TEST REPORT

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KCTL

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2020-04-03

2. Use of Report : Certification

3. Name of Product and Model : Smart Wearable / SM-R855U

4. Manufacturer and Country of Origin : Samsung Electronics Co., Ltd. / Vietnam

5. FCC ID : A3LSMR855

6. IC Certificate No. : 649E-SMR855

7. Date of Test : 2020-04-14 to 2020-05-25

8. Location of Test : ■ Permanent Testing Lab □ On Site Testing (Address: Address of testing location)

9. Test method used : FCC Part 15 Subpart C, 15.247
RSS-247 Issue 2 February 2017
RSS-Gen Issue 5 March 2019

10. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Kwonse Kim (Signature)	Technical Manager Name : Seungyong Kim (Signature)

2020-05-25

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2020-05-24	Originally issued	-
2020-05-25	Updated	5,22,26,27,28,34

Note. The report No. KR20-SRF0133 is superseded by the report No. KR20-SRF0133-A

General remarks for test reports

Nothing significant to report.

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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
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 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	Smart Wearable
Model	:	SM-R855U
Derivative model	:	SM-R855F
Modulation technique	:	Bluetooth(BDR/EDR)_ GFSK, π/4DQPSK, 8DPSK Bluetooth(BLE)_GFSK WIFI(802.11b/g/n20)_DSSS, OFDM LTE_QPSK, 16QAM
Number of channels	:	Bluetooth(BDR/EDR)_79 ch Bluetooth(BLE)_40 ch WIFI(802.11b/g/n20)_13 ch
Power source	:	DC 3.85 V
Antenna specification	:	LTE/WCDMA_PIFA (Housing metal) Antenna WIFI/Bluetooth(BDR/EDR/BLE)_LDS Antenna
Antenna gain	:	WIFI/Bluetooth(BDR/EDR/BLE) : -6.34 dBi

Frequency range	:	Bluetooth(BDR/EDR/BLE)_2 402 ㎒ ~ 2 480 ㎒
		WIFI(802.11b/g/n20)_2 412 ㎒ ~ 2 472 ㎒
		LTE Band 2_1 850.7 ㎒ ~ 1 909.3 ㎒
		LTE Band 4_1 710.7 ㎒ ~ 1 754.3 ㎒
		LTE Band 5_824.7 ㎒ ~ 848.3 ㎒
		LTE Band 12_699.7 ㎒ ~ 715.3 ㎒
		LTE Band 13_779.5 ㎒ ~ 784.5 ㎒
		LTE Band 25_1 850.7 ㎒ ~ 1 914.3 ㎒
		LTE Band 26_824.7 ㎒ ~ 848.3 ㎒, 814.7 ㎒ ~ 823.3 ㎒
		LTE Band 66_1 710.7 ㎒ ~ 1 779.3 ㎒
		LTE Band 71_665.5 ㎒ ~ 688.0 ㎒
		WCDMA 850_826.4 ㎒ ~ 846.6 ㎒
		WCDMA 1700_1 712.4 ㎒ ~ 1 752.6 ㎒
		WCDMA 1900_1 852.4 ㎒ ~ 1 907.6 ㎒
Software version	:	SM-R855U_R855U.001, SM-R855F_R855F.001
Hardware version	:	REV1.0
Test device serial No.	:	Conducted(R3AN300BVQH)
		Radiated(R3AN300B2AP, R3AN300AZXW, R3AN301WD1E)
Operation temperature	:	-30 ℃ ~ 50 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	FCC ID & IC
Wireless charger	Samsung Electronics Co., Ltd.	EP-OR825	-	DC 5.0 V, 1.0 A	A3LEPOR825 / 649E-EPOR825

2.2. Model Information

The difference between basic model (SM-R855U) and derivative model (SM-R855F) is:

H/W is identical with the basic model and software is as follows.
a. RF Supported Band is Different.
   (R855U: 3G (B2, B4, B5), 4G (B2, B4, B5, B12, B13, B25, B26, B66, B71))
   (R855F: 3G (B1, B2, B4, B5, B8), 4G (B1, B2, B3, B4, B5, B7, B8, B12, B13, B20, B25, B28, B66))
   - In EUR R855F : 3G (B1, B5, B8), 4G(B1, B3, B5, B7, B8, B20, B28)
b. All other protocol part is same.
c. All other features of Volte, SUPL is same.
d. In USA & Canada, 4G (B7) disabled by MCC code.
   Because device doesn't support B7 roaming in USA & Canada.

