TEST REPORT

DT&C Co., Ltd.

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1.	Report	No	:	DRTFCC1804-0111
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Dt&C

- 2. Customer
 - Name (FCC): Sena Technologies, Inc.
 - Name (IC): Sena Technologies, Inc.
 - Address (FCC) : 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, South Korea
 - · Address (IC) : 210 Yangjae-dong, Seocho-gu Seoul 137-130 Korea (Republic Of)
- 3. Use of Report : FCC & IC Original Grant
- 4. Product Name / Model Name : Motorcycle Bluetooth Camera & Communication System / SP56 FCC ID : S7A-SP56 / IC : 8154A-SP56
- 5. Test Method Used : KDB558074 D01v04 Test Specification : FCC Part 15.247

RSS-247 Issue 2 (2017-02), RSS-GEN Issue 4 (2014-11)

- 6. Date of Test : 2018.03.28 ~ 2018.04.16
- 7. Testing Environment : See appended test report.
- 8. Test Result : Refer to the attached test result.

Affirmation	Tested by	6	Reviewed by		
112012/001201/0221214/2014/2012020201201201201	Name : InHee Bae	Statt	Name : GeunKi Son	(Signatur	e)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2018.04.30.

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If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1804-0111	Apr. 30, 2018	Initial issue



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1. EUT DESCRIPTION

FCC Equipment Class	Digital Transmission System(DTS)
Product	Motorcycle Bluetooth Camera & Communication System
Model Name	SP56
Add Model Name	NA
Hardware Version	1.0
Software Version	1.0
Power Supply	DC 3.7 V
Frequency Range	• 802.11b/g/n(20 MHz) : 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band • 802.11b : 10.85 dBm • 802.11g : 16.56 dBm • 802.11n (HT20) : 16.54 dBm
Modulation Type	• 802.11b: CCK, DSSS • 802.11g/n: OFDM
Antenna Specification	Antenna type: Internal Antenna Antenna gain: 0.2 dBi

2. INFORMATION ABOUT TESTING

2.1 Test mode

Test	Worst case data rate	Tested Frequency(MHz)			
mode		Lowest	Middle	Highest	
TM 1	802.11b 1 Mbps	2412	2437	2462	
TM 2	802.11g 6 Mbps	2412	2437	2462	
TM 3	802.11n(HT20) MCS 0	2412	2437	2462	

Note 1: The worst case data rate is determined as above test mode according to the power measurements. Note 2: The power measurement results for all modes and data rate were reported.

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.3 Tested environment

Temperature	: 21 ~ 25 °C
Relative humidity content	: 41 ~ 45 %
Details of power supply	: DC 3.7 V

2.4 EMI suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing \rightarrow None

2.5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power	0.7 dB (The confidence level is about 95 %, $k = 2$)
Conducted spurious emission	1.1 dB (The confidence level is about 95 %, k = 2)
AC conducted emission	2.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

3. SUMMARY OF TESTS

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 2,3
15.207	RSS-Gen [8.8]	AC Line Conducted Emissions	FCC 15.207 limits	AC Line Conducted	С
15.203	RSS-Gen [8.3]	Antenna Requirements	FCC 15.203	-	С

Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This test item was performed in each axis and the worst case data was reported.



4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 D01v04. 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

4.1 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.

4.2 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.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB558074 D01v04.

So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

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 KDB558074 D01v04. 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 KDB558074 D01V04.

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. 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.

4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics. A test program is used to control the EUT for staying in continuous transmitting mode.



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.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site comply with the requirements of § 2.948 according to ANSI 63.4-2014.

- FCC MRA Accredited Test Firm No. : KR0034

- IC Test site	- IC Test site No. : 5740A-4				
www.dtnc.net	www.dtnc.net				
Telephone	:	+ 82-31-321-2664			
FAX : +82-31-321-1664					

6.2 Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, loop, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203

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 antenna is permanently printed on PCB. (Refer to Internal Photo file.) Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6dB bandwidth

Test Requirements and limit, §15.247(a)

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

The minimum permissible 6 dB bandwidth is 500 kHz.

Test Configuration:

Refer to the APPENDIX I.

Test Procedure:

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

D01V04

- 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.

