



FCC RF Test Report

APPLICANT : HMD Global Oy
EQUIPMENT : GSM/WCDMA/LTE Mobile Phone
BRAND NAME : Nokia
MODEL NAME : TA-1092
FCC ID : 2AJOTTA-1092
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Oct. 29, 2018 and testing was completed on Nov. 21, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.



Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone,
Jiangsu Province 215335, China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR8O2901-01C	Rev. 01	Initial issue of report	Dec. 11, 2018



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	1
-	-	99% Bandwidth	-	Pass	1
-	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	1
-	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	1
-	15.247(d)	Conducted Band Edges Conducted Spurious Emission	≤ 20dBc	Pass	1
3.1	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.17 dB at 4926.00 MHz
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 11.13 dB at 3.276 MHz
3.3	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-
<p>Remark 1: Test items are performed on original report which can be referred to Sporton report number FR832104C.</p>					



1 General Description

1.1 Applicant

HMD Global Oy

Bertel Jungin aukio 9, 02600 Espoo, Finland

1.2 Manufacturer

HMD Global Oy

Bertel Jungin aukio 9, 02600 Espoo, Finland

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	GSM/WCDMA/LTE Mobile Phone
Brand Name	Nokia
Model Name	TA-1092
FCC ID	2AJOTTA-1092
EUT supports Radios application	GSM/GPRS/EGPRS/ WCDMA/HSPA/DC-HSDPA/ HSPA+(16QAM uplink is not supported)/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 Bluetooth BR/EDR/LE
IMEI Code	864520040008403/864520040008411
HW Version	HW0541
SW Version	000C_0_390
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This project is FCC change ID application (original report FCC ID: 2AJOTTA-1080) and changed dual SIM card slot to single SIM card slots, changed Model Name and HW Version. Since the test result is not affected by the changes, so all the test results release from original report which can be referred to Sporton report number FR8O2901C, FCC ID: 2AJOTTA-1080.



1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Antenna Type / Gain	PIFA Antenna with gain -3.00 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Re-use of Measured Data

1.6.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: TA-1080, FCC ID: 2AJOTTA-1080) is electrically identical to the reference device (Model: TA-1084, FCC ID: 2AJOTTA-1084) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 484596 D01.

1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration.

The re-used RF data includes the following bands provided in Appendix A (Sporton RF Report No. FR832104C for the reference device Model: TA-1084, FCC ID: 2AJOTTA-1084).

1.6.3 Reference detail Section:

Equipment Class	Reference FCC ID	Folder Test	Report Title/Section
DSS (BR/EDR)	2AJOTTA-1084	Part15C (FR832104A)	All sections applicable except AC Conducted Emission and Radiated Spurious Emission.
DTS (BLE)	2AJOTTA-1084	Part15C (FR832104B)	All sections applicable except AC Conducted Emission and Radiated Spurious Emission.
DTS (WLAN)	2AJOTTA-1084	Part15C (FR832104C)	All sections applicable except AC Conducted Emission and Radiated Spurious Emission.



1.6.4 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, spot check measurements were performed on the subject device for the following test items, the test result were consistent with FCC ID: 2AJOTTA-1084.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.

Test Item	Mode	2AJOTTA-1084 Worst Result	2AJOTTA-1080 Worst Result	Difference (dB)
Peak Conducted Power (dBm)	802.11b	18.18	17.22	-0.96
	802.11g	23.18	22.85	-0.33
	11n HT20	23.04	21.81	-1.23
	11n HT40	23.29	22.72	-0.57
	BT (1Mbps)	9.83	9.69	-0.14
	BT (2Mbps)	10.67	10.49	-0.18
	BT (3Mbps)	10.88	10.88	0
	BT LE	1.12	1.14	0.02



1.7 Testing Location

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0).

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958		
Test Site No.	Sporton Site No.	FCC designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH04-KS	CN5013	630927

