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TEST REPORT

of

FCC Part 15 Subpart C §15.247
IC RSS-247 Issue 3 and RSS-Gen Issue 5

FCC ID: 2AP7NFANLIGHT5
IC ID: 24019-FANLIGHT5

Equipment Under Test	:	BIBI OFFICIAL LIGHT STICK
Model Name	:	BIBI OFFICIAL LIGHT STICK
Variant Model Name(s)	:	-
FCC Applicant	:	FANLIGHT Co.,Ltd.
IC Applicant	:	FANLIGHT Co.,Ltd.
Manufacturer	:	FANLIGHT Co.,Ltd.
Date of Receipt	:	2025.01.20
Date of Test(s)	:	2025.01.31 ~ 2025.03.07
Date of Issue	:	2025.03.13

In the configuration tested, the EUT complied with the standards specified above.
This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
3) This test report cannot be reproduced, except in full, without prior written permission of the Company.
4) The data marked ※ in this report was provided by the customer and may affect the validity of the test results.
We are responsible for all the information of this test report except for the data(※) provided by the customer

Tested by: Dave Kim

Technical Manager: Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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1.2. Details of Applicant

Applicant : FANLIGHT Co.,Ltd
Address : 4F, 22, Nonhyeon-ro 128-gil, Gangnam-gu, Seoul, South Korea, 06105
Contact Person : Lee, Gil-won
Phone No. : +82 10 4786 7000

1.3. Details of Manufacturer

Company : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product	BIBI OFFICIAL LIGHT STICK
Model Name	BIBI OFFICIAL LIGHT STICK
Serial Number	Conducted: C-001 Radiated: R-001
Power Supply	DC 4.50 V
Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth Low Energy)
Modulation Technique	GFSK
Number of Channels	40 channels (Bluetooth Low Energy)
Antenna Type	PCB pattern Antenna
Antenna Gain※	2.90 ㏈i
H/W Version	1.0
S/W Version	1.0
FVIN	1.0

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMA100B	106887	Oct. 11, 2024	Annual	Oct. 11, 2025
Spectrum Analyzer	R&S	FSV30	103211	Feb. 18, 2025	Annual	Feb. 18, 2026
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 10, 2024	Annual	Sep. 10, 2025
Attenuator	MCLI	FAS-23-20	23835	Feb. 24, 2025	Annual	Feb. 24, 2026
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-10SS	21	Jun. 07, 2024	Annual	Jun. 07, 2025
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	Jun. 07, 2024	Annual	Jun. 07, 2025
Low Pass Filter	Mini-Circuits	NLP-1200+	V8979400903-2	Feb. 04, 2025	Annual	Feb. 04, 2026
Power Sensor	R&S	NRP-Z81	100669	May 17, 2024	Annual	May 17, 2025
DC Power Supply	Agilent	U8002A	MY49030063	Jan. 23, 2025	Annual	Jan. 23, 2026
Preamplifier	H.P.	8447F	2944A03909	Aug. 09, 2024	Annual	Aug. 09, 2025
Preamplifier	R&S	SCU18	102218	Mar. 08, 2024	Annual	Mar. 08, 2025
Pre Amplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Oct. 14, 2024	Annual	Oct. 14, 2025
Loop Antenna	Schwarzbeck Mess-Elektronik	HFRAE 5161	5161-028	Nov. 06, 2024	Biennial	Nov. 06, 2026
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	9163-396	Apr. 02, 2024	Biennial	Apr. 02, 2026
Horn Antenna	R&S	HF907	102271	Mar. 08, 2024	Annual	Mar. 08, 2025
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	Dec. 11, 2024	Annual	Dec. 11, 2025
EMI Test Receiver	R&S	ESU26	100109	Jan. 13, 2025	Annual	Jan. 13, 2026
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SENSORVIEW	NMST-13A26-NMST-5 m	TPC2402190004	Oct. 04, 2024	Semi-Annual	Apr. 04, 2025
Coaxial Cable	SENSORVIEW	NMST-13A26-NMST-10 m	TPC2402190001	Oct. 04, 2024	Semi-Annual	Apr. 04, 2025
Coaxial Cable	RFONE	PL360P-292M292M-1.5M-A	20200324002	Oct. 11, 2024	Semi-Annual	Apr. 11, 2025

Note;

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date

1.6. Declaration by the Manufacturer

The EUT supports BLE version 5.0.
The EUT operates only PHY 1M with 37 bytes.

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C, RSS-247 Issue 3 and RSS-Gen Issue 5			
Section in FCC	**Section in IC**	**Test Item(s)**	**Result**
15.205(a) 15.209 15.247(d)	RSS-247 Issue 3 5.5 RSS-Gen Issue 5 8.9	Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	Pass
15.247(a)(2)	RSS-247 Issue 3 5.2(a) RSS-Gen Issue 5 6.7	6 dB Bandwidth & 99 % Bandwidth	Pass
15.247(b)(3)	RSS-247 Issue 3 5.4(d)	Maximum Peak Conducted Output Power	Pass
15.247(e)	RSS-247 Issue 3 5.2(b)	Power Spectral Density	Pass
15.207	RSS-Gen Issue 5 8.8	AC Power Line Conducted Emission	N/A[1)]

Note;

1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

1.8. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 15.247 Meas Guidance v05r02 were used in the measurement of the DUT.

1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

1.9.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.9.2. Radiation Test

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB/m) + Cable loss (dB) - Amplifier gain (dB) + Duty factor (dB)

1.10. Information of software for test

- Using the software of Non_Signaling_Test_tool(v1.9) for Desktop to testing of EUT.

1.11. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Maximum Peak Conducted Output Power	0.34 ㏈	
Power Spectral Density	0.64 ㏈	
99 % Bandwidth	0.02 ㎒	
6 ㏈ Bandwidth	0.07 ㎒	
Conducted Spurious Emission	0.80 ㏈	
Radiated Emission, 9 ㎑ to 30 ㎒	H	3.40 ㏈
	V	3.40 ㏈
Radiated Emission, below 1 ㎓	H	4.60 ㏈
	V	5.00 ㏈
Radiated Emission, above 1 ㎓	H	3.60 ㏈
	V	3.60 ㏈

All measurement uncertainty values are shown with a coverage factor of *k*=2 to indicate a 95 % level of confidence.

1.12. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501-RF-RTL005841	2025.03.13	Initial

1.13. Duty Cycle of EUT

Regarding to KDB 558074 D01 15.247 Meas Guidance v05r02, 6, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below;
Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

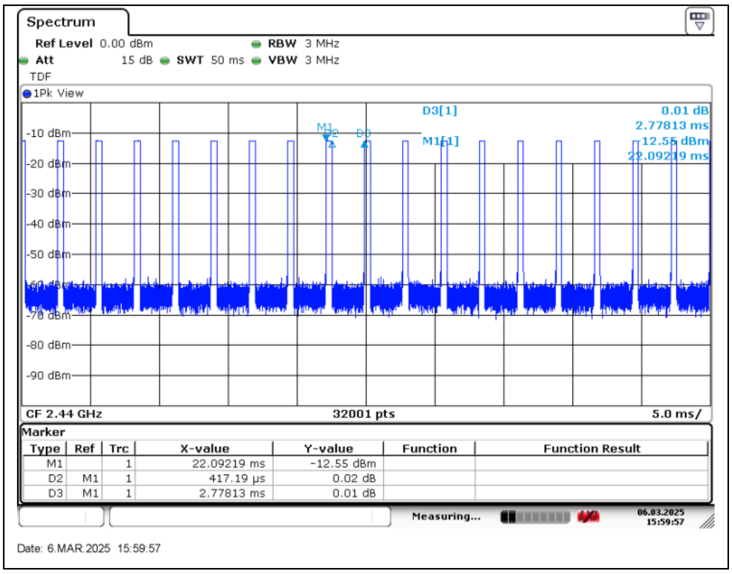
Mode	Duty Cycle (%)	Correction factor (dB)
GFSK	15.01	8.24

