RF TEST REPORT

FCC ID: 2BLKE-SOM7981

Test Report No……..:	RF240311020-02-002
Product(s) Name……...:	Wi-Fi module
Model(s)……..:	SOM7981
Trade Mark……....:	N/A
Applicant……..…:	OpenEmbed M&C
Address……..…...:	408, Building 3, Minle Industrial Zone,Minle Community, Minzhi Street, Longhua District, Shenzhen, Guangdong, China.
Receipt Date……..:	2024.04.26
Test Date……....:	2024.05.13~2024.08.27
Issued Date……..…:	2024.09.03
Standards……..:	47 CFR FCC Part 15, Subpart E(Section 15.407); ANSI C63.10:2013
Testing Laboratory……:	Shenzhen Haiyun Standard Technical Co., Ltd.

Prepared By:	Checked By:	Approved By:	
Jason Huang	Tim Zhang	Misue Su	Shenzhen Haiyun Standard Technical Co., Ltd. HAIYUN Report Seal
Jason huang	Tim.zhang	Misue Su	

Table of Contents

History of this test report.....4

1. General Information 5

1.1 Applicant.....5
1.2 Manufacturer 5
1.3 Factory.....5
1.4 Basic Description of Equipment Under Test.....5
1.5 Transmit Operating Mode.....6

2. Summary of Test Results 7

2.1 Summary of Test Items 7
2.2 Application of Standard 7
2.3 Test Instruments.....8
2.4 Operation Mode.....10
2.5 Test Condition 10
2.6 Duty Cycle of Test Signal 11
2.7 Measurement Uncertainty 29
2.8 Test Location.....29
2.9 SUPPORT UNITS 29

3. Test Procedure And Results 30

3.1 AC Power Line Conducted Emission.....30
3.1.1 Limit 30
3.1.2 Test Procedure 30
3.1.3 Test Setup.....30
3.1.4 Test Result.....31
3.2 Radiated Emission.....33
3.2.1 Limit 33
3.2.2 Test Procedure 34
3.2.3 Test Setup.....35
3.2.4 Test Result.....36
3.3 Spectrum Bandwidth 208
3.3.1 Limit 208

3.3.2 Test Procedure 208
3.3.3 Test Setup....209
3.3.4 Test Result....210
3.4 Conducted Output Power 525
3.4.1 Limit 525
3.4.2 Test Procedure 525
3.4.3 Test Setup....525
3.4.4 Table of Parameters of Text Software Setting 526
3.4.5 The Result....528
3.5 Power Spectral Density 542
3.5.1 Limit 542
3.5.2 Test Procedure 542
3.5.3 Test Setup....543
3.5.4 The Result....544

History of this test report

Original Report Issue Date: 2024.09.03

● No additional attachment

○ Additional attachments were issued following record

Attachment No.	Issue Date	Description

1. General Information

1.1 Applicant

OpenEmbed M&C

408, Building 3, Minle Industrial Zone,Minle Community, Minzhi Street, Longhua District, Shenzhen, Guangdong, China.

1.2 Manufacturer

OpenEmbed M&C

408, Building 3, Minle Industrial Zone,Minle Community, Minzhi Street, Longhua District, Shenzhen, Guangdong, China.

1.3 Factory

Dongguan Yue Shun electronic technology Co., LTD

No. 19 Junpeng Road, Shitanpu Community, Tangxia Town, Dongguan City

1.4 Basic Description of Equipment Under Test

Product No.	POC240311020-S001	
Equipment Name	Wi-Fi module	
Model Name	SOM7981	
Trade Mark	N/A	
Power Supply	DC 12V from adapter	
Operating Temperature	-20℃-60℃	
EUT Stage	○ Product Unit	●Final-Sample
Operating Band & Max Conducted Output Power	5150MHz ~5250MHz	802.11n40: 21.12dBm(0.129W)
	5250MHz ~5350MHz	802.11n20: 19.97dBm(0.097W)
	5470MHz ~5725MHz	802.11a: 20.20dBm(0.110W)
	5725MHz ~5850MHz	802.11n40: 21.81dBm(0.152W)
Product Type	IEEE 802.11a: WLAN (SISO) IEEE 802.11a/n/ac/ax: WLAN (MIMO)	
Nominal Bandwidth	20MHz / 40MHz / 80MHz / 160MHz	
Modulation	IEEE 802.11a/n/ac: OFDM IEEE 802.11ax: OFDMA	
Antenna gain	Ant1: 5.16 dBi, Ant2: 5.16 dBi, Ant3: 5.16 dBi	
Antenna type	External antenna	
Data Rate (Mbps)	IEEE 11a mode : 6/9/12/18/24/36/48/54 IEEE 11n mode : up to 450 IEEE 11ac mode : up to 1560 IEEE 11ax mode : up to 3603	

Channel Information			
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
5150-5250	802.11a /n /ac /ax (20MHz)	5180-5240	36-48
5250-5350		5260-5320	52-64
5470-5725		5500-5700	100-140
5725-5850		5745-5825	149-165
5150-5250	802.11n /ac /ax (40MHz)	5190-5230	38-46
5250-5350		5270-5310	54-62
5470-5725		5510-5670	102-134
5725-5850		5755-5795	151-159
5150-5250	802.11ac /ax (80MHz)	5210	42
5250-5350		5290	58
5470-5725		5530-5610	106-122
5725-5850		5775	155
5150-5350	802.11 ac /ax (160MHz)	5250	50
5470-5725		5570	114

Note: For 802.11ax mode only support full RU mode.

1.5 Transmit Operating Mode

Transmit Operating Mode							Transmit Multiple Antennas					
●	Operating mode 1 (single antenna)						●	1TX				
●	Operating mode 2 (multiple antenna, no beam forming)						○	2TX	●	3TX	○	4TX
○	Operating mode 3 (multiple antenna, with beam forming)						○	2TX	○	3TX	○	4TX
●	802.11a	Operating mode	●	1TX	○	2TX	○	3TX	○	4TX		
●	802.11n(20MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11n(40MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ac(20MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ac(40MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ac(80MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ac(160MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ax(20MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ax(40MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ax(80MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		
●	802.11ax(160MHz)	Operating mode	○	1TX	○	2TX	●	3TX	○	4TX		

2. Summary of Test Results

2.1 Summary of Test Items

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Test item	Standard	Results	Remarks
AC Power Conducted Emission	15.207 15.407(b)	Pass	Meet the requirement of the limit
Radiated Emission	15.205(a) 15.209(a) 15.407(b)	Pass	Meet the requirement of the limit
Antenna Requirements	15.203	Compliance	Note
Spectrum Bandwidth	15.407(a) 15.407(e)	Pass	Meet the requirement of the limit
Conducted Output Power	15.407(a)	Pass	Meet the requirement of the limit
Power Spectral Density	15.407(a)	Pass	Meet the requirement of the limit
Dynamic Frequency Selection (DFS)	15.407(h)	Pass	See the report RF240311020-02-003 for details
Note: The EUT has three detachable attached external antenna units.			

2.2 Application of Standard

47 CFR FCC Part 15, Subpart E

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

ANSI C63.10:2013

2.3 Test Instruments

Radiated Emissions							
No.	Equipment	Manufacturer	Type No.	Serial No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal. Due date (yyyy/mm/dd)
1	Test receiver	Rohde&Schwarz	ESU	100184	JLE011	2024/4/24	2025/4/23
2	Log periodic antenna	Schwarzbeck	VULB 9168	1151	JLE012	2024/4/20	2025/4/19
3	Low frequency amplifier	/	LNA 0920N	2014	JLE023	2024/4/24	2025/4/23
4	High frequency amplifier	Schwarzbeck	BBV 9718	284	JLE024	2024/4/24	2025/4/23
5	Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1273	JLE028	2024/4/20	2025/4/19
6	Temp&Humidity Recorder	Meideshi	JR900	/	JLE021	2024/4/24	2025/4/23
7	Horn Antenna	SCHWARZBECK	BBHA 9170	9170#685	JLE029	2024/7/15	2025/7/14
8	Loop Antenna	SCHWARZBECK	FMZB1519B	00029	JLE030	2024/7/15	2025/7/14
9	Broadband preamplifier	Schwarzbeck	BBV9721	9721-019	JLE025	2024/4/24	2025/4/23
10	Test software	Farad Technology Co., Ltd	EZ-EMC Ver.TW-03A2				
Conducted Emission							
1	LISN	Rohde&Schwarz	ENV216	100075	JLE002	2024/4/24	2025/4/23
2	ISN	Schwarzbeck	CATE 5 8158	#171	JLE003	2024/4/24	2025/4/23
3	Test receiver	Rohde&Schwarz	ESCI	100718	JLE010	2024/4/24	2025/4/23
4	Pulse limiter	Rohde&Schwarz	ESH3-Z2	102299	JLE047	2024/4/24	2025/4/23
5	Temp&Humidity Recorder	Meideshi	JR900	/	JLE020	2024/4/24	2025/4/23
6	Test software	Farad Technology Co., Ltd	EZ-EMC Ver.TW-03A2				

RF Conducted Emission							
1	MXA Signal Analyzer	Keysight	N9021B	MY60080169	JLE050	2024/4/20	2025/4/19
2	RF Control Unit	dsusoft	JS0806-2	21G8060449	JLE053	2024/4/20	2025/4/19
3	power supply unit	dsusoft	JS0806-4ADC	N/A	JLE055	2024/4/20	2025/4/19
4	VXG Signal Generator	Keysight	M9384B	MY61270787	JLE051	2024/4/20	2025/4/19
5	EXG Analog Signal Generator	Keysight	N5173B	MY59101282	JLE052	2024/4/20	2025/4/19
6	Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	1201.0002K50-116064-Dt	JLE054	2024/4/20	2025/4/19
7	Test software	dsusoft	JS1120-3 Ver.3.2.22.0				

2.4 Operation Mode

The EUT was supplied by and it was run in TX mode that was controlled by Master provided RF testing program. The worst case test result was showed in the report.

