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TEST REPORT

Applicant Address	:	Sharp Corporation, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, JAPAN
Products	:	Smart Phone
Model No.	:	SH-04G
SERIAL NO.	:	004401115451060
		004401115450807
FCC ID	:	APYHRO00223
Test Standard	:	CFR 47 FCC Rules and Regulations Part 15
Test Results	:	Passed
Date of Test	:	April 10 ~ 15, 2015



Kousei Shibata Manager Japan Quality Assurance Organization KITA-KANSAI Testing Center SAITO EMC Branch 7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

- The measurement values stated in Test Report was made with traceable to National Institute of Advanced Industrial Science and Technology (AIST) of Japan and National Institute of Information and Communications Technology (NICT) of Japan.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
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	Description of the Equipment Under Test

DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT

EUT	: Equipment Under Test	
·		

- **AE** : Associated Equipment
- N/A : Not Applicable
- N/T : Not Tested

- EMC: Electromagnetic CompatibilityEMI: Electromagnetic InterferenceEMS: Electromagnetic Susceptibility
- \boxtimes indicates that the listed condition, standard or equipment is applicable for this report.
- □ indicates that the listed condition, standard or equipment is not applicable for this report.



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1 Description of the Equipment Under Test

1.	Manufacturer	:	Sharp Corporation, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, JAPAN
2.	Products	:	Smart Phone
3.	Model No.	:	SH-04G
4.	Serial No.	:	004401115451060
		:	004401115450807
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	February, 2015
7.	Power Rating	:	4.0VDC (Lithium-ion Battery UBATIA263AFN1 2450mAh)
8.	Grounding	:	None
9.	Transmitting Frequency	:	WLAN: 2412.0 MHz(01CH) –2462.0MHz(11CH) Bluetooth LE: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
10.	Receiving Frequency	:	WLAN: 2412.0 MHz(01CH) –2462.0MHz(11CH) Bluetooth LE: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
11.	Max. RF Output Power	: : :	17.21dBm(Measure Value of IEEE802.11b) 21.08dBm(Measure Value of IEEE802.11g) 20.42dBm(Measure Value of IEEE802.11n) 5.47dBm(Measure Value of Bluetooth LE)
12.	Antenna Type	:	Inverted-L Type Antenna (Integral)
13.	Antenna Gain	:	2.14 dBi
14.	Category	:	DTS
15.	EUT Authorization	:	Certification
16.	Received Date of EUT	:	April 10, 2015

17. Channel Plan

WLAN:

The carrier spacing is 5 MHz. The carrier frequency is designated by the absolute frequency channel number (ARFCN). The carrier frequency is expressed in the equation shown as follows:

Transmitting Frequency (in MHz) = 2407.0 + 5*nReceiving Frequency (in MHz) = 2407.0 + 5*nwhere, n : channel number ($1 \le n \le 11$)

Bluetooth Low Energy Mode: The carrier spacing is 2 MHz. The carrier frequency is designated by the absolute frequency channel number (ARFCN). The carrier frequency is expressed in the equation shown as follows:

Transmitting Frequency (in MHz) = 2402.0 + 2*nReceiving Frequency (in MHz) = 2402.0 + 2*nwhere, n : channel number ($0 \le n \le 39$)



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2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 15 Subpart C – Intentional Radiators

The EUT described in clause 1 was tested according to the applied standard shown above. Details of the test configuration is shown in clause 6.

The conclusion for the test items of which are required by the applied standard is indicated under the test result.

 \boxtimes - The test result was **passed** for the test requirements of the applied standard.

 $\hfill\square$ - The test result was **failed** for the test requirements of the applied standard.

□ - The test result was **not judged** the test requirements of the applied standard.

In the approval of test results,

- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

Shigeru Kinoshita Assistant Manager JQA KITA-KANSAI Testing Center SAITO EMC Branch

Tested by:

higen Osawa

Shigeru Osawa Deputy Manager JQA KITA-KANSAI Testing Center SAITO EMC Branch



3 Test Procedure

Test Requirements:§15.247, §15.207 and §15.209Test Procedure:ANSI C63.10–2009
Testing unlicensed wireless devices.KDB 558074 D01

DTS Meas Guidance v03r02: June 5, 2014.

4 Test Location

Japan Quality Assurance Organization (JQA) KITA-KANSAI Testing Center 7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan SAITO EMC Branch 7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No.	:	VLAC-001-2 (Expiry date : March 30, 2016)
VCCI Registration No.	:	A-0002 (Expiry date : March 30, 2016)
BSMI Registration No.	:	SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006
		(Expiry date : September 14, 2016)
IC Registration No.	:	2079E-3, 2079E-4 (Expiry date : July 16, 2017)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Expiry date : February 22, 2016)

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6 Description of Test Setup

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
А	Smart Phone	Sharp	SH-04G	004401115451060*1) 004401115450807*2)	APYHRO00223
В	AC Adapter	Fujitsu Corporation	05	XFA	N/A
С	Stereo Handsfree	Sharp	SHLDL1		N/A
D	DTV Antenna	Sharp	SH01		N/A

*1) Used for AC Powerline Conducted Emission and Field Strength of Spurious Emission

*2) Used for Antenna Conducted Emission

The auxiliary equipment used for testing :

None

Type of Cable:

No	Description	Identification	Connector	Cable	Ferrite	Length
INO.	Description	(Manu. etc.)	Shielded	Shielded	Core	(m)
1	USB conversion cable			NO	YES	1.2
2	Handsfree Cable			NO	NO	1.5
3	DTV Antenna Cable			NO	NO	0.3



6.2 Test Arrangement (Drawings)

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b) AC Adapter used



c) Earphone used





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6.3 Operating Condition

Transmitting/Receiving

WLAN:	
Transmitting frequency	: 2412.0 MHz(1CH) – 2462.0 MHz(11CH)
Receiver frequency	: 2412.0 MHz(1CH) – 2462.0 MHz(11CH)

Bluetooth Low Energy Mode()	Bluetooth 4.0 + EDR + LE):
Transmitting frequency	: 2402.0 MHz(0CH) – 2480.0 MHz(39CH)
Receiver frequency	: 2402.0 MHz(0CH) – 2480.0 MHz(39CH)

Modulation Type 1. 802.11b : DSSS 2. 802.11g : OFDM 3. 802.11n : OFDM 4. LE Packet (Modulation Type : GFSK)

Other Clock Frequency 19.2MHz, 27.12MHz

The tests were performed in the following worst condition.

Mode	Condition
IEEE802.11b	11 Mbps
IEEE802.11g	18 Mbps
IEEE802.11n	MCS1 (13 Mbps)

Note: The worst condition was determined based on the test result of Maximum Peak Output Power(Mid channel).

The EUT was rotated through three orthogonal axis (X, Y and Z axis) in radiated measurement. The EUT with temporary antenna port was used in conducted measurement.