1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		



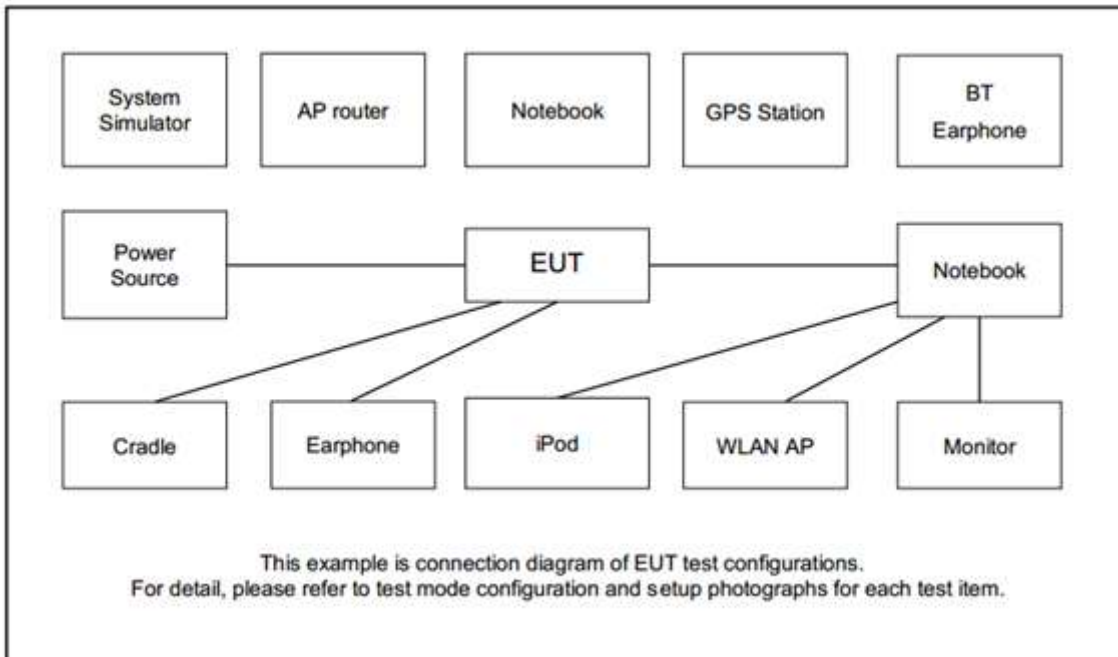
2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + USB Cable (Charging from Adapter)
Remark: For Radiated Test Cases, The tests were performed with Adapter, Earphone and USB Cable.	

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
4.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.



3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

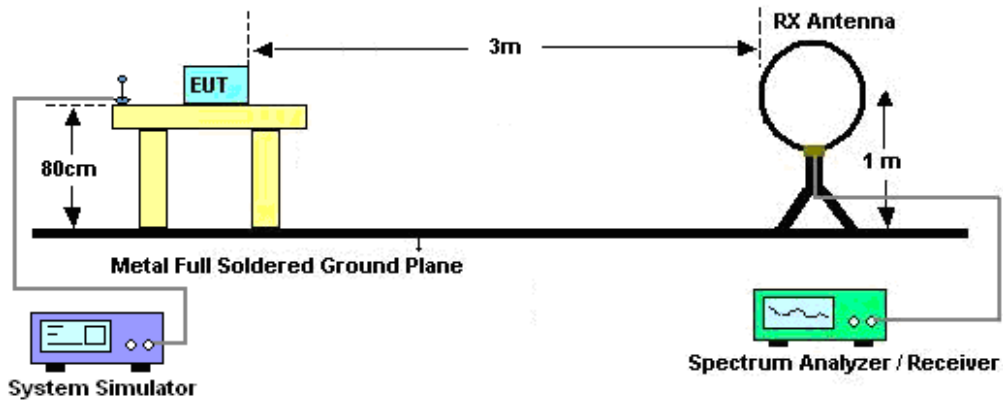


3.1.3 Test Procedures

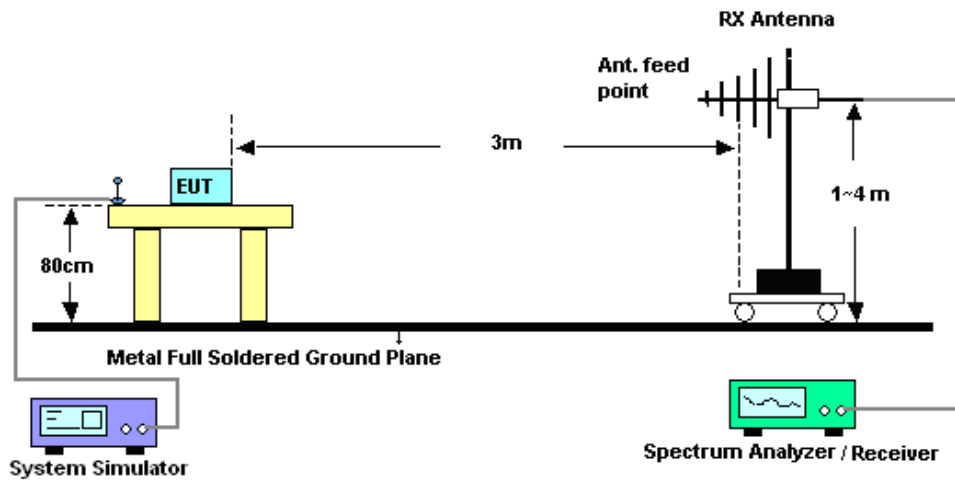
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - $VBW = 10$ Hz, when duty cycle is no less than 98 percent.
 - $VBW \geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.1.4 Test Setup

