



# 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** : (DSS) Spread Spectrum Transmitter

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.



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Approved by: James Huang / Manager

***Sporton International (Kunshan) Inc.***  
***No. 1098, Pengxi North Road, Kunshan Economic Development Zone,***  
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## TABLE OF CONTENTS

<b>REVISION HISTORY.....</b>	<b>3</b>
<b>SUMMARY OF TEST RESULT .....</b>	<b>4</b>
<b>1 GENERAL DESCRIPTION.....</b>	<b>5</b>
1.1 Applicant.....	5
1.2 Manufacturer.....	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Product Specification of Equipment Under Test.....	6
1.5 Modification of EUT .....	6
1.6 Re-use of Measured Data .....	7
1.7 Testing Location .....	9
1.8 Applicable Standards.....	9
<b>2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....</b>	<b>10</b>
2.1 Carrier Frequency Channel .....	10
2.2 Test Mode.....	11
2.3 Connection Diagram of Test System.....	12
2.4 Support Unit used in test configuration and system .....	12
2.5 EUT Operation Test Setup .....	12
<b>3 TEST RESULT .....</b>	<b>13</b>
3.1 Radiated Band Edges and Spurious Emission Measurement .....	13
3.2 AC Conducted Emission Measurement.....	17
3.3 Antenna Requirements .....	19
<b>4 LIST OF MEASURING EQUIPMENT.....</b>	<b>20</b>
<b>5 UNCERTAINTY OF EVALUATION.....</b>	<b>21</b>
<b>APPENDIX A. AC CONDUCTED EMISSION TEST RESULT</b>	
<b>APPENDIX B. RADIATED SPURIOUS EMISSION</b>	
<b>APPENDIX C. DUTY CYCLE PLOTS</b>	
<b>APPENDIX D. SETUP PHOTOGRAPHS</b>	
<b>APPENDIX E. REFERENCE REPORT</b>	



## REVISION HISTORY

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



## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(1)	Number of Channels	$\geq 15\text{Chs}$	Pass	1
-	15.247(a)(1)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass	1
-	15.247(a)(1)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	1
-	15.247(a)(1)	20dB Bandwidth	NA	Pass	1
-	-	99% Bandwidth	-	Pass	1
-	15.247(b)(1)	Peak Output Power	$\leq 125\text{ mW}$	Pass	1
-	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	1
-	15.247(d)	Conducted Spurious Emission	$\leq 20\text{dBc}$	Pass	1
3.1	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 11.61 dB at 46.490 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	-
<b>Remark 1:</b> Test items are performed on original report which can be referred to Sporton report number FR832104A.					



# 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 FR8O2901A, FCC ID: 2AJOTTA-1080.



## 1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
<b>Tx/Rx Frequency Range</b>	2402 MHz ~ 2480 MHz
<b>Number of Channels</b>	79
<b>Carrier Frequency of Each Channel</b>	2402+n*1 MHz; n=0~78
<b>Antenna Type / Gain</b>	PIFA Antenna with gain -3.00 dBi
<b>Type of Modulation</b>	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

## 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. FR832104A 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).

<b>Test Site</b>	Sporton International (Kunshan) Inc.		
<b>Test Site Location</b>	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958		
<b>Test Site No.</b>	<b>Sporton Site No.</b>	<b>FCC designation No.</b>	<b>FCC Test Firm Registration No.</b>
	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