Test Results: Comply

Test Mode	Frequency	Test Results[MHz]
	Lowest	7.575
TM 1	Middle	7.621
	Highest	7.620
	Lowest	15.060
TM 2	Middle	15.060
	Highest	15.310
	Lowest	16.100
ТМ 3	Middle	16.100
	Highest	16.110



RESULT PLOTS

6 dB Bandwidth



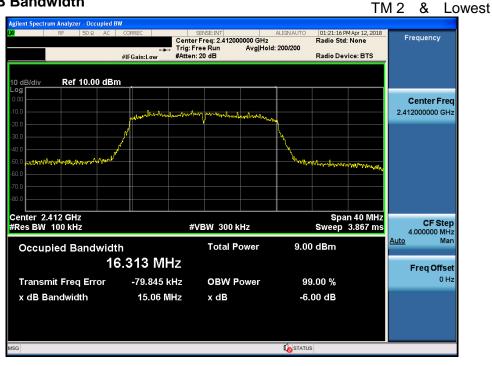
6 dB Bandwidth

TM 1 & Middle





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6 dB Bandwidth





Dt&C

Bandwidth					TM	28	λ Hi	ghest
Agilent Spectrum Analyzer - Occupied BW								Í
ιχι RF 50.Ω AC COR	Center Fre	q: 2.462000000 GHz	R	01:23:23 PM adio Std: 1		Freq	uency	
#IFC	Gain:Low #Atten: 20			adio Devid	e: BTS			
10 dB/div Ref 10.00 dBm								
Log 0.00 -10.0	June marker of the second second of the	mburnonperandrushe					n ter Freq 00000 GHz	
-20.0 -30.0 -40.0								
-50.0 www.mm.tm.mm.mm.MMm.			Wyw Hylwlow	www.	- Monson M			
-70.0								
Center 2.462 GHz #Res BW 100 kHz	#VBI	W 300 kHz	S		40 MHz .867 ms	4.00	CF Step	
Occupied Bandwidth		Total Power	6.49 d	Bm		<u>Auto</u>	Man	
16.3	47 MHz					Fre	eq Offset	
Transmit Freq Error	-69.821 kHz	OBW Power	99.0	0 %			0 Hz	
x dB Bandwidth	15.31 MHz	x dB	-6.00	dB				
MSG			K STATUS					

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Log Center Freq 200 100 200	Bandwidth					ΤN	13	&	Low	est
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and a second sec	-10.0	white the two the	Anna parteration of a base low							
Center 2.412 GHz #VBW 300 kHz Span 40 MHz Center 2.412 GHz #VBW 300 kHz Sweep 3.867 ms Center 2.412 GHz #VBW 300 kHz Sweep 3.867 ms Occupied Bandwidth Total Power 8.51 dBm 17.469 MHz OBW Power 99.00 % x dB Bandwidth 16.10 MHz x dB	-30.0									
Center 2.412 GHz #Res BW 100 kHz #VBW 300 kHz Span 40 MHz Sweep 3.867 ms CF Step 4.00000 MHz Sweep 3.867 ms Occupied Bandwidth 17.469 MHz Total Power 8.51 dBm Transmit Freq Error -70.290 kHz OBW Power 99.00 % -6.00 dB x dB Bandwidth 16.10 MHz x dB -6.00 dB		чур. 		W WYMW	WWwwww	May Marth				
#Res BW 100 kHz #VBW 300 kHz Sweep 3.867 ms Occupied Bandwidth Total Power 8.51 dBm 17.469 MHz Transmit Freq Error -70.290 kHz X dB Bandwidth 16.10 MHz X dB -6.00 dB -6.00 dB										
Occupied Bandwidth Total Power 8.51 dBm 17.469 MHz Transmit Freq Error -70.290 kHz OBW Power 99.00 % x dB Bandwidth 16.10 MHz x dB -6.00 dB		#	≠VBW 300 kHz	· · · · · · · · · · · · · · · · · · ·			4.			
Transmit Freq Error -70.290 kHz OBW Power 99.00 % 0 Hz x dB Bandwidth 16.10 MHz x dB -6.00 dB	Occupied Bandwi	dth	Total Power	8.51	dBm		<u>Auto</u>	N	lan	
x dB Bandwidth 16.10 MHz x dB -6.00 dB		17.469 MHz					F			
	Transmit Freq Error	-70.290 kHz	OBW Power	99.0	00 %			0	Hz	
MSG STATUS	x dB Bandwidth	16.10 MHz	x dB	-6.0	0 dB					
	MSG			I STATUS						