2.5 Test Condition

Test Item	Environmental conditions	Input Power	Tested by
AC Power Conducted Emission	25°C, 53% RH	AC 120V/60Hz	Freedom Zhuo
Radiated Emission	24°C, 51% RH	AC 120V/60Hz	Freedom Zhuo
Spectrum Bandwidth	24.4°C, 53% RH	DC 12V	Albert Fan
Conducted Power	24.4°C, 53% RH	DC 12V	Albert Fan
Power Spectral Density	24.4°C, 53% RH	DC 12V	Albert Fan

Note: Adapter supply voltage AC 120V/60Hz.

The applicant declare the operating environment of EUT as below:

Normal conditions: 12V DC,-20~60°C

2.6 Duty Cycle of Test Signal

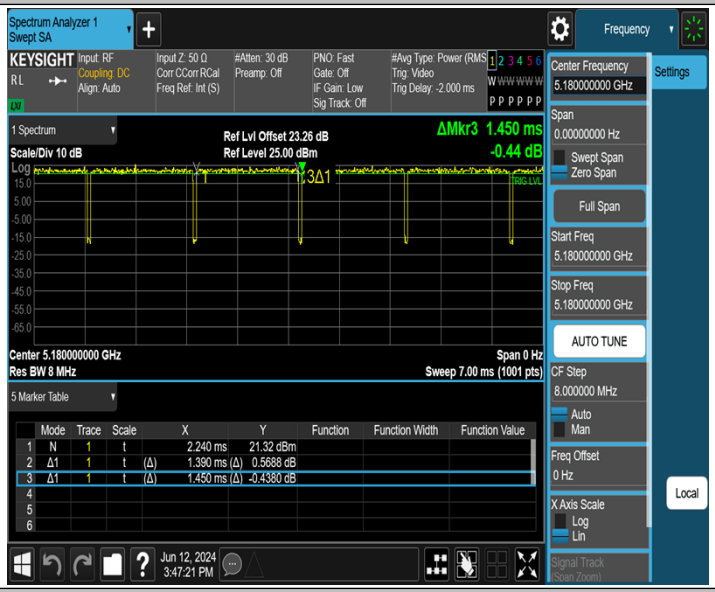
If duty cycle is ≥ 98 %, duty factor is not required.

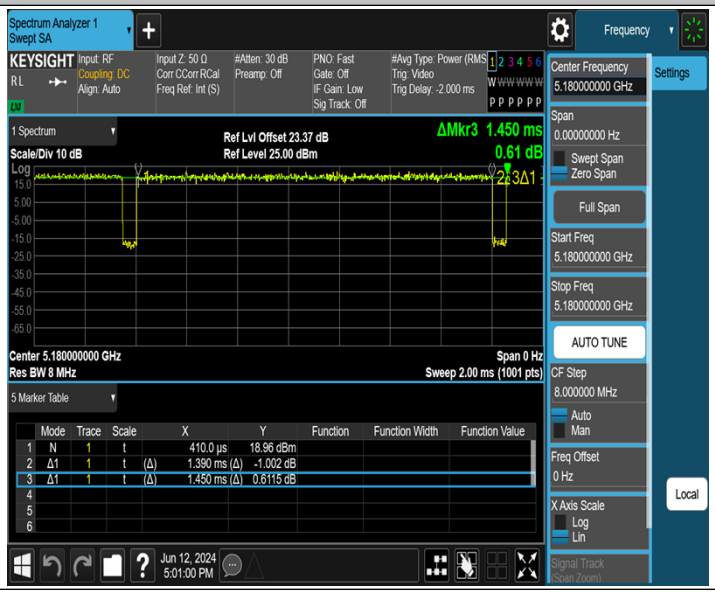
If duty cycle is < 98 %, duty factor shall be considered.

All the duty factor of other test mode have been considered.

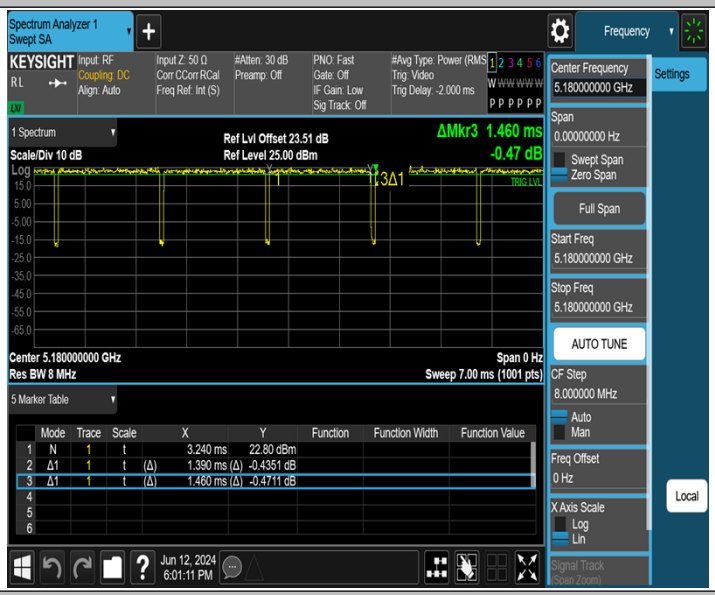
Test Mode	Freq(MHz)	Antenna	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	5180	Ant1	1.39	1.45	95.86
		Ant2	1.39	1.45	95.86
		Ant3	1.39	1.46	95.21
11N20 MIMO	5180	Ant1	1.31	1.37	95.62
		Ant2	1.31	1.37	95.62
		Ant3	1.31	1.36	96.32
11N40 MIMO	5190	Ant1	0.65	0.71	91.55
		Ant2	0.65	0.70	92.86
		Ant3	0.65	0.71	91.55
11AC20 MIMO	5180	Ant1	0.48	0.54	88.89
		Ant2	0.48	0.54	88.89
		Ant3	0.48	0.54	88.89
11AC40 MIMO	5190	Ant1	0.26	0.31	83.87
		Ant2	0.26	0.32	81.25
		Ant3	0.26	0.31	83.87
11AC80 MIMO	5210	Ant1	0.15	0.20	75.00
		Ant2	0.14	0.20	70.00
		Ant3	0.15	0.20	75.00
11AC160 MIMO	5250	Ant1	0.18	0.24	75.00
		Ant2	0.19	0.25	76.00
		Ant3	0.18	0.24	75.00
11AX20 MIMO	5180	Ant1	0.43	0.49	87.76
		Ant2	0.43	0.49	87.76
		Ant3	0.42	0.48	87.50
11AX40 MIMO	5190	Ant1	0.27	0.33	81.82
		Ant2	0.27	0.33	81.82
		Ant3	0.27	0.33	81.82
11AX80 MIMO	5210	Ant1	0.41	0.47	87.23
		Ant2	0.41	0.47	87.23
		Ant3	0.41	0.47	87.23
11AX160 MIMO	5250	Ant1	0.18	0.24	75.00
		Ant2	0.18	0.24	75.00
		Ant3	0.18	0.24	75.00

