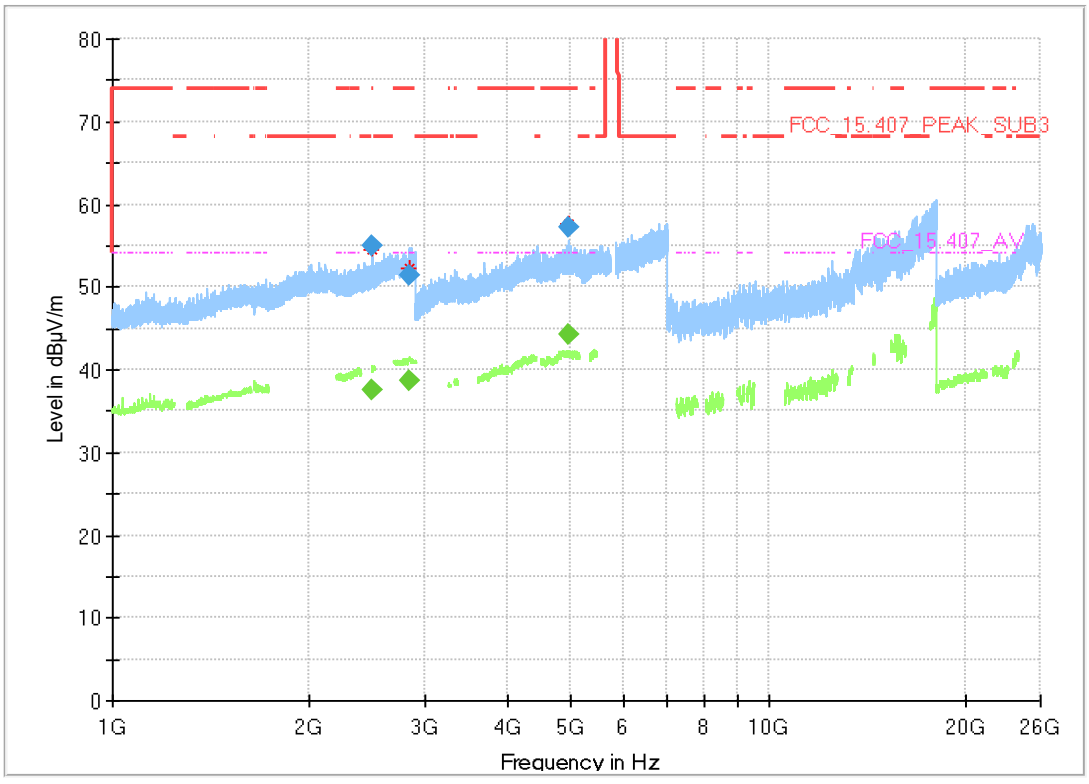
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-1 (S01_AB01)



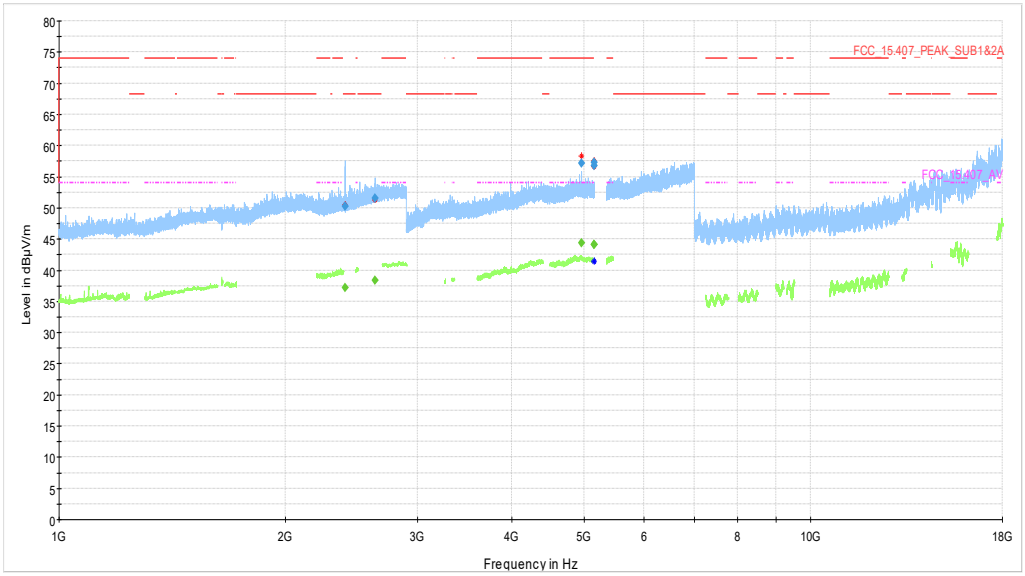
Radio Technology = WLAN a, Operating Frequency = mid,
Measurement range = 30MHz - 1GHz, Subband = U-NII-3
(S01_AB01)



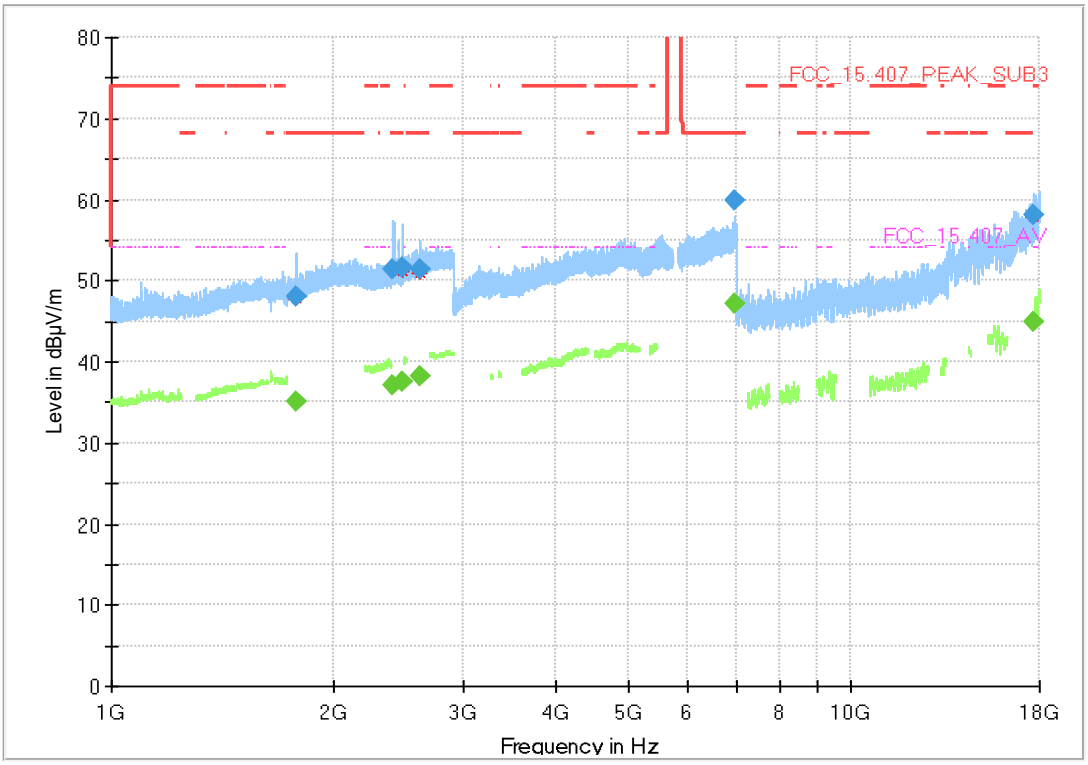
Radio Technology = WLAN a, Operating Frequency = mid,
Measurement range = 1GHz - 26GHz, Subband = U-NII-3
(S01_AB01)



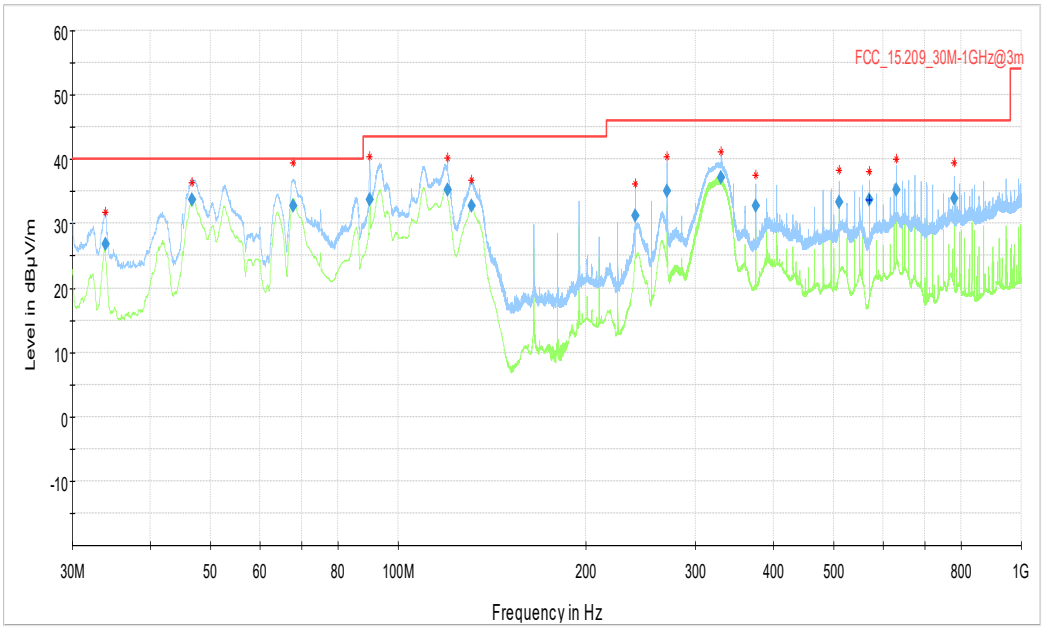
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 1GHz - 18GHz, Subband = U-NII-1 (S01_AB01)



