

6.5. 99% Occupied Bandwidth(conducted)

6.5.1 Measurement Limit

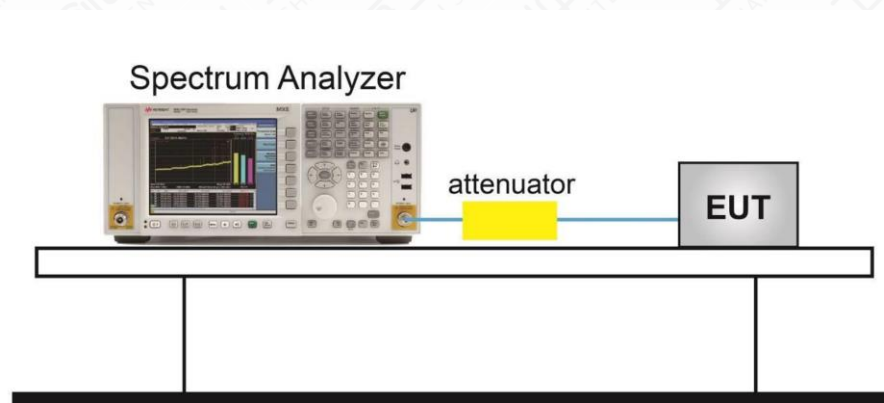
Standard	Limit(MHz)
15.407(a)	N/A
RSS-247 6.2	N/A

6.5.2 Test Procedure

The measurement method is made according to KDB 789033 D

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot$ RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

6.5.3 Test Setup



Note: The attenuator shown in the figure is the attenuation of the entire test system.

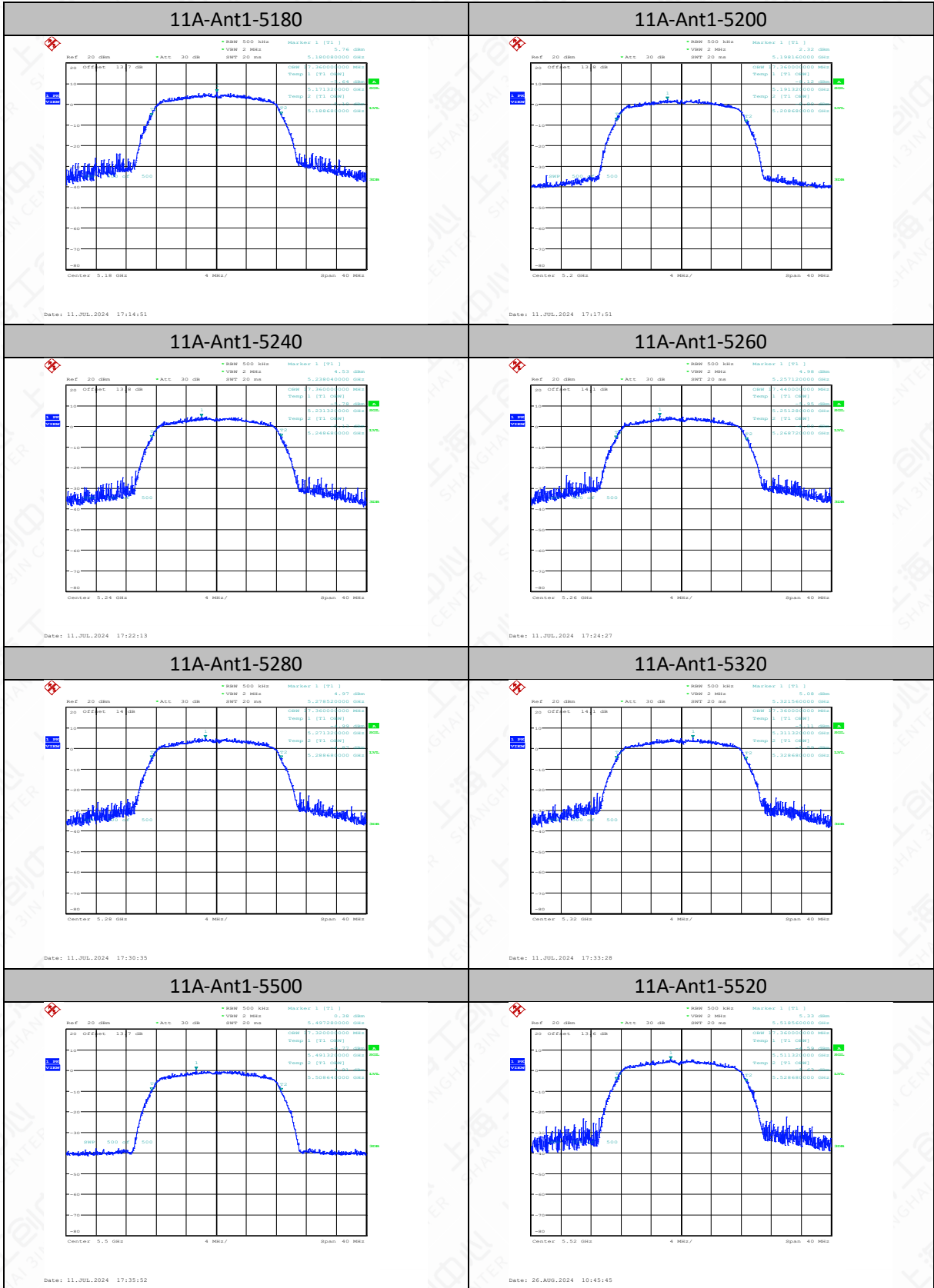
6.5.4 Measurement Results

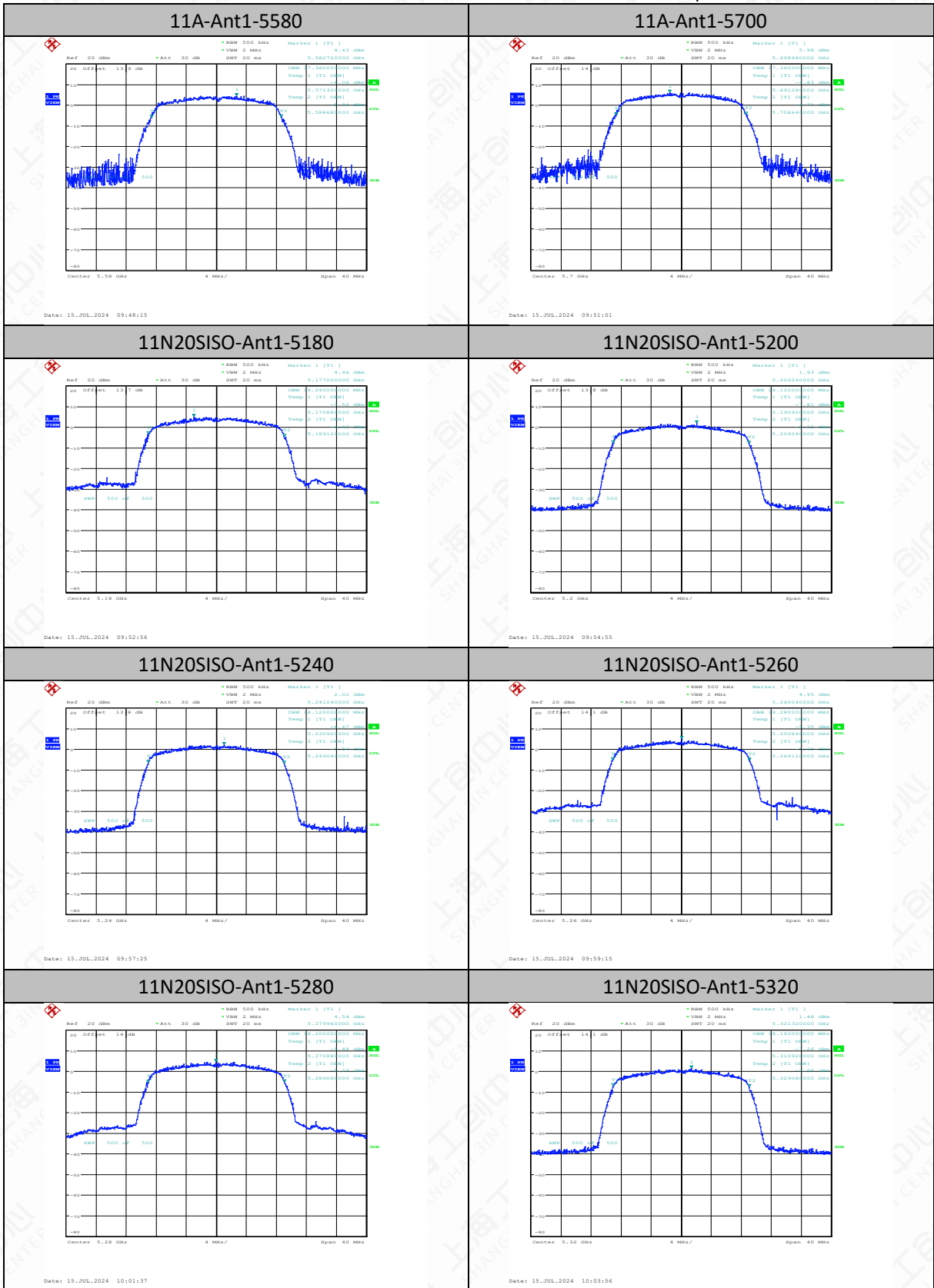
TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	17.36	5171.3200	5188.6800	---	---
11A	Ant1	5200	17.36	5191.3200	5208.6800	---	---
11A	Ant1	5240	17.36	5231.3200	5248.6800	---	---

