TEST REPORT

Applicant Name :	Shenzhen Jiteng Network Technology Co., Ltd
Address :	No.1202, Bitian Pavilion, Bizhong Garden, No.10 Bibo First Street, Bibo Community, Huangbei Street, Luohu District, Shenzhen City, China
Report Number :	SZNS1220505-18180E-00B
FCC ID:	2AY4C-GM04

Test Standard (s)

FCC Part 15.247

Sample Description

Product:	Mini PC
Trademark:	GEEKOM
Tested Model:	MiniAir 11
Date Received:	2022-05-05
Date of Test:	2022-05-10 to 2022-05-27
Report Date:	2022-05-30

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Black Ding

EMC Engineer

Approved By:

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Mini PC
Tested Model	MiniAir 11
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz
Maximum Conducted Peak Output Power	BLE 1M: 1.57dBm Wi-Fi: 15.98dBm(802.11b), 14.99dBm(802.11g), 14.99dBm(802.11n20), 14.71dBm(802.11n40)
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification*	Internal Antenna: Ant 1: 2.68 dBi; Ant 2: 1.63 dBi; (provided by the applicant)
Voltage Range	DC19V from adapter
Sample serial number	SZNS1220505-18180E-RF-S1 (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter 1 information	Model: BSY065T1903423D, Input: 100-240V~50/60Hz, 1.5A, Output: 19V/3.42A
Adapter 2 information	Model: A481-1902360U, Input: 100-240V~50/60Hz 1.5A, Output: 19V/2.36A

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

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, and KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

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.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 mode, total 11 channels are provided to testing:

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	/	/

802.11b, 802.11g and 802.11n-HT20 mode was tested with Channel1, 6 and 11.
802.11n-HT40 mode was tested with Channel 3, 6 and 9.

For BLE mode, 40 channels are provided to testing:

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

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Software “DRTU”* was used during testing and power level as below:

Mode	Data Rate (Mbps)	Power Level* (Ant 1 & Ant 2)
802.11 b	1	14
802.11 g	6	13
802.11 n20	MCS0	13
802.11 n40	MCS0	13
BLE	/	Default

The worse-case data rates are determined to be as above for each mode based upon investigations by measuring the output power and PSD across all data rates, bandwidths and modulations.

The device supports SISO and MIMO in all modes for Wi-Fi, per pretest, the MIMO mode was the worst mode for all the modes. All the antenna ports have the same power level for SISO and MIMO modes.

Duty cycle

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

Support Equipment List and Details

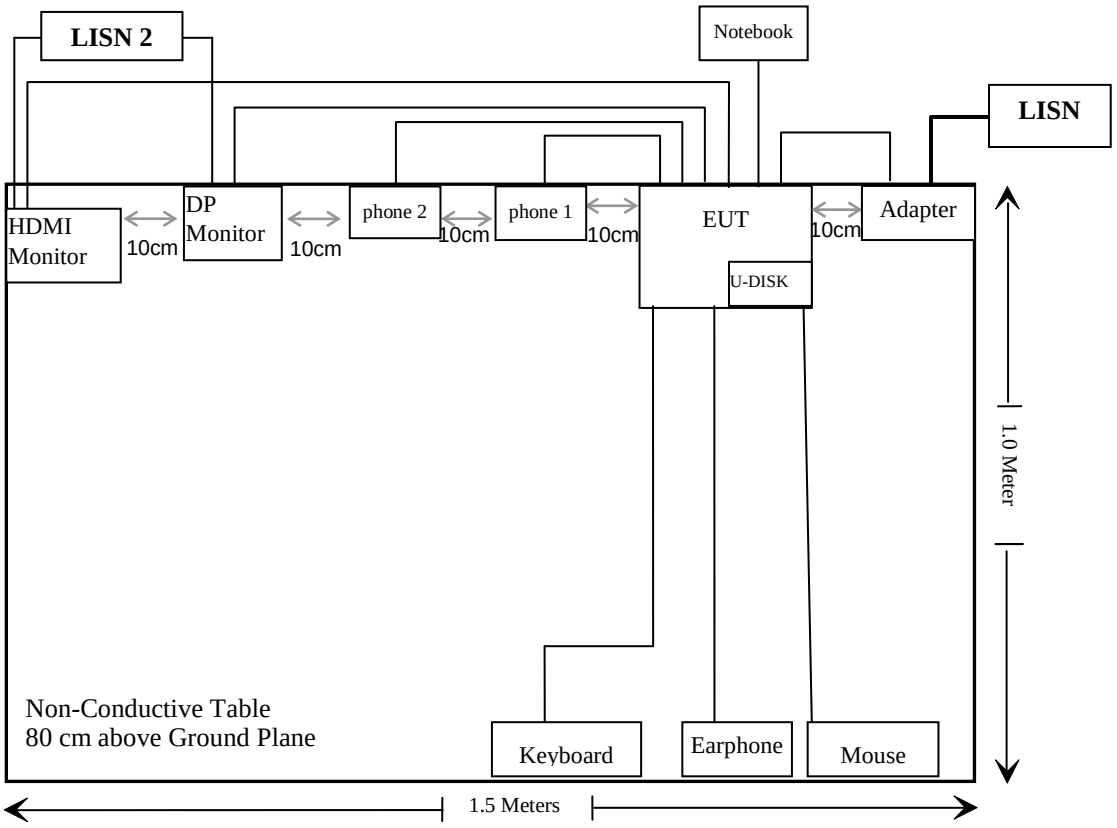
Manufacturer	Description	Model	Serial Number
DELL	Keyboard	L100	CN0RH66658985C018C
DELL	Mouse	MOC5UG	Unknown
PHILIPS	DP Monitor	275M7C	Unknown
DELL	HDMI Monitor	ST2310f	CN-05MKKK-72872-053
Unknown	U Disk	Unknown	Unknown
Huawei	Phone 1	TAS-AL00	88Y5T19A03011842
Shenzhen Wanplas Technology Co., LTD	Phone 2	GM1900	2a0a4328
SCI	Earphone	SCRC-130A	Unknown
Lenovo	Notebook	T430	Unknown

External I/O Cable

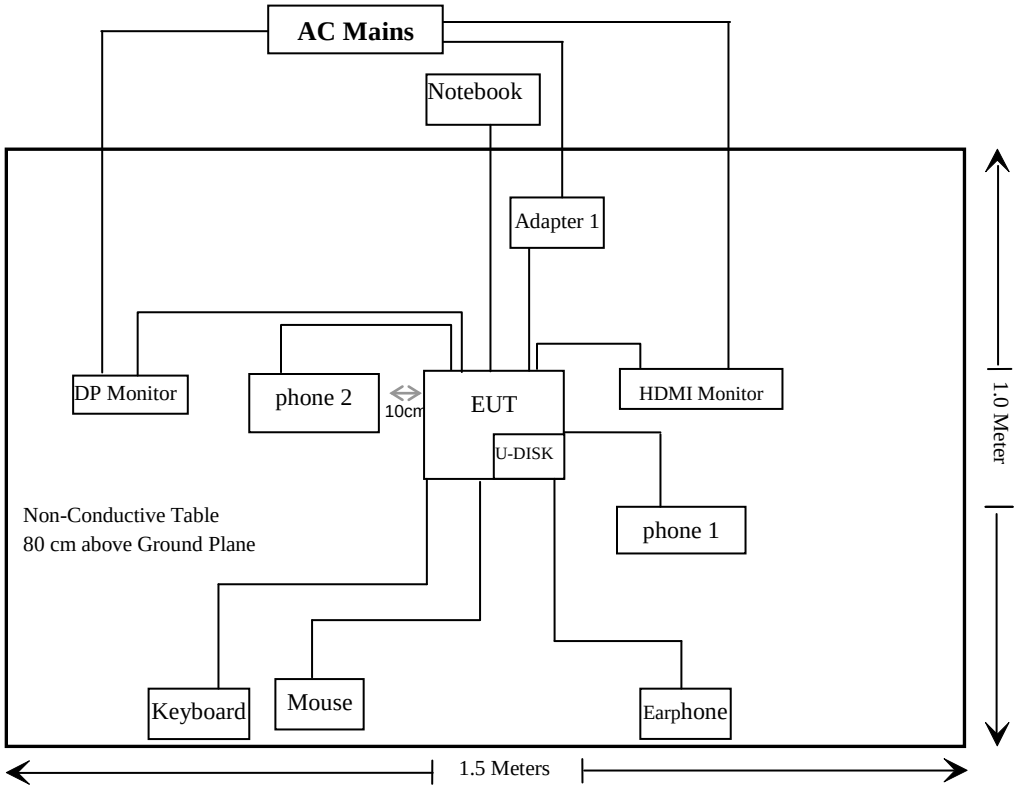
Cable Description	Length (m)	From Port	To
Unshielded Detachable DC output Cable	1.2	Adapter 1	EUT
Unshielded Detachable DC output Cable	1.2	Adapter 2	EUT
Unshielded Detachable AC power Cable	1.0	EUT	Adapter 1
Shielded Detachable HDMI Cable	2.0	EUT	HDMI Monitor
Shielded Detachable DP Cable	1.0	EUT	DP Monitor
Unshielded Detachable USB Cable	1.5	EUT	Mouse
Unshielded Detachable USB Cable	1.5	EUT	Keyboard
Unshielded Detachable TYPE-C Cable 1	1.0	EUT	Phone
Unshielded Detachable TYPE-C2 Cable 2	1.0	EUT	Phone
Unshielded Detachable earphone Cable	0.75	EUT	Earphone
Unshielded Detachable RJ45 Cable	10.0	EUT	Notebook

Block Diagram of Test Setup

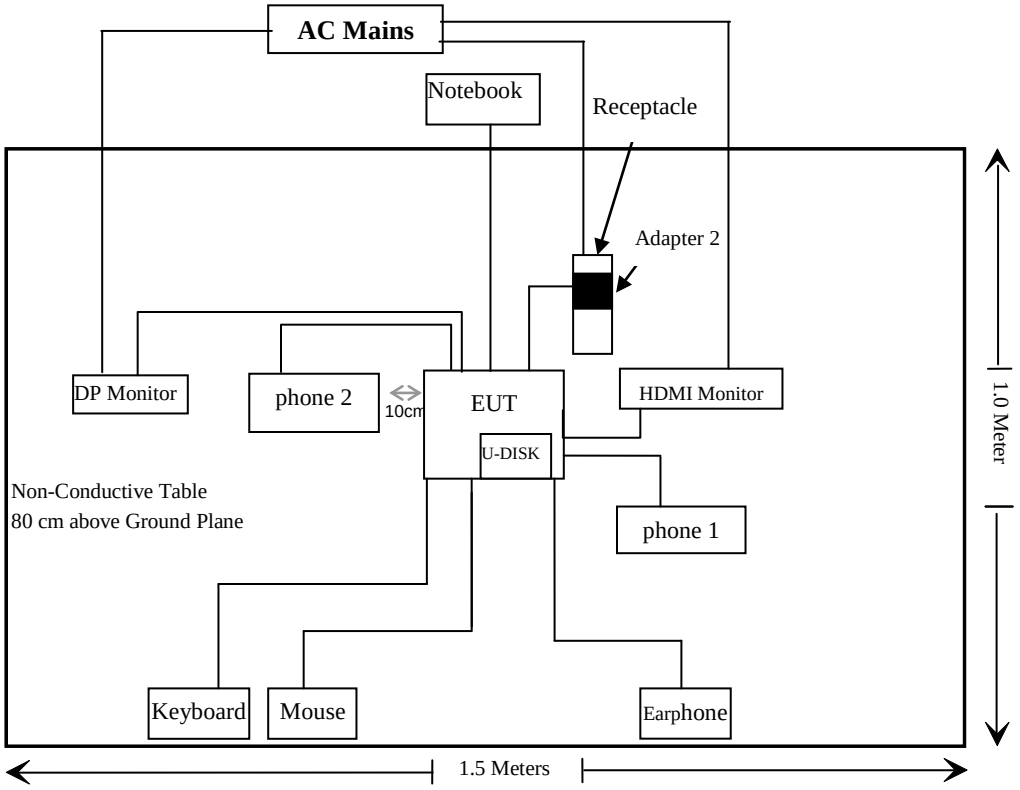
For conducted emission:



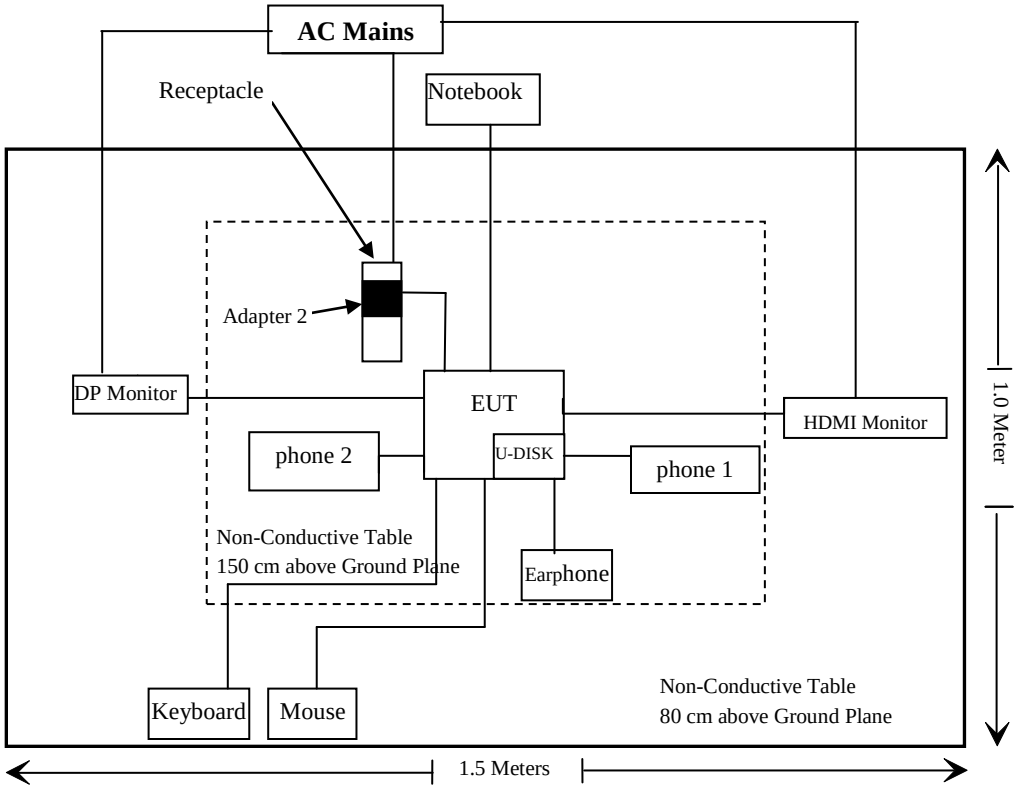
For Radiated emission:
Below 1GHz:
Adapter 1:



Adapter 2:



Above 1GHz:


AC Mains
Receptacle
Notebook
Adapter 2
DP Monitor
EUT
HDMI Monitor
phone 2
U-DISK
phone 1
Non-Conductive Table
150 cm above Ground Plane
Earphone
Keyboard
Mouse
Non-Conductive Table
80 cm above Ground Plane
1.0 Meter
1.5 Meters

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §2.1091	Maximum Permissible Exposure(MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
R & S	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b(V9)					
Radiated Emissions Test					
Rohde & Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2021/12/14	2022/12/13
Mini-Circuits	High Pass Filter	NHP-600+	15542	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Radiated Emission Test Software: e3 19821b(V9)					

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2021/12/13	2022/12/12
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2021/12/13	2022/12/12
WEINSCHEL	10dB Attenuator	5324	AU 3842	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.33	RF-03	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, 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.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

For worst case:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
BT	2402-2480	2.68	1.85	3.5	2.24	20	0.0008	1.0
BLE	2402-2480	2.68	1.85	2.0	1.58	20	0.0006	1.0
2.4G Wi-Fi	2412-2462	2.68	1.85	16.0	39.81	20	0.0147	1.0
5G Wi-Fi Band 1	5150-5250	3.39	2.18	15.5	35.48	20	0.0154	1.0
5G Wi-Fi Band 4	5725-5850	4.31	2.70	16.0	39.81	20	0.0214	1.0

Note: 1. The BT function can transmit at the same time with the Wi-Fi function.
2. The 2.4G Wi-Fi function can't transmit at the same time with the 5G Wi-Fi function.

Simultaneous transmitting consideration:

The ratio= MPE_{BT}/limit + $MPE_{5G\ Wi\text{-}Fi}$/limit=0.0008/1+0.0214/1=0.0222＜1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §15.203 - ANTENNA REQUIREMENT

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. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one Internal Antenna arrangement for BLE and two Internal Antennas for Wi-Fi, which was permanently attached and the antenna gain is 2.68dBi (Ant1) and 1.63dBi (Ant2), fulfill the requirement of this section. Please refer to the EUT photos.

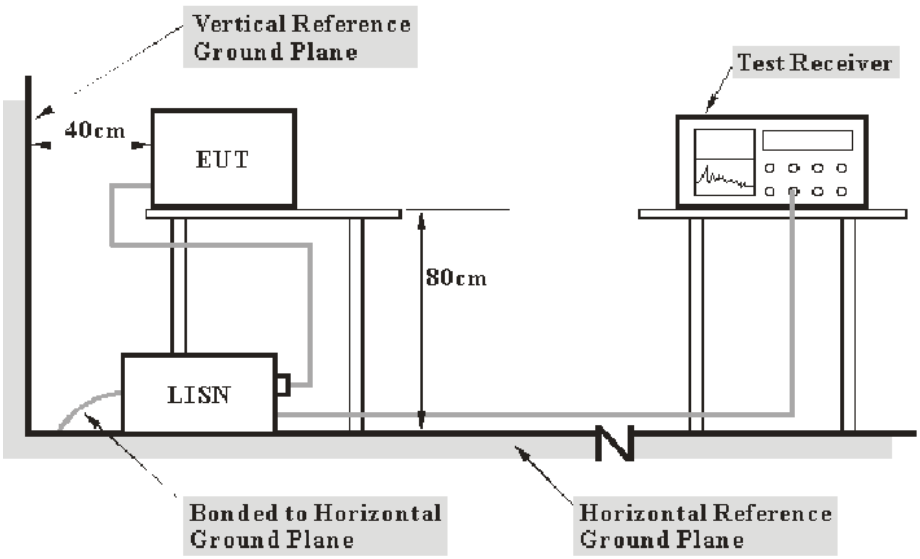
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

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

Factor & Margin Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

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 calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

Environmental Conditions

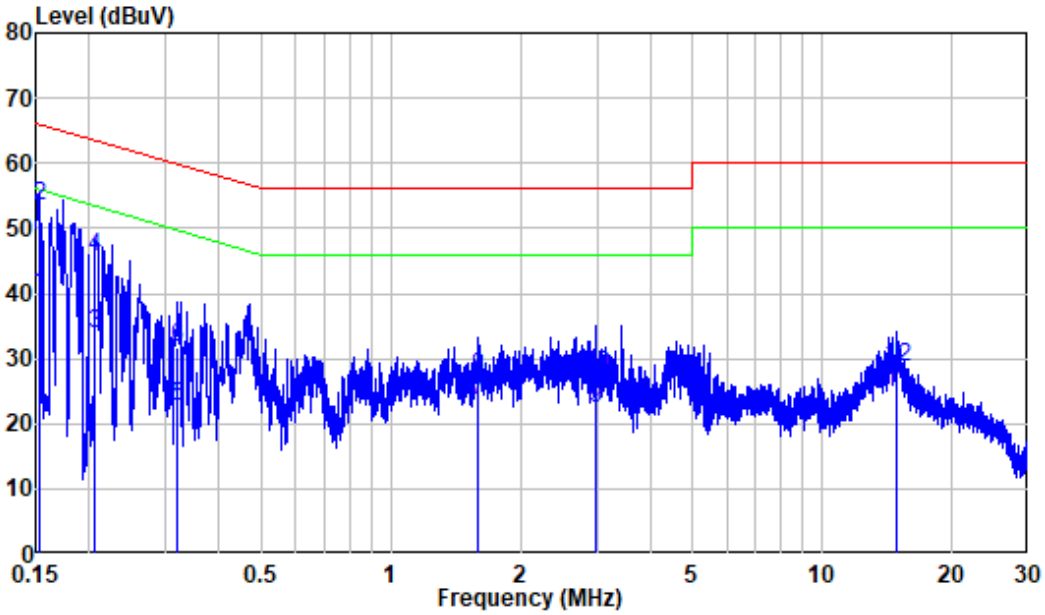
Temperature:	23 ℃
Relative Humidity:	49 %
ATM Pressure:	101.1 kPa

The testing was performed by Jason Liu on 2022-05-27.

EUT operation mode: 2.4G Wi-Fi Transmitting (Worst case for 802.11B high channel as below)

Adepter 1:

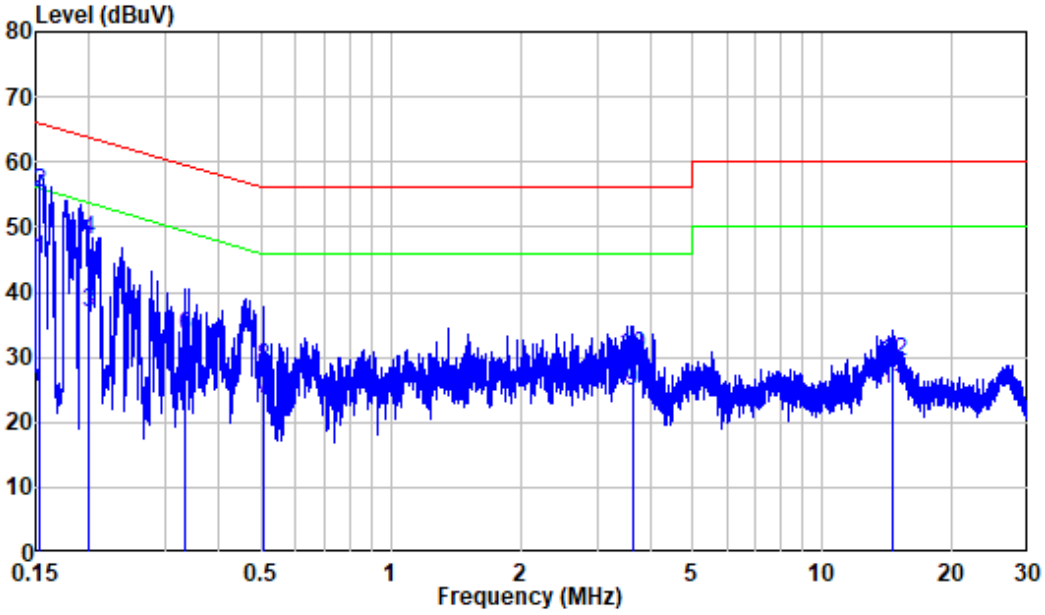
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : SZNS1220505-18180E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz
Adapter : BSY065T1903423D

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.153	9.80	30.12	39.92	55.86	-15.94	Average
2	0.153	9.80	43.55	53.35	65.86	-12.51	QP
3	0.206	9.80	24.11	33.91	53.36	-19.45	Average
4	0.206	9.80	35.66	45.46	63.36	-17.90	QP
5	0.320	9.80	12.76	22.56	49.70	-27.14	Average
6	0.320	9.80	21.88	31.68	59.70	-28.02	QP
7	1.598	9.82	13.70	23.52	46.00	-22.48	Average
8	1.598	9.82	17.42	27.24	56.00	-28.76	QP
9	2.995	9.83	12.42	22.25	46.00	-23.75	Average
10	2.995	9.83	17.52	27.35	56.00	-28.65	QP
11	14.848	9.95	14.85	24.80	50.00	-25.20	Average
12	14.848	9.95	18.77	28.72	60.00	-31.28	QP

AC 120V/60 Hz, Neutral

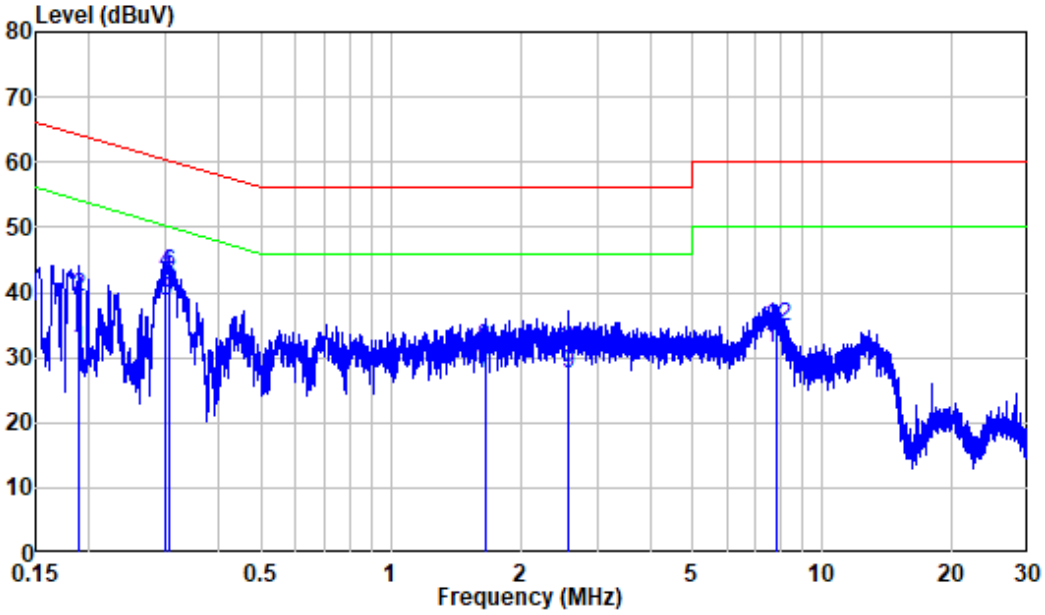


Site : Shielding Room
Condition: Neutral
Job No. : SZNS1220505-18180E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz
Adapter : BSY065T1903423D

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.154	9.80	35.33	45.13	55.79	-10.66	Average
2	0.154	9.80	45.44	55.24	65.79	-10.55	QP
3	0.200	9.80	26.92	36.72	53.61	-16.89	Average
4	0.200	9.80	38.19	47.99	63.61	-15.62	QP
5	0.334	9.80	17.03	26.83	49.35	-22.52	Average
6	0.334	9.80	23.39	33.19	59.35	-26.16	QP
7	0.505	9.80	13.74	23.54	46.00	-22.46	Average
8	0.505	9.80	18.49	28.29	56.00	-27.71	QP
9	3.623	9.84	14.94	24.78	46.00	-21.22	Average
10	3.623	9.84	20.37	30.21	56.00	-25.79	QP
11	14.536	10.05	15.04	25.09	50.00	-24.91	Average
12	14.536	10.05	19.22	29.27	60.00	-30.73	QP

Adepter 2:

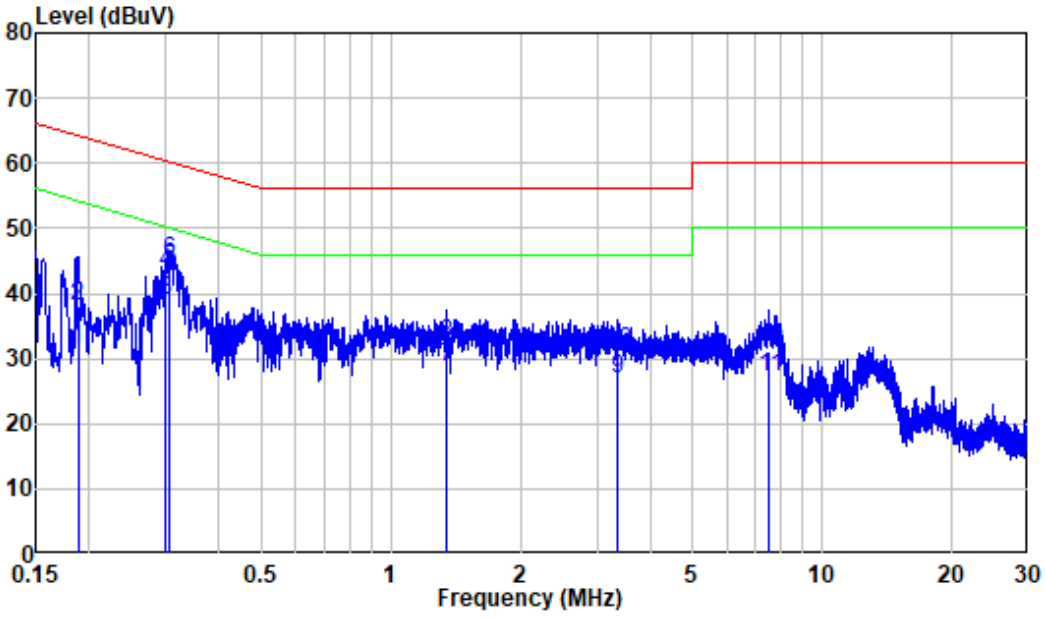
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : SZNS1220505-18180E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz
Adapter : A481-1902360U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.189	9.80	21.38	31.18	54.10	-22.92	Average
2	0.189	9.80	29.55	39.35	64.10	-24.75	QP
3	0.299	9.80	28.75	38.55	50.26	-11.71	Average
4	0.299	9.80	32.99	42.79	60.26	-17.47	QP
5	0.307	9.80	31.29	41.09	50.05	-8.96	Average
6	0.307	9.80	33.19	42.99	60.05	-17.06	QP
7	1.649	9.82	17.77	27.59	46.00	-18.41	Average
8	1.649	9.82	21.47	31.29	56.00	-24.71	QP
9	2.576	9.83	17.54	27.37	46.00	-18.63	Average
10	2.576	9.83	21.38	31.21	56.00	-24.79	QP
11	7.810	9.88	21.58	31.46	50.00	-18.54	Average
12	7.810	9.88	24.93	34.81	60.00	-25.19	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : SZNS1220505-18180E-RF
Mode : 2.4G WIFI Transmitting
Power : AC 120V 60Hz
Adapter : A481-1902360U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.188	9.80	21.68	31.48	54.12	-22.64	Average
2	0.188	9.80	28.27	38.07	64.12	-26.05	QP
3	0.299	9.80	29.22	39.02	50.26	-11.24	Average
4	0.299	9.80	33.44	43.24	60.26	-17.02	QP
5	0.308	9.80	34.08	43.88	50.03	-6.15	Average
6	0.308	9.80	35.10	44.90	60.03	-15.13	QP
7	1.344	9.81	18.74	28.55	46.00	-17.45	Average
8	1.344	9.81	22.55	32.36	56.00	-23.64	QP
9	3.346	9.83	17.08	26.91	46.00	-19.09	Average
10	3.346	9.83	21.19	31.02	56.00	-24.98	QP
11	7.526	9.98	17.05	27.03	50.00	-22.97	Average
12	7.526	9.98	21.20	31.18	60.00	-28.82	QP

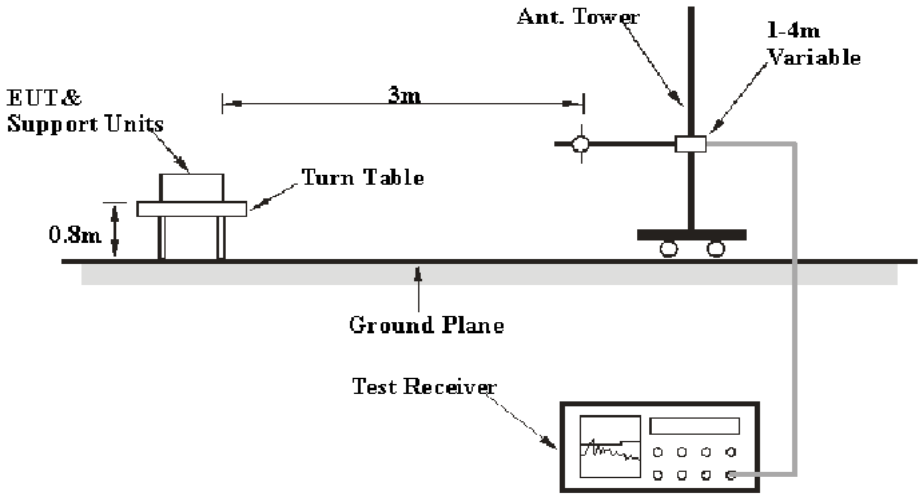
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

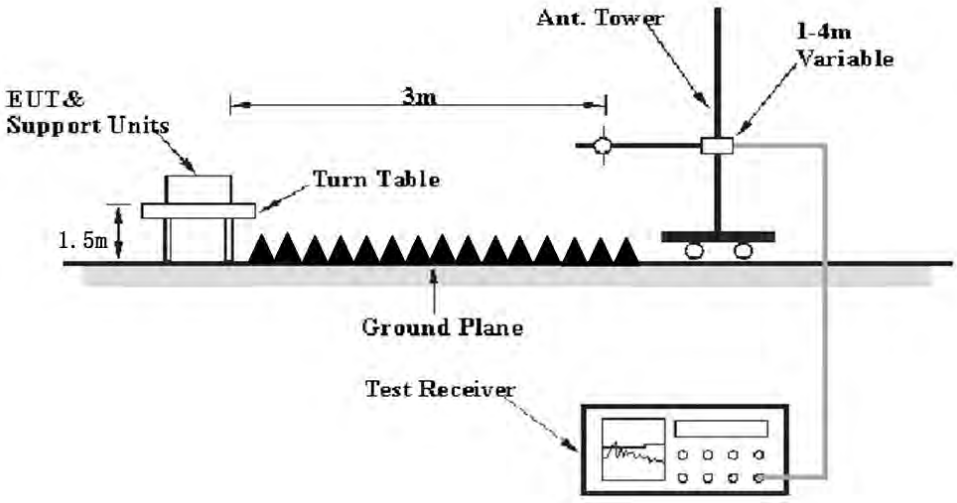
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

If the maximized peak measured value complies with the limit, then it is unnecessary to perform QP/Avera ge measurement.

Factor & Margin Calculation

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

Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	22~24℃
Relative Humidity:	49~61%
ATM Pressure:	101.0~103.0 kPa

The testing was performed by Level Li on 2022-05-27 for below 1GHz and Leo Li from 2022-05-10 to 2022-05-18 for above 1GHz.

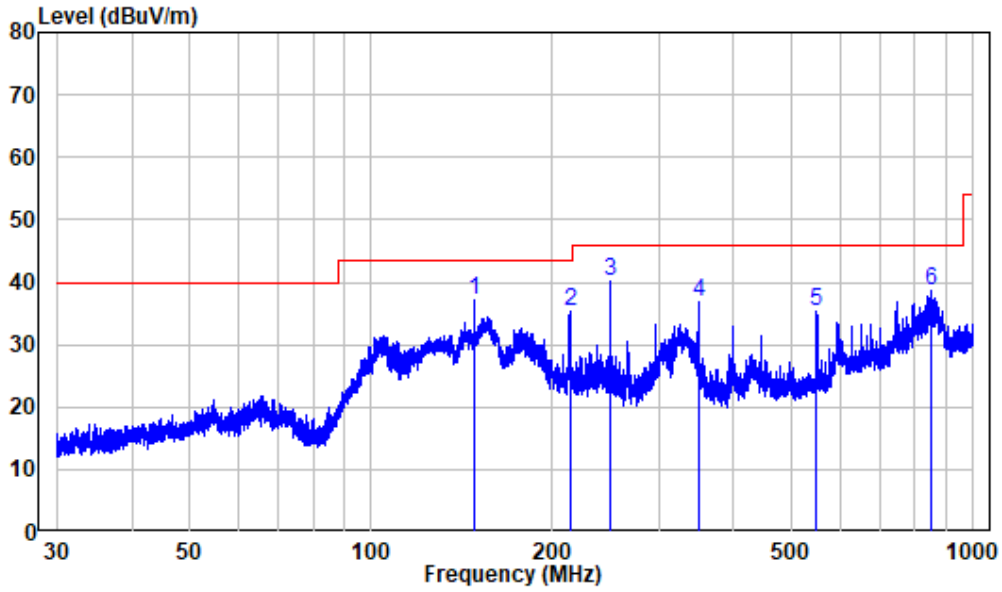
EUT operation mode: 2.4G Wi-Fi Transmitting.

30MHz-1GHz: (Worst case)

Wi-Fi: 802.11B mode, High Channel

Adapter 1:

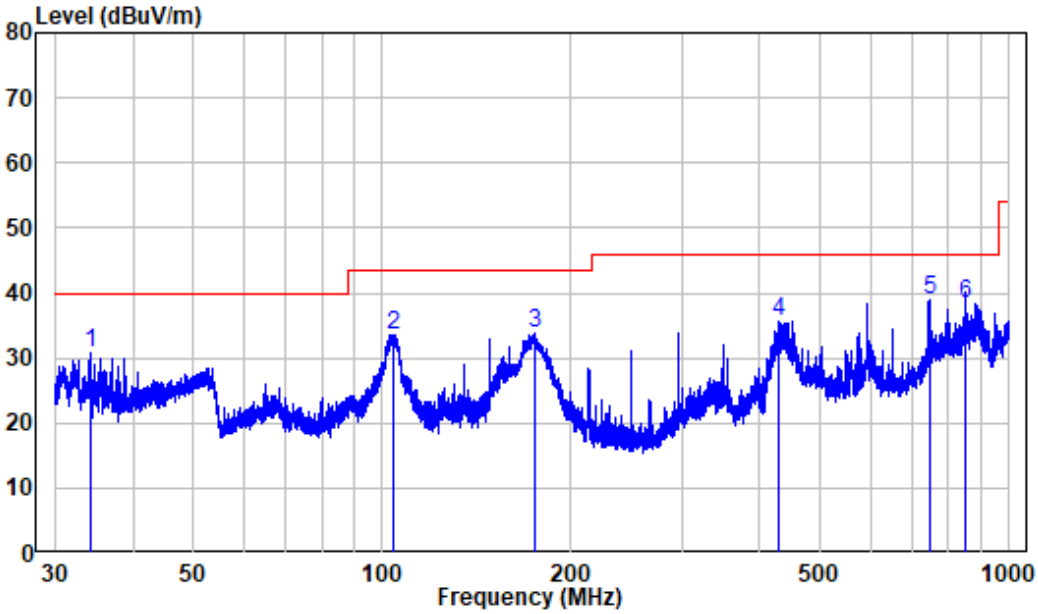
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220505-18180E-RF
Test Mode: 2.4G WIFI Transmitting
Adepter : BSY065t1903423D

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	148.506	-15.35	52.47	37.12	43.50	-6.38	Peak
2	213.763	-11.72	46.92	35.20	43.50	-8.30	Peak
3	249.972	-10.74	50.74	40.00	46.00	-6.00	Peak
4	350.016	-7.31	44.14	36.83	46.00	-9.17	Peak
5	549.983	-4.03	39.29	35.26	46.00	-10.74	Peak
6	854.399	0.33	38.23	38.56	46.00	-7.44	Peak

Vertical

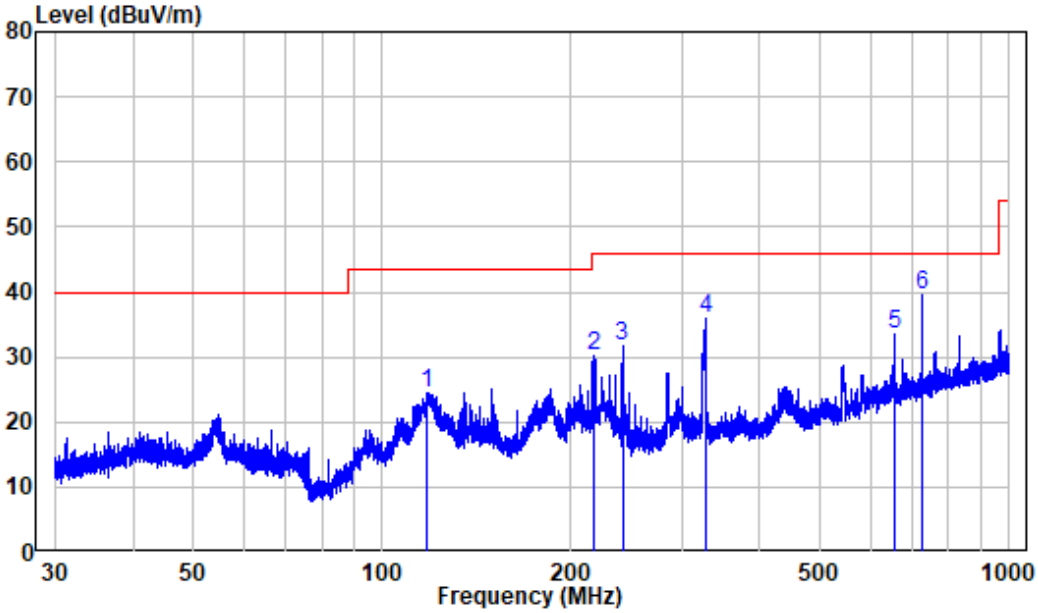


Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220505-18180E-RF
Test Mode: 2.4G WIFI Transmitting
Adepter : BSY065t1903423D

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.231	-11.78	42.65	30.87	40.00	-9.13	Peak
2	103.942	-11.73	45.38	33.65	43.50	-9.85	Peak
3	174.577	-13.14	47.07	33.93	43.50	-9.57	Peak
4	428.583	-5.81	41.49	35.68	46.00	-10.32	Peak
5	750.108	-0.87	39.96	39.09	46.00	-6.91	Peak
6	850.290	0.36	37.90	38.26	46.00	-7.74	QP

Adapter 2:

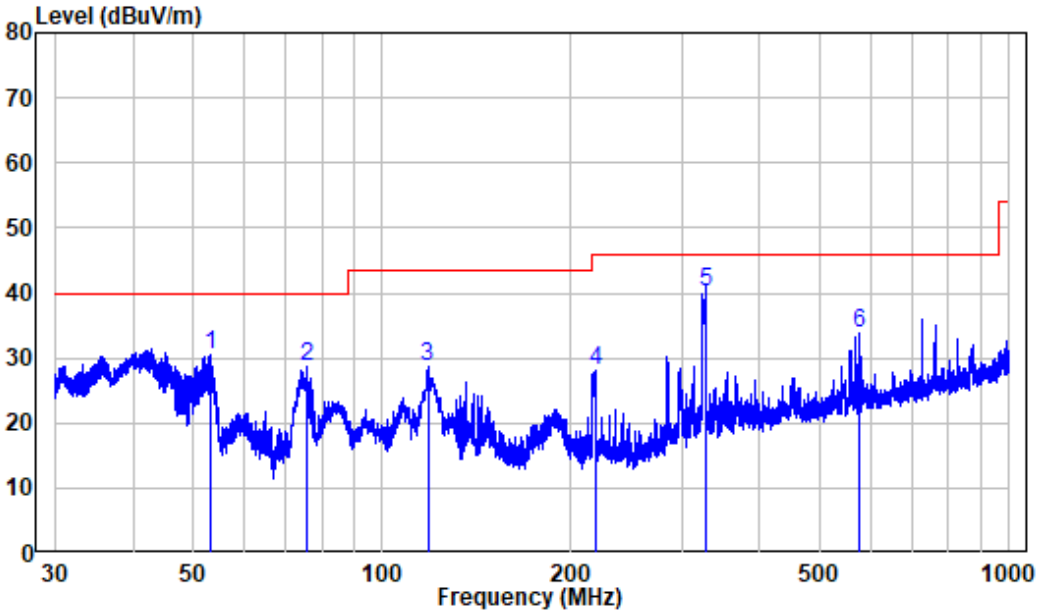
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220505-18180E-RF
Test Mode: 2.4G WIFI Transmitting
Adepter : A481-1902360U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	117.876	-13.14	37.70	24.56	43.50	-18.94	Peak
2	218.213	-11.51	41.57	30.06	46.00	-15.94	Peak
3	241.465	-10.81	42.56	31.75	46.00	-14.25	Peak
4	327.600	-8.12	44.05	35.93	46.00	-10.07	Peak
5	657.970	-1.62	35.20	33.58	46.00	-12.42	Peak
6	724.579	-1.29	40.81	39.52	46.00	-6.48	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220505-18180E-RF
Test Mode: 2.4G WIFI Transmitting
Adepter : A481-1902360U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	53.201	-10.20	40.61	30.41	40.00	-9.59	Peak
2	75.944	-16.41	45.08	28.67	40.00	-11.33	Peak
3	118.134	-13.19	41.86	28.67	43.50	-14.83	Peak
4	218.309	-11.50	39.56	28.06	46.00	-17.94	Peak
5	327.456	-8.13	48.31	40.18	46.00	-5.82	QP
6	575.887	-3.72	37.44	33.72	46.00	-12.28	Peak

