

KCTL Inc.

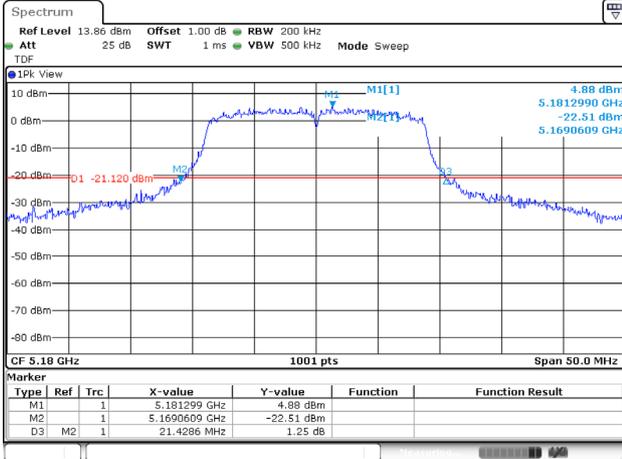
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

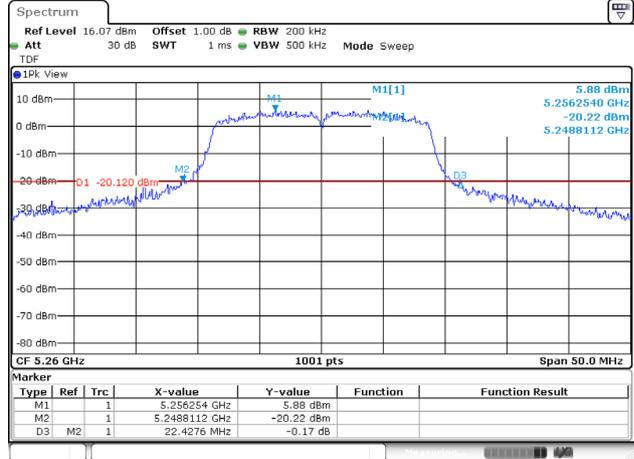
Page (62) of (219)



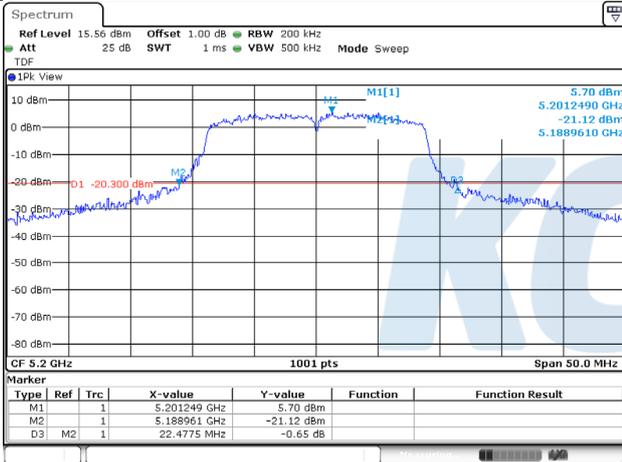
UNII-1 / 802.11ac VHT20 / Low ch.



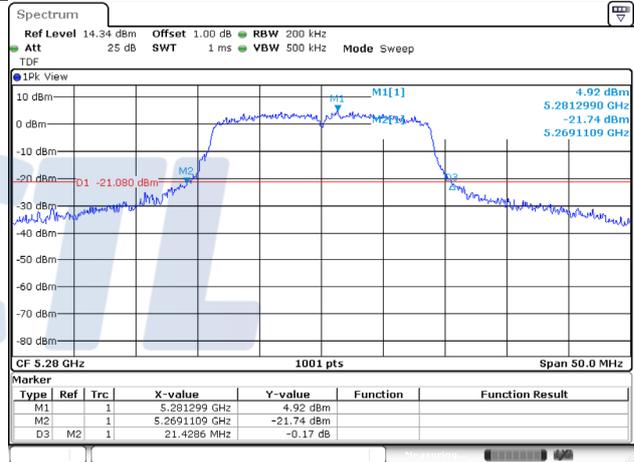
UNII-2A / 802.11ac VHT20 / Low ch.



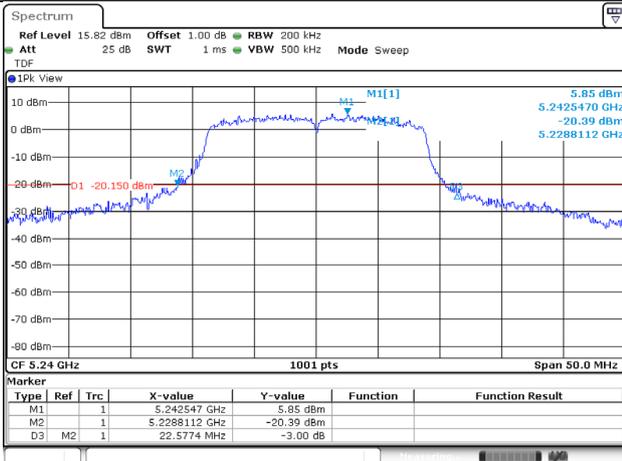
UNII-1 / 802.11ac VHT20 / Mid ch.



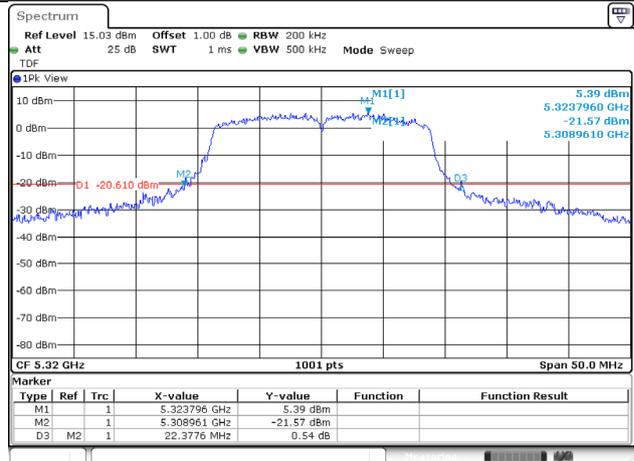
UNII-2A / 802.11ac VHT20 / Mid ch.



UNII-1 / 802.11ac VHT20 / High ch.



UNII-2A / 802.11ac VHT20 / High ch.



KCTL Inc.

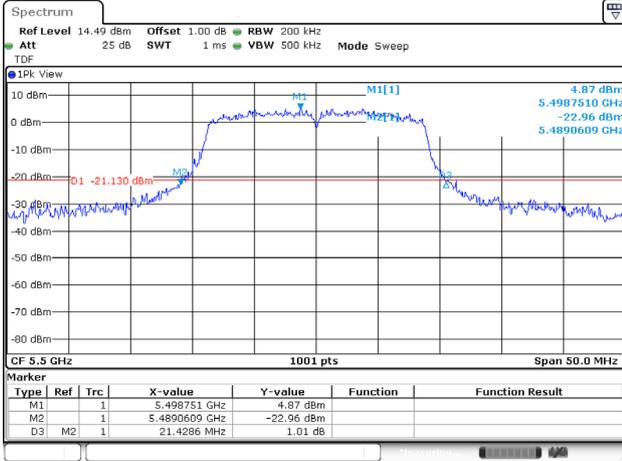
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

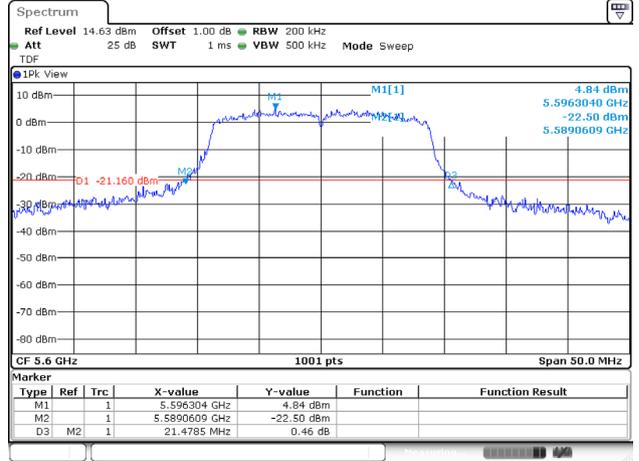
Page (63) of (219)



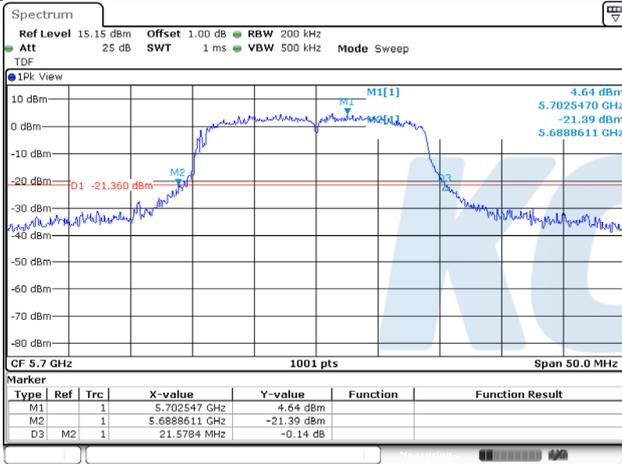
UNII-2C / 802.11ac VHT20 / Low ch.



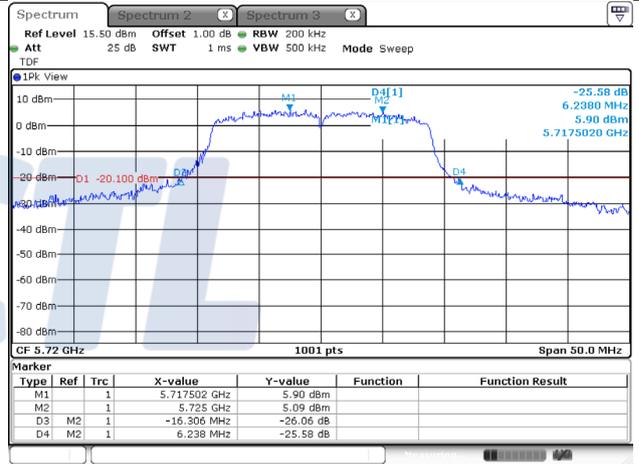
UNII-2C / 802.11ac VHT20 / Mid ch.



UNII-2C / 802.11ac VHT20 / High ch.



UNII-2C / 802.11ac VHT20 / Straddle ch.



KCTL Inc.