Remark;

1. Duty Cycle (%) = (Tx on time / Tx on + off time) x 100
2. Correction Factor (dB) = 10 log (1 / Duty Cycle)

- Test plot

PHY 1M

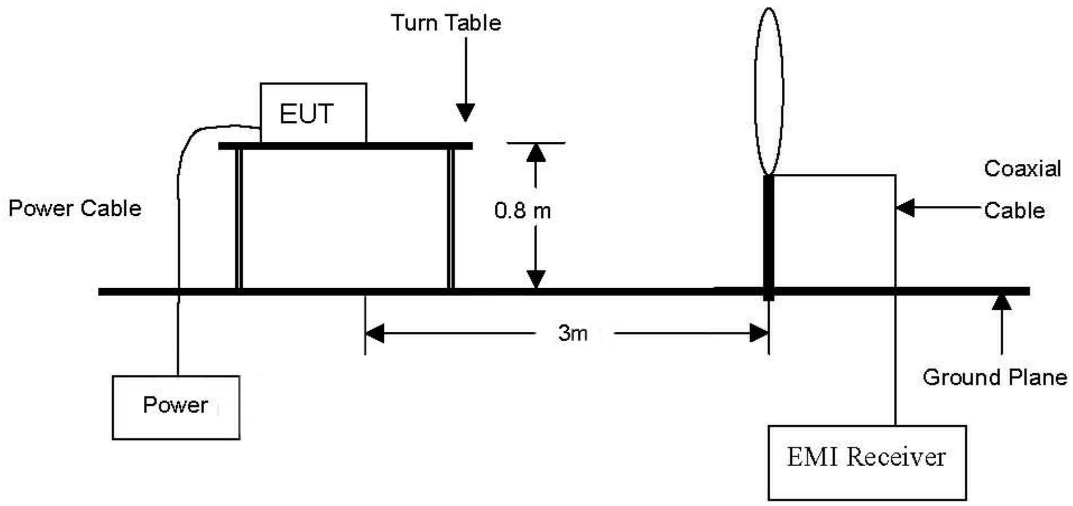


2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emissions

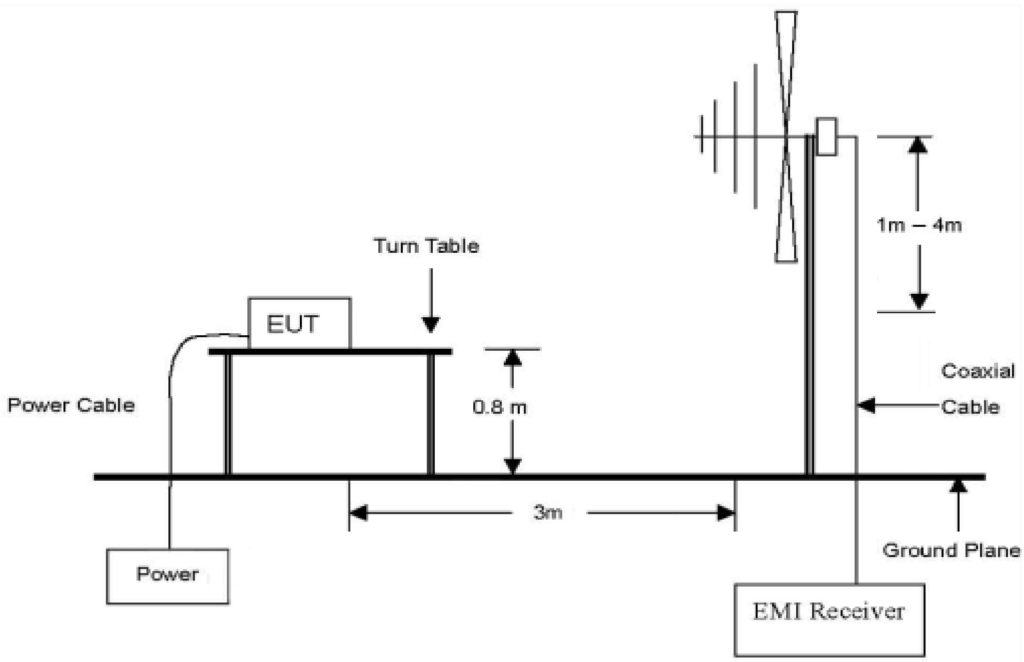
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

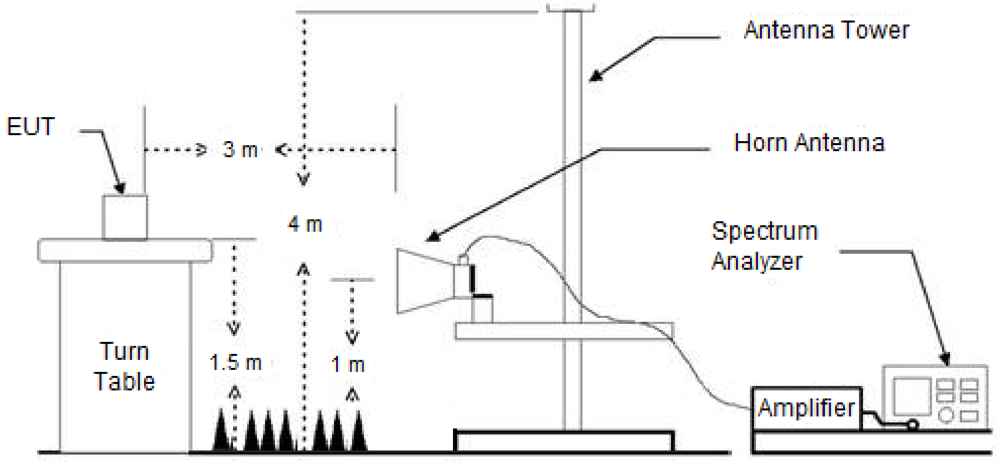
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ emissions.



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



The diagram below shows the test setup that is utilized to make the measurements for emission.
The spurious emissions were investigated from 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.1.2. Conducted Spurious Emissions

2.2. Limit

2.2.1. FCC

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field Strength (㎶/m)	Measurement Distance (Meters)
0.009-0.490	2 400/F(㎑)	300
0.490-1.705	24 000/F(㎑)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

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

2.2.2. IC

According to RSS-247 Issue 3, 5.5, in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided 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 ㏈ instead of 20 ㏈. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen Issue 5, 8.9, except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General Field Strength Limits at frequencies above 30 ㎒

Frequency (㎒)	Field Strength (㎶/m at 3 m)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 6 – General Field Strength Limits at frequencies below 30 ㎒

Frequency	Magnetic Field Strength (H-Field) (㎂/m)	Measurement Distance (meters)
9-490 ㎑ [1]	6.37/F (F in ㎑)	300
490-1 705 ㎑	63.7/F (F in ㎑)	30
1.705-30 ㎒	0.08	30

Note[1]: The emission limits for the ranges 9-90 ㎑ and 110-490 ㎑ are based on measurements employing a linear average detector.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 ㎓ and 1.5 meters above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. For measurements below 1 ㎓ resolution bandwidth is set to 100 ㎑ for peak detection measurements or 120 ㎑ for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.
6. For measurements Above 1 ㎓ resolution bandwidth is set to 1 ㎒, the video bandwidth is set to 3 ㎒ for peak measurements and as applicable for average measurements.

2.3.3. Test Procedures for Conducted Spurious Emissions

1. Unwanted Emissions into Non-Restricted Frequency Bands

- The Reference Level Measurement refer to section 11.11.2
Set analyzer center frequency to DTS channel center frequency, SPAN ≥ 1.5 times the DTS bandwidth, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold.

- Unwanted Emissions Level Measurement refer to section 11.11.3
Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold.