6 dB Bandwidth





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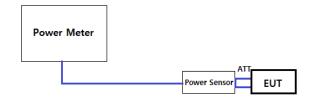
Bandwidth					TM	3 &	Hig	ghest
	CORREC #IFGain:Low	SENSE:INT Center Freq: 2.462000 Trig: Free Run #Atten: 20 dB	ALIGNAUTO 1000 GHz Avg Hold: 200/200	01:25:38 PM Radio Std: Radio Dev		Freque	ency	ſ
10 dB/div Ref 10.00 dBm Log 0.00 -10.0	. In Antrology	wanter marked				Cent 2.462000	e r Freq 000 GHz	
-20.0 -30.0 -40.0 -60.0				hornhauthan	Palan . 11 .			
-60.0 -70.0 -80.0 Center 2.462 GHz					n 40 MHz			
#Res BW 100 kHz		#VBW 300 ki			3.867 ms		CF Step 000 MHz Man	
	.500 MH	z				Free	q Offset	
Transmit Freq Error x dB Bandwidth	-64.481 ki 16.11 Mi			9.00 % .00 dB			0 Hz	
MSG			K STATI	IS				

8.2 Maximum peak conducted output power

Test Requirements and limit, §15.247(b)

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

1. PKPM1 Peak power meter method of KDB558074 D01V04

The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

2. Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074 D01V04

The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Test Results: Comply

From		Maximum Peak Conducted Output Power (dBm) for 802.11b									
Freq. (MHz)	Det.	Data Rate [Mbps]									
		1	2	5.5	11	-	-	-	-		
2412	PK	10.85	10.77	10.74	10.81	-	-	-	-		
2412	AV	8.04	7.85	7.96	7.82	-	-	-	-		
2427	PK	10.81	10.70	10.76	10.79	-	-	-	-		
2437	AV	7.89	7.74	7.64	7.84	-	-	-	-		
2462	PK	10.77	10.63	10.75	10.68	-	-	-	-		
2402	AV	7.83	7.67	7.53	7.71	-	-	-	-		

From		Maximum Peak Conducted Output Power (dBm) for <u>802.11g</u>										
Freq. (MHz)	Det.	Data Rate [Mbps]										
		6	9	12	18	24	36	48	54			
2412	PK	16.56	16.38	16.21	16.38	16.45	16.41	16.45	16.28			
2412	AV	7.80	7.66	7.79	7.62	7.68	7.74	7.84	7.68			
2437	PK	16.51	16.49	16.30	16.42	16.39	16.43	16.49	16.46			
2437	AV	7.94	7.75	7.64	7.81	7.85	7.76	7.88	7.83			
2462	PK	16.34	16.22	16.15	16.28	16.26	16.22	16.18	16.31			
2402	AV	7.88	7.71	7.75	7.67	7.71	7.82	7.63	7.68			

Frog			Maximum Peak Conducted Output Power (dBm) for 802.11n(HT20)									
Freq. (MHz)	Det.	Data Rate [MCS]										
		0	1	2	3	4	5	6	7			
2412	PK	16.34	16.27	16.21	16.24	16.21	16.31	16.26	16.25			
2412	AV	7.73	7.62	7.58	7.63	7.70	7.71	7.68	7.64			
2437	PK	16.54	16.21	16.35	16.32	16.24	16.33	16.05	16.29			
2437	AV	7.84	7.78	7.83	7.75	7.72	7.82	7.83	7.71			
2462	PK	16.35	16.25	16.20	16.28	16.20	16.30	16.24	16.26			
2402	AV	7.79	7.66	7.64	7.71	7.68	7.64	7.56	7.74			

8.3 Maximum power spectral density

Test requirements and limit, §15.247(e)

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.

Test Configuration:

Refer to the APPENDIX I.

Test Procedure

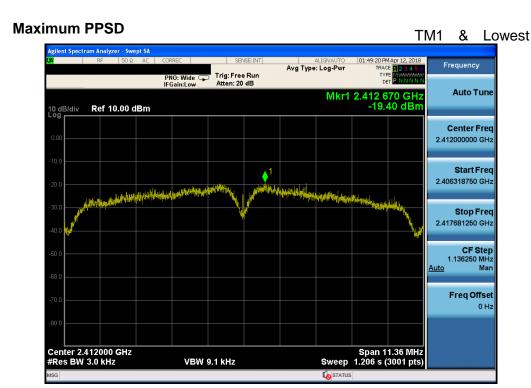
Method PKPSD of KDB558074 D01V04 is used.

