

FCC CERTIFICATION TEST REPORT

FOR

Applicant	:	MOTREX CO., LTD.
Address	:	Seoyoung Bldg. 25, Hwangsaеul-ro 258beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
Equipment under Test	:	Equipo de Audio y Video para Vehiculo
Model No.	:	MTXMO440LBL7m, MTXMO410LNQ5a
Trade Mark	:	HYUNDAI/KIA
FCC ID	:	BP9-MO440LBL7M
Manufacturer	:	Skypine Electronics(Shenzhen) Co.,Ltd
Address	:	3rd Floor of Building B, Jingang Technology Park, Qiaotou Village, Fuhai Sub-District, Baoan, Shenzhen, China

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

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REPORT

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TEST REPORT DECLARE

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Manufacturer	:	Skypine Electronics(Shenzhen) Co.,Ltd
Address	:	3rd Floor of Building B, Jingang Technology Park, Qiaotou Village, Fuhai Sub-District, Baoan, Shenzhen, China

Test Standard Used:

FCC Rules and Regulations Part 15 Subpart C

Test procedure used:

ANSI C63.10:2013, 558074 D01 15.247 Meas Guidance v05r02

We Declare:

The equipment described above is tested by Dongguan 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 Dongguan 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 standards.

Report No:	DDT-R22092815-2E02		
Date of Receipt:	Oct. 28, 2022	Date of Test:	Oct. 28, 2022 ~ Nov. 25, 2022

Prepared By:*Johnny Wang***Johnny Wang/Engineer****Approved By:****Damon Hu/EMC Manager**

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

Revision history

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Nov. 25, 2022	

1. Summary of test results

The EUT have been tested according to the applicable standards as referenced below.		
Description of Test Item	Standard	Results
6dB Bandwidth and 99% Bandwidth	FCC Part 15: 15.247 ANSI C63.10:2013	Pass
Conducted Output Power	FCC Part 15: 15.247 ANSI C63.10:2013	Pass
Power Spectral Density	FCC Part 15:15.247 ANSI C63.10:2013	Pass
Band-edge and Spurious Emissions (Conducted)	FCC Part 15: 15.209 FCC Part 15: 15.247 ANSI C63.10: 2013	Pass
Radiated Spurious Emissions	FCC Part 15: 15.247 ANSI C63.10:2013	Pass
Radiated Band Edge Compliance	FCC Part 15: 15.209 FCC Part 15: 15.247 ANSI C63.10: 2013	Pass
Power Line Conducted Emission	FCC Part 15: 15.207 ANSI C63.10: 2013	N/A
Antenna requirement	FCC Part 15: 15.203	Pass
Note: N/A is an abbreviation for Not Applicable		

2. General test information

2.1. Description of EUT

EUT* Name	: Equipo de Audio y Video para Vehiculo
Model Number	: MTXMO440LBL7m, MTXMO410LNQ5a
Difference of models	: Their head unit electrical circuit design, layout, components used and internal wiring are identical, the shape and the material are also identical. Only the frontpanel and the packaging material size are different, but the frontpanel circuit design and principle are the same. Therefore the test performed on the model MTXMO440LBL7m and record in this report.
EUT function description	: Please reference user manual of this device
Power supply	: DC 12V
Radio Technology	: IEEE 802.11b/g/n
FCC 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: up to 72.2 Mbps IEEE 802.11n HT40: up to 150 Mbps
Antenna Gain	: 3.53 dBi
Sample Number	: S22092815-05

Note: 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

Assistant equipment	Manufacturer	Model number	Other
N/A	N/A	N/A	N/A

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
N/A	N/A	N/A	N/A	N/A

2.4. Block diagram of EUT configuration for test



Test software: Xshell.exe

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table:

The pathloss of external cable: 0.5dB (According to the manufacturer's claims)

Tested mode, channel, setting Tx power and rand data rate information

Mode	Setting Tx Power	data rate (Mbps) (see Note)	Channel	Frequency (MHz)
	ANT1			
Tx mode 802.11b	40	1	LCH: CH1	2412
	40	1	MCH: CH6	2437
	40	1	HCH: CH11	2462
Tx mode 802.11g	35	6	LCH: CH1	2412
	35	6	MCH: CH6	2437
	35	6	HCH: CH11	2462
Tx mode 802.11n HT20	35	MCS 0	LCH: CH1	2412
	35	MCS 0	MCH: CH6	2437
	35	MCS 0	HCH: CH11	2462
Tx mode 802.11n HT40	32	MCS 0	LCH: CH3	2422
	32	MCS 0	MCH: CH6	2437
	32	MCS 0	HCH: CH9	2452

Note: 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 °C to +25 °C
Humidity range:	40% to 75%
Pressure range:	86 kPa to 106 kPa

2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd.

Add.: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808.

Tel.: +86-0769-38826678, <http://www.dgddt.com>, Email: ddt@dgddt.com.

CNAS Accreditation No. L6451; A2LA Accreditation Number: 3870.01

FCC Designation Number: CN1182, Test Firm Registration Number: 540522

Innovation, Science and Economic Development Canada Site Registration Number: 10288A

Conformity Assessment Body identifier: CN0048

VCCI facility registration number: C-20087, T-20088, R-20123, R-20155, G-20118

2.8. Measurement uncertainty

Test Item	Uncertainty
Bandwidth	1.1%
Peak Output Power (Conducted) (Spectrum analyzer)	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$);
	1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Peak Output Power (Conducted) (Power Sensor)	0.74 dB
Power Spectral Density	0.74 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$);
	1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Frequencies Stability	6.7×10^{-8} (Antenna couple method)
	5.5×10^{-8} (Conducted method)
Conducted spurious emissions	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$);
	1.40 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
	1.66 dB ($8 \text{ GHz} \leq f < 26.5 \text{ GHz}$)
Uncertainty for radio frequency (RBW < 20 kHz)	3×10^{-8}
Temperature	0.4 °C
Humidity	2 %
Uncertainty for Radiation Emission test (9 kHz – 30 MHz)	3.44 dB
Uncertainty for Radiation Emission test (30 MHz - 1 GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz - 40 GHz)	4.10 dB (1 - 6 GHz)
	4.40 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	3.34dB (150KHz-30MHz)
	3.72dB (9KHz-150KHz)

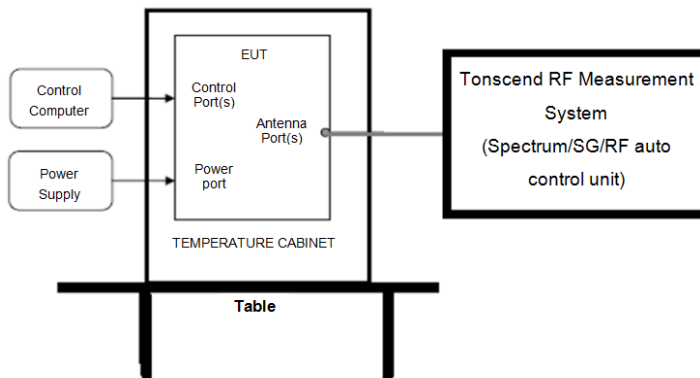
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. Equipment used during test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☑RF Connected Test (Tonscend RF Measurement System 3#)					
SPECTRUM ANALYZER	R&S	FSV40	101407	Jul. 21, 2022	1 Year
Wideband Radio Communication tester	R&S	CMW500	117491	May 18, 2022	1 Year
Vector Signal Generator	Agilent	N5182A	MY19060405	May 18, 2022	1 Year
Vector Signal Generator	Agilent	N5182A	MY48180912	May 18, 2022	1 Year
RF Control Unit	Tonsend	JS0806-2	DDT-ZC01449	May 18, 2022	1 Year
Temp&Humi Programmable	ZHIXIANG	ZXGDJS-150L	ZX170110-A	May 26, 2022	1 Year
Test Software	JS Tonscend	JS1120-3	Ver.2.6.77.0518	N/A	N/A
☑Radiation 3#chamber					
EMI Test Receiver	R&S	ESU	100472	May 18, 2022	1 Year
Spectrum analyzer	Agilent	E4447A	MY50180031	May 18, 2022	1 Year
Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Sep. 29, 2022	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB 9163	01429	Jul. 22, 2022	1 Year
Double Ridged Horn Antenna	Schwarzbeck	BBHA 9120 D	02468	Sep. 29, 2022	1 Year
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	790	May 06, 2022	1 Year
Pre-amplifier	COM-POWER	PAM-118A	18040084	Aug. 17, 2022	1 Year
Pre-amplifier	COM-POWER	PAM-840A	461369	Apr. 11, 2022	1 Year
RE Cable	N/A	W23.02 CP1-X2 + W23.09 AP1-X8+ JCT26S-NJ- NJ-1.5M+ JCT26S-NJ- NJ-1.5M	4.5M+8M+1.5M+ 1.5M	Aug.17, 2022	1 Year
RF Cable	Yuhu Technology	JCTB810-NJ- NJ-9M	21123964	May. 19,2022	1 Year
Test software	Tonscend	JS32-RE	V 5.0.0.1	N/A	N/A
☑Power Line Conducted Emissions Test 1#					
Test Receiver	R&S	ESCI	100551	Aug. 26, 2022	1 Year
LISN 1	R&S	ENV216	101109	Aug. 26, 2022	1 Year
LISN 2	R&S	ESH2-Z5	100309	Aug. 26, 2022	1 Year
Pulse Limiter	R&S	ESH3-Z2	101242	Aug. 26, 2022	1 Year
CE Cable 1	HUBSER	N/A	W10.01	Aug. 26, 2022	1 Year
Test software	Tonscend	JS32-RE	V 5.0.0.1	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:	$\geq 3\text{RBW}$
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