1-25 GHz: (Worst case: 2TX, Adapter 2)

Wi-Fi:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/AV		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	55.22	PK	355	1.7	H	-7.23	47.99	74	-26.01
2310	54.47	PK	208	1.5	V	-7.23	47.24	74	-26.76
2390	55.67	PK	23	2.1	H	-7.21	48.46	74	-25.54
2390	59.36	PK	259	2.0	V	-7.21	52.15	74	-21.85
4824	44.97	PK	248	1.4	H	-3.53	41.44	74	-32.56
4824	46.25	PK	103	1.8	V	-3.53	42.72	74	-31.28
802.11B, Middle Channel									
4874	44.68	PK	71	2.2	H	-3.42	41.26	74	-32.74
4874	45.88	PK	200	1.9	V	-3.42	42.46	74	-31.54
802.11B, High Channel									
2483.5	57.27	PK	300	1.8	H	-7.2	50.07	74	-23.93
2483.5	58.74	PK	122	1.6	V	-7.2	51.54	74	-22.46
2500	54.92	PK	339	1.4	H	-7.18	47.74	74	-26.26
2500	56.41	PK	345	1.8	V	-7.18	49.23	74	-24.77
4924	46.99	PK	80	1.3	H	-3.16	43.83	74	-30.17
4924	47.65	PK	136	1.1	V	-3.16	44.49	74	-29.51
802.11G, Low Channel									
2310	51.78	PK	134	1.9	H	-7.23	44.55	74	-29.45
2310	54.45	PK	68	1.8	V	-7.23	47.22	74	-26.78
2390	59.9	PK	191	1.6	H	-7.21	52.69	74	-21.31
2390	65.16	PK	37	1.9	V	-7.21	57.95	74	-16.05
2390	51.22	AV	37	1.9	V	-7.21	44.01	54	-9.99
4824	44.82	PK	175	1.9	H	-3.53	41.29	74	-32.71
4824	44.94	PK	240	2.0	V	-3.53	42.41	74	-31.59
802.11G, Middle Channel									
4874	45.01	PK	235	2.0	H	-3.42	41.59	74	-32.41
4874	46.89	PK	27	1.5	V	-3.42	43.47	74	-30.53
802.11G, High Channel									
2483.5	58.52	PK	173	1.8	H	-7.2	51.32	74	-22.68
2483.5	57.83	PK	174	1.4	V	-7.2	50.63	74	-23.37
2500	56.15	PK	134	1.8	H	-7.18	48.97	74	-25.03
2500	57.08	PK	265	1.6	V	-7.18	49.90	74	-24.10
4924	44.59	PK	84	1.4	H	-3.16	41.43	74	-32.57
4924	45.37	PK	89	1.7	V	-3.16	42.21	74	-31.79

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/AV		Height (m)	Polar (H/V)				
802.11N20, Low Channel									
2310	54.04	PK	188	1.7	H	-7.23	46.81	74	-27.19
2310	54.08	PK	58	1.5	V	-7.23	46.85	74	-27.15
2390	61.1	PK	159	1.8	H	-7.21	53.89	74	-20.11
2390	68.25	PK	68	2.1	V	-7.21	61.04	74	-12.96
2390	51.19	AV	68	2.1	V	-7.21	43.98	54	-10.02
4824	44.59	PK	261	1.4	H	-3.53	41.06	74	-32.94
4824	46.16	PK	55	1.6	V	-3.53	42.63	74	-31.37
802.11N20, Middle Channel									
4874	44.87	PK	149	1.6	H	-3.42	41.45	74	-32.55
4874	45.24	PK	344	2.0	V	-3.42	41.82	74	-32.18
802.11N20, High Channel									
2483.5	56.65	PK	156	2.0	H	-7.2	49.45	74	-24.55
2483.5	57.71	PK	19	1.6	V	-7.2	50.51	74	-23.49
2500	54.69	PK	211	2.0	H	-7.18	47.51	74	-26.49
2500	56.46	PK	104	2.0	V	-7.18	49.28	74	-24.72
4924	44.31	PK	216	1.2	H	-3.16	41.15	74	-32.85
4924	45.43	PK	79	1.8	V	-3.16	42.27	74	-31.73
802.11N40, Low Channel									
2310	52.03	PK	177	1.5	H	-7.23	44.80	74	-29.20
2310	52.76	PK	40	1.7	V	-7.23	45.53	74	-28.47
2390	59.63	PK	200	1.6	H	-7.21	52.42	74	-21.58
2390	65.22	PK	2	1.8	V	-7.21	58.01	74	-15.99
2390	55.13	AV	2	1.8	V	-7.21	47.92	54	-6.08
4844	44.95	PK	39	1.7	H	-3.54	41.41	74	-32.59
4844	45.01	PK	359	1.2	V	-3.54	41.47	74	-32.53
802.11N40, Middle Channel									
4874	44.32	PK	269	1.6	H	-3.42	40.90	74	-33.10
4874	44.68	PK	127	1.5	V	-3.42	41.26	74	-32.74
802.11N40, High Channel									
2483.5	56.08	PK	124	2.1	H	-3.26	52.82	74	-21.18
2483.5	59.9	PK	38	2.0	V	-3.26	56.64	74	-17.36
2483.5	47.11	AV	38	2.0	V	-3.26	43.85	54	-10.15
2500	52.71	PK	151	1.9	H	-3.26	49.45	74	-24.55
2500	55.18	PK	124	2.1	V	-3.26	51.92	74	-22.08
4904	44.31	PK	38	1.5	H	-3.16	41.15	74	-32.85
4904	44.73	PK	135	1.3	V	-3.16	41.57	74	-32.43

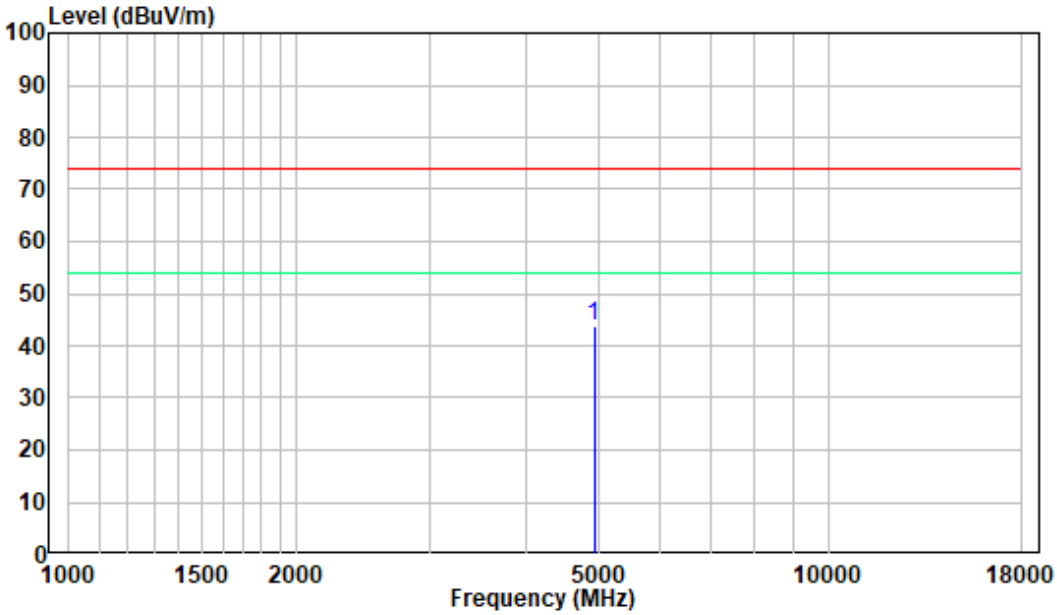
BLE:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	42.62	PK	66	1.6	H	-7.23	35.39	74	-38.61
2310	44.26	PK	55	1.3	V	-7.23	37.03	74	-36.97
2390	49.27	PK	311	1.8	H	-7.21	42.06	74	-31.94
2390	50.79	PK	131	2.0	V	-7.21	43.58	74	-30.42
4804	45.3	PK	175	2.2	H	-3.52	41.78	74	-32.22
4804	45.84	PK	233	1.8	V	-3.52	42.32	74	-31.68
BLE 1M, Middle Channel									
4880	45.37	PK	229	1.6	H	-3.38	41.99	74	-32.01
4880	46.27	PK	266	1.5	V	-3.38	42.89	74	-31.11
BLE 1M, High Channel									
2483.5	49.27	PK	209	1.5	H	-7.2	42.07	74	-31.93
2483.5	51.58	PK	165	1.6	V	-7.2	44.38	74	-29.62
2500	45.3	PK	135	1.4	H	-7.18	38.12	74	-35.88
2500	44.26	PK	81	2.0	V	-7.18	37.08	74	-36.92
4960	45.72	PK	340	1.8	H	-3.01	42.71	74	-31.29
4960	46.47	PK	350	1.4	V	-3.01	43.46	74	-30.54

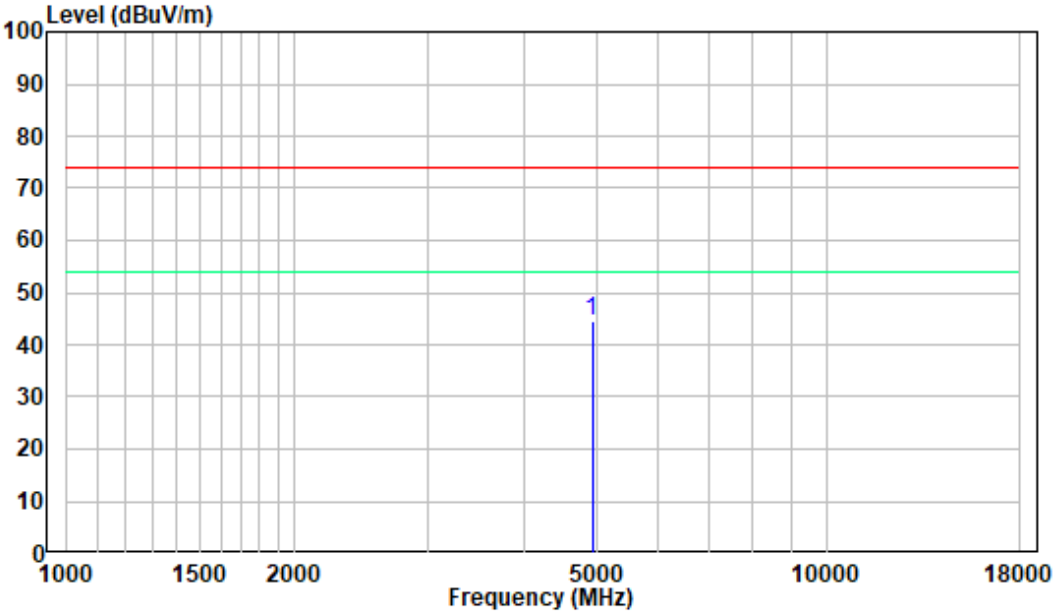
Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level (Corrected Amplitude) = Factor + Reading
Margin = Absolute Level (Corrected Amplitude) – Limit
The other spurious emission which is in the noise floor level was not recorded.
For above 1GHz, the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, so just peak value was recorded.

1-18 GHz: (Worst case)

Pre-scan plots
802.11 b High Channel
Horizontal

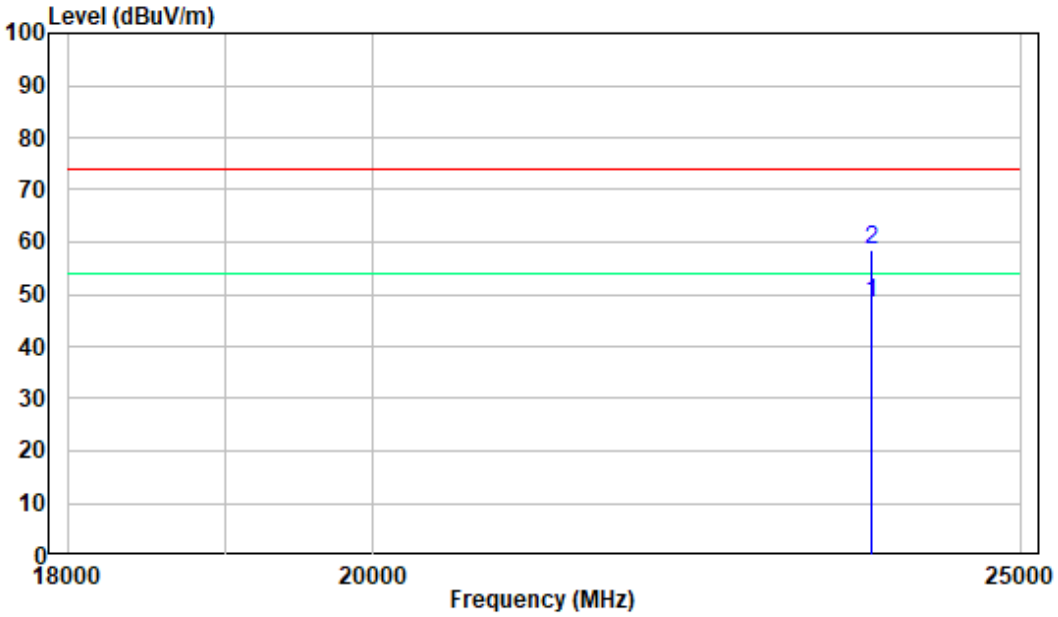


Vertical

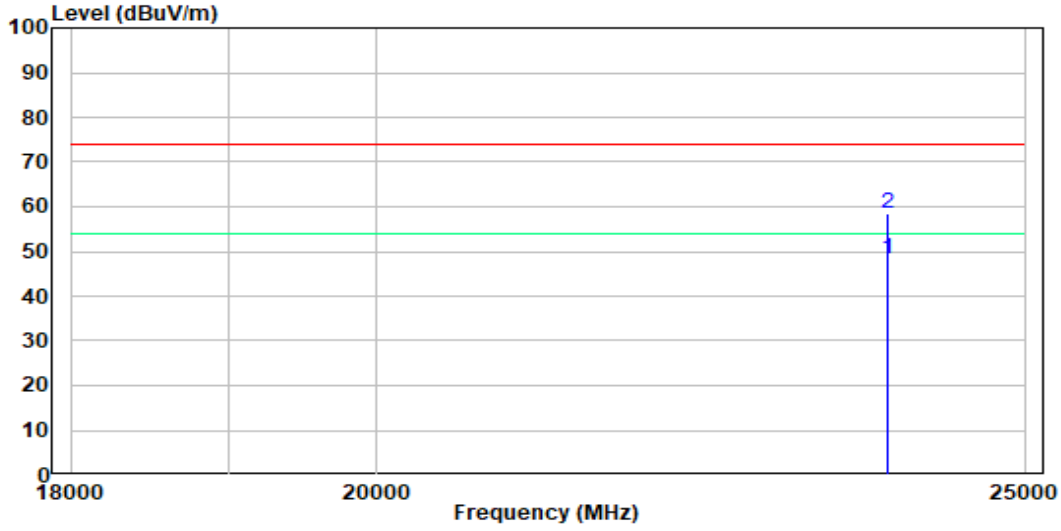


18 -25GHz: (Worst case)

Pre-scan plots
802.11 b High Channel
Horizontal



Vertical



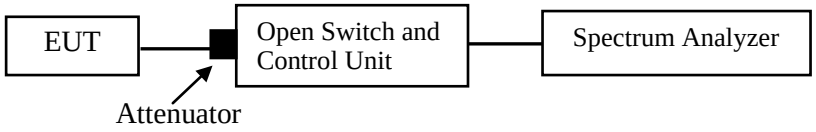
FCC §15.247(A) (2) – 6 DB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

Applicable Standard

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.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	23 ~ 24 ℃
Relative Humidity:	51 ~ 52 %
ATM Pressure:	101.1~101.2 kPa

The testing was performed by Cat Kang on 2022-05-10 for BLE and from 2022-05-11 to 2022-05-27 for Wi-Fi.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

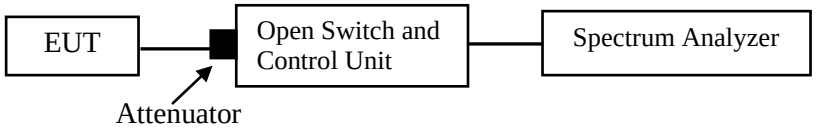
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for 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.

Test Procedure

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 one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	23 ~ 24 ℃
Relative Humidity:	51 ~ 52 %
ATM Pressure:	101.1~101.2 kPa

The testing was performed by Cat Kang on 2022-05-10 for BLE and from 2022-05-11 to 2022-05-27 for Wi-Fi.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

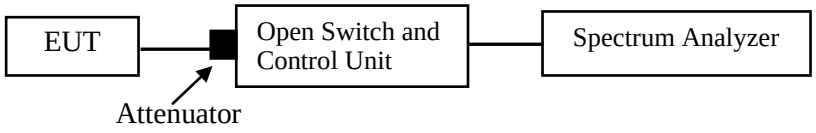
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

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)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	23 ~ 24 ℃
Relative Humidity:	51 ~ 52 %
ATM Pressure:	101.1~101.2 kPa

The testing was performed by Cat Kang on 2022-05-10 for BLE and 2022-05-27 for Wi-Fi.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi and Appendix BLE.

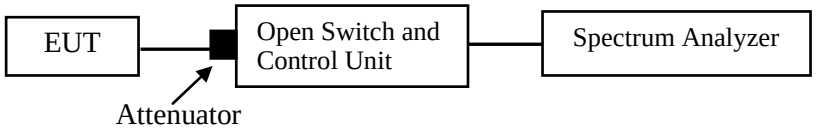
FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
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 limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	23 ~ 24 ℃
Relative Humidity:	51 ~ 52 %
ATM Pressure:	101.1~101.2 kPa

The testing was performed by Cat Kang on 2022-05-10 for BLE and from 2022-05-12 to 2022-05-27 for Wi-Fi.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi and Appendix BLE.

APPENDIX Wi-Fi

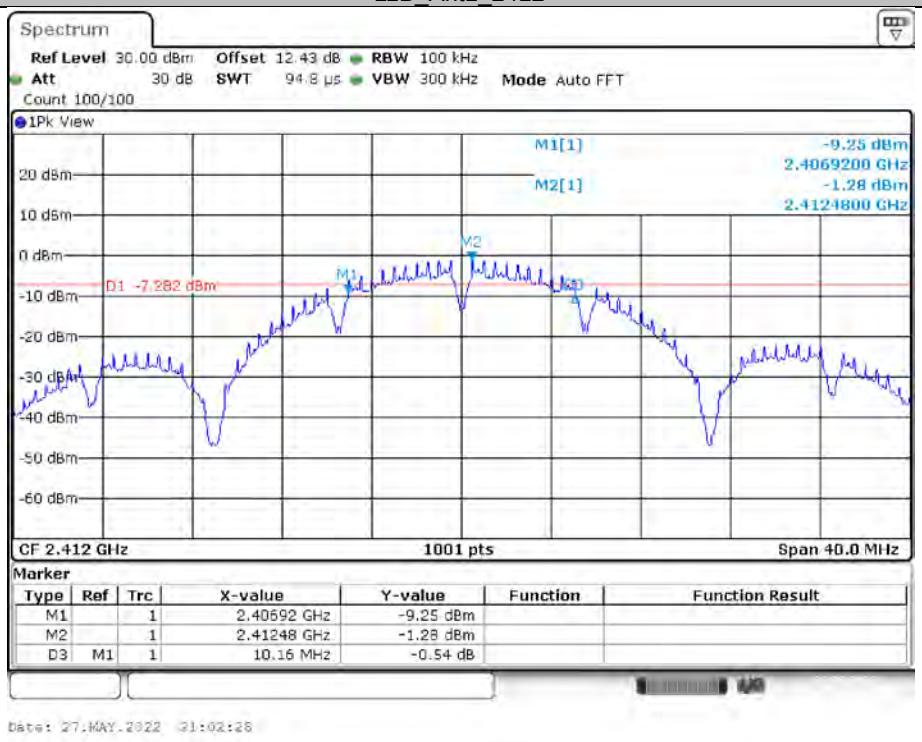
Appendix A: 6dB Emission Bandwidth

Test Result

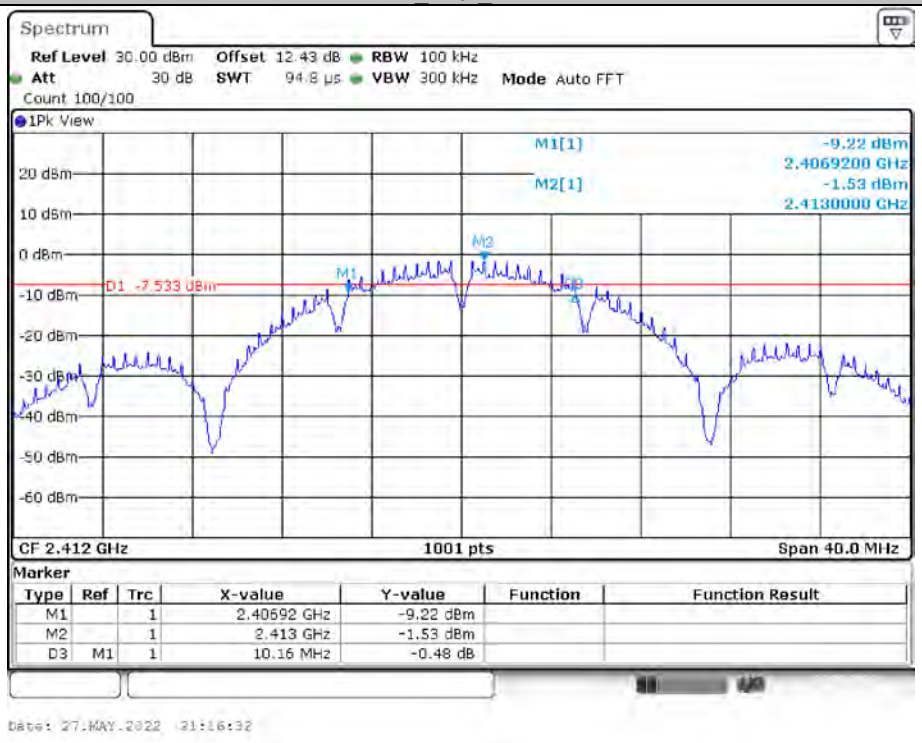
TestMode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	10.160	0.5	PASS
	Ant2	2412	10.160	0.5	PASS
	Ant1	2437	10.160	0.5	PASS
	Ant2	2437	9.640	0.5	PASS
	Ant1	2462	9.120	0.5	PASS
	Ant2	2462	9.120	0.5	PASS
11G	Ant1	2412	15.200	0.5	PASS
	Ant2	2412	15.200	0.5	PASS
	Ant1	2437	13.920	0.5	PASS
	Ant2	2437	15.200	0.5	PASS
	Ant1	2462	15.200	0.5	PASS
	Ant2	2462	15.520	0.5	PASS
11N20MIMO	Ant1	2412	15.200	0.5	PASS
	Ant2	2412	15.200	0.5	PASS
	Ant1	2437	15.200	0.5	PASS
	Ant2	2437	15.400	0.5	PASS
	Ant1	2462	15.200	0.5	PASS
	Ant2	2462	15.200	0.5	PASS
11N40MIMO	Ant1	2422	35.280	0.5	PASS
	Ant2	2422	35.280	0.5	PASS
	Ant1	2437	35.280	0.5	PASS
	Ant2	2437	35.280	0.5	PASS
	Ant1	2452	35.280	0.5	PASS
	Ant2	2452	35.280	0.5	PASS