### 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-



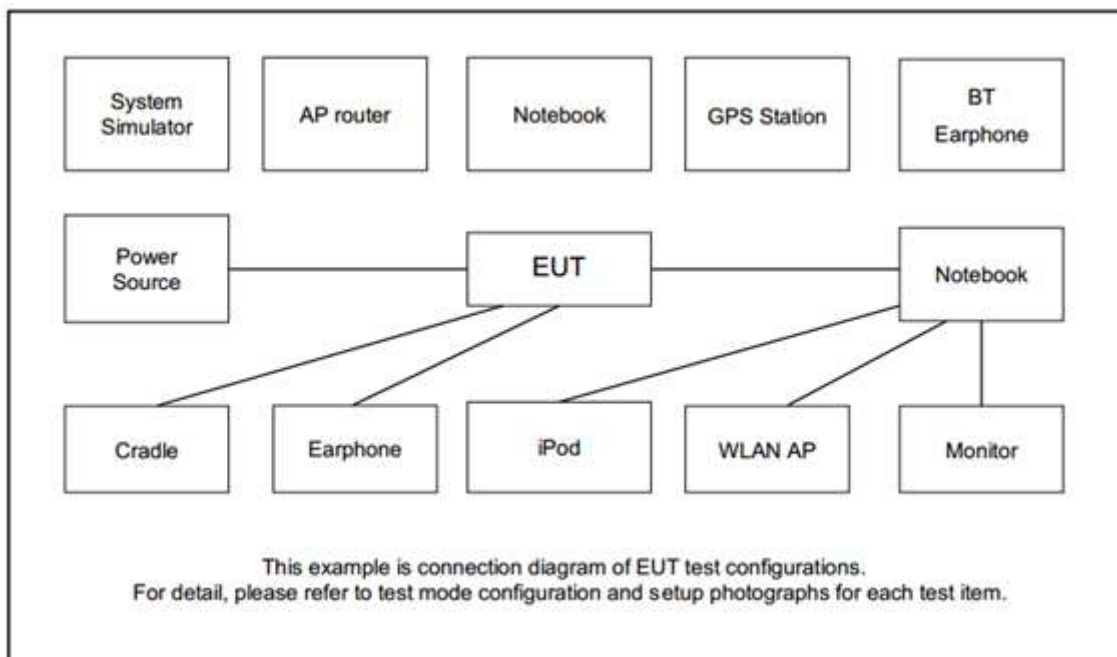
## 2.2 Test Mode

- 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: 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, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.

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

Summary table of Test Cases	
Radiated Test Cases	Bluetooth EDR 3Mbps 8-DPSK
	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 (2.4G) Link + Earphone + USB Cable (Charging from Adapter)
<b>Remark:</b> 1. For radiated test cases, the worst mode data rate 3Mbps 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.	

## 2.3 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.	BT Base Station	R&S	CBT	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
5.	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 Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous 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.



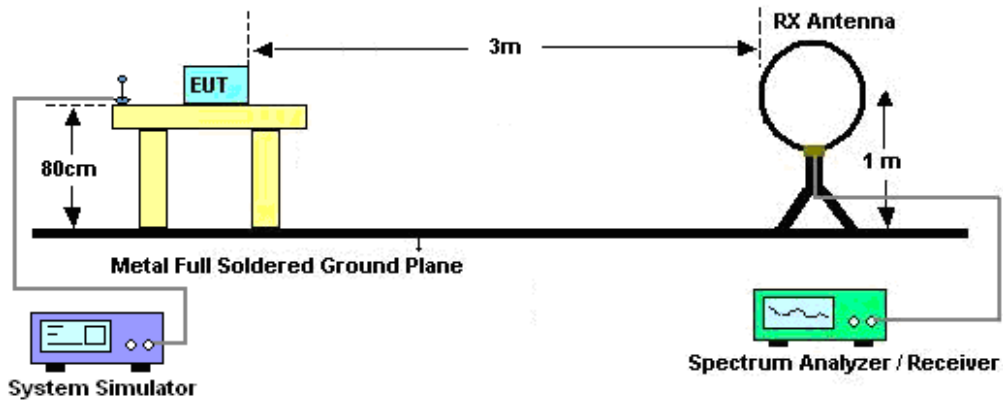
### 3.1.3 Test Procedures

1. The 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  
$$\text{On time} = N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$$
  
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
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.

