FCC RF Test Report

APPLICANT	:	Motorola Mobility LLC
EQUIPMENT	:	Mobile Cellular Phone
BRAND NAME	:	Motorola
MODEL NAME	:	9889, 9890
FCC ID	:	IHDT56WE3
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on Jan. 19, 2017 and testing was completed on Mar. 08, 2017. 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.

James Huang

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR711902C	Rev. 01	Initial issue of report	Mar. 30, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 7.76 dB at 36.790 MHz
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 12.68 dB at 0.552 MHz
3.3	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Motorola Mobility LLC
222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

1.2 Manufacturer

Motorola Mobility LLC
222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
Model Name	9889, 9890
FCC ID	IHDT56WE3
EUT supports Radios application	GSM/GPRS/EDGE/WCDMA/HSPA/DC-HSDPA/HSPA+/LTE/ WLAN 2.4GHz 802.11b/g/n HT20/ Bluetooth v3.0 + EDR/Bluetooth v4.0 LE/ Bluetooth v4.1 LE/Bluetooth v4.2 LE
IMEI Code	Radiation: 355647080006330/355647080006348 Conduction: 355647080005456/355647080005464 for Sample 1 355648080001560 for Sample 2
HW Version	WKHMA1B2-2
SW Version	NRD90M.04 for Dual SIM mobile NRD90M.05 for Single SIM mobile
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. There are two types of EUT sample 1 and sample 2, the differences between two samples are only for SIM slot, sample 1(model name: 9889) is dual SIM slot, sample 2(model name: 9890) is single SIM slot.

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
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Specification of Accessory

Specification of Accessory				
AC Adapter IN	**Brand Name**	Motorola (AcBel)	**Model Name**	C-P49 SPN5946A
	Power Rating	I/P: 100-240 Vac, 300mA, O/P: 5.2 Vdc, 2000mA		
AC Adapter US	**Brand Name**	Motorola (AcBel)	**Model Name**	C-P35 SPN5945A
	Power Rating	I/P: 100-240 Vac, 300mA, O/P: 5.2 Vdc, 2000mA		
AC Adapter EU	**Brand Name**	Motorola (AcBel)	**Model Name**	C-P36 SPN5944A
	Power Rating	I/P: 100-240 Vac, 300mA, O/P: 5.2 Vdc, 2000mA		
AC Adapter UK	**Brand Name**	Motorola (AcBel)	**Model Name**	C-P37 SPN5940A
	Power Rating	I/P: 100-240 Vac, 300mA, O/P: 5.2 Vdc, 2000mA		
AC Adapter AR	**Brand Name**	Motorola (AcBel)	**Model Name**	C-P47 SPN5942A
	Power Rating	I/P: 100-240 Vac, 500mA, O/P: 5.2 Vdc, 2000mA		
Battery	**Brand Name**	Motorola (Sunwoda)	**Model Name**	HC60
	Power Rating	3.8Vdc,3780/4000mAh (Min/Typ)	**Type**	Li-ion
Earphone	**Brand Name**	Motorola (hetong)	**Model Name**	PY-13A1602-01KC39
	Signal Line Type	1.3 meter, non-shielded cable, without ferrite core		
USB Cable	**Brand Name**	Motorola (Sai Bao)	**Model Name**	SYD-A017A
	Signal Line Type	1.0 meter, shielded cable, without ferrite core		

1.6 Modification of EUT

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

1.7 Testing Location

Test Site	Sporton International (KunShan) INC.		
Test Site Location	No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958		
Test Site No.	**Sporton Site No.**		**FCC Registration No.**
	CO01-KS	03CH02-KS	418269

Note: The test site complies with ANSI C63.4 2014 requirement.

1.8 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05
- 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.

1.9 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: 9889, 9890, FCC ID: IHDT56WE3) is electrically identical to the reference device (Model: 9888, FCC ID: IHDT56WE1) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 178919 D01.

1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Operational Description.

The re-used RF data includes the following bands provided in Appendix D (Sporton RF Report No. FR711809C for the reference device Model: 9888, FCC ID: IHDT56WE1):

1.6.3 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 radiated spurious emission, the test result were consistent with FCC ID: IHDT56WE1.

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.

1.6.4 Reference detail Section:

Equipment Class	Reference FCC ID	Folder Test/RF Exposure	Report Title/Section
DSS	IHDT56WE1	Part15C(FR711809A)	Conducted item
DTS (BLE)	IHDT56WE1	Part15C(FR711809B)	Conducted item
DTS (WLAN)	IHDT56WE1	Part15C(FR711809C)	Conducted item

2 Test Configuration of Equipment Under Test

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: radiated 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 case was recorded in this report.

