

FCC AND ISED CERTIFICATION TEST REPORT

Report No.: DDT-B23102009-2E02

Applicant	:	Beijing Orion Star Technology Co., Ltd.
Address	:	Room A-2570, 2nd Floor, No. 30, Shixing Street, Shijingshan District, Beijing China
Equipment under Test	:	AI Delivery Robot
Model No.	:	OS-R-DR02-A
Trade Mark	:	ORIONSTAR
FCC ID	:	2A3BD-OSRDR02
IC	:	27780-OSRDR02
Manufacturer	:	Beijing Orion Star Technology Co., Ltd.
Address	:	Room A-2570, 2nd Floor, No. 30, Shixing Street, Shijingshan District, Beijing China

Issued By: Tianjin Dongdian Testing Service Co., Ltd.

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REPORT

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Test Report Declare

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Equipment under Test	:	AI Delivery Robot
Model No.	:	OS-R-DR02-A
Trade Mark	:	ORIONSTAR
Manufacturer	:	Beijing Orion Star Technology Co., Ltd.
Address	:	Room A-2570, 2nd Floor, No. 30, Shixing Street, Shijingshan District, Beijing China

Test Standard Used: FCC Rules and Regulations Part 15 Subpart C, RSS-247 Issue 3 August 2023.

Test procedure used: ANSI C63.10:2020, RSS-Gen Issue 5, Apr. 2018, KDB 558074 D01 15.247 Meas Guidance v05r02

We Declare:

The equipment described above is tested by Tianjin Dongdian Testing Service Co., Ltd and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Tianjin Dongdian Testing Service Co., Ltd is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC&ISED standards.

Report No:	DDT-B23102009-2E02		
Date of Receipt:	Nov. 13, 2023	Date of Test:	Nov. 13, 2023 ~ Nov. 29, 2023

Prepared By:

Novak Wei

Novak Wei/Engineer

Approved By:

Aaron Zhang

Aaron Zhang/Manager

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Tianjin Dongdian Testing Service Co., Ltd.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Revision History

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Nov. 29, 2023	

1. Summary of Test Results

The EUT have been tested according to the applicable standards as referenced below.		
Description of Test Item	Standard	Verdict
6dB Bandwidth and 99% Bandwidth	FCC 15.247 (a) (2) RSS-247 Clause 5.2 (a)	Pass ¹
Maximum Conducted Output Power	FCC 15.247 (b) (3) RSS-247 Clause 5.4 (e)	Pass ¹
Power Spectral Density	FCC 15.247 (e) RSS-247 Clause 5.2 (b)	Pass ¹
Band-edge and Spurious Emissions (Conducted)	FCC 15.247 (d) RSS-247 Clause 5.5	Pass ¹
Radiated Spurious Emissions	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Pass
Radiated Band Edge Compliance	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Pass ¹
Power Line Conducted Emission	FCC 15.207 RSS-GEN Clause 8.8	Pass ¹
Antenna Requirement	FCC 15.203 RSS-GEN Clause 6.8	Pass ¹
Note 1: This report adds auto door in term of appearance on the basics of the original model no OS-R-DR02, because the auto door no RF circuit and no impact on RF test result. Therefore, depending on the module and the whole machine , only the Radiated Spurious Emissions retest and update it to the report. And mark as Pass. Note 2: The above “pass¹” items data are refer from the Tianjin Dongdian Testing Service.,Ltd (Date of Test: Jan. 18, 2023 ~ Mar. 15, 2023). The report number is DDT-B23020801-2E02.		

2. General Test Information

2.1. Description of EUT

EUT* Name	: AI Delivery Robot
Model Number	: OS-R-DR02-A
Models Difference	OS-R-DR02-A compare with original model OS-R-DR02: 1.Added four auto door in term of appearance. 2.Added usbhub motherboard, control motor to open or close the door, the usbhub motherboard has no RF circuit, No impact on RF test results. Others hardware and software exactly same, such as modules, PCBA, antenna, crystal oscillator and so on. So the Report data based on original model OS-R-DR02, Only the Radiated Spurious Emissions data is updated, the original model report number is DDT-B23020802-2E02.
EUT Function Description	: Please reference user manual of this device
Power supply	: DC 25.55V by Polymer Li-ion built-in battery AC 100-240V~50/60Hz by ac/dc adapter for charge
Radio Technology	: IEEE 802.11b/g/n
Operation Frequency	: IEEE 802.11b: 2412MHz-2462MHz IEEE 802.11g: 2412MHz-2462MHz IEEE 802.11n HT20: 2412MHz-2462MHz IEEE 802.11n HT40: 2422MHz-2452MHz
Modulation	: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20, HT40: OFDM (64QAM, 16QAM, QPSK, BPSK)
Transmitter Rate	: IEEE 802.11b: 1, 2, 5.5, 11 Mbps IEEE 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11n HT20, HT40: MCS0~MCS7
Antenna Type	: Dipole antenna with IPEX connector, maximum PK gain: 2.0dBi
Serial Number	: N/A

Note1: EUT is the ab. of equipment under test.

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

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number	Description	Remark
AC/DC ADAPTER	FOSHAN SHUNDE GUANYUDA POWER SUPPLY CO., LTD	GM262-3200 780-1F	INPUT:100-240V~50/60Hz 3.5A, OUTPUT:32V-7.8A	GVE

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
Notebook	Lenovo Beijing Co. Ltd.	ThinkPad	FCC/CE	TP00067A

2.4. Block diagram of EUT configuration for test

EUT

Run the special test software “QRCT.exe” provided by manufacturer to control EUT work in Continuous Tx mode, and select test channel, wireless mode and data rate.

Tested mode, channel, setting Tx power and rand data rate information				
Mode	Setting Tx Power	Data rate (Mbps) (see Note)	Channel	Frequency (MHz)
IEEE 802.11b	8	1	LCH: CH1	2412
	8	1	MCH: CH6	2437
	8	1	HCH: CH11	2462
IEEE 802.11g	12	6	LCH: CH1	2412
	12	6	MCH: CH6	2437
	12	6	HCH: CH11	2462
IEEE 802.11n HT20	14	MCS 0	LCH: CH1	2412
	14	MCS 0	MCH: CH6	2437
	14	MCS 0	HCH: CH11	2462
IEEE 802.11n HT40	14	MCS 0	LCH: CH3	2422
	14	MCS 0	MCH: CH6	2437
	14	MCS 0	HCH: CH9	2452

Note1: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test.

2.5. Deviations of test standard

No Deviation

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-28℃
Humidity range:	20-75%
Pressure range:	86-106kPa

2.7. Test laboratory

Tianjin Dongdian Testing Service Co., Ltd.

Address: Building D-1, No. 19, Weisi Road, Microelectronics Industrial Park Development Area, Tianjin, China.

Tel: +86-22-58038033, <http://www.ddttest.com>, Email: ddt@dgddt.com

NVLAP (National Voluntary Laboratory Accreditation Program) CODE: 500036-0

CNAS (China National Accreditation Service for Conformity Assessment) CODE: L13402

FCC Designation Number: CN5004; FCC Test Firm Registration Number: 368676

ISED (Innovation, Science and Economic Development Canada) Company Number: 27768

Conformity Assessment Body Identifier: CN0125

VCCI Facility Registration Number: C-20089, T-20093, R-20125, G-20122

2.8. Measurement uncertainty

Test Item	Uncertainty
Bandwidth	0.14%
Peak Output Power (Conducted) (Spectrum Analyzer)	0.12 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 0.32 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Peak Output Power (Conducted) (Power Sensor)	0.51 dB
Power Spectral Density	0.12 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 0.32 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Frequencies Stability	6.7×10^{-8} (Antenna couple method) 3.4×10^{-8} (Conducted method)
Conducted Spurious Emissions	0.12 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 0.32 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$); 0.52 dB ($8 \text{ GHz} \leq f < 22 \text{ GHz}$)
Uncertainty for Radio Frequency (RBW < 20 kHz)	3×10^{-7}
Temperature	$\pm 2^{\circ}\text{C}$
Humidity	$\pm 1\%$
Uncertainty for Radiation Emission Test (30 MHz - 1 GHz)	2.72 dB (Antenna Polarize: V) 2.72 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission Test (1 GHz - 40 GHz)	2.74 dB (1 - 6 GHz) 2.72 dB (6 GHz - 18 GHz) 3.54 dB (18 GHz - 26 GHz) 4.30 dB (26 GHz - 40 GHz)
Uncertainty for Power Line Conduction Emission Test	3.40 dB (150 kHz - 30 MHz)

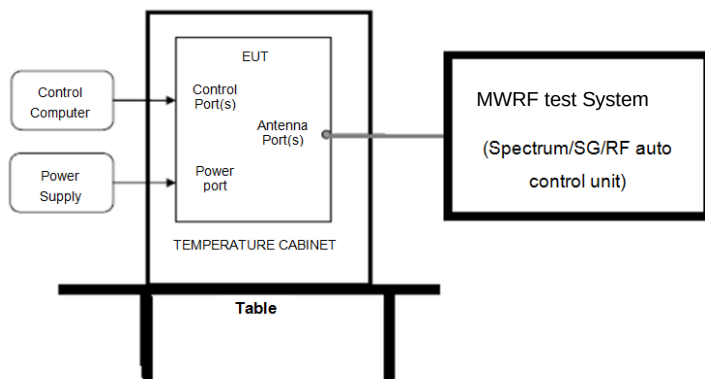
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. Equipment Used During Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
RF Connected Test (MWRFTest system)					
Microwave Signal Generator	R&S	SMF100A	101396	2023/05/29	1 Year
MXG Vector Signal Generator	Keysight	N5182A	MY50143288	2023/03/06	1 Year
EMI Test Receiver	R&S	ESU26	100243	2023/03/03	1 Year
Wideband Radio Communication Tester	R&S	CMW500	158800	2023/06/20	1 Year
Power Sensor	KEYSIGHT	U2021XA	MY59150007	2023/03/22	1 Year
DC Power Supply	inSTEK	PSP-2010	EN122317	2023/02/12	1 Year
Test Software	MWRFTest	MTS8310	V03	N/A	N/A
Radiated Emission -10m EMI Chamber					
Broadband Horn Antenna	TESEQ	BHA 9118	31754	2023/10/11	1 Year
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	790	2023/05/06	1 Year
Active Loop Antenna	R&S	HFH2-Z2	100269	2022/07/11	2 Year
Low noise amplifier	MITEQ	TPA0118-36	0914	2023/02/16	1 Year
EMI Test Receiver	R&S	ESCI	101024	2023/02/15	1 Year
EMI Test Receiver	R&S	ESCI	101030	2023/02/15	1 Year
EMI Test Receiver	R&S	ESU26	100244	2023/03/03	1 Year
Bilog Antenna	TESEQ	CBL6112D	29068	2022/10/10	2 Year
Bilog Antenna	TESEQ	CBL6112D	29069	2022/10/10	2 Year
Amplifier	Sonoma	310N	300913	2023/02/15	1 Year
Amplifier	Sonoma	310N	300914	2023/02/15	1 Year
Ant Mast	Innco	MA4000	N/A	N/A	N/A
Ant Mast	Innco	MA4000	N/A	N/A	N/A
Mast Controller	Innco	CO2000	N/A	N/A	N/A
Mast Controller	Innco	CO2000	N/A	N/A	N/A
RF Selector 4CH	TOYO	NS4904N	Selector1	N/A	N/A
RF Selector 4CH	TOYO	NS4904N	Selector2	N/A	N/A
Test software	TOYO	EP5/RSE	Ver 1.9.1	N/A	N/A
Test software	Audix	E3	V 6.11111b	N/A	N/A
Power Line Conducted Emissions Test					
Test Receiver	R&S	ESCI	101397	2023/02/15	1 Year
LISN	R&S	ENV216	101122	2023/02/15	1 Year
Test software	TOYO	EP5/CE	V 5.4.40	N/A	N/A

4. 6dB Bandwidth and 99% Bandwidth

4.1. Block diagram of test setup



4.2. Limits

For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz

4.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) 99% Bandwidth set the spectrum analyzer as follows:

RBW: 1% to 5% of the OBW

VBW: Three times the RBW

Detector Mode: Peak

Sweep time: auto

Trace mode: Max hold

(3) 6dB Bandwidth set the spectrum analyzer as follows:

RBW: 100 kHz

VBW: 300 kHz

Detector Mode: Peak

Sweep time: auto

Trace mode: Max hold

(4) Allow the trace to stabilize, 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.

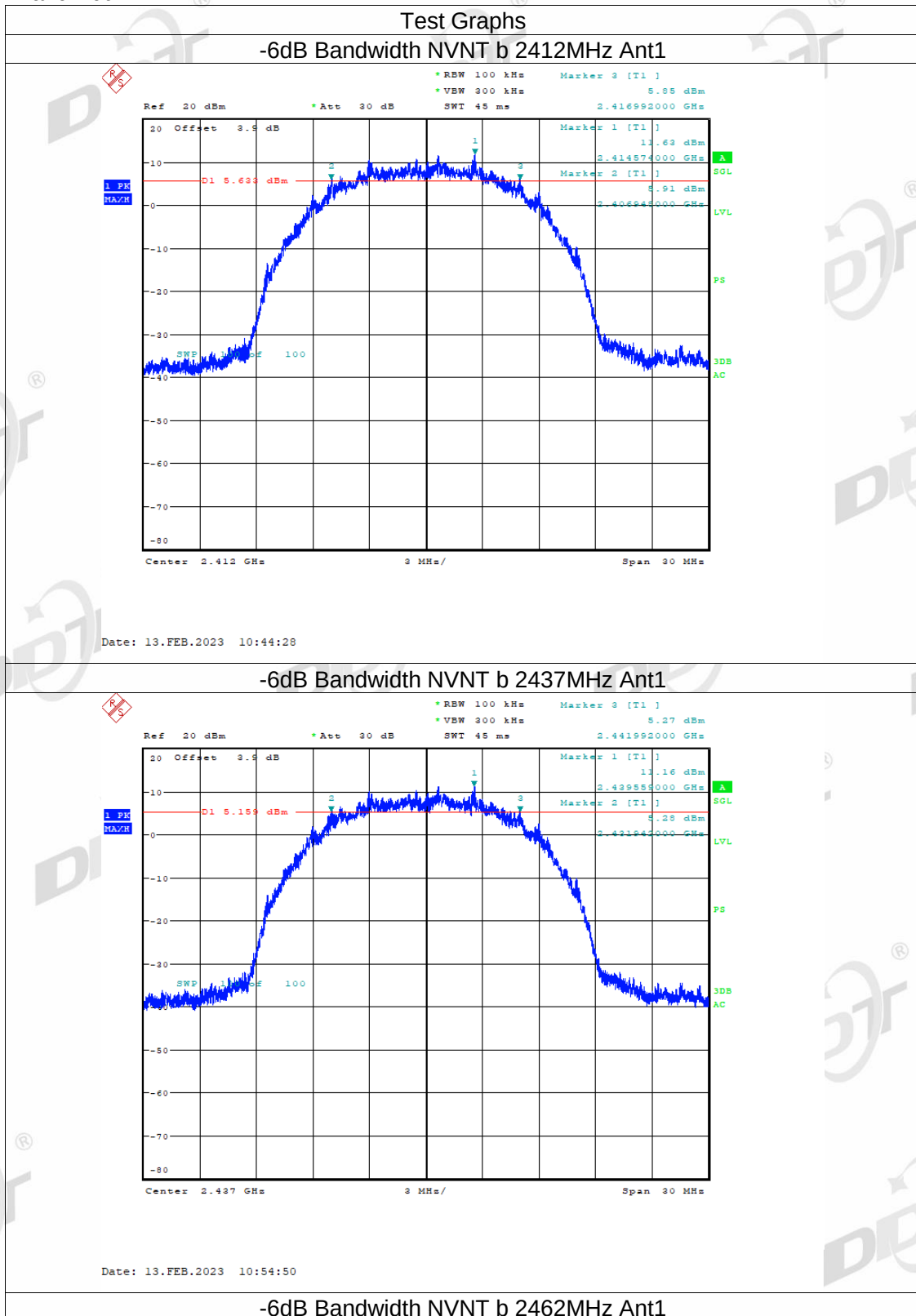
4.4. Test result

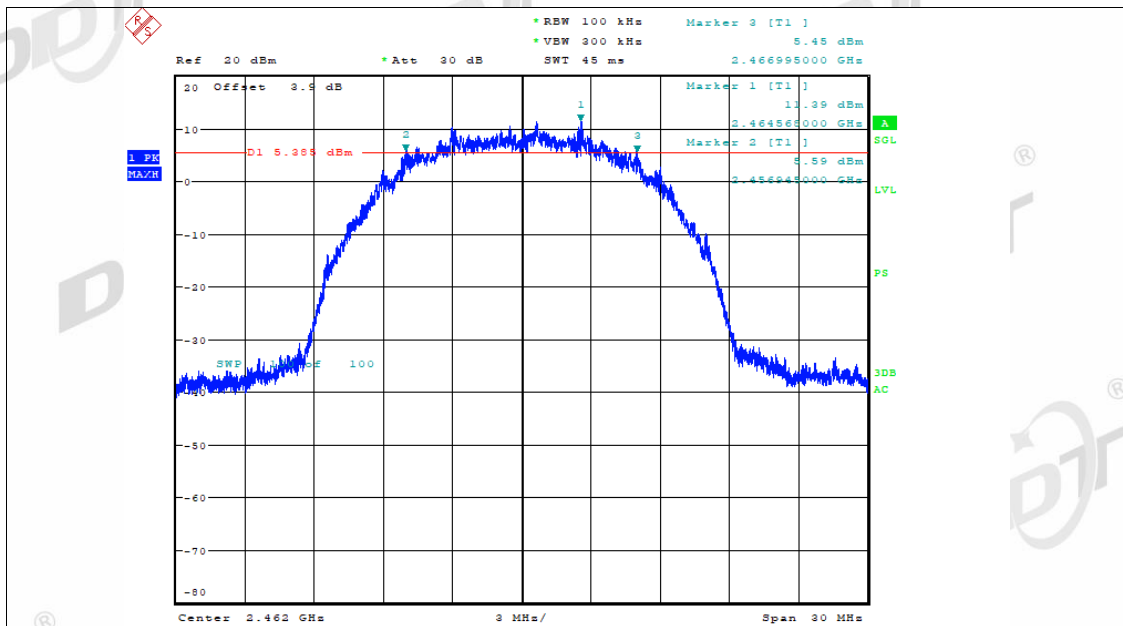
Test Mode	Test Channel	Ant	6dB Bandwidth (MHz)	Limit (MHz)	Verdict
11B	2412	Ant1	10.044	≥ 0.5	Pass
11B	2437	Ant1	10.050	≥ 0.5	Pass
11B	2462	Ant1	10.050	≥ 0.5	Pass
11G	2412	Ant1	16.485	≥ 0.5	Pass
11G	2437	Ant1	16.506	≥ 0.5	Pass
11G	2462	Ant1	16.497	≥ 0.5	Pass
11N20	2412	Ant1	17.829	≥ 0.5	Pass
11N20	2437	Ant1	17.823	≥ 0.5	Pass
11N20	2462	Ant1	17.829	≥ 0.5	Pass
11N40	2422	Ant1	36.492	≥ 0.5	Pass
11N40	2437	Ant1	36.516	≥ 0.5	Pass
11N40	2452	Ant1	36.492	≥ 0.5	Pass

Test Mode	Test Channel	Ant	99% OBW (MHz)	Limit (MHz)	Verdict
11B	2412	Ant1	13.170	---	Pass
11B	2437	Ant1	13.164	---	Pass
11B	2462	Ant1	13.167	---	Pass
11G	2412	Ant1	17.178	---	Pass
11G	2437	Ant1	17.154	---	Pass
11G	2462	Ant1	17.142	---	Pass
11N20	2412	Ant1	17.949	---	Pass
11N20	2437	Ant1	17.940	---	Pass
11N20	2462	Ant1	17.937	---	Pass
11N40	2422	Ant1	37.176	---	Pass
11N40	2437	Ant1	37.206	---	Pass
11N40	2452	Ant1	37.176	---	Pass

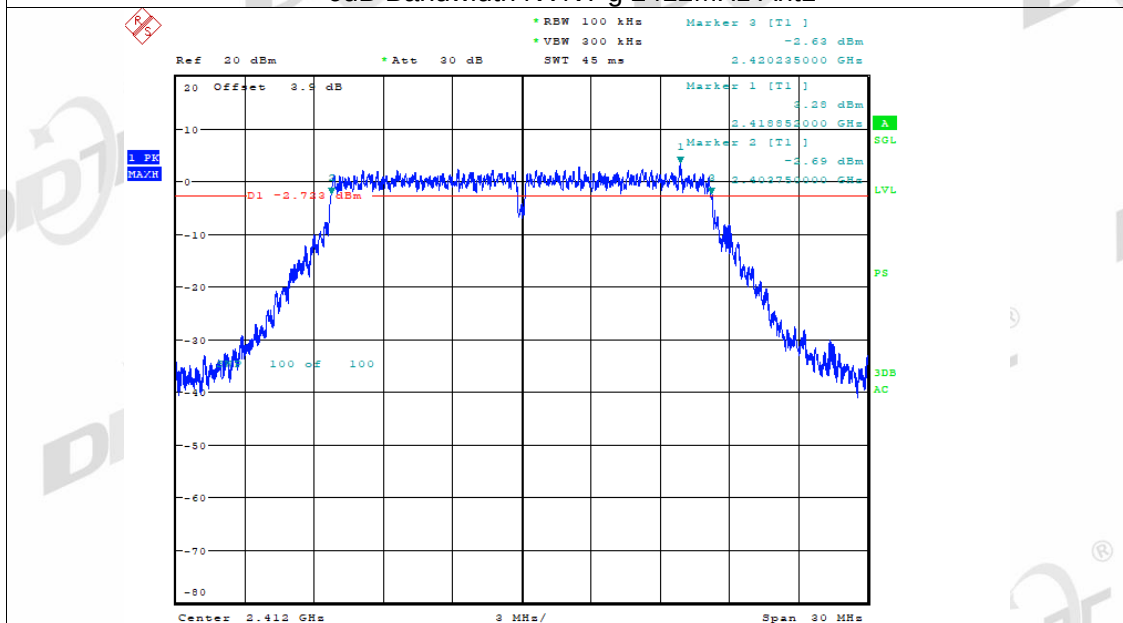
4.5. original test data

6dB Bandwidth:

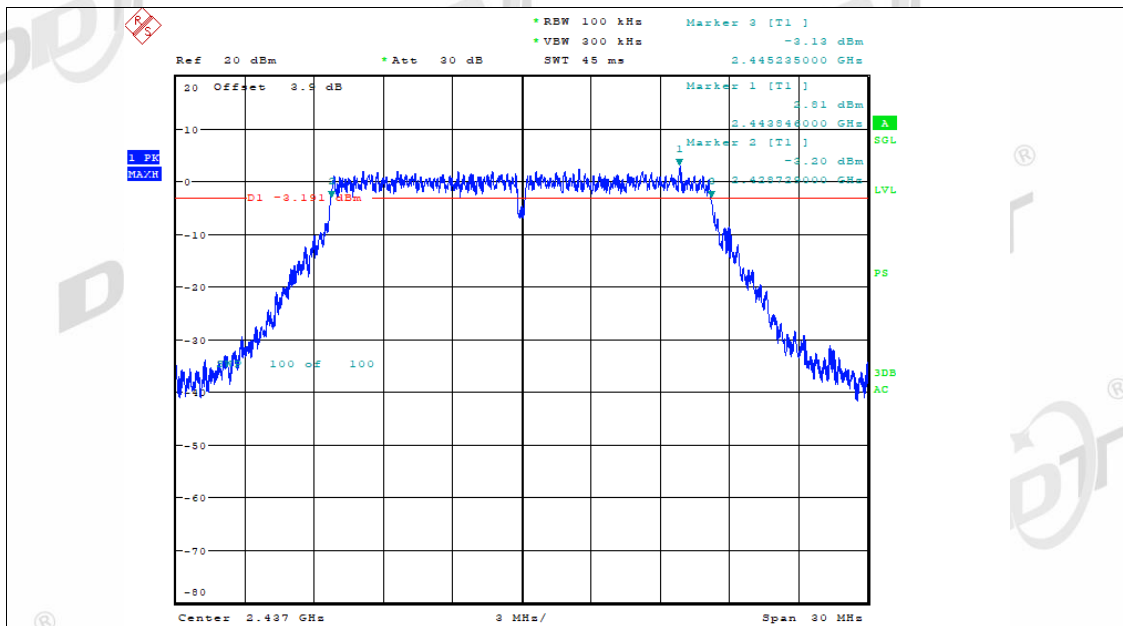




-6dB Bandwidth NVNT g 2412MHz Ant1

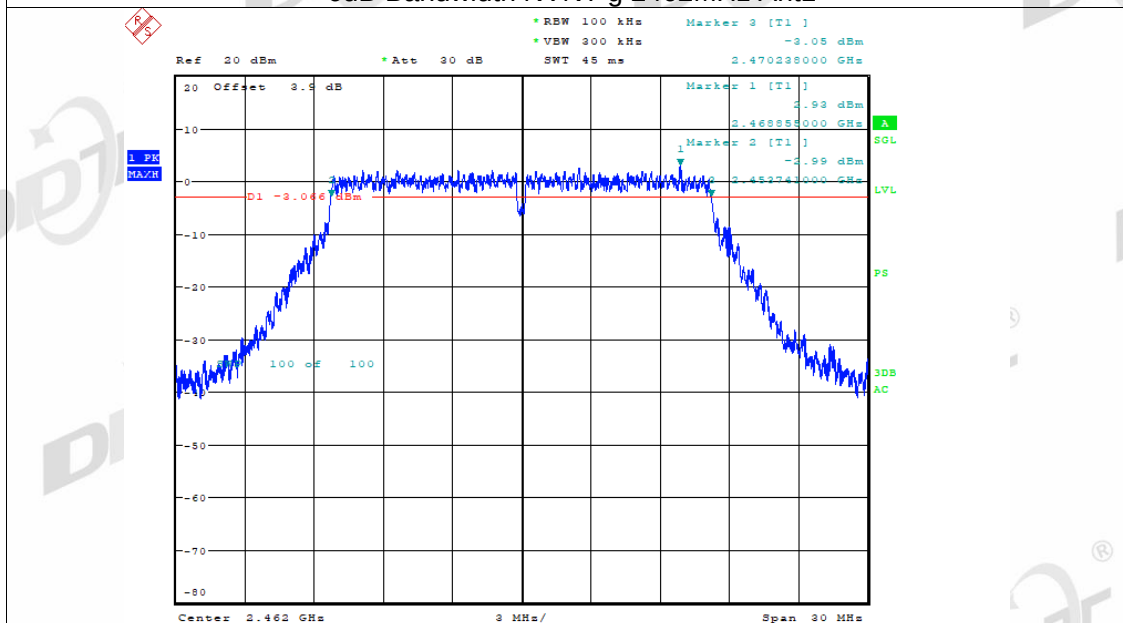


-6dB Bandwidth NVNT g 2437MHz Ant1



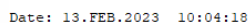
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-6dB Bandwidth NVNT g 2462MHz Ant1



