



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.: KR21-SRF0136 Page (1) of (127)	
<p>1. Client</p> <ul style="list-style-type: none"> ◦ Name : Samsung Electronics Co., Ltd. ◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea ◦ Date of Receipt : 2021-04-13 <p>2. Use of Report : Certification</p> <p>3. Name of Product / Model : Mobile Phone / SM-M225FV/DS</p> <p>4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam</p> <p>5. FCC ID : A3LSMM225FV</p> <p>6. Date of Test : 2021-05-11 to 2021-06-10</p> <p>7. Location of Test <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address:65,Sinwon-roYeongtong-gu,Suwon-si,Gyeonggi-do,16677, Korea)</p> <p>8. Test method used : FCC Part 15 Subpart E, 15.407</p> <p>9. Test Results : Refer to the test result in the test report</p>		
Affirmation	Tested by Name : Taeyoung Kim (Signature)	Technical Manager Name : Seungyong Kim (Signature)
2021-06-14		
<h2>KCTL Inc.</h2>		
As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.		

REPORT REVISION HISTORY

Date	Revision	Page No
2021-06-14	Originally issued	-

This report shall not be reproduced except in full, without the written approval of KCTL Inc. This document may be altered or revised by KCTL Inc. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KCTL Inc. will constitute fraud and shall nullify the document. This test report is a general report that does not use the KOLAS accreditation mark and is not related to KS Q ISO/IEC 17025 and KOLAS accreditation.

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

Statement not required by the standard or client used for type testing

CONTENTS

1.	General information	4
2.	Device information	4
2.1.	Frequency/channel operations.....	6
2.2.	Simultaneous Tx Condition	7
2.3.	Duty Cycle Factor	7
3.	Antenna requirement	9
4.	Summary of tests	10
5.	Measurement uncertainty	11
6.	Measurement results explanation example	12
7.	Test results	13
7.1.	Maximum conducted output power	13
7.2.	Maximum Power Spectral Density	18
7.3.	26 dB Bandwidth & 99% Bandwidth.....	27
7.4.	6 dB Bandwidth.....	37
7.5.	Straddle channel.....	40
7.6.	Spurious Emission, Band Edge and Restricted bands.....	48
7.7.	AC Conducted emission	125
8.	Measurement equipment	127

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.:
KR21-SRF0136
Page (4) of (127)



1. General information

Client : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677,
Rep. of Korea
Manufacturer : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677,
Rep. of Korea
Factory : Samsung Electronics Vietnam Co., Ltd.
Address : Yen Phong Industrial Zone 1, Yen Trung, Yen Phong, Bac Ninh Province,
Vietnam
Laboratory : KCTL Inc.
Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
CAB Identifier: KR0040
ISED Number: 8035A
KOLAS No.: KT231

2. Device information

Equipment under test : Mobile Phone
Model : SM-M225FV/DS
Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
Bluetooth(BLE)_GFSK
WIFI(802.11a/b/g/n/ac)_DSSS, OFDM
LTE_QPSK, 16QAM, 64QAM
WCDMA_QPSK
GSM_GMSK, 8-PSK
NFC_ASK
Number of channels : Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch
802.11b/g/n_HT20 : 13 ch
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
NFC: 1 ch
Power source : DC 3.86 V
Antenna specification : LTE/WCDMA/GSM_FPCB Antenna
WIFI/Bluetooth(BDR/EDR/BLE)_FPCB Antenna
NFC_FPCB Antenna

Antenna gain : WIFI/Bluetooth(BDR/EDR/BLE)_-4.00 dBi
UNII-1 : -5.40 dBi
UNII-2A : -5.80 dBi
UNII-2C : -4.60 dBi
UNII-3 : -4.90 dBi

Frequency range : Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz
2 412 MHz ~ 2 472 MHz (802.11b/g/n_HT20)
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n/ac_HT20/VHT20)
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n/ac_HT40/VHT40)
UNII-1: 5 210 MHz (802.11ac_VHT80)
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n/ac_HT40/VHT40)
UNII-2A: 5 290 MHz (802.11ac_VHT80)
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n/ac_HT40/VHT40)
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n/ac_HT20/VHT20)
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n/ac_HT40/VHT40)
UNII-3: 5 775 MHz (802.11ac_VHT80)
LTE Band 2_1 850.7 MHz ~ 1 909.3 MHz
LTE Band 4_1 710.7 MHz ~ 1 754.3 MHz
LTE Band 5_824.7 MHz ~ 848.3 MHz
LTE Band 12_699.7 MHz ~ 715.3 MHz
LTE Band 17_706.5 MHz ~ 713.5 MHz
LTE Band 26_824.7 MHz ~ 848.3 MHz, 814.7 MHz ~ 823.3 MHz
LTE Band 41_2 498.5 MHz ~ 2 687.5 MHz
LTE Band 66_1 710.7 MHz ~ 1 779.3 MHz
GSM 850_824.2 MHz ~ 848.8 MHz
GSM 1900_1 850.2 MHz ~ 1 909.8 MHz
WCDMA 850_826.4 MHz ~ 846.6 MHz
WCDMA 1700_1 712.4 MHz ~ 1 752.6 MHz
WCDMA 1900_1 852.4 MHz ~ 1 907.6 MHz
NFC_13.56 MHz

Software version : M225F.001
Hardware version : REV1.0
Test device serial No. : Conducted(R38R401JFWX)
Radiated(R38R401K16R)

Operation temperature : -30 °C ~ 50 °C

2.1. Frequency/channel operations

This device contains the following capabilities:

WiFi (802.11a/b/g/n/ac), Bluetooth (BDR/EDR/BLE), NFC

LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 17, LTE Band 26, LTE Band 41,
LTE Band 66, GSM 850, GSM 1900, WCDMA 850, WCDMA 1700, WCDMA 1900**UNII-1**

Ch.	Frequency (MHz)
36	5 180
40	5 200
48	5 240

UNII-2A

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

UNII-2C

Ch.	Frequency (MHz)
100	5 500
120	5 600
140	5 700
144	5 720

UNII-3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

Table 2.1-1. 802.11a/n/ac_HT20/VHT20 mode

UNII-1

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-2A

Ch.	Frequency (MHz)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (MHz)
102	5 510
118	5 590
134	5 670
142	5 710

UNII-3

Ch.	Frequency (MHz)
151	5 755
159	5 795

Table 2.1-2. 802.11n/ac_HT40/VHT40 mode

UNII-1

Ch.	Frequency (MHz)
42	5 210

UNII-2A

Ch.	Frequency (MHz)
58	5 290

UNII-2C

Ch.	Frequency (MHz)
106	5 530
122	5 610
138	5 690

UNII-3

Ch.	Frequency (MHz)
155	5 775

Table 2.1-3. 802.11ac_VHT80 mode

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.:
KR21-SRF0136
Page (7) of (127)



2.2. Simultaneous Tx Condition

Mode	Bluetooth	WLAN 5 GHz
WLAN 5 GHz + Bluetooth	O	O

2.3. Duty Cycle Factor

Test mode	Period (ms)	T _{on} time (ms)	Duty cycle		Duty cycle factor (dB)
			(Linear)	(%)	
802.11a	1.432 8	1.387 2	0.968 2	96.82	0.14
802.11n_HT20	1.341 0	1.294 8	0.965 5	96.55	0.15
802.11n_HT40	0.692 4	0.6471	0.934 6	93.46	0.29
802.11ac_VHT20	1.353 0	1.307 4	0.966 3	96.63	0.15
802.11ac_VHT40	0.696 3	0.651 3	0.935 4	93.54	0.29
802.11ac_VHT80	0.368 8	0.324 0	0.878 5	87.85	0.56

Notes.

1. Duty cycle (Linear) = T_{on} time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if duty cycle is more than 98%

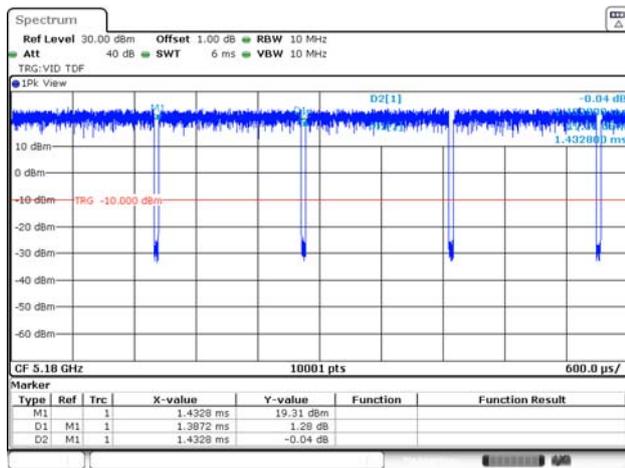
KCTL Inc.

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

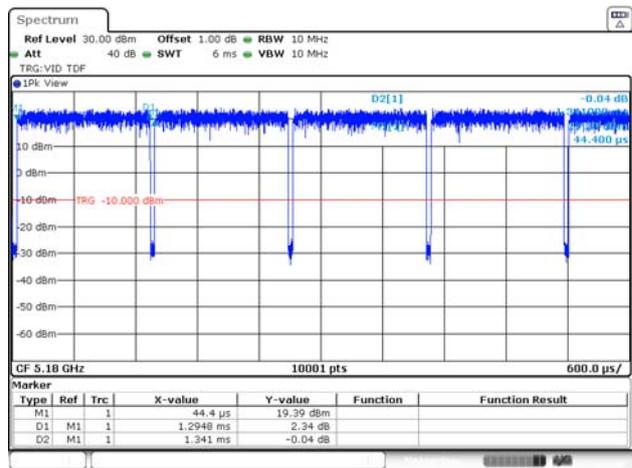
Report No.:
KR21-SRF0136
Page (8) of (127)



