

5.5 Spurious RF Radiated emissions

5.5.1 Standard Applicable [FCC §15.407(b.1)~(b.4)]

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band:
 - (i) All emissions shall be limited to a level of -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, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

§15.209 and RSS-Gen limits for radiated emissions measurements (distance at 3 m)

Frequency Band [MHz]	DISTANCE [Meters]	Limit [$\mu\text{W}/\text{m}$]	Limit [dB $\mu\text{W}/\text{m}$]	Detector
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)	Peak
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)	Peak
1.705 ~ 30.0	30	30	29.54	Peak
30 - 88	3	100 **	40.00	Quasi peak
88 - 216	3	150 **	43.52	Quasi peak
216 - 960	3	200 **	46.02	Quasi peak
Above 960	3	500	54.00	Average
Above 1000	3	74.0 dB $\mu\text{W}/\text{m}$ (Peak), 54.0 dB $\mu\text{W}/\text{m}$ (Average)		

** fundamental emissions from intentional radiators operation under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, or 470-806 MHz. However, operation within these Frequency bands is permitted under other sections of this Part Section 15.231 and 15.241

§15.205. Restrict Band of Operation for FCC

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505**	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 - 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 - 1 427	8.025 - 8.
4.177 25 - 4.177 75	37.5 - 38.25	1 435 - 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 - 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 - 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 - 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 - 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 - 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.38 6 75	156.7 - 156.9	2 690 - 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 - 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 - 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 - 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 - 4 400	Above 38.6
13.36 - 13.41			

** Until February 1, 1999, this restricted band shall be 0.490-0.510

5.5.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (54~ 55) % R.H.

5.5.3 Measurement Procedure

The measurements procedure of the transmitter radiated E-field is as following describe method.

The test is performed in a Shield chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna. (The chamber is ensured that comply with at least 6 dB above the ambient noise level)

- ① The EUT was powered ON with continuously operating mode and placed on a 0.8 meter high non-conductive table on the reference ground plane.
 - ② The test antenna was used on Horn antenna for above 1 GHz, and if the below 1 GHz, broad-band antenna and Loop antenna were used for below 30 MHz and it's antenna positioned in both the horizontal and vertical plane was location at EUT during the test for maximized the emission measurement.
 - ③ The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the frequency range according to required standard
 - ④ The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure(according ANSI C63.10:2009 clause 4.2.3.2.3 procedure for average measure). Both PK and AV level test, PK detector is used.
 - ⑤ The fundamental frequency at which a relevant radiated signal component is detected, the test antenna will be raised and lowered through the specified range of heights in horizontal and vertical polarized orientation, until an maximum signal level is detected on the measuring receiver.
 - ⑥ The transmitter is position x, y, z axis on rotating through 360 degrees, until the maximum signal level is detected by the measuring receiver.
 - ⑦ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with required standard.
- The measurement results are obtained as described below:
Result(dB μ V/m) = Reading(dB μ V) + Antenna factor(dB/m) + CL(dB) + other applicable factor (dB)
 - According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

For the transmitter unwanted emissions shall be measured using following options below:

Refer as FCC KDB 789033 D02, clause G)2) for unwanted emissions into non-restricted bands.

Refer as FCC KDB 789033 D02, clause G)1) for unwanted emissions into restricted bands.

For the transmitter bandedge emissions shall be measured using following options below:

Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.

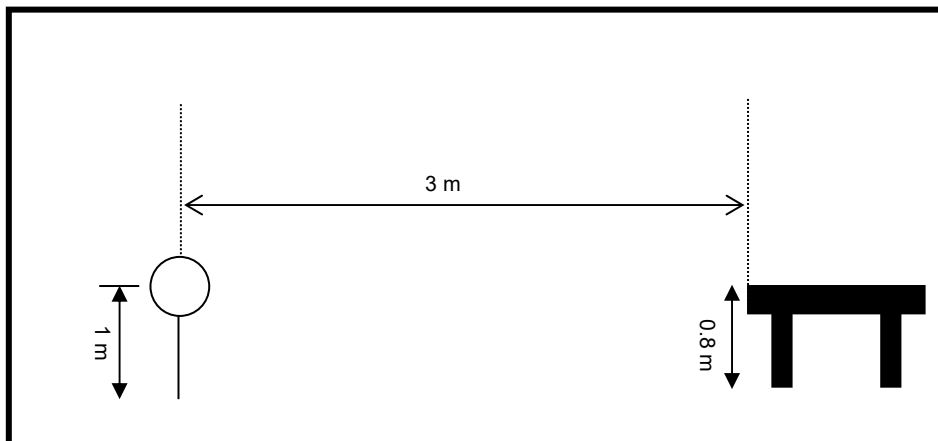
5.5.4 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

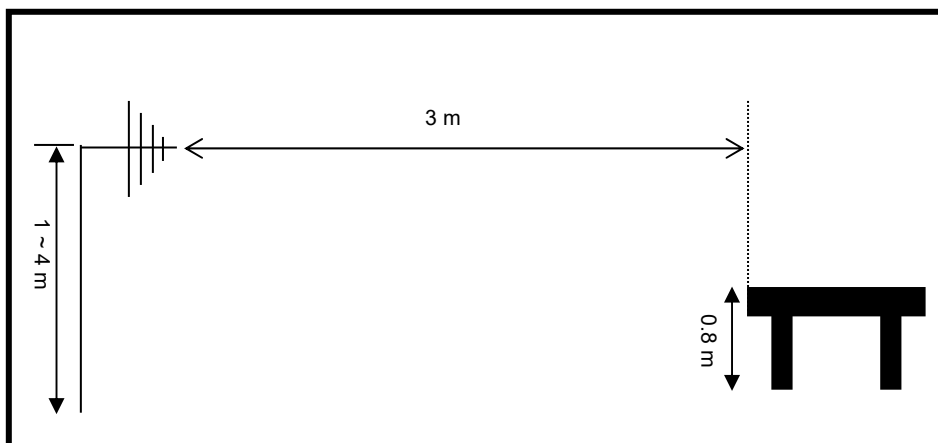
Radiated Emission measurement: Below 1 GHz: 3.62 dB (CL: Approx 95 %, k=2)
Above 1 GHz: 4.06 dB (CL: Approx 95 %, k=2)