2.3. Frequency/channel operations

This device contains the following capabilities:
2.4㎓ WIFI(802.11b/g/n(HT20)), Bluetooth(BDR/EDR/BLE), LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 25, LTE Band 26, LTE Band 66, LTE Band 71, WCDMA 850, WCDMA 1700, WCDMA 1900

Ch.	Frequency (㎒)
01	2 412
.	.
06	2 437
.	.
11	2 462
12	2 467
13	2 472

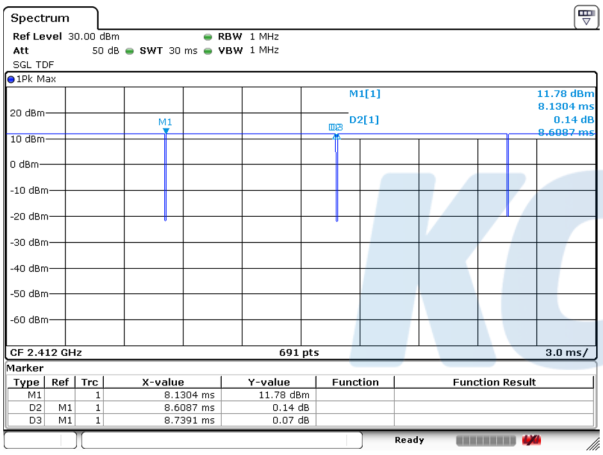
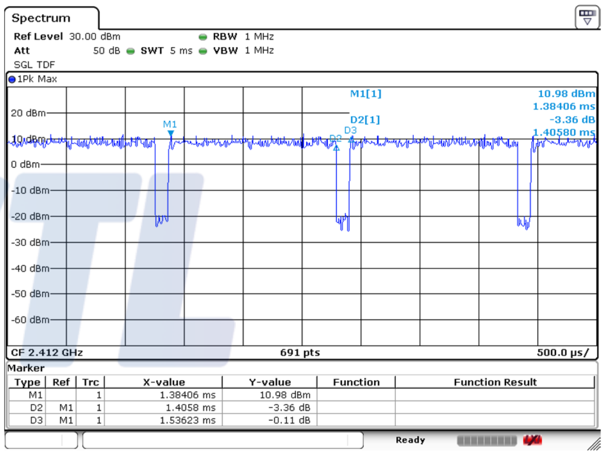
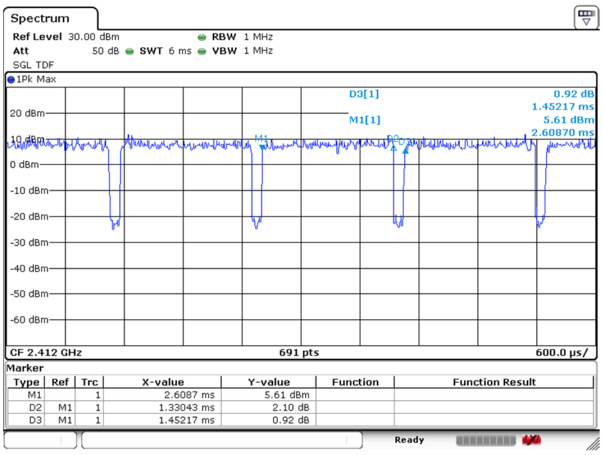
Table 2.3.1. 802.11b/g/n HT20 mode

2.4. Duty Cycle Factor

Test mode	Period (ms)	On time (ms)	Duty cycle		Duty Cycle Factor (dB)
			(Linear)	(%)	
802.11b	8.739 1	8.608 7	0.985 1	98.51	0.07
802.11g	1.536 2	1.405 8	0.915 1	91.51	0.39
802.11n_HT20	1.452 1	1.330 4	0.916 2	91.62	0.38

Notes.

1. Duty cycle (Linear) = Ton time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)

802.11b	802.11g
	
802.11n_HT20	
	Blank

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.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).
When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The transmitter has permanently attached LDS Antenna (internal antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.247.