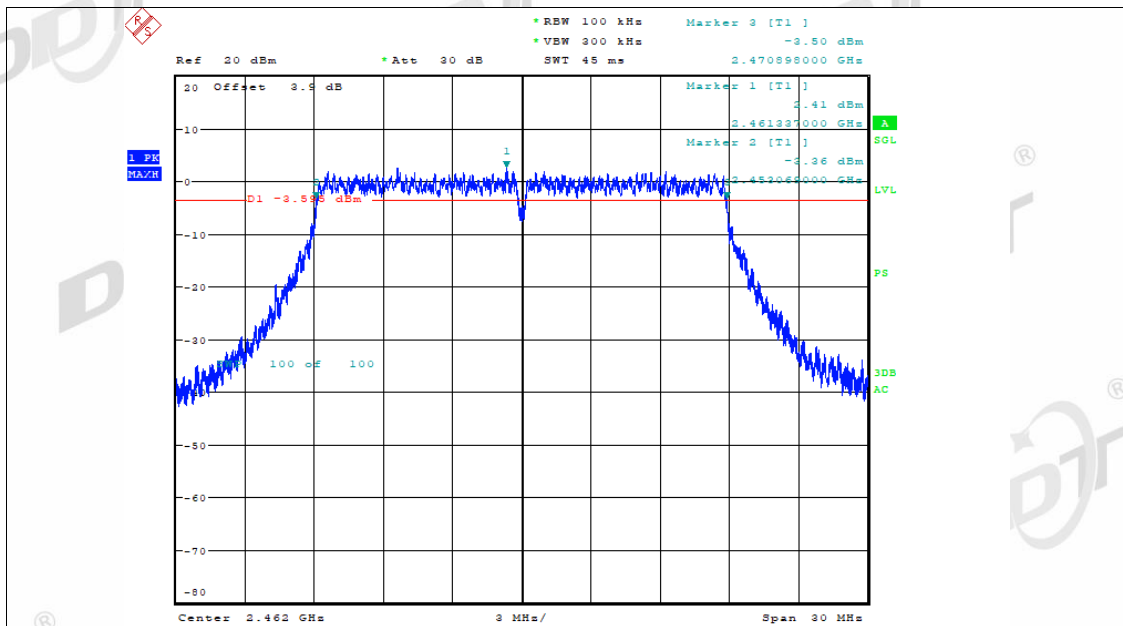
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-6dB Bandwidth NVNT n20 2412MHz Ant1

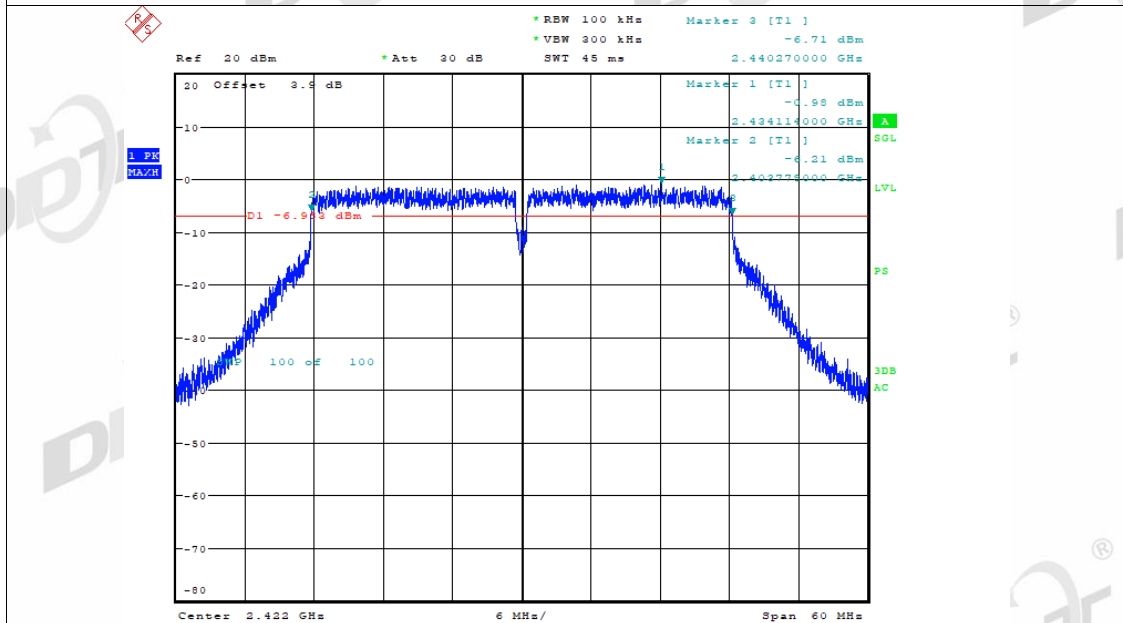


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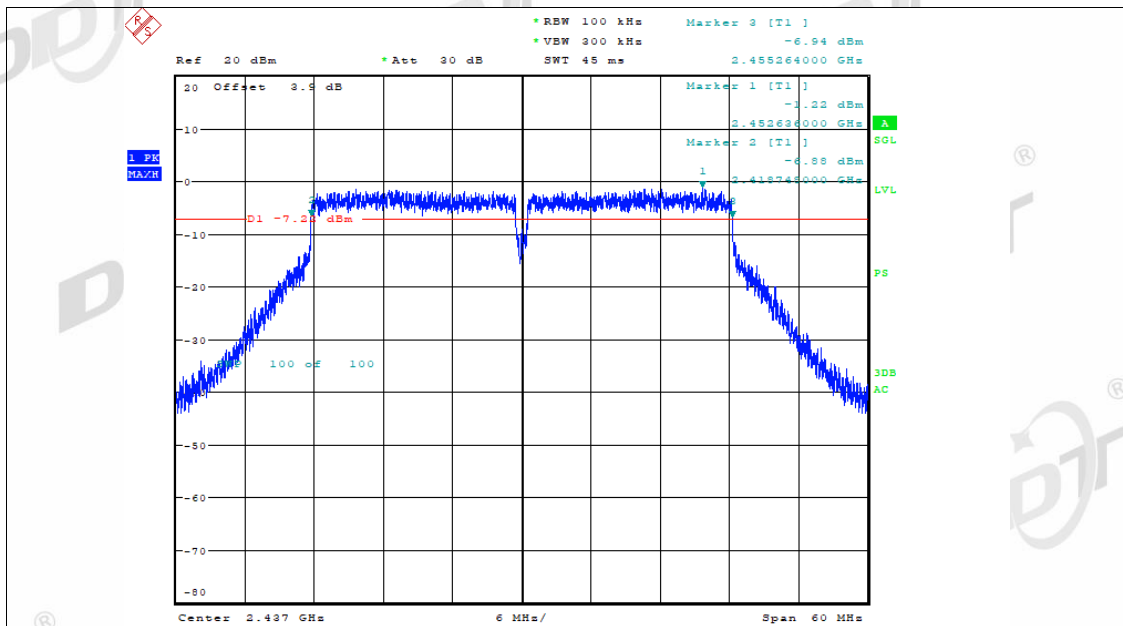
-6dB Bandwidth NVNT n20 2462MHz Ant1



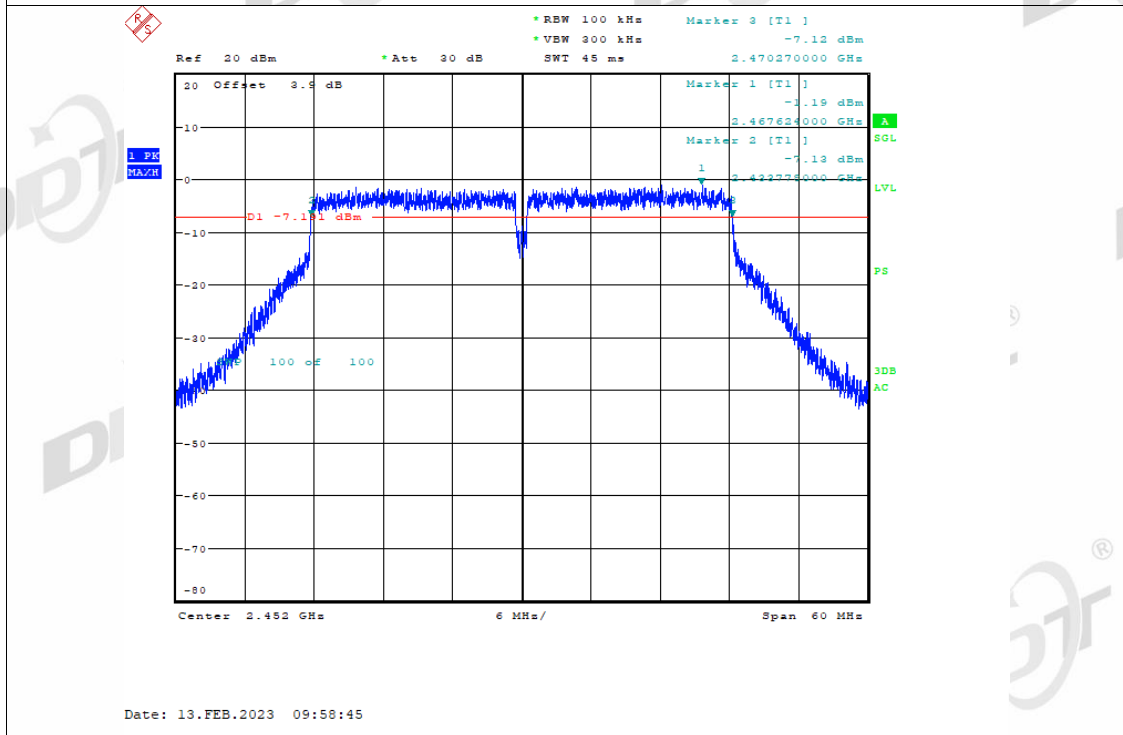
-6dB Bandwidth NVNT n40 2422MHz Ant1



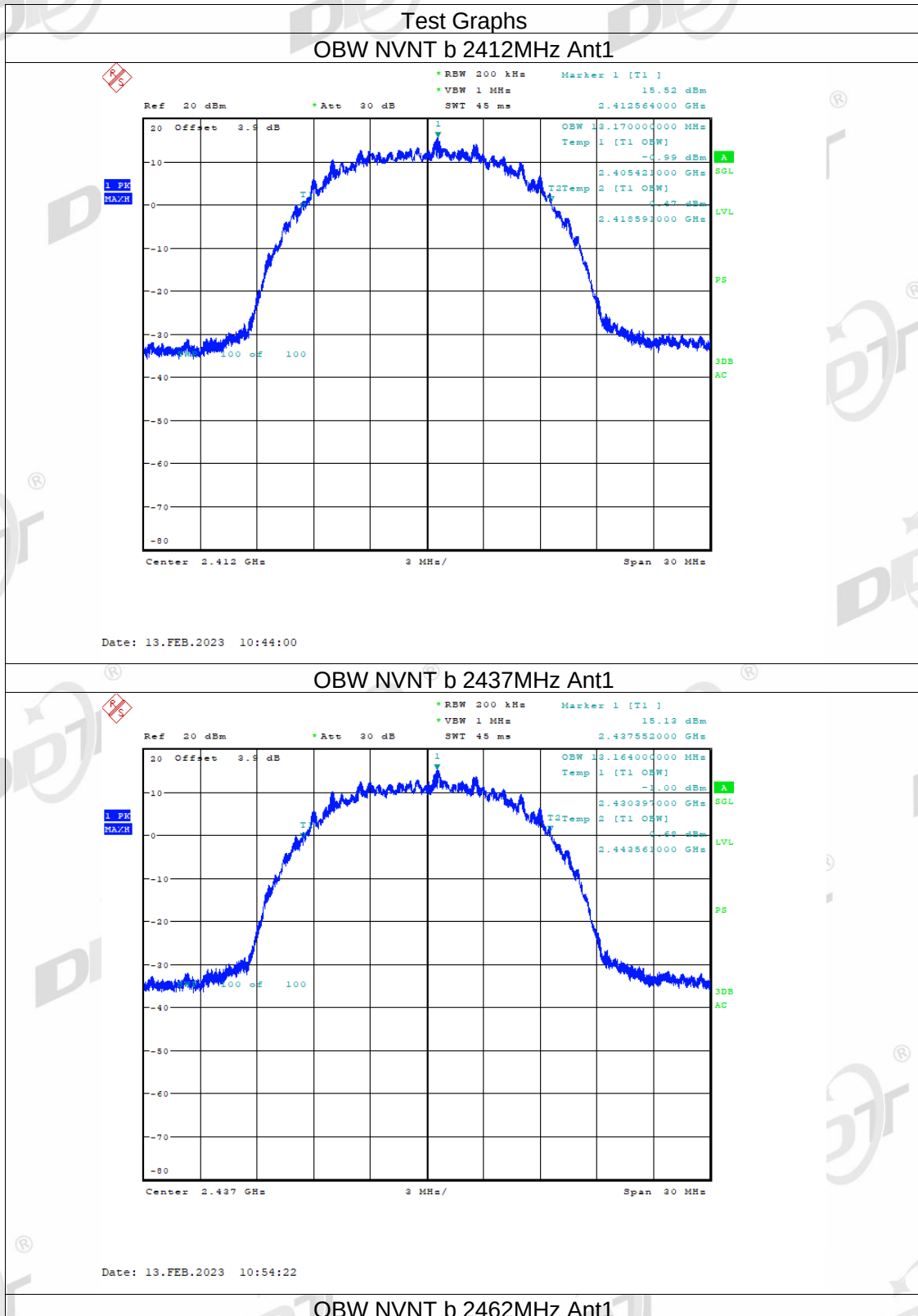
-6dB Bandwidth NVNT n40 2437MHz Ant1

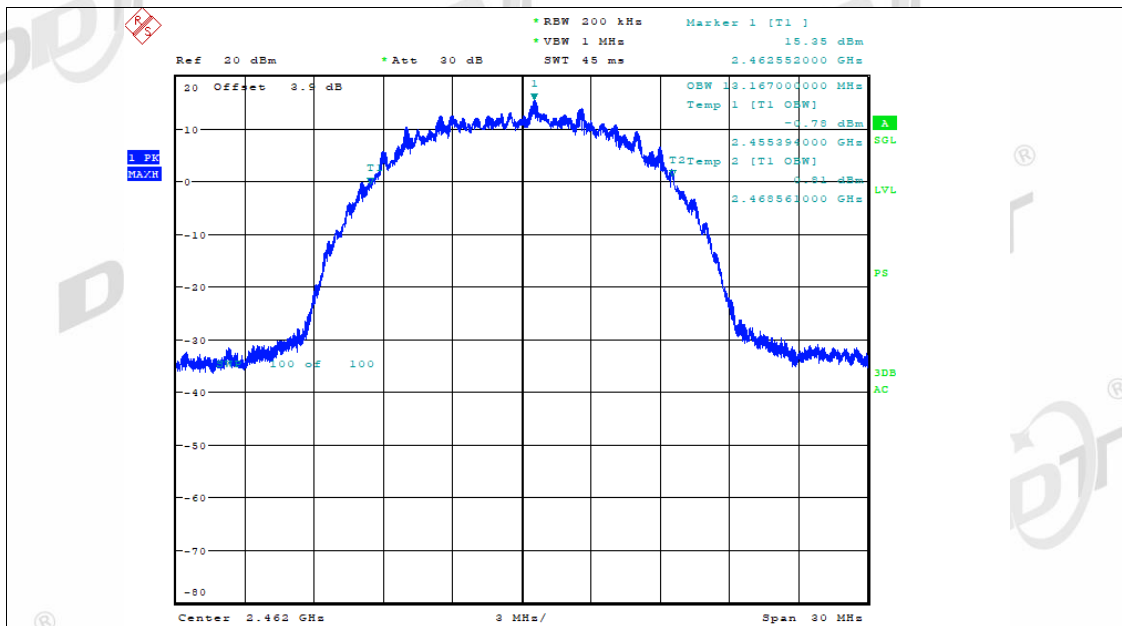


-6dB Bandwidth NVNT n40 2452MHz Ant1



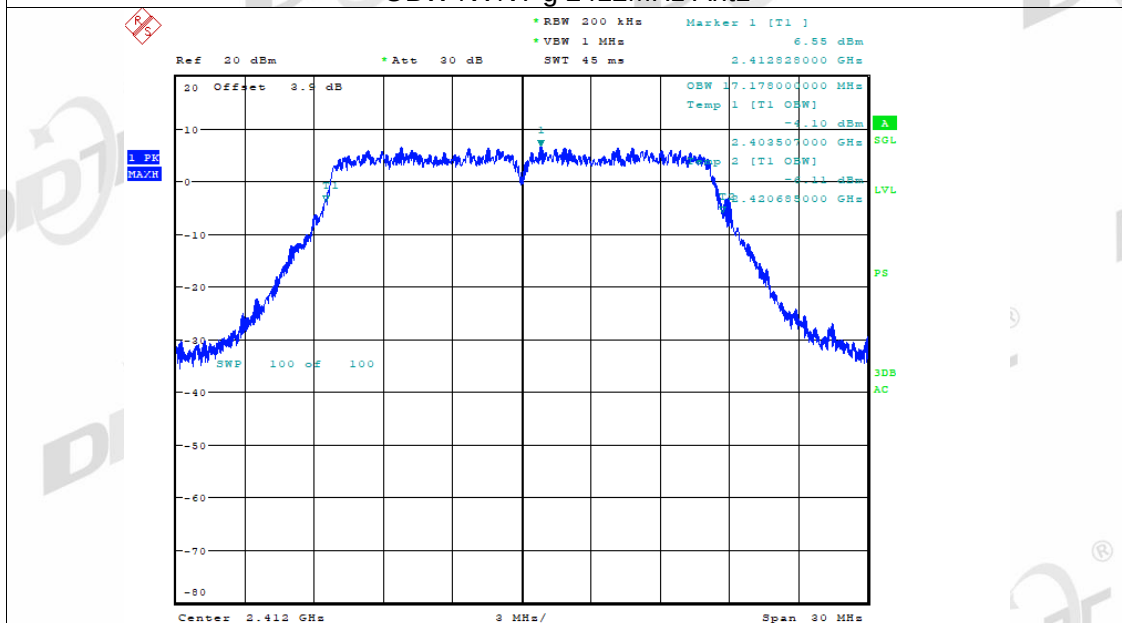
99% Bandwidth





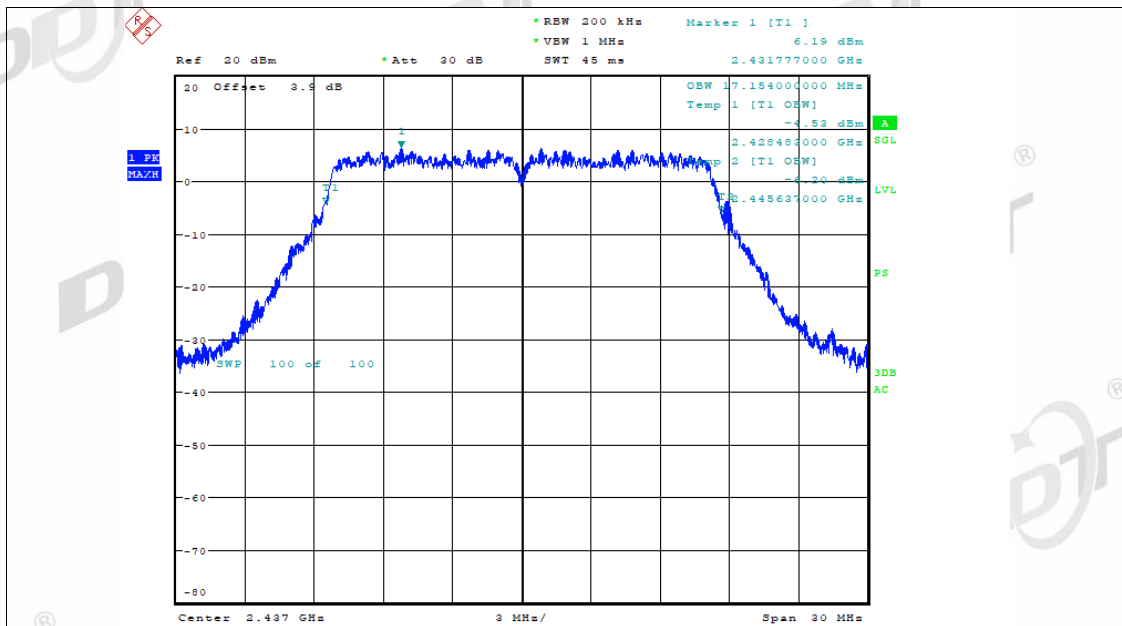
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OBW NVNT g 2412MHz Ant1



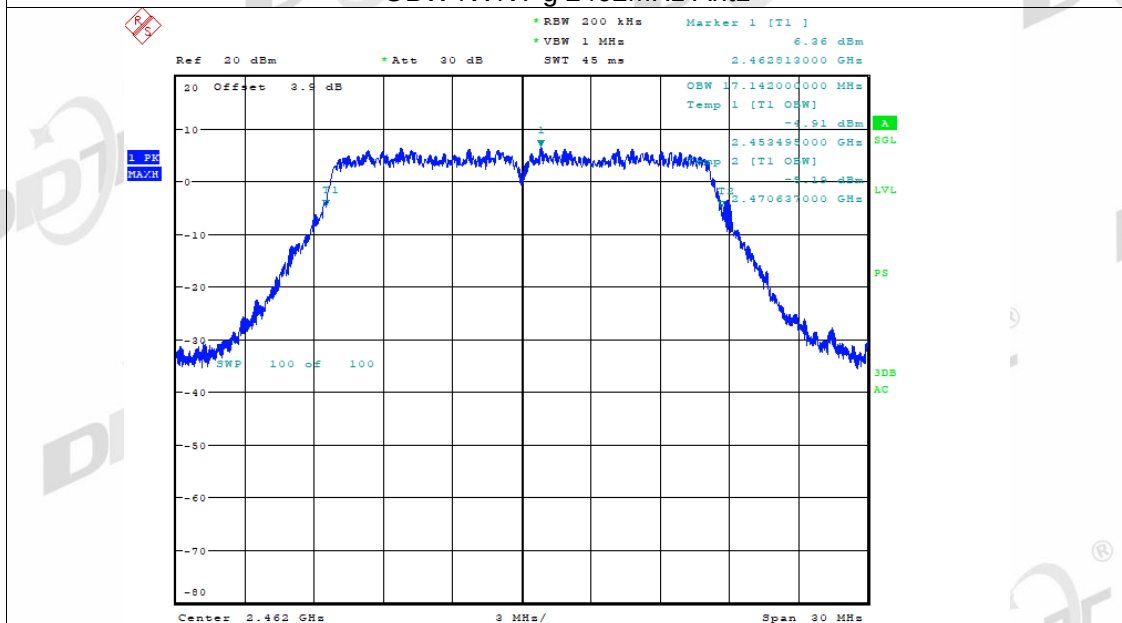
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OBW NVNT g 2437MHz Ant1



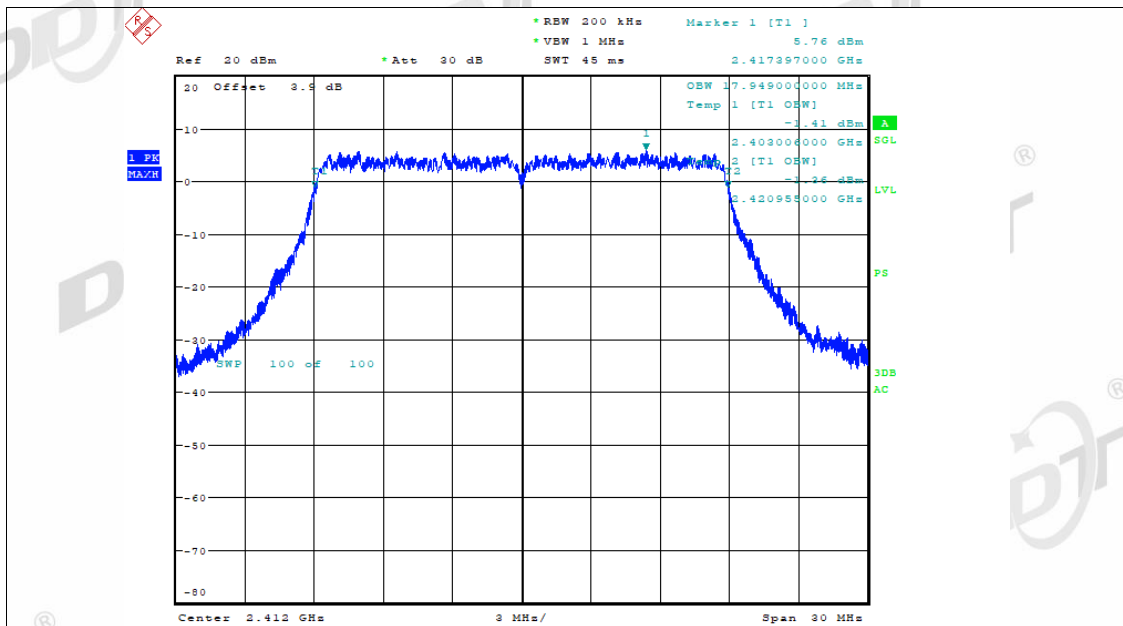
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OBW NVNT g 2462MHz Ant1



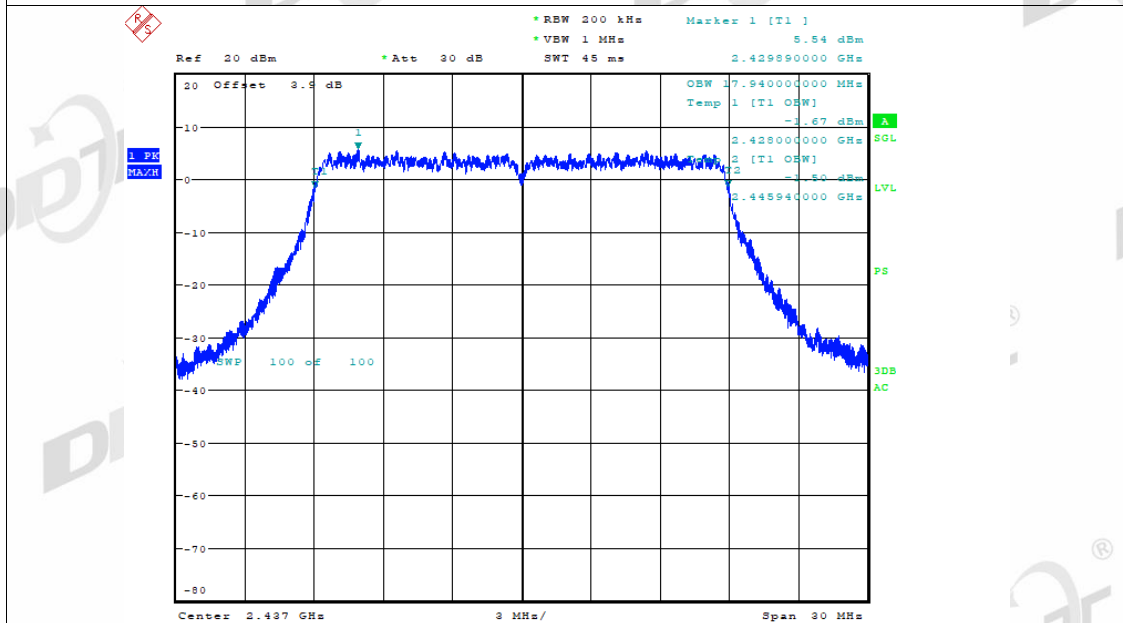
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OBW NVNT n20 2412MHz Ant1