2.1 Carrier Frequency and 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

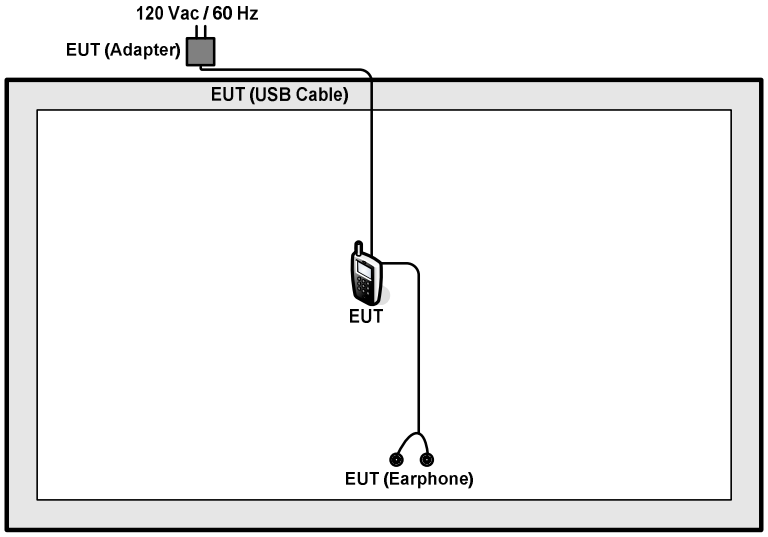
Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

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

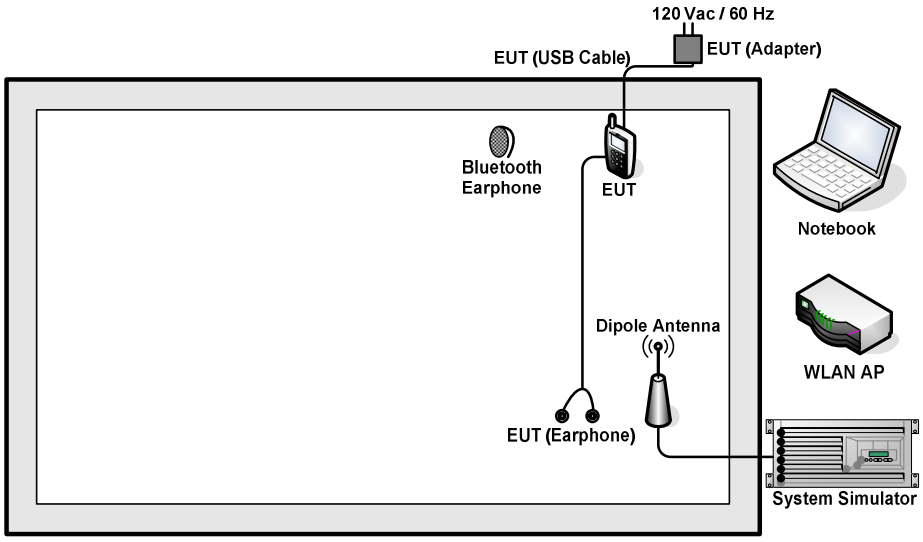
Test Cases		
AC Conducted Emission	Mode 1 :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) + SIM 1 for Sample 1
	Mode 2 :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) for Sample 2

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



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	Linksys	WRT600N	Q87-WRT600NV11	N/A	Unshielded, 1.8 m
3.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated band edge and Spurious Emission Measurement

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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 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

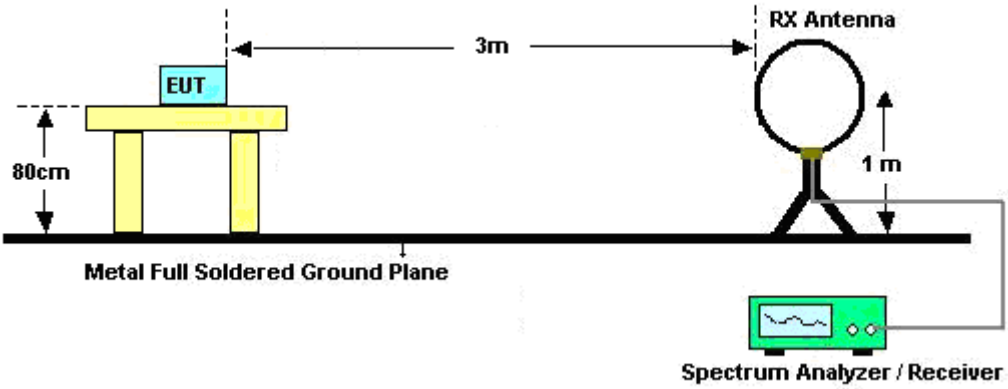
The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

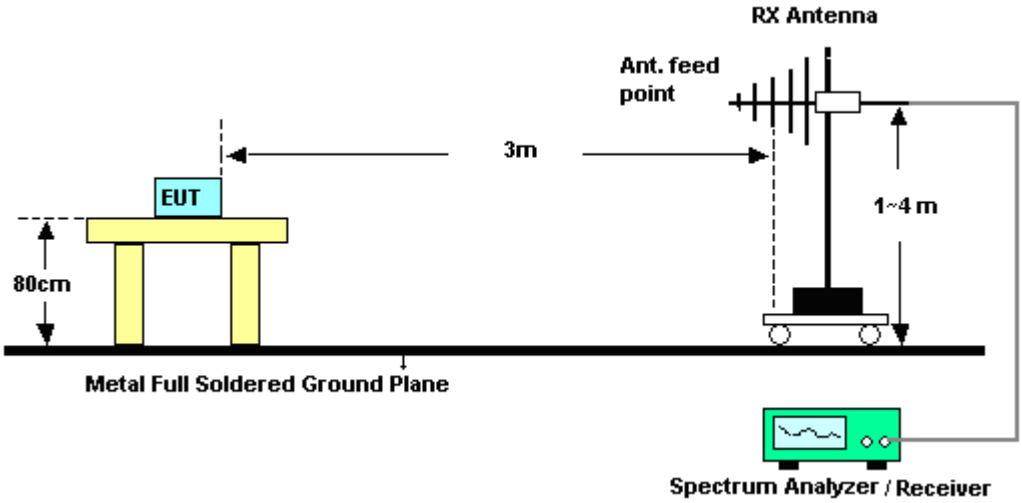
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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 measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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