4. Summary of tests

FCC Part section(s)	IC Rule Referene	Parameter	Test results
15.247(b)(3)	RSS-247 (5.4)(d)	Maximum Peak Output Power	Pass
15.247(e)	RSS-247 (5.2)(b)	Peak Power Spectral Density	Pass
15.247(a)(2)	RSS-247 (5.2)(a)	6 ㏈ Channel Bandwidth	Pass
-	RSS-Gen (6.7)	Occupied Bandwidth	Pass
15.247(d), 15.205(a), 15.209(a)	RSS-Gen (8.9), (8.10) RSS-247(5.5)	Spurious emission	Pass
		Band-edge, restricted band	Pass
15.207(a)	RSS-Gen (8.8)	Conducted Emissions	Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. 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.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation
4. All the radiated tests have been performed two modes (with charger and without charger) and the with charger is the worst case mode.
5. The worst-case data rate were:
   802.11b mode : 1 Mbps
   802.11g mode : 6 Mbps
   802.11n HT20 mode : MCS0
6. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 558074 D01 V05r02

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 of 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 (±)	
Conducted RF power	1.3 ㏈	
Conducted spurious emissions	1.3 ㏈	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒:	2.3 ㏈
	30 ㎒ ~ 300 ㎒	5.4 ㏈
	300 ㎒ ~ 1 000 ㎒	5.5 ㏈
	Above 1 ㎓	6.7 ㏈
Conducted emissions	9 ㎑ ~ 150 ㎑	3.7 ㏈
	150 ㎑ ~ 30 ㎒	3.3 ㏈

6. Measurement results explanation example

Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	9.29	9 000	12.34
50	9.36	10 000	12.61
100	9.43	11 000	12.79
200	9.55	12 000	12.81
300	9.64	13 000	12.85
400	9.73	14 000	12.99
500	9.80	15 000	13.10
600	9.85	16 000	13.52
700	9.89	17 000	13.55
800	9.94	18 000	13.74
900	10.03	19 000	13.77
1 000	10.05	20 000	13.82
2 000	10.12	21 000	14.14
3 000	10.74	22 000	14.44
4 000	11.06	23 000	14.64
5 000	11.33	24 000	14.71
6 000	11.55	25 000	15.01
7 000	12.16	26 000	15.06
8 000	12.26	26 500	15.10

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

7. Test results

7.1. Maximum peak output power

Test setup

EUT — Attenuator — Power sensor

Limit

FCC

According to §15.247(b)(3), For systems using digital modulation in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

IC

According to RSS-247 5.4(d), For DTSs employing digital modulation techniques operating in the bands 902-928 ㎒ and 2400-2483.5 ㎒, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

Test procedure

ANSI C63.10 - Section 11.9
Used test method is section 11.9.1.3 and 11.9.2.3.1

Test settings

General
Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth (see ANSI C63.10 for measurement guidance).

When using a spectrum analyzer or EMI receiver to perform these measurements, it shall be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW to set a bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins.

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level. The intent is to test at 100 % duty cycle; however a small reduction in duty cycle (to no lower than 98 %) is permitted, if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

If continuous transmission (or at least 98 % duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level, with the transmit duration as long as possible, and the duty cycle as high as possible during which sweep triggering/signal gating techniques may be used to perform the measurement over the transmission duration.

11.9.1. Maximum peak conducted output power
One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

11.9.1.1. RBW ≥ DTS bandwidth
The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

11.9.1.3. PKPM1 Peak power meter method
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

11.9.2.3.1. Measurement using a power meter (PM)

Method AVGPM is a measurement using an RF average power meter, as follows:

a) As an alternative to spectrum analyzer or EMI receiver measurements, 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:
   1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
   2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
   3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle, D, of the transmitter output signal as described in 11.6.

c) Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.

d) Adjust the measurement in dBm by adding [10 log(1/D)], where D is the duty cycle

Notes:

A peak responding power sensor is used, where the power sensor system video bandwidth is greater than the occupied bandwidth of the EUT.

