RF
TEST REPORT

Report No.	**: 190104020SZN-003**
Model No.	**: TW03**
FCC ID:	**: 2AL8TTW03**
Issued Date	**: 16 January 2019**

Applicant: **Kenxen Digitech Limited**

Test Method/ Standard: **FCC Part 15 Subpart E;**
KDB 789033 D02 v02r01;
KDB 662911 D01 v02r01;
ANSI C63.10-2013

Test By: **Intertek Testing Services Shenzhen Ltd. Longhua Branch 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen.**

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Summary of Tests

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15.407 a (1)/(3)	Power Spectrum Density test	4	Pass
15.407 e	6dB Bandwidth	5	Pass
15.407 b, 15.205, 15.209	Radiated spurious emission test	6	Pass
15.207	AC line conducted emission test	7	Pass
15.407 g	Frequency Stability	8	Pass

1. General information

1.1 Identification of the EUT

Product:	Dash Camera
Model No.:	TW03
Type of Device:	Slave device
Nominal Channel Bandwidth:	802.11a/n-HT20 (20 MHz), 802.11n-HT40 (40MHz), 802.11ac (20/40/80MHz)
Operating Frequency:	5725~5850MHz
Channel Number:	5 channels for 5745 MHz ~ 5825 MHz (802.11a/n/ac-HT20); 2 channels for 5755 MHz ~ 5795 MHz (802.11n/ac-HT40); 1 channels for 5775 MHz (802.11ac-HT80);
Rated Power:	DC 5.0V, 1.5A (powered by external USB)
Test Date(s):	4 January 2019 to 14 January 2019
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is a Dash Camera with Bluetooth and WIFI functions. 5G WIFI and Bluetooth share an integral antenna to transmit and receive, but they can't transmit at the same time.

For more detail features, please refer to User's description as file name "descri.pdf".

Related Submittal(s) Grants

This is an application for certification of U–NII device (5GHz Wi-Fi transmitter portion).
For the Bluetooth 4.2 BLE function was tested and demonstrated in report 190104020SZN -001.
For the 2.4GHz WIFI function was tested and demonstrated in report 190104020SZN-002.
For other functions were reported in the SDOC report: 190104020SZN-004.

1.3 Antenna description (15.203)

The EUT uses Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

Antenna Gain: 2.7dBi Max for 5G WIFI

1.4 Peripherals equipment

Description	Manufacturer	Model No.
Adapter	provided by Intertek	XIAOMI, MDY-08-EI
USB cable	provided by Intertek	Unshielded, 0.5m

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 E, Section15.203, 15.207, 15.209, 15.407 and ANSI C63.10/2013, method of measurement: KDB 789033 D02.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band was all meet limit requirement, thus we evaluate the EUT pass the specified test.

The AC power conducted emissions was invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz (15.207 paragraph).

Radiated emissions were invested cover the frequency range from 9KHz to 30MHz using a receiver RBW of 9kHz, from 30 MHz to 1000 MHz using a receiver RBW of 120 kHz record QP reading, and the frequency over 1 GHz using a spectrum analyzer RBW of 1 MHz, VBW of 3MHz, Detector=Peak record for Peak reading, RBW of 1 MHz, VBW of 3MHz, Detector=RMS record for Average reading recorded on the report.

The EUT setup configurations please refer to the photo of radiated setup photos.pdf & conducted setup photos.pdf.

2.2 Operation mode

The EUT was supplied by USB port and it was run in TX mode that was controlled by client provided RF testing program.

The EUT was transmitted continuously during the test. The worst case test result was showed in the report.

With individual verifying, the maximum output power was found at 6 Mbps data rate for 802.11a mode, 6.5 Mbps data rate for 802.11n-HT20 mode, 13.5 Mbps data rate for 802.11n-HT40 mode, 29.3Mbps data rate for 802.11ac. The final tests were executed under these conditions and recorded in this report individually.

Table for Parameters of Test Software Setting
During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

3. Maximum Output Power test (FCC 15.407)

3.1 Operating environment

Temperature:	24	℃
Relative Humidity:	53	%
Atmospheric Pressure:	1001	hPa

3.2 Test setup & procedure

The power output per FCC §15.407(a) was measured on the EUT using a 50ohm SMA cable connected to spectrum analyzer and the measurement method refer to 789033 D02. Power was read directly and cable loss correction (1.0dB) was added to the reading to obtain power at the EUT antenna terminals.

3.3 Limit

Operating Frequency (MHz)	Max Conducted TX Power	Max EIRP
5725~5850	30dBm (1W)	*$_2$4W (36dBm) with 6dBi antenna

Remark: *$_1$ The device declared as Slave device.

*$_2$ Tx Power Reduction (dBm-by-dBi) required when antenna exceeds 6dBi.

1). 5.8G band Ant: 2.7dBi, so the Power limit will reduce to 30dBm for conducted TX power and 36dBm for EIRP.

3.4 Measured data of Maximum Output Power test results

5725 MHz ~ 5850 MHz

Mode	Channel	Data Rate (Mbps)	Output Power (dBm)	Limit (dBm)
802.11a	149	6	10.33	30
	157		11.24	30
	165		10.37	30
802.11n-HT20	149	6.5	12.26	30
	157		11.04	30
	165		11.15	30
802.11n-HT40	151	13.5	11.23	30
	159		10.26	30
802.11ac-HT20	149	6.5	14.10	30
	157		13.04	30
	165		10.06	30
802.11ac-HT40	151	13.5	10.34	30
	159		9.06	30
802.11ac-HT80	155	29.3	10.90	30

Max EIRP-Worst case: individual transmit

Mode	Channel	Data Rate (Mbps)	Duty cycle	Output Power (dBm)	Gain (dBi)	E.I.R.P (dBm)	Limit (dBm)
802.11a	149	6	99%	10.33	2.7	13.03	36
	157			11.24	2.7	13.94	36
	165			10.37	2.7	13.07	36
802.11n-HT20	149	6.5	99%	12.26	2.7	14.96	36
	157			11.04	2.7	13.74	36
	165			11.15	2.7	13.85	36
802.11n-HT40	151	13.5	99%	11.23	2.7	13.93	36
	159			10.26	2.7	12.96	36
802.11ac-HT20	149	6.5	99%	14.10	2.7	16.80	36
	157			13.04	2.7	15.74	36
	165			10.06	2.7	12.76	36
802.11ac-HT40	151	13.5	99%	10.34	2.7	13.04	36
	159			9.06	2.7	11.76	36
802.11ac-HT80	155	29.3	99%	10.90	2.7	13.60	36

4. Power Spectrum Density test (FCC 15.407)

4.1 Operating environment

Temperature:	23	℃
Relative Humidity:	53	%
Atmospheric Pressure:	1003	hPa

4.2 Test setup & procedure

Method of Measurement:

The power spectrum density per FCC §15.407(a) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 1MHz/500KHz, the video bandwidth set at 3 MHz/2MHz (measurement method refer to KDB 789033 D02). Power spectrum density was read directly and cable loss (1.0 dB) reading to obtain power at the EUT antenna terminals.

4.3 Limit

Operating Frequency (MHz)	Max Conducted Power Spectral Density
5725~5850	30dBm/500KHz

Remark: *$_1$ The device declared as Slave device.

*$_2$ Tx Power Reduction (dBm-by-dBi) required when antenna exceeds 6dBi.

1). 5.8G band Ant: 2.7dBi, so the PSD limit is 30dBm/500KHz for Conducted Power Spectral Density.

4.4 Measured data of Power Spectrum Density test results

5725 MHz ~ 5850 MHz

Mode	Channel	Data Rate (Mbps)	PSD (dBm/MHz or 500KHz) (See remark)	Limit (dBm/MHz or 500KHz) (See remark)
802.11a	149	6	-1.32	30
	157		-0.45	30
	165		-1.68	30
802.11n-HT20	149	6.5	0.09	30
	157		-0.99	30
	165		-0.40	30
802.11n-HT40	151	13.5	-4.02	30
	159		-4.96	30
802.11ac-HT20	149	6.5	1.84	30
	157		0.63	30
	165		-2.16	30
802.11ac-HT40	151	13.5	-4.86	30
	159		-6.34	30
802.11ac-HT80	155	29.3	-8.60	30

5. Minimum 6 dB RF Bandwidth (FCC 15.407)

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	49	%
Atmospheric Pressure:	1001	hPa

5.2 Test setup & procedure

The Minimum 6 dB RF Bandwidth per 789033 D02 was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 100KHz, and set the video bandwidth (VBW) ≥ 3 x RBW. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

For 26dB down Emission Bandwidth

The 26dB down Emission Bandwidth per 789033 D02 was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set RBW = approximately 1% of the emission bandwidth. Set the VBW > RBW, Detector = Peak, Trace mode = max hold (Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%).