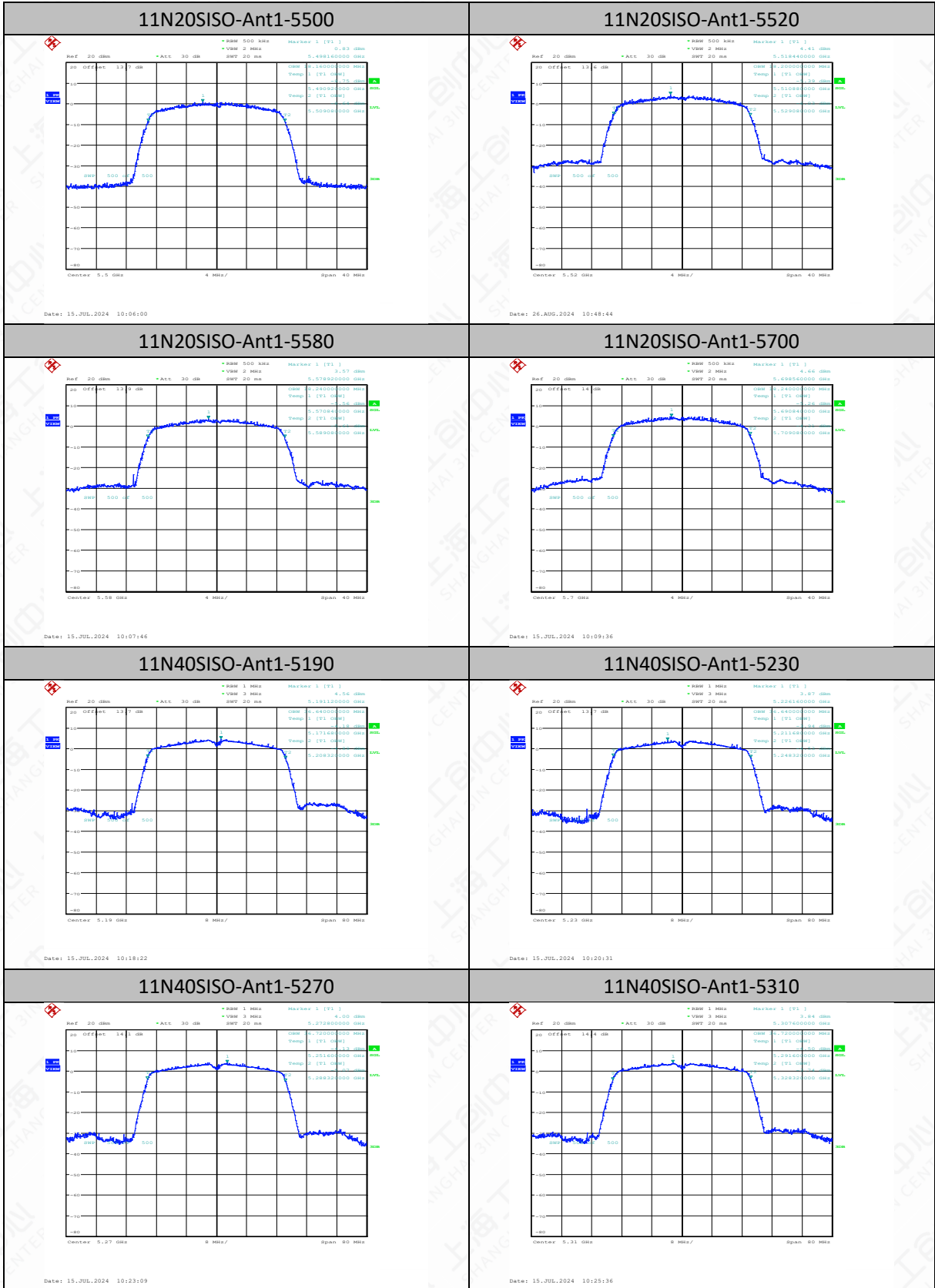
11A	Ant1	5260	17.44	5251.2800	5268.7200	---	---
11A	Ant1	5280	17.36	5271.3200	5288.6800	---	---
11A	Ant1	5320	17.36	5311.3200	5328.6800	---	---
11A	Ant1	5500	17.32	5491.3200	5508.6400	---	---
11A	Ant1	5520	17.36	5511.3200	5528.6800	---	---
11A	Ant1	5580	17.36	5571.3200	5588.6800	---	---
11A	Ant1	5700	17.36	5691.2800	5708.6400	---	---
11N20SISO	Ant1	5180	18.24	5170.8800	5189.1200	---	---
11N20SISO	Ant1	5200	18.12	5190.9200	5209.0400	---	---
11N20SISO	Ant1	5240	18.12	5230.9200	5249.0400	---	---
11N20SISO	Ant1	5260	18.28	5250.8400	5269.1200	---	---
11N20SISO	Ant1	5280	18.2	5270.8800	5289.0800	---	---
11N20SISO	Ant1	5320	18.16	5310.9200	5329.0800	---	---
11N20SISO	Ant1	5500	18.16	5490.9200	5509.0800	---	---
11N20SISO	Ant1	5520	18.2	5510.8800	5529.0800	---	---
11N20SISO	Ant1	5580	18.24	5570.8400	5589.0800	---	---
11N20SISO	Ant1	5700	18.24	5690.8400	5709.0800	---	---
11N40SISO	Ant1	5190	36.64	5171.6800	5208.3200	---	---
11N40SISO	Ant1	5230	36.64	5211.6800	5248.3200	---	---
11N40SISO	Ant1	5270	36.72	5251.6000	5288.3200	---	---
11N40SISO	Ant1	5310	36.72	5291.6000	5328.3200	---	---
11N40SISO	Ant1	5510	36.64	5491.6800	5528.3200	---	---
11N40SISO	Ant1	5550	36.72	5531.6000	5568.3200	---	---
11N40SISO	Ant1	5670	36.72	5651.6000	5688.3200	---	---
11AC20SISO	Ant1	5180	18.16	5170.9200	5189.0800	---	---
11AC20SISO	Ant1	5200	18.16	5190.8800	5209.0400	---	---
11AC20SISO	Ant1	5240	18.12	5230.9200	5249.0400	---	---
11AC20SISO	Ant1	5260	18.2	5250.8800	5269.0800	---	---
11AC20SISO	Ant1	5280	18.16	5270.9200	5289.0800	---	---
11AC20SISO	Ant1	5320	18.16	5310.9200	5329.0800	---	---
11AC20SISO	Ant1	5500	18.12	5490.9200	5509.0400	---	---
11AC20SISO	Ant1	5580	18.16	5570.9200	5589.0800	---	---
11AC20SISO	Ant1	5700	18.16	5690.8800	5709.0400	---	---
11AC40SISO	Ant1	5190	36.56	5171.6800	5208.2400	---	---
11AC40SISO	Ant1	5230	36.56	5211.6800	5248.2400	---	---
11AC40SISO	Ant1	5270	36.64	5251.6800	5288.3200	---	---
11AC40SISO	Ant1	5310	36.72	5291.6000	5328.3200	---	---
11AC40SISO	Ant1	5510	36.64	5491.6800	5528.3200	---	---
11AC40SISO	Ant1	5550	36.72	5531.6000	5568.3200	---	---
11AC40SISO	Ant1	5670	36.64	5651.6000	5688.2400	---	---
11AC80SISO	Ant1	5210	75.36	5172.2400	5247.6000	---	---
11AC80SISO	Ant1	5290	75.36	5252.2400	5327.6000	---	---

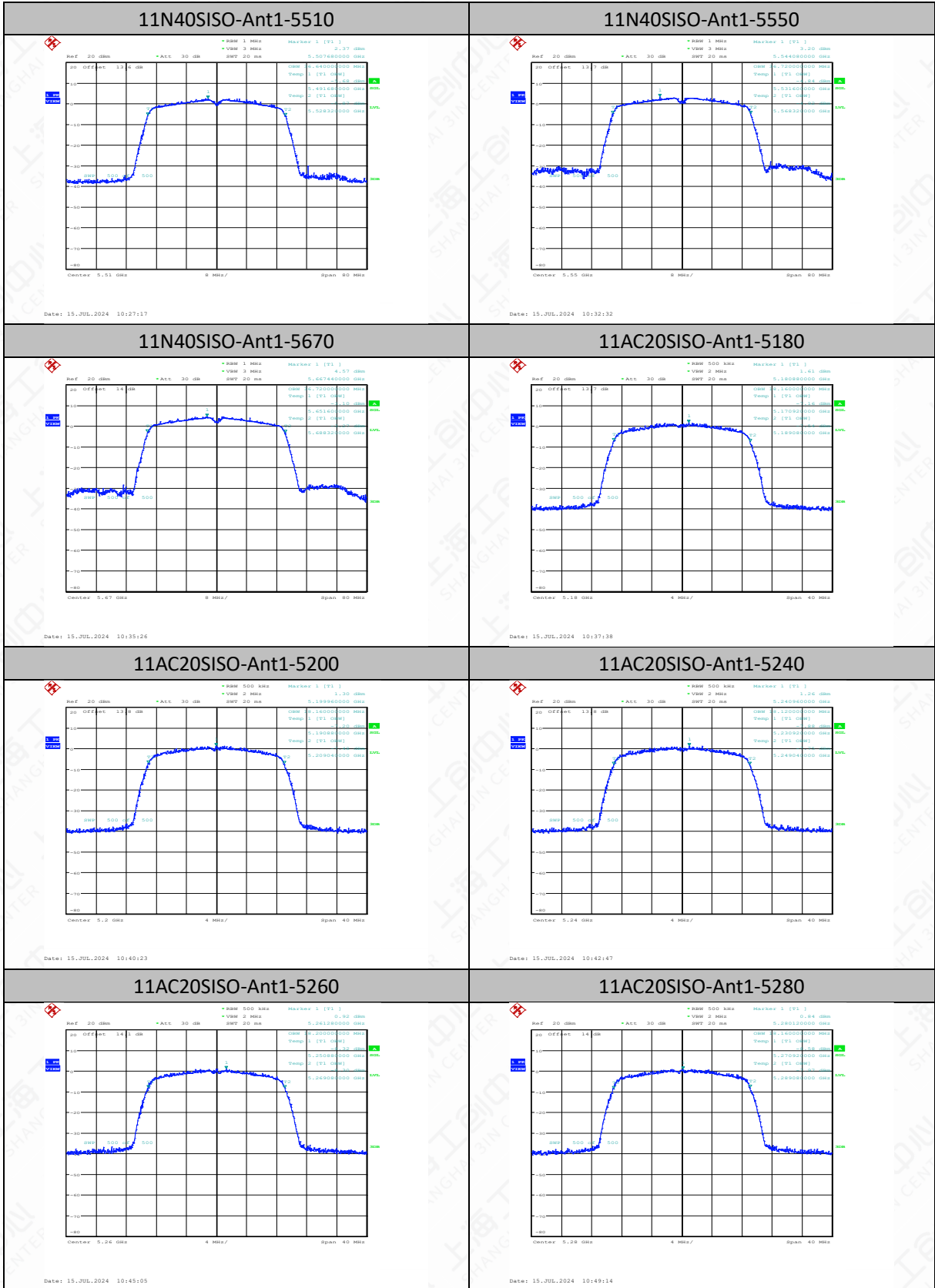
11AC80SISO	Ant1	5530	75.36	5492.2400	5567.6000	---	---
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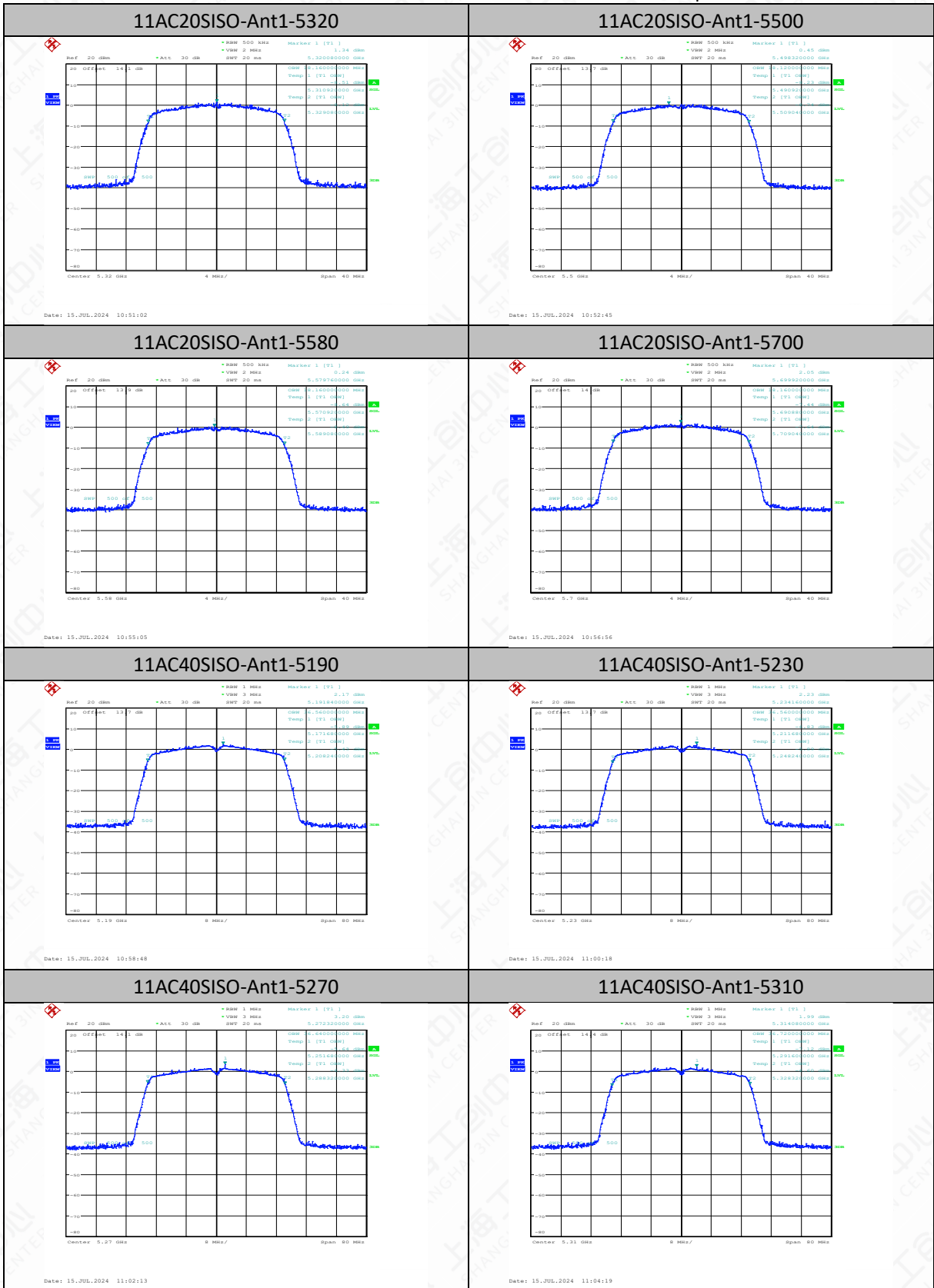
Test Graphs

