

Report No.: SEWM2207000133RG03

Rev.: 01

Page: 1 of 195

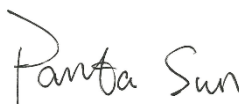
TEST REPORT

Application No.: SEWM2207000133RG
Applicant: Quectel Wireless Solutions Co., Ltd
Address of Applicant: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer: Quectel Wireless Solutions Co., Ltd
Address of Manufacturer: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
EUT Description: Smart Module
Model No.: SA800U-WF
Trade Mark: QUECTEL
FCC ID: XMR2022SA800UWF
Standards: FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2022/08/09
Date of Test: 2022/08/15 to 2022/09/12
Date of Issue: 2022/09/13

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:




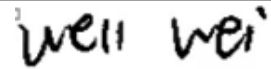
Panta Sun
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022/09/13		Original

Prepared By		 <hr/> (Tizy Song) / Test Engineer
Checked By		 <hr/> (Well Wei) / Reviewer



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013 Section 6.2	Clause 4.2	PASS
Duty Cycle	--	--	Clause 4.3	Reporting only
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013 Section 11.9.2.3	Clause 4.4	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013 Section 11.8 Option 2 / 6.9.3	Clause 4.5	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10 2013 Section 11.10.2	Clause 4.6	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013 Section 11.11	Clause 4.7	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013 Section 11.11	Clause 4.8	PASS
Radiated Spurious Emissions	15.247(d);15.205/15.209	ANSI C63.10 2013 Section 11.12	Clause 4.9	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d);15.205/15.209	ANSI C63.10 2013 Section 11.12	Clause 4.10	PASS



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Contents

1	Version	2
2	Test Summary	3
3	General Information	5
3.1	Details of Client	5
3.2	Test Location	5
3.3	Test Facility	5
3.4	General Description of EUT	6
3.5	Test Environment and Mode	8
3.6	Description of Support Units	8
3.7	Worst-case configuration and mode	8
4	Test results and Measurement Data	9
4.1	Antenna Requirement	9
4.2	AC Power Line Conducted Emissions	11
4.3	Duty Cycle	15
4.4	Conducted Output Power	16
4.5	DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	17
4.6	Power Spectral Density	18
4.7	Band-edge for RF Conducted Emissions	19
4.8	RF Conducted Spurious Emissions	20
4.9	Radiated Spurious Emissions	21
4.10	Restricted bands around fundamental frequency	24
5	Measurement Uncertainty (95% confidence levels, k=2)	27
6	Equipment List	28
7	Photographs - Setup Photos	30



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3 General Information

3.1 Details of Client

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Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	Lves Cheng, Tizzy Song

3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

<ul style="list-style-type: none"> A2LA (Certificate No. 6336.01) SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01. Innovation, Science and Economic Development Canada SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory. CAB identifier: CN0120. IC#: 27594. FCC –Designation Number: CN1312 SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory. Designation Number: CN1312. Test Firm Registration Number: 717327
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3.4 General Description of EUT

EUT Description:	Smart Module	
Model No.:	SA800U-WF	
Trade Mark:	QUECTEL	
Hardware Version:	R1.0	
Software Version:	SA800UWFPAR01A06	
IMEI:	RF Conducted	P1C20LH18000327
	RSE & AC power line	P1C20LH18000832
Operation Frequency:	802.11b/g/n(HT20):	2412MHz to 2462MHz
	802.11n(HT40):	2422MHz to 2452MHz
Modulation Type:	802.11b:	DSSS (DBPSK, DQPSK, CCK)
	802.11g/n:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Number of Channels:	802.11b/g/n(HT20): 11 802.11n(HT40): 7	
Channel Spacing:	5MHz	
Smart System:	<input checked="" type="checkbox"/> SISO	802.11b/g/n
	<input checked="" type="checkbox"/> MIMO	802.11n: 2Tx & 2Rx
	<input checked="" type="checkbox"/> Diversity	802.11b/g : 2Tx & 2Rx
Antenna Type:	PCB Antenna	
Antenna Gain:	4.61dBi(Ant1); 4.61dBi(Ant2)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	0.5dB	
Remark:	As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.	



Operation Frequency of each channel (802.11b/g/n HT20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		
Operation Frequency of each channel (802.11n HT40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
3	2422MHz	6	2437MHz	9	2452MHz		
4	2427MHz	7	2442MHz				
5	2432MHz	8	2447MHz				
Remark: In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:							
Channel		Frequency for 802.11 b/g/n (HT20)			Frequency for 802.11n (HT40)		
The Lowest channel		2412MHz			2422MHz		
The Middle channel		2437MHz			2437MHz		
The Highest channel		2462MHz			2452MHz		



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3.5 Test Environment and Mode

Environment Parameter	101.0 kPa Selected Values During Tests	
Relative Humidity	44-46 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~23	3.8
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

Description	Manufacturer	Model No.
Test auxiliary PCB board	Quectel	N/A
Remark: all above the information of table are provided by client.		

3.7 Worst-case configuration and mode

Low data rate was used to test on antenna port conducted tests and radiated spurious emissions since it has the highest maximum power. Following are the worst-case data rates set for test:

Modulation Type	SISO - Data Rate	CDD/MIMO - Data Rate
802.11b	1 Mbps	2 Mbps
802.11g	6 Mbps	12 Mbps
802.11n (HT 20)	MCS0 (6.5 Mbps)	MCS0 (13 Mbps)
802.11n (HT 40)	MCS0 (13.5 Mbps)	MCS0 (27 Mbps)



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 Wireless Laboratory

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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, 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 in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>	
<p>The antenna is PCB Antenna on the main PCB and no consideration of replacement. The best case gain of the antenna is 4.61dBi(Ant1); 4.61dBi(Ant2). *</p>	
<p><i>*Note:</i> <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i></p> <p><i>Remark:</i> <i>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</i></p>	



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Cyclic Delay Diversity (CDD) System:

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

If all antennas have the same gain, G_{ANT} , Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power measurements on IEEE 802.11 devices:
 Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
 Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;
 Array Gain = $5 \log(N_{ANT}/N_{SS}=1)$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

Unequal antenna gains, with equal transmit powers. For antenna gains given by G_1, G_2, \dots, G_N dBi

- If transmit signals are correlated, then
 Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
- If all transmit signals are completely uncorrelated, then
 Directional gain = $10 \log[(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N_{ANT}]$ dBi

The Power and PSD limit should be modified if the directional gain of eut is over 6dBi.

Power Limit Reduction =

The EUT supports CDD System.

All antennas have the same gain:

ANT Gain1 (dBi)	ANT Gain2 (dBi)	Power DG (dBi)	PSD DG (dBi)	Power Limit Reduction(dB)	PSD Limit Reduction(dB)
4.61	4.61	4.61	7.62	0	1.62

Power Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi) =0

PSD Limit Reduction = Directional gain – 6dBi, (Directional gain > 6dBi) =7.62 – 6 = 1.62



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4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		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.			
Test Procedure:	<p>1) The mains terminal disturbance voltage test was conducted in a shielded room.</p> <p>2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.</p> <p>3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,</p> <p>4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</p>		



<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Refer to section 3.7 for details. Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 6 for details.</p>
<p>Test Results:</p>	<p>Pass</p>

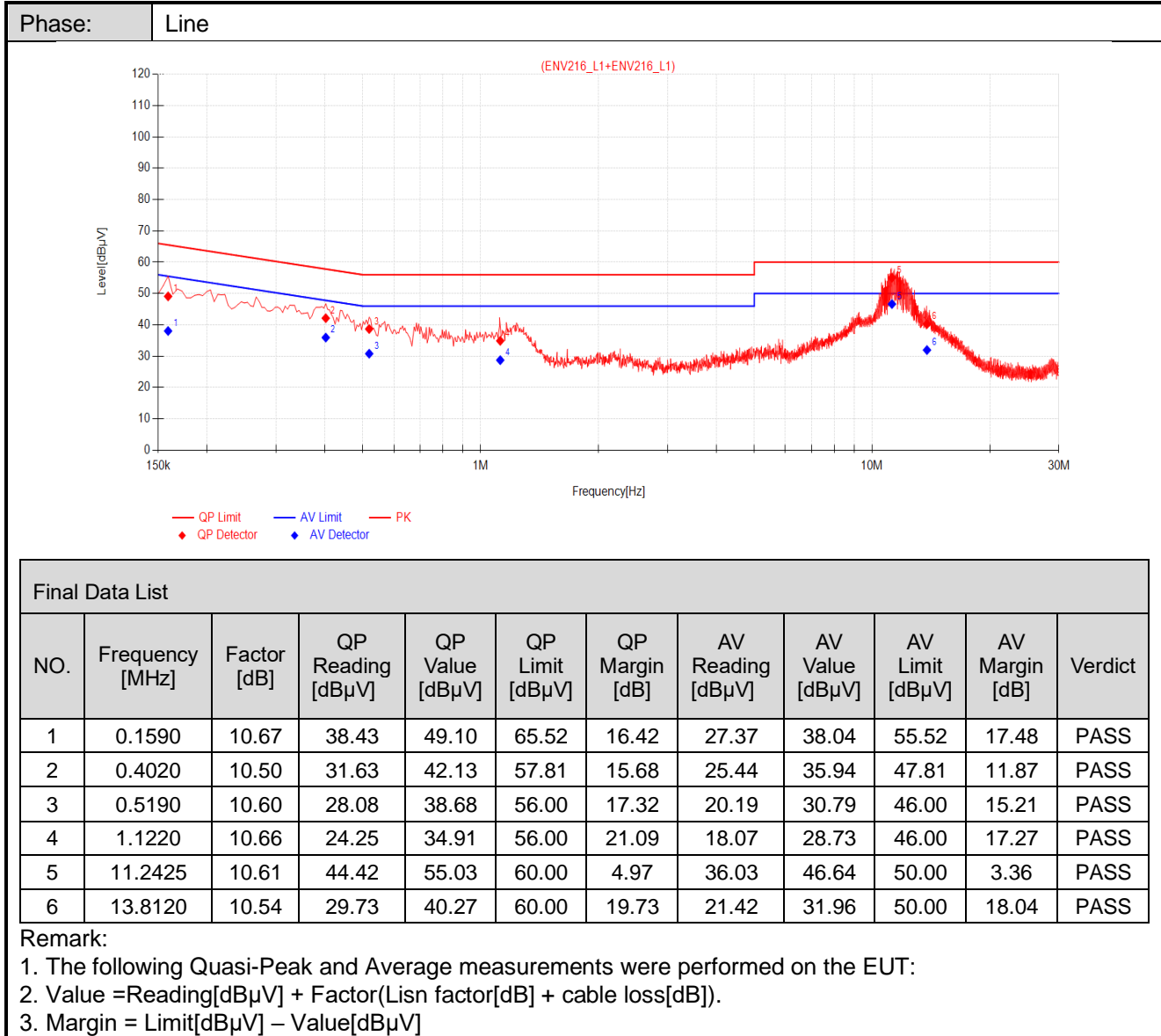


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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

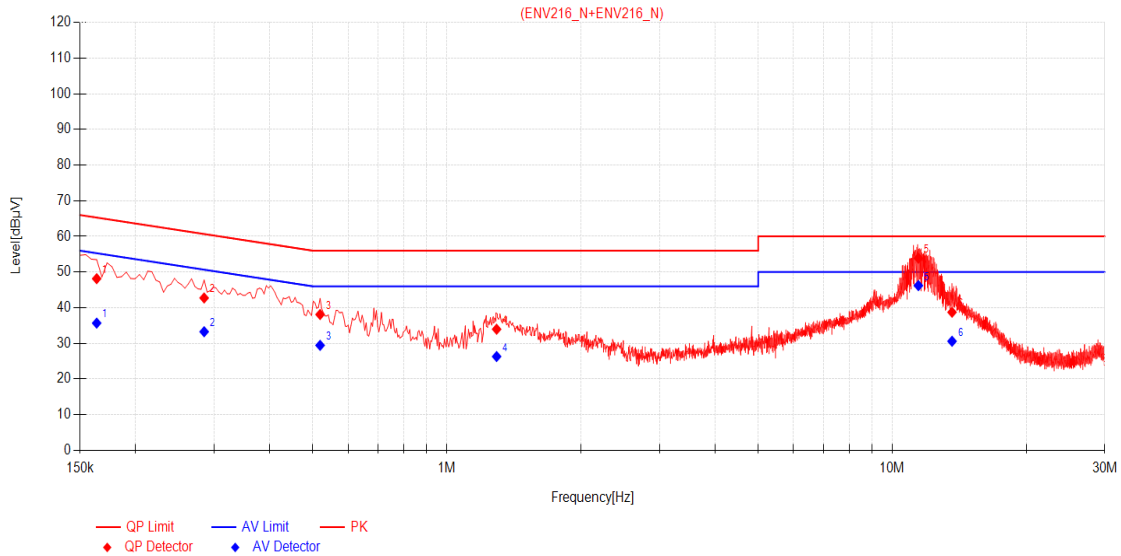


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Phase: Neutral



Final Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1635	10.72	37.42	48.14	65.28	17.14	24.96	35.68	55.28	19.60	PASS
2	0.2850	10.74	31.99	42.73	60.67	17.94	22.53	33.27	50.67	17.40	PASS
3	0.5190	10.79	27.31	38.10	56.00	17.90	18.66	29.45	46.00	16.55	PASS
4	1.2930	10.77	23.20	33.97	56.00	22.03	15.53	26.30	46.00	19.70	PASS
5	11.4450	10.65	43.23	53.88	60.00	6.12	35.55	46.20	50.00	3.80	PASS
6	13.6230	10.62	28.11	38.73	60.00	21.27	19.97	30.59	50.00	19.41	PASS

Remark:

- The following Quasi-Peak and Average measurements were performed on the EUT:
- Value = Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
- Margin = Limit[dBµV] – Value[dBµV]



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Report No.: SEWM2207000133RG03

Rev.: 01

Page: 15 of 195

4.3 Duty Cycle

The detailed test data see: **Appendix**



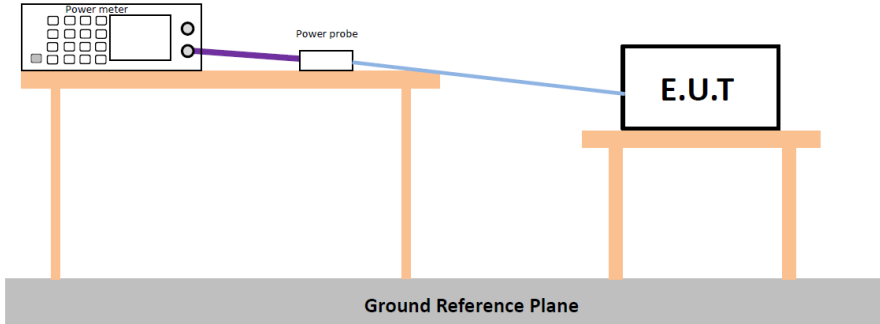
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Wireless Laboratory

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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10 :2013 Section 11.9.2.3
Test Setup:	 <p>* Test with power meter (Detector function: Peak)</p>
Test Instruments:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	30dBm
Test Results:	Pass
The detailed test data see: Appendix	



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4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8 Option 2 / 6.9.3
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	≥ 500 kHz
Test Results:	Pass
The detailed test data see: Appendix	



4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	≤8.00dBm/3kHz
Test Results:	Pass
The detailed test data see: Appendix	



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4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	In any 100 kHz bandwidth outside the frequency band 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, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	



4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	In any 100 kHz bandwidth outside the frequency band 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, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	



4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 :2013 Section 11.12				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Test Frequency:	9kHz ~ 25GHz				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak	
	Peak	1MHz	3MHz	Peak	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					



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Test Setup:

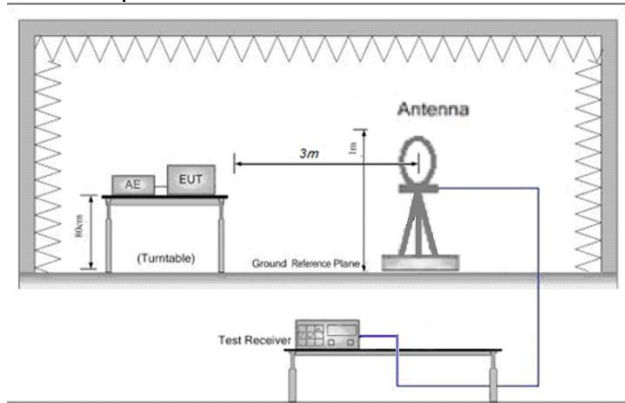


Figure 1. Below 30MHz

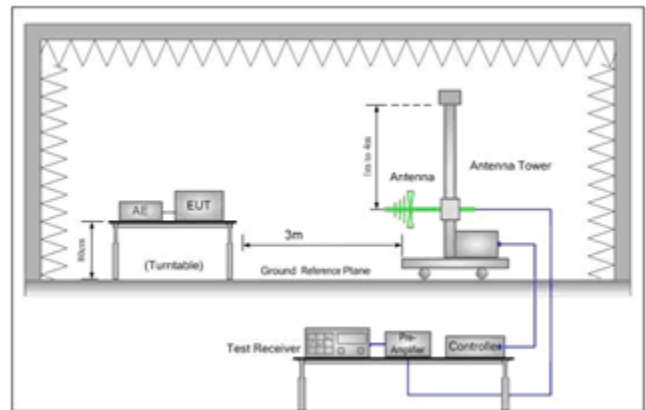


Figure 2. 30MHz to 1GHz

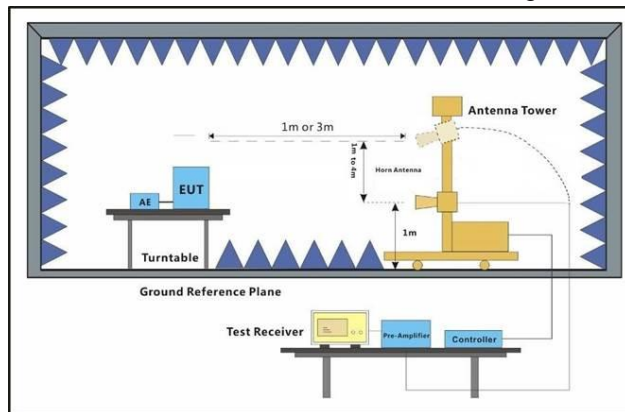


Figure 3. Above 1 GHz

Test Procedure:

