



TEST REPORT

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.: KR17-SRF0077-B Page (1) of (115)	
1. Client - Name : Rayence Co.,Ltd. - Address : 14, Samsung 1-ro 1-gil, Hwaseong-si, Gyeonggi-do, South Korea, 18449 - Date of Receipt : 2017-06-21 2. Use of Report : - 3. Name of Product and Model : Medical Image Processing Unit / 1417WCC 4. Manufacturer and Country of Origin : Rayence Co.,Ltd. / Korea 5. FCC ID : QIIRY1417WHD 6. IC ID : 10742A-1417WHD 7. Date of Test : 2017-07-19 to 2017-07-31 8. Test Standards : FCC Part 15 Subpart E, 15.407 RSS-247 Issue 1 May 2015 RSS GEN Issue 4 November 2014 9. Test Results : Refer to the test result in the test report		
Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Changmin Kim (Signature)
2017-08-18		
KCTL Inc.		
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REPORT REVISION HISTORY

Date	Revision	Page No
2017-08-02	Originally issued	-
2017-08-11	Revised some items of section 3.2 General description	6,7
2017-08-18	Revised transmit power	7

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[Contents]

1. Client information.....	4
2. Laboratory information.....	5
3. Description of E.U.T.	6
3.1 Basic description.....	6
3.2 General description.....	6
3.3 Test frequency.....	8
3.4 Test Voltage.....	8
4. Summary of test results	9
4.1 Standards & results.....	9
4.2 Uncertainty.....	9
5. Test results.....	10
5.1 Antenna Requirement	10
5.2 Maximum Conducted Output Power.....	13
5.3 Bandwidth Measurement	38
5.4 Peak Power Spectral Density	73
5.5 Spurious Emission, Band Edge And Restricted Bands	93
5.6 Frequency Stability.....	106
5.7 Conducted Emission	113
6. Test equipment used for test	115

1. Client information

Applicant: Rayence Co.,Ltd.
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Telephone number: 82 31 8015 6465
Facsimile number: 82 31 8015 6300
Contact person: Namyoung Ha / namyoung.ha@rayence.com

Manufacturer: Rayence Co.,Ltd.
Address: 14, Samsung 1-ro 1-gil, Hwaseong-si, Gyeonggi-do,
South Korea, 18449

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Report No.:
KR17-SRF0077-B

Page (5) of (115)

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2. Laboratory information

Address

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Facsimile Number: 82 505 299 8311

FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



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KCTL-TIR001-003/2

3. Description of E.U.T.

3.1 Basic description

Applicant	Rayence Co.,Ltd.
Address of Applicant	14, Samsung 1-ro 1-gil, Hwaseong-si, Gyeonggi-do, South Korea, 18449
Manufacturer	Rayence Co.,Ltd.
Address of Manufacturer	14, Samsung 1-ro 1-gil, Hwaseong-si, Gyeonggi-do, South Korea, 18449
Type of equipment	Medical Image Processing Unit
Basic Model	1417WCC
Variant Model ¹⁾	1417WGC
Serial number	N/A

1) 1417WCC and 1417WGC are identical electrical components except for scintillator. But scintillator layer are different.

3.2 General description

Frequency Range	2 412 MHz ~ 2 462 MHz (802.11g/n_HT20) 2 422 MHz ~ 2 452 MHz (802.11n_HT40) 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20) 5 190 MHz ~ 5 230 MHz (802.11n_HT40) 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20) 5 755 MHz ~ 5 795 MHz (802.11n_HT40)
Type of Modulation	802.11a/g/n : OFDM
The number of channels	2.4 GHz: 11 ch (802.11b/g/n_HT20), 7 ch (802.11n_HT40) 5 GHz: 5 150 MHz Band: 4 (802.11a/n_HT20) 5 150 MHz Band: 2 (802.11n_HT40) 5 725 MHz Band: 4 (802.11a/n_HT20) 5 725 MHz Band: 2 (802.11n_HT40)

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Report No.:
KR17-SRF0077-B

Page (7) of (115)



Type of Antenna	PCB Antenna
Antenna Gain	2.4 GHz: -1.32 dBi (2 400 MHz ~ 2 483.5 MHz)_MIMO 2 Tx (ANT 0+1) 5.0 GHz: 0.67 dBi (5 150 MHz ~ 5 250 MHz)_MIMO 2 Tx (ANT 0+1) 5.12 dBi (5 725 MHz ~ 5 850 MHz)_MIMO 2 Tx (ANT 0+1)
Transmit Power	19.66 dBm
Power supply	DC 11.1 V
Product SW/HW version	FW-000.026 / 7.0
Radio SW/HW version	0.1 / 0.1
Test SW Version	FW-000.026
RF power setting in TEST SW	5 150 MHz Band: 802.11a: 17 (Low) / 17 (Mid) / 17 (High) 802.11n HT20: 15 (Low) / 17 (Mid) / 17 (High) 802.11n HT40: 10 (Low) / 17 (Mid) 5 725 MHz Band: 802.11a: 20 (Low) / 16 (Mid) / 13 (High) 802.11n HT20: 17 (Low) / 17 (Mid) / 17 (High) 802.11n HT40: 17 (Low) / 17 (Mid)

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency

- 802.11a/n HT20

Frequency	Band 1	Band 4
Lowest frequency	5 180 MHz	5 745 MHz
Middle frequency	5 200 MHz	5 785 MHz
Highest frequency	5 240 MHz	5 825 MHz

- 802.11n HT40

Frequency	Band 1	Band 4
Lowest frequency	5 190 MHz	5 755 MHz
Middle frequency	5 230 MHz	5 795 MHz

3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 11.1 V

4. Summary of test results

4.1 Standards & results

FCC Rule	IC Rule	Parameter	Report Section	Test Result
15.203 15.407(a)(1)(2)(3)	-	Antenna Requirement	5.1	C
15.407(a)(1)(2)	RSS-247, 5.4	Maximum Conducted Output Power	5.2	C
15.403(i), 15.407(e)	RSS-247, 5.1 RSS-GEN, 6.6	Bandwidth Measurement	5.3	C
15.407(a)(1)(2)(5)	RSS-247, 5.3, (2)	Peak Power Spectral Density	5.4	C
15.205(a), 15.209(a), 15.407(b)(1), 15.407(b)(2), 15.407(b)(3)	RSS-247, 5.5 RSS-GEN, 8.9, 10	Spurious Emission, Band Edge and Restricted bands	5.5	C
15.407(g)	RSS-GEN, 6.11	Frequency Stability	5.6	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.7	C
15.407(h)	RSS-247, 6.3	Dynamic Frequency Selection	-	NA
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable				

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 MHz ~ 1 000 MHz:	+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
	1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB
Conducted Emissions	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses 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 a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.407(a)(1)(2)(3), If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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Report No.:
KR17-SRF0077-B
Page (11) of (115)



5.1.2 Result

-Complied

The transmitter has Connected PCB Antenna.

The total directional peak gain of the antenna not exceeds 6.0 dBi

	5 150 MHz Band	5 725 MHz Band
ANT Gain	0.67 dBi	5.12 dBi

According to KDB 662911 D01 Multiple Transmitter Output v02r01

- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power measurements on IEEE 802.11 devices

- 5 150 MHz Band

In case of 2 Tx MIMO

For power spectral density (PSD) measurements on all devices,

Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

Total gain = 3.68 dBi (individual gain(0.67 dBi) + Array gain(3.01 dBi))

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

Total gain = 0.67 dBi (individual gain(0.67 dBi) + Array gain(0 dBi))

For power measurements on all other devices:

Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

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Report No.:
KR17-SRF0077-B
Page (12) of (115)

**- 5 725 MHz Band**

In case of 2 Tx MIMO

For power spectral density (PSD) measurements on all devices,

Array Gain = $10 \log(N_{\text{ANT}}/N_{\text{SS}})$ dB.

Total gain = 8.13 dBi (individual gain(5.12 dBi) + Array gain(3.01 dBi))

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for $N_{\text{ANT}} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{\text{ANT}}/N_{\text{SS}})$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{\text{ANT}} \geq 5$.

Total gain = 5.12 dBi (individual gain(5.12 dBi) + Array gain(0 dBi))

For power measurements on all other devices:

Array Gain = $10 \log(N_{\text{ANT}}/N_{\text{SS}})$ dB.



5.2 Maximum Conducted Output Power

5.2.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2.2 Measurement Procedure

These test measurement settings are specified in section C of 789033 D02 General UNII Test Procedures.

5.2.2.1 Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep):

- (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (ii) Set RBW = 1 MHz.
- (iii) Set VBW $\geq$ 3 MHz.
- (iv) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
- (v) Sweep time = auto.
- (vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.
- (vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq$ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."
- (viii) Trace average at least 100 traces in power averaging (rms) mode.
- (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

5.2.2.2 Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- (i) Measure the duty cycle, x , of the transmitter output signal as described in section II.B.
- (ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (iii) Set RBW = 1 MHz.
- (iv) Set VBW $\geq$ 3 MHz.
- (v) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
- (vi) Sweep time = auto.
- (vii) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.
- (viii) Do not use sweep triggering. Allow the sweep to “free run.”
- (ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
- (x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (xi) Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log (1/0.25) = 6 \text{ dB}$ if the duty cycle is 25 %.

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Report No.:
KR17-SRF0077-B

Page (16) of (115)

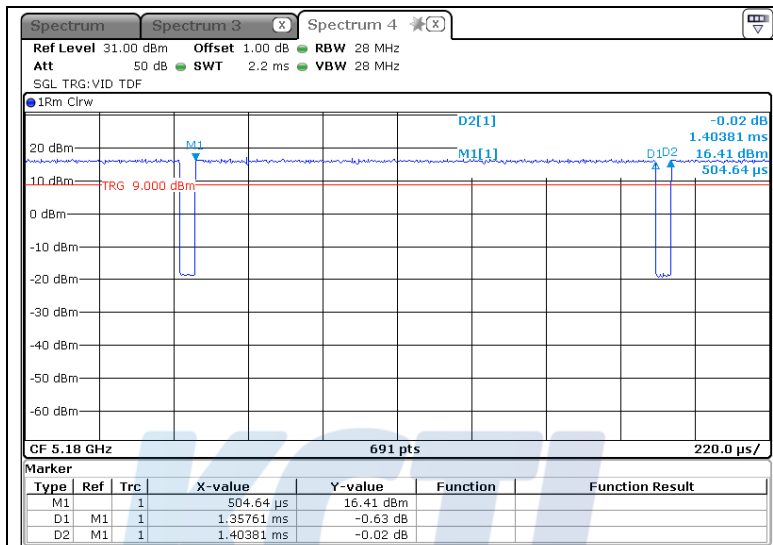
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- Duty Cycle Correction Factor

- 5 150 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11a

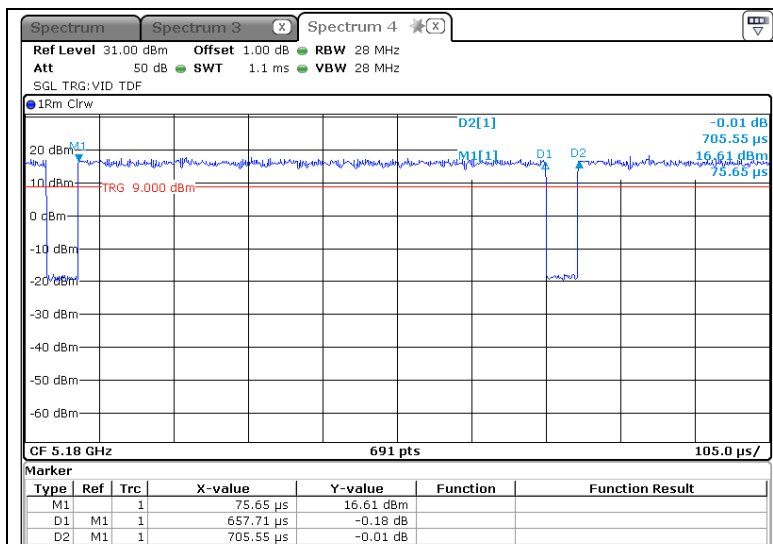


Note₁) : period : 1.40 ms, On time : 1.36 ms

Note₂) : $DCCF = 10 \log(1 / x) = 10 \log(1.40 / 1.36) = 0.15$, $x = 0.97$

Note₃) : 802.11a is a continuous transmission (duty cycle $\leq 98\%$)"

- 802.11n HT20



Note₁) : period : 0.71 ms, On time : 0.66 ms

Note₂) : $DCCF = 10 \log(1 / x) = 10 \log(0.71 / 0.66) = 0.31$, $x = 0.93$

Note₃) : 802.11n HT20 is a continuous transmission (duty cycle $\leq 98\%$)"

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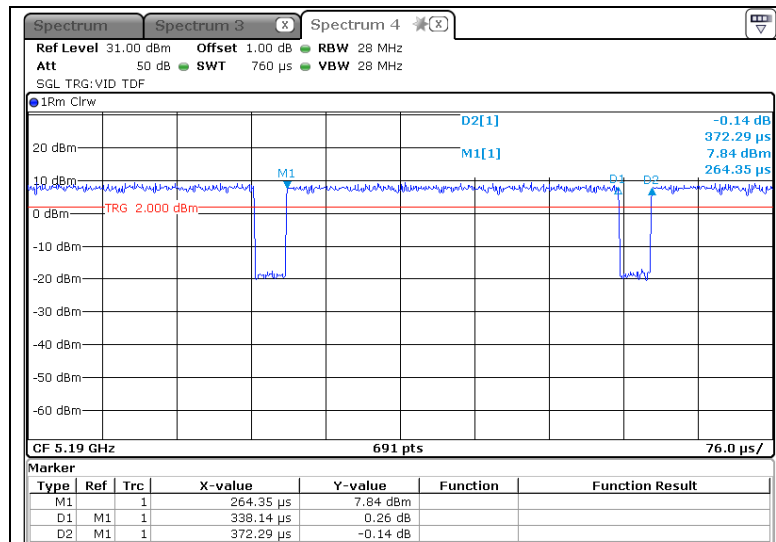
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Report No.:
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Page (17) of (115)

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- 802.11n HT40



Note₁) : period : 0.37 ms, On time : 0.34 ms

Note₂) : $DCCF = 10 \log(1 / x) = 10 \log(0.37 / 0.34) = 0.42$, $x = 0.91$

Note₃) : 802.11n HT40 is a continuous transmission (duty cycle $\leq 98\%$)"

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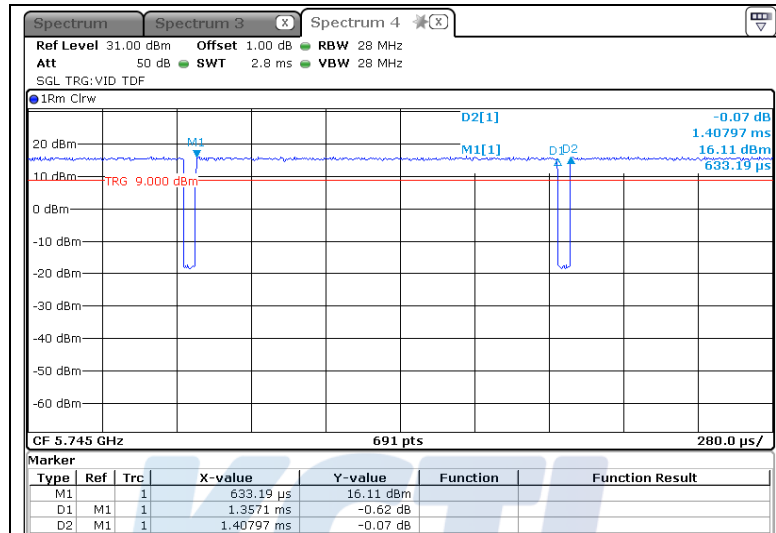
Report No.:
KR17-SRF0077-B
Page (18) of (115)



- 5 725 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11a

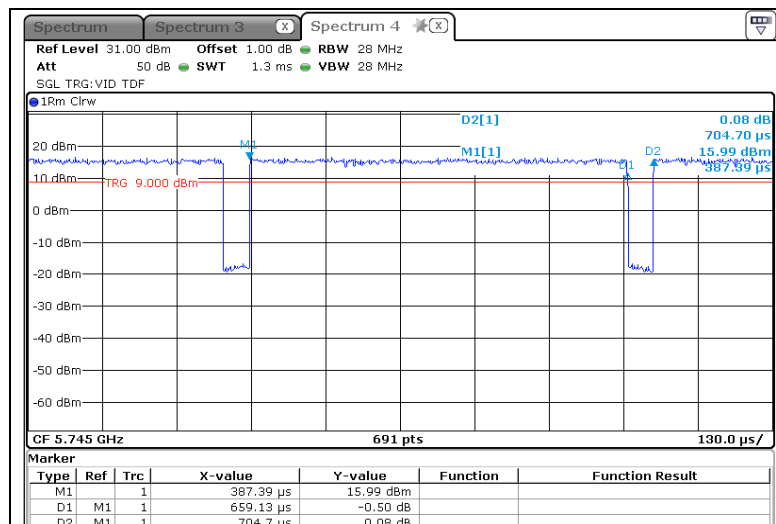


Note₁) : period : 1.41 ms, On time : 1.36 ms

Note₂) : DCCF = $10 \log(1 / x) = 10 \log(1.41 / 1.36) = 0.16$, $x = 0.96$

Note₃) : 802.11a is a continuous transmission (duty cycle $\geq 98\%$)"

- 802.11n HT20



Note₁) : period : 0.70 ms, On time : 0.66 ms

Note₂) : DCCF = $10 \log(1 / x) = 10 \log(0.70 / 0.66) = 0.29$, $x = 0.94$

Note₃) : 802.11n HT20 is a continuous transmission (duty cycle $\geq 98\%$)"

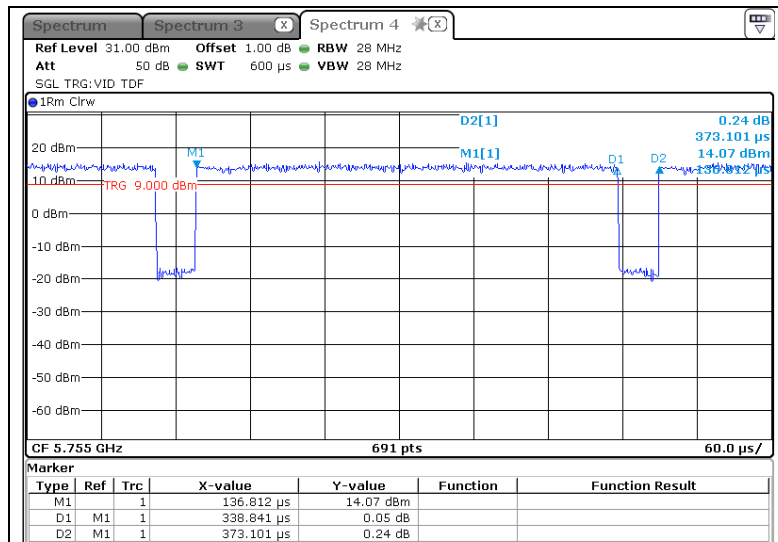
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Report No.:
KR17-SRF0077-B
Page (19) of (115)

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- 802.11n HT40



Note₁) : period : 0.37 ms, On time : 0.34 ms

Note₂) : $DCCF = 10 \log(1 / x) = 10 \log(0.37 / 0.34) = 0.43$, $x = 0.91$

Note₃) : 802.11n HT40 is a continuous transmission (duty cycle >=98 %)"

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Report No.:
KR17-SRF0077-B

Page (20) of (115)



5.2.3 Test Result

-Complied

- 5 150 Band

- MIMO 2 Tx (ANT 0+1)

-802.11a

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 180	15.19	16.28	0.15	18.92	30.00	11.08
Middle	5 200	15.71	14.91	0.15	18.48	30.00	11.52
Highest	5 240	16.34	16.53	0.15	19.59	30.00	10.41

-802.11n HT20

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 180	14.26	13.17	0.31	17.07	30.00	12.93
Middle	5 200	15.69	14.98	0.31	18.67	30.00	11.33
Highest	5 240	16.20	16.49	0.31	19.66	30.00	10.34

-802.11n HT40

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 190	8.73	8.14	0.42	11.87	30.00	18.13
Highest	5 230	16.25	16.21	0.42	19.66	30.00	10.34

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Report No.:
KR17-SRF0077-B

Page (21) of (115)

**- 5 725 Band****- MIMO 2 Tx (ANT 0+1)****-802.11n HT20**

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 745	14.99	15.62	0.16	18.49	30.00	11.51
Middle	5 785	14.06	14.58	0.16	17.50	30.00	12.50
Highest	5 825	13.81	13.8	0.16	16.98	30.00	13.02

-802.11ac VHT20

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 745	15.05	15.61	0.29	18.64	30.00	11.36
Middle	5 785	14.10	14.35	0.29	17.52	30.00	12.48
Highest	5 825	13.68	14.46	0.29	17.38	30.00	12.62

-802.11n HT40

Channel	Frequency [MHz]	Result_ ANT0 [dBm]	Result_ ANT1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	5 755	14.61	15.23	0.43	18.37	30.00	11.63
Highest	5 795	13.75	14.39	0.43	17.52	30.00	12.48

Note: D.C.C.F = Duty cycle correction factor = $10\log(1/\text{Duty Cycle})$

5.2.4 Test Plot

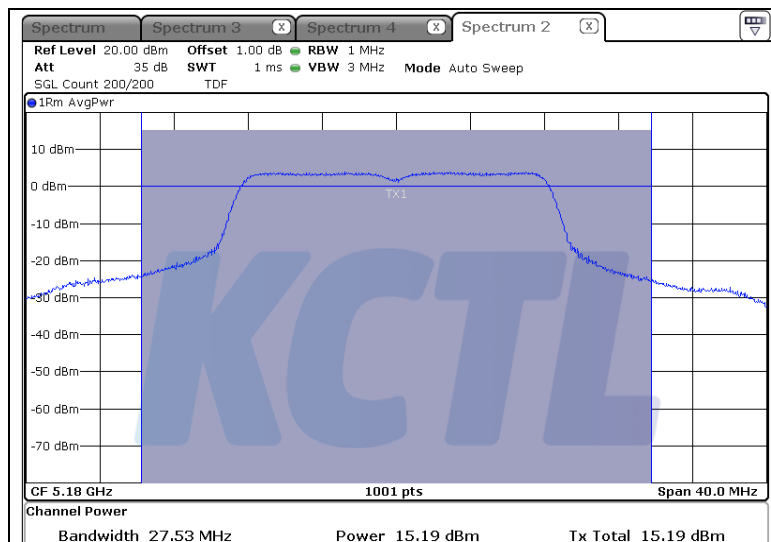
Figure 1. Conducted Output Power

- 5 150 Band

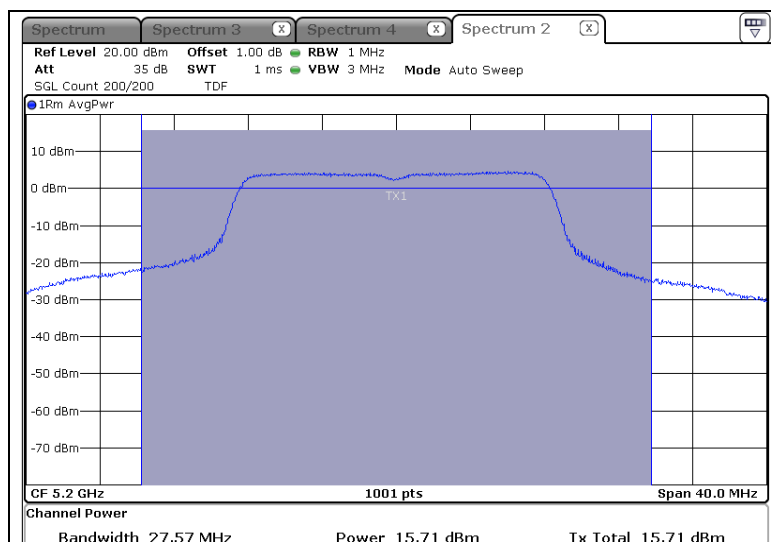
- MIMO 2 Tx (ANT 0)

-802.11a

Lowest Channel (5 180 MHz)



Middle Channel (5 200 MHz)



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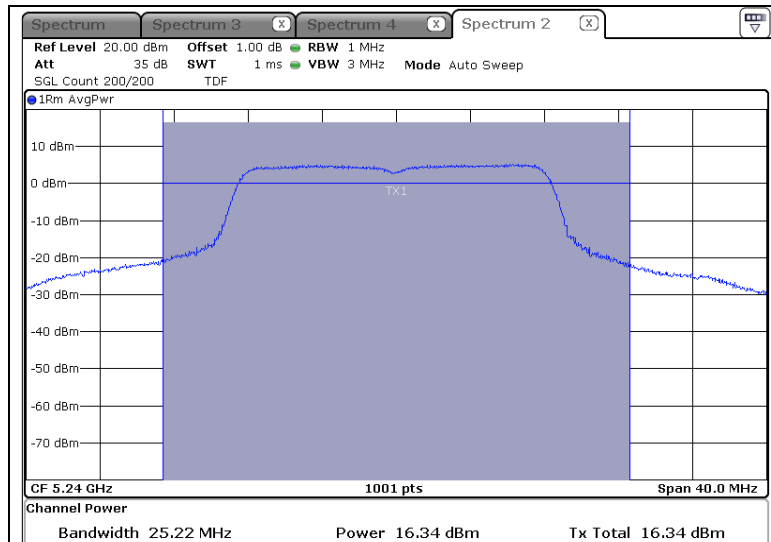
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

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KR17-SRF0077-B

Page (23) of (115)

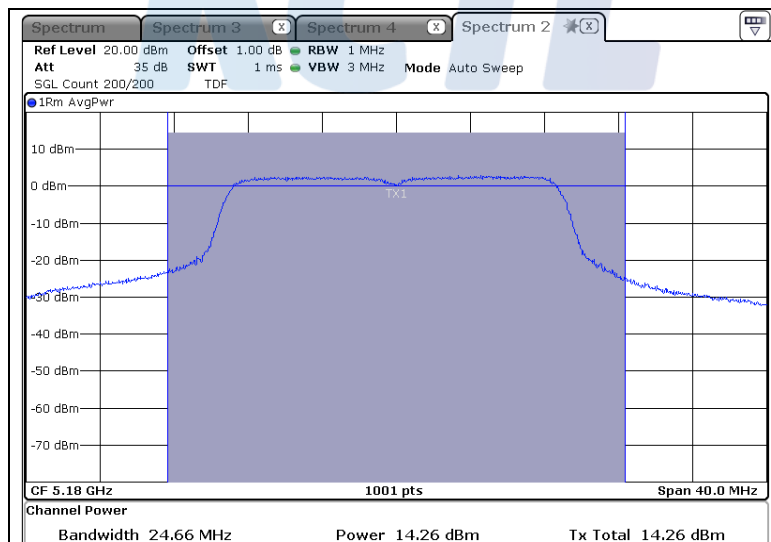
KCTL

Highest Channel (5 240 MHz)



-802.11n HT20

Lowest Channel (5 180 MHz)



KCTL Inc.

