TEST REPORT

Report Number	BWTR-2133-NABLE
FCC ID	2AILI-SDFV02101
IC	27697-SDFV02101
Applicant	SWISSDIGITAL (ASIA) CO., LIMITED
Product Name	FMN Finder
Marketing Name	N/A
Brand Name	SWISSDIGITAL DESIGN
Model Name	SWISSDIGITAL DESIGN
Serial Number	No.1: ebc7f1f03fd9cdd3
	No.2: f64a16f03fd9169c
Test Standard	FCC 47 CFR Part 15 Subpart C
	ISED RSS-247 Issue 2
	ISED RSS-Gen Issue 5
Tested Date	Sep. 08, 2021 ~ Sep. 14, 2021

CONTENTS

1 Summary of Test Result 4

2 General Information 5
2.1 Applicant 5
2.2 Manufacturer 5
2.3 Product Feature of Equipment Under Test 5
2.4 Ancillary Equipment 5
2.5 Description of Test Modes 6
2.6 Duty Cycle of Test Signal 6
2.7 Applicable Standards 7
2.8 Test Facilities 7

3 Test Result 8
3.1 6dB Bandwidth & 99% Occupied Bandwidth 8
3.2 Output Power 16
3.3 Power Spectral Density 17
3.4 Conducted Out of Band Emission 21
3.5 Authorized-band Band-edge 32
3.6 Spurious Radiated Emissions and Restricted-band Band-edge 35
3.7 AC Power Line Conducted Emission 48

4 Test Instruments 50

Revision History

Revision	Description	Issued Date
A	Initial issue of report	2021/11/11

1 Summary of Test Result

Report Section	FCC Section	ISED Section	Description	Result
3.1	15.247 (a)(2)	RSS-247 5.2 (a) & RSS-Gen 6.7	6dB Bandwidth & 99% Occupied Bandwidth	Pass
3.2	15.247 (b)(3)	RSS-247 5.4 (d)	Output Power	Pass
3.3	15.247 (e)	RSS-247 5.2 (b)	Power Spectral Density	Pass
3.4	15.247 (d)	RSS-247 5.5	Conducted Out of Band Emission	Pass
3.5	15.247 (d)	RSS-247 5.5	Authorized-band Band-edge	Pass
3.6	15.247(d)/15.35(b)/15.209	RSS-247 5.5 & RSS-Gen 8.9/8.10	Spurious Radiated Emissions and Restricted-band Band-edge	Pass
3.7	15.207	RSS-Gen 8.8	AC Power Line Conducted Emission	N/A[Note]
2.3	15.203	RSS-Gen 6.8	Antenna Requirement	Pass

Note: The test was not performed since the EUT is only powered by the button battery.

We, Beijing Boomwave Test Service Co. Ltd., would like to declare that the tested sample has been evaluated and in compliance with the requirements of applicable standards.

Prepared by:		2021.11.11 14:34:20 +08'00'
Reviewed by:		2021.11.11 21:24:47 +08'00'
Approved by:		2021.11.11 21:25:11 +08'00'

Rationale:
The test results in this report apply exclusively to the tested model / sample.
The electrical copy of test report is invalid without the signatures. The hard copy is invalid without seal.
The test report shall not be modified, republished or copied without the written authorization of the laboratory.

2 General Information

2.1 Applicant

SWISSDIGITAL (ASIA) CO., LIMITED
FLAT/RM 1505B 15/F FORTRESS TOWER, 250 KING'S ROAD, NORTH POINT, Hong Kong, P.R. China

2.2 Manufacturer

SWISSDIGITAL DESIGN
Chengnan Industrial Zone, Hui'an County, Quanzhou City, Fujian Province, P.R.China

2.3 Product Feature of Equipment Under Test

Product Name	FMN Finder
Marketing Name	N/A
Model Name	SWISSDIGITAL DESIGN
Sample Status	Prototype
Operating Frequency Range	2402MHz ~ 2480MHz
Type of Wireless Technology	Bluetooth V5.2 LE
Modulation Type and Data Rate	GFSK: 1Mbps / 2Mbps
Number of Channels	40
Nominal Channel Bandwidth	2MHz
Number of Antenna	1
Antenna Type	PCB
Antenna Gain	1.1dBi
Hardware Version	EH-MY01-FinderT-V1.1
Software Version	V1.0.0
Power Supply Rating	DC 3.3V
Sample Received Date	2021/09/07

Note: 1) The EUT is designed based on SIG specification. It has a full support to Medium Access Protocol and full compliant with KDB558074 requirements.
2) According to the declaration of applicant, the EUT has various appearance and colors due to its marketing requirement. And the materials for these differences are all the same plastic. Since this case will not affect any wireless performance, all tests of this report were performed with only one appearance and color of EUT.

2.4 Ancillary Equipment

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following ancillary equipment were used to form a representative test configuration during the tests.

Support Unit	Engineering Controller
Manufacturer	Telink
Model Name	Burning evk
Serial Number	---

Support Unit	Laptop
Manufacturer	Lenovo
Model Name	ThinkPad E480
Serial Number	PF-1E0EL9

2.5 Description of Test Modes

40 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

The EUT was linked by Bluetooth simulator or controlled by engineering test software to work in continious trasmitting and receiving mode. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.

Following channels were selected for test:

Channel	No.	Frequency (MHz)
CH Lowest	0	2402
CH Middle	19	2440
CH Highest	39	2480

2.6 Duty Cycle of Test Signal

Modulation Type	Duty Cycle
GFSK (BLE 1Mbps)	100.00%
GFSK (BLE 2Mbps)	100.00%

2.7 Applicable Standards

Standard	Version	Title
FCC 47 CFR Part 15 Subpart C	2020	Requirements for Intentional Radiators
ISED RSS-247	Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISED RSS-Gen	Issue 5	General Requirements for Compliance of Radio Apparatus
FCC KDB 558074 D01	v05r02	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under Section 15.247 of the FCC rules
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices - Electromagnetic Compatibility

2.8 Test Facilities

Company Name: Beijing Boomwave Test Service Co. Ltd

Address: EMC Building, No.1 Wang Jing East Road, Chao Yang District Beijing, P.R. China 100102

FCC Test Firm Registration Number: 613197

ISED Canada Registration No.: 24289 (CAB Identifier: CN0010)

VCCI Registration No.: R-20062, G-20063, C-20050, T-20049

Test Site	Description	Dimension	Ground Plane Size
☐ SAC10	10m semi-anechoic chamber	19.5m×12.9m×8.6m	4m×4m
☒ SAC3	3m semi-anechoic chamber	9.6m×6.4m×6.0m	---
☐ SR#1	Shielding Room for EMS test	8.1m×4.05m×2.755m	8.1m×4.05m
☒ SR#2	Shielding Room for RF test	8.1m×4.05m×2.755m	---

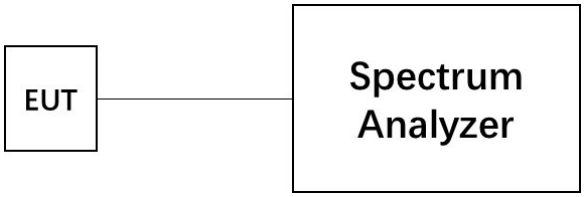
3 Test Result

3.1 6dB Bandwidth & 99% Occupied Bandwidth

3.1.1. Limit

FCC 47 CFR Part 15 Subpart C - §15.247 (a)(2)
ISED RSS-247 - §5.2 (a)
ISED RSS-Gen - §6.7
For systems using digital modulation techniques operating in the 2400-2483.5MHz, the minimum 6dB bandwidth shall be at least 500kHz.

3.1.2. Test Setup



3.1.3. Test Procedures

6dB Bandwith:

1) The measurement procedure follows ANSI C63.10-2013, clause 11.8.1.
2) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3) Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
4) Use the following spectrum analyzer settings:
   a) Set RBW = 100kHz;
   b) Set VBW ≥ 3×RBW;
   c) Detector = Peak;
   d) Trace Mode = Max Hold;
   e) Sweep = Auto Couple;
   f) Allow the trace to 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 6dB relative to the maximum level measured in the fundamental emission.

