



1 CO-LOCATION

1.1 Transmitter Radiated Unwanted Emissions

1.1.1 Transmitter Radiated Unwanted Emissions Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

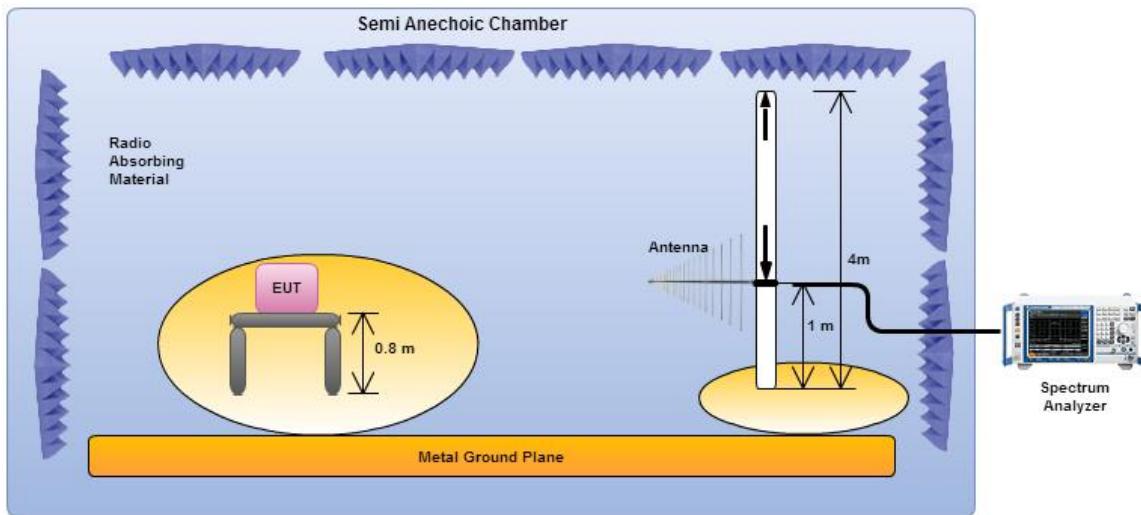
Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30
Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.	
Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.	

**1.1.2 Test Procedures**

Test Method	
<input checked="" type="checkbox"/>	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).
<input checked="" type="checkbox"/>	The average emission levels shall be measured in [duty cycle \geq 98 or duty factor].
<input checked="" type="checkbox"/>	For the transmitter unwanted emissions shall be measured using following options below:
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 and 9.2.1 Option 1 (spectral trace averaging)
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 and 9.2.1 Option 2 (slow sweep speed).
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). $VBW \geq 1/T$, where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.4 and 9.1.1 measurement procedure peak limit.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.3 measurement procedure Quasi-Peak limit.
<input checked="" type="checkbox"/>	For radiated measurement, refer as FCC KDB 558074, clause 12.1.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m.
<input type="checkbox"/>	For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.
	<input type="checkbox"/> For conducted unwanted emissions into non-restricted bands (relative emission limits). Devices with multiple transmit chains: Refer as FCC KDB 662911, when testing out-of-band and spurious emissions against relative emission limits, tests may be performed on each output individually without summing or adding 10 log(N) if the measurements are made relative to the in-band emissions on the individual outputs.
	<input type="checkbox"/> For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB

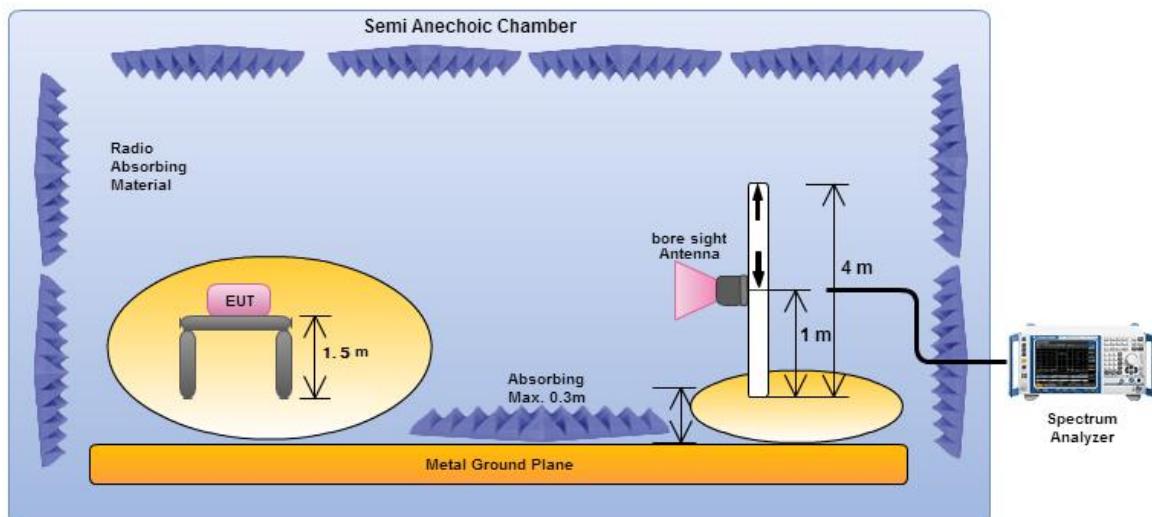
1.1.3 Test Setup

Transmitter Radiated Unwanted Emissions (below 1GHz)



Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna.

Transmitter Radiated Unwanted Emissions (Above 1GHz)



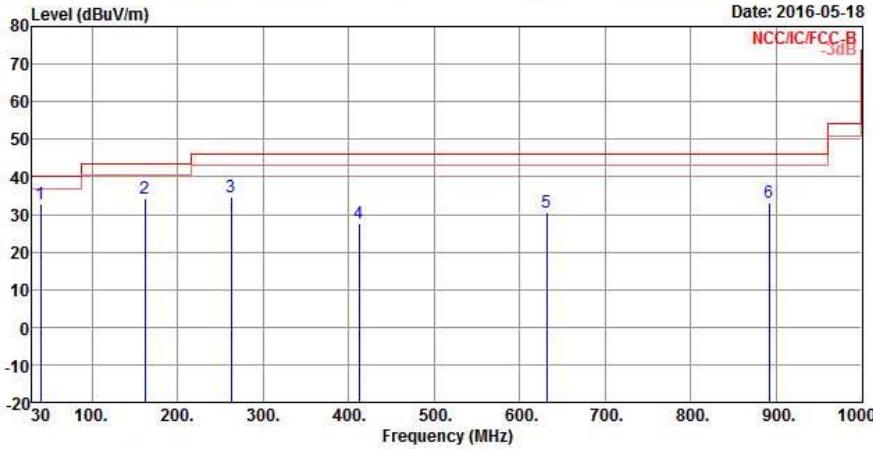
Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

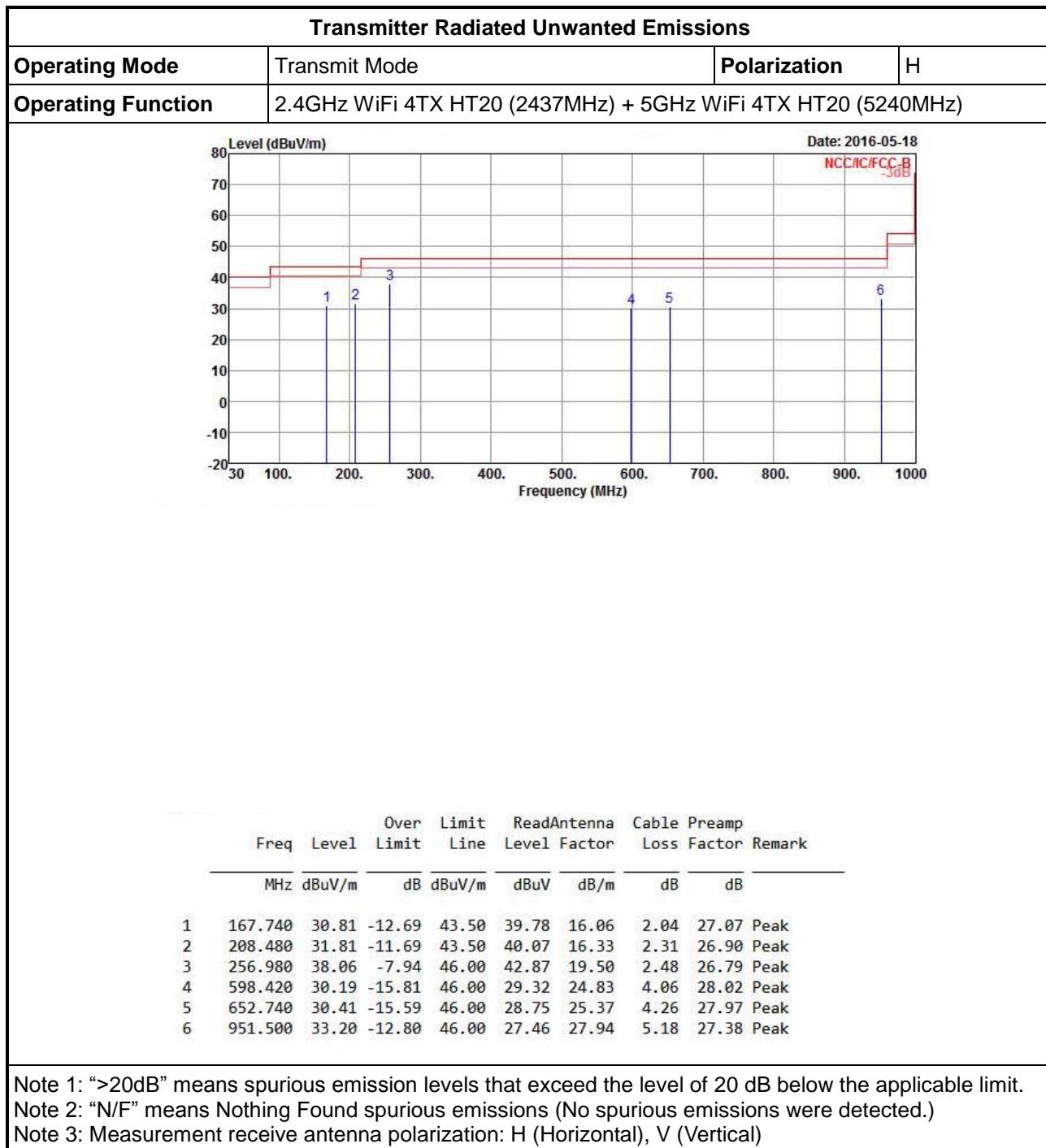
1.1.4 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.