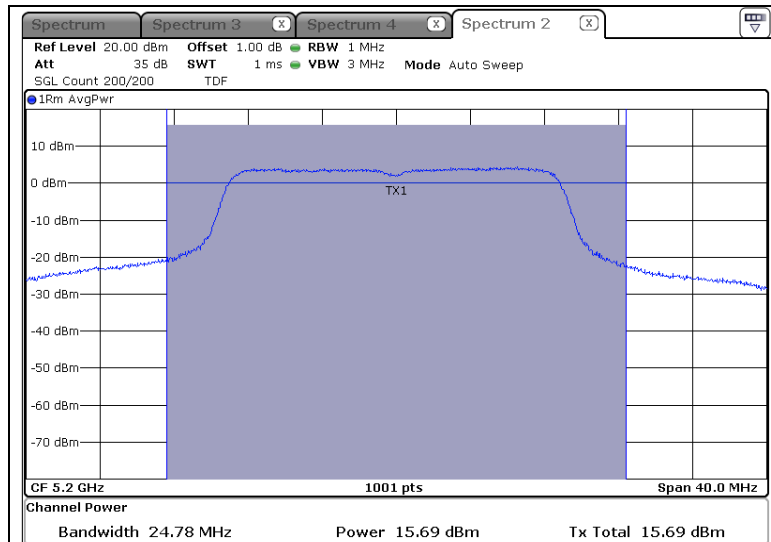
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
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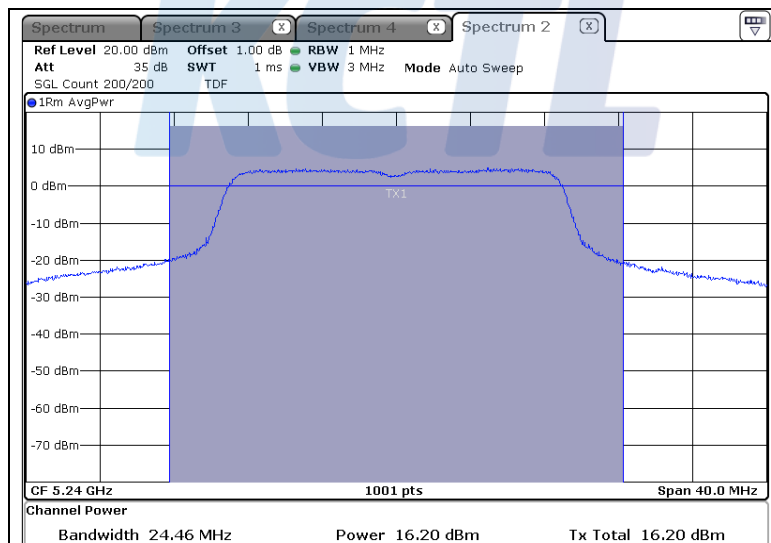
Page (24) of (115)

KCTL

Middle Channel (5 200 MHz)



Highest Channel (5 240 MHz)



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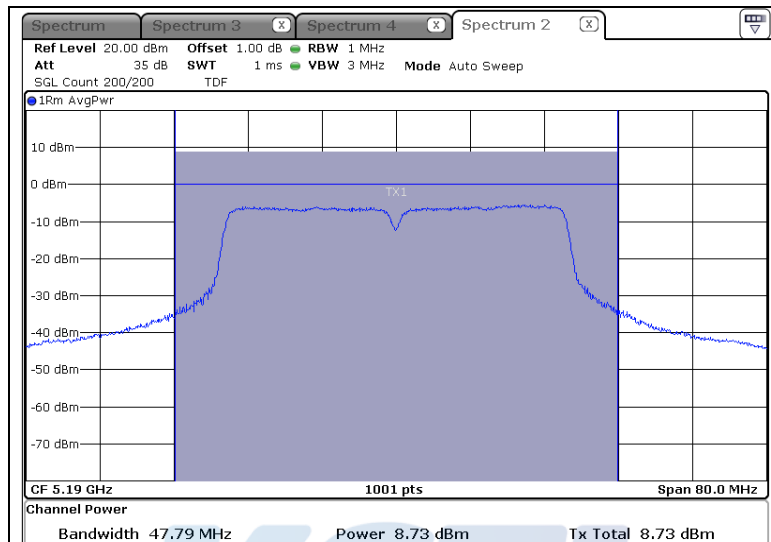
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KR17-SRF0077-B

Page (25) of (115)

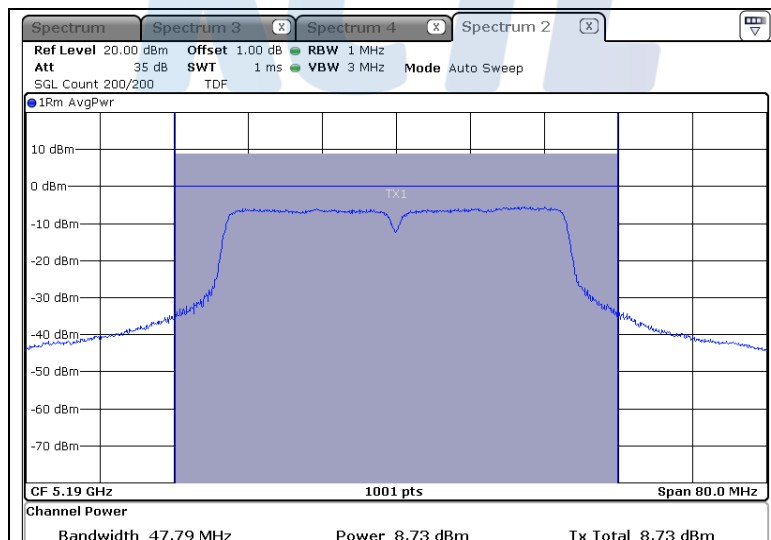
KCTL

-802.11n_HT40

Lowest Channel (5 190 MHz)



Middle Channel (5 230 MHz)



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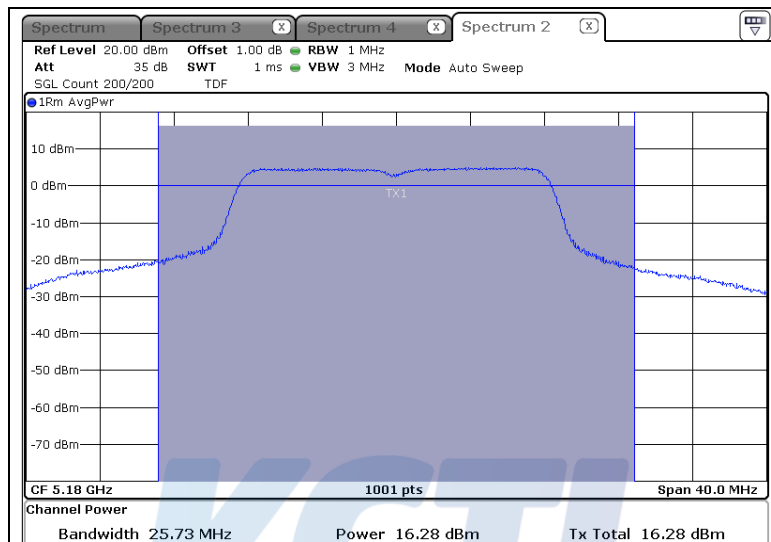
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KCTL

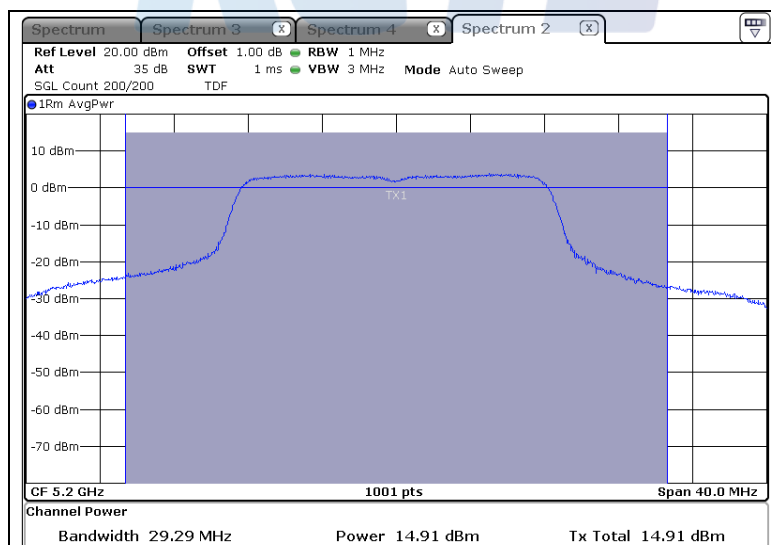
- MIMO 2 Tx (ANT 1)

-802.11a

Lowest Channel (5 180 MHz)



Middle Channel (5 200 MHz)



KCTL Inc.

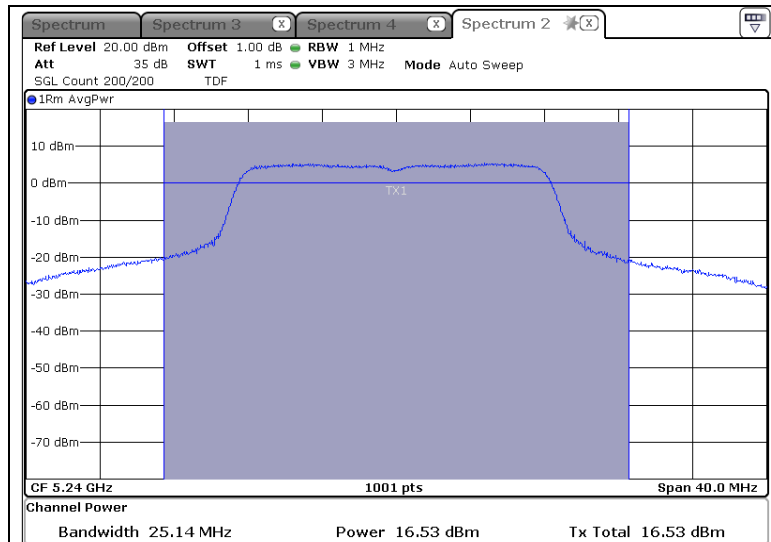
65, Sinwon-ro, Yeongtong-gu,
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TEL: 82-31-285-0894 FAX: 82-505-299-8311
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Page (27) of (115)

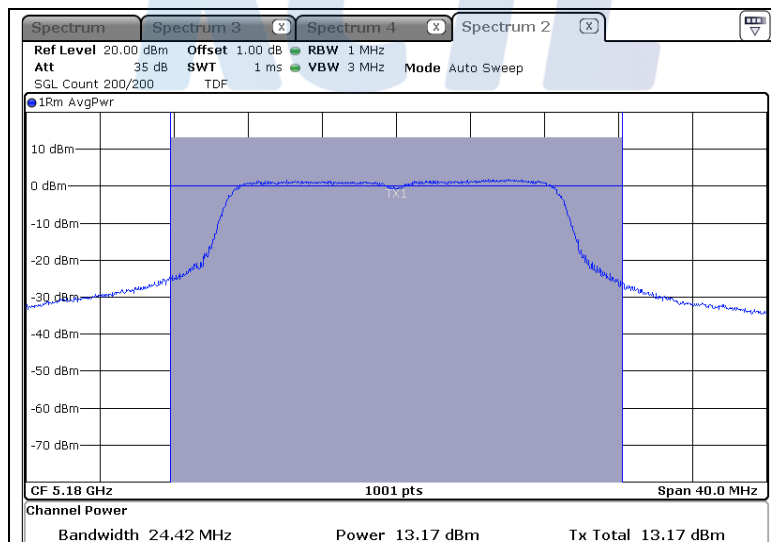
KCTL

Highest Channel (5 240 MHz)



-802.11n HT20

Lowest Channel (5 180 MHz)



KCTL Inc.

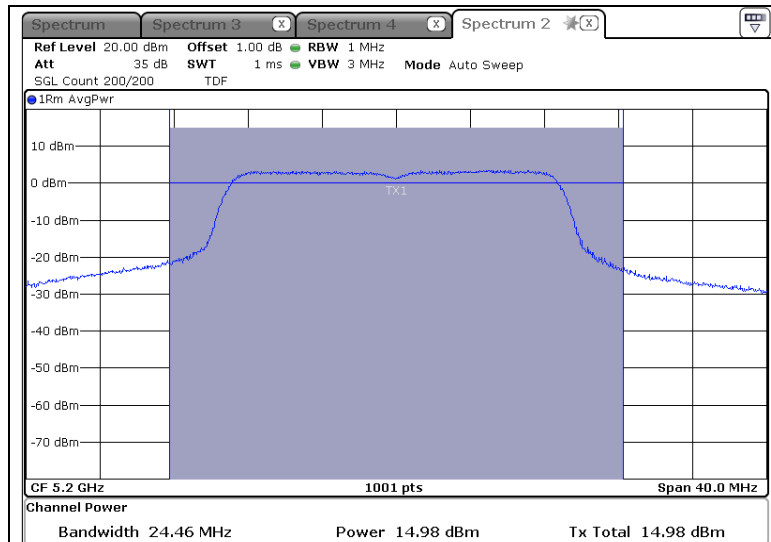
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
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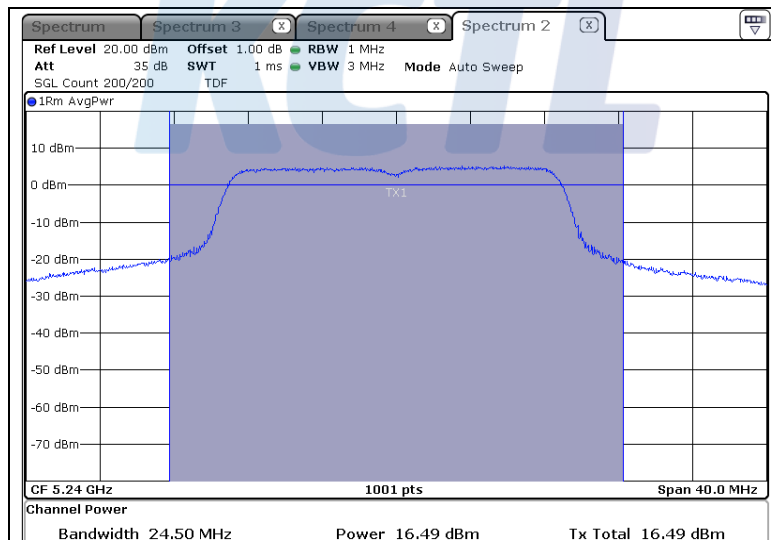
Page (28) of (115)

KCTL

Middle Channel (5 200 MHz)



Highest Channel (5 240 MHz)



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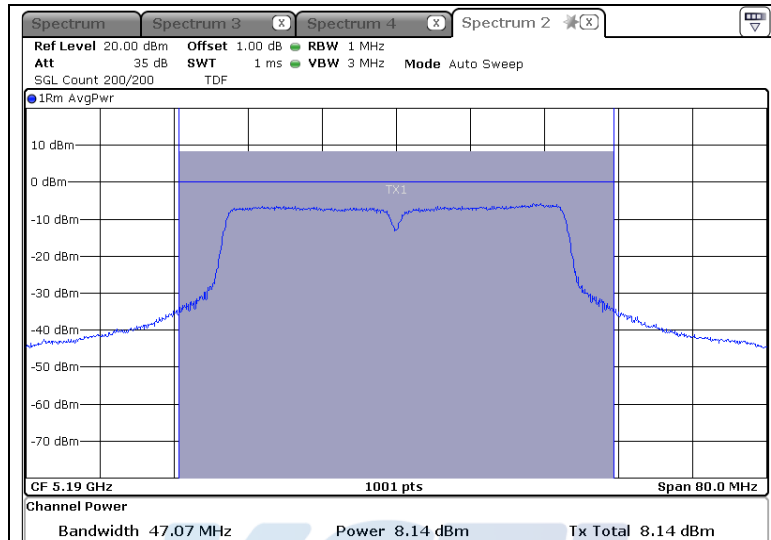
Report No.:
KR17-SRF0077-B

Page (29) of (115)

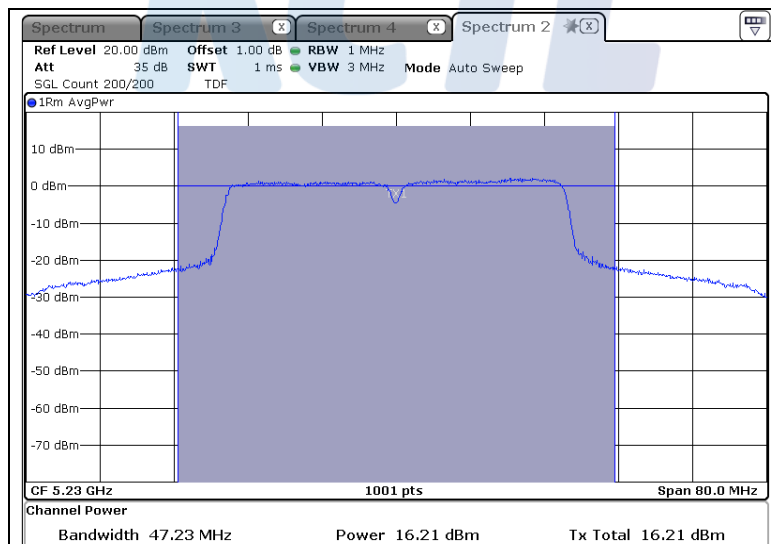
KCTL

-802.11n_HT40

Lowest Channel (5 190 MHz)



Middle Channel (5 230 MHz)



KCTL Inc.

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Report No.:
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Page (30) of (115)

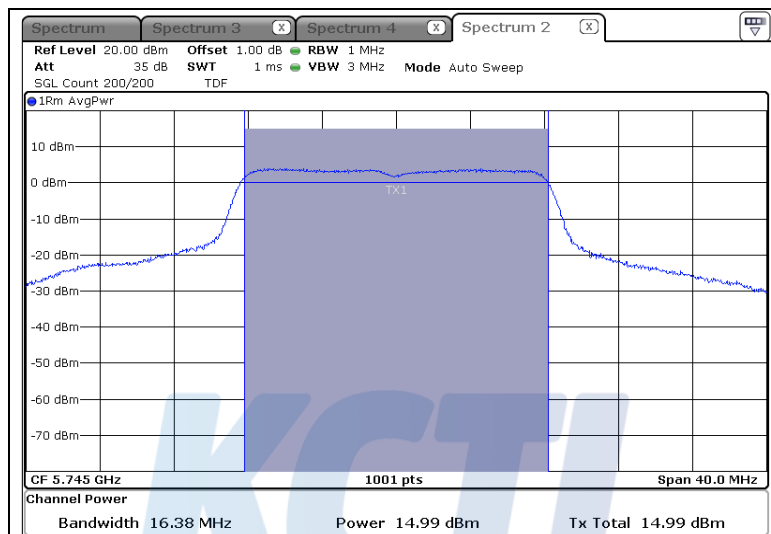
KCTL

5 725 Band

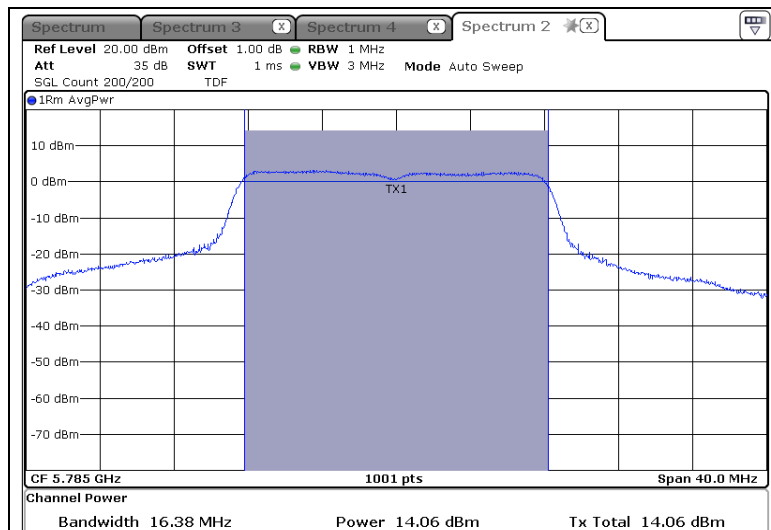
- MIMO 2 Tx (ANT 0)

-802.11a

Lowest Channel (5 745 MHz)



Middle Channel (5 785 MHz)



KCTL Inc.

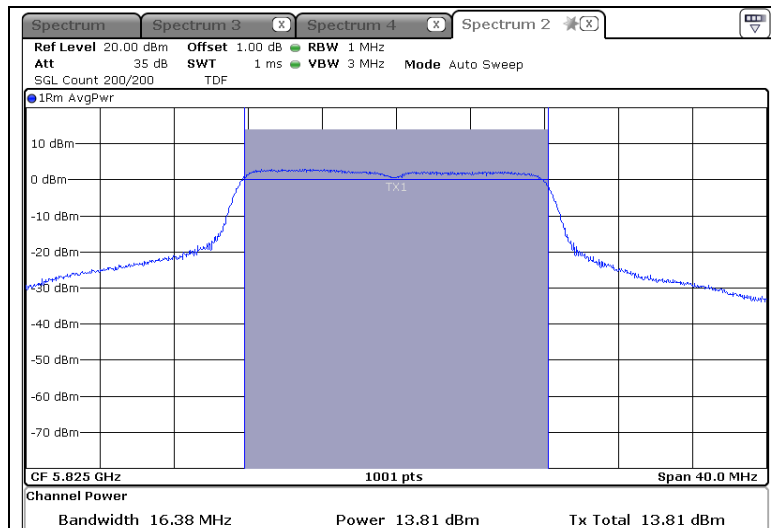
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Report No.:
KR17-SRF0077-B

Page (31) of (115)

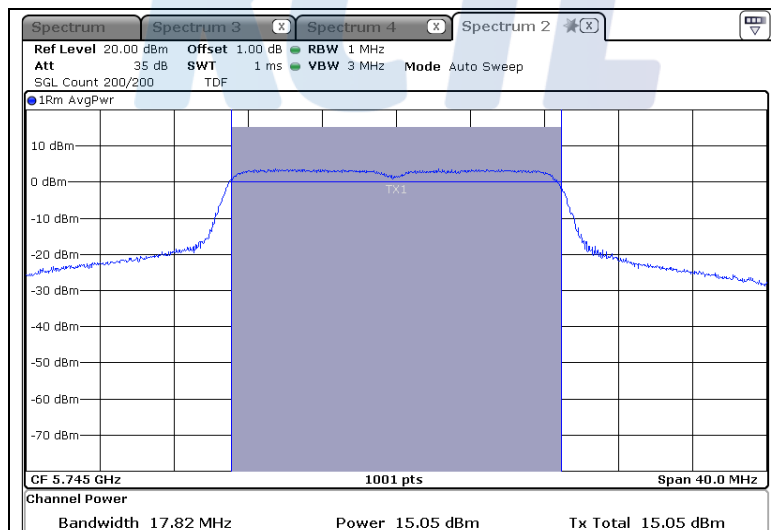
KCTL

Highest Channel (5 825 MHz)



-802.11n HT20

Lowest Channel (5 745 MHz)



KCTL Inc.

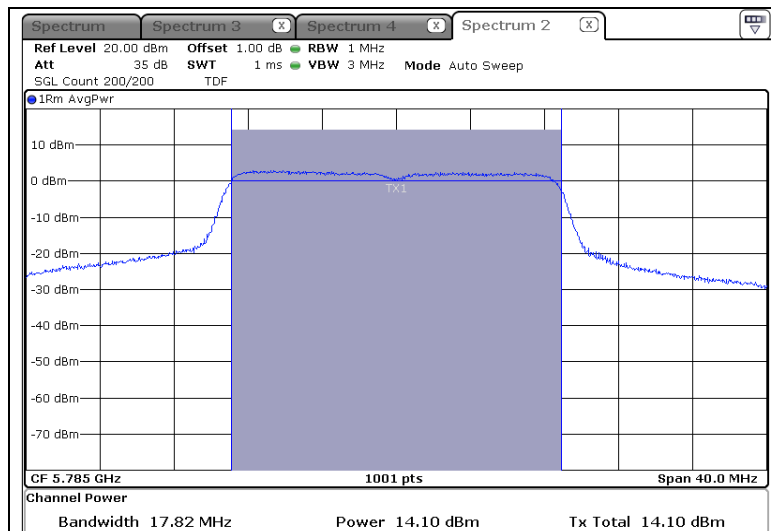
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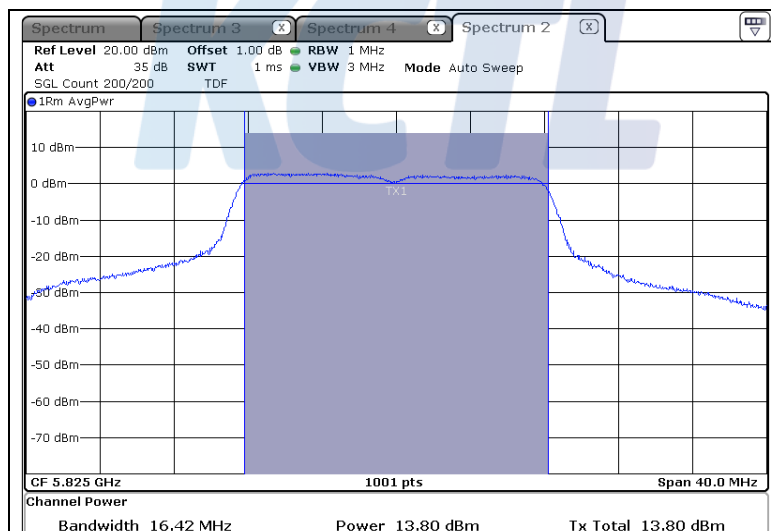
Page (32) of (115)

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Middle Channel (5 785 MHz)



Highest Channel (5 825 MHz)



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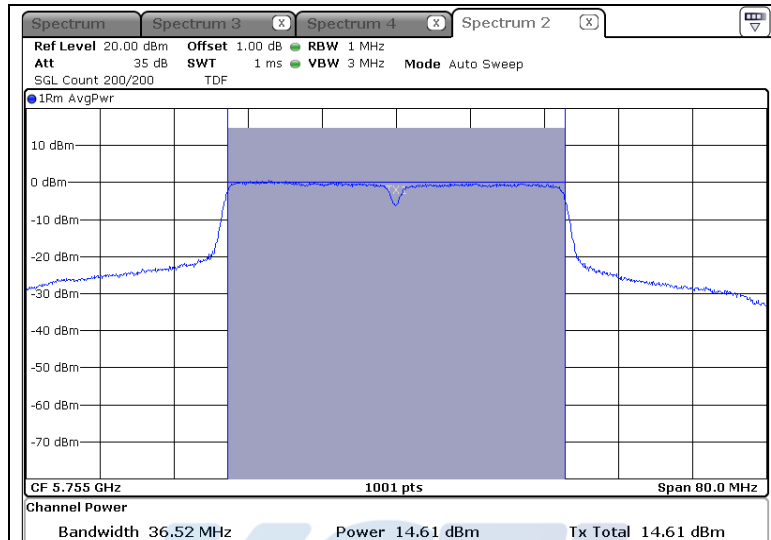
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Page (33) of (115)

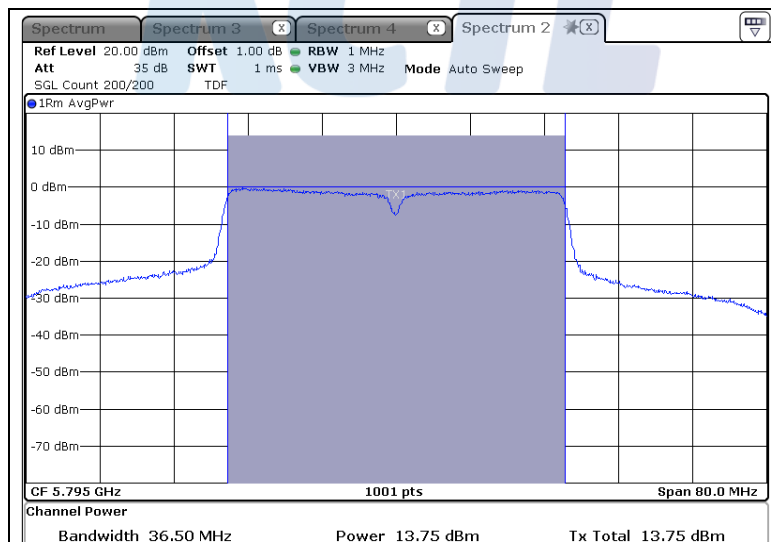
KCTL

-802.11n HT40

Lowest Channel (5 755 MHz)



Middle Channel (5 795 MHz)



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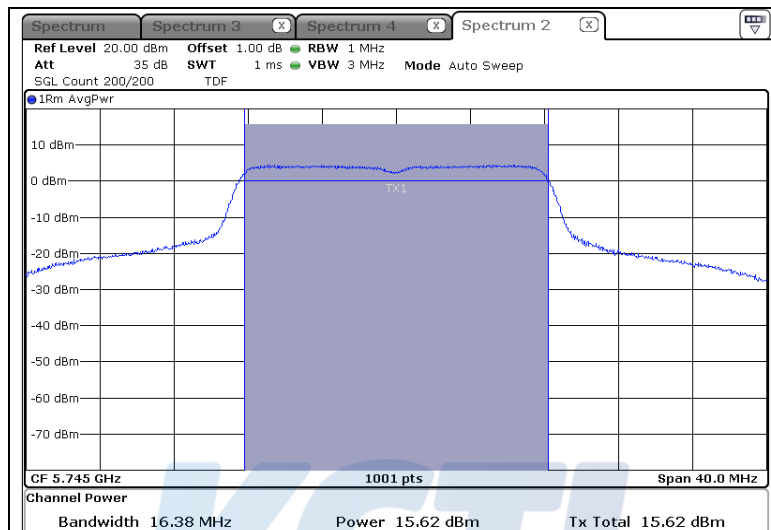
Page (34) of (115)

KCTL

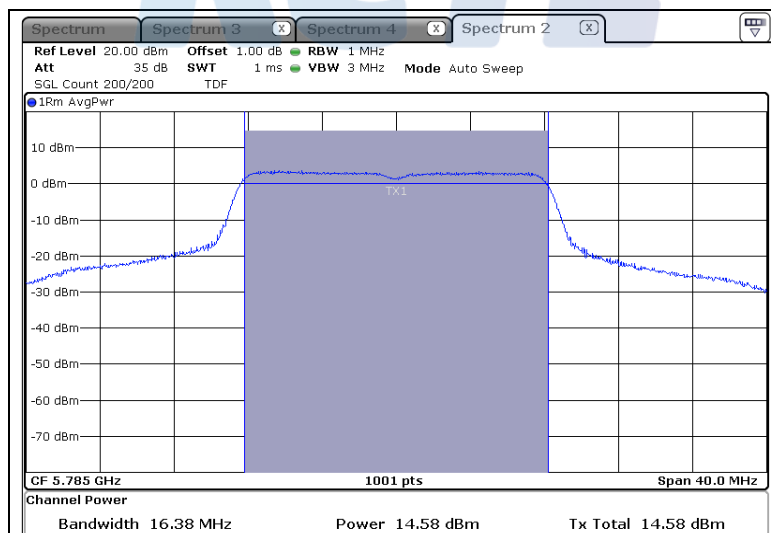
- MIMO 2 Tx (ANT 1)

-802.11a

Lowest Channel (5 745 MHz)



Middle Channel (5 785 MHz)



KCTL Inc.