5.5.5 Test Configuration

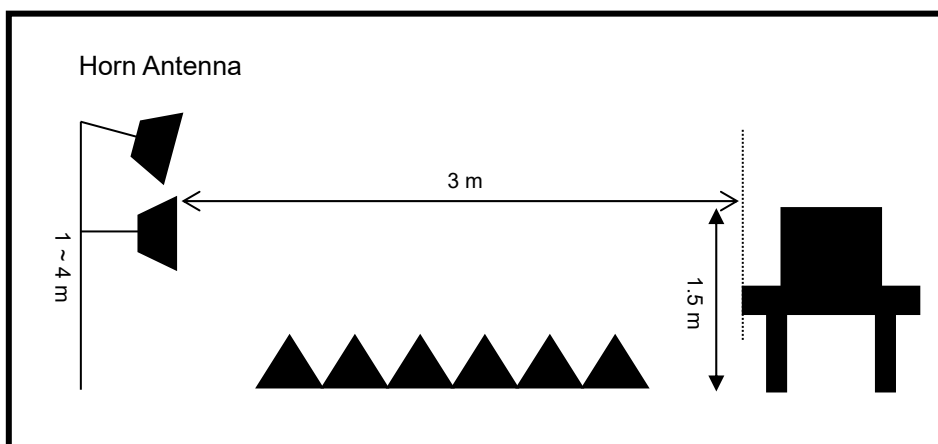
Radiated emission setup, below 30 MHz



Radiated emission setup, below 1 000 MHz



Radiated emission setup, above 1 GHz



5.5.6 Measurement Result

■ Restricted Band Emissions

5 180 ~ 5 320 MHz

802.11a CH 36(5 180 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.149	39.46	28.87	0	1.5	H	33.50	9.61	-29.83	52.74	42.15	74	54	21.26	11.85	Compliance
5.149	40.44	28.55	0	1.5	V	33.50	9.61	-29.83	53.72	41.83	74	54	20.28	12.17	Compliance

802.11a CH 64(5 320 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.351	38.99	26.18	0	1.5	H	34.00	10.25	-29.81	53.42	40.61	74	54	20.58	13.39	Compliance
5.351	36.38	26.92	0	1.5	V	34.00	10.25	-29.81	50.81	41.35	74	54	23.19	12.65	Compliance

802.11n(HT20) CH 36(5 180 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.147	36.95	28.24	0	1.5	H	33.49	9.61	29.83	50.22	41.51	74	54	23.78	12.49	Compliance
5.146	36.79	27.91	0	1.5	V	33.48	9.61	29.83	50.06	41.18	74	54	23.94	12.82	Compliance

802.11n(HT20) CH 64(5 320 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.350	36.19	27.62	50	1.5	H	34.00	10.24	29.81	50.61	42.04	74	54	23.39	11.96	Compliance
5.351	35.76	28.04	50	1.5	V	34.00	10.25	29.81	50.19	42.47	74	54	23.81	11.53	Compliance

802.11n(HT40) CH 38(5 190 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.149	41.45	29.45	120	1.5	H	33.50	9.61	29.83	54.73	42.73	74	54	19.27	11.27	Compliance
5.149	44.97	31.83	120	1.5	V	33.50	9.61	29.83	58.25	45.11	74	54	15.75	8.89	Compliance

802.11n(HT40) CH 62(5 310 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.350	45.02	34.27	120	1.5	H	34.00	10.24	29.81	59.44	48.69	74	54	14.56	5.31	Compliance
5.350	42.61	30.72	120	1.5	V	34.00	10.24	29.81	57.03	45.14	74	54	16.97	8.86	Compliance

802.11ac(VHT20) CH 36(5 180 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.148	36.98	28.97	180	1.5	H	33.49	9.61	-29.83	50.26	42.25	74	54	23.74	11.75	Compliance
5.147	37.26	27.91	180	1.5	V	33.49	9.61	-29.83	50.53	41.18	74	54	23.47	12.82	Compliance

802.11ac(VHT20) CH 64(5 320 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.350	36.47	27.16	120	1.5	H	34.00	10.24	-29.81	50.89	41.58	74	54	23.11	12.42	Compliance
5.351	37.37	27.50	120	1.5	V	34.00	10.25	-29.81	51.80	41.93	74	54	22.20	12.07	Compliance

802.11ac(VHT40) CH 38(5 190 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.148	42.60	29.73	120	1.5	H	33.49	9.61	-29.83	55.88	43.01	74	54	18.12	10.99	Compliance
5.148	43.35	31.54	120	1.5	V	33.49	9.61	-29.83	56.63	44.82	74	54	17.37	9.18	Compliance

802.11ac(VHT40) CH 62(5 310 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.354	44.42	32.12	120	1.5	H	34.01	10.26	-29.81	58.87	46.57	74	54	15.13	7.43	Compliance
5.350	41.30	31.87	120	1.5	V	34.00	10.24	-29.81	55.72	46.29	74	54	18.28	7.71	Compliance

802.11ac(VHT80) CH 42(5 210 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.145	40.50	30.69	50	1.5	H	33.48	9.61	-29.83	53.76	43.95	74	54	20.24	10.05	Compliance
5.145	40.82	31.40	50	1.5	V	33.48	9.61	-29.83	54.08	44.66	74	54	19.92	9.34	Compliance

802.11 ac(VHT80) CH 58(5 290 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.353	41.47	33.17	50	1.5	H	34.01	10.26	-29.81	55.91	47.61	74	54	18.09	6.39	Compliance
5.352	39.67	31.99	50	1.5	V	34.00	10.25	-29.81	54.11	46.43	74	54	19.89	7.57	Compliance

5 500 ~ 5 720 MHz

802.11a CH 100(5 500 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.435	37.33	27.28	20	1.5	H	34.14	10.56	-29.81	52.21	42.16	74	54	21.79	11.84	Compliance
5.457	37.67	27.60	20	1.5	V	34.16	10.60	-29.81	52.61	42.54	74	54	21.39	11.46	Compliance

802.11a CH 140(5 700 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.852	35.84	27.46	50	1.5	H	34.20	11.09	-30.00	51.14	42.76	74	54	22.86	11.24	Compliance
5.853	35.89	26.90	50	1.5	V	34.21	11.09	-30.00	51.19	42.20	74	54	22.81	11.80	Compliance

802.11a CH 144(5 720 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.873	36.23	27.97	50	1.5	H	34.25	11.08	-30.01	51.55	43.29	74	54	22.45	10.71	Compliance
5.865	35.96	26.41	50	1.5	V	34.23	11.09	-30.00	51.27	41.72	74	54	22.73	12.28	Compliance

802.11n(HT20) CH 100(5 500 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.456	36.20	28.22	0	1.5	H	34.16	10.60	-29.81	51.14	43.16	74	54	22.86	10.84	Compliance
5.457	37.04	27.49	0	1.5	V	34.16	10.60	-29.81	51.98	42.43	74	54	22.02	11.57	Compliance

802.11n(HT20) CH 140(5 700 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.856	35.38	26.78	0	1.5	H	34.21	11.09	-30.00	50.68	42.08	74	54	23.32	11.92	Compliance
5.867	36.08	27.01	0	1.5	V	34.23	11.09	-30.00	51.39	42.32	74	54	22.61	11.68	Compliance

802.11n(HT20) CH 144(5 720 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.868	36.99	27.23	0	1.5	H	34.24	11.09	-30.00	52.30	42.54	74	54	21.70	11.46	Compliance
5.855	37.25	27.46	0	1.5	V	34.21	11.09	-30.00	52.55	42.76	74	54	21.45	11.24	Compliance

802.11n(HT40) CH 102(5 510 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.459	36.31	27.04	180	1.5	H	34.16	10.60	-29.81	51.26	41.99	74	54	22.74	12.01	Compliance
5.455	36.25	26.82	180	1.5	V	34.16	10.59	-29.81	51.18	41.75	74	54	22.82	12.25	Compliance