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7 Test Requirements

7.0 Summary of the Test Results

Test Item	FCC Specification	Reference of the Test Report	Results	Remarks
Antenna Requirement	Section 15.203	Section 1.12	Passed	-
Channel Separation	Section 15.247(a)(1)	-		-
Minimum Hopping Channel	Section 15.247(a)(1)(iii)	-	-	-
Occupied Bandwidth	Section 15.247(a)(2)	Section 7.3	Passed	-
Dwell Time	Section 15.247(a)(1)(iii)	-	-	-
Peak Output Power	Section 15.247(b)(3)	Section 7.5	Passed	-
(Conduction)				
Peak Power Density	Section 15.247(e)	Section 7.6	Passed	-
(Conduction)				
Spurious Emissions	Section 15.247(d)	Section 7.7	Passed	-
(Conduction)				
AC Powerline Conducted	Section 15.207	Section 7.8	Passed	-
Emission				
Radiated Emission	Section 15.247(d)	Section 7.9	Passed	-

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	Standard	CFR 47 FCC Ru	lles and Regulati	ions Part	t 15		Page 10
7.1 Channel Sepa	aration						rage ro
For the require	ments, 🗌 - Apj 🛛 - Not	plicable [🗌 - Tes Applicable	ted. 🗌 - Not t	ested by	appl	icant reque	est.]
For the limits,	🗌 - Pas	sed 🗌 - Failed	🗌 - Not judg	ged			
7.2 Minimum Ho	pping Channel						
For the require	ments, 🗌 - Apj 🛛 - Not	olicable [🗌 - Tes Applicable	ted. 🗌 - Not t	ested by	appl	icant reque	est.]
For the limits,	🗌 - Pas	sed 🗌 - Failed	🗌 - Not judg	ged			
7.3 Occupied Ban For the require	ndwidth ments, 🛛 - Apj □ - Not	olicable [🛛 - Tes	ted. 🗌 - Not t	ested by	appl	icant reque	est.]
For the limits,	🖂 - Pas	sed 🗌 - Failed	🗌 - Not judg	ged			
731 Worst Poin	nt and Measurer	nent Uncertainty					
The 00% Pendu	ridth of IEEE00		12 026	MUa	at	9497 0	MUa
The 99% Bandw	vidth of IEEE80	2.11g is	16.503	MHz	at _	2437.0 2437.0	MHz
The 99% Bandw	vidth of IEEE80	2.11n is	17.676	MHz	at	2462.0	MHz
The 99% Bandw	vidth of Bluetoot	h LE is	1089.6	kHz	at	2402.0	MHz
The 6dB Bandw	vidth of IEEE802	2.11b is	8.869	MHz	at _	2412.0	MHz
The 6dB Bandw	vidth of IEEE802	2.11g is	16.490	MHz	at _	2462.0	MHz
	JAL of TEEEOO	2.11n is	17.731	MHz	at _	2462.0	MHz
The 6dB Bandw	ath of IEEE80.						
The 6dB Bandw The 6dB Bandw	vidth of Bluetoot	h LE is	670.5	kHz	at _	2480.0	MHz

Remarks:



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7.3.2 Test Instruments

Shielded Room S4						
TypeModelManufacturerID No.Last Cal.Interval						
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year	
Attenuator	54A-10	Weinschel	D-28	2014/9	1 Year	
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year	

7.3.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

	WLAN	Bluetooth	
Res. Bandwidth	100 kHz	$100 \mathrm{kHz}$	
Video Bandwidth	300 kHz	$300 \mathrm{kHz}$	
Span	$30 \mathrm{~MHz}$	3 MHz	
Sweep Time	AUTO	AUTO	
Trace	Maxhold	Maxhold	



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7.3.4 Test Data

Mode of EUT : WLAN

Test Date : April 11, 2015 Temp.:21°C, Humi:48%

The resolution bandwidth was set to 100 kHz, -6dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

A) IEEE 802.11b

Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (MHz)	Minimum -6dBc Bandwidth Limit (kHz)
01	2412.0	13.011	8.869	500
06	2437.0	13.036	7.573	500
11	2462.0	13.002	8.315	500



Transmit Freq Error	87.236 kHz
Occupied Bandwidth	8.869 MHz

🔆 Agilent

Low Channel



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Transmit Freq Error	34.020 kHz
Occupied Bandwidth	7.573 MHz



Transmit Freq Error	27.045 kHz
Occupied Bandwidth	8.315 MHz



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B)	IEEE	802.	11g
----	------	------	-----

Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (MHz)	Minimum -6dBc Bandwidth Limit (kHz)
01	2412.0	16.491	16.462	500
06	2437.0	16.503	16.475	500
11	2462.0	16.494	16.490	500



Transmit Freq Error	31.841 kHz
Occupied Bandwidth	16.462 MHz

Low Channel



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Transmit Freq Error	5.583 kHz
Occupied Bandwidth	16.475 MHz



Transmit Freq Error	11.189 kHz
Occupied Bandwidth	16.490 MHz



C) IE<u>EE 802.11n</u>

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ш.						
	Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (MHz)	Minimum -6dBc Bandwidth Limit (kHz)	
	01	2412.0	17.665	17.645	500	
	06	2437.0	17.673	17.711	500	
	11	2462.0	17.676	17.731	500	





RL



Transmit Freq Error	31.666 kHz
Occupied Bandwidth	17.645 MHz



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Transmit Freq Error	6.448 kHz
Occupied Bandwidth	17.711 MHz



Transmit Freq Error	9.826 kHz
Occupied Bandwidth	17.731 MHz



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Mode of EUT : Bluetooth Low Energy

<u>Test Date : April 13, 2015</u> <u>Temp.:22°C, Humi:52%</u>

The resolution bandwidth was set to 100 kHz, -6dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

1)Packet Setting : LE (Modulation type : GFSK)

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-6dBc Bandwidth (kHz)	Minimum -6dBc Bandwidth Limit (kHz)
00	2402.0	1089.6	665.9	500
19	2440.0	1088.1	666.5	500
39	2480.0	1089.0	670.5	500



Transmit Freq Error	7.952 kHz
Occupied Bandwidth	665.867 kHz



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Transmit Freq Error	7.231 kHz
Occupied Bandwidth	670.499 kHz

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7.4 Dwell Time					
For the requirem	nents, 🗌 - App 🛛 - Not	olicable [🗌 - Test Applicable	ed. 🗌 - Not test	ted by appli	cant request.]
For the limits,	🗌 - Pas	sed 🗌 - Failed	🗌 - Not judged	L	
7.5 Peak Output H	Power(Conducti	on)			
For the requirem	nents, 🛛 - App 🗌 - Not	olicable [⊠ - Test Applicable	ed. 🗌 - Not test	ted by appli	cant request.]
For the limits,	🛛 - Pas	sed 🗌 - Failed	🗌 - Not judged	l	
7.5.1 Worst Poin	t and Measurer	nent Uncertainty			
Peak Output Pov Peak Output Pov Peak Output Pov Peak Output Pov	wer of IEEE802 wer of IEEE802 wer of IEEE802 wer of Bluetooth	.11b is .11g is .11n is n LE is	$\begin{array}{c c} 17.21 & d \\ \hline 21.08 & d \\ \hline 20.42 & d \\ \hline 5.47 & d \end{array}$	Bm at <u>2</u> Bm at _ Bm at _ Bm at _	2437.0/2462.0 MHz 2412.0 MHz 2462.0 MHz 2402.0 MHz
Uncertainty of M	leasurement Re	esults at Amplitude		_	+/-0.9 dB(2σ)

Remarks : _____



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7.5.2 Test Instruments

Shielded Room S4							
Туре	Model	Manufacturer	ID No.	Last Cal.	Interval		
Power Meter	N1911A	Agilent	B-63	2014/7	1 Year		
Power Sensor	N1921A	Agilent	B-64	2014/7	1 Year		
Attenuator	54A-10	Weinschel	D-28	2014/9	1 Year		
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year		

7.5.3 Test Method and Test Setup (Diagrammatic illustration)

The Conducted RF Power Output was measured with a power meter, one 10dB attenuator and a short, low loss cable.