99% Occupied Bandwidth:

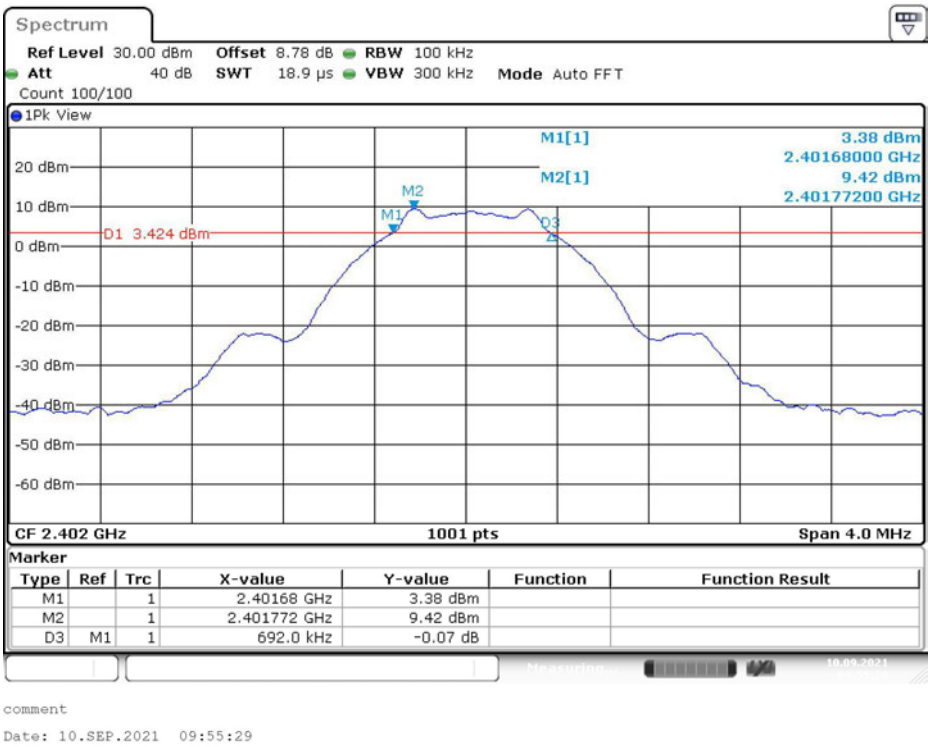
1) The measurement procedure follows ANSI C63.10-2013, clause 6.9.3.
2) Use the following spectrum analyzer settings:
   a) Set RBW = 1% to 5% of the Occupied Bandwidth;
   b) Set VBW ≥ 3×RBW;
   c) Detector = Peak;
   d) Trace Mode = Max Hold;
   e) Sweep = Auto Couple;
   f) Allow the trace to stabilize;
   g) Use the 99% power bandwidth function and record the measured result.

3.1.4. Test Result

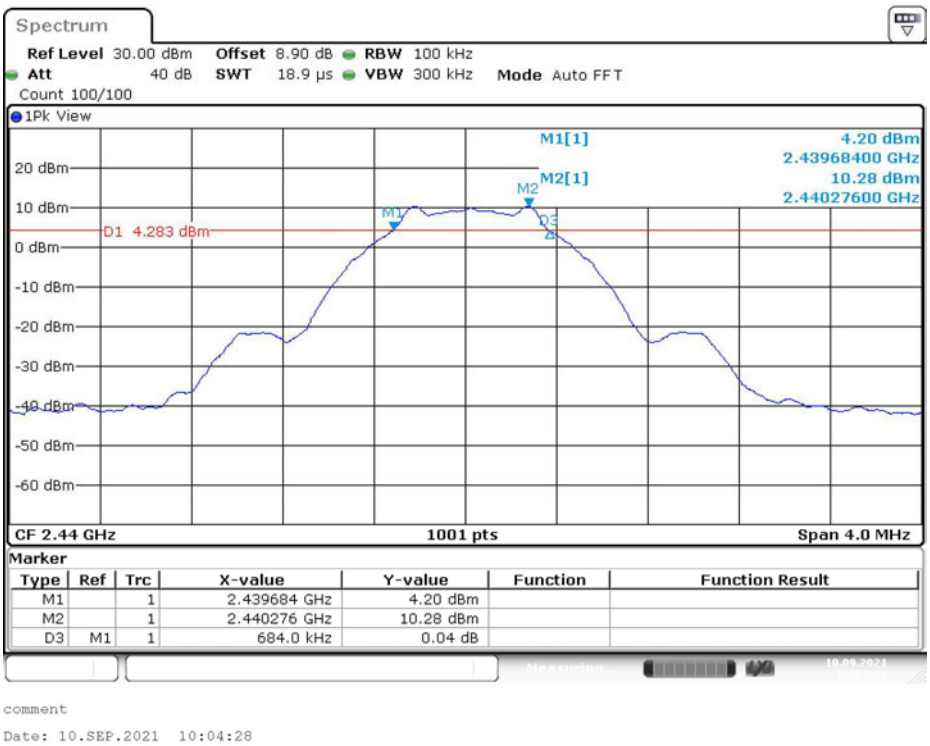
Test Engineer	Xu Dongxu	**Test Date**	2021/09/10
Temperature	23.7°C	**Relative Humidity**	62.0%
Pressure	104.9kPa	**Test Sample Selected**	No.1

Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK (BLE 1Mbps)	CH Lowest (No.0)	2402	0.69	1.03
	CH Middle (No.19)	2440	0.68	1.02
	CH Highest (No.39)	2480	0.70	1.03
GFSK (BLE 2Mbps)	CH Lowest (No.0)	2402	1.37	2.02
	CH Middle (No.19)	2440	1.38	2.04
	CH Highest (No.39)	2480	1.41	2.03

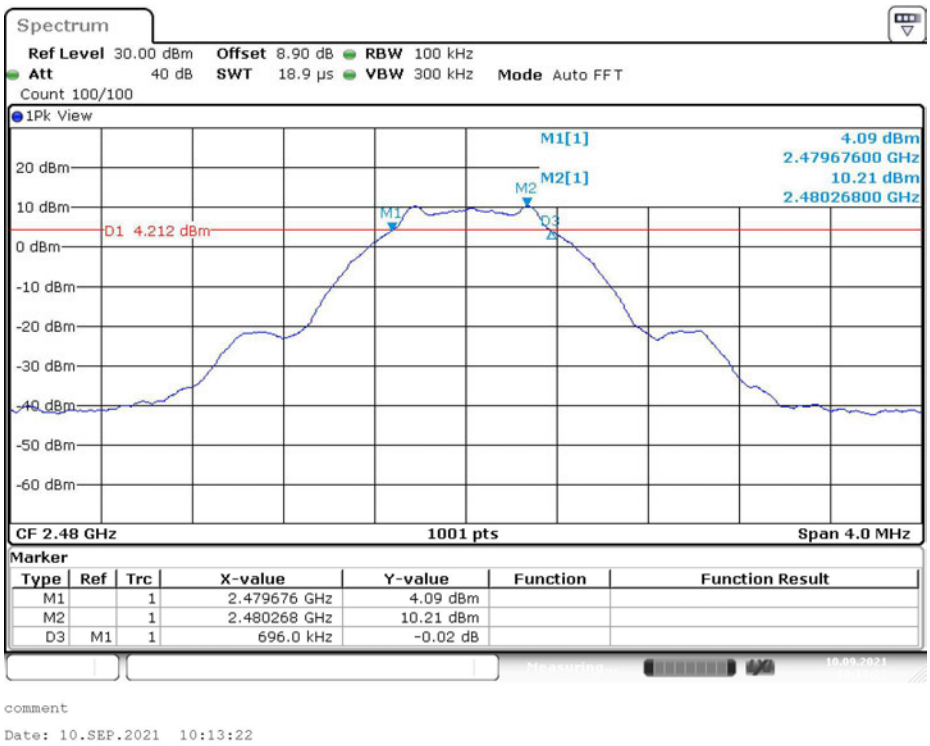
6dB Bandwidth – GFSK (BLE 1Mbps):



CH Lowest (No.0)

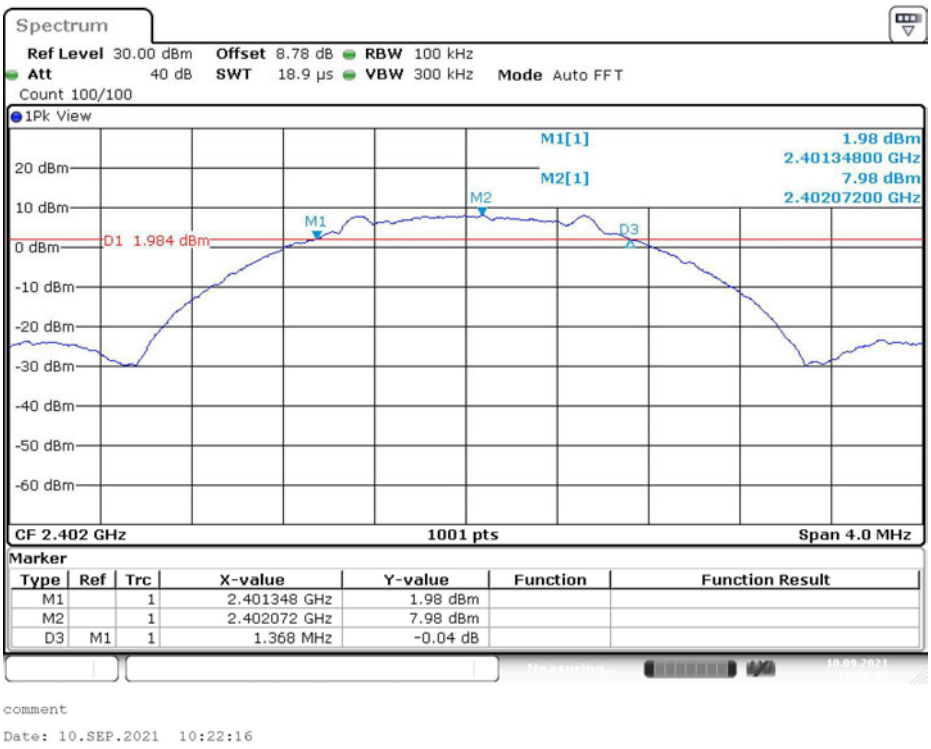


CH Middle (No.19)