802.11n(HT40) CH 134(5 670 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.895	36.81	27.74	180	1.5	H	34.29	11.07	-30.02	52.15	43.08	74	54	21.85	10.92	Compliance
5.910	36.21	27.12	180	1.5	V	34.34	11.10	-30.03	51.62	42.53	74	54	22.38	11.47	Compliance

802.11n(HT40) CH 142(5 710 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.856	36.86	27.68	120	1.5	H	34.21	11.09	-30.00	52.16	42.98	74	54	21.84	11.02	Compliance
5.871	36.73	27.44	120	1.5	V	34.24	11.08	-30.01	52.05	42.76	74	54	21.95	11.24	Compliance

802.11ac(VHT20) CH 100(5 500 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.445	36.40	26.58	0	1.5	H	34.15	10.58	-29.81	51.31	41.49	74	54	22.69	12.51	Compliance
5.453	36.63	27.05	0	1.5	V	34.15	10.59	-29.81	51.56	41.98	74	54	22.44	12.02	Compliance

802.11ac(VHT20) CH 140(5 700 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.854	36.52	27.35	0	1.5	H	34.21	11.09	-30.00	51.82	42.65	74	54	22.18	11.35	Compliance
5.881	36.75	27.10	0	1.5	V	34.26	11.08	-30.01	52.08	42.43	74	54	21.92	11.57	Compliance

802.11ac(VHT20) CH 144(5 720 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.868	36.16	27.56	15	1.5	H	34.24	11.09	-30.00	51.47	42.87	74	54	22.53	11.13	Compliance
5.875	36.65	26.99	15	1.5	V	34.25	11.08	-30.01	51.97	42.31	74	54	22.03	11.69	Compliance

802.11ac(VHT40) CH 102(5 510 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.450	36.44	27.61	120	1.5	H	34.15	10.59	-29.81	51.36	42.53	74	54	22.64	11.47	Compliance
5.456	36.16	26.93	120	1.5	V	34.16	10.60	-29.81	51.10	41.87	74	54	22.90	12.13	Compliance

802.11ac(VHT40) CH 134(5 670 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.874	36.54	26.99	120	1.5	H	34.25	11.08	-30.01	51.86	42.31	74	54	22.14	11.69	Compliance
5.935	36.99	26.60	120	1.5	V	34.44	11.18	-30.04	52.57	42.18	74	54	21.43	11.82	Compliance

802.11ac(VHT40) CH 142(5 710 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.876	35.90	27.22	100	1.5	H	34.25	11.08	-30.01	51.22	42.54	74	54	22.78	11.46	Compliance
5.874	36.15	27.11	100	1.5	V	34.25	11.08	-30.01	51.47	42.43	74	54	22.53	11.57	Compliance

802.11ac(VHT80) CH 106(5 530 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.455	37.40	27.72	180	1.5	H	34.16	10.59	-29.81	52.33	42.65	74	54	21.67	11.35	Compliance
5.459	37.25	26.57	180	1.5	V	34.16	10.60	-29.81	52.20	41.52	74	54	21.80	12.48	Compliance

802.11 ac(VHT80) CH 122(5 610 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.862	36.00	27.12	180	1.5	H	34.22	11.09	-30.00	51.31	42.43	74	54	22.69	11.57	Compliance
5.879	36.54	27.55	180	1.5	V	34.26	11.08	-30.01	51.86	42.87	74	54	22.14	11.13	Compliance

802.11 ac(VHT80) CH 138(5 690 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.869	36.04	27.45	180	1.5	H	34.24	11.09	-30.00	51.35	42.76	74	54	22.65	11.24	Compliance
5.856	36.60	27.13	180	1.5	V	34.21	11.09	-30.00	51.90	42.43	74	54	22.10	11.57	Compliance

5 745 ~ 5 825 MHz

802.11a CH 149(5 745 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.582	43.46	32.87	50	1.5	H	34.04	10.79	-29.85	58.43	47.84	74	54	15.57	6.16	Compliance
5.591	42.43	32.89	50	1.5	V	34.02	10.81	-29.86	57.39	47.85	74	54	16.61	6.15	Compliance

802.11a CH 165(5 825 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.950	43.80	32.27	50	1.5	H	34.50	11.23	-30.05	59.48	47.95	74	54	14.52	6.05	Compliance
5.932	42.59	32.40	50	1.5	V	34.43	11.17	-30.04	58.15	47.96	74	54	15.85	6.04	Compliance

802.11n(HT20) CH 149(5 745 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.589	42.85	32.18	0	1.5	H	34.02	10.80	-29.85	57.82	47.15	74	54	16.18	6.85	Compliance
5.520	42.91	32.72	0	1.5	V	34.16	10.70	-29.82	57.95	47.76	74	54	16.05	6.24	Compliance

802.11n(HT20) CH 165(5 825 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.935	41.47	31.68	0	1.5	H	34.44	11.18	-30.04	57.05	47.26	74	54	16.95	6.74	Compliance
5.989	43.15	31.99	0	1.5	V	34.66	11.36	-30.06	59.09	47.93	74	54	14.91	6.07	Compliance

802.11n(HT40) CH 151(5 755 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.584	42.63	32.87	100	1.5	H	34.03	10.80	-29.85	57.60	47.84	74	54	16.40	6.16	Compliance
5.631	42.90	32.23	100	1.5	V	34.00	10.84	-29.88	57.86	47.19	74	54	16.14	6.81	Compliance

802.11n(HT40) CH 159(5 795 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.955	41.55	32.23	100	1.5	H	34.52	11.25	-30.05	57.27	47.95	74	54	16.73	6.05	Compliance
5.973	43.08	32.10	100	1.5	V	34.59	11.30	-30.06	58.92	47.94	74	54	15.08	6.06	Compliance

802.11ac(VHT20) CH 149(5 745 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.581	42.63	32.17	120	1.5	H	34.04	10.79	-29.85	57.60	47.14	74	54	16.40	6.86	Compliance
5.593	43.07	32.89	120	1.5	V	34.01	10.81	-29.86	58.03	47.85	74	54	15.97	6.15	Compliance

802.11ac(VHT20) CH 165(5 825 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.970	41.88	32.12	120	1.5	H	34.58	11.29	-30.06	57.70	47.94	74	54	16.30	6.06	Compliance
5.943	42.09	32.33	120	1.5	V	34.47	11.21	-30.04	57.72	47.96	74	54	16.28	6.04	Compliance

802.11ac(VHT40) CH 151(5 755 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.600	42.87	32.20	100	1.5	H	34.00	10.82	-29.86	57.83	47.16	74	54	16.17	6.84	Compliance
5.599	43.68	32.89	100	1.5	V	34.00	10.82	-29.86	58.64	47.85	74	54	15.36	6.15	Compliance

802.11ac(VHT40) CH 159(5 795 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.933	42.37	32.3	100	1.5	H	34.43	11.18	-30.04	57.94	47.96	74	54	16.06	6.04	Compliance
5.940	42.74	32.35	100	1.5	V	34.46	11.20	-30.04	58.35	47.96	74	54	15.65	6.04	Compliance

802.11ac(VHT80) CH 155(5 775 MHz)

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
5.507	43.28	32.00	270	1.5	H	34.19	10.68	-29.81	58.33	47.05	74	54	15.67	6.95	Compliance
5.592	43.48	32.89	270	1.5	V	34.02	10.81	-29.86	58.44	47.85	74	54	15.56	6.15	Compliance
5.962	41.73	32.19	270	1.5	H	34.55	11.27	-30.05	57.49	47.95	74	54	16.51	6.05	Compliance
5.949	41.83	32.28	270	1.5	V	34.50	11.23	-30.04	57.50	47.95	74	54	16.50	6.05	Compliance

■ Unwanted Emissions

Above 1 GHz

Freq. (GHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL+Pre AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
-	-	-	-	-	-	-	-	-	-	74	54	-	-	Compliance

There are no spurious emissions.