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz).
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the



	<p>maximum reading.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. Test the EUT in the lowest channel, the middle channel ,the Highest channel.</p> <p>h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.</p> <p>i. Repeat above procedures until all frequencies measured was complete.</p> <p>j. 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</p> <p>k. The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed.</p> <p>l. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.</p>
Test Configuration:	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW \geq 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW \geq [3 *RBW] • Detector = RMS (power averaging), if span / (# of points in sweep) \leq (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. • Sweep time = auto • Perform a trace average of at least 100 traces.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.
Final Test Mode:	Refer to section 3.7 for details.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10: 2013 Section 11.12		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
Above 1GHz		54.0	Average Value
		74.0	Peak Value

Test Setup:

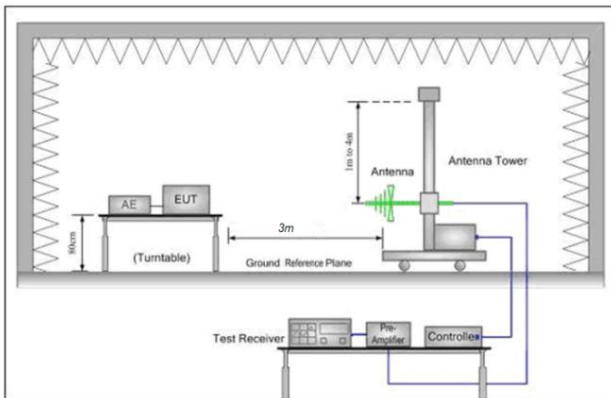


Figure 1. 30MHz to 1GHz

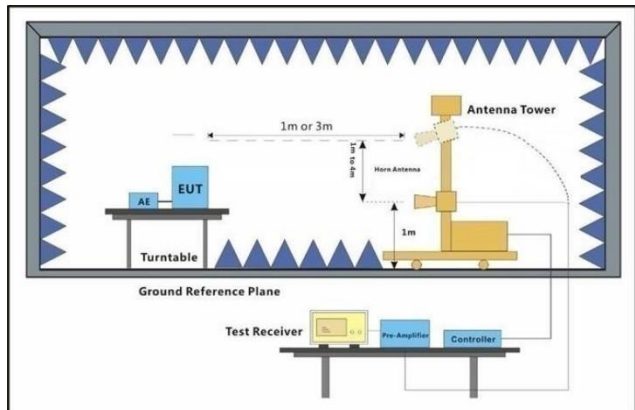


Figure 2. Above 1 GHz



<p>Test Procedure:</p>	<ol style="list-style-type: none"> a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.
<p>Test Configuration:</p>	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ [3 *RBW] • Detector = RMS (power averaging), if span / (# of points in sweep) ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. • Sweep time = auto • Perform a trace average of at least 100 traces.
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.</p>



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Report No.: SEWM2207000133RG03

Rev.: 01

Page: 26 of 195

Final Test Mode:	Refer to section 3.7 for details.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.54dB
2	RF power density, conducted	±1.03dB
3	Spurious emissions, conducted	±0.54dB
4	Radio Frequency	±1.0 %
5	Duty Cycle	±0.37%
6	Occupied Bandwidth	±1.0 %
7	Conduction Emission	± 2.90dB (150kHz to 30MHz)
8	Radiated Emission	± 3.13dB (9k -30MHz)
		± 4.80dB (30M -1GHz)
		± 4.80dB (1GHz to 18GHz)
		± 4.80dB (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/ETSI Uncertainty), so the test results
 – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
 – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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6 Equipment List

RF Test Equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2022/02/16	2023/02/15
Signal Analyzer	ROHDE &SCHWARZ	FSV3030	SUWI-01-02-02	2022/05/17	2023/05/16
Measurement Software	Tonscend	JS1120-3 Test System V3.1.55	SUWI-02-09-09	NCR	NCR
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/02/15	2023/02/14
Signal Analyzer	ROHDE &SCHWARZ	FSW43	SUWI-01-02-04	2022/05/28	2023/05/27
Power meter	Anritsu	ML2495A	SUWI-01-31-01	2021/12/04	2022/12/03
Pulse power sensor	Anritsu	MA2411b	SUWI-01-32-01	2021/12/04	2022/12/03
MXG Vector signal genitor	KEYSIGHT	N5182B	SUWI-01-38-01	2022/02/14	2023/02/13
Temperature Chamber	ESPEC	SU-242	SUWI-01-13-01	2022/02/15	2023/02/14
Wideband Radio Communication Tester	ROHDE &SCHWARZ	CMW500	SUWI-01-16-05	2022/02/14	2023/02/13

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-03-01	2021/05/08	2024/05/07
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-01	2022/02/19	2023/02/18
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-02	2022/02/19	2023/02/18
Measurement Software	Tonscend	JS32-CE V4.0.0.2	SUWI-02-09-05	NCR	NCR
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/02/19	2023/02/18
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-06	2022/02/16	2023/02/15
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/02/15	2023/02/14



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-01	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2022/02/16	2023/02/15
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2022/05/28	2023/05/27
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-05	2021/12/04	2022/12/03
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/02/19	2023/02/18
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9163	SUWI-01-11-01	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-02	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2021/05/14	2023/05/13
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-01	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP01018050	SUWI-01-14-02	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP18040048	SUWI-01-14-03	2022/02/19	2023/02/18
Active Loop Antenna	SCHWRZBECK MESS-ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2021/06/10	2023/06/09
Measurement Software	Tonscend	JS32-RSE V4.0.0.0	SUWI-02-09-06	NCR	NCR



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Rev.: 01

Page: 30 of 195

7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Page: 31 of 195

Appendix



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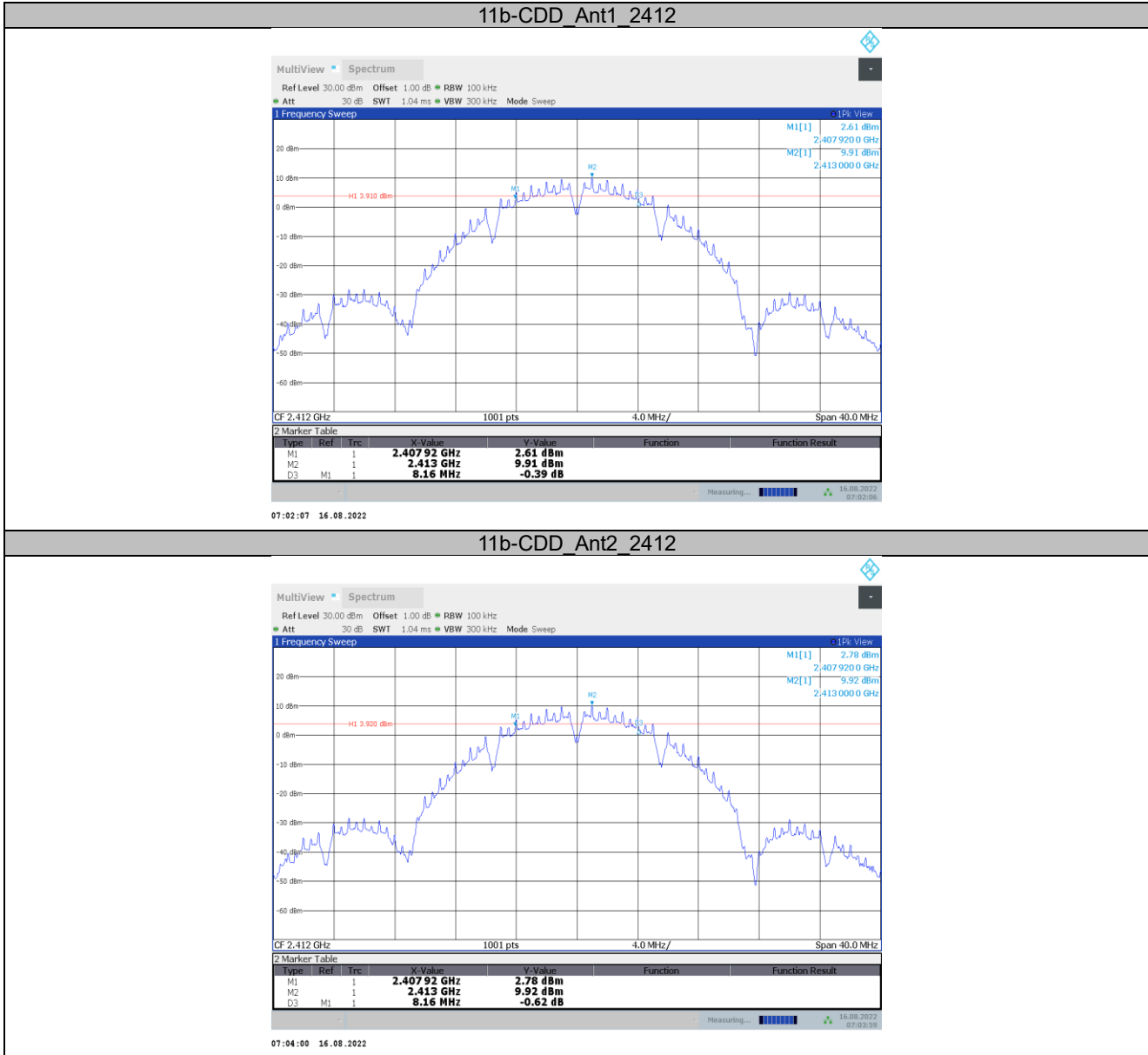
**DTS Bandwidth
Test Result**

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11b-CDD	Ant1	2412	8.16	2407.92	2416.08	≥0.5	PASS
	Ant2	2412	8.16	2407.92	2416.08	≥0.5	PASS
	Ant1	2437	8.12	2432.92	2441.04	≥0.5	PASS
	Ant2	2437	8.16	2432.92	2441.08	≥0.5	PASS
	Ant1	2462	8.12	2457.92	2466.04	≥0.5	PASS
	Ant2	2462	8.12	2457.92	2466.04	≥0.5	PASS
11g-CDD	Ant1	2412	15.76	2404.40	2420.16	≥0.5	PASS
	Ant2	2412	15.72	2404.44	2420.16	≥0.5	PASS
	Ant1	2417	15.56	2409.36	2424.92	≥0.5	PASS
	Ant2	2417	15.96	2409.20	2425.16	≥0.5	PASS
	Ant1	2437	15.80	2428.80	2444.60	≥0.5	PASS
	Ant2	2437	15.76	2428.80	2444.56	≥0.5	PASS
	Ant1	2462	15.80	2453.80	2469.60	≥0.5	PASS
	Ant2	2462	15.72	2453.80	2469.52	≥0.5	PASS
11n20MIMO	Ant1	2412	17.28	2403.52	2420.80	≥0.5	PASS
	Ant2	2412	16.08	2404.36	2420.44	≥0.5	PASS
	Ant1	2417	14.40	2410.40	2424.80	≥0.5	PASS
	Ant2	2417	16.04	2409.36	2425.40	≥0.5	PASS
	Ant1	2437	17.40	2428.16	2445.56	≥0.5	PASS
	Ant2	2437	16.04	2428.56	2444.60	≥0.5	PASS
	Ant1	2462	16.44	2453.16	2469.60	≥0.5	PASS
	Ant2	2462	16.44	2453.16	2469.60	≥0.5	PASS
11n40MIMO	Ant1	2422	34.00	2405.60	2439.60	≥0.5	PASS
	Ant2	2422	31.52	2405.60	2437.12	≥0.5	PASS
	Ant1	2437	35.52	2419.08	2454.60	≥0.5	PASS
	Ant2	2437	35.28	2419.32	2454.60	≥0.5	PASS
	Ant1	2447	35.84	2428.76	2464.60	≥0.5	PASS
	Ant2	2447	35.84	2428.76	2464.60	≥0.5	PASS
	Ant1	2452	35.84	2433.76	2469.60	≥0.5	PASS
	Ant2	2452	35.28	2434.32	2469.60	≥0.5	PASS



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Test Graphs

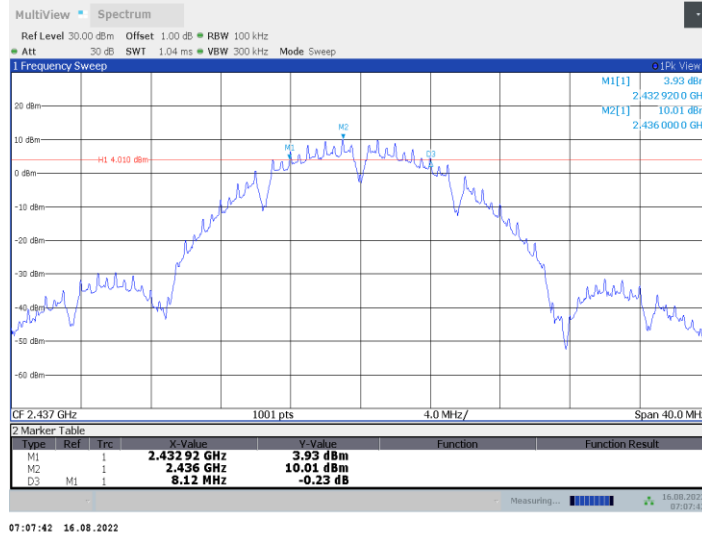


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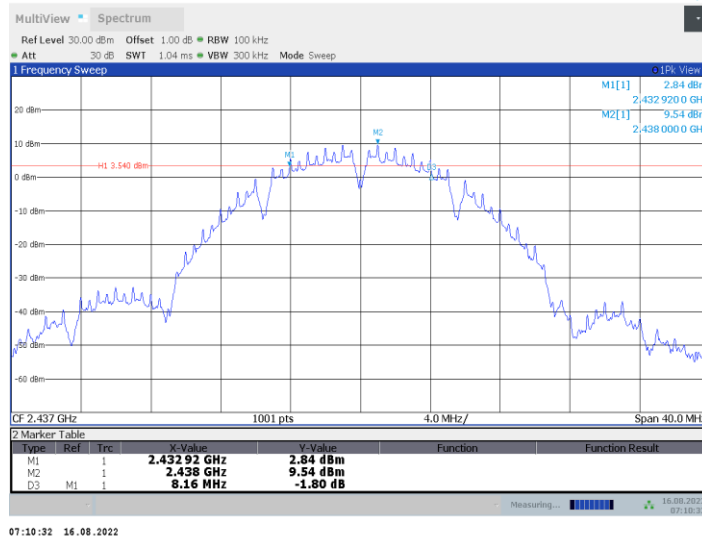
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11b-CDD_Ant1_2437



11b-CDD_Ant2_2437

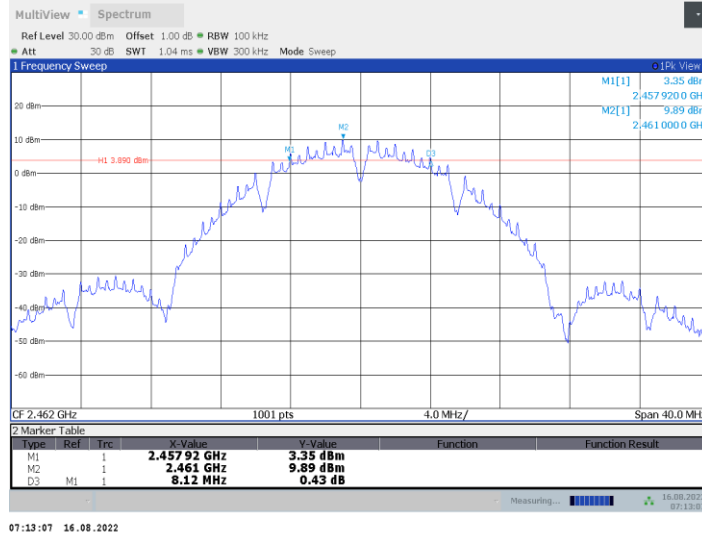


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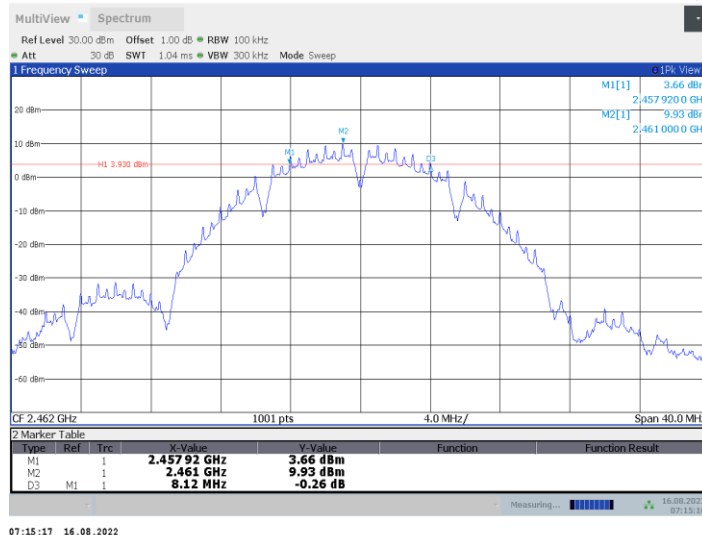
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11b-CDD_Ant1_2462



