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-SRF0208 Page (1) of (45)	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 : 2020-07-01

2. Use of Report : Certification

3. Name of Product / Model : Tablet PC / SM-T575

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

5. FCC ID : A3LSMT575

6. Date of Test : 2020-07-14 to 2020-08-19

7. Location of Test : ■ Permanent Testing Lab □ 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 Name : Taeyoung Kim (Signature)	Technical Manager Name : Seungyong Kim (Signature)

2020-08-26

KCTL Inc.

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
2020-08-26	Originally issued	-

General remarks for test reports

Nothing significant to report.

CONTENTS

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 (SEVT)
Address	:	Yen binh Industrial Park, Dong Tien Ward, Pho Yen Town Thai Nguyen 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 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	Tablet PC
Model	:	SM-T575
Derivative model	:	SM-T577
Modulation technique	:	Bluetooth(BDR/EDR)_ GFSK, π/4DQPSK, 8DPSK Bluetooth(BLE)_GFSK WIFI(802.11a/b/g/n/ac/ax)_DSSS, OFDM, OFDMA NFC_ASK LTE_QPSK, 16QAM, 64QAM WCDMA_QPSK GSM_GMSK, 8-PSK
Number of channels	:	Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch 802.11b/g/n/ac/ax_HT20/VHT20/HE20 : 13 ch UNII-1: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2A: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2C: 12 ch (20 ㎒), 6 ch (40 ㎒), 3 ch (80 ㎒) UNII-3: 5 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) NFC: 1 ch
Power source	:	DC 3.85 Ⅴ
Antenna specification	:	LTE/WCDMA_LDS carrier Antenna WIFI/Bluetooth(BDR/EDR/BLE)_LDS carrier Antenna NFC_FPCB Antenna

Antenna gain	:	WIFI/Bluetooth(BDR/EDR/BLE): ANT 1: -2.50 dBi, ANT 2: -2.50 dBi UNII-1 ANT 1: -3.20 dBi, ANT 2: -3.70 dBi UNII-2A ANT 1: -3.20 dBi, ANT 2: -3.80 dBi UNII-2C ANT 1: -6.20 dBi, ANT 2: -6.70 dBi UNII-3 ANT 1: -6.50 dBi, ANT 2: -6.40 dBi
Frequency range	:	Bluetooth(BDR/EDR/BLE)_2 402 ㎒ ~ 2 480 ㎒ 2 412 ㎒ ~ 2 472 ㎒ (802.11b/g/n/ac/ax_HT20/VHT20/HE20) UNII-1: 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n/ac/ax_HT20/VHT20/HE20) UNII-1: 5 190 ㎒ ~ 5 230 ㎒ (802.11n/ac/ax_HT40/VHT40/HE40) UNII-1: 5 210 ㎒ (802.11ac/ax_VHT80/HE80) UNII-2A: 5 260 ㎒ ~ 5 320 ㎒ (802.11a/n/ac/ax_HT20/VHT20/HE20) UNII-2A: 5 270 ㎒ ~ 5 310 ㎒ (802.11n/ac/ax_HT40/VHT40/HE40) UNII-2A: 5 290 ㎒ (802.11ac/ax_VHT80/HE80) UNII-2C: 5 500 ㎒ ~ 5 720 ㎒ (802.11a/n/ac/ax_HT20/VHT20/HE20) UNII-2C: 5 510 ㎒ ~ 5 710 ㎒ (802.11n/ac/ax_HT40/VHT40/HE40) UNII-2C: 5 530 ㎒ ~ 5 690 ㎒ (802.11ac/ax_VHT80/HE80) UNII-3: 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n/ac/ax_HT20/VHT20/HE20) UNII-3: 5 755 ㎒ ~ 5 795 ㎒ (802.11n/ac/ax_HT40/VHT40/HE40) UNII-3: 5 775 ㎒ (802.11ac/ax_VHT80/HE80) 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 17_706.5 ㎒ ~ 713.5 ㎒ LTE Band 41_2 498.5 ㎒ ~ 2 687.5 ㎒ LTE Band 66_1 710.7 ㎒ ~ 1 779.3 ㎒ GSM 850_824.2 ㎒ ~ 848.8 ㎒ GSM 1900_1 850.2 ㎒ ~ 1 909.8 ㎒ WCDMA 850_826.4 ㎒ ~ 846.6 ㎒ WCDMA 1700_1 712.4 ㎒ ~ 1 752.6 ㎒ WCDMA 1900_1 852.4 ㎒ ~ 1 907.6 ㎒ NFC_13.56 ㎒
Software version	:	T575.001(SM-T575), T577.001(SM-T577)
Hardware version	:	REV1.0
Test device serial No.	:	Conducted(R32N800373B, R32N400L04T, 2c57b421cb496110) Radiated(R32N6011AEK,2cf1a3f3cabbe910,2c907e7dc049f110)
Operation temperature	:	-30 ℃ ~ 50 ℃

Note. The Product equality letter includes detailed information about the differences between basic and derivative model.

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	FCC ID
Travel Adapter	SOLU-M	EP-TA200	R37M12L1AC1 HM3	Input : 100-240V, 50-60㎐ (0.5A) Output : 9.0V, 1.67A or 5.0V, 2.0A	-
Data Cable	RFTECH	EP-DT725BBE	-	-	-
External Earphone	ALMUS	EHS64AVF BE	-	-	-
Protective Cover	WILLTECH VINA	GH98-45810A	-	-	-
S-Pen	WACOM	CP-913W-00B	-	-	-

2.2. Frequency/channel operations

This device contains the following capabilities:
WiFi (802.11a/b/g/n/ac/ax), Bluetooth (BDR/EDR/BLE), NFC,
LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 17, LTE Band 41, LTE Band 66, GSM 850, GSM 1900, WCDMA 850, WCDMA 1700, WCDMA 1900

Ch.	Frequency (㎒)
00	2 402
.	.
19	2 440
.	.
39	2 480

Table 2.2.1. Bluetooth Low Energy

2.3. Simultaneous Tx Condition

For Simultaneous mode (Bluetooth, WLAN), please refer to
Test report #KR20-SRF0215_03436_Samsung Electronics_SM-T575_WiFi (P15.407)_ax.

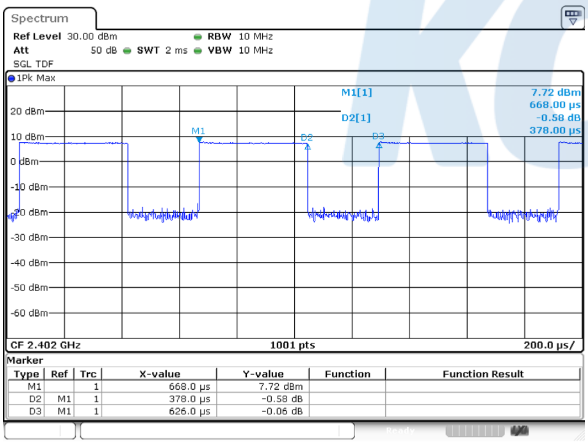
2.4. Duty Cycle Factor

Test mode	Period (ms)	On time (ms)	Duty cycle		Duty Cycle Factor (dB)
			(Linear)	(%)	
1M Bits/s, 37 Packet	0.626	0.378	0.603 8	60.38	2.19
1M Bits/s, 255 Packet	2.506	2.118	0.845 2	84.52	0.73
2M Bits/s, 37 Packet	0.626	0.194	0.309 9	30.99	5.09
2M Bits/s, 255 Packet	1.876	1.062	0.566 1	56.61	2.47
125k, 37 Packet	3.758	3.098	0.824 4	82.44	0.84
125k, 255 Packet	17.478	17.018	0.973 7	97.37	0.12
500k, 37 Packet	1.876	1.054	0.561 8	56.18	2.50
500k, 255 Packet	5.008	4.546	0.907 7	90.77	0.42

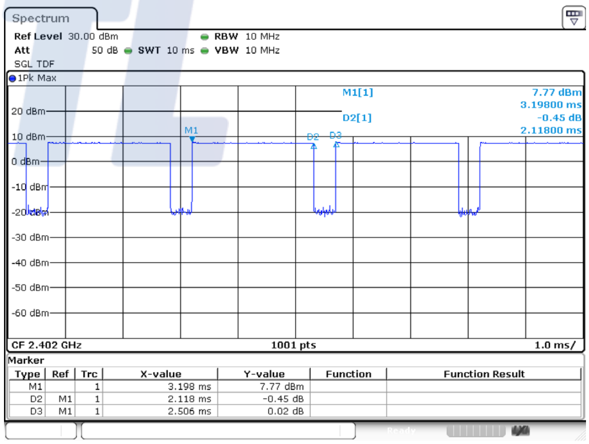
Notes.