For 99% Occupied Bandwidth

The 99% Occupied Bandwidth per 789033 D02 was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set center frequency to the nominal EUT channel center frequency, set span = 1.5 times to 5.0 times the OBW, set RBW = 1 % to 5 % of the OBW, set VBW ≥ 3x RBW, The 99% occupied bandwidth was determined from where the channel output spectrum intersected the display line.

5.3 Limit

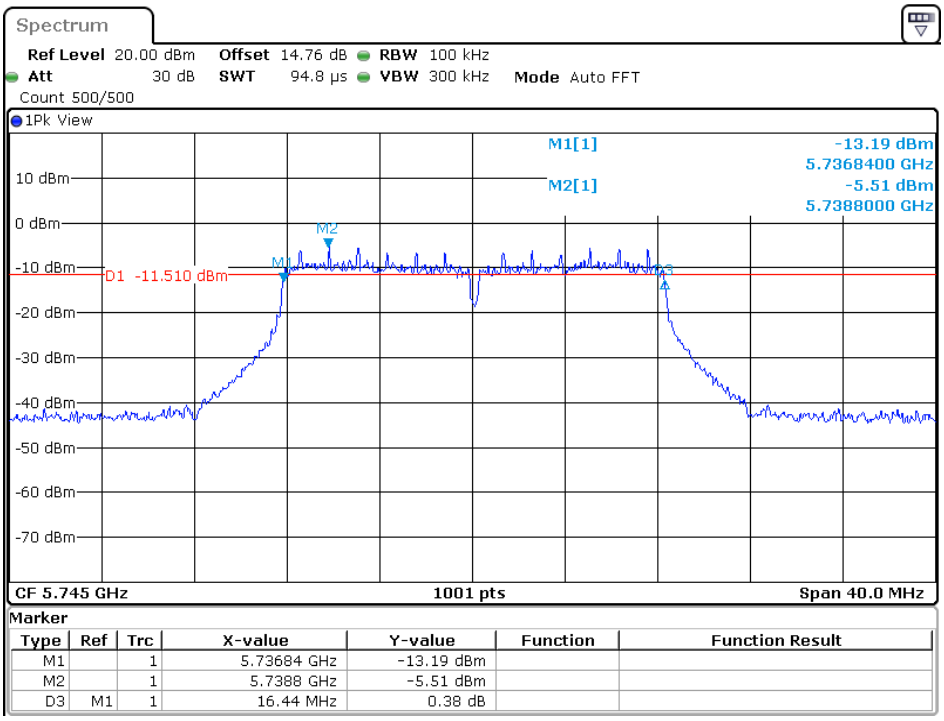
Operating Frequency (MHz)	Minimum 6 dB RF Bandwidth Limit
5725~ 5850	≥500KHz

5.4 Measured data of 6dB down Emission Bandwidth test results

Test Mode	Test Channel	EBW[MHz]	Limit[MHz]	Verdict
11a	5745	16.44	0.5	PASS
11a	5785	16.40	0.5	PASS
11a	5825	16.40	0.5	PASS
11n-HT20	5745	17.00	0.5	PASS
11n-HT20	5785	17.00	0.5	PASS
11n-HT20	5825	16.64	0.5	PASS
11n-HT40	5755	35.60	0.5	PASS
11n-HT40	5795	35.68	0.5	PASS
11ac-HT20	5745	17.12	0.5	PASS
11ac-HT20	5785	17.00	0.5	PASS
11ac-HT20	5825	16.64	0.5	PASS
11ac-HT40	5755	36.00	0.5	PASS
11ac-HT40	5795	35.68	0.5	PASS
11ac-HT80	5775	75.52	0.5	PASS

The test plots are attached as below.

11a:



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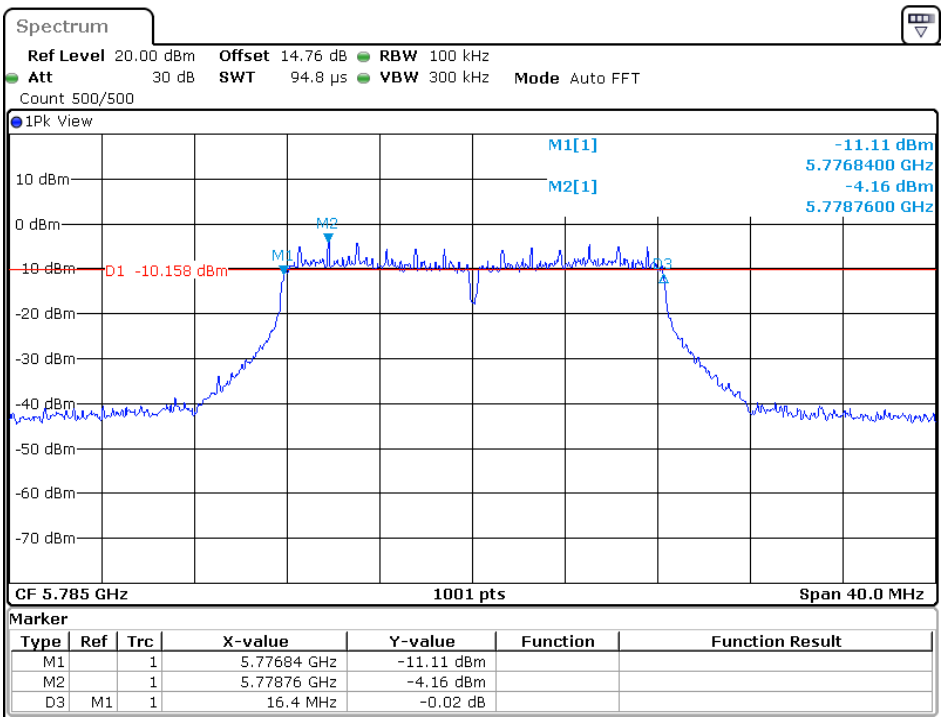

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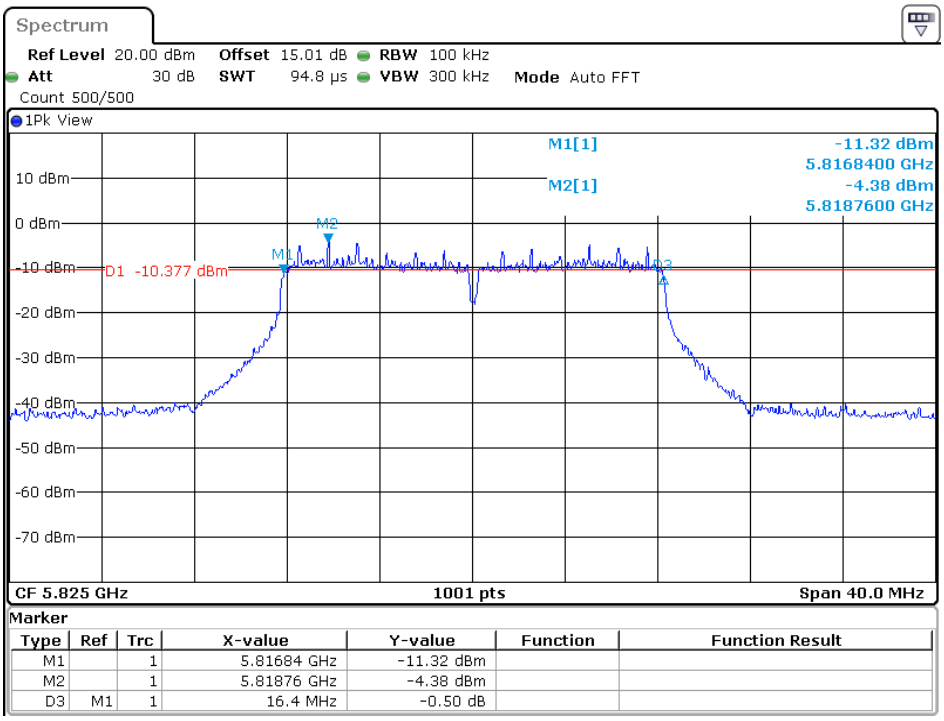