Test Graphs

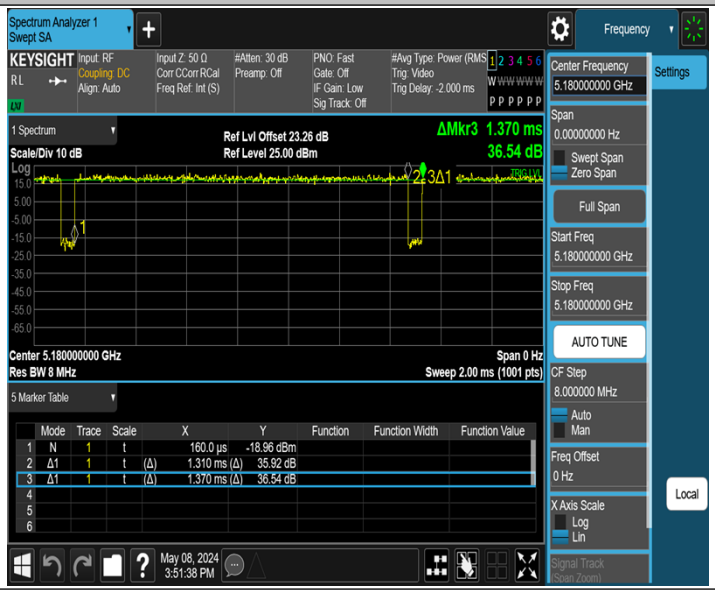
11A_Ant1_5180


11A_Ant2_5180


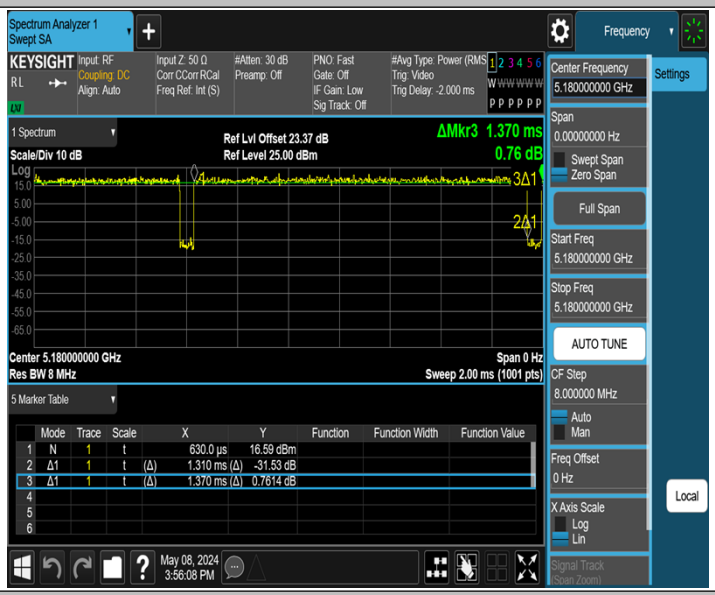
11A_Ant3_5180



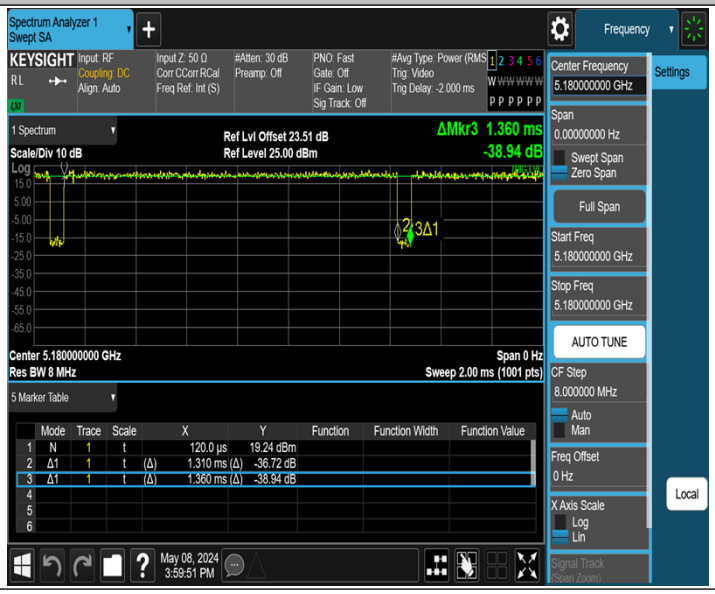
11N20MIMO_Ant1_5180

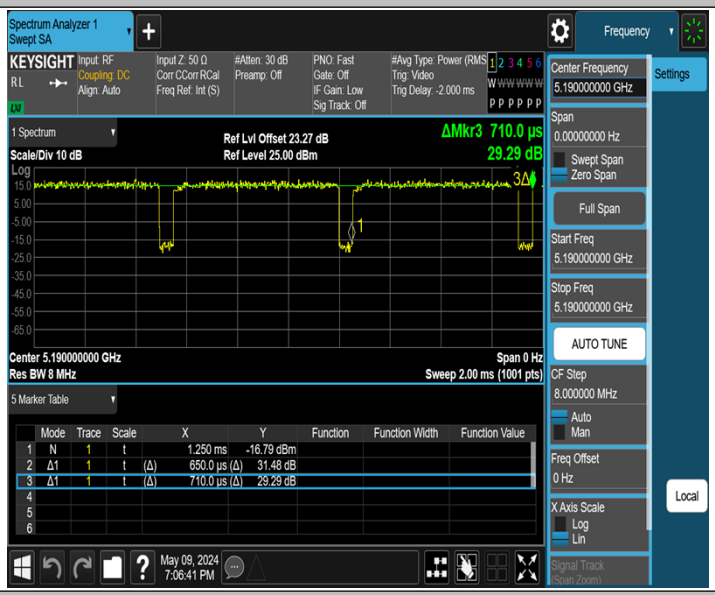


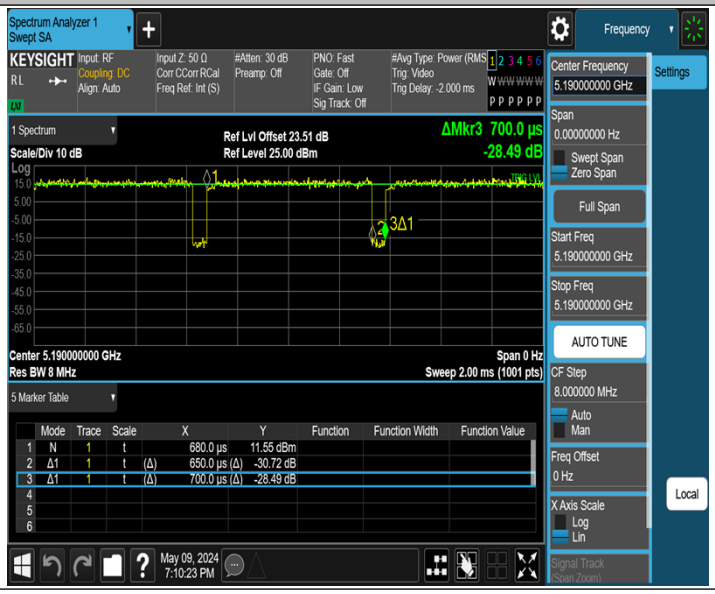
11N20MIMO_Ant2_5180



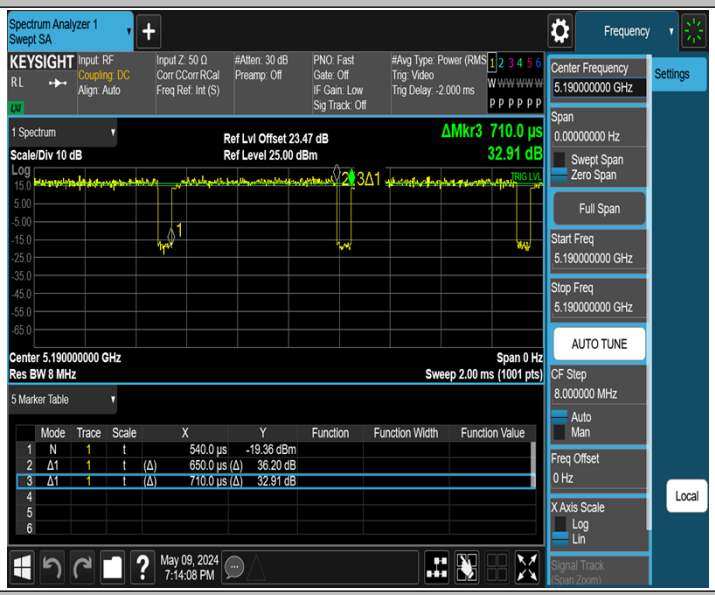
11N20MIMO_Ant3_5180



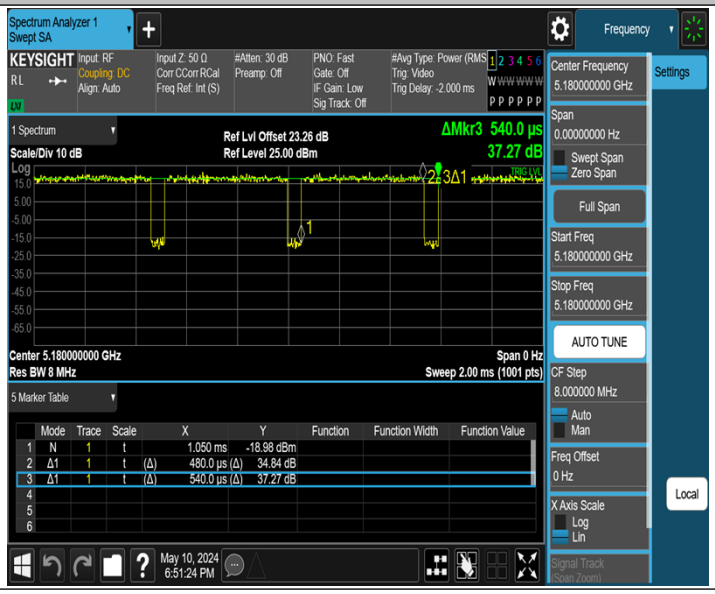
11N40MIMO_Ant1_5190


11N40MIMO_Ant2_5190


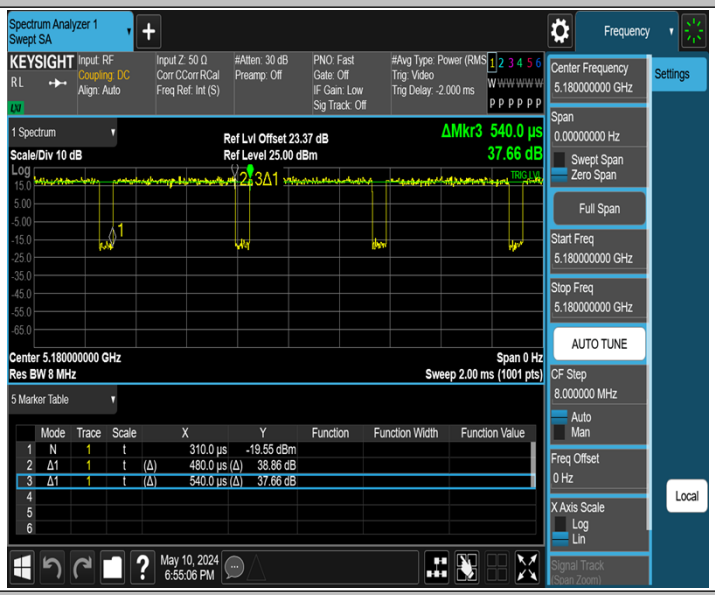
11N40MIMO_Ant3_5190



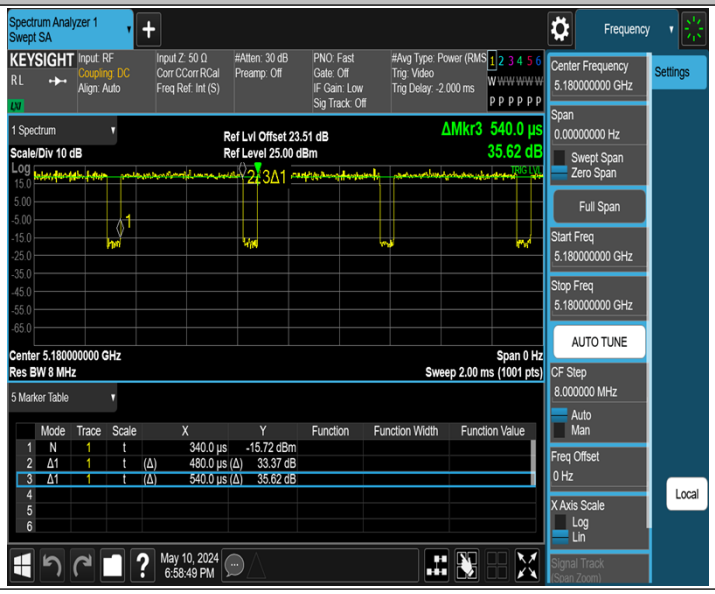