Below 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
31.94	54.86	180	1.0	V	16.26	1.17	-35.58	36.72	40.00	1.28	Compliance
63.05	56.76	180	1.0	V	16.72	1.32	-37.94	36.86	40.00	3.14	Compliance
269.10	48.54	100	1.8	V	16.08	2.82	-35.89	31.56	46.00	14.44	Compliance
346.85	43.05	90	2.2	H	14.88	3.06	-23.58	37.41	46.00	8.59	Compliance
599.56	44.63	90	1.6	H	20.14	3.72	-28.35	40.13	46.00	5.87	Compliance

※ Note

- Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
- Limit: 54 dB μ V/m(Average), 74 dB μ V/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- For the below 30 MHz, measured any other signal is not detected on test receiver
- The transmitter radiated spectrum was investigated from 9 kHz to 40 GHz.

Freq.(MHz) : Measurement frequency, Reading(dB μ V/m) : Indicated value for test receiver,

Table (Deg) : Directional degree of Turn table,

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor

Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)

Meas Result (dB μ V/m) : Reading(dB μ V/m)+ Antenna factor.(dB/m) + CL(dB) - Pre AMP(dB)

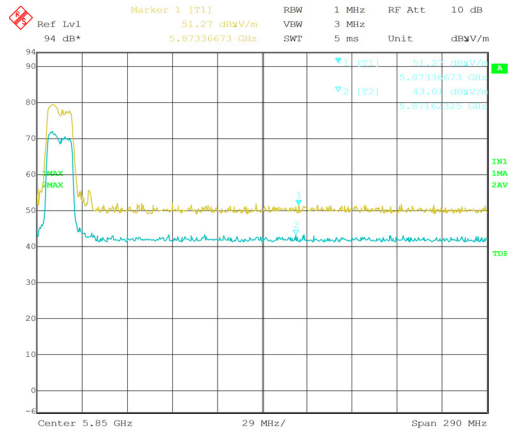
Limit(dB μ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB μ V/m) – Meas Result(dB μ V/m)

Radiated Out of Band Emission (OOBE) Measurement (For UNII3 band)

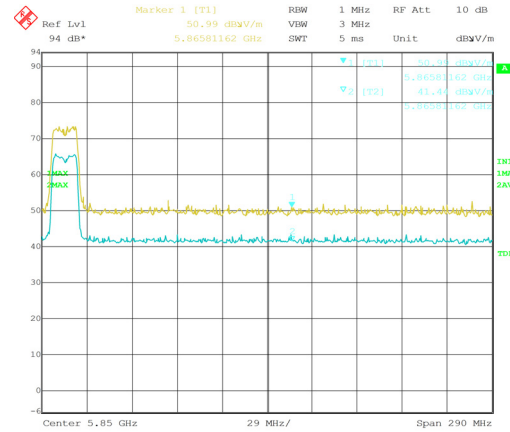
802.11a

CH 144(5 720 MHz)

Horizontal



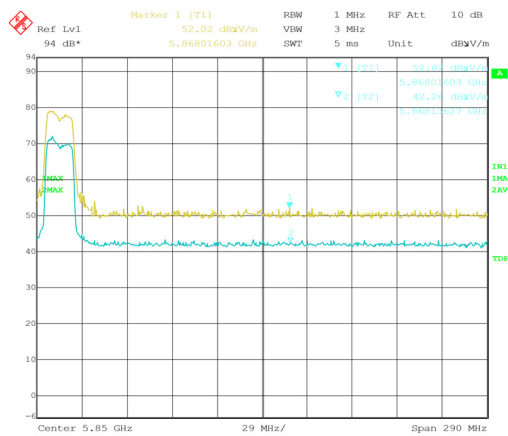
Vertical



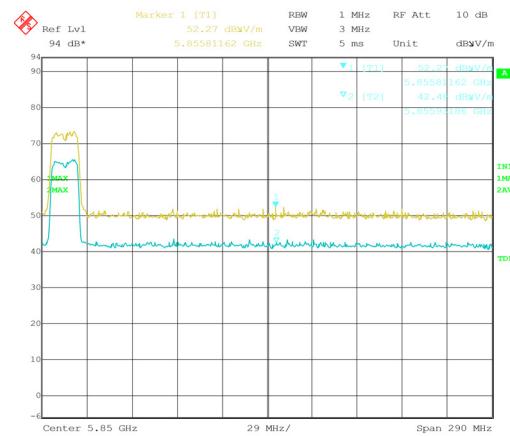
802.11n(HT20)

CH 144(5 720 MHz)

Horizontal



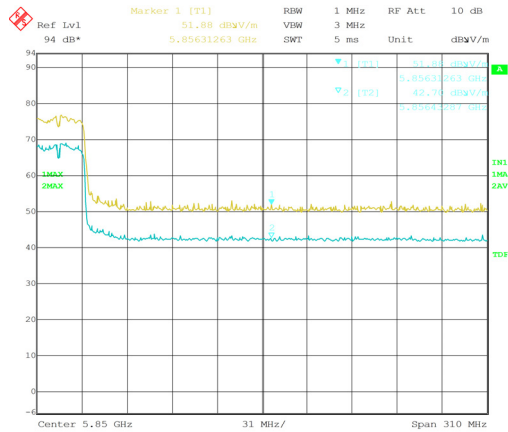
Vertical



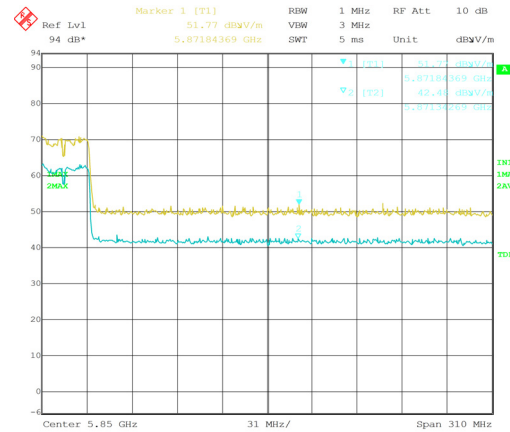
802.11n(HT40)

CH 142(5 710 MHz)