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

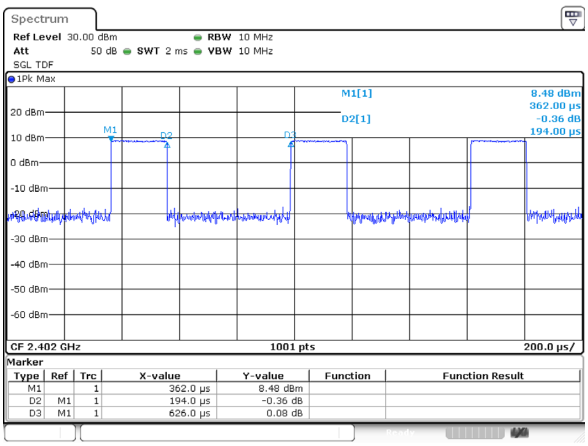
1M Bits/s, 37 Packet



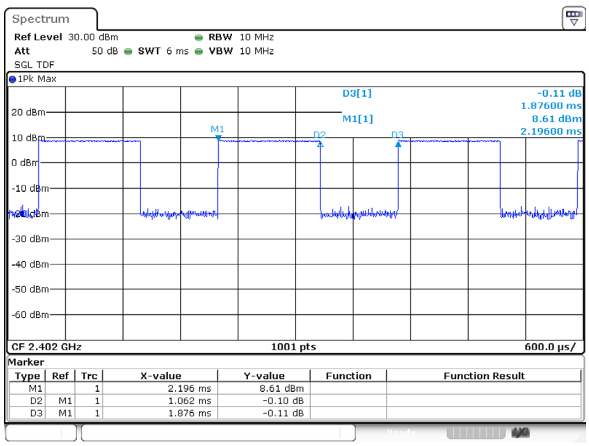
1M Bits/s, 255 Packet



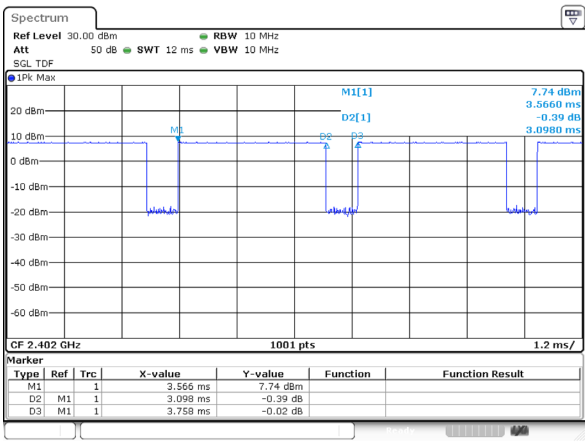
2M Bits/s, 37 Packet



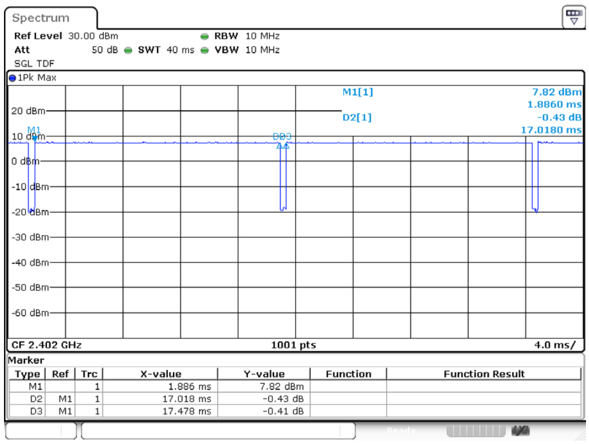
2M Bits/s, 255 Packet



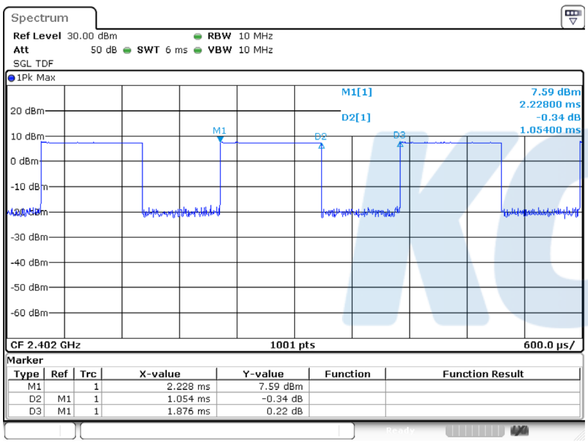
125k Bits/s, 37 Packet



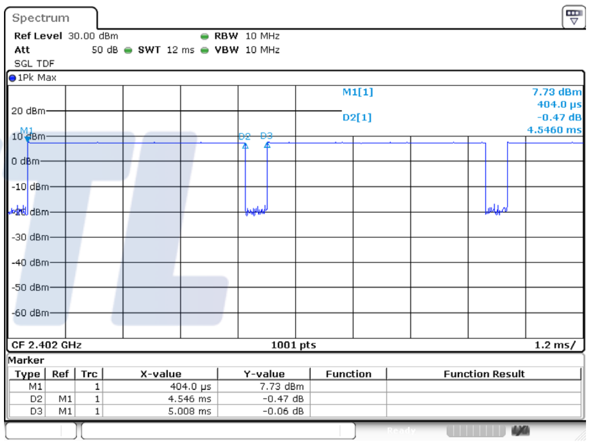
125k Bits/s, 255 Packet



500k Bits/s, 37 Packet



500k Bits/s, 255 Packet



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 LDS carrier Antenna (Internal antenna) on board.

4. Summary of tests

FCC Part section(s)	Parameter	Test Condition	Test results
15.247(b)(3)	Maximum Peak Output Power	Conducted	Pass
15.247(e)	Peak Power Spectral Density		Pass
15.247(a)(2)	6 dB Channel Bandwidth		Pass
15.207(a)	AC Conducted Emissions		Pass
15.247(d)	Conducted Spurious Emissions		Pass
15.205(a), 15.209(a)	Spurious emission	Radiated	Pass
	Band-edge, restricted band		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 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.
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 several case.
   (Stand-alone, with accessories (earphone, cover, TA etc.))
   Worst case: stand-alone
5. The worst-case data rate were: 1M Bits/s, Packet length 37 Bytes
   2M Bits/s, Packet length 37 Bytes
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

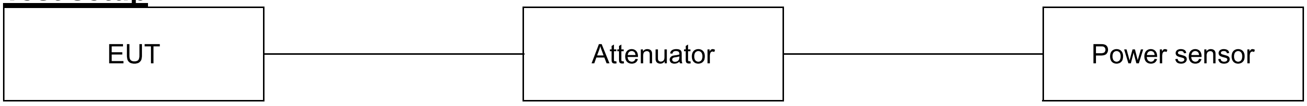
Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	9.29	9 000	12.34
50	9.36	10 000	12.61
100	9.43	11 000	12.79
200	9.55	12 000	12.81
300	9.64	13 000	12.85
400	9.73	14 000	12.99
500	9.80	15 000	13.10
600	9.85	16 000	13.52
700	9.89	17 000	13.55
800	9.94	18 000	13.74
900	10.03	19 000	13.77
1 000	10.09	20 000	13.82
2 000	10.93	21 000	14.14
3 000	11.21	22 000	14.44
4 000	11.54	23 000	14.64
5 000	11.89	24 000	14.71
6 000	12.17	25 000	15.01
7 000	12.05	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



Limit

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 ㏈i. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 ㏈i 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 ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

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 an 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 ㏈m 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

Frequency(㎒)	Data rate (Bits/s)	Packet length (Bytes)	Measured output power (㏈m)		Limit(㏈m)
			Peak	Average	
2 402	1M	37	6.85	6.22	30
		255	6.82	6.19	
	2M	37	8.26	7.49	
		255	8.24	7.39	
	125k	37	6.86	6.17	
		255	6.86	6.16	
	500k	37	6.86	6.19	
		255	6.84	6.13	
2 440	1M	37	7.78	7.17	
		255	7.75	7.13	
	2M	37	8.66	7.89	
		255	8.62	7.80	
	125k	37	7.74	7.11	
		255	7.74	7.06	
	500k	37	7.71	7.10	
		255	7.71	7.04	
2 480	1M	37	7.39	6.84	
		255	7.33	6.78	
	2M	37	8.39	7.74	
		255	8.38	7.65	
	125k	37	7.42	6.74	
		255	7.44	6.72	
	500k	37	7.44	6.77	
		255	7.43	6.71	

Note

Measured output power(Average) = reading value of average power + D.C.F

7.2. Peak Power Spectral Density

Test setup

EUT	Attenuator	Spectrum analyzer

Limit

According to §15.247(e), 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 kHz 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

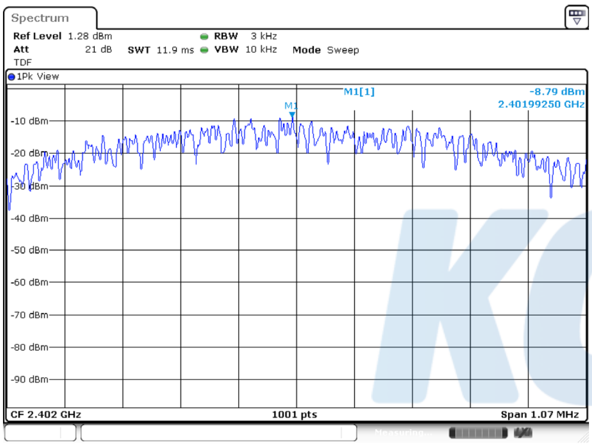
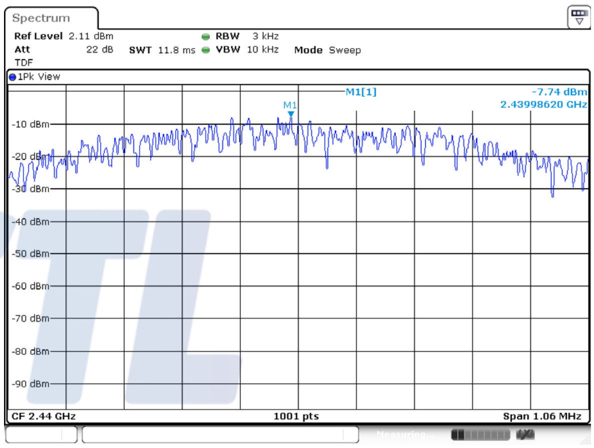
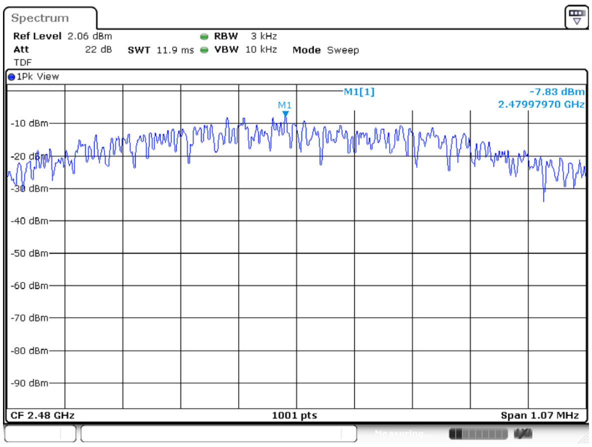
Method PKPSD (peak PSD)

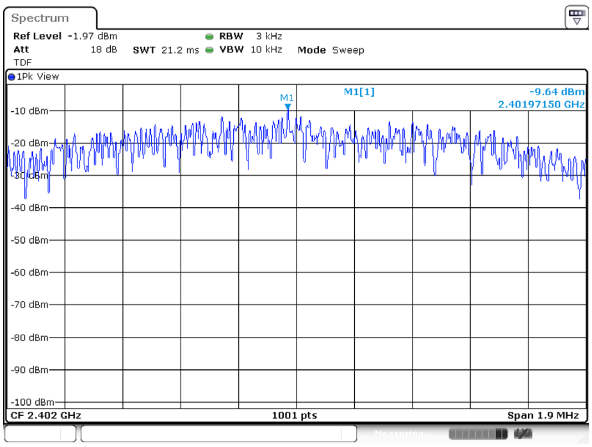
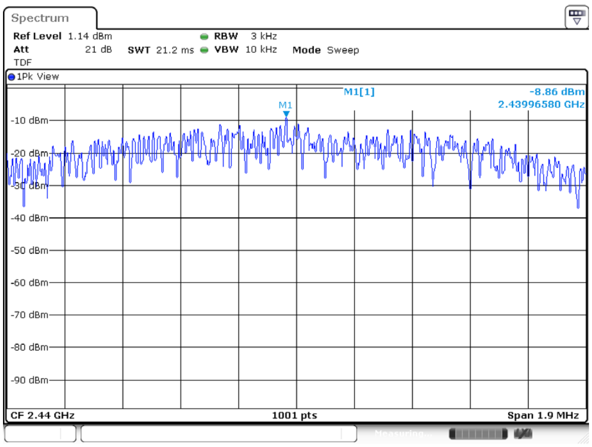
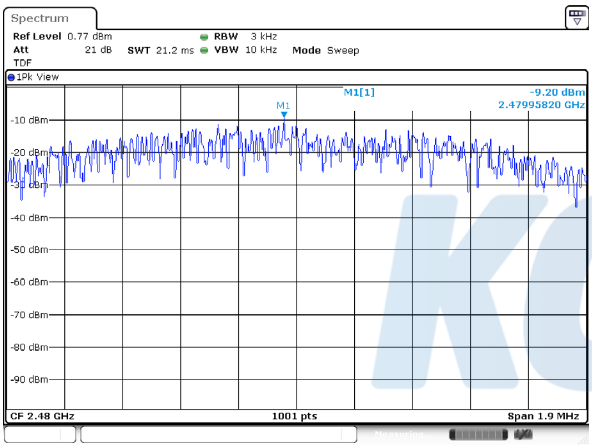
The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

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 kHz ≤ RBW ≤ 100 kHz.
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 kHz) and repeat.

