

Report on the RF Testing of:

KYOCERA Corporation
Mobile Phone, Model: EB1157
FCC ID: JOYEB1157

In accordance with FCC Part15 Subpart C

Prepared for: KYOCERA Corporation
Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku
Yokohama-shi, Kanagawa, Japan
Phone: +81-45-943-6253 Fax: +81-45-943-6314



Japan

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Document Number: JPD-TR-23076-0

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Hiroaki Suzuki	Deputy Manager of RF Group	Approved Signatory	2023.08.18

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Japan Ltd. document control rules.

EXECUTIVE SUMMARY – Result: Complied

A sample of this product was tested and the result above was confirmed in accordance with FCC Part15 Subpart C.



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TÜV SÜD Japan Ltd.
Yonezawa Testing Center
5-4149-7 Hachimanpara,
Yonezawa-shi, Yamagata,
992-1128 Japan

Phone: +81 (0) 238 28 2881
www.tuvsud.com/ja-jp



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1 Summary of Test

1.1 Modification history of the test report

Document Number	Modification History	Issue Date
JPD-TR-23076-0	First Issue	Refer to the cover page

1.2 Standards

CFR47 FCC Part 15 Subpart C

1.3 Test methods

ANSI C63.10-2013
KDB 558074 D01 15.247 Meas Guidance v05r02

1.4 Deviation from standards

None

1.5 List of applied test(s) of the EUT

Test item section	Test item	Condition	Result	Remark
15.247(a)(2)	DTS Bandwidth / Occupied Bandwidth (99%)	Conducted	PASS	-
15.247(b)(3)	Maximum conducted (average) output power	Conducted	PASS	-
15.247(d)	Band Edge Compliance of RF Conducted Emissions	Conducted	PASS	-
15.247(d) 15.205 15.209	Spurious Emissions	Conducted	PASS	-
		Radiated	PASS	-
15.247(d) 15.205 15.209	Restricted Bands of Operation	Radiated	PASS	-
15.247(e)	Transmitter Power Spectral Density	Conducted	PASS	-
15.207	AC Power Line Conducted Emissions	Conducted	PASS	-

1.6 Test information

None

1.7 Test set up

Table-top

1.8 Test period

7-July-2023 - 24-July-2023

2 Equipment Under Test

All information in this chapter was provided by the applicant.

2.1 EUT information

Applicant	KYOCERA Corporation Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi, Kanagawa, Japan Phone: +81-45-943-6253 Fax: +81-45-943-6314
Equipment Under Test (EUT)	Mobile Phone
Model number	EB1157
Serial number	358018240001198, 358018240001065
Trade name	Kyocera
Number of sample(s)	2
EUT condition	Pre-Production
Power rating	Battery: DC 3.87 V
Size	(W) 75 mm x (D) 14.6 mm x (H) 154 mm
Environment	Indoor and Outdoor use
Terminal limitation	-20 °C to 60 °C
Hardware version	Pre-Production
Software version	0.130RI
Firmware version	Not applicable
RF Specification	
Protocol	IEEE802.11ax (HE20)
Frequency range	IEEE802.11ax (HE20): 2412 MHz-2462 MHz
Number of RF Channels	11 Channels
Modulation type	IEEE802.11ax (HE20): OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Data rate	IEEE802.11ax (HE20 LGI): 7.3, 14.6, 21.9, 29.3, 43.9, 58.5, 65.8, 73.1, 87.8, 97.5, 109.7, 121.9Mbps IEEE802.11ax (HE20 SGI): 8.6, 17.2, 25.8, 34.4, 51.6, 68.8, 77.4, 86, 103.2, 114.7, 129, 143.4Mbps
Channel separation	5 MHz
Conducted power	149.555 mW (IEEE802.11ax)
Antenna type	Internal antenna
Antenna gain	Chain 0 : +1.0 dBi Chain 1 : -1.1 dBi

2.2 Modification to the EUT

The table below details modifications made to the EUT during the test project.

Modification State	Description of Modification	Modification fitted by	Date of Modification
Model: EB1157, Serial Number: 358018240001198, 358018240001065			
0	As supplied by the applicant	Not Applicable	Not Applicable

2.3 Variation of family model(s)

2.3.1 List of family model(s)

Not applicable

2.3.2 Reason for selection of EUT

Not applicable

2.4 Operating channels and frequencies

Channel	Frequency [MHz]
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

2.5 Description of test mode

The EUT had been tested under operating condition.
There are three channels have been tested as following:

Tested Channel [11ax(HE20)]	Frequency [MHz]
Low	2412
Middle	2437
High	2462

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Tested Channel	Modulation Type	Data Rate
Low, Middle, High	IEEE802.11ax (HE20 LGI): OFDM	MCS0 (7.3Mbps)

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.

The worst emission was found in X-axis, Chain Both and the worst case recorded.

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.

2.6 Operating flow

- Tx mode

- i) Test program setup to the Software
- ii) Select a Test mode
[IEEE802.11ax (HE20)]
Operating frequency: Channel Low: 2412MHz, Channel Middle: 2437MHz, Channel High: 2462MHz
- iii) Start test mode

- Rx mode

- i) Test program setup to the Software
- ii) Select a Test mode
[IEEE802.11ax (HE20)]
Operating frequency: Channel Low: 2412MHz, Channel Middle: 2437MHz, Channel High: 2462MHz
- iii) Start test mode

3 Configuration of Equipment

Numbers assigned to equipment on the diagram in “3.3 System configuration” correspond to the list in “3.1 Equipment used” and “3.2 Cable(s) used”.

This test configuration is based on the manufacture’s instruction.

Cabling and setup(s) were taken into consideration and test data was taken under worse case condition.

3.1 Equipment used

No.	Equipment	Company	Model No.	Serial No.	FCC ID/DoC	Comment
1	Mobile Phone	KYOCERA	EB1157	358018240001198 358018240001065	JOYEB1157	EUT
2	AC Adapter	KDDI	0602PQA	N/A	N/A	*

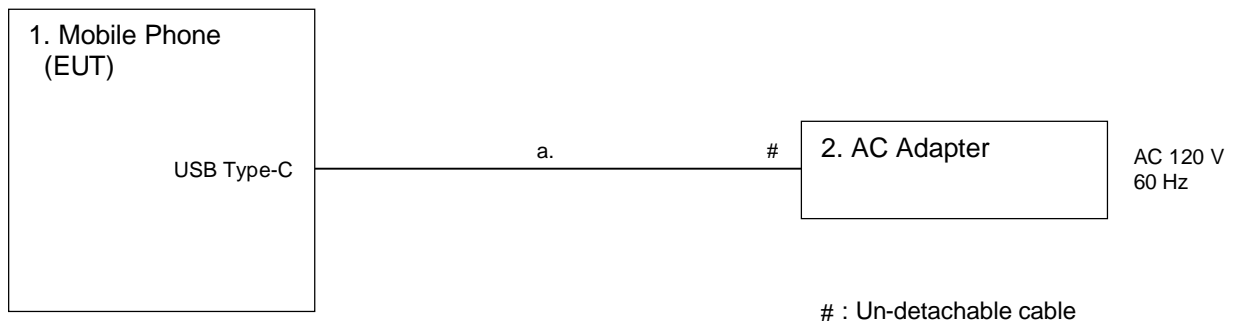
*:AC power line Conducted Emission Test.

3.2 Cable(s) used

No.	Equipment	Length[m]	Shield	Connector	Comment
a	USB cable (for AC Adapter)	1.5	No	Plastic	*

*:AC power line Conducted Emission Test.

3.3 System configuration



4 Test Result

4.1 DTS Bandwidth / Occupied Bandwidth (99%)

4.1.1 Measurement procedure

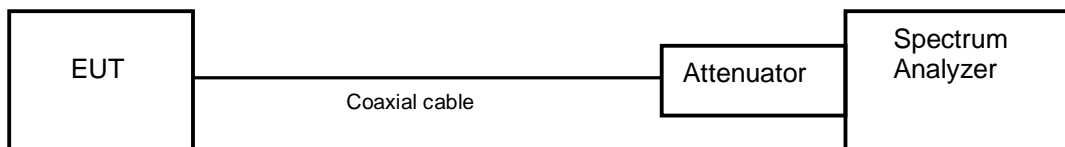
[FCC 15.247(a)(2), KDB 558074 D01 v05r02, Section 8.2]

The bandwidth at 6dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW = 100kHz.
- VBW $\geq 3 \times$ RBW.
- Sweep time = auto-couple.
- Detector = peak.
- Trace mode = max hold.

- Test configuration



4.1.2 Limit

The minimum permissible 6 dB bandwidth is 500 kHz.



Japan

4.1.3 Measurement result

Date : 20-July-2023
Temperature : 23.8 [°C]
Humidity : 61.3 [%]
Test place : Shielded room No.4

Test engineer : Kazunori Saito

Date : 21-July-2023
Temperature : 23.7 [°C]
Humidity : 65.8 [%]
Test place : Shielded room No.4

Test engineer : Kazunori Saito



[Chain 0]

Channel	DTS bandwidth [MHz]			
	26-Tones	52-Tones	106-Tones	242-Tones
	RU Index L:0, M:4, H:8	RU Index L:37, M:38, H:40	RU Index L:53, M:53, H:54	RU Index 61
Low	2.139	17.110	18.122	19.088
Middle	7.603	15.107	17.161	19.043
High	2.133	17.094	17.163	19.058

[Chain 0]

Channel	Occupied bandwidth [MHz]			
	26-Tones	52-Tones	106-Tones	242-Tones
	RU Index L:0, M:4, H:8	RU Index L:37, M:38, H:40	RU Index L:53, M:53, H:54	RU Index 61
Low	18.3656	18.1598	18.1737	18.9812
Middle	17.3306	17.2428	18.1442	18.9953
High	18.3325	18.1772	18.2661	18.9651

[Chain 1]

Channel	DTS bandwidth [MHz]			
	26-Tones	52-Tones	106-Tones	242-Tones
	RU Index L:0, M:4, H:8	RU Index L:37, M:38, H:40	RU Index L:53, M:53, H:54	RU Index 61
Low	2.152	17.117	18.141	19.117
Middle	8.878	15.099	17.150	18.988
High	8.267	17.038	17.137	18.998

[Chain 1]

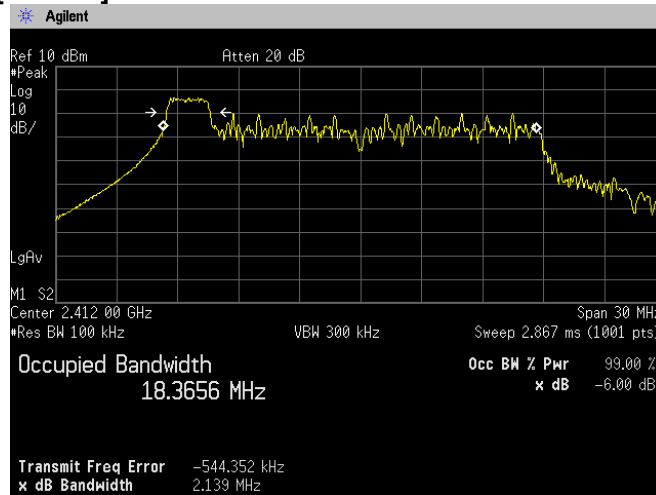
Channel	Occupied bandwidth [MHz]			
	26-Tones	52-Tones	106-Tones	242-Tones
	RU Index L:0, M:4, H:8	RU Index L:37, M:38, H:40	RU Index L:53, M:53, H:54	RU Index 61
Low	18.3782	18.2077	18.2233	19.0333
Middle	17.2900	17.1849	18.1034	18.9780
High	18.1937	18.0573	18.1541	18.9493



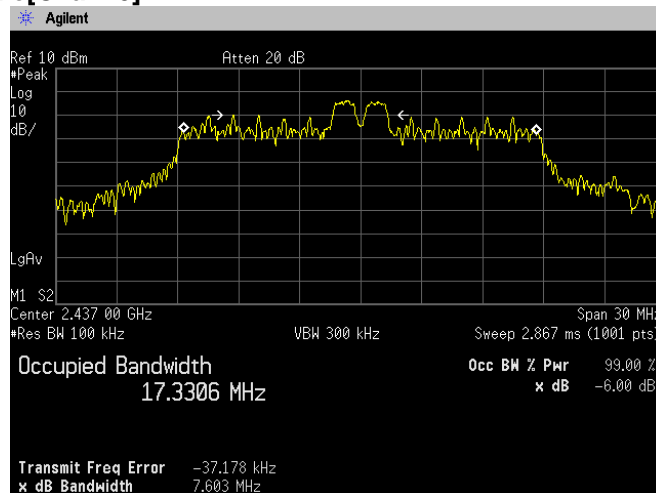
4.1.4 Trace data

[IEEE802.11ax (HE20)_26-Tones]

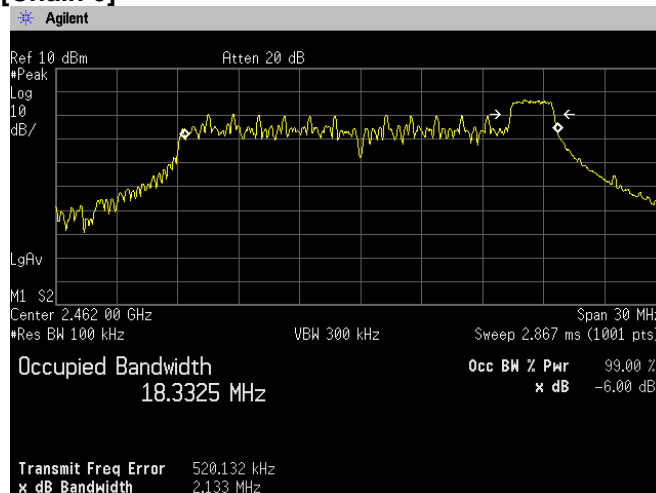
Channel Low[Chain 0]



Channel Middle[Chain 0]



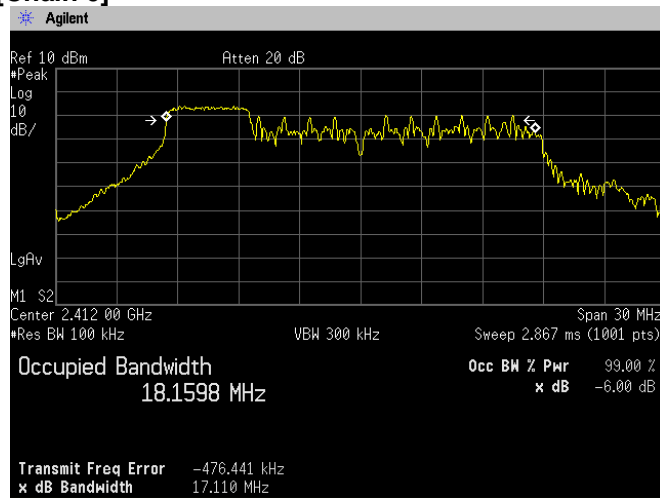
Channel High[Chain 0]



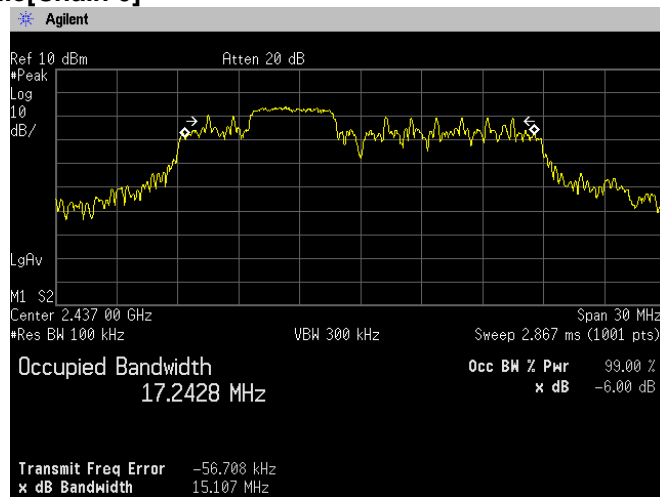


[IEEE802.11ax (HE20)_52-Tones]

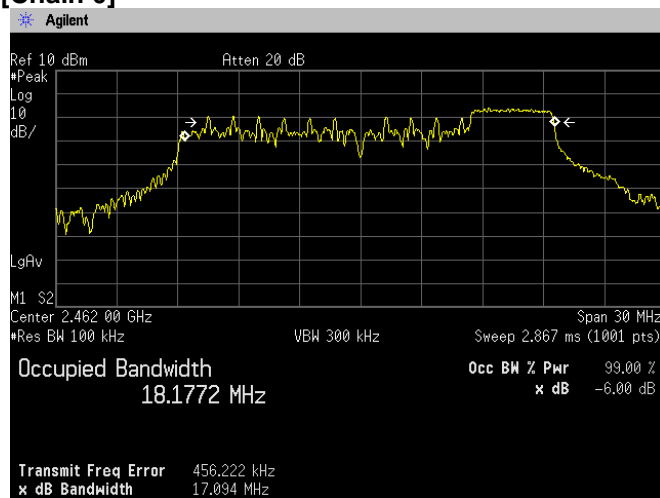
Channel Low[Chain 0]



Channel Middle[Chain 0]

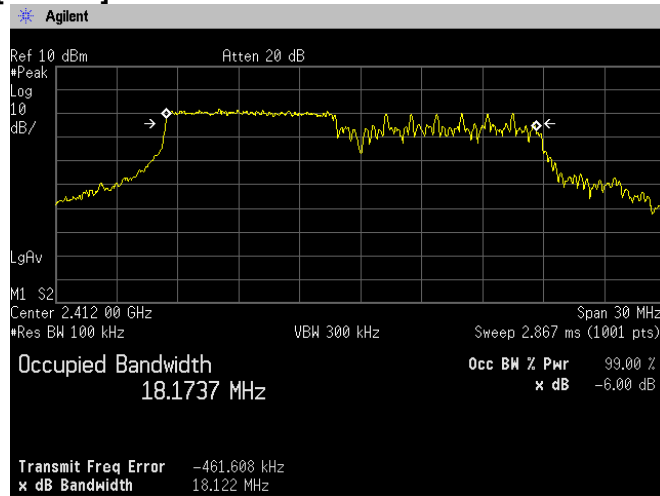


Channel High[Chain 0]

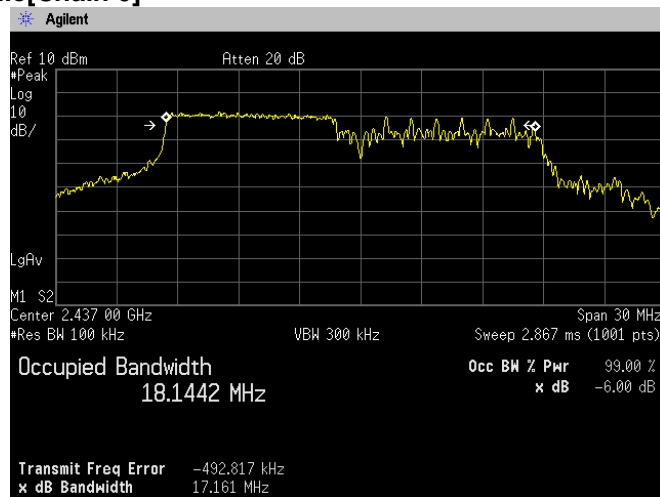


[IEEE802.11ax (HE20)_106-Tones]

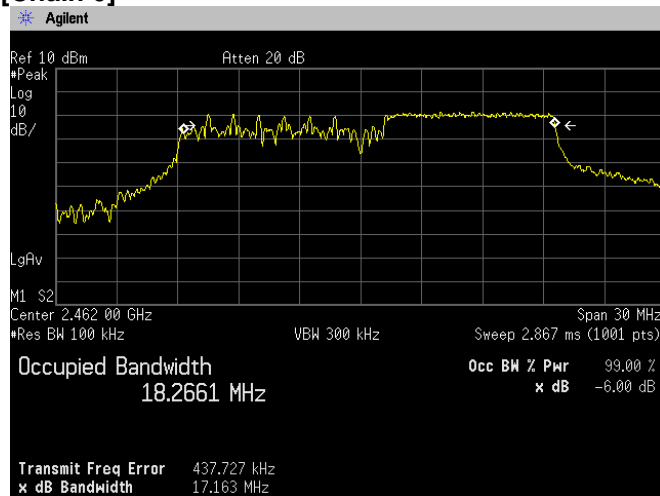
Channel Low[Chain 0]



Channel Middle[Chain 0]



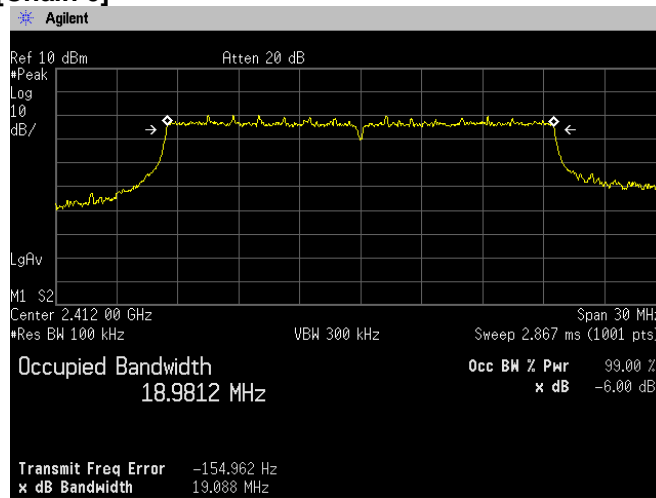
Channel High[Chain 0]



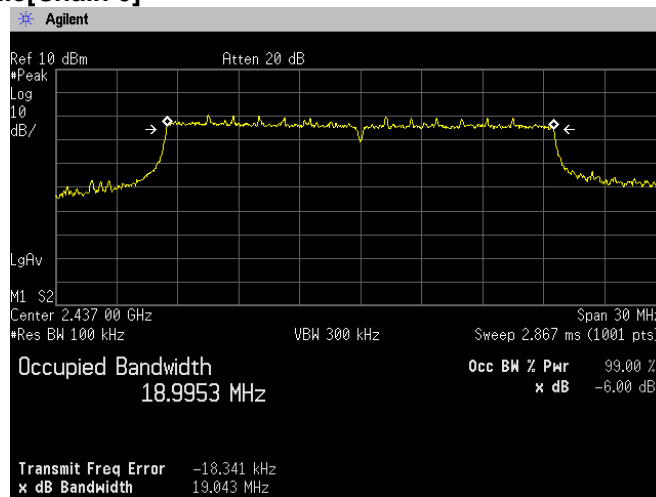


[IEEE802.11ax (HE20)_242-Tones]

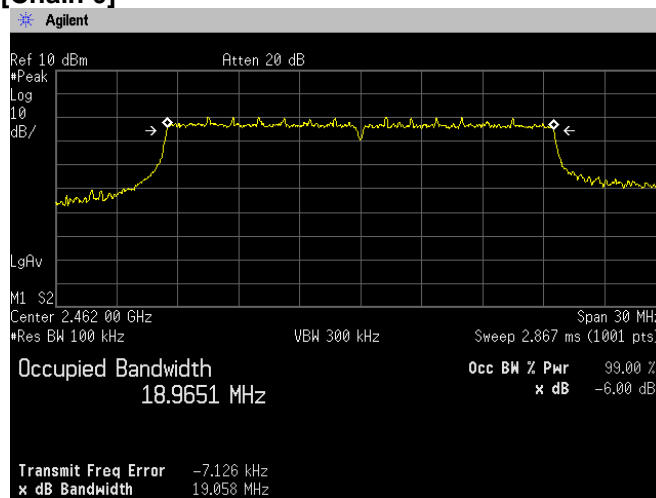
Channel Low[Chain 0]



Channel Middle[Chain 0]



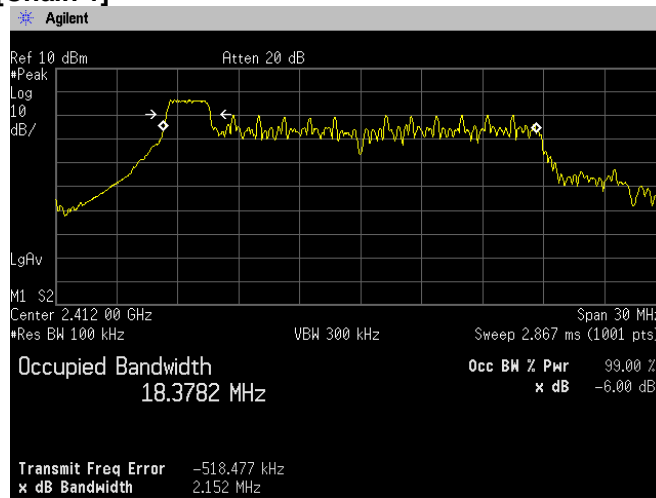
Channel High[Chain 0]



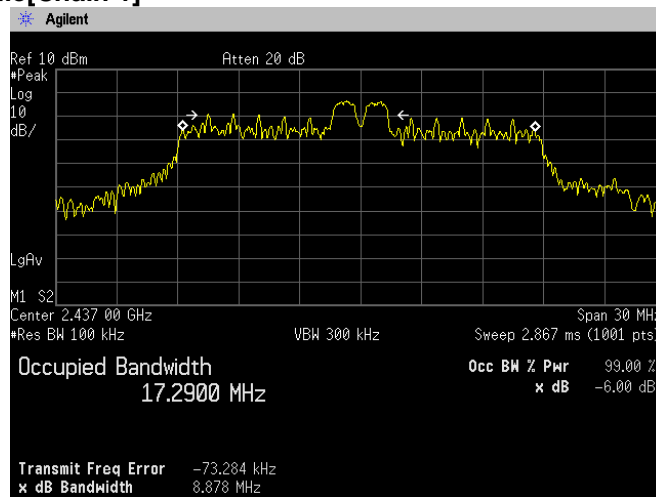


[IEEE802.11ax (HE20)_26-Tones]

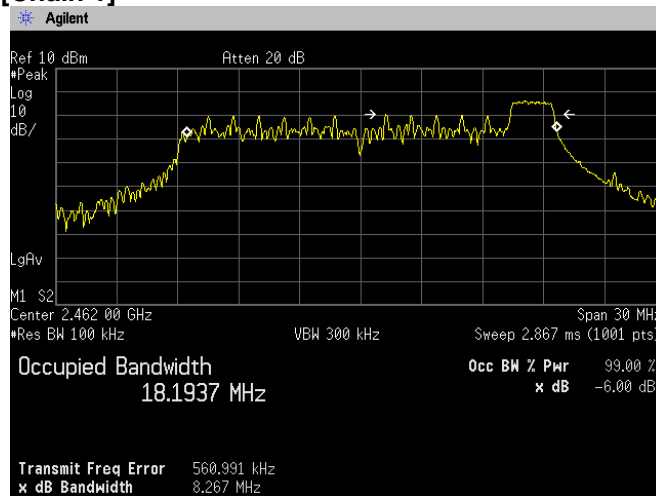
Channel Low[Chain 1]



Channel Middle[Chain 1]

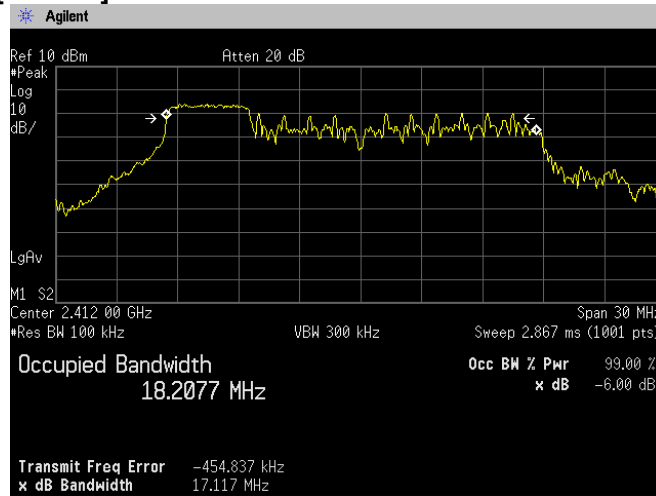


Channel High[Chain 1]

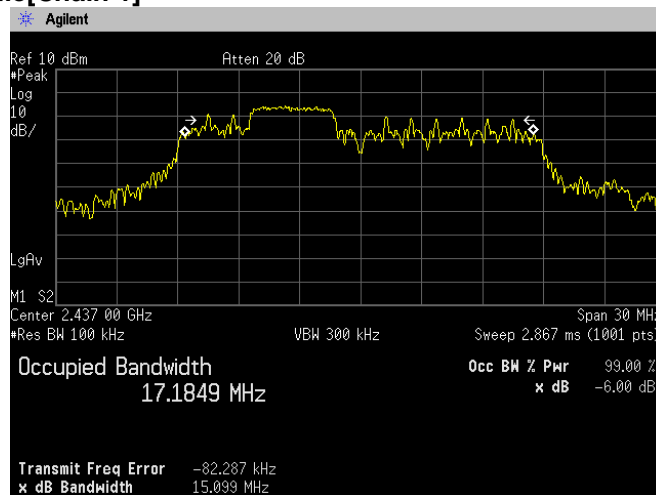


[IEEE802.11ax (HE20)_52-Tones]

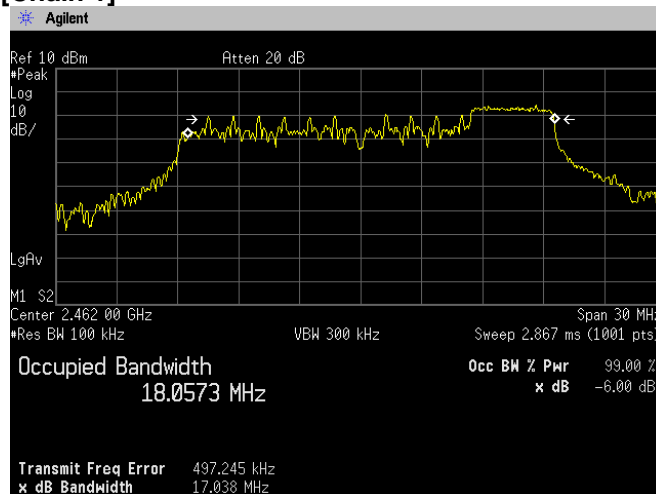
Channel Low[Chain 1]



Channel Middle[Chain 1]

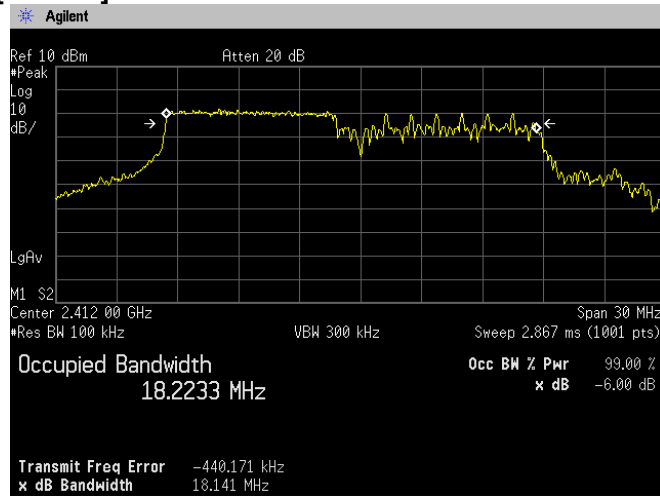


Channel High[Chain 1]

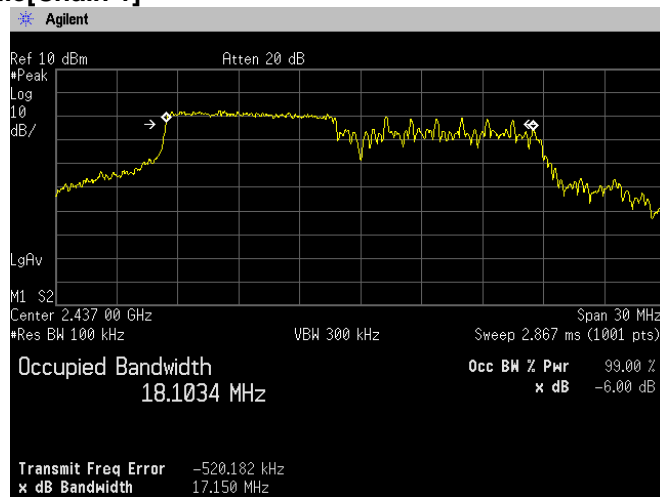


[IEEE802.11ax (HE20)_106-Tones]

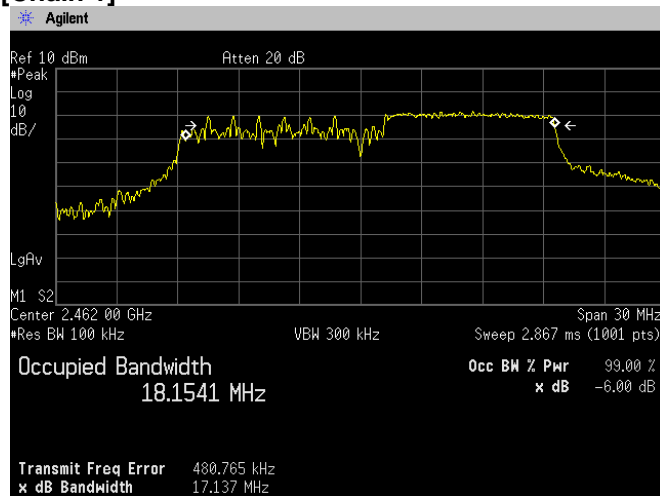
Channel Low[Chain 1]



Channel Middle[Chain 1]

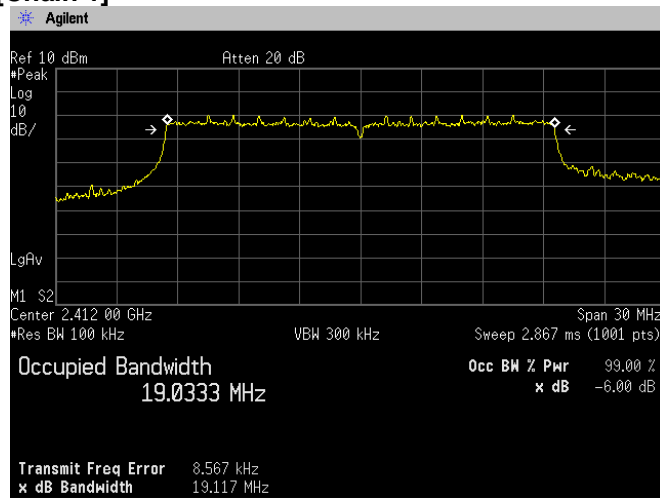


Channel High[Chain 1]

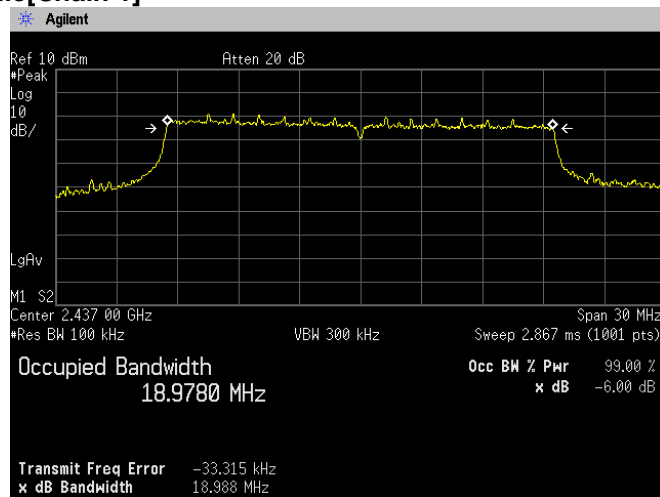


[IEEE802.11ax (HE20)_242-Tones]

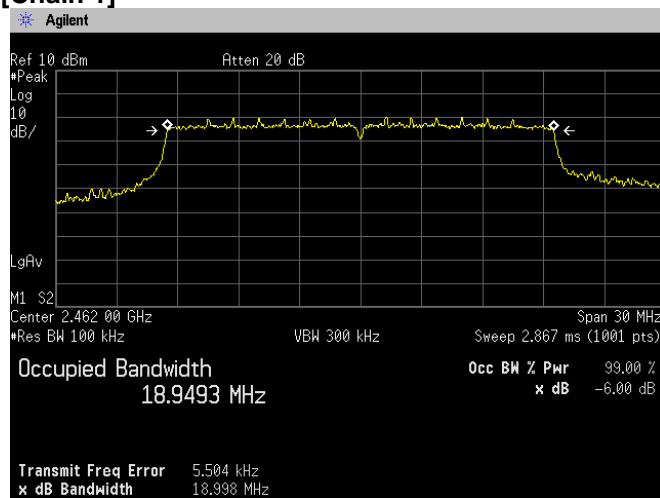
Channel Low[Chain 1]



Channel Middle[Chain 1]



Channel High[Chain 1]





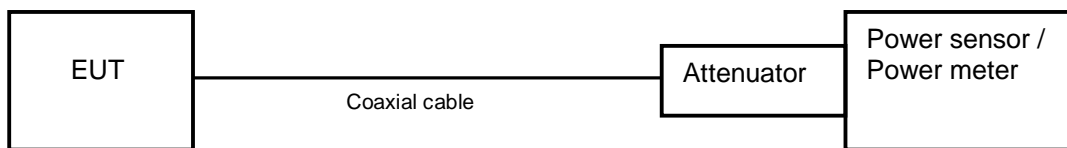
4.2 Maximum Conducted Output Power

4.2.1 Measurement procedure

[FCC 15.247(b)(3), KDB 558074 D01 v05r02, Section 8.3.1.3]

The peak power is measured with a power sensor connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

- Test configuration



4.2.2 Limit

1 W (1000 mW) or less

4.2.3 Measurement result

Date : 21-July-2023
Temperature : 23.7 [°C]
Humidity : 65.8 [%]
Test place : Shielded room No.4

Test engineer : Kazunori Saito

**[IEEE802.11ax (HE20)_26-Tones]
Battery Full[Chain 0]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.91	10.83	21.74	149.314	≤ 1000	PASS
Middle	2437	9.24	10.83	20.07	101.531	≤ 1000	PASS
High	2462	9.80	10.83	20.63	115.531	≤ 1000	PASS

**[IEEE802.11ax (HE20)_52-Tones]
Battery Full[Chain 0]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.92	10.83	21.75	149.555	≤ 1000	PASS
Middle	2437	9.23	10.83	20.06	101.298	≤ 1000	PASS
High	2462	9.82	10.83	20.65	116.038	≤ 1000	PASS

**[IEEE802.11ax (HE20)_106-Tones]
Battery Full[Chain 0]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.88	10.83	21.71	148.149	≤ 1000	PASS
Middle	2437	9.15	10.83	19.98	99.472	≤ 1000	PASS
High	2462	9.83	10.83	20.66	116.493	≤ 1000	PASS

**[IEEE802.11ax (HE20)_242-Tones]
Battery Full[Chain 0]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.81	10.83	21.64	145.781	≤ 1000	PASS
Middle	2437	9.17	10.83	20.00	99.885	≤ 1000	PASS
High	2462	9.99	10.83	20.82	120.837	≤ 1000	PASS

Calculation;

$$\text{Reading (dBm)} + \text{Factor (dB)} = \text{Level (dBm)}$$

$$10\log P = \text{Level (dBm)}$$

$$P = 10^{(\text{Maximum Peak Output Power} / 10)} \text{ (mW)}$$

**[IEEE802.11ax (HE20)_26-Tones]
Battery Full[Chain 1]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.58	10.83	21.41	138.325	≤ 1000	PASS
Middle	2437	9.84	10.83	20.67	116.708	≤ 1000	PASS
High	2462	9.34	10.83	20.17	104.088	≤ 1000	PASS

**[IEEE802.11ax (HE20)_52-Tones]
Battery Full[Chain 1]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.53	10.83	21.36	136.773	≤ 1000	PASS
Middle	2437	9.79	10.83	20.62	115.425	≤ 1000	PASS
High	2462	9.35	10.83	20.18	104.256	≤ 1000	PASS

**[IEEE802.11ax (HE20)_106-Tones]
Battery Full[Chain 1]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.47	10.83	21.30	134.896	≤ 1000	PASS
Middle	2437	9.77	10.83	20.60	114.921	≤ 1000	PASS
High	2462	9.39	10.83	20.22	105.269	≤ 1000	PASS

**[IEEE802.11ax (HE20)_242-Tones]
Battery Full[Chain 1]**

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412	10.54	10.83	21.37	137.120	≤ 1000	PASS
Middle	2437	9.84	10.83	20.67	116.708	≤ 1000	PASS
High	2462	9.42	10.83	20.25	105.803	≤ 1000	PASS

Calculation;

$$\text{Reading (dBm)} + \text{Factor (dB)} = \text{Level (dBm)}$$

$$10\log P = \text{Level (dBm)}$$

$$P = 10^{(\text{Maximum Peak Output Power} / 10)} \text{ (mW)}$$

**[IEEE802.11ax (HE20)_26-Tones]
Battery Full[Chain 0+1]**

Channel	Center Frequency (MHz)	Level (dBm)		Total Output Power (mW)	Limit (mW)	Result
		Chain 0	Chain 1			
Low	2412	21.74	21.41	287.639	≤ 1000	PASS
Middle	2437	20.07	20.67	218.239	≤ 1000	PASS
High	2462	20.63	20.17	219.619	≤ 1000	PASS

**[IEEE802.11ax (HE20)_52-Tones]
Battery Full[Chain 0+1]**

Channel	Center Frequency (MHz)	Level (dBm)		Total Output Power (mW)	Limit (mW)	Result
		Chain 0	Chain 1			
Low	2412	21.75	21.36	286.328	≤ 1000	PASS
Middle	2437	20.06	20.62	216.723	≤ 1000	PASS
High	2462	20.65	20.18	220.294	≤ 1000	PASS

**[IEEE802.11ax (HE20)_106-Tones]
Battery Full[Chain 0+1]**

Channel	Center Frequency (MHz)	Level (dBm)		Total Output Power (mW)	Limit (mW)	Result
		Chain 0	Chain 1			
Low	2412	21.71	21.30	283.046	≤ 1000	PASS
Middle	2437	19.98	20.60	214.393	≤ 1000	PASS
High	2462	20.66	20.22	221.762	≤ 1000	PASS

**[IEEE802.11ax (HE20)_242-Tones]
Battery Full[Chain 0+1]**

Channel	Center Frequency (MHz)	Level (dBm)		Total Output Power (mW)	Limit (mW)	Result
		Chain 0	Chain 1			
Low	2412	21.64	21.37	282.900	≤ 1000	PASS
Middle	2437	20.00	20.67	216.593	≤ 1000	PASS
High	2462	20.82	20.25	226.641	≤ 1000	PASS

Calculation;

Reading (dBm) + Factor (dB) = Level (dBm)

$10\log P = \text{Level (dBm)}$

$P = 10^{(\text{Maximum Peak Output Power} / 10)} \text{ (mW)}$

4.3 Band Edge Compliance of RF Conducted Emissions

4.3.1 Measurement procedure

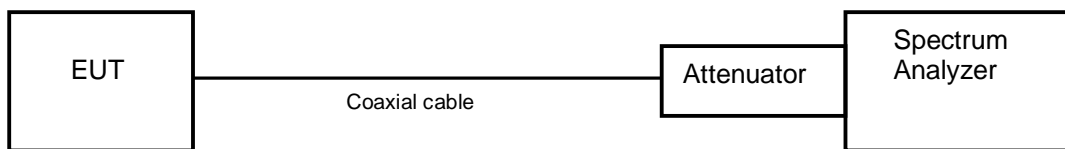
[FCC 15.247(d), KDB 558074 D01 v05r02, Section 8.5]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- a) Span = Arbitrary setting. (Setting suitable for measurement.)
- b) RBW = 100kHz.
- c) VBW $\geq 3 \times$ RBW
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



4.3.2 Limit

In any 100 kHz bandwidth outside the frequency band 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.