2. Unwanted Emissions into Restricted Frequency Bands

- Peak Power measurement procedure refer to section 11.12.2.4
Set RBW = as specified in Table 9, VBW ≥ 3 x RBW, Detector = Peak, Sweep time = auto, Trace = Max hold.

Table 9 – RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

If the peak – detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

- Average Power measurements procedure refer to section 11.12.2.5.2
The EUT shall be configured to operate at the maximum achievable duty cycle.
Measure the duty cycle D of the transmitter output signal as described in section 11.6.
Set RBW = 1 ㎒, VBW ≥ 3 x RBW, Detector = RMS, if span / (# of points in sweep) ≤ (RBW/2).
Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied then the detector mode shall be set to peak.

Averaging type = power (i.e., RMS).
As an alternative the detector and averaging type may be set for linear voltage averaging.
Some instruments require linear display mode in order to use linear voltage averaging. Log or ㏈ averaging shall not be used. Sweep time = auto, Perform a trace average of at least 100 traces.

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in step f), then the applicable correction factor is [10 log (1 / D)], where D is the duty cycle.
2) If a specific emission is demonstrated to be continuous (D ≥ 98%) rather than turning ON and OFF with the transmit cycle, then no duty cycled correction is required for that emission.

3. Definition of DUT Axis.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z described in the test setup photo. All radiated testing of EUT was performed with worst case axis.

2.3.4. Test Procedures for Conducted Spurious Emissions

Per the guidance of ANSI C63.10-2013, section 11.11.1 & 11.11.2 & 11.11.3, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 ㎑. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 20 ㏈ below the fundamental emission level measured in a 100 ㎑ bandwidth.

1. Conducted Emissions at Band Edge
 - The Measurement refer to section 11.11.3
   Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace mode = Max hold, The trace was allowed to stabilize.

2. Conducted Spurious Emissions
 - The Measurement refer to section 11.11.3
   Start frequency was set to 9 ㎑ and stop frequency was set to 25 ㎓ (separated into two plots per channel), RBW = 1 ㎒, VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold, The trace was allowed to stabilize.

3. TDF function
 - For plots showing conducted spurious emissions from 9 ㎑ to 25 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.
   So, the reading values shown in plots were final result.

2.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emissions below 1 000 ㎒

The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated.

PHY 1M

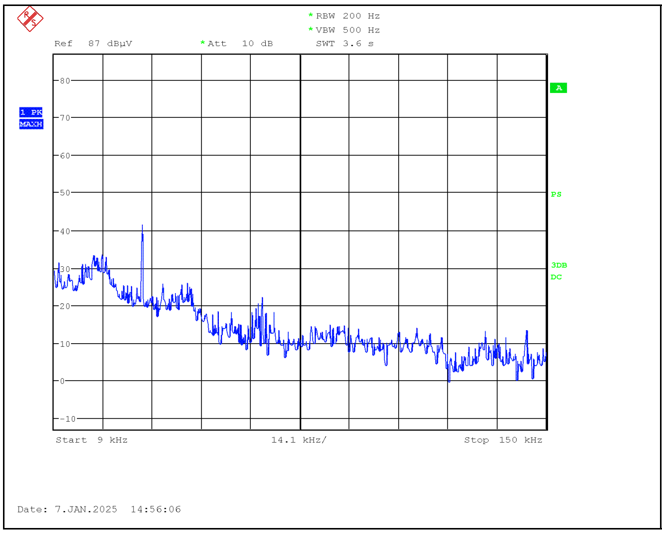
Radiated Emissions			Ant.	Correction (㏈/m)	Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.		Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
Below 30.00	Not detected	-	-	-	-	-	-
Above 30.00	Not detected	-	-	-	-	-	-

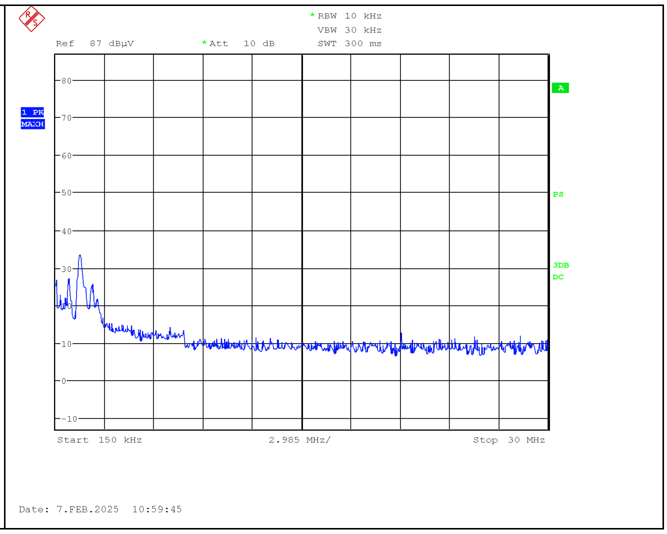
Remark;

1. Spurious emissions for all channels were investigated and almost the same below 1 ㎓.
2. Test from 30 ㎒ to 1 000 ㎒ was performed using the software of ELEKTRA(V5.02) from Rohde & Schwarz GmbH & Co. KG.
3. Reported spurious emissions are in **Low channel** as worst case among other channels.
4. Radiated spurious emission measurement as below.
   (Actual = Reading + AF + AMP + CL)
   (Correction = Antenna Factor + AMP Factor + Cable Loss)
5. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