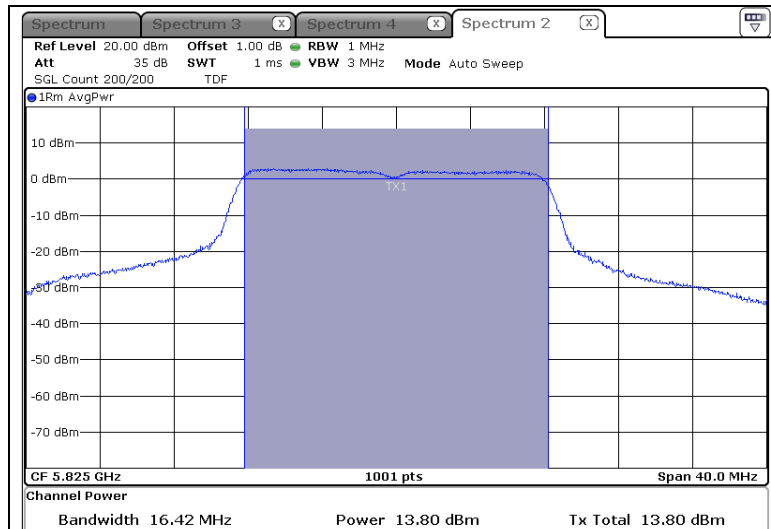
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Suwon-si, Gyeonggi-do, 16677, Korea
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Report No.:
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Page (35) of (115)

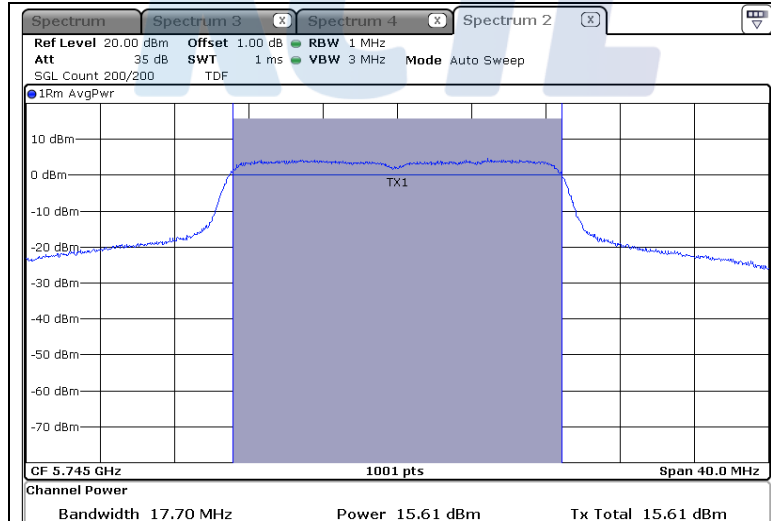
KCTL

Highest Channel (5 825 MHz)



-802.11n HT20

Lowest Channel (5 745 MHz)



KCTL Inc.

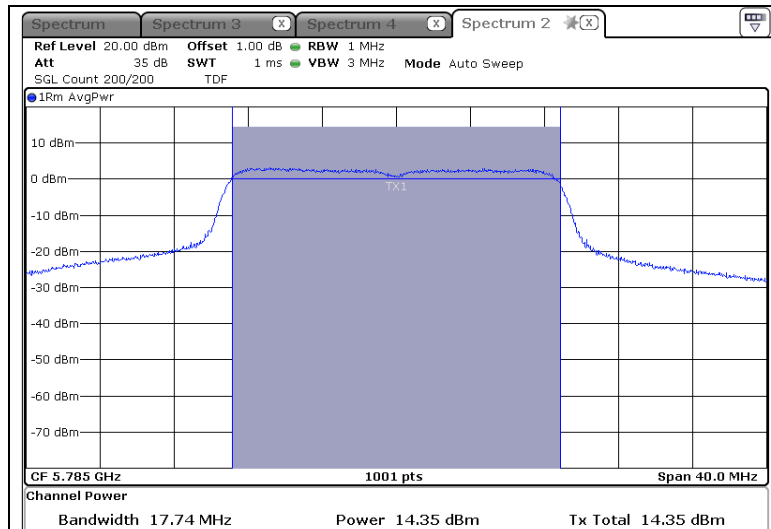
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
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Report No.:
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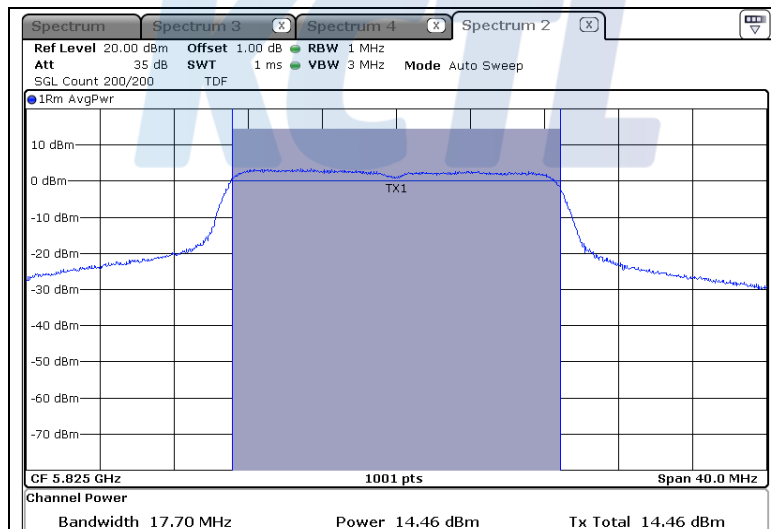
Page (36) of (115)

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Middle Channel (5 785 MHz)



Highest Channel (5 825 MHz)



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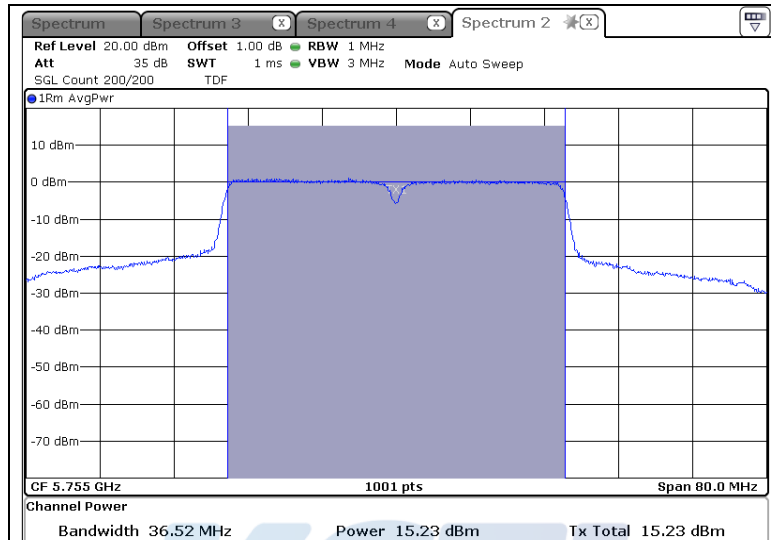
Report No.:
KR17-SRF0077-B

Page (37) of (115)

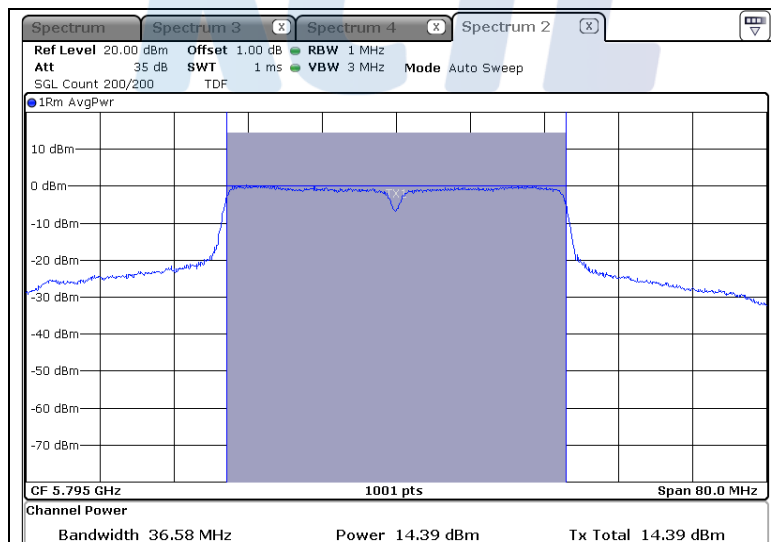
KCTL

-802.11n HT40

Lowest Channel (5 755 MHz)



Middle Channel (5 795 MHz)



5.3 Bandwidth Measurement

5.3.1 Regulation

According to §15.403,(i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

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

5.3.2 Measurement Procedure

1.Emission Bandwidth (EBW)

- a) Set RBW = approximately 1% of the emission bandwidth.
- b) Set the VBW > RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2.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 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) 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.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

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Page (39) of (115)



5.3.3 Test Result

-Complied

- 5 150 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11a

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 180	27.53	25.73	0.50	18.18	17.50
Middle	5 200	27.57	29.29	0.50	18.02	17.66
Highest	5 240	25.22	25.14	0.50	18.46	17.86

- 802.11n HT20

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 180	24.66	24.42	0.50	18.18	18.26
Middle	5 200	24.78	24.46	0.50	18.38	18.22
Highest	5 240	24.46	24.50	0.50	18.38	18.42

- 802.11n HT40

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 190	-5.86	-6.47	0.42	-2.73	17.00
Middle	5 230	1.69	1.88	0.42	5.21	17.00

- 5 725 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11n HT20

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 745	16.38	16.38	0.50	18.81	18.52
Middle	5 785	16.38	16.38	0.50	18.81	18.81
Highest	5 825	16.38	16.42	0.50	17.95	18.06

- 802.11ac VHT20

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 745	17.82	17.70	0.50	18.87	19.04
Middle	5 785	17.82	17.74	0.50	18.93	19.22
Highest	5 825	17.70	17.70	0.50	18.58	18.60

- 802.11n HT40

Channel	Frequency [MHz]	6 dB Bandwidth _ANT 0 [MHz]	6 dB Bandwidth _ANT 1 [MHz]	Min. Limit [MHz]	OBW_ANT0 [MHz]	OBW_ANT 1 [MHz]
Lowest	5 755	36.52	36.52	0.50	37.74	37.74
Highest	5 795	36.50	36.58	0.50	37.97	37.74

5.3.4 Test Plot

Figure 1. Plot of Bandwidth Measurement

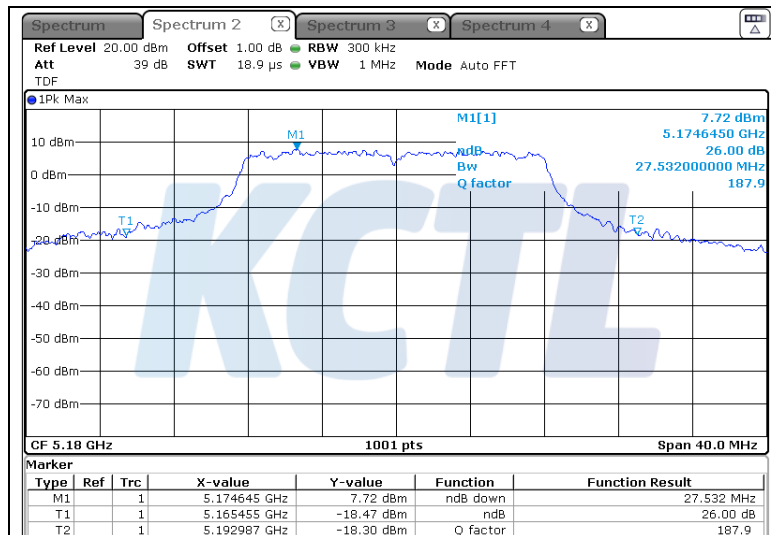
- 5 150 Band

- MIMO 2 Tx (ANT 0)

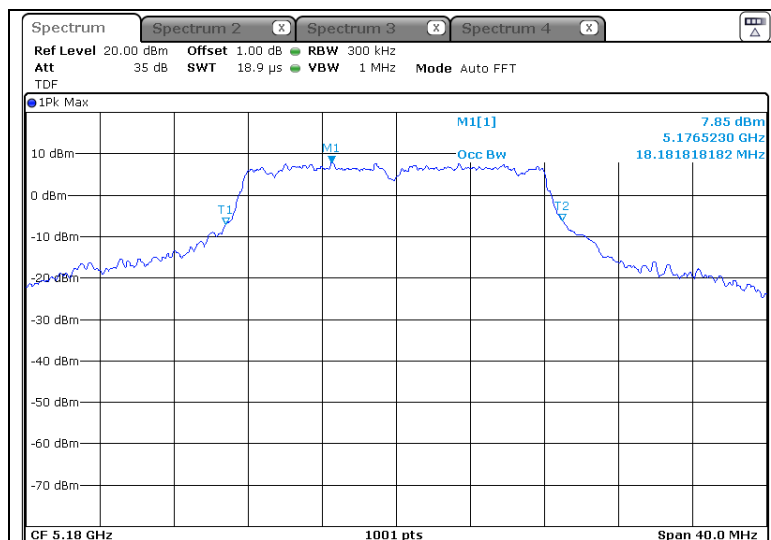
- 802.11a

- 5 180 MHz

EBW



OBW



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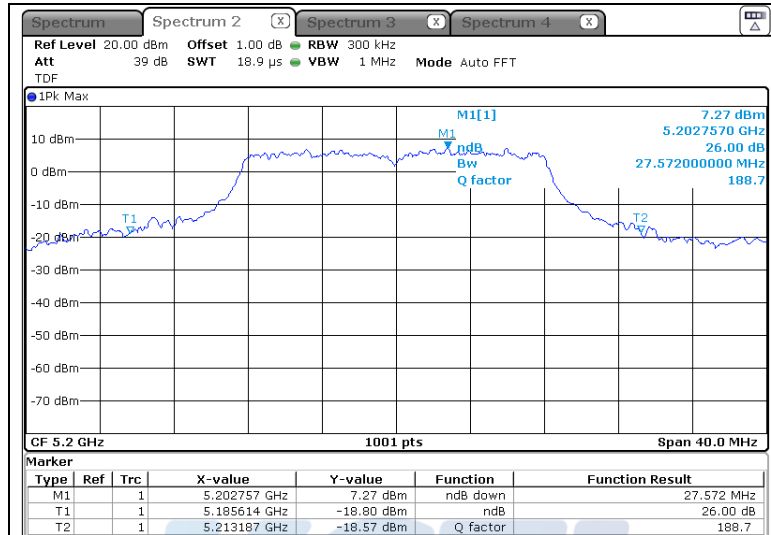
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Report No.:
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Page (42) of (115)

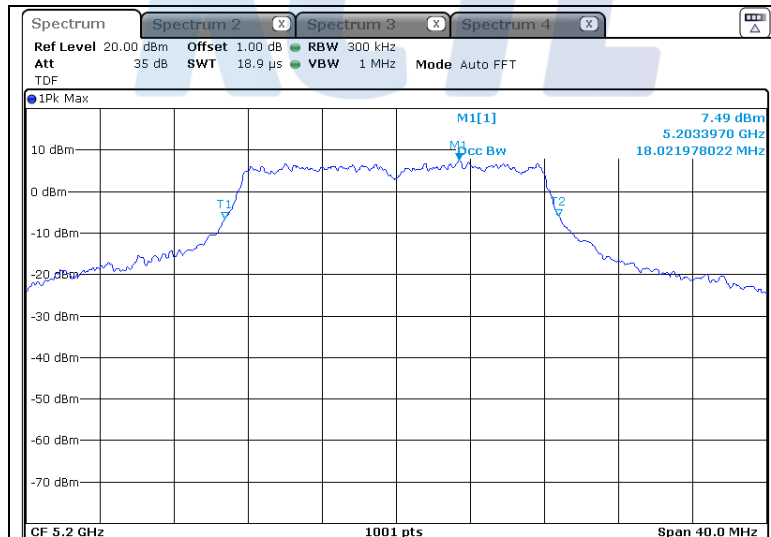
KCTL

- 5 200 MHz

EBW



OBW



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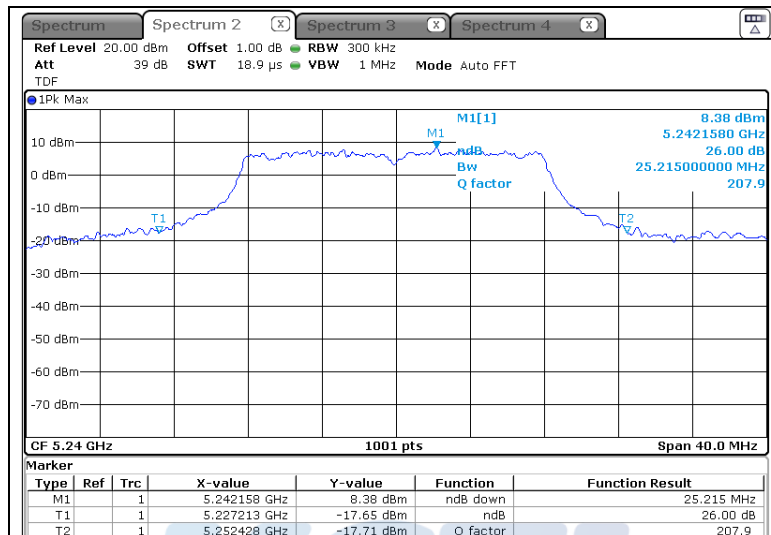
Report No.:
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Page (43) of (115)

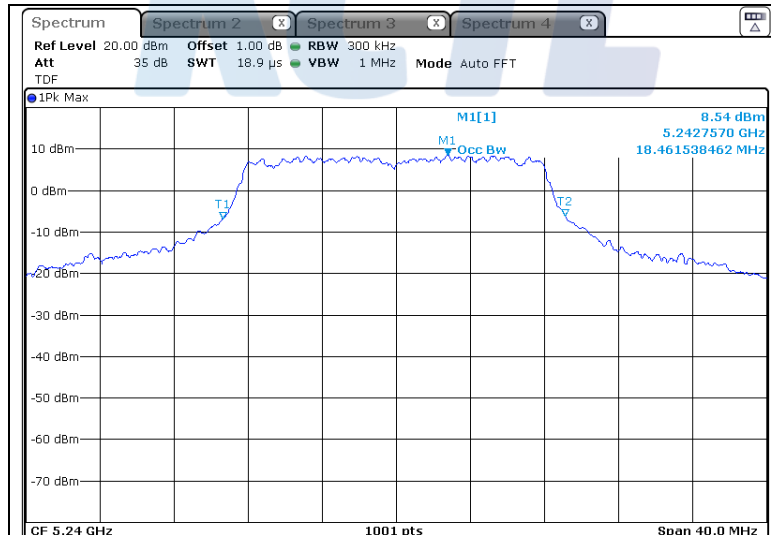
KCTL

- 5 240 MHz

EBW



OBW



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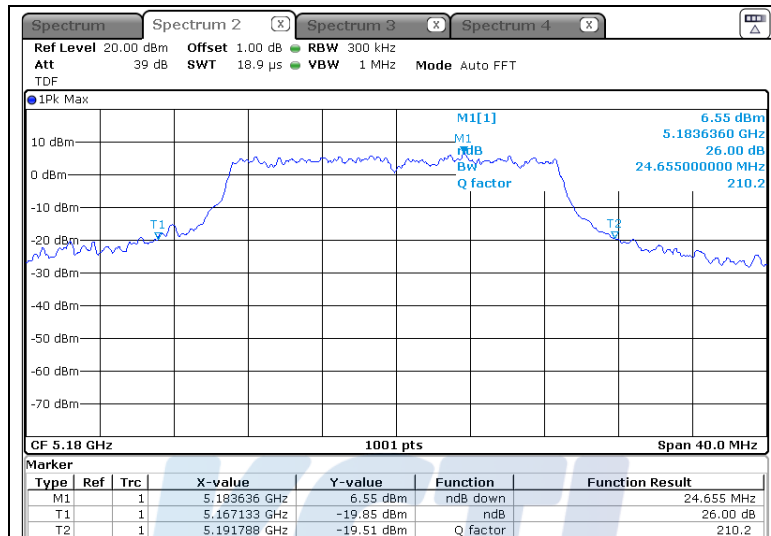
Report No.:
KR17-SRF0077-B
Page (44) of (115)

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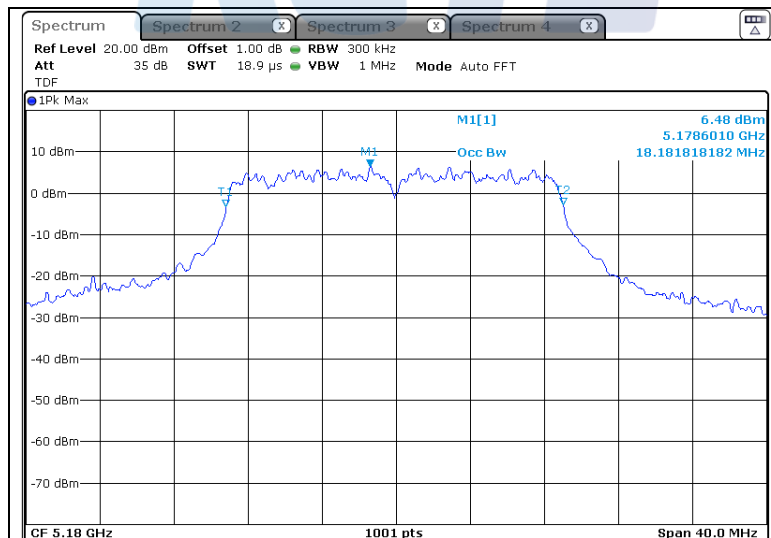
- 802.11n HT20

- 5 180 MHz

EBW



OBW



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Page (45) of (115)

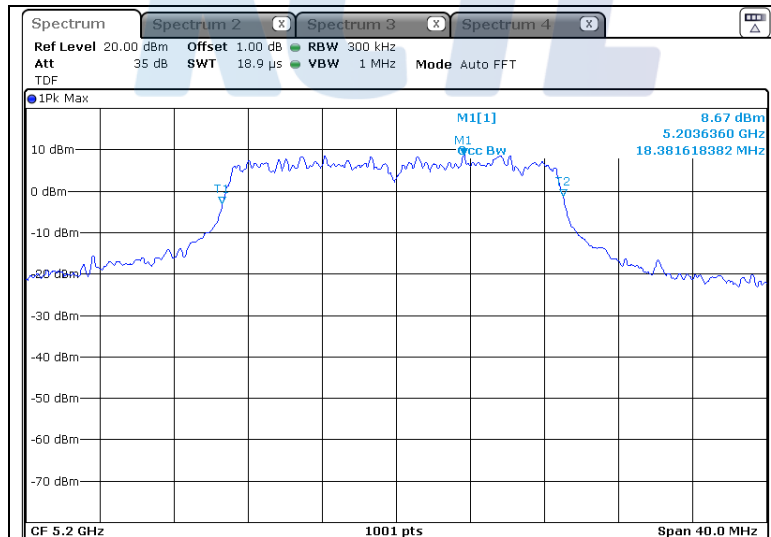
KCTL

- 5 200 MHz

EBW



OBW



KCTL Inc.

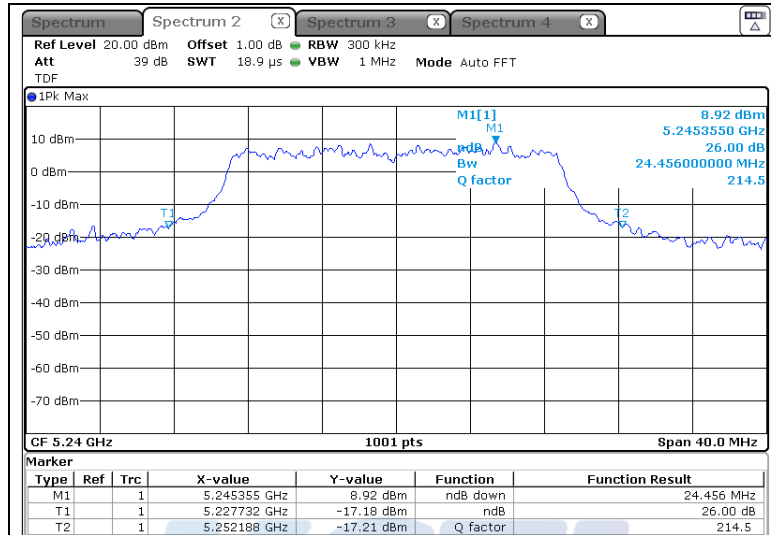
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
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Page (46) of (115)

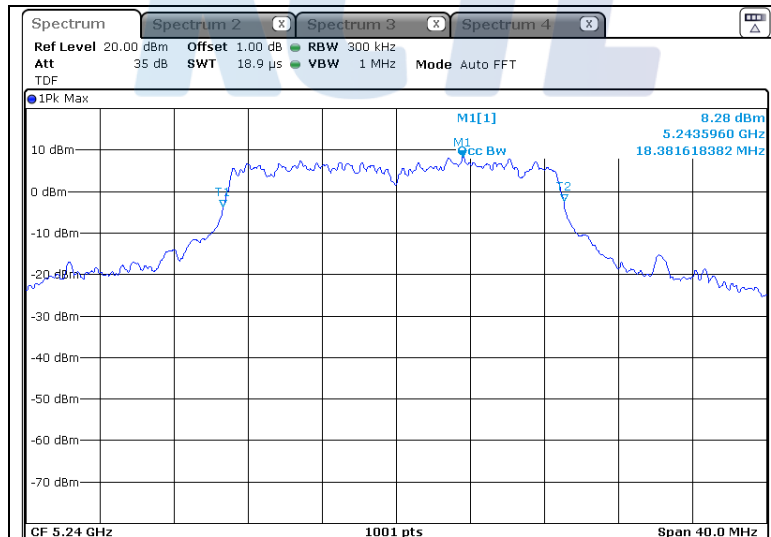
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- 5 240 MHz

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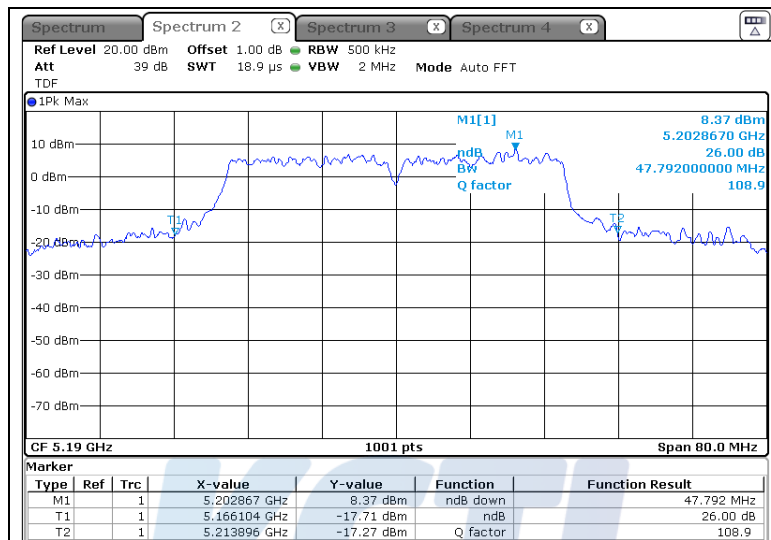
Page (47) of (115)

KCTL

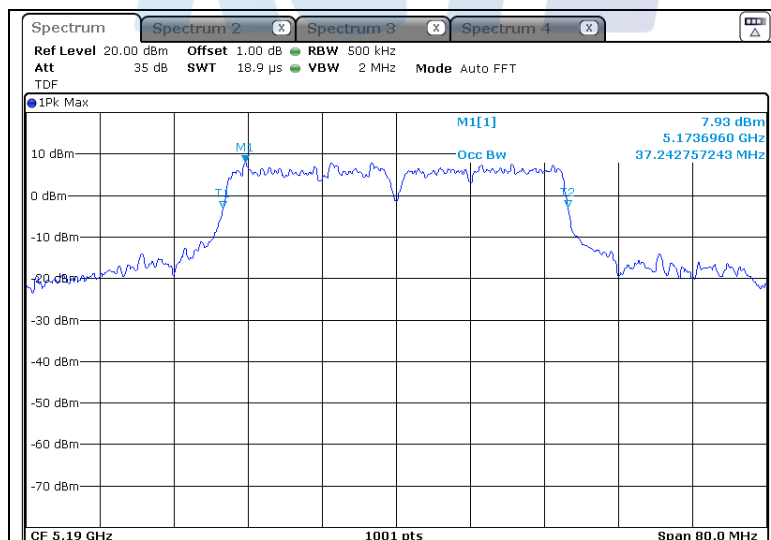
- 802.11n HT40

- 5 190 MHz

EBW



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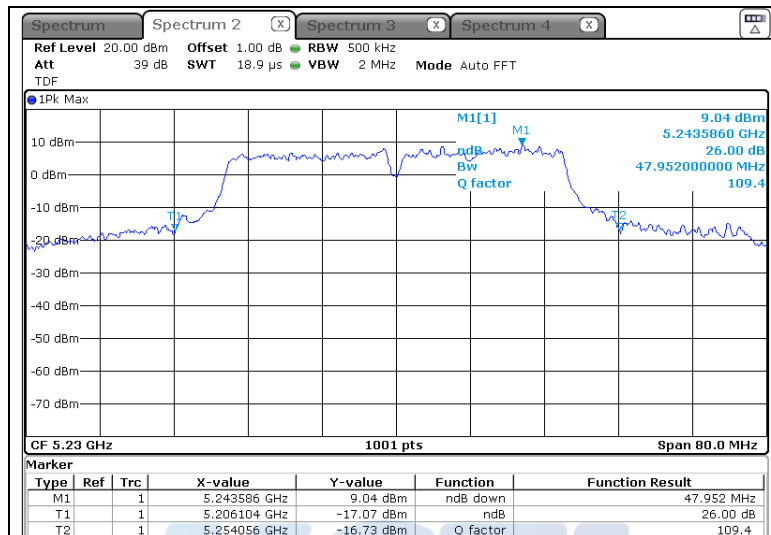
Report No.:
KR17-SRF0077-B

