

## 4.6. Conducted Spurious Emissions and Band Edge Compliance of RF Emission

### TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### TEST PROCEDURE

According to KDB 558074 D01 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for average detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies  $\leq 30$  MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies  $> 1000$  MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:  

$$E = \text{EIRP} - 20\log D + 104.8$$

where:

E = electric field strength in dB $\mu$ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

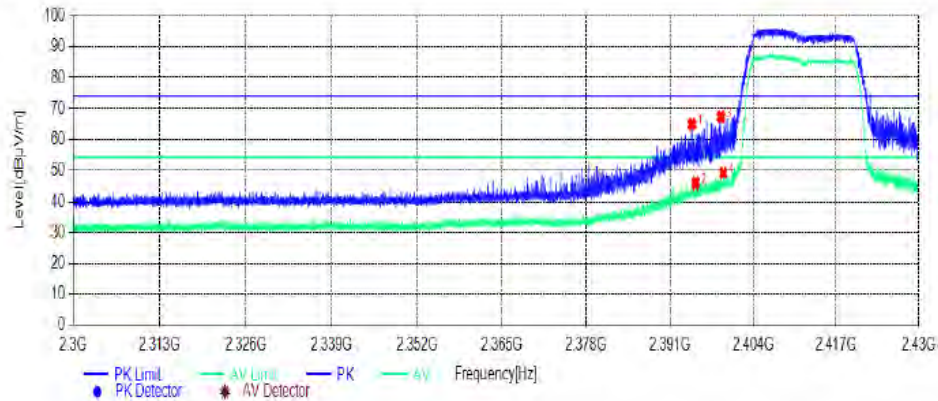
### LIMIT

Below -20dB of the highest emission level in operating band.

Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

**TEST RESULTS****4.6.1 For Radiated Bandedge Measurement**

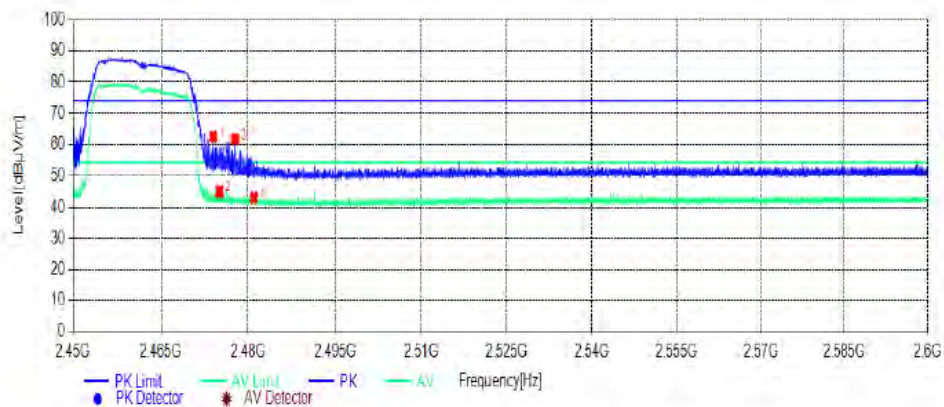
Temperature	23.8℃	Humidity	53.7%
Test Engineer	Jenny Zeng	Configurations	IEEE 802.11b/g/n

**Horizontal (802.11g-2412MHz)****Test Graph****Suspected List**

NO.	Frequency [MHz]	Factor [dB]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	2394.4544	4.26	9.16	150	220	PK	Horizontal	PASS
2	2395.0265	4.27	8.24	150	150	AV	Horizontal	PASS
3	2398.9659	4.28	6.72	150	210	PK	Horizontal	PASS
4	2399.3429	4.28	4.99	150	110	AV	Horizontal	PASS

Note: 1. Result (dBuV/m) = Reading(dBuV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

**Horizontal (802.11g-2462MHz)****Test Graph****Suspected List**

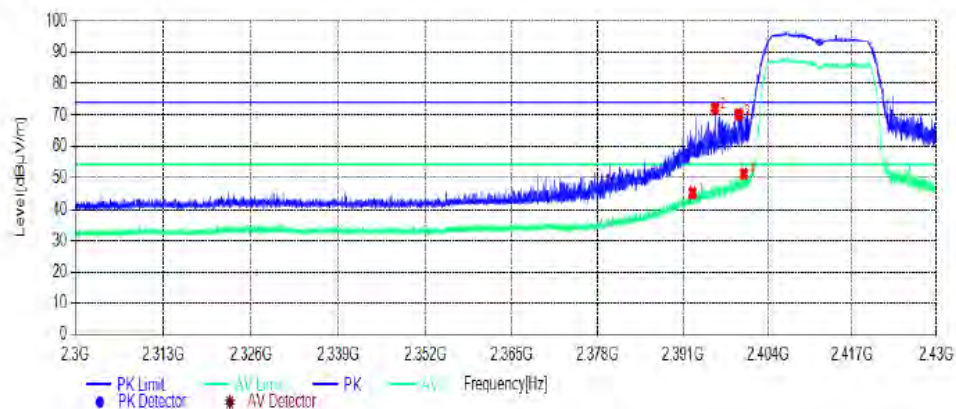
NO.	Frequency [MHz]	Factor [dB]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	2473.9874	4.57	11.63	150	40	PK	Horizontal	PASS
2	2475.0525	4.58	9.16	150	150	AV	Horizontal	PASS
3	2477.7378	4.60	12.40	150	190	PK	Horizontal	PASS
4	2480.9781	4.62	11.13	150	280	AV	Horizontal	PASS

Note: 1. Result (dBuV/m) = Reading(dBuV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical(802.11g-2412MHz)

Test Graph



## Suspected List

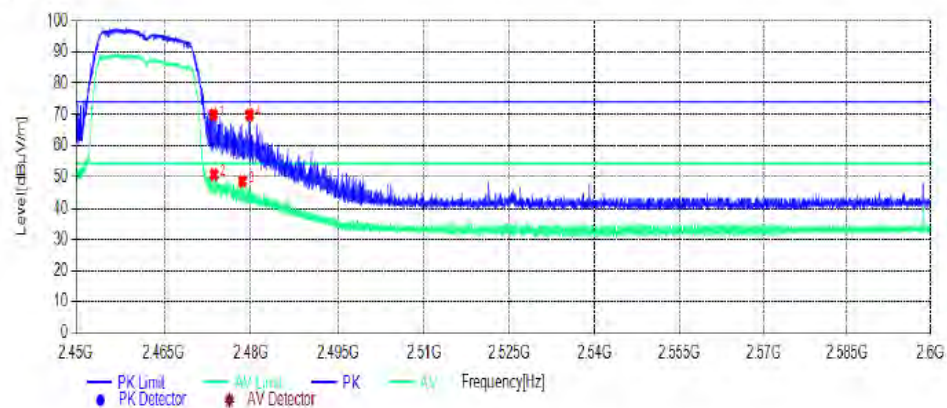
NO.	Frequency [MHz]	Factor [dB]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	2392.4912	4.26	8.98	150	110	AV	Vertical	PASS
2	2395.9236	4.27	1.84	150	80	PK	Vertical	PASS
3	2399.5640	4.28	3.80	150	150	PK	Vertical	PASS
4	2400.3440	4.28	2.96	150	20	AV	Vertical	PASS

Note: 1. Result (dBuV/m) = Reading(dBuV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical(802.11g-2462MHz)

Test Graph



## Suspected List

NO.	Frequency [MHz]	Factor [dB]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	2473.5524	4.57	4.11	150	240	PK	Vertical	PASS
2	2473.6424	4.57	3.46	150	140	AV	Vertical	PASS
3	2478.5179	4.60	5.58	150	160	AV	Vertical	PASS
4	2479.7480	4.61	4.17	150	210	PK	Vertical	PASS

Note: 1. Result (dBuV/m) = Reading(dBuV/m) + Factor (dB) .

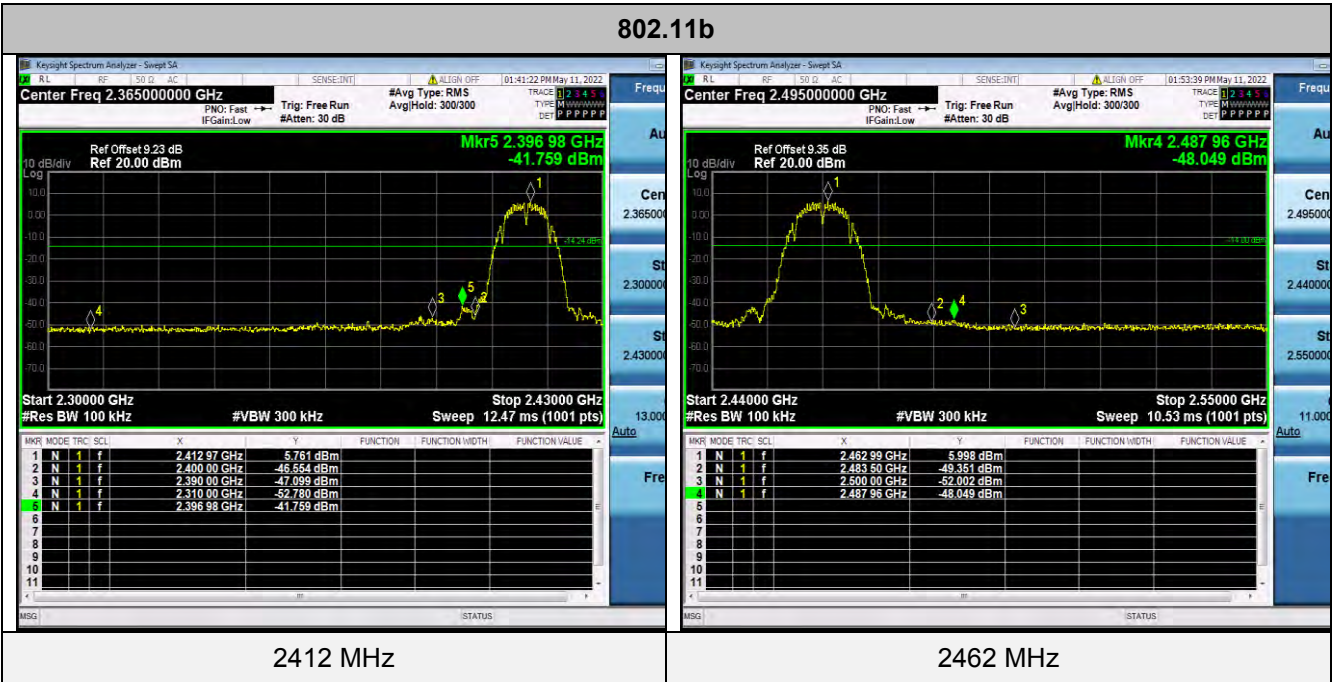
2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