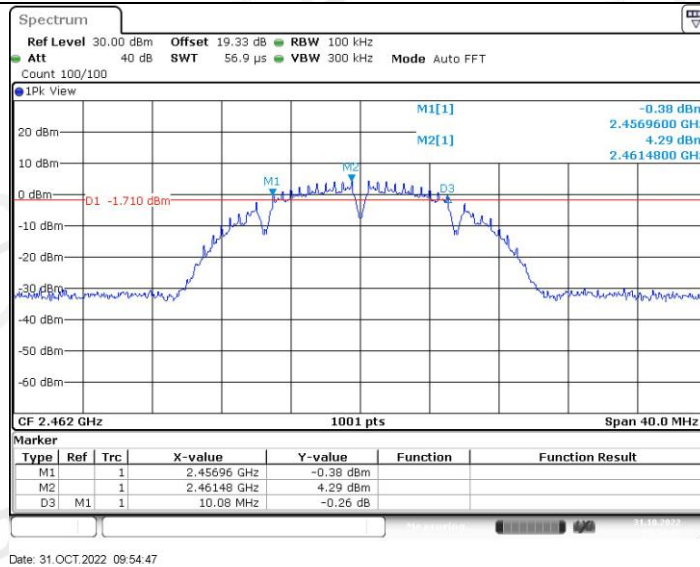
Test Mode	Test	Ant	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
11B	2412	Ant1	10.08	0.5	Pass
11B	2437	Ant1	10.08	0.5	Pass
11B	2462	Ant1	10.08	0.5	Pass
11G	2412	Ant1	16.32	0.5	Pass
11G	2437	Ant1	16.32	0.5	Pass
11G	2462	Ant1	16.32	0.5	Pass
11N20SISO	2412	Ant1	17.28	0.5	Pass
11N20SISO	2437	Ant1	17.28	0.5	Pass
11N20SISO	2462	Ant1	17.28	0.5	Pass
11N40SISO	2422	Ant1	36.08	0.5	Pass
11N40SISO	2437	Ant1	35.84	0.5	Pass
11N40SISO	2452	Ant1	36.08	0.5	Pass

Test Mode	Test	Ant	99% OBW [MHz]	Limit [MHz]	Verdict
11B	2412	Ant1	15.744	---	Pass
11B	2437	Ant1	15.824	---	Pass
11B	2462	Ant1	15.864	---	Pass
11G	2412	Ant1	17.662	---	Pass
11G	2437	Ant1	18.541	---	Pass
11G	2462	Ant1	17.662	---	Pass
11N20SISO	2412	Ant1	19.021	---	Pass
11N20SISO	2437	Ant1	19.061	---	Pass
11N20SISO	2462	Ant1	18.741	---	Pass
11N40SISO	2422	Ant1	36.843	---	Pass
11N40SISO	2437	Ant1	36.523	---	Pass
11N40SISO	2452	Ant1	36.523	---	Pass

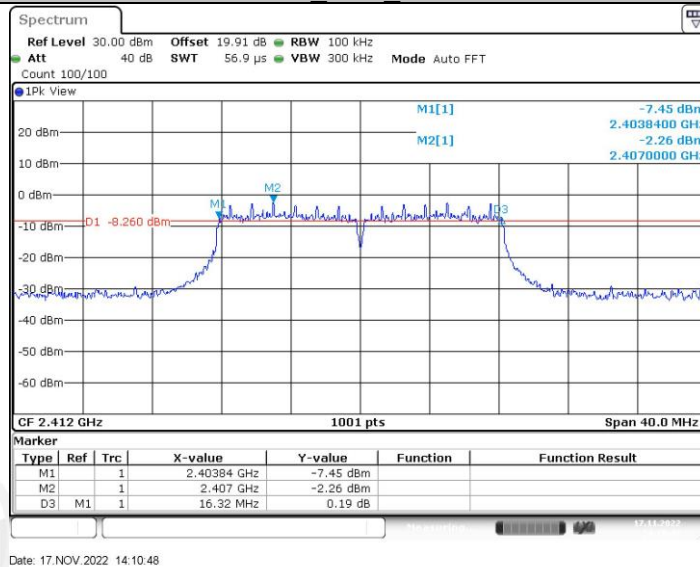
4.5. Original test data

6 dB bandwidth:

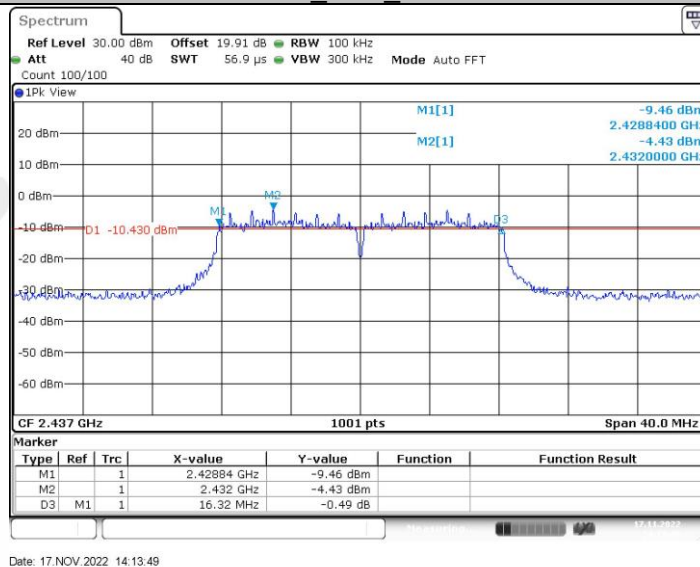




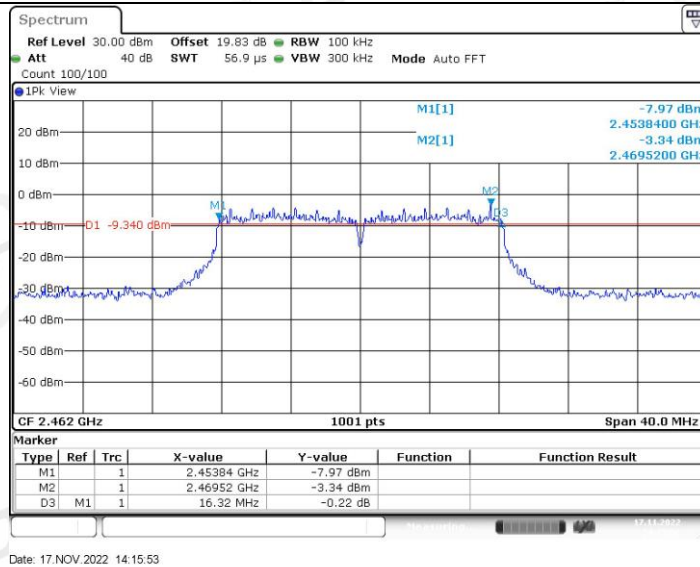
11G_Ant1_2412



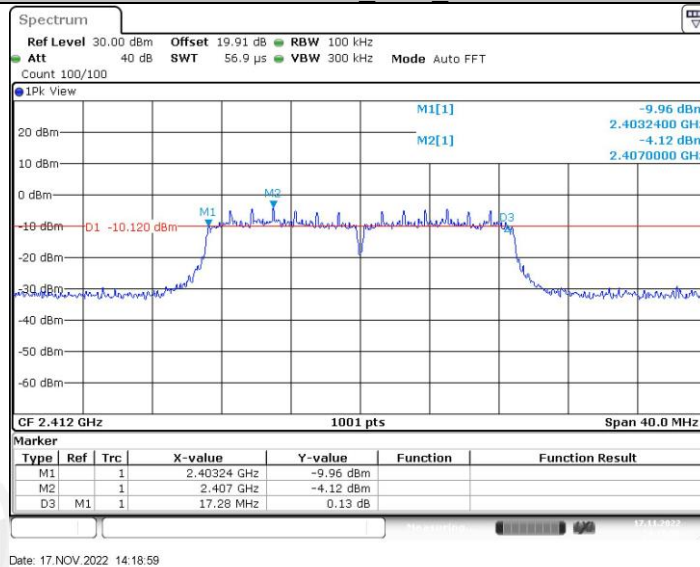
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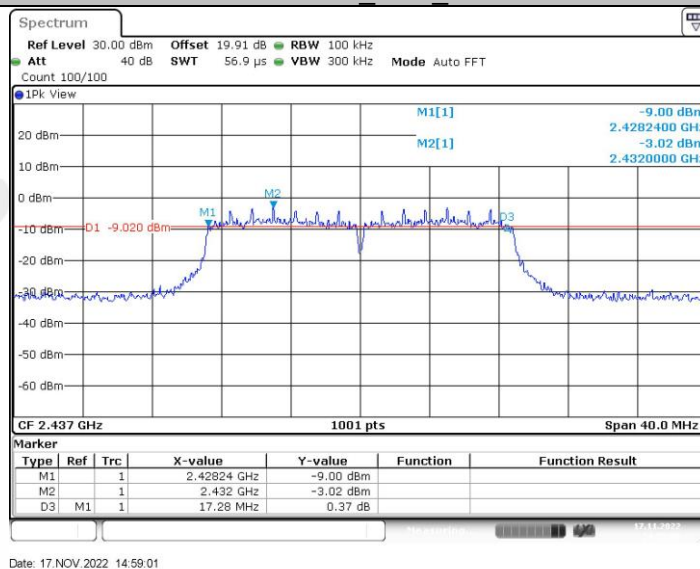
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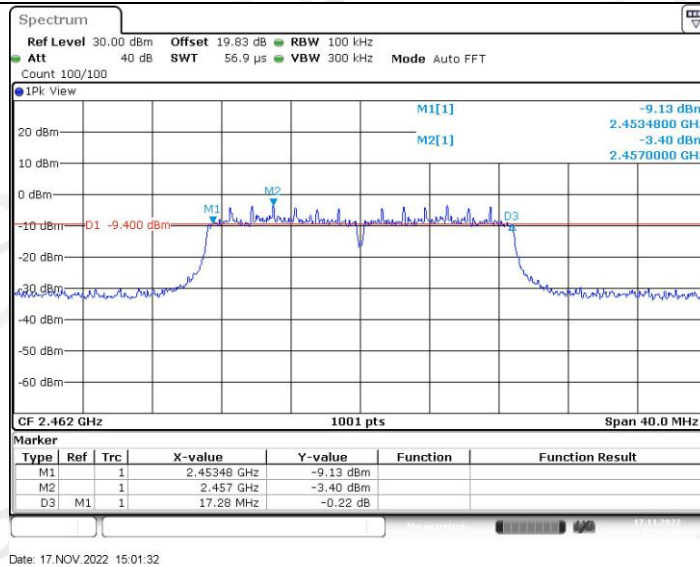
11N20SISO Ant1_2412