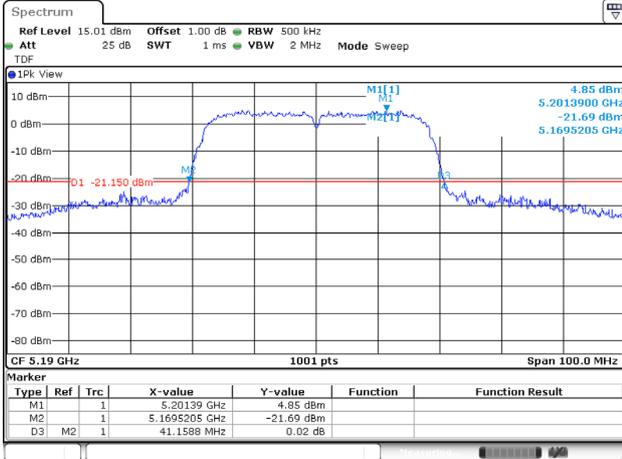
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

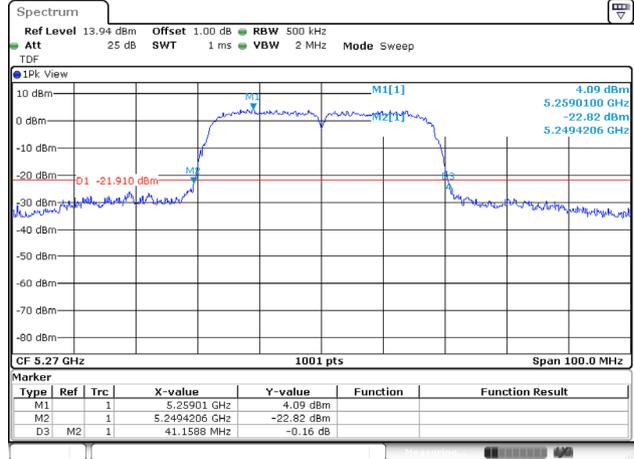
Page (64) of (219)



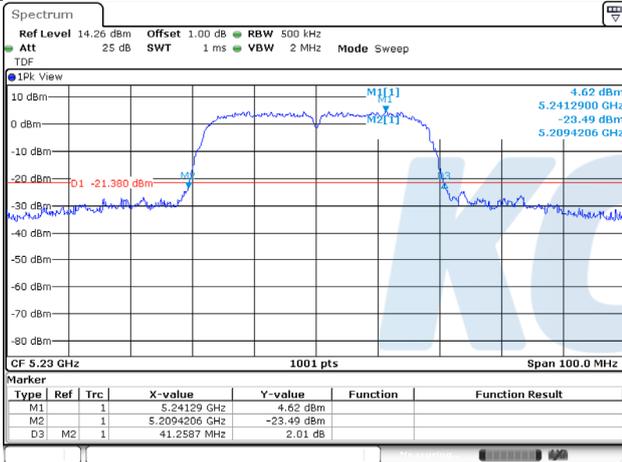
UNII-1 / 802.11ac VHT40 / Low ch.



UNII-2A / 802.11ac VHT40 / Low ch.



UNII-1 / 802.11ac VHT40 / High ch.



UNII-2A / 802.11ac VHT40 / High ch.



KCTL Inc.

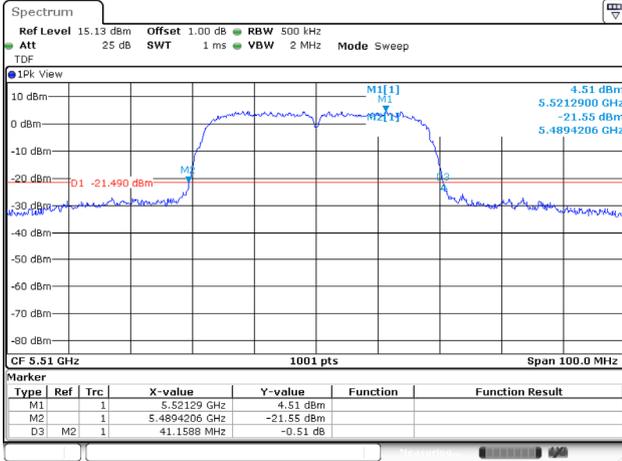
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

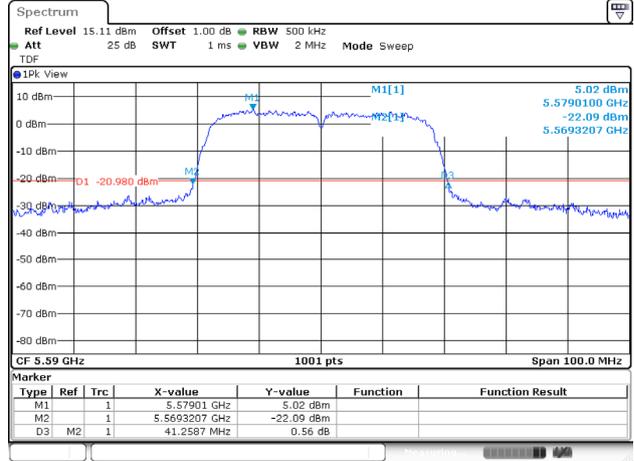
Page (65) of (219)



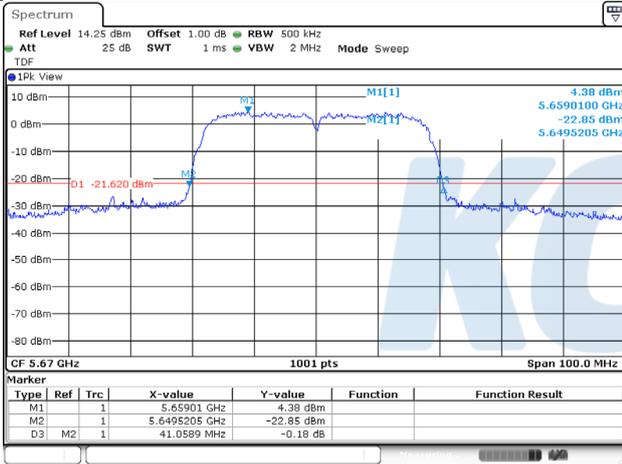
UNII-2C / 802.11ac VHT40 / Low ch.



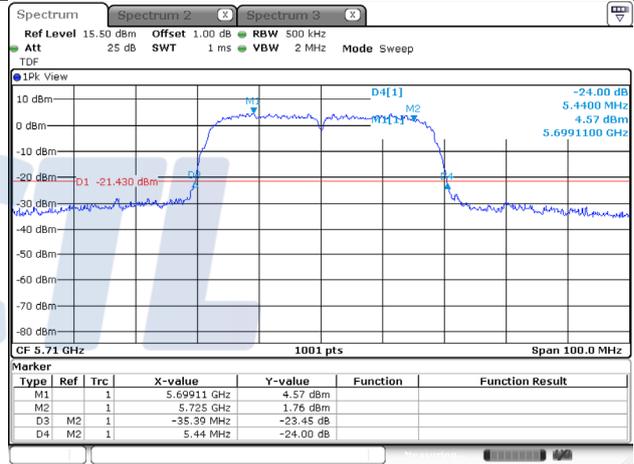
UNII-2C / 802.11ac VHT40 / Mid ch.



UNII-2C / 802.11ac VHT40 / High ch.



UNII-2C / 802.11ac VHT40 / Straddle ch.



KCTL Inc.

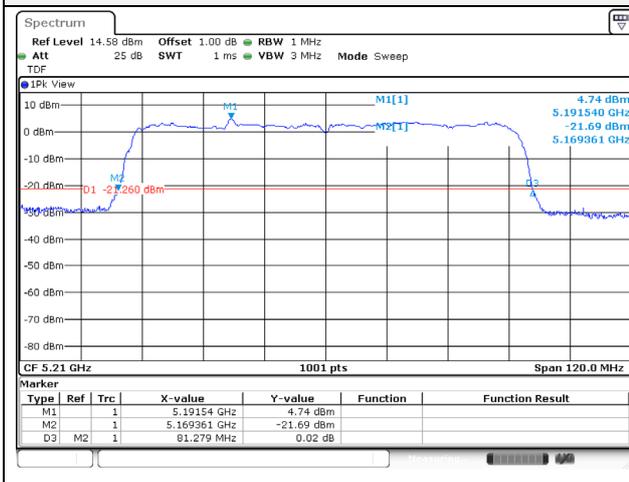
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

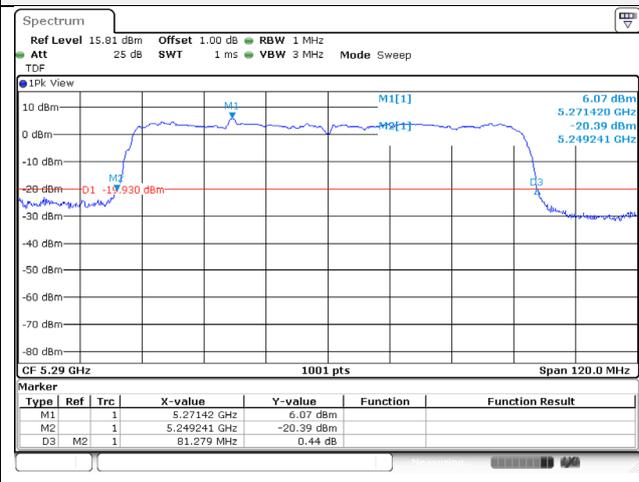
Page (66) of (219)



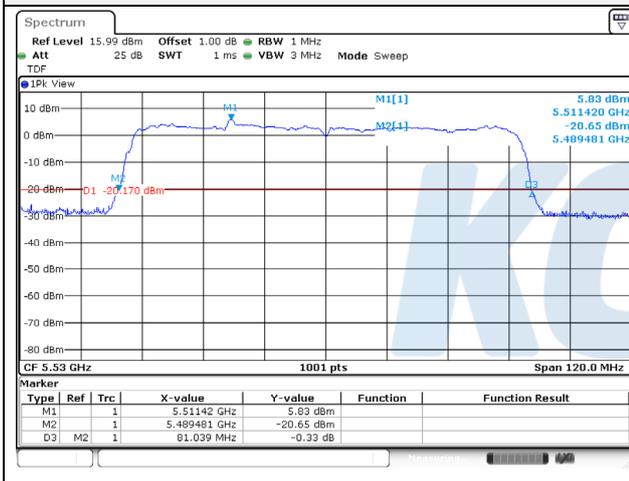
UNII-1 / 802.11ac VHT80 / Low ch.



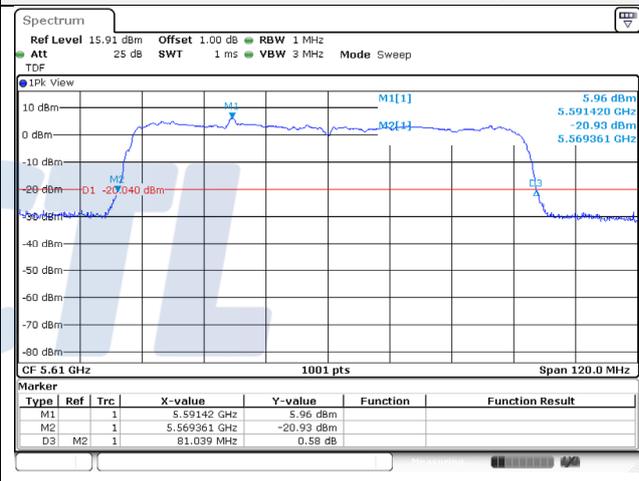
UNII-2A / 802.11ac VHT80 / Low ch.



