TEST REPORT

CTK Co., Ltd.
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Report No.: CTK-2022-01997

1. Applicant

◦ Name : MobiFren Co., Ltd.

◦ Address : (Gupyeong Dong), 88, Indong 52 Gil, Gumi, Gyeongbuk, 39445, Korea

◦ Date of Receipt : 2022-05-18

2. Manufacturer

◦ Name : Ovtech Industrial Co., Ltd

◦ Address : 3F, Bldg 3,Dong Wangyang Industrial Park Huangtian Xixiang Baoan.
Shenzhen Guang Dong China

3. Use of Report : For FCC Certification

4. Test Sample / Model: Bluetooth bone-conduction Earphone / MFB-HC7700

5. Date of Test : 2022-07-21 to 2022-07-23

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

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

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK

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

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

2022-07-27

CTK Co., Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2022-07-27	Issued (CTK-2022-01997)	all

CONTENTS

1. General Product Description

1.1 Client Information

Company	MobiFren Co., Ltd.
Contact Point	(Gupyeong Dong), 88, Indong 52 Gil, Gumi, Gyeongbuk, 39445, Korea
Contact Person	Name : Jin Yun, Seo E-mail : jyseo@mobifren.com Tel : +82-54-474-2220 Fax : +82-54-474-2251

1.2 Product Information

FCC ID	UZCMFB-HC7700
Product Description	Bluetooth bone-conduction Earphone
Basic model	MFB-HC7700
Variant Model name	-
Operating Frequency	2 402 MHz – 2 480 MHz
RF Output Power	GFSK : -5.300 dBm (0.295 mW) - Peak Conducted
Antenna type	FPC Antenna
Antenna gain	-0.13 dBi
Number of channels	79
Channel Spacing	1 MHz
Type of Modulation	GFSK (1 Mbps)
Power Source	DC 3.7 V (Battery)
Test Software	BT_Tool_v1.1.1
RF Power setting in Test SW	Power Setting "7"

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6P
AC/DC Adapter	HP	HSTNN-LA40	7628011101

2. Facility and Accreditations

2.1 Test Facility

5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, 17142 Korea

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	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. Test Specifications

3.1 Standards

Section in FCC	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	Carrier Frequency Separation	C	Conducted
15.247(a)	Number of Hopping Frequencies	C	
15.247(a)	20 dB Bandwidth	C	
15.247(a)	Time of occupancy (Dwell Time)	C	
15.247(b)	Maximum peak conducted output power	C	
15.247(d)	Unwanted emission	C	
15.209	Transmitter emission	C	Radiated
15.207(a)	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			
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.558074, ANSI C63.10-2013			
Note 5: This device is frequency hopping system(FHS), and complies frequency hopping system requirement.			

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	2 441 MHz	2 480 MHz

Test mode

Modulation	Packet type	Data rate	Duty Cycle	Duty Cycle Factor
GFSK	DH5	1 Mbps	77.10 %	1.13 dB

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 ≤ 30 MHz)	1.5 dB (C.L. : Approx. 95 %, k = 2)
Radiated Emissions (f ≤ 1 GHz)	3.88 dB (C.L. : Approx. 95 %, k = 2)
Radiated Emissions (f > 1 GHz)	4.62 dB (C.L. : Approx. 95 %, k = 2)
AC Conducted Emission	1.94 dB (C.L. : Approx. 95 %, k = 2)

4. Technical Characteristic Test

4.1 Carrier Frequency Separation

Test Procedures

ANSI C63.10-2013 7.8.2

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.
After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to :

a) Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)
b) RBW = 300 kHz (Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel)
c) VBW = 300 kHz (≥ RBW)
d) Sweep = auto
e) Detector function = peak
f) Trace = max hold

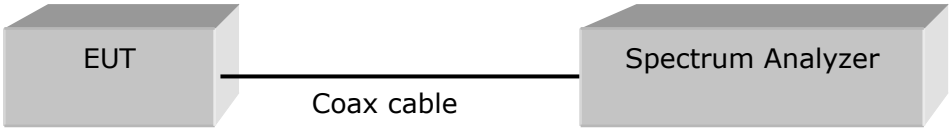


Figure 1 : Measurement setup for the carrier frequency separation

Limit

FHSS operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater.

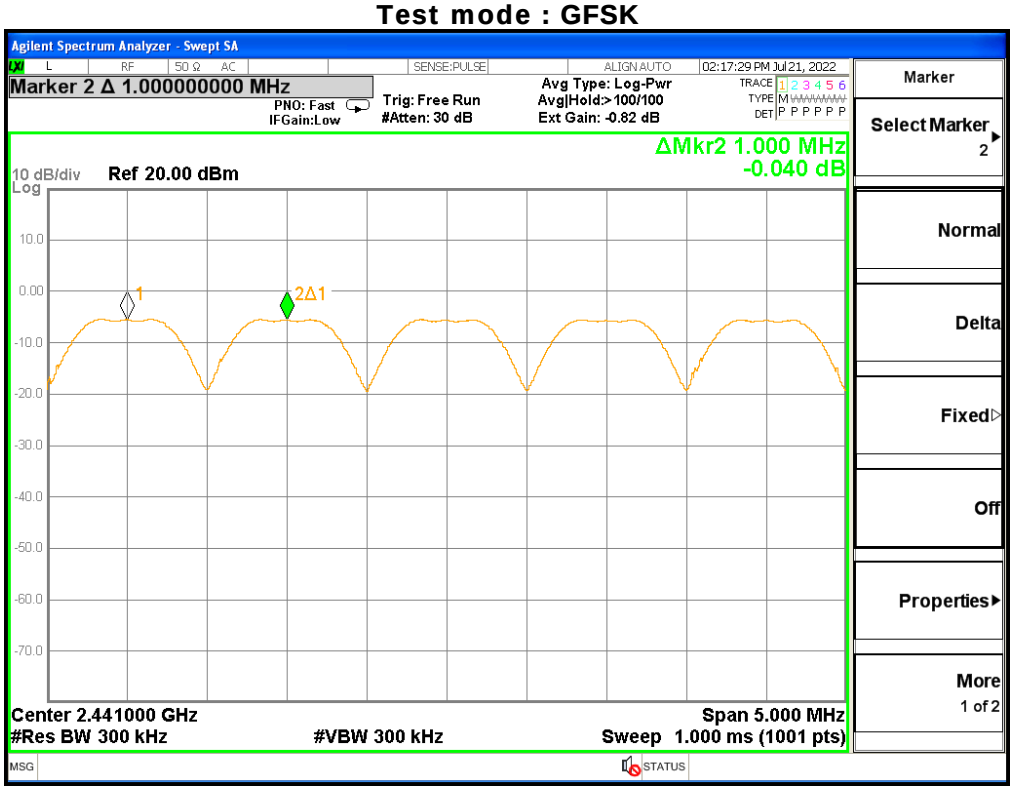
Test Results

Test mode : GFSK

Channel	Adjacent Hopping Channel Separation [kHz]	Two-third of 20dB bandwidth [kHz]	Minimum Bandwidth [kHz]	Result
Middle	1000	628.1	25	Complies

See next pages for actual measured spectrum plots.

Test mode : GFSK



4.2 Number of Hopping Frequencies

Test Procedures

ANSI C63.10-2013 7.8.3

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to :

a) Frequency range 1: Start = 2 390.0 MHz, Stop = 2 439.5 MHz
2: Start = 2 439.5 MHz, Stop = 2 489.5 MHz

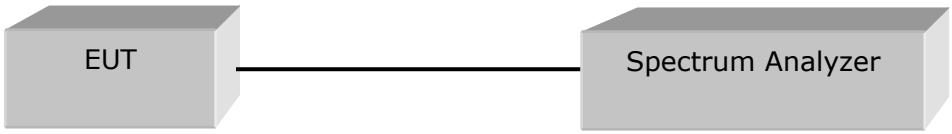
b) RBW = 300 kHz (To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller)

c) VBW = 300 kHz (≥ RBW)

d) Sweep = auto

e) Detector function = peak

f) Trace = max hold



Limit

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

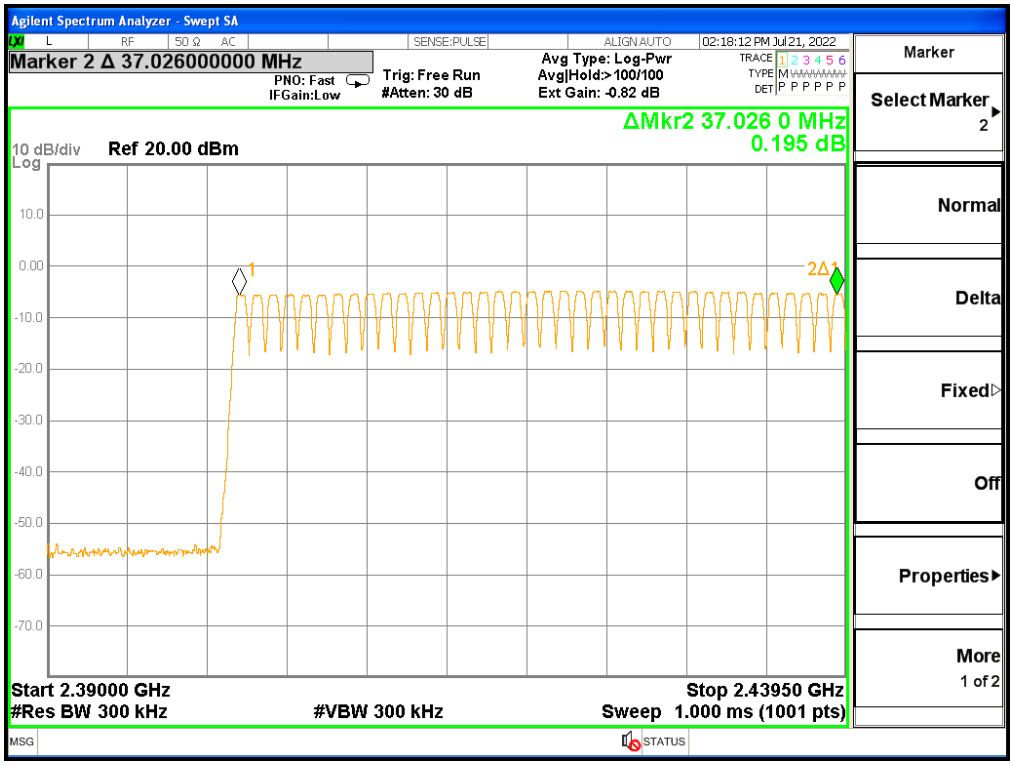
Test Results

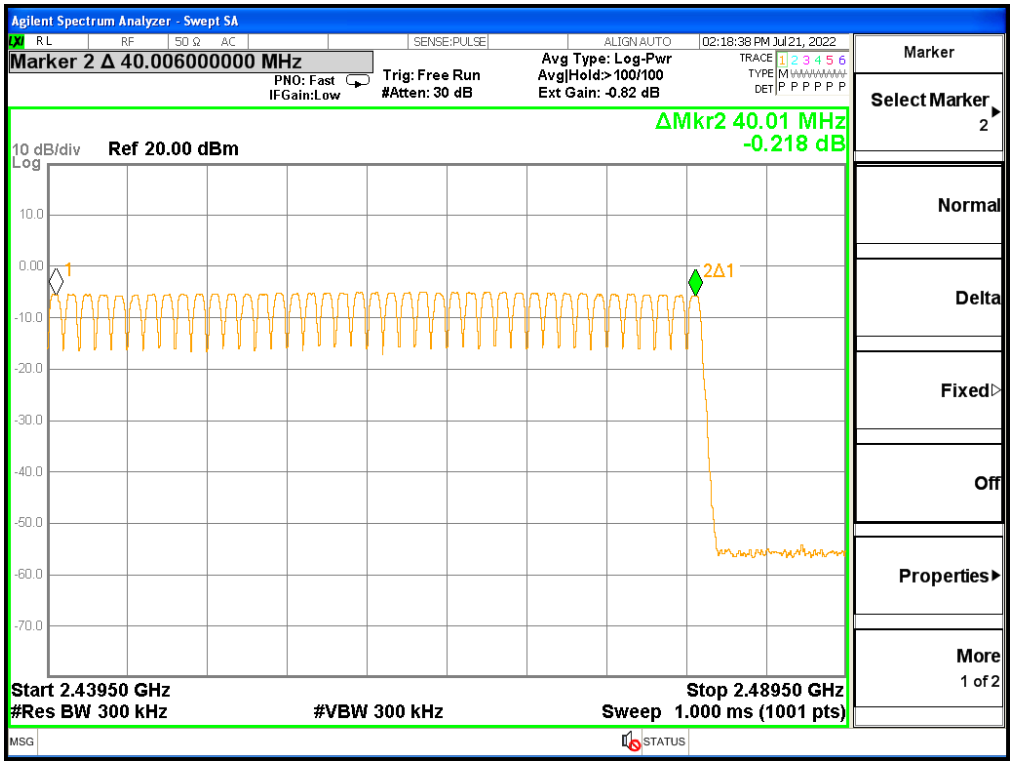
Test mode : GFSK

Total number of Hopping Channels	Result
79	Complies

See next pages for actual measured spectrum plots.

Test Mode : GFSK





4.3 20 dB 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 20 dB relative to the maximum level measured in the fundamental emission.

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.