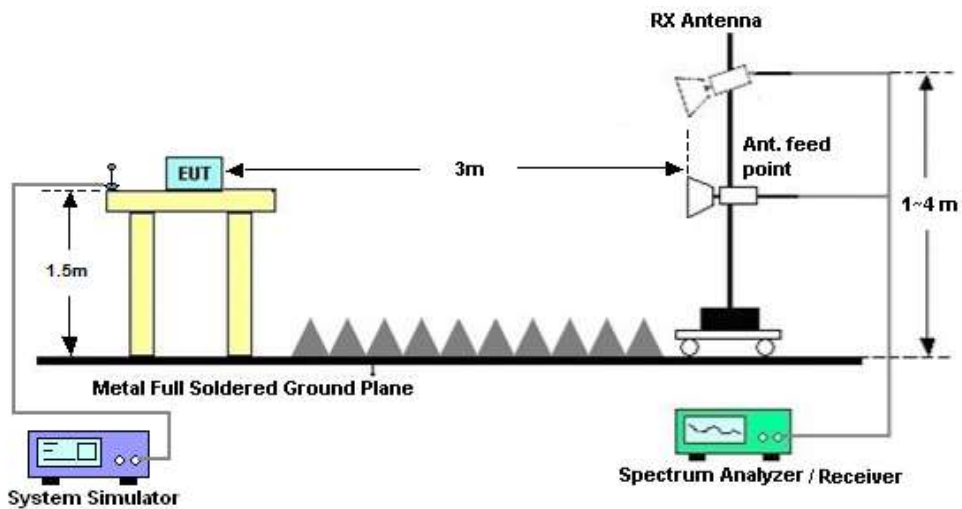
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.



3.2 AC Conducted Emission Measurement

3.2.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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.

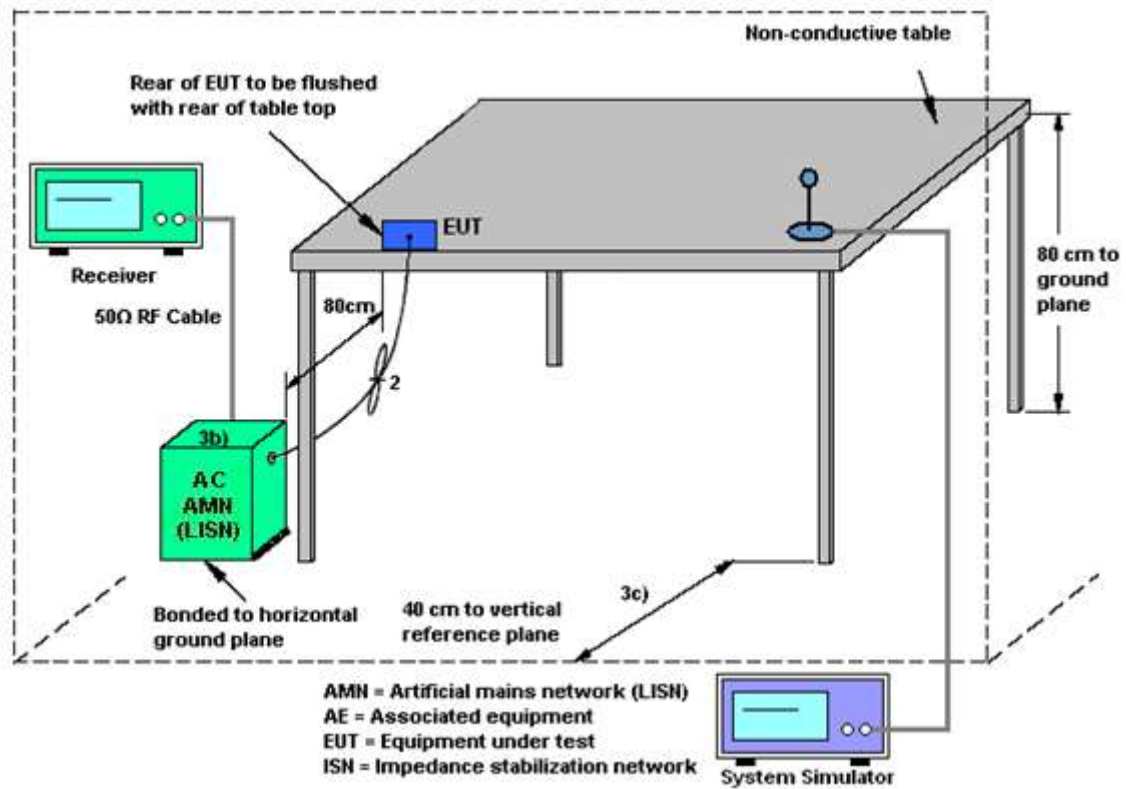
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.2.4 Test Setup



