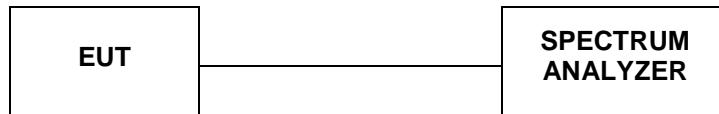


## 4.5. 6dB Bandwidth

### TEST CONFIGURATION



### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with  $RBW=100$  KHz and  $VBW=300$ KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

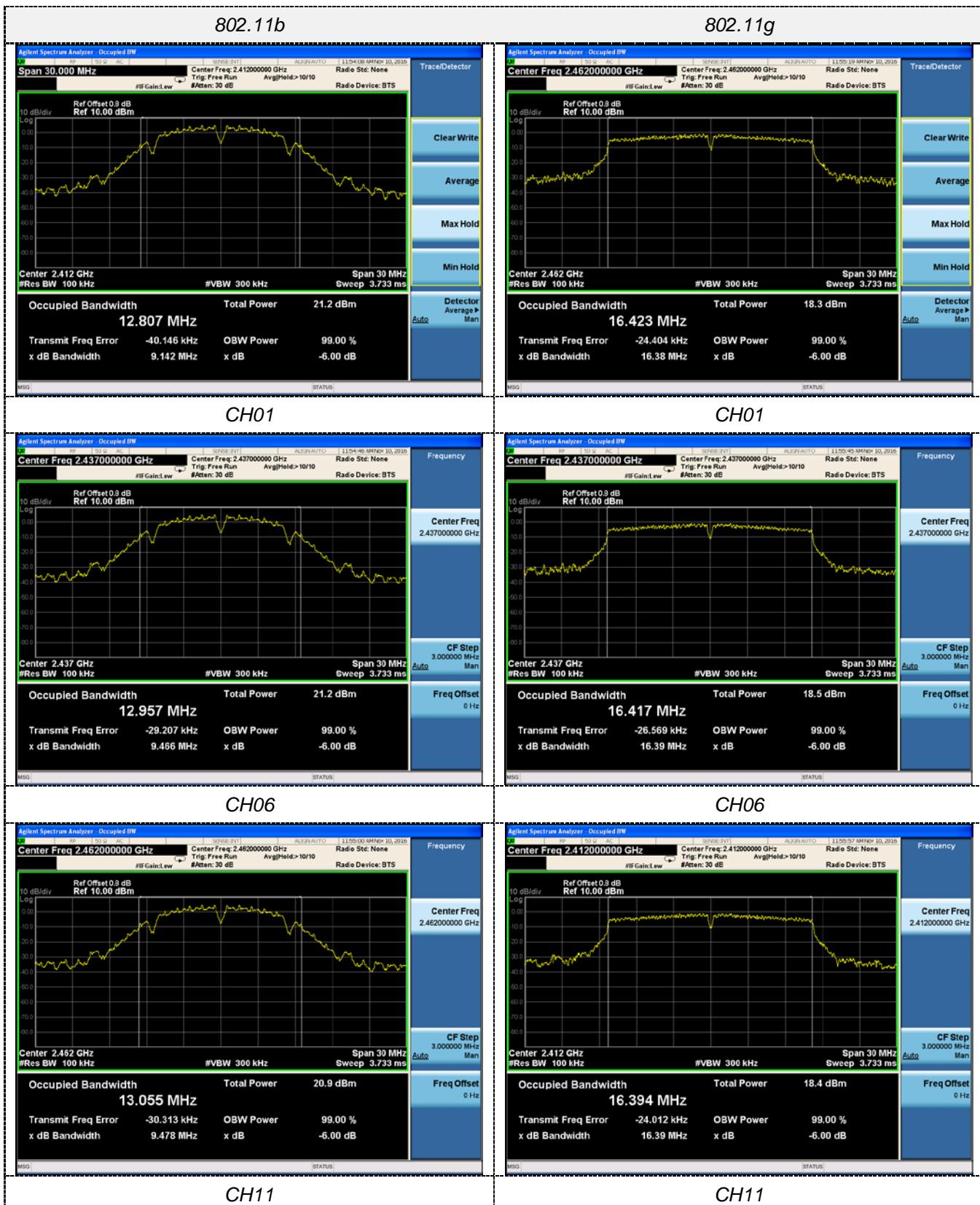
1. Set  $RBW = 100$  KHz.
2. Set the video bandwidth ( $VBW$ )  $\geq 3$   $RBW$ .
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