Test results

Test mode	Frequency (㎒)	Conducted output power (dBm)		Conducted Power Limit (dBm)	Ant. Gain (dBi)	Max. E.I.R.P.(dB m)		Max. E.I.R.P. Limit (dBm)
		Peak	Average			Peak	Average	
802.11b	2 412	20.20	17.12	30	-6.34	13.86	10.78	36.02
	2 437	20.05	16.84			13.71	10.50	
	2 462	20.54	17.61			14.20	11.27	
	2 467	13.68	10.38			7.34	4.04	
	2 472	10.99	7.80			4.65	1.46	
802.11g	2 412	25.03	15.55	30	-6.34	18.69	9.21	36.02
	2 437	25.26	15.34			18.92	9.00	
	2 462	24.81	15.85			18.47	9.51	
	2 467	21.85	11.43			15.51	5.09	
	2 472	19.06	8.83			12.72	2.49	
802.11n HT20	2 412	24.43	14.46	30	-6.34	18.09	8.12	36.02
	2 437	25.06	14.24			18.72	7.90	
	2 462	24.24	14.79			17.90	8.45	
	2 467	21.04	11.20			14.70	4.86	
	2 472	18.21	8.60			11.87	2.26	

Notes:
1. Measured output power(Average) = reading value of average power + D.C.F
2. E.I.R.P. Calculation: E.I.R.P. (dB m) = Conducted output power (dB m) + Antenna gain (dB i)

7.2. Peak Power Spectral Density

Test setup

Limit

According to §15.247(e) and RSS-247(5.2), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test procedure

ANSI C63.10 - Section 11.10.2

Test settings

Method PKPSD (peak PSD)

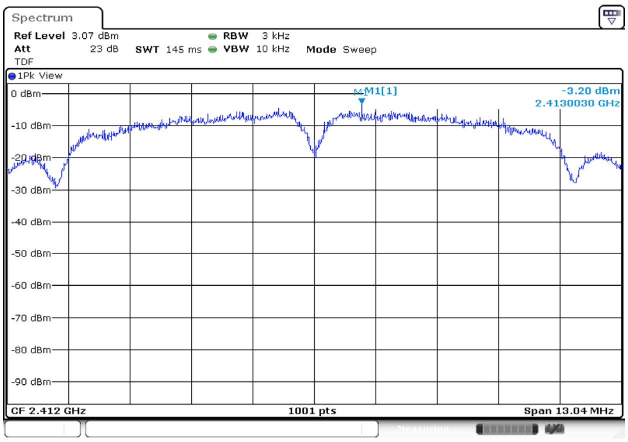
The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1) Set analyzer center frequency to DTS channel center frequency.
2) Set the span to 1.5 times the DTS bandwidth.
3) Set the RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.
4) Set the VBW ≥ 3 x RBW.
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level within the RBW.
10) If measured value exceeds limit, reduce RBW (no less than 3 ㎑) and repeat.

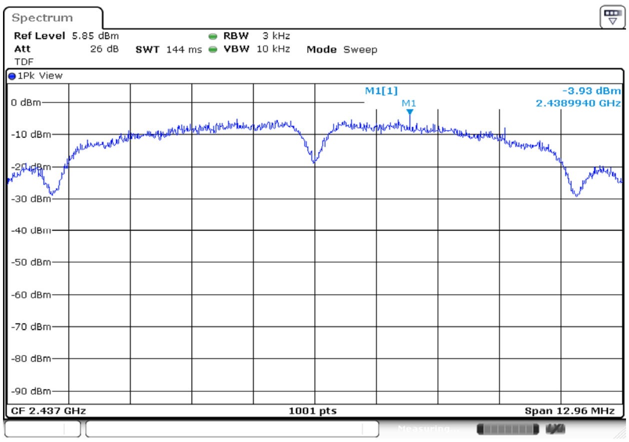
Test results

Test mode	Frequency(㎒)	Result(dBm/ 3㎑)	Limit(dBm/ 3㎑)
802.11b	2 412	-3.20	8.00
	2 437	-3.93	
	2 462	-4.58	
	2 467	-9.77	
	2 472	-14.91	
802.11g	2 412	-9.33	
	2 437	-9.08	
	2 462	-9.05	
	2 467	-13.52	
	2 472	-15.05	
802.11n HT20	2 412	-10.04	
	2 437	-9.45	
	2 462	-9.96	
	2 467	-12.51	
	2 472	-15.48	