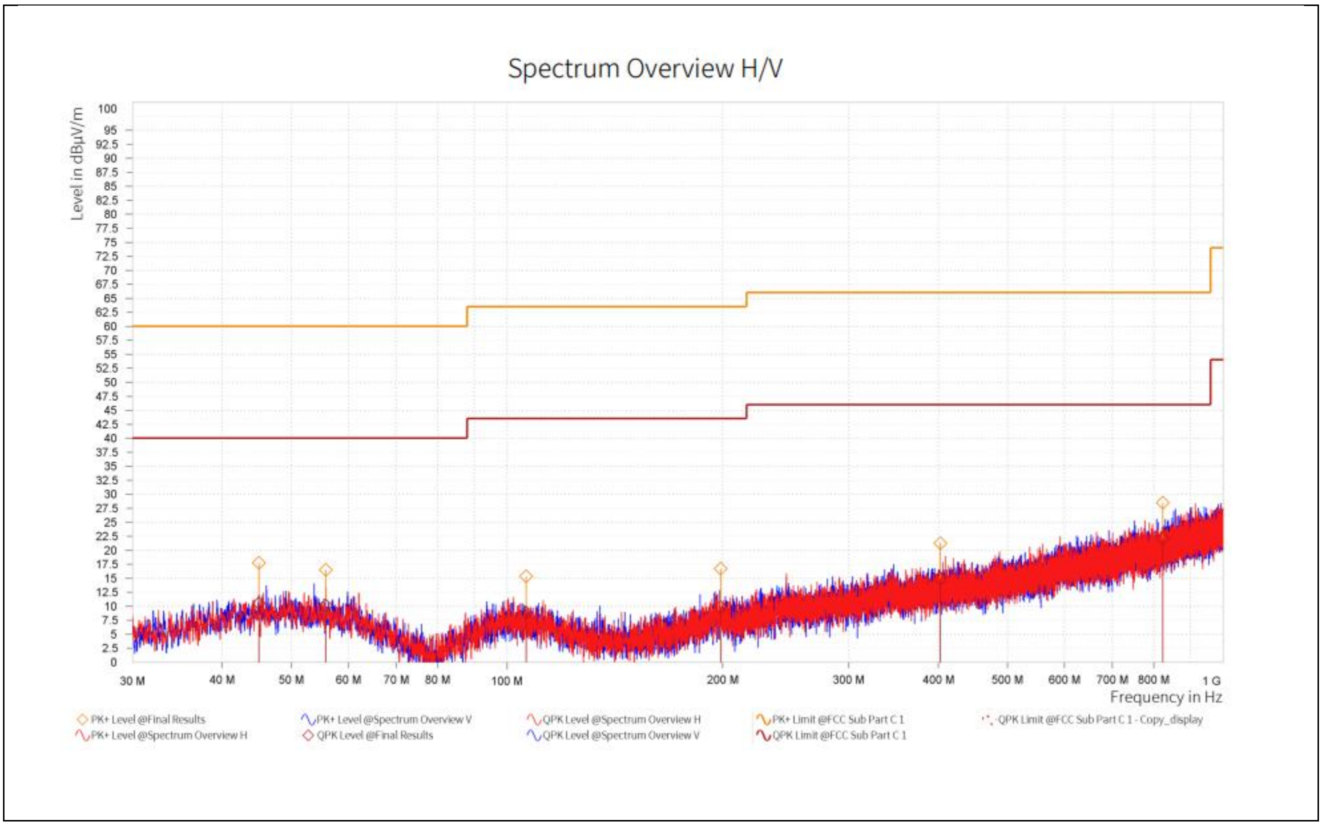
- Test plots

9 ㎑ – 150 ㎑ **150 ㎑ – 30 ㎒**





30 ㎒ – 1 ㎓



2.4.2. Radiated Spurious Emissions above 1 000 ㎒

The frequency spectrum above 1 000 ㎒ was investigated. All reading values are peak and average values.

Test mode: PHY 1M

Low Channel (2 402 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	14.27	Peak	V	28.54	7.02	-	49.83	74.00	24.17
*2 310.00	3.64	Average	V	28.54	7.02	8.24	47.44	54.00	6.56
*2 325.76	16.52	Peak	V	28.60	6.96		52.08	74.00	21.92
*2 383.33	3.79	Average	V	28.70	7.22	8.24	47.95	54.00	6.05
*2 390.00	14.92	Peak	V	28.70	7.31	-	50.93	74.00	23.07
*2 390.00	4.07	Average	V	28.70	7.31	8.24	48.32	54.00	5.68

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 803.57	48.85	Peak	V	34.31	-31.77	-	51.39	74.00	22.61
Above 4 900.00	Not detected	-	-	-	-	-	-	-	-

Middle Channel (2 440 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	**Reading (dB㎶)**	**Detect Mode**	**Pol.**	**AF (dB/m)**	**AMP+CL (dB)**	**DF (dB)**	**Actual (dB㎶/m)**	**Limit (dB㎶/m)**	**Margin (dB)**
*4 879.79	48.07	Peak	V	34.56	-31.80	-	50.83	74.00	23.17
*7 320.85	46.07	Peak	V	35.80	-28.42	-	53.45	74.00	20.55
Above 7 400.00	Not detected	-	-	-	-	-	-	-	-

High Channel (2 480 ㎒)

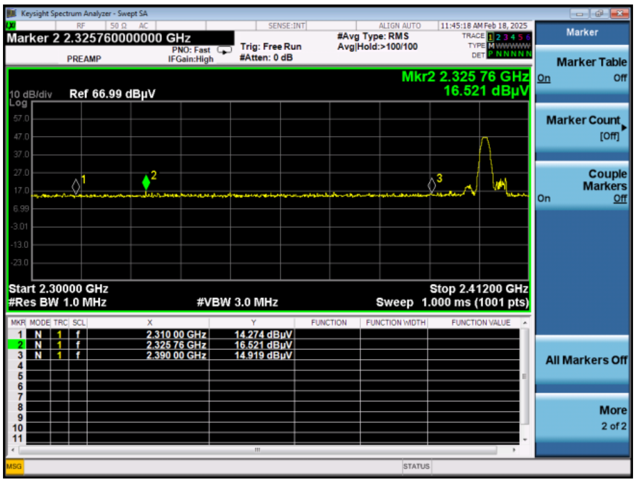
Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	19.23	Peak	V	29.30	7.36	-	55.89	74.00	18.11
*2 483.50	4.10	Average	V	29.30	7.36	8.24	49.00	54.00	5.00
*2 484.37	20.19	Peak	V	29.31	7.36	-	56.86	74.00	17.14
*2 484.34	3.85	Average	V	29.31	7.36	8.24	48.76	54.00	5.24
*2 500.00	15.28	Peak	V	29.40	7.24	-	51.92	74.00	22.08
*2 500.00	3.89	Average	V	29.40	7.24	8.24	48.77	54.00	5.23

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 959.74	47.32	Peak	V	34.58	-31.74	-	50.16	74.00	23.84
*7 439.07	46.14	Peak	V	35.98	-27.96	-	54.16	74.00	19.84
*7 439.47	34.74	Average	V	35.98	-27.95	8.24	**51.01**	54.00	2.99
Above 7 500.00	Not detected	-	-	-	-	-	-	-	-

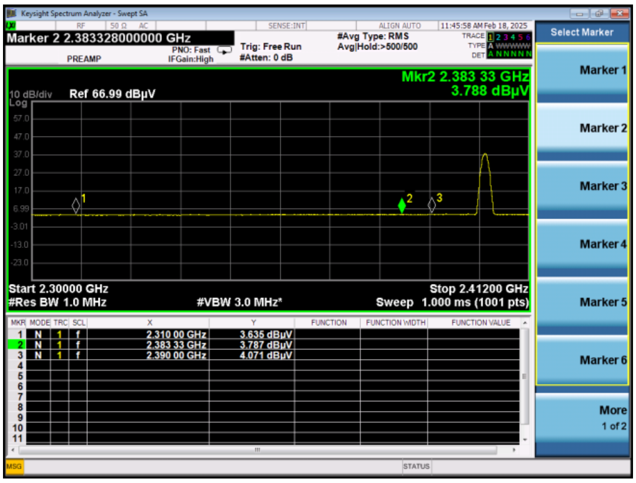
1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL + (DF) or Reading + AF + AMP + CL + (DF).
5. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 ㏈.
6. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.
7. AF = Antenna Factor, CL = Cable Loss, DF = Duty Correction Factor.

- Test plots

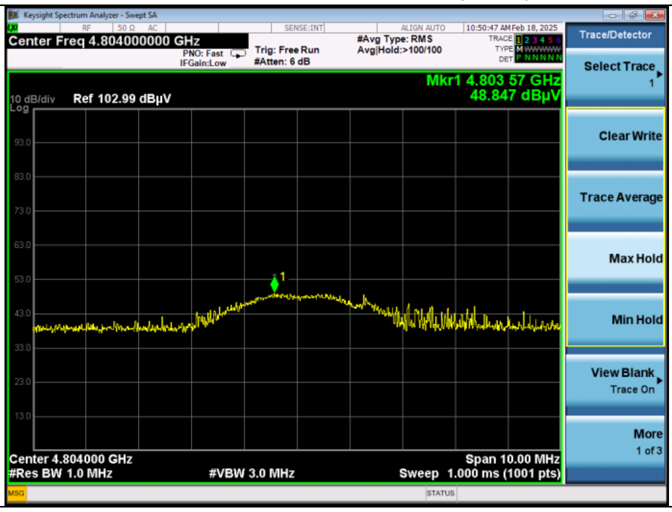
Low channel band edge (Peak)



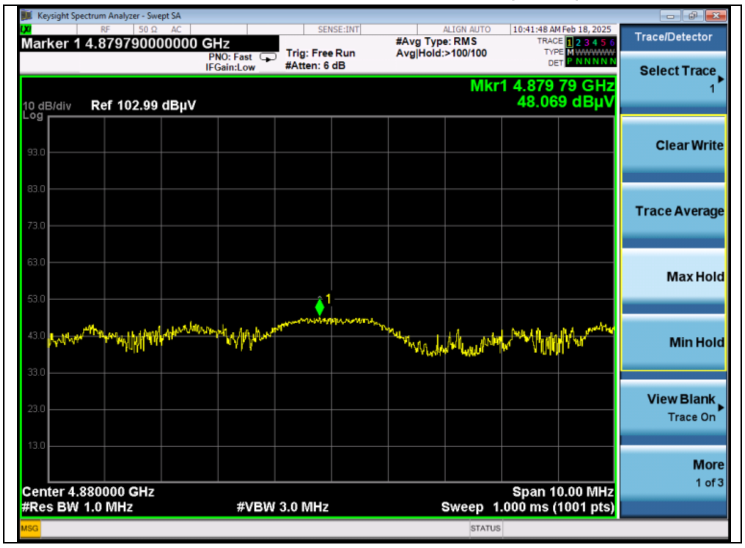
Low channel band edge (Average)