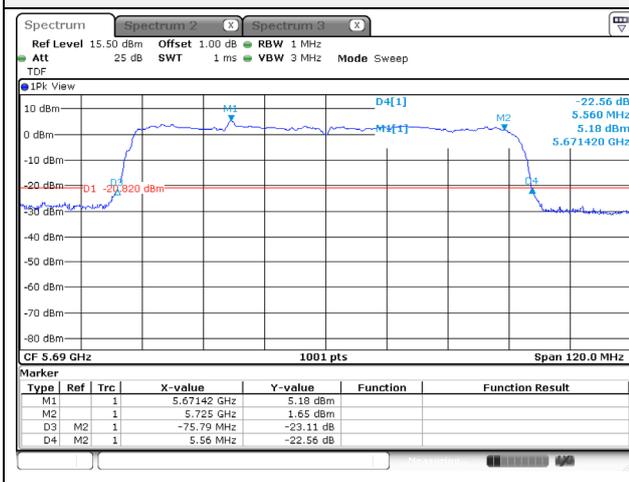
UNII-2C / 802.11ac VHT80 / Low ch.



UNII-2C / 802.11ac VHT80 / High ch.

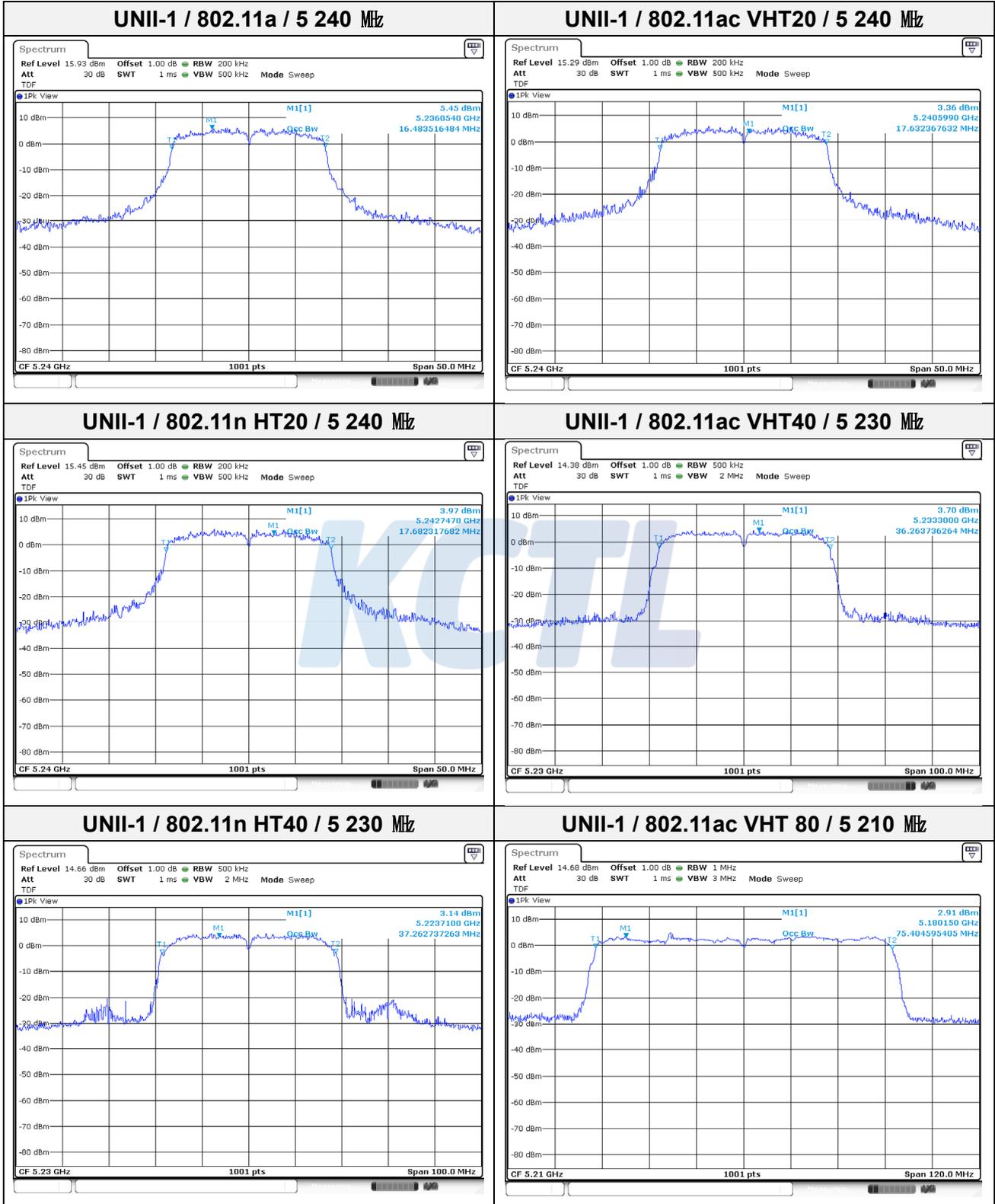


UNII-2C / 802.11ac VHT80 / Straddle ch.



Blank

99% bandwidth



KCTL Inc.

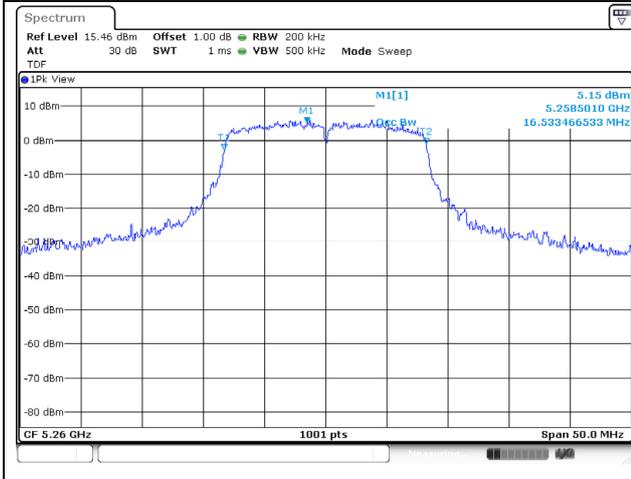
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

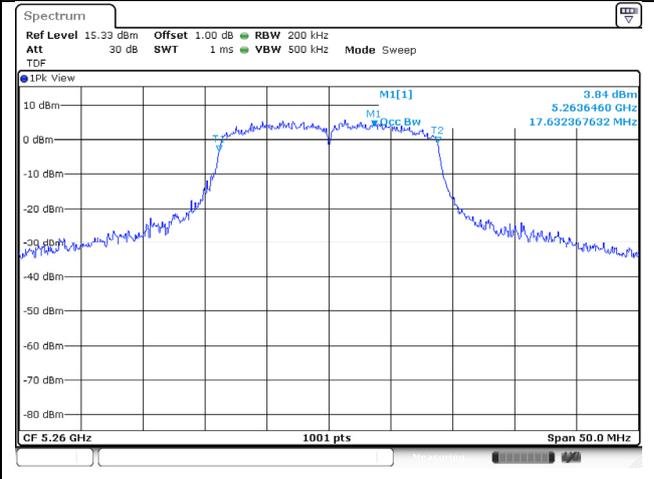
Page (68) of (219)



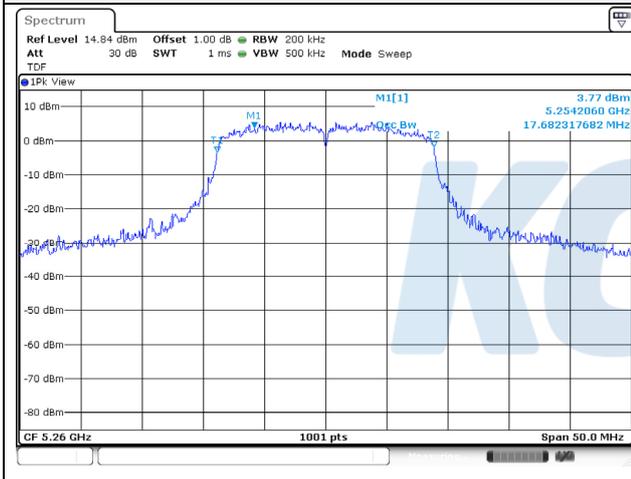
UNII-2A / 802.11a / 5 260 MHz



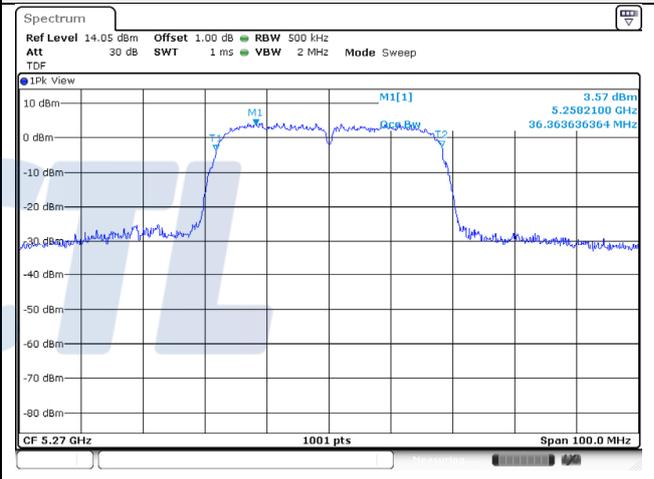
UNII-2A / 802.11ac VHT20 / 5 260 MHz



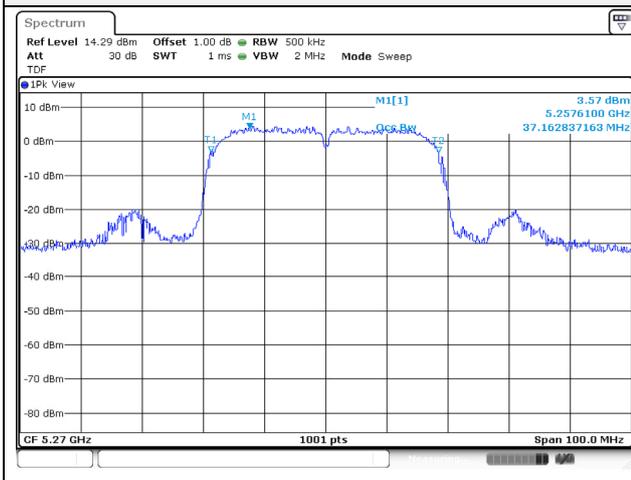
UNII-2A / 802.11n HT20 / 5 260 MHz



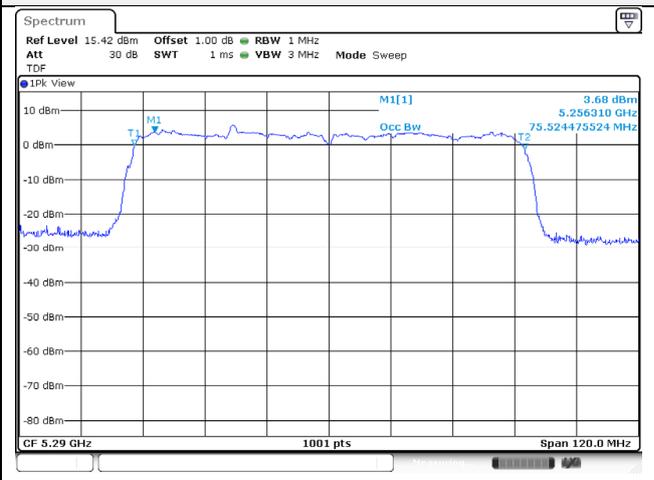
UNII-2A / 802.11ac VHT40 / 5 270 MHz



UNII-2A / 802.11n HT40 / 5 270 MHz

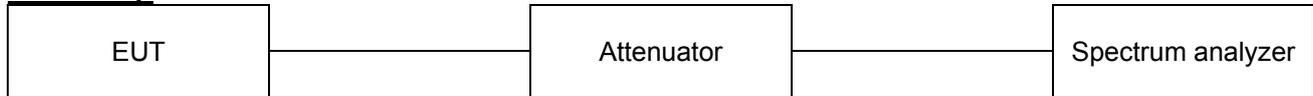


UNII-2A / 802.11ac VHT 80 / 5 290 MHz



7.4. 6 dB Bandwidth

Test setup



Limit

According to §15.407(e), Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth if U-NII devices shall be at least 500kHz