Horizontal



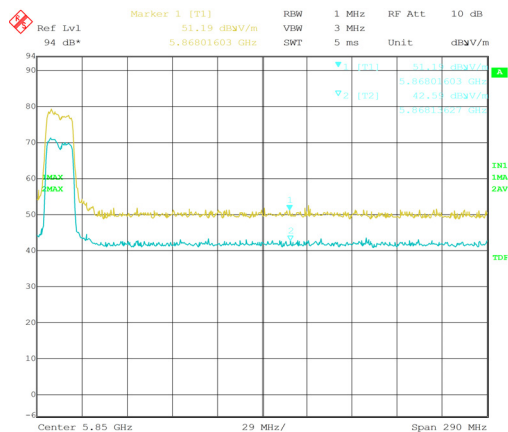
Vertical



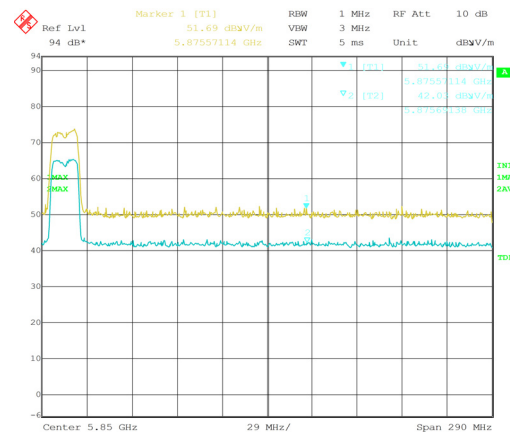
802.11ac(VHT20)

CH 144(5 720 MHz)

Horizontal



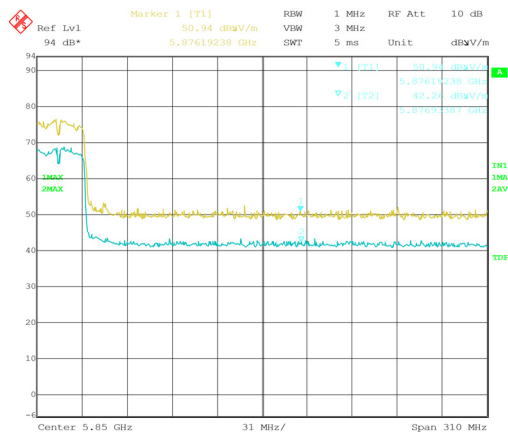
Vertical



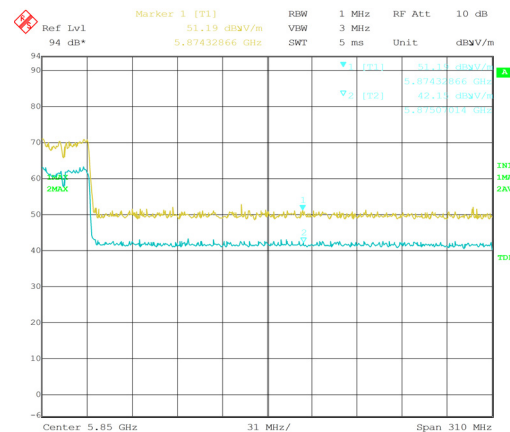
802.11ac(VHT40)

CH 142(5 710 MHz)

Horizontal



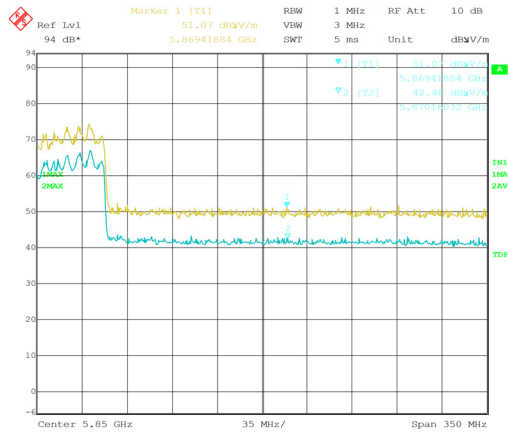
Vertical



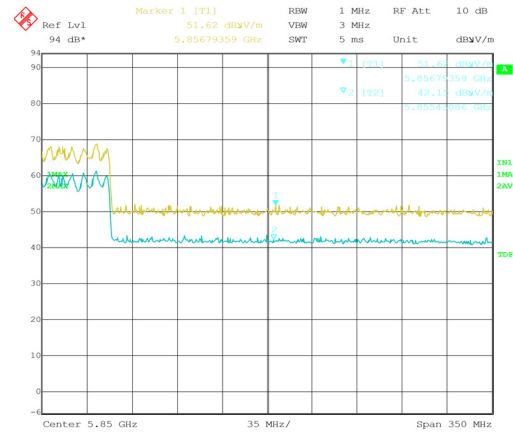
802.11ac(VHT80)

CH 138(5 690 MHz)

Horizontal



Vertical

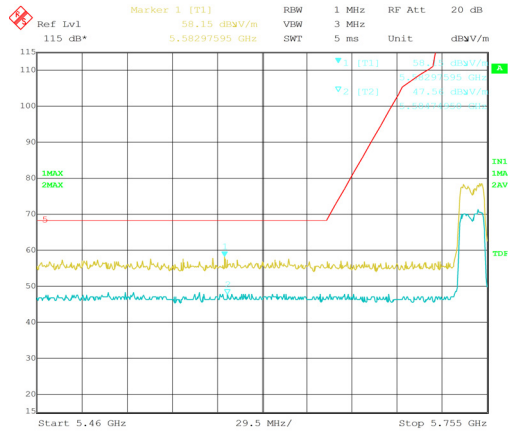


Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

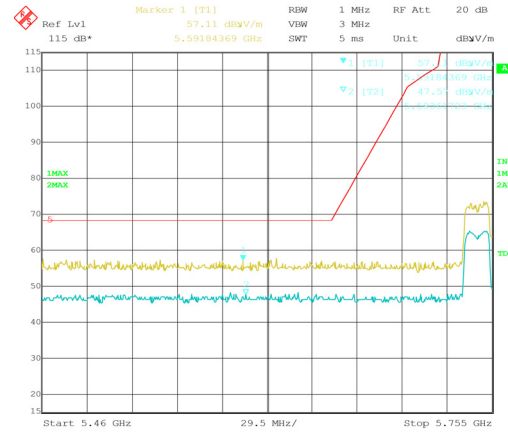
802.11a

CH Low(5 745 MHz)

Horizontal

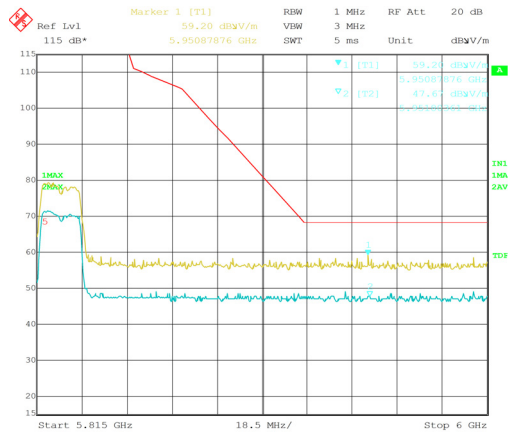


Vertical

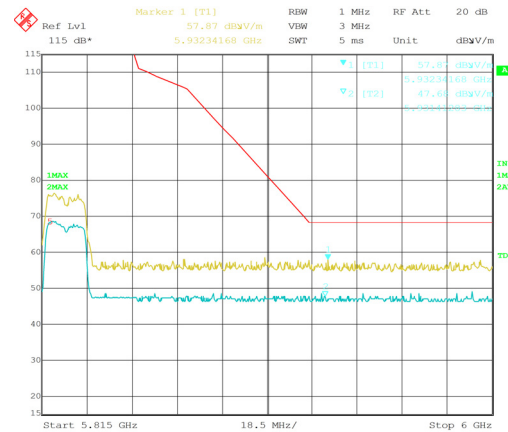


CH High(5 825 MHz)