802.11b / 2 412 ㎒



802.11b / 2 437 ㎒



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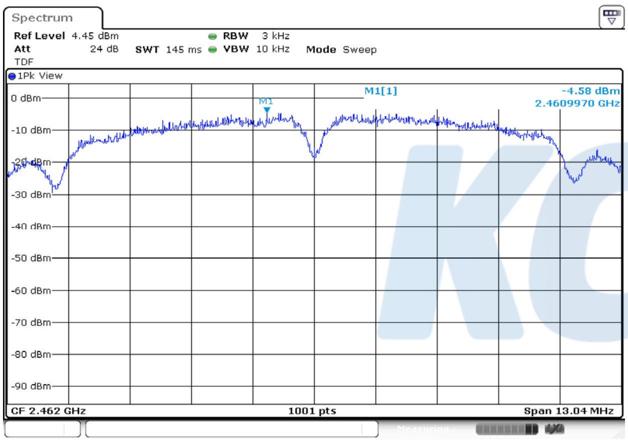

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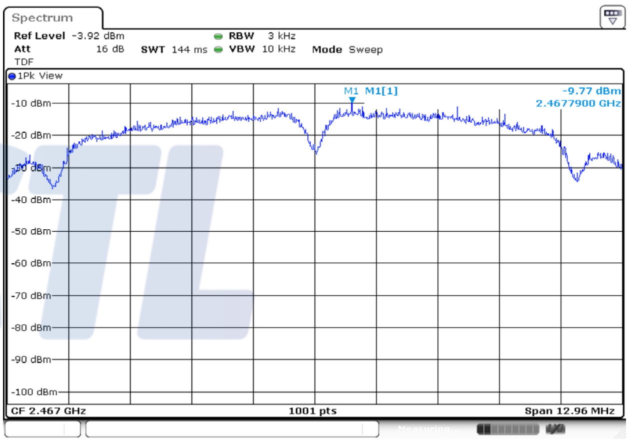

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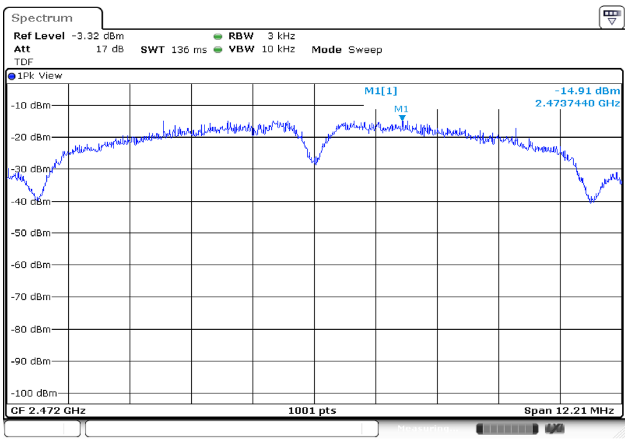

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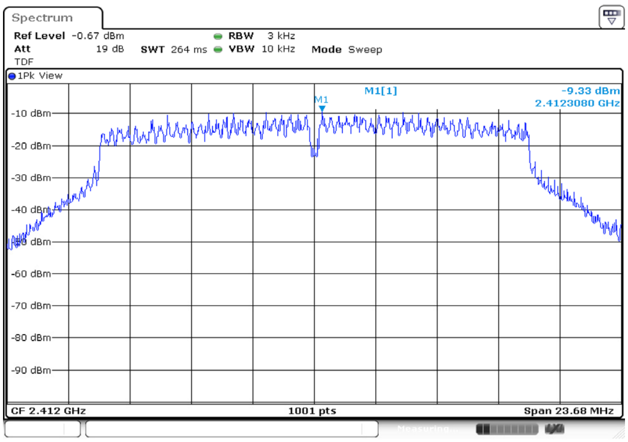
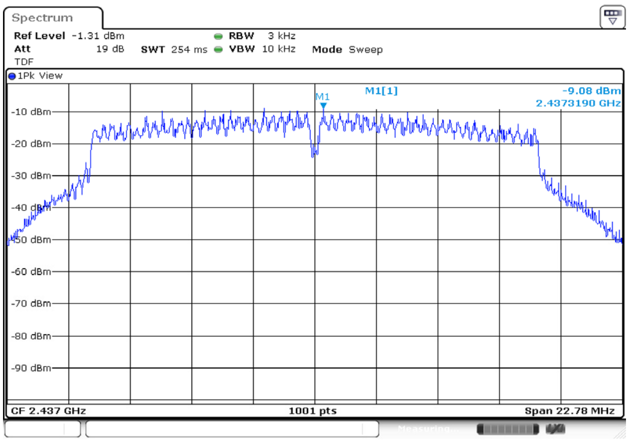
802.11g / 2 412 ㎒	802.11g / 2 437 ㎒
	