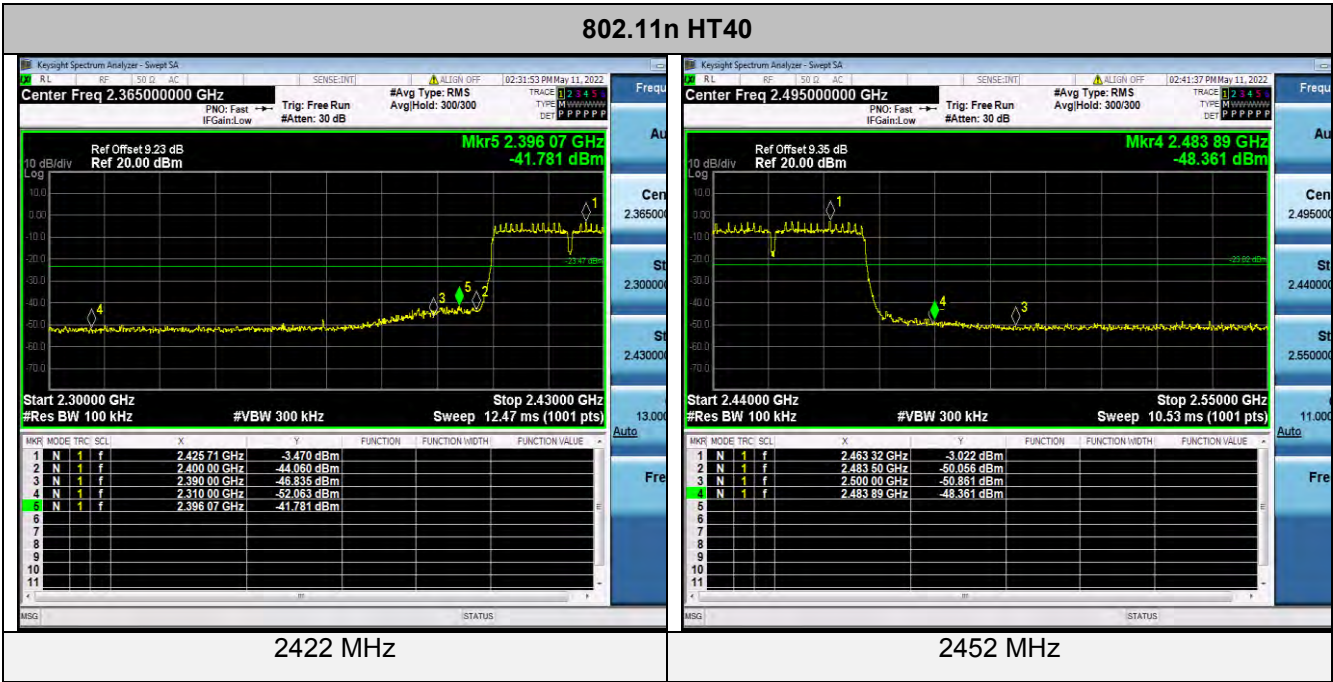
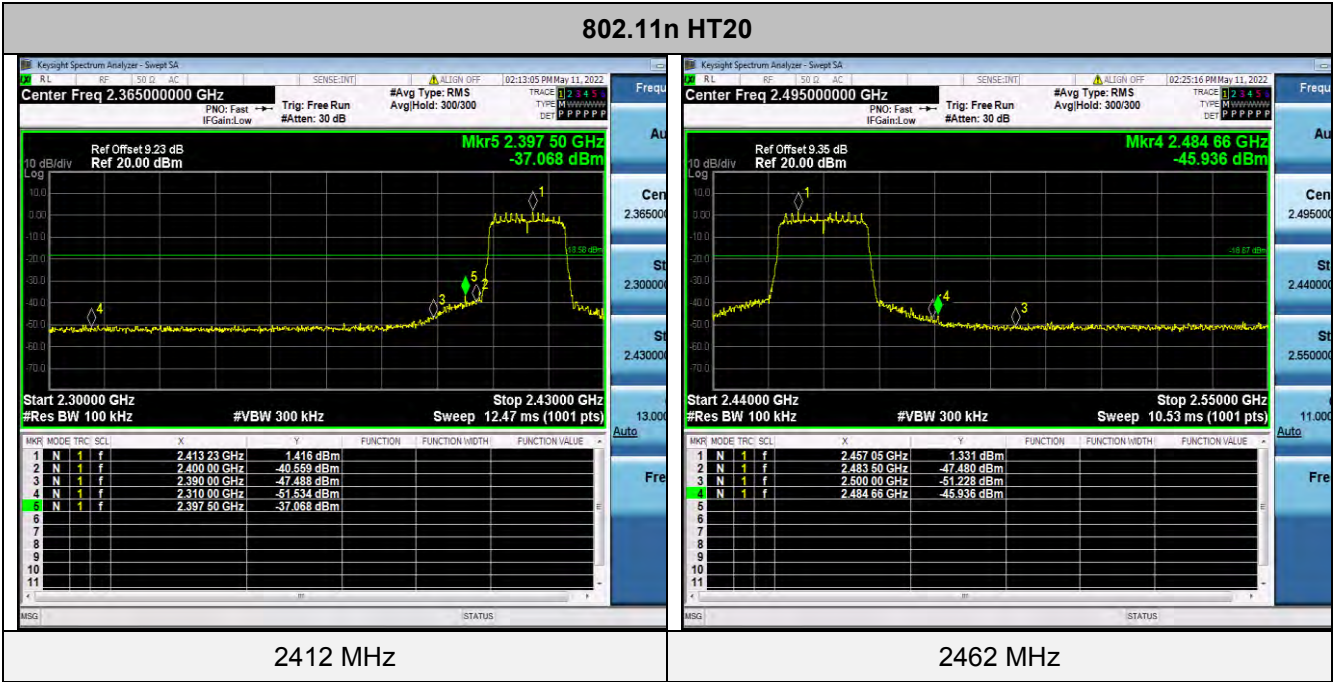
**NOTE: All the modes have been tested and recorded worst mode in the report(Version A:802.11g ).**



4.6.2 For Conducted Bandedge Measurement

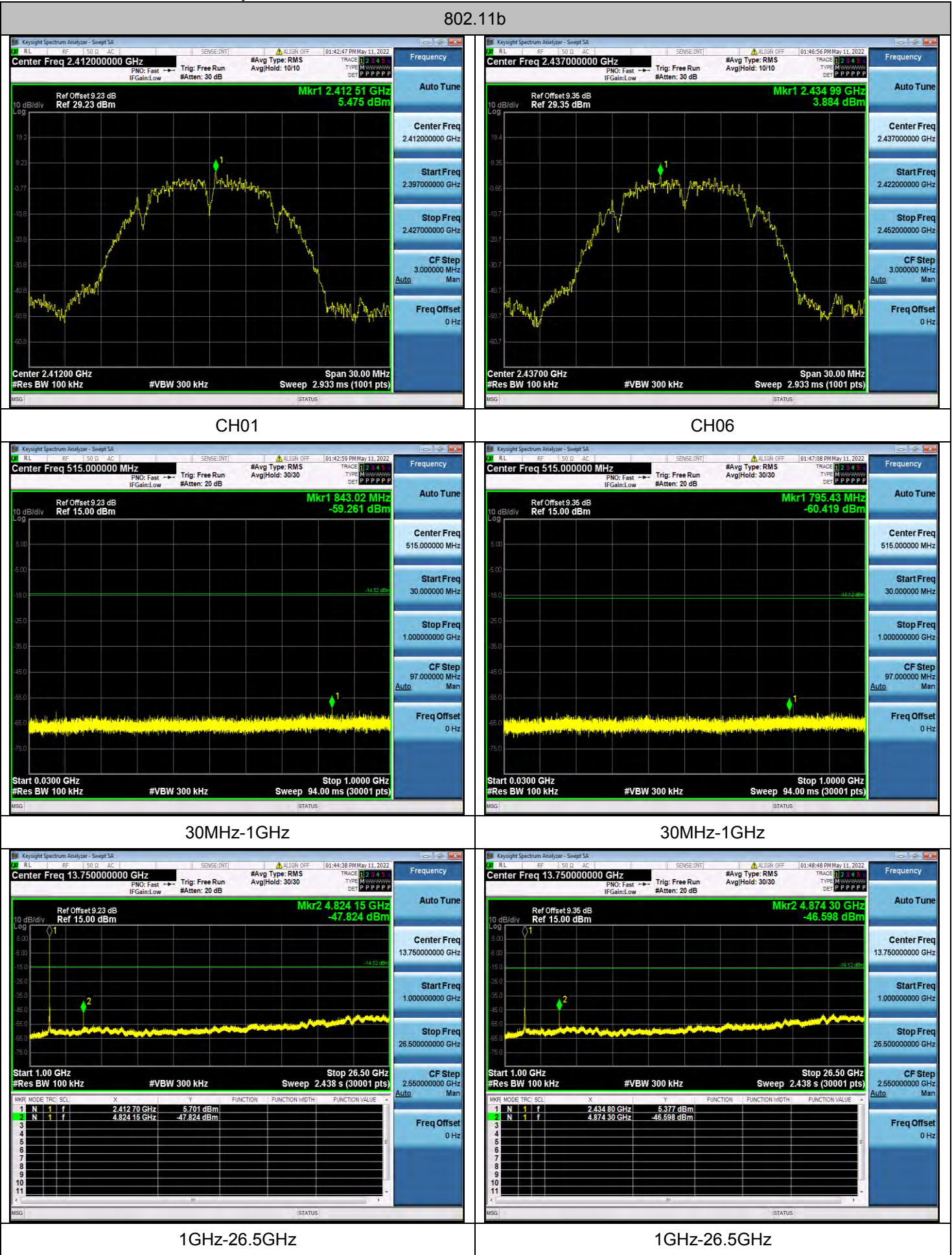
Temperature	23.4℃	Humidity	52.7%
Test Engineer	Jenny Zeng	Configurations	IEEE 802.11b/g/n



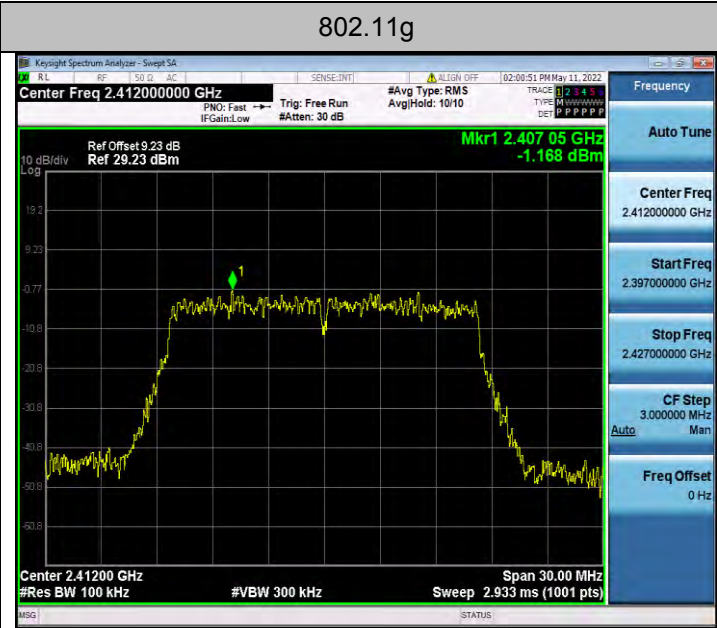
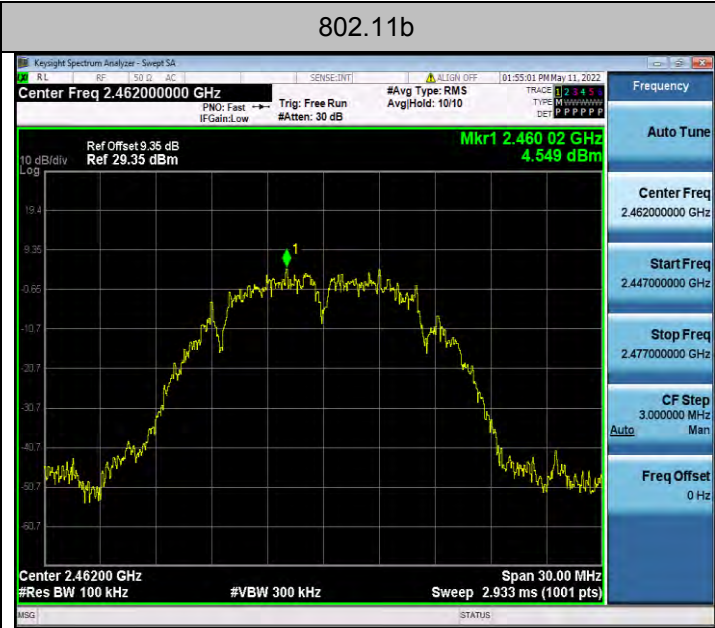