4.3.3 Measurement result

Date : 21-July-2023
 Temperature : 23.7 [°C]
 Humidity : 65.8 [%]
 Test place : Shielded room No.4
 Test engineer : Kazunori Saito

Date : 24-July-2023
 Temperature : 23.0 [°C]
 Humidity : 59.3 [%]
 Test place : Shielded room No.4
 Test engineer : Kazunori Saito

[IEEE802.11ax (HE20) 26-Tones] [Chain 0]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-3.48	2399.92	-38.54	35.06	At least 20dB below from peak of RF	PASS
High	2462	-3.26	2484.22	-49.67	46.41	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 52-Tones] [Chain 0]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-5.88	2399.84	-39.33	33.45	At least 20dB below from peak of RF	PASS
High	2462	-6.04	2484.70	-49.32	43.28	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 106-Tones] [Chain 0]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-8.01	2399.84	-37.59	29.58	At least 20dB below from peak of RF	PASS
High	2462	-8.54	2483.98	-51.62	43.08	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 242-Tones] [Chain 0]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2422	-9.76	2398.80	-42.39	32.63	At least 20dB below from peak of RF	PASS
High	2452	-9.64	2484.78	-44.83	35.19	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 26-Tones] [Chain 1]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-3.63	2399.92	-39.09	35.46	At least 20dB below from peak of RF	PASS
High	2462	-3.66	2484.22	-48.38	44.72	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 52-Tones] [Chain 1]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-6.09	2399.76	-36.55	30.46	At least 20dB below from peak of RF	PASS
High	2462	-6.28	2484.78	-48.70	42.42	At least 20dB below from peak of RF	PASS

[IEEE802.11ax (HE20) 106-Tones] [Chain 1]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-8.05	2399.84	-35.71	27.66	At least 20dB below from peak of RF	PASS
High	2462	-8.39	2484.06	-50.15	41.76	At least 20dB below from peak of RF	PASS

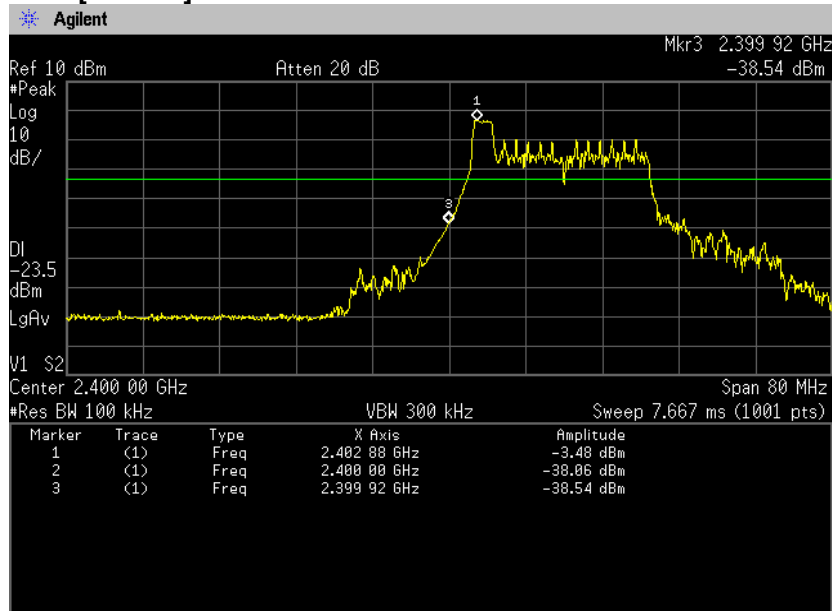
[IEEE802.11ax (HE20) 242-Tones] [Chain 1]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412	-9.80	2399.28	-40.81	31.01	At least 20dB below from peak of RF	PASS
High	2462	-9.50	2484.86	-42.75	33.25	At least 20dB below from peak of RF	PASS

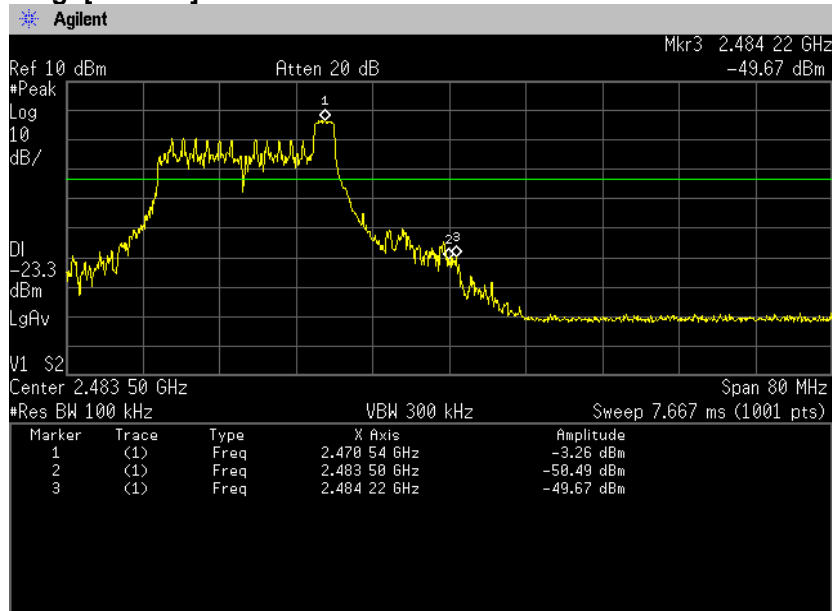
4.3.4 Trace data

[IEEE802.11ax (HE20)_26-Tones]

Channel Low[Chain 0]

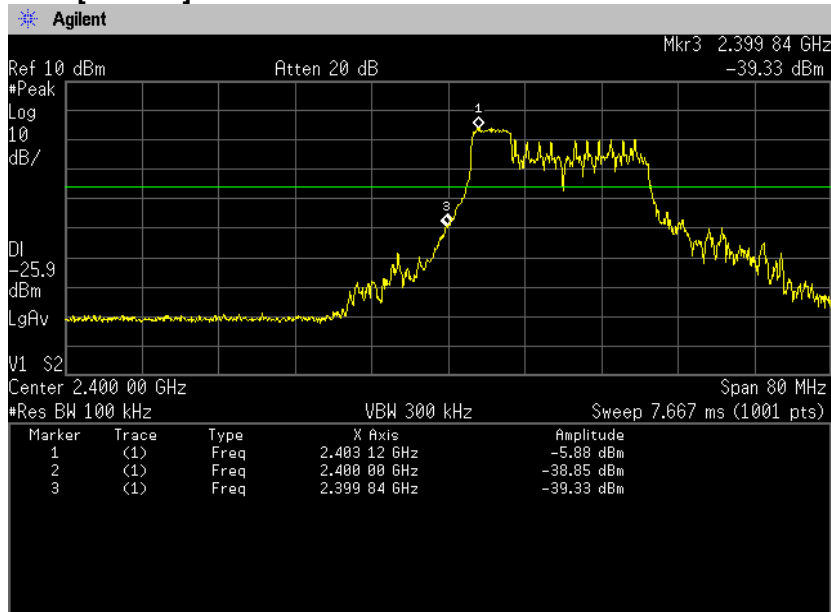


Channel High[Chain 0]

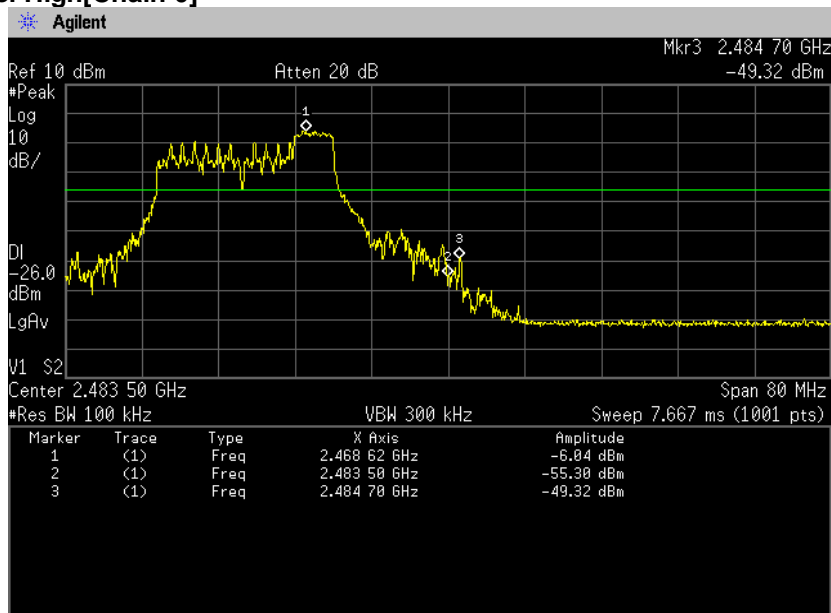


[IEEE802.11ax (HE20)_52-Tones]

Channel Low[Chain 0]

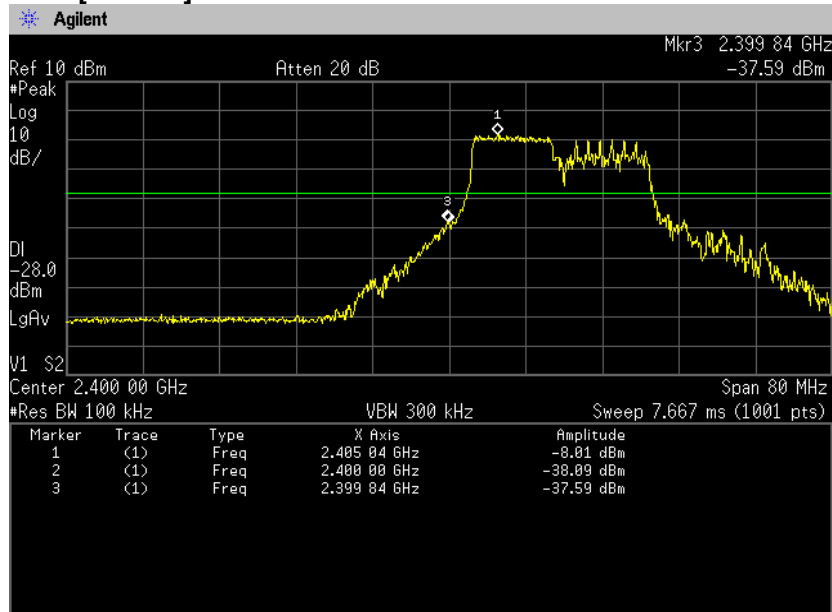


Channel High[Chain 0]

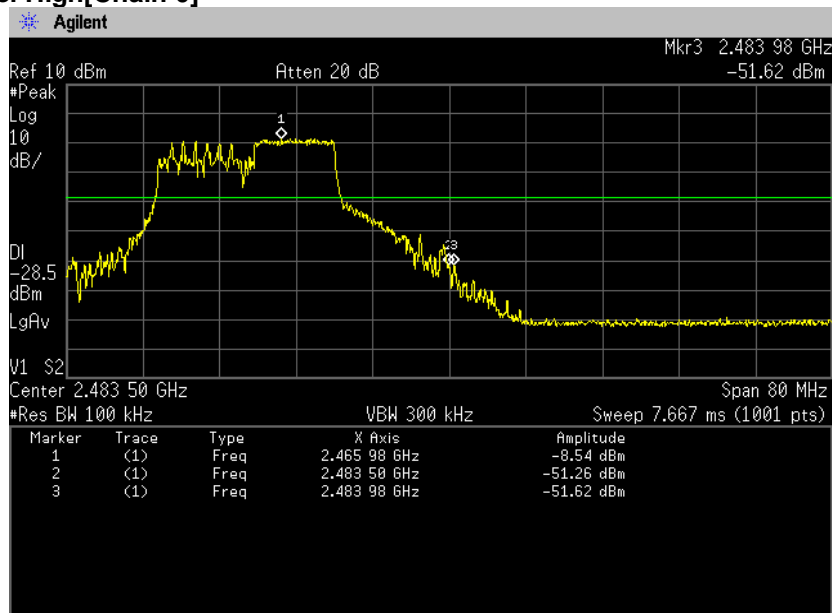


[IEEE802.11ax (HE20)_106-Tones]

Channel Low[Chain 0]

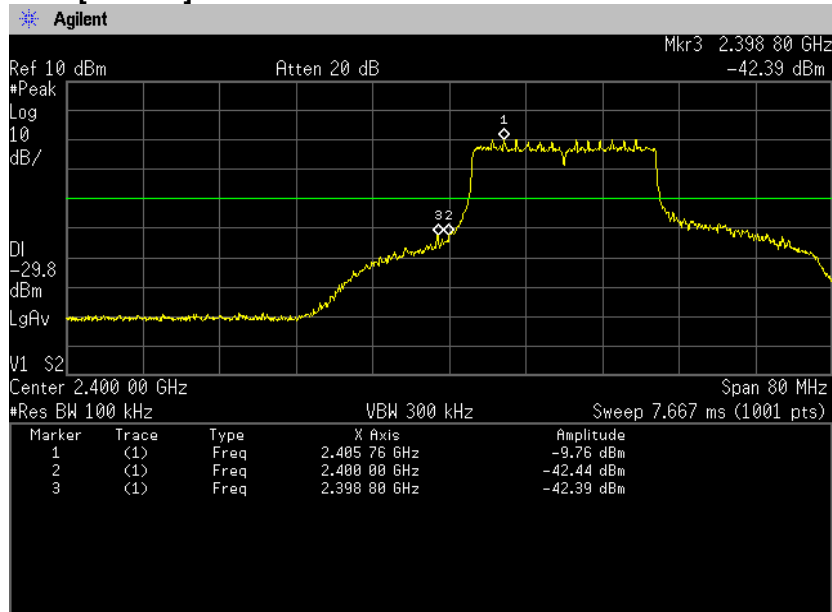


Channel High[Chain 0]

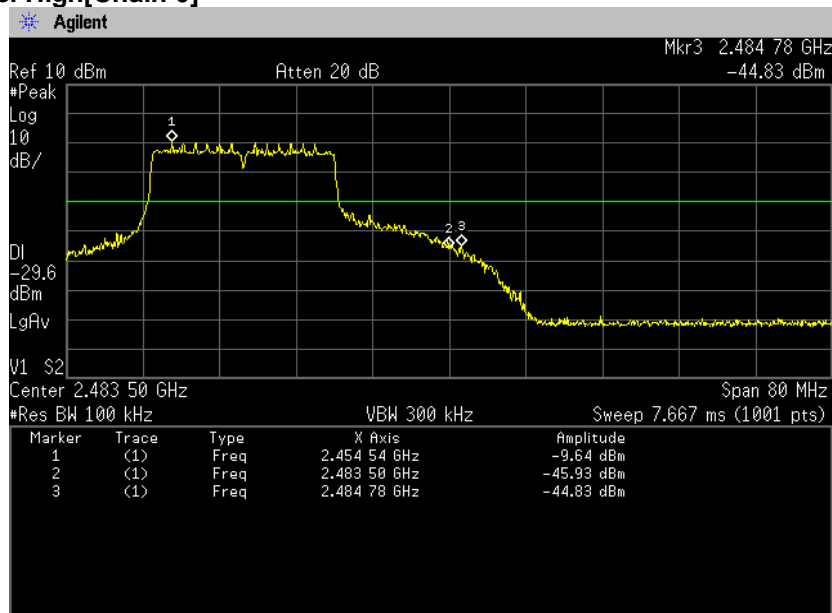


[IEEE802.11ax (HE20)_242-Tones]

Channel Low[Chain 0]

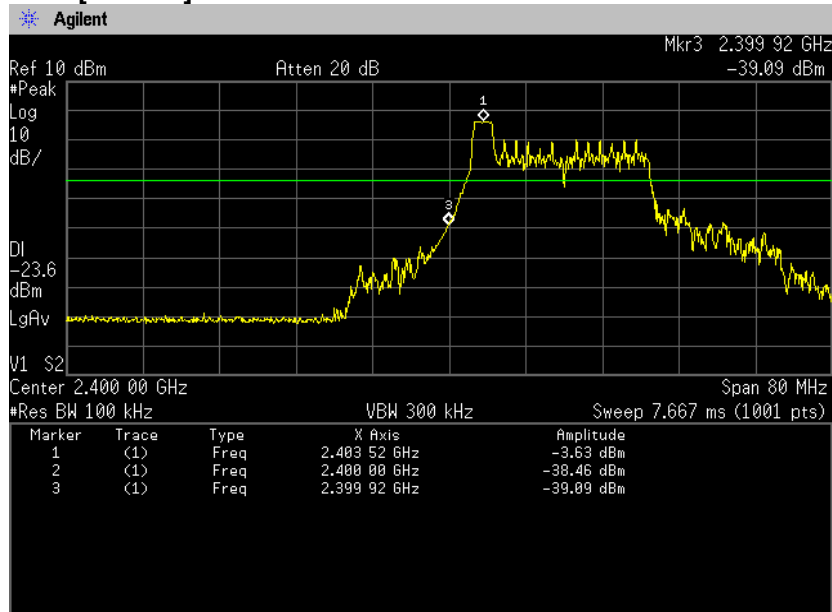


Channel High[Chain 0]

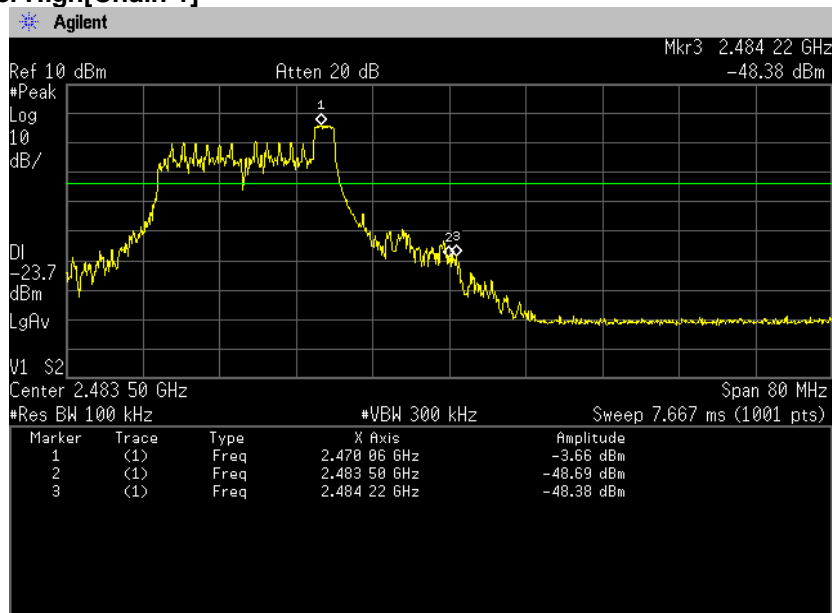


[IEEE802.11ax (HE20)_26-Tones]

Channel Low[Chain 1]

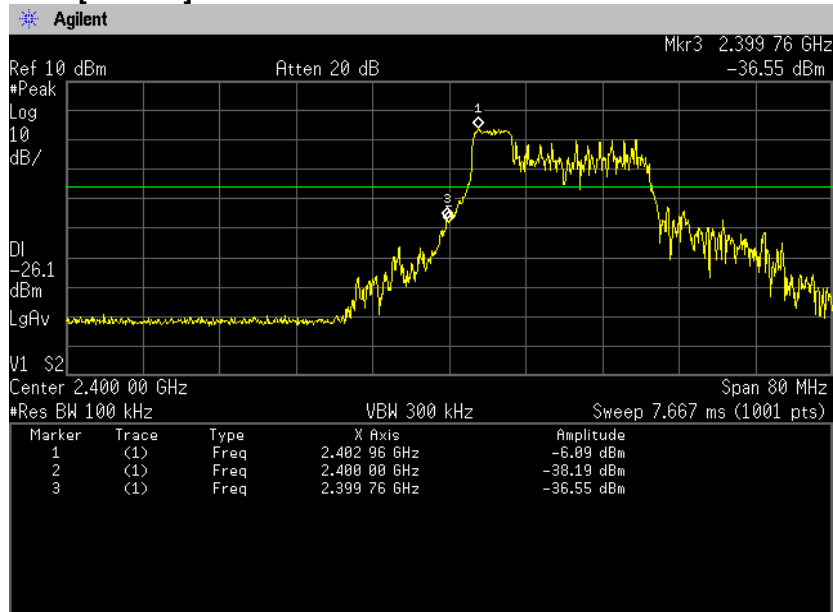


Channel High[Chain 1]

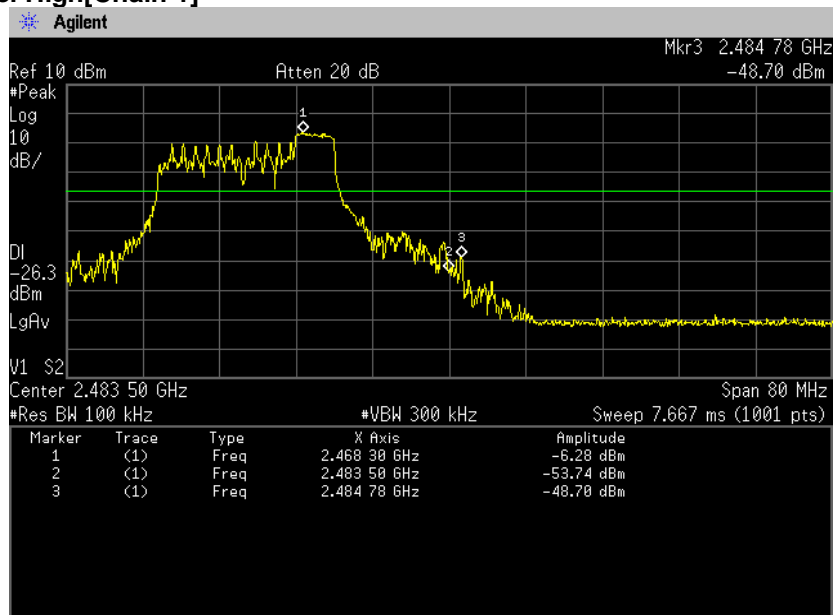


[IEEE802.11ax (HE20)_52-Tones]

Channel Low[Chain 1]

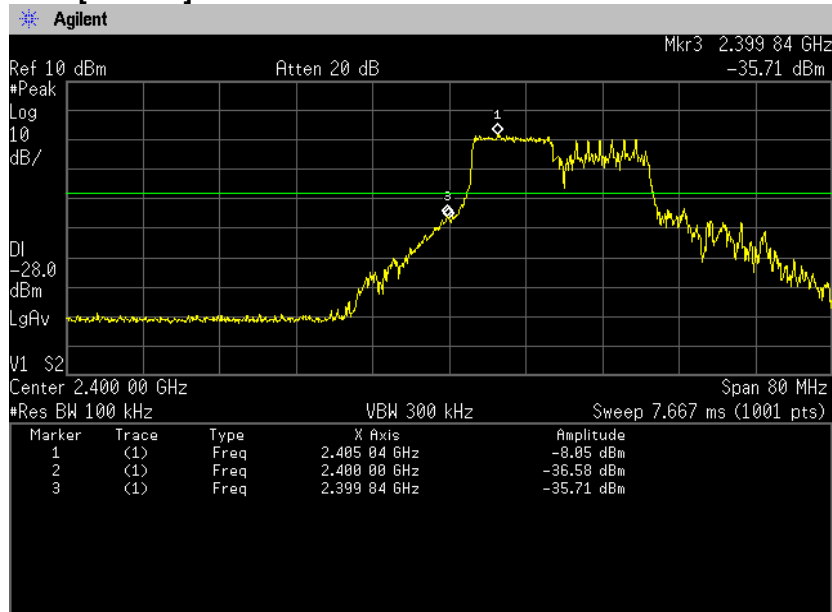


Channel High[Chain 1]

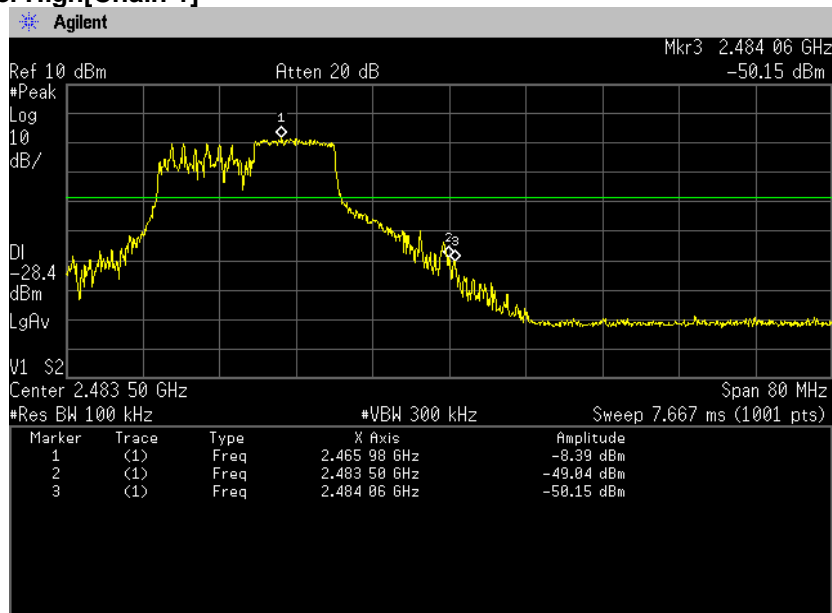


[IEEE802.11ax (HE20)_106-Tones]

Channel Low[Chain 1]

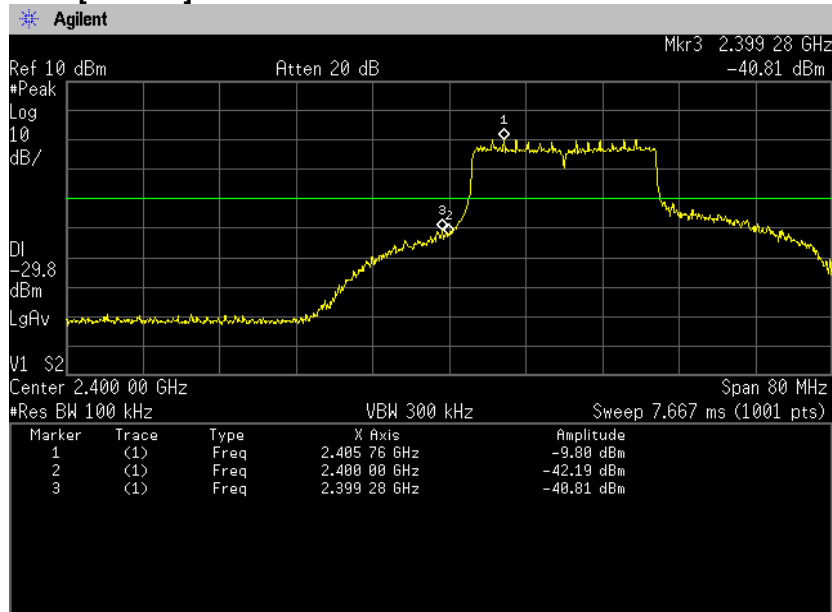


Channel High[Chain 1]

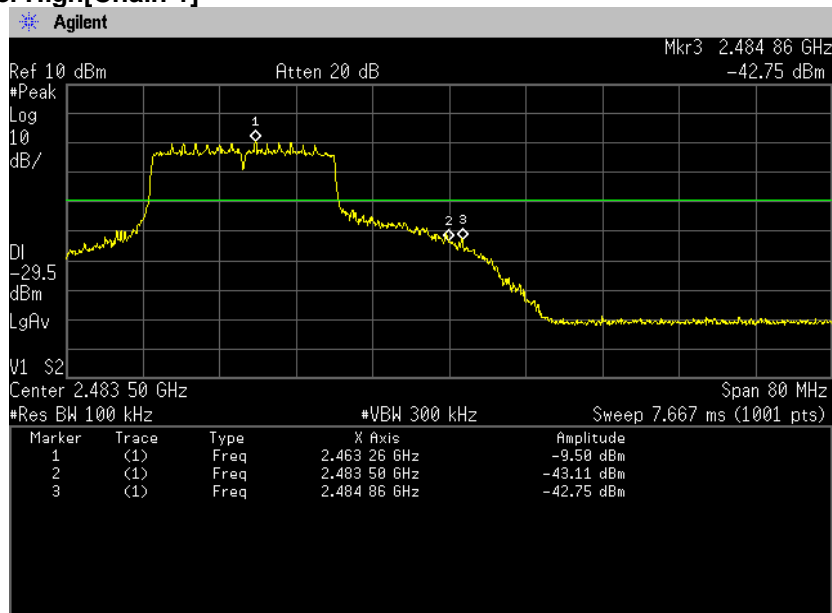


[IEEE802.11ax (HE20)_242-Tones]

Channel Low[Chain 1]



Channel High[Chain 1]



4.4 Spurious Emissions - Conducted -

4.4.1 Measurement procedure

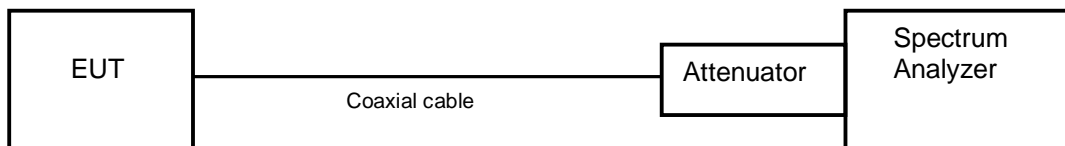
[FCC 15.247(d), KDB 558074 D01 v05r02, Section 8.5]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- a) Span = wide enough to fully capture the emission being measured.
- b) RBW = 100 kHz.
- c) VBW \geq RBW.
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



4.4.2 Limit

In any 100 kHz bandwidth outside the frequency band 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.



