TEST REPORT

KCTL Inc.
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Suwon-si, Gyeonggi-do, 16677, Korea
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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2019-10-18

2. Use of Report : Class II Permissive change

3. Name of Product and Model : Smart Wearable / SM-R835F

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

5. FCC ID : A3LSMR835

6. Date of Test : 2019-10-30 to 2019-11-05

7. Test Standards : FCC Part 15 Subpart C, 15.247

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

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

2019-11-15

KCTL Inc.

Report revision history

Date	Revision	Page No
2019-11-15	Initial 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 Co., Ltd.
Address	:	94-1, Imsu-dong, Gumi-si, Gyengsangbuk-do, 730-722, Rep. of Korea
Factory	:	Samsung Electronics VIETNAM Co., Ltd.
Address	:	Yenphong 1 - I.P Yentrung Commune, Yenphong Dist., 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
		Industry Canada Registration No. : 8035A
		KOLAS No.: KT231

2. Device information

Equipment under test	:	Smart Wearable
Model	:	SM-R835F
Frequency range	:	Bluetooth(BDR/EDR/BLE)_2 402 ㎒ ~ 2 480 ㎒
		WIFI(802.11b/g/n20)_2 412 ㎒ ~ 2 472 ㎒
		LTE Band 5_824.7 ㎒ ~ 848.3 ㎒
		WCDMA 850_826.4 ㎒ ~ 846.6 ㎒
Modulation technique	:	Bluetooth(BDR/EDR)_ GFSK, π/4DQPSK, 8DPSK
		Bluetooth(BLE)_GFSK
		WIFI(802.11b/g/n20)_DSSS, OFDM
		LTE_QPSK, 16QAM
		WCDMA_QPSK
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) : -6.4 ㏈i
Software version	:	R835F.001
Hardware version	:	REV1.0

Test device serial No. : Conducted(353343/11/000040/0)
Radiated(R3AM90016TK, R3AM90016QF, R3AM900174Y)

Operation temperature : -30 ℃ ~ 50 ℃

2.1. Accessory information

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

2.2. Frequency/channel operations

This device contains the following capabilities:
Bluetooth(BDR/EDR/BLE), WIFI(802.11b/g/n20), LTE Band 5, WCDMA 850

Ch.	Frequency (㎒)
00	2 402
. .	. .
39	2 441
. .	. .
78	2 480

Table 2.2.1. Bluetooth mode

15.247 Requirements for Bluetooth transmitter:
- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
  1) This system is hopping pseudo-randomly.
  2) Each frequency is used equally on the average by each transmitter.
  3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters
  4) The receiver shifts frequencies in synchronization with the transmitted signals.
- 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.
- 15.247(h): The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

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 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)	Parameter	Test results
15.247(b)(1),(4)	Maximum peak output power	Pass
15.247(a)(1)	Carrier frequency separation	N/T(Note1)
15.247(a)(1)	20dB channel bandwidth	N/T(Note1)
-	Occupied bandwidth	N/T(Note1)
15.247(a)(iii) 15.247(b)(1)	Number of hopping channel	N/T(Note1)
15.247(a) (iii)	Time of occupancy(dwell time)	N/T(Note1)
15.205(a), 15.209(a)	Spurious emission	Pass
15.247(d),	Band-edge, restricted band	Pass

Notes: (N/T: Not Tested, N/A: Not Applicable)

1. These test item was performed. (FCC ID: A3LSMR835)
   Test Report No. KR19-SRF0093-A issued on 8, August, 2019 by KCTL Inc.)
2. C2PC model is electrically identical to the Original model.
   The Product Equality Declaration includes detailed information about the changes between the devices.
3. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 7.
4. Output power was verified to be within the expected tune up tolerances prior to performing the spot checks for radiated spurious emissions and band edge to confirm that the proposed changes to the digital circuitry had not adversely affected the previously reported values in the original filing.
5. The test scenario for spot check is based on the worst-case of original report results.

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	1.76 dB	
Conducted spurious emissions	4.03 dB	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.28 dB
	30 MHz ~ 300 MHz	4.98 dB
	300 MHz ~ 1 000 MHz	5.14 dB
	1 GHz ~ 6 GHz	6.70 dB
	Above 6 GHz	6.60 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.