3.2.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.3 Antenna Requirements

3.3.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Ma x 30dBm	Aug.06, 2018	Nov. 16, 2018	Aug.05, 2019	Radiation (03CH04-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44G,MAX 30dB	Apr.17, 2018	Nov. 16, 2018	Apr. 16, 2019	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 19, 2018	Nov. 16, 2018	Oct. 18, 2019	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	44483	30MHz-1GHz	Jan. 29, 2018	Nov. 16, 2018	Jan. 28, 2019	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1648	1GHz~18GHz	Dec. 16, 2017	Nov. 16, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 07, 2018	Nov. 16, 2018	Feb. 06, 2019	Radiation (03CH04-KS)
Amplifier	Burgeon	BPA-530	102219	0.01MHz~3000MHz	Dec. 16, 2017	Nov. 16, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
Amplifier	MITEQ	TTA1840-35-HG	2014749	18~40GHz	Feb. 8, 2018	Nov. 16, 2018	Feb. 07, 2019	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Apr. 17, 2018	Nov. 16, 2018	Apr. 16, 2019	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5G Hz	Dec. 16, 2017	Nov. 16, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Nov. 16, 2018	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 16, 2018	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 16, 2018	NCR	Radiation (03CH04-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 19, 2018	Nov. 21, 2018	Apr. 18, 2019	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 12, 2018	Nov. 21, 2018	Oct. 11, 2019	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Nov. 23, 2017	Nov. 21, 2018	Nov. 22, 2018	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2018	Nov. 21, 2018	Oct. 11, 2019	Conduction (CO01-KS)



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.9dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.9dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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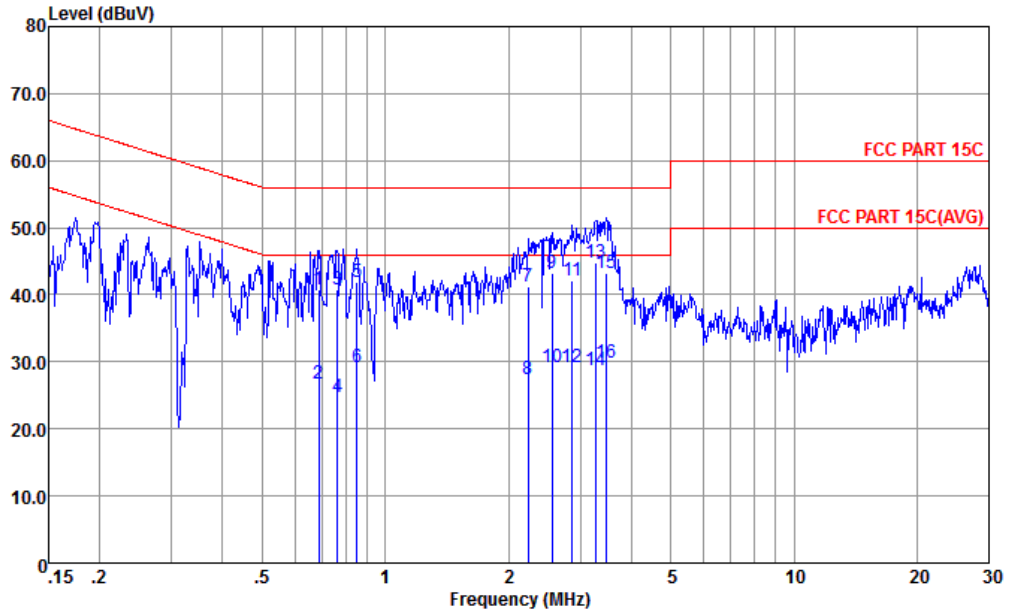
Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Appendix A. AC Conducted Emission Test Results

Test Engineer :	Amos Zhang	Temperature :	25.3~26.2°C
		Relative Humidity :	48~50%
Test Voltage :	120Vac / 60Hz	Phase :	Line

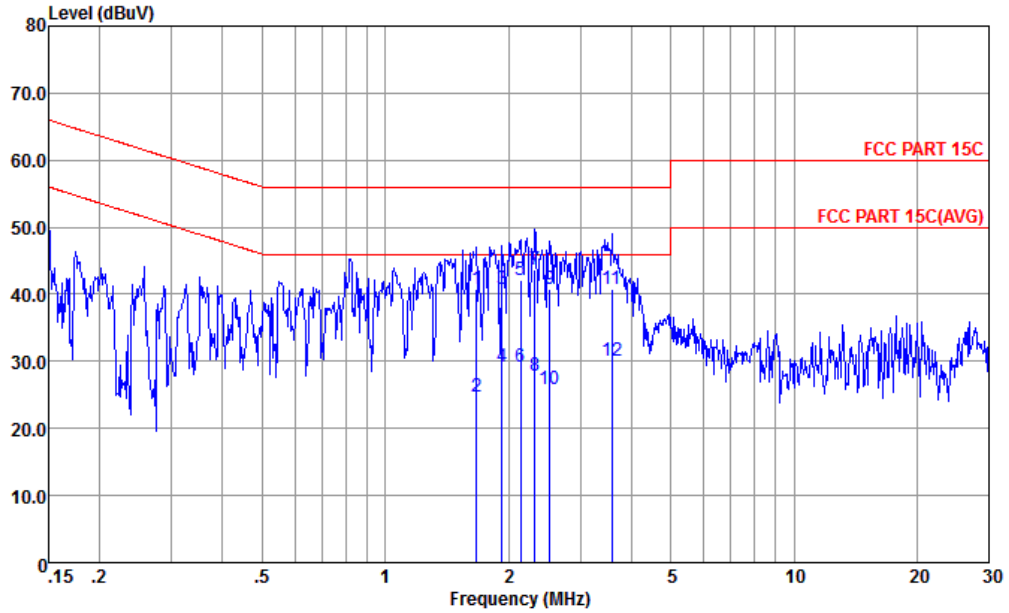


Site : CO01-KS
 Condition : FCC PART 15C LISN-L-171013-060103 LINE
 Project : (FR) 802901
 mode : Mode 1
 : 356940093897764/356940093977764 #11