Japan

4.4.3 Measurement result

Date : 21-July-2023
 Temperature : 23.7 [°C]
 Humidity : 65.8 [%]
 Test place : Shielded room No.4

Test engineer : Kazunori Saito

Date : 24-July-2023
 Temperature : 23.0 [°C]
 Humidity : 59.3 [%]
 Test place : Shielded room No.4

Test engineer : Kazunori Saito

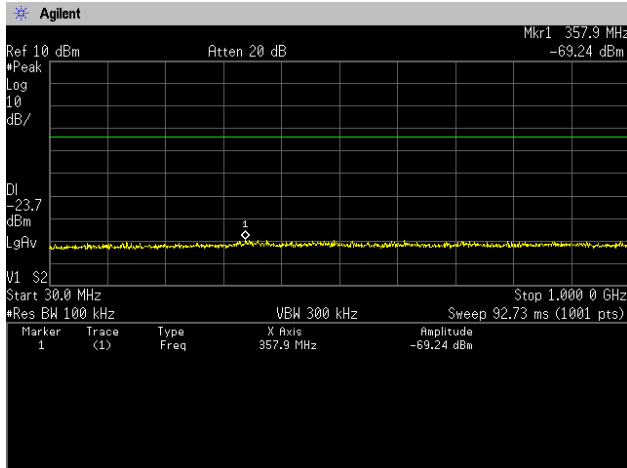
[IEEE802.11b, IEEE802.11g, IEEE802.11ax (HE20)]

Channel	Frequency [MHz]	Limit [dB]	Results Chart	Result
Low	2412	At least 20dB below from peak of RF	See the trace Data	PASS
Middle	2437	At least 20dB below from peak of RF	See the trace Data	PASS
High	2462	At least 20dB below from peak of RF	See the trace Data	PASS

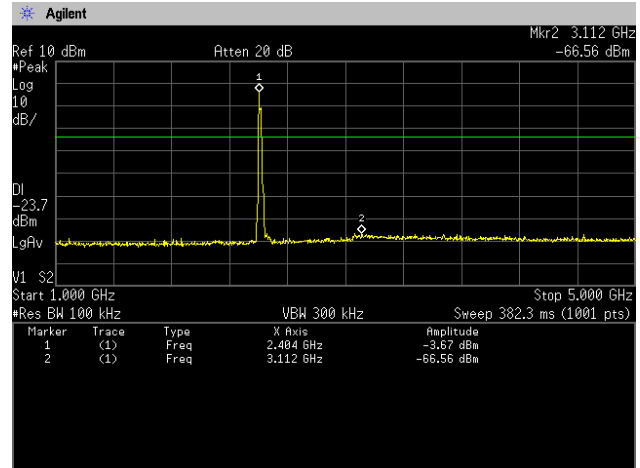


4.4.4 Trace data

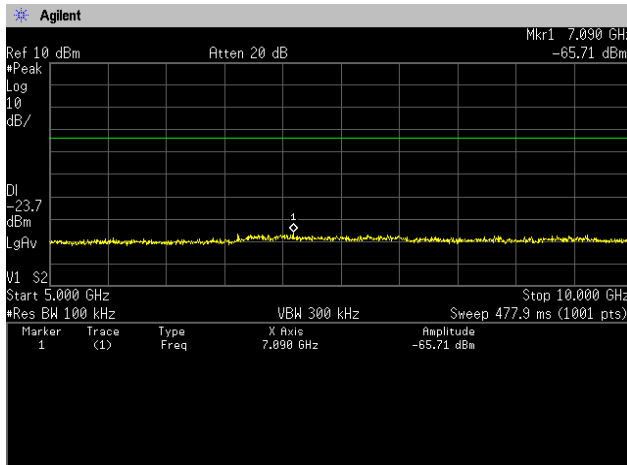
[IEEE802.11ax (HE20)_26-Tones]
Channel Low[Chain 0]
30MHz-1GHz



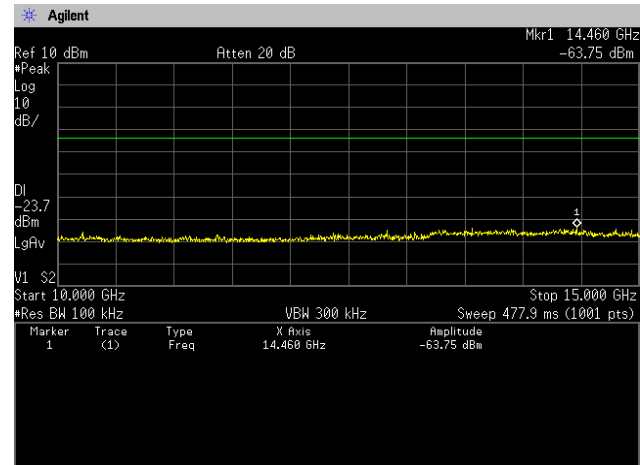
1GHz-5GHz



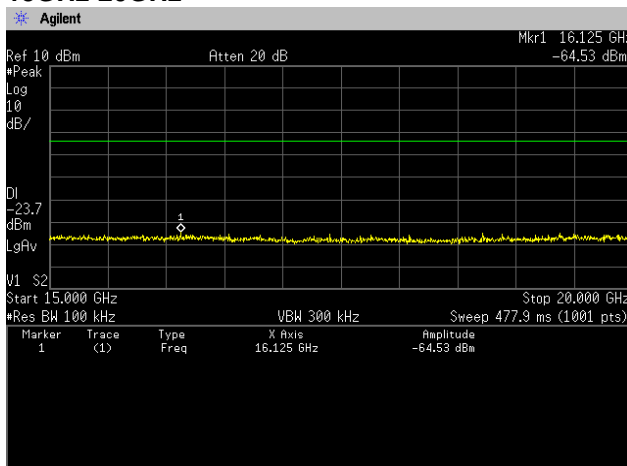
5GHz-10GHz



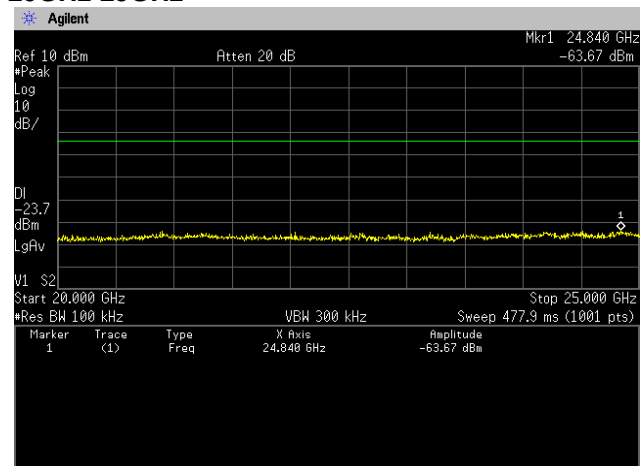
10GHz-15GHz



15GHz-20GHz

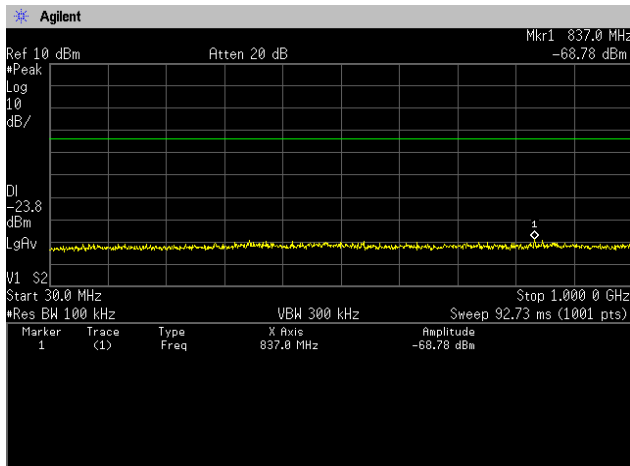


20GHz-25GHz

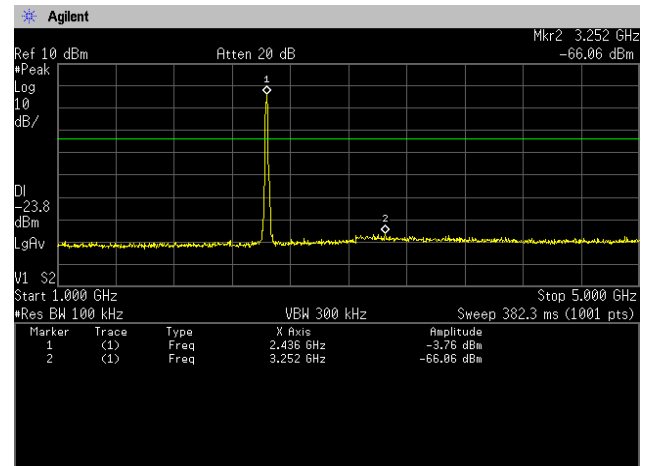




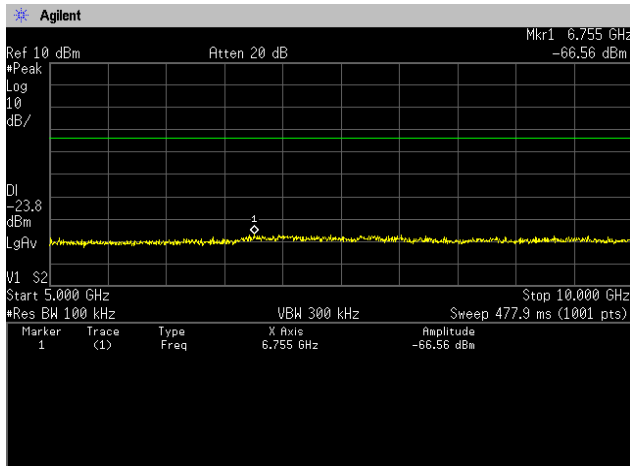
**Channel Middle[Chain 0]
30MHz-1GHz**



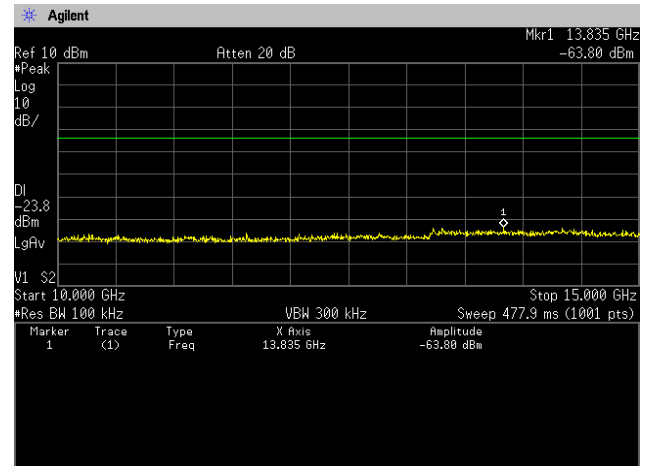
1GHz-5GHz



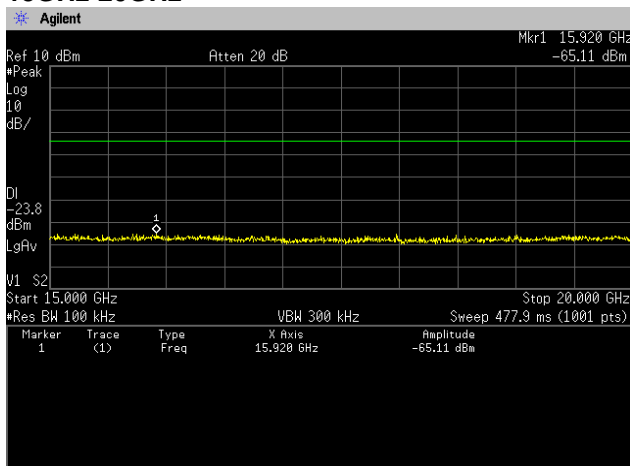
5GHz-10GHz



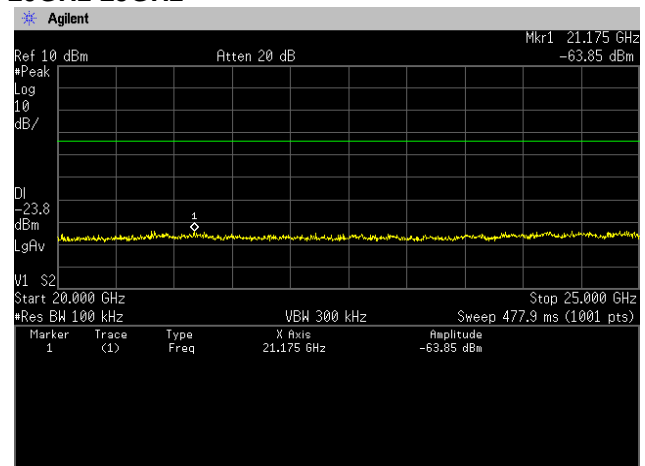
10GHz-15GHz



15GHz-20GHz

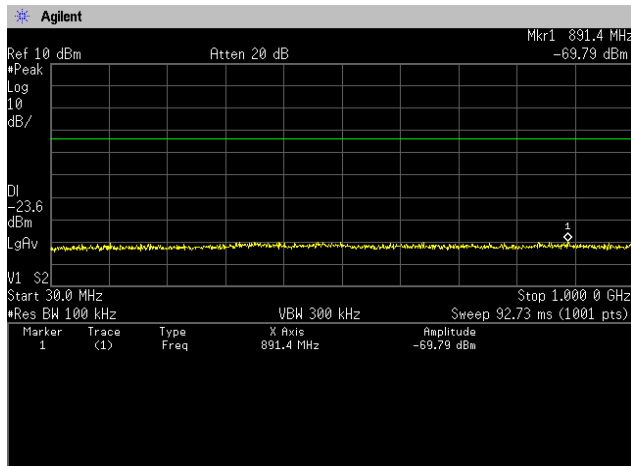


20GHz-25GHz

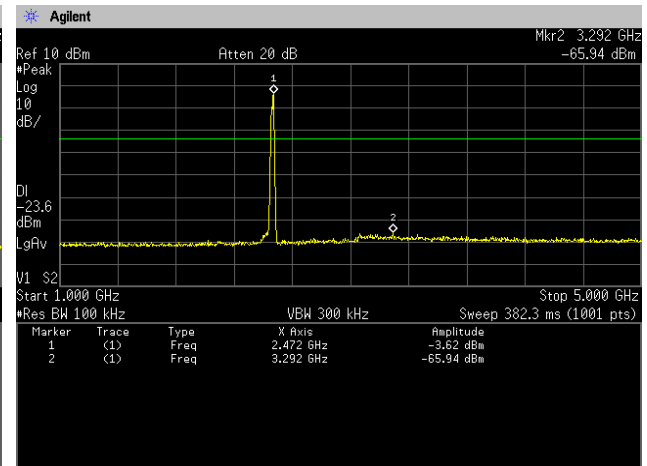




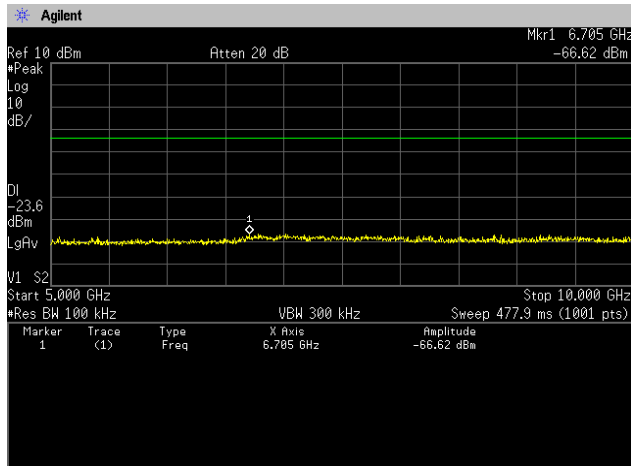
**Channel High[Chain 0]
30MHz-1GHz**



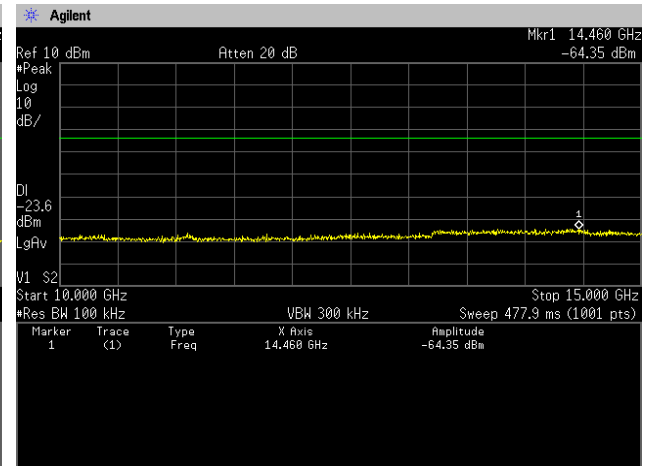
1GHz-5GHz



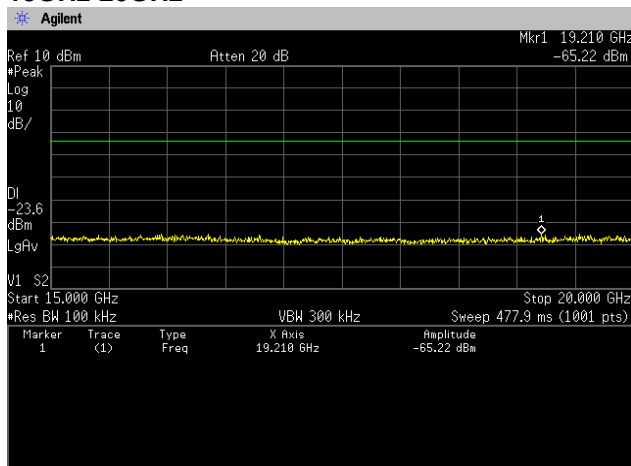
5GHz-10GHz



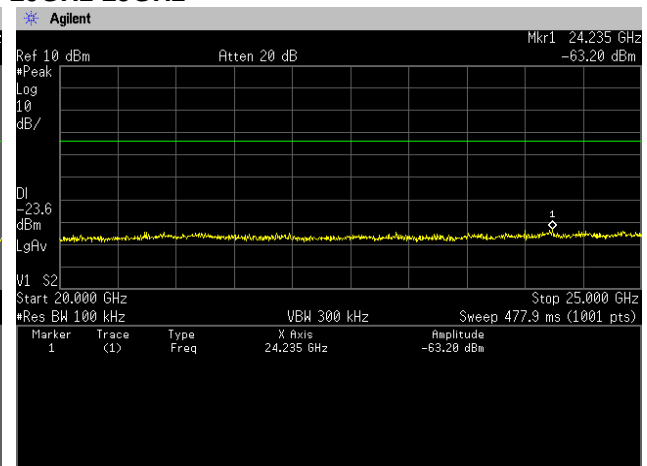
10GHz-15GHz



15GHz-20GHz

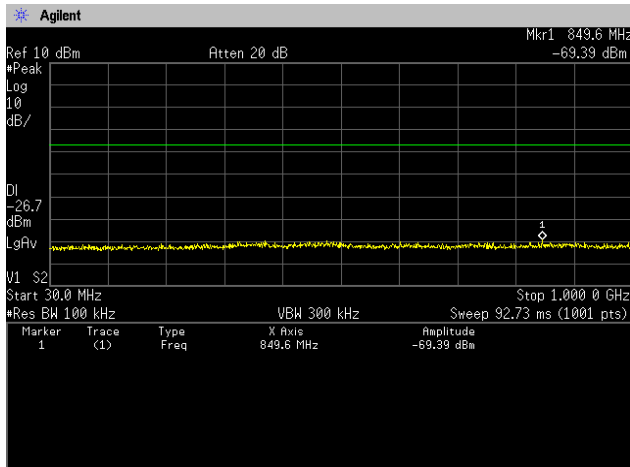


20GHz-25GHz

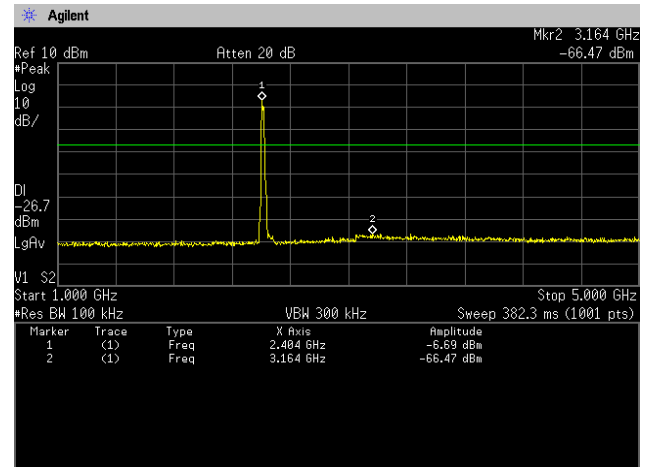




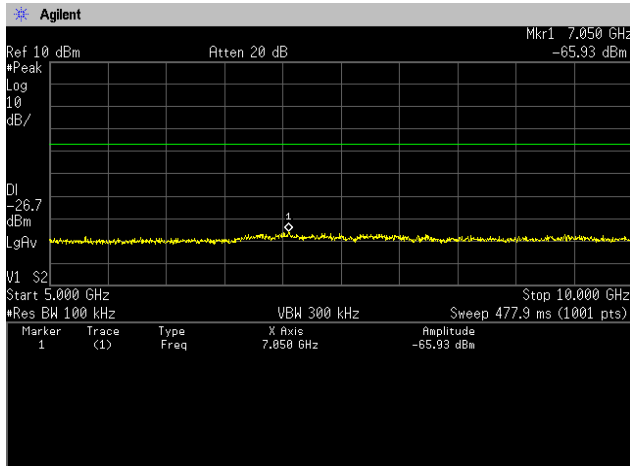
**[IEEE802.11ax (HE20)_52-Tones]
Channel Low[Chain 0]
30MHz-1GHz**



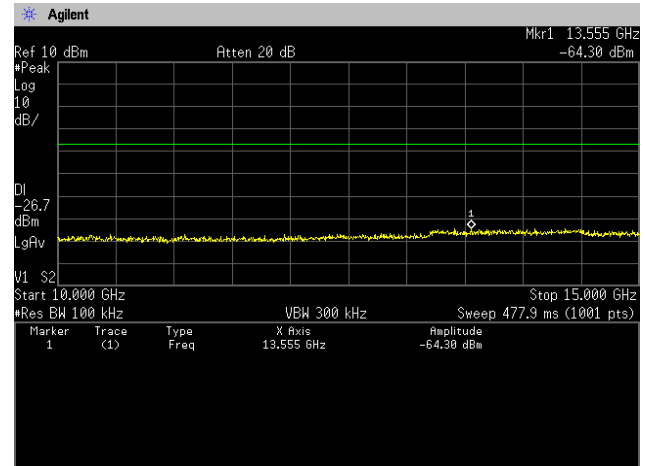
1GHz-5GHz



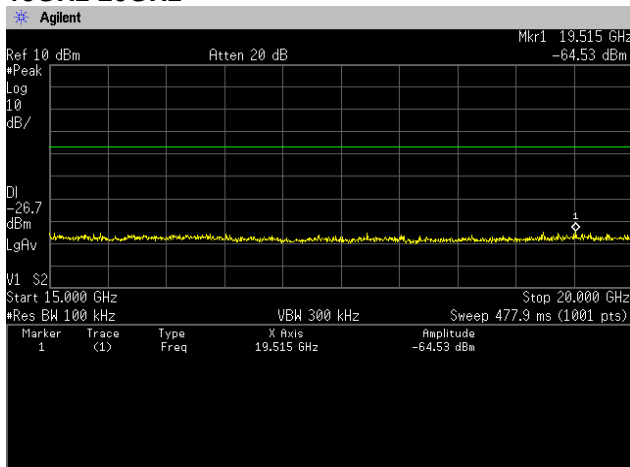
5GHz-10GHz



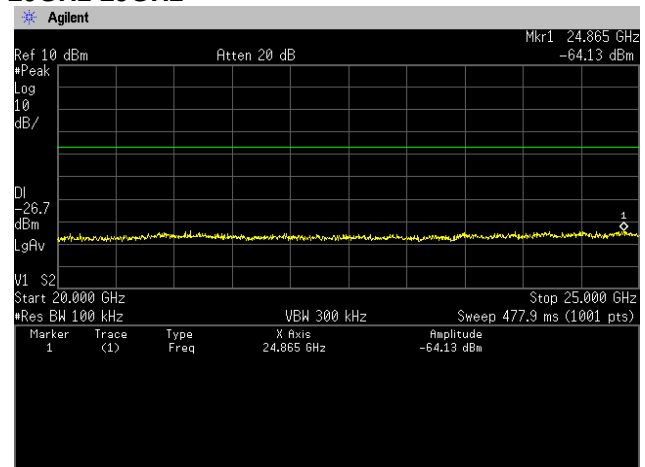
10GHz-15GHz



15GHz-20GHz

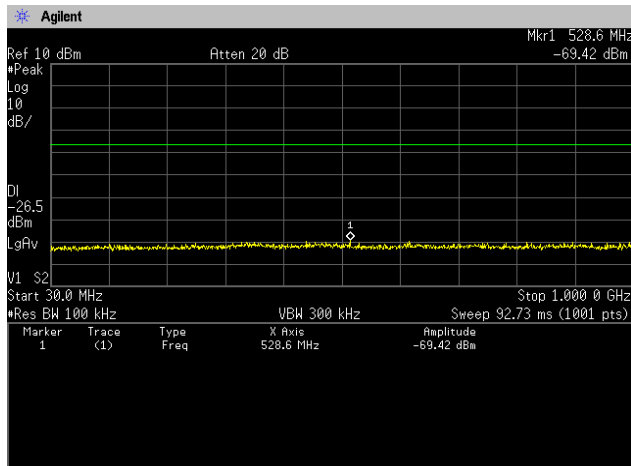


20GHz-25GHz

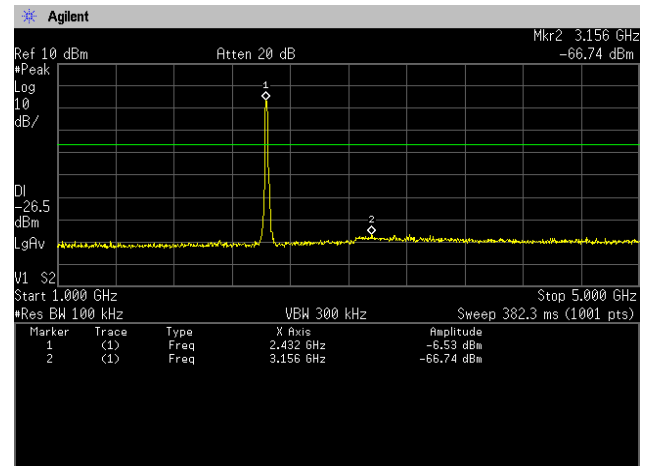




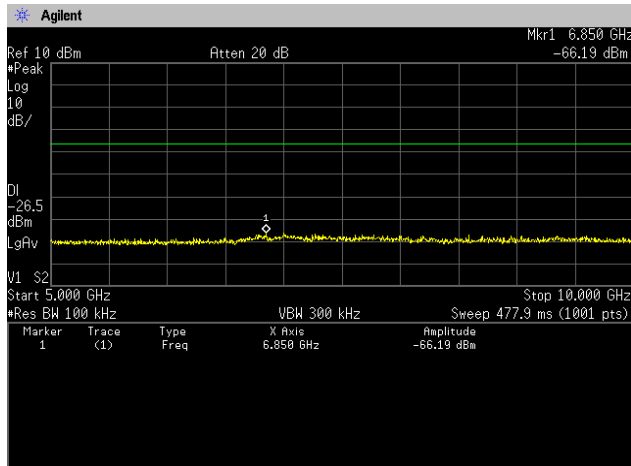
**Channel Middle[Chain 0]
30MHz-1GHz**



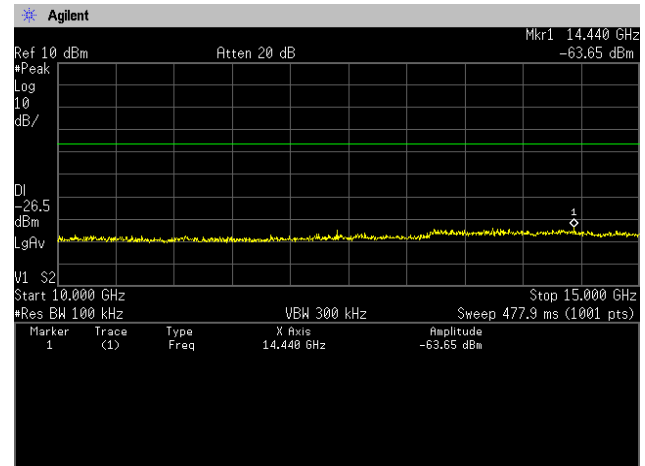
1GHz-5GHz



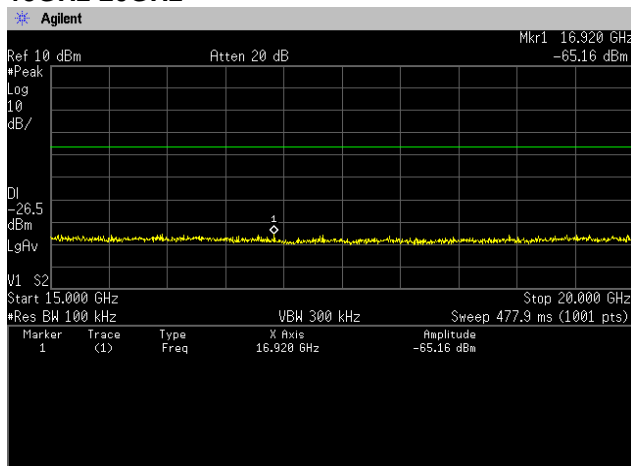
5GHz-10GHz



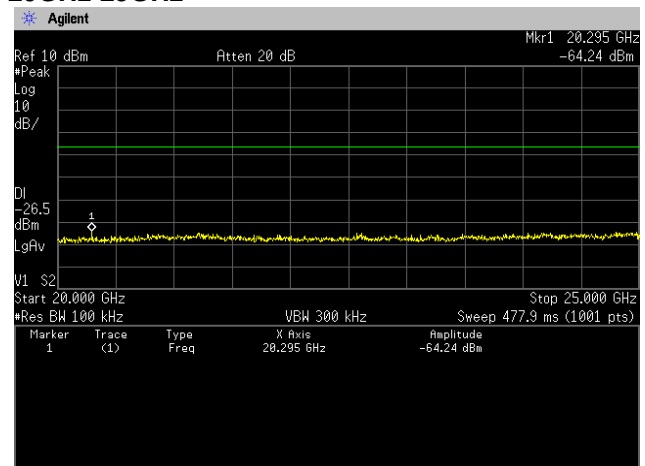
10GHz-15GHz



15GHz-20GHz

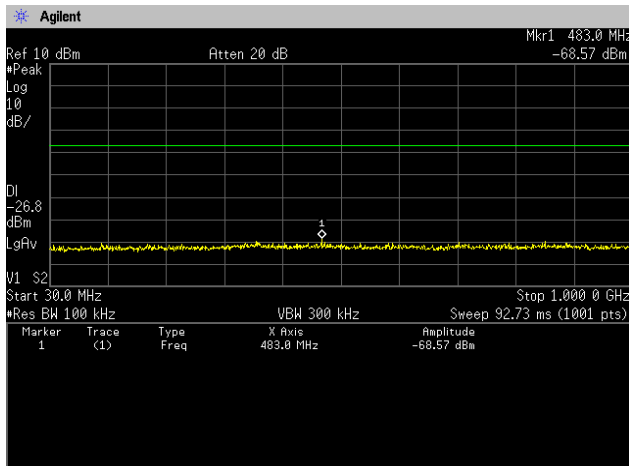


20GHz-25GHz

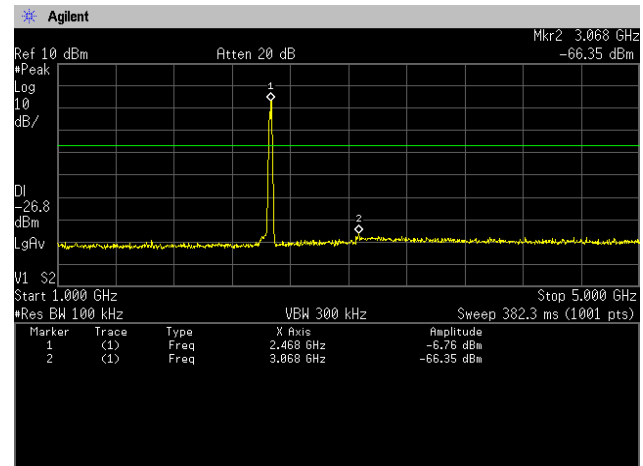




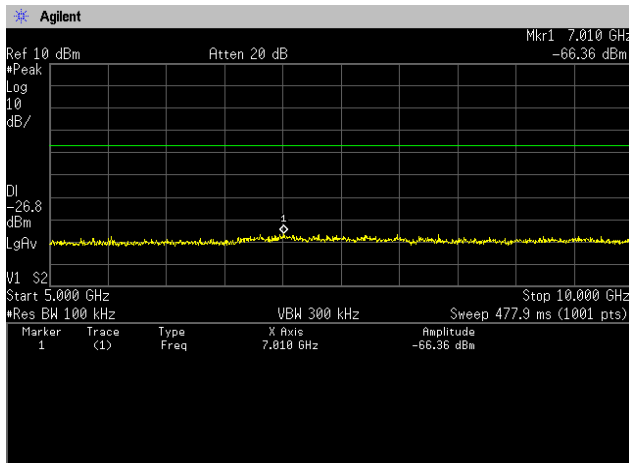
**Channel High[Chain 0]
30MHz-1GHz**



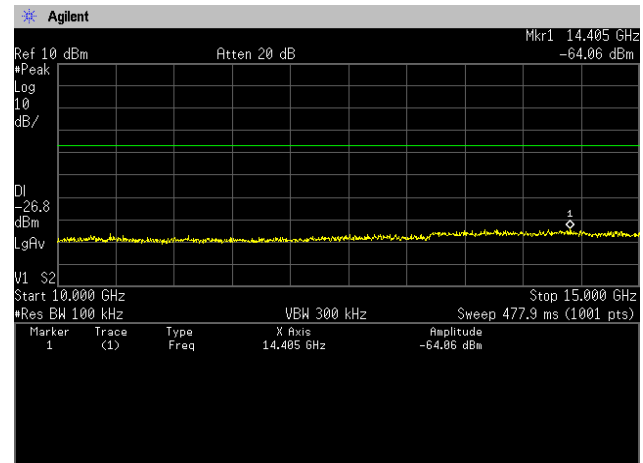
1GHz-5GHz



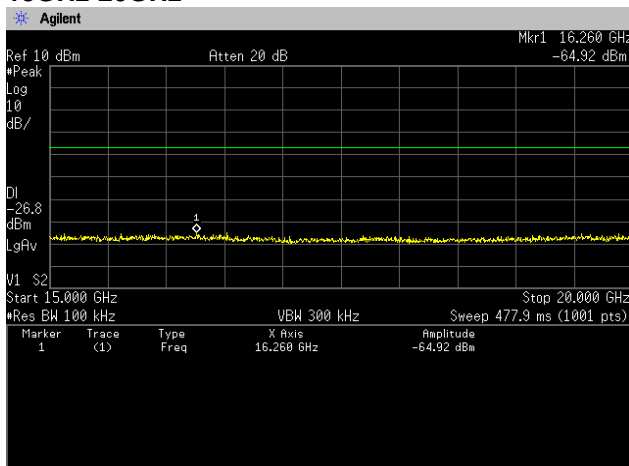
5GHz-10GHz



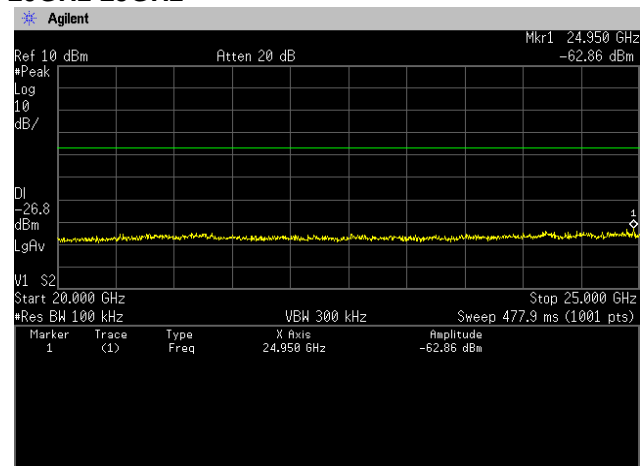
10GHz-15GHz



15GHz-20GHz

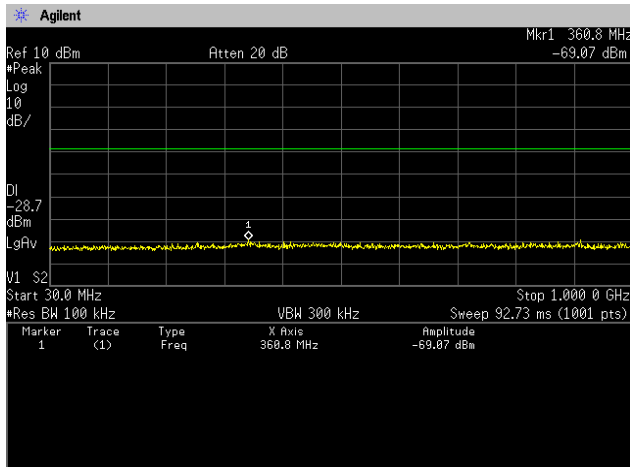


20GHz-25GHz

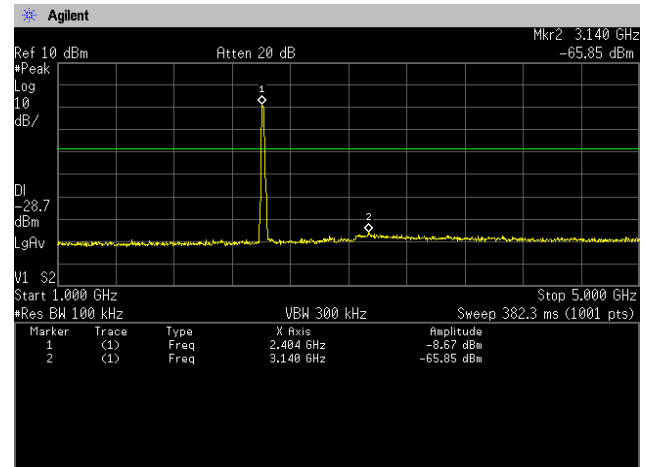




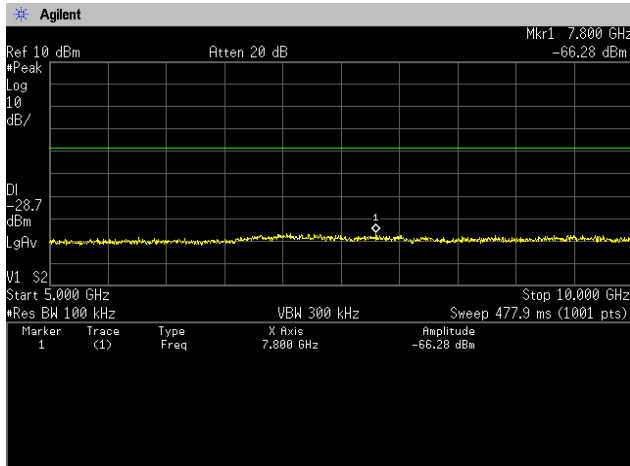
**[IEEE802.11ax (HE20)_106-Tones]
Channel Low[Chain 0]
30MHz-1GHz**



