FCC Part 15.247

TEST REPORT

For

KK Intelligent Technology Inc.

7F, No.495, Guangfu S. Rd, Xinyi Dist, Taipei City 110 Taiwan

FCC ID: 2BG7Q-MA000

Report Type:	**Product Type:**
Original Report	MATRIX R4 Controller Set

Report Producer : Coco Lin

Report Number : RXZ240731090RF01

Report Date : 2024-11-22

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ240731090	RXZ240731090RF01	2024-11-22	Original Report	Coco Lin

TABLE OF CONTENTS

1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	KK Intelligent Technology Inc.
	7F, No.495, Guangfu S. Rd, Xinyi Dist, Taipei City 110 Taiwan
Brand(Trade) Name	MATRIX
Product (Equipment)	MATRIX R4 Controller Set
Main Model Name	MA-000
Series Model Name	N/A
Frequency Range	IEEE 802.11b/g/n HT20 Mode: 2412 ~ 2462 MHz IEEE 802.11n HT40 Mode: 2422 ~ 2452 MHz BLE(1M): 2402 ~ 2480 MHz
Conducted Peak Output Power	IEEE 802.11b Mode: 15.29 dBm IEEE 802.11g Mode: 18.22 dBm IEEE 802.11n HT20 Mode: 16.68 dBm IEEE 802.11n HT40 Mode: 16.62 dBm BLE(1M) Mode : -7.18 dBm
Modulation Technique	IEEE 802.11b Mode: DSSS IEEE 802.11g Mode: OFDM IEEE 802.11n HT20 Mode: OFDM IEEE 802.11n HT40 Mode: OFDM BLE(1M) Mode: GFSK
Power Operation (Voltage Range)	Working Voltage : 5Vdc Input Voltage : 6Vdc ~ 24Vdc
Received Date	2024/08/29
Date of Test	2024/09/03 ~ 2024/11/01

*All measurement and test data in this report was gathered from production sample serial number: RXZ240731090-1 (Assigned by BACL, New Taipei Laboratory).

1.2 Objective

This report is prepared on behalf of *KK Intelligent Technology Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
KDB 558074 D01 15.247 Meas Guidance v05r02.

1.4 Statement

Decision Rule: No, (The test results do not include MU judgment)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.5 Measurement Uncertainty

Parameter		Uncertainty
AC Mains		+/- 3.02 dB
RF output power, conducted		+/- 0.57 dB
Power Spectral Density, conducted		+/- 0.60 dB
Occupied Bandwidth		+/- 0.09 %
Unwanted Emissions, conducted		+/- 1.09 dB
Emissions, radiated	9 kHz~30 MHz	+/- 3.20 dB
	30 MHz~1 GHz	+/- 3.30 dB
	1 GHz~18 GHz	+/- 5.14 dB
	18 GHz~40 GHz	+/- 4.75 dB
Temperature		+/- 0.76 °C
Humidity		+/- 0.41 %

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

1.6 Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2024/9/27~2024/10/29	23.8~24.7	42~61	1007.6~1011.1	Jing Chang
Radiation Spurious Emissions	2024/9/20~2024/11/1	23~25.1	63~69	1003.8~1011.6	Aaron Lin
Duty Cycle	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang
Conducted Spurious Emissions	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang
Emission Bandwidth	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang
Maximum Output Power	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang
100 kHz Bandwidth of Frequency Band Edge	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang
Power Spectral Density	2024/9/3~2024/10/21	23.5~25.4	51~52	1005.4~1014.3	Jing Chang

1.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 221, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: TW3732.

2 System Test Configuration

2.1 Description of Test Configuration

For WIFI 2.4GHz mode, there are totally 11 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

For 802.11 b/g/n HT20 Modes were tested with channel 1, 6 and 11.

For 802.11n HT40 Mode were tested with channel 3, 6 and 9.

For BLE mode, there are totally 40 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	--	--
2	2406	--	--
3	2408	37	2476
--	--	38	2478
19	2440	39	2480

For BLE Modes were tested with channel 0, 19 and 39.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

The test software was used “EspRFTestTool_v3.6”

The system was configured for testing in engineering mode, which was provided by Applicant.

Test Frequency		Low	Middle	High
Power Level Setting	802.11b Mode	0(default MAX)	0(default MAX)	0(default MAX)
	802.11g Mode	0(default MAX)	0(default MAX)	0(default MAX)
	802.11n HT20 Mode	0(default MAX)	0(default MAX)	0(default MAX)
	802.11n HT40 Mode	0(default MAX)	0(default MAX)	0(default MAX)
	BLE 1M	7	7	7

The worst case data rates are as follows:

802.11b: 1Mbps

802.11g: 6Mbps

802.11n HT20: MCS0

802.11n HT40: MCS0

BLE 1M : 1 Mbps

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number
NB	DELL	E6410
Battery*2	Panasonic	Panasonic-3400
Matrix Laser Sensor*3	MATRIX	MS-009
Matrix Color Sensor*3	MATRIX	MS-002V2
Matrix Gray Scale Sensor*6	MATRIX	MS-003V2
Matrix TT Encoder Motor*4	MATRIX	METT-MG001-BK

2.5 External Cable List and Details

Description	Manufacturer	Cable length
USB to Type-C cable	BACL	1.5M
JST Cable*16	MATRIX	216-22-220-5 JST 1007#24*4pin Dupont Line 1 black 2 red 3 white 4 blue213*2.5 20*25 20 +PH2.0+4F+FH2.0+4F-1 to 1

2.6 Test Mode

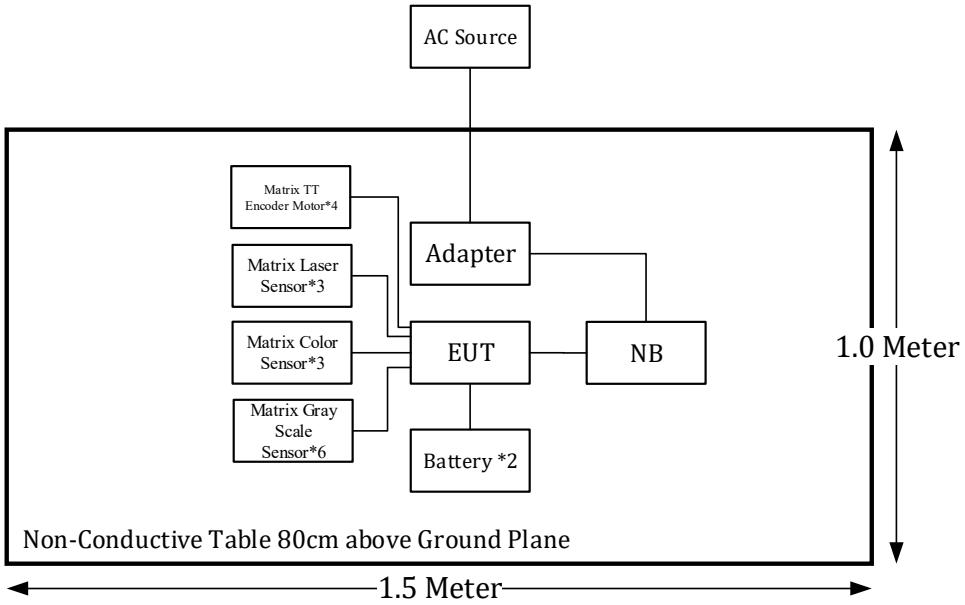
Full System (model: MA-000) for all test item.

2.7 Block Diagram of Test Setup

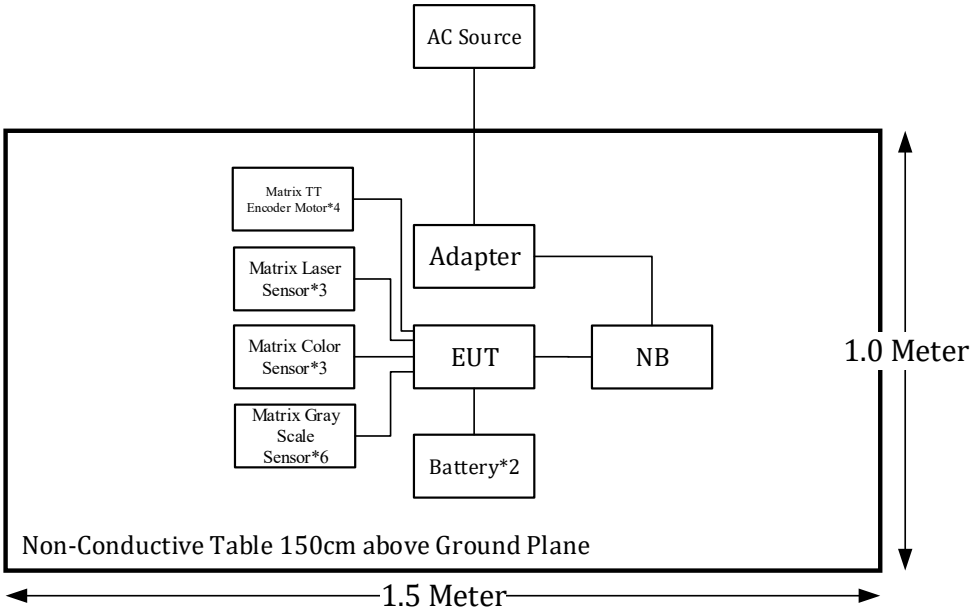
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

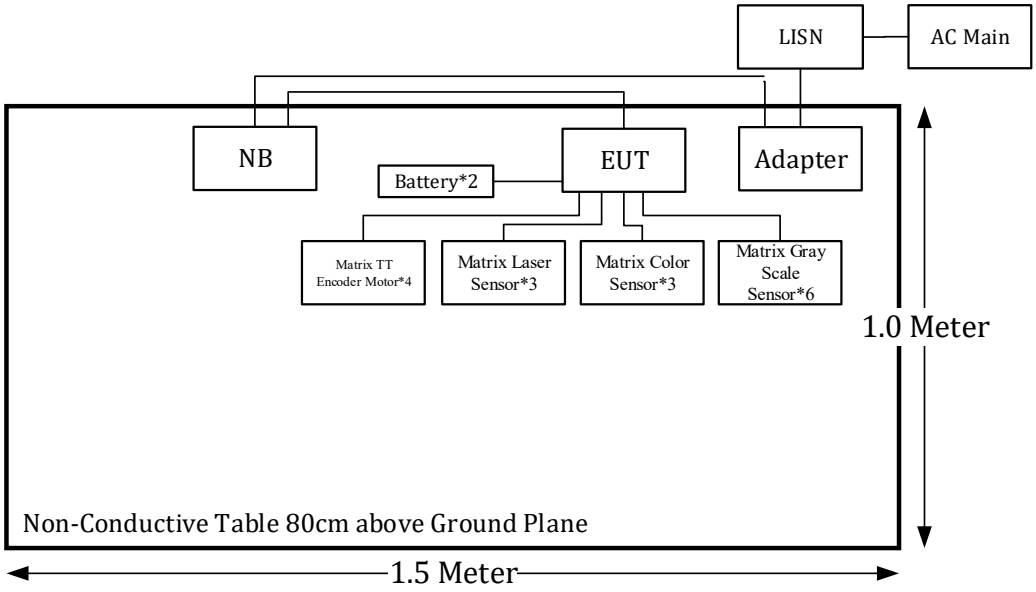
Below 1GHz



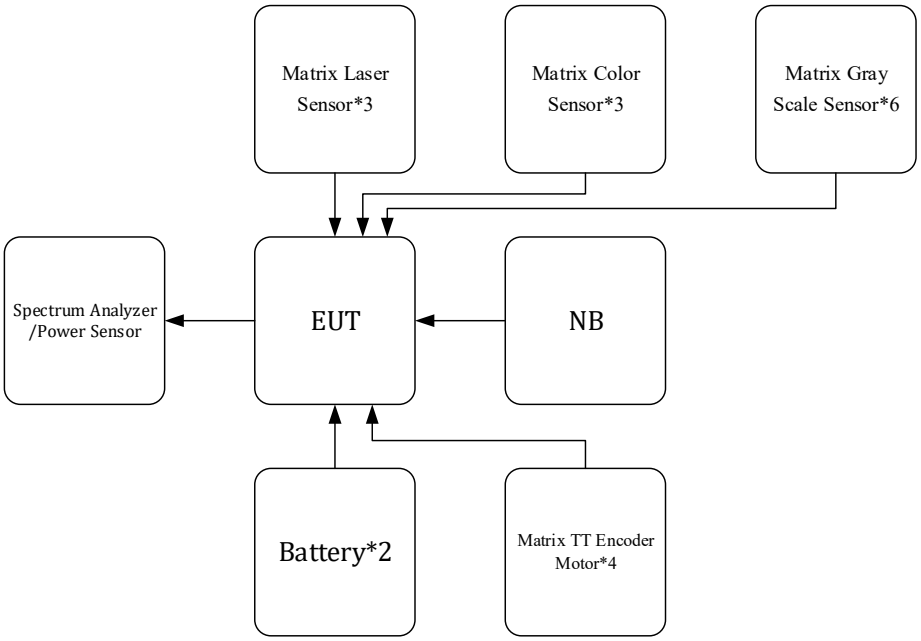
Above 1GHz:



Conduction:



Conducted:



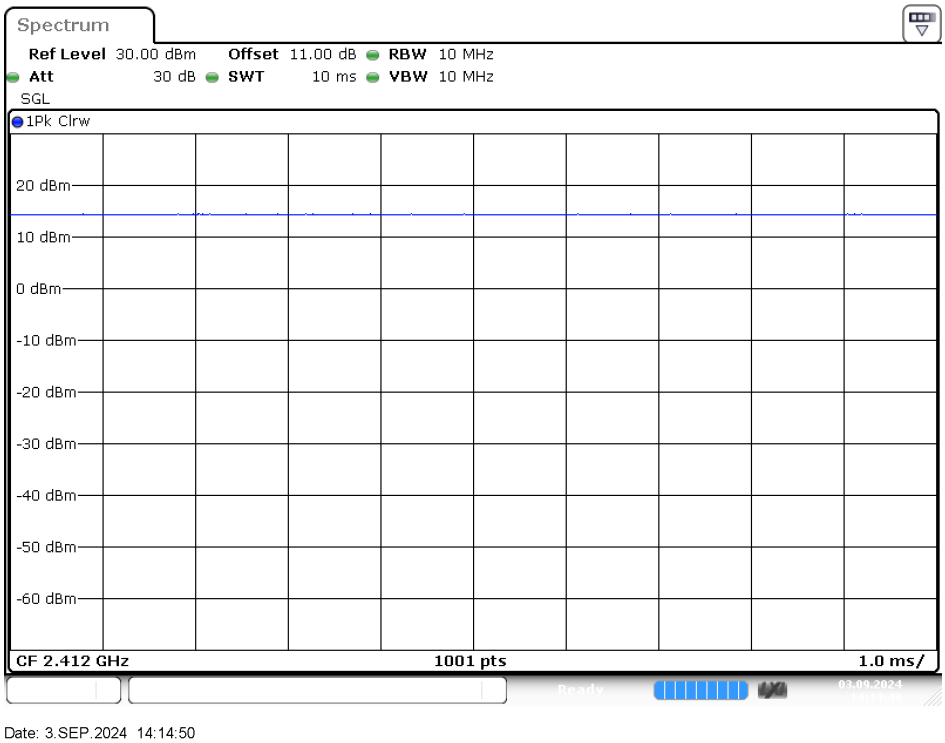
2.8 Duty Cycle

The duty cycle as below:

Radio Mode	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	1/T (kHz)	VBW Setting (kHz)
802.11b	100	100	100	/	0.01
802.11g	100	100	100	/	0.01
802.11n HT20	100	100	100	/	0.01
802.11n HT40	2.42	2.49	97	0.41	0.5
BLE(1M)	2.087	2.507	83	0.48	0.5

Please refer to the following plots.

B Mode



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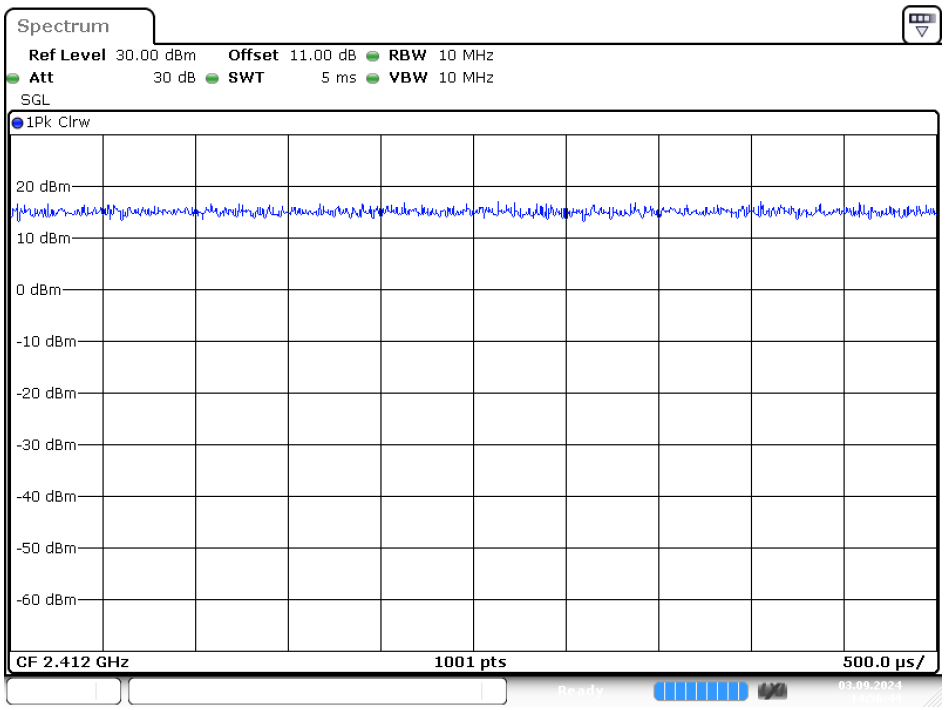
G Mode



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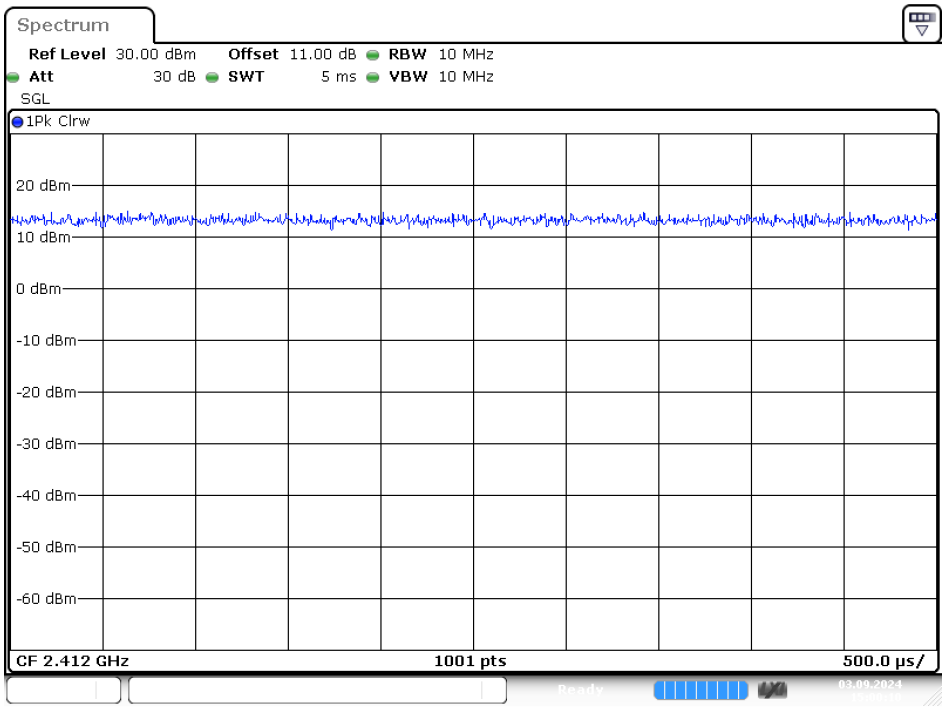
N20 Mode



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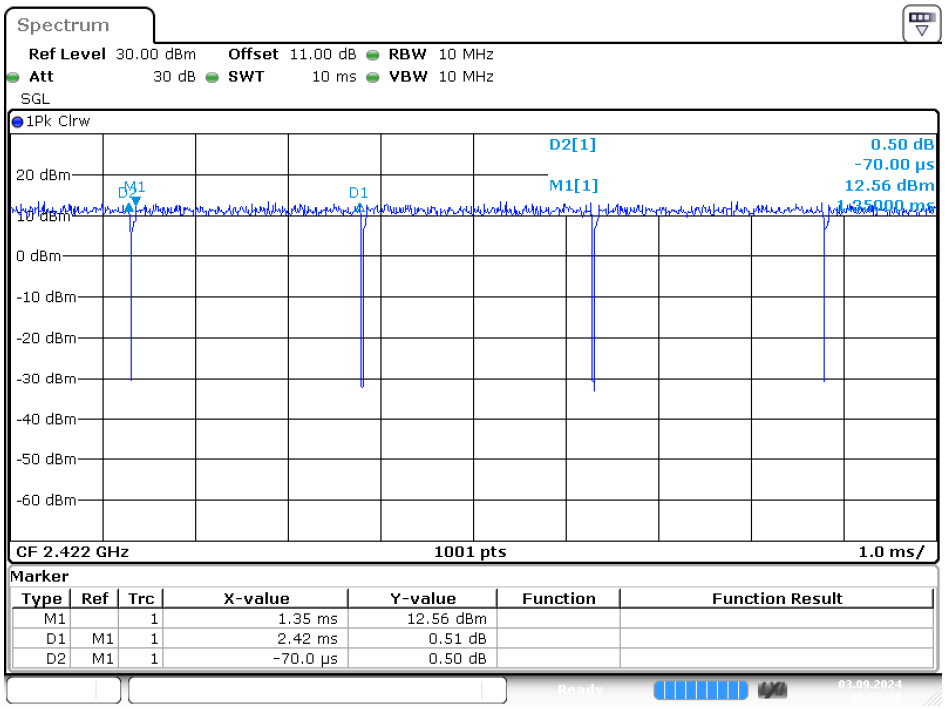
N40 Mode



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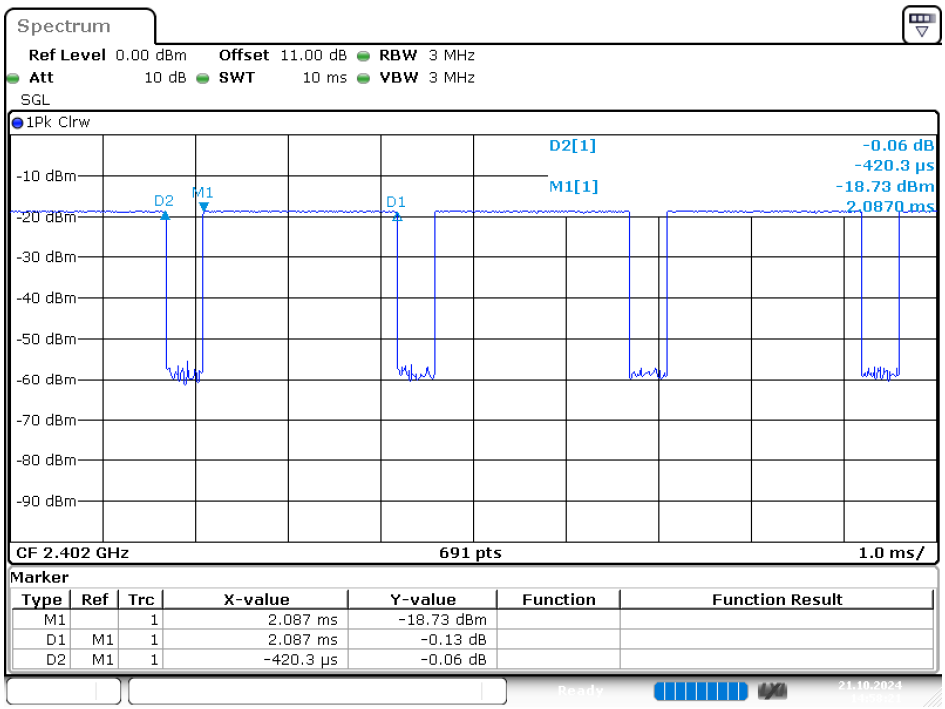
BLE(1M) Mode



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3 Summary of Test Results

Rules	Description of Test	Results
FCC §15.247(i), §1.1307(b)(3)(i)	RF Exposure	Compliance
FCC §15.203	Antenna Requirement	Compliance
FCC §15.207(a)	AC Line Conducted Emissions	Compliance
FCC §15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
FCC §15.247(a)(2)	Emission Bandwidth	Compliance
FCC §15.247(b)(3)	Maximum Peak Output Power	Compliance
FCC §15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC §15.247(e)	Power Spectral Density	Compliance

4 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2024/2/16	2025/2/15
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2024/5/24	2025/5/23
RF Cable	EMEC	EM-CB5D	1	2024/6/5	2025/6/4
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Active Loop Antenna	ETS-Lindgren	6502	35796	2024/3/27	2025/3/26
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2024/1/19	2025/1/18
Double Ridged Guide Horn Antenna	A.H. system	SAS-571	1020	2024/5/21	2025/5/20
Horn Antenna	ETS-Lindgren	3116	62638	2024/8/30	2025/8/29
Preamplifier	Sonoma	310N	130601	2024/1/29	2025/1/28
Preamplifier	Channel	ERA-100M-18G-01D1748	EC2300051	2024/3/29	2025/3/28
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2024/1/8	2025/1/7
Spectrum Analyzer	Rohde & Schwarz	FSV40	101939	2024/3/27	2025/3/26
EMI Test Receiver	Rohde & Schwarz(R&S)	ESR3	102099	2024/6/24	2025/6/23
Microflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2024/1/23	2025/1/22
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2024/1/23	2025/1/22
Coaxial Cable	COMMATE	PEWC	8Dr	2023/12/23	2024/12/22
Cable	EMC	EMC105-SM-SM-10000	201003	2024/1/23	2025/1/22
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2023/12/23	2024/12/22
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2024/1/23	2025/1/22
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2024/1/23	2025/1/22
Band-stop filter	Woken	STI15-9831	STI15-9831-1	2023/10/20	2024/10/19
				2024/10/19	2025/10/19
High-pass filter	XINGBOKEJI	XBLBQ-GTA54	200108-3-2	2023/10/20	2024/10/19
				2024/10/19	2025/10/19
Software	AUDIX	E3	18621a	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz(R&S)	FSV40	101204	2024/5/30	2025/5/29
Cable	UTIFLEX	UFA210A	9435	2023/10/2	2024/10/1
				2024/10/1	2025/10/1
Power Sensor	Boonton	RTP5006	11037	2024/5/21	2025/5/20
Attenuator	MCL	BW-S10W5+	1419	2024/2/23	2025/2/22

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

5 FCC §15.247(i), §1.1307(b)(3)(i) - RF Exposure

5.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1307(b)(3)(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

6

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

5.2 RF Exposure Evaluation Result

Project info

Band	Freq (MHz)	Tune-up Power (dBm)	Ant Gain (dBi)	Distances (mm)	Tune-up Power (mW)	ERP (dBm)	ERP (mW)
WiFi 2.4GHz	2412	18.5	4.54	200	70.79	20.89	122.74
BLE	2402	-7	4.54	200	0.20	-4.61	0.35

§ 1.1307(b)(3)(i)(A) method is not applicable.

§ 1.1307(b)(3)(i)(C)

Band	Freq (MHz)	λ/2π (mm)	Distances applies	ERP Limit (mW)	Result Option C
WiFi 2.4GHz	2412	19.8	apply	768.00	exempt
BLE	2402	19.88	apply	768.00	exempt

The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates
ERP (watts) is no more than the calculated value prescribed for that frequency
R must be at least $\lambda/2\pi$
λ is the free-space operating wavelength in meters

Note: The Tune-up output power was declared by the Applicant.
Wi-Fi 2.4G and BLE can't transmit simultaneously.

Result: The device compliant the RF exposure evaluation at 20cm distance.

6 FCC §15.203 – Antenna Requirements

6.1 Applicable Standard

According to §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 user of a standard antenna jack or electrical connector is prohibited.

6.2 Antenna Information

Manufacturer	Model	Type	Antenna Gain	Impedance
Espressif Systems	ESP32-S3-MINI-1	PCB Antenna	4.54 dBi	50Ω

Antenna was permanently attached to the unit.