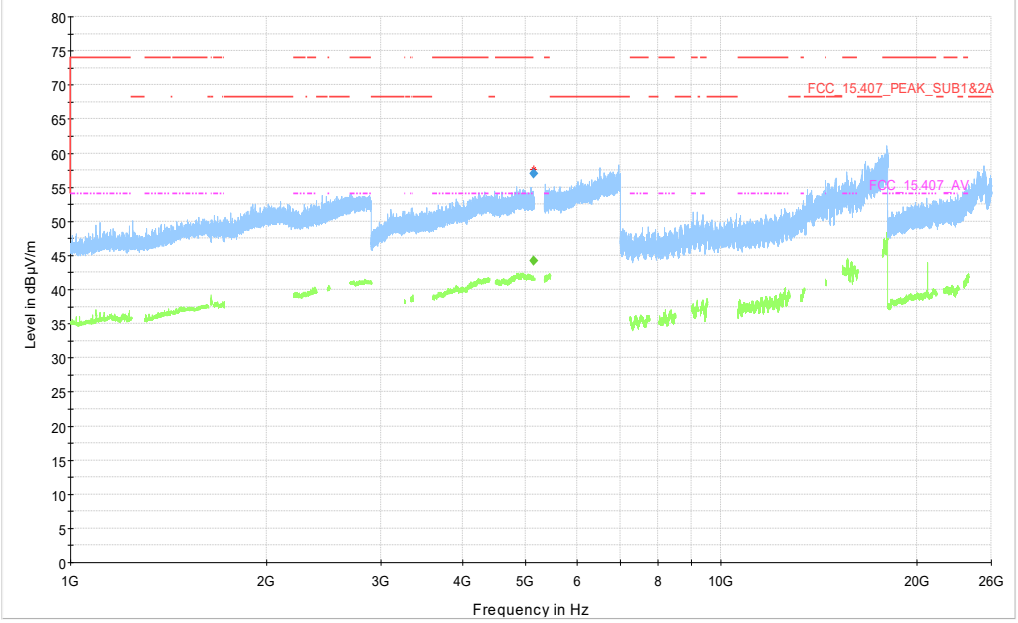
Radio Technology = WLAN n 20 MHz, Operating Frequency = mid, Measurement range = 1GHz - 18GHz, Subband = U-NII-3 (S01_AB01)



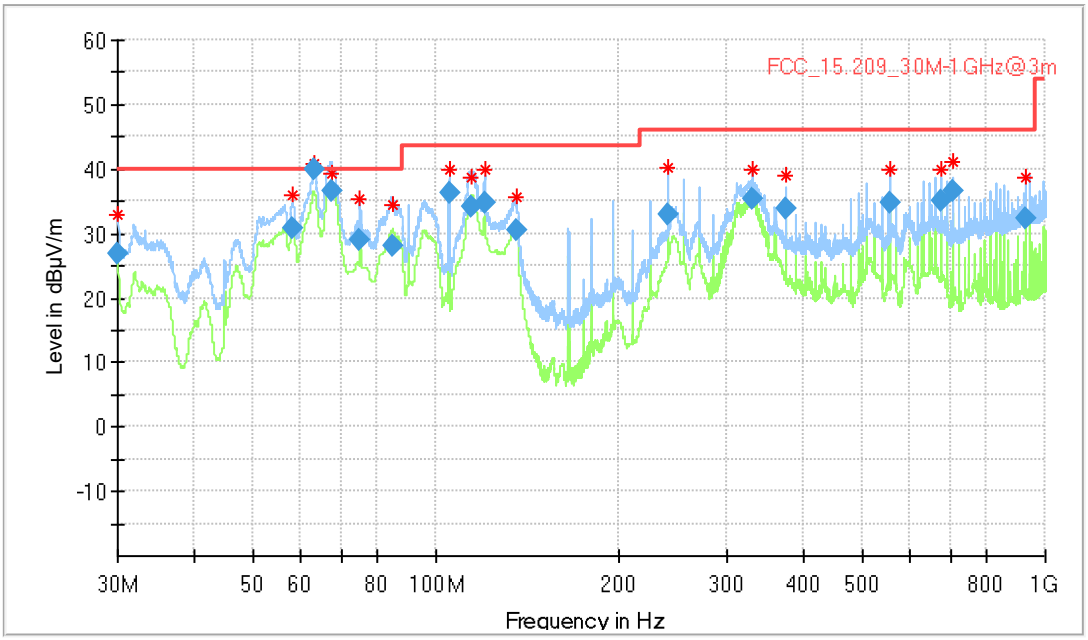
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Measurement range = 30MHz - 1GHz, Subband = U-NII-1 (S01_AB01)



Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-1 (S01_AB01)



Radio Technology = WLAN n 40 MHz, Operating Frequency = high,
Measurement range = 30MHz - 1GHz, Subband = U-NII-3
(S01_AB01)



5.6.5 TEST EQUIPMENT USED

- Radiated Emissions SAC H-Field
- Radiated Emissions FAR 5 GHz FCC
- Radiated Emissions SAC up to 1 GHz

5.7 BAND EDGE

Standard FCC Part 15 Subpart E

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

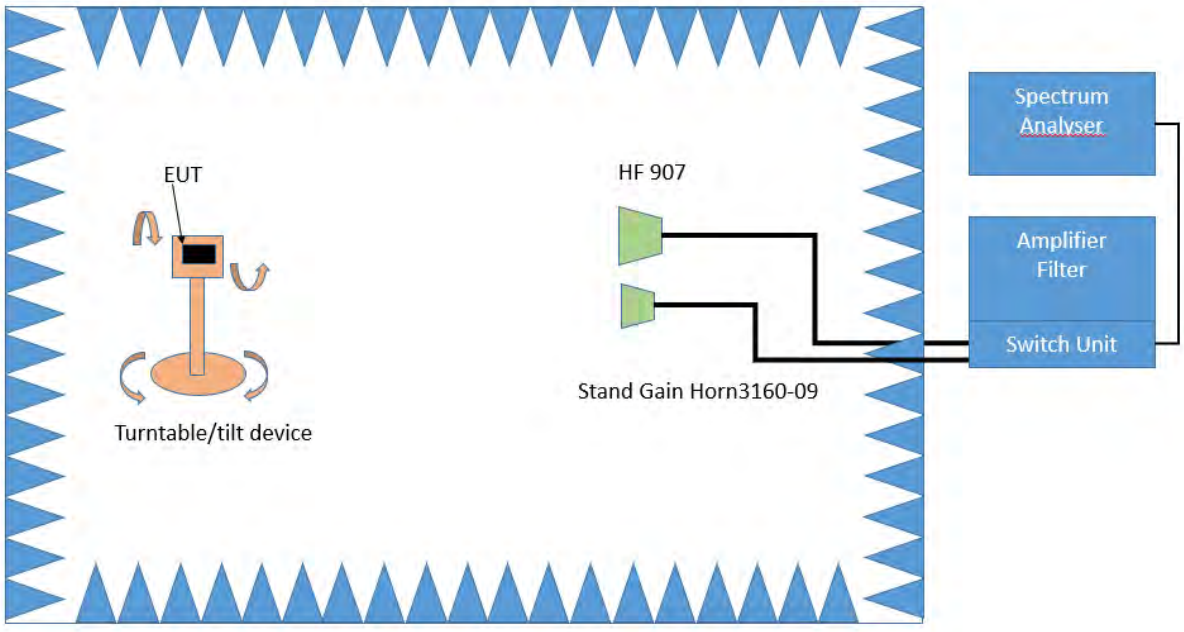
5.7.1 TEST DESCRIPTION

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

- Chapter 6.10.5

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.
All steps were performed with one height (1.5 m) of the receiving antenna only (procedure according ANSI C63.10, chapter 6.6.5.

3. Measurement above 1 GHz



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

Step 1:
The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.
The turn table step size (azimuth angle) for the preliminary measurement is 45 °.
Spectrum analyser settings:
- Detector: Peak, Average
- RBW = 1 MHz
- VBW = 3 MHz

Step 2:
The turn table azimuth will slowly vary by ± 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

5.7.2 TEST REQUIREMENTS / LIMITS

A) FCC

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

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

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

FCC Part 15 Subpart E, §15.407 (b)(4)
For transmitters operating in the 5725−5850 MHz band:
Limit: −27 dBm/MHz at 75 MHz or more above or below the band edge
increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge
increasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edge
increasing linearly to 27 dBm/MHz at the band edge.

FCC Part 15 Subpart E, §15.407 (b) (5)
For transmitters operating within the 5.925-7.125 GHz band:
Limit: −27 dBm/MHz EIRP outside of the band 5.925-7.125 GHz.

FCC Part 15 Subpart E, §15.407 (b) (6)
For transmitters operating within the 5.925-7.125 GHz bands:
Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

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

RSS-247, 6.2.1.2, Emissions outside the band 5150-5250 MHz, indoor operation only:
Limit: −27 dBm/MHz EIRP outside of the band 5150−5250 MHz.

RSS-247, 6.2.2.2, Emissions outside the band 5250-5350 MHz:
Limit: −27 dBm/MHz EIRP outside of the band 5250−5350 MHz.

RSS-247, 6.2.3.2, Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:
Limit: −27 dBm/MHz EIRP outside of the band 5470−5725 MHz.
However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p.at 5850 MHz instead of 5725 MHz.
Note: No operation is permitted for the frequency range 5600−5650 MHz.