Page (48) of (115)

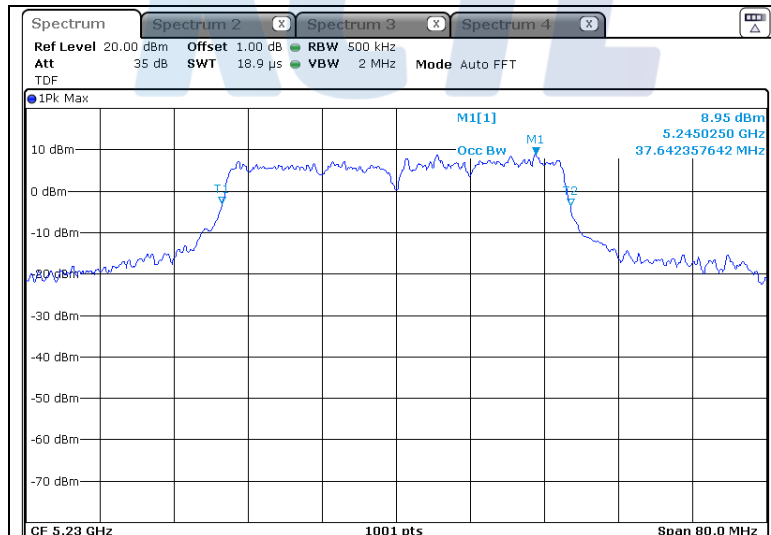
KCTL

- 5 230 MHz

EBW



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Report No.:
KR17-SRF0077-B

Page (49) of (115)

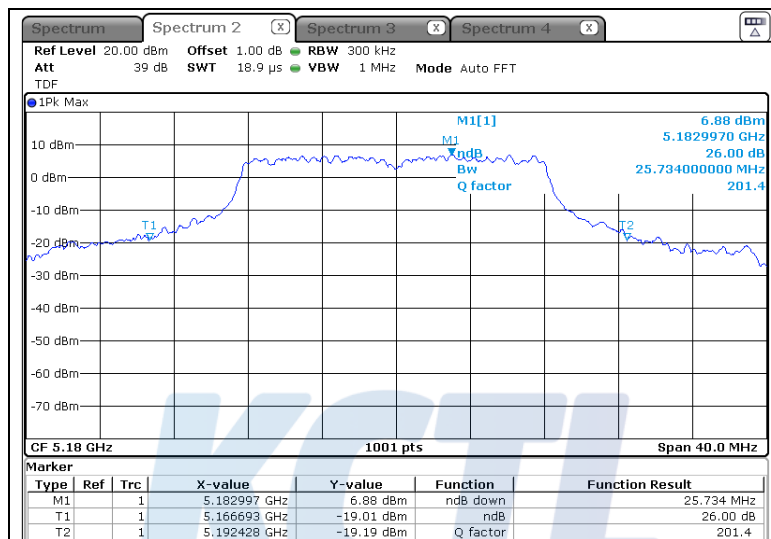
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- MIMO 2 Tx (ANT 1)

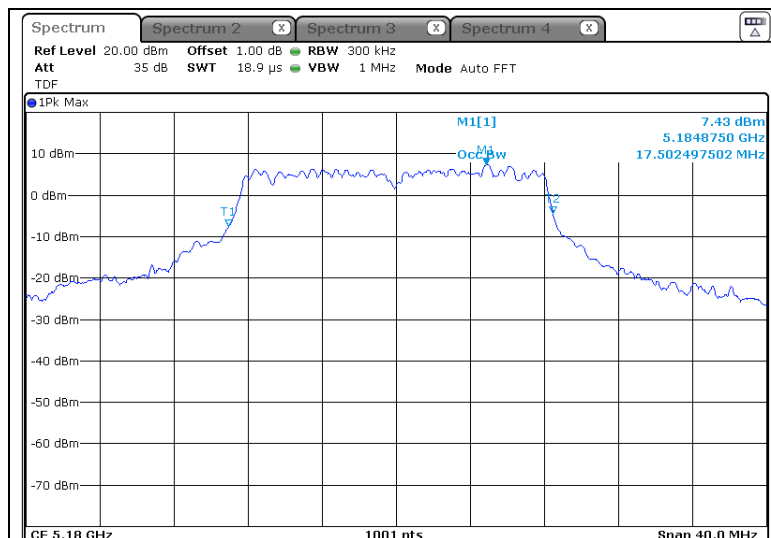
- 802.11a

- 5 180 MHz

EBW



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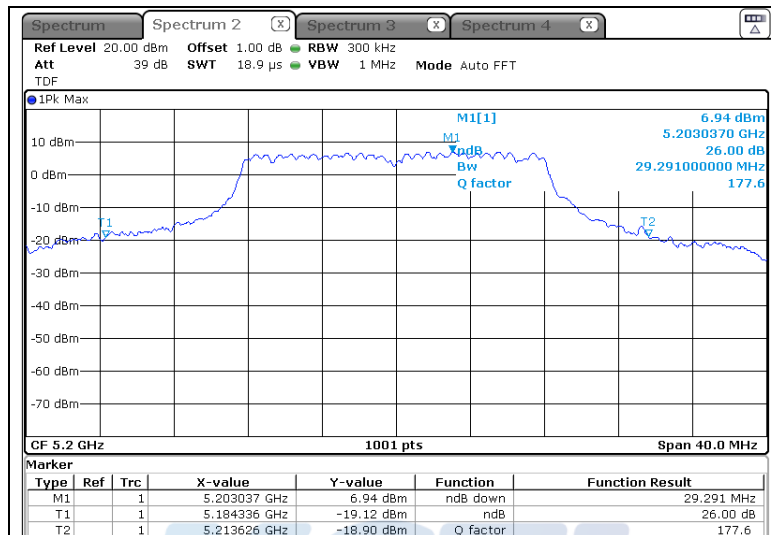
Report No.:
KR17-SRF0077-B

Page (50) of (115)

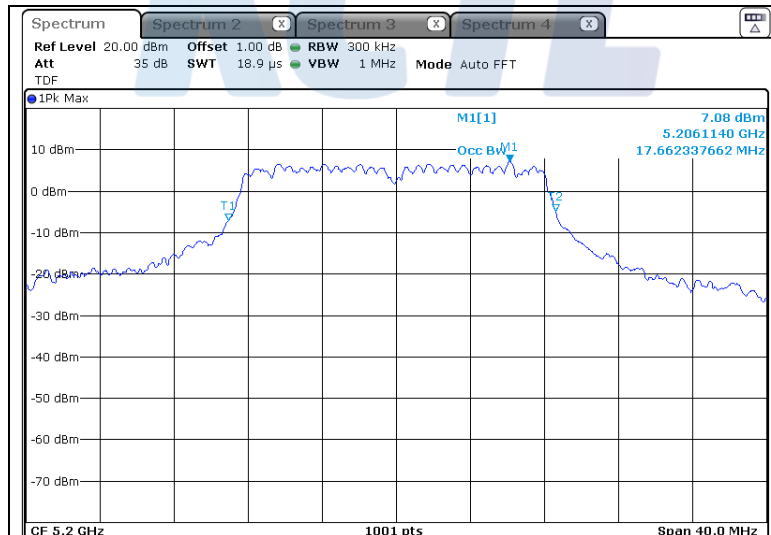
KCTL

- 5 200 MHz

EBW



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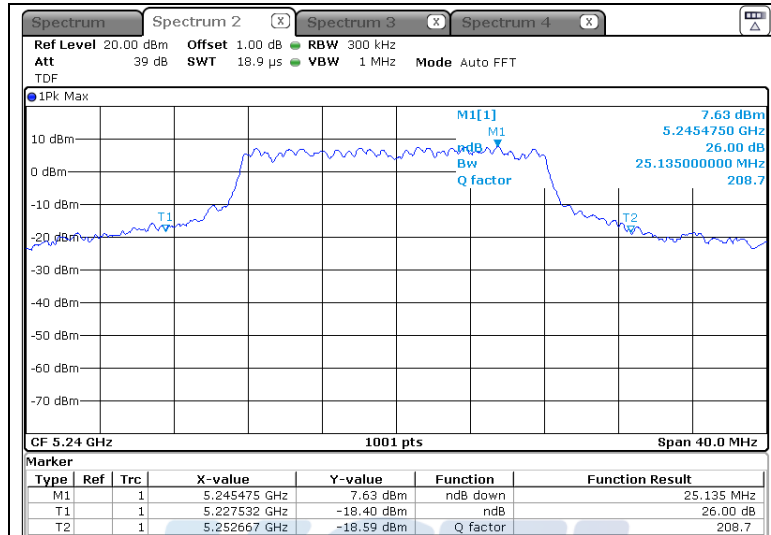
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Report No.:
KR17-SRF0077-B
Page (51) of (115)

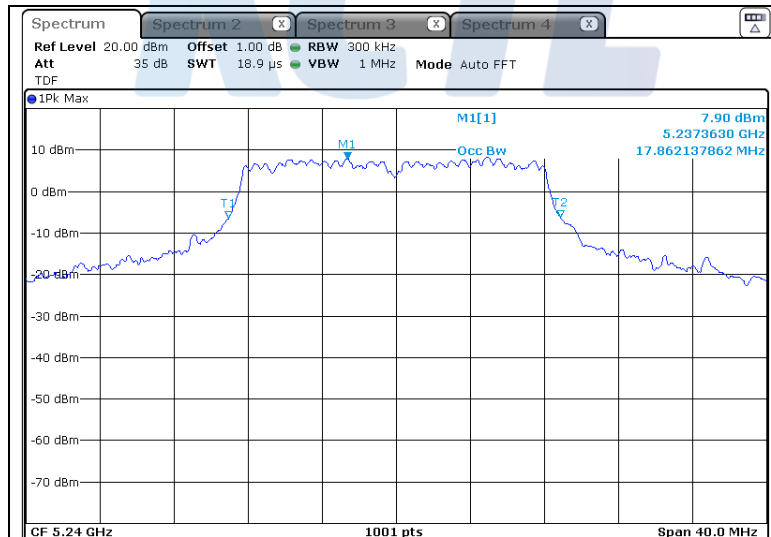
KCTL

- 5 240 MHz

EBW



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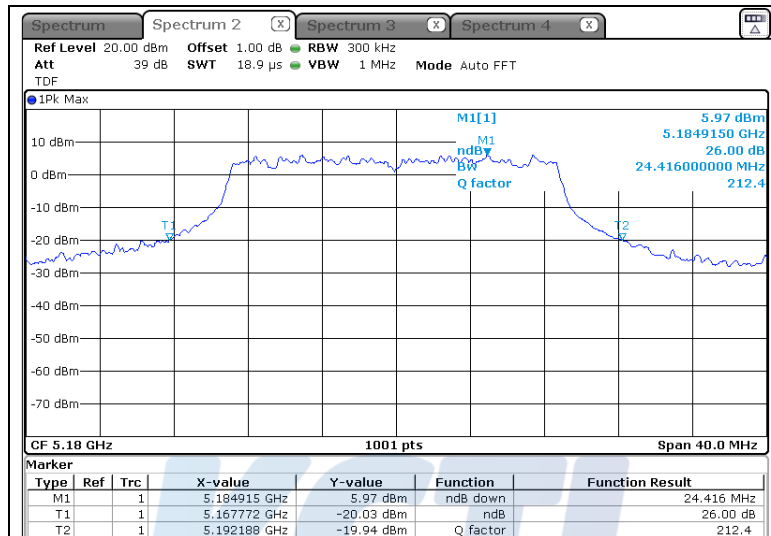
Report No.:
KR17-SRF0077-B
Page (52) of (115)

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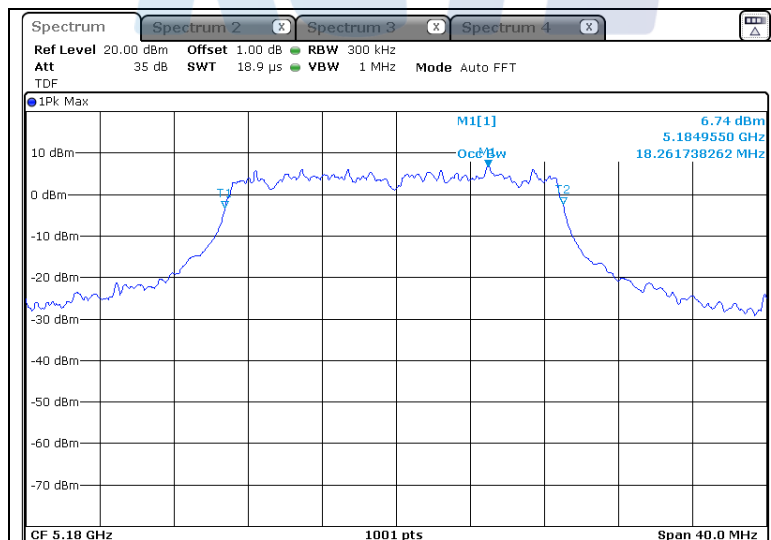
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- 5 180 MHz

EBW

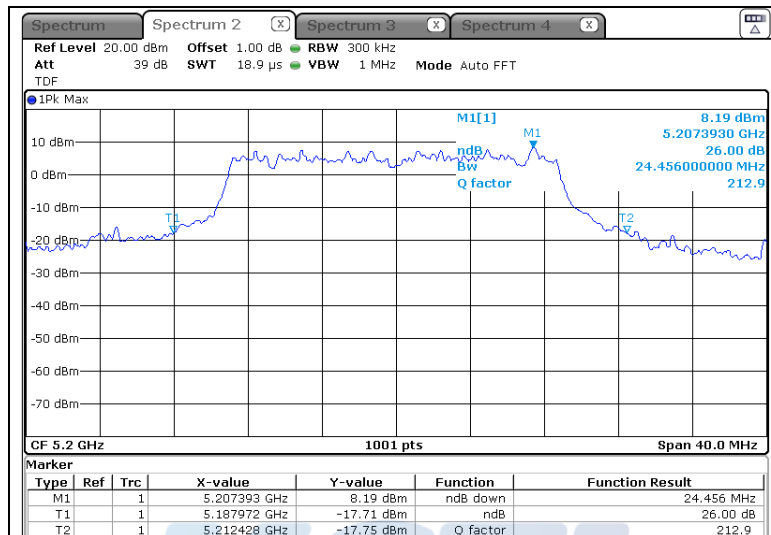


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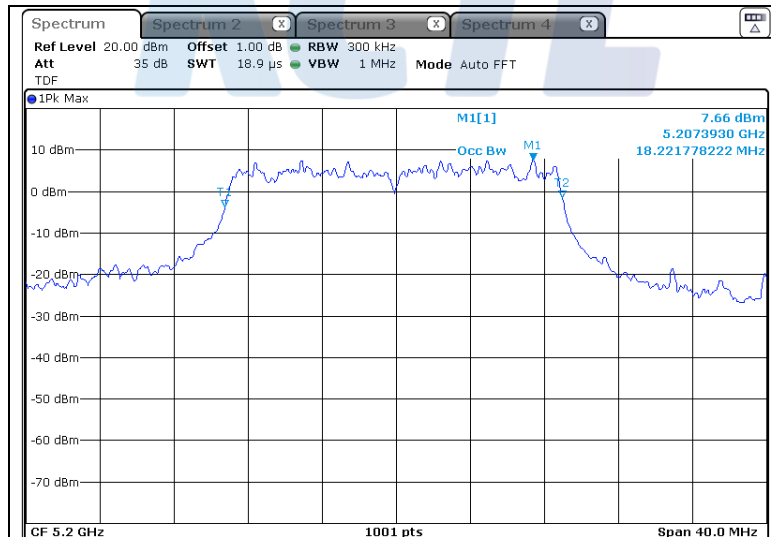


- 5 200 MHz

EBW



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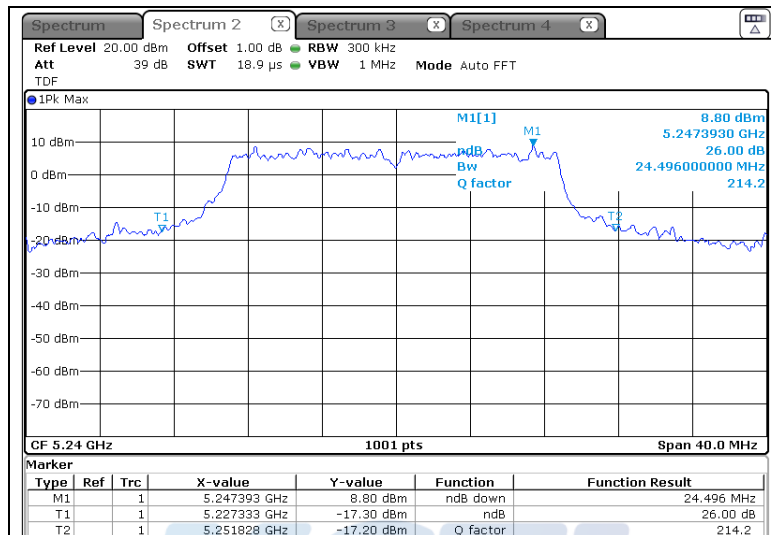
Report No.:
KR17-SRF0077-B

Page (54) of (115)

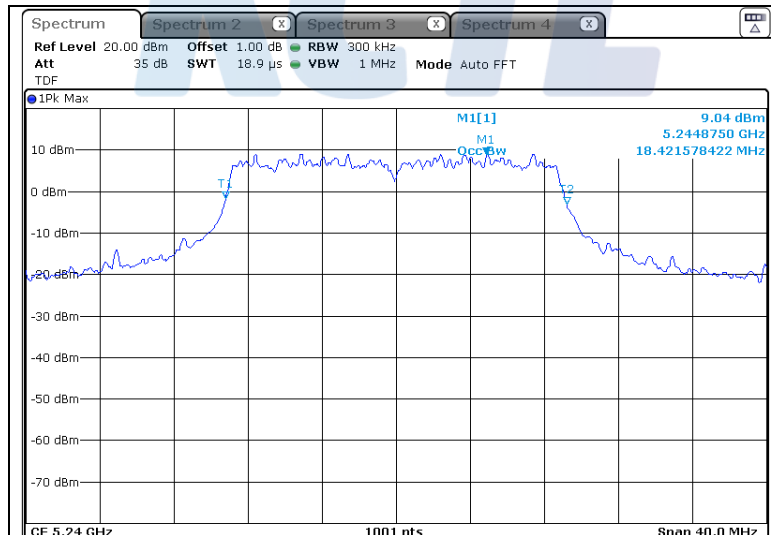
KCTL

- 5 240 MHz

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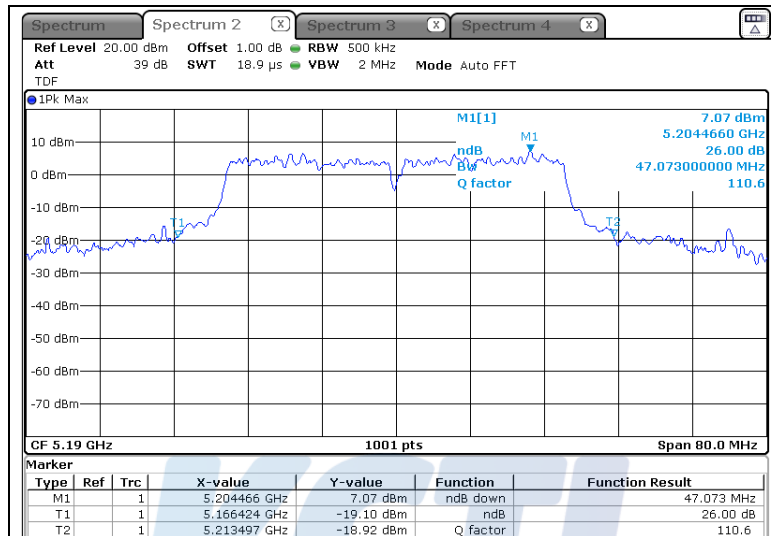
Report No.:
KR17-SRF0077-B
Page (55) of (115)

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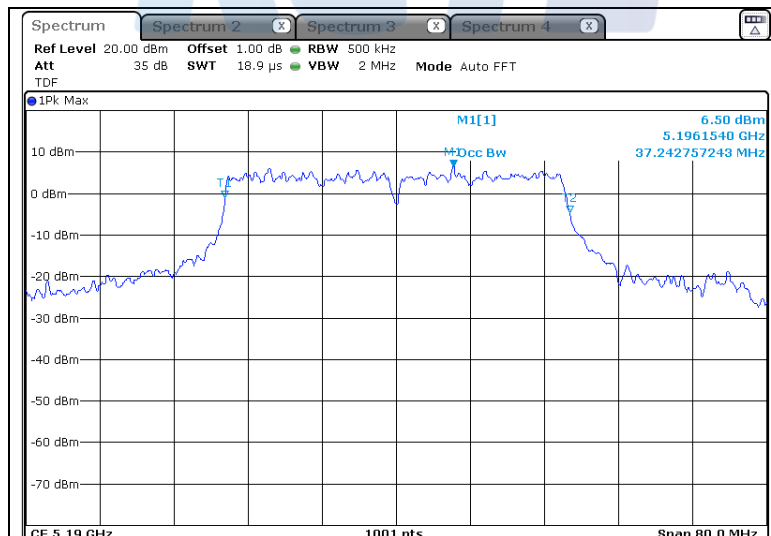
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- 5 190 MHz

EBW



OBW



KCTL Inc.

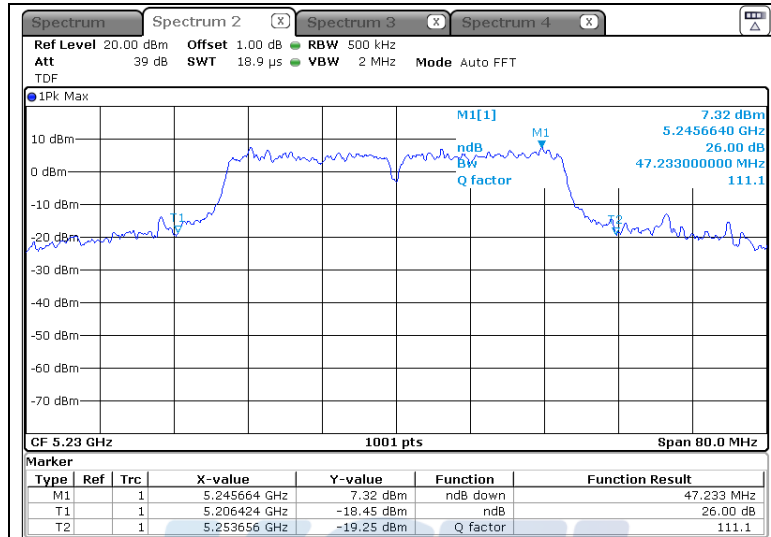
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KR17-SRF0077-B
Page (56) of (115)

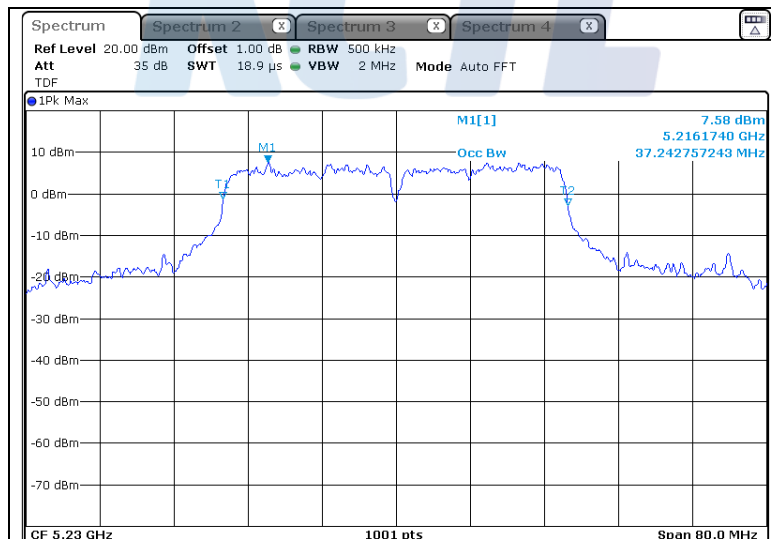
KCTL

- 5 230 MHz

EBW



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KR17-SRF0077-B

Page (57) of (115)

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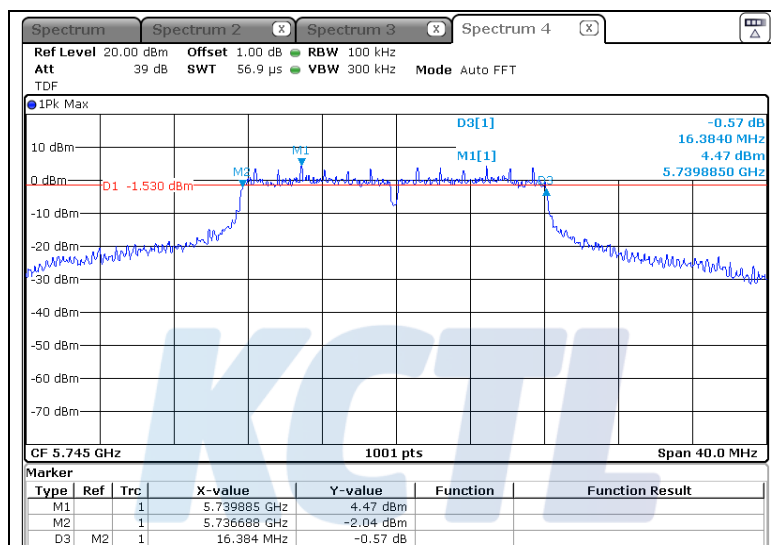
- 5 745 Band

MIMO 2 Tx (ANT 0)

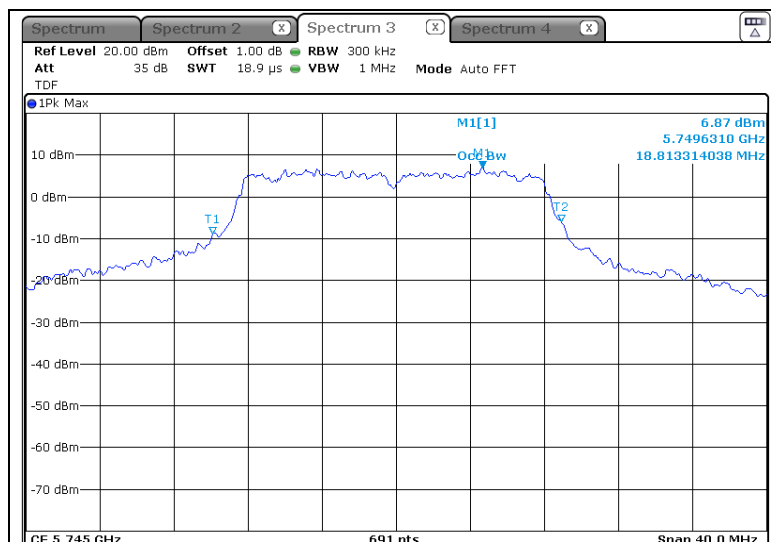
- 802.11a

- 5 745 MHz

EBW



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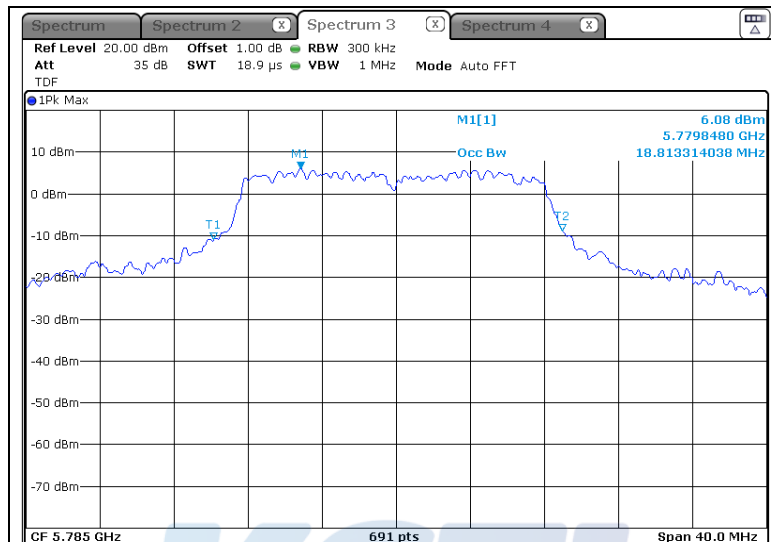
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KR17-SRF0077-B

Page (58) of (115)