Result: Compliance

7 FCC §15.207(a) – AC Line Conducted Emissions

7.1 Applicable Standard

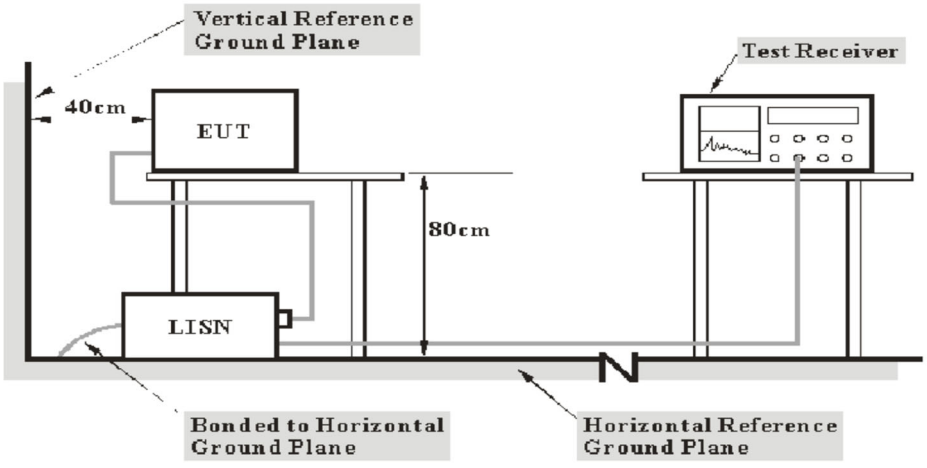
According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

7.2 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

7.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150kHz – 30MHz	9kHz

7.4 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

7.5 Corrected Factor & Over Limit Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The “Over Limit” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Result – Limit Line

7.6 Test Results

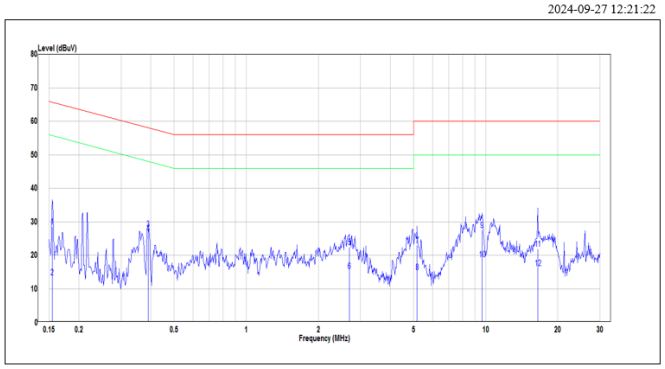
Test Mode: Transmitting

Main: AC120 V, 60 Hz

WIFI Mode

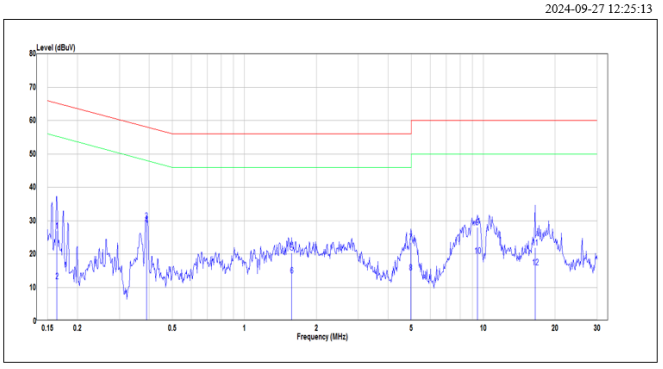
(Worst case is 802.11g mode, High Channel)

Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark	Phase
	(MHz)	dBuV	Factor(dB)	dBuV	dBuV	(dB)		
1	0.155	18.60	9.84	28.44	65.74	-37.29	QP	Line
2	0.155	3.55	9.84	13.39	55.74	-42.35	Average	Line
3	0.389	17.58	10.18	27.76	58.08	-30.32	QP	Line
4	0.389	16.26	10.18	26.43	48.08	-21.64	Average	Line
5	2.692	12.07	10.36	22.43	56.00	-33.57	QP	Line
6	2.692	4.90	10.36	15.26	46.00	-30.74	Average	Line
7	5.166	12.56	10.41	22.97	60.00	-37.03	QP	Line
8	5.166	4.63	10.41	15.04	50.00	-34.96	Average	Line
9	9.654	17.05	10.45	27.50	60.00	-32.50	QP	Line
10	9.654	8.33	10.45	18.78	50.00	-31.22	Average	Line
11	16.486	11.30	10.58	21.88	60.00	-38.12	QP	Line
12	16.486	5.63	10.58	16.21	50.00	-33.79	Average	Line

Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark	Phase
	(MHz)	dBuV	Factor(dB)	dBuV	dBuV	(dB)		
1	0.164	17.11	9.89	27.00	65.25	-38.25	QP	Neutral
2	0.164	1.99	9.89	11.88	55.25	-43.37	Average	Neutral
3	0.389	19.65	10.19	29.84	58.08	-28.24	QP	Neutral
4	0.389	18.50	10.19	28.69	48.08	-19.39	Average	Neutral
5	1.577	9.93	10.35	20.28	56.00	-35.72	QP	Neutral
6	1.577	3.25	10.35	13.60	46.00	-32.40	Average	Neutral
7	4.978	13.02	10.41	23.43	56.00	-32.57	QP	Neutral
8	4.978	4.09	10.41	14.50	46.00	-31.50	Average	Neutral
9	9.451	17.57	10.46	28.03	60.00	-31.97	QP	Neutral
10	9.451	9.00	10.46	19.47	50.00	-30.53	Average	Neutral
11	16.486	11.22	10.63	21.86	60.00	-38.14	QP	Neutral
12	16.486	5.44	10.63	16.07	50.00	-33.93	Average	Neutral

Note:

Result = Reading + Factor

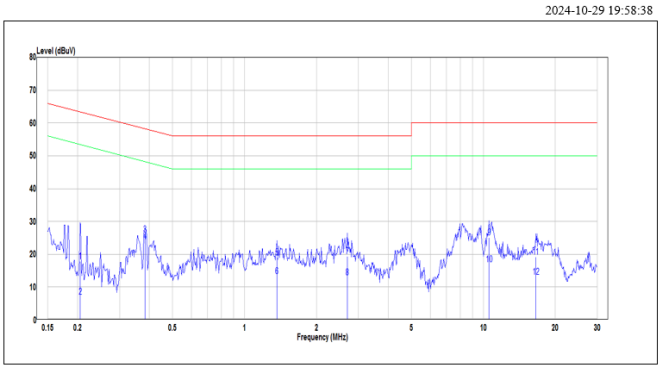
Over Limit = Result – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

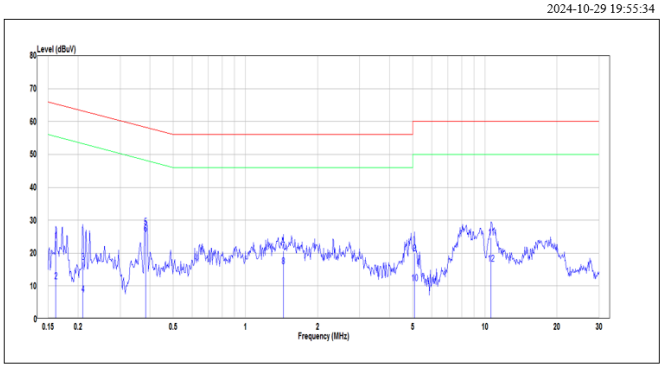
BLE 1M Mode

(Worst case is Middle Channel)

Line	Neutral



No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.205	7.84	10.03	17.87	63.40	-45.53	QP	Line
2	0.205	-2.97	10.03	7.06	53.40	-46.34	Average	Line
3	0.383	15.86	10.17	26.03	58.21	-32.18	QP	Line
4	0.383	13.72	10.17	23.89	48.21	-24.32	Average	Line
5	1.367	8.66	10.34	19.00	56.00	-37.00	QP	Line
6	1.367	2.91	10.34	13.25	46.00	-32.75	Average	Line
7	2.692	8.95	10.36	19.30	56.00	-36.70	QP	Line
8	2.692	2.49	10.36	12.84	46.00	-33.16	Average	Line
9	10.564	14.71	10.46	25.17	60.00	-34.83	QP	Line
10	10.564	6.44	10.46	16.90	50.00	-33.10	Average	Line
11	16.573	8.66	10.58	19.24	60.00	-40.76	QP	Line
12	16.573	2.53	10.58	13.11	50.00	-36.89	Average	Line



No.	Frequency (MHz)	Reading dBuV	Correct Factor(dB)	Result dBuV	Limit dBuV	Over limit (dB)	Remark	Phase
1	0.162	13.91	9.88	23.79	65.38	-41.59	QP	Neutral
2	0.162	1.61	9.88	11.49	55.38	-43.90	Average	Neutral
3	0.209	7.26	10.05	17.31	63.23	-45.92	QP	Neutral
4	0.209	-2.65	10.05	7.40	53.23	-45.83	Average	Neutral
5	0.383	17.81	10.18	27.99	58.21	-30.22	QP	Neutral
6	0.383	15.76	10.18	25.94	48.21	-22.27	Average	Neutral
7	1.441	10.42	10.35	20.77	56.00	-35.23	QP	Neutral
8	1.441	5.59	10.35	15.94	46.00	-30.06	Average	Neutral
9	5.085	9.59	10.41	20.00	60.00	-40.00	QP	Neutral
10	5.085	0.33	10.41	10.75	50.00	-39.25	Average	Neutral
11	10.620	14.18	10.49	24.67	60.00	-35.33	QP	Neutral
12	10.620	6.23	10.49	16.72	50.00	-33.28	Average	Neutral

Note:

Result = Reading + Factor

Over Limit = Result – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

8 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	608 – 614	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	5. 35 – 5. 46
2.1735 – 2.1905	16.80425 – 16.80475	1300 – 1427	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1435 – 1626.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1645.5 – 1646.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1660 – 1710	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1718.8 – 1722.2	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2200 – 2300	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2310 – 2390	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2483.5 – 2500	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2690 – 2900	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3260 – 3267	22.01 – 23.12
8.41425 – 8.41475	162.0125 –167.17	3.332 – 3.339	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3 3458 – 3 358	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3.600 – 4.400	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

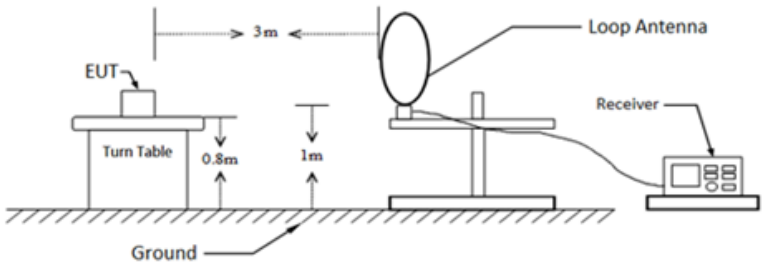
According to ANSI C63.10-2013, section 5.3.3

Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field, and the emissions to be measured can be detected by the measurement equipment (see 4.3.4). Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. Measurements from 18 GHz to 40 GHz are typically made at distances significantly less than 3 m from the EUT. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade of distance (inverse of linear distance for field-strength measurements or inverse of linear distance-squared for power-density measurements).

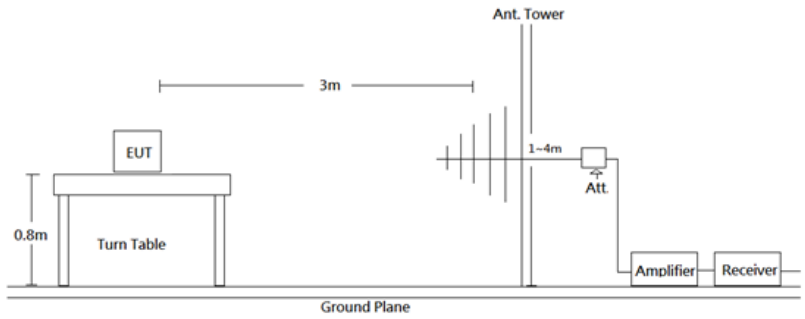
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided 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 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions 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).

8.2 EUT Setup

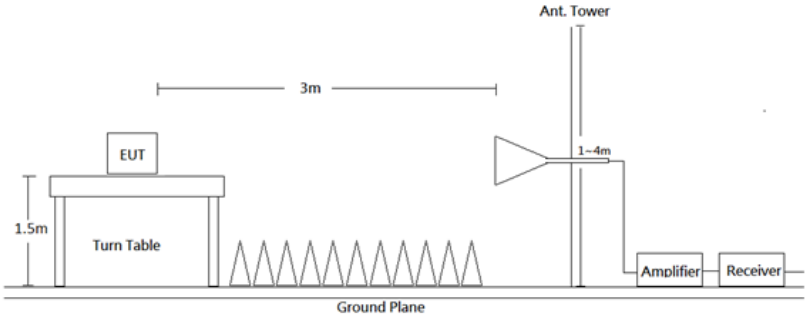
9kHz-30MHz:



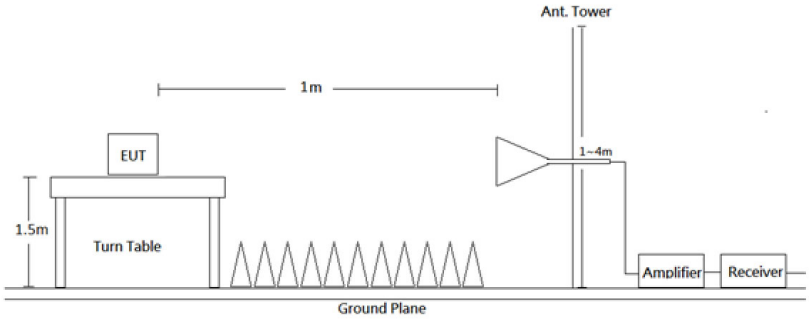
30MHz-1GHz:



1-18 GHz:



18-26.5 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209, FCC 15.247 Limits.

8.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method	Detector
9 kHz - 150 kHz	300 Hz	1 kHz	/	QP/AV	QP/AV
150 kHz - 30 MHz	10 kHz	30 kHz	/	QP/AV	QP/AV
30-1000 MHz	120 kHz	300 kHz	/	QP	QP
Above 1 GHz	Pre-scan :				
	1 MHz	3 MHz	/	PK	PK
	1 MHz	3 kHz	>98%	Ave	Ave
	1 MHz	≥ 1/Ton, not less than 3 kHz	<98%	Ave	Ave
	Final measurement for emission identified during pre-scan :				
	1 MHz	3 MHz	/	PK	PK
	1 MHz	10 Hz	>98%	Ave	Ave
	1 MHz	≥ 1/Ton	<98%	Ave	Ave

Note: Ton is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

8.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in Quasi-peak and average detector mode from 9 kHz to 30 MHz, Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

8.5 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Level – Limit

8.6 Test Results

Test Mode: Transmitting

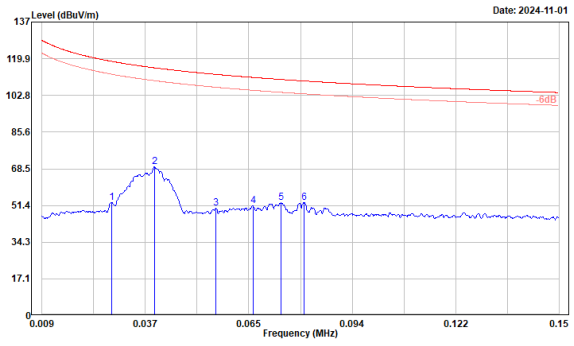
(Pre-scan with three orthogonal axis, and worse case as X axis.)

9kHz-30MHz:

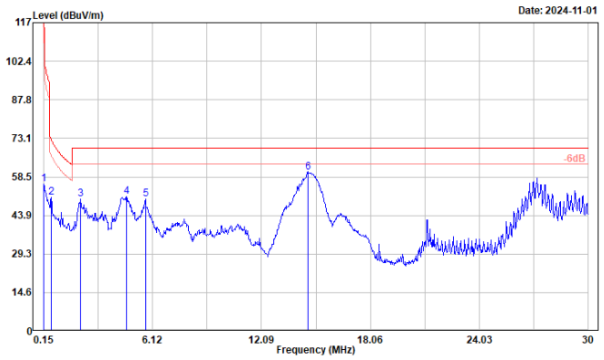
(Pre-scan using three directional polarities, worst case as parallel.)

WIFI Mode (Worst case is 802.11g mode, high channel)

9kHz-150kHz	150kHz-30MHz



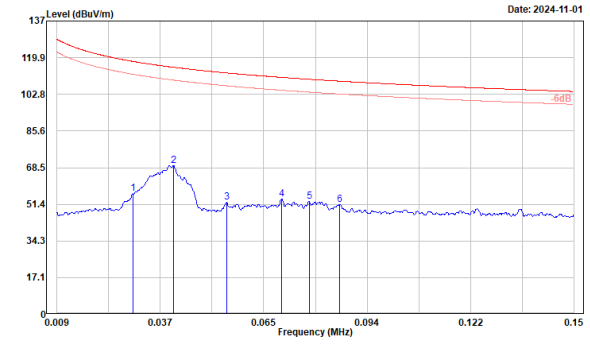
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.028	38.80	13.98	52.78	118.65	-65.87	100	360	Average
0.040	56.37	12.94	69.31	115.62	-46.31	100	360	Average
0.057	37.87	12.08	49.95	112.56	-62.61	100	360	Average
0.067	39.55	11.61	51.16	111.14	-59.98	100	360	Average
0.074	41.18	11.44	52.62	110.20	-57.58	100	360	Average
0.080	41.58	11.32	52.90	109.49	-56.59	100	360	Average



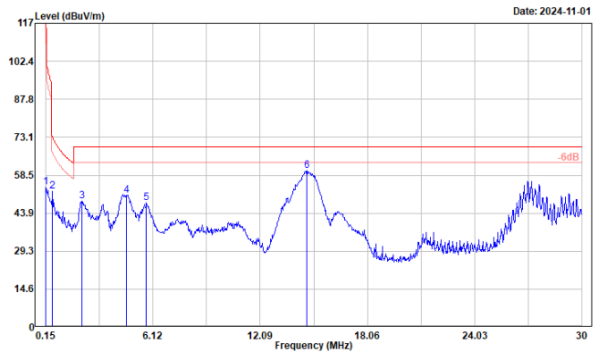
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.150	44.53	11.37	55.90	104.08	-48.18	100	360	Average
0.568	39.16	11.48	50.64	72.52	-21.88	100	360	QP
2.180	39.28	10.69	49.97	69.54	-19.57	100	360	QP
4.687	40.31	10.66	50.97	69.54	-18.57	100	360	QP
5.732	38.57	11.52	50.09	69.54	-19.45	100	360	QP
14.627	48.82	11.58	60.40	69.54	-9.14	100	360	QP

BLE(1M) Mode (Worst case is Middle channel)

9kHz-150kHz	150kHz-30MHz



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.030	42.67	13.75	56.42	118.14	-61.72	100	0	Average
0.041	56.65	12.89	69.54	115.38	-45.84	100	0	Average
0.055	40.04	12.18	52.22	112.76	-60.54	100	0	Average
0.070	42.39	11.51	53.90	110.66	-56.76	100	0	Average
0.078	41.52	11.36	52.88	109.78	-56.90	100	0	Average
0.086	40.10	11.32	51.42	108.90	-57.48	100	0	Average



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
0.150	42.62	11.37	53.99	104.08	-50.09	100	0	Average
0.538	40.88	11.47	52.35	72.99	-20.64	100	0	QP
2.150	37.90	10.70	48.60	69.54	-20.94	100	0	QP
4.657	40.13	10.66	50.79	69.54	-18.75	100	0	QP
5.762	36.28	11.55	47.83	69.54	-21.71	100	0	QP
14.687	48.55	11.58	60.13	69.54	-9.41	100	0	QP

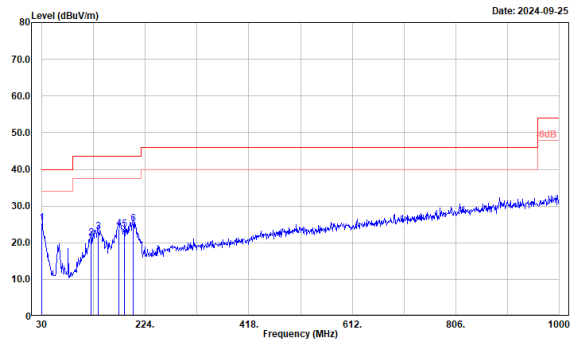
WIFI Mode

30MHz-1GHz:

(Worst case is 802.11g mode)

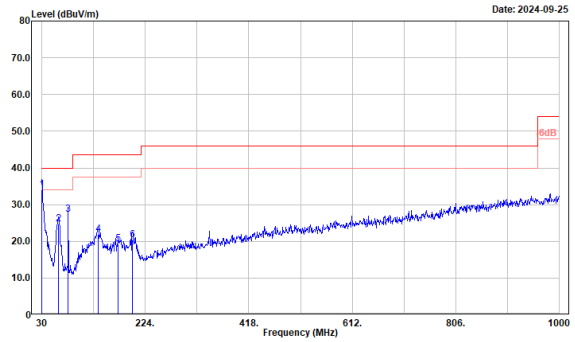
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	27.82	-2.53	25.29	40.00	-14.71	100	110	QP
122.150	30.62	-9.27	21.35	43.50	-22.15	100	60	QP
135.730	32.44	-9.48	22.96	43.50	-20.54	100	45	QP
174.530	35.32	-11.47	23.85	43.50	-19.65	100	335	QP
185.200	35.46	-11.83	23.63	43.50	-19.87	100	175	QP
201.690	35.54	-10.44	25.10	43.50	-18.40	100	343	QP

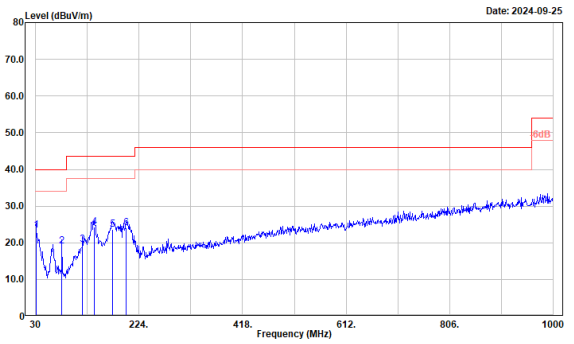
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	36.47	-2.53	33.94	40.00	-6.06	100	180	QP
61.040	40.65	-15.83	24.82	40.00	-15.18	100	116	QP
79.470	42.94	-15.63	27.31	40.00	-12.69	100	360	QP
135.730	31.36	-9.48	21.88	43.50	-21.62	100	193	QP
173.560	30.84	-11.48	19.36	43.50	-24.14	100	303	QP
199.750	30.29	-9.83	20.46	43.50	-23.04	100	306	QP

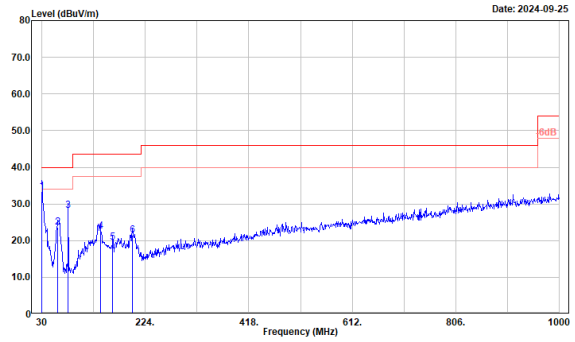
Middle channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.970	26.38	-3.00	23.38	40.00	-16.62	100	56	QP
79.470	34.62	-15.63	18.99	40.00	-21.01	100	67	QP
118.270	29.12	-9.60	19.52	43.50	-23.98	100	71	QP
139.610	33.89	-9.67	24.22	43.50	-19.28	100	52	QP
174.530	35.16	-11.47	23.69	43.50	-19.81	100	335	QP
199.750	33.94	-9.83	24.11	43.50	-19.39	100	360	QP

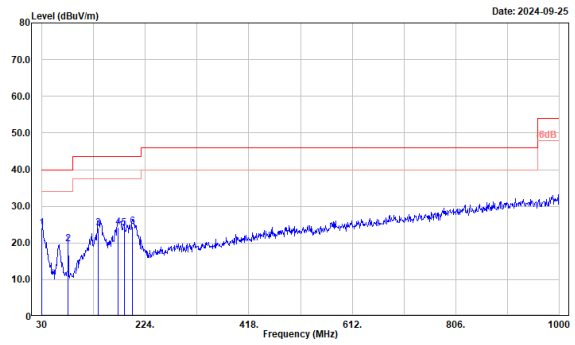
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	35.99	-2.53	33.46	40.00	-6.54	100	143	QP
60.070	39.35	-15.75	23.60	40.00	-16.40	100	83	QP
79.470	43.80	-15.63	28.17	40.00	-11.83	100	232	QP
139.610	32.16	-9.67	22.49	43.50	-21.01	100	182	QP
162.890	29.85	-10.40	19.45	43.50	-24.05	100	288	QP
199.750	31.32	-9.83	21.49	43.50	-22.01	100	323	QP

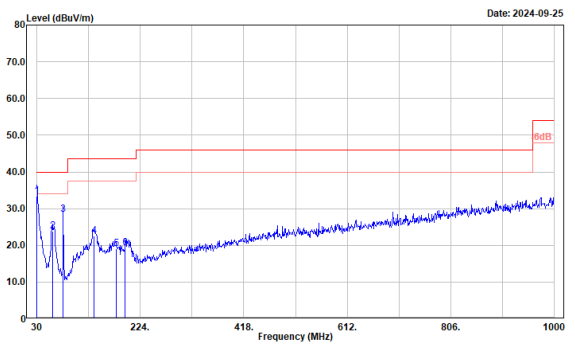
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	26.58	-2.53	24.05	40.00	-15.95	100	322	QP
79.470	35.41	-15.63	19.78	40.00	-20.22	100	203	QP
135.730	33.60	-9.48	24.12	43.50	-19.38	100	40	QP
172.590	35.71	-11.40	24.31	43.50	-19.19	100	360	QP
184.230	35.79	-11.83	23.96	43.50	-19.54	100	336	QP
199.750	34.41	-9.83	24.58	43.50	-18.92	100	358	QP

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
30.000	35.90	-2.53	33.37	40.00	-6.63	100	168	QP
59.100	39.84	-15.92	23.92	40.00	-16.08	100	92	QP
79.470	44.12	-15.63	28.49	40.00	-11.51	100	207	QP
136.700	32.21	-9.58	22.63	43.50	-20.87	100	199	QP
178.410	30.84	-11.74	19.10	43.50	-24.40	100	252	QP
195.870	29.94	-10.56	19.38	43.50	-24.12	100	322	QP

Level = Reading + Factor.

Margin = Level – Limit.

