TEST REPORT

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
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Report No.:
CTK-2023-00257

1. Applicant

◦ Name : SJI Co.,Ltd

◦ Address : 54-33, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, Republic of Korea

◦ Date of Receipt : 2022-10-25

2. Manufacturer

◦ Name : SJI Co.,Ltd

◦ Address : 54-33, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, Republic of Korea

3. Use of Report : For FCC Certification & Canadian Certification

4. Test Sample / Model : UWB Radio Communication Device / UWM210

5. Date of Test : 2022-12-01 to 2023-01-05

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247, ANSI C63.10-2013, RSS-247, RSS-Gen

7. Testing Environment : Temp.: (23 ± 1) ℃, Humidity: (51 ± 3) % R.H.

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
(Address : 5, 221beon-gil, Dongbu-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea)

Approval	Tested by Bong-seok Kim: (Signature)	Technical Manager Young-taek Lee: (Signature)

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2023-01-20

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REPORT REVISION HISTORY

Date	Revision	Page No
2023-01-20	Issued (CTK-2023-00257)	all

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1. General Product Description

1.1 Applicant Information

Company	SJI Co.,Ltd
Contact Point	54-33, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, Republic of Korea
Contact Person	Name : Lee sangyoung E-mail : sylee@seongji.co.kr Tel : +82-31-239-8194 Fax : -

1.2 Product Information

FCC ID	2AS8LUWM210
IC	25119-UWM210
Product Description	UWB Radio Communication Device
Model name	UWM210
Variant Model name	-
Operating Frequency	2 402 MHz - 2 480 MHz
RF Output Power	6.409 dBm(4.374 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : 4.5 dBi
Number of channels	40
Channel Spacing	2 MHz
Type of Modulation	GFSK
Power Source	DC 3.3 V
FVIN	1.0
Test Software(Version)	Tera term (Version 4.8.5)

1.3 Peripheral Devices

-For Conducted Measurement and Radiated Measurement

Device	Manufacturer	Model No.	Serial No.
Notebook	HP Inc.	HP Probook 455 G7	5CD0234DWW
AC Adapter	HP Inc.	TPN-LA16	PA-1650-20HL

2. Facility and Accreditations

2.1 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A
KOREA	NRRA	KR0025

2.2 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. 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 & 99% 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
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
Note 2: The data in this test report are traceable to the national or international standards.				
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-Gen Issue 5.				
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.558074.				

3.2 Mode of operation during the test

The EUT 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. All modulation modes were tests.
The results are only attached worst cases.

Test Frequency

Lowest channel	Middle channel	Highest channel
2 402 MHz	2 440 MHz	2 480 MHz

Modulation Type

Modulation type	GFSK (1 Mbps, 2 Mbps)

Test mode

Modulation	Duty Cycle
GFSK_1 Mbps	64.86 %
GFSK_2 Mbps	35.63 %

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 (C.L. : Approx. 95%, k=2)
Occupied Bandwidth	0.1 MHz (C.L. : Approx. 95%, k=2)
Unwanted Emission(conducted)	3.0 dB (C.L. : Approx. 95%, k=2)
Radiated Emissions (f ≤ 1 GHz)	4.0 dB (C.L. : Approx. 95%, k=2)
Radiated Emissions (f > 1 GHz)	5.0 dB (C.L. : Approx. 95%, k=2)

4. Technical Characteristic Test

4.1 6dB Bandwidth & 99% 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(6dB Bandwidth),
30 kHz(99% Bandwidth)

b) VBW ≥ 3 x 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 > 500 kHz

Limit : 99 % Bandwidth

N/A

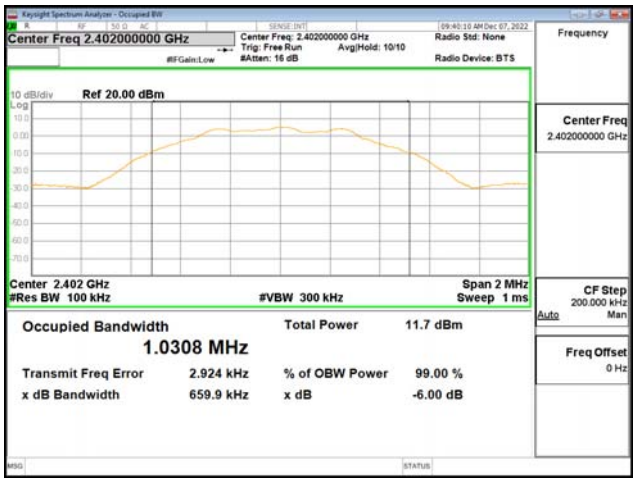
Test Data :

Mode	Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Result
GFSK, 1 Mbps	Low	2 402	0.659 9	1.030 8	Complies
	Middle	2 440	0.660 4	1.036 8	
	High	2 480	0.670 0	1.036 8	
GFSK, 2 Mbps	Low	2 402	1.141 0	2.051 8	
	Middle	2 440	1.142 0	2.055 3	
	High	2 480	1.141 0	2.058 0	

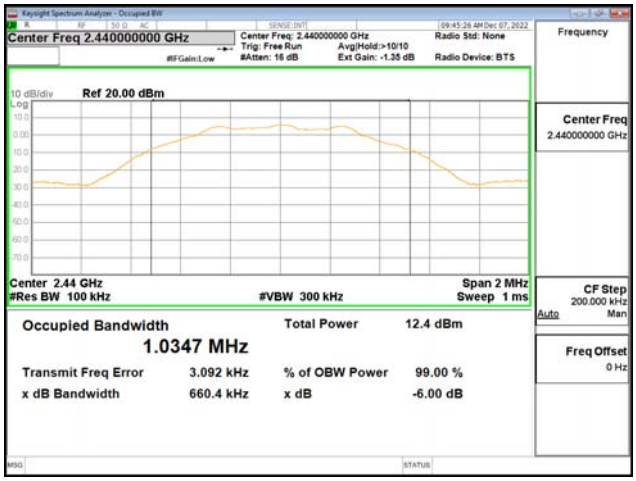
See next pages for actual measured spectrum plots.

Test Mode : GFSK, 1 Mbps
6 dB Bandwidth& 99 % Bandwidth

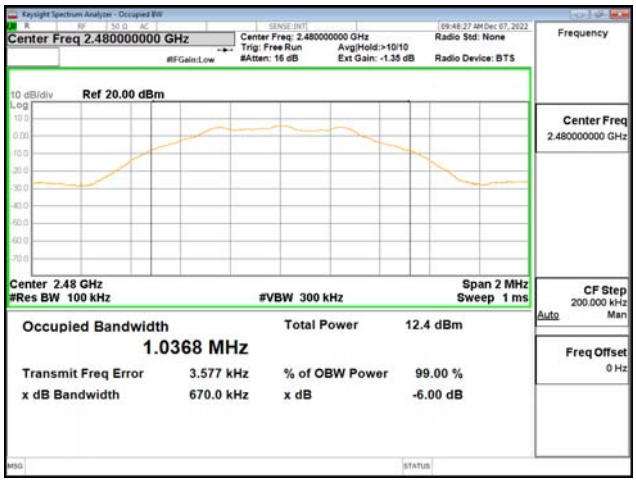
Low channel



Middle channel

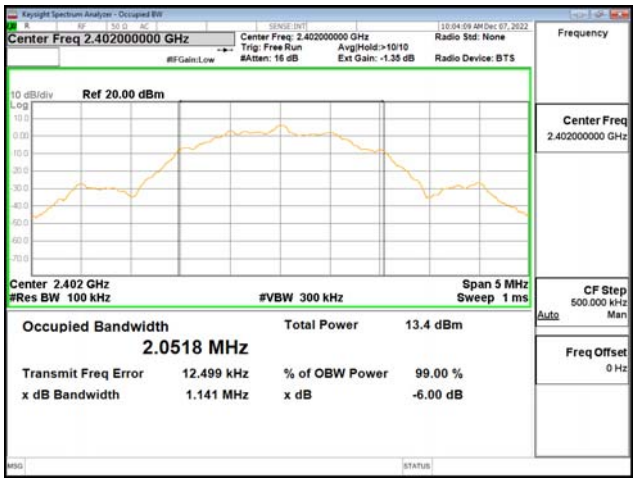


High channel



Test Mode : GFSK, 2 Mbps
6 dB Bandwidth& 99% Bandwidth

Low channel



Middle channel

High channel

4.2 Maximum peak Conducted Output Power

Test Procedures(ANSI C63.10-2013 11.9.1)

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth:

Test Settings:

Center frequency = the highest, middle and the lowest channels

a) RBW ≥ DTS Bandwidth

b) VBW ≥ 3 x RBW

c) span ≥ 3 x 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.

Limit :

Maximum Output Power	<	1 W (30 dBm)

Test Data :

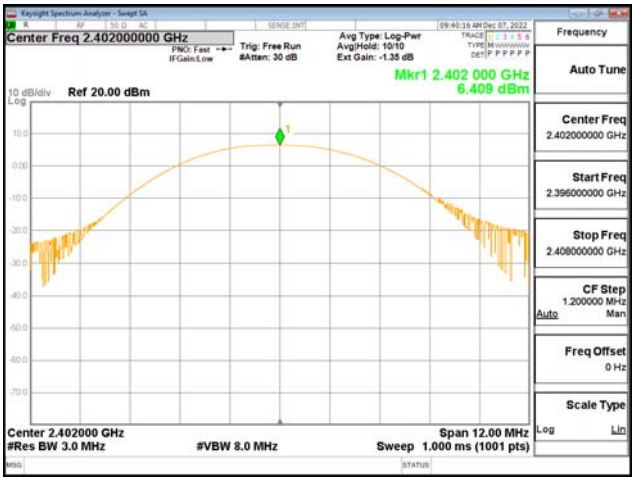
Mode	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
GFSK, 1 Mbps	Low	2 402	6.409	30	Complies
	Middle	2 440	5.810		
	High	2 480	5.821		
GFSK, 2 Mbps	Low	2 402	6.278		
	Middle	2 440	5.861		
	High	2 480	5.727		

See next pages for actual measured spectrum plots.

