

TEST REPORT



CTK Co., Ltd.
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Report No.:
CTK-2018-00830
Page (1) / (35) Pages

1. Client

- Name : Samsung Electronics Co Ltd
- Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey
- Date of Receipt : 2018-03-19

2. Manufacturer

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea, 16677

3. Use of Report : For FCC & IC Certification

4. Test Sample / Model: Audio Transceiver / WSN720S

5. Date of Test : 2018-03-20 to 2018-03-30

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247 RSS-247 Issue 2

7. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (48 ± 5) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Bongseok Kim: (Signature)	Technical Manager Young-taek Lee: (Signature)
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2018-04-02

Republic of KOREA **CTK Co., Ltd.**



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REPORT REVISION HISTORY

Date	Revision	Page No
2018-04-02	Issued (CTK-2018-00830)	all

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1.0 General Product Description

1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	19 Chapin Rd., Building D, Pine Brook, New Jersey
Contact Person	Name : Minhyung Cho E-mail : mh719.cho@samsung.com Tel : +82-31-277-2688

1.2 Product Information

FCC ID	A3LWSN720S
IC	649E-WSN720S
Product Description	Audio Transceiver
Model name	WSN720S
Operating Frequency	2 412 MHz - 2 464 MHz(3 channels)
RF Output Power	15.59 dBm (36.22 mW)
Antenna type	PCB Antenna
Antenna gain	Antenna A : 0.8 dBi Antenna B : 2.5 dBi
Type of Modulation	QPSK
Power Source	DC 5.0 V
Firmware Version Id Number(FVIN)	TX(CU) : ver 2** RX(MU) : ver 1**
Test Software(Version)	MP Tool(1.0.0.1)

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253QRM
AC/DC Adapter	HP	HSTNN-LA40	854054-001

2.0 Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	ISED	ISED EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	NRRA	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3.0 Test Specifications

3.1 Standards

Section in FCC	Section in RSS	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	RSS-247 5.2(a)	6 dB Bandwidth	C	Conducted
15.247(e)	RSS-247 5.2(b)	Transmitter power spectral density	C	
15.247(b)	RSS-247 5.4(d)	Maximum peak conducted output power	C	
15.247(d)	RSS-247 5.5	Unwanted emission	C	
15.209	RSS-Gen 6.13	Transmitter emission	C	Radiated
15.207(a)	RSS-Gen 8.8	AC Conducted Emission	C	Line Conducted
<u>Note 1:</u> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<u>Note 2:</u> The data in this test report are traceable to the national or international standards.				
<u>Note 3:</u> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2				
<u>Note 4:</u> The tests were performed according to the method of measurements prescribed in KDB No.558074.				

3.2 Mode of operation during the test

The UUT is operated in a manner representative of the typical of the equipments.
During at testing, system components were manipulated within the confines of typical usage to maximize each emission.
The results are only attached worst cases.

Test Frequency

Lowest channel	Middle channel	Highest channel
2 412 MHz	2 438 MHz	2 464 MHz

Test antenna

Antenna 1	Antenna 2
ANT-A	ANT-B

Duty cycle

Test item	Duty cycle
Radiated emission	18.9 %(On time : 0.48 ms, 2.06 ms)
Conducted emission	100 %

3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor $k = 2$, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	± 1.5 dB
Power Spectral Density	± 1.5 dB
Occupied Bandwidth	± 0.1 MHz
Unwanted Emission(conducted)	± 3.0 dB
Radiated Emissions ($f \leq 1$ GHz)	± 4.0 dB
Radiated Emissions ($f > 1$ GHz)	± 5.0 dB

4.0 Technical Characteristic Test

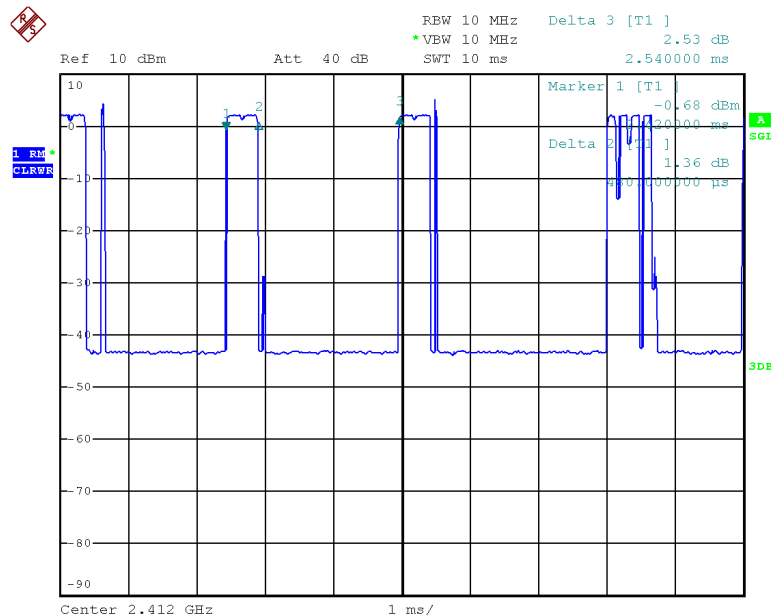
4.1 ON Time, Duty Cycle

Test Procedures

KDB 558074 Zero-Span Spectrum Analyzer Method.

Test Data:

ON Time (ms)	Period (ms)	TX OFF (ms)	Duty Cycle (linear)	Duty Cycle (%)
0.48	2.54	2.06	0.189	18.9



Date: 29.MAR.2018 16:15:05

4.2 6dB Bandwidth

Test Procedures (ANSI C63.10-2013 6.9.2)

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Procedures (ANSI C63.10-2013 6.9.3)

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit :

6 dB Bandwidth > 500kHz

Test Data:

ANT-A

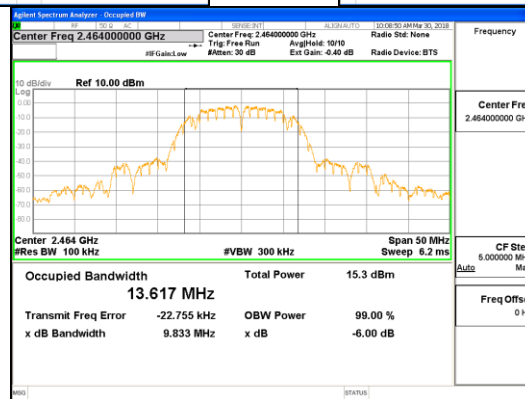
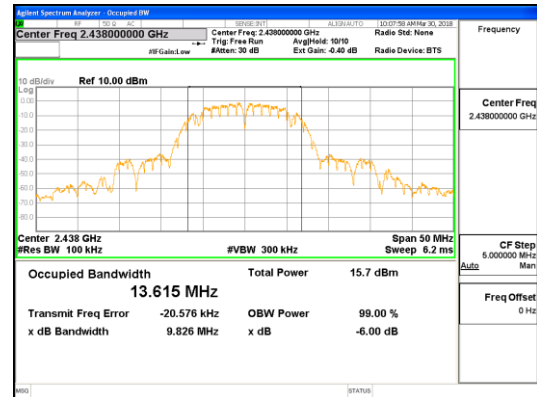
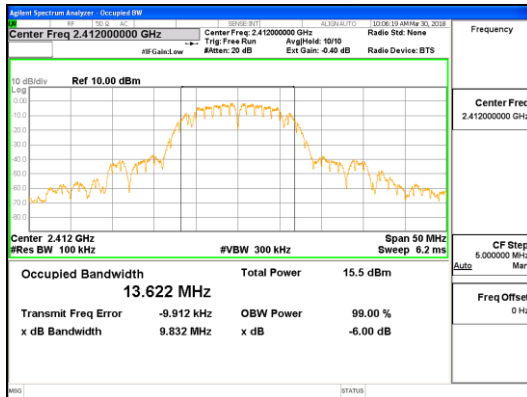
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2 412	9.832	13.622	Complies
Middle	2 438	9.826	13.615	Complies
High	2 464	9.833	13.617	Complies