Test Graphs

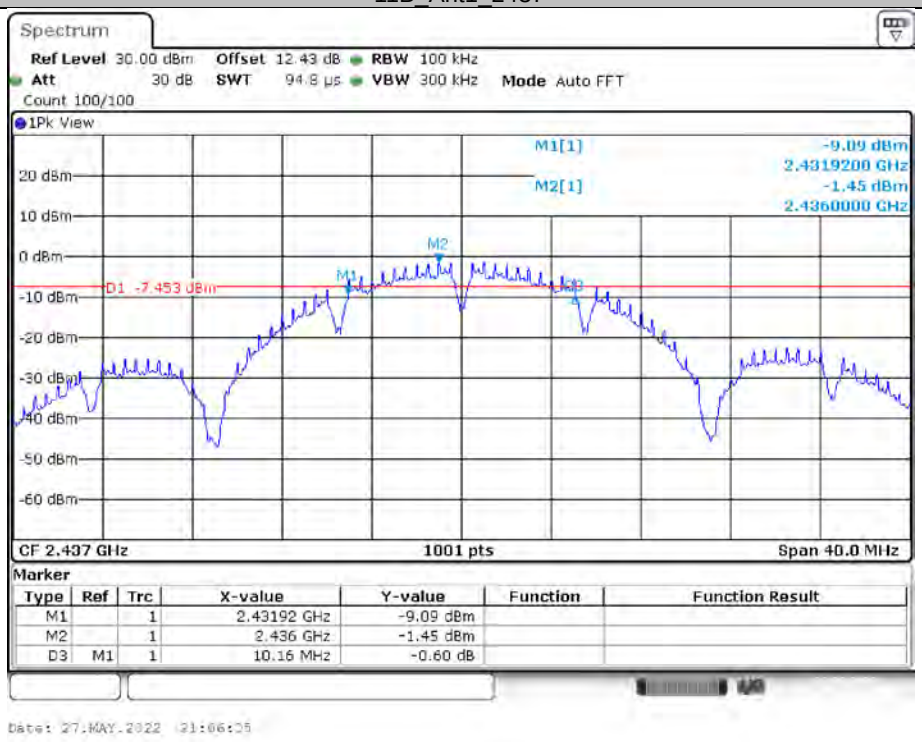
11B_Ant1_2412



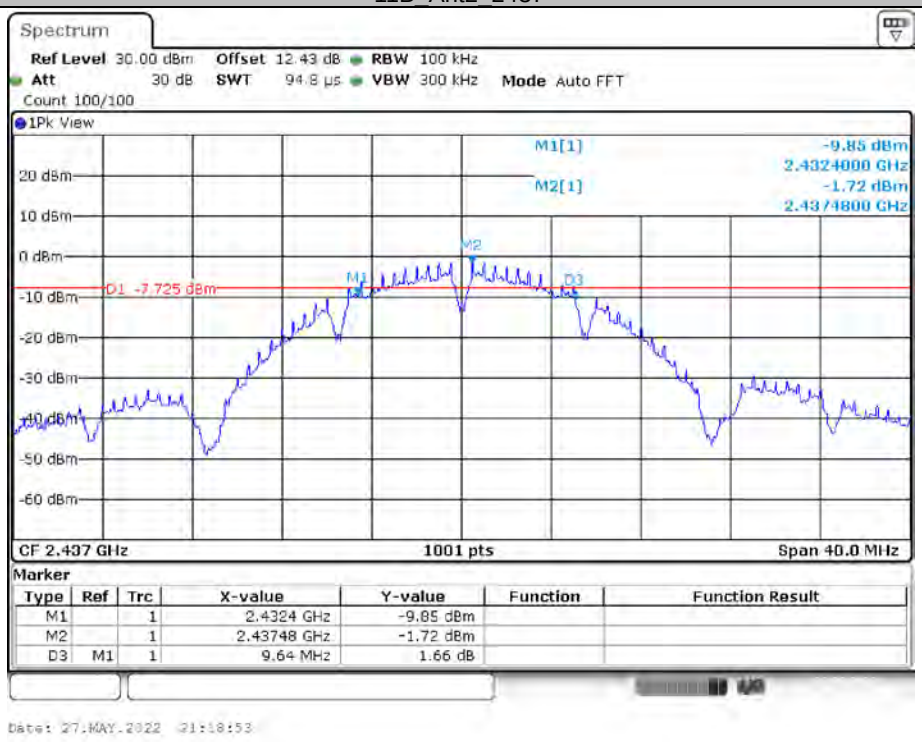
11B_Ant2_2412



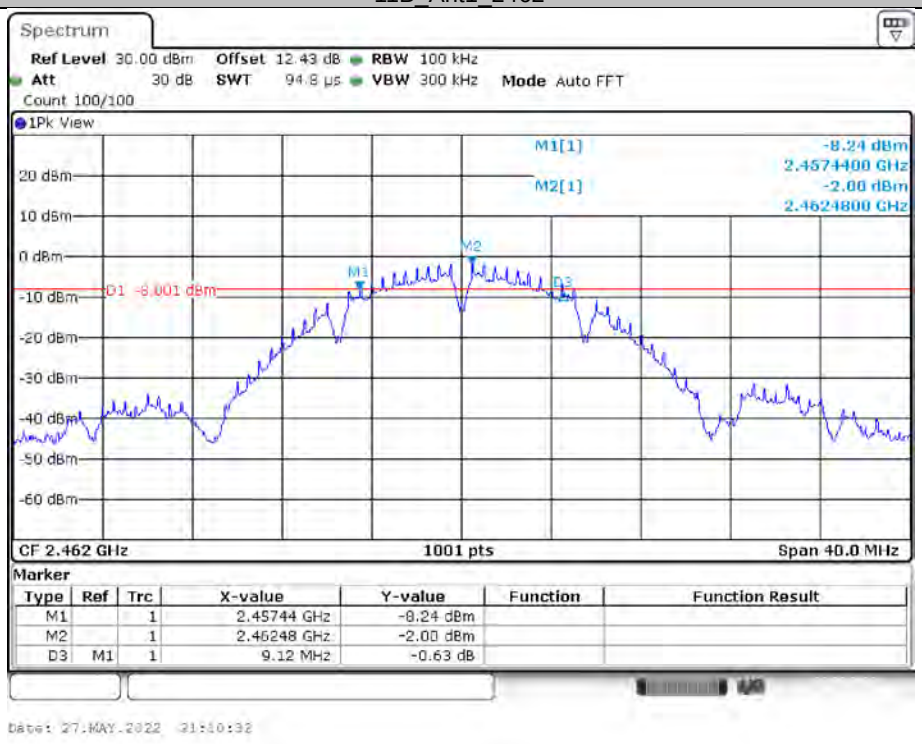
11B_Ant1_2437



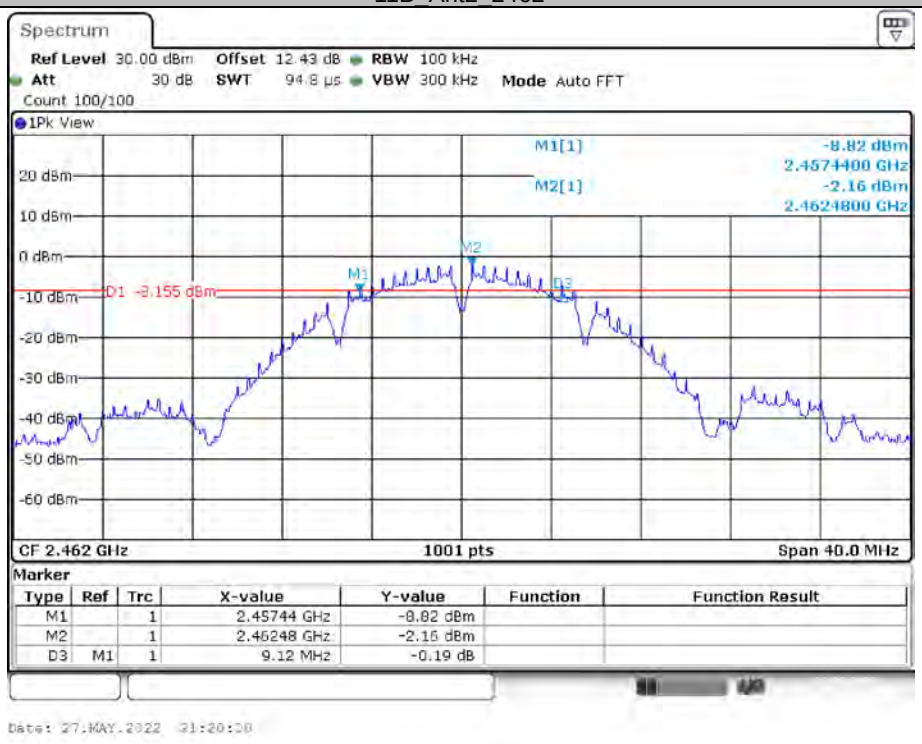
11B_Ant2_2437



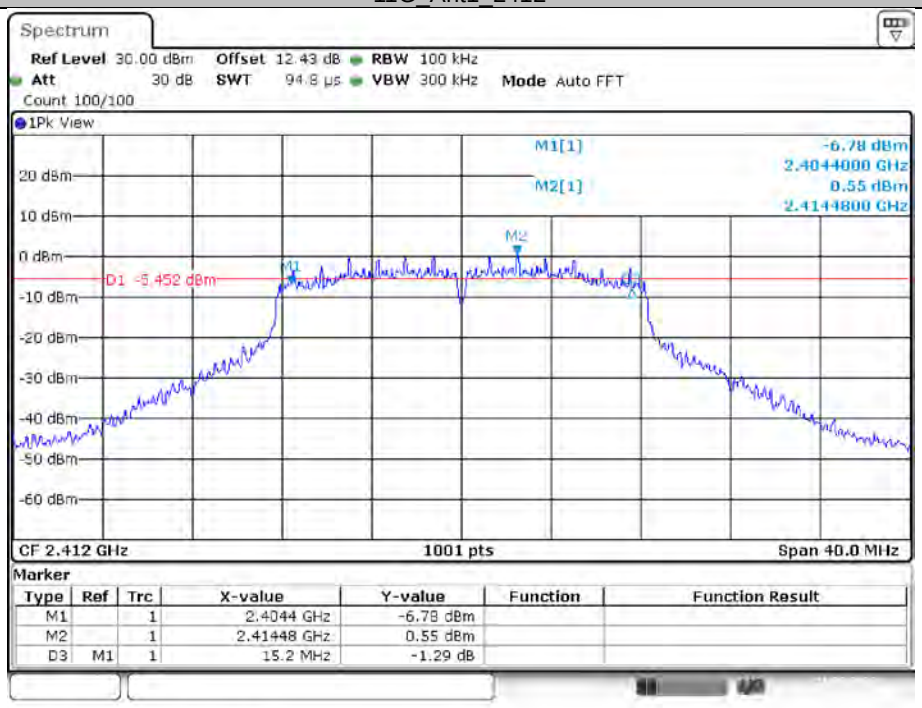
11B_Ant1_2462



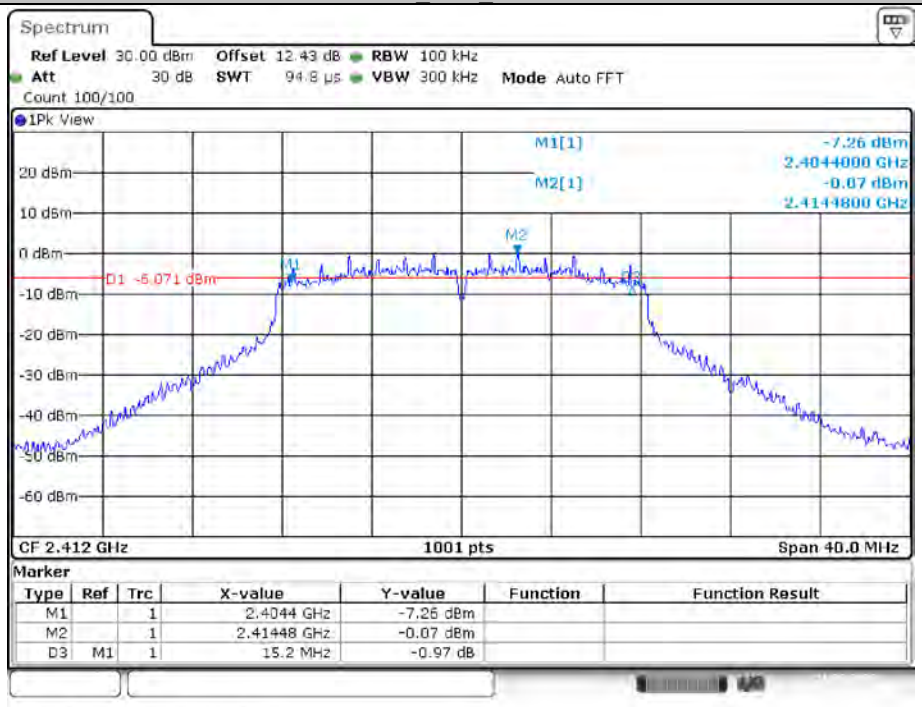
11B_Ant2_2462



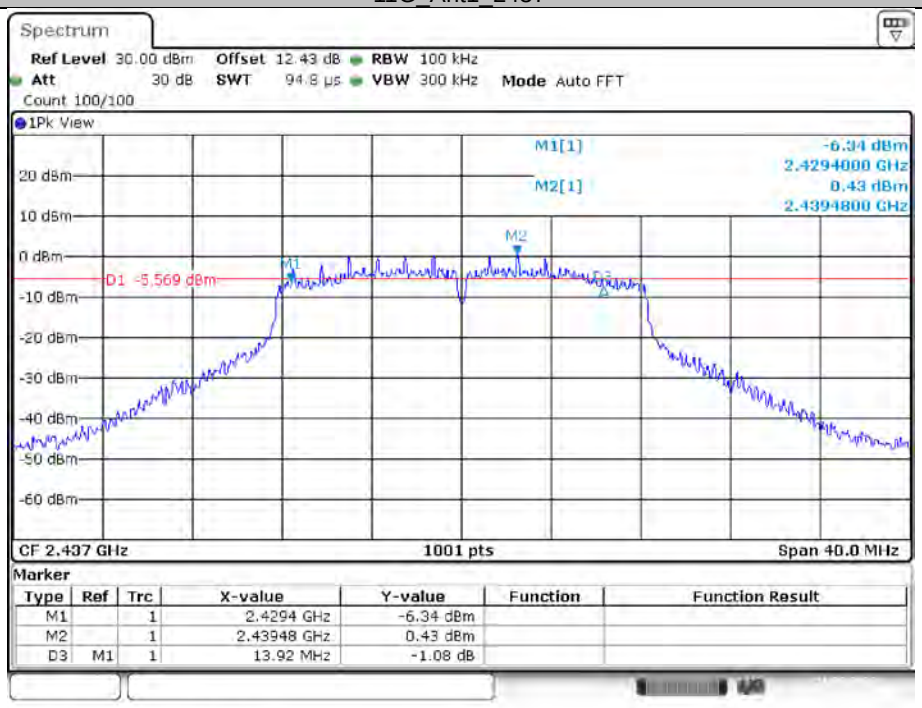
11G_Ant1_2412



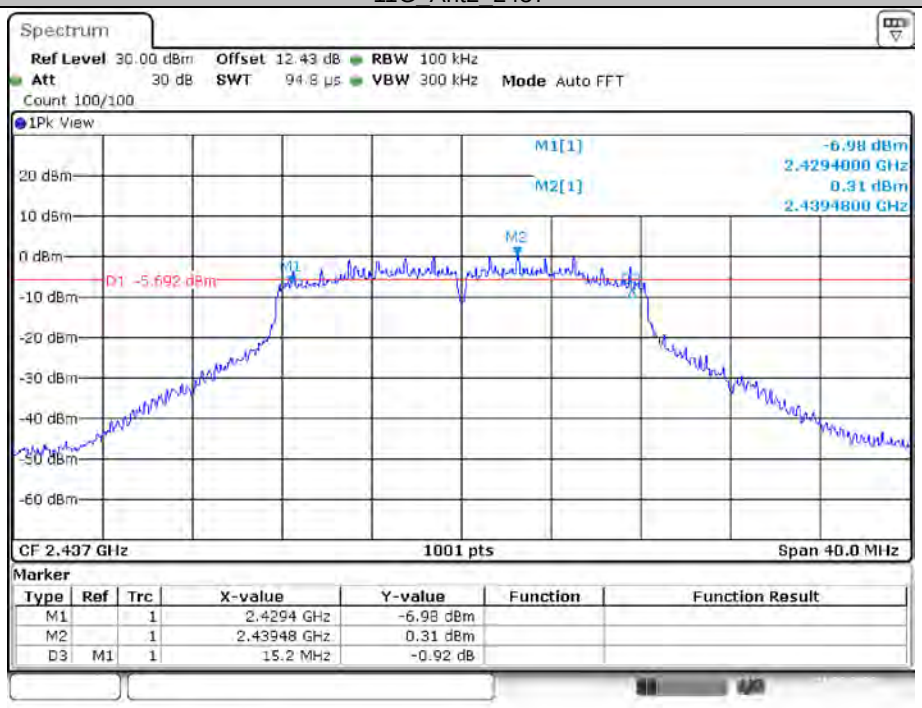
11G_Ant2_2412



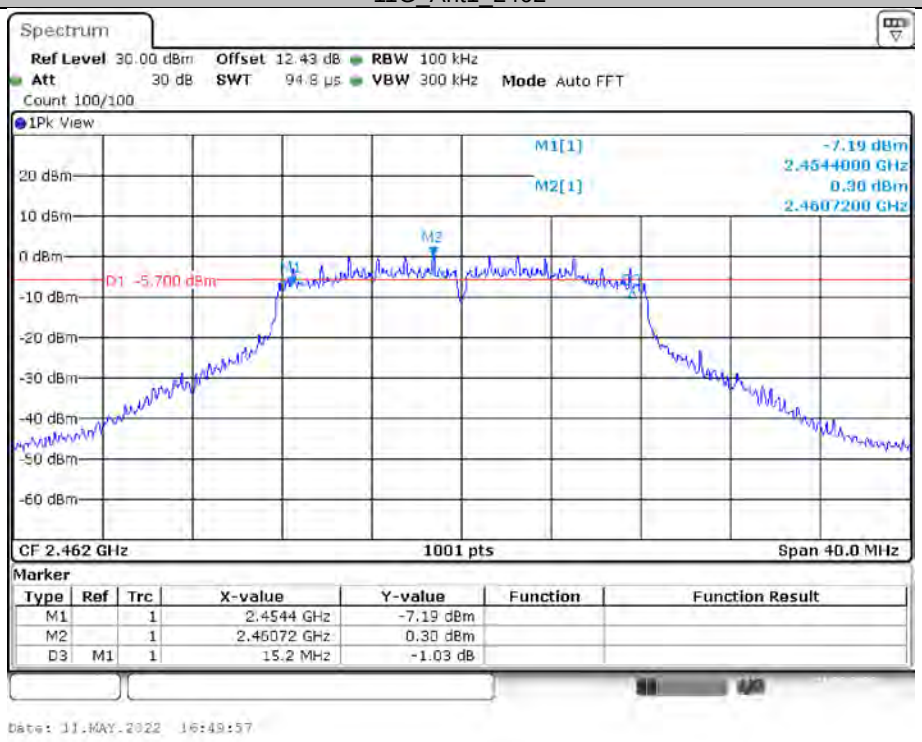
11G_Ant1_2437



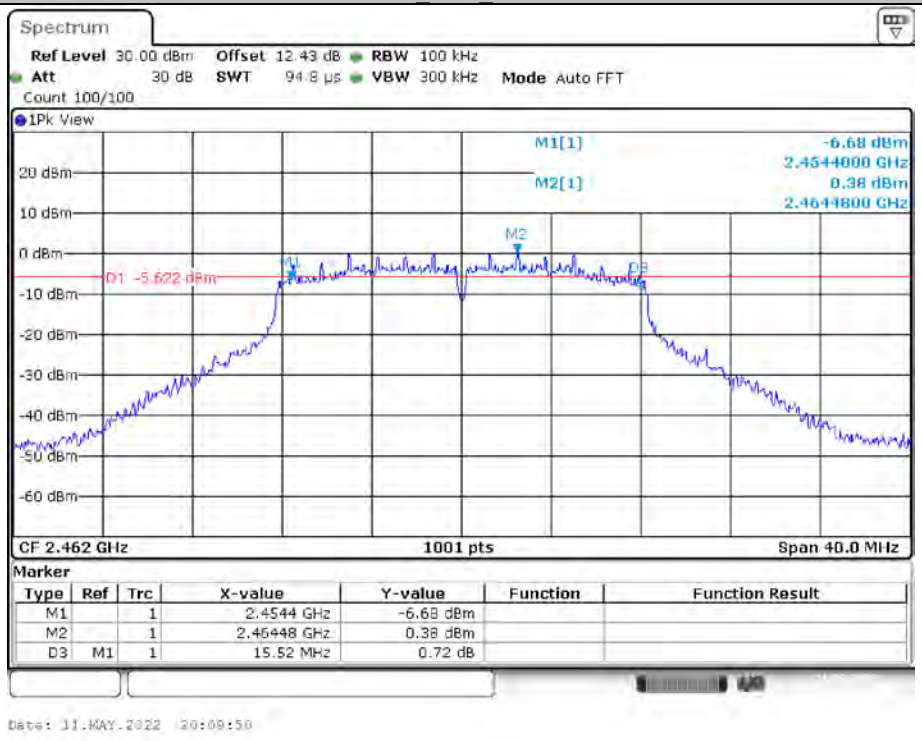
11G_Ant2_2437



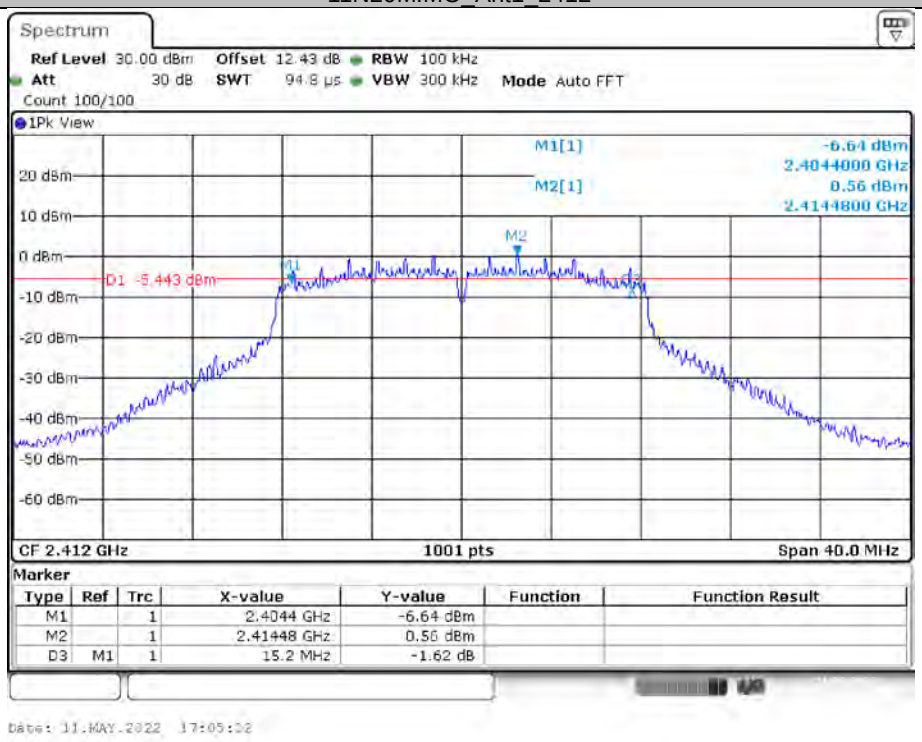
11G_Ant1_2462



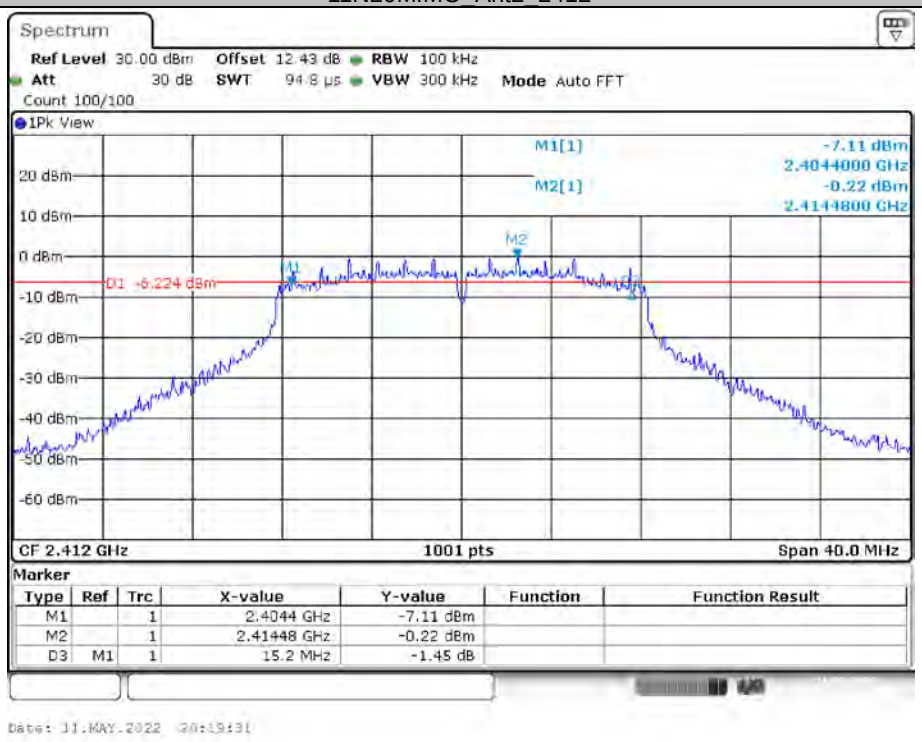
11G_Ant2_2462



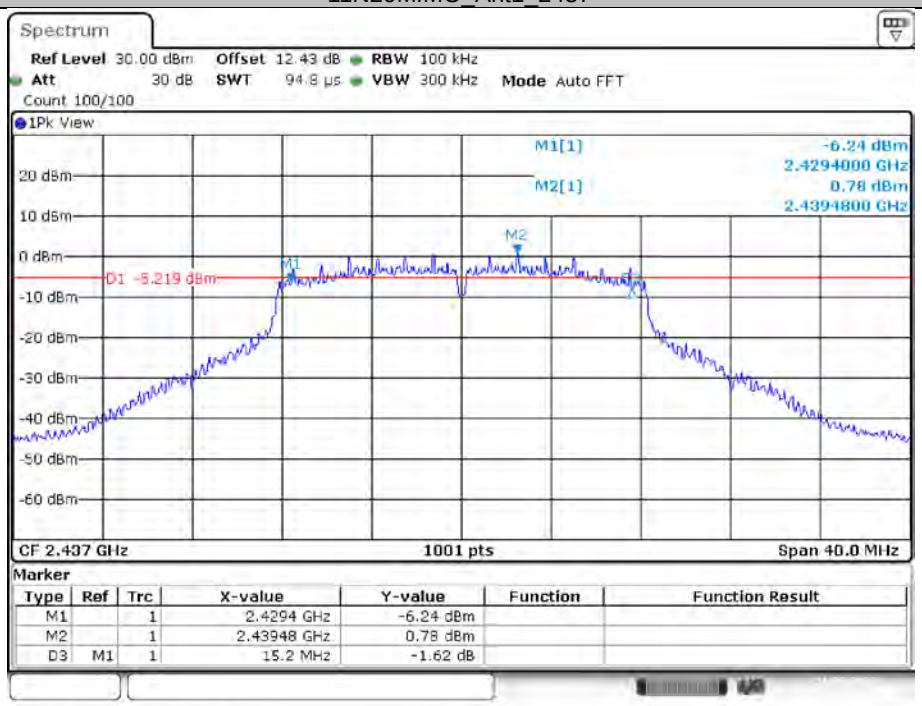
11N20MIMO_Ant1_2412



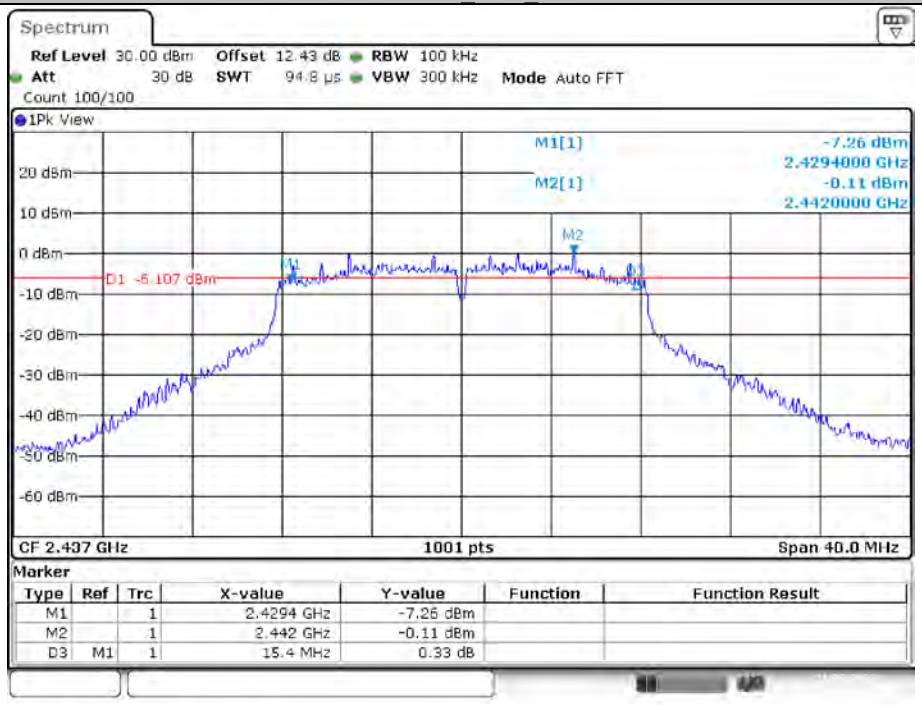
11N20MIMO_Ant2_2412



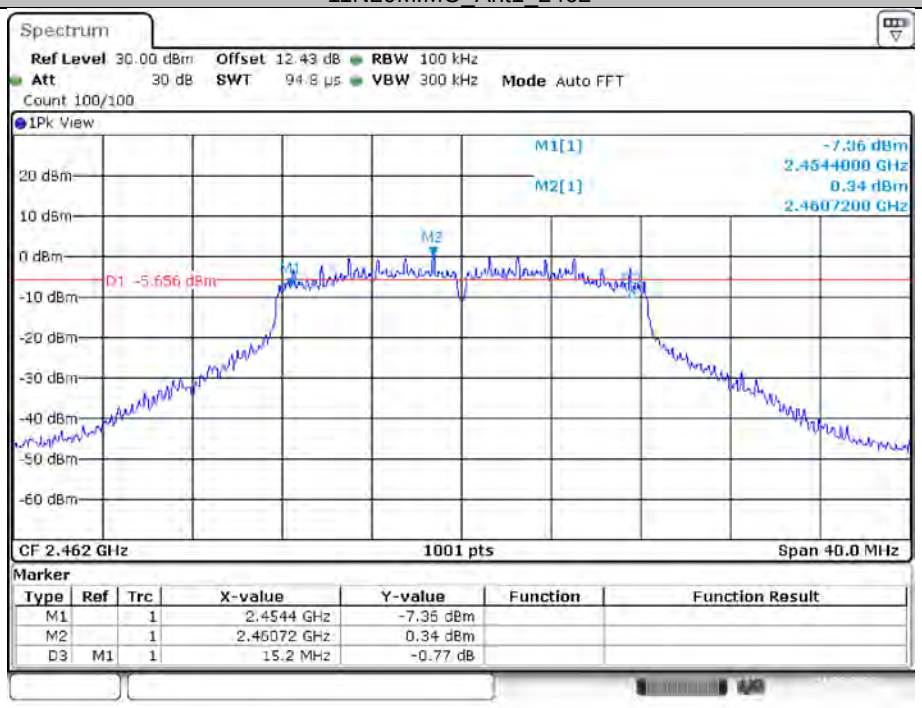
11N20MIMO_Ant1_2437



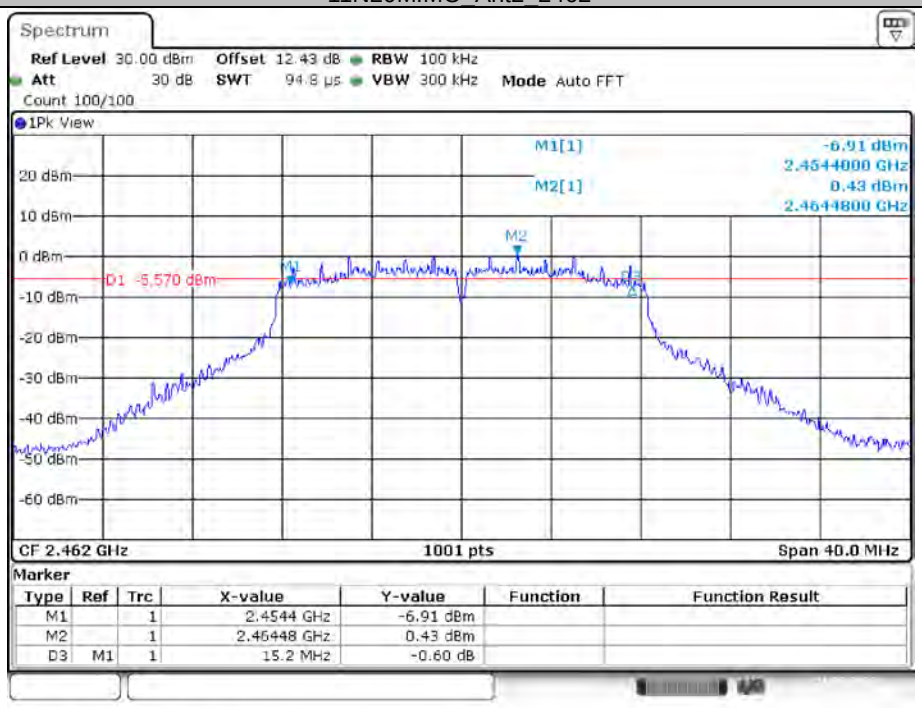
11N20MIMO_Ant2_2437



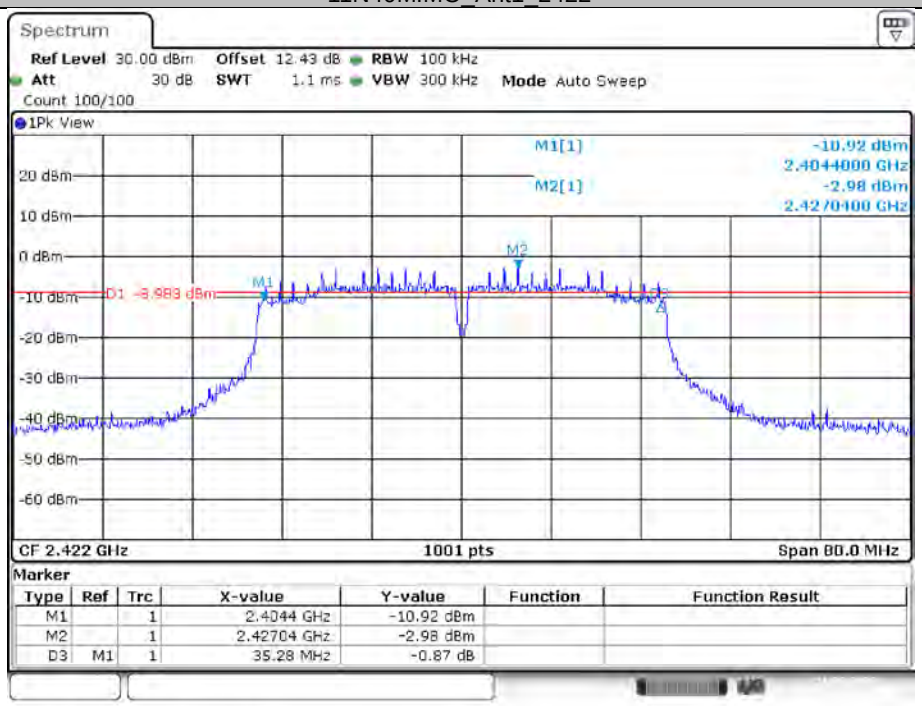
11N20MIMO_Ant1_2462



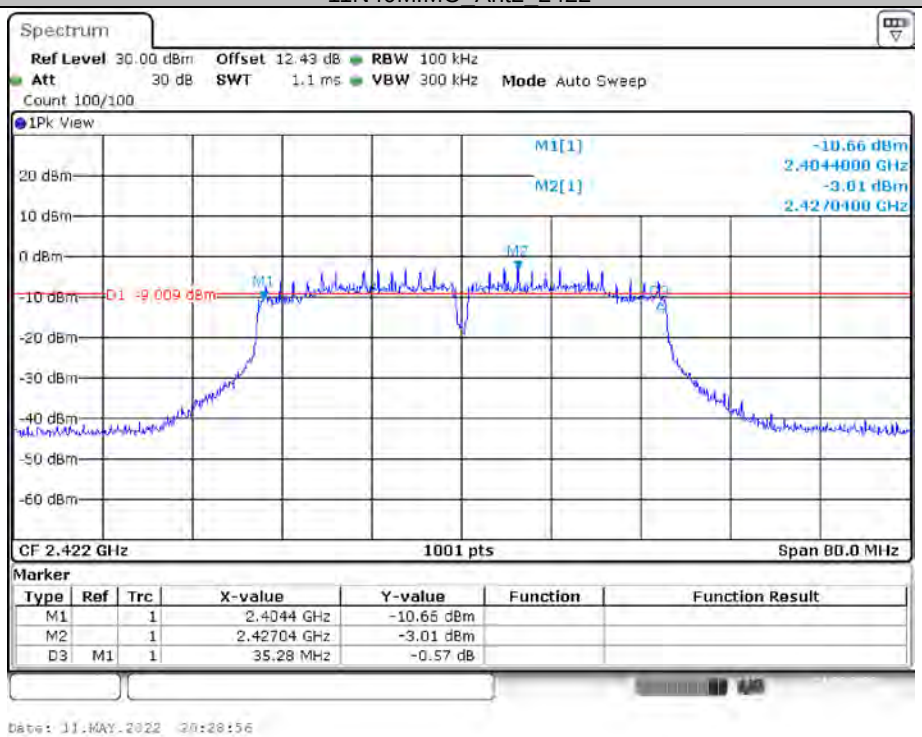
11N20MIMO_Ant2_2462



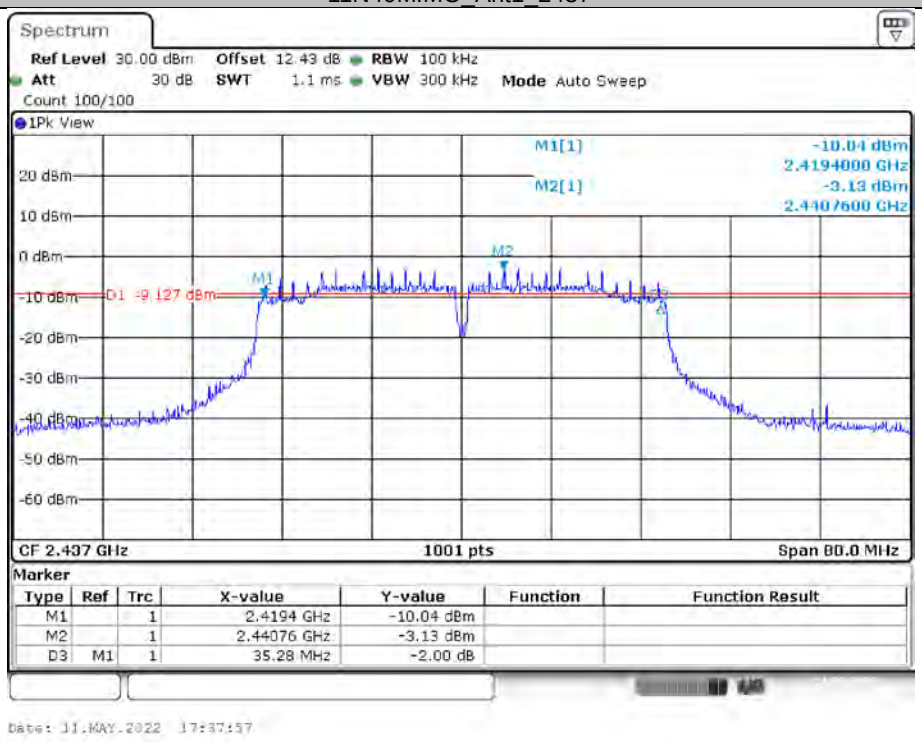
11N40MIMO_Ant1_2422



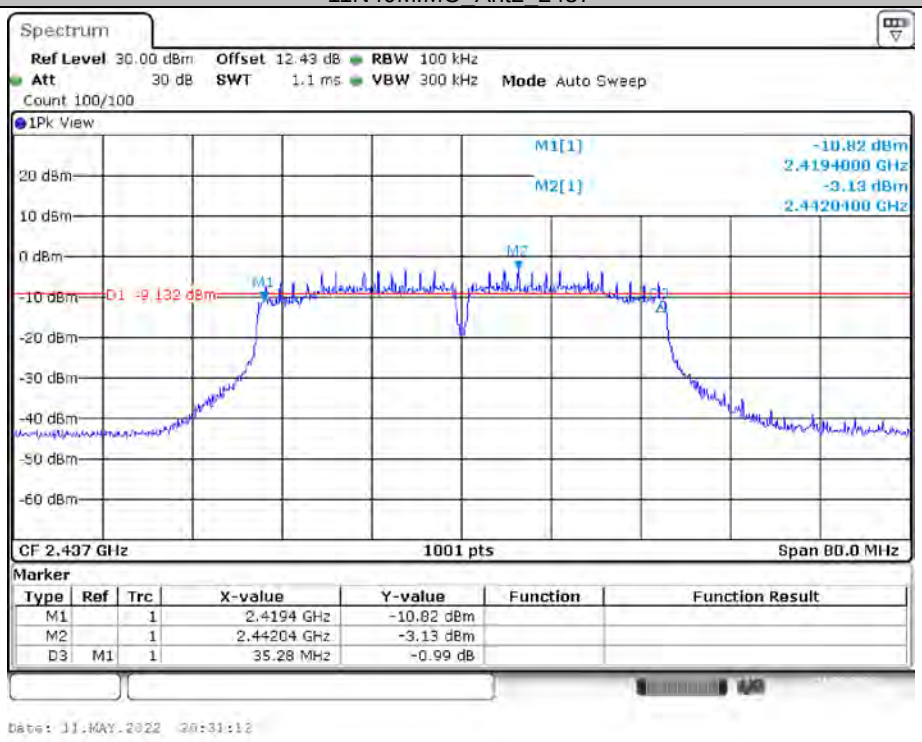
11N40MIMO_Ant2_2422



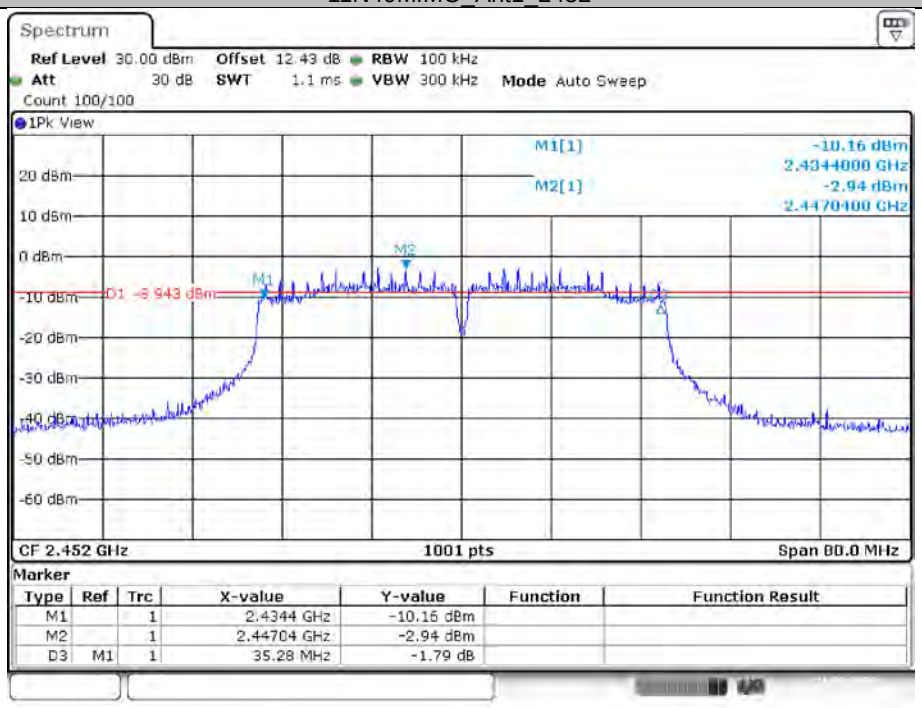
11N40MIMO_Ant1_2437



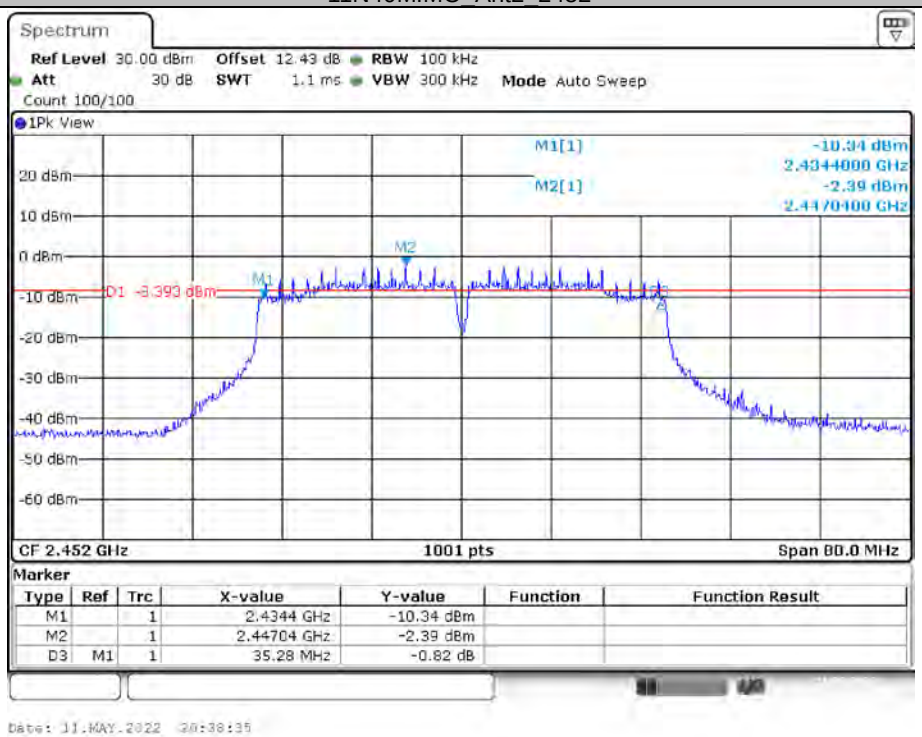
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



11N40MIMO_Ant2_2452



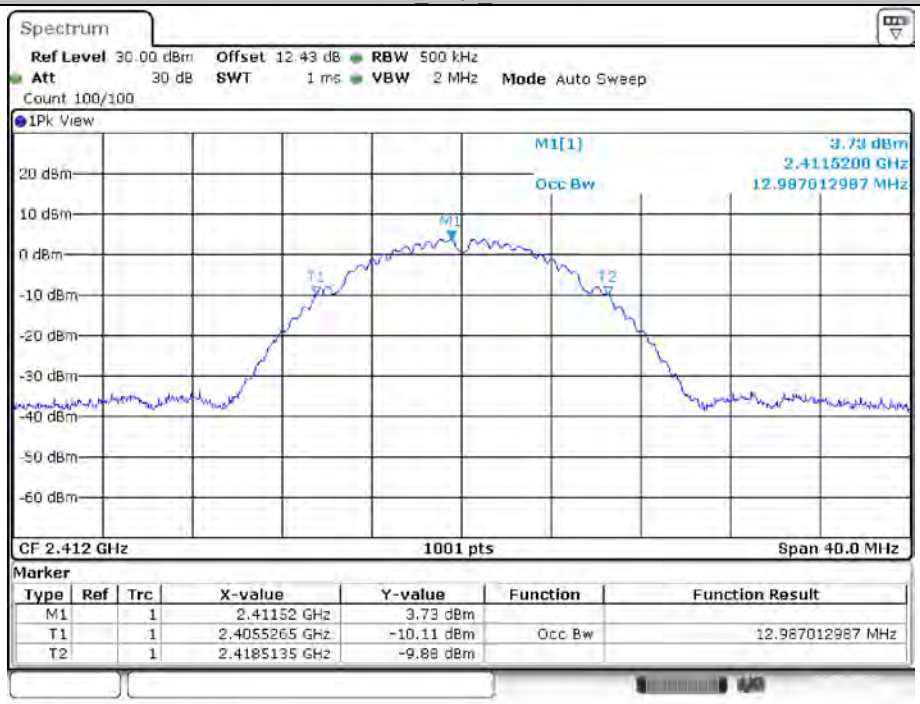
Appendix B: Occupied Channel Bandwidth

Test Result

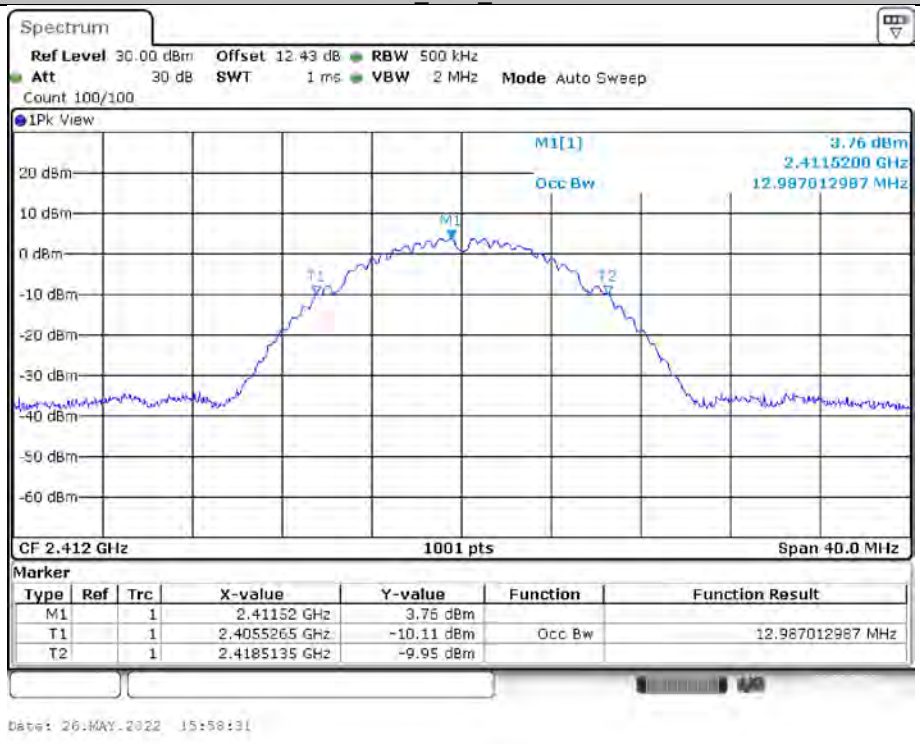
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	12.987	2403.409	2420.711	---	PASS
	Ant2	2412	12.987	2403.369	2420.711	---	PASS
	Ant1	2437	12.987	2428.409	2445.671	---	PASS
	Ant2	2437	12.987	2428.449	2445.671	---	PASS
	Ant1	2462	12.987	2453.369	2470.631	---	PASS
	Ant2	2462	12.987	2453.409	2470.591	---	PASS
11G	Ant1	2412	17.223	2403.449	2420.671	---	PASS
	Ant2	2412	17.303	2403.369	2420.671	---	PASS
	Ant1	2437	17.263	2428.409	2445.671	---	PASS
	Ant2	2437	17.263	2428.409	2445.671	---	PASS
	Ant1	2462	17.263	2453.369	2470.631	---	PASS
	Ant2	2462	17.263	2453.369	2470.631	---	PASS
11N20MIMO	Ant1	2412	17.223	2403.449	2420.671	---	PASS
	Ant2	2412	17.223	2403.409	2420.631	---	PASS
	Ant1	2437	17.303	2428.369	2445.671	---	PASS
	Ant2	2437	17.223	2428.449	2445.671	---	PASS
	Ant1	2462	17.263	2453.369	2470.631	---	PASS
	Ant2	2462	17.223	2453.409	2470.631	---	PASS
11N40MIMO	Ant1	2422	36.603	2403.778	2440.382	---	PASS
	Ant2	2422	36.364	2403.938	2440.302	---	PASS
	Ant1	2437	36.523	2418.778	2455.302	---	PASS
	Ant2	2437	36.364	2418.938	2455.302	---	PASS
	Ant1	2452	36.364	2433.938	2470.302	---	PASS
	Ant2	2452	36.364	2433.938	2470.302	---	PASS