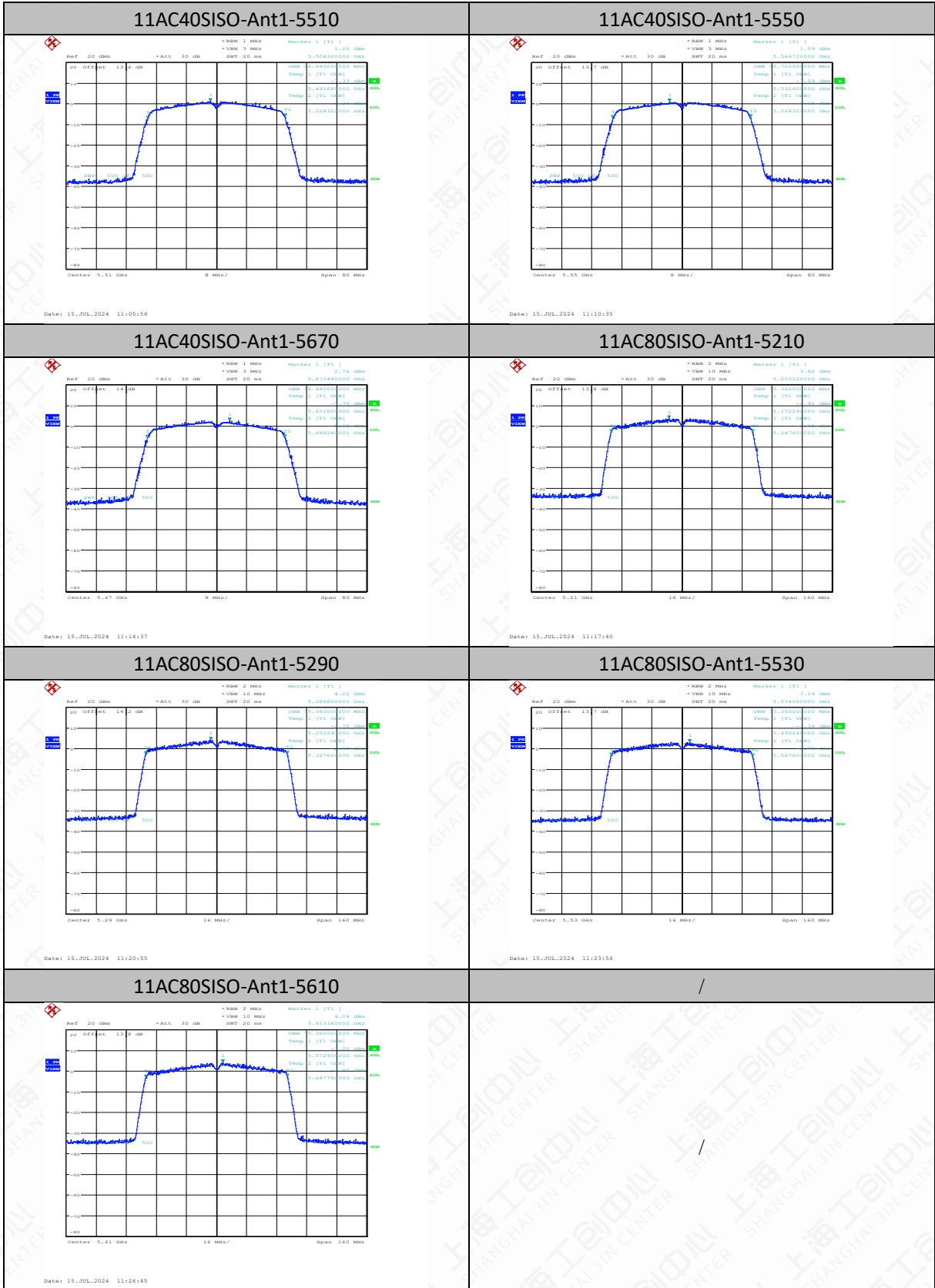












6.6. Band Edges Compliance

6.6.1 Measurement Limit

Above 1G, non-restricted band

Standard	EIRP Limit
15.407(b)	<-27dBm/MHz
RSS-247 6.2	<-27dBm/MHz

Above 1G, Restricted band

Standard	EIRP Limit	
15.407(b)	<-27dBm/MHz	
15.209	Peak	74dB μ V/m
	Average	54dB μ V/m
RSS-247 6.2	<-27dBm/MHz	
RSS-Gen 8.9	Peak	74dB μ V/m
	Average	54dB μ V/m

$$\text{EIRP}[\text{dBm}] = \text{E}[\text{dB}\mu\text{V}/\text{m}] + 20 \log(d[\text{m}]) - 104.7$$

$$\text{E}[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{m}]) + 104.7$$

$$\text{E}[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2 = 68.2, \text{ for } d = 3\text{m}$$

6.6.2 Test Procedure

The measurement is made according to KDB 789033.

Marker-Delta Method: The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge.

Procedure for peak unwanted emissions measurements above 1000 MHz

The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:

a) Follow the requirements in 12.7.4.

b) Peak emission levels are measured by setting the instrument as follows:

- 1) RBW = 1 MHz.
- 2) VBW \geq [3 \times RBW].
- 3) Detector = peak.
- 4) Sweep time = auto.
- 5) Trace mode = max hold.
- 6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous,

then the time required for the trace to stabilize will increase by a factor of approximately $1 / D$, where D is the duty cycle. For example, at 50% duty cycle, the measurement time will increase by a factor of two, relative to measurement time for continuous transmission.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1 MHz.

b) Video bandwidth:

1) If the EUT is configured to transmit with $D \geq 98\%$, then set $VBW \leq RBW / 100$ (i.e., 10 kHz), but not less than 10 Hz.

2) If the EUT D is $< 98\%$, then set $VBW \geq 1 / T$, where T is defined in item a1) of 12.2.

c) Video bandwidth mode or display mode:

1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).

2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to "voltage" regardless of the display mode.

d) Detector = peak.

e) Sweep time = auto.

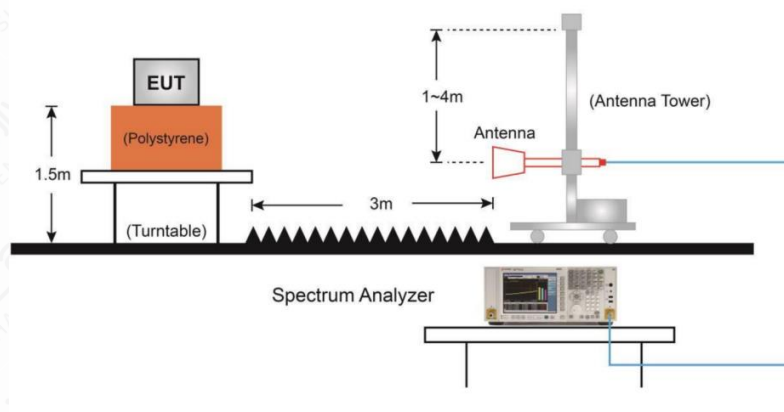
f) Trace mode = max hold.

g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of $1/x$, where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25%. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

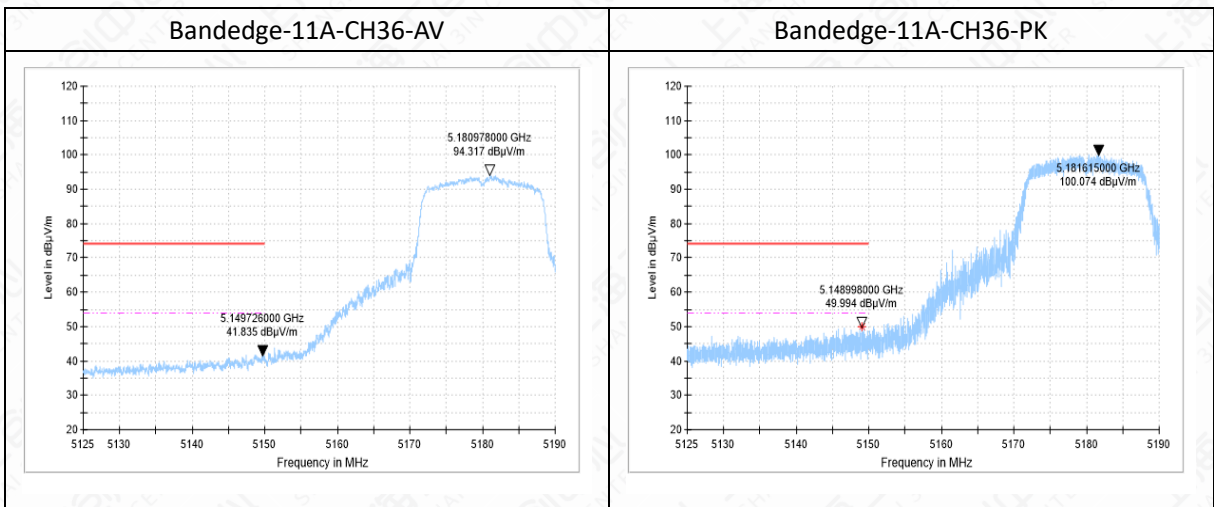
The measurement was applied in a fully anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna. Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. During the tests, the antenna height varied from 1m to 4m and the EUT azimuth were varied from 0° to 360° in order to identify the maximum level of

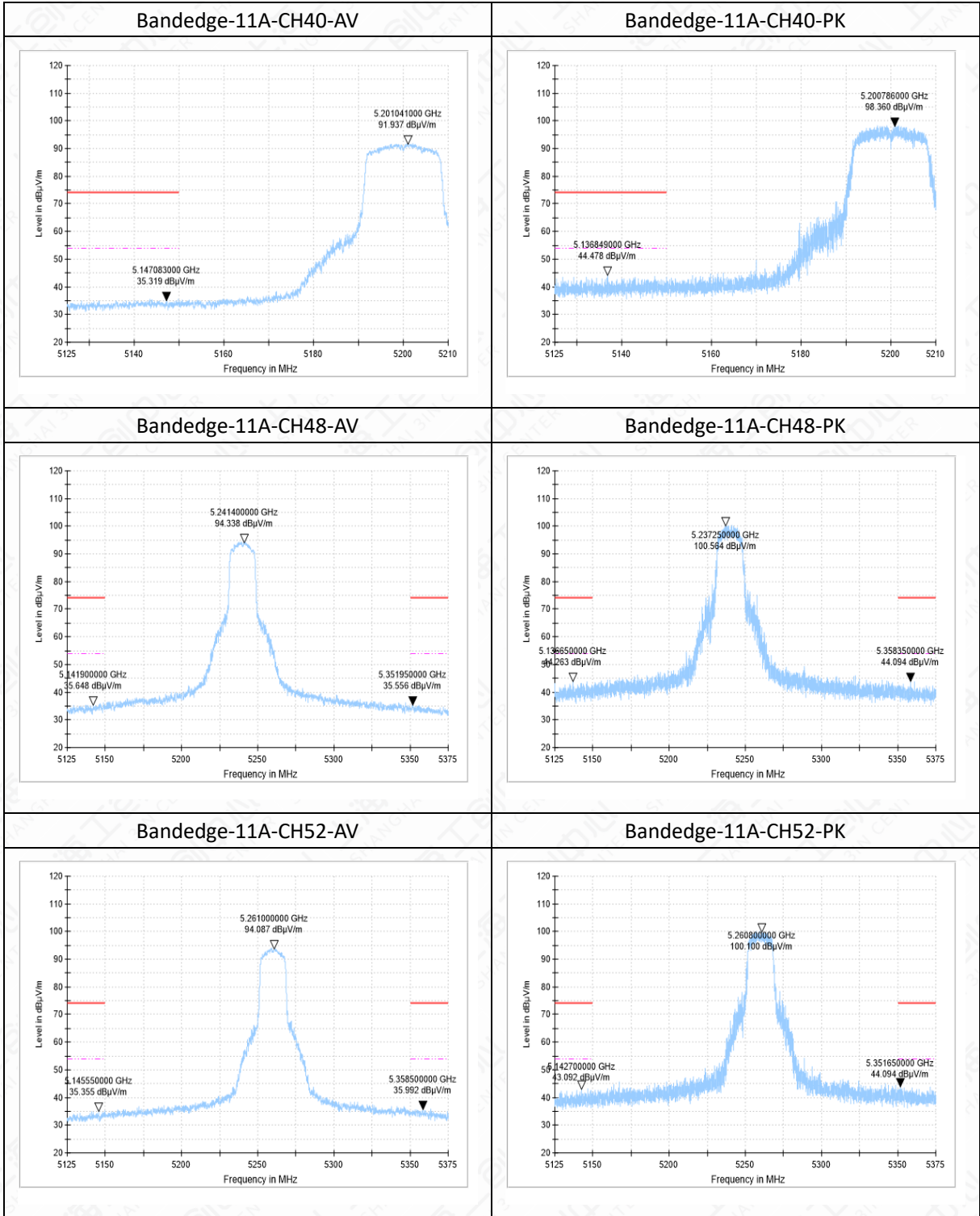
emissions from the EUT. In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