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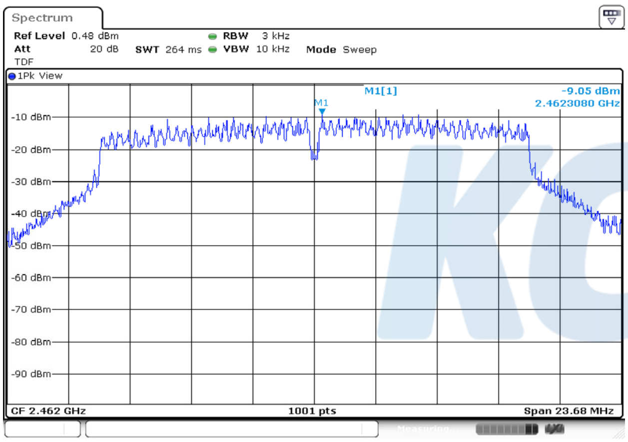	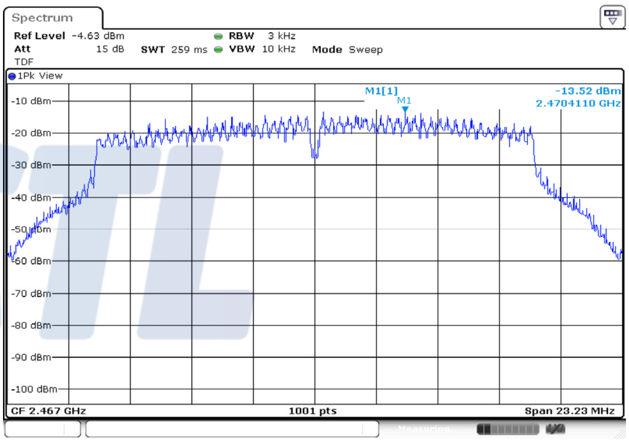
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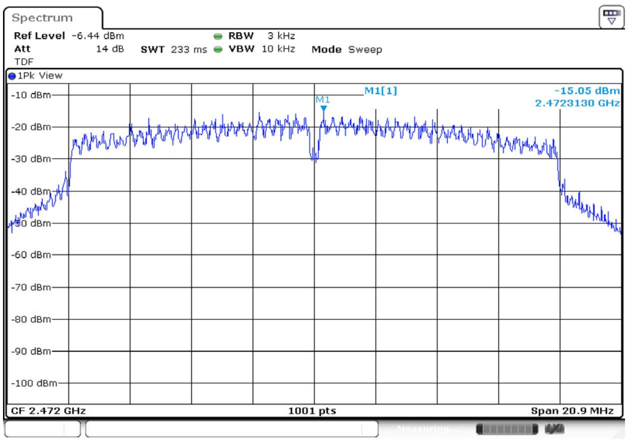	Blank