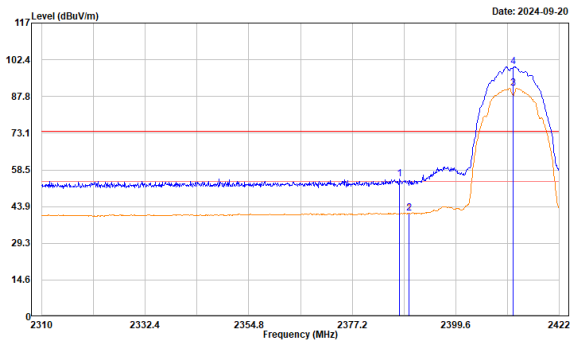
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Band-Edge:

802.11b Mode

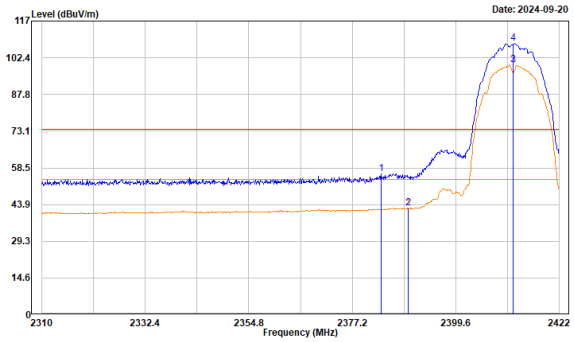
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2387.504	65.99	-11.10	54.89	74.00	-19.11	111	314	Peak
2389.408	52.38	-11.09	41.29	54.00	-12.71	111	314	Average
2412.000	102.11	-11.02	91.09			111	314	Average
2412.000	110.60	-11.02	99.58			111	314	Peak

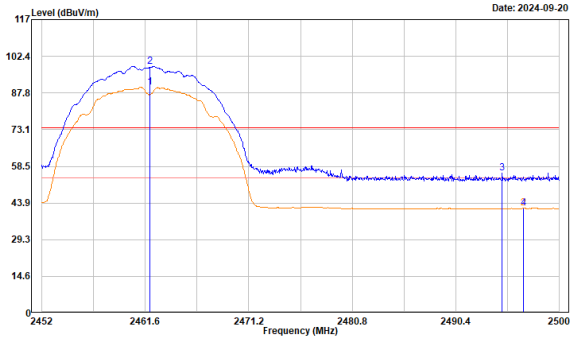
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2383.472	67.32	-11.14	56.18	74.00	-17.82	130	2	Peak
2389.296	53.50	-11.09	42.41	54.00	-11.59	130	2	Average
2412.000	110.43	-11.02	99.41			130	2	Average
2412.000	119.02	-11.02	108.00			130	2	Peak

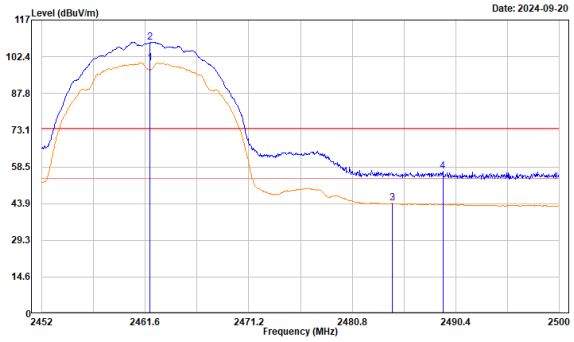
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	100.92	-10.88	90.04			112	317	Average
2462.000	109.19	-10.88	98.31			112	317	Peak
2494.720	66.35	-10.48	55.87	74.00	-18.13	112	317	Peak
2496.688	52.45	-10.46	41.99	54.00	-12.01	112	317	Average

Vertical

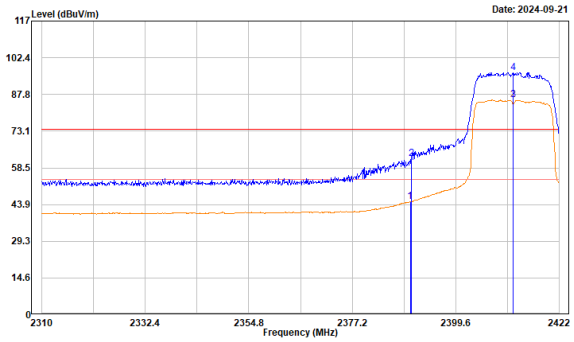


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	110.91	-10.88	100.03			105	4	Average
2462.000	119.08	-10.88	108.20			105	4	Peak
2484.496	54.55	-10.60	43.95	54.00	-10.05	105	4	Average
2489.200	67.29	-10.55	56.74	74.00	-17.26	105	4	Peak

802.11g mode

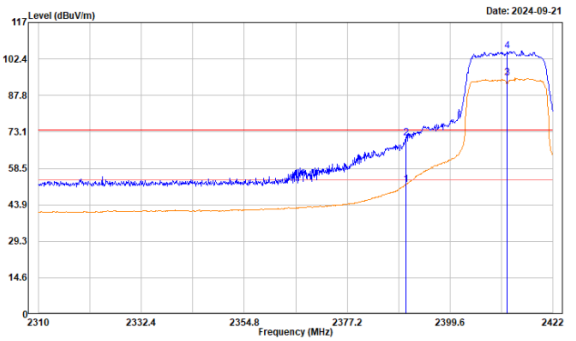
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.744	56.22	-11.09	45.13	54.00	-8.87	110	321	Average
2389.968	73.20	-11.09	62.11	74.00	-11.89	110	321	Peak
2412.000	96.51	-11.02	85.49			110	321	Average
2412.000	107.47	-11.02	96.45			110	321	Peak

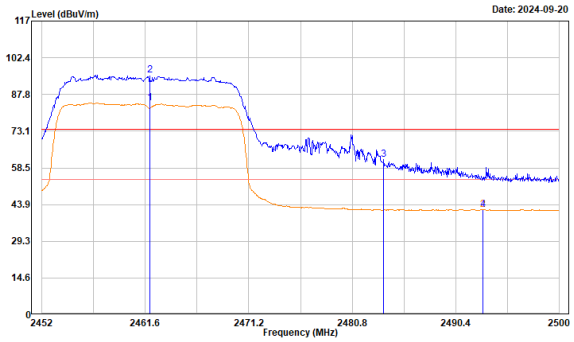
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.968	63.24	-11.09	52.15	54.00	-1.85	119	9	Average
2389.968	81.76	-11.09	70.67	74.00	-3.33	119	9	Peak
2412.000	105.70	-11.02	94.68			119	9	Average
2412.000	116.66	-11.02	105.64			119	9	Peak

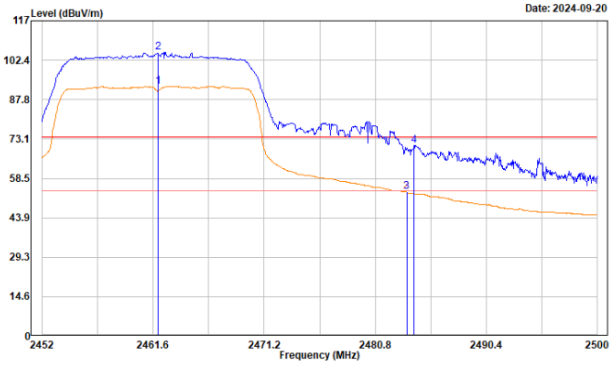
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	95.28	-10.88	84.40			113	315	Average
2462.000	106.24	-10.88	95.36			113	315	Peak
2483.728	72.30	-10.61	61.69	74.00	-12.31	113	315	Peak
2492.944	52.38	-10.50	41.88	54.00	-12.12	113	315	Average

Vertical

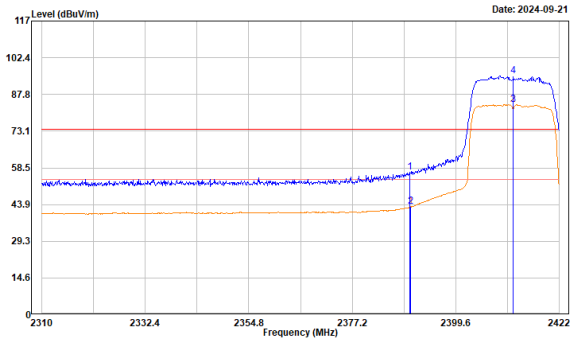


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	103.56	-10.88	92.68			148	296	Average
2462.000	116.23	-10.88	105.35			148	296	Peak
2483.522	64.08	-10.61	53.47	54.00	-0.53	148	296	Average
2484.160	81.31	-10.60	70.71	74.00	-3.29	148	296	Peak

802.11n HT20 Mode

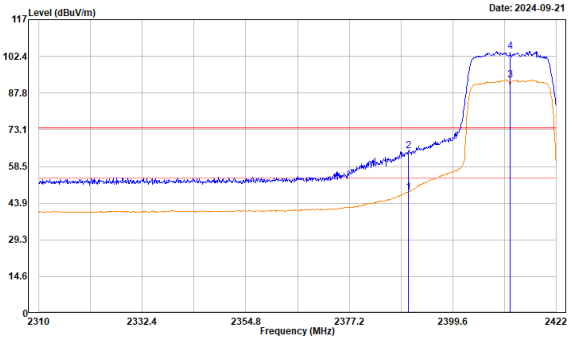
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.632	67.99	-11.09	56.90	74.00	-17.10	109	321	Peak
2389.856	54.12	-11.09	43.03	54.00	-10.97	109	321	Average
2412.000	94.66	-11.02	83.64			109	321	Average
2412.000	106.23	-11.02	95.21			109	321	Peak

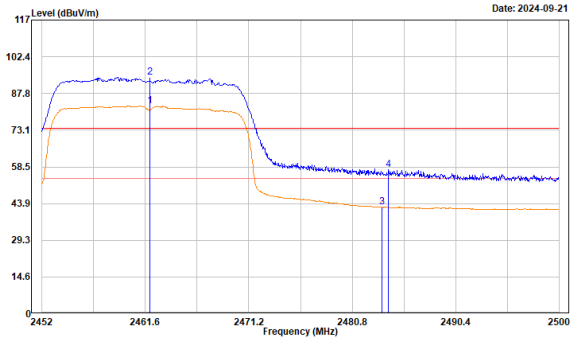
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.968	59.38	-11.09	48.29	54.00	-5.71	167	10	Average
2389.968	75.80	-11.09	64.71	74.00	-9.29	167	10	Peak
2412.000	103.97	-11.02	92.95			167	10	Average
2412.000	115.29	-11.02	104.27			167	10	Peak

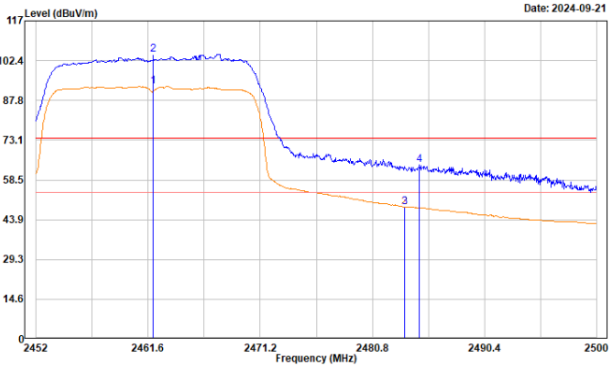
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	93.64	-10.88	82.76			103	254	Average
2462.000	104.99	-10.88	94.11			103	254	Peak
2483.584	53.05	-10.61	42.44	54.00	-11.56	103	254	Average
2484.160	68.05	-10.60	57.45	74.00	-16.55	103	254	Peak

Vertical

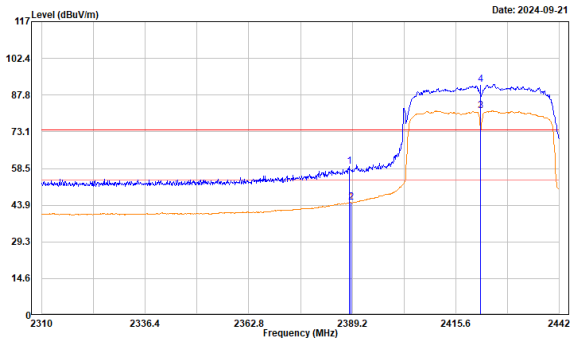


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2462.000	103.83	-10.88	92.95			143	6	Average
2462.000	115.55	-10.88	104.67			143	6	Peak
2483.540	59.25	-10.61	48.64	54.00	-5.36	143	6	Average
2484.832	74.76	-10.59	64.17	74.00	-9.83	143	6	Peak

802.11n HT40 Mode

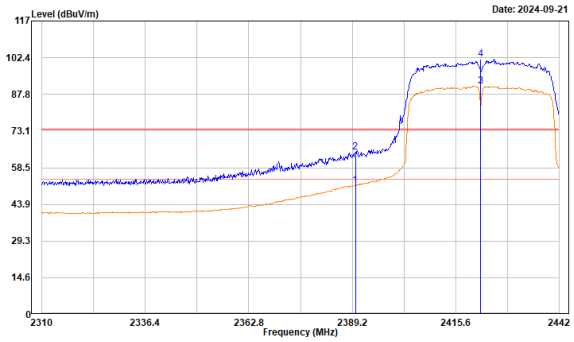
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2388.408	70.30	-11.10	59.20	74.00	-14.80	119	322	Peak
2388.804	56.21	-11.10	45.11	54.00	-8.89	119	322	Average
2422.000	92.55	-11.01	81.54			119	322	Average
2422.000	103.03	-11.01	92.02			119	322	Peak

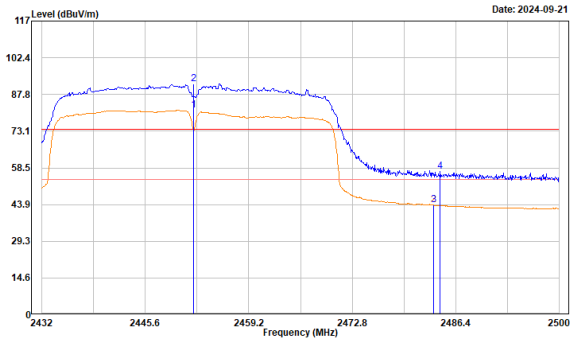
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2389.992	62.53	-11.09	51.44	54.00	-2.56	154	7	Average
2389.992	75.77	-11.09	64.68	74.00	-9.32	154	7	Peak
2422.000	102.10	-11.01	91.09			154	7	Average
2422.000	112.66	-11.01	101.65			154	7	Peak

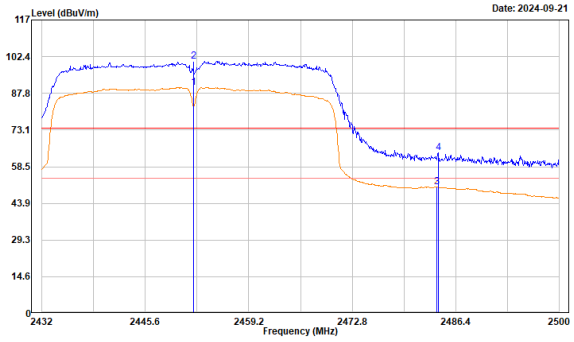
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2452.000	92.46	-10.99	81.47			102	325	Average
2452.000	102.82	-10.99	91.83			102	325	Peak
2483.544	54.35	-10.61	43.74	54.00	-10.26	102	325	Average
2484.360	67.56	-10.60	56.96	74.00	-17.04	102	325	Peak

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2452.000	101.08	-10.99	90.09			160	7	Average
2452.000	111.54	-10.99	100.55			160	7	Peak
2483.952	61.10	-10.60	50.50	54.00	-3.50	160	7	Average
2484.088	74.75	-10.60	64.15	74.00	-9.85	160	7	Peak

Level = Reading + Factor.

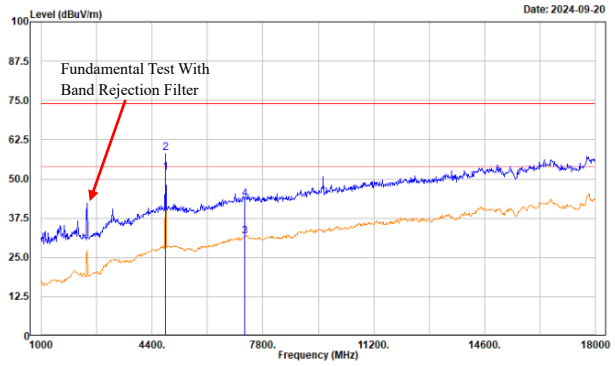
Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

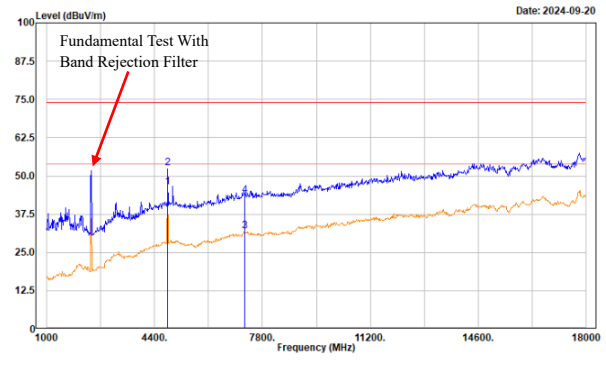
1GHz-18GHz:

(worst case is 802.11b mode, low channel)

Horizontal	Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	55.92	-3.96	51.96	54.00	-2.04	109	329	Average
4824.000	62.10	-3.96	58.14	74.00	-15.86	109	329	Peak
7236.000	31.15	0.55	31.70	54.00	-22.30	152	123	Average
7236.000	43.07	0.55	43.62	74.00	-30.38	152	123	Peak

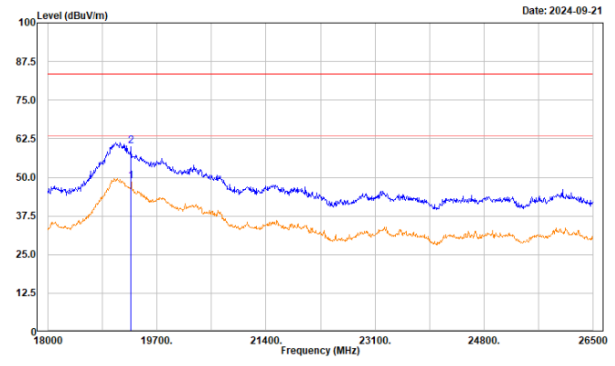


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	50.30	-3.96	46.34	54.00	-7.66	102	305	Average
4824.000	56.62	-3.96	52.66	74.00	-21.34	102	305	Peak
7236.000	31.30	0.55	31.85	54.00	-22.15	154	360	Average
7236.000	43.14	0.55	43.69	74.00	-30.31	154	360	Peak

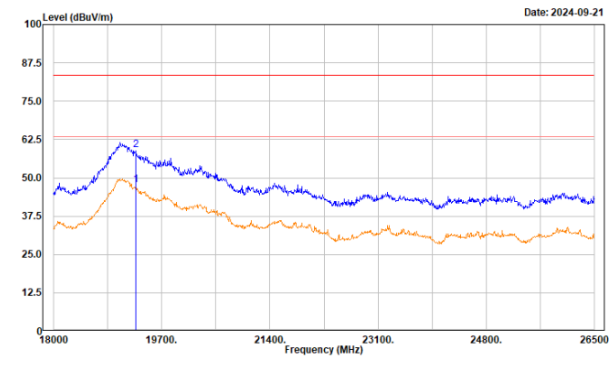
18GHz-26.5GHz:

(worst case is 802.11b mode, low channel)

Horizontal	Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19296.000	33.34	15.52	48.86	63.50	-14.64	150	250	Average
19296.000	44.56	15.52	60.08	83.50	-23.42	150	250	Peak



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19296.000	32.23	15.52	47.75	63.50	-15.75	150	128	Average
19296.000	43.46	15.52	58.98	83.50	-24.52	150	128	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

For 18-26.5GHz Convert the test distance limit of 3 meters to a limit of 1 meter:

Conversion factor = 20 log (1m/3m) = 9.5 dB,

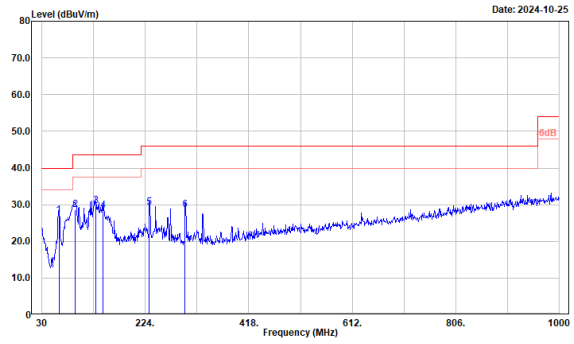
Average Limit = 54+9.5 = 63.50 dBuV/m@1m , Peak Limit = 63.50+20 = 83.50 dBuV/m@1m

BLE(1M) Mode

30MHz-1GHz:

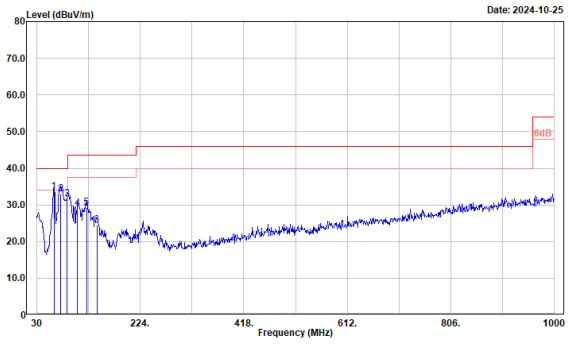
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.010	43.00	-15.81	27.19	40.00	-12.81	100	29	QP
92.080	43.61	-15.05	28.56	43.50	-14.94	100	116	QP
130.880	38.90	-9.11	29.79	43.50	-13.71	100	161	QP
144.460	38.14	-9.84	28.30	43.50	-15.20	100	97	QP
231.760	40.73	-11.42	29.31	46.00	-16.69	100	172	QP
298.690	37.35	-8.80	28.55	46.00	-17.45	100	33	QP

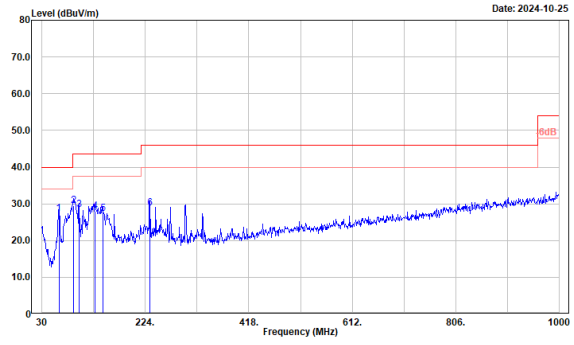
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.010	49.39	-15.81	33.58	40.00	-6.42	100	92	QP
74.620	48.19	-15.18	33.01	40.00	-6.99	100	84	QP
87.230	47.48	-15.85	31.63	40.00	-8.37	100	23	QP
106.630	40.52	-11.41	29.11	43.50	-14.39	100	39	QP
123.120	38.53	-9.26	29.27	43.50	-14.23	100	31	QP
142.520	34.33	-9.75	24.58	43.50	-18.92	100	12	QP

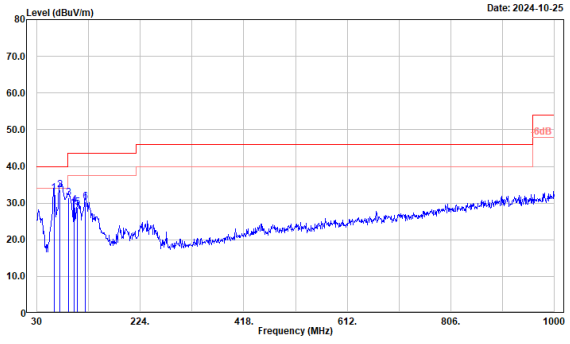
Middle channel

Horizontal



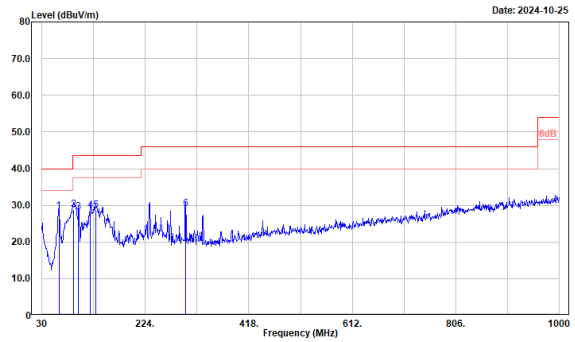
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.010	43.19	-15.81	27.38	40.00	-12.62	100	9	QP
90.140	44.90	-15.46	29.44	43.50	-14.06	100	111	QP
99.840	41.46	-13.16	28.30	43.50	-15.20	100	97	QP
129.910	37.06	-9.11	27.95	43.50	-15.55	100	142	QP
144.460	37.24	-9.84	27.40	43.50	-16.10	100	89	QP
232.730	40.14	-11.37	28.77	46.00	-17.23	100	100	QP

Vertical

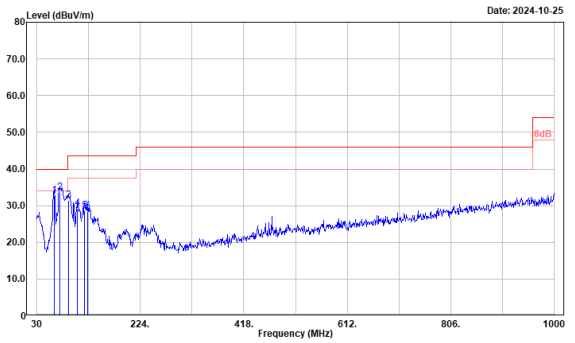


Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.010	48.55	-15.81	32.74	40.00	-7.26	100	58	QP
72.680	48.74	-15.14	33.60	40.00	-6.40	100	99	QP
90.140	46.91	-15.46	31.45	43.50	-12.05	100	19	QP
99.840	42.74	-13.16	29.58	43.50	-13.92	100	50	QP
106.630	40.21	-11.41	28.80	43.50	-14.70	100	176	QP
120.210	39.80	-9.38	30.42	43.50	-13.08	100	46	QP

High channel	
Horizontal	**Vertical**



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.010	44.16	-15.81	28.35	40.00	-11.65	100	0	QP
90.140	44.23	-15.46	28.77	43.50	-14.73	100	115	QP
98.870	41.52	-13.36	28.16	43.50	-15.34	100	115	QP
121.180	38.07	-9.35	28.72	43.50	-14.78	100	280	QP
130.880	37.79	-9.11	28.68	43.50	-14.82	100	276	QP
299.660	37.90	-8.80	29.10	46.00	-16.90	100	160	QP



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
62.980	48.23	-15.60	32.63	40.00	-7.37	100	101	QP
72.680	48.71	-15.14	33.57	40.00	-6.43	100	56	QP
89.170	46.96	-15.56	31.40	43.50	-12.10	100	11	QP
106.630	40.78	-11.41	29.37	43.50	-14.13	100	48	QP
119.240	38.22	-9.54	28.68	43.50	-14.82	100	48	QP
126.030	37.48	-9.03	28.45	43.50	-15.05	100	52	QP

Level = Reading + Factor.