Test Graphs

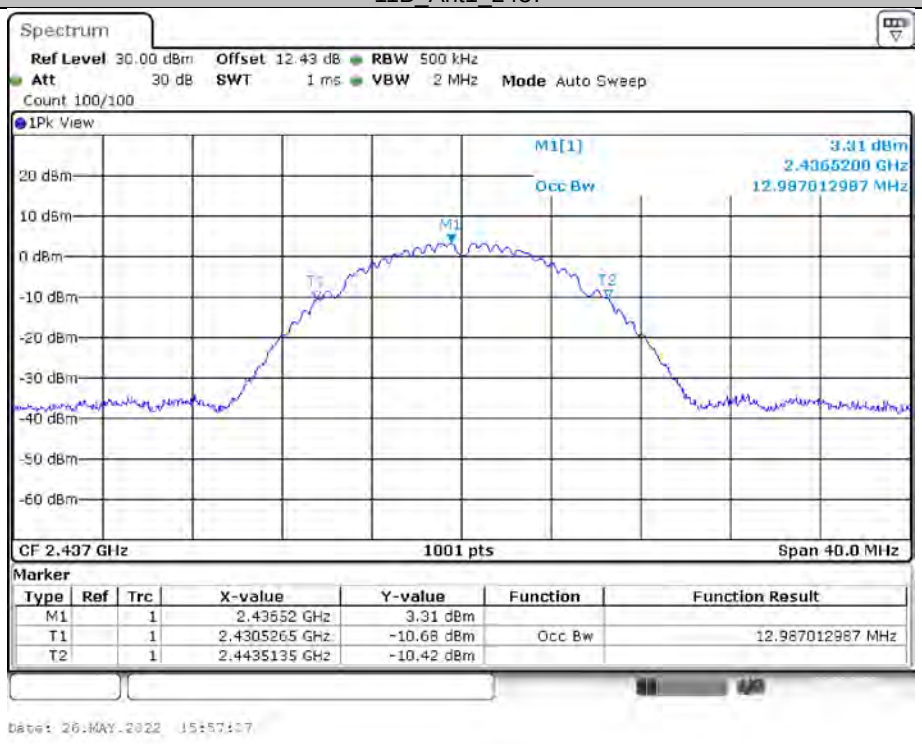
11B_Ant1_2412



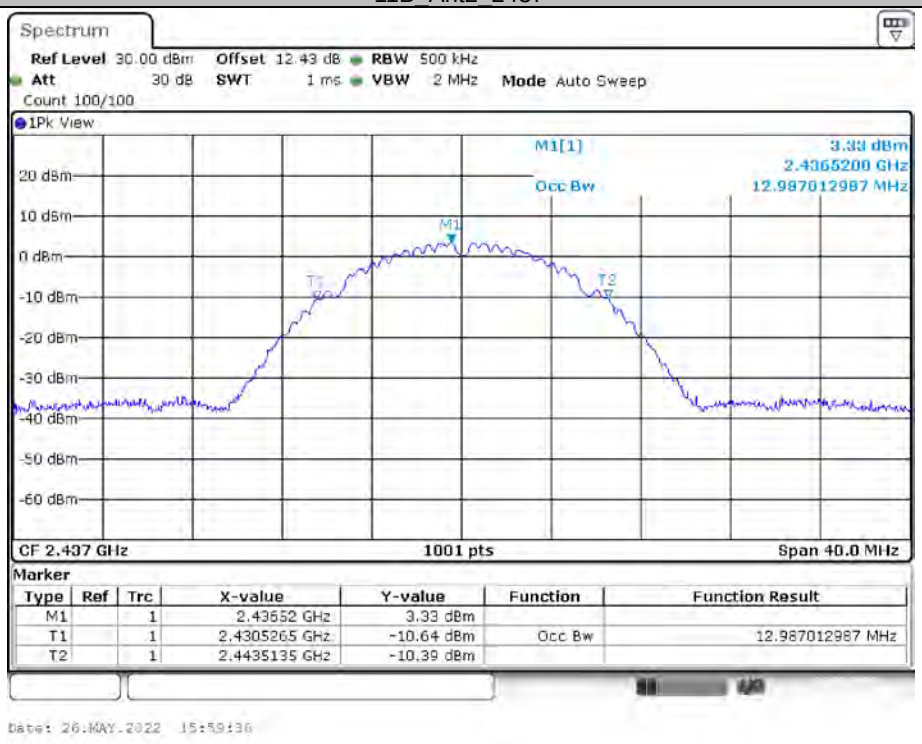
11B_Ant2_2412



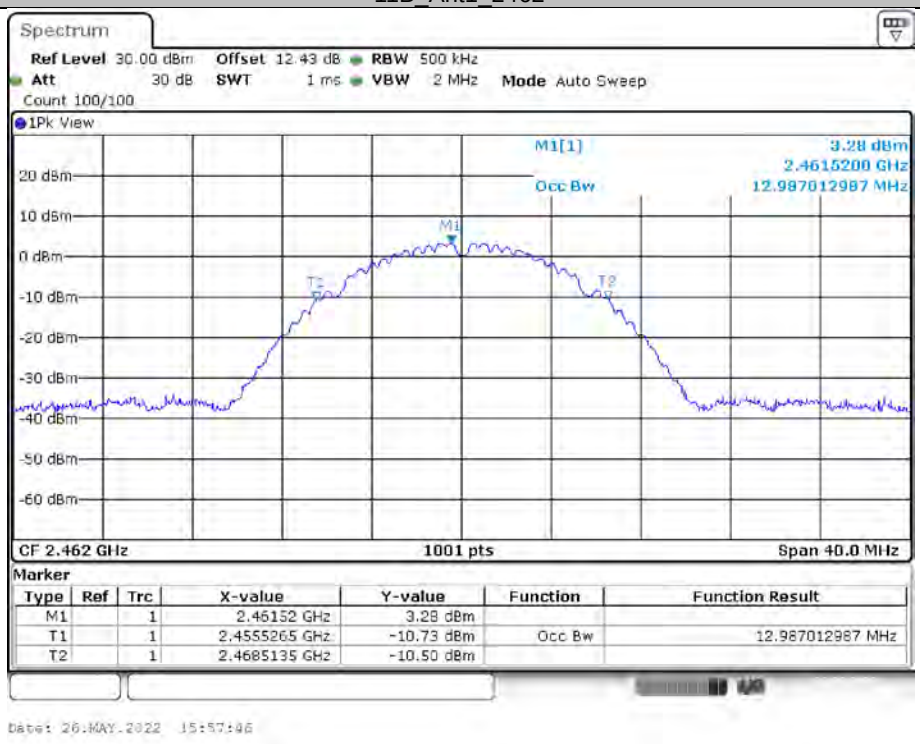
11B_Ant1_2437



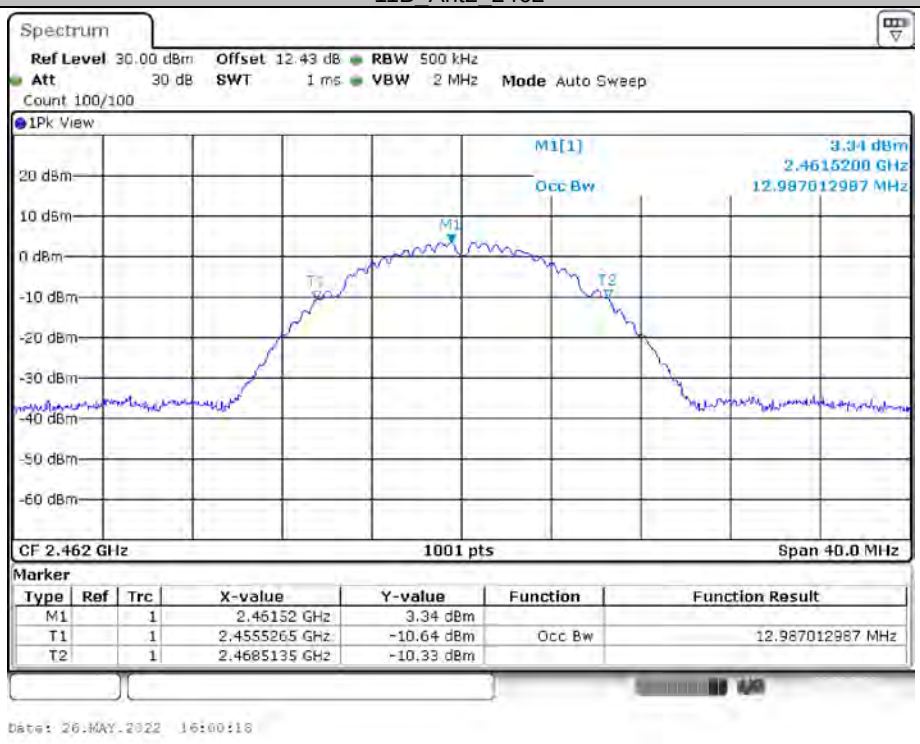
11B_Ant2_2437



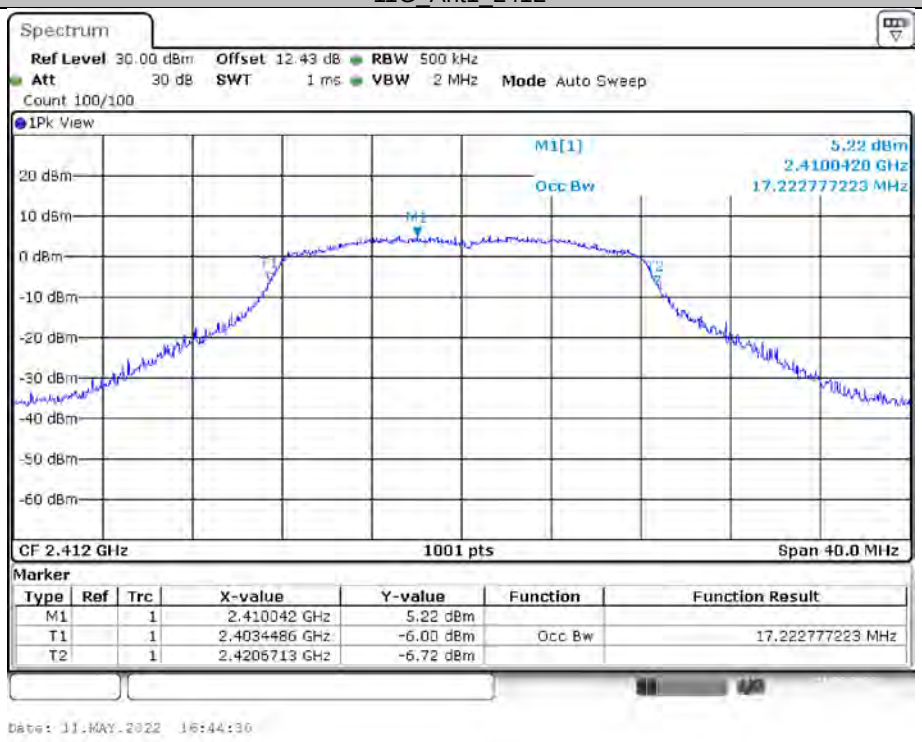
11B_Ant1_2462



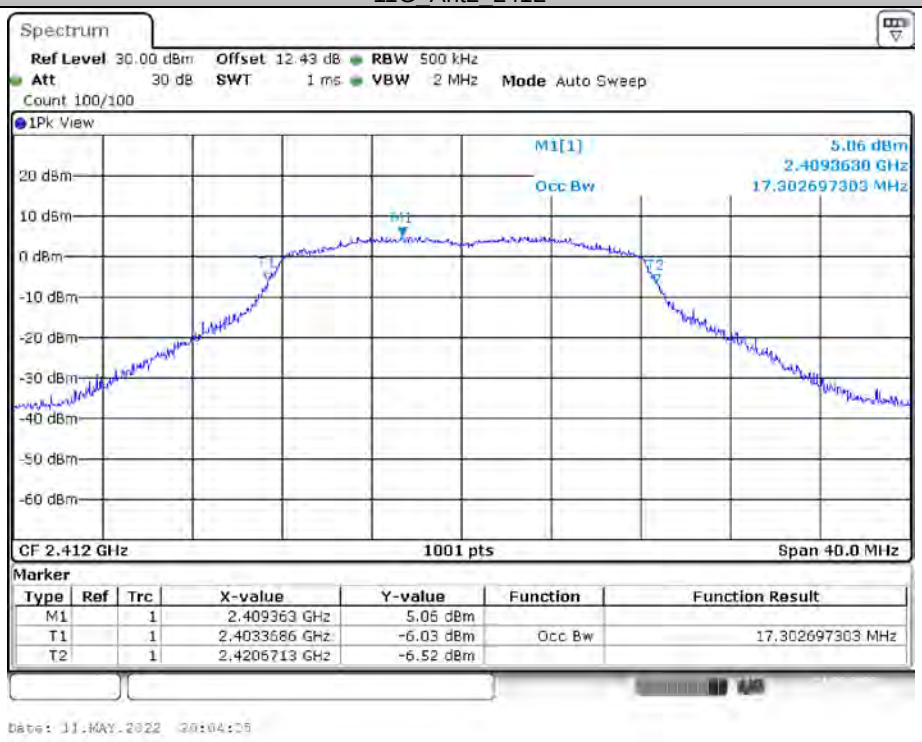
11B_Ant2_2462



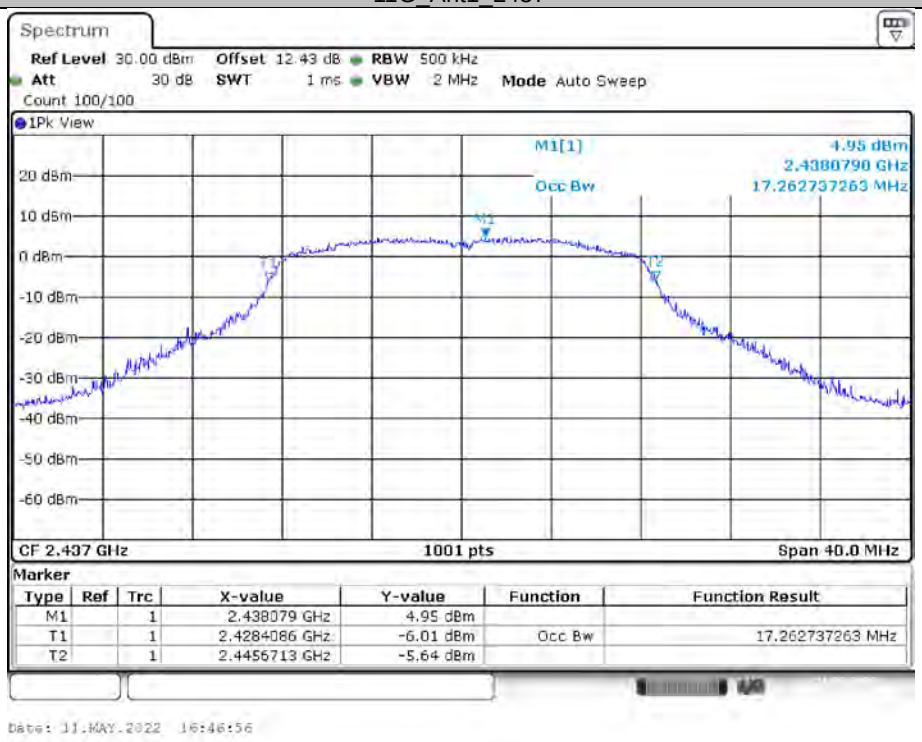
11G_Ant1_2412



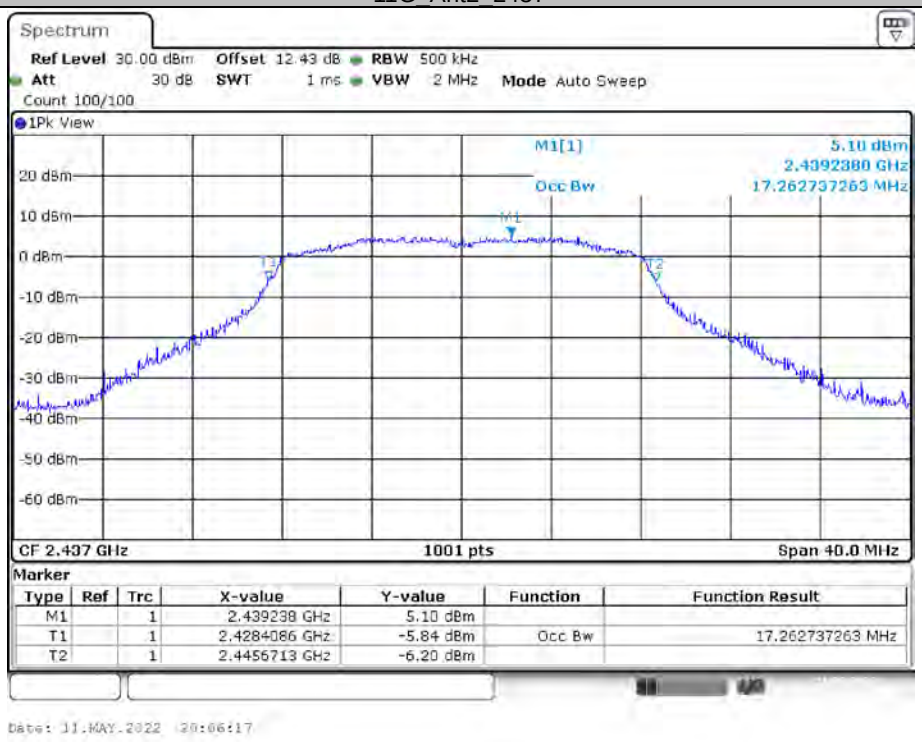
11G_Ant2_2412



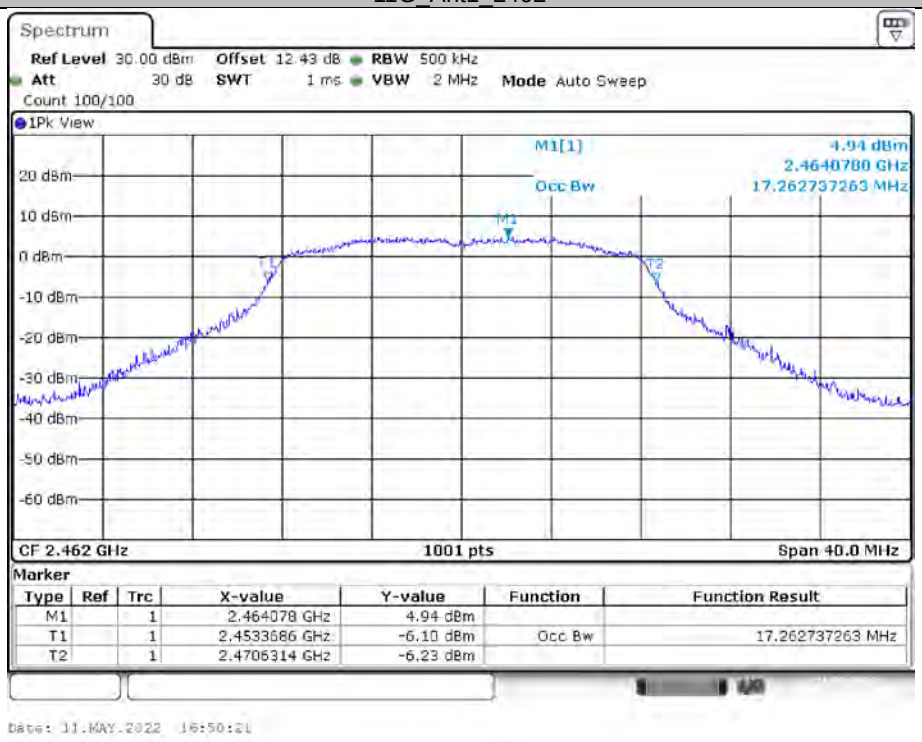
11G_Ant1_2437



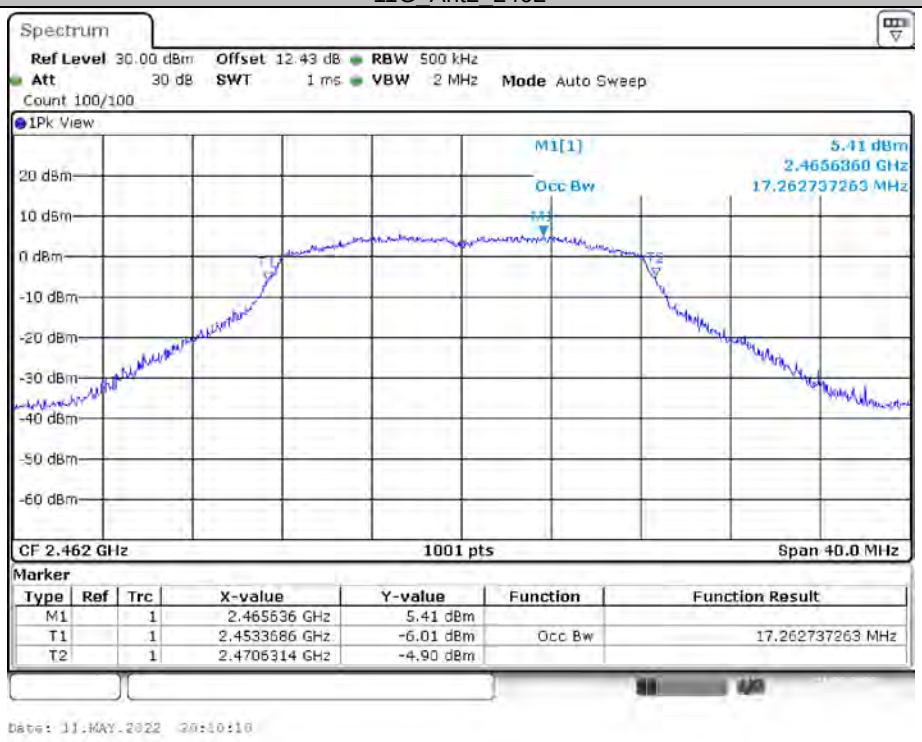
11G_Ant2_2437



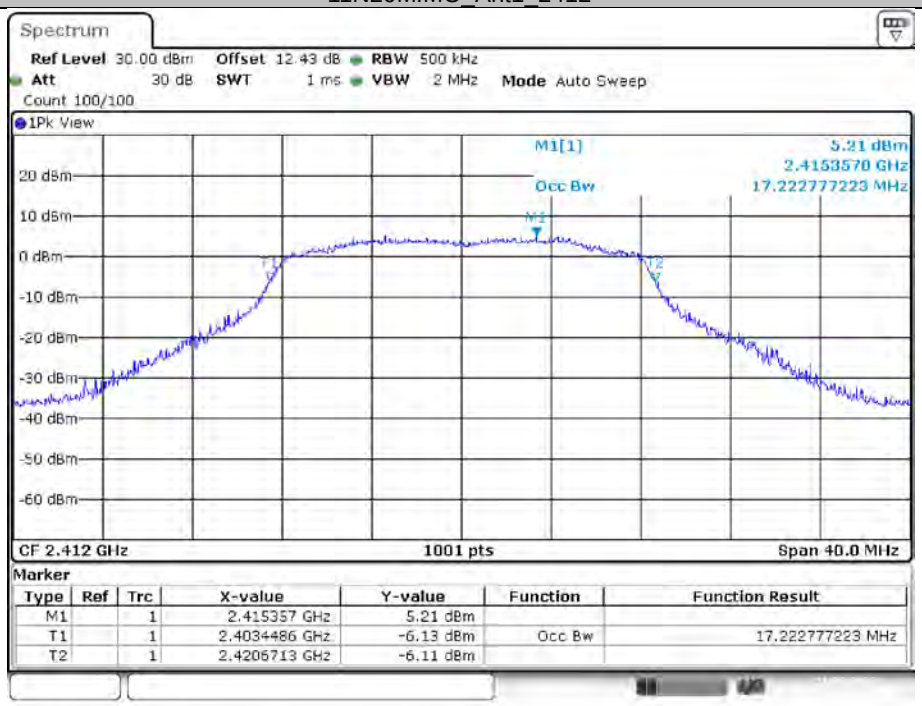
11G_Ant1_2462



11G_Ant2_2462

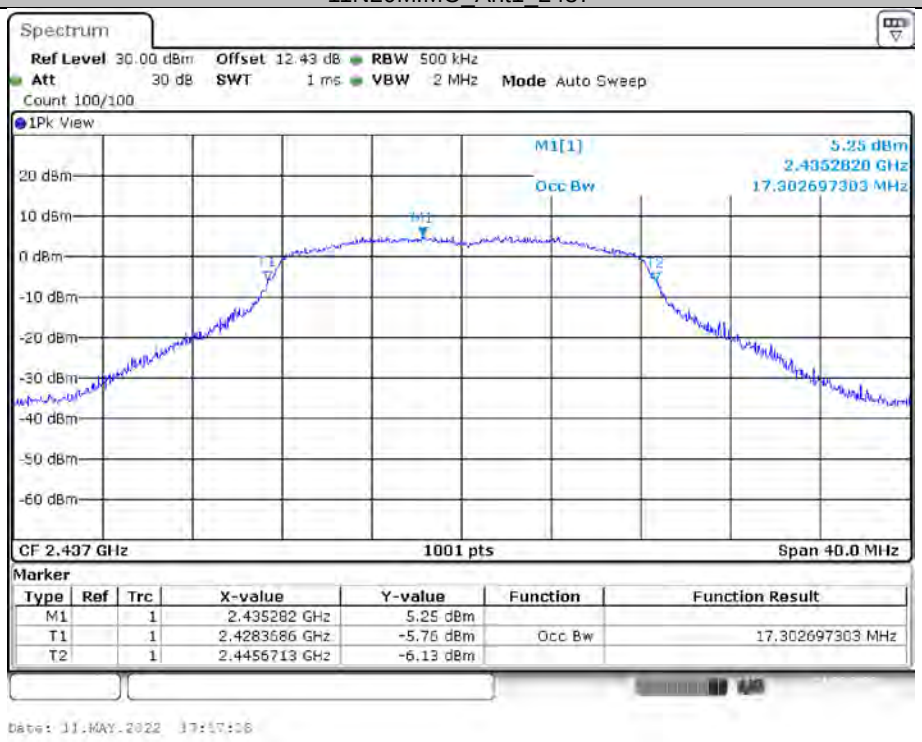


11N20MIMO_Ant1_2412

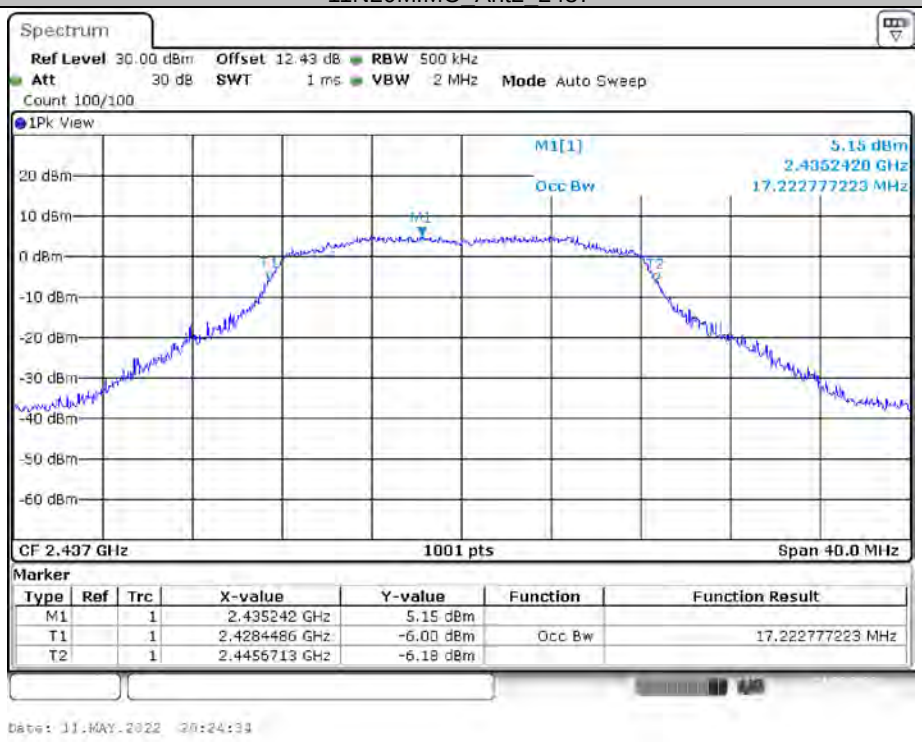


11N20MIMO_Ant2_2412

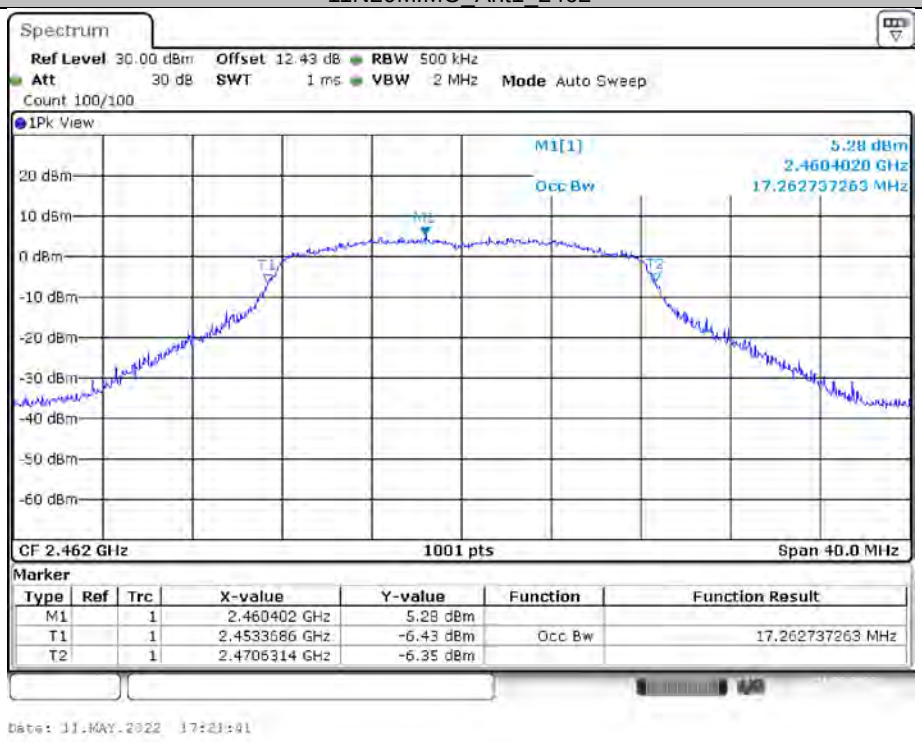
11N20MIMO_Ant1_2437



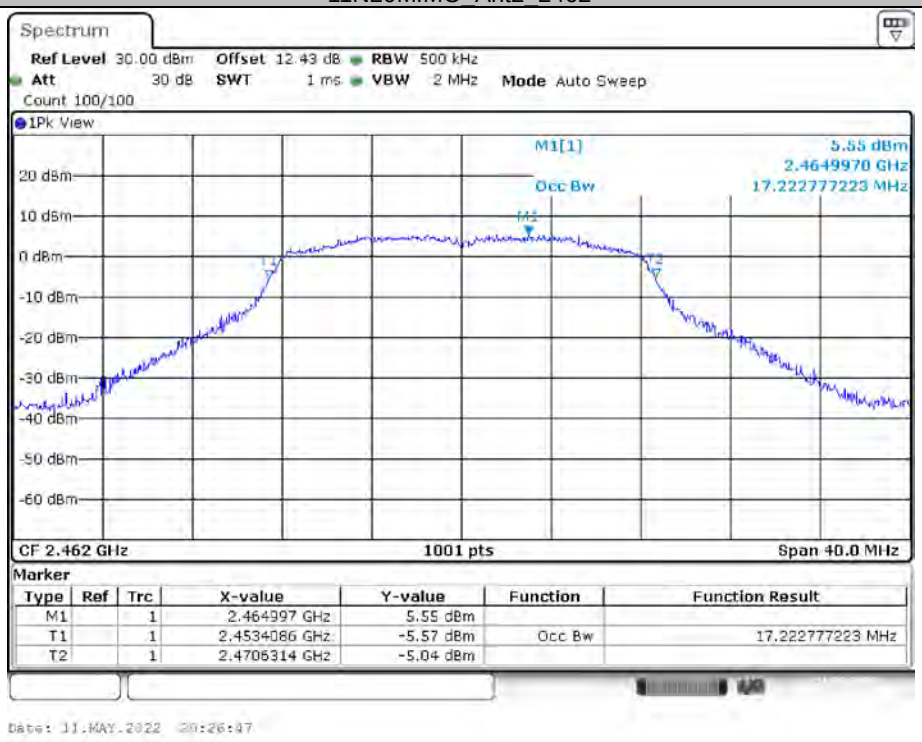
11N20MIMO_Ant2_2437



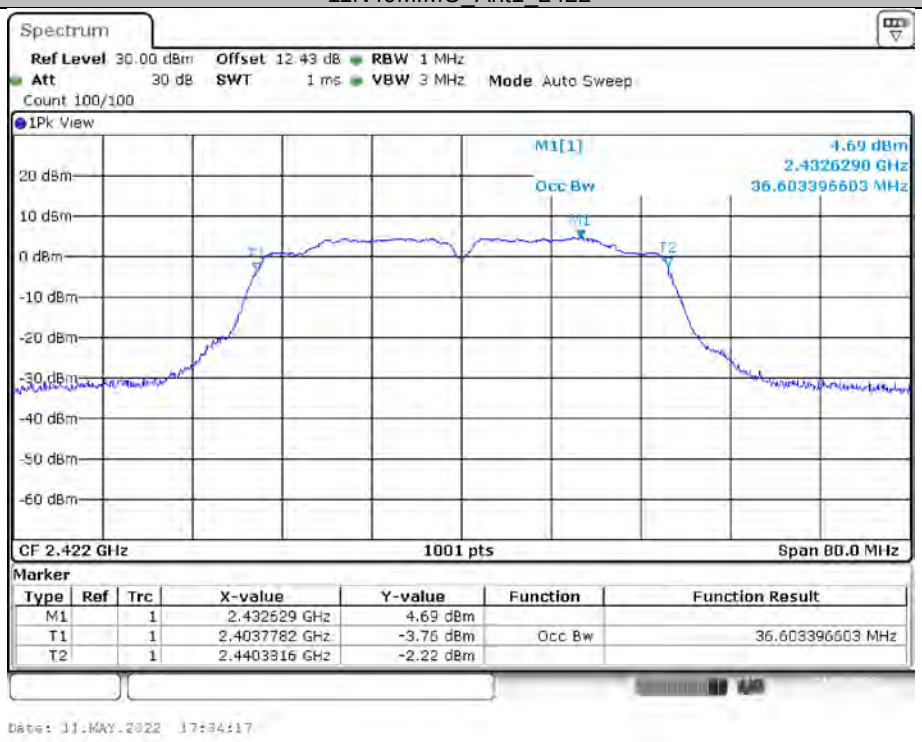
11N20MIMO_Ant1_2462



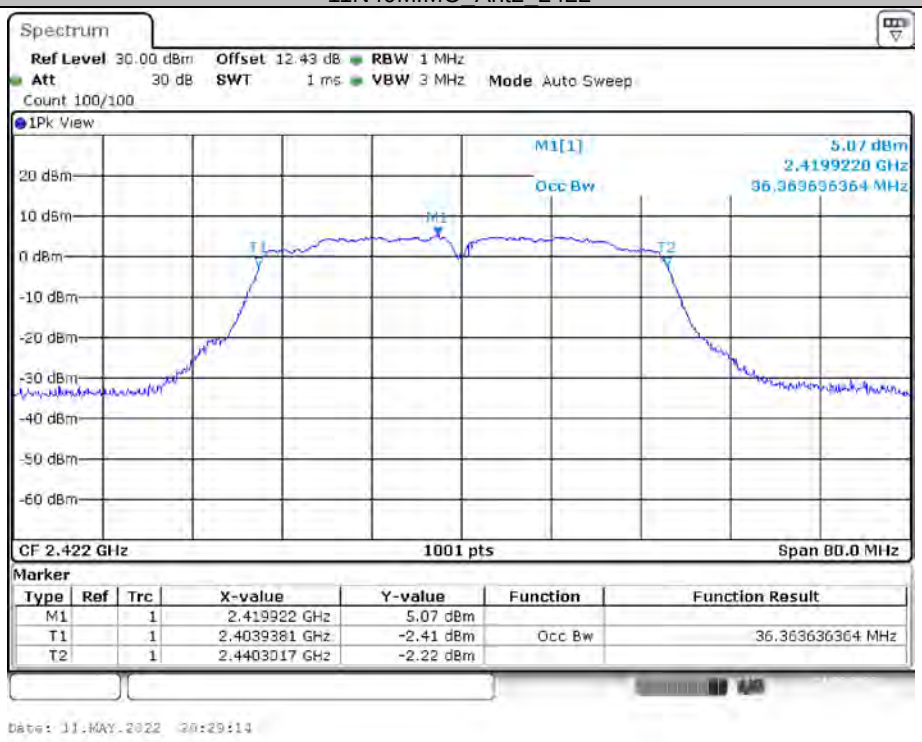
11N20MIMO_Ant2_2462



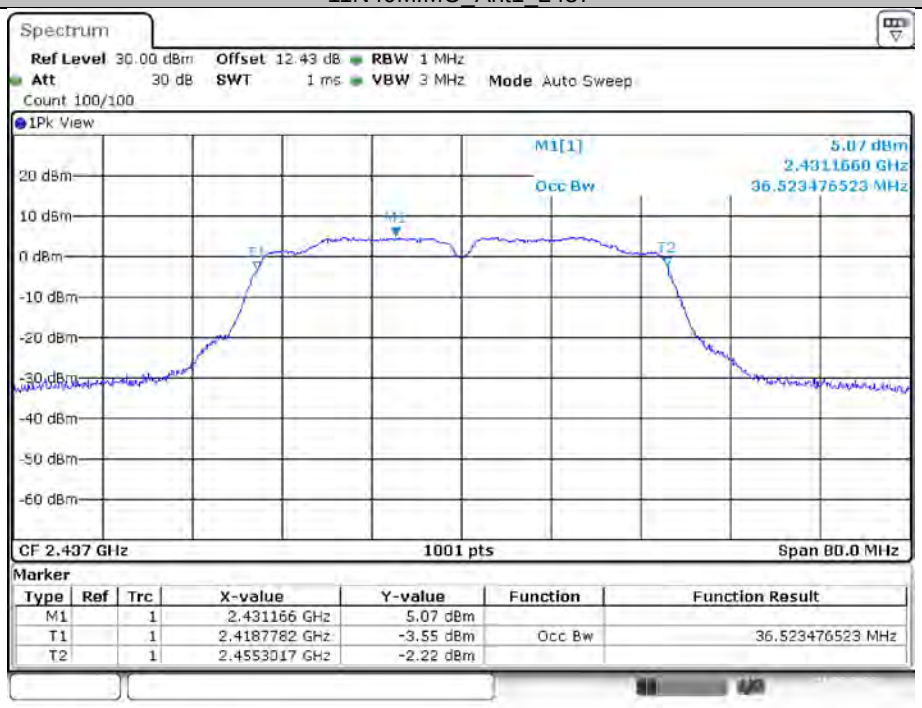
11N40MIMO_Ant1_2422



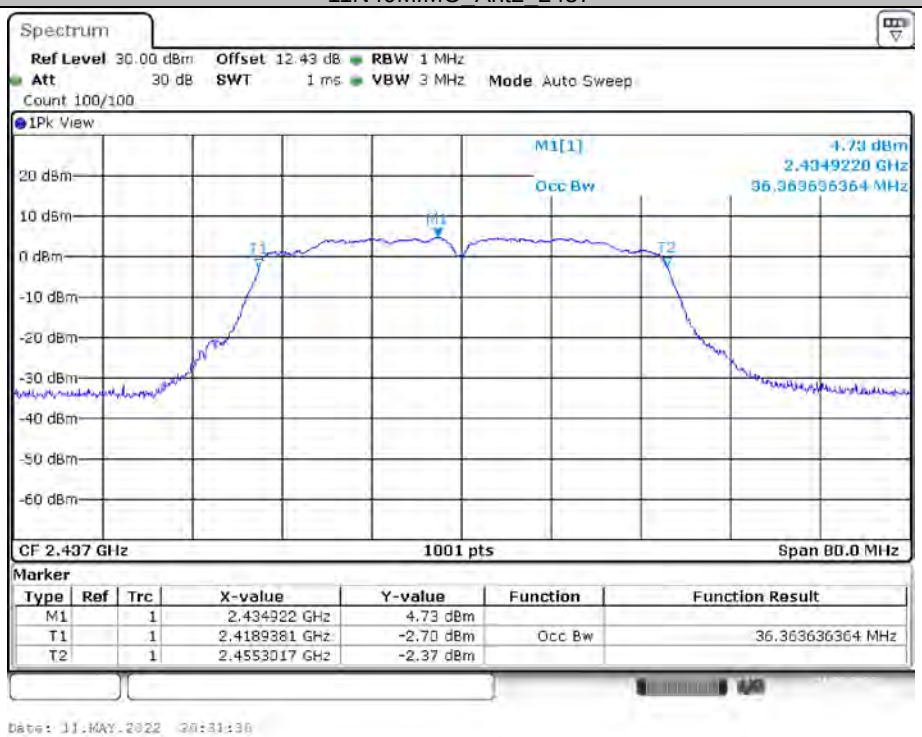
11N40MIMO_Ant2_2422



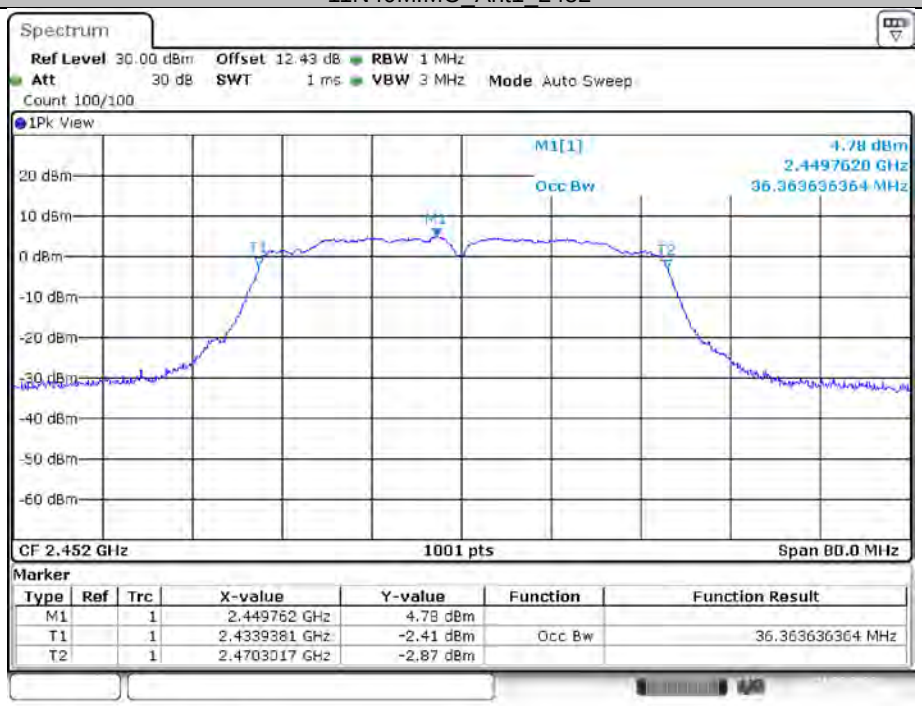
11N40MIMO_Ant1_2437



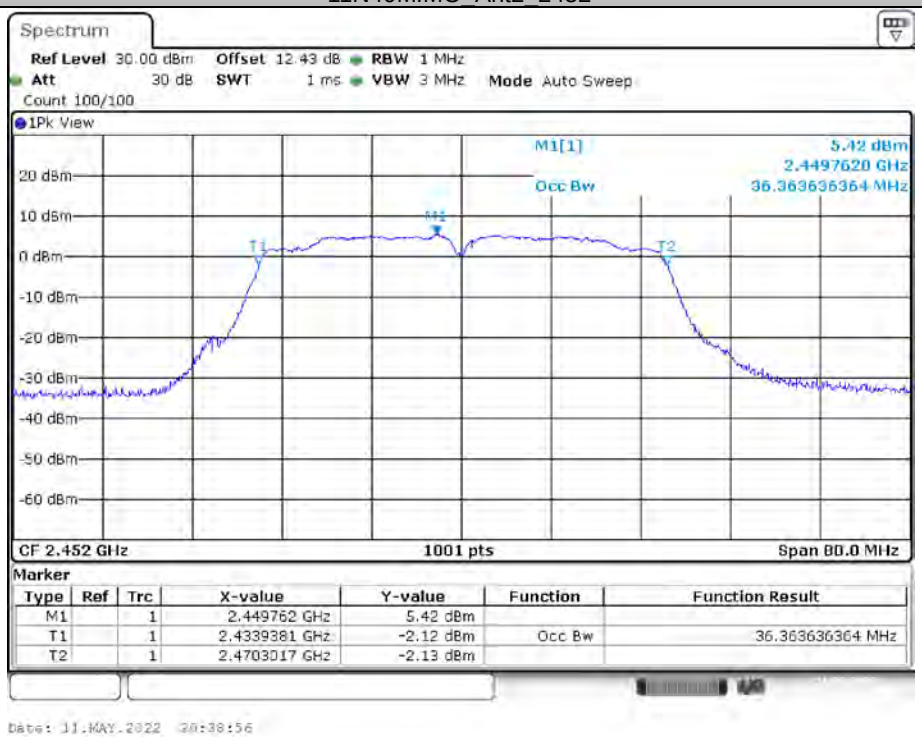
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



11N40MIMO_Ant2_2452



Appendix C: Maximum conducted output power

Test Result

Peak:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	12.90	<=30	PASS
	Ant2	2412	12.88	<=30	PASS
	total	2412	15.89	<=30	PASS
	Ant1	2437	12.53	<=30	PASS
	Ant2	2437	12.98	<=30	PASS
	total	2437	15.88	<=30	PASS
	Ant1	2462	12.95	<=30	PASS
	Ant2	2462	12.77	<=30	PASS
	total	2462	15.98	<=30	PASS
11G	Ant1	2412	11.96	<=30	PASS
	Ant2	2412	11.94	<=30	PASS
	total	2412	14.95	<=30	PASS
	Ant1	2437	12.08	<=30	PASS
	Ant2	2437	11.90	<=30	PASS
	total	2437	14.99	<=30	PASS
	Ant1	2462	12.00	<=30	PASS
	Ant2	2462	11.83	<=30	PASS
	total	2462	14.92	<=30	PASS
11N20MIMO	Ant1	2412	12.01	<=30	PASS
	Ant2	2412	11.94	<=30	PASS
	total	2412	14.98	<=30	PASS
	Ant1	2437	11.86	<=30	PASS
	Ant2	2437	11.90	<=30	PASS
	total	2437	14.88	<=30	PASS
	Ant1	2462	12.14	<=30	PASS
	Ant2	2462	11.83	<=30	PASS
	total	2462	14.99	<=30	PASS
11N40MIMO	Ant1	2422	11.44	<=30	PASS
	Ant2	2422	11.87	<=30	PASS
	total	2422	14.67	<=30	PASS
	Ant1	2437	11.58	<=30	PASS
	Ant2	2437	11.83	<=30	PASS
	total	2437	14.71	<=30	PASS
	Ant1	2452	11.42	<=30	PASS
	Ant2	2452	11.76	<=30	PASS
	total	2452	14.6	<=30	PASS

Note 1: The maximum antenna gain is 2.68dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0dB (i.e., no array gain) For $N_{ANT} \leq 4$;

So: Directional gain=2.68dBi <6dBi

Appendix D: Power spectral density

Test Result

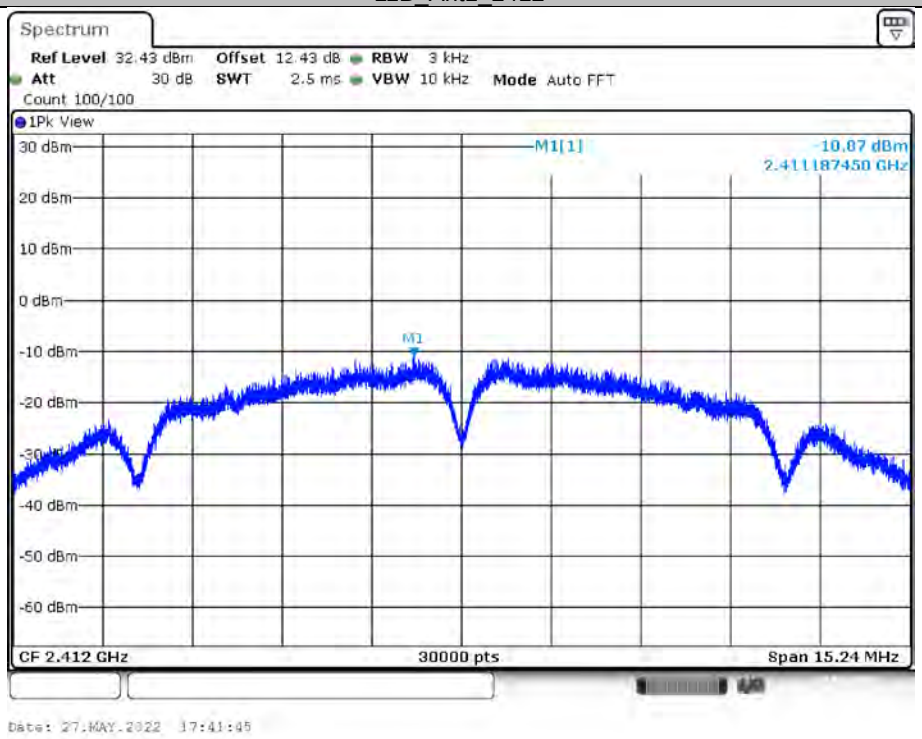
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-10.87	<=8	PASS
	Ant2	2412	-11.13	<=8	PASS
	total	2412	-7.99	<=8	PASS
	Ant1	2437	-11.43	<=8	PASS
	Ant2	2437	-11.71	<=8	PASS
	total	2437	-8.56	<=8	PASS
	Ant1	2462	-10.52	<=8	PASS
	Ant2	2462	-11.9	<=8	PASS
	total	2462	-8.15	<=8	PASS
11G	Ant1	2412	-14.45	<=8	PASS
	Ant2	2412	-14.43	<=8	PASS
	total	2412	-11.43	<=8	PASS
	Ant1	2437	-14.64	<=8	PASS
	Ant2	2437	-14.6	<=8	PASS
	total	2437	-11.61	<=8	PASS
	Ant1	2462	-15.05	<=8	PASS
	Ant2	2462	-14.87	<=8	PASS
	total	2462	-11.94	<=8	PASS
11N20MIMO	Ant1	2412	-14.91	<=8	PASS
	Ant2	2412	-12.76	<=8	PASS
	total	2412	-10.69	<=8	PASS
	Ant1	2437	-15.21	<=8	PASS
	Ant2	2437	-14.05	<=8	PASS
	total	2437	-11.58	<=8	PASS
	Ant1	2462	-14.92	<=8	PASS
	Ant2	2462	-14.53	<=8	PASS
	total	2462	-11.71	<=8	PASS
11N40MIMO	Ant1	2422	-17.32	<=8	PASS
	Ant2	2422	-19.26	<=8	PASS
	total	2422	-15.17	<=8	PASS
	Ant1	2437	-19.18	<=8	PASS
	Ant2	2437	-18.44	<=8	PASS
	total	2437	-15.78	<=8	PASS
	Ant1	2452	-17.55	<=8	PASS
	Ant2	2452	-19.96	<=8	PASS
	total	2452	-15.58	<=8	PASS

Note 1: The maximum antenna gain is Ant1: 2.68 dBi, Ant2: 1.63dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices

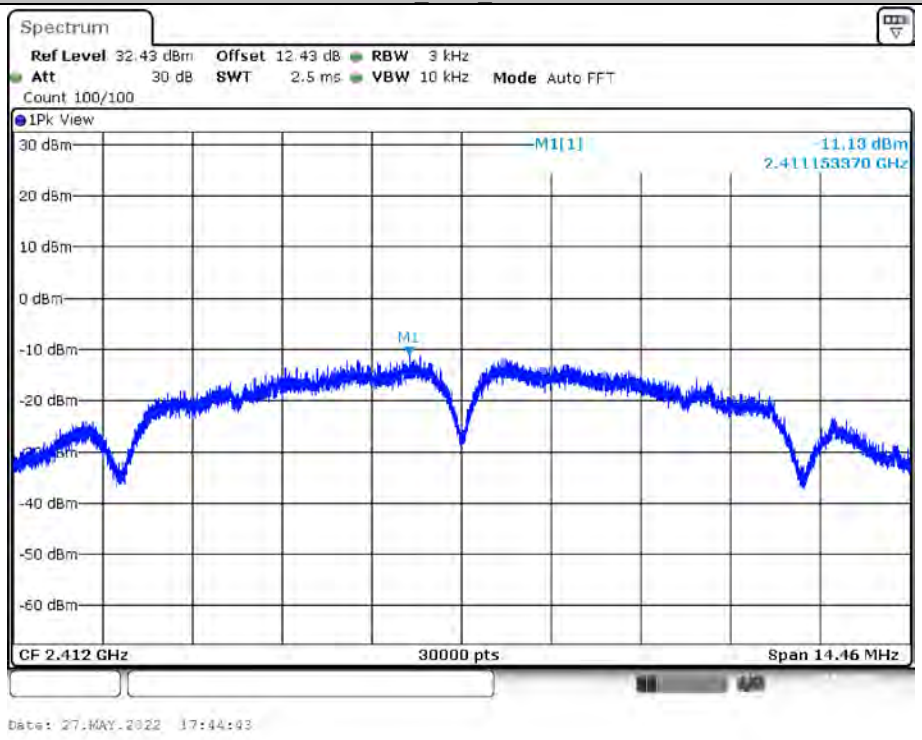
So: Directional gain = G_{ANT} + Array Gain
Array Gain=10*log($N_{ant/}N_{ss}$) dB
For the worst case, N_{ss}=1, so:
Directional gain=2.68dBi+10*log(2/1)dB=5.69dBi<6dBi