Test procedure

ANSI C63.10-2013 Section 6.9.2
KDB 789033 D02 v02r01 - Section C.2

Test settings

Minimum Emission Bandwidth for the band 5.725–5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725–5.85 GHz. The following procedure shall be used for measuring this bandwidth:

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

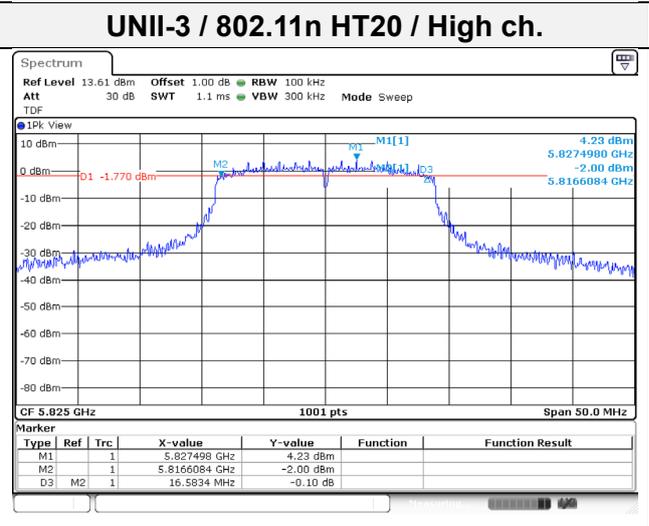
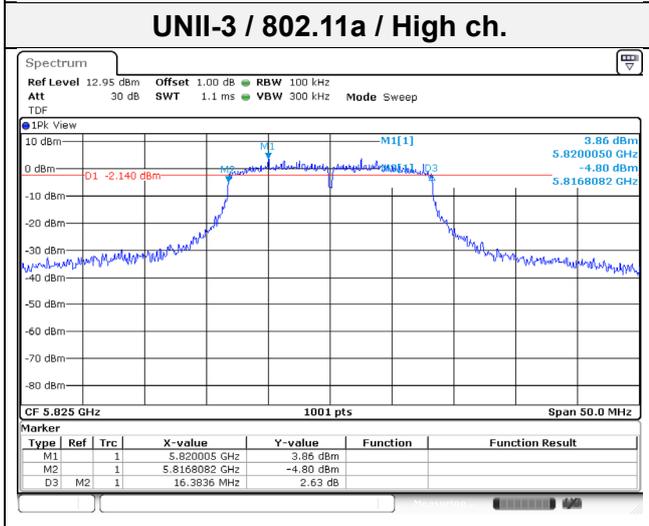
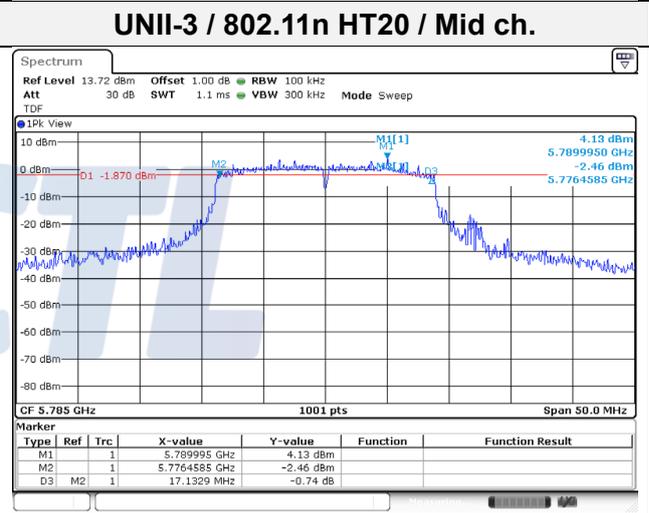
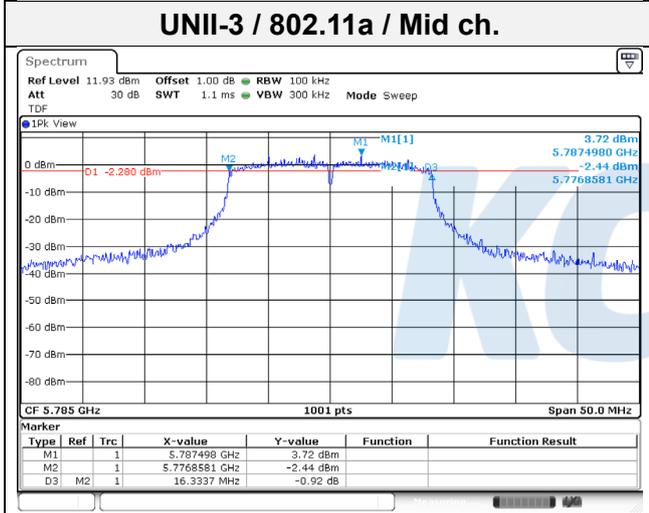
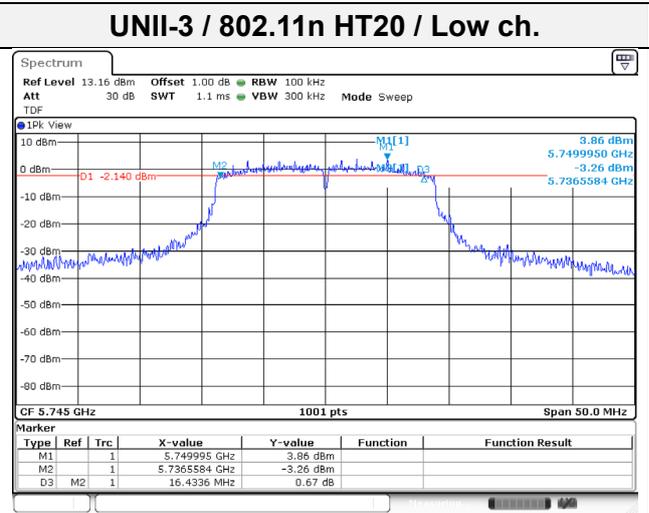
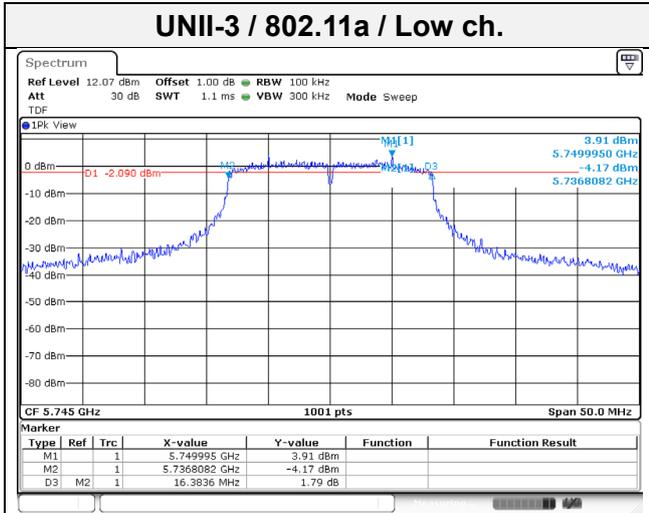
Notes:

1. ¹⁾ means Band-crossing channels.

Test results

Test mode	Band	Frequency (MHz)	Measured Bandwidth (MHz)	Limit (MHz)
802.11a	UNII-3	5 720 ¹⁾	3.19	0.50
		5 745	16.38	
		5 785	16.33	
		5 825	16.38	
802.11n HT20	UNII-3	5 720 ¹⁾	3.19	
		5 745	16.43	
		5 785	17.13	
		5 825	16.58	
802.11n HT40	UNII-3	5 710 ¹⁾	2.69	
		5 755	35.26	
		5 795	35.26	
802.11ac VHT20	UNII-3	5 720 ¹⁾	3.59	
		5 745	17.63	
		5 785	16.98	
		5 825	16.43	
802.11ac VHT40	UNII-3	5 710 ¹⁾	2.69	
		5 755	35.26	
		5 795	35.26	
802.11ac VHT80	UNII-3	5 690 ¹⁾	2.81	
		5 775	75.40	

6 dB bandwidth



KCTL Inc.

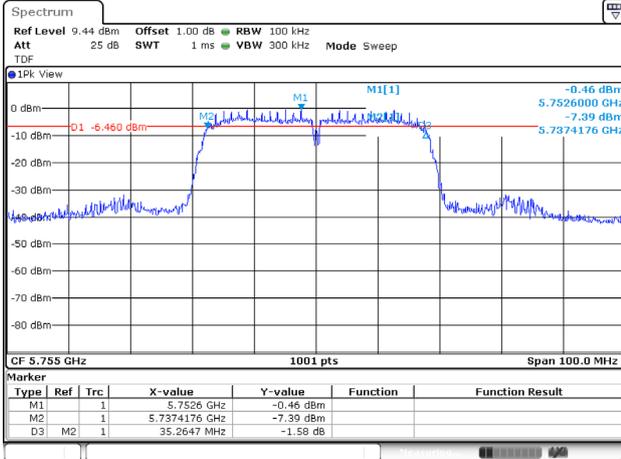
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

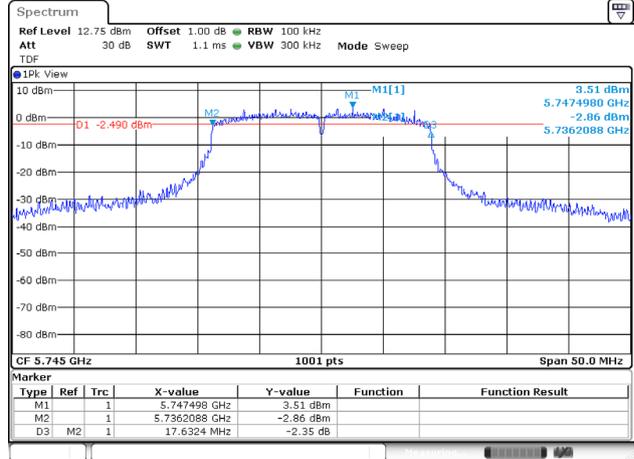
Page (72) of (219)



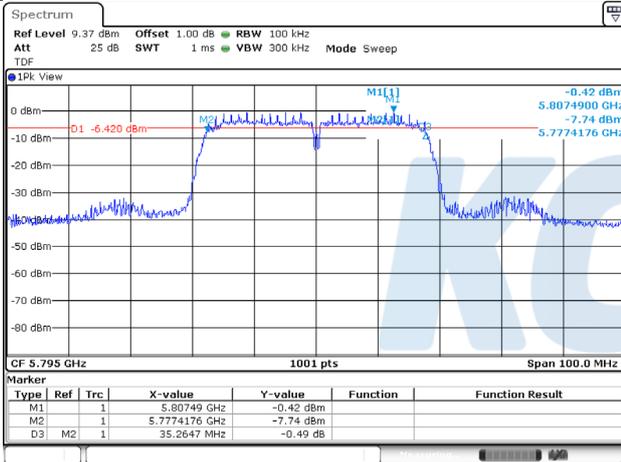
UNII-3 / 802.11n HT40 / Low ch.