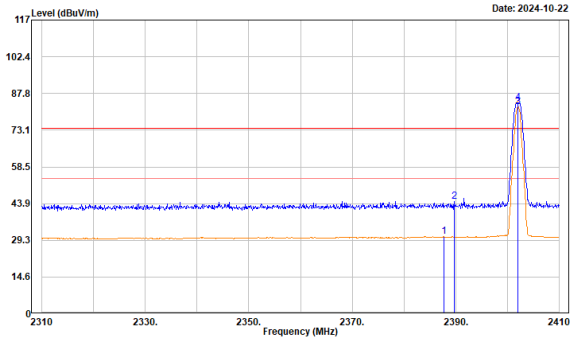
Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Band-Edge:

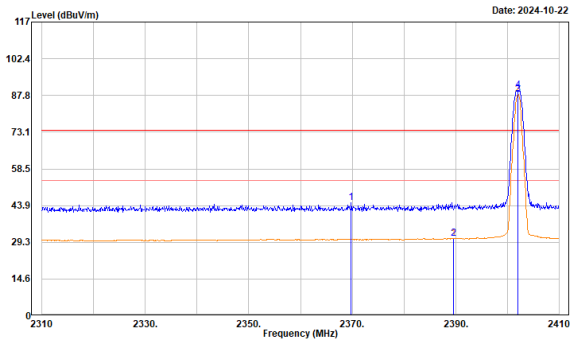
Low channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2387.700	41.76	-11.10	30.66	54.00	-23.34	232	302	Average
2389.700	55.95	-11.09	44.86	74.00	-29.14	232	302	Peak
2402.000	93.51	-11.02	82.49			232	302	Average
2402.000	95.08	-11.02	84.06			232	302	Peak

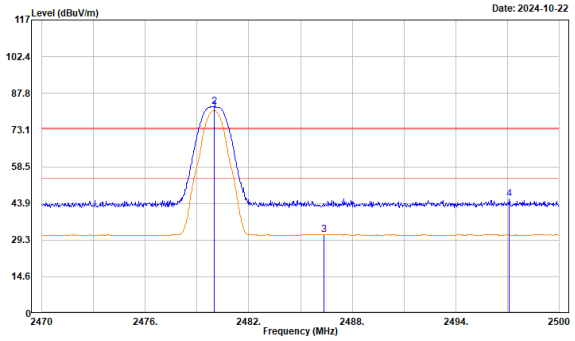
Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2369.800	56.14	-11.25	44.89	74.00	-29.11	140	351	Peak
2389.600	41.91	-11.09	30.82	54.00	-23.18	140	351	Average
2402.000	99.20	-11.02	88.18			140	351	Average
2402.000	100.73	-11.02	89.71			140	351	Peak

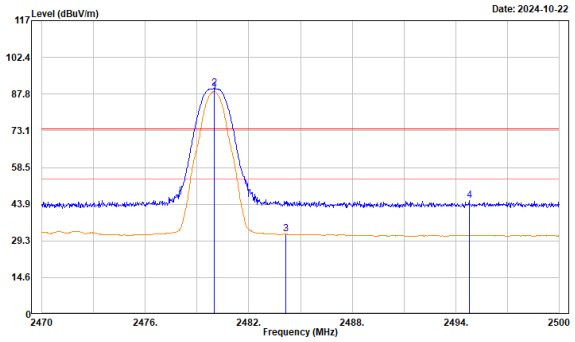
High channel

Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	91.59	-10.66	80.93			223	306	Average
2480.000	93.15	-10.66	82.49			223	306	Peak
2486.380	42.06	-10.58	31.48	54.00	-22.52	223	306	Average
2497.120	56.02	-10.45	45.57	74.00	-28.43	223	306	Peak

Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	99.41	-10.66	88.75			141	350	Average
2480.000	100.58	-10.66	89.92			141	350	Peak
2484.130	42.57	-10.60	31.97	54.00	-22.03	141	350	Average
2494.780	55.74	-10.48	45.26	74.00	-28.74	141	350	Peak

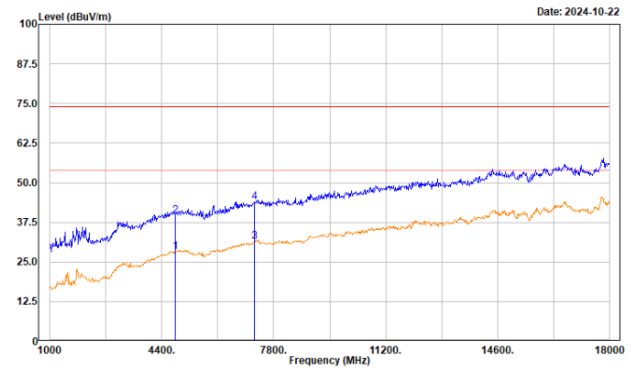
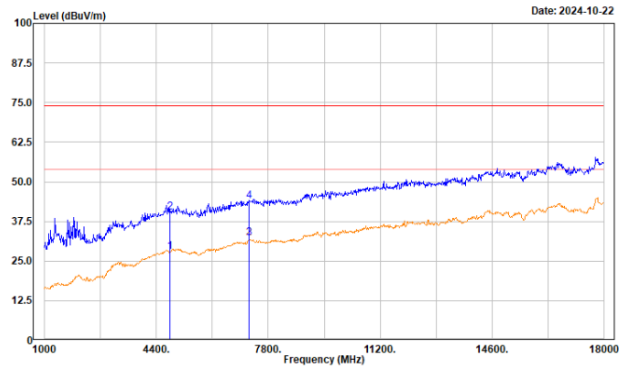
Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

1GHz-18GHz:

(worst case is low channel)

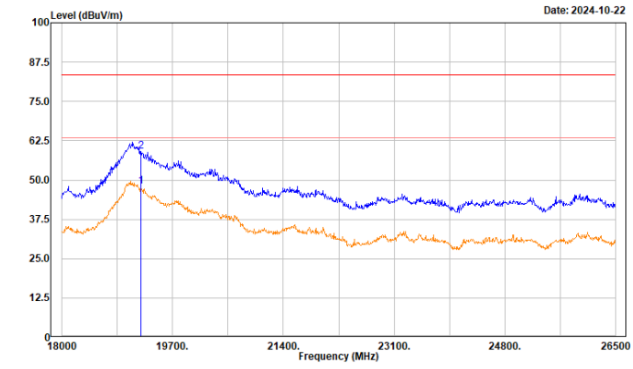
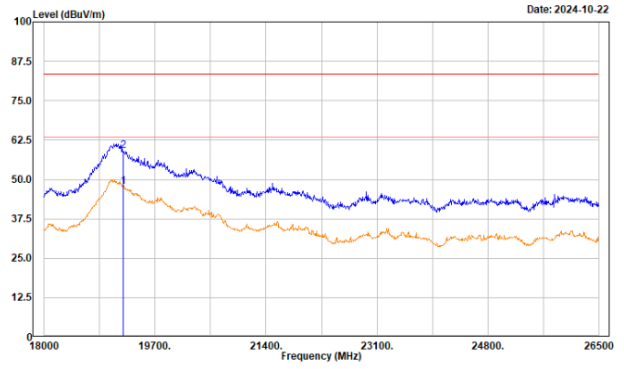
Horizontal	Vertical
	

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.23	-4.09	28.14	54.00	-25.86	150	311	Average
4804.000	43.67	-4.09	39.58	74.00	-34.42	150	311	Peak
7206.000	31.08	0.43	31.51	54.00	-22.49	150	158	Average
7206.000	43.37	0.43	43.80	74.00	-30.20	150	158	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.13	-4.09	28.04	54.00	-25.96	150	162	Average
4804.000	44.46	-4.09	40.37	74.00	-33.63	150	162	Peak
7206.000	31.88	0.43	32.31	54.00	-21.69	150	189	Average
7206.000	43.43	0.43	43.86	74.00	-30.14	150	189	Peak

18GHz-26.5GHz:

(worst case is low channel)

Horizontal	Vertical
	

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	31.56	16.43	47.99	63.50	-15.51	150	124	Average
19216.000	42.69	16.43	59.12	83.50	-24.38	150	124	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	31.35	16.43	47.78	63.50	-15.72	150	262	Average
19216.000	42.57	16.43	59.00	83.50	-24.50	150	262	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

For 18-26.5GHz Convert the test distance limit of 3 meters to a limit of 1 meter:

Conversion factor = 20 log (1m/3m) = 9.5 dB,

Average Limit = 54+9.5 = 63.50 dBuV/m@1m , Peak Limit = 63.50+20 = 83.50 dBuV/m@1m

Above 1GHz

802.11b Mode:

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	55.92	-3.96	51.96	54.00	-2.04	109	329	Average
4824.000	62.10	-3.96	58.14	74.00	-15.86	109	329	Peak
7236.000	31.15	0.55	31.70	54.00	-22.30	152	123	Average
7236.000	43.07	0.55	43.62	74.00	-30.38	152	123	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	50.30	-3.96	46.34	54.00	-7.66	102	305	Average
4824.000	56.62	-3.96	52.66	74.00	-21.34	102	305	Peak
7236.000	31.30	0.55	31.85	54.00	-22.15	154	360	Average
7236.000	43.14	0.55	43.69	74.00	-30.31	154	360	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	51.73	-3.59	48.14	54.00	-5.86	106	324	Average
4874.000	58.07	-3.59	54.48	74.00	-19.52	106	324	Peak
7311.000	31.52	0.56	32.08	54.00	-21.92	152	1	Average
7311.000	44.02	0.56	44.58	74.00	-29.42	152	1	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	48.17	-3.59	44.58	54.00	-9.42	304	25	Average
4874.000	55.31	-3.59	51.72	74.00	-22.28	304	25	Peak
7311.000	31.92	0.56	32.48	54.00	-21.52	155	90	Average
7311.000	43.60	0.56	44.16	74.00	-29.84	155	90	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	49.30	-3.51	45.79	54.00	-8.21	102	325	Average
4924.000	55.99	-3.51	52.48	74.00	-21.52	102	325	Peak
7386.000	31.63	0.22	31.85	54.00	-22.15	151	109	Average
7386.000	43.19	0.22	43.41	74.00	-30.59	151	109	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	49.68	-3.51	46.17	54.00	-7.83	294	27	Average
4924.000	56.38	-3.51	52.87	74.00	-21.13	294	27	Peak
7386.000	31.75	0.22	31.97	54.00	-22.03	152	267	Average
7386.000	42.84	0.22	43.06	74.00	-30.94	152	267	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

802.11g Mode:

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	44.55	-3.96	40.59	54.00	-13.41	104	11	Average
4824.000	60.77	-3.96	56.81	74.00	-17.19	104	11	Peak
7236.000	32.84	0.55	33.39	54.00	-20.61	150	2	Average
7236.000	43.29	0.55	43.84	74.00	-30.16	150	2	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	40.35	-3.96	36.39	54.00	-17.61	275	309	Average
4824.000	57.64	-3.96	53.68	74.00	-20.32	275	309	Peak
7236.000	32.66	0.55	33.21	54.00	-20.79	152	356	Average
7236.000	44.12	0.55	44.67	74.00	-29.33	152	356	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	40.35	-3.59	36.76	54.00	-17.24	105	336	Average
4874.000	55.62	-3.59	52.03	74.00	-21.97	105	336	Peak
7311.000	31.51	0.56	32.07	54.00	-21.93	156	4	Average
7311.000	43.37	0.56	43.93	74.00	-30.07	156	4	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	40.11	-3.59	36.52	54.00	-17.48	244	328	Average
4874.000	55.24	-3.59	51.65	74.00	-22.35	244	328	Peak
7311.000	32.10	0.56	32.66	54.00	-21.34	151	325	Average
7311.000	44.54	0.56	45.10	74.00	-28.90	151	325	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	38.02	-3.51	34.51	54.00	-19.49	105	313	Average
4924.000	53.26	-3.51	49.75	74.00	-24.25	105	313	Peak
7386.000	30.81	0.22	31.03	54.00	-22.97	158	11	Average
7386.000	42.99	0.22	43.21	74.00	-30.79	158	11	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	38.46	-3.51	34.95	54.00	-19.05	260	40	Average
4924.000	54.41	-3.51	50.90	74.00	-23.10	260	40	Peak
7386.000	30.48	0.22	30.70	54.00	-23.30	156	123	Average
7386.000	43.62	0.22	43.84	74.00	-30.16	156	123	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

802.11n HT20 Mode:

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	41.66	-3.96	37.70	54.00	-16.30	129	325	Average
4824.000	57.84	-3.96	53.88	74.00	-20.12	129	325	Peak
7236.000	31.62	0.55	32.17	54.00	-21.83	155	287	Average
7236.000	43.01	0.55	43.56	74.00	-30.44	155	287	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4824.000	35.92	-3.96	31.96	54.00	-22.04	154	314	Average
4824.000	51.53	-3.96	47.57	74.00	-26.43	154	314	Peak
7236.000	31.48	0.55	32.03	54.00	-21.97	154	203	Average
7236.000	43.84	0.55	44.39	74.00	-29.61	154	203	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	38.98	-3.59	35.39	54.00	-18.61	102	323	Average
4874.000	53.38	-3.59	49.79	74.00	-24.21	102	323	Peak
7311.000	31.57	0.56	32.13	54.00	-21.87	151	0	Average
7311.000	43.91	0.56	44.47	74.00	-29.53	151	0	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	37.52	-3.59	33.93	54.00	-20.07	234	9	Average
4874.000	53.04	-3.59	49.45	74.00	-24.55	234	9	Peak
7311.000	31.40	0.56	31.96	54.00	-22.04	153	247	Average
7311.000	44.11	0.56	44.67	74.00	-29.33	153	247	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	37.30	-3.51	33.79	54.00	-20.21	107	329	Average
4924.000	52.00	-3.51	48.49	74.00	-25.51	107	329	Peak
7386.000	31.46	0.22	31.68	54.00	-22.32	157	144	Average
7386.000	43.37	0.22	43.59	74.00	-30.41	157	144	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4924.000	36.97	-3.51	33.46	54.00	-20.54	245	83	Average
4924.000	52.13	-3.51	48.62	74.00	-25.38	245	83	Peak
7386.000	31.73	0.22	31.95	54.00	-22.05	156	72	Average
7386.000	43.85	0.22	44.07	74.00	-29.93	156	72	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

802.11n HT40 Mode:

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4844.000	38.56	-3.83	34.73	54.00	-19.27	106	323	Average
4844.000	53.11	-3.83	49.28	74.00	-24.72	106	323	Peak
7266.000	31.64	0.60	32.24	54.00	-21.76	150	323	Average
7266.000	43.21	0.60	43.81	74.00	-30.19	150	323	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4844.000	33.15	-3.83	29.32	54.00	-24.68	152	61	Average
4844.000	45.40	-3.83	41.57	74.00	-32.43	152	61	Peak
7266.000	31.87	0.60	32.47	54.00	-21.53	157	160	Average
7266.000	43.83	0.60	44.43	74.00	-29.57	157	160	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	36.61	-3.59	33.02	54.00	-20.98	102	322	Average
4874.000	52.01	-3.59	48.42	74.00	-25.58	102	322	Peak
7311.000	31.56	0.56	32.12	54.00	-21.88	150	188	Average
7311.000	43.61	0.56	44.17	74.00	-29.83	150	188	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4874.000	33.25	-3.59	29.66	54.00	-24.34	158	325	Average
4874.000	45.24	-3.59	41.65	74.00	-32.35	158	325	Peak
7311.000	31.51	0.56	32.07	54.00	-21.93	155	104	Average
7311.000	44.46	0.56	45.02	74.00	-28.98	155	104	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4904.000	35.83	-3.40	32.43	54.00	-21.57	104	15	Average
4904.000	50.32	-3.40	46.92	74.00	-27.08	104	15	Peak
7356.000	31.89	0.39	32.28	54.00	-21.72	156	57	Average
7356.000	43.56	0.39	43.95	74.00	-30.05	156	57	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4904.000	33.95	-3.40	30.55	54.00	-23.45	151	199	Average
4904.000	46.00	-3.40	42.60	74.00	-31.40	151	199	Peak
7356.000	31.81	0.39	32.20	54.00	-21.80	153	296	Average
7356.000	43.16	0.39	43.55	74.00	-30.45	153	296	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

BLE(1M) Mode

Low channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.23	-4.09	28.14	54.00	-25.86	150	311	Average
4804.000	43.67	-4.09	39.58	74.00	-34.42	150	311	Peak
7206.000	31.08	0.43	31.51	54.00	-22.49	150	158	Average
7206.000	43.37	0.43	43.80	74.00	-30.20	150	158	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.13	-4.09	28.04	54.00	-25.96	150	162	Average
4804.000	44.46	-4.09	40.37	74.00	-33.63	150	162	Peak
7206.000	31.88	0.43	32.31	54.00	-21.69	150	189	Average
7206.000	43.43	0.43	43.86	74.00	-30.14	150	189	Peak

Middle channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	32.10	-3.54	28.56	54.00	-25.44	157	32	Average
4880.000	44.08	-3.54	40.54	74.00	-33.46	157	32	Peak
7320.000	31.03	0.53	31.56	54.00	-22.44	155	168	Average
7320.000	43.09	0.53	43.62	74.00	-30.38	155	168	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	32.26	-3.54	28.72	54.00	-25.28	151	105	Average
4880.000	44.32	-3.54	40.78	74.00	-33.22	151	105	Peak
7320.000	31.09	0.53	31.62	54.00	-22.38	156	3	Average
7320.000	43.73	0.53	44.26	74.00	-29.74	156	3	Peak

High channel

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	32.24	-3.67	28.57	54.00	-25.43	154	288	Average
4960.000	43.88	-3.67	40.21	74.00	-33.79	154	288	Peak
7440.000	31.12	0.28	31.40	54.00	-22.60	151	181	Average
7440.000	44.12	0.28	44.40	74.00	-29.60	151	181	Peak

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	32.18	-3.67	28.51	54.00	-25.49	158	200	Average
4960.000	44.35	-3.67	40.68	74.00	-33.32	158	200	Peak
7440.000	31.16	0.28	31.44	54.00	-22.56	155	359	Average
7440.000	43.58	0.28	43.86	74.00	-30.14	155	359	Peak

Level = Reading + Factor.

Margin = Level – Limit.

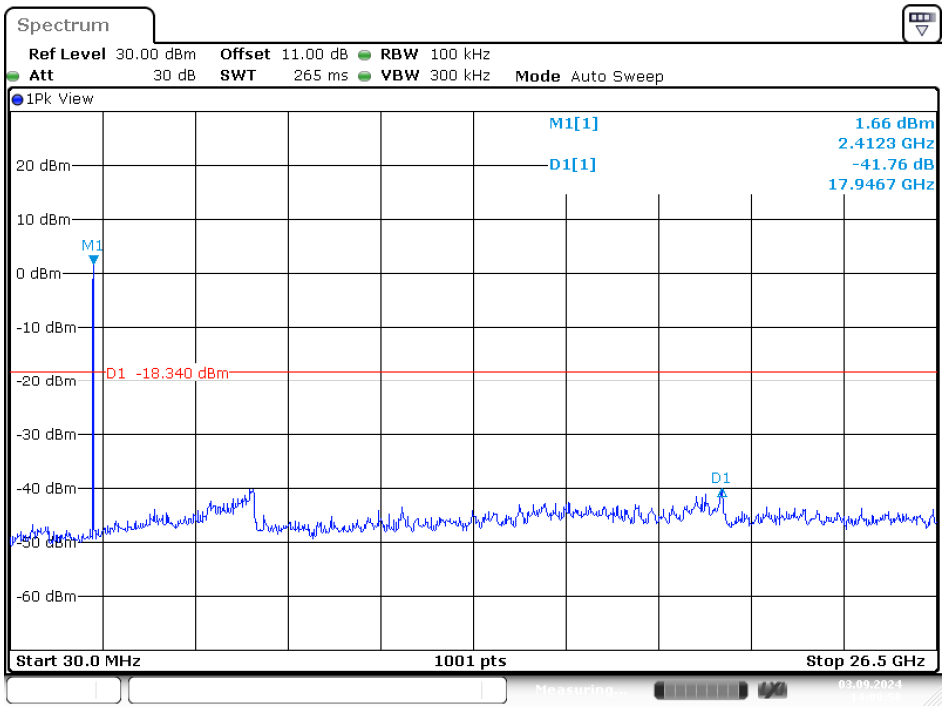
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
B Mode				
Low	2412	41.76	≥ 20	PASS
Middle	2437	41.54	≥ 20	PASS
High	2462	41.82	≥ 20	PASS
G Mode				
Low	2412	35.58	≥ 20	PASS
Middle	2437	36.24	≥ 20	PASS
High	2462	36.74	≥ 20	PASS
N20 Mode				
Low	2412	35.11	≥ 20	PASS
Middle	2437	35.26	≥ 20	PASS
High	2462	34.88	≥ 20	PASS
N40 Mode				
Low	2422	31.90	≥ 20	PASS
Middle	2437	32.53	≥ 20	PASS
High	2452	32.25	≥ 20	PASS
BLE(1M) Mode				
Low	2402	45.63	≥ 20	PASS
Mid	2440	45.03	≥ 20	PASS
High	2480	44.04	≥ 20	PASS

