TEST REPORT

D	3%	Co.,	Ltd.
		,	

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664

Report No : DRTFCC1602-0028 Pages:(1) / (41) page



1. Customer

- Name : POINTMOBILE CO., LTD.
- Address : B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu, Seoul, Korea 153-709
- 2. Use of Report : FCC & IC Original Grant
- 3. Product Name (FCCID, IC) : Mobile Computer (V2X-PM80W, 10664A-PM80W)
- 4. Date of Test : 2015-10-12 ~ 2015-11-25
- 5. Test Method Used: FCC Part 15 Subpart C.247, RSS-247
- 6. Testing Environment : See appended test report
- 7. Test Result : 🛛 Pass 📋 Fail

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Name : Jaejin Lee	(Signature)	Technical Manager Name : Bongjin Kim
		0	
		2016 . 02 . 03	3.
		DT&C Co.,	Ltd.



Test Report Version

Test Report No.	Date	Description
DRTFCC1602-0028	Feb. 03, 2016	Initial issue



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1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.					
Stand	ard	Site num	ber Address		
	\square	165783	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935		
FCC		804488	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935		
FUU		596748	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935		
		678747	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080		
10	\square	5740A-	3 42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935		
IC		5740A-	2 683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080		
www.d	tnc.ne	<u>t</u>			
Teleph	one	:	-31-321-2664		
FAX		:	2-31-321-1664		

1.2 Details of Applicant

Applicant	:	POINTMOBILE CO., LTD.
Address	:	B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu, Seoul, Korea 153-709
Contact person	:	Wilson Park



1.3 Description of EUT

EUT	Mobile Computer	
Model Name	PM80-W	
Add Model Name	NA	
Serial Number	Identical prototype	
Hardware version	Rev.5	
Software version	80.02	
Power Supply	DC 3.8 V	
Frequency Range	2402 MHz ~ 2480 MHz	
Max. RF Output Power	1.31 dBm	
Modulation Technique	GFSK	
Antenna Specification	Antenna Type: Internal Antenna Gain: -0.84 dBi(PK)	

1.4 Declaration by the applicant / manufacturer

- NA

1.5 Test Conditions

Ambient Condition	
 Temperature 	+23 ℃
 Relative Humidity 	43 %



1.6 Test Equipment List

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent Technologies	N9020A	15/09/09	16/09/09	MY46471248
Multimeter	FLUKE	17B	15/04/27	16/04/27	26030065WS
DC Power Supply	HP	66332A	15/01/22	16/01/22	US37471368
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Signal Generator	Rohde Schwarz	SMF100A	15/06/29	16/06/29	102341
Thermohygrometer	BODYCOM	BJ5478	15/02/26	16/02/26	1209
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
TRILOG Broadband Test-Antenna	Schwarzbeck	VULB 9160	14/04/30	16/04/30	3358
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	140394
Horn Antenna	A.H.Systems	SAS-574	15/04/30	17/04/30	154
Low Noise Pre Amplifier	tsj	MLA-010K01-B01- 27	15/04/09	16/04/09	1844538
Amplifier (30dB)	Agilent	8449B	15/11/06	16/11/06	3008A02108
High-pass filter (3GHz)	Wainwright Instruments	WHKX3.0	15/01/06	16/01/06	12
EMI TEST RECEIVER	R&S	ESR7	15/10/19	16/10/19	101109
EMI TEST RECEIVER	R&S	ESCI	15/02/25	16/02/25	100364
SINGLE-PHASE MASTER	NF	4420	15/09/09	16/09/09	3049354420023
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	15/06/26	16/06/26	000WX20305



1.7 Summary of Test Results

FCC Part	RSS Std.	Parameter	Limit	Test Condition	Status Note 1	
15.247(a)	RSS-247 [5.2]	6 dB Bandwidth	> 500 kHz		С	
15.247(b)	RSS-247 [5.4]	Transmitter Output Power	< 1 Watt		С	
15.247(d)	RSS-247 [5.5]	Out of Band Emissions / Band Edge	20 dBc in any 100 kHz BW	Conducted	С	
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density	< 8 dBm/3 kHz		С	
-	RSS-Gen [6.6]	Occupied Bandwidth (99 %)	RSS-Gen(6.6)		С	
15.247(d) 15.205 15.209	RSS-247 [5.5] RSS-GEN [8.9] RSS-GEN [8.10]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	FCC 15.209 limits	Radiated	C Note 2	
15.207	RSS-Gen [8.8]	RSS-Gen [8.8] AC Line Conducted Emissions FCC 15.2		AC Line Conducted	С	
15.203	-	Antenna Requirements	FCC 15.203	-	С	
	Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: This test item was performed in each axis and the worst case data was reported.					