ANT-B

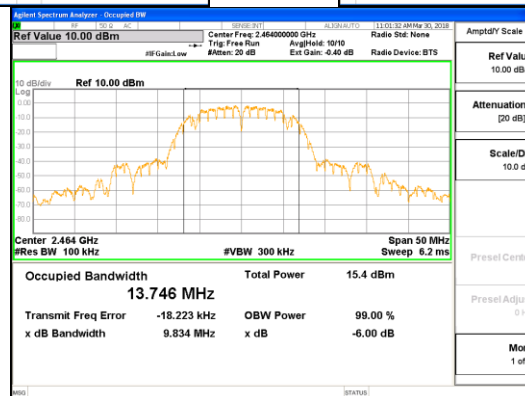
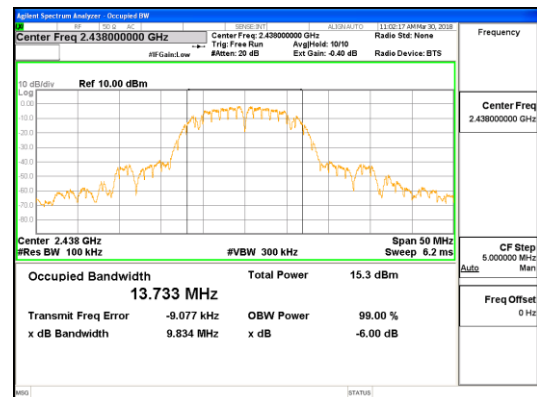
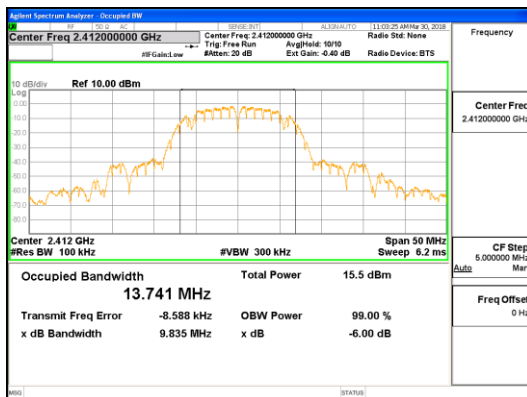
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2 412	9.835	13.741	Complies
Middle	2 438	9.834	13.733	Complies
High	2 464	9.834	13.746	Complies

See next pages for actual measured spectrum plots.

ANT-A



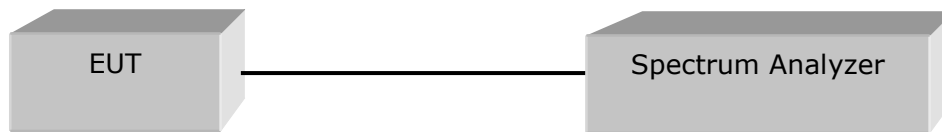
ANT-B



4.3 Maximum peak Conducted Output Power

Test Procedures(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-1)

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) span $\geq 1.5 \times \text{OBW}$
- b) RBW = 1 MHz
- c) VBW $\geq 3 \times \text{RBW}$
- d) Sweep time = auto
- e) Detector = RMS
- f) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Limit

Maximum Output Power < 1 W (30 dBm)

Test Data

ANT-A

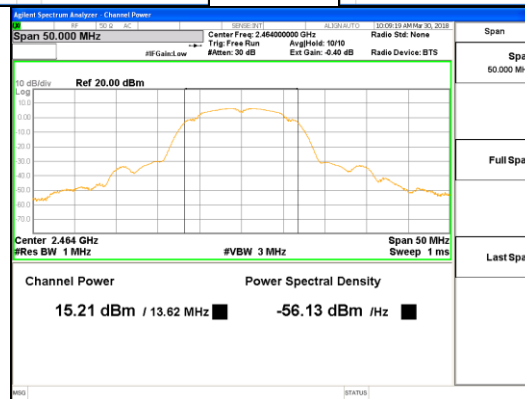
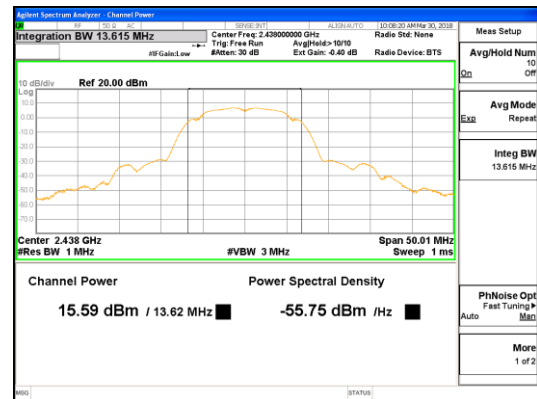
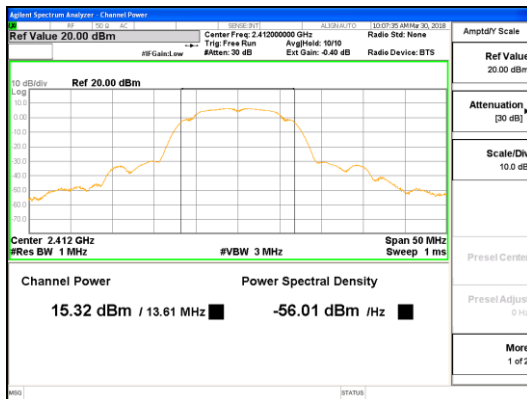
Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2 412	15.32	30	Complies
Middle	2 438	15.59	30	Complies
High	2 464	15.21	30	Complies

ANT-B

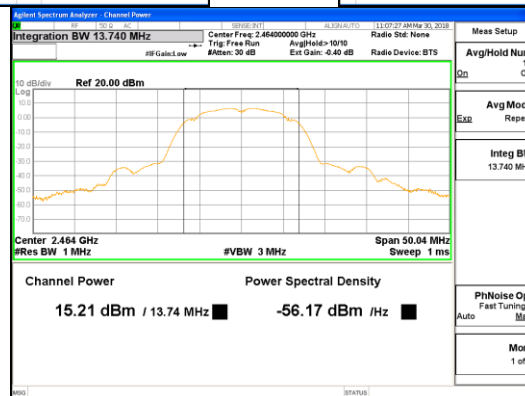
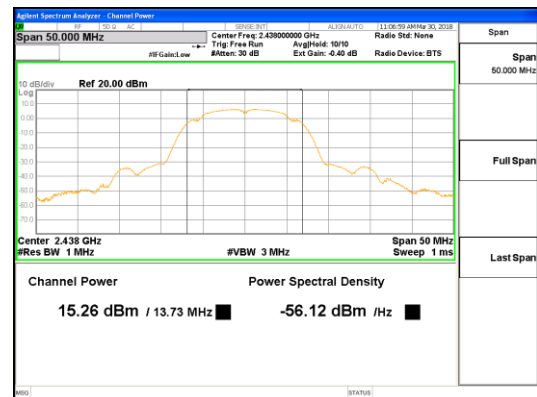
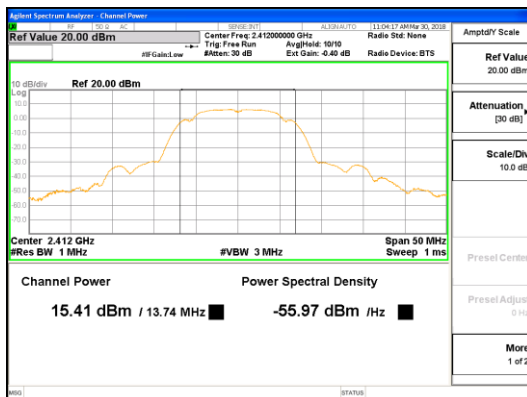
Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2 412	15.41	30	Complies
Middle	2 438	15.26	30	Complies
High	2 464	15.21	30	Complies

See next pages for actual measured spectrum plots.

ANT-A



ANT-B



4.4 Power Spectral Density

Test Procedures(ANSI C63.10-2013 11.10.2)

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW : $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- b) VBW $\geq 3 \times \text{RBW}$
- c) span $\geq 1.5 \times \text{DTS bandwidth}$
- d) Sweep time = auto couple
- e) Detector = peak
- f) Trace mode= max hold
- g) Allow trace to fully stabilize
- h) Use the peak marker function to determine the maximum amplitude level within the RBW.