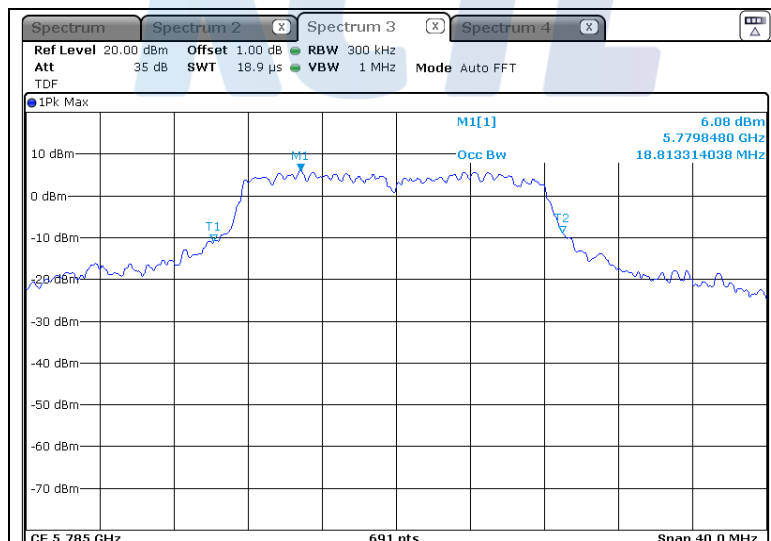
KCTL

- 5 785 MHz

EBW



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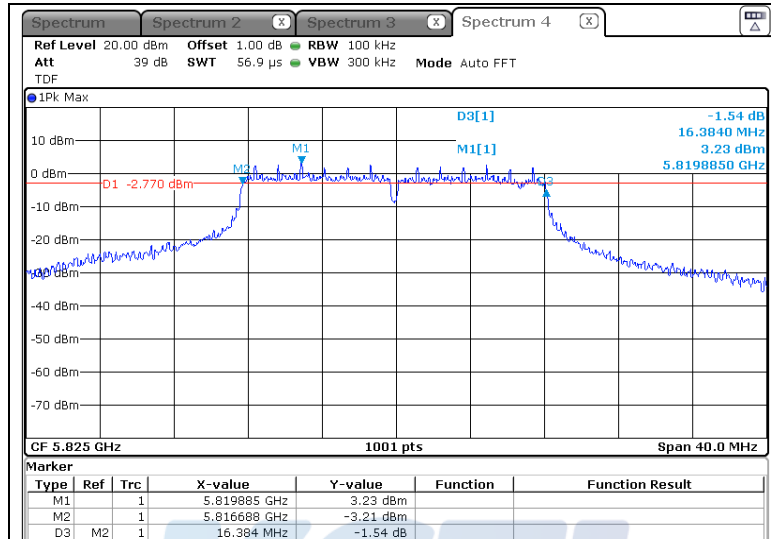
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KR17-SRF0077-B
Page (59) of (115)

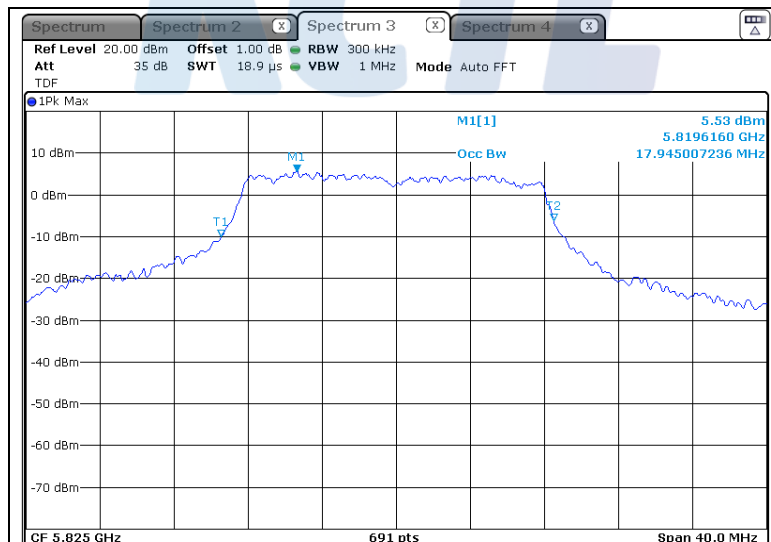
KCTL

- 5 825 MHz

EBW



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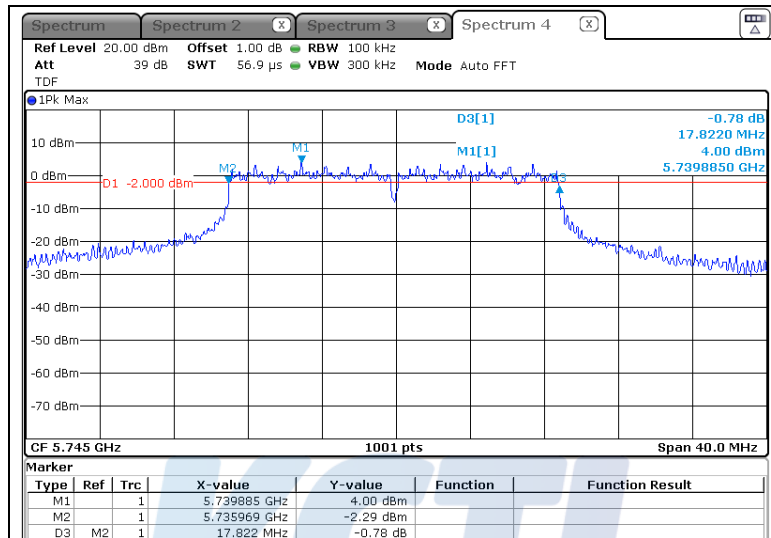
Report No.:
KR17-SRF0077-B
Page (60) of (115)

KCTL

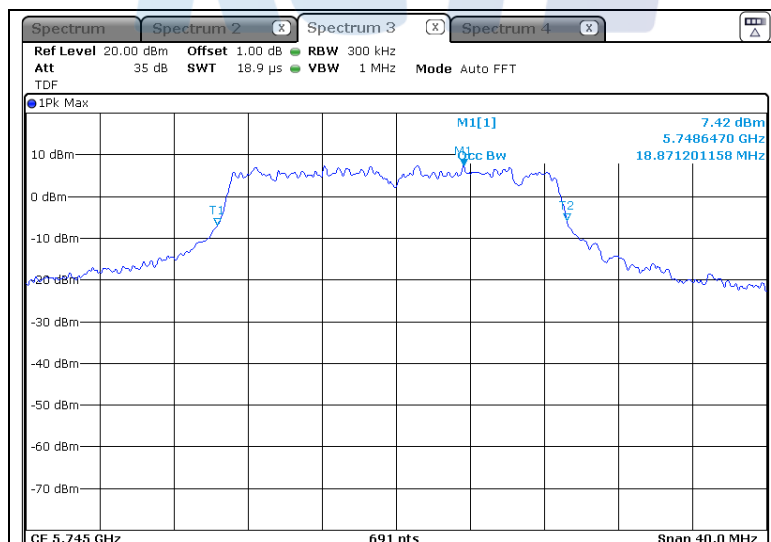
- 802.11n HT20

- 5 745 MHz

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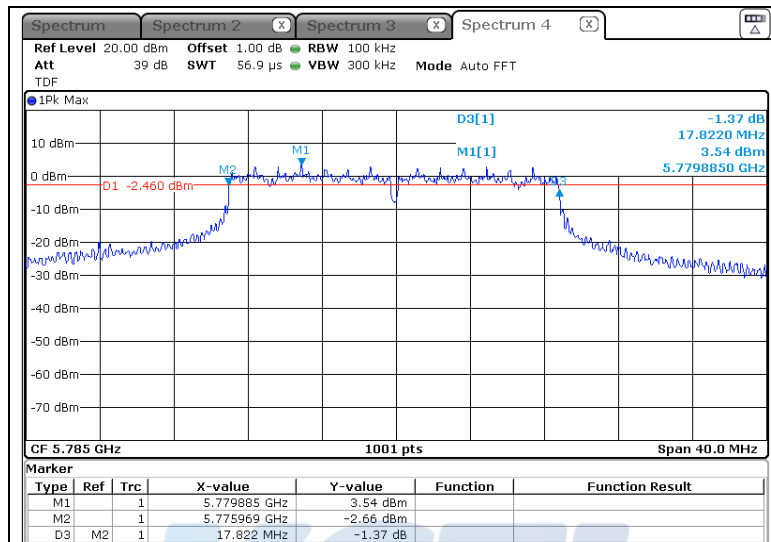
Report No.:
KR17-SRF0077-B

Page (61) of (115)

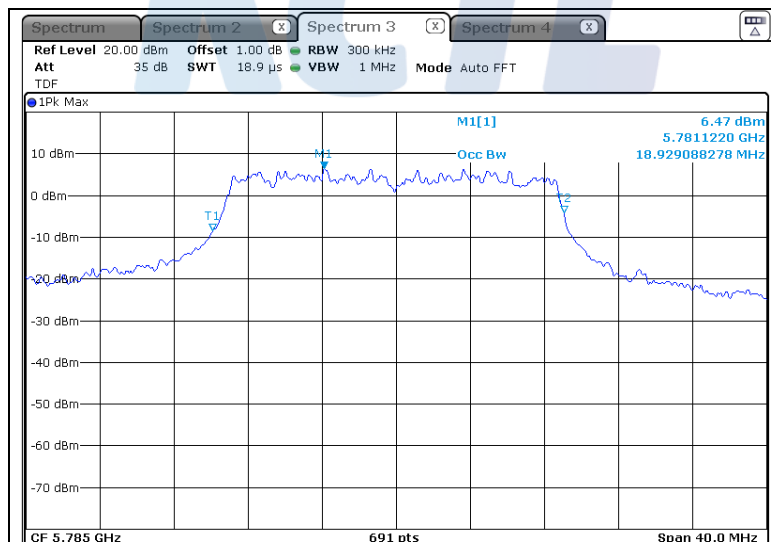
KCTL

- 5 785 MHz

EBW



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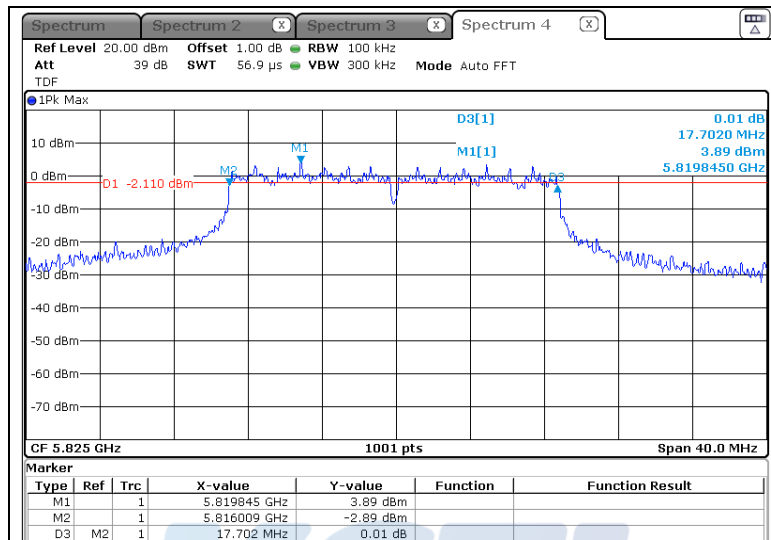
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KR17-SRF0077-B
Page (62) of (115)

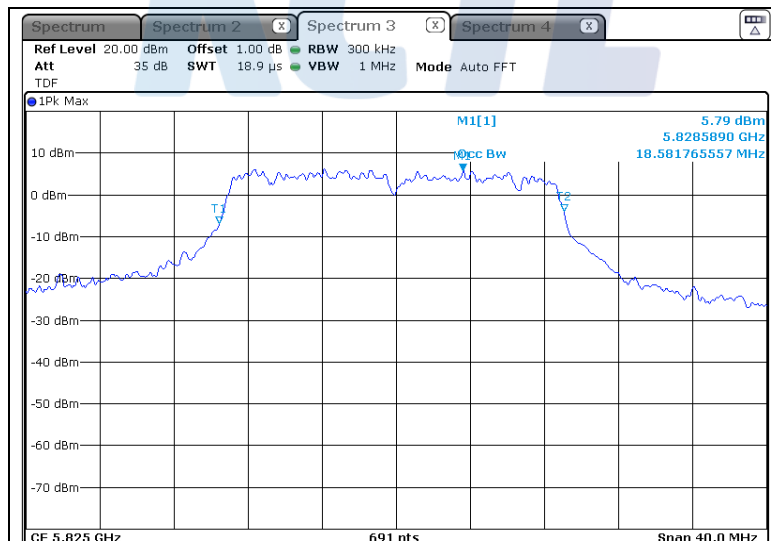
KCTL

- 5 825 MHz

EBW



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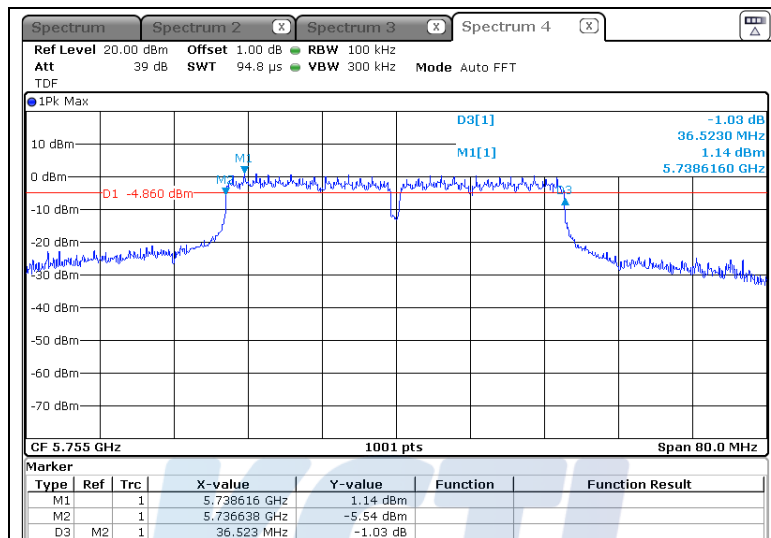
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KCTL

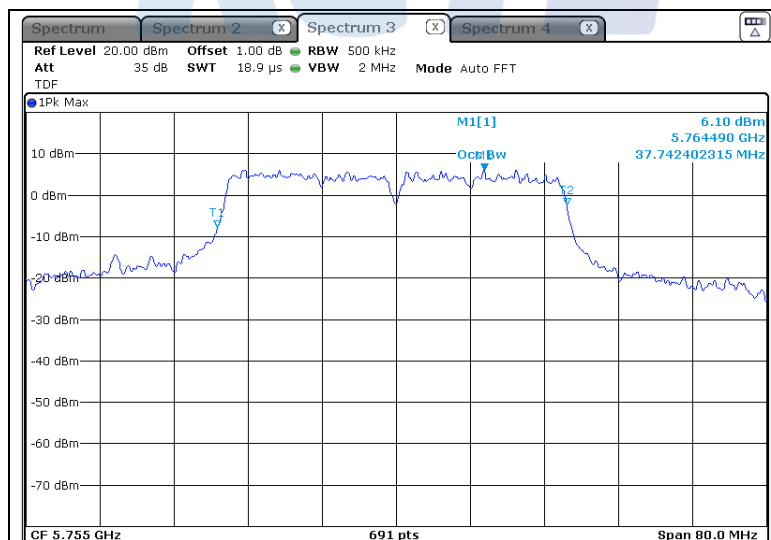
- 802.11n HT40

- 5 755 MHz

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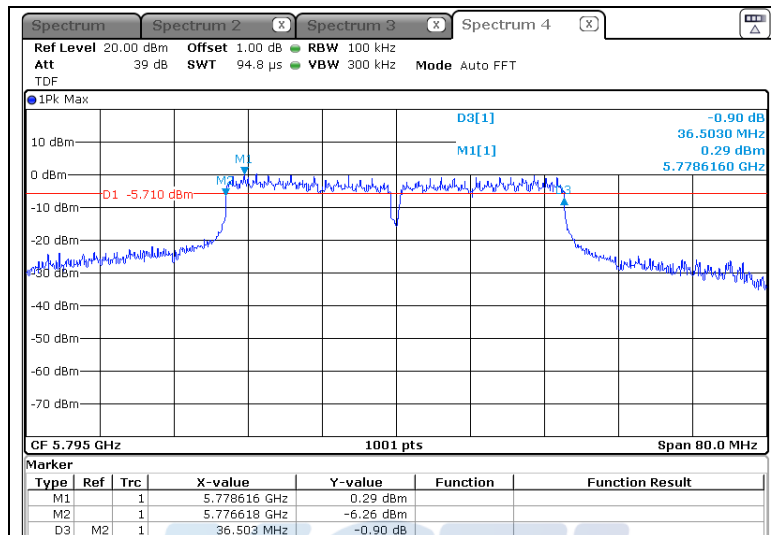
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KR17-SRF0077-B

Page (64) of (115)

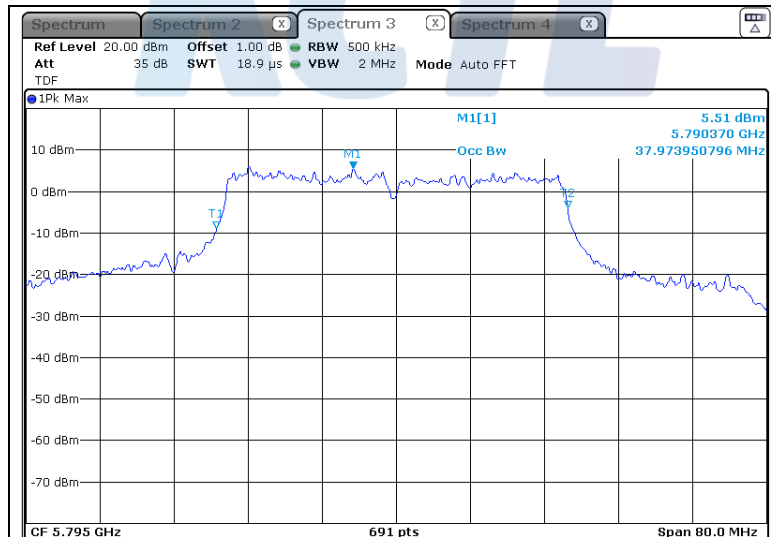
KCTL

- 5 795 MHz

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Page (65) of (115)

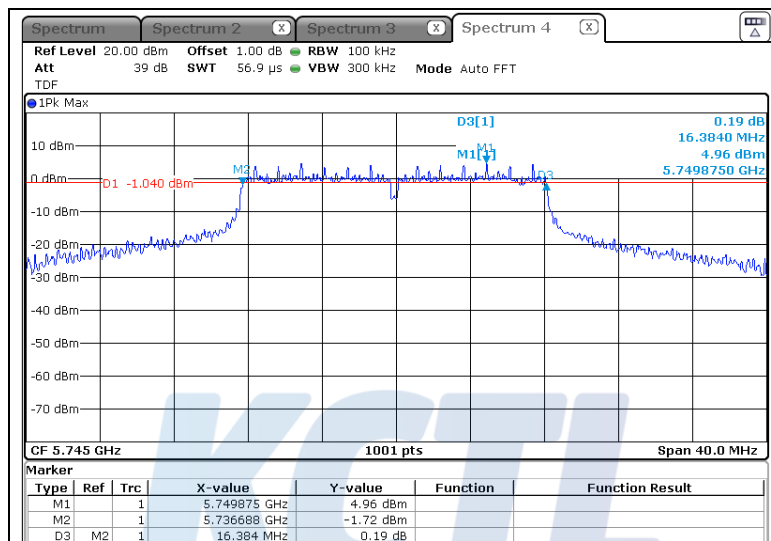
KCTL

MIMO 2 Tx (ANT 1)

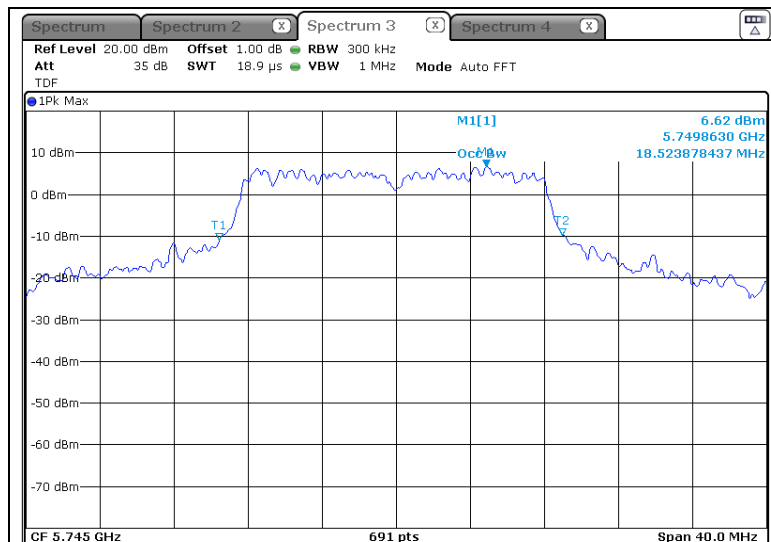
- 802.11a

- 5 745 MHz

EBW



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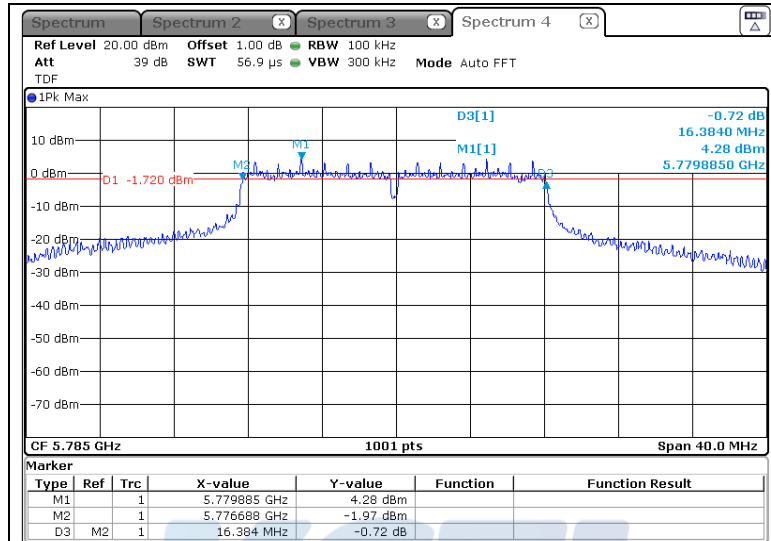
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KR17-SRF0077-B
Page (66) of (115)

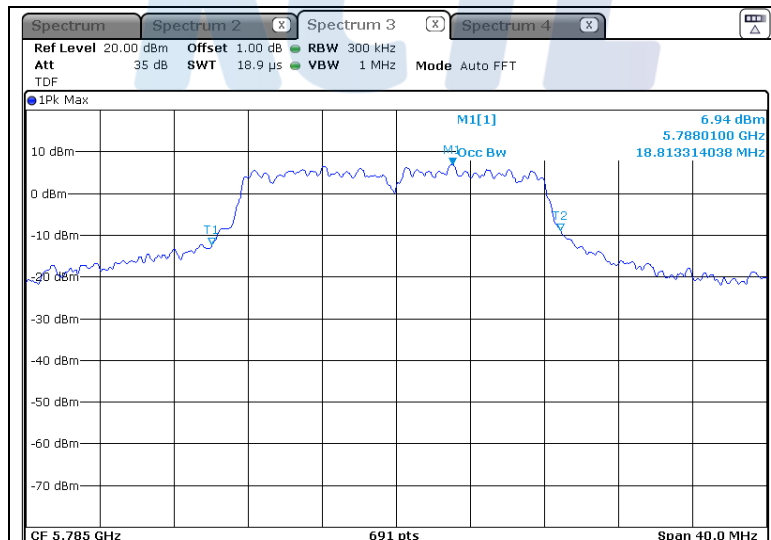
KCTL

- 5 785 MHz

EBW



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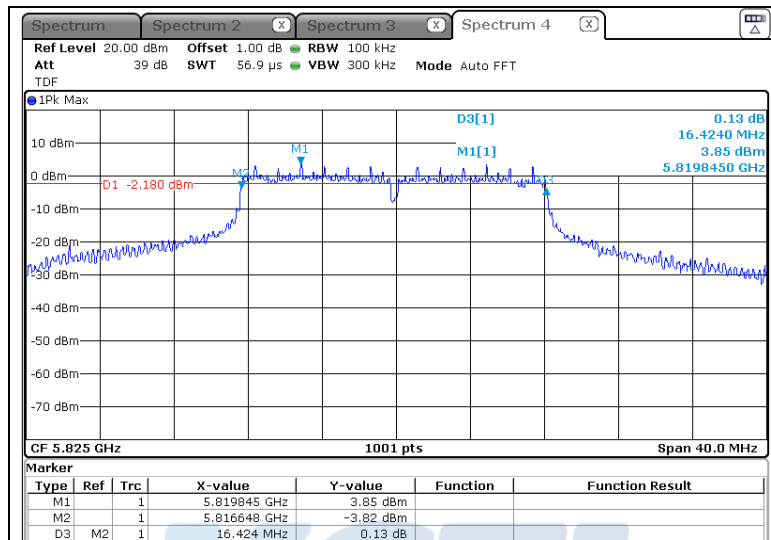
Report No.:
KR17-SRF0077-B

Page (67) of (115)

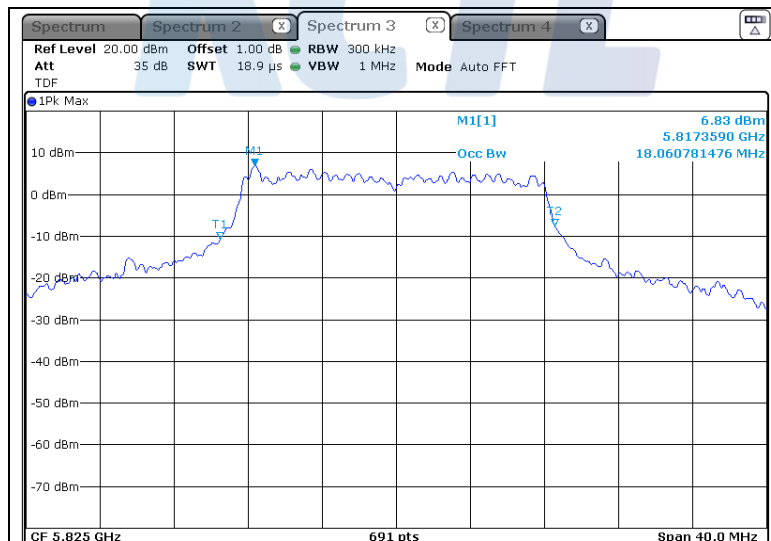
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- 5 825 MHz

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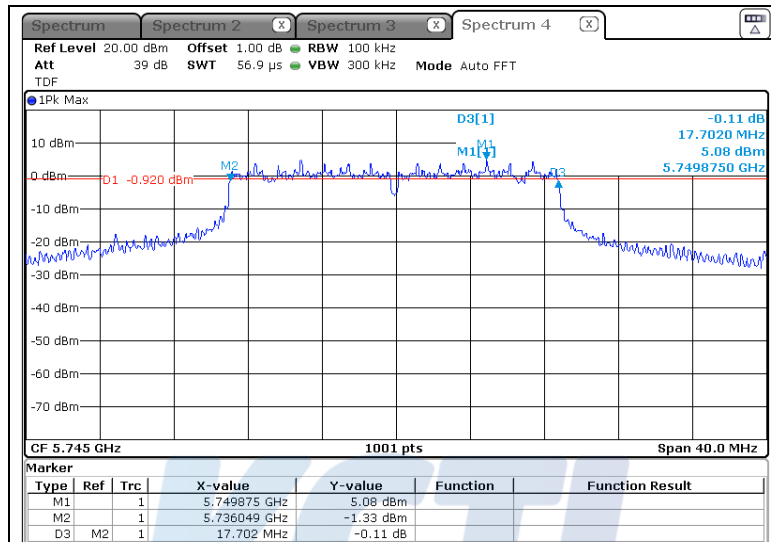
Report No.:
KR17-SRF0077-B
Page (68) of (115)

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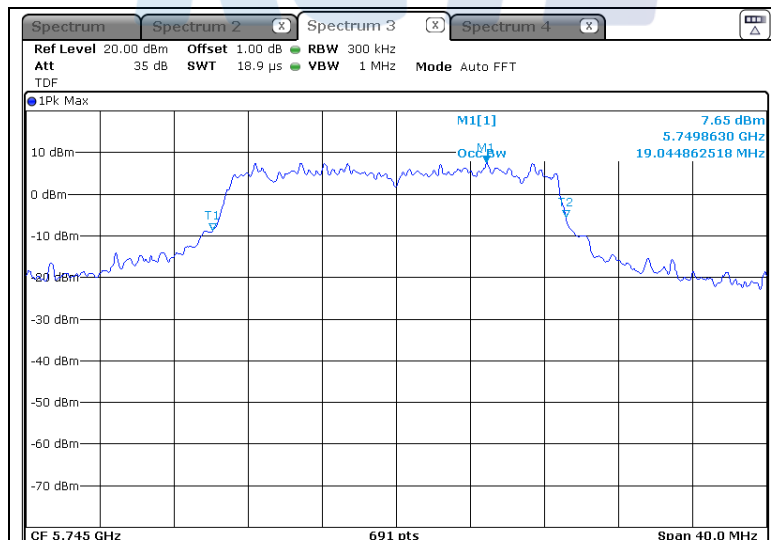
- 802.11n HT20

