FCC/ISED RF Test Report

APPLICANT	:	Motorola Solutions Inc.
EQUIPMENT	:	WAVE PTX TWO-WAY RADIO
BRAND NAME	:	MOTOROLA
MODEL NAME	:	TLK 25 Wi-Fi
FCC MODEL NUMBER	:	HK2198A
HVIN	:	HK2206A
IC MODEL NUMBER	:	HK2206A
PMN	:	TLK 25 Wi-Fi
FCC ID	:	AZ499FT7172
IC	:	109U-99FT7172
STANDARD	:	FCC Part 15 Subpart C § 15.247 ISED RSS-247 Issue 2
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Jun. 14, 2023 ~ Jun. 30, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR341404-01C	Rev. 01	Initial issue of report	Jul. 12, 2023
FR341404-01C	Rev. 02	Update Emission Designator on Page 4	Aug. 02, 2023

SUMMARY OF TEST RESULT

Report Section	FCC Rule	ISED Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-247 5.2(a)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	RSS-Gen 6.7	Emission Designator	-	Report Only	802.11b : 13M9G1D 802.11g : 17M4D1D 802.11n HT20 : 18M3D1D 802.11n HT40 : 36M8D1D
3.2	15.247(b)	RSS-247 5.4(d)	Power Output Measurement	≤ 30dBm	Pass	802.11b : 19.69 dBm (0.0931 W) 802.11g : 20.32 dBm (0.1076 W) 802.11n HT20 : 20.23 dBm (0.1054 W) 802.11n HT40 : 20.74 dBm (0.1186 W)
3.3	15.247(e)	RSS-247 5.2(b)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	RSS-247 5.5	Conducted Band Edges	≤ 20dBc	Pass	-
			Conducted Spurious Emission		Pass	-
3.5	15.247(d)	RSS-247 5.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d) / RSS-Gen [8.9 Table 5, Table 6 and Table 7]	Pass	Under limit 5.22 dB at 2483.63 MHz for Band Edge Under limit 5.20 dB at 4874.00 MHz for Harmonic Under limit 6.43 dB at 35.82 MHz for LF
3.6	15.207	RSS-GEN 8.8	AC Conducted Emission	15.207(a) / RSS-Gen [8.8 Table 4]	Pass	Under limit 18.45 dB at 4.622 MHz
3.7	15.203 & 15.247(b)	N/A	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Applicant

Motorola Solutions Inc.
8000 West Sunrise Boulevard, Fort Lauderdale, Florida

1.2 Manufacturer

Motorola Solutions Inc.
8000 West Sunrise Boulevard, Fort Lauderdale, Florida

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	WAVE PTX TWO-WAY RADIO
Brand Name	MOTOROLA
Model Name	TLK 25 Wi-Fi
FCC Model Number	HK2198A
IC Model Number	HK2206A
HVIN	HK2206A
PMN	TLK 25 Wi-Fi
FCC ID	AZ499FT7172
IC	109U-99FT7172
SN	Conducted: 64222ZJ0072 Conduction: 64222ZJ0083 Radiation: 64222ZJ0090
HW Version	P2B
SW Version / FVIN	VANGOGH_BASE_ENG_D00.00.09_AP_D00.00.40_WNA
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to antenna	802.11b : 19.69 dBm (0.0931 W) 802.11g : 20.32 dBm (0.1076 W) 802.11n HT20 : 20.23 dBm (0.1054 W) 802.11n HT40 : 20.74 dBm (0.1186 W)
99% Occupied Bandwidth	802.11b : 13.866MHz 802.11g : 17.423MHz 802.11n HT20 : 18.262MHz 802.11n HT40 : 36.763MHz
Antenna Type / Gain	PIFA Antenna type with gain -2.1 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Specification of Accessory

Accessories Information				
AC Adapter	**Brand Name**	MOTOROLA	**Model Name**	PS000150A31
Battery	**Brand Name**	MOTOROLA	**Model Name**	PMNN4602A
Earphone 1	**Brand Name**	MOTOROLA	**Model Name**	PMLN8536A
USB Cable	**Brand Name**	MOTOROLA	**Model Name**	PMKN4294A
Badge Clip	**Brand Name**	MOTOROLA	**Model Name**	PMLN8538A

1.7 Testing Location

<FCC>

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH06-KS TH01-KS	CN1257	314309

<IC>

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02

Test Firm	Sporton International Inc. (KunShan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL: +86-512-57900158		
Test Site No.	**Sporton Site No.**	**Company Number**	**CAB identifier**
	CO01-KS 03CH06-KS TH01-KS	4086E	CN0050

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013
- ISED RSS-247 Issue 2
- ISED RSS-Gen Issue 5

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

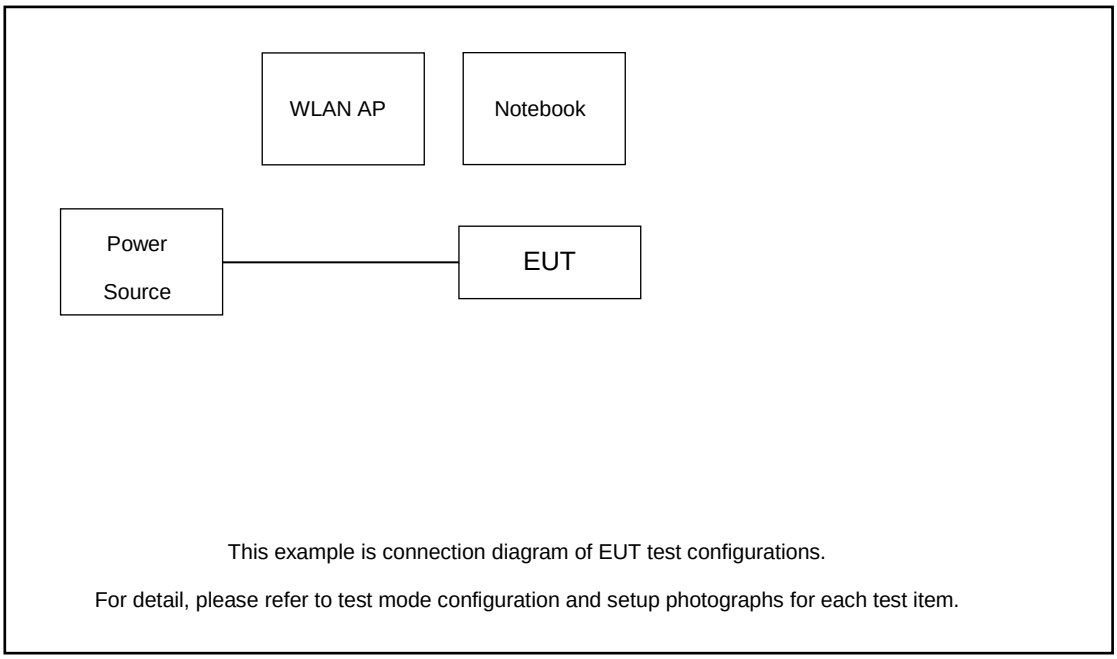
Conducted Test Cases	
Modulation	**Data Rate**
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20	**MCS0**
802.11n HT40	**MCS0**

Test Cases	
AC Conducted Emission	Mode 1 :WLAN Link(2.4G) + USB Cable(Charging From Adapter)
Remark: For Radiated Test Cases, The tests were performed with Adapter, Earphone 1, USB Cable	

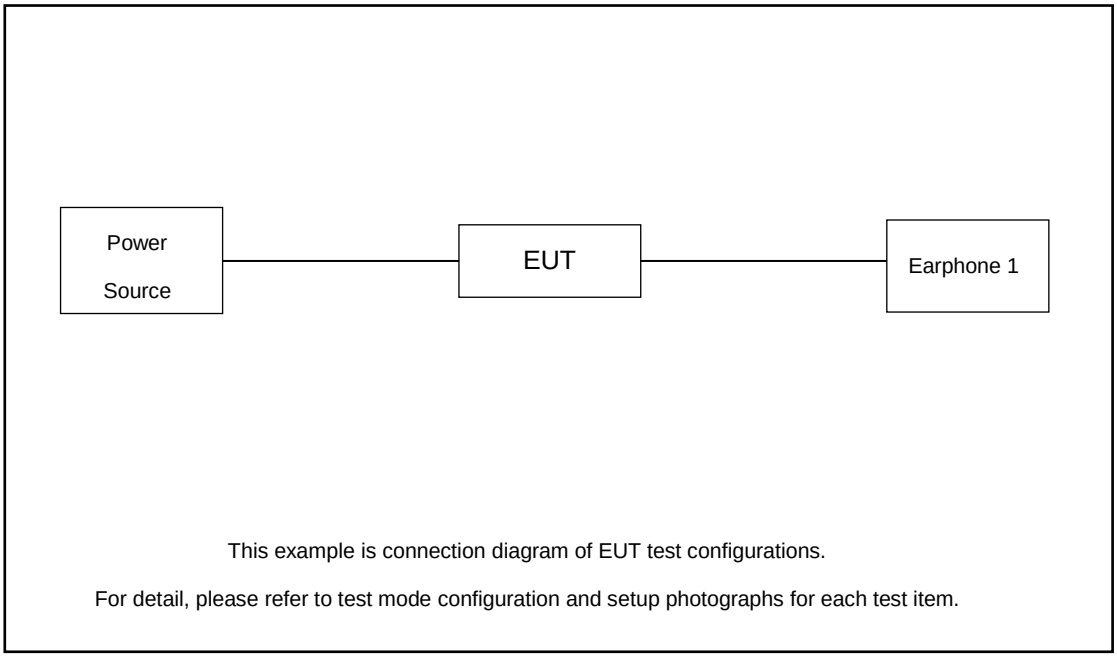
Radiated Test Cases	
Modulation	**Data Rate**
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20	**MCS0**
802.11n HT40	**MCS0**

2.3 Connection Diagram of Test System

For Conducted Emission:



For Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-Link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
2.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 2.45 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 2.45 + 10 = 12.45 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

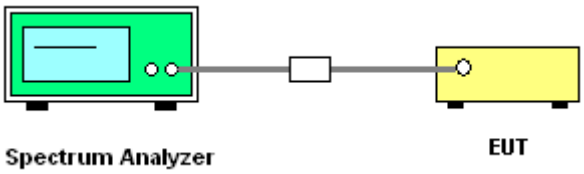
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1%~5% of OBW and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

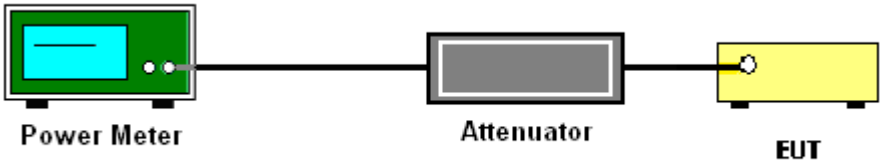
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

2.4GHz Band Single Antenna										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
11b	1Mbps	1	1	2412	19.69	30.00	-2.10	17.59	36.00	Pass
11b	1Mbps	1	6	2437	17.60	30.00	-2.10	15.50	36.00	Pass
11b	1Mbps	1	11	2462	17.38	30.00	-2.10	15.28	36.00	Pass
11g	6Mbps	1	1	2412	20.08	30.00	-2.10	17.98	36.00	Pass
11g	6Mbps	1	6	2437	20.32	30.00	-2.10	18.22	36.00	Pass
11g	6Mbps	1	11	2462	19.83	30.00	-2.10	17.73	36.00	Pass
HT20	MCS0	1	1	2412	19.93	30.00	-2.10	17.83	36.00	Pass
HT20	MCS0	1	6	2437	20.23	30.00	-2.10	18.13	36.00	Pass
HT20	MCS0	1	11	2462	19.99	30.00	-2.10	17.89	36.00	Pass
HT40	MCS0	1	3	2422	20.04	30.00	-2.10	17.94	36.00	Pass
HT40	MCS0	1	6	2437	20.74	30.00	-2.10	18.64	36.00	Pass
HT40	MCS0	1	9	2452	20.53	30.00	-2.10	18.43	36.00	Pass

3.2.6 Test Result of Average Output Power (Reporting Only)

2.4GHz Band Single Antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power with duty factor (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail	Power Setting
11b	1Mbps	1	1	2412	0.05	17.28	30.00	-2.10	15.18	36.00	Pass	17.00
11b	1Mbps	1	6	2437	0.05	15.31	30.00	-2.10	13.21	36.00	Pass	15.00
11b	1Mbps	1	11	2462	0.05	15.00	30.00	-2.10	12.90	36.00	Pass	15.00
11g	6Mbps	1	1	2412	0.08	15.32	30.00	-2.10	13.22	36.00	Pass	15.50
11g	6Mbps	1	6	2437	0.08	15.64	30.00	-2.10	13.54	36.00	Pass	15.50
11g	6Mbps	1	11	2462	0.08	15.09	30.00	-2.10	12.99	36.00	Pass	15.50
HT20	MCS0	1	1	2412	0.09	15.13	30.00	-2.10	13.03	36.00	Pass	15.50
HT20	MCS0	1	6	2437	0.09	15.50	30.00	-2.10	13.40	36.00	Pass	15.50
HT20	MCS0	1	11	2462	0.09	14.92	30.00	-2.10	12.82	36.00	Pass	15.50
HT40	MCS0	1	3	2422	0.26	14.02	30.00	-2.10	11.92	36.00	Pass	13.50
HT40	MCS0	1	6	2437	0.26	14.53	30.00	-2.10	12.43	36.00	Pass	13.50
HT40	MCS0	1	9	2452	0.26	14.24	30.00	-2.10	12.14	36.00	Pass	13.50

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

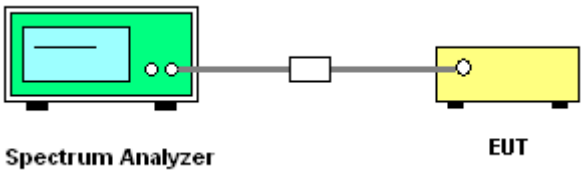
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

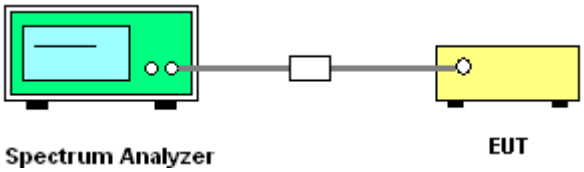
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.11
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Please refer to Appendix A.

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

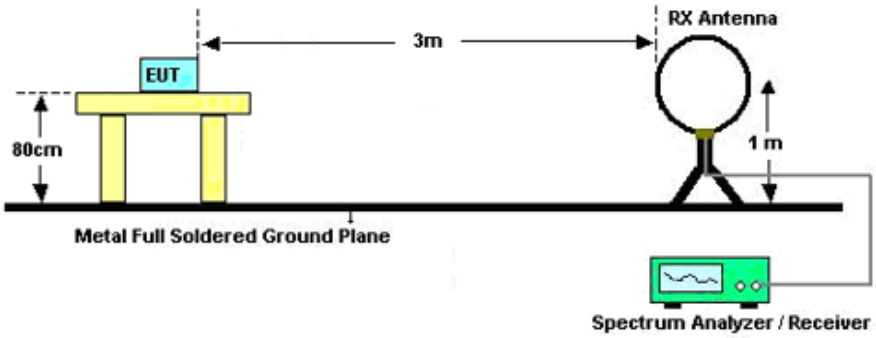
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

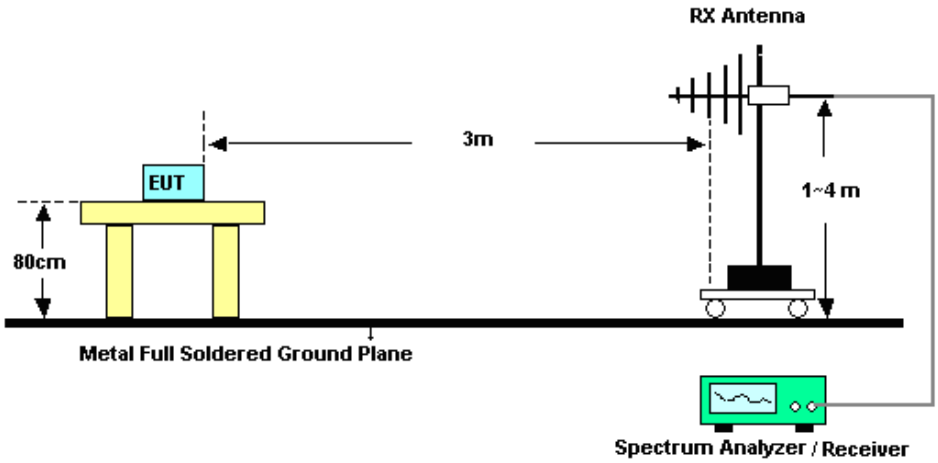
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

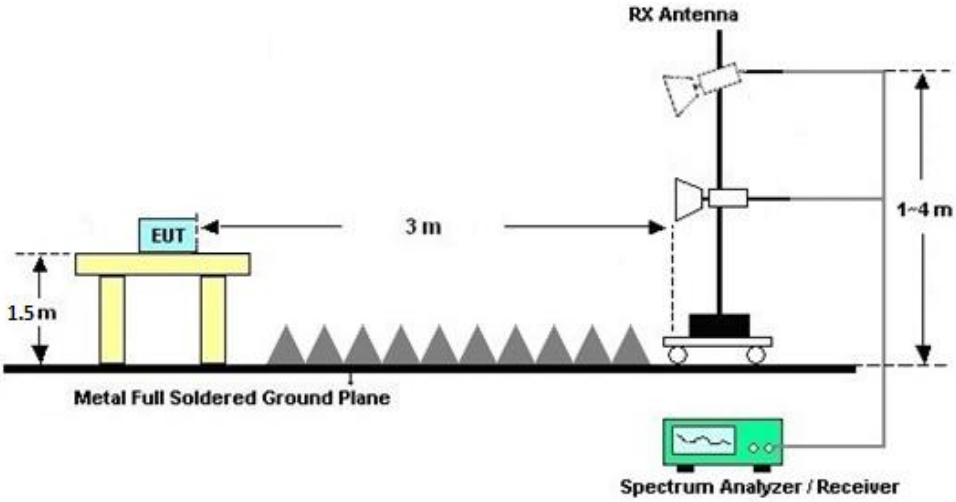
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

*Decreases with the logarithm of the frequency.

