



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 : (DSS) Spread Spectrum Transmitter

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.

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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 8.53 dB at 37.760 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 Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Antenna Type / Gain	PIFA Antenna
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

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
- 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. FR711809A 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

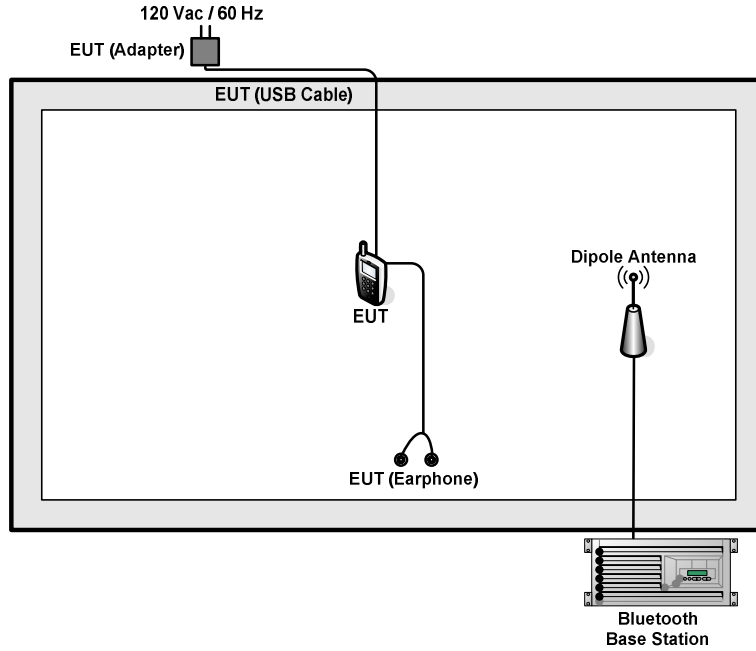
2.1 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

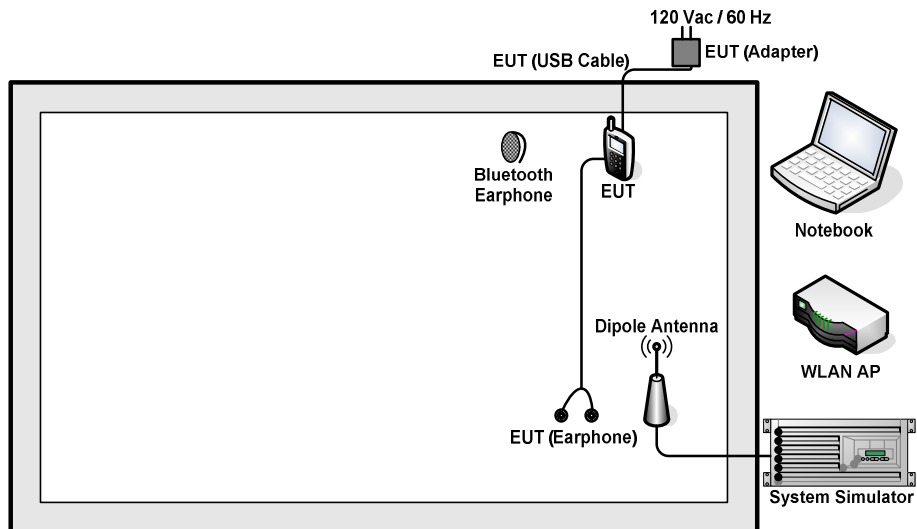
Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth BR 1Mbps GFSK
Radiated Test Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz
AC Conducted Emission	Mode 1 :GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) + SIM 1 for Sample 1 Mode 2 :GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter) for Sample 2
Remark: 1. For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and no other significantly frequencies found in conducted spurious emission. 2. For Radiated Test Cases, The tests were performed with Adapter, Earphone and USB Cable.	

2.2 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>





2.3 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.	Bluetooth Base Station	R&S	CBT	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	Linksys	WRT600N	Q87-WRT600NV11	N/A	Unshielded, 1.8 m
4.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A

2.4 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive.

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



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 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.