7.5.4 Test Data

1) IEEE 802.11b

Data Rate : 11Mbps

Test Date: A	pril 10, 2015
Temp.: 21 °C,	Humi: 60 %

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Transmi	tting Frequency	Correction	Meter Reading	Cone Book Out	lucted	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
01	2412	10.34	6.79	17.13	51.64	30.00	+12.87
06	2437	10.34	6.87	17.21	52.60	30.00	+12.79
11	2462	10.35	6.86	17.21	52.60	30.00	+12.79

Calculated result at 2437.000) MHz. as the worst	point shown or	underline:	
Correction Factor	=	10.34	lB	
+) Meter Reading	=	6.87	lBm	
Result	=	17.21	dBm = 52.60 mW	
Minimum Margin: 30.00 - 17.	21 = 12.79 (dB)			

NOTES

ſ

1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

2. Setting of measuring instrument(s) :

Detector Function	Video B.W.	
Peak	OFF	

СН	[MHz]	
06	2437	
Rate	Meter Reading	Remark
	[dBm]	
1Mbps	6.84	
2Mbps	6.80	
5.5Mbps	6.83	

6.87

* : Worst Rate

11Mbps

All comparison were performed on the same measurement condition.



2) IEEE 802.11g

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Data Rate : 1	8Mbps	<u>Test</u> Temp.	Test Date: April 10, 201 Temp.: 21 °C, Humi: 60 9				
Transm	itting Frequency	Correction Factor	Meter Reading	Con Peak Ou	ducted tput Power	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
01	2412	10.34	10.74	21.08	128.23	30.00	+ 8.92
06	2437	10.34	10.72	21.06	127.64	30.00	+ 8.94
11	2462	10.35	10.61	20.96	124.74	30.00	+ 9.04

Calculated result at 2412.000 M	Hz, as the wor	st point shown on underline:			
Correction Factor	=	10.34 dB			
+) Meter Reading	=	10.74 dBm			
Result	=	21.08 dBm = 128.23 mW			
Minimum Margin: 30.00 - 21.08 = 8.92 (dB)					

NOTES

1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	OFF

СН 06	[MHz] 2437			
Rate	Meter Reading	Remark		
	[dBm]			
6Mbps	10.54			
9Mbps	10.53			
12Mbps	10.46			
18Mbps	10.72	*		
24Mbps	10.63			
36Mbps	10.47			
48Mbps	10.68			
54Mbps	10.61			

 $*: Worst \, Rate$

All comparison were performed on the same measurement condition.



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3) IEEE 802.11n

Test Date: A	pril 10,	2015
Temp.: 21 °C,	Humi	60 %

Data Rate : N	ACS1(13Mbps)					Temp.	<u>: 21 °C, Humi: 60 %</u>	
Trans mi	itting Frequency	Correction Factor	Meter Reading	Con Peak Ou	ducte d tput Powe r	Limits	Margin	
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]	
01	2412	10.34	9.96	20.30	107.15	30.00	+ 9.70	
06	2437	10.34	10.02	20.36	108.64	30.00	+ 9.64	
11	2462	10.35	10.07	20.42	110.15	30.00	+ 9.58	

Calculated result at 2462.000 MHz, as the worst point shown on underline:					
Correction Factor	=	10.35 dB			
+) Meter Reading	=	10.07 dBm			
Result	=	20.42 dBm = 110.15 mW			
Minimum Margin: 30.00 - 20.42 = 9.58 (dB)					

NOTES

1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	OFF

CH 06	[MHz] 2437	
Rate	Meter Reading [dBm]	Remark
MCS0(6.5Mbps)	9.80	
MCS1(13Mbps)	10.02	*
MCS2(19.5Mbps)	9.98	
MCS3(26Mbps)	9.89	
MCS4(39Mbps)	9.98	
MCS5(52Mbps)	10.01	
MCS6(58.5Mbps)	9.91	
MCS7(65Mbps)	9.97	

* : Worst Rate

All comparison were performed on the same measurement condition.



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4) Bluetooth LE(Modulation type : GFSK)

Test Date: A	pril 13, 2015
Temp.: 22 °C,	Humi: 52 %

Transmi	tting Frequency	Correction Factor	Meter Reading	Cond Peak Out	lucted put Power	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.34	-4.87	5.47	3.52	30.00	+24.53
19	2440	10.35	-5.51	4.84	3.05	30.00	+25.16
39	2480	10.36	-5.73	4.63	2.90	30.00	+25.37

Calculated result at 2402.000 M	Hz, as the wo	rst point shown on underline:	
Correction Factor	=	10.34 dB	
+) Meter Reading	=	-4.87 dBm	
Result	=	5.47 dBm = 3.52 mW	-
Minimum Margin: 30.00 - 5.47 =	24.53 (dB)		

NOTES

1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	Off
P	



Remarks :

7.6.2 Test Instruments

Shielded Room S4							
Туре	Model	Manufacturer	ID No.	Last Cal.	Interval		
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year		
Attenuator	54A-10	Weinschel	D-28	2014/9	1 Year		
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year		

7.6.3 Test Method and Test Setup (Diagrammatic illustration)

The Conducted RF Power Output was measured with a power meter, one 10dB attenuator and a short, low loss cable.

	Antenna	10dB Attonuator		Spectrum
EUI	Terminal	Toud Attenuator		Analyzer



7.6.4 Test Data

1) IEEE 802.11b

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Data Rate : 11Mbps							<u>te: April 11, 2015</u> 1 °C, Humi: 48 %
Transm	itting Frequency	Correction Factor	Meter Reading	Cond Peak Pow	lucted er Density	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
01	2412	10.34	-8.34	2.00	1.58	8.00	+ 6.00
06	2437	10.34	-8.76	1.58	1.44	8.00	+ 6.42
11	2462	10.35	-8.12	2.23	1.67	8.00	+ 5.77

Calculated result at 2462.000 M	IHz, as the wor	rst point shown on underline:
Correction Factor	=	10.35 dB
+) Meter Reading	=	-8.12 dBm
Result	=	2.23 dBm = 1.67 mW
Minimum Margin: 8.00 - 2.23 =	5.77 (dB)	

NOTES

- 1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
- 2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
- 3. Setting of measuring instrument(s) :





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2) IEEE 802.11g

Data Rate : 18Mbps							te: April 11, 2015 1 °C, Humi: 48 %	,
Transmi	itting Frequency	Correction Factor	Meter Reading	Cond Peak Powe	ucted er Density	Limits	Margin	
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]	
01 06	2412 2437	10.34 10.34	-14.27 -13.36	-3.93 -3.02	0.40 0.50	8.00 8.00	+11.93 +11.02	
11	2462	10.35	-14.04	-3.69	0.43	8.00	+11.69	