### TEST RESULTS

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11b	01	9.124	$\geq 500$	Pass
	06	9.466		
	11	9.478		
802.11g	01	16.423	$\geq 500$	Pass
	06	16.417		
	11	16.394		
802.11nHT20	01	17.600	$\geq 500$	Pass
	06	17.600		
	11	17.600		





## 4.6. 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:  
$$E = EIRP - 20\log D + 104.8$$

where:

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

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

Remark: Test site: Shenzhen CTL Testing Technology Co., Ltd.

### 4.6.1 For Radiated Bandedge Measurement

#### 802.11b

Frequency(MHz):		2412			Polarity:			HORIZONTAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2390.00	55.82	PK	74.00	18.18	1.00	77	61.13	27.49	3.32	36.12	-5.31
2390.00	42.82	AV	54.00	11.18	1.00	77	48.13	27.49	3.32	36.12	-5.31
Frequency(MHz):		2412			Polarity:			VERTICAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2390.00	57.80	PK	74.00	16.20	1.00	122	63.11	27.49	3.32	36.12	-5.31
2390.00	42.63	AV	54.00	11.37	1.00	122	47.94	27.49	3.32	36.12	-5.31
Frequency(MHz):		2462			Polarity:			HORIZONTAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2483.50	58.43	PK	74.00	15.57	1.00	215	64.15	27.45	3.38	36.55	-5.72
2483.50	41.78	AV	54.00	12.22	1.00	215	47.50	27.45	3.38	36.55	-5.72
Frequency(MHz):		2462			Polarity:			VERTICAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2483.50	59.27	PK	74.00	14.73	1.00	165	64.99	27.45	3.38	36.55	-5.72
2483.50	41.50	AV	54.00	12.50	1.00	165	47.22	27.45	3.38	36.55	-5.72