The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

a) Span = 3 MHz (between 2 times and 5 times the OBW)

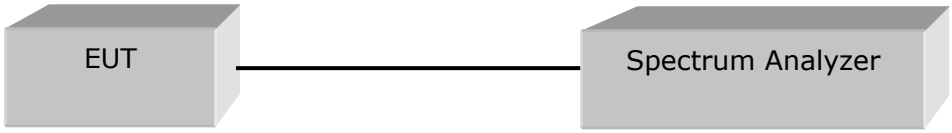
b) RBW = 30 kHz (1 % to 5 % of the OBW)

c) VBW = 100 kHz (approximately 3 times RBW)

d) Sweep = auto

e) Detector function = peak

f) Trace = max hold



Limit

Limit : N/A

Test Results

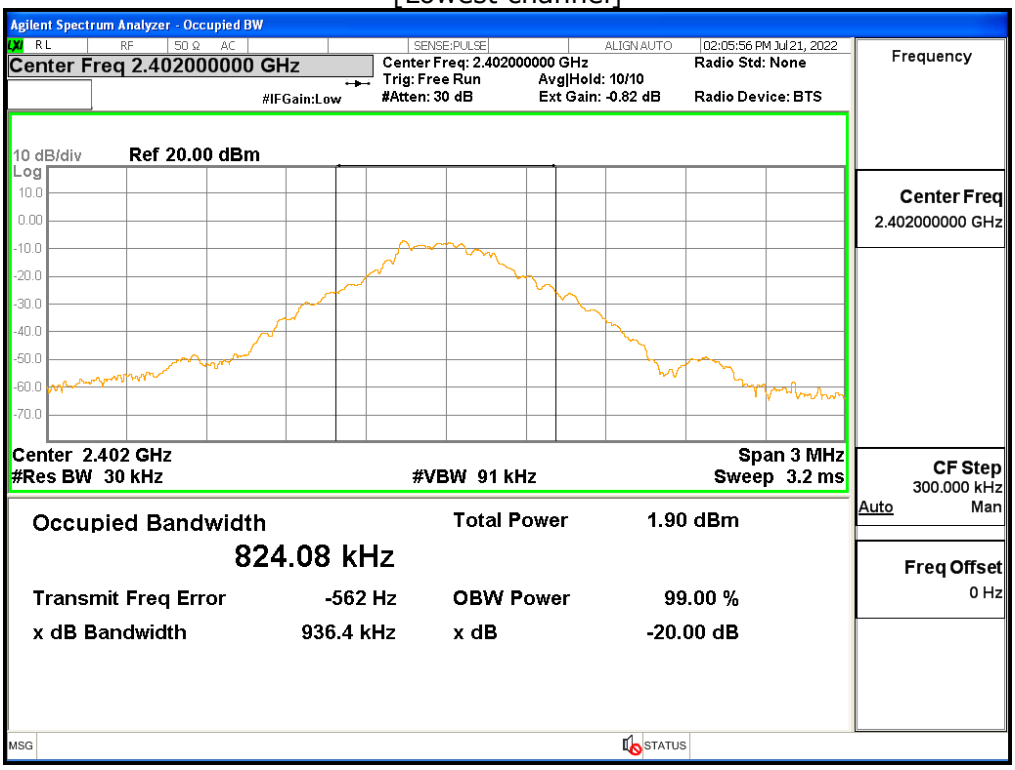
Test mode : GFSK

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Result
Lowest	2 402	0.936	0.824	Complies
Middle	2 441	0.942	0.821	Complies
Highest	2 480	0.935	0.819	Complies

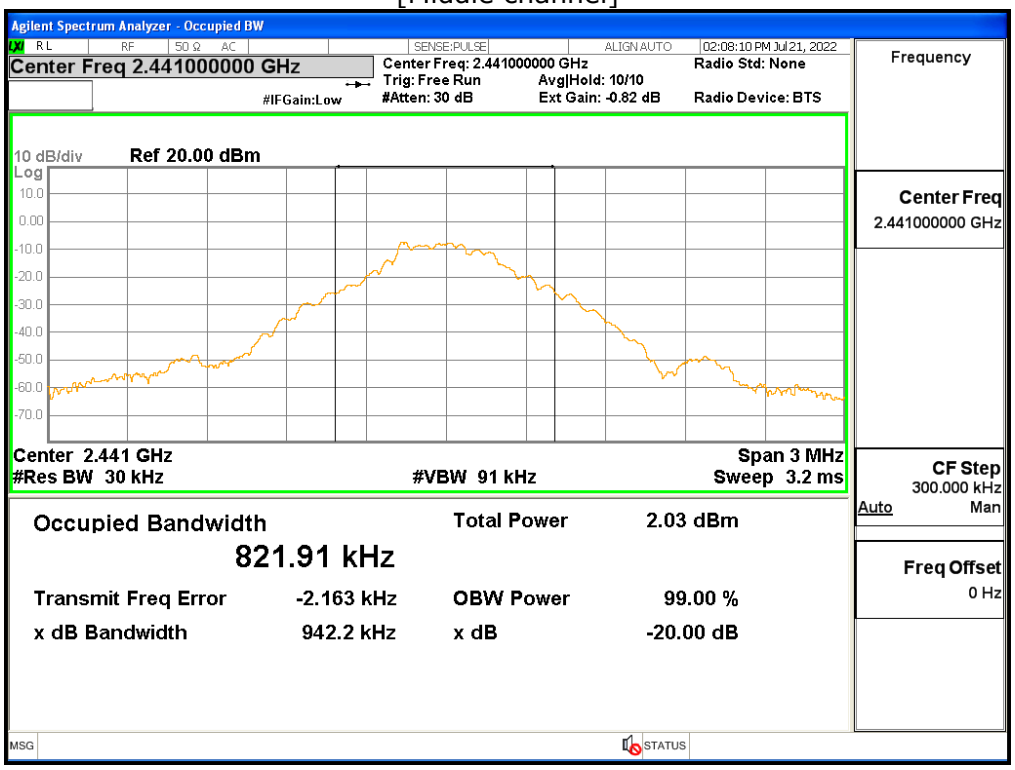
See next pages for actual measured spectrum plots.

20 dB bandwidth & 99 % Bandwidth - GFSK

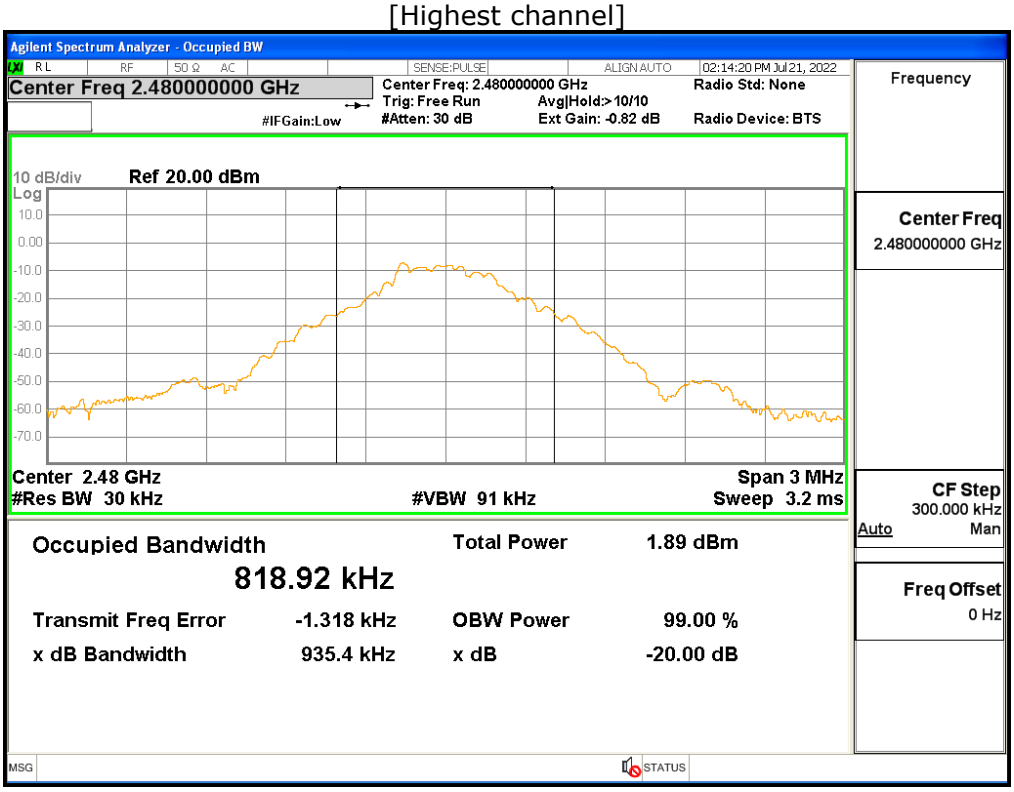
[Lowest channel]



[Middle channel]



[Highest channel]



4.4 Time of Occupancy (Dwell Time)

Test Procedures

ANSI C63.10-2013 7.8.4

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

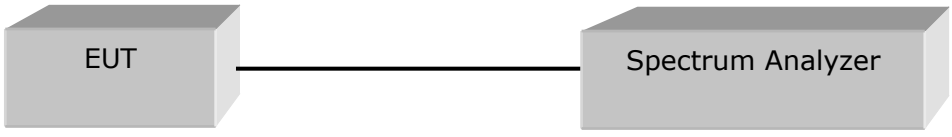
a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function : Peak.
e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

Number of hops in the period specified in the requirements =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.



Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Results

The requirements are:
☒ Complies

Test Data

Test mode : GFSK

Mode	Number of hops on spectrum analyzer	period specified in the requirement (sec)	analyzer sweep time (sec)	Number of transmission in a period (channel number*0.4 sec)	Transmission time per hop (msec)	average time of occupancy (msec)	Limit (msec)
1-DH1	47	31.6	5.0	297.04	0.405	120.301	400
1-DH3	23	31.6	5.0	145.36	1.655	240.571	400
1-DH5	18	31.6	5.0	113.76	2.895	329.335	400

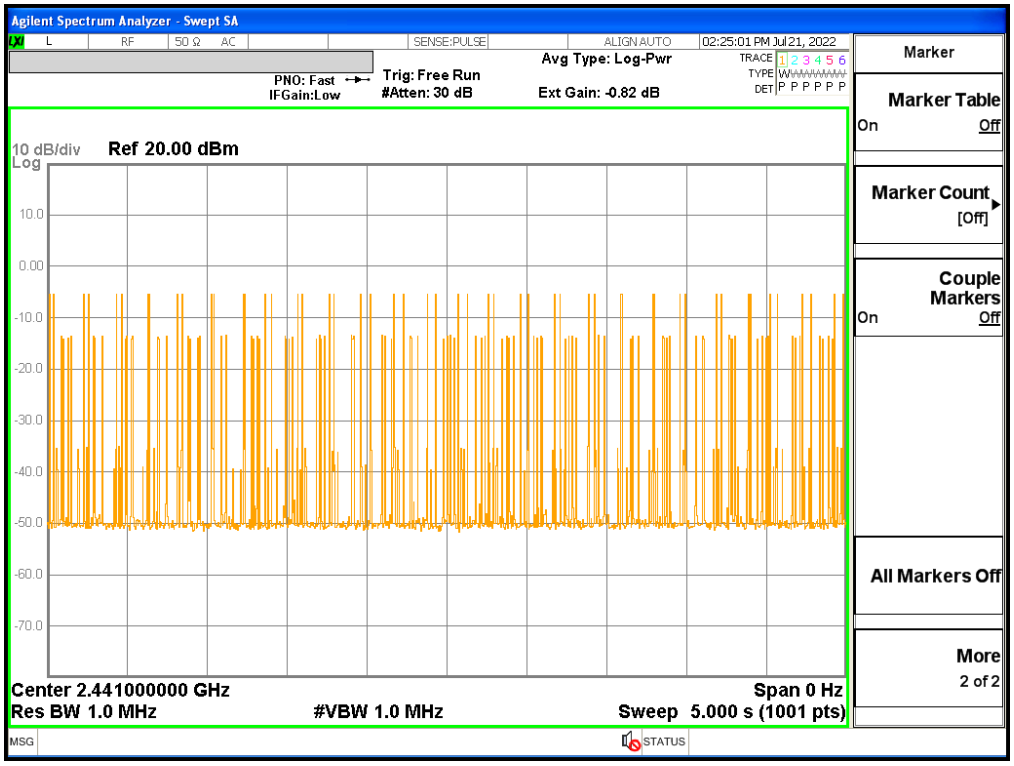
Remark:

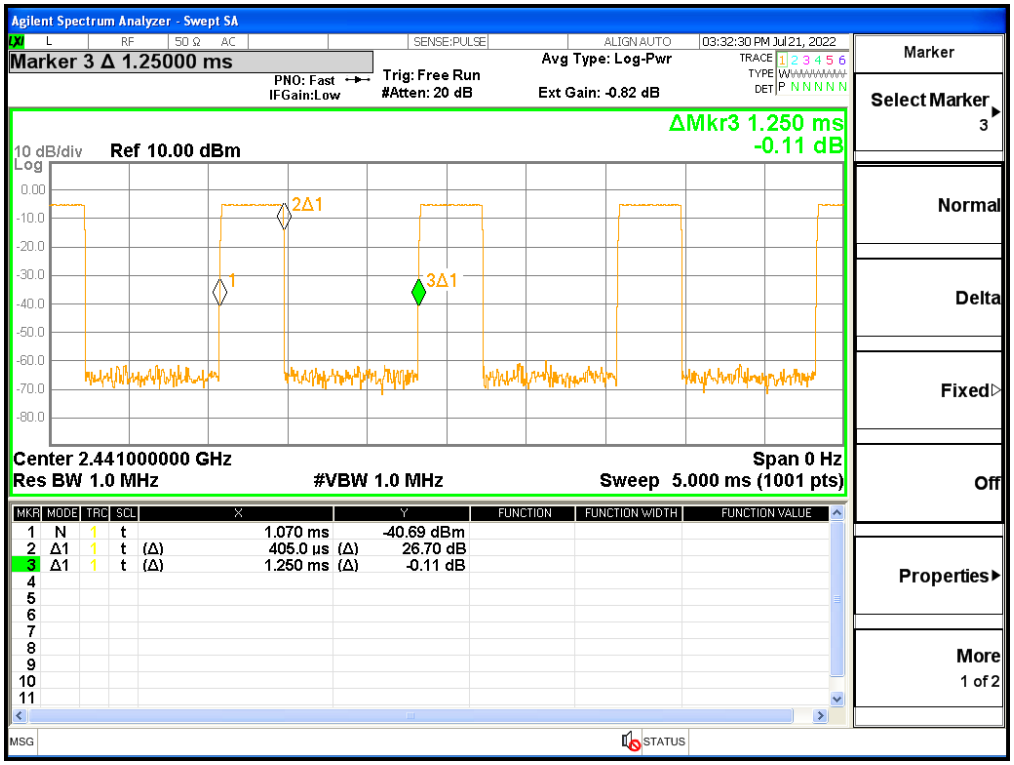
Number of transmission in a period(Channel number * 0.4)
= Number of hops on spectrum analyzer × (period specified in the requirement / analyzer sweep time)

Average time of occupancy = Number of transmission in a period × Transmission time per hop