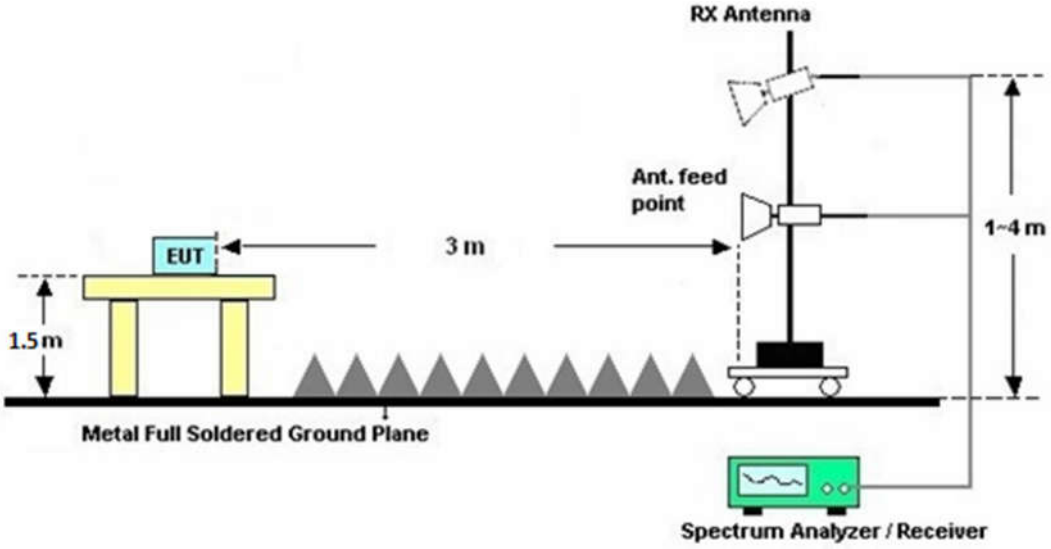
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Appendix B.

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

Please refer to Appendix A.

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.

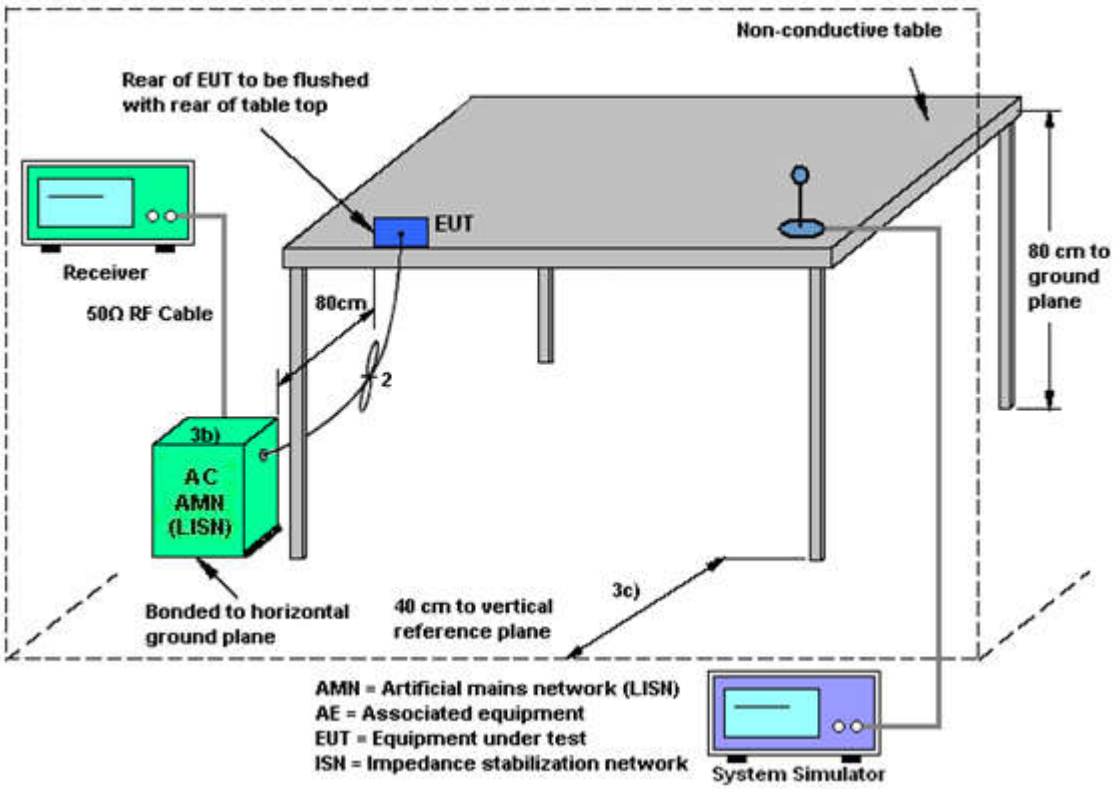
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