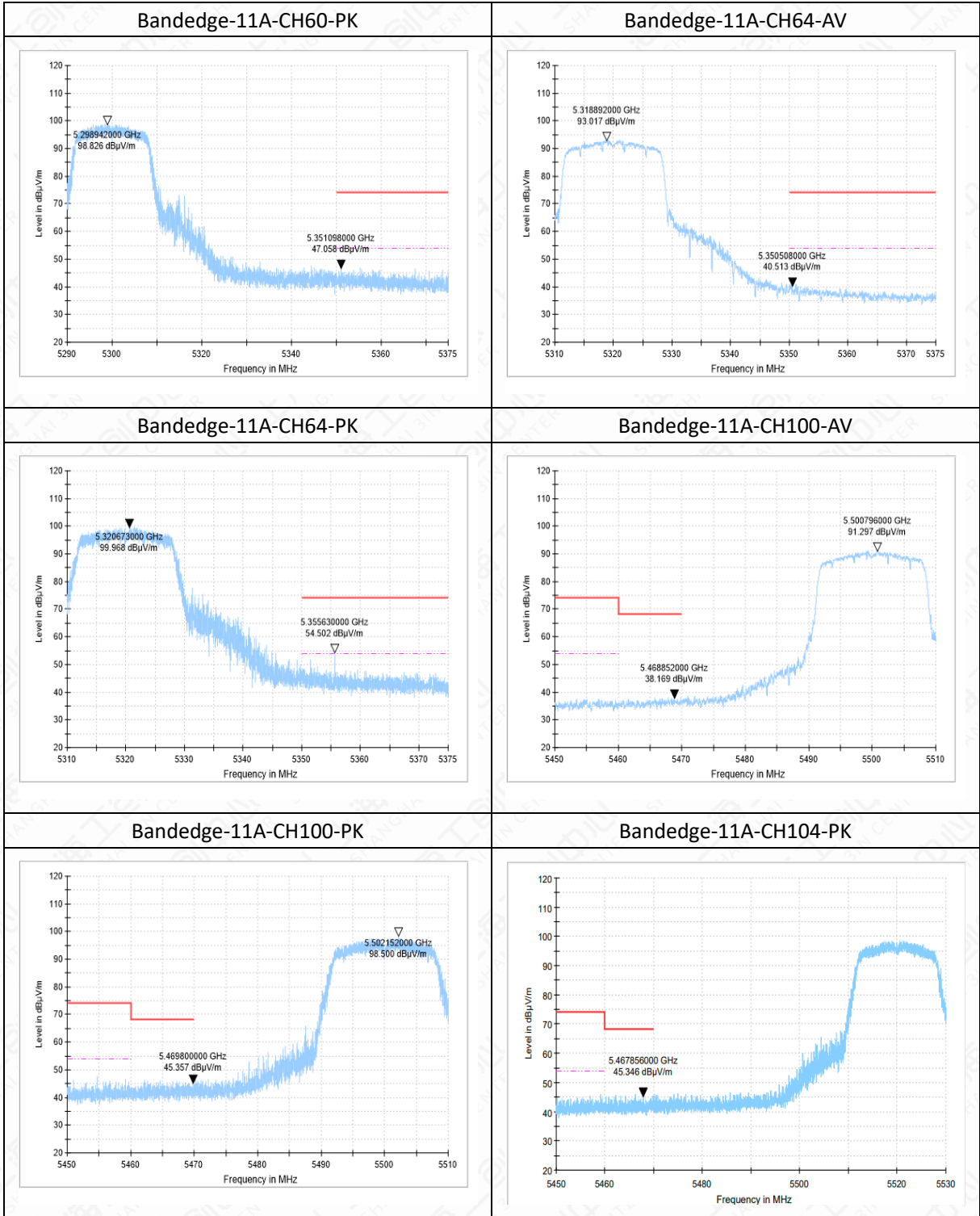
6.6.3 Test Setup

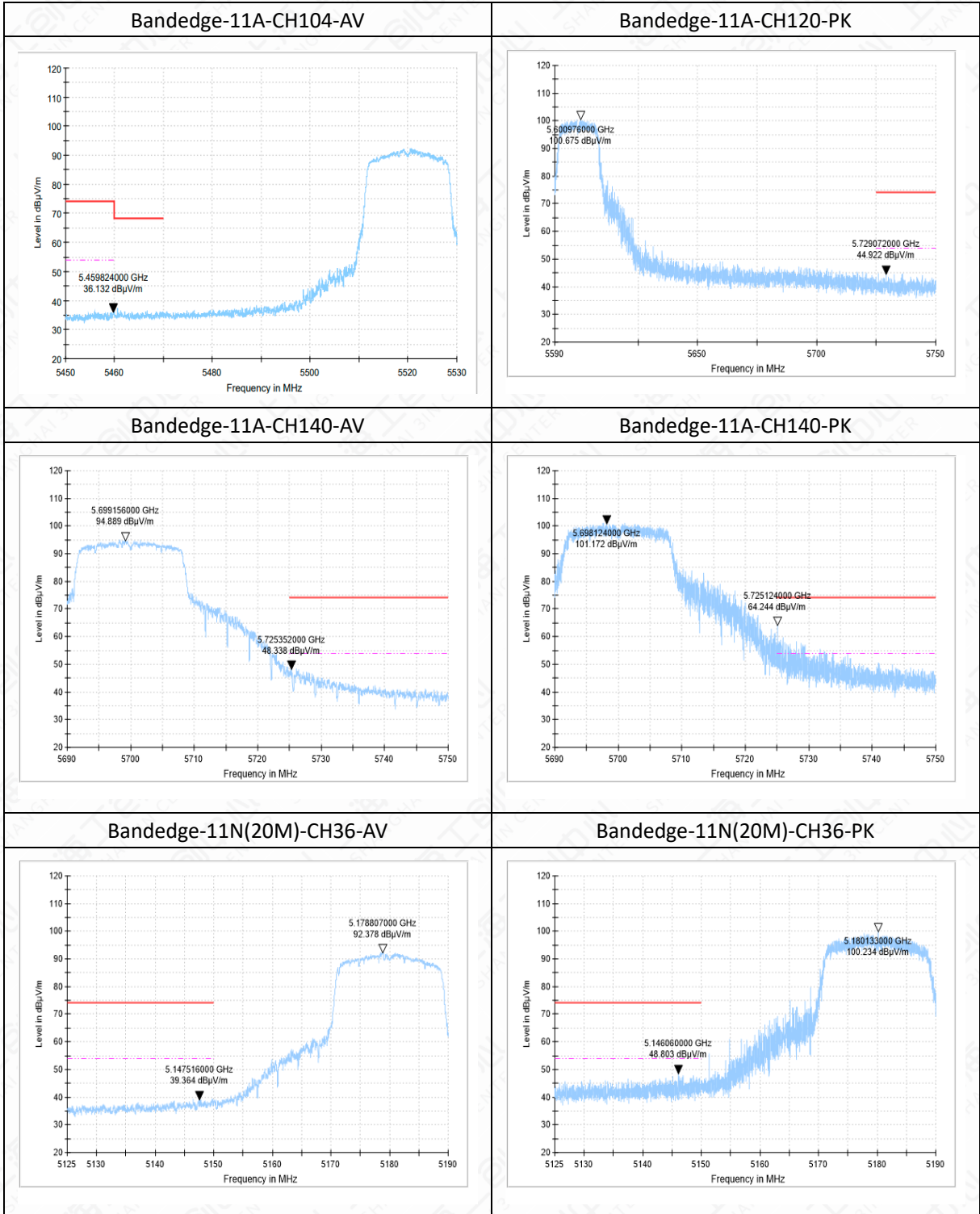


6.6.4 Measurement Result

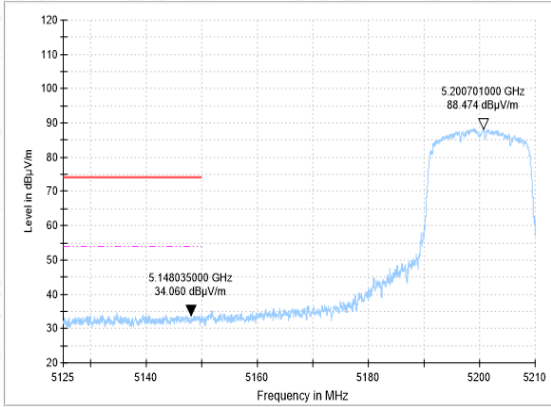




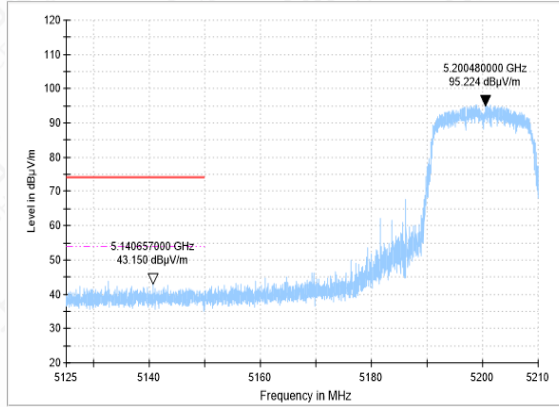




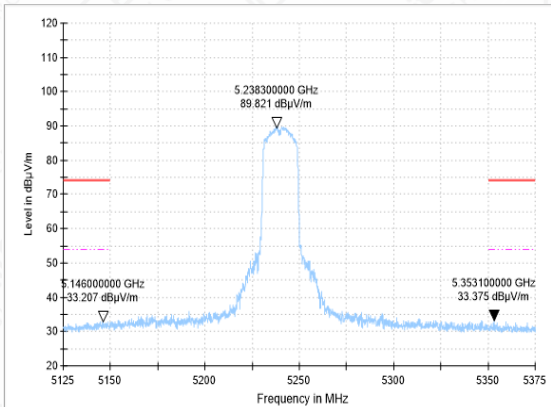
Bandedge-11N(20M)-CH40-AV



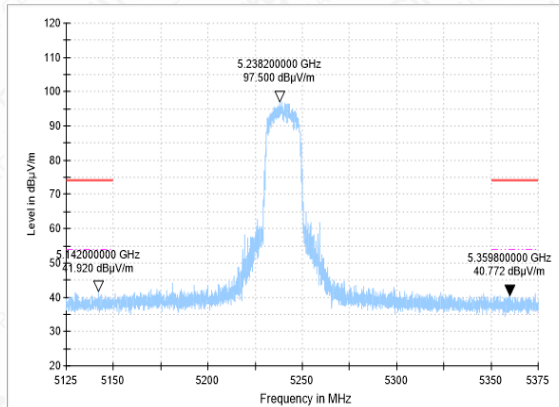
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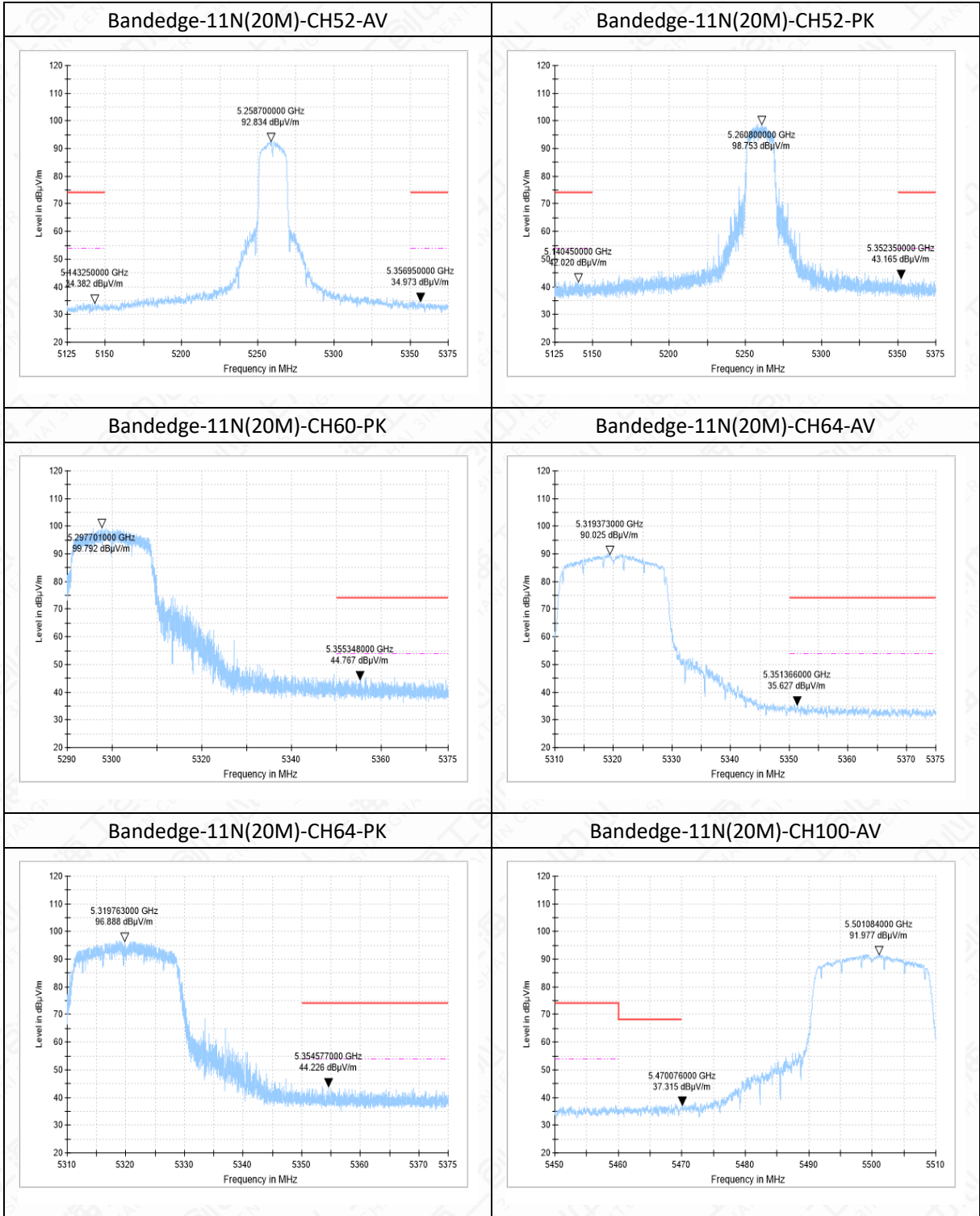