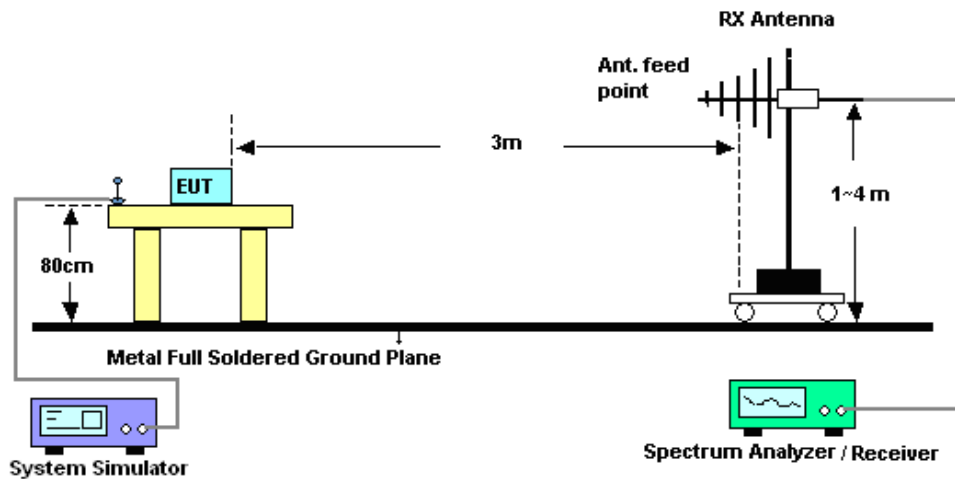
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from  $20 \log(\text{dwell time}/100\text{ms})$ . This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

### 3.1.4 Test Setup

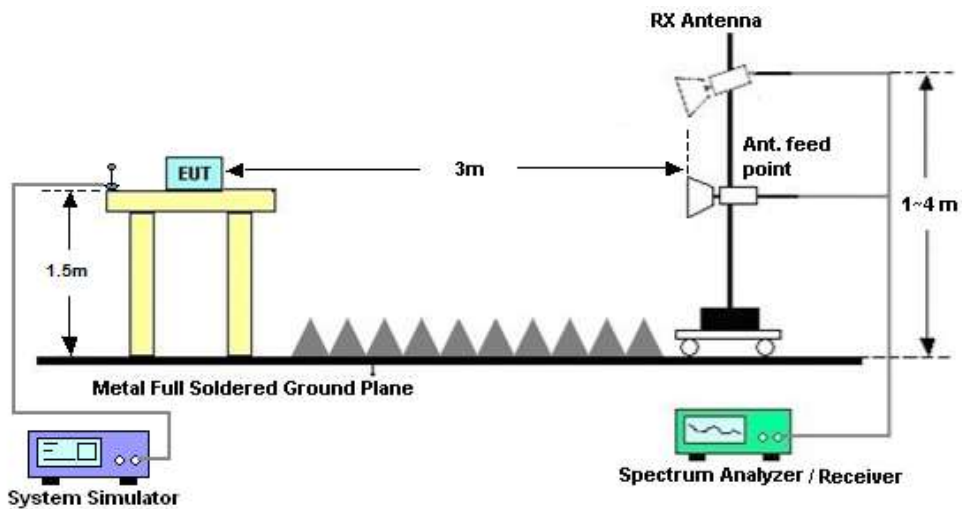
For radiated emissions below 30MHz



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 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 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)**

Please refer to Appendix B.

### **3.1.8 Duty cycle correction factor for average measurement**

Please refer to Appendix C.