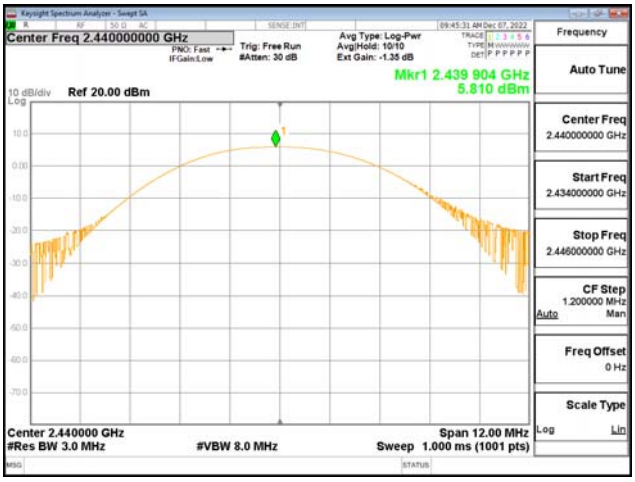
Output Power

Test Mode : GFSK, 1 Mbps

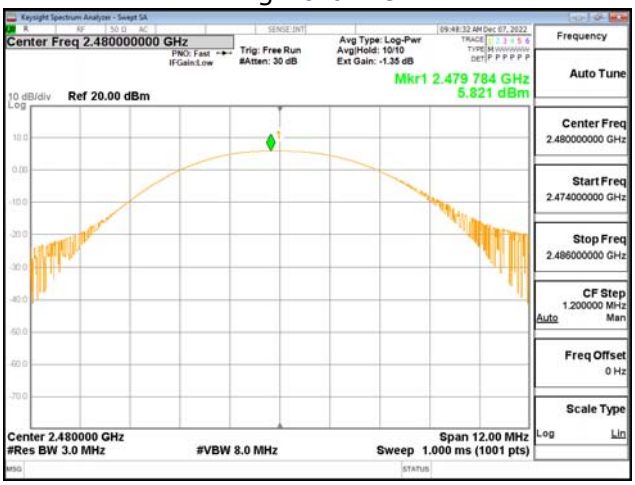
Low channel



Middle channel

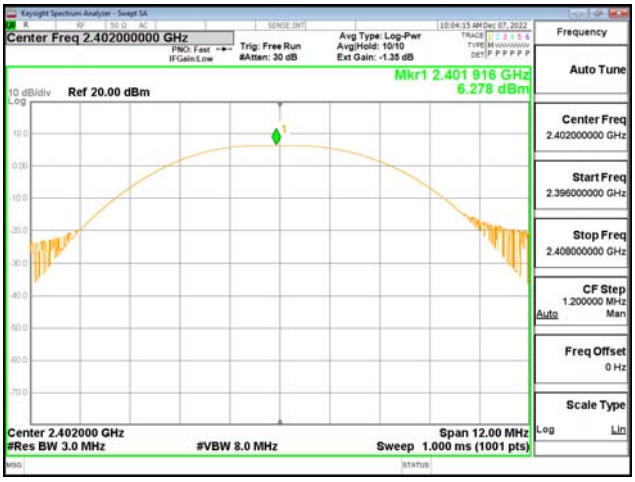


High channel

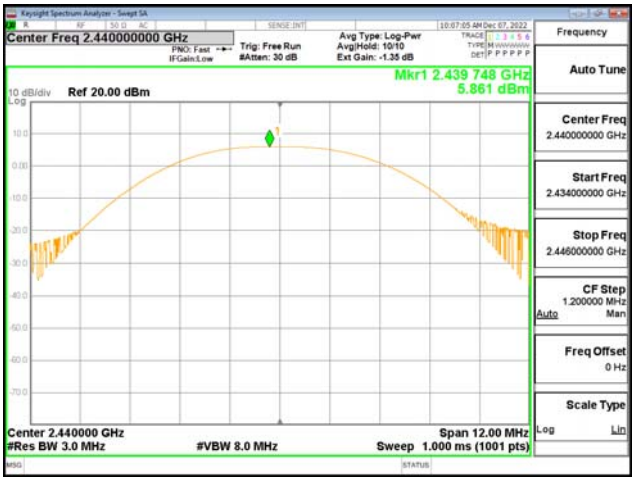


Test Mode : GFSK, 2 Mbps

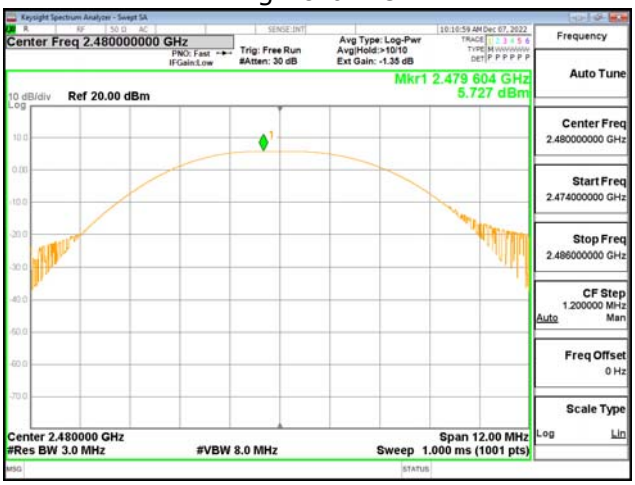
Low channel



Middle channel



High channel



4.3 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 kHz ≤ RBW ≤ 100 kHz

b) VBW ≥ 3 x RBW

c) span ≥ 1.5 x 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 :

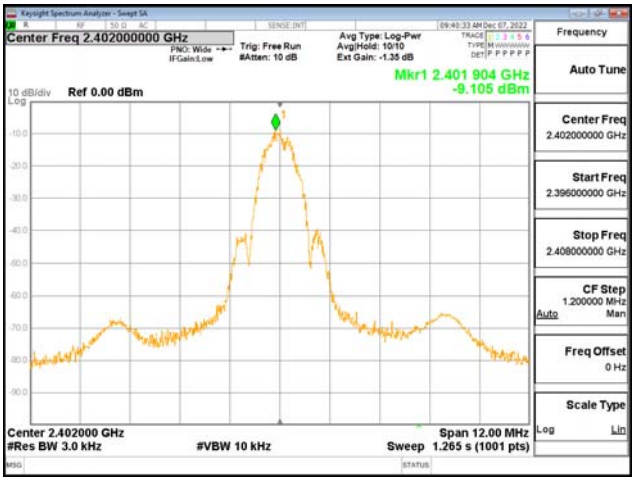
Mode	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
GFSK, 1 Mbps	Low	2 402	-9.105	8	Complies
	Middle	2 440	-9.752		
	High	2 480	-9.731		
GFSK, 2 Mbps	Low	2 402	-10.740		
	Middle	2 440	-11.295		
	High	2 480	-11.671		

See next pages for actual measured spectrum plots.

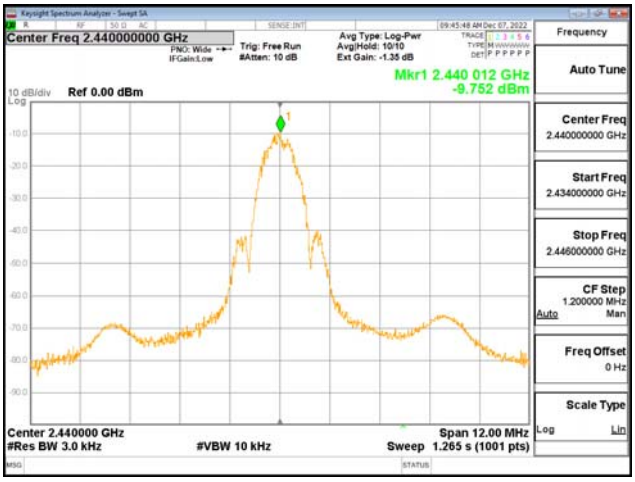
Power Spectral Density

Test Mode : GFSK, 1 Mbps

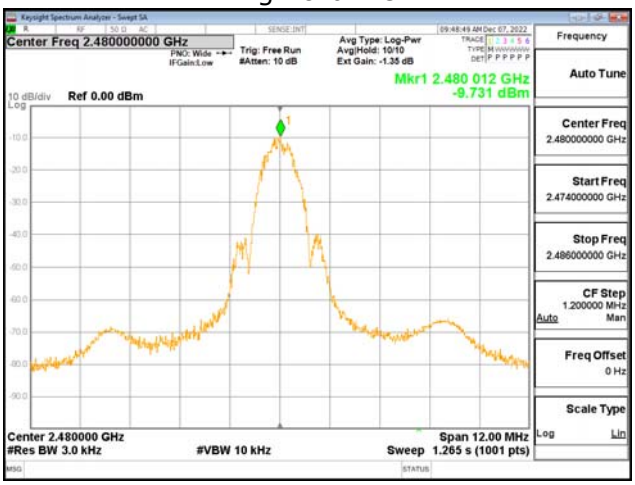
Low channel



Middle channel

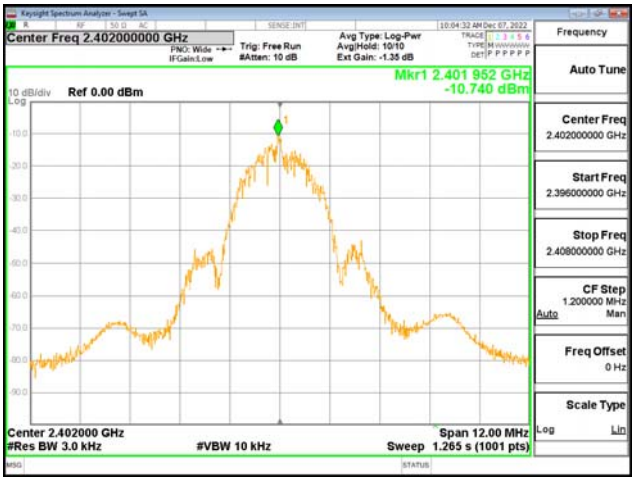


High channel

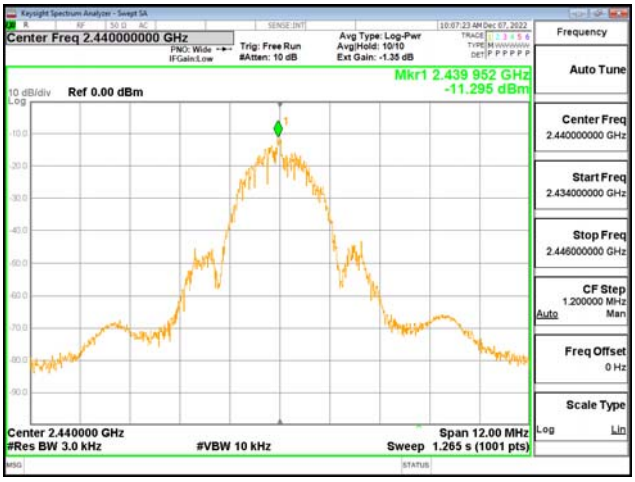


Test Mode : GFSK, 2 Mbps

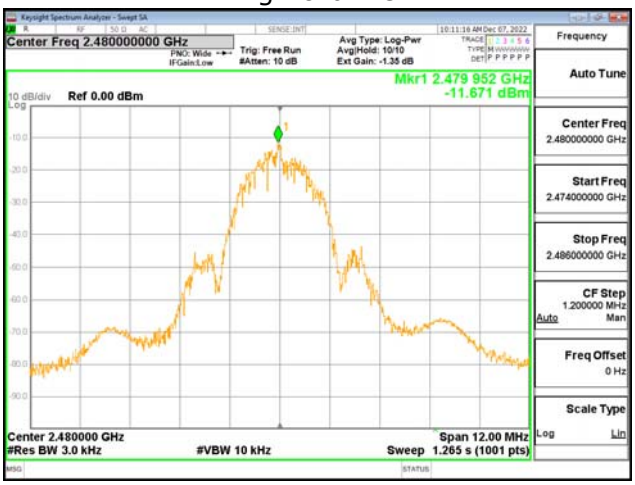
Low channel



Middle channel



High channel



4.4 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 ≥ 3 x 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	<	20 dBc