Horizontal



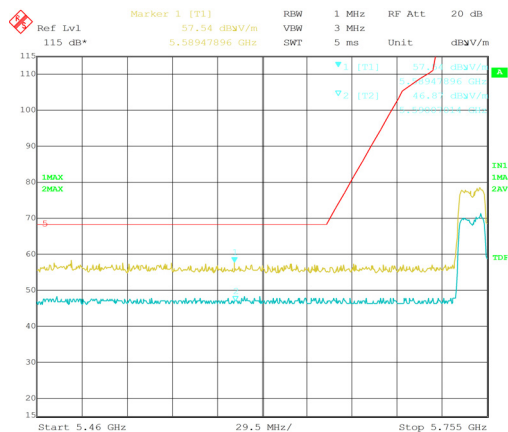
Vertical



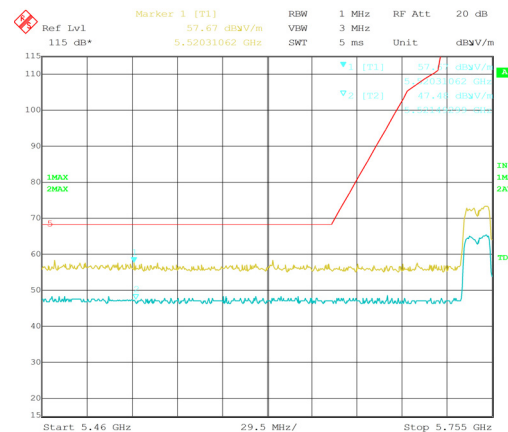
802.11n(HT20)

CH Low(5 745 MHz)

Horizontal

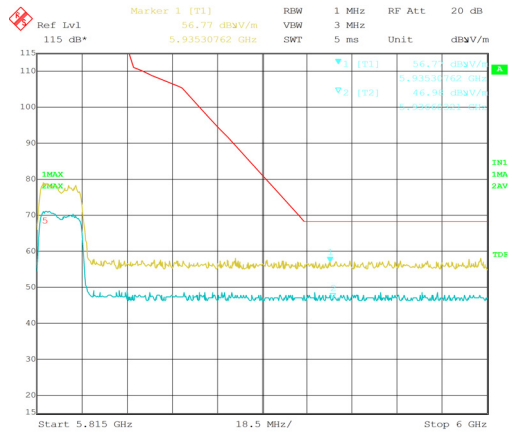


Vertical

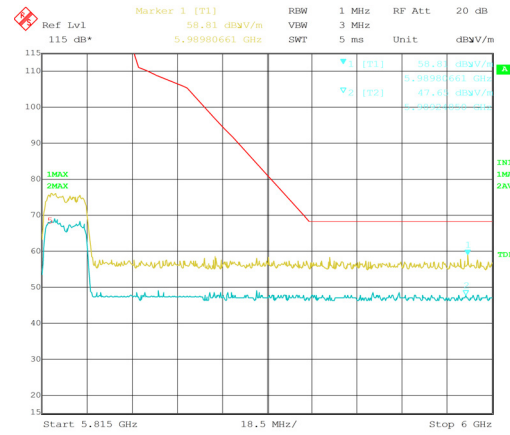


CH High(5 825 MHz)

Horizontal



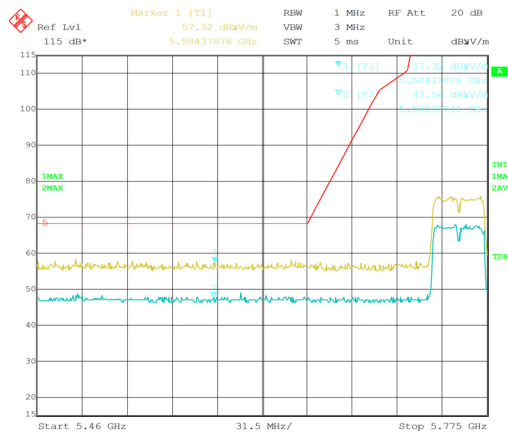
Vertical



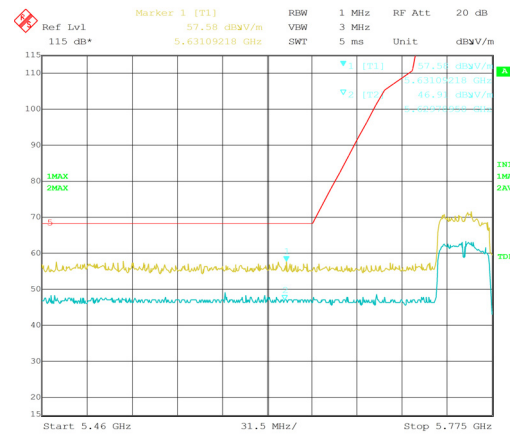
802.11n(HT40)

CH Low(5 755 MHz)

Horizontal

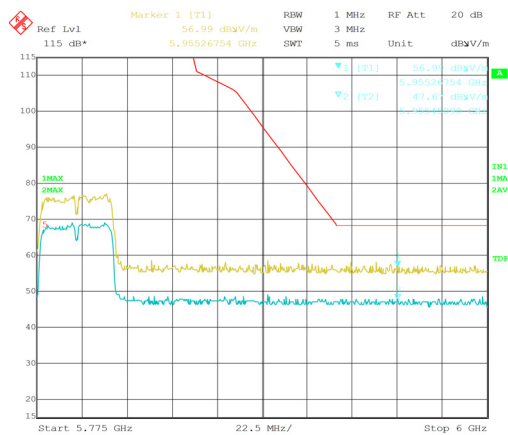


Vertical

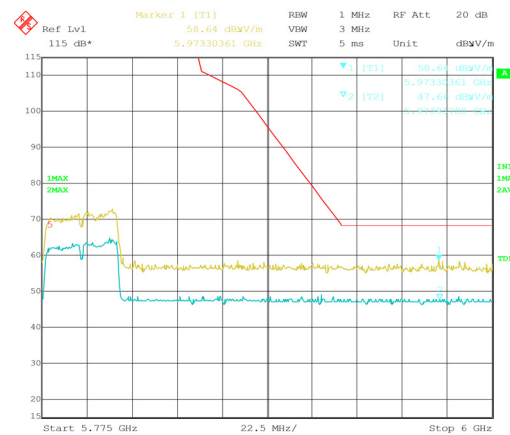


CH High(5 795 MHz)