Test results

Frequency(㎒)	Data rate (Bits/s)	Packet length (Bytes)	PSD(dBm/3 ㎑)	Limit(dBm/3 ㎑)
2 402	1M	37	-8.79	8
2 440			-7.74	
2 480			-7.83	
2 402	2M	37	-9.64	
2 440			-8.86	
2 480			-9.20	

BLE_1 MBits/s	
	
	Blank

BLE_2 MBits/s	
	
	Blank

7.3. 6 dB Bandwidth(DTS Channel Bandwidth)

Test setup

Limit

According to §15.247(a)(2), For Systems using digital modulation techniques may operate in the 902–928 ㎒, 2 400–2 483.5 ㎒, and 5 725–5 850 ㎒ bands. The minimum 6 ㏈ bandwidth shall be at least 500 ㎑.

Test procedure

ANSI C63.10 – Section 11.8.2

Test settings

DTS bandwidth

One of the following procedures may be used to determine the modulated DTS bandwidth.

Option 1

1) Set RBW = 100 ㎑.
2) Set the video bandwidth (VBW) ≥ 3 x 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 ㏈ relative to the maximum level measured in the fundamental emission.

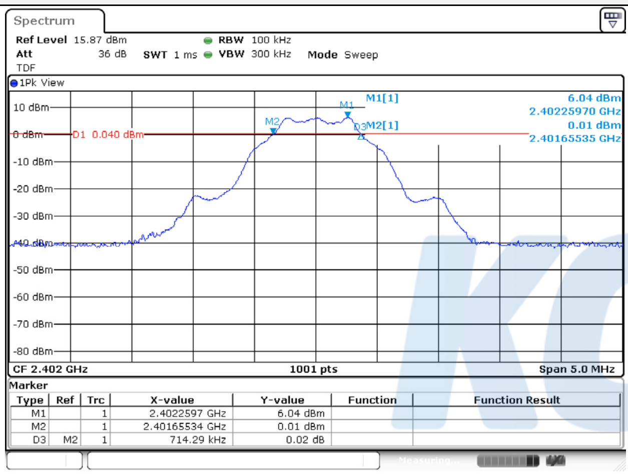
Option 2

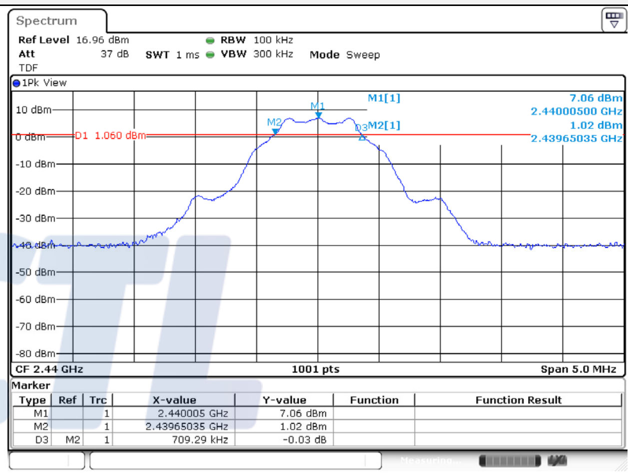
The automatic bandwidth measurement capability of an instrument may be employed using the X ㏈ bandwidth mode with X set to 6 ㏈, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 ㏈.

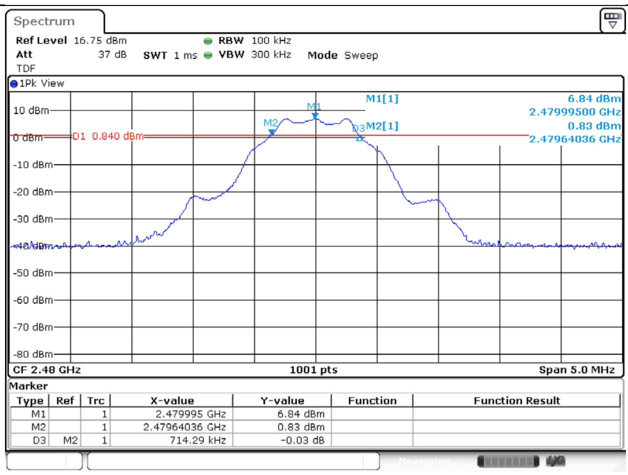
Test results

Frequency(㎒)	Data rate (Bits/s)	Packet length (Bytes)	6 dB bandwidth(㎒)
2 402	1M	37	0.71
2 440			0.71
2 480			0.71
2 402	2M	37	1.26
2 440			1.26
2 480			1.27

BLE_1MBits/s

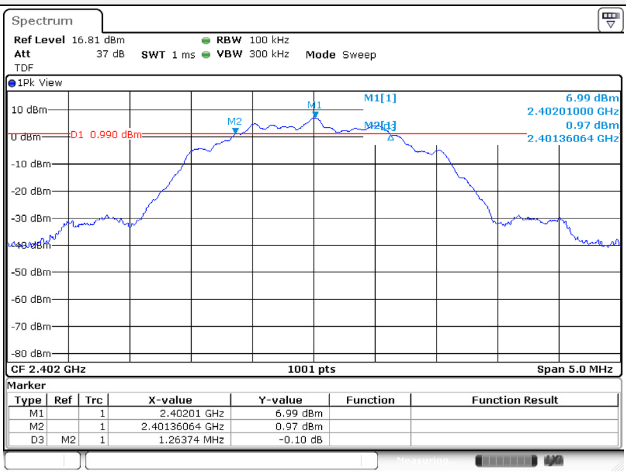


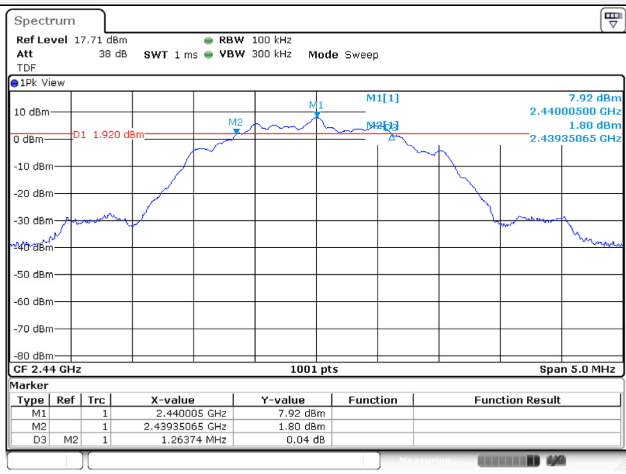


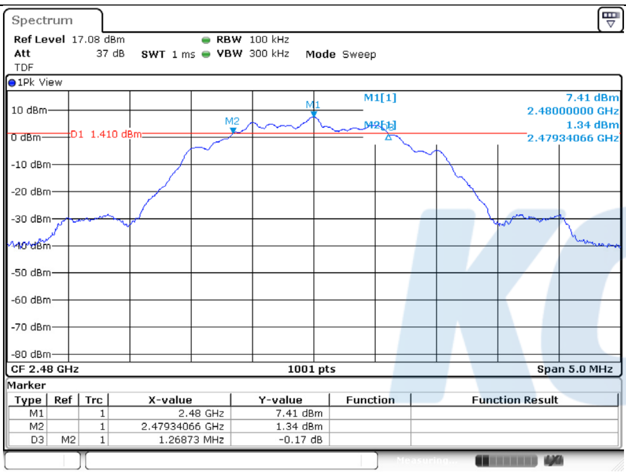


Blank

BLE_2MBits/s







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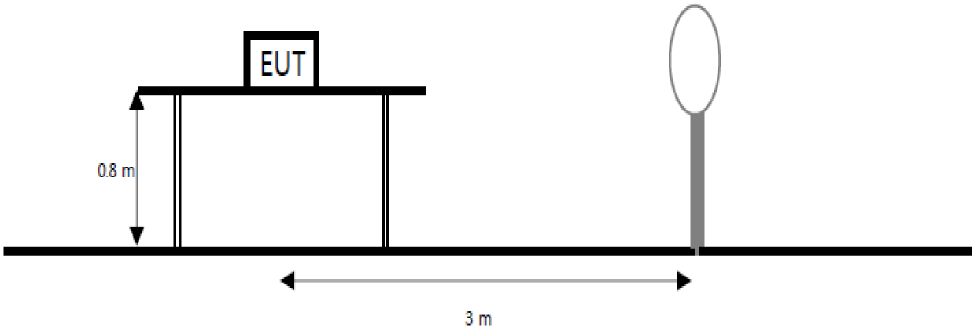
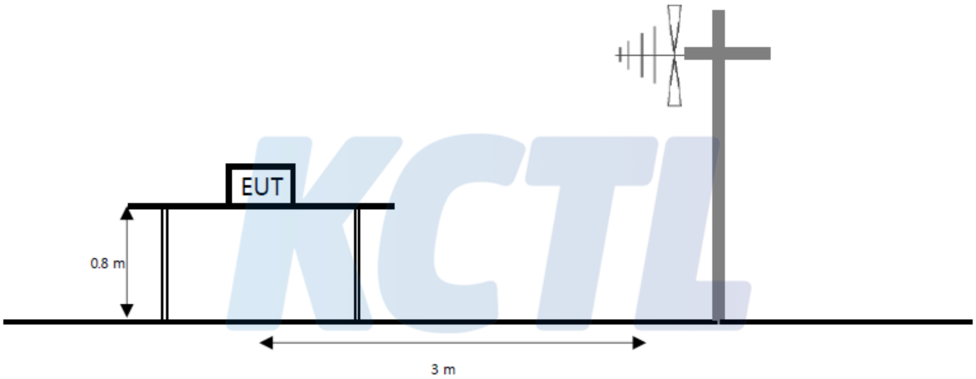
7.4. Spurious Emission, Band Edge and Restricted bands