Limit :

Power Spectral Density < 8 dBm @ 3 kHz BW

Test Data

ANT-A

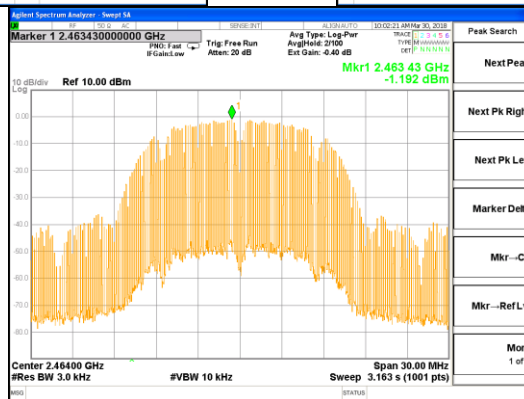
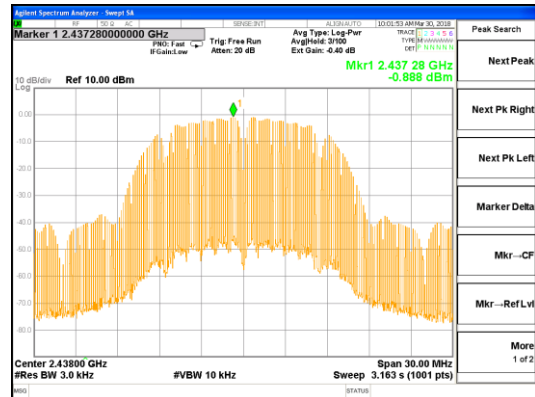
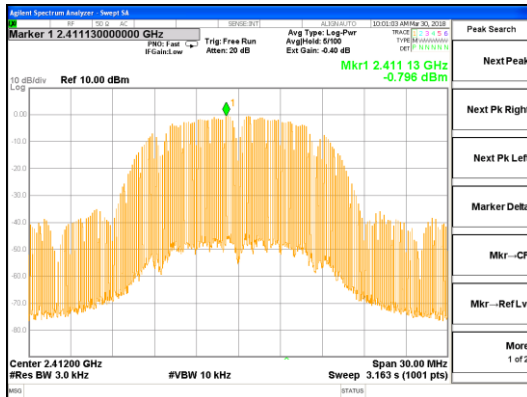
Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2 412	-0.796	8	Complies
Middle	2 438	-0.888	8	Complies
High	2 464	-1.192	8	Complies

ANT-B

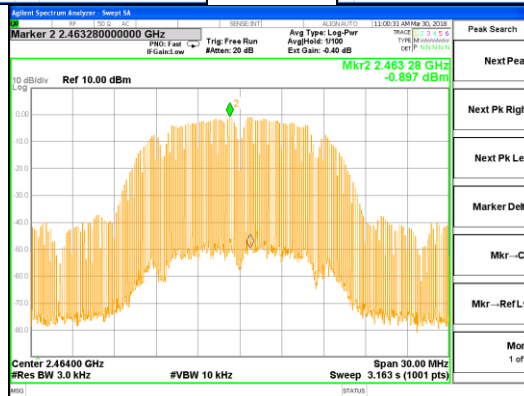
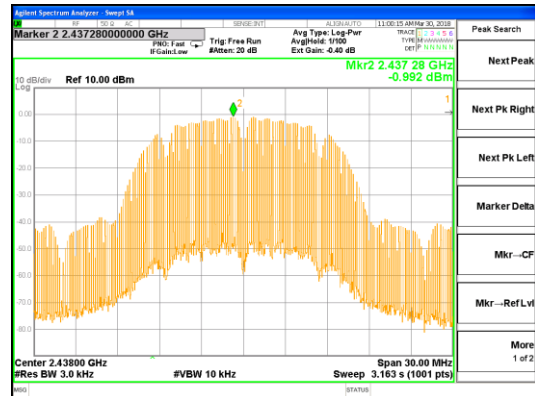
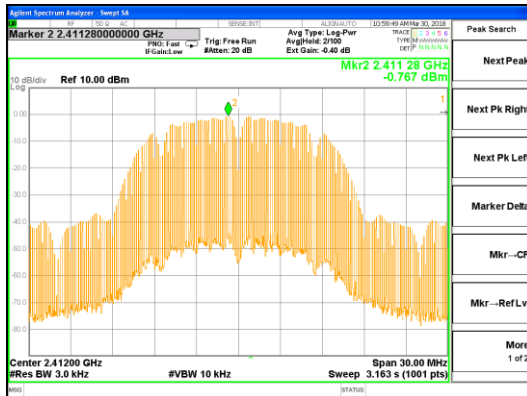
Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
Low	2 412	-0.767	8	Complies
Middle	2 438	-0.992	8	Complies
High	2 464	-0.897	8	Complies

See next pages for actual measured spectrum plots.

ANT-A



ANT-B



4.5 Band Edge & Conducted Spurious emission

Test Procedures(ANSI C63.10-2013 11.11.3)

The Unwanted emission from the EUT were measured according to the dictates PKPSD measurement procedure in section 11.11 of ANSI C63.10-2013.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- | | |
|---|-----------------------------|
| a) RBW = 100 kHz | b) VBW $\geq 3 \times$ RBW |
| c) Detector = peak | d) Sweep time = auto couple |
| e) Trace mode= max hold | |
| f) Allow trace to fully stabilize | |
| g) Use the peak marker function to determine the maximum amplitude level. | |

Limit :

Emission level < 30 dBc

Test Data: Complies

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest in-band spectral density. Therefore the applying equipment meets the requirement.

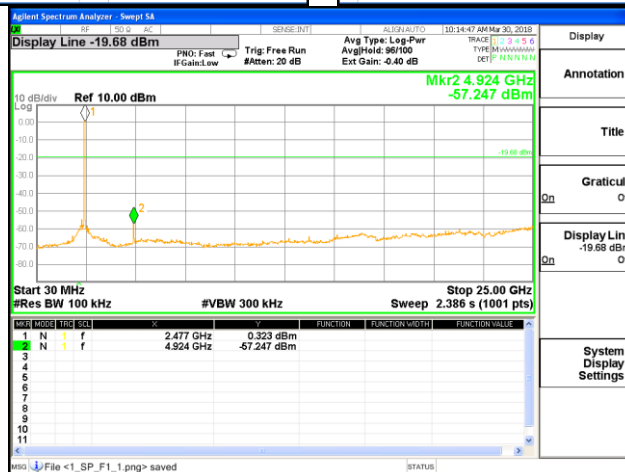
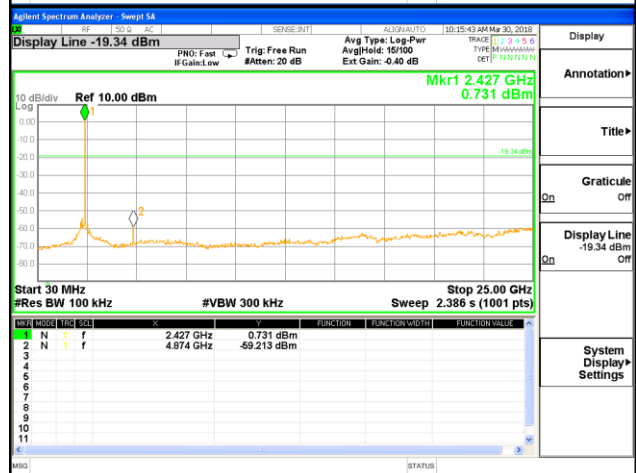
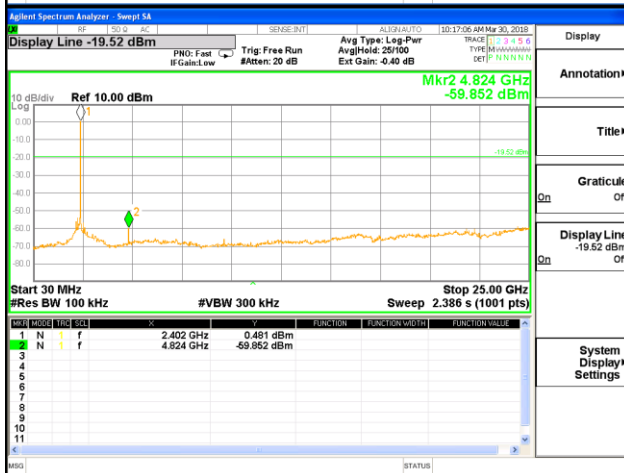
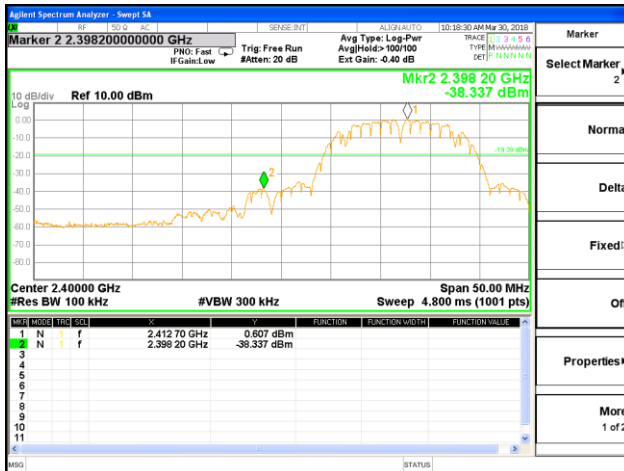
See next pages for actual measured spectrum plots.