Test Graphs

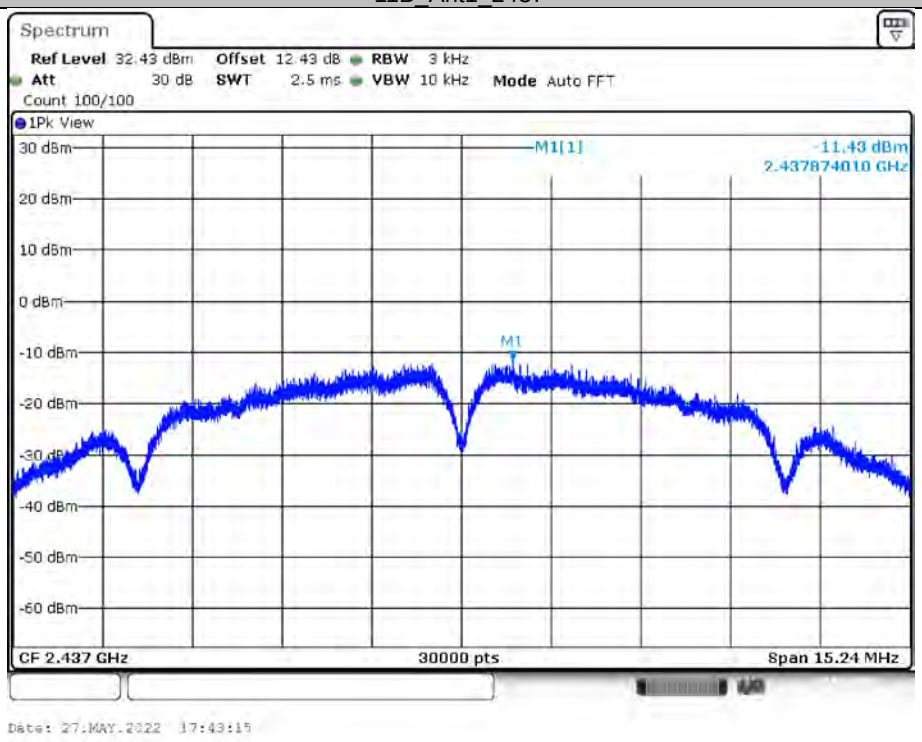
11B_Ant1_2412



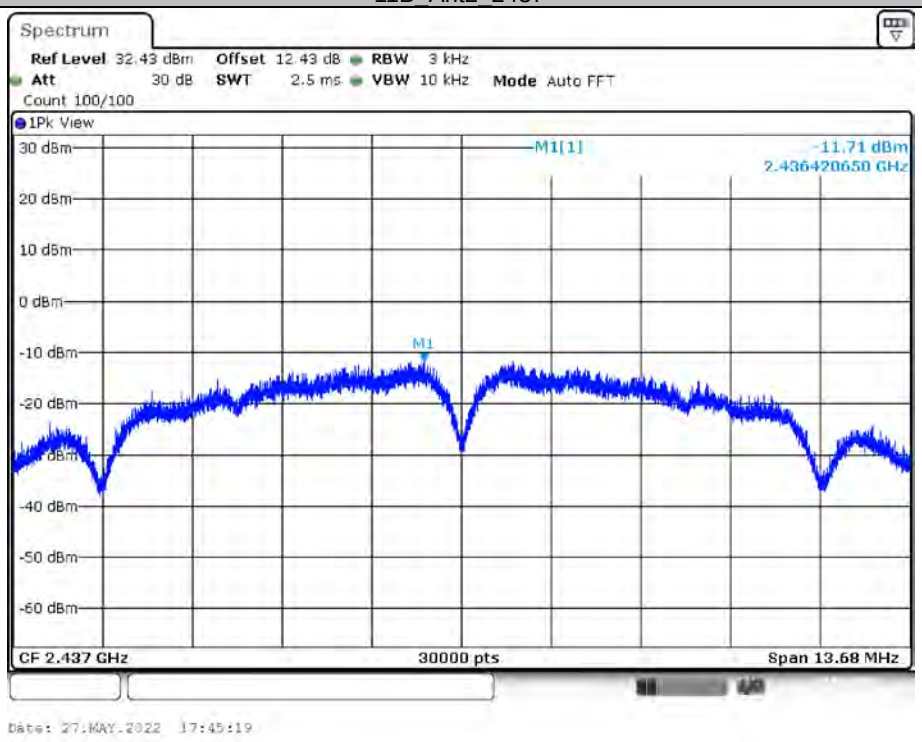
11B_Ant2_2412



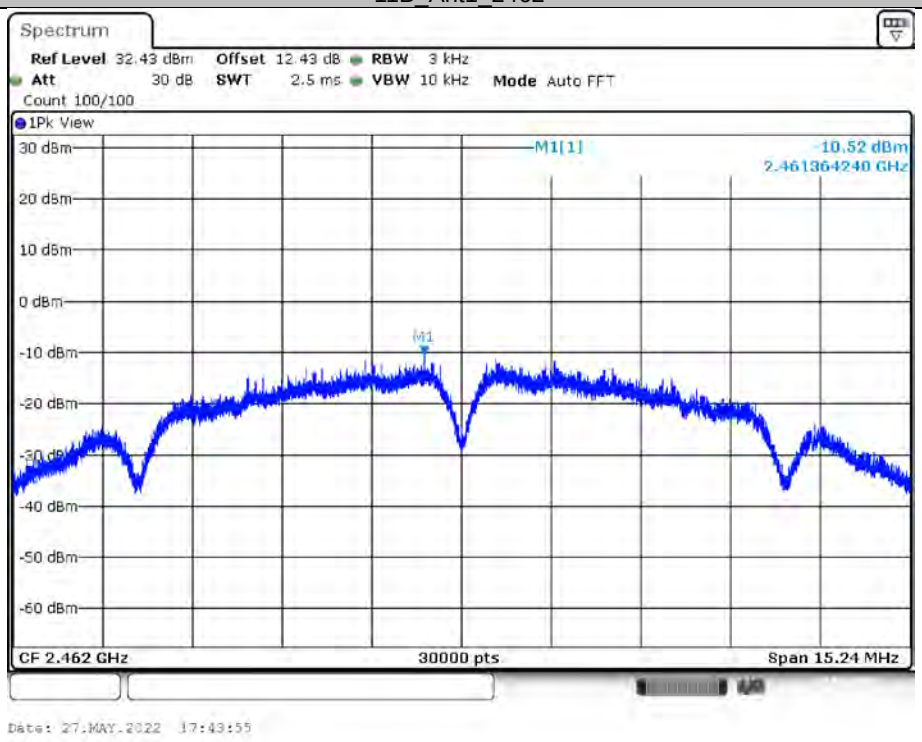
11B_Ant1_2437



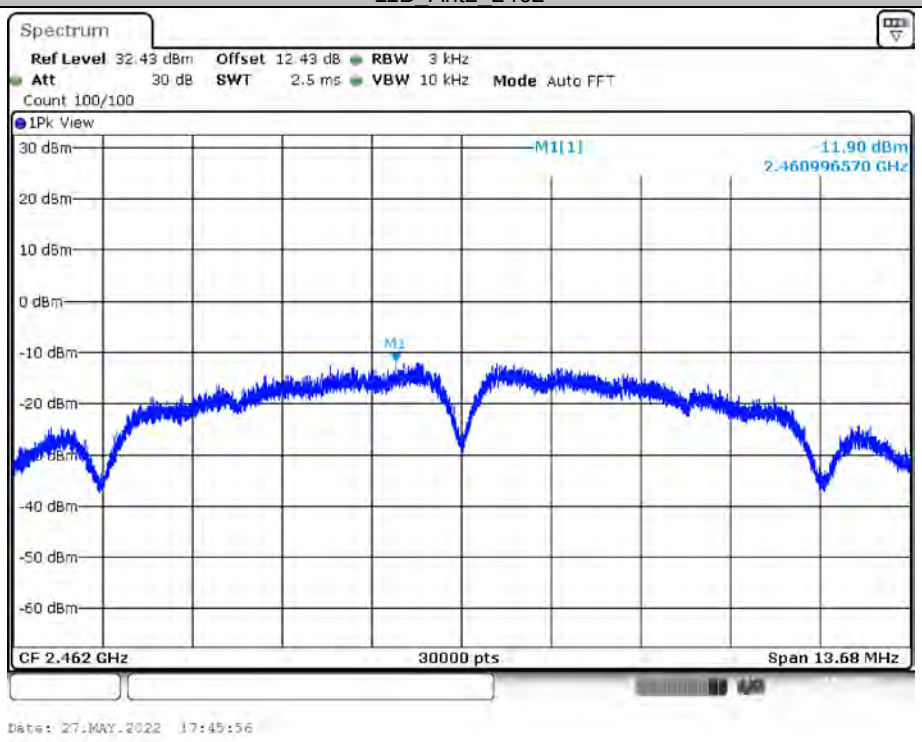
11B_Ant2_2437



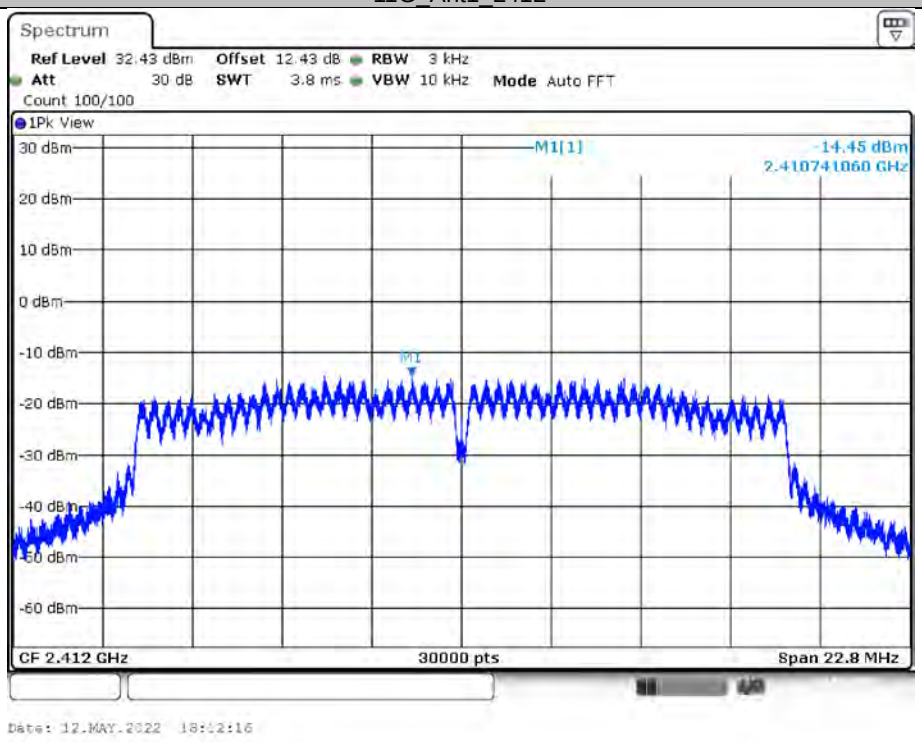
11B_Ant1_2462



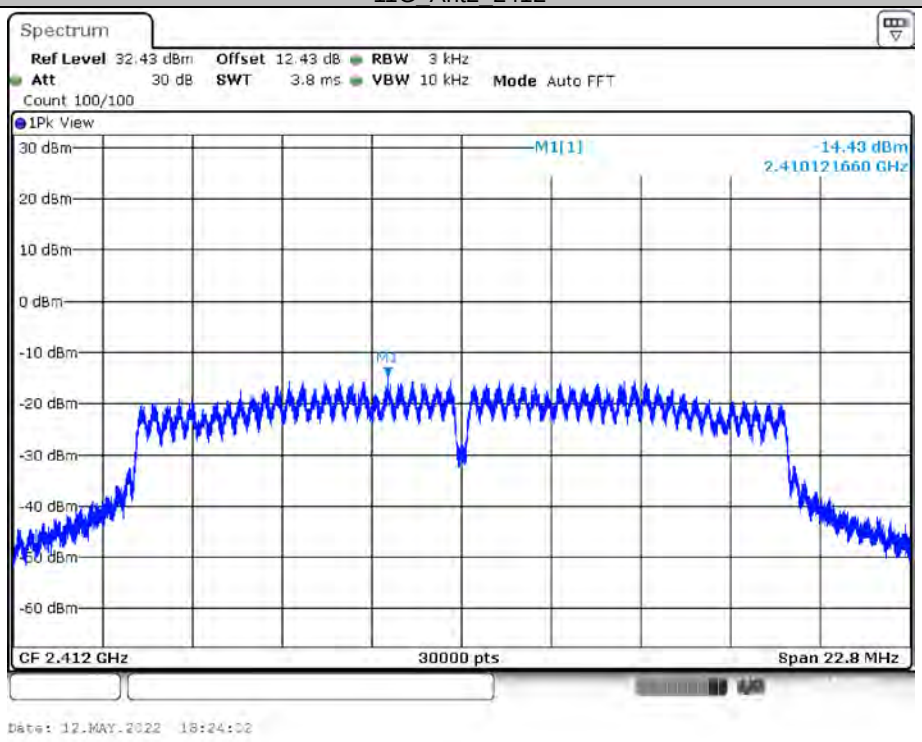
11B_Ant2_2462



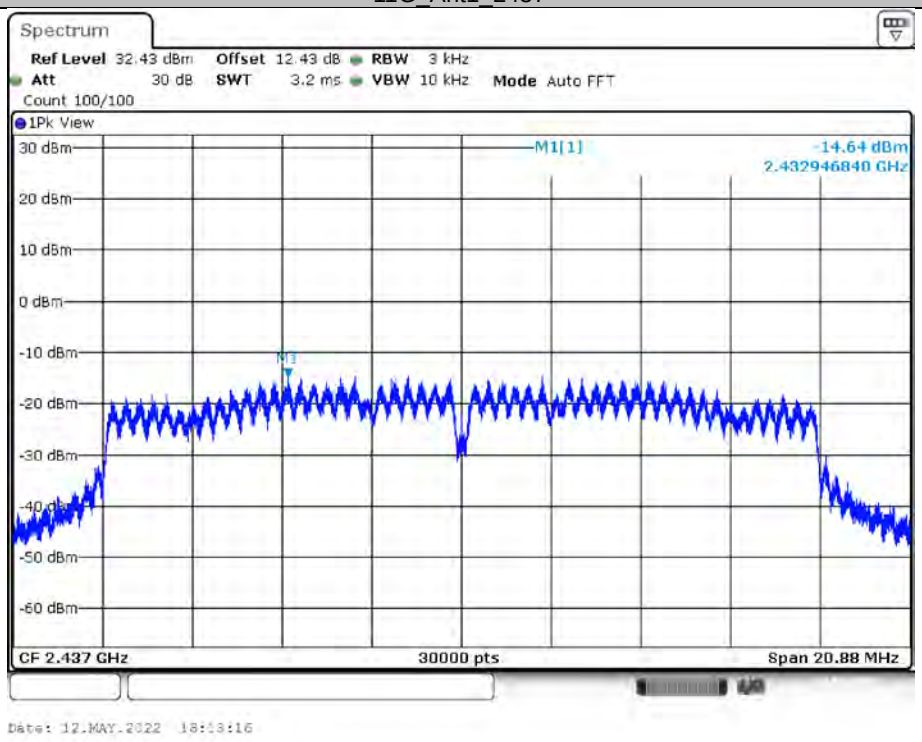
11G_Ant1_2412



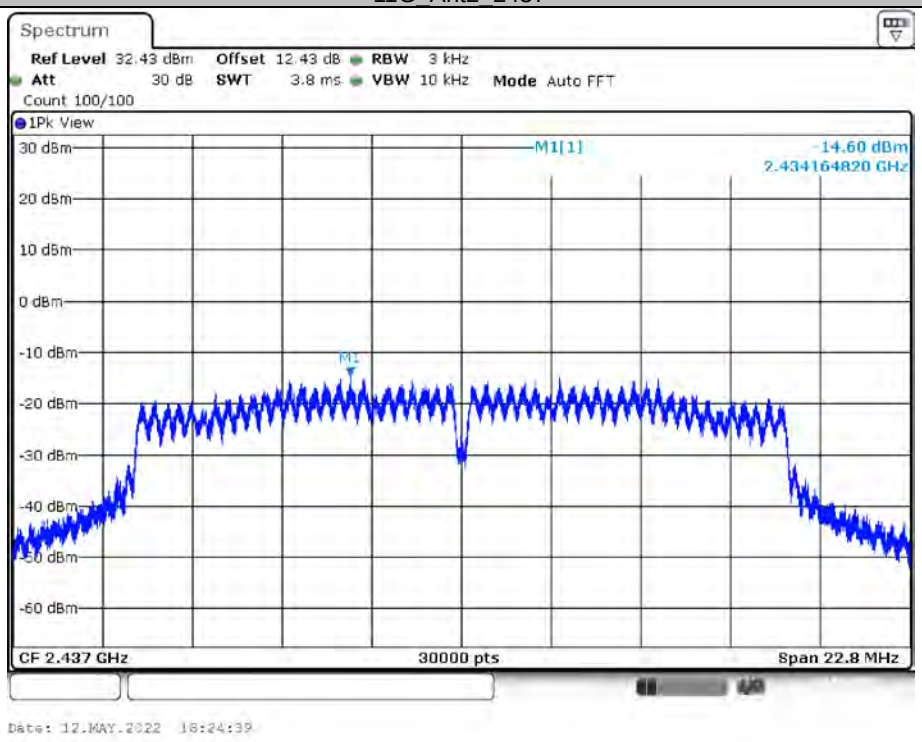
11G_Ant2_2412



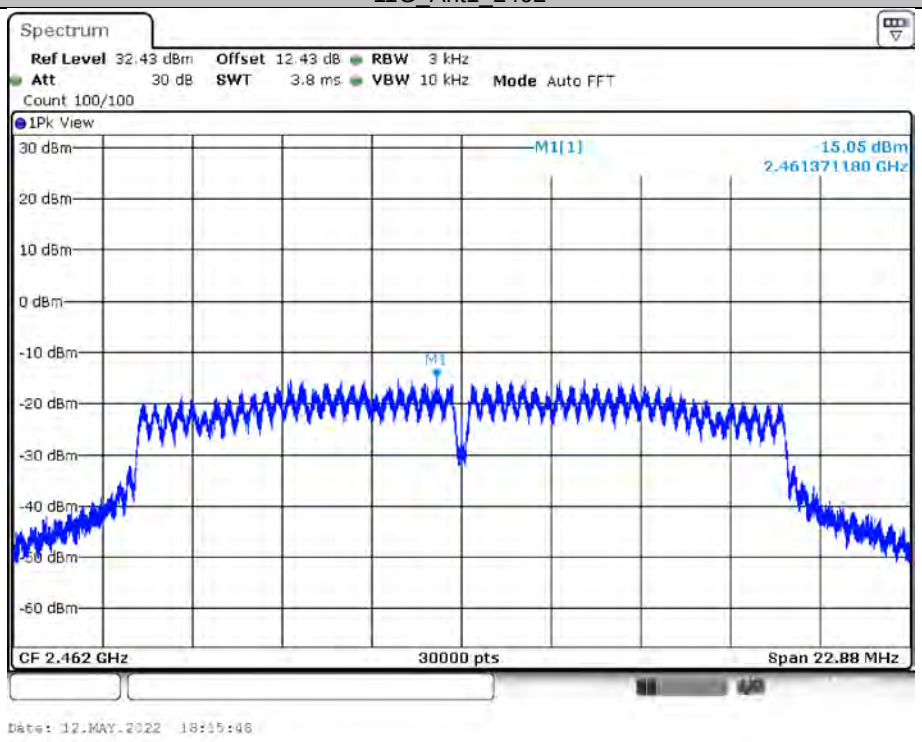
11G_Ant1_2437



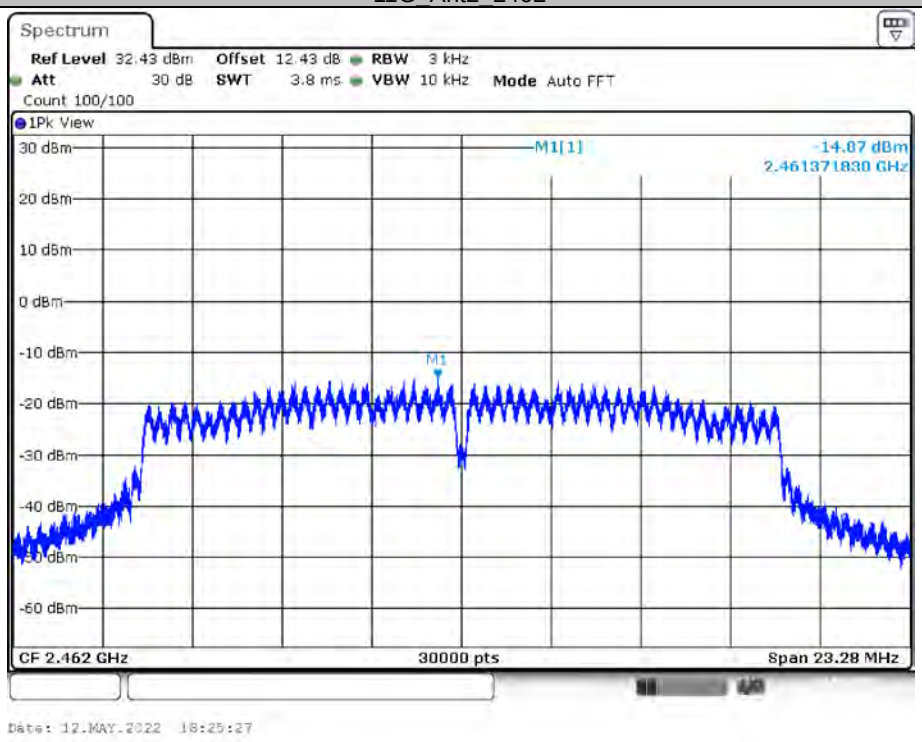
11G_Ant2_2437



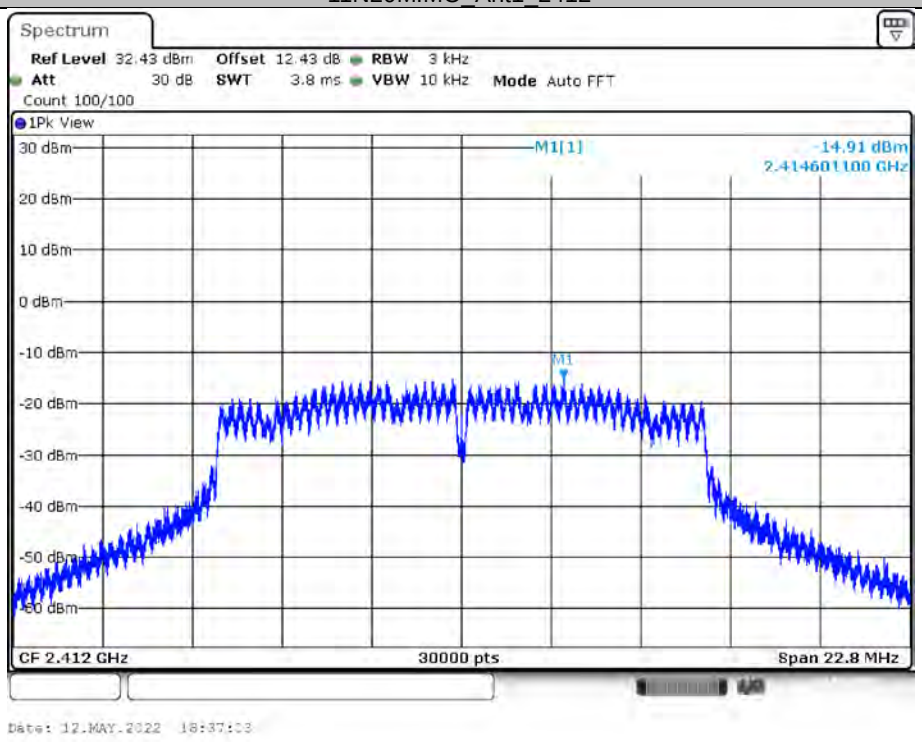
11G_Ant1_2462



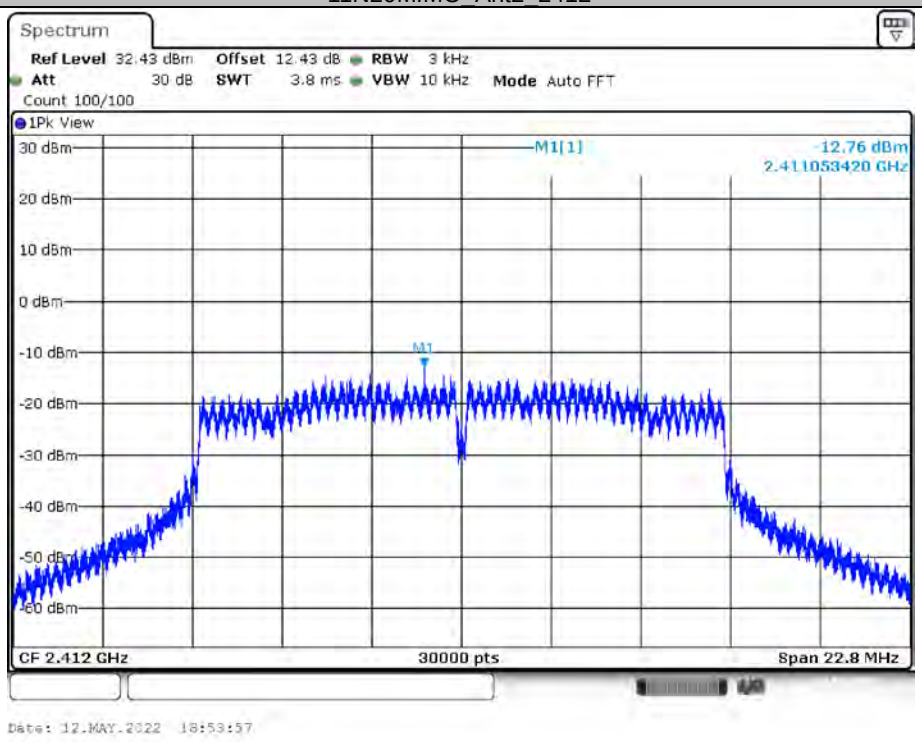
11G_Ant2_2462



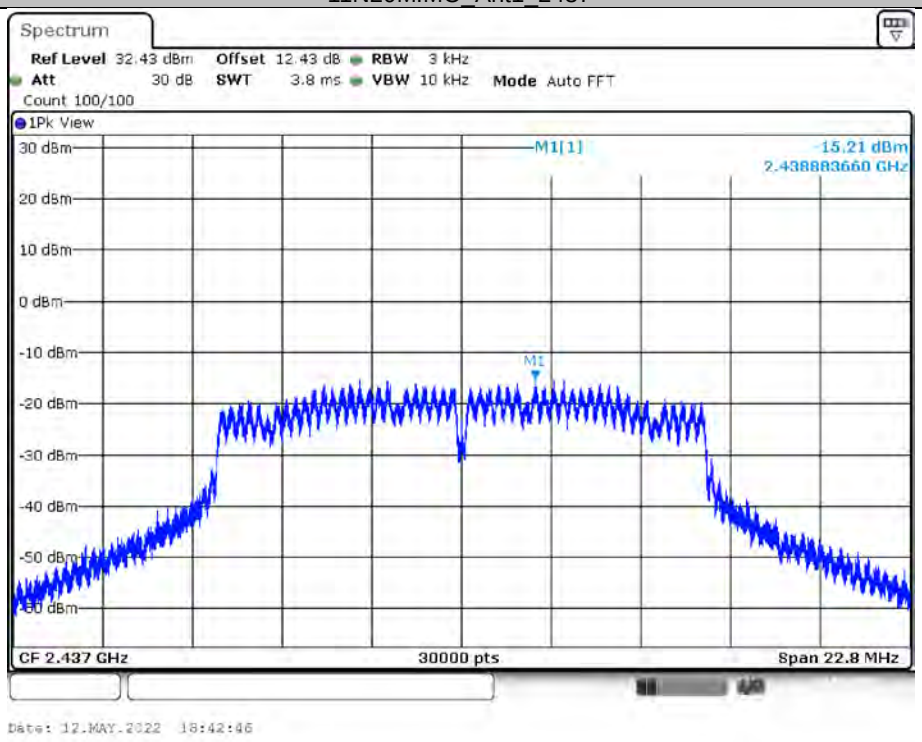
11N20MIMO_Ant1_2412



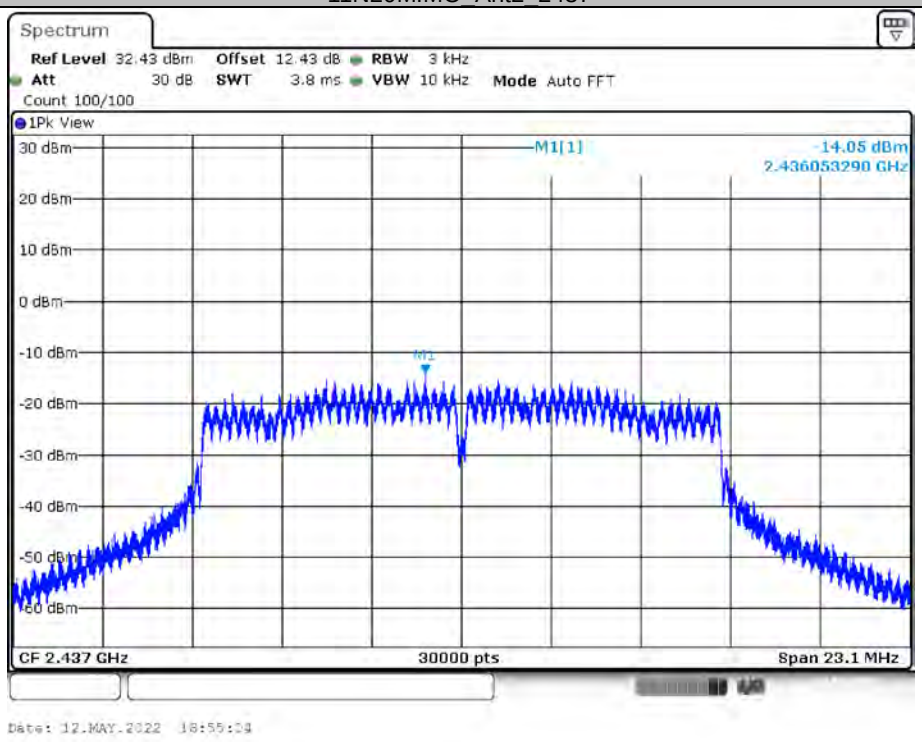
11N20MIMO_Ant2_2412



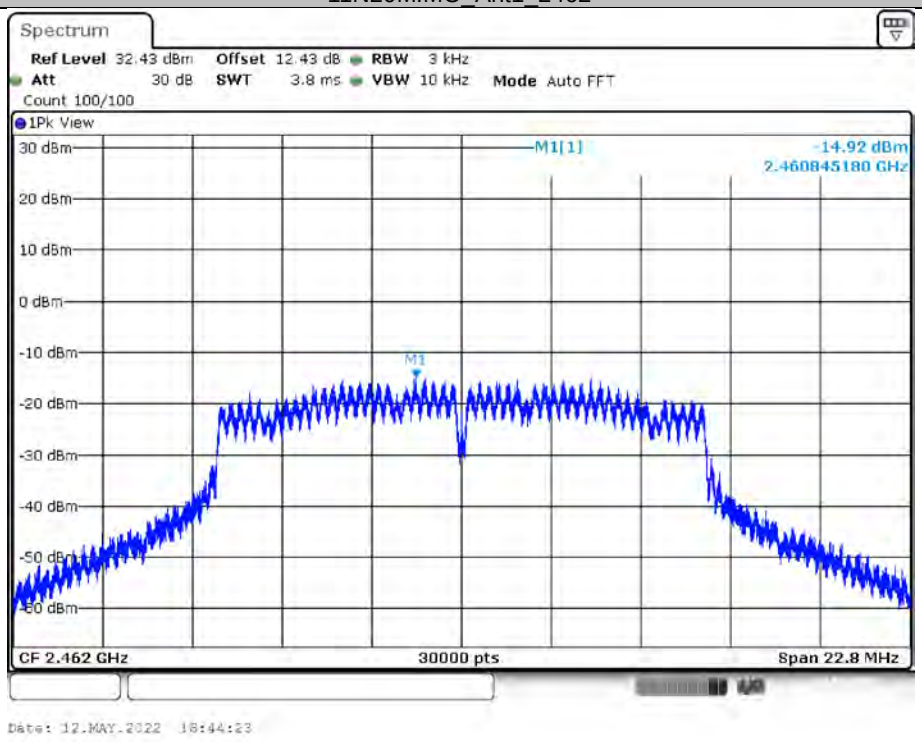
11N20MIMO_Ant1_2437



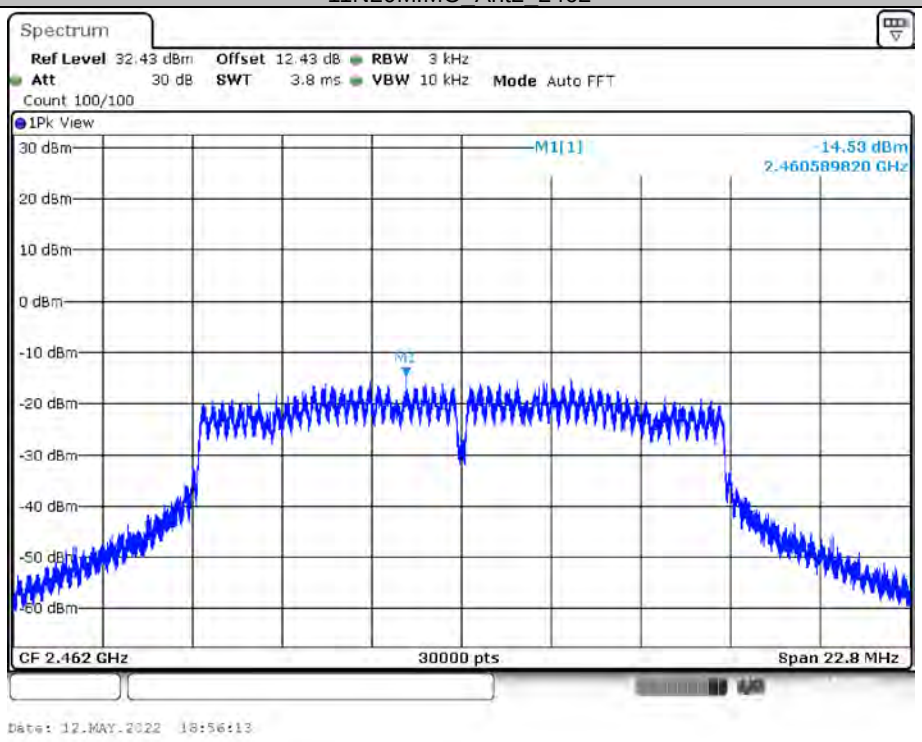
11N20MIMO_Ant2_2437



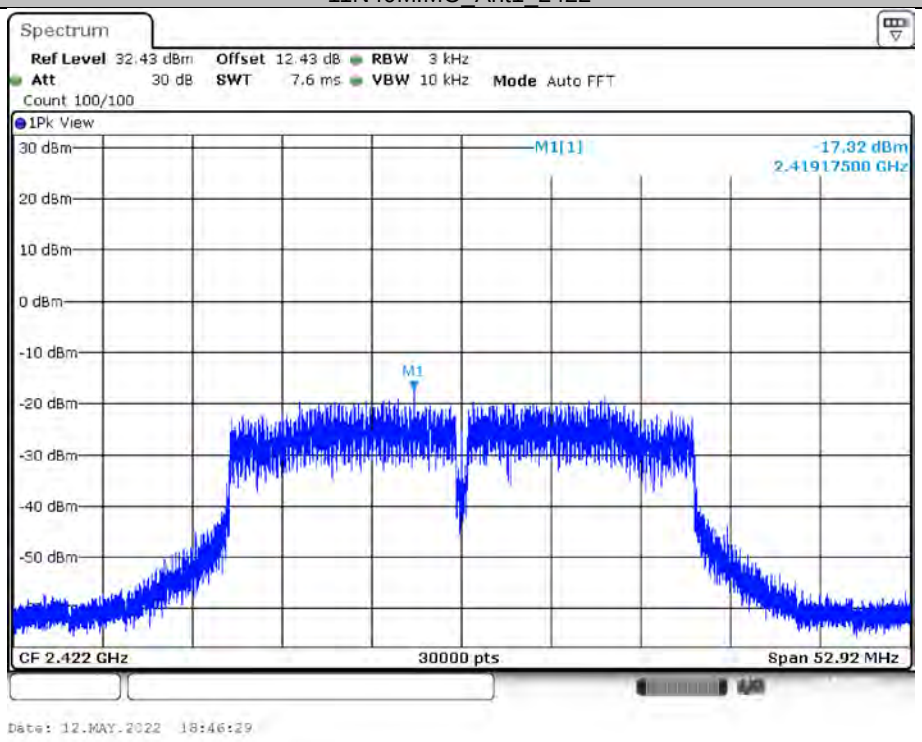
11N20MIMO_Ant1_2462



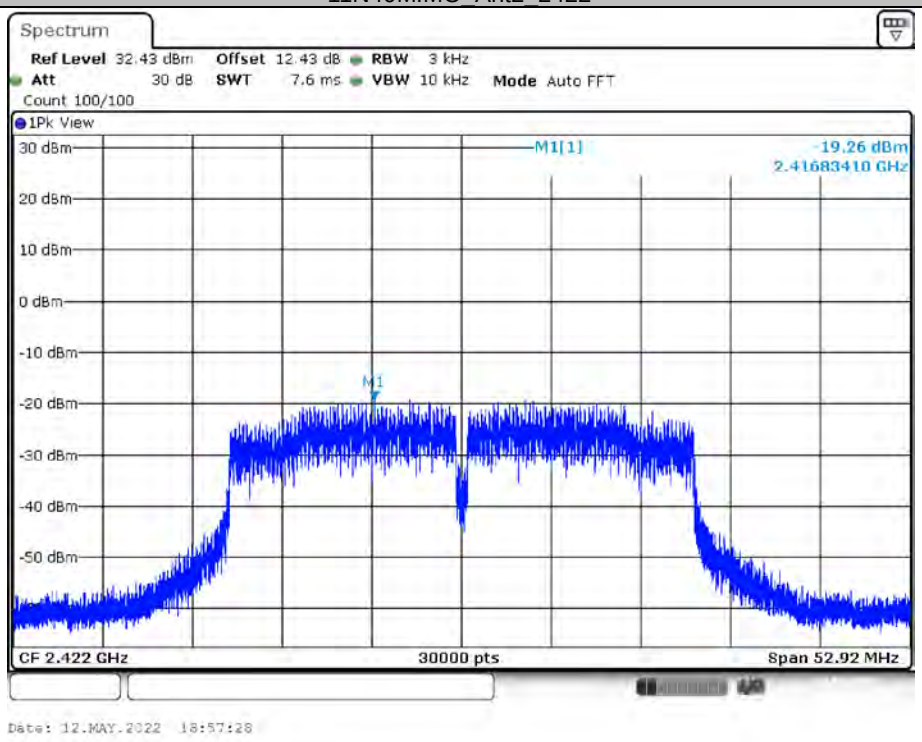
11N20MIMO_Ant2_2462



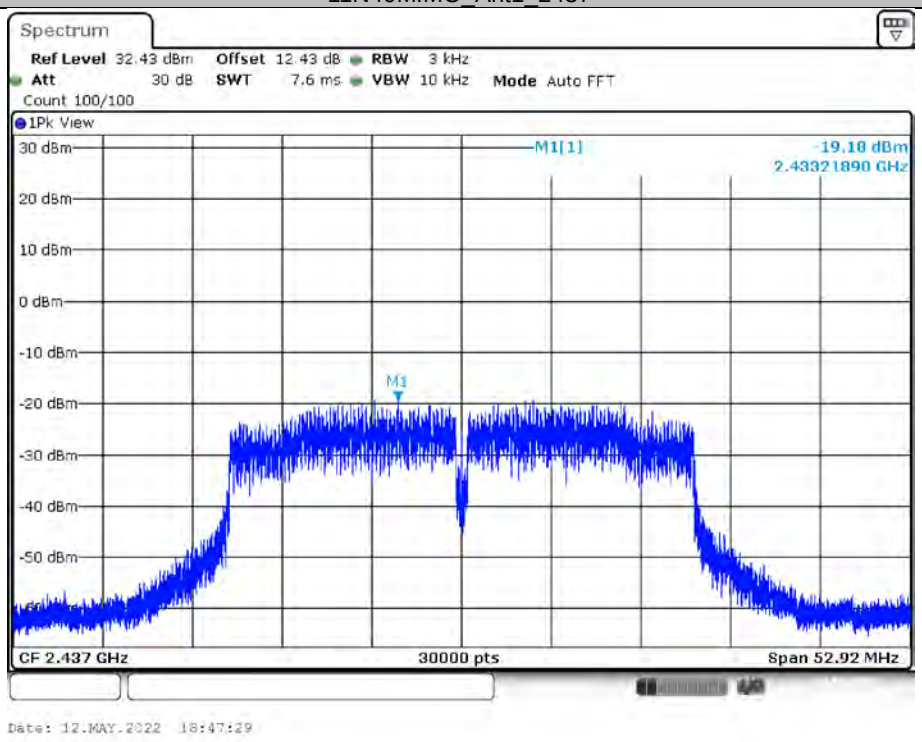
11N40MIMO_Ant1_2422



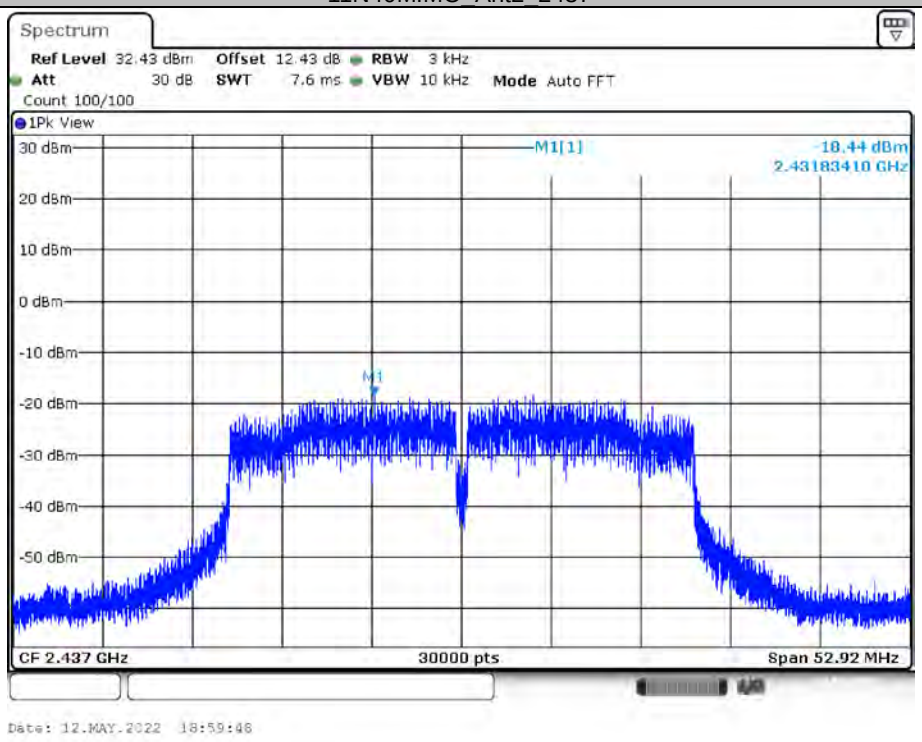
11N40MIMO_Ant2_2422



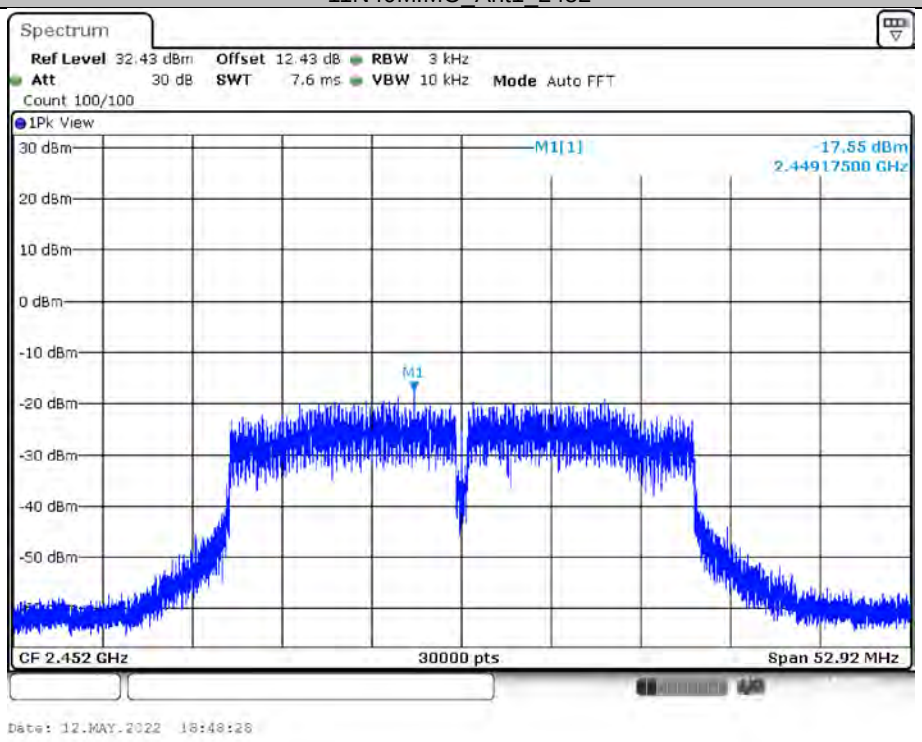
11N40MIMO_Ant1_2437



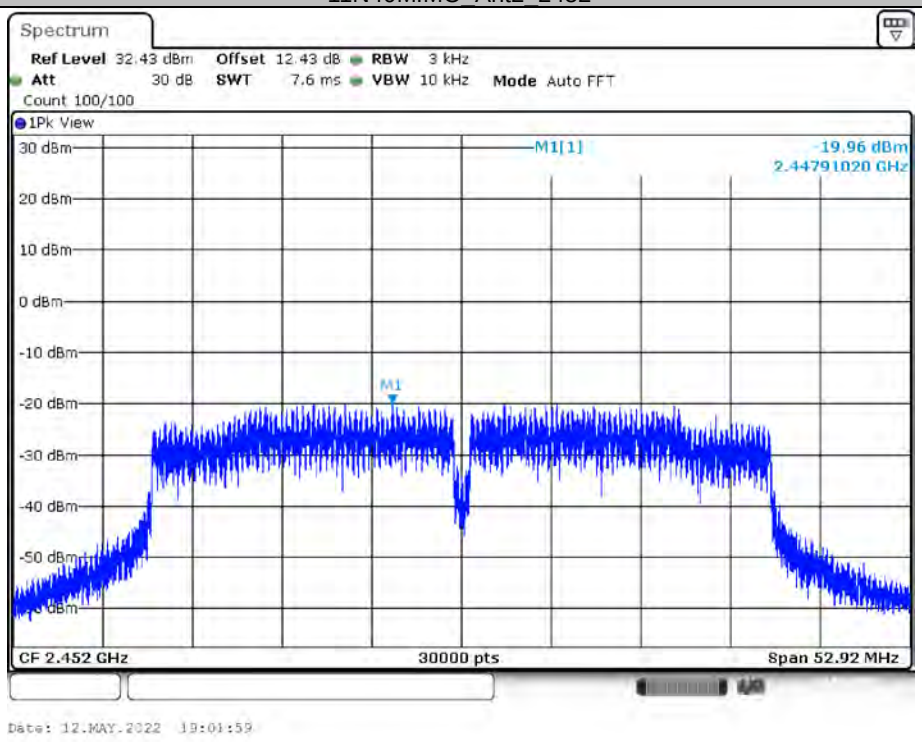
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