Calculated result at 2437.000 MHz, as the worst point shown on underline: **Correction Factor** = 10.34 dB +) Meter Reading = -13.36 dBm Result = -3.02 dBm = 0.50 mW Minimum Margin: 8.00 - -3.02 = 11.02 (dB)

NOTES

- 1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
- 2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

3. Setting of measuring instrument(s):

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz





3) IEEE 802.11n

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Data Rate : N	MCS1(13Mbps)					<u>Test Da</u> <u>Temp.: 2</u>	<u>te: April 11, 2015</u> 1 °C, Humi: 48 %
Transm	itting Frequency	Correction Factor	Meter Reading	Cond Peak Pow	ucted er Density	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
01	2412	10.34	-15.16	-4.82	0.33	8.00	+12.82
06	2437	10.34	-15.05	-4.71	0.34	8.00	+12.71
11	2462	10.35	-15.76	-5.41	0.29	8.00	+13.41

Calculated result at 2437.000 MHz, as the worst point shown on underline: **Correction Factor** = 10.34 dB +) Meter Reading = -15.05 dBm Result = -4.71 dBm = 0.34 mW Minimum Margin: 8.00 - -4.71 = 12.71 (dB)

NOTES

- 1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
- 2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

3. Setting of measuring instrument(s):

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz





: APYHRO00223

4) Bluetooth LE(Modulation type : GFSK)

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						<u>Test Da</u> <u>Temp.: 25</u>	te: April 13, 2015 2 °C, Humi: 52 %
Transmi	tting Frequency	Correction Factor	Meter Reading	Cond Peak Pow	lucted er Density	Limits	Margin
СН	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.34	-8.12	2.22	1.67	8.00	+ 5.78
19	2440	10.35	-8.80	1.55	1.43	8.00	+ 6.45
39	2480	10.36	-8.97	1.39	1.38	8.00	+ 6.61

Calculated result at 2402.000 MHz, as the worst point shown on underline: **Correction Factor** = 10.34 dB +) Meter Reading = -8.12 dBm Result = 2.22 dBm = 1.67 mWMinimum Margin: 8.00 - 2.22 = 5.78 (dB)

NOTES

- 1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
- 2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
- 3. Setting of measuring instrument(s) :

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz





Remarks:

7.7.2 Test Instruments

Shielded Room S4							
Туре	Model	Manufacturer	ID No.	Last Cal.	Interval		
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year		
Attenuator	54A-10	Weinschel	D-28	2014/9	1 Year		
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year		

18 GHz - 40 GHz

<u>+/-2.3</u> dB(2 σ)

7.7.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:

EUT Antenna Terminal	— 10dB Attenuator -	Spectrum Analyzer
-------------------------	---------------------	----------------------

The setting of the spectrum analyzer are shown as follows:

Frequency Range	30 MHz - 25 GHz	Band-Edge
Res. Bandwidth	100 kHz	100 kHz
Video Bandwidth	300 kHz	300 kHz
Sweep Time	AUTO	AUTO
Trace	Maxhold	Maxhold



7.7.4 Test Data

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Test Date : April 11, 2015 Temp.:21°C, Humi:48%





Low Channel



Middle Channel

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High Channel

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2) IEEE 802.11g

Low Channel





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Middle channel




High Channel

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Page 38 of 88

3) IEEE 802.11n

Low Channel





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Middle Channel





High Channel

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4) Bluetooth Low Energy

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🔆 Agilent RL 🔆 Agilent RL Mkr1 891.2 MHz -80.52 dBm Mkr1 13.685 GHz -71.54 dBm Ref0 dBm ≢Peak [Ref0 dBm ≢Peak [Atten 10 dB Atten 10 dB Log Log 10 10 dB/ dB/ DI -25.2 dBm DI -25.2 dBm LgAv LgAv M1 S2 Start 30.0 MHz M1 S2 Stop 15.000 GHz Sweep 478.4 ms (8192 pts) Stop 1.000 0 GHz Start 10.000 GHz #VBW 300 kHz Sweep 92.83 ms (8192 pts) #VBW 300 kHz #Res BW 100 kHz #Res BW 100 kHz Marker 1 Trace (1) Marker 1 Trace (1) Amplitude -71.54 dBm Type Freq X Axis 891.2 MHz Amplitude -80.52 dBm Type Freq X Axis 13.685 GHz RL RL 🔆 Agilent 🔆 Agilent Mkr1 2.402 GHz Mkr1 15.291 GHz Ref Ø dBm #Peak Atten 10 dB -5.12 dBm Ref Ø dBm #Peak Atten 10 dB -71.20 dBm Log 10 dB/ Log 10 dB/ DI DI -25.2 dBm -25.2 dBm \$ LgAv LgAv M1 \$2 M1 S2 Start 1.000 GHz Stop 5.000 GHz Start 15.000 GHz Stop 20.000 GHz Sweep 382.8 ms (8192 pts) Sweep 478.4 ms (8192 pts) #Res BW 100 kHz Marker Track 1 (1) #VBW 300 kHz #VBW 300 kHz *Res BW 100 kHz Trace (1) Marker 1 Trace (1) Type Freq X Axis 2.402 GHz Amplitude -5.12 dBm Type Freq X Axis 15.291 GHz Amplitude -71.20 dBm 🔆 Agilent RL 🔆 Agilent RL Mkr1 7.144 GHz Mkr1 24.185 GHz Ref0 dBm ≢Peak [Atten 10 dB -74.37 dBm Ref0dBm ≢Peak Atten 10 dB -71.01 dBm Log 10 Log 10 dB/ dB/ DI -25.2 DI -25.2 dBm dBm 1 LgAv LgAv M1 S2 Start 5.000 GHz M1 S2 Stop 10.000 GHz Start 20.000 GHz Stop 25.000 GHz #Res BW 100 kHz Marker Trace 1 (1) #Res BW 100 kHz #VBW 300 kHz Sweep 478.4 ms (8192 pts) ∗VBW 300 kHz Sweep 478.4 ms (8192 pts) Marker 1 Trace (1) Type Freq Trace (1) Type Freq Amplitude -74.37 dBm X Axis 24.185 GHz Amplitude -71.01 dBm 7.144 GHz

Low Channel



Middle Channel

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High Channel

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Band-Edge Emission

1) IEEE 802.11b

Low Channel



High Channel



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2) IEEE 802.11g

Low Channel



High Channel





3) IEEE 802.11n

Low Channel



High Channel



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4) Bluetooth Low Energy

Low Channel



High Channel





Remarks: <u>WLAN mode</u>

7.8.2 Test Instruments

Measurement Room M2								
Туре	Model	Manufacturer	ID No.	Last Cal.	Interval			
Test Receiver	ESU 26	Rohde & Schwarz	A-6	2014/5	1 Year			
AMN (main)	ESH3-Z5	Rohde & Schwarz	D-12	2014/8	1 Year			
RF Cable	RG223/U	SUHNER	H-34	2014/6	1 Year			



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7.8.3 Test Method and Test Setup (Diagrammatic illustration)

The preliminary tests were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT.

The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for final tests.







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7.8.4 Test Data

1) Mode of EUT : (WLAN) All modes have been investigated and the worst case mode for channel (06ch: 2437MHz / IEEE 802.11b, IEEE 802.11g and IEEE 802.11n) has been listed.