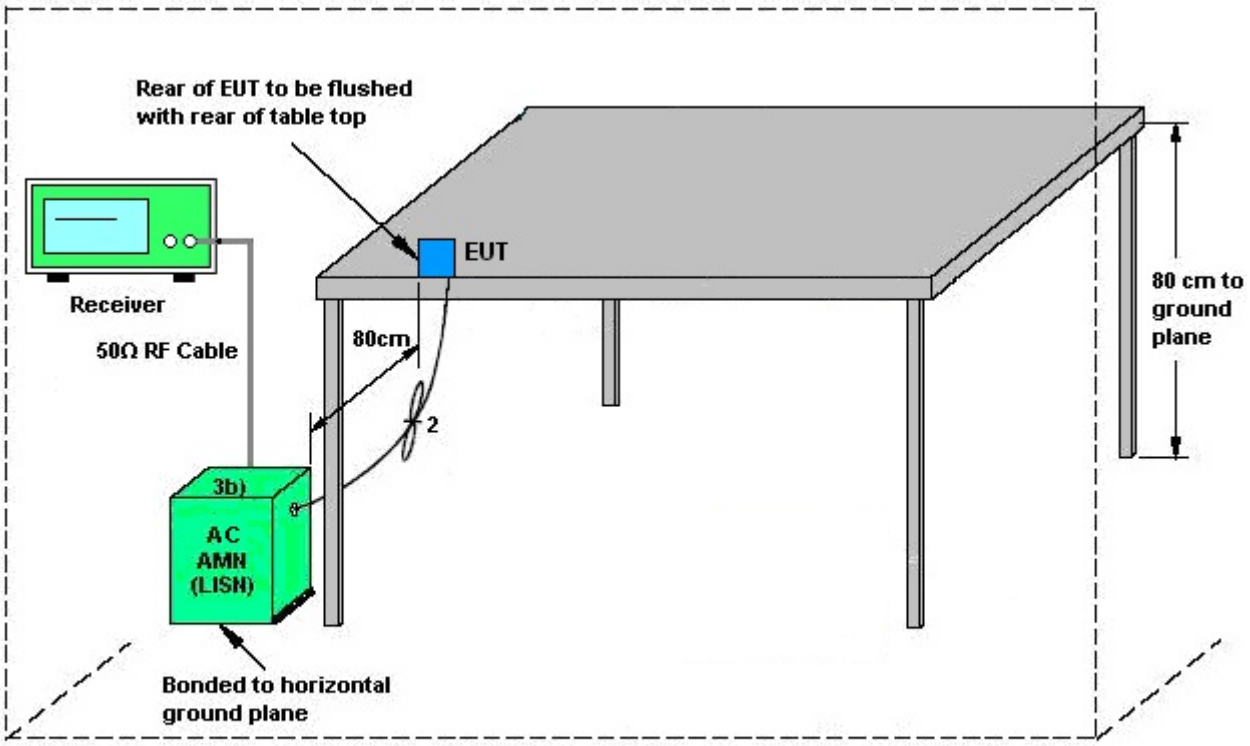
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Jun. 16, 2023~ Jun. 30, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2023	Jun. 16, 2023~ Jun. 30, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Jun. 16, 2023~ Jun. 30, 2023	Jan. 04, 2024	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 001	30MHz~40GHz	Jun. 18, 2022	Jun. 16, 2023~ Jun. 30, 2023	Jun. 17, 2023	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 001	30MHz~40GHz	Jun. 17, 2023		Jun. 16, 2024	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 002	30MHz~40GHz	Jun. 18, 2022	Jun. 16, 2023~ Jun. 30, 2023	Jun. 17, 2023	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 002	30MHz~40GHz	Jun. 17, 2023		Jun. 16, 2024	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 003	30MHz~40GHz	Jun. 18, 2022	Jun. 16, 2023~ Jun. 30, 2023	Jun. 17, 2023	Conducted (TH01-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX 104	TH01KS 003	30MHz~40GHz	Jun. 17, 2023		Jun. 16, 2024	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 13, 2022	Jun. 14, 2023	Oct. 12, 2023	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY60242126	10Hz-44GHz	Oct. 13, 2022	Jun. 14, 2023	Oct. 12, 2023	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Jun. 14, 2023	Oct. 15, 2023	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	Apr. 09, 2023	Jun. 14, 2023	Apr. 08, 2024	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 06, 2023	Jun. 14, 2023	Apr. 05, 2024	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 08, 2023	Jun. 14, 2023	Jan. 07, 2024	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	380827	9KHz ~1GHZ	Jul. 11, 2022	Jun. 14, 2023	Jul. 10, 2023	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2023	Jun. 14, 2023	Jan. 04, 2024	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2082395	1Ghz-18Ghz	Jan. 05, 2023	Jun. 14, 2023	Jan. 04, 2024	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270319	500MHz~26.5GHz	Oct. 12, 2022	Jun. 14, 2023	Oct. 11, 2023	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jun. 14, 2023	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jun. 14, 2023	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jun. 14, 2023	NCR	Radiation (03CH06-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX126E	03CH06KS001	30Mhz-18Ghz	Jul. 01, 2022	Jun. 14, 2023	Jun. 30, 2023	Radiation (03CH06-KS)
RF Cable	HUBER+SUHNER	SUCOFLEX126E	03CH06KS002	30Mhz-18Ghz	Jul. 01, 2022	Jun. 14, 2023	Jun. 30, 2023	Radiation (03CH06-KS)
High Pass Filter	Wainwright Instruments Gmbh	WHKX10-5850-6500-18000-40ST	1	6.5G High Pass	Jan. 07, 2023	Jun. 14, 2023	Jan. 06, 2024	Radiation (03CH06-KS)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Jun. 19, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Jun. 19, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Jun. 19, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Jun. 19, 2023	Oct. 11, 2023	Conduction (CO01-KS)
RF Cable	WOKEN	Y5T	00100N1Q 3N1	9kHz~30MHz	Sep. 15, 2022	Jun. 19, 2023	Sep. 14, 2023	Conduction (CO01-KS)
Transient limiter	COM-POWER	LIT-153	531040	150kHz~30MHz	Sep. 15, 2022	Jun. 19, 2023	Sep. 14, 2023	Conduction (CO01-KS)

NCR: No Calibration Required

5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±2.26 dB
Occupied Channel Bandwidth	±0.1 %
Conducted Power Spectral Density	±0.88 dB

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.94 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.26 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.02 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.26 dB

---------- THE END ----------

Appendix A. Conducted Test Results

Case No. : 341404-01	
Ambient Condition: 25 ℃, 45 %RH	
According Standard: ■Part15C/RSS-247	
Test Date: 2023.6.16~2023.6.30	**Test Engineer:** Jiang Jun

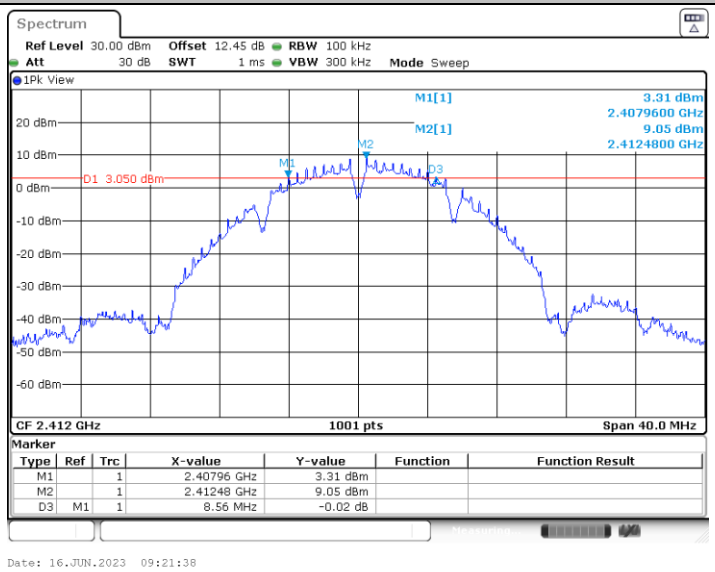
DTS Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.56	2407.96	2416.52	0.5	PASS
		2437	8.08	2432.96	2441.04	0.5	PASS
		2462	8.56	2457.96	2466.52	0.5	PASS
11G	Ant1	2412	15.96	2404.24	2420.20	0.5	PASS
		2437	15.68	2428.84	2444.52	0.5	PASS
		2462	15.64	2454.52	2470.16	0.5	PASS
11N20SISO	Ant1	2412	16.04	2404.48	2420.52	0.5	PASS
		2437	16.20	2428.36	2444.56	0.5	PASS
		2462	16.20	2454.44	2470.64	0.5	PASS
11N40SISO	Ant1	2422	33.84	2405.76	2439.60	0.5	PASS
		2437	36.08	2418.92	2455.00	0.5	PASS
		2452	36.32	2433.92	2470.24	0.5	PASS

Test Graphs

11B_Ant1_2412



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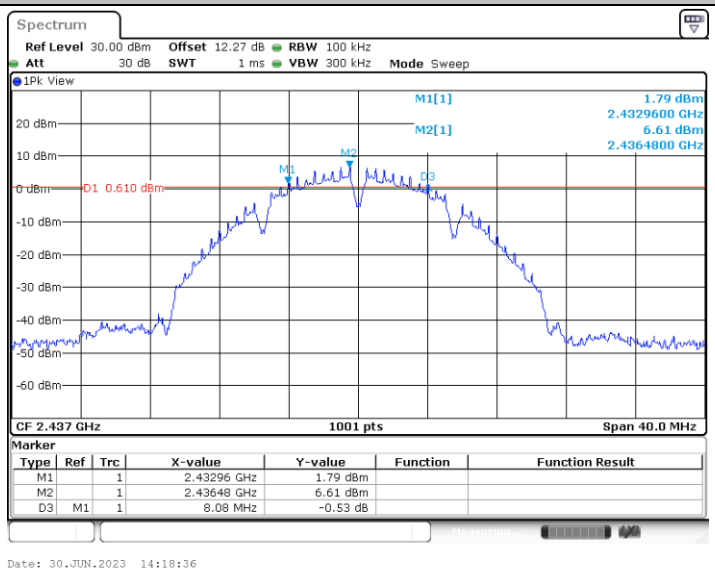

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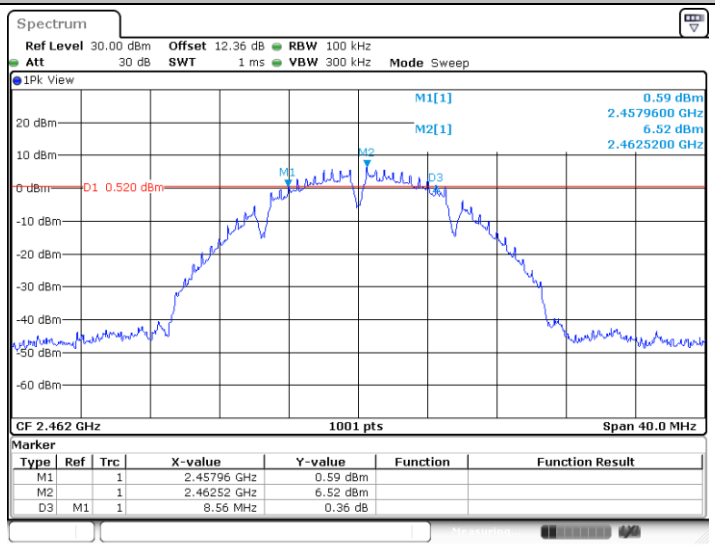

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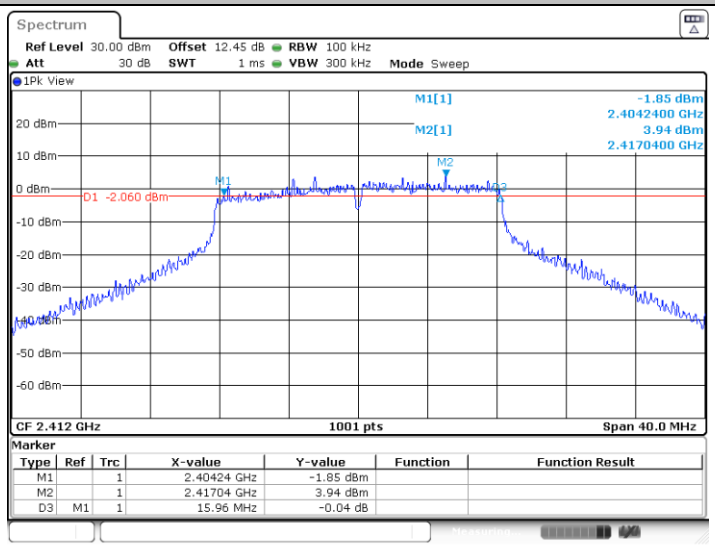

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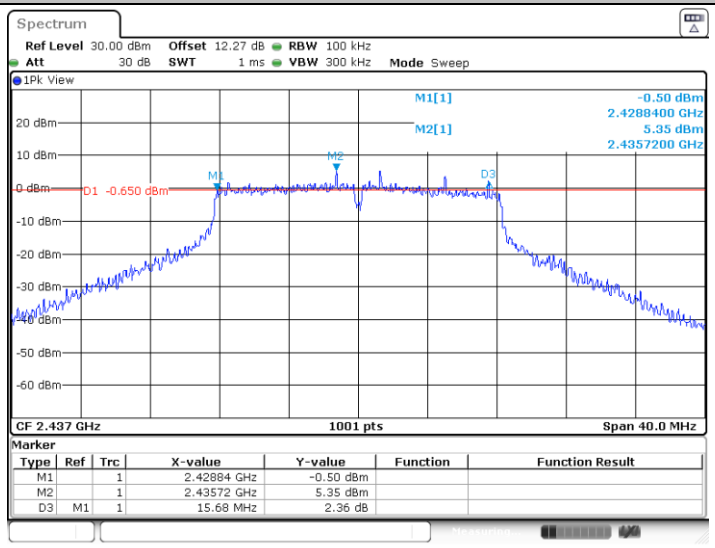

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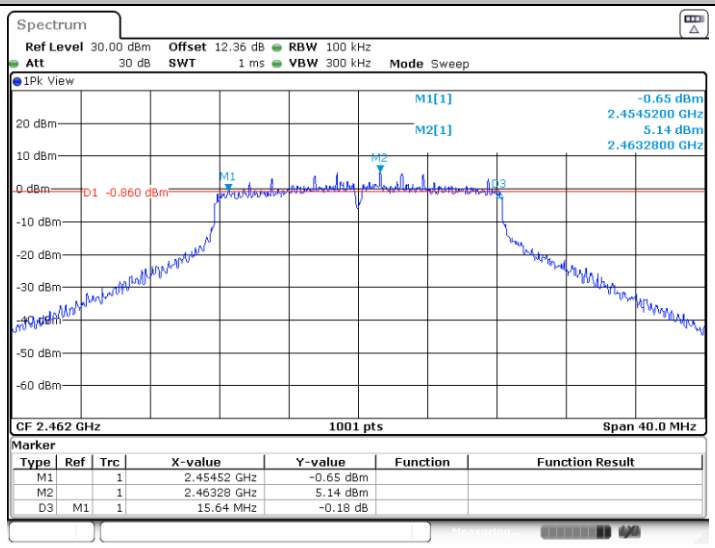

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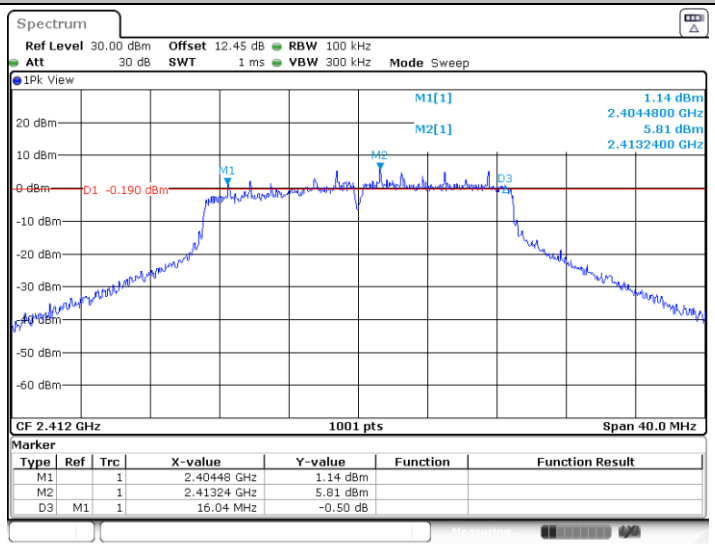

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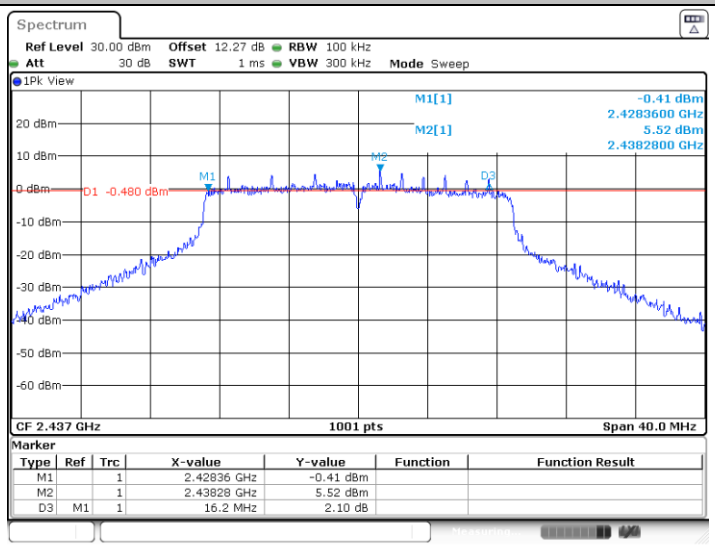