- 5 745 MHz

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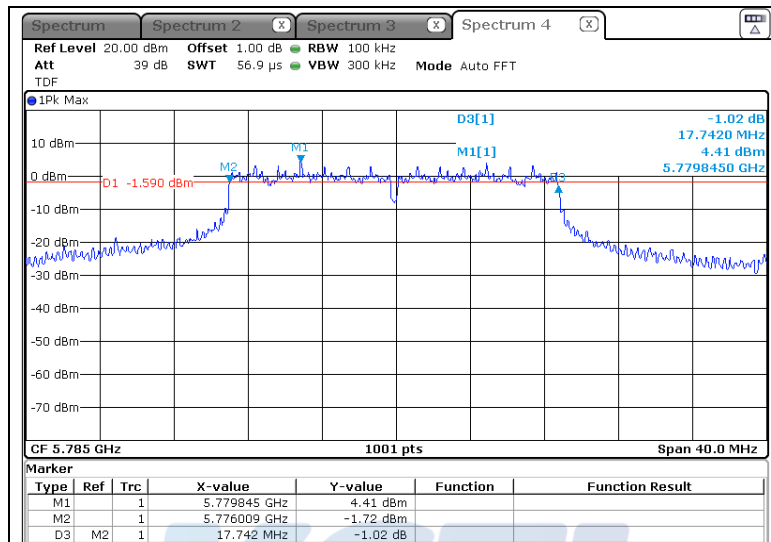
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Page (69) of (115)

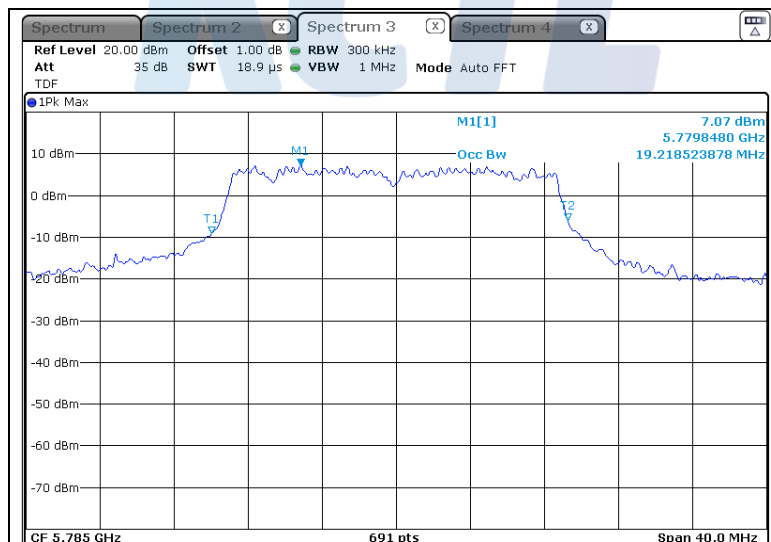
KCTL

- 5 785 MHz

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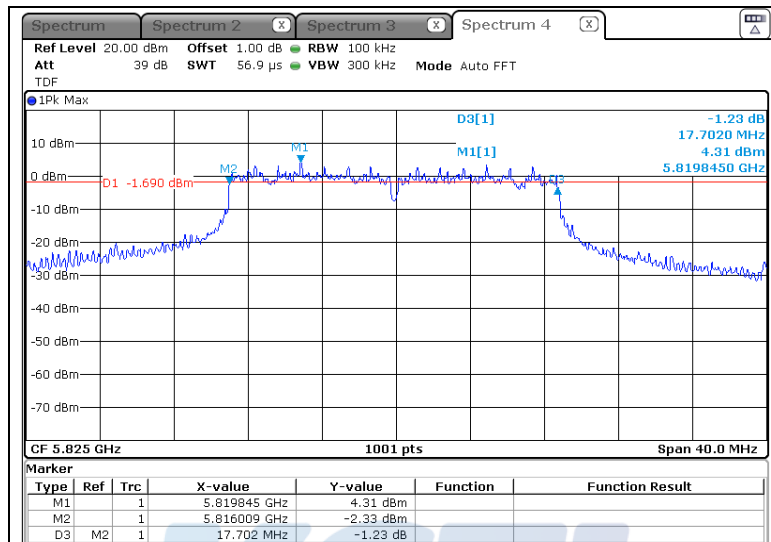
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Page (70) of (115)

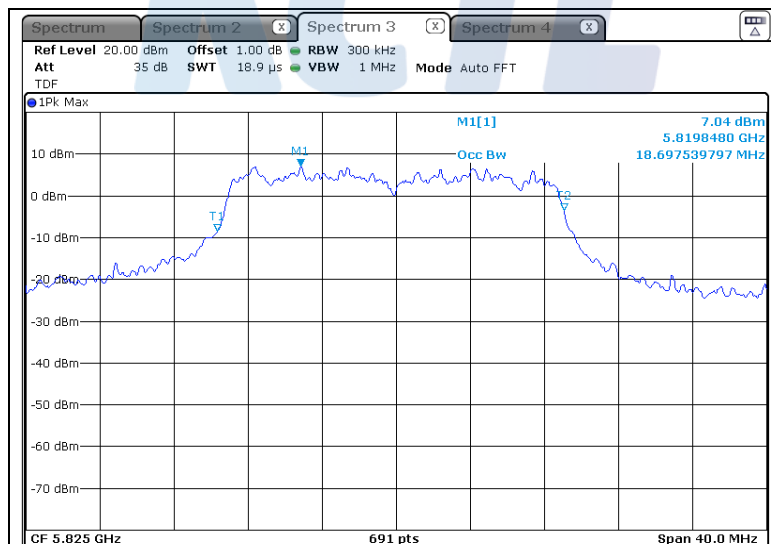
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- 5 825 MHz

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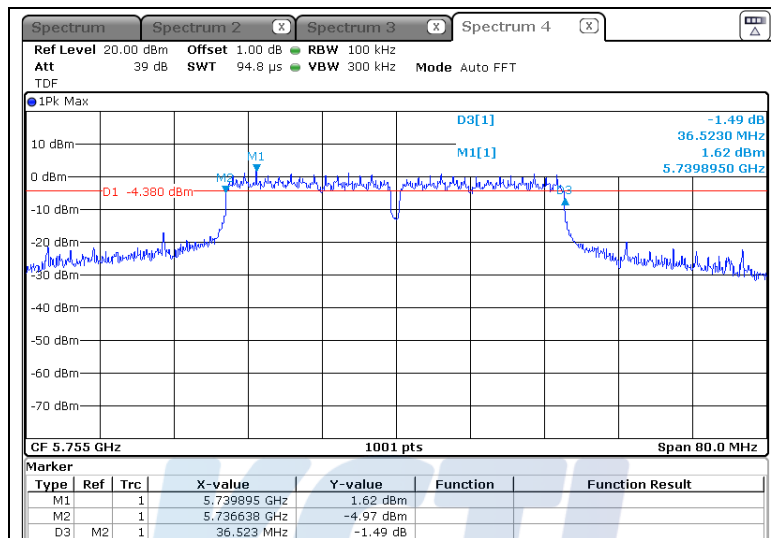
Page (71) of (115)

KCTL

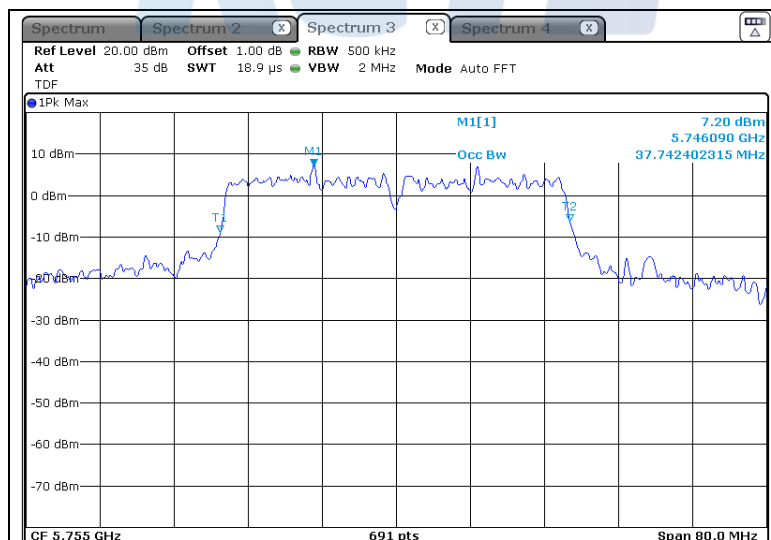
- 802.11n HT40

- 5 755 MHz

EBW



OBW



KCTL Inc.

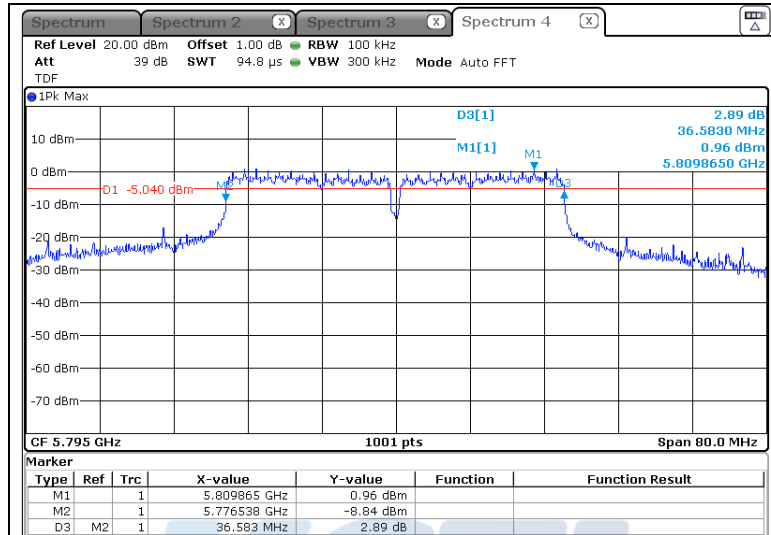
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Report No.:
KR17-SRF0077-B
Page (72) of (115)

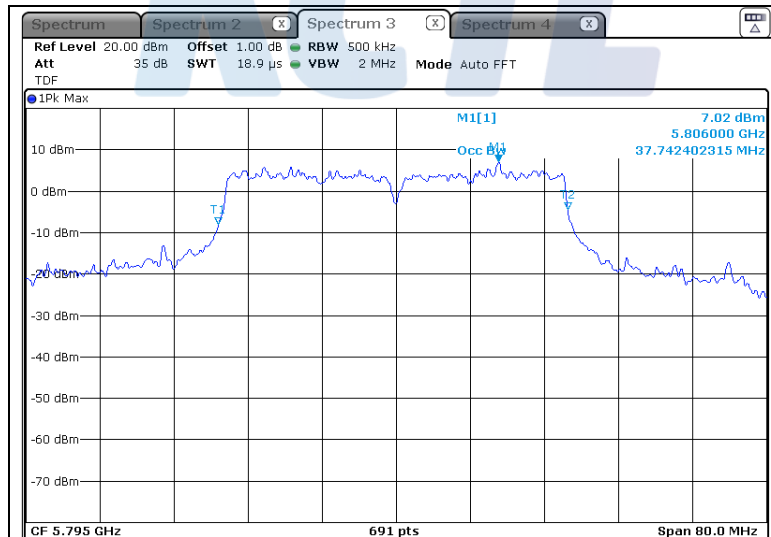
KCTL

- 5 795 MHz

EBW



OBW



5.4 Peak Power Spectral Density

5.4.1 Regulation

According to §15.407(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a) (3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.4.2 Measurement Procedure

These test measurement settings are specified in section F of 789033 D02 General UNII Test Procedures New Rules v01.

5.4.2.1 Maximum power spectral density (PSD)

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth ($< 1 \text{ MHz}$, or $< 500 \text{ kHz}$) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set $\text{RBW} \geq 1/T$, where T is defined in section II.B.1.a).
 - c) Set $\text{VBW} \geq 3 \text{ RBW}$.
 - d) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log(500 \text{ kHz} / \text{RBW})$ to the measured result, whereas $\text{RBW} (< 500 \text{ kHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 - e) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log(1 \text{ MHz} / \text{RBW})$ to the measured result, whereas $\text{RBW} (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since $\text{RBW}=100 \text{ kHz}$ is available on nearly all spectrum analyzers.

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Page (75) of (115)



5.4.3 Test Result

-Complied

- 5 150 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11a

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 180	4.54	3.81	0.15	7.35	17.00	9.65
5 200	5.06	3.43	0.15	7.48	17.00	9.52
5 240	4.77	4.36	0.15	7.73	17.00	9.27

- 802.11n HT20

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 180	2.22	1.15	0.31	5.03	17.00	11.97
5 200	4.06	3.29	0.31	7.01	17.00	9.99
5 240	4.34	4.40	0.31	7.69	17.00	9.31

- 802.11n HT40

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 190	-5.86	-6.47	0.42	-2.73	17.00	19.73
5 230	1.69	1.88	0.42	5.21	17.00	11.79

- 5 725 Band

- MIMO 2 Tx (ANT 0+1)

- 802.11a

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 745	0.23	0.69	0.16	3.64	27.87	24.23
5 785	-0.30	0.23	0.16	3.14	27.87	24.73
5 825	-0.83	0.14	0.16	2.85	27.87	25.02

- 802.11n HT20

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 745	0.26	0.76	0.29	3.81	27.87	24.06
5 785	-0.76	-0.14	0.29	2.86	27.87	25.01
5 825	-1.16	-0.11	0.29	2.69	27.87	25.18

- 802.11n HT40

Frequency [MHz]	Result_ANT 0 (RBW=3 kHz) [dBm]	Result_ANT 1 (RBW=3 kHz) [dBm]	Duty Factor [dB]	Total result [dBm/MHz]	Limit [dBm]	Margin [dB]
5 755	-2.57	-1.92	0.43	1.21	27.87	26.66
5 795	-3.45	-3.16	0.43	0.14	27.87	27.73

Note:

1. D.C.C.F = Duty cycle correction factor

5.4.4 Test Plot

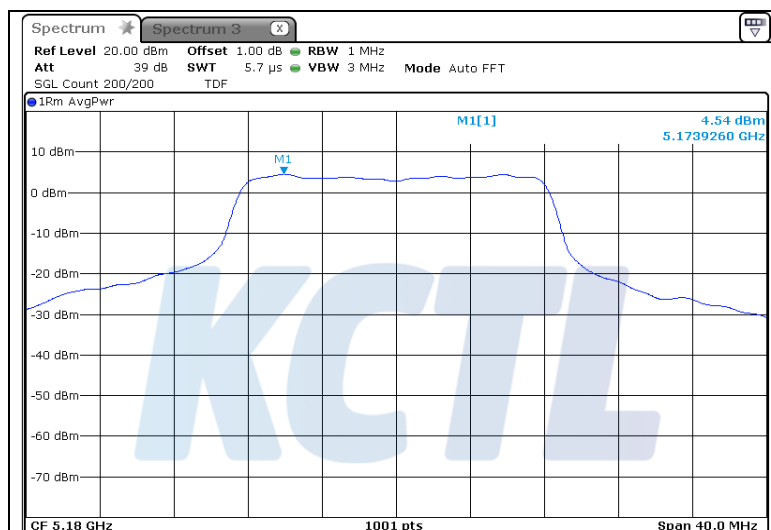
Figure 2. Plot of the Power Spectral Density

- 5 150 Band

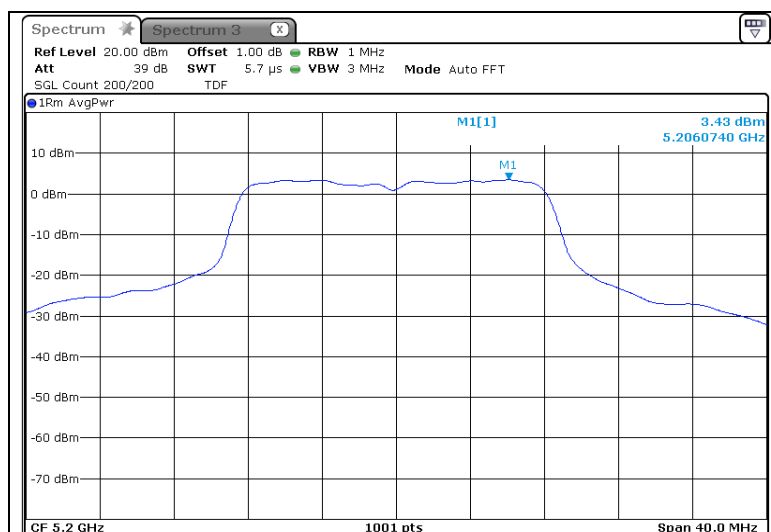
- MIMO 2 Tx (ANT 0)

802.11a

5 180 MHz



5 200 MHz



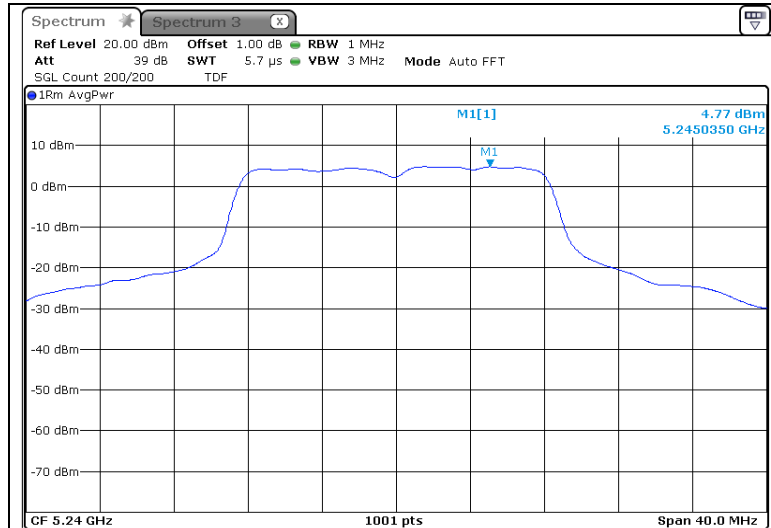
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Report No.:
KR17-SRF0077-B
Page (78) of (115)

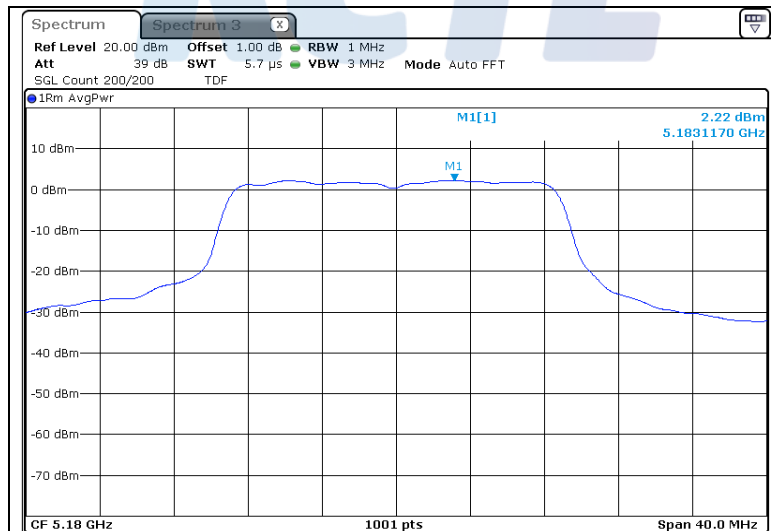
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5 240 MHz



- 802.11n HT20

5 180 MHz



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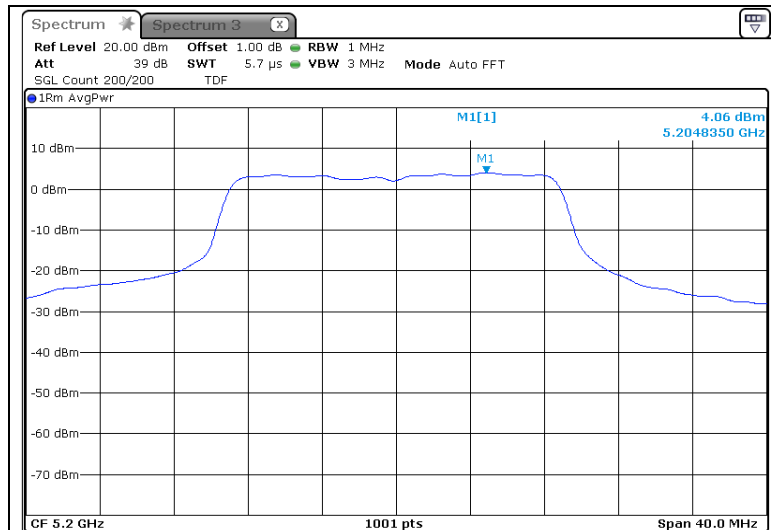
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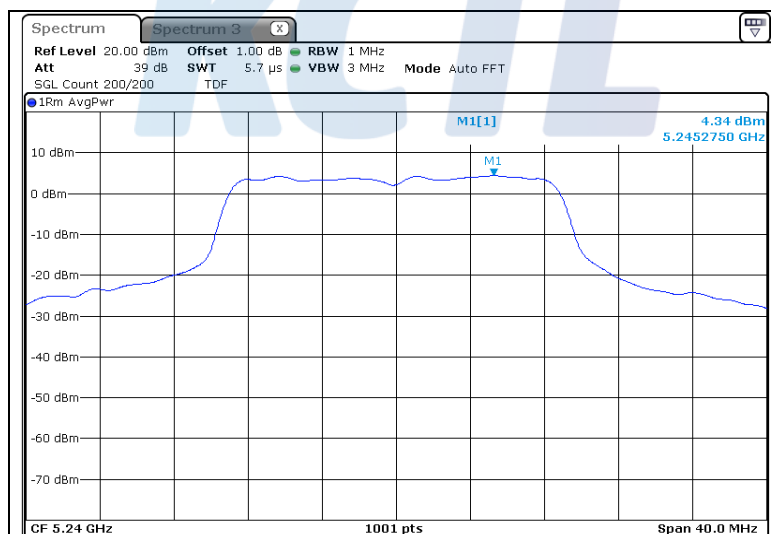
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Page (79) of (115)

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5 200 MHz



5 240 MHz



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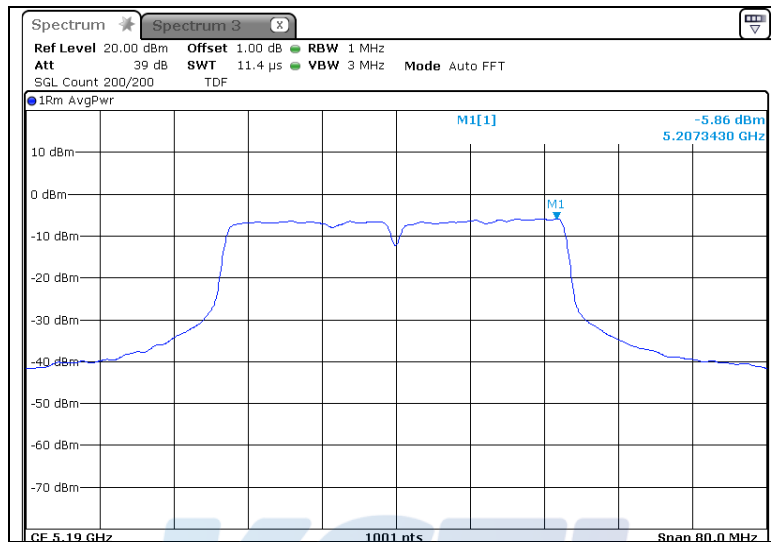
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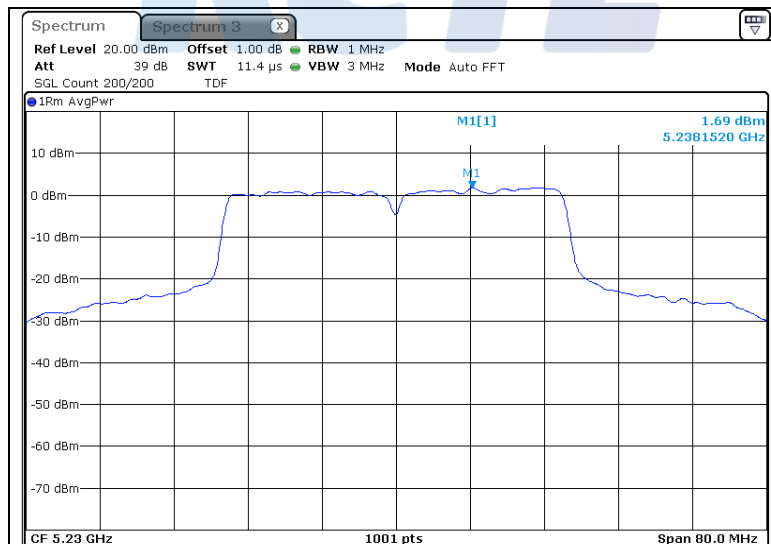
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- 802.11n HT40

5 190 MHz



5 230 MHz



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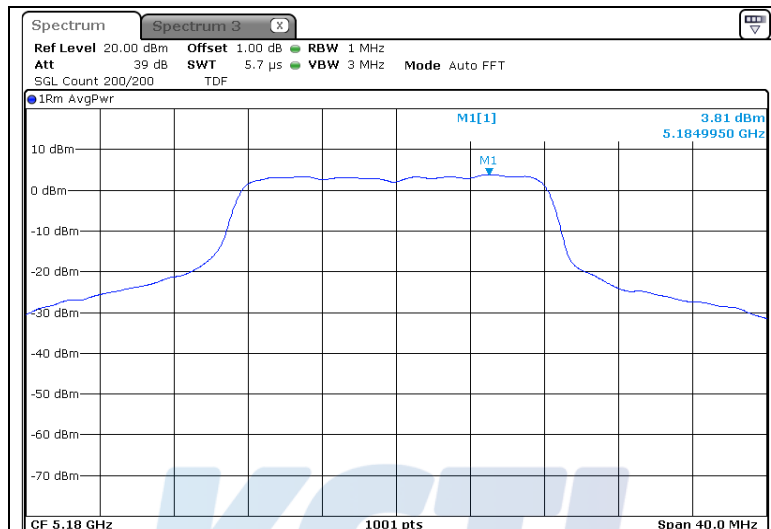
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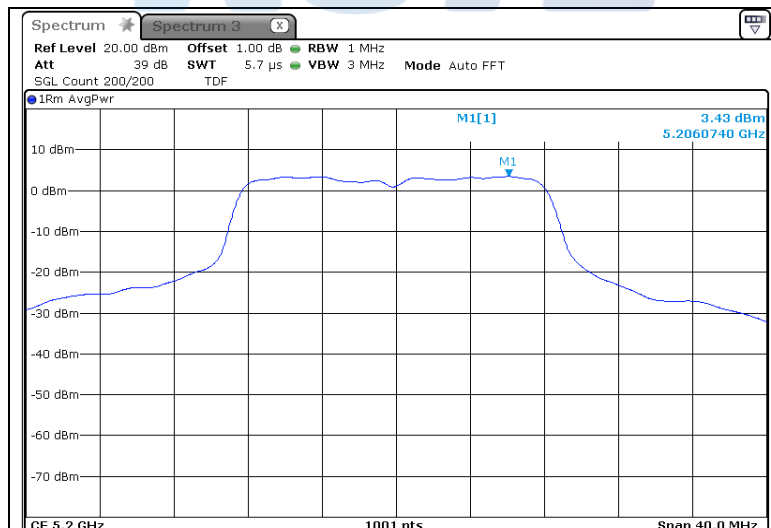
- MIMO 2 Tx (ANT 1)

802.11a

5 180 MHz



5 200 MHz



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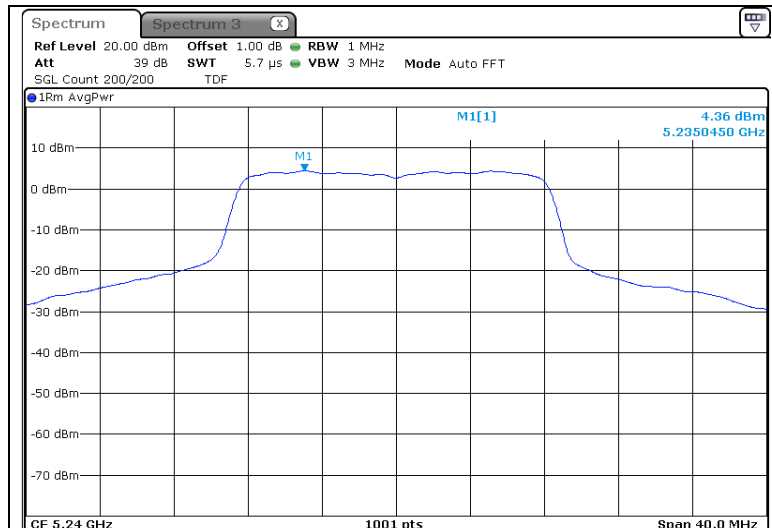
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Page (82) of (115)

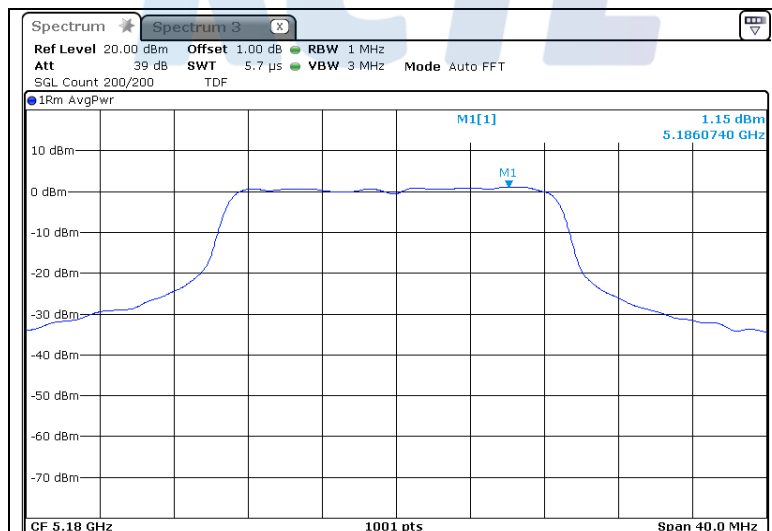
KCTL

5 240 MHz



- 802.11n HT20

5 180 MHz



KCTL Inc.