## 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.

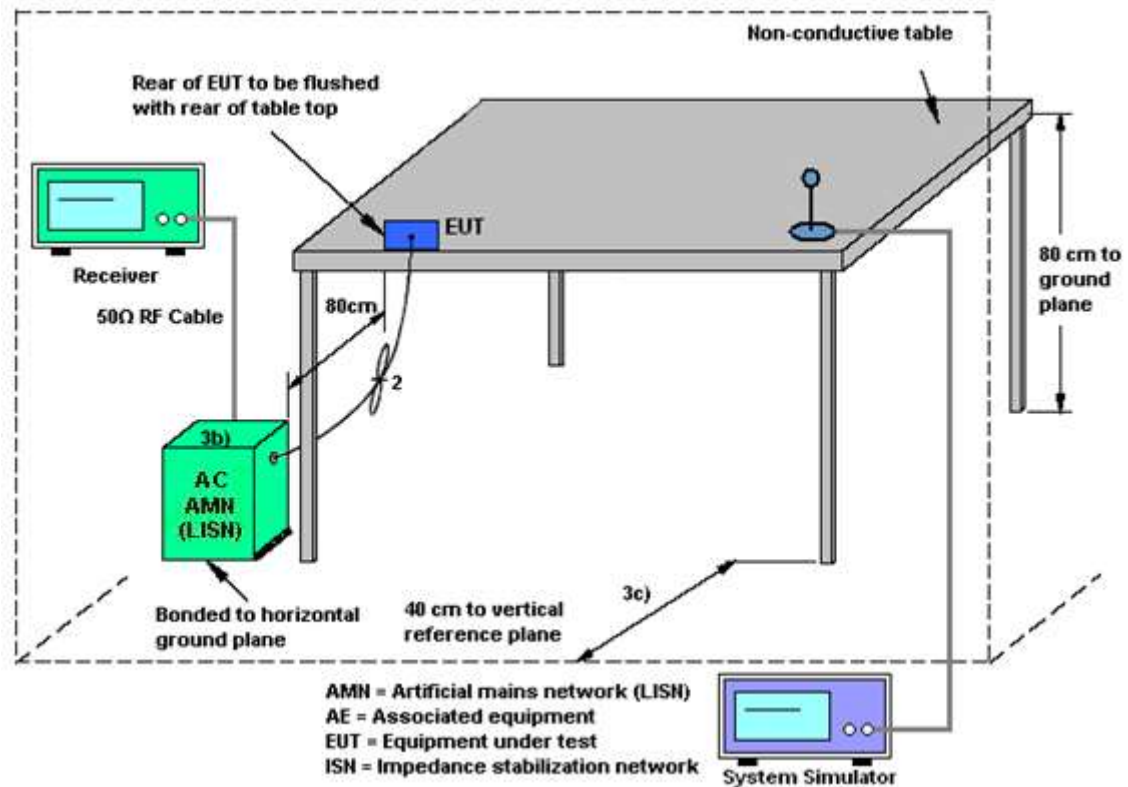
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

8. 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.
9. Connect EUT to the power mains through a line impedance stabilization network (LISN).
10. All the support units are connecting to the other LISN.
11. The LISN provides 50 ohm coupling impedance for the measuring instrument.
12. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
13. Both sides of AC line were checked for maximum conducted interference.
14. The frequency range from 150 kHz to 30 MHz was searched.
15. 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

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. 20, 2018	Aug.05, 2019	Radiation (03CH04-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 08	10Hz-44G,MAX 30dB	Apr.17, 2018	Nov. 20, 2018	Apr. 16, 2019	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 19, 2018	Nov. 20, 2018	Oct. 18, 2019	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	44483	30MHz-1GHz	Jan. 29, 2018	Nov. 20, 2018	Jan. 28, 2019	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1648	1GHz~18GHz	Dec. 16, 2017	Nov. 20, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA1702 49	15GHz~40GHz	Feb. 07, 2018	Nov. 20, 2018	Feb. 06, 2019	Radiation (03CH04-KS)
Amplifier	Burgeon	BPA-530	102219	0.01MHz ~3000MHz	Dec. 16, 2017	Nov. 20, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
Amplifier	MITEQ	TTA1840-35- HG	2014749	18~40GHz	Feb. 8, 2018	Nov. 20, 2018	Feb. 07, 2019	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Apr. 17, 2018	Nov. 20, 2018	Apr. 16, 2019	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY532702 03	500MHz~26.5G Hz	Dec. 16, 2017	Nov. 20, 2018	Dec. 15, 2018	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Nov. 20, 2018	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 20, 2018	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 20, 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	ABP00000 0811	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)