RSS-247, 6.2.4.2, Emissions outside the band 5725-5850 MHz:

a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 Bm/MHz at 5 MHz above or below the band edges;
b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

C) FCC & IC

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)

5.7.3 TEST PROTOCOL

Ambient temperature: 21-22 °C
Air Pressure: 998-1008 hPa
Humidity: 38-40 %
WLAN a-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0.7 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC / IC?	RSE Level uncorrect. [dBµV/m]
1	5180	5150.0	57.8	PEAK	1000	74.0	16.2	BE-RB	FCC&IC	57.8
1	5180	5150.0	45.1	AV	1000	54.0	8.9	BE-RB	FCC&IC	44.4
3	5745	5725.0	57.4	PEAK	1000	119.2	61.8	BE-UE	FCC&IC	57.4
3	5825	5850.0	58.2	PEAK	1000	120.4	62.2	BE-UE	FCC&IC	58.2

WLAN n-Mode; 20 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.7 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC / IC?	RSE Level uncorrect. [dBµV/m]
1	5180	5150.0	57.3	PEAK	1000	74.0	16.7	BE-RB	FCC&IC	57.3
1	5180	5150.0	44.7	AV	1000	54.0	9.3	BE-RB	FCC&IC	44
3	5745	5725.0	57.4	PEAK	1000	122.2	64.8	BE-UE	FCC&IC	57.4
3	5825	5850.0	58.2	PEAK	1000	122.2	64.0	BE-UE	FCC&IC	58.2

WLAN n-Mode; 40 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 1.4 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC / IC?	RSE Level uncorrect. [dBµV/m]
1	5190	5150.0	57.0	PEAK	1000	74.0	17.0	BE-RB	FCC&IC	57
1	5190	5150.0	45.6	AV	1000	54.0	8.4	BE-RB	FCC&IC	44.2
3	5755	5725.0	57.8	PEAK	1000	120.3	62.5	BE-UE	FCC&IC	57.8
3	5795	5850.0	57.3	PEAK	1000	119.6	62.3	BE-UE	FCC&IC	57.3

WLAN ac-Mode; 20 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.7 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?	RSE Level uncorrect. [dBµV/m]
1	5180	5150.0	57.6	PEAK	1000	74.0	16.4	BE-RB	FCC&IC	57.6
1	5180	5150.0	44.9	AV	1000	54.0	9.1	BE-RB	FCC&IC	44.2
3	5745	5725.0	57.7	PEAK	1000	122.2	64.5	BE-UE	FCC&IC	57.7
3	5825	5850.0	57.4	PEAK	1000	122.2	64.8	BE-UE	FCC&IC	57.4

WLAN ac-Mode; 40 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 1 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?	RSE Level uncorrect. [dBµV/m]
1	5190	5150.0	57.5	PEAK	1000	74.0	16.5	BE-RB	FCC&IC	57.5
1	5190	5150.0	45.6	AV	1000	54.0	8.4	BE-RB	FCC&IC	44.2
3	5755	5725.0	64.9	PEAK	1000	120.8	55.9	BE-UE	FCC&IC	64.9
3	5795	5850.0	57.6	PEAK	1000	119.6	62.0	BE-UE	FCC&IC	57.6

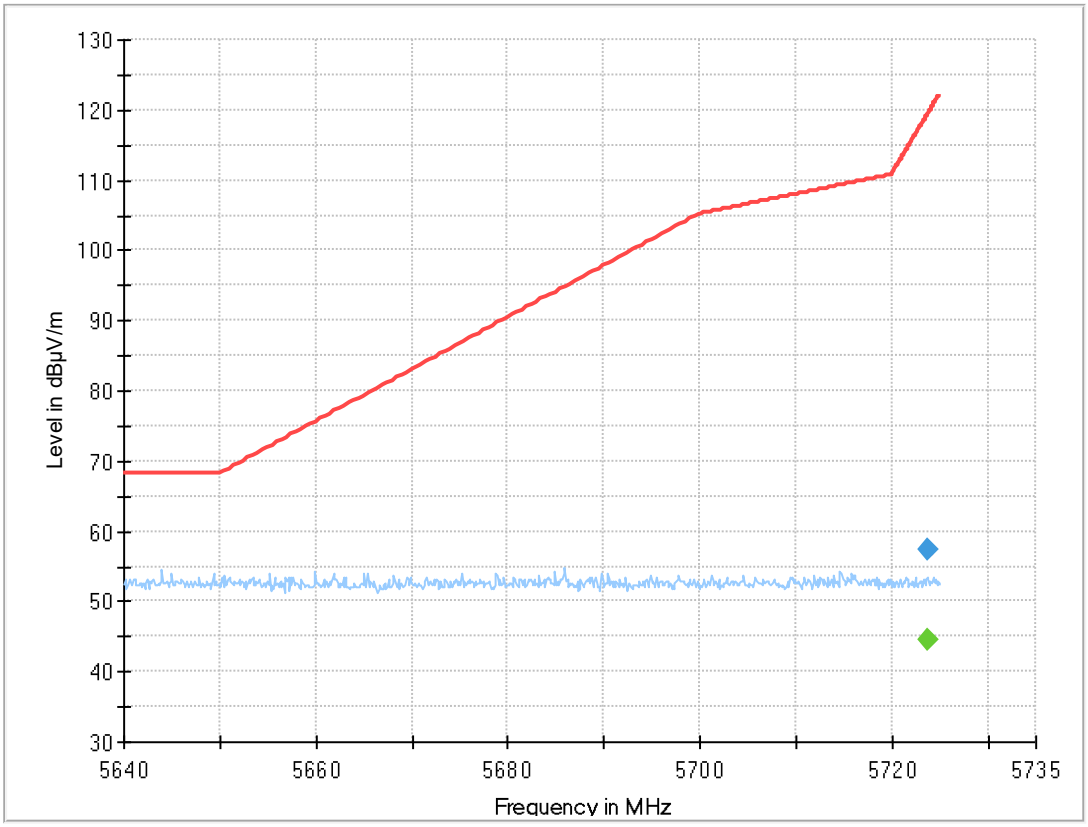
WLAN ac-Mode; 80 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 1.9 dB

U-NII-Subband	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?	RSE Level uncorrect. [dBµV/m]
1	5210	5150.0	56.6	PEAK	1000	74.0	17.4	BE-RB	FCC&IC	56.6
1	5210	5150.0	45.7	AV	1000	54.0	8.3	BE-RB	FCC&IC	43.8
3	5775	5725.0	58.1	PEAK	1000	122.2	64.1	BE-UE	FCC&IC	58.1
3	5775	5850.0	57.6	PEAK	1000	122.2	64.6	BE-UE	FCC&IC	57.6

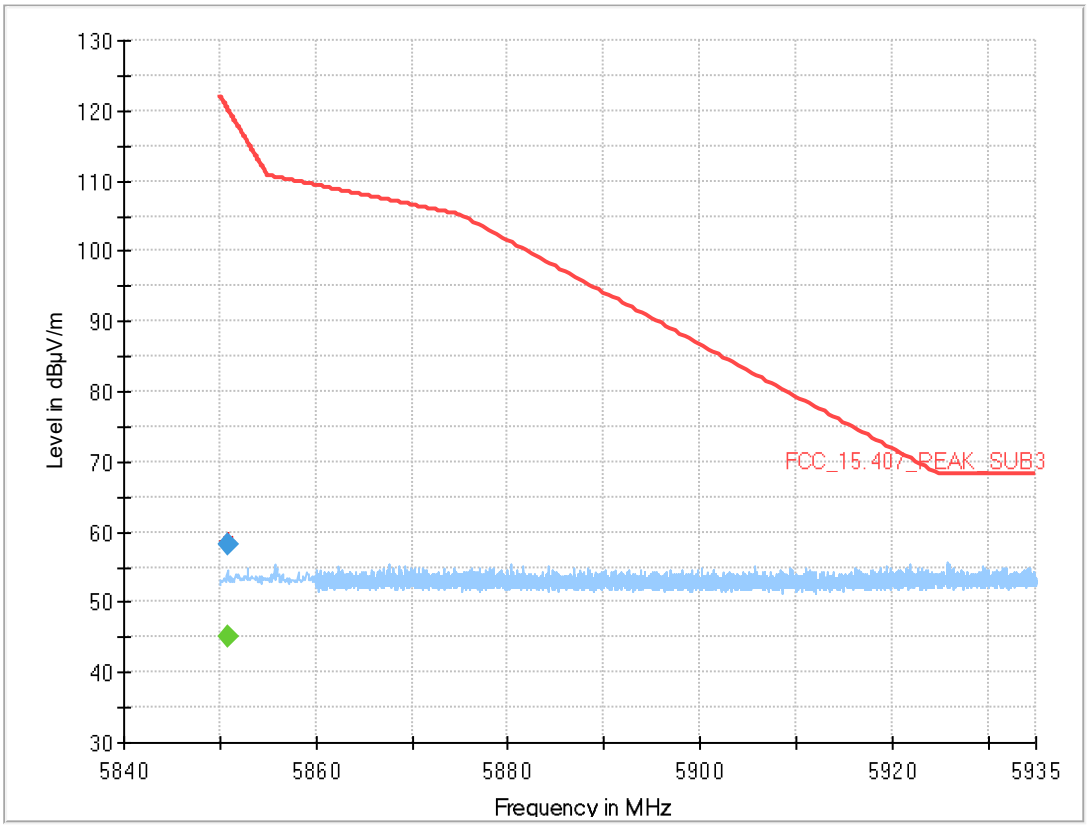
Remark: Please see next sub-clause for the measurement plot.