4.6.3 For Conducted Spurious Emissions Measurement

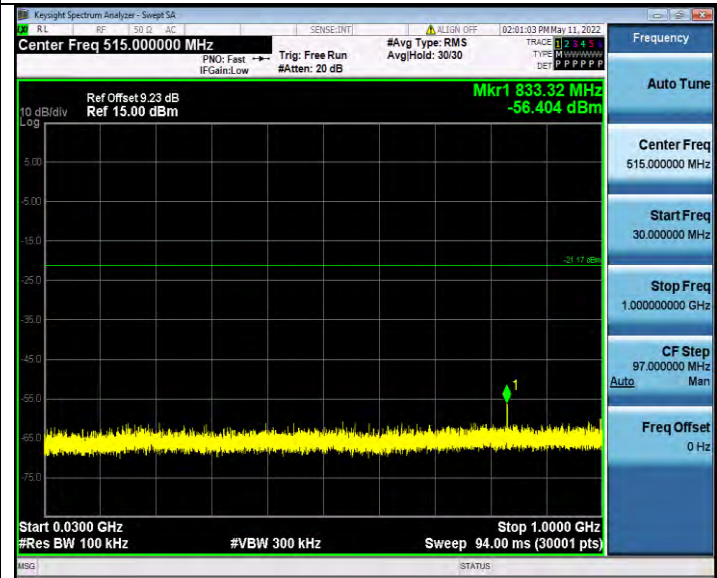
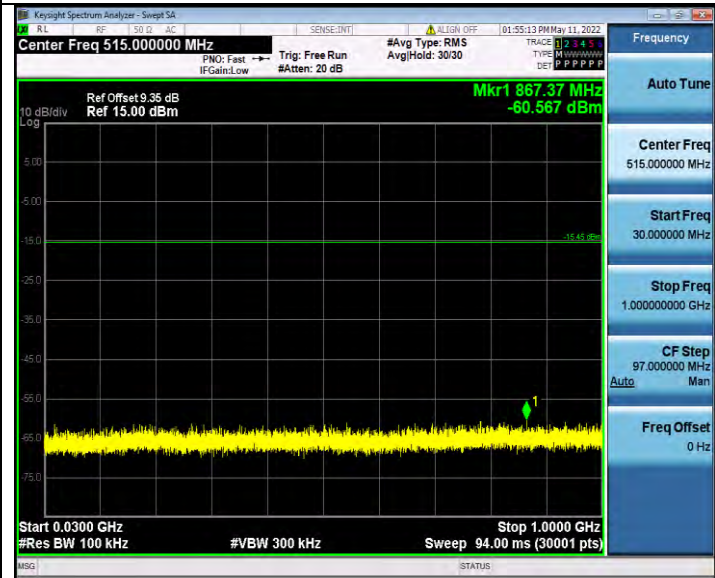






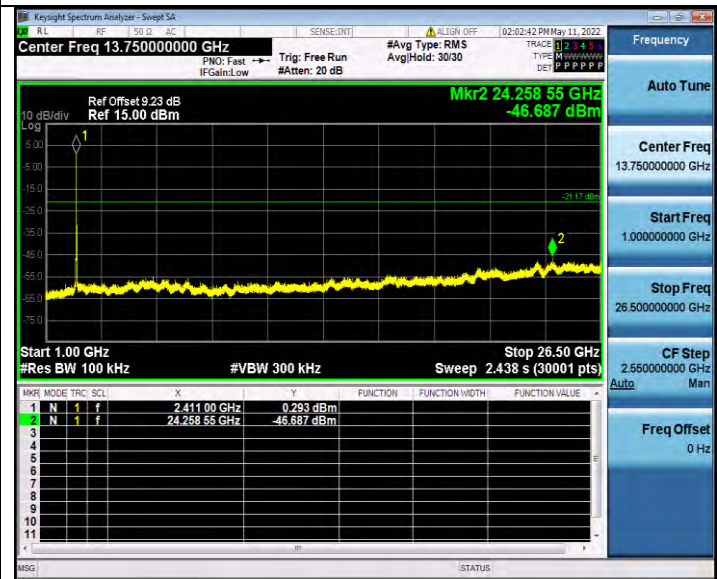
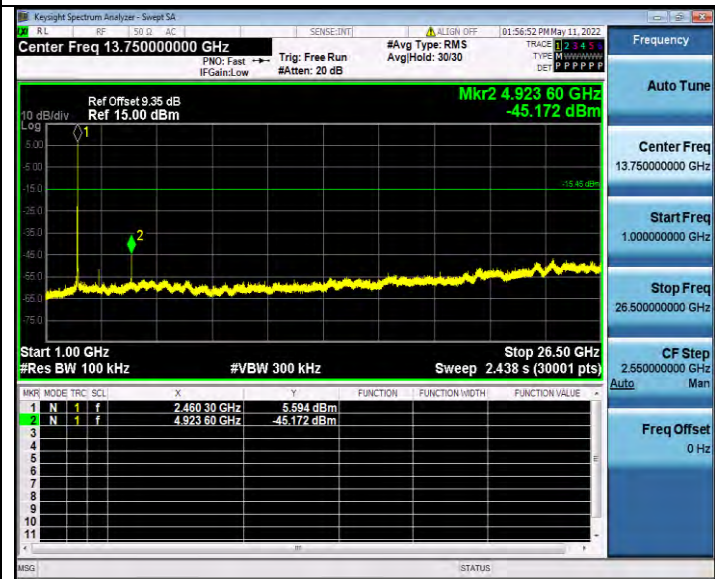
CH11

CH01



30MHz-1GHz

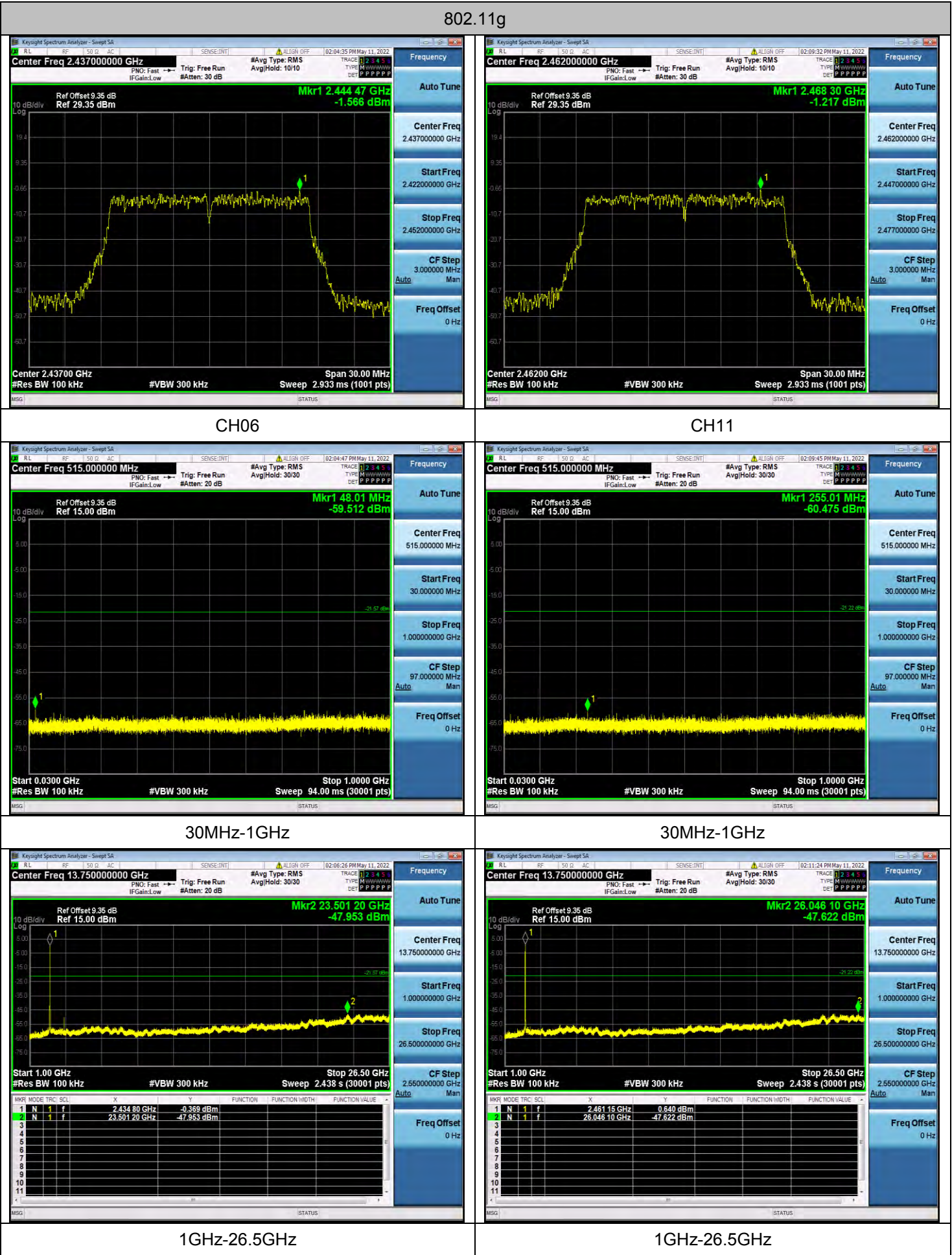
30MHz-1GHz



1GHz-26.5GHz

1GHz-26.5GHz





KeySight Spectrum Analyzer - Swept SA

Center Freq 515.0000000 MHz

Ref Offset 9.35 dB  
Ref 15.00 dBm

Mkr1 255.01 MHz  
-60.475 dBm

10 dB/div  
Log

Start Freq 0.0300 GHz  
Stop Freq 1.0000 GHz  
CF Step 97.000000 MHz  
Freq Offset 0 Hz

Start 0.0300 GHz  
#Res BW 100 kHz  
#VBW 300 kHz  
Sweep 94.00 ms (30001 pts)

