





8. EQUIVALENT ISOTROPIC RADIATED POWER TEST

8.1.Limit

Use the test method described in FCC Part 15.407(h) (1):

Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

8.2.Test Procedure

Use the test method described in ANSI C63.10 Annex G :

(1) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator ,set the Spectrum Analyzer as below:

Span: Zero

RBW:100KHz

VBW:100KHz

Read out the duty cycle(X) of the transmitter and record as X

(2) The channel power measure function of spectrum Analyzer was used to measure out average output power of transmitter.

(3)Calculated e.i.r.p according to the formula: Read + Cable loss + Atten loss + Antenna Gain + $10\log(1/x)$

(4)Repeated test at the lowest, the middle, and the highest frequency of the stated frequency range.

8.3.Test Results

U-NII-1 Band:

EUT: Smart Signboard		
M/N: IAD-18001		
Test date: 2023-02-13	Pressure: 101.8±1.0 kpa	Humidity: 52.3±3.0%
Tested by: Lili	Test site: RF site	Temperature:22.0±0.6 °C

Test Mode	Frequency (MHz)	EIRP (dBm)	Limit (dBm)
11a	5180	11.76	N/A
	5200	11.75	
	5240	12.02	
11n HT20	5180	11.33	N/A
	5200	11.5	
	5240	11.61	
11n HT40	5190	11.29	N/A
	5230	11.45	
11ac VHT20	5180	11.29	N/A
	5200	11.35	
	5240	11.55	
11ac VHT40	5190	11.37	N/A
	5230	11.49	
11ac VHT80	5210	10.96	N/A
Conclusion: PASS			

9. SPECTRAL DENSITY TEST

9.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.07,22	1 Year
2.	RF Cable	Mini-Circuits	CBL-1M-SMSM+	No.7	Oct.10,22	1 Year

9.2. Limit

Band 5150-5250 MHz:

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

Band 5725-5850 MHz:

The power spectral density shall not exceed 30 dBm in any 500 KHz band.

9.3. Test Procedure

For the Band 5.15-5.25GHz:

The transmitter output was connected to a spectrum analyzer. Power density was measured by spectrum analyzer with 1MHz RBW and 3MHz VBW; Detector: RMS mode.

For the band 5.725-5.85 GHz:

The transmitter output was connected to a spectrum analyzer. Power density was measured by spectrum analyzer with 1MHz RBW and 3MHz VBW, RMS Detector.

So use the test method described in KDB789033 clause E

- 1) Set the RBW=100kHz and VBW ≥ 3 RBW
- 2) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
- 3) Sweep time = auto
- 4) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- 5) Use the "peak search" function of spectrum analyzer find the max value, then add $10\log(500\text{kHz}/\text{RBW})$ to the measured result.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

9.4.Test Results

U-NII-1 Band:

EUT: Smart Signboard		
M/N: IAD-18001		
Test date: 2023-04-07	Pressure: 101.8±1.0 kpa	Humidity: 52.3±3.0%
Tested by: Lili	Test site: RF site	Temperature:22.0±0.6 °C