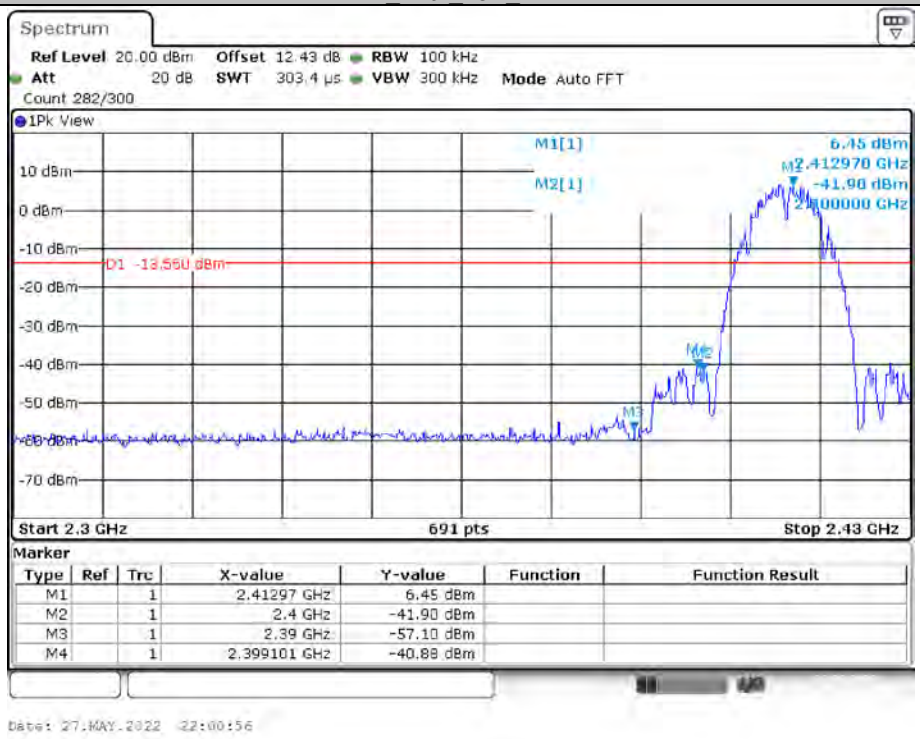
11N40MIMO_Ant2_2452



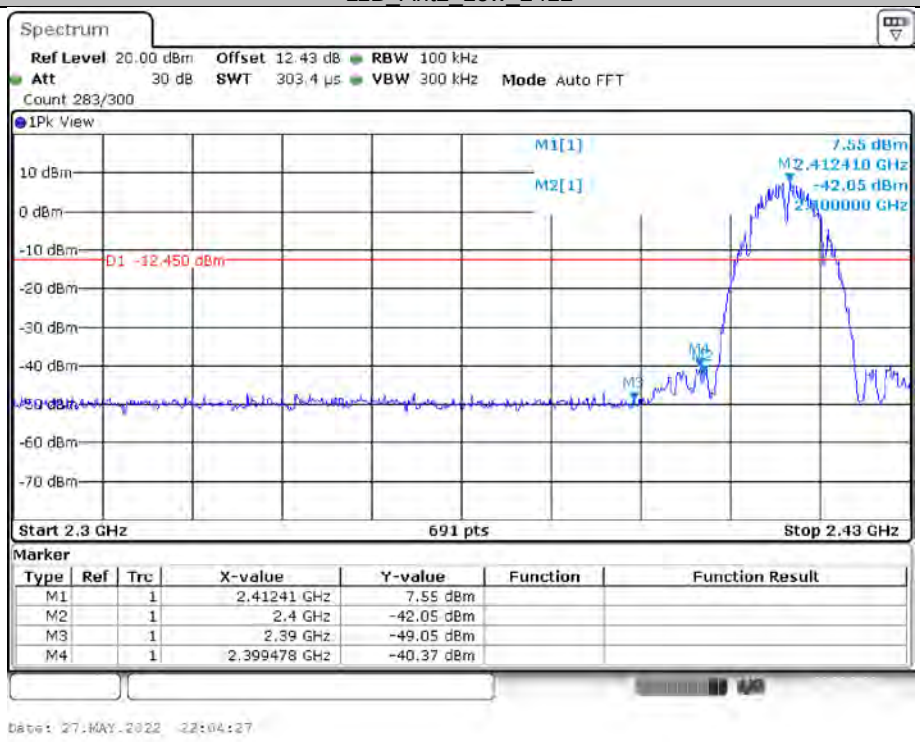
Appendix E: Band edge measurements

Test Graphs

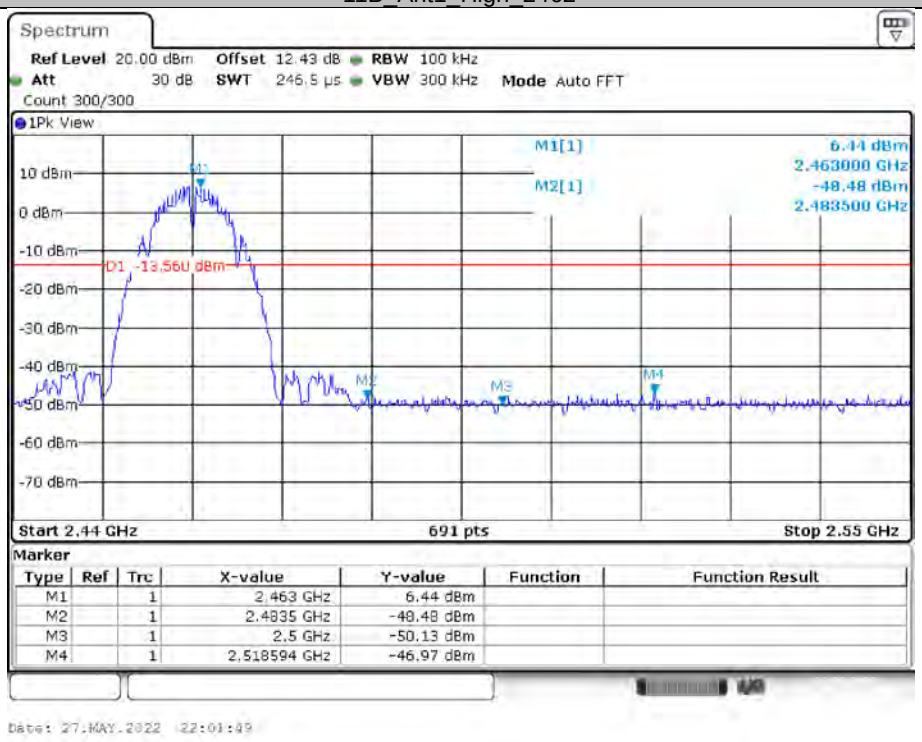
11B_Ant1_Low_2412



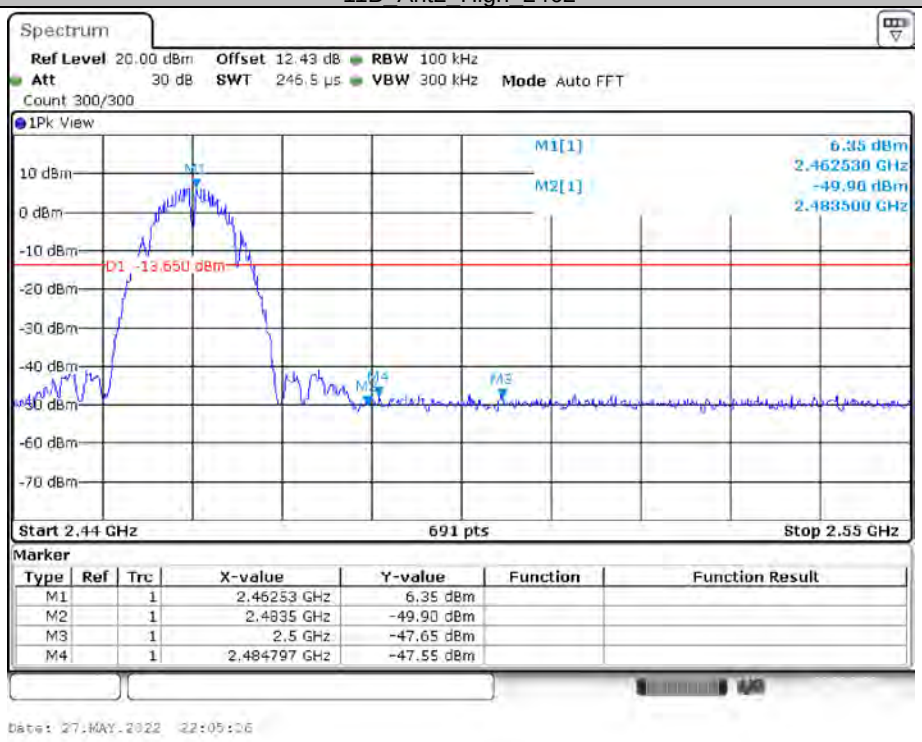
11B_Ant2_Low_2412



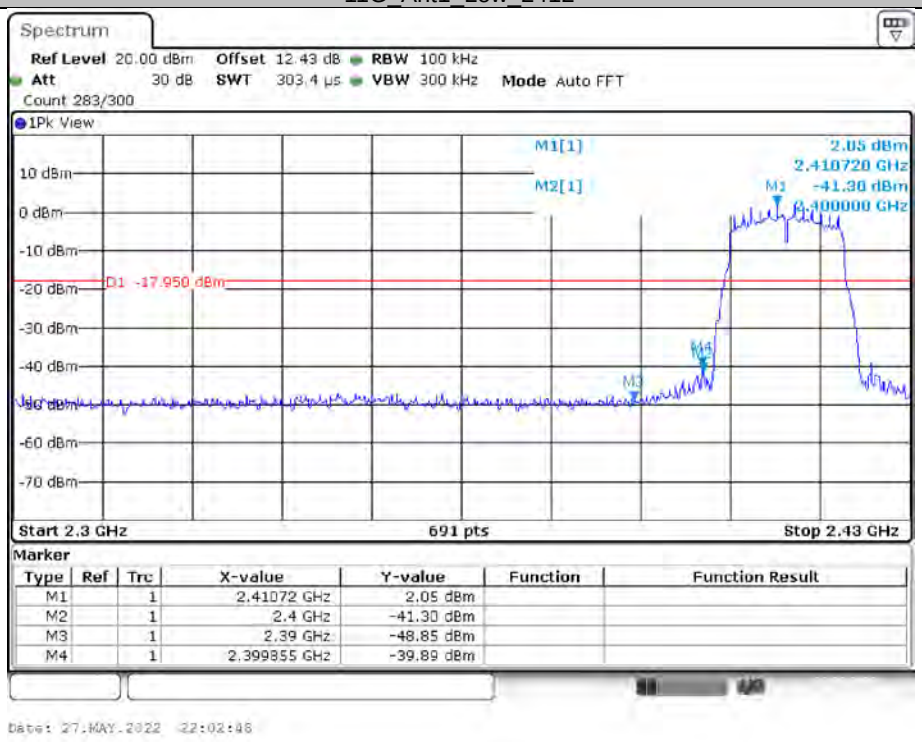
11B_Ant1_High_2462



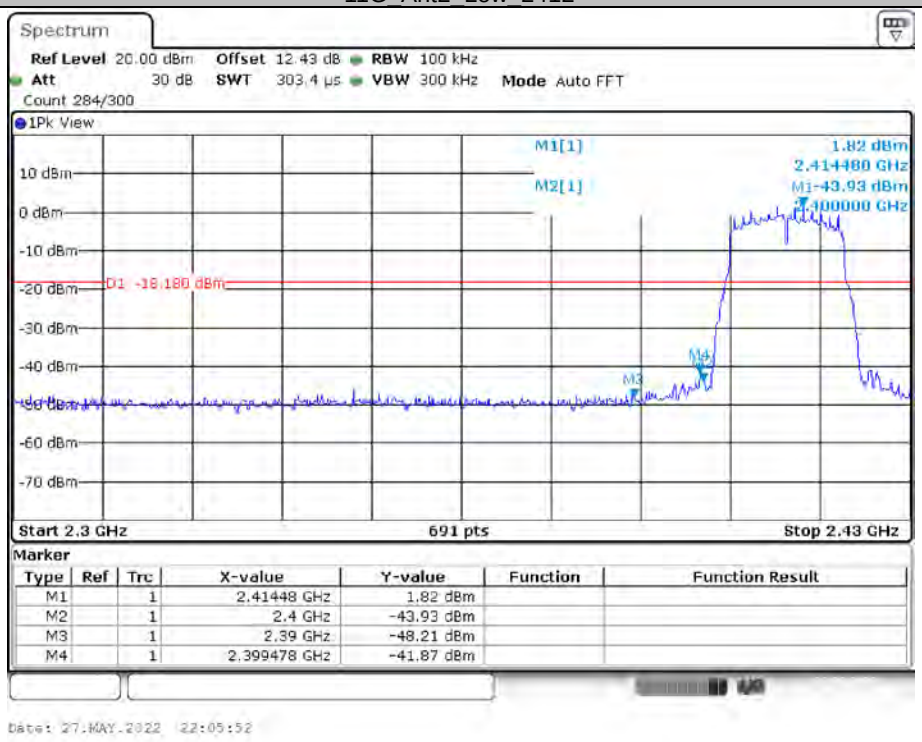
11B_Ant2_High_2462



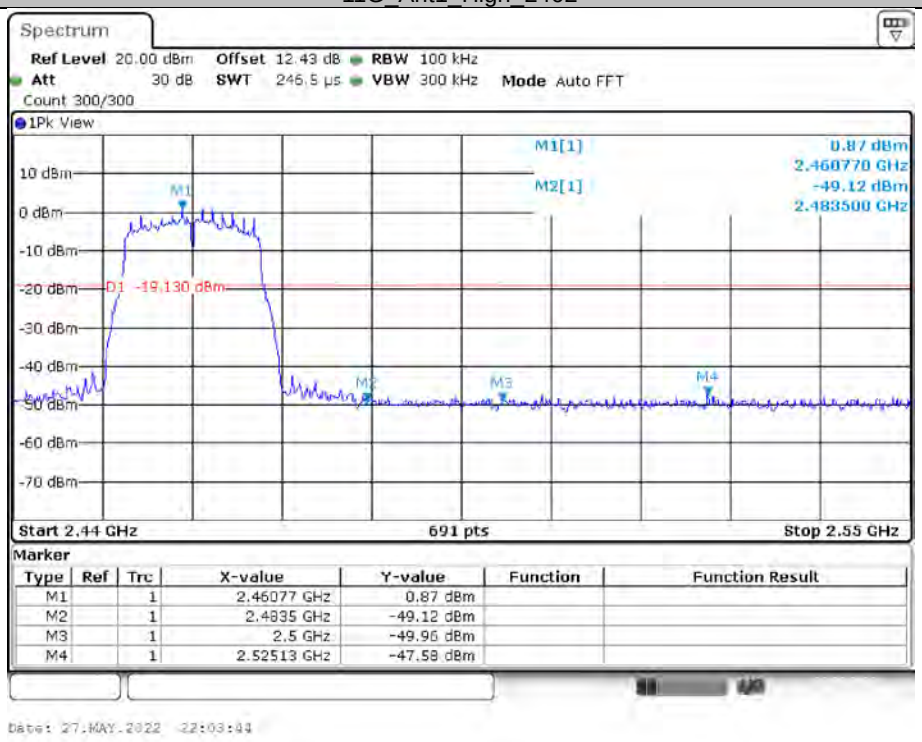
11G_Ant1_Low_2412



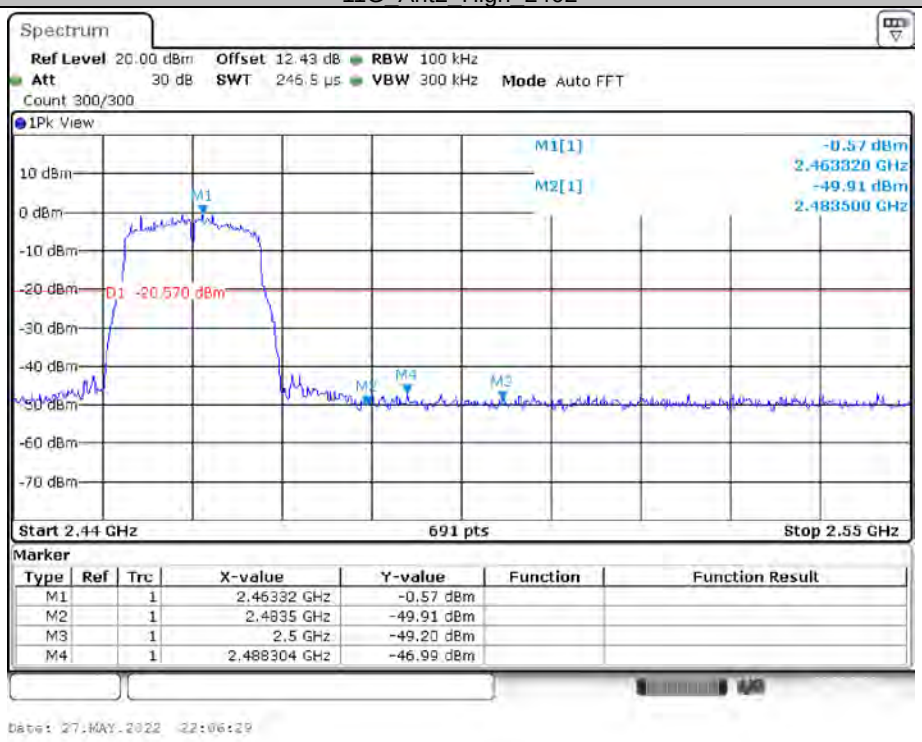
11G_Ant2_Low_2412



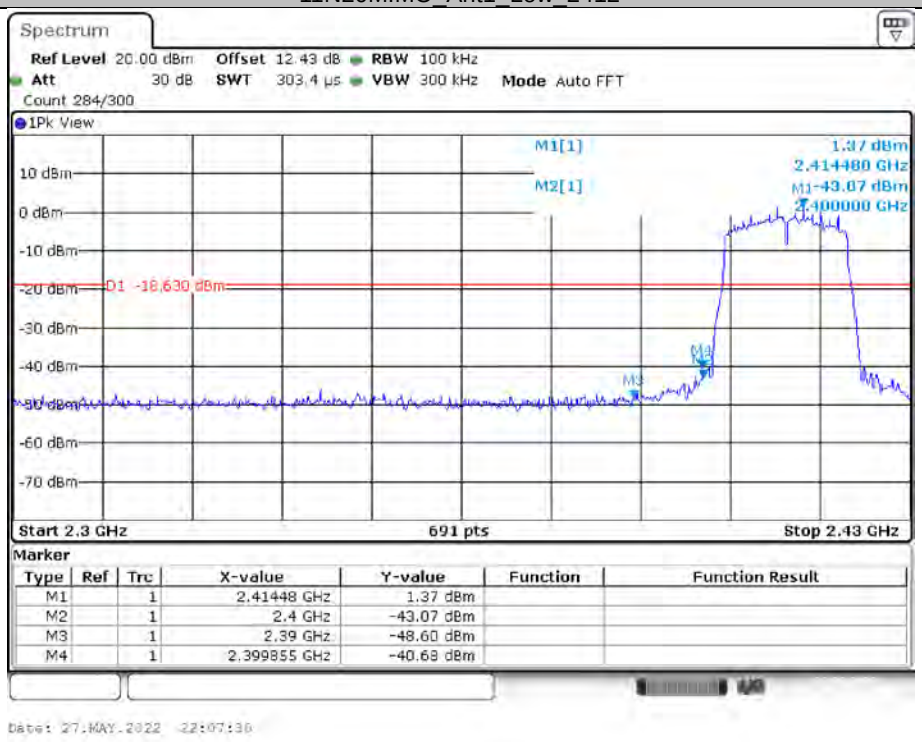
11G_Ant1_High_2462



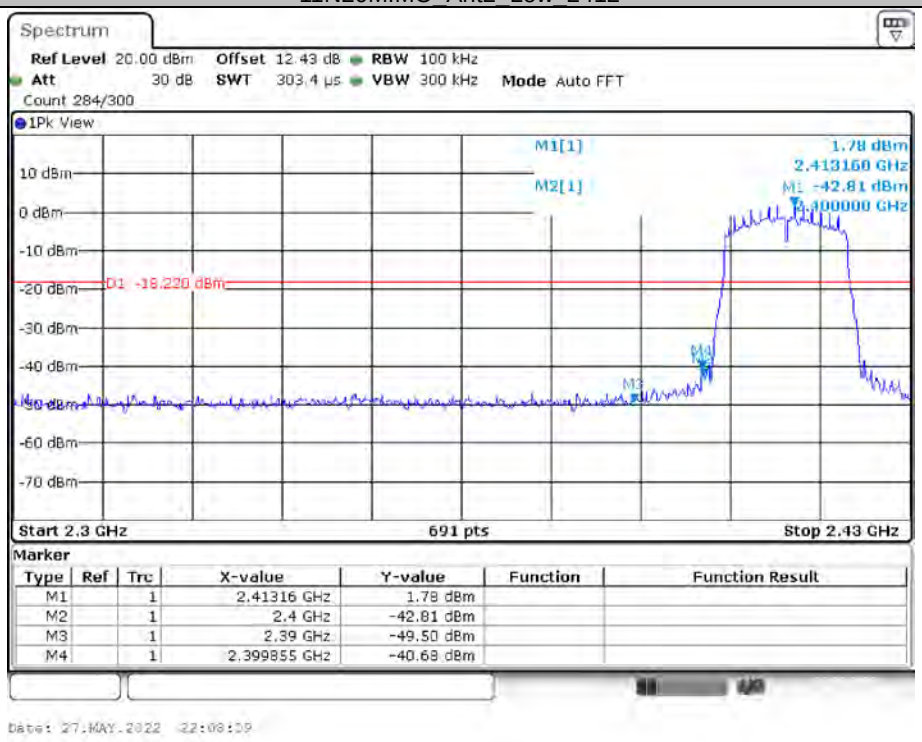
11G_Ant2_High_2462



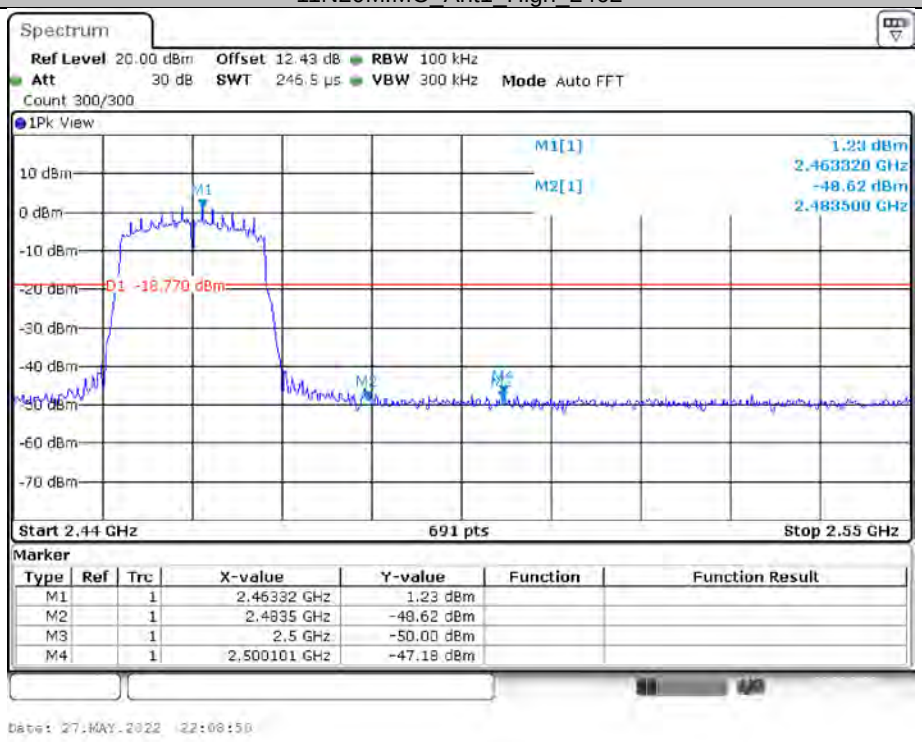
11N20MIMO_Ant1_Low_2412



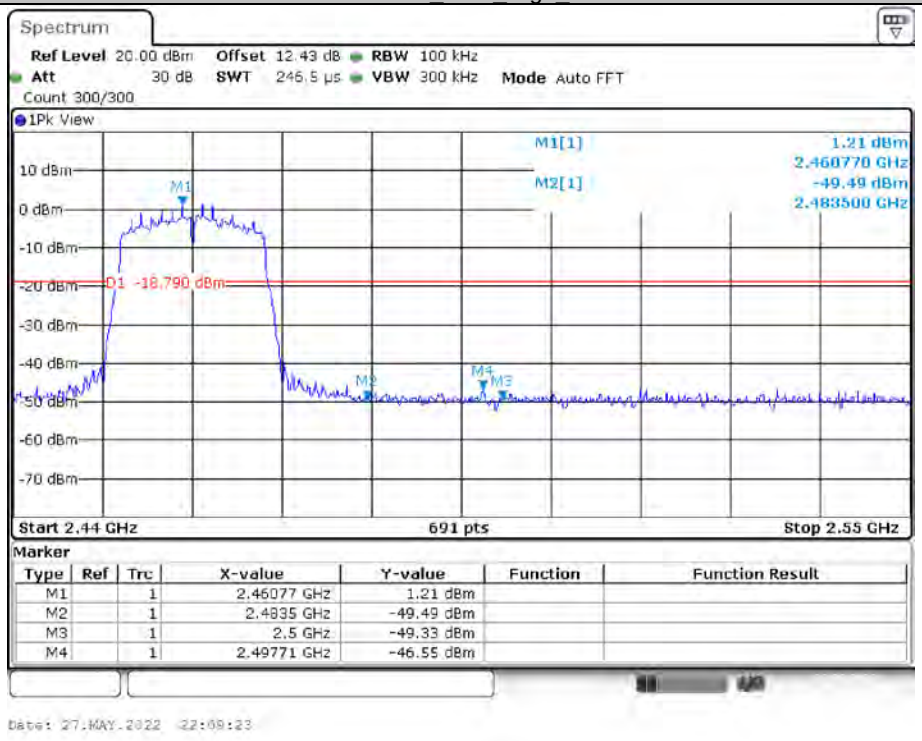
11N20MIMO_Ant2_Low_2412



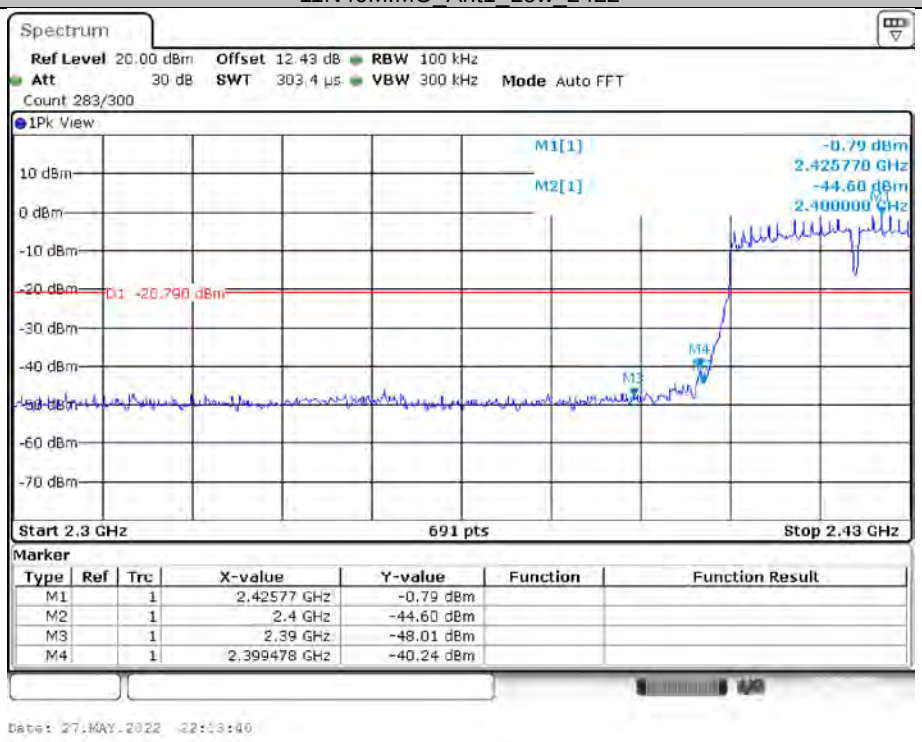
11N20MIMO_Ant1_High_2462



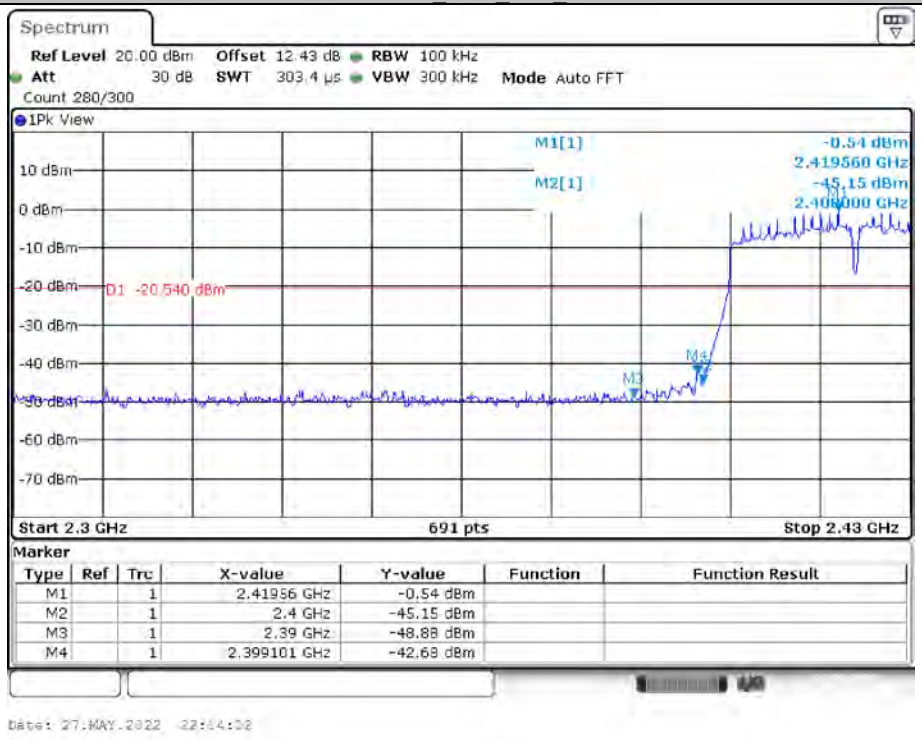
11N20MIMO_Ant2_High_2462



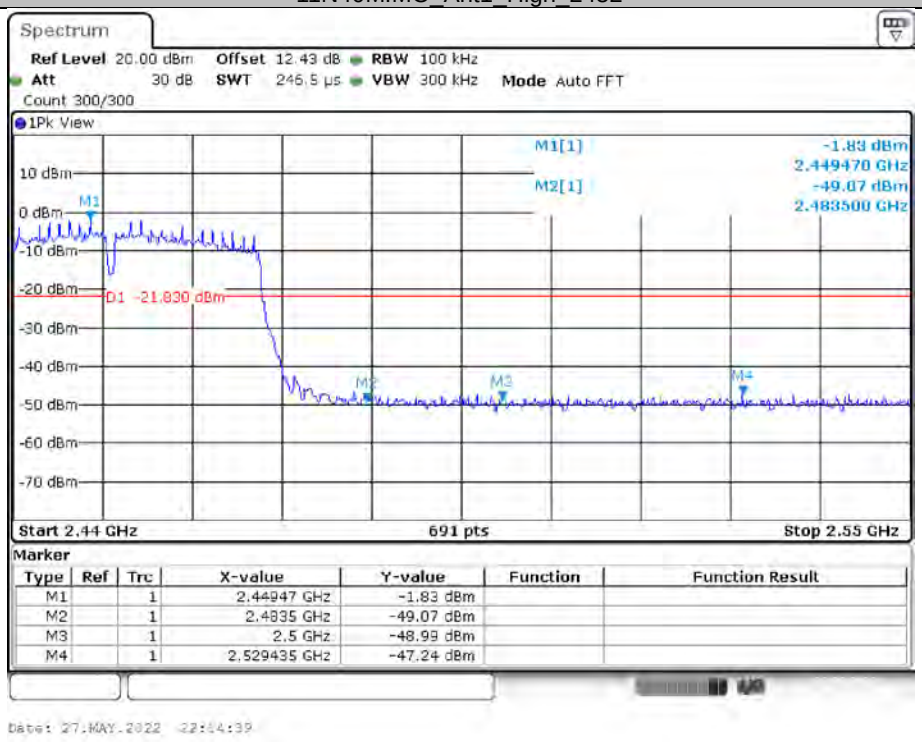
11N40MIMO_Ant1_Low_2422



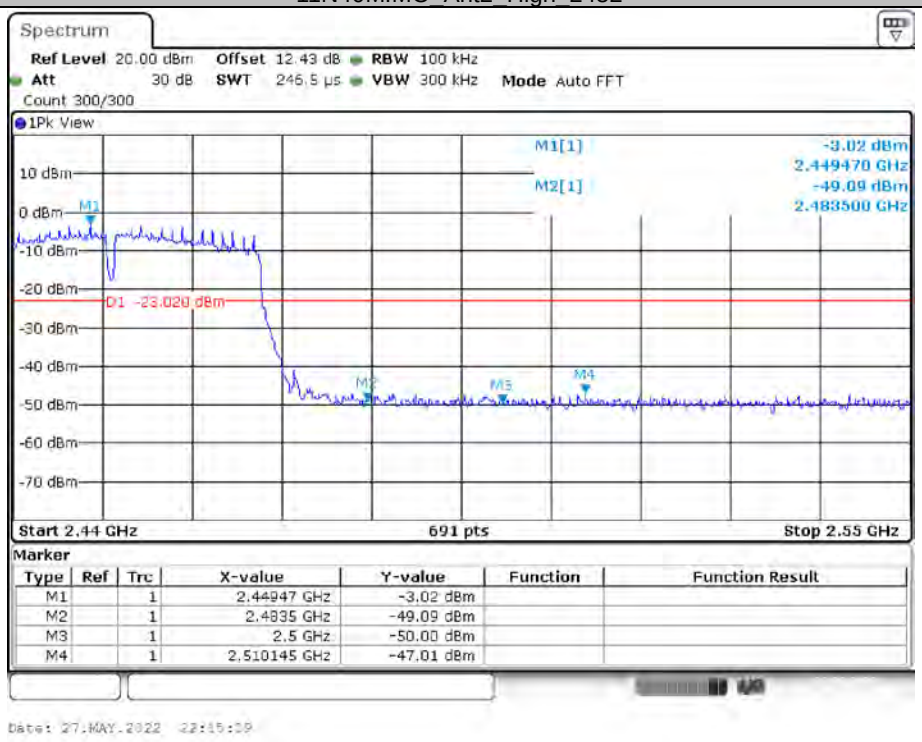
11N40MIMO_Ant2_Low_2422



11N40MIMO_Ant1_High_2452



11N40MIMO_Ant2_High_2452



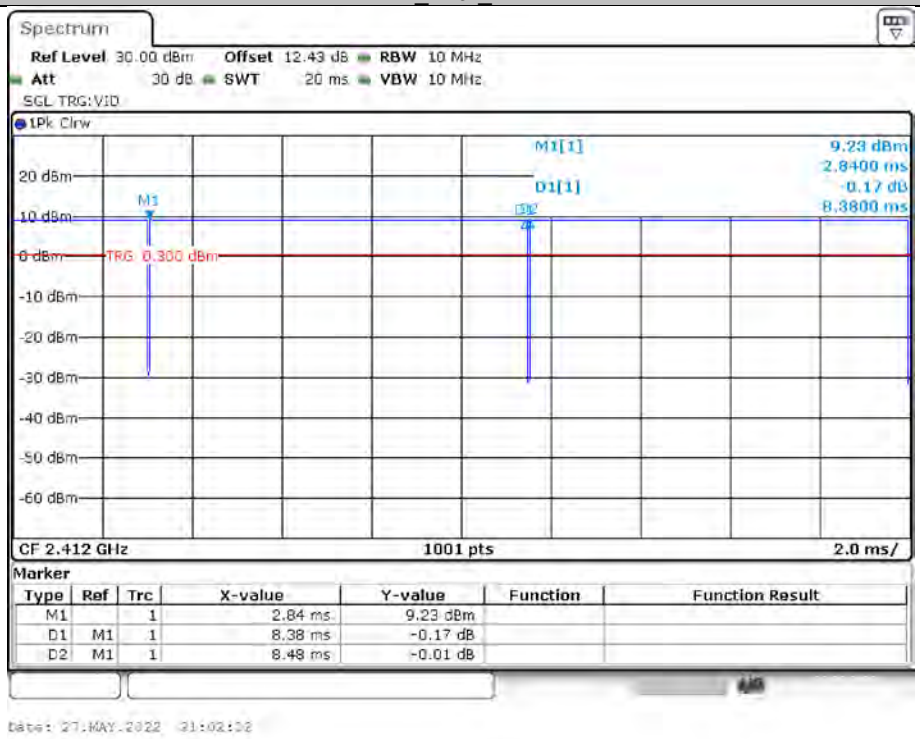
Appendix F: Duty Cycle

Test Result

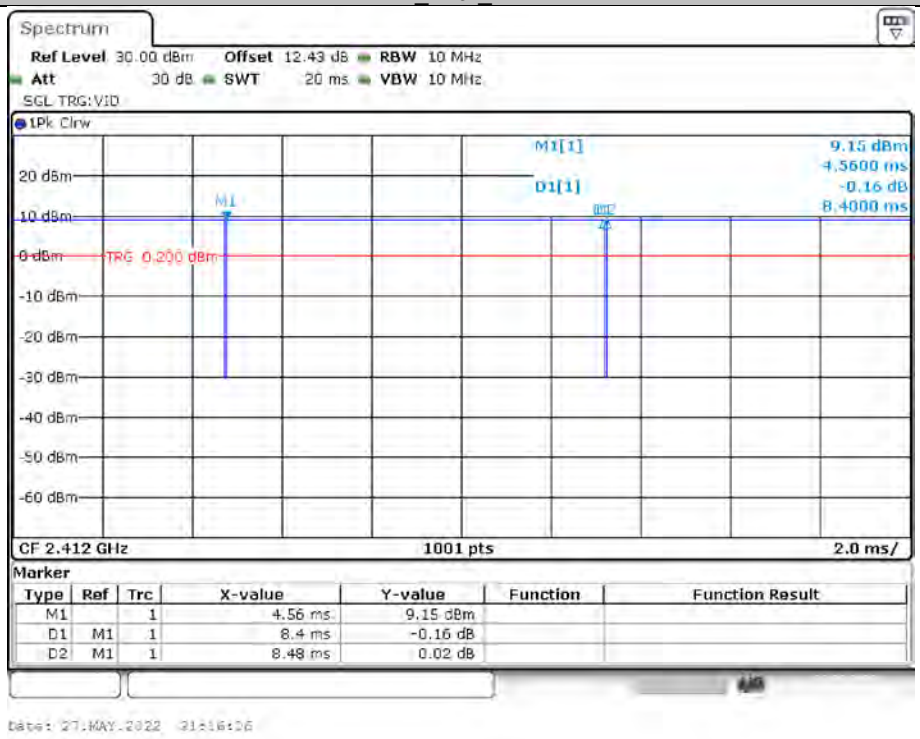
TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2412	8.38	8.48	98.82
	Ant2	2412	8.40	8.48	99.06
	Ant1	2437	8.38	8.48	98.82
	Ant2	2437	8.38	8.48	98.82
	Ant1	2462	8.38	8.48	98.82
	Ant2	2462	8.38	8.48	98.82
11G	Ant1	2412	1.37	1.45	94.48
	Ant2	2412	1.38	1.46	94.52
	Ant1	2437	1.38	1.46	94.52
	Ant2	2437	1.37	1.45	94.48
	Ant1	2462	1.38	1.45	95.17
	Ant2	2462	1.38	1.46	94.52
11N20MIMO	Ant1	2412	1.29	1.37	94.16
	Ant2	2412	1.29	1.37	94.16
	Ant1	2437	1.29	1.36	94.85
	Ant2	2437	1.29	1.37	94.16
	Ant1	2462	1.28	1.36	94.12
	Ant2	2462	1.29	1.37	94.16
11N40MIMO	Ant1	2422	0.62	0.70	88.57
	Ant2	2422	0.63	0.71	88.73
	Ant1	2437	0.63	0.71	88.73
	Ant2	2437	0.62	0.70	88.57
	Ant1	2452	0.62	0.70	88.57
	Ant2	2452	0.63	0.71	88.73