Frequency

Auto Tune

Center Freq 515.0000000 MHz

Start Freq 30.000000 MHz

Stop Freq 1.000000000 GHz

CF Step 97.000000 MHz  
Auto

Man

Freq Offset 0 Hz

30MHz-1GHz

KeySight Spectrum Analyzer - Swept SA

Center Freq 13.750000000 GHz

Ref Offset 9.35 dB  
Ref 15.00 dBm

Mkr2 23.501 20 GHz  
-47.953 dBm

10 dB/div  
Log

Start Freq 1.0000 GHz  
Stop Freq 26.5000 GHz  
CF Step 2.550000000 GHz  
Freq Offset 0 Hz

Start 1.00 GHz  
#Res BW 100 kHz  
#VBW 300 kHz  
Sweep 2.438 s (30001 pts)

Mkr MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE  
1 N 1 f 2.434 80 GHz -0.369 dBm  
2 N 1 f 23.501 20 GHz -47.953 dBm

Frequency

Auto Tune

Center Freq 13.750000000 GHz

Start Freq 1.000000000 GHz

Stop Freq 26.500000000 GHz

CF Step 2.550000000 GHz  
Auto

Man

Freq Offset 0 Hz

1GHz-26.5GHz

KeySight Spectrum Analyzer - Swept SA

Center Freq 13.750000000 GHz

Ref Offset 9.35 dB  
Ref 15.00 dBm

Mkr2 26.046 10 GHz  
-47.622 dBm

10 dB/div  
Log

Start Freq 1.0000 GHz  
Stop Freq 26.5000 GHz  
CF Step 2.550000000 GHz  
Freq Offset 0 Hz

Start 1.00 GHz  
#Res BW 100 kHz  
#VBW 300 kHz  
Sweep 2.438 s (30001 pts)

Mkr MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE  
1 N 1 f 2.461 15 GHz 0.640 dBm  
2 N 1 f 26.046 10 GHz -47.622 dBm