- 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 to : **3 kHz** ≤ 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 amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Results: Comply

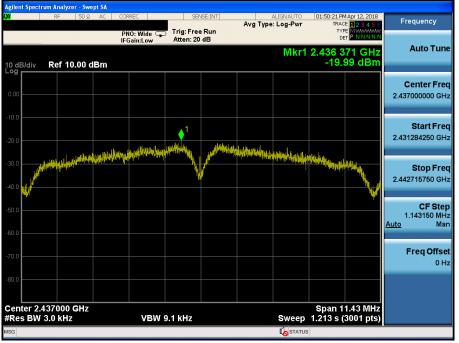
Test Mode	Frequency	RBW	PKPSD [dBm]
	Lowest	3 kHz	-19.40
TM 1	Middle	3 kHz	-19.99
	Highest	3 kHz	-20.22
	Lowest	3 kHz	-21.60
TM 2	Middle	3 kHz	-23.21
	Highest	3 kHz	-23.40
	Lowest	3 kHz	-21.37
TM 3	Middle	3 kHz	-22.67
	Highest	3 kHz	-23.97

RESULT PLOTS









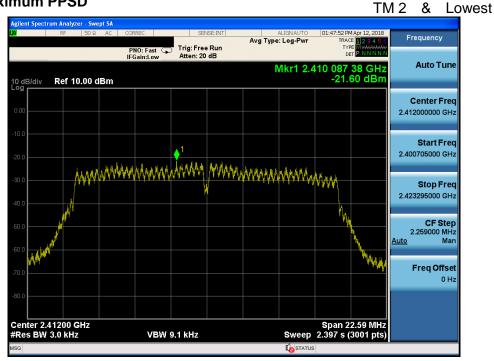
Dt&C

Maximum PPSD



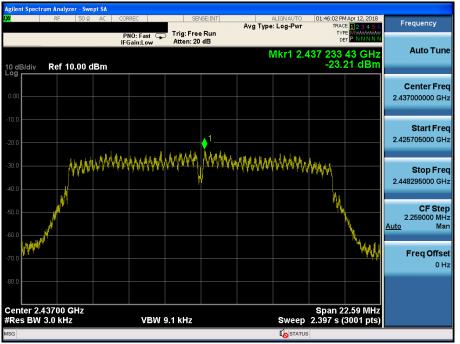
TDt&C

Maximum PPSD



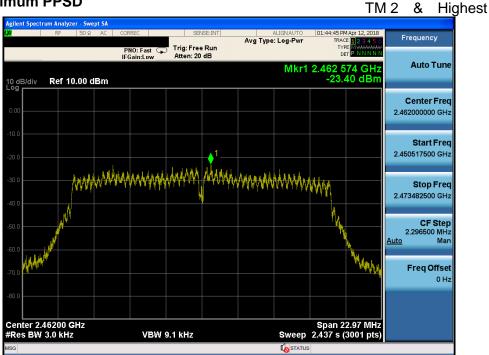
Maximum PPSD

TM2 & Middle



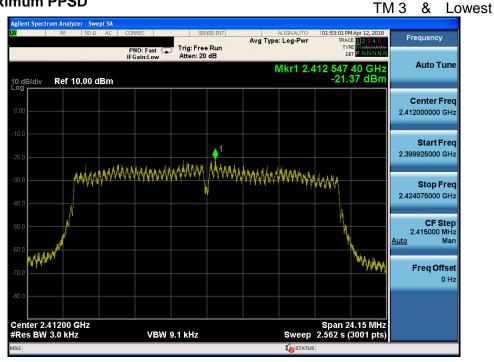
Dt&C

Maximum PPSD



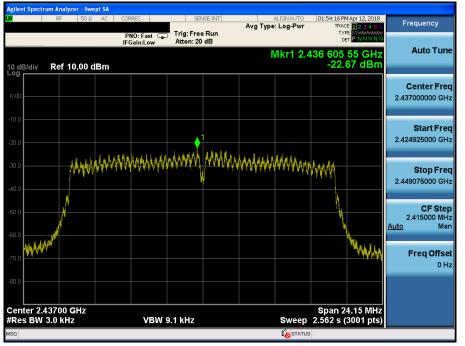
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Maximum PPSD



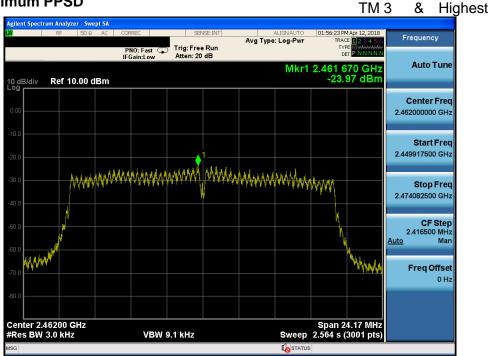
Maximum PPSD

TM3 & Middle



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Maximum PPSD



8.4 Out of band emissions at the band edge / conducted spurious emissions

Test requirements and limit, §15.247(d)

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

Test Configuration:

Refer to the APPENDIX I.