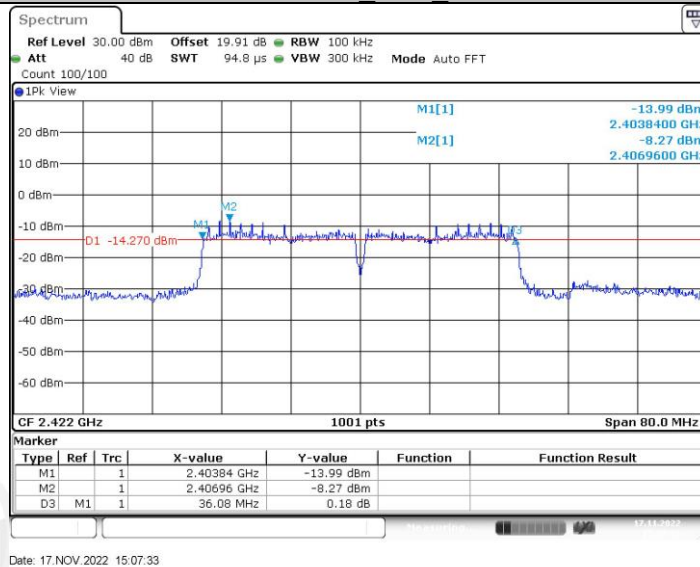
11N20SISO Ant1_2437



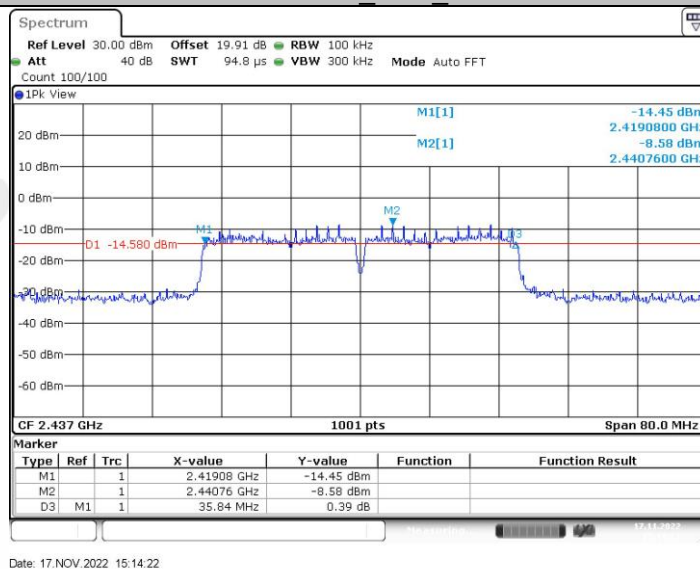
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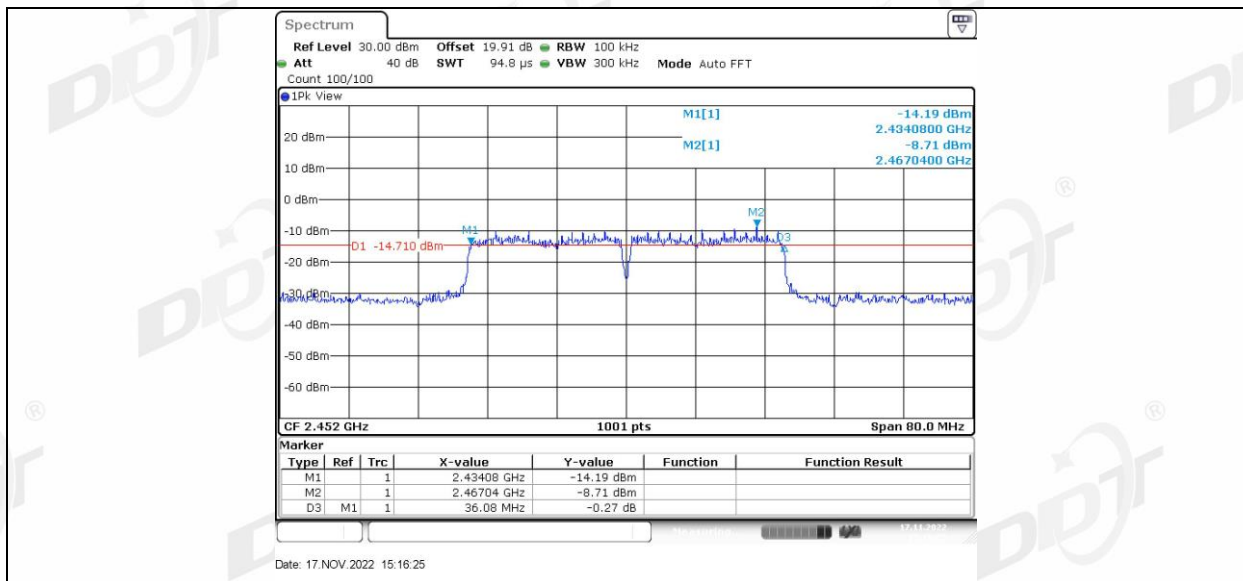
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11N40SISO_Ant1_2437