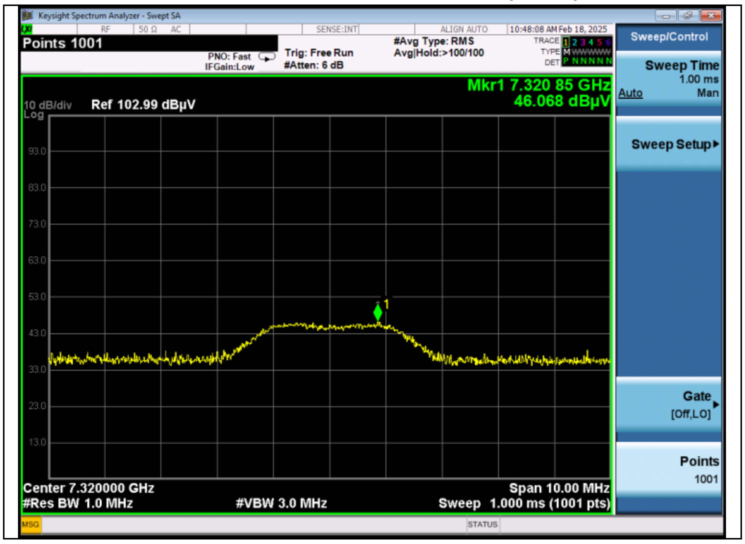
Low channel 2nd harmonic (Peak)



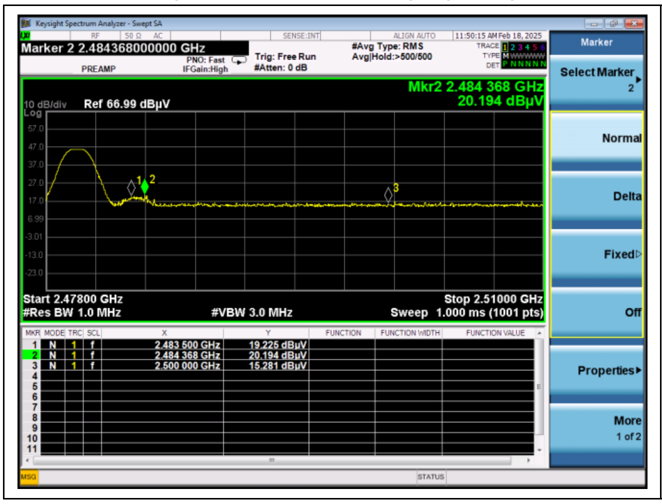
Middle channel 2nd harmonic (Peak)



Middle channel 3rd harmonic (Peak)

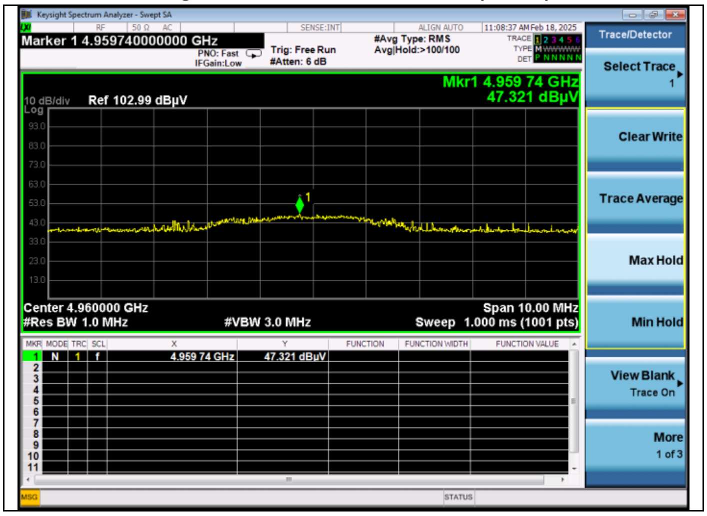


High channel band edge (Peak)

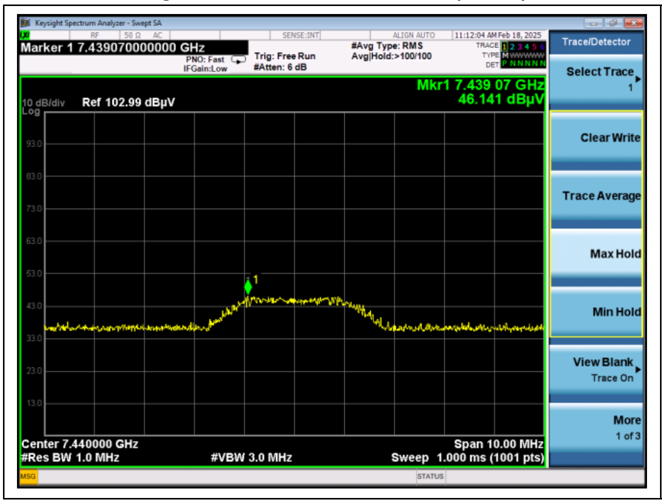


High channel band edge (Average)

High channel 2nd harmonic (Peak)



High channel 3rd harmonic (Peak)

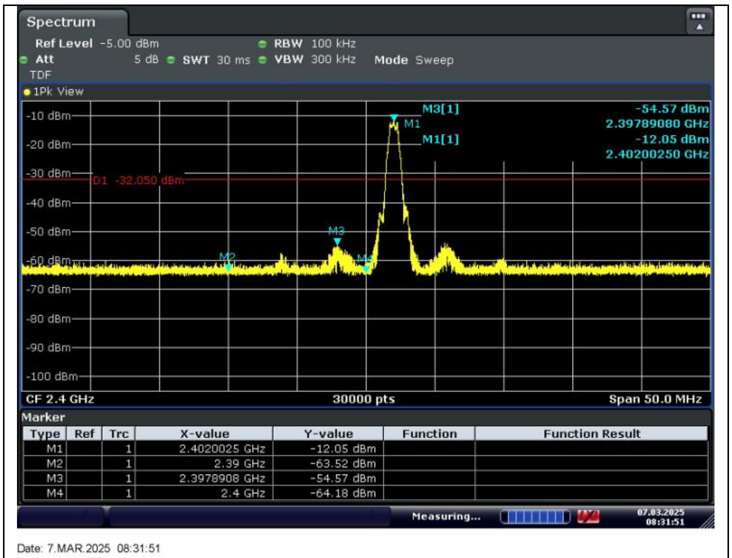


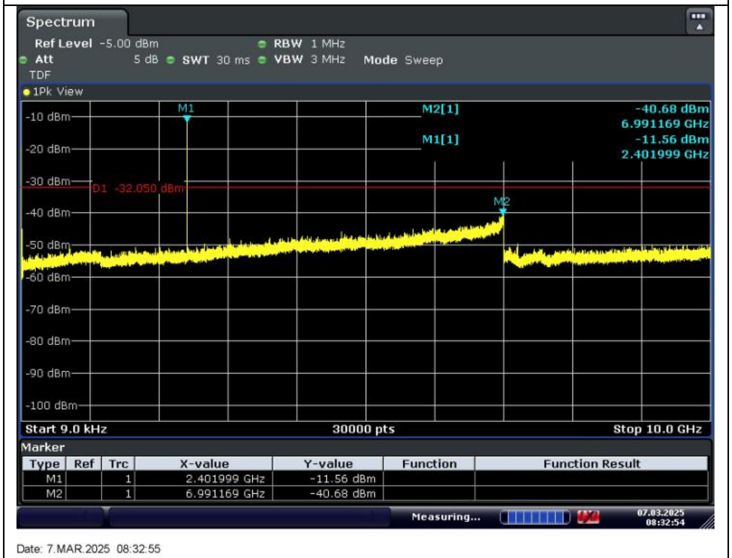
High channel 3rd harmonic (Average)