Test results: Complies

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB 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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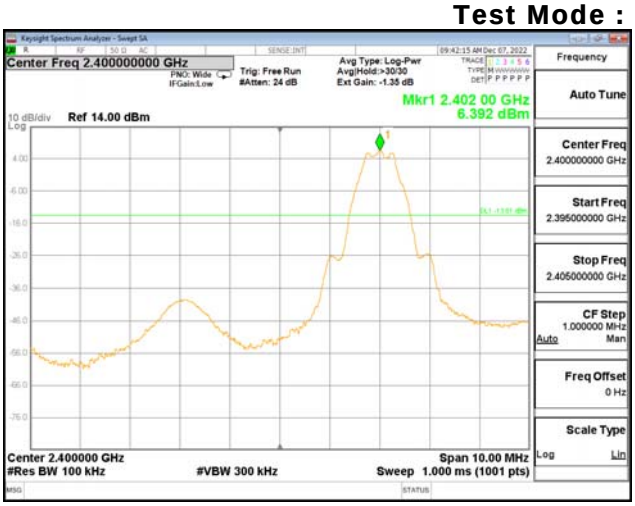
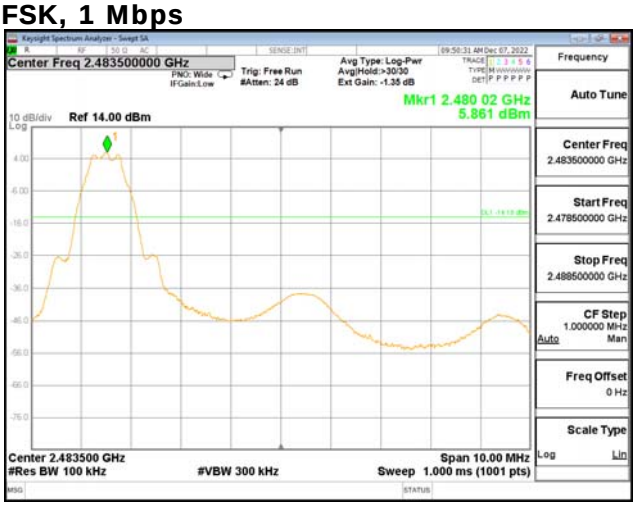
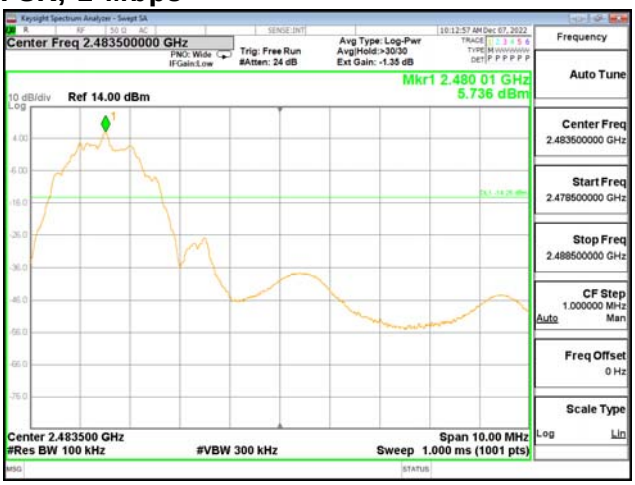
Band–edge

Test Mode : GFSK, 1 Mbps





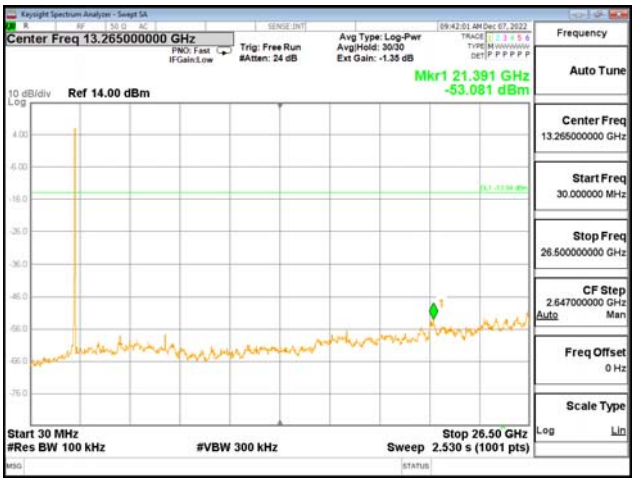
Test Mode : GFSK, 2 Mbps



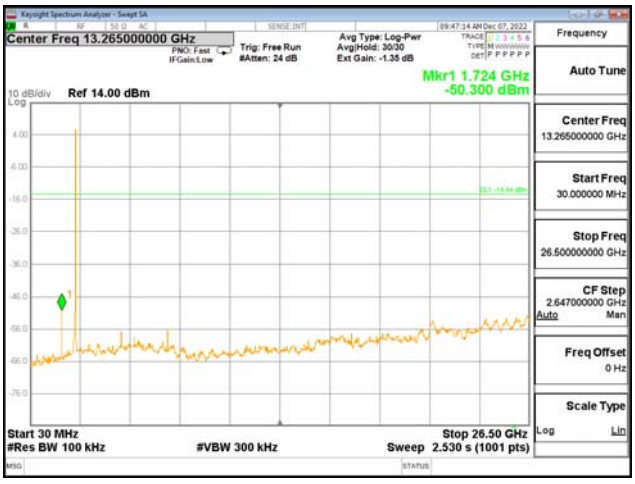
Spurious

Test Mode : GFSK, 1 Mbps

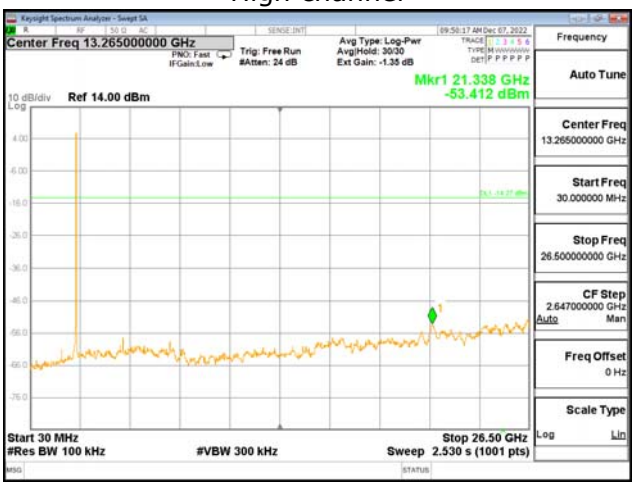
Low channel



Middle channel

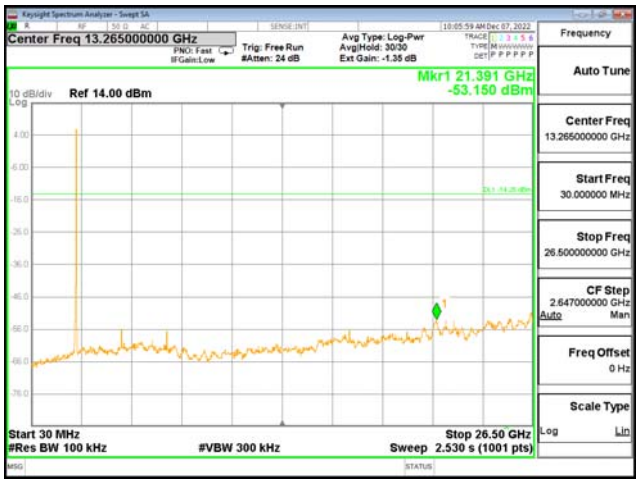


High channel

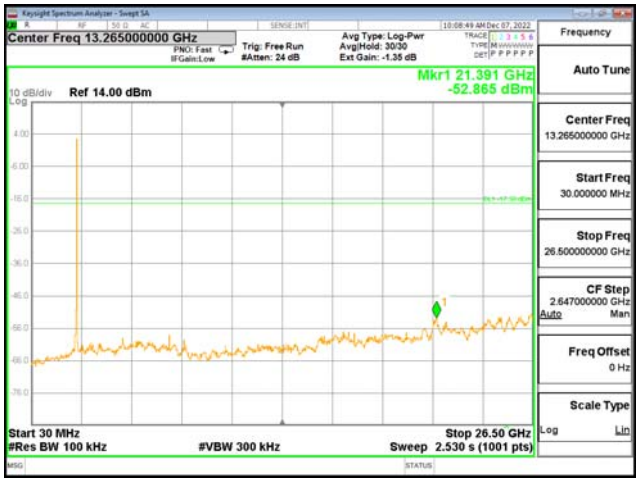


Test Mode : GFSK, 2 Mbps

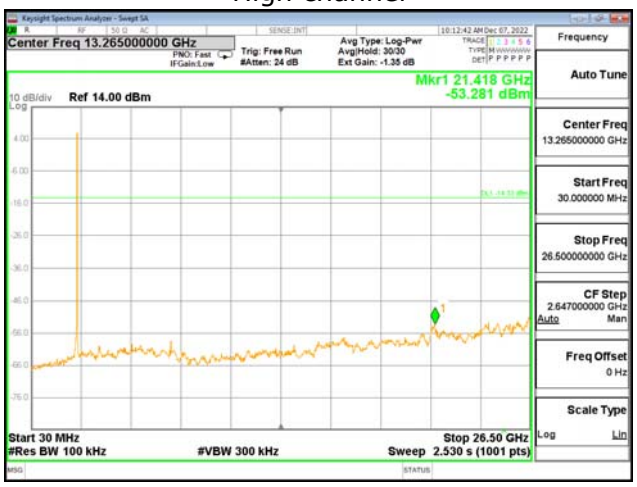
Low channel



Middle channel



High channel



4.5 Radiated Emission

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 rage 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 10^{th} harmonic)

a) RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ 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 is 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.

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 :

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 2 Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 2. General Field Strength Limits for Licence-Exempt Transmitters

Frequency(MHz)	Field Strength (uA/m)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance (meters)
0.009-0.490	6.37/F (F in kHz)	2400/F(kHz)	48.5 - 13.8	300
0.490-1.705	63.7/F (F in kHz)	24000/F(kHz)	33.8 - 23	30
1.705-30	0.08	30	29.5	30
30-88	-	100**	40	3
88-216	-	150**	43.5	3
216-960	-	200**	46	3
Above 960	-	500	54	3

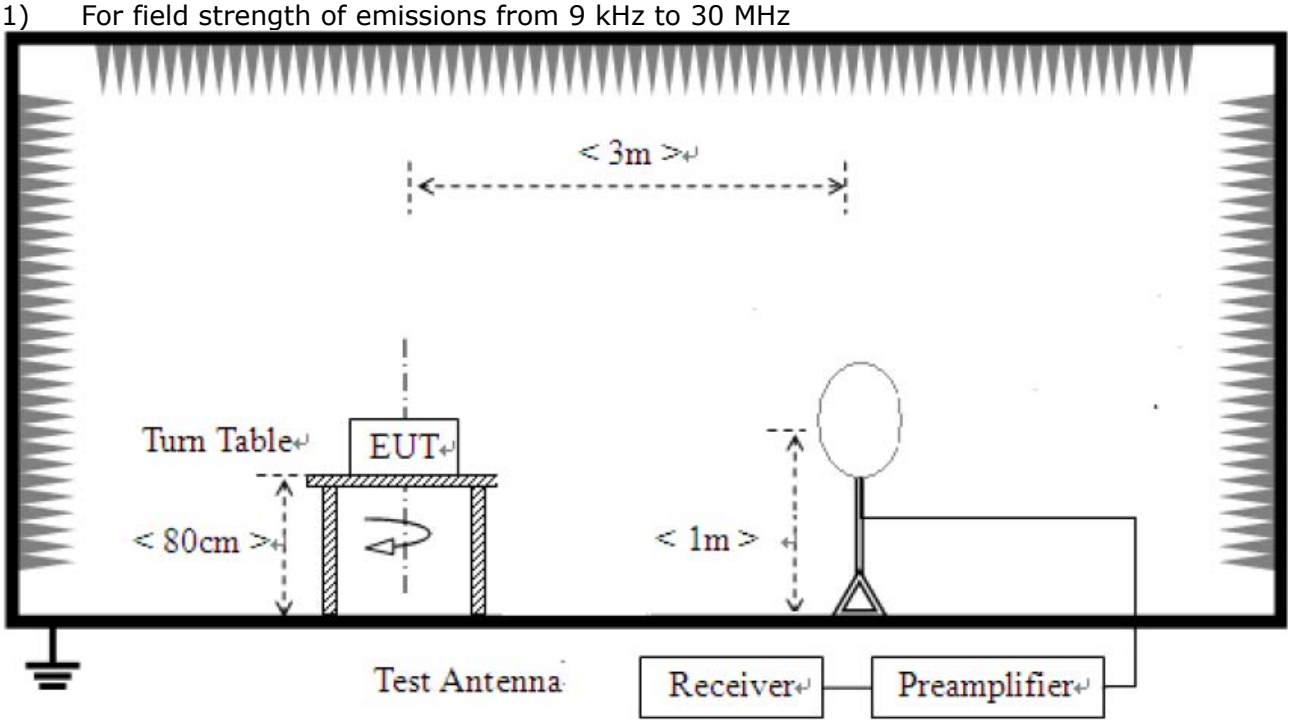
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231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