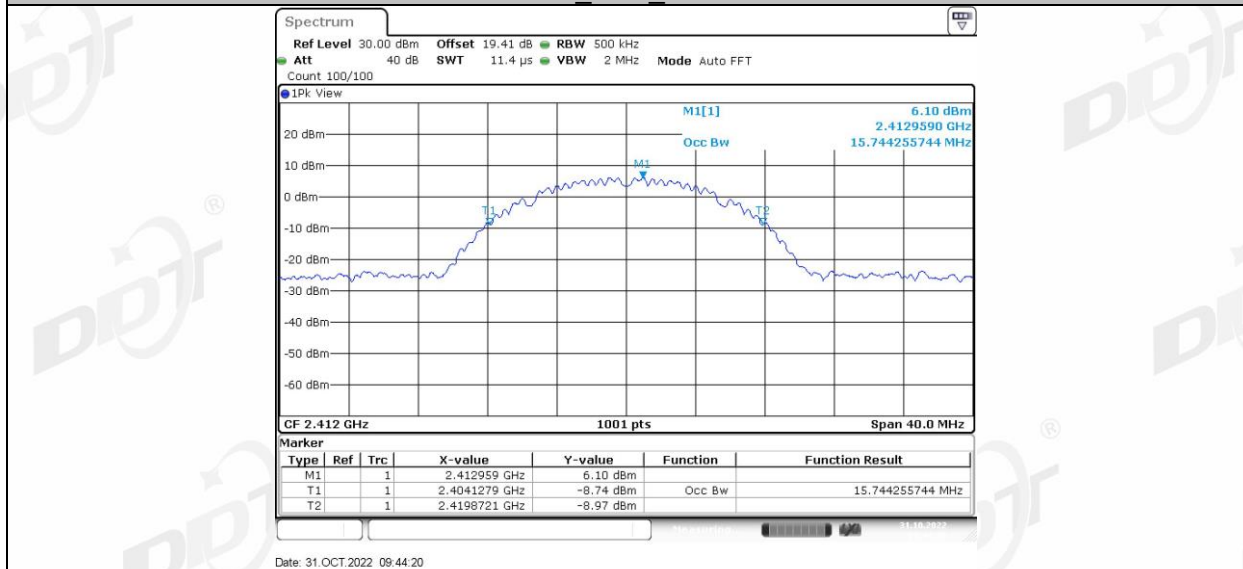


11N40SISO_Ant1_2452

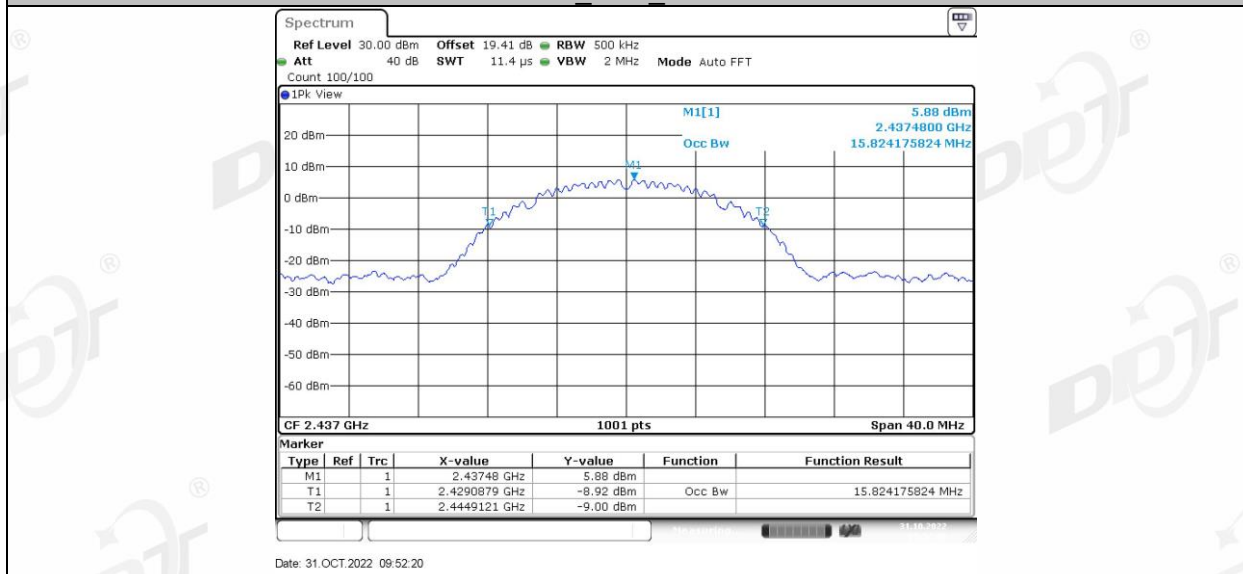


99% bandwidth:

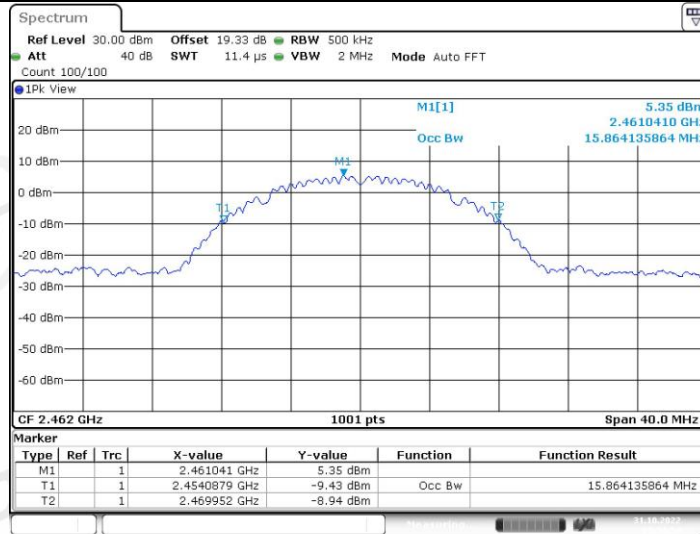
11B_Ant1_2412



11B_Ant1_2437

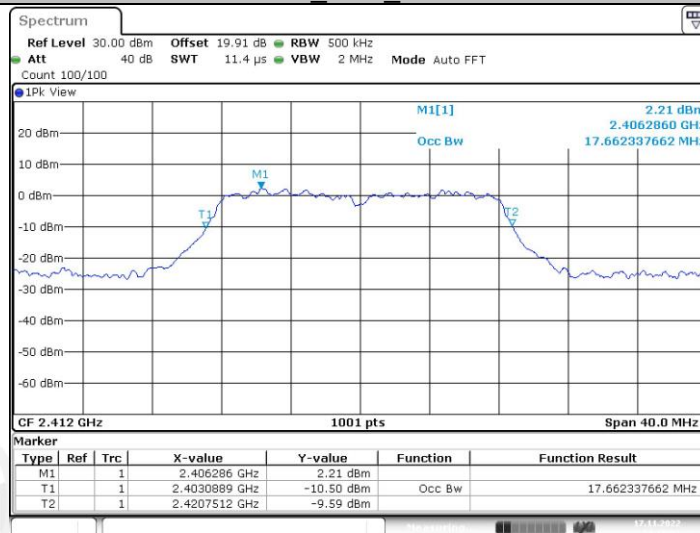


11B_Ant1_2462



Date: 31.OCT.2022 09:54:54

11G_Ant1_2412



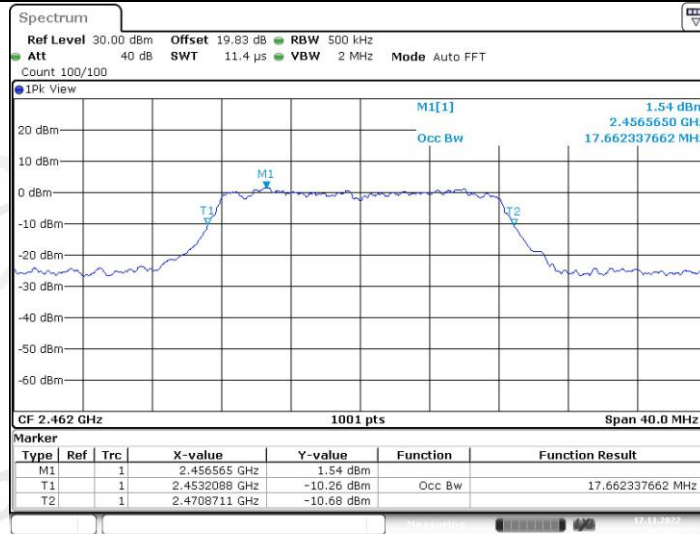
Date: 17.NOV.2022 14:10:54

11G_Ant1_2437

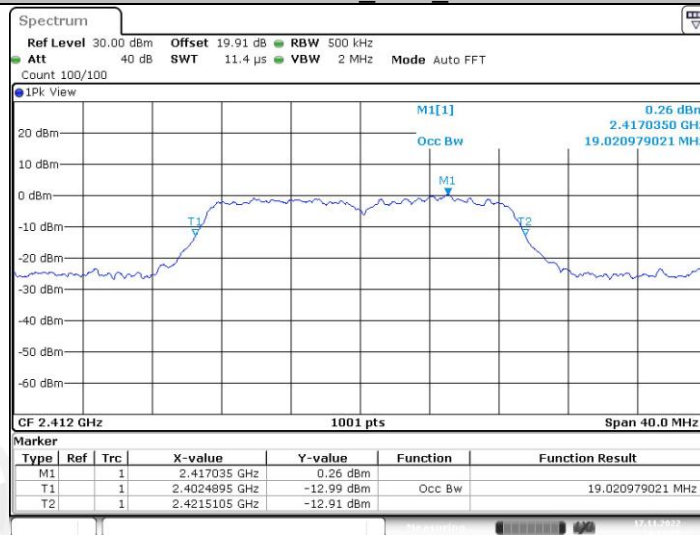


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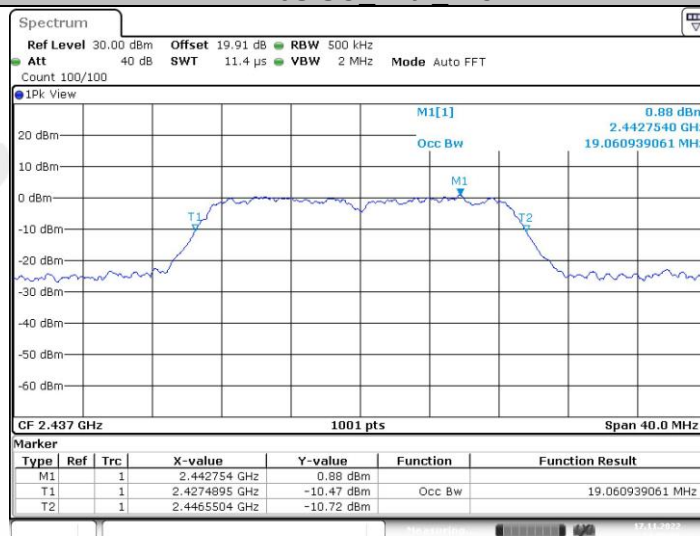
11G_Ant1_2462



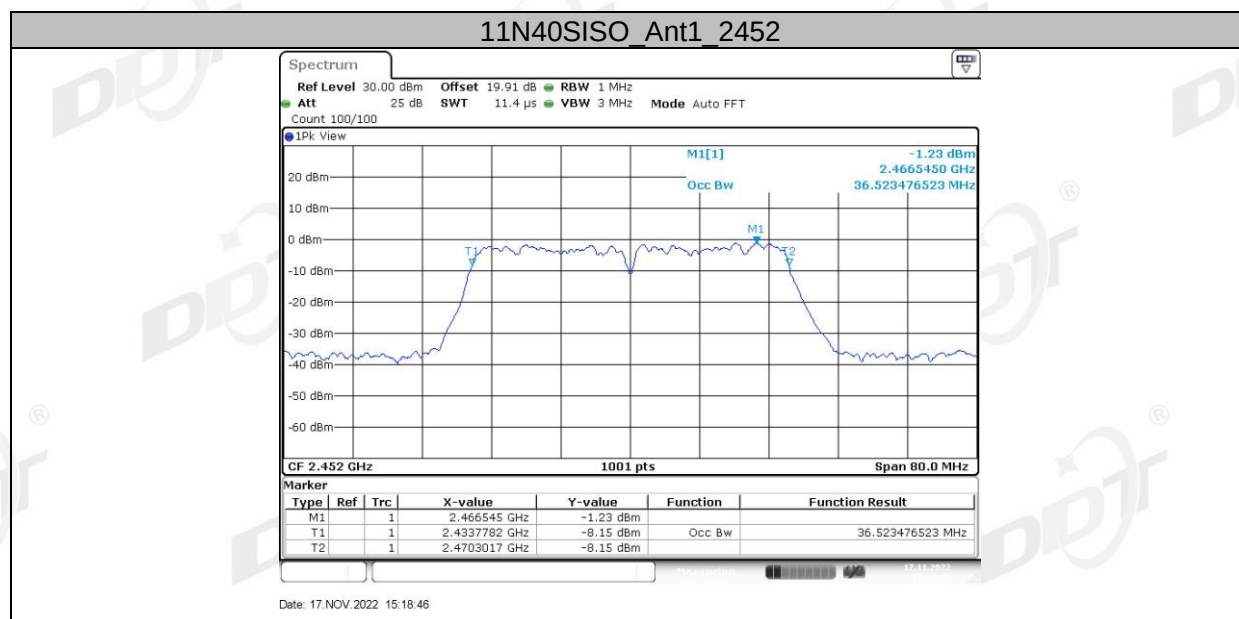
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437