Test voltage : 120VAC 60Hz

<u>Test Date: April 15, 2015</u> <u>Temp.: 21 °C, Humi.: 47 %</u>

Measured phase : L1

Frequency	Corr. Factor	Meter R [dB(j	eadings 1V)]	Lin [dB(nits µV)]	Res [dB(ults µV)]	Mar [dF	gin 8]	Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.151	10.1	40.5		65.9	55.9	50.6		+15.3		_
0.200	10.1	36.6		63.6	53.6	46.7		+16.9		-
0.472	10.1	31.6		56.5	46.5	41.7		+14.8		_
0.523	10.2	34.0		56.0	46.0	44.2		+11.8		-
0.675	10.1	30.7		56.0	46.0	40.8		+15.2		-
1.053	10.3	30.5		56.0	46.0	40.8		+15.2		-
1.582	10.3	31.1		56.0	46.0	41.4		+14.6		-
2.688	10.3	36.8	16.5	56.0	46.0	47.1	26.8	+ 8.9	+19.2	-
3.248	10.3	39.5	20.0	56.0	46.0	49.8	30.3	+ 6.2	+15.7	-
4.323	10.3	28.1		56.0	46.0	38.4		+17.6		_



NOTES

- 1. The spectrum was checked from 0.15 MHz to 30 MHz.
- 2. The correction factor includes the AMN insertion loss and the cable loss.
- 3. The symbol of "<" means "or less".
- 4. The symbol of ">" means "more than".
- 5. The symbol of "--" means "not applicable".
- 6. Calculated result at 3.248 MHz, as the worst point shown on underline: Correction Factor + Meter Reading (QP) = $10.3 + 39.5 = 49.8 \text{ dB}(\mu \text{V})$
- 7. QP : Quasi-Peak Detector / AVE : Average Detector
- 8. Test receiver setting(s) : CISPR QP 9 kHz / Average 9 kHz

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<u>Test Date: April 15, 2015</u> <u>Temp.: 21 °C, Humi.: 47 %</u>

Test voltage : 120VAC 60Hz

Measured phase : L2

Frequency	Corr. Factor	Meter Ro [dB(µ	eadings (V)]	Lin [dB(nits µV)]	Res [dB()	ults µV)]	Mar [dB	gin]	Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.151	10.2	41.7		65.9	55.9	51.9		+14.0		_
0.200	10.1	38.1		63.6	53.6	48.2		+15.4		-
0.472	10.2	35.6		56.5	46.5	45.8		+10.7		_
0.523	10.1	33.7		56.0	46.0	43.8		+12.2		-
0.675	10.2	27.1		56.0	46.0	37.3		+18.7		-
1.053	10.3	23.3		56.0	46.0	33.6		+22.4		-
1.582	10.3	19.1		56.0	46.0	29.4		+26.6		-
2.688	10.3	29.2		56.0	46.0	39.5		+16.5		_
3.248	10.3	34.5		56.0	46.0	44.8		+11.2		_
4.323	10.4	30.6		56.0	46.0	41.0		+15.0		_



NOTES

- 1. The spectrum was checked from $0.15~\mathrm{MHz}$ to 30 MHz.
- 2. The correction factor includes the AMN insertion loss and the cable loss.
- 3. The symbol of "<" means "or less".
- 4. The symbol of ">" means "more than".
- 5. The symbol of "--" means "not applicable".
- 6. Calculated result at 0.472 MHz, as the worst point shown on underline: Correction Factor + Meter Reading (QP) = $10.2 + 35.6 = 45.8 \text{ dB}(\mu\text{V})$
- 7. QP : Quasi-Peak Detector / AVE : Average Detector
- 8. Test receiver setting (s) : CISPR QP 9 kHz / Average 9 kHz



2) Mode of EUT : Bluetooth Low Energy

Test voltage : 120VAC 60Hz

Measured phase : L1

Frequency	Corr. Factor	Meter R [dB(j	eadings µV)]	Lin [dB(nits [µV)]	Res [dB(ults µV)]	Mar [dB	gin 5]	Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.151	10.1	40.5		65.9	55.9	50.6		+15.3		-
0.200	10.1	36.5		63.6	53.6	46.6		+17.0		-
0.472	10.1	31.5		56.5	46.5	41.6		+14.9		-
0.523	10.2	34.0		56.0	46.0	44.2		+11.8		-
0.675	10.1	30.9		56.0	46.0	41.0		+15.0		-
1.044	10.3	30.6		56.0	46.0	40.9		+15.1		-
1.582	10.3	30.3		56.0	46.0	40.6		+15.4		-
2.704	10.3	35.8	18.2	56.0	46.0	46.1	28.5	+ 9.9	+17.5	-
3.243	10.3	39.1	20.0	56.0	46.0	49.4	30.3	+ 6.6	+15.7	-
4.318	10.3	27.9		56.0	46.0	38.2		+17.8		_



NOTES

- 1. The spectrum was checked from 0.15 MHz to 30 MHz.
- 2. The correction factor includes the AMN insertion loss and the cable loss.
- 3. The symbol of "<" means "or less".
- 4. The symbol of ">" means "more than".
- 5. The symbol of "--" means "not applicable".
- 6. Calculated result at 3.243 MHz, as the worst point shown on underline: Correction Factor + Meter Reading (QP) = $10.3 + 39.1 = 49.4 \text{ dB}(\mu \text{V})$
- 7. QP : Quasi-Peak Detector / AVE : Average Detector
- 8. Test receiver setting (s) : CISPR QP 9 kHz / Average 9 kHz

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<u>Test Date: April 15, 2015</u> <u>Temp.: 21 °C, Humi.: 47 %</u>



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<u>Test Date: April 15, 2015</u> <u>Temp.: 21 °C, Humi.: 47 %</u>

Test voltage : 120VAC 60Hz

Measured phase : L2

Frequency	Corr. Factor	Meter R [dB(J	eadings 1V)]	Lin [dB()	nits µV)]	Res [dB(ults µV)]	Mar [dB	gin]	Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.151	10.2	41.7		65.9	55.9	51.9		+14.0		-
0.200	10.1	38.0		63.6	53.6	48.1		+15.5		_
0.472	10.2	35.6		56.5	46.5	45.8		+10.7		-
0.523	10.1	33.7		56.0	46.0	43.8		+12.2		-
0.675	10.2	27.3		56.0	46.0	37.5		+18.5		-
1.044	10.3	22.3		56.0	46.0	32.6		+23.4		-
1.582	10.3	18.2		56.0	46.0	28.5		+27.5		-
2.704	10.3	26.9		56.0	46.0	37.2		+18.8		-
3.243	10.3	33.9		56.0	46.0	44.2		+11.8		_
4.318	10.4	30.1		56.0	46.0	40.5		+15.5		-



NOTES

- 1. The spectrum was checked from $0.15\ \mathrm{MHz}$ to 30 MHz.
- 2. The correction factor includes the AMN insertion loss and the cable loss.
- 3. The symbol of "<" means "or less".
- 4. The symbol of ">" means "more than".
- 5. The symbol of "--" means "not applicable".
- 6. Calculated result at 0.472 MHz, as the worst point shown on underline: Correction Factor + Meter Reading (QP) = $10.2 + 35.6 = 45.8 \text{ dB}(\mu \text{V})$
- 7. QP : Quasi-Peak Detector / AVE : Average Detector
- 8. Test receiver setting (s) : CISPR QP 9 kHz / Average 9 kHz



Remarks: <u>IEEE802.11g mode</u>, Z axis position.