Test Procedure

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level of KDB558074 D01v04

- 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.

- Measurement Procedure 2 - Unwanted Emissions of KDB558074 D01v04

- 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 \geq 3 x RBW. (Actual 3 MHz, See below note)
- 4. Detector = **Peak**.
- 5. Ensure that the number of measurement points \geq 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: 9 kHz ~ 30 MHz RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

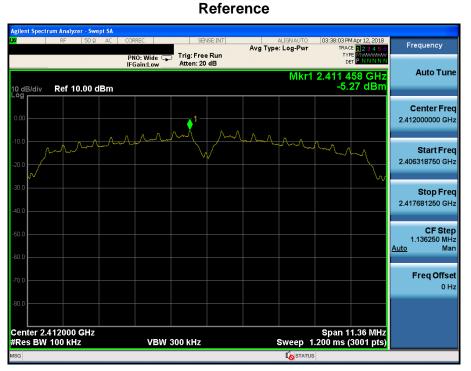
Frequency range: 30 MHz ~ 10 GHz, 10 GHz ~25 GHz RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

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.

RESULT PLOTS

TM 1 & Lowest



Low Band-edge



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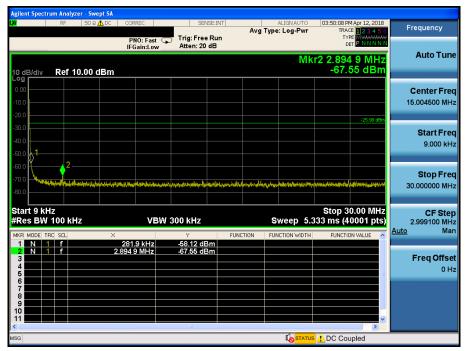
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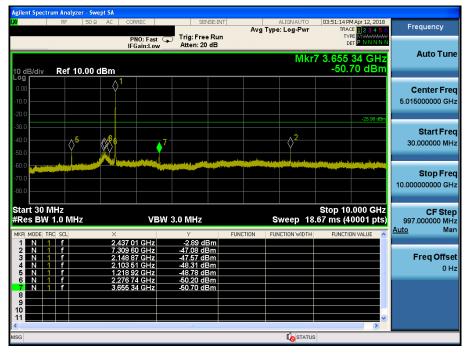


TM 1 & Middle

Reference







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Start 10.000 GHz #Res BW 1.0 MHz	VBW	3.0 MHz	Sweep 42	Stop 26.500 GHz .67 ms (40001 pts)	CF Step 1.650000000 GHz
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TM 1 & Highest

Reference



High Band-edge



Agilent Spectrum Analyzer -									
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TM 2 & Lowest

Reference

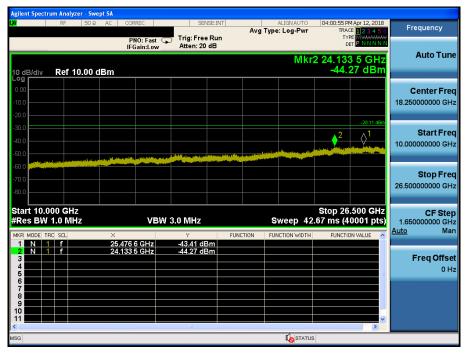


Low Band-edge



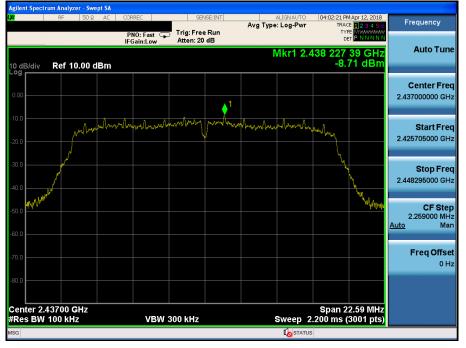
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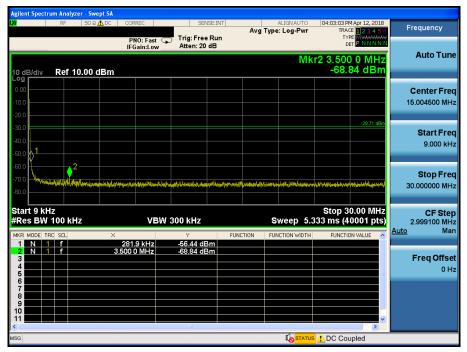
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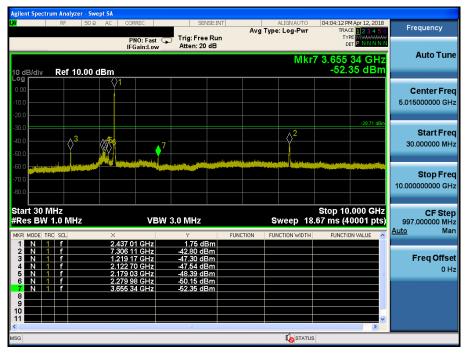