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

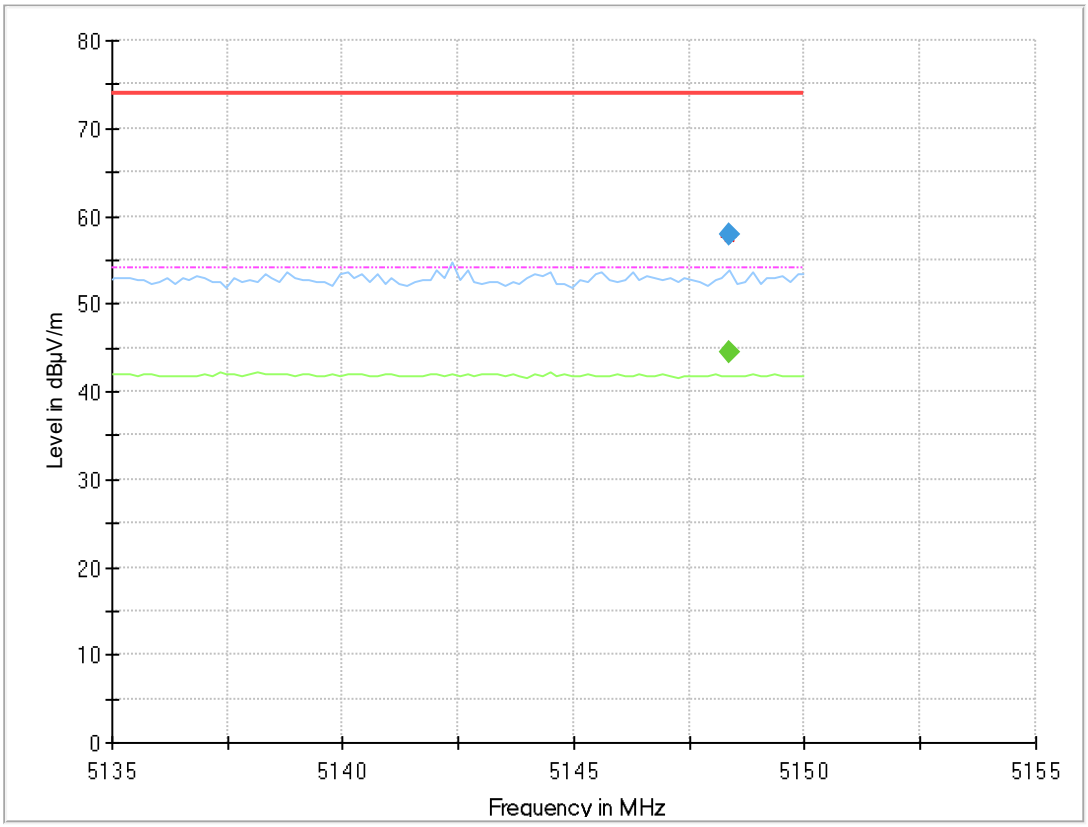
Radio Technology = WLAN a, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)



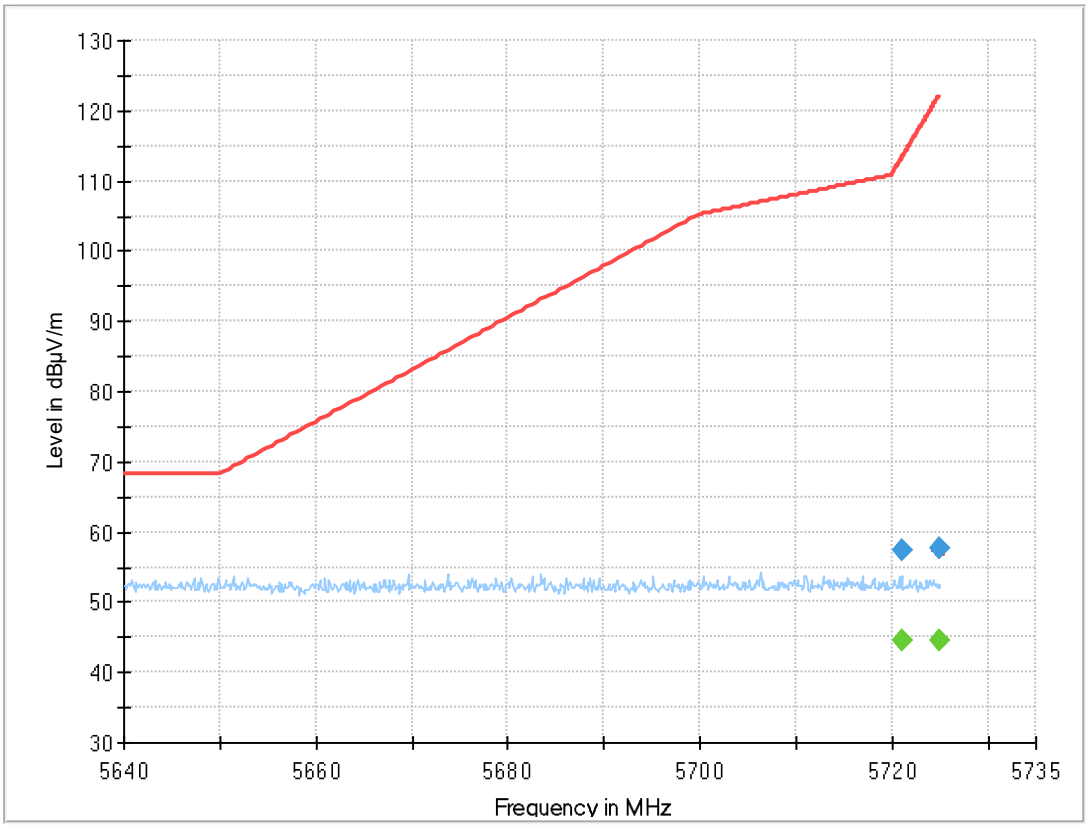
Radio Technology = WLAN a, Operating Frequency = high, Subband = U-NII-3 (S01_AB01)



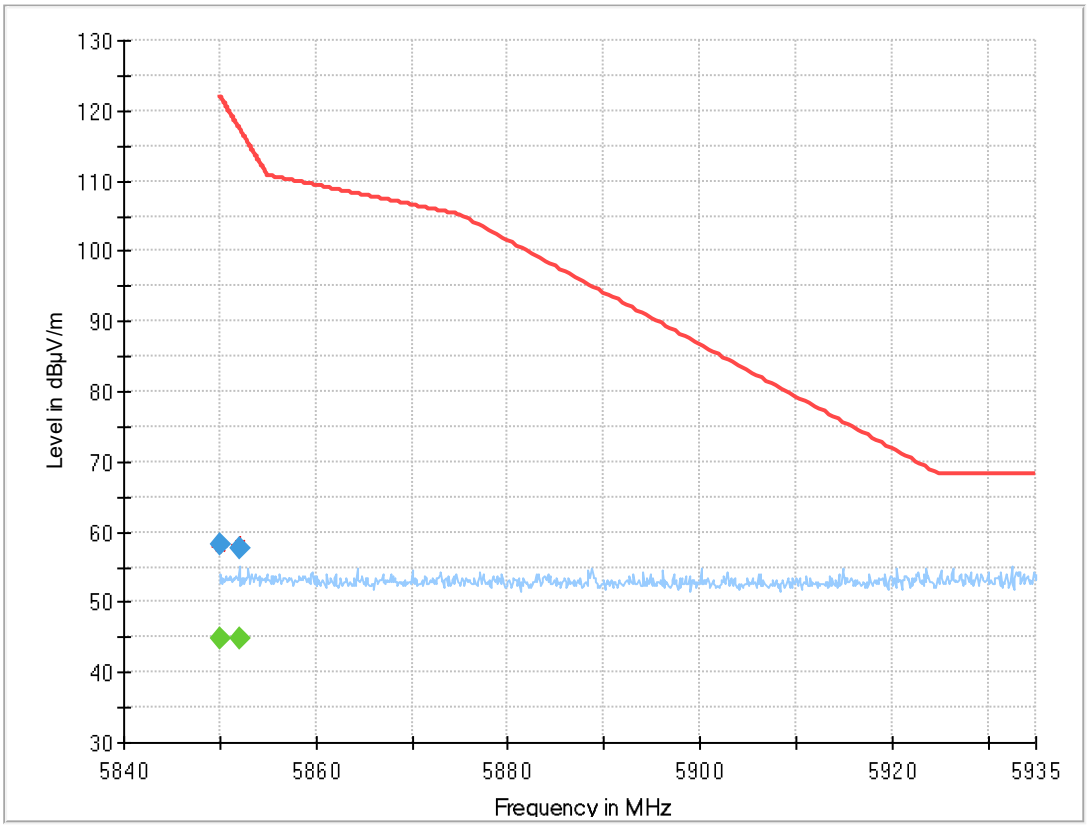
Radio Technology = WLAN a, Operating Frequency = low, Subband = U-NII-1 (S01_AB01)



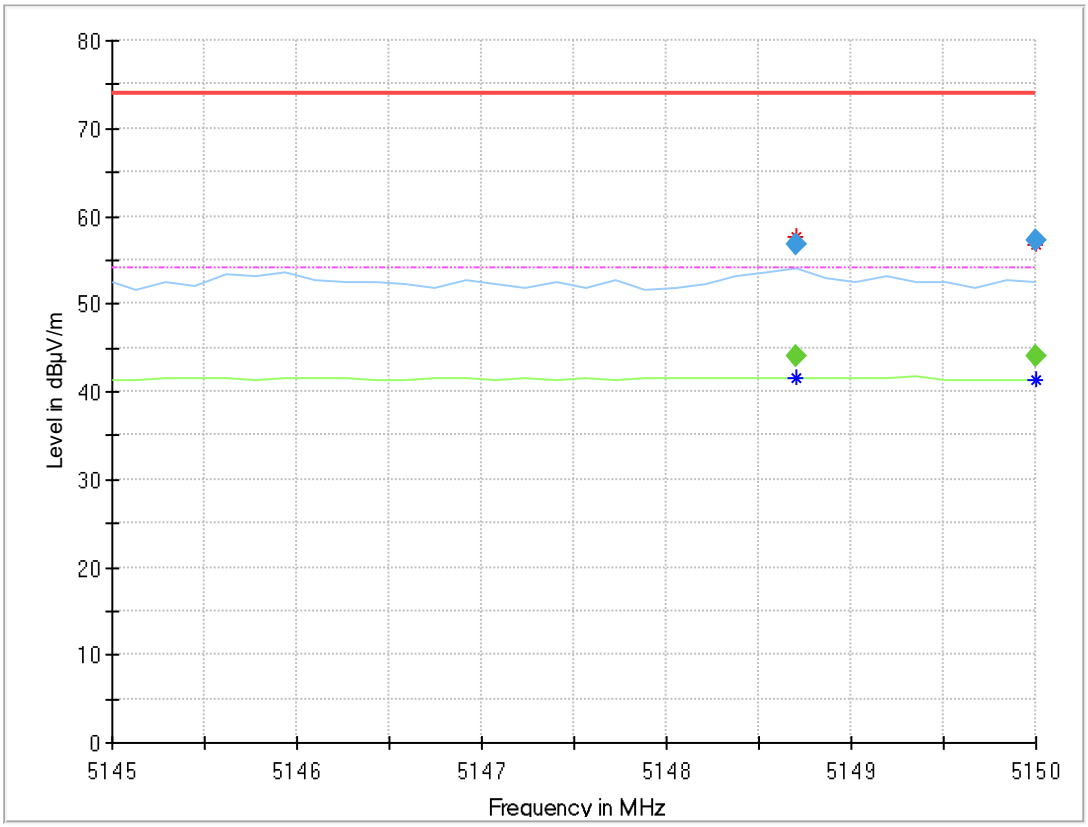
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)