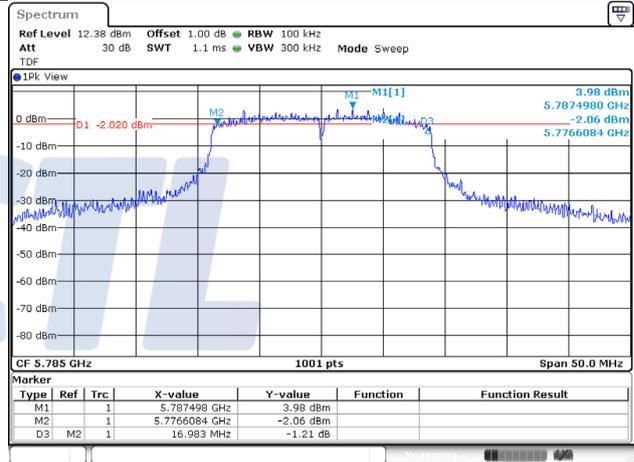
UNII-3 / 802.11ac VHT20 / Low ch.



UNII-3 / 802.11n HT40 / High ch.

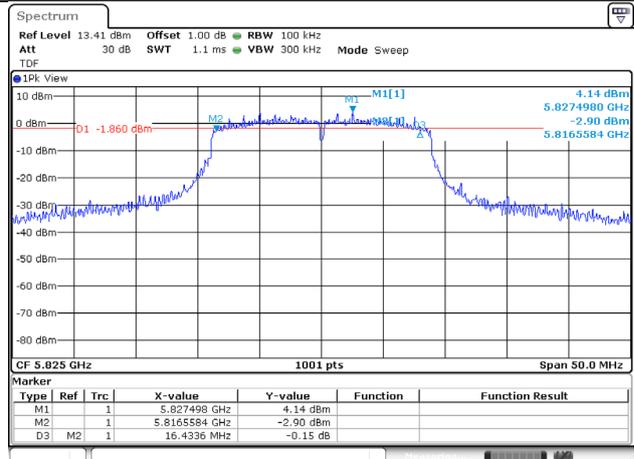


UNII-3 / 802.11ac VHT20 / Mid ch.



Blank

UNII-3 / 802.11ac VHT20 / High ch.



KCTL Inc.

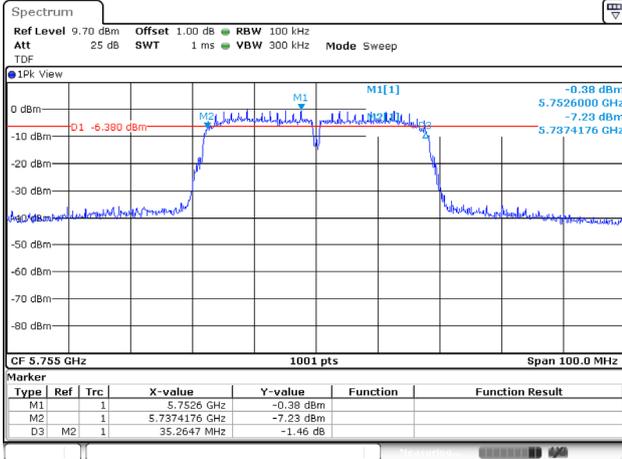
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

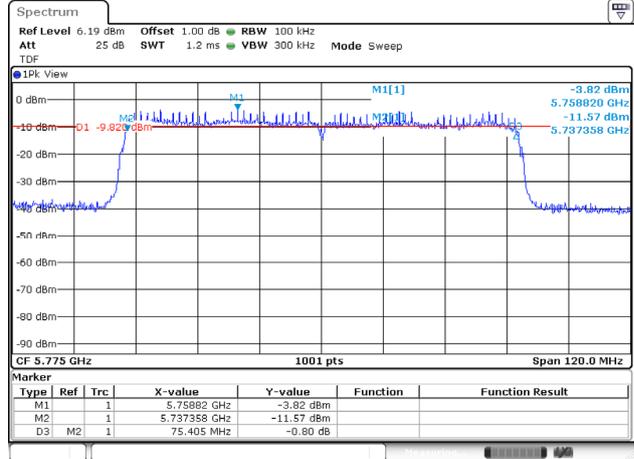
Page (73) of (219)



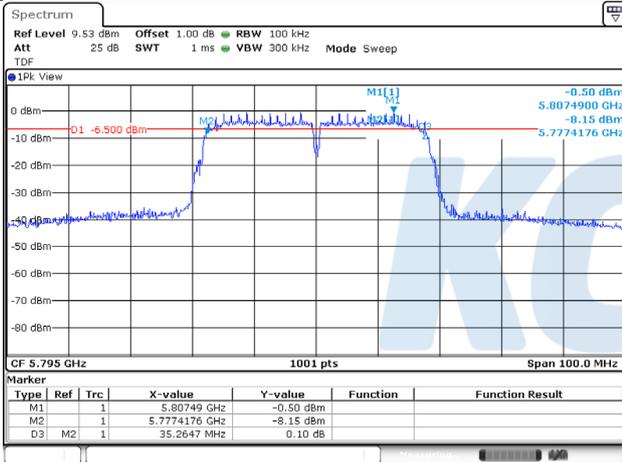
UNII-3 / 802.11ac VHT40 / Low ch.



UNII-3 / 802.11ac VHT80 / Low ch.



UNII-3 / 802.11ac VHT40 / High ch.



Blank

KCTL Inc.

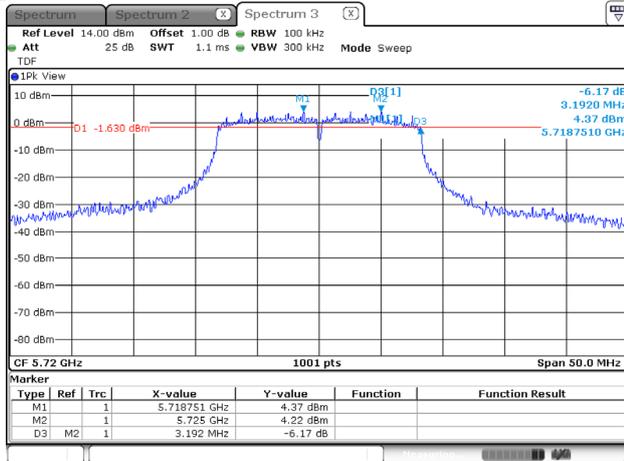
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

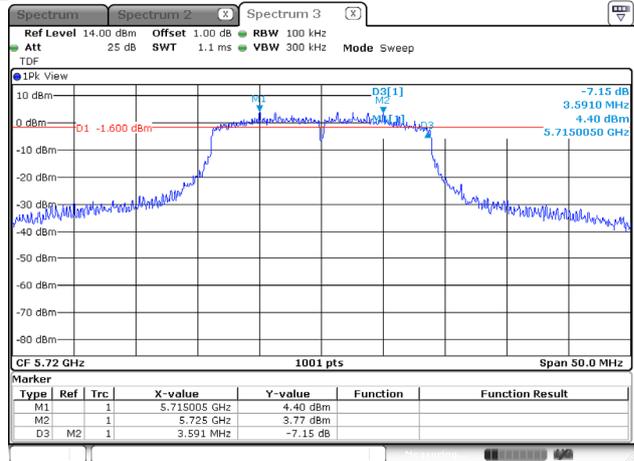
Page (74) of (219)