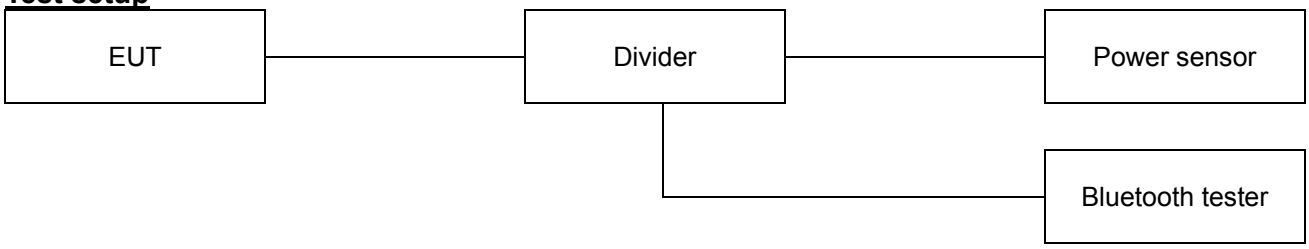
Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	6.84	9 000	9.51
100	6.90	10 000	9.54
200	6.99	11 000	9.91
300	7.00	12 000	9.96
400	7.08	13 000	10.40
500	7.13	14 000	10.41
600	7.19	15 000	10.19
700	7.27	16 000	10.31
800	7.29	17 000	10.46
900	7.33	18 000	10.77
1 000	7.40	19 000	11.43
2 000	7.74	20 000	11.64
3 000	8.08	21 000	12.37
4 000	8.41	22 000	13.37
5 000	8.68	23 000	14.10
6 000	9.02	24 000	15.33
7 000	9.20	25 000	14.69
8 000	9.38	26 000	13.67

Note.
Offset(㏈) = RF cable loss(㏈) + Power Divider(㏈)

7. Test results

7.1. Maximum peak output power

Test setup



Limit

According to §15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 ㎒ band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

According to §15.247(b)(1), for frequency hopping systems operating in the 2 400-2 483.5 ㎒ band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 ㎒ band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 ㎒ band: 0.125 watts.

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 C63.10-2013 - Section 7.8.5

Test settings

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:
Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 ㏈ bandwidth, centered on a hopping channel.
2) RBW > 20 ㏈ bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.
7) Allow trace to stabilize.

Notes:

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

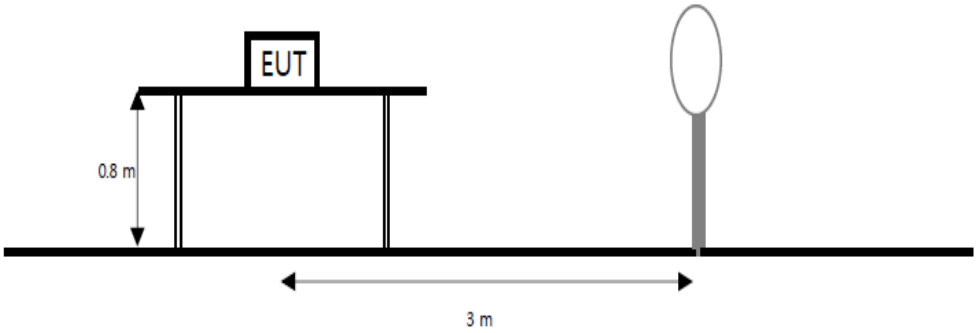
Test results

Frequency (㎒)	Data rate (Mbps)	Measured output power(dBm)		Limit(dBm)
		Peak	Average	
2 402	1	15.58	13.55	20.97
2 441	1	16.18	14.48	
2 480	1	15.28	13.77	
2 402	2	10.17	6.05	20.97
2 441	2	11.07	6.96	
2 480	2	9.17	5.06	
2 402	3	10.37	5.90	20.97
2 441	3	11.57	7.09	
2 480	3	9.87	5.19	

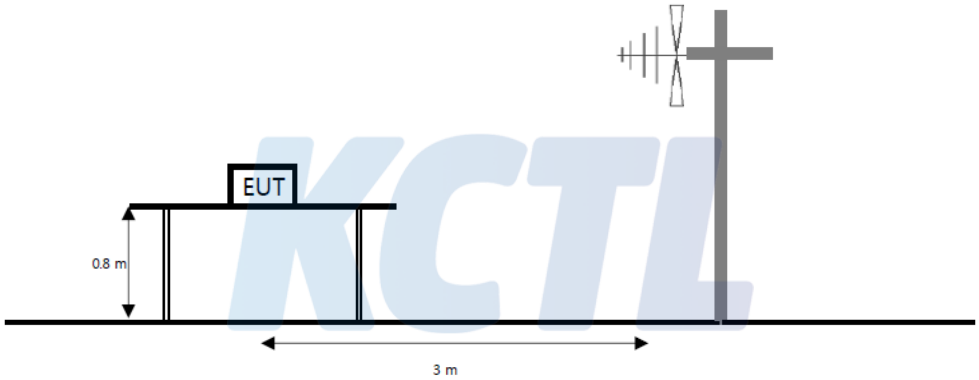
7.2. Radiated spurious emissions & band edge