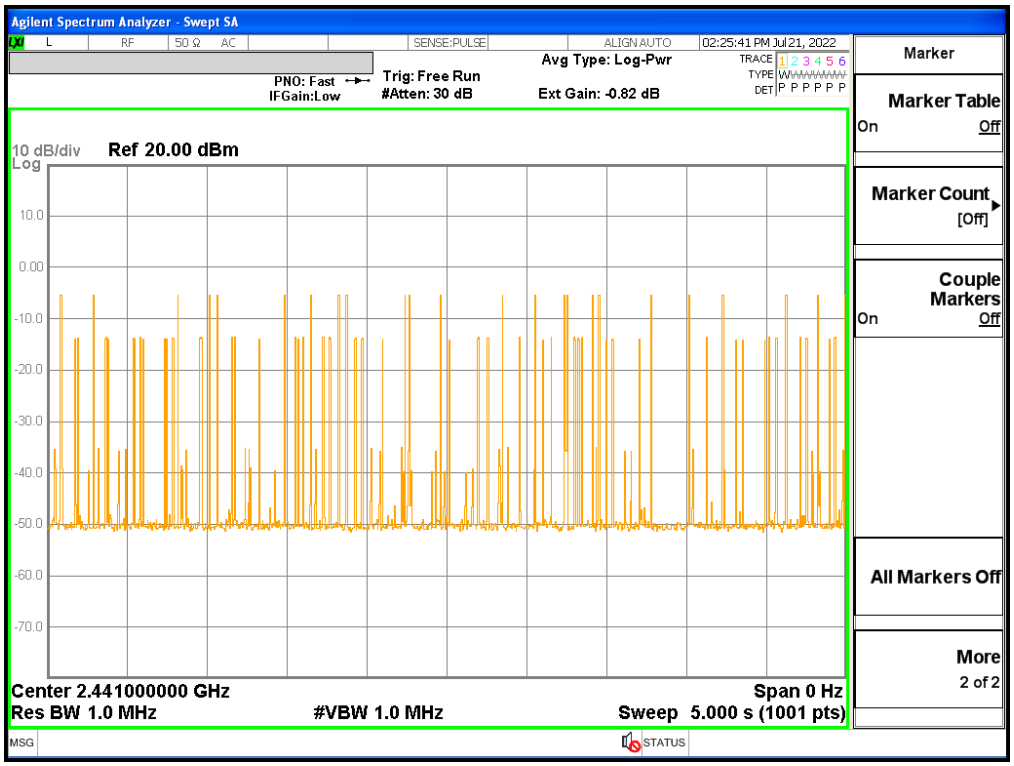
See next pages for actual measured spectrum plots.

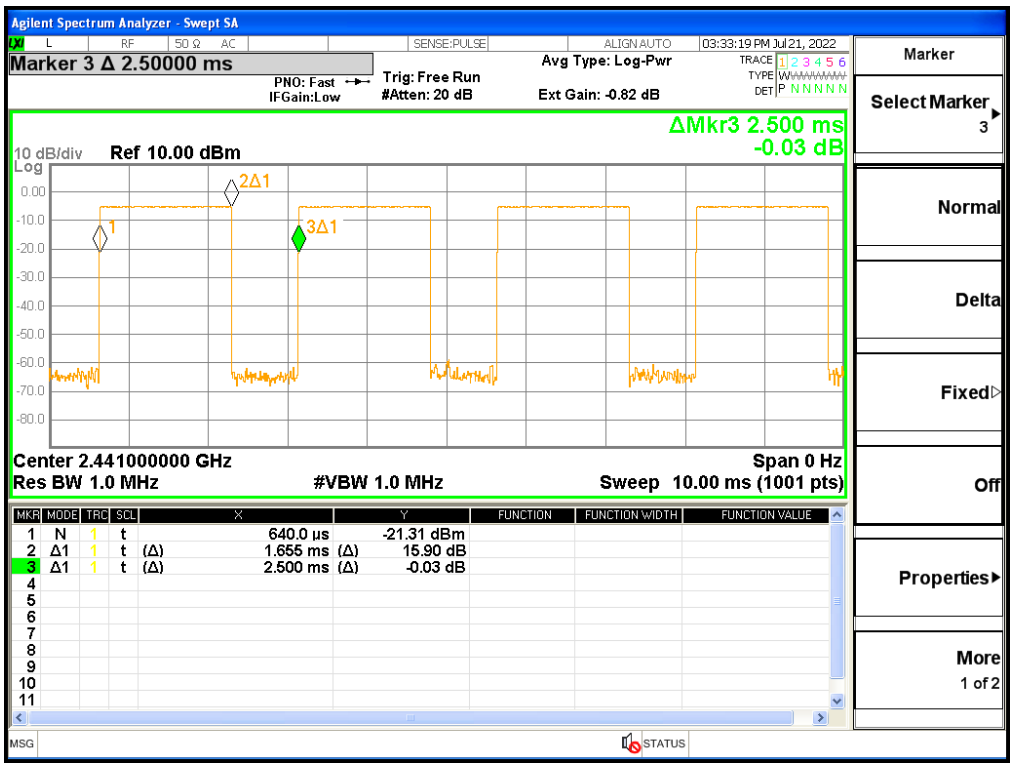
Time of Occupancy for Packet Type 1-DH1(GFSK)



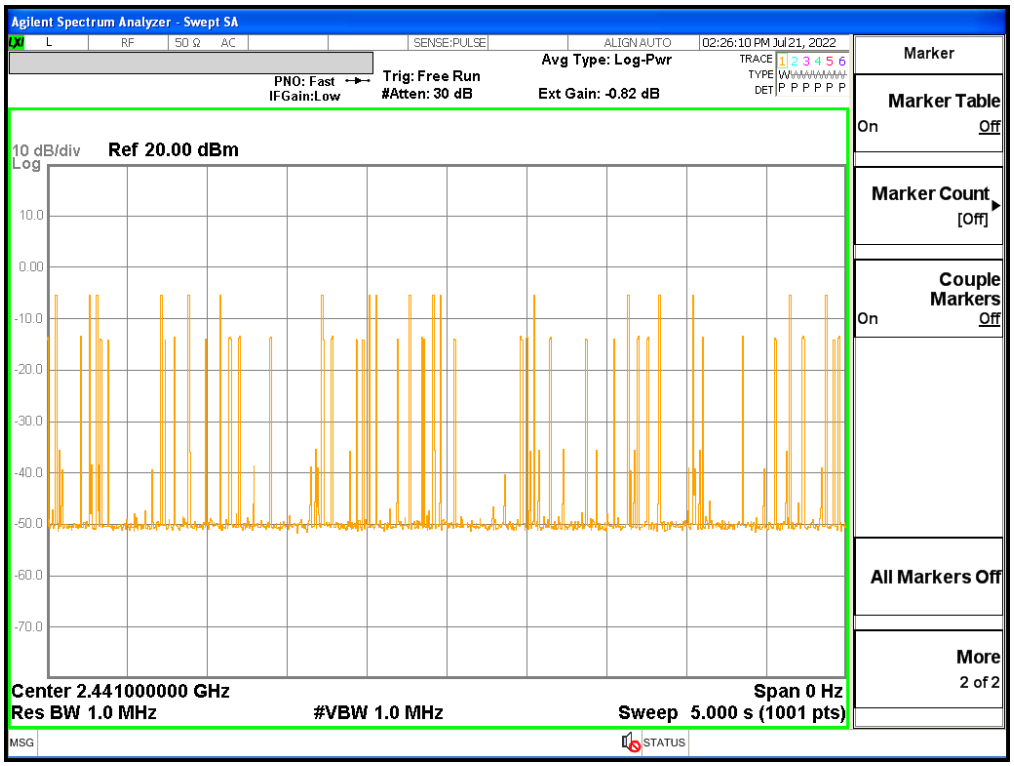


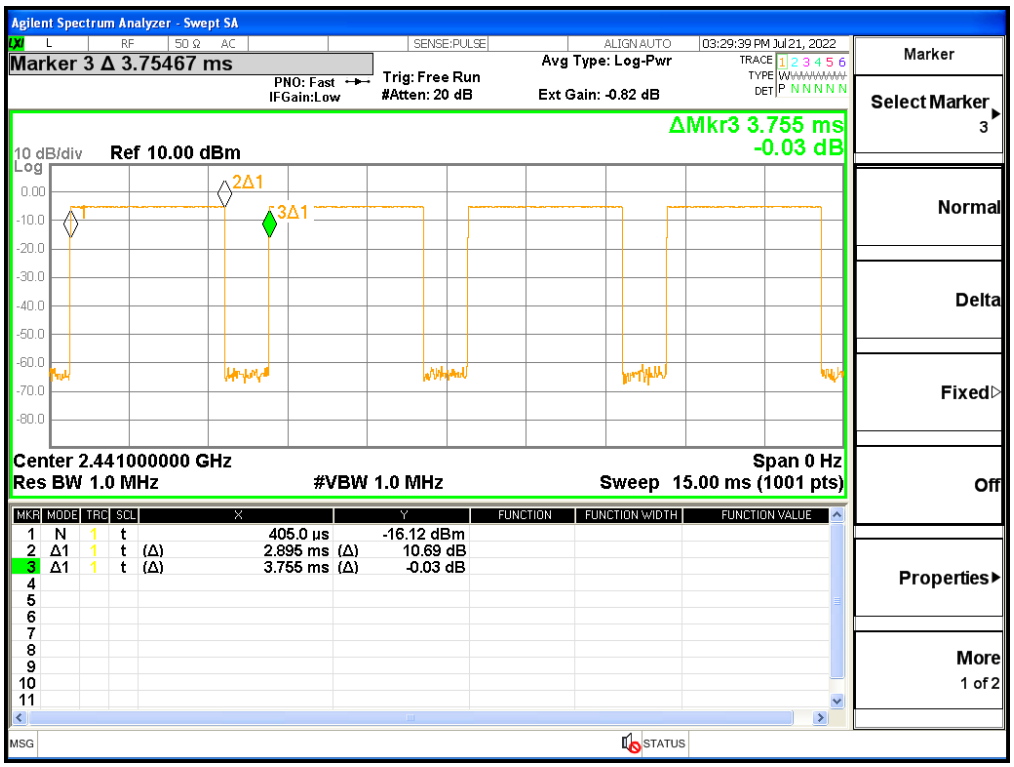
Time of Occupancy for Packet Type 1-DH3(GFSK)





Time of Occupancy for Packet Type 1-DH5(GFSK)





4.5 Maximum peak Conducted Output Power

Test Procedures

ANSI C63.10-2013 7.8.5

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test.

The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

a) Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)

b) RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)

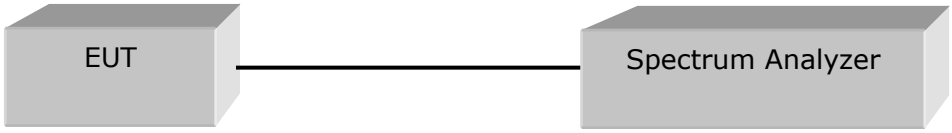
c) VBW = 3 MHz (≥ RBW)

d) Detector = peak

e) Trace = max hold

f) Sweep = auto

Allow trace to stabilize.
Use the marker-to-peak function to set the marker to the peak of the emission.



Limit

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W

Test Results

Test mode : GFSK

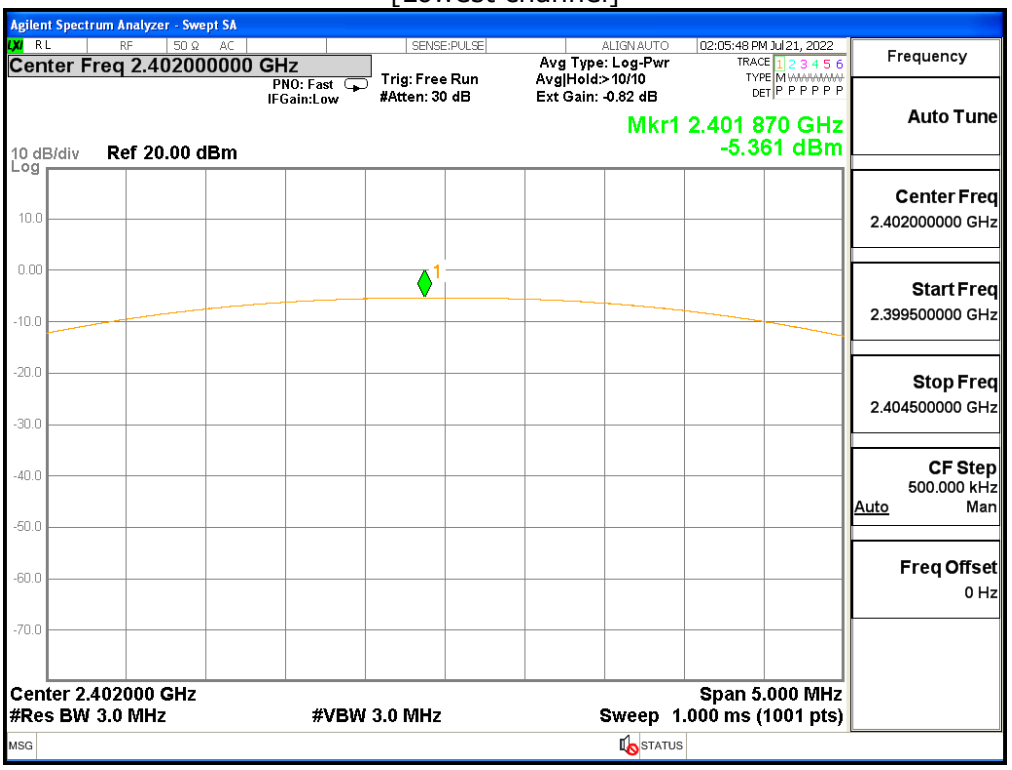
Frequency [MHz]	Conducted Power [dBm]	Conducted power [mW]	e.i.r.p. [dBm]	e.i.r.p. [W]	Result
2 402	-5.361	0.291	-5.491	0.000 3	Complies
2 441	-5.300	0.295	-5.430	0.000 3	Complies
2 480	-5.484	0.283	-5.614	0.000 3	Complies

Remark
1. e.i.r.p.[dBm] = Conducted Power[dBm] + Antenna Gain[dBi]
2. Antenna Gain [dBi] = -0.13