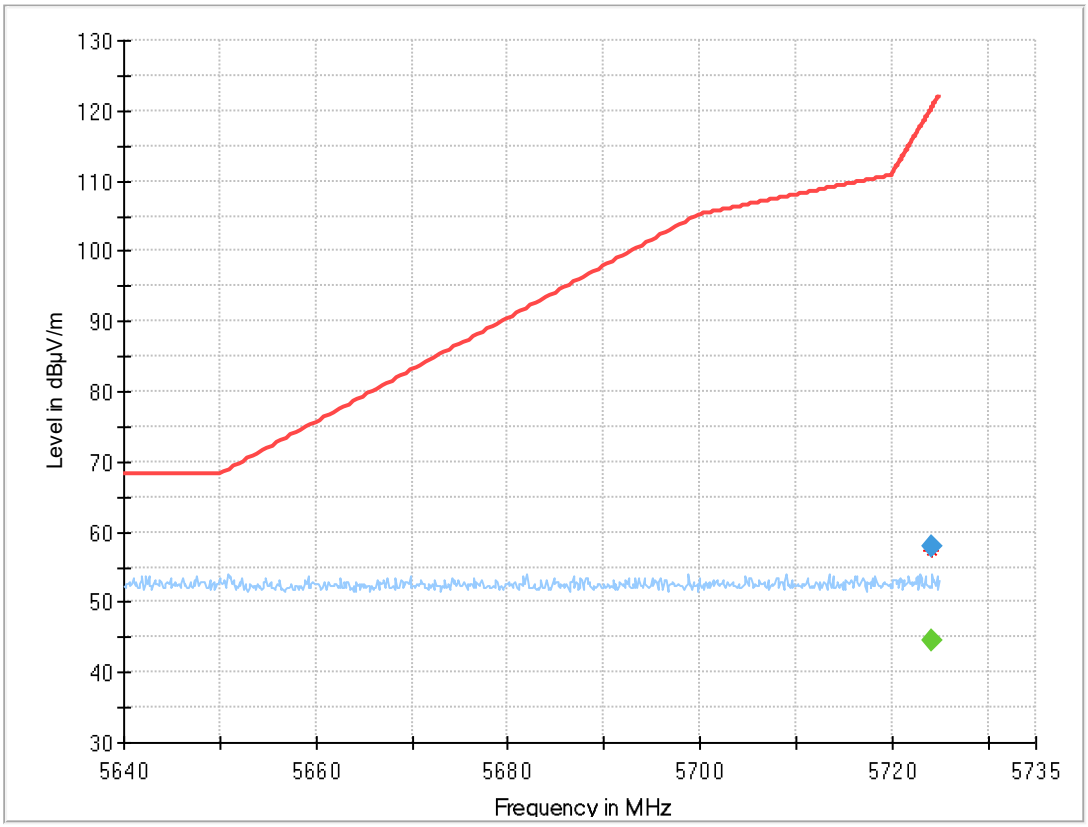
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-3 (S01_AB01)



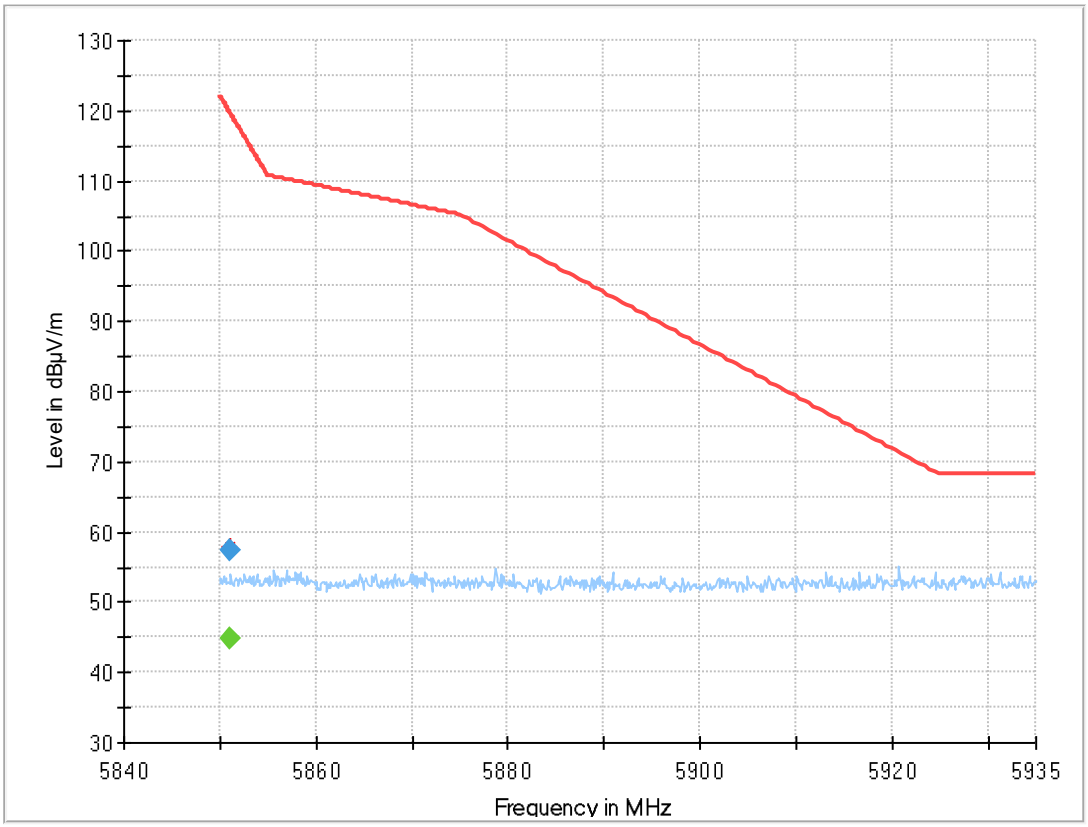
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-1 (S01_AB01)



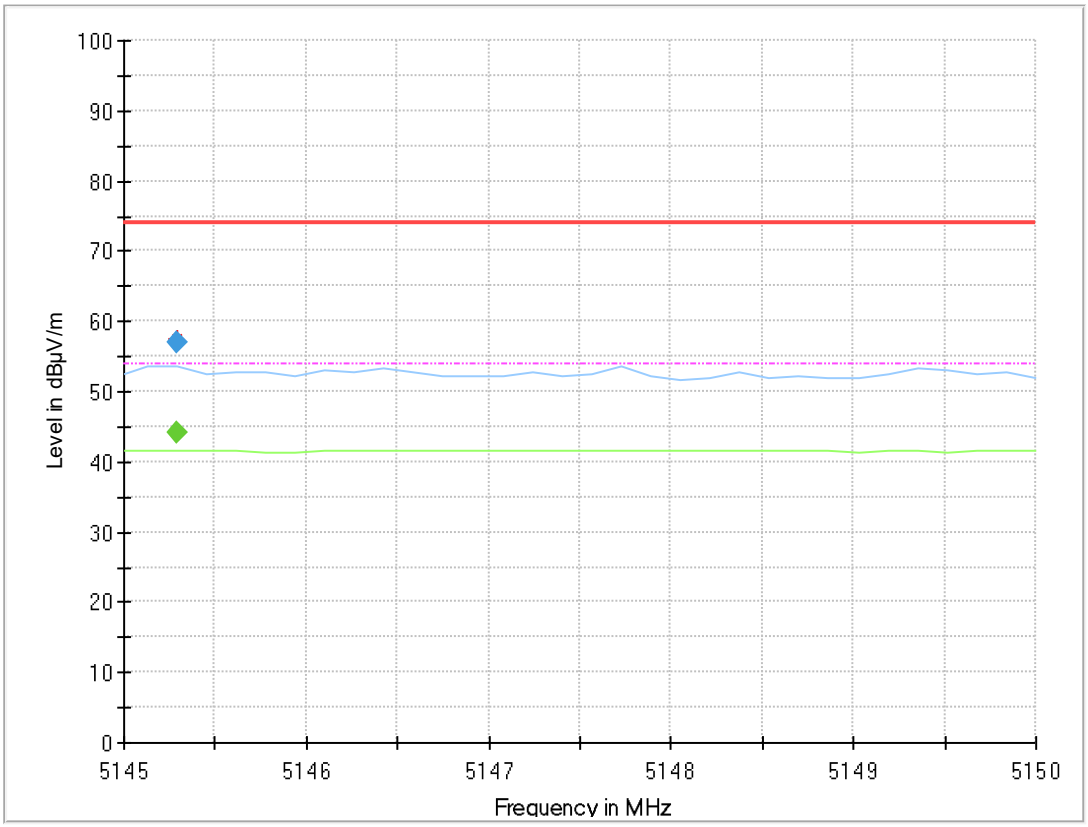
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)



