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检测
TESTING
CNAS L2264



RF TEST REPORT

Applicant Huawei Technologies Co., Ltd.
FCC ID QISEAN9810A
Product eLTE-U AirEdge
Model eAN9810A
Report No. RHA1712-0109RF01R2
Issue Date January 8, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2015)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Xianqing Li

Approved by: Kai Xu

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Summary of measurement results

Number	Summary of measurements of results	Clause in FCC rules	Verdict
1	Maximum peak conducted output power	15.407(a)	PASS
2	Occupied bandwidth	15.407(a)	PASS
3	Frequency stability	15.407(g)	PASS
4	Maximum power spectral density	15.407(a)	PASS
5	Unwanted Emissions	15.407(b)	PASS
6	Conducted spurious emissions at antenna port	15.407(b)	PASS
7	Conducted Emissions	15.207	PASS
Date of Testing: February 15, 2017~ March 2, 2017 and June 30, 2017			

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
Post code: 201201
Country: P. R. China
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Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China

General information

General Information

EUT Description			
Model:	eAN9810A		
SN:	2102311RKU10GA800040		
Hardware Version:	eAN3810A V100		
Software Version:	eAN3810A V100		
Power Supply:	AC Power Supply		
Antenna Type:	Omni-directional		
Antenna Gain:	ANT1= ANT2= ANT3= ANT4=5dBi		
Directional Gain:	8dBi		
Test Mode:	5725 MHz - 5850 MHz		
Modulation Type:	OFDM		
Max. Conducted Power	27.44 dBm		
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	5G	5725 - 5850	5725 - 5850
EUT Accessory			
Adapter	Manufacture: PSP Model : POE85-56A		
Note: The information of the EUT is declared by the manufacturer.			

eAN9810A (RHA1712-0109RF) is a variant model of eAN3810A (RHA1702-0018RF01R8). Test values duplicated from Original for variant. There is no test for variant in this report.

The FPGA chip on board of eAN3810A has changed. The FPGA chips are from different manufactures. The change does not influence RF performance.

And eAN3810A eLTE-U AirNode changes Model and Product name to be eAN9810A, eLTE-U AirEdge. Actually they are the same hardware.

Model	eAN3810A	eAN9810A
Product name	eLTE-U AirNode	eLTE-U AirEdge
FCC ID	QISEAN3810A	QISEAN9810A



3. Test Information

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC CFR47 Part 15E (2017) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

KDB 789033 D02 General UNII Test Procedures New Rules v01r04

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration and all antennas for confirming worst case. Data rate below means worst-case rate of each test item.

Test Mode	Modulation Type
TM1	QPSK
TM2	16QAM
TM3	64QAM
The device can not work alone in the BPSK modulation mode, when we test QPSK, 16QAM, 64QAM, a small number of OFDM symbols using BPSK modulation and not fixed	

The worst case Antenna mode for each of the following tests:

Test Cases	Antenna 1	Antenna 2	Antenna 3	Antenna 4	MIMO
Maximum peak conducted output power	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3
Occupied bandwidth	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	--
Frequency stability	TM3	TM3	TM3	TM3	--
Maximum power spectral density	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3	TM1/ TM2/ TM3
Unwanted Emissions	--	--	--	--	TM3
Conducted spurious emission at antenna port	TM3	TM3	TM3	TM3	--
Conducted Emissions	TM3	--	--	--	--

5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

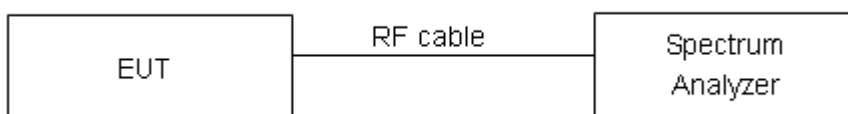
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 100 kHz, VBW $\geq 3 \times$ RBW, 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.

Set RBW = 1 % to 5 % of the OBW, VBW $\geq 3 \times$ RBW, Use the 99 % power bandwidth function of the instrument (if available).

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.

Test Setup



Limits

Rule FCC Part §15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:
TM1

Antenna	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum -6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
Antenna 1	5735	17.875	17.96	500	PASS
	5790	17.823	17.97	500	PASS
	5840	17.922	17.98	500	PASS
Antenna 2	5735	17.872	17.97	500	PASS
	5790	17.879	17.98	500	PASS
	5840	17.849	17.99	500	PASS
Antenna 3	5735	17.840	18.01	500	PASS
	5790	17.878	17.67	500	PASS
	5840	17.867	17.97	500	PASS
Antenna 4	5735	17.892	17.95	500	PASS
	5790	17.934	17.90	500	PASS
	5840	17.896	18.00	500	PASS

TM2

Antenna	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum -6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
Antenna 1	5735	17.834	18.00	500	PASS
	5790	17.858	17.97	500	PASS
	5840	17.833	17.96	500	PASS
Antenna 2	5735	17.842	18.04	500	PASS
	5790	17.866	18.02	500	PASS
	5840	17.796	17.99	500	PASS
Antenna 3	5735	17.854	17.26	500	PASS
	5790	17.893	17.73	500	PASS
	5840	17.865	17.96	500	PASS
Antenna 4	5735	17.898	18.02	500	PASS
	5790	17.895	17.98	500	PASS
	5840	17.853	18.02	500	PASS

TM3

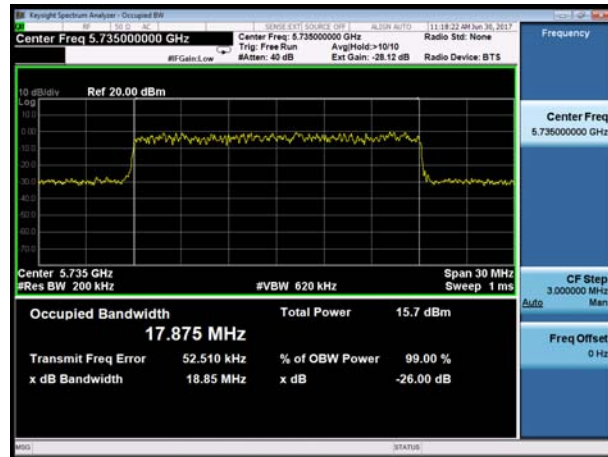
Antenna	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum -6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
Antenna 1	5735	17.895	18.01	500	PASS
	5790	17.885	18.00	500	PASS
	5840	17.865	18.03	500	PASS
Antenna 2	5735	17.930	18.00	500	PASS
	5790	17.921	18.00	500	PASS
	5840	17.911	18.04	500	PASS
Antenna 3	5735	17.863	18.03	500	PASS
	5790	17.839	18.03	500	PASS
	5840	17.846	17.99	500	PASS
Antenna 4	5735	17.891	18.03	500	PASS
	5790	17.896	17.99	500	PASS
	5840	17.885	18.00	500	PASS



TM1

Antenna 1

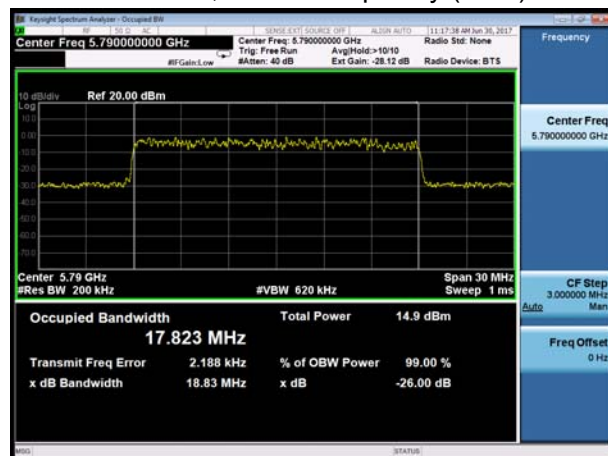
99% bandwidth, Carrier frequency (MHz): 5735



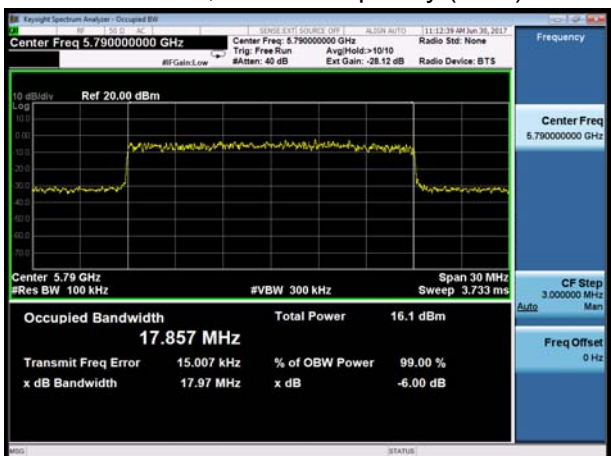
-6dB bandwidth, Carrier frequency (MHz): 5735



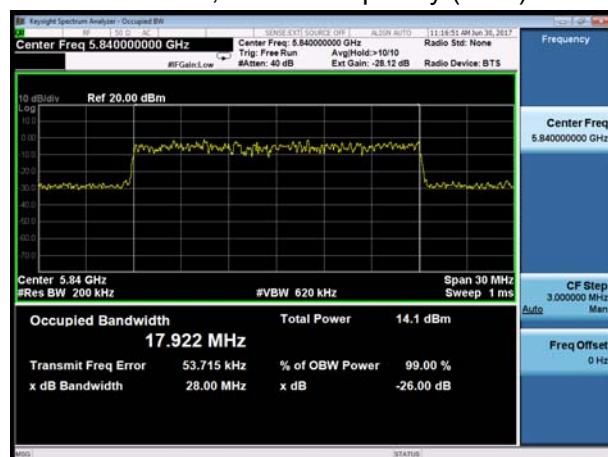
99% bandwidth, Carrier frequency (MHz): 5790



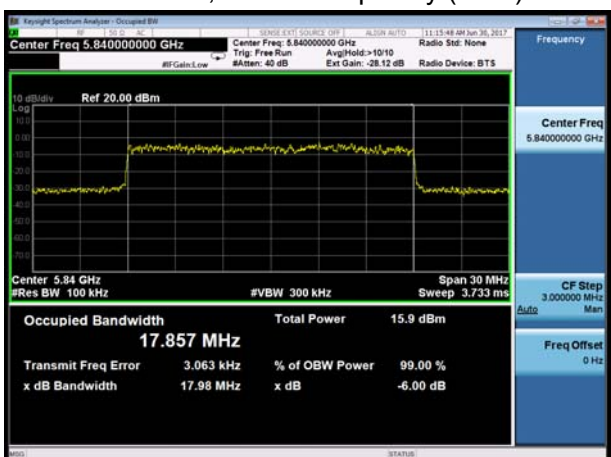
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





Antenna 2

99% bandwidth, Carrier frequency (MHz): 5735



-6dB bandwidth, Carrier frequency (MHz): 5735



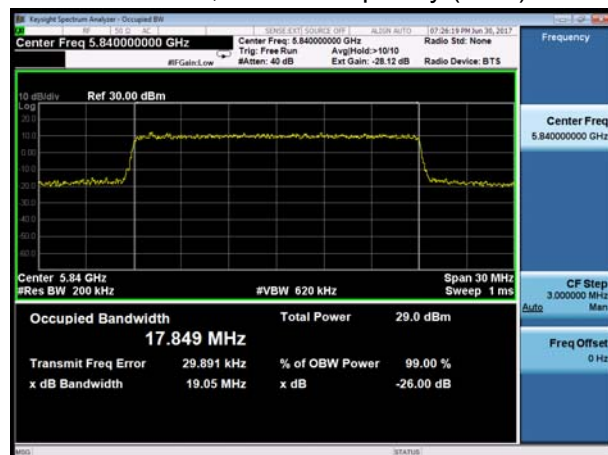
99% bandwidth, Carrier frequency (MHz): 5790



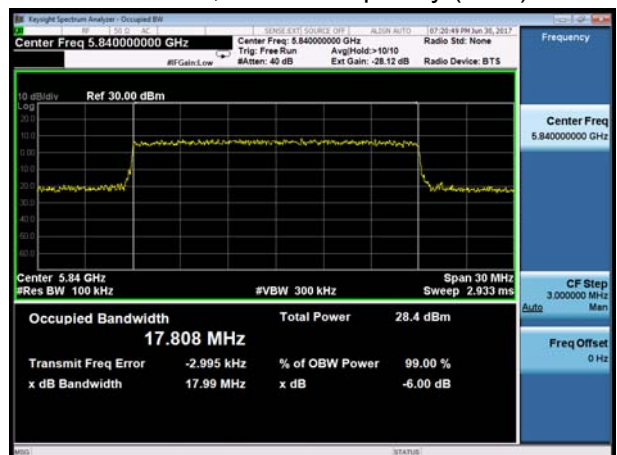
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840