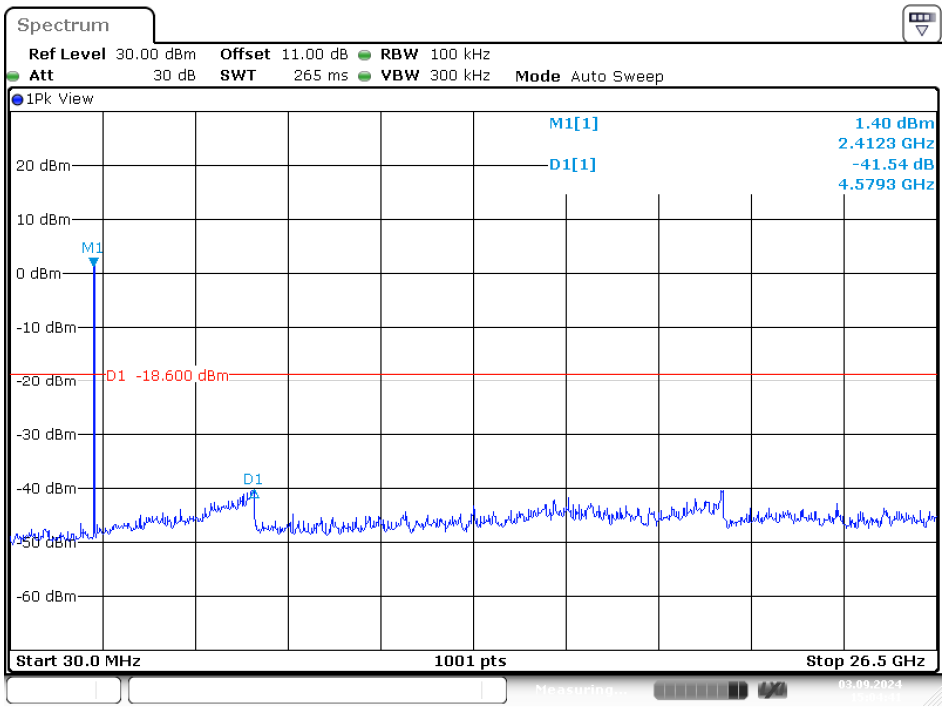
B Mode

Low Channel



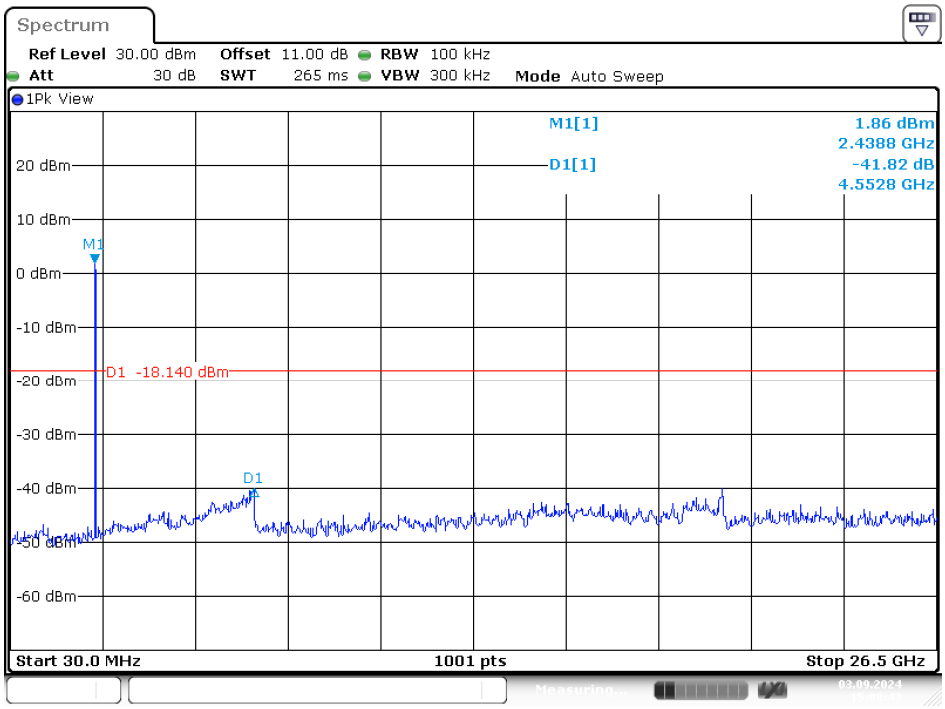
Date: 3.SEP.2024 14:09:58

Middle Channel



Date: 3.SEP.2024 15:04:40

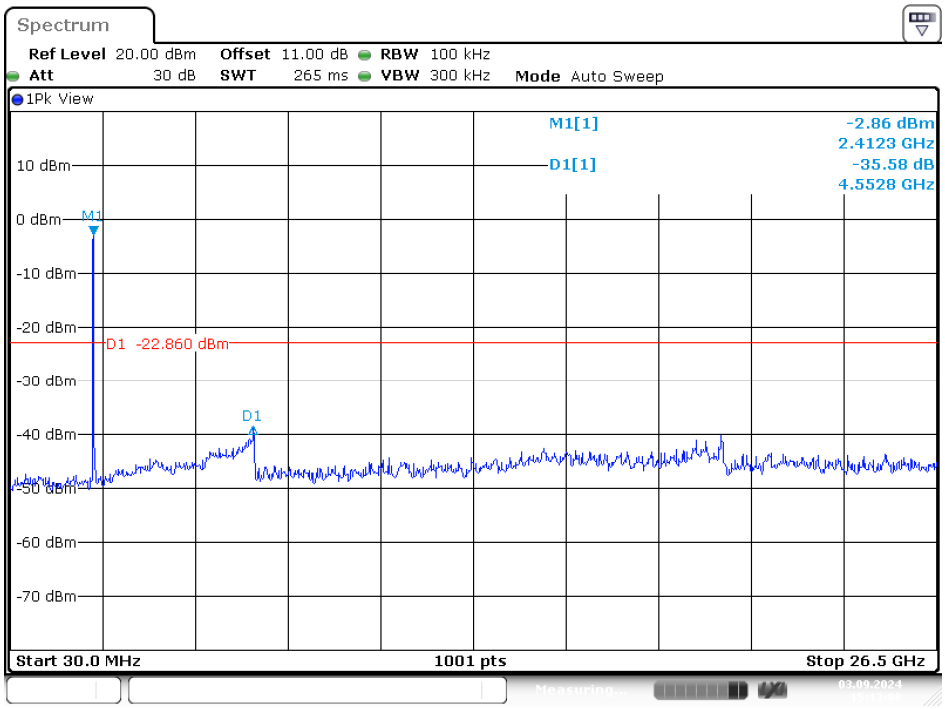
High Channel



Date: 3.SEP.2024 15:08:43

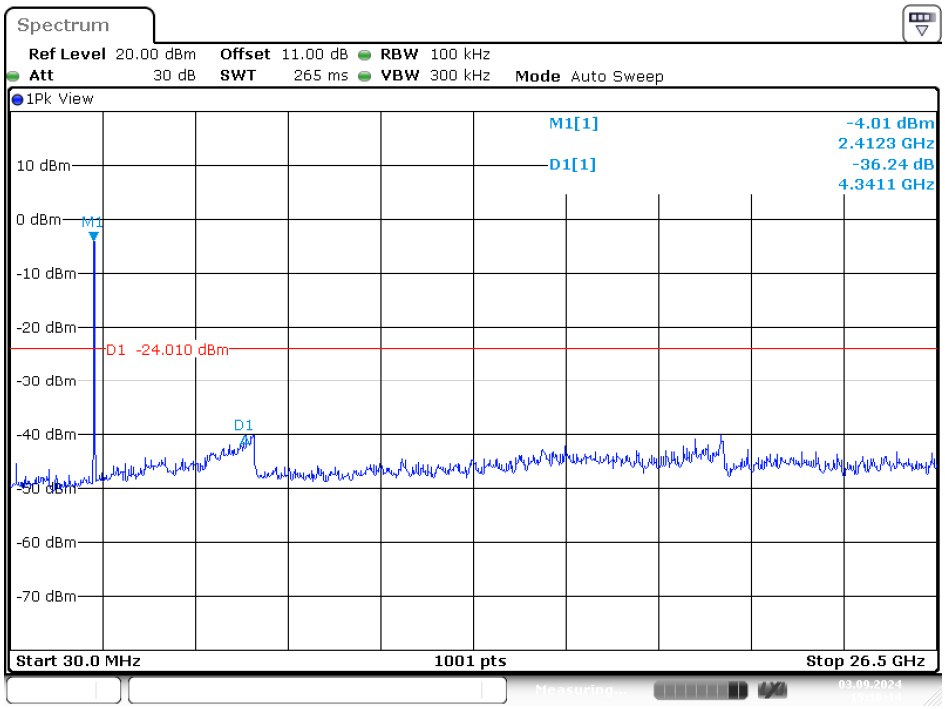
G Mode

Low Channel



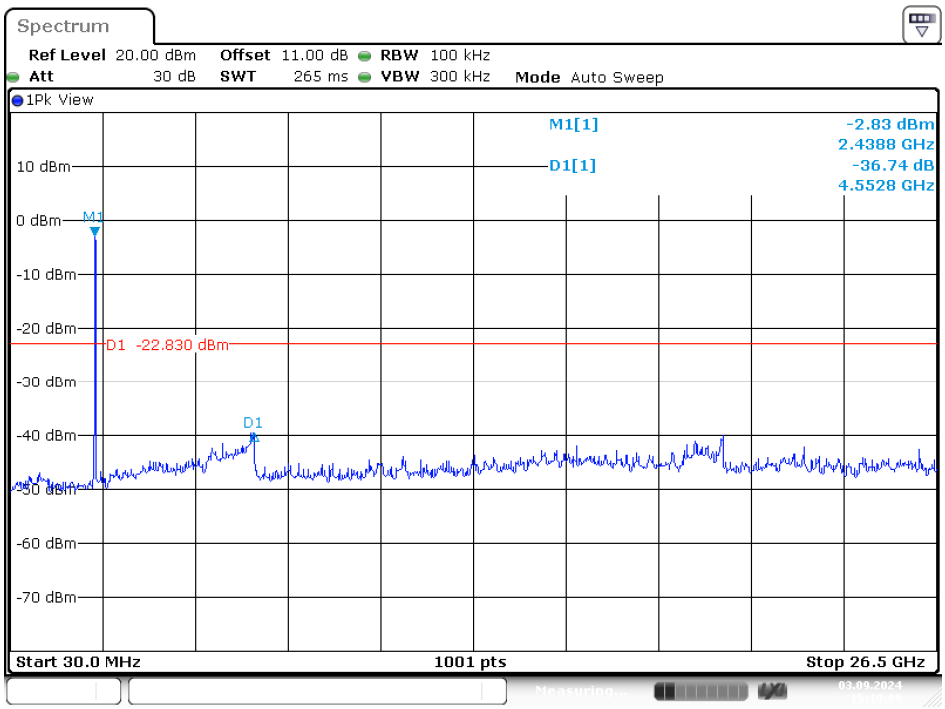
Date: 3.SEP.2024 15:13:08

Middle Channel



Date: 3.SEP.2024 15:16:15

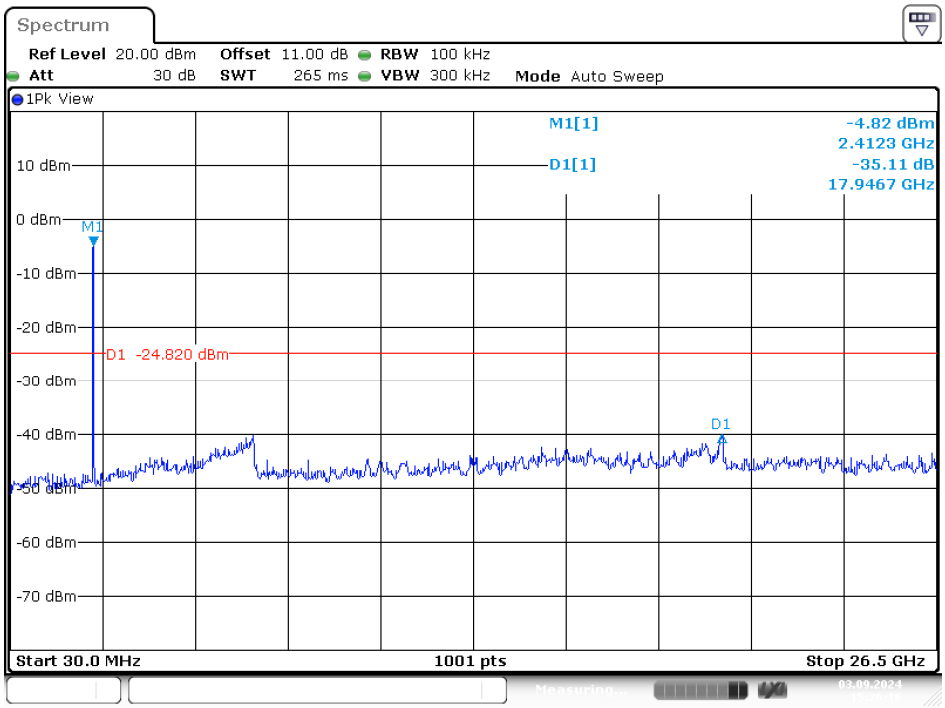
High Channel



Date: 3.SEP.2024 15:19:09

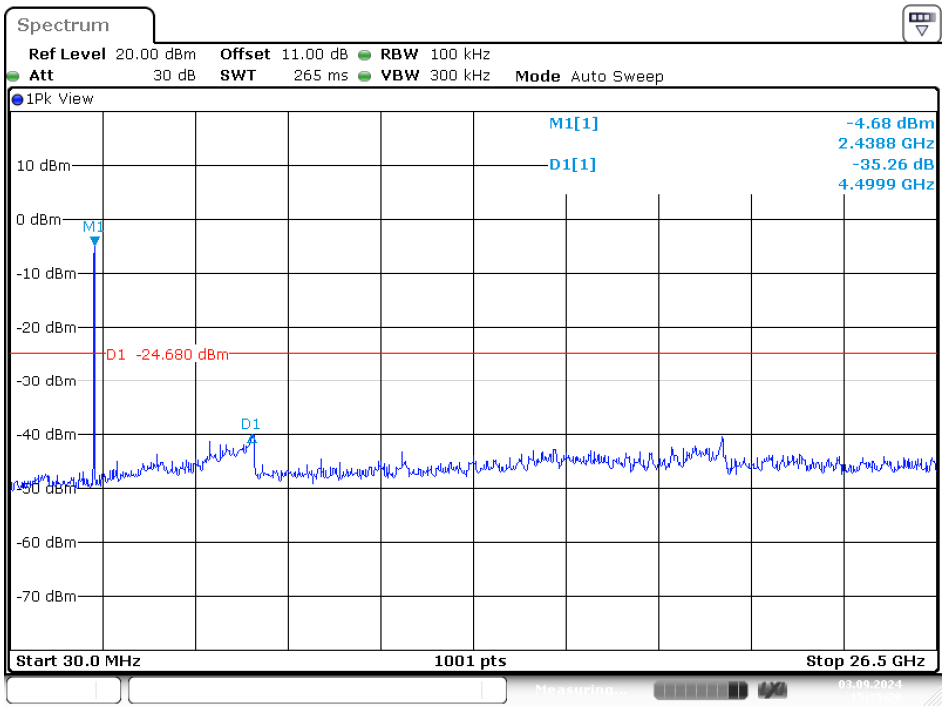
N20 Mode

Low Channel



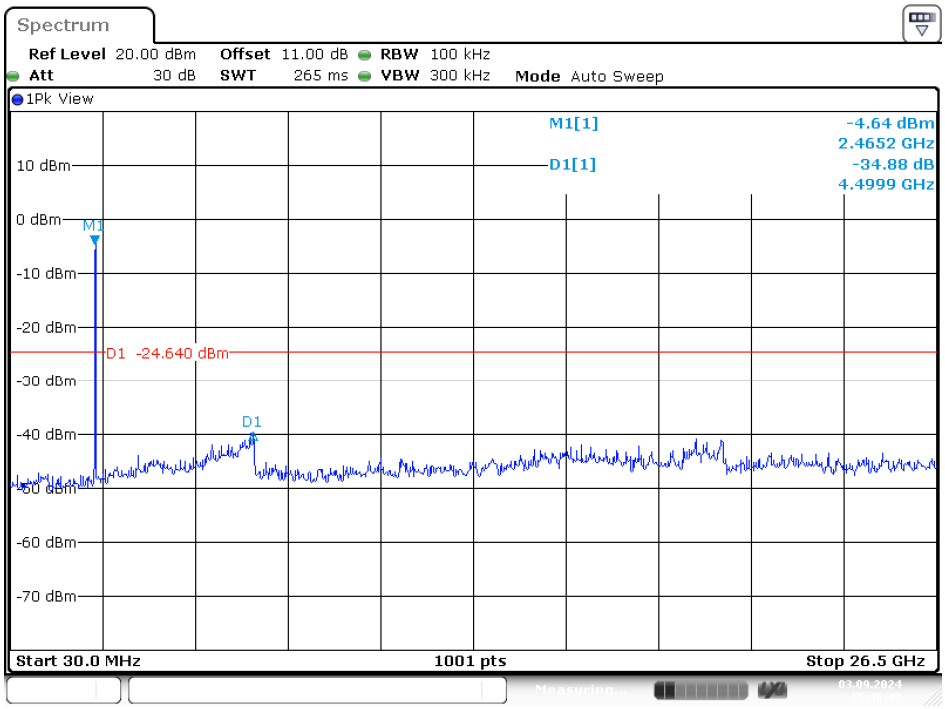
Date: 3.SEP.2024 15:26:16

Middle Channel



Date: 3.SEP.2024 15:35:20

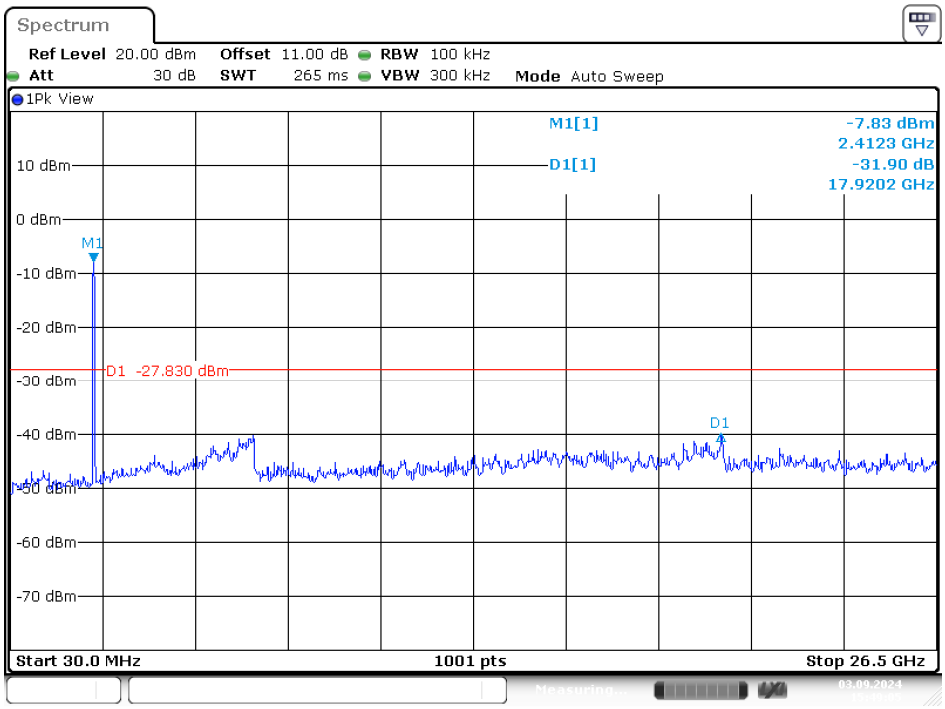
High Channel



Date: 3.SEP.2024 15:46:48

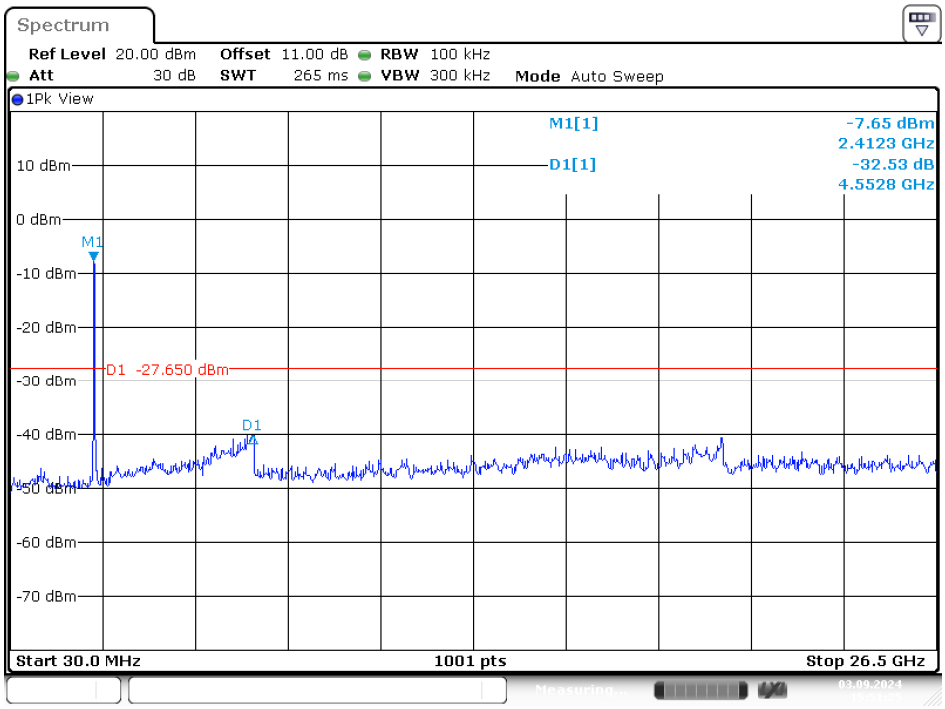
N40 Mode

Low Channel



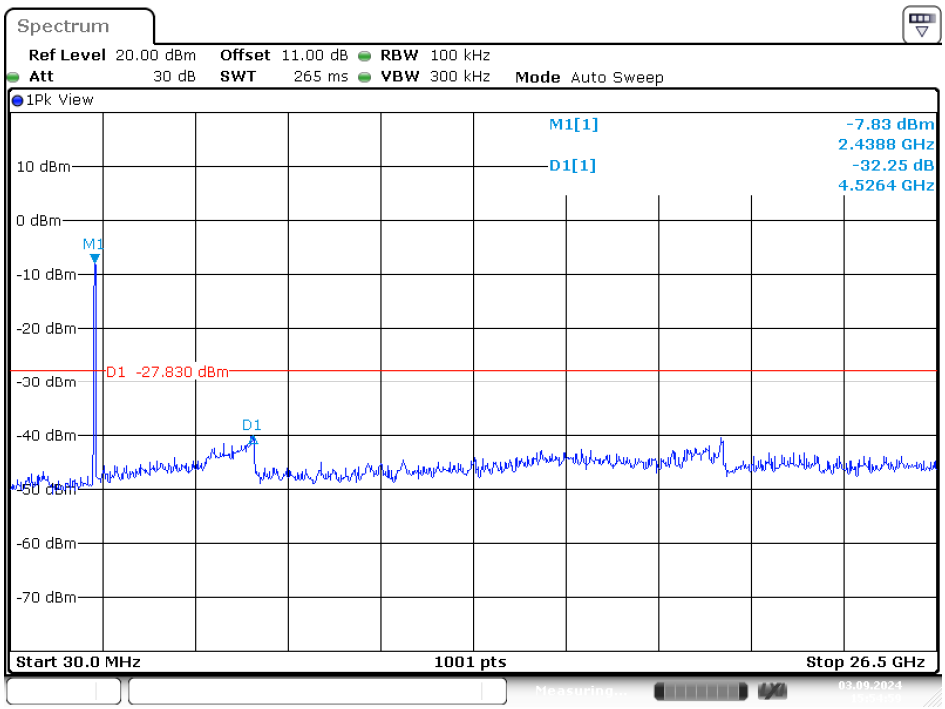
Date: 3.SEP.2024 15:49:05

Middle Channel



Date: 3.SEP.2024 15:51:26

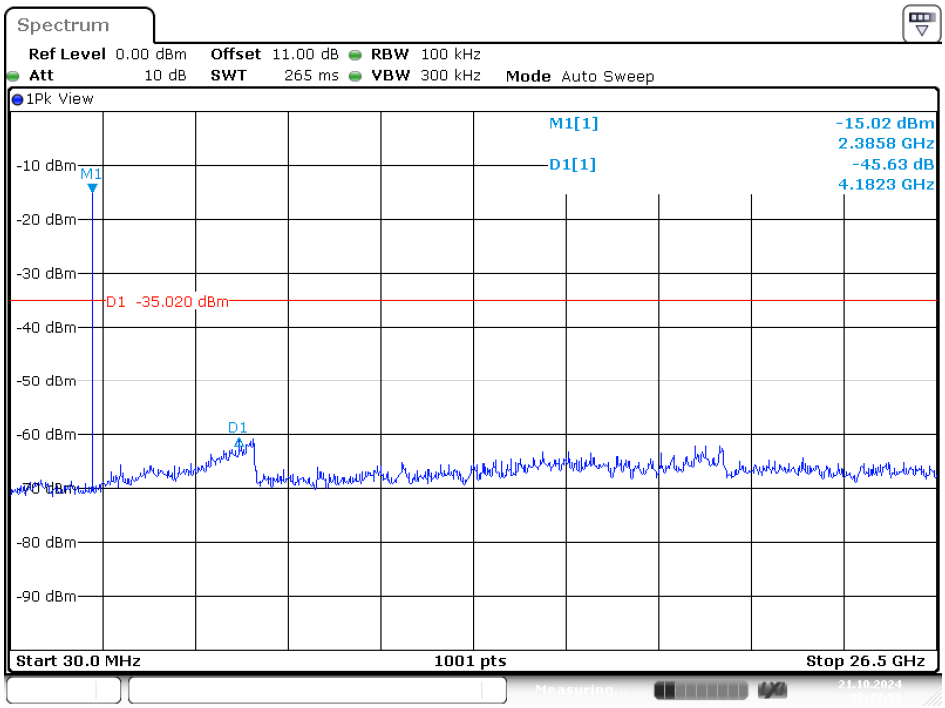
High Channel



Date: 3.SEP.2024 15:55:00

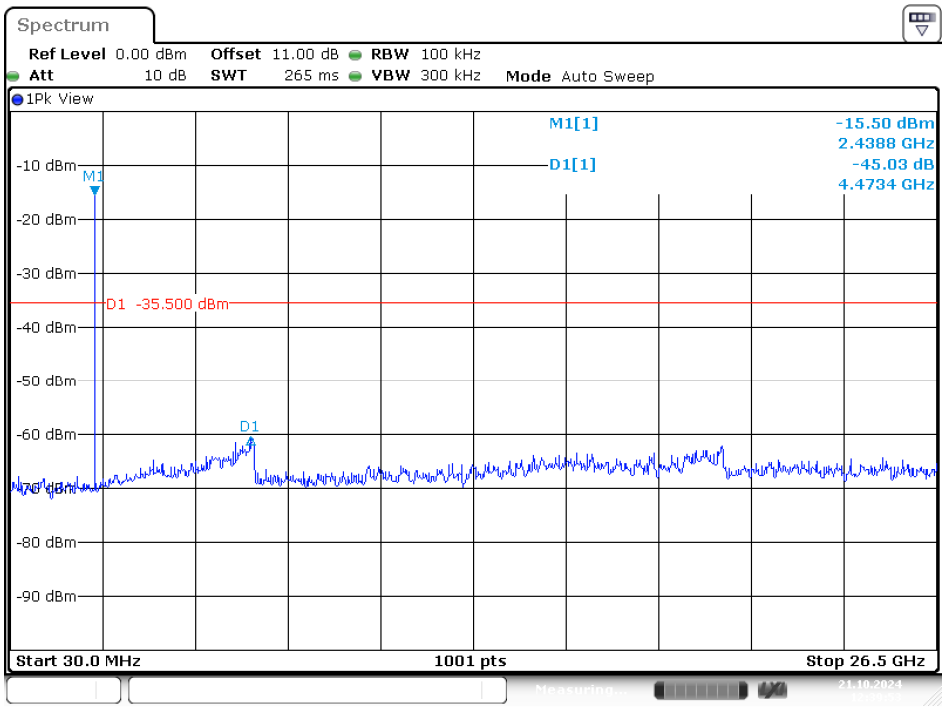
BLE(1M) Mode

Low Channel



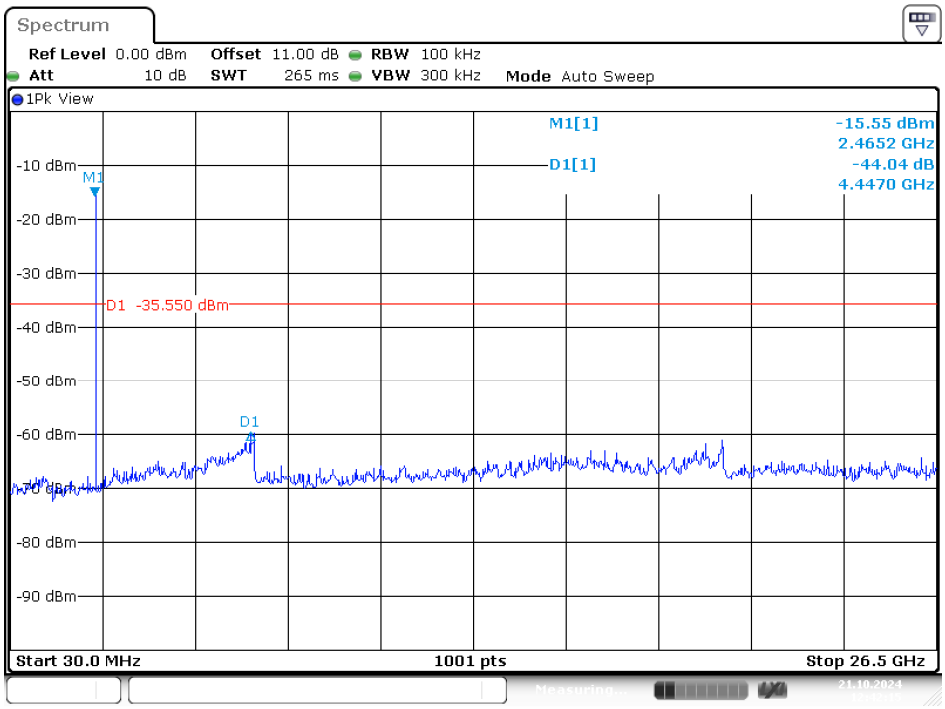
Date: 21.OCT.2024 12:33:59

Middle Channel



Date: 21.OCT.2024 12:39:53

High Channel



Date: 21.OCT.2024 12:42:15

9 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2).

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 Test Procedure

According to ANSI C63.10-2013, section 11.8

The steps for the first option are as follows:

a) Set RBW = 100 kHz.

b) Set the 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 6 dB relative to the maximum level measured in the fundamental emission.

9.3 Test Results

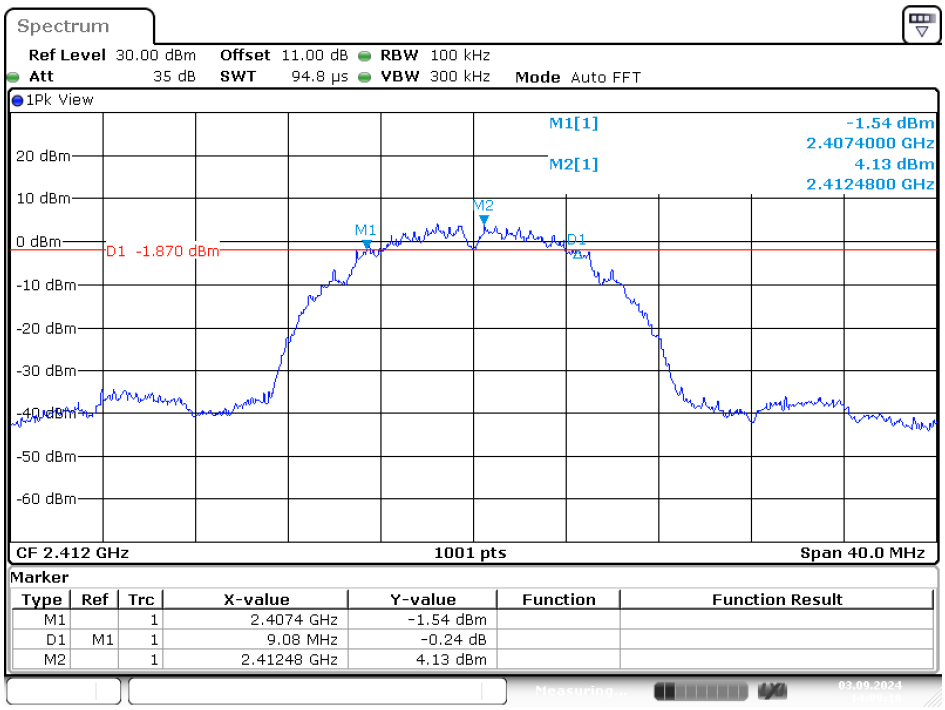
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Result
B Mode				
Low	2412	9.08	> 500	PASS
Middle	2437	9.56	> 500	PASS
High	2462	9.60	> 500	PASS
G Mode				
Low	2412	16.32	> 500	PASS
Middle	2437	16.32	> 500	PASS
High	2462	16.32	> 500	PASS
N20 Mode				
Low	2412	16.52	> 500	PASS
Middle	2437	16.32	> 500	PASS
High	2462	16.32	> 500	PASS
N40 Mode				
Low	2422	35.04	> 500	PASS
Middle	2437	35.04	> 500	PASS
High	2452	35.04	> 500	PASS
BLE(1M) Mode				
Low	2402	0.64	> 500	PASS
Middle	2440	0.65	> 500	PASS
High	2480	0.65	> 500	PASS