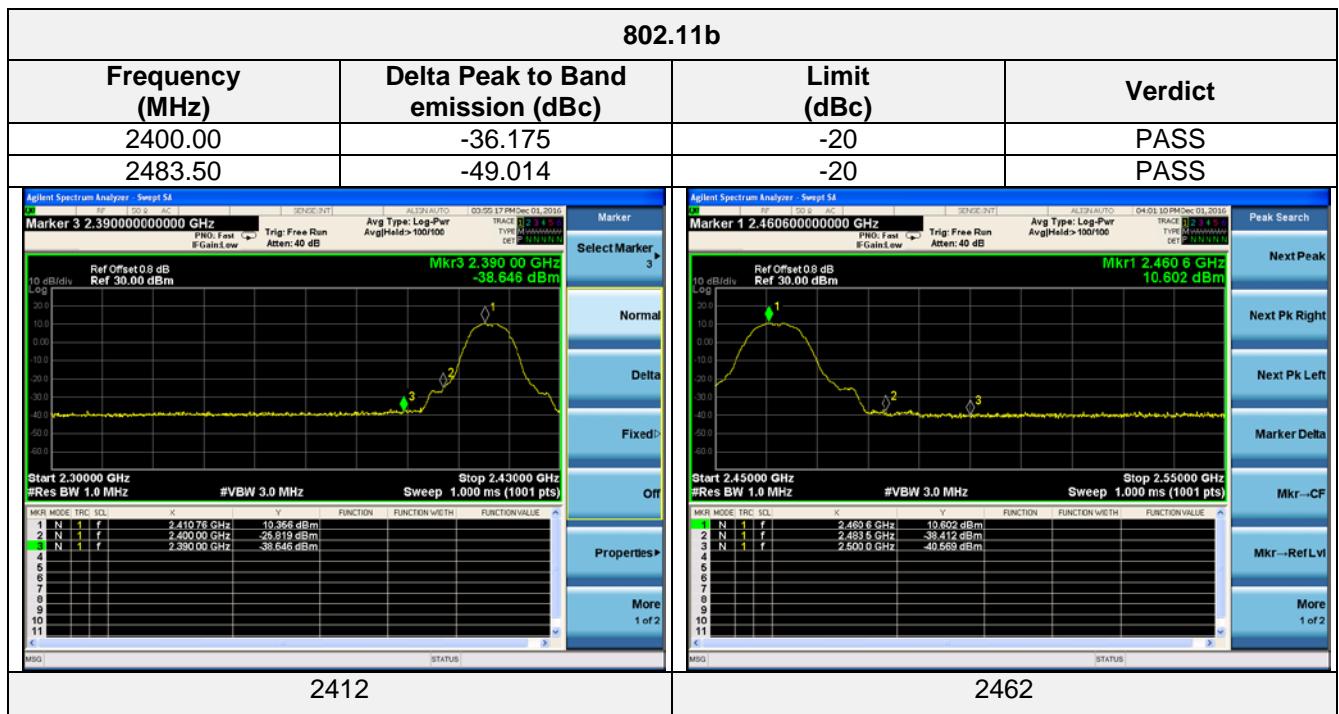
#### 802.11g

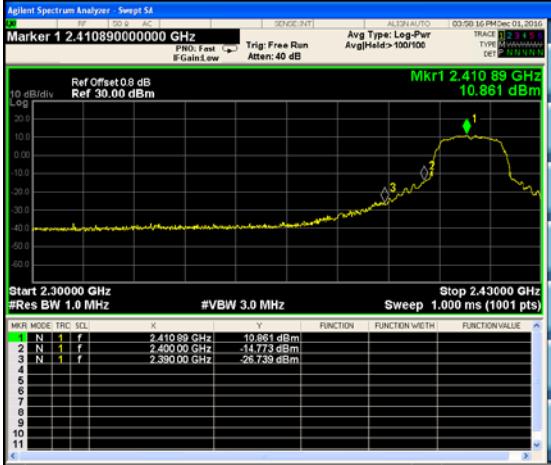
Frequency(MHz):		2412			Polarity:			HORIZONTAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2390.00	59.24	PK	74.00	14.76	1.00	148	64.55	27.49	3.32	36.12	-5.31
2390.00	42.94	AV	54.00	11.06	1.00	148	48.25	27.49	3.32	36.12	-5.31
Frequency(MHz):		2412			Polarity:			VERTICAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2390.00	60.46	PK	74.00	13.54	1.00	231	65.77	27.49	3.32	36.12	-5.31
2390.00	41.56	AV	54.00	12.44	1.00	231	46.87	27.49	3.32	36.12	-5.31
Frequency(MHz):		2462			Polarity:			HORIZONTAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2483.50	58.04	PK	74.00	15.96	1.00	164	63.76	27.45	3.38	36.55	-5.72
2483.50	43.19	AV	54.00	10.81	1.00	164	48.91	27.45	3.38	36.55	-5.72
Frequency(MHz):		2462			Polarity:			VERTICAL			
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)	
2483.50	56.51	PK	74.00	17.49	1.00	93	62.23	27.45	3.38	36.55	-5.72
2483.50	42.84	AV	54.00	11.16	1.00	93	48.56	27.45	3.38	36.55	-5.72

## 802.11n HT20

Frequency(MHz):		2412			Polarity:			HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2390.00	51.51 PK	74.00	22.49	1.00	182	56.82	27.49	3.32	36.12	-5.31
2390.00	42.79 AV	54.00	11.21	1.00	182	48.10	27.49	3.32	36.12	-5.31
Frequency(MHz):		2412			Polarity:			VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2390.00	52.33 PK	74.00	21.67	1.00	215	57.64	27.49	3.32	36.12	-5.31
2390.00	43.47 AV	54.00	10.53	1.00	215	48.78	27.49	3.32	36.12	-5.31
Frequency(MHz):		2462			Polarity:			HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2483.50	51.39 PK	74.00	22.61	1.00	113	57.11	27.45	3.38	36.55	-5.72
2483.50	43.35 AV	54.00	10.65	1.00	113	49.07	27.45	3.38	36.55	-5.72
Frequency(MHz):		2462			Polarity:			VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2483.50	50.90 PK	74.00	23.10	1.00	168	56.62	27.45	3.38	36.55	-5.72
2483.50	44.10 AV	54.00	9.90	1.00	168	49.82	27.45	3.38	36.55	-5.72