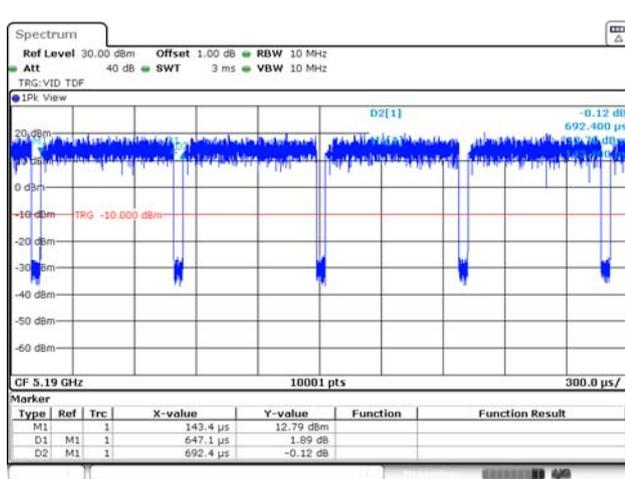
802.11a



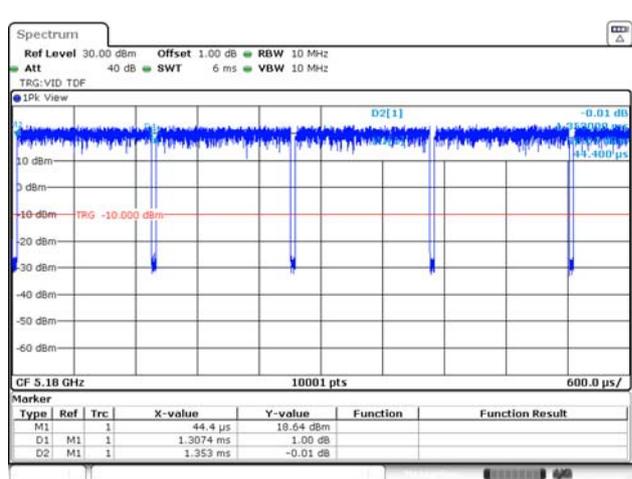
802.11n_HT20



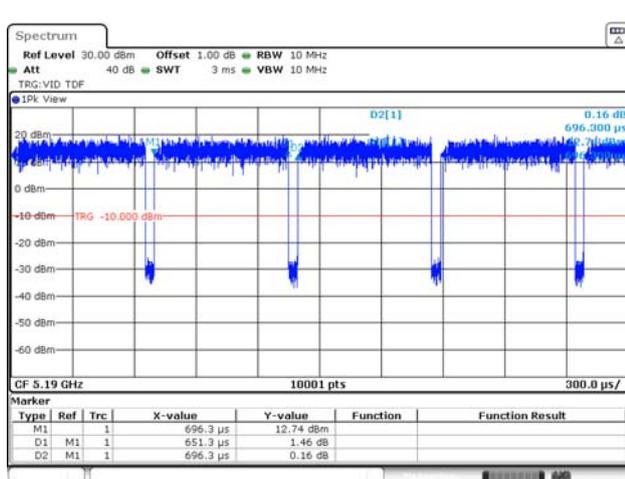
802.11n_HT40



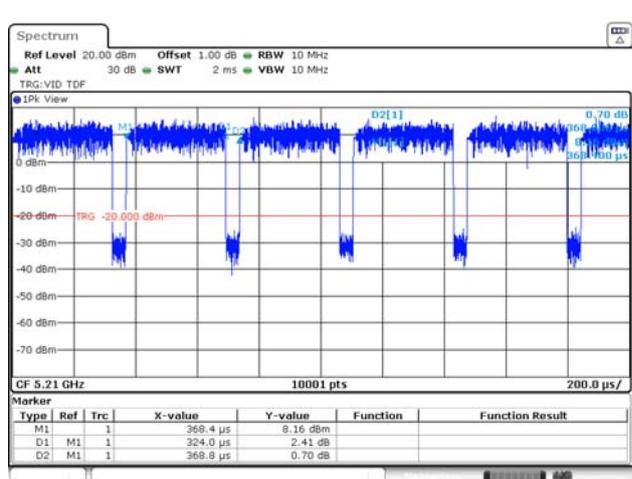
802.11ac_VHT20



802.11ac_VHT40



802.11ac_VHT80



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.:
KR21-SRF0136
Page (9) of (127)

**3. Antenna requirement**

Requirement of FCC part section 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 transmitter has permanently attached FPCB Antenna (Internal antenna) on board.

4. Summary of tests

FCC Part section(s)	Parameter	Test Condition	Test results
15.407(a)	Maximum conducted output power	Conducted	Pass
15.407(a)	Maximum power spectral density		Pass
15.407(a)	26 dB Channel Bandwidth		Pass
15.407(e)	6 dB Channel Bandwidth		Pass
15.207(a)	AC Conducted Emissions		Pass
15.407(b), 15.205(a), 15.209(a)	Spurious emission	Radiated	Pass
	Band-edge, restricted band		Pass

Notes:

- All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field 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.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Z** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Z** orientation.
- All the radiated tests have been performed several case.
(Stand-alone, with TA, with Earphone)
Worst case: Stand-alone
- The test procedure(s) in this report were performed in accordance as following.
 - ANSI C63.10-2013
 - KDB 789033 D02 v02r01
- Based on the baseline scan, the worst-case data rates were:
 - 802.11a mode: 6Mbps
 - 802.11n HT20 mode: MCS0
 - 802.11n HT40 mode: MCS0
 - 802.11ac VHT20 mode: MCS0
 - 802.11ac VHT40 mode: MCS0
 - 802.11ac VHT80 mode: MCS0

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.:
KR21-SRF0136
Page (11) of (127)



5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (\pm)	
Conducted RF power	0.9 dB	
Conducted spurious emissions	1.6 dB	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.3 dB
	30 MHz ~ 1 000 MHz	2.2 dB
	1 000 MHz ~ 18 000 MHz	5.6 dB
	Above 18 000 MHz	5.7 dB
Conducted emissions	9 kHz ~ 150 kHz	3.7 dB
	150 kHz ~ 30 MHz	3.3 dB

6. Measurement results explanation example

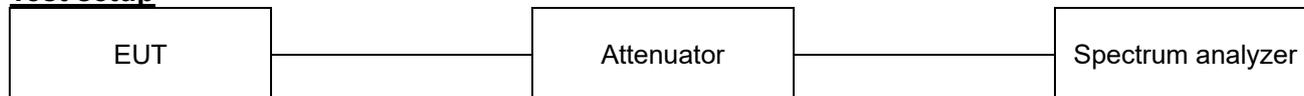
The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.

With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
30	9.92	9 000	13.25
50	9.99	10 000	13.27
100	10.06	11 000	13.35
200	10.19	12 000	13.47
300	10.29	13 000	13.51
400	10.34	14 000	13.54
500	10.39	15 000	13.55
600	10.46	16 000	13.71
700	10.49	17 000	13.73
800	10.54	18 000	13.75
900	10.55	19 000	13.76
1 000	10.56	20 000	13.84
2 000	11.27	21 000	13.85
3 000	11.63	22 000	13.96
4 000	12.01	23 000	14.25
5 000	12.33	24 000	14.45
6 000	12.71	25 000	14.65
7 000	12.72	26 000	14.83
8 000	13.02	26 500	15.21

Notes:

Offset(dB) = RF cable loss(dB) + Attenuator(dB)

7. Test results**7.1. Maximum conducted output power****Test setup****Limit**

According to §15.407(a),

Band	EUT category		Conducted output power limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	250 mW (23.98 dBm)
UNII-2A		√	250 mW or 11 dBm + 10logB ¹⁾
UNII-2C		√	250 mW or 11 dBm + 10logB ¹⁾
UNII-3		√	1 W (30 dBm)

Note:

1) Conducted output power limit B is the 26 dB emission bandwidth.

Test procedureANSI C63.10-2013-Section 12.3.3.2 and 14.2
KDB 789033 D02 v02r01 - Section E.2.d) or e)

Test settings**Used test method is Section E.2.d)**◆ **KDB 789033 D02 v02r01****Section E.2.d)****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 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 RBW \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 $10 \log(1/0,25) = 6$ dB if the duty cycle is 25%.

Section E.2.e)**Method SA-2 Alternative (power averaging(rms) detection with slow sweep with each spectrum bin 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 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 RBW \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) Manually set sweep time $\geq 10 \times (\text{number of points in sweep}) \times (\text{total on/off period of the transmitted signal})$.
- (vii) Set detector = power averaging (rms)
- (viii) Perform a single sweep.
- (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.

- (x) 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 $10 \log(1/0.25) = 6$ dB if the duty cycle is 25%.

Section E.3.a)

Method PM (Measurement using an RF average power meter):

- (xi) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five
- (xii) If the transmitter does not transmit continuously, measure the duty cycle, x , of the transmitter output signal as described in II
- (xiii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- (xiv) Adjust the measurement in dBm by adding $10 \log(1/x)$ where x is the duty cycle (e.g., $10 \log(1/0.25)$ if the duty cycle is 25%).

Section E.3.b)

Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

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.:
KR21-SRF0136
Page (16) of (127)

**Test results**

Test mode	Band	Frequency (MHz)	Measured output power			Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)	
802.11a	UNII 1	5 180	17.30	0.14	17.44	23.98
		5 200	17.36	0.14	17.50	
		5 240	17.55	0.14	17.69	
	UNII 2A	5 260	17.06	0.14	17.20	23.96
		5 280	17.29	0.14	17.43	
		5 320	17.31	0.14	17.45	
	UNII 2C	5 500	17.69	0.14	17.83	23.97
		5 600	17.41	0.14	17.55	
		5 700	17.74	0.14	17.88	
	UNII 3	5 745	16.76	0.14	16.90	30.00
		5 785	16.35	0.14	16.49	
		5 825	16.40	0.14	16.54	
802.11n HT20	UNII 1	5 180	17.34	0.15	17.49	23.98
		5 200	17.01	0.15	17.16	
		5 240	17.19	0.15	17.34	
	UNII 2A	5 260	16.93	0.15	17.08	23.98
		5 280	16.96	0.15	17.11	
		5 320	16.97	0.15	17.12	
	UNII 2C	5 500	17.56	0.15	17.71	23.98
		5 600	16.90	0.15	17.05	
		5 700	17.54	0.15	17.69	
	UNII 3	5 745	16.17	0.15	16.32	30.00
		5 785	15.99	0.15	16.14	
		5 825	16.15	0.15	16.30	
802.11n HT40	UNII 1	5 190	15.05	0.29	15.34	23.98
		5 230	14.92	0.29	15.21	
	UNII 2A	5 270	14.74	0.29	15.03	23.98
		5 310	14.87	0.29	15.16	
	UNII 2C	5 510	14.97	0.29	15.26	23.98
		5 590	14.73	0.29	15.02	
		5 670	14.89	0.29	15.18	
	UNII 3	5 755	14.79	0.29	15.08	30.00
		5 795	14.50	0.29	14.79	

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.:
KR21-SRF0136
Page (17) of (127)



Test mode	Band	Frequency (MHz)	Measured output power			Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)	
802.11ac VHT20	UNII 1	5 180	17.29	0.15	17.44	23.98
		5 200	17.16	0.15	17.31	
		5 240	17.37	0.15	17.52	
	UNII 2A	5 260	16.88	0.15	17.03	23.98
		5 280	17.05	0.15	17.20	
		5 320	16.92	0.15	17.07	
	UNII 2C	5 500	17.44	0.15	17.59	23.98
		5 600	16.90	0.15	17.05	
		5 700	17.36	0.15	17.51	
	UNII 3	5 745	16.02	0.15	16.17	30.00
		5 785	16.19	0.15	16.34	
		5 825	16.28	0.15	16.43	
802.11ac VHT40	UNII 1	5 190	15.06	0.29	15.35	23.98
		5 230	14.94	0.29	15.23	
	UNII 2A	5 270	14.84	0.29	15.13	23.98
		5 310	14.84	0.29	15.13	
	UNII 2C	5 510	14.90	0.29	15.19	23.98
		5 590	14.64	0.29	14.93	
		5 670	14.81	0.29	15.10	
	UNII 3	5 755	14.82	0.29	15.11	30.00
		5 795	14.62	0.29	14.91	
	802.11ac VHT80	UNII 1	5 210	13.63	0.56	14.19
UNII 2A		5 290	13.44	0.56	14.00	23.98
UNII 2C		5 530	13.38	0.56	13.94	23.98
		5 610	13.34	0.56	13.90	
UNII 3		5 775	13.30	0.56	13.86	30.00

Note.