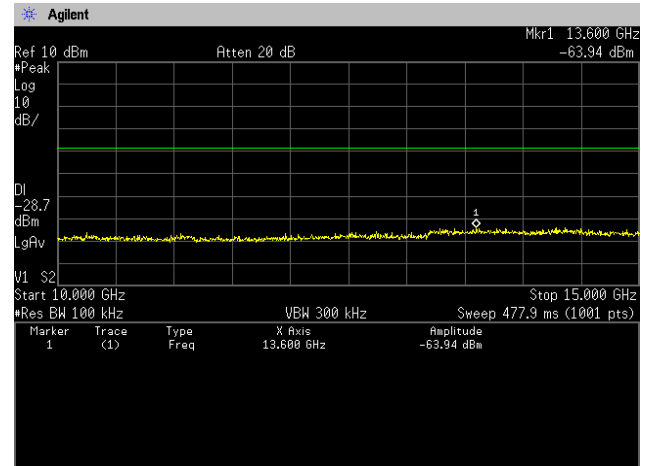
1GHz-5GHz



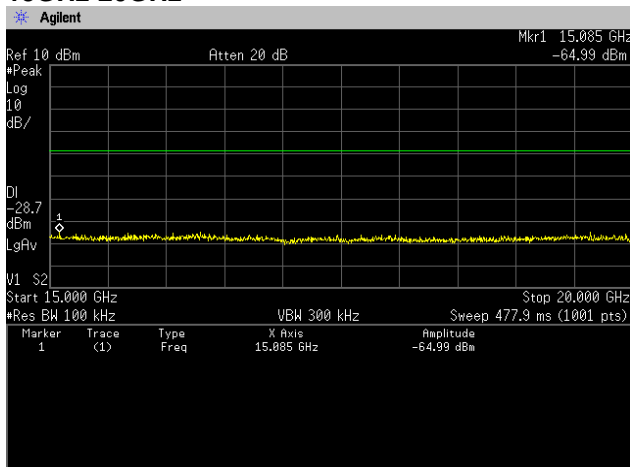
5GHz-10GHz



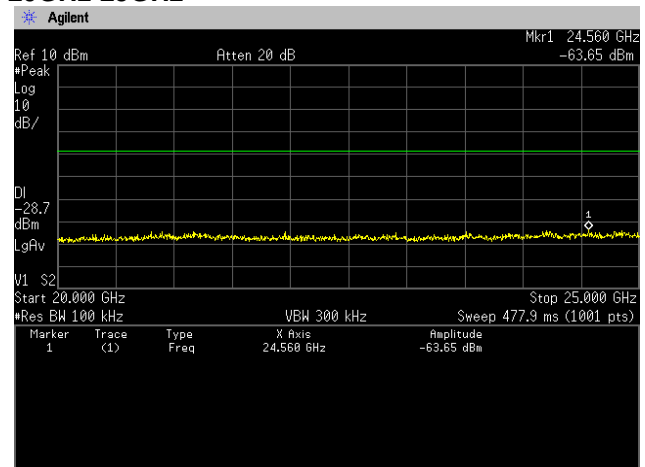
10GHz-15GHz



15GHz-20GHz

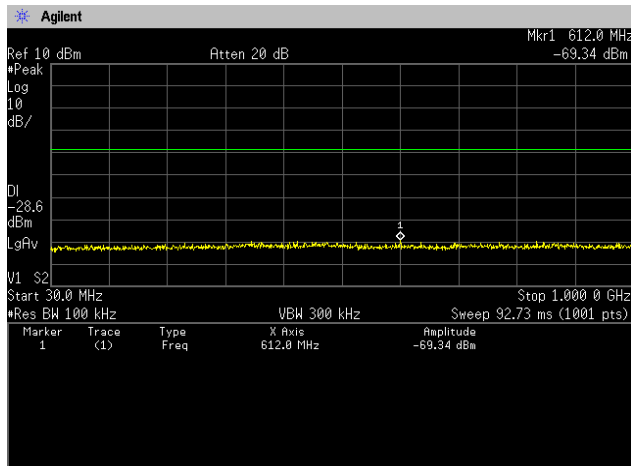


20GHz-25GHz

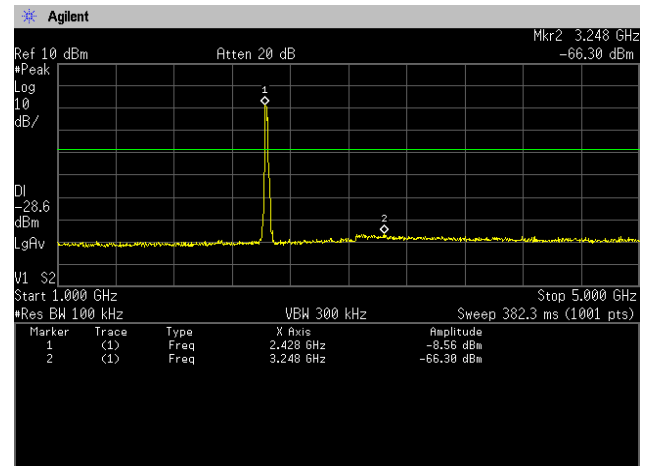




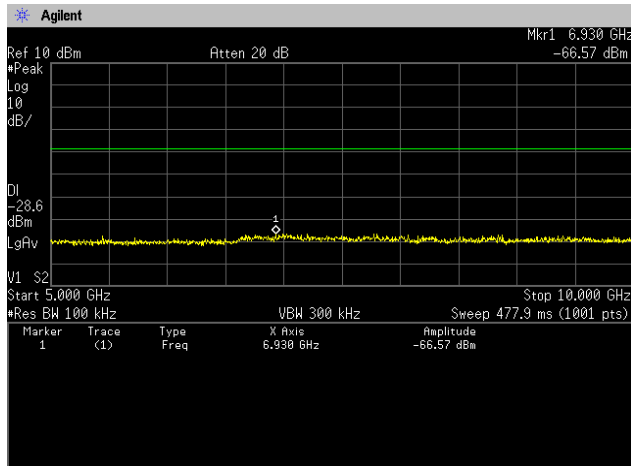
**Channel Middle[Chain 0]
30MHz-1GHz**



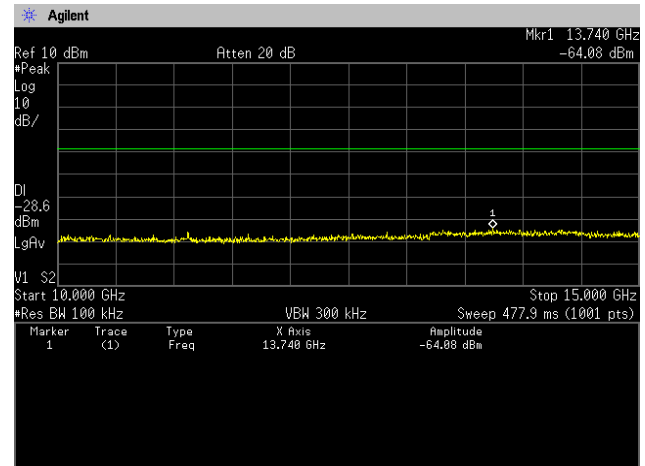
1GHz-5GHz



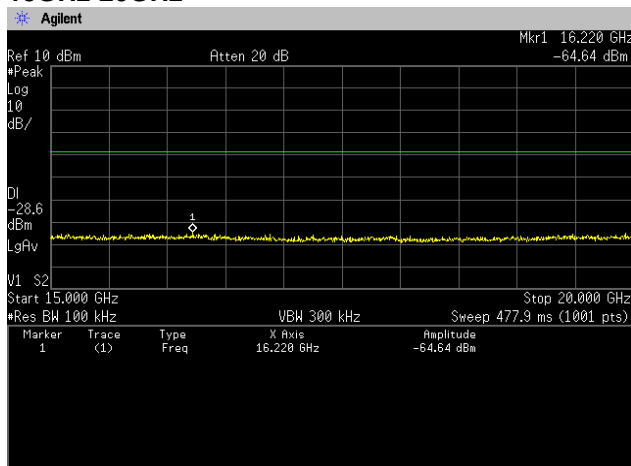
5GHz-10GHz



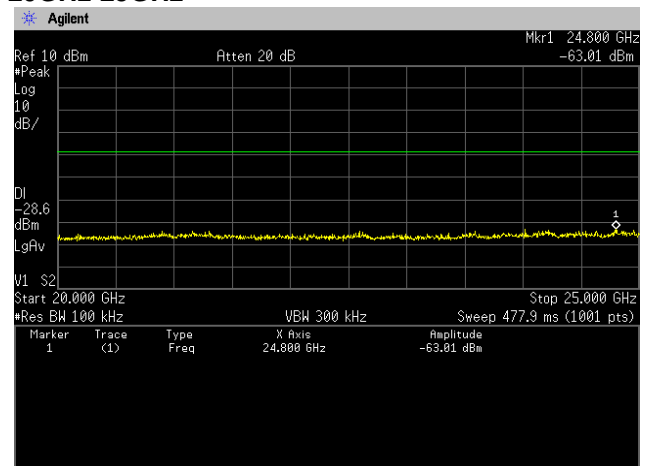
10GHz-15GHz



15GHz-20GHz

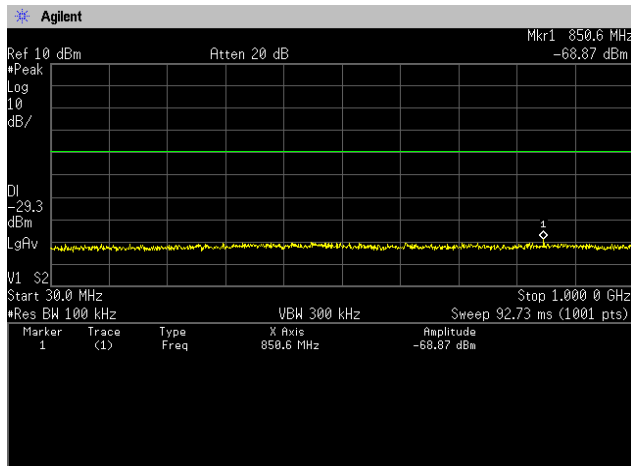


20GHz-25GHz

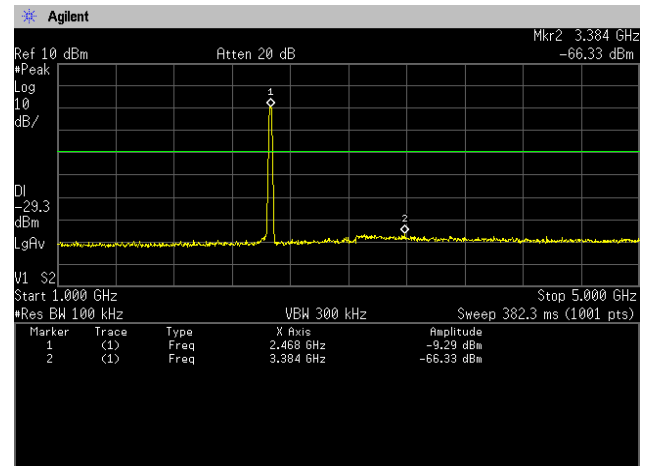




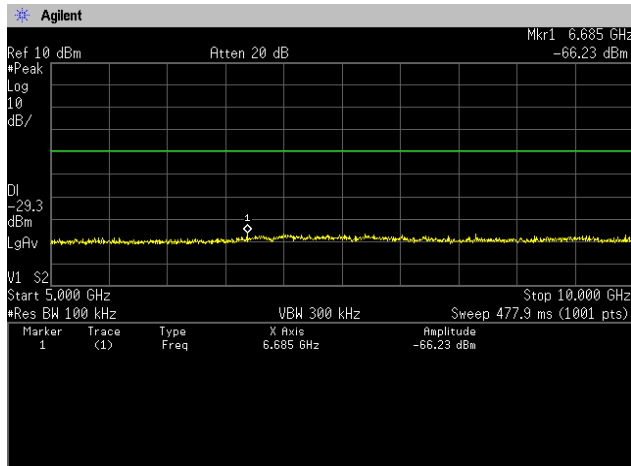
**Channel High[Chain 0]
30MHz-1GHz**



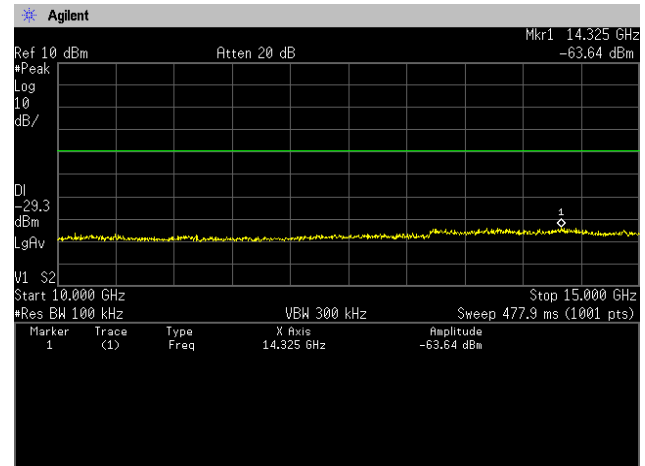
1GHz-5GHz



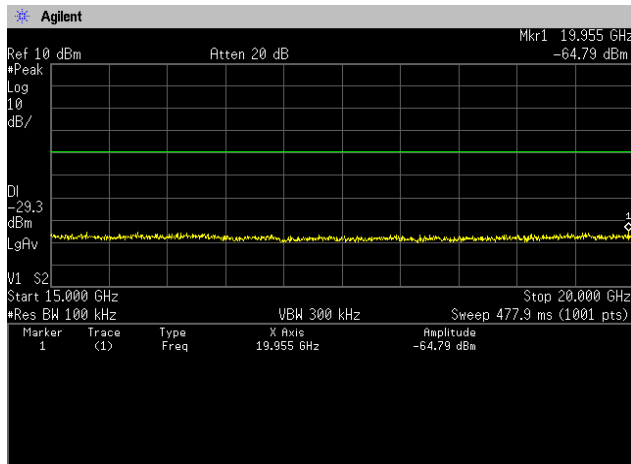
5GHz-10GHz



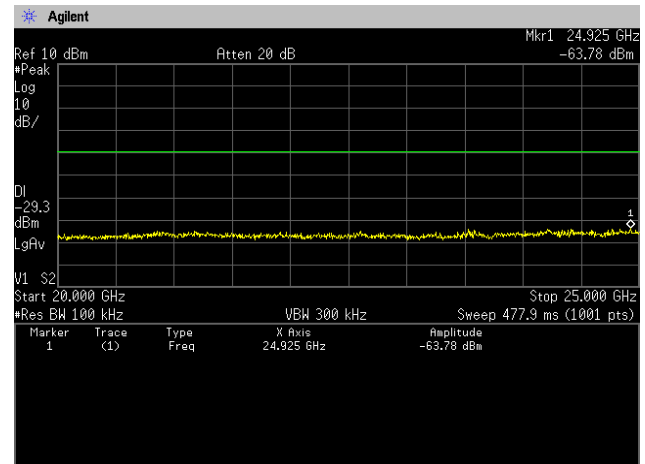
10GHz-15GHz



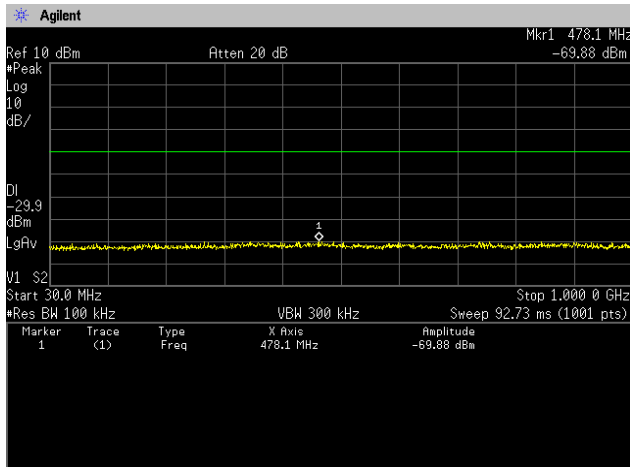
15GHz-20GHz



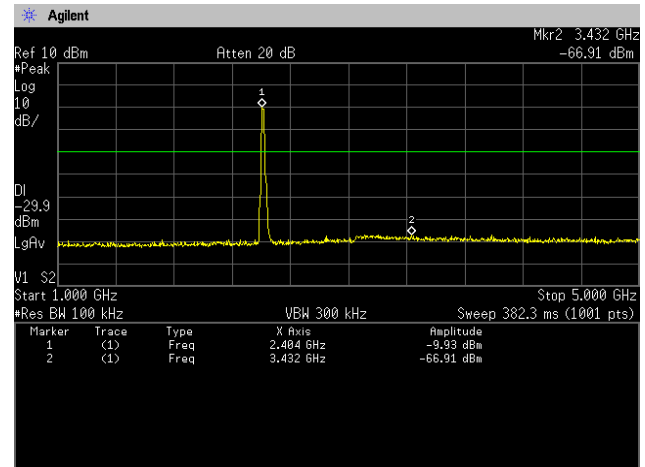
20GHz-25GHz



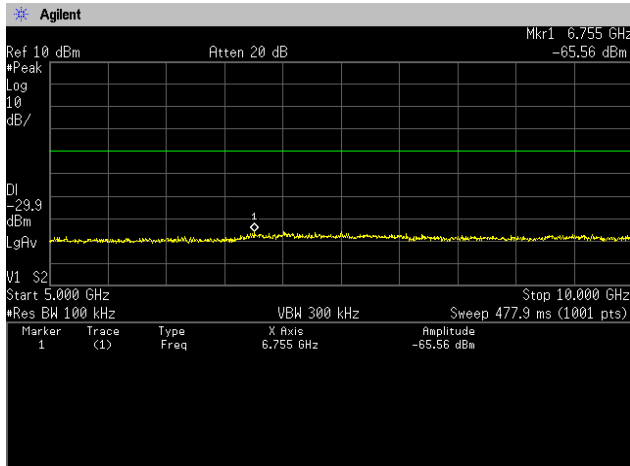
**[IEEE802.11ax (HE20)_242-Tones]
Channel Low[Chain 0]
30MHz-1GHz**



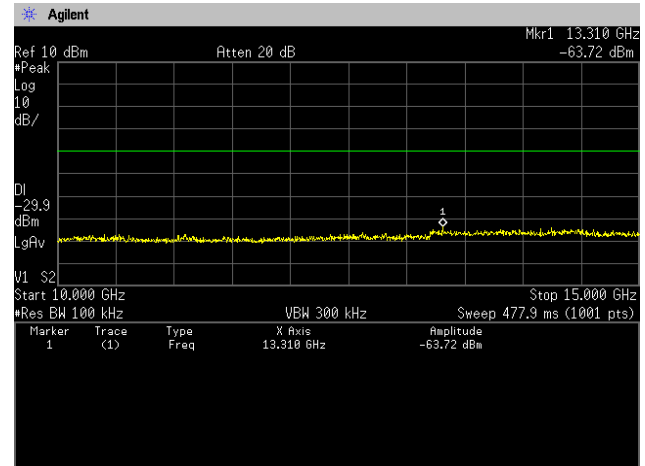
1GHz-5GHz



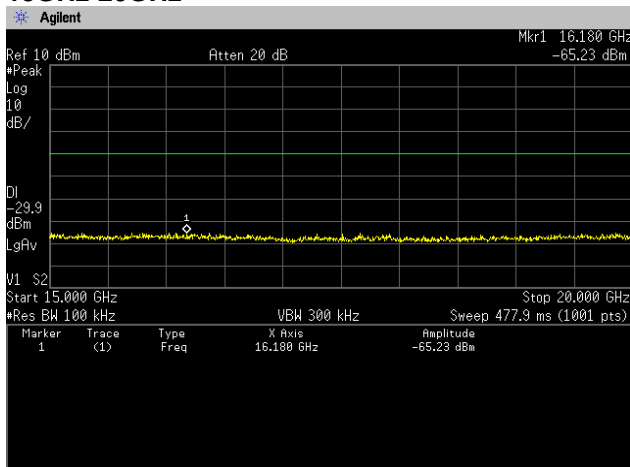
5GHz-10GHz



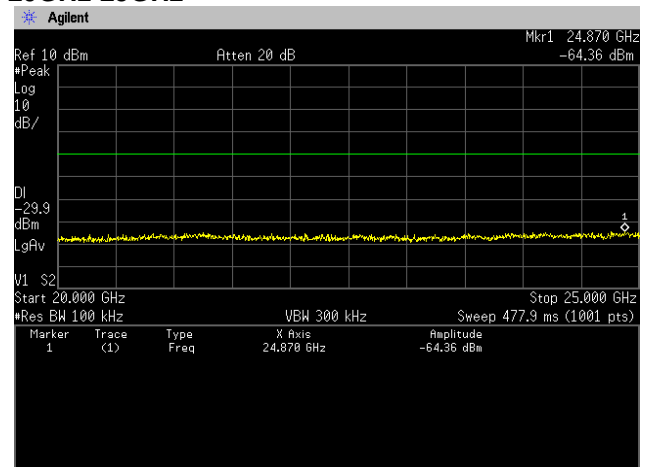
10GHz-15GHz



15GHz-20GHz

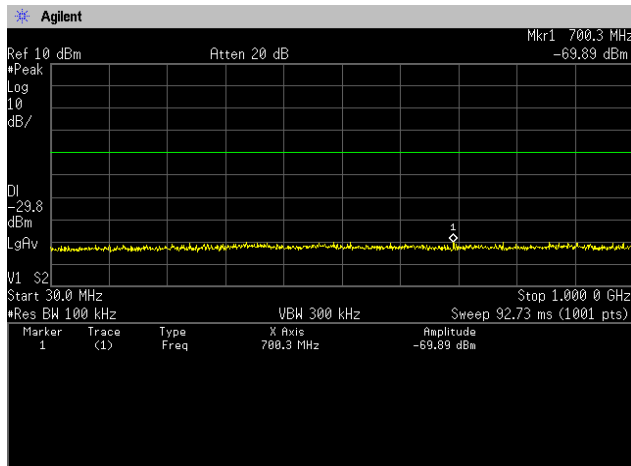


20GHz-25GHz

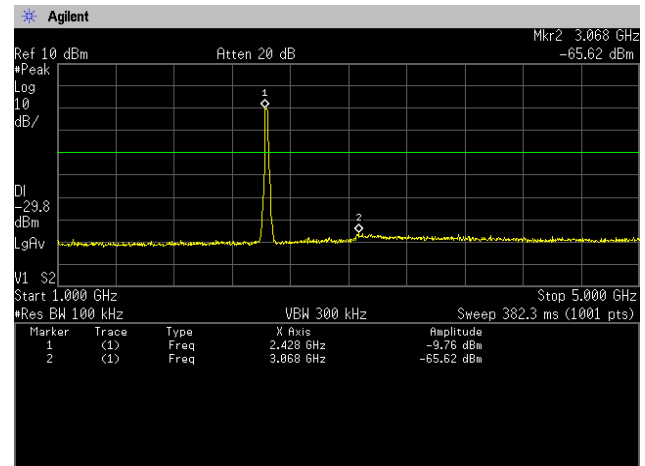




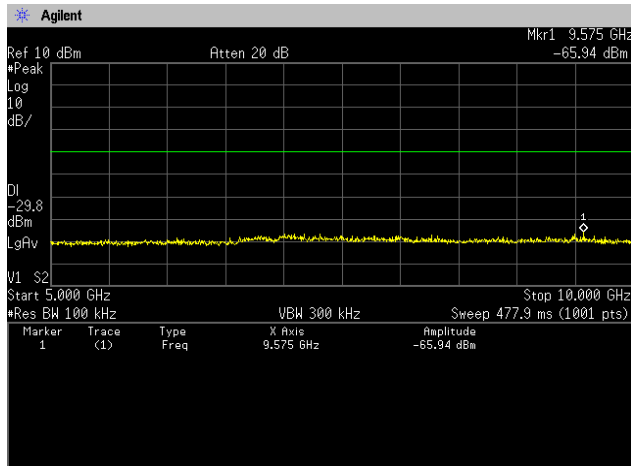
**Channel Middle[Chain 0]
30MHz-1GHz**



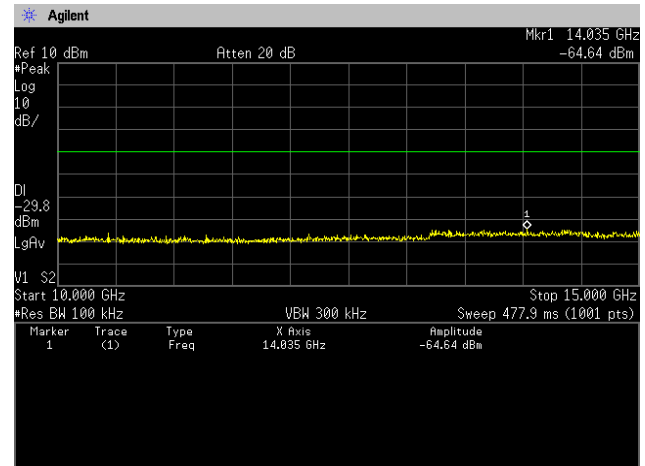
1GHz-5GHz



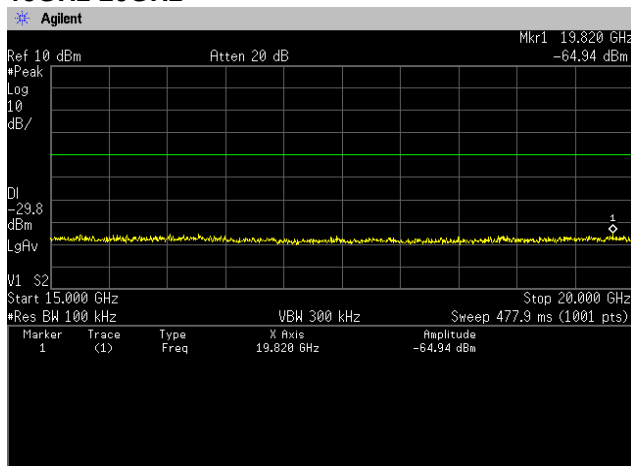
5GHz-10GHz



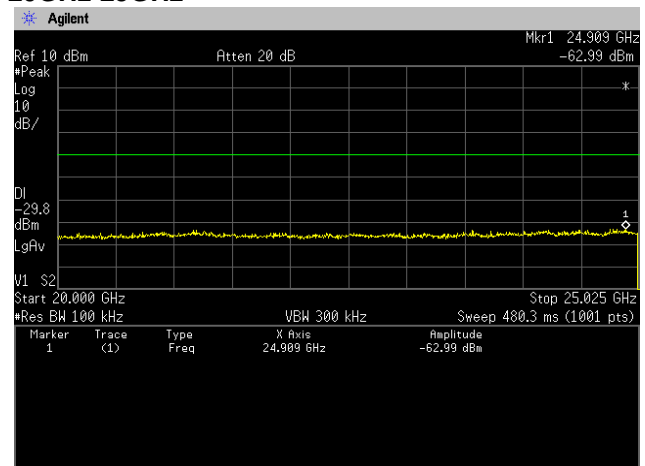
10GHz-15GHz



15GHz-20GHz

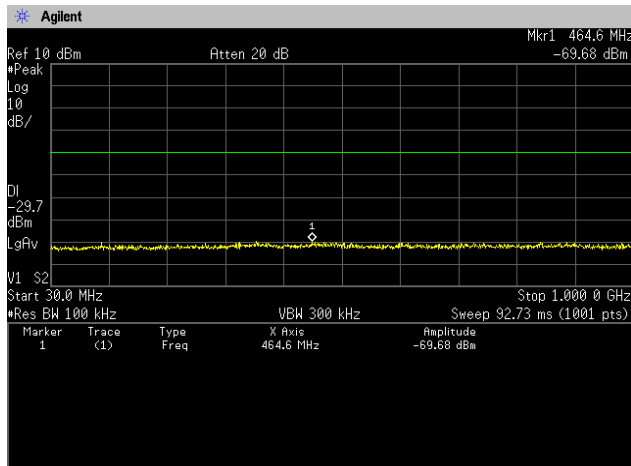


20GHz-25GHz

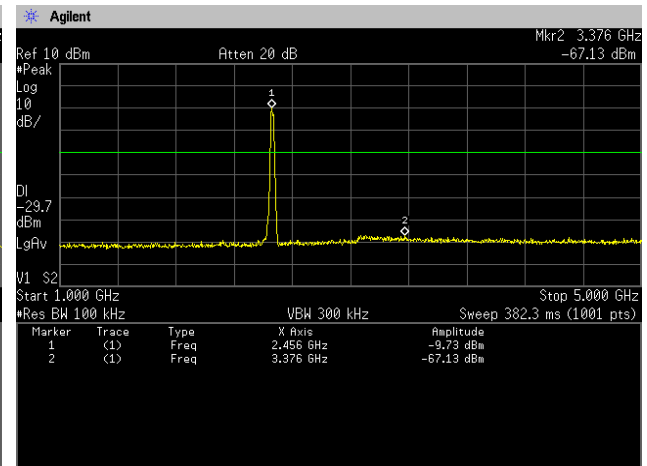




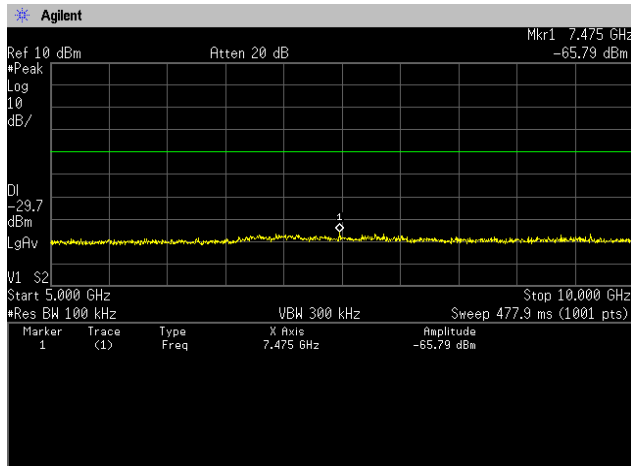
**Channel High[Chain 0]
30MHz-1GHz**



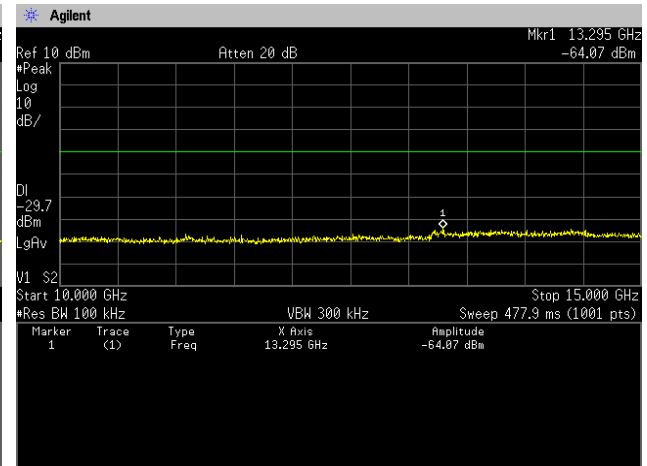
1GHz-5GHz



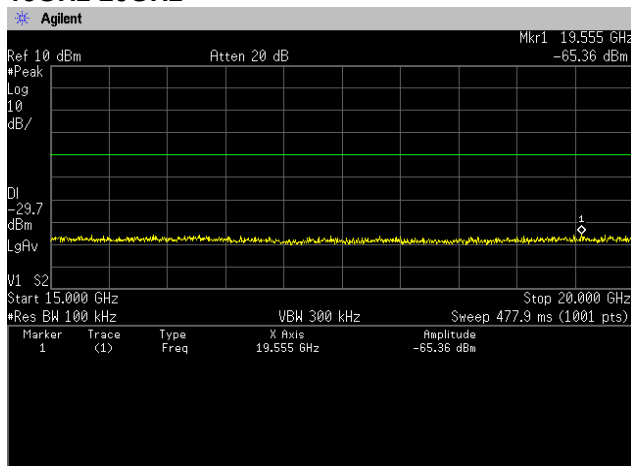
5GHz-10GHz



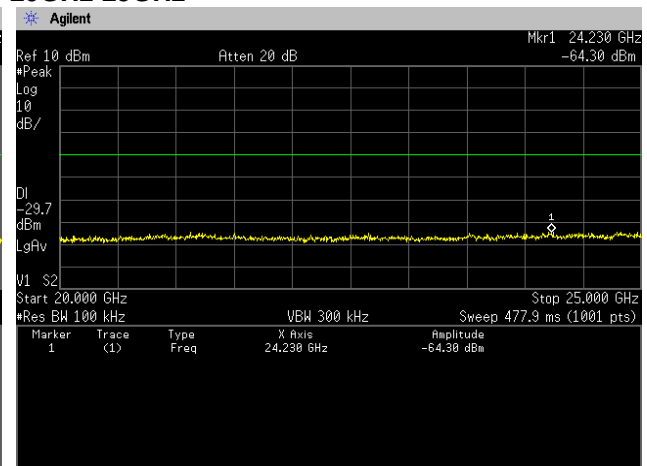
10GHz-15GHz



15GHz-20GHz

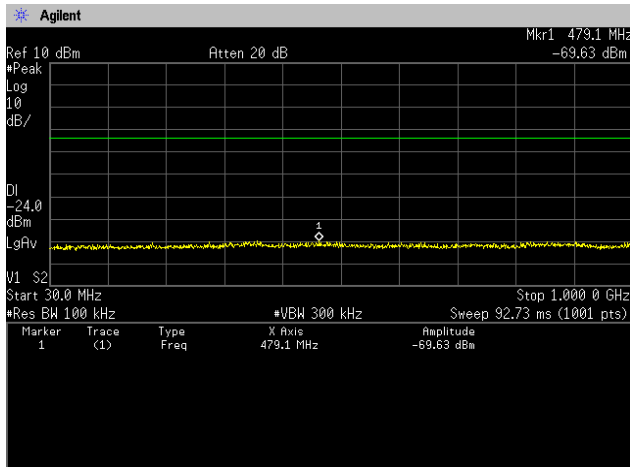


20GHz-25GHz

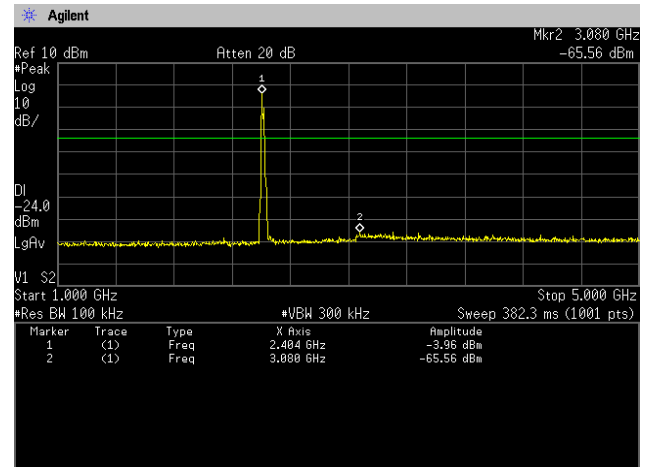




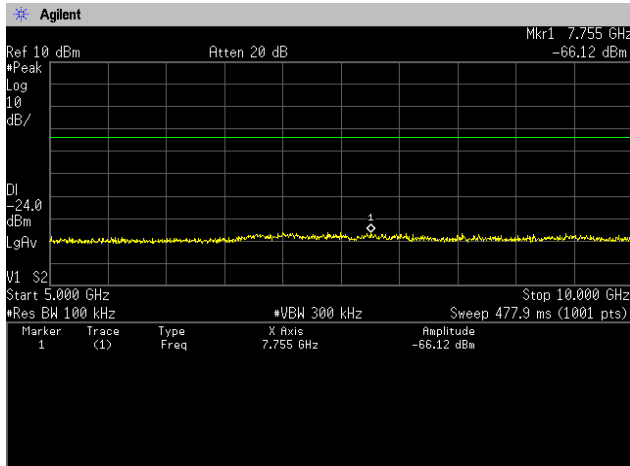
**[IEEE802.11ax (HE20)_26-Tones]
Channel Low[Chain 1]
30MHz-1GHz**