Please refer to the following plots

6 dB Emission Bandwidth

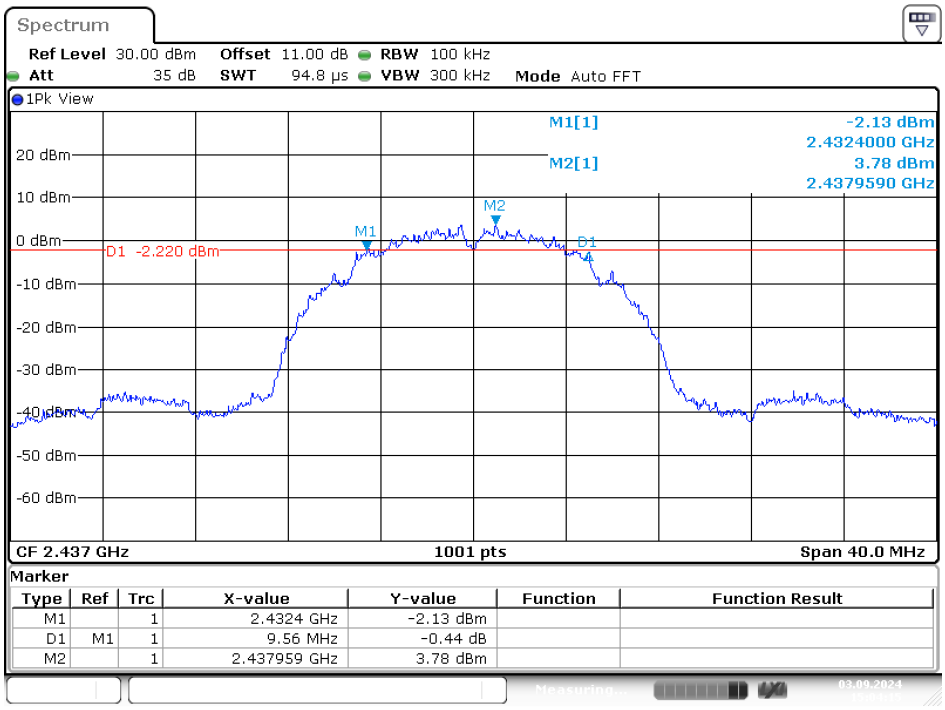
B Mode

Low Channel



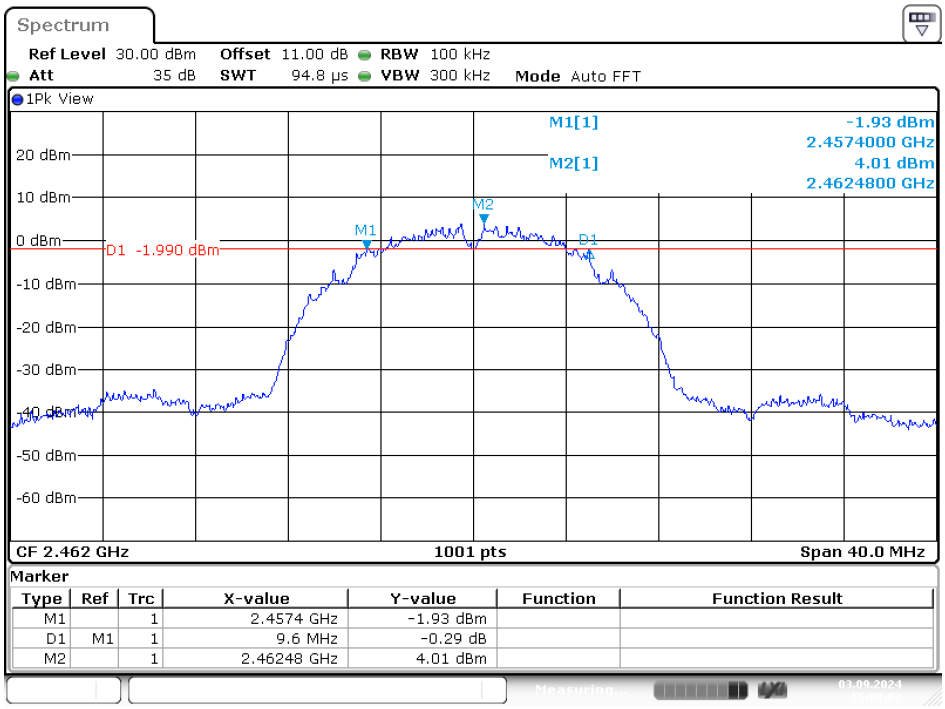
Date: 3.SEP.2024 14:09:18

Middle Channel



Date: 3.SEP.2024 15:04:16

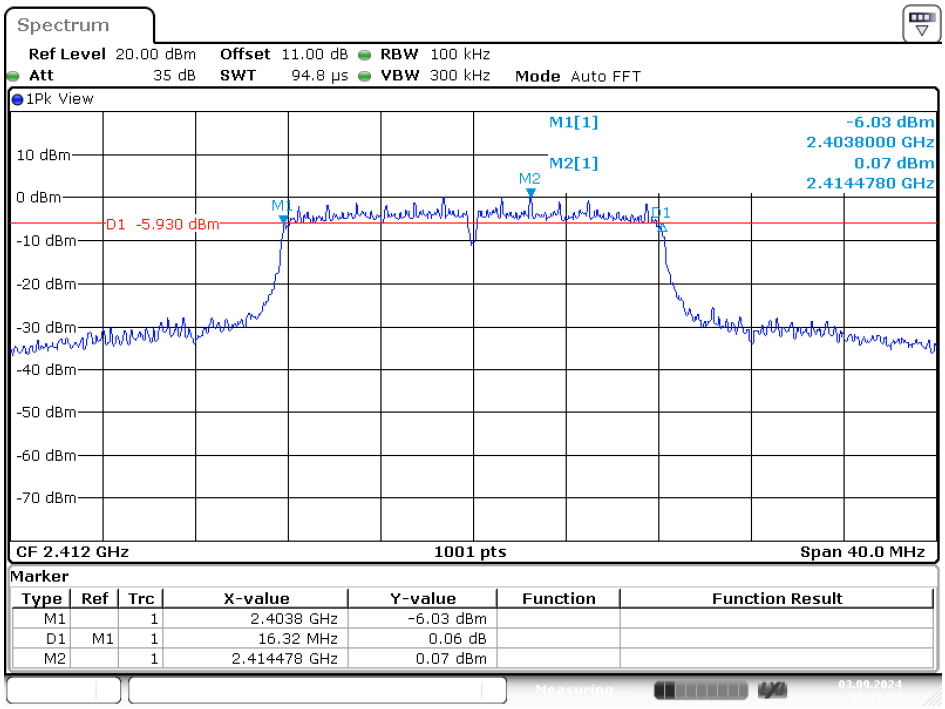
High Channel



Date: 3.SEP.2024 15:08:03

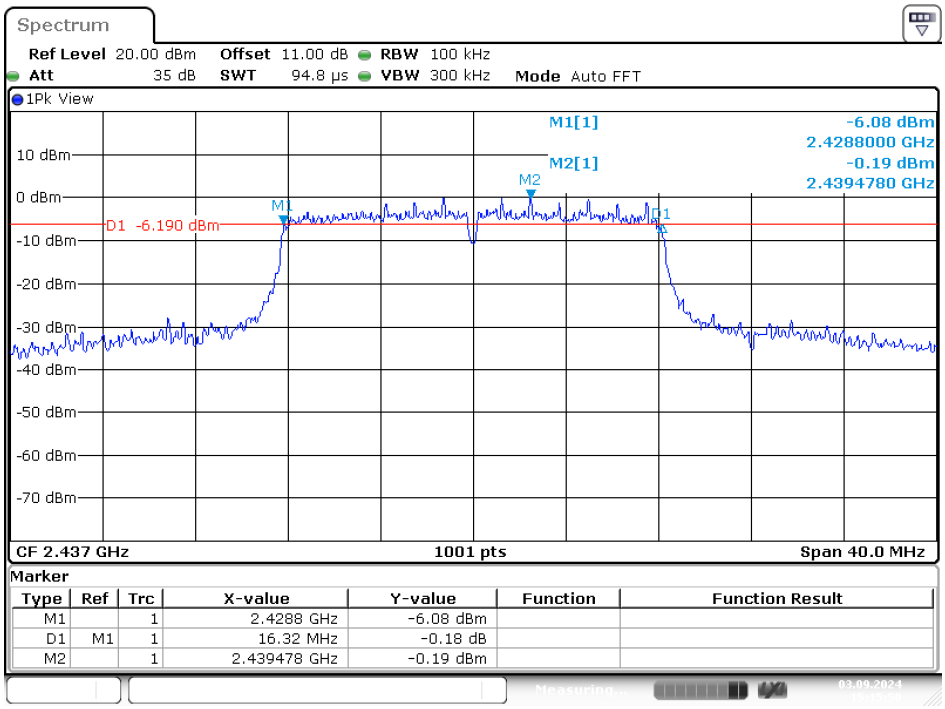
G Mode

Low Channel



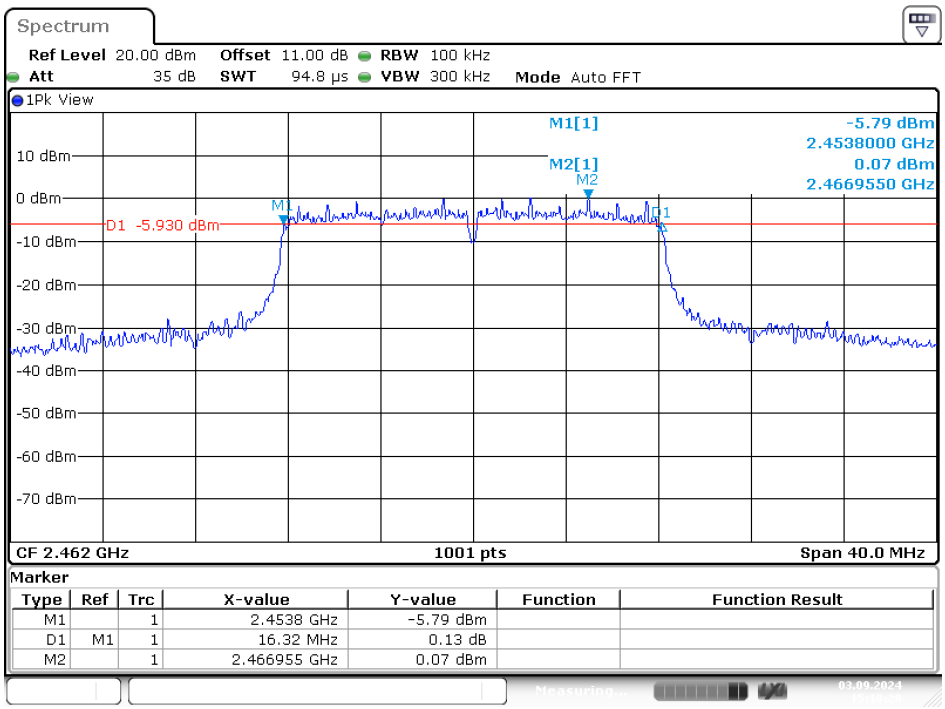
Date: 3.SEP.2024 15:12:28

Middle Channel



Date: 3.SEP.2024 15:15:50

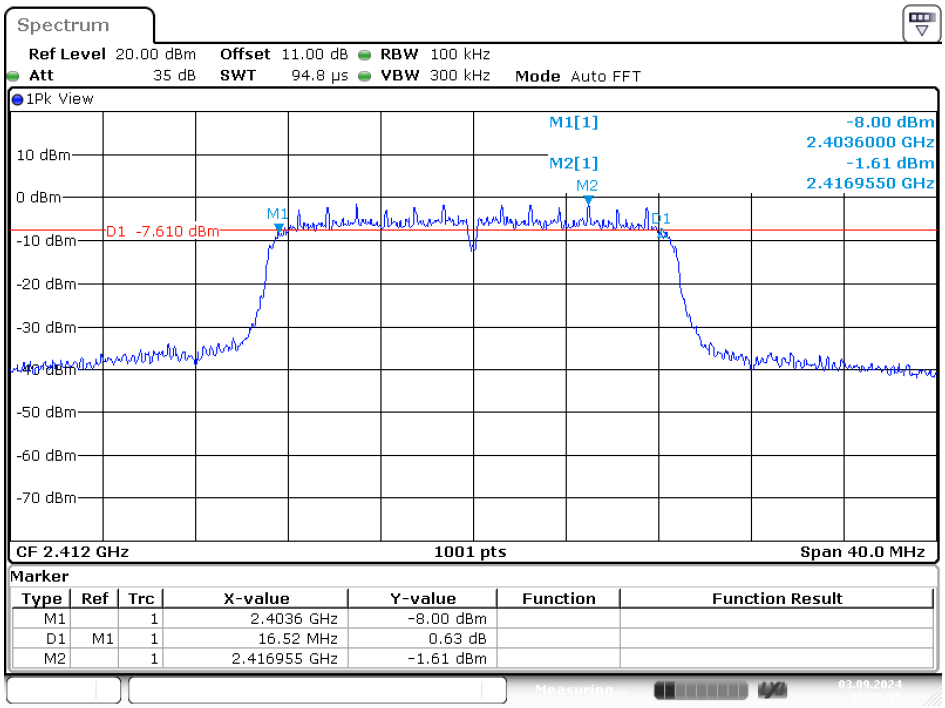
High Channel



Date: 3.SEP.2024 15:18:29

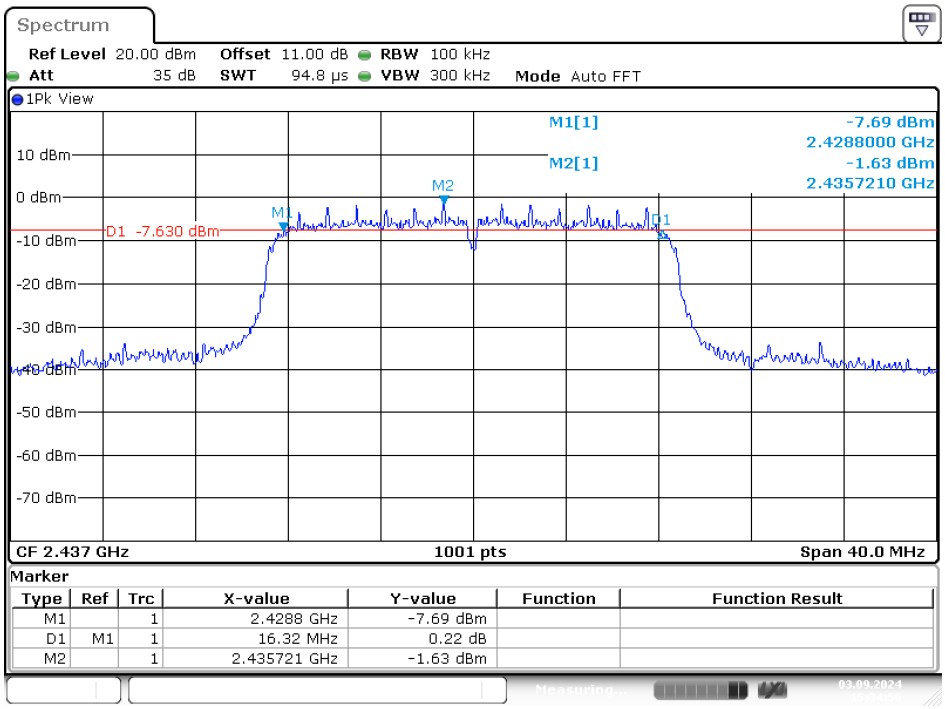
N20 Mode

Low Channel



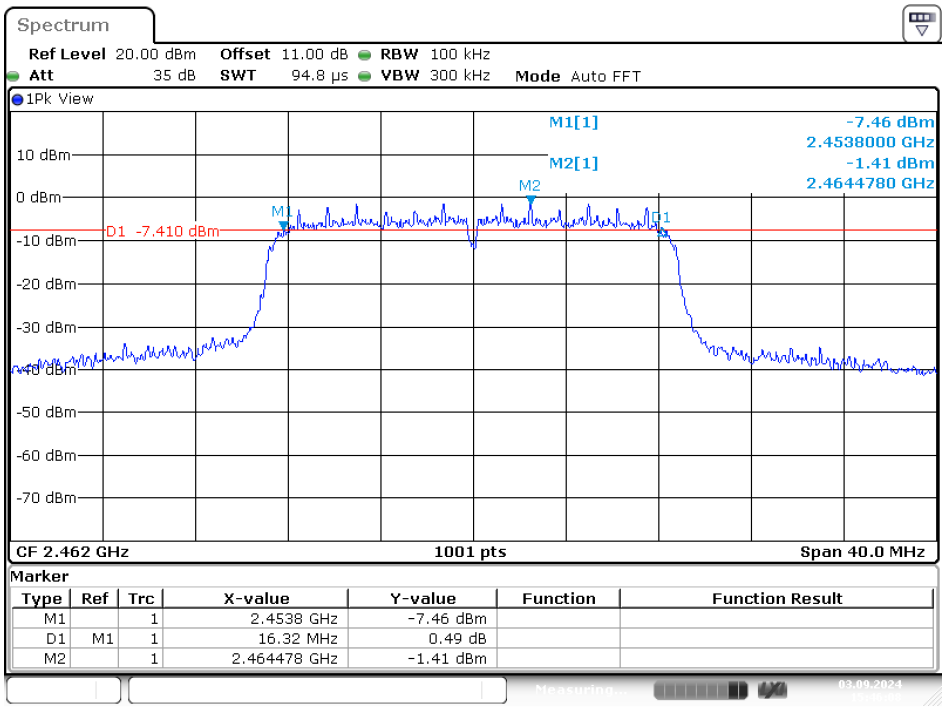
Date: 3.SEP.2024 15:25:35

Middle Channel



Date: 3.SEP.2024 15:34:56

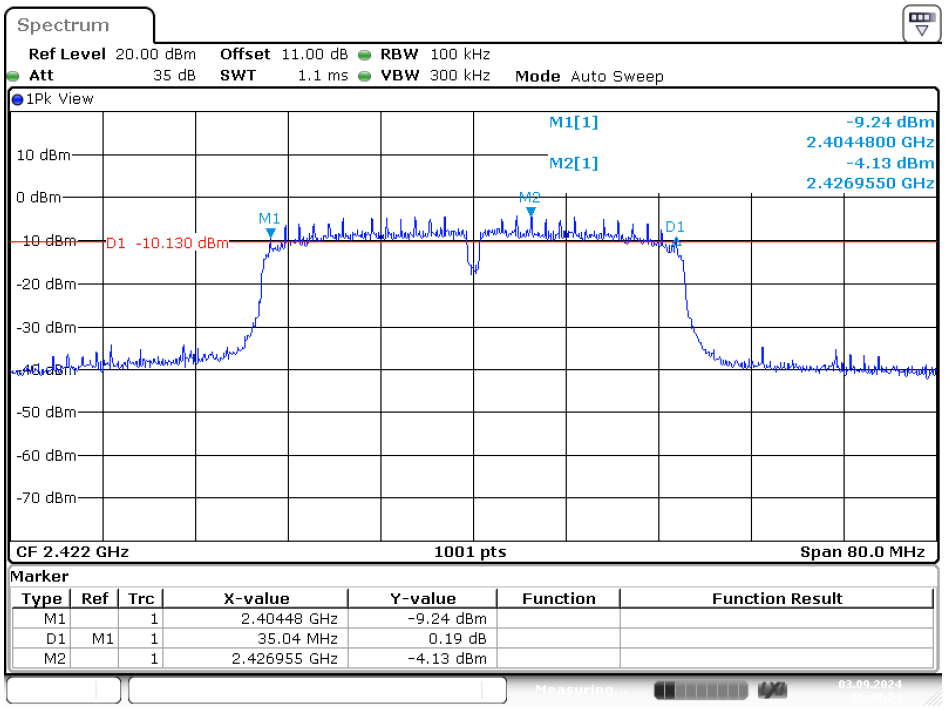
High Channel



Date: 3.SEP.2024 15:46:08

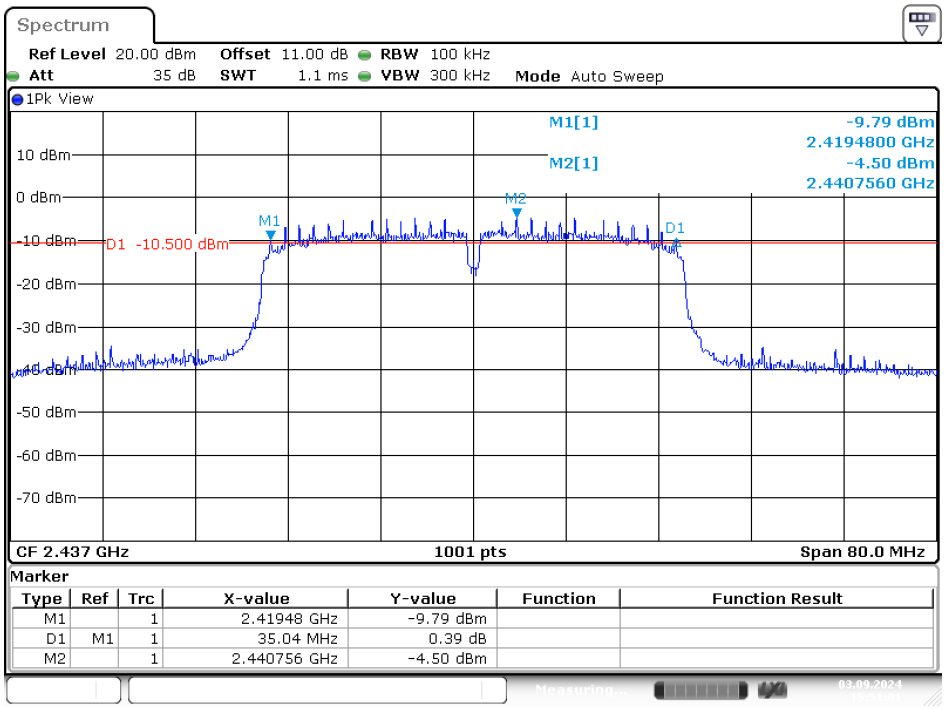
N40 Mode

Low Channel



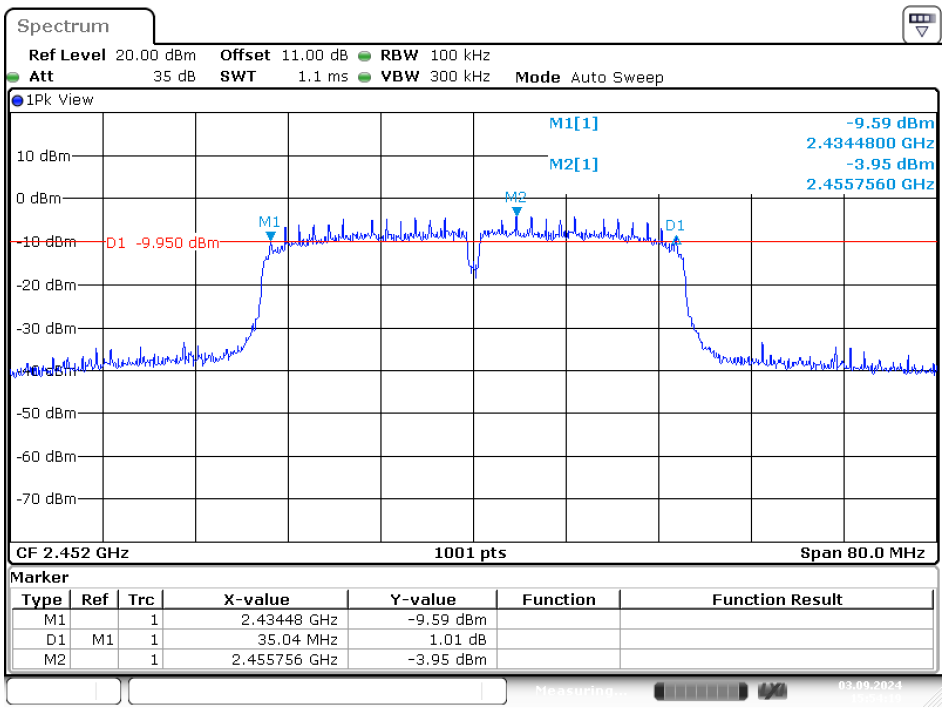
Date: 3.SEP.2024 15:48:24

Middle Channel



Date: 3.SEP.2024 15:51:01

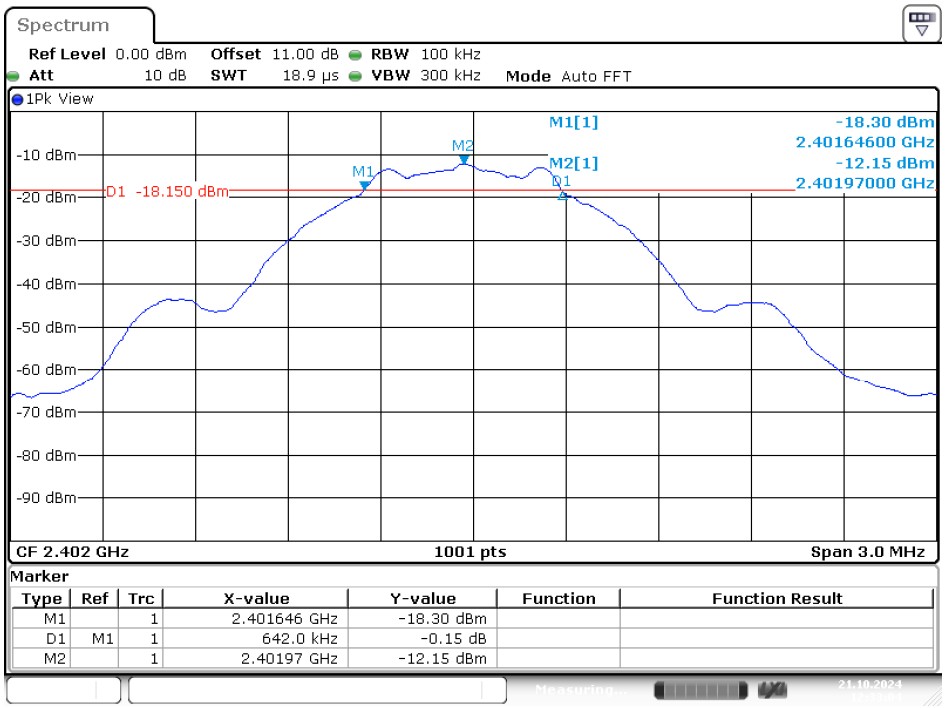
High Channel



Date: 3.SEP.2024 15:54:19

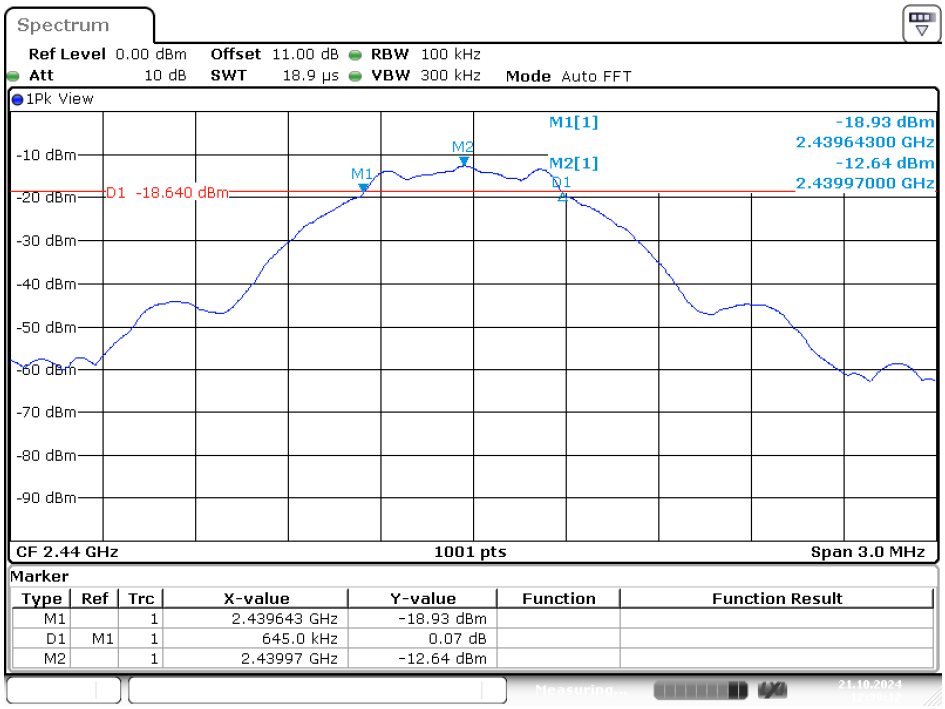
BLE(1M) Mode

Low Channel



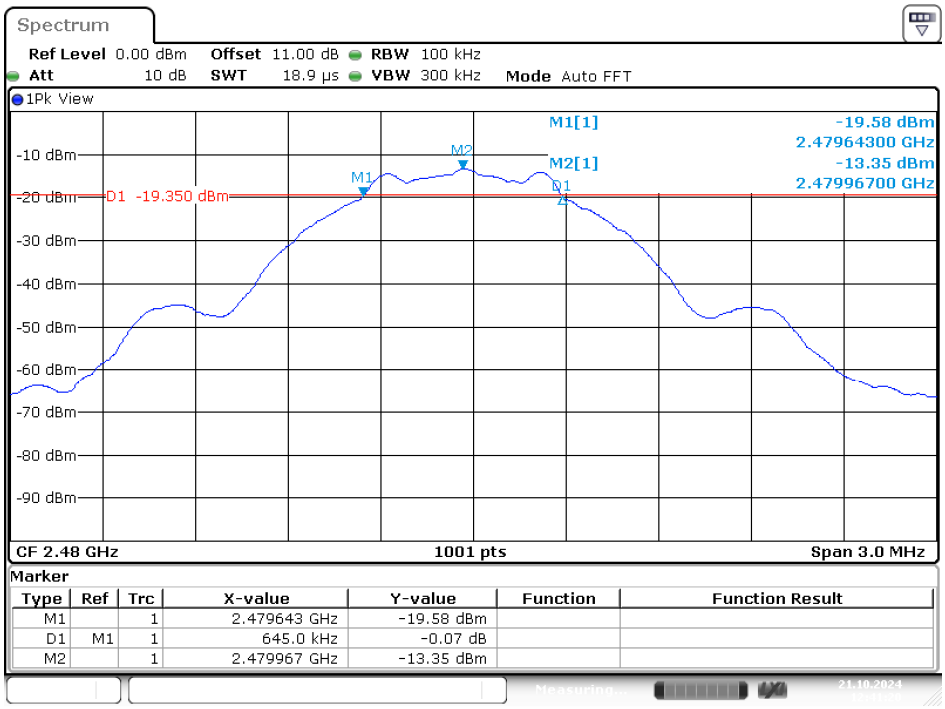
Date: 21.OCT.2024 12:33:04

Middle Channel



Date: 21.OCT.2024 12:39:13

High Channel



Date: 21.OCT.2024 12:41:20

10 FCC §15.247(b)(3) – Maximum Output Power

10.1 Applicable Standard

According to FCC §15.247(b) (3).

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 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.

10.2 Test Procedure

According to ANSI C63.10-2013, section 11.9.1.3

1. Place the EUT on a bench and set it in transmitting mode.

2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

10.3 Test Results

Conducted Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Power (W)	Limit (W)	Result
802.11b Mode					
Low	2412	15.06	0.032	1	PASS
Middle	2437	14.98	0.031	1	PASS
High	2462	15.29	0.034	1	PASS
802.11g Mode					
Low	2412	17.54	0.057	1	PASS
Middle	2437	17.76	0.060	1	PASS
High	2462	18.22	0.066	1	PASS
802.11n HT20 Mode					
Low	2412	16.45	0.044	1	PASS
Middle	2437	16.29	0.043	1	PASS
High	2462	16.68	0.047	1	PASS
802.11n HT40 Mode					
Low	2422	16.59	0.046	1	PASS
Middle	2437	16.37	0.043	1	PASS
High	2452	16.62	0.046	1	PASS
BLE(1M) Mode					
Low	2402	-7.69	0.0002	1	PASS
Middle	2440	-7.18	0.0002	1	PASS
High	2480	-7.22	0.0002	1	PASS

11 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

11.1 Applicable Standard

According to FCC §15.247(d).

In any 100 kHz 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 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 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 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions 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)).