Test Graphs

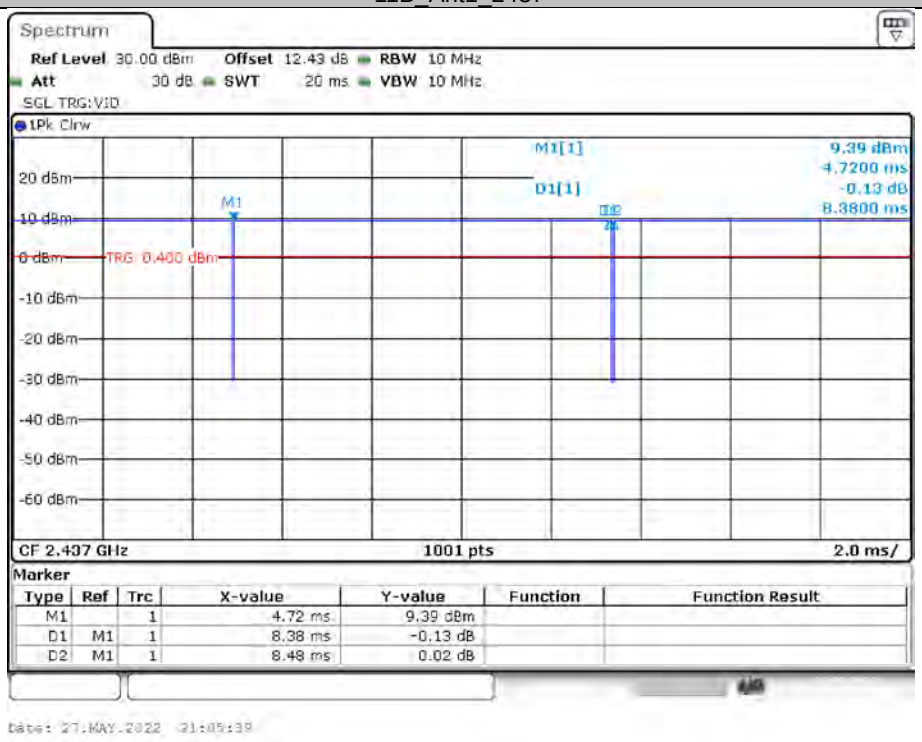
11B_Ant1_2412



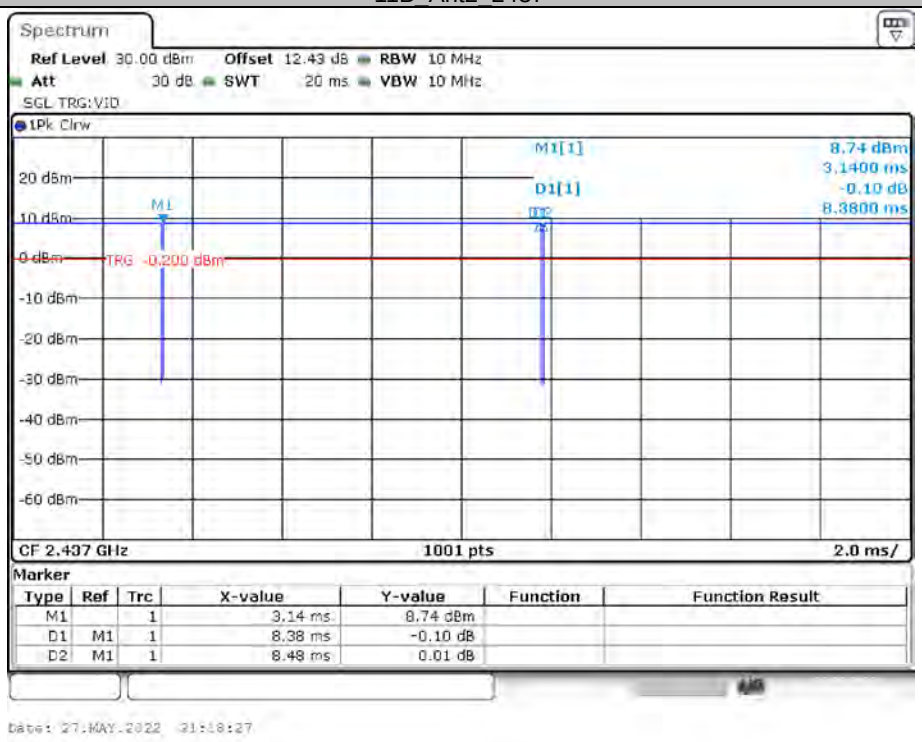
11B_Ant2_2412



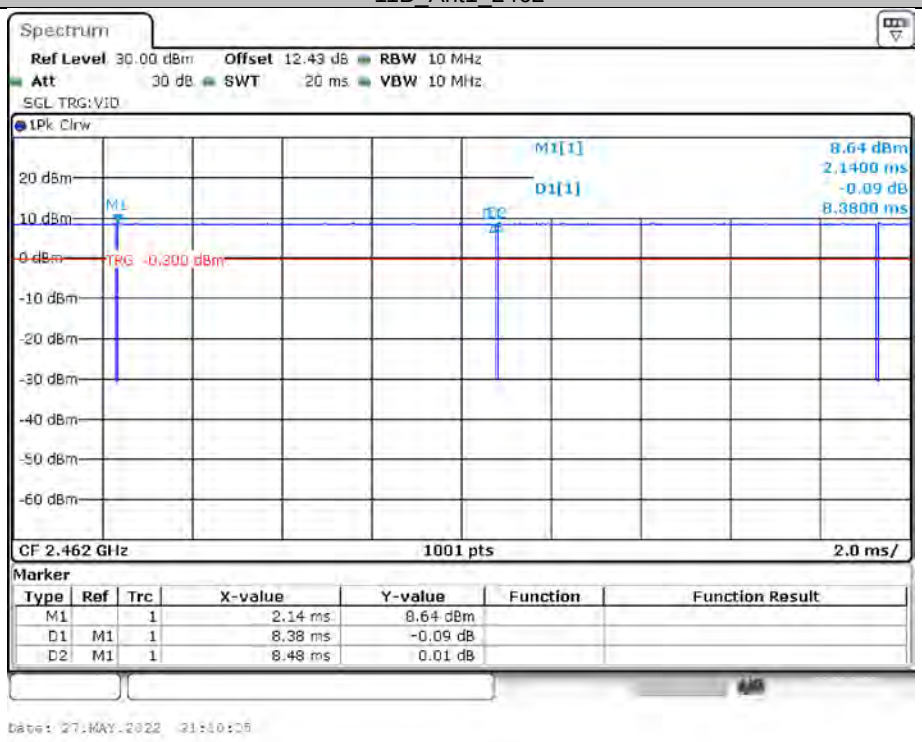
11B_Ant1_2437



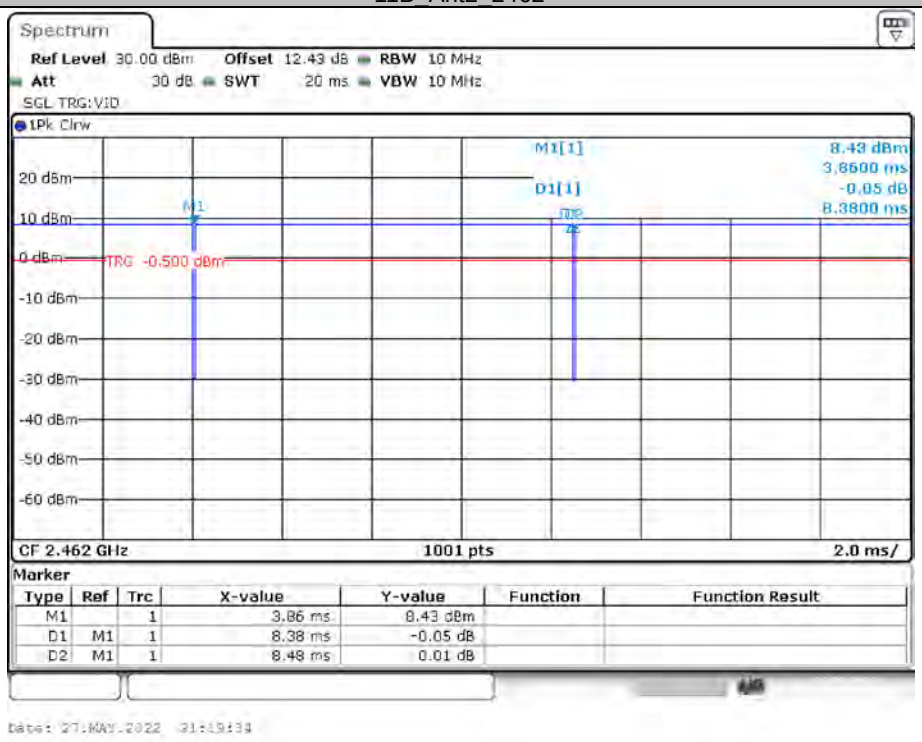
11B_Ant2_2437



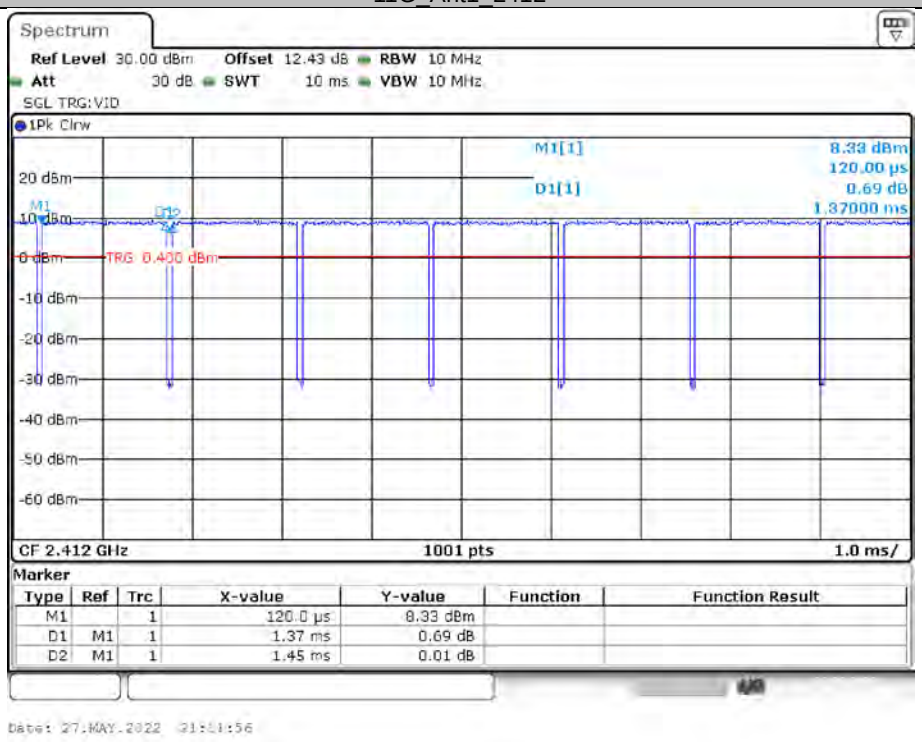
11B_Ant1_2462



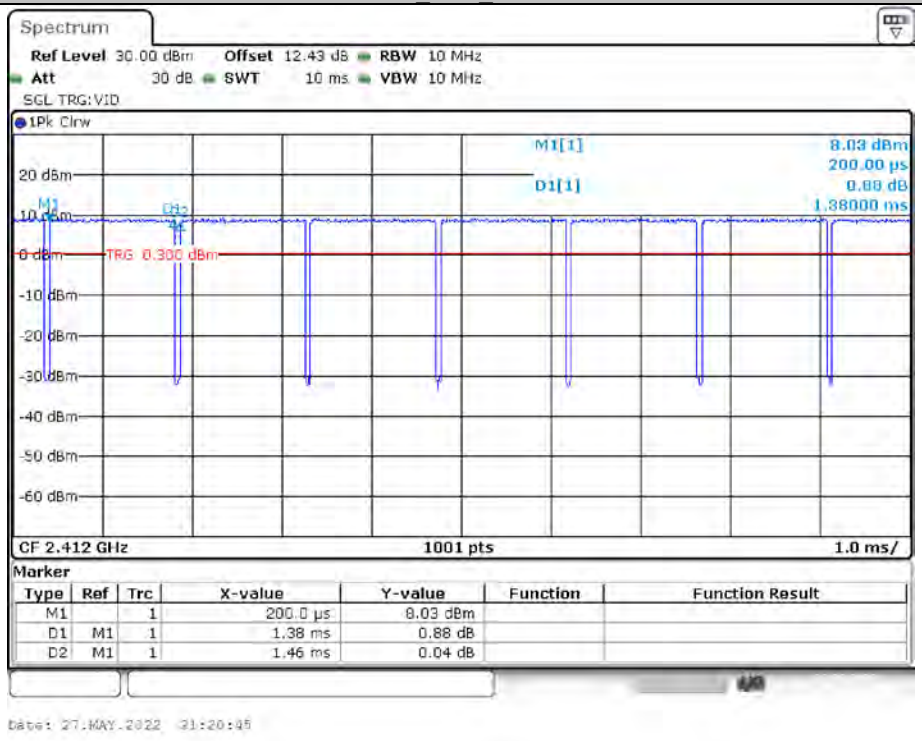
11B_Ant2_2462



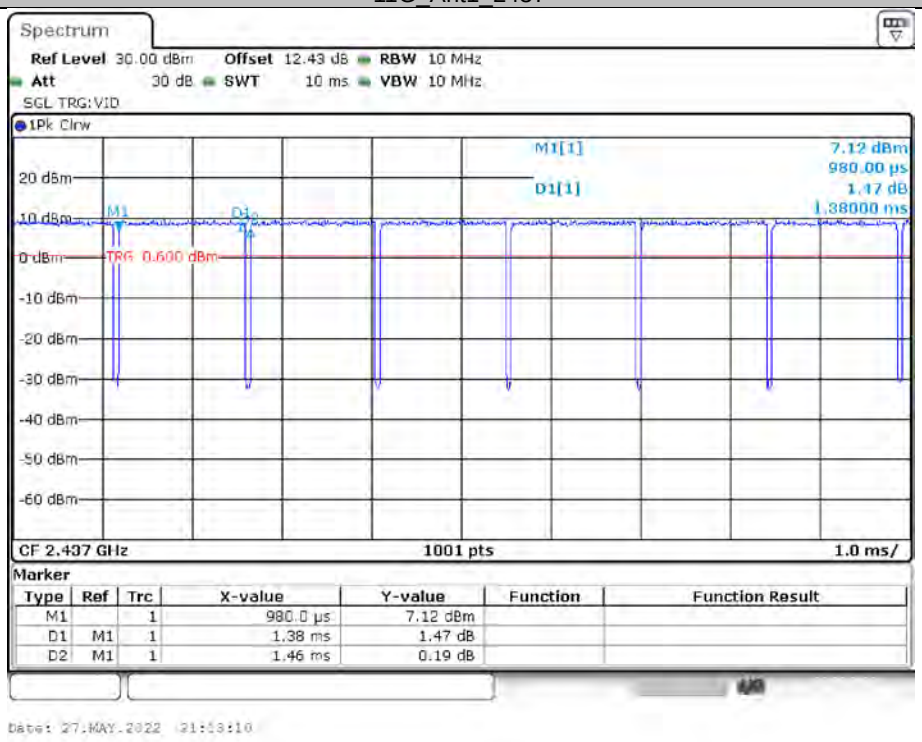
11G_Ant1_2412



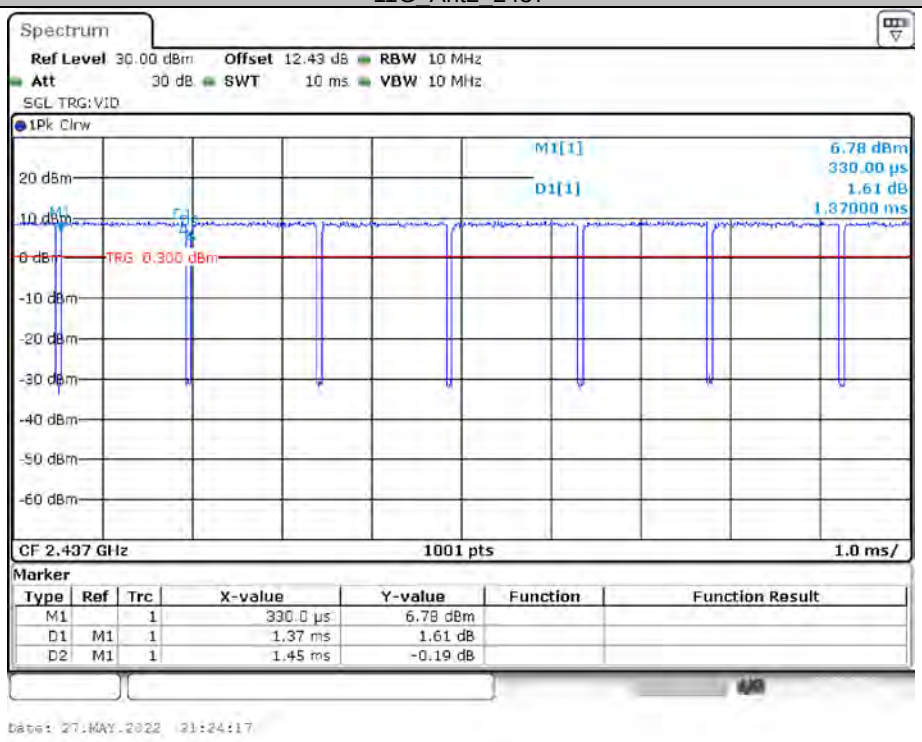
11G_Ant2_2412



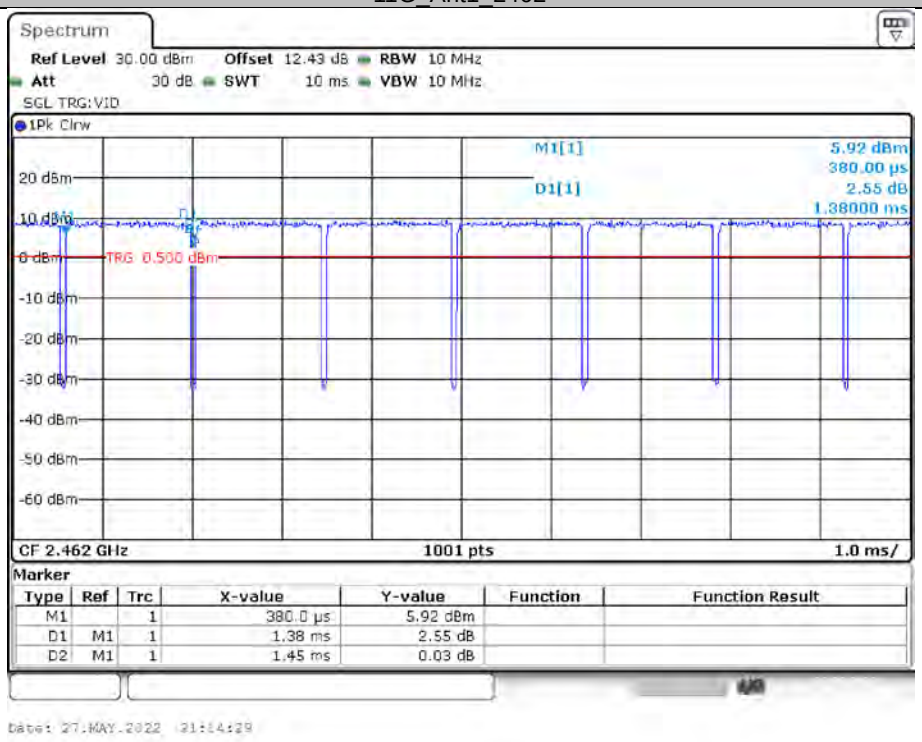
11G_Ant1_2437



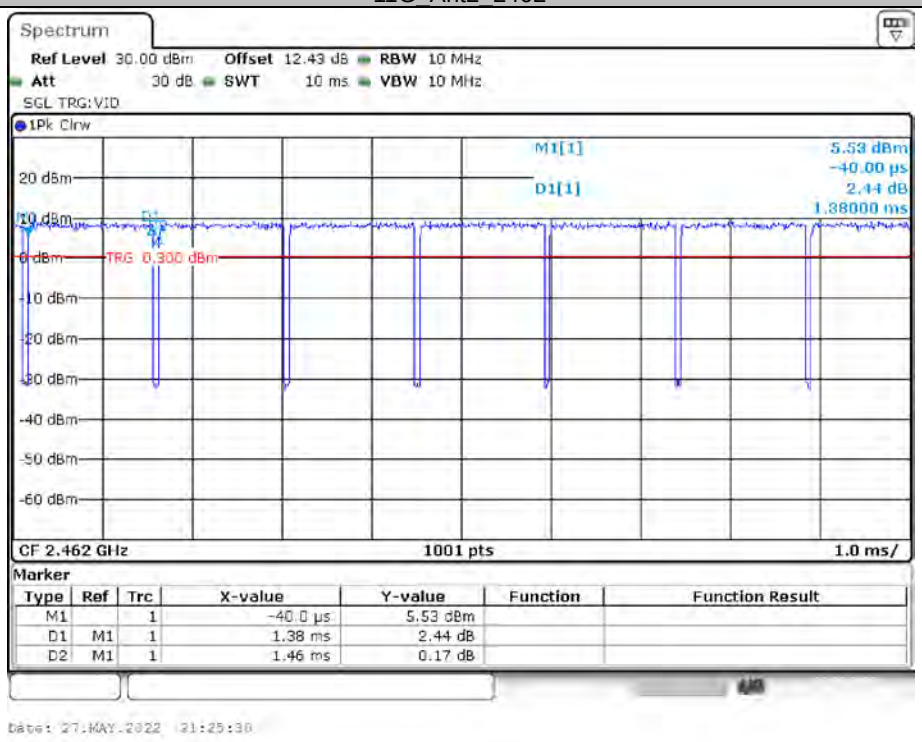
11G_Ant2_2437



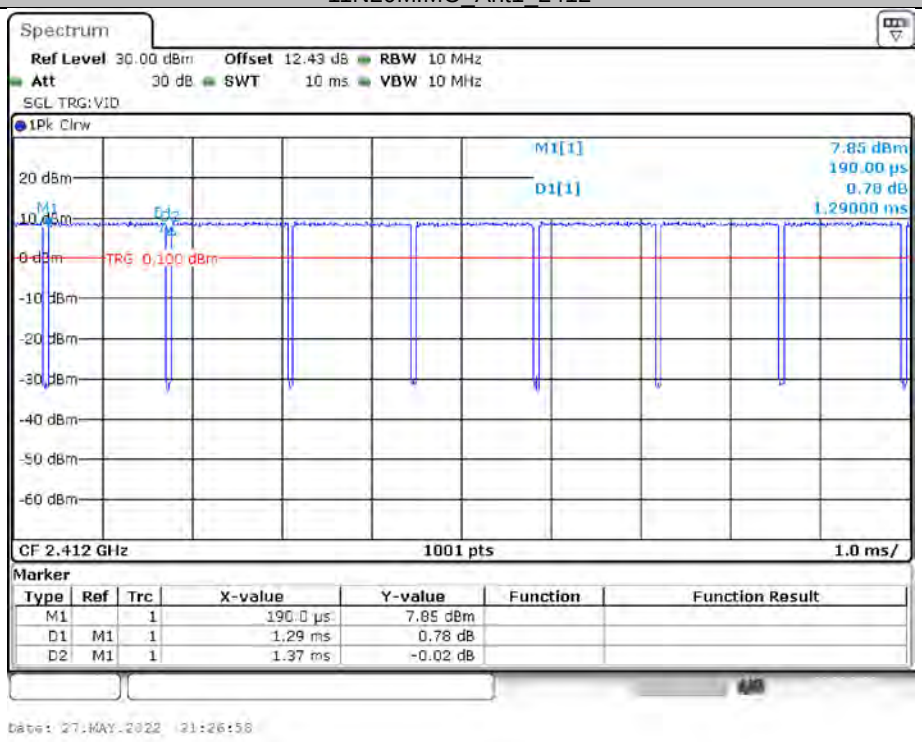
11G_Ant1_2462



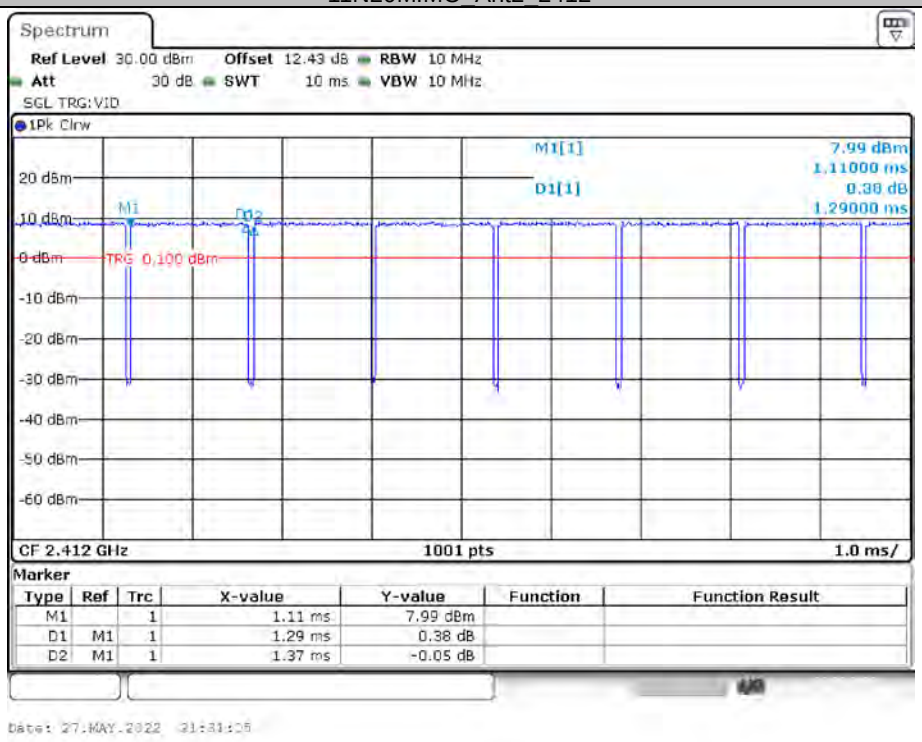
11G_Ant2_2462



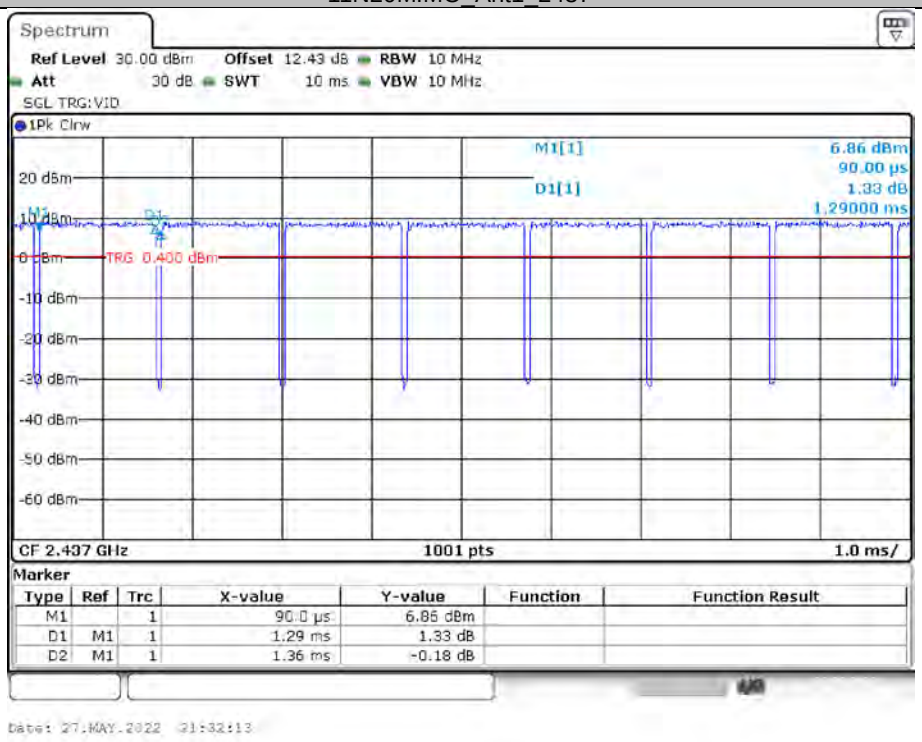
11N20MIMO_Ant1_2412



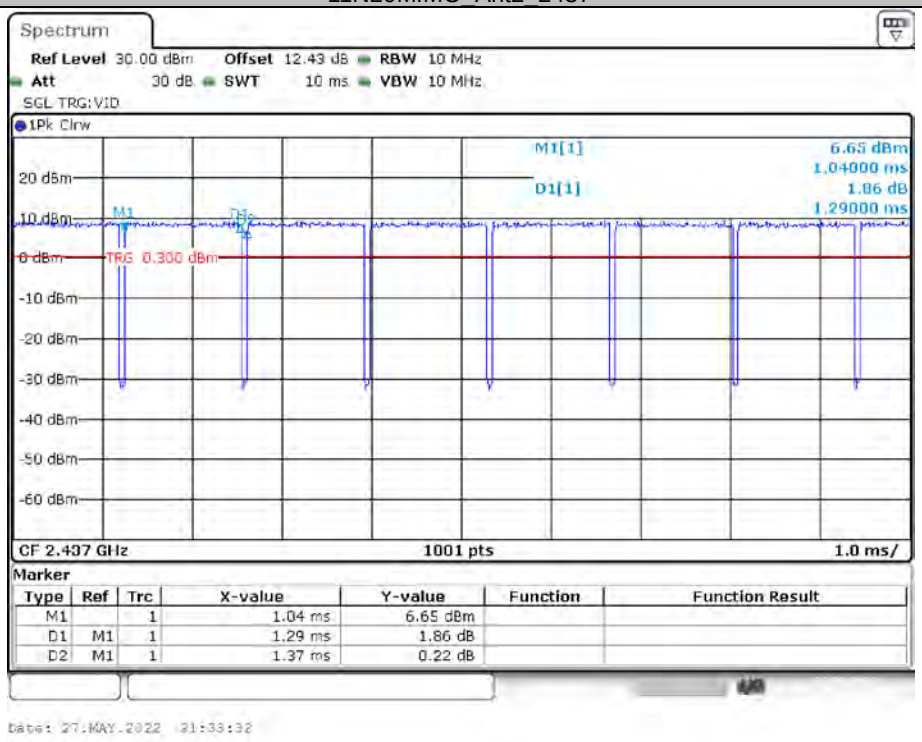
11N20MIMO_Ant2_2412



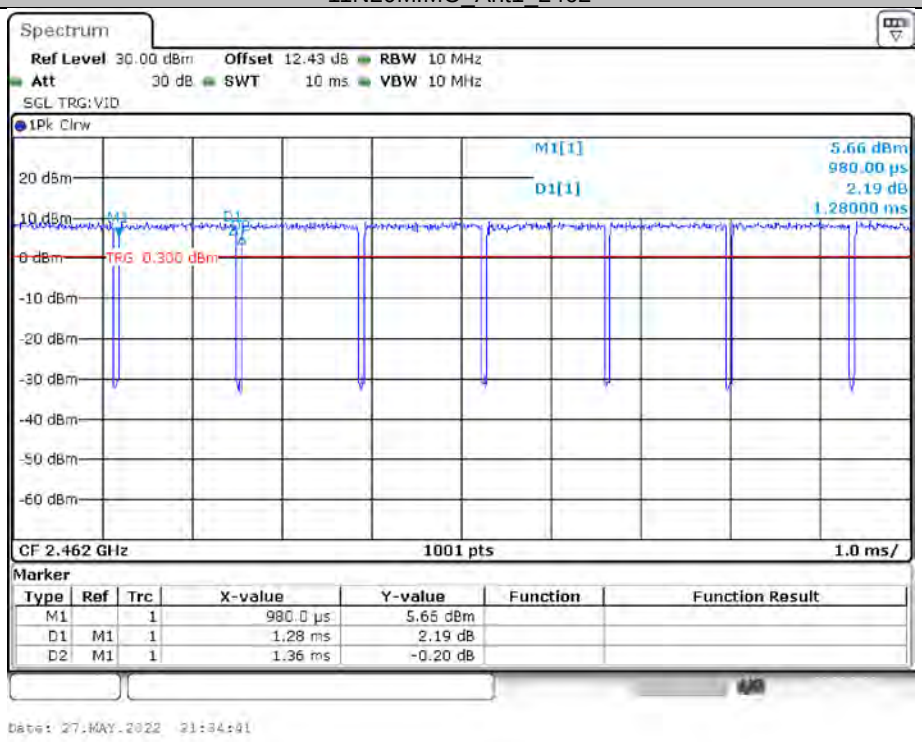
11N20MIMO_Ant1_2437



11N20MIMO_Ant2_2437

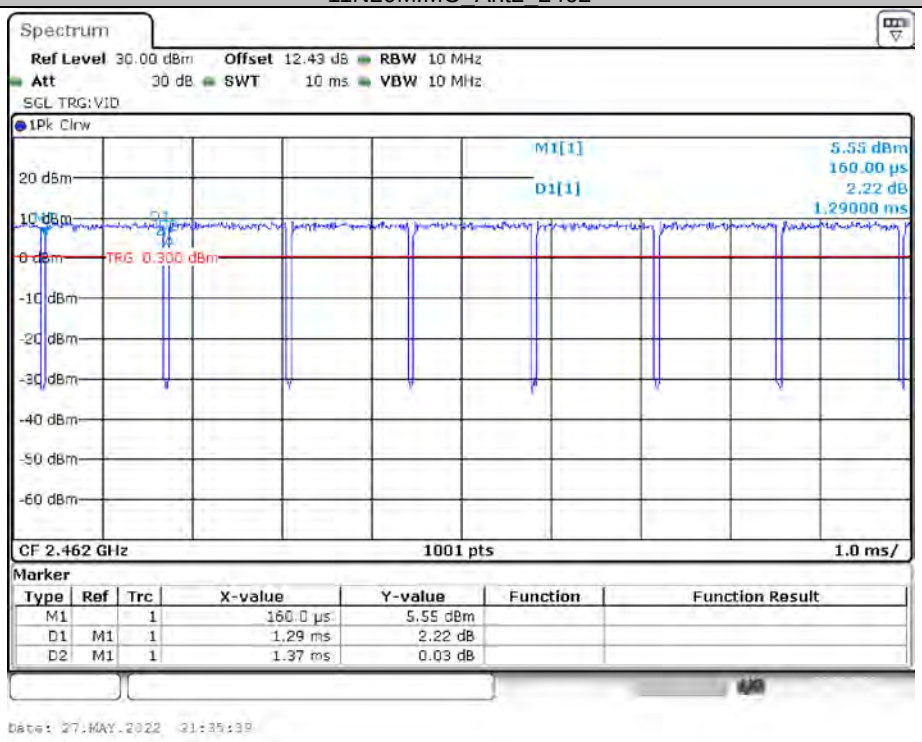


11N20MIMO_Ant1_2462



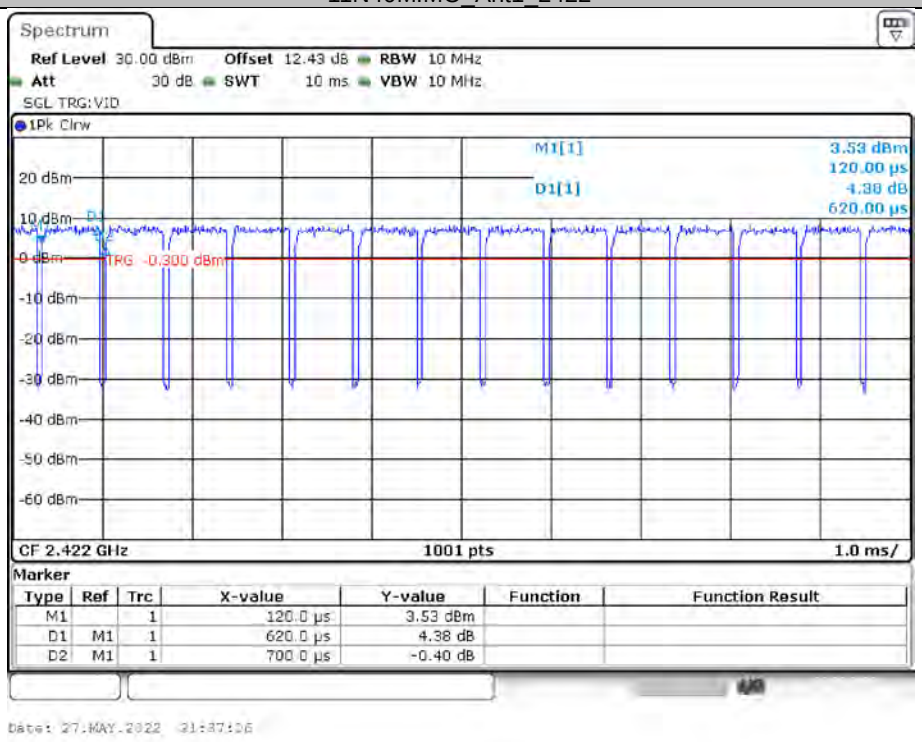
Date: 27.MAY.2022 21:34:01

11N20MIMO_Ant2_2462

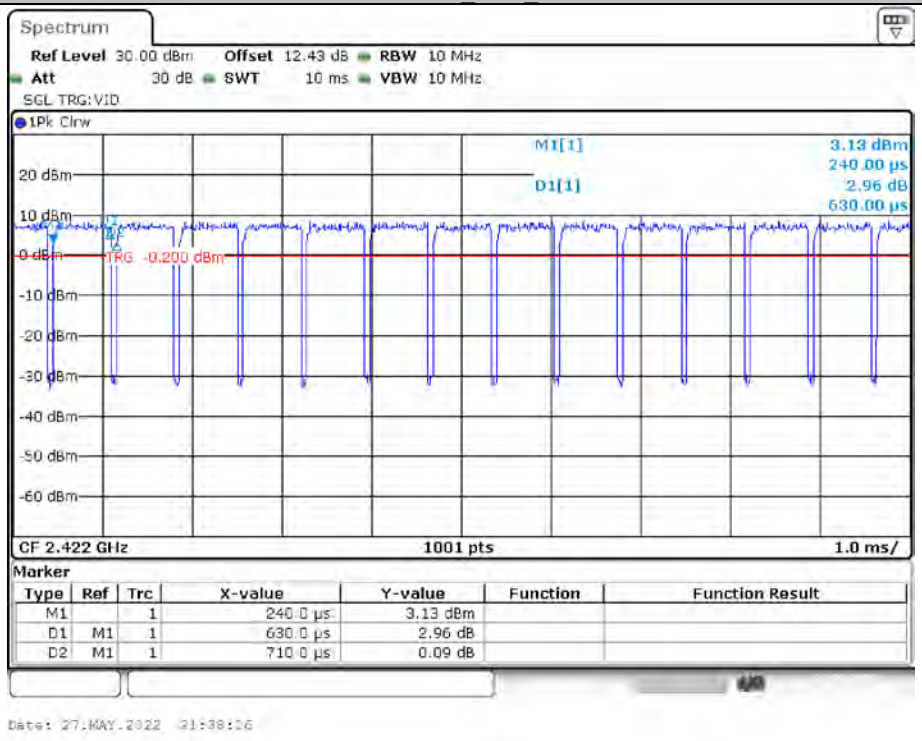


Date: 27.MAY.2022 21:35:39

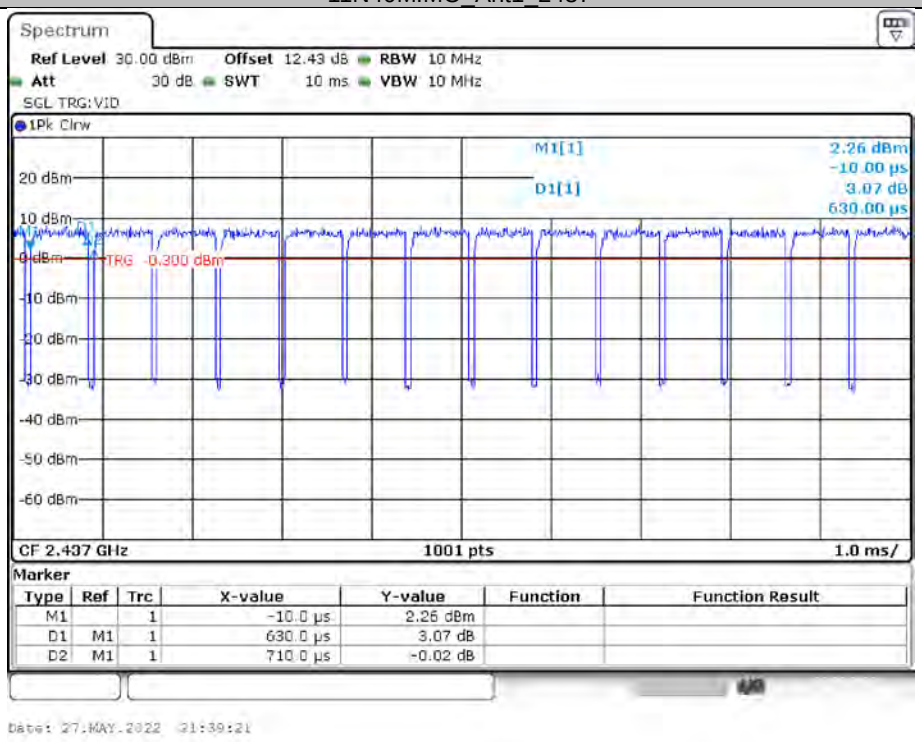
11N40MIMO_Ant1_2422



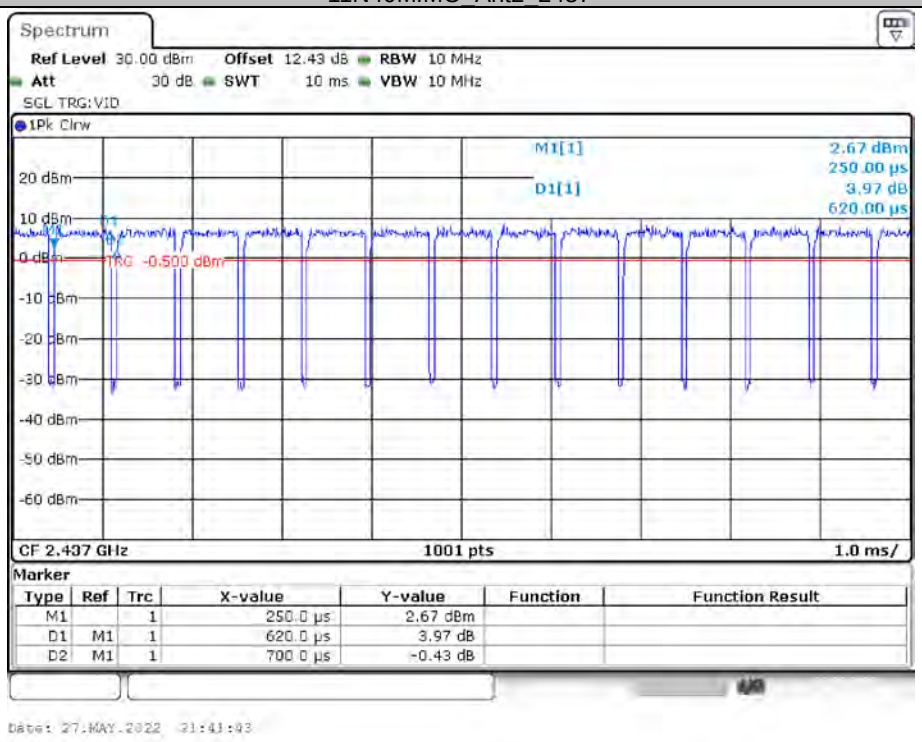
11N40MIMO_Ant2_2422



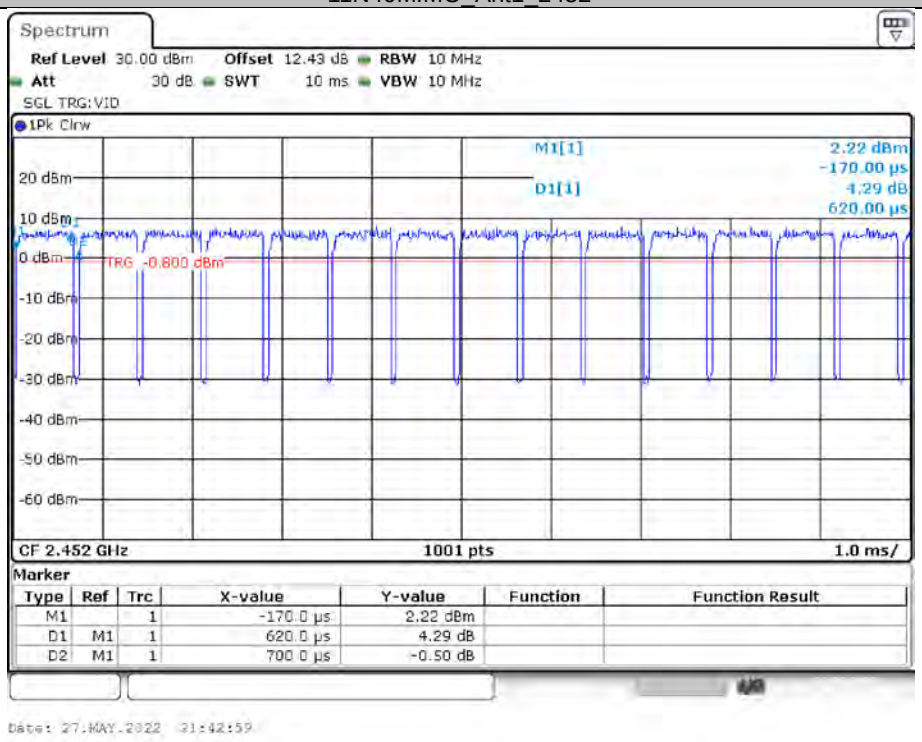
11N40MIMO_Ant1_2437



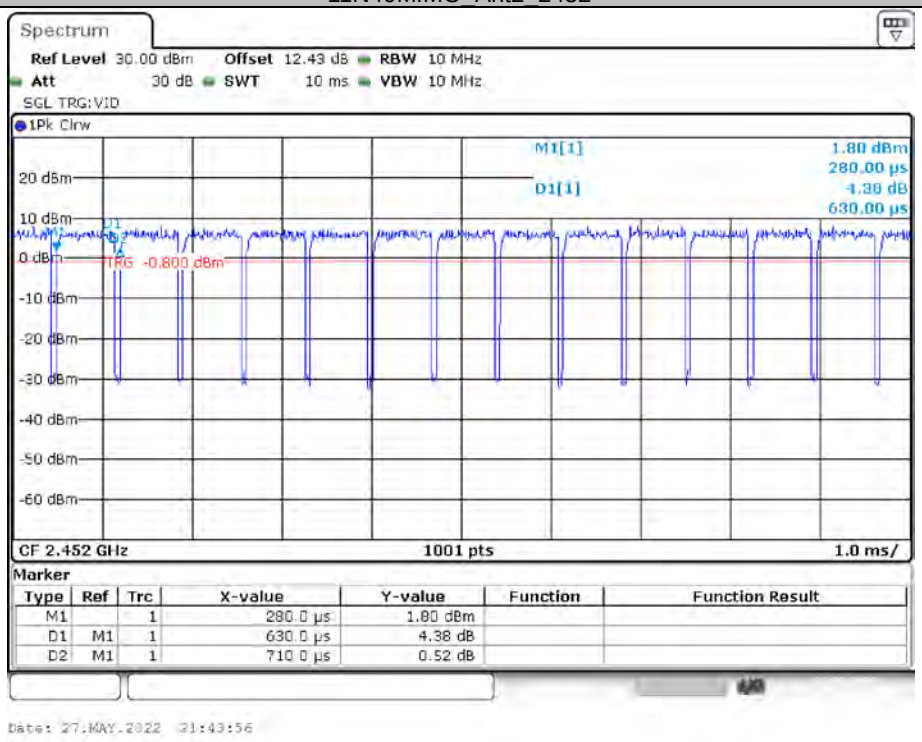
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