Note :

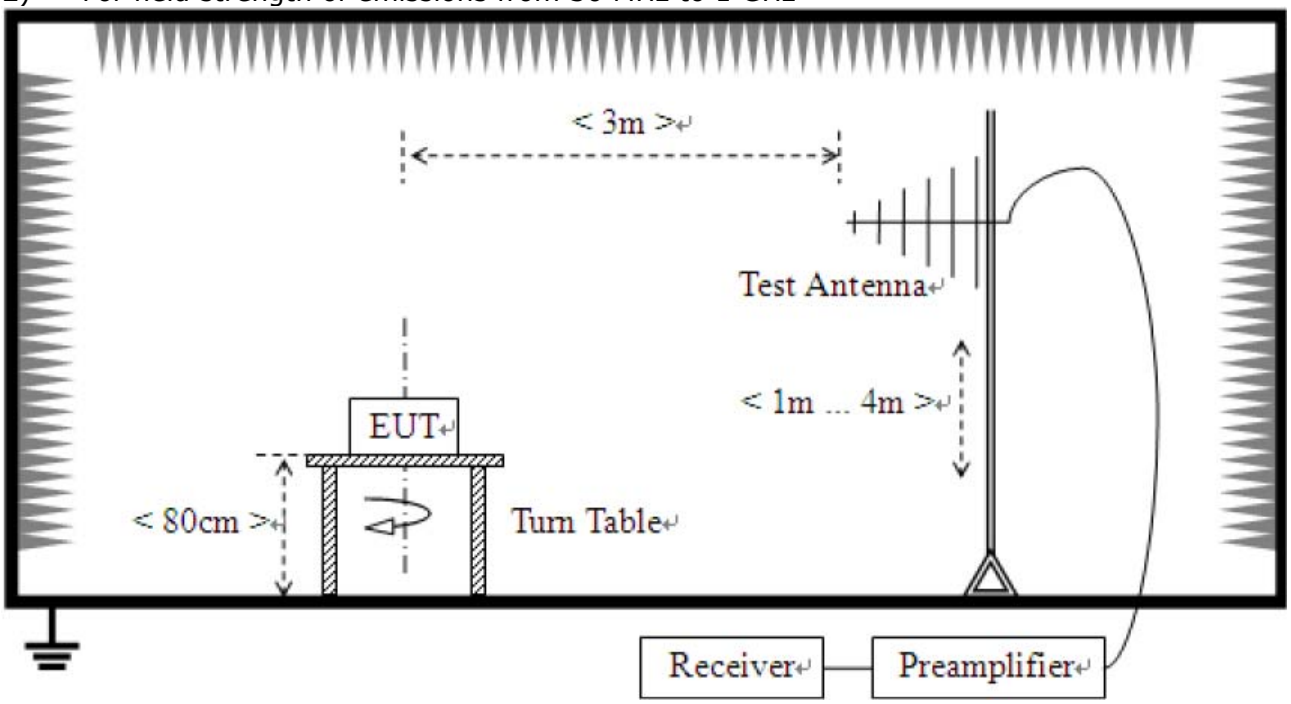
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of 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 3 MHz and detector is peak for peak measurement and detector RMS and Trace Averaging type for average measurement.

Test Setup:

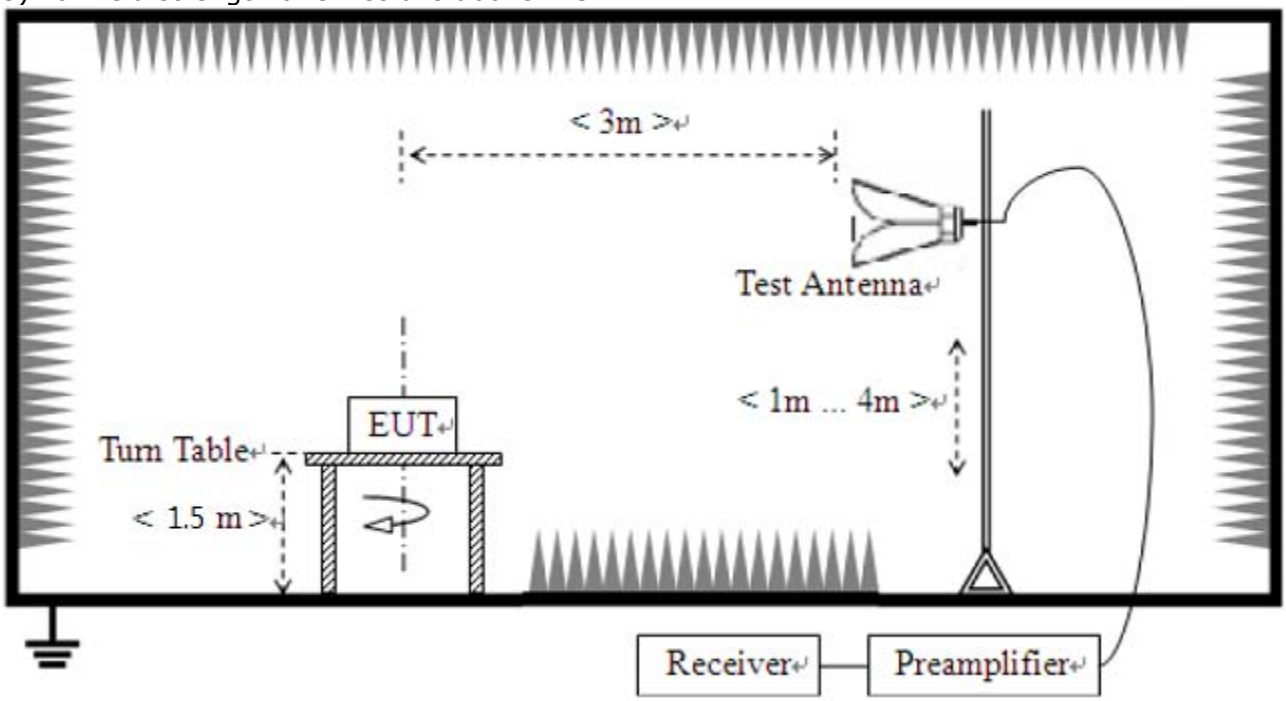
1) For field strength of emissions from 9 kHz to 30 MHz



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



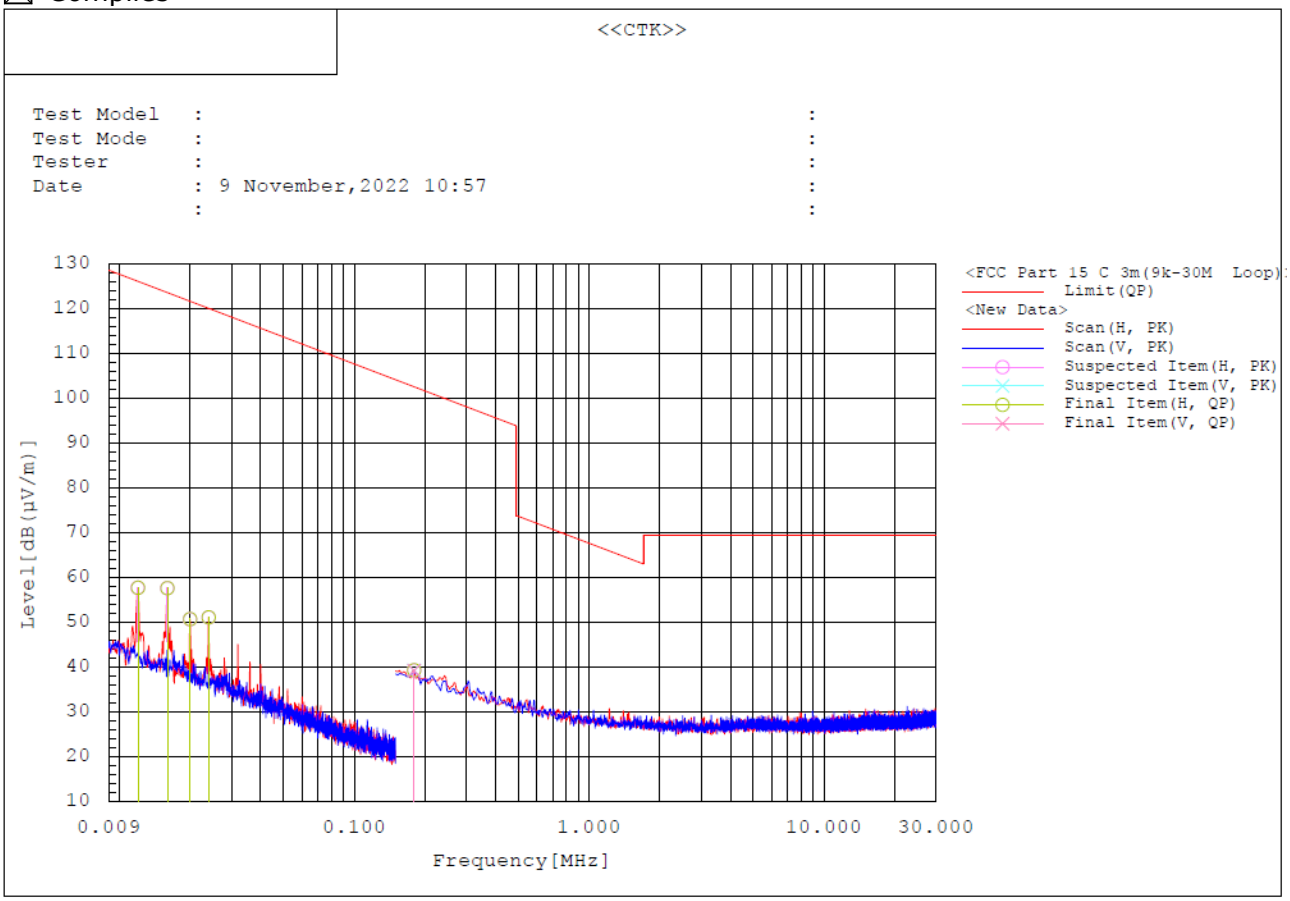
3) For field strength of emissions above 1 GHz