1. Result(dBm) = Reading Power + D.C.F

7.2. Maximum Power Spectral Density

Test setup



Limit

According to §15.407(a)

Band	EUT category		Limit
UNII-1		Outdoor access point	17dBm/MHz
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	11 dBm /MHz
UNII-2A		√	11 dBm /MHz
UNII-2C		√	11 dBm /MHz
UNII-3		√	30 dBm /500 kHz

Notes:

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain if the antenna exceed 6 dBi

Test procedure

ANSI C63.10-2013 Section 12.3.2.2, 14.3.2.2
 KDB 789033 D02 v02r01 - Section F

Test settings

Section F

The rules requires “maximum power spectral density” measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. Refer to III.A for additional guidance for devices that use channel aggregation.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in 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. Search function on the instrument to find the peak of the spectrum and record its value.
3. 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 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 1MHz 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 preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference

bandwidth specified in Section 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 RBWs less than 1MHz, 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 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

- a) Set $RBW \geq 1/T$, where T is defined in II.B.I.a).
- b) Set $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log(500 \text{ kHz} / RBW)$ to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log(1\text{MHz}/RBW)$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
- e) 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 II.F.5.c) and II.F.5.d), since $RBW=100 \text{ kHz}$ is available on nearly all spectrum analyzers.

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.:
KR21-SRF0136
Page (20) of (127)

**Test results**

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII 1	5 180	7.12	0.14	7.26	11
		5 200	6.80	0.14	6.94	
		5 240	7.04	0.14	7.18	
	UNII 2A	5 260	6.95	0.14	7.09	11
		5 280	6.82	0.14	6.96	
		5 320	7.06	0.14	7.20	
	UNII 2C	5 500	7.46	0.14	7.60	11
		5 600	6.79	0.14	6.93	
		5 700	7.45	0.14	7.59	
802.11n HT20	UNII 1	5 180	6.66	0.15	6.81	11
		5 200	6.53	0.15	6.68	
		5 240	6.83	0.15	6.98	
	UNII 2A	5 260	6.58	0.15	6.73	11
		5 280	6.50	0.15	6.65	
		5 320	6.91	0.15	7.06	
	UNII 2C	5 500	7.18	0.15	7.33	11
		5 600	6.55	0.15	6.70	
		5 700	6.91	0.15	7.06	
802.11n HT40	UNII 1	5 190	1.70	0.29	1.99	11
		5 230	1.57	0.29	1.86	
	UNII 2A	5 270	1.55	0.29	1.84	11
		5 310	1.75	0.29	2.04	
	UNII 2C	5 510	1.91	0.29	2.20	11
		5 590	1.29	0.29	1.58	
802.11ac VHT20	UNII 1	5 180	7.00	0.15	7.15	11
		5 200	6.68	0.15	6.83	
		5 240	6.69	0.15	6.84	
	UNII 2A	5 260	6.55	0.15	6.70	11
		5 280	6.64	0.15	6.79	
		5 320	6.42	0.15	6.57	
	UNII 2C	5 500	7.09	0.15	7.24	11
		5 600	6.41	0.15	6.56	
		5 700	7.20	0.15	7.35	

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.:
KR21-SRF0136
Page (21) of (127)



Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dBm/MHz)	Limit (dBm/MHz)
802.11ac VHT40	UNII 1	5 190	1.81	0.29	2.10	11
		5 230	1.44	0.29	1.73	
	UNII 2A	5 270	1.73	0.29	2.02	11
		5 310	2.07	0.29	2.36	
	UNII 2C	5 510	1.65	0.29	1.94	11
		5 590	1.47	0.29	1.76	
5 670		1.82	0.29	2.11		
802.11ac VHT80	UNII 1	5 210	-2.81	0.56	-2.25	11
	UNII 2A	5 290	-2.85	0.56	-2.29	11
	UNII 2C	5 530	-3.28	0.56	-2.72	11
		5 610	-2.56	0.56	-2.00	

Test mode	Band	Frequency (MHz)	Measured PSD (dBm /500 kHz)	DCF (dB)	Maximum PSD (dBm /500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII 3	5 745	3.90	0.14	4.04	30
		5 785	3.56	0.14	3.70	
		5 825	3.82	0.14	3.96	
802.11n HT20		5 745	3.44	0.15	3.59	
		5 785	3.36	0.15	3.51	
		5 825	3.38	0.15	3.53	
802.11n HT40		5 755	-1.21	0.29	-0.92	
		5 795	-1.17	0.29	-0.88	
802.11ac VHT20		5 745	3.20	0.15	3.35	
		5 785	3.38	0.15	3.53	
		5 825	3.61	0.15	3.76	
802.11ac VHT40		5 755	-1.25	0.29	-0.96	
		5 795	-0.84	0.29	-0.55	
802.11ac VHT80		5 775	-5.72	0.56	-5.16	

Notes:

- Maximum PSD calculation
- Maximum PSD = Measured PSD + D.C.F

KCTL Inc.

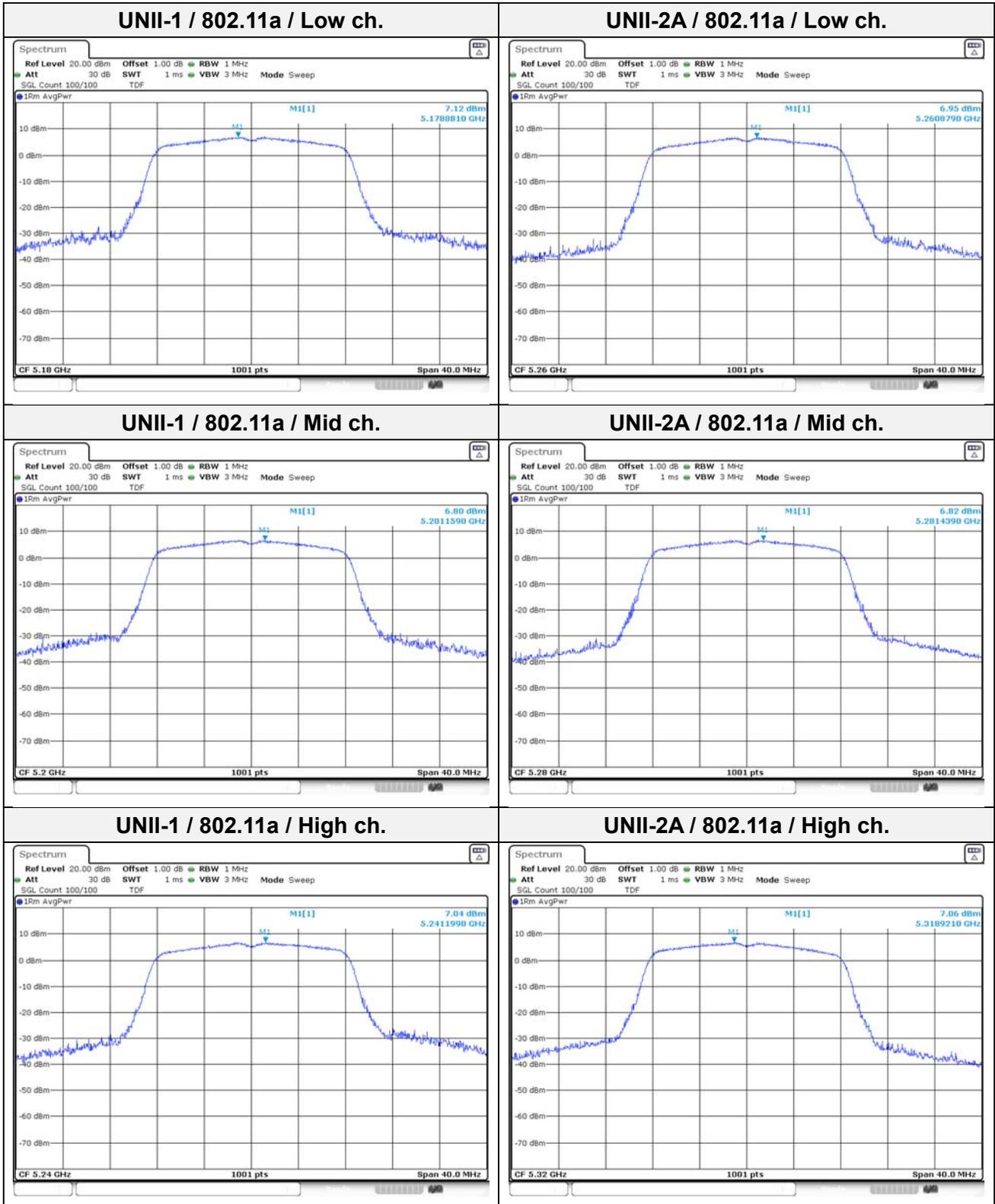
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (22) of (127)



Power Spectral Density

In order to simplify the report, attached plots were only the Worst Case per bandwidth.



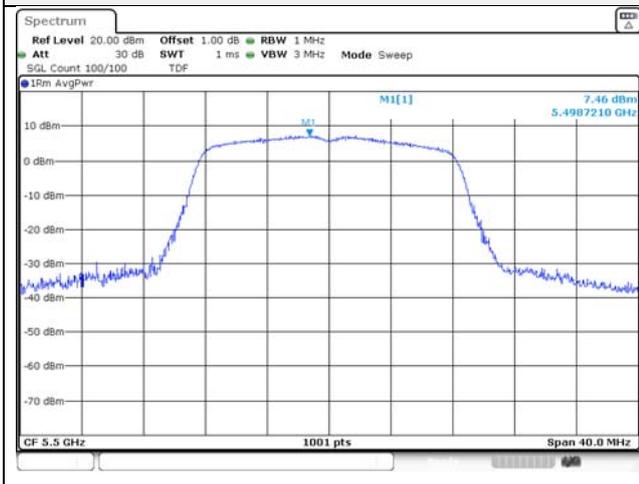
KCTL Inc.

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

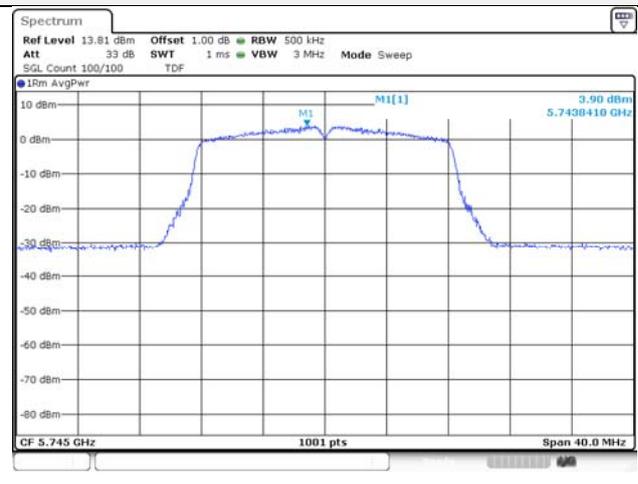
Report No.:
KR21-SRF0136
Page (23) of (127)



UNII-2C / 802.11a / Low ch.



