



TEST REPORT

KCTL KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR20-SRF0265 Page (1) of (20)	
1. Client <div style="margin-left: 20px;"> ◦ Name : Samsung Electronics Co., Ltd. ◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea ◦ Date of Receipt : 2020-09-28 </div>		
2. Use of Report : Class II Permissive change		
3. Name of Product / Model : Mobile phone / SM-F415F/DS		
4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam		
5. FCC ID : A3LSMM315F		
6. Date of Test : 2020-10-06 to 2020-10-15		
7. Location of Test : <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address: Address of testing location)		
8. Test method used : FCC Part 15 Subpart C, 15.247		
9. Test Result : Refer to the test result in the test report		
Affirmation	Tested by <div style="text-align: right;"> Name : Kwonse Kim (Signature) </div>	Technical Manager <div style="text-align: right;"> Name : Seungyong Kim (Signature) </div>
2020-10-16		
<h2>KCTL Inc.</h2>		
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REPORT REVISION HISTORY

Date	Revision	Page No
2020-10-16	Originally issued	-

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General remarks for test reports

Nothing significant to report.

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CONTENTS

1.	General information	4
2.	Device information	4
2.1.	Accessory information	6
2.2.	Frequency/channel operations.....	6
2.3.	Duty Cycle Factor	7
3.	Summary of tests	8
4.	Measurement uncertainty	9
5.	Test results	10
5.1.	Spurious Emission, Band Edge and Restricted bands.....	10
6.	Measurement equipment	20



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 Thai Nguyen Co., Ltd
 Address : 506-723 16000 Yen Phong 1 Industrial Zone, Yen Trung Commu, Yen Phong District, Bac Ninh Province, Vietnam
 Factory : Samsung India Electronics PVT. Ltd
 Address : B-1, Sector-8 NOIDA Uttar Pradesh, India 201-305
 Factory : Samsung Electronics Co., Ltd.
 Address : 94-1, Imsu-dong, Gumi-si, Gyeongsangbuk-ro, 730-722, Republic 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 : Mobile phone
 Model : SM-F415F/DS
 Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
 Bluetooth(BLE)_GFSK
 WIFI(802.11b/g/n20/n40/ac20/ac40/ac80)_DSSS, OFDM
 LTE_QPSK, 16QAM
 WCDMA_QPSK
 GSM_GMSK, 8-PSK
 Number of channels : Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch
 WIFI(802.11b/g/n20)_11 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)
 Power source : DC 3.85 V
 Antenna specification : LTE/GSM/WCDMA_LDS Antenna
 WIFI/Bluetooth(BDR/EDR/BLE)_LDS Antenna

Antenna gain : WIFI/Bluetooth(BDR/EDR/BLE) : -3.4 dBi
UNII-1 -5.9 dBi
UNII-2A -6.3 dBi
UNII-2C -5.3 dBi
UNII-3 -6.6 dBi

Frequency range : Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20)
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40)
UNII-1: 5 210 MHz (802.11ac_VHT80)
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20)
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40)
UNII-2A: 5 290 MHz (802.11ac_VHT80)
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20)
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40)
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20)
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_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 13_779.5 MHz ~ 784.5 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

Software version : M315F.001
Hardware version : REV1.0
Test device serial No. : Conducted(R38N101EBQY), Radiated(R38N8004GRZ)
Operation temperature : -30 °C ~ 50 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Travel Adapter	Samsung Electronics Co., Ltd.	EP-TA200	R37M4NR27T1SE3	AC 100-240V 50-60 Hz, 0.5A, 9.0V-1.67A, 5.0V-2.0A
Micro USB Data Cable	Samsung Electronics Co., Ltd.	-	-	-

2.2. Frequency/channel operations

This device contains the following capabilities:

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

LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 17, LTE Band 26,
 LTE Band41, LTE Band66, WCDMA 850, WCDMA 1700, WCDMA 1900, GSM 850, GSM 1900

Ch.	Frequency (MHz)
01	2 412
.	.
06	2 437
.	.
11	2 462

Table 2.2.1. 802.11b/g/n HT20 mode

3. Summary of tests

FCC Part section(s)	Parameter	Test condition	Test results
15.247(d), 15.205(a), 15.209(a)	Spurious emission	Radiated	Pass
	Band-edge, restricted band		Pass