Frequency

Auto Tune

Center Freq 13.750000000 GHz

Start Freq 1.000000000 GHz

Stop Freq 26.500000000 GHz

CF Step 2.550000000 GHz  
Auto

Man

Freq Offset 0 Hz

1GHz-26.5GHz



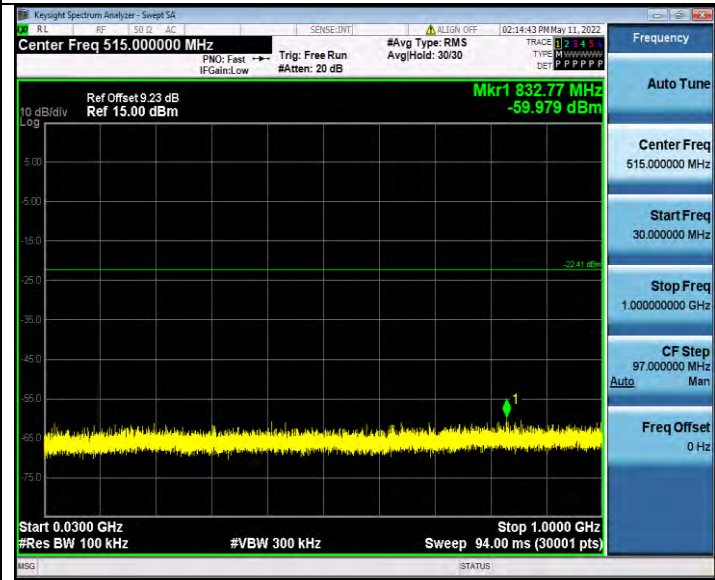
802.11n HT20



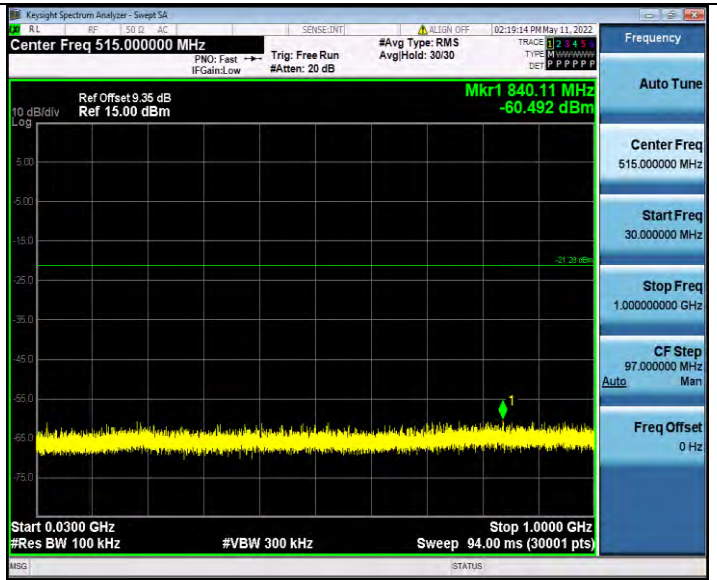
CH01



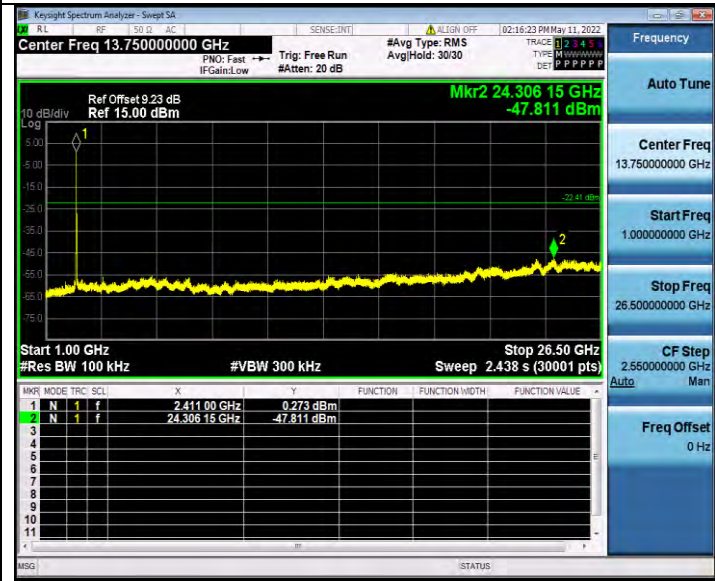
CH06



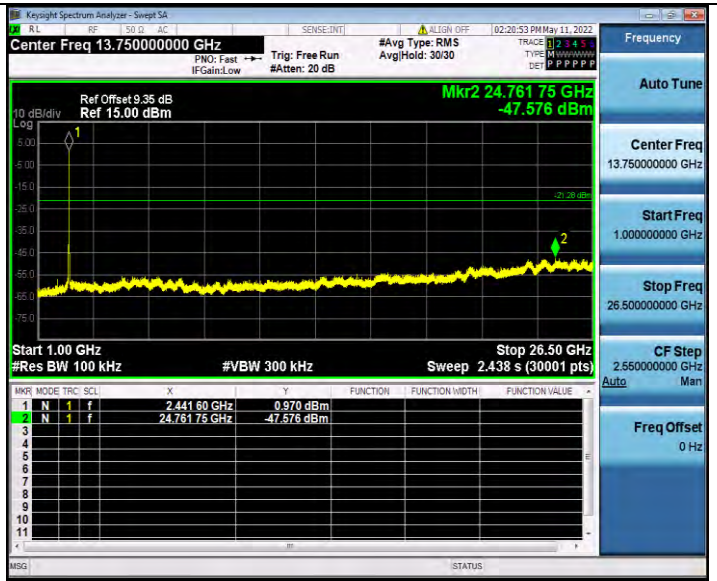
30MHz-1GHz



30MHz-1GHz



1GHz-26.5GHz

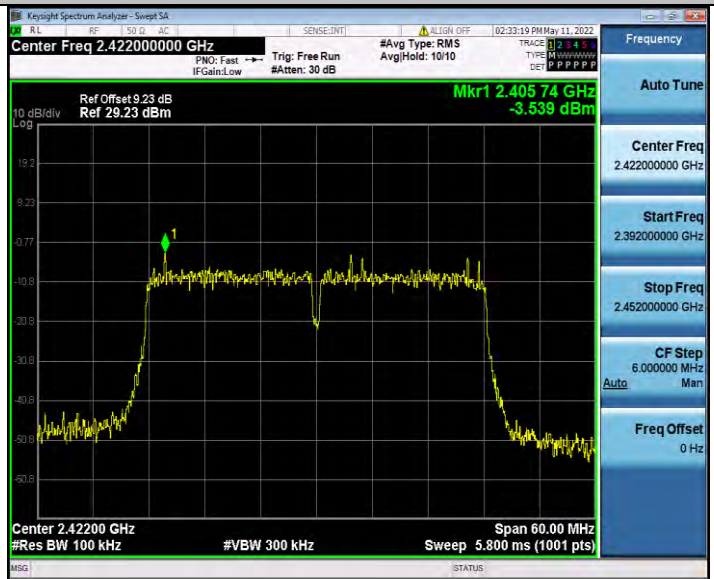


1GHz-26.5GHz

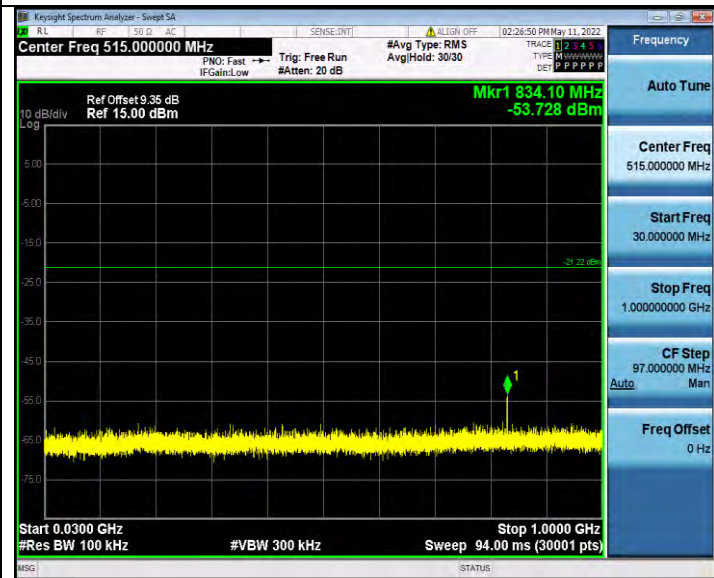
802.11n HT20



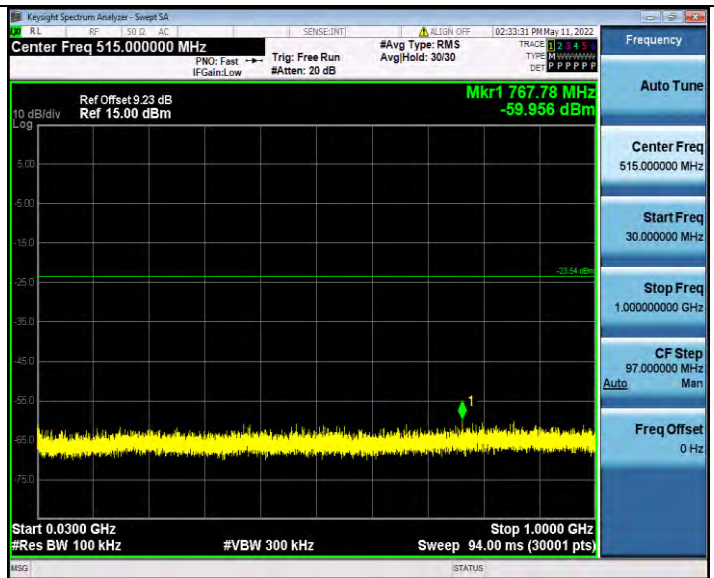
802.11n HT40



CH11



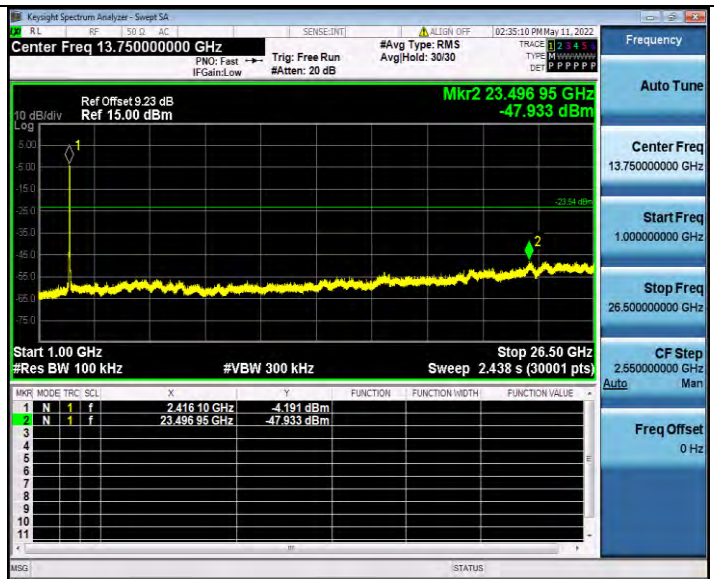
CH03



30MHz-1GHz



30MHz-1GHz

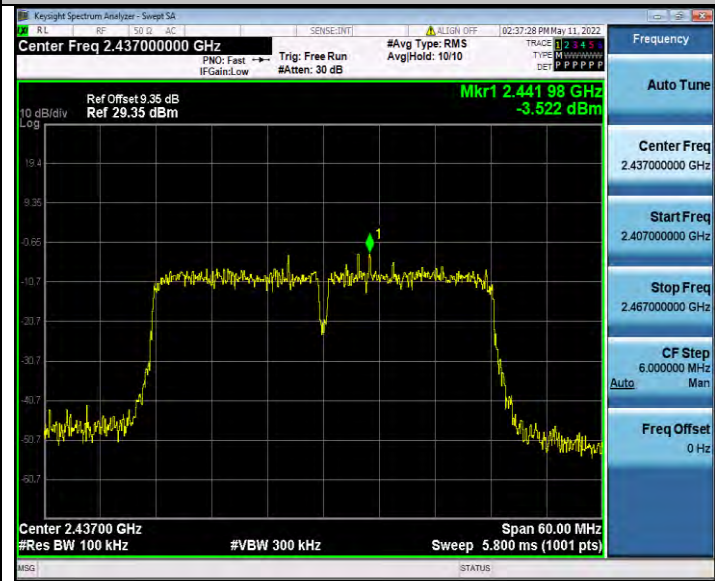


1GHz-26.5GHz

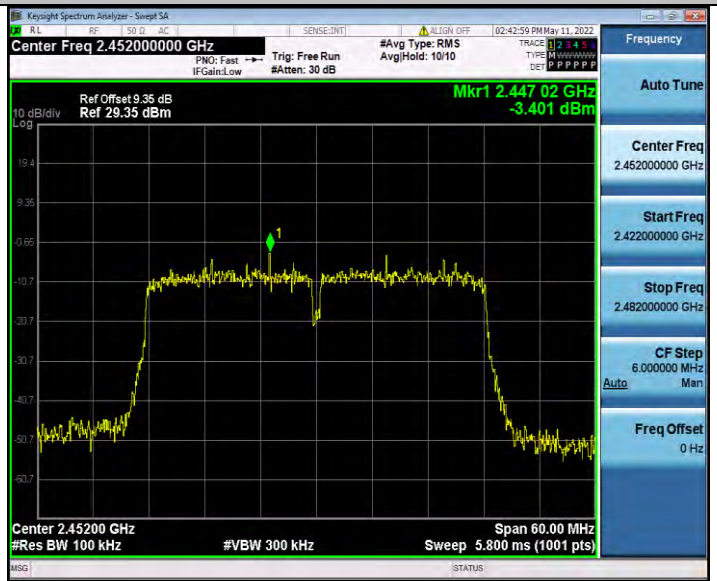
1GHz-26.5GHz



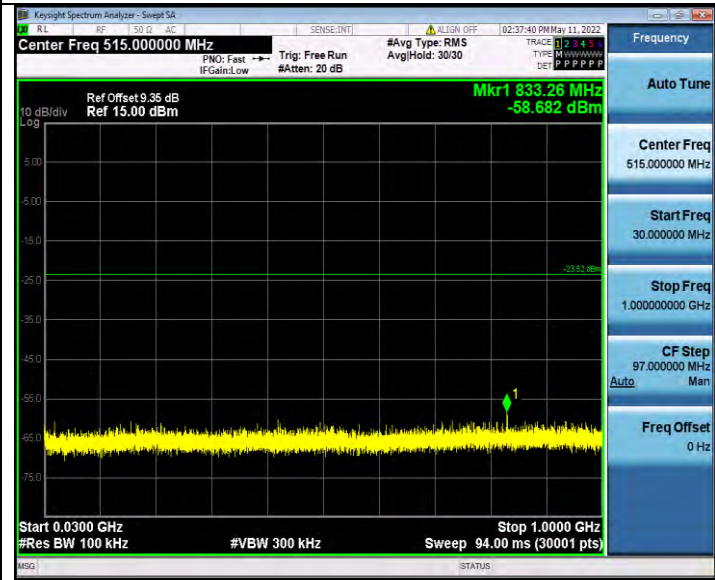
802.11n HT40



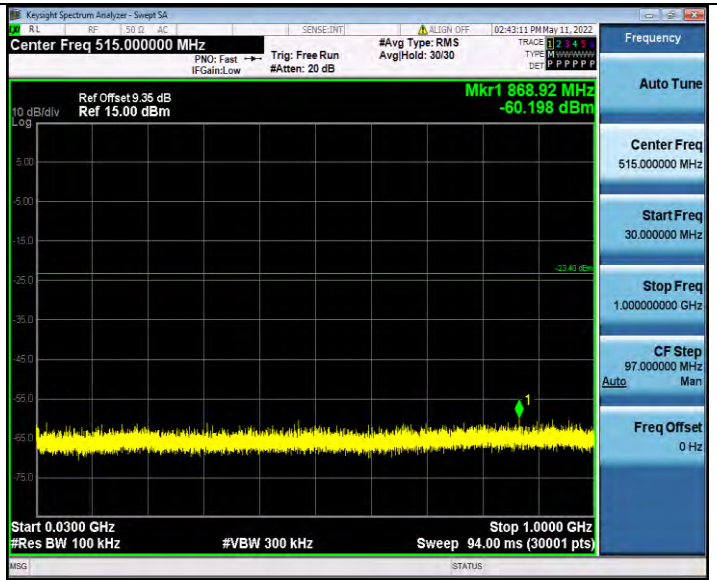
CH06



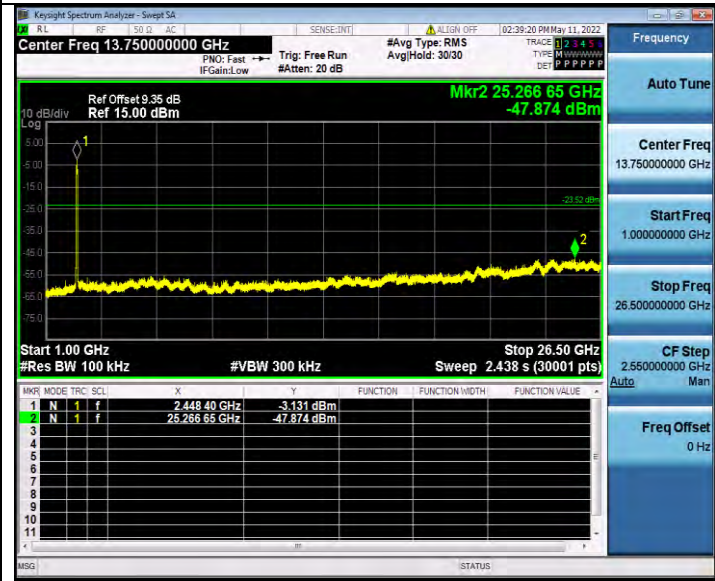
CH09



30MHz-1GHz



30MHz-1GHz



1GHz-26.5GHz



1GHz-26.5GHz

## 4.7. Antenna Requirement

### **Standard Applicable**

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **Antenna Information**

The antenna is FPC Antenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 3.00dBi.

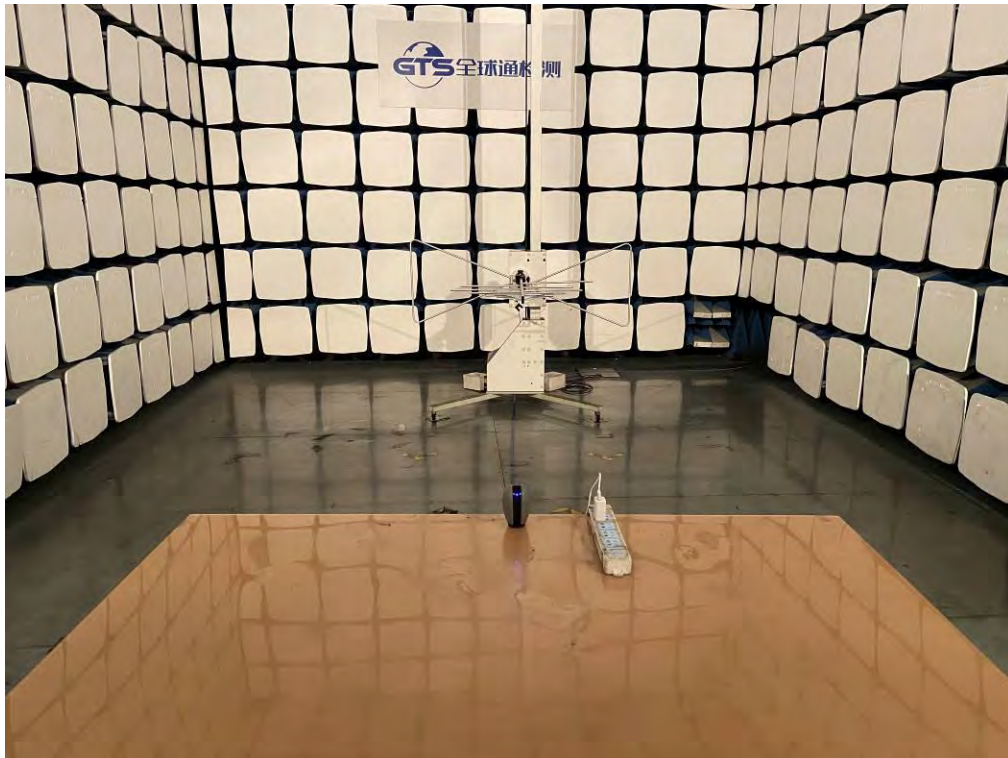
Reference to the **Internal photos**.