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.686	40.80	-15.20	56.00	30.30	0.26	10.24	QP
2	0.686	26.80	-19.20	46.00	16.30	0.26	10.24	Average
3	0.763	40.80	-15.20	56.00	30.30	0.26	10.24	QP
4	0.763	24.80	-21.20	46.00	14.30	0.26	10.24	Average
5	0.853	42.00	-14.00	56.00	31.50	0.26	10.24	QP
6	0.853	29.10	-16.90	46.00	18.60	0.26	10.24	Average
7	2.237	41.12	-14.88	56.00	30.60	0.29	10.23	QP
8	2.237	27.42	-18.58	46.00	16.90	0.29	10.23	Average
9	2.554	43.14	-12.86	56.00	32.60	0.30	10.24	QP
10	2.554	29.14	-16.86	46.00	18.60	0.30	10.24	Average
11	2.869	42.16	-13.84	56.00	31.60	0.32	10.24	QP
12	2.869	29.16	-16.84	46.00	18.60	0.32	10.24	Average
13 *	3.276	44.87	-11.13	56.00	34.30	0.33	10.24	QP
14	3.276	28.77	-17.23	46.00	18.20	0.33	10.24	Average
15	3.472	43.18	-12.82	56.00	32.60	0.33	10.25	QP
16	3.472	29.88	-16.12	46.00	19.30	0.33	10.25	Average



Test Engineer :	Amos Zhang	Temperature :	25.3~26.2°C
		Relative Humidity :	48~50%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-KS
 Project : (FR) 802901
 mode : Mode 1
 : 356940093897764/356940093977764 #11
 I-N-171013-060103 NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	1.671	40.75	-15.25	56.00	30.20	0.32	10.23	QP
2	1.671	24.75	-21.25	46.00	14.20	0.32	10.23	Average
3	1.928	40.75	-15.25	56.00	30.20	0.32	10.23	QP
4	1.928	29.15	-16.85	46.00	18.60	0.32	10.23	Average
5	2.144	42.15	-13.85	56.00	31.60	0.32	10.23	QP
6	2.144	29.15	-16.85	46.00	18.60	0.32	10.23	Average
7 *	2.321	43.76	-12.24	56.00	33.21	0.32	10.23	QP
8	2.321	27.86	-18.14	46.00	17.31	0.32	10.23	Average
9	2.527	40.86	-15.14	56.00	30.29	0.33	10.24	QP
10	2.527	25.76	-20.24	46.00	15.19	0.33	10.24	Average
11	3.584	40.78	-15.22	56.00	30.20	0.33	10.25	QP
12	3.584	30.18	-15.82	46.00	19.60	0.33	10.25	Average



Appendix B. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2347.44	53.93	-20.07	74	48.2	32.1	5.43	31.8	105	89	P	H
		2389.95	43.68	-10.32	54	38	32	5.48	31.8	105	89	A	H
	*	2412	104.81	-	-	99	32.13	5.48	31.8	105	89	P	H
	*	2410	101.63	-	-	95.82	32.13	5.48	31.8	105	89	A	H
		2380.85	53.75	-20.25	74	48.09	32.03	5.43	31.8	385	114	P	V
		2389.69	42.73	-11.27	54	37.05	32	5.48	31.8	385	114	A	V
	*	2412	101.75	-	-	95.94	32.13	5.48	31.8	385	114	P	V
	*	2412	98.61	-	-	92.8	32.13	5.48	31.8	385	114	A	V
802.11b CH 11 2462MHz	*	2462	100.41	-	-	94.37	32.33	5.51	31.8	119	75	P	H
	*	2460	97.15	-	-	91.11	32.33	5.51	31.8	119	75	A	H
		2498.56	53.42	-20.58	74	47.47	32.2	5.55	31.8	119	75	P	H
		2483.86	43.04	-10.96	54	37.02	32.27	5.55	31.8	119	75	A	H
	*	2462	97.38	-	-	91.34	32.33	5.51	31.8	370	106	P	V
	*	2460	94.37	-	-	88.33	32.33	5.51	31.8	370	106	A	V
		2488.6	53.8	-20.2	74	47.85	32.2	5.55	31.8	370	106	P	V
		2483.56	42.91	-11.09	54	36.89	32.27	5.55	31.8	370	106	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**2.4GHz 2400~2483.5MHz
WIFI 802.11b (Harmonic @ 3m)**