Notes:

1. 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.
2. 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.
3. The test procedure(s) in this report were performed in accordance as following.
 - ◆ ANSI C63.10-2013
 - ◆ KDB 558074 D01 V05r02
4. This is the C2PC test report to add a variant model, SM-F415F/DS as documented in the C2PC letter. Because the change does not affect RF characteristics, therefore, only radiated spurious emission test was done against the worst case from the main model, SM-M315F/DS, documented in the original filing and approved in 02/07/2020. All rest tests documented in original filing under model SM-M315F/DS remains representative of the variant model, SM-F415F/DS.

4. Measurement uncertainty

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

All measurement uncertainty values are shown with a coverage factor of $k=2$ to 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)	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.3 dB
	30 MHz ~ 300 MHz	5.4 dB
	300 MHz ~ 1 000 MHz	5.5 dB
	Above 1 GHz	6.7 dB

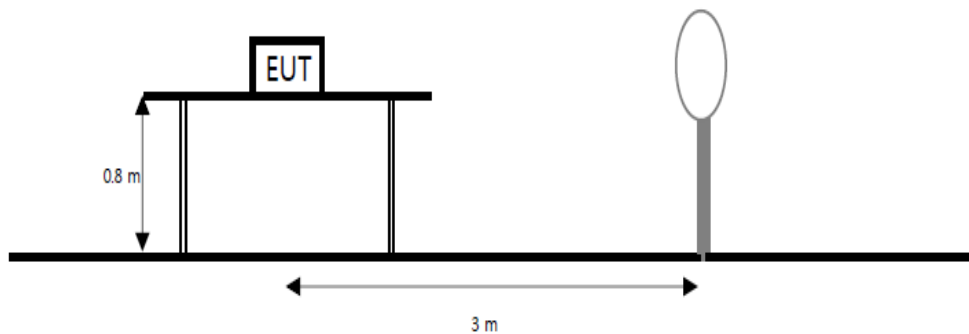
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5. Test results

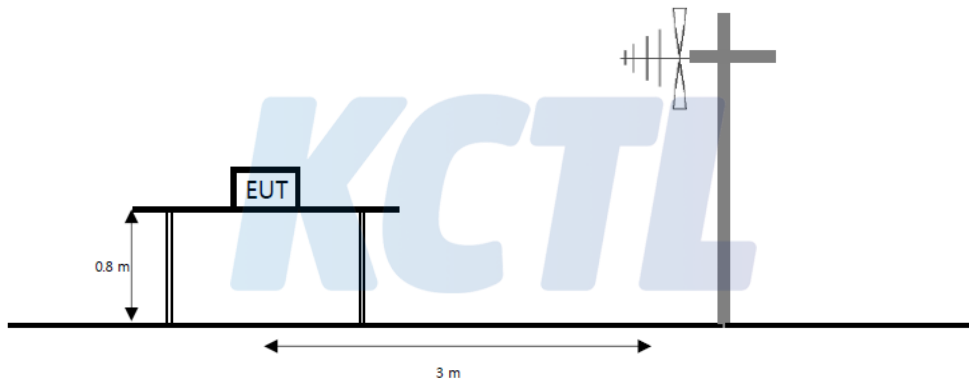
5.1. Spurious Emission, Band Edge and Restricted bands

Test setup

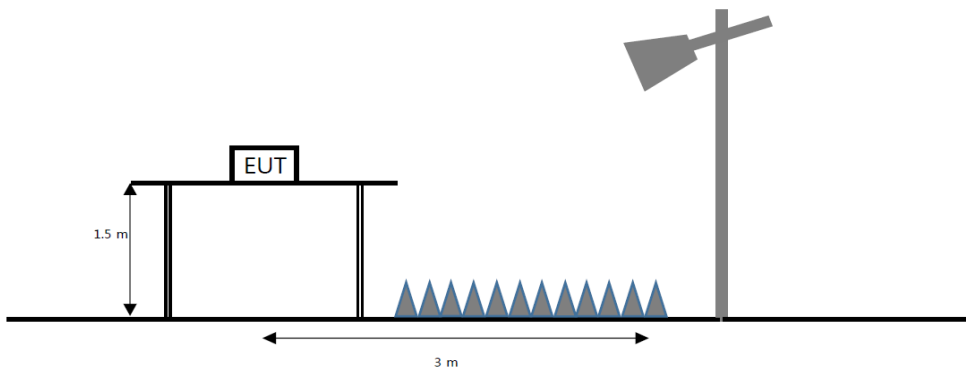
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



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



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



Limit

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

Frequency (MHz)	Field strength ($\mu V/m$)	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.