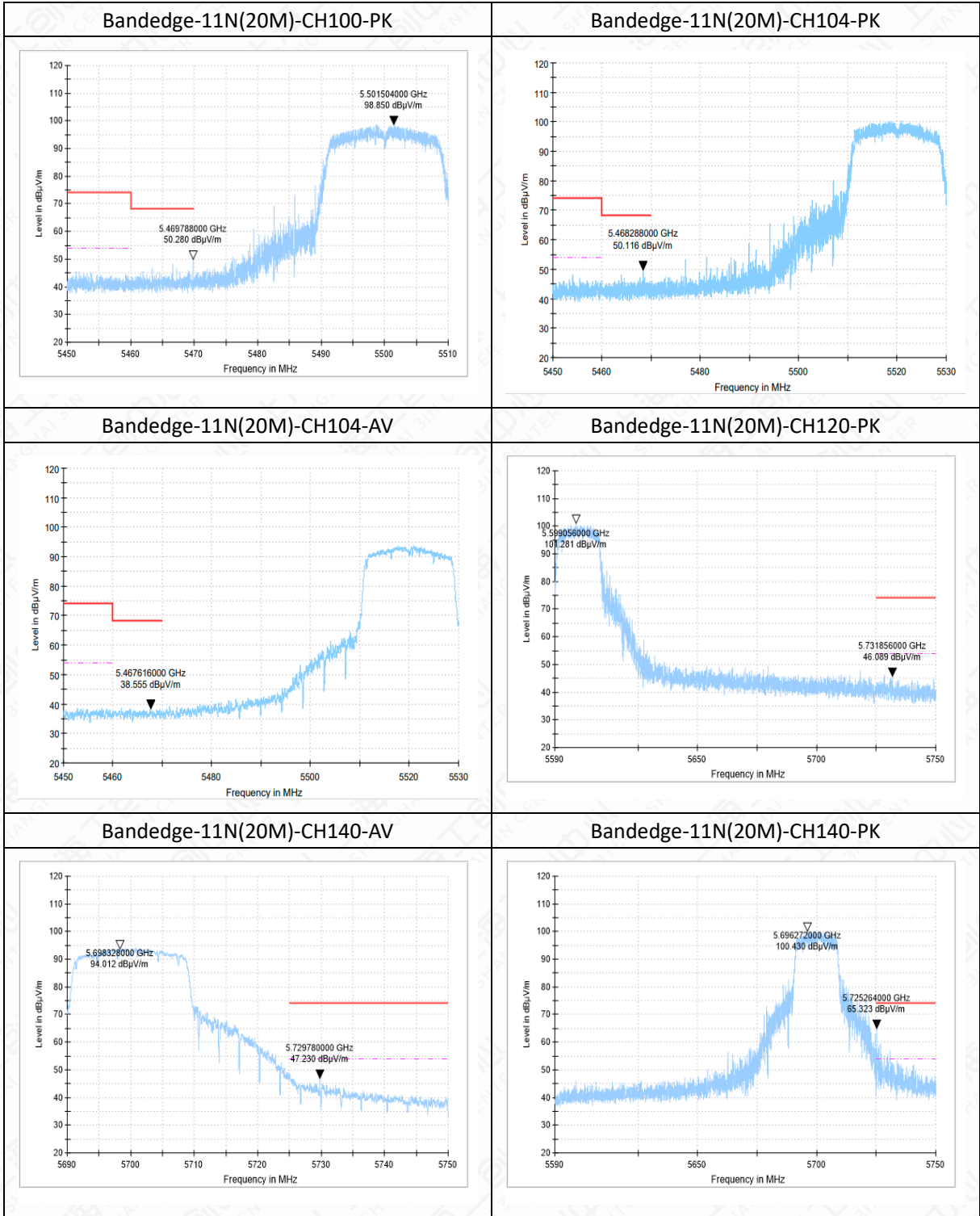
Bandedge-11N(20M)-CH48-AV

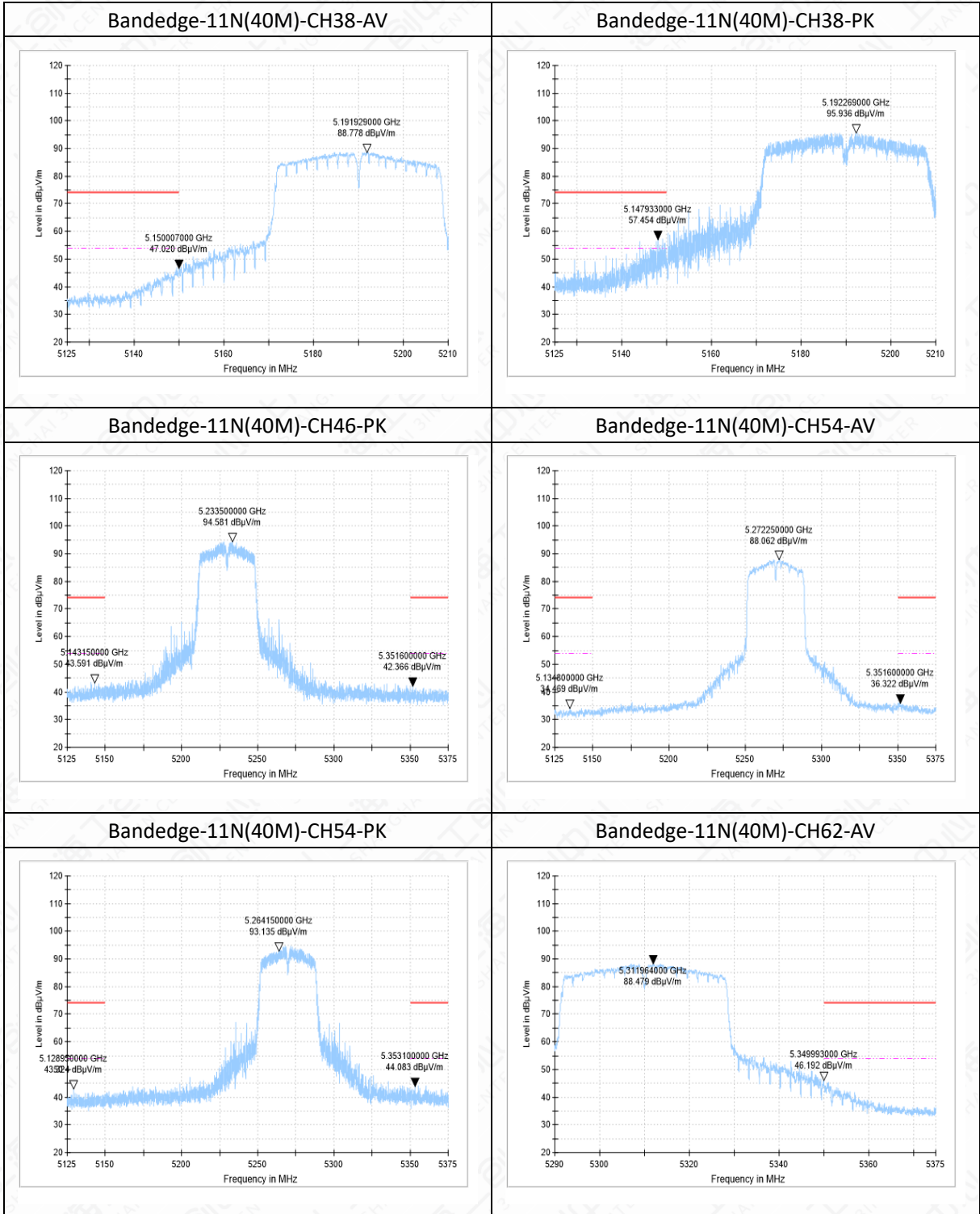


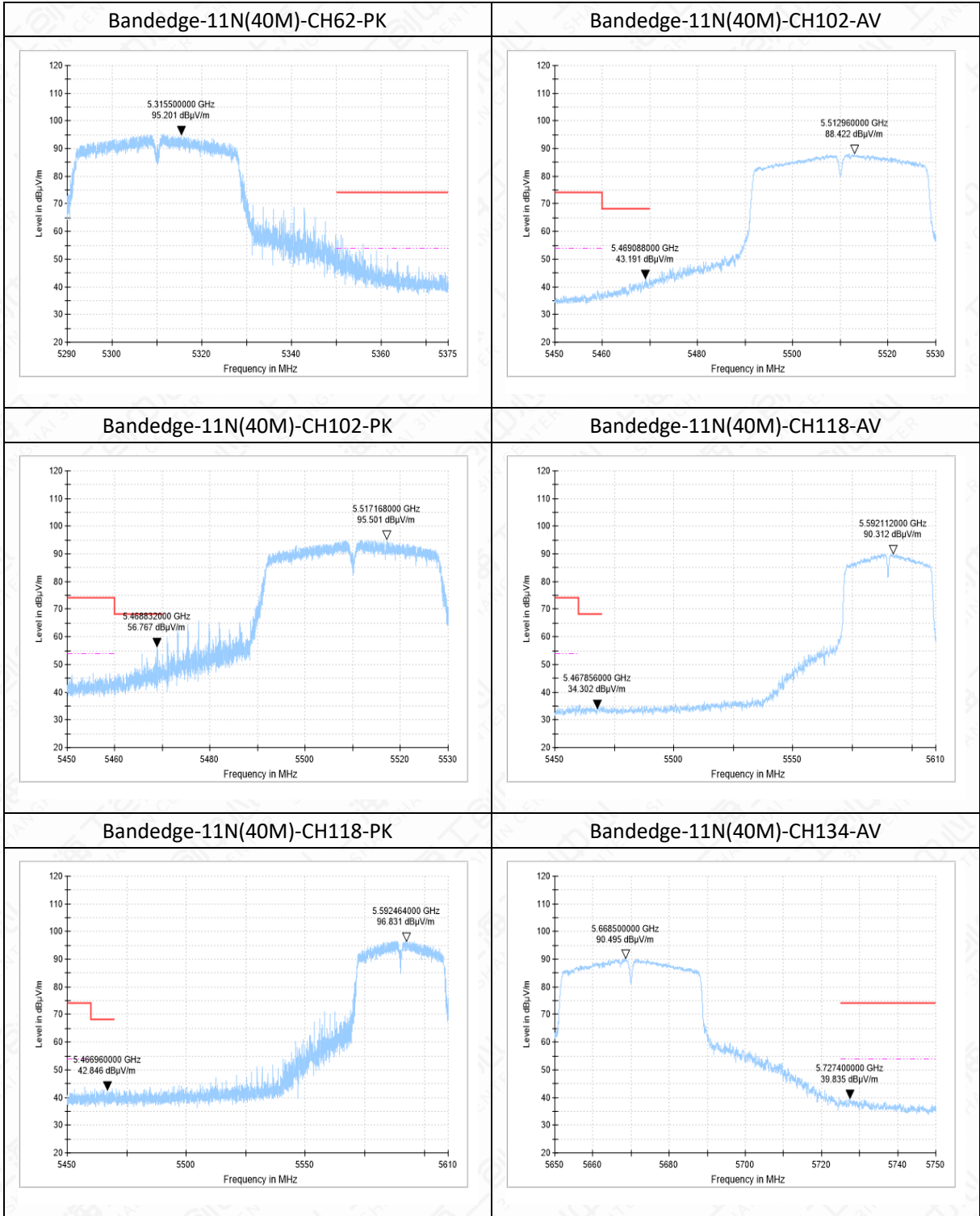
Bandedge-11N(20M)-CH48-PK

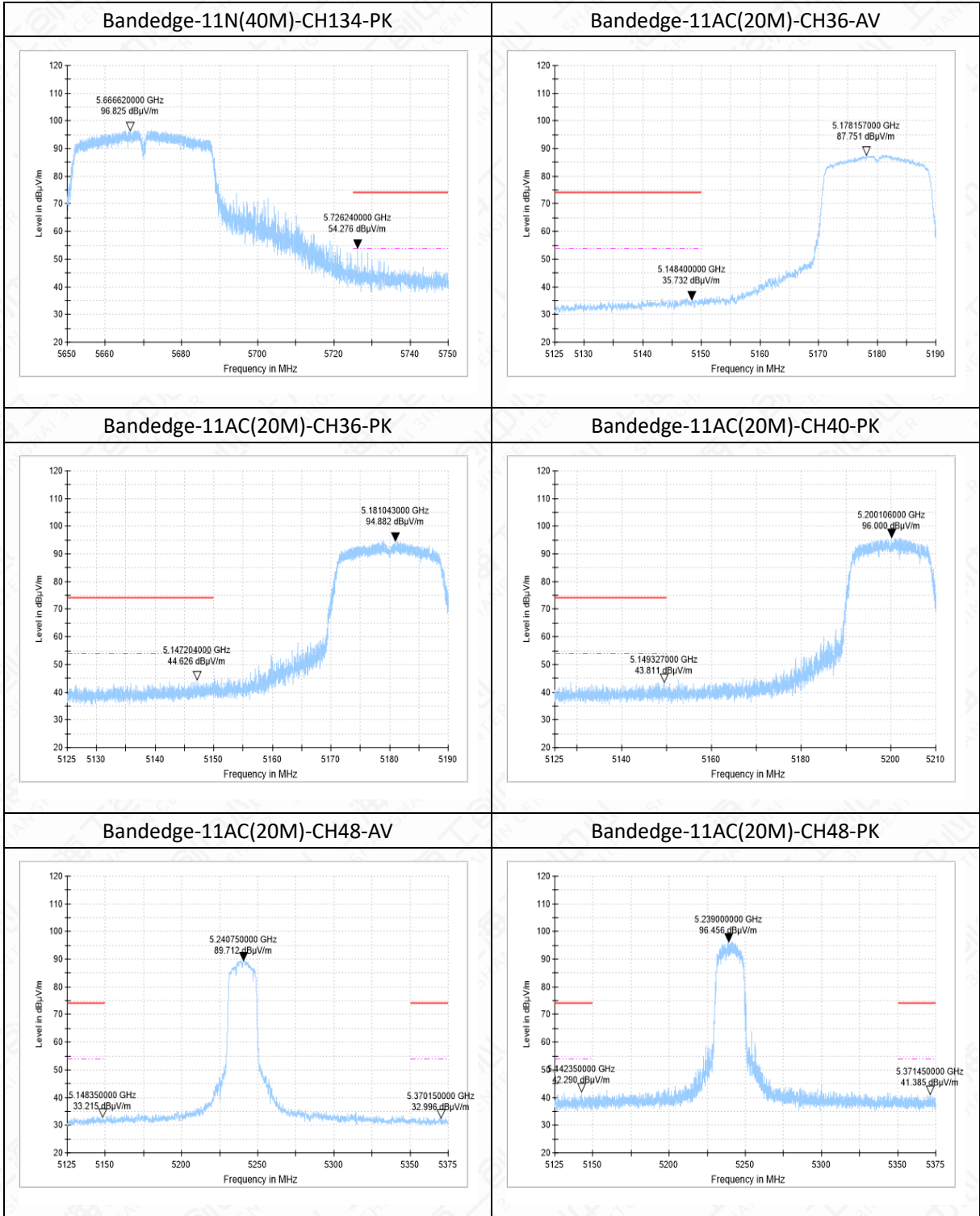


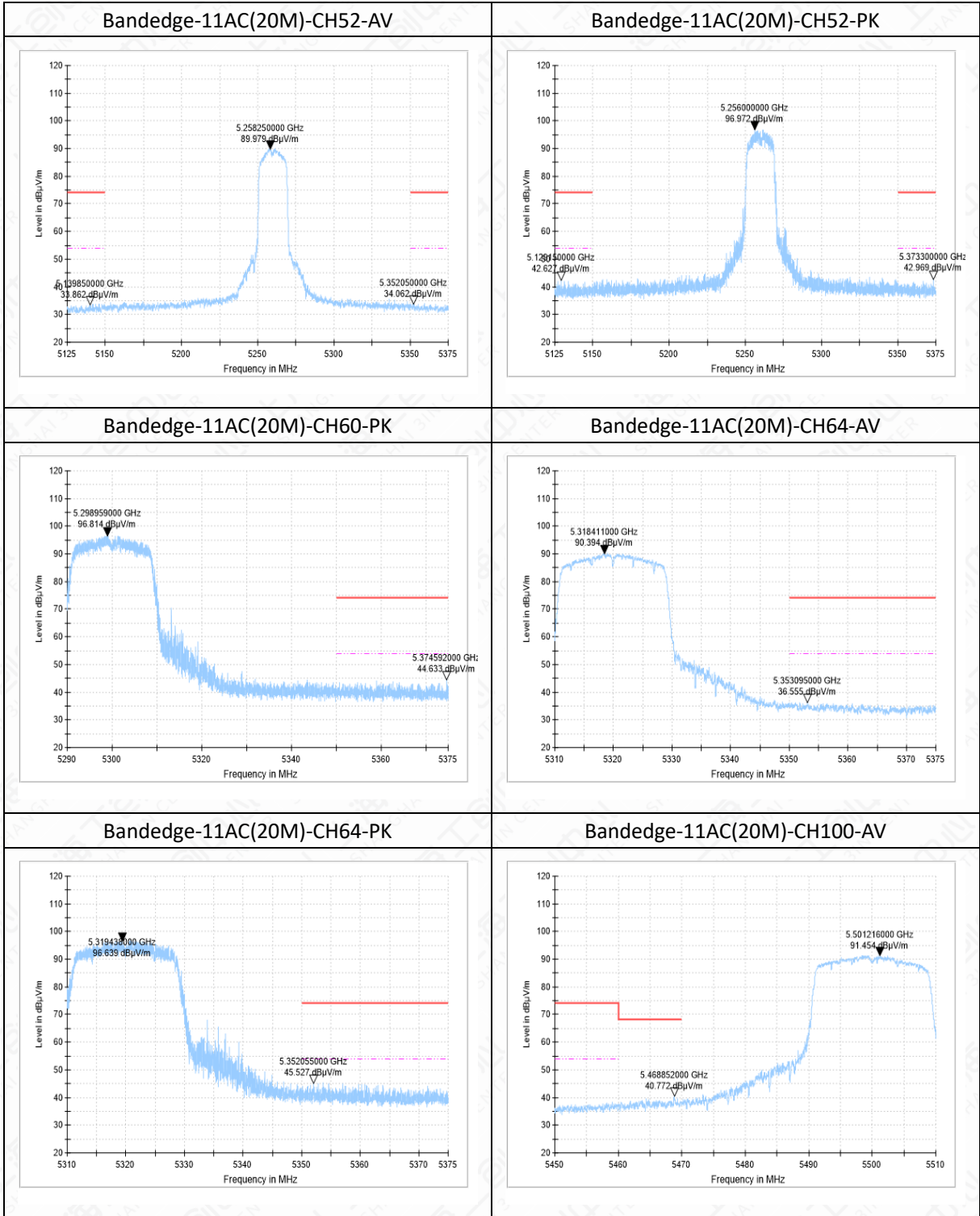


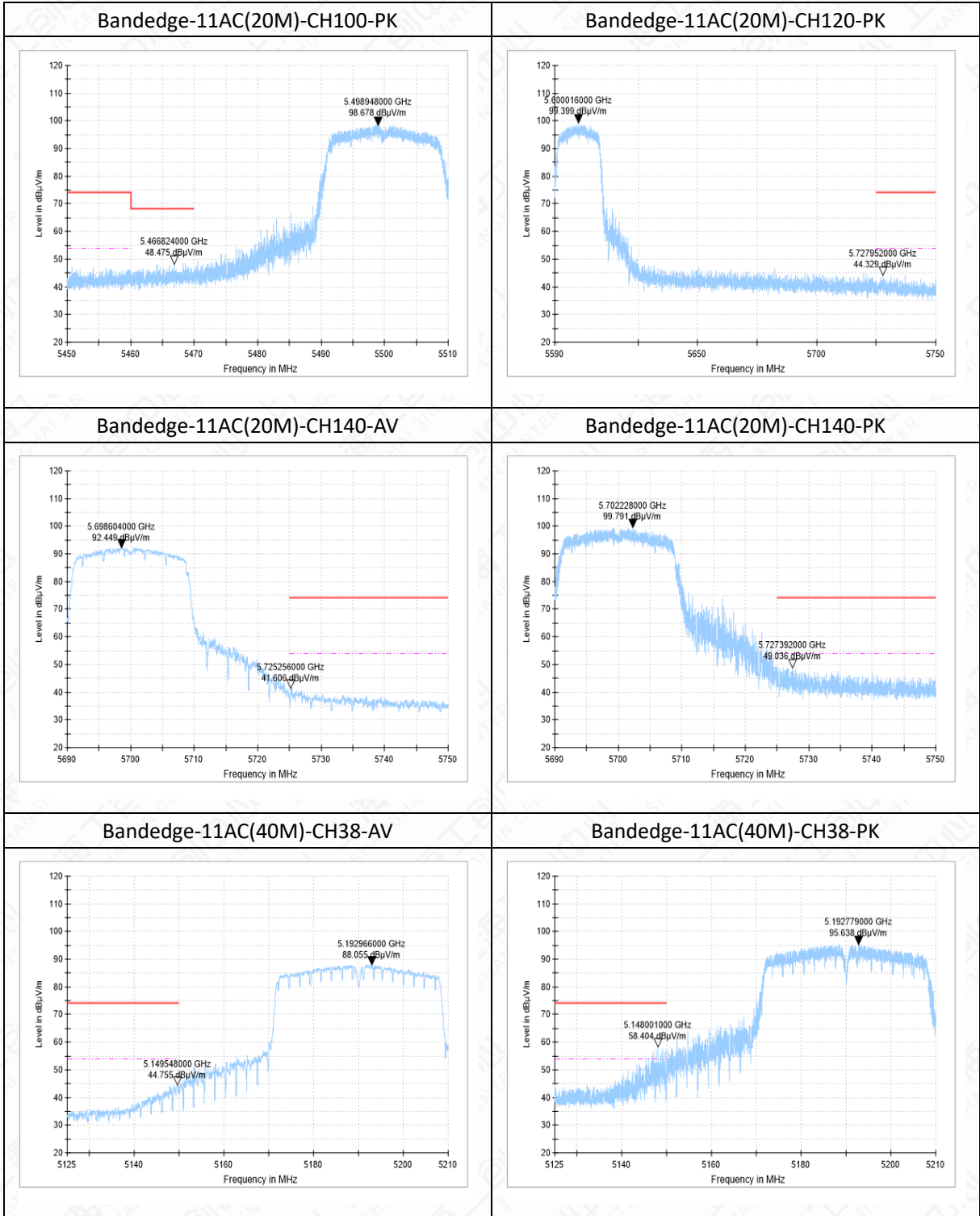




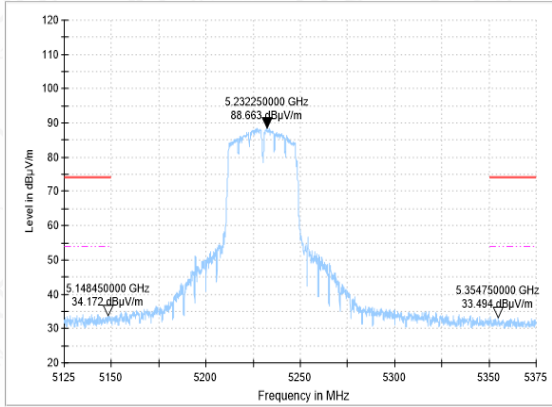