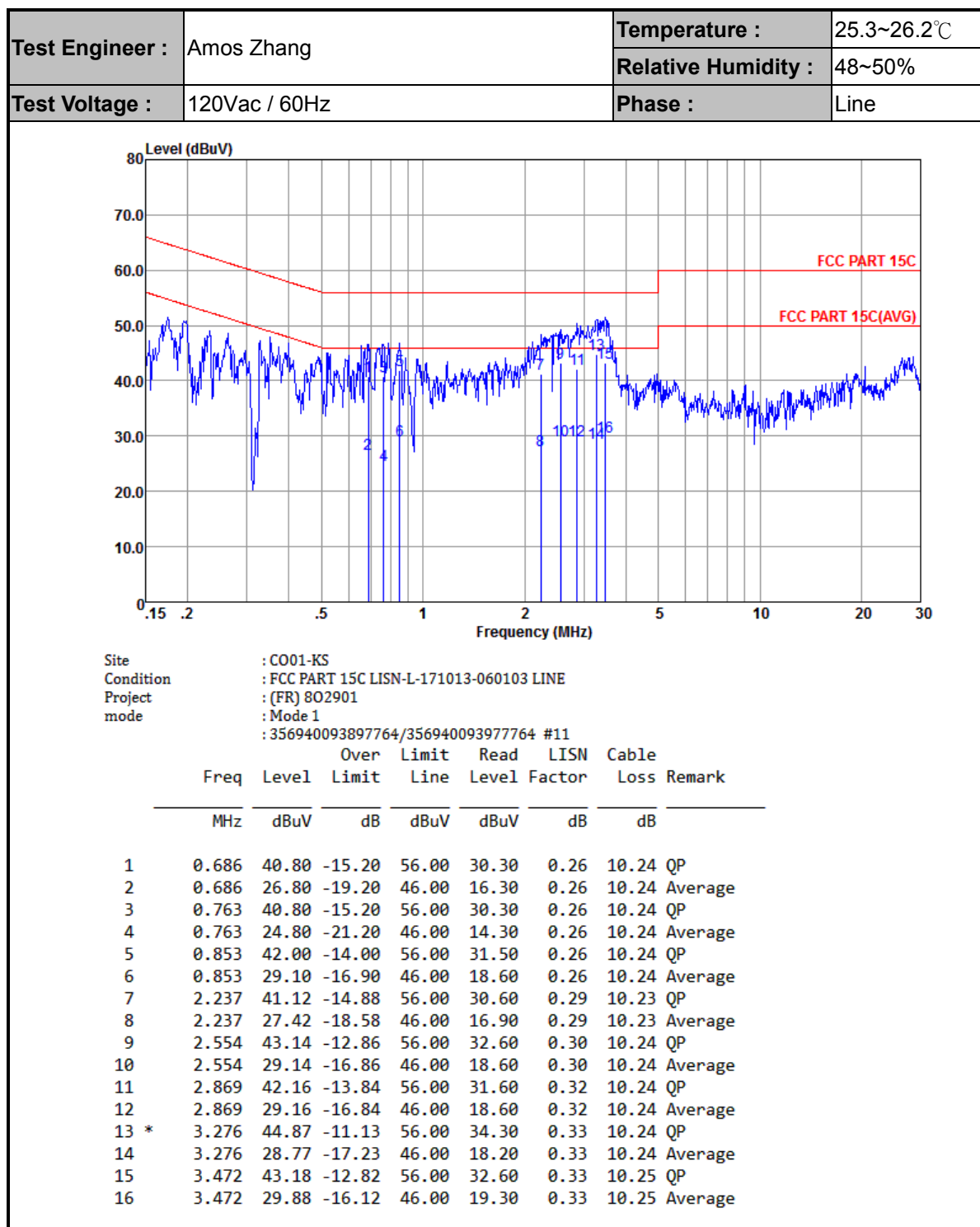
Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.0dB
--	-------