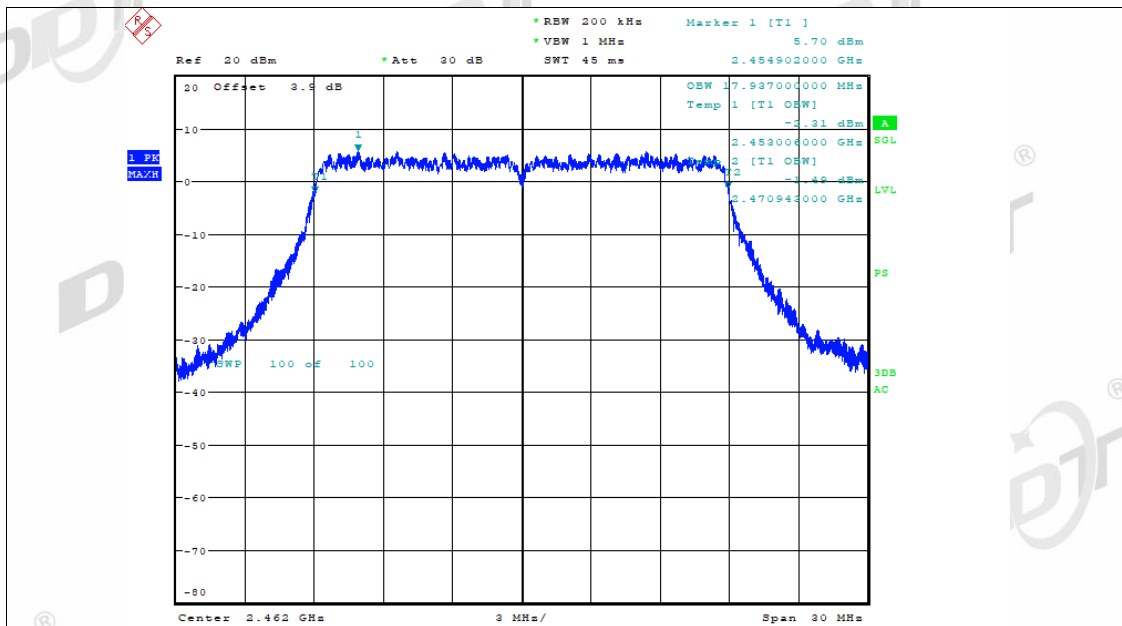
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OBW NVNT n20 2437MHz Ant1



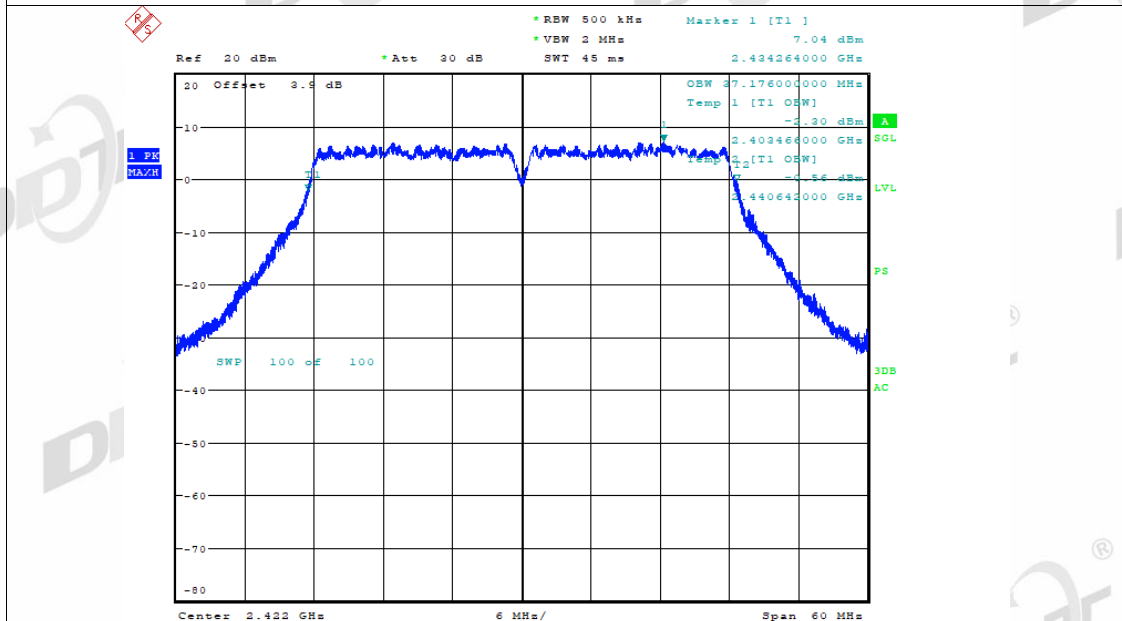
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OBW NVNT n20 2462MHz Ant1



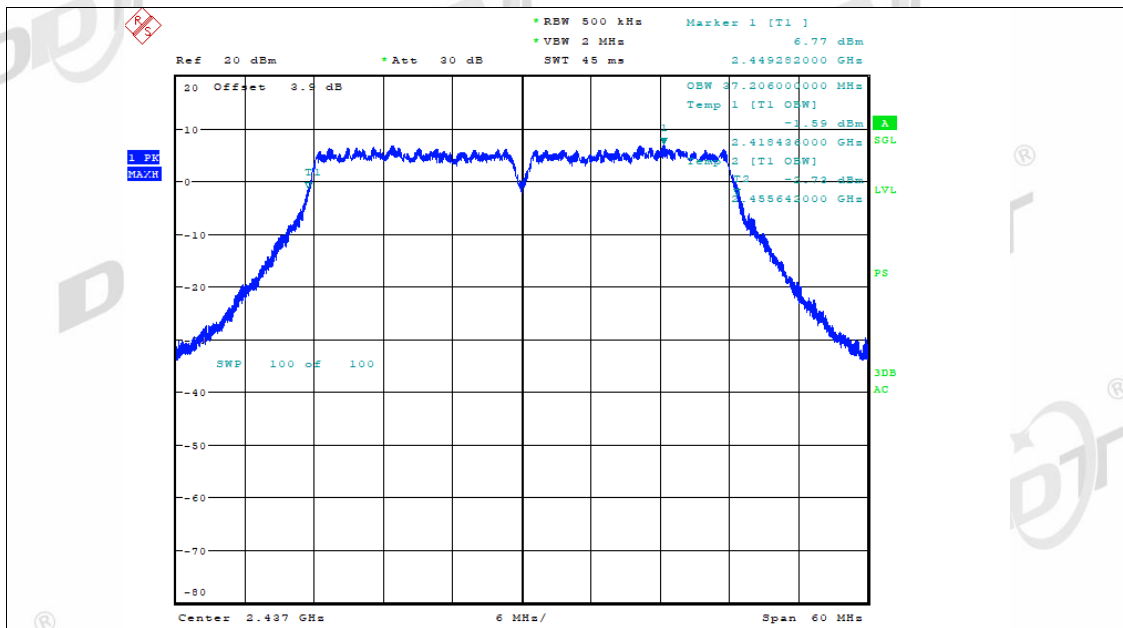
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OBW NVNT n40 2422MHz Ant1



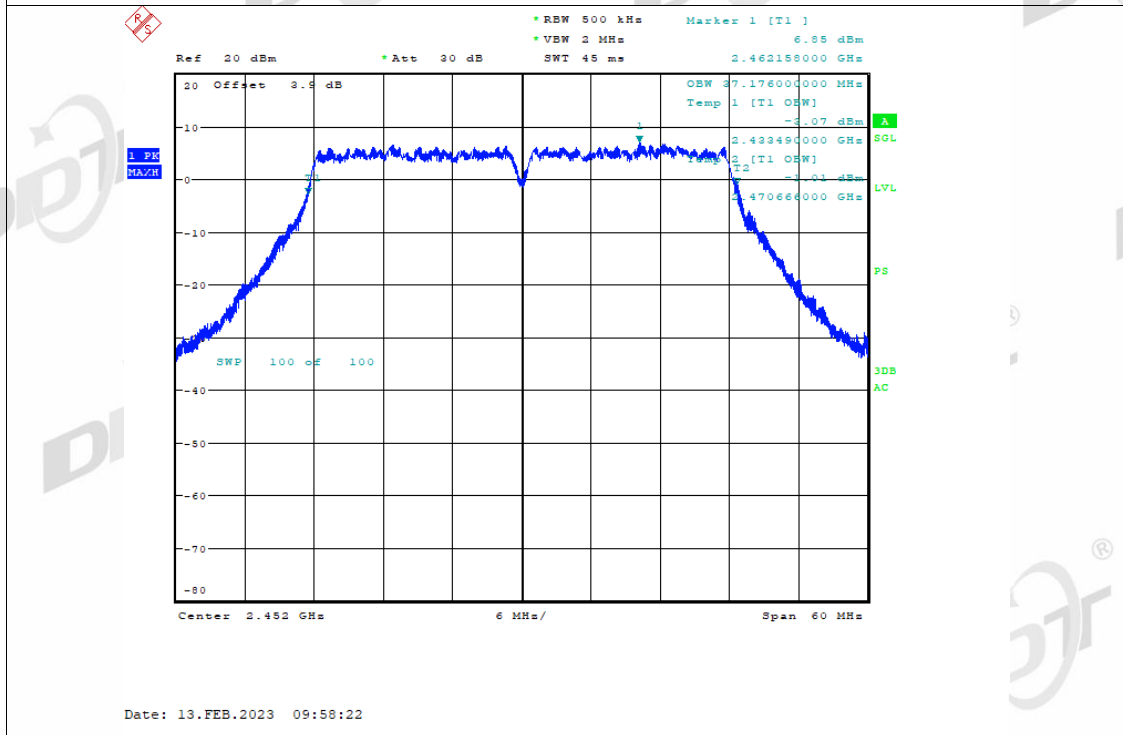
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OBW NVNT n40 2437MHz Ant1



Date: 13.FEB.2023 09:54:39

OBW NVNT n40 2452MHz Ant1



Date: 13.FEB.2023 09:58:22

5. Maximum PK Conducted Output Power

5.1. Block diagram of test setup

Same as section 4.1

5.2. Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3. Test procedure

Connect each EUT's antenna output to power sensor by RF cable and attenuator
Measure the Maximum output power of antenna port by power sensor.

5.4. Test result

Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Verdict
11B	2412	Ant1	20.38	30	22.38	36	Pass
11B	2437	Ant1	20.00	30	22.00	36	Pass
11B	2462	Ant1	19.81	30	21.81	36	Pass
11G	2412	Ant1	20.17	30	22.17	36	Pass
11G	2437	Ant1	19.87	30	21.87	36	Pass
11G	2462	Ant1	19.52	30	21.52	36	Pass
11N20	2412	Ant1	20.03	30	22.03	36	Pass
11N20	2437	Ant1	19.55	30	21.55	36	Pass
11N20	2462	Ant1	19.42	30	21.42	36	Pass
11N40	2422	Ant1	19.76	30	21.76	36	Pass
11N40	2437	Ant1	19.29	30	21.29	36	Pass
11N40	2452	Ant1	19.20	30	21.20	36	Pass

6. Power Spectral Density

6.1. Block diagram of test setup

Same as section 4.1

6.2. Limits

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.

6.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Set the spectrum analyzer as follows:

Center frequency	DTS Channel center frequency
RBW:	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW:	$\geq 3\text{RBW}$
Span	1.5 times the DTS bandwidth
Detector Mode:	peak
Sweep time:	auto
Trace mode	Max hold

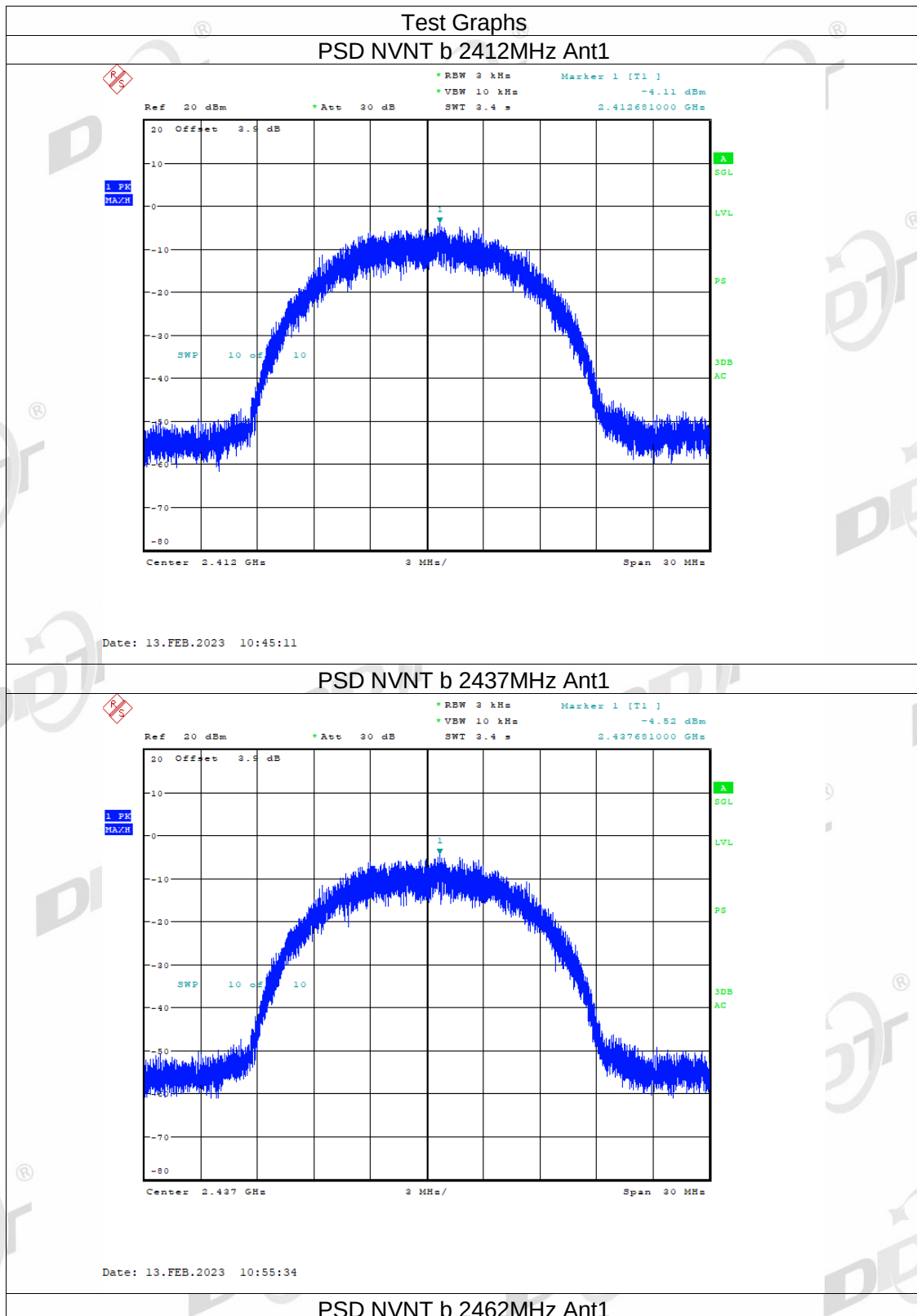
(3) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.

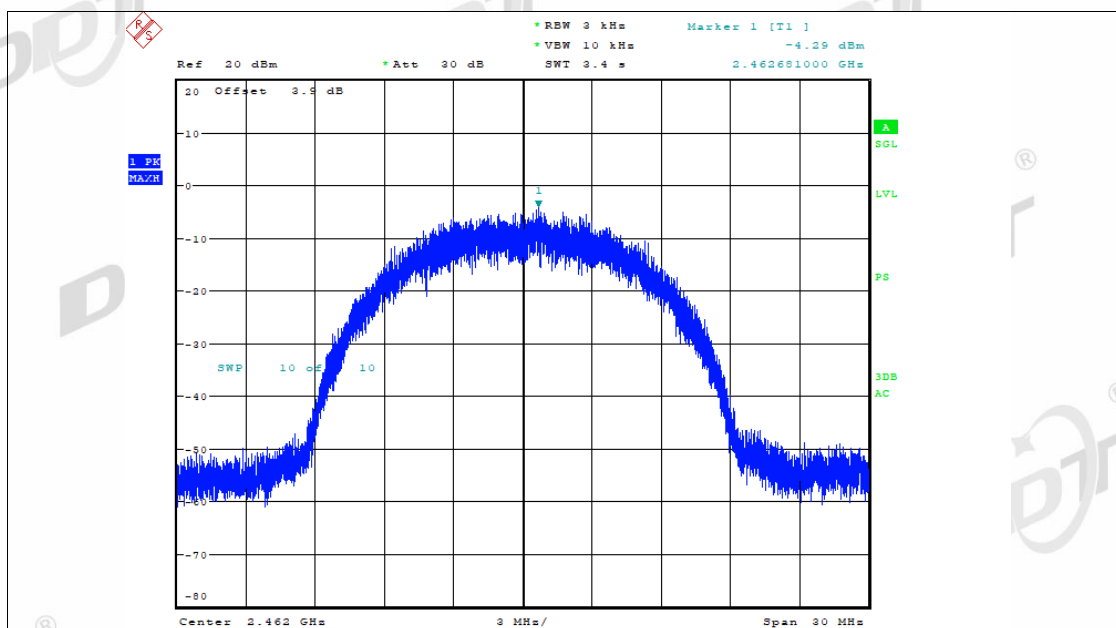
(4) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.4. Test result

Test Mode	Test Channel	Ant	PSD (dBm/3kHz)	Limit(dBm/3kHz)	Verdict
11B	2412	Ant1	-4.11	8.00	Pass
11B	2437	Ant1	-4.52	8.00	Pass
11B	2462	Ant1	-4.29	8.00	Pass
11G	2412	Ant1	-12.04	8.00	Pass
11G	2437	Ant1	-12.14	8.00	Pass
11G	2462	Ant1	-12.21	8.00	Pass
11N20	2412	Ant1	-12.28	8.00	Pass
11N20	2437	Ant1	-12.24	8.00	Pass
11N20	2462	Ant1	-12.24	8.00	Pass
11N40	2422	Ant1	-13.66	8.00	Pass
11N40	2437	Ant1	-13.95	8.00	Pass
11N40	2452	Ant1	-14.42	8.00	Pass