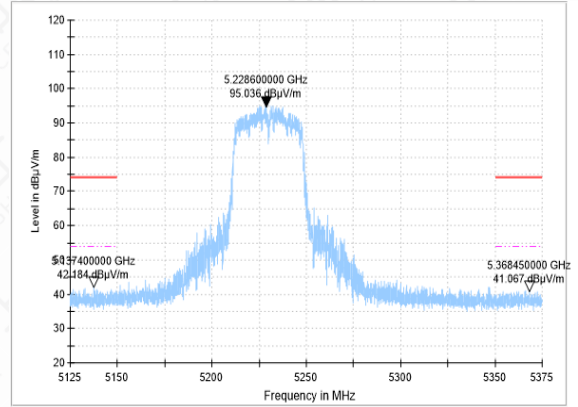




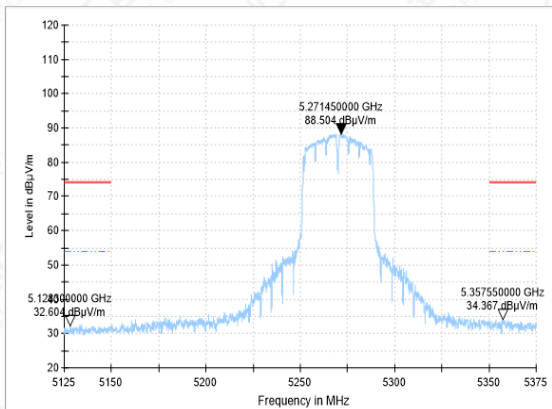
Bandedge-11AC(40M)-CH46-AV



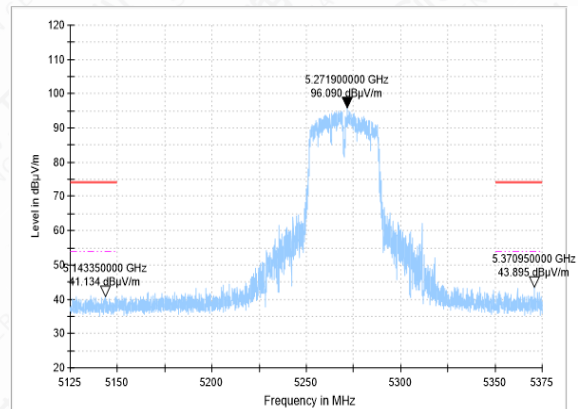
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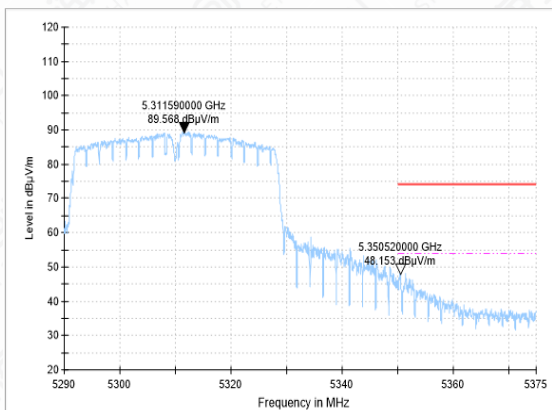
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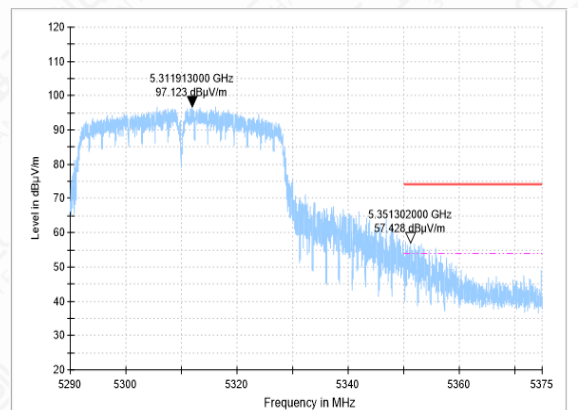
Bandedge-11AC(40M)-CH54-PK