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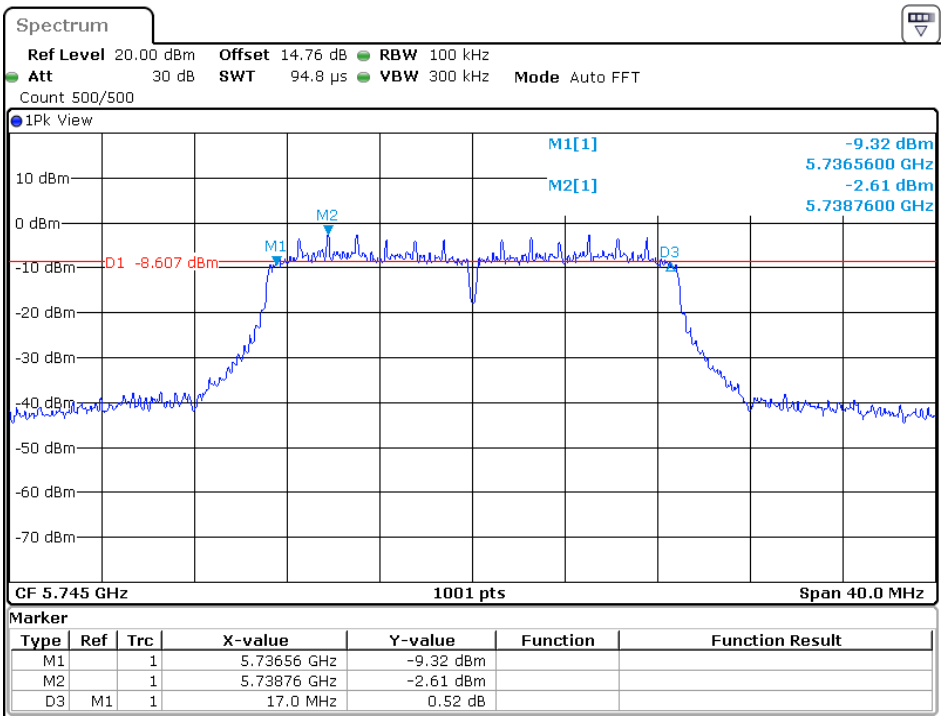
11n-HT20：



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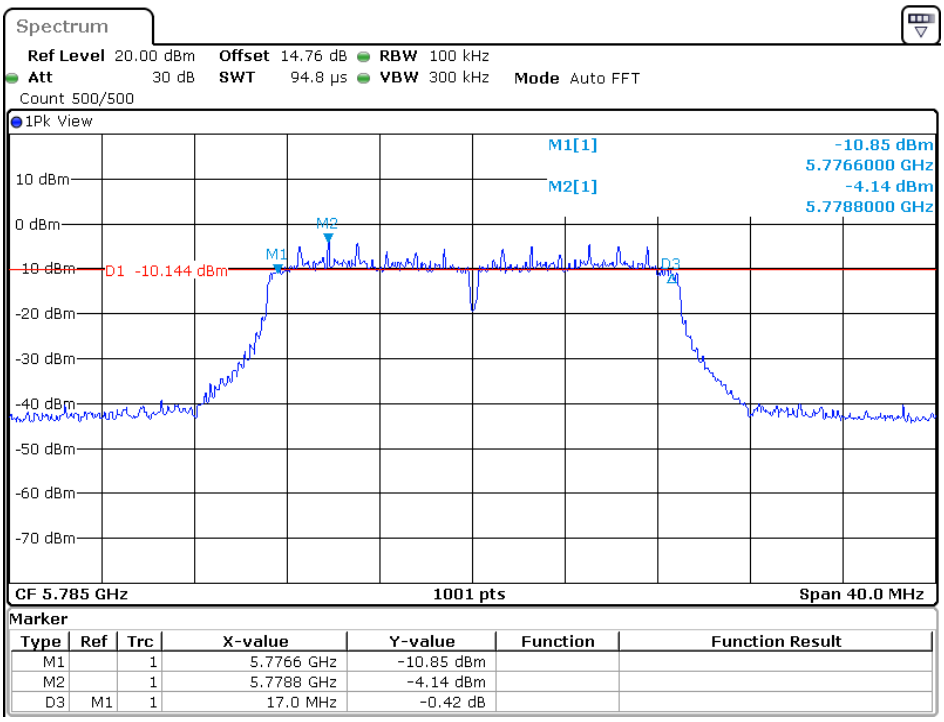
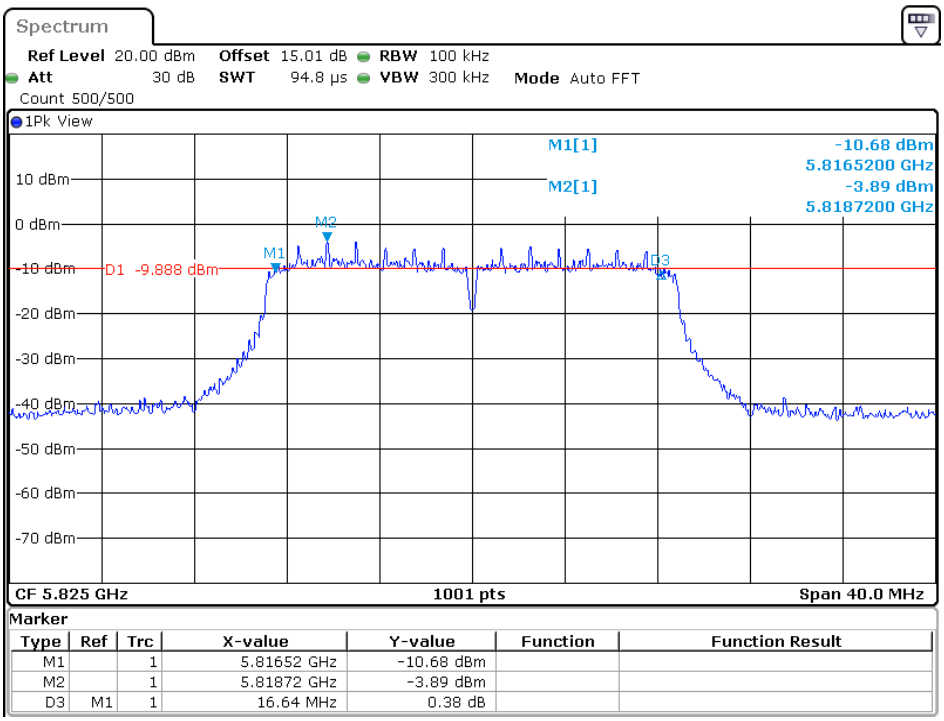


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.7766 GHz	-10.85 dBm		
M2		1	5.7788 GHz	-4.14 dBm		
D3	M1	1	17.0 MHz	-0.42 dB		