Test procedure

ANSI C63.10-2013

Test settings**Peak field strength measurements**

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

Table. RBW as a function of frequency

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

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

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

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

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

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

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

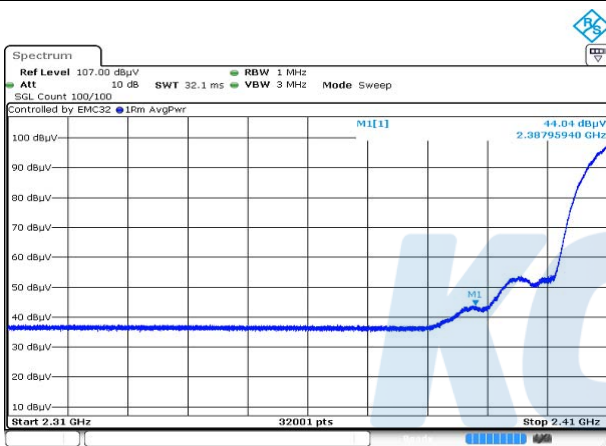
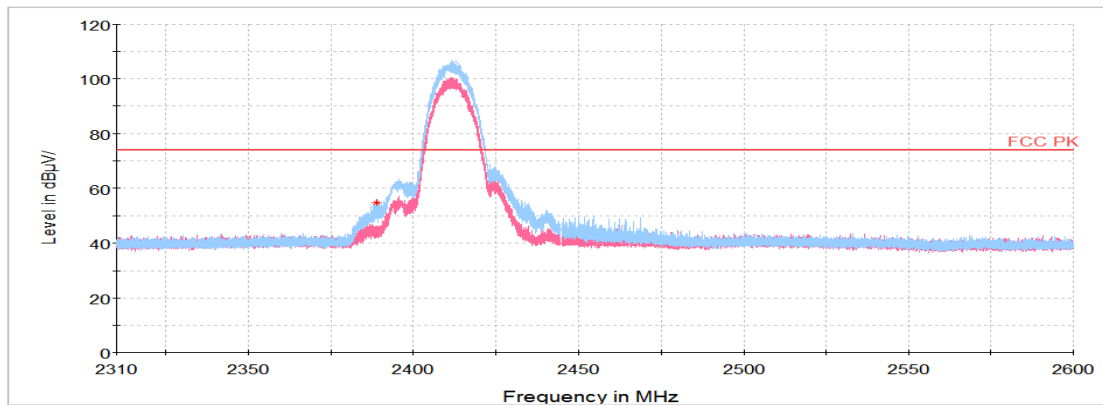
6. Averaging type = power (i.e., rms):
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace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

Notes:

1. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40 \log(D_m/D_s)$
 $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20 \log(D_m/D_s)$
 Where:
 F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters
2. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d (dB)
3. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. ¹⁾ means restricted band.

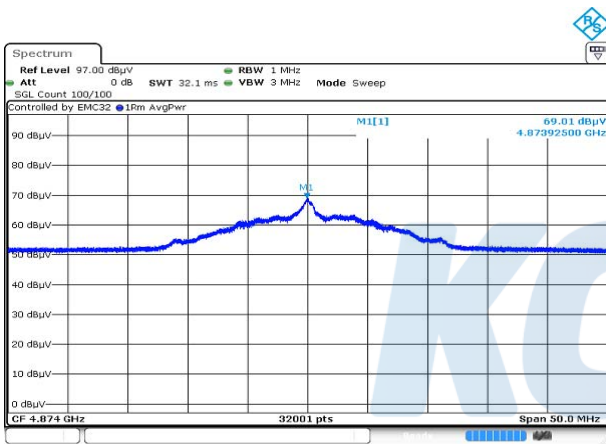
Test results (Above 1 000 MHz)**802.11b / Band-edge****Lowest Channel (2 412 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
2 387.96 ¹⁾	H	51.72	31.88	-29.05	-	54.55	74.00	19.45
Average Data								
2 387.96 ¹⁾	H	44.04	31.88	-29.05	0.48	47.35	54.00	6.65