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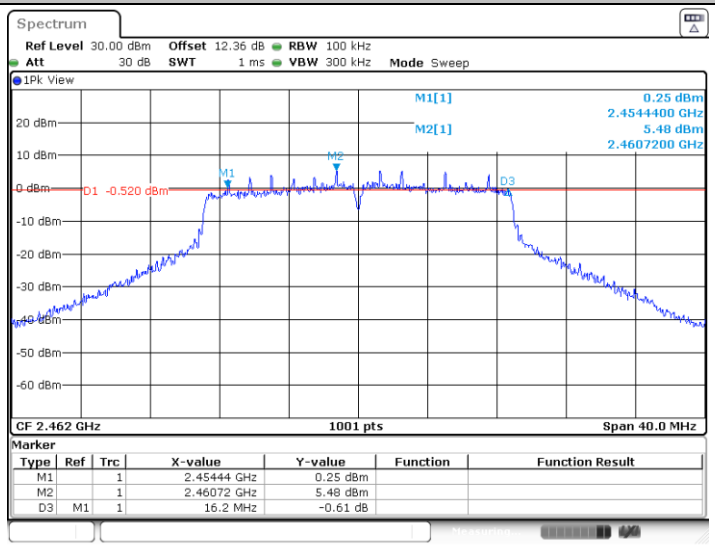

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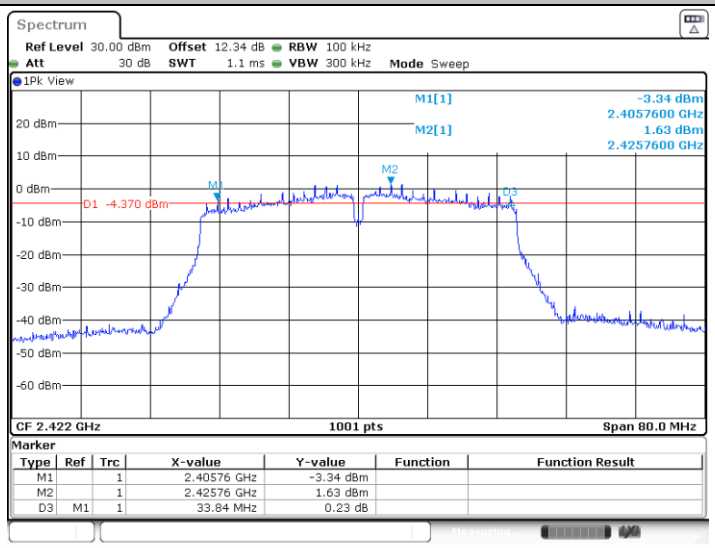

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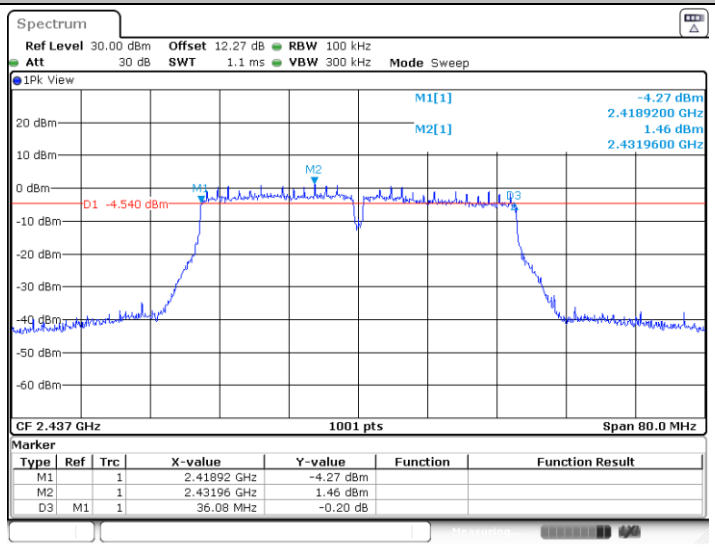

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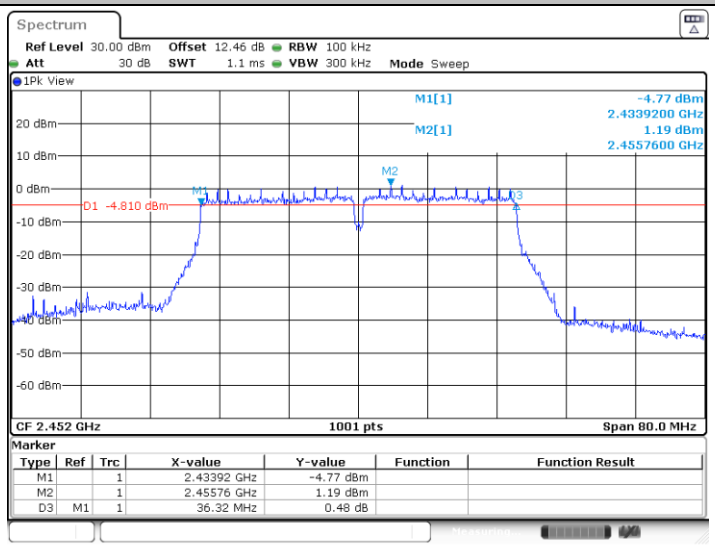


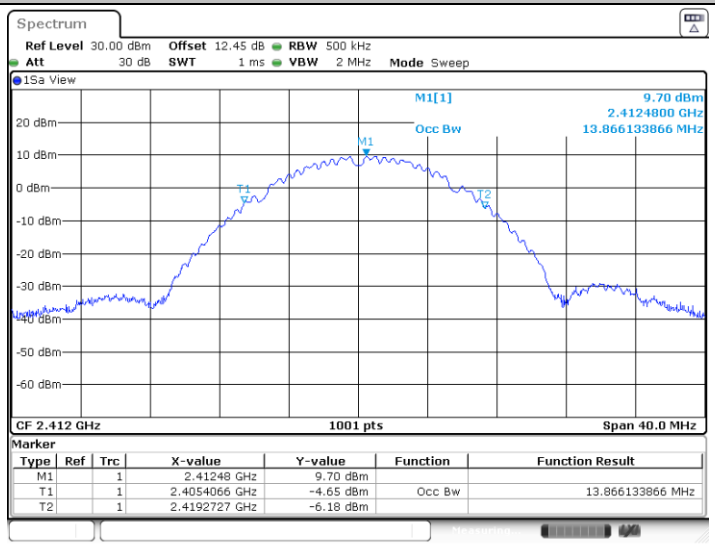
Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.866	2405.4066	2419.2727	---	---
		2437	13.826	2429.9271	2443.7532	---	---
		2462	13.706	2455.3267	2469.0330	---	---
11G	Ant1	2412	17.263	2403.6084	2420.8711	---	---
		2437	17.423	2428.1688	2445.5914	---	---
		2462	17.223	2453.4885	2470.7113	---	---
11N20SISO	Ant1	2412	18.262	2403.0889	2421.3506	---	---
		2437	18.262	2427.7293	2445.9910	---	---
		2462	18.262	2452.9690	2471.2308	---	---
11N40SISO	Ant1	2422	36.204	2404.0180	2440.2218	---	---
		2437	36.603	2418.6184	2455.2218	---	---
		2452	36.763	2433.6184	2470.3816	---	---

Test Graphs

11B_Ant1_2412



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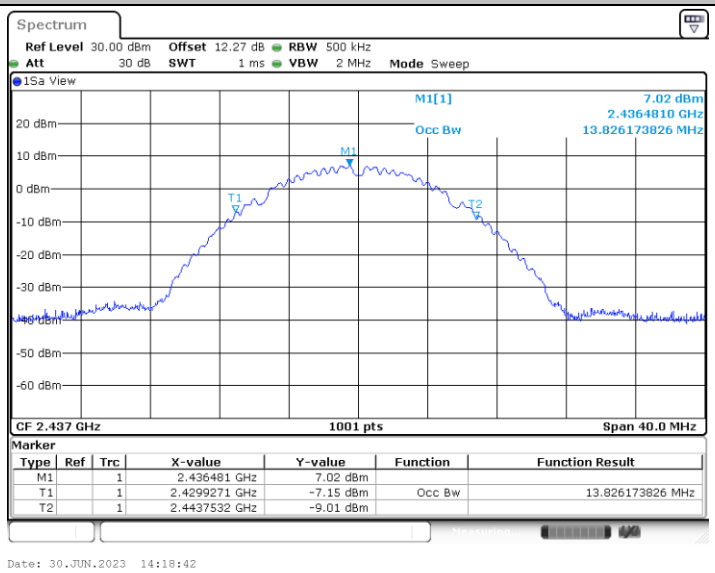

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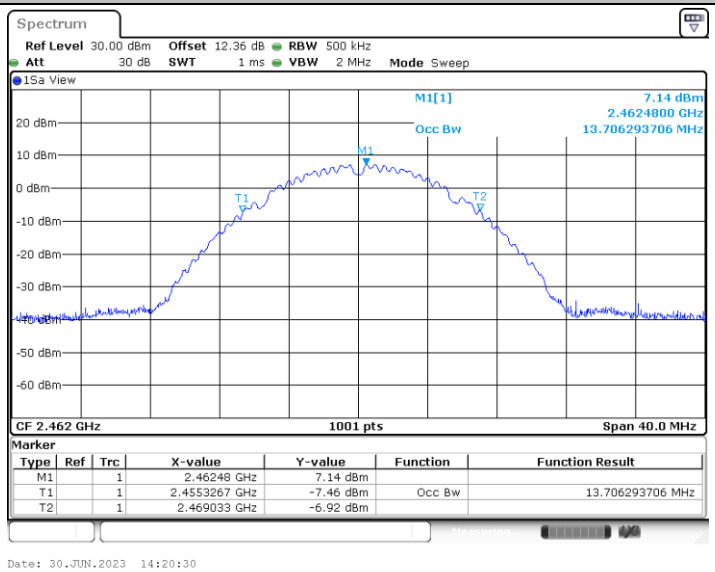

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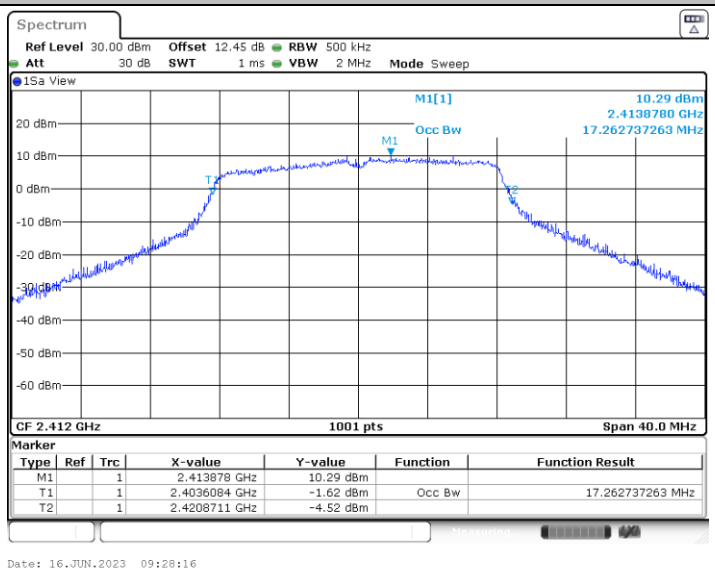

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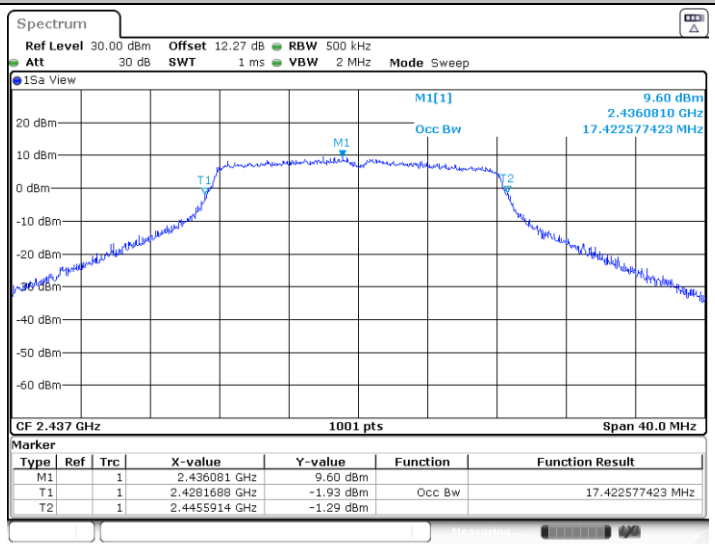

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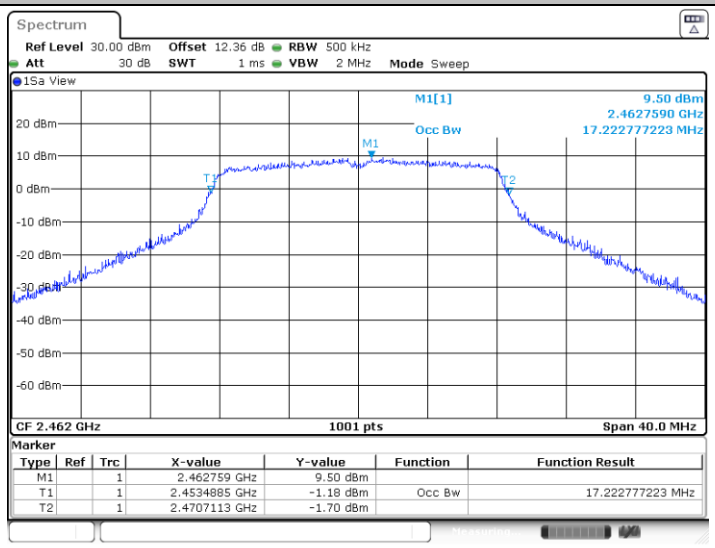

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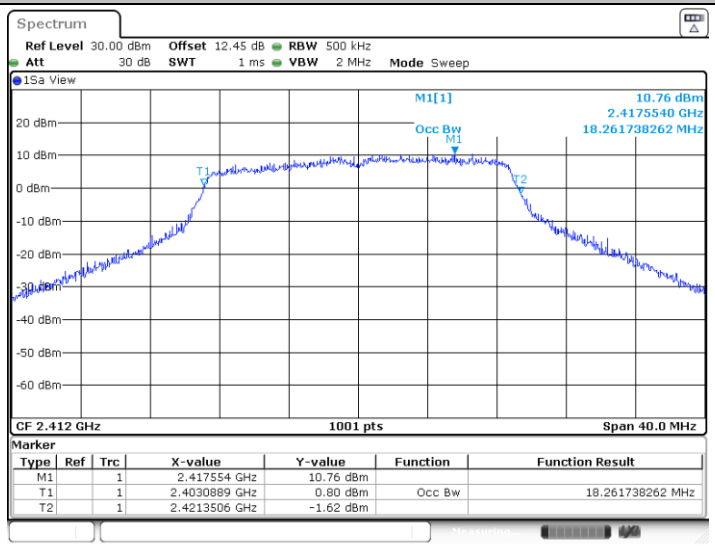

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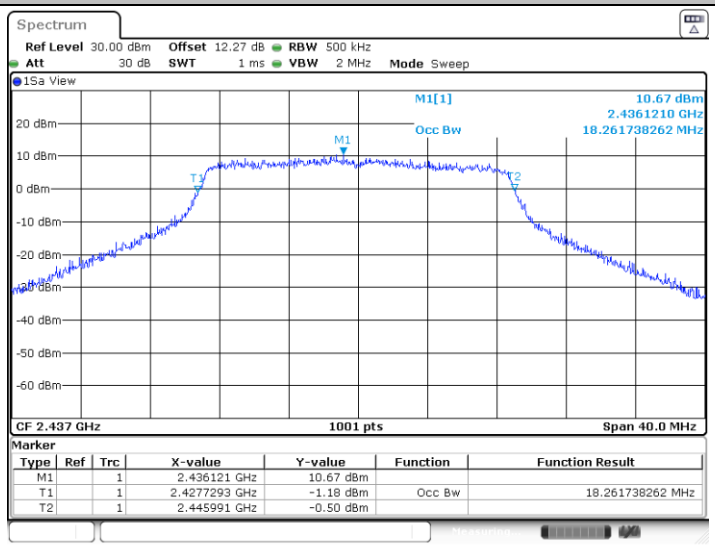

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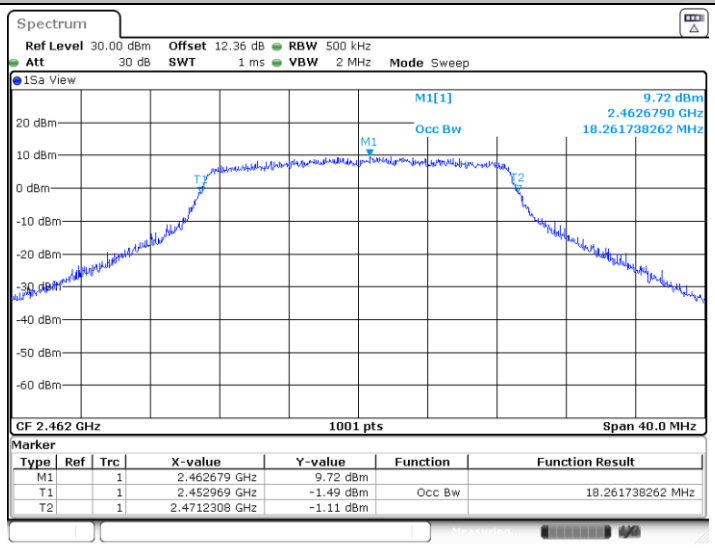