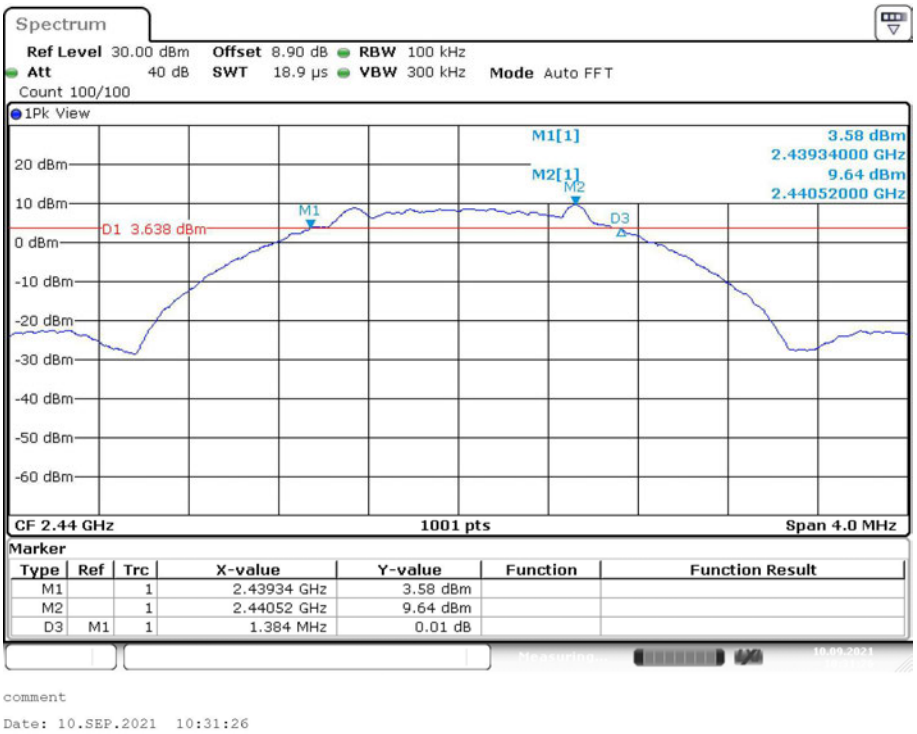


CH Highest (No.39)

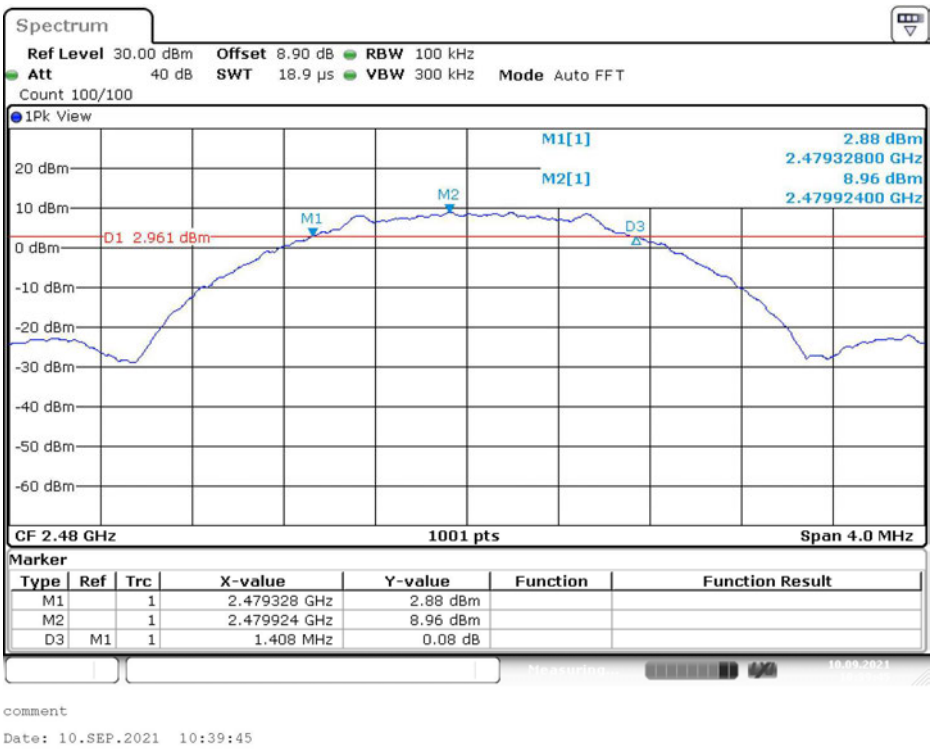
6dB Bandwidth – GFSK (BLE 2Mbps):



CH Lowest (No.0)

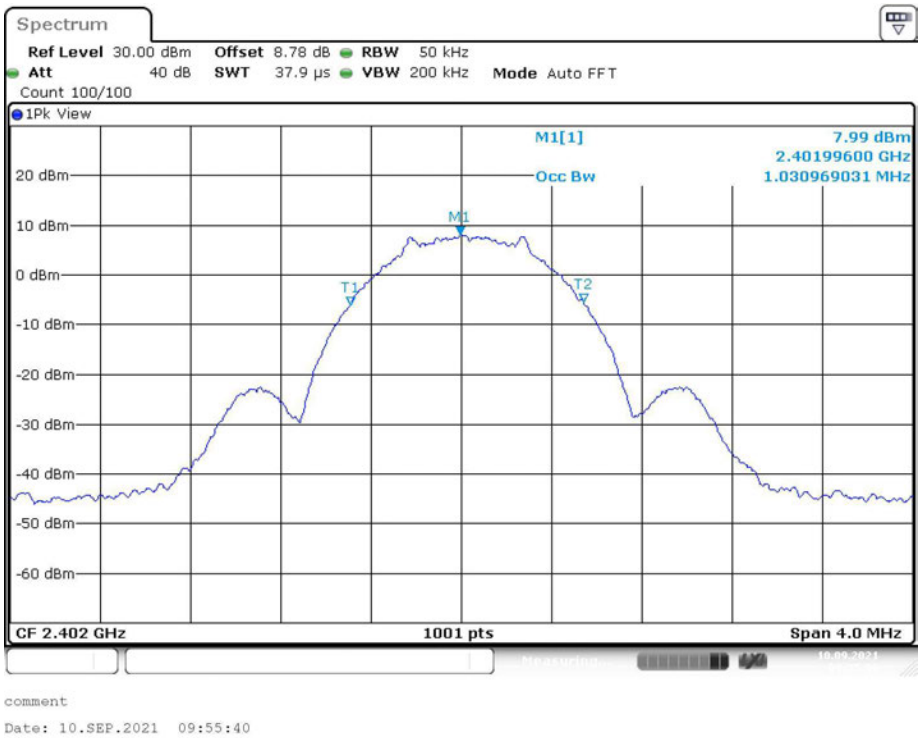


CH Middle (No.19)

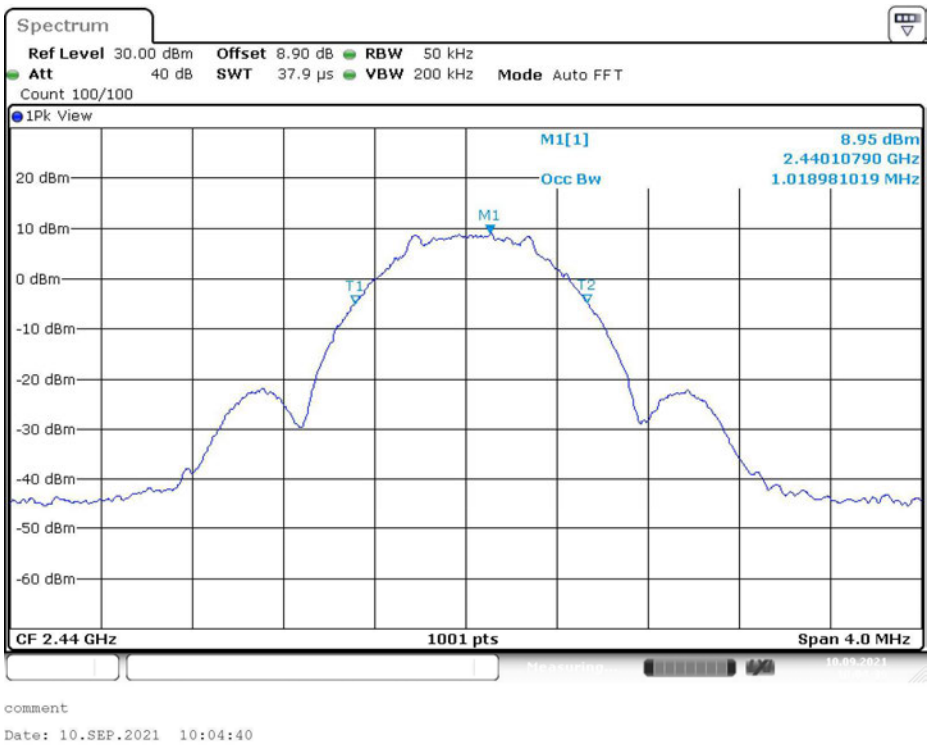


CH Highest (No.39)

