

TEST REPORT

FCC Standards : FCC 47CFR part 15 subpart C
Industry Canada Standards :RSS-247 Issue 1 & RSS-GEN Issue 4

Test Report No. : CTK-2016-00003
Date of Issue : 2016-01-02
FCC ID : A3LWCK720Q
Certification Number IC : 649E-WCK720Q
Model/Type No. : WCK720Q
Kind of Product : Wi-Fi/BT Transceiver
Applicant : Samsung Electronics Co., Ltd.
Applicant Address : 129, Samsung-ro Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea, 16677
Manufacturer : Samsung Electronics Co., Ltd.
Manufacturer Address : 19 Chapin Rd., Building D Pine Brook, New Jersey, United States, 07058
Factory #1 : WISOL CO., LTD.
Factory Address : 531-7 Gajang-ro, Osan-si, Gyeonggi-do, Korea
Factory #2 : WISOL HANOI CO., LTD.
Factory Address : 26, ROAD 05, VSIP, PHU CHAN COMMUNE, TU SON DISTRICT, BAC NINH PROVINCE, VIETNAM
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Telephone : +82-31-277-2688
Received Date : 2015-12-09
Test period : Start : 2015-12-18 End : 2016-01-02

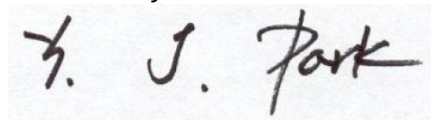
The test results presented in this report relate only to the object tested.

Tested by



Won-Jae, Hwang
Test Engineer
Date: 2016-01-02

Reviewed by



Young-Joon, Park
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Date: 2016-01-02

REPORT REVISION HISTORY

Date	Revision	Page No
2016-01-02	Issued (CTK-2016-00003)	All

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TABLE OF CONTENTS

REPORT REVISION HISTORY	2
1.0 General Product Description	4
1.1 Tested Frequency	5
1.2 Device Modifications	5
1.3 Peripheral Devices	5
1.4 Calibration Details of Equipment Used for Measurement	5
1.5 Test Facility	5
1.6 Laboratory Accreditations and Listings	6
2 Summary of tests	7
2.1 Technical Characteristic Test	8
2.1.1 ON Time, Duty Cycle	8
2.1.2 6dB Bandwidth and 99% Bandwidth	9
2.1.3 OUTPUT POWER	15
2.1.4 Power Spectral Density	21
2.1.5 Band - edge	27
2.1.6 Field Strength of Emissions	35
Test Data	39
2.1.7 AC Conducted Emissions	48
APPENDIX A – Test Equipment Used For Tests	51

1.0 General Product Description

Equipment model name	WCK720Q				
Serial number	Prototype				
EUT condition	Pre-production, not damaged				
Frequency Range	802.11b/g/n_HT20 : 2412 MHz - 2462 MHz 802.11n_HT40 : 2422 MHz - 2452 MHz				
RF output power :					
Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	ANT1 (SISO)	ANT2 (SISO)	ANT1+2 (MIMO)
			RF output power (dBm)		
802.11b	20	2412 - 2462	16.08	-	-
802.11g	20		14.81	13.69	18.06
802.11n_HT20	20		15.21	14.49	17.62
802.11n_HT40	40	2422 - 2452	14.52	13.23	16.93
Number of channels	11				
Transfer Rate	802.11b : 11 / 5.5 / 2 / 1 Mbps 802.11g : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 300 Mbps				
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM				
Power Source	DC 5 V				
Duty Cycle	802.11b : 91.0 % 802.11g : 90.5 % 802.11n_HT20 : 89.8 % 802.11n_HT40 : 91.0 %				
Antenna Type	- Metal Invertes F antenna				
Antenna Gain	COM300A : 1.9 dBi @2.4GHz, 3.9 dBi @5GHz				

* Test mode

The worst-case data rates are determined to be as follows for each mode.

802.11b mode, 1 Mb/s, CCK Modulation

802.11g mode, 6 Mb/s, OFDM Modulation

802.11n HT20 mode and 802.11n HT40 mode, MCS 0, OFDM Modulation

1.1 Tested Frequency

802.11b, 802.11g, 802.11n_HT20

	LOW	MID	HIGH
Frequency (MHz)	2412	2437	2462

802.11n_HT40

	LOW	MID	HIGH
Frequency (MHz)	2422	2437	2452

1.2 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	Hp	-	-
AC Adapter	Hp	PPP012D-S	-

1.4 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.5 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.6 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

2 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Maximum Output Power	< 1 Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz		C
				C
15.209	Field Strength of Harmonics	15.209(a)	Radiated	C
15.207	AC Conducted Emissions	15.207(a)	Line Conducted	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:

- FCC Part 15.247, ANSI C63.10-2013

The tests were performed according to the method of measurements prescribed in

KDB No.558074 D01 DTS Meas Guidance v03r03

KDB No.662911 D01 Multiple Transmitter Output v02r01

2.1 Technical Characteristic Test

2.1.1 ON Time, Duty Cycle

Procedure:

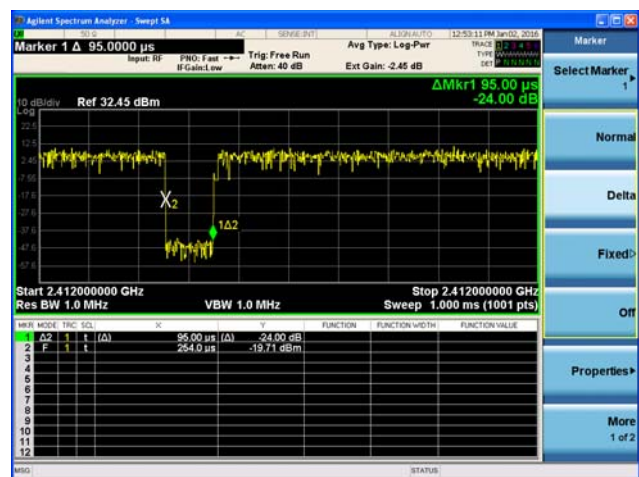
KDB 558074 Zero-Span Spectrum Analyzer Method.

Measurement Data:

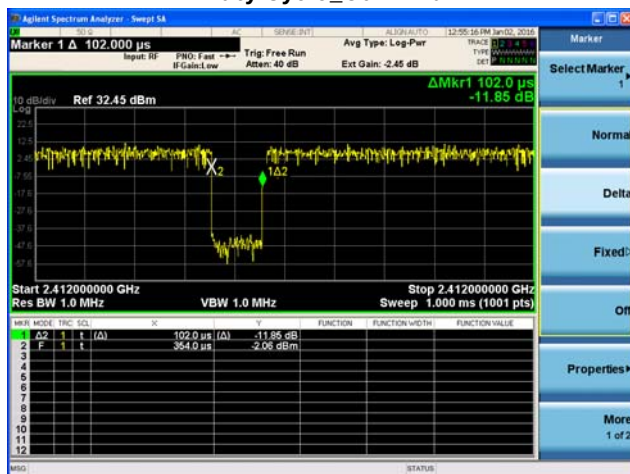
	ON Time (ms)	Period (ms)	TX OFF (ms)	Duty Cycle (linear)	Duty Cycle (%)
802.11b	0.910	1.000	0.090	0.910	91.0
802.11g	0.905	1.000	0.095	0.905	90.5
802.11n_HT20	0.898	1.000	0.102	0.898	89.8
802.11n_HT40	0.910	1.000	0.090	0.910	91.0



Duty Cycle_802.11b



Duty Cycle_802.11g



Duty Cycle_802.11n_HT20



Duty Cycle_802.11n_HT40

2.1.2 6dB Bandwidth and 99 % Bandwidth

Procedure:

The bandwidth at 6dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 50 MHz

VBW = 300 kHz (3 x RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Ant : A1

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Frequency	2412 MHz		2437 MHz		2462 MHz	
Mode	6dB	99%	6dB	99%	6dB	99%
802.11b	8.13	13.44	8.12	13.40	8.11	13.51
802.11g	16.33	16.38	16.32	16.38	16.31	16.36
802.11n HT20	16.86	17.56	16.84	17.57	16.88	17.56
Measurement uncertainty	$\pm 3 \text{ Db}$					

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Frequency	2422 MHz		2437 MHz		2452 MHz	
Mode	6dB	99%	6dB	99%	6dB	99%
802.11n HT40	35.19	36.01	35.49	36.04	35.21	35.99
Measurement uncertainty	$\pm 3 \text{ dB}$					

Ant : A2

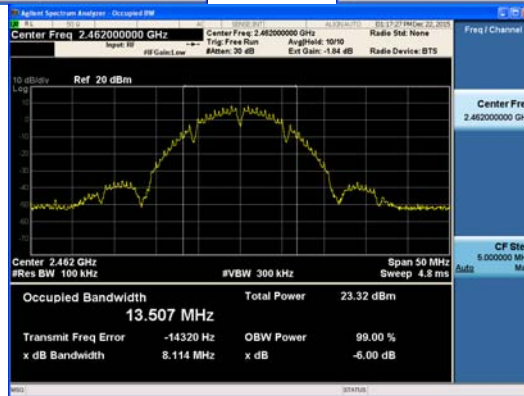
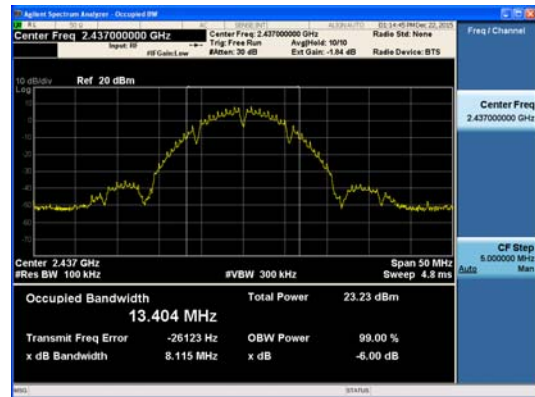
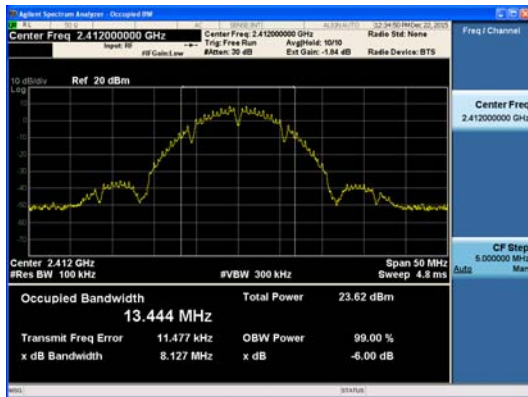
	6 dB Bandwidth and 99% Bandwidth (MHz)					
Frequency	2412 MHz		2437 MHz		2462 MHz	
Mode	6dB	99%	6dB	99%	6dB	99%
802.11g	16.07	16.36	16.32	16.36	16.29	16.36
802.11n HT20	16.87	17.56	16.91	17.56	16.86	17.56
Measurement uncertainty	$\pm 3 \text{ dB}$					