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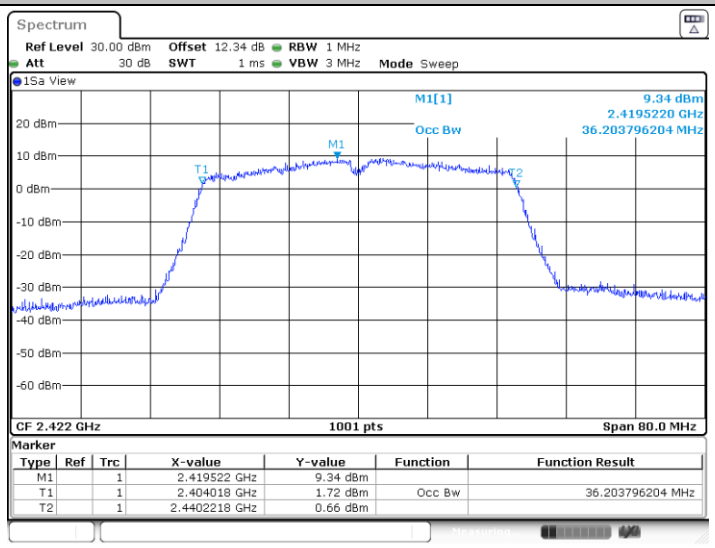

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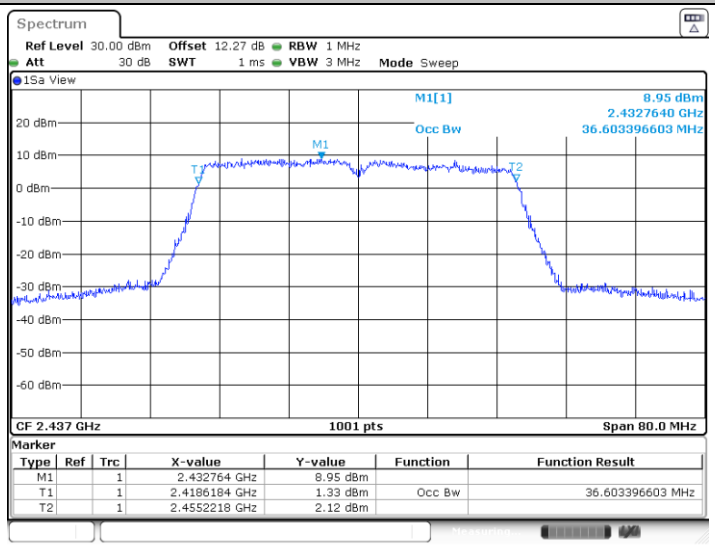

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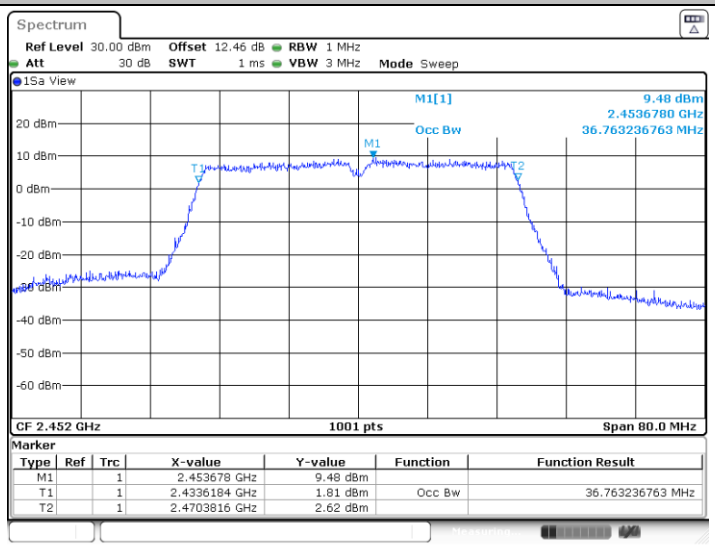


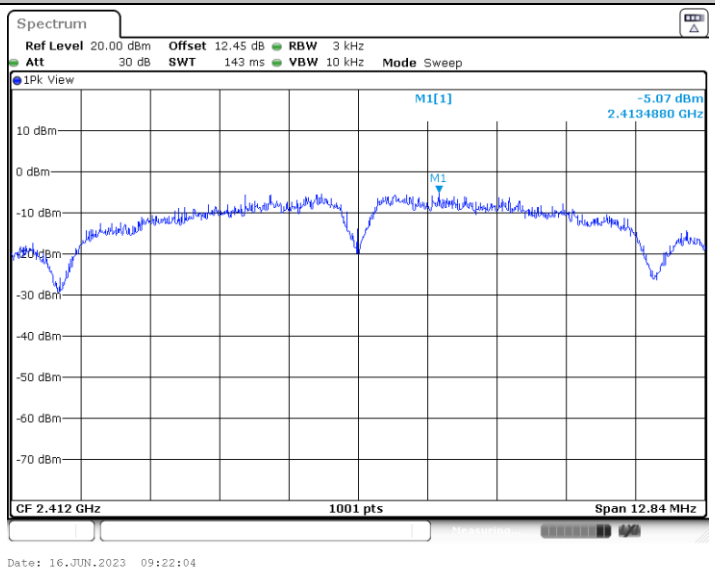
Power spectral density

Test Result

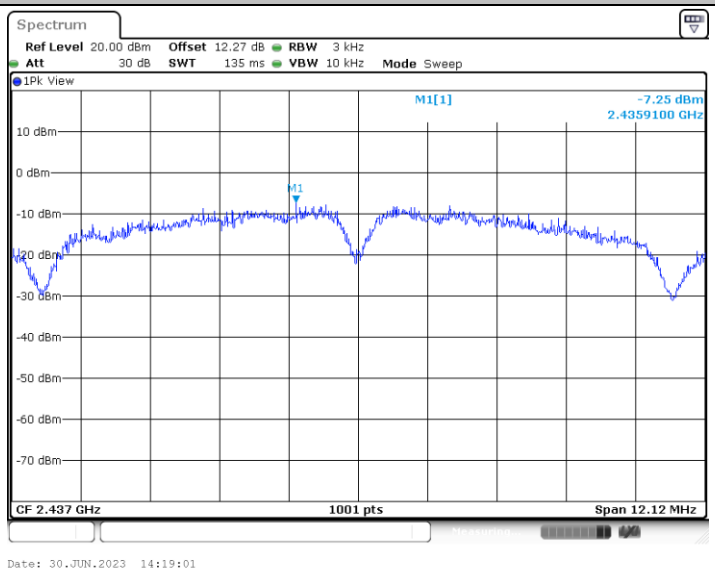
TestMode	Antenna	Freq(MHz)	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant1	2412	-5.07	≤8.00	PASS
		2437	-7.25	≤8.00	PASS
		2462	-7.18	≤8.00	PASS
11G	Ant1	2412	-8.33	≤8.00	PASS
		2437	-8.6	≤8.00	PASS
		2462	-9	≤8.00	PASS
11N20SISO	Ant1	2412	-10.5	≤8.00	PASS
		2437	-10.89	≤8.00	PASS
		2462	-10.54	≤8.00	PASS
11N40SISO	Ant1	2422	-14.54	≤8.00	PASS
		2437	-14.75	≤8.00	PASS
		2452	-14.57	≤8.00	PASS

Test Graphs

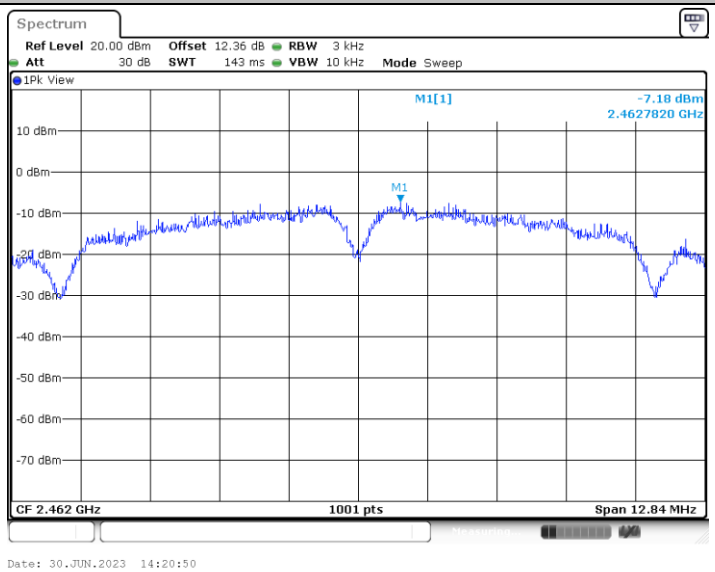
11B_Ant1_2412



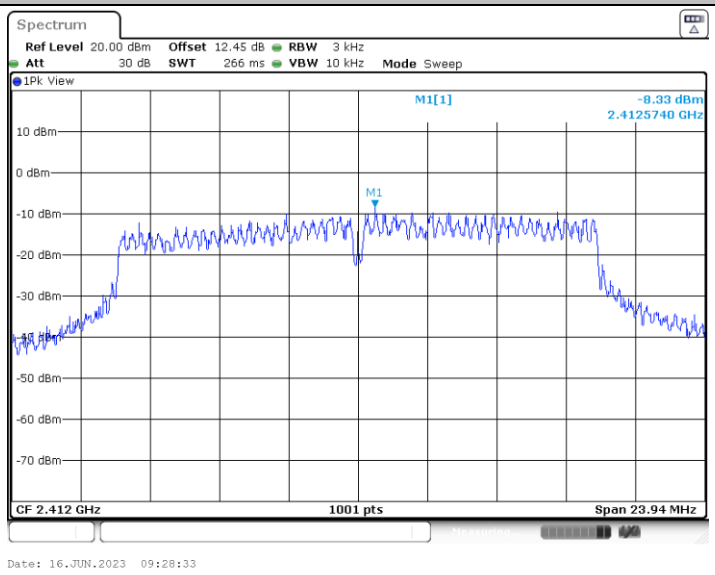
11B_Ant1_2437



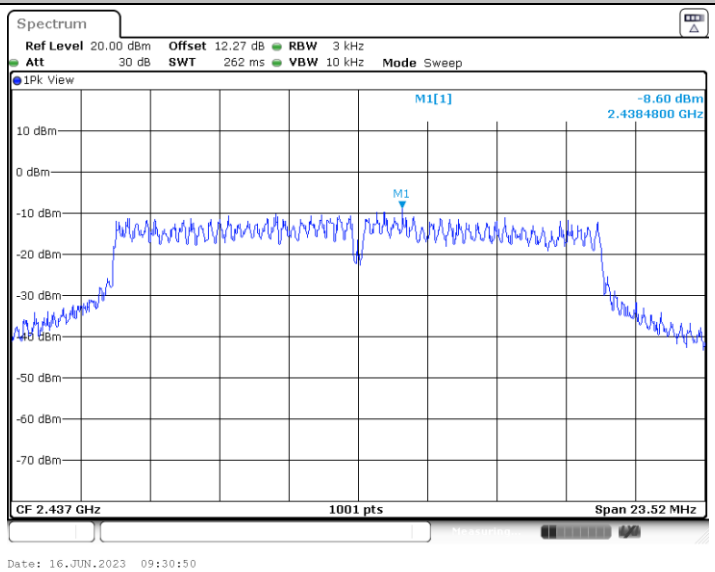
11B_Ant1_2462



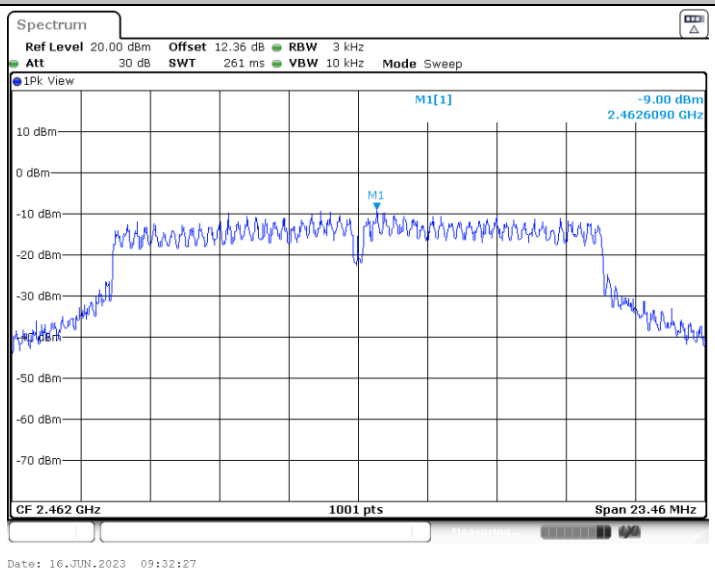
11G_Ant1_2412



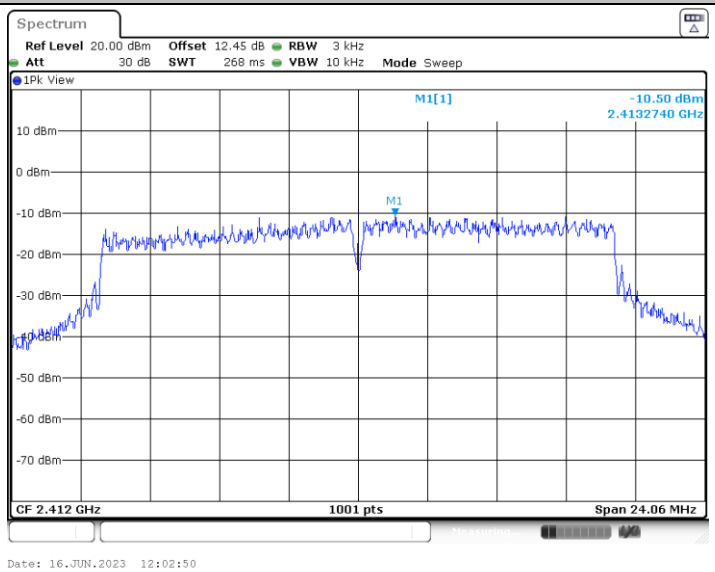
11G_Ant1_2437



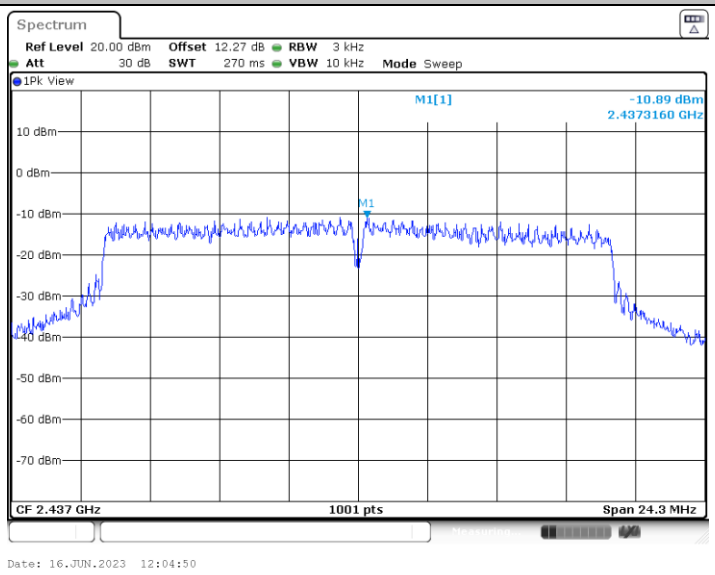
11G_Ant1_2462



11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



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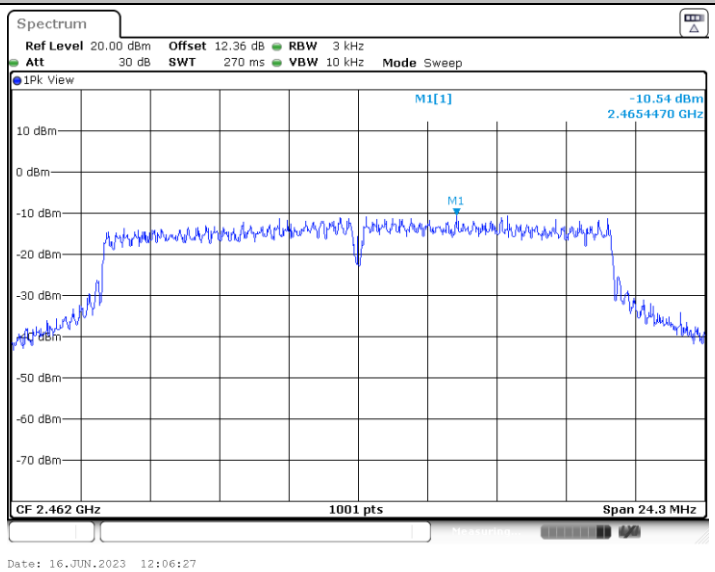
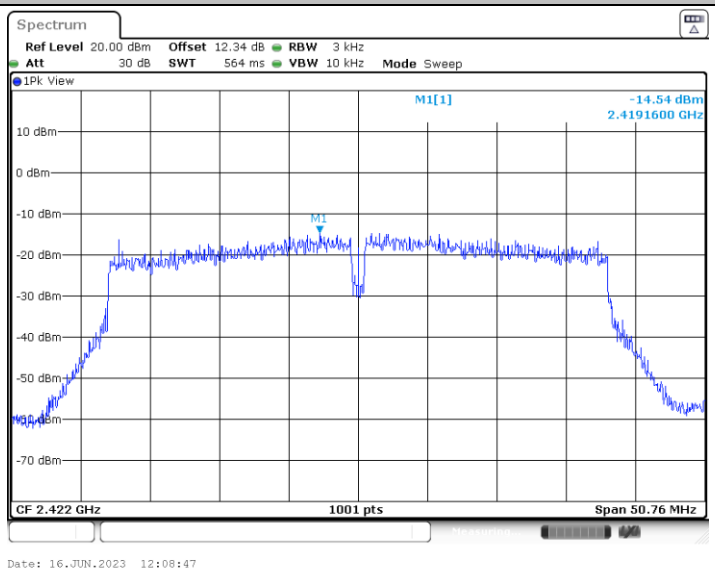
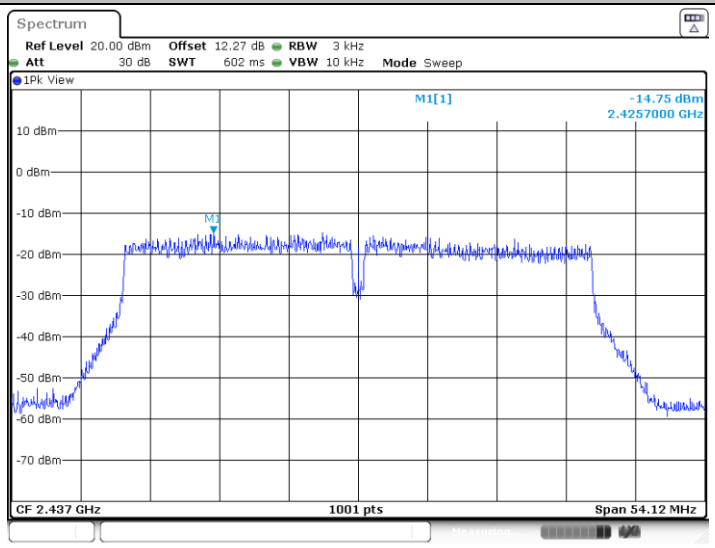