## 5. TEST SETUP PHOTOS OF THE EUT

Adapter: TPA-46B050100UU

Radiated Emission

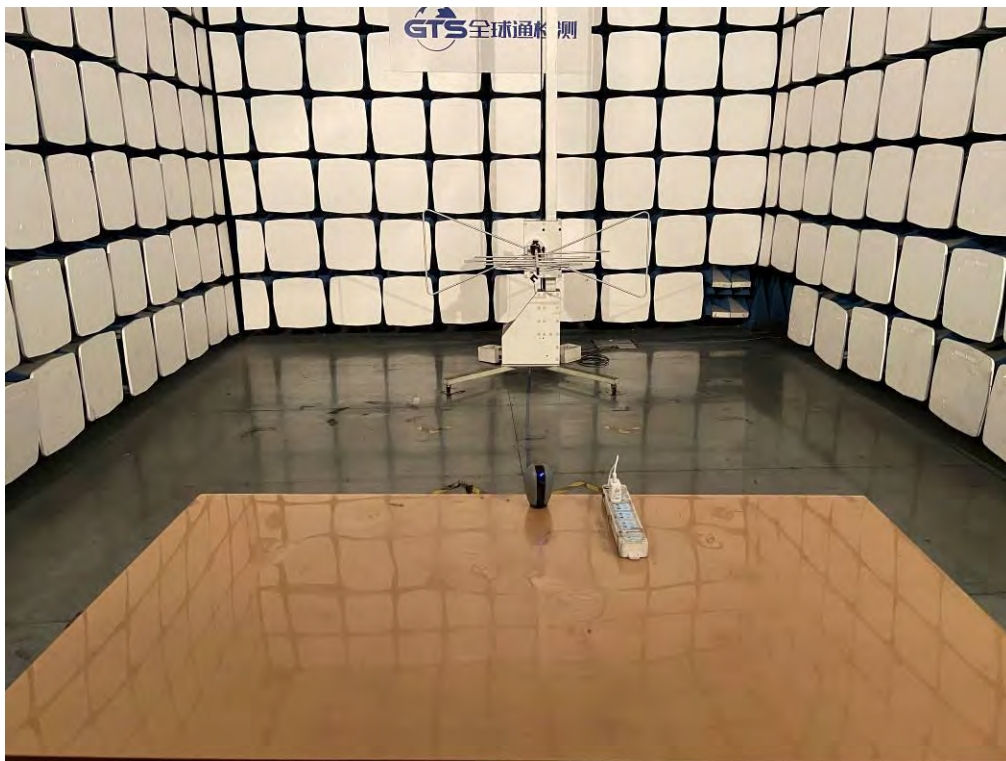


Conducted Emission



Adapter:GTA92-0501000US

Radiated Emission







Conducted Emission



## 6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

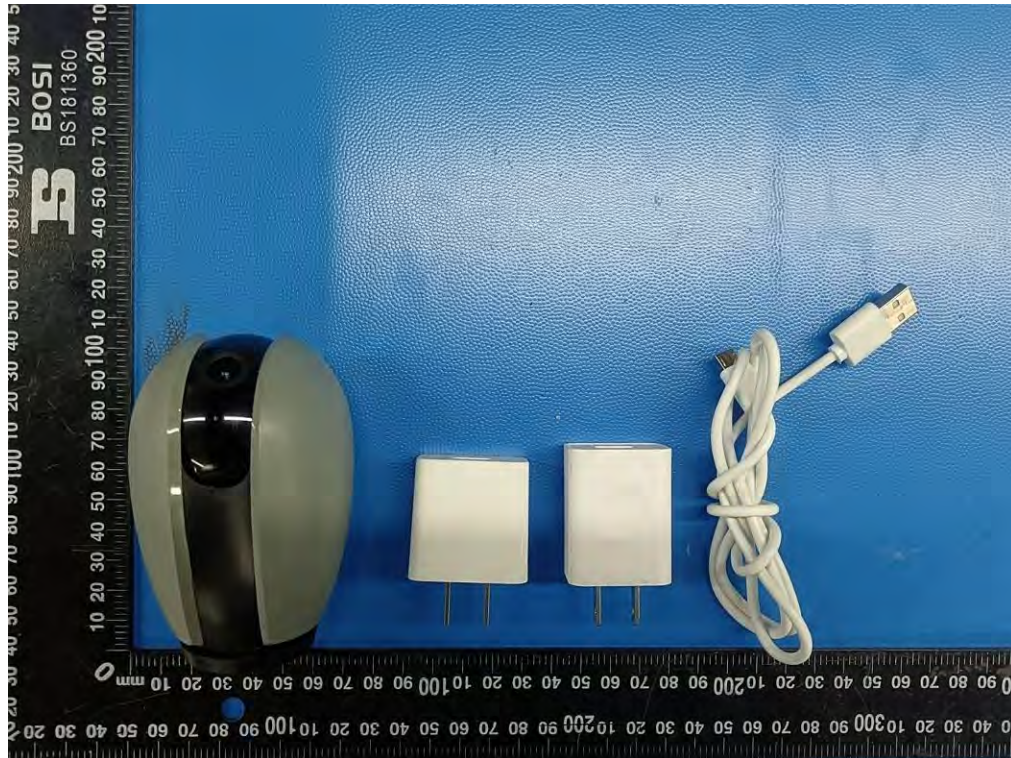


Fig. 1



Fig. 2





Fig. 3