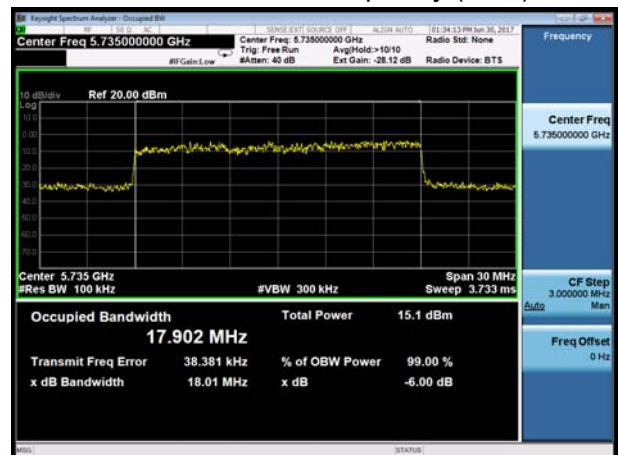


Antenna 3

99% bandwidth, Carrier frequency (MHz): 5735



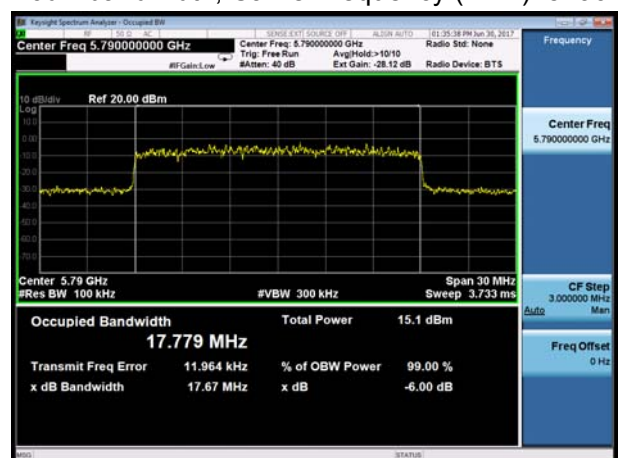
-6dB bandwidth, Carrier frequency (MHz): 5735



99% bandwidth, Carrier frequency (MHz): 5790



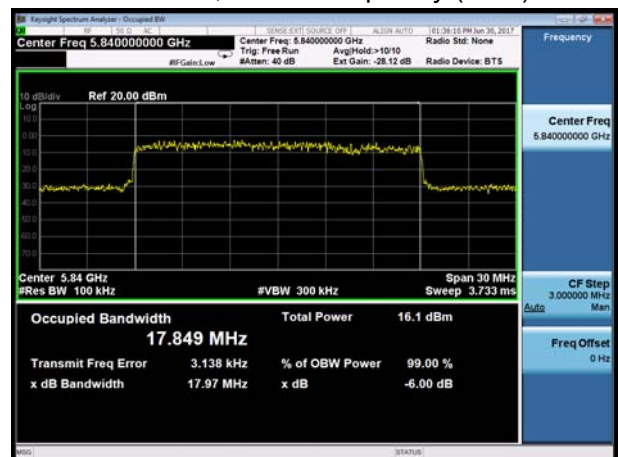
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840



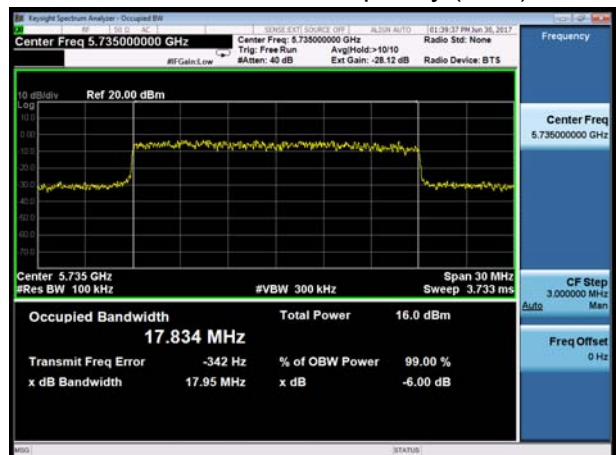


Antenna 4

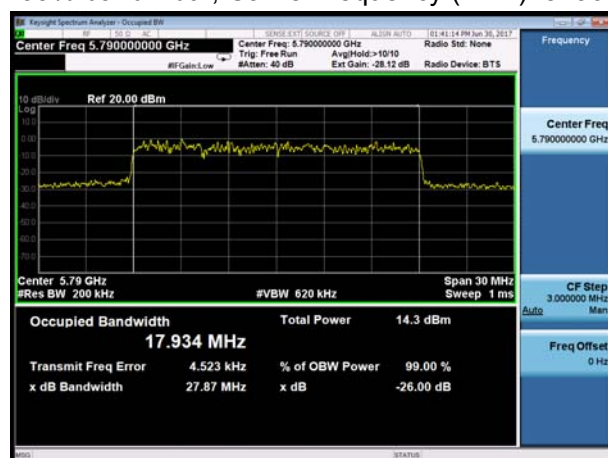
99% bandwidth, Carrier frequency (MHz): 5735



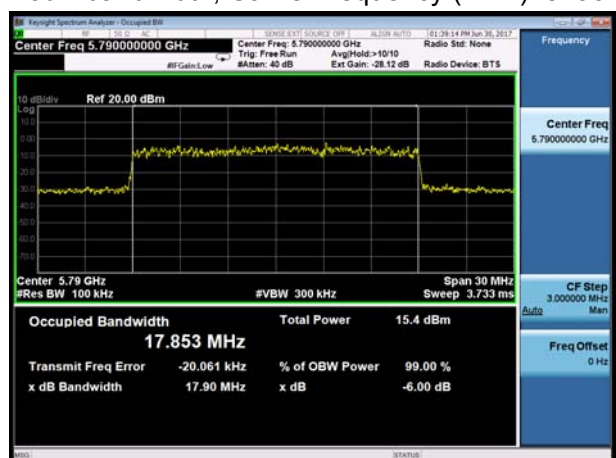
-6dB bandwidth, Carrier frequency (MHz): 5735



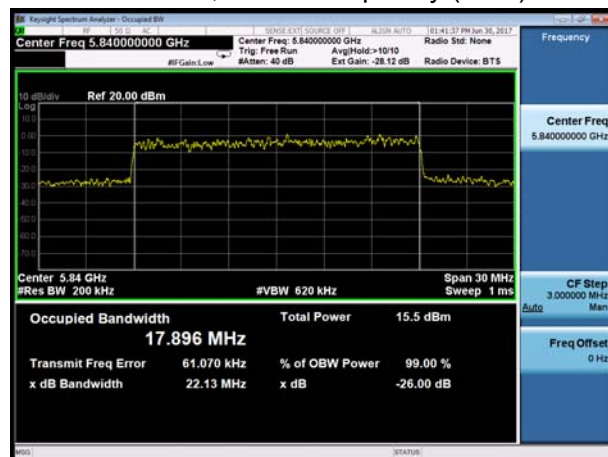
99% bandwidth, Carrier frequency (MHz): 5790



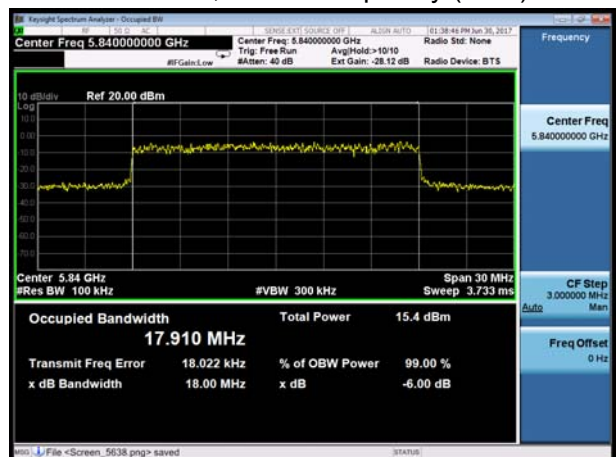
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





TM2

Antenna 1

99% bandwidth, Carrier frequency (MHz): 5735



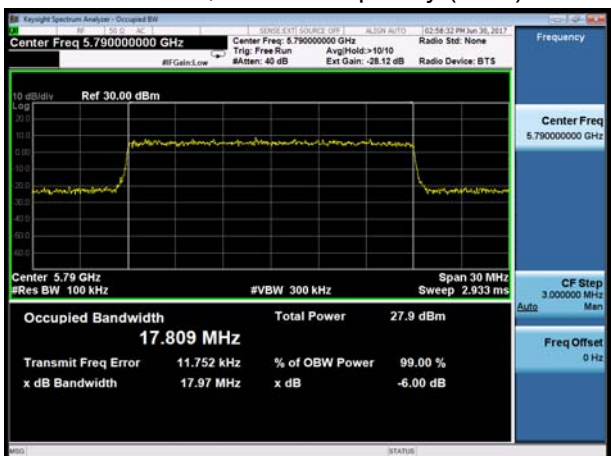
-6dB bandwidth, Carrier frequency (MHz): 5735



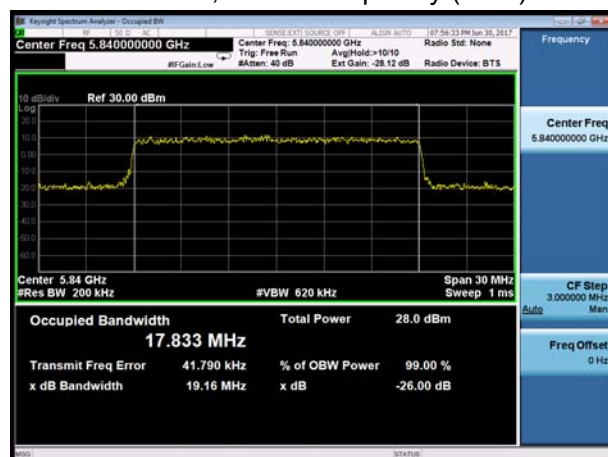
99% bandwidth, Carrier frequency (MHz): 5790



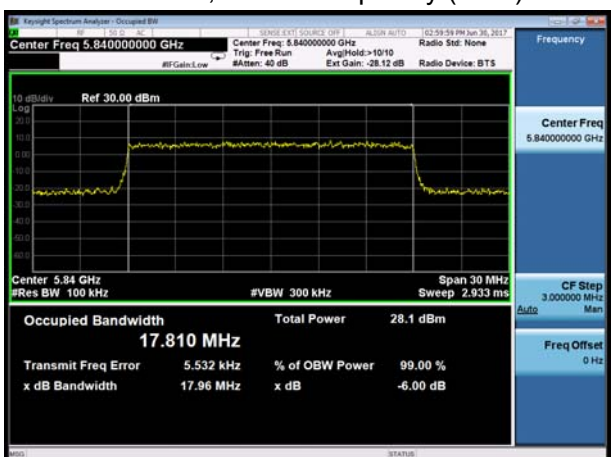
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





Antenna 2

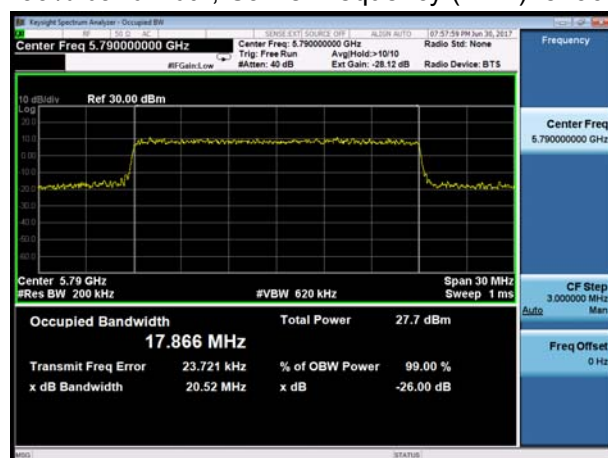
99% bandwidth, Carrier frequency (MHz): 5735



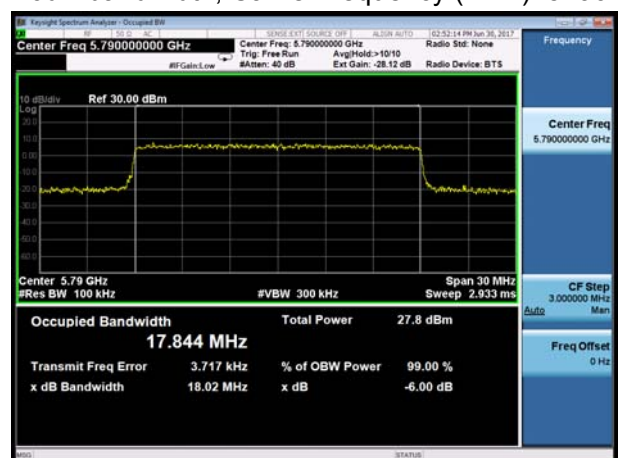
-6dB bandwidth, Carrier frequency (MHz): 5735