TM 2 & Middle

Reference







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TM 2 & Highest

Reference



High Band-edge



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-60.0					
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Start 9 kHz				Stop 30.00 MHz	CF Step
#Res BW 100 kHz	VBW	300 kHz	Sweep 5.3	333 ms (40001 pts)	2.999100 MHz
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	2.461 18 GHz 7.392 35 GHz	-2.47 dBm -42.98 dBm			
3 N 1 f	1.231 63 GHz 2.158 10 GHz	-45.48 dBm -45.84 dBm			Freq Offset
5 N 1 f	2.219 16 GHz	-47.79 dBm		=	0 Hz
	2.079 33 GHz 3.690 73 GHz	-47.84 dBm -51.11 dBm			
8					
10					
11 (×	
MSG			to status		

RF 50	Ω AC	CORREC	SENSE:IN	Т	ALIGN AUTO	04:10:51 PM Apr 12, 2018	_
		PNO: Fast C IFGain:Low	Trig: Free Rur Atten: 20 dB		Type: Log-Pwr	TRACE 12345 TYPE MANNAN DET PNNNN	**
0 dB/div Ref 10.00	dBm				Mkr	2 21.559 9 GHz -46.78 dBm	
og 0.00 10.0 20.0							Center Fre 18.250000000 GH
30.0 40.0	مى بىلى بىرىنا يەرىيا مەلىلىغ يەن يەرىيا يەرى	eystane	Hill (M.)	11 * (11 × 11 ° + +++) (1 × ++ + + + + + +++)	2	-30.11 dBn	Start Fre 10.000000000 G⊦
60.0 70.0 30.0							Stop Fre 26.50000000 G⊦
tart 10.000 GHz Res BW 1.0 MHz		VBW	/ 3.0 MHz			Stop 26.500 GHz .67 ms (40001 pts	
KKR MODE TRC SCL 1 N 1 f 2 N 1 f 3 - - 4 - - 5 - -		071 0 GHz 559 9 GHz	√ -43.02 dBm -46.78 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Freq Offs
6 7 8 9							
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from the second s					I STATUS		

Dt&C

TM 3 & Lowest

Reference



Low Band-edge



gilent Spectrum Analyzer - Swe RF 50 Ω		SENSE:INT	ALIGNAUTO	04:13:13 PM Apr 12, 2018	
RF 50Ω,			Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB		DET P N N N N N	
			Mk	r2 2.744 2 MHz	Auto Tune
10 dB/div Ref 10.00 c	dBm			-68.39 dBm	
					Center Free
10.0					15.004500 MH
-20.0					
-30.0				-28.90 dBm	
-40.0					Start Free 9.000 kH:
-50.0					5.000 KH
-60.0					
-70.0	table and service such the off-man	alita perdutat score das cilli sitte ille schi eta i	erise des Also des transmissiones de la competencia de	on the ten as interal start this have a	Stop Free
-80.0					30.000000 MH
Start 9 kHz				Stop 30.00 MHz	
Res BW 100 kHz	VB	N 300 kHz	Sweep 5.3	333 ms (40001 pts)	CF Stej 2.999100 MH
MKR MODE TRC SCL	×	Y F	UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mai
1 N 1 f 2 N 1 f	292.4 kHz 2.744 2 MHz	-58.72 dBm -68.39 dBm			
3	2.744 2 10112	-00.39 0.511			Freq Offse
5					0 H
6					
8					
10					
				~	
				>	