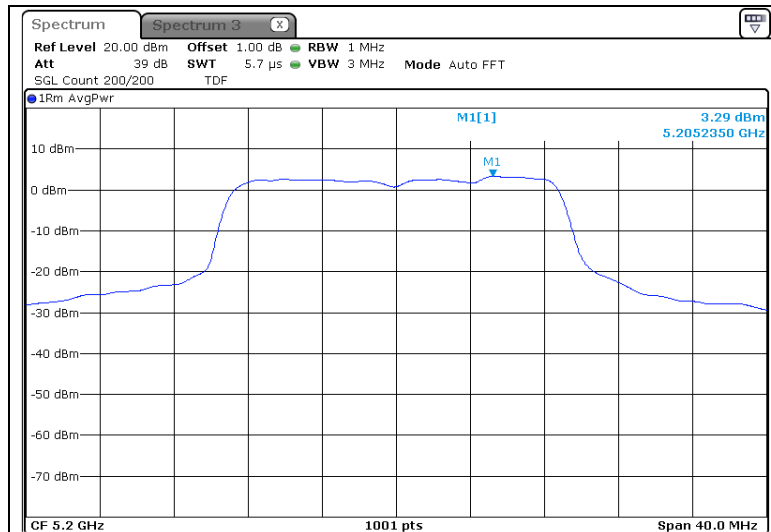
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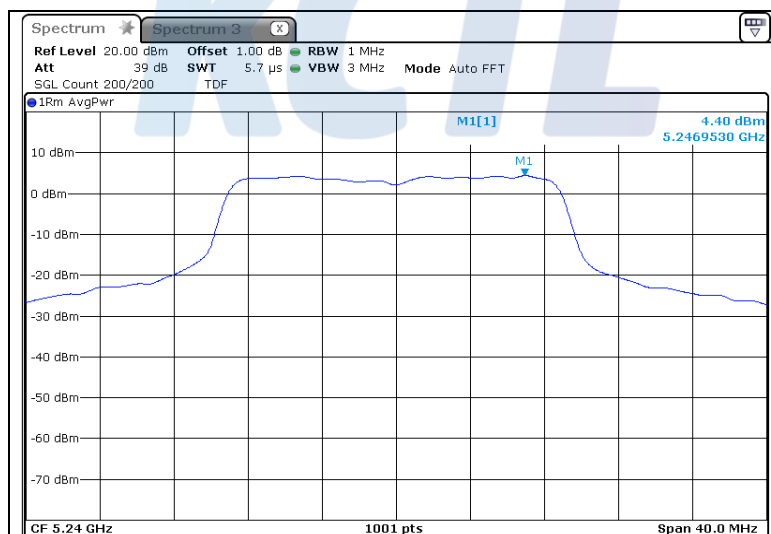
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5 200 MHz



5 240 MHz



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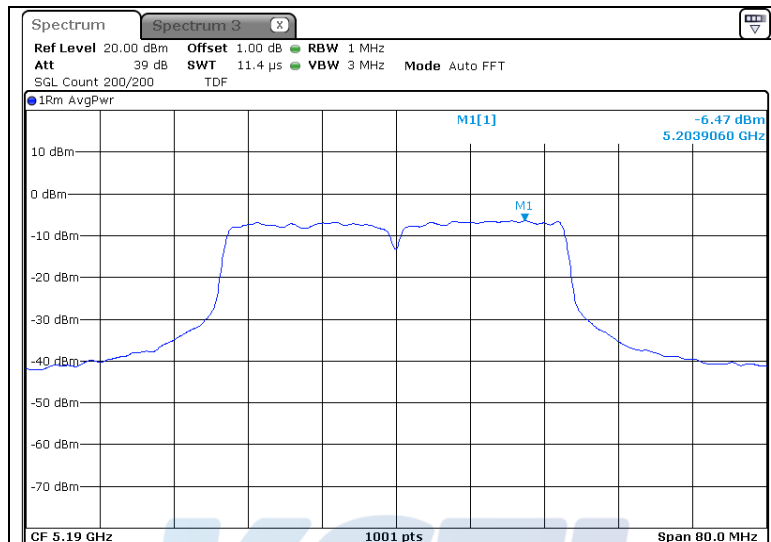
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Page (84) of (115)

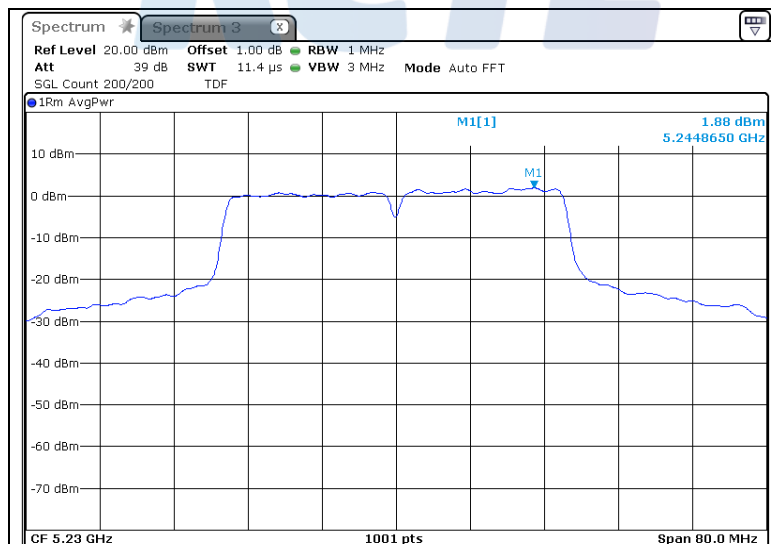
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- 802.11n HT40

5 190 MHz



5 230 MHz



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Page (85) of (115)

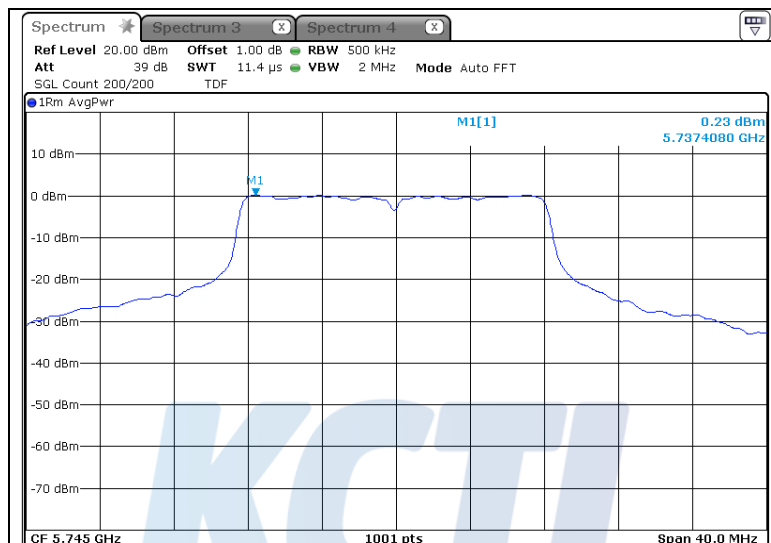
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- 5 725 Band

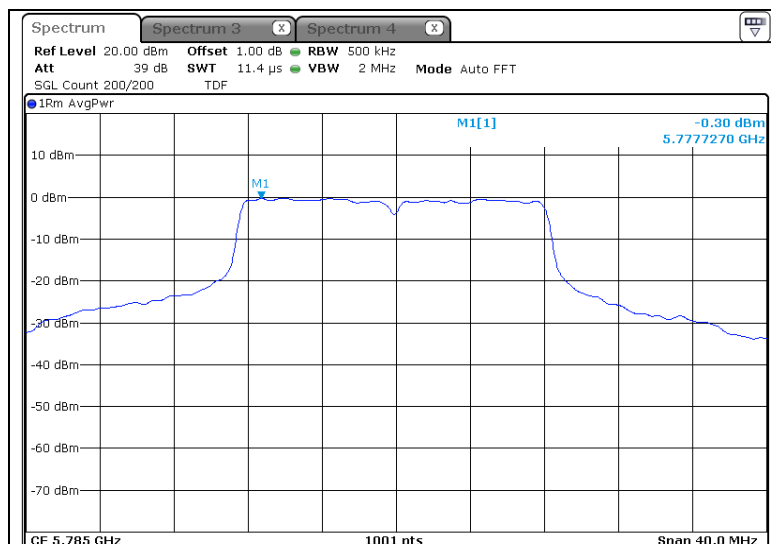
- MIMO 2 Tx (ANT 0)

- 802.11a

5 745 MHz



5 785 MHz



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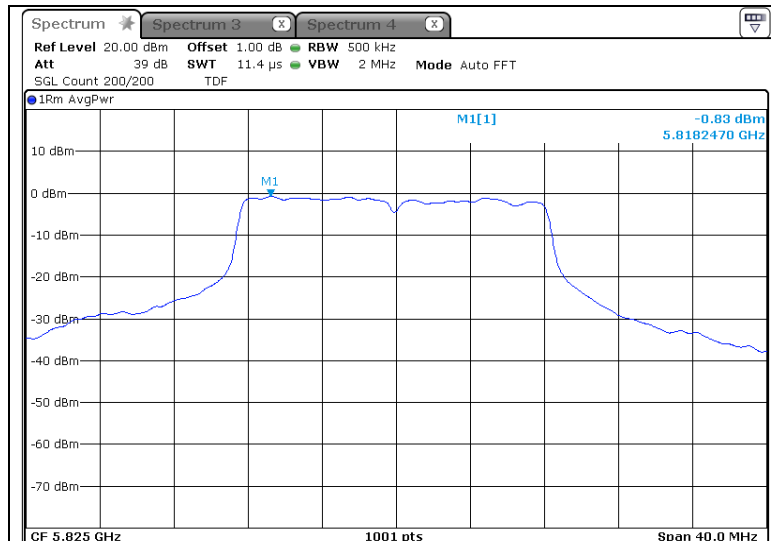
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Page (86) of (115)

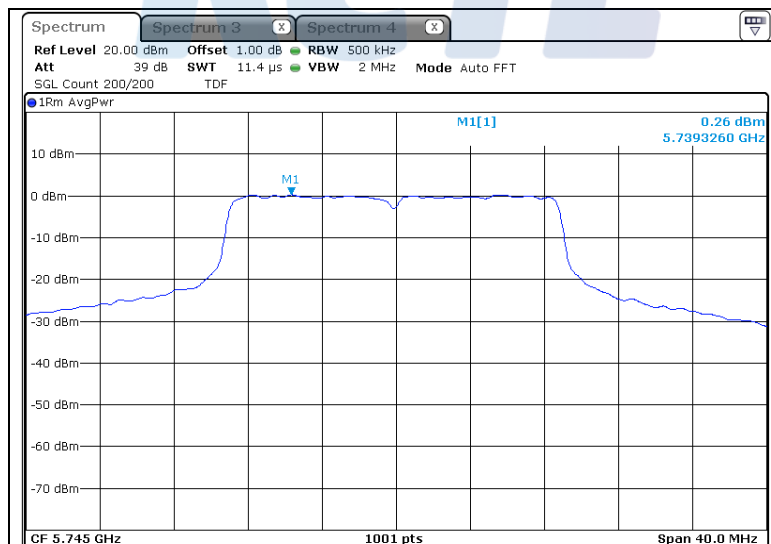
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5 825 MHz



- 802.11n HT20

5 745 MHz



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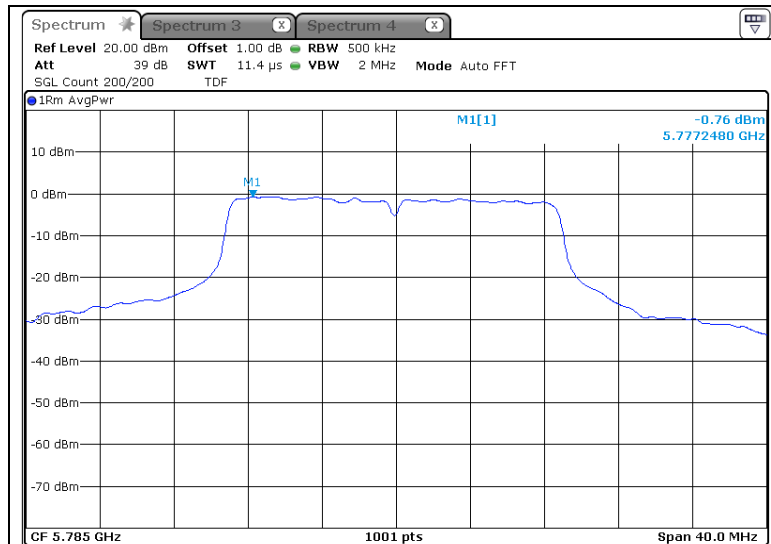
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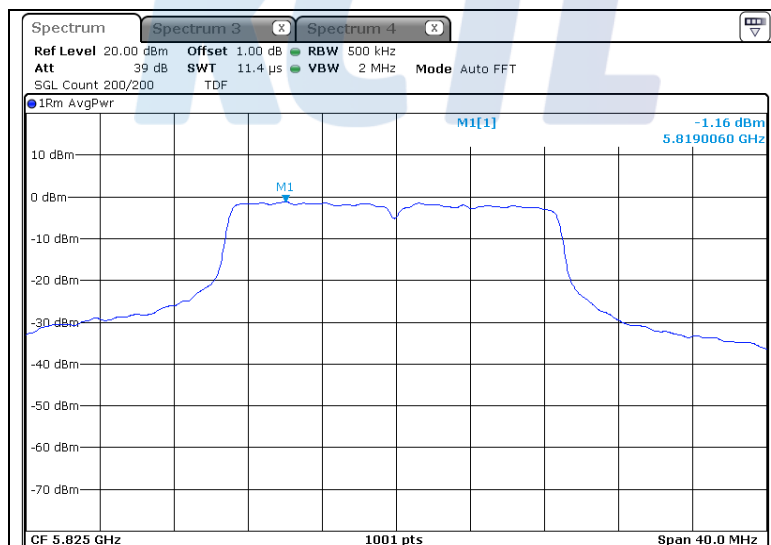
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5 785 MHz



5 825 MHz



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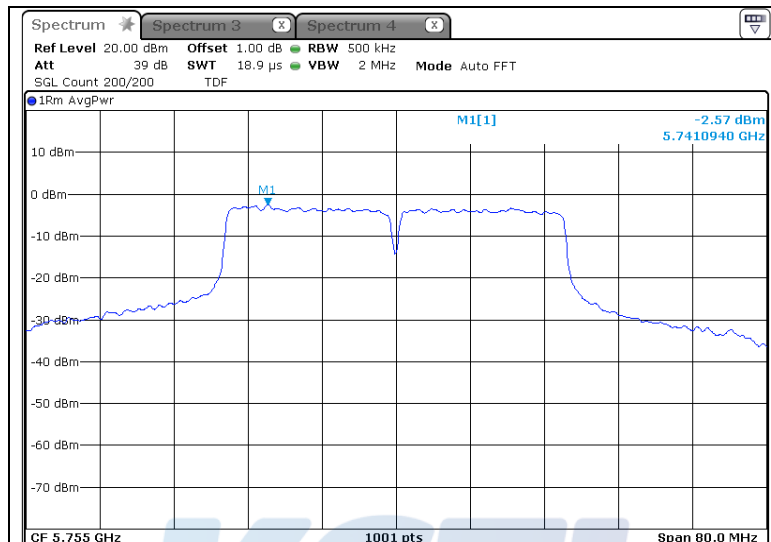
Report No.:
KR17-SRF0077-B

Page (88) of (115)

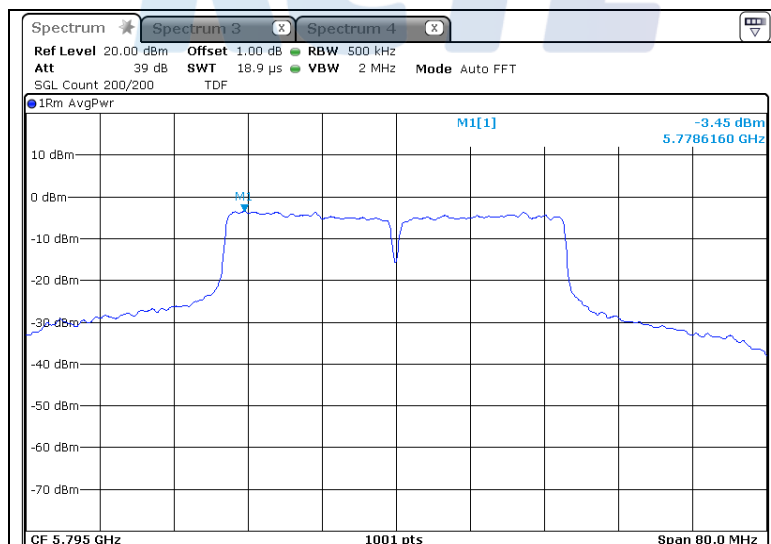
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- 802.11n HT40

5 755 MHz



5 795 MHz



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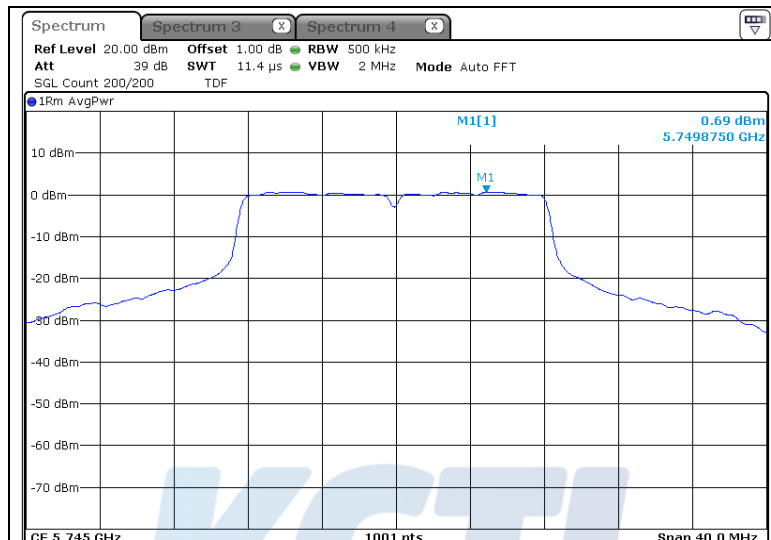
Page (89) of (115)

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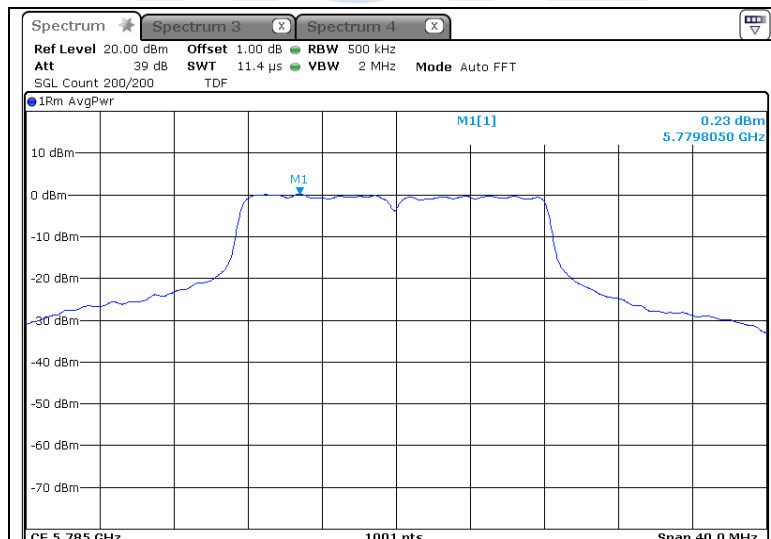
- MIMO 2 Tx (ANT 1)

- 802.11a

5 745 MHz



5 785 MHz



KCTL Inc.

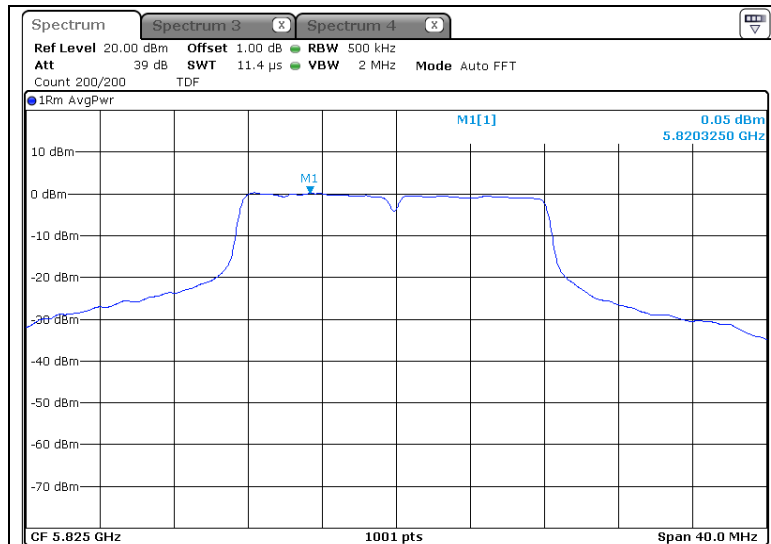
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KR17-SRF0077-B

Page (90) of (115)

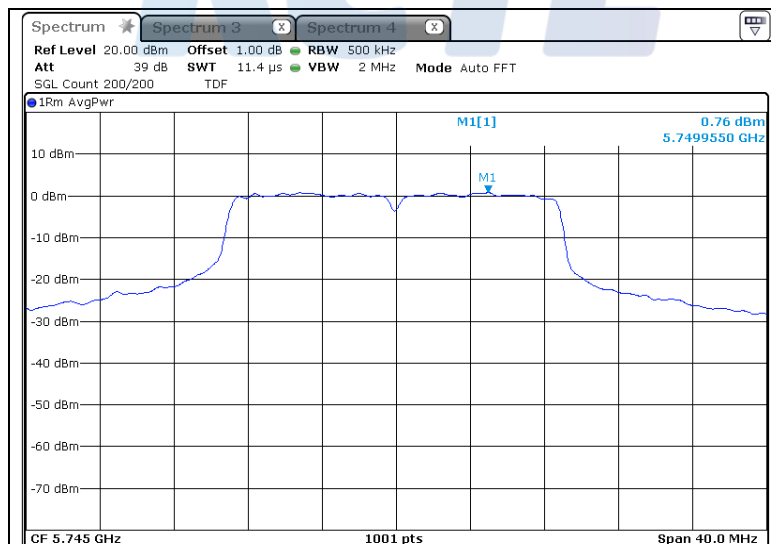
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5 825 MHz



- 802.11n HT20

5 745 MHz



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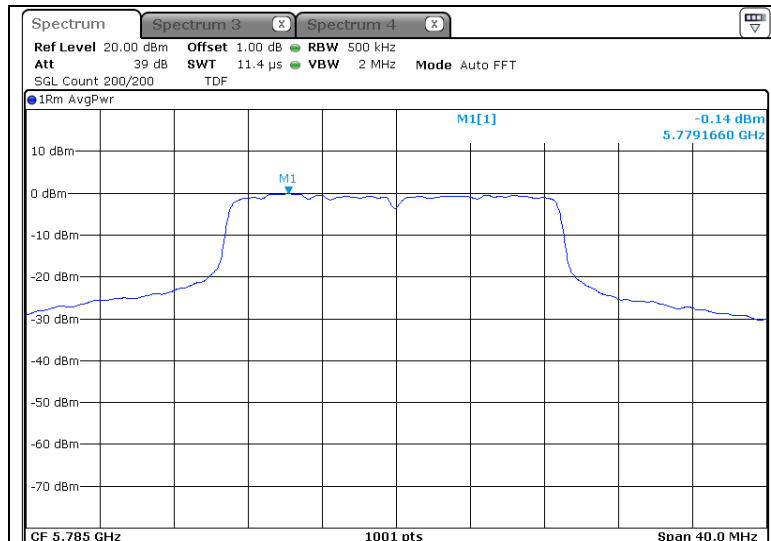
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Page (91) of (115)

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5 785 MHz



5 825 MHz



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Page (92) of (115)

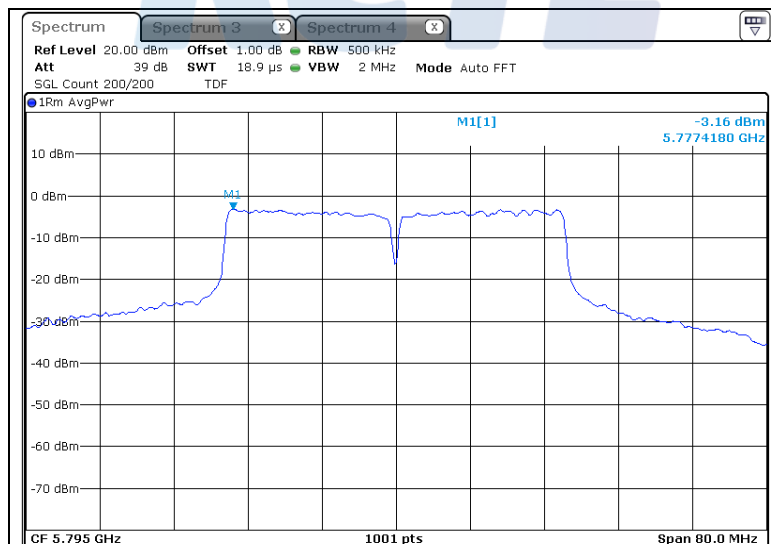
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- 802.11n HT40

5 755 MHz



5 795 MHz



5.5 Spurious Emission, Band Edge And Restricted Bands

5.5.1 Regulation

According to §15.407(b)(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 EIRP of -27 dBm/MHz.

According to §15.407(b) (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.

According to §15.407(b) 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.

According to §15.407(b) (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

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

According to §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 (μV/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

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

According to §15.407(b)(7) The provisions of §15.205 apply to intentional radiators operating under this section. (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

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Report No.:
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Page (94) of (115)



According to § 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 25	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 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			

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

5.5.2 Measurement Procedure

These test measurement settings are specified in section G of 789033 D02 General UNII Test Procedures New Rules v01.

For all radiated emissions tests, measurements must correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.5.2.1 Unwanted Emission Measurement

5.5.2.1.1 1. Unwanted Emissions in the Restricted Bands

- a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."
- b) At frequencies below 1 000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements Below 1 000 MHz."
- c) At frequencies above 1 000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.
- d) For conducted measurements above 1 000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172): (i) $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules; (ii) $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters.
- e) For conducted measurements below 1 000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1 000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

5.5.2.1.1 2. Unwanted Emissions that fall Outside of the Restricted Bands

- a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."
- b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements Below 1000 MHz."
- c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., "Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1 000 MHz."
- (i) Section 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.
- (ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.
- d) If radiated measurements are performed, field strength is then converted to EIRP as follows:
 - (i) $EIRP = ((E \times d)^2) / 30$ where:
 - E is the field strength in V/m;
 - d is the measurement distance in meters;
 - EIRP is the equivalent isotropically radiated power in watts.
 - (ii) Working in dB units, the above equation is equivalent to: $EIRP[dBm] = E[dB\mu V/m] + 20 \log(d[meters]) - 104.77$
 - (iii) Or, if d is 3 meters: $EIRP[dBm] = E[dB\mu V/m] - 95.2$

5.5.2.2 Spurious Radiated Emissions:

1. The preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 40 000 MHz using the horn antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
5. The 0.8m height is measurement for below 1 GHz and 1.5m is for above 1 GHz measurement.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.