Test results
1) Spurious
1. 9 kHz to 30 MHz

Test mode : GFSK, 1 Mbps, Lowest channel(Worst case)

The requirements are:
☒ Complies



Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]

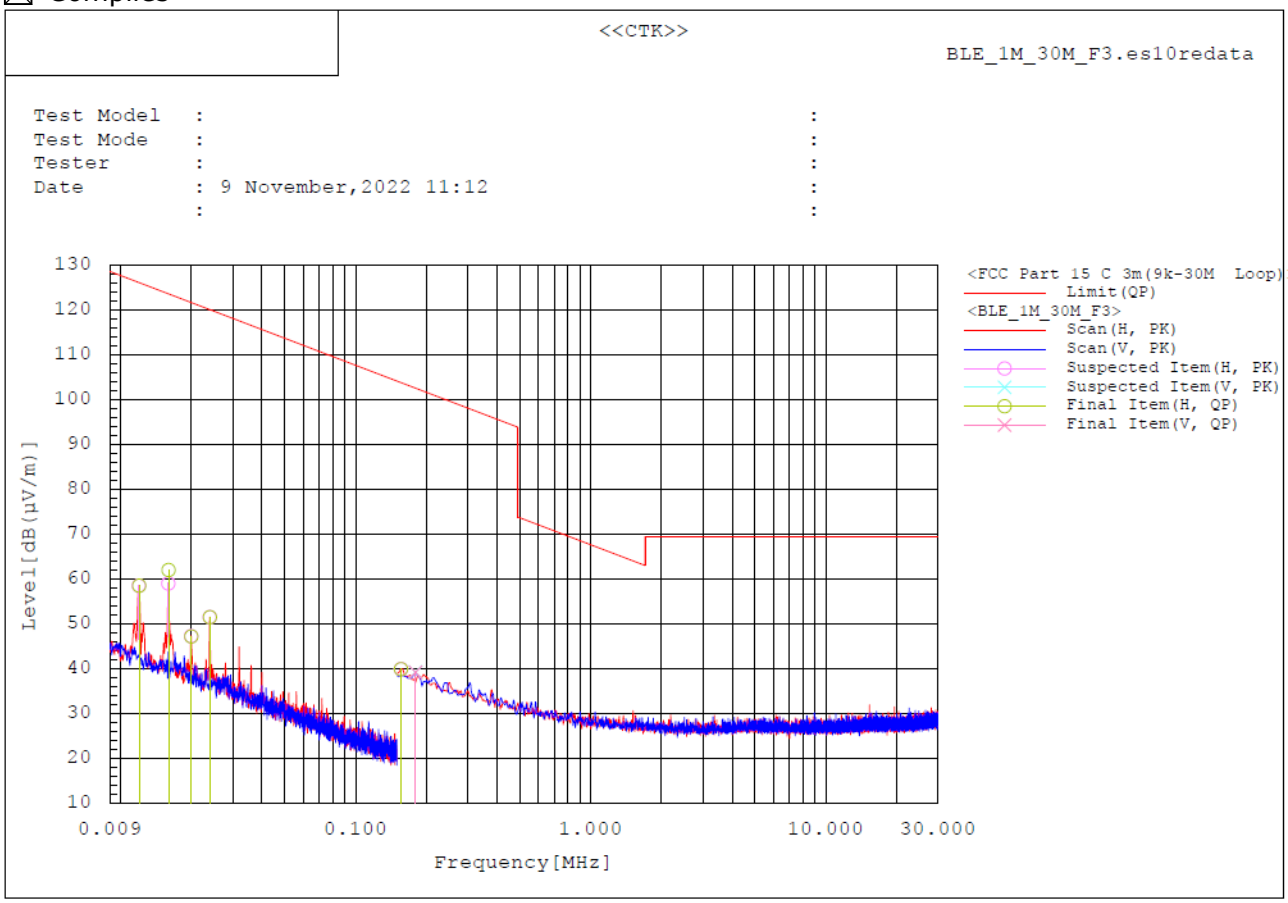
The emissions above 1 GHz were 20 dB lower than the limit.

Note :
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(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator

* Reading data is the peak value.

Test mode : GFSK, 2 Mbps, Lowest channel(Worst case)

The requirements are:
☒ Complies



Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
The emissions above 1 GHz were 20 dB lower than the limit.											

Note :
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(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator

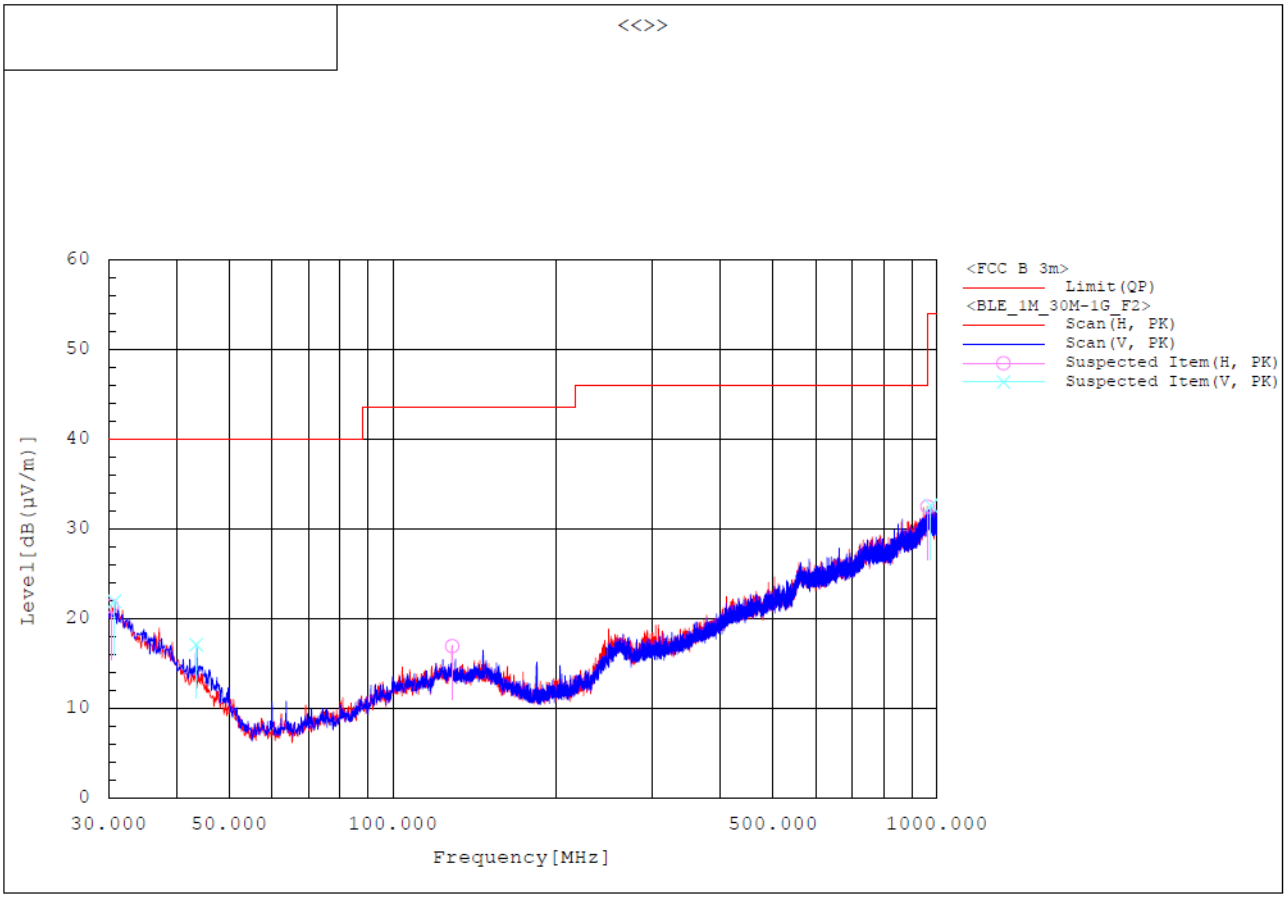
* Reading data is the peak value.

2. 30 MHz to 1 GHz

Test mode : GFSK, 1 Mbps, Transmit, Middle Channel(Worst case)

The requirements are:
☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	Pol	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP-PK [dB]	Height [cm]	Angle [deg]	Remark
1	30.388	H	28.1	-6.7	21.4	40.0	18.6	99.9	0.0	
2	30.776	V	28.7	-6.8	21.9	40.0	18.1	399.9	161.5	
3	43.483	V	30.9	-13.8	17.1	40.0	22.9	100.1	285.5	
4	128.552	H	29.6	-12.7	16.9	43.5	26.6	200.1	0.1	
5	961.297	H	26.2	6.3	32.5	54.0	21.5	99.9	329.1	
6	975.168	V	26.1	6.5	32.6	54.0	21.4	399.9	175.1	

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(Z 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

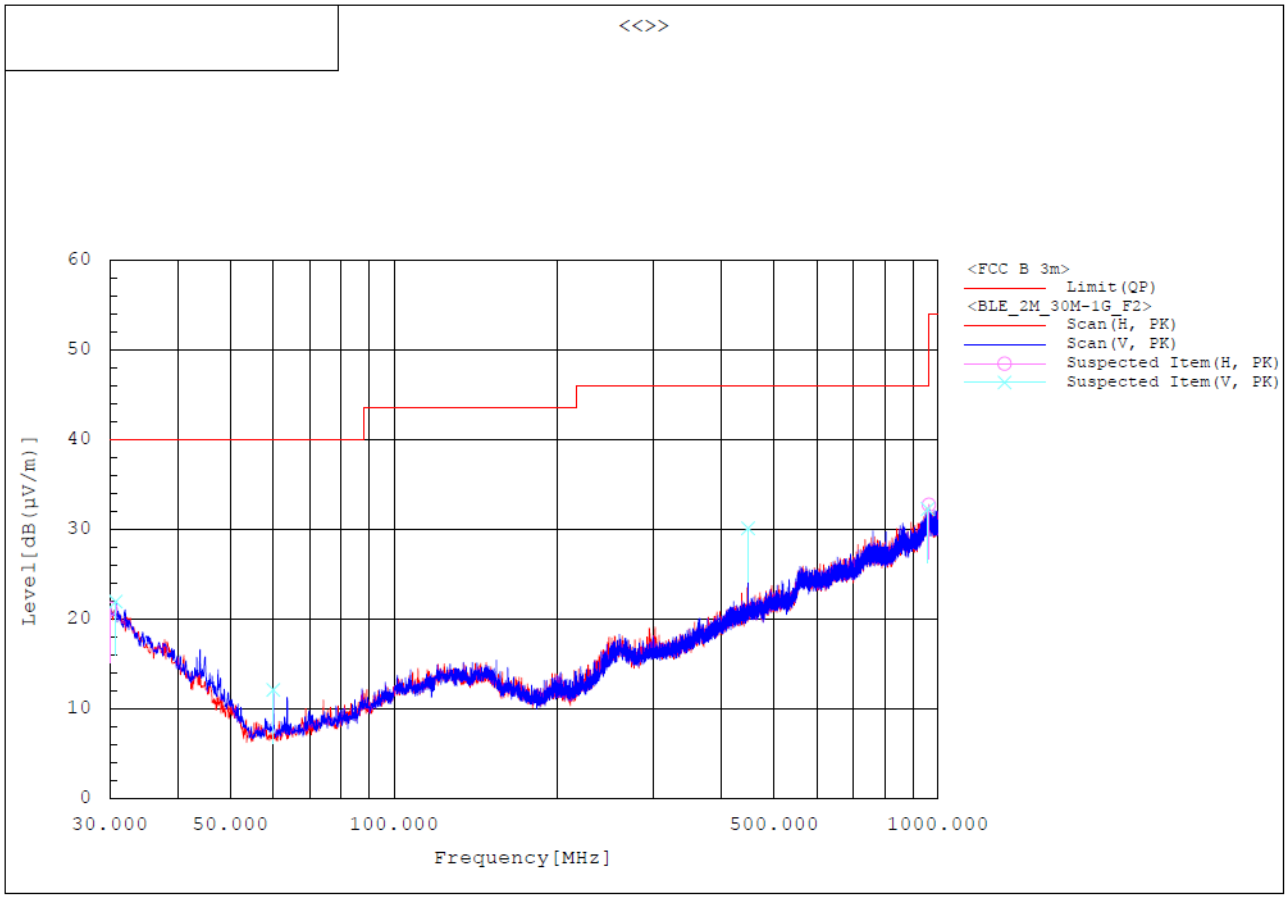
* Reading data is the peak value.