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7.9.2 Test Instruments

Anechoic Chamber A2								
Туре	Model	Manufacturer	ID No.	Last Cal.	Interval			
Test Receiver	ESU 26	Rohde & Schwarz	A-6	2014/5	1 Year			
Loop Antenna	HFH2-Z2	Rohde & Schwarz	C-2	2014/8	1 Year			
RF Cable	RG213/U	SUHNER	H-28	2014/8	1 Year			
Biconical Antenna	VHA9103/BBA9106	Schwarzbeck	C-30	2014/5	1 Year			
Log-periodic Antenna	UHALP9108-A1	Schwarzbeck	C-31	2014/5	1 Year			
RF Cable	S 10162 B-11 etc.	SUHNER	H-4	2015/4	1 Year			
Site Attenuation			H-15	2015/1	1 Year			
Pre-Amplifier	TPA0118-36	ТОҮО	A-37	2014/5	1 Year			
Pre-Amplifier	RP1826G-45H	EMCS	A-53	2014/7	1 Year			
Horn Antenna	91888-2	EATON	C-41-1	2014/7	1 Year			
Horn Antenna	91889-2	EATON	C-41-2	2014/7	1 Year			
Horn Antenna	3160-04	EMCO	C-55	2014/6	1 Year			
Horn Antenna	3160-05	EMCO	C-56	2014/6	1 Year			
Horn Antenna	3160-06	EMCO	C-57	2014/6	1 Year			
Horn Antenna	3160-07	EMCO	C-58	2014/6	1 Year			
Horn Antenna	3160-08	EMCO	C-59	2014/6	1 Year			
Horn Antenna	3160-09	EMCO	C-48	2014/7	1 Year			
Attenuator	54A-10	Weinschel	D-29	2014/9	1 Year			
Attenuator	2-10	Weinschel	D-79	2014/11	1 Year			
Band Rejection Filter	BRM50701	MICRO-TRONICS	D-93	2015/2	1 Year			
RF Cable	SUCOFLEX104	SUHNER	C-66	2015/1	1 Year			
RF Cable	SUCOFLEX104	SUHNER	C-67	2015/1	1 Year			
RF Cable	SUCOFLEX102EA	SUHNER	C-69	2015/1	1 Year			
SVSWR			H-19	2015/2	1 Year			
Pre-Amplifier	310N	SONOMA	A-17	2015/4	1 Year			



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7.9.3 Test Method and Test Setup (Diagrammatic illustration)

7.9.3.1 Radiated Emission 9 kHz – 30 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for the final tests.





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7.9.3.2 Radiated Emission 30 MHz – 1000 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for the final tests.





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7.9.3.3 Radiated Emission above 1 GHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for the final tests.

The setting of the measuring instruments are shown as follows:

Type	Peak	Average
Detector Function	Peak	Peak
Res. Bandwidth	1 MHz	1 MHz
Video Bandwidth	3 MHz	$\geq 1/T * 1)$
Video Filtering	Linear Voltage	Linear Voltage
Sweep Time	AUTO	AUTO
Trace	Max Hold	Max Hold

Note: 1. T: Minimum transmission duration







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7.9.4 Test Data

7.9.4.1 Band-edge Compliance

<u>Test Date : April 13, 2015</u> <u>Temp.:21°C, Humi:58%</u>

Mode of EUT : (1ch: 2412 MHz, (IEEE 802.11b)) Antenna Polarization : Horizontal





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Mode of EUT : (1ch: 2412 MHz, (IEEE 802.11b)) Antenna Polarization : Vertical





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Mode of EUT : (11ch: 2462 MHz, (IEEE 802.11b)) Antenna Polarization : Horizontal





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Mode of EUT : (11ch: 2462 MHz, (IEEE 802.11b)) Antenna Polarization : Vertical





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Mode of EUT : (1ch: 2412 MHz, (IEEE 802.11g)) Antenna Polarization : Vertical





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Mode of EUT : (1ch: 2412 MHz, (IEEE 802.11n)) Antenna Polarization : Horizontal





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Mode of EUT : (1ch: 2412 MHz, (IEEE 802.11n)) Antenna Polarization : Vertical





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Mode of EUT : (11ch: 2462 MHz, (IEEE 802.11n)) Antenna Polarization : Vertical





Page 71 of 88 <u>Test Date : April 13, 2015</u> <u>Temp.:21°C, Humi:58%</u>







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Mode of EUT : Bluetooth Low Energy, Hopping off (39ch: 2480 MHz) Antenna Polarization : Horizontal



Note: The trace 1 is Peak . The trace 2 is Average.



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Mode of EUT : Bluetooth Low Energy, Hopping off (39ch: 2480 MHz) Antenna Polarization : Vertical



Note: The trace 1 is Peak . The trace 2 is Average.



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Test Date : April 14, 2015 Temp.:21°C, Humi:70%

7.9.4.2 Other Spurious Emission (9kHz – 30MHz)

Mode of EUT : WLAN/Bluetooth LE

 $\ensuremath{\mathsf{Results}}$: No spurious emissions in the range 20dB below the limit.

7.9.4.3 Other Spurious Emission (30MHz - 1000MHz)

Mode of EUT : (WLAN) All modes have been investigated and the worst case mode for channel (06ch: 2437MHz / IEEE802.11b, IEEE802.11g and IEEE802.11n) has been listed.

Antenna pole :	Horizontal					<u>Test Date: Ap</u> <u>Temp.: 21 °C,</u>	oril 14, 2015 Humi: 70 %
Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(µV)]	Limits [dB(µV/m)]	Results [dB(µV/m)]	Margin [dB]	Remarks
205.29	16.6	-25.8	29.0	43.5	19.8	+23.7	-
410.57	16.5	-24.6	30.3	46.0	22.2	+23.8	-



NOTES

1. Test Distance : 3 m

- 2. The spectrum was checked from $30~\mathrm{MHz}$ to $1000~\mathrm{MHz}.$
- 3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.
- 4. The symbol of "<" means "or less".
- 5. The symbol of ">" means "more than".
- 6. Calculated result at 205.29 MHz, as the worst point shown on underline:
 - Antenna Factor + Coorection Factor + Meter Reading = $16.6 + (-25.8) + 29.0 = 19.8 \text{ dB}(\mu\text{V/m})$ Antenna Height : 1.67 m, Turntable Angle : $73 \circ$
- 7. Test receiver setting(s) : CISPR QP 120 kHz (QP : Quasi-Peak)

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Test Date: April 14, 2015 Temp.: 21 °C, Humi: 70 %

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(µV)]	Limits [dB(µV/m)]	Results [dB(µV/m)]	Margin [dB]	Remarks
30.10	18.8	-27.5	30.7	40.0	22.0	+18.0	-
45.26	13.0	-27.3	39.3	40.0	25.0	+15.0	-
73.21	6.3	-26.9	36.9	40.0	16.3	+23.7	-



NOTES

1. Test Distance : 3 m

2. The spectrum was checked from 30 MHz to 1000 MHz.

3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. Calculated result at 45.26 MHz, as the worst point shown on underline: Antenna Factor + Coorection Factor + Meter Reading = $13.0 + (-27.3) + 39.3 = 25.0 \text{ dB}(\mu\text{V/m})$ Antenna Height $\stackrel{:}{:} 1.00$ m, Turntable Angle $\stackrel{:}{:} 167$ °