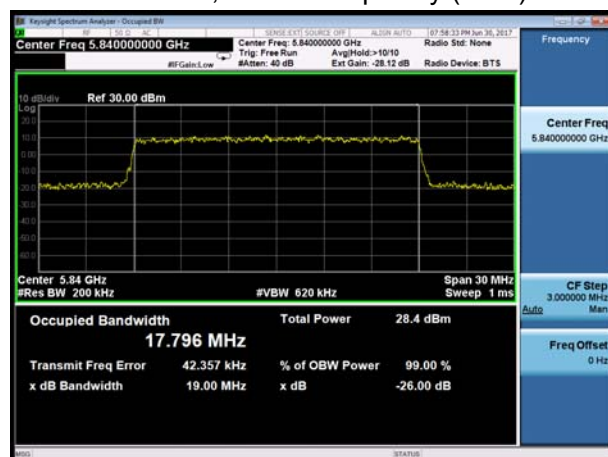
99% bandwidth, Carrier frequency (MHz): 5790



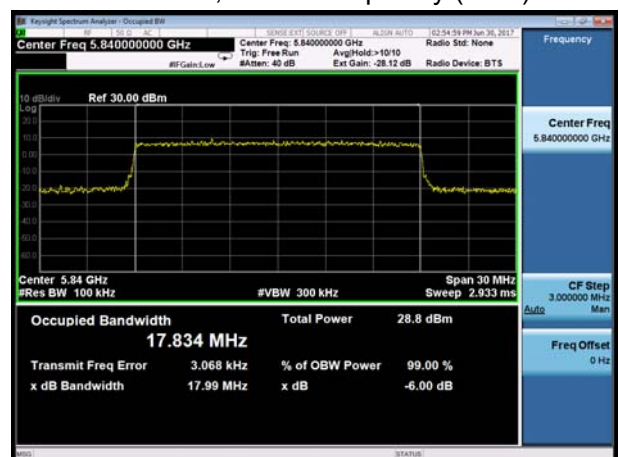
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840



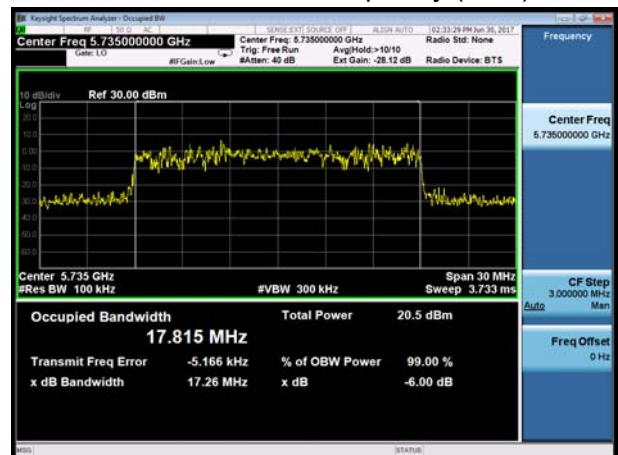


Antenna 3

99% bandwidth, Carrier frequency (MHz): 5735



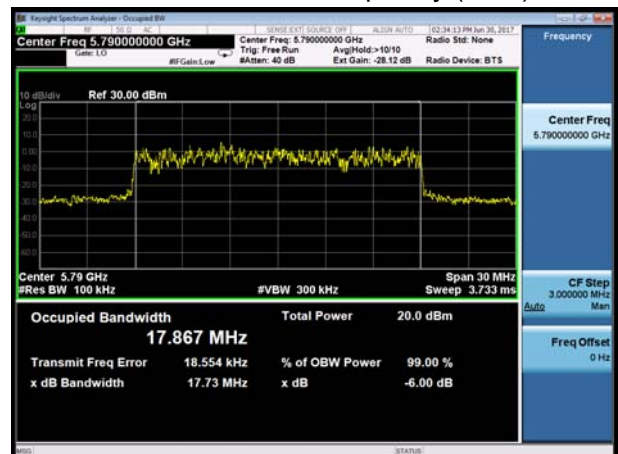
-6dB bandwidth, Carrier frequency (MHz): 5735



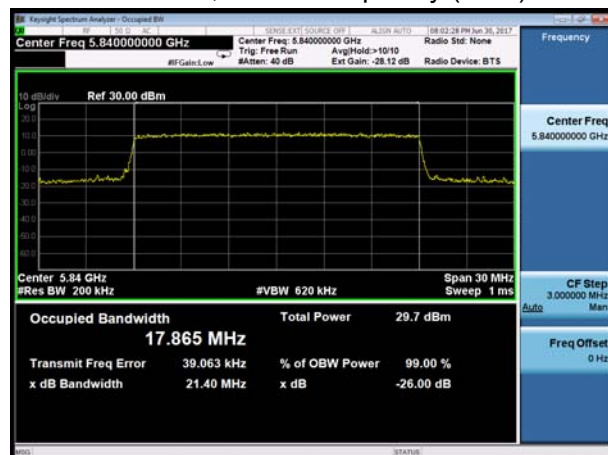
99% bandwidth, Carrier frequency (MHz): 5790



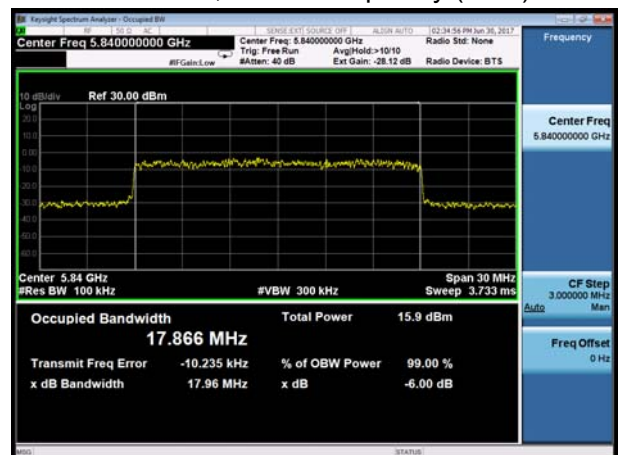
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





Antenna 4

99% bandwidth, Carrier frequency (MHz): 5735



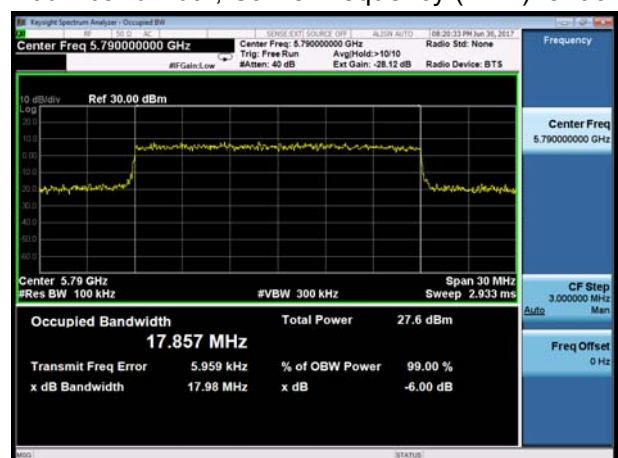
-6dB bandwidth, Carrier frequency (MHz): 5735



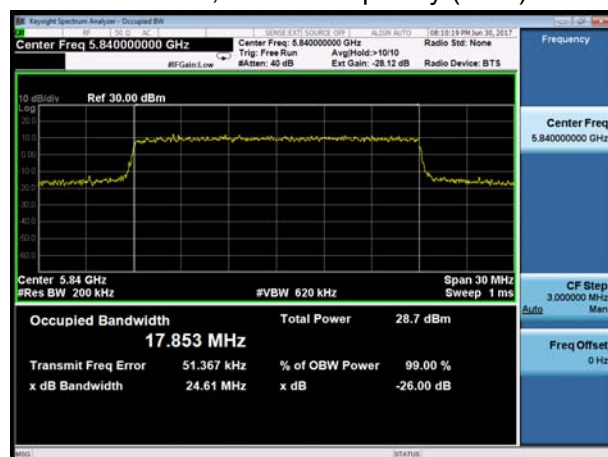
99% bandwidth, Carrier frequency (MHz): 5790



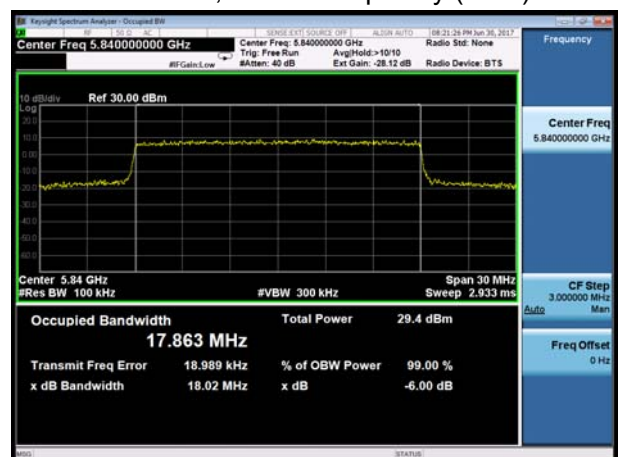
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





TM3

Antenna 1

99% bandwidth, Carrier frequency (MHz): 5735



-6dB bandwidth, Carrier frequency (MHz): 5735



99% bandwidth, Carrier frequency (MHz): 5790



-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840



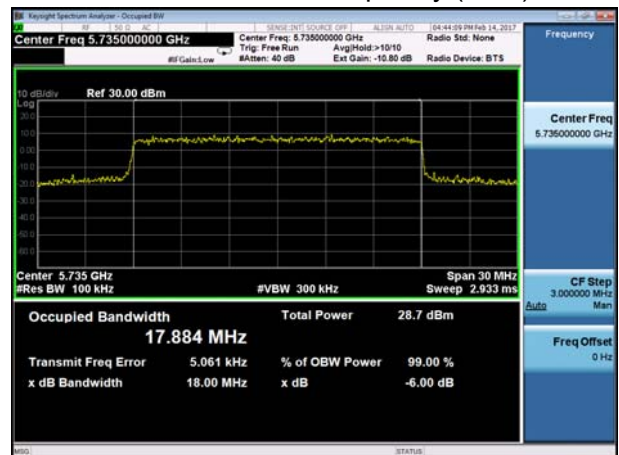


Antenna 2

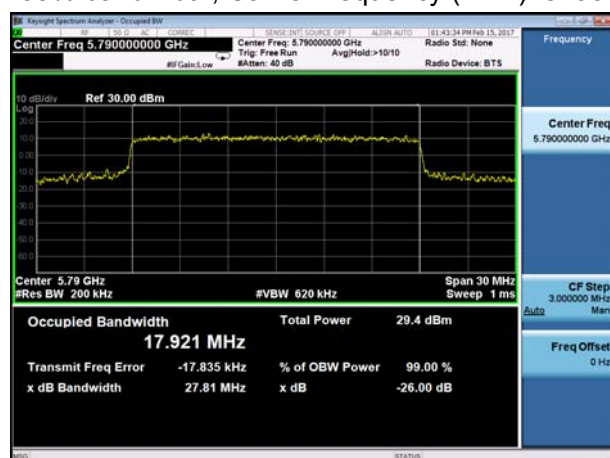
99% bandwidth, Carrier frequency (MHz): 5735



-6dB bandwidth, Carrier frequency (MHz): 5735



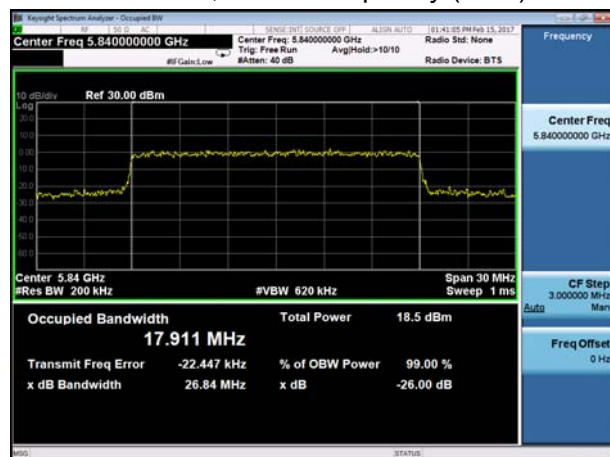
99% bandwidth, Carrier frequency (MHz): 5790