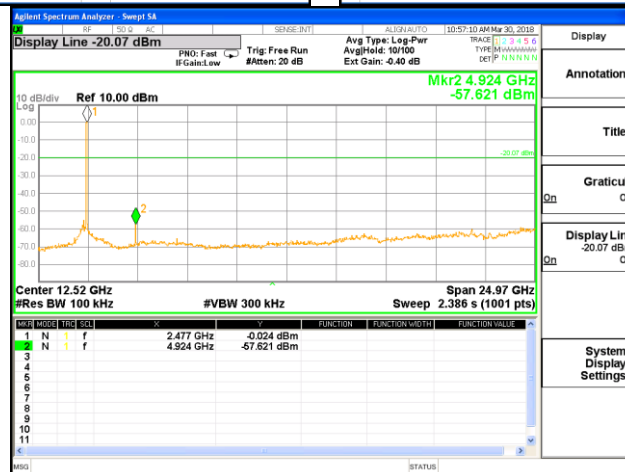
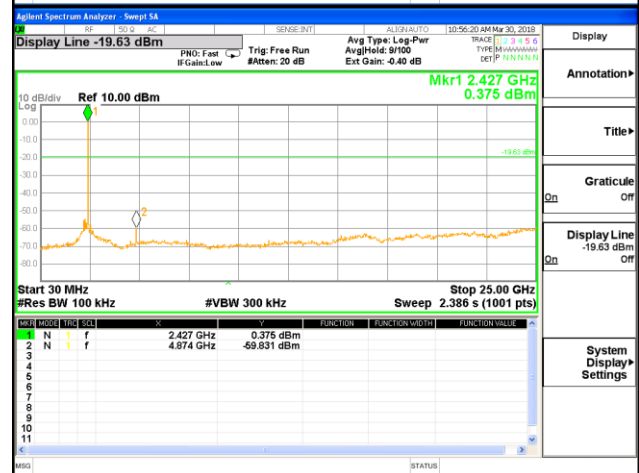
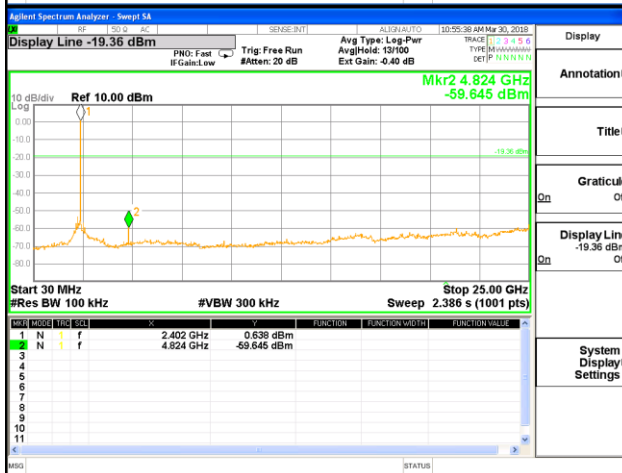
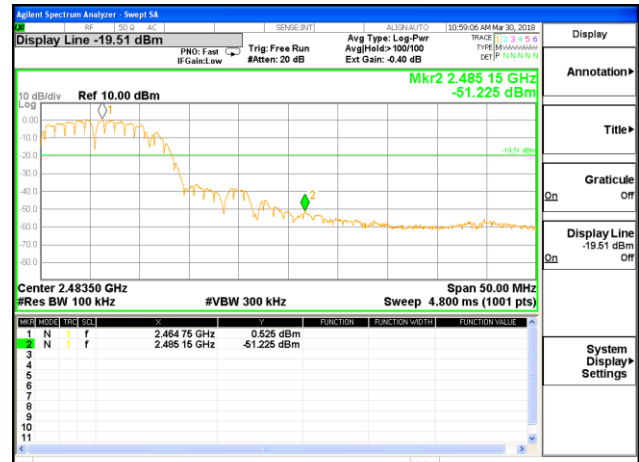
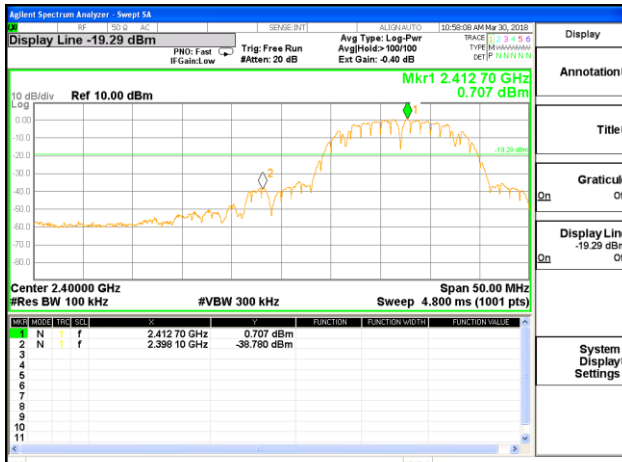
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4.6 Radiated Emissions

Test Location

- ☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Instrument Settings

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10th harmonic)

- a) RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
- b) VBW $\geq$ RBW
- c) Sweep time = auto couple

Limit :

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Table 1. Restricted Frequency Bands*

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
¹ 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475-156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	² Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), 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 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 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.

*Certain frequency bands listed in Table 6 and in band above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300-series of RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

FCC Part 15 § 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 uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

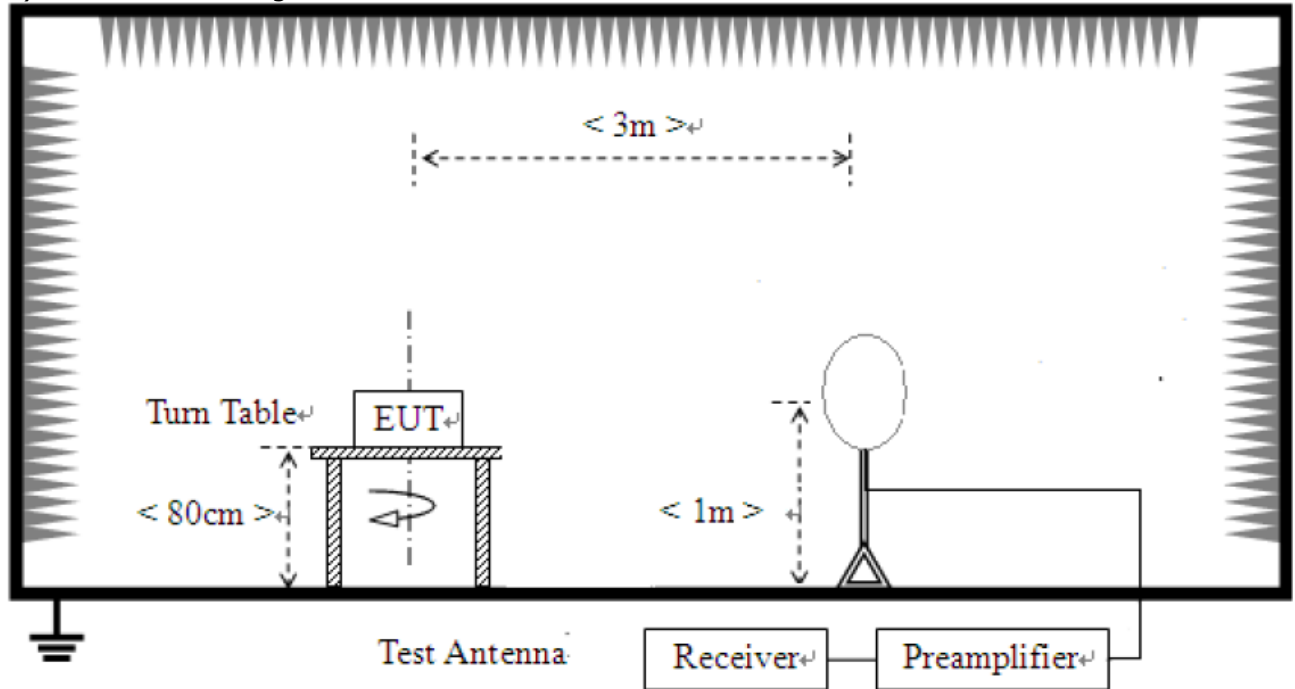
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