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Frequency	2422 MHz		2437 MHz		2452 MHz	
Mode	6dB	99%	6dB	99%	6dB	99%
802.11n HT40	35.21	36.00	35.35	35.99	35.51	36.04
Measurement uncertainty	$\pm 3 \text{ dB}$					

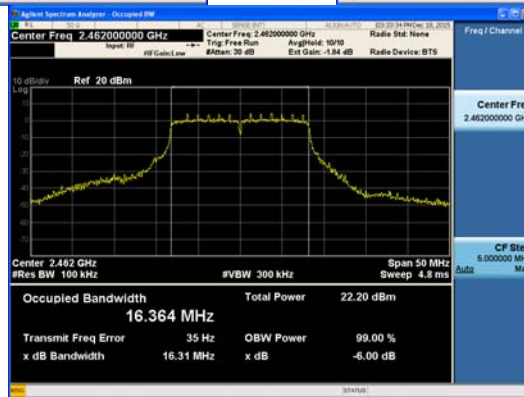
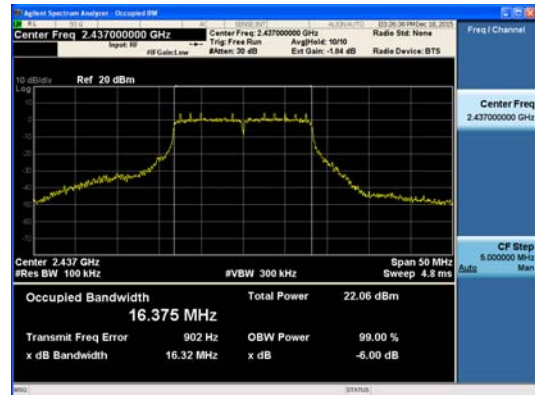
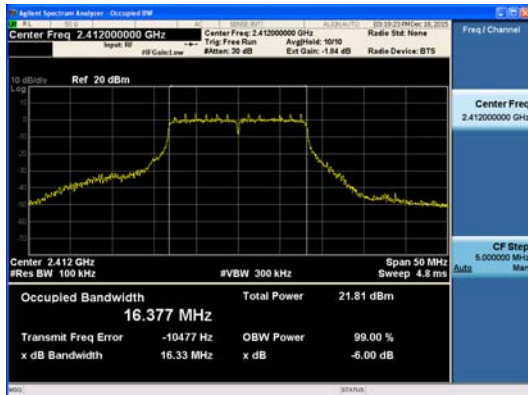
Minimum Standard:

6 dB Bandwidth > 500kHz

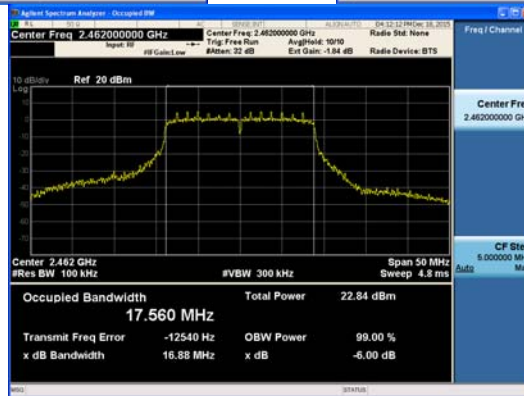
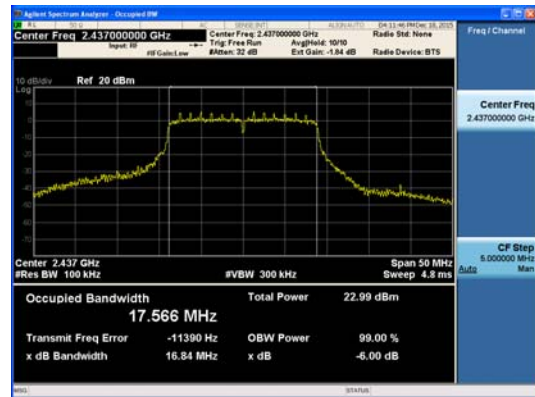
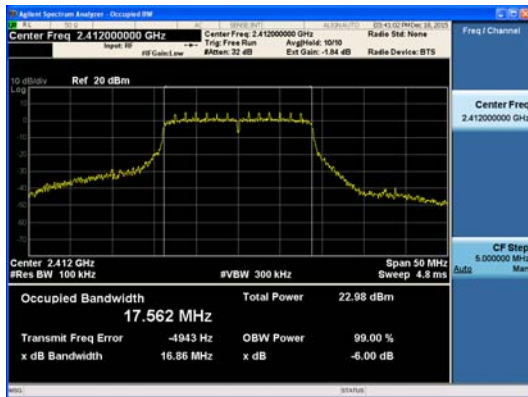
See next pages for actual measured spectrum plots.



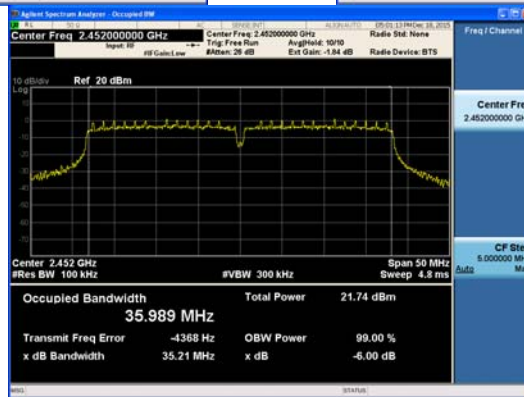
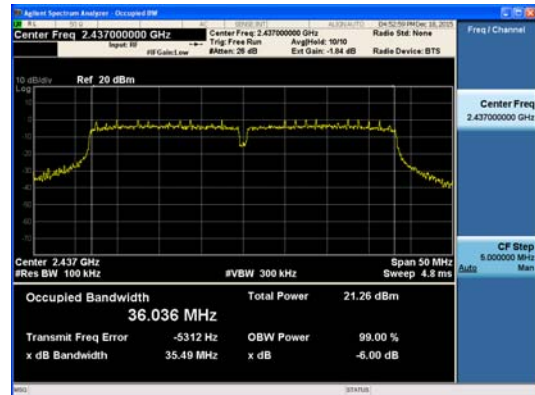
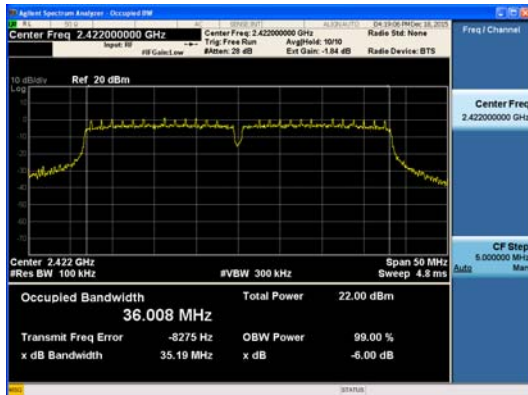
Ant : A1_802.11b



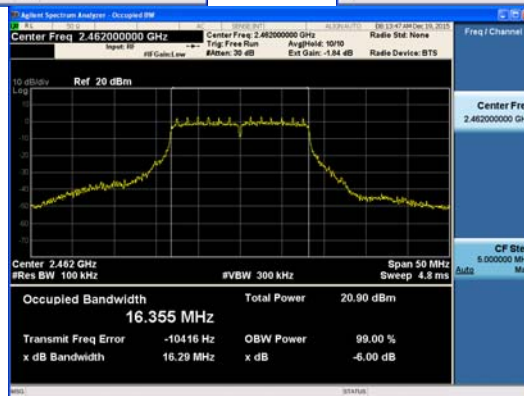
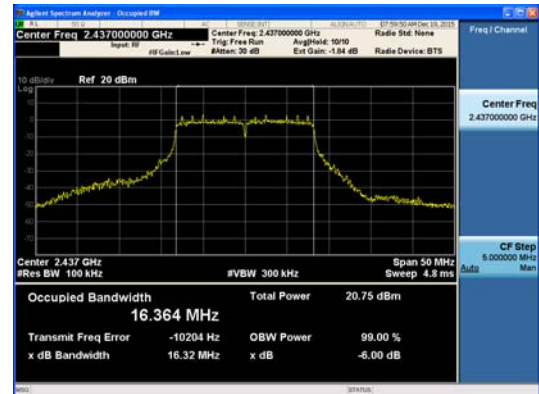
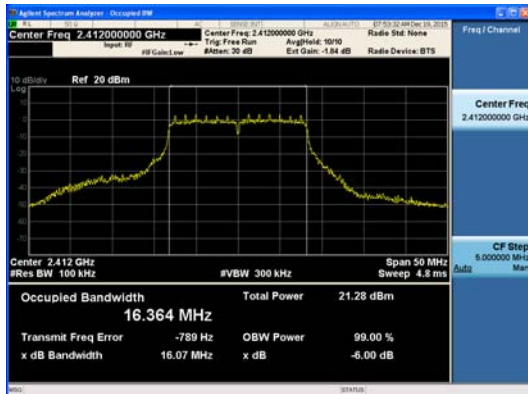
Ant : A1_802.11g