Test setup

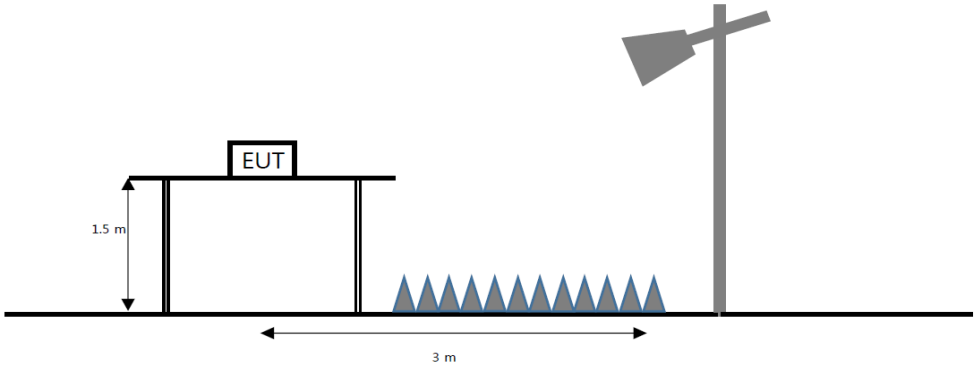
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



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 - Section 6.6.4.3

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

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 ㎒
3. VBW = 1/T ≥ 1 ㎐
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to run for at least 50 times(1/duty cycle) traces

Notes:

1. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
2. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
3. Average test would be performed if the peak result were greater than the average limit.
4. [1)] mean is restricted band.

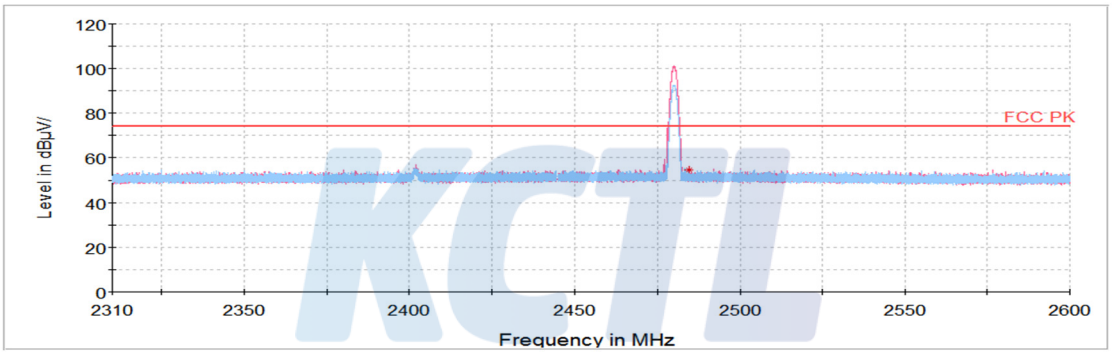
Test results

GFSK / Band-edge

78 Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 483.66[1)]	H	51.00	32.07	-29.21	-	53.86	74.00	20.14
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for Band-edge

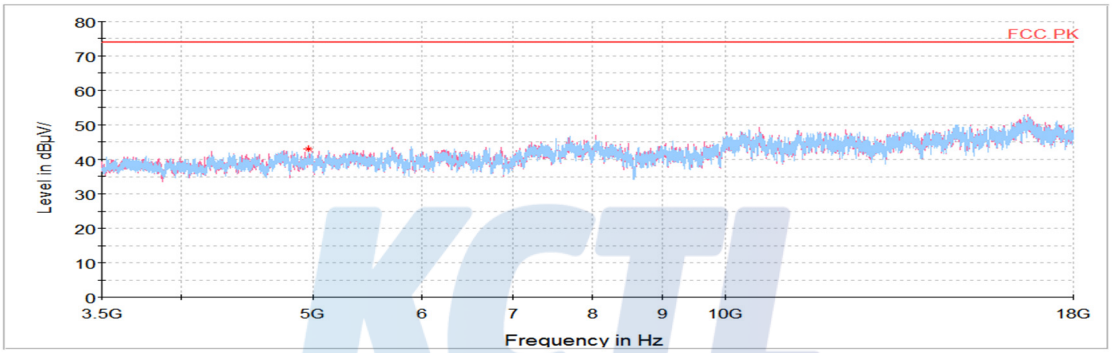


GFSK / RSE

78 Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 960.88[1)]	V	63.54	33.98	-54.59	-	42.93	74.00	31.07
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓