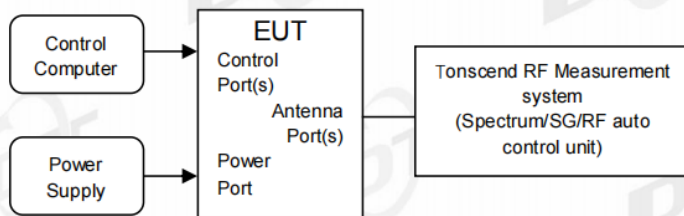






5. Duty Cycle

5.1. Block diagram of test setup



5.2. Limit

Just for Report.

5.3. Test procedure

- (1) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator, The cable loss and attenuator loss have been put into spectrum analyzer as amplitude offset. set the Spectrum Analyzer as below:

Centre Frequency: The centre frequency of the middle hopping channel.

Resolution BW: 10 MHz.

Video BW: 10 MHz.

Span: Zero span.

Detector: Peak.

Trace Mode: Max Hold.

Sweep: Video Trigger

- (2) When the trace is complete, measure the sending time of 1 burst and the duty cycle of 1 burst cycle.

- (3) Calculate dwell time follow below formula:

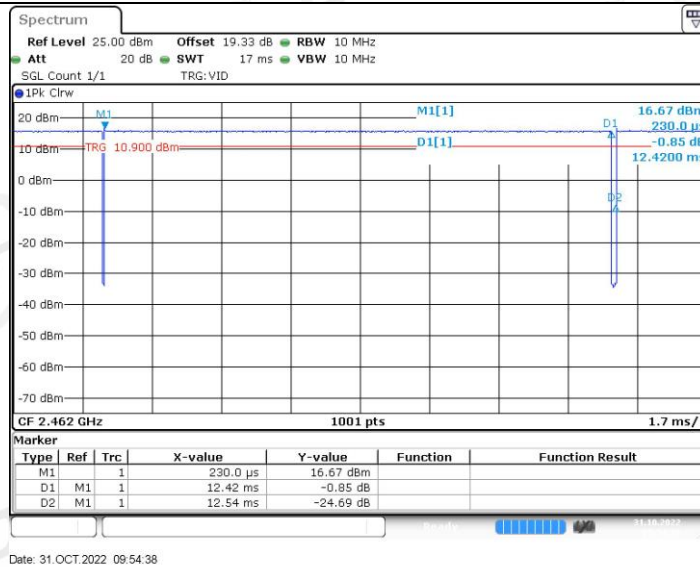
Duty cycle= Pulse's on time / Burst cycle

5.4. Test result

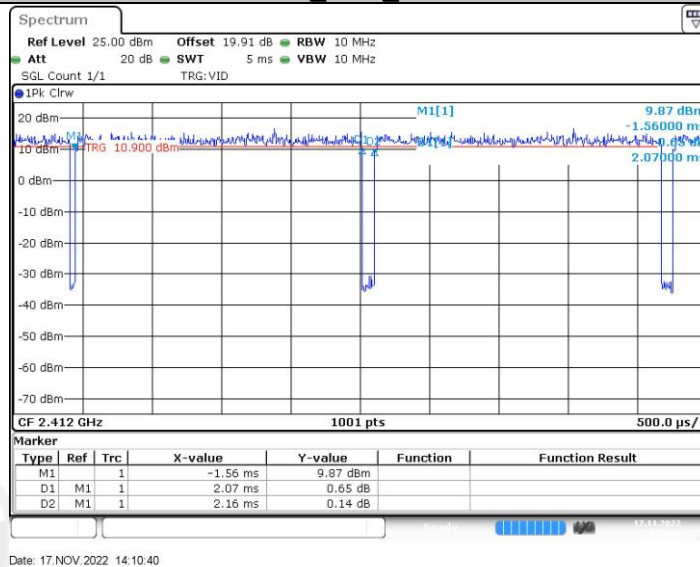
Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2412	12.44	12.56	99.04
		2437	12.42	12.54	99.04
		2462	12.42	12.54	99.04
11G	Ant1	2412	2.07	2.16	95.83
		2437	2.07	2.17	95.39
		2462	2.07	2.24	92.41
11N20SISO	Ant1	2412	1.93	2.06	93.69
		2437	1.93	2.06	93.69
		2462	1.93	2.10	91.90
11N40SISO	Ant1	2422	0.95	1.01	94.06
		2437	0.94	1.02	92.16
		2452	0.95	1.10	86.36