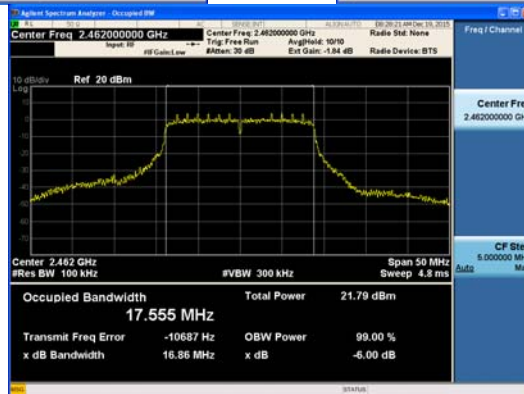
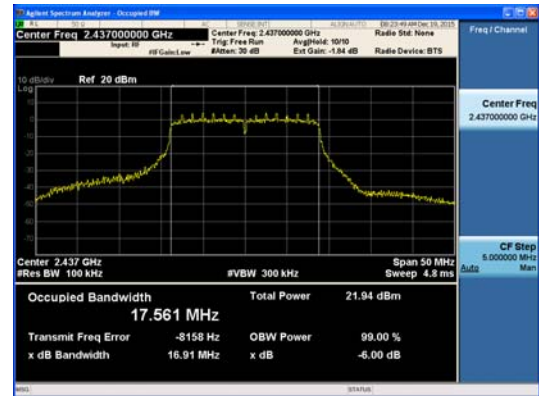
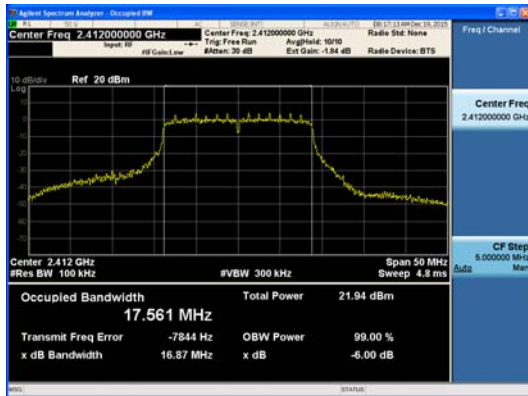
Ant : A1_802.11n_HT20



Ant : A1_802.11n_HT40



Ant : A2_802.11g



Ant : A2_802.11n_HT20



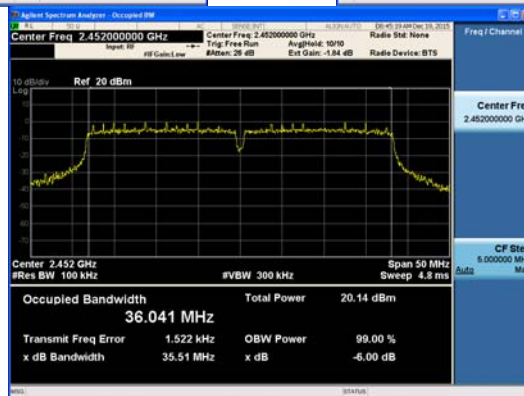
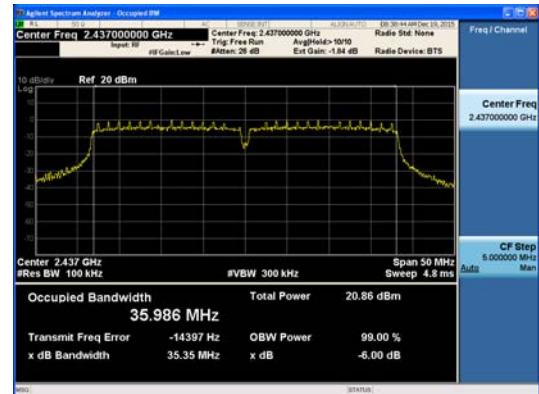
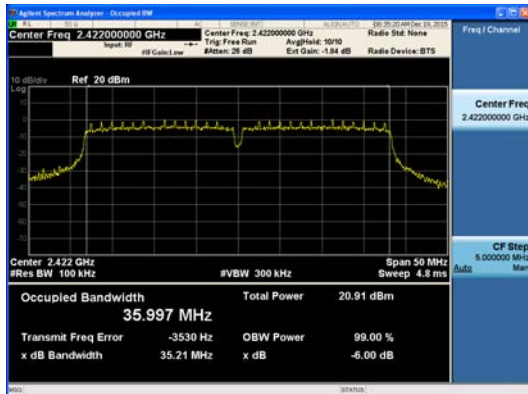
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Ant : A2_802.11n_HT40

2.1.3 OUTPUT POWER

Test Location

RF Test Room

Test Procedures

Average Power(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-1)

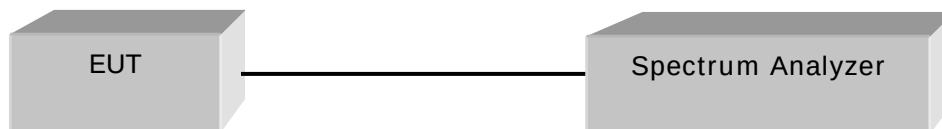
The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

The EUT supports multiple transmit chains.

Refer as FCC KDB 662911 D01 Multiple Transmitter Output v02r01, power measurements. The measure-and-sum technique shall be used for measuring in-band transmit power of a device. Total power is the sum of the conducted power levels measured at the various output ports.

Multiple transmit chains, Total power calculation could be following as methods:

$$P_{total} = P_1 + P_2 + \dots + P_n$$



The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1 MHz

Span = about 36 MHz, 50 MHz

VBW = 3 MHz (3 x RBW)

Sweep = auto

Trace = average at least 100

Detector function = RMS

Limit

Operating Mode	Mode	ANT Configuration	ANT G_{ANT} (dBi)	Limit (dBm)	
				FCC	IC
SISO	802.11b/g/n_20/n_40	ANT1	1.9	30	36
SISO	802.11b/g/n_20/n_40	ANT2	1.9	30	36
MIMO (2Tx)	802.11g/n_20/n_40	ANT1 + ANT2	4.91	30	36

Note 1 : For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:

Any transmit signals are correlated, Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi

All transmit signals are completely uncorrelated, Directional gain = G_{ANT}

Test Results

Ant : A1

	Measured Output Power (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11b	16.08	15.94	15.97
802.11g	14.34	14.81	14.74
802.11n HT20	15.21	15.05	15.20
Measurement uncertainty	± 3 dB		

	Measured Output Power (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	14.13	14.52	13.96
Measurement uncertainty	± 3 dB		

Ant : A2

	Measured Output Power (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11g	13.69	13.49	13.38
802.11n HT20	14.49	14.39	14.35
Measurement uncertainty	± 3 dB		

	Measured Output Power (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	13.18	13.23	13.18
Measurement uncertainty	± 3 dB		

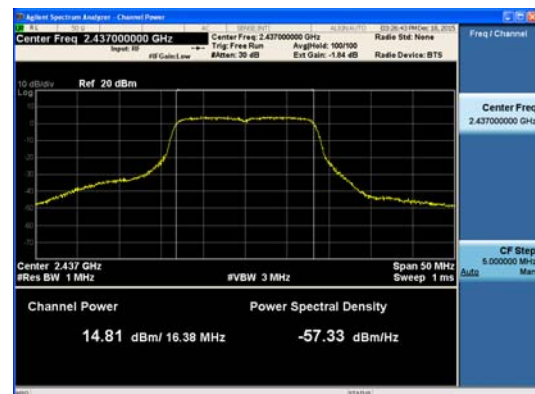
Ant : A1 + A2

	Measured Output Power (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11g	18.06	17.90	17.88
802.11n HT20	17.43	17.62	17.56
Measurement uncertainty	± 3 dB		

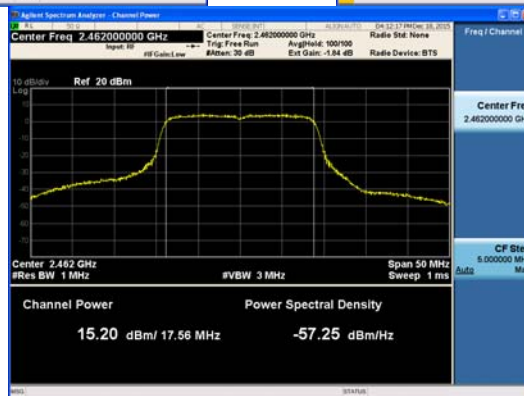
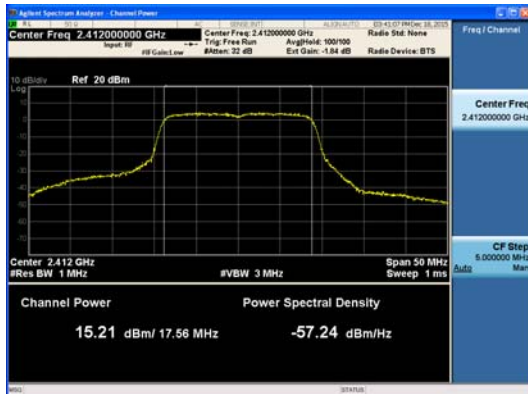
	Measured Output Power (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	16.69	16.93	16.60
Measurement uncertainty	± 3 dB		



Ant : A1_802.11b



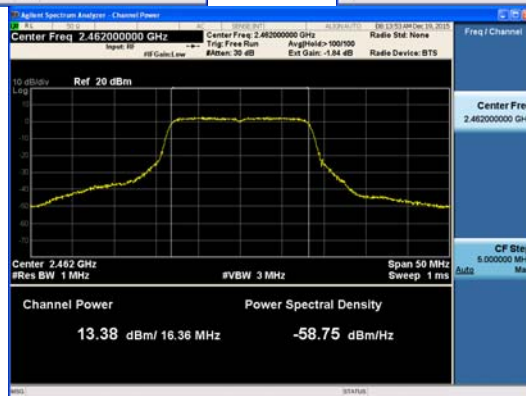
Ant : A1_802.11g



Ant : A1_802.11n_HT20



Ant : A1_802.11n_HT40



Ant : A2_802.11g



Ant : A2_802.11n_HT20



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Ant : A2_802.11n_HT40

2.1.4 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The EUT supports multiple transmit chains.