11AC20MIMO_Ant1_5180



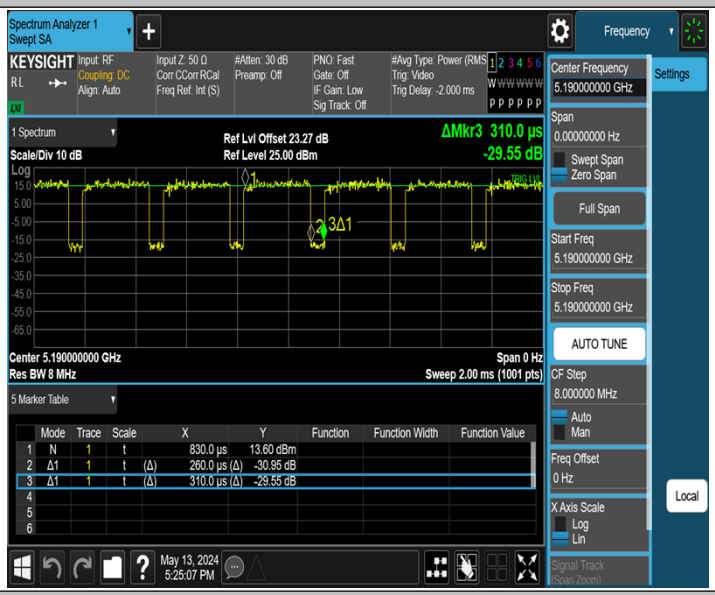
11AC20MIMO_Ant2_5180



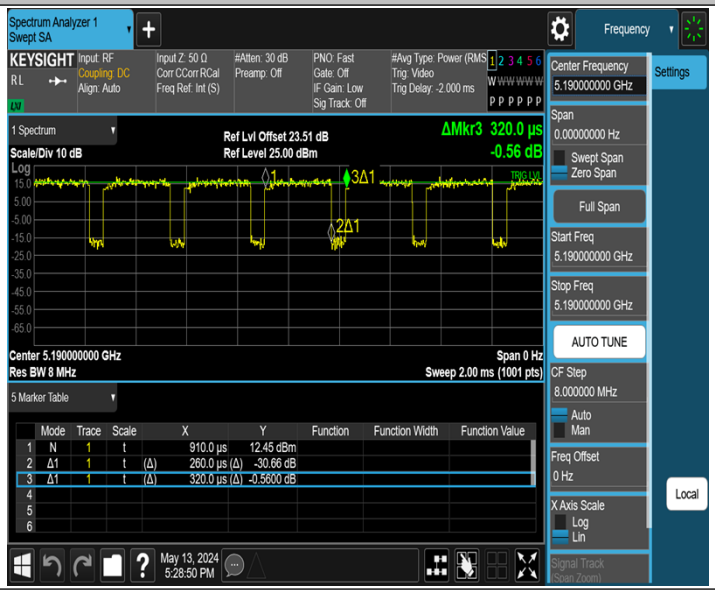
11AC20MIMO_Ant3_5180



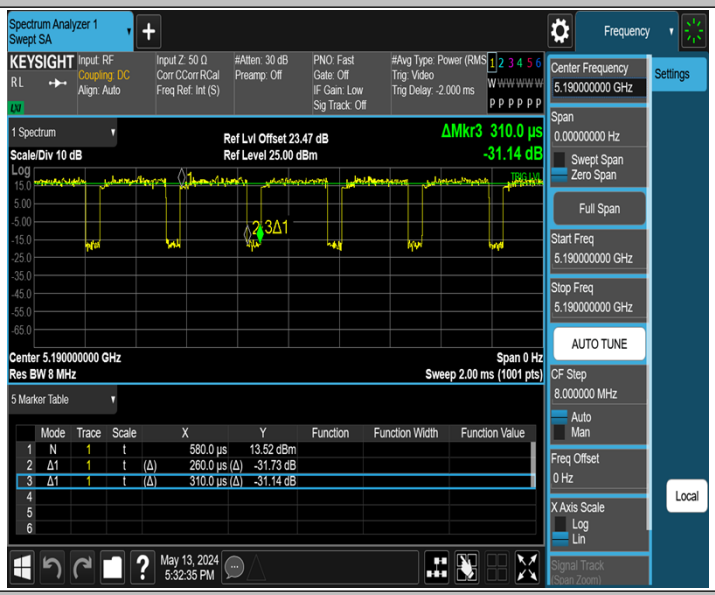
11AC40MIMO_Ant1_5190



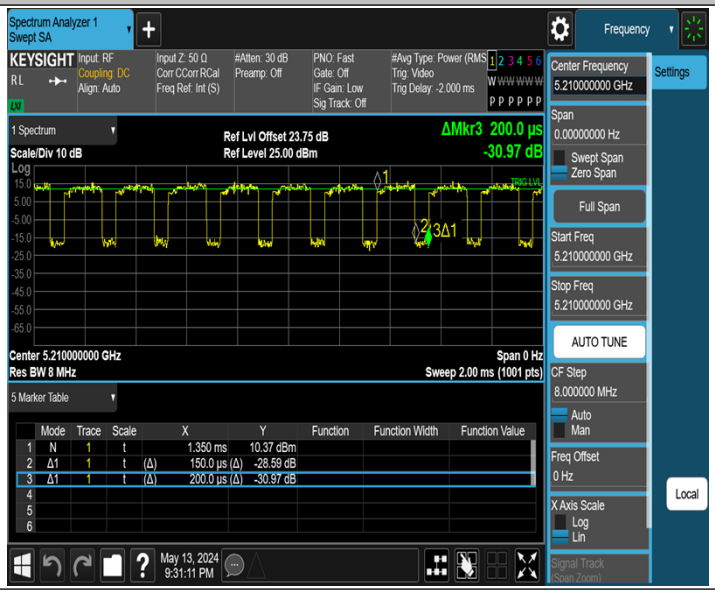
11AC40MIMO_Ant2_5190



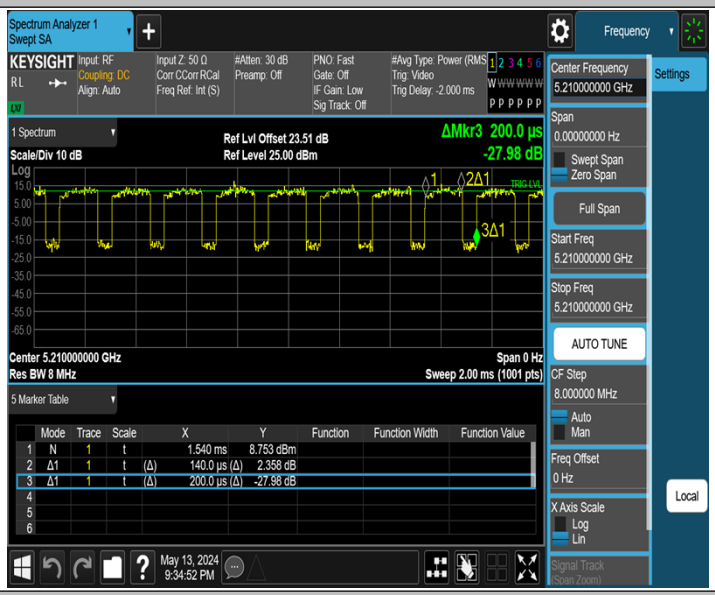
11AC40MIMO_Ant3_5190



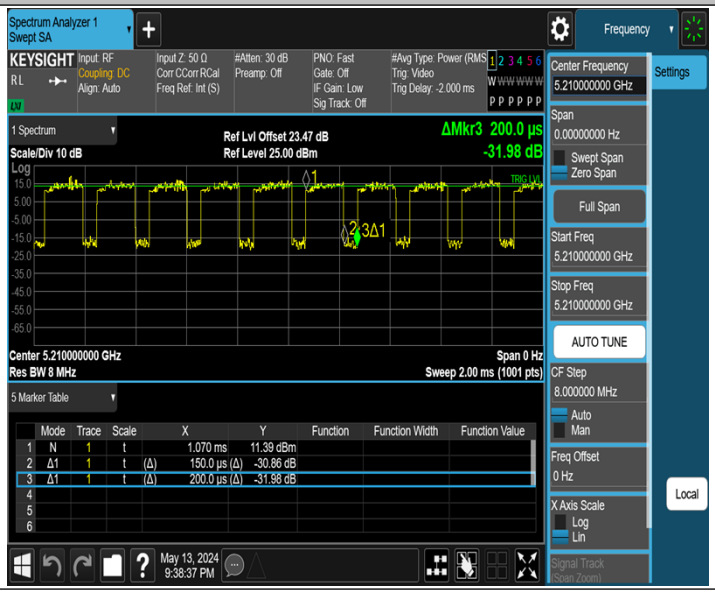
11AC80MIMO_Ant1_5210



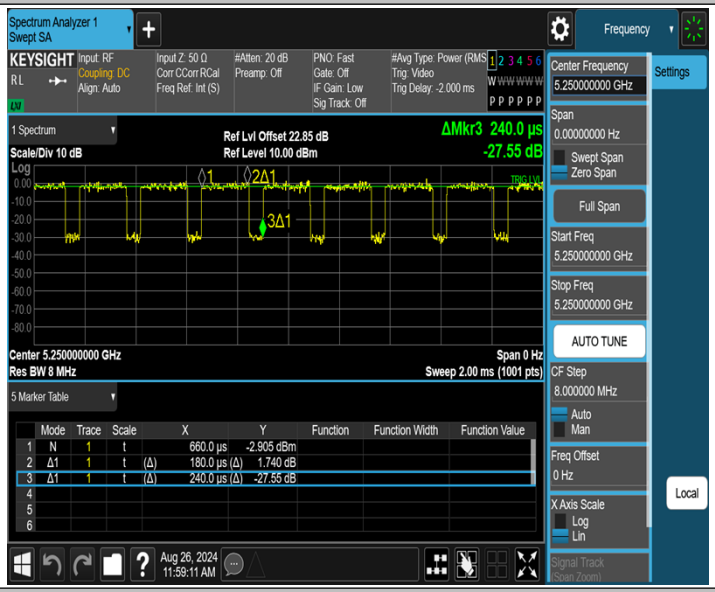
11AC80MIMO_Ant2_5210



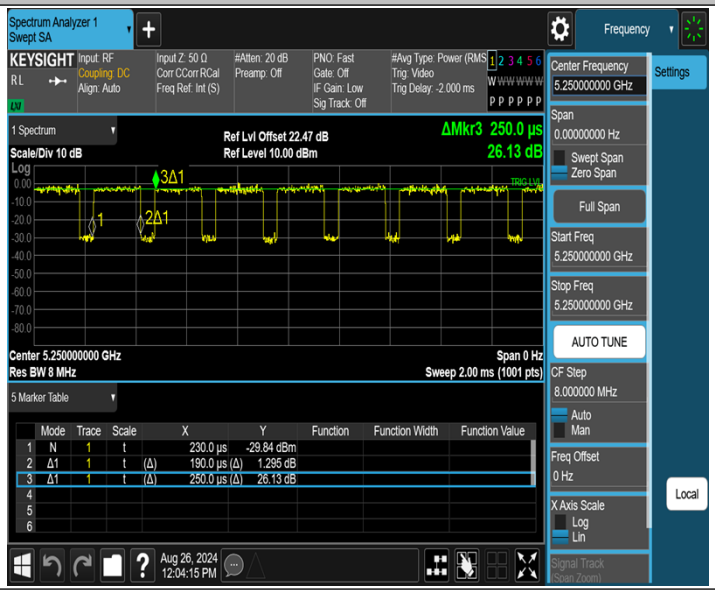
11AC80MIMO_Ant3_5210



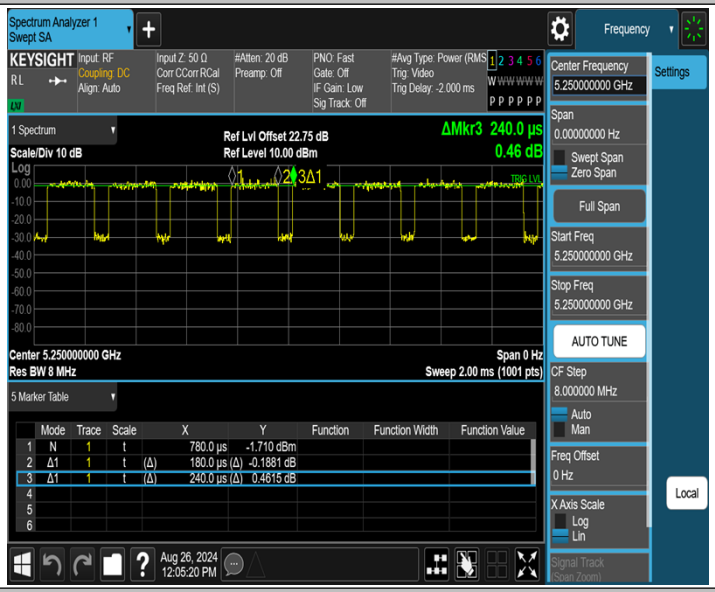