-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





Antenna 3

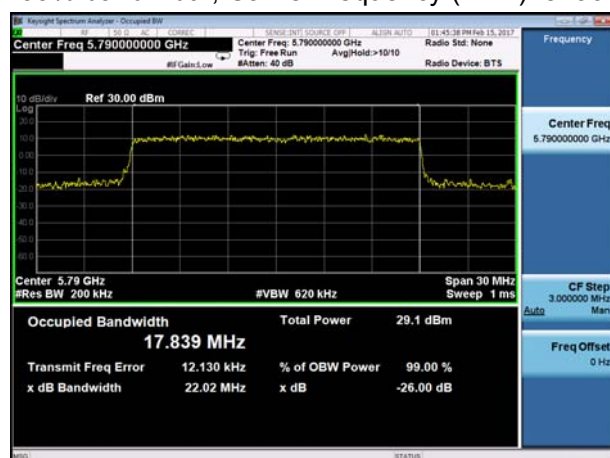
99% bandwidth, Carrier frequency (MHz): 5735



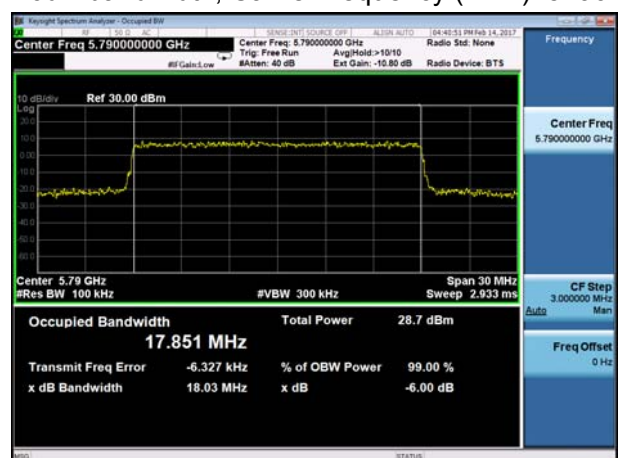
-6dB bandwidth, Carrier frequency (MHz): 5735



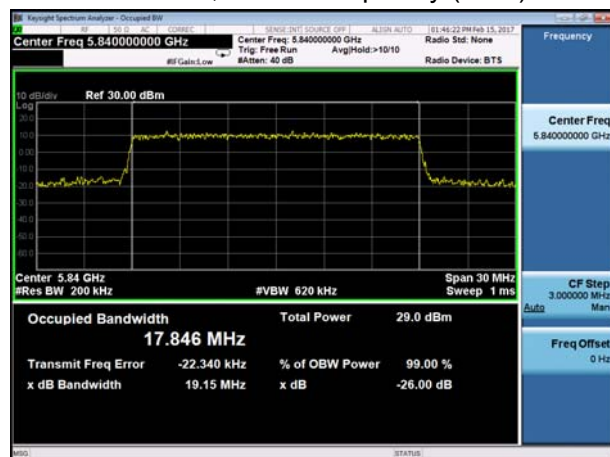
99% bandwidth, Carrier frequency (MHz): 5790



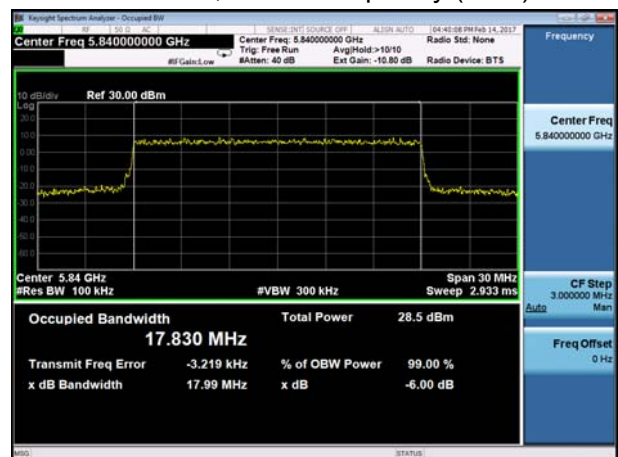
-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840





Antenna 4

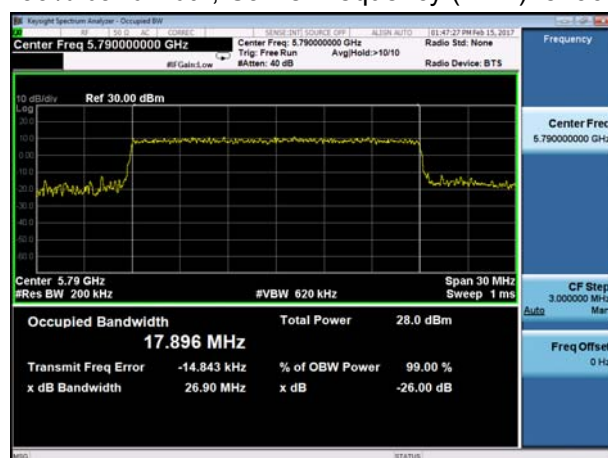
99% bandwidth, Carrier frequency (MHz): 5735



-6dB bandwidth, Carrier frequency (MHz): 5735



99% bandwidth, Carrier frequency (MHz): 5790



-6dB bandwidth, Carrier frequency (MHz): 5790



99% bandwidth, Carrier frequency (MHz): 5840



-6dB bandwidth, Carrier frequency (MHz): 5840



5.2. Power Output –Conducted

Ambient condition

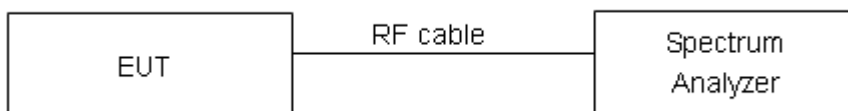
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the average power meter through an external attenuator and a known loss cable. The EUT is max power transmission with proper modulation. We use Maximum average Conducted Output Power Level Method in KDB789033 for this test.

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test Setup



Limits

Rule FCC Part 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

Test Results

TM1

Antenna	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	Conclusion
Antenna 1	5735	20.56	30.00	PASS
	5790	20.53	30.00	PASS
	5840	20.44	30.00	PASS
Antenna 2	5735	20.38	30.00	PASS
	5790	19.72	30.00	PASS
	5840	20.75	30.00	PASS
Antenna 3	5735	20.03	30.00	PASS
	5790	20.17	30.00	PASS
	5840	20.70	30.00	PASS
Antenna 4	5735	20.77	30.00	PASS
	5790	20.15	30.00	PASS
	5840	20.66	30.00	PASS

Frequency (MHz)	Average Output Power (dBm)										Limit (dBm)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	20.56	113.76	20.38	109.14	20.03	100.69	20.77	119.40	443.00	26.46	28.00	PASS
5790	20.53	112.98	19.72	93.76	20.17	103.99	20.15	103.51	414.24	26.17	28.00	PASS
5840	20.44	110.66	20.75	118.85	20.70	117.49	20.66	116.41	463.42	26.66	28.00	PASS

Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 1), the average output power= $10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}+10^{(\text{Power antenna4 in dBm}/10)})$

2. For MIMO mode, the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi= $5+10\log(2)=8\text{dBi}>6\text{dBi}$.So the power limit shall be reduced to $30-(8-6)=28\text{dBm}$.

TM2

Antenna	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	Conclusion
Antenna 1	5735	20.62	30.00	PASS
	5790	20.34	30.00	PASS
	5840	20.54	30.00	PASS
Antenna 2	5735	20.35	30.00	PASS
	5790	19.93	30.00	PASS
	5840	20.91	30.00	PASS
Antenna 3	5735	20.67	30.00	PASS
	5790	20.19	30.00	PASS
	5840	20.81	30.00	PASS
Antenna 4	5735	21.02	30.00	PASS
	5790	20.54	30.00	PASS
	5840	20.84	30.00	PASS

Frequency (MHz)	Average Output Power (dBm)										Limit (dBm)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	20.62	115.35	20.35	108.39	20.67	116.68	21.02	126.47	466.89	26.69	28.00	PASS
5790	20.34	108.14	19.93	98.40	20.19	104.47	20.54	113.24	424.25	26.28	28.00	PASS
5840	20.54	113.24	20.91	123.31	20.81	120.50	20.84	121.34	478.39	26.80	28.00	PASS
Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 1), the average output power=$10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}+10^{(\text{Power antenna4 in dBm}/10)})$ 2. For MIMO mode, the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi=$5+10\log(2)=8\text{dBi}>6\text{dBi}$.So the power limit shall be reduced to $30-(8-6)=28\text{dBm}$.												

TM3

Antenna	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	Conclusion
Antenna 1	5735	20.73	30.00	PASS
	5790	21.19	30.00	PASS
	5840	20.41	30.00	PASS
Antenna 2	5735	21.39	30.00	PASS
	5790	21.05	30.00	PASS
	5840	19.83	30.00	PASS
Antenna 3	5735	21.92	30.00	PASS
	5790	21.47	30.00	PASS
	5840	20.24	30.00	PASS
Antenna 4	5735	21.54	30.00	PASS
	5790	19.88	30.00	PASS
	5840	20.57	30.00	PASS

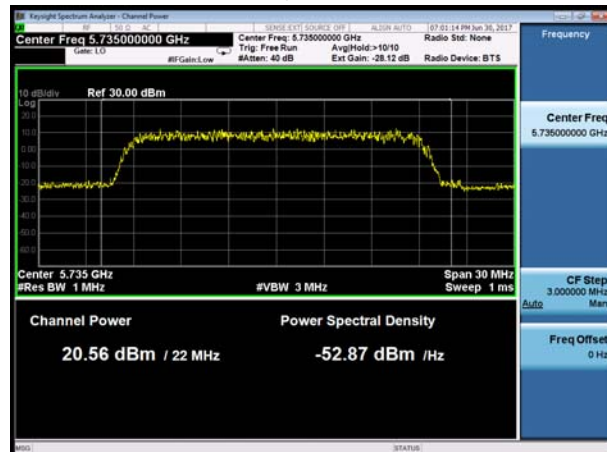
Frequency (MHz)	Average Output Power (dBm)										Limit (dBm)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	20.73	118.30	21.39	137.72	21.92	155.60	21.54	142.56	554.18	27.44	28.00	PASS
5790	21.19	131.52	21.05	127.35	21.47	140.28	19.88	97.27	496.42	26.96	28.00	PASS
5840	20.41	109.90	19.83	96.16	20.24	105.68	20.57	114.02	425.76	26.29	28.00	PASS
Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 1), the average output power=$10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}+10^{(\text{Power antenna4 in dBm}/10)})$ 2. For MIMO mode, the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi=$5+10\log(2)=8\text{dBi}>6\text{dBi}$.So the power limit shall be reduced to $30-(8-6)=28\text{dBm}$.												