Test setup

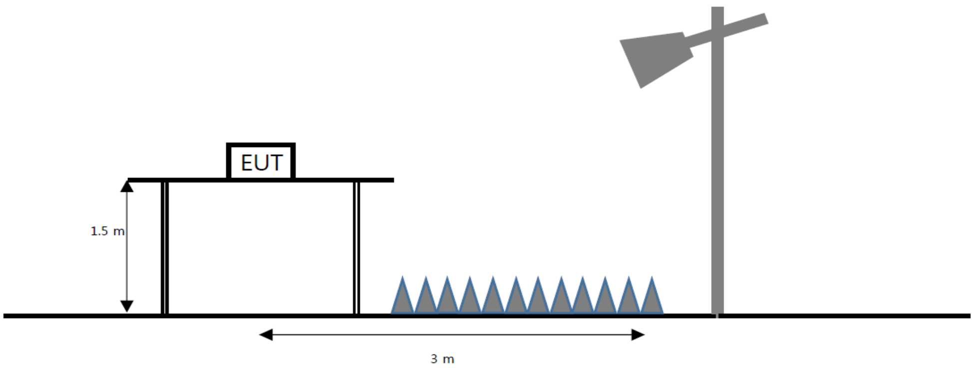
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ 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 (㎒)	Field strength (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	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 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

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

㎒	㎒	㎒	㎓
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 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, 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 ≥ (3×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 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

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 ≥ 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):
1. RBW = 1 ㎒ (unless otherwise specified).
2. VBW ≥ (3×RBW).
3. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (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 ㏈ 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 ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±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 ㎒ (unless otherwise specified).
4. VBW ≥ [3 × RBW].
5. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (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 ㏈ 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 ≥ 98%) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

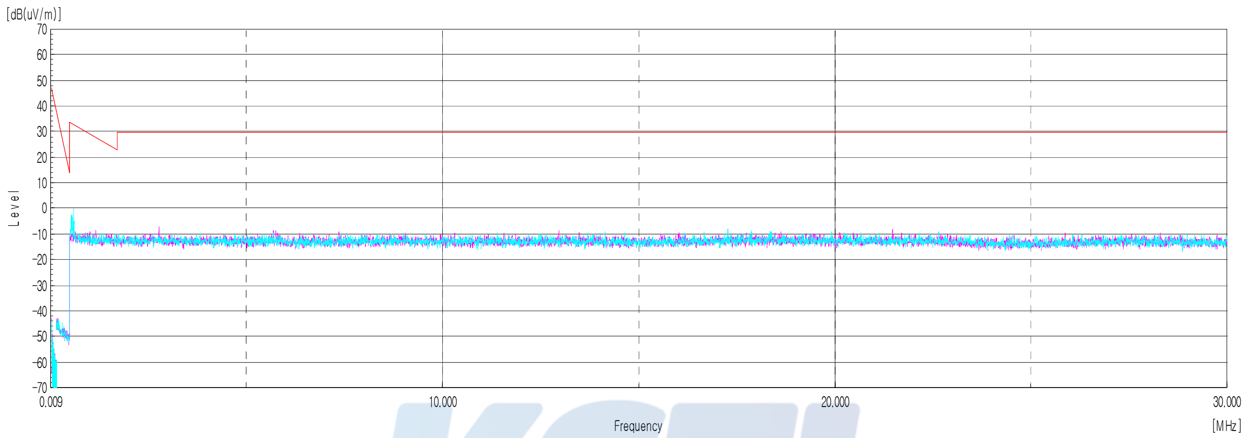
Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. F_d = 40log(D_m/Ds)
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. F_d = 20log(D_m/Ds)
   Where:
   F_d= Distance factor in ㏈
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
3. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ 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 (Below 30 ㎒) –Worst case: 2 MBits/s(37 Bytes) 2 440 ㎒

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(㎶)]	[dB]	[dB]	[dB]	[dB]	[dB(㎶/m)]	[dB(㎶/m)]	[dB]
No spurious emissions were detected within 20 ㏈ of the limit.									

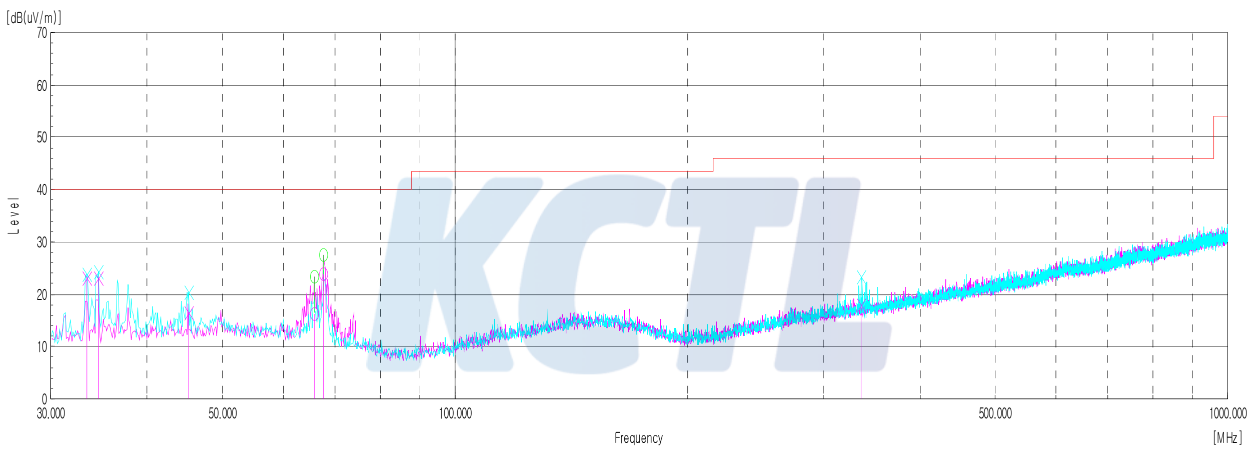
Horizontal/Vertical



Test results (Below 1 000 ㎒) –Worst case: 2 MBits/s (37 Bytes) 2 440 ㎒

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
33.40	V	36.10	17.21	-30.55	-	22.76	40.00	17.24
34.61	V	35.90	17.51	-30.51	-	22.90	40.00	17.10
45.28	V	28.40	18.31	-30.25	-	16.46	40.00	23.54
65.77	H	28.90	16.89	-29.79	-	16.00	40.00	24.00
67.59	H	36.80	16.64	-29.75	-	23.69	40.00	16.31
335.55	V	24.20	20.08	-26.40	-	17.88	46.00	28.12

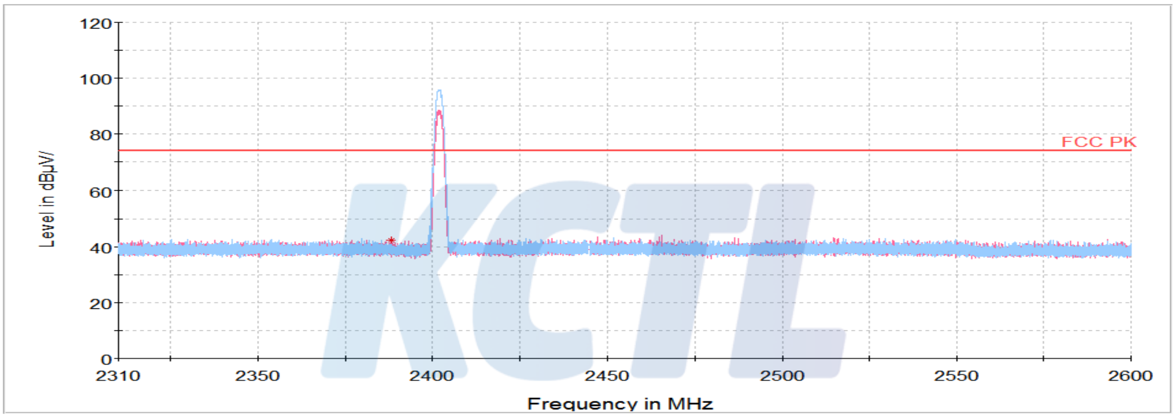
Horizontal/Vertical



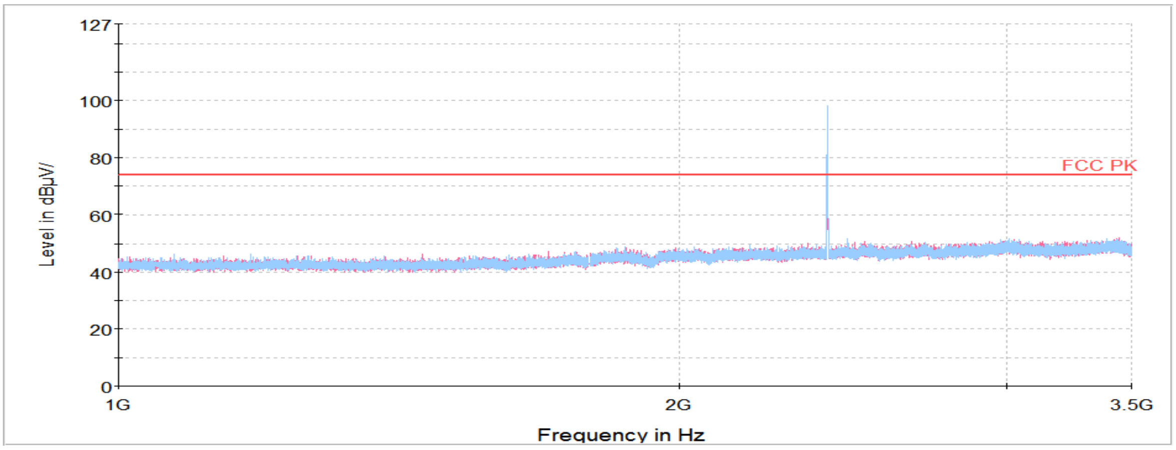
Test results (Above 1 000 ㎒)_1 MBits/s(37 Bytes)
Low Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
2 388.38[1)]	V	39.55	31.88	-29.05	-	42.38	74.00	31.62
3 693.48[1)]	H	74.60	32.75	-57.06	-	50.29	74.00	23.71
7 207.02	V	66.51	35.40	-53.08	-	48.83	74.00	25.17
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