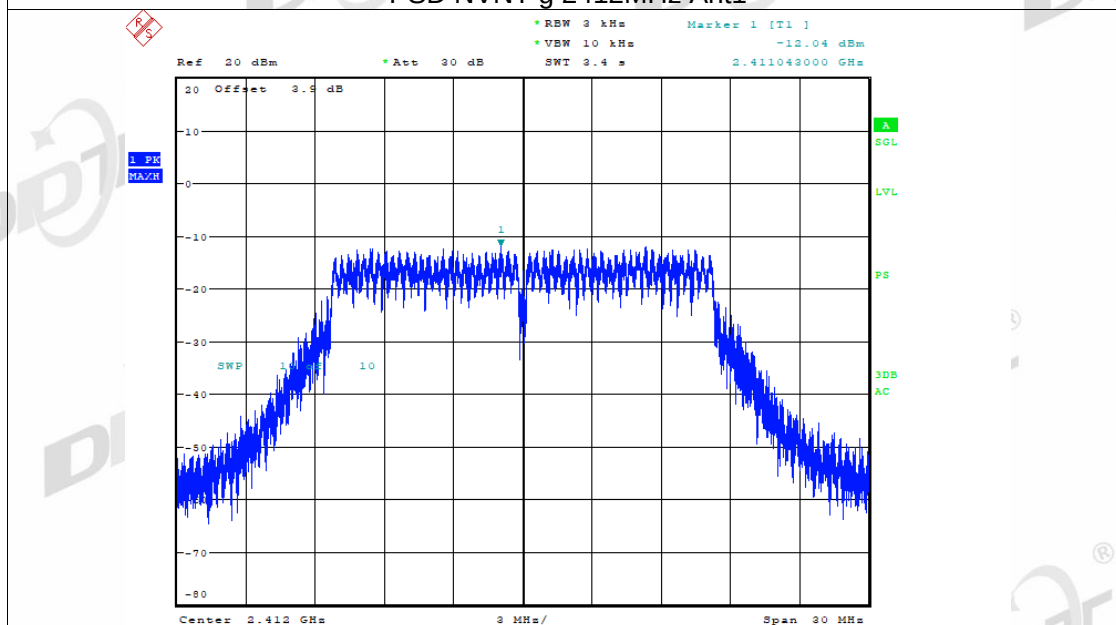
6.5. original test data





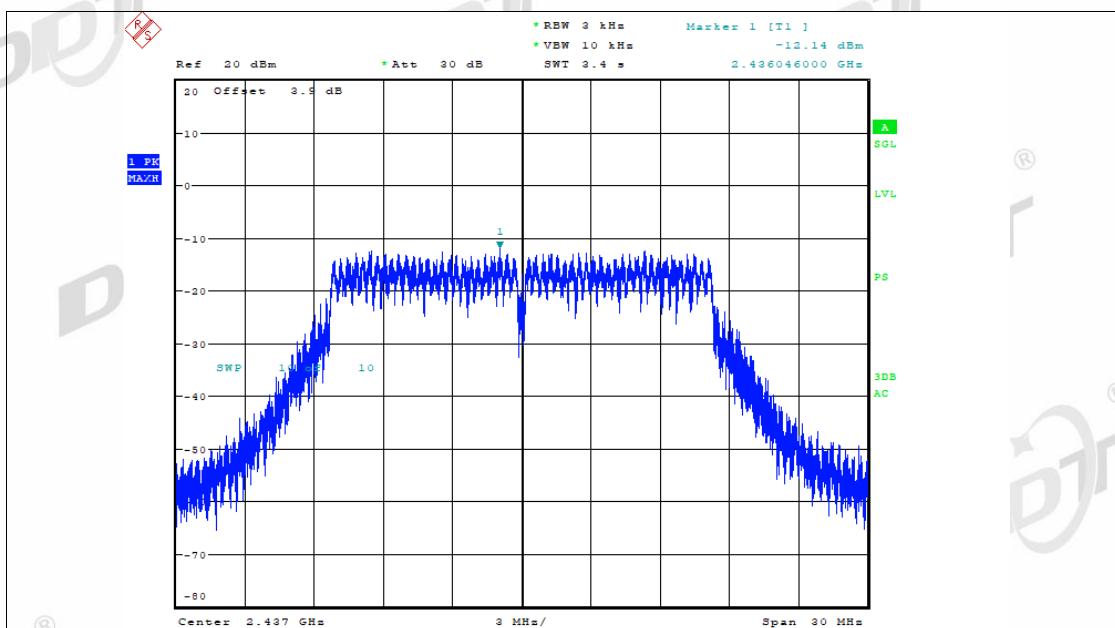
Date: 13.FEB.2023 11:01:14

PSD NVNT g 2412MHz Ant1



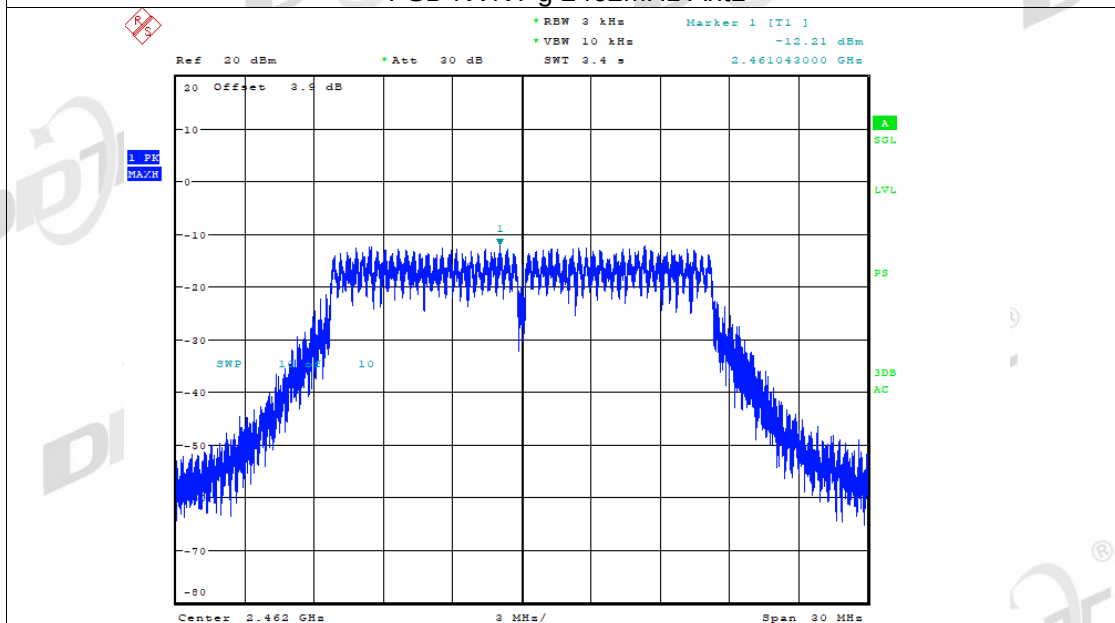
Date: 13.FEB.2023 10:24:12

PSD NVNT g 2437MHz Ant1



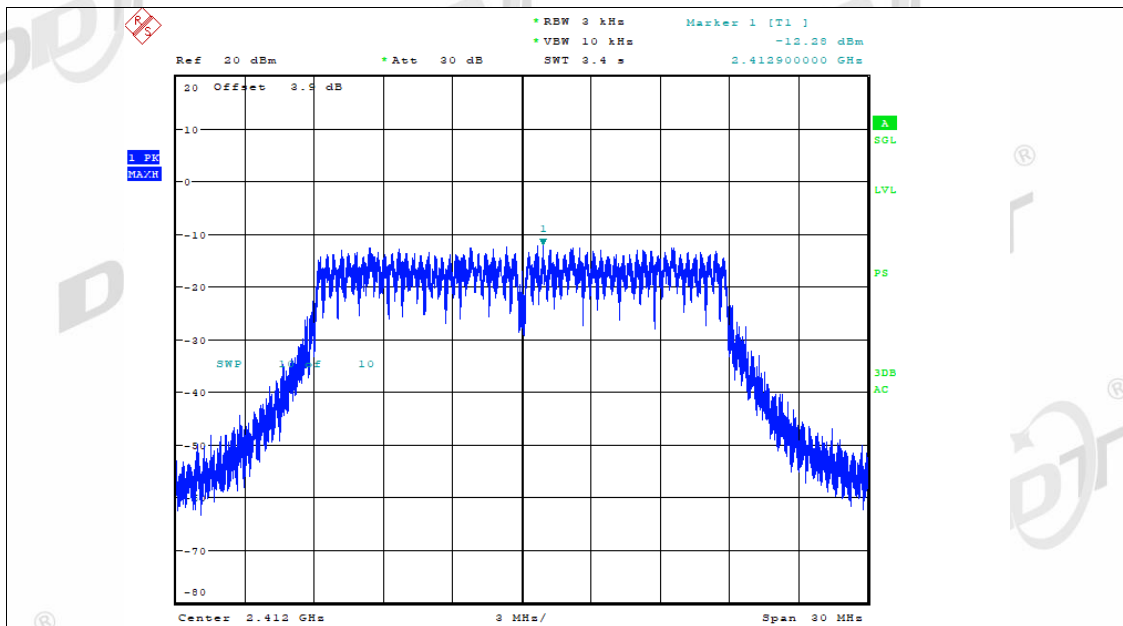
Date: 13.FEB.2023 10:32:54

PSD NVNT g 2462MHz Ant1



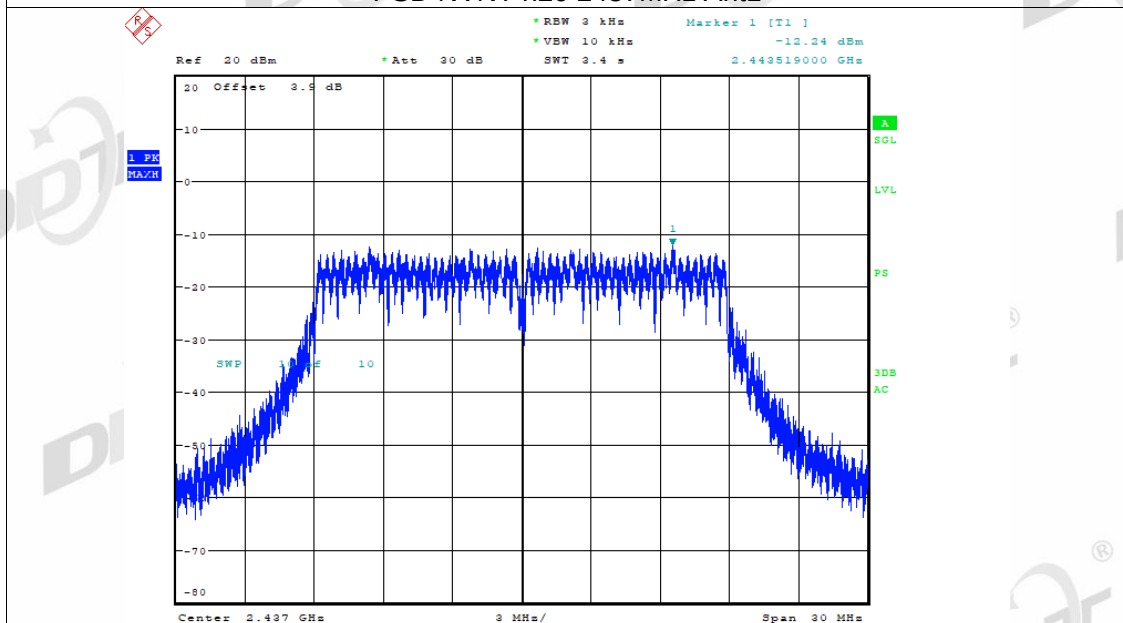
Date: 13.FEB.2023 10:39:18

PSD NVNT n20 2412MHz Ant1



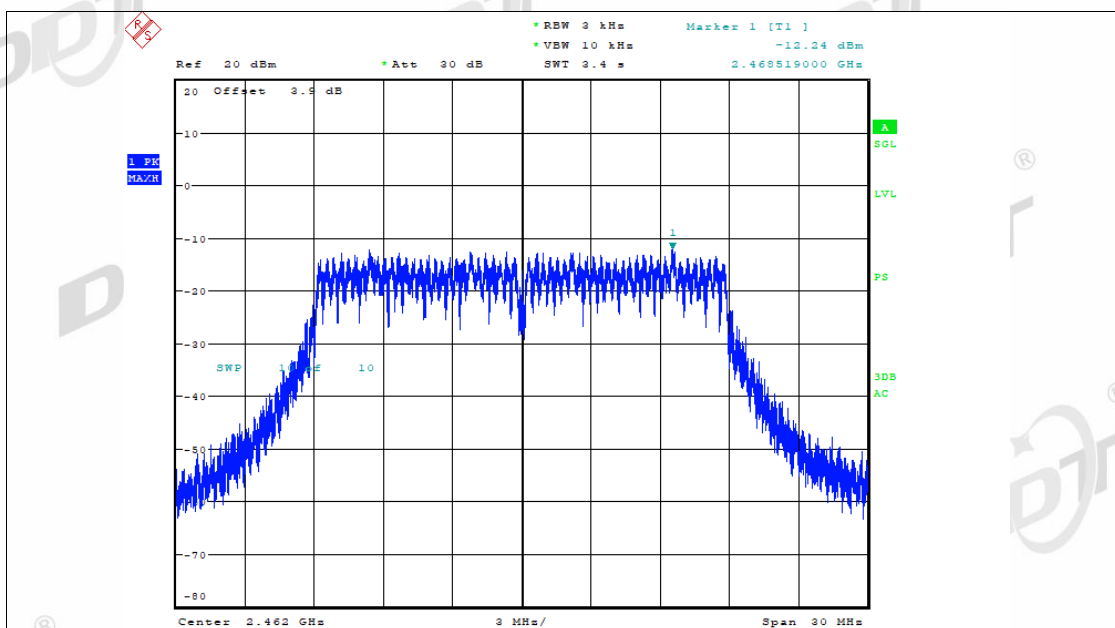
Date: 13.FEB.2023 10:04:58

PSD NVNT n20 2437MHz Ant1



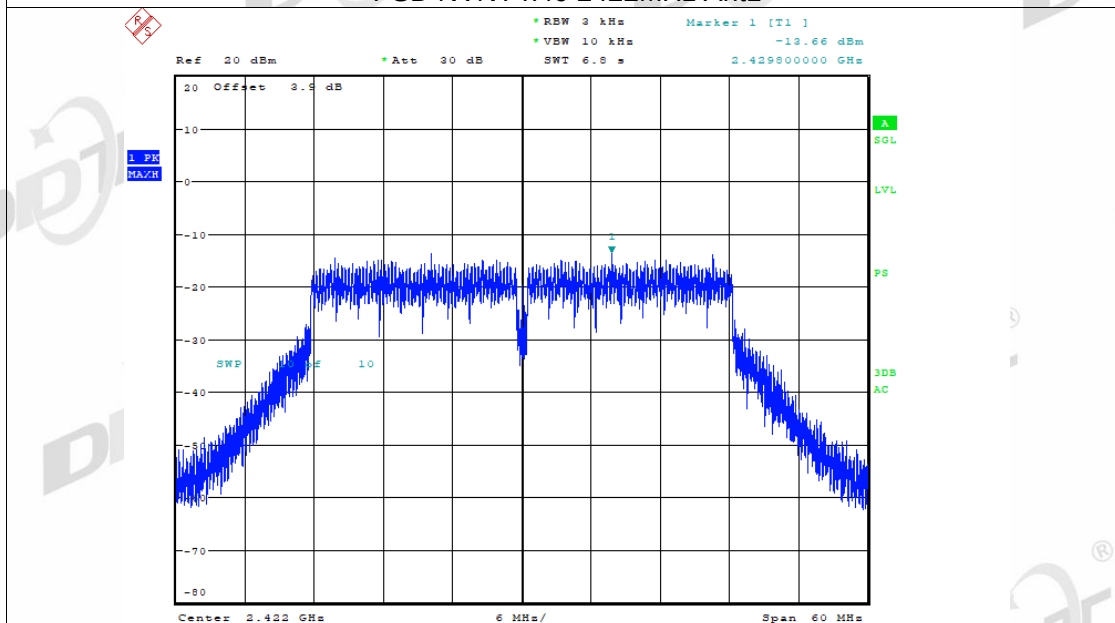
Date: 13.FEB.2023 10:09:39

PSD NVNT n20 2462MHz Ant1



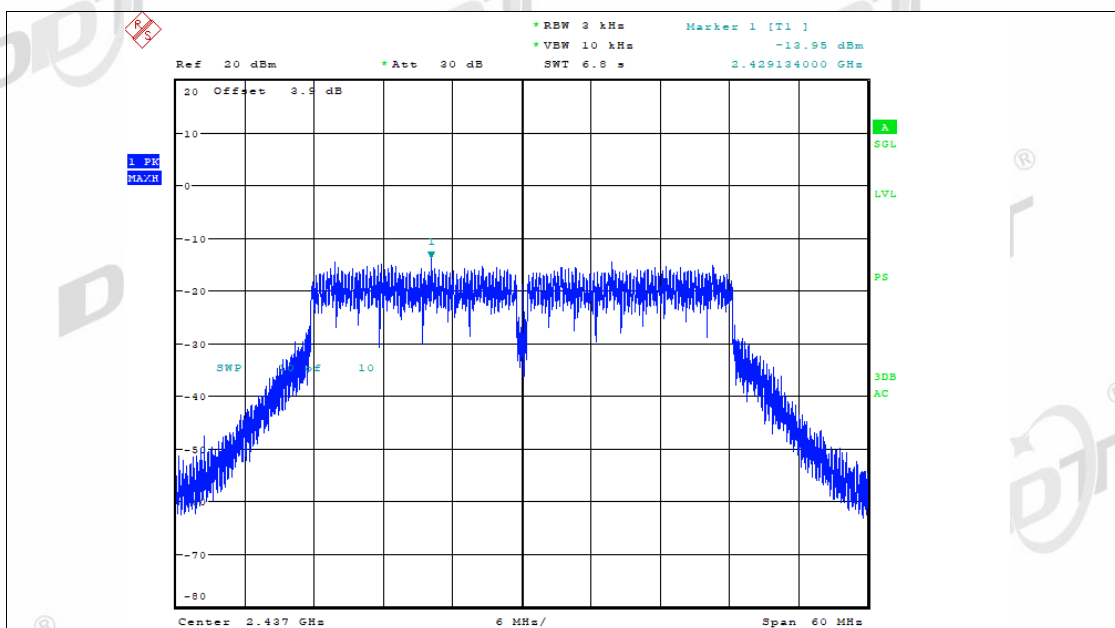
Date: 13.FEB.2023 10:17:25

PSD NVNT n40 2422MHz Ant1



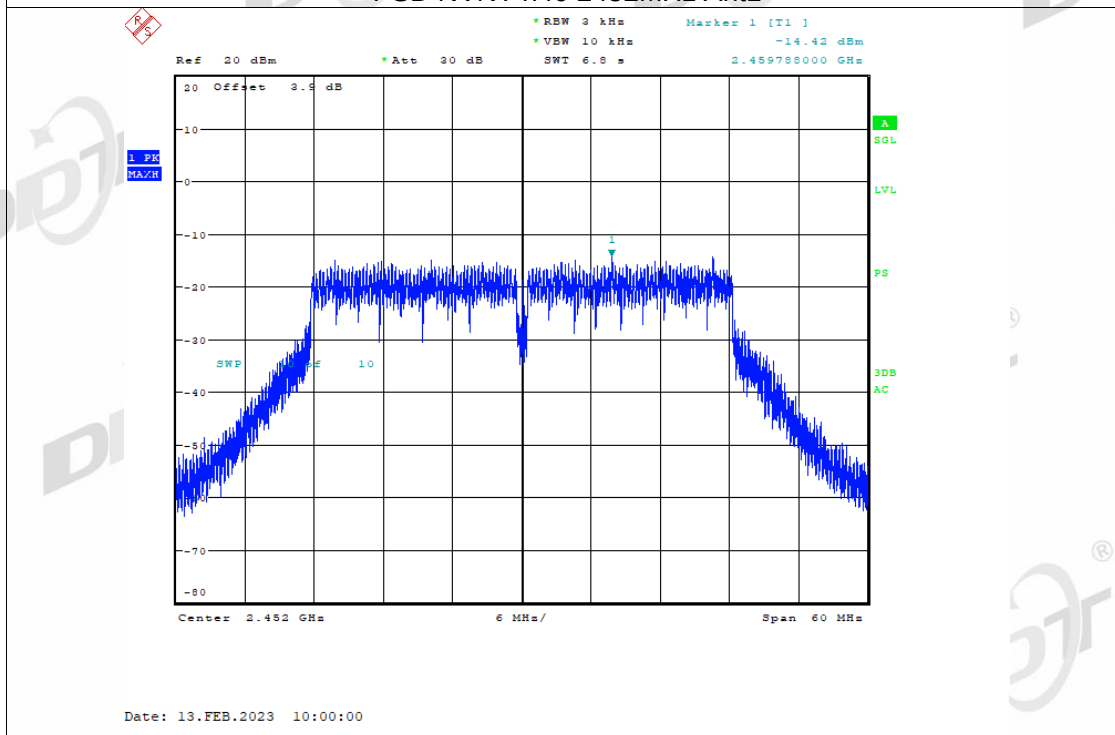
Date: 13.FEB.2023 09:51:52

PSD NVNT n40 2437MHz Ant1



Date: 13.FEB.2023 09:56:17

PSD NVNT n40 2452MHz Ant1



Date: 13.FEB.2023 10:00:00

7. Band Edge Compliance (Conducted Method)

7.1. Block diagram of test setup

Same as section 4.1

7.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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.

7.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

Center frequency	DTS Channel center frequency
RBW:	100 kHz
VBW:	300 kHz
Span	1.5 times the DTS bandwidth
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Set the spectrum analyzer as follows:

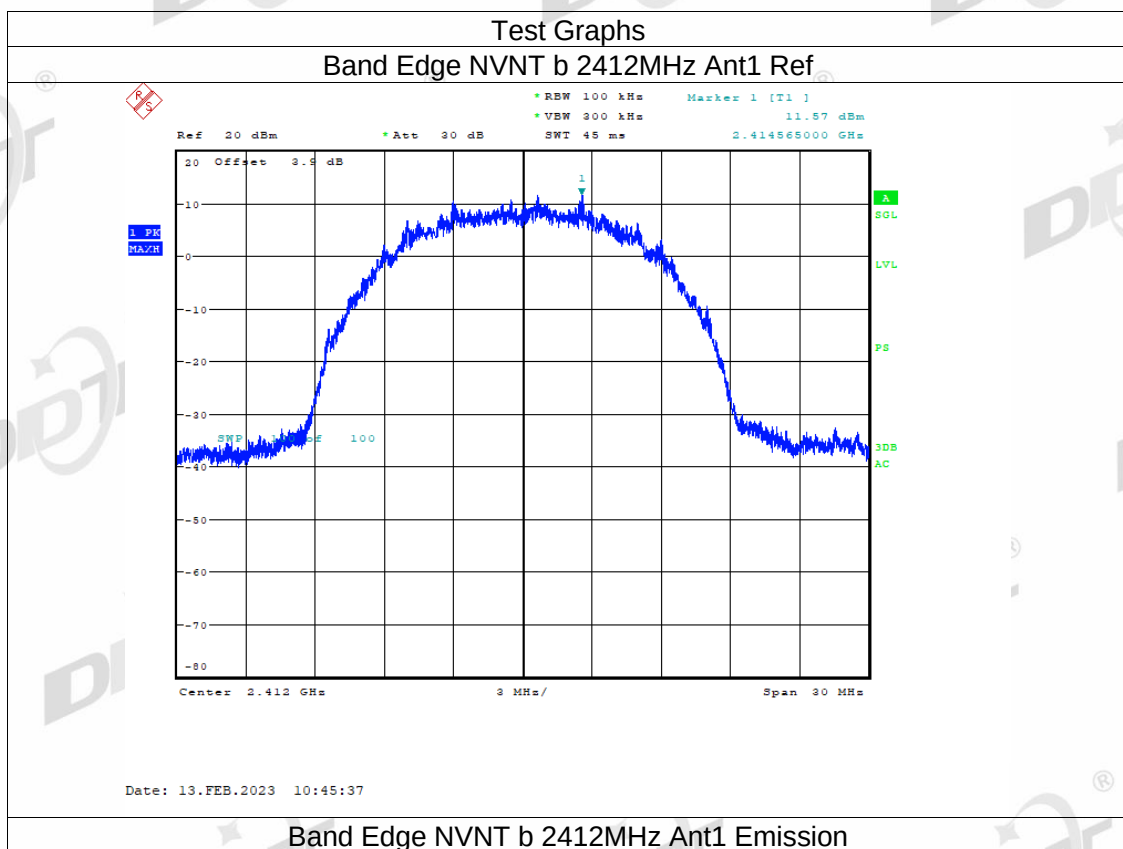
RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Number of measurement points	$\geq \text{span/RBW}$
Detector Mode:	Peak
Sweep time:	auto
Trace mode	Max hold

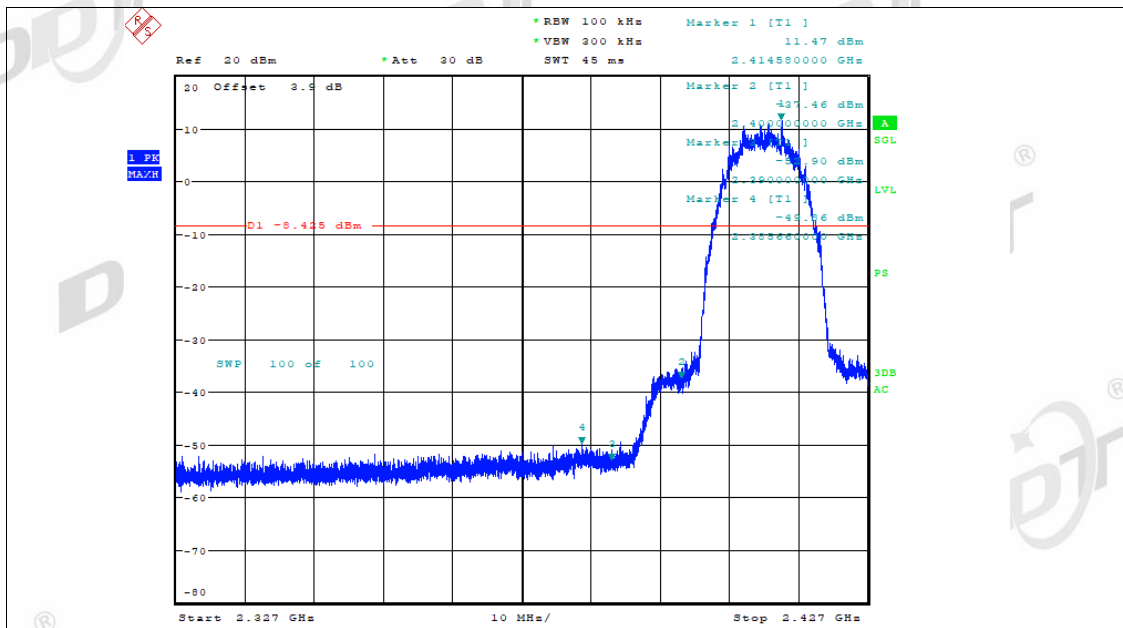
(5) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

7.4. Test result

EUT Set Mode	CH or Frequency	Ant1 Result (dBm)	EUT Set Mode	CH or Frequency	Ant1 Result (dBm)
11b	CH1	Pass	11n HT 20	CH1	Pass
	CH11	Pass		CH11	Pass
11g	CH1	Pass	11n HT 40	CH3	Pass
	CH11	Pass		CH9	Pass