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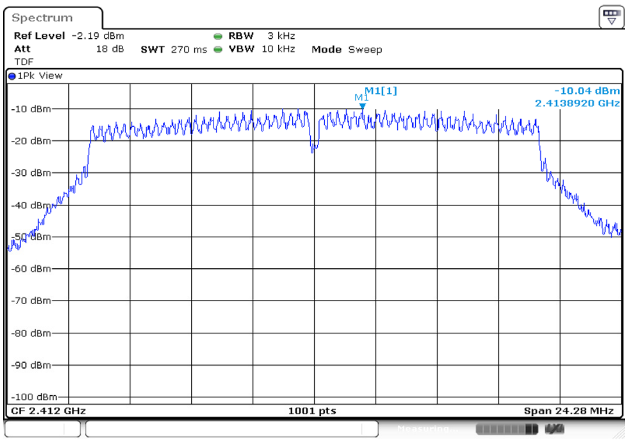
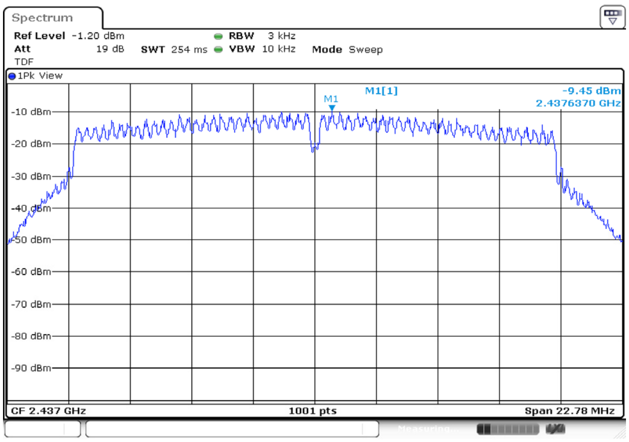
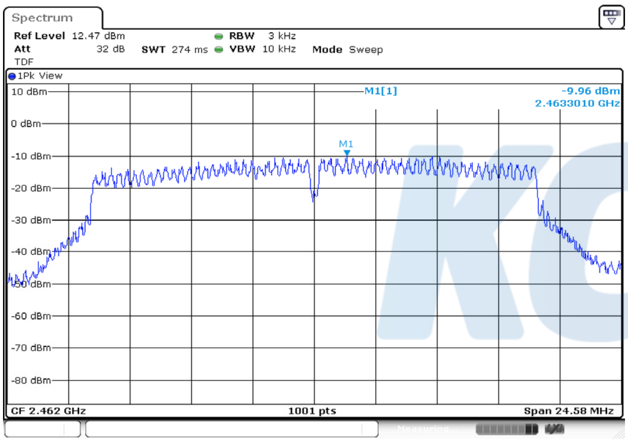
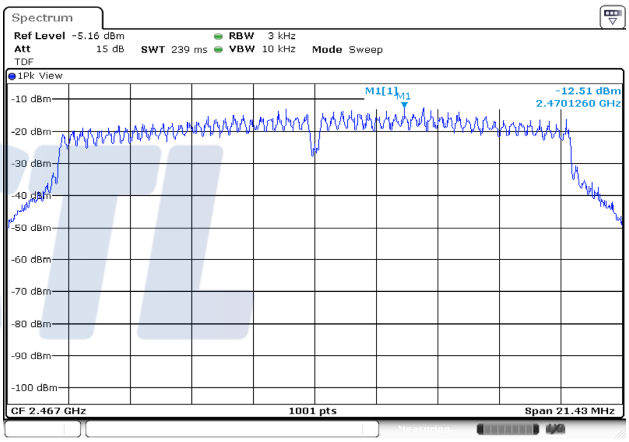
	

802.11n HT20 / 2 462 ㎒	802.11n HT20 / 2 467 ㎒
	

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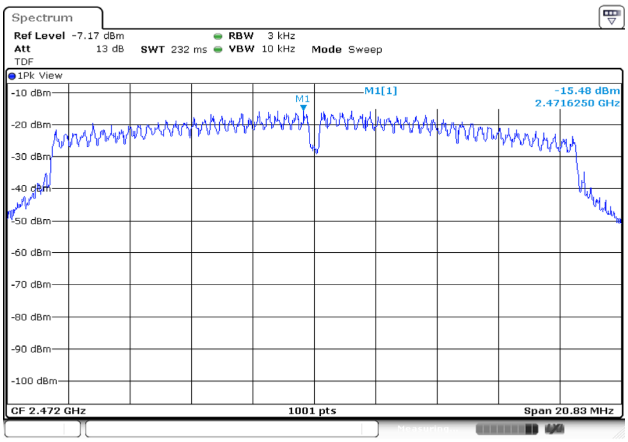	Blank