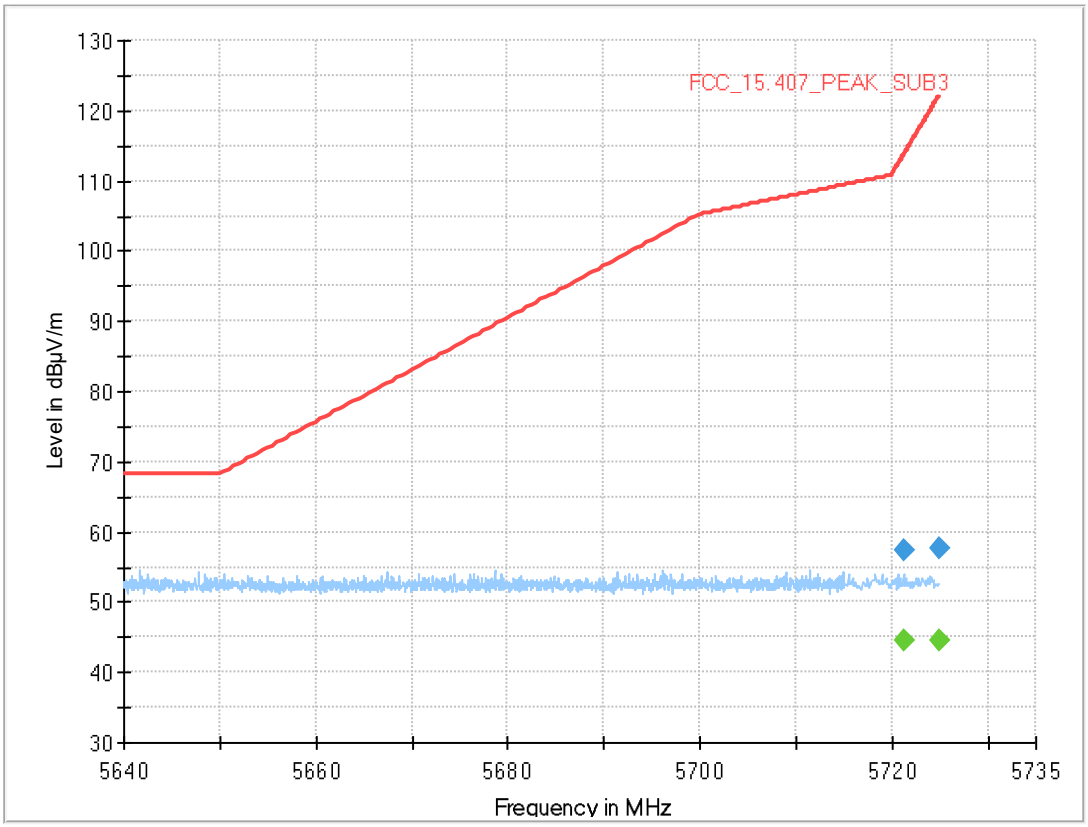
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-3 (S01_AB01)



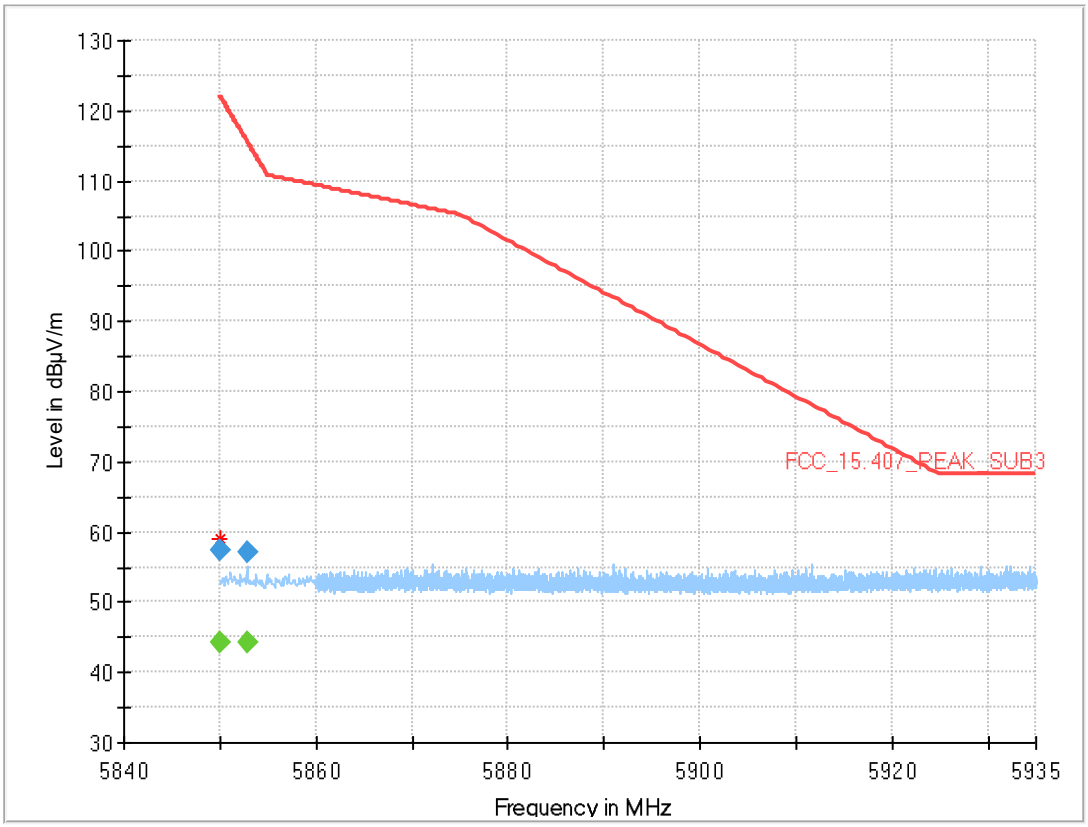
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-1 (S01_AB01)



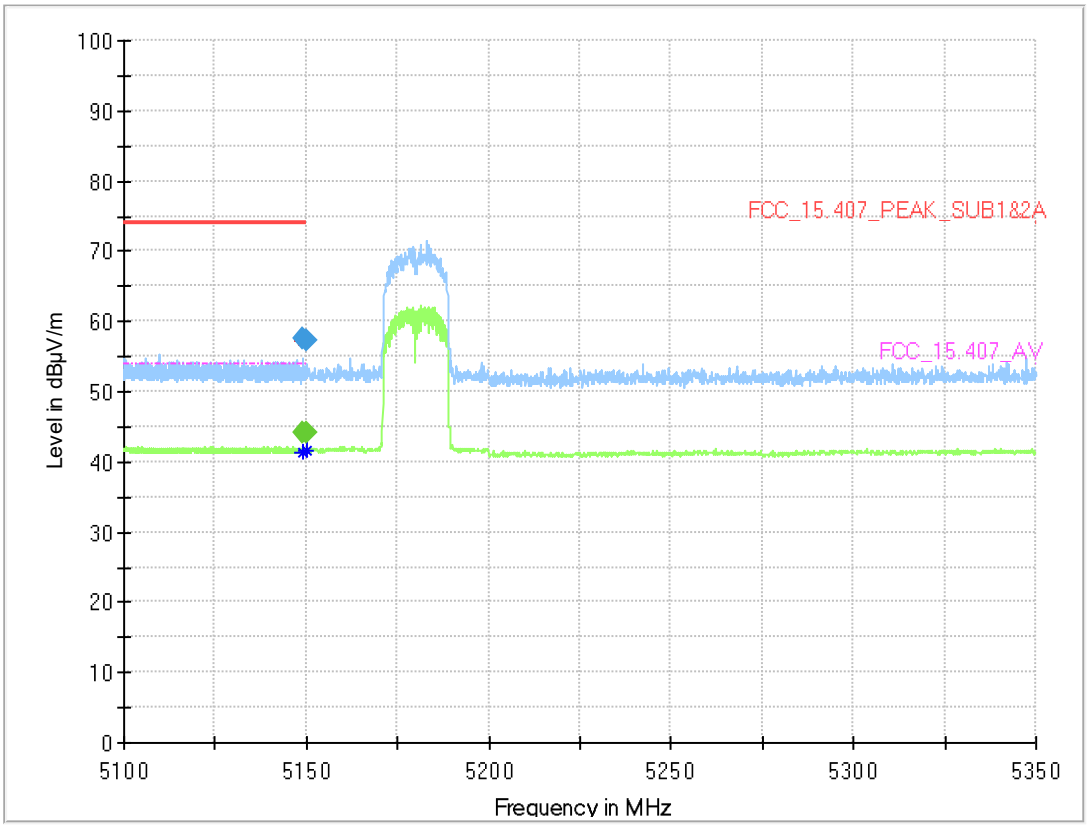
Radio Technology = WLAN ac 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)