11N40MIMO_Ant2_2452



APPENDIX BLE

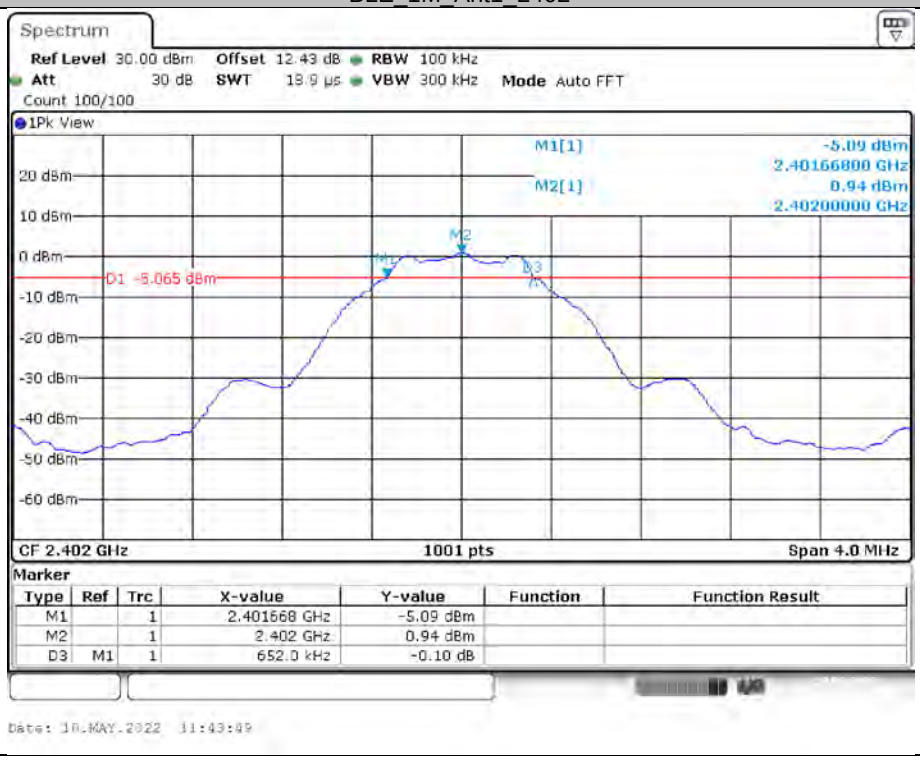
Appendix A: 6dB Emission Bandwidth

Test Result

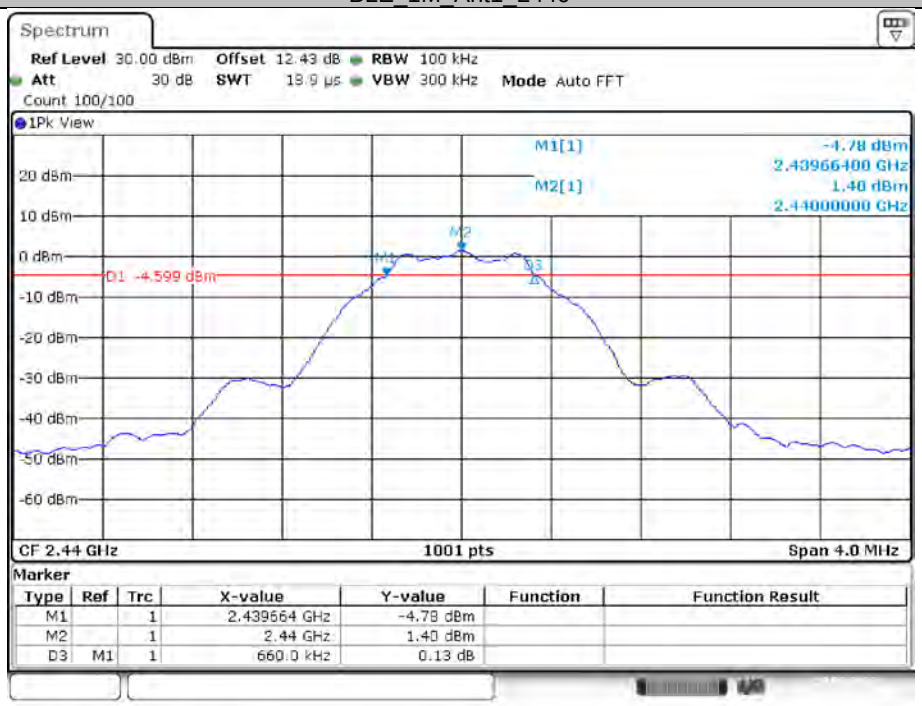
TestMode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.652	0.5	PASS
		2440	0.660	0.5	PASS
		2480	0.668	0.5	PASS

Test Graphs

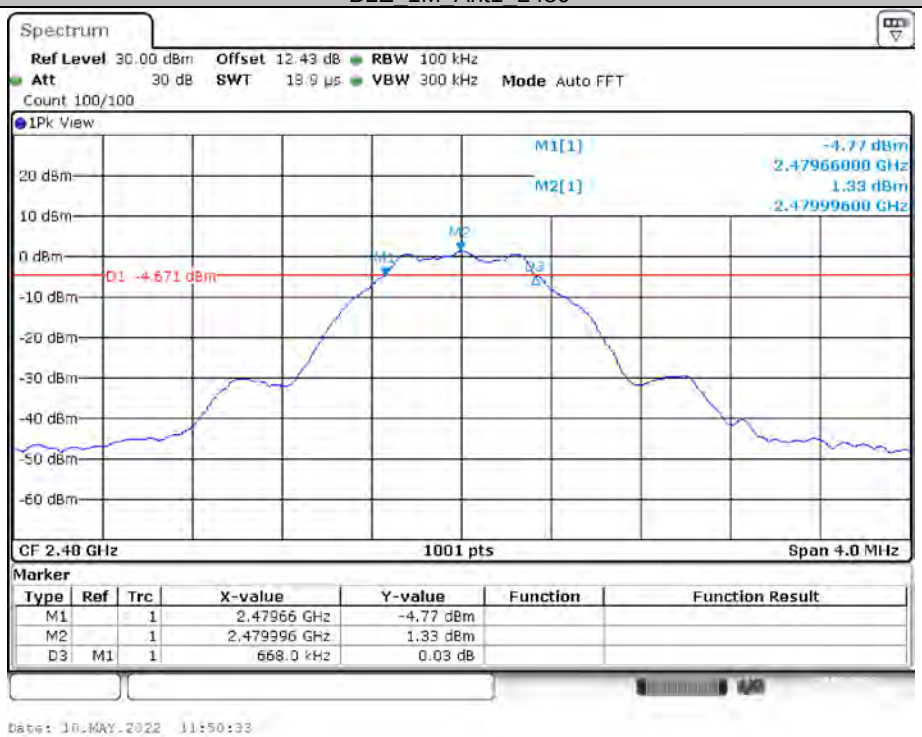
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



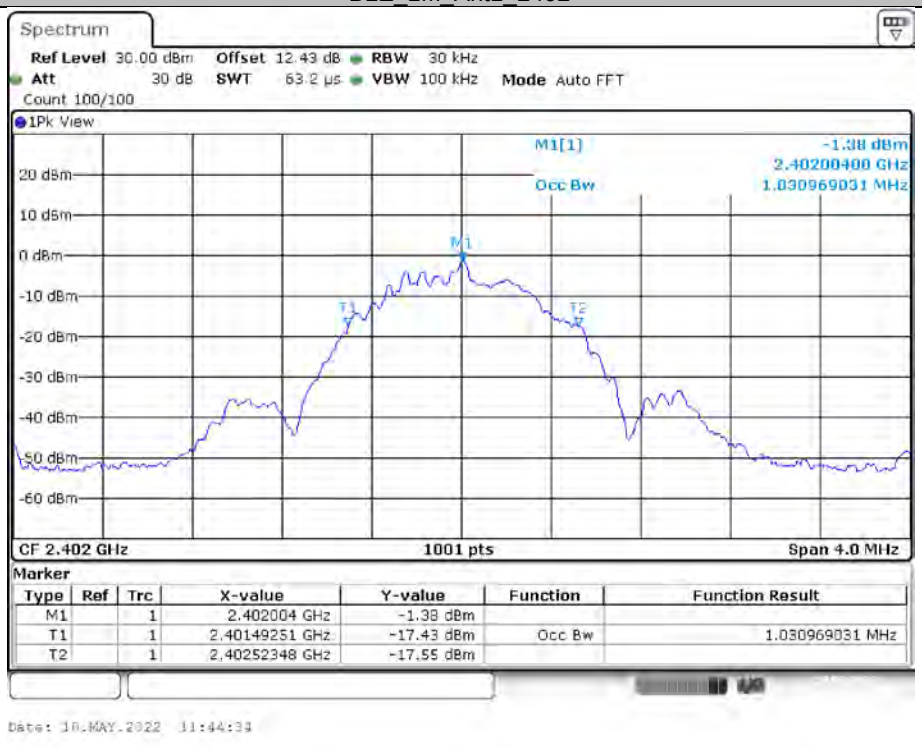
Appendix B: Occupied Channel Bandwidth

Test Result

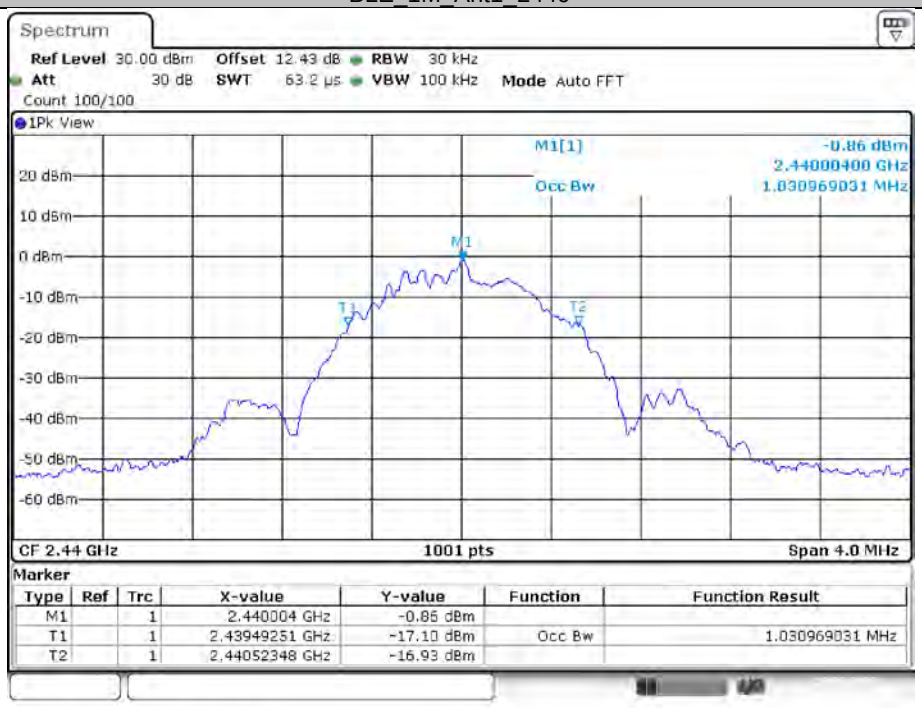
TestMode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.031	---	PASS
		2440	1.031	---	PASS
		2480	1.027	---	PASS

Test Graphs

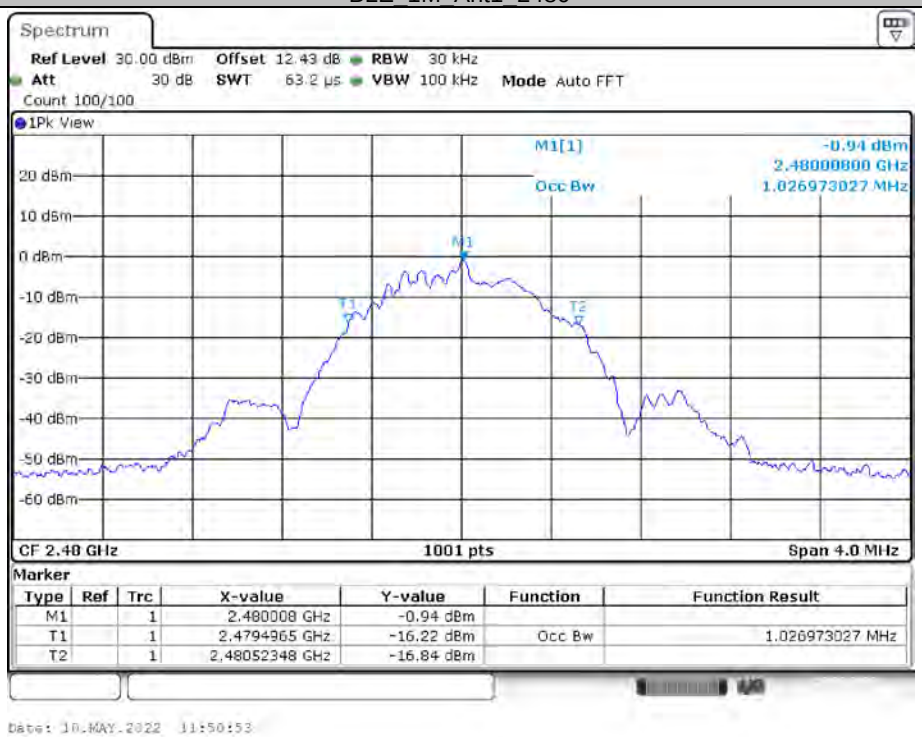
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



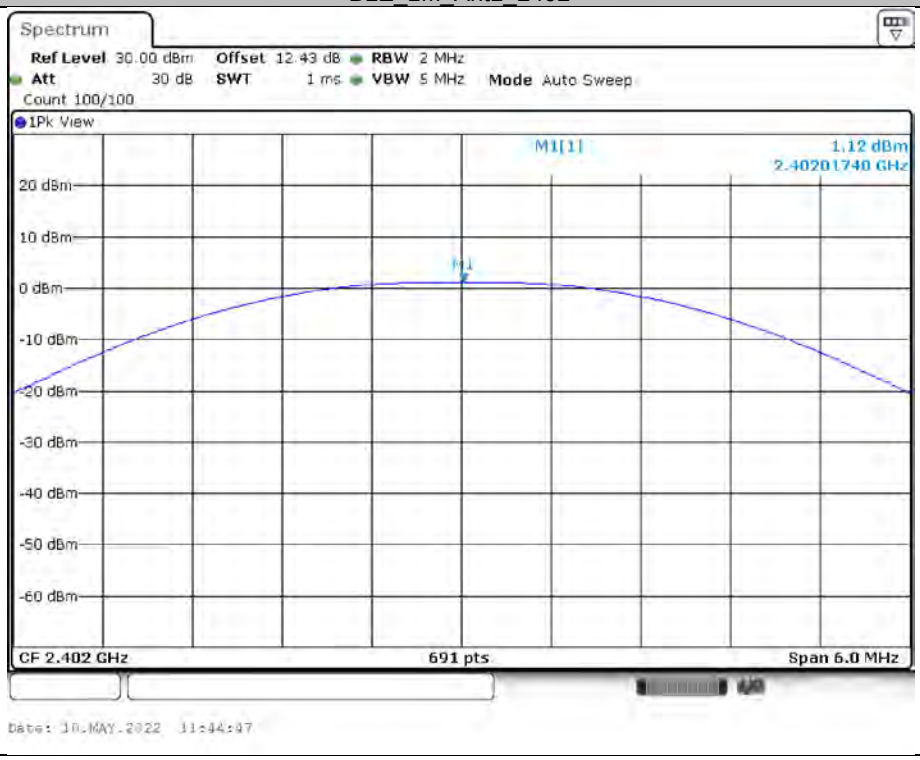
Appendix C: Maximum conducted output power

Test Result

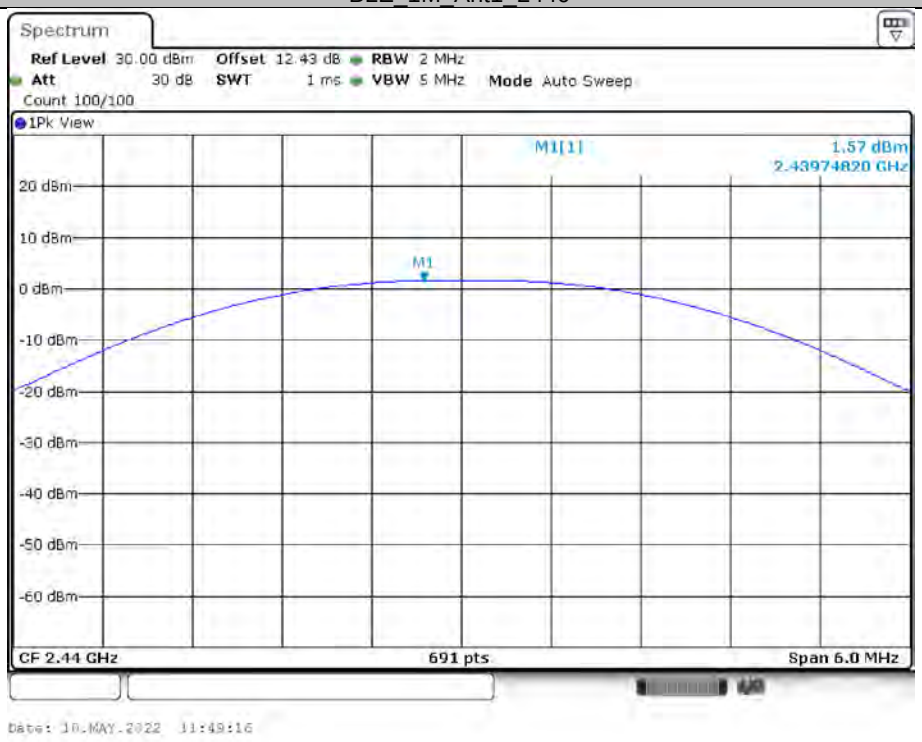
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	1.12	<=30	PASS
		2440	1.57	<=30	PASS
		2480	1.52	<=30	PASS

Test Graphs

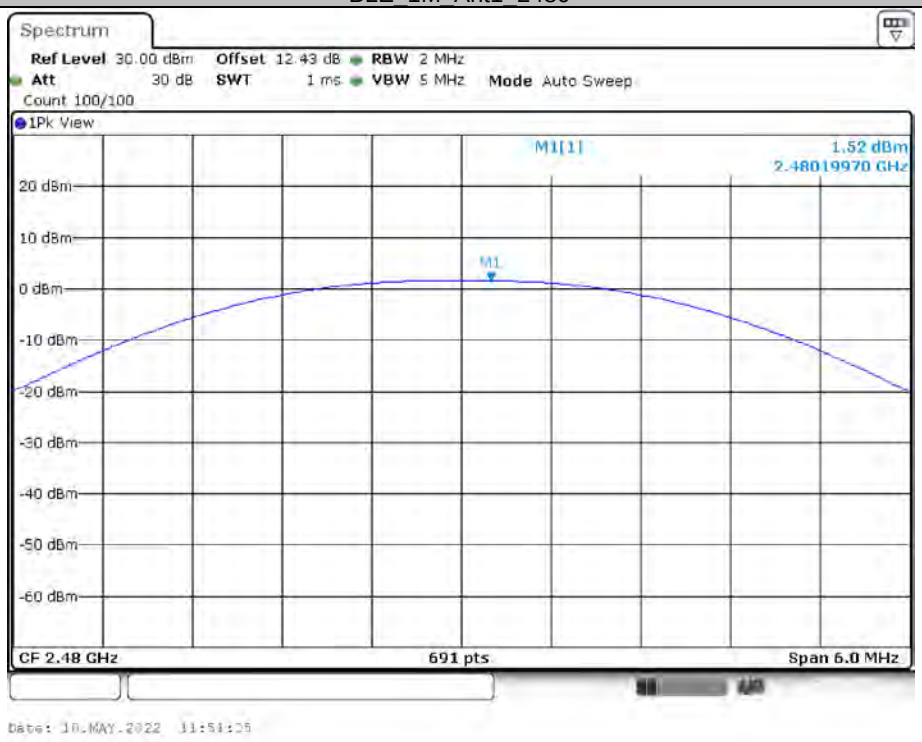
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



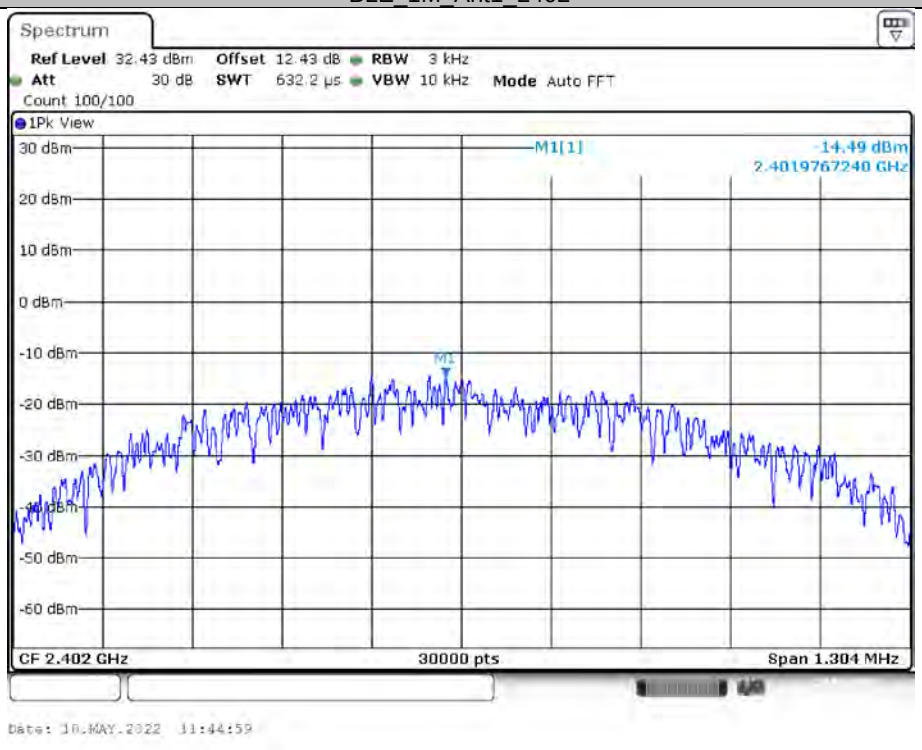
Appendix D: Power spectral density

Test Result

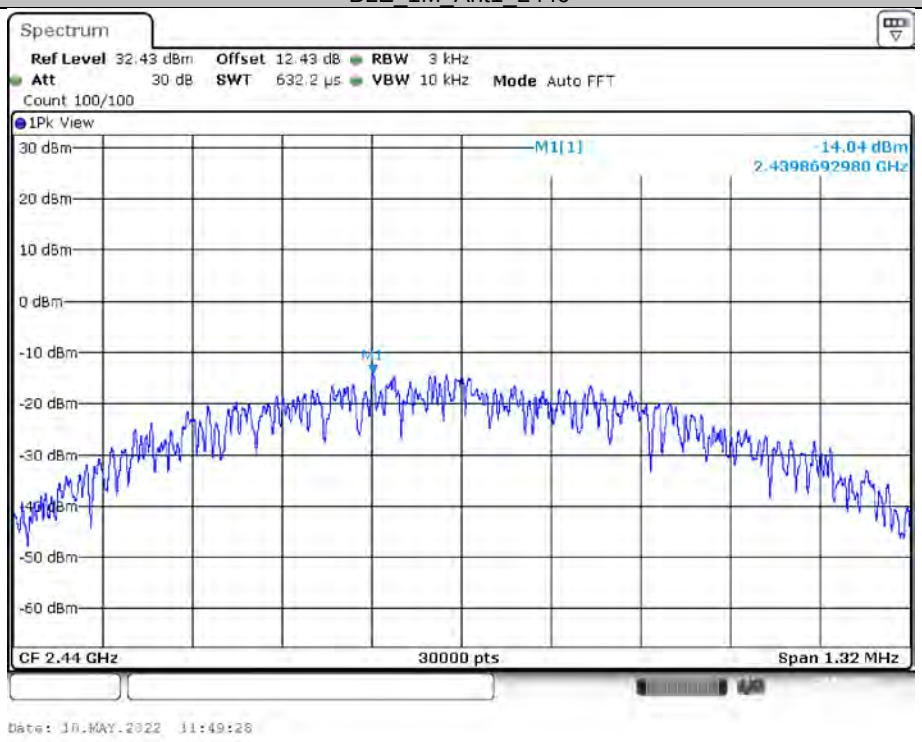
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.49	<=8	PASS
		2440	-14.04	<=8	PASS
		2480	-13.99	<=8	PASS

Test Graphs

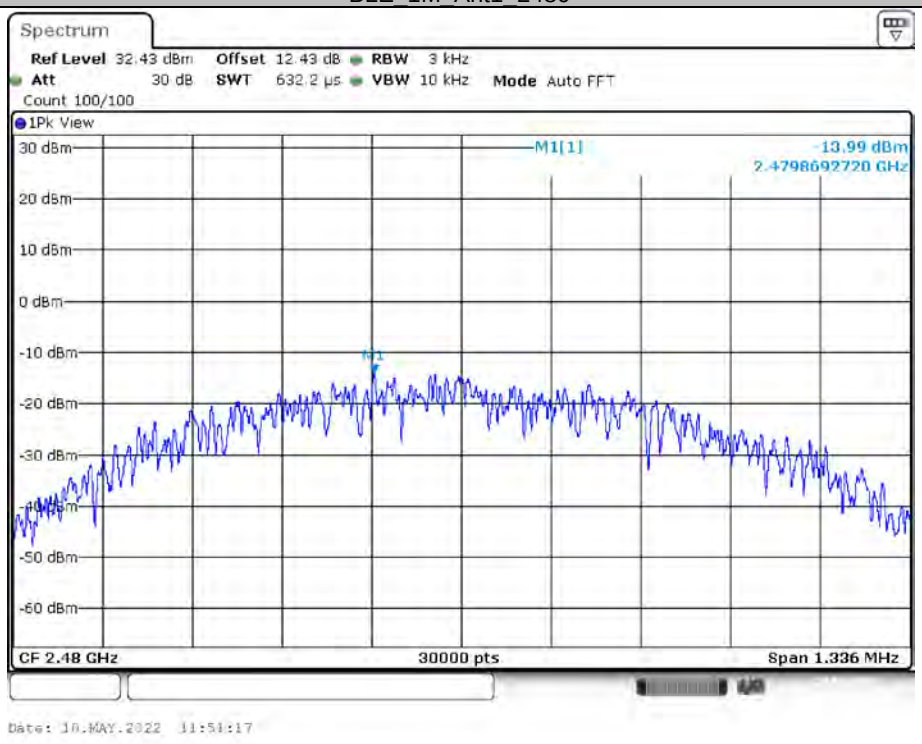
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



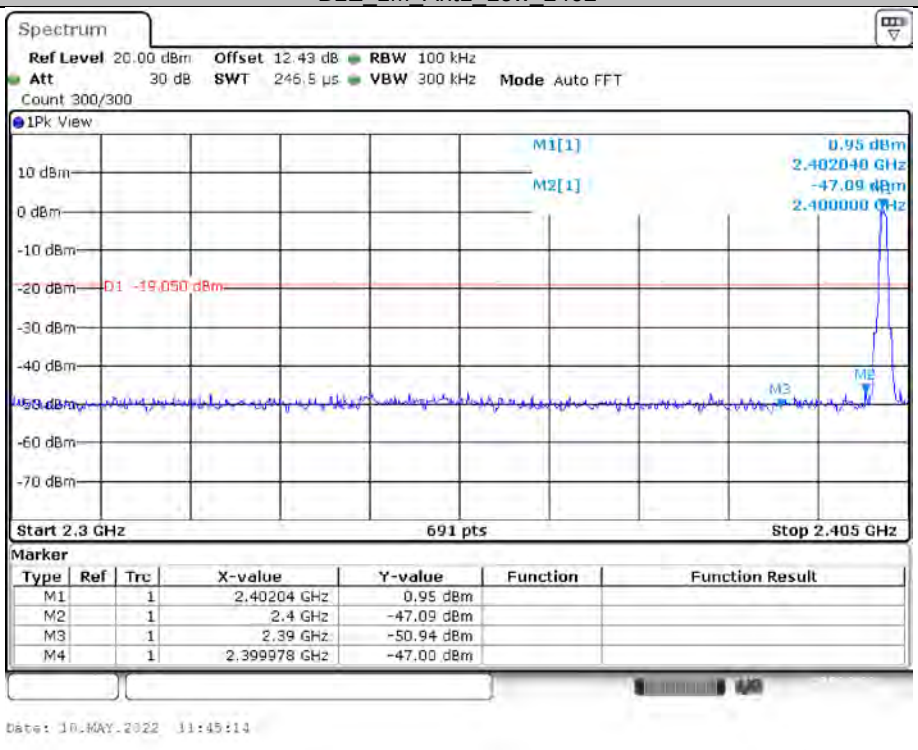
BLE_1M_Ant1_2480



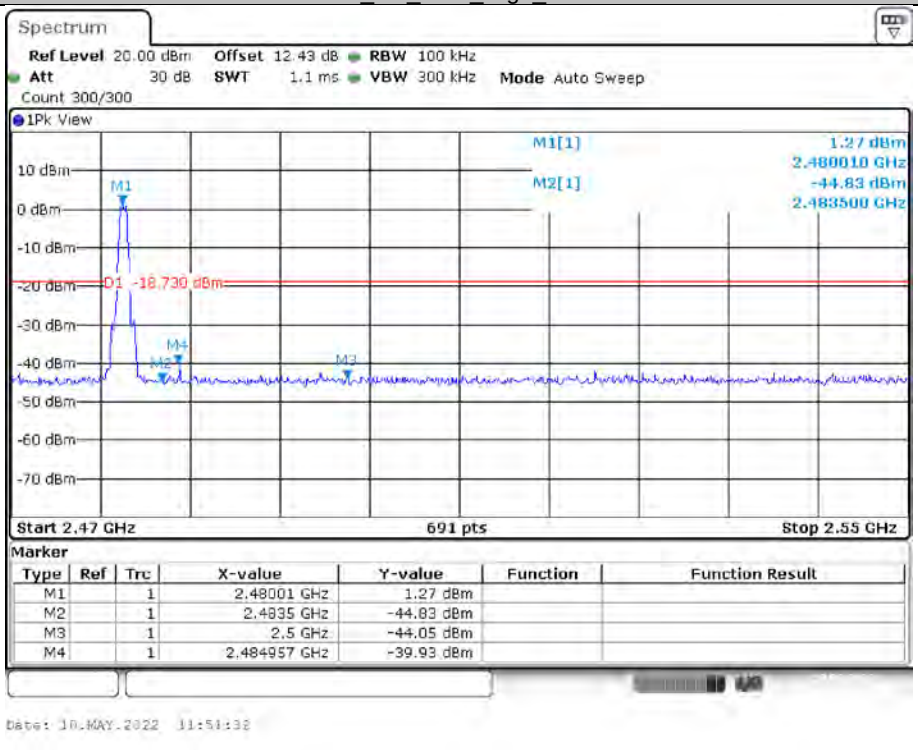
Appendix E: Band edge measurements

Test Graphs

BLE_1M_Ant1_Low_2402



BLE_1M_Ant1_High_2480



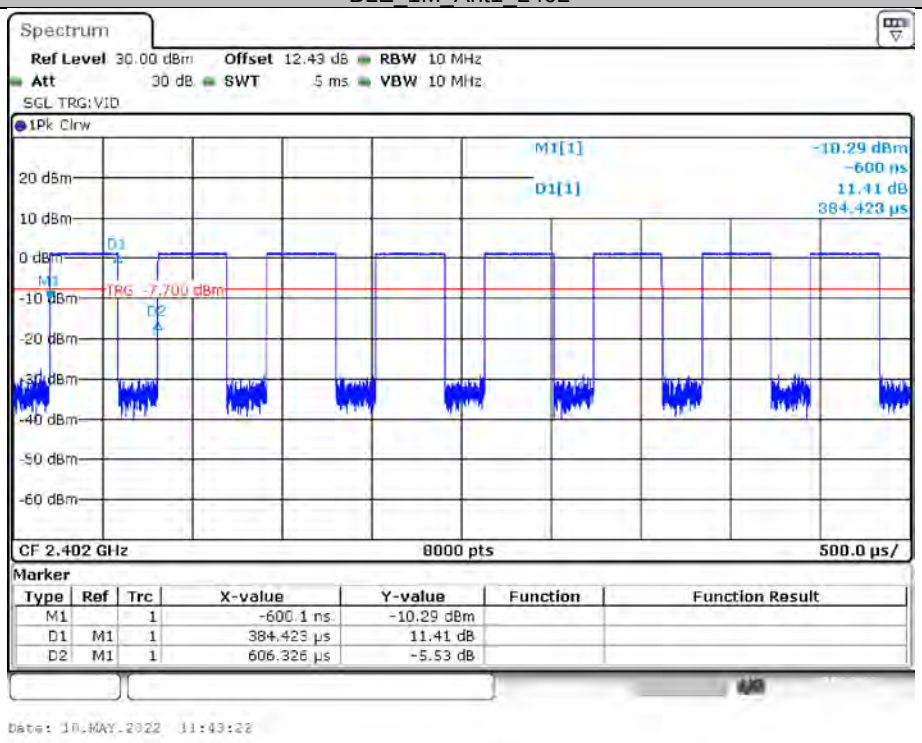
Appendix F: Duty Cycle

Test Result

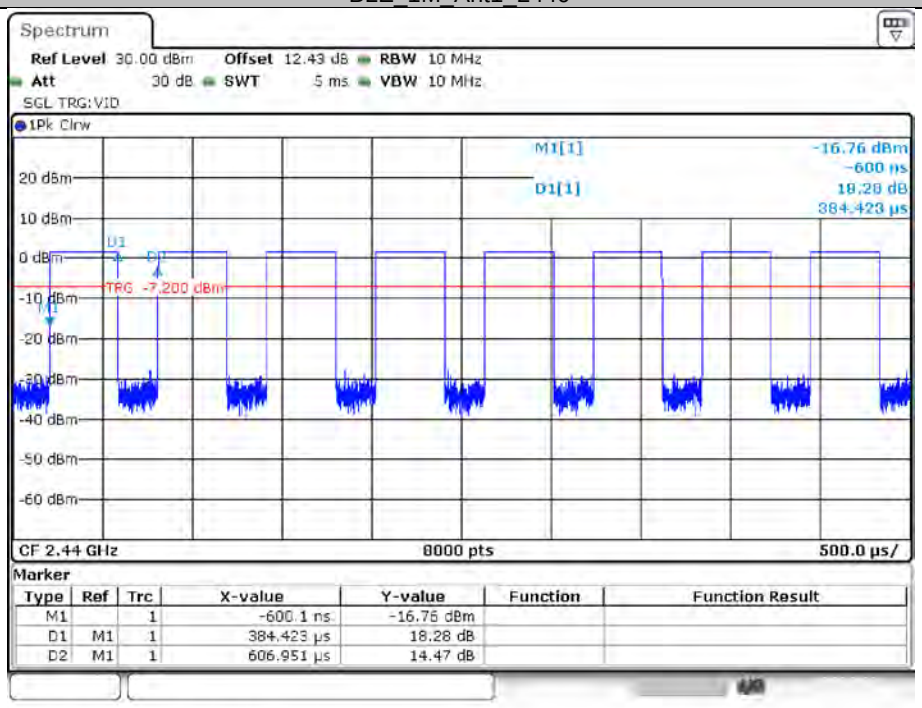
TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
BLE_1M	Ant1	2402	0.38	0.61	63.30
		2440	0.38	0.61	63.30
		2480	0.38	0.61	63.30

Test Graphs

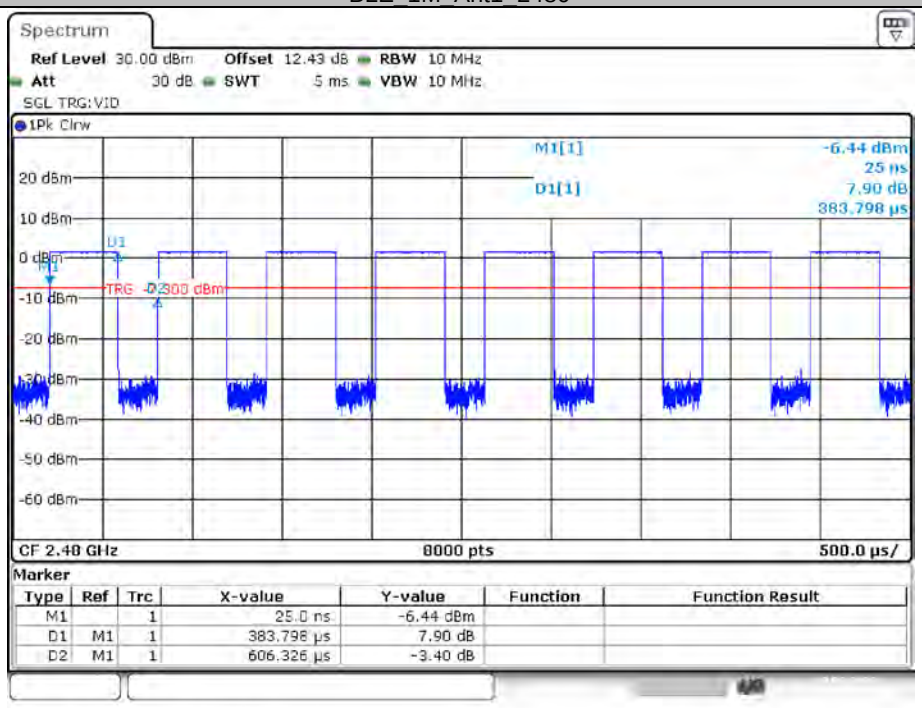
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



******* END OF REPORT *******