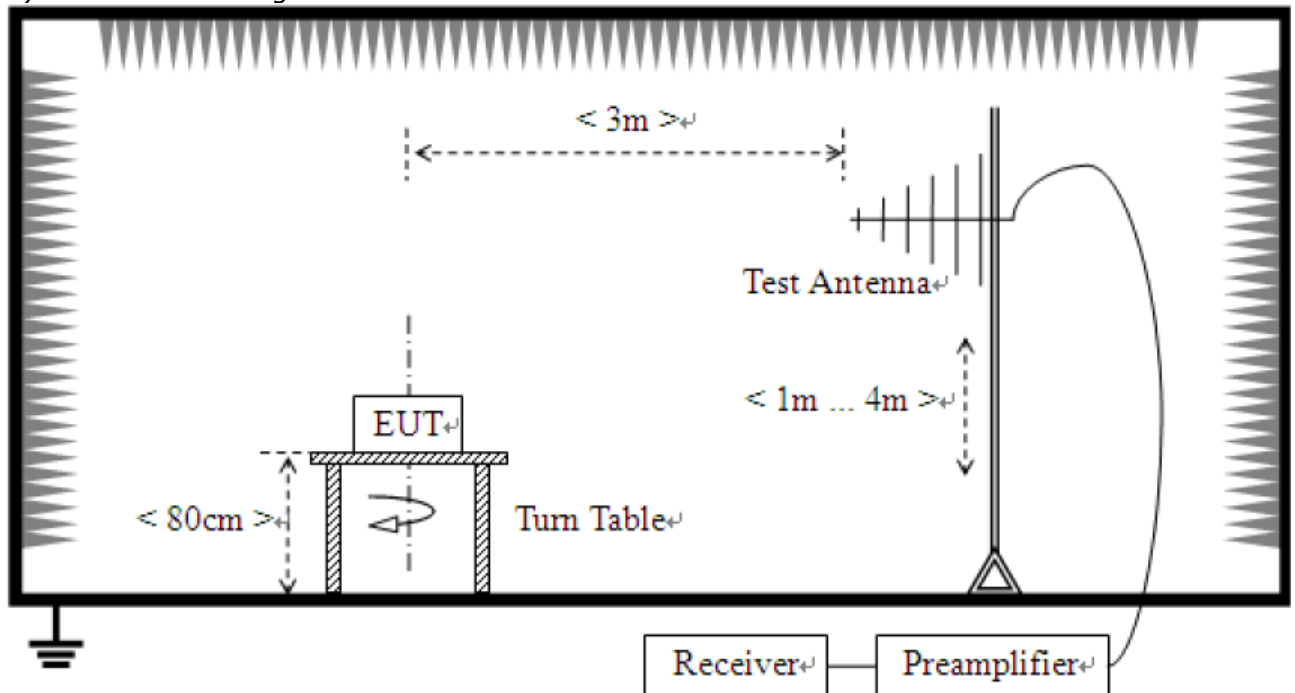
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.(Duty Cycle is > 98%,)
- 4) Duty Cycle is < 98%, VBW setting will need to > 1/T.

Test Setup:

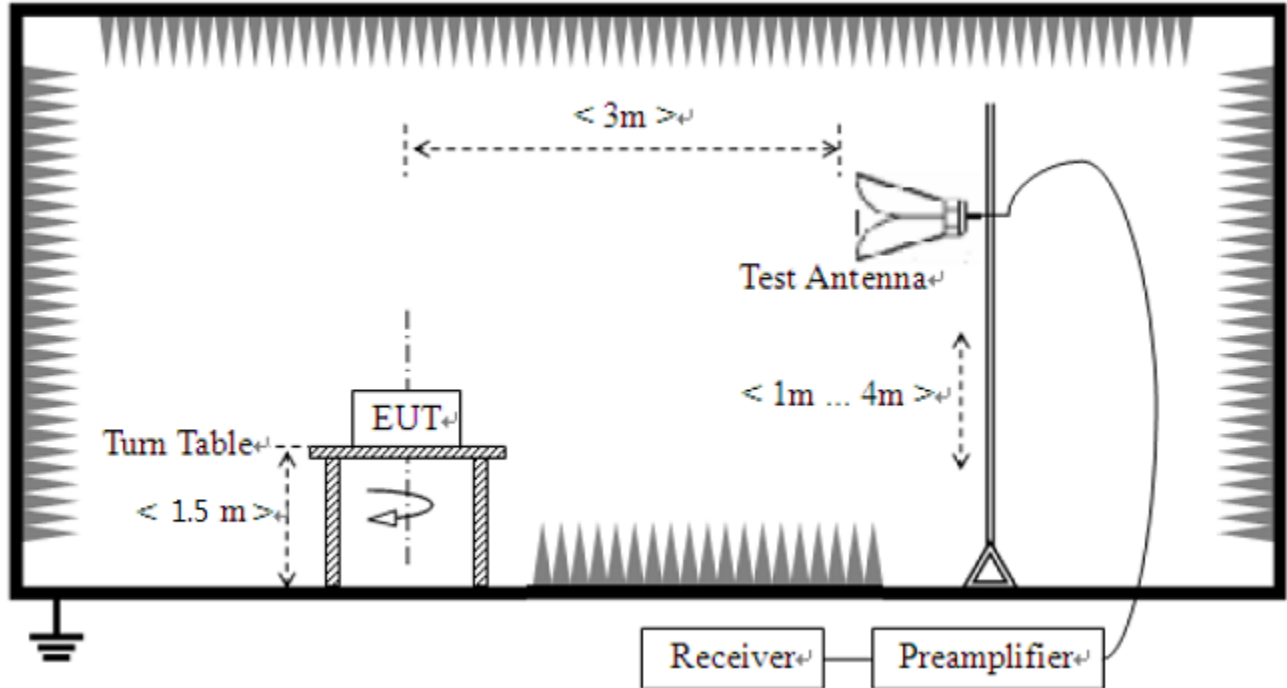
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test results

1) 9 kHz to 30 MHz

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)