Date: 11.JAN.2019 11:51:07

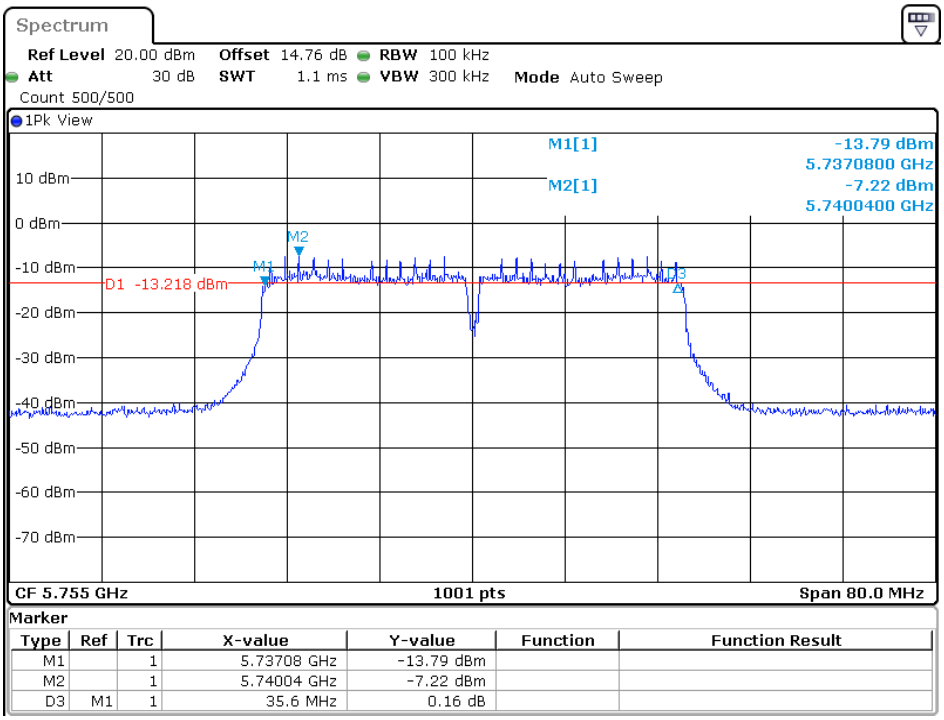


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.81652 GHz	-10.68 dBm		
M2		1	5.81872 GHz	-3.89 dBm		
D3	M1	1	16.64 MHz	0.38 dB		

Date: 11.JAN.2019 13:12:01

11n-HT40：



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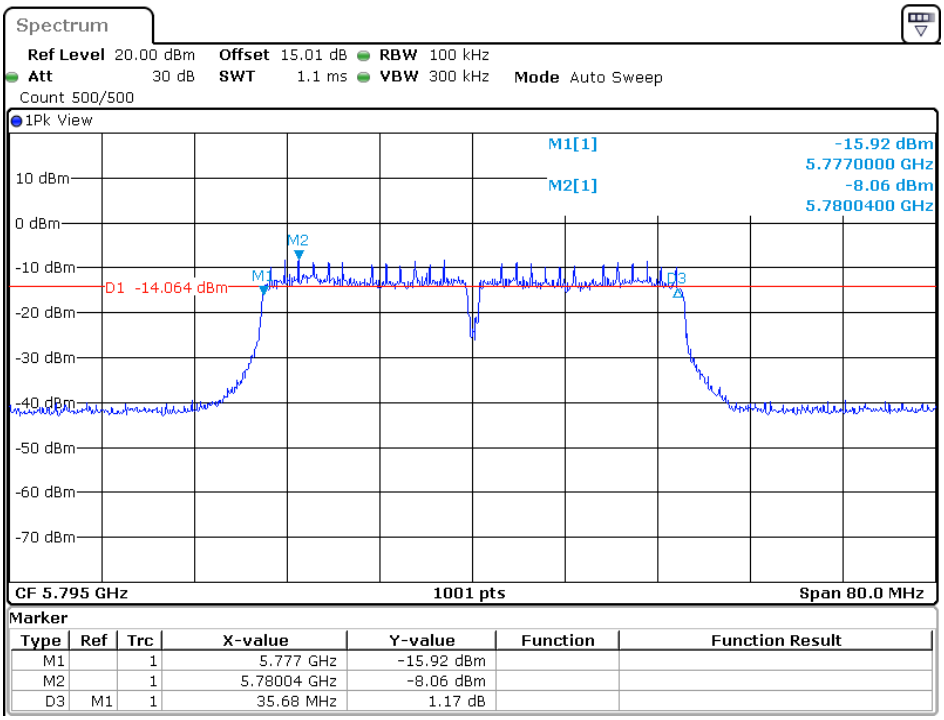

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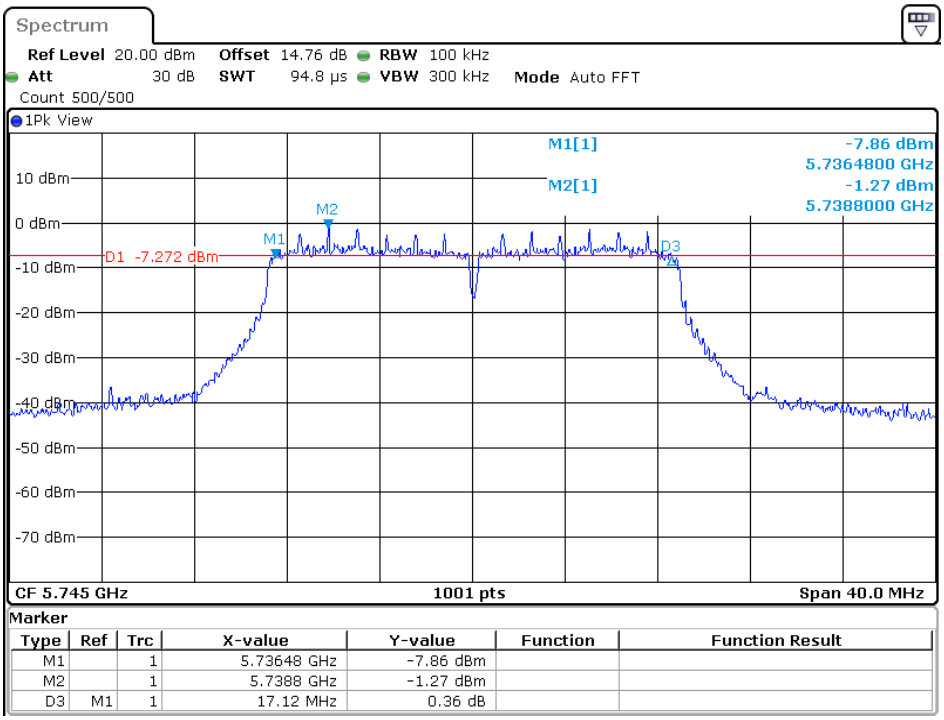
11ac-HT20：



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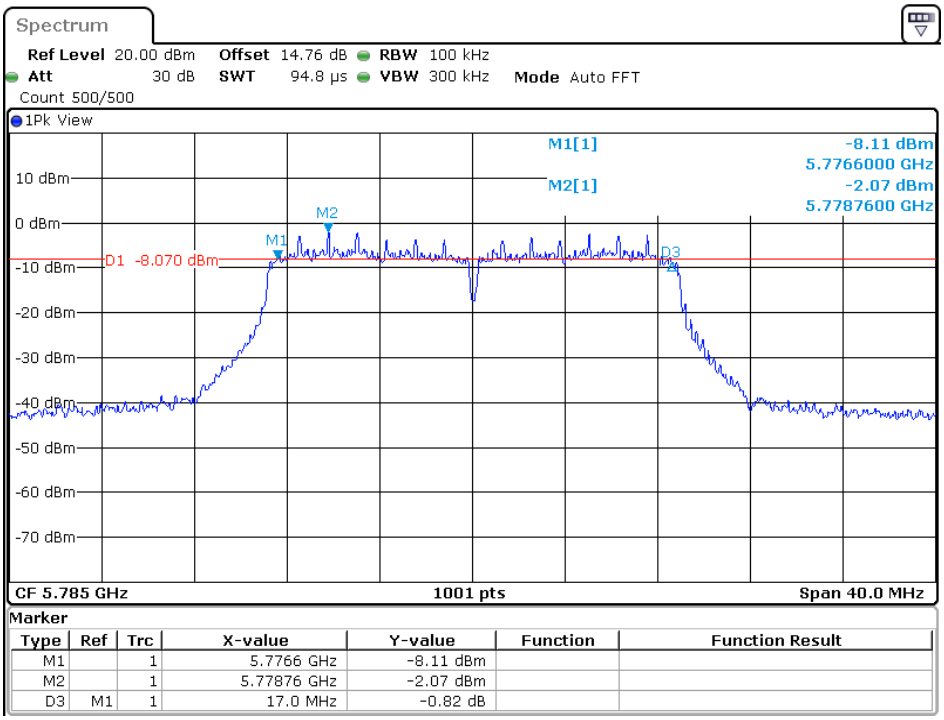