### 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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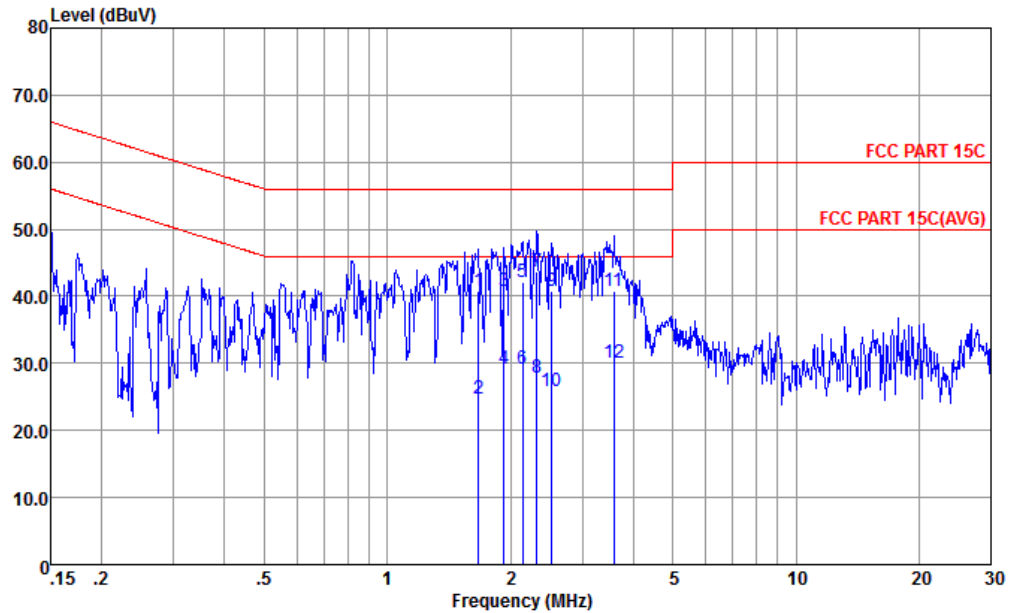


## Appendix A. AC Conducted Emission Test Results





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



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

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			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

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
BT CH00 2402MHz		2389.43	41.17	-32.83	74	42.94	25.6	5.63	33	123	63	P	H
		2389.43	16.38	-37.62	54	-	-	-	-	-	-	A	H
	*	2402	104.62	-	-	106.42	25.6	5.63	33.03	123	63	P	H
	*	2402	79.83	-	-	-	-	-	-	-	-	A	H
		2388.39	40.24	-33.76	74	42.01	25.6	5.63	33	357	88	P	V
		2388.39	15.45	-38.55	54	-	-	-	-	-	-	A	V
	*	2402	100.93	-	-	102.73	25.6	5.63	33.03	357	88	P	V
	*	2402	76.14	-	-	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		2483.51	53.99	-20.01	74	54.23	26.53	5.72	32.49	100	83	P	H
		2483.51	29.2	-24.8	54	-	-	-	-	-	-	A	H
	*	2480	105.16	-	-	105.4	26.53	5.72	32.49	100	83	P	H
	*	2480	80.37	-	-	-	-	-	-	-	-	A	H
		2483.51	51.82	-22.18	74	52.06	26.53	5.72	32.49	384	97	P	V
		2483.51	27.03	-26.97	54	-	-	-	-	-	-	A	V
	*	2480	101.77	-	-	102.01	26.53	5.72	32.49	384	97	P	V
	*	2480	76.98	-	-	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												