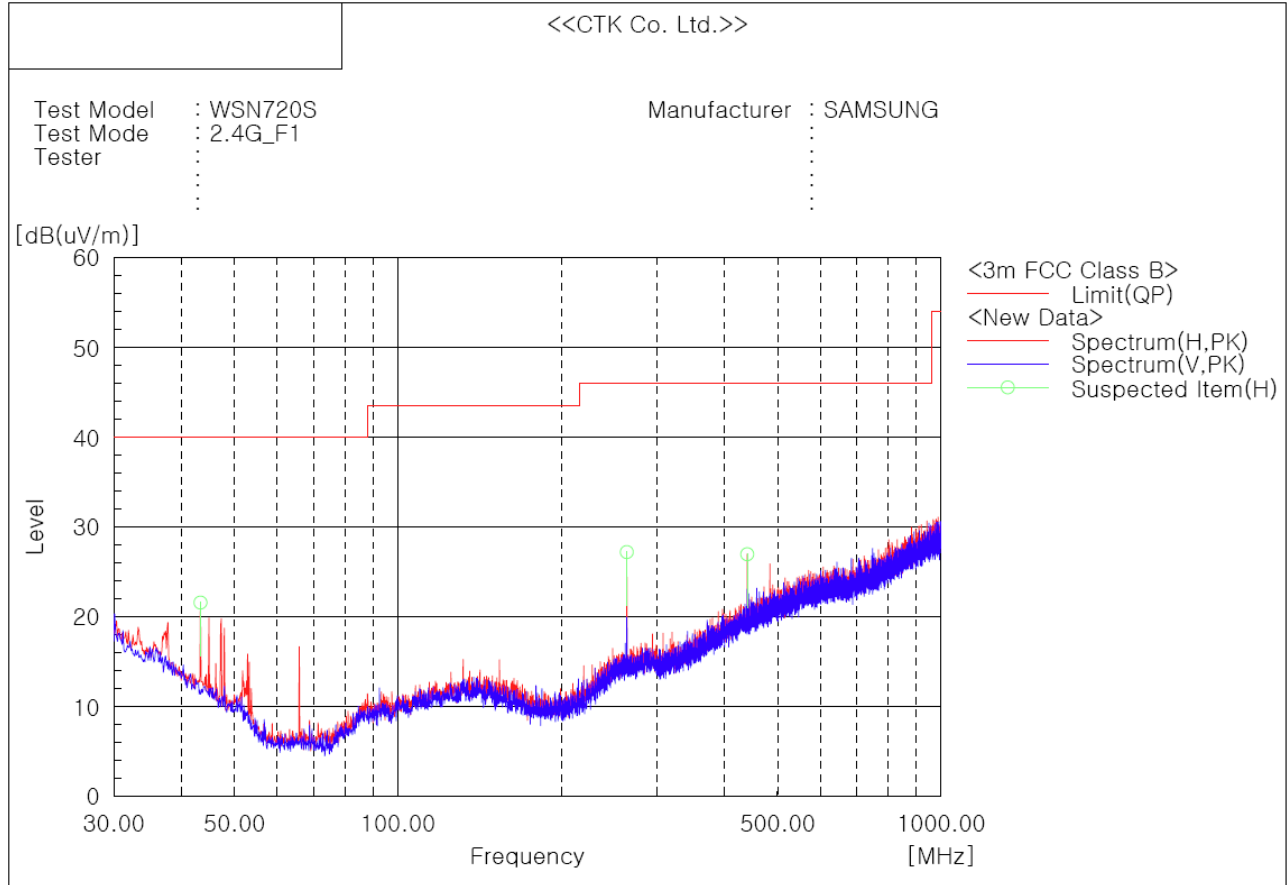
2) 30 MHz to 1 GHz

Test mode : Transmit, ANT-A, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	43.338	H	34.6	-13.0	21.6	40.0	18.4	101.0	0.0
2	264.013	H	36.0	-8.8	27.2	46.0	18.8	101.0	2.0
3	439.946	H	30.1	-3.1	27.0	46.0	19.0	101.0	33.0

Remark :

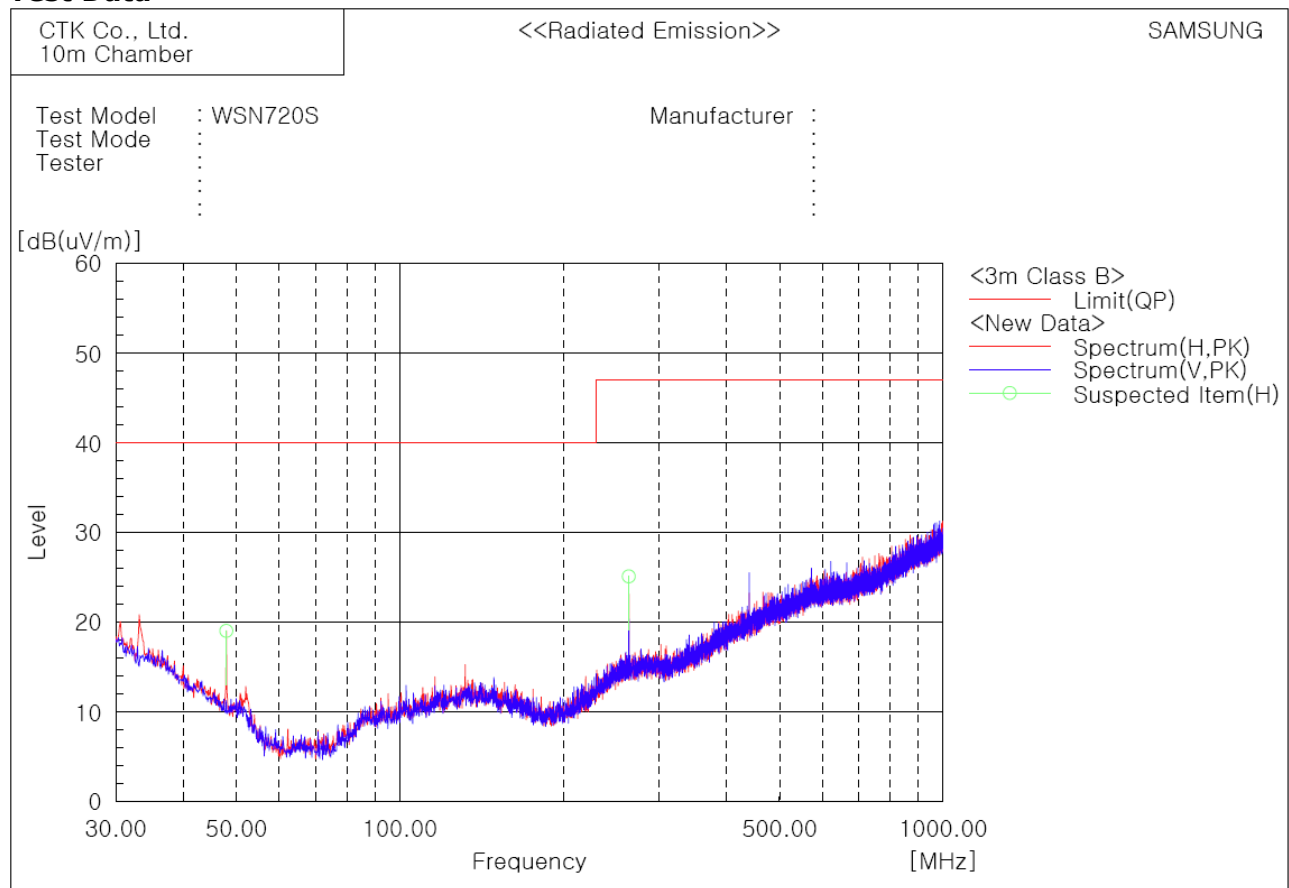
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

Test mode : Receiver, ANT-A, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	47.945	H	33.6	-14.6	19.0	40.0	21.0	399.0	0.0
2	264.013	H	33.9	-8.8	25.1	47.0	21.9	100.0	39.0

Remark :