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Test mode : GFSK, 2 Mbps, Transmit, Middle Channel(Worst case)

The requirements are:
☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	Pol	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP-PK [dB]	Height [cm]	Angle [deg]	Remark
1	30.097	H	27.8	-6.6	21.2	40.0	18.8	300.0	359.7	
2	30.776	V	28.7	-6.8	21.9	40.0	18.1	300.0	16.5	
3	59.973	V	31.5	-19.4	12.1	40.0	27.9	99.9	276.2	
4	447.682	V	35.5	-5.4	30.1	46.0	15.9	99.9	0.2	
5	958.096	V	26.1	6.1	32.2	46.0	13.8	99.9	326.9	
6	962.946	H	26.3	6.4	32.7	54.0	21.3	200.2	205.2	

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(Z 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

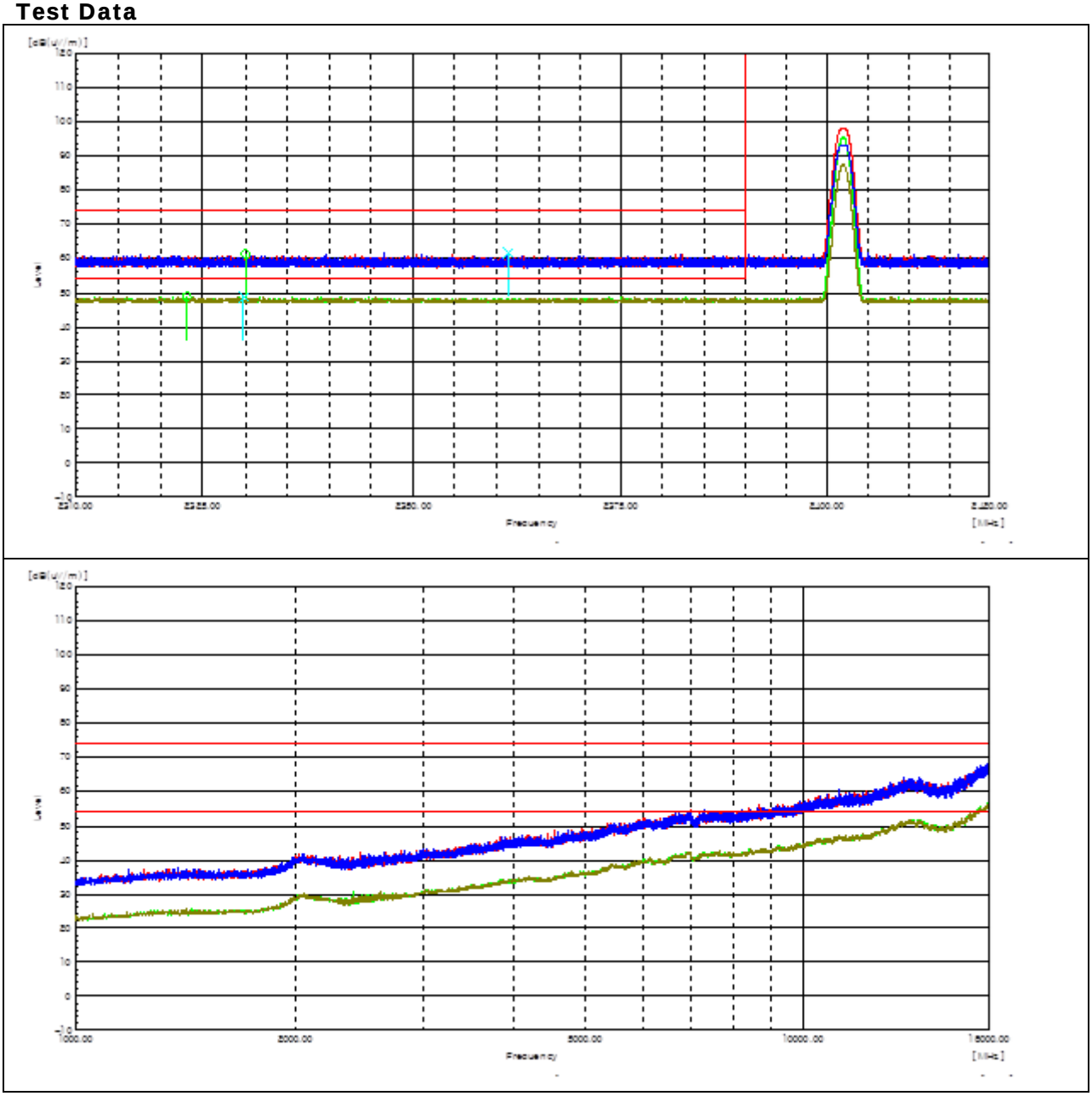
* Reading data is the peak value.

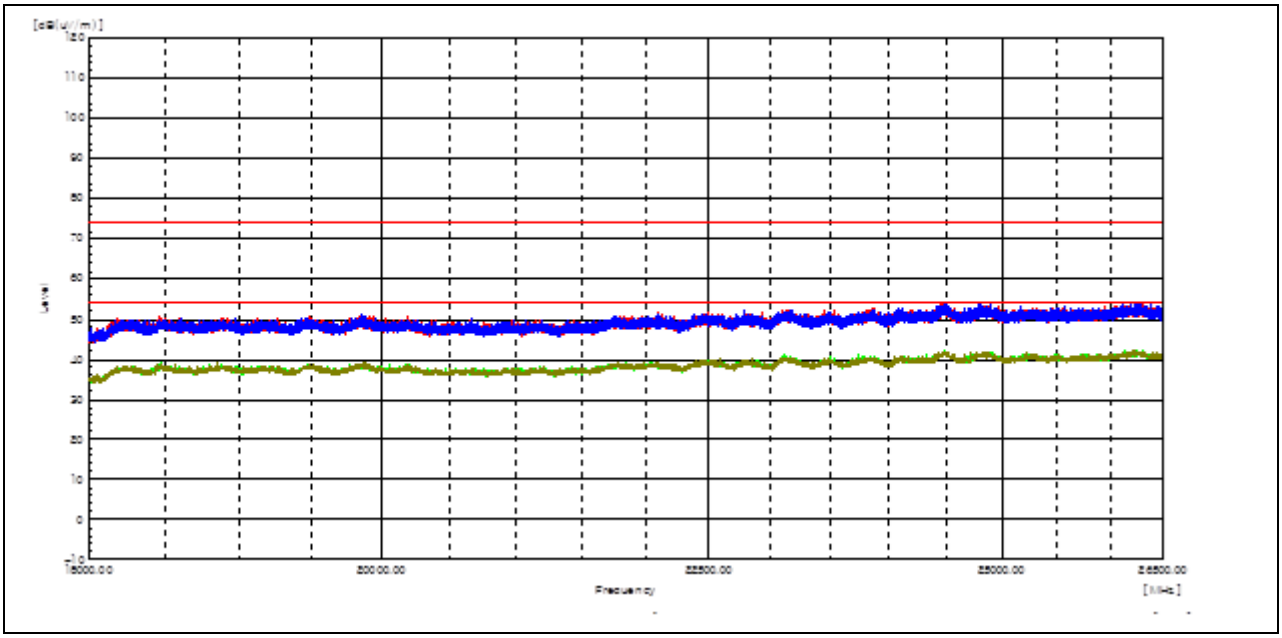
3. 1 GHz to 26.5 GHz

Test mode : GFSK, 1 Mbps, Transmit, Lowest Channel(Worst case)

The requirements are:
☒ Complies

Test Data





Lowest channel (2 402 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2 330.0	H	67.3	-----	-6.0	61.3	-----	74.0	-----	12.7	-----
2 323.1	H	-----	54.8	-6.0	-----	48.8	-----	54.0	-----	5.2
2 361.3	V	67.9	-----	-6.0	61.9	-----	74.0	-----	12.1	-----
2 329.9	V	-----	55.0	-6.0	-----	49.0	-----	54.0	-----	5.0