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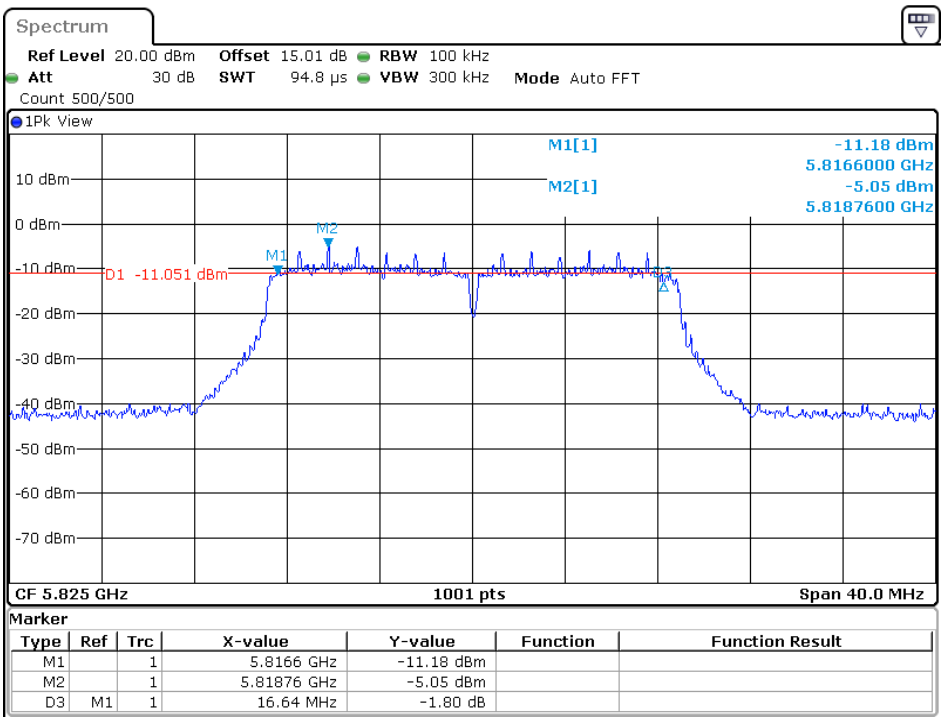

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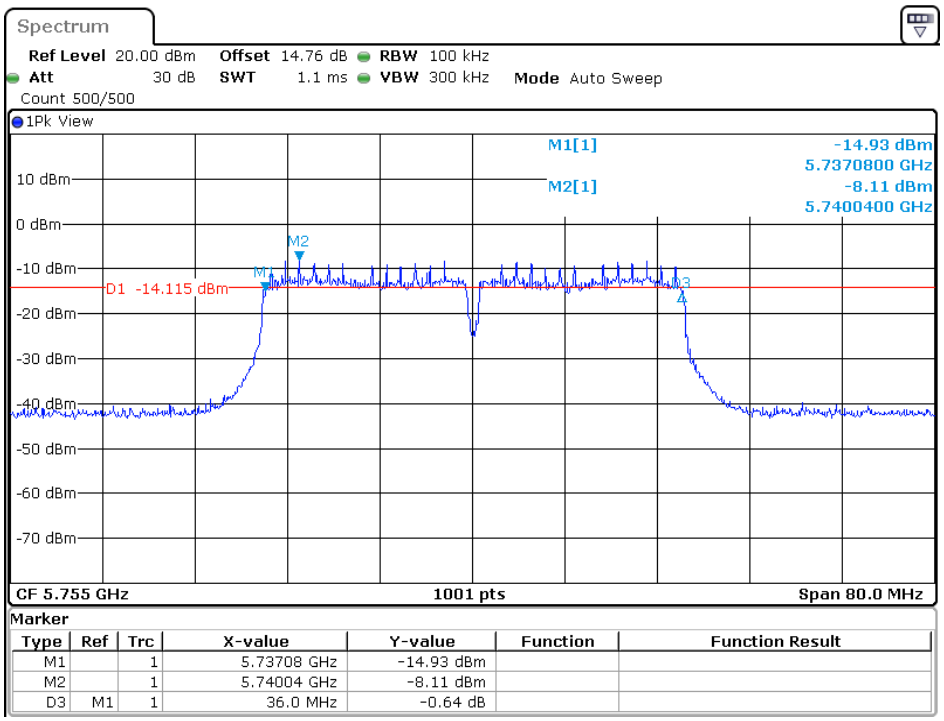
11ac-HT40：



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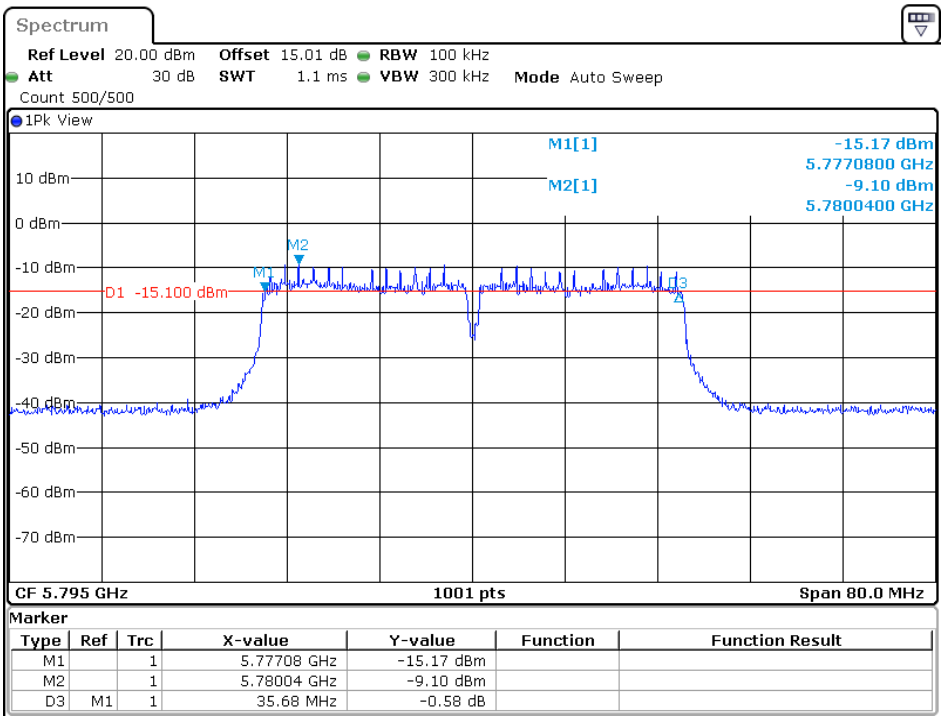
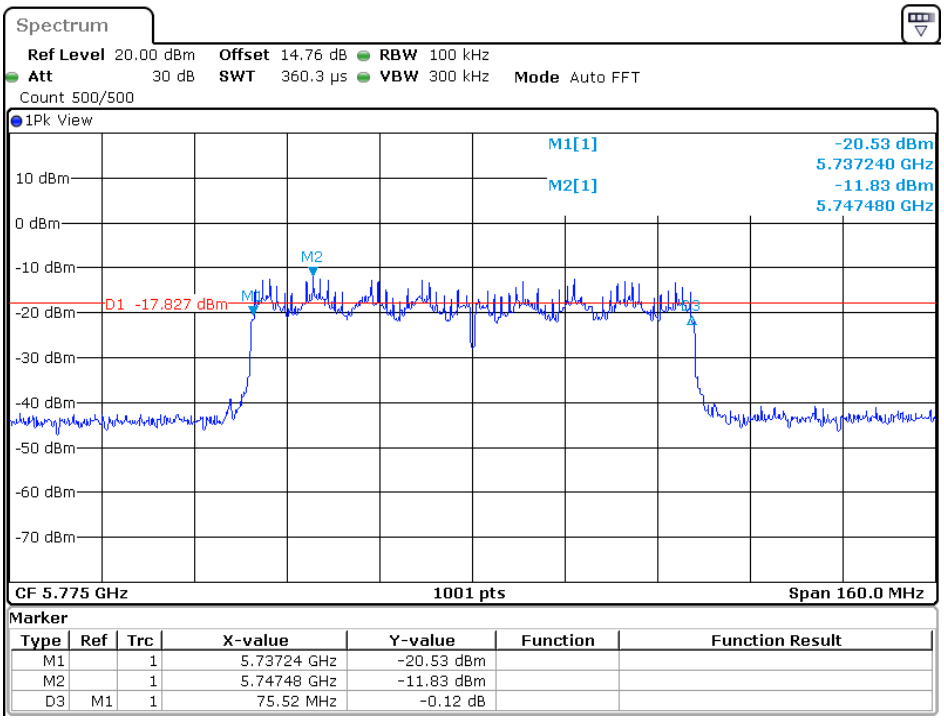