2. Test Methodology

Generally the tests were performed according to the KDB558074 D01 v03r03. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the test mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3 General Test Procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB 558074.

So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB 558074. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10 as stated on section 12.1 of the KDB 558074.

The EUT is placed on a non-conductive table. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axes.

2.4 Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting. The Bluetooth low energy mode with below low, middle and high channels were tested and reported.

		Frequency [MHz]			
	Test Mode	Lowest Frequency	Middle Frequency	Highest Frequency	
TM 1	BT LE	2402	2440	2480	
TM 2	-	-	-	-	
TM 3	-	-	-	-	
TM 4	-	-	-	-	

2.5 Instrument Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



3. Test Result

3.1 Maximum Peak Conducted Output Power

Test Requirements and limit, §15.247(b) & RSS-247 [5.4]

A transmitter antenna terminal of EUT is connected to the input of a spectrum analyzer.

Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

3.1.1 Test Setup

Refer to the APPENDIX I.

3.1.2 Test Procedures

Maximum Peak Conducted Output Power is measured using Measurement Procedure Option 1 of KDB558074

- 1. Set the RBW ≥ DTS bandwidth. Actual RBW = 2 MHz
- 2. Set VBW \ge 3 x RBW. Actual VBW = 6 MHz
- 3. Set span ≥ 3 x RBW.
- 4. Sweep time = **auto couple**
- 5. Detector = **peak**
- 6. Trace mode = **max hold**
- 7. Allow trace to fully stabilize
- 8. Use peak marker function to determine the peak amplitude level.

3.1.3 Test Results

Test Mode	Tested Channel	Test Results (dBm)
	Lowest	1.31
TM 1	Middle	0.92
	Highest	1.02



Peak Output Power

Test Channel : Lowest



Peak Output Power

Test Channel : Middle





Peak Output Power

Test Channel : Highest





3.2 6 dB Bandwidth Measurement

■ Test Requirements and limit, §15.247(a) & RSS-247 [5.2]

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the EUT's antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

3.2.1 Test Setup

Refer to the APPENDIX I.

3.2.2 Test Procedures

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of KDB558074

- 1. Set resolution bandwidth (RBW) = 100 kHz
- 2. Set the video bandwidth (VBW) \ge 3 x RBW.

(<u>RBW : 100 kHz / VBW : 300 kHz</u>)

- 3. Detector = **peak**.
- 4. Trace mode = **max hold**.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.
- 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.2.3 Test Results

Test Mode	Tested Channel	Test Results [MHz]		
	Lowest	0.6807		
TM 1	Middle	0.6822		
	Highest	0.6871		



6 dB Bandwidth

Test Channel : Lowest



6 dB Bandwidth

Test Channel : Middle





6 dB Bandwidth

Test Channel : Highest





3.3 Maximum Power Spectral Density.

Test requirements and limit, §15.247(e) & RSS-247 [5.2]

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

3.3.1 Test Setup

Refer to the APPENDIX I.

3.3.2 Test Procedures

Method PKPSD of KDB558074 is used.

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS bandwidth.
- 3. Set the RBW : 3 kHz \leq RBW \leq 100 kHz.
- 4. Set the VBW ≥ **3 x RBW.**
- 5. Detector = **peak.**
- 6. Sweep time = **auto couple.**
- 7. Trace mode = **max hold.**
- 8. Allow trace to fully stabilize.
- 9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

3.3.3 Test Results

Test Mode	Tested Channel	PKPSD [dBm]
	Lowest	-13.86
TM 1	Middle	-14.38
	Highest	-14.15



Maximum PKPSD

Test Channel : Lowest



Maximum PKPSD

Test Channel : Middle





Maximum PKPSD

Test Channel : Highest





3.4 Unwanted Emissions (Conducted)

Test requirements and limit, §15.247(d) & RSS-247 [5.5]

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions :

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate

compliance to 15.247(b)(3) requirements, then the power in any 100 kHz outside of the authorized frequency band

shall be attenuated by at least 30 dB relative to the maximum measured inband average PSD level.

In either case, attenuation to levels below the general emission limits specified in §15.209(a) is not required.

3.4.1 Test Setup

Refer to the APPENDIX I including path loss

3.4.2 Test Procedures

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 Reference Level
- 1. Set instrument center frequency to DTS channel center frequency.
- 2. Set the span to \geq 1.5 times the DTS bandwidth.
- 3. Set the RBW = 100 kHz.
- 4. Set the VBW \geq 3 x RBW.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum PSD level LIMIT LINE = 20 dB below of the reference level.