5.5. Test Graphs

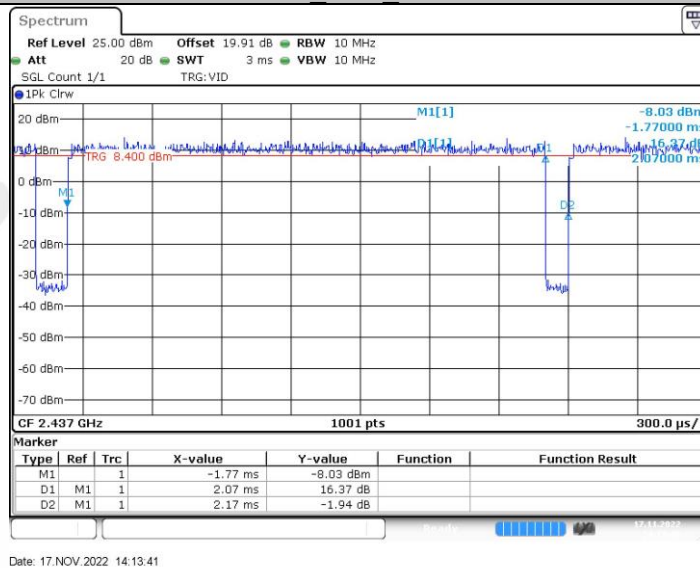




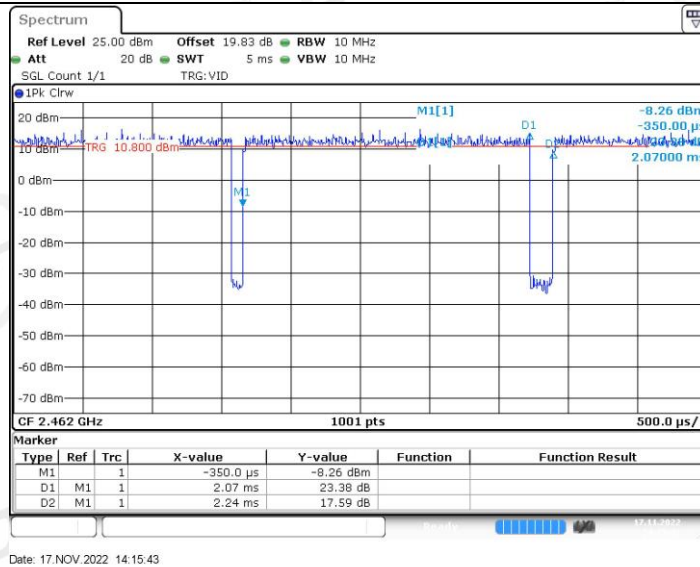
11G_Ant1_2412



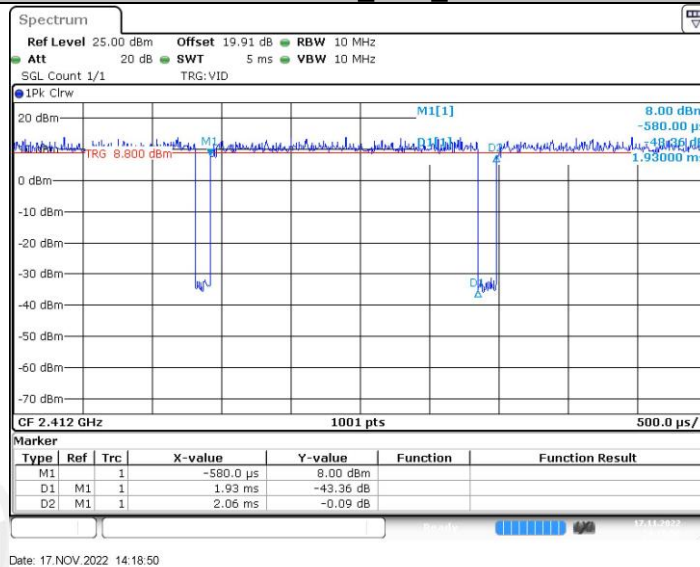
11G_Ant1_2437



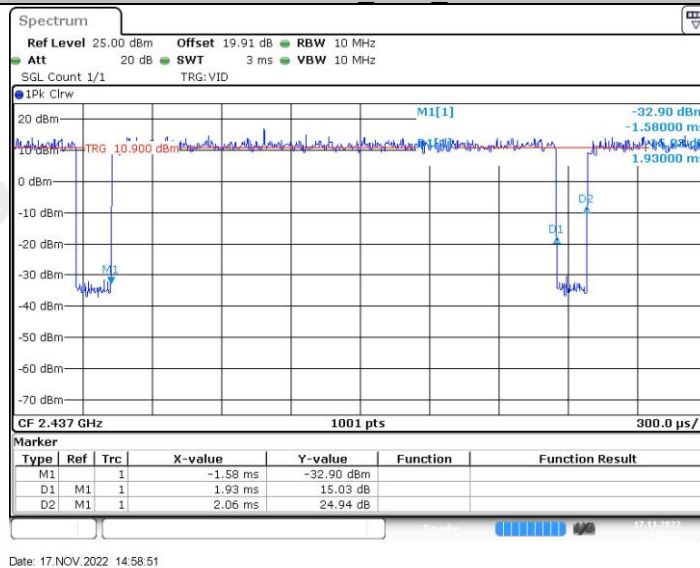
11G_Ant1_2462



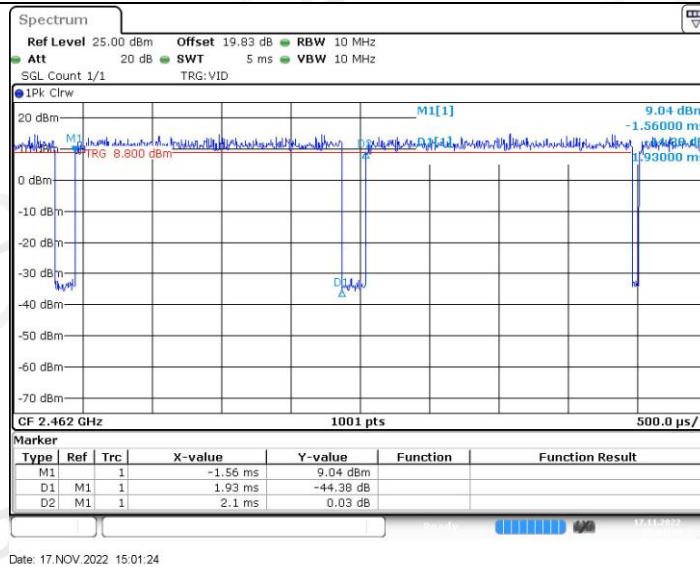
11N20SISO_Ant1_2412



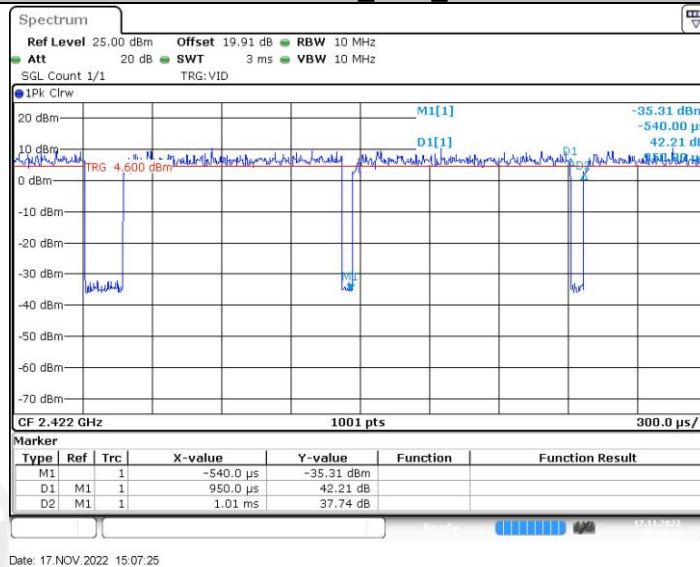
11N20SISO_Ant1_2437



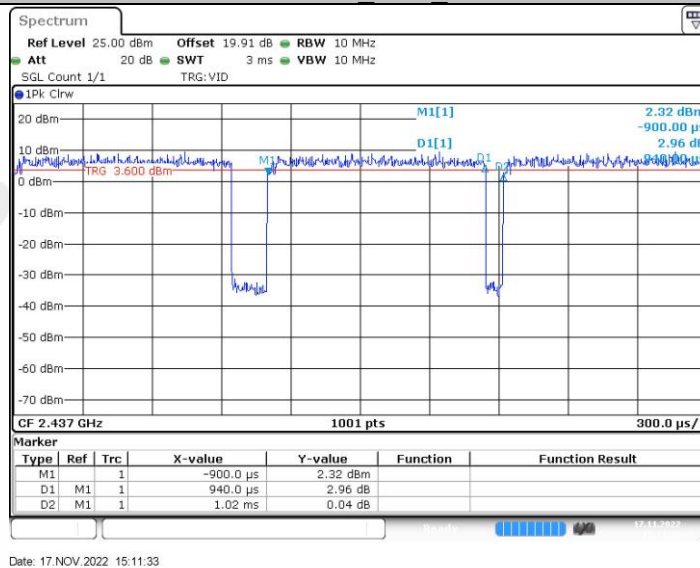
11N20SISO_Ant1_2462



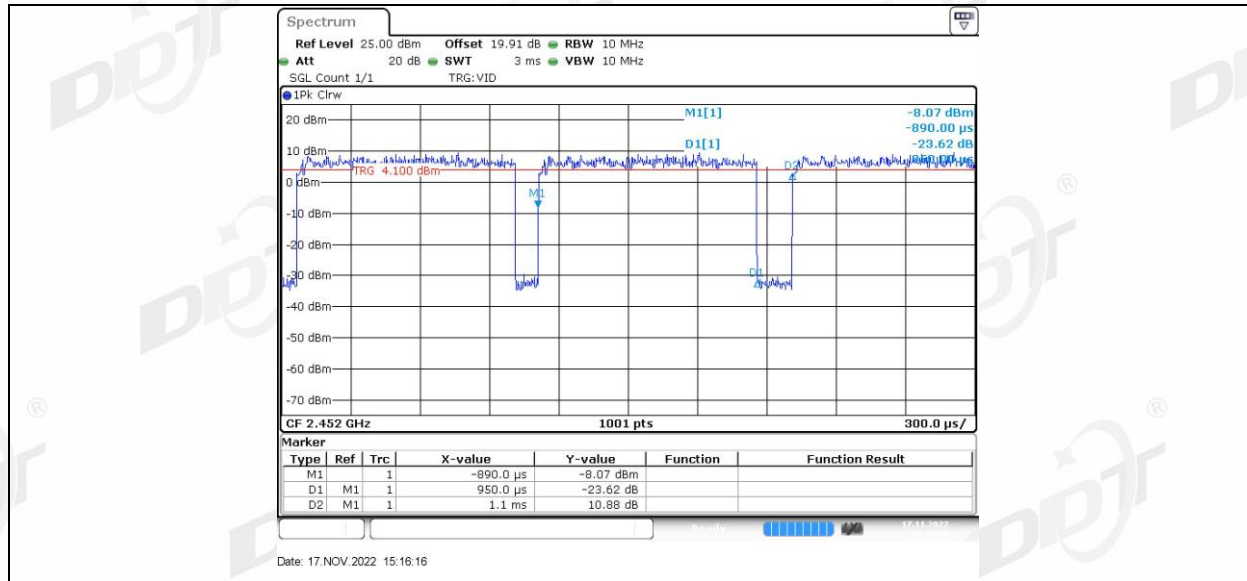
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



6. Conducted Output Power

6.1. Block diagram of test setup

Same as section 4.1

6.2. 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.

6.3. Test Procedure

Connect each EUT's antenna output to power sensor by RF cable and attenuator

Measure the output power of each antenna port by power meter.

6.4. Test Result

Test Mode	Test Channel	Ant	Average power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Conducted Output Power (dBm)	Limit [dBm]	Verdict
11B	2412	Ant1	15.27	99.04	0.04	15.31	30	Pass
11B	2437	Ant1	14.65	99.04	0.04	14.69	30	Pass
11B	2462	Ant1	14.40	99.04	0.04	14.44	30	Pass
11G	2412	Ant1	8.93	95.83	0.18	9.11	30	Pass
11G	2437	Ant1	6.76	95.39	0.20	6.96	30	Pass
11G	2462	Ant1	8.50	92.41	0.34	8.84	30	Pass
11N20SISO	2412	Ant1	6.83	93.69	0.28	7.11	30	Pass
11N20SISO	2437	Ant1	8.08	93.69	0.28	8.36	30	Pass
11N20SISO	2462	Ant1	7.76	91.90	0.37	8.13	30	Pass
11N40SISO	2422	Ant1	5.49	94.06	0.27	5.76	30	Pass
11N40SISO	2437	Ant1	5.37	92.16	0.35	5.72	30	Pass
11N40SISO	2452	Ant1	5.48	86.36	0.64	6.12	30	Pass

7. Power Spectral Density

7.1. Block diagram of test setup

Same as section 4.1

7.2. 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.

7.3. 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:	RMS
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.