11ac-HT80：



Note: 99% Occupied Bandwidth within the U-NII-1 band and 26dB Emission Bandwidth for reference. The plots are saved with filename: “26dB OBW” and “99% OBW”

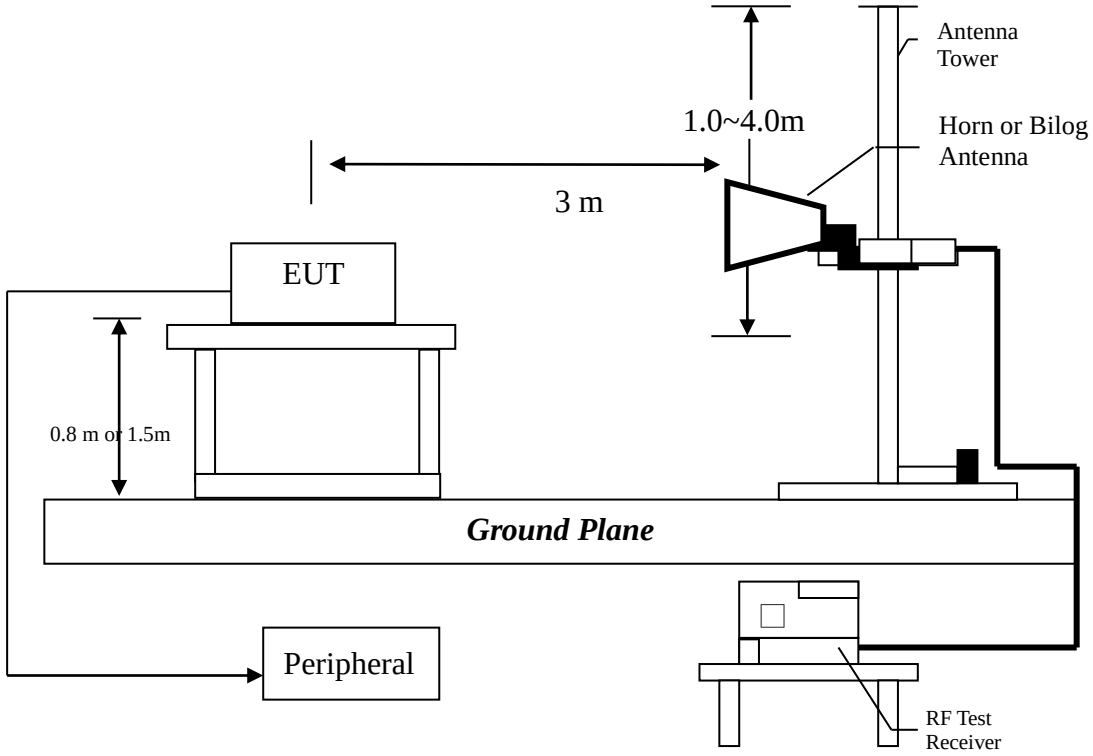
6. Radiated Emission test (FCC 15.205 & 15.209 & 15.407)

6.1 Operating environment

Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure	1007	hPa

6.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emission measurements were performed from 9KHz to tenth harmonic or 40GHz.
The EUT for testing is arranged on a styrene turntable with the height of 0.8m up to 1GHz and 1.5m above 1GHz. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meters reading using inverse scaling with distance.

Testing settings (refer to KDB 789033 D02)
Peak Measurements below 1GHz
1, Analyzer center frequency was set to the frequency of the radiated spurious emission.
2, Span=encompass the entire emission
3, RBW=120KHz
4, Detector=Quasi-Peak
5, Trace was allowed to stabilize

Peak Measurements above 1GHz
1, Analyzer center frequency was set to the frequency of the radiated spurious emission.
2, Span=encompass the entire emission
3, RBW=1MHz
4, VBW=3MHz
4, Detector= Peak (Max-hold)
5, Trace was allowed to stabilize

Average Measurements above 1GHz
1, Analyzer center frequency was set to the frequency of the radiated spurious emission.
2, Span=encompass the entire emission
3, RBW=1MHz
4, VBW=3MHz
4, Detector= RMS (Max-hold)
5, Trace was allowed to stabilize

6.3 Limit

The spurious Emission shall test through the 10th harmonic or 40GHz (whichever is lower). 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).

Notes:
1, All emission out-side of the 5.15-5.35GHz & 5.47-5.725GHz band shall not exceed an EIRP of -27dBm/MHz (68.2dBuV/m, test distance: 3 meter), for band 5.725-5.85GHz shall not exceed an≤-17dBm/MHz (78.2dBuV/m, test distance: 3 meter) within 5715-5725MHz and 5850-5860MHz, ≤-27dBm/MHz (68.2dBuV/m, test distance: 3 meter) outside 5715-5860MHz.
2, The spectrum is measured from 9KHz to the 10^{th} harmonic of the fundamental frequency of the transmitter using QP detector below 1GHz, above 1GHz, average & peak measurements were taken using for test. The worst-case emission is reported however emission whose levels were not within 20dB of the respective limited were not reported.
3, The test was performed on EUT under 802.11a/n-HT20/40/ac-HT20/40/80 continuously transmitting mode. Simultaneous transmitting was considered during the testing. All mode had been tested, but only the worst-case is recorded in the following graph and table.

Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD

Example
Assume a receiver reading of 62.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB. The net field strength for comparison to the appropriate emission limit is 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 62.0 dBμV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 dBμV/m

Level in mV/m = Common Antilogarithm [(42 dBμV/m)/20] = 125.9 μV/m

6.4 Radiated spurious emission test data

6.4.1 Measurement results: frequencies equal to or less than 1 GHz

The worst case occurred at 802.11n-HT20, 149/6.5Mbps

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	95.0	35.4	20.0	8.6	24.0	43.5	-19.5
Horizontal	296.8	45.1	20.0	13.9	39.0	46.0	-7.0
Horizontal	697.8	28.6	20.0	23.2	31.8	46.0	-14.2
Vertical	44.0	36.2	20.0	10.5	26.7	40.0	-13.3
Vertical	403.8	33.9	20.0	17.3	31.2	46.0	-14.8
Vertical	552.9	31.5	20.0	20.0	31.5	46.0	-14.5

6.4.2 Measurement results: frequency above 1GHz

The worst case occurred at 802.11n-HT40

Channel 149/6.5Mbps

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	11490.000	54.6	36.3	38.9	57.2	68.2	-11.0
Horizontal	17235.000	53.4	34.7	41.0	59.7	68.2	-8.5

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	11490.000	42.5	36.3	38.9	45.1	54.0	-8.9
Horizontal	17235.000	40.9	34.7	41.0	47.2	54.0	-6.8

Channel 165/6.5Mbps

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	11650.000	54.5	36.3	38.9	57.1	68.2	-11.1
Horizontal	17475.000	52.5	34.7	41.0	58.8	68.2	-9.4

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	11650.000	42.2	36.3	38.9	44.8	54.0	-9.2
Horizontal	17475.000	40.3	34.7	41.0	46.6	54.0	-7.4