Refer as FCC KDB 662911 D01 Multiple Transmitter Output v02r01, power measurements.

The measure-and-sum technique shall be used for measuring in-band transmit power of a device. Total power is the sum of the conducted power levels measured at the various output ports.

Multiple transmit chains, Total power calculation could be following as methods:

$$PPSD_{total} = PPSD_1 + PPSD_2 + \dots + PPSD_n$$

The spectrum analyzer is set to:

RBW = 3 kHz

VBW = 10 kHz

Sweep = Auto

Span = 20 MHz

Detector function = peak

Trace = max hold

Limit

Operating Mode	Mode	ANT Configuration	ANT G_{ANT} (dBi)	Limit (dBm)
				FCC, IC
SISO	802.11b/g/n 20/n 40	ANT1	1.9	8
SISO	802.11b/g/n 20/n 40	ANT2	1.9	8
MIMO (2Tx)	802.11g/n 20/n 40	ANT1 + ANT2	4.91	8

Note 1 : For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:

Any transmit signals are correlated, Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi

All transmit signals are completely uncorrelated, Directional gain = G_{ANT}

Test Results

Ant : A1

	Measured Power Density (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11b	-11.11	-11.43	-11.51
802.11g	-14.43	-13.99	-14.07
802.11n HT20	-13.74	13.78	13.59
Measurement uncertainty	± 3 dB		

	Measured Power Density (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	-17.14	-16.57	-16.84
Measurement uncertainty	± 3 dB		

Ant : A2

	Measured Power Density (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11g	-15.08	-15.28	-15.26
802.11n HT20	-14.23	-14.12	-14.51
Measurement uncertainty	± 3 dB		

	Measured Power Density (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	-17.47	-17.21	-17.52
Measurement uncertainty	± 3 dB		

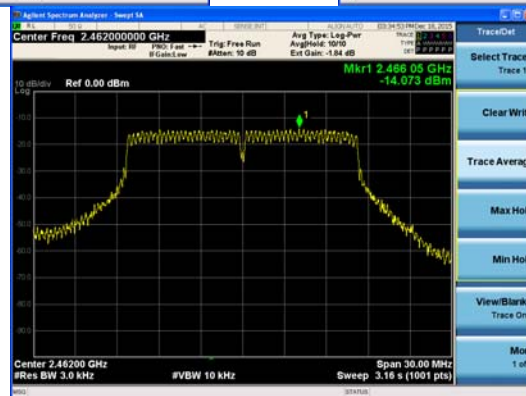
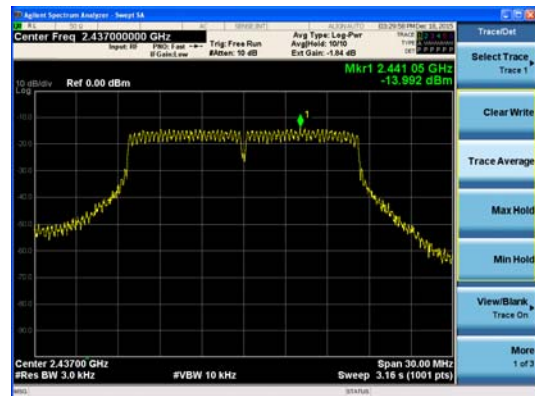
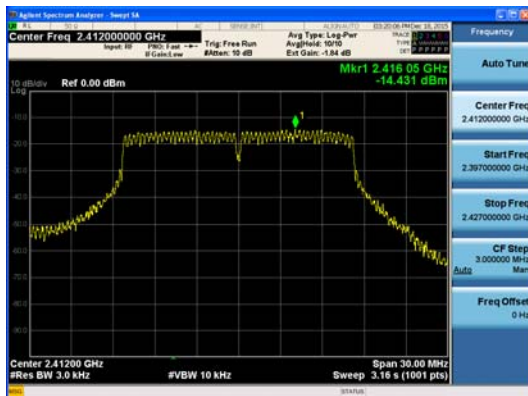
Ant : A1 + A2

	Measured Power Density (dBm)		
Mode	2412 MHz	2437 MHz	2462 MHz
802.11g	-9.65	-9.93	-9.98
802.11n HT20	-11.32	-11.04	-11.27
Measurement uncertainty	± 3 dB		

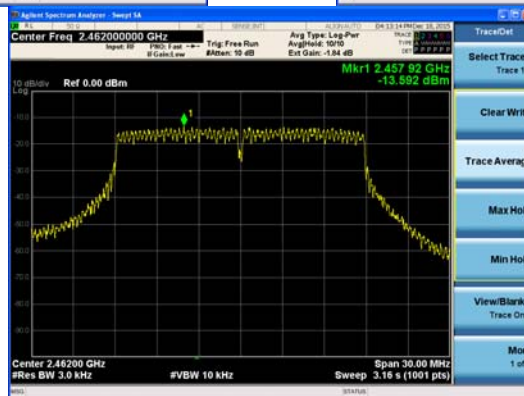
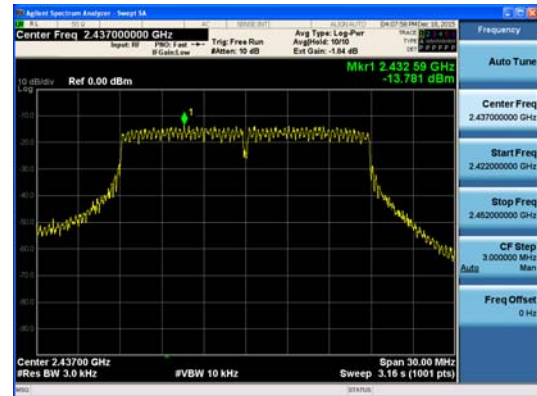
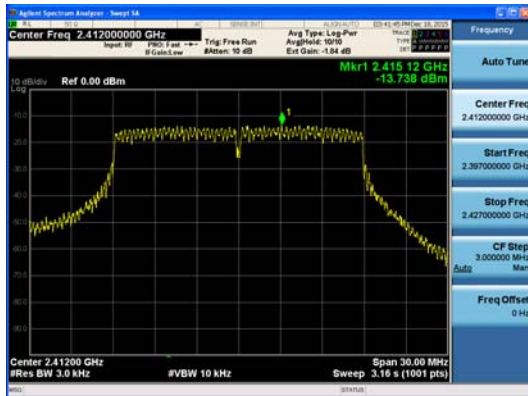
	Measured Power Density (dBm)		
Mode	2422 MHz	2437 MHz	2452 MHz
802.11n HT40	-14.29	-13.87	-14.16
Measurement uncertainty	± 3 dB		



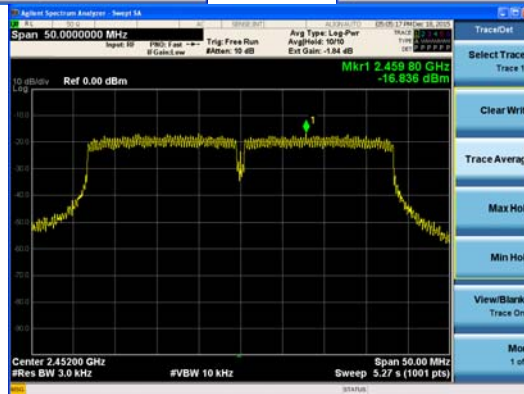
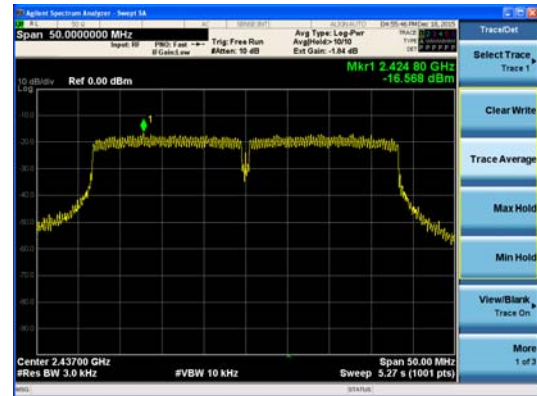
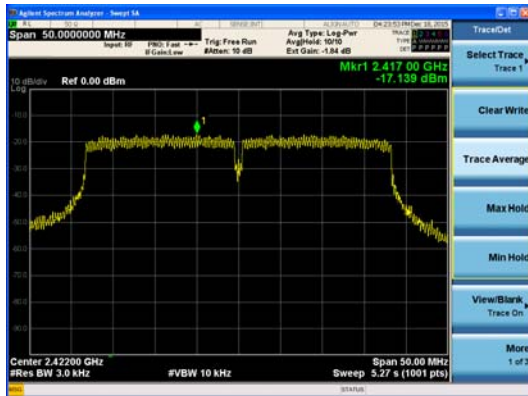
Ant : A1_802.11b



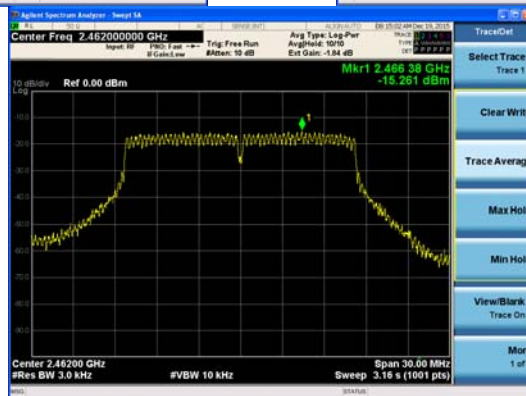
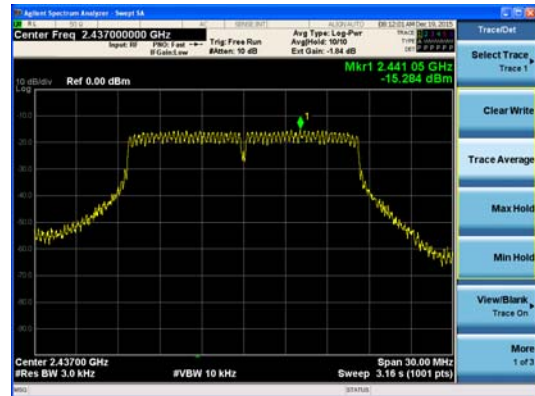
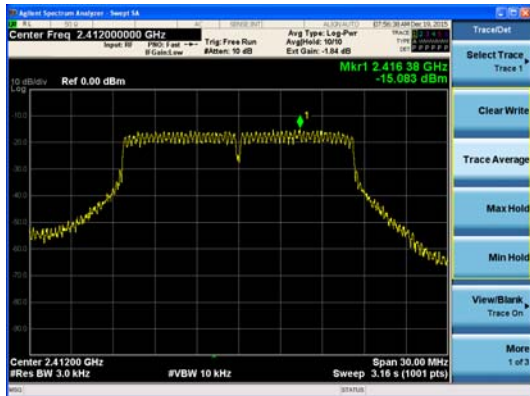
Ant : A1_802.11g