1.1.5 Results of Radiated Emissions (30MHz~1GHz)

Transmitter Radiated Unwanted Emissions																																																																																
Operating Mode	Transmit Mode				Polarization	V																																																																										
Operating Function	2.4GHz WiFi 4TX HT20 (2437MHz) + 5GHz WiFi 4TX HT20 (5240MHz)																																																																															
																																																																																
<table><thead><tr><th>Freq</th><th>Level</th><th>Over Limit</th><th>Line</th><th>Read</th><th>Antenna Factor</th><th>Cable Loss</th><th>Preamp Factor</th><th>Remark</th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th></th></tr></thead><tbody><tr><td>1</td><td>39.700</td><td>32.72</td><td>-7.28</td><td>40.00</td><td>39.66</td><td>19.69</td><td>0.90</td><td>27.53 Peak</td></tr><tr><td>2</td><td>161.920</td><td>34.32</td><td>-9.18</td><td>43.50</td><td>43.08</td><td>16.34</td><td>2.00</td><td>27.10 Peak</td></tr><tr><td>3</td><td>262.800</td><td>34.73</td><td>-11.27</td><td>46.00</td><td>39.36</td><td>19.65</td><td>2.50</td><td>26.78 Peak</td></tr><tr><td>4</td><td>412.180</td><td>27.68</td><td>-18.32</td><td>46.00</td><td>28.73</td><td>22.50</td><td>3.28</td><td>26.83 Peak</td></tr><tr><td>5</td><td>631.400</td><td>30.40</td><td>-15.60</td><td>46.00</td><td>29.04</td><td>25.17</td><td>4.18</td><td>27.99 Peak</td></tr><tr><td>6</td><td>891.360</td><td>33.22</td><td>-12.78</td><td>46.00</td><td>28.41</td><td>27.45</td><td>4.90</td><td>27.54 Peak</td></tr></tbody></table>									Freq	Level	Over Limit	Line	Read	Antenna Factor	Cable Loss	Preamp Factor	Remark	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		1	39.700	32.72	-7.28	40.00	39.66	19.69	0.90	27.53 Peak	2	161.920	34.32	-9.18	43.50	43.08	16.34	2.00	27.10 Peak	3	262.800	34.73	-11.27	46.00	39.36	19.65	2.50	26.78 Peak	4	412.180	27.68	-18.32	46.00	28.73	22.50	3.28	26.83 Peak	5	631.400	30.40	-15.60	46.00	29.04	25.17	4.18	27.99 Peak	6	891.360	33.22	-12.78	46.00	28.41	27.45	4.90	27.54 Peak
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1.1.6 Results for Radiated Emissions (1GHz~10th Harmonic)