LIMIT LINE = 20 0D below of the reference level.

- Measurement Procedure 2 - Unwanted Emissions

- 1. Set the center frequency and span to encompass frequency range to be measured.
- 2. Set the RBW = 100 kHz.(Actual 1 MHz , See below note)
- 3. Set the VBW ≥ 3 x RBW.(Actual 3 MHz, See below note)
- 4. Detector = **peak**.
- 5. Ensure that the number of measurement points ≥ span / RBW
- 6. Sweep time = auto couple.
- 7. Trace mode = **max hold.**
- 8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
- 9. Use the peak marker function to determine the maximum amplitude level.

Note : The conducted spurious emission was tested with below settings.

Frequency range	RBW	VBW	Detector	Trace	Sweep Point
9 kHz ~ 30 MHz	100 kHz	300 kHz			
30 MHz ~ 10 GHz	1 MHz	3 MHz	Peak	Max Hold	40001
10 GHz ~ 25 GHz	1 MHz	3 MHz			

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

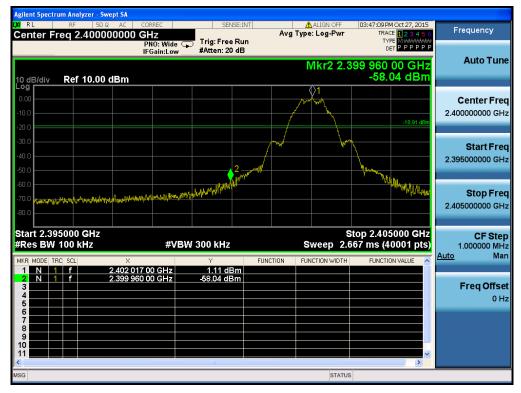


3.4.3 Test Results

	rum Analyzer - Swept SA							
Center E	RF 50 Ω AC req 2.40200000		SENSE:INT	Avg Type:	ALIGN OFF		Oct 27, 2015	Frequency
		PNO: Wide G	Trig: Free Run #Atten: 20 dB		-	TYP DE 402 007		Auto Tune
10 dB/div	Ref 10.00 dBm					1.0	Jo dBill	
0.00								Center Freq 2.402000000 GHz
-10.0						Solo and a second	and a state of the	
								Start Freq 2.401489482 GHz
-20.0								
-30.0								Stop Freq 2.402510518 GHz
-40.0								2.402310318 6112
-50.0								CF Step 102.104 kHz
-60.0								<u>Auto</u> Man
-70.0								Freq Offset
-80.0								0 Hz
Center 2.4 #Res BW	4020000 GHz 100 kHz	#VBW	/ 300 kHz		Sweep 1	Span 1. .000 ms (:	021 MHz 3001 pts)	
MSG					STATUS			

Reference (Test Channel : Lowest)

Low Band-edge

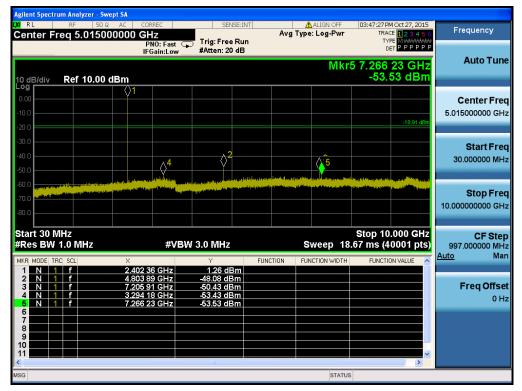




	ipectrum		zer - Swe										_	
LXI RL Cente	er Fre	RF a 15	50 Ω	<u>∿</u> ⊡c c 00 MH:	ORREC		SENSE:I	NT	Avg T	ALIGN OFF		M Oct 27, 2015 CE 1 2 3 4 5 6	Fre	equency
Contro		9 10			- PNO: Fast IFGain:Low		Free Ru n: 20 dB				TY			
10 dB/	div	Ref '	10.00 c	lBm						M		1 1 MHz 34 dBm		Auto Tune
Log 0.00 -														enter Freq
-10.0 -20.0												-18.91 dBm	15.	004500 MHz
-30.0														Start Freq
-40.0	1													9.000 kHz
-60.0	·	2—												
-70.0	WWWWWWWWW	a de la caractería	ha na k aka kaka kaka kaka kaka kaka kaka	وتلعليها والمراجع	بلودي المريان والمسالي			and the second		here when the second second		مەربىيە ئەربىيە ئەربى	30.	Stop Freq 000000 MHz
-80.0														
Start #Res	9 kHz BW 10	00 kl	Hz		#V	BW 300 k	Hz			Sweep 5		0.00 MHz 0001 pts)		CF Step 999100 MHz
		SCL f		× 28	31.9 kHz	Y -58.5	9 dBm	FUNC	CTION	FUNCTION WIDTH	I FUNCTI	ON VALUE	<u>Auto</u>	Man
2 N 3	1	f			1 1 MHz	-70.3	4 dBm						F	req Offset
4 5 6												=		0 Hz
7 8														
9 10 11		4												
<										CTAT				
MSG		_								SIAI	J <mark>S <u>1</u> DC Co</mark>	upiea		