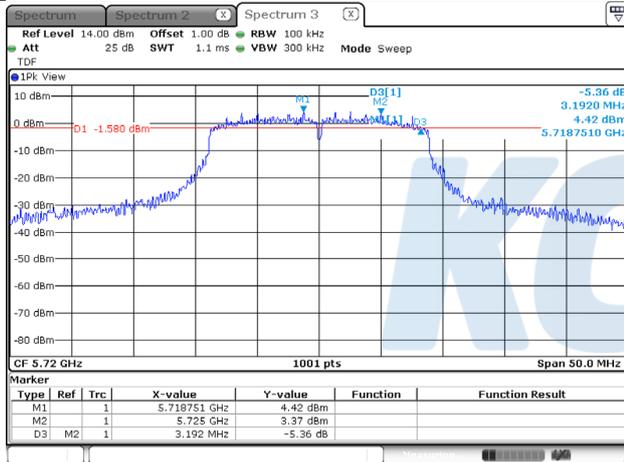
UNII-3 / 802.11a / 5 720 MHz



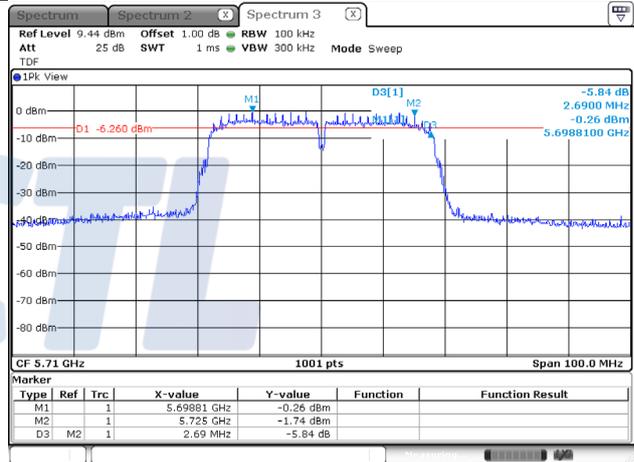
UNII-3 / 802.11ac VHT20 / 5 720 MHz



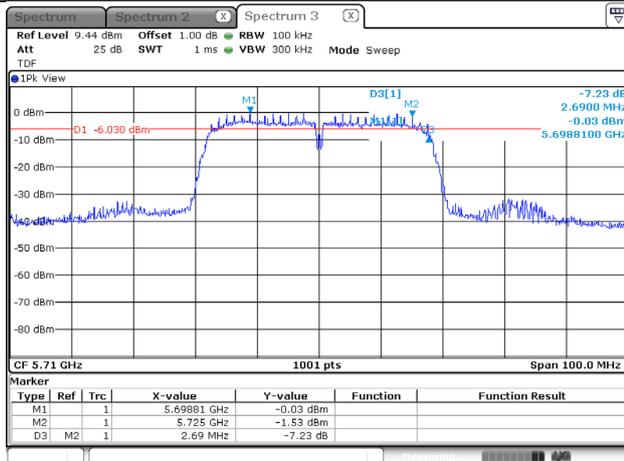
UNII-3 / 802.11n HT20 / 5 720 MHz



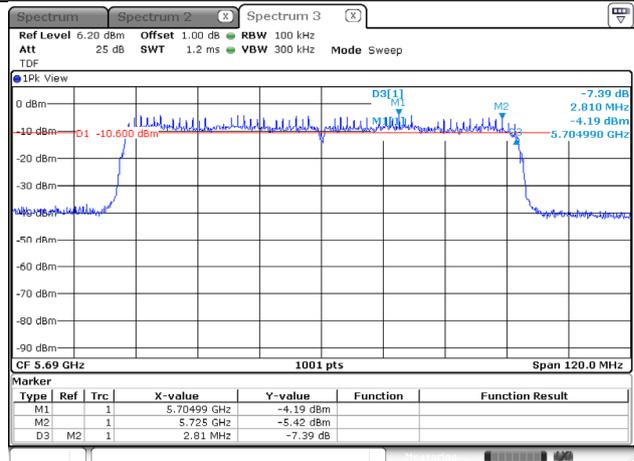
UNII-3 / 802.11ac VHT40 / 5 710 MHz



UNII-3 / 802.11n HT40 / 5 710 MHz

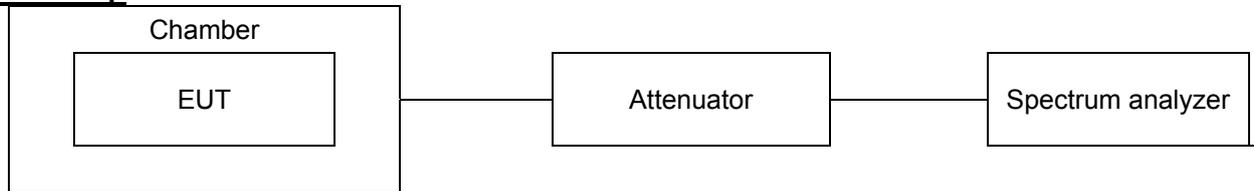


UNII-3 / 802.11ac VHT80 / 5 690 MHz



7.5. Frequency Stability

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2013, clause 6.8.1

Test settings

The frequency stability of the carrier frequency of the intentional radiator shall be maintained all conditions of normal operation as specified in the user manual. The frequency stability shall be maintained over a temperature variation of specified in the user manual at normal supply voltage, and over a variation in the primary supply voltage of specified in the user manual of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

1. The EUT was placed inside the environmental test chamber.
2. The temperature was incremented by 10 °C intervals from lowest temperature.
3. Each increase step of temperature measured the frequency.
4. The test temperature was set 20°C and the supply voltage was then adjusted on the EUT from 85 % to 115% and the frequency record.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (76) of (219)

**Test results**

Test mode : UNII-1

Frequency(Hz) : 5 200 000 000

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	3.85	+22(Ref)	Startup	5 200 002 894	2 894	0.000 06
			2 minutes	5 200 002 845	2 845	0.000 06
			5 minutes	5 200 002 796	2 796	0.000 05
			10 minutes	5 200 002 704	2 704	0.000 05
		-30	Startup	5 200 000 810	810	0.000 02
			2 minutes	5 200 000 835	835	0.000 02
			5 minutes	5 200 000 866	866	0.000 02
			10 minutes	5 200 000 983	983	0.000 02
		-20	Startup	5 200 001 664	1 664	0.000 03
			2 minutes	5 200 001 638	1 638	0.000 03
			5 minutes	5 200 001 622	1 622	0.000 03
			10 minutes	5 200 001 601	1 601	0.000 03
		-10	Startup	5 200 002 010	2 010	0.000 04
			2 minutes	5 200 002 055	2 055	0.000 04
			5 minutes	5 200 002 136	2 136	0.000 04
			10 minutes	5 200 002 245	2 245	0.000 04
		0	Startup	5 200 002 402	2 402	0.000 05
			2 minutes	5 200 002 431	2 431	0.000 05
			5 minutes	5 200 002 507	2 507	0.000 05
			10 minutes	5 200 002 534	2 534	0.000 05
		10	Startup	5 200 002 611	2 611	0.000 05
			2 minutes	5 200 002 633	2 633	0.000 05
			5 minutes	5 200 002 718	2 718	0.000 05
			10 minutes	5 200 002 766	2 766	0.000 05
		20	Startup	5 200 002 967	2 967	0.000 06
			2 minutes	5 200 003 001	3 001	0.000 06
			5 minutes	5 200 003 021	3 021	0.000 06
			10 minutes	5 200 003 105	3 105	0.000 06
		30	Startup	5 200 003 204	3 204	0.000 06
			2 minutes	5 200 003 228	3 228	0.000 06
			5 minutes	5 200 003 256	3 256	0.000 06
			10 minutes	5 200 003 307	3 307	0.000 06
		40	Startup	5 200 003 465	3 465	0.000 07
			2 minutes	5 200 003 499	3 499	0.000 07
			5 minutes	5 200 003 501	3 501	0.000 07
			10 minutes	5 200 003 528	3 528	0.000 07
		50	Startup	5 200 003 531	3 531	0.000 07
			2 minutes	5 200 003 568	3 568	0.000 07
			5 minutes	5 200 003 603	3 603	0.000 07
			10 minutes	5 200 003 637	3 637	0.000 07
85	3.27	+22(Ref)	Startup	5 200 003 039	3 039	0.000 06
			2 minutes	5 200 003 005	3 005	0.000 06
			5 minutes	5 200 002 985	2 985	0.000 06
			10 minutes	5 200 002 849	2 849	0.000 06
115	4.43	+22(Ref)	Startup	5 200 002 967	2 967	0.000 06
			2 minutes	5 200 002 951	2 951	0.000 06
			5 minutes	5 200 002 889	2 889	0.000 06
			10 minutes	5 200 002 868	2 868	0.000 06

This test report shall not be reproduced, except in full, without the written approval

KCTL-TIR001-003/2

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (77) of (219)



Test mode : UNII-2A

Frequency(Hz) : 5 280 000 000

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	3.85	+22(Ref)	Startup	5 280 002 894	2 894	0.000 06
			2 minutes	5 280 002 966	2 966	0.000 06
			5 minutes	5 280 003 057	3 057	0.000 06
			10 minutes	5 280 003 115	3 115	0.000 06
		-30	Startup	5 280 000 781	781	0.000 02
			2 minutes	5 280 000 801	801	0.000 02
			5 minutes	5 280 000 866	866	0.000 02
			10 minutes	5 280 000 906	906	0.000 02
		-20	Startup	5 280 001 679	1 679	0.000 03
			2 minutes	5 280 001 704	1 704	0.000 03
			5 minutes	5 280 001 751	1 751	0.000 03
			10 minutes	5 280 001 903	1 903	0.000 04
		-10	Startup	5 280 002 158	2 158	0.000 04
			2 minutes	5 280 002 166	2 166	0.000 04
			5 minutes	5 280 002 205	2 205	0.000 04
			10 minutes	5 280 002 266	2 266	0.000 04
		0	Startup	5 280 002 547	2 547	0.000 05
			2 minutes	5 280 002 576	2 576	0.000 05
			5 minutes	5 280 002 616	2 616	0.000 05
			10 minutes	5 280 002 688	2 688	0.000 05
		10	Startup	5 280 002 826	2 826	0.000 05
			2 minutes	5 280 002 845	2 845	0.000 05
			5 minutes	5 280 002 877	2 877	0.000 05
			10 minutes	5 280 002 901	2 901	0.000 06
		20	Startup	5 280 003 039	3 039	0.000 06
			2 minutes	5 280 003 105	3 105	0.000 06
			5 minutes	5 280 003 131	3 131	0.000 06
			10 minutes	5 280 003 225	3 225	0.000 06
		30	Startup	5 280 003 303	3 303	0.000 06
			2 minutes	5 280 003 328	3 328	0.000 06
			5 minutes	5 280 003 379	3 379	0.000 06
			10 minutes	5 280 003 406	3 406	0.000 07
		40	Startup	5 280 003 495	3 495	0.000 07
			2 minutes	5 280 003 525	3 525	0.000 07
			5 minutes	5 280 003 577	3 577	0.000 07
			10 minutes	5 280 003 580	3 580	0.000 07
		50	Startup	5 280 003 589	3 589	0.000 07
			2 minutes	5 280 003 602	3 602	0.000 07
			5 minutes	5 280 003 634	3 634	0.000 07
			10 minutes	5 280 003 699	3 699	0.000 07
85	3.27	+22(Ref)	Startup	5 280 003 068	3 068	0.000 06
			2 minutes	5 280 003 135	3 135	0.000 06
			5 minutes	5 280 003 268	3 268	0.000 06
			10 minutes	5 280 003 295	3 295	0.000 06
115	4.43	+22(Ref)	Startup	5 280 003 039	3 039	0.000 06
			2 minutes	5 280 003 101	3 101	0.000 06
			5 minutes	5 280 003 168	3 168	0.000 06
			10 minutes	5 280 003 298	3 298	0.000 06

This test report shall not be reproduced, except in full, without the written approval

KCTL-TIR001-003/2

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (78) of (219)