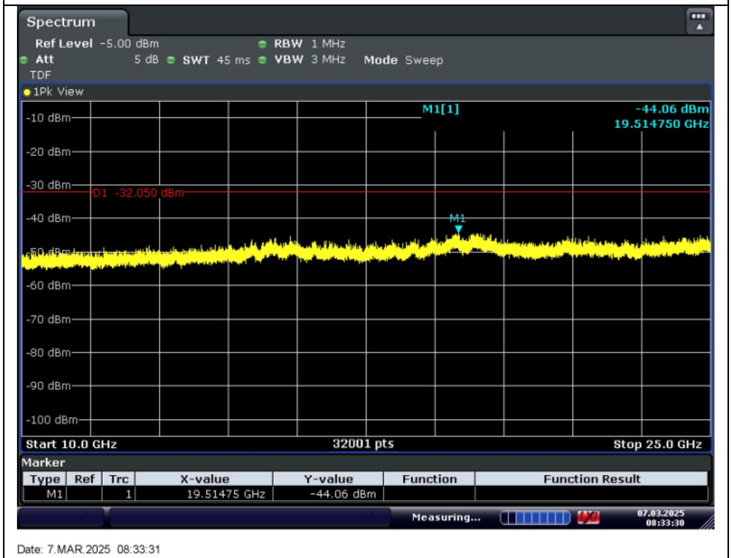
2.4.3. Plot of Conducted Spurious Emissions