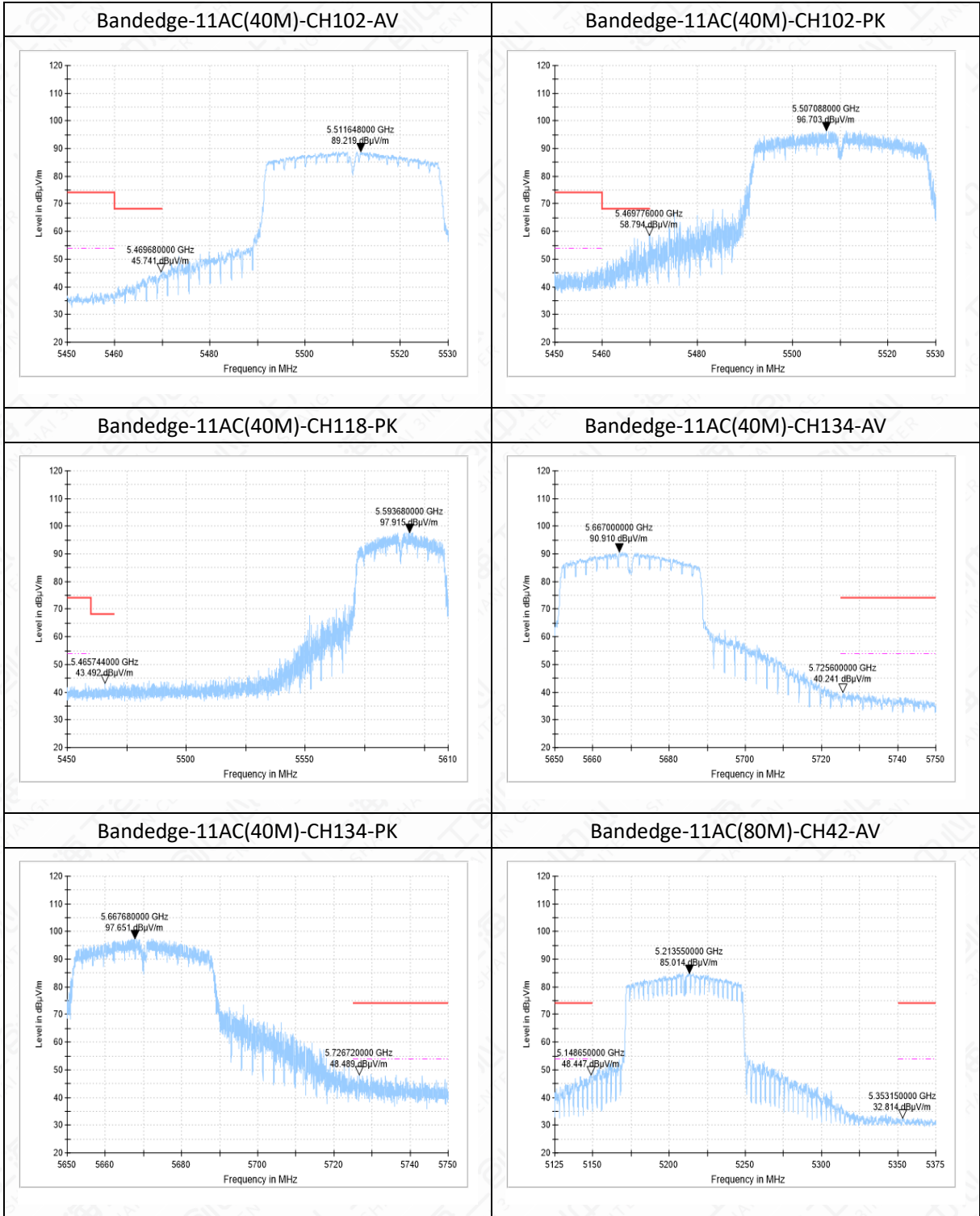


Bandedge-11AC(40M)-CH62-AV

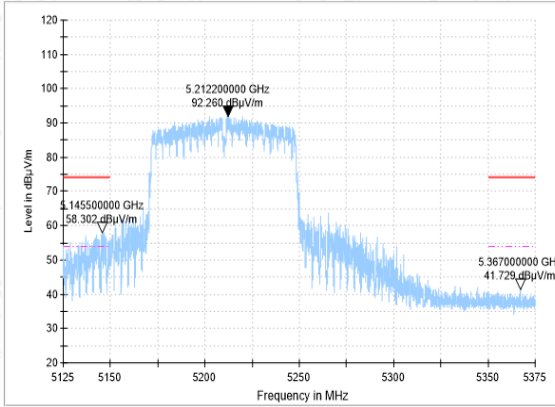


Bandedge-11AC(40M)-CH62-PK

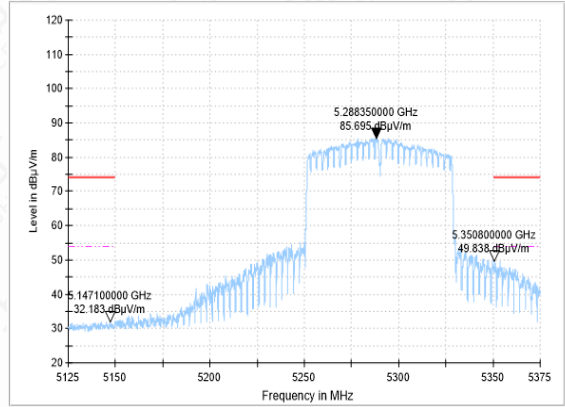




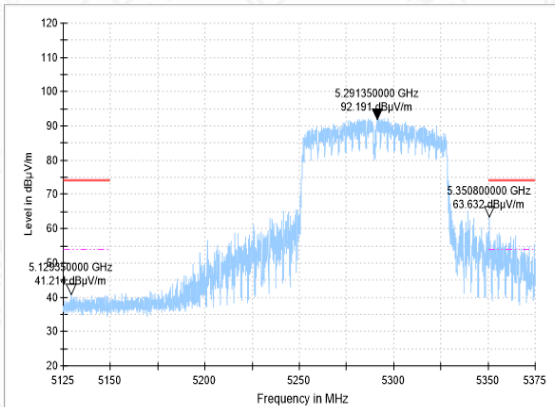
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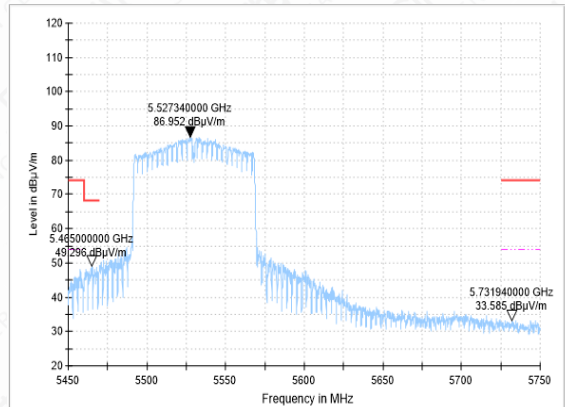
Bandedge-11AC(80M)-CH58-AV