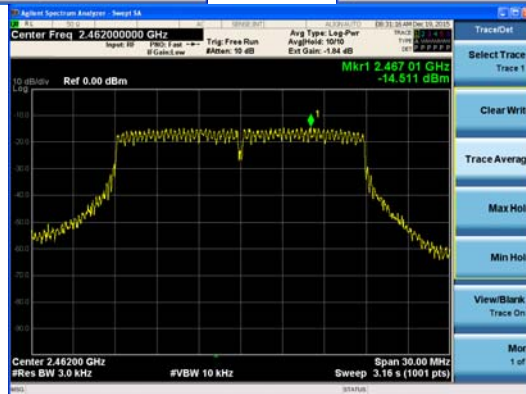
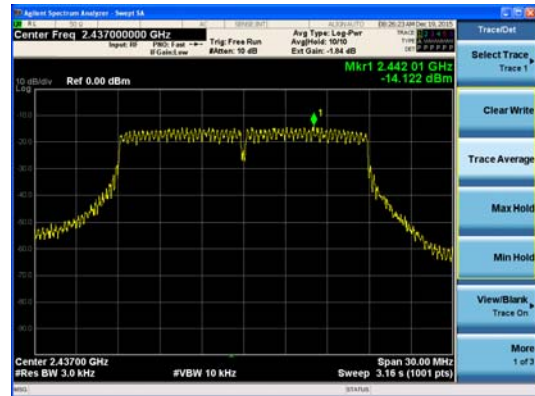
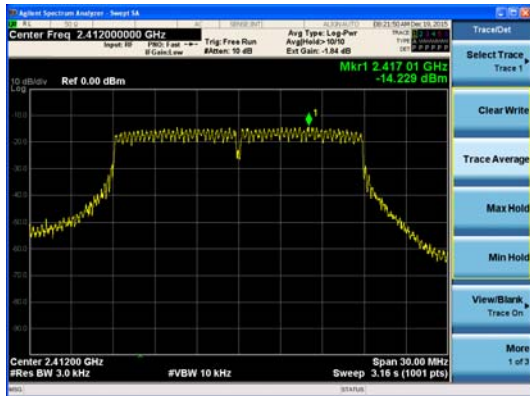
Ant : A1_802.11n_HT20



Ant : A1_802.11n_HT40



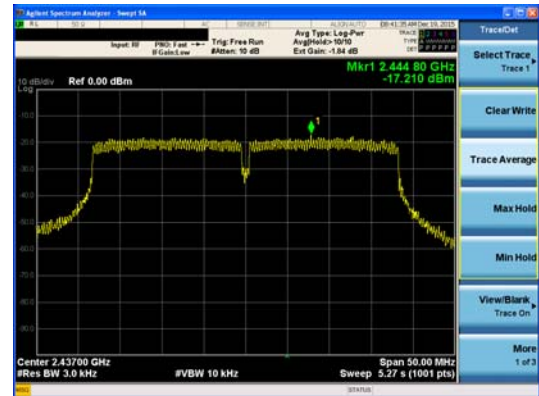
Ant : A2_802.11g



Ant : A2_802.11n_HT20



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2.1.5 Band - edge

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 300 kHz

Span = 50 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

Minimum Standard:	> 20 dBc
--------------------------	----------

See next pages for actual measured spectrum plots.

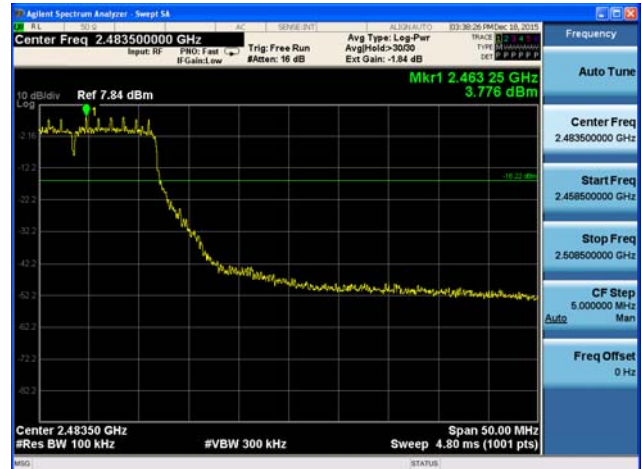


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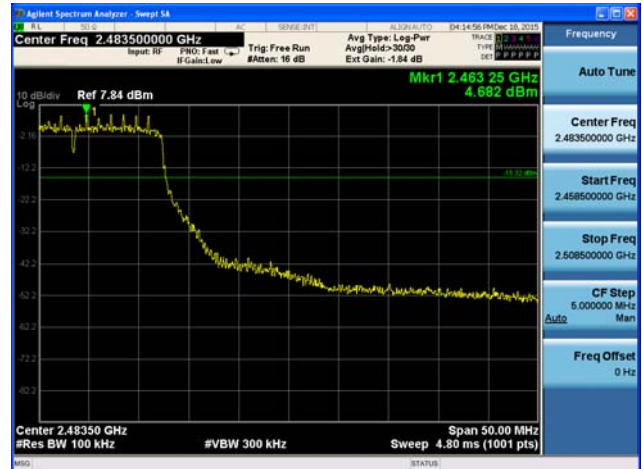
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Ant : A1_802.11b



Ant : A1_802.11g



Ant : A1_802.11n_HT20



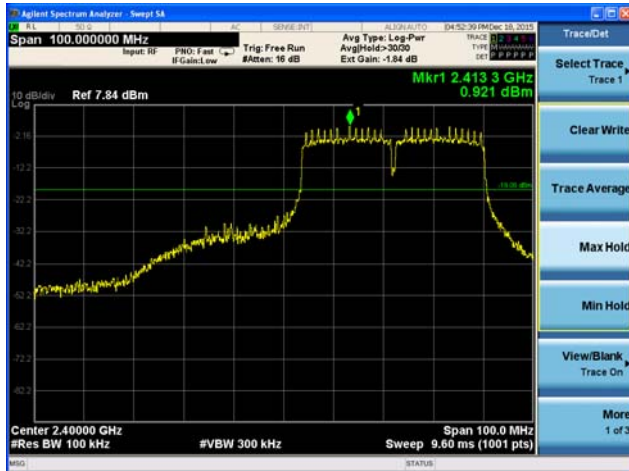
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Tel: +82-31-339-9970 Fax: +82-31-624-9501

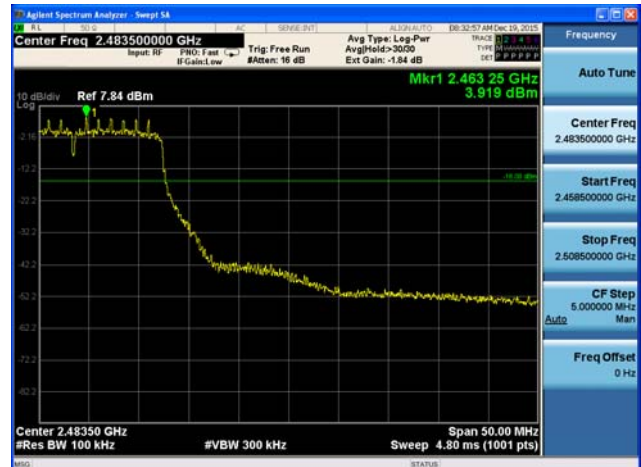
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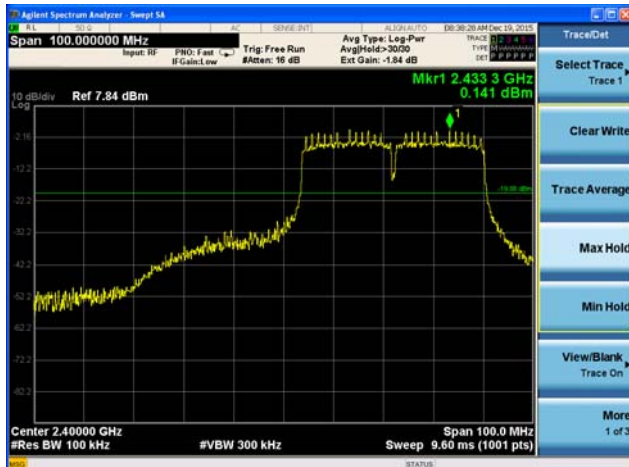
Ant : A1_802.11n_HT40



Ant : A2_802.11g



Ant : A2_802.11n_HT20



Ant : A2_802.11n_HT40

2.1.6 Field Strength of Emissions

Test Location

- ☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10th harmonic)
RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
VBW $\geq$ RBW
Sweep = auto