KCTL

Test mode : UNII-2C

Frequency(Hz) : 5 600 000 000

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	3.85	+22(Ref)	Startup	5 600 003 126	3 126	0.000 06
			2 minutes	5 600 003 205	3 205	0.000 06
			5 minutes	5 600 003 288	3 288	0.000 06
			10 minutes	5 600 003 415	3 415	0.000 06
		-30	Startup	5 600 000 724	724	0.000 01
			2 minutes	5 600 000 805	805	0.000 01
			5 minutes	5 600 000 829	829	0.000 02
			10 minutes	5 600 000 911	911	0.000 02
		-20	Startup	5 600 001 708	1 708	0.000 03
			2 minutes	5 600 001 795	1 795	0.000 03
			5 minutes	5 600 001 864	1 864	0.000 03
			10 minutes	5 600 001 938	1 938	0.000 04
		-10	Startup	5 600 002 415	2 415	0.000 04
			2 minutes	5 600 002 437	2 437	0.000 04
			5 minutes	5 600 002 466	2 466	0.000 04
			10 minutes	5 600 002 507	2 507	0.000 05
		0	Startup	5 600 002 750	2 750	0.000 05
			2 minutes	5 600 002 779	2 779	0.000 05
			5 minutes	5 600 002 884	2 884	0.000 05
			10 minutes	5 600 002 906	2 906	0.000 05
		10	Startup	5 600 003 003	3 003	0.000 05
			2 minutes	5 600 003 034	3 034	0.000 05
			5 minutes	5 600 003 109	3 109	0.000 06
			10 minutes	5 600 003 145	3 145	0.000 06
		20	Startup	5 600 003 271	3 271	0.000 06
			2 minutes	5 600 003 305	3 305	0.000 06
			5 minutes	5 600 003 328	3 328	0.000 06
			10 minutes	5 600 003 419	3 419	0.000 06
		30	Startup	5 600 003 540	3 540	0.000 06
			2 minutes	5 600 003 567	3 567	0.000 06
			5 minutes	5 600 003 590	3 590	0.000 06
			10 minutes	5 600 003 622	3 622	0.000 07
		40	Startup	5 600 003 752	3 752	0.000 07
			2 minutes	5 600 003 798	3 798	0.000 07
			5 minutes	5 600 003 816	3 816	0.000 07
			10 minutes	5 600 003 830	3 830	0.000 07
		50	Startup	5 600 003 821	3 821	0.000 07
			2 minutes	5 600 003 867	3 867	0.000 07
			5 minutes	5 600 003 878	3 878	0.000 07
			10 minutes	5 600 003 925	3 925	0.000 07
85	3.27	+22(Ref)	Startup	5 600 003 300	3 300	0.000 06
			2 minutes	5 600 003 387	3 387	0.000 06
			5 minutes	5 600 003 416	3 416	0.000 06
			10 minutes	5 600 003 488	3 488	0.000 06
115	4.43	+22(Ref)	Startup	5 600 003 343	3 343	0.000 06
			2 minutes	5 600 003 399	3 399	0.000 06
			5 minutes	5 600 003 415	3 415	0.000 06
			10 minutes	5 600 003 480	3 480	0.000 06

This test report shall not be reproduced, except in full, without the written approval

KCTL-TIR001-003/2

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (79) of (219)



Test mode : UNII-3

Frequency(Hz) : 5 785 000 000

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	3.85	+22(Ref)	Startup	5 785 003 256	3 256	0.000 06
			2 minutes	5 785 003 277	3 277	0.000 06
			5 minutes	5 785 003 301	3 301	0.000 06
			10 minutes	5 785 003 325	3 325	0.000 06
		-30	Startup	5 785 000 695	695	0.000 01
			2 minutes	5 785 000 710	710	0.000 01
			5 minutes	5 785 000 733	733	0.000 01
			10 minutes	5 785 000 811	811	0.000 01
		-20	Startup	5 785 001 737	1 737	0.000 03
			2 minutes	5 785 001 801	1 801	0.000 03
			5 minutes	5 785 001 866	1 866	0.000 03
			10 minutes	5 785 001 897	1 897	0.000 03
		-10	Startup	5 785 002 551	2 551	0.000 04
			2 minutes	5 785 002 603	2 603	0.000 05
			5 minutes	5 785 002 638	2 638	0.000 05
			10 minutes	5 785 002 716	2 716	0.000 05
		0	Startup	5 785 002 865	2 865	0.000 05
			2 minutes	5 785 002 904	2 904	0.000 05
			5 minutes	5 785 003 010	3 010	0.000 05
			10 minutes	5 785 003 088	3 088	0.000 05
		10	Startup	5 785 003 158	3 158	0.000 06
			2 minutes	5 785 003 177	3 177	0.000 06
			5 minutes	5 785 003 216	3 216	0.000 06
			10 minutes	5 785 003 330	3 330	0.000 06
		20	Startup	5 785 003 401	3 401	0.000 06
			2 minutes	5 785 003 422	3 422	0.000 06
			5 minutes	5 785 003 468	3 468	0.000 06
			10 minutes	5 785 003 510	3 510	0.000 06
		30	Startup	5 785 003 609	3 609	0.000 06
			2 minutes	5 785 003 622	3 622	0.000 06
			5 minutes	5 785 003 688	3 688	0.000 06
			10 minutes	5 785 003 701	3 701	0.000 06
		40	Startup	5 785 003 816	3 816	0.000 07
			2 minutes	5 785 003 833	3 833	0.000 07
			5 minutes	5 785 003 901	3 901	0.000 07
			10 minutes	5 785 003 928	3 928	0.000 07
		50	Startup	5 785 003 994	3 994	0.000 07
			2 minutes	5 785 004 010	4 010	0.000 07
			5 minutes	5 785 004 055	4 055	0.000 07
			10 minutes	5 785 004 110	4 110	0.000 07
85	3.27	+22(Ref)	Startup	5 785 003 329	3 329	0.000 06
			2 minutes	5 785 003 356	3 356	0.000 06
			5 minutes	5 785 003 402	3 402	0.000 06
			10 minutes	5 785 003 425	3 425	0.000 06
115	4.43	+22(Ref)	Startup	5 785 003 473	3 473	0.000 06
			2 minutes	5 785 003 498	3 498	0.000 06
			5 minutes	5 785 003 523	3 523	0.000 06
			10 minutes	5 785 003 577	3 577	0.000 06

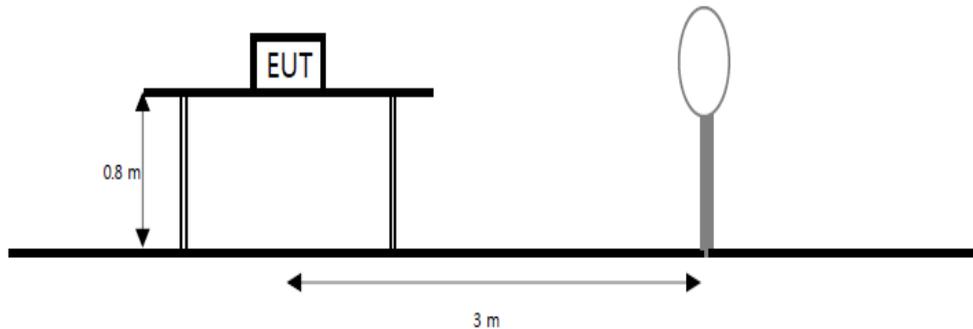
This test report shall not be reproduced, except in full, without the written approval

KCTL-TIR001-003/2

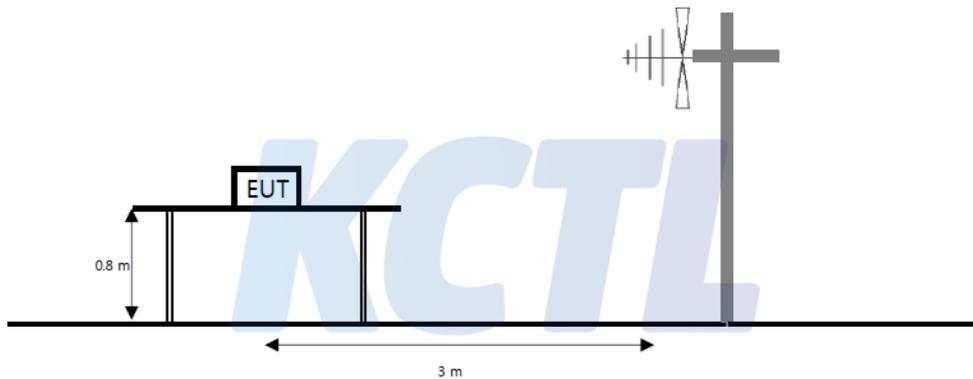
7.6. Spurious Emission, Band Edge and Restricted bands

Test setup

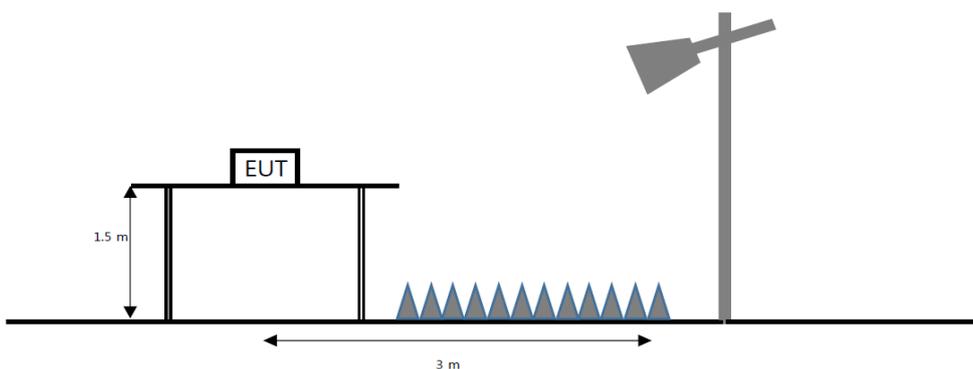
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



Limit

According to section 15.209(a) except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating 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, e.g., Section 15.231 and 15.241.

According to section 15.205(a) and (b) only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 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 - 8.5
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	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	2 690 - 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 - 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 - 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 - 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 - 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (82) of (219)

KCTL

According to section 15.407(b), 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:

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

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.

For transmitters operating in the 5.725-5.85 GHz band: 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.

KCTL

Test procedure

ANSI C63.10-2013 Section 12.7.5, 12.7.6, 12.7.7.2

Test settings**Peak field strength measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW \geq (3 \times RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

Table. RBW as a function of frequency

Frequency	RBW
9 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 000 MHz	100 kHz to 120 kHz
> 1 000 MHz	1 MHz

Average field strength measurements**Trace averaging with continuous EUT transmission at full power**

If the EUT can be configured or modified to transmit continuously (D \geq 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1. RBW = 1 MHz (unless otherwise specified).
2. VBW \geq (3 \times RBW).
3. Detector = RMS (power averaging), if [span / (# of points in sweep)] \leq (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
4. Averaging type = power (i.e., rms):
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (D \geq 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 MHz (unless otherwise specified).
4. VBW \geq [3 \times RBW].
5. Detector = RMS (power averaging), if [span / (# of points in sweep)] \leq (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

6. Averaging type = power (i.e., rms):
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in step f), then the applicable correction factor is $[10 \log (1 / D)]$, where D is the duty cycle.
 - 2) If linear voltage averaging mode was used in step f), then the applicable correction factor is $[20 \log (1 / D)]$, where D is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous ($D \geq 98\%$) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz ($\geq 1/T$) for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)
2. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40 \log(D_m/D_s)$
 $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20 \log(D_m/D_s)$
Where:
 - F_d = Distance factor in dB
 - D_m = Measurement distance in meters
 - D_s = Specification distance in meters
3. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d (dB)
4. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
5. Average test would be performed if the peak result were greater than the average limit.
6. ¹⁾ means restricted band.
7. According to part 15.31(f)(2), an extrapolation factor of 40 dB/decade is applied because measured distance of radiated emission is 3 m.