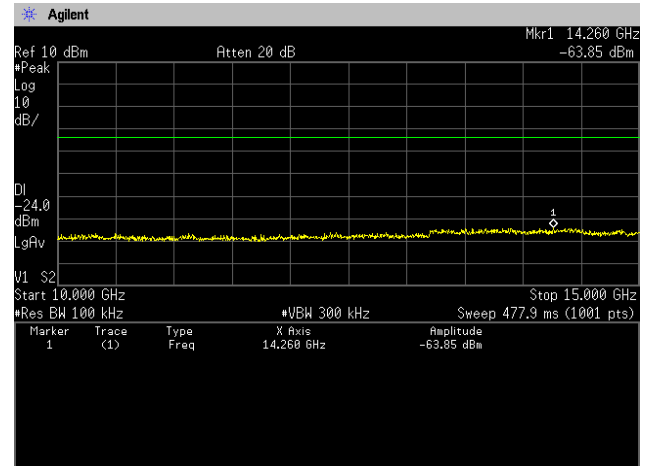
1GHz-5GHz



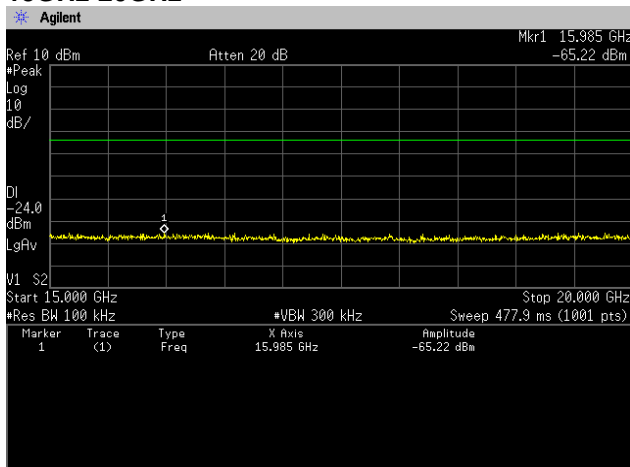
5GHz-10GHz



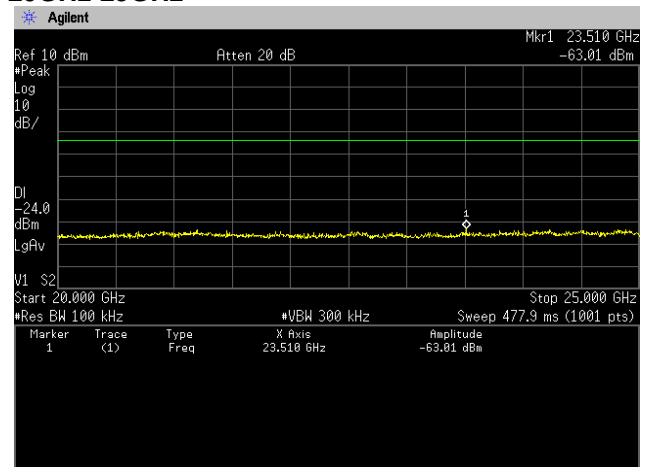
10GHz-15GHz



15GHz-20GHz

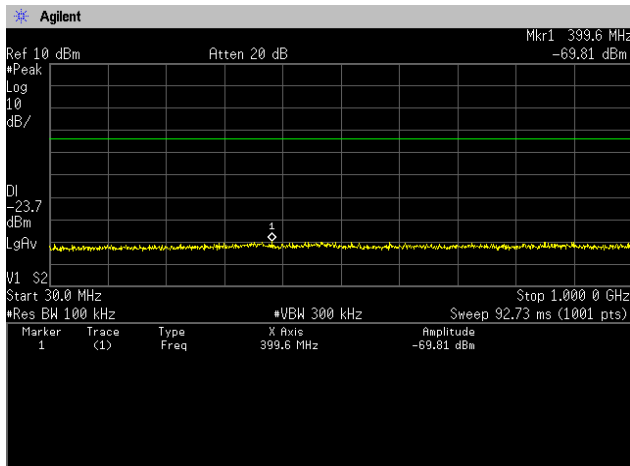


20GHz-25GHz

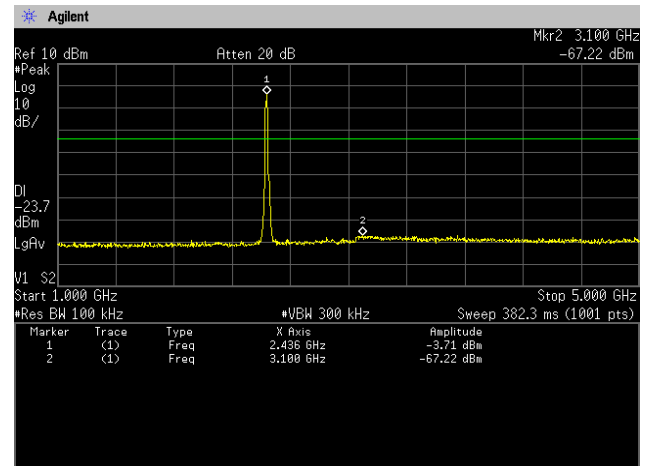




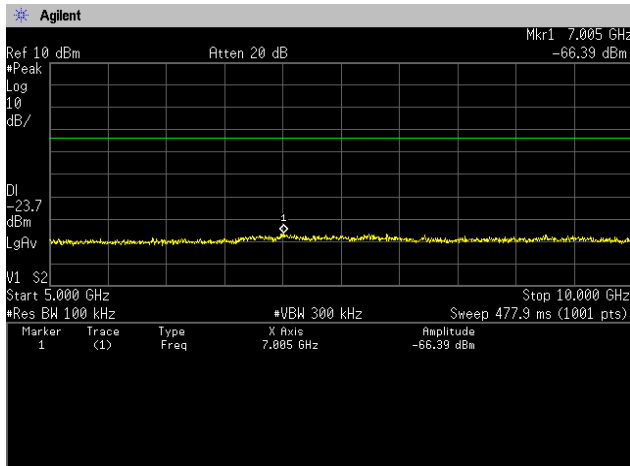
**Channel Middle[Chain 1]
30MHz-1GHz**



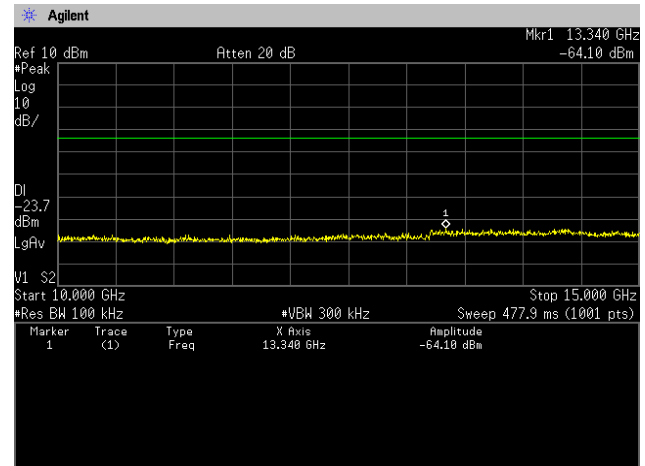
1GHz-5GHz



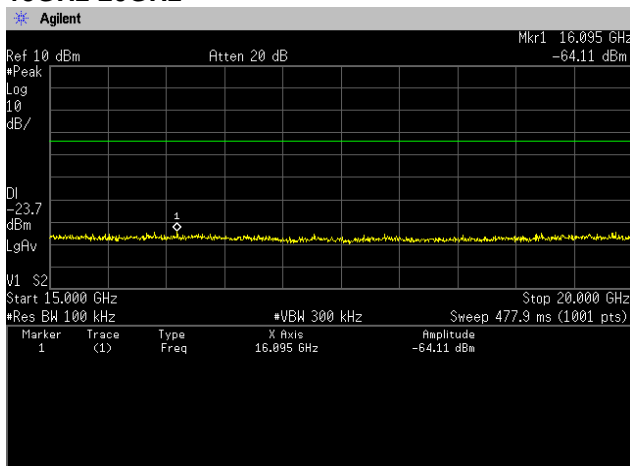
5GHz-10GHz



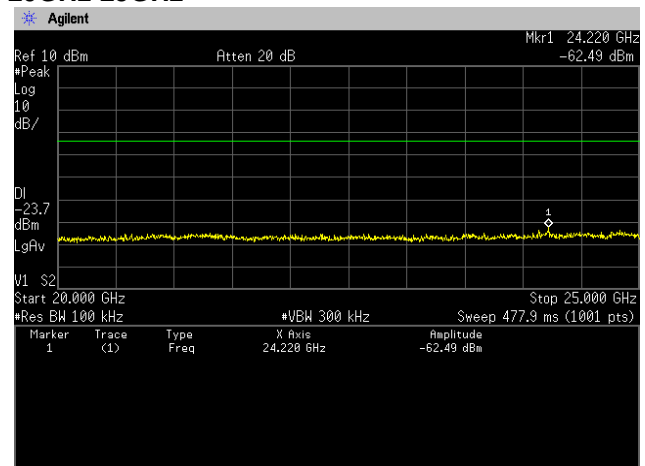
10GHz-15GHz



15GHz-20GHz

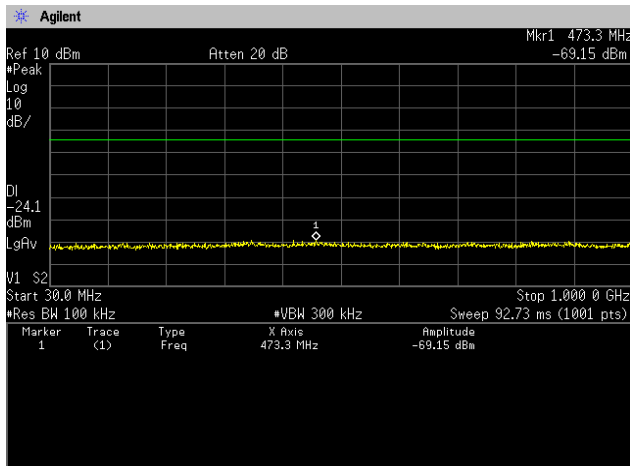


20GHz-25GHz

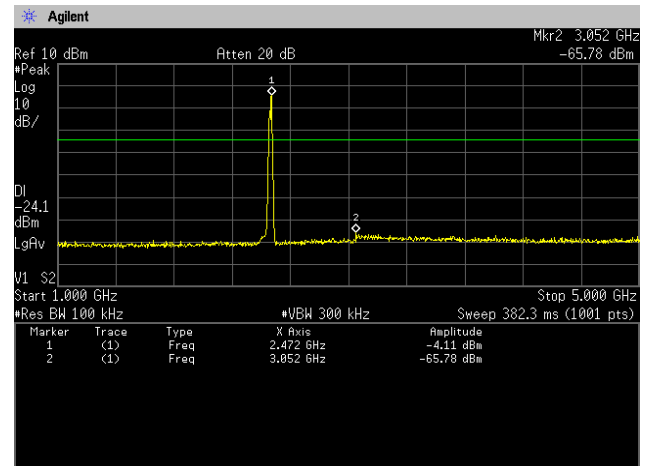




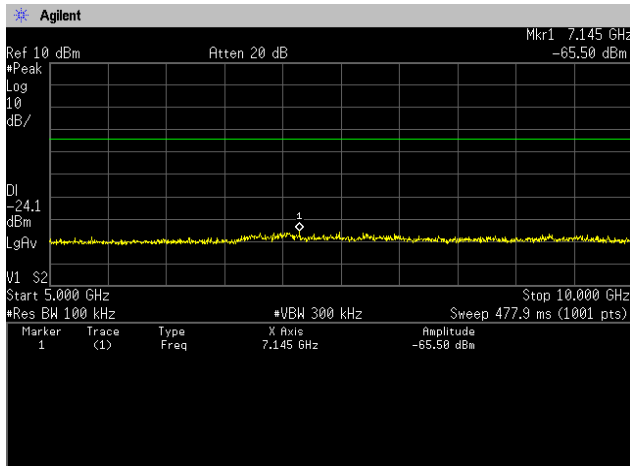
**Channel High[Chain 1]
30MHz-1GHz**



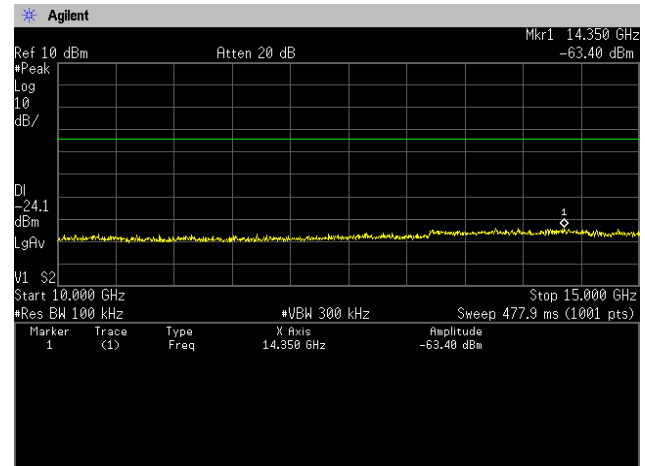
1GHz-5GHz



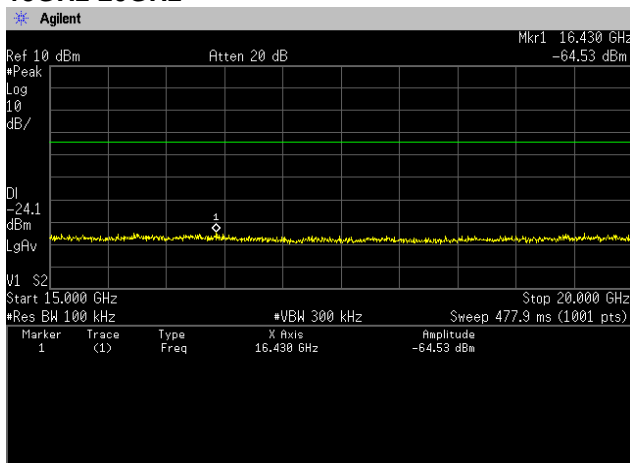
5GHz-10GHz



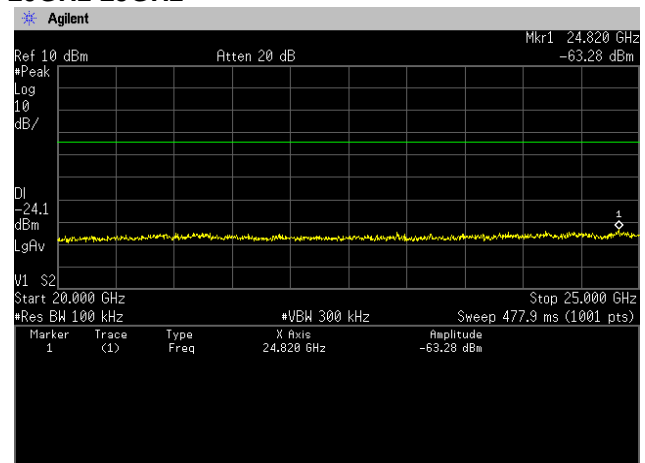
10GHz-15GHz



15GHz-20GHz

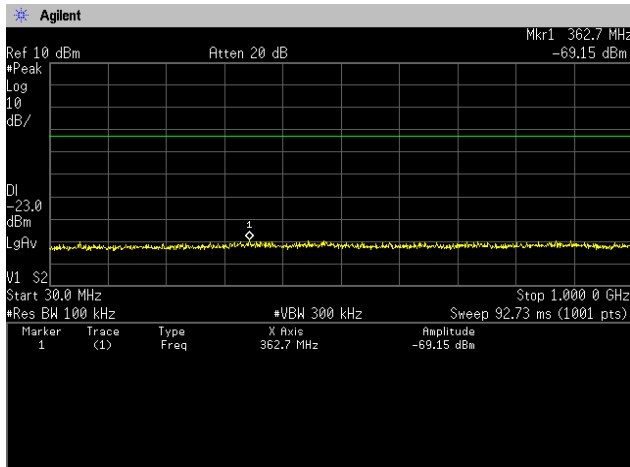


20GHz-25GHz

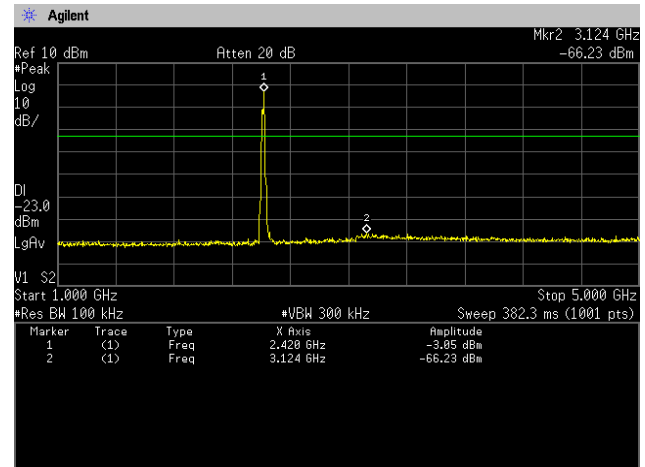




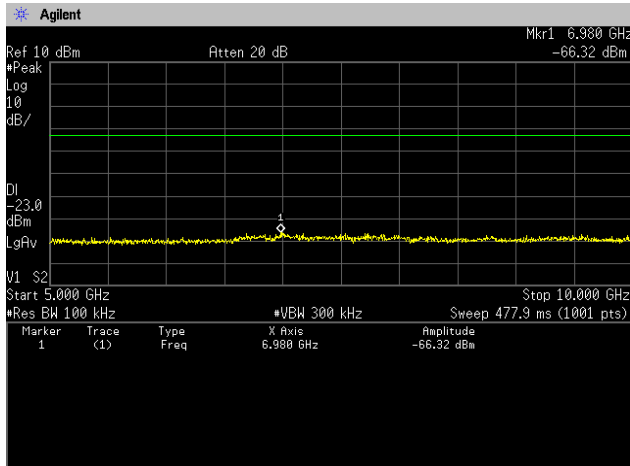
**[IEEE802.11ax (HE20)_52-Tones]
Channel Low[Chain 1]
30MHz-1GHz**



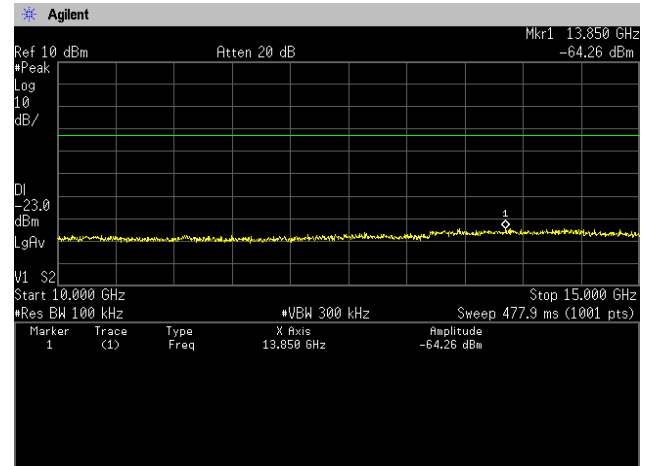
1GHz-5GHz



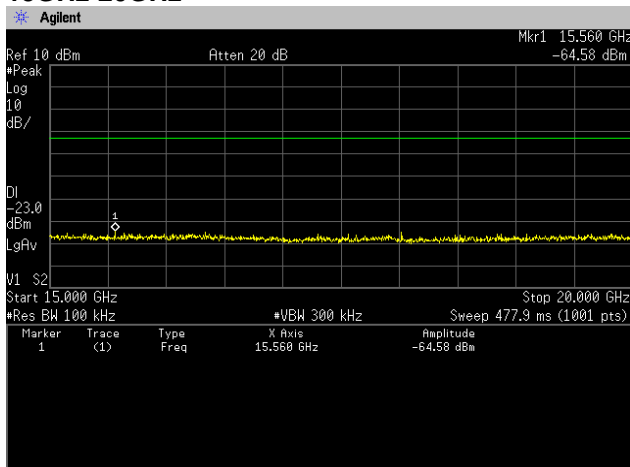
5GHz-10GHz



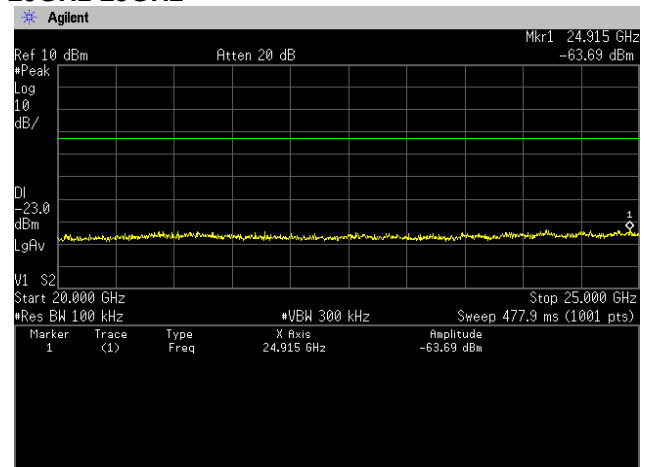
10GHz-15GHz



15GHz-20GHz

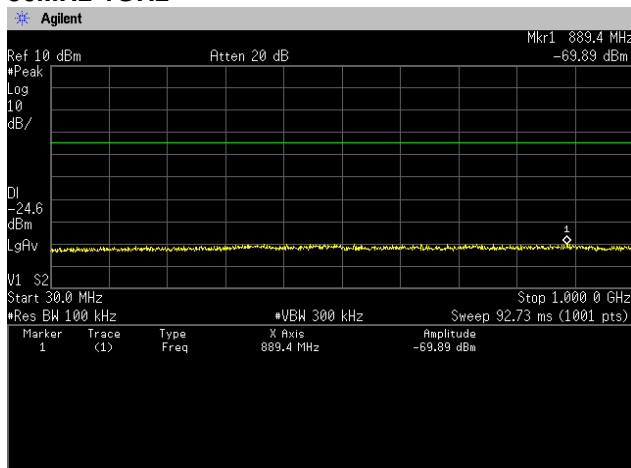


20GHz-25GHz

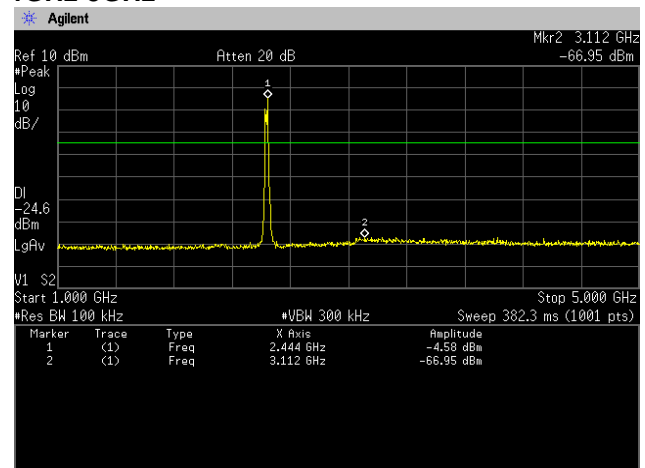




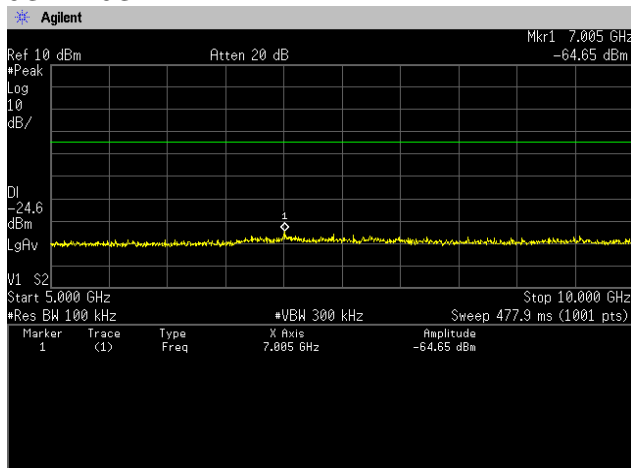
**Channel Middle[Chain 1]
30MHz-1GHz**



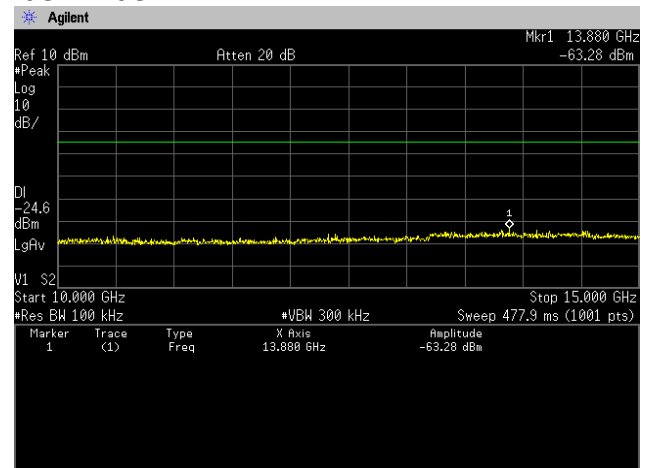
1GHz-5GHz



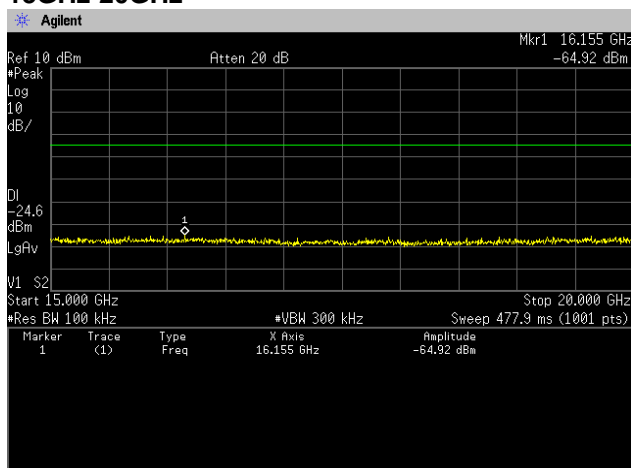
5GHz-10GHz



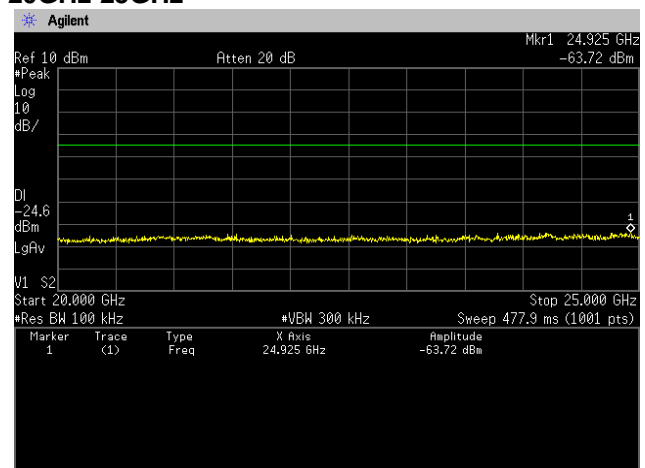
10GHz-15GHz



15GHz-20GHz

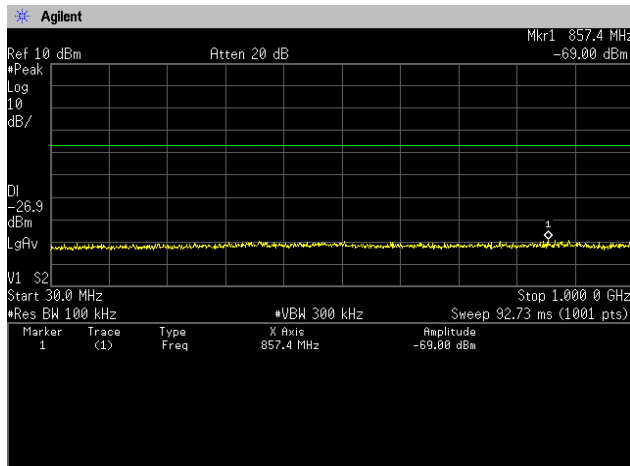


20GHz-25GHz

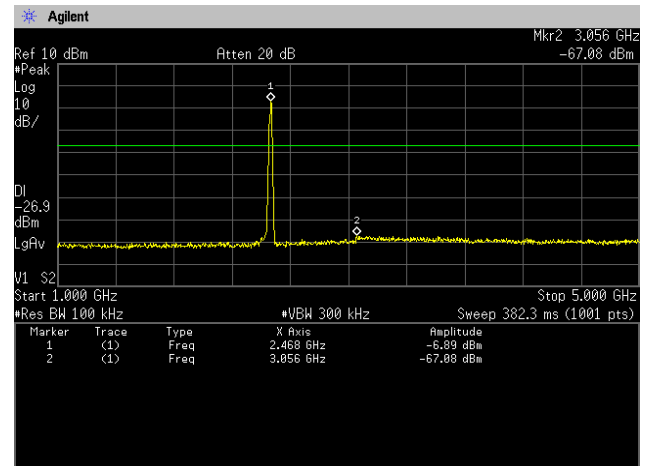




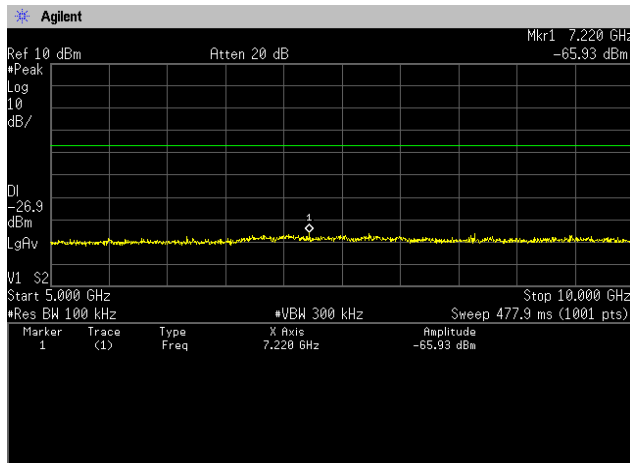
**Channel High[Chain 1]
30MHz-1GHz**



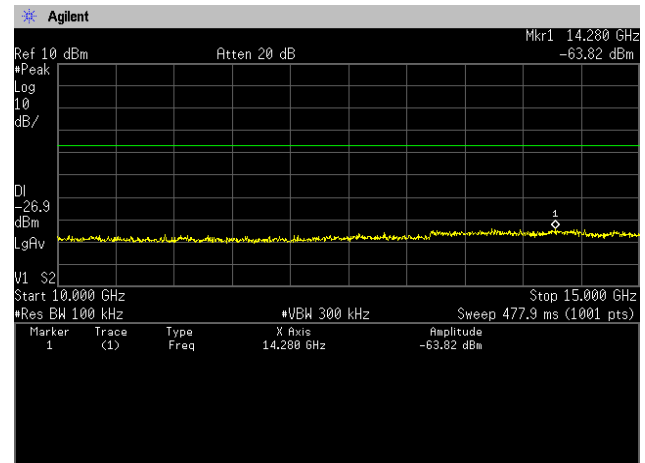
1GHz-5GHz



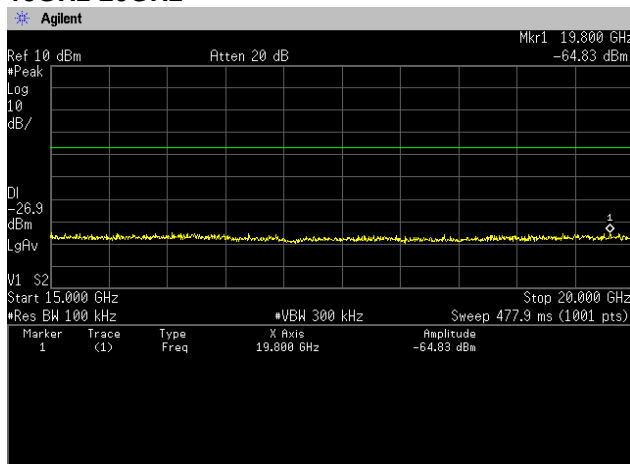
5GHz-10GHz



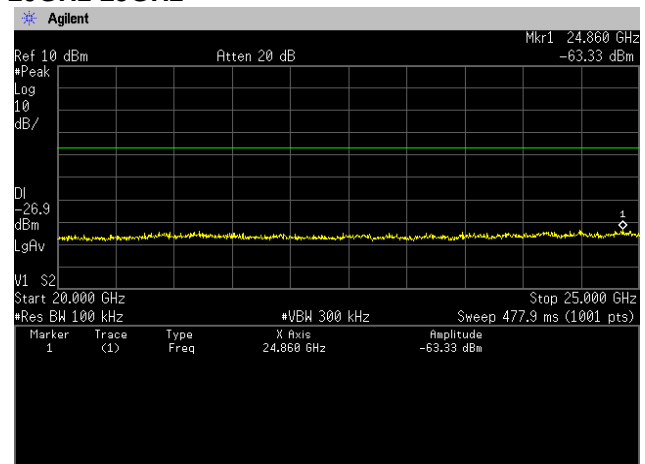
10GHz-15GHz



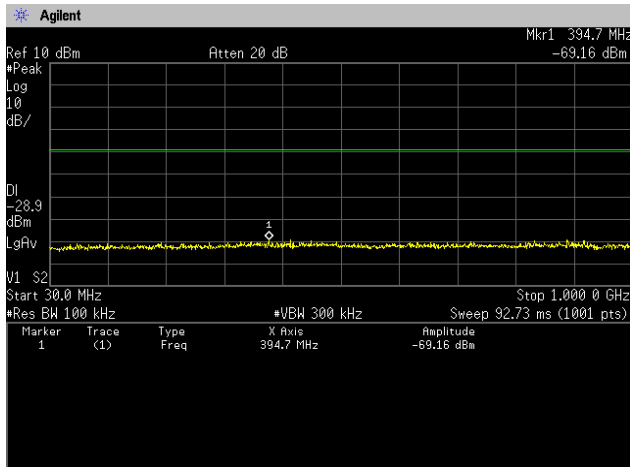
15GHz-20GHz



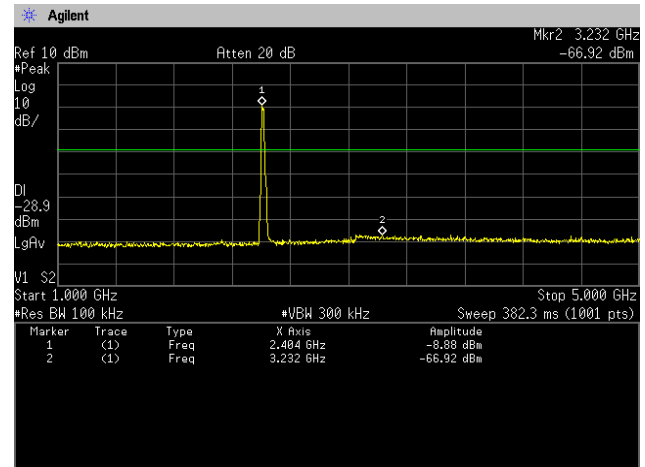
20GHz-25GHz



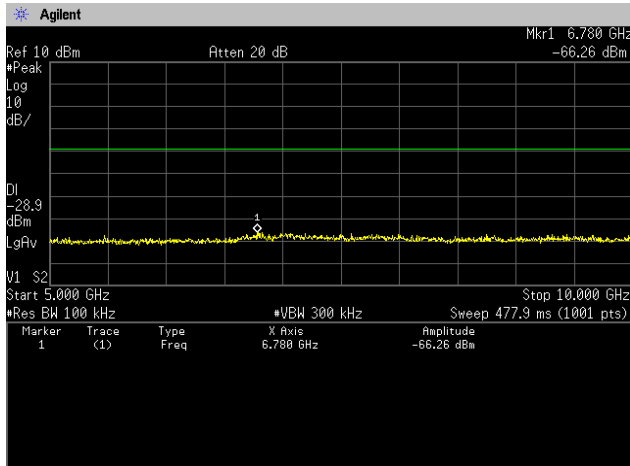
**[IEEE802.11ax (HE20)_106-Tones]
Channel Low[Chain 1]
30MHz-1GHz**