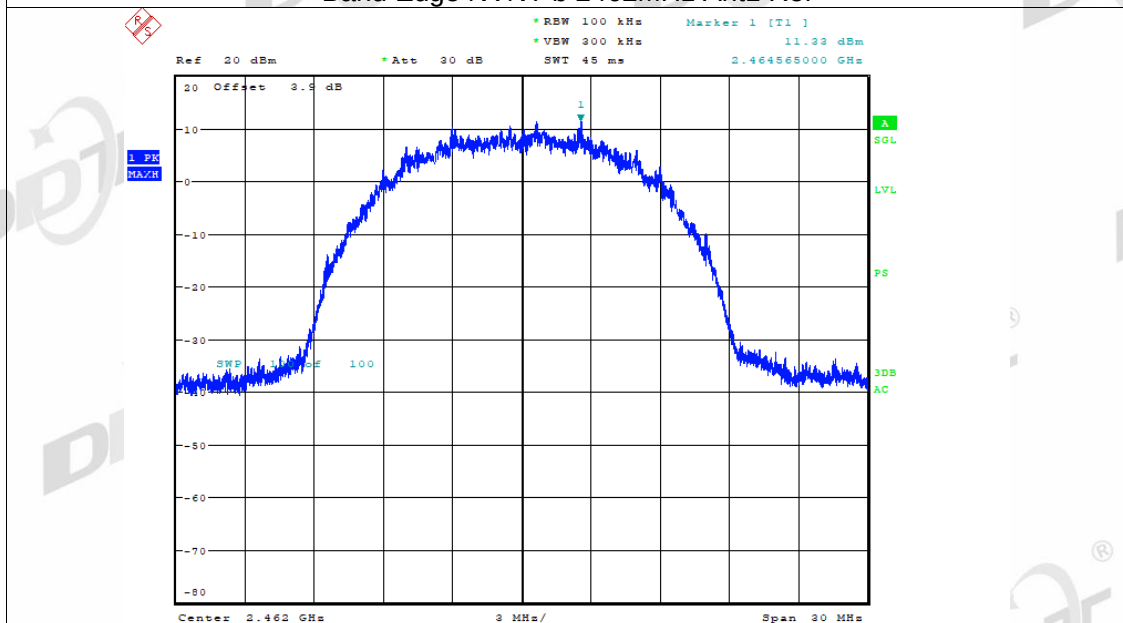
7.5. original test data





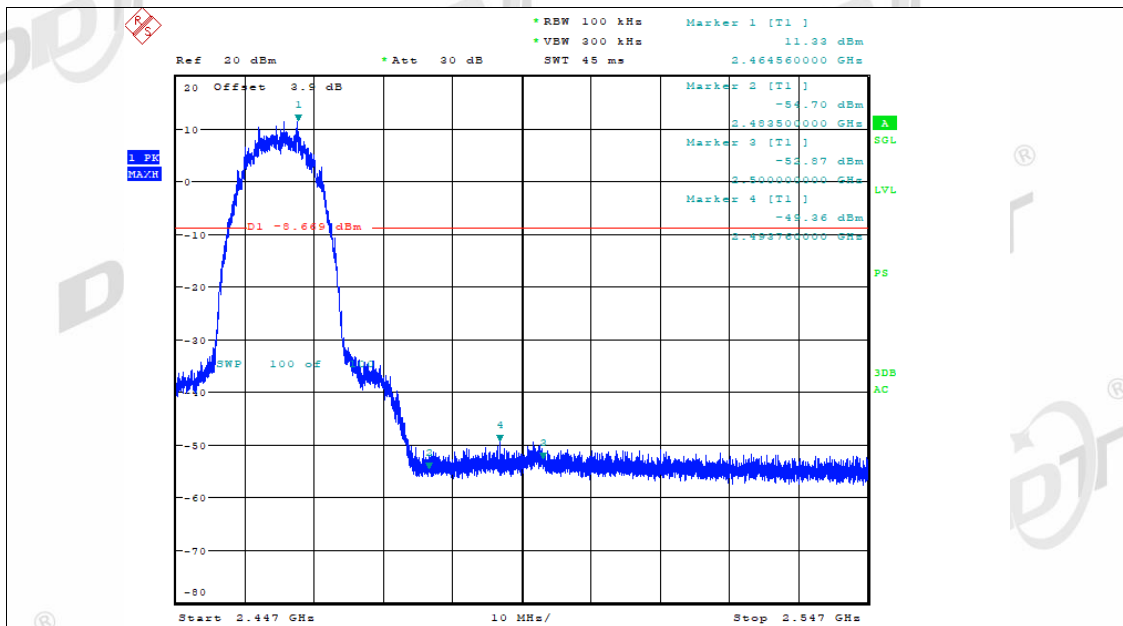
Date: 13.FEB.2023 10:45:56

Band Edge NVNT b 2462MHz Ant1 Ref



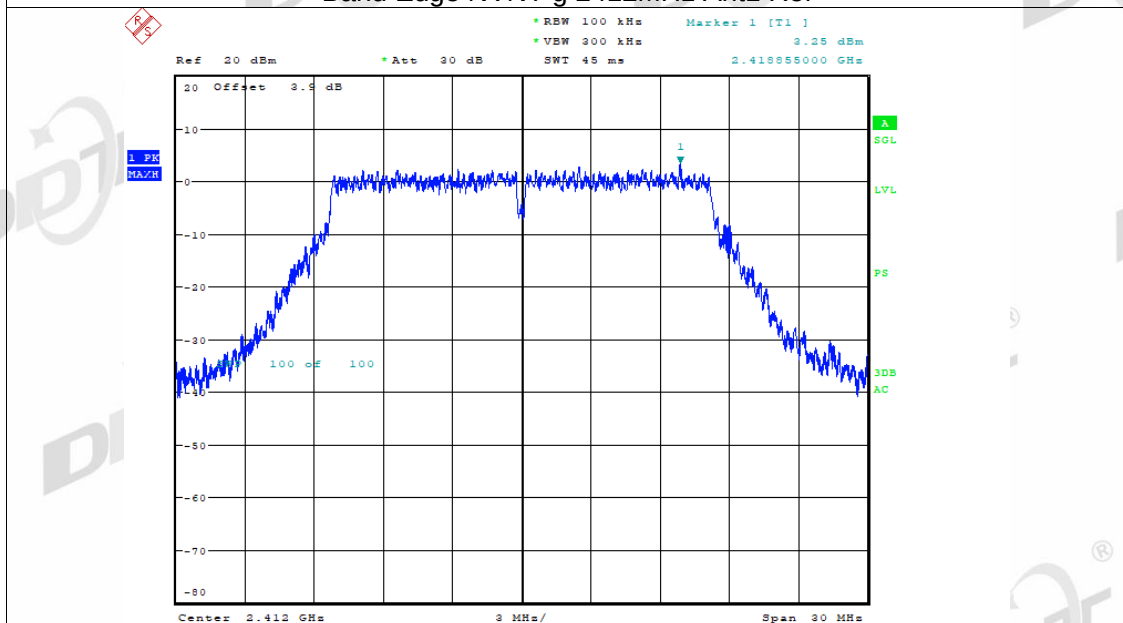
Date: 13.FEB.2023 11:01:42

Band Edge NVNT b 2462MHz Ant1 Emission



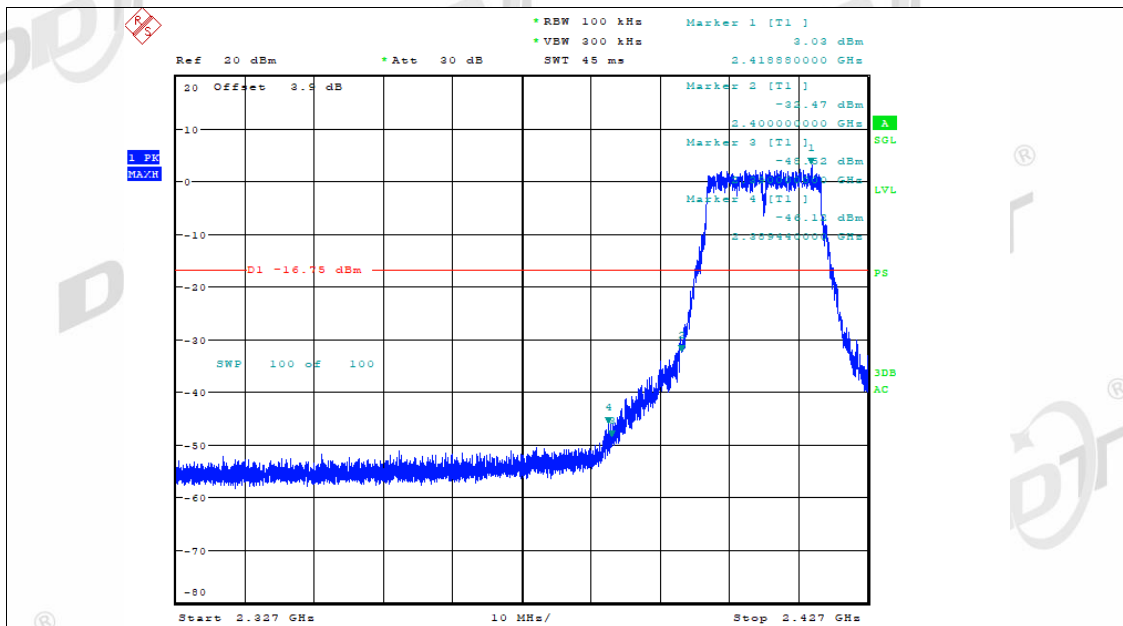
Date: 13.FEB.2023 11:02:01

Band Edge NVNT g 2412MHz Ant1 Ref



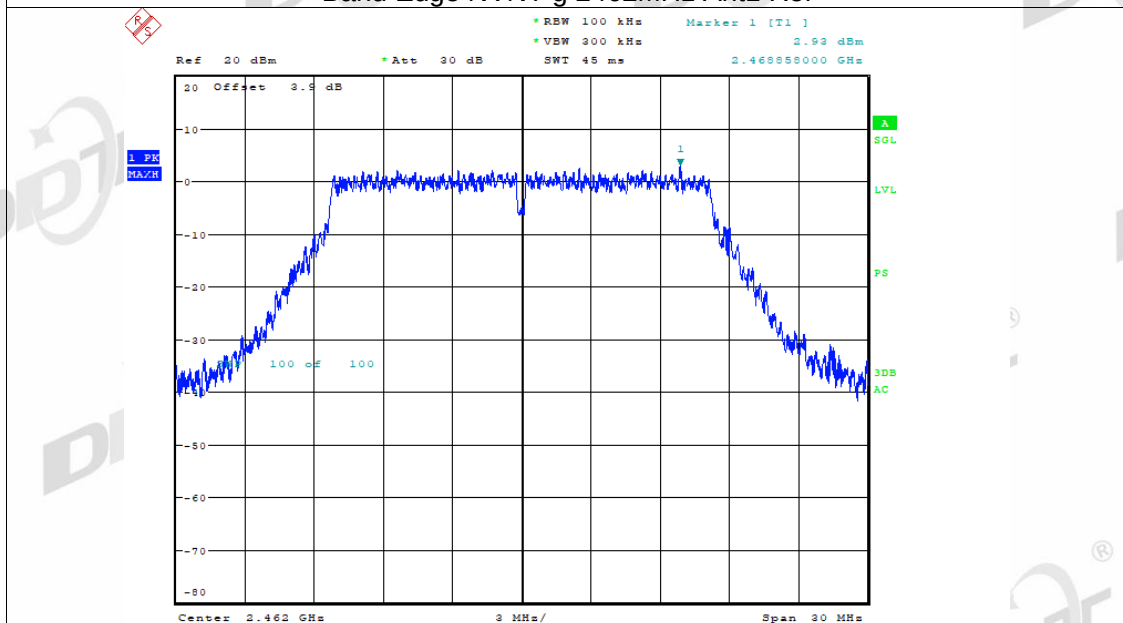
Date: 13.FEB.2023 10:24:37

Band Edge NVNT g 2412MHz Ant1 Emission



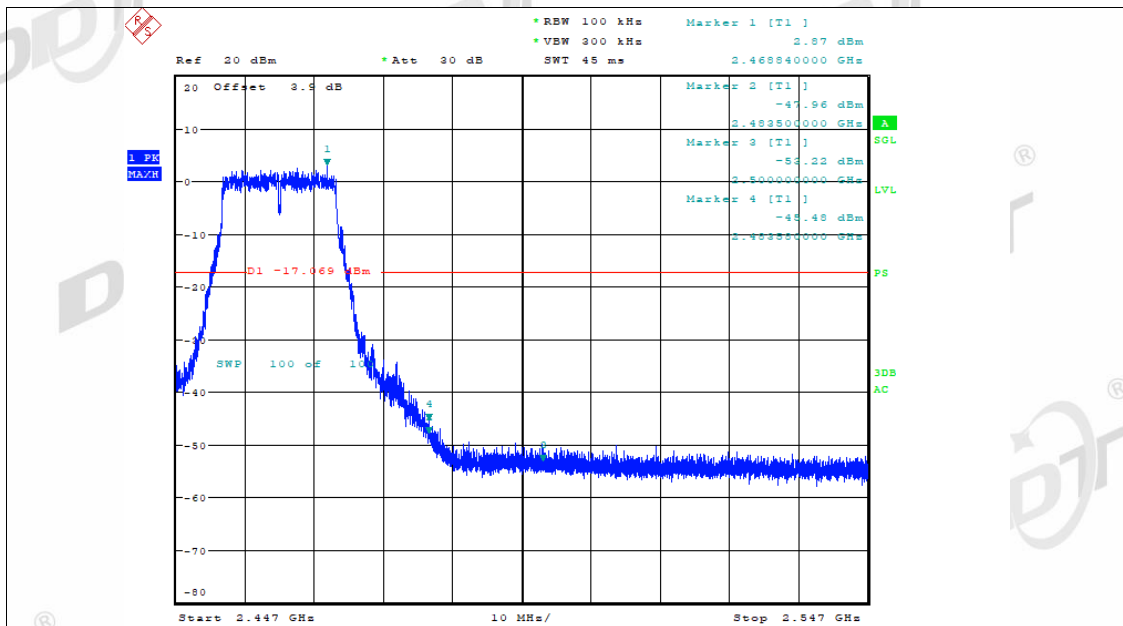
Date: 13.FEB.2023 10:24:56

Band Edge NVNT g 2462MHz Ant1 Ref



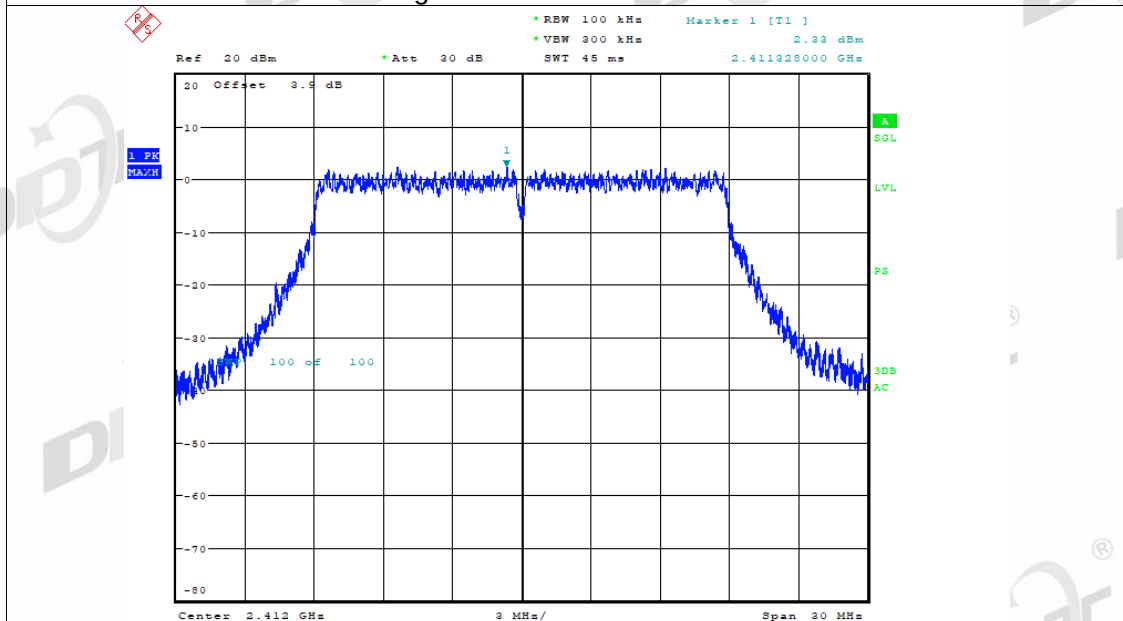
Date: 13.FEB.2023 10:39:44

Band Edge NVNT g 2462MHz Ant1 Emission



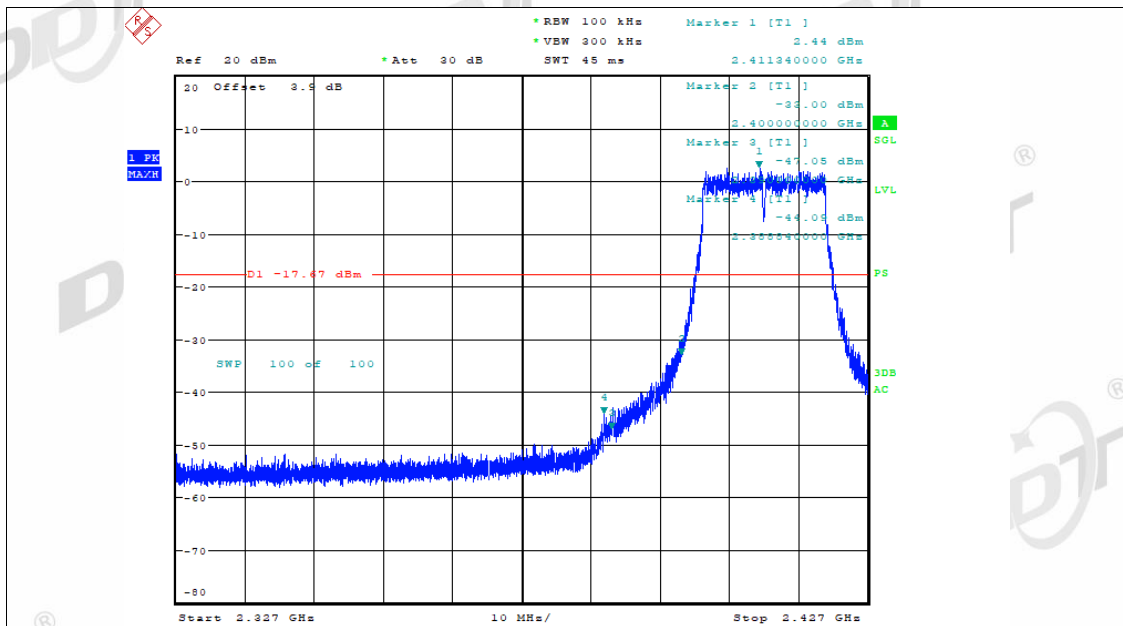
Date: 13.FEB.2023 10:40:03

Band Edge NVNT n20 2412MHz Ant1 Ref



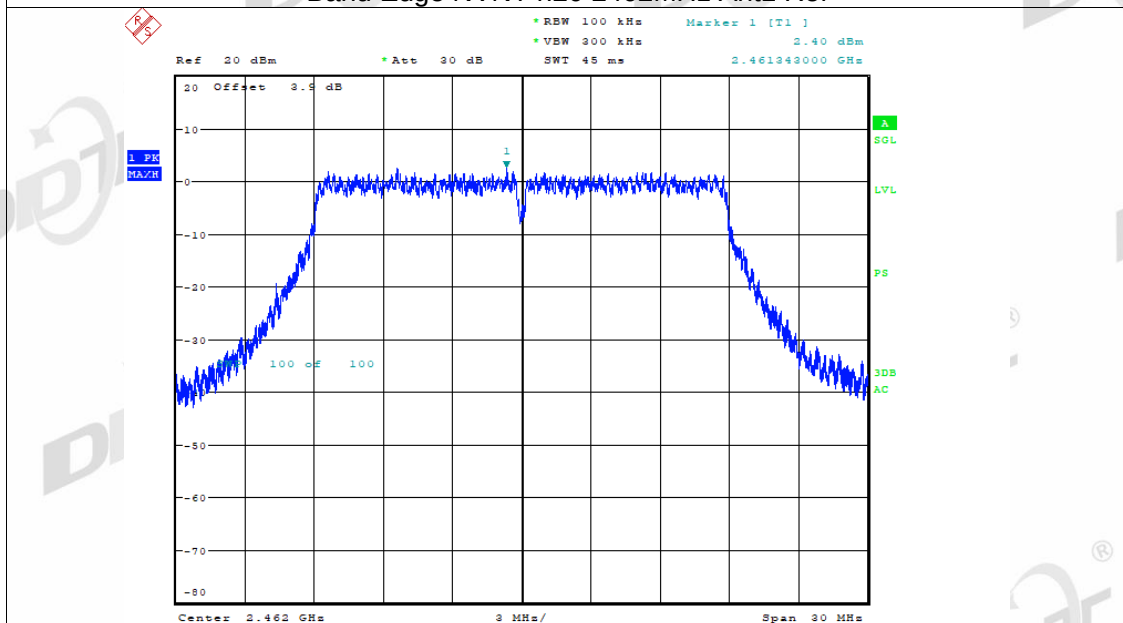
Date: 13.FEB.2023 10:05:23

Band Edge NVNT n20 2412MHz Ant1 Emission



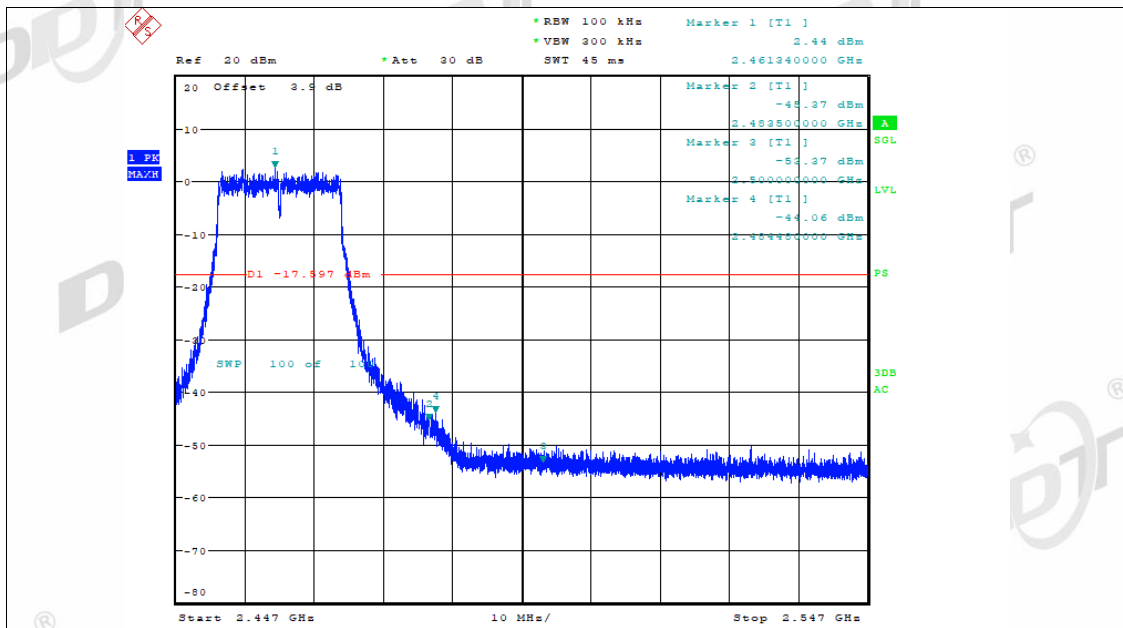
Date: 13.FEB.2023 10:05:42

Band Edge NVNT n20 2462MHz Ant1 Ref



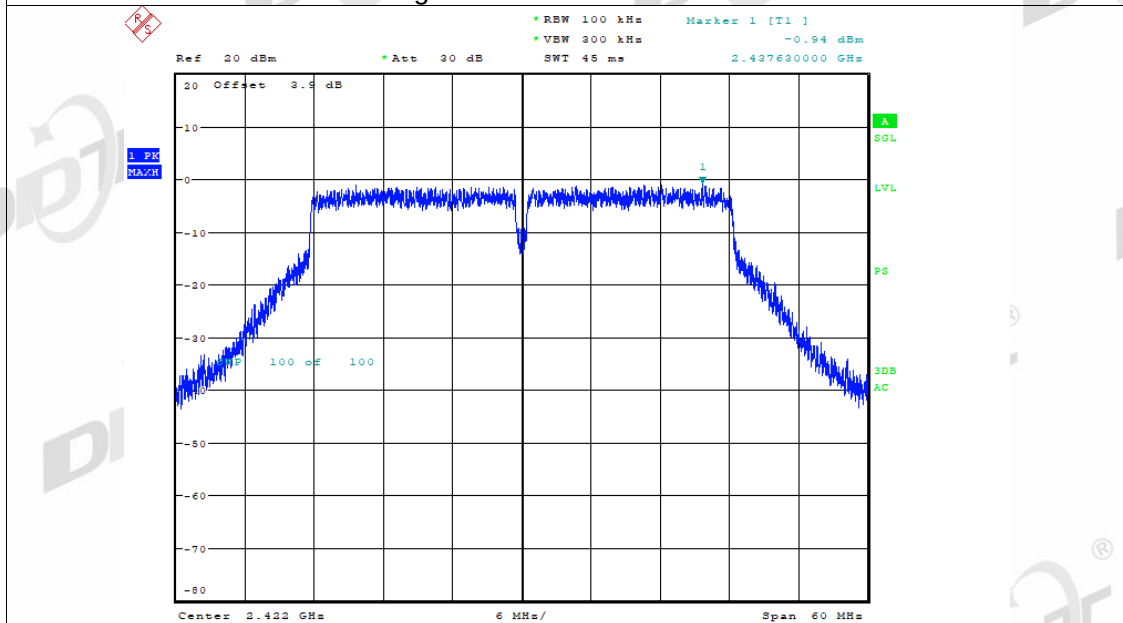
Date: 13.FEB.2023 10:17:50

Band Edge NVNT n20 2462MHz Ant1 Emission



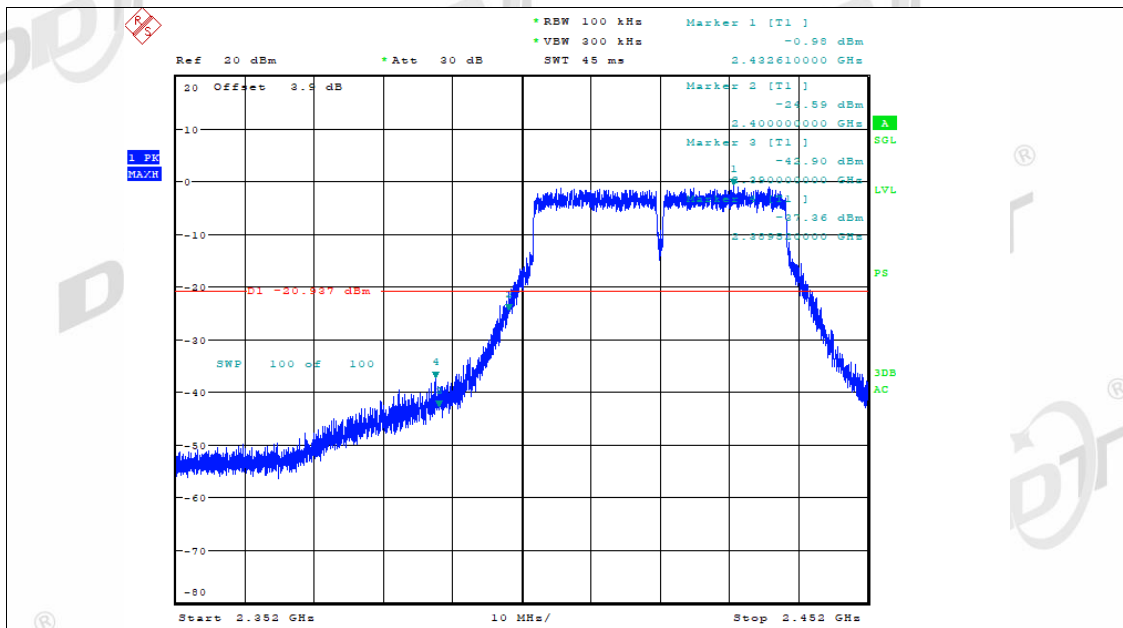
Date: 13.FEB.2023 10:18:09

Band Edge NVNT n40 2422MHz Ant1 Ref



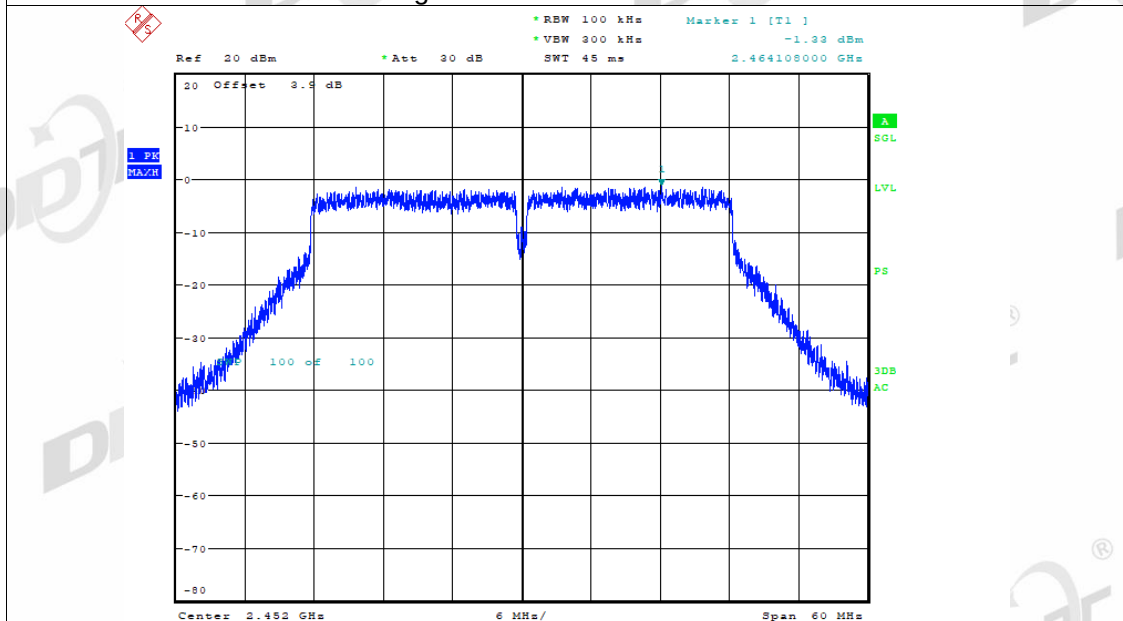
Date: 13.FEB.2023 09:52:13

Band Edge NVNT n40 2422MHz Ant1 Emission



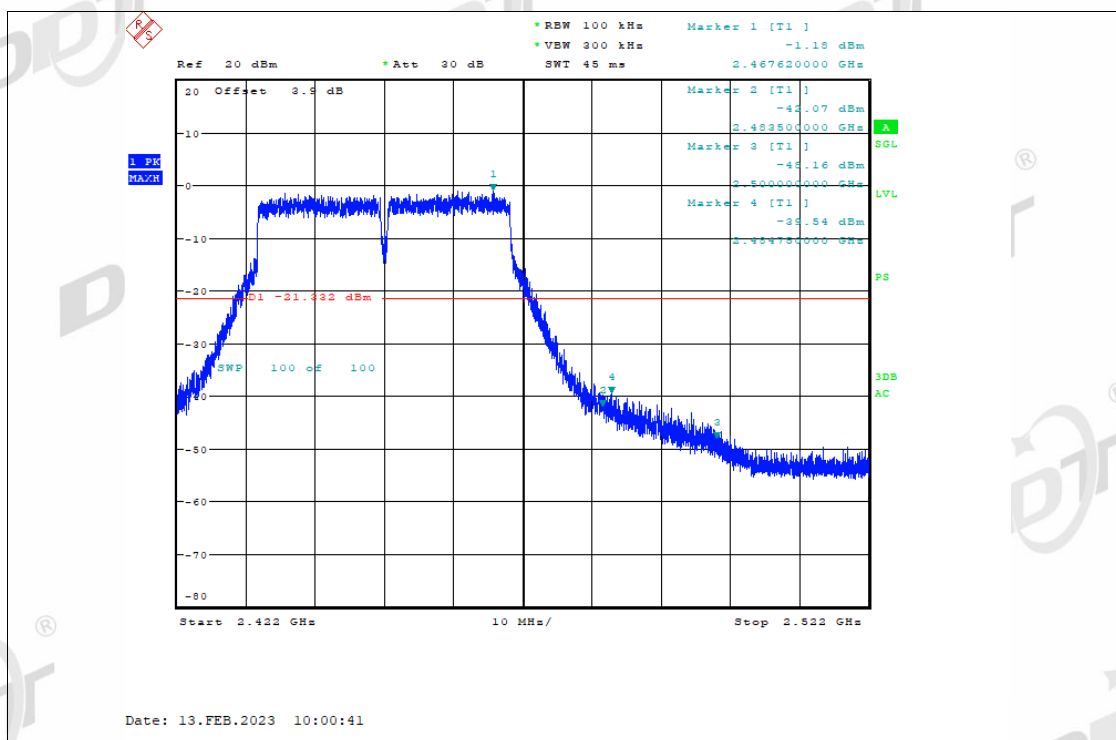
Date: 13.FEB.2023 09:52:32

Band Edge NVNT n40 2452MHz Ant1 Ref



Date: 13.FEB.2023 10:00:22

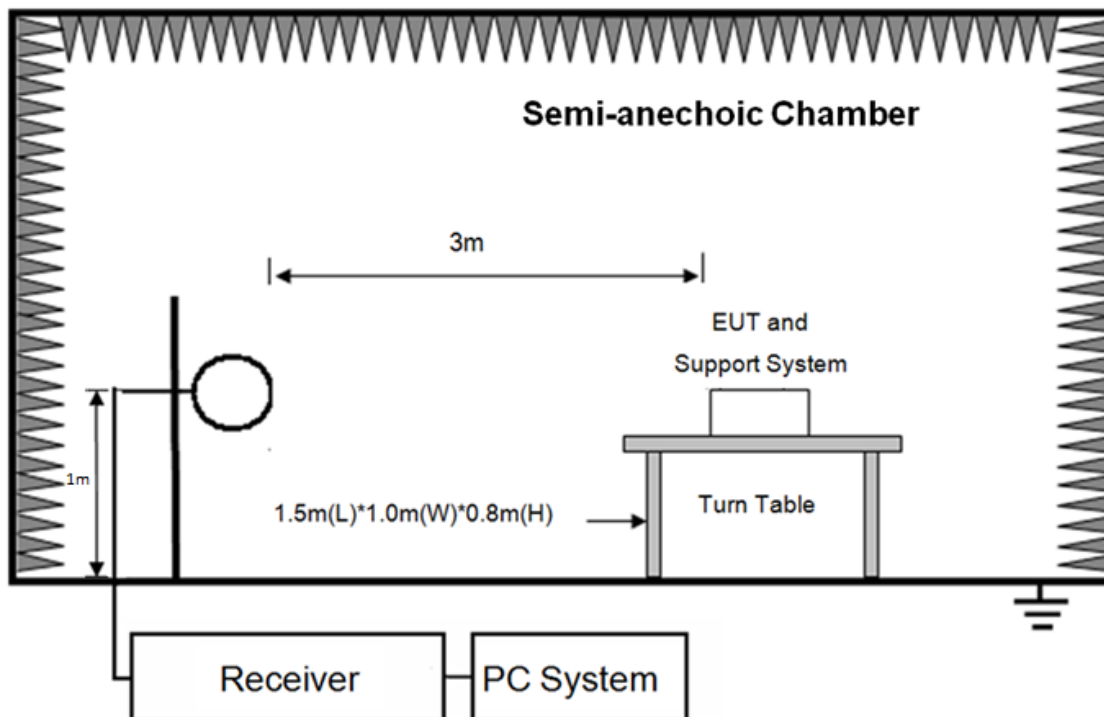
Band Edge NVNT n40 2452MHz Ant1 Emission



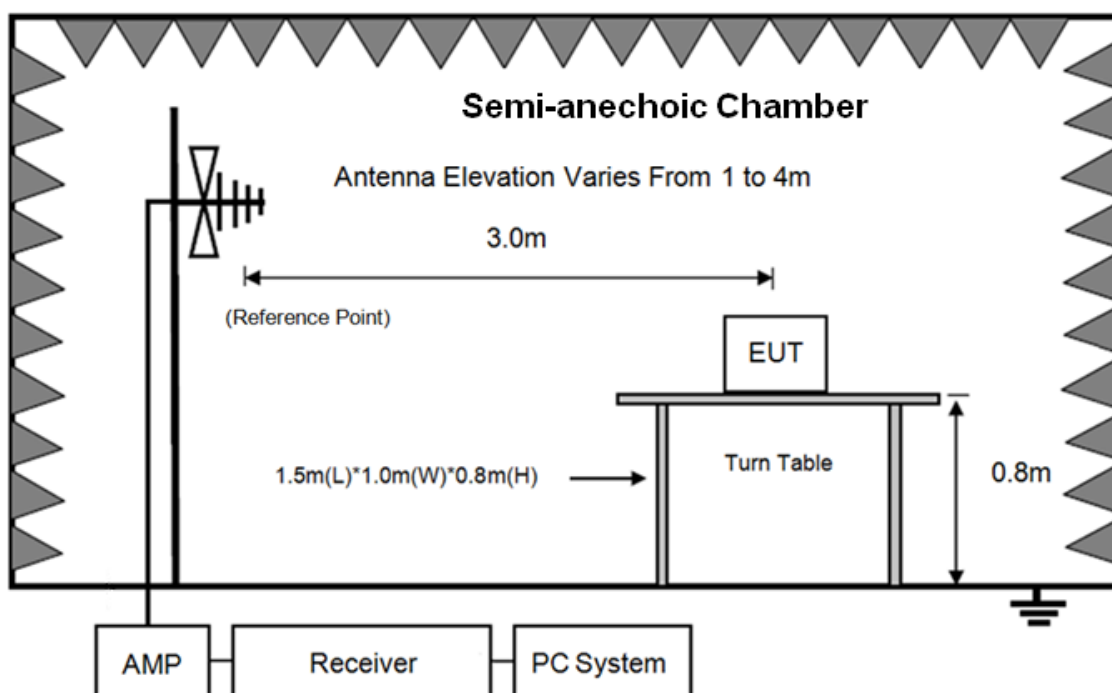
8. Radiated Spurious Emissions

8.1. Block diagram of test setup

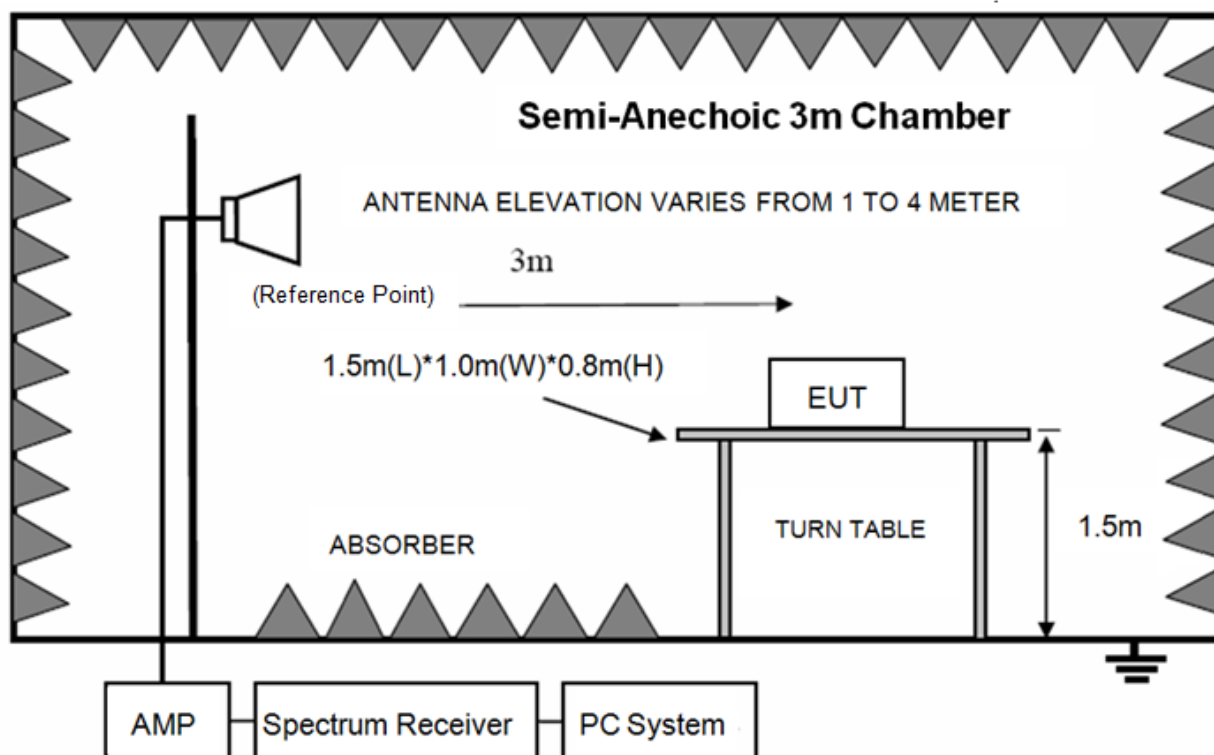
In 3 m Anechoic Chamber, test setup diagram for 9 kHz - 30 MHz:



In 3 m Anechoic Chamber, test setup diagram for 30 MHz – 1 GHz:



In 3 m Anechoic Chamber, test setup diagram for frequency above 1 GHz:



Note: For harmonic emissions test an appropriate high pass filter was inserted in the input port of AMP.