07:13:07 16.08.2022

11b-CDD_Ant2_2462



07:15:17 16.08.2022



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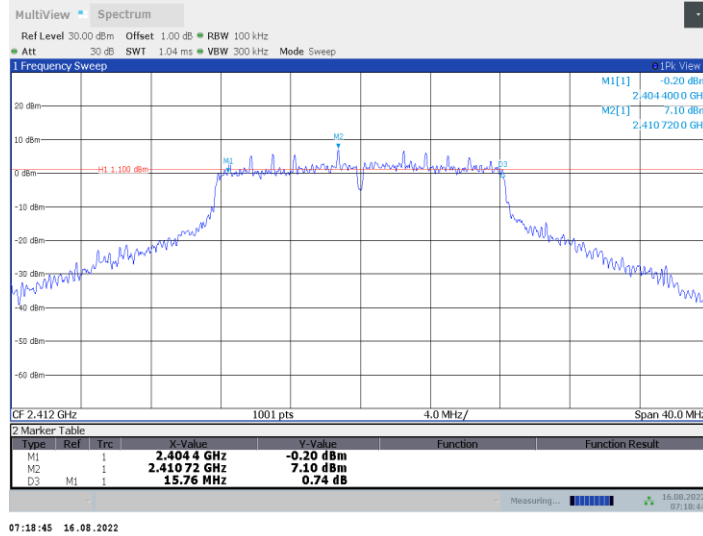
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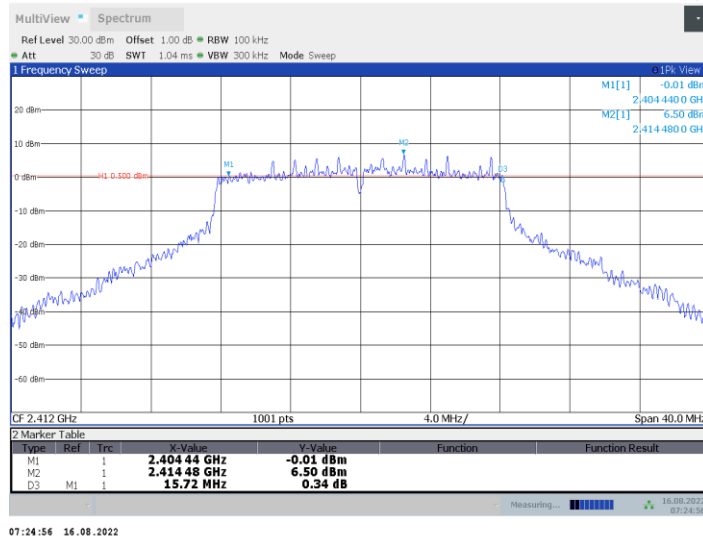
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11g-CDD_Ant1_2412



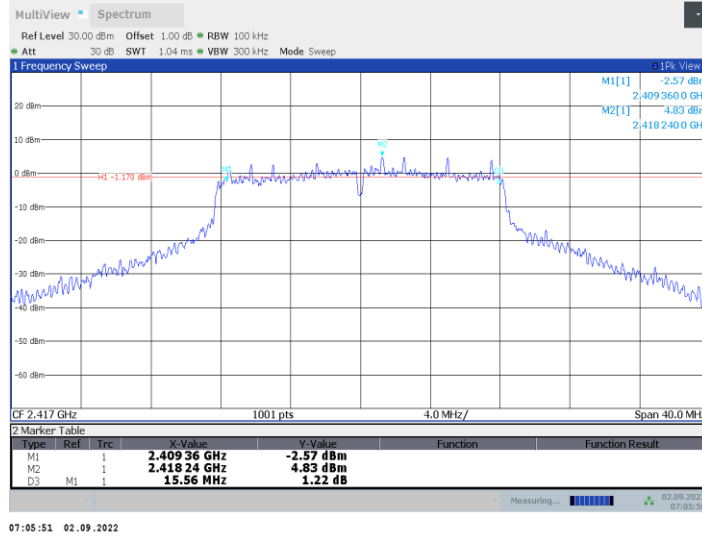
11g-CDD_Ant2_2412



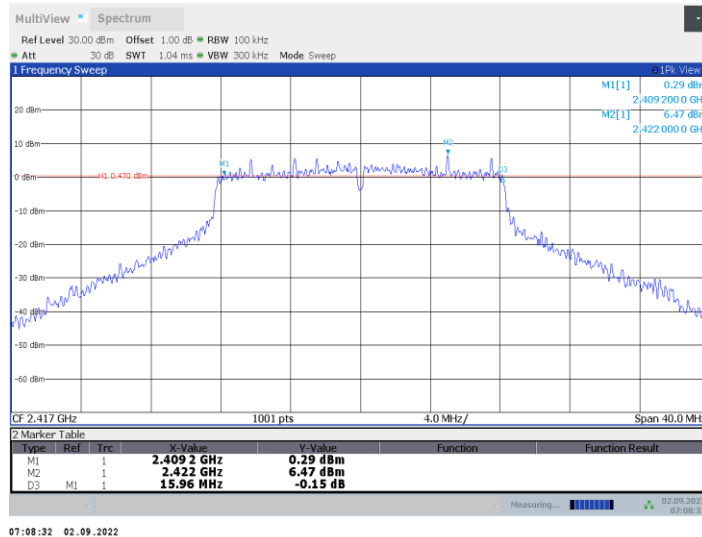
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11g-CDD_Ant1_2417



11g-CDD_Ant2_2417



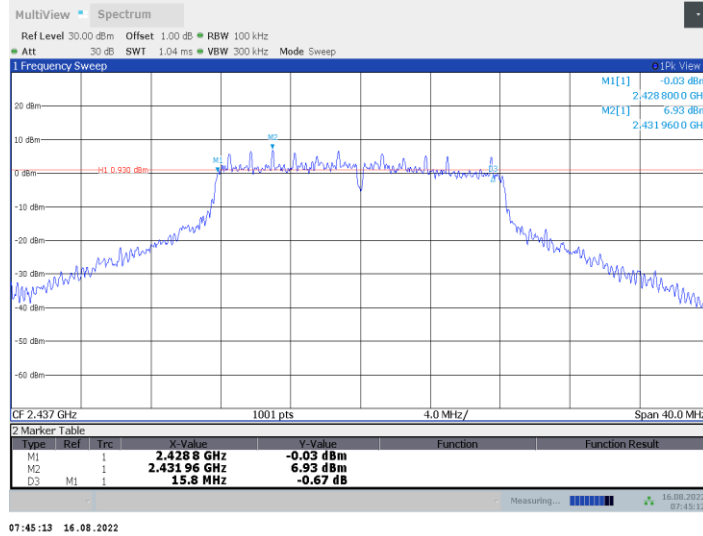
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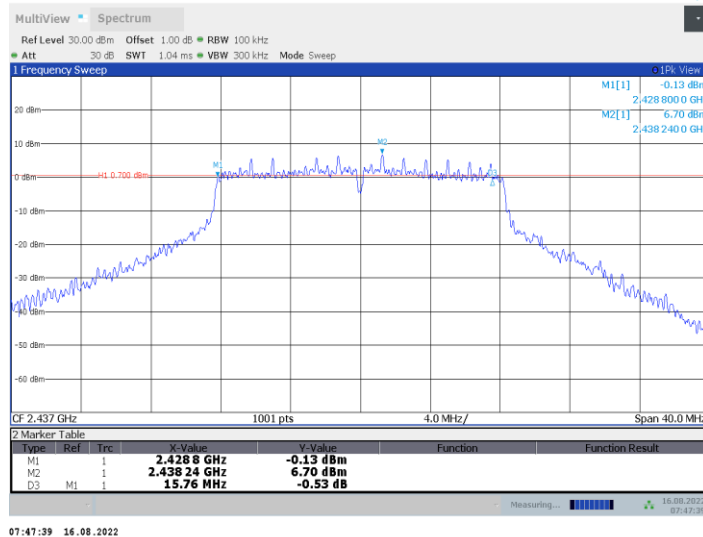
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11g-CDD_Ant1_2437



11g-CDD_Ant2_2437

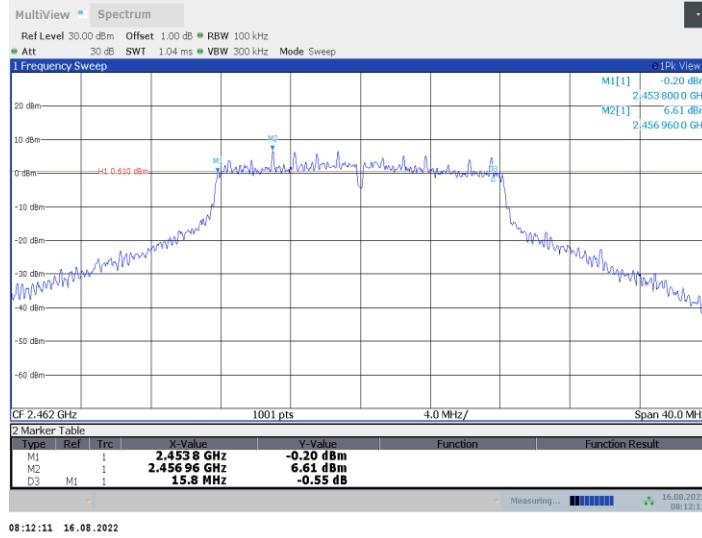


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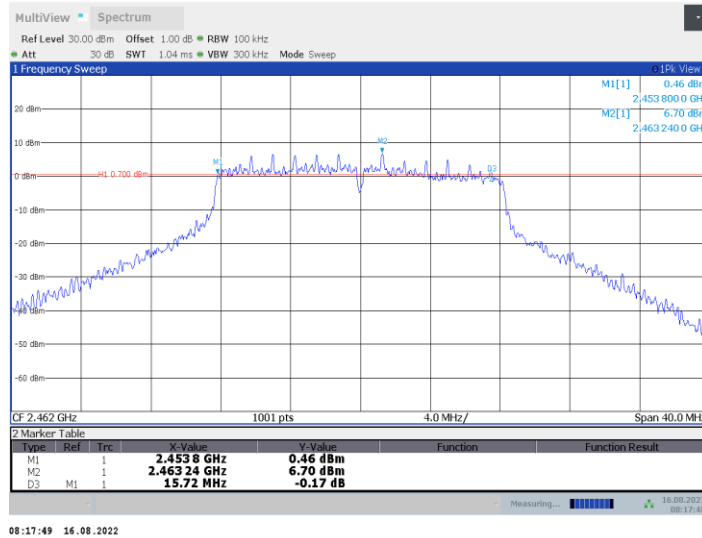
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11g-CDD Ant1 2462



11g-CDD Ant2 2462

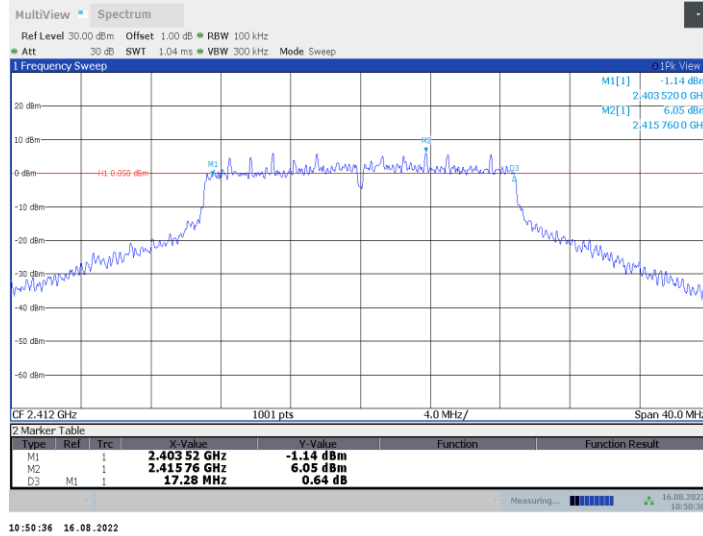


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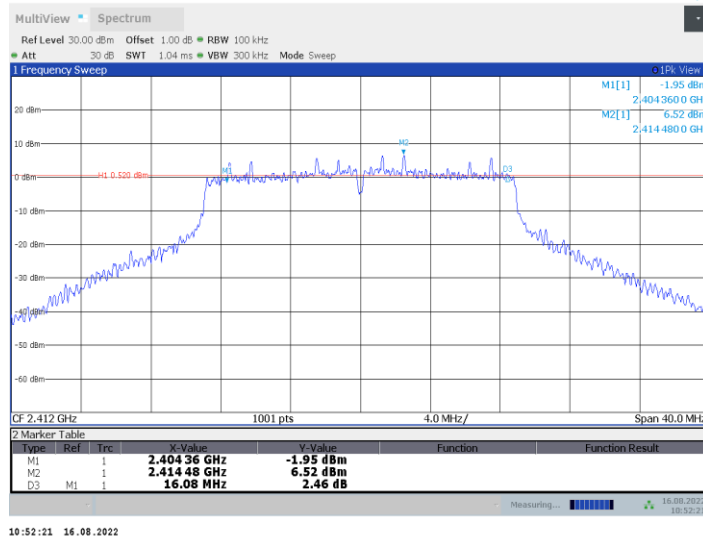
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11n20MIMO_Ant1_2412



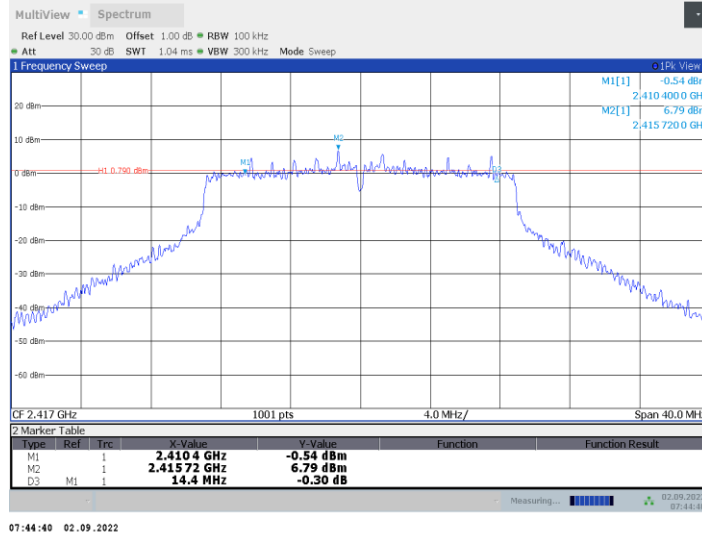
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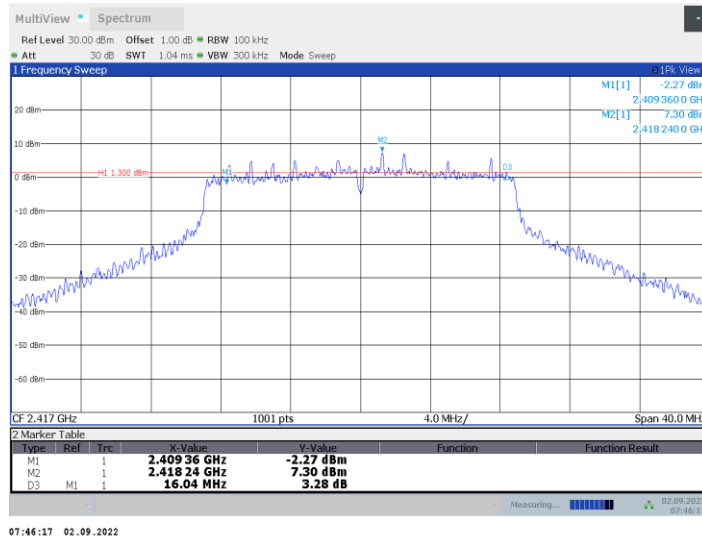
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11n20MIMO_Ant1_2417