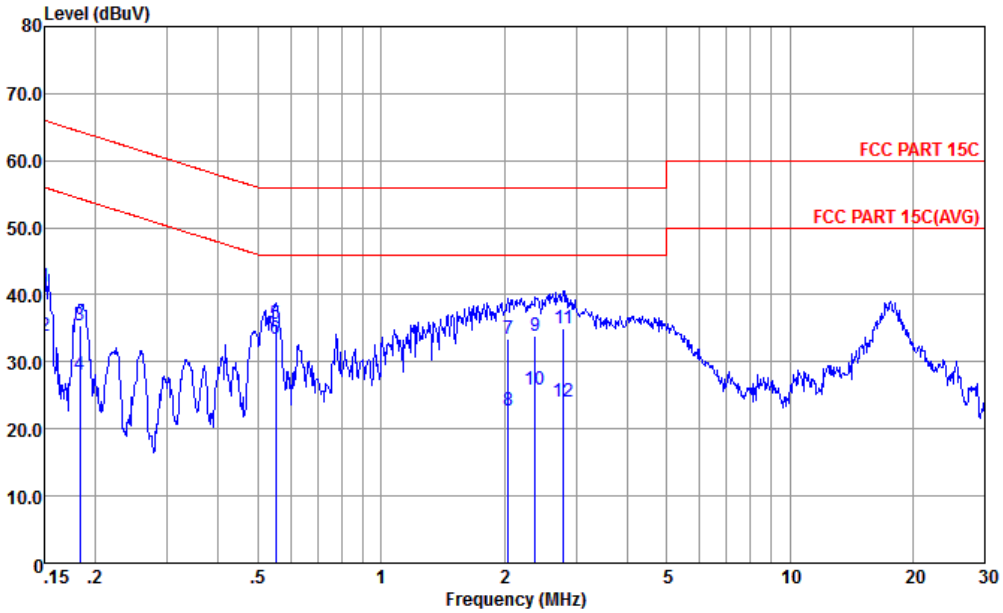
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other 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

Test Mode :	Mode 1	**Temperature :**	20~22℃
Test Engineer :	Peter Wei	**Relative Humidity :**	40~42%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) + SIM 1 for Sample 1		

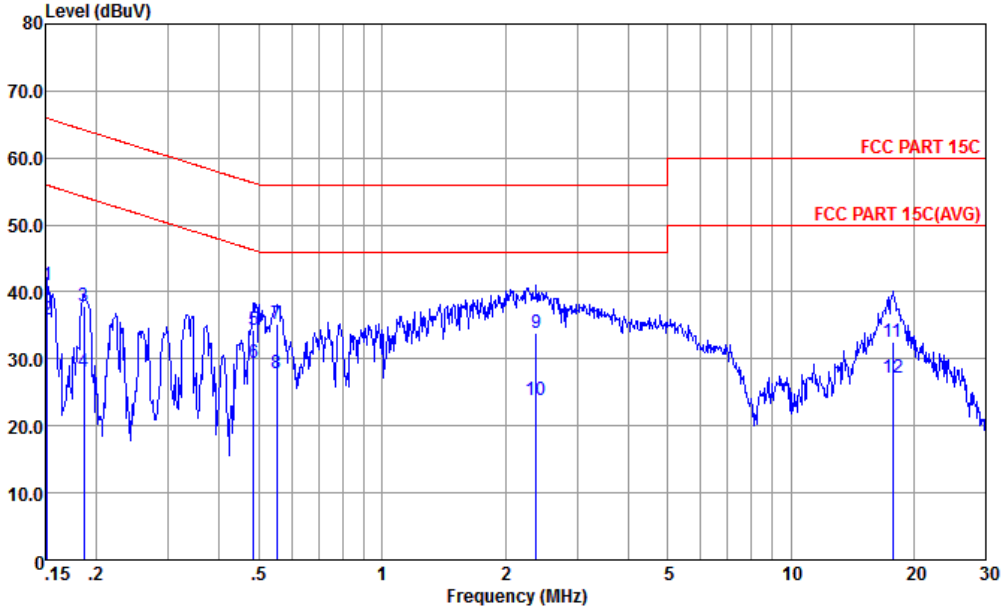


Site : CO01-KS
Condition : FCC PART 15C LISN-L-20151024 LINE

mode : Mode 1
IMEI : 355647080005456/355647080005464 #11

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.150	41.32	-24.68	66.00	30.40	0.53	10.39	QP
2	0.150	33.92	-22.08	56.00	23.00	0.53	10.39	Average
3	0.183	35.46	-28.87	64.33	24.80	0.31	10.35	QP
4	0.183	28.16	-26.17	54.33	17.50	0.31	10.35	Average
5	0.552	35.62	-20.38	56.00	25.21	0.23	10.18	QP
6 *	0.552	33.32	-12.68	46.00	22.91	0.23	10.18	Average
7	2.044	33.37	-22.63	56.00	23.00	0.18	10.19	QP
8	2.044	22.67	-23.33	46.00	12.30	0.18	10.19	Average
9	2.384	33.78	-22.22	56.00	23.40	0.18	10.20	QP
10	2.384	25.88	-20.12	46.00	15.50	0.18	10.20	Average
11	2.794	35.00	-21.00	56.00	24.61	0.18	10.21	QP
12	2.794	24.00	-22.00	46.00	13.61	0.18	10.21	Average