8.2. Limit

(1) FCC 15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.1772&4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.2072&4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6

(2) RSS-GEN Restricted frequency band*

MHz	MHz	MHz	GHz
0.090-0.110	12.57675-12.57725	399.9-410	7.25-7.75
0.495-0.505	13.36-13.41	608-614	8.025-8.5
2.1735-2.1905	16.42-16.423	960-1427	9.0-9.2
3.020-3.026	16.69475-16.69525	1435-1626.5	9.3-9.5
4.125-4.128	16.80425-16.80475	1645.5-1646.5	10.6-12.7
4.17725-4.17775	25.5-25.67	1660-1710	13.25-13.4
4.20725-4.20775	37.5-38.25	1718.8-1722.2	14.47-14.5
5.677-5.683	73-74.6	2200-2300	15.35-16.2
6.215-6.218	74.8-75.2	2310-2390	17.7-21.4
6.26775-6.26825	108-138	2483.5-2500	22.01-23.12
6.31175-6.31225	149.9-150.05	2655-2900	23.6-24.0
8.291-8.294	156.52475-156.52525	3260-3267	31.2-31.8
8.362-8.366	156.7-156.9	3332-3339	36.43-36.5
8.37625-8.38675	162.0125-167.17	3345.8-3358	Above 38.6
8.41425-8.41475	167.72-173.2	3500-4400	
12.29-12.293	240-285	4.5-5.15	
12.51975-12.52025	322-335.4	5.35-5.46	

* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

(3) FCC 15.209 & RSS-GEN Limit.

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$$\text{Limit}_{3m}(\text{dB}\mu\text{V}/\text{m}) = \text{Limit}_{30m}(\text{dB}\mu\text{V}/\text{m}) + 40\text{Log}(30m/3m)$$

(4) Limit for this EUT

All the emissions appearing within 15.205 & RSS-GEN restricted frequency bands shall not exceed the limits shown in 15.209 & RSS-GEN, all the other emissions shall be at least 20dB below the fundamental emissions or comply with 15.209 & RSS-GEN limits.

8.3. Test procedure

- (1) EUT height should be 0.8 m for below 1 GHz at a semi-anechoic chamber while EUT height should be 1.5 m for above 1 GHz at full chamber or semi-anechoic chamber ground with absorbers.
- (2) The antenna used as below table.

Test frequency range	Test antenna used	Measuring distance
9 kHz-30 MHz	Active Loop antenna	3 m
30 MHz-1 GHz	Trilog Broadband Antenna	10 m
1 GHz-18 GHz	Double Ridged Horn Antenna(1GHz-18GHz)	3 m
18 GHz-40 GHz	Horn Antenna(18GHz-40GHz)	3 m

According ANSI C63.10:2020 clause 6.4.4.2 and 6.5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30 MHz, the Trilog Broadband Antenna was located 10 m, Horn Antenna was located 3 m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

- (3) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9 kHz to 25 GHz:

- (a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degrees, the antenna height was varied from 1 m to 4 m (Except loop antenna, it's fixed 1m above ground.)

- (b) Change work frequency or channel of device if practicable.

- (c) Change modulation type of device if practicable.

- (d) Change power supply range from 85% to 115% of the rated supply voltage

- (e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.

Spectrum frequency from 9 kHz to 25 GHz (tenth harmonic of fundamental frequency) was

investigated, and no any obvious emission were detected from 18GHz to 25GHz, so below final test was performed with frequency range from 9kHz to 18GHz.

- (4) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipment and all of the interface cables were changed according to ANSI C63.10 2020 on Radiated Emission test.
- (5) The emissions from 9 kHz to 1 GHz were measured based on CISPR QP detector except for the frequency bands 9-90 kHz, 110-490 kHz, for emissions from 9 kHz-90 kHz, 110 kHz-490 kHz and above 1 GHz were measured based on average detector, for emissions above 1 GHz, peak emissions also be measured and need comply with Peak limit.
- (6) The emissions from 9 kHz to 1 GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9 kHz-150 kHz	200 Hz
150 kHz-30 MHz	9 kHz
30 MHz-1 GHz	120 kHz

- (7) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1 MHz, VBW is set at 3 MHz for Peak measure; According ANSI C63.10:2020 clause 4.1.4.2.2 procedure for Average measure.
- (8) X axis, Y axis, Z axis are tested, and worse setup X axis is reported.

8.4. Test result

Pass. (See below detailed test result)

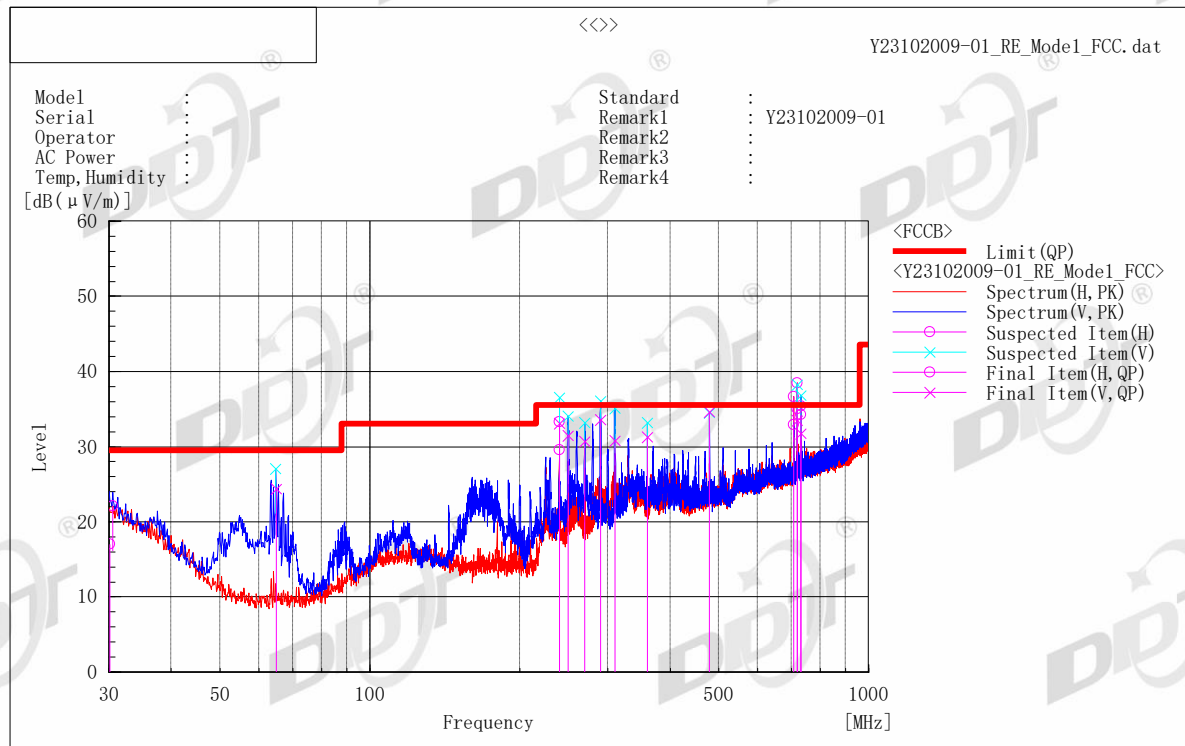
All the emissions except fundamental emission from 9 kHz to 25 GHz were comply with 15.209 limit.

Note1: According exploratory test no any obvious emission was detected from 9 kHz to 30 MHz and 18 GHz to 25 GHz, so the final test was performed with frequency range from 30 MHz to 18 GHz and recorded in below.

Note2: For emissions below 1 GHz, according exploratory explorer test, when change Tx mode and channel, have no distinct influence on emissions level, so for emissions below 1 GHz, the final test was only performed with EUT working in transmission mode.

Note3: Scan with all modes, the worst case was recorded in this report.

Radiated Emission test (below 1GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB (μV)]	c.f [dB(1/m)]	Result QP [dB (μV/m)]	Limit QP [dB (μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	System	Remark
1	30.140	H	22.3	-5.3	17.0	29.5	12.5	316.0	317.8	1	
2	240.011	H	39.9	-10.3	29.6	35.5	5.9	220.0	55.8	1	
3	708.072	H	32.2	0.7	32.9	35.5	2.6	112.0	67.7	1	
4	719.975	H	33.8	1.2	35.0	35.5	0.5	119.0	192.3	1	
5	732.086	H	32.6	1.7	34.3	35.5	1.2	114.0	148.2	1	
6	64.846	V	41.6	-17.2	24.4	29.5	5.1	326.0	187.2	2	
7	240.013	V	43.2	-10.1	33.1	35.5	2.4	385.0	177.9	2	
8	249.892	V	40.5	-9.0	31.5	35.5	4.0	142.0	175.2	2	
9	269.465	V	39.2	-8.5	30.7	35.5	4.8	137.0	192.8	2	
10	289.644	V	41.5	-7.9	33.6	35.5	1.9	125.0	334.3	2	
11	310.350	V	38.1	-7.3	30.8	35.5	4.7	132.0	24.5	2	
12	360.010	V	37.1	-5.8	31.3	35.5	4.2	228.0	349.4	2	
13	480.006	V	36.7	-2.1	34.6	35.5	0.9	116.0	358.0	2	
14	719.994	V	31.9	1.6	33.5	35.5	2.0	312.0	277.8	2	
15	732.136	V	30.0	1.8	31.8	35.5	3.7	305.0	215.3	2	

Note) Receiving antenna polarization: Horizontal and/or Vertical

Test Distance: 10 m, Antenna Height: 1 m to 4 m

Level QP (Quasi-Peak) = Reading QP + Factor (Antenna Factor + Cable Loss - Amp. Gain)

Margin QP (Quasi-Peak) = Limit - Level QP

Radiated Emission test (1GHz -3GHz)

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

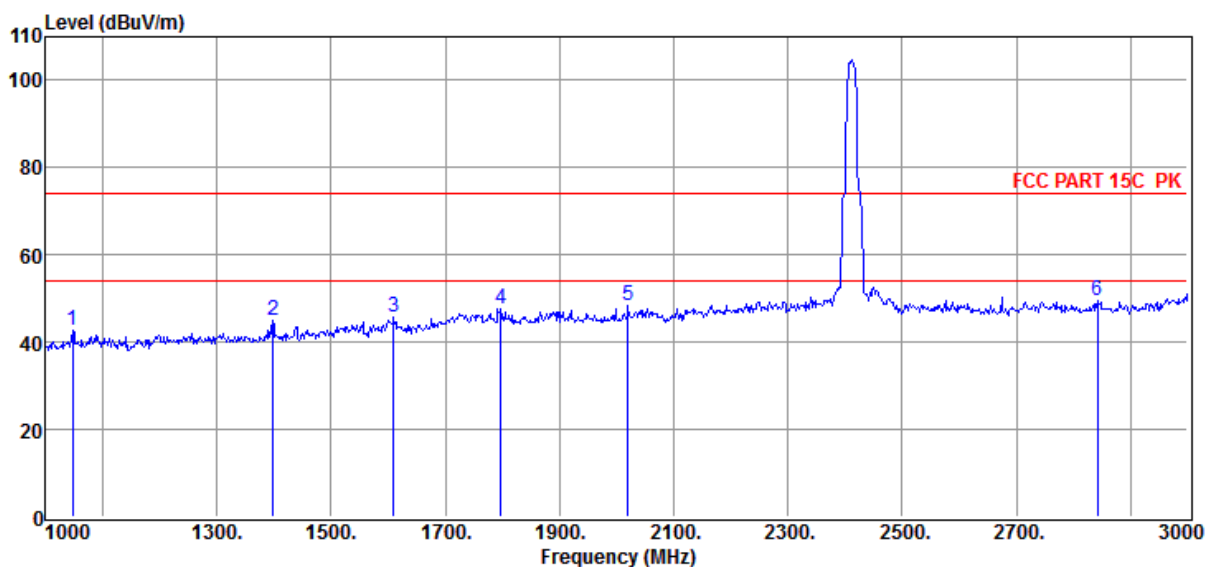
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2412MHz ESP32

Data: 127



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1048.00	49.67	27.38	-34.32	42.73	74.00	-31.27	Peak	VERTICAL
2	1398.00	48.99	29.49	-33.60	44.88	74.00	-29.12	Peak	VERTICAL
3	1610.00	47.90	30.94	-33.23	45.61	74.00	-28.39	Peak	VERTICAL
4	1798.00	48.92	31.69	-32.83	47.78	74.00	-26.22	Peak	VERTICAL
5	2020.00	47.92	33.08	-32.48	48.52	74.00	-25.48	Peak	VERTICAL
6	2842.00	42.85	37.64	-30.98	49.51	74.00	-24.49	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

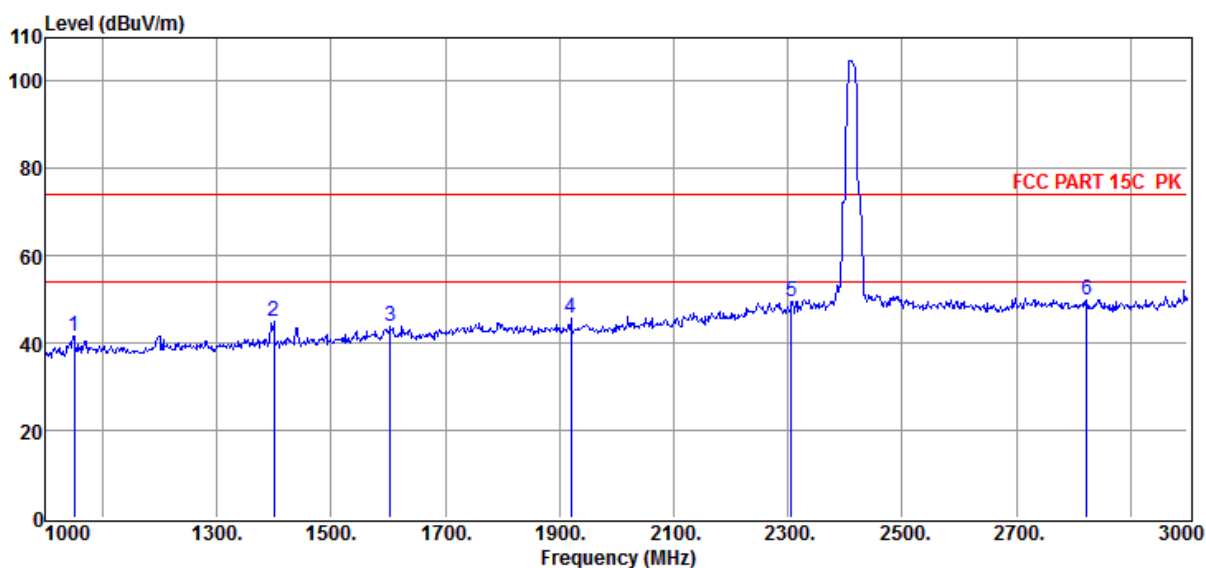
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2412MHz ESP32

Data: 128



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	48.61	27.40	-34.32	41.69	74.00	-32.31	Peak	HORIZONTAL
2	1400.00	48.98	29.50	-33.60	44.88	74.00	-29.12	Peak	HORIZONTAL
3	1604.00	46.14	30.98	-33.26	43.86	74.00	-30.14	Peak	HORIZONTAL
4	1920.00	45.80	32.64	-32.56	45.88	74.00	-28.12	Peak	HORIZONTAL
5	2306.00	47.40	33.98	-31.93	49.45	74.00	-24.55	Peak	HORIZONTAL
6	2824.00	43.53	37.49	-30.95	50.07	74.00	-23.93	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

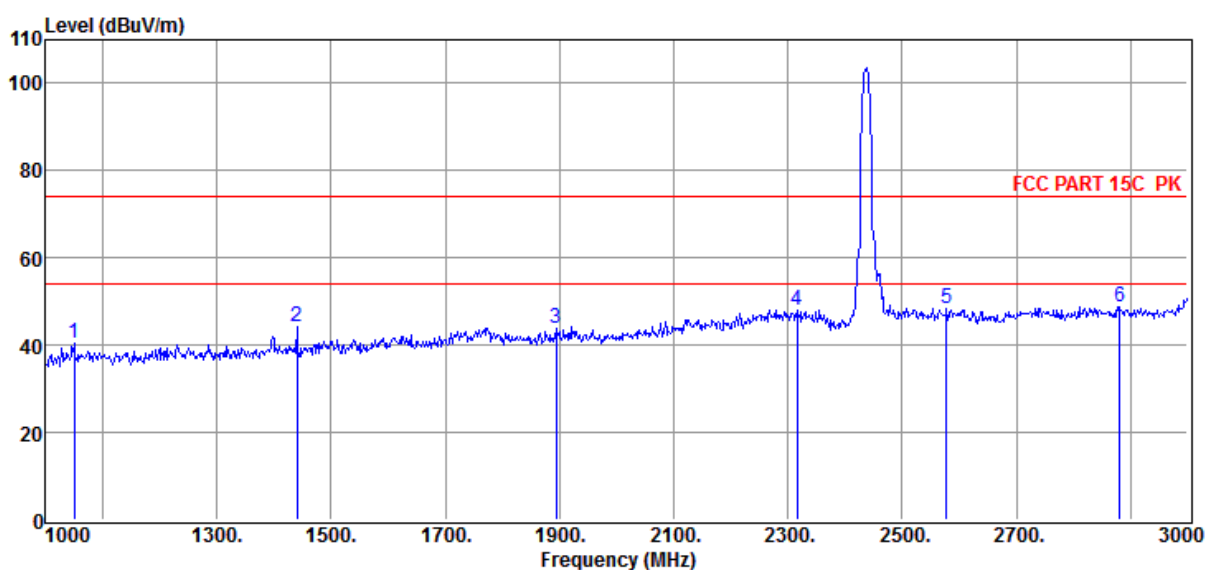
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2437MHz ESP32

Data: 129



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	47.23	27.40	-34.32	40.31	74.00	-33.69	Peak	VERTICAL
2	1440.00	47.93	29.90	-33.50	44.33	74.00	-29.67	Peak	VERTICAL
3	1894.00	43.90	32.55	-32.65	43.80	74.00	-30.20	Peak	VERTICAL
4	2316.00	45.84	34.12	-31.81	48.15	74.00	-25.85	Peak	VERTICAL
5	2578.00	43.13	36.56	-31.14	48.55	74.00	-25.45	Peak	VERTICAL
6	2882.00	42.03	37.57	-30.68	48.92	74.00	-25.08	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

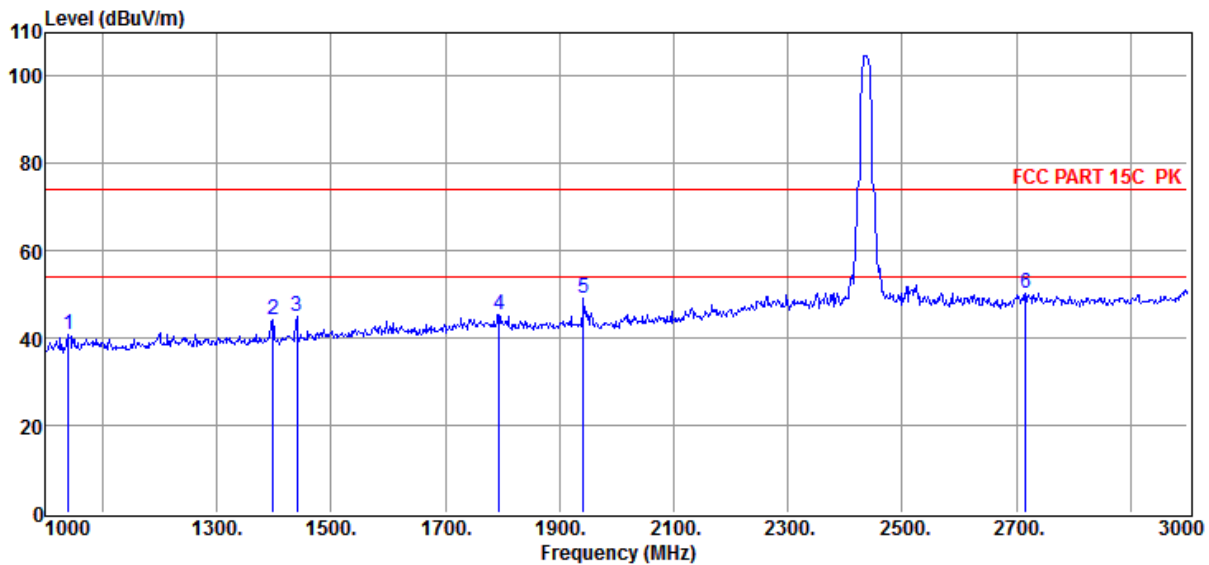
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2437MHz ESP32

Data: 130



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1040.00	47.85	27.30	-34.34	40.81	74.00	-33.19	Peak	HORIZONTAL
2	1398.00	48.37	29.49	-33.60	44.26	74.00	-29.74	Peak	HORIZONTAL
3	1440.00	48.43	29.90	-33.50	44.83	74.00	-29.17	Peak	HORIZONTAL
4	1794.00	46.67	31.66	-32.83	45.50	74.00	-28.50	Peak	HORIZONTAL
5	1942.00	48.88	32.68	-32.44	49.12	74.00	-24.88	Peak	HORIZONTAL
6	2716.00	44.01	36.99	-30.85	50.15	74.00	-23.85	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

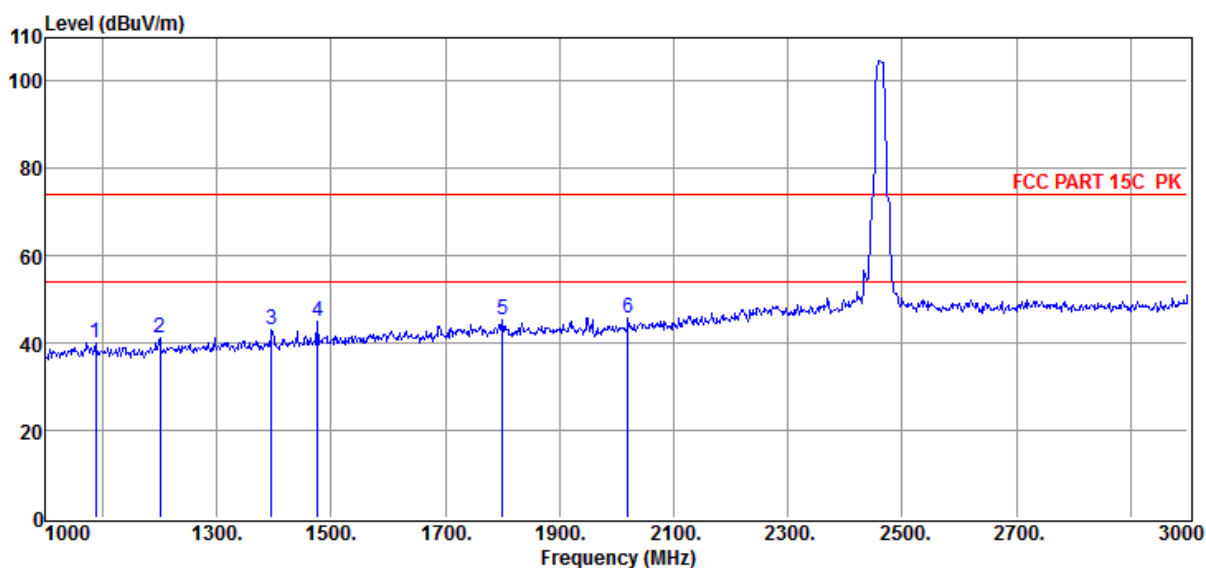
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2462MHz ESP32

Data: 131



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1088.00	46.97	27.48	-34.27	40.18	74.00	-33.82	Peak	HORIZONTAL
2	1200.00	46.49	28.70	-34.02	41.17	74.00	-32.83	Peak	HORIZONTAL
3	1396.00	47.17	29.48	-33.60	43.05	74.00	-30.95	Peak	HORIZONTAL
4	1476.00	48.12	30.26	-33.46	44.92	74.00	-29.08	Peak	HORIZONTAL
5	1800.00	46.40	31.70	-32.83	45.27	74.00	-28.73	Peak	HORIZONTAL
6	2020.00	45.00	33.08	-32.48	45.60	74.00	-28.40	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