11n20MIMO_Ant2_2417

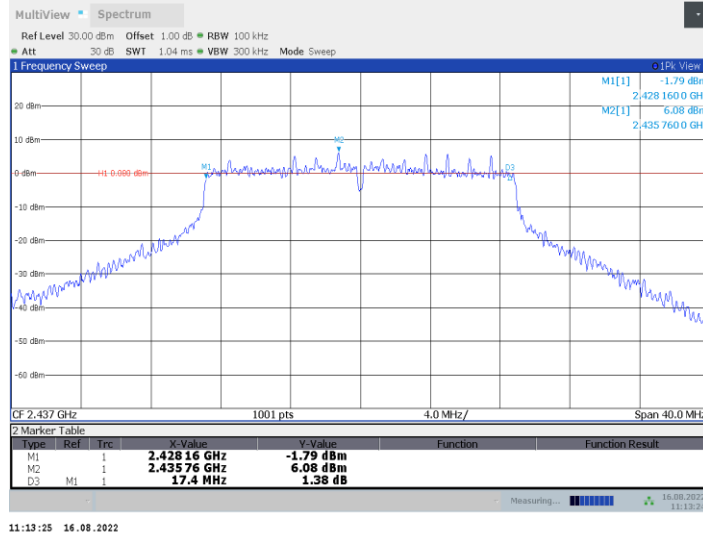


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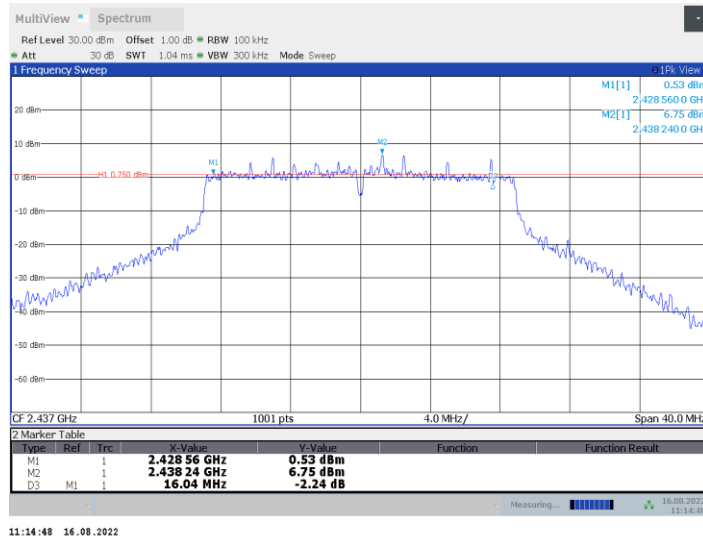
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11n20MIMO_Ant1_2437



11n20MIMO_Ant2_2437

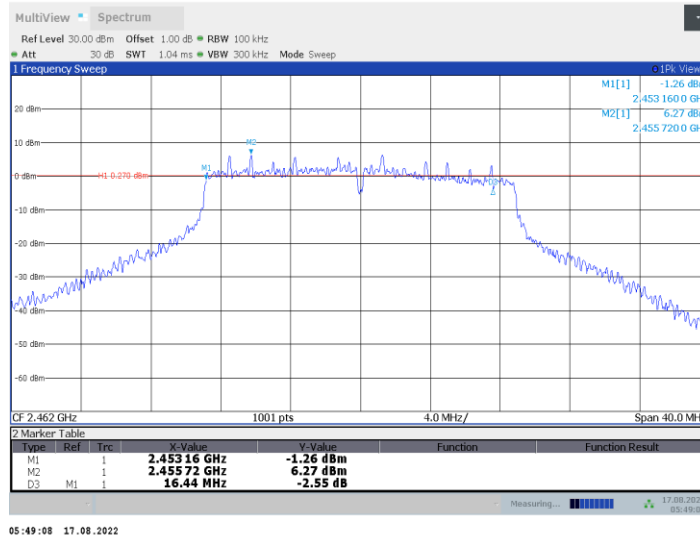


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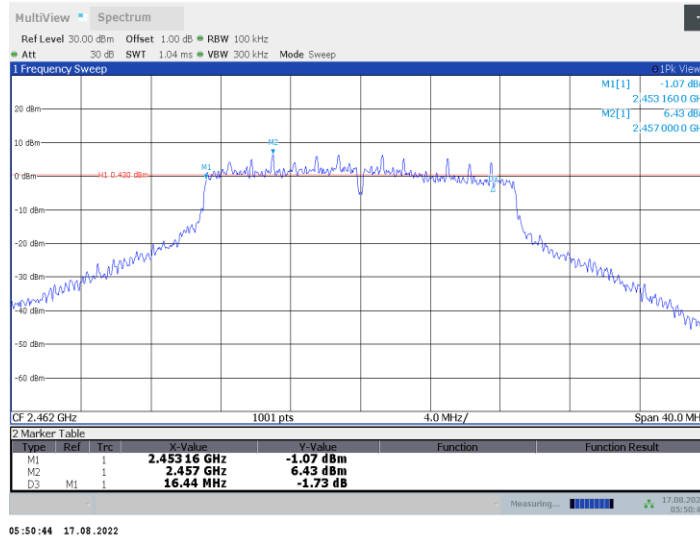
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11n20MIMO Ant1 2462



11n20MIMO Ant2 2462

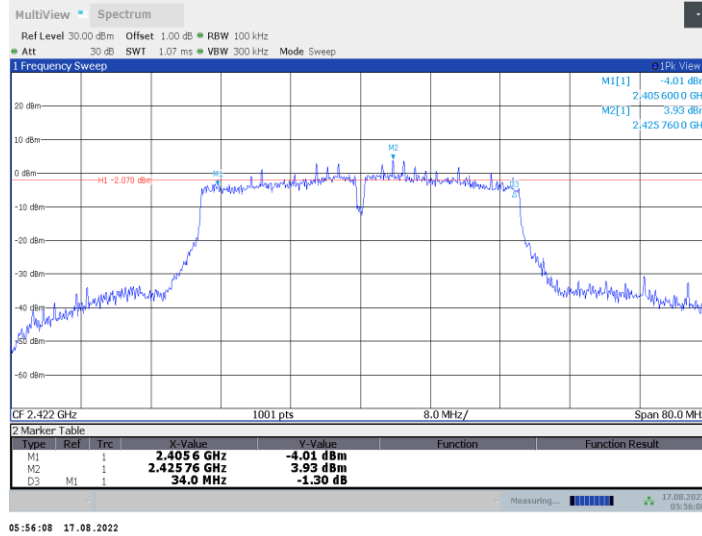


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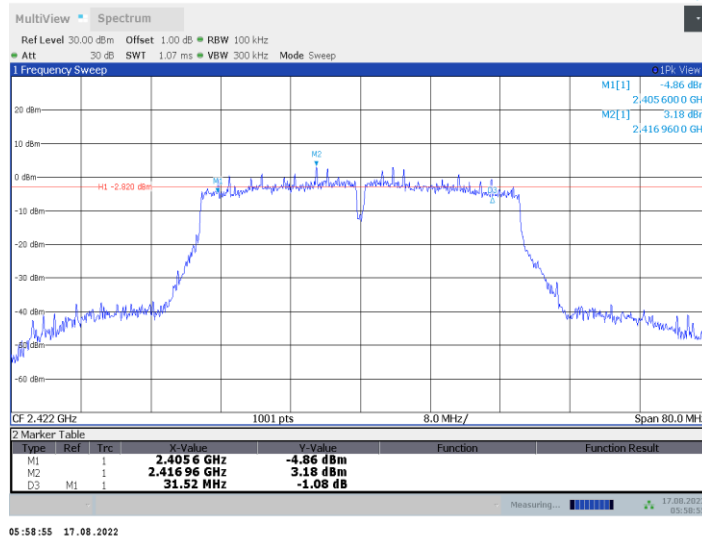
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11n40MIMO_Ant1_2422



11n40MIMO_Ant2_2422



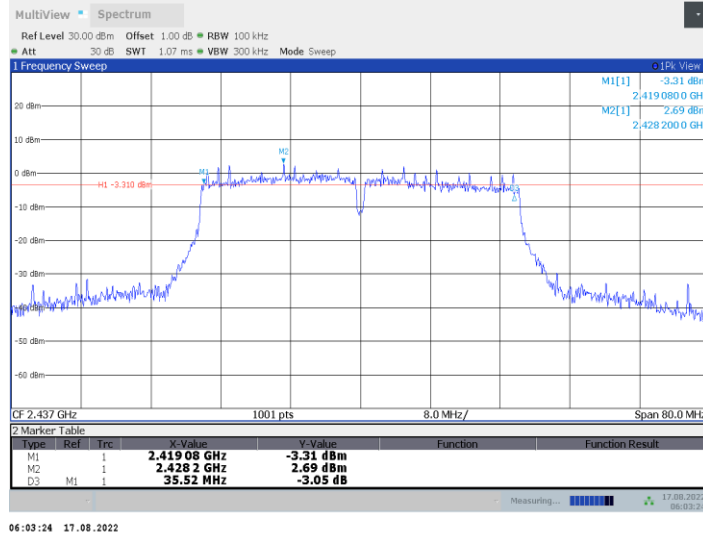
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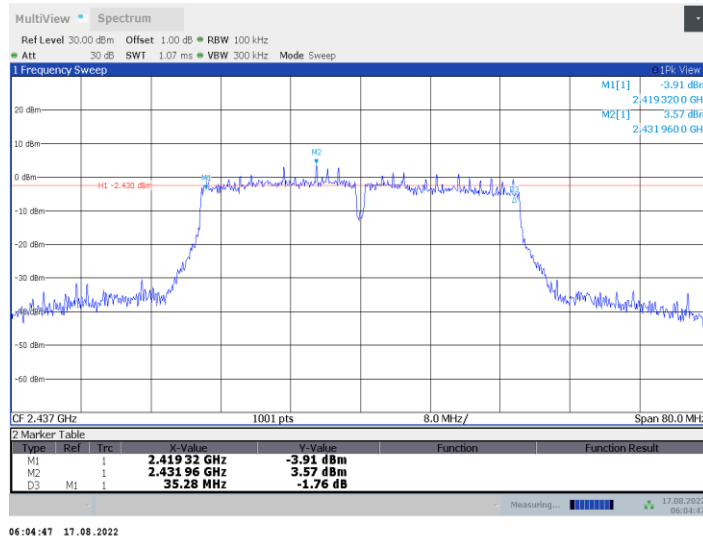
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11n40MIMO_Ant1_2437



11n40MIMO_Ant2_2437



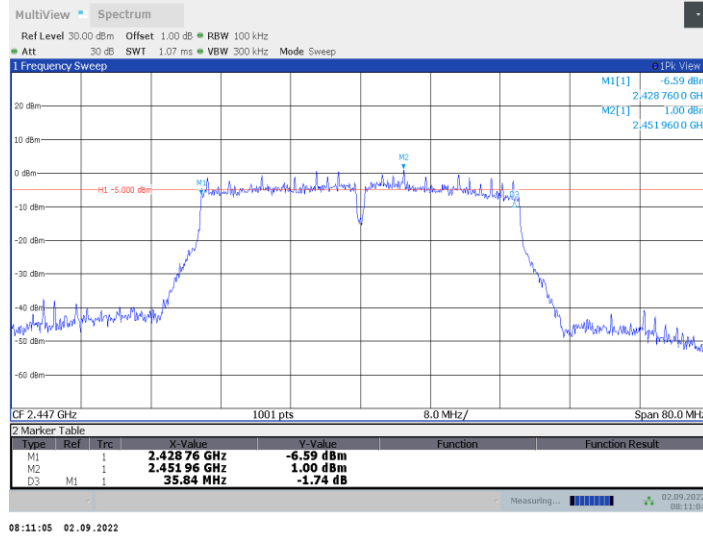
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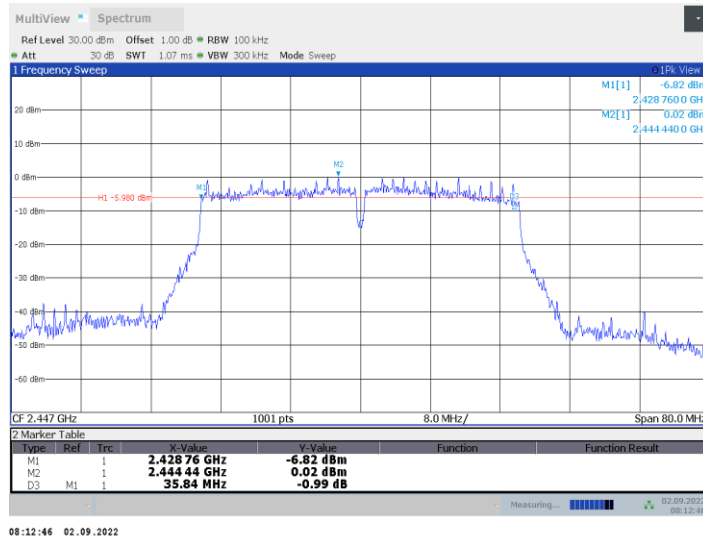
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11n40MIMO_Ant1_2447



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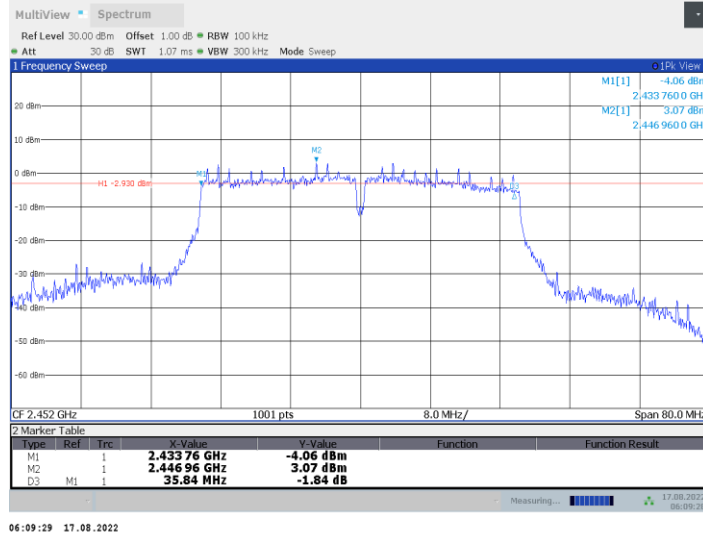


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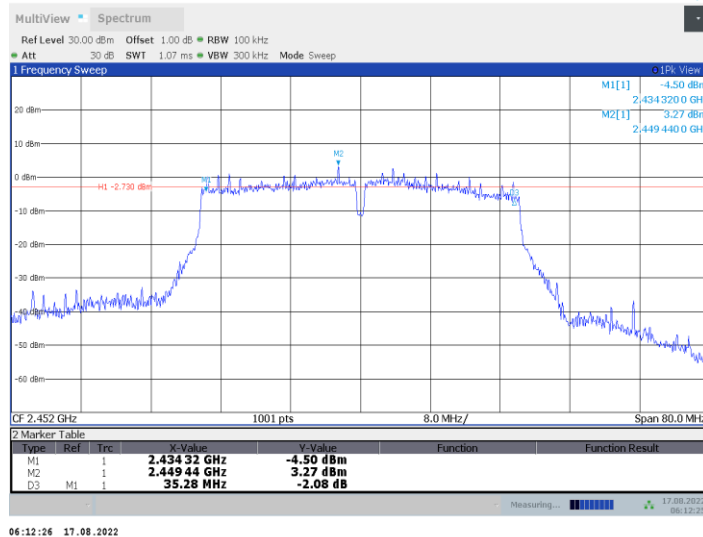
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11n40MIMO_Ant1_2452



11n40MIMO_Ant2_2452



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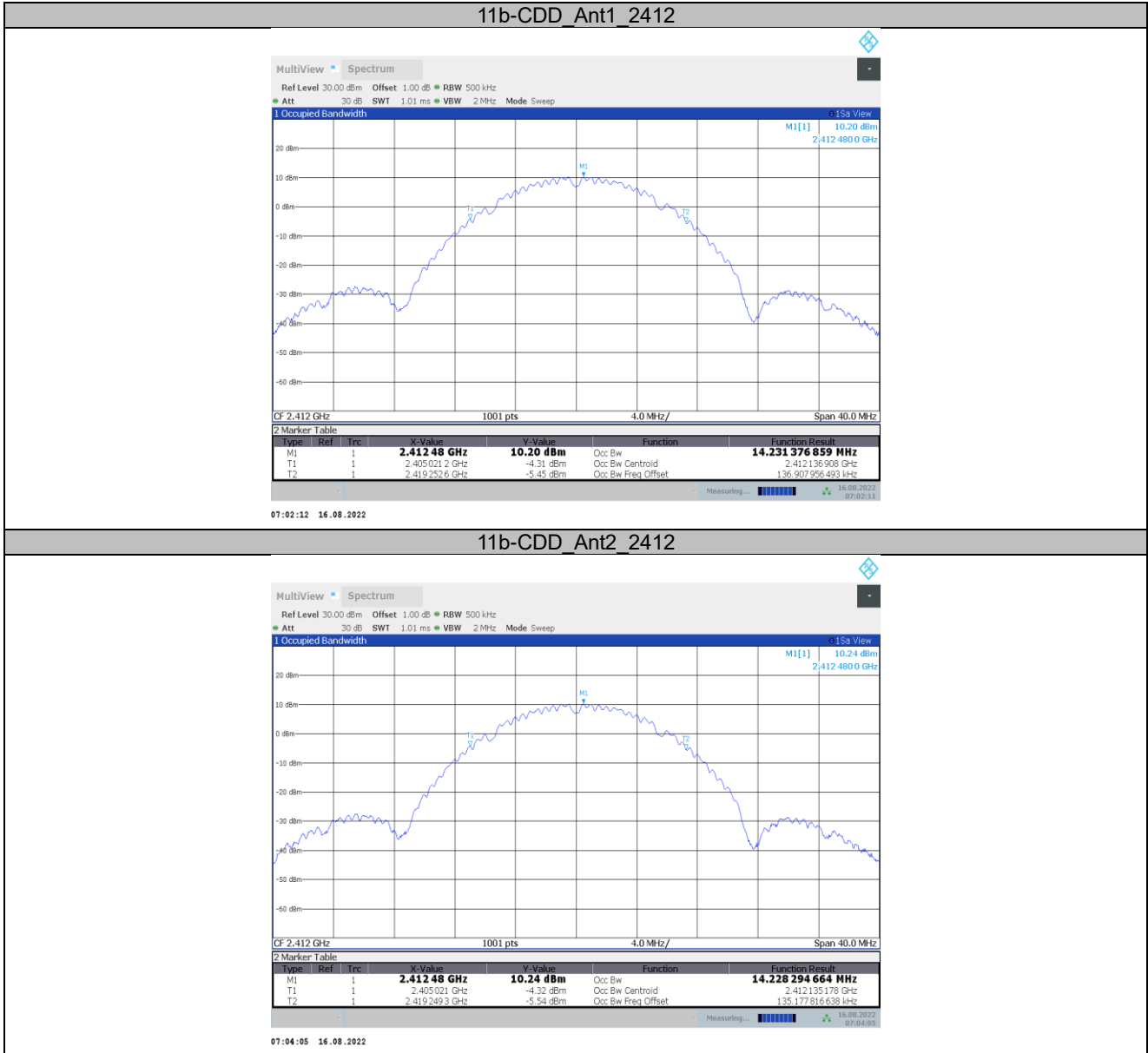
Occupied Channel Bandwidth Test Result