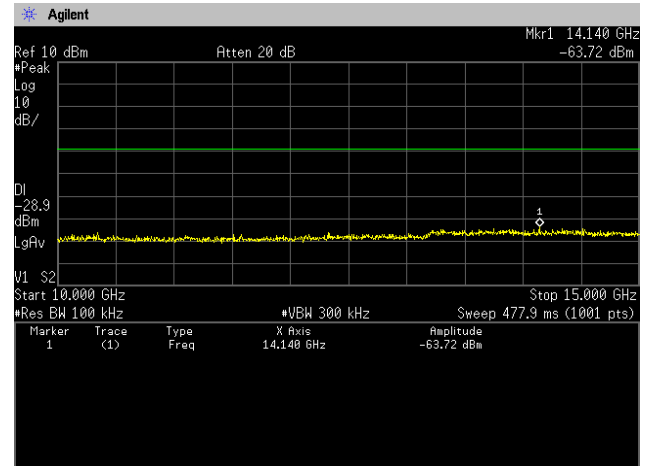
1GHz-5GHz



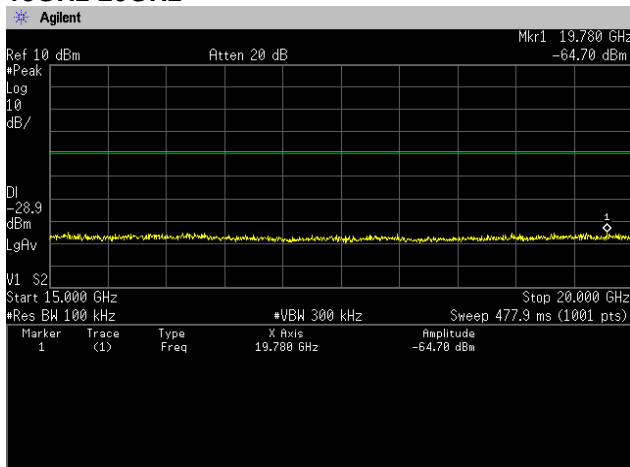
5GHz-10GHz



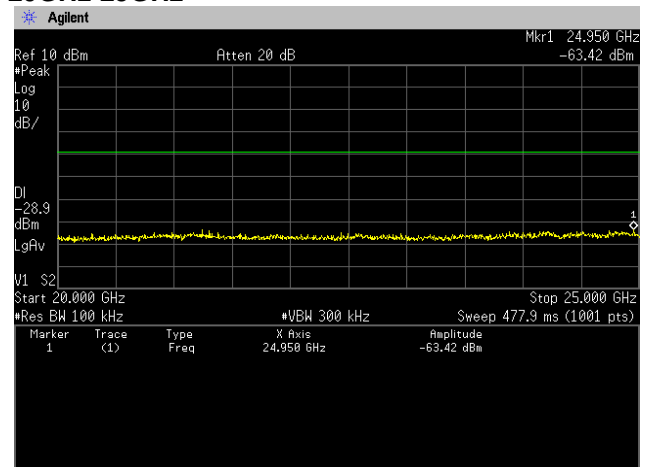
10GHz-15GHz



15GHz-20GHz

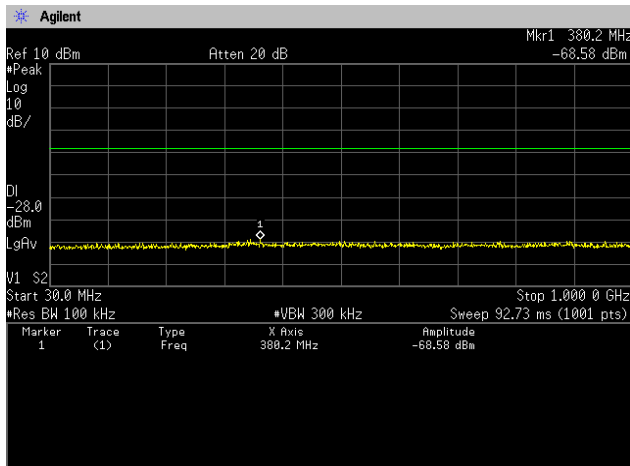


20GHz-25GHz

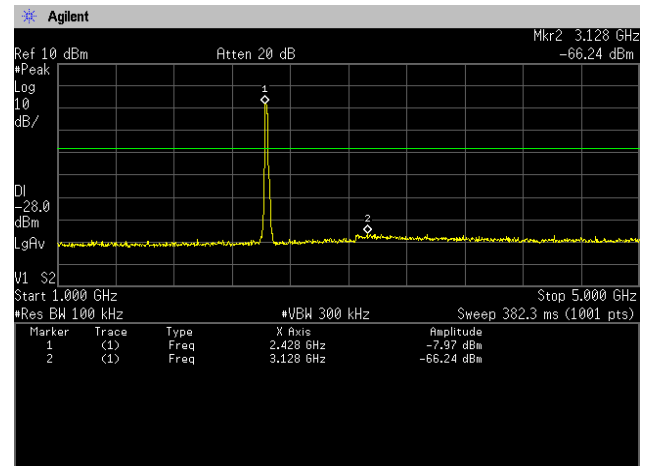




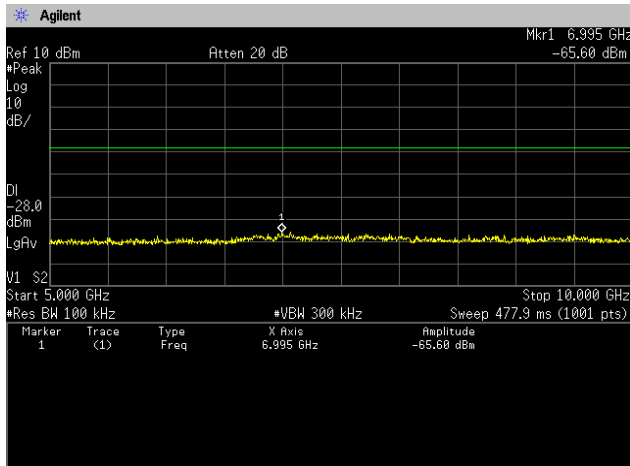
**Channel Middle[Chain 1]
30MHz-1GHz**



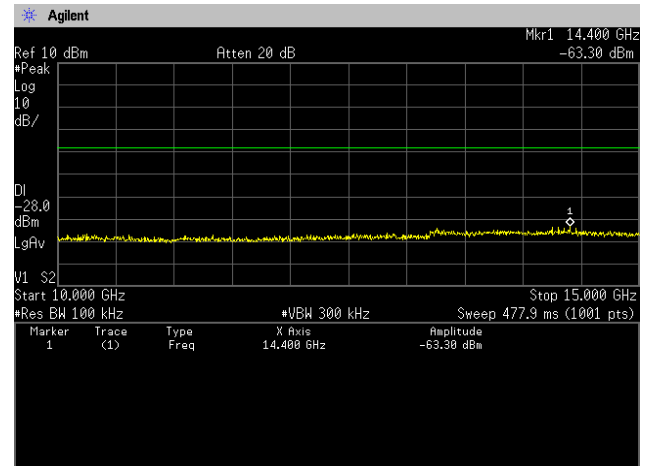
1GHz-5GHz



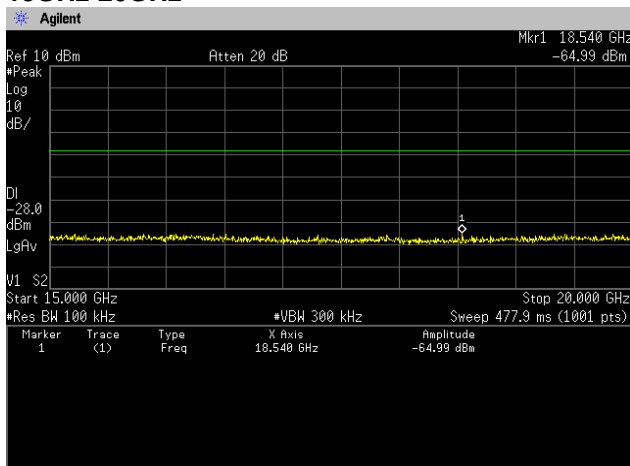
5GHz-10GHz



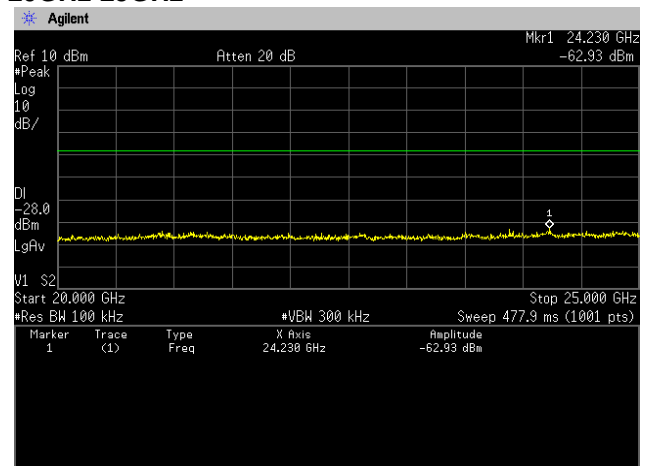
10GHz-15GHz



15GHz-20GHz

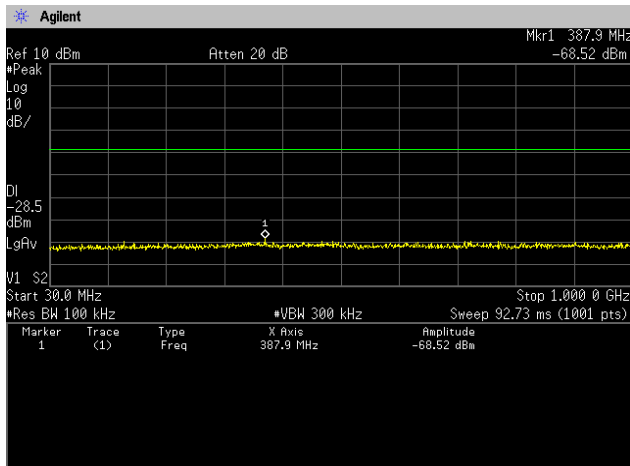


20GHz-25GHz

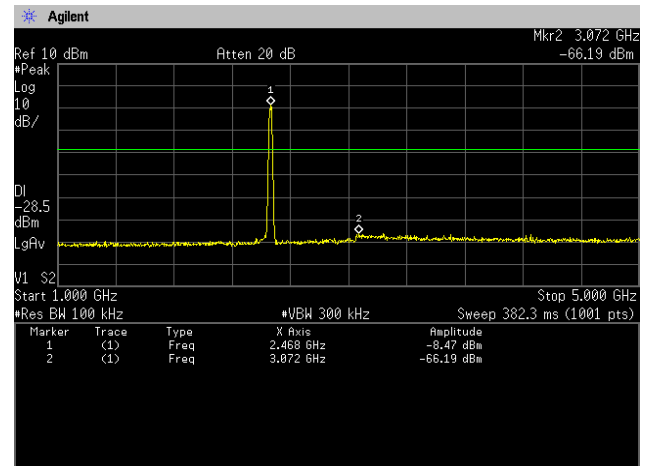




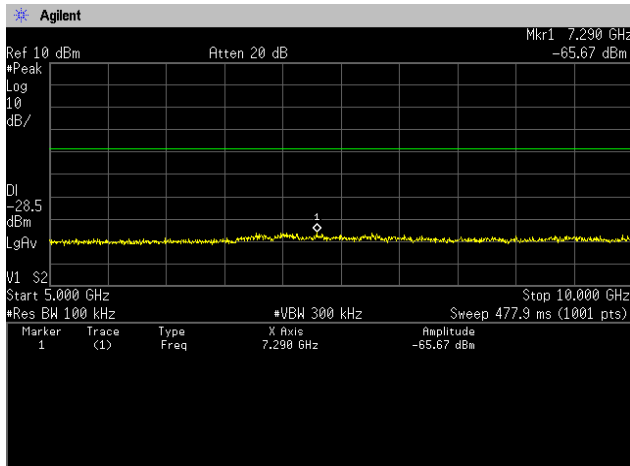
**Channel High[Chain 1]
30MHz-1GHz**



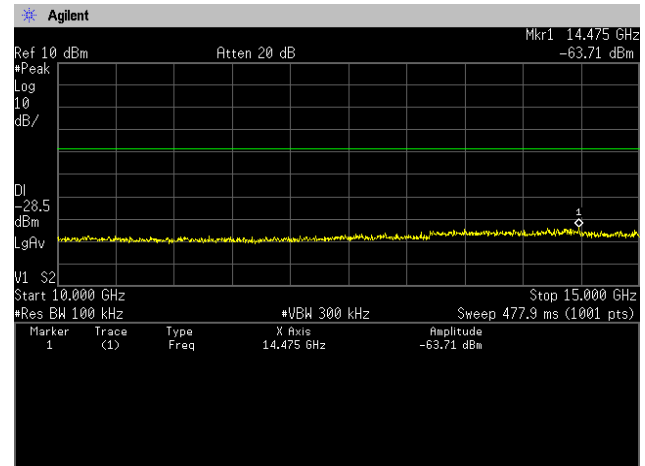
1GHz-5GHz



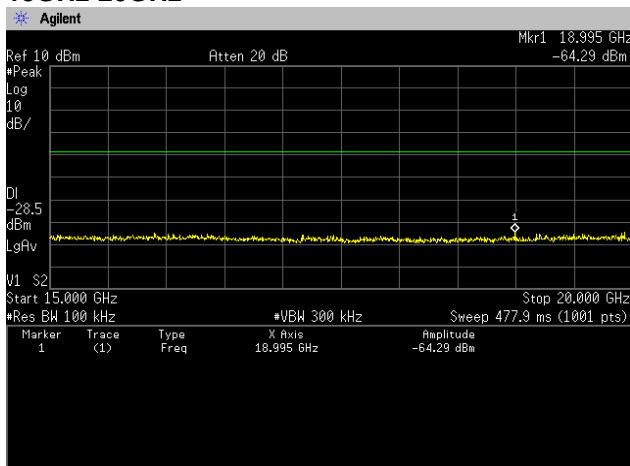
5GHz-10GHz



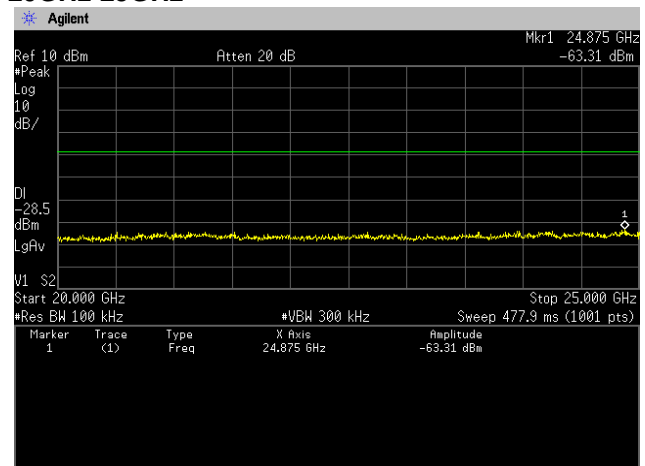
10GHz-15GHz



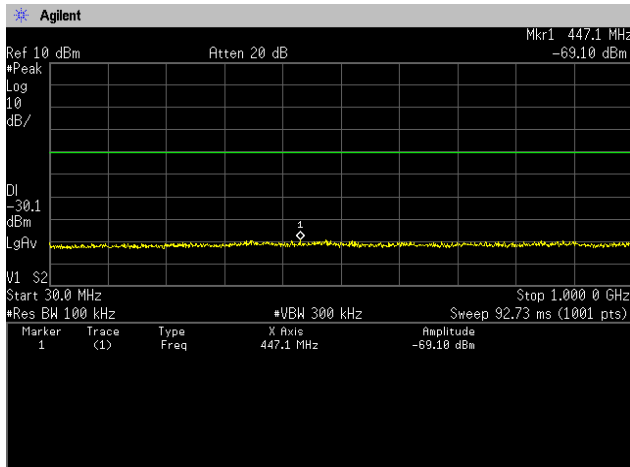
15GHz-20GHz



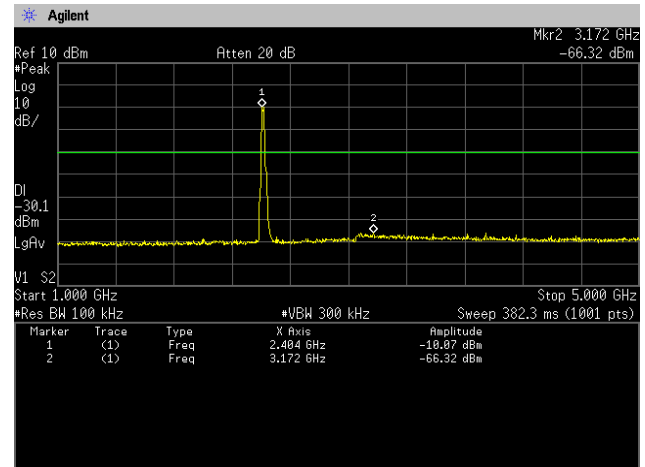
20GHz-25GHz



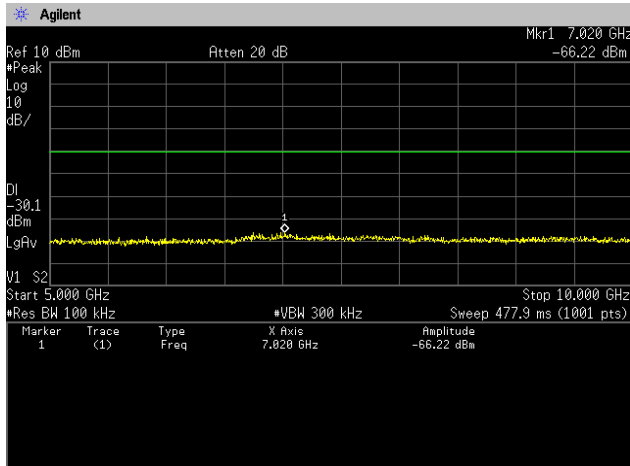
**[IEEE802.11ax (HE20)_242-Tones]
Channel Low[Chain 1]
30MHz-1GHz**



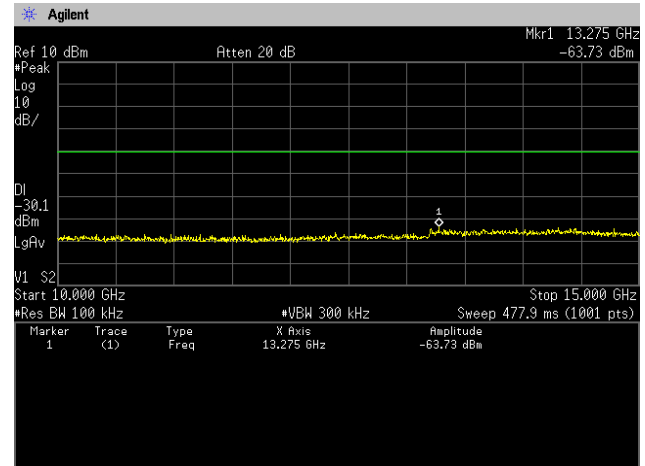
1GHz-5GHz



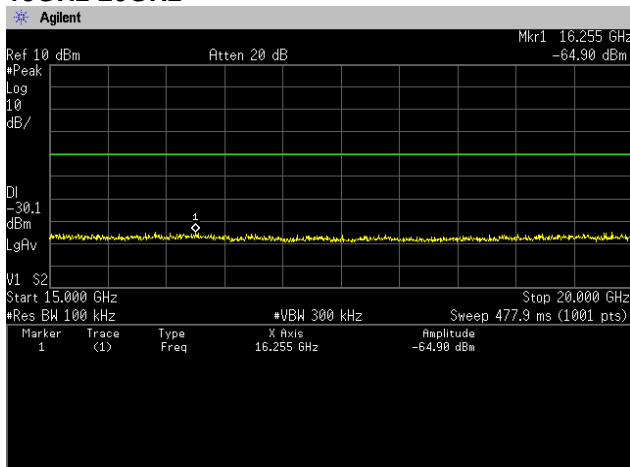
5GHz-10GHz



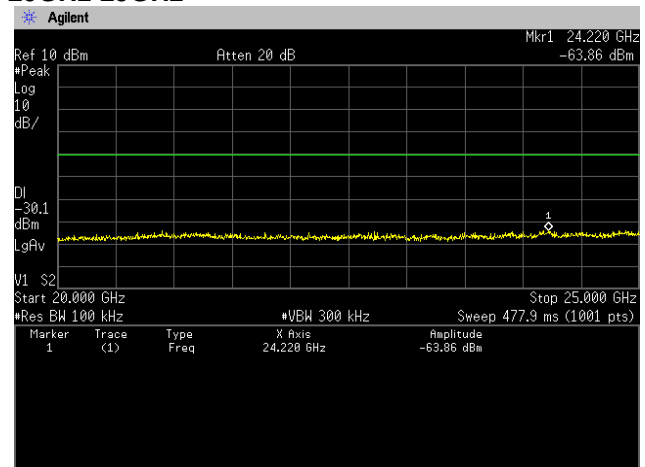
10GHz-15GHz



15GHz-20GHz

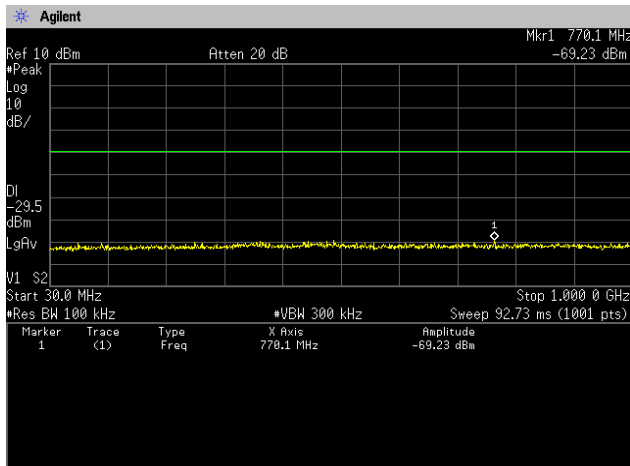


20GHz-25GHz

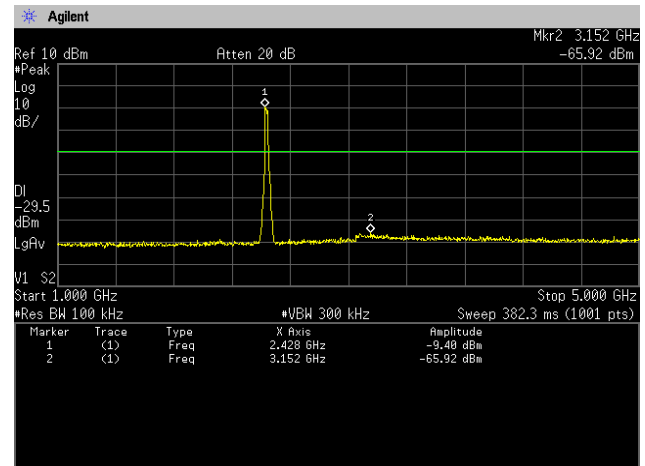




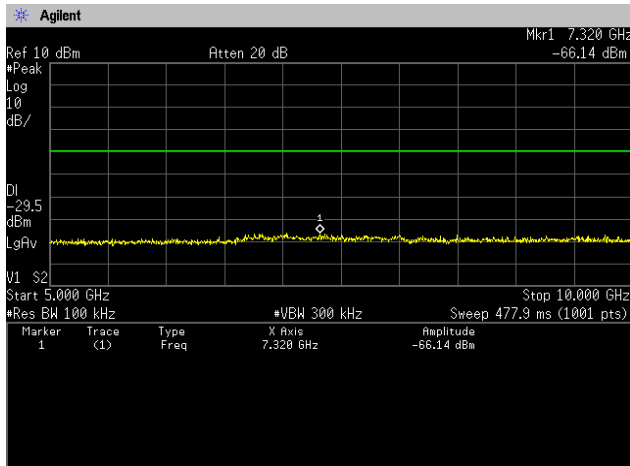
**Channel Middle[Chain 1]
30MHz-1GHz**



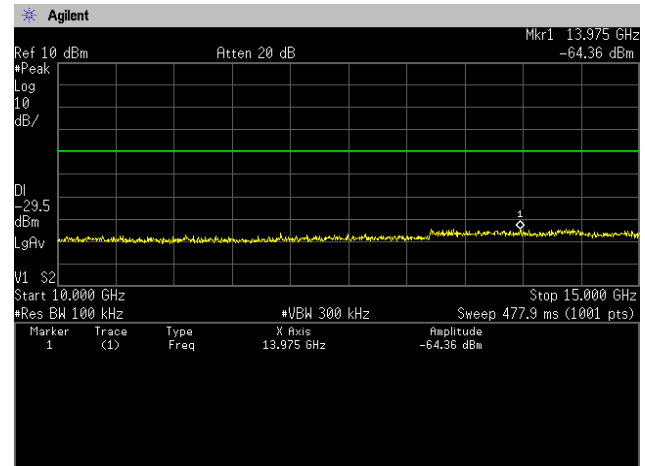
1GHz-5GHz



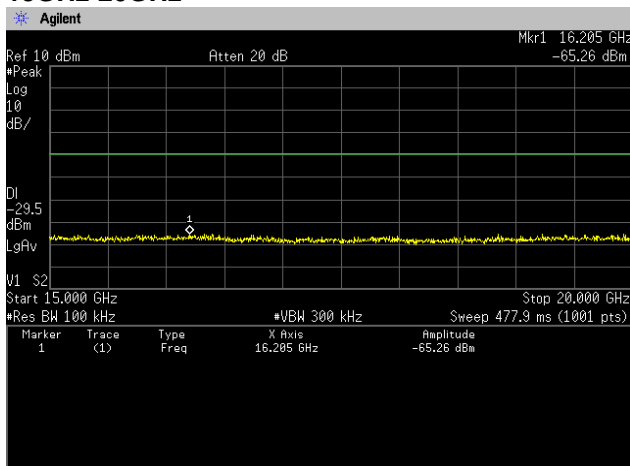
5GHz-10GHz



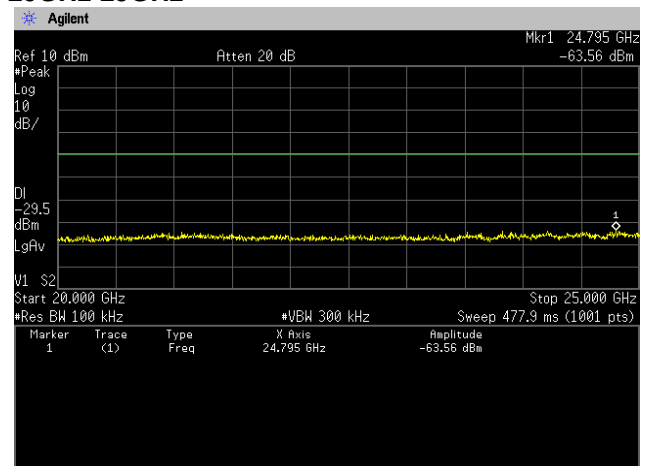
10GHz-15GHz



15GHz-20GHz

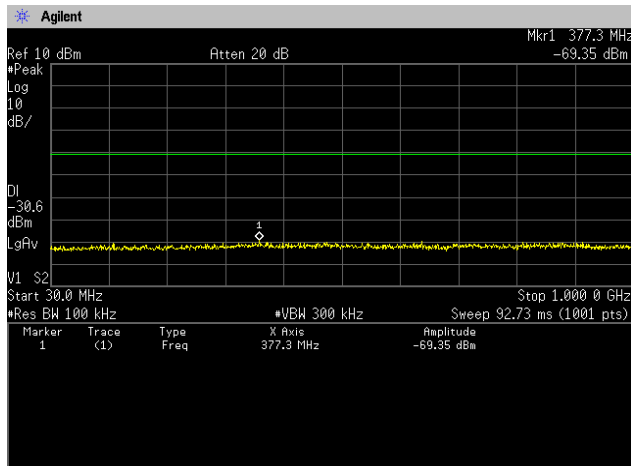


20GHz-25GHz

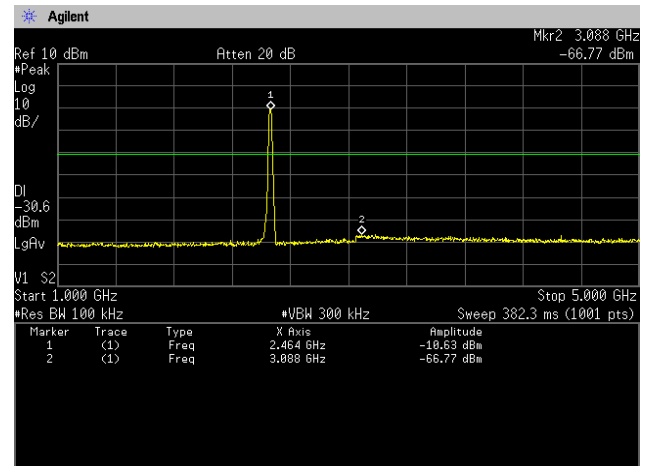




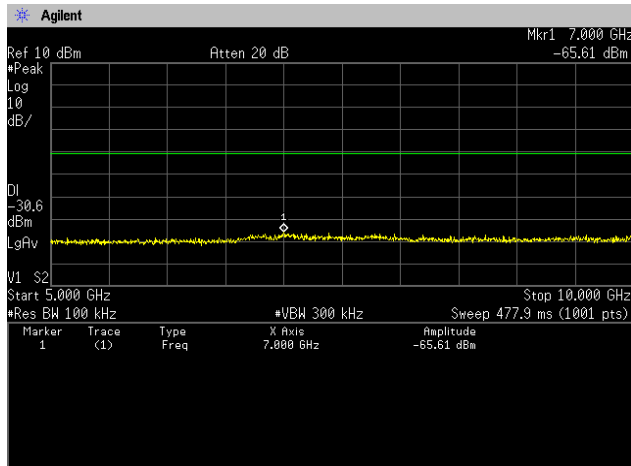
**Channel High[Chain 1]
30MHz-1GHz**



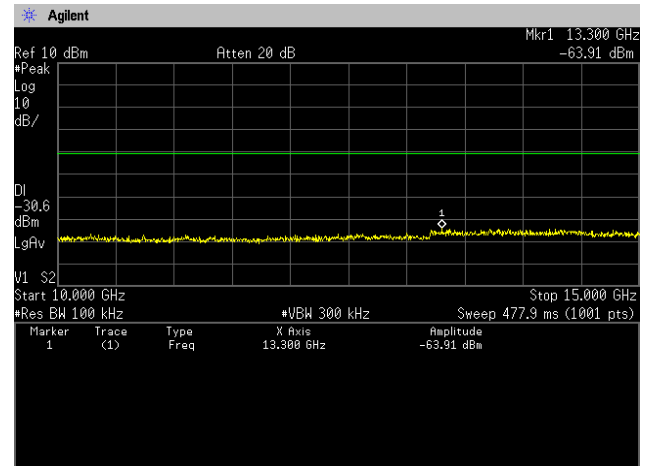
1GHz-5GHz



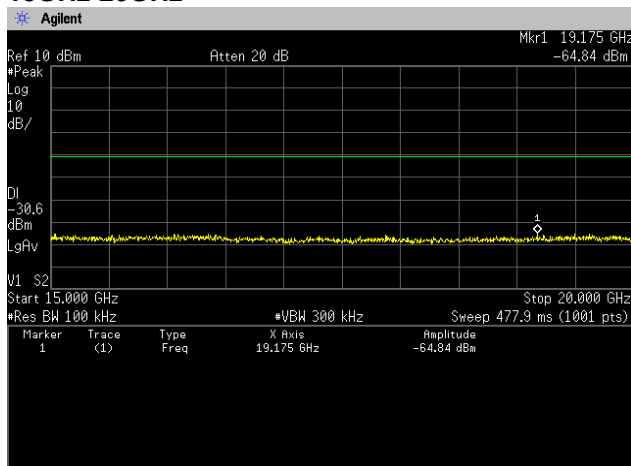
5GHz-10GHz



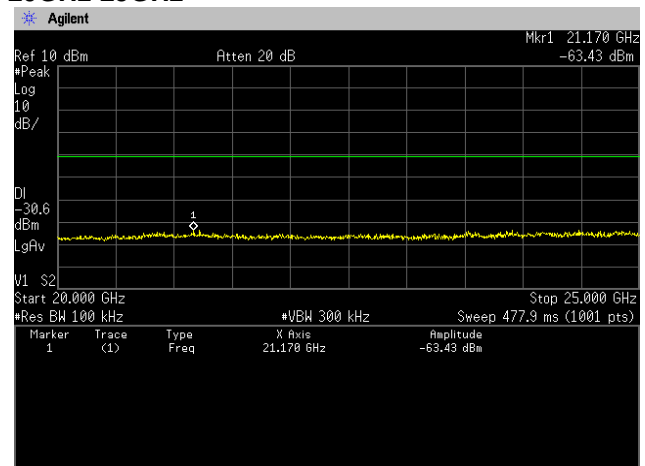
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz



4.5 Spurious Emissions - Radiated -

4.5.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, KDB 558074 D01 v05r02, Section 8.6]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Frequency range	:	9 kHz to 25 GHz
Test place	:	3m Semi-anechoic chamber
EUT was placed on	:	Styrofoam table / (W) 1.0 x (D) 1.0 x (H) 0.8 m (below 1 GHz) Styrofoam table / (W) 0.6 x (D) 0.6 x(H)1.5 m (above 1 GHz)
Antenna distance	:	3 m
Test receiver setting	:	Below 1 GHz
- Detector	:	Average (9 kHz-90 kHz, 110 kHz-490 kHz), Quasi-peak
- Bandwidth	:	200 Hz, 120 kHz
Spectrum analyzer setting	:	Above 1 GHz
- Peak	:	RBW=1 MHz, VBW=3 MHz, Span=0 Hz, Sweep=auto
- Average	:	11ax: RBW=1 MHz, VBW=10Hz, Span=0 Hz, Sweep=auto Display mode=Linear

Average Measurement Setting [VBW]

mode	Duty Cycle (%)	Ton [μs]	Toff [μs]	1/Ton (kHz)	Determined VBW Setting
11ax HE20: 26-Tones	99.65	5.088	0.018	196.541	10Hz
11ax HE20: 52-Tones	99.53	5.07	0.024	197.239	10Hz
11ax HE20: 106-Tones	99.54	4.764	0.022	209.908	10Hz
11ax HE20: 242-Tones	99.53	4.67	0.022	214.133	10Hz

Although these tests were performed other than open area test site, adequate comparison measurements

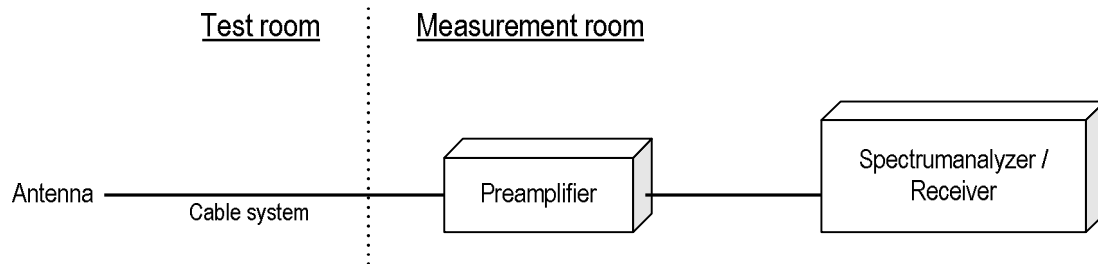
were confirmed against 30 m open are test site.

Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, Biconical antenna, Log periodic antenna and Double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop antenna is 1m above the ground plane.

The EUT is Placed on a turntable, which is 0.8m/1.5m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst cases emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration



4.5.2 Calculation method

[9 kHz to 150 kHz]

Emission level = Reading + (Ant factor + Cable system loss)

Margin = Limit – Emission level

[150 kHz to 25 GHz]

Emission level = Reading + (Ant factor + Cable system loss - Amp. Gain)

Margin = Limit – Emission level

Example:

Limit @ 4824.0 MHz: 74.0 dBuV/m (Peak Limit)

S.A Reading = 49.5 dBuV Cable system loss = 8.4 dB

Result = 49.5 + 8.4 = 45.1 dBuV/m

Margin = 74.0 - 45.1 = 16.1 dB

4.5.3 Limit

Frequency [MHz]	Field strength		Distance [m]
	[uV/m]	[dBuV/m]	
0.009-0.490	2400 / F [kHz]	20logE [uV/m]	300
0.490-1.705	24000 / F [kHz]	20logE [uV/m]	30
1.705-30	30	29.5	30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition modulation.



Japan

4.5.4 Test data

Date : 12-July-2023
Temperature : 22.9 [°C]
Humidity : 71.7 [%]
Test place : 3m Semi-anechoic chamber

Test engineer : Chiaki Kanno

Date : 15-July-2023
Temperature : 23.7 [°C]
Humidity : 75.9 [%]
Test place : 3m Semi-anechoic chamber

Test engineer : Chiaki Kanno

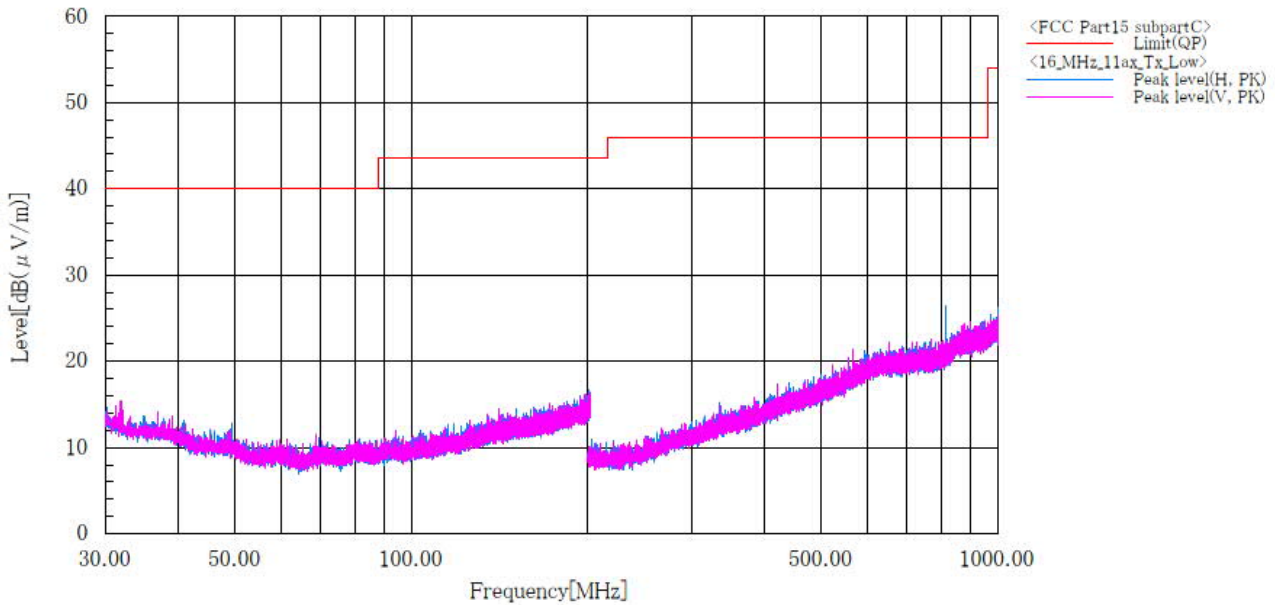


4.5.4.1 Transmission mode

[IEEE802.11ax (HE20)]
 Channel Low
 BELOW 1GHz(Worst)

Company name : KYOCERA Corporation
 EUT : Mobile Phone
 Model No. : EB1157
 Serial No. : N/A
 Test mode : WLAN_11ax_Tx_ch:Low

Sheet No. : 16
 Standard : FCC Part15 subpart C
 Operator : C.Kanno
 Temp,Hum,Atm : 22.9 [° C], 71.7 [%]
 Note1 : T26, I0, 2SS, Chain:Both



Final Result

Note:

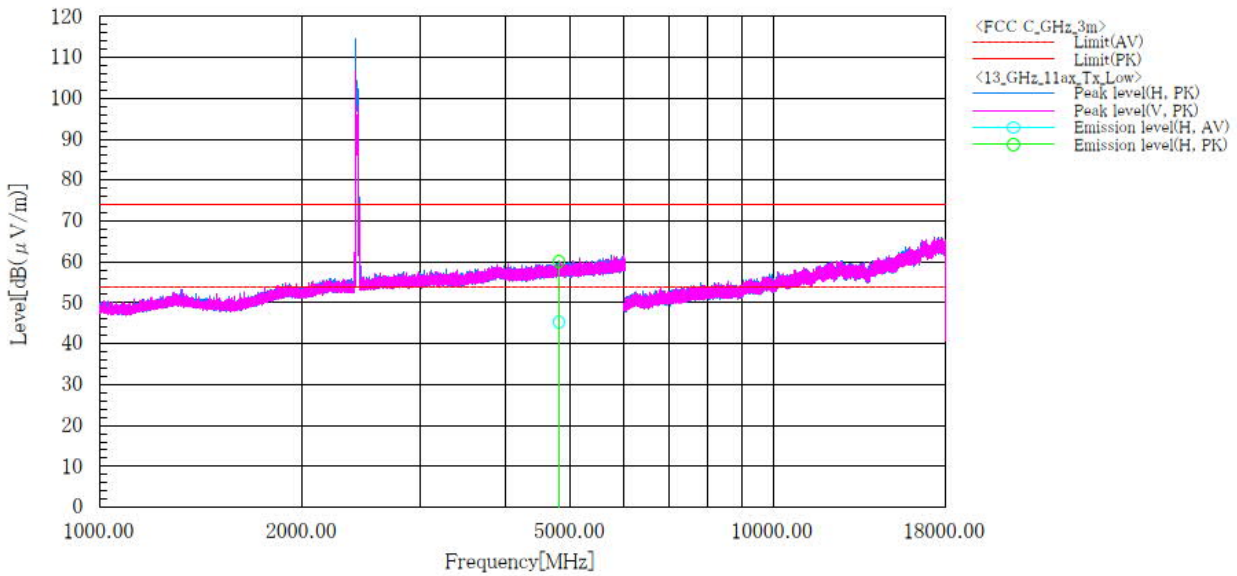
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable - Amp)]
2. No emission were detected in frequency range 9kHz to 1000MHz at the 3 meters distance.



[IEEE802.11ax (HE20)]
Channel Low
ABOVE 1GHz(Worst)

Company name : KYOCERA Corporation
 EUT : Mobile Phone
 Model No. : EB1157
 Serial No. : N/A
 Test mode : WLAN_11ax_Tx_ch:Low

Standard : FCC Part.15 subpart C
 Operator : C.Kanno
 Temp,Hum,Atm : 23.7 [°C], 75.9 [%]
 Note1 : Ch:1(2412MHz)
 Note2 : T26, I0, 2SS, Chain:Both



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	4806.600	H	34.6	49.4	10.7	45.3	60.1	54.0	74.0	8.7	13.9	100.0	86.0

Note:

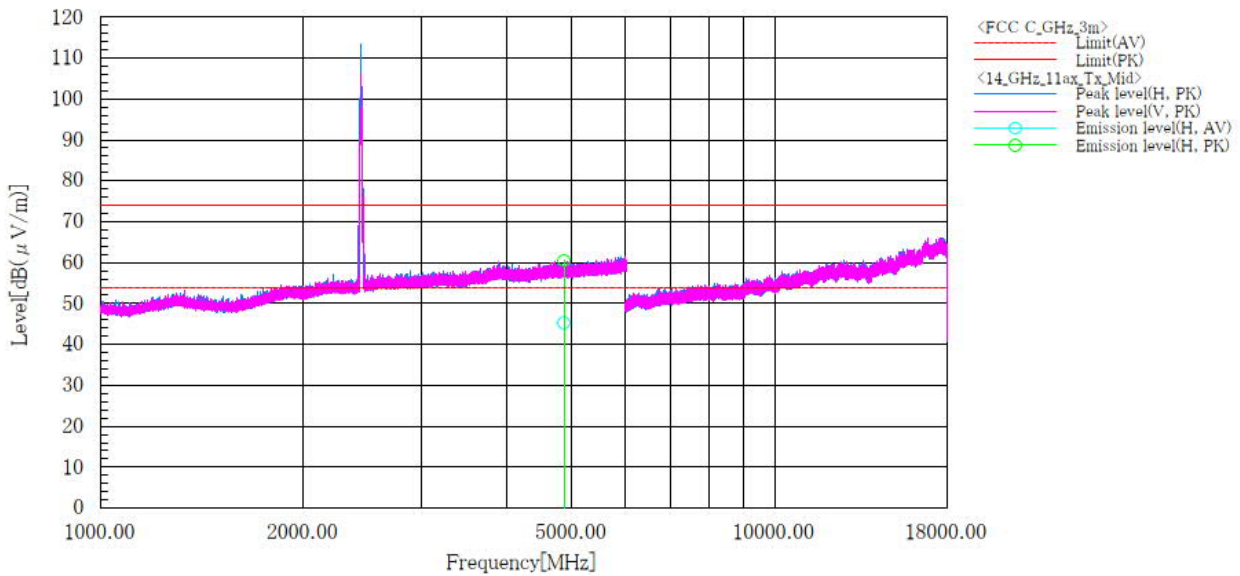
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.



[IEEE802.11ax (HE20)]
Channel Middle
ABOVE 1GHz(Worst)

Company name : KYOCERA Corporation
 EUT : Mobile Phone
 Model No. : EB1157
 Serial No. : N/A
 Test mode : WLAN_11ax_Tx_ch:Mid

Standard : FCC Part.15 subpart C
 Operator : C.Kanno
 Temp,Hum,Atm : 23.7 [°C], 75.9 [%]
 Note1 : Ch:6(2437MHz)
 Note2 : T26, I4, 2SS, Chain:Both



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	4872.400	H	34.6	49.8	10.7	45.3	60.5	54.0	74.0	8.7	13.5	100.0	121.0

Note:

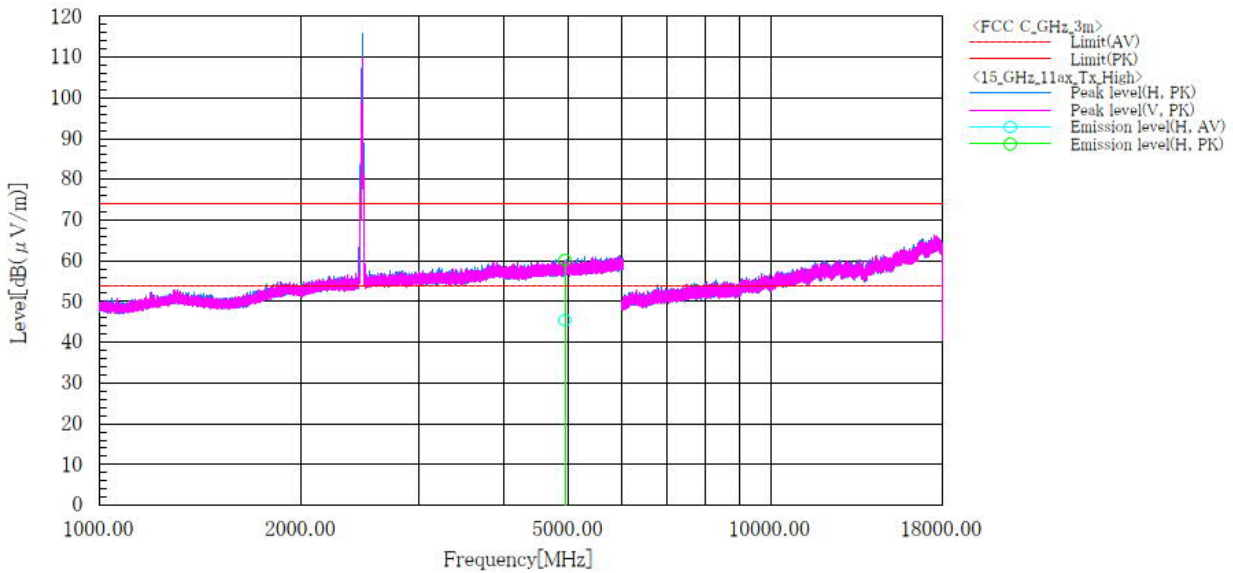
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.



[IEEE802.11ax (HE20)]
Channel High
ABOVE 1GHz(Worst)

Company name : KYOCERA Corporation
 EUT : Mobile Phone
 Model No. : EB1157
 Serial No. : N/A
 Test mode : WLAN_11ax_Tx_ch:High

Standard : FCC Part.15 subpart C
 Operator : C.Kanno
 Temp,Hum,Atm : 23.7 [° C], 75.9 [%]
 Note1 : Ch:11(2462MHz)
 Note2 : T26, I8, 2SS, Chain:Both



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	4941.900	H	34.6	49.3	10.9	45.5	60.2	54.0	74.0	8.5	13.8	100.0	107.0

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.

4.6 Restricted Band of Operation

4.6.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, KDB 558074 D01 v05r02, Section 8.6]

Test was applied by following conditions.