11N40SISO_Ant1_2422

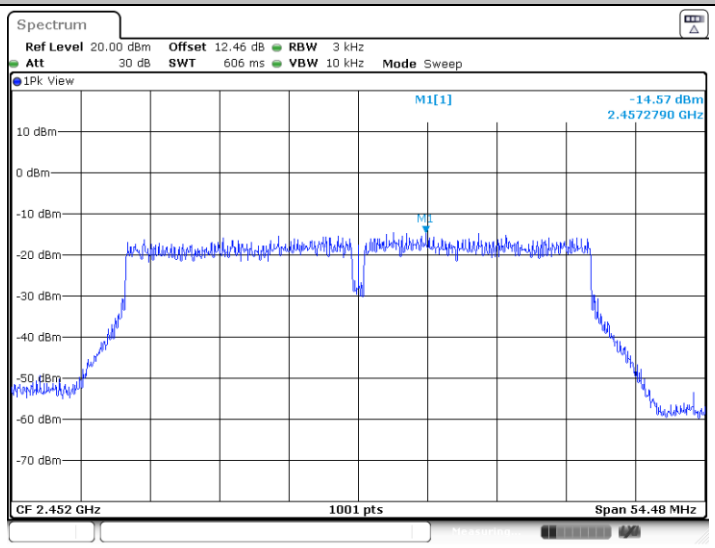


11N40SISO_Ant1_2437



Date: 16.JUN.2023 12:10:46

11N40SISO_Ant1_2452



Date: 16.JUN.2023 12:12:19

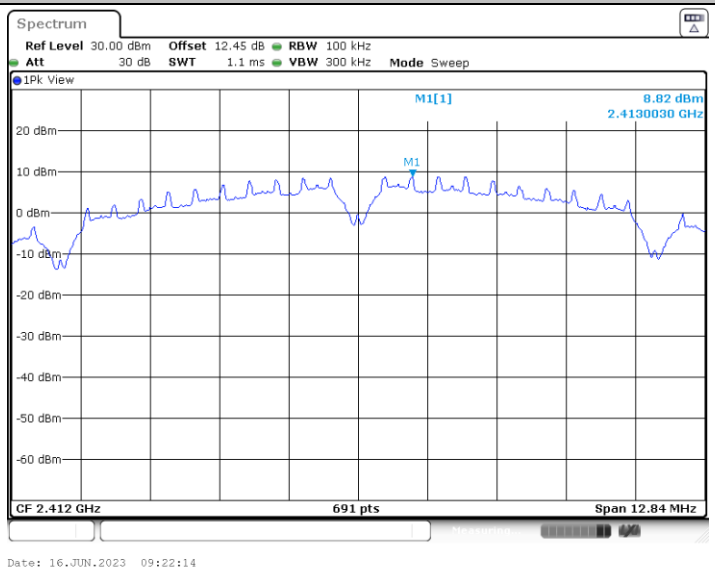
Reference level measurement

Test Result

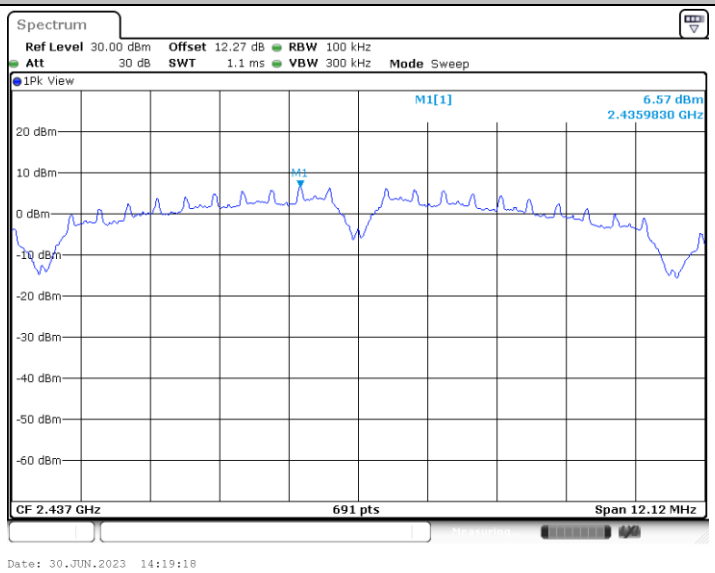
TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
11B	Ant1	2412	2413.00	8.82
		2437	2435.98	6.57
		2462	2462.48	6.75
11G	Ant1	2412	2414.49	5.65
		2437	2435.71	5.04
		2462	2463.26	5.63
11N20SISO	Ant1	2412	2414.47	5.57
		2437	2435.73	5.57
		2462	2463.27	5.73
11N40SISO	Ant1	2422	2425.75	1.56
		2437	2431.99	1.39
		2452	2456.97	1.09

Test Graphs

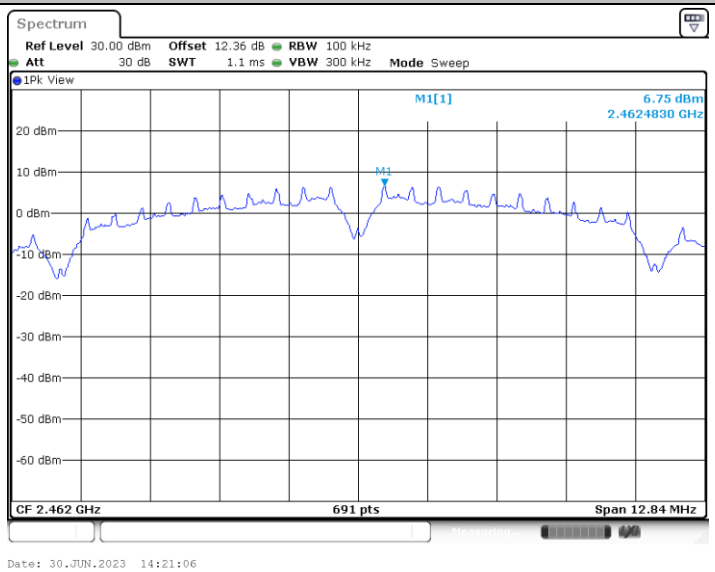
11B_Ant1_2412



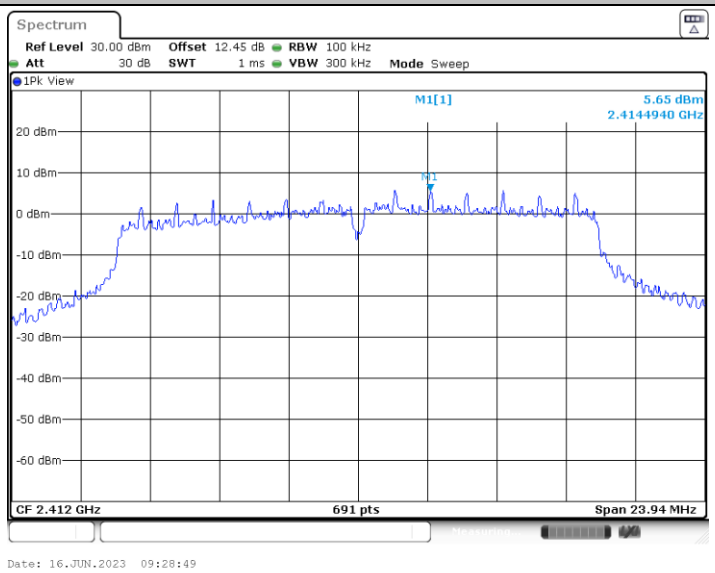
11B_Ant1_2437



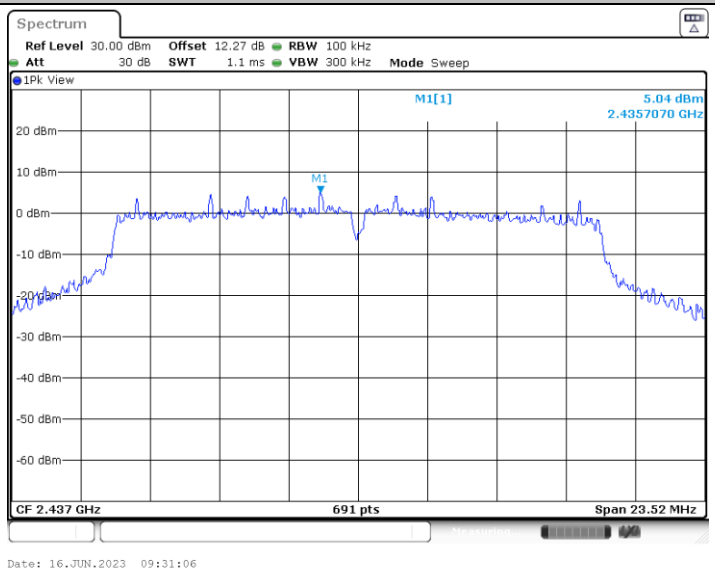
11B_Ant1_2462



11G_Ant1_2412



11G_Ant1_2437



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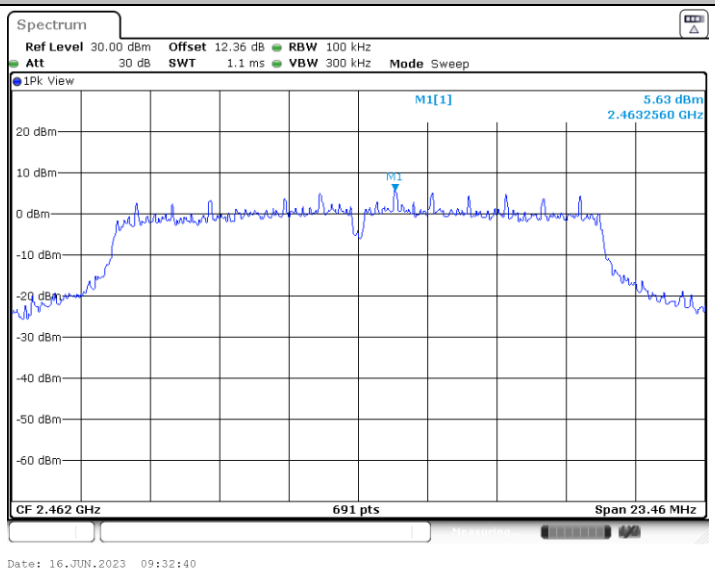
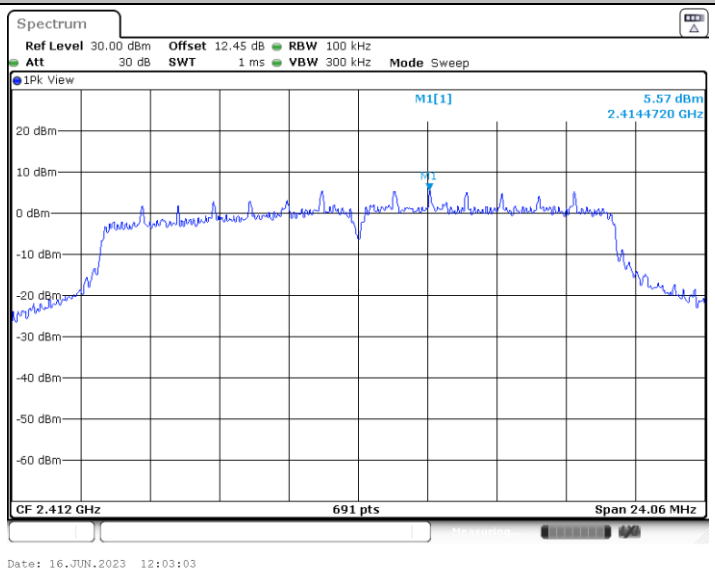
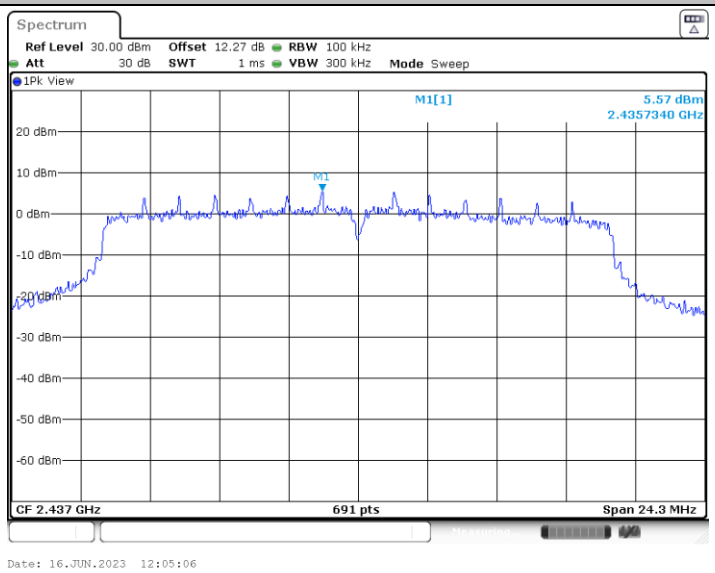


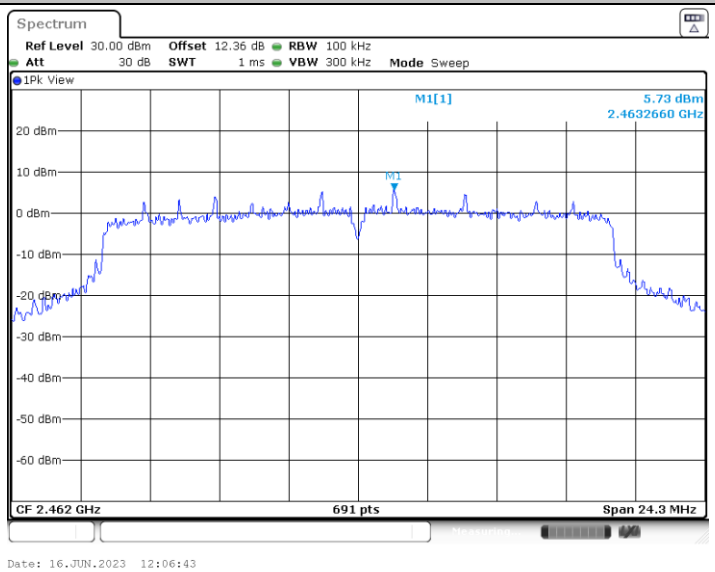
11N20SISO_Ant1_2412



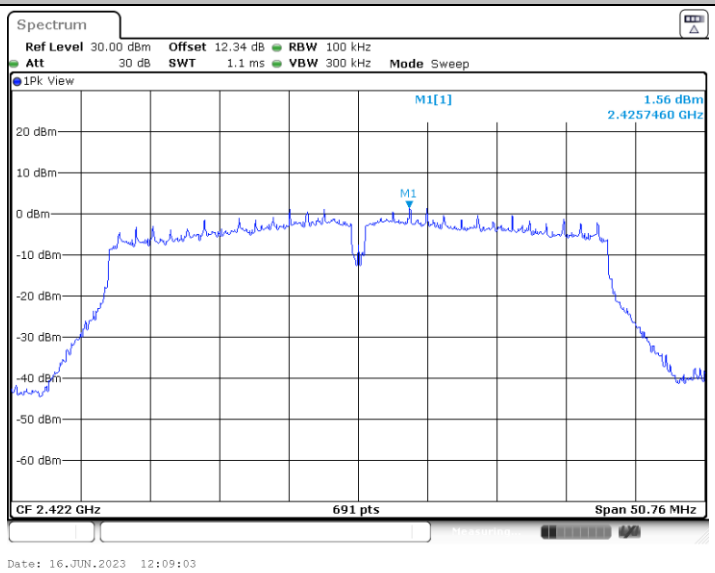
11N20SISO_Ant1_2437



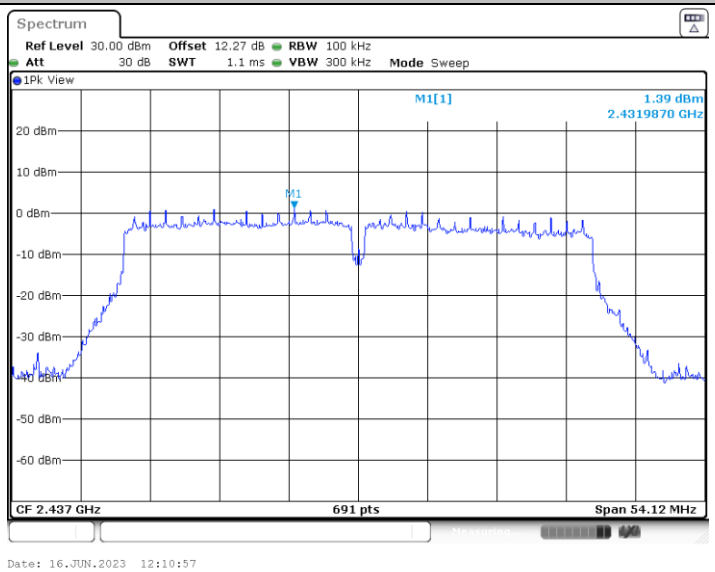
11N20SISO_Ant1_2462



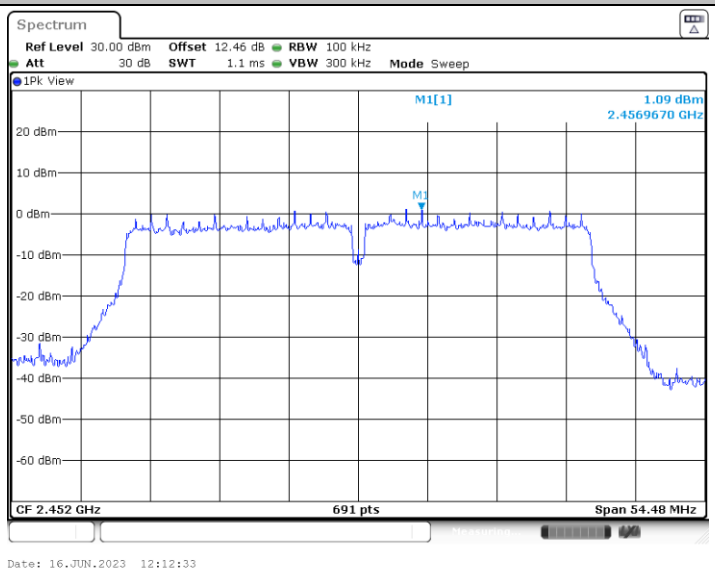
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