Fig. 4



Fig. 5





Fig. 6



Fig. 7



Fig. 8





Fig. 9



Fig. 10





Fig. 11

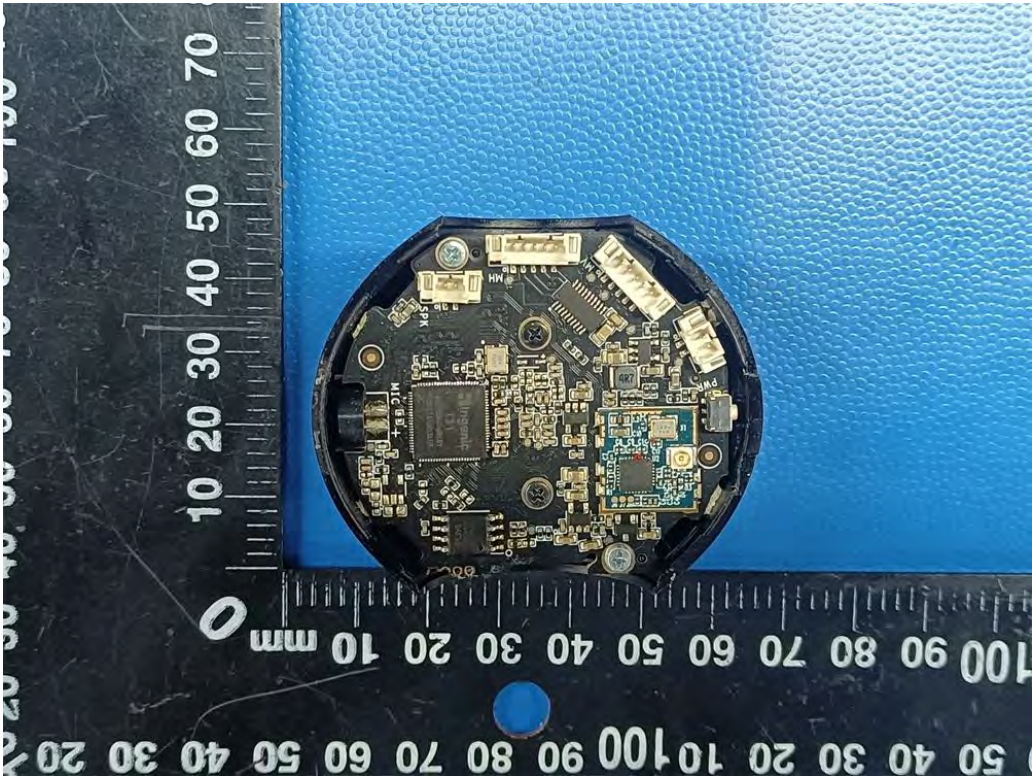


Fig. 12



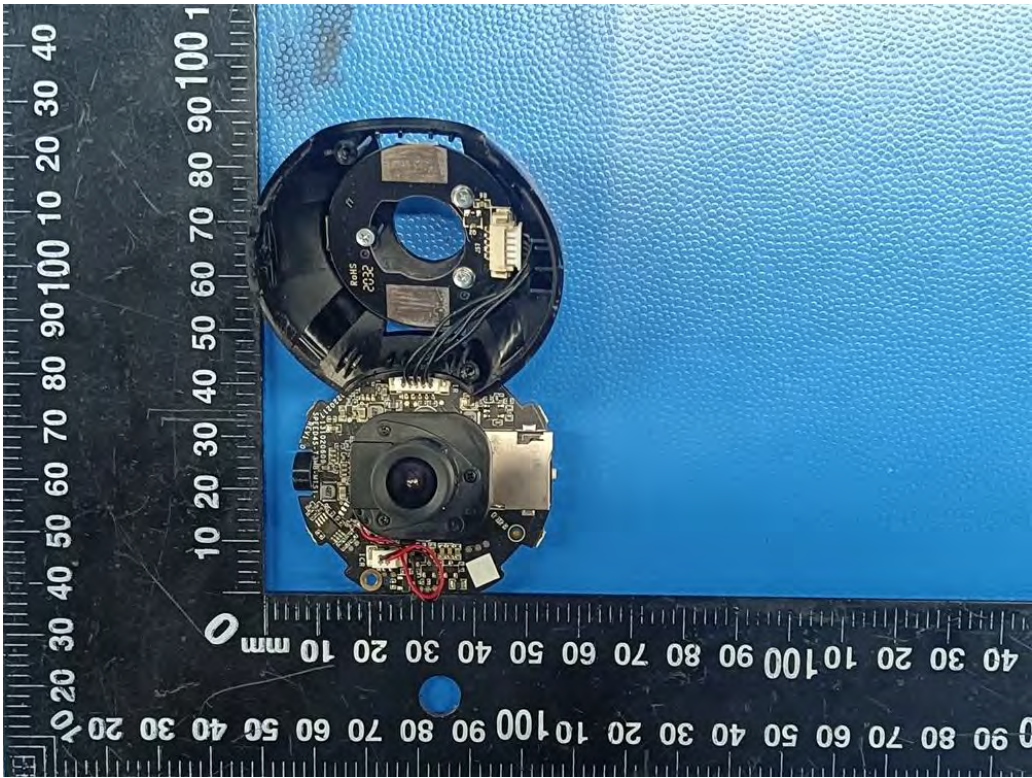


Fig. 13

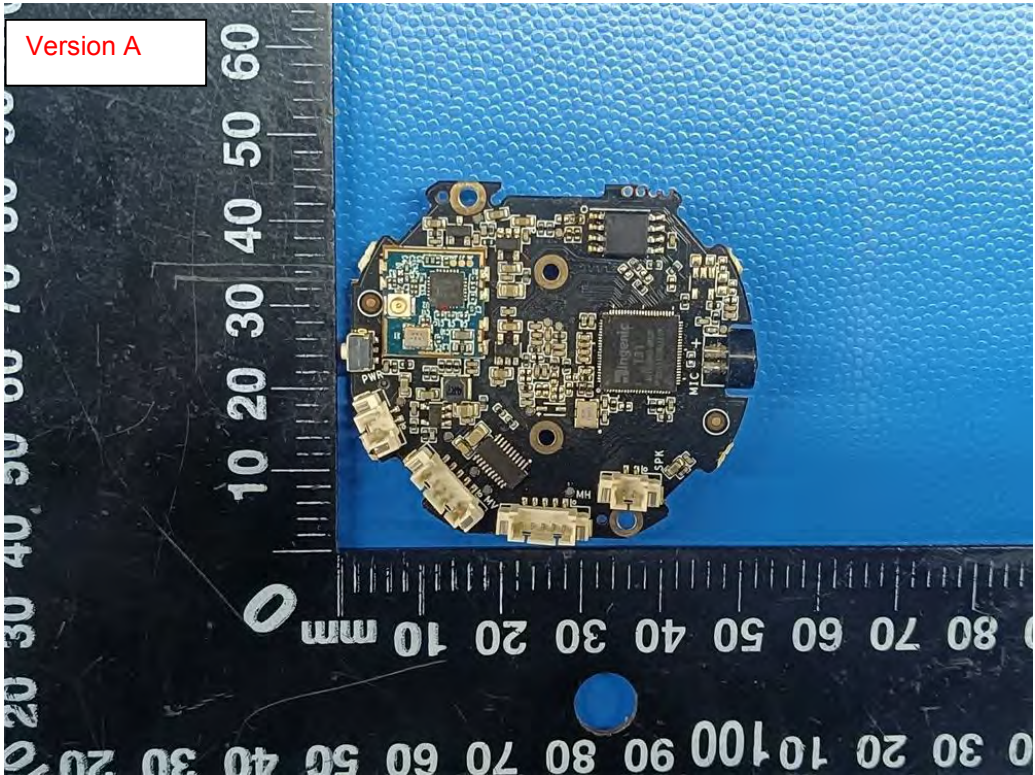


Fig. 14



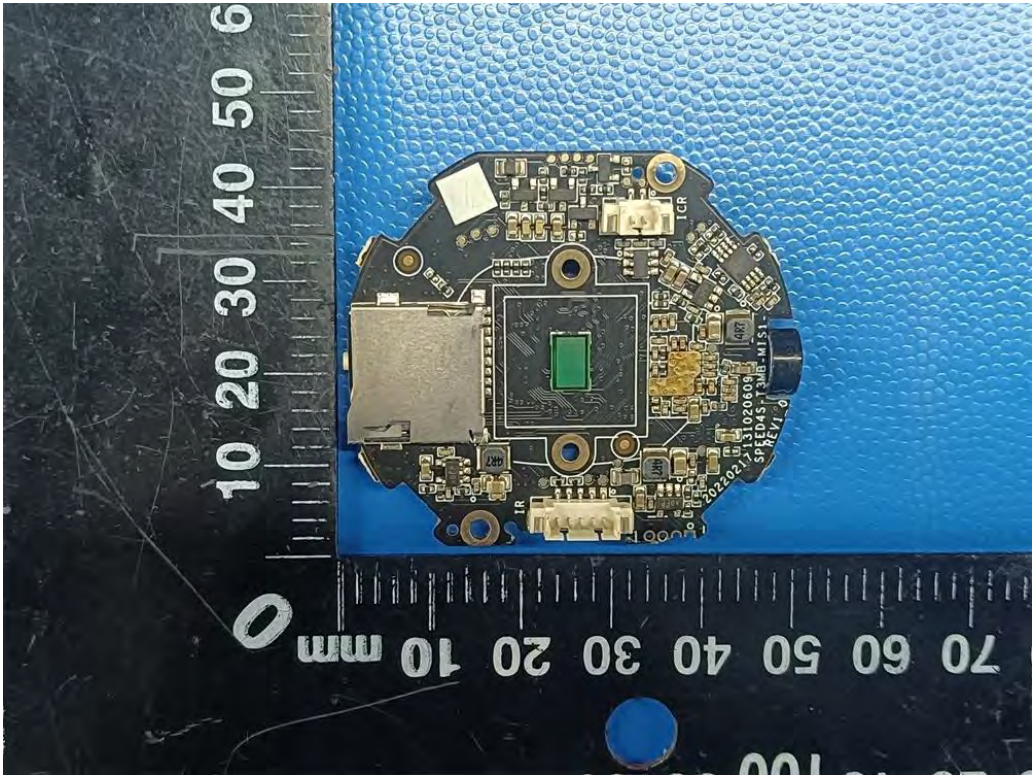


Fig. 15

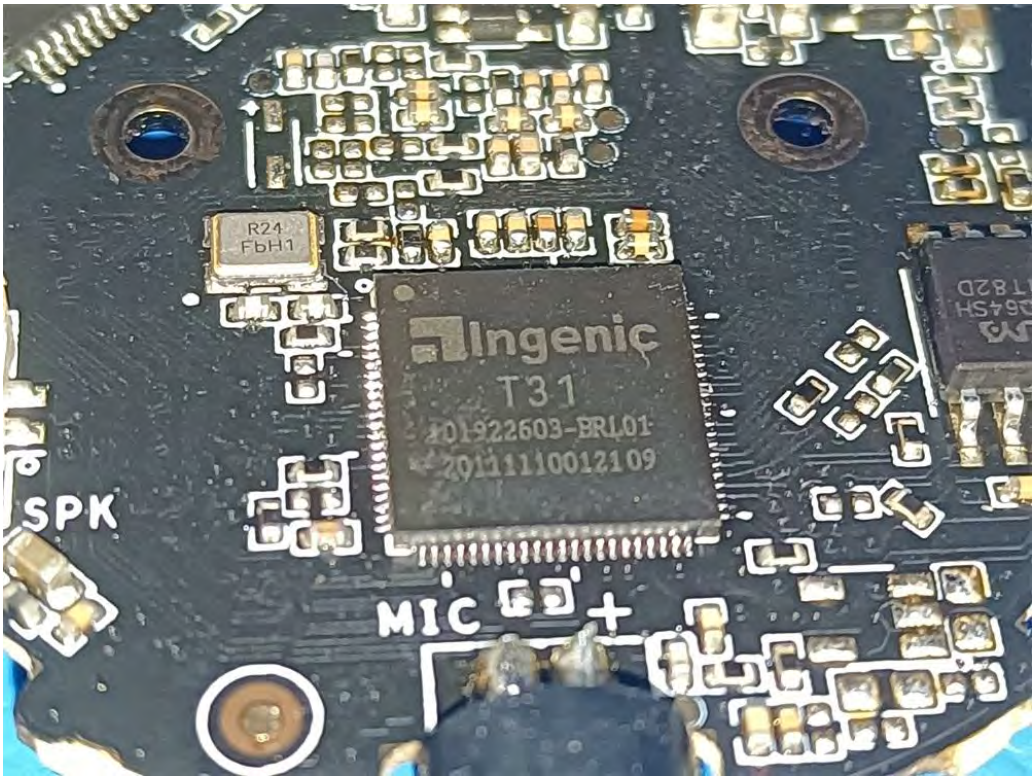


Fig. 16