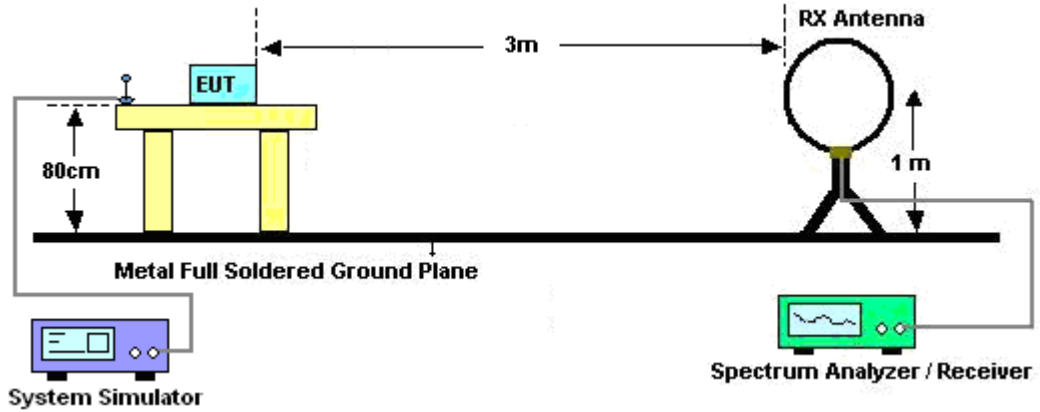
3.1.3 Test Procedures

1. The 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.
1. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
2. For each suspected emission, 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 to comply with the guidelines.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. 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, RBW=1MHz for $f > 1$ GHz ; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

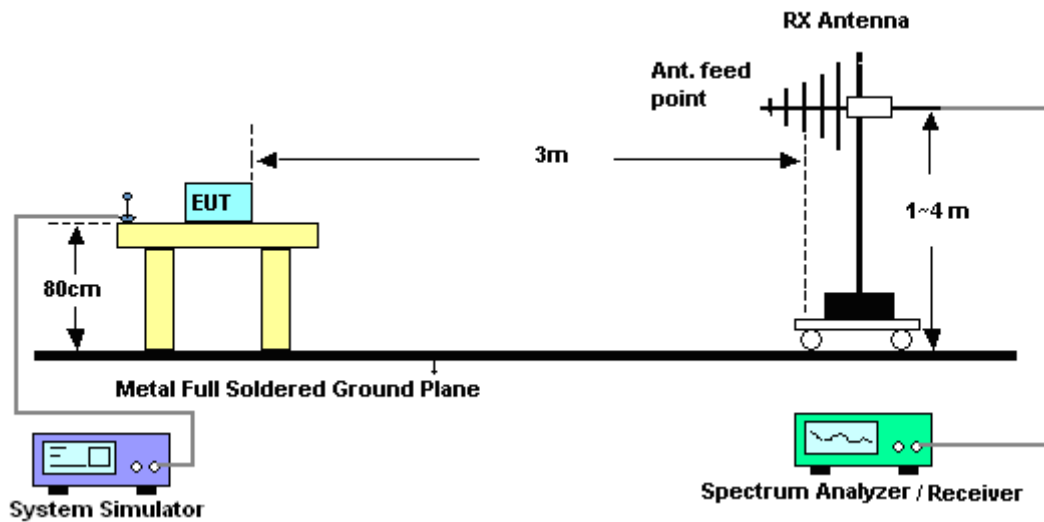
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.82dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.1.4 Test Setup

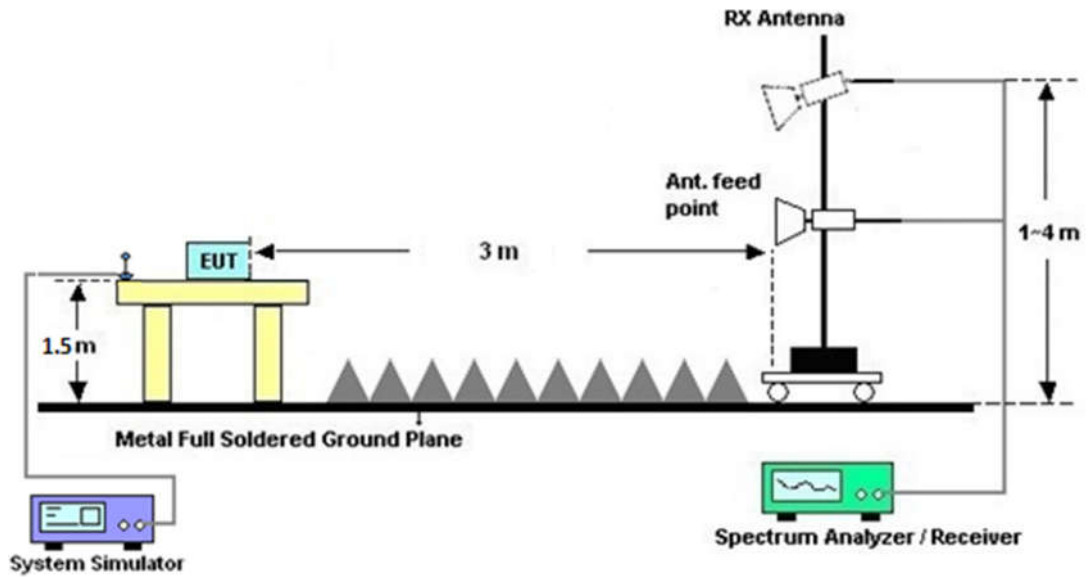
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