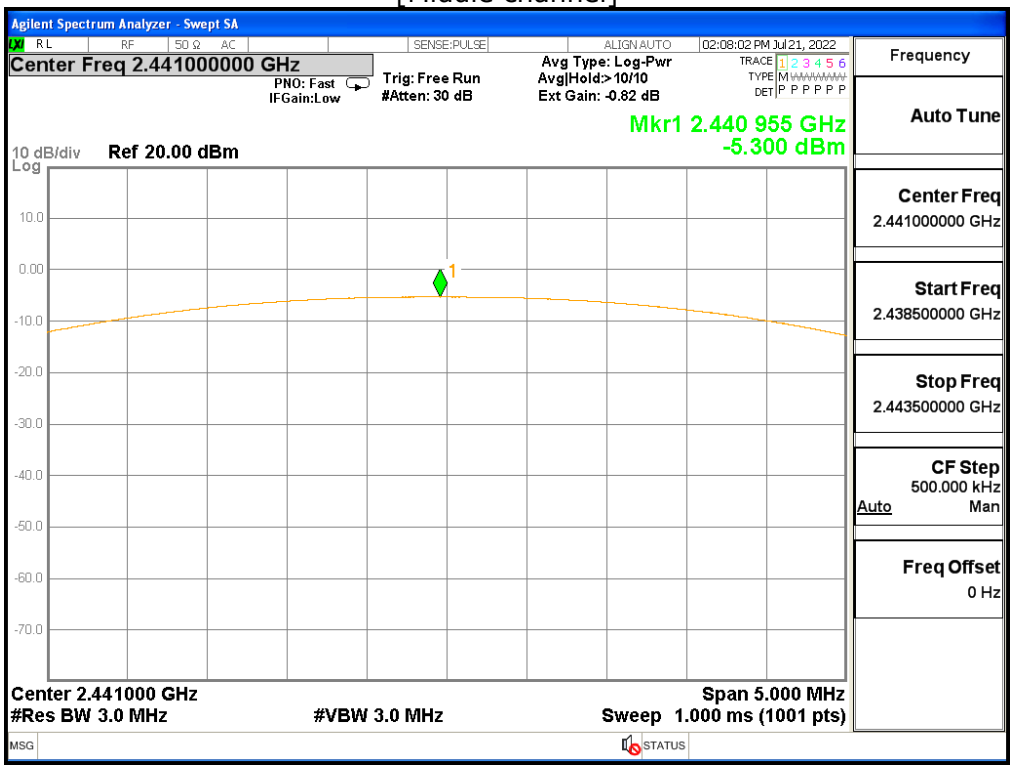
See next pages for actual measured spectrum plots.

Test Mode : GFSK

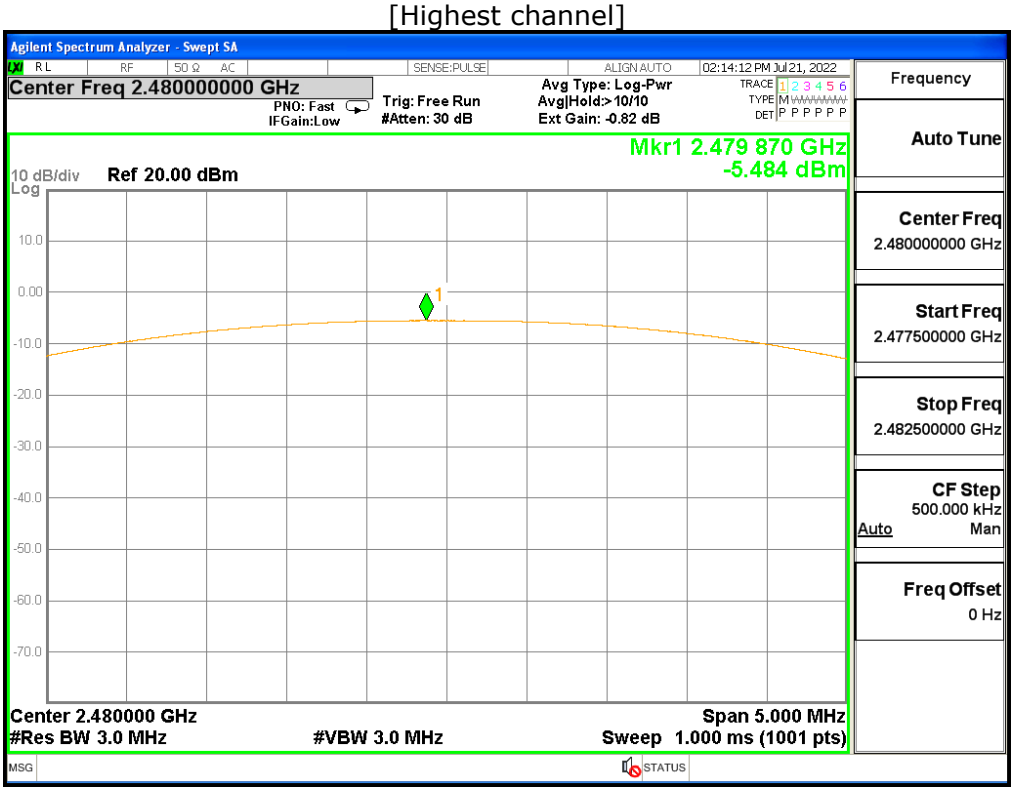
[Lowest channel]



[Middle channel]



[Highest channel]



4.6 Unwanted Emissions (Conducted)

Test Procedures

ANSI C63.10-2013 7.8.6 / ANSI C63.10-2013 7.8.8

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(d), the attenuation required shall be 30 dB instead of 20 dB.

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

a) RBW = 100 kHz

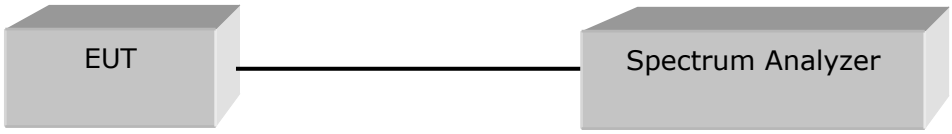
b) VBW = 300 kHz (≥ RBW)

c) Span = 30 MHz to 10 times the operating frequency in GHz

d) Detector = peak

e) Trace = max hold

f) Sweep = auto



Limit

> 20 dBc

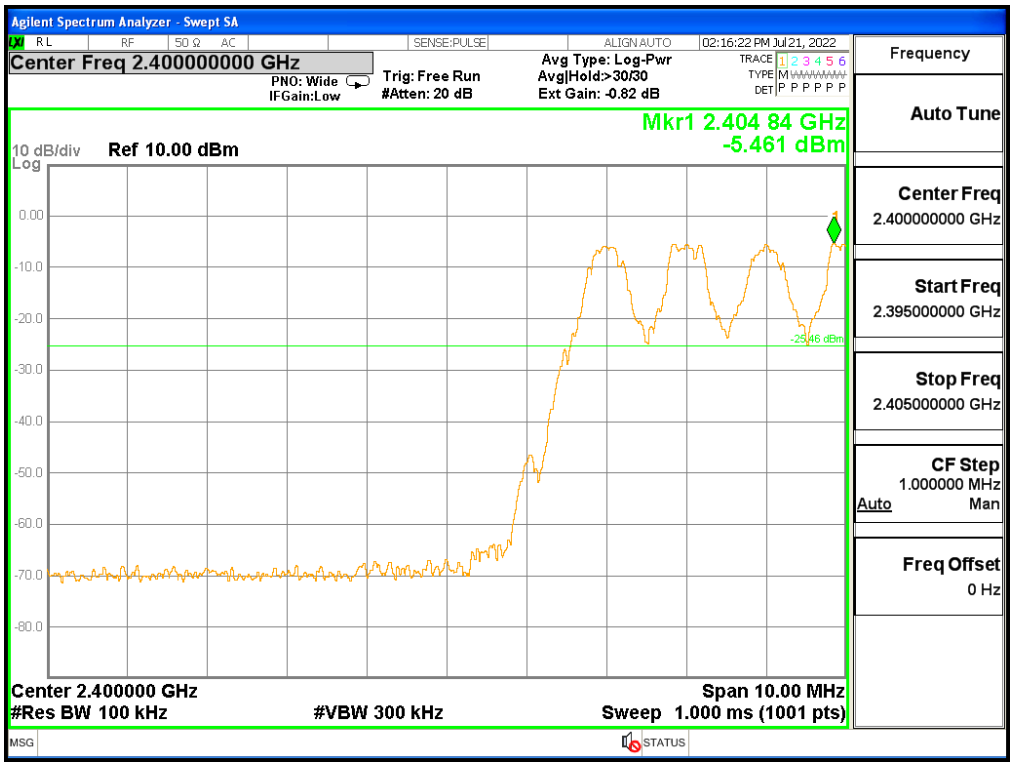
Test Results

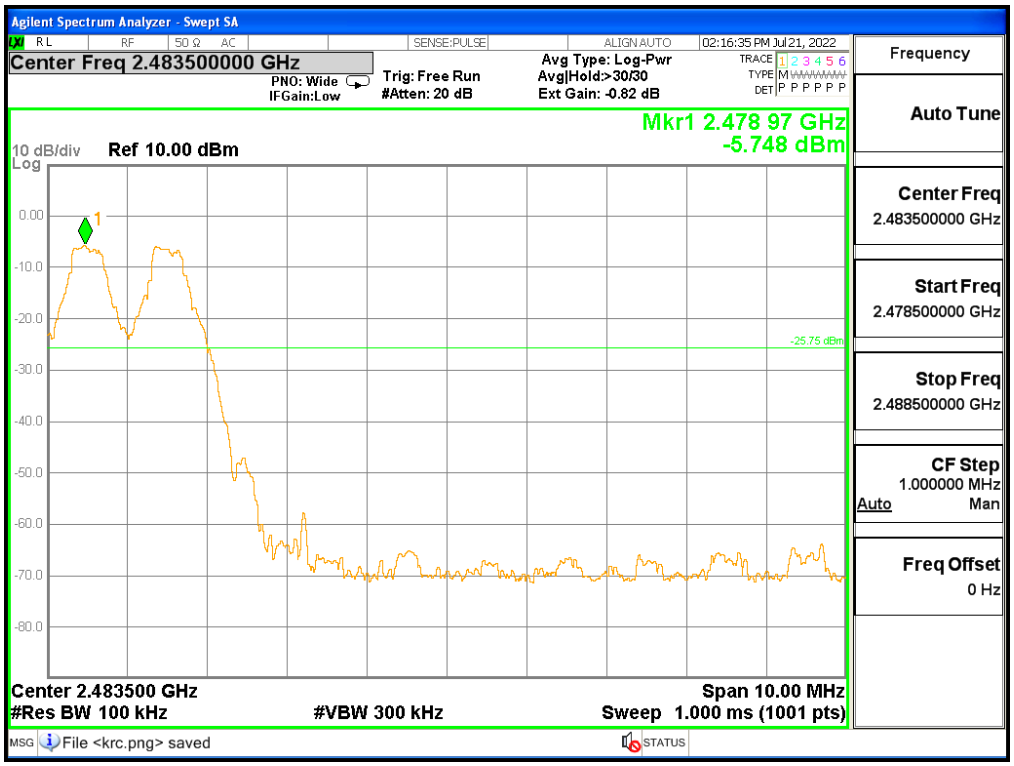
All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the in-band spectral density.
Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.