Test mode: PHY 1M

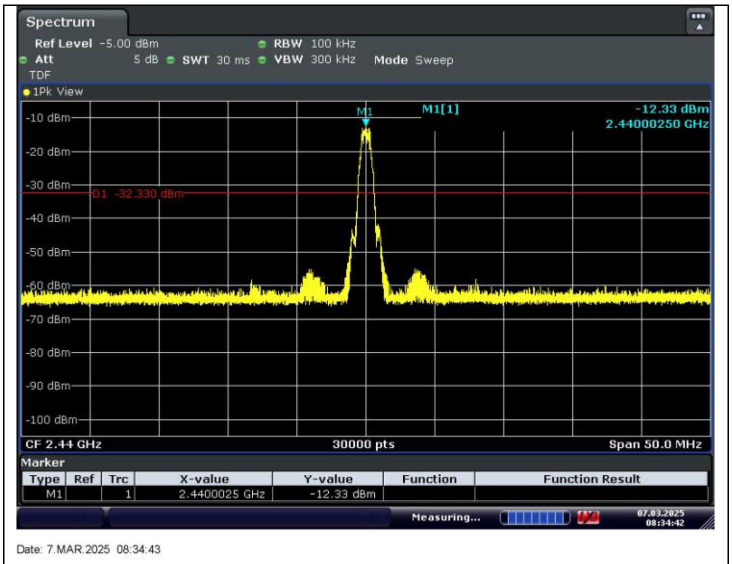
Low Channel

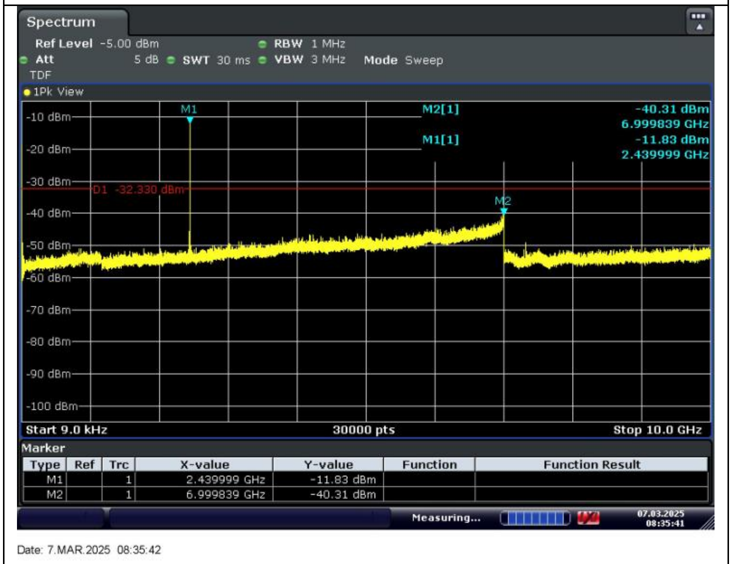


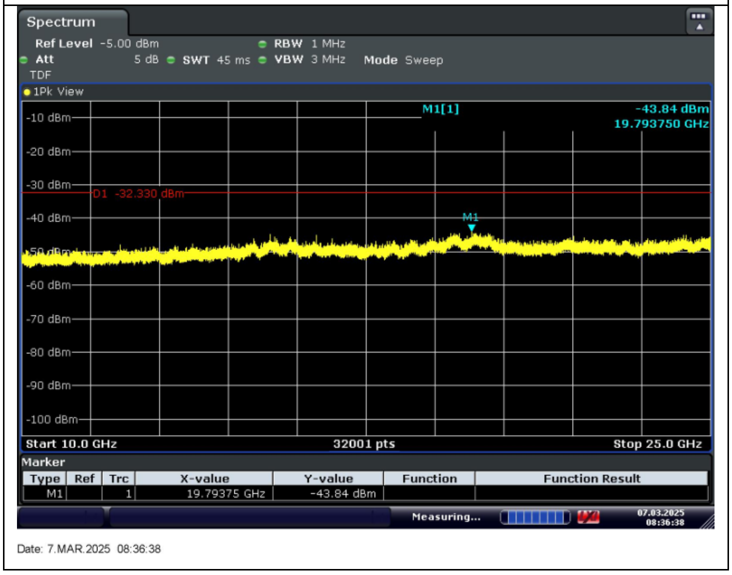




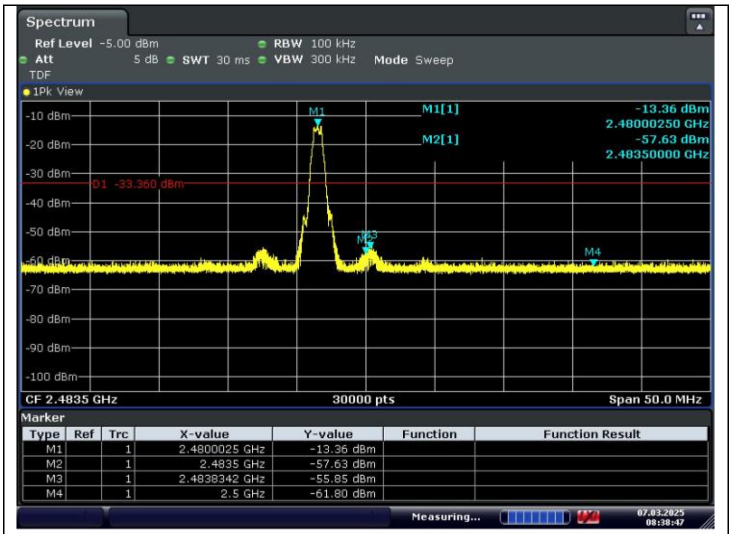
Middle Channel



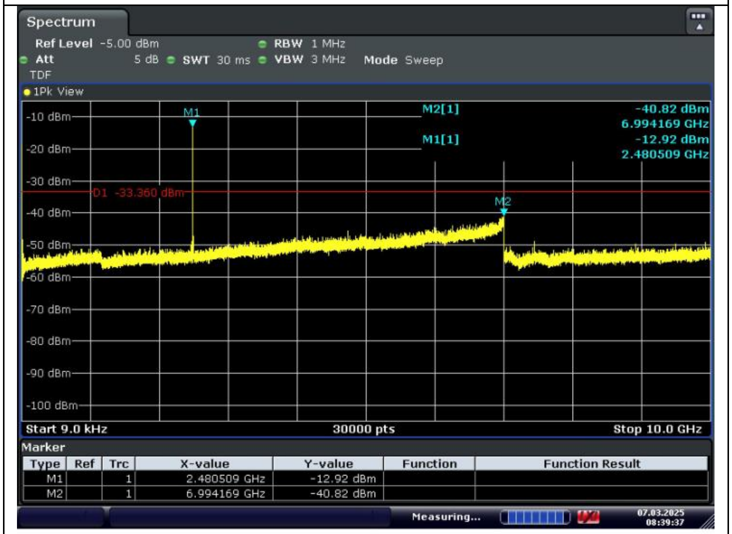




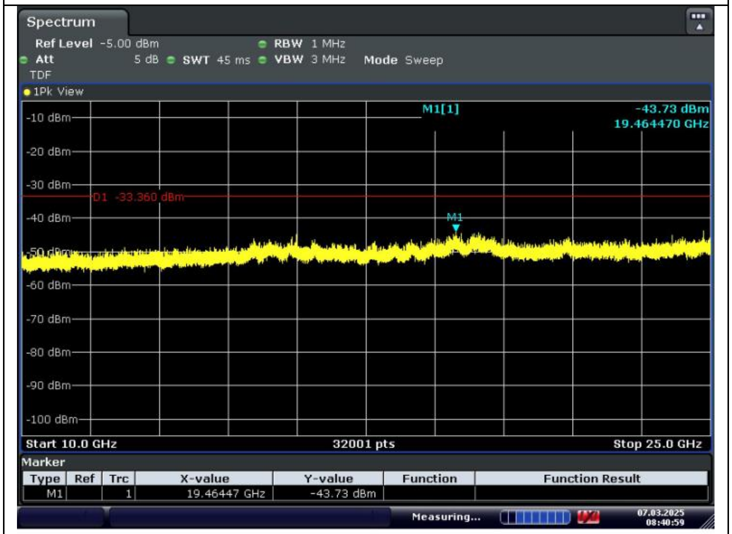
High Channel



Date: 7.MAR.2025 08:38:47



Date: 7.MAR.2025 08:39:37



Date: 7.MAR.2025 08:40:59

3. 6 ㏈ Bandwidth and 99 % Bandwidth

3.1. Test Setup

3.2. Limit

3.2.1. FCC

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

3.2.2. IC

According to RSS-247 Issue 3, 5.2(a), the minimum 6 ㏈ bandwidth shall be 500 ㎑.

3.3. Test Procedure

The test follows section 11.8 DTS bandwidth of ANSI C63.10-2013.
Tests performed using section 11.8.1 Option 1.

3.3.1. 6 ㏈ Bandwidth

- Option 1:
1. Set RBW to = 100 ㎑.
2. Set the VBW ≥ [3 x RBW].
3. Detector = peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 ㏈ relative to the maximum level measured in the fundamental emission.

3.3.2. 99 % Bandwidth

The following conditions shall be observed for measuring the occupied bandwidth and x ㏈ bandwidth:

● The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

● The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

● The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x ㏈ bandwidth if the device is not transmitting continuously.

● The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x ㏈ bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- 6 ㏈ Bandwidth

Mode	Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	Minimum Bandwidth (㎑)
GFSK	Low	2 402	0.719	500
	Middle	2 440	0.719	
	High	2 480	0.739	

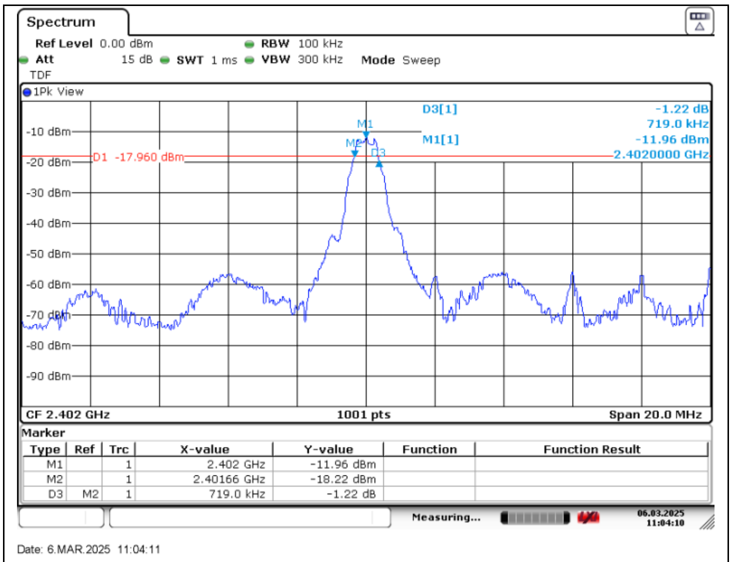
- 99 % Bandwidth

Mode	Channel	Frequency (㎒)	99 % Bandwidth (㎒)	Limit
GFSK	Low	2 402	1.028	-
	Middle	2 440	1.028	
	High	2 480	1.031	