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	53.82	-20.18	74	73.64	34.2	8.1	62.12	100	70	P	H
		4824	53.6	-0.4	54	73.42	34.2	8.1	62.12	100	70	A	H
		4824	47.29	-26.71	74	67.11	34.2	8.1	62.12	100	360	P	V
802.11b CH 06 2437MHz		4872	47.2	-26.8	74	67.09	34.13	8.09	62.11	100	360	P	H
		7308	43.02	-30.98	74	59.44	36.6	9.75	62.77	100	360	P	H
		4872	44.54	-29.46	74	64.43	34.13	8.09	62.11	100	360	P	V
		7308	42.78	-31.22	74	59.2	36.6	9.75	62.77	100	360	P	V
802.11b CH 11 2462MHz		4926	54.11	-19.89	74	74.04	34.1	8.06	62.09	108	293	P	H
		4926	53.83	-0.17	54	73.76	34.1	8.06	62.09	108	293	A	H
		7386	42.05	-31.95	74	58.52	36.5	9.81	62.78	108	293	P	H
		4926	48.04	-25.96	74	67.97	34.1	8.06	62.09	100	360	P	V
		7386	42.6	-31.4	74	59.07	36.5	9.81	62.78	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2389.56	62.27	-11.73	74	56.59	32	5.48	31.8	100	250	P	H
		2389.95	47.6	-6.4	54	41.92	32	5.48	31.8	100	250	A	H
	*	2408	102.21	-	-	96.4	32.13	5.48	31.8	100	250	P	H
	*	2408	94.6	-	-	88.79	32.13	5.48	31.8	100	250	A	H
		2388.39	57.09	-16.91	74	51.41	32	5.48	31.8	391	287	P	V
		2389.95	44.34	-9.66	54	38.66	32	5.48	31.8	391	287	A	V
	*	2416	99.06	-	-	93.25	32.13	5.48	31.8	391	287	P	V
	*	2416	91.36	-	-	85.55	32.13	5.48	31.8	391	287	A	V
802.11g CH 11 2462MHz	*	2456	101.56	-	-	95.52	32.33	5.51	31.8	124	73	P	H
	*	2454	93.86	-	-	87.82	32.33	5.51	31.8	124	73	A	H
		2494.48	54.27	-19.73	74	48.32	32.2	5.55	31.8	124	73	P	H
		2483.5	43.79	-10.21	54	37.77	32.27	5.55	31.8	124	73	A	H
	*	2456	98.6	-	-	92.56	32.33	5.51	31.8	371	121	P	V
	*	2454	89.91	-	-	83.87	32.33	5.51	31.8	371	121	A	V
		2489.14	53.69	-20.31	74	47.74	32.2	5.55	31.8	371	121	P	V
		2483.56	43.6	-10.4	54	37.58	32.27	5.55	31.8	371	121	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	49.11	-24.89	74	68.93	34.2	8.1	62.12	100	360	P	H
		4824	44.33	-29.67	74	64.15	34.2	8.1	62.12	100	360	P	V
802.11g CH 06 2437MHz		4872	43.79	-30.21	74	63.68	34.13	8.09	62.11	100	360	P	H
		7308	42.28	-31.72	74	58.7	36.6	9.75	62.77	100	360	P	H
		4872	40.05	-33.95	74	59.94	34.13	8.09	62.11	100	360	P	V
		7308	43.22	-30.78	74	59.64	36.6	9.75	62.77	100	360	P	V
802.11g CH 11 2462MHz		4926	54.18	-19.82	74	74.11	34.1	8.06	62.09	100	73	P	H
		4926	42.76	-11.24	54	62.69	34.1	8.06	62.09	100	73	A	H
		7386	42.55	-31.45	74	59.02	36.5	9.81	62.78	100	360	P	H
		4926	44.33	-29.67	74	64.26	34.1	8.06	62.09	100	360	P	V
		7386	42.38	-31.62	74	58.85	36.5	9.81	62.78	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Band Edge @ 3m)**

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.17	60.03	-13.97	74	54.35	32	5.48	31.8	100	90	P	H
		2389.95	46.72	-7.28	54	41.04	32	5.48	31.8	100	90	A	H
	*	2408	101.29	-	-	95.48	32.13	5.48	31.8	100	90	P	H
	*	2408	93.51	-	-	87.7	32.13	5.48	31.8	100	90	A	H
		2389.69	57.62	-16.38	74	51.94	32	5.48	31.8	385	115	P	V
		2389.95	45.83	-8.17	54	40.15	32	5.48	31.8	385	115	A	V
	*	2416	99.71	-	-	93.9	32.13	5.48	31.8	385	115	P	V
	*	2416	91.96	-	-	86.15	32.13	5.48	31.8	385	115	A	V
802.11n HT20 CH 11 2462MHz	*	2456	103.75	-	-	97.71	32.33	5.51	31.8	124	251	P	H
	*	2454	96.03	-	-	89.99	32.33	5.51	31.8	124	251	A	H
		2483.5	58.11	-15.89	74	52.09	32.27	5.55	31.8	124	251	P	H
		2483.5	45.36	-8.64	54	39.34	32.27	5.55	31.8	124	251	A	H
	*	2454	97.42	-	-	91.38	32.33	5.51	31.8	288	123	P	V
	*	2454	89.86	-	-	83.82	32.33	5.51	31.8	288	123	A	V
		2484.52	54.14	-19.86	74	48.12	32.27	5.55	31.8	288	123	P	V
	2484.34	43.65	-10.35	54	37.63	32.27	5.55	31.8	288	123	A	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Harmonic @ 3m)**