Conducted Spurious Emissions 1 (Test Channel : Lowest)

Conducted Spurious Emissions 2 (Test Channel : Lowest)





gilent Spectrum Analyzer - Swept SA ALIGN OFF 03:47:35 PM Oct 27, 2015 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P RL Frequency Center Freq 17.500000000 GHz PNO: Fast Trig: Free Run IFGain:Low #Atten: 20 dB Auto Tune Mkr3 23.795 125 GHz -45.38 dBm Ref 10.00 dBm 10 dB/div Log **Center Freq** 17.50000000 GHz Start Freq 3 \Diamond 10.000000000 GHz Stop Freq 25.00000000 GHz Start 10.000 GHz #Res BW 1.0 MHz Stop 25.000 GHz Sweep 40.00 ms (40001 pts) **CF Step** 1.50000000 GHz <u>uto</u> Man #VBW 3.0 MHz Auto FUNCTION FUNCTION WIDTH FUNCTION -44.41 dBm -45.07 dBm -45.38 dBm N N N 24.576 250 GHz 21.222 250 GHz 23.795 125 GHz **Freq Offset** 0 Hz STATUS

Conducted Spurious Emissions 3 (Test Channel : Lowest)



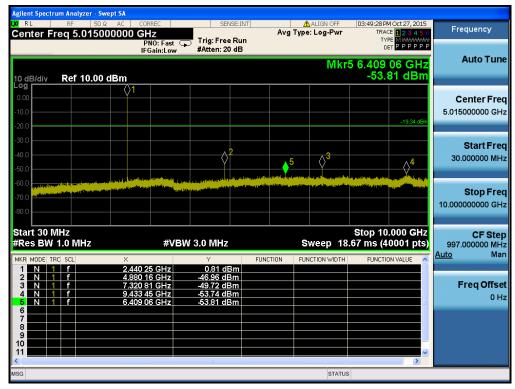
Reference (Test Channel : Middle)



Conducted Spurious Emissions 1 (Test Channel : Middle)

	Analyzer - Swept S/ RF 50 Ω 🚹 DC		SENSE:	INT	🛕 ALIGN OFF	03:49:19 PM Oct 27, 20	15	-
Center Fred	15.004500	MHz PNO: Fast IFGain:Low	Trig: Free Ru #Atten: 20 dB	in Č	Type: Log-Pwr	TRACE 1234 TYPE MWWW DET PPPP	56 \\\\ 9 P	Frequency
10 dB/div R	ef 10.00 dBn		#Atten: 20 de	3	Mkr	2 23.462 0 MH -70.99 dB	Z	Auto Tune
Log 0.00 -10.0 -20.0						-19.34 d	Bm	Center Freq 15.004500 MHz
-30.0 -40.0 -50.0								Start Freq 9.000 kHz
-60.0 -70.0 -80.0	frationalisation	utherslavethersen	(taget to style date of the set of	hatelorphises, mary second	¢2 haterisistatultesisteelee	2 Hellyd fan syllyddyn ^f an ^g wrhytespolarhyd	~	Stop Freq 30.000000 MHz
Start 9 kHz #Res BW 10			W 300 kHz			Stop 30.00 MH 333 ms (40001 pt	s)	CF Step 2.999100 MHz uto Mar
MKR MODE TRC S 1 N 1 3 3 2 N 1 3 4 5 5 6 6 6 7 7 7 8 9 9 10 11 10 10 10 11 <td>f</td> <td>× 288.7 kHz 23.462 0 MHz</td> <td>-57,61 dBm -70.99 dBm</td> <td>FUNCTION</td> <td></td> <td>FORCHON VALUE</td> <td></td> <td>Freq Offsel 0 Hz</td>	f	× 288.7 kHz 23.462 0 MHz	-57,61 dBm -70.99 dBm	FUNCTION		FORCHON VALUE		Freq Offsel 0 Hz
ISG					STATUS	DC Coupled		