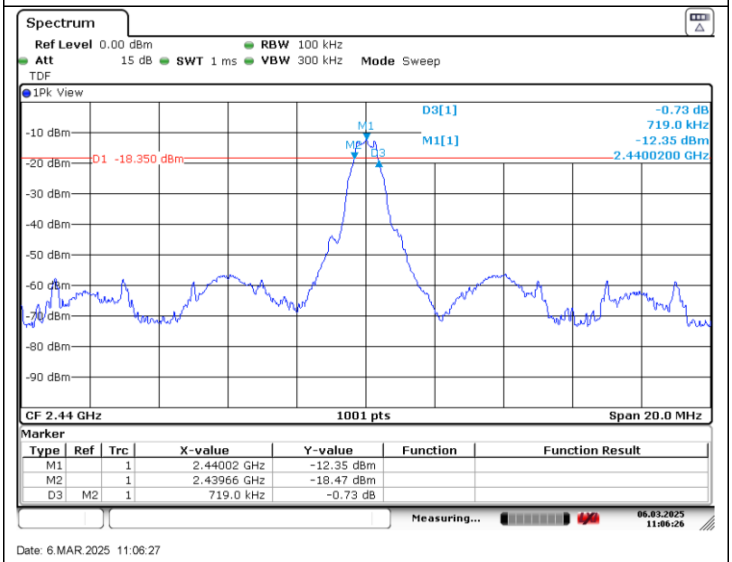
- Test plots

- 6 dB Bandwidth

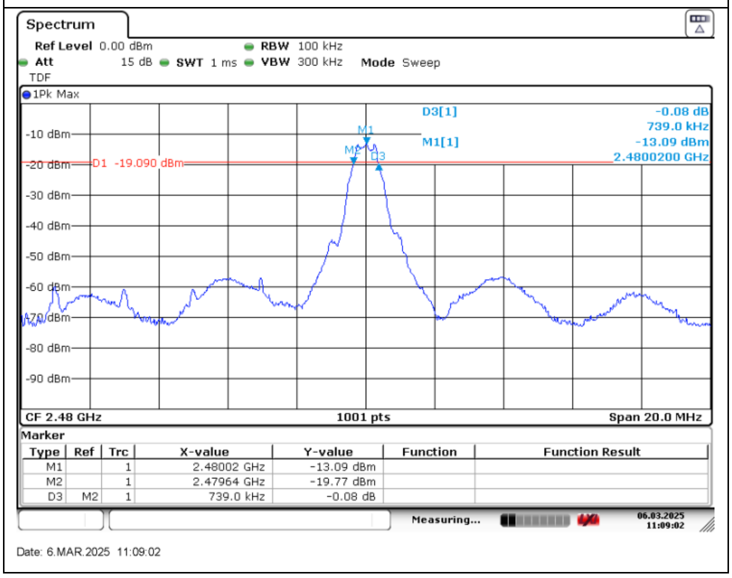
Low Channel



Middle Channel



High Channel



- 99 % Bandwidth

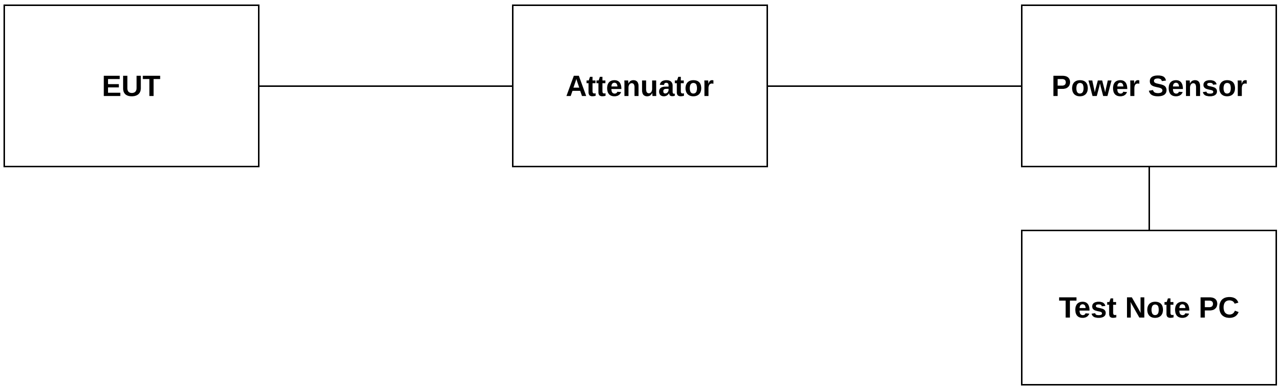
Low Channel

Middle Channel

High Channel

4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2 400-2 483.5 MHz, and 5 725-5 850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2. IC

According to RSS-247 Issue 3, 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2 400-2 483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

4.3. Test Procedure

The test follows section 11.9.1.3 of ANSI C63.10-2013.

PKPM1 Peak-reading power meter method
- The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The test follows section 11.9.2.3.2 of ANSI C63.10-2013.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)
- Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)

1. Initially overall offset for attenuator and cable loss is measured per frequency.
2. Measured offset is inserted in test program in advance of measurement for output power.
3. Power for each frequency (channel) of device is investigated as final result.
4. Final result reported on this section from R&S power viewer program includes with several factors and test program shows only final result.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Mode	Frequency (㎒)	Average Power Result (㏈m)	Peak Power Result (㏈m)	Limit (㏈m)
GFSK	2 402	**-11.53**	**-9.81**	30
	2 440	-12.26	-10.47	
	2 480	-12.26	-10.33	

5. Power Spectral Density

5.1. Test Setup

5.2. Limit

5.2.1 FCC

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.2.2 IC

According to RSS-247 Issue 3, 5.2(b), the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.3. Test Procedure

The measurements are recorded using the PKPSD measurement procedure in section 11.10.2 of ANSI C63.10-2013.

- This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 ㎑ ≤ RBW ≤ 100 ㎑.
4. Set the VBW ≥ [3 x RBW].
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds requirement, then reduce RBW (but no less than 3 ㎑) and repeat.

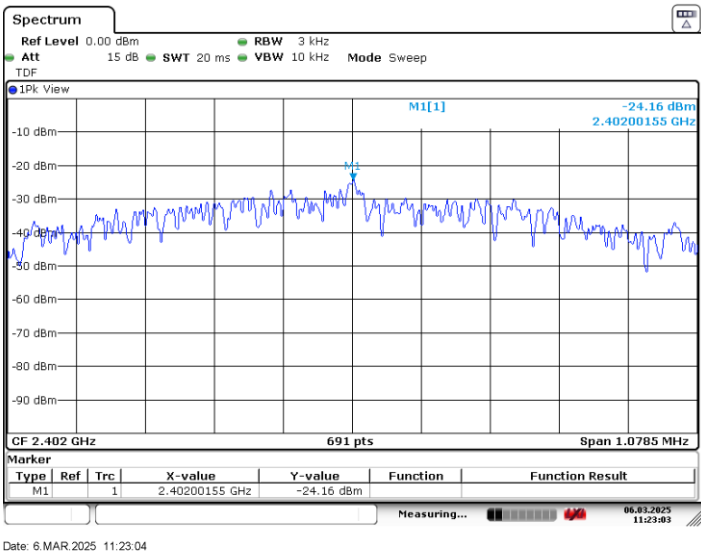
5.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

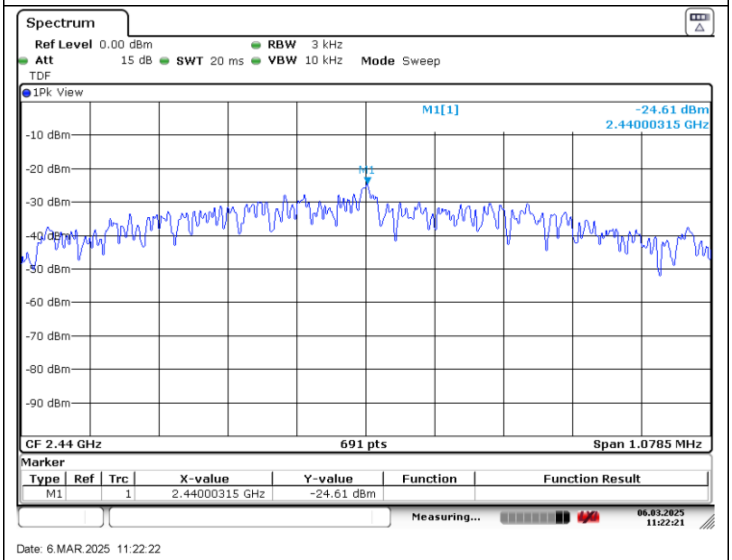
Mode	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)	Limit (㏈ m/3 ㎑)
GFSK	Low	2 402	-24.16	8
	Middle	2 440	-24.61	
	High	2 480	-25.29	

- Test plots

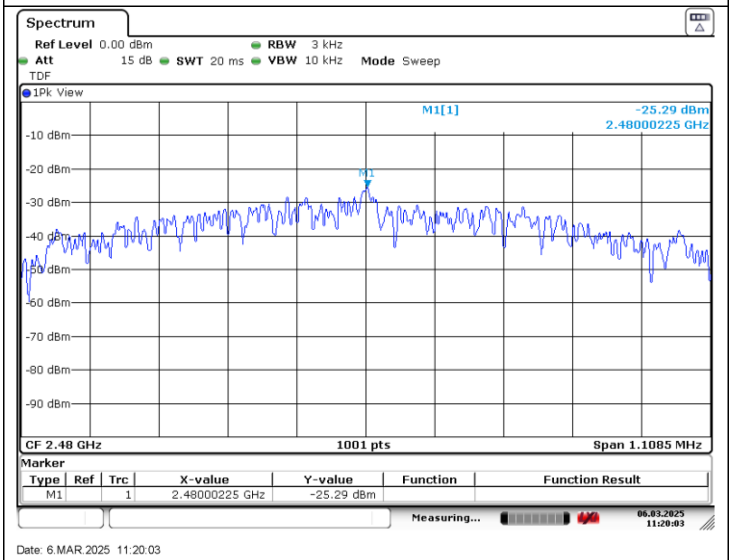
Low Channel



Middle Channel



High Channel



6. Antenna Requirement

6.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. And according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 ㏈i are used, the conducted output power shall be reduced appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

6.2. Antenna Connected Construction

Antenna used in this product is PCB Pattern Antenna with gain of 2.90 ㏈i.

- End of the Test Report -