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	46.26	-27.74	74	66.08	34.2	8.1	62.12	100	360	P	H
		4824	41.61	-32.39	74	61.43	34.2	8.1	62.12	100	360	P	V
802.11n HT20 CH 06 2437MHz		4872	43.44	-30.56	74	63.33	34.13	8.09	62.11	100	360	P	H
		7308	42.92	-31.08	74	59.34	36.6	9.75	62.77	100	360	P	H
		4872	39.34	-34.66	74	59.23	34.13	8.09	62.11	100	360	P	V
		7308	42.83	-31.17	74	59.25	36.6	9.75	62.77	100	360	P	V
802.11n HT20 CH 11 2462MHz		4926	54.63	-19.37	74	74.56	34.1	8.06	62.09	100	74	P	H
		4926	42.96	-11.04	54	62.89	34.1	8.06	62.09	100	74	A	H
		7386	42.25	-31.75	74	58.72	36.5	9.81	62.78	100	360	P	H
		4926	42.7	-31.3	74	62.63	34.1	8.06	62.09	100	360	P	V
		7386	42.24	-31.76	74	58.71	36.5	9.81	62.78	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Band Edge @ 3m)**

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		2389.04	60.81	-13.19	74	55.13	32	5.48	31.8	209	255	P	H
		2389.69	48.86	-5.14	54	43.18	32	5.48	31.8	209	255	A	H
	*	2412	97.96	-	-	92.15	32.13	5.48	31.8	209	255	P	H
	*	2412	90.21	-	-	84.4	32.13	5.48	31.8	209	255	A	H
		2484.04	53.56	-20.44	74	47.54	32.27	5.55	31.8	209	255	P	H
		2485.48	43.01	-10.99	54	36.99	32.27	5.55	31.8	209	255	A	H
		2389.82	60.67	-13.33	74	54.99	32	5.48	31.8	385	106	P	V
		2389.95	47.61	-6.39	54	41.93	32	5.48	31.8	385	106	A	V
	*	2412	96.36	-	-	90.55	32.13	5.48	31.8	385	106	P	V
	*	2412	88.5	-	-	82.69	32.13	5.48	31.8	385	106	A	V
		2484.4	53.52	-20.48	74	47.5	32.27	5.55	31.8	385	106	P	V
		2483.68	43.35	-10.65	54	37.33	32.27	5.55	31.8	385	106	A	V
802.11n HT40 CH 09 2452MHz		2388	53.91	-20.09	74	48.23	32	5.48	31.8	100	65	P	H
		2389.17	43.82	-10.18	54	38.14	32	5.48	31.8	100	65	A	H
	*	2446	97.38	-	-	91.27	32.4	5.51	31.8	100	65	P	H
	*	2448	89.08	-	-	82.97	32.4	5.51	31.8	100	65	A	H
		2485.36	58.67	-15.33	74	52.65	32.27	5.55	31.8	100	65	P	H
		2483.56	44.32	-9.68	54	38.3	32.27	5.55	31.8	100	65	A	H
		2357.19	54.54	-19.46	74	48.84	32.07	5.43	31.8	295	124	P	V
		2389.56	42.97	-11.03	54	37.29	32	5.48	31.8	295	124	A	V
	*	2448	92.95	-	-	86.84	32.4	5.51	31.8	295	124	P	V
	*	2448	84.46	-	-	78.35	32.4	5.51	31.8	295	124	A	V
	2485.3	53.87	-20.13	74	47.85	32.27	5.55	31.8	295	124	P	V	
	2485.36	43.59	-10.41	54	37.57	32.27	5.55	31.8	295	124	A	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Harmonic @ 3m)**