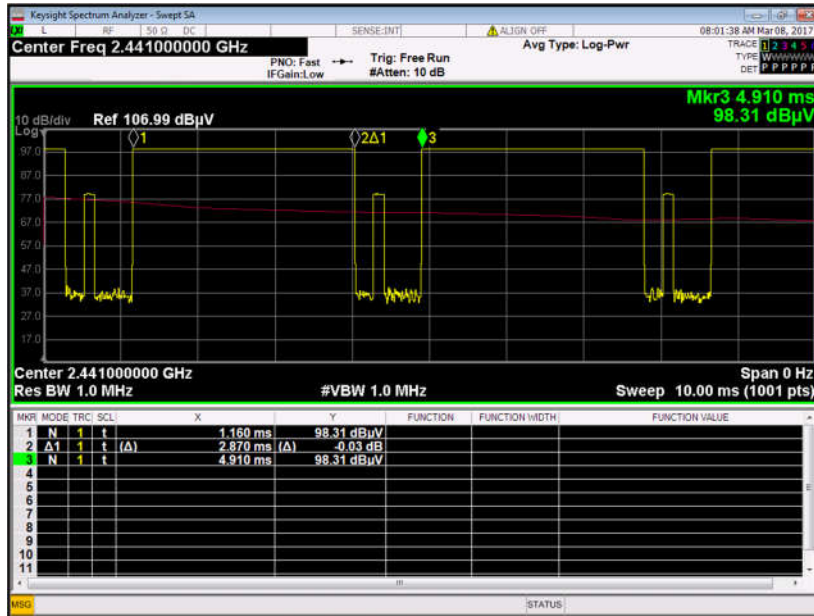
3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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

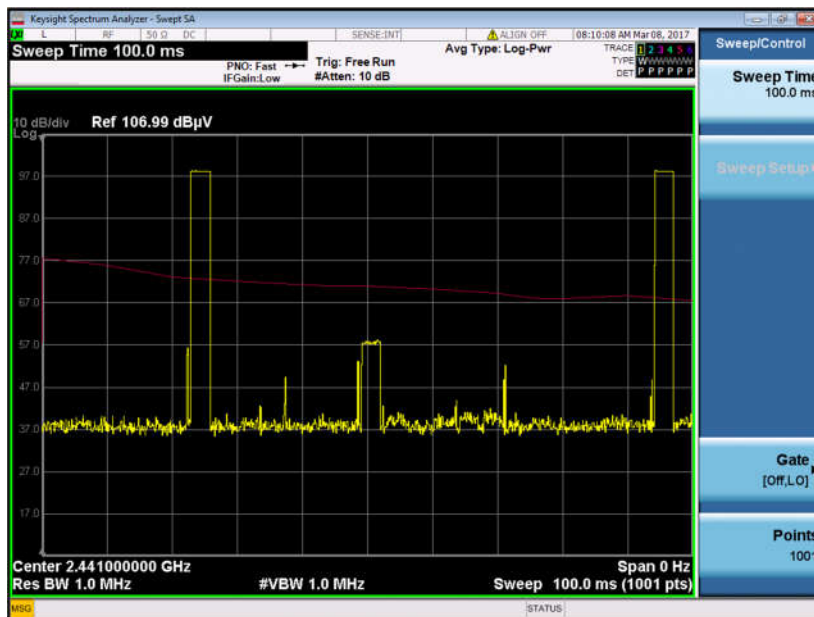


3.1.6 Duty cycle correction factor for average measurement

DH5 on time (One Pulse) Plot on Channel 39



DH5 on time (Count Pulses) Plot on Channel 39



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.87 / 100 = 5.74 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.82 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.



Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.87 \text{ ms} \times 20 \text{ channels} = 57.4 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.87 \text{ ms} \times 2 = 5.74 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.74 \text{ ms}/100\text{ms}) = -24.82 \text{ dB}$$

3.1.7 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

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.

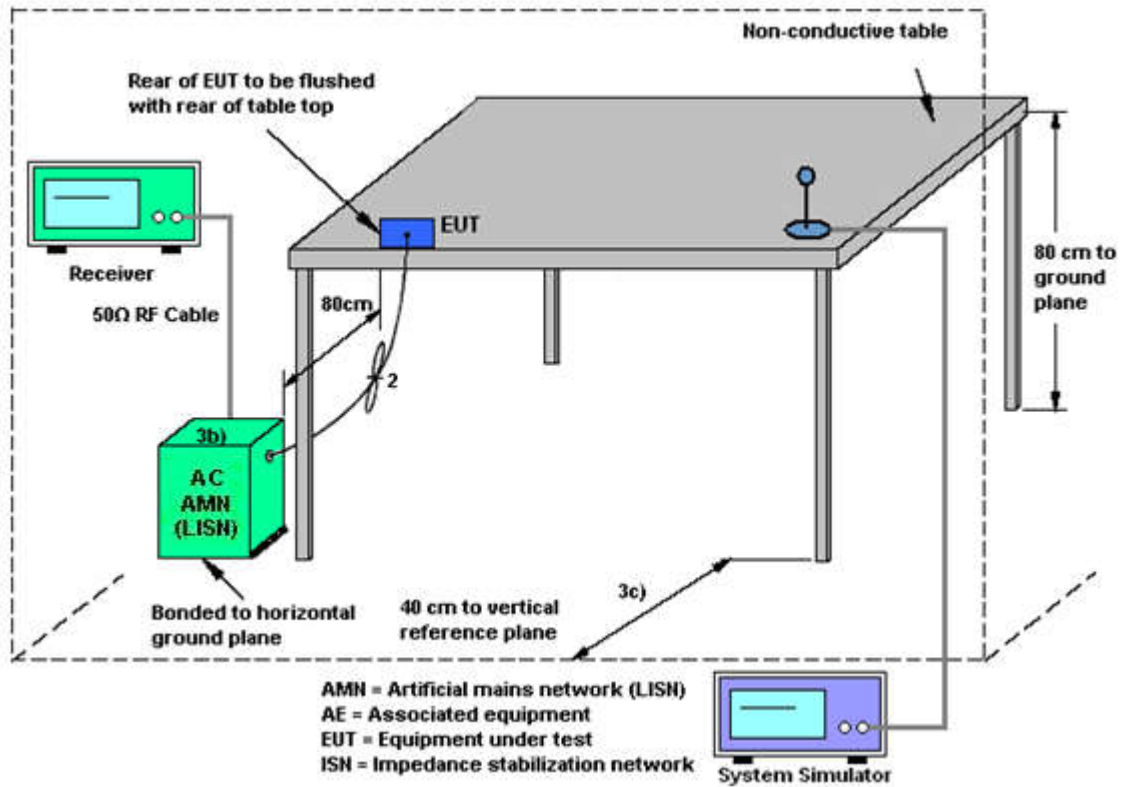
3.2.2 Measuring Instruments

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 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. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