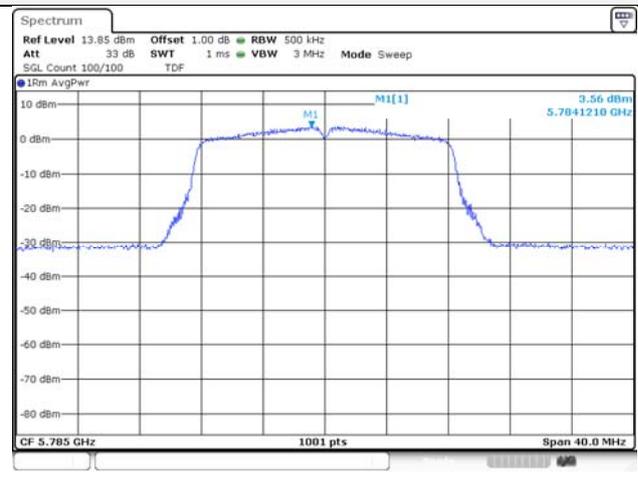
UNII-3 / 802.11a / Low ch.



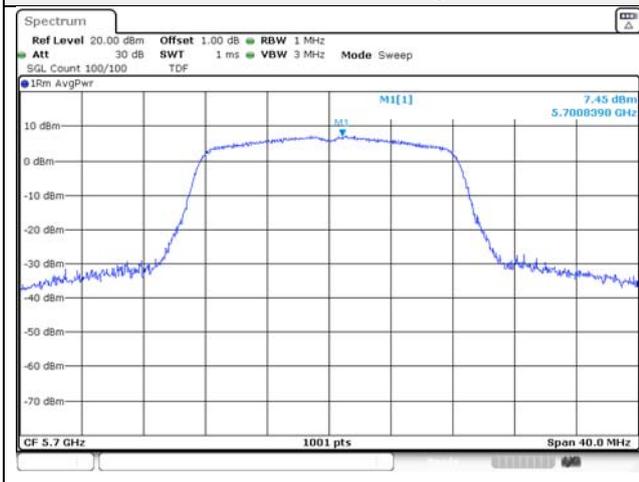
UNII-2C / 802.11a / Mid ch.



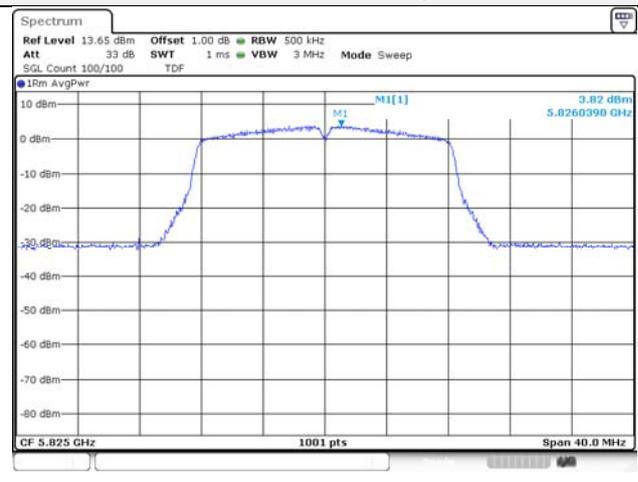
UNII-3 / 802.11a / Mid ch.



UNII-2C / 802.11a / High ch.



UNII-3 / 802.11a / High ch.



KCTL Inc.

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

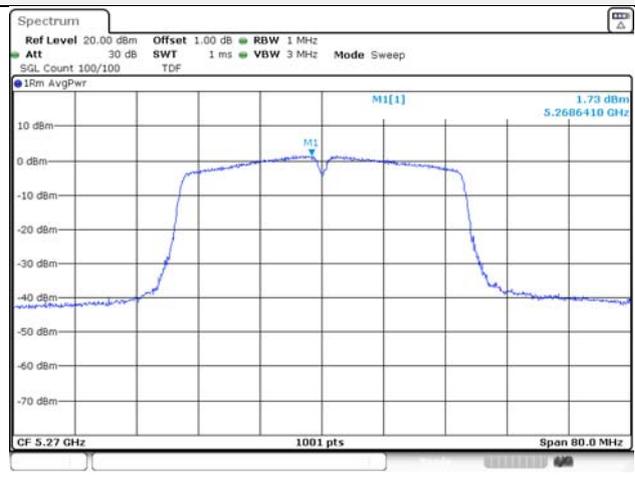
Report No.:
KR21-SRF0136
Page (24) of (127)



UNII-1 / 802.11ac VHT40 / Low ch.



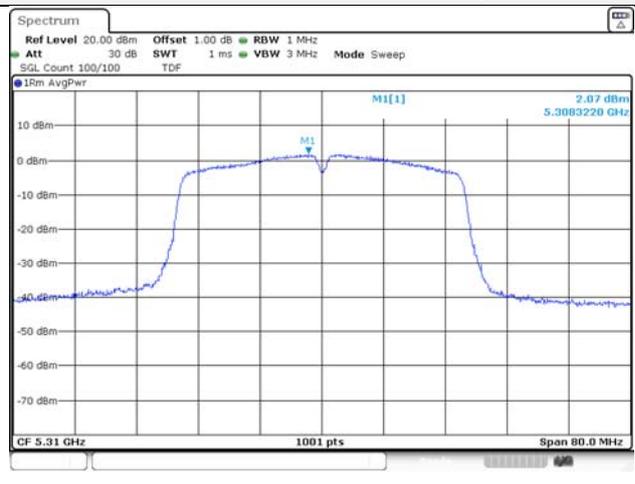
UNII-2A / 802.11ac VHT40 / Low ch.



UNII-1 / 802.11ac VHT40 / High ch.



UNII-2A 802.11ac VHT40 / High ch.



KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (25) of (127)



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



UNII-3 / 802.11ac VHT40 / Low ch.



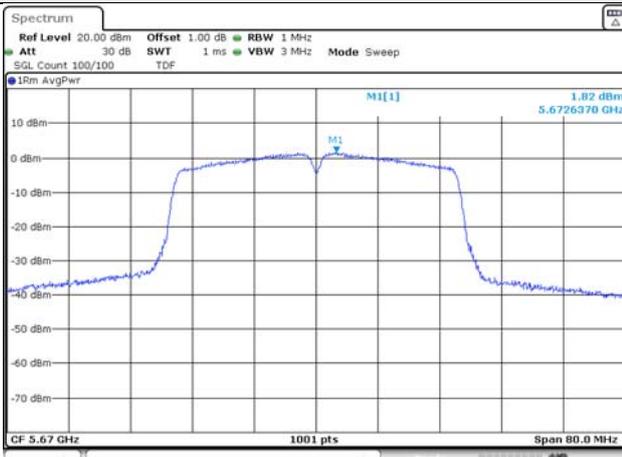
UNII-2C / 802.11ac VHT40 / Mid ch.



UNII-3 / 802.11ac VHT40 / High ch.



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



Blank

KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (26) of (127)



UNII-1 / 802.11ac VHT80 / Low ch.



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



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



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



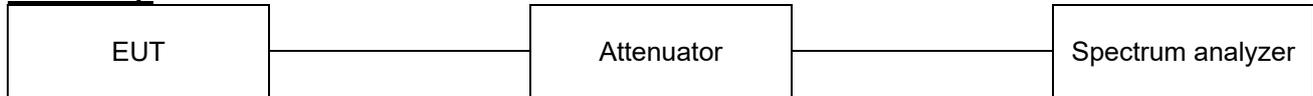
UNII-3 / 802.11ac VHT80 / Low ch.



Blank

7.3. 26 dB Bandwidth & 99% Bandwidth

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2013 Section 12.4

KDB 789033 D02 v02r01 - Section C.1 (26dB bandwidth)

KDB 789033 D02 v02r01 - Section D (99% bandwidth)

Test settings

1. 26 dB Bandwidth

- 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. 99% Occupied Bandwidth

- a. Set center frequency to the nominal EUT channel center frequency.
- b. Set span = 1.5 times to 5.0 times the OBW.
- c. Set RBW = 1% to 5% of the OBW
- d. Set VBW $\geq 3 \times$ RBW
- e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f. Use the 99% power bandwidth function of the instrument (if available).
- g. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

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.:
KR21-SRF0136
Page (28) of (127)

**Test results****26 dB bandwidth**

Test mode	Band	Frequency(MHz)	Measured Bandwidth (MHz)
802.11a	UNII-1	5 180	21.58
		5 200	19.98
		5 240	19.68
	UNII-2A	5 260	19.83
		5 280	19.88
		5 320	19.78
	UNII-2C	5 500	19.93
		5 600	19.98
		5 700	19.83
802.11n HT20	UNII-1	5 180	21.78
		5 200	20.93
		5 240	21.23
	UNII-2A	5 260	20.03
		5 280	20.33
		5 320	20.13
	UNII-2C	5 500	20.18
		5 600	20.38
		5 700	20.23
802.11n HT40	UNII-1	5 190	40.86
		5 230	41.06
	UNII-2A	5 270	41.06
		5 310	40.36
	UNII-2C	5 510	41.46
		5 590	40.96
		5 670	40.86

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.:
KR21-SRF0136
Page (29) of (127)



Test mode	Band	Frequency(MHz)	Measured Bandwidth (MHz)
802.11ac VHT20	UNII-1	5 180	20.13
		5 200	20.23
		5 240	20.23
	UNII-2A	5 260	20.28
		5 280	20.33
		5 320	20.23
	UNII-2C	5 500	20.08
		5 600	20.48
		5 700	20.28
802.11ac VHT40	UNII-1	5 190	40.96
		5 230	41.06
	UNII-2A	5 270	40.96
		5 310	40.66
	UNII-2C	5 510	40.06
		5 590	41.26
802.11ac VHT80	UNII-1	5 210	81.88
	UNII-2A	5 290	81.04
	UNII-2C	5 530	82.00
		5 610	81.52

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.:
KR21-SRF0136
Page (30) of (127)

**99% bandwidth**

Test mode	Band	Frequency(MHz)	Measured Bandwidth (MHz)
802.11a	UNII-1	5 240	16.53
	UNII-2A	5 260	16.48
802.11n HT20	UNII-1	5 240	17.73
	UNII-2A	5 260	17.58
802.11n HT40	UNII-1	5 230	36.36
	UNII-2A	5 270	36.16
802.11ac VHT20	UNII-1	5 240	17.68
	UNII-2A	5 260	17.58
802.11ac VHT40	UNII-1	5 230	36.26
	UNII-2A	5 270	36.16
802.11ac VHT80	UNII-1	5 210	75.40
	UNII-2A	5 290	74.93

KCTL Inc.