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Peter Wei	Relative Humidity :	40~42%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) + SIM 1 for Sample 1		



Site : CO01-KS
Condition : FCC PART 15C LISN-N-20151024 NEUTRAL

mode : Mode 1
IMEI : 355647080005456/355647080005464 #11

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.152	40.99	-24.92	65.91	30.30	0.30	10.39	QP
2	0.152	35.89	-20.02	55.91	25.20	0.30	10.39	Average
3	0.186	37.86	-26.34	64.20	27.20	0.31	10.35	QP
4	0.186	28.16	-26.04	54.20	17.50	0.31	10.35	Average
5	0.484	34.41	-21.86	56.27	23.90	0.32	10.19	QP
6 *	0.484	29.41	-16.86	46.27	18.90	0.32	10.19	Average
7	0.552	35.11	-20.89	56.00	24.60	0.33	10.18	QP
8	0.552	27.81	-18.19	46.00	17.30	0.33	10.18	Average
9	2.384	33.98	-22.02	56.00	23.40	0.38	10.20	QP
10	2.384	23.78	-22.22	46.00	13.20	0.38	10.20	Average
11	17.755	32.58	-27.42	60.00	21.60	0.26	10.72	QP
12	17.755	27.18	-22.82	50.00	16.20	0.26	10.72	Average

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 FCC 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; Max 30dBm	Aug. 09, 2016	Mar. 08, 2017	Aug. 08, 2017	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44GHz, MAX 30dB	Apr. 22, 2016	Mar. 08, 2017	Apr. 21, 2017	Radiation (03CH02-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 23, 2016	Mar. 08, 2017	Nov. 22, 2017	Radiation (03CH01-KS)
Bilog Antenna	TeseQ	CBL6112D	37879	30MHz~2GHz	Aug. 20, 2016	Mar. 08, 2017	Aug. 19, 2017	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 22, 2016	Mar. 08, 2017	Oct. 21, 2017	Radiation (03CH02-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 15, 2017	Mar. 08, 2017	Feb. 14, 2018	Radiation (03CH02-KS)
Amplifier	com-power	PA-103A	161069	1kHz~1000MHz / 32 dB	Apr. 22, 2016	Mar. 08, 2017	Apr. 21, 2017	Radiation (03CH02-KS)
Amplifier	Agilent	8449B	3008A02384	1GHz~26.5GHz	Oct. 13, 2016	Mar. 08, 2017	Oct. 12, 2017	Radiation (03CH02-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 15, 2017	Mar. 08, 2017	Feb. 14, 2018	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Mar. 08, 2017	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Mar. 08, 2017	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Mar. 08, 2017	NCR	Radiation (03CH02-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz	Apr. 29, 2016	Feb. 27, 2017	Apr. 28, 2017	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2016	Feb. 27, 2017	Oct. 12, 2017	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 13, 2016	Feb. 27, 2017	Oct. 12, 2017	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 13, 2016	Feb. 27, 2017	Oct. 12, 2017	Conduction (CO01-KS)

NCR: No Calibration Required

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))	2.3dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.2dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.7dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.3dB

Appendix A. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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)
802.11b CH 01 2412MHz		2388.52	42.59	-31.41	74	43.95	25.4	4.76	31.52	380	269	P	H
		2387.48	32.89	-21.11	54	34.25	25.4	4.76	31.52	380	269	A	H
	*	2412	101.47	-	-	102.65	25.54	4.78	31.5	380	269	P	H
	*	2410	98.32	-	-	99.5	25.54	4.78	31.5	380	269	A	H
		2387.61	41.42	-32.58	74	42.78	25.4	4.76	31.52	387	302	P	V
		2388.91	31.23	-22.77	54	32.59	25.4	4.76	31.52	387	302	A	V
	*	2412	99.51	-	-	100.69	25.54	4.78	31.5	387	302	P	V
	*	2410	96.39	-	-	97.57	25.54	4.78	31.5	387	302	A	V
802.11b CH 06 2437MHz		2388.65	42.16	-31.84	74	43.52	25.4	4.76	31.52	376	268	P	H
		2387.87	30.72	-23.28	54	32.08	25.4	4.76	31.52	376	268	A	H
	*	2438	101.91	-	-	102.74	25.83	4.82	31.48	376	268	P	H
	*	2438	98.77	-	-	99.6	25.83	4.82	31.48	376	268	A	H
		2485.72	43.31	-30.69	74	43.8	26.11	4.86	31.46	376	268	P	H
		2483.5	32.17	-21.83	54	32.66	26.11	4.86	31.46	376	268	A	H
		2365.51	40.65	-33.35	74	42.17	25.29	4.73	31.54	334	317	P	V
		2387.61	29.66	-24.34	54	31.02	25.4	4.76	31.52	334	317	A	V
	*	2438	97.76	-	-	98.59	25.83	4.82	31.48	334	317	P	V
	*	2438	94.58	-	-	95.41	25.83	4.82	31.48	334	317	A	V
		2487.46	42	-32	74	42.49	26.11	4.86	31.46	334	317	P	V
		2483.5	31.23	-22.77	54	31.72	26.11	4.86	31.46	334	317	A	V