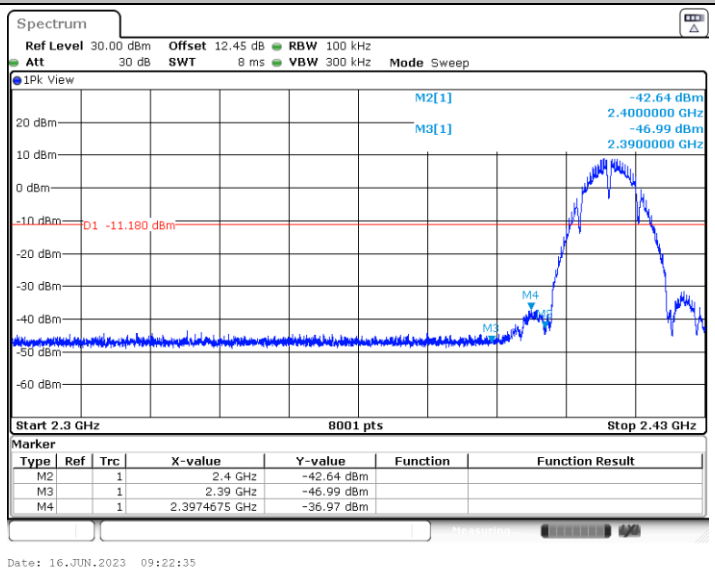
Band edge measurements

Test Result

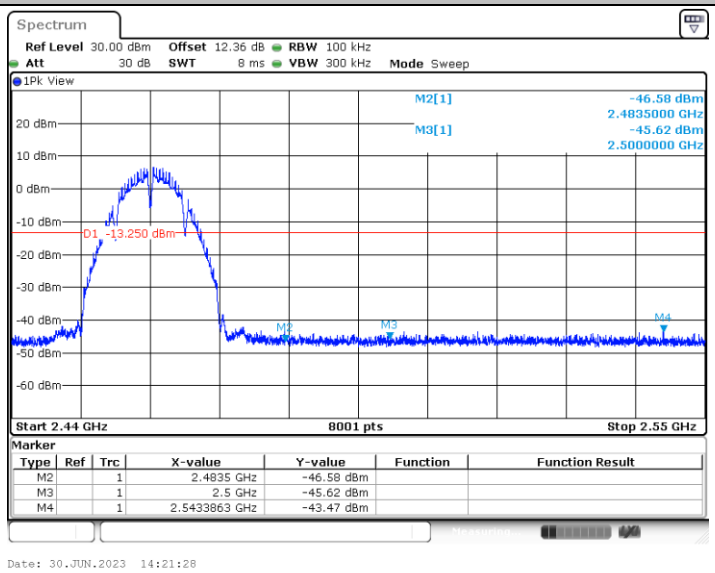
TestMode	Antenna	ChName	Freq(MHz)	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
11B	Ant1	Low	2412	8.82	-36.97	≤-11.18	PASS
		High	2462	6.75	-43.47	≤-13.25	PASS
11G	Ant1	Low	2412	5.65	-24.86	≤-14.35	PASS
		High	2462	5.63	-43.05	≤-14.37	PASS
11N20SISO	Ant1	Low	2412	5.57	-25.2	≤-14.43	PASS
		High	2462	5.73	-42.78	≤-14.27	PASS
11N40SISO	Ant1	Low	2422	1.56	-39.03	≤-18.44	PASS
		High	2452	1.09	-40.15	≤-18.91	PASS

Test Graphs

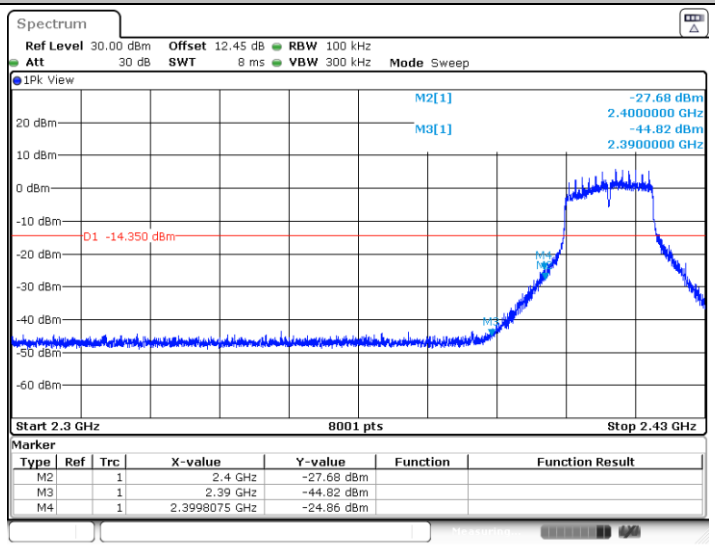
11B_Ant1_Low_2412



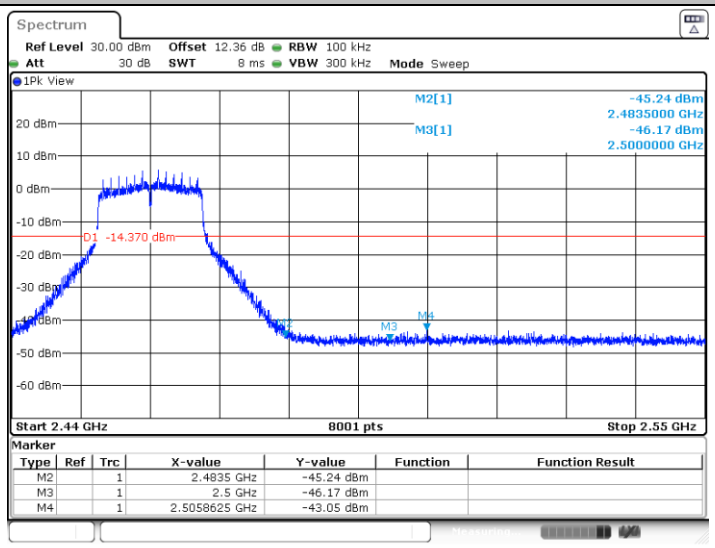
11B_Ant1_High_2462



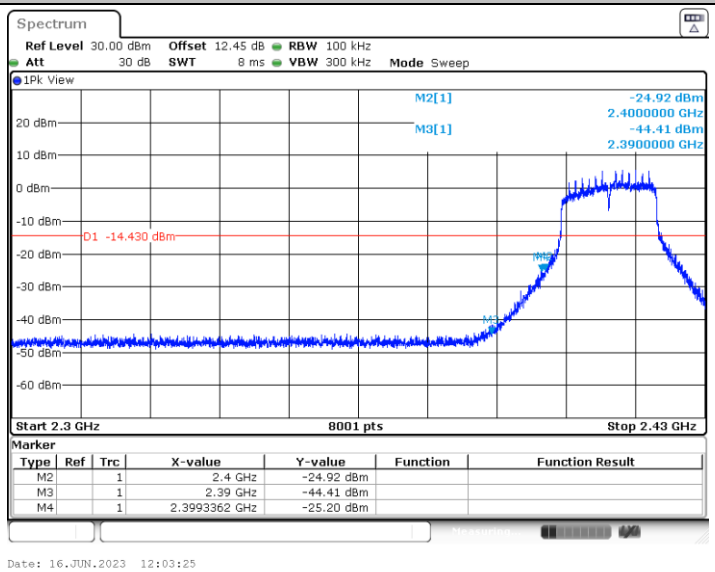
11G_Ant1_Low_2412



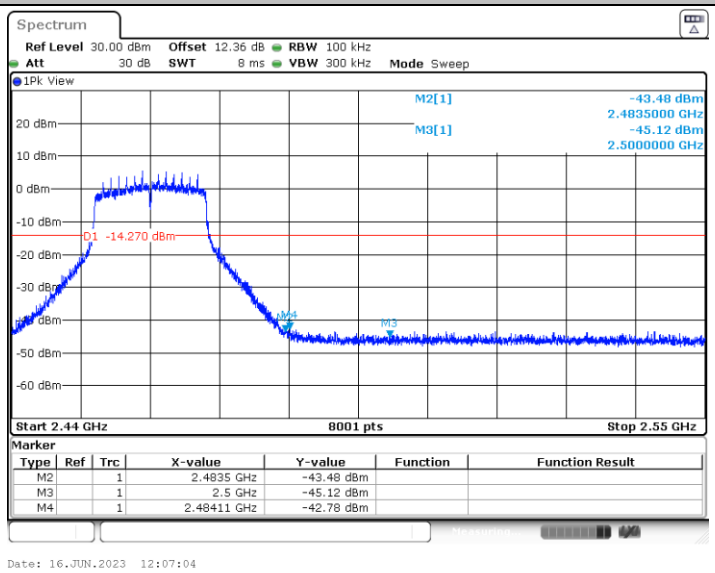
11G_Ant1_High_2462



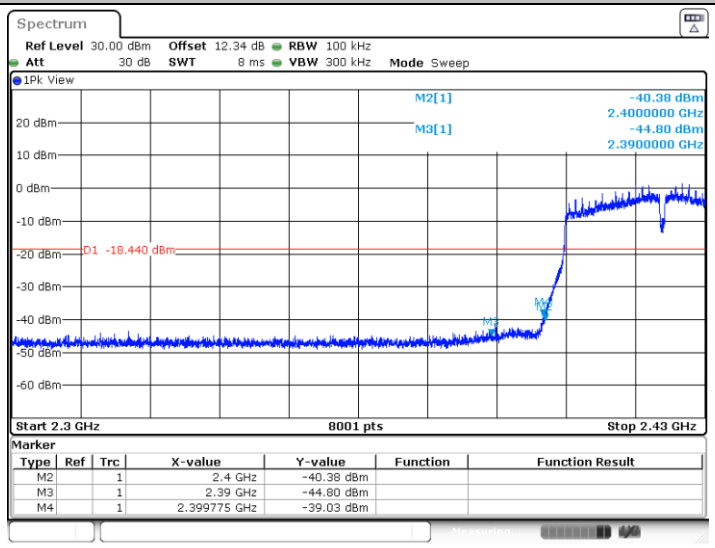
11N20SISO_Ant1_Low_2412



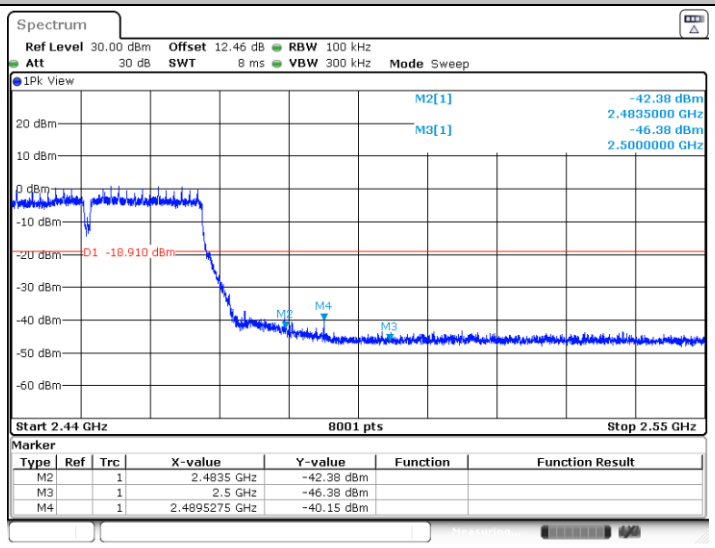
11N20SISO_Ant1_High_2462



11N40SISO_Ant1_Low_2422



11N40SISO_Ant1_High_2452



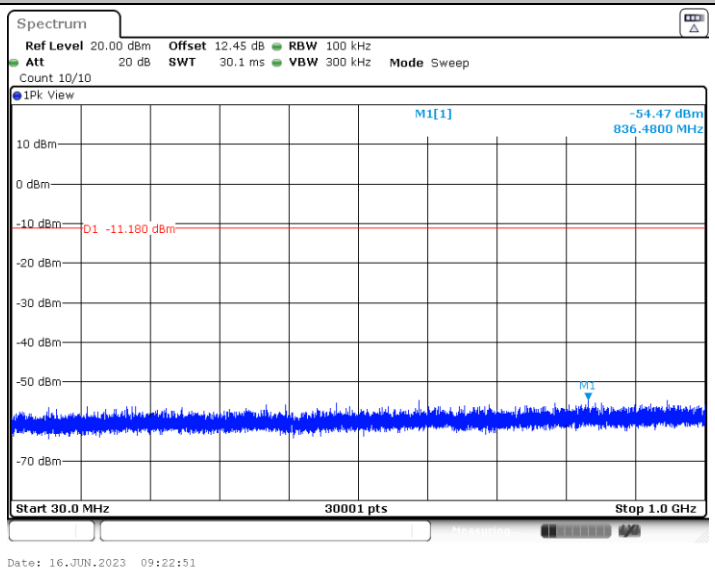
Conducted Spurious Emission

Test Result

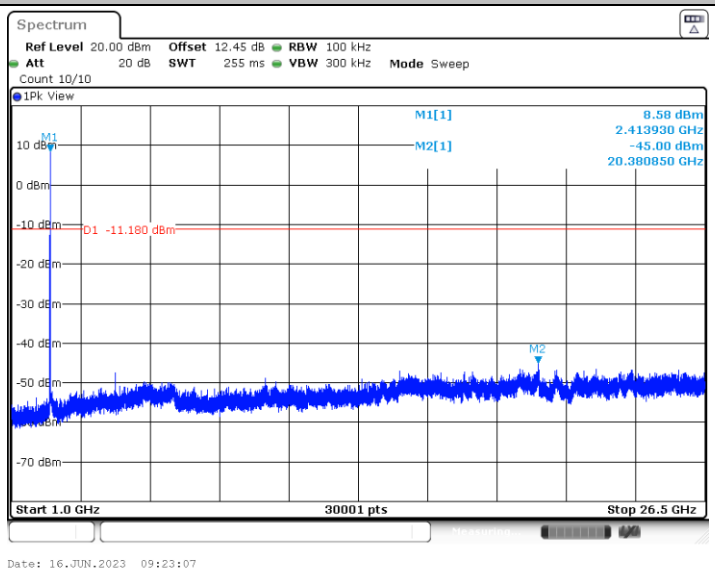
TestMode	Antenna	Freq(MHz)	FreqRange [Mhz]	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
11B	Ant1	2412	30~1000	8.82	-54.47	≤-11.18	PASS
			1000~26500	8.82	-45	≤-11.18	PASS
		2437	30~1000	6.57	-54.93	≤-13.43	PASS
			1000~26500	6.57	-46.3	≤-13.43	PASS
		2462	30~1000	6.75	-55.1	≤-13.25	PASS
			1000~26500	6.75	-45.88	≤-13.25	PASS
11G	Ant1	2412	30~1000	5.65	-55	≤-14.35	PASS
			1000~26500	5.65	-45.89	≤-14.35	PASS
		2437	30~1000	5.04	-54.34	≤-14.96	PASS
			1000~26500	5.04	-45.82	≤-14.96	PASS
		2462	30~1000	5.63	-54.31	≤-14.37	PASS
			1000~26500	5.63	-46.51	≤-14.37	PASS
11N20SISO	Ant1	2412	30~1000	5.57	-54.5	≤-14.43	PASS
			1000~26500	5.57	-45.88	≤-14.43	PASS
		2437	30~1000	5.57	-54.91	≤-14.43	PASS
			1000~26500	5.57	-45.65	≤-14.43	PASS
		2462	30~1000	5.73	-54.77	≤-14.27	PASS
			1000~26500	5.73	-45.94	≤-14.27	PASS
11N40SISO	Ant1	2422	30~1000	1.56	-55.28	≤-18.44	PASS
			1000~26500	1.56	-46.18	≤-18.44	PASS
		2437	30~1000	1.39	-55.13	≤-18.61	PASS
			1000~26500	1.39	-46.47	≤-18.61	PASS
		2452	30~1000	1.09	-54.29	≤-18.91	PASS
			1000~26500	1.09	-45.82	≤-18.91	PASS