TM1

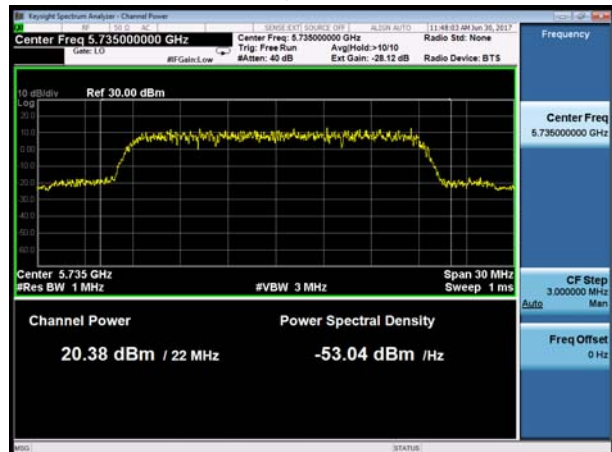
Antenna 1

Frequency (MHz): 5735

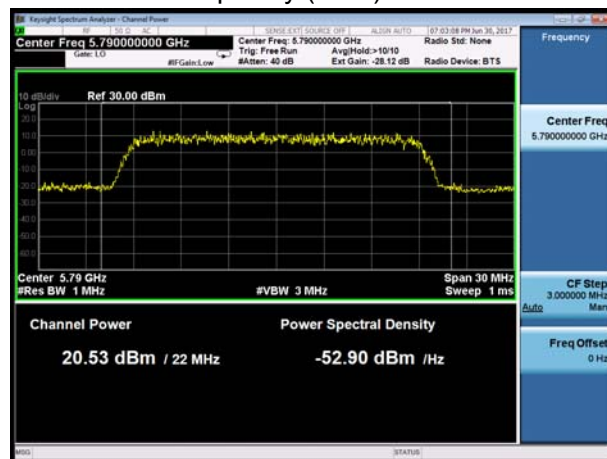


Antenna 2

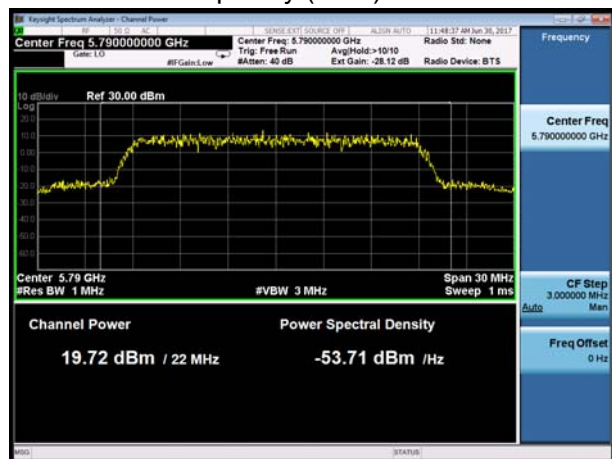
Frequency (MHz): 5735



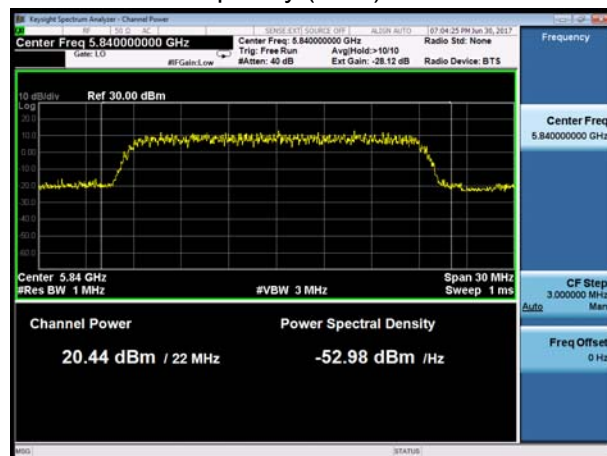
Frequency (MHz): 5790



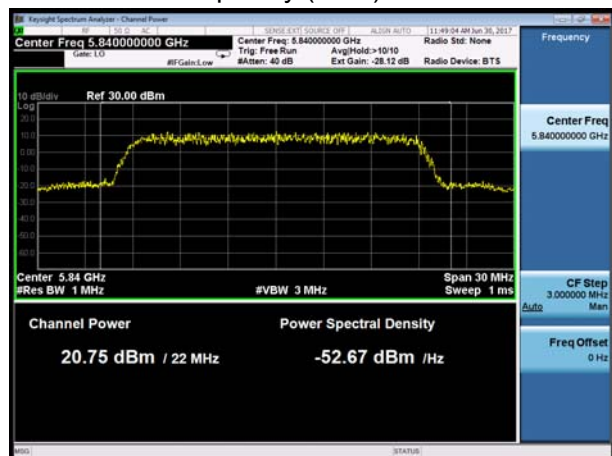
Frequency (MHz): 5790



Frequency (MHz): 5840



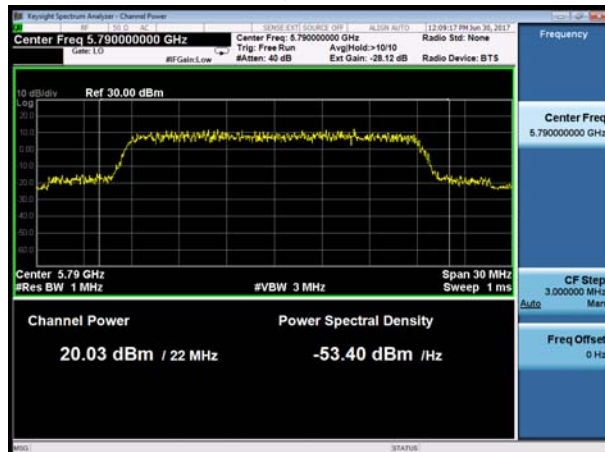
Frequency (MHz): 5840





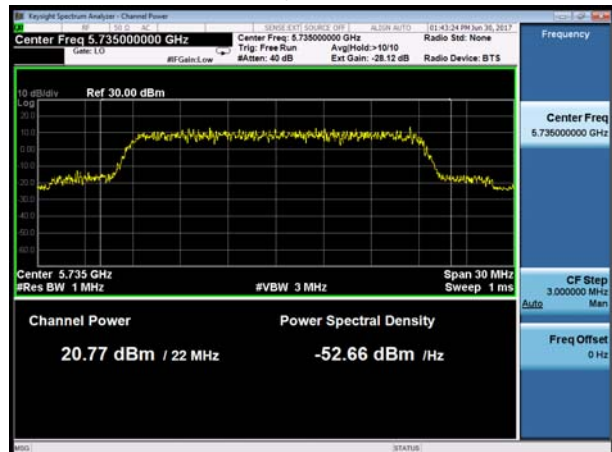
Antenna 3

Frequency (MHz): 5735

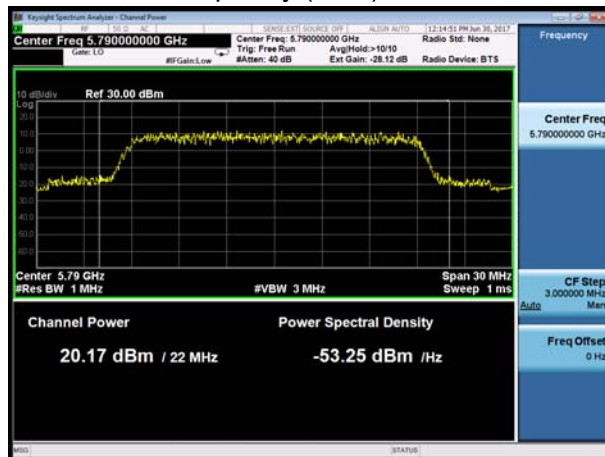


Antenna 4

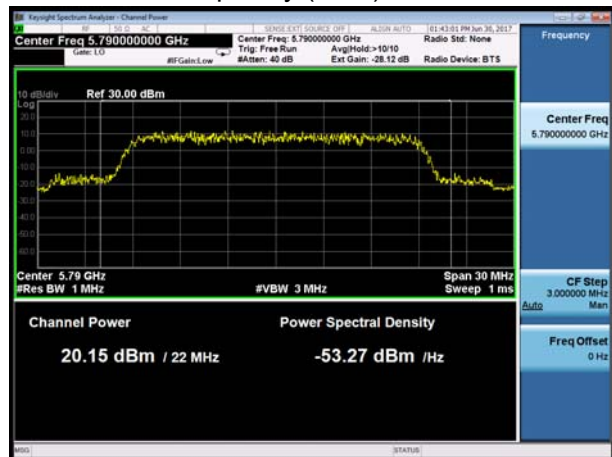
Frequency (MHz): 5735



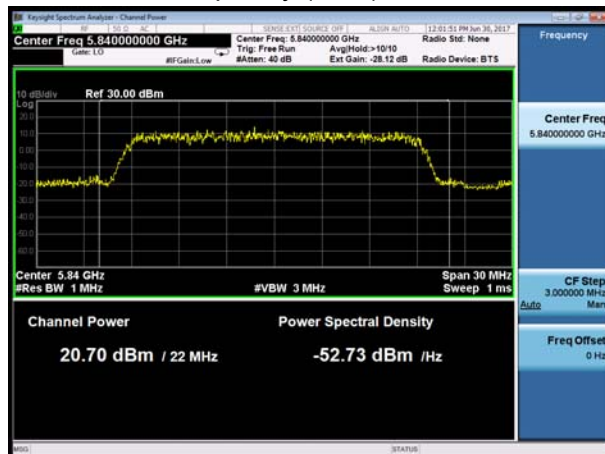
Frequency (MHz): 5790



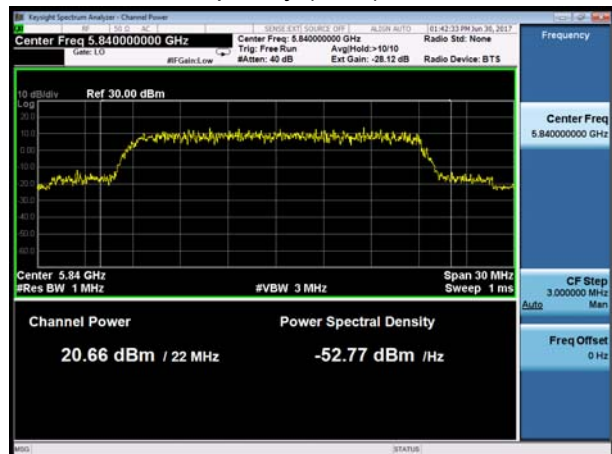
Frequency (MHz): 5790



Frequency (MHz): 5840



Frequency (MHz): 5840

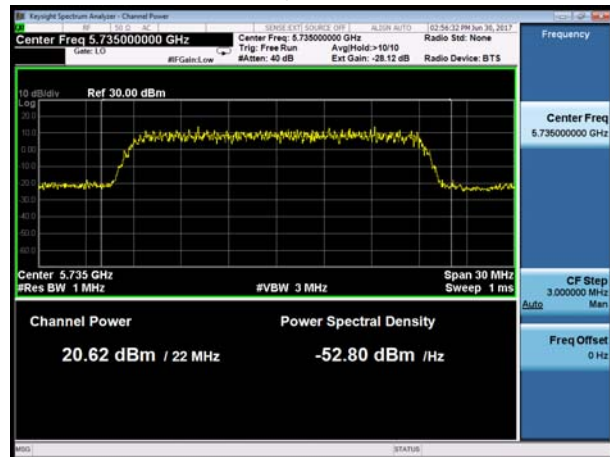




TM2

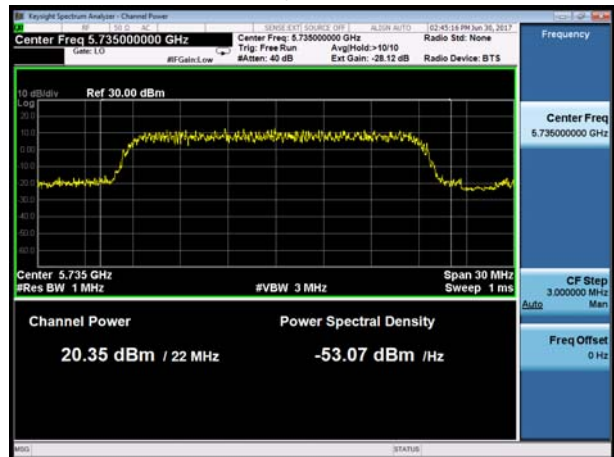
Antenna 1

Frequency (MHz): 5735

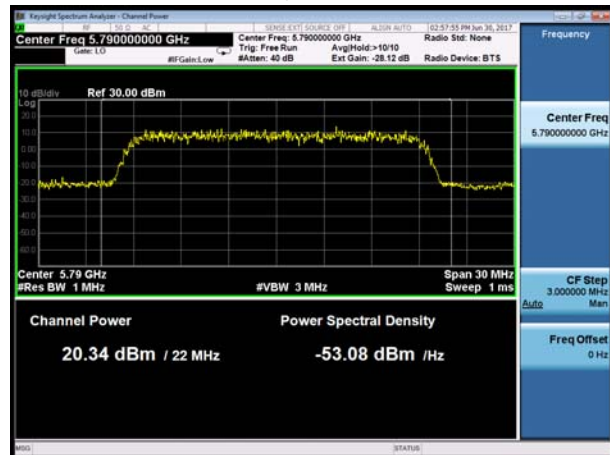


Antenna 2

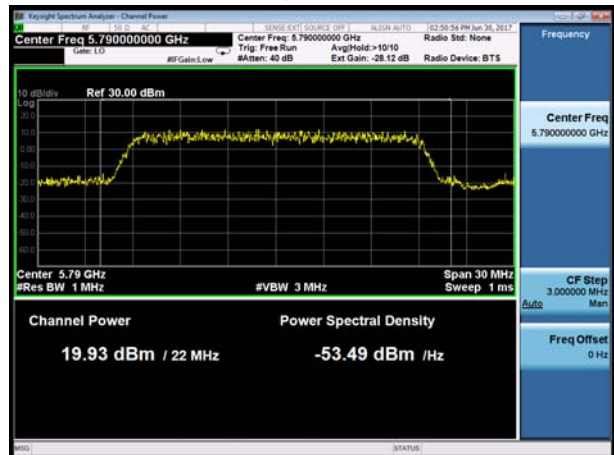
Frequency (MHz): 5735



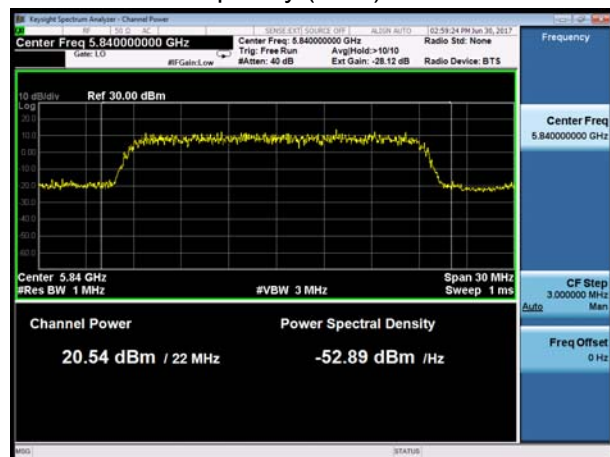
Frequency (MHz): 5790



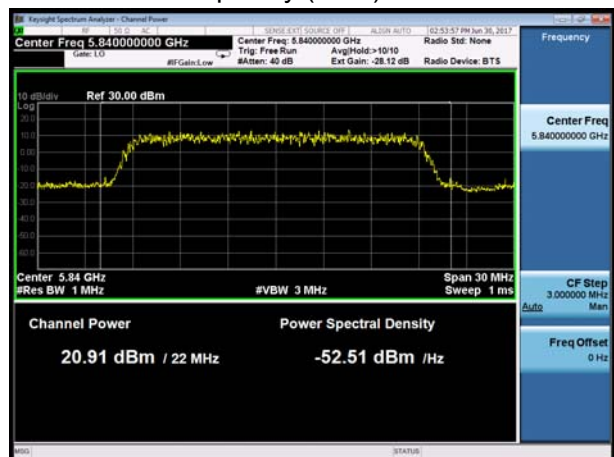
Frequency (MHz): 5790



Frequency (MHz): 5840