Conducted Spurious Emissions 2 (Test Channel : Middle)

Conducted Spurious Emissions 3 (Test Channel : Middle)

Agilent Spectrum		ept SA AC CORRE	En l	SEM	SE:INT		ALIGN OFF	03:49:36 PM	1 Oct 27, 2015	
Center Fred		000000 GH			Run	Avg T	ype: Log-Pwr	TRAC	E 123456 E M WWWW T P P P P P	Frequency
10 dB/div	tef 10.00						Mkr3 2	4.181 3 -45.9	75 GHz 99 dBm	Auto Tune
Log 0.00 -10.0 -20.0									-19.34 dBm	Center Freq 17.500000000 GHz
-30.0 -40.0 -50.0				A state of the second stat	ى <u>ئەمرەر</u> لىقىشلەر ھى.	a la specia de la sela		Q ²	3)1	Start Fred 10.000000000 GHz
-60.0 Heler Could -70.0			and a state of the second states		editeration per disease					Stop Freq 25.000000000 GHz
Start 10.000 #Res BW 1.0	0 MHz	×	#VBW	/ 3.0 MHz Y	FUN	CTION	Sweep 40	.00 ms (4	.000 GHz 0001 pts)	CF Step 1.500000000 GHz <u>Auto</u> Mar
1 N 1 2 N 1 3 N 1 4 5	f f f	24.612 250 23.189 875 24.181 375	GHz	-44.02 dB -45.99 dB -45.99 dB	m					Freq Offset 0 Hz
6 7 8 9 10 11										
MSG							STATUS			





Reference (Test Channel : Highest)

High Band-edge (Test Channel : Highest)

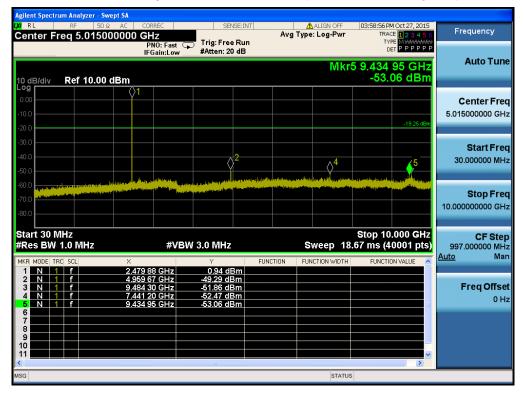




	um Analyzer -									
Center F		ງລ <u>≜</u> dc corr 4500 MHz	EC	SENS			ALIGN OFF : Log-Pwr	TRA	4 Oct 27, 2015 E 1 2 3 4 5 6	Frequency
10 dB/div	Ref 10.0	PN IFGa	D: Fast ⊊ ain:Low	Trig: Free F #Atten: 20 d			Mkr	□ 2 20.58	7 3 MHz 89 dBm	Auto Tune
Log 0.00 -10.0									-19.25 dBm	Center Freq 15.004500 MHz
-30.0 -40.0 -50.0										Start Freq 9.000 kHz
-60.0 -70.0 -80.0	hytenhist Antoyneyseyis	1. Augusta Markara an Angalan A	uutinte hetten A	Raj p ^{a si} n meningan jarkemar da	Annanaithine	rlebarghetersertikele gel	2 makuloomhilanna	hriftagliðfalmfafræð	hadhaghannanghah	Stop Freq 30.000000 MHz
Start 9 kH #Res BW	100 kHz	×	#VBV	V 300 kHz	FUNC		weep 5.3	333 ms (4	0.00 MHz 0001 pts)	CF Step 2.999100 MHz <u>Auto</u> Man
1 N 1 2 N 1 3 4 5	f	281.9 20.587 3	KHz MHz	-59.54 dBr -70.89 dBr	n					Freq Offset 0 Hz
6 7 8 9 10 11										
MSG				Ш			STATUS	DC Co	upled	

Conducted Spurious Emissions 1 (Test Channel : Highest)