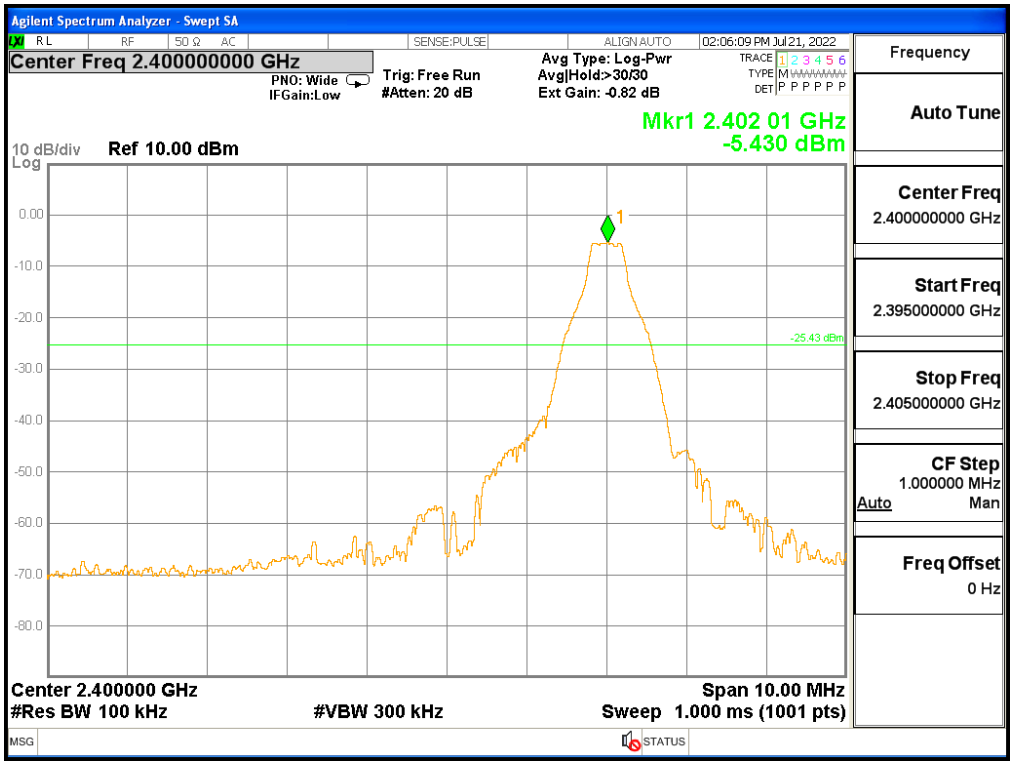
Band Edge

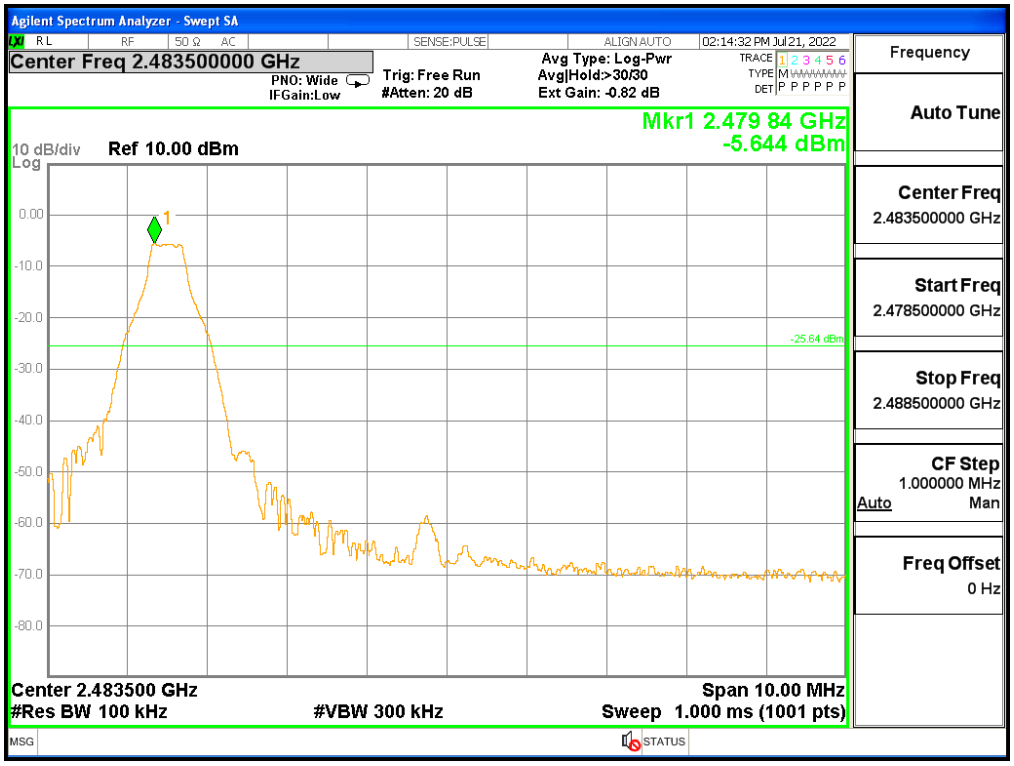
Test Mode : Hopping mode, GFSK





Test Mode : Non-Hopping mode, GFSK

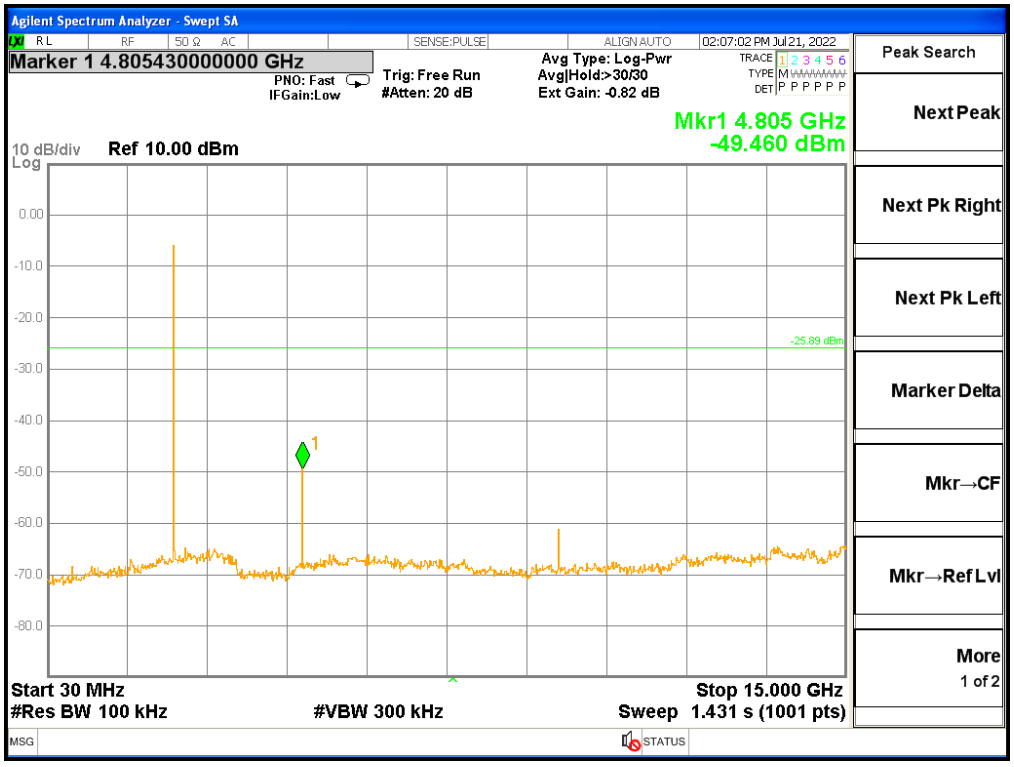


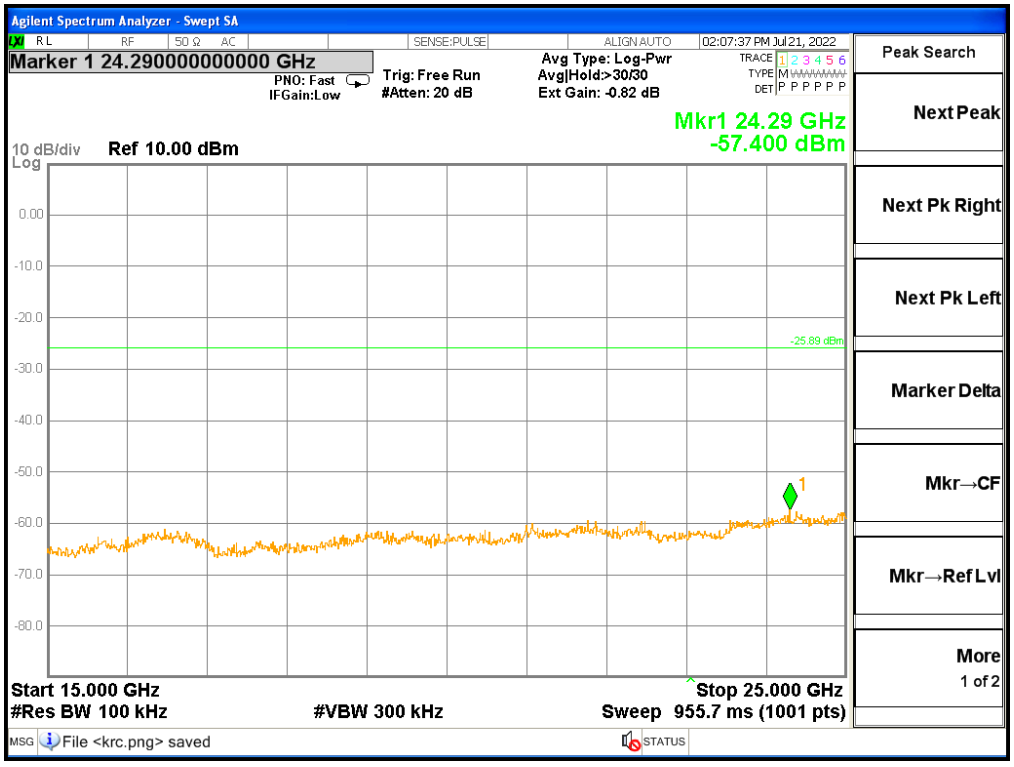


Spurious Emission

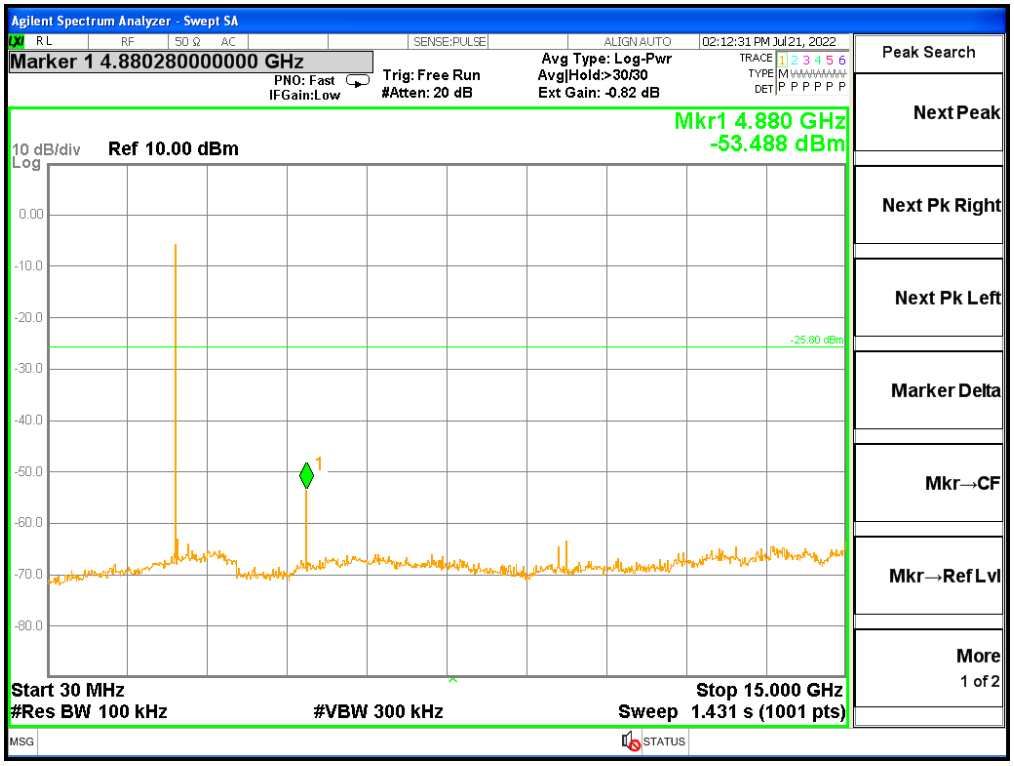
Test Mode : GFSK

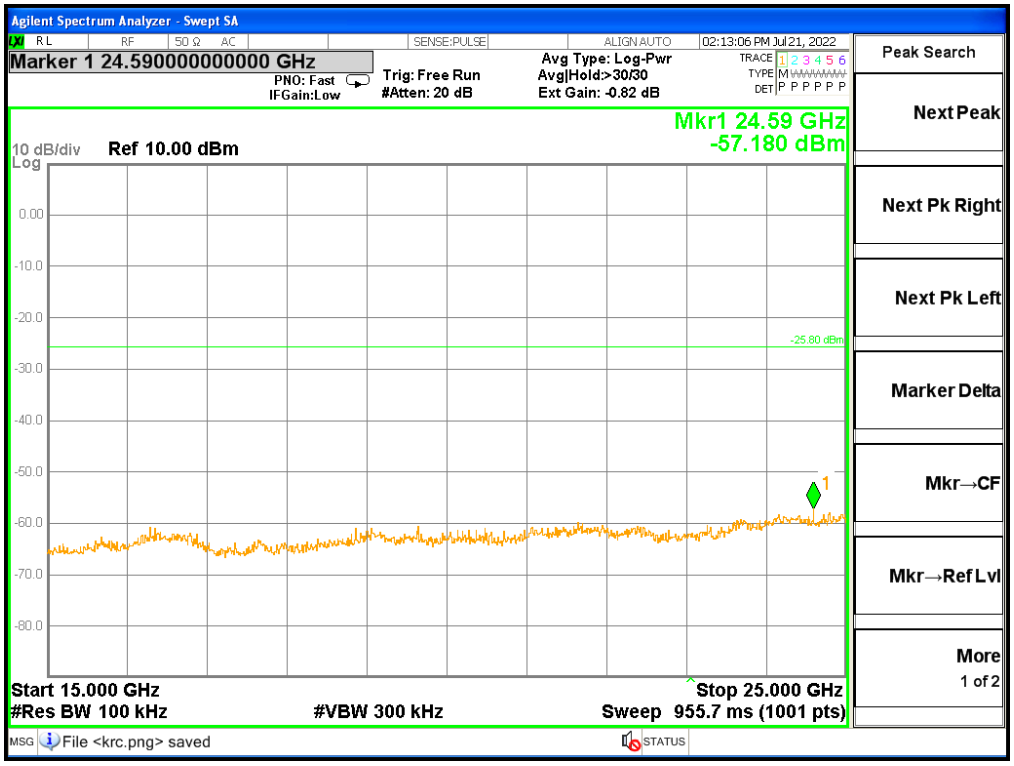
[Lowest Channel]