Limit

- 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

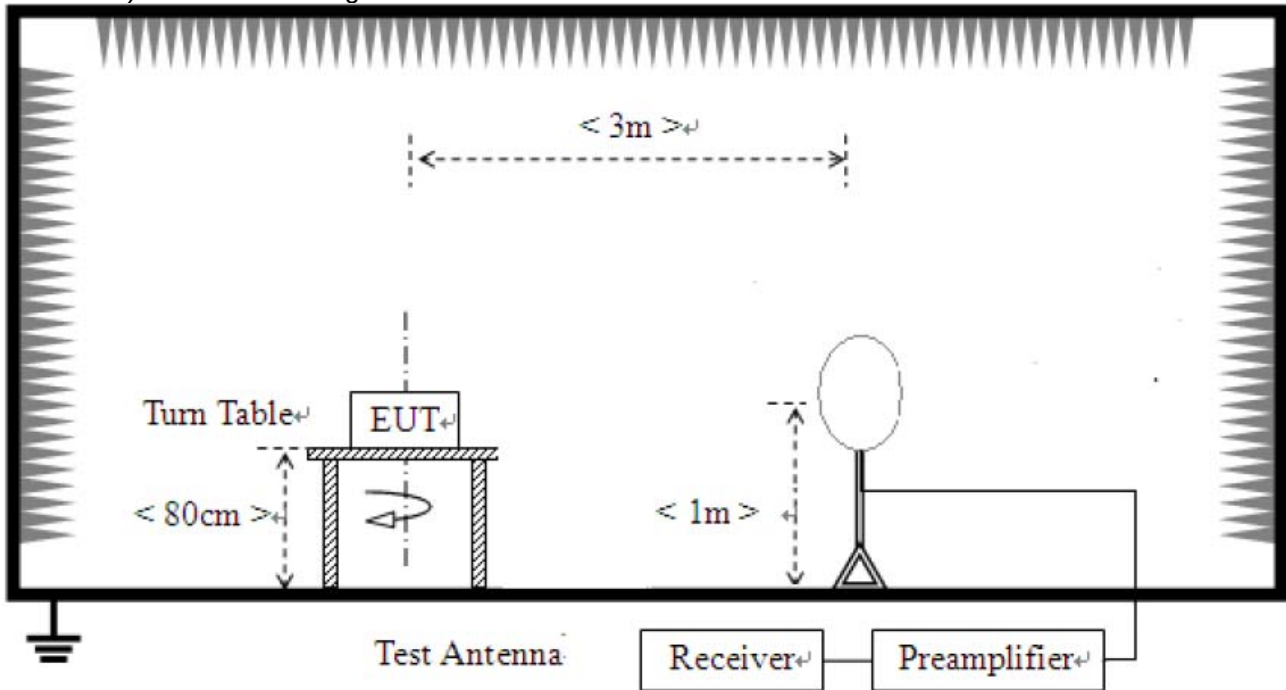
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

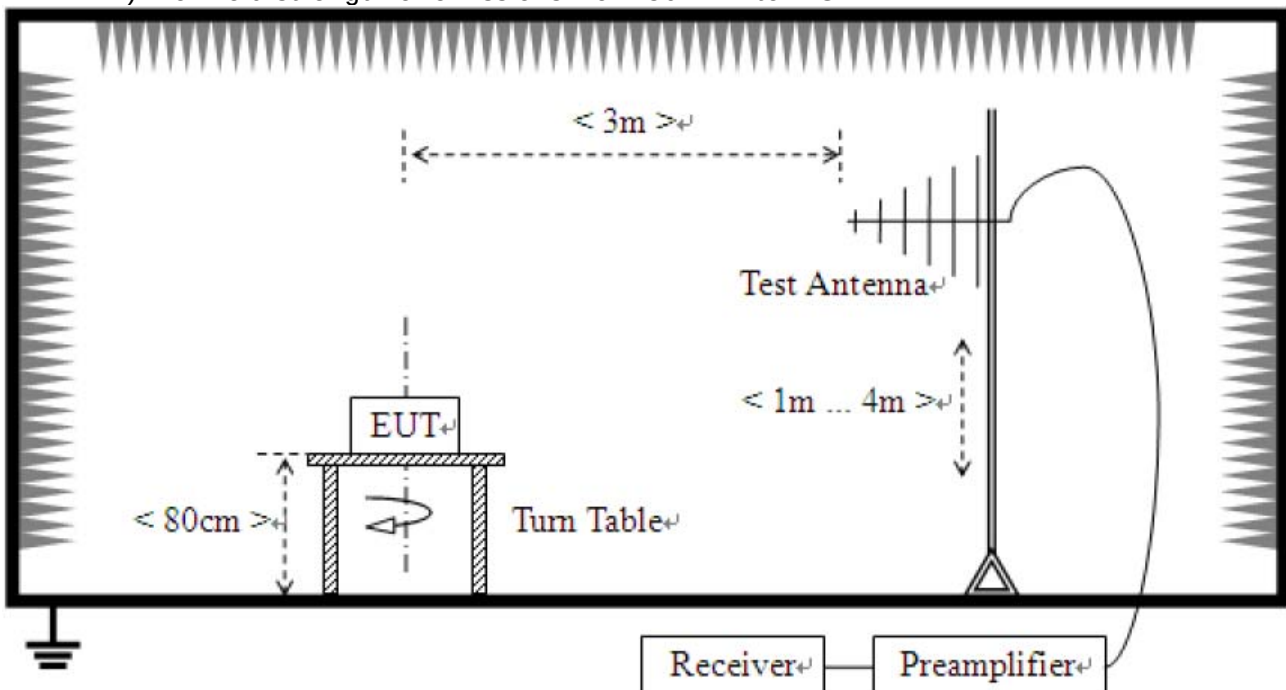
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)

Test Setup:

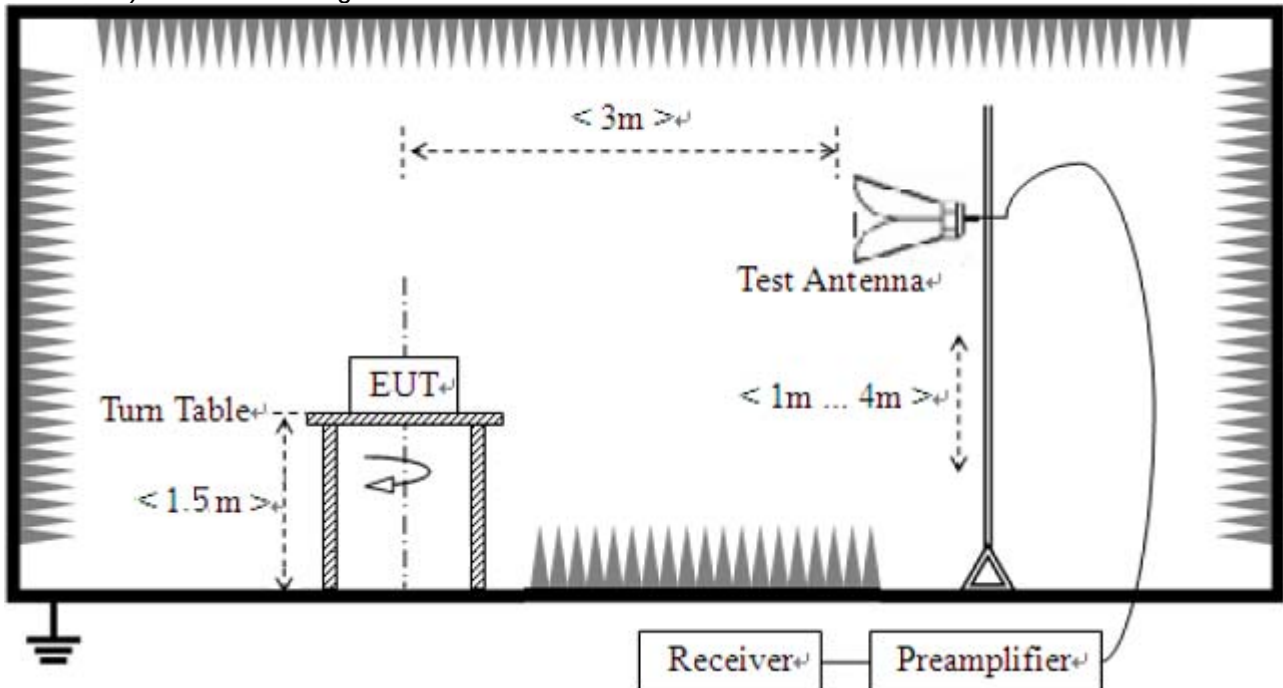
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test Mode

The worst-case antenna configuration are determined to be as follows for each mode.

- 802.11b mode : ANT1 (SISO)
- 802.11g mode : ANT1 + ANT2
- 802.11n HT20 mode : ANT1 + ANT2
- 802.11n HT40 mode : ANT1 + ANT2

Test Results

1) 9 kHz to 30 MHz

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	9 kHz – 30 MHz
Test mode	802.11b,802.11g, 802.11n_HT20/ HT40	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBUV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

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

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)

2) 30 MHz to 1 GHz

Test mode : 802.11n

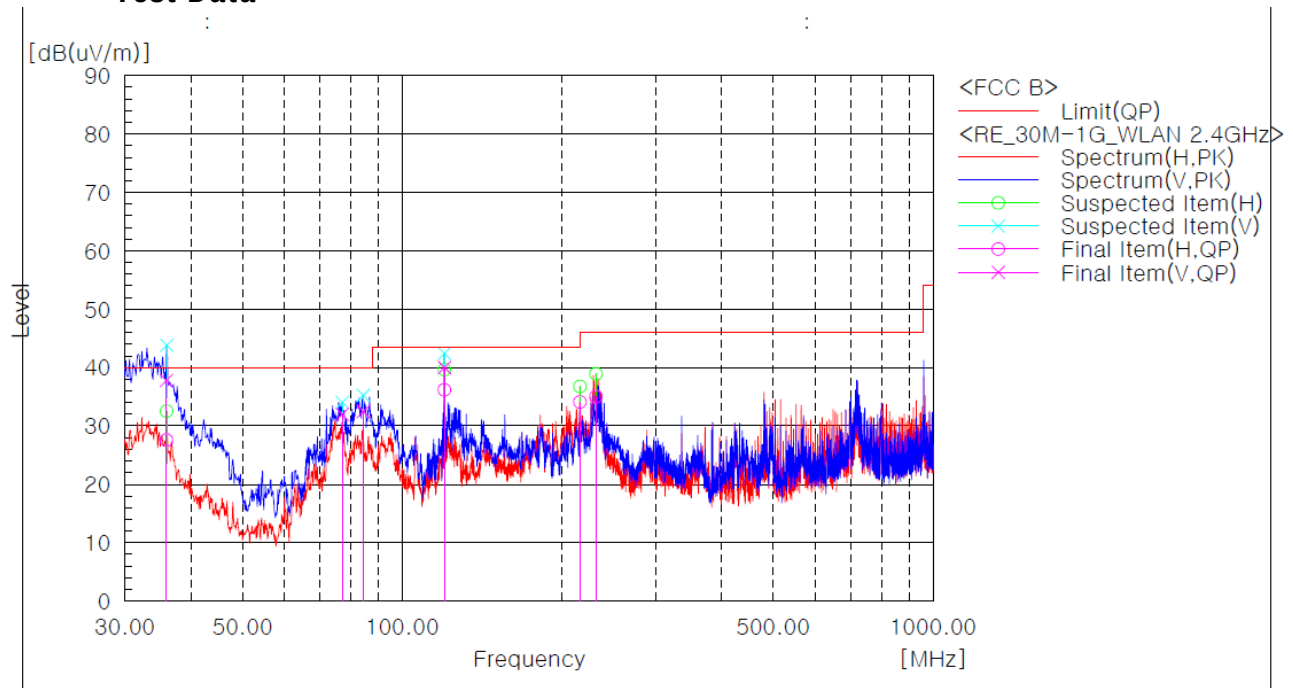
EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	Below 1000MHz
Configuration	ANT A1+A2	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.941	37.8	2.2	Quasi-peak