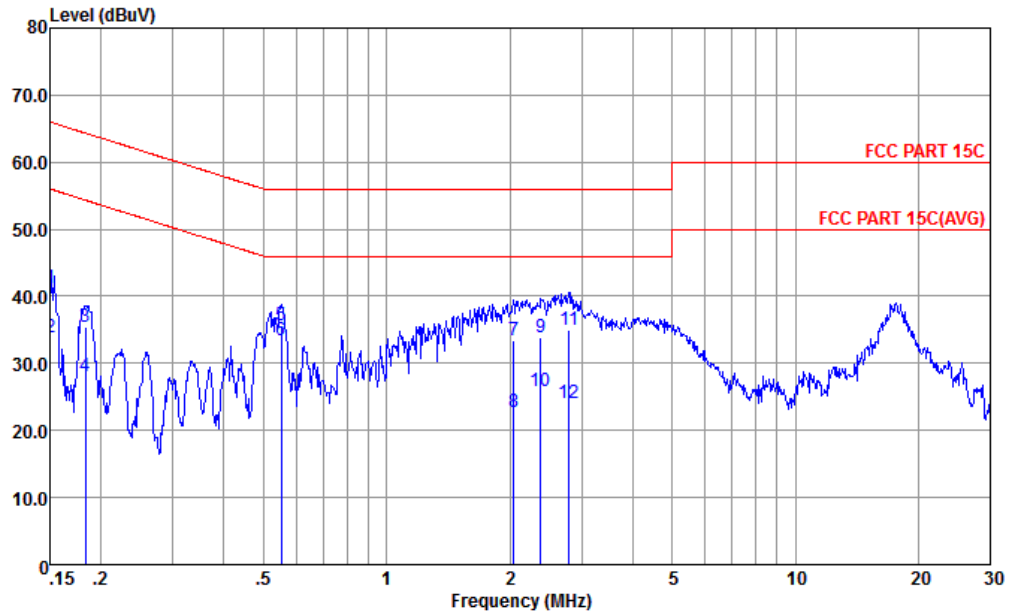
3.2.4 Test Setup





3.2.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22°C
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		



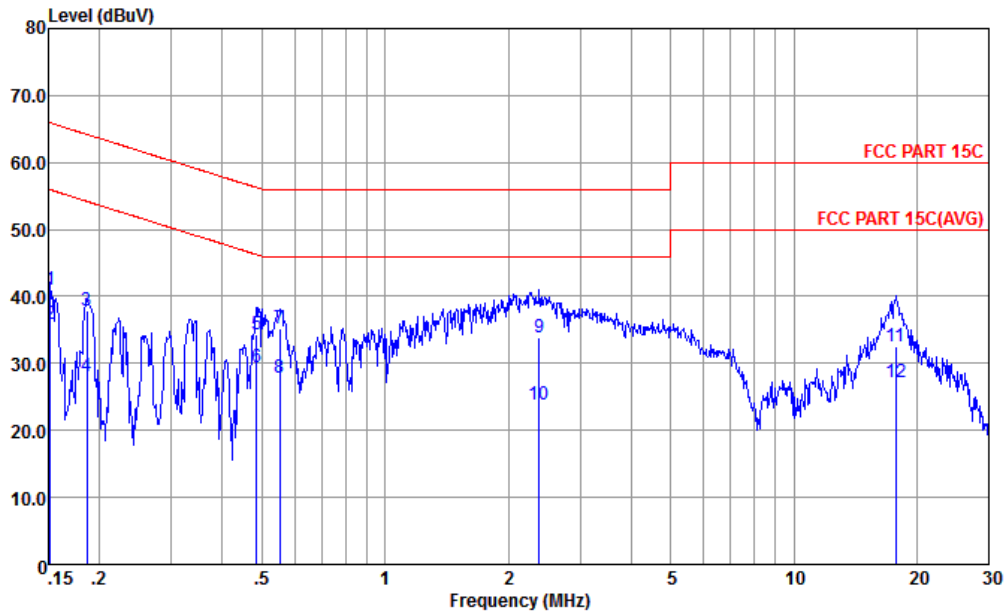
Site : CO01-KS
 Condition : FCC PART 15C LISN-L-20151024 LINE

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°C
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	MY551502 08	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	BBHA1702 49	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	3008A023 84	1GHz~26.5GHz	Oct. 13, 2016	Mar. 08, 2017	Oct. 12, 2017	Radiation (03CH02-KS)
High Gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	1943529	1GHz~18GHz	Jan. 19, 2017	Mar. 08, 2017	Jan. 18, 2018	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002 473	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	ABP00000 0811	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
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.7dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.3dB
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Appendix A. Radiated Spurious Emission