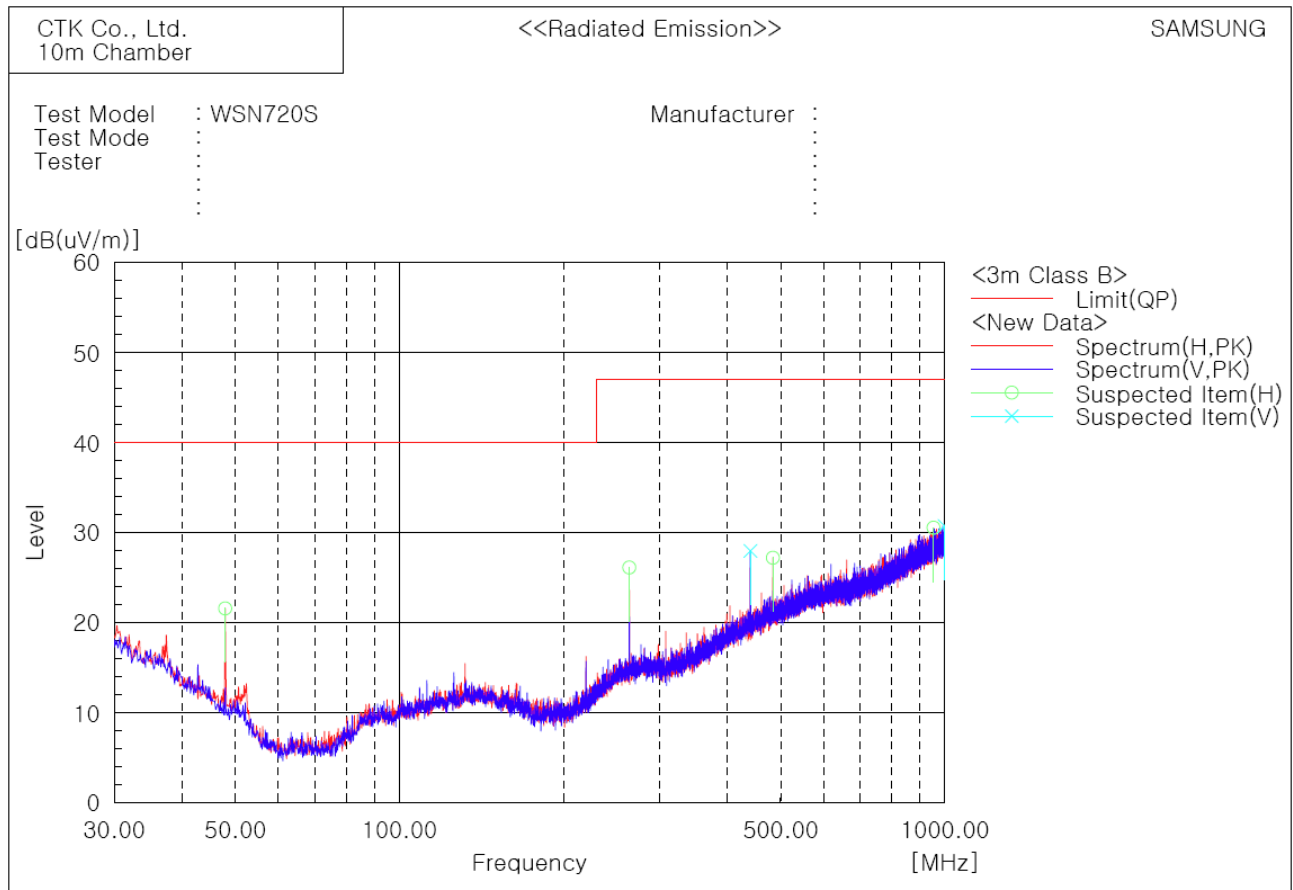
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

Test mode : Transmit, ANT-B, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	47.945	H	36.2	-14.6	21.6	40.0	18.4	400.0	0.0
2	264.013	H	34.9	-8.8	26.1	47.0	20.9	101.0	169.0
3	440.068	V	31.1	-3.1	28.0	47.0	19.0	101.0	111.0
4	484.081	H	28.9	-1.7	27.2	47.0	19.8	199.0	244.0
5	953.561	H	23.7	6.8	30.5	47.0	16.5	400.0	164.0
6	999.030	V	22.5	8.2	30.7	47.0	16.3	200.0	249.0

Remark :

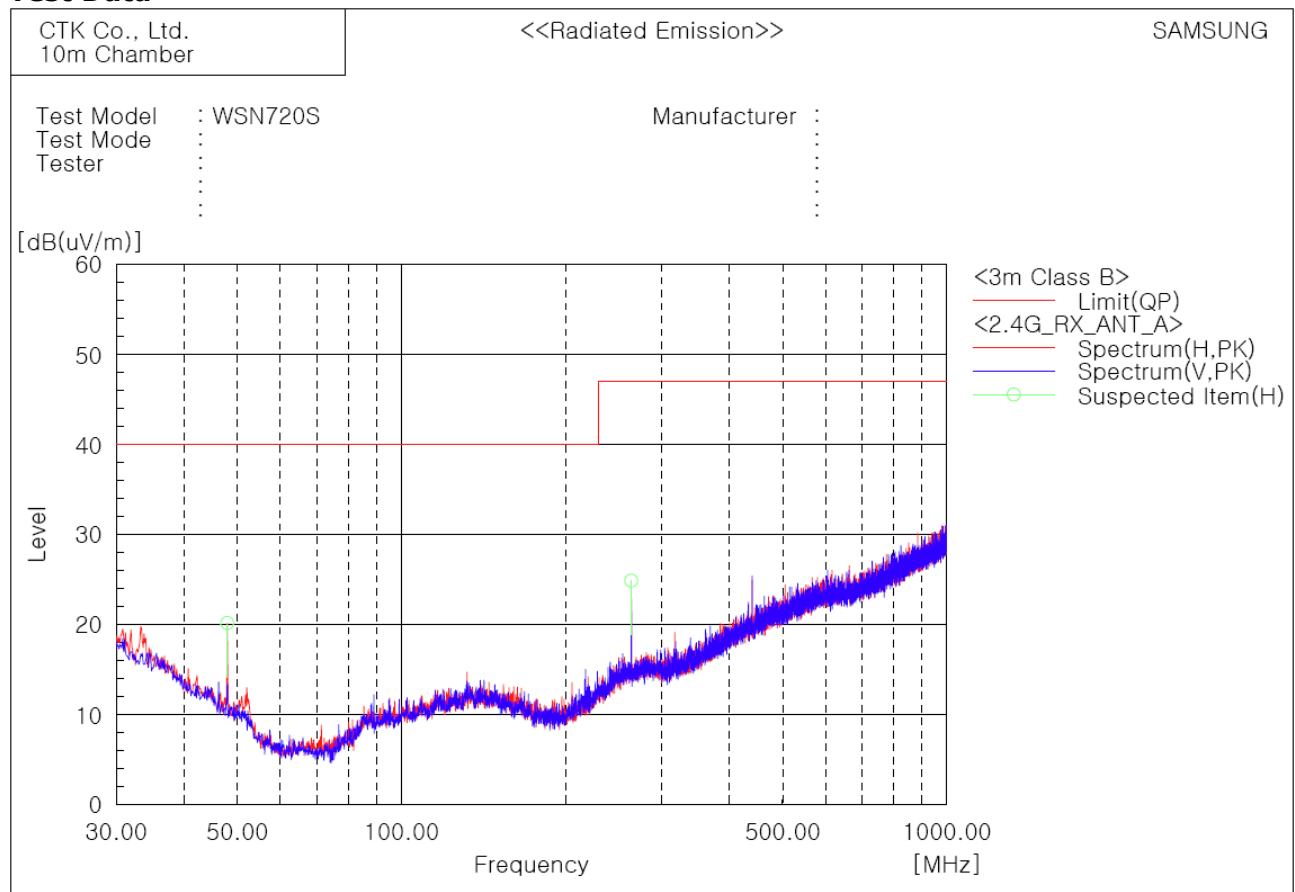
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

Test mode : Receiver, ANT-B, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	47.945	H	34.8	-14.6	20.2	40.0	19.8	399.0	321.0
2	264.013	H	33.7	-8.8	24.9	47.0	22.1	101.0	226.0

Remark :

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

3) above 1 GHz

The requirements are:

☒ Complies

Test Data

ANT-A

Low(2 412 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
2 386.24	V	39.01 / 56.01	-3.91	35.10 / 52.10	54.00 / 74.00	18.90 / 21.90
4 824.14	V	40.37 / 57.37	1.32	41.69 / 58.69	54.00 / 74.00	12.31 / 15.31

Mid(2 438 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
4 876.20	V	35.32 / 52.32	1.32	36.64 / 53.64	54.00 / 74.00	17.36 / 20.36

High(2 464 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
2 485.94	V	34.87 / 51.87	-3.74	31.13 / 48.13	54.00 / 74.00	22.87 / 25.87
4 927.88	V	33.44 / 50.44	1.42	34.86 / 51.86	54.00 / 74.00	19.14 / 22.14

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

ANT-B

Low(2 412 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
2 389.36	V	37.76 / 54.76	-3.91	33.84 / 50.84	54.00 / 74.00	20.16 / 23.16
4 824.16	V	30.48 / 47.48	1.32	31.80 / 48.80	54.00 / 74.00	22.20 / 25.20

Mid(2 438 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
4 875.96	V	27.88 / 44.88	1.32	29.20 / 46.20	54.00 / 74.00	24.80 / 27.80

High(2 464 MHz)

Frequency [MHz]	(P)	Reading AV/PK [dBuV/m]	Correction Factor	Result AV/PK [dBuV/m]	Limit AV/PK [dBuV/m]	Margin AV/PK [dB]
2 485.66	V	35.63 / 52.63	-3.74	31.89 / 48.89	54.00 / 74.00	22.11 / 25.11
4 928.12	V	26.25 / 43.25	1.42	27.67 / 44.67	54.00 / 74.00	26.33 / 29.33

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

4.7 AC Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average**
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

Test Results

The requirements are:

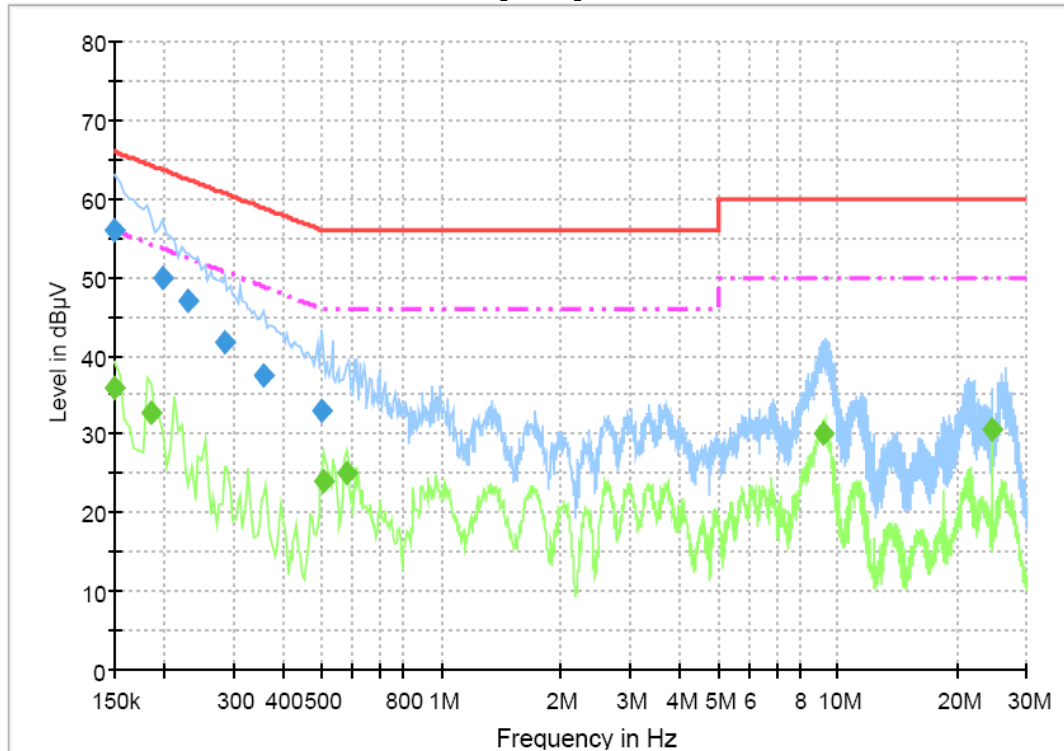
☒ Complies

Test mode : Transmit, ANT-A, low channel(Worst case)

Frequency [MHz]	Measured Data [dBuV]	Margin [dB]	Remark
0.150	56.0	10.0	Quasi-peak

Test Data

[LINE]



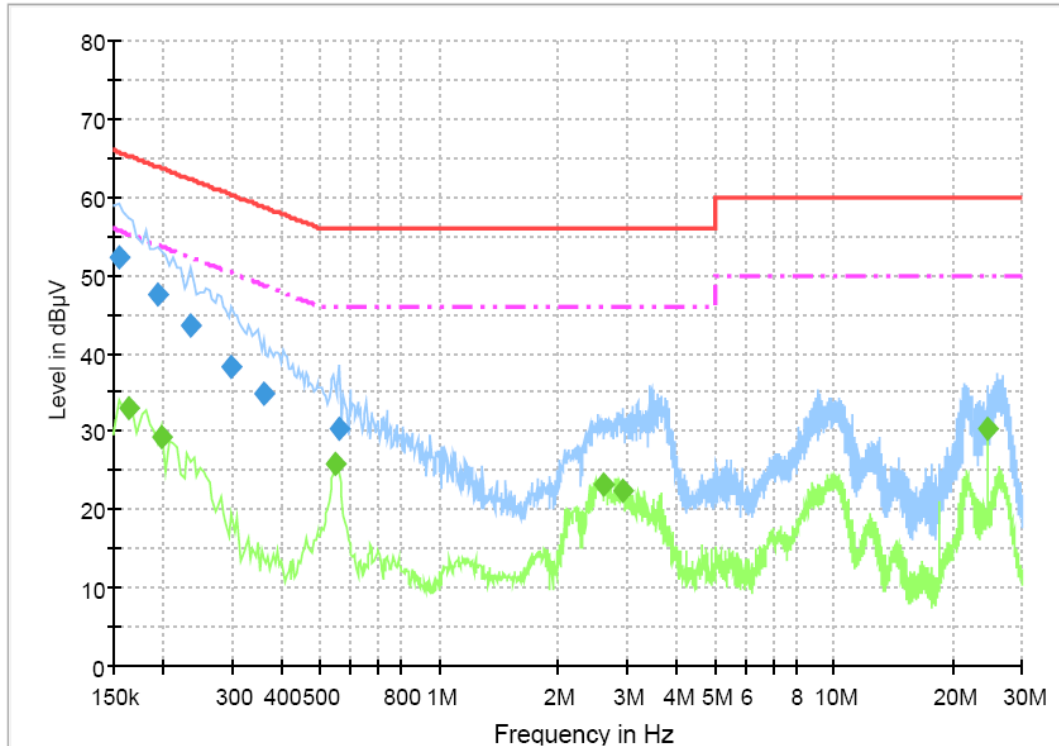
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	56.0	1000.0	9.000	On	L1	9.8	10.0	66.0
0.199500	49.9	1000.0	9.000	On	L1	9.8	13.8	63.6
0.231000	46.9	1000.0	9.000	On	L1	9.7	15.5	62.4
0.285000	41.7	1000.0	9.000	On	L1	9.8	19.0	60.7
0.357000	37.5	1000.0	9.000	On	L1	9.9	21.3	58.8
0.501000	32.9	1000.0	9.000	On	L1	10.0	23.1	56.0

Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	36.0	1000.0	9.000	On	L1	9.8	20.0	56.0
0.186000	32.8	1000.0	9.000	On	L1	9.8	21.4	54.2
0.505500	24.0	1000.0	9.000	On	L1	10.0	22.0	46.0
0.577500	25.0	1000.0	9.000	On	L1	9.9	21.0	46.0
9.190500	30.1	1000.0	9.000	On	L1	9.9	19.9	50.0
24.576000	30.6	1000.0	9.000	On	L1	10.2	19.4	50.0

[NEUTRAL]



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.154500	52.2	1000.0	9.000	On	N	9.8	13.6	65.8
0.195000	47.5	1000.0	9.000	On	N	9.9	16.3	63.8
0.235500	43.6	1000.0	9.000	On	N	9.8	18.6	62.3
0.298500	38.2	1000.0	9.000	On	N	9.8	22.1	60.3
0.361500	35.0	1000.0	9.000	On	N	9.9	23.7	58.7
0.559500	30.4	1000.0	9.000	On	N	9.9	25.6	56.0

Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.163500	33.0	1000.0	9.000	On	N	9.8	22.3	55.3
0.199500	29.4	1000.0	9.000	On	N	9.9	24.2	53.6
0.546000	25.8	1000.0	9.000	On	N	9.9	20.2	46.0
2.607000	23.3	1000.0	9.000	On	N	9.8	22.7	46.0
2.917500	22.5	1000.0	9.000	On	N	9.8	23.5	46.0
24.576000	30.4	1000.0	9.000	On	N	10.2	19.6	50.0

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY50510324	2018-01-26	2019-01-26
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2017-11-01	2018-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2017-10-25	2018-10-25
4	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2017-10-25	2018-10-25
7	AMPLIFIER	SONOMA	310	291721	2018-02-02	2019-02-02
8	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2018-02-01	2019-02-01
9	LISN	Rohde & Schwarz	ENV216	101235	2018-01-31	2019-01-31
10	Preamplifier	Agilent	8449B	3008A02011	2017-11-30	2018-11-30
11	Horn Antenna	ETS-Lindgren	3116	00062504	2017-12-04	2019-12-04
12	Horn Antenna	ETS-Lindgren	3117	00154525	2017-09-14	2019-09-14
13	Band Reject Filter	Micro Tronics	BRM50702	G233	2018-01-26	2019-01-26
14	Dual-Tracking DC Power Supply	Topward Electric Instruments Co.,Ltd.	6303D	711196	2018-01-30	2019-01-30