Test method : ANSI C63.10
 Test place : 3m Semi-anechoic chamber
 EUT was placed on : Styrofoam table / (W) 1.0 x (D) 1.0 x (H) 0.8 m (below 1 GHz)
 Styrofoam table / (W) 0.6 x (D) 0.6 x(H) 1.5 m (above 1 GHz)
 Antenna distance : 3m

Spectrum analyzer setting
 - Peak : RBW=1 MHz, VBW=3 MHz, Span=Arbitrary setting, Sweep=auto
 - Average : 11ax: RBW=1 MHz, VBW=10Hz, Span=0 Hz, Sweep=auto
 Display mode=Linear

Average Measurement Setting [VBW]

mode	Duty Cycle (%)	Ton [μs]	Toff [μs]	1/Ton (kHz)	Determined VBW Setting
11ax HE20: 26-Tones	99.65	5.088	0.018	196.541	10Hz
11ax HE20: 52-Tones	99.53	5.07	0.024	197.239	10Hz
11ax HE20: 106-Tones	99.54	4.764	0.022	209.908	10Hz
11ax HE20: 242-Tones	99.53	4.67	0.022	214.133	10Hz

Although these tests were performed other than open area test site, adequate comparison measurements

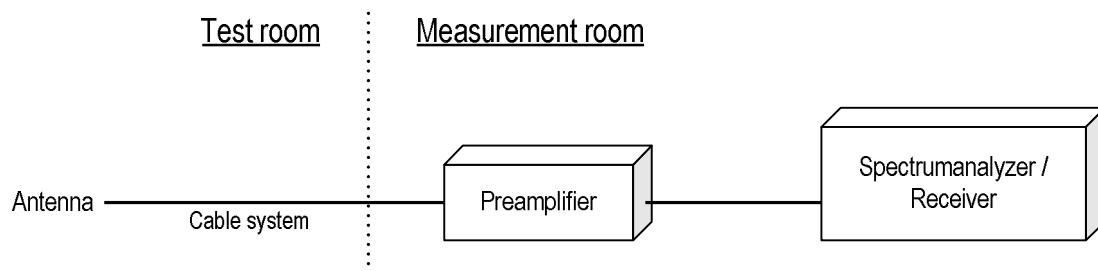
were confirmed against 30 m open are test site.

Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

Radiated emission measurements are performed at 3m distance with the broadband antenna (Double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission.

The EUT is Placed on a turntable, which is 0.8m/1.5m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration





4.6.2 Limit

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.

4.6.3 Measurement Result

IEEE802.11ax (HE20)]

Channel	Frequency [MHz]	Results Chart	Result
Low	2412	See the Trace Data	Pass
High	2462	See the Trace Data	Pass

4.6.4 Test data

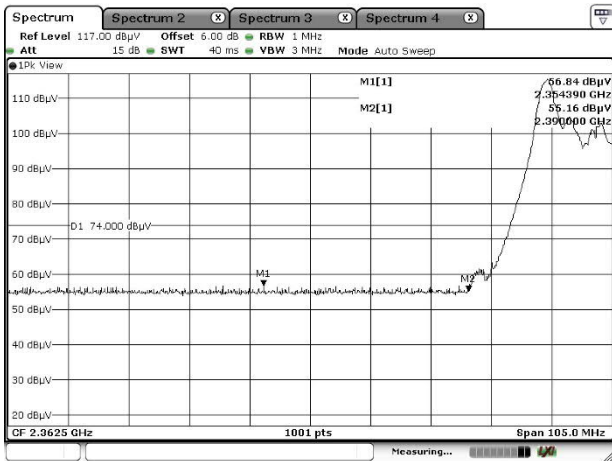
Date : 7-July-2023
Temperature : 24.5 [°C]
Humidity : 66.5 [%]
Test place : 3m Semi-anechoic chamber

Test engineer : Chiaki Kanno

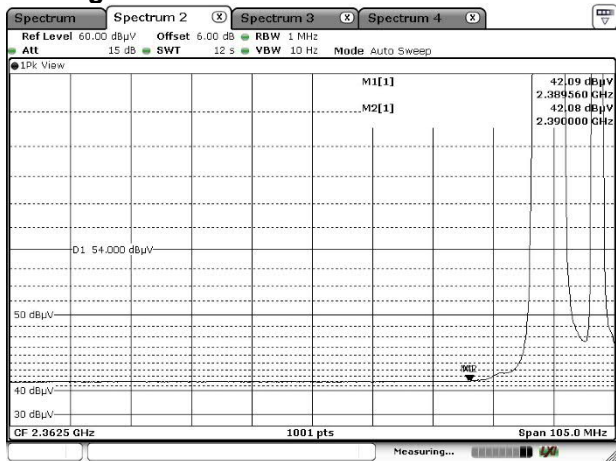


[IEEE802.11ax (HE20)_26-Tones]

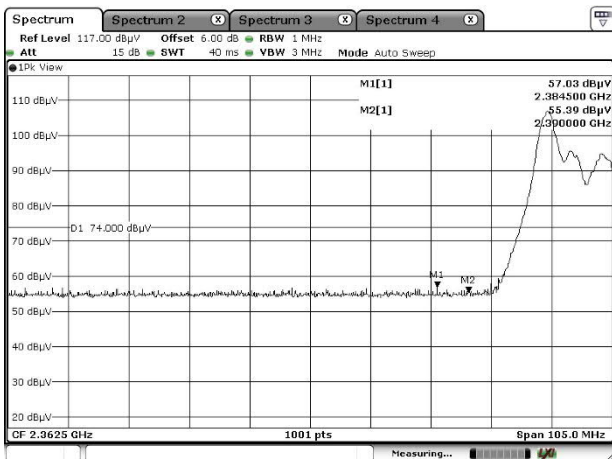
Channel Low
Horizontal
Peak



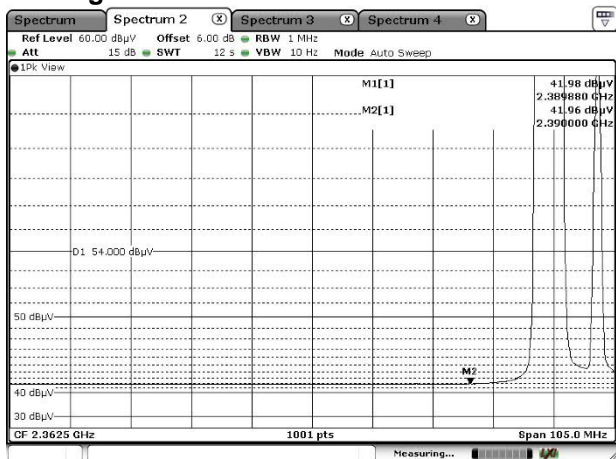
Average



Vertical
Peak



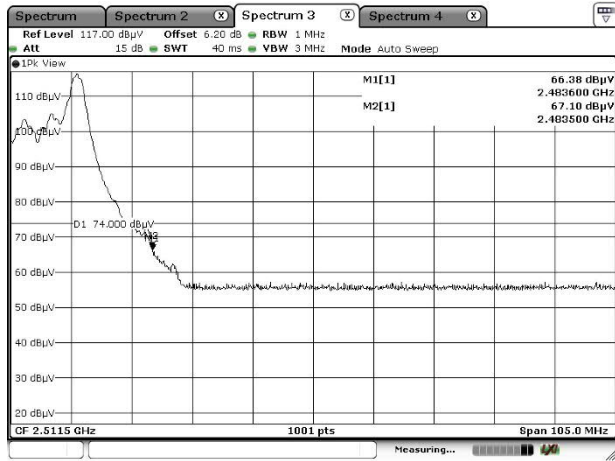
Average



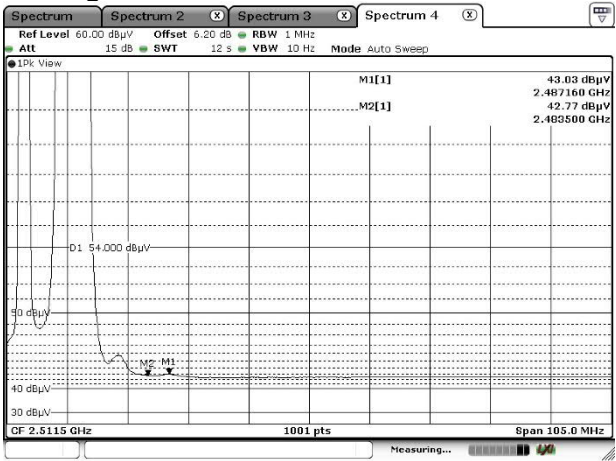


[IEEE802.11ax (HE20)_26-Tones]

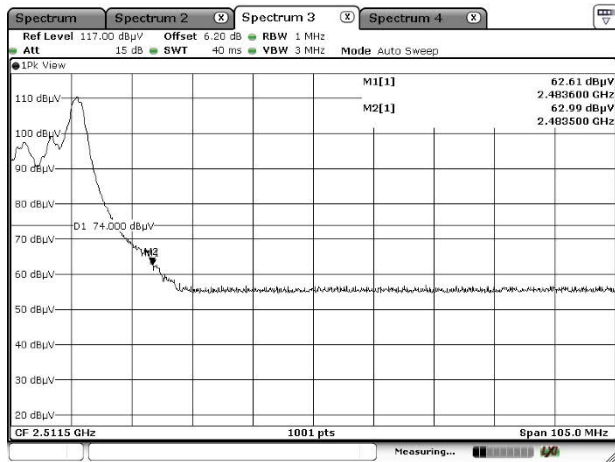
Channel High
Horizontal
Peak



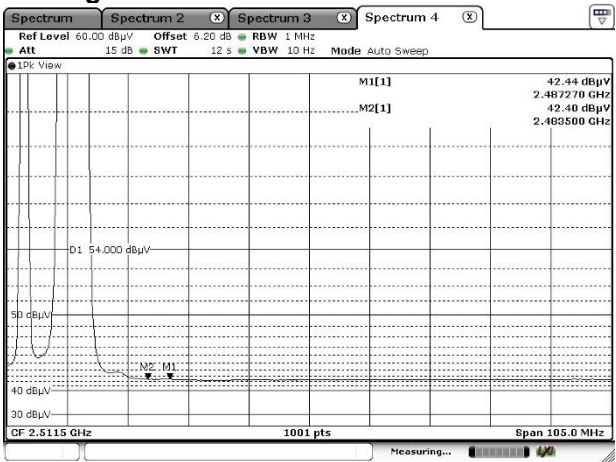
Average



Vertical
Peak



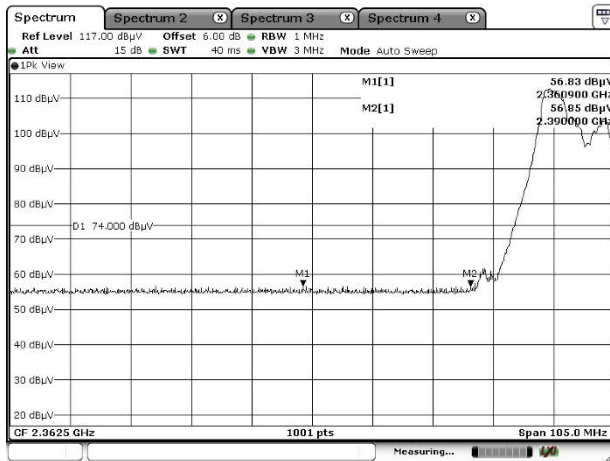
Average



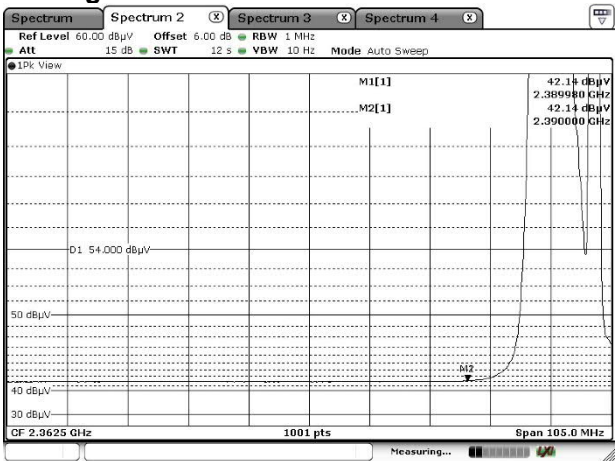


[IEEE802.11ax (HE20)_52-Tones]

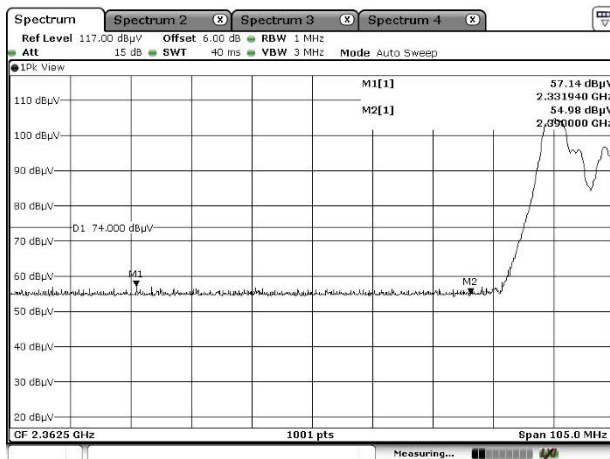
Channel Low
Horizontal
Peak



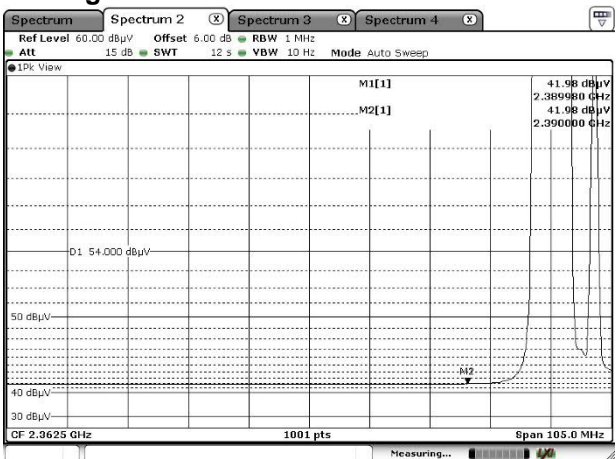
Average



Vertical
Peak



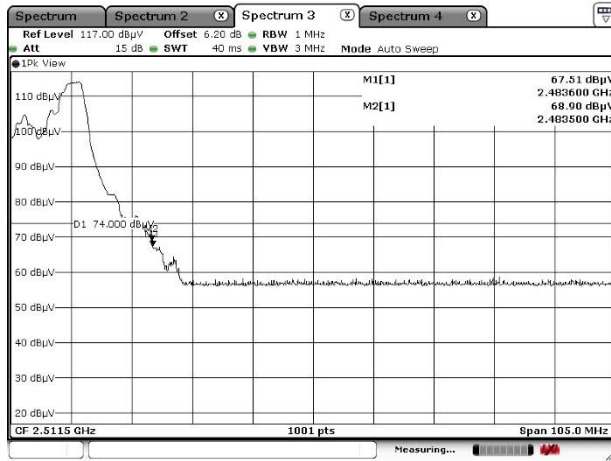
Average



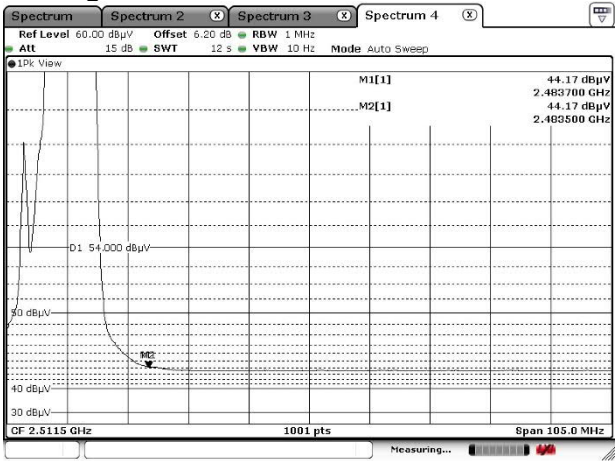


[IEEE802.11ax (HE20)_52-Tones]

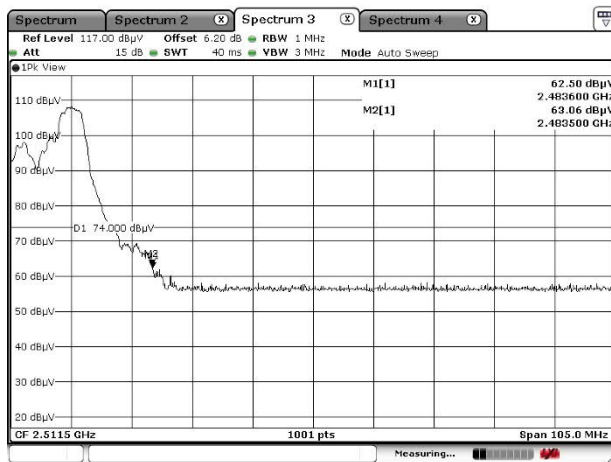
Channel High
Horizontal
Peak



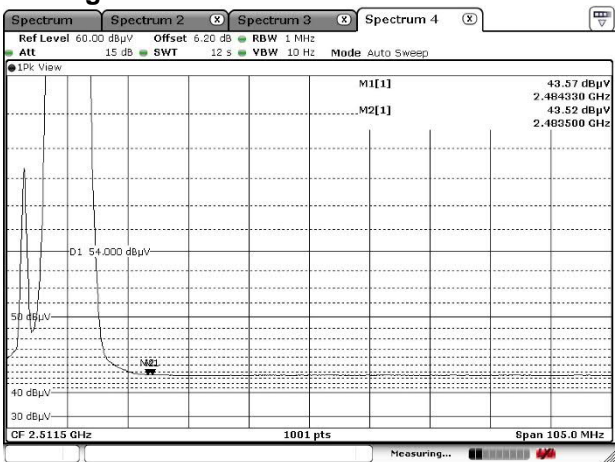
Average



Vertical
Peak



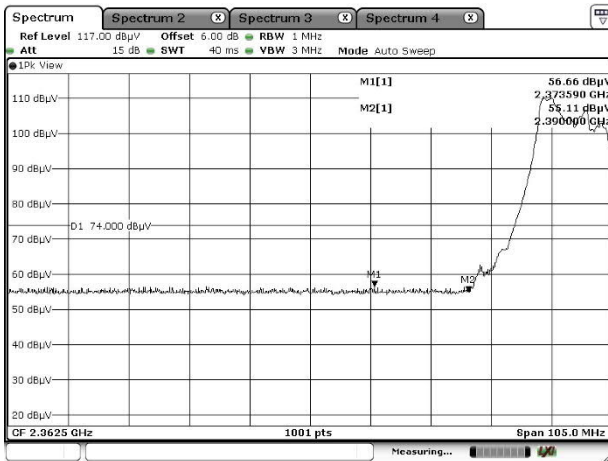
Average



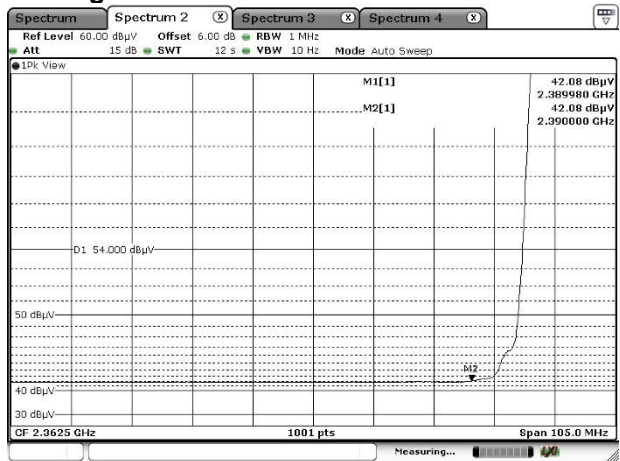


[IEEE802.11ax (HE20)_106-Tones]

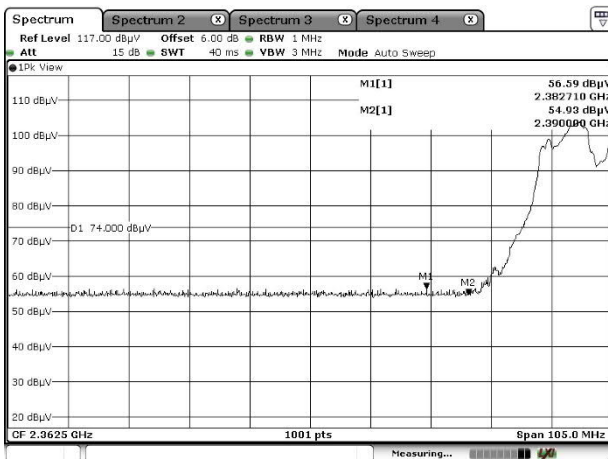
Channel Low
Horizontal
Peak



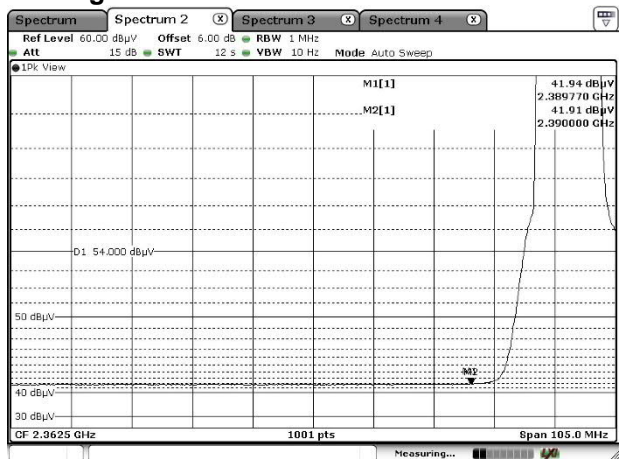
Average



Vertical
Peak



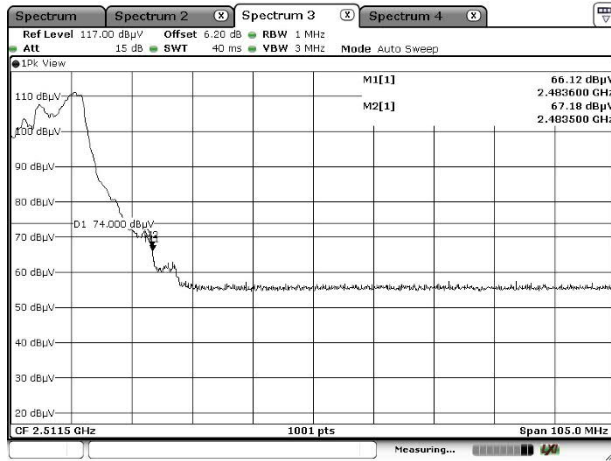
Average



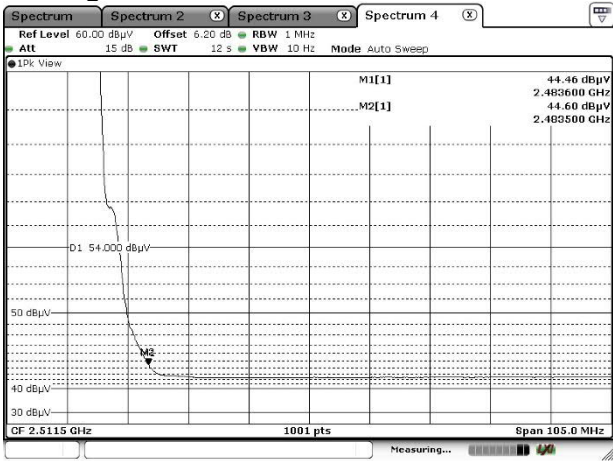


[IEEE802.11ax (HE20)_106-Tones]

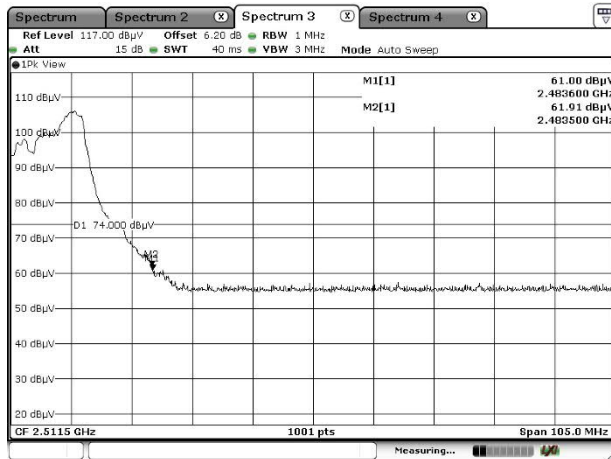
Channel High
Horizontal
Peak



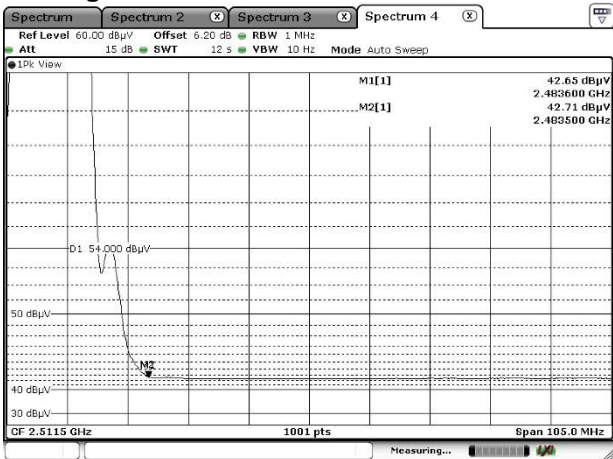
Average



Vertical
Peak



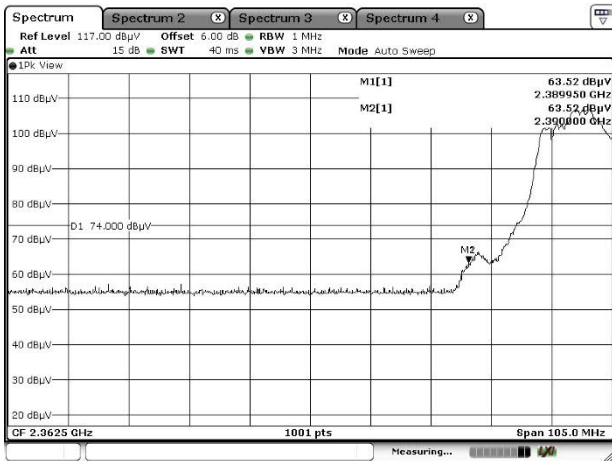
Average



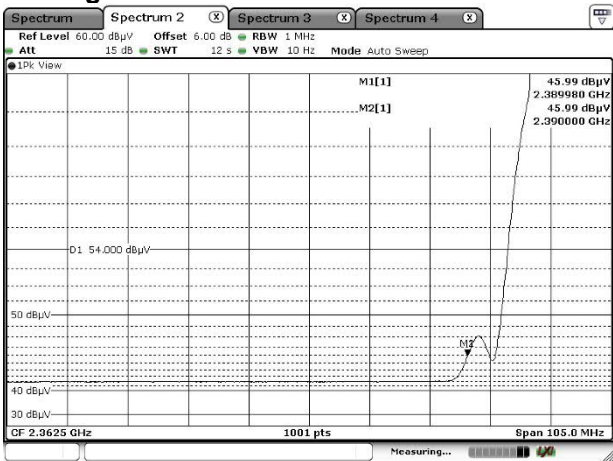


[IEEE802.11ax (HE20)_242-Tones]

Channel Low Horizontal Peak



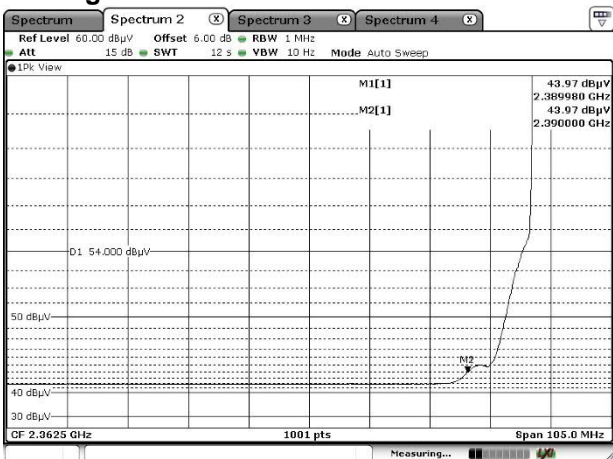
Average



Vertical Peak



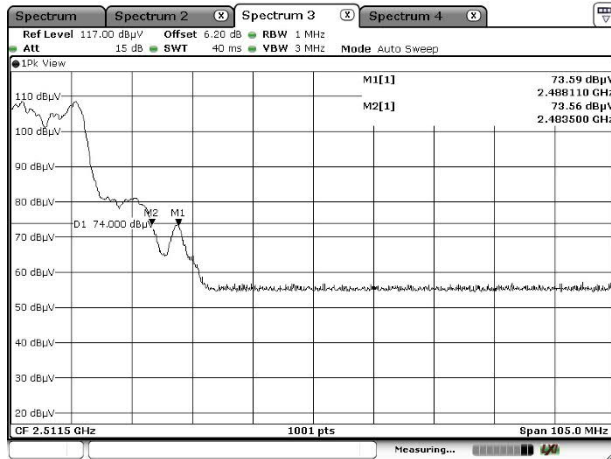
Average



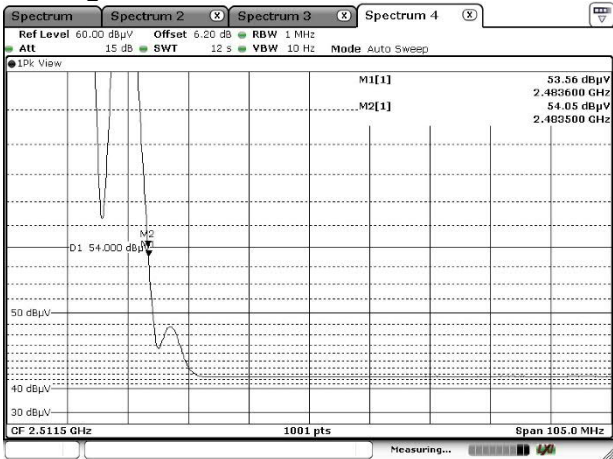


[IEEE802.11ax (HE20)_242-Tones]

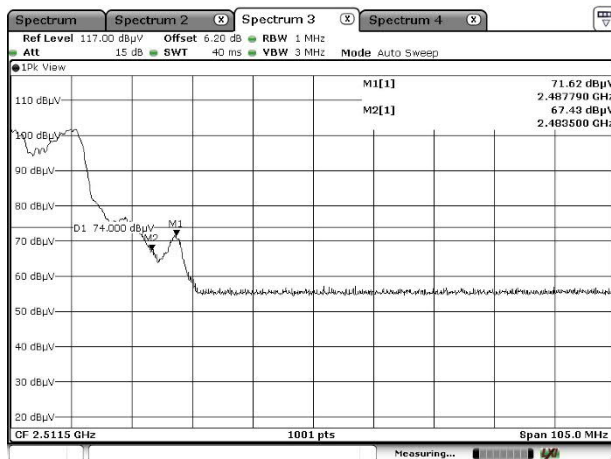
Channel High
Horizontal
Peak



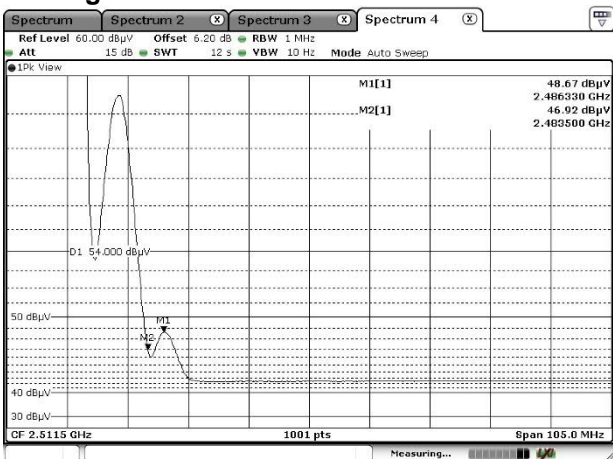
Average



Vertical
Peak



Average



4.7 Transmitter Power Spectral Density

4.7.1 Measurement procedure

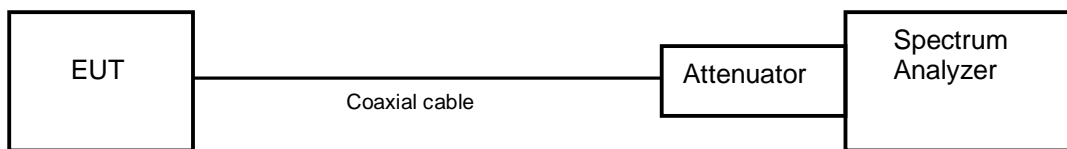
[FCC 15.247(e), KDB 558074 D01 v05r02, Section 8.4]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- a) Span = 1.5 times the 6 dB bandwidth.
- b) RBW = 3kHz - 100kHz.
- c) VBW \geq 3 x RBW.
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



4.7.2 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band.

4.7.3 Measurement result

Date : 20-July-2023
 Temperature : 23.8 [°C]
 Humidity : 61.3 [%]
 Test place : Shielded room No.4

Test engineer : Kazunori Saito

Date : 24-July-2023
 Temperature : 23.0 [°C]
 Humidity : 59.3 [%]
 Test place : Shielded room No.4

Test engineer : Kazunori Saito

[IEEE802.11ax (HE20)_26-Tones] [Chain 0]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-15.96	10.83	-5.13	8.00	13.13	PASS
Middle	2437	-16.85	10.83	-6.02	8.00	14.02	PASS
High	2462	-16.68	10.83	-5.85	8.00	13.85	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_52-Tones] [Chain 0]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-17.55	10.83	-6.72	8.00	14.72	PASS
Middle	2437	-17.77	10.83	-6.94	8.00	14.94	PASS
High	2462	-17.58	10.83	-6.75	8.00	14.75	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_106-Tones] [Chain 0]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-21.07	10.83	-10.24	8.00	18.24	PASS
Middle	2437	-20.94	10.83	-10.11	8.00	18.11	PASS
High	2462	-21.07	10.83	-10.24	8.00	18.24	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_242-Tones] [Chain 0]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-23.77	10.83	-12.94	8.00	20.94	PASS
Middle	2437	-23.61	10.83	-12.78	8.00	20.78	PASS
High	2462	-23.69	10.83	-12.86	8.00	20.86	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_26-Tones] [Chain 1]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-15.28	10.83	-4.45	8.00	12.45	PASS
Middle	2437	-14.99	10.83	-4.16	8.00	12.16	PASS
High	2462	-15.47	10.83	-4.64	8.00	12.64	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_52-Tones] [Chain 1]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-17.95	10.83	-7.12	8.00	15.12	PASS
Middle	2437	-17.72	10.83	-6.89	8.00	14.89	PASS
High	2462	-16.98	10.83	-6.15	8.00	14.15	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_106-Tones] [Chain 1]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-21.11	10.83	-10.28	8.00	18.28	PASS
Middle	2437	-20.28	10.83	-9.45	8.00	17.45	PASS
High	2462	-20.75	10.83	-9.92	8.00	17.92	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_242-Tones] [Chain 1]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412	-23.85	10.83	-13.02	8.00	21.02	PASS
Middle	2437	-22.72	10.83	-11.89	8.00	19.89	PASS
High	2462	-22.69	10.83	-11.86	8.00	19.86	PASS

Calculation;

$$\text{Transmitter Power Spectral Density Level (Margin)} = \text{Limit} - (\text{Reading} + \text{Factor})$$

[IEEE802.11ax (HE20)_26-Tones] [Chain 0+1]

Channel	Center Frequency (MHz)	Level (dBm)		Total Level (dBm)	Limit (dBm)	Margin (dBm)	Result
		Chain 0	Chain 1				
Low	2412	-5.13	-4.45	-1.7664	8	9.7664	PASS
Middle	2437	-6.02	-4.16	-1.9809	8	9.9809	PASS
High	2462	-5.85	-4.64	-2.1927	8	10.1927	PASS

Calculation;

Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

[IEEE802.11ax (HE20)_52-Tones] [Chain 0+1]

Channel	Center Frequency (MHz)	Level (dBm)		Total Level (dBm)	Limit (dBm)	Margin (dBm)	Result
		Chain 0	Chain 1				
Low	2412	-6.72	-7.12	-3.9051	8	11.9051	PASS
Middle	2437	-6.94	-6.89	-3.9046	8	11.9046	PASS
High	2462	-6.75	-6.15	-3.4293	8	11.4293	PASS

Calculation;

Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

[IEEE802.11ax (HE20)_106-Tones] [Chain 0+1]

Channel	Center Frequency (MHz)	Level (dBm)		Total Level (dBm)	Limit (dBm)	Margin (dBm)	Result
		Chain 0	Chain 1				
Low	2412	-10.24	-10.28	-7.2497	8	15.2497	PASS
Middle	2437	-10.11	-9.45	-6.7572	8	14.7572	PASS
High	2462	-10.24	-9.92	-7.0668	8	15.0668	PASS

Calculation;

Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

[IEEE802.11ax (HE20)_242-Tones] [Chain 0+1]

Channel	Center Frequency (MHz)	Level (dBm)		Total Level (dBm)	Limit (dBm)	Margin (dBm)	Result
		Chain 0	Chain 1				
Low	2412	-12.94	-13.02	-9.9695	8	17.9695	PASS
Middle	2437	-12.78	-11.89	-9.3019	8	17.3019	PASS
High	2462	-12.86	-11.86	-9.3210	8	17.3210	PASS

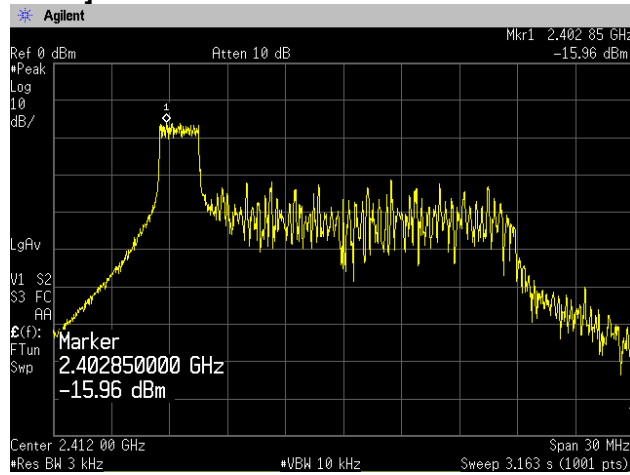
Calculation;

Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

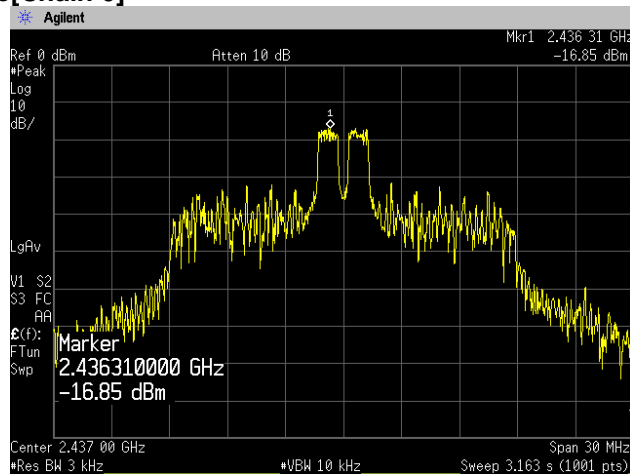
4.7.4 Trace data

[IEEE802.11ax (HE20)_26-Tones]

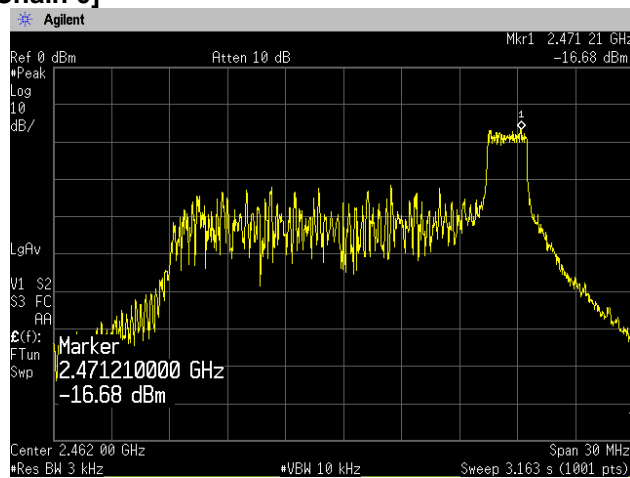
Channel Low[Chain 0]