Conducted Spurious Emissions 2 (Test Channel : Highest)





	um Analyzer - S									
Center Fr		0 Ω AC CORRE		SENS			ALIGN OFF	TRAC	4 Oct 27, 2015 E 1 2 3 4 5 6	Frequency
		PNO	:Fast 🖵 in:Low	Trig: Free F #Atten: 20 d				DE		
							Mkr3 2	4.877 3	75 GHz	Auto Tune
10 dB/div Log	Ref 10.0	0 dBm						-44.:	98 dBm	
0.00										Center Freq
-10.0										17.50000000 GHz
-20.0									-19.25 dBm	
-30.0									. 2 . 2	Start Freq
-40.0									— Q ²Q `	10.00000000 GHz
-50.0	مىلاھىيە بىلىدى يىل	The second s		A CONTRACTOR OF A CONTRACTOR O	a a la sub a		The subfiction of the	And in the local distribution of the local d	Contraction of the local distance of the loc	
-60.0			مانان و رائن در							Stop Freq
-70.0										25.000000000 GHz
-80.0										
Start 10.0	00 GHz			II			1	Stop 25	.000 GHz	CF Step
#Res BW	1.0 MHz		#VBW	/ 3.0 MHz		S	weep 40	.00 ms (4	0001 pts)	1.50000000 GHz
MKR MODE TF	RC SCL	X		Y 10.00 JD		CTION FUN	ICTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u> Man
1 N 1 2 N 1	f	24.563 875 (24.090 250 (GHz	-43.90 dBn -44.85 dBn	1					_
3 N 1 4	f	24.877 375 (GHz	-44.98 dBn	1					Freq Offset
5										0 Hz
7										
8										
10									~	
<										
MSG							STATUS	6		

Conducted Spurious Emissions 3 (Test Channel : Highest)



3.5 Unwanted Emissions (Radiated)

Test Requirements and limit,

§15.247(d), §15.205, §15.209 & RSS-247 [5.5], RSS-Gen [8.9], RSS-Gen [8.10]

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

• FCC Part 15.209(a) and (b)

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

• FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4400		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

• FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



3.5.1 Test Setup

Refer to the APPENDIX I.

3.5.2 Test Procedures

- 1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.

Note: Measurement Instrument Setting for Radiated Emission Measurements.

1. Frequency Range Below 1 GHz

RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

2. Frequency Range > 1 GHz

Peak Measurement > 1 GHz

RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes **Average** Measurement> **1GHz**

- 1. RBW = 1 MHz (unless otherwise specified).
- 2. VBW \geq 3 x RBW.
- 3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
- 4. Averaging type = power (i.e., RMS).
- 5. Sweep time = auto.
- 6. Perform a trace average of at least 100 traces.
- 7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
- 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
- 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
- 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Test Mode	Duty Cycle (%)	T _{on} (ms)	T _{on} + T _{off} (ms)	DCF = 10 log(1/Duty) (dB)	
TM 1	62.65	0.391	0.6241	2.03	

Note : Refer to appendix II for duty cycle measurement procedure and plots



3.5.3 Test Results

Frequency Range : 9 kHz ~ 25 GHz

Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2385.81	Н	Y	PK	45.97	2.84	N/A	N/A	48.81	74.00	25.19
2387.71	Н	Y	AV	35.22	2.84	2.03	N/A	40.09	54.00	13.91
4803.67	Н	Y	PK	45.65	7.99	N/A	N/A	53.64	74.00	20.36
4804.01	Н	Y	AV	35.39	7.99	2.03	N/A	45.41	54.00	8.59

Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4879.84	Н	Y	PK	46.76	8.03	N/A	N/A	54.79	74.00	19.21
4879.90	Н	Y	AV	37.70	8.03	2.03	N/A	47.76	54.00	6.24

Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.51	Н	Y	PK	52.79	3.19	N/A	N/A	55.98	74.00	18.02
2483.55	Н	Y	AV	37.43	3.19	2.03	N/A	42.65	54.00	11.35
4959.78	Н	Y	PK	45.02	8.19	N/A	N/A	53.21	74.00	20.79
4959.86	Н	Y	AV	34.21	8.19	2.03	N/A	44.43	54.00	9.57

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor(-9.54 dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = 20 log(1 m / 3 m) = -9.54 dB

When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

DCF = Duty Cycle Correction Factor.



3.6 Power line Conducted Emissions

Test Requirements and limit, §15.207 & RSS-Gen [8.8]

For an intentional radiator 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, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

	Conducted Limit (dBuV)					
Frequency Range (MHz)	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