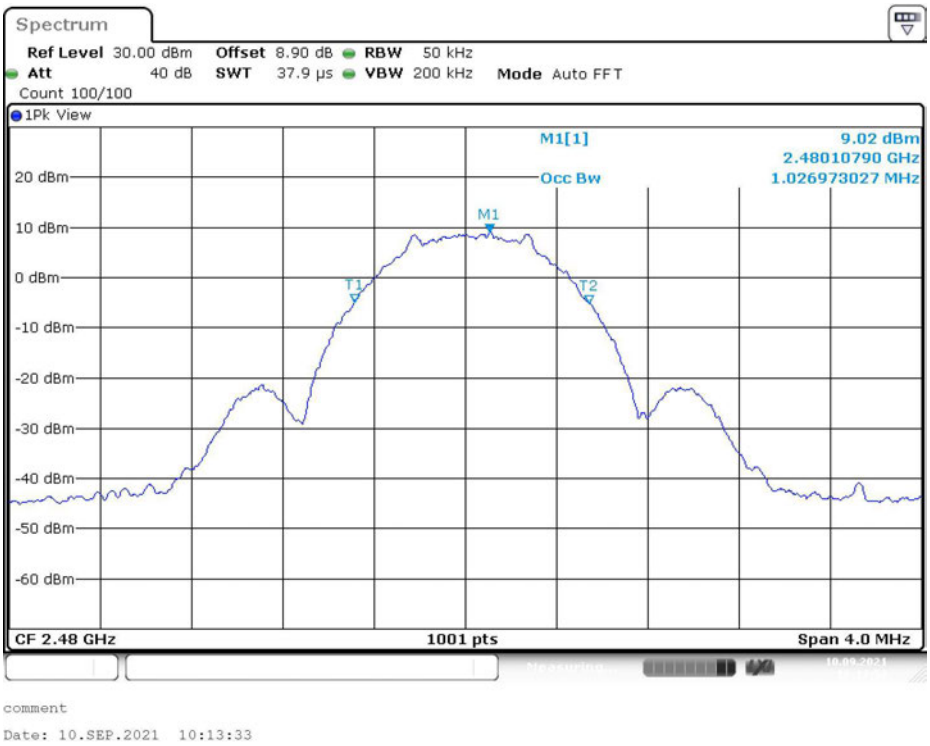
99% Occupied Bandwidth – GFSK (BLE 1Mbps):



CH Lowest (No.0)

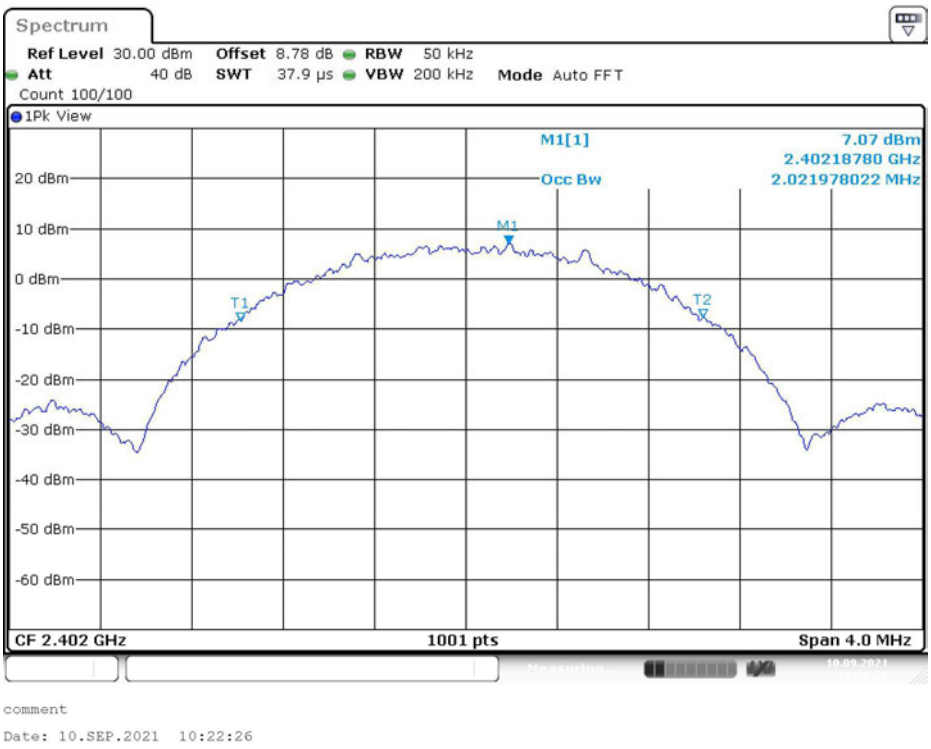


CH Middle (No.19)

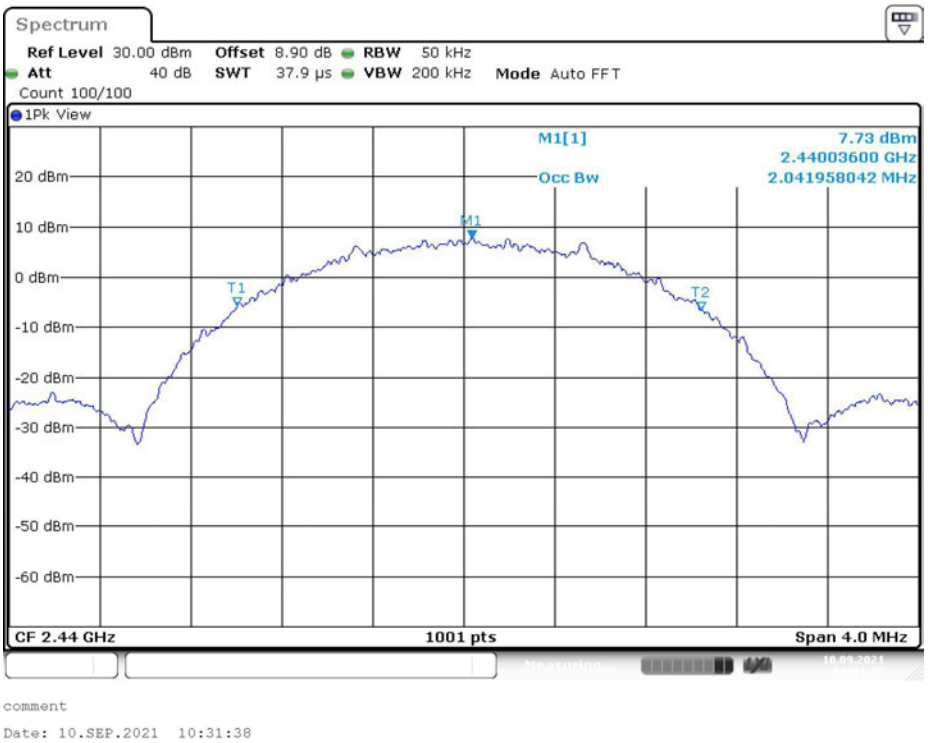


CH Highest (No.39)