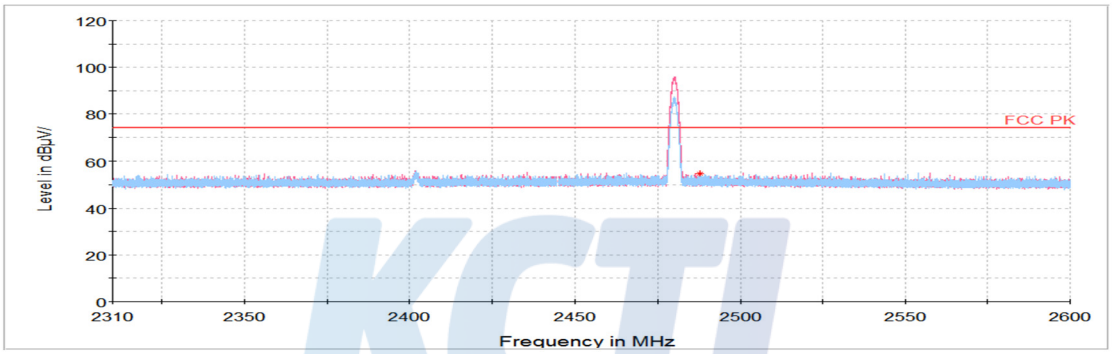


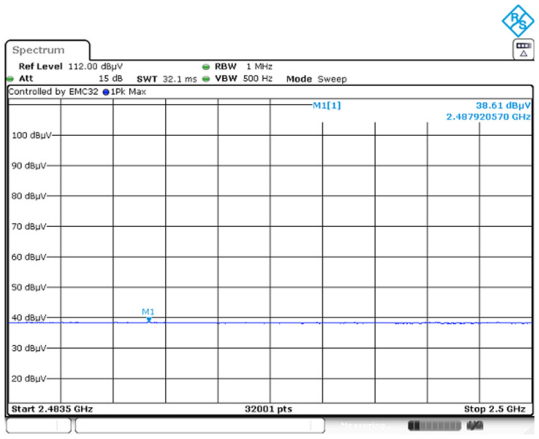
8DPSK / Band-edge

78 Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
2 487.92[1)]	V	51.62	32.08	-29.23	-	54.47	74.00	19.53
Average Data								
2 487.92[1)]	V	38.61	32.08	-29.23	-	41.46	54.00	12.54

Horizontal/Vertical for Band-edge



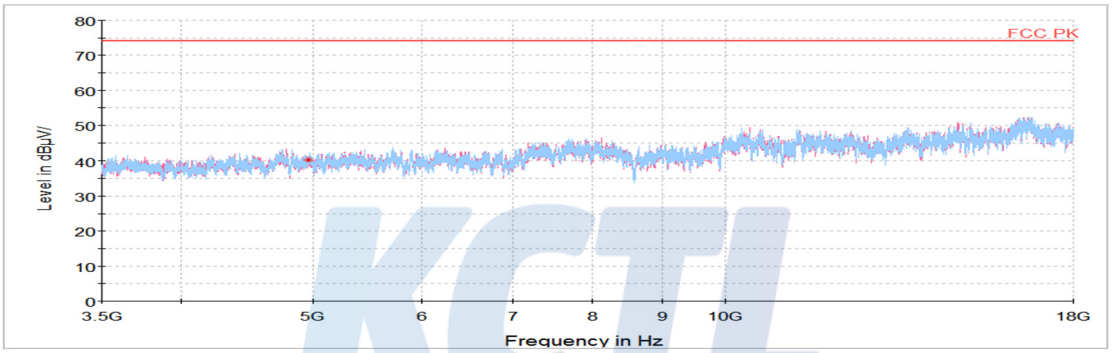
Average data	
	Blank

8DPSK / RSE

78 Channel

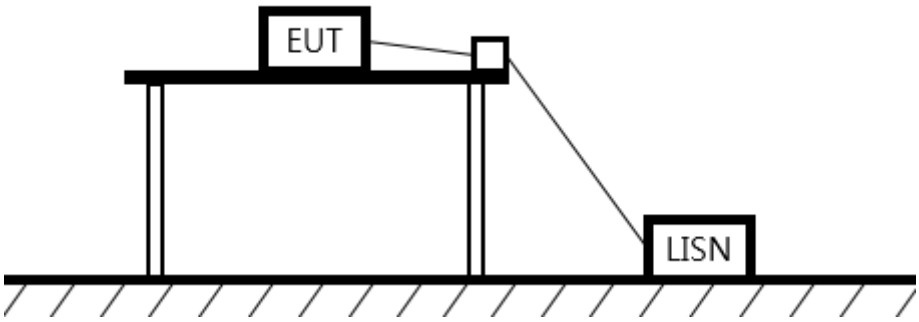
Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 959.52[1)]	H	60.63	33.98	-54.59	-	40.02	74.00	33.98
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



7.3. 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.