Horizontal



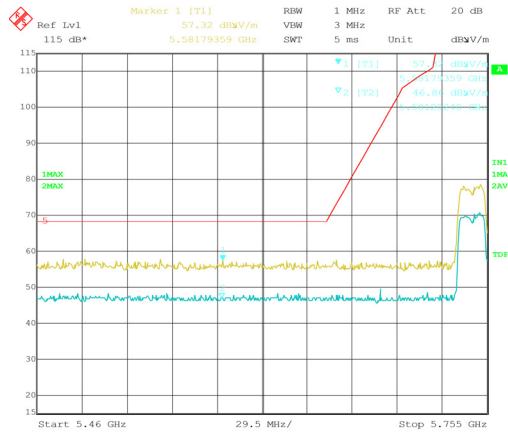
Vertical



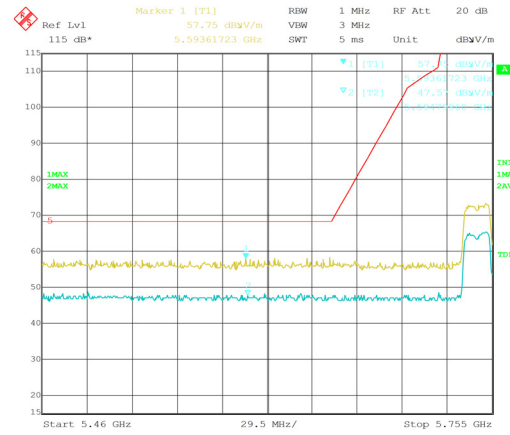
802.11ac(VHT20)

CH Low(5 745 MHz)

Horizontal

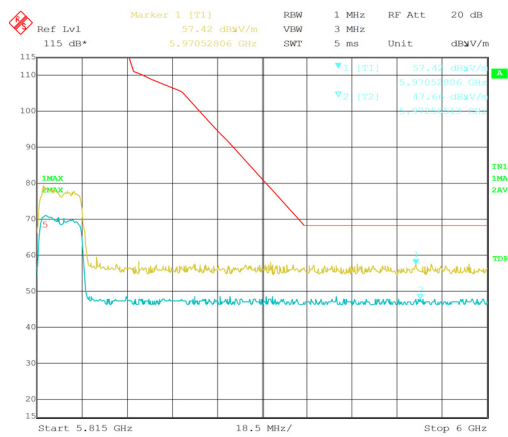


Vertical

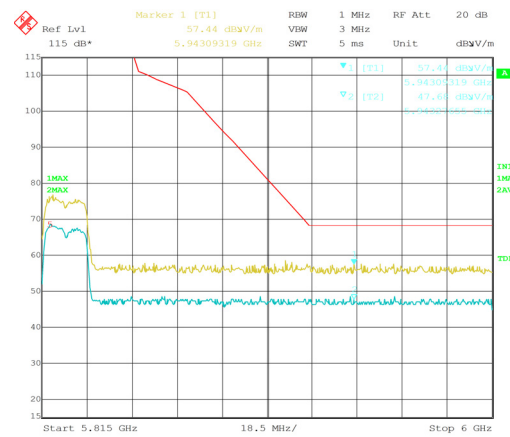


CH High(5 825 MHz)

Horizontal



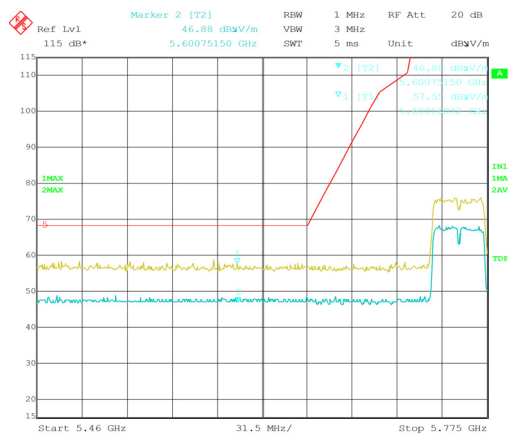
Vertical



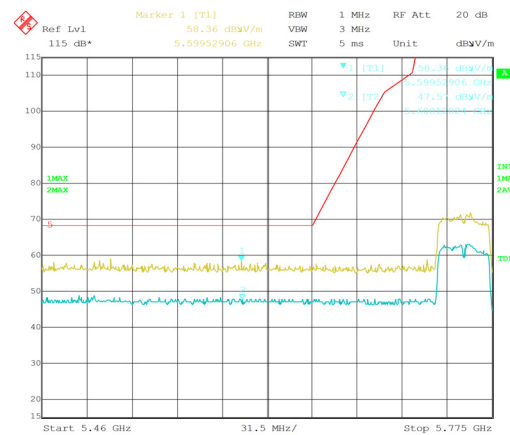
802.11ac(VHT40)

CH Low(5 755 MHz)

Horizontal

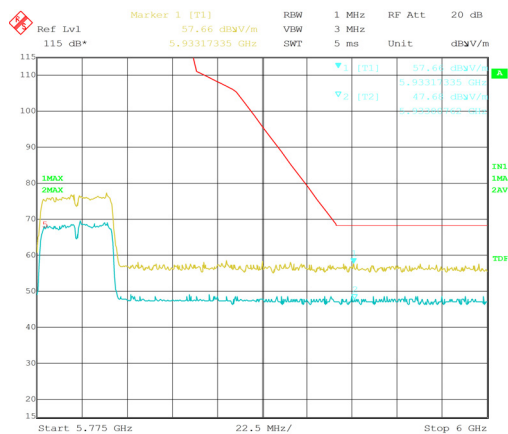


Vertical

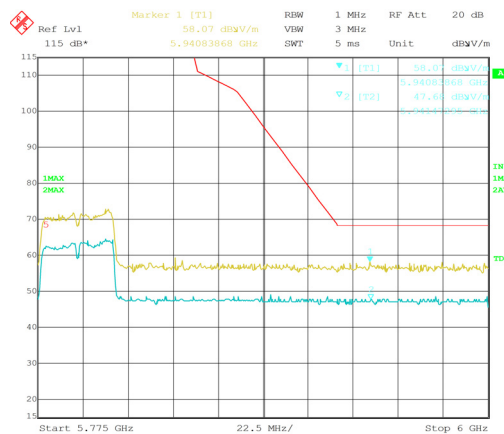


CH High(5 795 MHz)

Horizontal



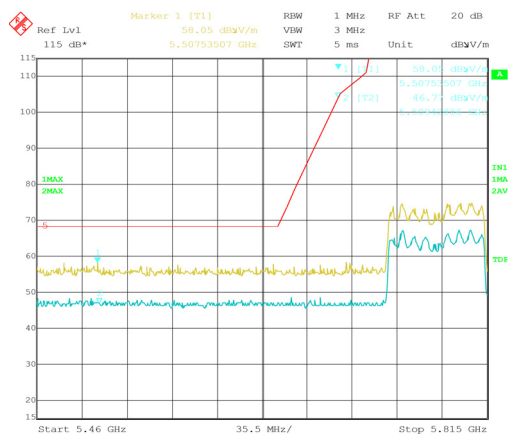
Vertical



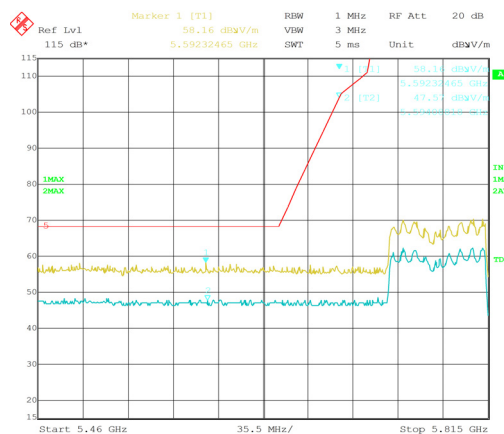
802.11ac(VHT80)