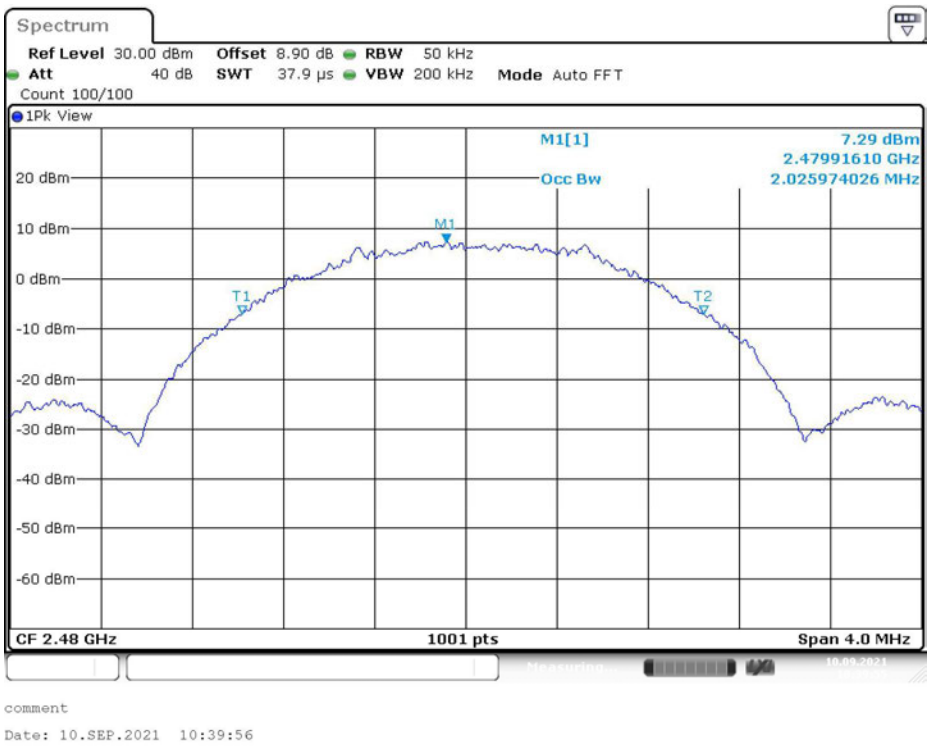
99% Occupied Bandwidth – GFSK (BLE 2Mbps):



CH Lowest (No.0)



CH Middle (No.19)



CH Highest (No.39)

3.1.5. Uncertainty

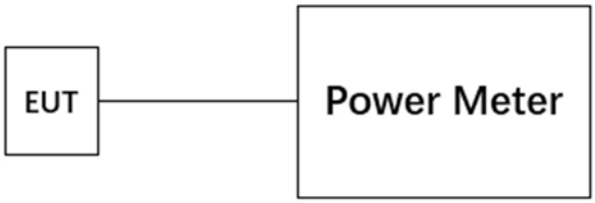
Frequency (MHz)	U_{lab}	k
2402	187.46Hz	2
2440	190.33Hz	2
2480	193.35Hz	2

3.2 Output Power

3.2.1. Limit

FCC 47 CFR Part 15 Subpart C - §15.247 (b)(3)
ISED RSS-247 - §5.4 (d)
For systems using digital modulation in the 2400-2483.5MHz band, if the maximum antenna gain is less than or equal to 6 dBi, the maximum peak conducted output power shall not exceed 1Watt (30dBm), the e.i.r.p. shall not exceed 4Watt (36dBm).

3.2.2. Test Setup



3.2.3. Test Procedures

1) The measurement procedure follows ANSI C63.10-2013, clause 11.9.1.
2) The transmitter output power is measured using a wideband peak and average power meter.

3.2.4. Test Result

Test Engineer	Xu Dongxu	**Test Date**	2021/09/09
Temperature	23.9°C	**Relative Humidity**	61.0%
Pressure	104.8kPa	**Test Sample Selected**	No.1

Modulation Type	Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	E.I.R.P (dBm)
GFSK (BLE 1Mbps)	CH Lowest (No.0)	2402	0.90	3.74	4.84
	CH Middle (No.19)	2440	1.26	3.95	5.05
	CH Highest (No.39)	2480	1.65	4.48	5.58
GFSK (BLE 2Mbps)	CH Lowest (No.0)	2402	1.14	3.89	4.99
	CH Middle (No.19)	2440	1.10	4.01	5.11
	CH Highest (No.39)	2480	1.94	4.64	5.74

3.2.5. Uncertainty

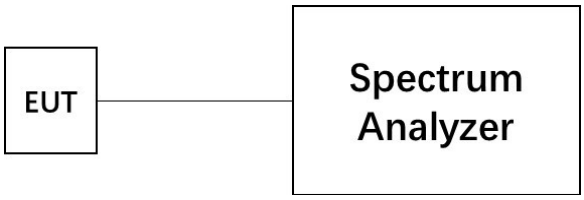
U_{lab}=1.08dB (k=2)

3.3 Power Spectral Density

3.3.1. Limit

FCC 47 CFR Part 15 Subpart C - §15.247 (e)
ISED RSS-247 - §5.2 (b)
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

3.3.2. Test Setup



3.3.3. Test Procedures

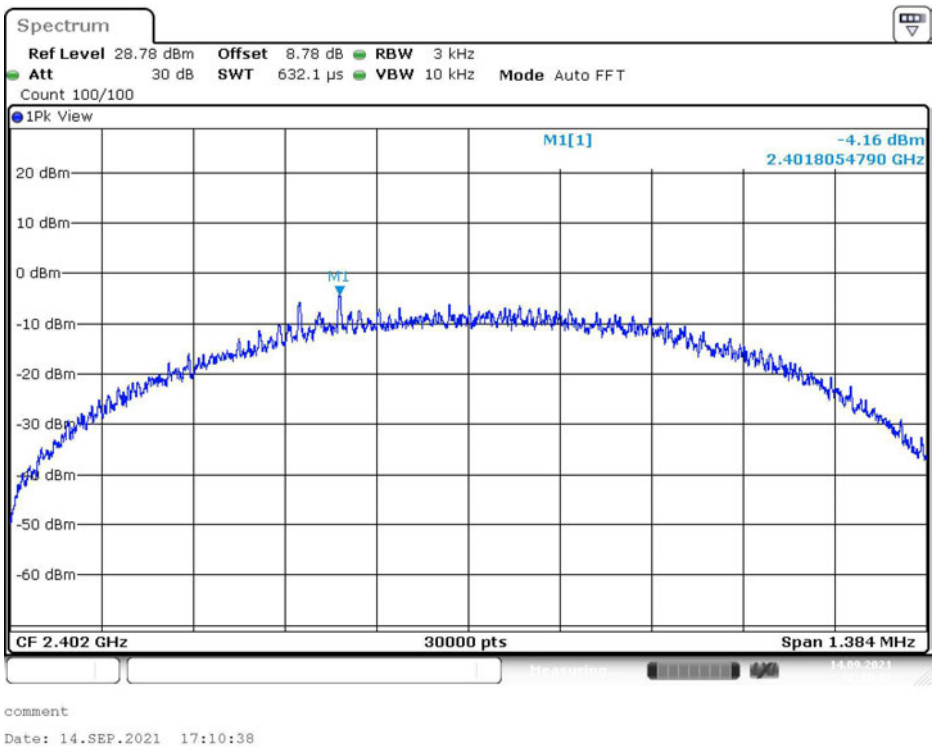
1) The measurement procedure follows ANSI C63.10-2013, clause 11.10.2.
2) Use the following spectrum analyzer settings:
   a) Set analyzer center frequency to DTS channel center frequency;
   b) Set the span to 1.5 times the DTS bandwidth;
   c) Set the RBW to 3kHz ≤ RBW ≤ 100kHz;
   d) Set the VBW ≥ 3×RBW;
   e) Detector function: Peak;
   f) Sweep = Auto Couple;
   g) Trace: Max hold;
   h) Allow the trace to stabilize;
   i) Use the peak marker function to determine the maximum amplitude level within the RBW;
   j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

3.3.4. Test Result

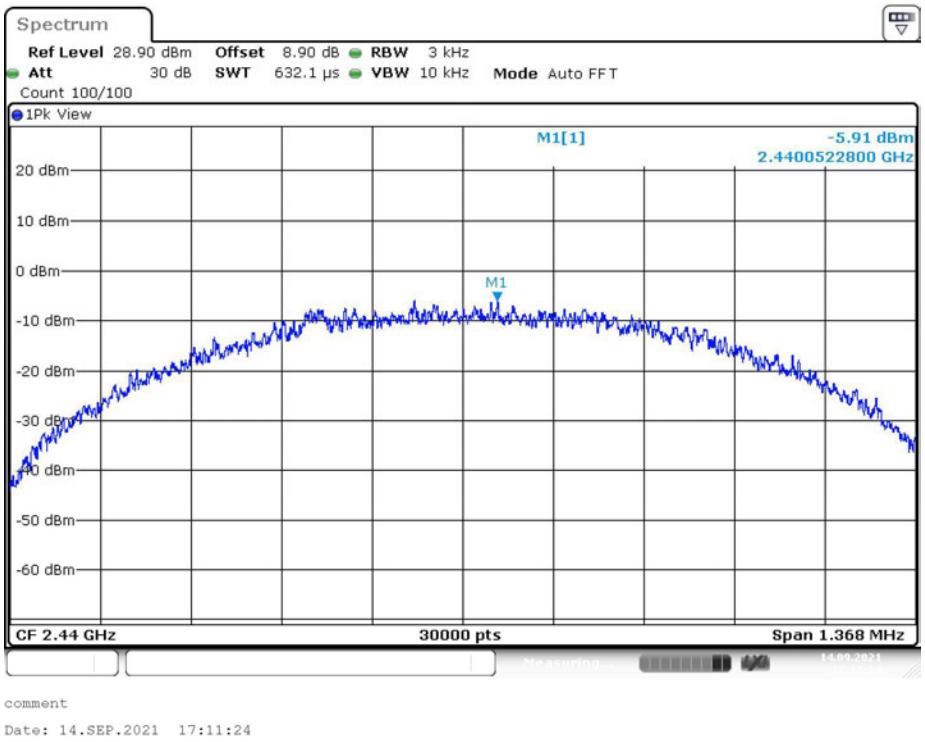
Test Engineer	Xu Dongxu	**Test Date**	2021/09/14
Temperature	24.8°C	**Relative Humidity**	64.0%
Pressure	105.2kPa	**Test Sample Selected**	No.1