TestMode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
11b-CDD	Ant1	2412	14.231	2405.021	2419.253	Reporting only
	Ant2	2412	14.228	2405.021	2419.249	
	Ant1	2437	14.064	2429.801	2443.865	
	Ant2	2437	13.907	2430.008	2443.915	
	Ant1	2462	13.961	2454.907	2468.868	
	Ant2	2462	13.78	2454.910	2468.690	
11g-CDD	Ant1	2412	17.184	2403.488	2420.672	
	Ant2	2412	16.822	2403.637	2420.459	
	Ant1	2417	17.052	2408.556	2425.608	
	Ant2	2417	16.743	2408.630	2425.373	
	Ant1	2437	17.076	2428.316	2445.392	
	Ant2	2437	16.896	2428.500	2445.396	
	Ant1	2462	17.027	2453.365	2470.392	
	Ant2	2462	16.822	2453.461	2470.282	
11n20MIMO	Ant1	2412	18.354	2402.912	2421.266	
	Ant2	2412	18.083	2403.021	2421.104	
	Ant1	2417	18.002	2408.014	2426.016	
	Ant2	2417	18.16	2407.993	2426.153	
	Ant1	2437	18.144	2427.905	2446.048	
	Ant2	2437	18.115	2427.902	2446.018	
	Ant1	2462	18.05	2452.822	2470.872	
	Ant2	2462	18.046	2452.835	2470.881	
11n40MIMO	Ant1	2422	36.348	2403.876	2440.225	
	Ant2	2422	36.261	2403.874	2440.136	
	Ant1	2437	36.415	2418.759	2455.174	
	Ant2	2437	36.452	2418.718	2455.170	
	Ant1	2447	36.305	2428.762	2465.067	
	Ant2	2447	36.314	2428.748	2465.061	
	Ant1	2452	36.542	2433.591	2470.132	
	Ant2	2452	36.181	2433.807	2469.988	



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Test Graphs

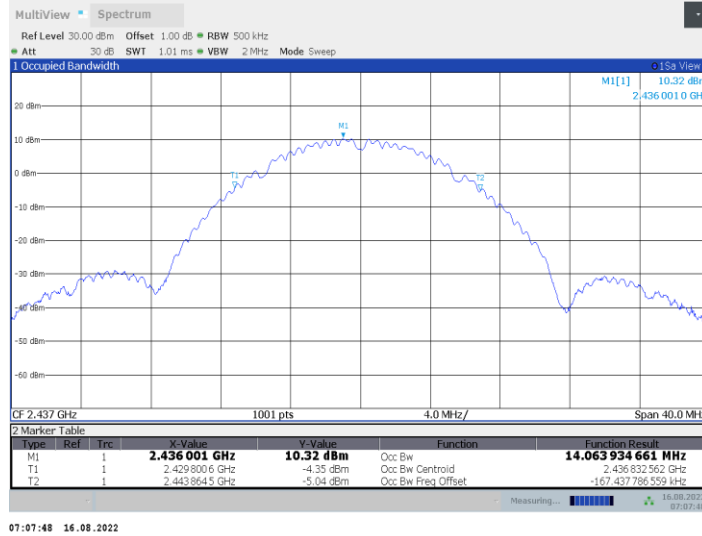


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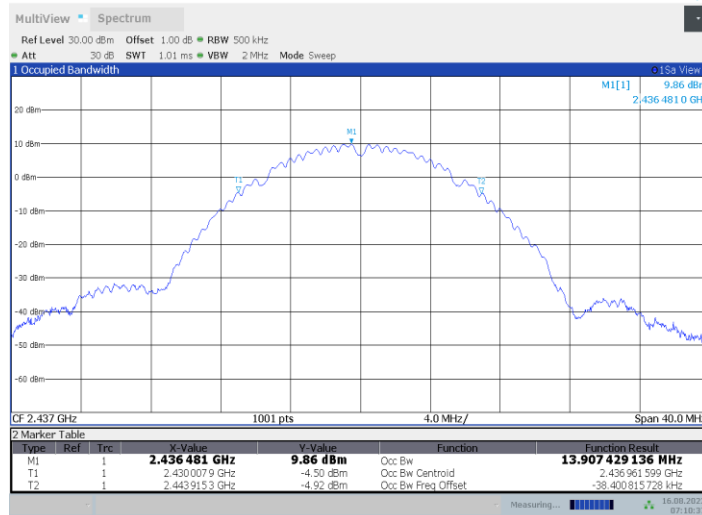
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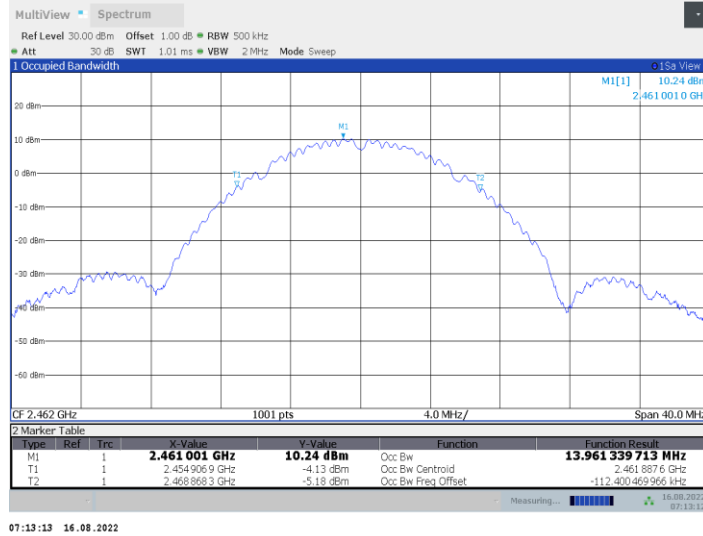
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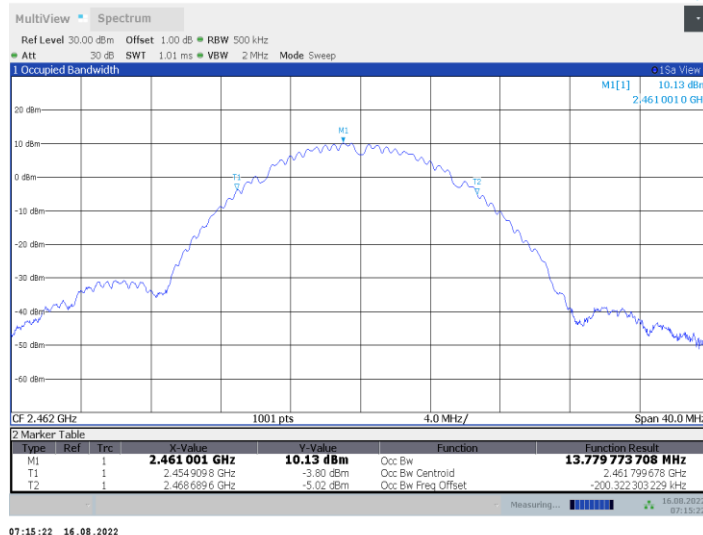
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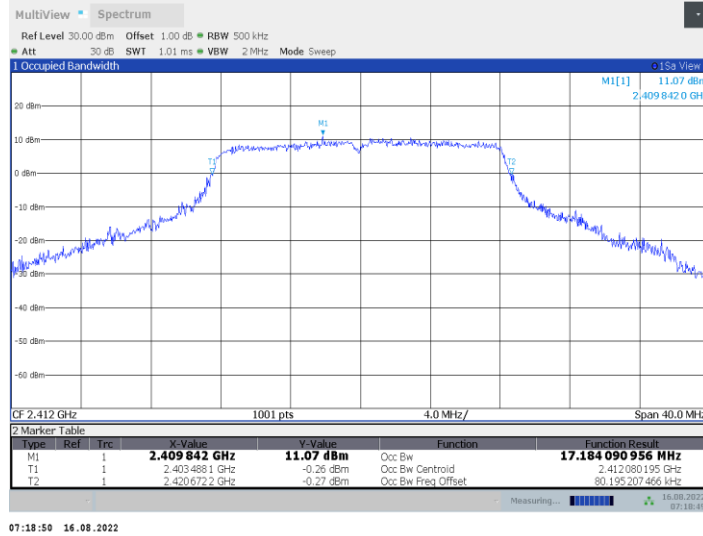
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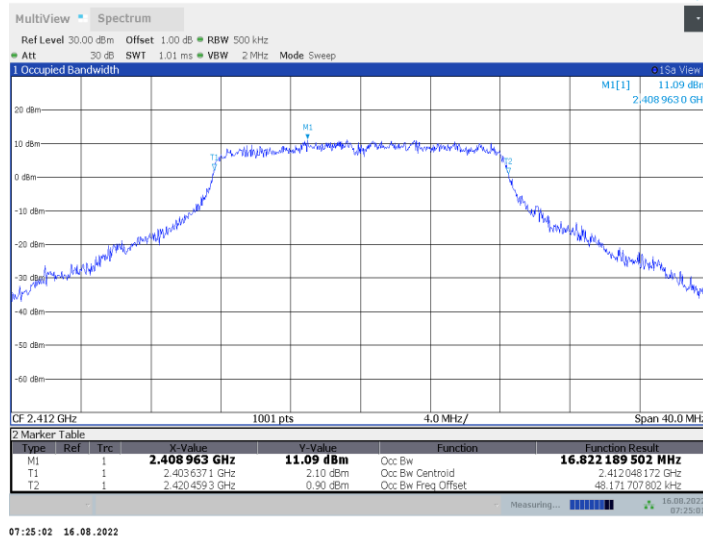
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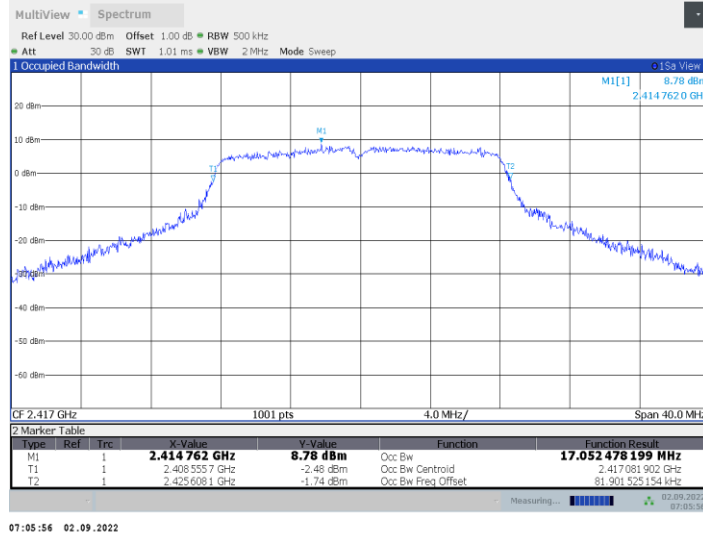


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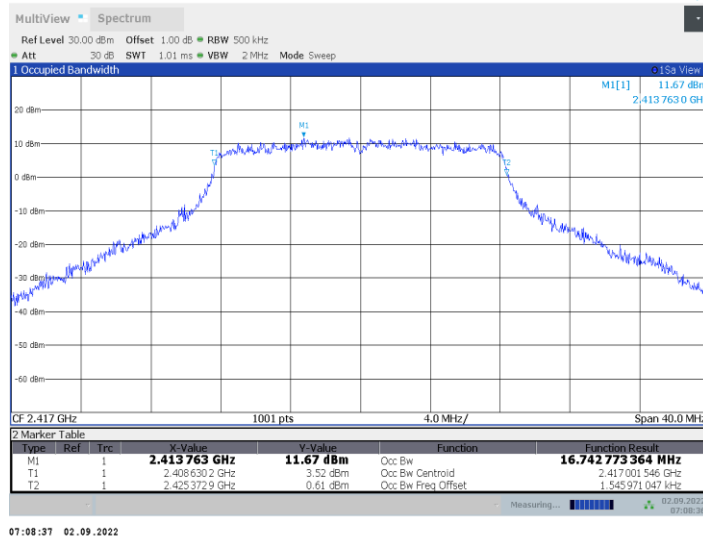
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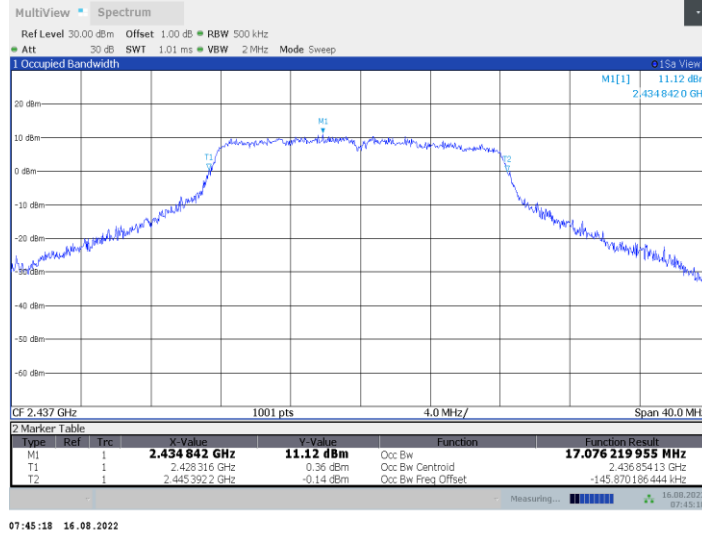