5.5.3 Test Result

-complied

1. Band-edge & Conducted Spurious Emissions was shown in figure 3.
Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Measured value of the Field strength of spurious Emissions (Radiated)
3. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

- Below 1 GHz data (Worst-case: 5 240 Band 802.11n 20_ANT 1)

802.11n 20_Highest Channel (5 240 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 MHz										
-	-	-	-	-	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz										
46.49	120	V	32.88	1.52	-31.12	14.40	-15.20	17.68	40.00	22.32
135.00	120	H	41.57	2.50	-31.15	8.55	-20.10	21.47	43.50	22.03
240.01	120	H	36.05	3.97	-31.85	12.48	-15.40	20.65	46.00	25.35
269.95	120	H	35.89	3.95	-31.57	13.12	-14.50	21.39	46.00	24.61
405.03	120	H	52.73	4.61	-31.38	15.87	-10.90	41.83	46.00	4.17
675.05	120	V	30.91	6.14	-31.17	19.53	-5.50	25.41	46.00	20.59

NOTE 1. Factor = Cable loss + Amp gain + Antenna factor

NOTE 2. Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site.
 Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

- Above 1 GHz data

- 5 150 Band

- MIMO 2 Tx (ANT 0)

802.11a_Lowest channel (5 180 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 214.67	1 000	V	-3.24	3.26	-64.36	24.66	-36.44	33.20	74.00	40.80
5 148.53 ¹⁾	1 000	V	41.10	6.97	-42.53	33.12	-2.44	43.54	74.00	30.46
10 282.06	1 000	H	32.44	10.36	-63.52	37.98	-15.18	47.62	74.00	26.38
13 997.64	1 000	H	42.65	12.09	-61.67	40.99	-8.59	51.24	74.00	22.76
22 198.56	1 000	V	49.14	12.40	-47.88	44.90	9.42	39.73	74.00	34.27
31 433.75	1 000	V	60.19	13.90	-46.02	46.00	13.88	46.31	74.00	27.69
Average DATA. Emissions above 1 GHz										
1 214.67	1 000	V	70.38	3.26	-64.36	24.66	-36.44	33.94	54.00	20.06
5 148.53 ¹⁾	1 000	V	46.45	6.97	-42.53	33.12	-2.44	44.01	54.00	9.99
10 282.06	1 000	H	54.08	10.36	-63.52	37.98	-15.18	38.90	54.00	15.10
13 997.64	1 000	H	51.24	12.09	-61.67	40.99	-8.59	42.65	54.00	11.35
22 198.56	1 000	V	25.62	12.40	-47.88	44.90	9.42	35.04	54.00	18.96
31 433.75	1 000	V	24.64	13.90	-46.02	46.00	13.88	38.52	54.00	15.48

¹⁾ Restricted band.

802.11a_Middle channel (5 200 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 001.89	1 000	V	-4.79	3.00	-64.10	23.81	-37.29	32.50	74.00	41.50
1 214.67	1 000	V	3.32	3.26	-64.36	24.66	-36.44	39.76	74.00	34.24
10 390.23	1 000	H	33.22	10.40	-63.52	38.02	-15.10	48.32	74.00	25.68
15 595.78	1 000	H	37.47	12.60	-62.79	38.63	-11.56	49.03	74.00	24.97
25 625.06	1 000	V	56.99	13.50	-44.37	45.40	14.53	42.46	74.00	31.54
33 551.94	1 000	V	61.82	14.10	-46.27	48.70	16.53	45.28	74.00	28.72
Average DATA. Emissions above 1 GHz										
1 001.89	1 000	V	69.77	3.00	-64.10	23.81	-37.29	32.48	54.00	21.52
1 214.67	1 000	V	70.22	3.26	-64.36	24.66	-36.44	33.78	54.00	20.22
10 390.23	1 000	H	53.68	10.40	-63.52	38.02	-15.10	38.58	54.00	15.42
15 595.78	1 000	H	50.11	12.60	-62.79	38.63	-11.56	38.55	54.00	15.45
25 625.06	1 000	V	24.36	13.50	-44.37	45.40	14.53	38.89	54.00	15.11
33 551.94	1 000	V	23.84	14.10	-46.27	48.70	16.53	40.37	54.00	13.63

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Report No.:
KR17-SRF0077-B

Page (100) of (115)

**802.11a_Highest channel (5 240 Mhz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 035.23	1 000	V	6.48	3.04	-64.18	23.94	-37.20	43.68	74.00	30.32
5 351.47 ¹⁾	1 000	V	33.06	7.09	-42.54	33.43	-2.02	35.08	74.00	38.92
10 477.20	1 000	H	33.93	10.42	-63.49	38.04	-15.03	48.97	74.00	25.03
15 718.33	1 000	H	36.91	12.72	-62.59	38.29	-11.58	48.49	74.00	25.51
18 919.19	1 000	V	47.35	12.20	-49.02	44.20	7.38	39.97	74.00	34.03
31 392.50	1 000	V	56.88	13.80	-45.94	46.00	13.86	43.02	74.00	30.98
Average DATA. Emissions above 1 GHz										
1 035.23	1 000	V	72.35	3.04	-64.18	23.94	-37.20	35.15	54.00	18.85
5 351.47 ¹⁾	1 000	V	39.10	7.09	-42.54	33.43	-2.02	37.08	54.00	16.92
10 477.20	1 000	H	54.81	10.42	-63.49	38.04	-15.03	39.78	54.00	14.22
15 718.33	1 000	H	49.38	12.72	-62.59	38.29	-11.58	37.80	54.00	16.20
18 919.19	1 000	V	31.93	12.20	-49.02	44.20	7.38	39.31	54.00	14.69
31 392.50	1 000	V	25.36	13.80	-45.94	46.00	13.86	39.22	54.00	14.78

¹⁾ Restricted band.

802.11n HT20_Lowest channel (5 180 Mhz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 214.84	1 000	V	-1.92	3.26	-64.36	24.66	-36.44	34.51	74.00	39.49
5 149.06 ¹⁾	1 000	V	35.11	6.97	-42.53	33.12	-2.44	37.56	74.00	36.44
10 354.66	1 000	H	33.30	10.38	-63.52	38.01	-15.13	48.43	74.00	25.57
14 382.53	1 000	V	43.54	12.05	-60.87	40.73	-8.09	51.64	74.00	22.36
23 044.19	1 000	V	49.78	12.60	-47.90	45.20	9.90	39.87	74.00	34.13
32 847.94	1 000	V	62.74	13.90	-45.89	47.80	15.81	46.92	74.00	27.08
Average DATA. Emissions above 1 GHz										
1 214.84	1 000	V	71.24	3.26	-64.36	24.66	-36.44	34.80	54.00	19.20
5 149.06 ¹⁾	1 000	V	48.47	6.97	-42.53	33.12	-2.44	46.03	54.00	7.97
10 354.66	1 000	H	54.94	10.38	-63.52	38.01	-15.13	39.81	54.00	14.19
14 382.53	1 000	V	49.61	12.05	-60.87	40.73	-8.09	41.52	54.00	12.48
23 044.19	1 000	V	30.54	12.60	-47.90	45.20	9.90	40.44	54.00	13.56
32 847.94	1 000	V	25.14	13.90	-45.89	47.80	15.81	40.95	54.00	13.05

¹⁾ Restricted band.

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Report No.:
KR17-SRF0077-B

Page (101) of (115)

**802.11n HT20_Middle channel (5 200 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 001.20	1 000	H	3.79	3.00	-64.09	23.80	-37.29	41.08	74.00	32.92
1 215.02	1 000	V	-2.34	3.26	-64.36	24.66	-36.44	34.10	74.00	39.90
10 399.58	1 000	H	36.43	10.40	-63.51	38.02	-15.09	51.52	74.00	22.48
15 600.09	1 000	H	37.88	12.60	-62.78	38.62	-11.56	49.44	74.00	24.56
19 478.81	1 000	V	47.47	12.20	-48.89	44.30	7.61	39.86	74.00	34.14
31 109.94	1 000	H	59.52	13.60	-45.58	45.70	13.72	45.80	74.00	28.20
Average DATA. Emissions above 1 GHz										
1 001.20	1 000	H	73.11	3.00	-64.09	23.80	-37.29	35.82	54.00	18.18
1 215.02	1 000	V	71.25	3.26	-64.36	24.66	-36.44	34.81	54.00	19.19
10 399.58	1 000	H	51.52	10.40	-63.51	38.02	-15.09	36.43	54.00	17.57
15 600.09	1 000	H	49.44	12.60	-62.78	38.62	-11.56	37.88	54.00	16.12
19 478.81	1 000	V	32.58	12.20	-48.89	44.30	7.61	40.19	54.00	13.81
31 109.94	1 000	H	28.11	13.60	-45.58	45.70	13.72	41.83	54.00	12.17

802.11n HT20_Highest channel (5 240 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 034.89	1 000	V	9.16	3.04	-64.18	23.94	-37.20	46.36	74.00	27.64
5 300.47 ¹⁾	1 000	V	24.22	7.06	-42.70	33.35	-2.29	26.51	74.00	47.49
10 364.00	1 000	V	31.89	10.39	-63.52	38.01	-15.12	47.01	74.00	26.99
14 437.88	1 000	H	41.22	12.04	-60.75	40.69	-8.02	49.25	74.00	24.75
22 727.25	1 000	V	53.06	12.50	-47.90	45.10	9.70	43.37	74.00	30.63
36 040.69	1 000	V	64.92	12.80	-45.02	49.00	16.78	48.14	74.00	25.86
Average DATA. Emissions above 1 GHz										
1 034.89	1 000	V	73.57	3.04	-64.18	23.94	-37.20	36.37	54.00	17.63
5 300.47 ¹⁾	1 000	V	37.21	7.06	-42.70	33.35	-2.29	34.92	54.00	19.08
10 364.00	1 000	V	50.26	10.39	-63.52	38.01	-15.12	35.14	54.00	18.86
14 437.88	1 000	H	50.11	12.04	-60.75	40.69	-8.02	42.09	54.00	11.91
22 727.25	1 000	V	32.28	12.50	-47.90	45.10	9.70	41.98	54.00	12.02
36 040.69	1 000	V	29.31	12.80	-45.02	49.00	16.78	46.09	54.00	7.91

¹⁾ Restricted band.

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Report No.:
KR17-SRF0077-B

Page (102) of (115)

**802.11n HT40_Lowest channel (5 190 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 214.84	1 000	V	-1.41	3.26	-64.36	24.66	-36.44	35.03	74.00	38.97
5 148.53 ¹⁾	1 000	V	50.67	6.97	-42.53	33.12	-2.44	53.11	74.00	20.89
10 919.59	1 000	V	32.96	10.57	-63.40	38.18	-14.65	47.61	74.00	26.39
14 498.97	1 000	H	43.39	12.04	-60.64	40.65	-7.95	51.34	74.00	22.66
21 715.94	1 000	V	51.76	12.30	-47.89	44.80	9.21	42.55	74.00	31.45
30 738.00	1 000	V	59.36	13.60	-45.06	45.70	14.24	45.11	74.00	28.89
Average DATA. Emissions above 1 GHz										
1 214.84	1 000	V	70.22	3.26	-64.36	24.66	-36.44	33.78	54.00	20.22
5 148.53 ¹⁾	1 000	V	46.16	6.97	-42.53	33.12	-2.44	43.72	54.00	10.28
10 919.59	1 000	V	51.11	10.57	-63.40	38.18	-14.65	36.46	54.00	17.54
14 498.97	1 000	H	50.36	12.04	-60.64	40.65	-7.95	42.41	54.00	11.59
21 715.94	1 000	V	32.12	12.30	-47.89	44.80	9.21	41.33	54.00	12.67
30 738.00	1 000	V	30.25	13.60	-45.06	45.70	14.24	44.49	54.00	9.51

¹⁾ Restricted band.

802.11n HT40_Middle channel (5 230 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 024.92	1 000	H	7.99	3.03	-64.16	23.90	-37.23	45.22	74.00	28.78
5 350.94 ¹⁾	1 000	V	24.65	7.09	-42.55	33.43	-2.03	26.68	74.00	47.32
10 941.88	1 000	V	33.33	10.58	-63.39	38.18	-14.63	47.95	74.00	26.05
16 597.72	1 000	V	38.08	13.12	-62.43	39.17	-10.14	48.22	74.00	25.78
23 901.50	1 000	H	54.90	13.20	-46.94	44.90	11.16	43.74	74.00	30.26
31 400.75	1 000	V	58.99	13.90	-46.04	46.00	13.86	45.13	74.00	28.87
Average DATA. Emissions above 1 GHz										
1 024.92	1 000	H	69.09	3.03	-64.16	23.90	-37.23	31.86	54.00	22.14
5 350.94 ¹⁾	1 000	V	39.08	7.09	-42.55	33.43	-2.03	37.05	54.00	16.95
10 941.88	1 000	V	50.87	10.58	-63.39	38.18	-14.63	36.24	54.00	17.76
16 597.72	1 000	V	51.05	13.12	-62.43	39.17	-10.14	40.91	54.00	13.09
23 901.50	1 000	H	30.48	13.20	-46.94	44.90	11.16	41.64	54.00	12.36
31 400.75	1 000	V	28.36	13.90	-46.04	46.00	13.86	42.22	54.00	11.78

¹⁾ Restricted band.

- 5 725 Band

-MIMO 2 Tx (ANT 0+1)

802.11a_Lowest channel (5 745 Mhz)

Frequency [Mhz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 286.86	1 000	V	-4.88	3.35	-64.53	24.95	-36.23	31.35	68.20	36.85
6 090.59	1 000	V	26.09	7.51	-64.16	34.52	-22.13	48.21	68.20	19.99
8 967.83	1 000	H	30.07	9.59	-63.66	37.67	-16.40	46.47	68.20	21.73
14 558.63	1 000	H	43.25	12.03	-60.76	40.61	-8.12	51.37	68.20	16.83
24 230.81	1 000	V	52.81	13.30	-46.66	44.90	11.54	41.28	68.20	26.92
32 129.50	1 000	V	59.79	14.20	-46.68	46.90	14.42	45.37	68.20	22.83
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

802.11a_Middle channel (5 785 Mhz)

Frequency [Mhz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 289.78	1 000	V	-4.88	3.35	-64.54	24.96	-36.23	31.35	68.20	36.85
5 945.19	1 000	V	25.79	7.43	-64.16	34.32	-22.41	48.21	68.20	19.99
7 923.13	1 000	V	26.40	9.17	-64.23	36.62	-18.44	44.83	68.20	23.37
16 437.80	1 000	V	35.84	13.09	-62.40	38.73	-10.58	46.43	68.20	21.77
24 545.00	1 000	V	54.11	13.30	-46.44	45.00	11.86	42.26	68.20	25.94
34 518.56	1 000	H	66.23	13.40	-46.16	49.70	16.94	49.29	68.20	18.91
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

802.11a_Highest channel (5 825 Mhz)

Frequency [Mhz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 251.63	1 000	V	-4.00	3.31	-64.45	24.81	-36.33	32.33	68.20	35.87
4 440.25	1 000	H	17.39	6.45	-64.85	32.62	-25.78	43.17	68.20	25.03
6 958.56	1 000	H	22.43	8.47	-63.99	35.65	-19.87	42.30	68.20	25.90
12 714.67	1 000	V	32.51	11.22	-62.94	38.81	-12.91	45.42	68.20	22.78
28 817.81	1 000	V	61.40	14.20	-44.27	45.90	15.83	45.57	68.20	22.63
35 644.69	1 000	H	66.09	12.70	-45.19	49.40	16.91	49.18	68.20	19.02
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

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Report No.:
KR17-SRF0077-B

Page (104) of (115)

**802.11n HT20_Lowest channel (5 745 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 276.72	1 000	V	4.84	3.34	-64.51	24.91	-36.26	41.11	68.20	27.09
6 158.31	1 000	V	32.25	7.55	-64.22	34.61	-22.06	54.30	68.20	13.90
7 093.33	1 000	V	24.57	8.56	-63.94	35.79	-19.59	44.16	68.20	24.04
12 742.70	1 000	H	33.38	11.23	-62.90	38.80	-12.87	46.26	68.20	21.94
26 060.94	1 000	V	58.58	13.60	-43.39	45.70	15.91	42.67	68.20	25.53
35 497.56	1 000	V	65.67	12.70	-45.37	49.60	16.93	48.74	68.20	19.46
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

802.11n HT20_Middle channel (5 785 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 268.30	1 000	V	5.16	3.33	-64.49	24.87	-36.29	41.44	68.20	26.76
6 110.36	1 000	V	31.77	7.52	-64.17	34.54	-22.11	53.88	68.20	14.32
7 147.59	1 000	H	24.11	8.60	-63.91	35.85	-19.46	43.57	68.20	24.63
16 454.69	1 000	V	35.98	13.10	-62.41	38.77	-10.54	46.52	68.20	21.68
26 804.13	1 000	V	63.28	13.60	-42.40	45.50	16.70	46.58	68.20	21.62
35 399.94	1 000	V	65.51	12.70	-45.50	49.70	16.90	48.61	68.20	19.59
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

802.11n HT20_Highest channel (5 825 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 247.50	1 000	V	4.90	3.30	-64.43	24.79	-36.34	41.24	68.20	26.96
6 126.00	1 000	V	31.66	7.53	-64.18	34.56	-22.09	53.75	68.20	14.45
6 546.72	1 000	V	23.30	8.25	-63.78	35.11	-20.42	43.72	68.20	24.48
16 343.64	1 000	V	35.63	13.08	-62.35	38.46	-10.81	46.43	68.20	21.77
25 453.88	1 000	V	58.64	13.40	-44.78	45.30	13.92	44.72	68.20	23.48
35 725.13	1 000	H	67.41	12.70	-45.20	49.40	16.90	50.51	68.20	17.69
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

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802.11n HT40_Lowest channel (5 755 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
2914.69	1 000	V	7.90	5.14	-64.28	29.54	-29.60	37.51	68.20	30.69
6166.39	1 000	V	27.27	7.55	-64.22	34.62	-22.05	49.32	68.20	18.88
7083.27	1 000	V	24.03	8.55	-63.94	35.78	-19.61	43.65	68.20	24.55
16441.03	1 000	V	36.02	13.09	-62.39	38.73	-10.57	46.59	68.20	21.61
25678.00	1 000	H	60.61	13.50	-44.19	45.40	14.71	45.90	68.20	22.30
36177.50	1 000	V	66.33	12.60	-44.67	48.60	16.53	49.80	68.20	18.40
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

¹⁾ Restricted band.

802.11n HT40_Middle channel (5 795 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
5306.67	1 000	H	23.11	7.06	-64.07	33.36	-23.65	46.76	68.20	21.44
6176.36	1 000	H	25.92	7.56	-64.23	34.63	-22.04	47.96	68.20	20.24
6562.53	1 000	V	23.30	8.26	-63.79	35.13	-20.40	43.71	68.20	24.49
16208.88	1 000	V	34.73	13.05	-62.26	38.08	-11.13	45.86	68.20	22.34
26031.38	1 000	V	63.61	13.60	-43.42	45.70	15.88	47.72	68.20	20.48
35727.88	1 000	H	67.26	12.70	-45.20	49.40	16.90	50.36	68.20	17.84
Average DATA. Emissions above 1 GHz										
-	-	-	-	-	-	-	-	-	-	-

5.6 Frequency Stability

5.6.1 Regulation

According to §15.407 (g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

5.6.2 Measurement Procedure

The frequency stability of the carrier frequency of the intentional radiator shall be maintained all conditions of normal operation as specified in the users manual. The frequency stability shall be maintained over a temperature variation of specified in the users manual at normal supply voltage, and over a variation in the primary supply voltage of specified in the users 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.

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Report No.:
KR17-SRF0077-B

Page (107) of (115)



5.6.3 Test Result

-Complied

- 5 150 Band

-5 180 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 179 900 000	100 000	0.001 93
		40	5 179 960 000	40 000	0.000 77
		30	5 179 840 500	159 500	0.003 08
		20	5 179 900 000	100 000	0.001 93
		10	5 179 960 500	39 500	0.000 76
		0	5 179 660 500	339 500	0.006 55
		-10	5 180 000 000	0	0.000 00
		-20	5 179 895 000	105 000	0.002 03
85	10.0	20	5 180 080 000	-80 000	-0.001 54
115	12.2	20	5 180 020 000	-20 000	-0.000 39

-5 200 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 200 020 000	-20 000	-0.000 38
		40	5 199 940 000	60 000	0.001 15
		30	5 200 020 000	-20 000	-0.000 38
		20	5 199 860 500	139 500	0.002 68
		10	5 200 060 000	-60 000	-0.001 15
		0	5 199 960 500	39 500	0.000 76
		-10	5 199 760 500	239 500	0.004 61
		-20	5 200 020 000	-20 000	-0.000 38
85	10.0	20	5 200 055 000	-55 000	-0.001 06
115	12.2	20	5 199 860 500	139 500	0.0026 8

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Report No.:
KR17-SRF0077-B

Page (108) of (115)



-5 240 MHz

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 239 980 000	20 000	0.000 38
		40	5 239 860 000	140 000	0.002 67
		30	5 240 120 000	-120 000	-0.002 29
		20	5 239 940 000	60 000	0.001 15
		10	5 239 860 500	139 500	0.002 66
		0	5 239 820 500	179 500	0.003 43
		-10	5 240 139 500	-139 500	-0.002 66
		-20	5 240 099 500	-99 500	-0.001 90
85	10.0	20	5 240 039 500	-39 500	-0.000 75
115	12.2	20	5 239 920 000	80 000	0.001 53

-5 190 MHz

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 190 120 000	-120 000	-0.002 31
		40	5 190 040 000	-40 000	-0.000 77
		30	5 189 880 000	120 000	0.002 31
		20	5 190 000 000	0	0.000 00
		10	5 189 760 000	240 000	0.004 62
		0	5 190 000 000	0	0.000 00
		-10	5 190 080 000	-80 000	-0.001 54
		-20	5 189 960 000	40 000	0.000 77
85	10.0	20	2 845 984 550	2 344 015 450	45.164 07
115	12.2	20	5 190 040 000	-40 000	-0.000 77

-5 230 MHz

Voltage [%]	Power [V]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 229 920 000	80 000	0.001 53
		40	5 230 080 000	-80 000	-0.001 53
		30	5 230 080 000	-80 000	-0.001 53
		20	5 230 000 000	0	0.000 00
		10	5 230 040 000	-40 000	-0.000 76
		0	5 230 280 000	-280 000	-0.005 35
		-10	5 230 000 000	0	0.000 00
		-20	5 230 160 000	-160 000	-0.003 06
85	10.0	20	5 230 200 000	-200 000	-0.003 82
115	12.2	20	5 230 000 000	0	0.000 00

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Report No.:
KR17-SRF0077-B

Page (110) of (115)

KCTL**- 5 725 Band****-5 745 MHz**

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 744 920 500	79 500	0.001 38
		40	5 744 940 000	60 000	0.001 04
		30	5 744 800 000	200 000	0.003 48
		20	5 744 920 000	80 000	0.001 39
		10	5 744 700 500	299 500	0.005 21
		0	5 744 920 000	80 000	0.001 39
		-10	5 745 040 000	-40 000	-0.000 70
		-20	5 744 920 000	80 000	0.001 39
85	10.0	20	5 744 940 000	60 000	0.001 04
115	12.2	20	5 745 040 000	-40 000	-0.000 70

-5 785 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 784 920 000	80 000	0.001 38
		40	5 784 780 500	219 500	0.003 79
		30	5 784 820 500	179 500	0.003 10
		20	5 784 820 500	179 500	0.003 10
		10	5 784 800 500	199 500	0.003 45
		0	5 784 860 500	139 500	0.002 41
		-10	5 784 800 500	199 500	0.003 45
		-20	5 784 860 500	139 500	0.002 41
85	10.0	20	5 784 800 500	199 500	0.003 45
115	12.2	20	5 784 900 000	100 000	0.001 73

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Report No.:
KR17-SRF0077-B

Page (111) of (115)

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-5 825 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 824 880 500	119 500	0.002 05
		40	5 824 760 500	239 500	0.004 11
		30	5 824 620 500	379 500	0.006 52
		20	5 824 900 000	100 000	0.001 72
		10	5 824 800 500	199 500	0.003 42
		0	5 824 900 500	99 500	0.001 71
		-10	5 824 840 500	159 500	0.002 74
		-20	5 825 020 000	-20 000	-0.000 34
85	10.0	20	5 824 760 500	239 500	0.004 11
115	12.2	20	5 824 660 500	339 500	0.005 83

-5 755 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 754 760 000	240 000	0.004 17
		40	5 754 680 000	320 000	0.005 56
		30	5 754 814 500	185 500	0.003 22
		20	5 754 879 500	120 500	0.002 09
		10	5 754 800 000	200 000	0.003 48
		0	5 754 960 000	40 000	0.000 70
		-10	5 754 920 000	80 000	0.001 39
		-20	5 754 840 000	160 000	0.002 78
85	10.0	20	5 754 960 000	40 000	0.000 70
115	12.2	20	5 754 281 000	719 000	0.012 49

-5 795 MHz

Voltage [%]	Power [W]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [%]
100	11.1	50	5 794 800 000	200 000	0.003 45
		40	5 794 760 000	240 000	0.004 14
		30	5 794 510 500	489 500	0.008 45
		20	5 794 840 000	160 000	0.002 76
		10	5 794 920 000	80 000	0.001 38
		0	5 794 760 000	240 000	0.004 14
		-10	5 794 880 000	120 000	0.002 07
		-20	5 794 960 000	40 000	0.000 69
85	10.0	20	5 794 720 000	280 000	0.004 83
115	12.2	20	5 794 760 000	240 000	0.004 14

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5.7 Conducted Emission

5.7.1 Regulation

According to §15.207(a), for an 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 frequency or frequencies, 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 Ω 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.

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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.7.2 Measurement Procedure

- 1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

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Report No.:
KR17-SRF0077-B
Page (114) of (115)

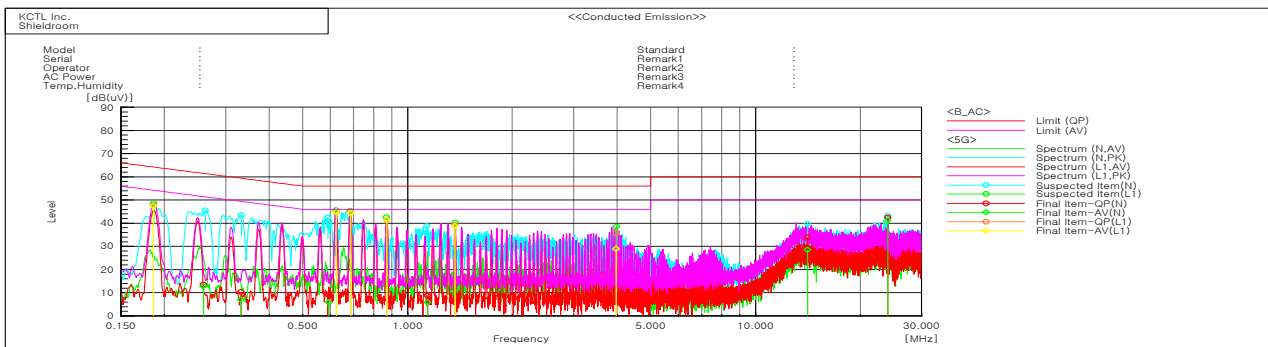


5.7.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

- Conducted worst-case data : 802.11n 20_ANT 1_Highest Chanel (5 240 MHz)



Final Result

N Phase									
No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin [dB]
1	0.25915	3.9	3.2	9.6	13.5	12.8	61.5	51.5	48.0
2	0.3318	0.6	-2.7	9.7	10.3	7.0	59.4	49.4	49.1
3	0.59224	-0.7	-3.9	9.8	9.1	5.9	56.0	46.0	46.9
4	1.14044	-0.9	-3.9	9.7	8.8	5.8	56.0	46.0	47.2
5	14.09394	23.9	18.5	10.0	33.9	28.5	60.0	50.0	26.1
6	23.99984	32.3	31.0	10.1	42.4	41.1	60.0	50.0	17.6

L1 Phase									
No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin [dB]
1	0.18608	37.8	37.2	10.1	47.9	47.3	64.2	54.2	16.3
2	0.62299	34.9	34.9	9.9	44.8	44.8	56.0	46.0	11.2
3	0.68507	35.1	34.4	9.9	45.0	44.3	56.0	46.0	11.0
4	0.87058	31.7	31.7	9.8	41.5	41.5	56.0	46.0	14.5
5	1.36692	29.4	28.9	9.8	39.2	38.7	56.0	46.0	16.8
6	3.97682	25.8	19.1	9.8	35.6	28.9	56.0	46.0	20.4

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Report No.:
KR17-SRF0077-B

Page (115) of (115)



6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Bilog Antenna	SCHWARZBECK	VULB9163	552	18.05.10
■	AMPLIFIER	SONOMA	310N	186280	18.04.06
■	ATTENUATOR	HP	8491A	16861	18.04.06
■	Horn Antenna	ETS.lindgren	3115	62589	17.11.11
■	Amplifier	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	18.06.12
■	Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	17.08.29
■	Horn Antenna	ETS.lindgren	3116	00086632	18.02.10
■	Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	17.08.23
■	High Pass Filter	WT	WT-A1699-HS	WT160411002	18.05.15
■	EMI TEST RECEIVER	R & S	ESCI	101408	17.08.25
■	Turn Table	Innco Systems	DT2000	79	-
■	Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
■	EMI TEST RECEIVER	R & S	ESCI	100001	17.10.20
■	TWO-LINE V-NETWORK	R & S	ENV216	101358	17.08.16
■	EMI TEST RECEIVER	R & S	ESCI7	100732	17.08.25
■	AMPLIFIER	SONOMA	310N	344922	17.08.26
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000	79	-
■	Loop Antenna	R & S	HFH2-Z2	100355	18.03.03
■	Spectrum Analyzer	R & S	FSV40	100988	18.01.06
■	Spectrum Analyzer	R & S	FSV30	100810	17.08.31
■	Signal Generator	R & S	SMR40	100007	18.05.15
■	Vector Signal Generator	R & S	SMBV100A	257566	18.01.06
■	Temp & Humid Chamber	Daejin Engineering	DJ-THR11000	10041	18.01.31
■	Cable Assembly	Radiall	-	-	-
■	Cable Assembly	HUER+SUHNER	SUCOFLEX 102	my3566/2	-
■	Cable Assembly	Gigalane	RF-400	-	-
■	Cable Assembly	Gigalane	RF-400	-	-
■	Cable Assembly	Radiall	2301762000PJ	1724.661	-

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KCTL-TIR001-003/2