Modulation Type	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)
GFSK (BLE 1Mbps)	CH Lowest (No.0)	2402	-4.16
	CH Middle (No.19)	2440	-5.91
	CH Highest (No.39)	2480	-4.00
GFSK (BLE 2Mbps)	CH Lowest (No.0)	2402	-8.19
	CH Middle (No.19)	2440	-8.46
	CH Highest (No.39)	2480	-8.49

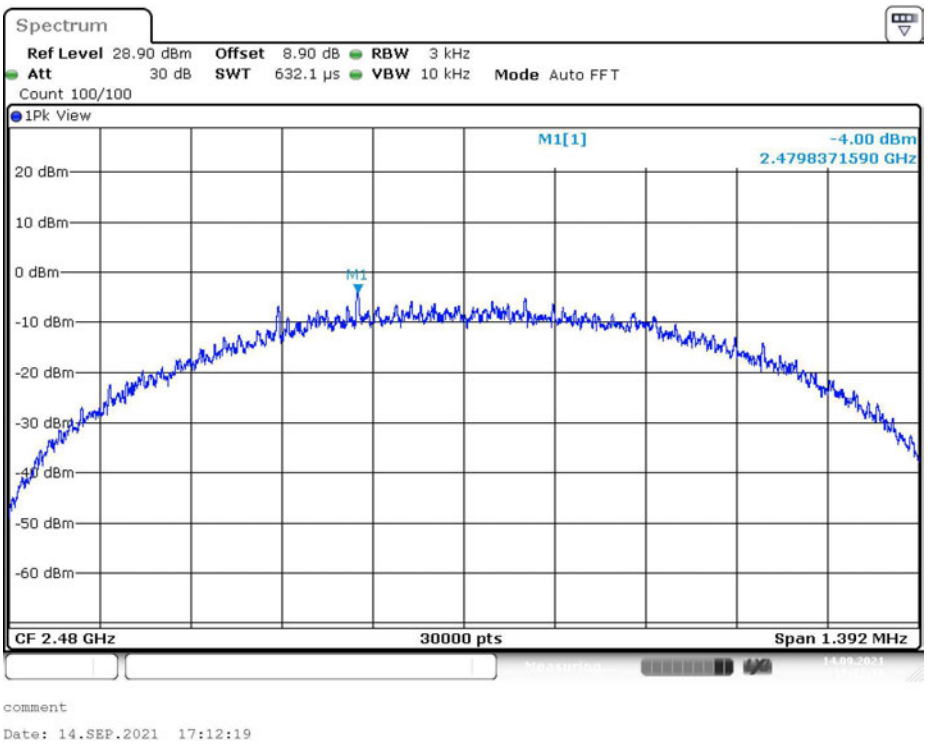
GFSK (BLE 1Mbps):



CH Lowest (No.0)

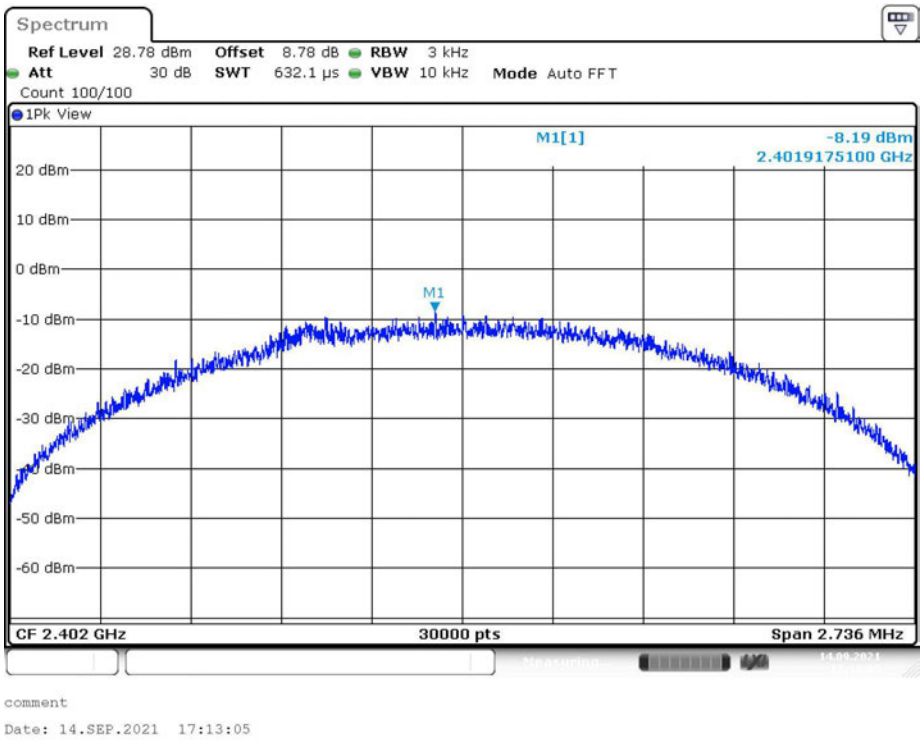


CH Middle (No.19)

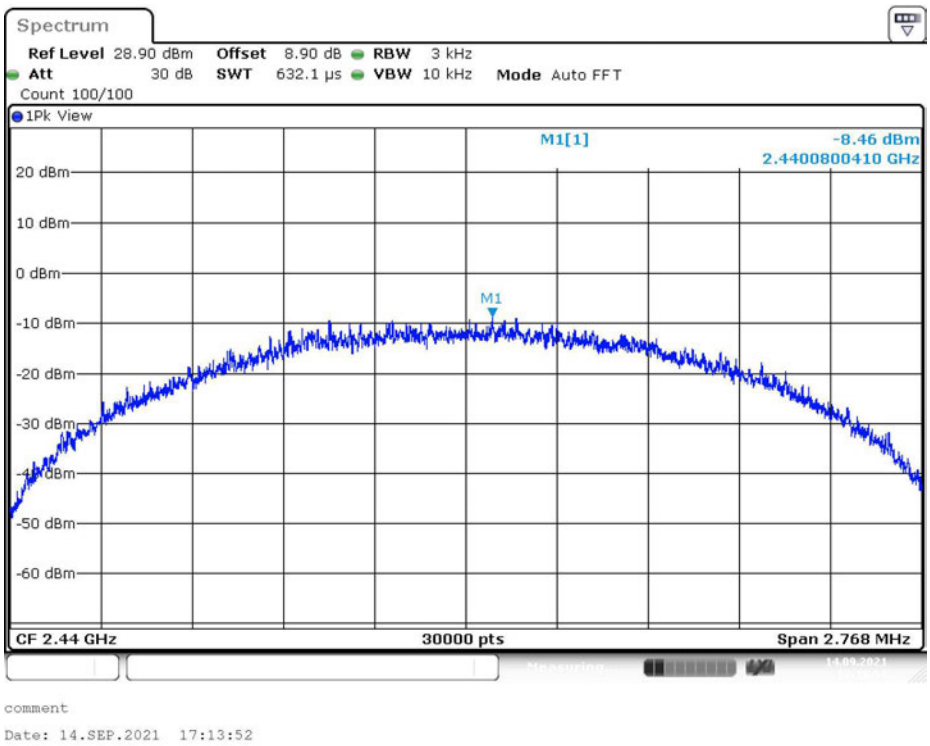


CH Highest (No.39)