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n		4842	44.44	-29.56	74	64.27	34.2	8.09	62.12	100	360	P	H
HT40		7266	42.88	-31.12	74	59.4	36.53	9.72	62.77	100	360	P	H
CH 03		4842	41.48	-32.52	74	61.31	34.2	8.09	62.12	100	360	P	V
2422MHz		7266	42.42	-31.58	74	58.94	36.53	9.72	62.77	100	360	P	V
802.11n		4872	41.6	-32.4	74	61.49	34.13	8.09	62.11	100	360	P	H
HT40		7308	42.71	-31.29	74	59.13	36.6	9.75	62.77	100	360	P	H
CH 06		4872	38.74	-35.26	74	58.63	34.13	8.09	62.11	100	360	P	V
2437MHz		7308	42.75	-31.25	74	59.17	36.6	9.75	62.77	100	360	P	V
802.11n		4902	42.13	-31.87	74	62.05	34.1	8.07	62.09	100	360	P	H
HT40		7356	42.7	-31.3	74	59.1	36.6	9.78	62.78	100	360	P	H
CH 09		4902	40.78	-33.22	74	60.7	34.1	8.07	62.09	100	360	P	V
2452MHz		7356	42.27	-31.73	74	58.67	36.6	9.78	62.78	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11b LF		30	23.56	-16.44	40	30.43	24.5	0.61	31.98	-	-	P	H
		62.01	22.79	-17.21	40	41.45	12.44	0.82	31.92	-	-	P	H
		127	27.4	-16.1	43.5	40.42	17.78	1.14	31.94	-	-	P	H
		193.93	26.7	-16.8	43.5	41.91	15.27	1.42	31.9	-	-	P	H
		287.05	33.1	-12.9	46	44.54	18.81	1.8	32.05	100	36	P	H
		373.38	28.45	-17.55	46	37.66	20.92	1.96	32.09	-	-	P	H
		30	26.82	-13.18	40	33.69	24.5	0.61	31.98	-	-	P	V
		61.04	26.04	-13.96	40	44.73	12.42	0.81	31.92	-	-	P	V
		127	32.19	-11.31	43.5	45.21	17.78	1.14	31.94	132	14	P	V
		191.02	24.46	-19.04	43.5	39.7	15.26	1.41	31.91	-	-	P	V
		252.13	22.51	-23.49	46	34.19	18.54	1.74	31.96	-	-	P	V
		289.96	21.94	-24.06	46	33.34	18.85	1.81	32.06	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical



A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 43.54(dBμV/m) – 54(dBμV/m)
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix C. Duty Cycle Plots

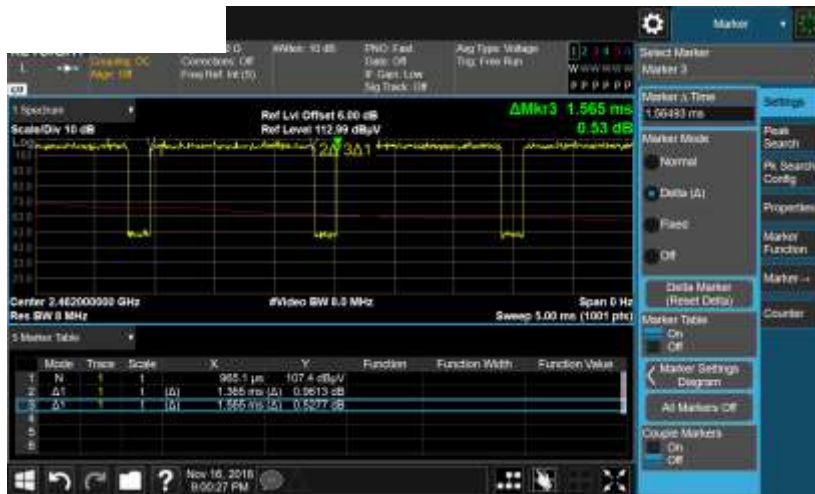
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	97.62	8.220	0.122	0.13KHz
802.11g	87.22	1.365	0.733	0.75KHz
802.11n HT20	86.44	1.275	0.784	0.82KHz
802.11n HT40	85.97	1.226	0.816	0.82KHz



802.11b



802.11g

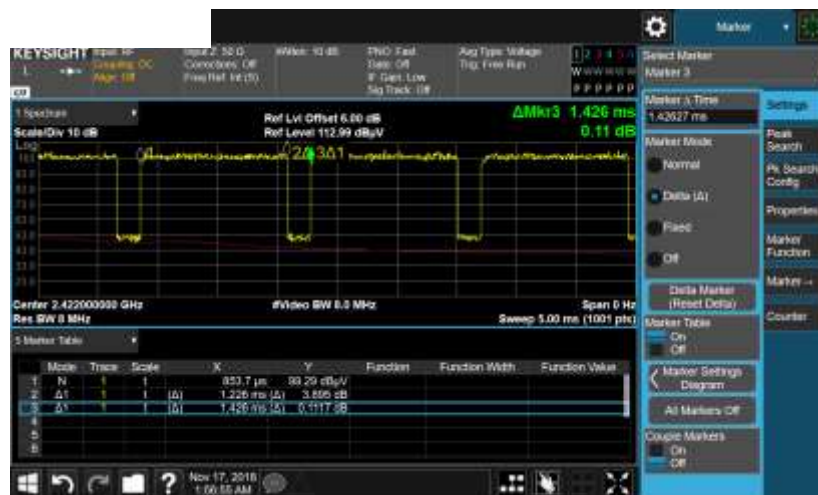




802.11n HT20



802.11n HT40





Appendix E. Reference Report

Please refer to Sporton report number FR832104C which is issued separately.