7. Test receiver setting(s) : CISPR QP 120 kHz (QP : Quasi-Peak)

Antenna pole : Vertical



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Mode of EUT : Bluetooth Low Energy

Antenna pole :	Horizontal					<u>Test Date: Ap</u> <u>Temp.: 20 °C,</u>	oril 15, 2015 Humi: 61 %
Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(µV)]	Limits [dB(µV/m)]	Results [dB(µV/m)]	Margin [dB]	Remarks
205.29 410.58	16.6 16.5	-25.8 -24.6	28.5 30.9	43.5 46.0	19.3 22.8	+24.2 +23.2	-



NOTES

- 1. Test Distance : 3 m
- 2. The spectrum was checked from 30 MHz to 1000 MHz.
- 3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.
- 4. The symbol of "<" means "or less".
- 5. The symbol of ">" means "more than".
- 6. Calculated result at 410.58 MHz, as the worst point shown on underline: Antenna Factor + Coorection Factor + Meter Reading = $16.5 + (-24.6) + 30.9 = 22.8 \text{ dB}(\mu\text{V/m})$ Antenna Height : 1.00 m, Turntable Angle : $38 \circ$
- 7. Test receiver setting(s) : CISPR QP 120 kHz (QP : Quasi-Peak)



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<u>Test Date: April 15, 2015</u> <u>Temp.: 20 °C, Humi: 61 %</u>

Antenna pole . vertical

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(µV)]	Limits [dB(µV/m)]	Results [dB(µV/m)]	Margin [dB]	Remarks
75.08	6.3	-26.9	30.6	40.0	10.0	+30.0	-



NOTES

1. Test Distance : 3 m

2. The spectrum was checked from 30 MHz to 1000 MHz.

3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. Calculated result at 75.08 MHz, as the worst point shown on underline: Antenna Factor + Coorection Factor + Meter Reading = $6.3 + (-26.9) + 30.6 = 10.0 \text{ dB}(\mu\text{V/m})$ Antenna Height : 1.28 m, Turntable Angle : 167 °

7. Test receiver setting(s) : CISPR QP 120 kHz (QP : Quasi-Peak)



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7.9.4.4 Other Spurious Emission (Above 1000MHz) 7.9.4.4.1 Mode of TX 7.9.4.4.1.1 IEEE802.11b

<u>Test Date: April 13, 2015</u> <u>Temp.: 21 °C, Humi: 58 %</u>

Frequency	Antenna	Corr.		Meter Read	lings [dB(µ	<i>n</i>]	Lir	nits	Re	sults	Margin	Remarks
	Factor	Factor	Hor	izontal	Ve	rtical	[dB(µ	ιV/m)]	[dB (μV/m)]	[dB]	
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test condition	: Tx Low Ch											
4824.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
12060.0	33.6	-25.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.7	< 35.7	> +18.3	
19296.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition	: TX Middle	Ch										

4874.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
7311.0	29.8	-16.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12185.0	33.5	-26.3	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.2	< 35.2	> +18.8	
19496.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	

Test condition : TX High Ch

cor condition .	in ingn c											
4924.0	27.3	-16.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.3	< 39.3	> +14.7	
7386.0	29.8	-16.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.9	< 40.9	> +13.1	
12310.0	33.4	-26.6	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 44.8	< 34.8	> +19.2	
19696.0	40.5	-42.9	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22158.0	40.6	-43.3	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.3	< 37.3	> +16.7	

Calculated result at 7311.0 MHz, a	s the	worst p	point shown on underline
Antenna Factor	=	29.8	dB(1/m)
Corr. Factor	=	-16.8	dB
+) Meter Reading	=	<28.0	dB(µV)
Result	=	<41.0	dB(µV/m)
Minimum Margin: 54.0 - <41.0 = >1	3.0 (IB)	

NOTES

- 1. Test Distance : 3 m
- 2. The spectrum was checked from $1~{\rm GHz}$ to $25~{\rm GHz}$ (10th harmonic of the highest fundamental frequency).
- 3. The correction factor is shown as follows:
 - Corr. Factor [dB] = Cable Loss + 20dB Pad Att. Pre-Amp. Gain [dB] (1.0 7.6GHz) Corr. Factor [dB] = Cable Loss + 10dB Pad Att. - Pre-Amp. Gain [dB] (7.6 - 18.0GHz)
 - Corr. Factor [dB] = Cable Loss Pre-Amp. Gain [dB] (over 18 GHz)
- 4. The symbol of "<" means "or less".
- 5. The symbol of ">" means "more than".
- 6. PK : Peak / AVE : Average



7.9.4.4.1.2 IEEE802.11g

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<u>Test Date: April 13, 2015</u> <u>Temp.: 21 °C</u>, Humi: 58 %

Frequency	Antenna	Corr.		Meter Read	lings [dB(µV	V)]	Lin	nits	Re	sults	Margin	Remarks
	Factor	Factor	Hor	izontal	Ve	rtical	[dB(µ	V/m)]	[dB (u V/m)]	[dB]	
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test condition	: Tx Low Ch											
4824.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
12060.0	33.6	-25.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.7	< 35.7	> +18.3	
19296.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition	: TX Middle	Ch										
4874.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
7311.0	29.8	-16.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12185.0	33.5	-26.3	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.2	< 35.2	> +18.8	
19496.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition	: TX High Cl	h										
4924.0	27.3	-16.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.3	< 39.3	> +14.7	
7386.0	29.8	-16.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.9	< 40.9	> +13.1	
12310.0	33.4	-26.6	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 44.8	< 34.8	> +19.2	
19696.0	40.5	-42.9	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22158.0	40.6	-43.3	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.3	< 37.3	> +16.7	

Calculated result at 7311.0 MHz, as the worst point shown on underline:

NOTES

1. Test Distance : 3 m

2. The spectrum was checked from 1 GHz to $25~\mathrm{GHz}$ (10th harmonic of the highest fundamental frequency).

3. The correction factor is shown as follows:

Corr. Factor [dB] = Cable Loss + 20dB Pad Att. • Pre•Amp. Gain [dB] (1.0 • 7.6GHz) Corr. Factor [dB] = Cable Loss + 10dB Pad Att. • Pre•Amp. Gain [dB] (7.6 • 18.0GHz) Corr. Factor [dB] = Cable Loss • Pre•Amp. Gain [dB] (over 18 GHz)

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. PK $\colon \mbox{Peak}$ / AVE $\colon \mbox{Average}$



7.9.4.4.1.3 IEEE802.11n

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<u>Test Date: April 13, 2015</u> <u>Temp.: 21 °C</u>, Humi: 58 %