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	35.941	V	53.6	-15.8	37.8	40.0	2.2	105.0	318.7
2	35.941	H	43.4	-15.8	27.6	40.0	12.4	203.0	334.1
3	77.045	V	51.4	-19.4	32.0	40.0	8.0	107.0	241.4
4	84.320	V	51.5	-19.0	32.5	40.0	7.5	107.0	241.4
5	119.968	V	55.1	-15.1	40.0	43.5	3.5	204.0	225.9
6	119.968	H	51.3	-15.1	36.2	43.5	7.3	294.0	334.1
7	215.998	H	48.5	-14.4	34.1	43.5	9.4	200.0	148.4
8	231.760	H	49.1	-14.1	35.0	46.0	11.0	105.0	4.8

Remark :

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

3) above 1 GHz

Test mode : 802.11b

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
Mode	ANT A1	Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4824.0	43.12	10.88	Average

Ch.1(2412 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4824.0	H	39.40	46.87	3.7	54.00	74.00	43.12	50.59	10.88	23.41
4824.0	V	38.55	46.54	3.7	54.00	74.00	42.27	50.26	11.73	23.74

Ch.6(2437 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4874.0	H	37.08	45.96	3.7	54.00	74.00	40.80	49.68	13.20	24.32
4874.0	V	36.93	45.63	3.7	54.00	74.00	40.65	49.35	13.35	24.65

Ch.11(2462 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4924.0	H	37.08	46.21	3.8	54.00	74.00	40.93	50.06	13.07	23.94
4924.0	V	39.02	46.75	3.8	54.00	74.00	42.87	50.60	11.13	23.40

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2384.0	H	45.69	58.28	-2.6	54.00	74.00	43.08	55.67	10.92	18.33
2385.0	V	40.95	51.86	-2.6	54.00	74.00	38.34	49.25	15.66	24.75
2387.0	H	41.21	55.82	-2.6	54.00	74.00	38.60	53.21	15.40	20.79

Test mode : 802.11g

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
Mode	ANT A1+A2	Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2390.0	47.01	6.99	Average

Ch.1(2412 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4824.0	H	33.53	45.74	3.7	54.00	74.00	37.25	49.46	16.75	24.54
4824.0	V	31.95	46.74	3.7	54.00	74.00	35.67	50.46	18.33	23.54

Ch.6(2437 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4874.0	H	32.87	45.34	3.7	54.00	74.00	36.59	49.06	17.41	24.94
4874.0	V	31.68	45.17	3.7	54.00	74.00	35.40	48.89	18.60	25.11

Ch.11(2462 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4924.0	H	32.75	46.84	3.8	54.00	74.00	36.60	50.69	17.40	23.31
4924.0	V	32.68	46.02	3.8	54.00	74.00	36.53	49.87	17.47	24.13

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.0	H	49.62	65.58	-2.6	54.00	74.00	47.01	62.97	6.99	11.03
2390.0	V	44.06	60.98	-2.6	54.00	74.00	41.45	58.37	12.55	15.63
2390.0	H	44.04	56.74	-2.6	54.00	74.00	41.43	54.13	12.57	19.87
2483.5	H	42.65	56.38	-2.5	54.00	74.00	40.13	53.86	13.87	20.14
2483.5	H	47.44	63.49	-2.5	54.00	74.00	44.92	60.97	9.08	13.03
2483.5	V	43.69	58.88	-2.5	54.00	74.00	41.17	56.36	12.83	17.64

Test mode : 802.11n_HT20

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
Mode	ANT A1+A2	Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2390.0	51.04	2.96	Average

Ch.1(2412 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4824.0	H	33.32	45.69	3.7	54.00	74.00	37.04	49.41	16.96	24.59

Ch.6(2437 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4874.0	H	32.83	45.53	3.7	54.00	74.00	36.55	49.25	17.45	24.75

Ch.11(2462 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4924.0	H	32.73	46.46	3.8	54.00	74.00	36.58	50.31	17.42	23.69

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.0	H	53.65	71.13	-2.6	54.00	74.00	51.04	68.52	2.96	5.48
2390.0	V	47.54	63.85	-2.6	54.00	74.00	44.93	61.24	9.07	12.76
2390.0	H	43.80	58.06	-2.6	54.00	74.00	41.19	55.45	12.81	18.55
2483.5	H	42.54	55.78	-2.5	54.00	74.00	40.02	53.26	13.98	20.74
2390.0	H	40.19	53.63	-2.6	54.00	74.00	37.58	51.02	16.42	22.98
2483.5	H	49.38	66.01	-2.5	54.00	74.00	46.86	63.49	7.14	10.51
2483.5	V	45.19	62.61	-2.5	54.00	74.00	42.67	60.09	11.33	13.91

Test mode : 802.11n_HT40

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
Mode	ANT A1+A2	Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2390.0	53.09	0.91	Average

Ch.1(2422 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
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No emissions were detected at a level greater than 20dB below limit.

Ch.6(2437 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	---------------------	---------------------	------------------	---------------------	---------------------	---------------------	---------------------	----------------	----------------

No emissions were detected at a level greater than 20dB below limit.

Ch.11(2452 MHz)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	---------------------	---------------------	------------------	---------------------	---------------------	---------------------	---------------------	----------------	----------------

No emissions were detected at a level greater than 20dB below limit.

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.0	H	55.70	75.52	-2.6	54.00	74.00	53.09	72.91	0.91	1.09
2390.0	V	50.37	68.59	-2.6	54.00	74.00	47.76	65.98	6.24	8.02
2390.0	H	46.88	70.18	-2.6	54.00	74.00	44.27	67.57	9.73	6.43
2390.0	V	43.22	65.05	-2.6	54.00	74.00	40.61	62.44	13.39	11.56
2390.0	H	42.10	67.73	-2.6	54.00	74.00	39.49	65.12	14.51	8.88
2390.0	V	40.92	64.63	-2.6	54.00	74.00	38.31	62.02	15.69	11.98
2483.5	H	41.65	63.77	-2.5	54.00	74.00	39.1	61.3	14.87	12.75
2483.5	V	39.57	61.44	-2.5	54.00	74.00	37.1	58.9	16.95	15.08
2483.5	H	45.61	66.10	-2.5	54.00	74.00	43.1	63.6	10.91	10.42
2483.5	V	42.57	62.43	-2.5	54.00	74.00	40.1	59.9	13.95	14.09
2483.5	H	51.30	70.83	-2.5	54.00	74.00	48.8	68.3	5.22	5.69
2483.5	V	47.62	68.28	-2.5	54.00	74.00	45.1	65.8	8.90	8.24

Test Results

1) 9 kHz to 30 MHz

Test mode : Receiver

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	9 kHz – 30 MHz
Mode	Receiver	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

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

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)

2) 30 MHz to 1 GHz

Test mode : Receiver

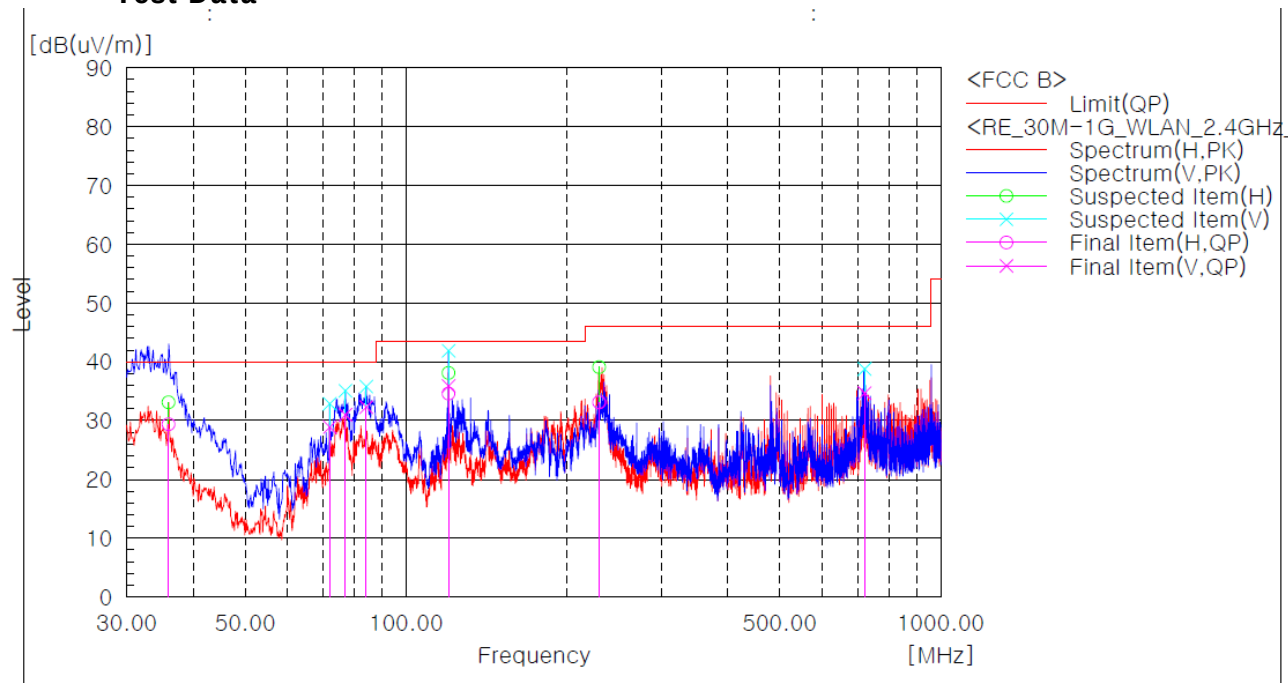
EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	Below 1000MHz
Mode	Receiver	Detector function	Quasi-Peak / Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
84.199	32.3	7.7	Quasi-Peak