802.11b CH 11 2462MHz		2483.62	47.37	-26.63	74	47.86	26.11	4.86	31.46	118	266	P	H
		2483.5	38.4	-15.6	54	38.89	26.11	4.86	31.46	118	266	A	H
	*	2460	101.33			101.99	25.97	4.84	31.47	118	266	P	H
	*	2460	97.89			98.55	25.97	4.84	31.47	118	266	A	H
		2483.5	45.7	-28.3	74	46.19	26.11	4.86	31.46	354	306	P	V
		2483.68	36.05	-17.95	54	36.54	26.11	4.86	31.46	354	306	A	V
	*	2462	96.4			97.06	25.97	4.84	31.47	354	306	P	V
	*	2464	93.18			93.84	25.97	4.84	31.47	354	306	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	49.82	-24.18	74	71.43	30.9	6.87	59.38	100	255	P	H
		4824	43.8	-30.2	74	65.41	30.9	6.87	59.38	150	360	P	V
802.11b CH 06 2437MHz		4872	48.78	-25.22	74	70.05	31.01	6.86	59.14	150	360	P	H
		7308	42.31	-31.69	74	57.05	35.34	8.47	58.55	150	360	P	H
		4872	43.27	-30.73	74	64.54	31.01	6.86	59.14	150	360	P	V
		7308	41.48	-32.52	74	56.22	35.34	8.47	58.55	150	360	P	V
802.11b CH 11 2462MHz		4926	45.77	-28.23	74	66.71	31.12	6.84	58.9	150	360	P	H
		7386	42.09	-31.91	74	57.03	35.55	8.49	58.98	150	360	P	H
		4926	43.25	-30.75	74	64.19	31.12	6.84	58.9	150	360	P	V
		7386	41.45	-32.55	74	56.39	35.55	8.49	58.98	150	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		2389.3	52.35	-21.65	74	53.71	25.4	4.76	31.52	382	260	P	H
		2389.95	38.44	-15.56	54	39.8	25.4	4.76	31.52	382	260	A	H
	*	2408	100.63	-	-	101.81	25.54	4.78	31.5	382	260	P	H
	*	2410	92.94	-	-	94.12	25.54	4.78	31.5	382	260	A	H
		2389.82	45.05	-28.95	74	46.41	25.4	4.76	31.52	343	314	P	V
		2389.95	33.46	-20.54	54	34.82	25.4	4.76	31.52	343	314	A	V
	*	2410	96.18	-	-	97.36	25.54	4.78	31.5	343	314	P	V
	*	2410	87.98	-	-	89.16	25.54	4.78	31.5	343	314	A	V
802.11g CH 06 2437MHz		2388.26	45.13	-28.87	74	46.49	25.4	4.76	31.52	345	262	P	H
		2389.95	34.93	-19.07	54	36.29	25.4	4.76	31.52	345	262	A	H
	*	2438	101.5	-	-	102.33	25.83	4.82	31.48	345	262	P	H
	*	2438	93.71	-	-	94.54	25.83	4.82	31.48	345	262	A	H
		2483.86	46.69	-27.31	74	47.18	26.11	4.86	31.46	345	262	P	H
		2484.1	37.06	-16.94	54	37.55	26.11	4.86	31.46	345	262	A	H
		2389.17	41.12	-32.88	74	42.48	25.4	4.76	31.52	331	315	P	V
		2389.95	31.28	-22.72	54	32.64	25.4	4.76	31.52	331	315	A	V
	*	2440	97.22	-	-	98.05	25.83	4.82	31.48	331	315	P	V
	*	2440	89.49	-	-	90.32	25.83	4.82	31.48	331	315	A	V
		2483.62	45.33	-28.67	74	45.82	26.11	4.86	31.46	331	315	P	V
		2483.56	33.89	-20.11	54	34.38	26.11	4.86	31.46	331	315	A	V