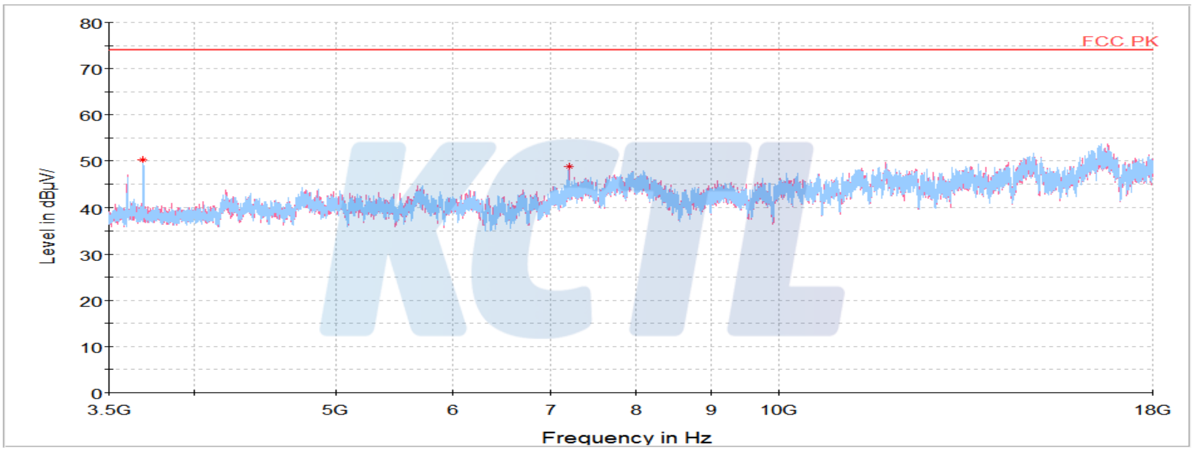
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



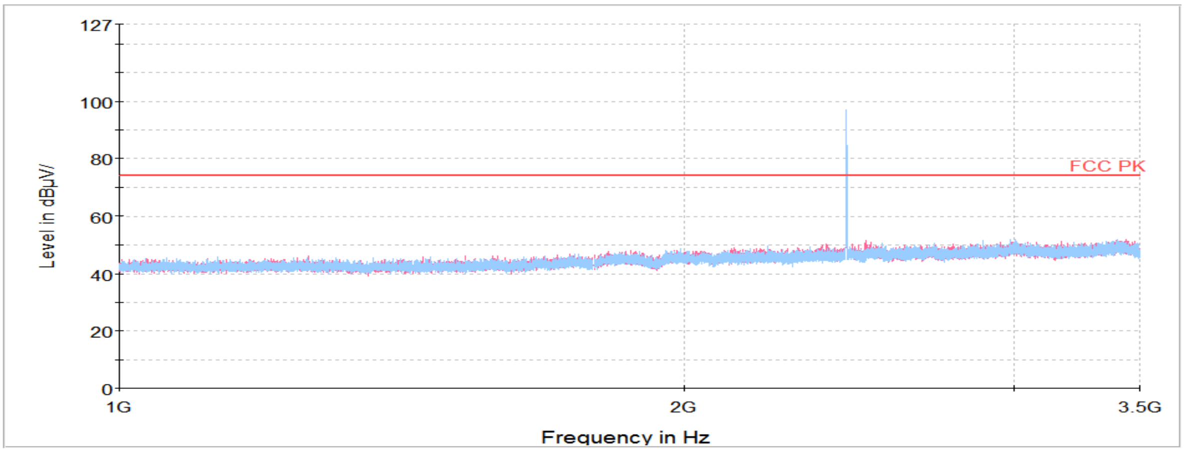
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



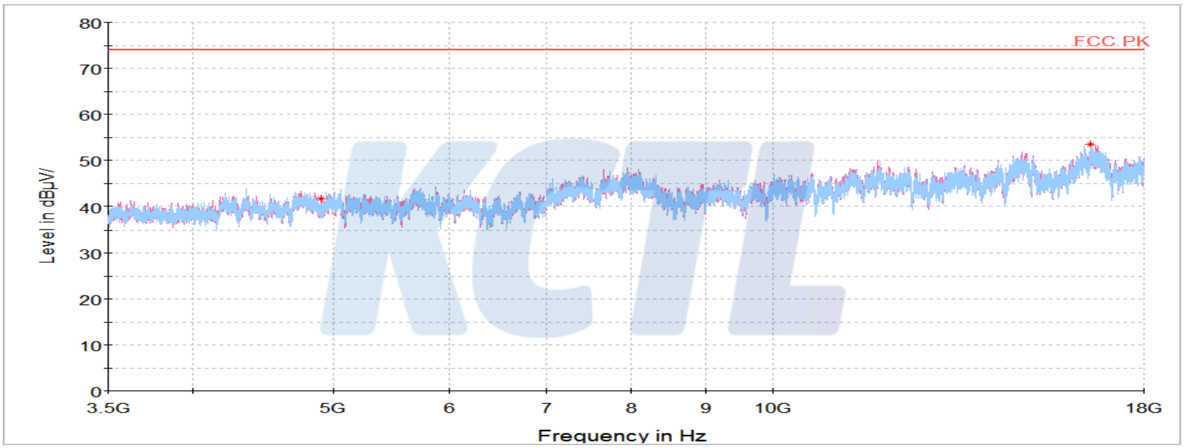
Middle Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[MHz]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
4 906.05[1)]	V	63.36	33.96	-55.63	-	41.69	74.00	32.31
16 545.02	H	57.56	41.55	-45.65	-	53.46	74.00	20.54
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



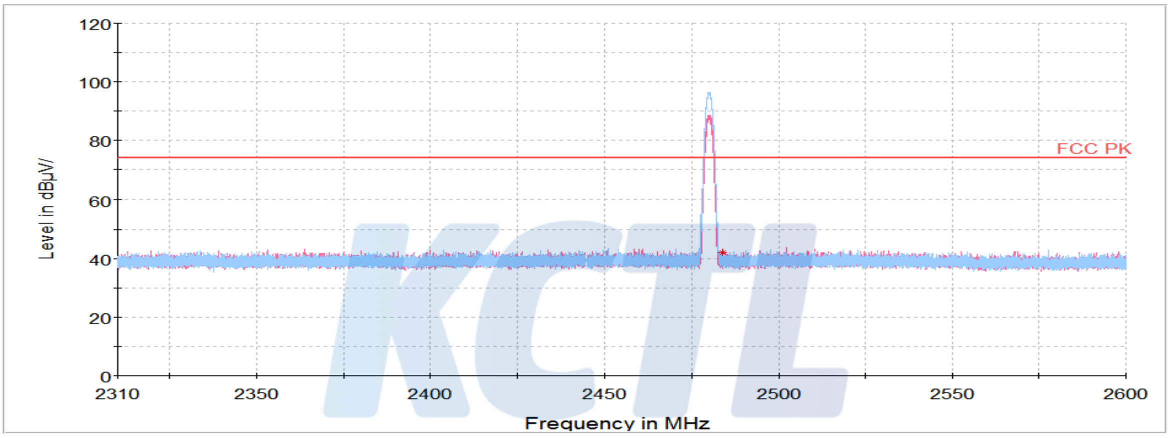
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓

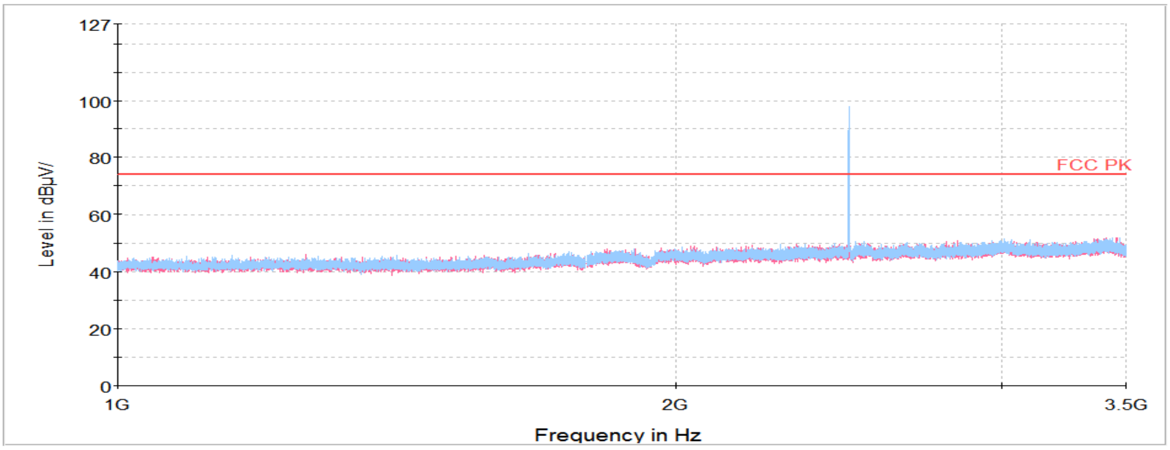
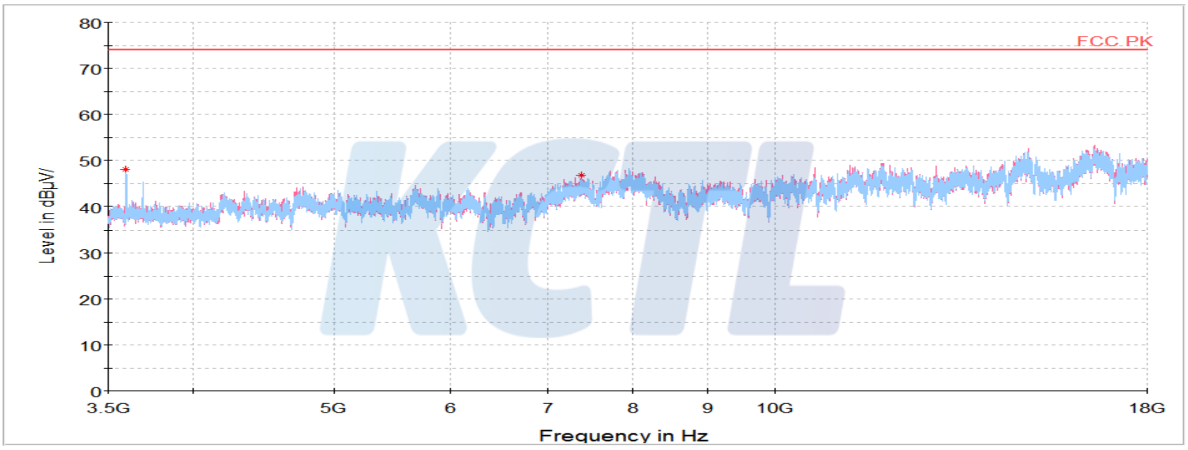


High Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[MHz]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
2 483.97[1)]	H	39.26	32.07	-29.22	-	42.11	74.00	31.89
3 601.05[1)]	H	71.63	32.68	-56.26	-	48.05	74.00	25.95
7 392.34[1)]	V	63.64	35.40	-52.38	-	46.66	74.00	27.34
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