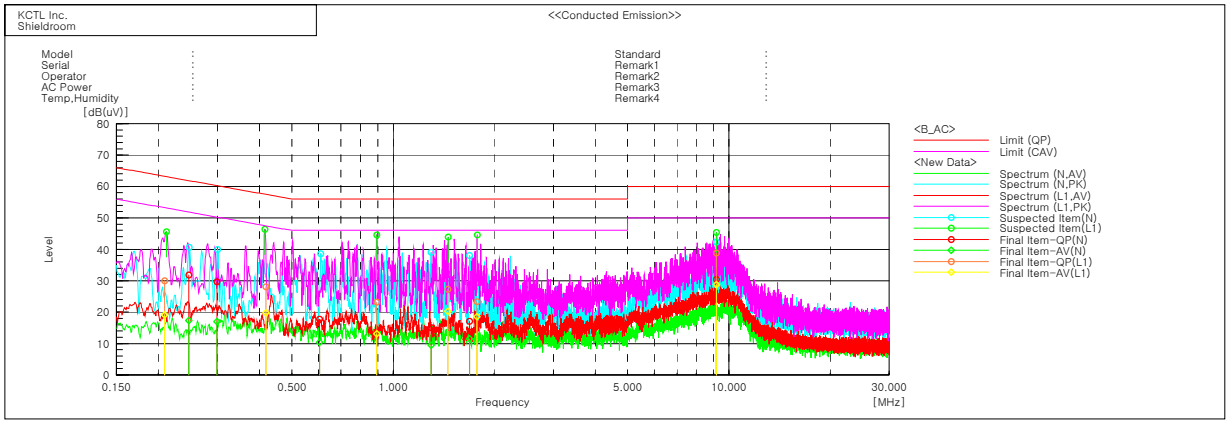
Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

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: GFSK / Middle frequency



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.24667	22.2	7.7	9.6	31.8	17.3	61.9	51.9	30.1	34.6
2	0.29883	19.9	7.3	9.7	29.6	17.0	60.3	50.3	30.7	33.3
3	0.60466	7.9	0.7	9.8	17.7	10.5	56.0	46.0	38.3	35.5
4	1.29969	5.4	-0.2	9.7	15.1	9.5	56.0	46.0	40.9	36.5
5	1.68831	7.4	1.9	9.7	17.1	11.6	56.0	46.0	38.9	34.4
6	9.17163	20.7	11.2	9.8	30.5	21.0	60.0	50.0	29.5	29.0

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.20886	20.1	9.2	9.9	30.0	19.1	63.3	53.3	33.3	34.2
2	0.41855	18.2	10.0	9.8	28.0	19.8	57.5	47.5	29.5	27.7
3	0.89393	13.5	3.4	9.8	23.3	13.2	56.0	46.0	32.7	32.8
4	1.45521	17.5	10.6	9.7	27.2	20.3	56.0	46.0	28.8	25.7
5	1.77595	13.6	8.9	9.7	23.3	18.6	56.0	46.0	32.7	27.4
6	9.19113	29.0	18.9	9.8	38.8	28.7	60.0	50.0	21.2	21.3

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV40	100988	20.01.04
Spectrum Analyzer	R&S	FSW50	101013	20.05.13
Bluetooth Tester	TESCOM	TC-3000B	3000B640056	20.01.25
Wideband Power Sensor	R&S	NRP-Z81	102398	20.01.25
ATTENUATOR	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31212	20.05.13
Horn antenna	ETS.lindgren	3116	00086632	20.02.15
Horn antenna	ETS.lindgren	3117	155787	20.10.24
Attenuator	API Inmet	40AH2W-10	12	20.05.15
Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	20.07.30
AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800 -22-10P	2031196	20.02.21
AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	20.01.28
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-
Highpass Filter	WT	WT-A1698-HS	WT160411001	20.05.14
TWO-LINE V - NETWORK	R&S	ENV216	101358	20.04.05
EMI TEST RECEIVER	R&S	ESCI	100001	20.08.22
Vector Signal Generator	R&S	SMBV100A	257566	20.01.04
Signal Generator	R&S	SMR40	100007	20.05.13

End of test report