3.6.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

3.6.2 Test Procedures

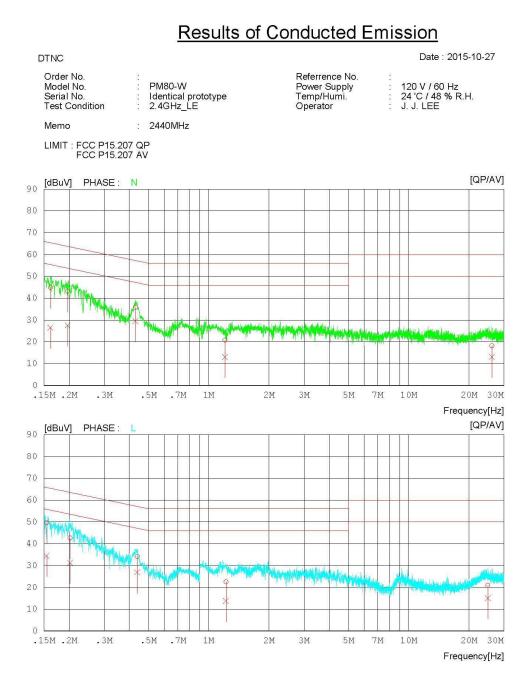
Conducted emissions from the EUT were measured according to the ANSI C63.10.

- The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.



3.6.3 Test Results

AC Line Conducted Emissions (Graph) = TM 1 & Test Channel : Middle





AC Line Conducted Emissions (List) = TM 1 & Test Channel : Middle

Results of Conducted Emission

			0									
DTNC										Date :	2015-10-27	
Order No. Model No. Serial No. Test Condition			PM80-W Identical prototype 2.4GHz_LE		Referrence No. Power Supply Temp/Humi. Operator			: 24	0 V / 60 'C / 48 ' J. LEE			
Mem	0	÷	2440MH	z								
LIMI	T : FCC P15 FCC P15											
NC) FREQ [MHz]	QP	DING AV][dBuV]	C.FACTOR [dB]	QP	SULT AV [dBuV]	QP	MIT AV][dBuV]	QP	RGIN AV][dBuV	PHASE]	
1 2 3 4 5 6 7 8 9 10	0.16148 0.19672 0.43007 1.20660 26.08360 0.15466 0.20251 0.43881 1.21880 24.88860	34.8 33.1 25.7 10.6 7.4 39.6 32.4 24.0 12.2 9.7	17.5 19.4 2.8 2.4 24.3 21.2 16.7 3.4	10.1 10.1 10.2 10.8 10.1 10.1 10.1 10.2 11.1	44.9 43.2 35.8 20.8 18.2 49.7 42.5 34.1 22.4 20.8	26.5 27.6 29.5 13.0 13.2 34.4 31.3 26.8 13.6 15.0	65.4 63.7 57.3 56.0 60.0 65.7 63.5 57.1 56.0 60.0	55.4 53.7 47.3 46.0 50.0 55.7 53.5 47.1 46.0 50.0	20.5 20.5 21.5 35.2 41.8 16.0 21.0 23.0 33.6 39.2	28.9 26.1 17.8 33.0 36.8 21.3 22.2 20.3 32.4 35.0	N N N L L L L L	



3.7 Occupied Bandwidth

Test Requirements, RSS-Gen [6.6]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

3.7.1 Test Setup

3.7.2 Test Procedures

The 99 % power bandwidth was measured with a calibrated spectrum analyzer.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately $3 \times RBW$.

Spectrum analyzer plots are included on the following pages.

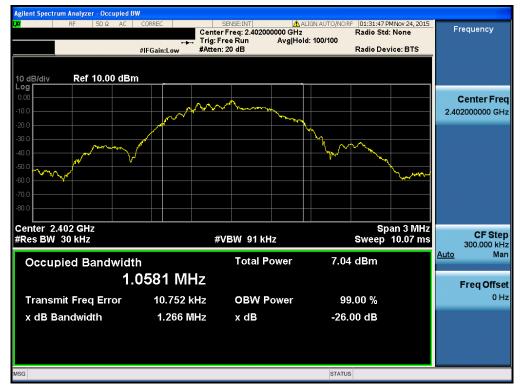
3.7.3 Test Results

Test Mode	Tested Channel	Test Results [MHz]				
	Lowest	1.0581				
TM 1	Middle	1.0564				
	Highest	1.0565				



99% Bandwidth

Test Channel : Lowest



99% Bandwidth

Test Channel : Middle





99% Bandwidth

Test Channel : Highest





4. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203 & RSS-Gen [6.7]

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. 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 provisions of this section."