11.2 Test Procedure

According to ANSI C63.10-2013 Section 11.11

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ [3 × RBW].
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

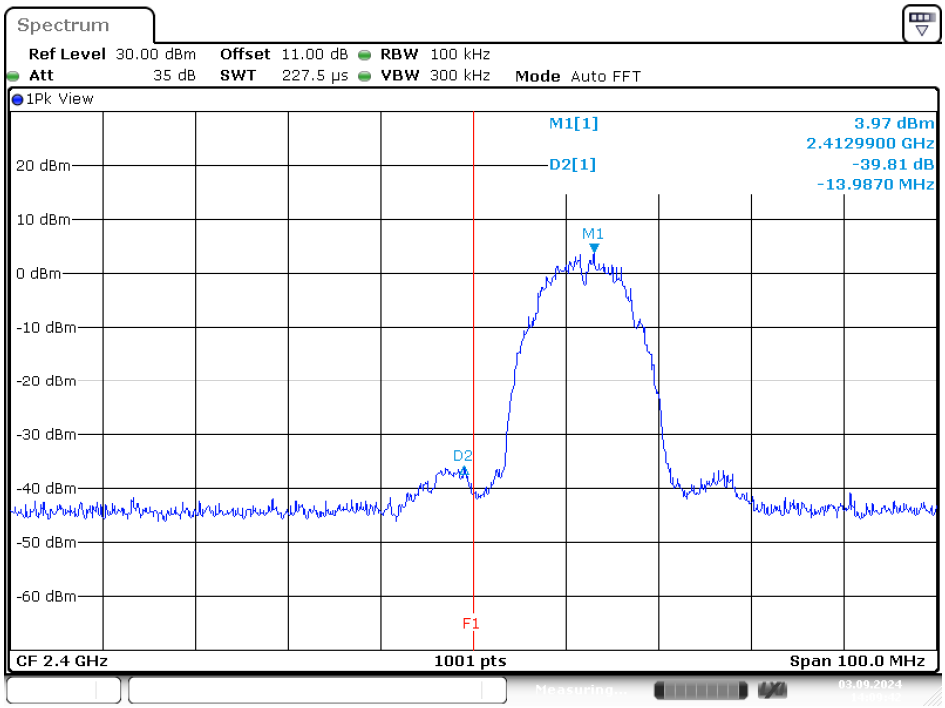
11.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
B Mode				
Low	2412	39.81	≥ 20	PASS
High	2462	43.88	≥ 20	PASS
G Mode				
Low	2412	26.62	≥ 20	PASS
High	2462	37.57	≥ 20	PASS
N20 Mode				
Low	2412	32.17	≥ 20	PASS
High	2462	38.60	≥ 20	PASS
N40 Mode				
Low	2422	31.70	≥ 20	PASS
High	2452	34.28	≥ 20	PASS
BLE(1M) Mode				
Low	2402	55.31	≥ 20	PASS
High	2480	55.26	≥ 20	PASS

Please refer to the following plots

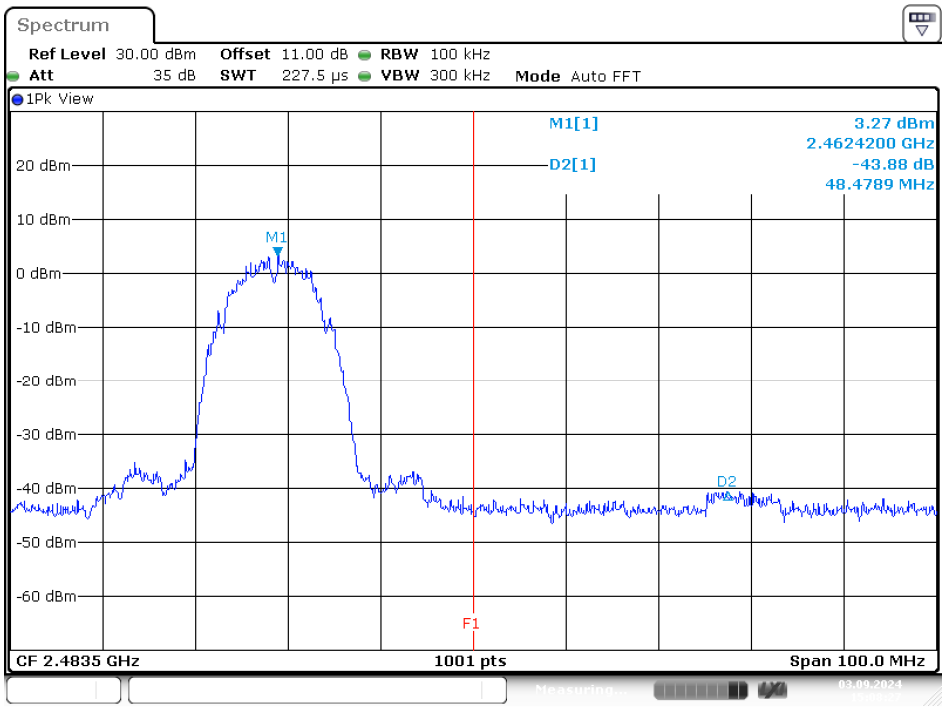
B Mode

Band Edge, Left Side



Date: 3.SEP.2024 14:09:43

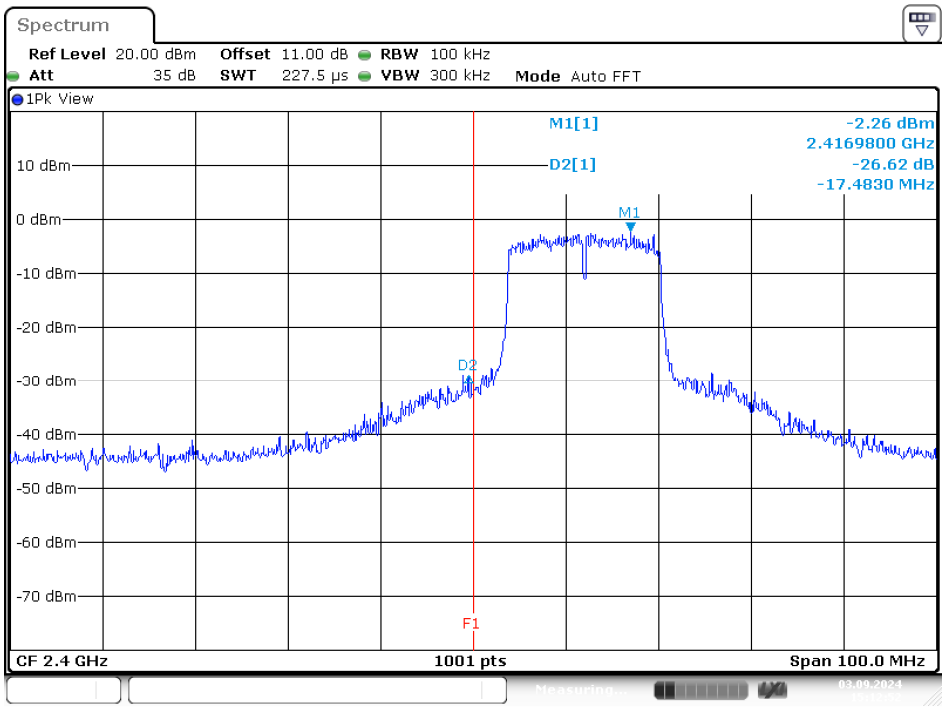
Band Edge, Right Side



Date: 3.SEP.2024 15:08:27

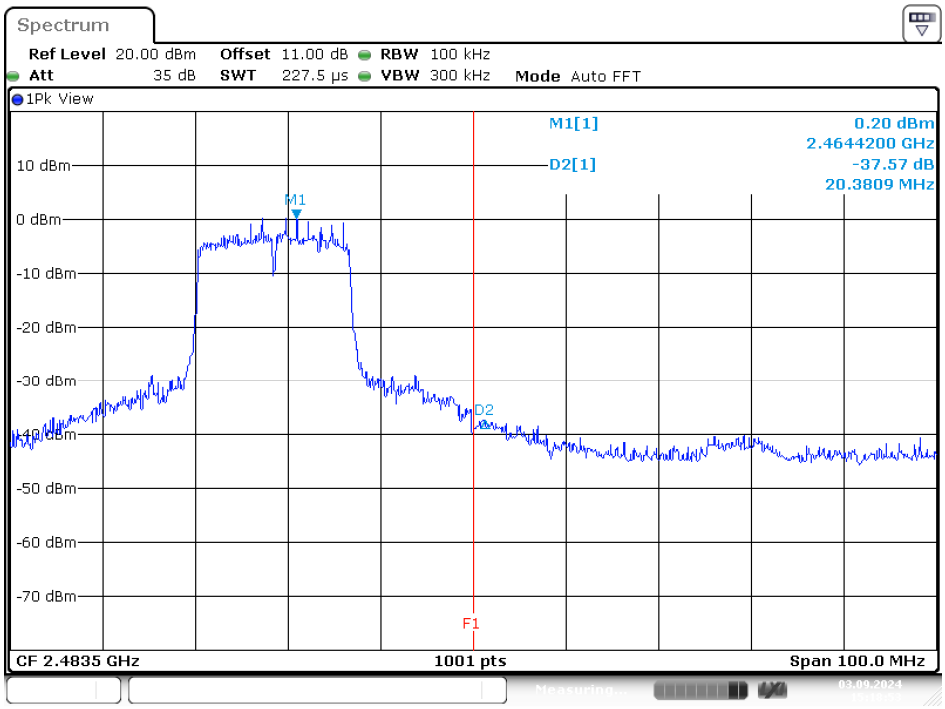
G Mode

Band Edge, Left Side



Date: 3.SEP.2024 15:12:53

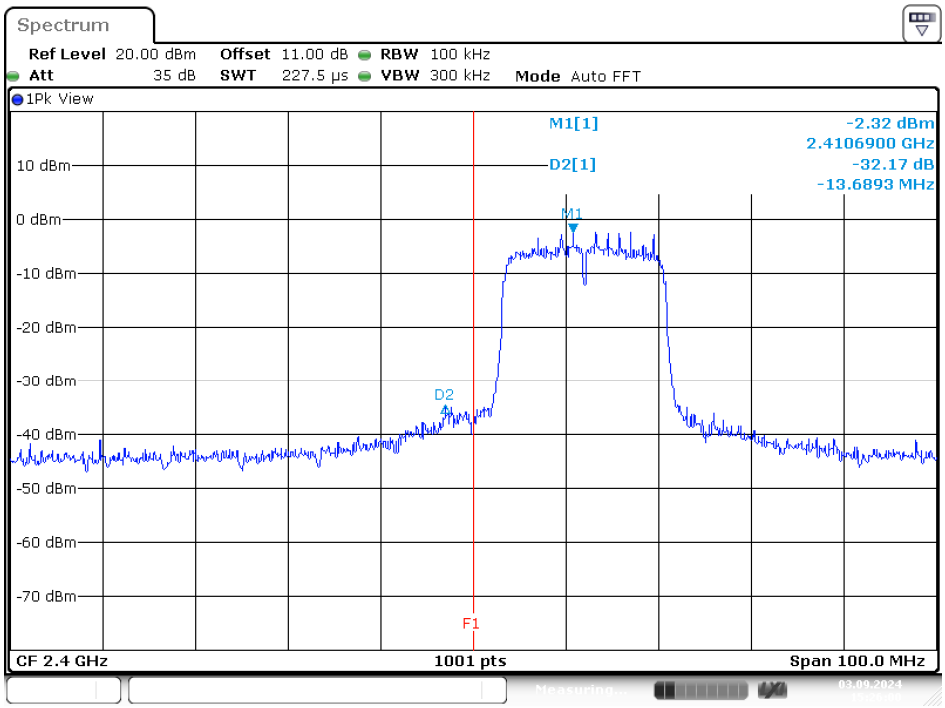
Band Edge, Right Side



Date: 3.SEP.2024 15:18:53

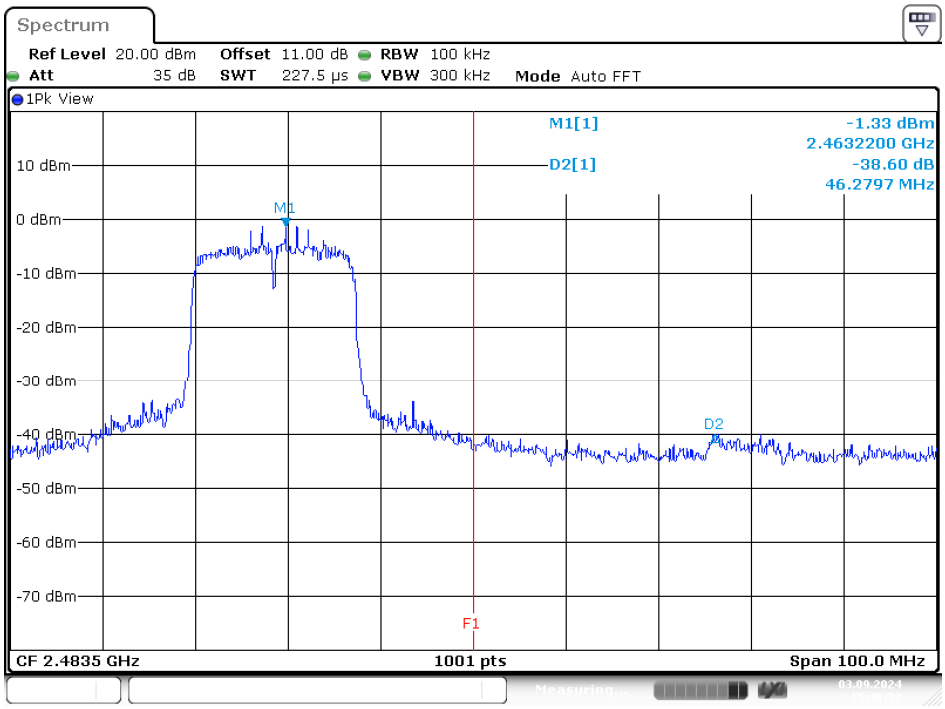
N20 Mode

Band Edge, Left Side



Date: 3.SEP.2024 15:26:00

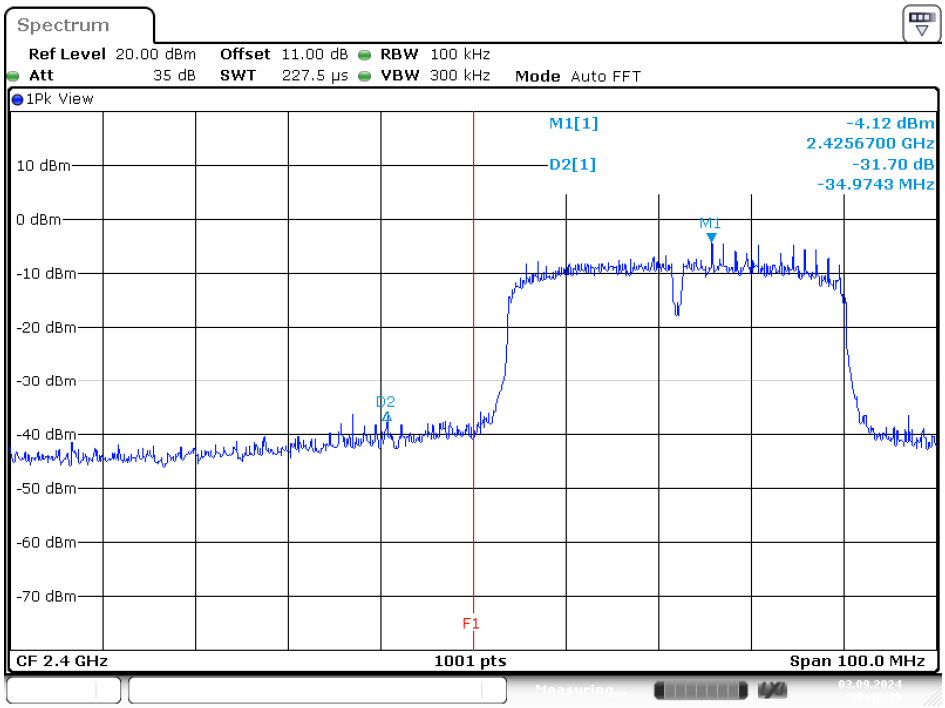
Band Edge, Right Side



Date: 3.SEP.2024 15:46:33

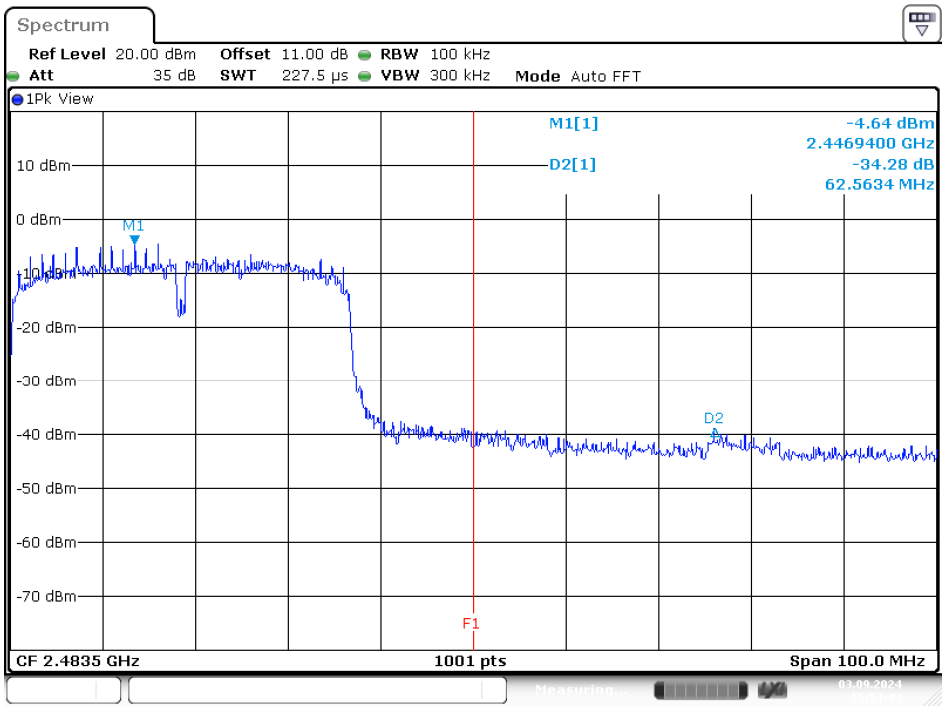
N40 Mode

Band Edge, Left Side



Date: 3.SEP.2024 15:48:50

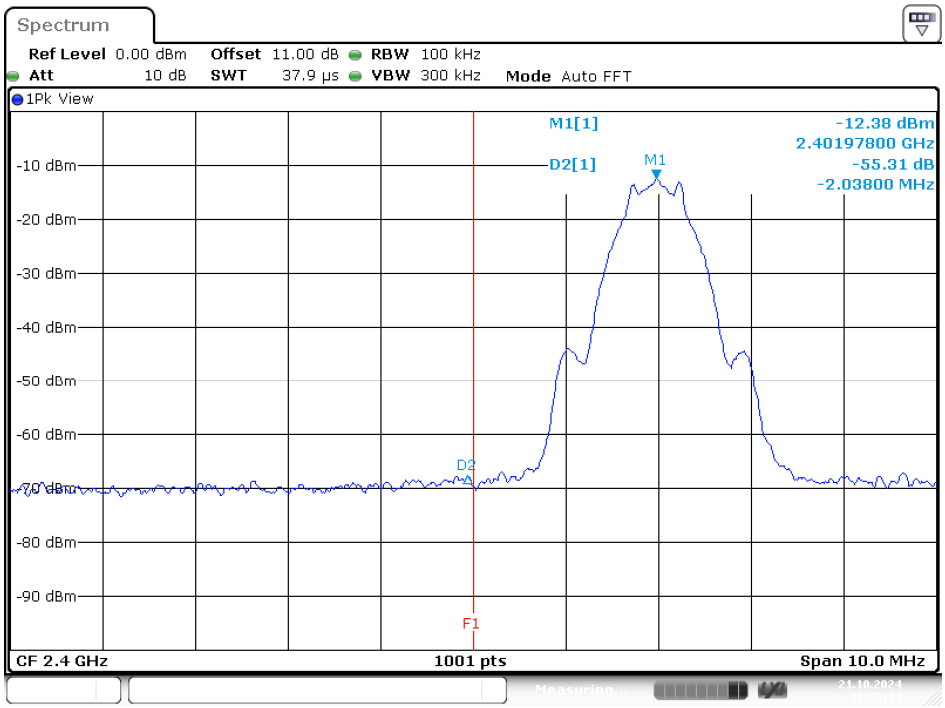
Band Edge, Right Side



Date: 3.SEP.2024 15:54:44

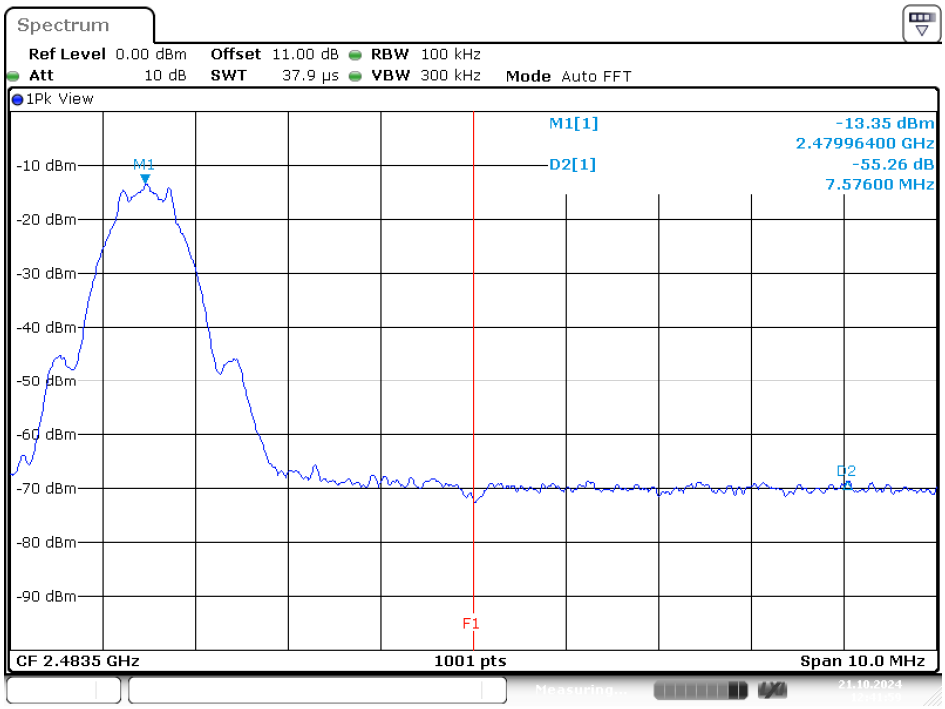
BLE(1M) Mode

Band Edge, Low Channel



Date: 21.OCT.2024 12:33:44

Band Edge, High Channel



Date: 21.OCT.2024 12:42:00

12 FCC §15.247(e) – Power Spectral Density

12.1 Applicable Standard

According to FCC §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 dBm in any 3 kHz 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.

12.2 Test Procedure

According to ANSI C63.10-2013, section 11.10.2

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 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ [3 × 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 kHz) and repeat

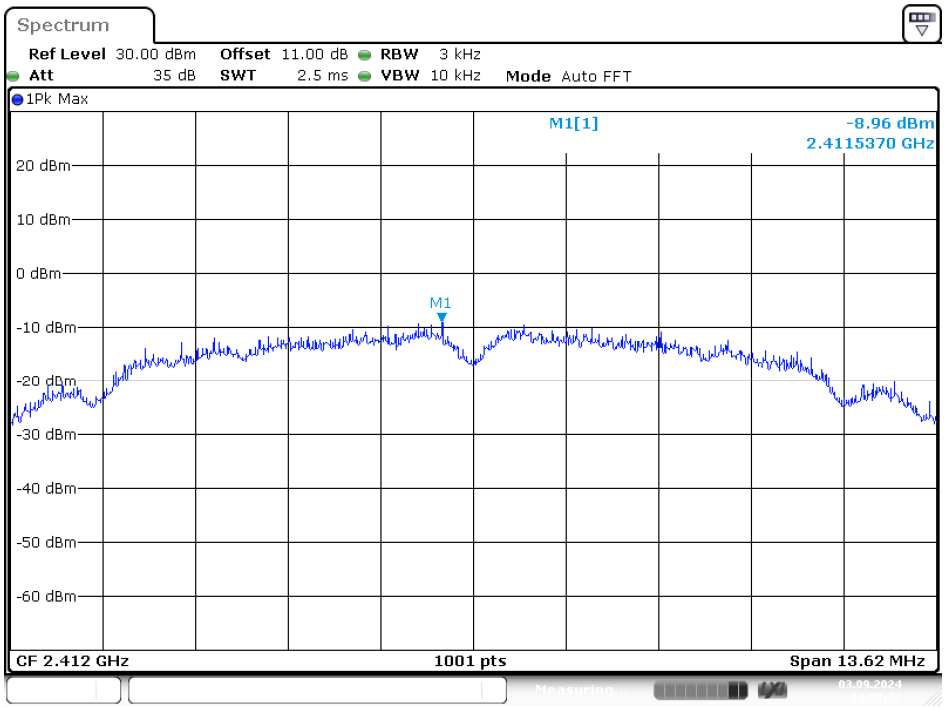
12.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
B Mode				
Low	2412	-8.96	8	PASS
Middle	2437	-9.16	8	PASS
High	2462	-8.86	8	PASS
G Mode				
Low	2412	-14.02	8	PASS
Middle	2437	-14.24	8	PASS
High	2462	-13.70	8	PASS
N20 Mode				
Low	2412	-14.66	8	PASS
Middle	2437	-14.84	8	PASS
High	2462	-14.49	8	PASS
N40 Mode				
Low	2422	-17.51	8	PASS
Middle	2437	-18.14	8	PASS
High	2452	-17.56	8	PASS
BLE(1M) Mode				
Low	2402	-27.75	8	PASS
Middle	2440	-28.13	8	PASS
High	2480	-28.85	8	PASS