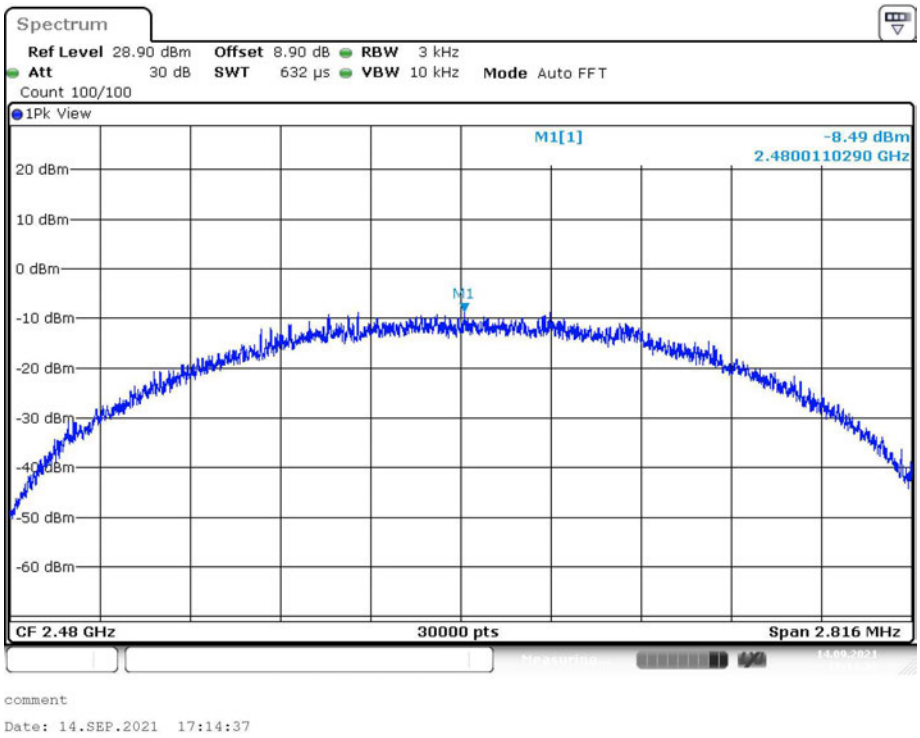
GFSK (BLE 2Mbps):



CH Lowest (No.0)



CH Middle (No.19)



CH Highest (No.39)

3.3.5. Uncertainty

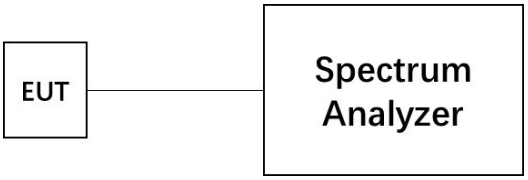
U_{lab}=1.08dB (k=2)

3.4 Conducted Out of Band Emission

3.4.1. Limit

FCC 47 CFR Part 15 Subpart C - §15.247 (d)
ISED RSS-247 - §5.5
In any 100kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on an RF conducted measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

3.4.2. Test Setup



3.4.3. Test Procedures

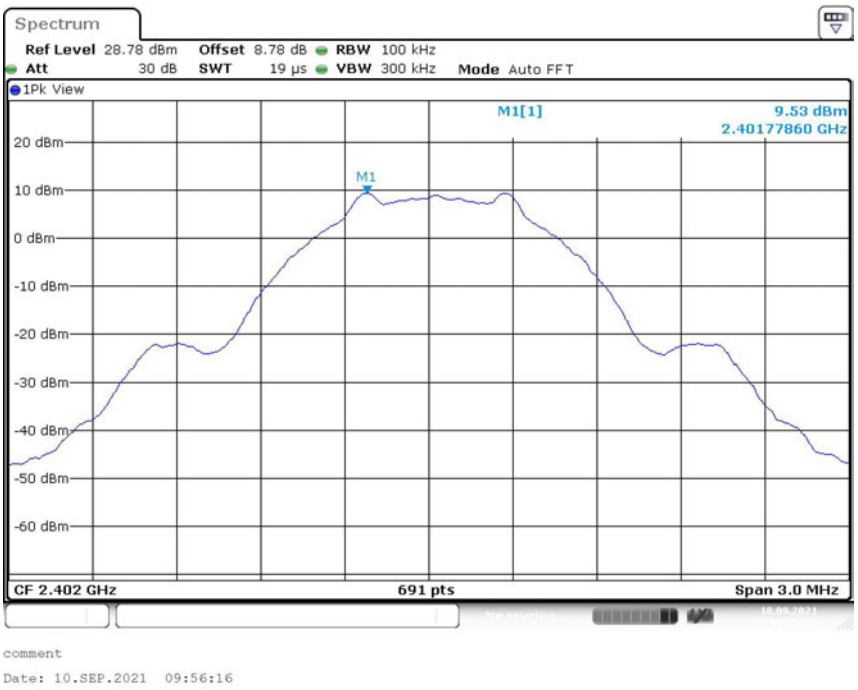
1) The measurement procedure follows ANSI C63.10-2013, clause 11.11.
2) Use the following spectrum analyzer settings to measure reference level:
   a) Set analyzer center frequency to DTS channel center frequency;
   b) Set the span to ≥ 1.5 times the DTS bandwidth;
   c) Set the RBW = 100kHz;
   d) Set the VBW ≥ 3×RBW;
   e) Detector function: Peak;
   f) Sweep = Auto Couple;
   g) Trace: Max hold;
   h) Allow the trace to stabilize;
   i) Use the peak marker function to determine the maximum PSD level;
   j) The channel found to contain the maximum PSD level can be used to establish the reference level.
3) Use the following spectrum analyzer settings to measure emission level:
   a) Set the center frequency and span to encompass frequency range to be measured;
   b) Set the RBW = 100kHz;
   c) Set the VBW ≥ 3×RBW;
   d) Detector function: Peak;
   e) Sweep = Auto Couple;
   f) Trace: Max hold;
   g) Allow the trace to stabilize;
   h) Use the peak marker function to determine the maximum amplitude level.

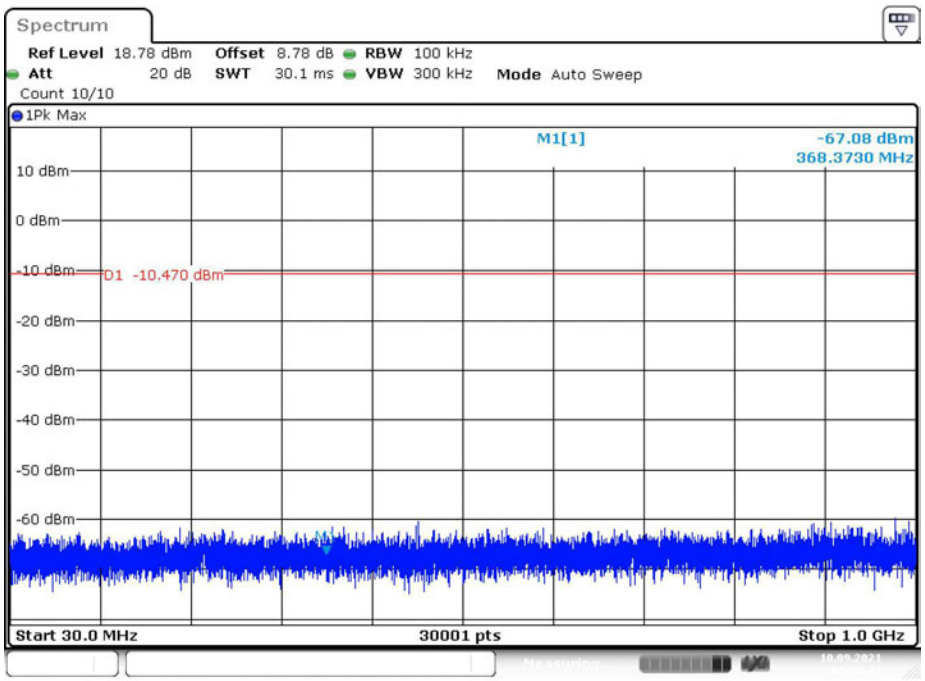
3.4.4. Test Result

Test Engineer	Xu Dongxu	**Test Date**	2021/09/10
Temperature	23.7°C	**Relative Humidity**	62.0%
Pressure	104.9kPa	**Test Sample Selected**	No.1

Modulation Type	**Channel**	**Frequency Range (MHz)**	**Ref Level (dBm)**	**Result (dBm)**	**-20dBc Limit (dBm)**
GFSK (BLE 1Mbps)	CH Lowest (No.0)	Reference	9.53	9.53	---
		30 ~ 1000	---	-60.39	≤-10.47
		1000 ~ 26500	---	-41.75	≤-10.47
	CH Middle (No.19)	Reference	10.30	10.30	---
		30 ~ 1000	---	-59.24	≤-9.70
		1000 ~ 26500	---	-42.70	≤-9.70
	CH Highest (No.39)	Reference	10.24	10.24	---
		30 ~ 1000	---	-60.03	≤-9.76
		1000 ~ 26500	--	-42.90	≤-9.76
GFSK (BLE 2Mbps)	CH Lowest (No.0)	Reference	8.14	8.14	---
		30 ~ 1000	--	-60.42	≤-11.86
		1000 ~ 26500	--	-43.47	≤-11.86
	CH Middle (No.19)	Reference	9.00	9.00	---
		30 ~ 1000	--	-59.32	≤-11
		1000 ~ 26500	--	-45.02	≤-11
	CH Highest (No.39)	Reference	8.47	8.47	---
		30 ~ 1000	---	-59.45	≤-11.53
		1000 ~ 26500	--	-45.99	≤-11.53