Horizontal/Vertical for Band-edge



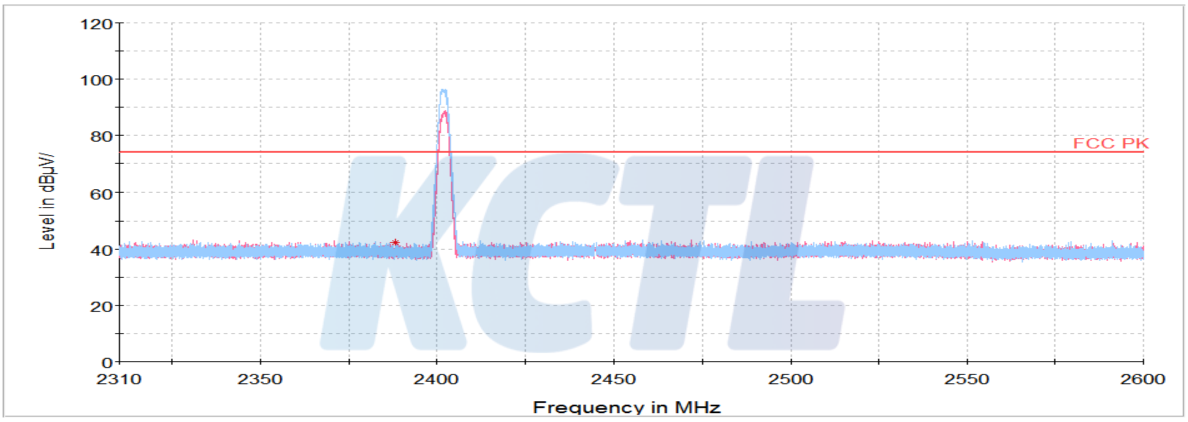
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓

Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓


2 MBits/s(37 Bytes)

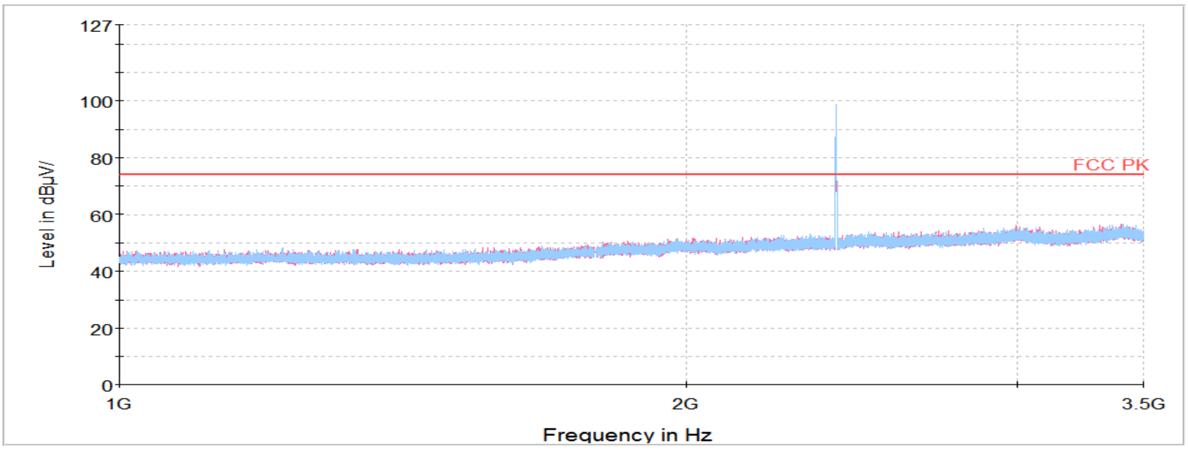
Low Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
2 388.21[1)]	H	39.61	31.88	-29.05	-	42.44	74.00	31.56
7 204.75	V	68.64	35.40	-53.09	-	50.95	74.00	23.05
16 564.95	H	57.24	41.56	-45.72	-	53.08	74.00	20.92
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

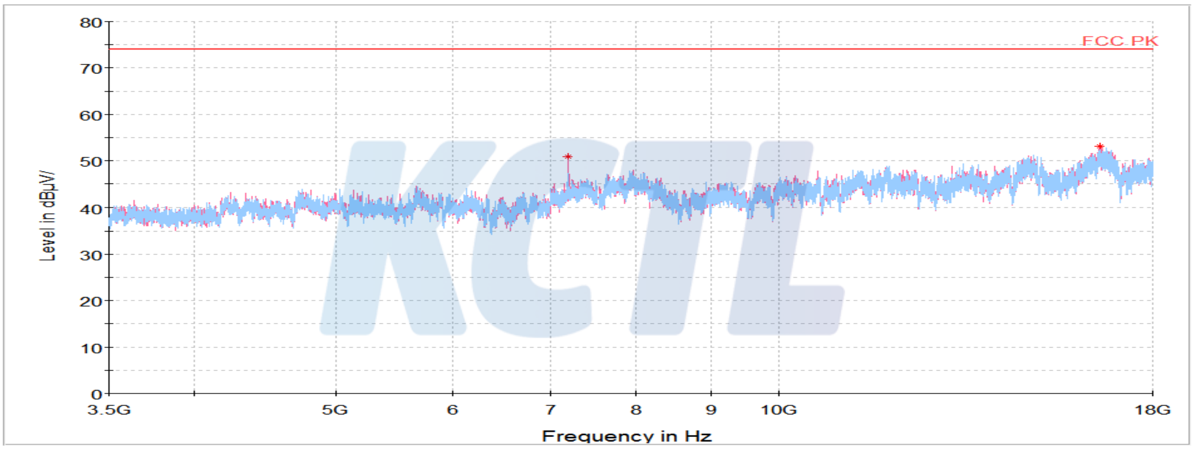
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



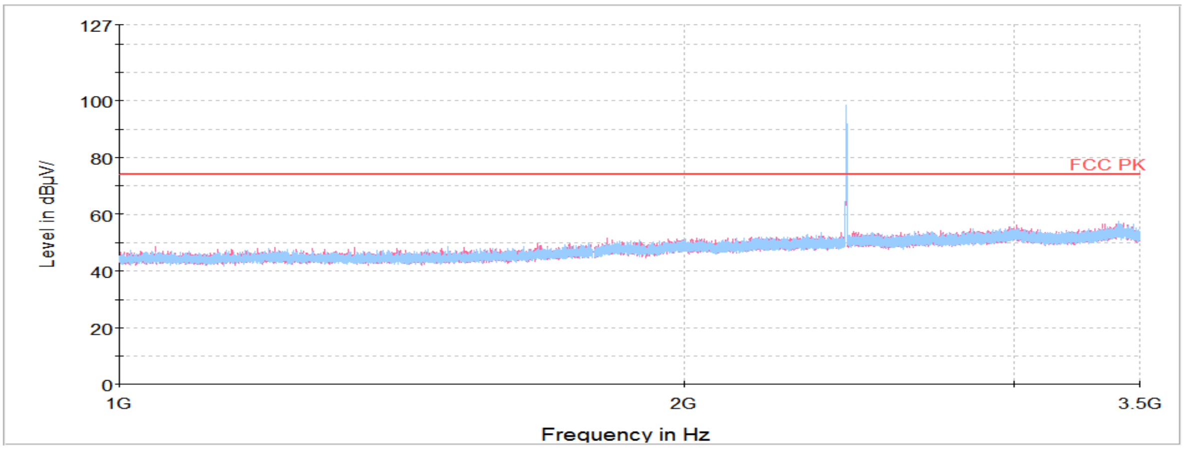
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



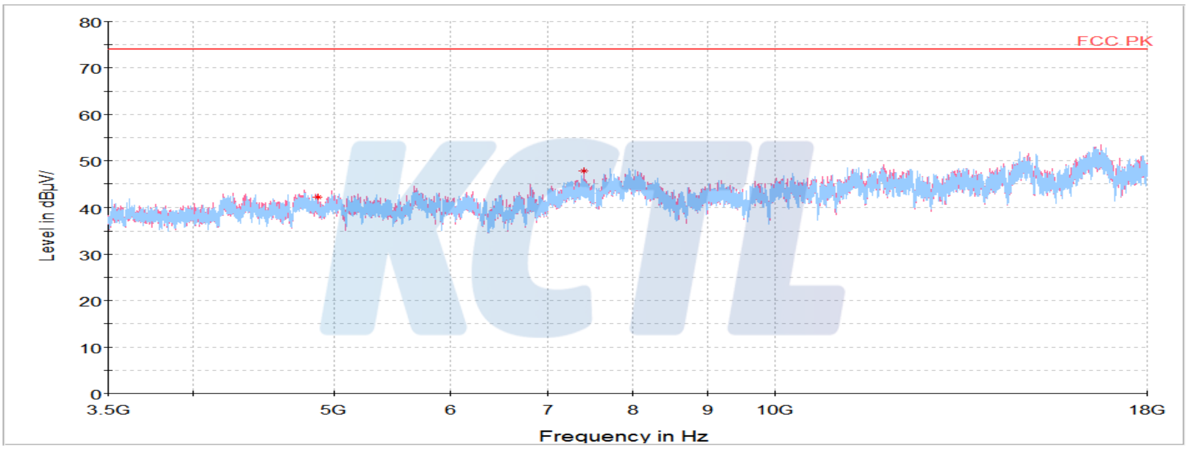
Middle Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(㎶)]	[dB]	[dB]	[dB]	[dB(㎶/m)]	[dB(㎶/m)]	[dB]
Peak data								
4 877.95 1)	V	63.38	33.95	-55.11	-	42.22	74.00	31.78
7 418.17 1)	V	64.64	35.40	-52.29	-	47.75	74.00	26.25
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



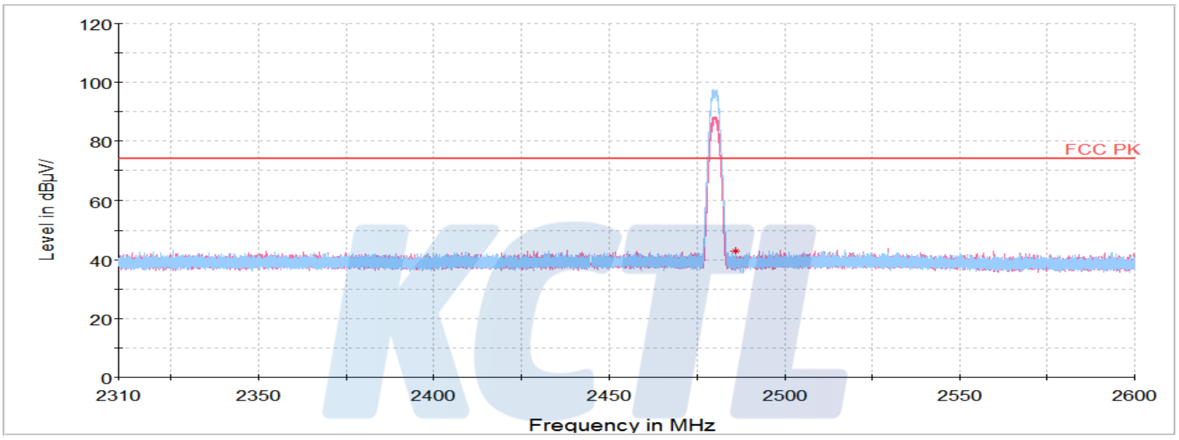
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