## 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	41.68	-32.32	74	64.5	30.88	8.43	62.13	100	0	P	H
		4806	39.45	-34.55	74	62.27	30.88	8.43	62.13	100	0	P	V
BT CH 39 2441MHz		4884	39.73	-34.27	74	62.36	31.05	8.43	62.11	100	0	P	H
		7320	40.03	-33.97	74	57.16	35.56	10.08	62.77	100	0	P	H
		4884	38.13	-35.87	74	60.76	31.05	8.43	62.11	100	0	P	V
		7320	40.4	-33.6	74	57.53	35.56	10.08	62.77	100	0	P	V
BT CH 78 2480MHz		4962	39.65	-34.35	74	62.02	31.27	8.44	62.08	100	0	P	H
		7440	39.71	-34.29	74	56.51	35.8	10.18	62.78	100	0	P	H
		4962	38.87	-35.13	74	61.24	31.27	8.44	62.08	100	0	P	V
		7440	39.36	-34.64	74	56.16	35.8	10.18	62.78	100	0	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.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	(dBμV)	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
2.4GHz BT LF		30	21.86	-18.14	40	30.18	24.2	0.46	32.98	110	216	P	H
		414.12	24.52	-21.48	46	33.66	21.86	2.15	33.15			P	H
		560.59	23.9	-22.1	46	30.59	24.12	2.51	33.32			P	H
		728.4	24.92	-21.08	46	29.91	25.24	2.95	33.18			P	H
		852.56	26.56	-19.44	46	29.55	26.31	3.27	32.57			P	H
		972.84	27.97	-26.03	54	28.83	27.16	3.49	31.51			P	H
		46.49	28.39	-11.61	40	45.01	15.74	0.6	32.96	100	231	P	V
		92.08	16.95	-26.55	43.5	33.84	15.1	0.93	32.92			P	V
		400.54	24.53	-21.47	46	33.91	21.62	2.12	33.12			P	V
		535.37	23.65	-22.35	46	30.68	23.82	2.44	33.29			P	V
		743.92	26.21	-19.79	46	30.93	25.42	2.99	33.13			P	V
		931.13	28.08	-17.92	46	29.83	26.78	3.41	31.94			P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



**Note symbol**

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	<b>Peak</b> or <b>Average</b>
H/V	<b>H</b> orizontal or <b>V</b> 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.	
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													
2412MHz		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)

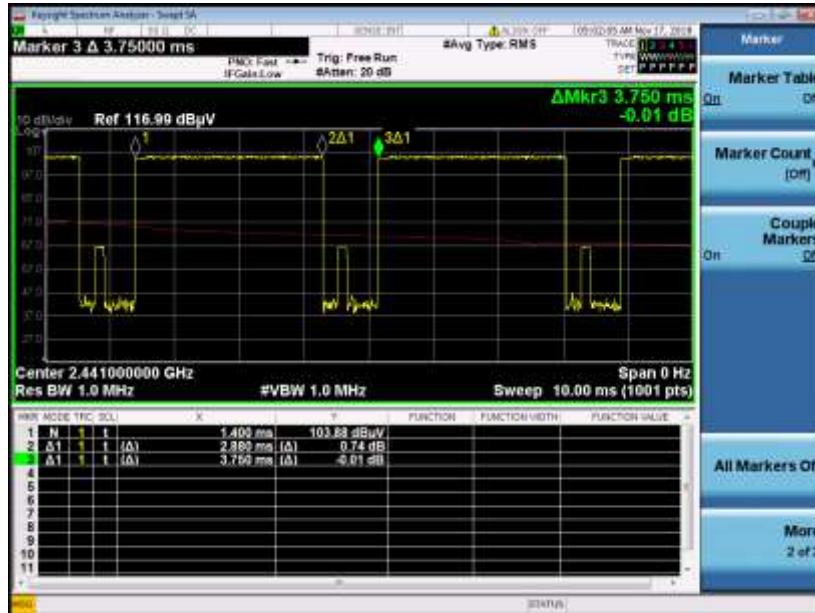
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

## Appendix C. Duty Cycle Plots

### 3DH5 on time (One Pulse) Plot on Channel 39



### 3DH5 on time (Count Pulses) Plot on Channel 39



#### Note:

1. Worst case Duty cycle = on time/100 milliseconds =  $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor =  $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. 3DH5 has the highest duty cycle worst case and is reported.



## **Appendix E. Reference Report**

Please refer to Sporton report number FR832104A which is issued separately.