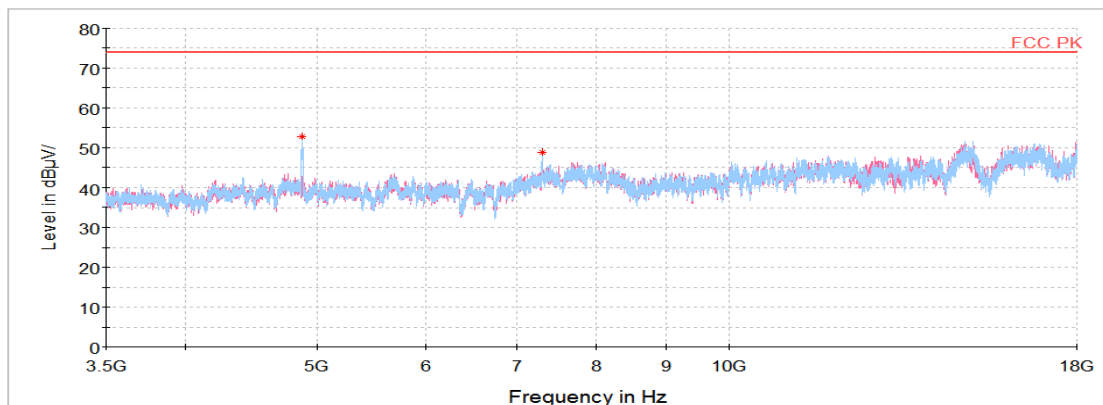
Average data**Horizontal/Vertical for Band-edge**

802.11b / Harmonic**Middle Channel (2 437 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
4 874.19 ¹⁾	H	73.86	33.95	-55.00	-	52.81	74.00	21.19
7 310.78 ¹⁾	H	66.08	35.40	-52.69	-	48.79	74.00	25.21
Average Data								
4 874.19 ¹⁾	H	69.01	33.95	-55.00	0.48	48.44	54.00	5.56

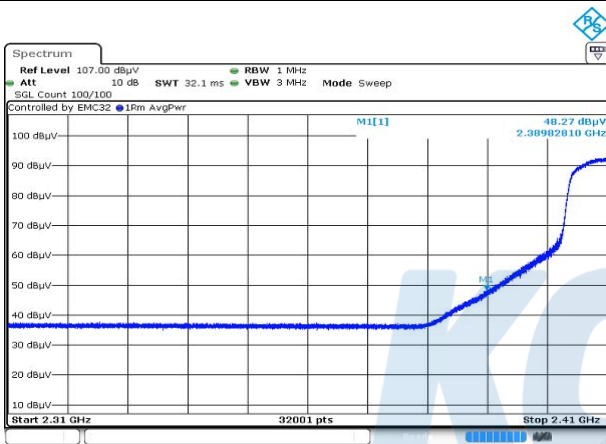
Average data

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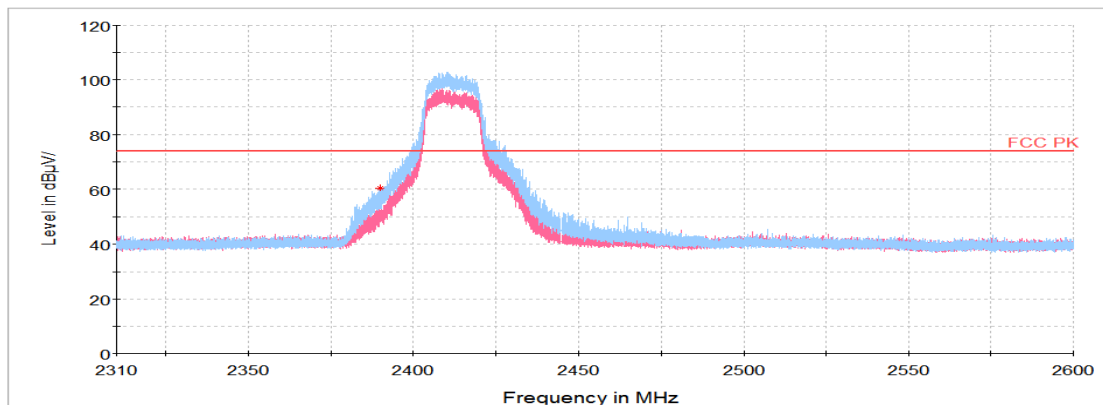
Horizontal/Vertical for 3.5 GHz ~ 18 GHz