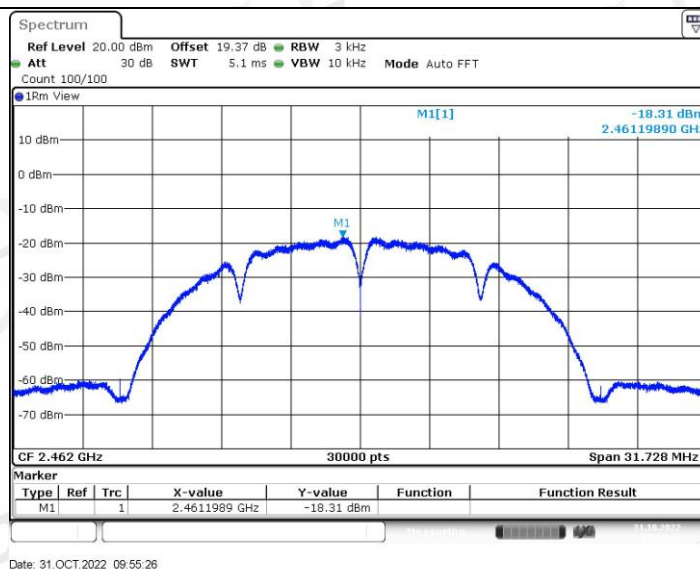
(4) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

7.4. Test Result

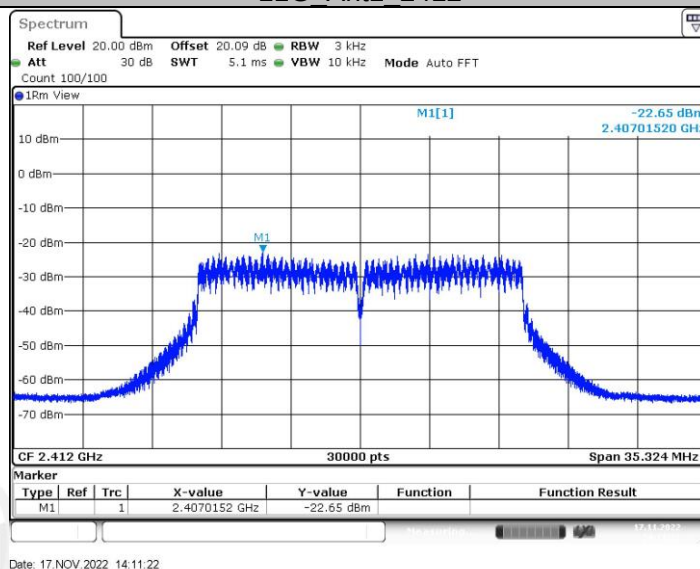
Test Mode	Test Channel	Ant	PSD [dBm]	Limit [dBm/3kHz]	Verdict
11B	2412	Ant1	-17.16	8.00	Pass
11B	2437	Ant1	-17.90	8.00	Pass
11B	2462	Ant1	-18.31	8.00	Pass
11G	2412	Ant1	-22.65	8.00	Pass
11G	2437	Ant1	-24.58	8.00	Pass
11G	2462	Ant1	-24.03	8.00	Pass
11N20SISO	2412	Ant1	-24.89	8.00	Pass
11N20SISO	2437	Ant1	-22.77	8.00	Pass
11N20SISO	2462	Ant1	-23.82	8.00	Pass
11N40SISO	2422	Ant1	-27.99	8.00	Pass
11N40SISO	2437	Ant1	-28.17	8.00	Pass
11N40SISO	2452	Ant1	-27.36	8.00	Pass