802.11g CH 11 2462MHz	*	2460	99.27	-	-	99.93	25.97	4.84	31.47	323	261	P	H
	*	2460	91.5	-	-	92.16	25.97	4.84	31.47	323	261	A	H
		2483.74	56.98	-17.02	74	57.47	26.11	4.86	31.46	323	261	P	H
		2483.5	43.33	-10.67	54	43.82	26.11	4.86	31.46	323	261	A	H
	*	2460	94.51	-	-	95.17	25.97	4.84	31.47	294	316	P	V
	*	2460	86.69	-	-	87.35	25.97	4.84	31.47	294	316	A	V
		2483.92	51.74	-22.26	74	52.23	26.11	4.86	31.46	294	316	P	V
		2483.5	39.05	-14.95	54	39.54	26.11	4.86	31.46	294	316	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	41.84	-32.16	74	63.45	30.9	6.87	59.38	150	360	P	H
		4824	39.24	-34.76	74	60.85	30.9	6.87	59.38	150	360	P	V
802.11g CH 06 2437MHz		4872	45.38	-28.62	74	66.65	31.01	6.86	59.14	150	360	P	H
		7308	41.61	-32.39	74	56.35	35.34	8.47	58.55	150	360	P	H
		4872	38.46	-35.54	74	59.73	31.01	6.86	59.14	150	360	P	V
		7308	42.04	-31.96	74	56.78	35.34	8.47	58.55	150	360	P	V
802.11g CH 11 2462MHz		4926	39.48	-34.52	74	60.42	31.12	6.84	58.9	150	360	P	H
		7386	40.57	-33.43	74	55.51	35.55	8.49	58.98	150	360	P	H
		4926	37.4	-36.6	74	58.34	31.12	6.84	58.9	150	360	P	V
		7386	40.1	-33.9	74	55.04	35.55	8.49	58.98	150	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		2389.95	54.34	-19.66	74	55.7	25.4	4.76	31.52	134	259	P	H
		2389.95	38.83	-15.17	54	40.19	25.4	4.76	31.52	134	259	A	H
	*	2410	99.77	-	-	100.95	25.54	4.78	31.5	134	259	P	H
	*	2410	92.14	-	-	93.32	25.54	4.78	31.5	134	259	A	H
		2389.95	48.59	-25.41	74	49.95	25.4	4.76	31.52	100	288	P	V
		2389.95	34.13	-19.87	54	35.49	25.4	4.76	31.52	100	288	A	V
	*	2410	94.47	-	-	95.65	25.54	4.78	31.5	100	288	P	V
	*	2410	86.89	-	-	88.07	25.54	4.78	31.5	100	288	A	V
802.11n HT20 CH 06 2437MHz		2388.52	43.5	-30.5	74	44.86	25.4	4.76	31.52	187	253	P	H
		2389.95	33.85	-20.15	54	35.21	25.4	4.76	31.52	187	253	A	H
	*	2440	100.53	-	-	101.36	25.83	4.82	31.48	187	253	P	H
	*	2438	92.78	-	-	93.61	25.83	4.82	31.48	187	253	A	H
		2483.86	46.28	-27.72	74	46.77	26.11	4.86	31.46	187	253	P	H
		2483.56	36.2	-17.8	54	36.69	26.11	4.86	31.46	187	253	A	H
		2389.43	41.53	-32.47	74	42.89	25.4	4.76	31.52	100	293	P	V
		2389.69	31.78	-22.22	54	33.14	25.4	4.76	31.52	100	293	A	V
	*	2442	96.71	-	-	97.54	25.83	4.82	31.48	100	293	P	V
	*	2438	88.77	-	-	89.6	25.83	4.82	31.48	100	293	A	V
		2483.8	44.76	-29.24	74	45.25	26.11	4.86	31.46	100	293	P	V
		2483.56	33.41	-20.59	54	33.9	26.11	4.86	31.46	100	293	A	V

802.11n HT20 CH 11 2462MHz	*	2462	98.48	-	-	99.14	25.97	4.84	31.47	162	259	P	H
	*	2460	90.62	-	-	91.28	25.97	4.84	31.47	162	259	A	H
		2483.86	57.18	-16.82	74	57.67	26.11	4.86	31.46	162	259	P	H
		2483.5	42.65	-11.35	54	43.14	26.11	4.86	31.46	162	259	A	H
	*	2460	95.56	-	-	96.22	25.97	4.84	31.47	100	257	P	V
	*	2460	87.92	-	-	88.58	25.97	4.84	31.47	100	257	A	V
		2483.56	54.19	-19.81	74	54.68	26.11	4.86	31.46	100	257	P	V
		2483.56	40.7	-13.3	54	41.19	26.11	4.86	31.46	100	257	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	42.96	-31.04	74	64.57	30.9	6.87	59.38	150	360	P	H
		4824	40.96	-33.04	74	62.57	30.9	6.87	59.38	150	360	P	V
802.11n HT20 CH 06 2437MHz		4872	35.92	-38.08	74	57.19	31.01	6.86	59.14	150	360	P	H
		7308	41.51	-32.49	74	56.25	35.34	8.47	58.55	150	360	P	H
		4872	37.06	-36.94	74	58.33	31.01	6.86	59.14	150	360	P	V
		7308	40.73	-33.27	74	55.47	35.34	8.47	58.55	150	360	P	V
802.11n HT20 CH 11 2462MHz		4926	39.97	-34.03	74	60.91	31.12	6.84	58.9	150	360	P	H
		7386	40.92	-33.08	74	55.86	35.55	8.49	58.98	150	360	P	H
		4926	37.62	-36.38	74	58.56	31.12	6.84	58.9	150	360	P	V
		7386	42.4	-31.6	74	57.34	35.55	8.49	58.98	150	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 802.11g (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11g LF		30	20.63	-19.37	40	25.34	26.3	0.09	31.1	100	297	P	H
		98.87	19.11	-24.39	43.5	31.76	17.7	0.37	30.72	-	-	P	H
		144.46	21.13	-22.37	43.5	33.7	17.36	0.95	30.88	-	-	P	H
		159.01	21.96	-21.54	43.5	34.26	17.02	1.62	30.94	-	-	P	H
		265.71	22.37	-23.63	46	33.3	18.43	1.93	31.29	-	-	P	H
		718.7	24.66	-21.34	46	26.04	26.99	2.49	30.86	-	-	P	H
		36.79	32.24	-7.76	40	41.06	22.14	0.12	31.08	100	214	P	V
		48.43	23.95	-16.05	40	38.87	15.93	0.62	31.47	-	-	P	V
		99.84	19.07	-24.43	43.5	31.58	17.8	0.39	30.7	-	-	P	V
		463.59	24.22	-21.78	46	29.46	23.52	2.84	31.6	-	-	P	V
		561.56	28.69	-17.31	46	32.4	24.96	2.83	31.5	-	-	P	V
		848.68	28.81	-17.19	46	29.07	28.49	2.44	31.19	-	-	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	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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 CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. 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)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. 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)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