11AC160MIMO_Ant1_5250



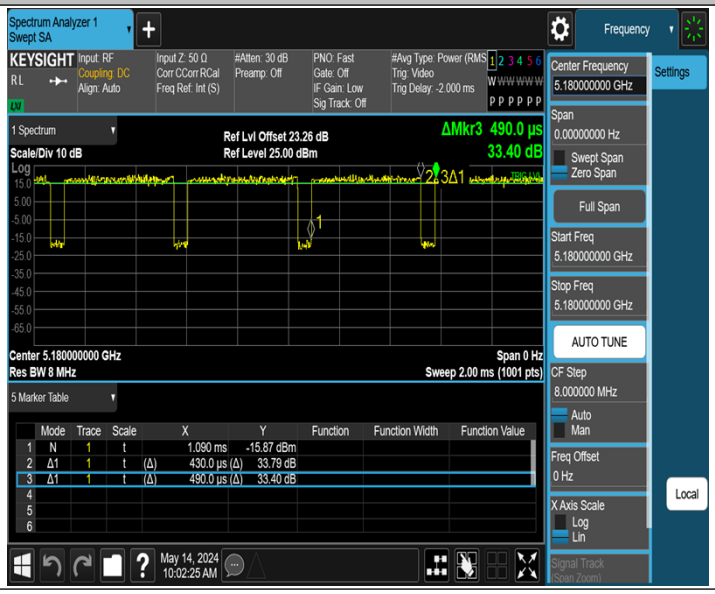
11AC160MIMO_Ant2_5250



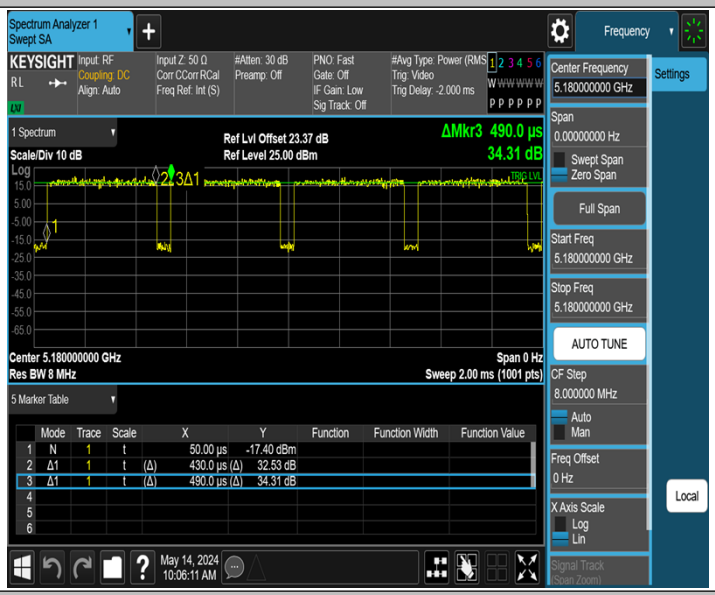
11AC160MIMO_Ant3_5250



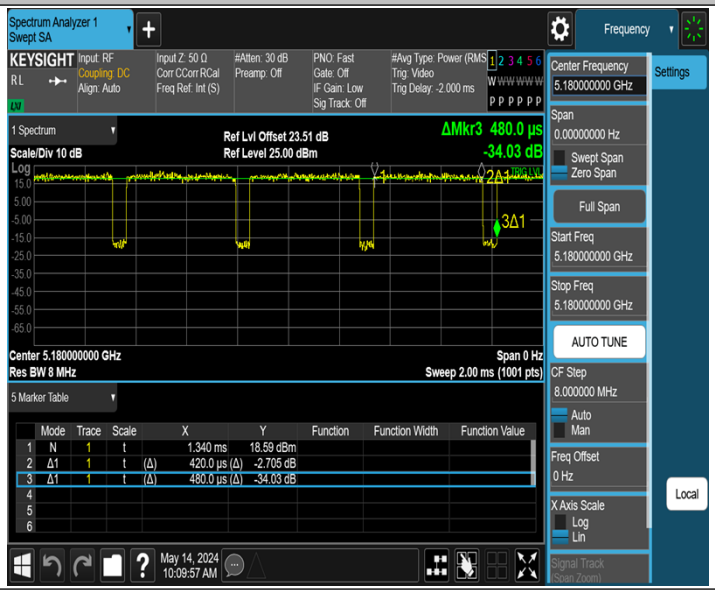
11AX20MIMO_Ant1_5180



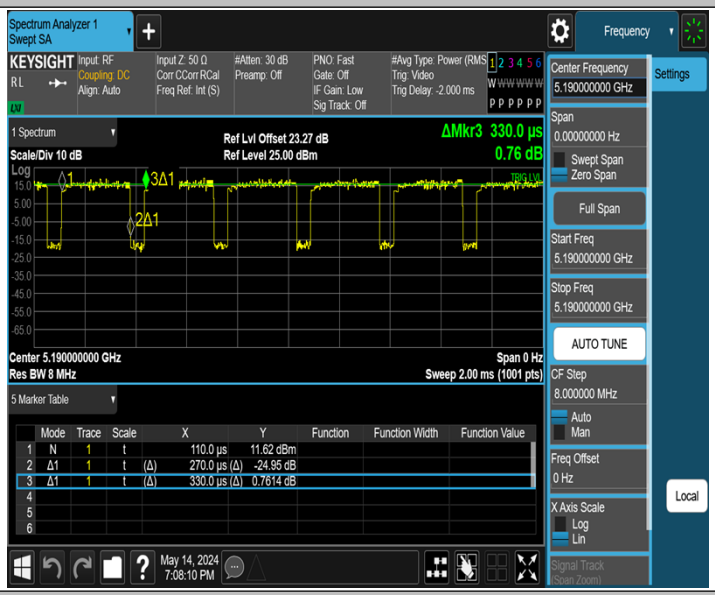
11AX20MIMO_Ant2_5180



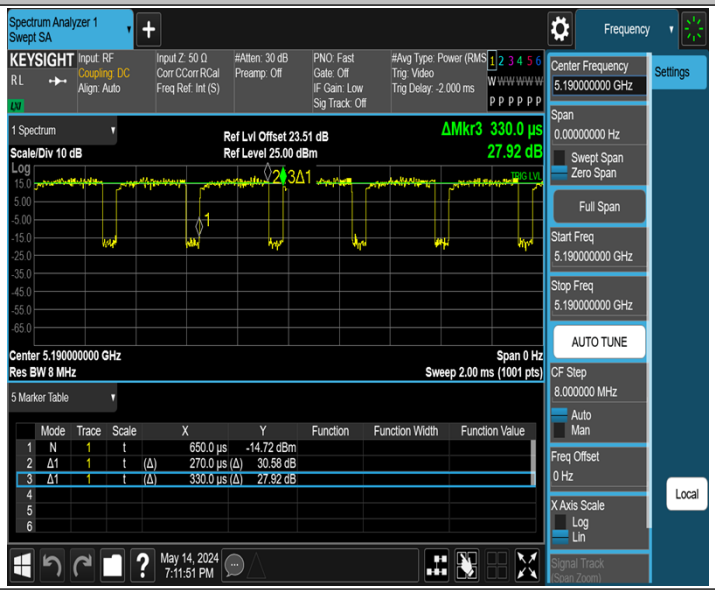
11AX20MIMO_Ant3_5180



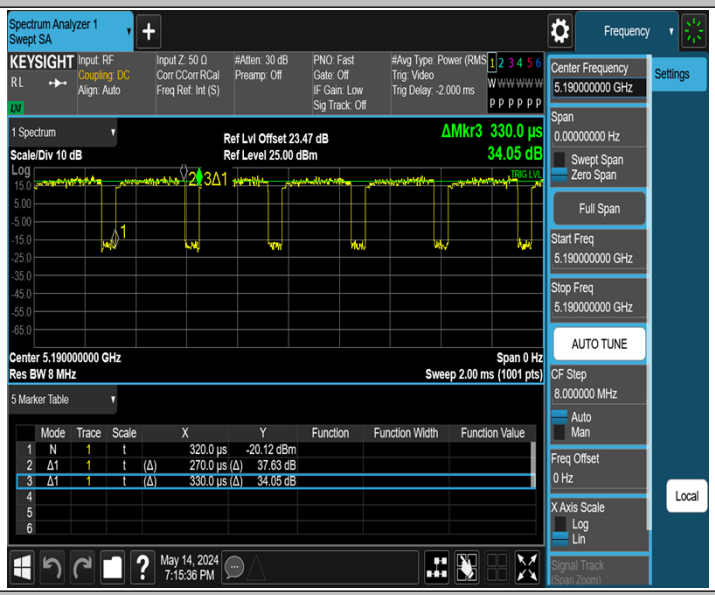
11AX40MIMO_Ant1_5190



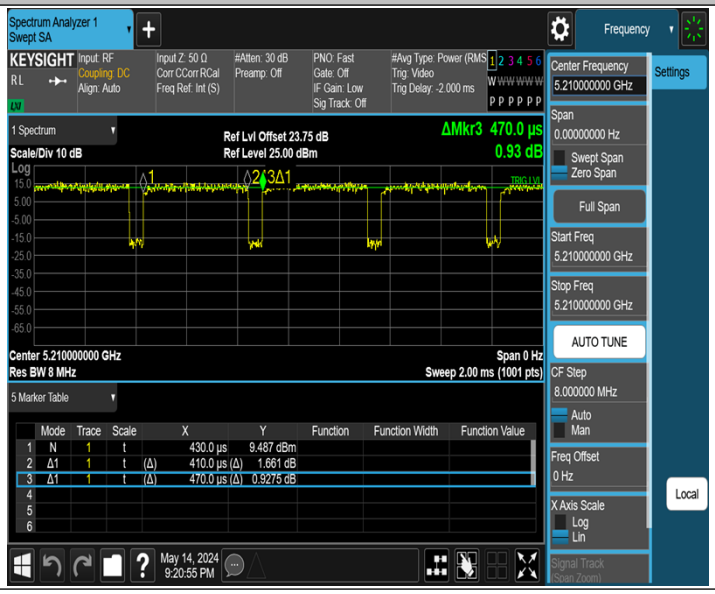
11AX40MIMO_Ant2_5190



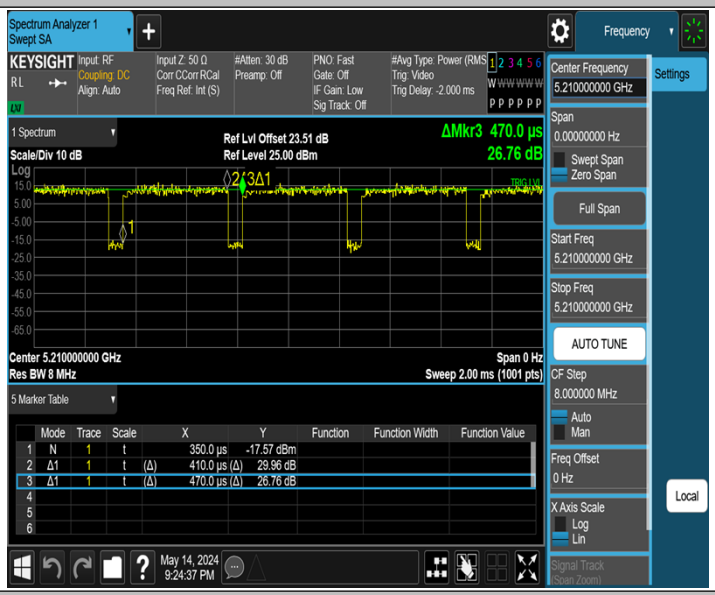
11AX40MIMO_Ant3_5190