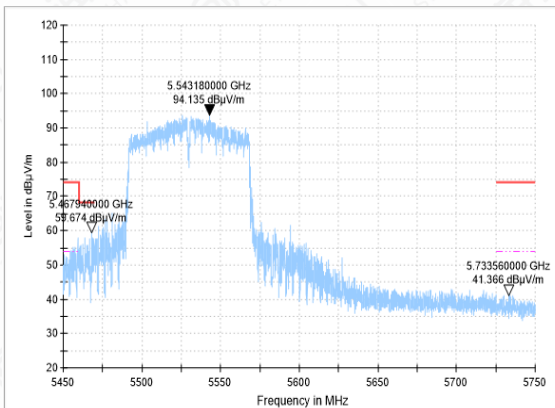
Bandedge-11AC(80M)-CH58-PK



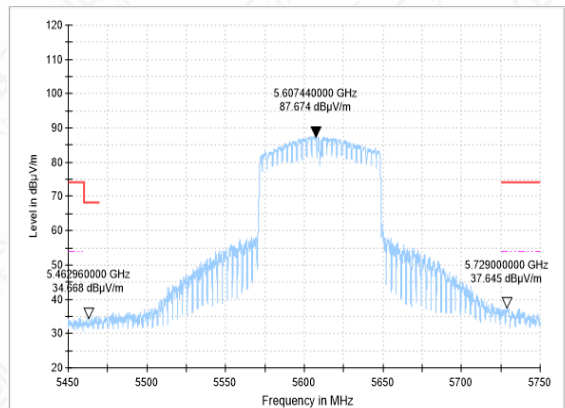
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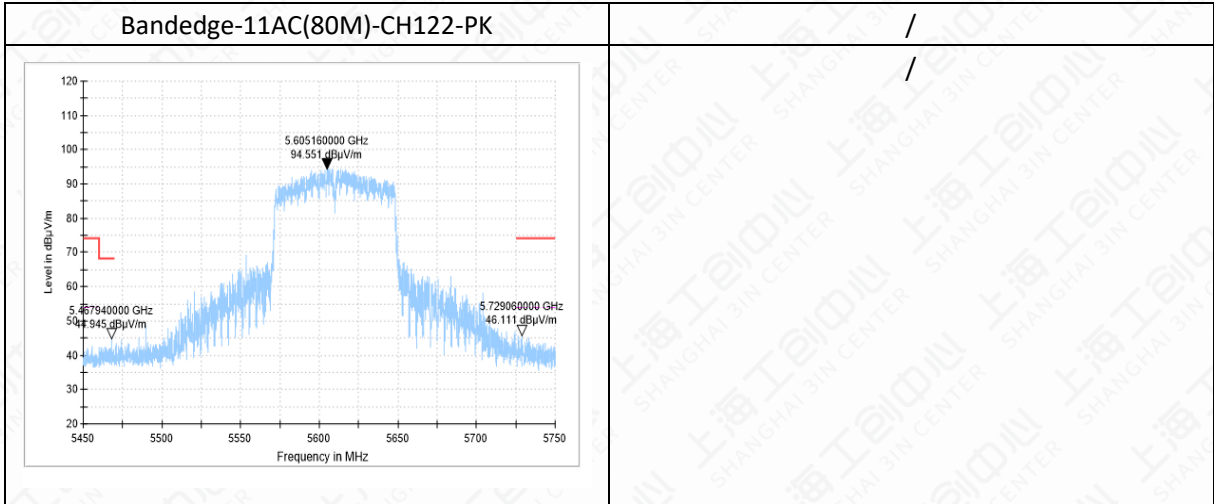


Bandedge-11AC(80M)-CH106-PK



Bandedge-11AC(80M)-CH122-AV





Note: Only data in worst mode is provided.

6.7. Transmitter Spurious Emission

6.7.1 Measurement Limit

Below 1G Limit:

Frequency of emission (MHz)	Field strength(dBμV/m)	Measurement distance(m)
0.009-0.490	129-94	3
0.490-1.705	74-63	3
1.705-30	70	3
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

Note: for frequency range below 960MHz, the limit in 15.209 is defined in 10m test distance. The limit used above is calculated from 10m to 3m

Above 1G, non-restricted band

Standard	EIRP Limit
15.407(b)	-27dBm/MHz
RSS-247 6.2	-27dBm/MHz

Above 1G, Restricted band

Standard	EIRP Limit	
15.407(b)	-27dBm/MHz	
15.209	Peak	74dBμV/m
	Average	54dBμV/m
RSS-247 6.2	-27dBm/MHz	
RSS-Gen 8.9	Peak	74dBμV/m
	Average	54dBμV/m

$$\text{EIRP[dBm]} = \text{E[dB}\mu\text{V/m]} + 20 \log(d[\text{m}]) - 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} - 20 \log(d[\text{m}]) + 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} + 95.2 = 68.2, \text{ for } d = 3\text{m}$$

6.7.2 Test Procedure

The measurement is made according to KDB 789033

Set the spectrum analyzer in the following:

Procedure for Unwanted Emissions Measurements below 1000 MHz:

a) Follow the requirements in II.G.3. "General Requirements for Unwanted Emissions Measurements."

b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

Detector: Peak and Quasi-Peak

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz:

a) Follow the requirements in II.G.3, "General Requirements for Unwanted Emissions Measurements."

b) Maximum emission levels are measured by setting the analyzer as follows:

(i) RBW = 1 MHz.

(ii) VBW \geq 3 MHz.

(iii) Detector = Peak.

(iv) Sweep time = auto.

(v) Trace mode = max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately $1/x$, where x is the duty cycle. For example, at 50% duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

Procedures for Average Unwanted Emissions Measurements above 1000 MHz:

a) Follow the requirements in section II.G.3., "General Requirements for Unwanted Emissions Measurements."

b) Average emission levels shall be measured using one of the following two methods.

c) Method AD (Average Detection): Primary method

(i) RBW = 1 MHz.

(ii) VBW \geq 3 MHz.

(iii) Detector = power averaging (rms), if $\text{span}/(\# \text{ of points in sweep}) \leq \text{RBW}/2$. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.

(iv) Averaging type = power averaging (rms)

As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission

is not continuous, the number of traces shall be increased by a factor of $1/x$, where x is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—rather than turning on and off with the transmit cycle, at least 100 traces shall be averaged.)

(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98%, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

If power averaging (rms) mode was used in step (iv) above, the correction factor is $10 \log (1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB must be added to the measured emission levels.

If linear voltage averaging mode was used in step (iv) above, the correction factor is $20 \log (1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB must be added to the measured emission levels.

If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. Below 18GHz , the measurement antenna was placed at a distance of 3 meters from the EUT. Above 18GHz , the measurement antenna was placed at a distance of 1 meter from the EUT. During the tests, the antenna height varied from 1m to 4m and the EUT azimuth were varied from 0° to 360° in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Remark:

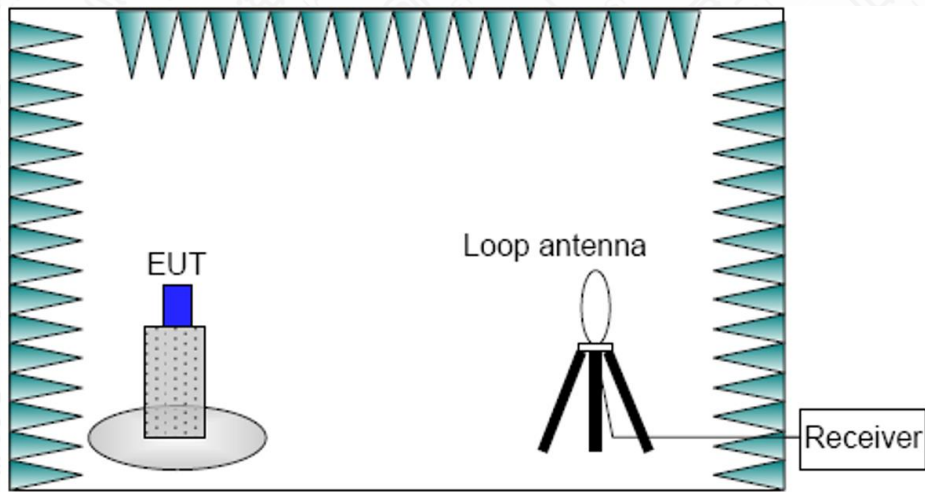
1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided

Note:

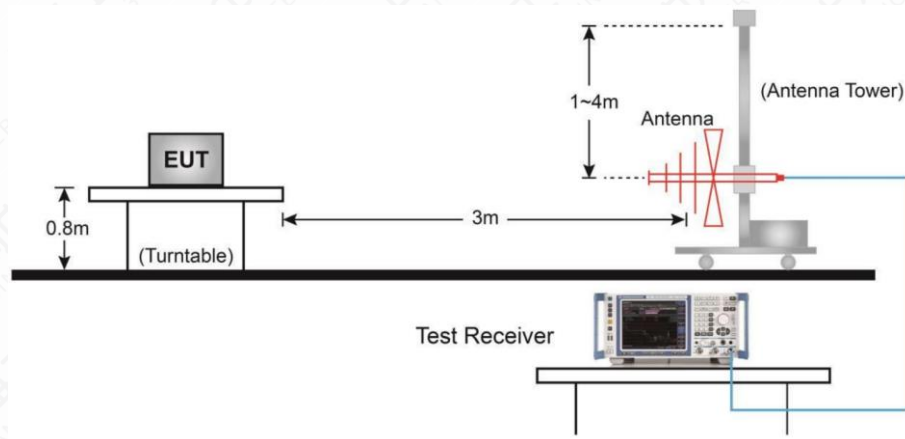
1. The out-of- limit signal in the picture is the main frequency signal.
2. Only data in worst mode is provided.
3. The test data below 30MHz is more than 20dB lower than the limit value, so it is not provided in the report.
4. Horizontal and vertical polarity is all have been tested, the result of them is synthesized in the above data diagram.

6.6.1 Test Setup

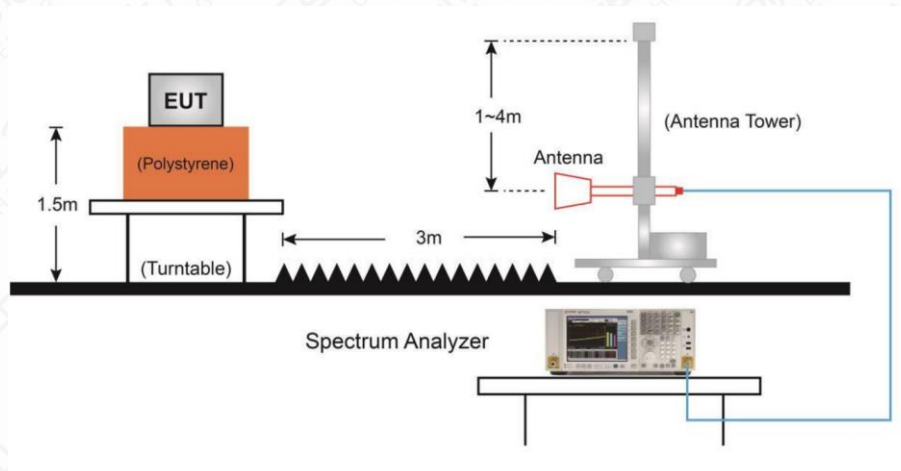
Below 30MHz Test Setup



Below 1GHz Test Setup



Above 1GHz Test Setup



6.6.2 Measurement Results