Test Graphs

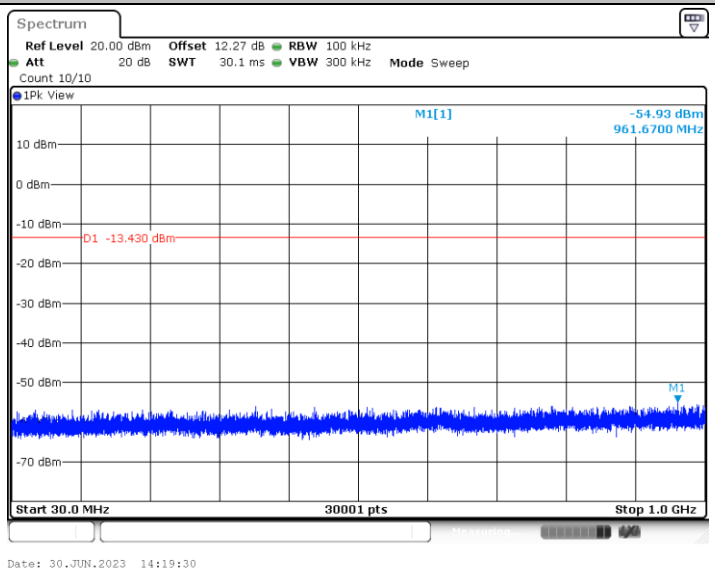
11B_Ant1_2412_30~1000



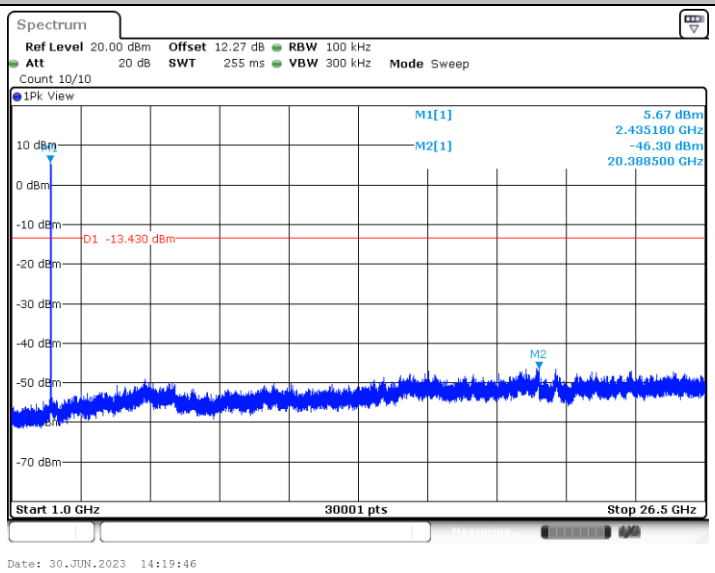
11B_Ant1_2412_1000~26500



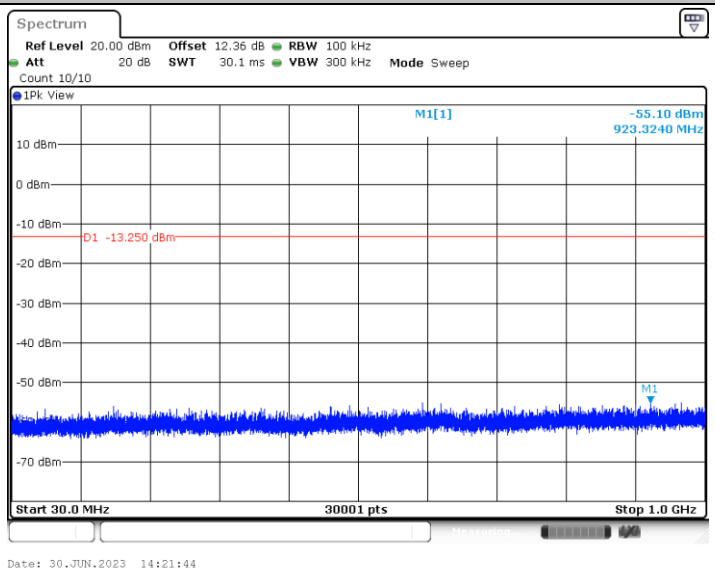
11B_Ant1_2437_30~1000



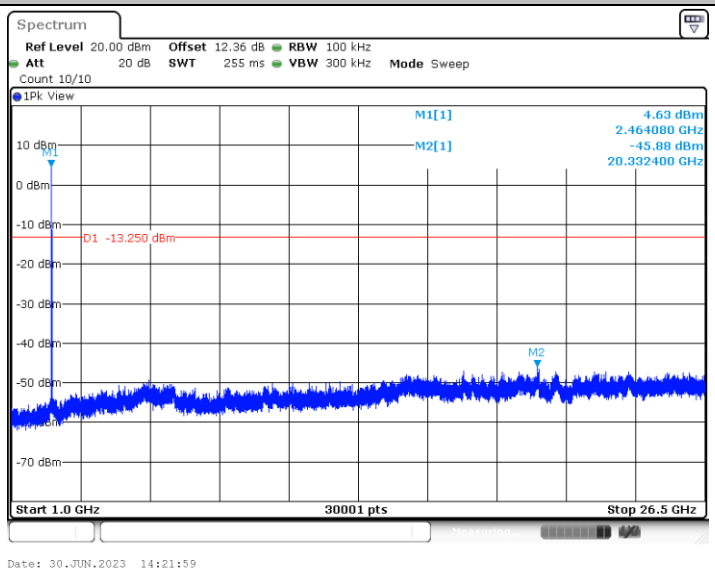
11B_Ant1_2437_1000~26500



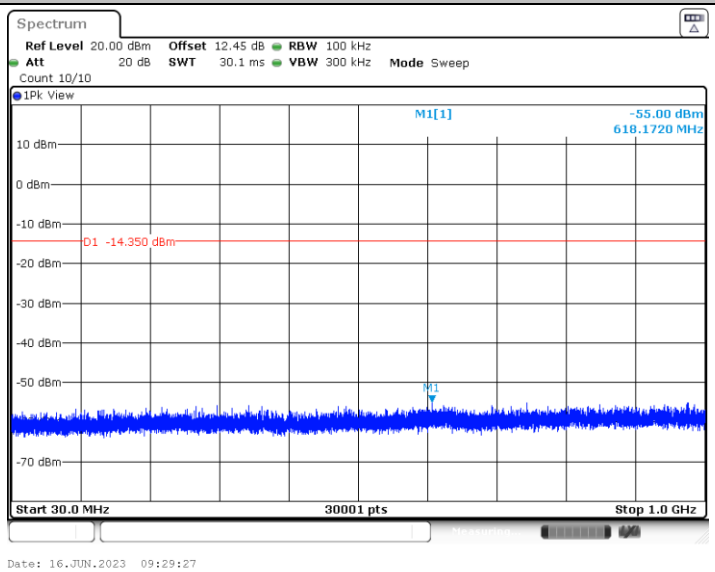
11B_Ant1_2462_30~1000



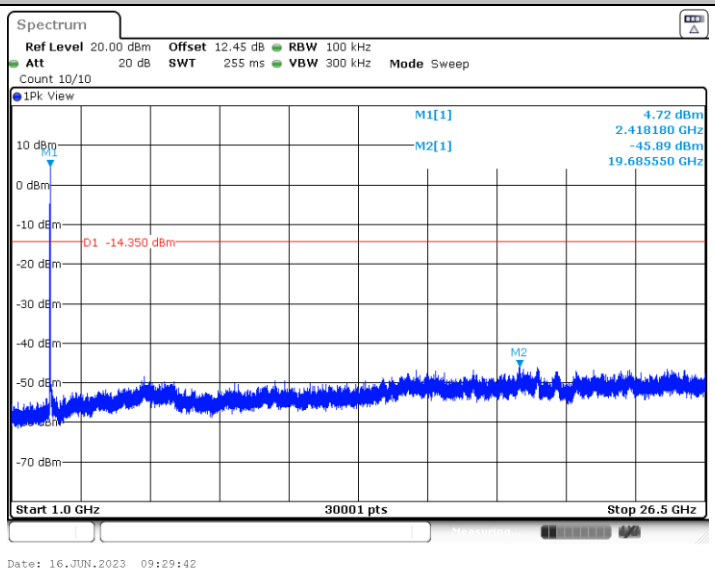
11B_Ant1_2462_1000~26500



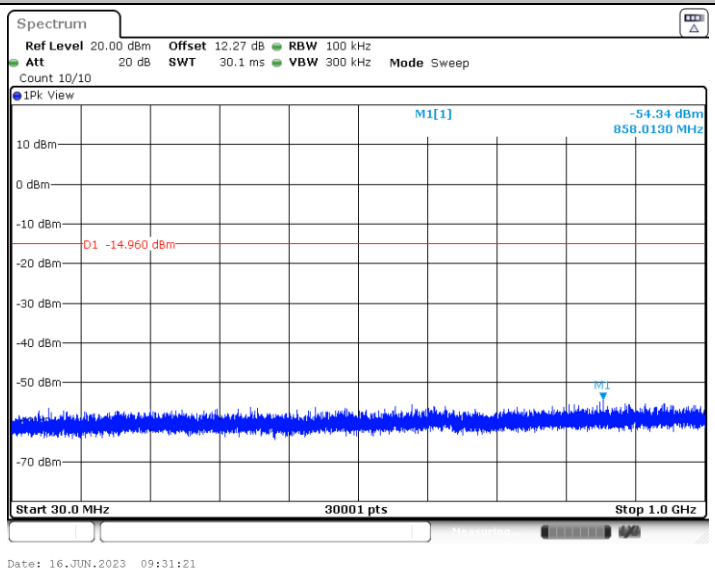
11G_Ant1_2412_30~1000



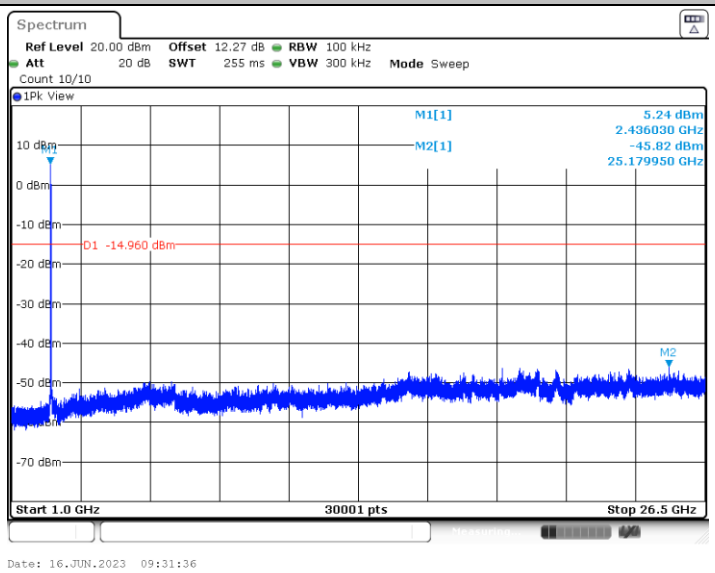
11G_Ant1_2412_1000~26500



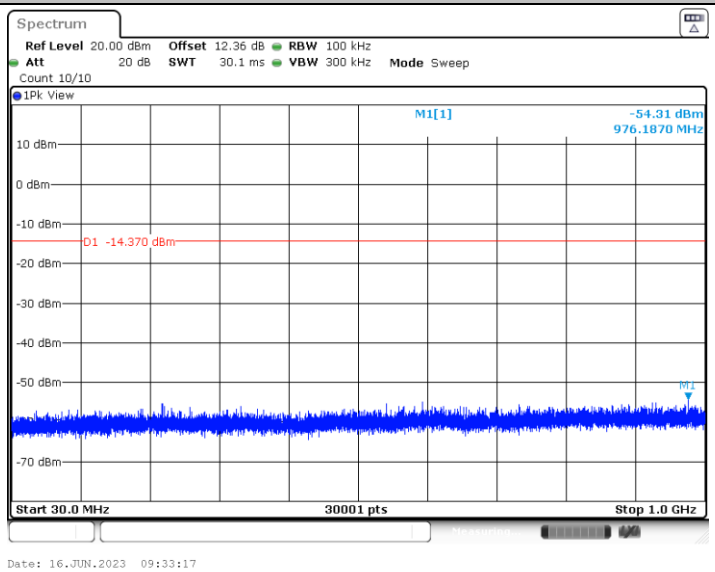
11G_Ant1_2437_30~1000



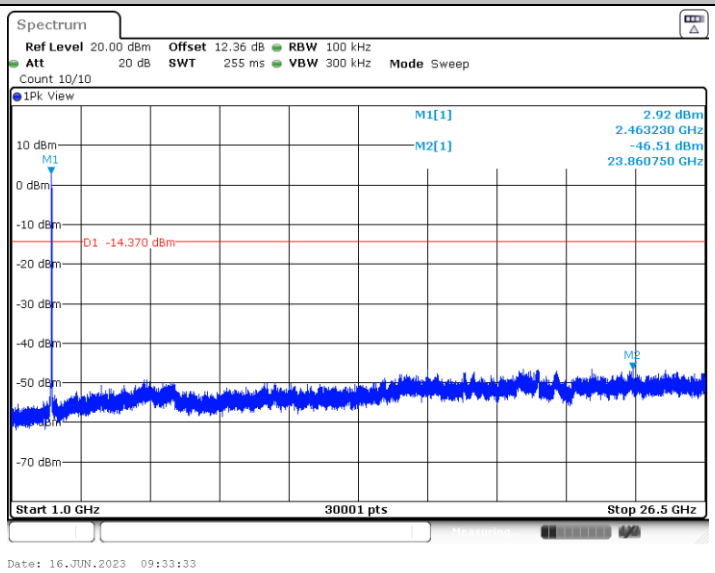
11G_Ant1_2437_1000~26500



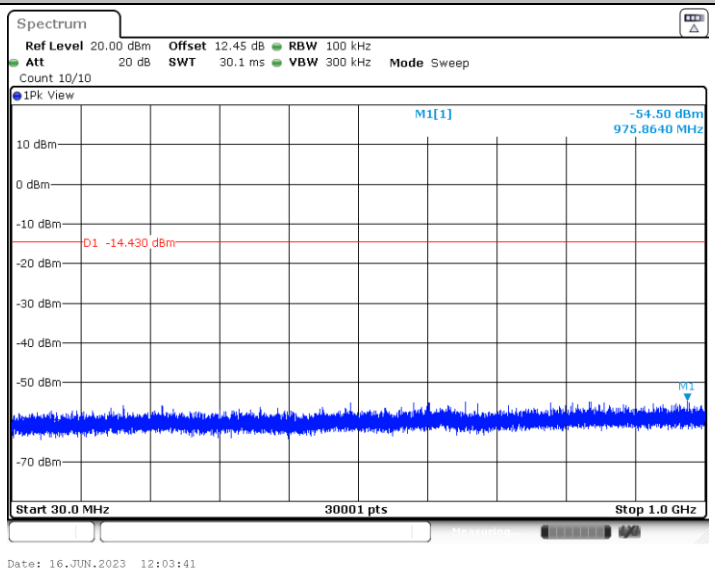
11G_Ant1_2462_30~1000



11G_Ant1_2462_1000~26500



11N20SISO_Ant1_2412_30~1000



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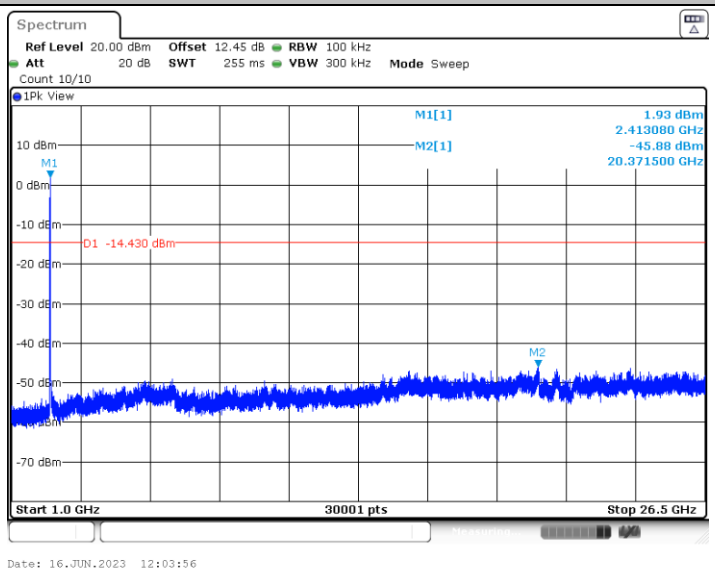

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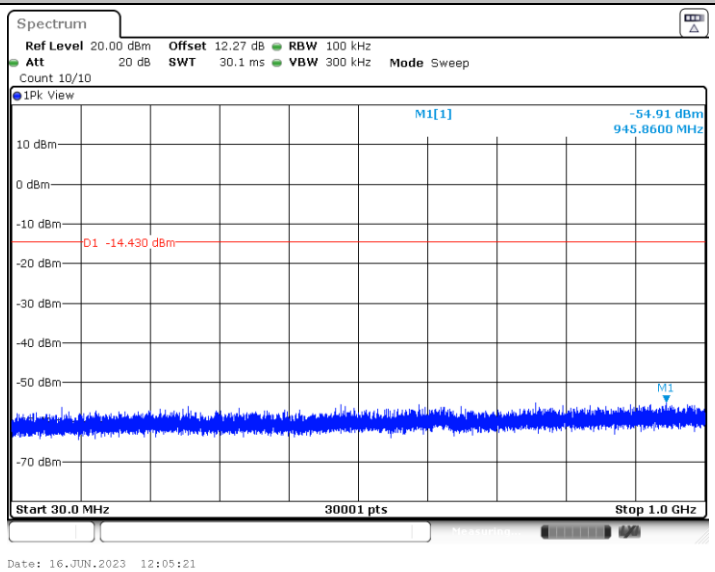