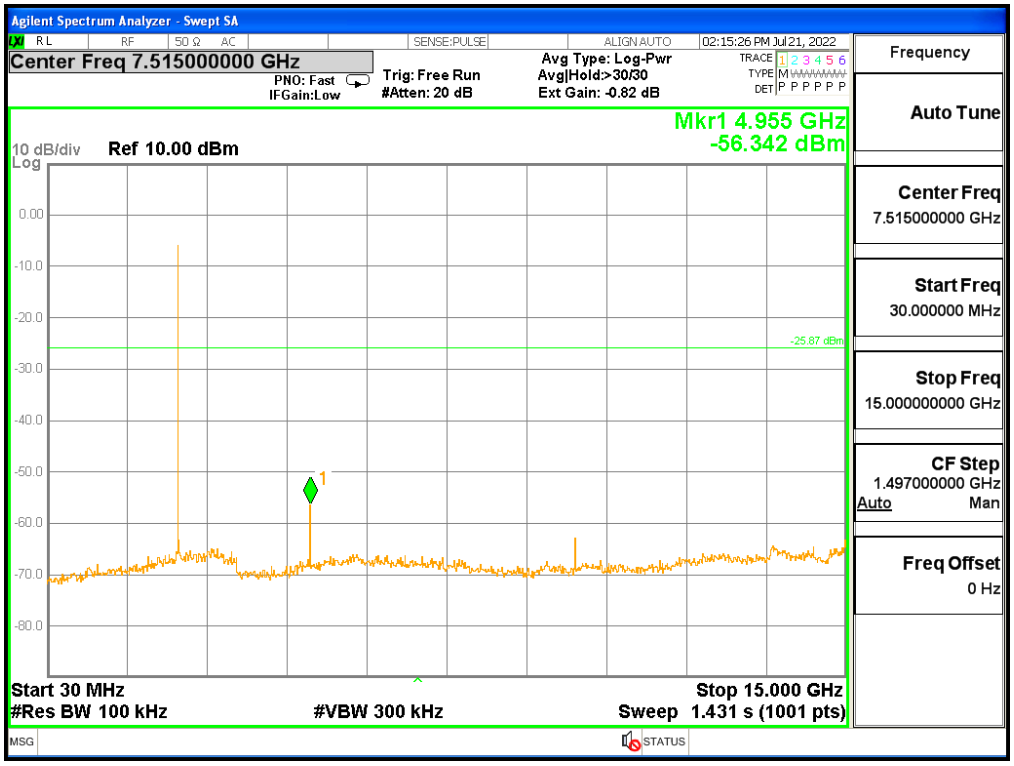


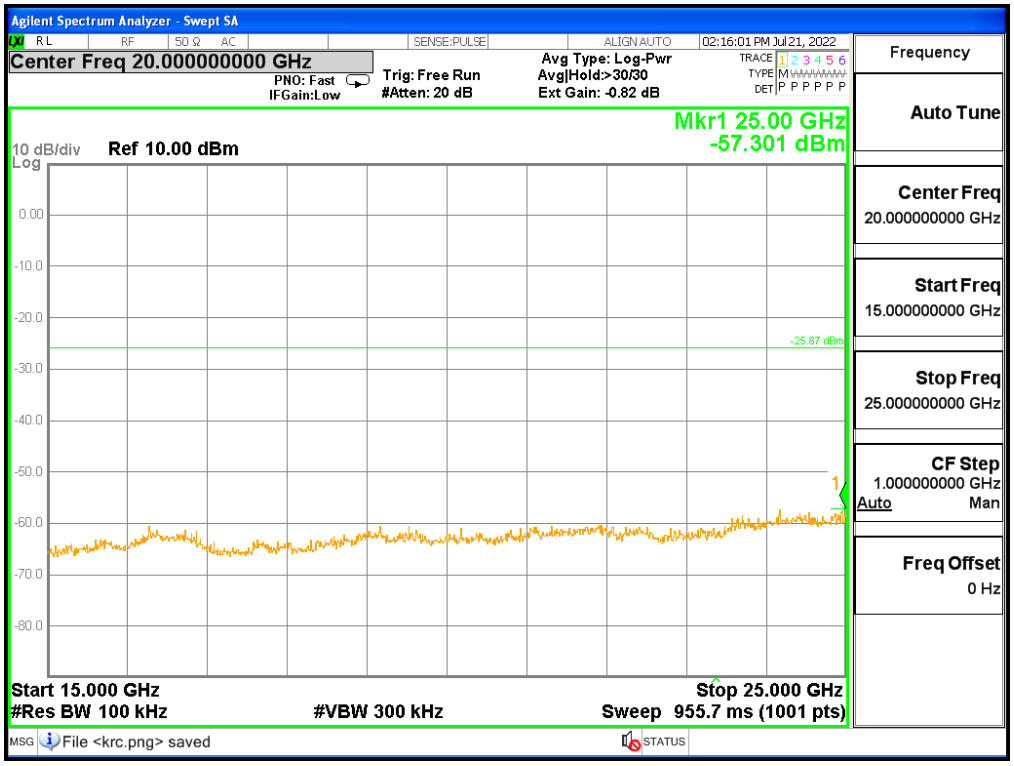
[Middle Channel]





[Highest Channel]





4.7 Radiated Emission

Test Location

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

Test Procedures

ANSI C63.10-2013 - Section 6.5, 6.6

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 ~ 26.5 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
200 Hz for f < 150 kHz

b) VBW ≥ RBW

c) Sweep time = auto couple

Limit :

Unwanted emissions that do not fall within the restricted frequency bands of Table 1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

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 2 :

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 (uV/m)	Field Strength (dBuV/m)	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	48.5 – 13.8	300
0.490-1.705	24000/F(kHz)	33.8 – 23	30
1.705-30	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

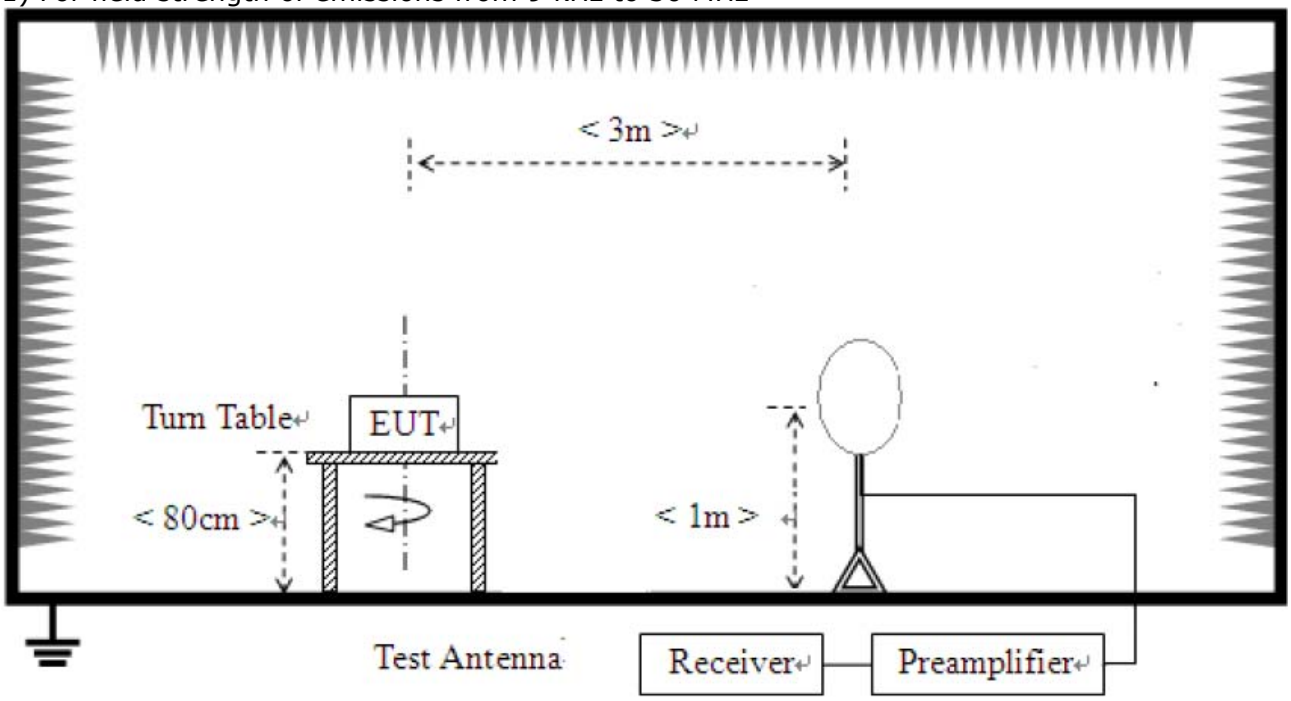
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231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

Note :

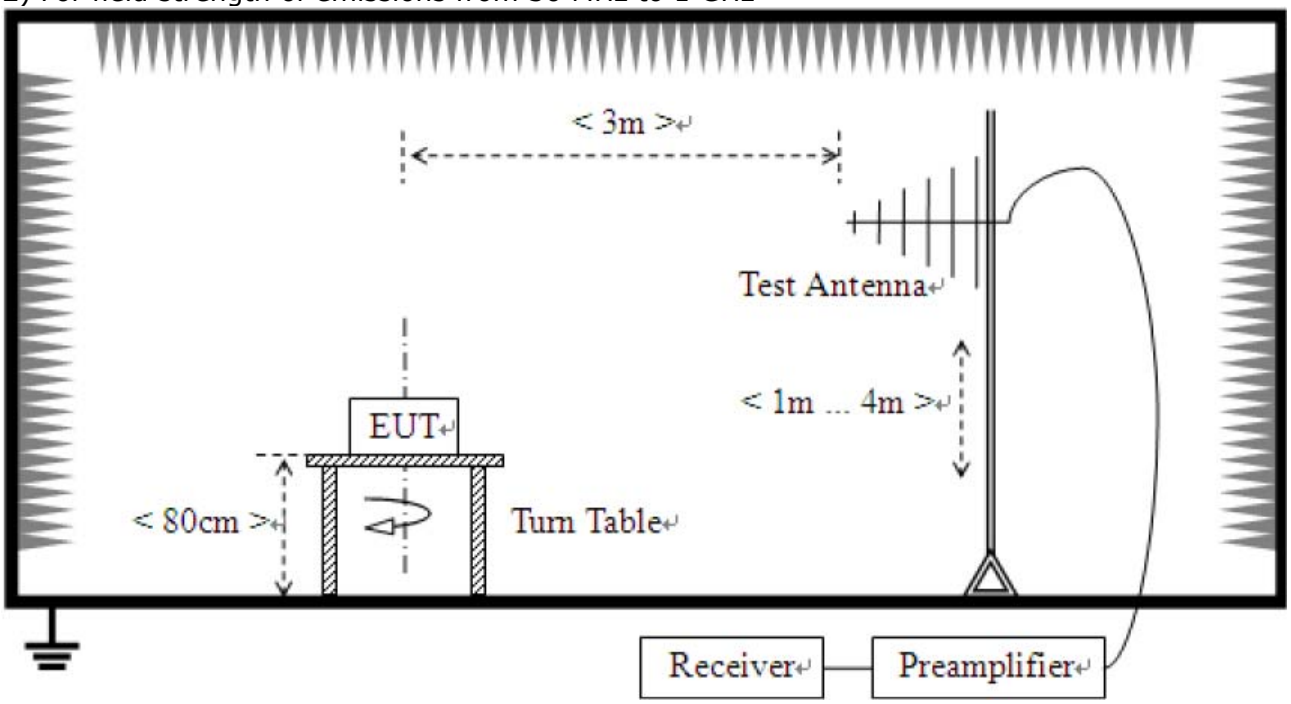
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of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

Test Setup:

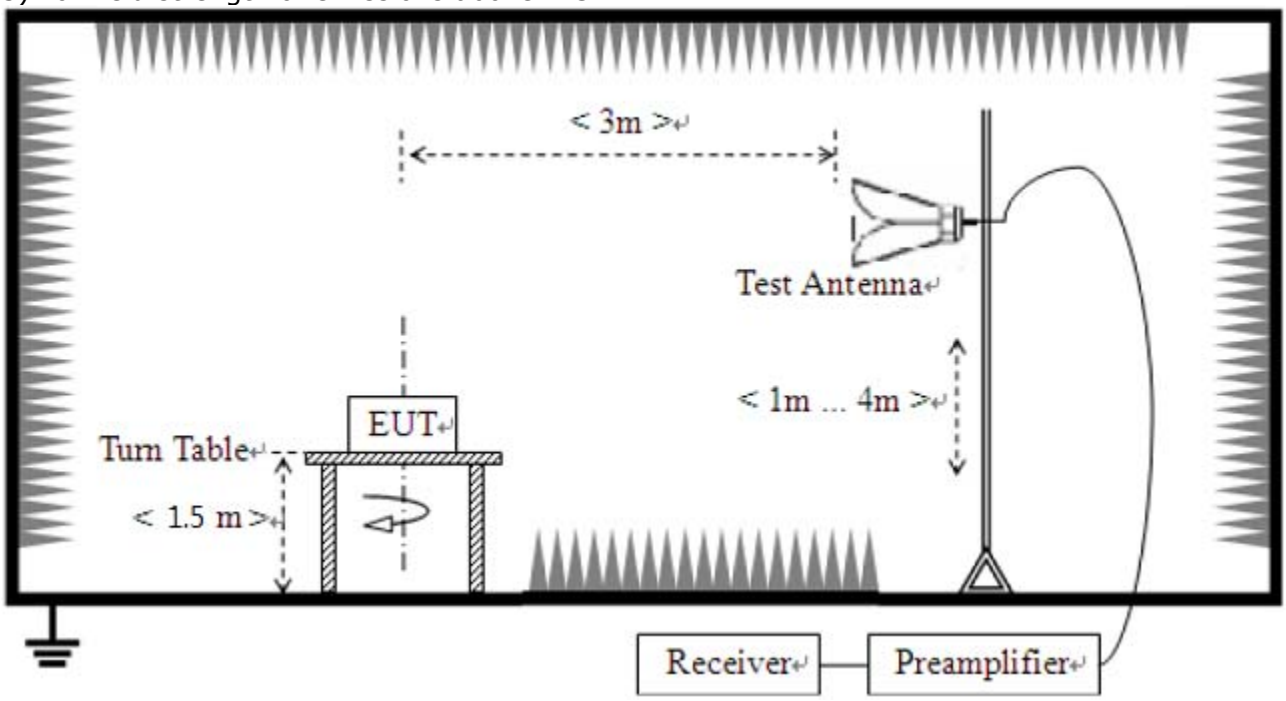
1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