Frequency	Antenna	Corr.		Meter Read	lings [dB(µV	V)]	Lin	nits	Re	sults	Margin	Remarks
	Factor	Factor	Hor	izontal	Ve	rtical	[dB(µ	V/m)]	[dB (µV/m)]	[dB]	
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test condition	• Ty I ow Ch											
4824 0	27 3	-16 1	~ 38 0	< 28 O	< 38 O	< 28 O	74 0	54 0	- 49 2	~ 30 2	> +14 8	
1021.0	27.5	-10.1	< 30.0	< 20.0	< 30.0	< 20.0	74.0	54.0	< 17.2	< 39.2	> 114.0	
12060.0	33.0	-25.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45./	< 35.7	> +18.3	
19296.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition	: TX Middle	Ch										
4874.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
7311.0	29.8	-16.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12185.0	33.5	-26.3	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.2	< 35.2	> +18.8	
19496.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition	: TX High Cl	h										
4924.0	27.3	-16.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.3	< 39.3	> +14.7	
7386.0	29.8	-16.9	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.9	< 40.9	> +13.1	
12310.0	33.4	-26.6	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 44.8	< 34.8	> +19.2	
19696.0	40.5	-42.9	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22158.0	40.6	-43.3	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.3	< 37.3	> +16.7	

Calculated result at 7311.0 MHz, as the worst point shown on underline:

 $\begin{array}{rcl} \mbox{Antenna Factor} & = & 29.8 \ \mbox{dB}(1/m) \\ \mbox{Corr. Factor} & = & -16.8 \ \mbox{dB} \\ + \) \ \mbox{Meter Reading} & = & <28.0 \ \ \mbox{dB}(\mu V) \\ \hline \mbox{Result} & = & <41.0 \ \ \mbox{dB}(\mu V/m) \\ \end{array}$

NOTES

1. Test Distance : 3 m

2. The spectrum was checked from 1 GHz to $25~\mathrm{GHz}$ (10th harmonic of the highest fundamental frequency).

3. The correction factor is shown as follows:

Corr. Factor [dB] = Cable Loss + 20dB Pad Att. • Pre-Amp. Gain [dB] (1.0 • 7.6GHz) Corr. Factor [dB] = Cable Loss + 10dB Pad Att. • Pre-Amp. Gain [dB] (7.6 • 18.0GHz) Corr. Factor [dB] = Cable Loss • Pre-Amp. Gain [dB] (over 18 GHz)

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. PK : Peak $\,/\,\mathrm{AVE}$: Average



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7.9.4.4.1.4 Bluetooth Low Energy

Test Dat	e: A	pril	13,	20	15
Temp.: 21	°C,	Hu	mi:	58	%

Frequency	Antenna	Corr.	Meter Readings [dB(µV)]				Limits [dB(µV/m)]		Results [dB(µV/m)]		Margin [dB]	Remarks
Factor		Factor	Horizontal		Vertical							
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test conditio	on:Tx Low	Ch										
4804.0	27.3	-16.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.2	< 39.2	> +14.8	
12010.0	33.7	-25.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.9	< 35.9	> +18.1	
19216.0	40.5	-42.9	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
Test conditio	on : TX Midd	le Ch										
4880.0	27.3	-16.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.3	< 39.3	> +14.7	
7320.0	29.8	-16.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12200.0	33.5	-26.3	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.2	< 35.2	> +18.8	
19520.0	40.4	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
Test conditio	on : TX High	Ch										
4960.0	27.3	-16.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.3	< 39.3	> +14.7	
7440.0	29.8	-17.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.8	< 40.8	> +13.2	
12400.0	33.5	-26.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 44.7	< 34.7	> +19.3	
19840.0	40.4	-43.0	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.4	< 37.4	> +16.6	
22320.0	40.6	-43.4	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.2	< 37.2	> +16.8	

Calculated result at 7320.0 MHz, as the worst point shown on underline: Antenna Factor = 29.8 dB(1/m) Corr. Factor = -16.8 dB +) Meter Reading = <28.0 dB(μ V) Result = <41.0 dB(μ V/m) Minimum Margin: 54.0 - <41.0 =>13.0 (dB)

NOTES

1. Test Distance : 3 m

2. The spectrum was checked from 1 GHz to 25 GHz (10th harmonic of the highest fundamental frequency).

3. The correction factor is shown as follows:

Corr. Factor [dB] = Cable Loss + 20dB Pad Att. - Pre-Amp. Gain [dB] (1.0 - 7.6GHz)

Corr. Factor [dB] = Cable Loss + 10dB Pad Att. - Pre-Amp. Gain [dB] (7.6 - 18.0GHz)

Corr. Factor [dB] = Cable Loss - Pre-Amp. Gain [dB] (over 18 GHz)

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. PK : Peak / AVE : Average



7.9.4.4.2 Mode of RX (WLAN)

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<u>Test Date: April 13, 2015</u> Temp.: 21 °C, Humi: 58 %

Frequency	Antenna Factor	Corr. Factor	Meter Rea Horizontal		ıdings [dB(μV)] Vertical		Limits [dB(µV/m)]		Results [dB(µV/m)]		Margin [dB]	Remarks
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test conditio	on : RX Midd	le Ch										
2437.0	21.5	-18.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 40.7	< 30.7	> +23.3	
4874.0	27.3	-16.4	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 48.9	< 38.9	> +15.1	
7311.0	29.8	-17.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.7	< 40.7	> +13.3	

Calculated result at 4874.0 MHz, as the worst point shown on underline:									
	Antenna Factor	=	27.3	dB(1/m)					
	Corr. Factor	=	-16.4	dB					
+)	Meter Reading	=	<28.0	dB(µV)					
	Result	=	<38.9	dB(µV/m)					
Minimum Margin: 54.0 - <38.9 =>13.3 (dB)									

NOTES

1. Test Distance : 3 m

2. The spectrum was checked from $1\,\mathrm{GHz}$ to $7.5\,\mathrm{GHz}$.

3. The correction factor is shown as follows:

Corr. Factor [dB] = Cable Loss + 20dB Pad Att. · Pre·Amp. Gain [dB] (1.0 · 7.6GHz)

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. PK : Peak / AVE : Average



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<u>Test Date: April 13, 2015</u> Temp.: 21 °C, Humi: 58 %

7.9.4.4.3 Mode of RX (Bluetooth Low Energy)

Frequency	ncy Antenna Corr. Factor Factor		Meter Readings [dB(µV)] Horizontal Vertical			Limits [dB(µV/m)]		Results [dB(µV/m)]		Margin [dB]	Remarks	
[MHz]	[dB(1/m)]	[dB]	РК	AVE	РК	AVE	РК	AVE	РК	AVE		
Test conditio	on : RX Midd	le Ch										
2440.0	21.5	-18.8	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 40.7	< 30.7	> +23.3	
4880.0	27.3	-16.3	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.0	< 39.0	> +15.0	
7320.0	29.8	-17.1	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 50.7	< 40.7	> +13.3	

Calculated result at 7320.0 MHz, as the worst point shown on underline: Antenna Factor = 29.8 dB(1/m) Corr. Factor = -17.1 dB +) Meter Reading = <28.0 dB(μ V) Result = <40.7 dB(μ V/m) Minimum Margin: 54.0 - <40.7 =>13.3 (dB)

NOTES

1. Test Distance : 3 m

- 2. The spectrum was checked from $1\,\mathrm{GHz}$ to $7.5\,\mathrm{GHz}$.
- 3. The correction factor is shown as follows:

Corr. Factor [dB] = Cable Loss + 20dB Pad Att. · Pre·Amp. Gain [dB] (1.0 · 7.6GHz)

4. The symbol of "<" means "or less".

5. The symbol of ">" means "more than".

6. PK : Peak / AVE : Average