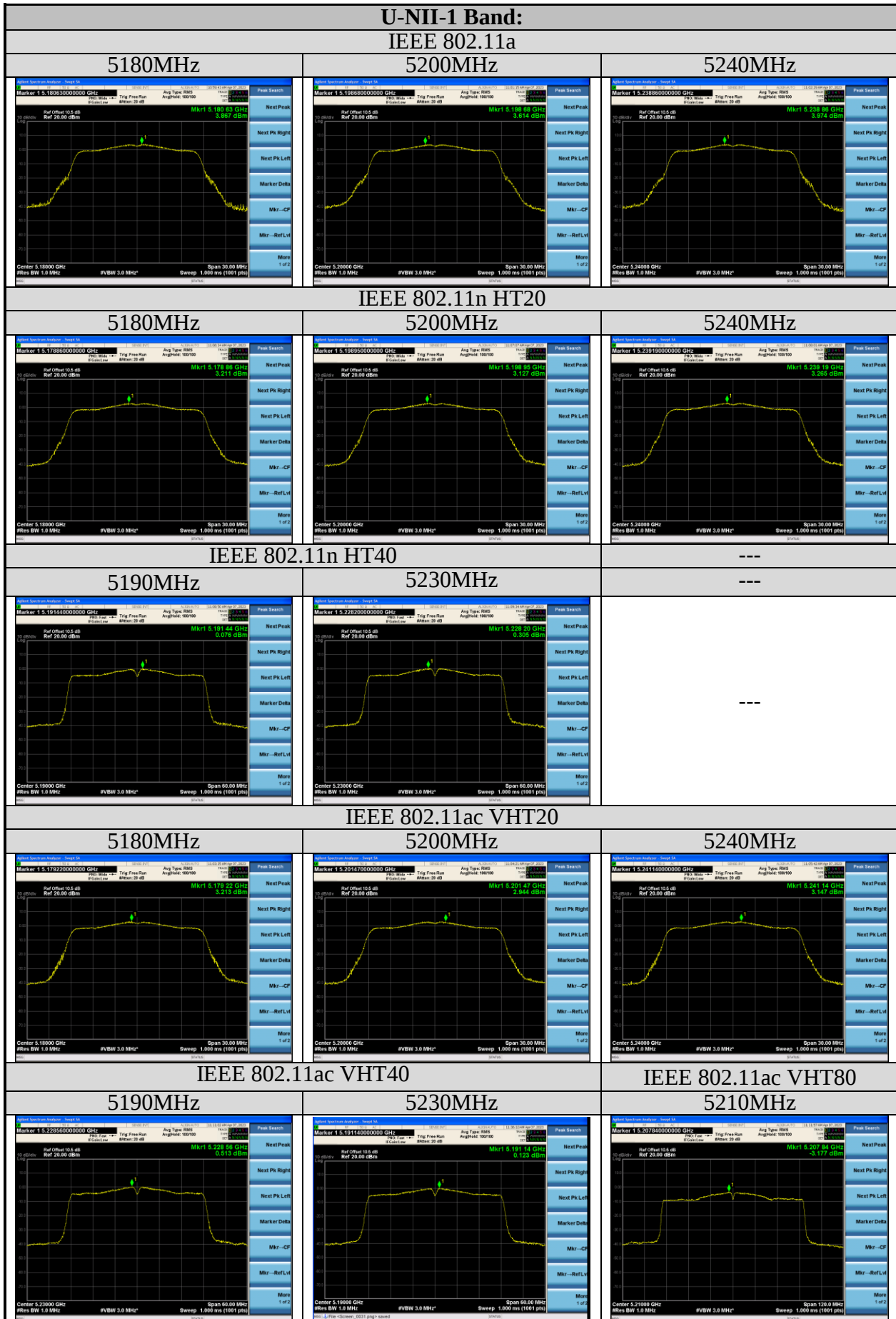
Test Mode	Frequency (MHz)	Power Spectral density (dBm/MHz)	Limit (dBm/MHz)
11a	5180	3.867	11
	5200	3.614	
	5240	3.974	
11n HT20	5180	3.211	11
	5200	3.127	
	5240	3.265	
11n HT40	5190	0.076	11
	5230	0.305	
11ac VHT20	5180	3.213	11
	5200	2.944	
	5240	3.147	
11ac VHT40	5190	0.123	11
	5230	0.513	
11ac VHT80	5210	-3.177	11
Conclusion: PASS			