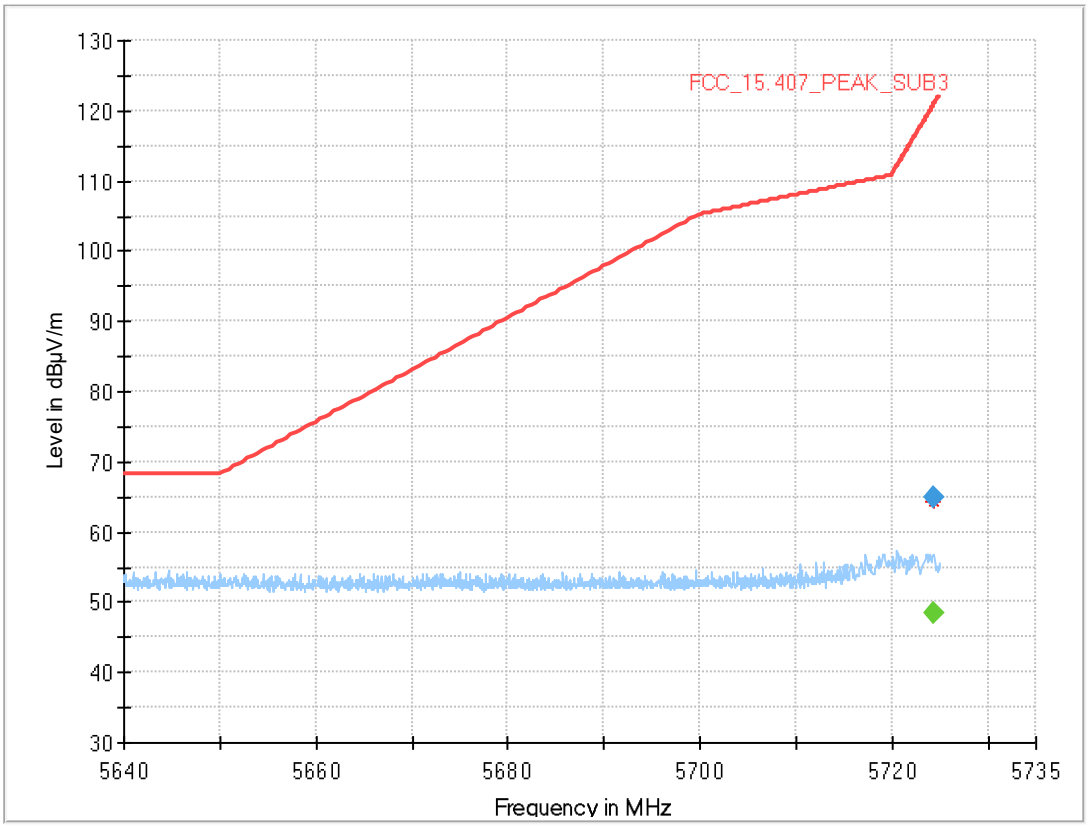
Radio Technology = WLAN ac 20 MHz, Operating Frequency = high, Subband = U-NII-3 (S01_AB01)



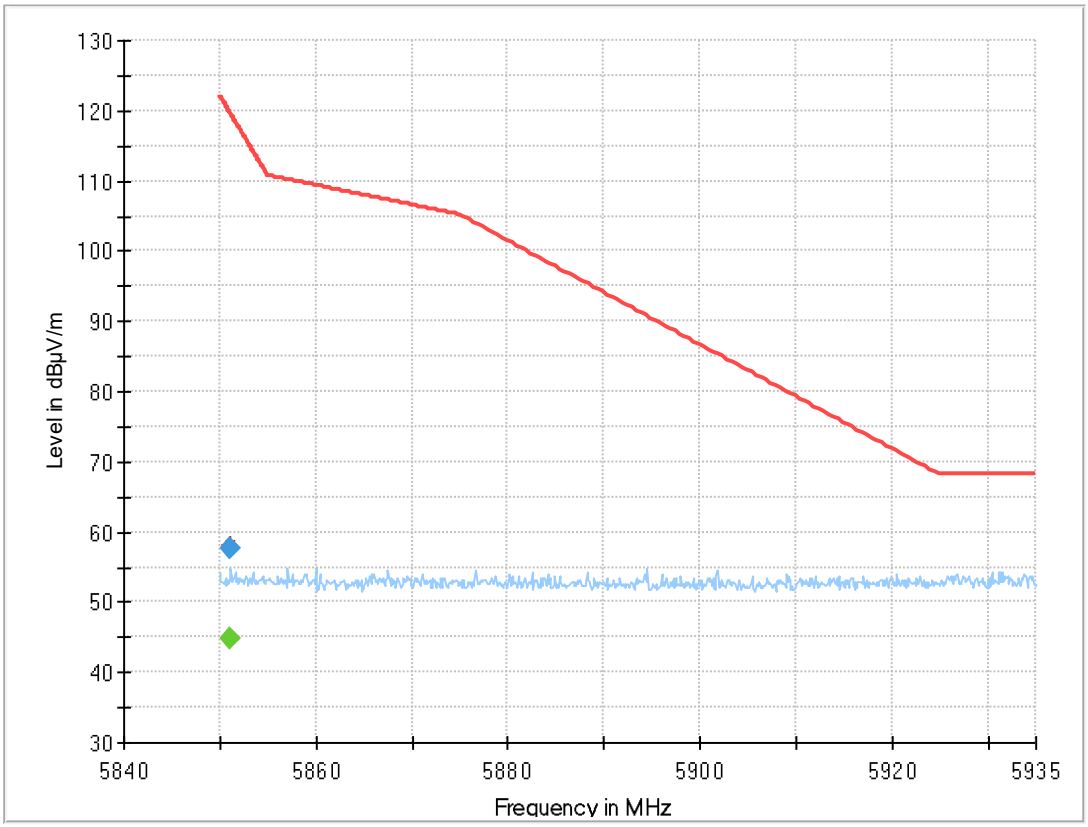
Radio Technology = WLAN ac 20 MHz, Operating Frequency = low, Subband = U-NII-1 (S01_AB01)



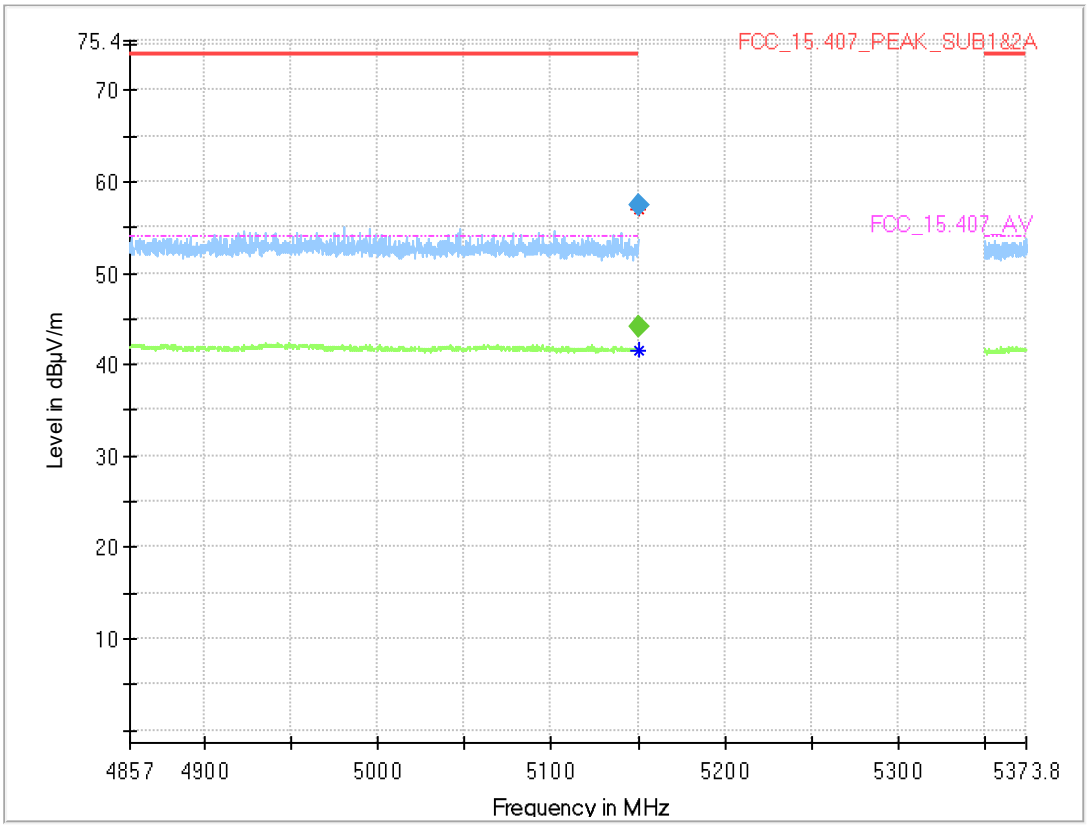
Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)



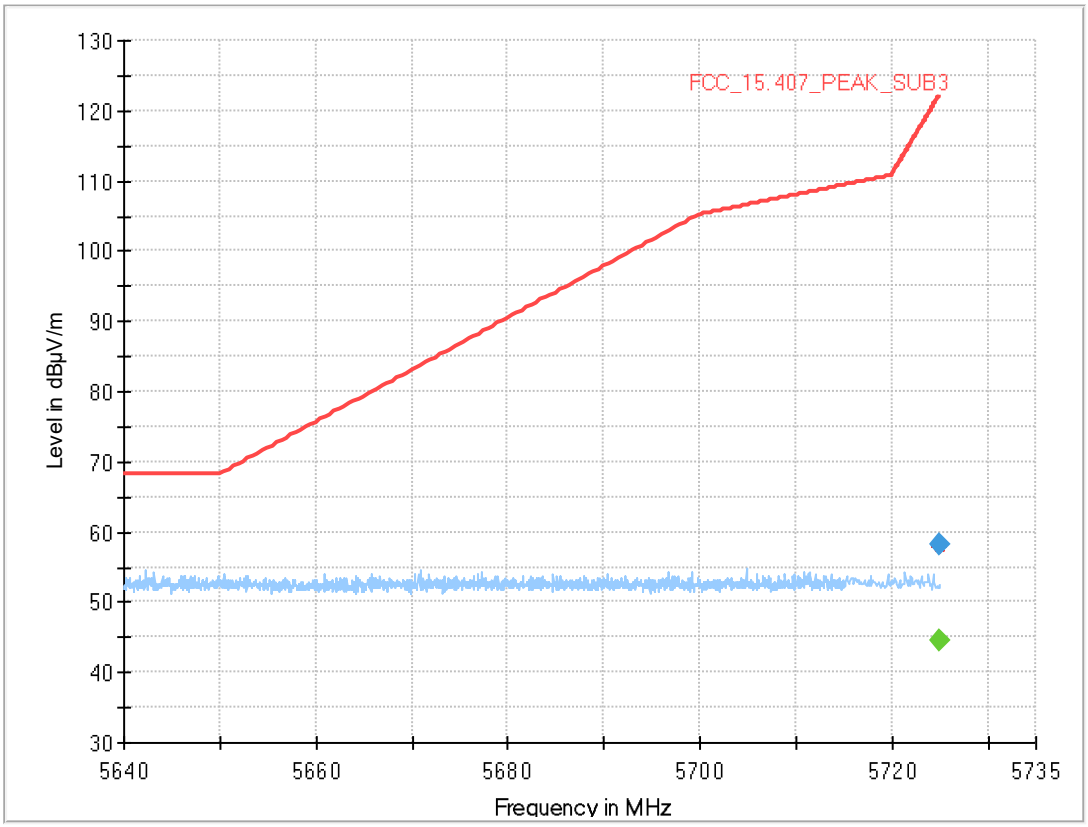
Radio Technology = WLAN ac 40 MHz, Operating Frequency = high, Subband = U-NII-3 (S01_AB01)