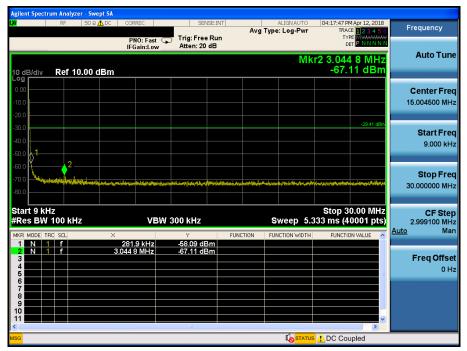
Agilent Spectrum Analyzer - Swe					
LXI RF 50 Ω	AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:15:02 PM Apr 12, 2018 TRACE 123456 TYPE MMAAAAAAAA	Frequency
	PNO: Fast 🖵 IFGain:Low	Atten: 20 dB		TYPE MUMMMMM DET PNNNNN	
10 dB/div Ref 10.00 d	dBm		Mkr	7 3.618 20 GHz -52.04 dBm	Auto Tune
-10.0					Center Freq 5.015000000 GHz
-30.0 -40.0 -50.0	2 ² 7			-28.90 dBm	Start Freq 30.000000 MHz
-60.0					Stop Freq 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	VBW	3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	×	Y FUN -0.68 dBm	TTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	2.411 09 GHz 7.230 83 GHz 2.142 14 GHz 2.164 08 GHz 1.206 71 GHz	-0.68 dBm -41.98 dBm -46.99 dBm -47.60 dBm -47.84 dBm			Freq Offset 0 Hz
6 N 1 F 7 N 1 F 8 9	2.084 57 GHz 3.618 20 GHz	-50.29 dBm -52.04 dBm			
10 11 <				~	
MSG			K STATUS		

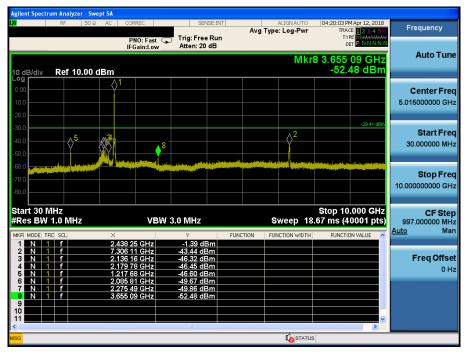
Avg Type: Log-Pwr Trig: Free Run Trig: Free Run Atten: 20 dB Trig: Free Run Atten: 20 dB Avg Type: Log-Pwr Trig: State Trig: Free Run Cert Auto Trig: Free Run Det State 10 dB/div Ref 10.00 dBm	RF 5	iOΩ AC	CORREC	SENSE:INT		ALIGNAUTO	04:15:37 PM Apr 12, 2018	
MKR2 21.682 8 GHz Center F 46.00 dBm -46.00 dBm 00 -46.00 dBm 010 -46.00 dBm 020 -46.00 dBm 10.00000000 -46.00 dBm 11.6500000000 -46.00 dBm 11.6			PNO: Fast ⊂ IFGain:Low		Avg	Type: Log-Pwr	TRACE 1 2 3 4 5 6	
1000 1	dB/div Ref 10.0	0 dBm				Mkr		
000 2 3	0.0							Center Fre 18.250000000 GH
Stop F 200 S	0.0		ng maganina ing pikihang ini Galang ing sa			2	-28.90 dBm	Start Fre 10.000000000 GF
Kes BW 1.0 MHz VBW 3.0 MHz Sweep 42.67 ms (40001 pts) 1.65000000 KR MODEL TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto N 1 f 26.036 4 GHz 43.33 dBm FUNCTION FUNCTION VALUE FUNCTIO	0.0							Stop Fre 26.500000000 GH
AF MODE THC SEL X Y FUNCTION FUNCTION VALUE 1 N 1 f 26.036 4 GHz 43.33 dBm 44.000 dBm 45.000 dBm 46.000	Res BW 1.0 MHz		VBW				.67 ms (40001 pts)	1.65000000 G
	1 N 1 f 2 N 1 f 3 0 0 0 0	26.		-43.33 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Freq Offs
	6 7 7 8 9							