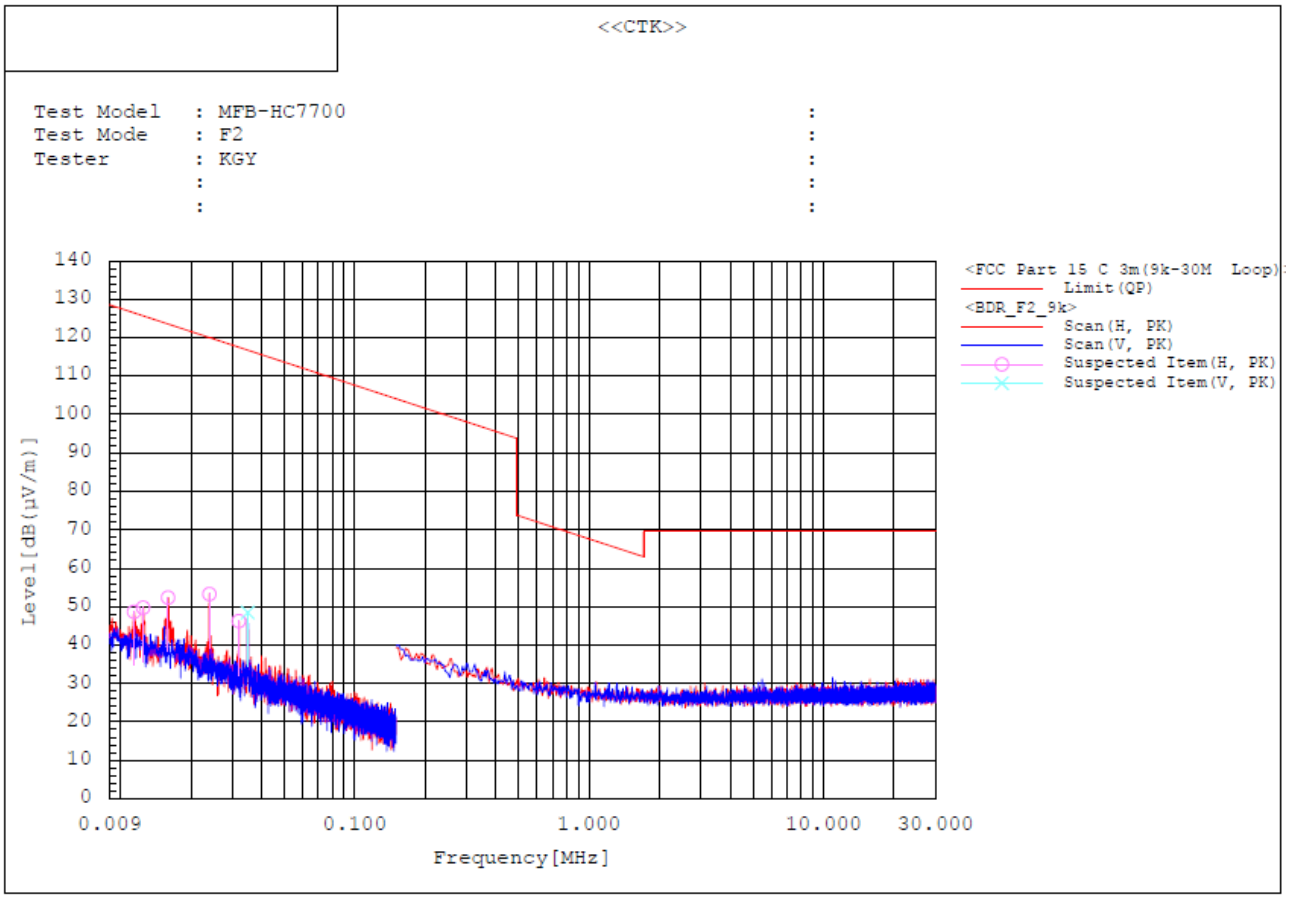
Test results

1) 9 kHz to 30 MHz

Test mode : GFSK Middle channel(Worst case)

The requirements are:
☒ Complies

Test Data



Result : There are more than 20 dB of margin compared to the reference value.

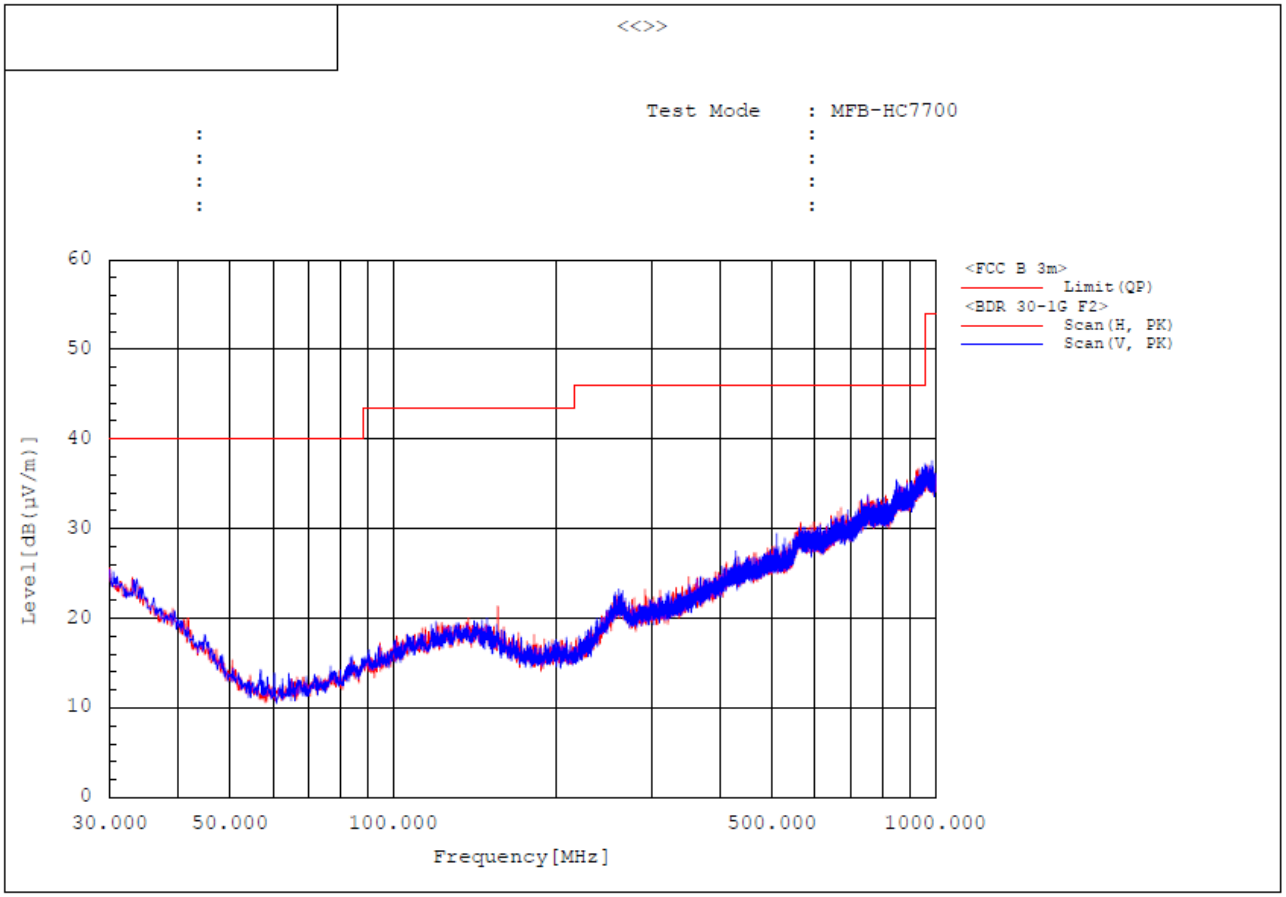
Remark :
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
4. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
5. This data is the Peak(PK) value.

2) 30 MHz to 1 GHz

Test mode : GFSK Middle channel(Worst case)

The requirements are:
☒ Complies

Test Data



Result : There are more than 20 dB of margin compared to the reference value.

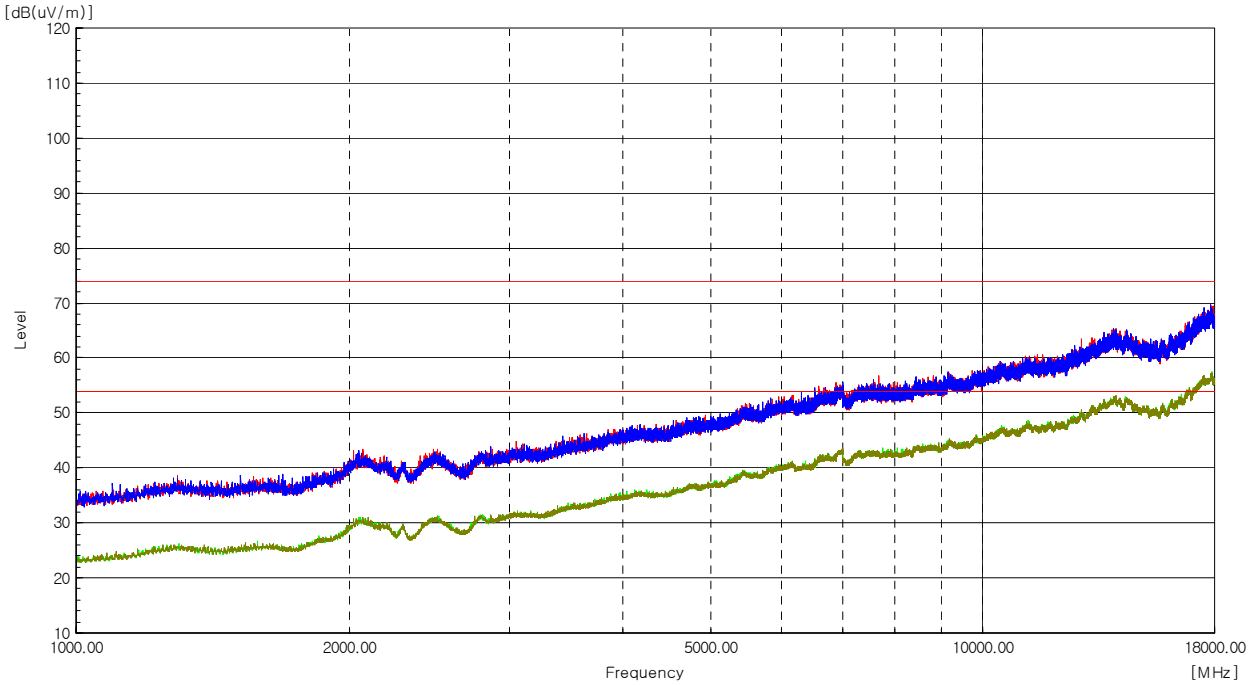
Remark :
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction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

3) 1 GHz to 18 GHz

Test mode : GFSK Middle channel(Worst case)

The requirements are:
☒ Complies

Test Data



Result : No peak found

Remarks

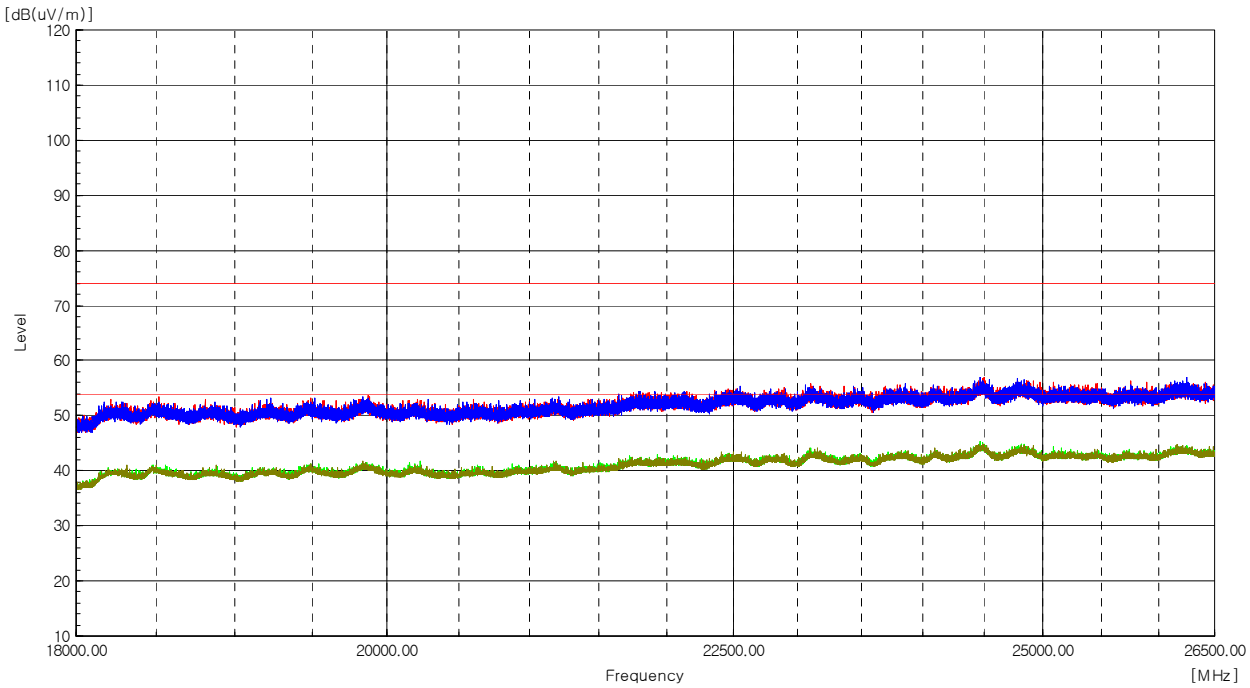
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain
4. Band reject filter was used from 1 GHz to 18 GHz
5. The 18 GHz end had no signal detected. As can be seen from the conducted spurious emission test, no signal was detected in the section.

4) 18 GHz to 26.5 GHz

Test mode : GFSK Middle channel(Worst case)

The requirements are:
☒ Complies

Test Data



Result : No peak found

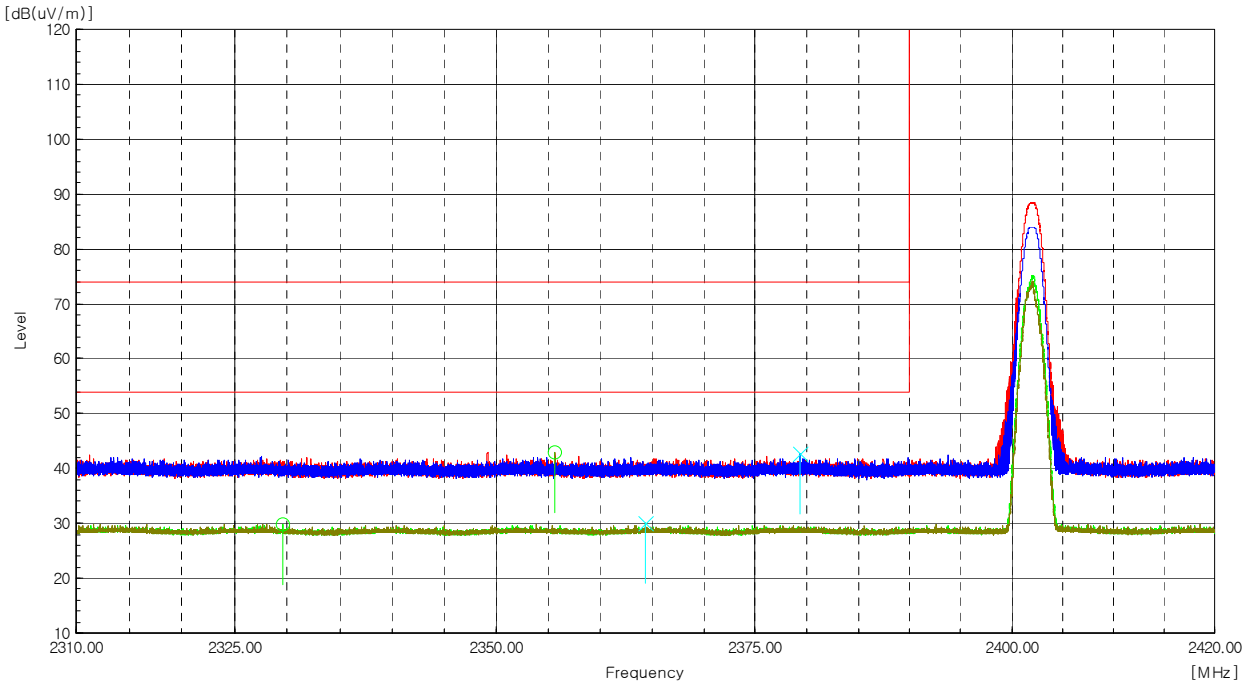
Remarks
1. Measuring position : The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction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