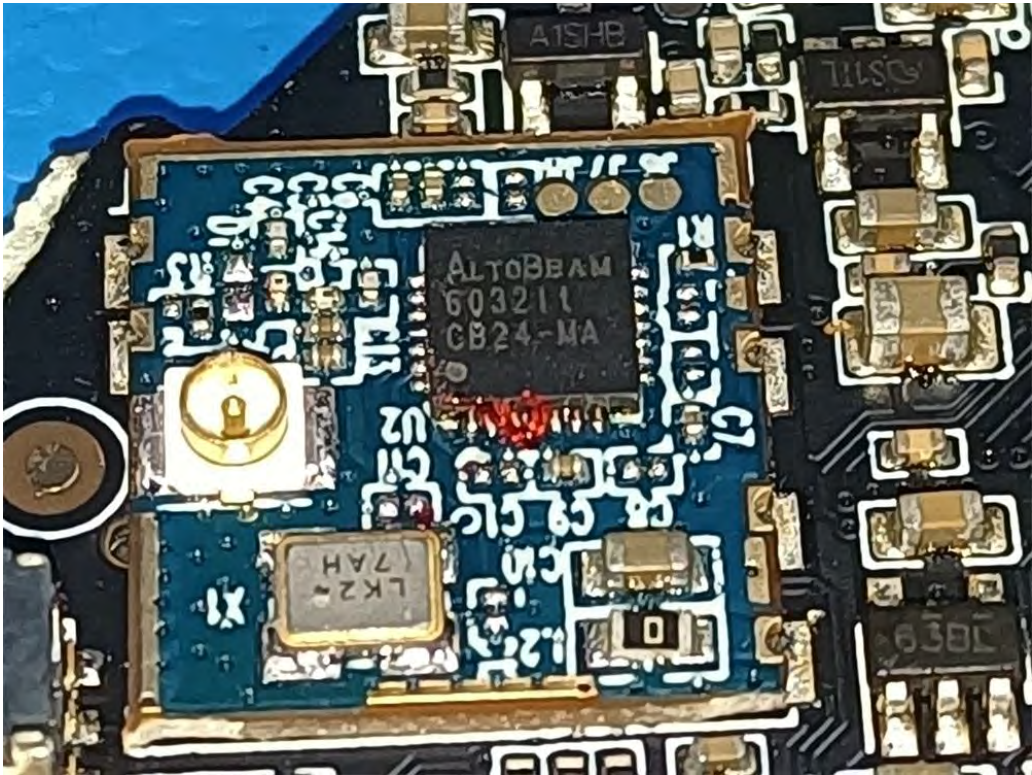


Fig. 17

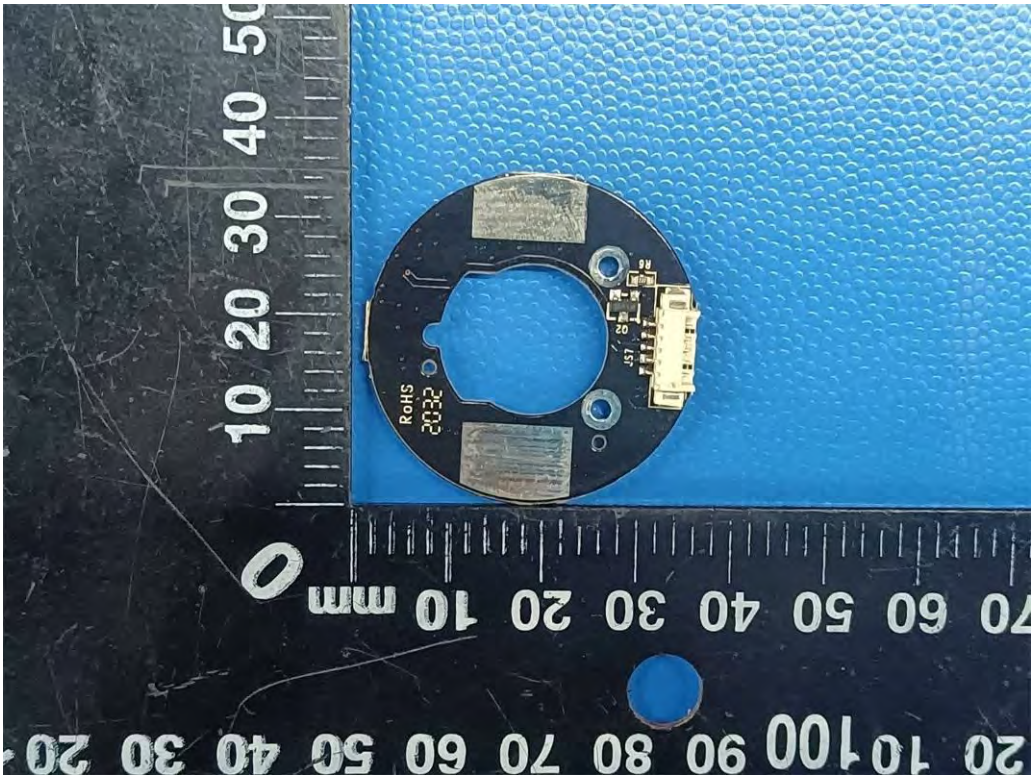


Fig. 18



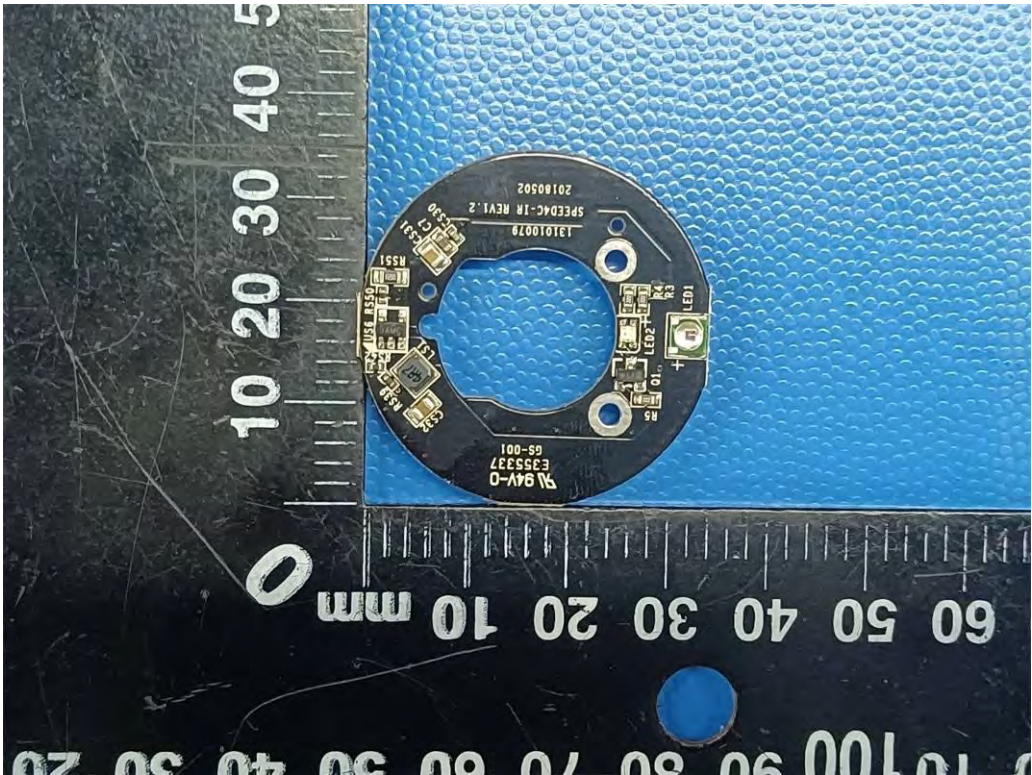


Fig. 19

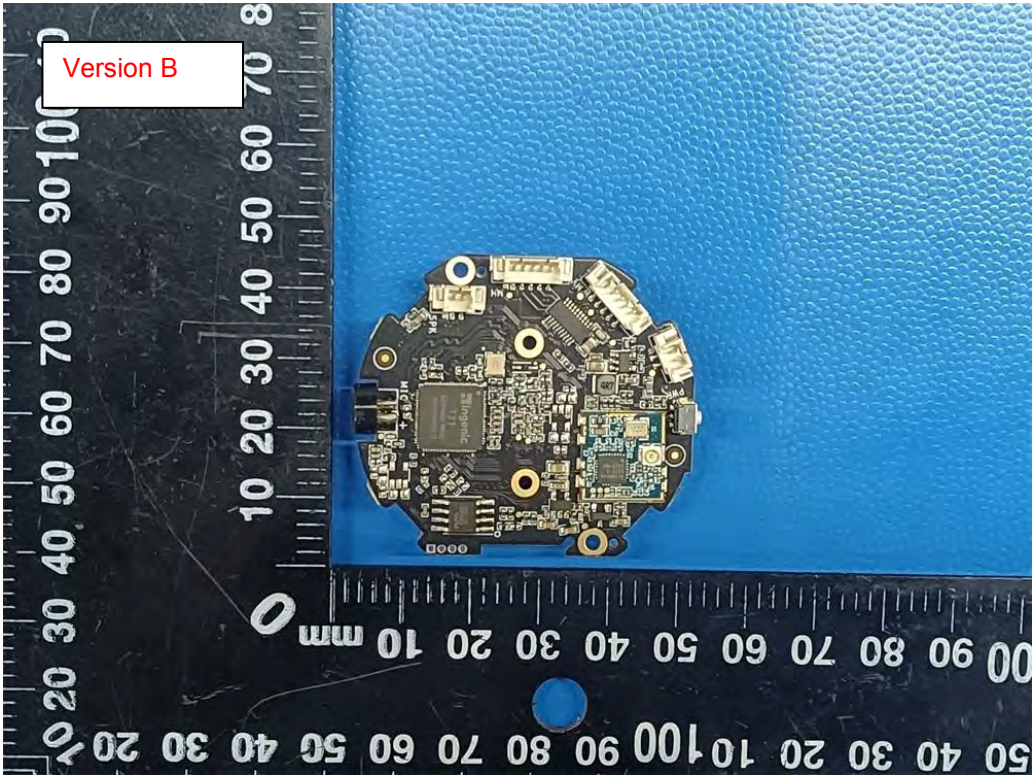


Fig. 20

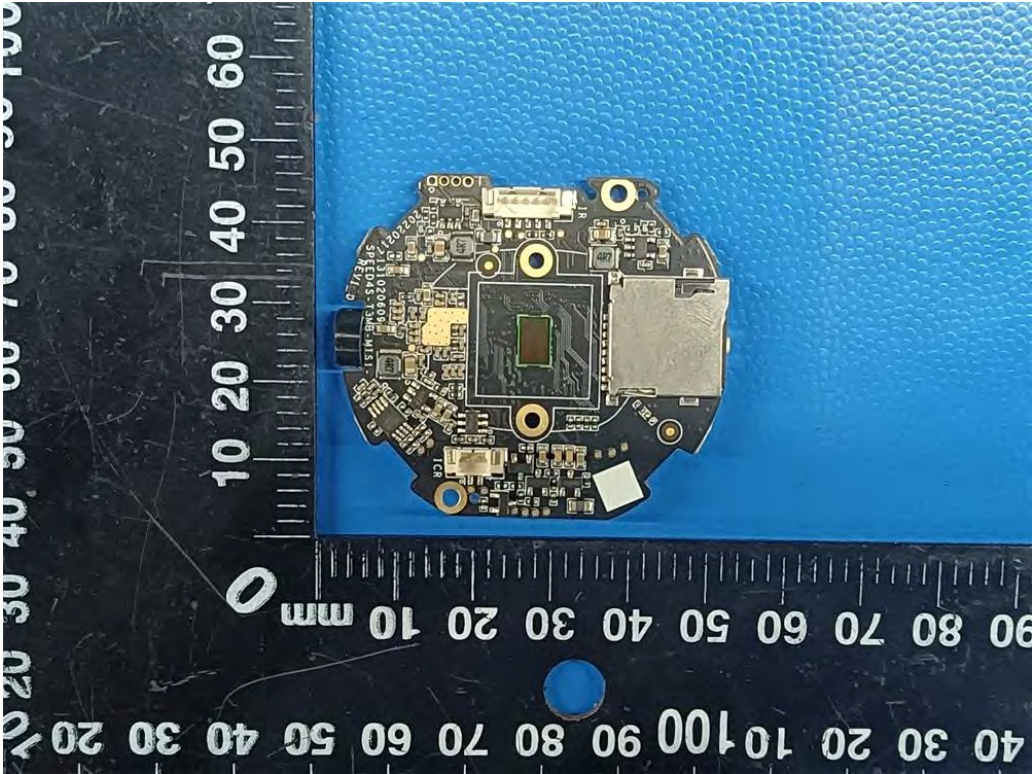


Fig. 21





Fig. 22



Fig. 23

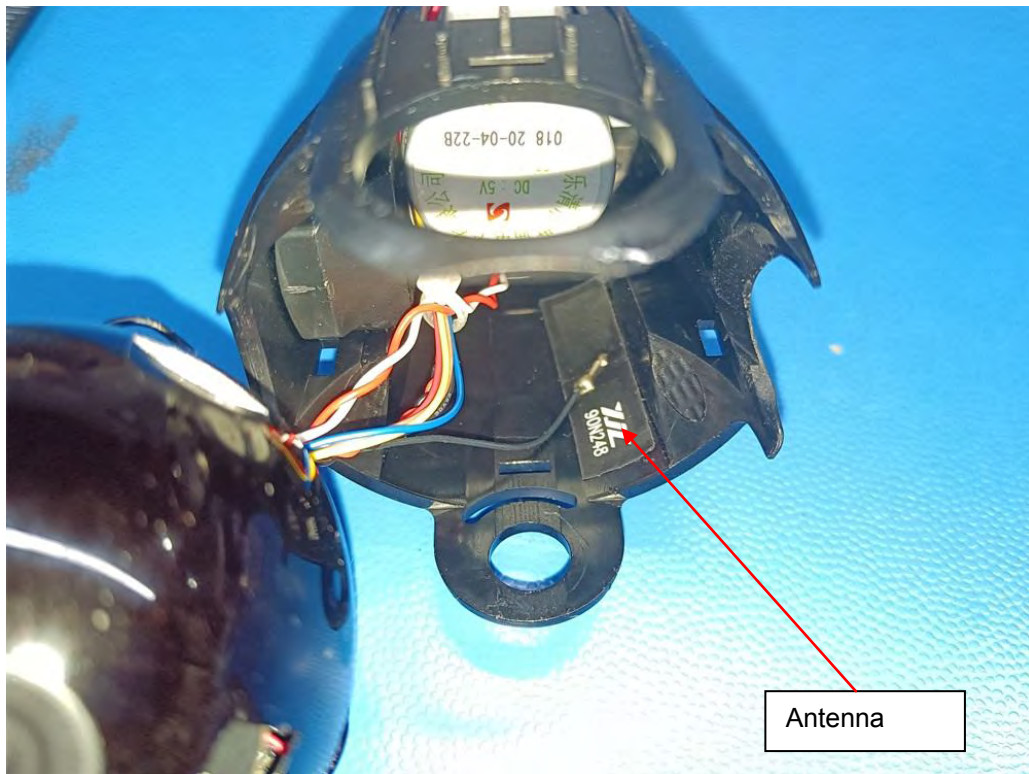


Fig. 24

.....End of Report.....