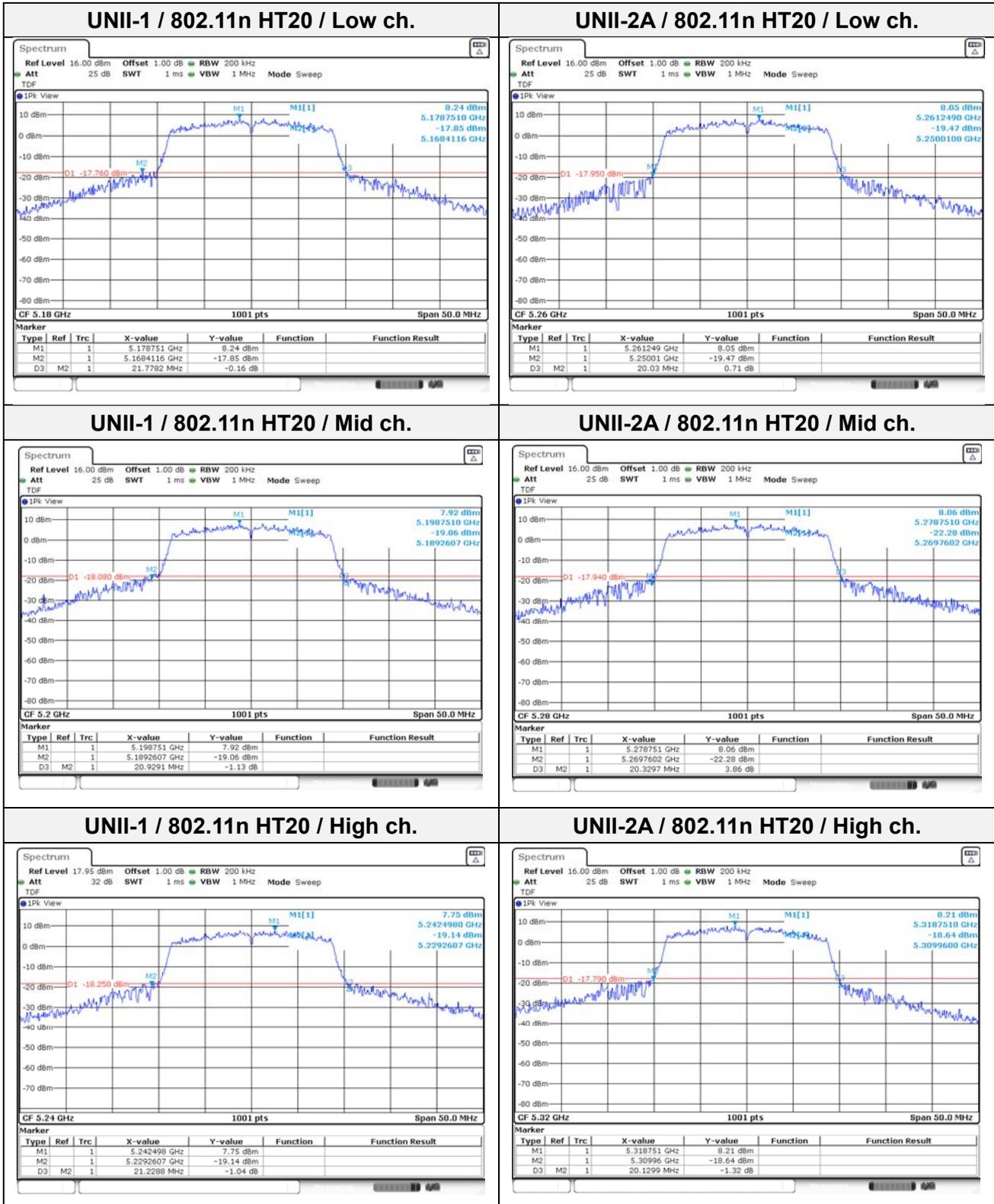
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (31) of (127)



26 dB bandwidth

In order to simplify the report, attached plots were only the Worst Case per bandwidth.



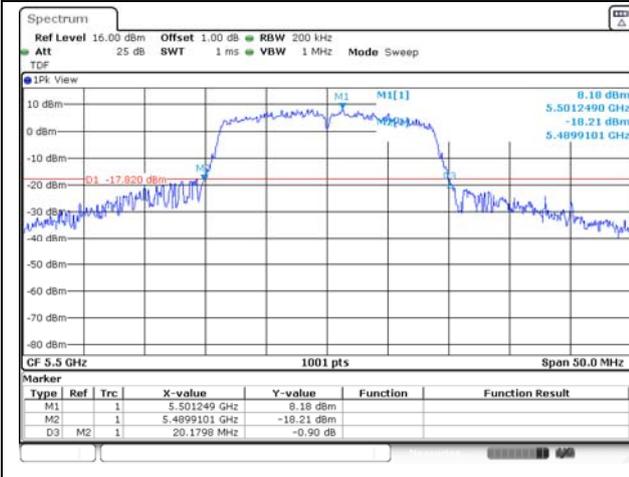
KCTL Inc.

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

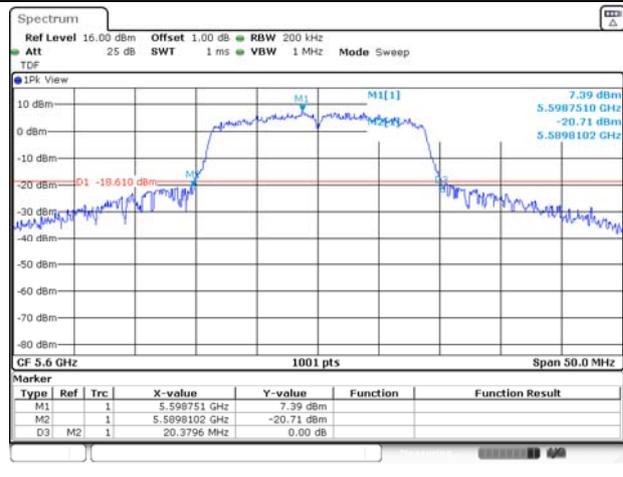
Report No.:
KR21-SRF0136
Page (32) of (127)



UNII-2C / 802.11n HT20 / Low ch.



UNII-2C / 802.11n HT20 / Mid ch.



UNII-2C / 802.11n HT20 / High ch.



Blank

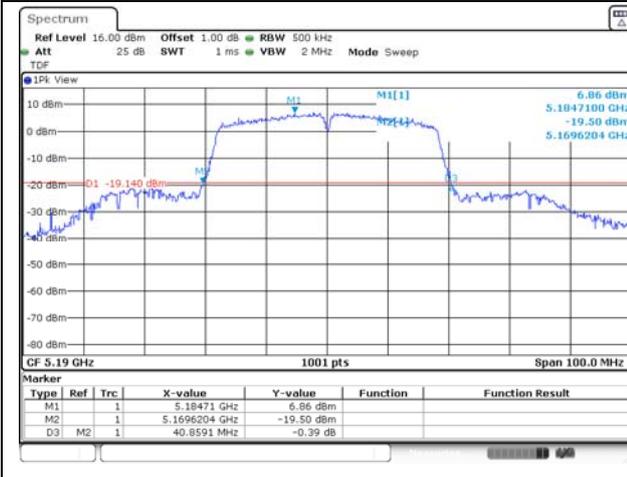
KCTL Inc.

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

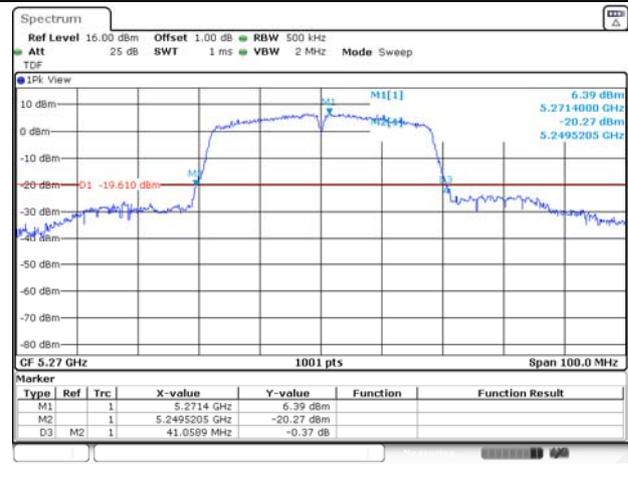
Report No.:
KR21-SRF0136
Page (33) of (127)



UNII-1 / 802.11n HT40 / Low ch.



UNII-2A / 802.11n HT40 / Low ch.



UNII-1 / 802.11n HT40 / High ch.



UNII-2A / 802.11n HT40 / High ch.



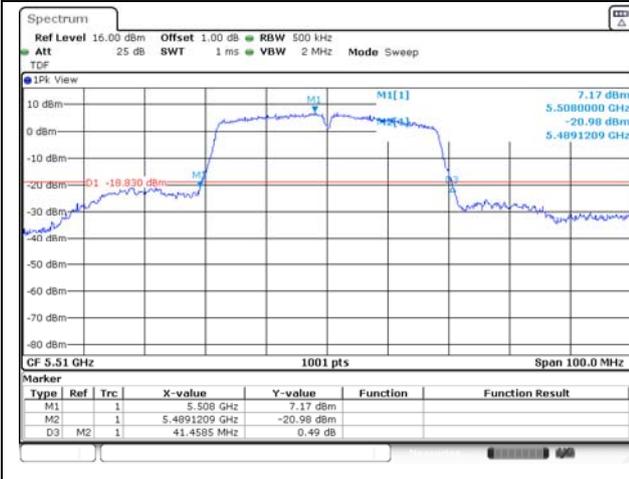
KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (34) of (127)



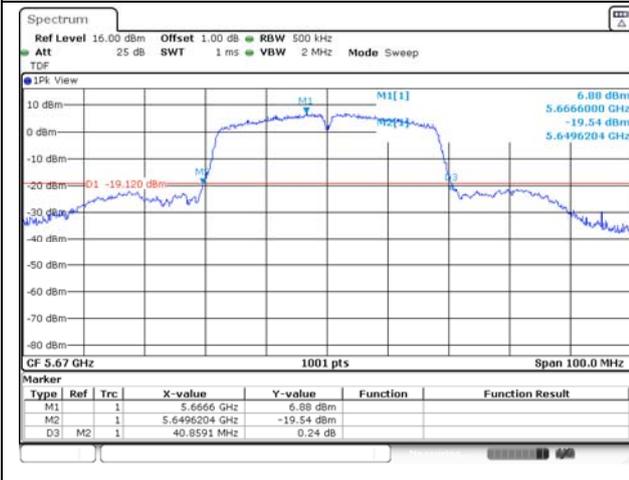
UNII-2C / 802.11n HT40 / Low ch.