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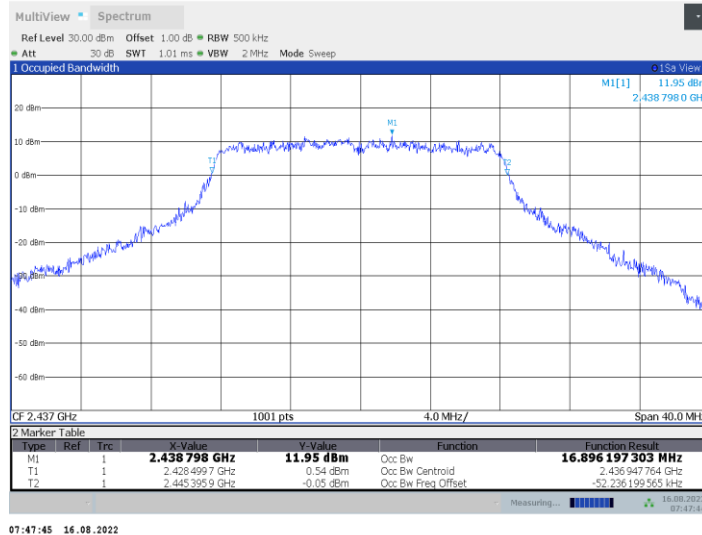
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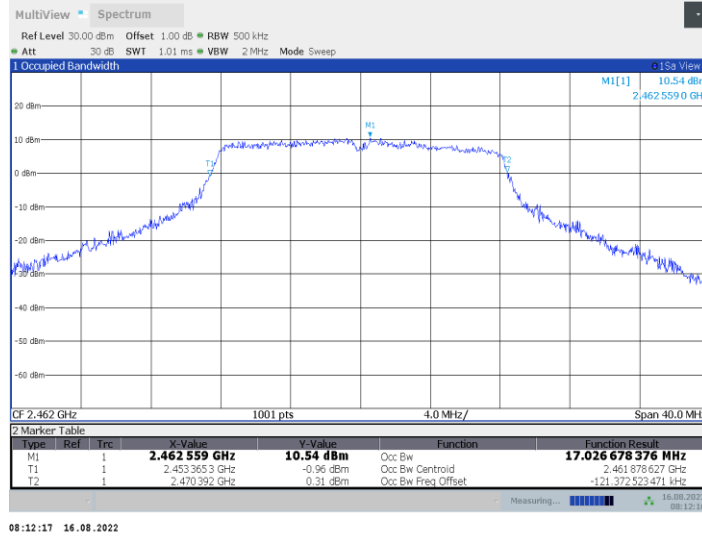
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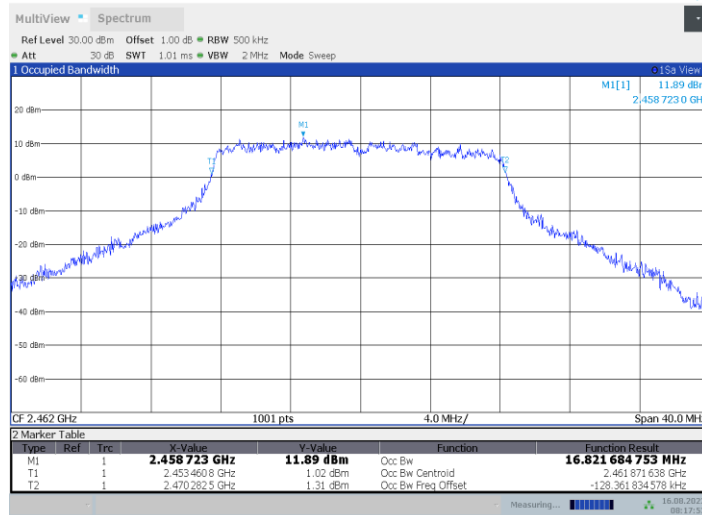
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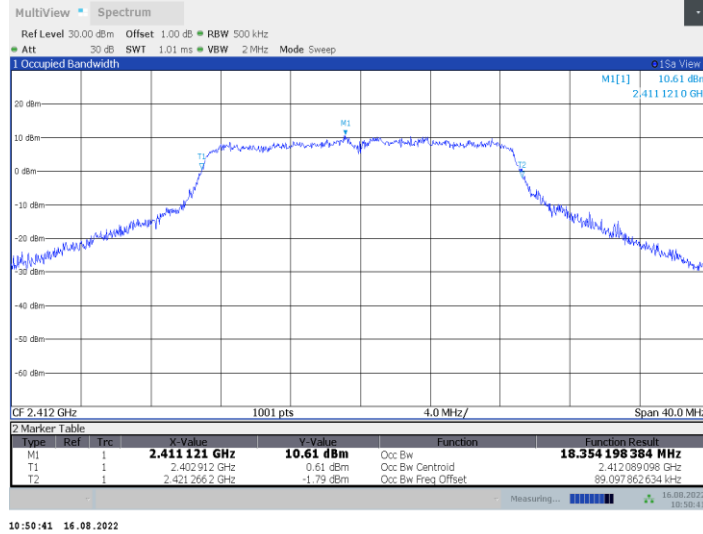
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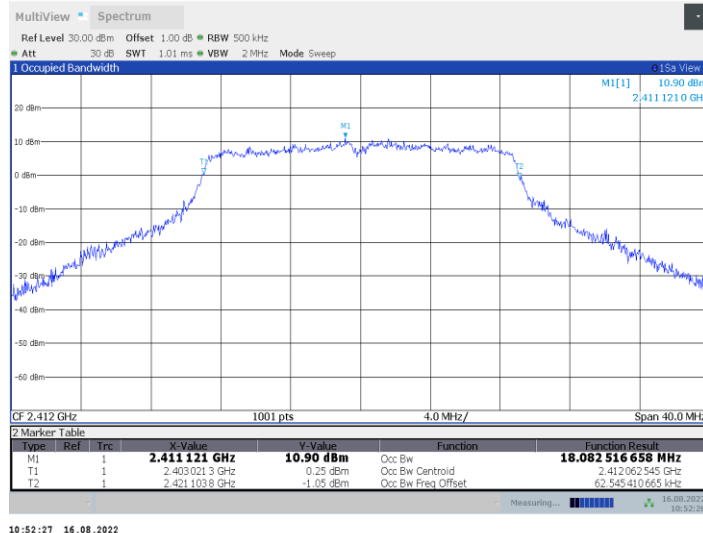
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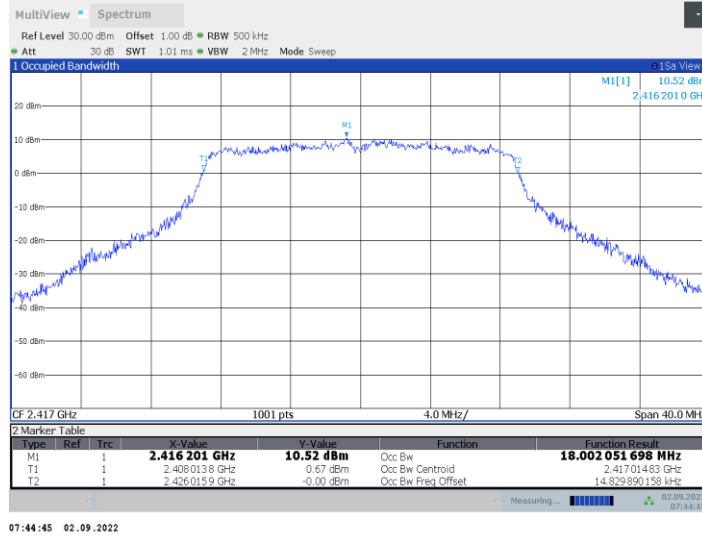
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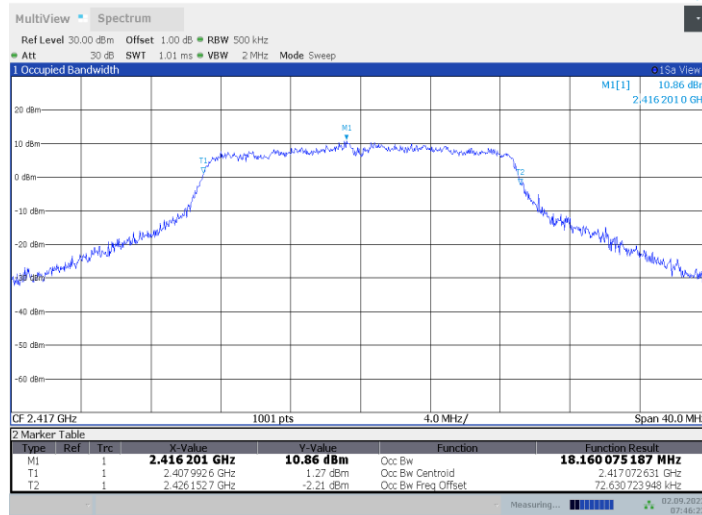
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07:46:23 02.09.2022



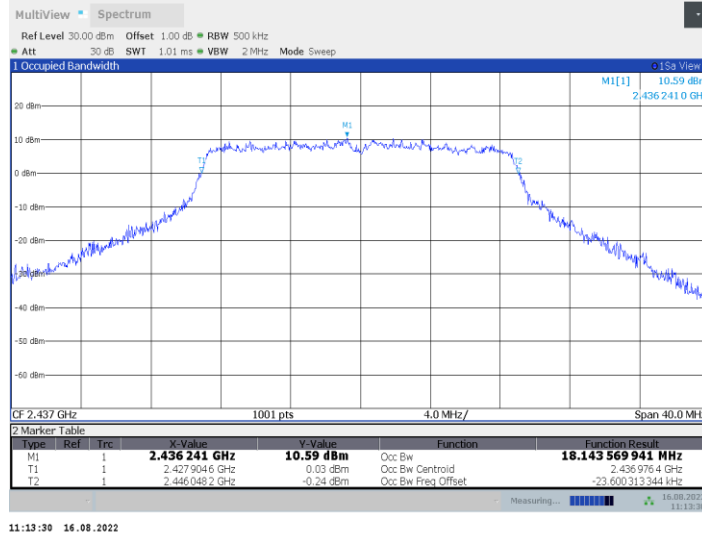
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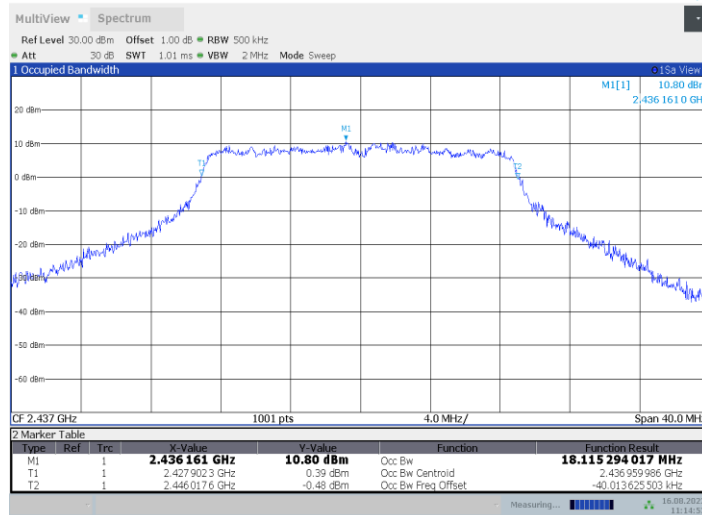
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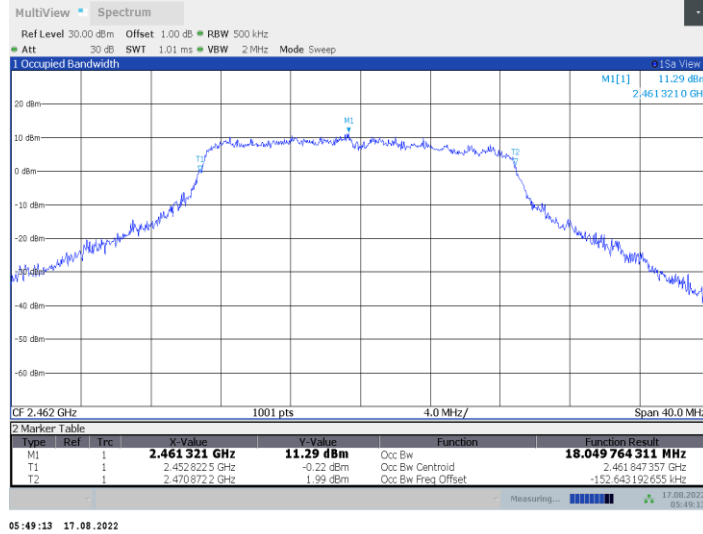
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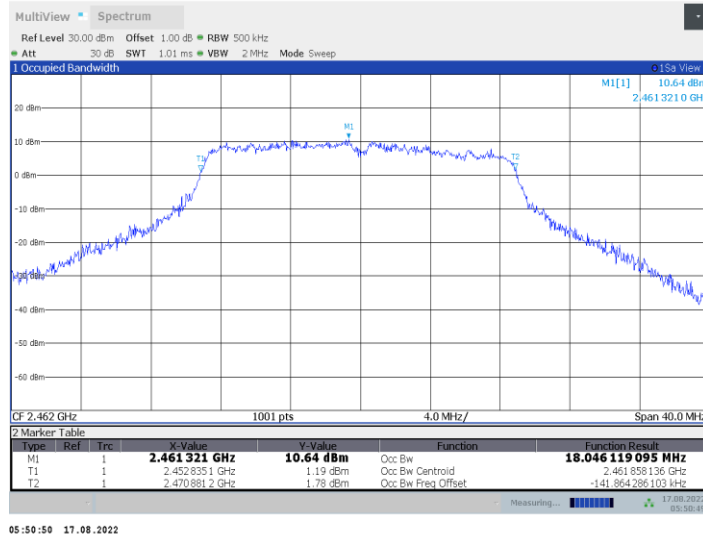
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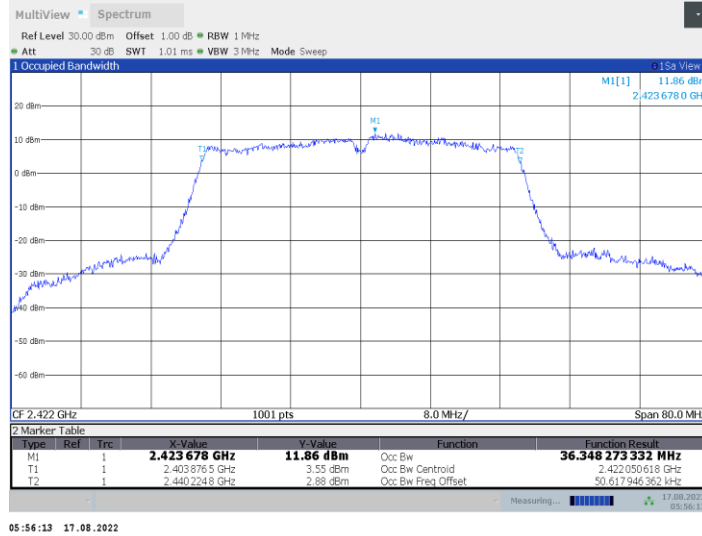


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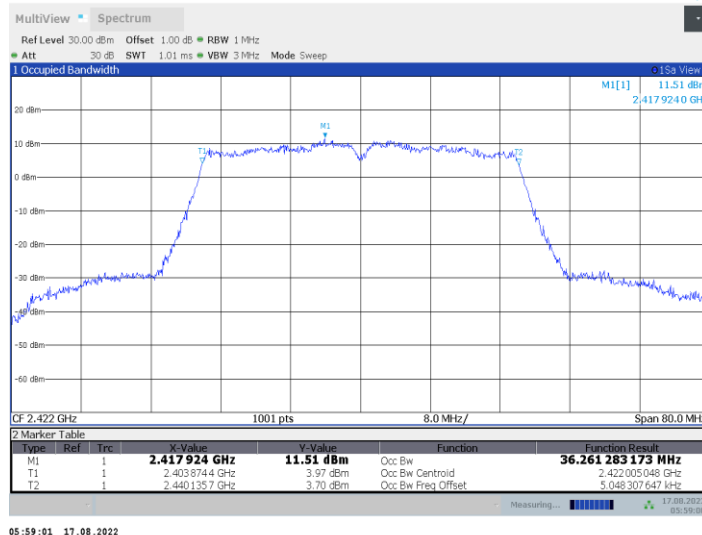
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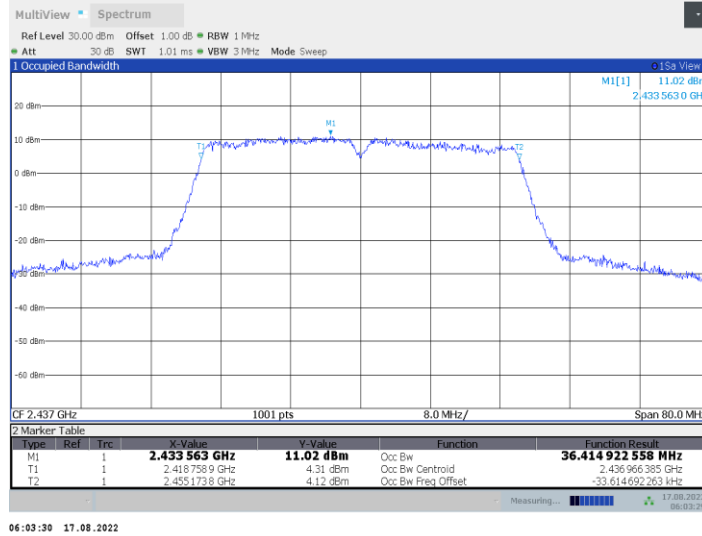
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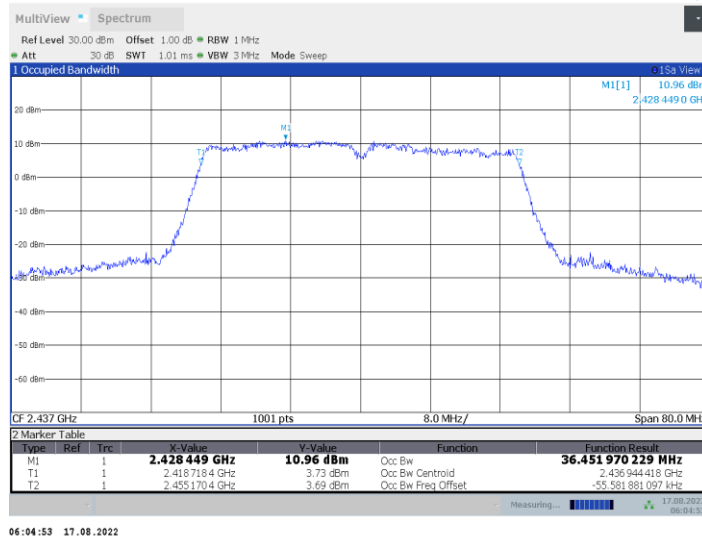
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11n40MIMO_Ant1_2437



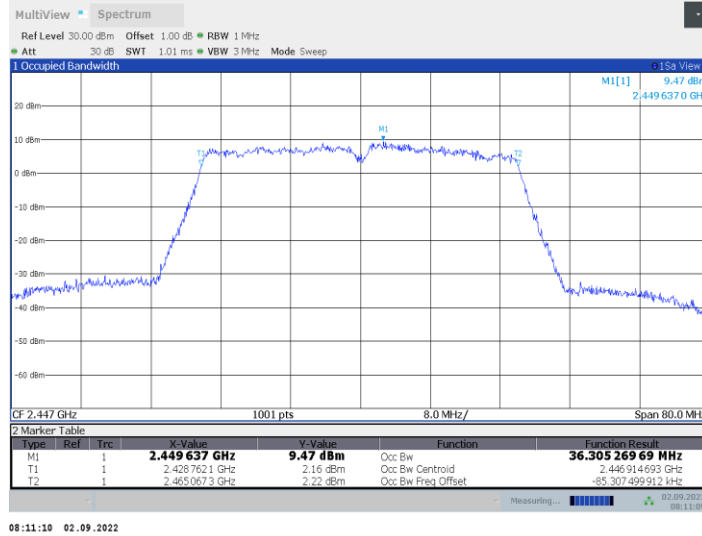
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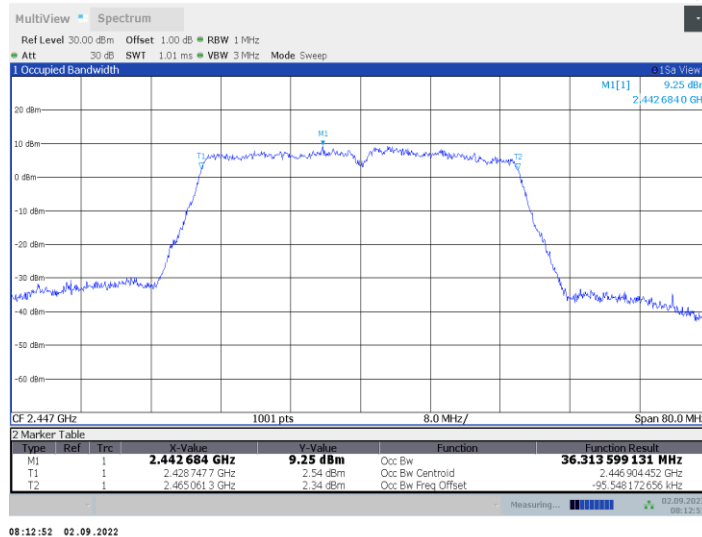
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11n40MIMO_Ant1_2447