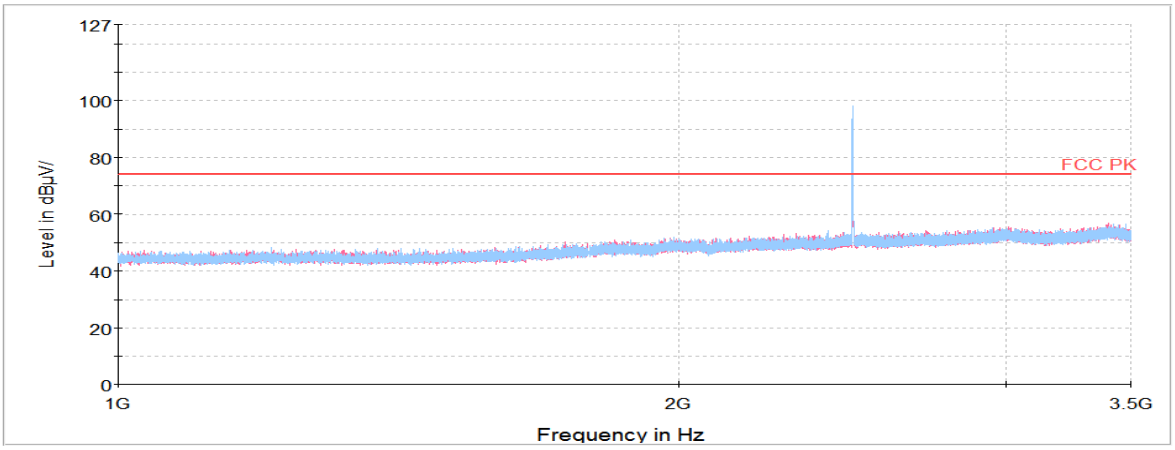
High Channel

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[MHz]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
2 485.91[1)]	H	40.07	32.07	-29.22	-	42.92	74.00	31.08
4 974.02[1)]	V	62.67	33.99	-54.41	-	42.25	74.00	31.75
7 472.55[1)]	V	63.35	35.40	-52.08	-	46.67	74.00	27.33
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

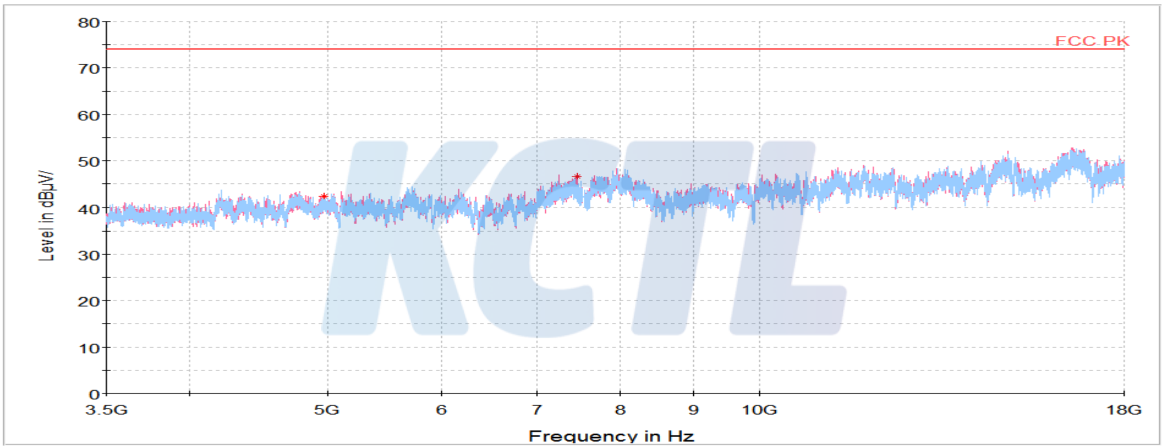
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓

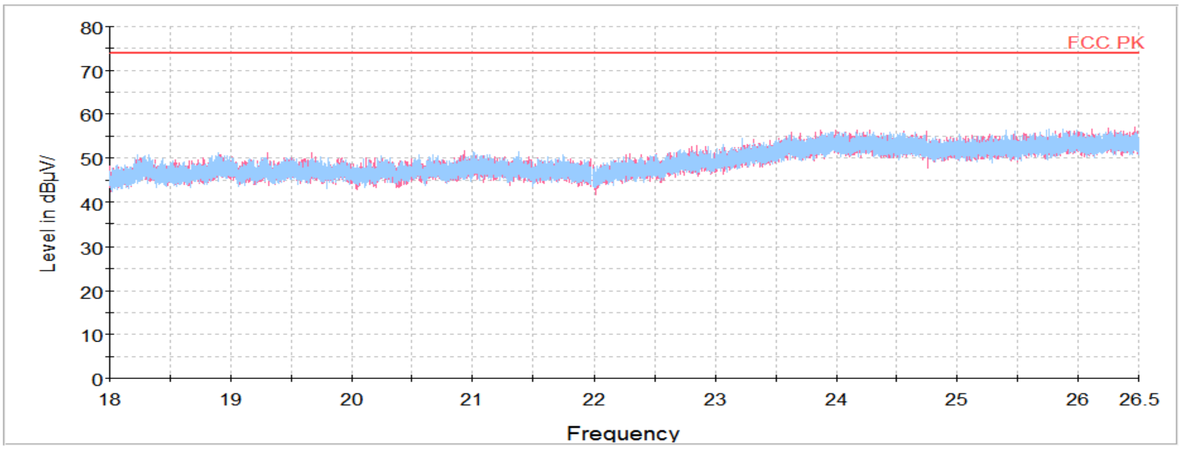


Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



Test results (Above 18 ㎓) – Worst case: 2 MBits/s (37 Bytes) 2 440 ㎒

Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓



7.5. Conducted Spurious Emission

Test setup

EUT	Attenuator	Spectrum analyzer

Limit

According to §15.247(d), In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operation, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation specified in §15.209(a) is not required. In addition, radiated emission limits specified in §15.209(a) (see §15.205(c)).
Limit : 20 ㏈c

Test procedure

ANSI C63.10-2013 - Section 11.11.3
KDB 558074 D01 v05 - Section 8.5
KDB 662911 D01 v02r01 – section (E)(3)(b)

Test settings

Establish an emission level by using the following procedure:

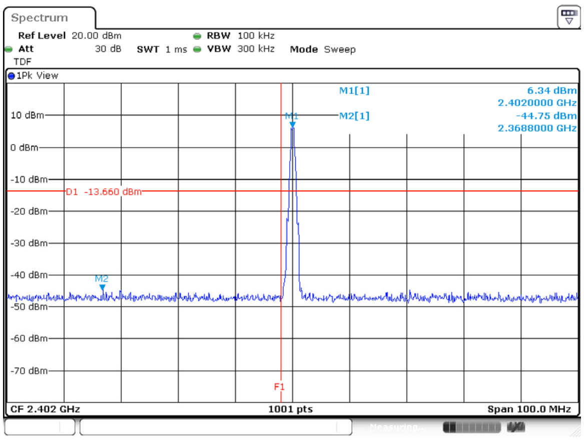
1) Set the center frequency and span to encompass frequency range to be measured.
2) Set the RBW = 100 ㎑
3) Set the VBW ≥ [3 x RBW]
4) Detector = peak
5) Sweep time = auto couple
6) Trace mode = max hold
7) Allow trace to fully stabilize.
8) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

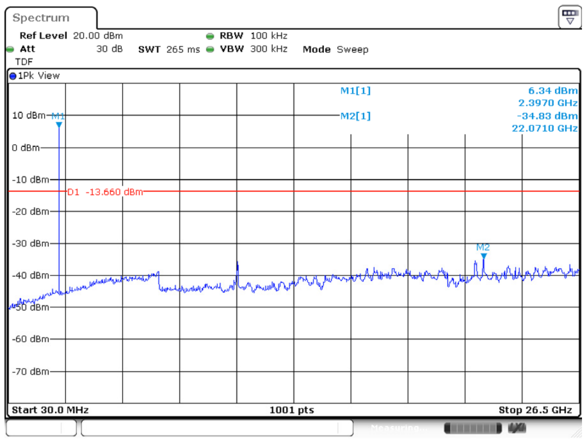
Test results

BLE_1 MBit/s(37 Bytes)

Conducted band-edge / Low ch.



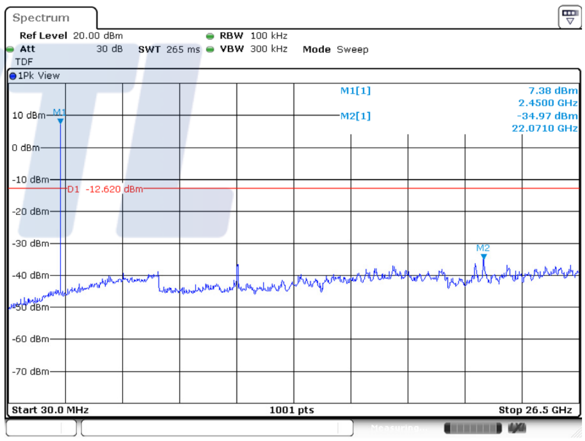
Conducted spurious / Low ch.



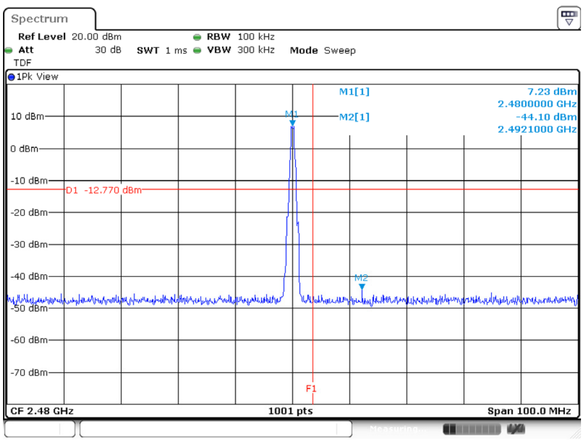
Conducted band-edge / Mid ch.