7.5. Original test data

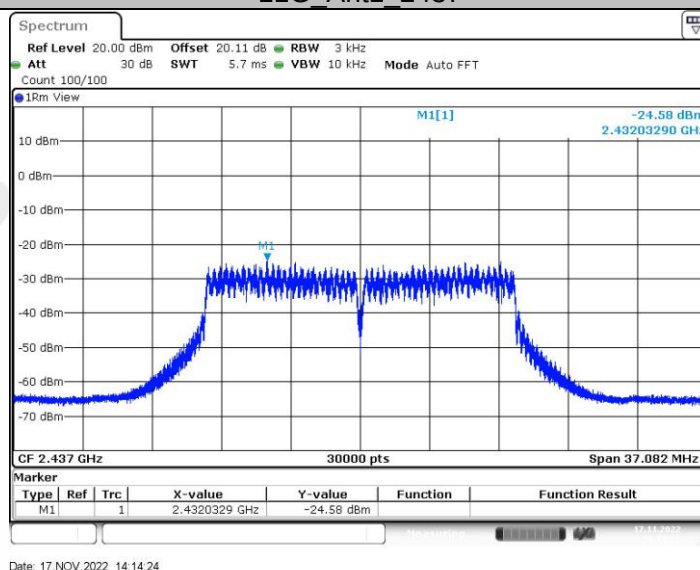




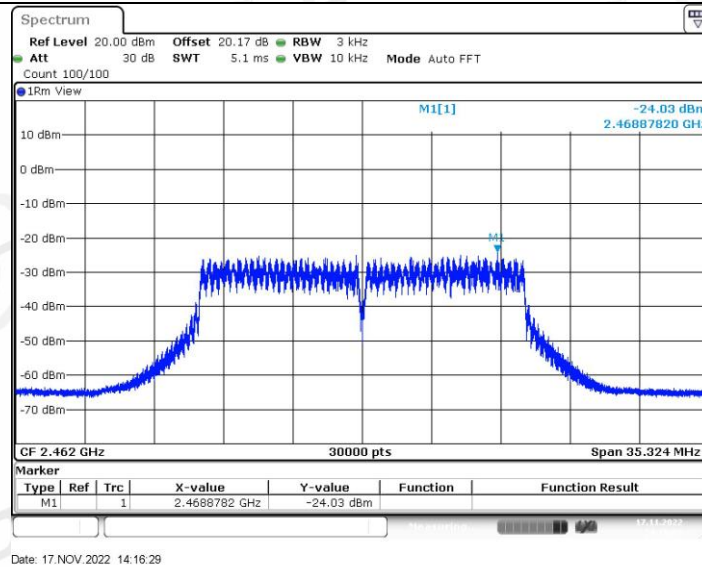
11G_Ant1_2412



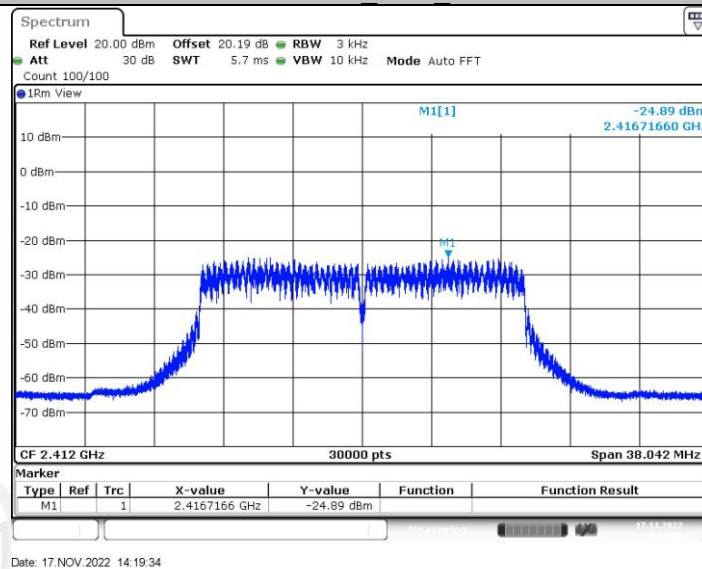
11G_Ant1_2437



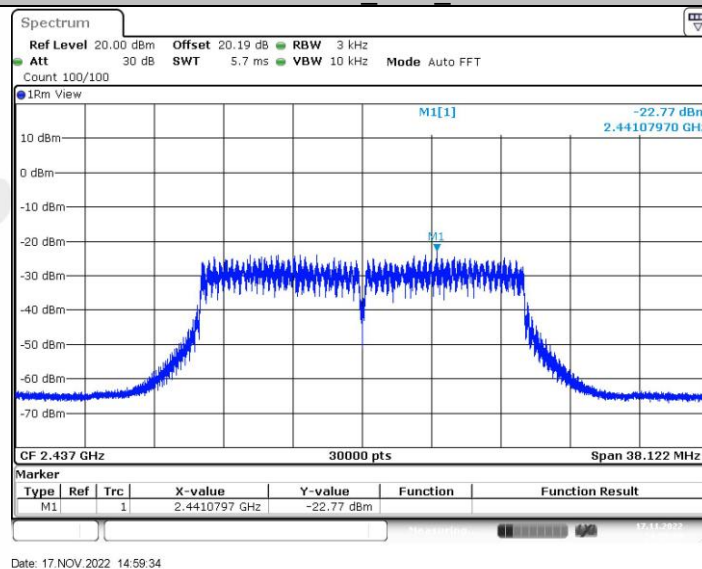
11G_Ant1_2462



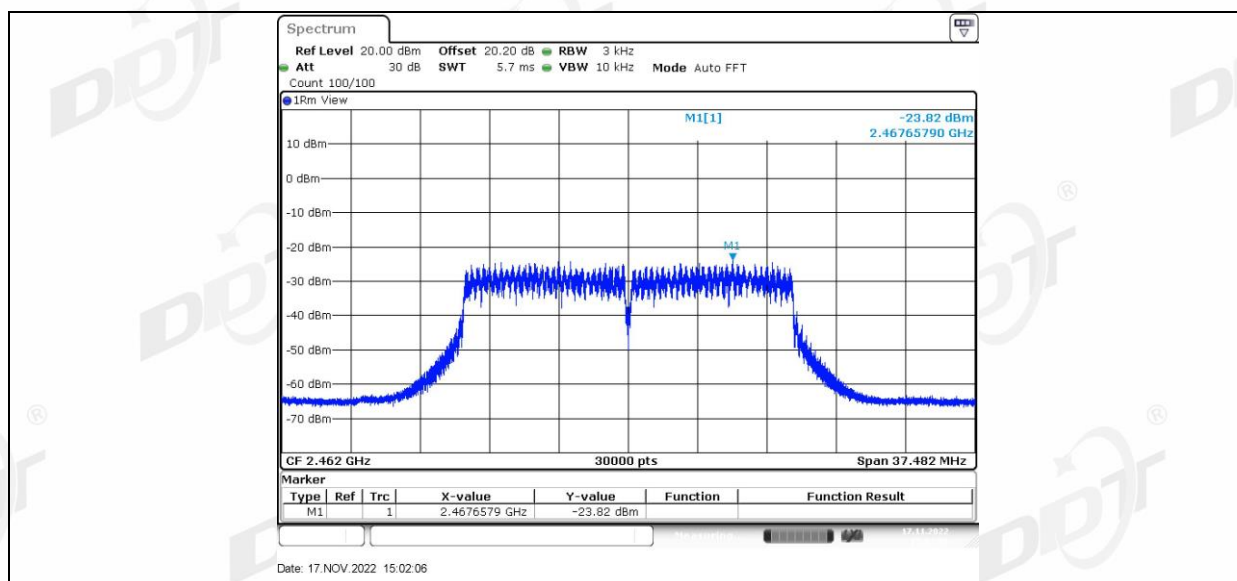
11N20SISO_Ant1_2412



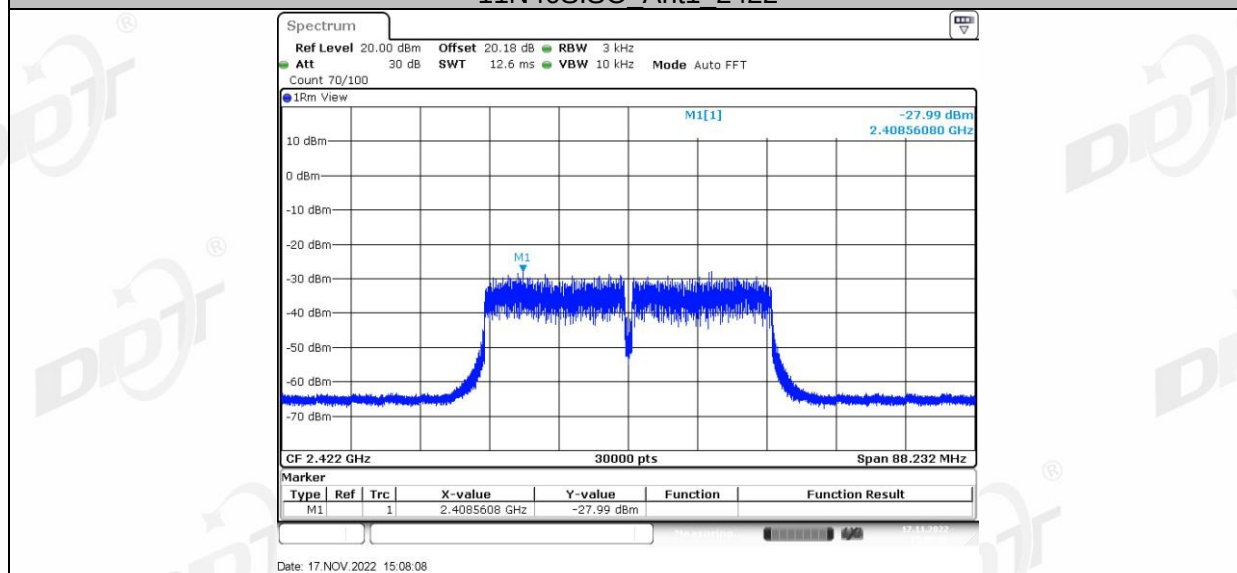
11N20SISO_Ant1_2437



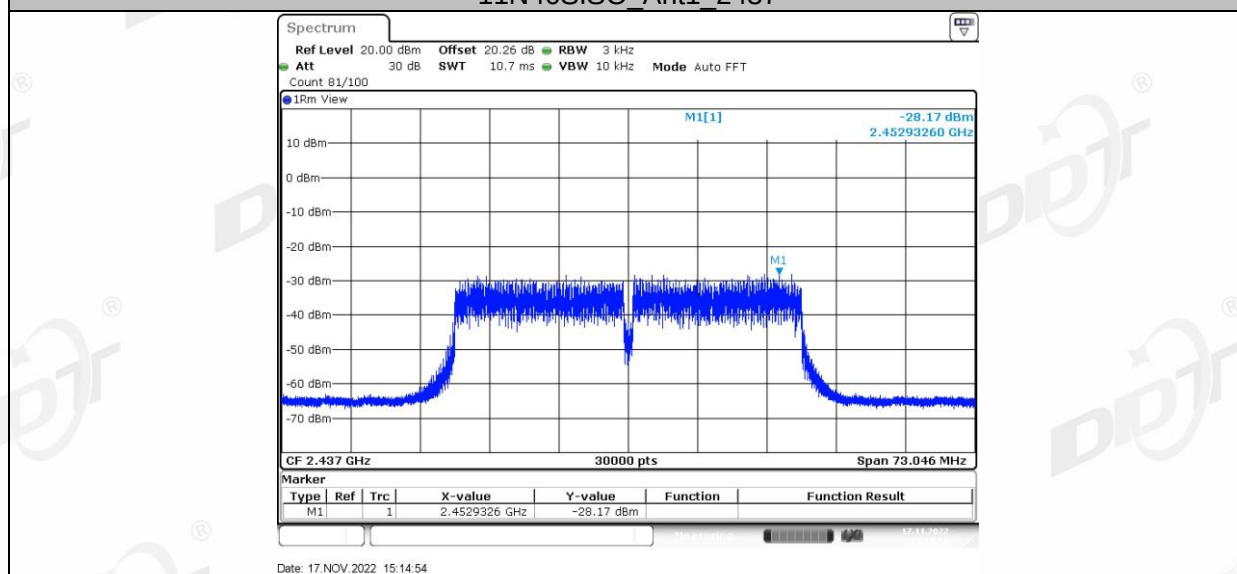
11N20SISO_Ant1_2462



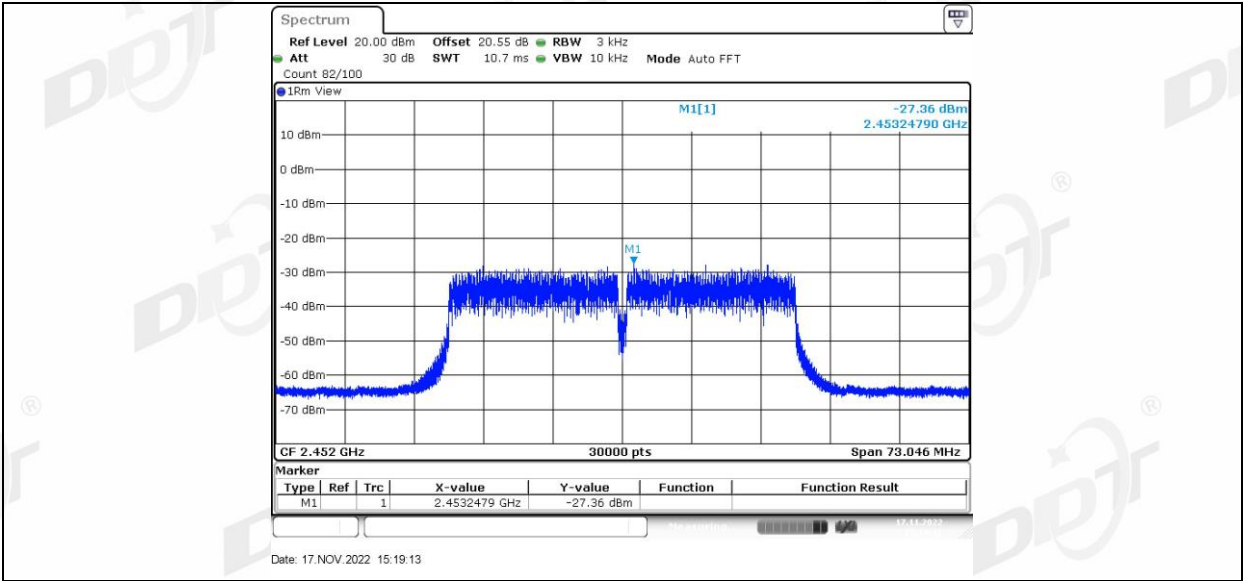
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



Note: The Duty Cycle Factor is compensated in the graph.

8. Band Edge Compliance (Conducted Method)

8.1. Block diagram of test setup

Same as section 4.1

8.2. 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 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

8.3. Test procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Establish a reference level by using the following procedure:

RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
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) Then mark the maximum amplitude of all unwanted emissions outside of the authorized frequency band.

8.4. Test Result

EUT Set Mode	CH or Frequency	Result (dBm)	EUT Set Mode	CH or Frequency	Result Result (dBm)
11b	CH1	Pass	11n HT 20	CH1	Pass
	CH6	Pass		CH6	Pass
	CH11	Pass		CH11	Pass
11g	CH1	Pass	11n HT 40	CH3	Pass
	CH6	Pass		CH6	Pass
	CH11	Pass		CH9	Pass