Transmitter Radiated Unwanted Emissions																																		
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Freq	Level	Over Limit	Limit	Read		Antenna	Cable	Preamp	Loss	Factor																								
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MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB			Remark																								
1	4874.000	45.00	-9.00	54.00	37.58	33.16	6.79	32.53	32.78	Average																								
2	4874.000	59.30	-14.70	74.00	51.88	33.16	6.79	32.53	32.78	Peak																								
3	7311.000	48.76	-5.24	54.00	37.64	36.01	7.91	32.80	32.80	Average																								
4	7311.000	61.48	-12.52	74.00	50.36	36.01	7.91	32.80	32.80	Peak																								
5	9748.000	60.11	-8.09	68.20	46.16	38.42	8.75	33.22	33.22	Peak																								
6	10480.000	64.73	-3.47	68.20	49.79	38.90	8.82	32.78	32.78	Peak																								
7	15720.000	45.80	-8.20	54.00	31.28	37.45	9.46	32.39	32.39	Average																								
8	15720.000	61.13	-12.87	74.00	46.61	37.45	9.46	32.39	32.39	Peak																								

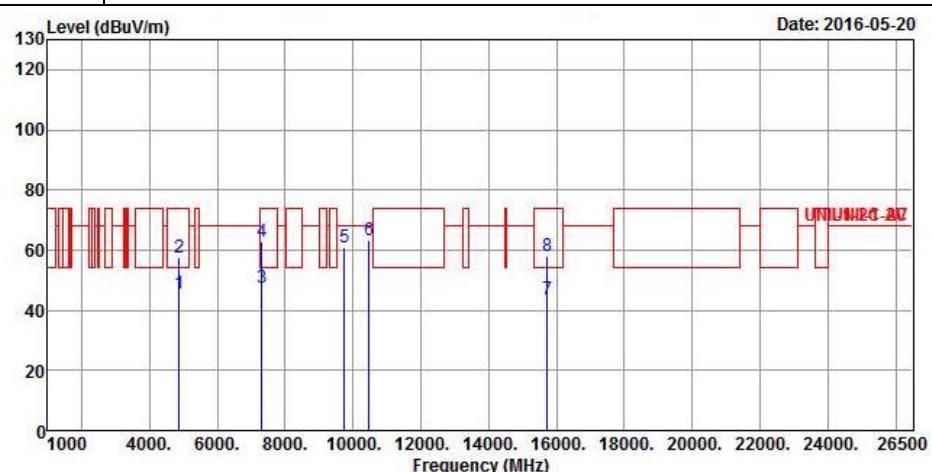
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Transmitter Radiated Unwanted Emissions

Operating Function 2.4GHz WiFi 4TX HT20 (2437MHz) + 5GHz WiFi 4TX HT20 (5240MHz)

Polarization H



Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Remark
		Limit	Line	Antenna	Level	Factor	Loss	
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1 4874.000	45.62	-8.38	54.00	38.20	33.16	6.79	32.53	Average
2 4874.000	57.59	-16.41	74.00	50.17	33.16	6.79	32.53	Peak
3 7311.000	47.61	-6.39	54.00	36.49	36.01	7.91	32.80	Average
4 7311.000	62.90	-11.10	74.00	51.78	36.01	7.91	32.80	Peak
5 9748.000	61.08	-7.12	68.20	47.13	38.42	8.75	33.22	Peak
6 10480.000	63.28	-4.92	68.20	48.34	38.90	8.82	32.78	Peak
7 15720.000	43.79	-10.21	54.00	29.27	37.45	9.46	32.39	Average
8 15720.000	57.87	-16.13	74.00	43.35	37.45	9.46	32.39	Peak

Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 30 dB relative to the maximum measured in-band level.



2 TEST EQUIPMENT AND CALIBRATION DATA

< Radiated Emission >

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Nov. 28, 2015	Nov. 27, 2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz ~ 18GHz 3m	Dec. 16, 2015	Dec. 15, 2016
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 10, 2016	May 09, 2017
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Sep. 02, 2015	Sep. 01, 2016
Spectrum	R&S	FSV40	101513	9kHz ~ 40GHz	Feb. 16, 2016	Feb. 15, 2017
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 18, 2015	Sep. 17, 2016
Horn Antenna	SCHWARZBECK	BBHA9120D	1531	1GHz ~ 18GHz	Apr. 22, 2016	Apr. 21, 2017
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 29, 2016	Jan. 28, 2017