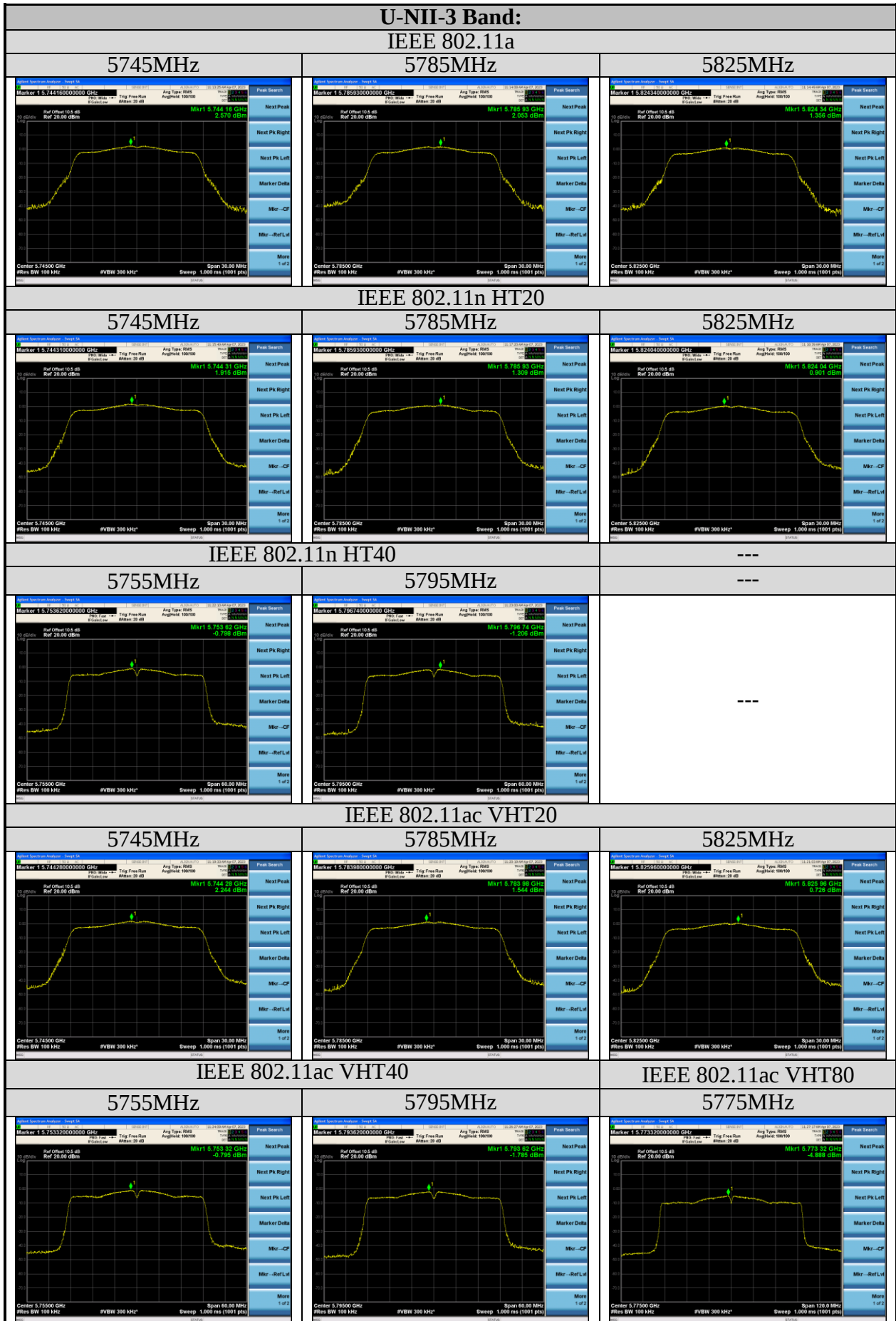
U-NII-3 Band:

EUT: Smart Signboard		
M/N: IAD-18001		
Test date: 2023-04-07	Pressure: 102.1±1.0 kpa	Humidity: 53.2±3.0%
Tested by: Lili	Test site: RF site	Temperature: 22.3±0.6 °C

Test Mode	Frequency (MHz)	Power Spectral density (dBm/500KHz)	Limit (dBm/500KHz)
11a	5745	9.560	30
	5785	9.043	
	5825	8.346	
11n HT20	5745	8.905	30
	5785	8.299	
	5825	7.891	
11n HT40	5755	6.192	30
	5795	5.784	
11ac VHT20	5745	9.234	30
	5785	8.534	
	5825	7.716	
11ac VHT40	5755	6.195	30
	5795	5.205	
11ac VHT80	5775	2.102	30
Conclusion: PASS			

Note: The total result = Reading + 10 log(500kHz/100kHz)





10.FREQUENCY STABILITY MEASUREMENT

10.1.Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.07,22	1 Year
2.	Attenuator	Agilent	8491B	MY39269201	Oct.09,22	1 Year
3.	RF Cable	RF Cable	Mini-Circuits	CBL-1M-SMS M+	No.7	1 Year

10.2.Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

10.3.Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
EUT have transmitted absence of modulation signal and fixed channelise. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings. fc is declaring of channel frequency. Then the frequency error formula is $(f_c - f) / f \times 10^{-6}$ ppm. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
2. Extreme temperature rule is 0°C~50°C.