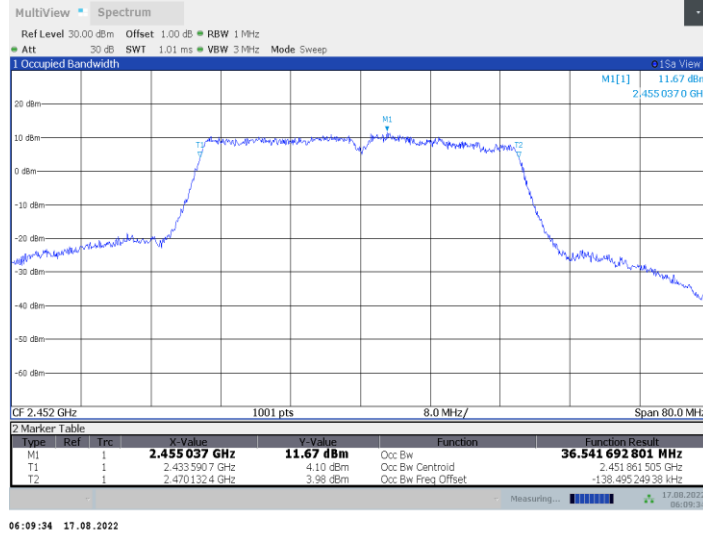
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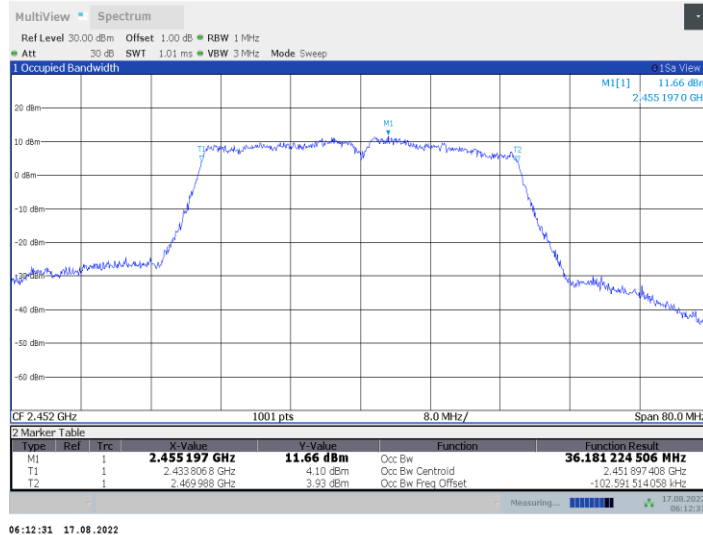
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11n40MIMO_Ant1_2452



11n40MIMO_Ant2_2452



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**Maximum conducted output power
Test Result Peak**

TestMode	Antenna	Frequency[MHz]	Peak Power[dBm]	Conducted Limit[dBm]	Verdict
11b-CDD	Ant1	2412	18.72	≤30.00	PASS
	Ant2	2412	18.75	≤30.00	PASS
	total	2412	21.75	≤30.00	PASS
	Ant1	2437	18.11	≤30.00	PASS
	Ant2	2437	18.38	≤30.00	PASS
	total	2437	21.26	≤30.00	PASS
	Ant1	2462	18.23	≤30.00	PASS
	Ant2	2462	18.11	≤30.00	PASS
	total	2462	21.18	≤30.00	PASS
11g-CDD	Ant1	2412	20.83	≤30.00	PASS
	Ant2	2412	20.65	≤30.00	PASS
	total	2412	23.75	≤30.00	PASS
	Ant1	2417	21.53	≤30.00	PASS
	Ant2	2417	21.25	≤30.00	PASS
	total	2417	24.40	≤30.00	PASS
	Ant1	2437	21.67	≤30.00	PASS
	Ant2	2437	21.36	≤30.00	PASS
	total	2437	24.53	≤30.00	PASS
	Ant1	2462	21.34	≤30.00	PASS
	Ant2	2462	21.02	≤30.00	PASS
	total	2462	24.19	≤30.00	PASS
11n20MIMO	Ant1	2412	20.21	≤30.00	PASS
	Ant2	2412	20.01	≤30.00	PASS
	total	2412	23.12	≤30.00	PASS
	Ant1	2417	21.21	≤30.00	PASS
	Ant2	2417	21.11	≤30.00	PASS
	total	2417	24.17	≤30.00	PASS
	Ant1	2437	21.32	≤30.00	PASS
	Ant2	2437	21.01	≤30.00	PASS
	total	2437	24.18	≤30.00	PASS
	Ant1	2462	21.23	≤30.00	PASS
	Ant2	2462	21.08	≤30.00	PASS
	total	2462	24.17	≤30.00	PASS
11n40MIMO	Ant1	2422	22.74	≤30.00	PASS
	Ant2	2422	22.01	≤30.00	PASS
	total	2422	25.40	≤30.00	PASS
	Ant1	2437	22.83	≤30.00	PASS
	Ant2	2437	22.43	≤30.00	PASS
	total	2437	25.64	≤30.00	PASS
	Ant1	2447	22.51	≤30.00	PASS
	Ant2	2447	22.22	≤30.00	PASS
	total	2447	25.38	≤30.00	PASS
	Ant1	2452	22.45	≤30.00	PASS
	Ant2	2452	22.34	≤30.00	PASS
	total	2452	25.41	≤30.00	PASS



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**Maximum power spectral density
Test Result**

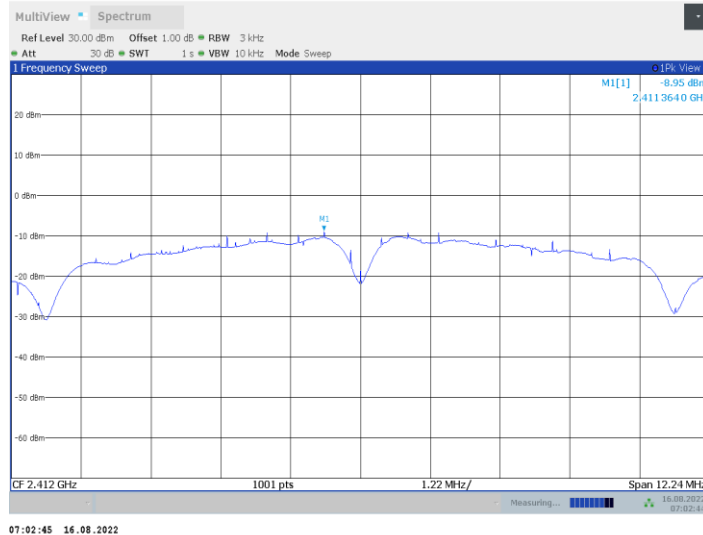
TestMode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11b-CDD	Ant1	2412	-8.95	≤8.00	PASS
	Ant2	2412	-8.63	≤8.00	PASS
	total	2412	-5.78	≤6.38	PASS
	Ant1	2437	-10.06	≤8.00	PASS
	Ant2	2437	-10.89	≤8.00	PASS
	total	2437	-7.44	≤6.38	PASS
	Ant1	2462	-10.22	≤8.00	PASS
	Ant2	2462	-10.24	≤8.00	PASS
	total	2462	-7.22	≤6.38	PASS
11g-CDD	Ant1	2412	-9.01	≤8.00	PASS
	Ant2	2412	-10.22	≤8.00	PASS
	total	2412	-6.56	≤6.38	PASS
	Ant1	2417	-11.73	≤8.00	PASS
	Ant2	2417	-9.9	≤8.00	PASS
	total	2417	-7.71	≤6.38	PASS
	Ant1	2437	-10.28	≤8.00	PASS
	Ant2	2437	-10.05	≤8.00	PASS
	total	2437	-7.15	≤6.38	PASS
	Ant1	2462	-9.2	≤8.00	PASS
	Ant2	2462	-8.81	≤8.00	PASS
	total	2462	-5.99	≤6.38	PASS
11n20MIMO	Ant1	2412	-9.24	≤8.00	PASS
	Ant2	2412	-10.49	≤8.00	PASS
	total	2412	-6.81	≤6.38	PASS
	Ant1	2417	-9.28	≤8.00	PASS
	Ant2	2417	-8.9	≤8.00	PASS
	total	2417	-6.08	≤6.38	PASS
	Ant1	2437	-10.47	≤8.00	PASS
	Ant2	2437	-9.65	≤8.00	PASS
	total	2437	-7.03	≤6.38	PASS
	Ant1	2462	-9.45	≤8.00	PASS
	Ant2	2462	-9.56	≤8.00	PASS
	total	2462	-6.49	≤6.38	PASS
11n40MIMO	Ant1	2422	-12.62	≤8.00	PASS
	Ant2	2422	-11.1	≤8.00	PASS
	total	2422	-8.78	≤6.38	PASS
	Ant1	2437	-12.55	≤8.00	PASS
	Ant2	2437	-12.35	≤8.00	PASS
	total	2437	-9.44	≤6.38	PASS
	Ant1	2447	-12.9	≤8.00	PASS
	Ant2	2447	-13.21	≤8.00	PASS
	total	2447	-10.04	≤6.38	PASS
	Ant1	2452	-12.52	≤8.00	PASS
	Ant2	2452	-13.21	≤8.00	PASS
	total	2452	-9.84	≤6.38	PASS



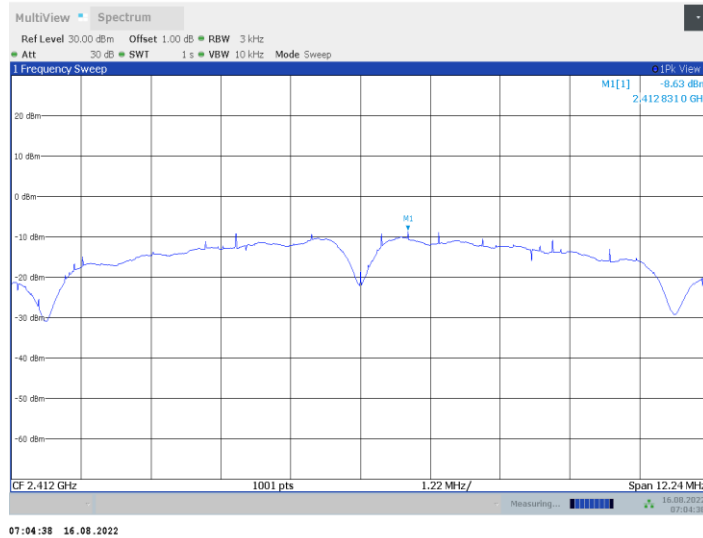
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Test Graphs

11b-CDD_Ant1_2412

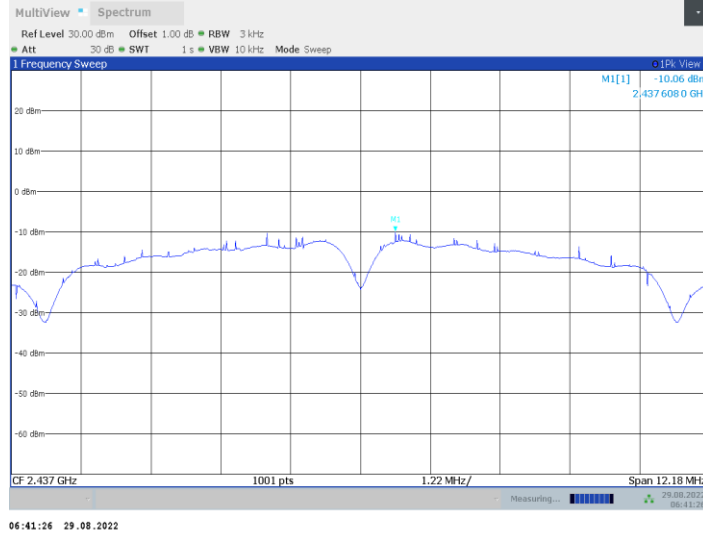


11b-CDD_Ant2_2412

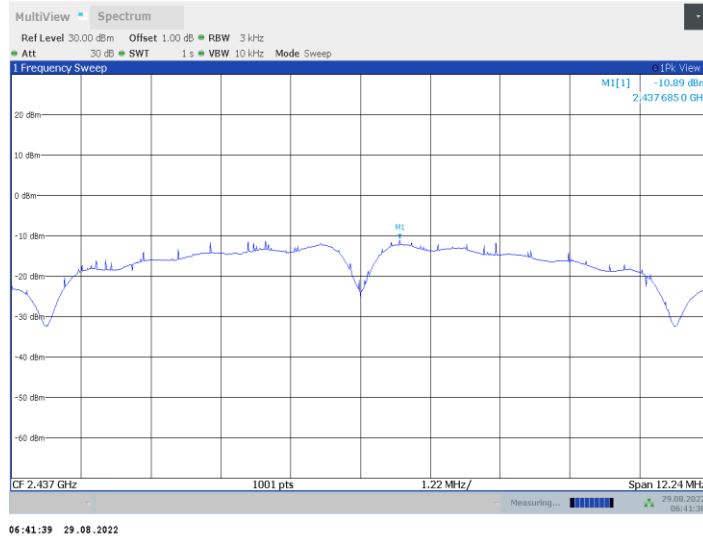


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11b-CDD Ant1_2437



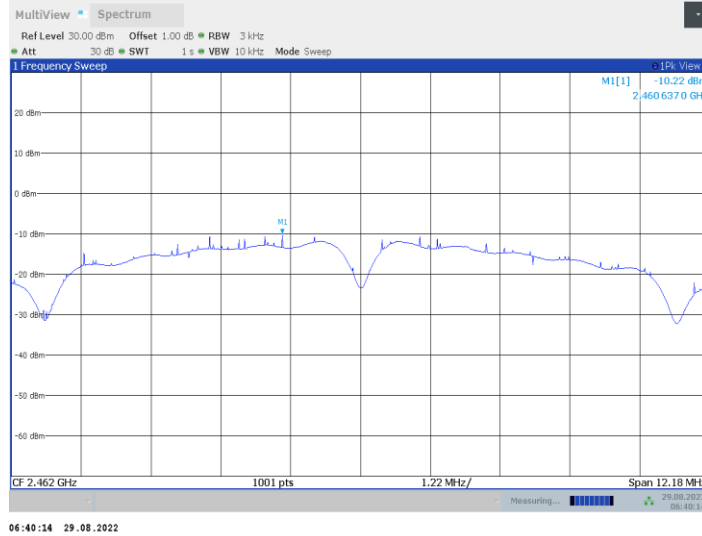
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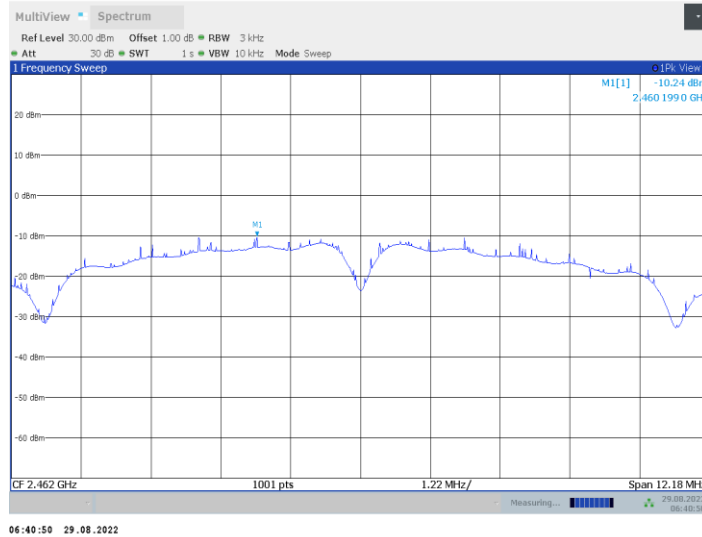
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11b-CDD Ant1_2462