5) Restricted Frequency Bands

Test mode : GFSK Lowest channel
(Test frequency range : 2 310 MHz – 2 390 MHz)

The requirements are:
☒ Complies

Test Data



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]
2355.678	H	49.0	-----	-6.0	43.0	-----	74.0	-----	31.0	-----
2329.594	H	-----	35.7	-6.0	-----	29.7	-----	54.0	-----	24.3
2379.373	V	48.6	-----	-5.9	42.7	-----	74.0	-----	31.3	-----
2364.404	V	-----	36.0	-6.0	-----	30.0	-----	54.0	-----	24.0

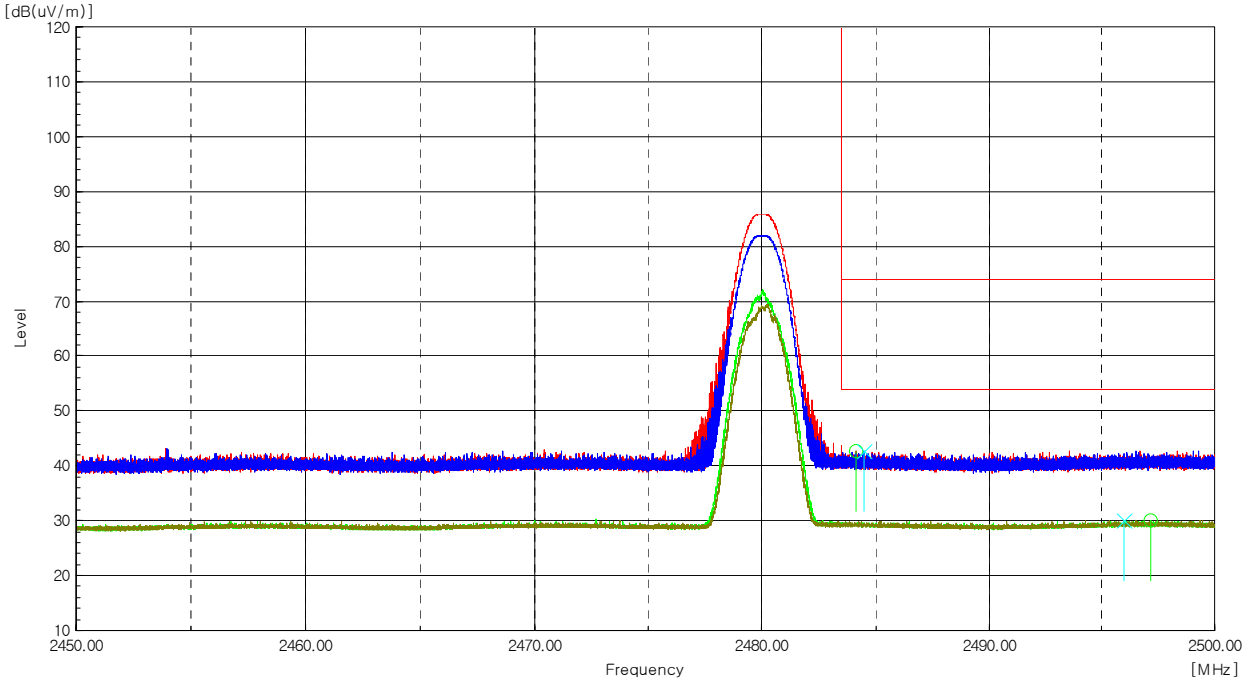
Remarks

1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

Test mode : GFSK Highest channel
(Test frequency range : 2 483.5 MHz – 2 500 MHz)

The requirements are:
☒ Complies

Test Data



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]
2484.155	H	48.1	-----	-5.3	42.8	-----	74.0	-----	31.2	-----
2497.144	H	-----	35.2	-5.2	-----	30.0	-----	54.0	-----	24.0
2484.491	V	48.1	-----	-5.3	42.8	-----	74.0	-----	31.2	-----
2495.986	V	-----	35.3	-5.2	-----	30.1	-----	54.0	-----	23.9

Remarks
1. Measuring position : 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(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

4.8 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

ANSI C63.10-2013 - Section 6.2.2

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

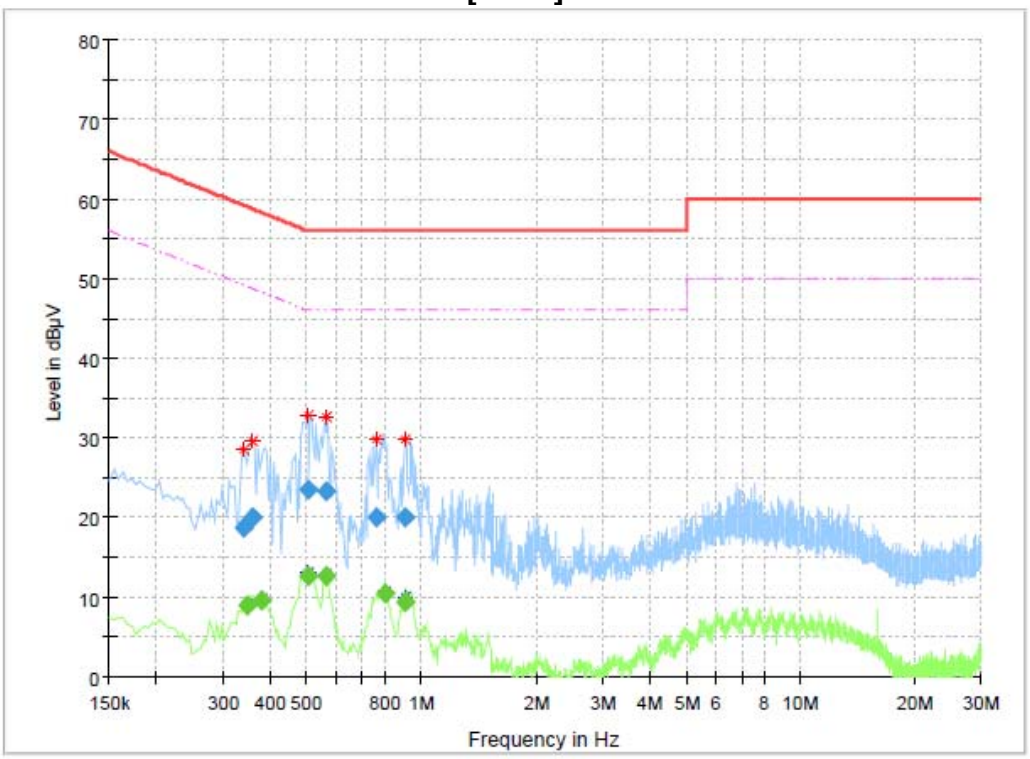
Test Results

The requirements are:
☒ Complies

Test Data

Test mode : GFSK Middle channel(Worst case)

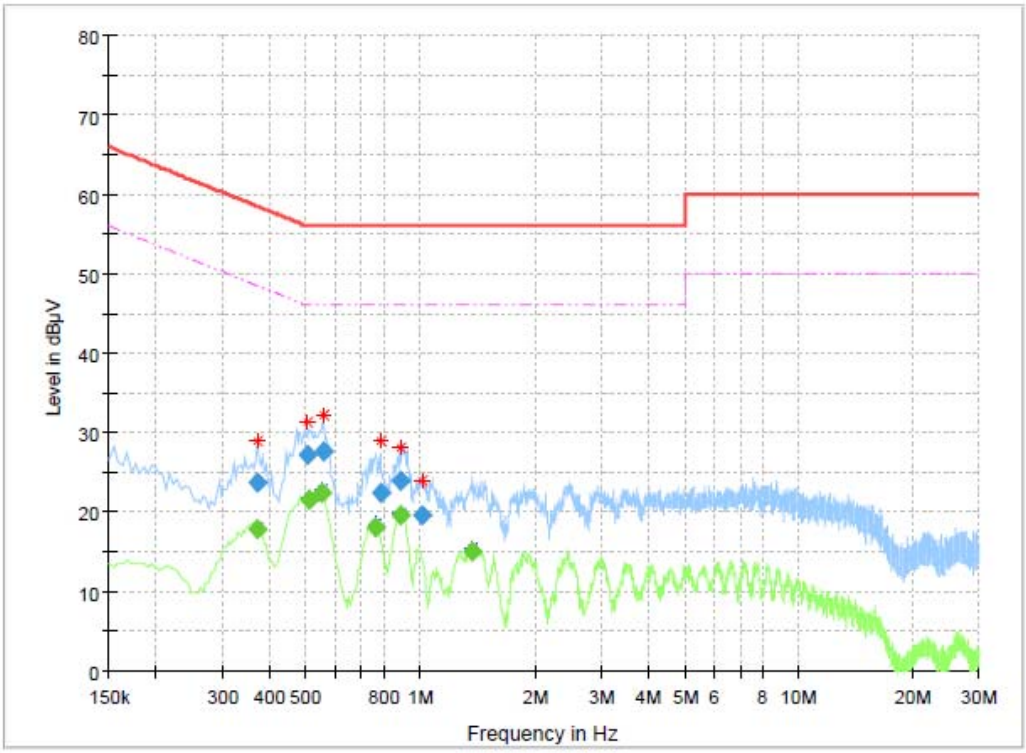
[LINE]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.339000	18.63	---	59.23	40.60	1000.0	9.000	L1	ON	9.9
0.348000	---	8.85	49.01	40.16	1000.0	9.000	L1	ON	9.9
0.357000	20.01	---	58.80	38.79	1000.0	9.000	L1	ON	10.0
0.379500	---	9.57	48.29	38.72	1000.0	9.000	L1	ON	10.0
0.501000	---	12.63	46.00	33.37	1000.0	9.000	L1	ON	10.0
0.501000	23.51	---	56.00	32.49	1000.0	9.000	L1	ON	10.0
0.559500	23.16	---	56.00	32.84	1000.0	9.000	L1	ON	10.0
0.559500	---	12.62	46.00	33.38	1000.0	9.000	L1	ON	10.0
0.762000	20.02	---	56.00	35.98	1000.0	9.000	L1	ON	10.0
0.802500	---	10.46	46.00	35.54	1000.0	9.000	L1	ON	10.0
0.910500	---	9.41	46.00	36.59	1000.0	9.000	L1	ON	9.9
0.910500	19.89	---	56.00	36.11	1000.0	9.000	L1	ON	9.9

[NEUTRAL]



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.370500	---	17.92	48.49	30.57	1000.0	9.000	N	ON	10.2
0.370500	23.61	---	58.49	34.88	1000.0	9.000	N	ON	10.2
0.505500	27.28	---	56.00	28.72	1000.0	9.000	N	ON	10.2
0.510000	---	21.44	46.00	24.56	1000.0	9.000	N	ON	10.2
0.550500	---	22.48	46.00	23.52	1000.0	9.000	N	ON	10.2
0.555000	27.68	---	56.00	28.32	1000.0	9.000	N	ON	10.2
0.757500	---	18.14	46.00	27.86	1000.0	9.000	N	ON	10.2
0.784500	22.44	---	56.00	33.56	1000.0	9.000	N	ON	10.2
0.883500	23.83	---	56.00	32.17	1000.0	9.000	N	ON	10.2
0.883500	---	19.49	46.00	26.51	1000.0	9.000	N	ON	10.2
1.014000	19.66	---	56.00	36.34	1000.0	9.000	N	ON	10.1
1.365000	---	15.03	46.00	30.97	1000.0	9.000	N	ON	10.1

5. APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY49101016	2021-10-08	2022-10-08
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2022-03-25	2023-03-25
3	EMI TEST RECEIVER	Rohde & Schwarz	ESCI7	100816	2021-10-20	2022-10-20
4	Bilog Antenna	TESEQ	CBL6111D	60654	2021-09-03	2023-09-03
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2022-04-15	2024-04-15
6	Attenuator	PASTERNACK	PE7AP006-06	L20210504000 023	2021-08-25	2022-08-25
7	AMPLIFIER	SONOMA	310N	411011	2021-08-25	2022-08-25
8	Spectrum Analyzer	Rohde & Schwarz	FSV40	101574	2022-01-12	2023-01-12
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	2021-11-16	2022-11-16
12	Band Reject Filter	Micro Tronics	BRM50702	G444	2021-10-08	2022-10-08
13	Low Noise Amplifier	TESTEK	TK-PA1840H	210124-L	2021-11-15	2022-11-15
14	LISN	Rohde & Schwarz	ENV216	102698	2022-05-13	2023-05-13
15	EMI Test Receiver	Rohde & Schwarz	ESR3	102826	2022-05-04	2023-05-04

	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (AC Power Line Emissions)	Canare Corporation	L-5D2W	N/A	2022-04-12
2	RF Cable (Conducted)	Junkosha Inc.	MWX221	2008S240	2022-07-21
3	RF Cable (9kHz-1GHz Radiated)	Canare Corporation	L-5D2W	N/A	2022-04-12
4	RF Cable (9kHz-1GHz Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2022-04-12
5	RF Cable (1GHz-18GHz Radiated)	Junkosha Inc.	MWX221	2008S246	2022-04-14
6	RF Cable (1GHz-18GHz Radiated)	Rosenberger	NONE	1520.9927.00	2022-04-14
7	RF Cable (1GHz-18GHz Radiated)	Sensorview Co., LTD	9S18	TPC2204060007	2022-04-14
8	RF Cable (18GHz-26.5GHz Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY2372/2	2022-04-14
9	RF Cable (18GHz-26.5GHz Radiated)	HUBER+SUHNER	SUCOFLEX 102	MY073/2	2022-04-14
10	RF Cable (18GHz-26.5GHz Radiated)	Sensorview Co., LTD	9S40	TP210713-001	2022-04-14

-END-