## 4.6.2 For Conducted Bandedge Measurement



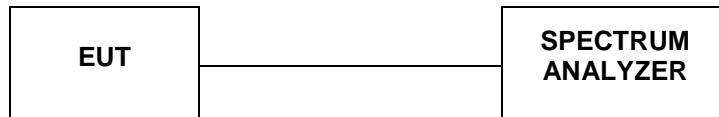
802.11g			
Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	-25.634	-20	PASS
2483.05	-36.072	-20	PASS
	2412		2462

802.11n HT20			
Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	-25.741	-20	PASS
2483.50	-34.742	-20	PASS
	2412		2462

## 4.7. Spurious RF Conducted Emission

### TEST CONFIGURATION



### TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and measure frequency range from 9KHz to 25GHz.

### LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

### TEST RESULTS

Remark: The measurement frequency range is from 9KHz to the 10<sup>th</sup> harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandwidth measurement data.



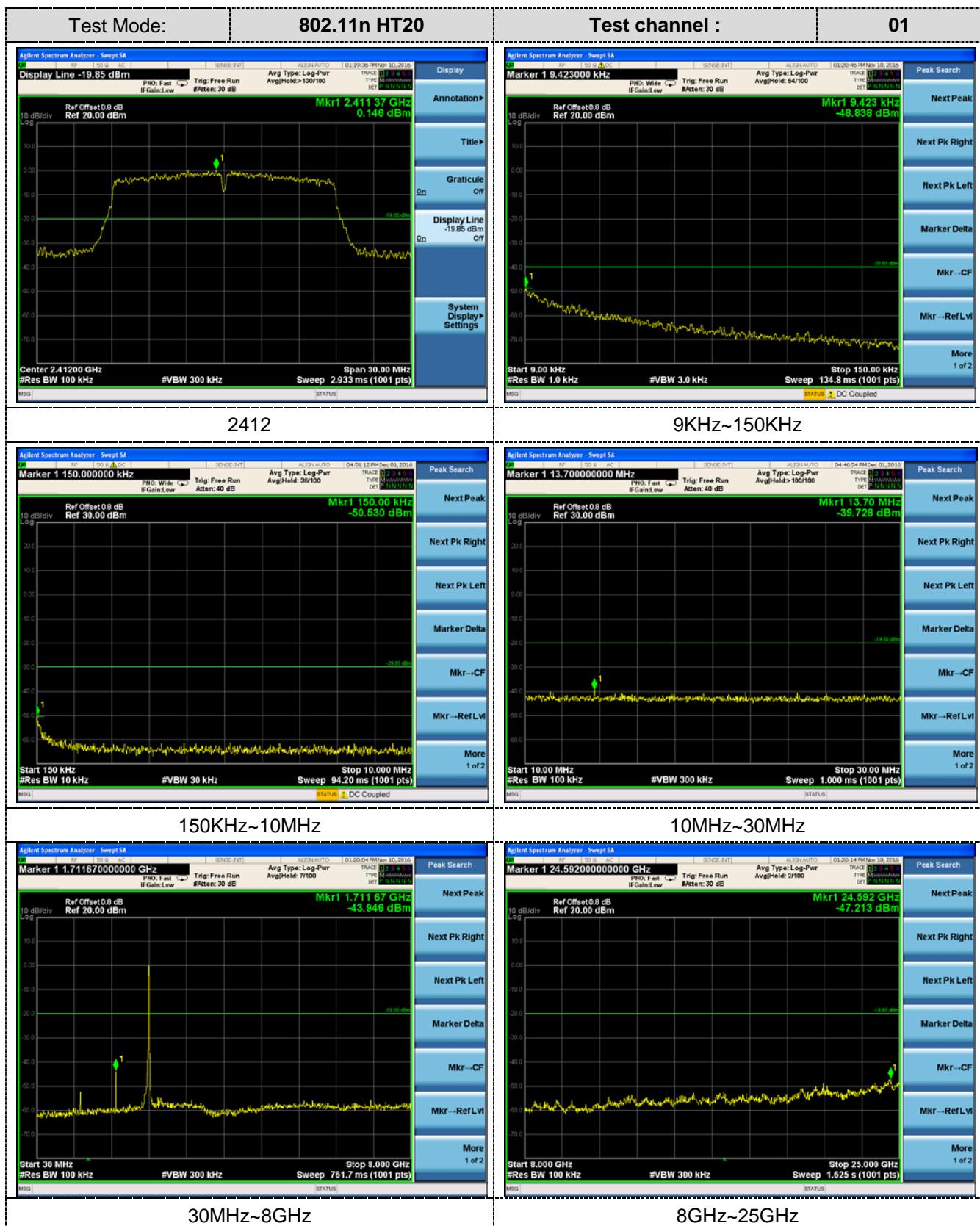
















#### 4.8. Antenna Requirement

##### Standard Applicable

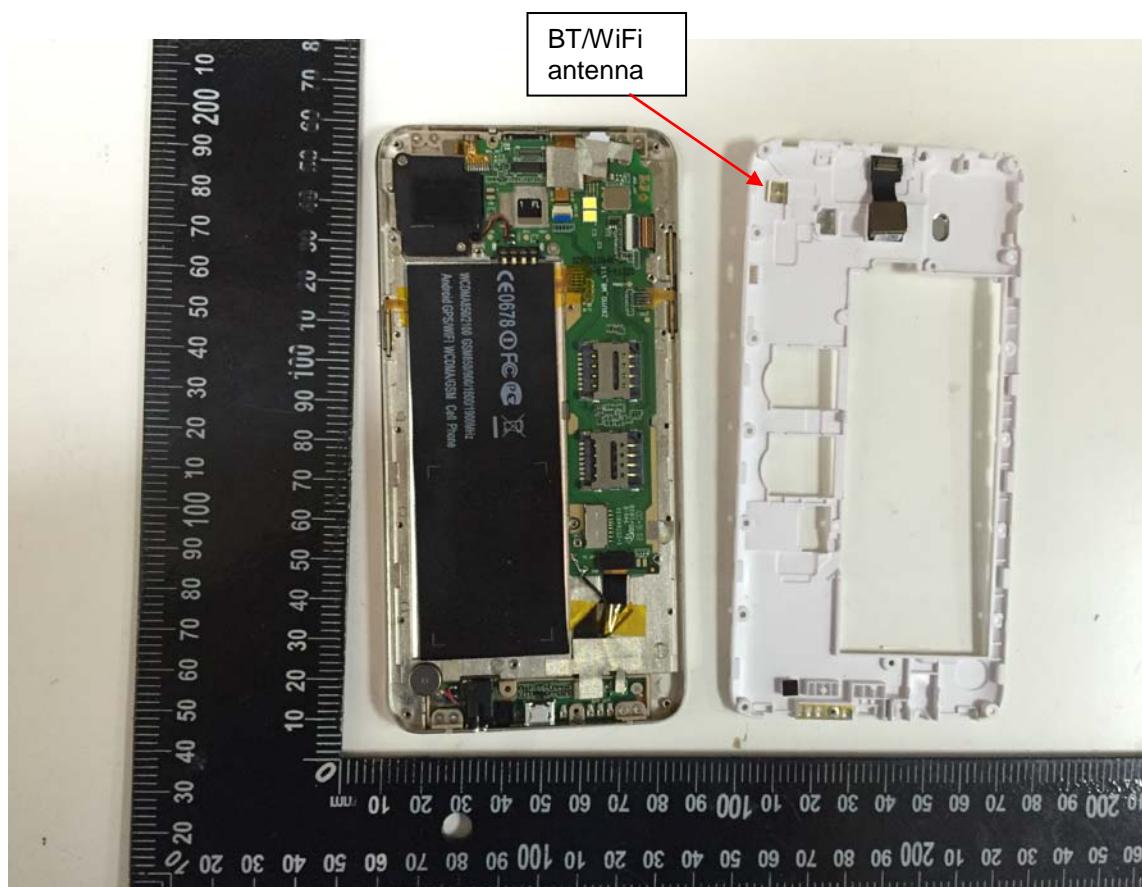
##### Standard Applicable

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.