UNII-2C / 802.11n HT40 / Mid ch.



UNII-2C / 802.11n HT40 / High ch.



Blank

KCTL Inc.

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

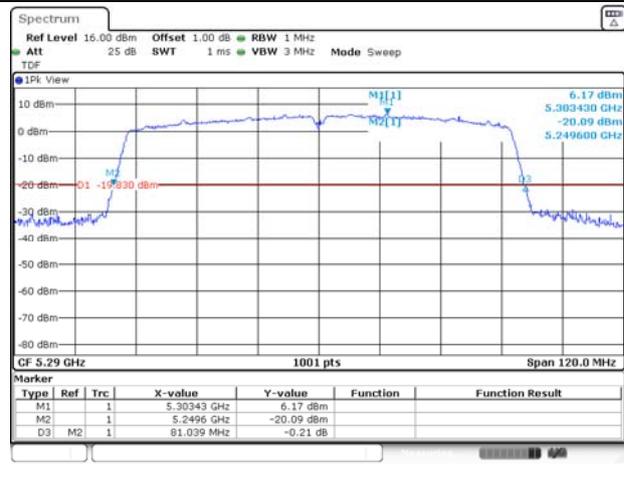
Report No.:
KR21-SRF0136
Page (35) of (127)



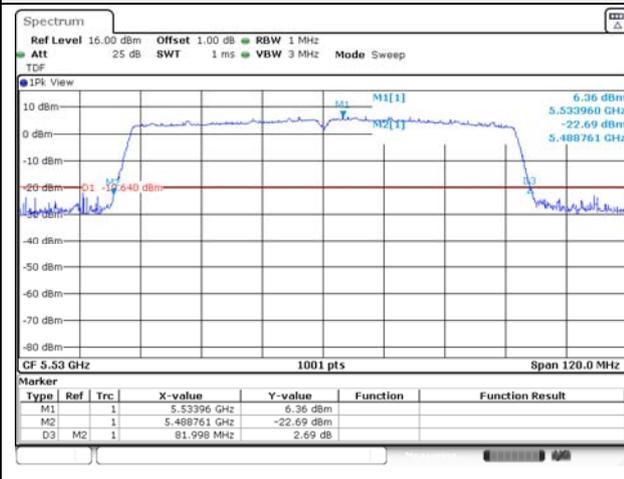
UNII-1 / 802.11ac VHT80 / Low ch.



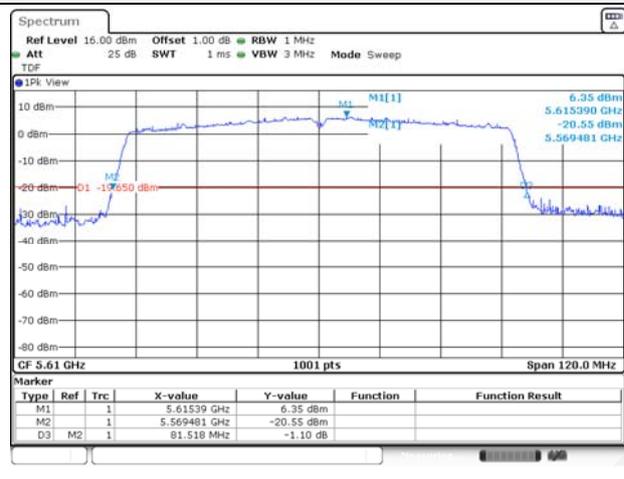
UNII-2A / 802.11ac VHT80 / Low ch.



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



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



KCTL Inc.

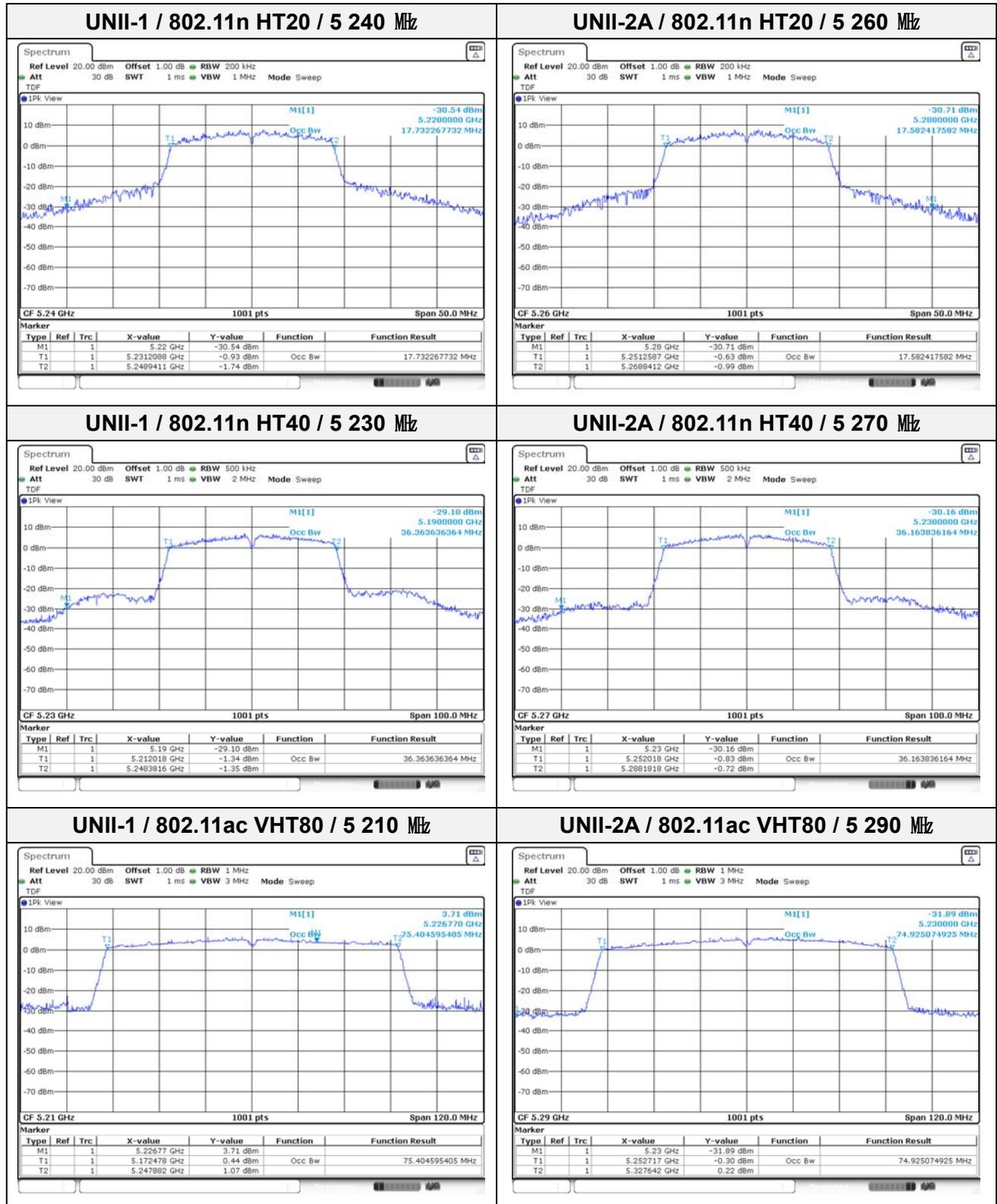
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (36) of (127)



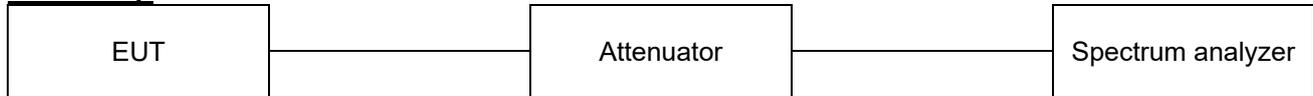
99% bandwidth

In order to simplify the report, attached plots were only the Worst Case per bandwidth.



7.4. 6 dB Bandwidth

Test setup



Limit

According to §15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth if U-NII devices shall be at least 500kHz

Test procedure

ANSI C63.10-2013 Section 6.9.2

KDB 789033 D02 v02r01 - Section C.2

Test settings

Minimum Emission Bandwidth for the band 5.725–5.85 GHz

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

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

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.:
KR21-SRF0136
Page (38) of (127)

**Test results**

Test mode	Band	Frequency (MHz)	Measured Bandwidth (MHz)	Limit (MHz)
802.11a	UNII-3	5 745	14.74	0.50
		5 785	15.13	0.50
		5 825	15.23	0.50
802.11n HT20	UNII-3	5 745	16.58	0.50
		5 785	15.18	0.50
		5 825	15.18	0.50
802.11n HT40	UNII-3	5 755	35.16	0.50
		5 795	35.26	0.50
802.11ac VHT20	UNII-3	5 745	15.23	0.50
		5 785	15.18	0.50
		5 825	15.78	0.50
802.11ac VHT40	UNII-3	5 755	35.16	0.50
		5 795	35.26	0.50
802.11ac VHT80	UNII-3	5 775	75.29	0.50

KCTL Inc.