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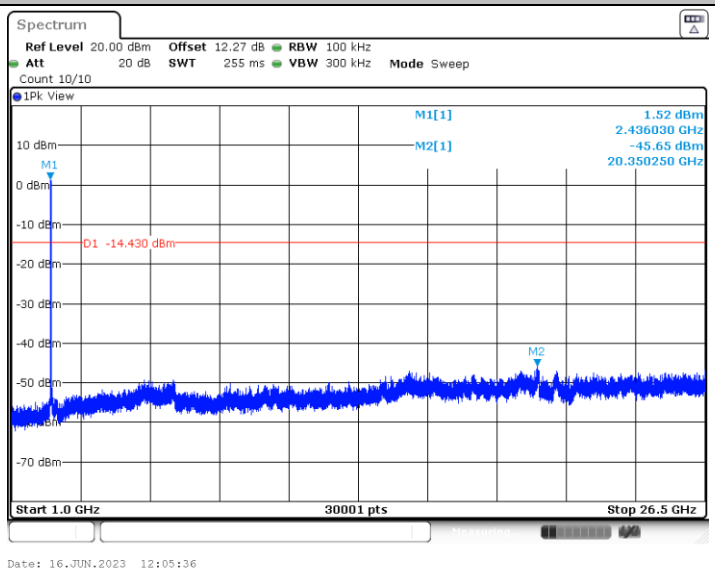

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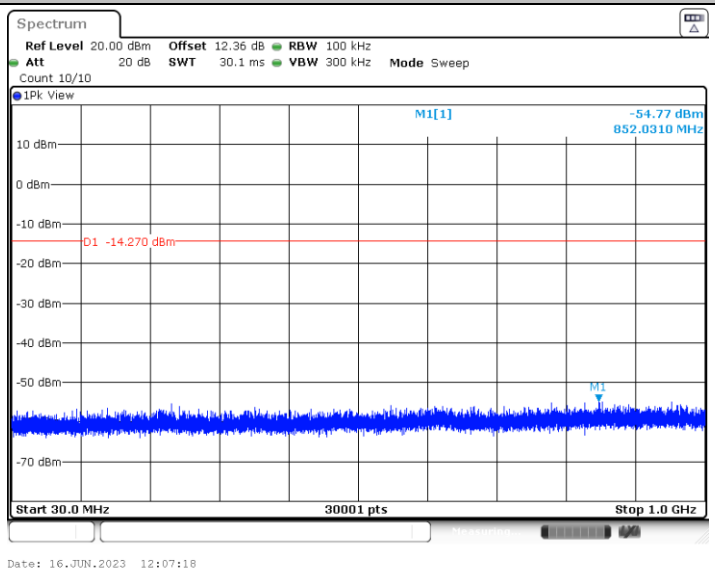

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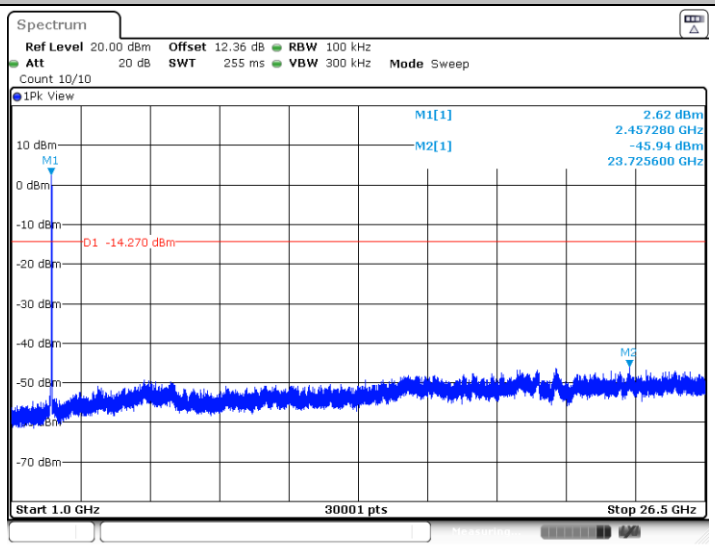

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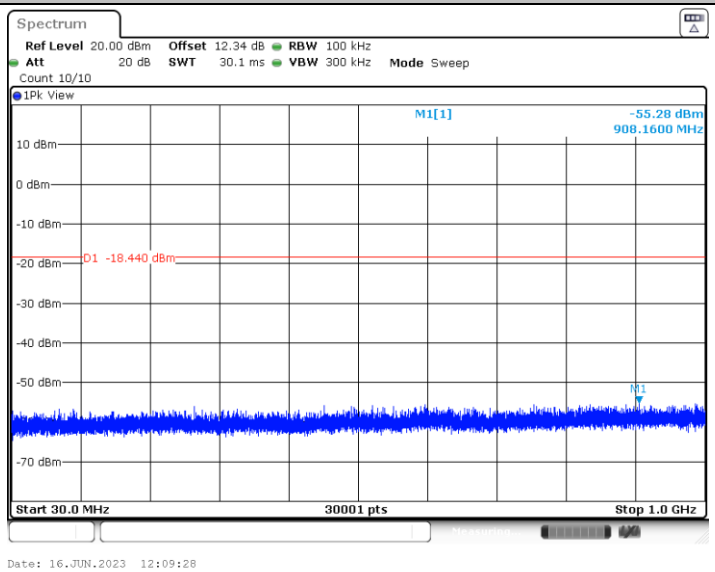

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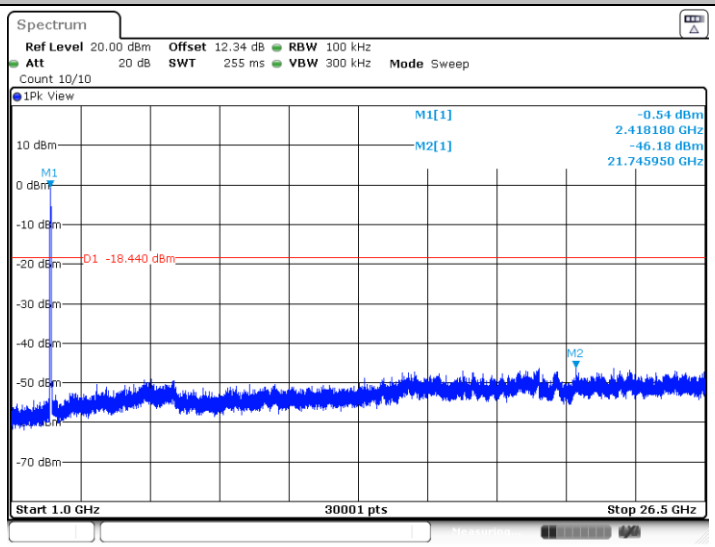

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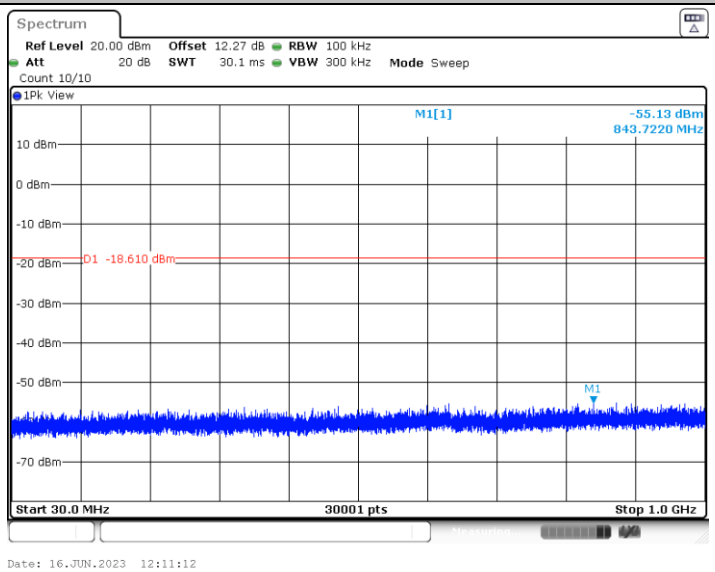

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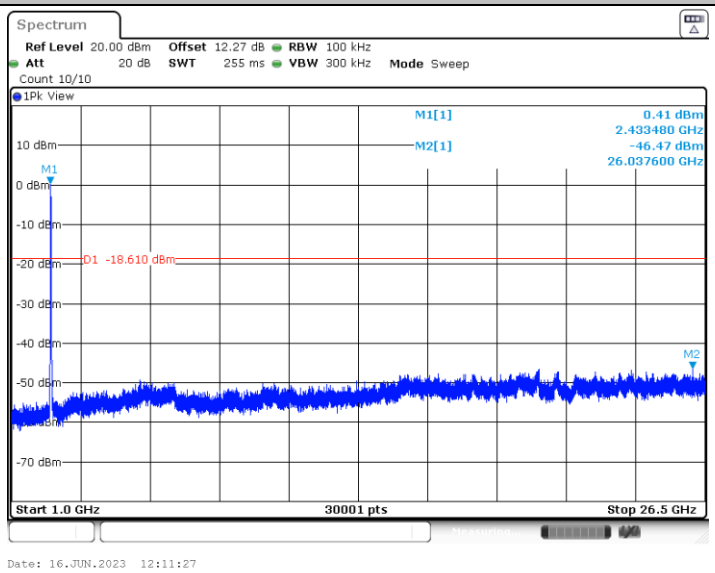

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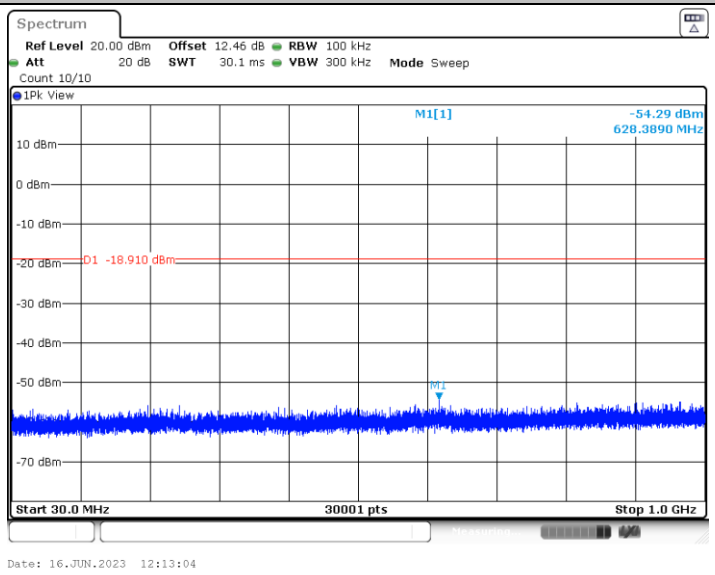

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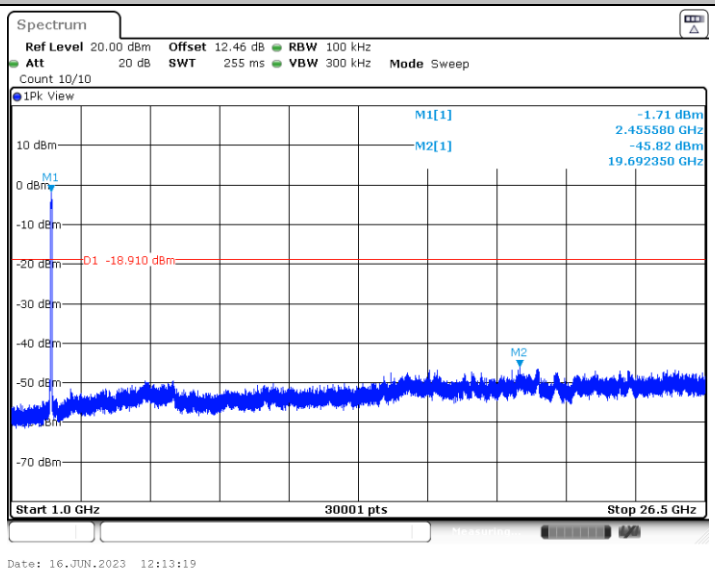
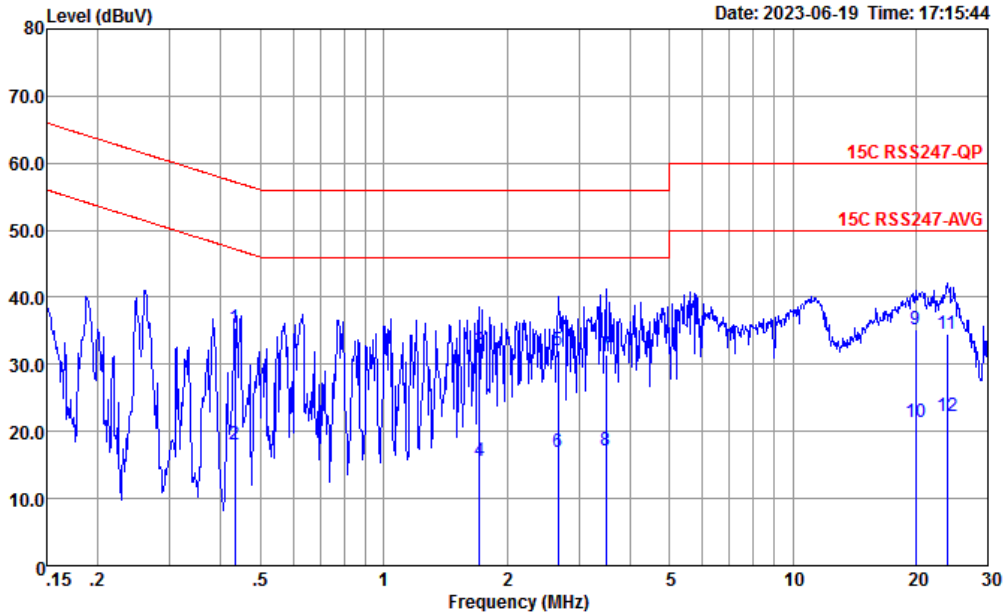


Appendix B. AC Conducted Emission Test Results

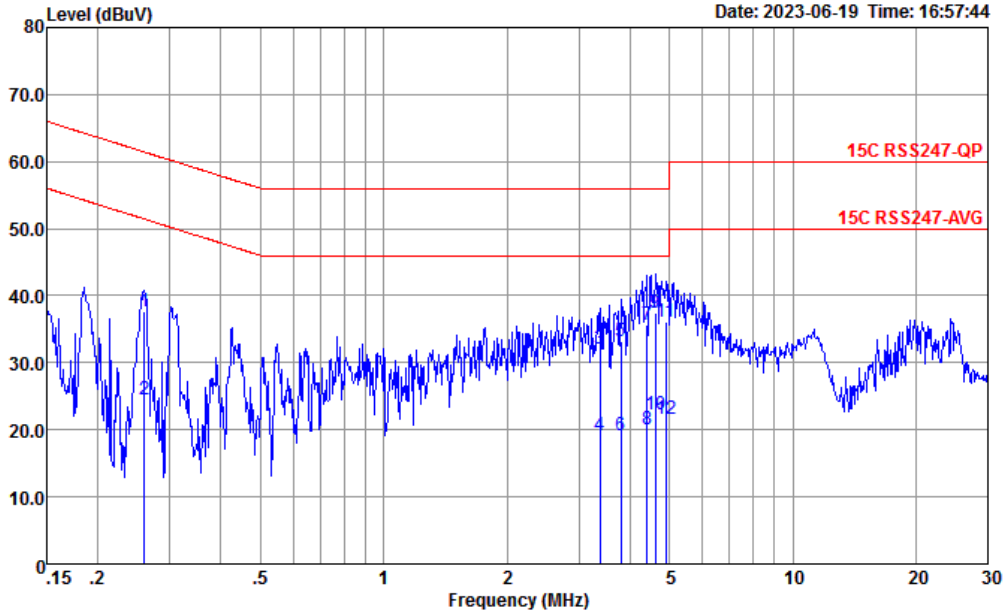
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15C RSS247-QP LISN-060105-LINE LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.433	35.46	-21.74	57.20	25.19	0.00	10.27	QP
2		0.433	18.06	-29.14	47.20	7.79	0.00	10.27	Average
3		1.716	32.16	-23.84	56.00	22.21	-0.12	10.07	QP
4		1.716	15.56	-30.44	46.00	5.61	-0.12	10.07	Average
5		2.664	32.15	-23.85	56.00	22.20	-0.11	10.06	QP
6		2.664	16.85	-29.15	46.00	6.90	-0.11	10.06	Average
7		3.491	31.45	-24.55	56.00	21.50	-0.11	10.06	QP
8		3.491	17.15	-28.85	46.00	7.20	-0.11	10.06	Average
9		19.950	35.11	-24.89	60.00	24.10	-0.32	11.33	QP
10		19.950	21.31	-28.69	50.00	10.30	-0.32	11.33	Average
11		23.888	34.64	-25.36	60.00	23.51	-0.34	11.47	QP
12		23.888	22.37	-27.63	50.00	11.24	-0.34	11.47	Average

Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15C RSS247-QP LISN-060105-NEUTRAL NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.260	37.66	-23.76	61.42	27.31	-0.02	10.37	QP
2	0.260	24.56	-26.86	51.42	14.21	-0.02	10.37	Average
3	3.381	32.13	-23.87	56.00	22.20	-0.13	10.06	QP
4	3.381	19.23	-26.77	46.00	9.30	-0.13	10.06	Average
5	3.799	33.14	-22.86	56.00	23.20	-0.12	10.06	QP
6	3.799	19.24	-26.76	46.00	9.30	-0.12	10.06	Average
7	4.407	35.54	-20.46	56.00	25.59	-0.11	10.06	QP
8	4.407	20.14	-25.86	46.00	10.19	-0.11	10.06	Average
9 *	4.622	37.55	-18.45	56.00	27.60	-0.11	10.06	QP
10	4.622	22.25	-23.75	46.00	12.30	-0.11	10.06	Average
11	4.900	36.15	-19.85	56.00	26.20	-0.11	10.06	QP
12	4.900	21.55	-24.45	46.00	11.60	-0.11	10.06	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)