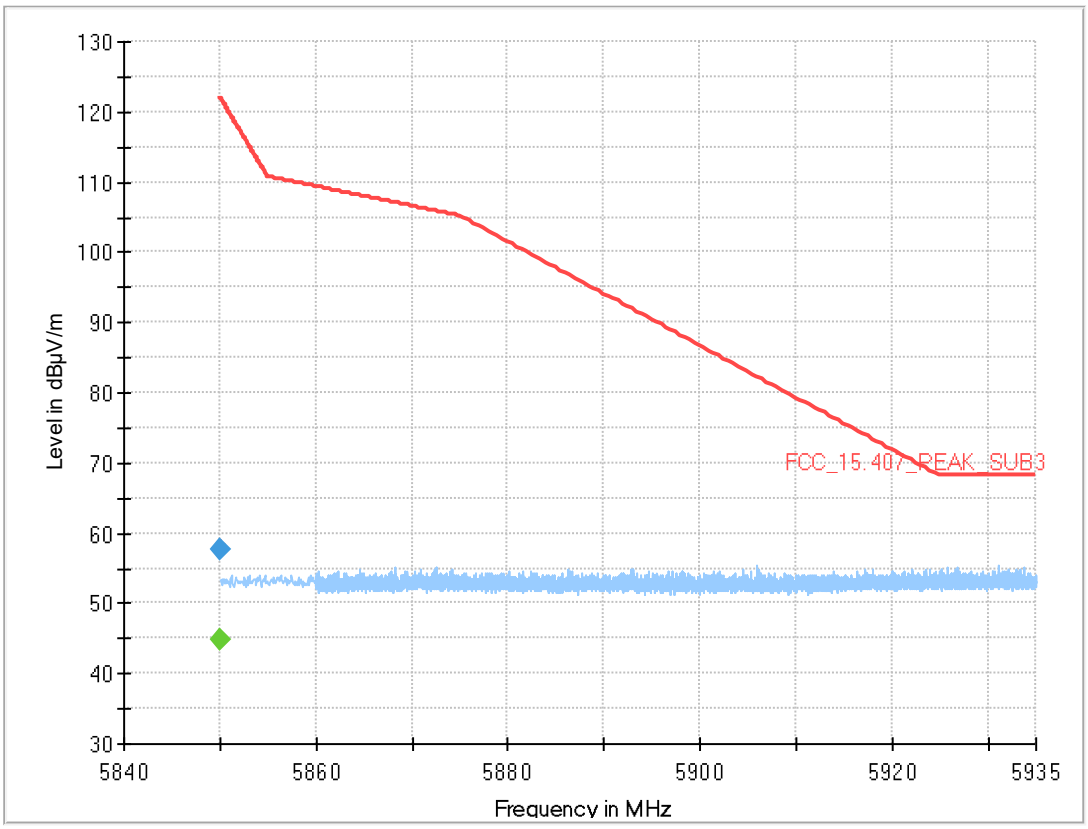


Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Subband = U-NII-1 (S01_AB01)

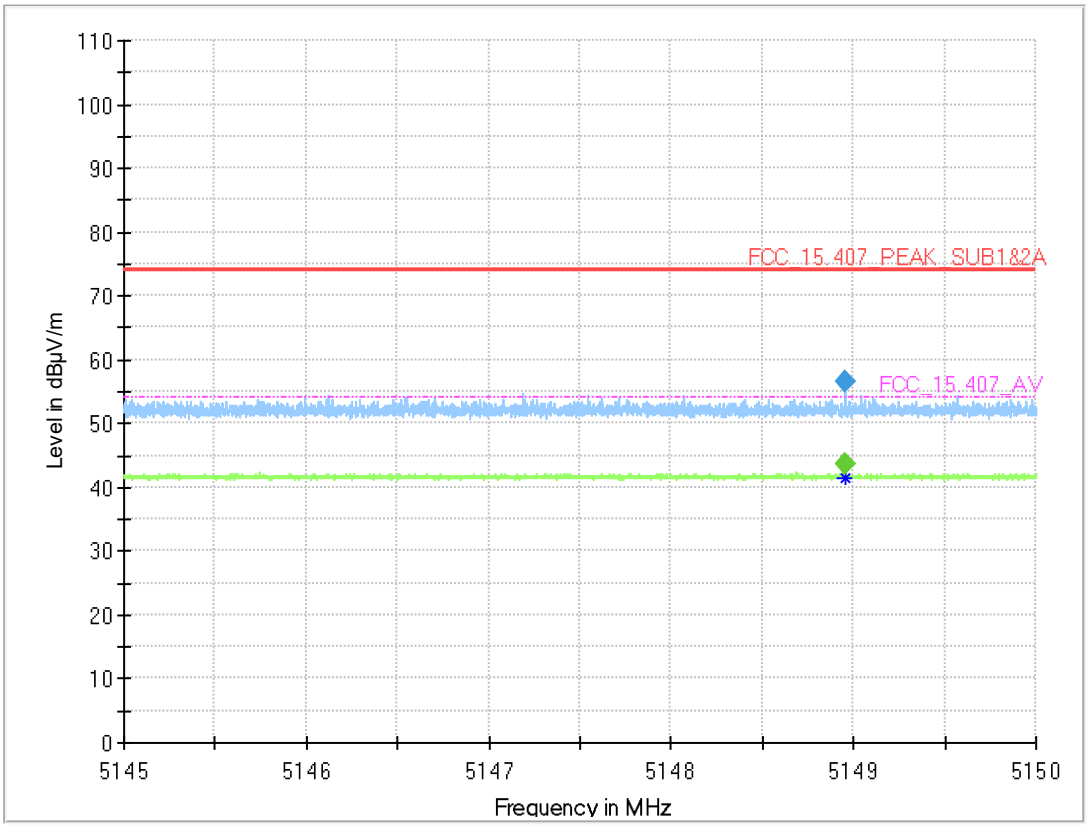


Radio Technology = WLAN ac 80 MHz, Operating Frequency = low, Subband = U-NII-3 (S01_AB01)




130
120
110
100
90
80
70
60
50
40
30
Level in dBµV/m
5840
5860
5880
5900
5920
5935
Frequency in MHz
FCC_15.407_PEAK_SUB3

Radio Technology = WLAN ac 80 MHz, Operating Frequency = mid, Subband = U-NII-1 (S01_AB01)



5.7.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 5 GHz FCC

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

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

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.2	SMF100A	Signal Generator	Rohde & Schwarz GmbH & Co. KG	104275	2023-08	2026-08
1.3	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	107695	2024-07	2027-07
1.4	EX520	Digital Multimeter 12	Extech Instruments Corp	05157876	2022-06	2024-06
1.5	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2023-08	2025-08
1.6	Temperature Chamber VT 4002	Temperature Chamber Vötsch 03	Vötsch	58566002150010	2024-07	2026-07
1.7	FSW43	Signal Analyser	Rohde & Schwarz GmbH & Co. KG	102013	2023-07	2025-07
1.8	Opus10 THI (8152.00)	T/H Logger 14	Lufft Mess- und Regeltechnik GmbH	13993	2023-12	2025-12
1.9	HMP2020	Programmable Power Supply	Rohde & Schwarz GmbH & Co. KG	101992	N/A	N/A
1.10	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2023-01	2026-01
1.11	OSP120	Contains Power Meter and Switching Unit OSP-B157W8 PLUS	Rohde & Schwarz	101158	2021-08	2024-08
1.12	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2024-10

2 Radiated Emissions FAR 5 GHz FCC

Radiated Emissions Tests for 5 GHz bands in a fully anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
2.2	Innco Systems CO3000	Controller for bore sight mast FAC	innco systems GmbH	CO3000/1460/54740522/P	N/A	N/A
2.3	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A	N/A
2.4	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
2.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
2.6	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A	N/A
2.7	FSW43	Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	103779	2023-04	2025-04
2.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
2.9	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069	N/A	N/A
2.10	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
2.11	MA3000/0800-XP-ET-compact	Bore Sight Antenna Mast	innco systems GmbH	9210522	N/A	N/A
2.12	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
2.13	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronic GmbH	00086675	N/A	N/A
2.14	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2023-08	2025-08
2.15	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
2.16	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
2.17	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2021-09	2024-09

3 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
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	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
3.6	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
3.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
3.8	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
3.9	HFH2-Z2	Loop Antenna + 3 Axis Tripod	Rohde & Schwarz GmbH & Co. KG	829324/006		
3.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2024-10