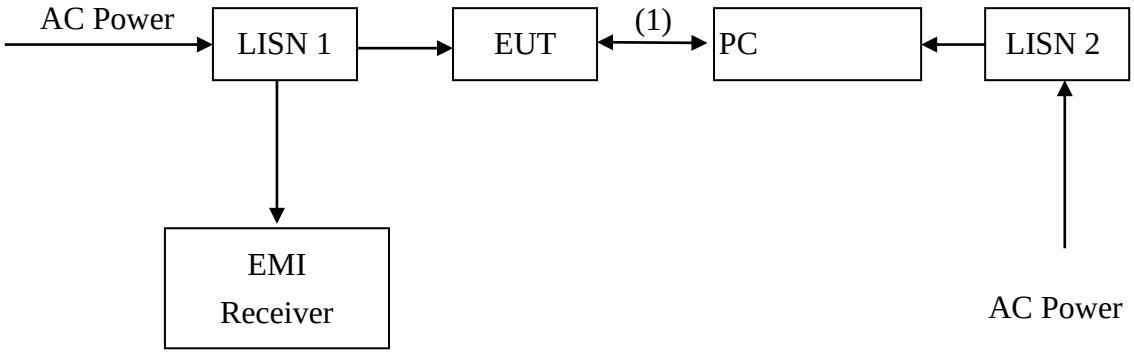
* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

7. Power Line Conducted Emission test

7.1 Operating environment

Temperature:	24	℃
Relative Humidity:	54	%
Atmospheric Pressure	1005	hPa

7.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50 uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10/2013 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCI 30) is set at 9 kHz.

7.3 Limit

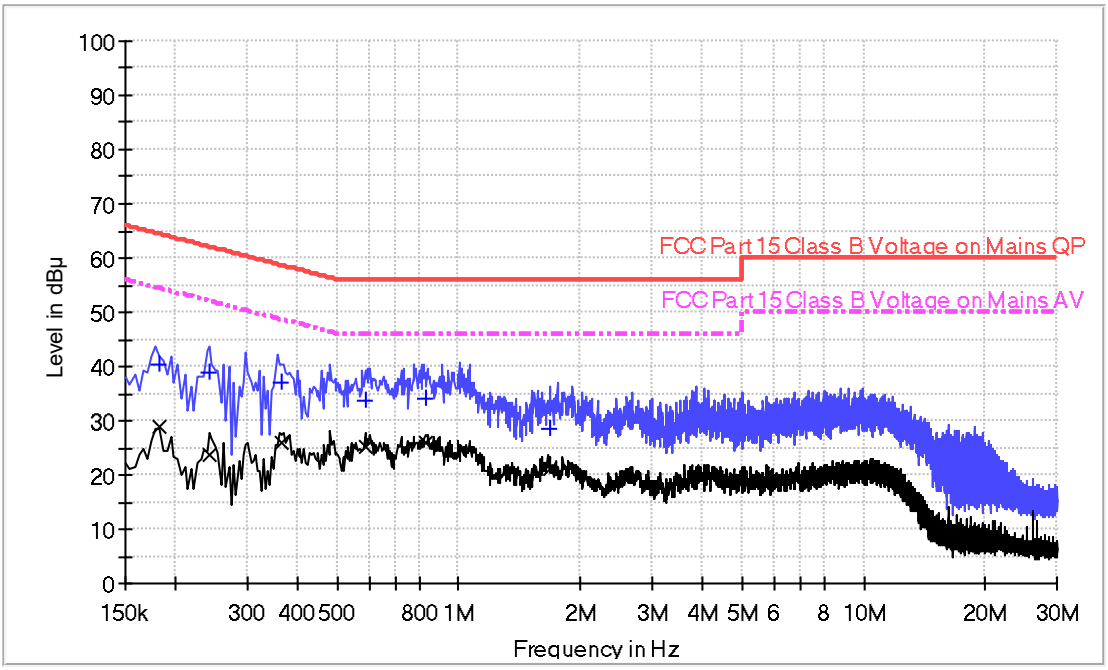
Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

7.4 Power Line Conducted Emission test data

The worst case test was performed on EUT under 802.11n-HT40 Link

Phase: Live
Test WIFI Link



Result Table QP

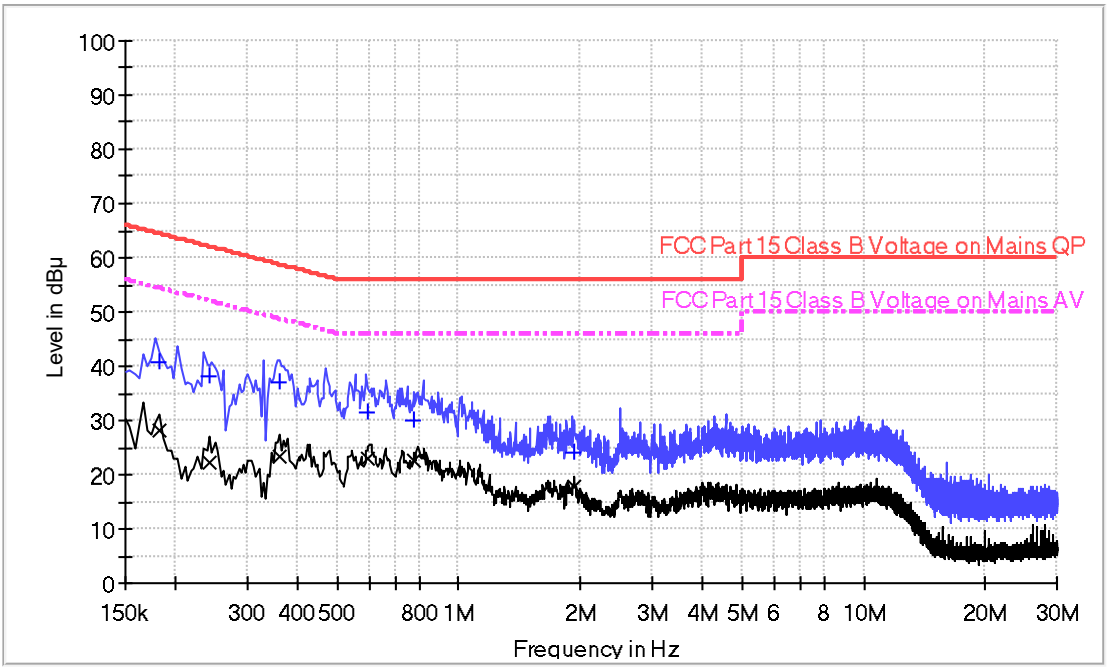
Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.182000	40.3	L1	9.6	24.1	64.4
0.242000	38.7	L1	9.6	23.3	62.0
0.366000	36.9	L1	9.6	21.7	58.6
0.586000	33.6	L1	9.7	22.4	56.0
0.830000	34.1	L1	9.7	21.9	56.0
1.674000	28.3	L1	9.7	27.7	56.0

Result Table AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.182000	29.0	L1	9.6	25.4	54.4
0.242000	23.6	L1	9.6	28.4	52.0
0.366000	25.8	L1	9.6	22.8	48.6
0.586000	25.1	L1	9.7	20.9	46.0
0.830000	26.0	L1	9.7	20.0	46.0
1.674000	21.2	L1	9.7	24.8	46.0

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Limit (dBuV) – Level (dBuV)

Phase: Neutral
Test Condition: WIFI Link



Result Table QP

Frequency (MHz)	QuasiPeak (dB µV)	Line	Corr. (dB)	Margin (dB)	Limit (dB µV)
0.182000	40.7	N	9.6	23.7	64.4
0.242000	38.1	N	9.6	23.9	62.0
0.362000	36.9	N	9.6	21.8	58.7
0.598000	31.3	N	9.7	24.7	56.0
0.778000	30.0	N	9.7	26.0	56.0
1.922000	24.1	N	9.7	31.9	56.0