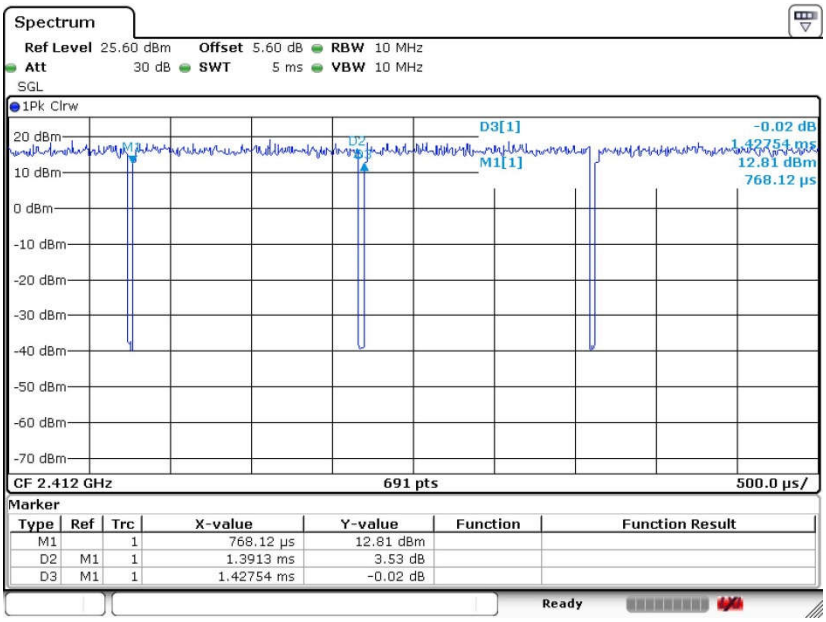
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix B. Duty Cycle Plots

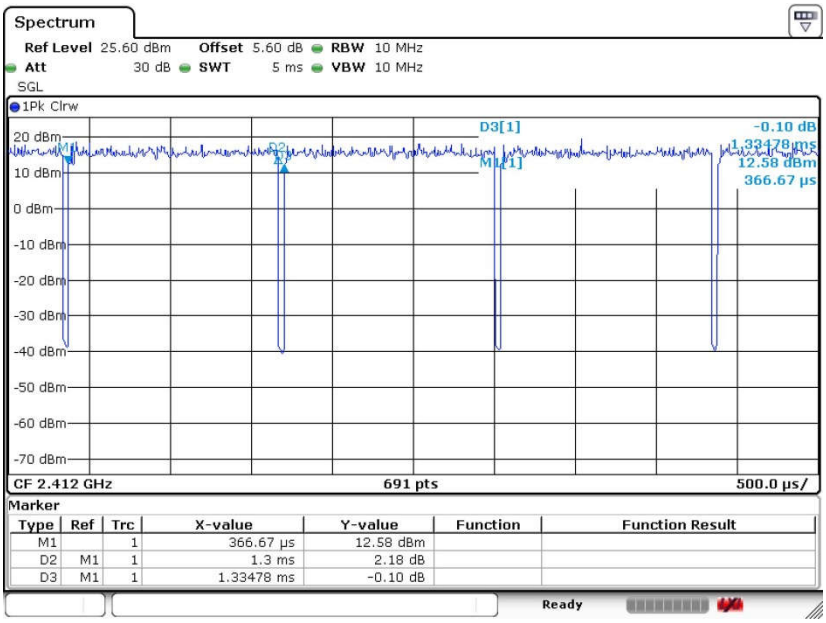
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	100.00	-	-	10Hz
802.11g	97.46	1.391	0.719	1kHz
802.11n HT20	97.39	1.300	0.769	1kHz

802.11b

802.11g



802.11n20



Appendix D. Reference Report

Please refer to Sporton report number FR711809C which is issued separately.