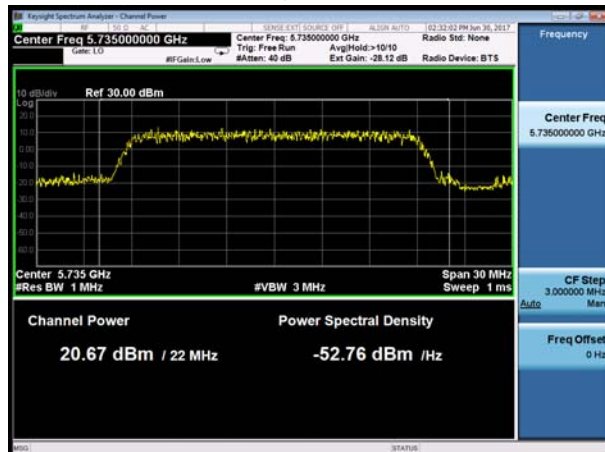
Frequency (MHz): 5840





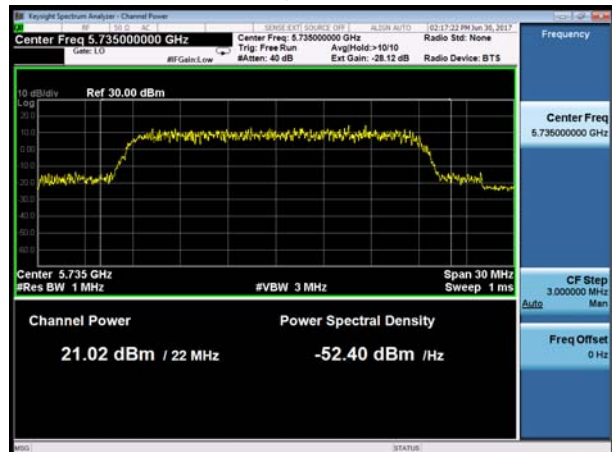
Antenna 3

Frequency (MHz): 5735

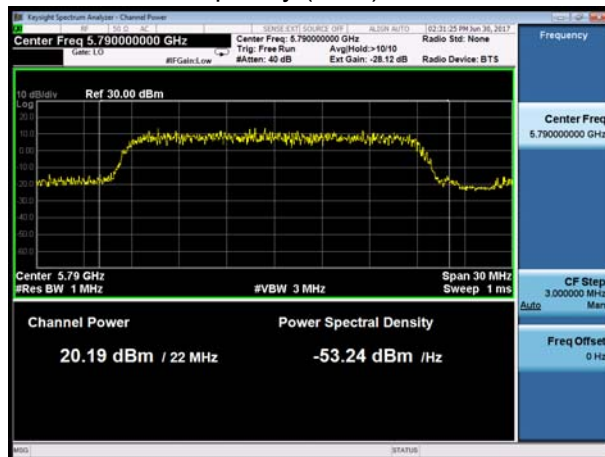


Antenna 4

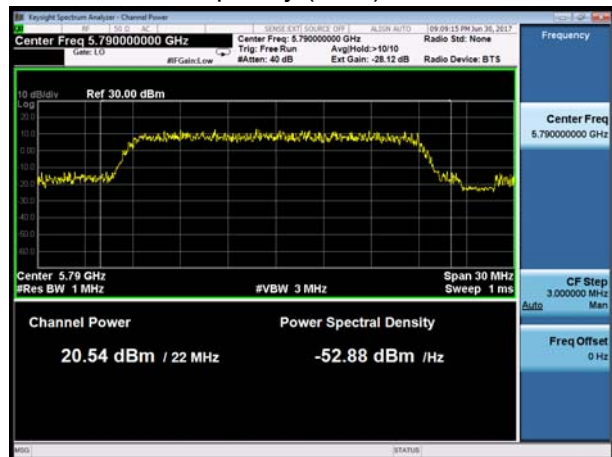
Frequency (MHz): 5735



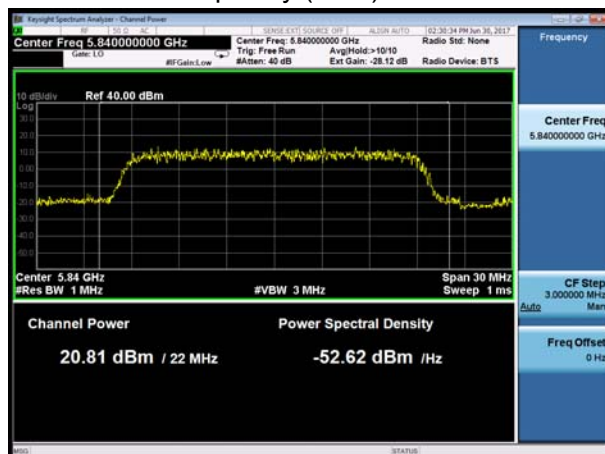
Frequency (MHz): 5790



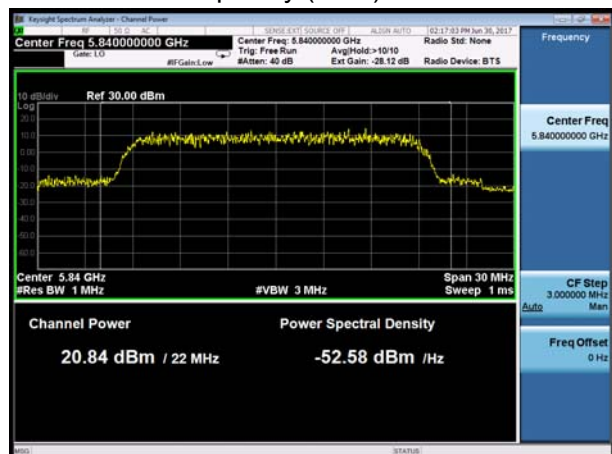
Frequency (MHz): 5790



Frequency (MHz): 5840



Frequency (MHz): 5840





TM3

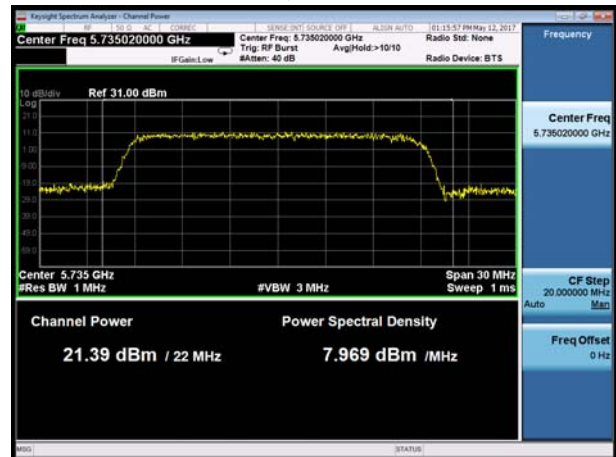
Antenna 1

Frequency (MHz): 5735



Antenna 2

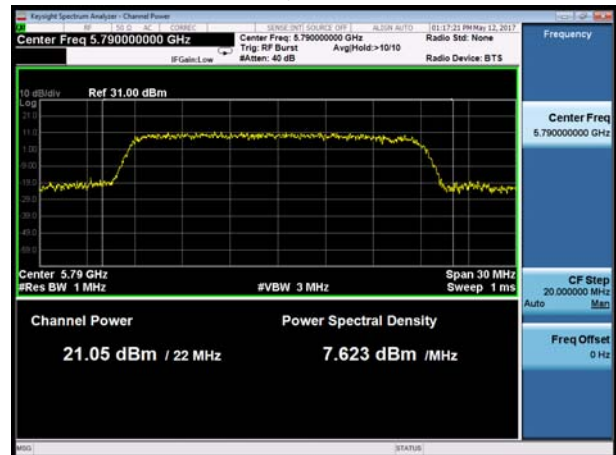
Frequency (MHz): 5735



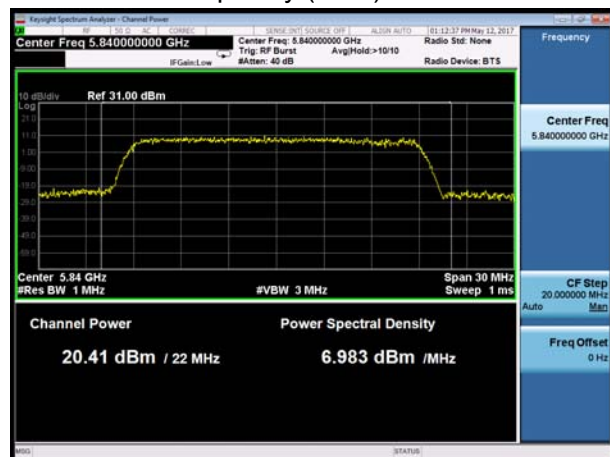
Frequency (MHz): 5790



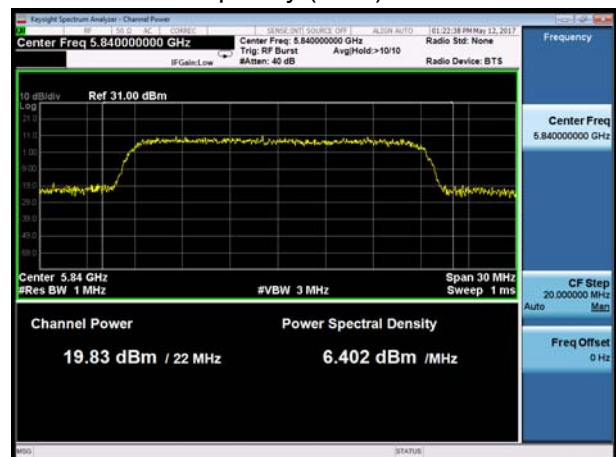
Frequency (MHz): 5790



Frequency (MHz): 5840



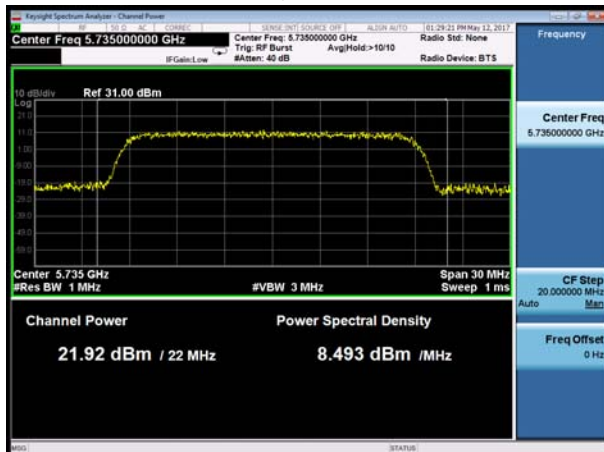
Frequency (MHz): 5840





Antenna 3

Frequency (MHz): 5735



Antenna 4

Frequency (MHz): 5735



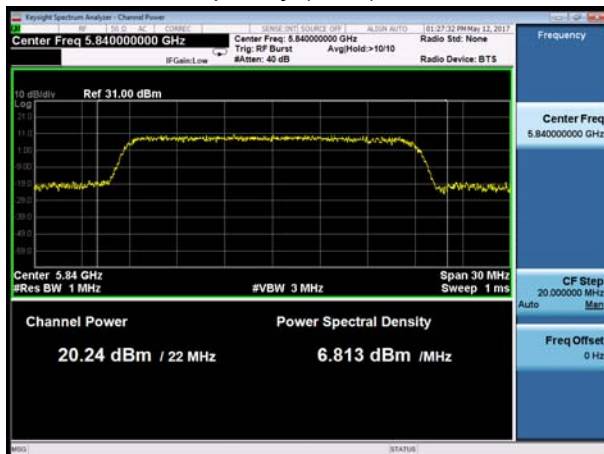
Frequency (MHz): 5790



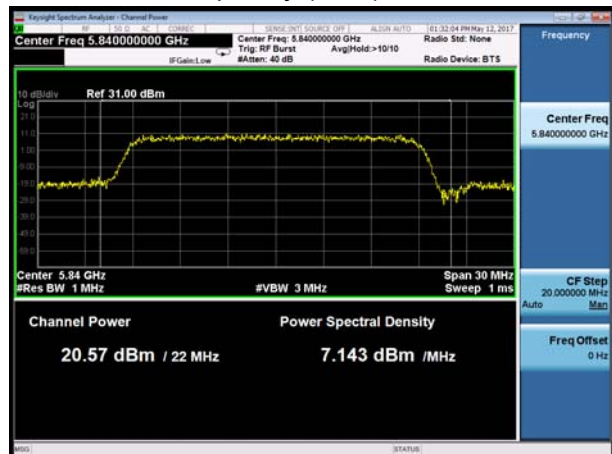
Frequency (MHz): 5790



Frequency (MHz): 5840



Frequency (MHz): 5840



5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. Frequency stability with respect to ambient temperature