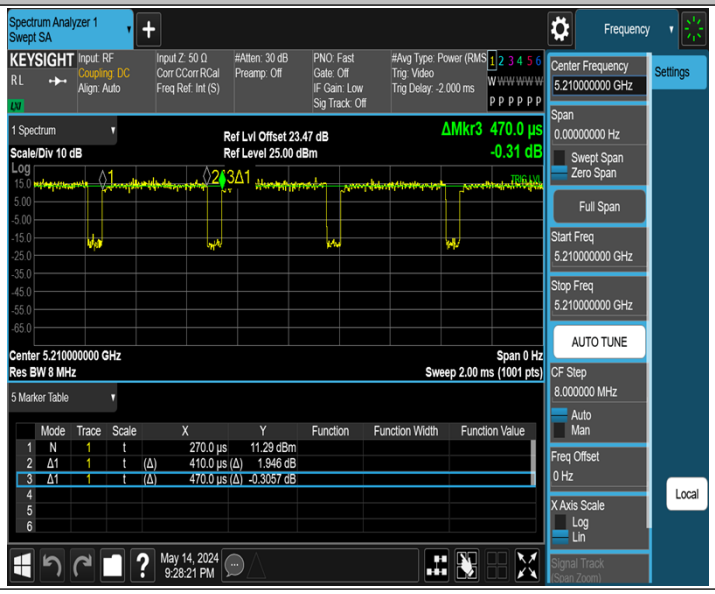
11AX80MIMO_Ant1_5210



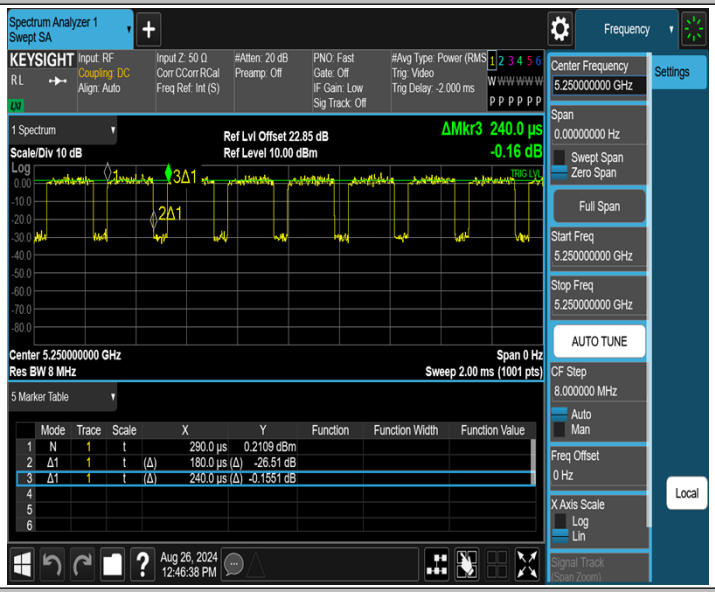
11AX80MIMO_Ant2_5210



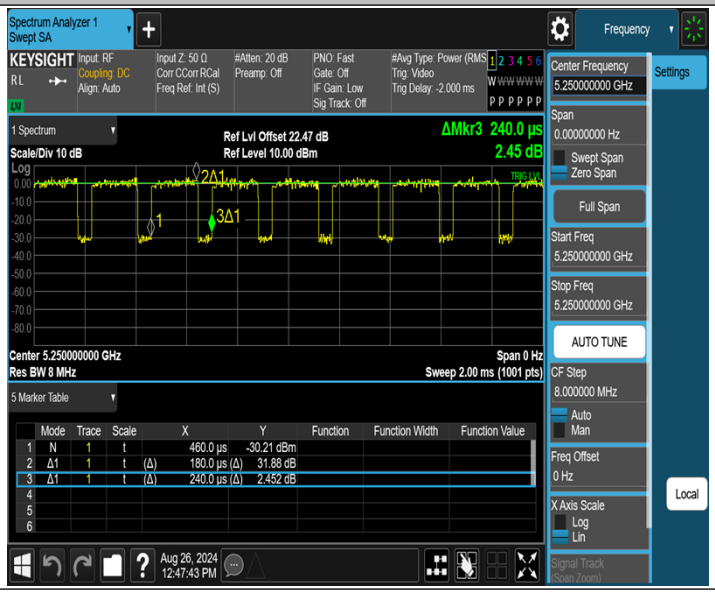
11AX80MIMO_Ant3_5210

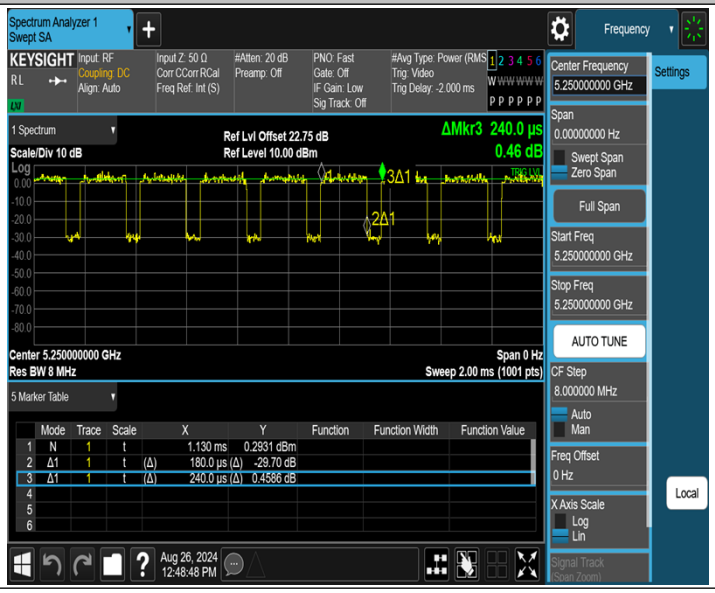


11AX160MIMO_Ant1_5250



11AX160MIMO_Ant2_5250



11AX160MIMO_Ant3_5250


2.7 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty	
Parameter	Uncertainty
Occupied Channel Bandwidth	±102kHz
Power Spectral Density	±0.743dB
Conducted Spurious Emission	±1.328dB
RF power conducted	±0.377dB
Conducted emission(9kHz~30MHz) AC main	±2.68dB
Radiated emission(9kHz~30MHz)	±2.74dB
Radiated emission (30MHz~1GHz)	±4.22dB
Radiated emission (1GHz~18GHz)	±5.06dB
Radiated emission (18GHz~40GHz)	±4.98dB

2.8 Test Location

Company:	Shenzhen Haiyun Standard Technical CO., Ltd.
Address:	No. 110-113, 115, 116, Block B, Jinyuan Business Building, Bao'an District, Shenzhen, China
CNAS Registration Number:	CNAS L18252
CAB identifier:	CN0145
A2LA Certificate Number:	6823.01
Telephone:	0755-26024411

2.9 SUPPORT UNITS

No.	Equipment	Model	Manufacturer	Series No
1	Adapter	SW-0799	Keli Electronics	/
2	Power conversion board	/	/	/