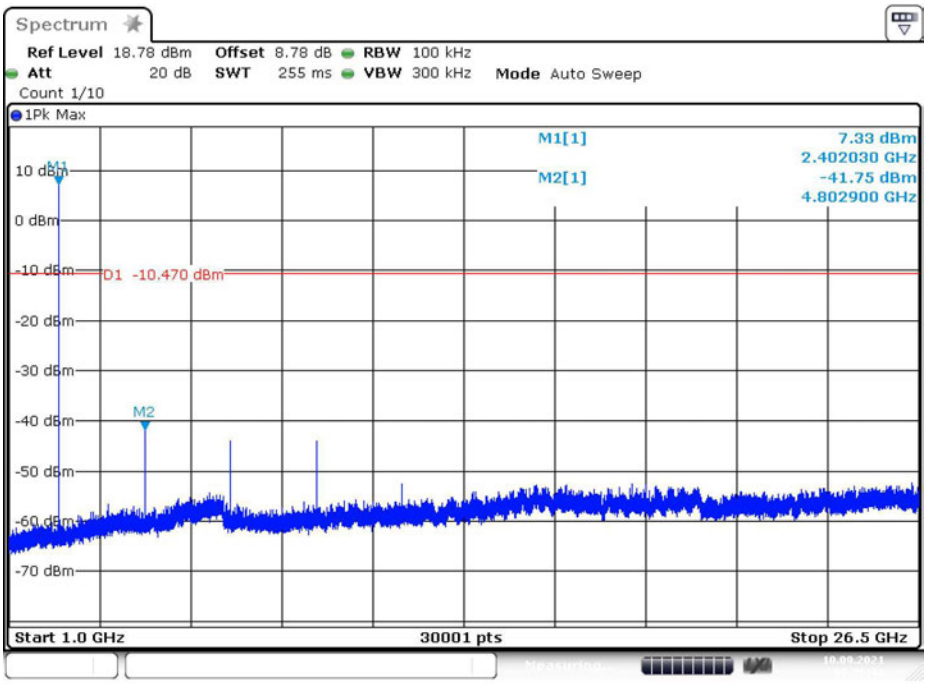
GFSK (BLE 1Mbps):
CH Lowest (No.0)





comment

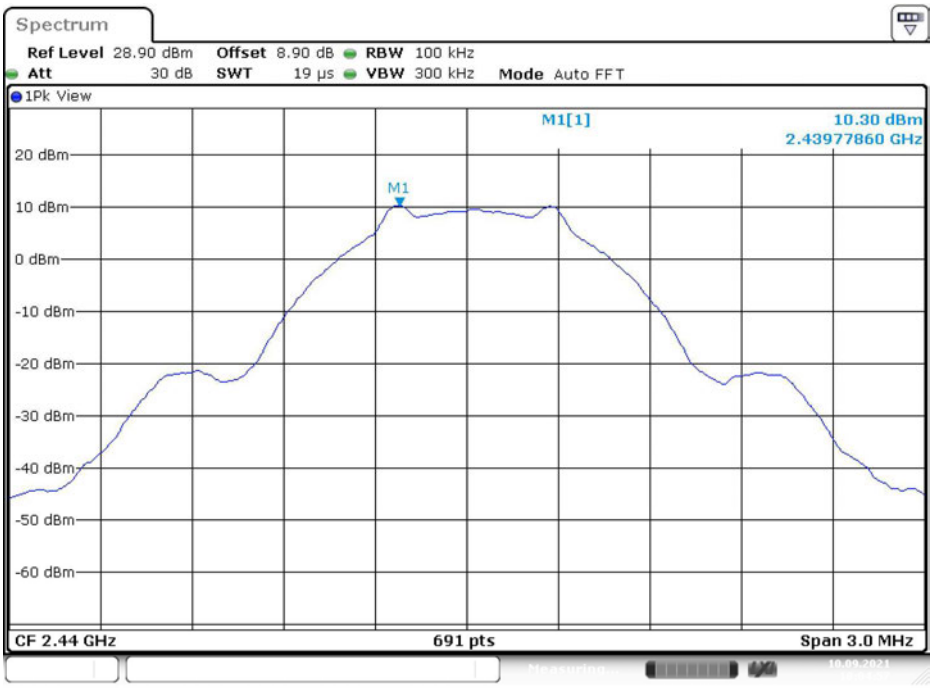
Date: 10.SEP.2021 09:56:21



comment

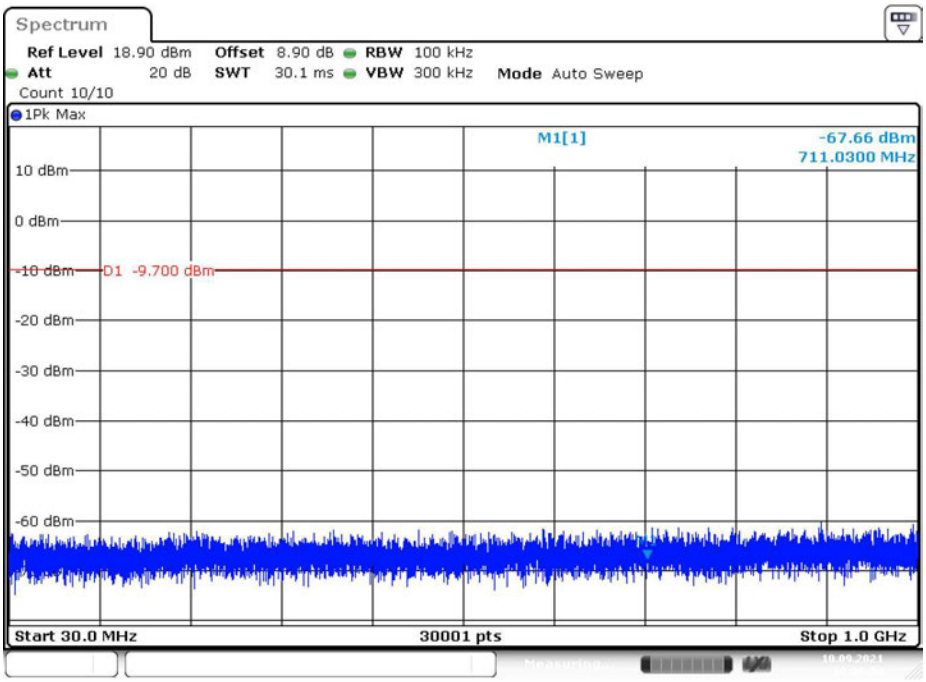
Date: 10.SEP.2021 09:56:44

CH Middle (No.19)



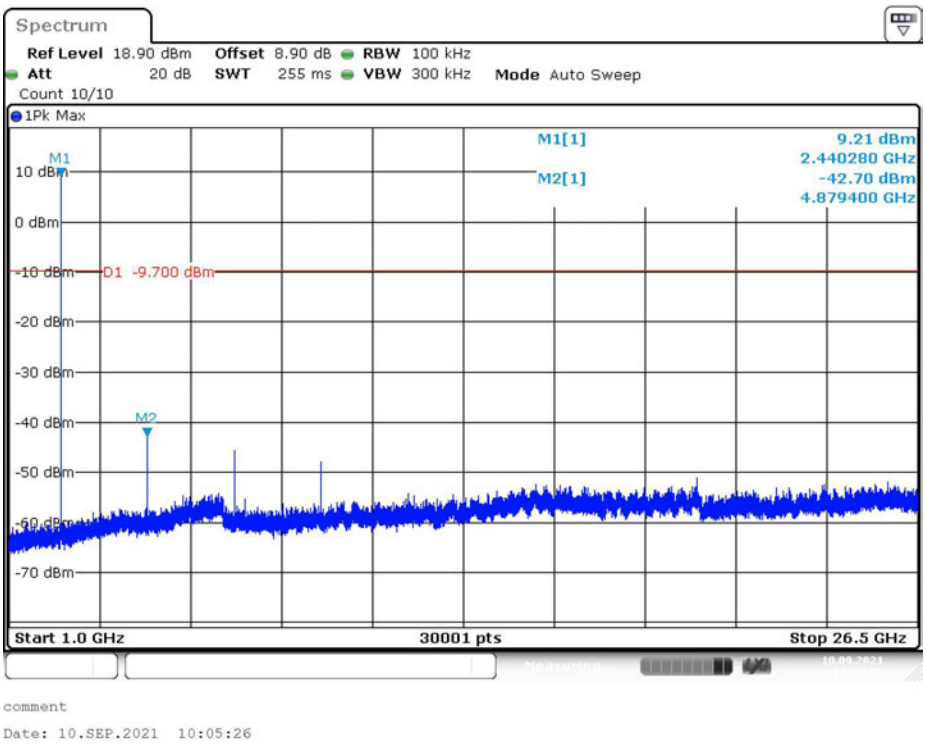
comment

Date: 10.SEP.2021 10:04:58



comment

Date: 10.SEP.2021 10:05:03



CH Highest (No.39)