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more than 10 C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15 C to +25 C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.

- b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
- c) Measure the frequency at each of the frequencies specified in 5.6.
- d) Repeat the above procedure at 85% and 115% of the nominal supply voltage.

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 users manual.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936\text{Hz}$

Test Results

TM3

Antenna 1

Voltage (V)	Temperature (°C)	Test Results			
		5735MHz			
		1min	2min	5min	10min
120	-30	5735.004	5734.998	5734.993	5734.992
120	-20	5735.008	5734.999	5734.994	5734.991
120	-10	5735.004	5734.995	5734.992	5734.988
120	0	5735.001	5734.989	5734.992	5734.979
120	10	5734.999	5734.984	5734.988	5734.976
120	20	5734.989	5734.981	5734.978	5734.970
120	30	5734.989	5734.981	5734.974	5734.961
120	40	5734.984	5734.974	5734.974	5734.959
120	50	5734.978	5734.965	5734.967	5734.956
102	20	5734.976	5734.956	5734.963	5734.952
138	20	5734.976	5734.952	5734.954	5734.948
MHz		-0.024	-0.048	-0.046	-0.052
PPM		-4.22861	-8.35061	-8.06881	-9.00112

Voltage (V)	Temperature (°C)	Test Results			
		5790MHz			
		1min	2min	5min	10min
120	-30	5790.006	5790.003	5790.003	5790.007
120	-20	5790.009	5790.003	5790.001	5790.008
120	-10	5790.004	5790.002	5789.993	5790.006
120	0	5790.001	5790.001	5789.986	5790.002
120	10	5789.992	5790.001	5789.981	5789.999
120	20	5789.982	5789.996	5789.976	5789.990
120	30	5789.973	5789.987	5789.967	5789.985
120	40	5789.973	5789.981	5789.962	5789.976
120	50	5789.966	5789.974	5789.957	5789.968
102	20	5789.965	5789.972	5789.951	5789.961
138	20	5789.963	5789.964	5789.945	5789.953
MHz		-0.037	-0.036	-0.055	-0.047
PPM		-6.30574	-6.13159	-9.42979	-8.05273

Voltage (V)	Temperature (°C)	Test Results			
		5840MHz			
		1min	2min	5min	10min
120	-30	5840.008	5840.006	5840.007	5840.005
120	-20	5840.007	5840.005	5840.006	5840.004
120	-10	5840.000	5840.002	5839.998	5839.996
120	0	5840.000	5839.992	5839.994	5839.989
120	10	5839.998	5839.983	5839.994	5839.985
120	20	5839.995	5839.979	5839.989	5839.981
120	30	5839.988	5839.976	5839.985	5839.977
120	40	5839.979	5839.970	5839.977	5839.969
120	50	5839.976	5839.961	5839.971	5839.962
102	20	5839.972	5839.952	5839.965	5839.958
138	20	5839.968	5839.949	5839.963	5839.948
MHz		-0.032	-0.051	-0.037	-0.052
PPM		-5.47128	-8.65524	-6.31380	-8.83301

Antenna 2

Voltage (V)	Temperature (°C)	Test Results			
		5735MHz			
		1min	2min	5min	10min
120	-30	5735.008	5735.004	5735.006	5734.997
120	-20	5735.007	5735.005	5735.004	5734.998
120	-10	5735.002	5735.005	5735.001	5734.995
120	0	5734.993	5734.997	5735.001	5734.987
120	10	5734.993	5734.988	5734.991	5734.987
120	20	5734.985	5734.987	5734.985	5734.984
120	30	5734.975	5734.977	5734.985	5734.979
120	40	5734.967	5734.972	5734.984	5734.973
120	50	5734.962	5734.969	5734.975	5734.965
102	20	5734.960	5734.962	5734.968	5734.961
138	20	5734.950	5734.953	5734.966	5734.960
MHz		-0.050	-0.047	-0.034	-0.040
PPM		-8.65472	-8.26822	-6.00492	-6.94895

Voltage (V)	Temperature (°C)	Test Results			
		5790MHz			
		1min	2min	5min	10min
120	-30	5790.002	5790.007	5790.006	5790.005
120	-20	5790.003	5790.009	5790.009	5790.004
120	-10	5789.999	5790.000	5790.004	5789.999
120	0	5789.998	5789.993	5790.004	5789.998
120	10	5789.992	5789.983	5790.000	5789.992
120	20	5789.984	5789.979	5789.997	5789.989
120	30	5789.975	5789.977	5789.988	5789.980
120	40	5789.973	5789.975	5789.981	5789.979
120	50	5789.965	5789.965	5789.981	5789.974
102	20	5789.958	5789.962	5789.979	5789.972
138	20	5789.953	5789.960	5789.975	5789.970
MHz		-0.047	-0.040	-0.025	-0.030
PPM		-8.18728	-6.88439	-4.34262	-5.14345

Voltage (V)	Temperature (°C)	Test Results			
		5840MHz			
		1min	2min	5min	10min
120	-30	5840.008	5840.005	5840.008	5840.000
120	-20	5840.009	5840.004	5840.007	5840.000
120	-10	5840.008	5840.003	5840.002	5839.998
120	0	5840.008	5839.995	5839.997	5839.990
120	10	5840.005	5839.993	5839.996	5839.985
120	20	5840.004	5839.990	5839.994	5839.977
120	30	5839.995	5839.987	5839.988	5839.973
120	40	5839.988	5839.977	5839.983	5839.973
120	50	5839.979	5839.974	5839.975	5839.973
102	20	5839.970	5839.970	5839.969	5839.964
138	20	5839.961	5839.963	5839.964	5839.957
MHz		-0.039	-0.037	-0.036	-0.043
PPM		-6.71382	-6.33108	-6.11488	-7.43721

Antenna 3

Voltage (V)	Temperature (°C)	Test Results			
		5735MHz			
		1min	2min	5min	10min
120	-30	5735.007	5734.998	5734.996	5734.996
120	-20	5735.008	5735.000	5734.998	5734.997
120	-10	5735.006	5734.996	5734.989	5734.996
120	0	5735.006	5734.992	5734.986	5734.992
120	10	5735.000	5734.992	5734.978	5734.992
120	20	5734.991	5734.985	5734.970	5734.985
120	30	5734.985	5734.978	5734.965	5734.976
120	40	5734.984	5734.973	5734.956	5734.972
120	50	5734.982	5734.969	5734.954	5734.969
102	20	5734.981	5734.960	5734.949	5734.965
138	20	5734.981	5734.957	5734.940	5734.958
MHz		-0.019	-0.043	-0.060	-0.042
PPM		-3.36574	-7.42795	-10.52147	-7.24852

Voltage (V)	Temperature (°C)	Test Results			
		5790MHz			
		1min	2min	5min	10min
120	-30	5790.007	5789.998	5790.003	5790.004
120	-20	5790.006	5789.998	5790.001	5790.003
120	-10	5789.998	5789.998	5789.991	5789.997
120	0	5789.997	5789.992	5789.988	5789.989
120	10	5789.991	5789.988	5789.980	5789.986
120	20	5789.988	5789.986	5789.973	5789.984
120	30	5789.983	5789.980	5789.968	5789.975
120	40	5789.980	5789.971	5789.960	5789.967
120	50	5789.979	5789.961	5789.954	5789.960
102	20	5789.977	5789.954	5789.950	5789.957
138	20	5789.967	5789.948	5789.945	5789.947
MHz		-0.033	-0.052	-0.055	-0.053
PPM		-5.67938	-9.00459	-9.57526	-9.08626

Voltage (V)	Temperature (°C)	Test Results			
		5840MHz			
		1min	2min	5min	10min
120	-30	5840.005	5840.005	5840.008	5840.007
120	-20	5840.006	5840.004	5840.007	5840.006
120	-10	5840.004	5840.003	5840.004	5839.998
120	0	5839.996	5840.000	5839.994	5839.995
120	10	5839.991	5839.999	5839.987	5839.986
120	20	5839.990	5839.994	5839.983	5839.985
120	30	5839.981	5839.990	5839.979	5839.980
120	40	5839.974	5839.984	5839.976	5839.974
120	50	5839.974	5839.982	5839.968	5839.967
102	20	5839.968	5839.981	5839.965	5839.960
138	20	5839.964	5839.971	5839.961	5839.960
MHz		-0.036	-0.029	-0.039	-0.040
PPM		-6.22369	-4.89896	-6.70216	-6.85863

Antenna 4

Voltage (V)	Temperature (°C)	Test Results			
		5735MHz			
		1min	2min	5min	10min
120	-30	5735.004	5735.004	5734.997	5734.987
120	-20	5735.003	5735.003	5734.998	5734.989
120	-10	5734.995	5734.994	5734.995	5734.983
120	0	5734.993	5734.988	5734.993	5734.979
120	10	5734.983	5734.987	5734.984	5734.979
120	20	5734.979	5734.984	5734.976	5734.976
120	30	5734.977	5734.979	5734.974	5734.975
120	40	5734.968	5734.977	5734.973	5734.975
120	50	5734.963	5734.977	5734.970	5734.973
102	20	5734.956	5734.975	5734.968	5734.966
138	20	5734.950	5734.974	5734.966	5734.957
MHz		-0.050	-0.026	-0.034	-0.043
PPM		-8.80224	-4.54678	-6.00068	-7.48464

Voltage (V)	Temperature (°C)	Test Results			
		5790MHz			
		1min	2min	5min	10min
120	-30	5790.004	5790.005	5790.006	5790.003
120	-20	5790.005	5790.006	5790.005	5790.002
120	-10	5790.004	5790.003	5789.997	5789.992
120	0	5790.001	5789.994	5789.988	5789.989
120	10	5790.000	5789.994	5789.988	5789.989
120	20	5789.991	5789.989	5789.979	5789.982
120	30	5789.983	5789.982	5789.976	5789.981
120	40	5789.977	5789.977	5789.973	5789.981
120	50	5789.977	5789.968	5789.965	5789.978
102	20	5789.970	5789.960	5789.964	5789.974
138	20	5789.970	5789.952	5789.963	5789.967
MHz		-0.030	-0.048	-0.037	-0.033
PPM		-5.25063	-8.37010	-6.44422	-5.64912

Voltage (V)	Temperature (°C)	Test Results			
		5840MHz			
		1min	2min	5min	10min
120	-30	5840.007	5840.007	5840.002	5840.008
120	-20	5840.008	5840.006	5840.001	5840.009
120	-10	5840.002	5839.997	5839.999	5840.003
120	0	5840.001	5839.988	5839.993	5839.994
120	10	5839.993	5839.987	5839.991	5839.986
120	20	5839.990	5839.985	5839.987	5839.985
120	30	5839.986	5839.984	5839.985	5839.980
120	40	5839.983	5839.977	5839.976	5839.975
120	50	5839.976	5839.973	5839.970	5839.972
102	20	5839.973	5839.973	5839.960	5839.966
138	20	5839.973	5839.963	5839.960	5839.956
MHz		-0.027	-0.037	-0.040	-0.044
PPM		-4.64219	-6.27712	-6.92594	-7.45700