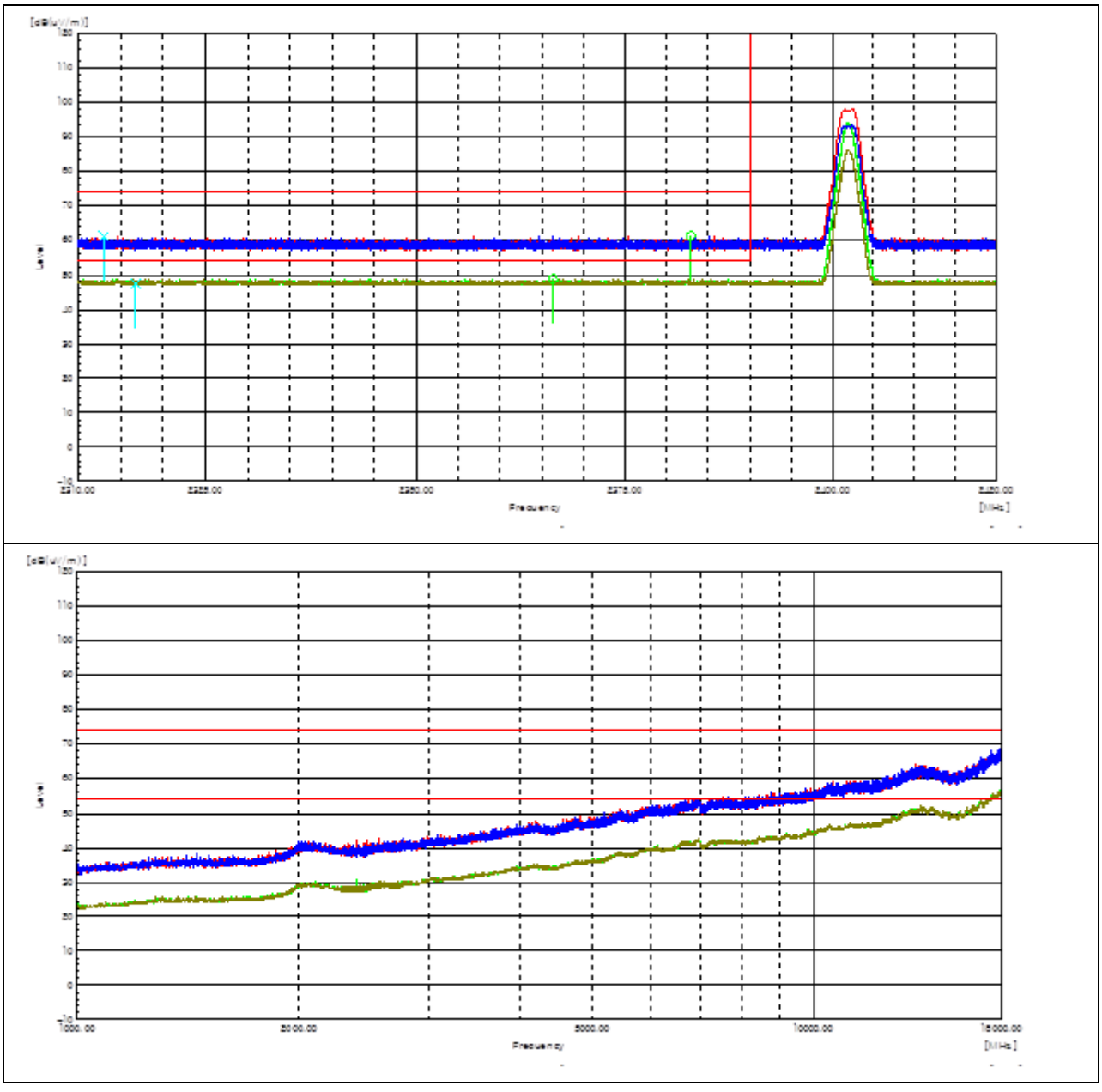
Remarks

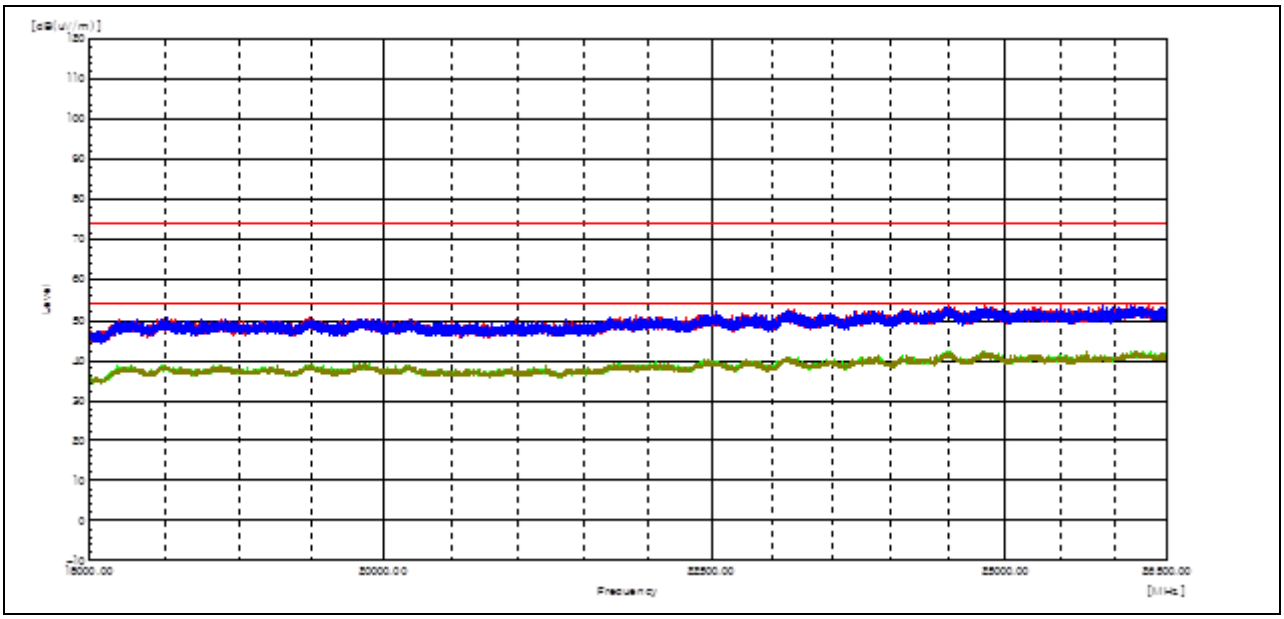
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.
2. Peak Result = Reading + c.f(Correction factor)
   Average Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain
4. BLE and UWB do not operate at the same time
5. Tested on a continuously transmitting EUT(duty cycle of greater than or equal to 98 %)

Test mode : GFSK, 2 Mbps, Transmit, Lowest Channel(Worst case)

The requirements are:
☒ Complies

Test Data





Highest channel (2 402 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2382.9	H	67.3	-----	-5.9	61.4	-----	74.0	-----	12.6	-----
2366.3	H	-----	54.8	-6.0	-----	48.8	-----	54.0	-----	5.2
2313.0	V	67.4	-----	-6.0	61.4	-----	74.0	-----	12.6	-----
2316.8	V	-----	53.5	-6.0	-----	47.5	-----	54.0	-----	6.5

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 stand-up position(Z axis) and the worst case was recorded.
2. Peak Result = Reading + c.f(Correction factor)
   Average Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain
4. BLE and UWB do not operate at the same time
5. Tested on a continuously transmitting EUT(duty cycle of greater than or equal to 98 %)

4.6 AC Power Line 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

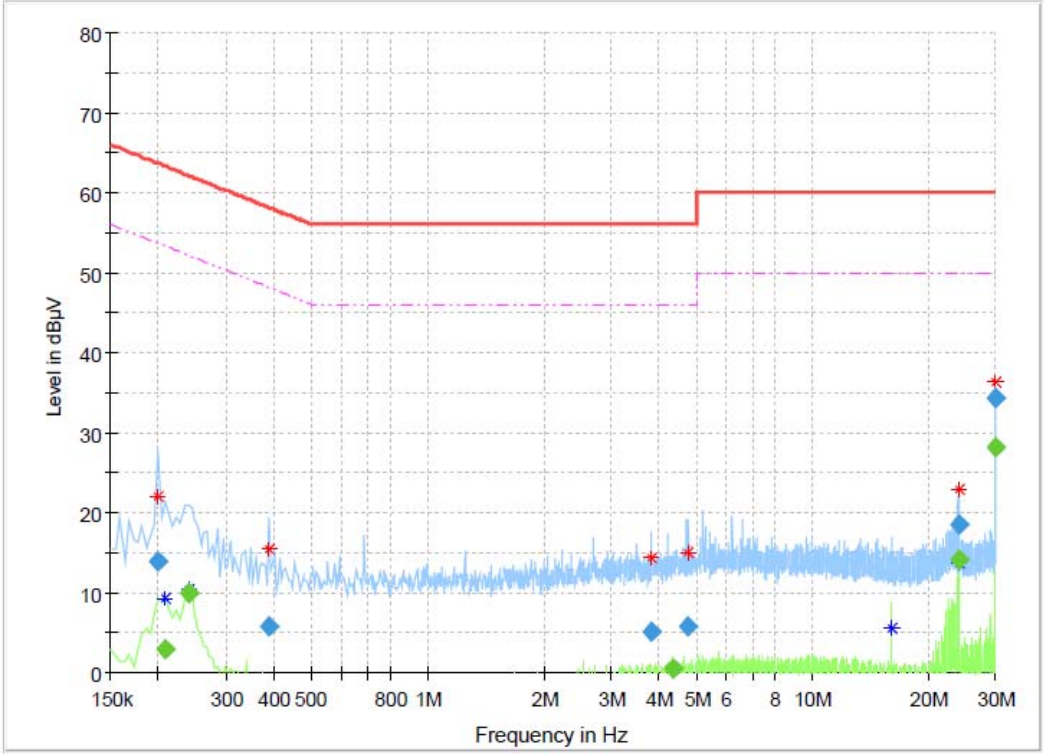
Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average**
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

Test Results :

The requirements are:
☒ Complies

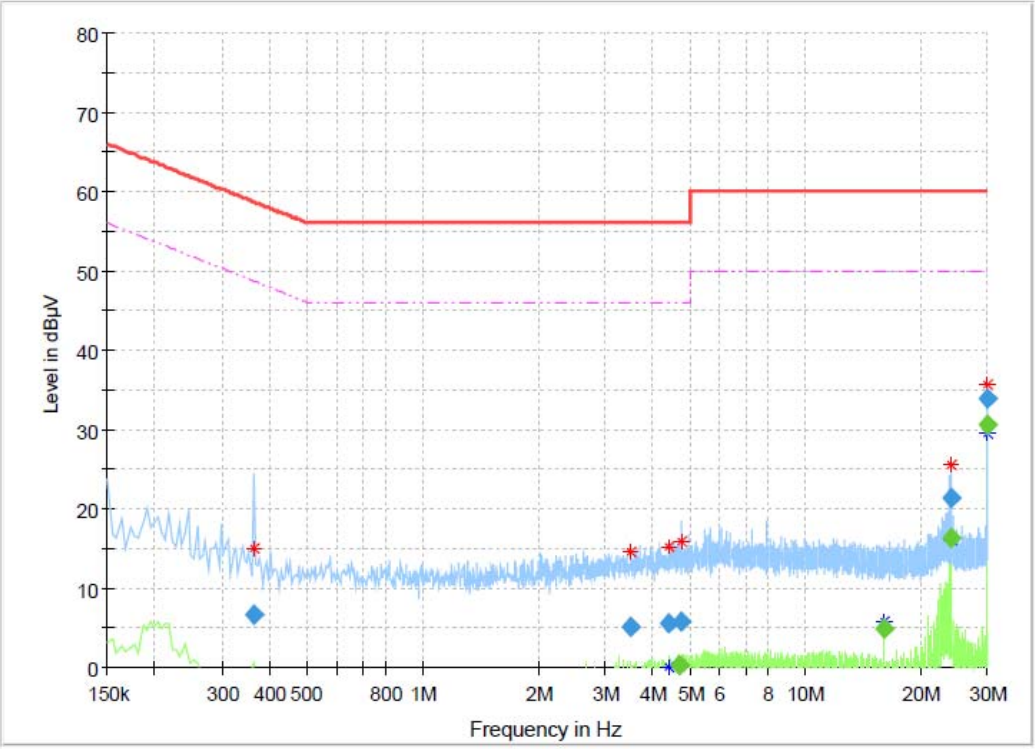
Test mode : GFSK, 1 Mbps, Transmit, Highest Channel(Worst case)
[L1]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.199500	13.79	---	63.63	49.84	15000.0	9.000	L1	ON	9.8
0.208500	---	2.88	53.27	50.39	15000.0	9.000	L1	ON	9.8
0.240000	---	9.87	52.10	42.23	15000.0	9.000	L1	ON	9.7
0.388500	5.66	---	58.10	52.44	15000.0	9.000	L1	ON	9.9
3.808500	5.09	---	56.00	50.91	15000.0	9.000	L1	ON	9.7
4.371000	---	0.41	46.00	45.59	15000.0	9.000	L1	ON	9.7
4.776000	5.80	---	56.00	50.20	15000.0	9.000	L1	ON	9.8
16.062000	---	-0.51	50.00	50.51	15000.0	9.000	L1	ON	10.0
23.995500	---	14.13	50.00	35.87	15000.0	9.000	L1	ON	10.0
24.004500	18.42	---	60.00	41.58	15000.0	9.000	L1	ON	10.0
29.994000	---	28.22	50.00	21.78	15000.0	9.000	L1	ON	10.1
29.998500	34.28	---	60.00	25.72	15000.0	9.000	L1	ON	10.1