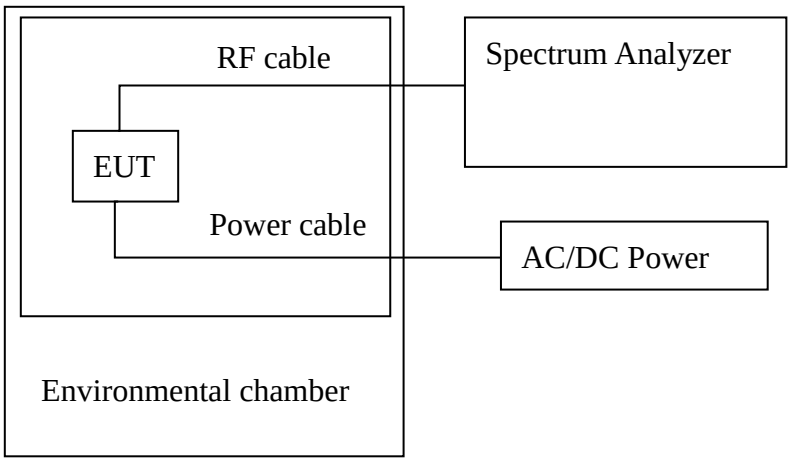
Result Table AV

Frequency (MHz)	Average (dB µV)	Line	Corr. (dB)	Margin (dB)	Limit (dB µV)
0.182000	28.0	N	9.6	26.4	54.4
0.242000	22.2	N	9.6	29.8	52.0
0.362000	23.3	N	9.6	25.4	48.7
0.598000	23.1	N	9.7	22.9	46.0
0.778000	22.6	N	9.7	23.4	46.0
1.922000	17.8	N	9.7	28.2	46.0

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Limit (dBuV) – Level (dBuV)

8. Frequency Stability Test

8.1 Test setup & procedure



Note1: The frequency stability is measured with the temperature variation range of -20˚C to +60˚C (20˚C increment), and voltage supply variation range of 85% to 115% of nominal DC supply voltage.

2: To ensure emission at the band-edge is maintained within the authorized band, the frequency 802.11a/n-HT20/40/ac-HT20/40/80 channel 36, 48, 38, 46, 42, 149, 165, 151, 159, 155 are selected to test and the worst case was reported.

8.2 Frequency Stability Test Data

20˚C is taken as temperature in normal condition.

Model: 802.11a, Operation frequency: 5745MHz, Channel: 149, Rate: 6Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5745.042	42	Pass
	0	5745.053	53	Pass
	+20	5745.057	57	Pass
	+40	5745.051	51	Pass
	+60	5745.043	43	Pass
4.25	+20	5745.055	55	Pass
5.75	+20	5745.045	45	Pass

Model: 802.11a, Operation frequency: 5825MHz, Channel: 165, Rate: 6Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5825.034	34	Pass
	0	5825.034	34	Pass
	+20	5825.035	35	Pass
	+40	5825.039	39	Pass
	+60	5825.043	43	Pass
4.25	+20	5825.047	47	Pass
5.75	+20	5825.031	31	Pass

Model: 802.11n-HT20, Operation frequency: 5745MHz, Channel: 149, Rate: 6.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5745.064	64	Pass
	0	5745.025	25	Pass
	+20	5745.035	35	Pass
	+40	5745.063	63	Pass
	+60	5745.051	51	Pass
4.25	+20	5745.049	49	Pass
5.75	+20	5745.038	38	Pass

Model: 802.11n-HT20, Operation frequency: 5825MHz, Channel: 165, Rate: 6.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5785.000	0	Pass
	0	5825.002	2	Pass
	+20	5825.007	7	Pass
	+40	5825.009	9	Pass
	+60	5825.005	5	Pass
4.25	+20	5825.008	8	Pass
5.75	+20	5825.003	3	Pass

Model: 802.11n-HT40, Operation frequency: 5755MHz, Channel: 151, Rate: 13.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5754.530	-470	Pass
	0	5754.532	-468	Pass
	+20	5754.800	-200	Pass
	+40	5754.641	-359	Pass
	+60	5754.623	-377	Pass
4.25	+20	5754.705	-295	Pass
5.75	+20	5754.733	-267	Pass

Model: 802.11n-HT40, Operation frequency: 5795MHz, Channel: 159, Rate: 13.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5794.524	-476	Pass
	0	5794.523	-477	Pass
	+20	5794.524	-476	Pass
	+40	5794.605	-395	Pass
	+60	5794.569	-431	Pass
4.25	+20	5794.518	-482	Pass
5.75	+20	5794.728	-272	Pass

Model: 802.11ac-HT20, Operation frequency: 5745MHz, Channel: 149, Rate: 6.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5745.037	37	Pass
	0	5745.030	30	Pass
	+20	5745.036	36	Pass
	+40	5745.037	37	Pass
	+60	5745.030	30	Pass
4.25	+20	5745.036	36	Pass
5.75	+20	5745.045	45	Pass

Model: 802.11ac-HT20, Operation frequency: 5825MHz, Channel: 165, Rate: 6.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5785.021	21	Pass
	0	5825.032	32	Pass
	+20	5825.035	35	Pass
	+40	5825.043	43	Pass
	+60	5825.041	41	Pass
4.25	+20	5825.029	29	Pass
5.75	+20	5825.040	40	Pass

Model: 802.11ac-HT40, Operation frequency: 5755MHz, Channel: 151, Rate: 13.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5755.018	18	Pass
	0	5755.027	27	Pass
	+20	5755.032	32	Pass
	+40	5755.039	39	Pass
	+60	5755.022	22	Pass
4.25	+20	5755.041	41	Pass
5.75	+20	5755.033	33	Pass

Model: 802.11ac-HT40, Operation frequency: 5795MHz, Channel: 159, Rate: 13.5Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (KHz)	Result
5	-20	5794.053	-47	Pass
	0	5795.015	15	Pass
	+20	5795.029	29	Pass
	+40	5795.012	12	Pass
	+60	5795.039	39	Pass
4.25	+20	5795.031	31	Pass
5.75	+20	5795.047	47	Pass

Model: 802.11ac-HT80, Operation frequency: 5775MHz, Channel: 155, Rate: 29.3Mbps

Input voltage (VDC)	Temperature (˚C)	Measured Frequency (MHz)	Frequency deviation (Hz)	Result
5	-20	5775.020	20	Pass
	0	5775.029	29	Pass
	+20	5775.037	37	Pass
	+40	5775.041	41	Pass
	+60	5775.039	39	Pass
4.25	+20	5775.032	32	Pass
5.75	+20	5775.035	35	Pass

Note: All emissions are maintained within the band of operation under all conditions of normal operation as specified in the user manual. It fulfills the requirement of 15.407(g).

Appendix A: Test equipment list

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	5-Jun-2018	5-Jun-2019
SZ182-02-01	Pulse Power Sensor	Anritsu	MA2411B	1207429	5-Jun-2018	5-Jun-2019
SZ070-24	Open Switch and Control Unit with TS8997 option for power measurement test	R&S	OSP120+B157	--	29-Oct-2018	29-Oct-2019
SZ061-03	BiConiLog Antenna	ETS	3142C	00078828	16-Oct-2018	16-Oct-2019
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	11-May-2018	11-May-2019
SZ061-09	Horn Antenna	ETS	3115	00092346	16-Oct-2018	16-Oct-2019
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	17-Mar-2018	17-Mar-2019
SZ185-01	EMI Receiver	R&S	ESCI	100547	24-Jan-2018	24-Jan-2019
SZ056-06	Signal Analyzer	R&S	FSV40	101101	5-Jun-2018	5-Jun-2019
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	24-Jan-2018	24-Jan-2019
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	16-Jan-2017	16-Jan-2019
SZ062-02	RF Cable	RADIALL	RG 213U	--	24-Jul-2018	24-Jan-2019
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	31-Aug-2018	28-Feb-2019
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	31-Aug-2018	28-Feb-2019
SZ067-17	Highpass Filter	Wainwright	WHK1.6/15G-10SS	--	28-Dec-2018	28-Dec-2019
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	5-Jun-2018	5-Jun-2019
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	26-Oct-2018	26-Oct-2019
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	04-Jul-2018	04-Jul-2019
SZ188-03	Shielding Room	ETS	RFD-100	4100	16-Jan-2017	16-Jan-2019
SZ016-12	Programmable Temperature & Humidity Chamber	Taili	MHK-120NK	AB0105	24-Jan-2018	24-Jan-2019
SZ006-30	DC Power Supply	Guwei	SPS-3610	GEQ920551	24-Jan-2018	24-Jan-2019

Expanded uncertainty of radiated emission measurement is ±4.9 dB.
Expanded uncertainty of conducted emission measurement is ±3.6 dB.

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