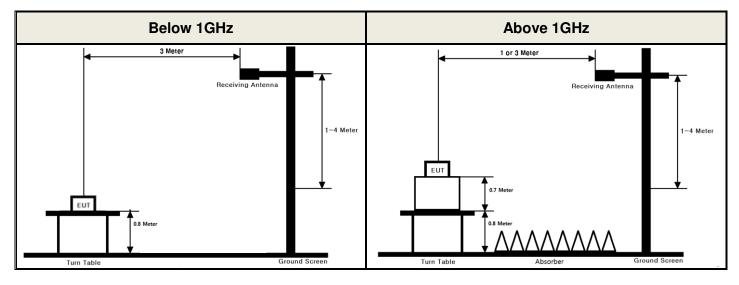
The internal antenna is attached on the main PCB using the special spring tension. Therefore this E.U.T Complies with the requirement of §15.203



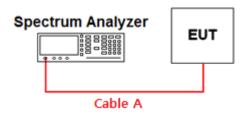
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)		
0.03	0.10	15	4.43		
1	1.15	20	5.74		
2.402 & 2.440 & 2.480	1.70	25	7.02		
5	3.55	-	-		
10	4.15	-	-		

Note 1 : The path loss from EUT to Spectrum analyzer was measured and used for test. Path loss (S/A's correction factor) = Cable A (Attenuator, Applied only when it was used externally)



APPENDIX II

Duty cycle plots

Test Procedure

Duty Cycle was measured using section 6.0 b) of KDB558074 :

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value. Set VBW \geq RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T \leq 16.7 microseconds.)

Duty Cycle

Test Channel : Middle



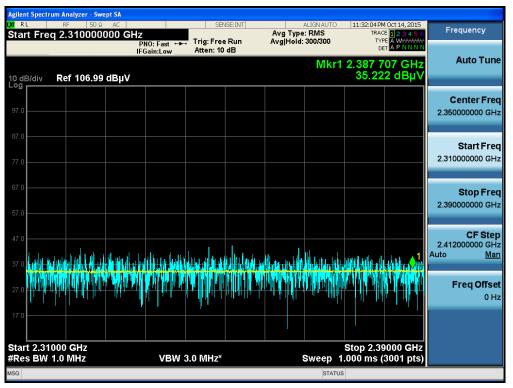


APPENDIX II

Unwanted Emissions (Radiated) Test Plot

Lowest & Edge

Detector Mode : AV



Highest & Edge

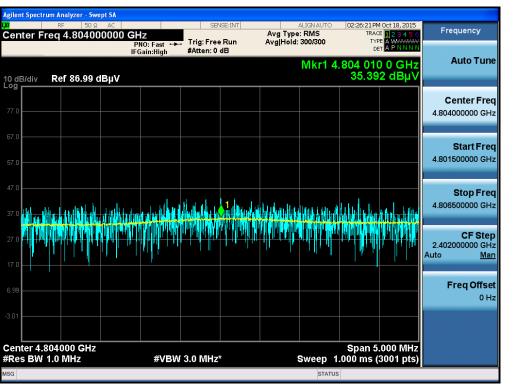
Detector Mode : AV

Agilent Spectrur	n Analyzer - Swe	pt SA								
LXI	RF 50 Ω	AC			VSE:INT	Avg Type		TRAC	4 Oct 14, 2015 ^E 1 2 3 4 5 6	Frequency
			PNO: Fast 🔸	Atten: 10		Avg Hold:		.483 54		Auto Tune
10 dB/div Log	Ref 106.99	dBµV						37.42	8 dBµV	
97.0										Center Fred 2.491750000 GHz
87.0										Start Free 2.483500000 GH2
67.0										Stop Fred 2.500000000 GH;
47.0 37.0	kalanti di kalaki ti			na di ang	diddada, the		H De stadet wi	hodini atali	tude ket fold allow as a	CF Step 2.41200000 GHz Auto <u>Mar</u>
27.0										Freq Offse 0 Hz
17.0										
Start 2.483 #Res BW 1			VBW :	3.0 MHz*			Sweep 1	Stop 2.500 .000 ms (0000 GHz 3001 pts)	
MSG							STATUS			



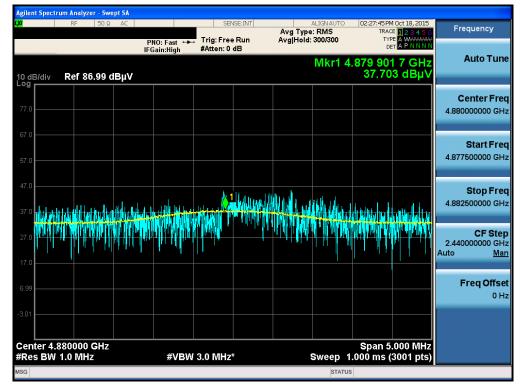
Detector Mode : AV

Lowest & Harmonic



Middle & Harmonic

Detector Mode : AV





Detector Mode : AV

Highest & Harmonic