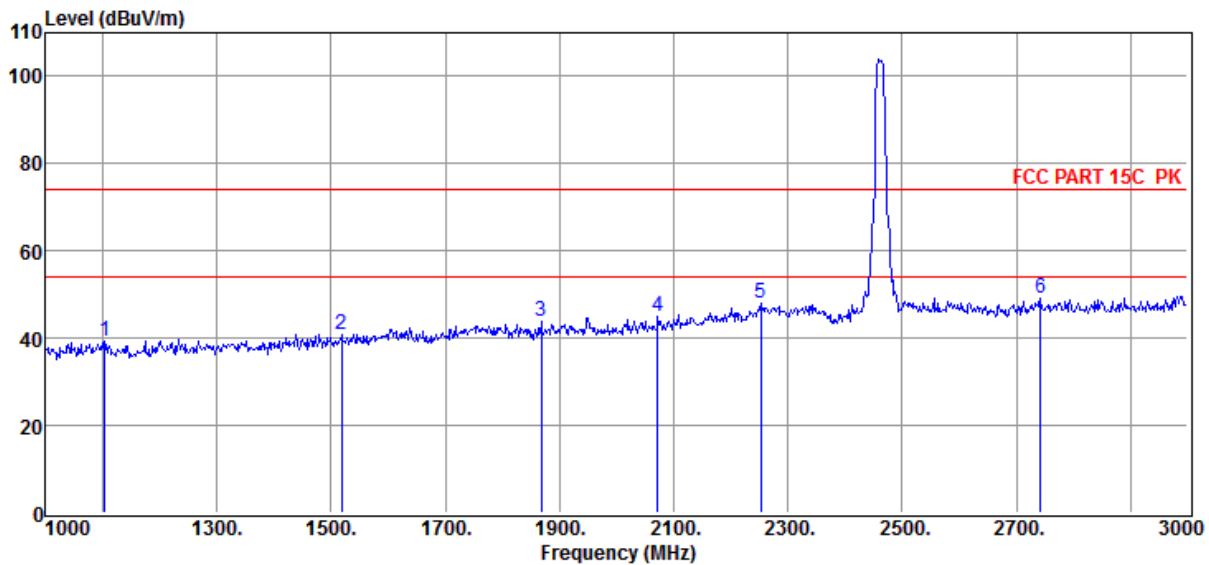
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11B 1M 2462MHz ESP32

Data: 132



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1104.00	45.85	27.52	-34.24	39.13	74.00	-34.87	Peak	VERTICAL
2	1518.00	43.70	30.61	-33.38	40.93	74.00	-33.07	Peak	VERTICAL
3	1868.00	44.27	32.34	-32.58	44.03	74.00	-29.97	Peak	VERTICAL
4	2072.00	44.18	33.24	-32.37	45.05	74.00	-28.95	Peak	VERTICAL
5	2252.00	45.53	34.19	-31.84	47.88	74.00	-26.12	Peak	VERTICAL
6	2742.00	42.47	37.30	-30.77	49.00	74.00	-25.00	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

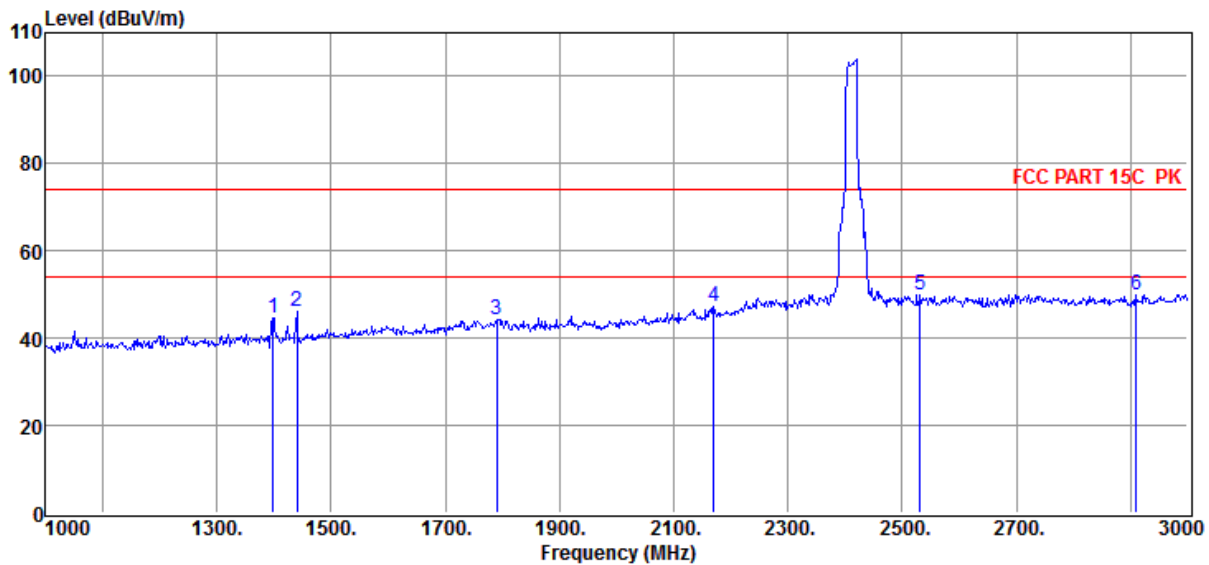
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2412MHz ESP32

Data: 133



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1398.00	48.89	29.49	-33.60	44.78	74.00	-29.22	Peak	HORIZONTAL
2	1440.00	49.56	29.90	-33.50	45.96	74.00	-28.04	Peak	HORIZONTAL
3	1790.00	45.37	31.64	-32.83	44.18	74.00	-29.82	Peak	HORIZONTAL
4	2170.00	45.43	33.74	-32.10	47.07	74.00	-26.93	Peak	HORIZONTAL
5	2532.00	45.56	35.71	-31.34	49.93	74.00	-24.07	Peak	HORIZONTAL
6	2910.00	42.89	37.44	-30.52	49.81	74.00	-24.19	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

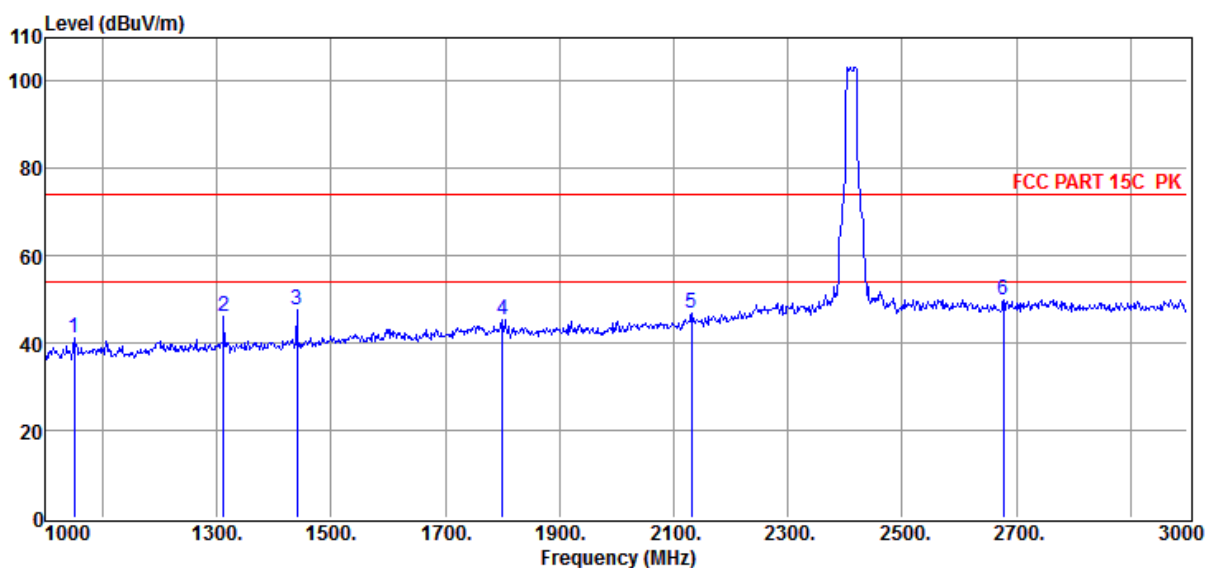
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2412MHz ESP32

Data: 134



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	48.14	27.40	-34.32	41.22	74.00	-32.78	Peak	VERTICAL
2	1312.00	50.67	29.15	-33.76	46.06	74.00	-27.94	Peak	VERTICAL
3	1440.00	51.19	29.90	-33.50	47.59	74.00	-26.41	Peak	VERTICAL
4	1800.00	46.45	31.70	-32.83	45.32	74.00	-28.68	Peak	VERTICAL
5	2132.00	45.78	33.16	-32.24	46.70	74.00	-27.30	Peak	VERTICAL
6	2678.00	44.19	36.71	-31.07	49.83	74.00	-24.17	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

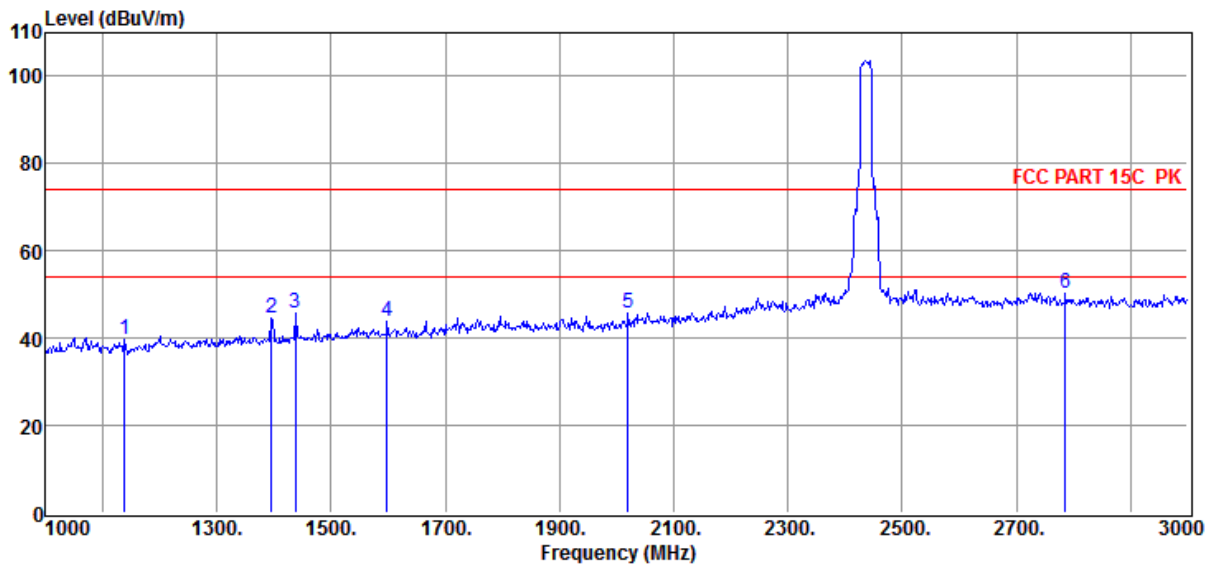
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2437MHz ESP32

Data: 135



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1138.00	46.23	27.73	-34.15	39.81	74.00	-34.19	Peak	VERTICAL
2	1396.00	48.79	29.48	-33.60	44.67	74.00	-29.33	Peak	VERTICAL
3	1438.00	49.46	29.88	-33.51	45.83	74.00	-28.17	Peak	VERTICAL
4	1598.00	46.30	30.99	-33.28	44.01	74.00	-29.99	Peak	VERTICAL
5	2020.00	45.30	33.08	-32.48	45.90	74.00	-28.10	Peak	VERTICAL
6	2786.00	43.81	37.33	-30.87	50.27	74.00	-23.73	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

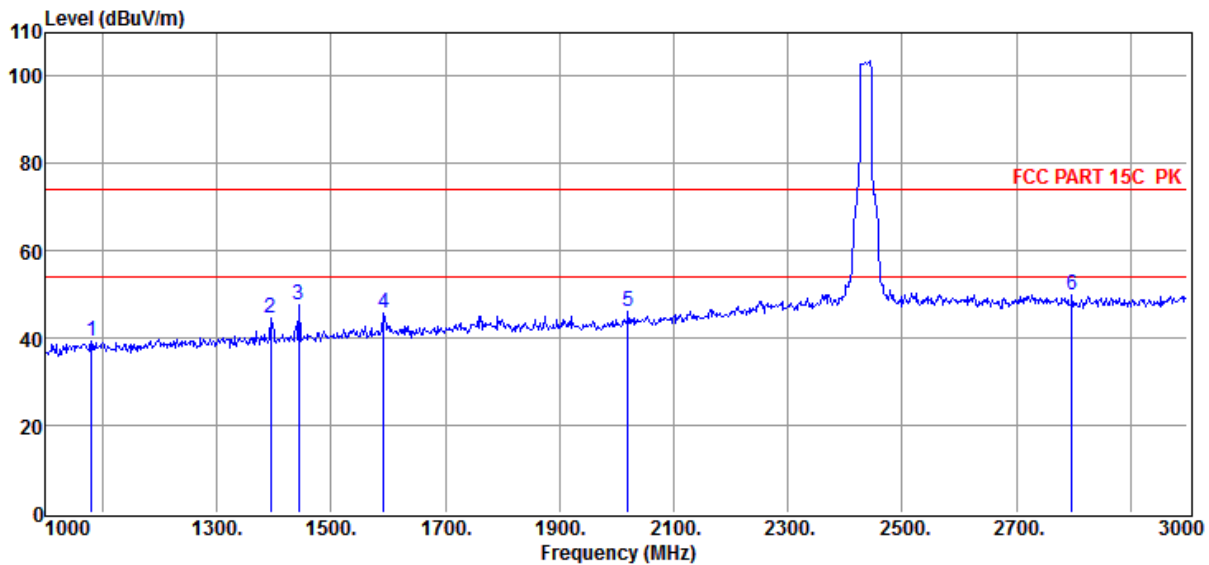
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2437MHz ESP32

Data: 136



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1080.00	46.23	27.46	-34.28	39.41	74.00	-34.59	Peak	HORIZONTAL
2	1394.00	48.75	29.48	-33.61	44.62	74.00	-29.38	Peak	HORIZONTAL
3	1444.00	51.09	29.94	-33.49	47.54	74.00	-26.46	Peak	HORIZONTAL
4	1592.00	47.90	30.97	-33.28	45.59	74.00	-28.41	Peak	HORIZONTAL
5	2020.00	45.45	33.08	-32.48	46.05	74.00	-27.95	Peak	HORIZONTAL
6	2798.00	43.68	37.30	-30.91	50.07	74.00	-23.93	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

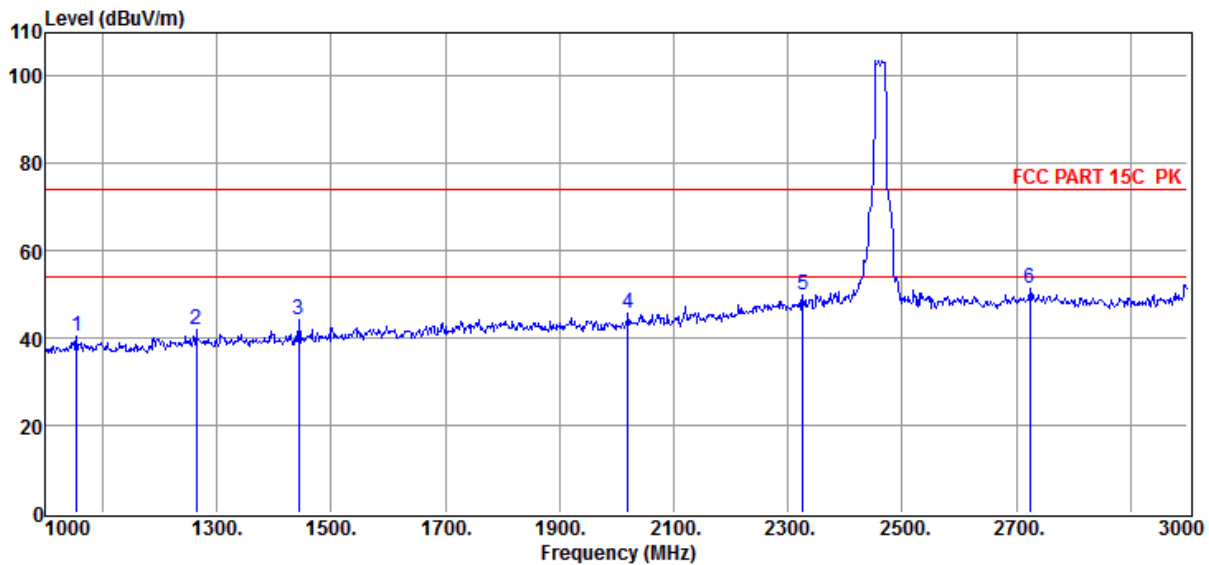
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2462MHz ESP32

Data: 137



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1054.00	47.18	27.41	-34.31	40.28	74.00	-33.72	Peak	HORIZONTAL
2	1264.00	46.67	29.10	-33.81	41.96	74.00	-32.04	Peak	HORIZONTAL
3	1444.00	47.66	29.94	-33.49	44.11	74.00	-29.89	Peak	HORIZONTAL
4	2020.00	45.06	33.08	-32.48	45.66	74.00	-28.34	Peak	HORIZONTAL
5	2326.00	47.34	34.26	-31.69	49.91	74.00	-24.09	Peak	HORIZONTAL
6	2724.00	45.17	37.09	-30.82	51.44	74.00	-22.56	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

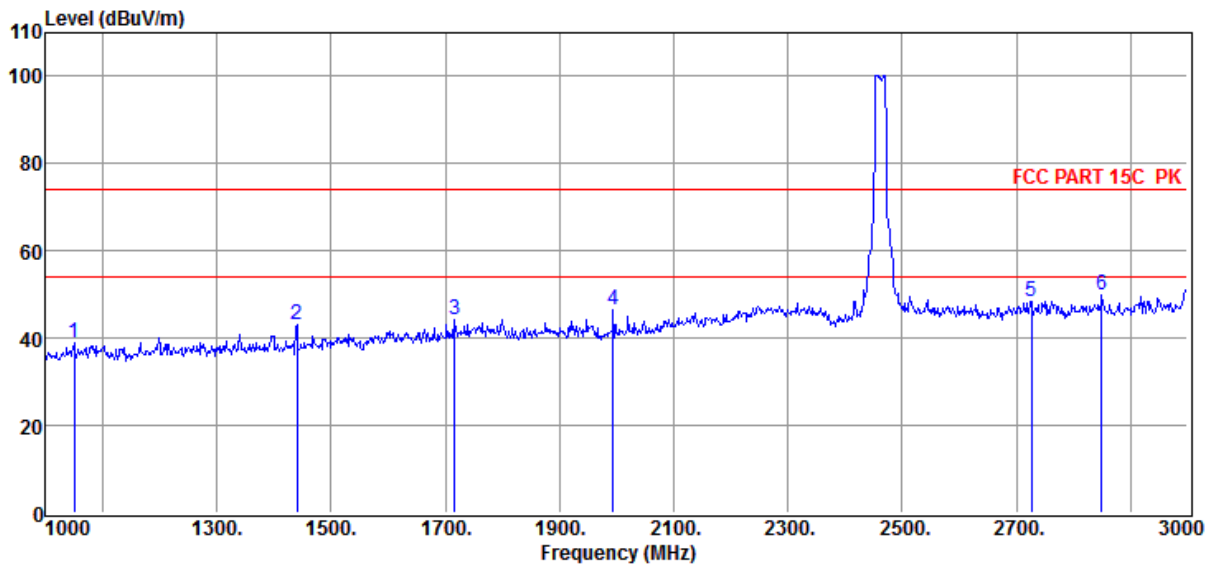
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11G 6M 2462MHz ESP32

Data: 138



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	45.87	27.40	-34.32	38.95	74.00	-35.05	Peak	VERTICAL
2	1440.00	46.63	29.90	-33.50	43.03	74.00	-30.97	Peak	VERTICAL
3	1716.00	45.92	31.20	-33.00	44.12	74.00	-29.88	Peak	VERTICAL
4	1994.00	46.25	32.79	-32.55	46.49	74.00	-27.51	Peak	VERTICAL
5	2726.00	42.17	37.11	-30.82	48.46	74.00	-25.54	Peak	VERTICAL
6	2850.00	43.37	37.70	-30.99	50.08	74.00	-23.92	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

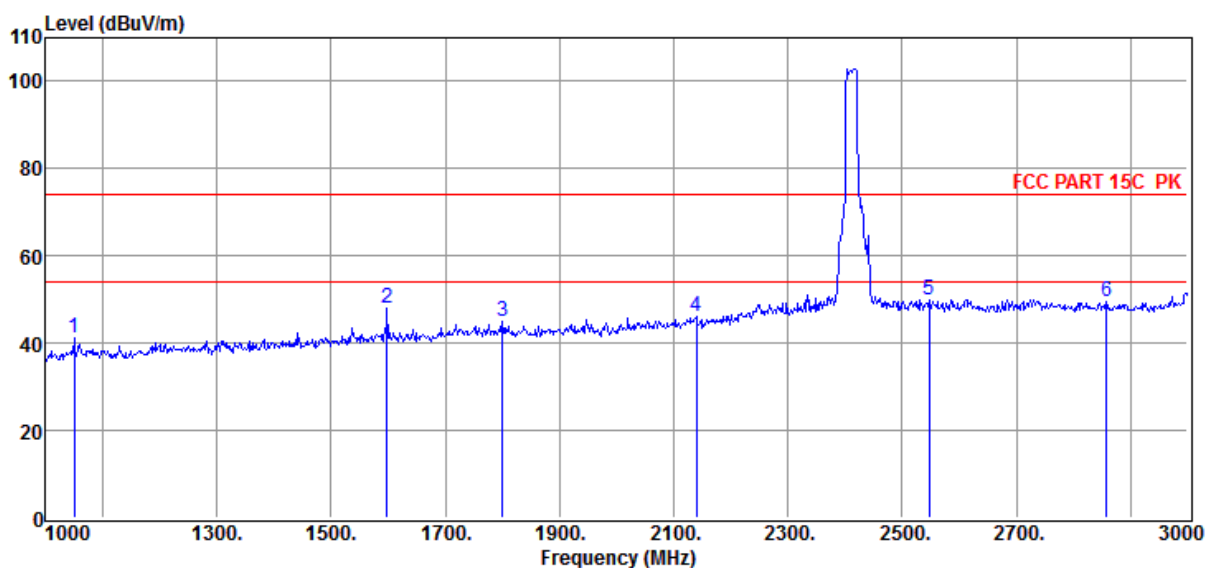
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2412MHz ESP32

Data: 139



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	48.12	27.40	-34.32	41.20	74.00	-32.80	Peak	VERTICAL
2	1598.00	50.41	30.99	-33.28	48.12	74.00	-25.88	Peak	VERTICAL
3	1800.00	46.05	31.70	-32.83	44.92	74.00	-29.08	Peak	VERTICAL
4	2140.00	44.94	33.22	-32.20	45.96	74.00	-28.04	Peak	VERTICAL
5	2548.00	45.19	35.97	-31.22	49.94	74.00	-24.06	Peak	VERTICAL
6	2858.00	42.85	37.67	-30.91	49.61	74.00	-24.39	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

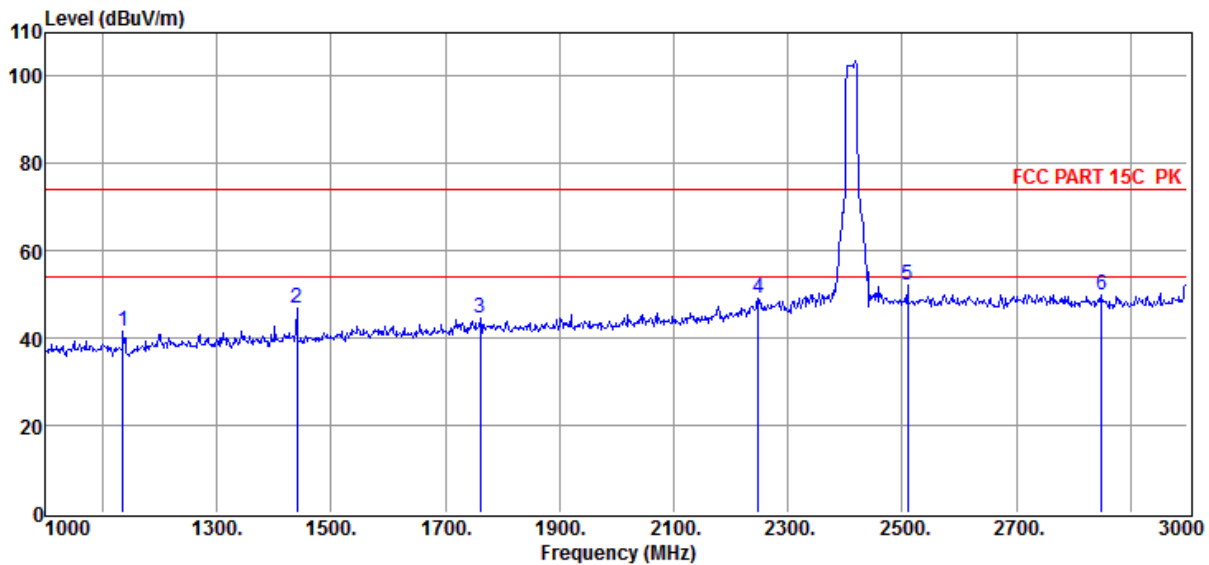
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2412MHz ESP32

Data: 140



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1136.00	47.93	27.72	-34.16	41.49	74.00	-32.51	Peak	HORIZONTAL
2	1440.00	50.42	29.90	-33.50	46.82	74.00	-27.18	Peak	HORIZONTAL
3	1762.00	45.92	31.47	-32.84	44.55	74.00	-29.45	Peak	HORIZONTAL
4	2248.00	46.61	34.21	-31.84	48.98	74.00	-25.02	Peak	HORIZONTAL
5	2510.00	48.21	35.36	-31.49	52.08	74.00	-21.92	Peak	HORIZONTAL
6	2850.00	43.04	37.70	-30.99	49.75	74.00	-24.25	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

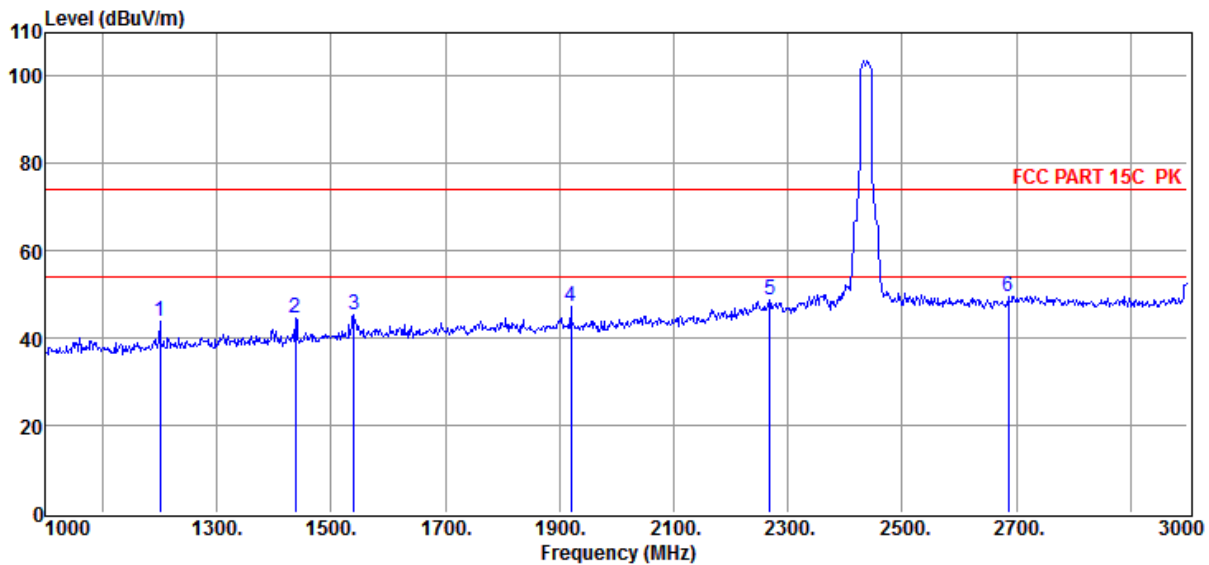
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2437MHz ESP32