15C 2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2362.39	41.34	-32.66	74	42.86	25.29	4.73	31.54	153	244	P	H
		2362.39	16.52	-37.48	54	-	-	-	-	-	-	A	H
	*	2402	99.32	-	-	100.68	25.4	4.76	31.52	153	244	P	H
	*	2402	74.5	-	-	-	-	-	-	-	-	A	H
		2389.95	41.71	-32.29	74	43.07	25.4	4.76	31.52	384	285	P	V
		2389.95	16.89	-37.11	54	-	-	-	-	-	-	A	V
	*	2402	95.14	-	-	96.5	25.4	4.76	31.52	384	285	P	V
	*	2402	70.32	-	-	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		2336.26	40.83	-33.17	74	42.43	25.24	4.71	31.55	135	243	P	H
		2336.26	16.01	-37.99	54	-	-	-	-	-	-	A	H
	*	2442	98.54	-	-	99.37	25.83	4.82	31.48	135	243	P	H
	*	2442	73.72	-	-	-	-	-	-	-	-	A	H
		2493.84	41.27	-32.73	74	41.58	26.26	4.88	31.45	135	243	P	H
		2493.84	16.45	-37.55	54	-	-	-	-	-	-	A	H
		2371.36	40.26	-33.74	74	41.69	25.35	4.75	31.53	371	299	P	V
		2371.36	15.44	-38.56	54	-	-	-	-	-	-	A	V
	*	2442	93.8	-	-	94.63	25.83	4.82	31.48	371	299	P	V
	*	2442	68.98	-	-	-	-	-	-	-	-	A	V
		2494.68	41.6	-32.4	74	41.91	26.26	4.88	31.45	371	299	P	V
		2494.68	16.78	-37.22	54	-	-	-	-	-	-	A	V



BT CH 78 2480MHz		2483.9	42.8	-31.2	74	43.29	26.11	4.86	31.46	138	241	P	H
		2483.9	17.98	-36.02	54	-	-	-	-	-	-	A	H
	*	2480	95.61	-	-	96.1	26.11	4.86	31.46	138	241	P	H
	*	2480	70.79	-	-	-	-	-	-	-	-	A	H
		2497.27	41.45	-32.55	74	41.76	26.26	4.88	31.45	258	107	P	V
		2497.27	16.63	-37.37	54	-	-	-	-	-	-	A	V
	*	2480	91.42	-	-	91.91	26.11	4.86	31.46	258	107	P	V
	*	2480	66.6	-	-	-	-	-	-	-	-	A	V

Remark	<ol style="list-style-type: none"> No other spurious found. All results are PASS against Peak and Average limit line. 												
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2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	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)
BT CH 00 2402MHz		4806	36.26	-37.74	74	57.98	30.86	6.88	59.46	150	360	P	H
		4806	35.99	-38.01	74	57.71	30.86	6.88	59.46	150	360	P	V
BT CH 39 2441MHz		4884	36.01	-37.99	74	57.28	31.01	6.86	59.14	100	360	P	H
		7320	41.48	-32.52	74	56.25	35.39	8.48	58.64	100	360	P	H
		4884	36.88	-37.12	74	58.15	31.01	6.86	59.14	100	360	P	V
		7320	41.1	-32.9	74	55.87	35.39	8.48	58.64	100	360	P	V
BT CH 78 2480MHz		4962	36.62	-37.38	74	57.34	31.19	6.83	58.74	100	360	P	H
		7440	39.56	-34.44	74	54.61	35.68	8.51	59.24	100	360	P	H
		4962	36.99	-37.01	74	57.71	31.19	6.83	58.74	100	360	P	V
		7440	40.02	-33.98	74	55.07	35.68	8.51	59.24	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		30	21.69	-18.31	40	26.4	26.3	0.09	31.1	100	36	P	H
		100.81	20.36	-23.14	43.5	32.86	17.79	0.41	30.7	-	-	P	H
		140.58	22.83	-20.67	43.5	35.38	17.4	0.91	30.86	-	-	P	H
		163.86	18.51	-24.99	43.5	31.02	16.86	1.58	30.95	-	-	P	H
		265.71	20.11	-25.89	46	31.04	18.43	1.93	31.29	-	-	P	H
		558.65	24.52	-21.48	46	28.28	24.92	2.82	31.5	-	-	P	H
		37.76	31.47	-8.53	40	40.96	21.46	0.17	31.12	100	254	P	V
		54.25	22.86	-17.14	40	39.48	14.12	0.76	31.5	-	-	P	V
		99.84	20.57	-22.93	43.5	33.08	17.8	0.39	30.7	-	-	P	V
		460.68	23.74	-22.26	46	29.09	23.47	2.78	31.6	-	-	P	V
		566.41	29.01	-16.99	46	32.65	25.03	2.83	31.5	-	-	P	V
		880.69	26.25	-19.75	46	25.68	28.87	2.84	31.14	-	-	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 per 15.209(c).
!	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.	
1+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		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H
2412MHz													

- 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. Reference Report

Please refer to Sporton report number FR711809A which is issued separately.