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	35.941	H	45.2	-15.8	29.4	40.0	10.6	201.0	343.6
2	71.953	V	47.4	-18.5	28.9	40.0	11.1	105.0	225.5
3	76.924	V	50.4	-19.4	31.0	40.0	9.0	307.0	209.9
4	84.199	V	51.3	-19.0	32.3	40.0	7.7	95.0	225.5
5	119.968	V	51.0	-15.1	35.9	43.5	7.6	189.0	240.9
6	119.968	H	49.7	-15.1	34.6	43.5	8.9	210.0	319.0
7	229.578	H	47.3	-14.2	33.1	46.0	12.9	104.0	356.5
8	720.034	V	39.8	-5.1	34.7	46.0	11.3	197.0	148.1

Remark :

1. The field strength of spurious 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 lie-down position(X axis) and the worst case was recorded.

Test mode : Receiver

EUT	Wi-Fi/BT Transceiver	Measurement Detail	
Model	WCK720Q	Frequency Range	1-25GHz
Mode	Receiver	Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
No emissions were detected at a level greater than 20dB below limit.			

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
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No emissions were detected at a level greater than 20dB below limit.

2.1.7 AC Conducted Emissions

Test Location

Shielded Room

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- 15.207(a)

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Results

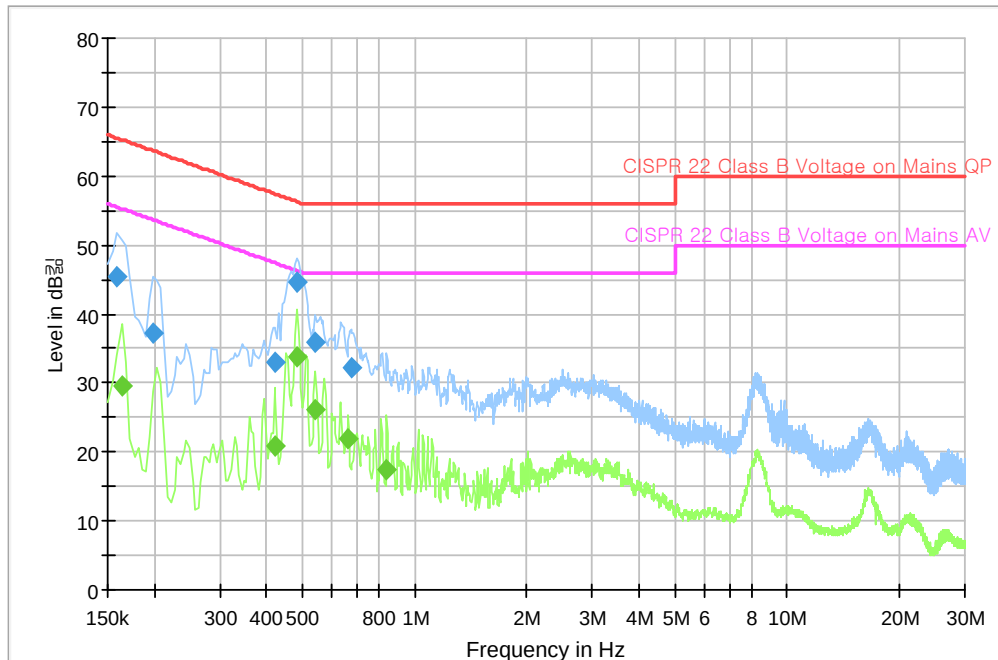
The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.483000	44.7	11.5	Quasi-Peak

Test Data

[L1]
3CE_CISPR 22 Class B_L1



Final Result 1

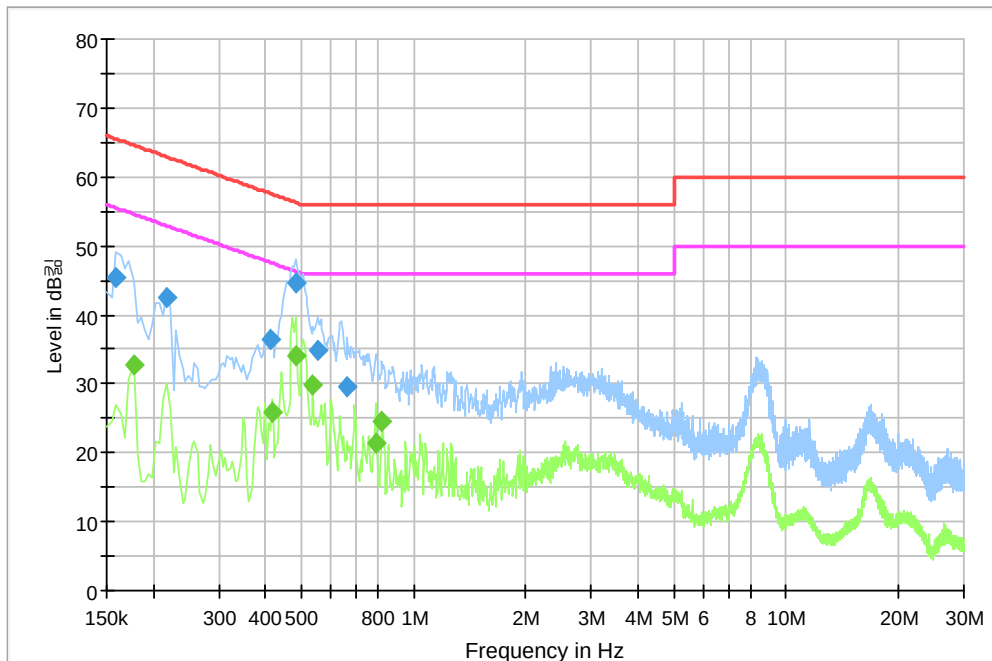
Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.159000	45.4	1000.0	9.000	On	L1	9.9	20.1	65.5
0.199500	37.3	1000.0	9.000	On	L1	10.0	26.3	63.6
0.420000	32.9	1000.0	9.000	On	L1	10.1	24.6	57.4
0.483000	44.7	1000.0	9.000	On	L1	10.1	11.5	56.3
0.541500	35.9	1000.0	9.000	On	L1	10.1	20.1	56.0
0.676500	32.1	1000.0	9.000	On	L1	10.1	23.9	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.163500	29.4	1000.0	9.000	On	L1	9.9	25.8	55.3
0.420000	20.8	1000.0	9.000	On	L1	10.1	26.6	47.4
0.483000	33.9	1000.0	9.000	On	L1	10.1	12.4	46.3
0.541500	26.1	1000.0	9.000	On	L1	10.1	19.9	46.0
0.663000	21.9	1000.0	9.000	On	L1	10.1	24.1	46.0
0.843000	17.4	1000.0	9.000	On	L1	10.0	28.6	46.0

[NEUTRAL]

3CE_CISPR 22 Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.159000	45.3	1000.0	9.000	On	N	9.9	20.2	65.5
0.217500	42.4	1000.0	9.000	On	N	9.8	20.5	62.9
0.411000	36.3	1000.0	9.000	On	N	10.0	21.3	57.6
0.483000	44.5	1000.0	9.000	On	N	10.0	11.8	56.3
0.555000	34.8	1000.0	9.000	On	N	10.0	21.2	56.0
0.663000	29.5	1000.0	9.000	On	N	10.0	26.5	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.177000	32.8	1000.0	9.000	On	N	9.9	21.8	54.6
0.415500	25.8	1000.0	9.000	On	N	10.0	21.7	47.5
0.483000	34.1	1000.0	9.000	On	N	10.0	12.2	46.3
0.537000	29.7	1000.0	9.000	On	N	10.0	16.3	46.0
0.789000	21.3	1000.0	9.000	On	N	9.9	24.7	46.0
0.820500	24.4	1000.0	9.000	On	N	9.9	21.6	46.0

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2015-11-02	2016-11-02
2	Signal Generator	Rohde & Schwarz	SMBV100A	258008	2015-05-13	2016-05-13
3	EMI Test Receiver	Rohde & Schwarz	ESCI3	100032	2015-02-02	2016-02-02
4	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2015-11-02	2016-11-02
5	Trilog Broadband Antenna	SCHWARZBECK	VULB 9161 SE	9161-4133	2015-06-18	2017-06-18
6	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2014-05-19	2016-05-19
7	6dB Attenuator	R&S	DNF	272.4110.50-2	2015-11-03	2016-11-03
8	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2015-02-06	2016-02-06
9	LISN	Rohde & Schwarz	ENV216	101235	2015-05-14	2016-05-14
10	EMI Test Receiver	Rohde & Schwarz	ESCI7	100816	2015-11-02	2016-11-02
11	Horn Antenna	ETS-Lindgren	3115	00078894	2015-09-02	2017-09-02
12	Horn Antenna	ETS-Lindgren	3117	00154525	2015-09-02	2017-09-02
13	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2015-05-15	2016-05-15
14	PREAMPLIFIER	Agilent	8449B	3008A02307	2015-10-01	2016-10-01
15	SPECTRUM ANALYZER	Rohde & Schwarz	FSP-30	100994	2015-11-02	2016-11-02
16	Band Reject Filter	Wainwright Instruments GmbH	WRCGV 2400/2483 - 2375/2505 -50/10EE	2	2015-05-14	2016-05-14