5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

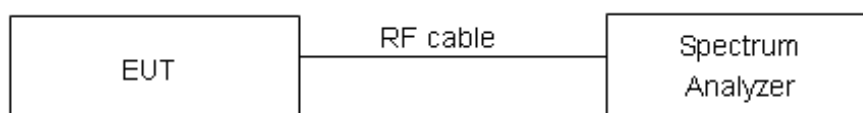
Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 510 kHz, VBW = 1.5MHz for the band 5.725-5.85 GHz

The conducted PSD is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup



Limits

Rule FCC Part 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Frequency Bands/MHz	Limits
5725-5850	30dBm/500kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

Test Results:
TM1

Antenna	Frequency (MHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
Antenna 1	5735	10.510	30	PASS
	5790	9.568	30	PASS
	5840	10.661	30	PASS
Antenna 2	5735	10.371	30	PASS
	5790	9.943	30	PASS
	5840	10.568	30	PASS
Antenna 3	5735	10.843	30	PASS
	5790	12.205	30	PASS
	5840	10.952	30	PASS
Antenna 4	5735	11.124	30	PASS
	5790	10.708	30	PASS
	5840	11.357	30	PASS

Frequency (MHz)	Power Spectral Density (dBm/500kHz)										Limit (dBm/ 500kHz)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	10.510	11.246	10.371	10.892	10.843	12.142	11.124	12.954	47.234	16.743	28	PASS
5790	9.568	9.053	9.943	9.870	12.205	16.615	10.708	11.771	47.309	16.749	28	PASS
5840	10.661	11.644	10.568	11.397	10.952	12.451	11.357	13.668	49.160	16.916	28	PASS

Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density= $10\log(10^{(\text{PSD antenna1 in dBm}/10)}+10^{(\text{PSD antenna2 in dBm}/10)}+10^{(\text{PSD antenna3 in dBm}/10)}+10^{(\text{PSD antenna4 in dBm}/10)})$

2. For MIMO mode,the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = GANT + 10 log(NANT) dBi=5+10log(2)=8dBi>6dBi.So the power limit shall be reduced to 30-(8-6)=28dBm.

TM2

Antenna	Frequency (MHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
Antenna 1	5735	10.676	30	PASS
	5790	10.826	30	PASS
	5840	11.191	30	PASS
Antenna 2	5735	9.876	30	PASS
	5790	10.299	30	PASS
	5840	11.195	30	PASS
Antenna 3	5735	10.571	30	PASS
	5790	10.897	30	PASS
	5840	11.295	30	PASS
Antenna 4	5735	11.530	30	PASS
	5790	10.770	30	PASS
	5840	11.422	30	PASS

Frequency (MHz)	Power Spectral Density (dBm/500kHz)										Limit (dBm/ 500kHz)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	10.676	11.684	9.876	9.719	10.571	11.405	11.530	14.223	47.031	16.724	28	PASS
5790	10.826	12.095	10.299	10.713	10.897	12.294	10.770	11.940	47.042	16.725	28	PASS
5840	11.191	13.155	11.195	13.167	11.295	13.474	11.422	13.874	53.670	17.297	28	PASS

Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density= $10\log(10^{(PSD \text{ antenna1 in dBm}/10)}+10^{(PSD \text{ antenna2 in dBm}/10)}+10^{(PSD \text{ antenna3 in dBm}/10)}+10^{(PSD \text{ antenna4 in dBm}/10)})$

2. For MIMO mode,the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = GANT + 10 log(NANT) dBi=5+10log(2)=8dBi>6dBi.So the power limit shall be reduced to 30-(8-6)=28dBm.

TM3

Antenna	Frequency (MHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
Antenna 1	5735	8.811	30	PASS
	5790	8.365	30	PASS
	5840	8.037	30	PASS
Antenna 2	5735	8.014	30	PASS
	5790	8.284	30	PASS
	5840	8.212	30	PASS
Antenna 3	5735	9.307	30	PASS
	5790	10.008	30	PASS
	5840	9.081	30	PASS
Antenna 4	5735	9.717	30	PASS
	5790	8.823	30	PASS
	5840	9.432	30	PASS

Frequency (MHz)	Power Spectral Density (dBm/500kHz)										Limit (dBm/ 500kHz)	Concl usion
	Antenna 1		Antenna 2		Antenna 3		Antenna 4		MIMO			
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(mW)	(dBm)		
5735	8.811	7.605	8.014	6.330	9.307	8.525	9.717	9.369	31.829	15.028	28	PASS
5790	8.365	6.863	8.284	6.736	10.008	10.018	8.823	7.626	31.243	14.948	28	PASS
5840	8.037	6.364	8.212	6.625	9.081	8.093	9.432	8.774	29.856	14.750	28	PASS

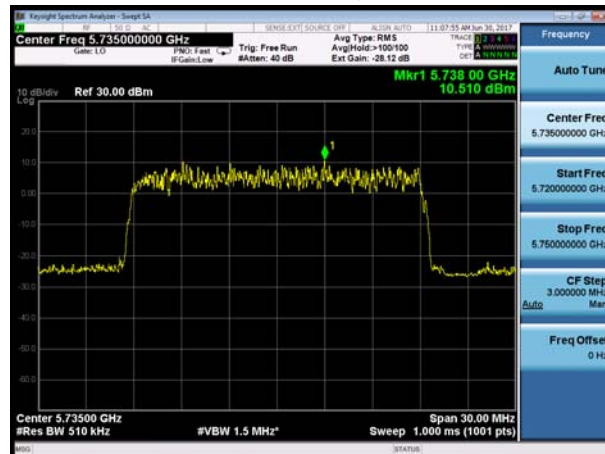
Note:1.For MIMO mode,according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density= $10\log(10^{(PSD\ antenna1\ in\ dBm/10)}+10^{(PSD\ antenna2\ in\ dBm/10)}+10^{(PSD\ antenna3\ in\ dBm/10)}+10^{(PSD\ antenna4\ in\ dBm/10)})$

2. For MIMO mode,the manufacturer declared the transmitter output signals are SFBC modes combine with CDD modes.The signals are antenna 1,2 correlated and 3,4 correlated. And 1,2 and 3,4 are completely uncorrelated.According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a)(i):If any transmit signals are correlated with each other,Directional gain = GANT + 10 log(NANT) dBi=5+10log(2)=8dBi>6dBi.So the power limit shall be reduced to 30-(8-6)=28dBm.



TM1

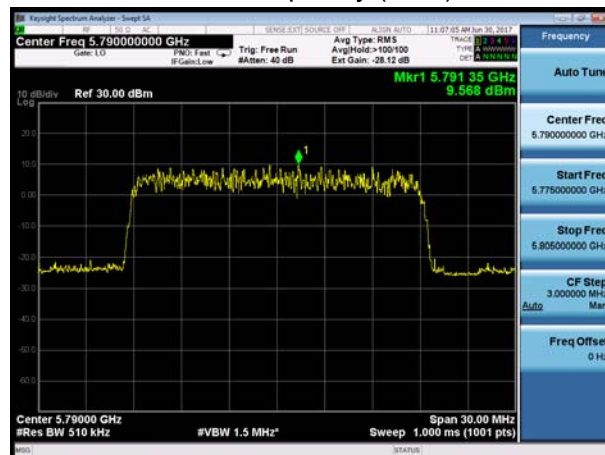
Antenna 1, Frequency (MHz): 5735



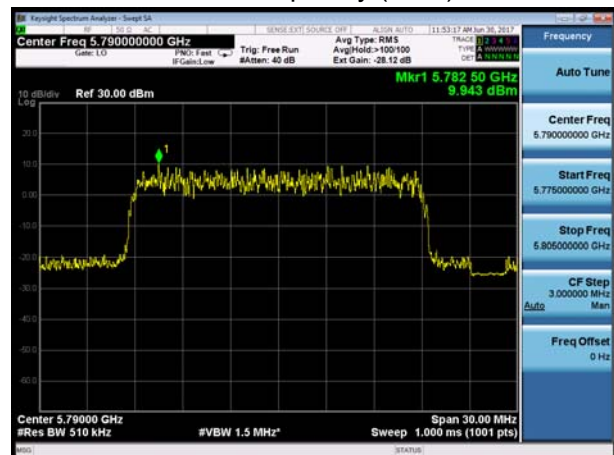
Antenna 2, Frequency (MHz): 5735



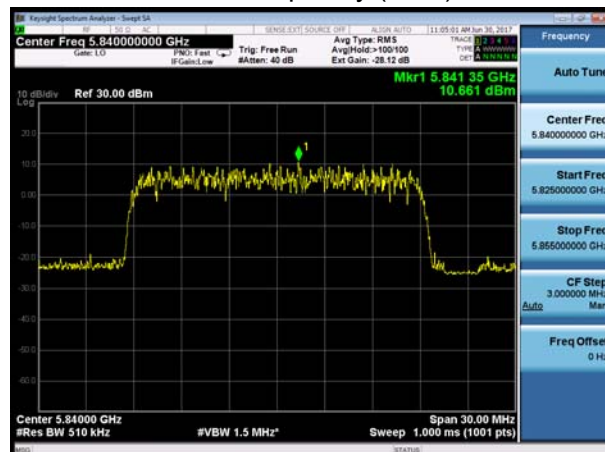
Antenna 1, Frequency (MHz): 5790



Antenna 2, Frequency (MHz): 5790



Antenna 1, Frequency (MHz): 5840

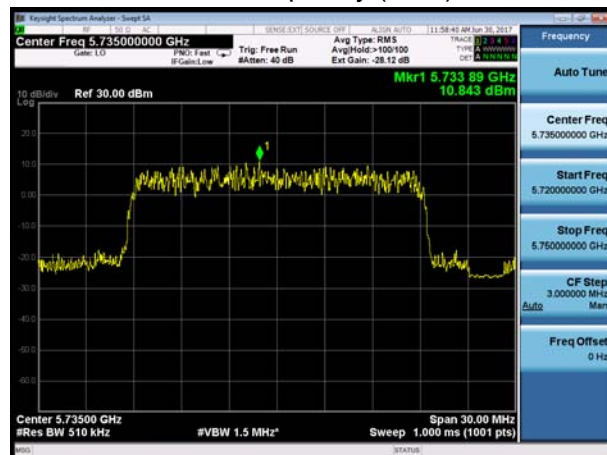


Antenna 2, Frequency (MHz): 5840





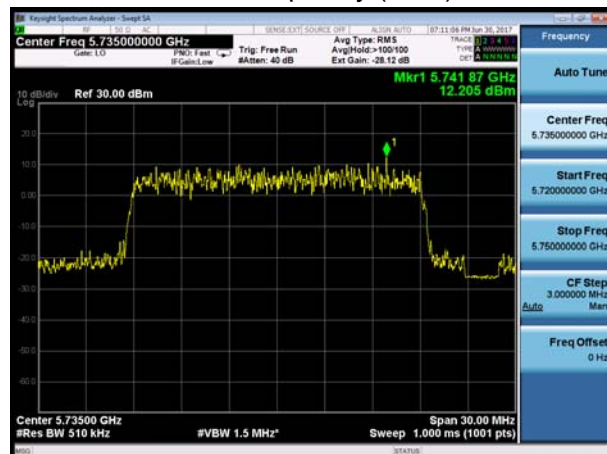
Antenna 3, Frequency (MHz): 5735



Antenna 4, Frequency (MHz): 5735



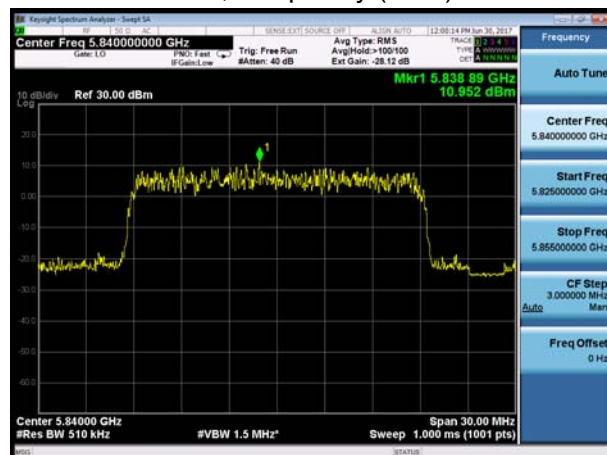
Antenna 3, Frequency (MHz): 5790



Antenna 4, Frequency (MHz): 5790



Antenna 3, Frequency (MHz): 5840



Antenna 4, Frequency (MHz): 5840