Blank

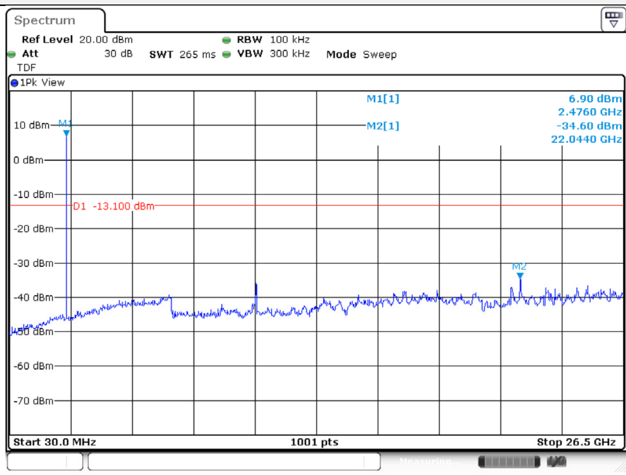
Conducted spurious / Mid ch.



Conducted band-edge / High ch.

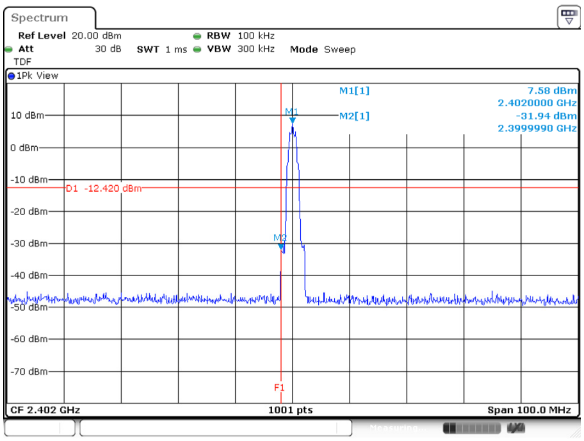


Conducted spurious / High ch.

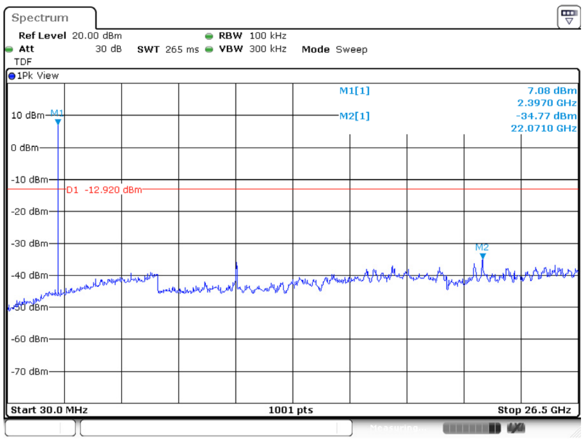


BLE_2 MBit/s(37 Bytes)

Conducted band-edge / Low ch.



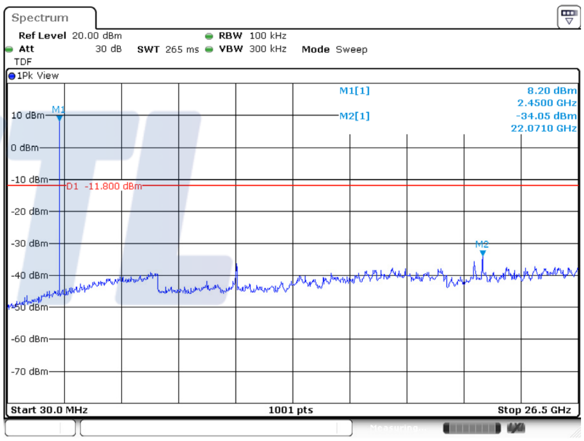
Conducted spurious / Low ch.



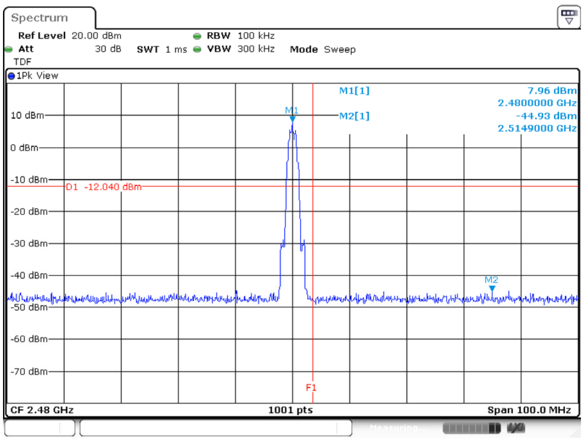
Conducted band-edge / Mid ch.

Blank

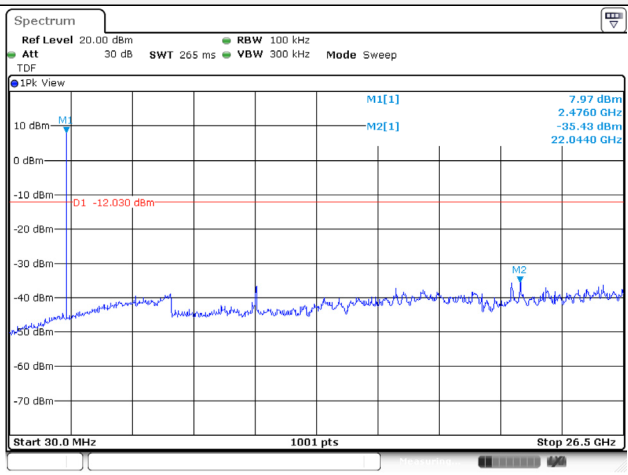
Conducted spurious / Mid ch.



Conducted band-edge / High ch.

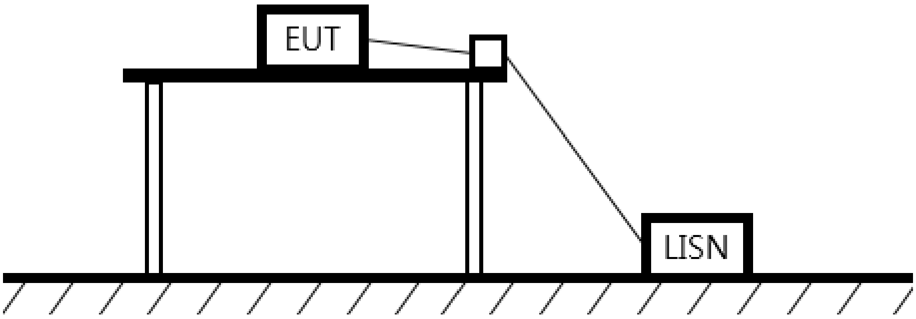


Conducted spurious / High ch.



7.6. AC Conducted emission

Test setup



Limit

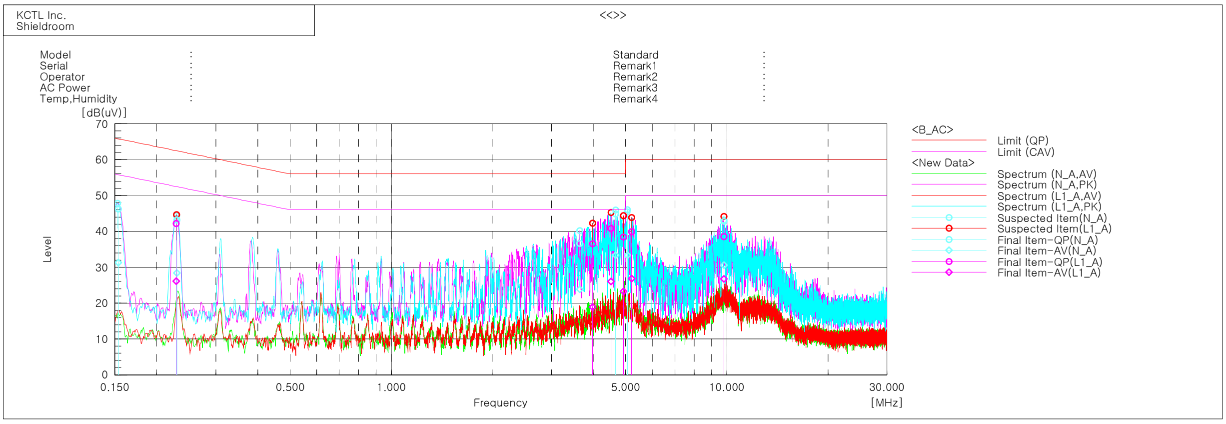
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

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

Test results-Worst case: 2 MBits/s(37 Bytes) 2 440 ㎒



Final Result

--- N_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.1536	36.2	21.2	10.1	46.3	31.3	65.8	55.8	19.5	24.5
2	0.22964	33.2	18.4	10.0	43.2	28.4	62.5	52.5	19.3	24.1
3	3.64911	26.2	13.5	10.4	36.6	23.9	56.0	46.0	19.4	22.1
4	4.66503	35.5	23.0	10.4	45.9	33.4	56.0	46.0	10.1	12.6
5	5.05104	35.6	23.0	10.4	46.0	33.4	60.0	50.0	14.0	16.6
6	9.80242	32.2	20.0	10.6	42.8	30.6	60.0	50.0	17.2	19.4

--- L1_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.22839	32.2	16.1	10.0	42.2	26.1	62.5	52.5	20.3	26.4
2	3.98586	26.1	8.5	10.4	36.5	18.9	56.0	46.0	19.5	27.1
3	4.51496	30.4	15.7	10.4	40.8	26.1	56.0	46.0	15.2	19.9
4	4.92022	28.0	12.9	10.4	38.4	23.3	56.0	46.0	17.6	22.7
5	5.20094	29.5	16.5	10.4	39.9	26.9	60.0	50.0	20.1	23.1
6	9.80836	27.8	16.0	10.7	38.5	26.7	60.0	50.0	21.5	23.3

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100806	21.07.29*
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
Power Sensor	R&S	NRP-Z81	1137.9009.02-106224-tg	21.05.25
Attenuator	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31210	21.05.11
DC Power Supply	AGILENT	E3632A	MY40001543	21.05.11
Spectrum Analyzer	R&S	FSV40	100989	21.01.03
EMI TEST RECEIVER	R&S	ESCI7	100732	20.08.22
Bi-Log Antenna	SCHWARZBECK	VULB9168	583	22.04.23
Amplifier	SONOMA INSTRUMENT	310N	284608	20.08.22
COAXIAL FIXED ATTENUATOR	Agilent	8491B-003	2708A18758	21.04.23
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 Pre-Amplifier	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
LOOP Antenna	R&S	HFH2-Z2	100355	20.08.24
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Turn Table	Innco Systems	DT2000	79	-
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-
High pass Filter	WT	WT-A1698-HS	WT160411001	21.05.11
TWO-LINE V - NETWORK	R&S	ENV216	101358	20.10.02
EMI TEST RECEIVER	R&S	ESCI	100001	20.08.22

* Tests related to this equipment were progressed after the calibration was completed.

End of test report