Channel Middle[Chain 0]

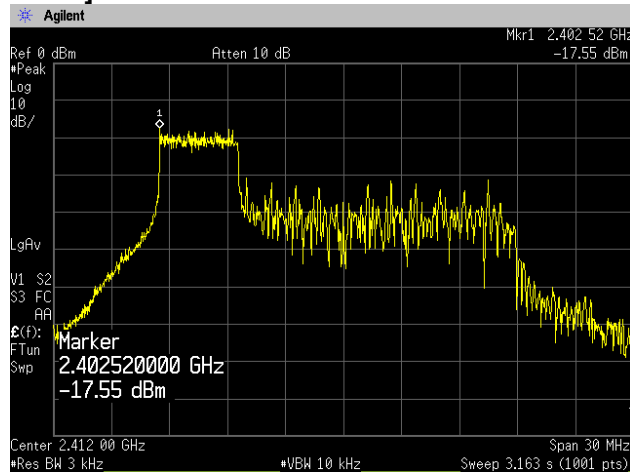


Channel High[Chain 0]

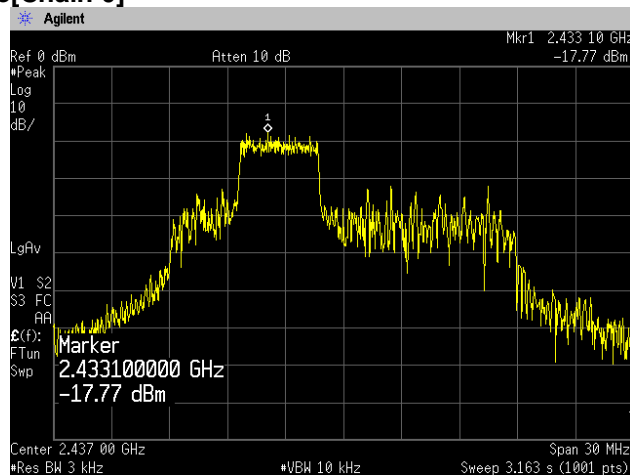


[IEEE802.11ax (HE20)_52-Tones]

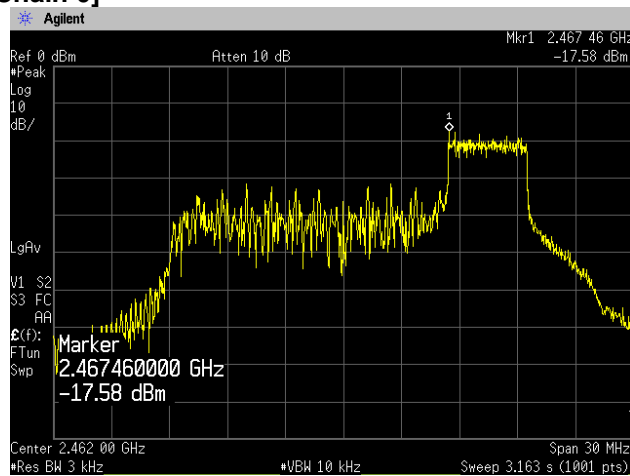
Channel Low[Chain 0]



Channel Middle[Chain 0]

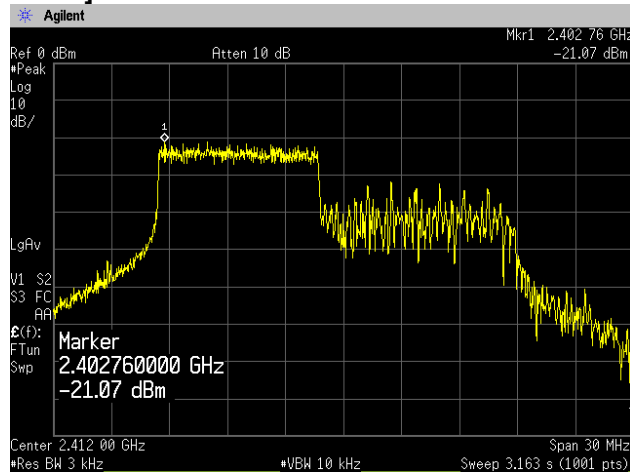


Channel High[Chain 0]

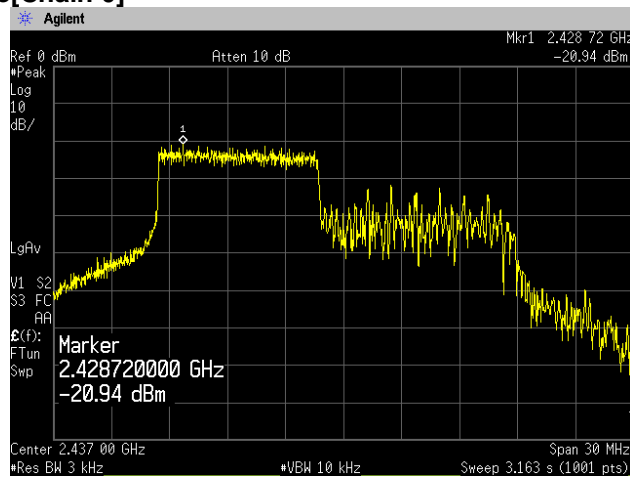


[IEEE802.11ax (HE20)_106-Tones]

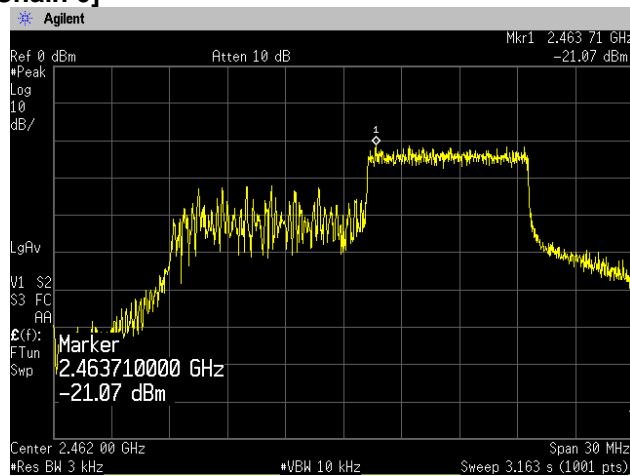
Channel Low[Chain 0]



Channel Middle[Chain 0]

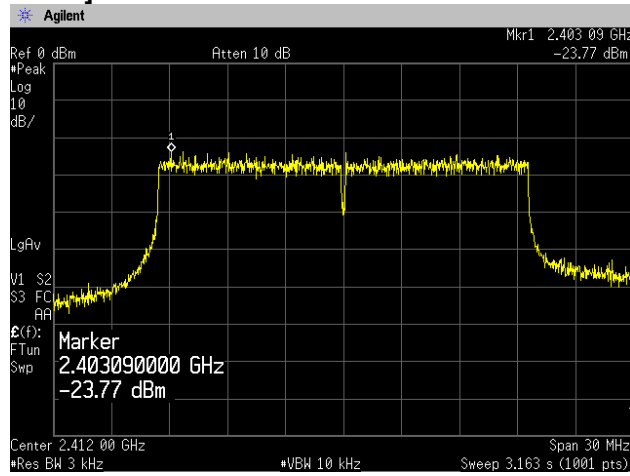


Channel High[Chain 0]

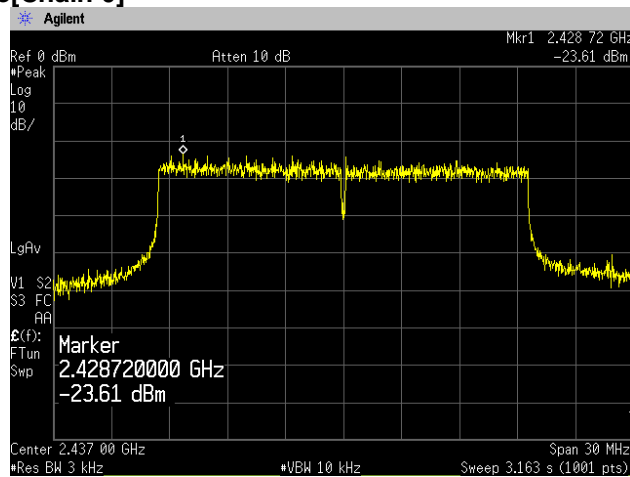


[IEEE802.11ax (HE20)_242-Tones]

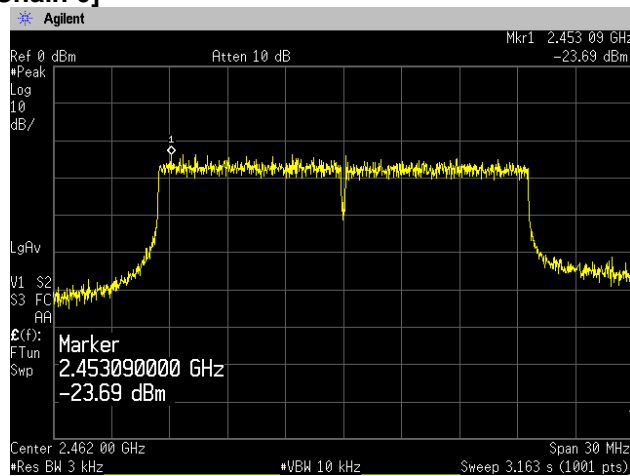
Channel Low[Chain 0]



Channel Middle[Chain 0]

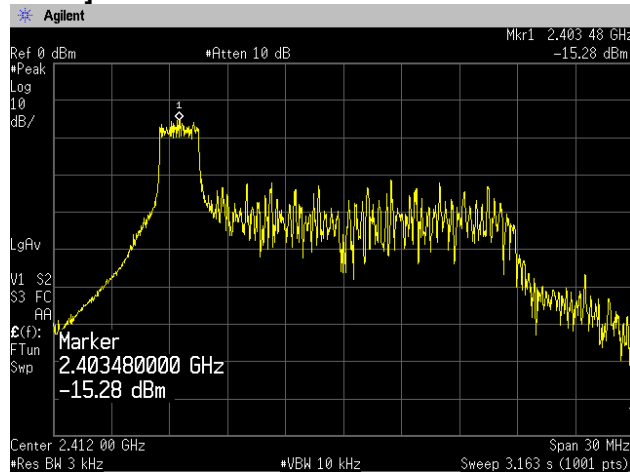


Channel High[Chain 0]

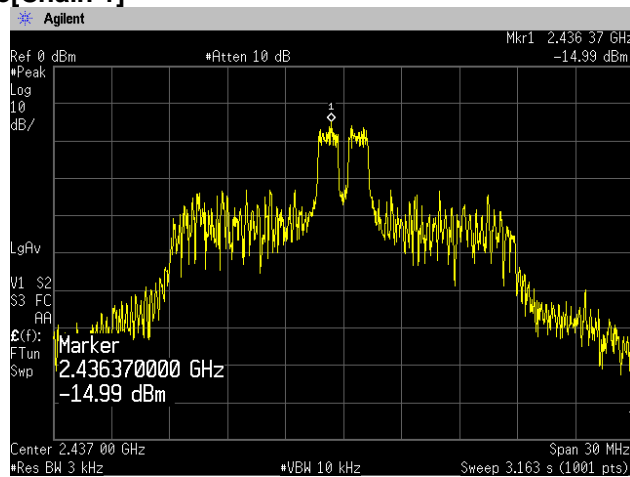


[IEEE802.11ax (HE20)_26-Tones]

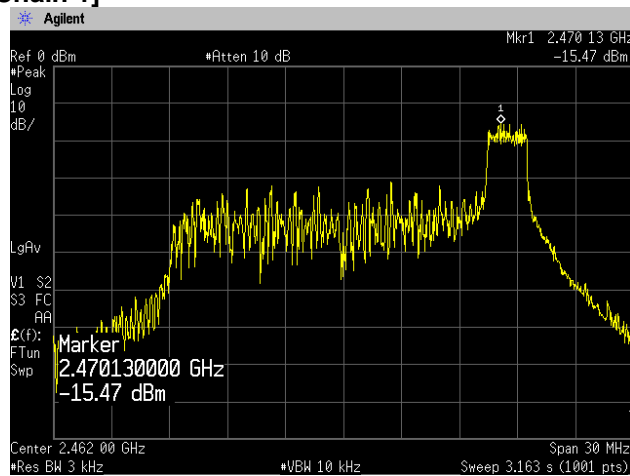
Channel Low[Chain 1]



Channel Middle[Chain 1]

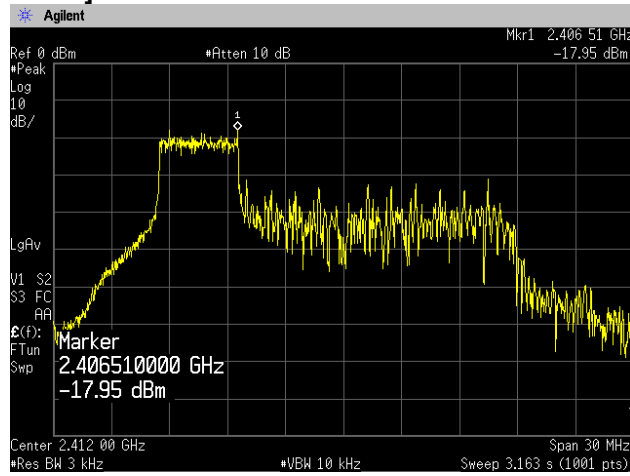


Channel High[Chain 1]

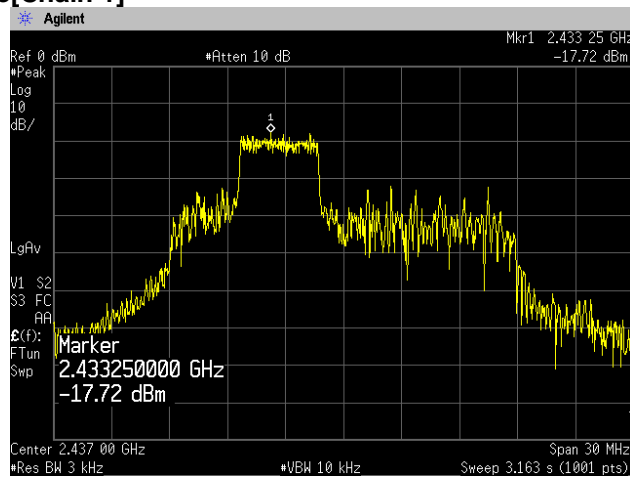


[IEEE802.11ax (HE20)_52-Tones]

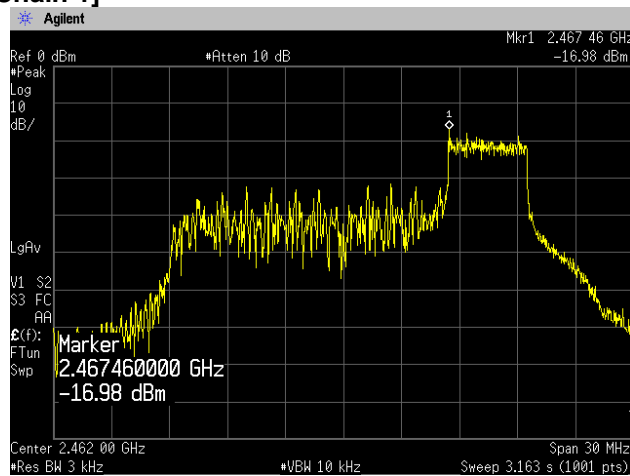
Channel Low[Chain 1]



Channel Middle[Chain 1]

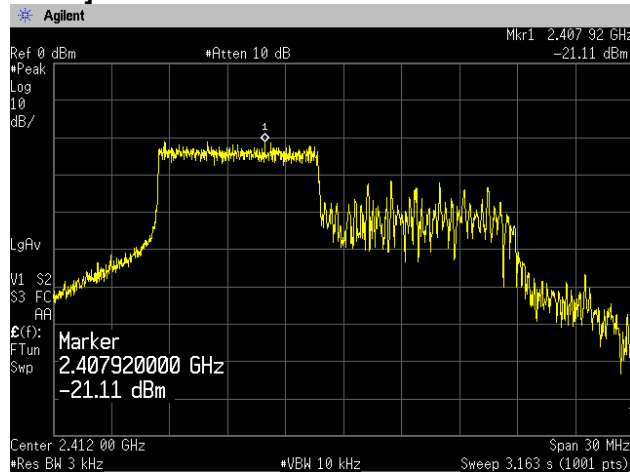


Channel High[Chain 1]

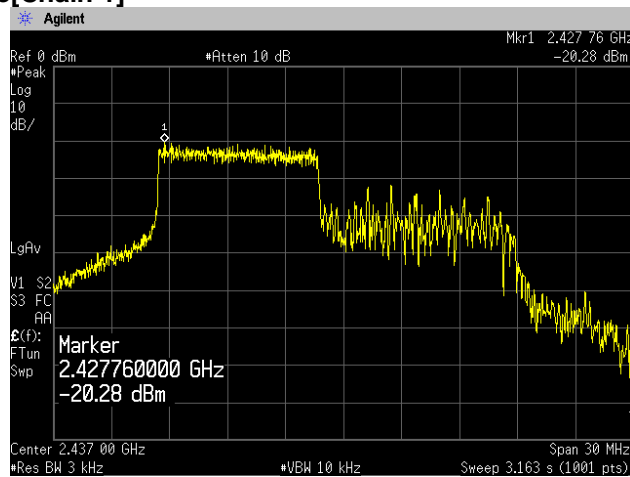


[IEEE802.11ax (HE20)_106-Tones]

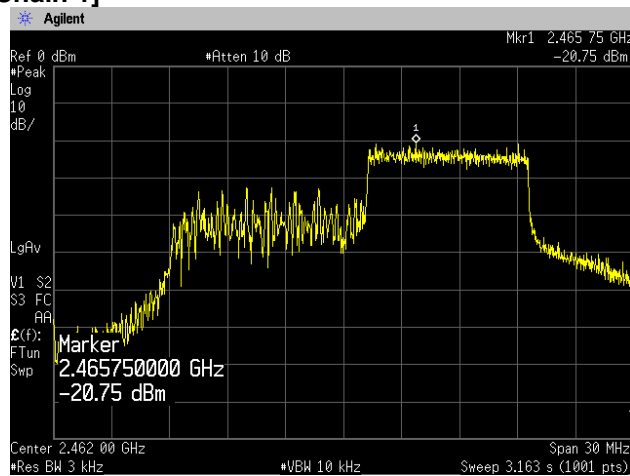
Channel Low[Chain 1]



Channel Middle[Chain 1]

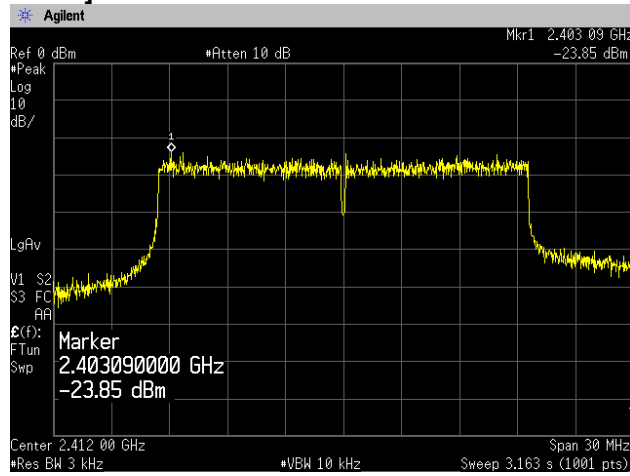


Channel High[Chain 1]

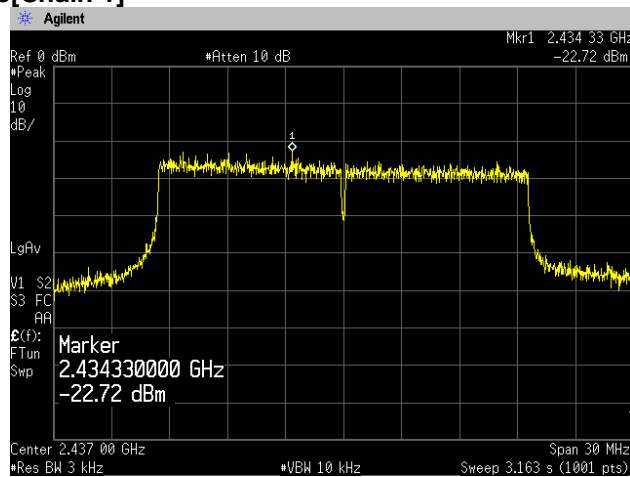


[IEEE802.11ax (HE20)_242-Tones]

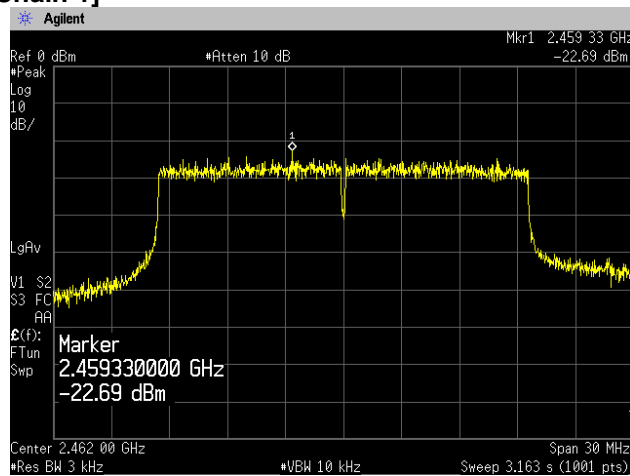
Channel Low[Chain 1]



Channel Middle[Chain 1]



Channel High[Chain 1]



4.8 AC Power Line Conducted Emissions

4.8.1 Measurement procedure

[FCC 15.207]

Test was applied by following conditions.

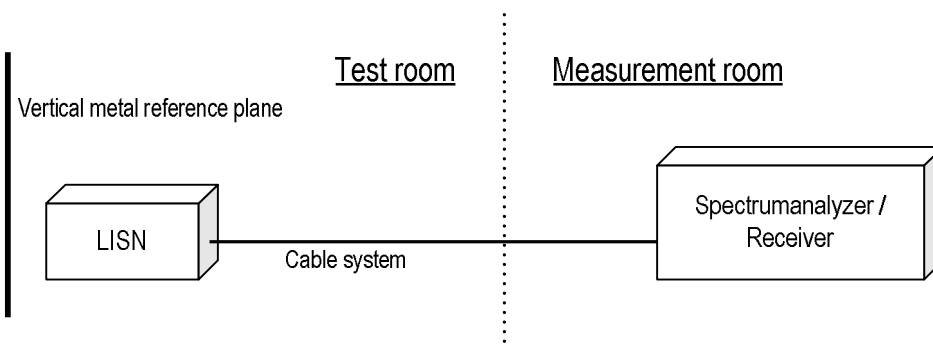
Test method	: ANSI C63.10
Frequency range	: 0.15 MHz to 30 MHz
Test place	: 3m Semi-anechoic chamber
EUT was placed on	: FRP table / (W) 2.0 x (D) 1.0 x (H) 0.8 m
Vertical Metal Reference Plane	: (W) 2.0 x (H) 2.0 m, 0.4 m away from EUT
Test receiver setting	
- Detector	: Quasi-peak, Average
- Bandwidth	: 9 kHz

EUT and peripherals are connected to 50Ω/50 μH Line Impedance Stabilization Network (LISN) which are connected to reference ground plane, and are placed 80cm away from EUT. Excess of AC power cable is bundled in center.

LISN for peripheral is terminated in 50Ω.

EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, peripherals, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, peripherals and test equipment is provided in order for them to warm up to their normal operating condition. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits.

- Test configuration



4.8.2 Calculation method

Emission level = Reading + (LISN. Factor + Cable system loss)

Margin = Limit – Emission level

Example:

Limit @ 0.403 MHz: 57.8 dBμV(Quasi-peak)
: 47.8 dBμV(Average)

(Quasi peak) Reading = 22.7 dBμV c.f. = 10.4 dB

Emission level = 22.7 + 10.4 = 33.1 dBμV

Margin = 57.8 – 33.1 = 24.7 dB

(Average) Reading = 6.5 dBμV c.f. = 10.4 dB

Emission level = 6.5 + 10.4 = 16.9 dBμV

Margin = 47.8 – 16.9 = 30.9 dB

4.8.3 Limit

Frequency [MHz]	Limit	
	QP [dBuV]	AV [dBuV]
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

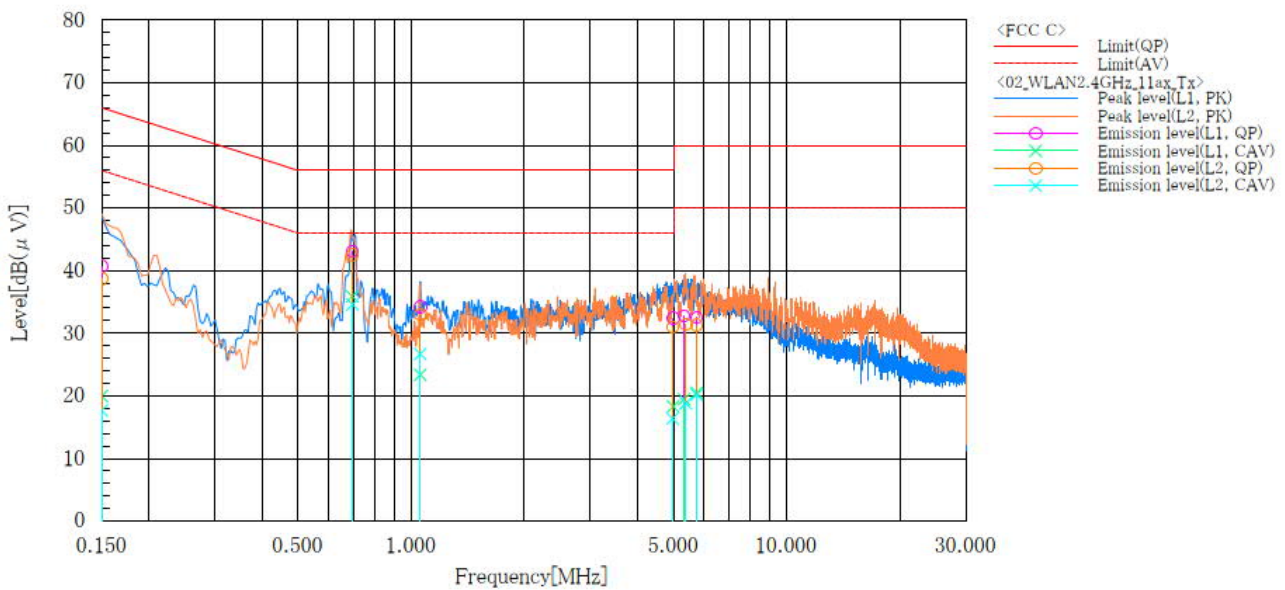
*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.



4.8.4 Test data

Date : 21-July-2023
 Temperature : 24.1 [°C]
 Humidity : 75.8 [%]
 Test place : 3m Semi-anechoic chamber
 Test engineer : Tadahiro Seino

Company name : KYOCERA Corporation
 EUT : Mobile Phone
 Model No. : EB1157
 Serial No. : N/A
 Test mode : WLAN_2.4GHz_Tx
 Standard : FCC Part 15 Subpart C
 Operator : T.Seino
 Temp,Hum,Atm : 24.1 [°C], 75.8 [%]
 Note1 : Ch:1(2412MHz), RU:26T, Index:0
 Note2 : 2SS, Chain:Both



Final Result

--- L1 ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.150	30.2	9.5	10.5	40.7	20.0	66.0	56.0	25.3	36.0
2	0.697	32.8	25.6	10.3	43.1	35.9	56.0	46.0	12.9	10.1
3	1.058	23.8	13.0	10.4	34.2	23.4	56.0	46.0	21.8	22.6
4	4.986	21.7	7.6	10.7	32.4	18.3	56.0	46.0	23.6	27.7
5	5.334	22.1	8.8	10.7	32.8	19.5	60.0	50.0	27.2	30.5
6	5.758	21.8	9.8	10.7	32.5	20.5	60.0	50.0	27.5	29.5

--- L2 ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.150	28.2	7.2	10.5	38.7	17.7	66.0	56.0	27.3	38.3
2	0.698	32.2	24.3	10.3	42.5	34.6	56.0	46.0	13.5	11.4
3	1.058	22.7	16.4	10.3	33.0	26.7	56.0	46.0	23.0	19.3
4	4.970	20.3	5.7	10.7	31.0	16.4	56.0	46.0	25.0	29.6
5	5.384	20.7	8.1	10.7	31.4	18.8	60.0	50.0	28.6	31.2
6	5.766	20.6	9.5	10.7	31.3	20.2	60.0	50.0	28.7	29.8



Japan

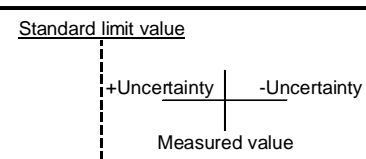
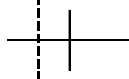

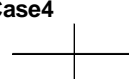
5 Antenna requirement

According to FCC section 15.203, 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 antenna is a special antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.

6 Measurement Uncertainty

Expanded uncertainties stated are calculated with a coverage Factor k=2.
 Please note that these results are not taken into account when measurement uncertainty considerations contained in ETSI TR 100 028 Parts 1 and 2 determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission, AMN (9 kHz – 150 kHz)	±3.7 dB
Conducted emission, AMN (150 kHz – 30 MHz)	±3.3 dB
Radiated emission (9kHz – 30 MHz)	±3.8 dB
Radiated emission (30 MHz – 1000 MHz)	±5.4 dB
Radiated emission (1 GHz – 6 GHz)	±4.6 dB
Radiated emission (6 GHz – 18 GHz)	±4.7 dB
Radiated emission (18 GHz – 40 GHz)	±6.4 dB
Radio Frequency	±1.3 * 10 ⁻⁸
RF power, conducted	±0.7 dB
Adjacent channel power	±1.5 dB
Temperature	±0.6 °C
Humidity	±1.2 %
Voltage (DC)	±0.4 %
Voltage (AC, <10kHz)	±0.2 %

Judge	Measured value and standard limit value
PASS	<p>Case1</p>  <p>Even if it takes uncertainty into consideration, a standard limit value is fulfilled.</p>
	<p>Case2</p>  <p>Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.</p>
FAIL	<p>Case3</p>  <p>Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.</p>
	<p>Case4</p>  <p>Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.</p>



Japan

7 Laboratory Information

Testing was performed and the report was issued at:

TÜV SÜD Japan Ltd. Yonezawa Testing Center

Address: 5-4149-7 Hachimanpara, Yonezawa-shi, Yamagata, 992-1128 Japan
Phone: +81-238-28-2881

Accreditation and Registration

A2LA

Certificate #3686.03

VLAC

Accreditation No.: VLAC-013

BSMI

Laboratory Code: SL2-IN-E-6018, SL2-A1-E-6018

Innovation, Science and Economic Development Canada

ISED#: 4224A

VCCI Council

Registration number: A-0166

Appendix A. Test Equipment

Antenna port conducted test

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
Spectrum analyzer	Agilent Technologies	E4440A	US44302655	30-Sep-2023	05-Sep-2022
Attenuator	HUBER+SUHNER	6810.19.A	N/A(S450)	31-Dec-2023	19-Dec-2022
Power meter	ROHDE&SCHWARZ	NRP2	103269	31-Mar-2024	13-Mar-2023
Power sensor	ROHDE&SCHWARZ	NRP-Z81	102467	31-Mar-2024	13-Mar-2023

Radiated emission

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI receiver	ROHDE&SCHWARZ	ESW44	103171	30-Sep-2023	20-Sep-2022
Spectrum analyzer	ROHDE&SCHWARZ	FSV40	101731	31-Jul-2023	19-Jul-2022
Preamplifier	SONOMA	310	372170	30-Sep-2023	28-Sep-2022
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	100515	30-Apr-2024	21-Apr-2023
Attenuator	TOYO Connector	NA-PJ-6	N/A(S507)	31-Mar-2024	15-Mar-2023
Biconical antenna	Schwarzbeck	VHBB9124/BBA9106	1145	30-Jun-2023	28-Jun-2022
Log periodic antenna	Schwarzbeck	VUSLP9111B	346	30-Nov-2023	16-Nov-2022
Attenuator	TOYO Connector	NA-PJ-6/6dB	N/A(S541)	30-Sep-2023	28-Sep-2022
Attenuator	TAMAGAWA.ELEC	CFA-10/3dB	N/A(S503)	31-Jul-2023	14-Jul-2022
Preamplifier	TSJ	MLA-100M18-B02-40	1929118	31-Dec-2023	22-Dec-2022
Attenuator	AEROFLEX	26A-10	081217-08	31-Dec-2023	19-Dec-2022
Double ridged guide antenna	ETS LINDGREN	3117	00052315	30-Jun-2024	22-Jun-2023
Attenuator	HUBER+SUHNER	6803.17.B	N/A(2340)	31-Dec-2023	22-Dec-2022
Double ridged guide antenna	A.H.Systems Inc.	SAS-574	469	31-Aug-2023	19-Aug-2022
Preamplifier	TSJ	MLA-1840-B03-35	1240332	31-Aug-2023	19-Aug-2022
Notch Filter	Micro-Tronics	BRM50702	G433	30-Sep-2023	28-Sep-2022
Microwave cable	HUBER+SUHNER	SUCOFLEX104/9m	800690/4	31-Oct-2023	26-Oct-2022
		SUCOFLEX104/1m	my24610/4	31-Dec-2023	19-Dec-2022
		SUCOFLEX104/9m	2001099/4	31-Dec-2023	22-Dec-2022
		SUCOFLEX104/1m	MY32976/4	31-Dec-2023	22-Dec-2022
		SUCOFLEX104/2m	SN MY28404/4	31-Dec-2023	19-Dec-2022
		SUCOFLEX104/7m	41625/6	31-Dec-2023	22-Dec-2022
PC	DELL	OPTIPLEX9010	00186-228-073-851	N/A	N/A
Software	TOYO Technica	ES10/RE-AJ	Ver.2021.10.001	N/A	N/A
Absorber	RIKEN	PPF30	N/A	N/A	N/A
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-NSA)	31-May-2024	28-May-2023
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-SVSWR)	31-May-2024	28-May-2023

Conducted emission at mains port

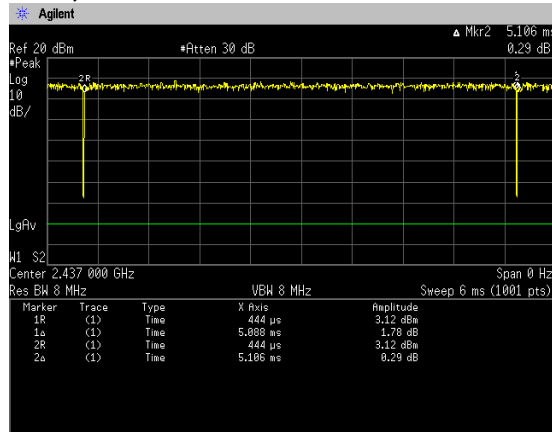
Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI receiver	ROHDE&SCHWARZ	ESW44	103171	30-Sep-2023	20-Sep-2022
Attenuator	HUBER+SUHNER	6810.01.A	N/A (S411)	31-Dec-2023	20-Dec-2022
Line impedance stabilization network	Kyoritsu Electrical Works, Ltd.	TNW-407F2	12-17-110-2	30-Jun-2024	22-Jun-2023
Microwave cable	HUBER+SUHNER	SUCOFLEX104/5m	MY33601/4	31-Oct-2023	27-Oct-2022
Microwave cable	HUBER+SUHNER	SUCOFLEX104/2m	MY37268/4	31-Oct-2023	27-Oct-2022
Coaxial cable	HUBER+SUHNER	RG214/U/10m	N/A (S194)	31-Dec-2023	22-Dec-2022
PC	DELL	OPTIPLEX9010	00186-228-073-851	N/A	N/A
Software	TOYO Technica	ES10/RE-AJ	Ver.2021.10.001	N/A	N/A

*: The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

Appendix B. Duty Cycle

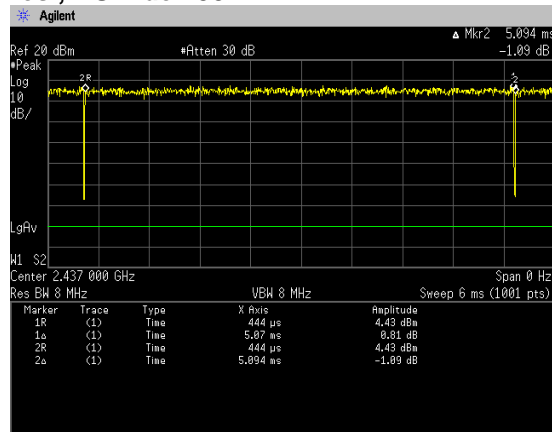
[Plot & Calculation]

11ax HE20: 26-Tones , RU index 4



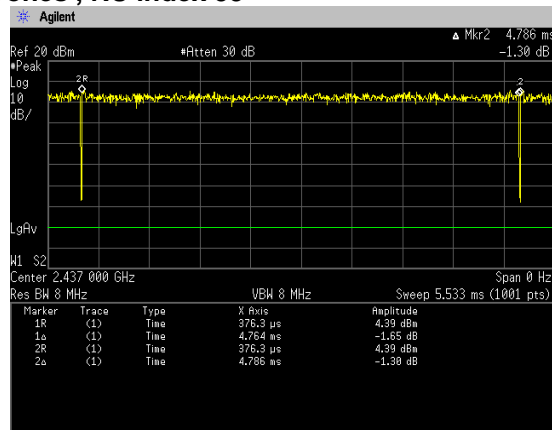
$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff}) = 5.088[\text{ms}] / (5.088[\text{ms}] + 0.018[\text{ms}]) = 99.65\%$$

11ax HE20: 52-Tones , RU index 38



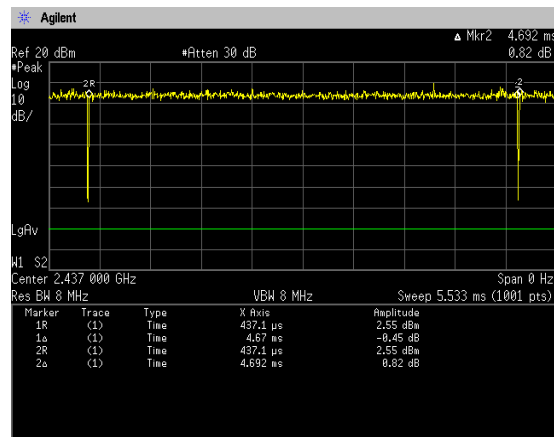
$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff}) = 5.07[\text{ms}] / (5.07[\text{ms}] + 0.024[\text{ms}]) = 99.53\%$$

11ax HE20: 106-Tones , RU index 53



$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff}) = 4.764[\text{ms}] / (4.764[\text{ms}] + 0.022[\text{ms}]) = 99.54\%$$

11ax HE20: 242-Tones , RU index 61



$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff}) = 4.67[\mu\text{s}] / (4.67[\mu\text{s}] + 0.022[\mu\text{s}]) = 99.53\%$$