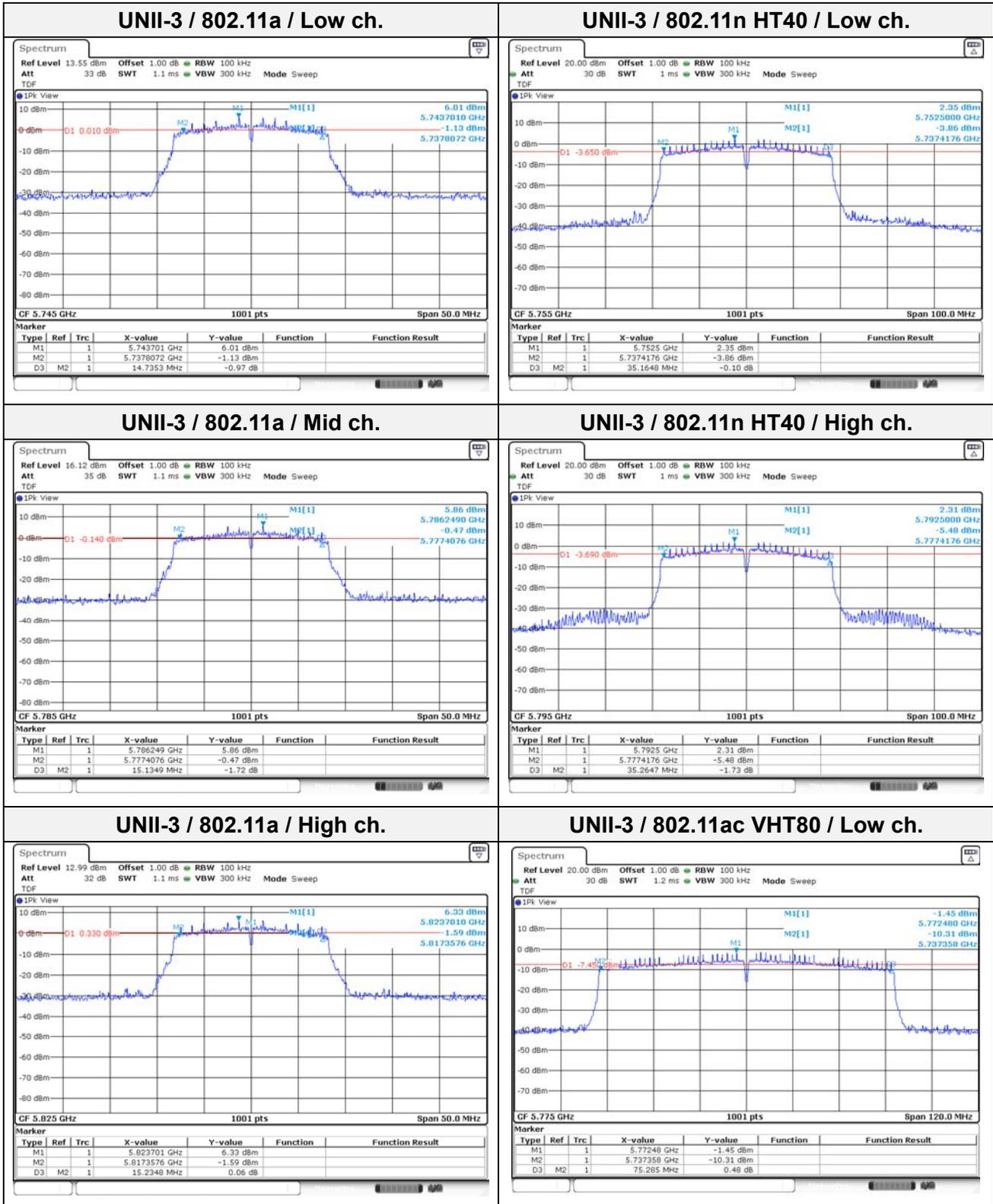
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (39) of (127)



6 dB bandwidth

In order to simplify the report, attached plots were only the Worst Case per bandwidth.



KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (40) of (127)



7.5. Straddle channel

26dB bandwidth

Test mode	Band	Frequency (MHz)	26dB Bandwidth (MHz)
802.11a	UNII-2C	5 720	15.04
802.11n HT20			15.19
802.11ac VHT20			15.09
802.11a	UNII-3	5 720	4.89
802.11n HT20			5.09
802.11ac VHT20			5.19
802.11n HT40	UNII-2C	5 710	35.38
802.11ac VHT40			35.68
802.11n HT40	UNII-3	5 710	5.58
802.11ac VHT40			5.58
802.11ac VHT80	UNII-2C	5 690	75.64
	UNII-3	5 690	6.00

Notes:

- [UNII-2C] 26dB Bandwidth = 5 725MHz – Measured Frequency[MHz]
- [UNII-3] 26dB Bandwidth = Measured Frequency[MHz] – 5 725MHz

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.:
 KR21-SRF0136
 Page (41) of (127)

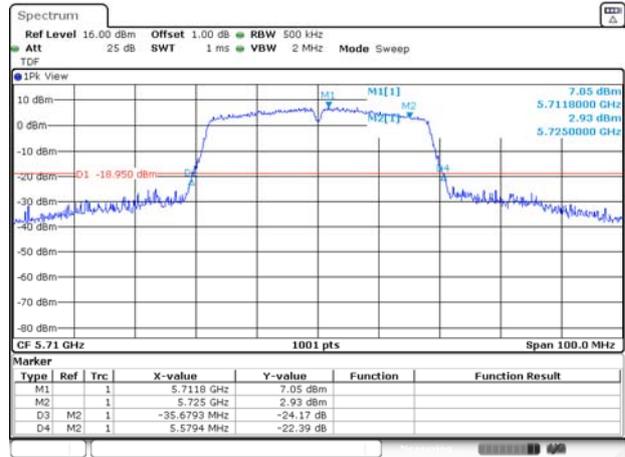


In order to simplify the report, attached plots were only the Worst Case per bandwidth.

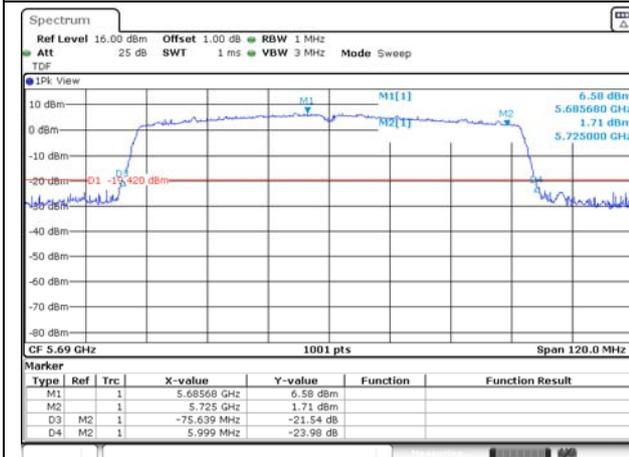
802.11ac VHT20



802.11ac VHT40



802.11ac VHT80



Blank

KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (42) of (127)

**6dB bandwidth**

Test mode	Band	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	UNII-3	5 720	2.59	0.50
802.11n HT20			2.59	0.50
802.11ac VHT20			2.59	0.50
802.11n HT40	UNII-3	5 710	2.68	0.50
802.11ac VHT40			2.68	0.50
802.11ac VHT80	UNII-3	5 690	2.64	0.50

Notes:

1. 6dB Bandwidth = Measured Frequency[MHz] – 5 725MHz

KCTL Inc.

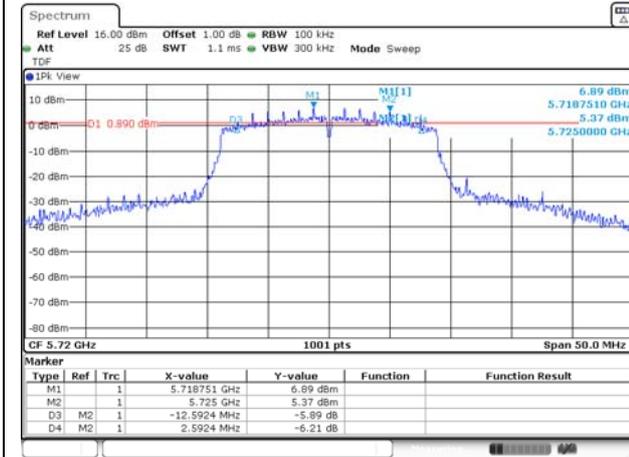
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (43) of (127)

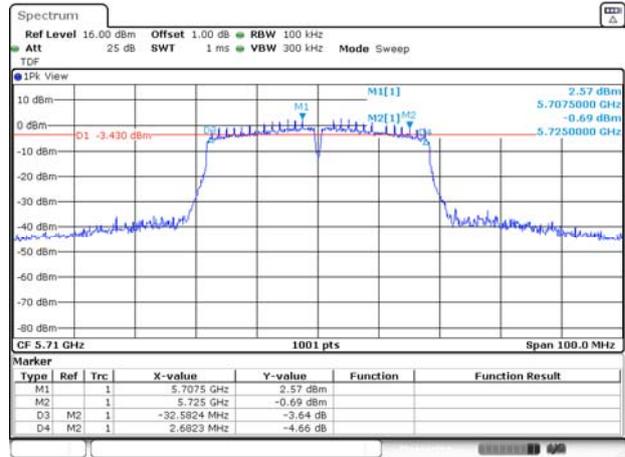


In order to simplify the report, attached plots were only the Worst Case per bandwidth.

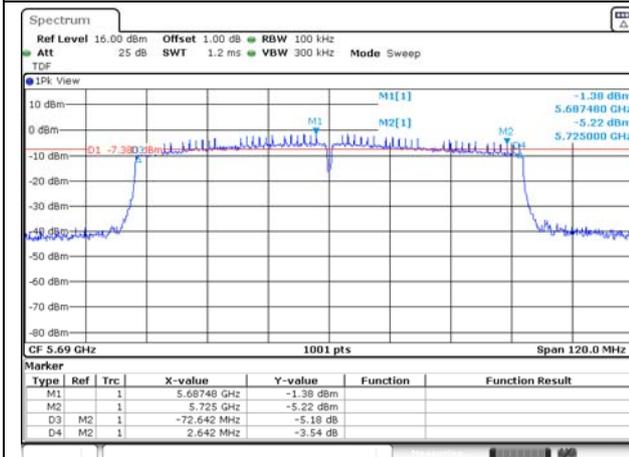
802.11ac VHT20



802.11ac VHT40



802.11ac VHT80



Blank

KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (44) of (127)

**Output Power**

Test mode	Band	Frequency (MHz)	Measured output power			Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)	
802.11a	UNII-2C	5 720	16.78	0.14	16.92	22.77
802.11n HT20			16.29	0.15	16.44	22.82
802.11ac VHT20			16.12	0.15	16.27	22.79
802.11a	UNII-3	5 720	9.32	0.14	9.46	30.00
802.11n HT20			9.16	0.15	9.31	
802.11ac VHT20			9.18	0.15	9.33	
802.11n HT40	UNII-2C	5 710	14.73	0.29	15.02	23.98
802.11ac VHT40			14.66	0.29	14.95	
802.11n HT40	UNII-3	5 710	2.66	0.29	2.95	30.00
802.11ac VHT40			2.56	0.29	2.85	
802.11ac VHT80	UNII-2C	5 690	13.62	0.56	14.18	23.98
	UNII-3	5 690	-2.18	0.56	-1.62	30.00

Note.