10.4. Test Result

EUT: Smart Signboard		
M/N: IAD-18001		
Test date: 2023-02-17	Pressure: 102.1±1.0 kpa	Humidity: 53.2±3.0%
Tested by: Lili	Test site: RF site	Temperature: 22.3±0.6 °C

Frequency Stability vs. Voltage:

Test Voltage	Temperature	CH	Max. Reading (MHz)	Target Frequency (MHz)	Result (ppm)
AC 120V	25°C	CH36	5180.0265	5180	5.12
		CH38	5190.0245	5190	4.72
		CH40	5200.0270	5200	5.19
		CH42	5210.0245	5210	4.70
		CH46	5230.0250	5230	4.78
		CH48	5240.0250	5240	4.77
		CH149	5745.0265	5745	4.61
		CH151	5755.0260	5755	4.52
		CH155	5775.0260	5775	4.50
		CH157	5785.0260	5785	4.49
		CH159	5795.0265	5795	4.57
		CH165	5825.0265	5825	4.55
AC 120V	0°C	CH36	5180.0275	5180	5.31
		CH38	5190.0298	5190	5.74
		CH40	5200.0271	5200	5.21
		CH42	5210.0251	5210	4.82
		CH46	5230.0252	5230	4.82
		CH48	5240.0251	5240	4.79
		CH149	5745.0264	5745	4.60
		CH151	5755.0263	5755	4.57
		CH155	5775.0263	5775	4.55
		CH157	5785.0262	5785	4.53
		CH159	5795.0267	5795	4.61
		CH165	5825.0269	5825	4.62

AC 120V	50°C	CH36	5180.0250	5180	4.83
		CH38	5190.0240	5190	4.62
		CH40	5200.0268	5200	5.15
		CH42	5210.0242	5210	4.64
		CH46	5230.0248	5230	4.74
		CH48	5240.0250	5240	4.77
		CH149	5745.0261	5745	4.54
		CH151	5755.0260	5755	4.52
		CH155	5775.0258	5775	4.47
		CH157	5785.0260	5785	4.49
		CH159	5795.0262	5795	4.52
		CH165	5825.0264	5825	4.53

Frequency Stability vs. Temperature:

Test Voltage	Temperature	CH	Max. Reading (MHz)	Target Frequency (MHz)	Result (ppm)
AC 120V	25°C	CH36	5180.0265	5180	5.12
		CH38	5190.0245	5190	4.72
		CH40	5200.0270	5200	5.19
		CH42	5210.0245	5210	4.70
		CH46	5230.0250	5230	4.78
		CH48	5240.0250	5240	4.77
		CH149	5745.0265	5745	4.61
		CH151	5755.0260	5755	4.52
		CH155	5775.0260	5775	4.50
		CH157	5785.0260	5785	4.49
		CH159	5795.0265	5795	4.57
		CH165	5825.0265	5825	4.55
AC 108V	25°C	CH36	5180.0266	5180	5.14
		CH38	5190.0247	5190	4.76
		CH40	5200.0271	5200	5.21
		CH42	5210.0255	5210	4.89
		CH46	5230.0251	5230	4.80
		CH48	5240.0251	5240	4.79
		CH149	5745.0267	5745	4.65
		CH151	5755.0261	5755	4.54
		CH155	5775.0261	5775	4.52
		CH157	5785.0262	5785	4.53
		CH159	5795.0266	5795	4.59
		CH165	5825.0266	5825	4.57

AC 132V	25℃	CH36	5180.0260	5180	5.02
		CH38	5190.0241	5190	4.64
		CH40	5200.0268	5200	5.15
		CH42	5210.0243	5210	4.66
		CH46	5230.0249	5230	4.76
		CH48	5240.0249	5240	4.75
		CH149	5745.0262	5745	4.56
		CH151	5755.0255	5755	4.43
		CH155	5775.0257	5775	4.45
		CH157	5785.0259	5785	4.48
		CH159	5795.0260	5795	4.49
		CH165	5825.0264	5825	4.53

11. ANTENNA REQUIREMENT

11.1. 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 15.407 (a), 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.

11.2. Antenna Connected Construction

The antennas used for this product are FPC antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is **U-NII-1 Band: 2.3dBi; U-NII-3 Band: 1.9dBi.**

12. DEVIATION TO TEST SPECIFICATIONS

[NONE]

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