Data: 141



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1200.00	49.16	28.70	-34.02	43.84	74.00	-30.16	Peak	HORIZONTAL
2	1438.00	48.28	29.88	-33.51	44.65	74.00	-29.35	Peak	HORIZONTAL
3	1540.00	48.09	30.74	-33.30	45.53	74.00	-28.47	Peak	HORIZONTAL
4	1920.00	47.25	32.64	-32.56	47.33	74.00	-26.67	Peak	HORIZONTAL
5	2268.00	46.50	34.09	-31.89	48.70	74.00	-25.30	Peak	HORIZONTAL
6	2686.00	43.86	36.74	-31.00	49.60	74.00	-24.40	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

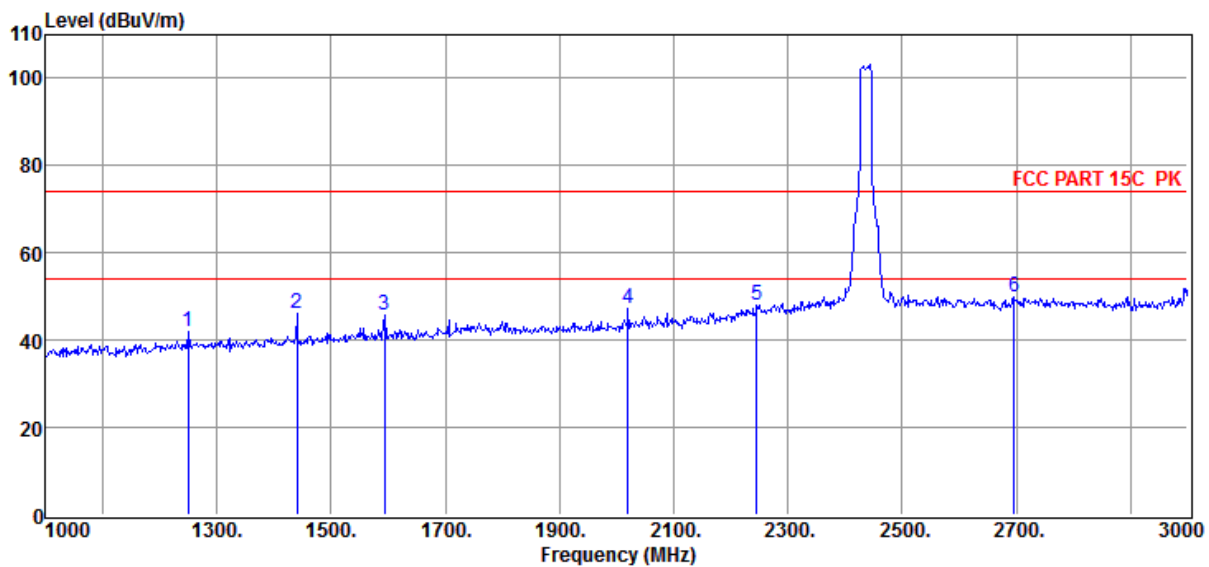
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2437MHz ESP32

Data: 142



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1250.00	46.75	29.10	-33.82	42.03	74.00	-31.97	Peak	VERTICAL
2	1440.00	49.72	29.90	-33.50	46.12	74.00	-27.88	Peak	VERTICAL
3	1594.00	48.05	30.98	-33.28	45.75	74.00	-28.25	Peak	VERTICAL
4	2020.00	46.56	33.08	-32.48	47.16	74.00	-26.84	Peak	VERTICAL
5	2246.00	45.60	34.22	-31.85	47.97	74.00	-26.03	Peak	VERTICAL
6	2696.00	44.07	36.78	-30.92	49.93	74.00	-24.07	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

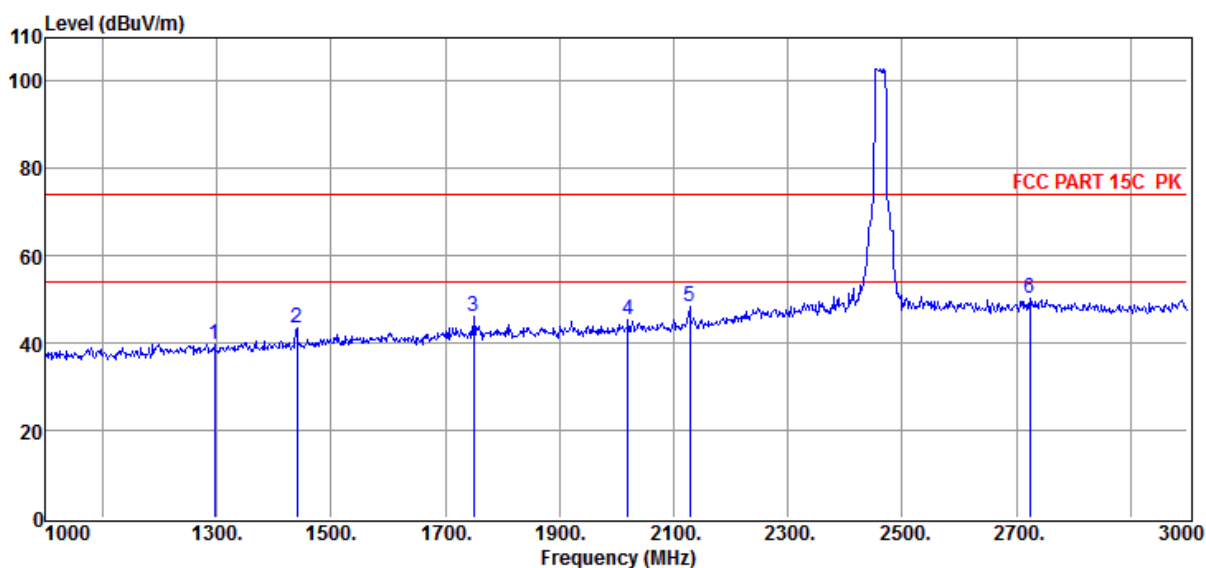
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2462MHz ESP32

Data: 143



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1296.00	44.51	29.10	-33.79	39.82	74.00	-34.18	Peak	VERTICAL
2	1440.00	47.07	29.90	-33.50	43.47	74.00	-30.53	Peak	VERTICAL
3	1750.00	47.37	31.40	-32.84	45.93	74.00	-28.07	Peak	VERTICAL
4	2020.00	44.90	33.08	-32.48	45.50	74.00	-28.50	Peak	VERTICAL
5	2128.00	47.51	33.12	-32.26	48.37	74.00	-25.63	Peak	VERTICAL
6	2724.00	44.08	37.09	-30.82	50.35	74.00	-23.65	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

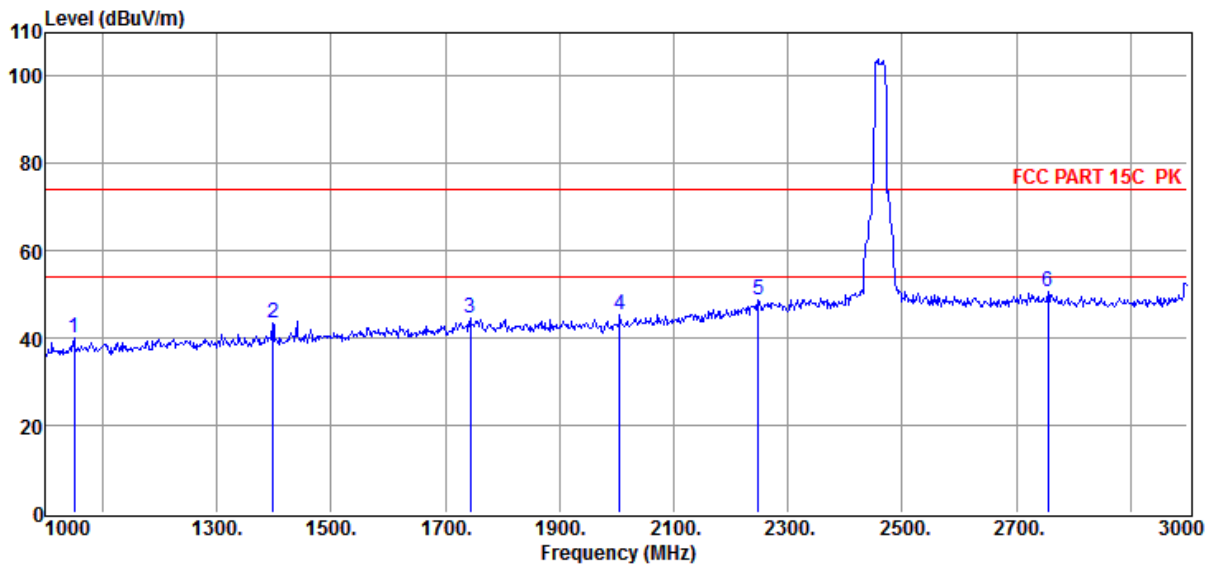
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N20 MCS0 2462MHz ESP32

Data: 144



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	47.12	27.40	-34.32	40.20	74.00	-33.80	Peak	HORIZONTAL
2	1398.00	47.57	29.49	-33.60	43.46	74.00	-30.54	Peak	HORIZONTAL
3	1744.00	46.29	31.36	-32.87	44.78	74.00	-29.22	Peak	HORIZONTAL
4	2006.00	44.83	32.88	-32.54	45.17	74.00	-28.83	Peak	HORIZONTAL
5	2248.00	46.38	34.21	-31.84	48.75	74.00	-25.25	Peak	HORIZONTAL
6	2756.00	43.87	37.39	-30.77	50.49	74.00	-23.51	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

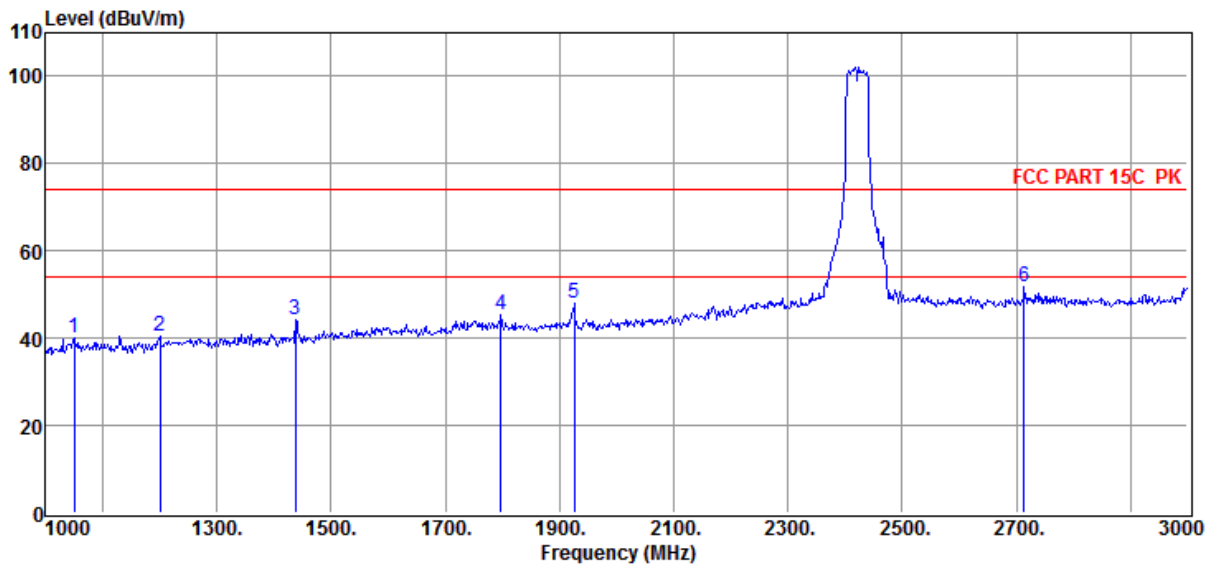
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2422MHz ESP32

Data: 145



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	46.96	27.40	-34.32	40.04	74.00	-33.96	Peak	HORIZONTAL
2	1200.00	45.86	28.70	-34.02	40.54	74.00	-33.46	Peak	HORIZONTAL
3	1438.00	47.85	29.88	-33.51	44.22	74.00	-29.78	Peak	HORIZONTAL
4	1798.00	46.65	31.69	-32.83	45.51	74.00	-28.49	Peak	HORIZONTAL
5	1926.00	47.95	32.65	-32.53	48.07	74.00	-25.93	Peak	HORIZONTAL
6	2714.00	45.60	36.97	-30.85	51.72	74.00	-22.28	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

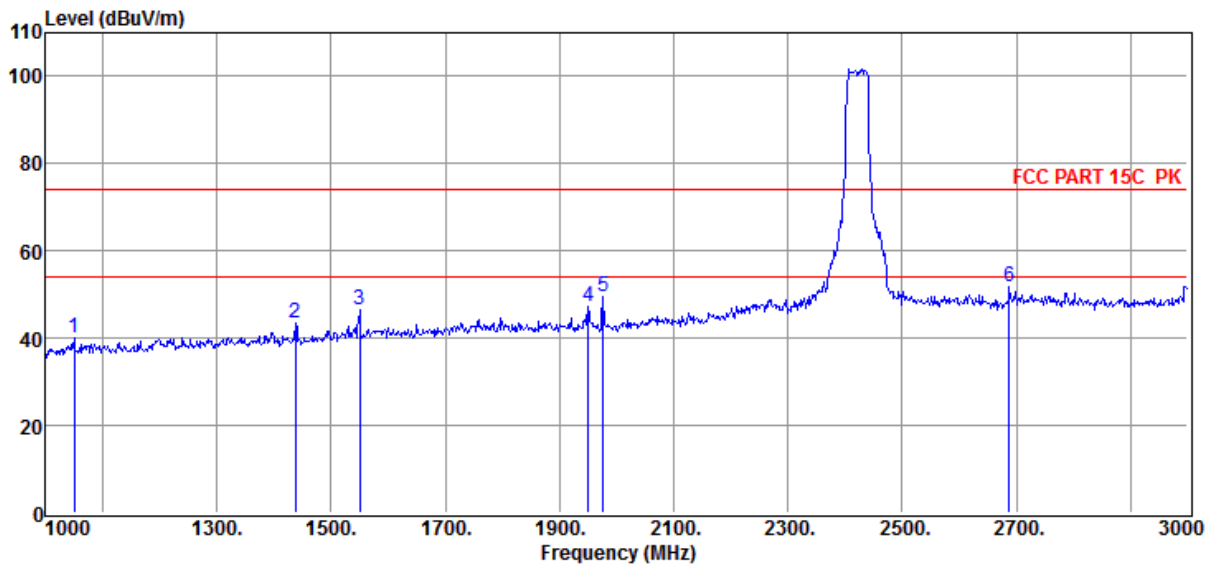
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2422MHz ESP32

Data: 146



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	46.82	27.40	-34.32	39.90	74.00	-34.10	Peak	VERTICAL
2	1438.00	47.19	29.88	-33.51	43.56	74.00	-30.44	Peak	VERTICAL
3	1550.00	49.05	30.80	-33.26	46.59	74.00	-27.41	Peak	VERTICAL
4	1950.00	46.97	32.70	-32.40	47.27	74.00	-26.73	Peak	VERTICAL
5	1976.00	49.07	32.75	-32.49	49.33	74.00	-24.67	Peak	VERTICAL
6	2688.00	46.08	36.75	-30.99	51.84	74.00	-22.16	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

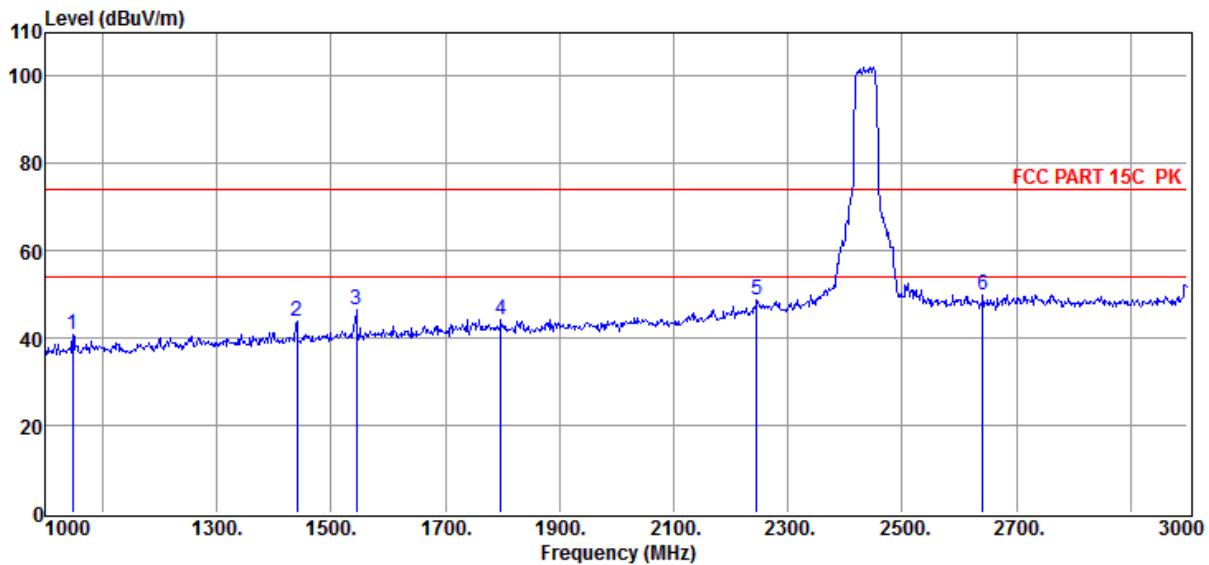
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2437MHz ESP32

Data: 147



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1048.00	47.71	27.38	-34.32	40.77	74.00	-33.23	Peak	VERTICAL
2	1440.00	47.32	29.90	-33.50	43.72	74.00	-30.28	Peak	VERTICAL
3	1544.00	48.86	30.76	-33.28	46.34	74.00	-27.66	Peak	VERTICAL
4	1798.00	45.47	31.69	-32.83	44.33	74.00	-29.67	Peak	VERTICAL
5	2246.00	46.44	34.22	-31.85	48.81	74.00	-25.19	Peak	VERTICAL
6	2642.00	44.47	36.66	-31.27	49.86	74.00	-24.14	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

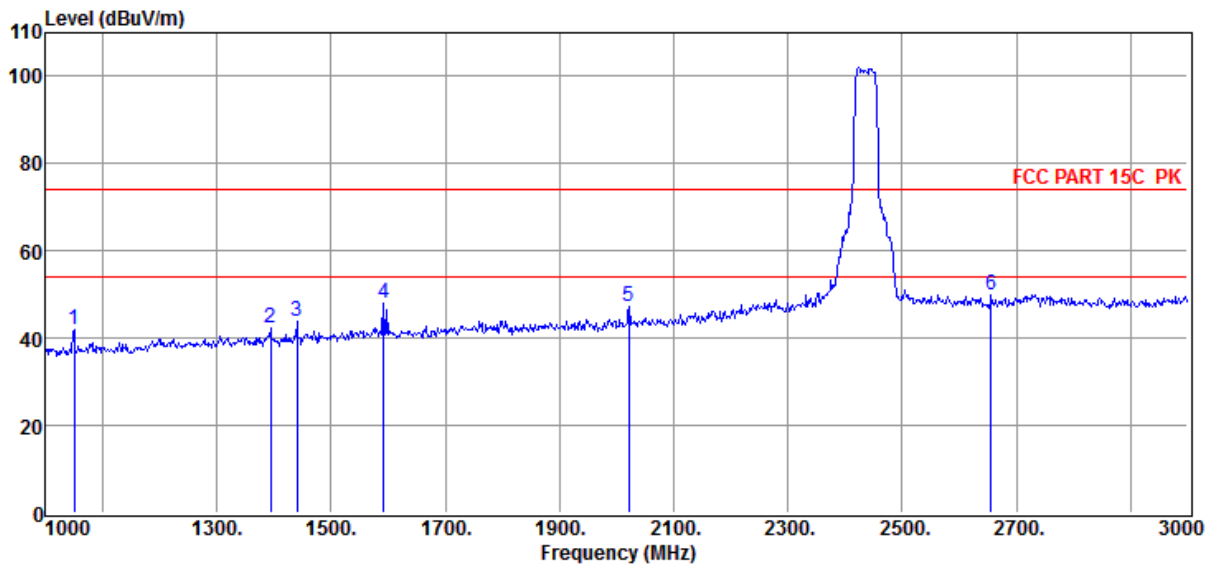
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2437MHz ESP32

Data: 148



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	49.00	27.40	-34.32	42.08	74.00	-31.92	Peak	HORIZONTAL
2	1394.00	46.40	29.48	-33.61	42.27	74.00	-31.73	Peak	HORIZONTAL
3	1440.00	47.54	29.90	-33.50	43.94	74.00	-30.06	Peak	HORIZONTAL
4	1592.00	50.49	30.97	-33.28	48.18	74.00	-25.82	Peak	HORIZONTAL
5	2022.00	46.67	33.11	-32.47	47.31	74.00	-26.69	Peak	HORIZONTAL
6	2656.00	44.69	36.62	-31.25	50.06	74.00	-23.94	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

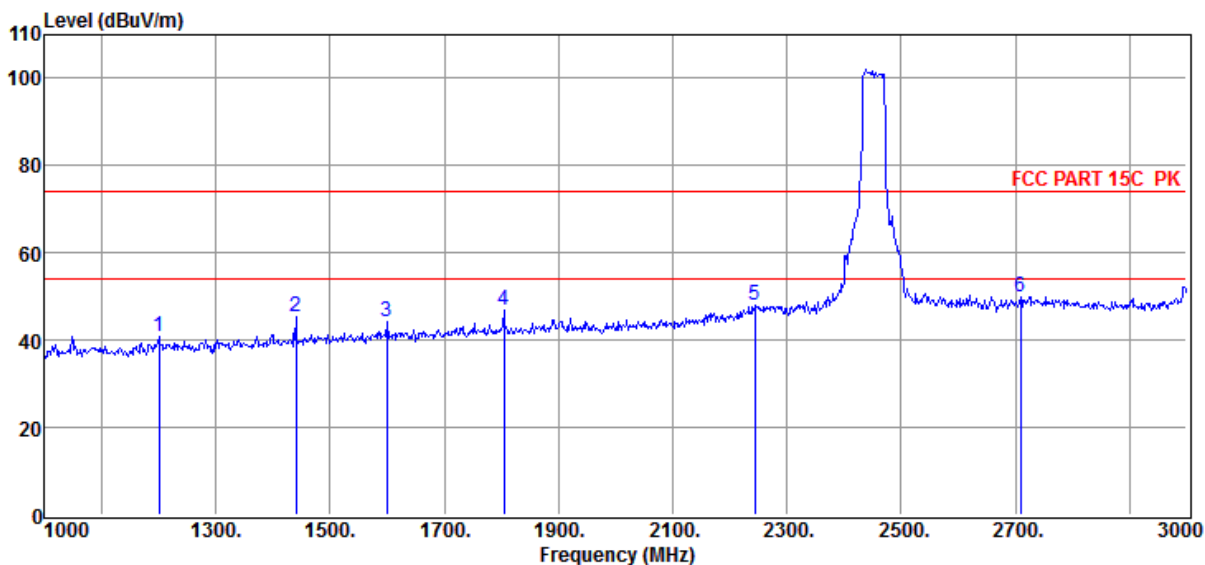
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2452MHz ESP32

Data: 149



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1200.00	46.16	28.70	-34.02	40.84	74.00	-33.16	Peak	VERTICAL
2	1440.00	48.92	29.90	-33.50	45.32	74.00	-28.68	Peak	VERTICAL
3	1600.00	46.40	31.00	-33.28	44.12	74.00	-29.88	Peak	VERTICAL
4	1804.00	48.02	31.74	-32.81	46.95	74.00	-27.05	Peak	VERTICAL
5	2244.00	45.51	34.22	-31.85	47.88	74.00	-26.12	Peak	VERTICAL
6	2710.00	43.93	36.92	-30.86	49.99	74.00	-24.01	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.

Radiated Emission Test Result

Test Site : 10m Chamber

Test Date : 11-27-2023

Tested By : Novak

EUT : AI Delivery Robot

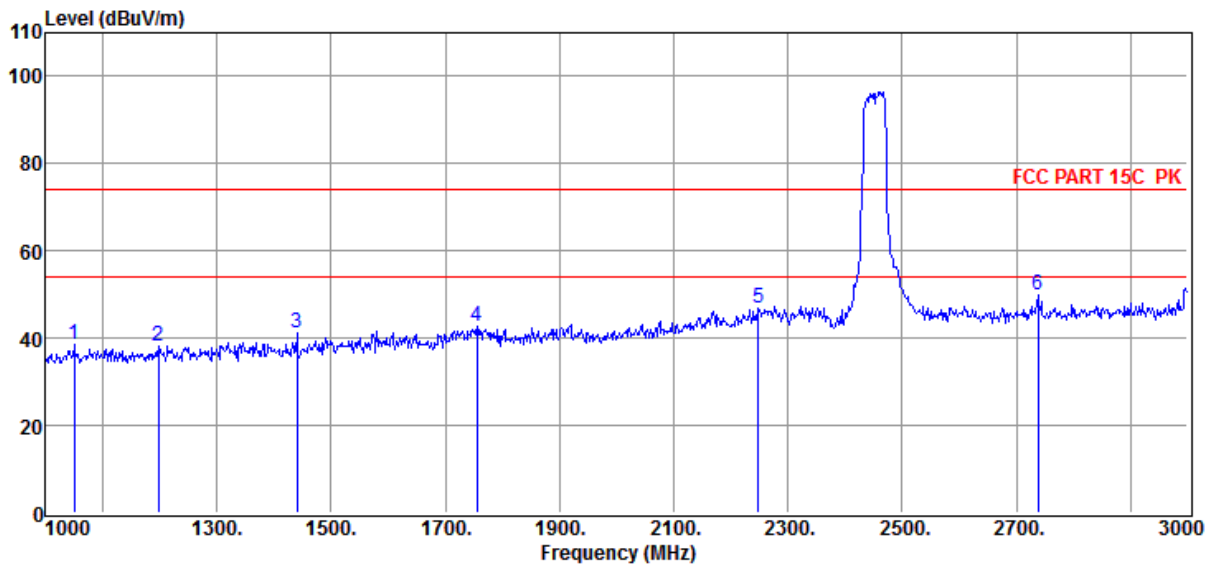
Model Number : OS-R-DR02-A

Power Supply : Battery

Test Mode : Tx mode

Memo : 11N40 MCS0 2452MHz ESP32

Data: 150



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	1050.00	45.43	27.40	-34.32	38.51	74.00	-35.49	Peak	HORIZONTAL
2	1198.00	43.70	28.66	-34.02	38.34	74.00	-35.66	Peak	HORIZONTAL
3	1440.00	44.95	29.90	-33.50	41.35	74.00	-32.65	Peak	HORIZONTAL
4	1756.00	44.05	31.44	-32.84	42.65	74.00	-31.35	Peak	HORIZONTAL
5	2248.00	44.68	34.21	-31.84	47.05	74.00	-26.95	Peak	HORIZONTAL
6	2738.00	43.23	37.26	-30.78	49.71	74.00	-24.29	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. Margin = Result Level - Limit.