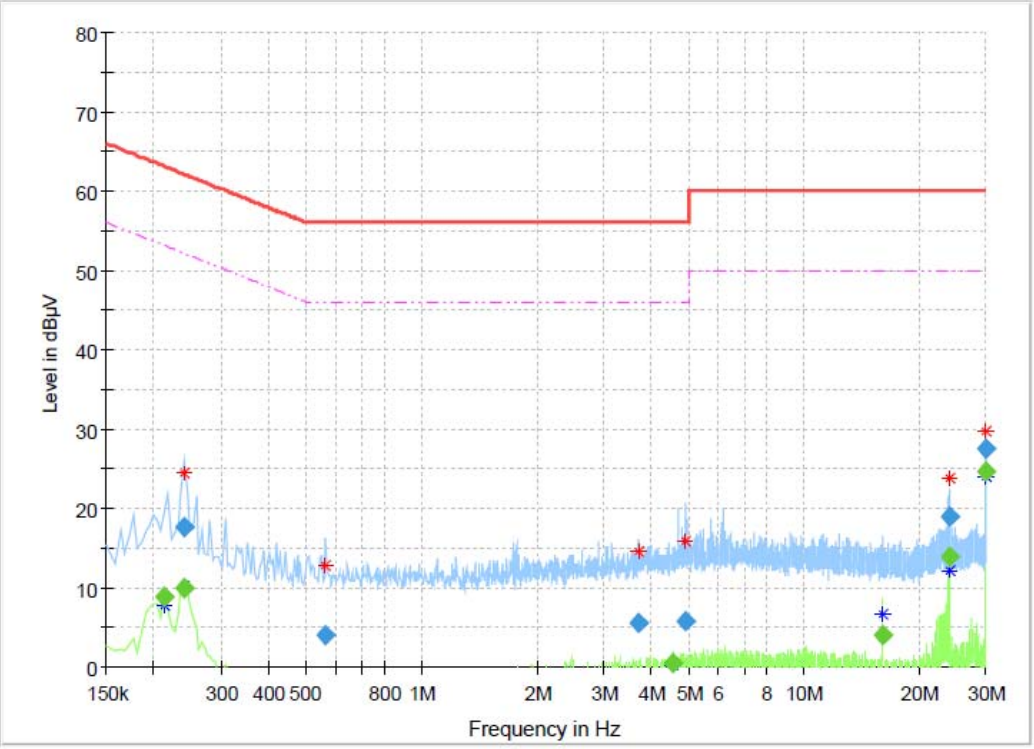
[NEUTRAL]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.361500	6.69	---	58.69	52.00	15000.0	9.000	N	ON	9.9
3.286500	---	-0.82	46.00	46.82	15000.0	9.000	N	ON	9.8
3.507000	4.96	---	56.00	51.04	15000.0	9.000	N	ON	9.8
4.398000	5.42	---	56.00	50.58	15000.0	9.000	N	ON	9.8
4.416000	---	-0.16	46.00	46.16	15000.0	9.000	N	ON	9.9
4.708500	---	0.11	46.00	45.89	15000.0	9.000	N	ON	9.9
4.771500	5.71	---	56.00	50.29	15000.0	9.000	N	ON	9.9
16.129500	---	4.77	50.00	45.23	15000.0	9.000	N	ON	10.1
24.004500	21.27	---	60.00	38.73	15000.0	9.000	N	ON	10.1
24.004500	---	16.37	50.00	33.63	15000.0	9.000	N	ON	10.1
29.998500	33.87	---	60.00	26.13	15000.0	9.000	N	ON	10.2
30.000000	---	30.46	50.00	19.54	15000.0	9.000	N	ON	10.2

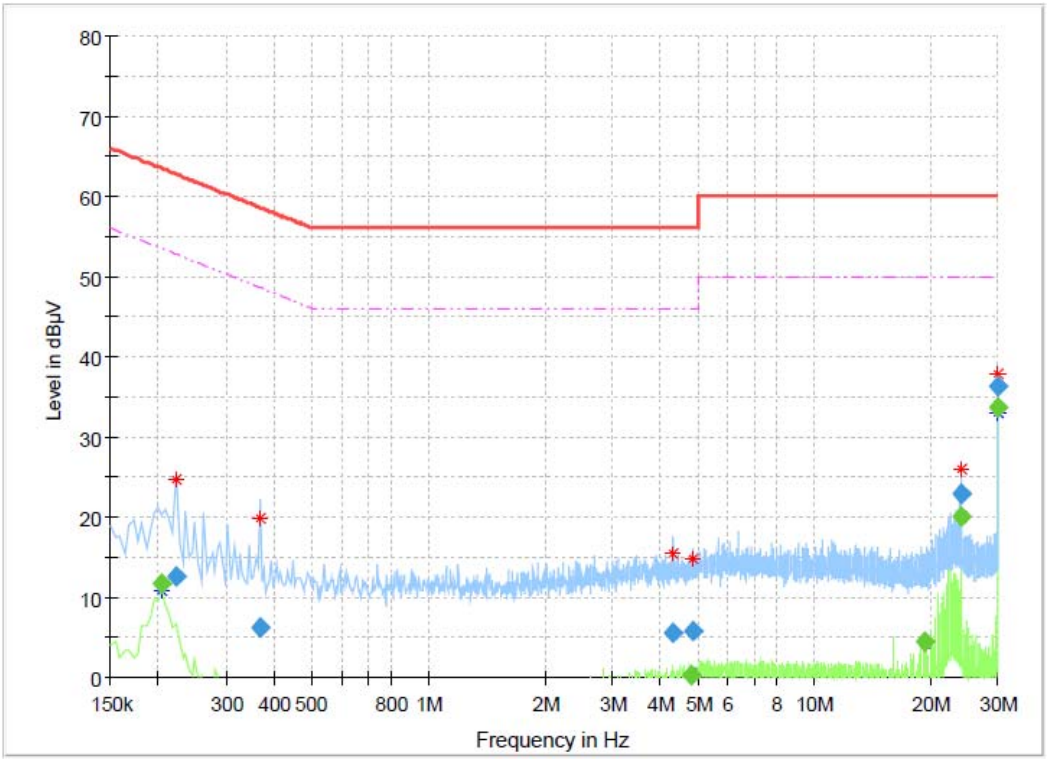
Test mode : GFSK, 2 Mbps, Transmit, Middle Channel (Worst case)
[L1]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.213000	---	8.83	53.09	44.26	15000.0	9.000	L1	ON	9.8
0.240000	---	9.97	52.10	42.13	15000.0	9.000	L1	ON	9.7
0.240000	17.50	---	62.10	44.60	15000.0	9.000	L1	ON	9.7
0.564000	3.98	---	56.00	52.02	15000.0	9.000	L1	ON	10.0
3.682500	5.42	---	56.00	50.58	15000.0	9.000	L1	ON	9.7
4.551000	---	0.34	46.00	45.66	15000.0	9.000	L1	ON	9.8
4.915500	5.75	---	56.00	50.25	15000.0	9.000	L1	ON	9.8
16.089000	---	3.99	50.00	46.01	15000.0	9.000	L1	ON	10.0
23.995500	---	13.84	50.00	36.16	15000.0	9.000	L1	ON	10.0
24.000000	18.99	---	60.00	41.01	15000.0	9.000	L1	ON	10.0
30.000000	---	24.52	50.00	25.48	15000.0	9.000	L1	ON	10.1
30.000000	27.43	---	60.00	32.57	15000.0	9.000	L1	ON	10.1

[NEUTRAL]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.204000	---	11.61	53.45	41.84	15000.0	9.000	N	ON	9.9
0.222000	12.53	---	62.74	50.21	15000.0	9.000	N	ON	9.8
0.366000	6.14	---	58.59	52.45	15000.0	9.000	N	ON	9.9
4.155000	---	-0.16	46.00	46.16	15000.0	9.000	N	ON	9.8
4.330500	5.42	---	56.00	50.58	15000.0	9.000	N	ON	9.8
4.821000	---	0.13	46.00	45.87	15000.0	9.000	N	ON	9.9
4.857000	5.66	---	56.00	50.34	15000.0	9.000	N	ON	9.9
19.437000	---	4.47	50.00	45.53	15000.0	9.000	N	ON	10.2
24.000000	22.93	---	60.00	37.07	15000.0	9.000	N	ON	10.1
24.000000	---	19.99	50.00	30.01	15000.0	9.000	N	ON	10.1
29.998500	---	33.58	50.00	16.42	15000.0	9.000	N	ON	10.2
30.000000	36.31	---	60.00	23.69	15000.0	9.000	N	ON	10.2

APPENDIX A – Test Equipment Used For Tests

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY50200512	2022-03-28	2023-03-28
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2022-03-25	2023-03-25
3	EMI TEST RECEIVER	Rohde & Schwarz	ESW44	102039	2022-05-04	2023-05-04
4	Spectrum Analyzer	R&S	FSV40	101574	2022-01-12 2023-01-11	2023-01-12 2024-01-11
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2022-04-15	2024-04-15
6	Bilog Antenna	TESEQ	CBL6111D	60654	2021-09-03	2023-09-03
7	AMPLIFIER	SONOMA INSTRUMENT	310N	411011	2022-08-10	2023-08-10
8	ATTENUATOR	PASTERNACK	PE7AP006-06	L2021050400002 3	2022-08-10	2023-08-10
9	Preamplifier	Agilent	8449B	3008A00620	2022-05-10	2023-05-10
10	Double Ridged Guide Antenna	ETS-Lindgren	3115	00078895	2022-04-14	2023-04-14
11	Horn Antenna	SCHWARZBECK	BBHA9170	01153	2022-10-31	2023-10-31
12	Low Noise Amplifier	TESTEK	TK-PA1840H	210124-L	2022-11-09	2023-11-09
13	LISN	R&S	ENV216	102698	2022-05-13	2023-05-13
14	Band Reject Filter	Micro Tronics	BRM50702	G233	2022-01-07 2023-01-03	2023-01-07 2024-01-03
15	Dual-Tracking DC Power Supply	Topward Electric Instruments Co.,Ltd.	6303D	711196	2022-04-15	2023-04-15
16	DC Power Supply	HP	E3632A	KR75305831	2022-07-14	2023-07-14

No.	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable(conducted)	Junkosha Inc.	MWX221	2008S240	2022-06-02
2	RF Cable (9kHz-1GHz Radiated)	Canare Corporation	L-5D2W	N/A	2022-09-21
3	RF Cable (9kHz-1GHz Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2022-09-21
4	RF Cable (1GHz-18GHz Radiated)	Junkosha Inc.	MWX221	2008S246	2022-04-14
5	RF Cable (1GHz-18GHz Radiated)	Rosenberger	NONE	1520.9927.00	2022-04-14
6	RF Cable (1GHz-18GHz Radiated)	Sensorview Co., LTD	9S18	TPC2204060007	2022-04-14
7	RF Cable (18GHz-26.5GHz Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY2372/2	2022-04-14
8	RF Cable (18GHz-26.5GHz Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY073/2	2022-04-14
9	RF Cable (18GHz-26.5GHz Radiated)	Sensorview Co., LTD	9S40	TP210713-001	2022-04-14

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