3. Test Procedure And Results

3.1 AC Power Line Conducted Emission

3.1.1 Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

3.1.2 Test Procedure

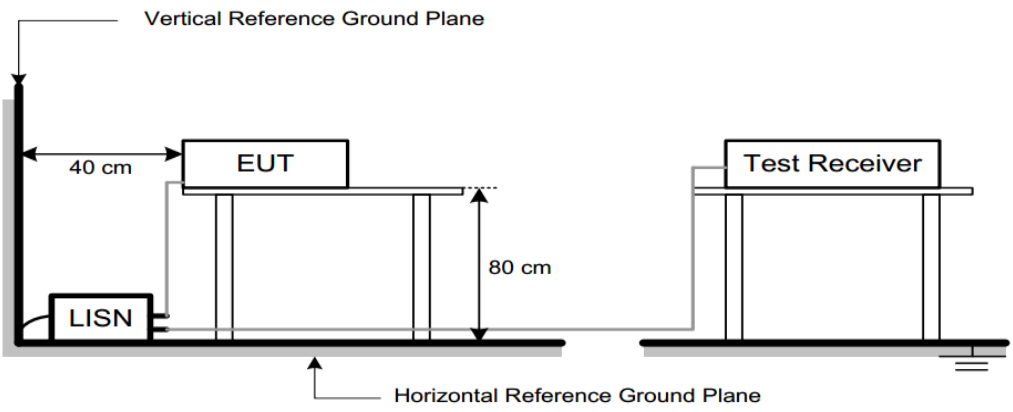
Test Method	
●Conducted Measurement	○Radiated Measurement
Test Channels	
○ Lowest, Middle and Highest Channel	○ Lowest and Highest Channel
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

a) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c) The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

3.1.3 Test Setup



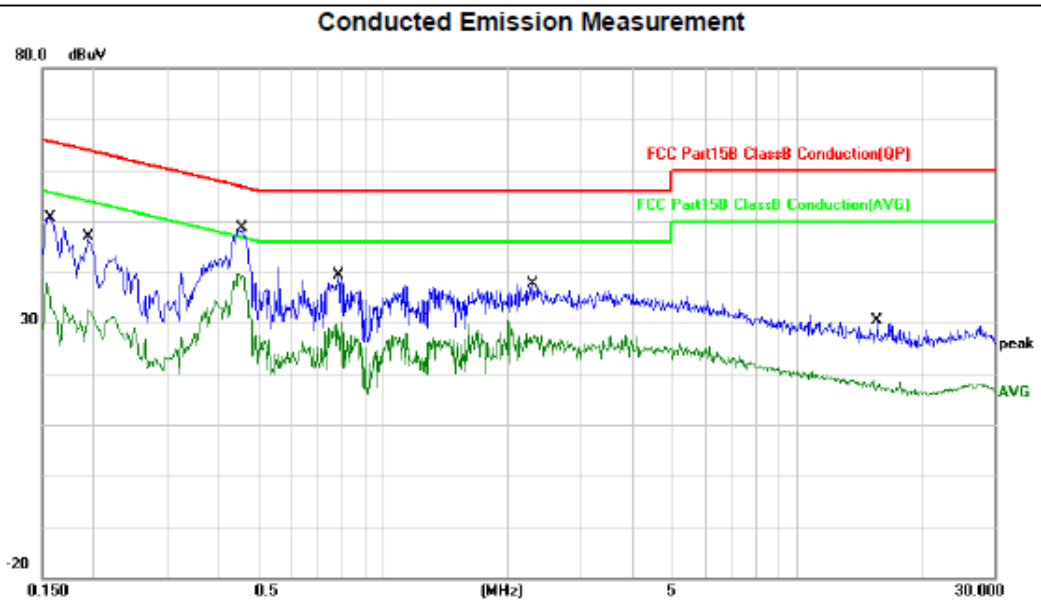
3.1.4 Test Result

Note:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Measurement = Reading + Correct Factor.
3. Over = Measurement – Limit
4. The TX N40 Mode Channel 159 is found to be the worst case and recorded.

150kHz~30MHz	TX 11N40MIMO Channel 159

Line

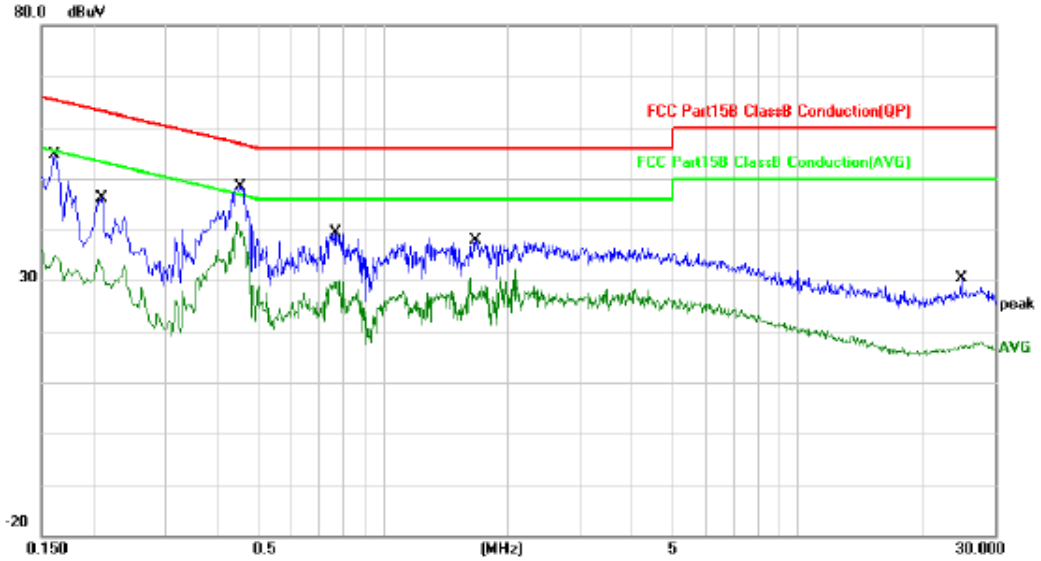


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1590	27.08	20.12	47.20	65.52	-18.32	QP	
2		0.1590	11.14	20.12	31.26	55.52	-24.26	AVG	
3		0.1940	21.20	20.06	41.26	63.86	-22.60	QP	
4		0.1940	8.31	20.06	28.37	53.86	-25.49	AVG	
5		0.4580	25.67	20.27	45.94	56.73	-10.79	QP	
6	*	0.4580	17.97	20.27	38.24	46.73	-8.49	AVG	
7		0.7820	16.03	20.27	36.30	56.00	-19.70	QP	
8		0.7820	6.77	20.27	27.04	46.00	-18.96	AVG	
9		2.3060	12.33	20.12	32.45	56.00	-23.55	QP	
10		2.3060	5.24	20.12	25.36	46.00	-20.64	AVG	
11		15.7140	1.06	20.17	21.23	60.00	-38.77	QP	
12		15.7140	-3.95	20.17	16.22	50.00	-33.78	AVG	

150kHz~30MHz	TX 11N40MIMO Channel 159

Neutral

Conducted Emission Measurement



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	27.23	20.30	47.53	65.36	-17.83	QP	
2		0.1620	10.88	20.30	31.18	55.36	-24.18	AVG	
3		0.2100	21.65	20.31	41.96	63.21	-21.25	QP	
4		0.2100	10.38	20.31	30.69	53.21	-22.52	AVG	
5		0.4540	26.96	20.12	47.08	56.80	-9.72	QP	
6	*	0.4540	19.05	20.12	39.17	46.80	-7.63	AVG	
7		0.7740	16.66	20.07	36.73	56.00	-19.27	QP	
8		0.7740	8.52	20.07	28.59	46.00	-17.41	AVG	
9		1.6740	12.60	20.35	32.95	56.00	-23.05	QP	
10		1.6740	6.69	20.35	27.04	46.00	-18.96	AVG	
11		24.8900	0.60	20.28	20.88	60.00	-39.12	QP	
12		24.8900	-4.28	20.28	16.00	50.00	-34.00	AVG	

3.2 Radiated Emission

3.2.1 Limit

1）Limit of radiated emission measurement:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency (MHz)	Distance Meters(m)	Field Strength Limit	
		μV/m	dB(μV)/m
0.009 – 0.49	300	2400/F(kHz)	-
0.490 – 1.705	30	24000/F(kHz)	-
1.705 – 30	30	30	-
30~88	3	100	40.0
88~216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1) Emission level dBμV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

2）Limit of unwanted emission out of the restricted bands:

Frequency(MHz)	EIRP Limit(dBm/MHz)	Equivalent Field Strength at 3m(dBμV/m)
5150-5250	-27	68.2
5250-5350	-27	68.2
5470-5725	-27	68.2
5725-5850	-27 NOTE (2)	68.2
	10 NOTE (2)	105.2
	15.6 NOTE (2)	110.8
	27 NOTE (2)	122.2

Note: (1) The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength: E[dBμV/m]=EIRP[dBm] +95.2, for d=3m

(2) According to 15.407(b)(4)(i), all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

3.2.2 Test Procedure

Test Method	
○Conducted Measurement	●Radiated Measurement
Test Channels	
●Lowest, Middle and Highest Channel	○ Lowest and Highest Channel
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

a) The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1 GHz)

b) The measuring distance of 3 m or 1.5m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)

c) The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).

e) The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

f) The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

g) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn‘t perform. (below 1 GHz)

h) All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn‘t perform. (above 1 GHz)

i) For the actual test configuration, please refer to the related Item -EUT Test Photos.