802.11g / Band-edge**Lowest Channel (2 412 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
2 389.83 ¹⁾	H	57.43	31.88	-29.04	-	60.27	74.00	13.73
Average Data								
2 389.83 ¹⁾	H	48.27	31.88	-29.04	0.38	51.49	54.00	2.51

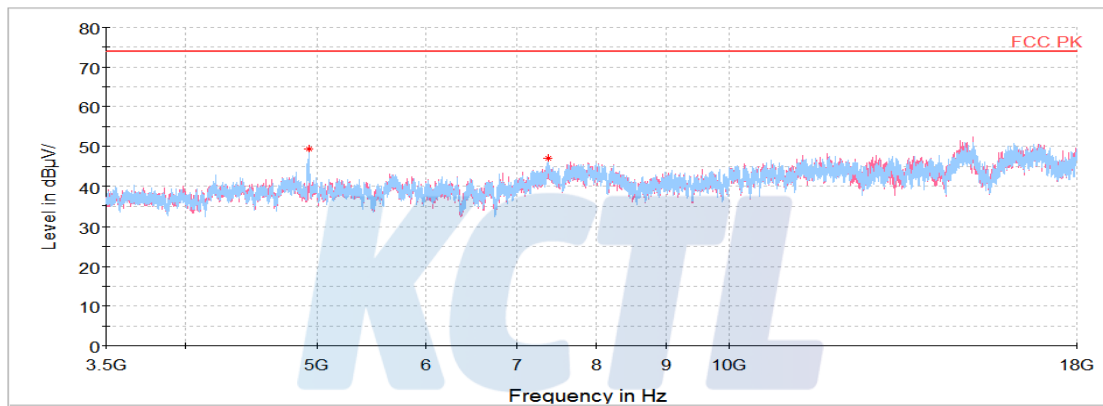
Average data

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Horizontal/Vertical for Band-edge

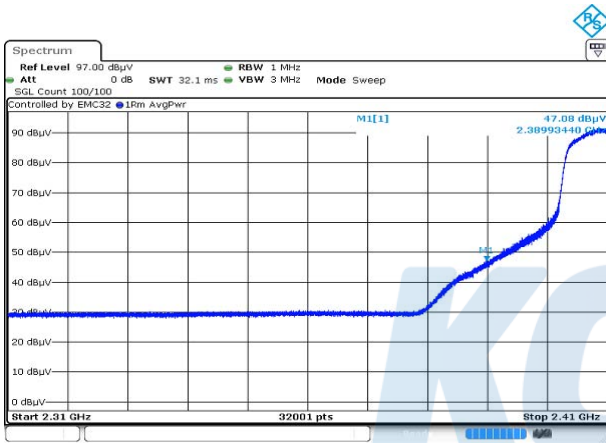
802.11g / Harmonic**Highest Channel (2 462 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
Peak data								
4 928.70 ¹⁾	H	70.58	33.97	-55.22	-	49.33	74.00	24.67
7 381.92 ¹⁾	H	64.10	35.40	-52.42	-	47.08	74.00	26.92
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