1. Result(dB m) = Reading Power + D.C.F

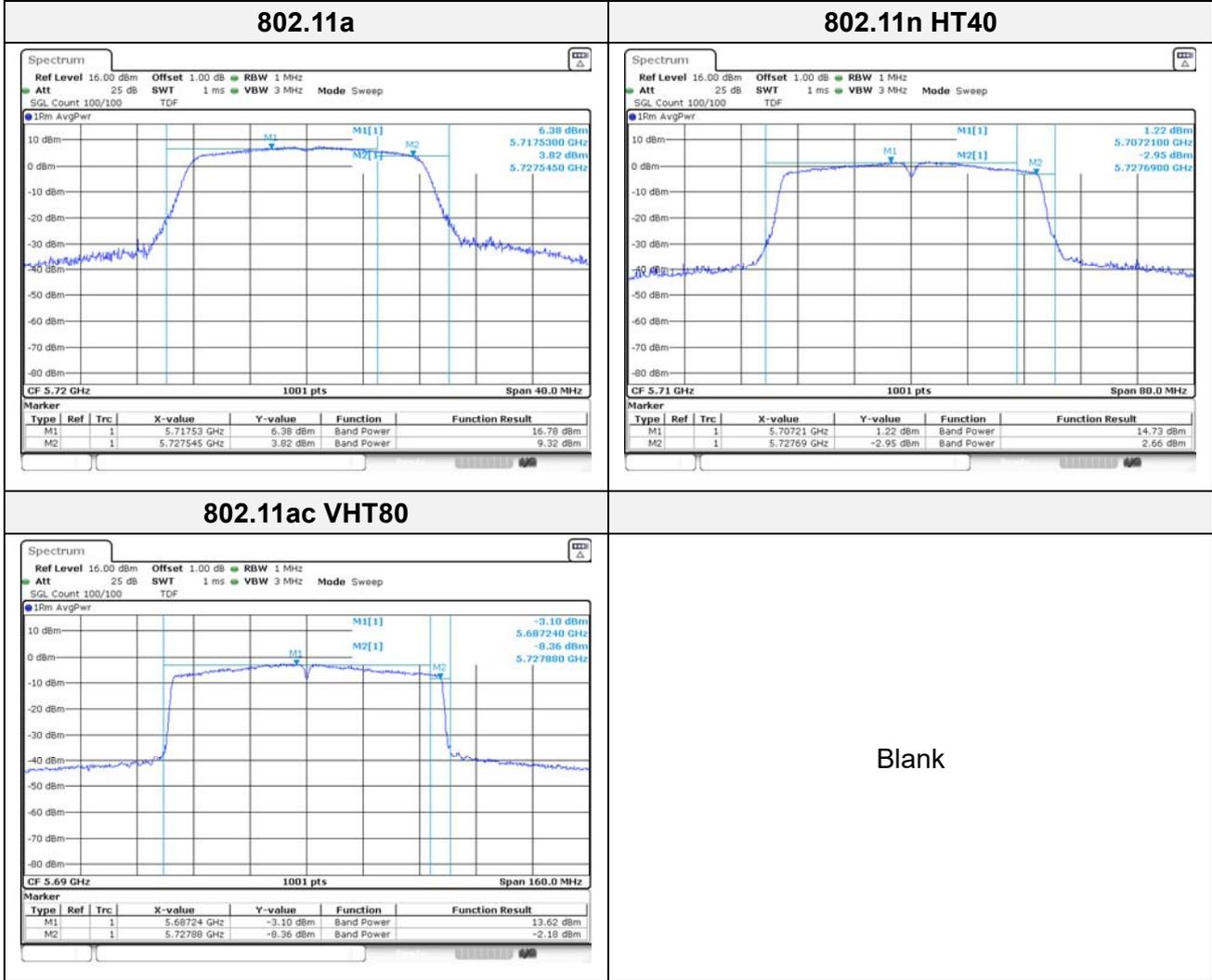
KCTL Inc.

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.:
 KR21-SRF0136
 Page (45) of (127)



In order to simplify the report, attached plots were only the Worst Case per bandwidth.



KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (46) of (127)

**Power Spectral Density**

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII-2C	5 720	7.08	0.14	7.22	11.00
802.11n HT20			6.56	0.15	6.71	
802.11ac VHT20			6.69	0.15	6.84	
802.11n HT40		5 710	1.62	0.29	1.91	
802.11ac VHT40			1.75	0.29	2.04	
802.11ac VHT80		5 690	-2.76	0.56	-2.20	

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/ 500 kHz)	DCF (dB)	Maximum PSD (dBm/ 500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII-3	5 720	2.39	0.14	2.53	30.00
802.11n HT20			2.00	0.15	2.15	
802.11ac VHT20			2.12	0.15	2.27	
802.11n HT40		5 710	-4.39	0.29	-4.10	
802.11ac VHT40			-4.31	0.29	-4.02	
802.11ac VHT80		5 690	-9.18	0.56	-8.62	

Notes:

- Maximum PSD calculation
- Maximum PSD = Measured PSD + D.C.F

KCTL Inc.

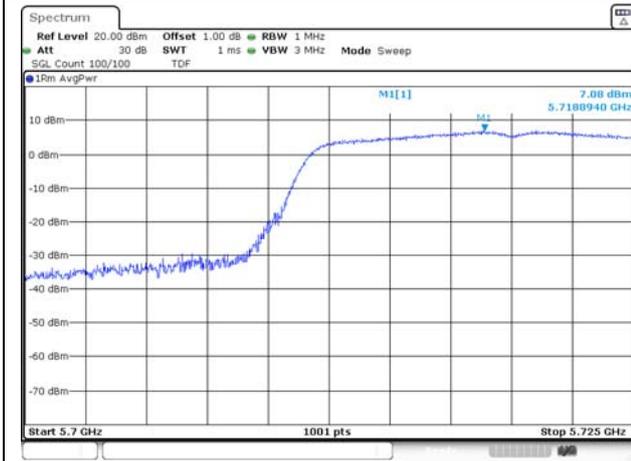
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR21-SRF0136
Page (47) of (127)



In order to simplify the report, attached plots were only the Worst Case per bandwidth.

UNII-2C / 802.11a



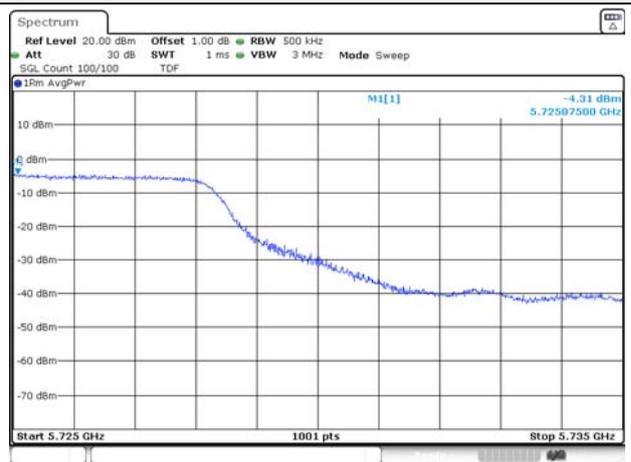
UNII-3 / 802.11a



UNII-2C / 802.11ac VHT40



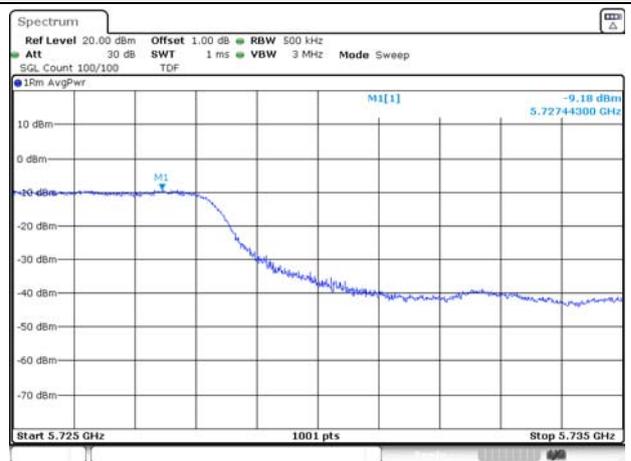
UNII-3 / 802.11ac VHT40



UNII-2C / 802.11ac VHT80



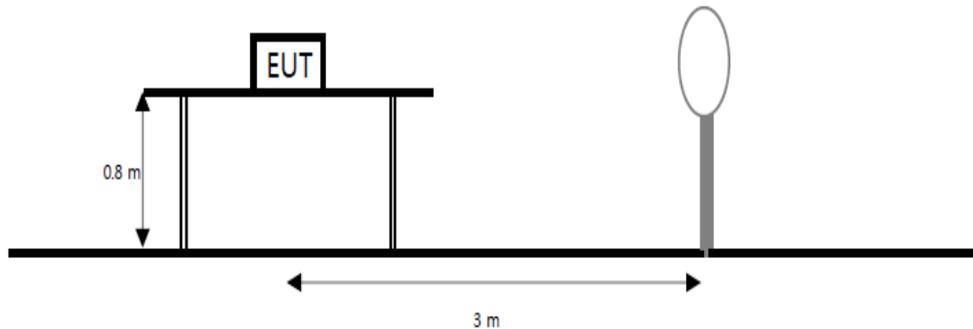
UNII-3 / 802.11ac VHT80



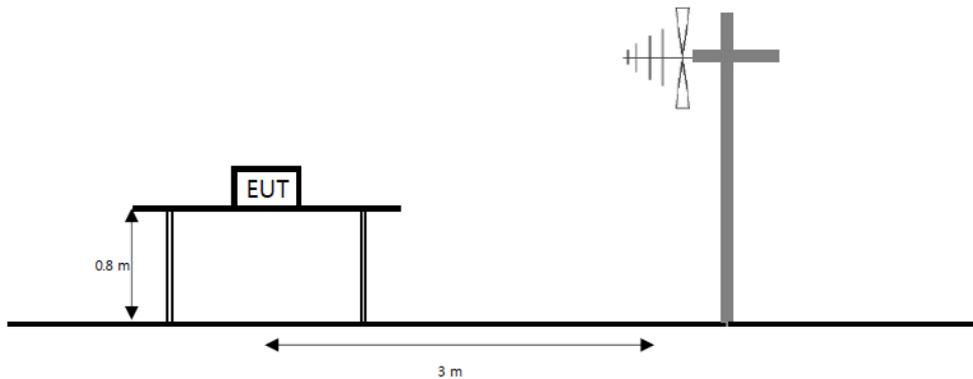
7.6. Spurious Emission, Band Edge and Restricted bands

Test setup

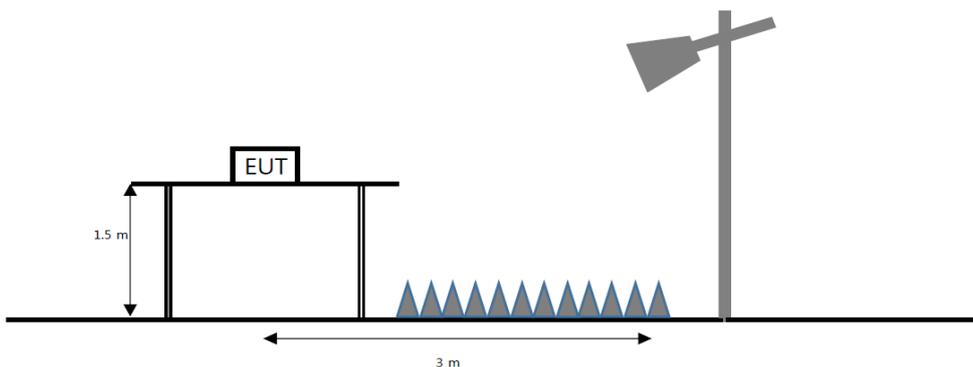
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



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



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



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.:
KR21-SRF0136
Page (49) of (127)

**Limit**

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

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

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section 15.231 and 15.241.

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

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 - 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 - 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 - 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 - 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 - 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 - 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 - 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 - 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	2 690 - 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 - 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 - 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 - 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 - 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

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

KCTL Inc.

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

Report No.:
KR21-SRF0136
Page (50) of (127)



According to section 15.407(b), undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.