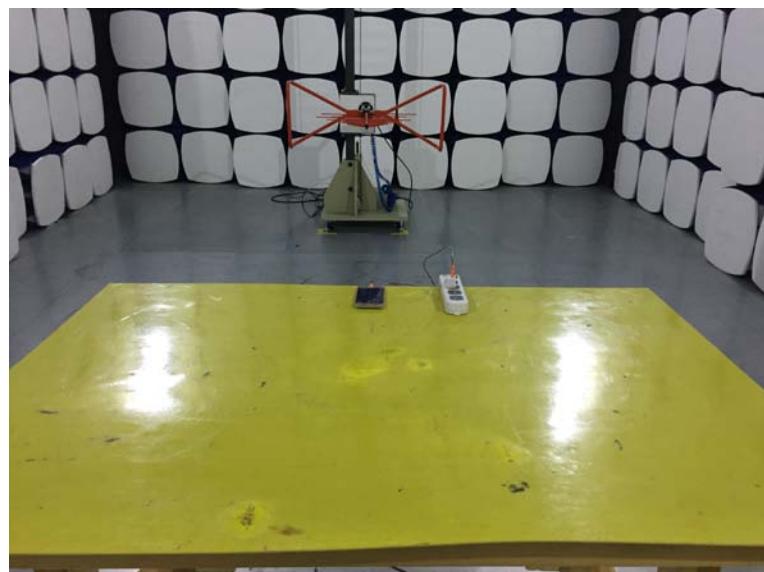
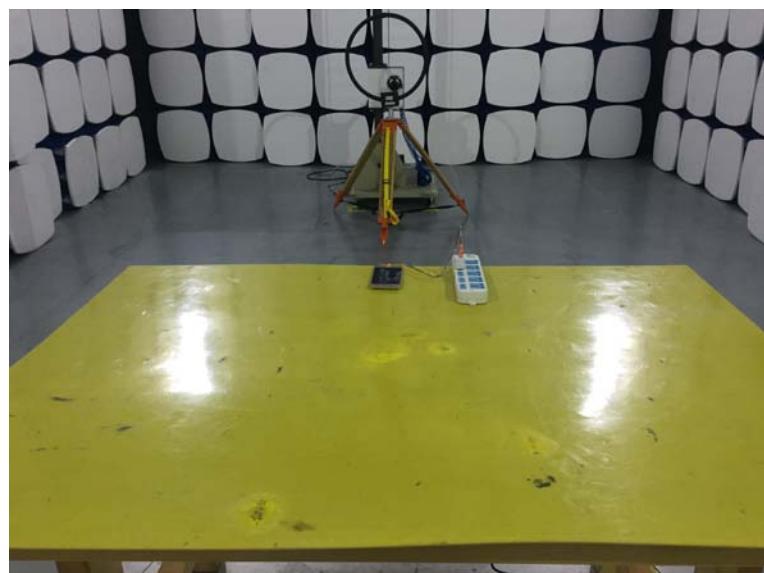
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

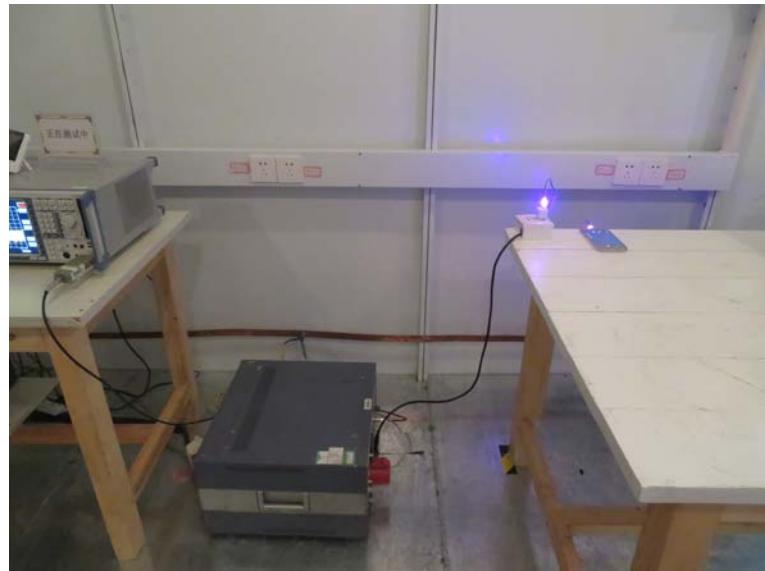
##### Antenna Information

The antenna is FPC antenna, The directional gains of antenna used for transmitting is -0.75dBi.



## 5. Test Setup Photos of the EUT





## **6. External and Internal Photos of the EUT**

Reference to the test report No. GTSR16110086-EDR

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