CH Middle(5 775 MHz)

Horizontal

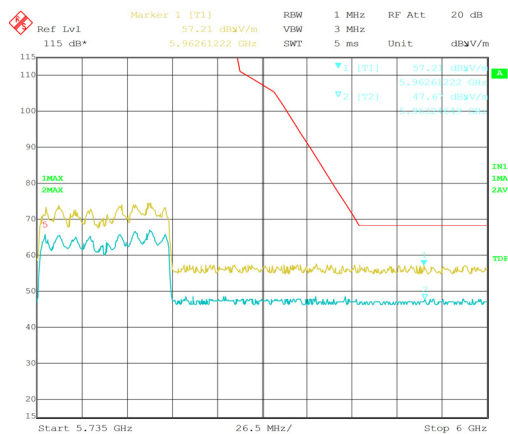


Vertical

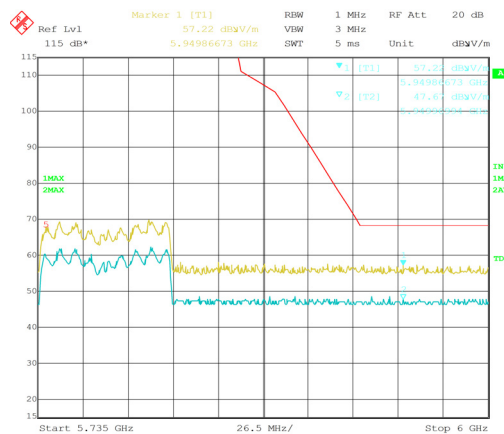


CH Middle(5 775 MHz)

Horizontal



Vertical



5.6 Antenna requirement

5.6.1 Standard applicable [FCC §15.203]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit so that broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.6.2 Antenna details

Frequency Band	Antenna Type	Gain [dBi]	Results
5 GHz	Internal PCB pattern antenna	6 dBi	Compliance

5.7 AC Power Conducted emissions

5.7.1 Standard Applicable [FCC §15.207(a)]

For intentional radiator that is designed to be connected to the public utility(AC)power line, the radio frequency. Voltage that is conducted back onto the AC power line on any frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

5.7.2 Test Environment conditions

• Ambient temperature : (23 ~ 25) °C • Relative Humidity : (52 ~ 56) % R.H.

5.7.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.7.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2021. 01. 21	1 year	☒
Pulse Limiter	ESH3-Z2	100097	Rohde & Schwarz	2021. 01. 21	1 year	☒
LISN	ESH2-Z5	100044	R&S	2021. 01. 21	1 year	☒
	ESH3-Z5	100147	R&S	2021. 01. 22	1 year	☒

*Test Program: " ESXS-K1 V2.2"

Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

0.009 ~ 0.15 MHz : 3.94 dB(CL: Approx 95 %, $k=2$)

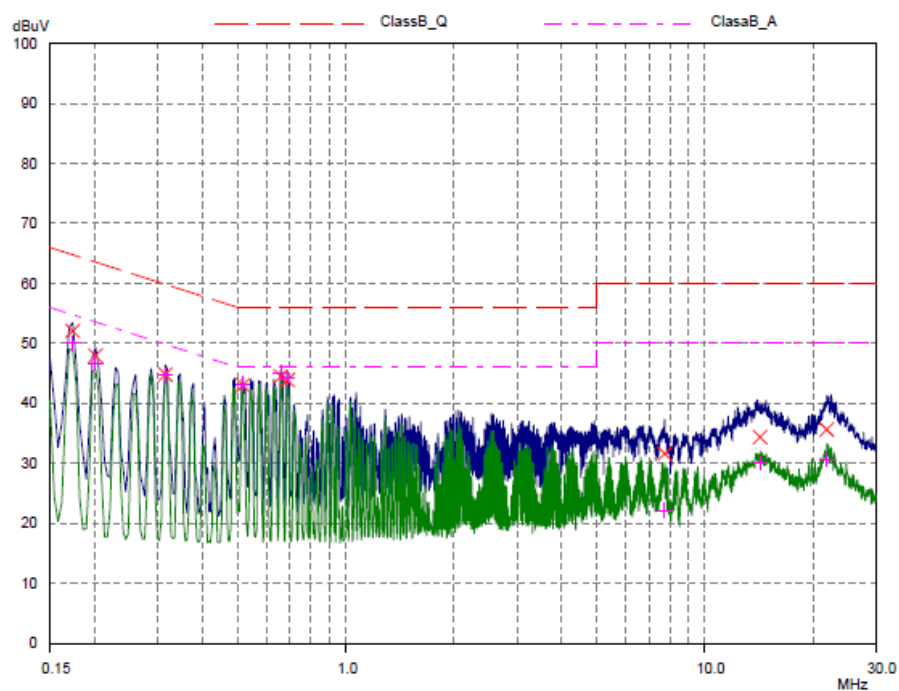
0.15 ~ 30 MHz : 3.32 dB(CL: Approx 95 %, $k=2$)

5.7.5 Measurement Result

Freq. [MHz]	Factor [dB]		POL	QP			CISPR AV		
				Limit	Reading	Result	Limit	Reading	Result
	LISN	CABLE +P/L		[dB/μV]	[dB/μV]	[dB/μV]	[dB/μV]	[dB/μV]	[dB/μV]
0.173	0.12	10.01	L	64.79	52.09	52.21	54.79	49.98	50.10
0.310	0.12	10.06	L	59.97	44.84	44.96	49.97	44.68	44.80
0.517	0.12	10.06	L	56.00	43.03	43.15	46.00	41.21	41.33
0.657	0.12	10.06	L	56.00	44.50	44.62	46.00	42.10	42.22
0.689	0.12	10.06	L	56.00	43.89	44.01	46.00	42.22	42.34
21.880	0.73	10.59	L	60.00	35.63	36.36	50.00	30.62	31.35
0.173	0.12	10.01	N	64.82	51.77	51.89	54.82	49.85	49.97
0.314	0.12	10.06	N	59.86	44.71	44.83	49.86	44.84	44.96
0.517	0.12	10.06	N	56.00	43.13	43.25	46.00	42.06	42.18
0.657	0.13	10.06	N	56.00	44.75	44.88	46.00	42.02	42.15
0.685	0.13	10.06	N	56.00	44.73	44.86	46.00	42.40	42.53
22.114	0.66	10.59	N	60.00	35.17	35.83	50.00	29.83	30.49

- * LISN: LISN insertion Loss, Cable: Cable Loss, P/L: pulse limiter factor
- * L: Line. Live, N: Line. Neutral
- * Reading: test receiver reading value (with cable loss & pulse limiter factor)
- * Result = LISN + Reading

Line. Live



Line. Neutral