11b-CDD Ant2_2462



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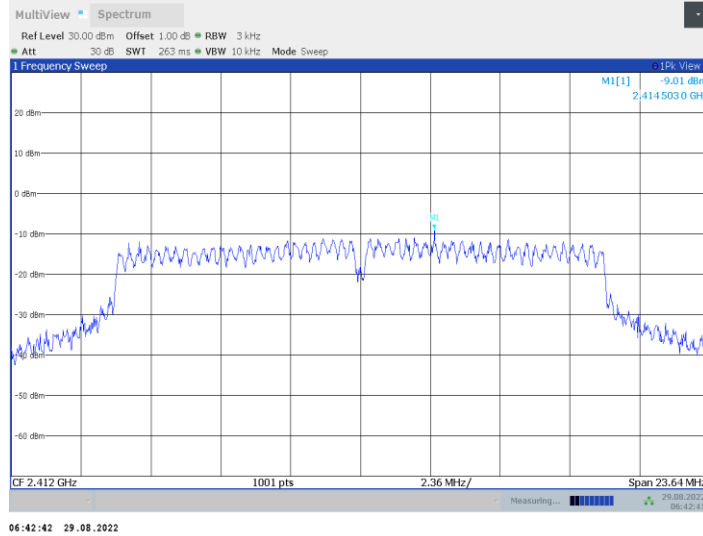
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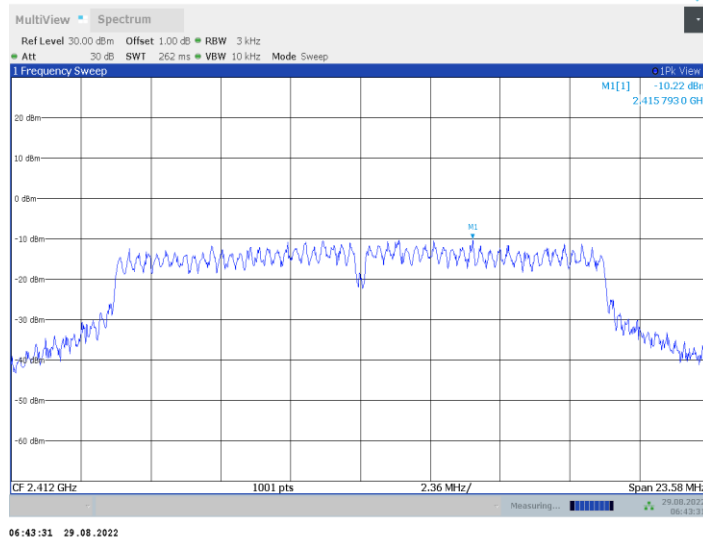
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11g-CDD Ant1_2412



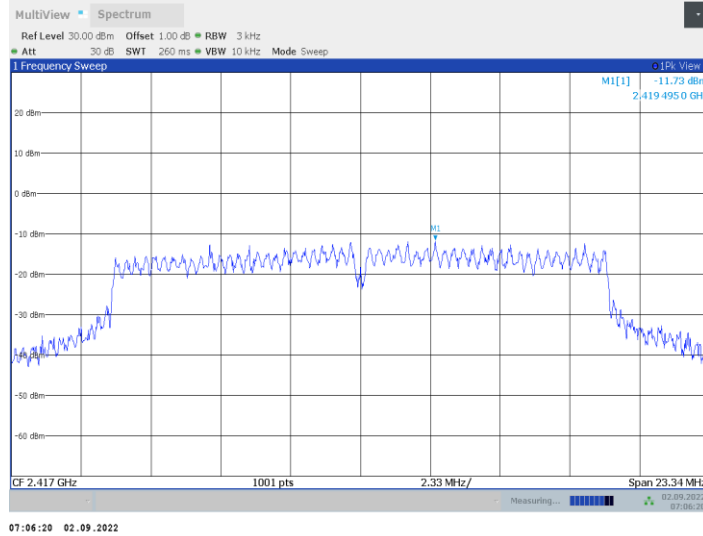
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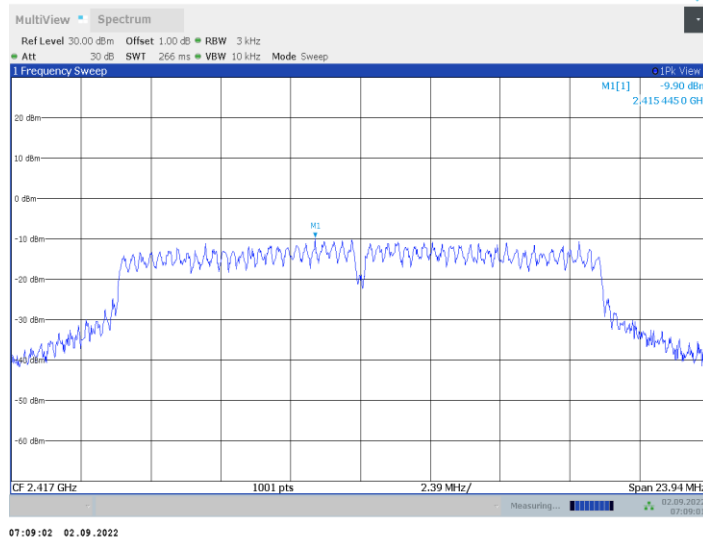
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11g-CDD Ant1_2417



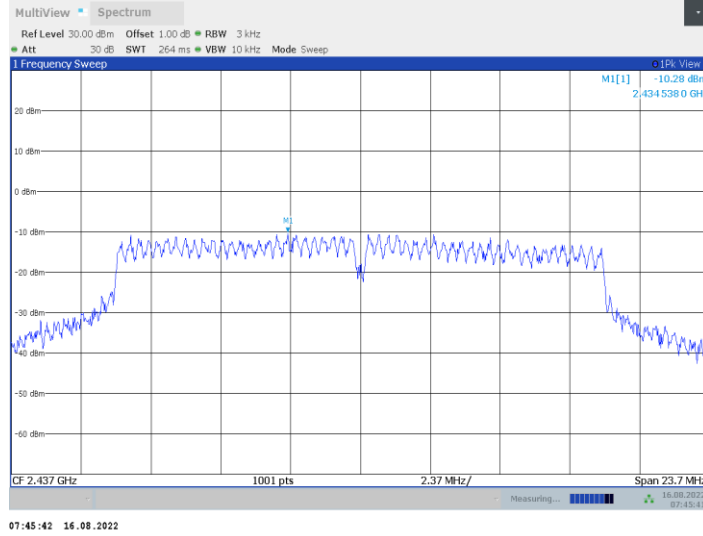
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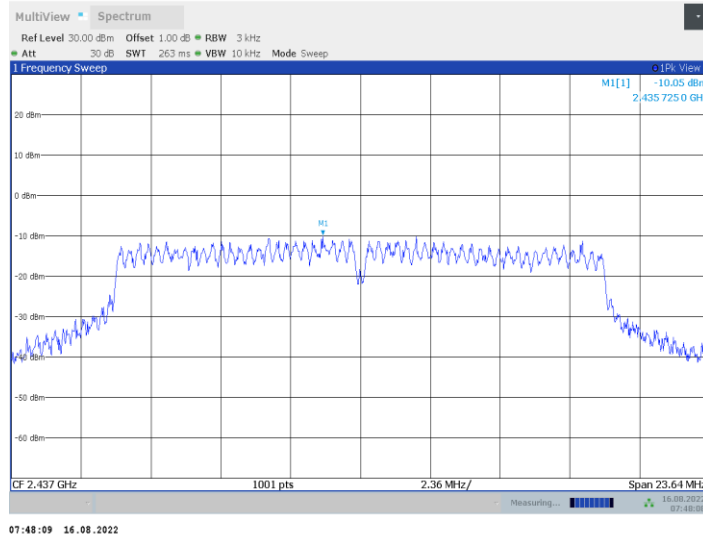
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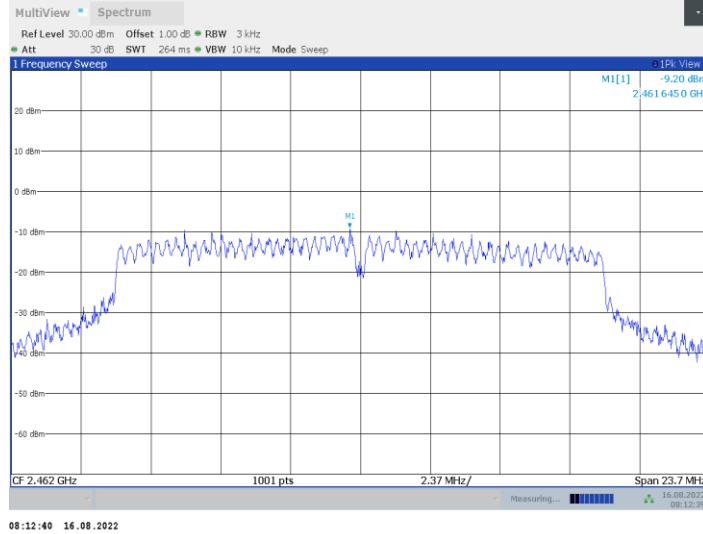
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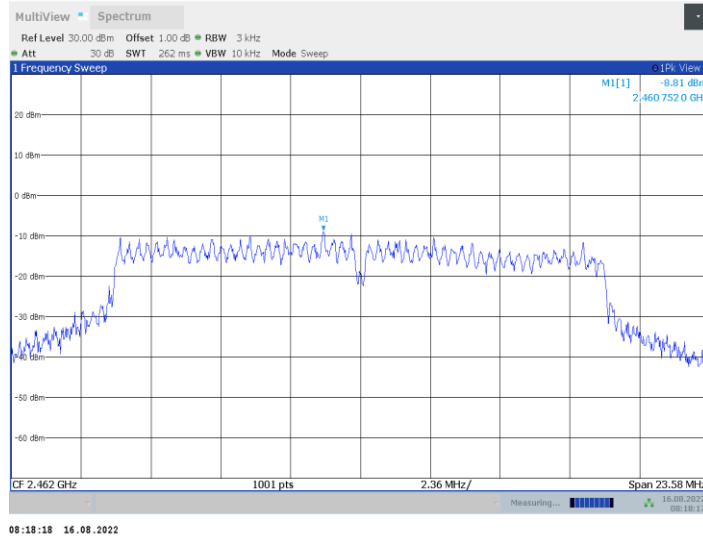
11g-CDD Ant2_2437



11g-CDD Ant1_2462

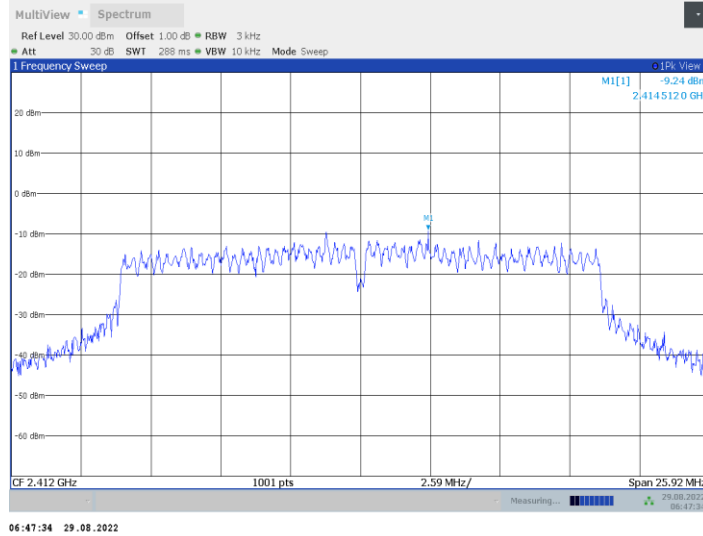


11g-CDD Ant2_2462

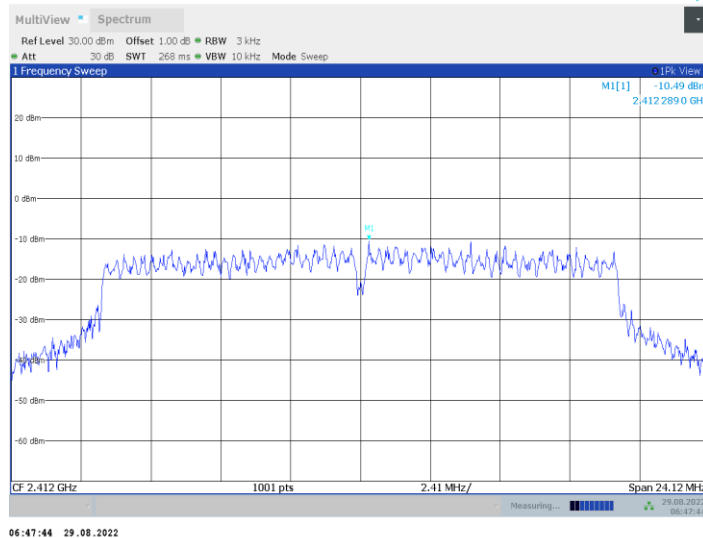


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11n20MIMO_Ant1_2412



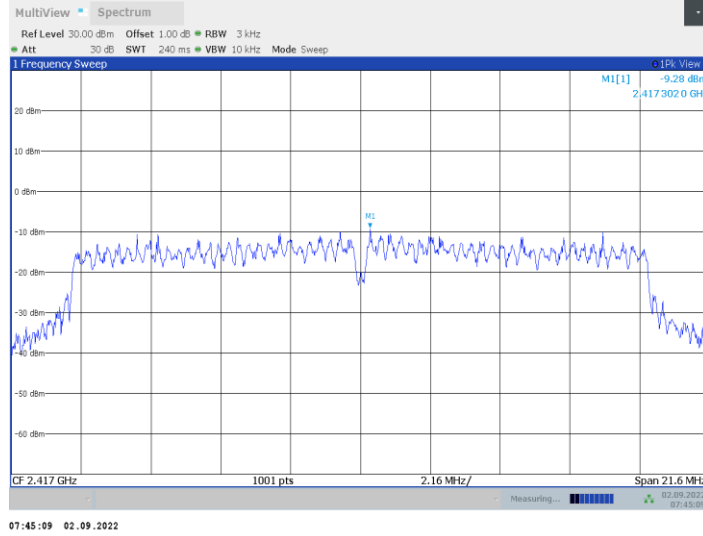
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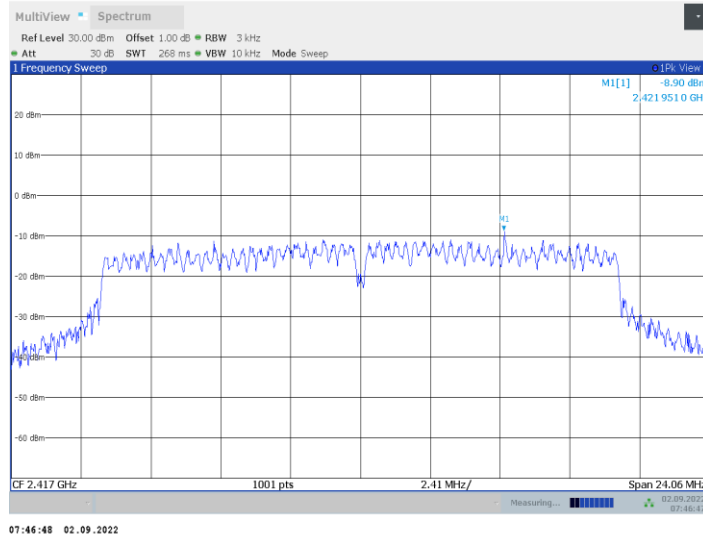
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11n20MIMO_Ant1_2417



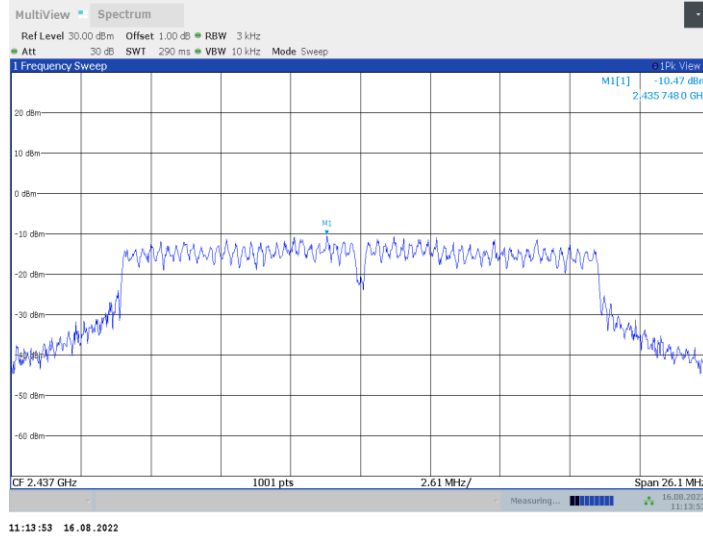
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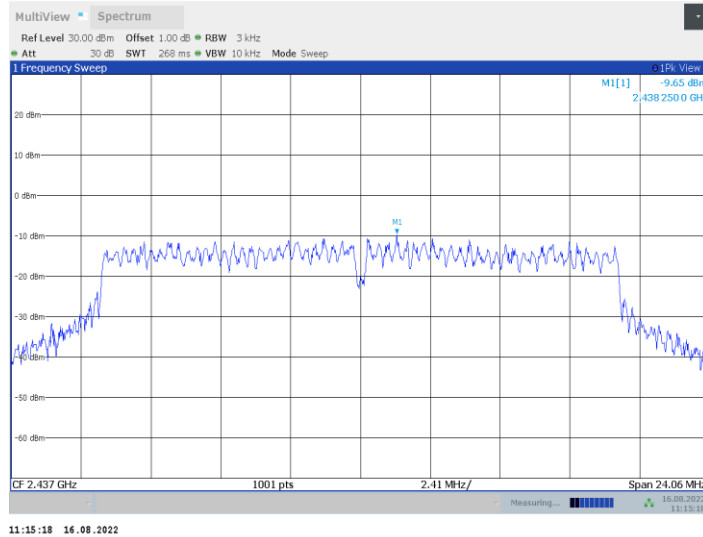
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