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (85) of (219)

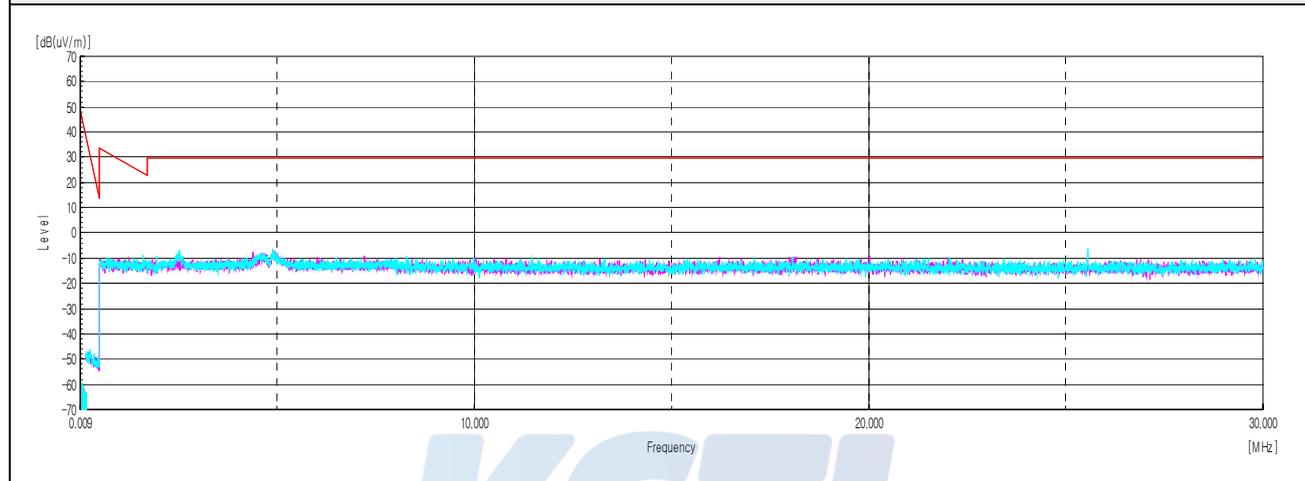
KCTL

Test results (Below 30 MHz) – Worst case: 802.11a / UNII-2C Straddle ch.

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)

No spurious emissions were detected within 20 dB of the limit.

Horizontal/Vertical



KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

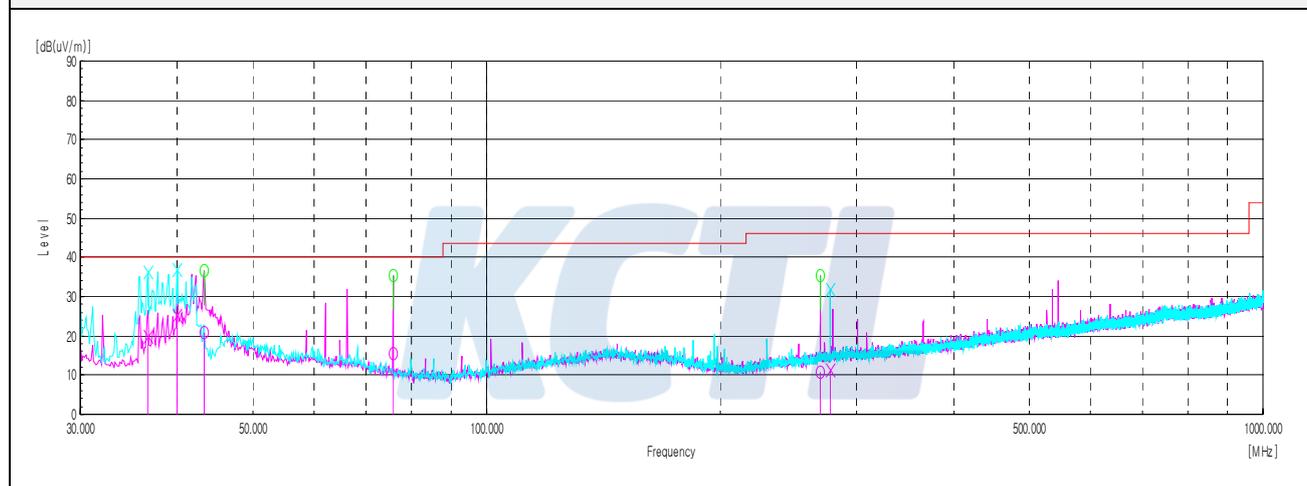
Page (86) of (219)



Test results (Below 1 000 MHz) – Worst case: 802.11a / UNII-2C Straddle ch.

Frequency	Reading	Pol.	Ant. Factor	Amp.+Cable	DCCF	Result	Limit	Margin
(MHz)	(dB(μV))	(V/H)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
36.67	32.80	V	17.73	-30.52	-	20.01	40.00	19.99
39.94	37.30	V	18.39	-30.45	-	25.24	40.00	14.76
43.34	32.90	H	18.40	-30.38	-	20.92	40.00	19.08
75.83	30.10	H	15.23	-29.79	-	15.54	40.00	24.46
269.23 ¹⁾	20.20	H	18.55	-28.08	-	10.67	46.00	35.33
276.99 ¹⁾	20.60	V	18.81	-28.01		11.40	46.00	34.60

Horizontal/Vertical



KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0016-A

Page (87) of (219)



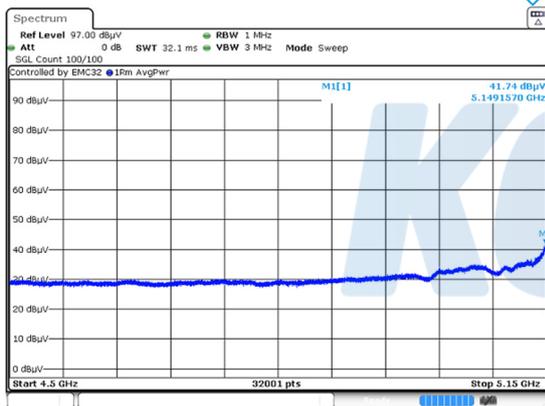
Test results (Above 1 000 MHz)

802.11a UNII-1

Lowest Channel (5 180 MHz)

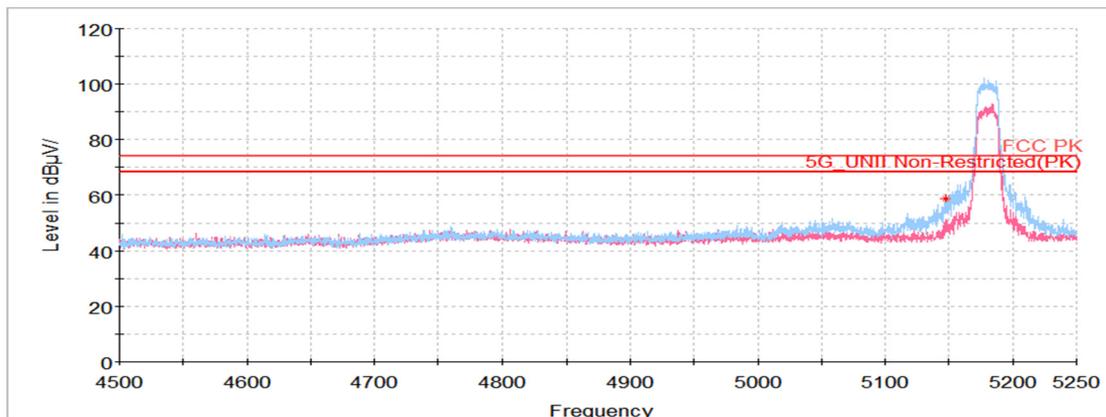
Frequency	Reading	Pol.	Ant. Factor	Amp.+Cable	DCCF	Result	Limit	Margin
(MHz)	(dB(μV))	(V/H)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
5 149.16 ¹⁾	51.53	H	34.24	-27.11	-	58.66	74.00	15.34
10 359.33	58.30	V	37.26	-50.29	-	45.27	68.20	22.93
15 540.44 ¹⁾	56.70	V	40.01	-48.57	-	48.14	74.00	25.86
Average Data								
5 149.16 ¹⁾	41.74	H	34.24	-27.11	-	48.87	54.00	5.13

Average data

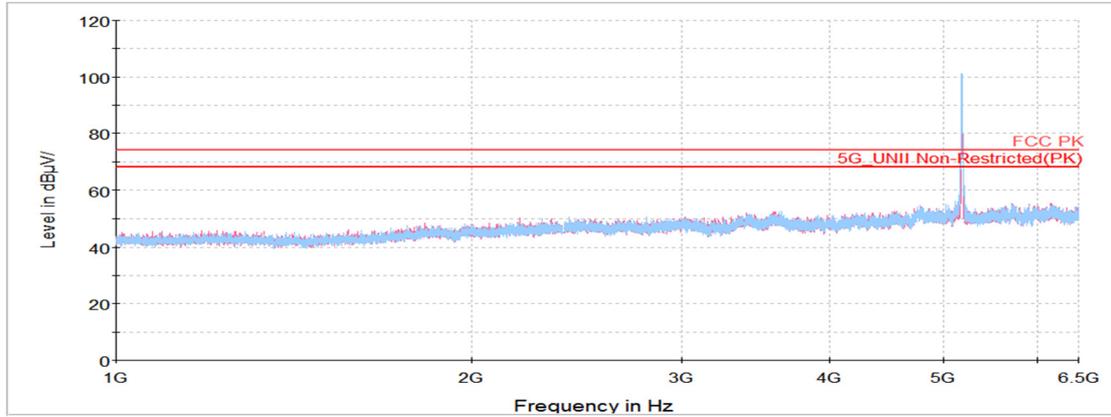


Blank

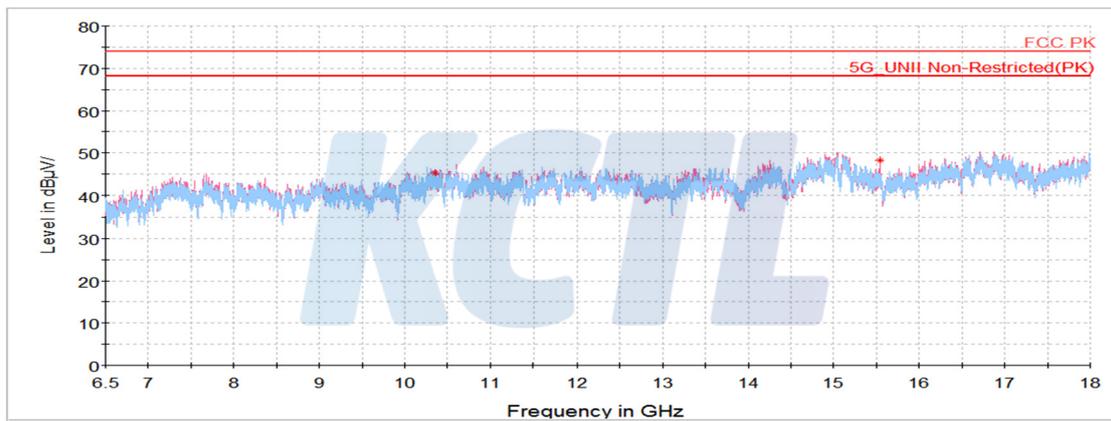
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 6.5 GHz



Horizontal/Vertical for 6.5 GHz ~ 18 GHz



Horizontal/Vertical for 18 GHz ~ 40 GHz