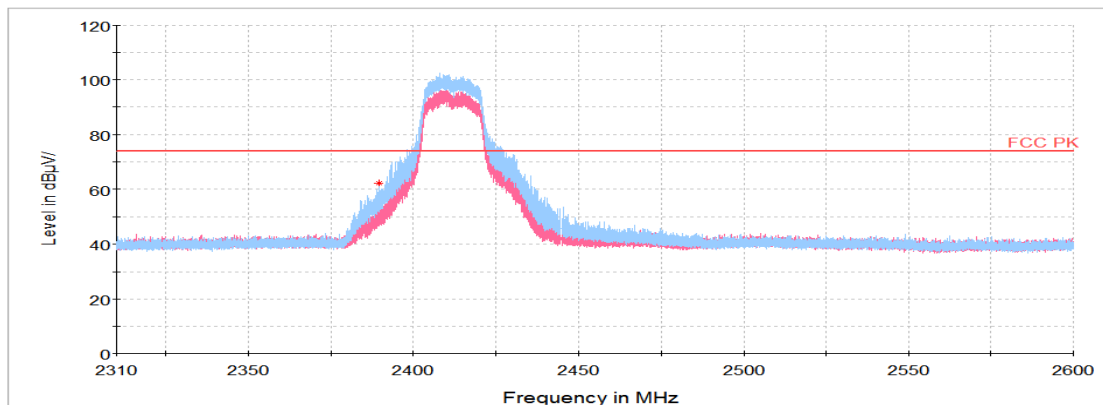
Horizontal/Vertical for 3.5 GHz ~ 18 GHz

802.11n HT20 / Band-edge**Lowest Channel (2 412 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μ V))	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
Peak data								
2 389.93 ¹⁾	H	59.13	31.88	-29.04	-	61.97	74.00	12.03
Average Data								
2 389.93 ¹⁾	H	47.08	31.88	-29.04	0.39	50.31	54.00	3.69

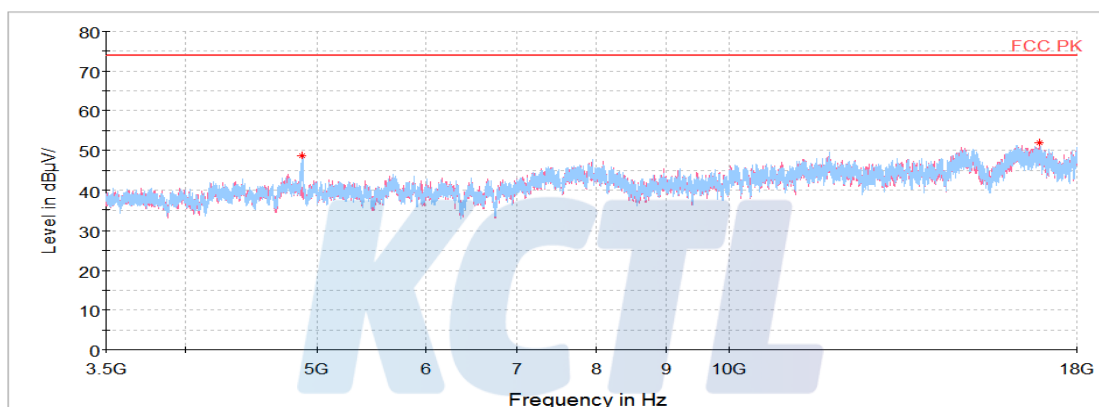
Average data

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Horizontal/Vertical for Band-edge

802.11n HT20 / Harmonic**Middle Channel (2 437 MHz)**

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
4 869.80 ¹⁾	H	69.56	33.95	-54.88	-	48.63	74.00	25.37
16 913.86 ¹⁾	V	56.93	41.91	-46.91	-	51.93	74.00	22.07
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

Horizontal/Vertical for 3.5 GHz ~ 18 GHz

6. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100806	21.07.29
Spectrum Analyzer	R&S	FSV40	100989	21.01.03
Attenuator	Weinschel ENGINEERING	56-10	51395	21.01.22
Signal Generator	R&S	SMB100A	176206	21.01.21
Vector Signal Generator	R&S	SMBV100A	257566	21.07.13
Signal Generator	R&S	SMR40	100007	21.04.08
Highpass Filter	WT	WT-A1698-HS	WT160411001	21.05.11
Horn antenna	ETS.lindgren	3117	155787	20.10.24
Horn antenna	ETS.lindgren	3116	00086632	21.02.17
Attenuator	API Inmet	40AH2W-10	12	21.05.12
Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	21.07.28
AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800 -22-10P	2031196	21.02.12
AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	21.01.22
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-

End of test report