Please refer to the following plots

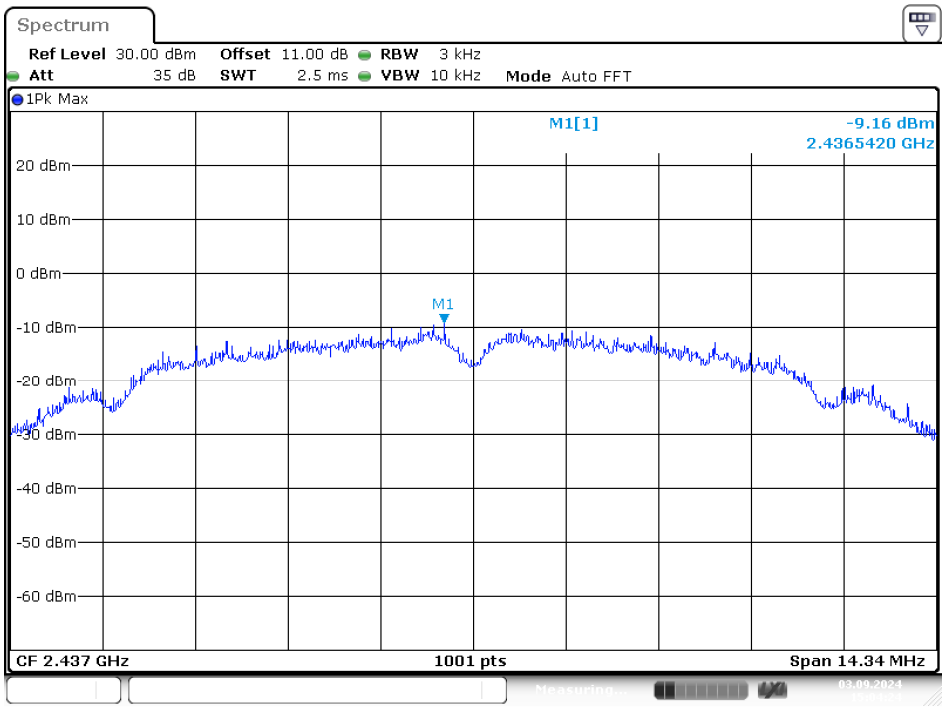
B Mode

Low Channel



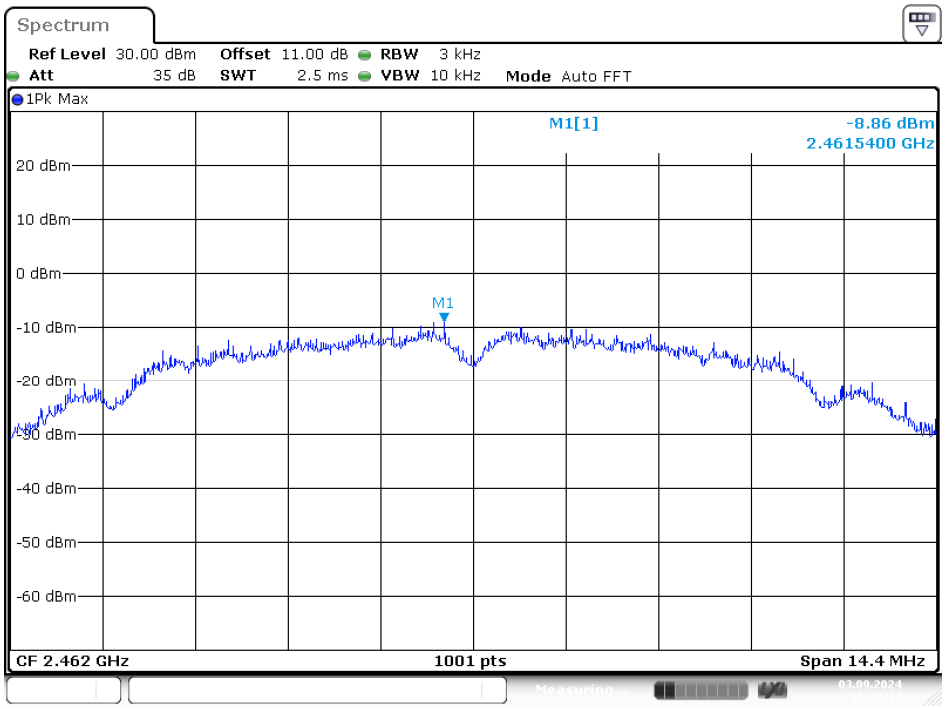
Date: 3.SEP.2024 14:09:27

Middle Channel



Date: 3.SEP.2024 15:04:25

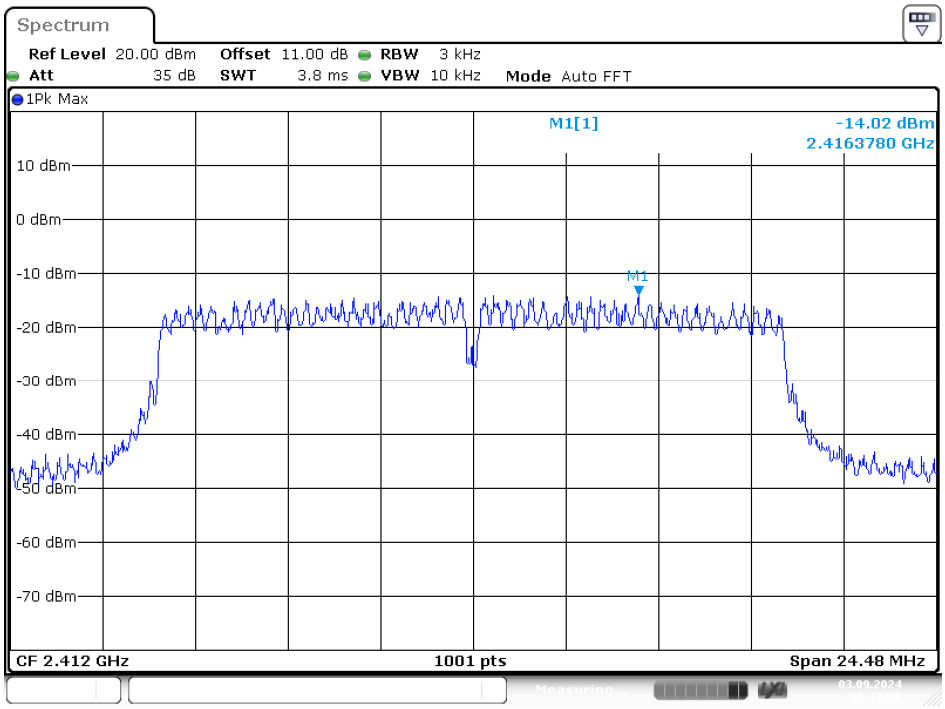
High Channel



Date: 3.SEP.2024 15:08:12

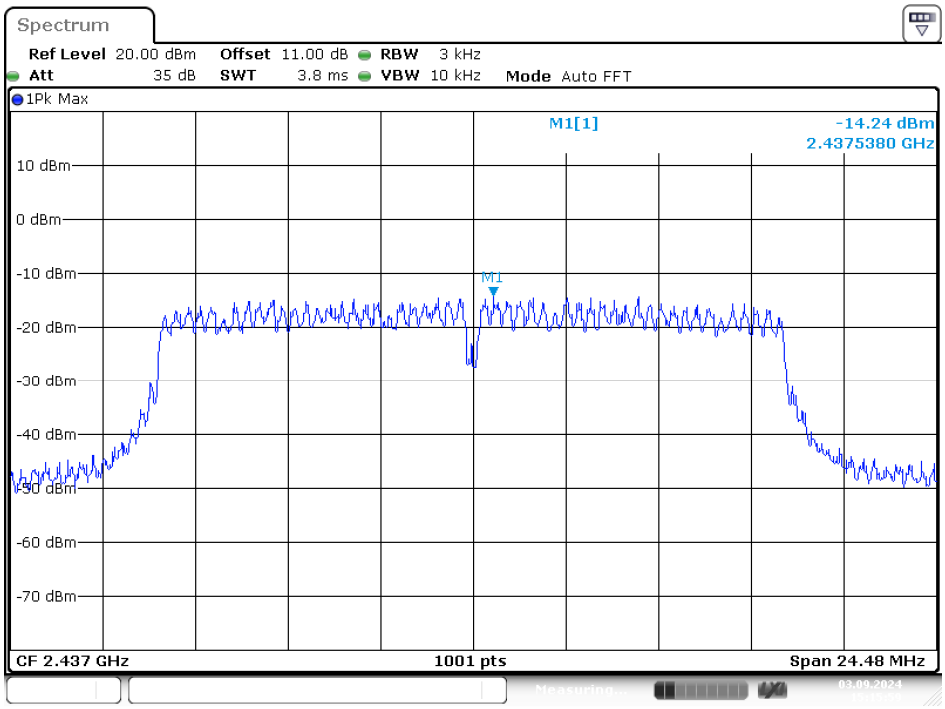
G Mode

Low Channel



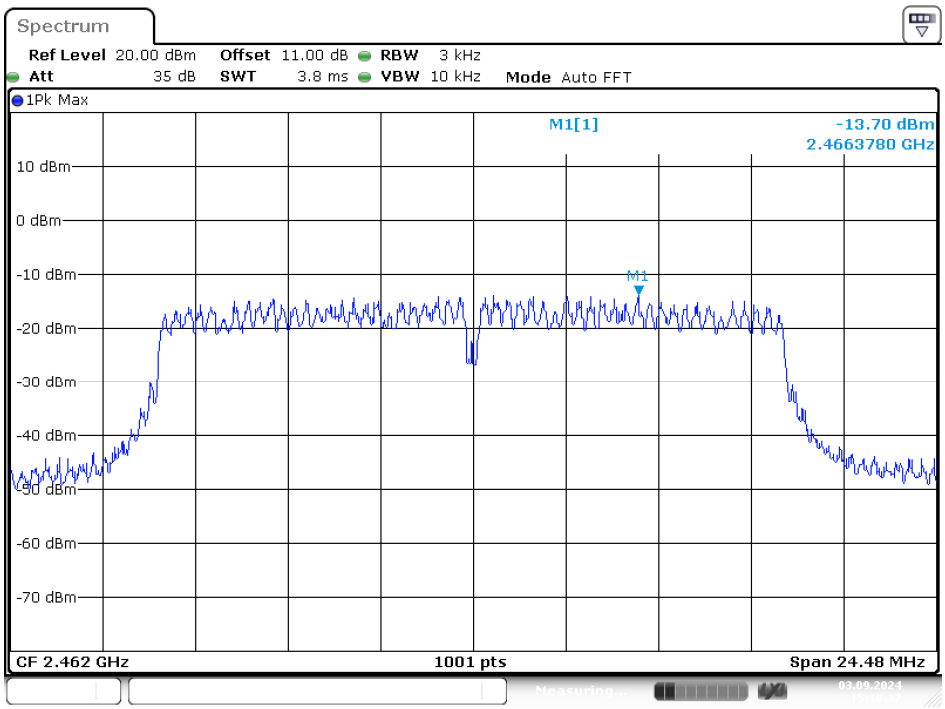
Date: 3.SEP.2024 15:12:37

Middle Channel



Date: 3.SEP.2024 15:15:59

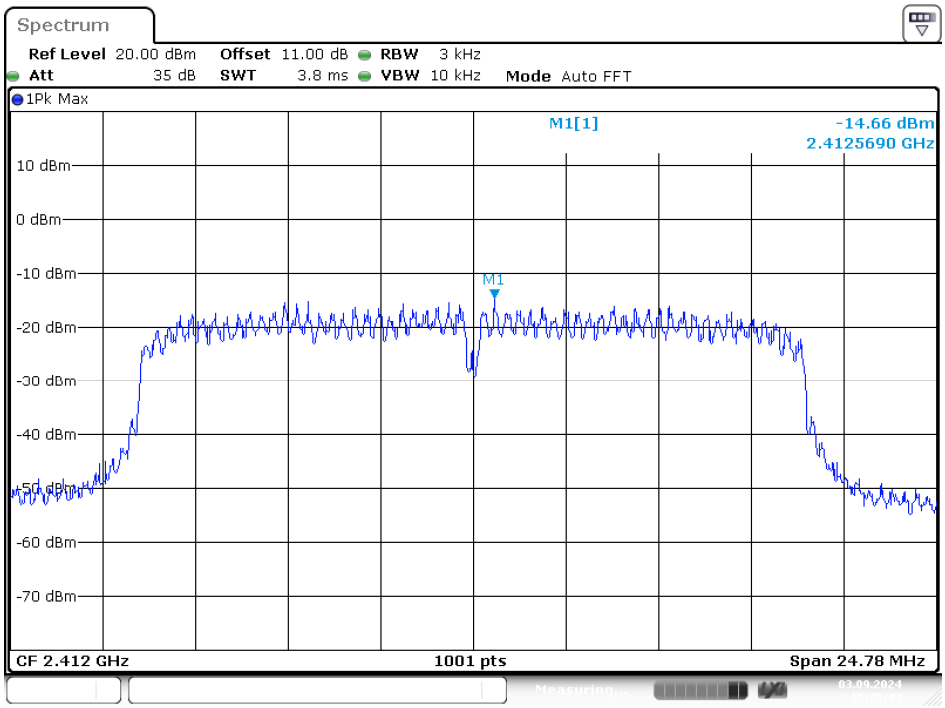
High Channel



Date: 3.SEP.2024 15:18:38

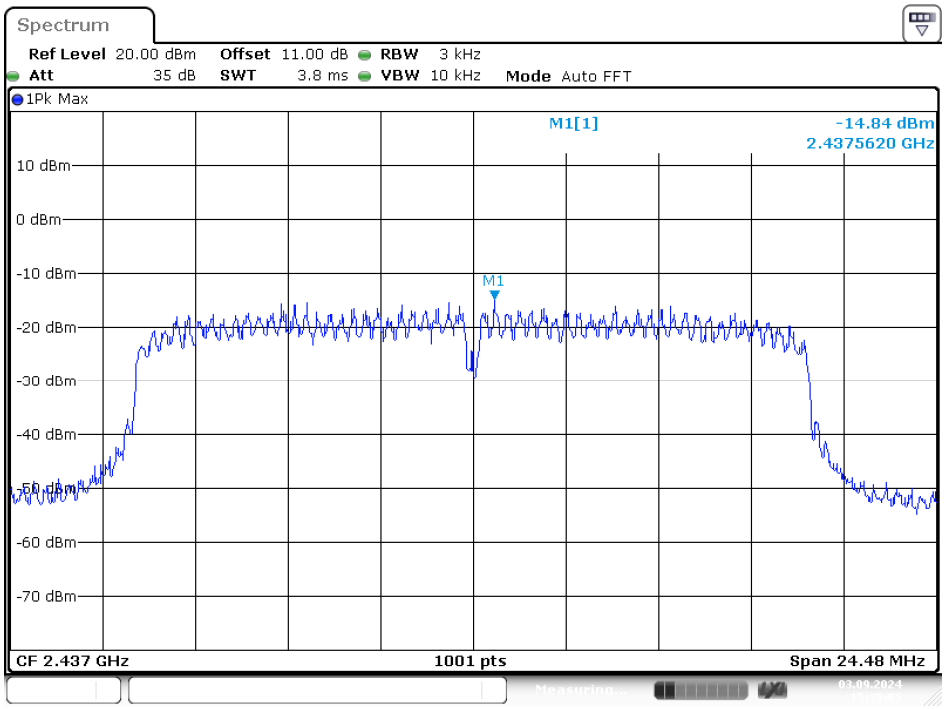
N20 Mode

Low Channel



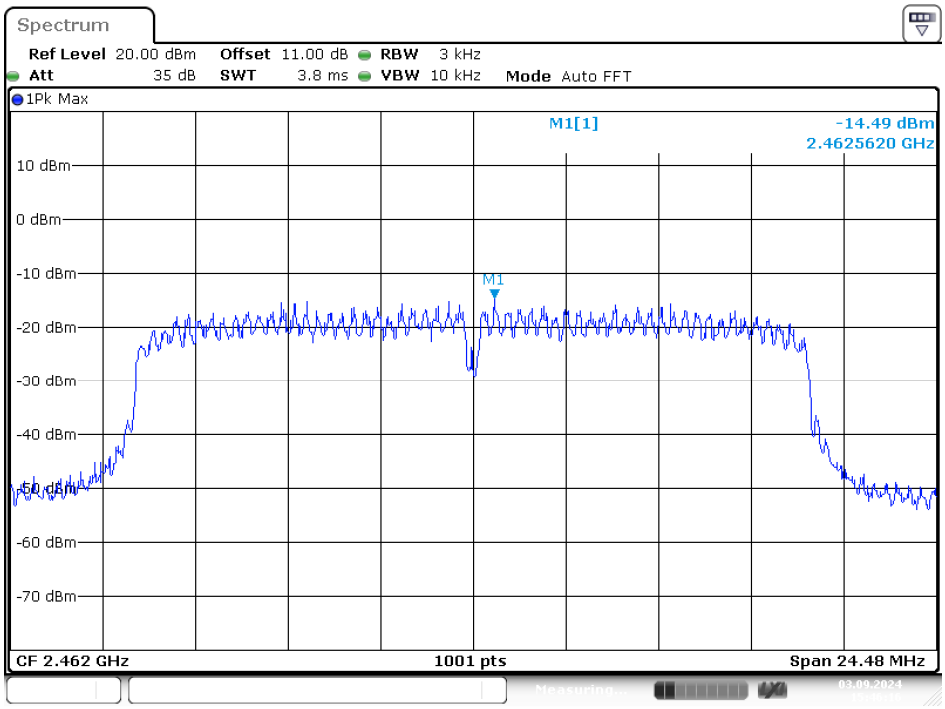
Date: 3.SEP.2024 15:25:44

Middle Channel



Date: 3.SEP.2024 15:35:05

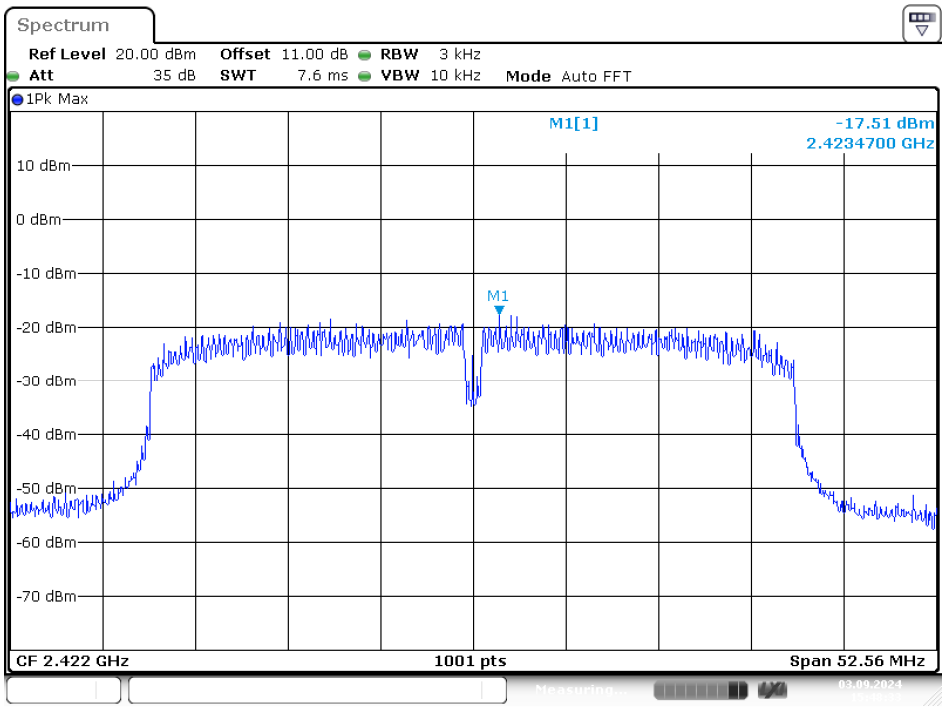
High Channel



Date: 3.SEP.2024 15:46:17

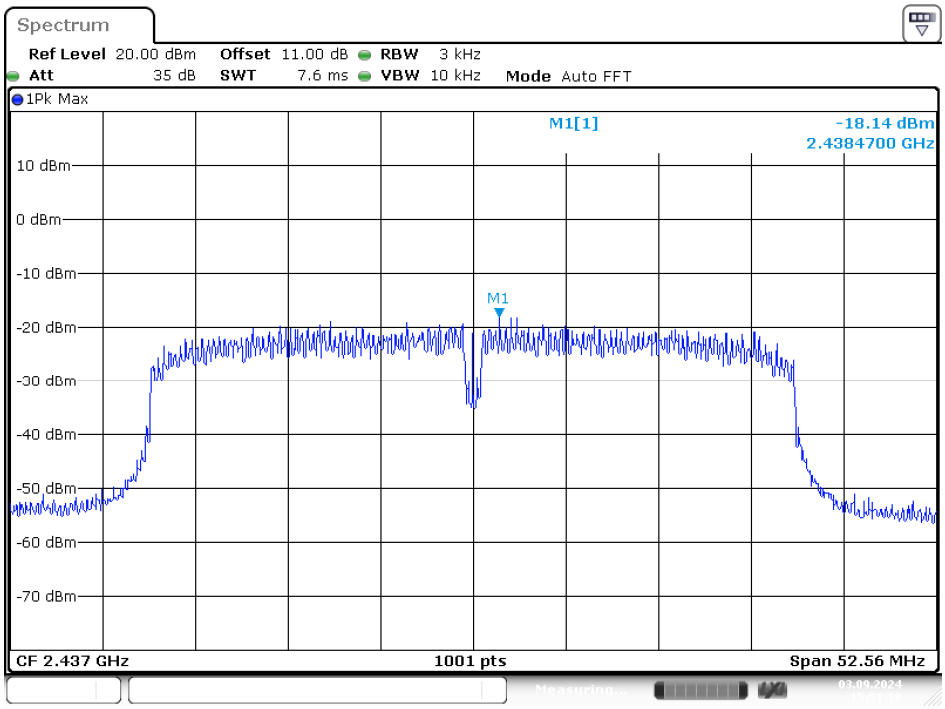
N40 Mode

Low Channel



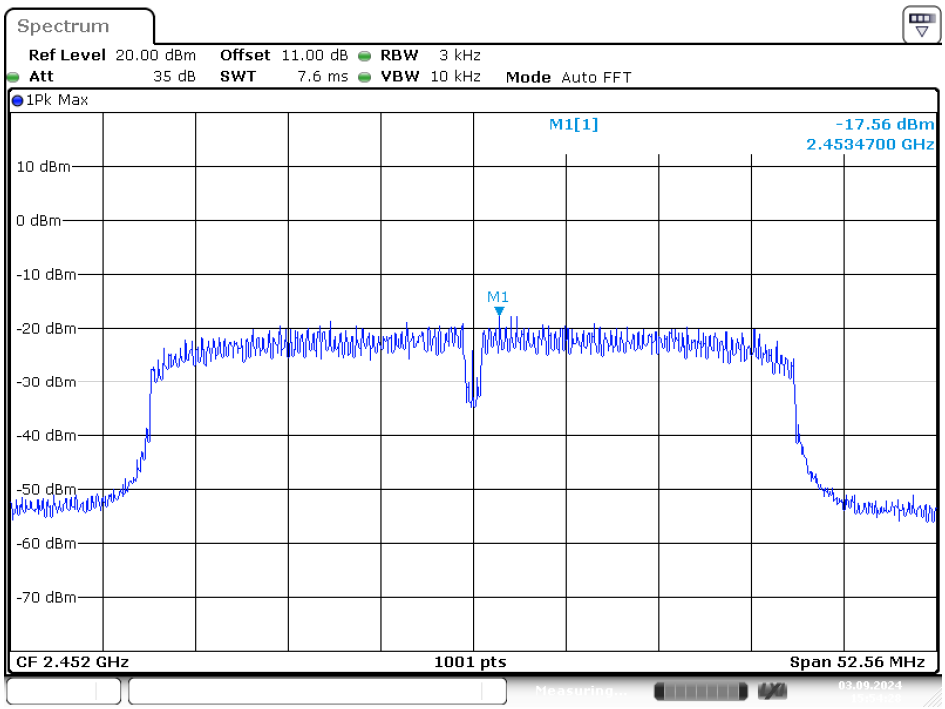
Date: 3.SEP.2024 15:48:33

Middle Channel



Date: 3.SEP.2024 15:51:10

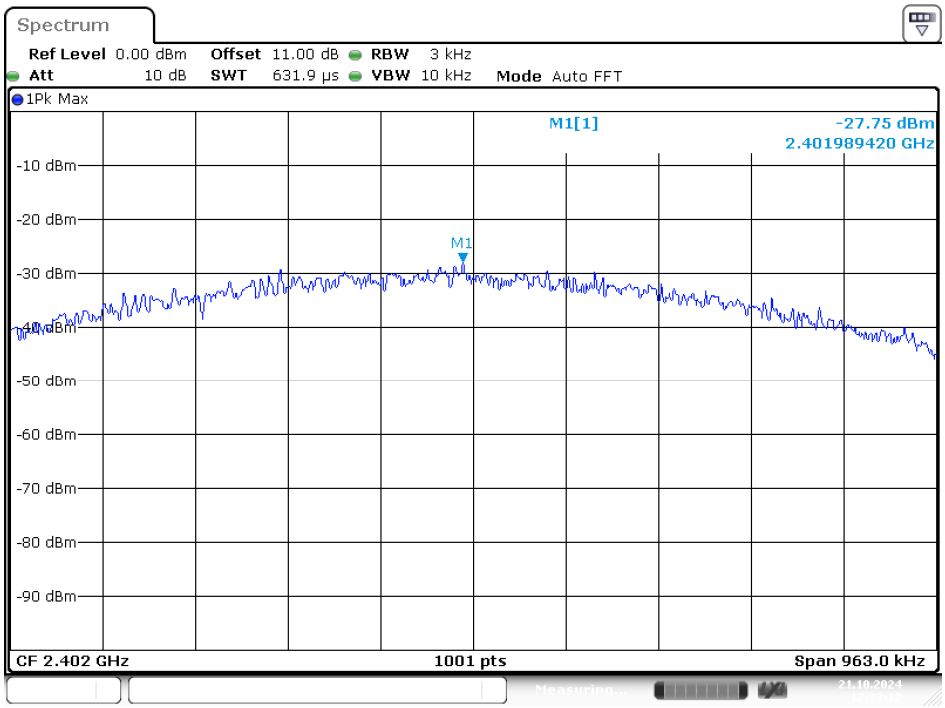
High Channel



Date: 3.SEP.2024 15:54:28

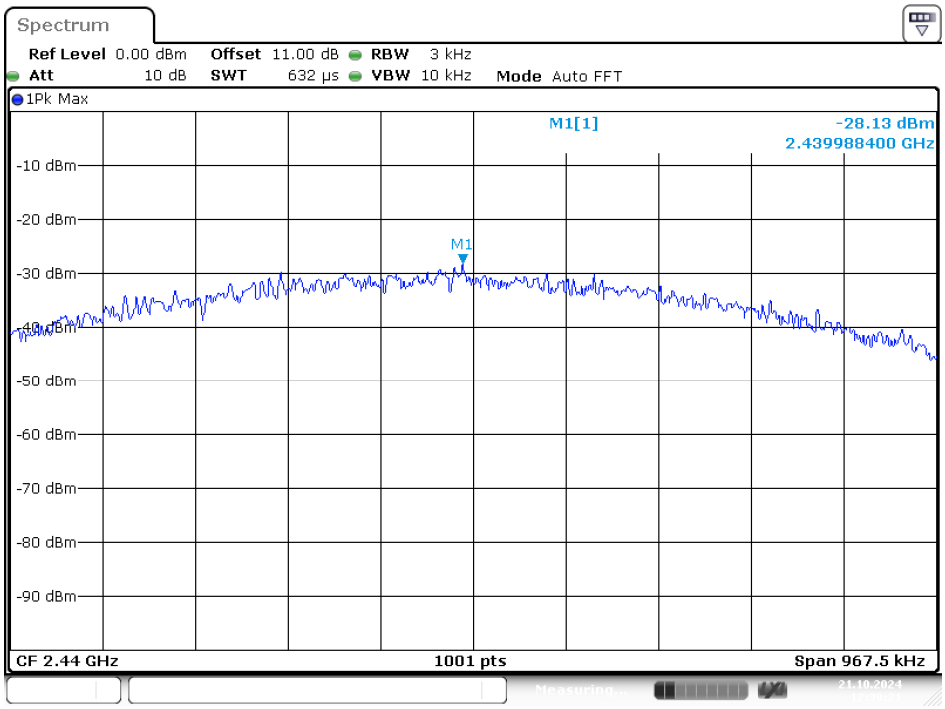
BLE(1M) Mode

Low Channel



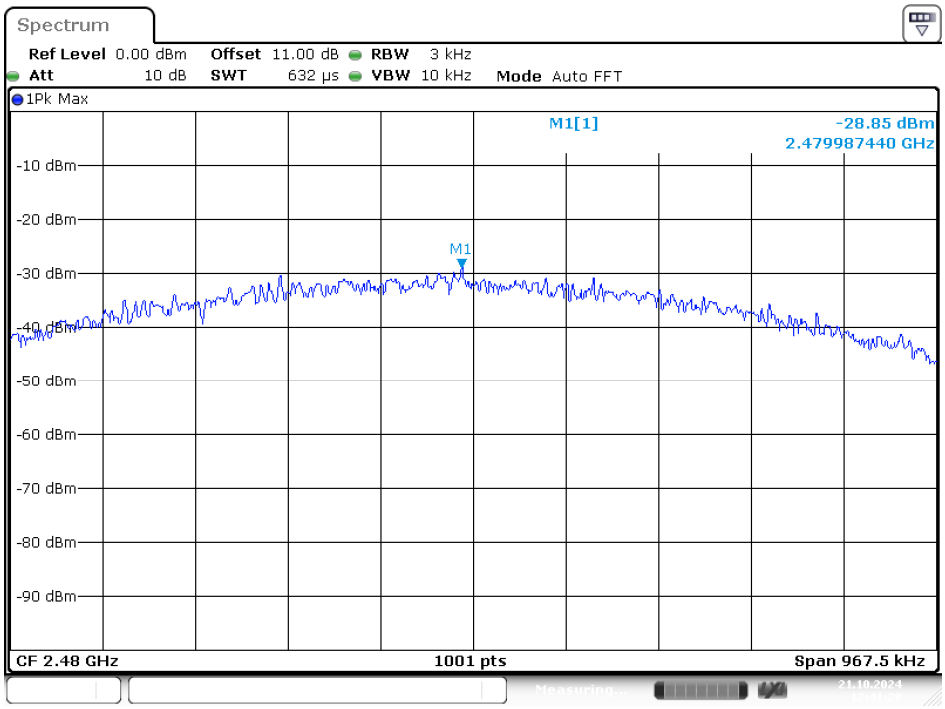
Date: 21.OCT.2024 12:33:13

Middle Channel



Date: 21.OCT.2024 12:39:22

High Channel



Date: 21.OCT.2024 12:41:29

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