TM 3 & Middle

Reference







Agilent Spect	rum Ana	lyzer - Swe	pt SA									
LXI	RF	50 Ω	AC	CORREC		SENS	E:INT		ALIGN AUTO		4 Apr 12, 2018	Frequency
				PNO: F IFGain:	ast 🖵 Low	Trig: Free Atten: 20		Avg	Type: Log-Pwr	TY	23456 PE MWWWW ET P N N N N N	
10 dB/div	Ref	10.00 c	iBm						Mkr		96 GHz 99 dBm	Auto Tune
Log 0.00 -10.0 -20.0												Center Freq 18.250000000 GHz
-30.0 -40.0 -50.0	d an astronet	regeneral based and							2		-29.41 dBm	Start Freq 10.000000000 GHz
-60.0 -70.0 -80.0												Stop Freq 26.50000000 GHz
Start 10. #Res BW					VBW :	3.0 MHz			Sweep 42	Stop 26 .67 ms (4	.500 GHz 0001 pts)	CF Step 1.65000000 GHz
MKR MODE T	1 f			102 4 GH 629 6 GH		√ -43.52 dB -46.99 dB	m	NCTION	FUNCTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u> Man
3 4 5 6				629 6 GF	12	-46.99 dB						Freq Offset 0 Hz
7 8 9 10												
11 											>	
MSG												

TM 3 & Highest

Reference



High Band-edge



Agilent Spectrum Analyzer - Swe					
RF 50 Ω	▲ DC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:23:38 PM Apr 12, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB		TYPE MWAAAAAAA DET P N N N N N	
	il odinizow		Mk	r2 2.698 4 MHz	Auto Tune
10 dB/div Ref 10.00 d	dBm			-68.13 dBm	
Log					
0.00					Center Free
10.0					15.004500 MH
-20.0				-29.99 dBm	
-30.0				-29.99 dbm	Start Fred
-40.0					9.000 kH:
-50.0					
-60.0					Oton Free
-70.0	Manage Another Report Harding	allements advances a little startly data and shakes.	Antesis estatic di Anterio di Antesis de Antesis de Antesis	والمراجعة والمراجعة والمراجع	Stop Freq 30.000000 MHz
-80.0	A C D D C C C C C C C C C C C C C C C C	an a			30.000000 MH
Start 9 kHz				Oton 20 00 Mills	
#Res BW 100 kHz	VB	N 300 kHz	Sweep 5.3	Stop 30.00 MHz 333 ms (40001 pts)	CF Step 2.999100 MH;
MKR MODE TRC SCL	×		FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto Mar
1 N 1 f	284.2 kHz	-56.62 dBm		FONCTION VALUE	
2 N 1 f	2.698 4 MHz	-68.13 dBm			Freq Offset
4					0 Hz
5				=========	
7 8					
9					
10				~	
<				>	

Agilent Spectrum Analyzer - Sw					
ιχι RF 50 Ω		SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:25:15 PM Apr 12, 2018 TRACE 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Frequency
	PNO: Fast 🕞 IFGain:Low	Atten: 20 dB		DET PNNNN	A
10 dB/div Ref 10.00	dBm		Mkr	8 3.693 98 GHz -51.26 dBm	Auto Tune
-10.0					Center Freq 5.015000000 GHz
-30.0 -40.0 -50.0			2	-29.99 dBm	Start Freq 30.000000 MHz
-60.0					Stop Freq 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	VBW	3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	×		CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f	2.460 69 GHz 7.386 36 GHz 1.232 88 GHz 2.154 36 GHz 2.177 04 GHz	-2.85 dBm -43.46 dBm -45.32 dBm -46.09 dBm -47.38 dBm			Freq Offset 0 Hz
S N 1 F 6 N 1 f 7 N 1 f 8 N 1 f	2.089 05 GHz 2.234 87 GHz 3.693 98 GHz	-47.38 dBm -48.20 dBm -49.85 dBm -51.26 dBm			
9 10 11				> >	
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8.5 Radiated spurious emissions

Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the operating frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 KHz bandwidth within the 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 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

• 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.

Test Configuration

Refer to the APPENDIX I.

Test Procedure

- 1. The EUT is placed on a non-conductive table, emission measurements at below 1 GHz, the table height is 80 cm and 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 1 or 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.



Measurement Instrument Setting for Radiated Emission Measurements.

The radiated emission was tested according to the section 6.3, 6.4, 6.5 and 6.6 of the ANSI C63.10-2013 with following settings.

Peak Measurement

RBW = As specified in below table, VBW \ge 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

Average Measurement:

- 1. RBW = 1 MHz (unless otherwise specified).
- 2. VBW ≥ 3 x RBW.
- 3. Detector = RMS (Number of points $\ge 2 \times \text{Span} / \text{RBW}$)
- 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.

Duty Cycle Correction factor

Test Mode	Date rate	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
TM 1	1Mbps	99.69	0.01
TM 2	6Mbps	97.08	0.13
TM 3	MCS0	97.03	0.13

Note: Refer to the APPENDIX II.

Test Results: Comply

Please refer to next page for data table and the appendix III for worst data plots.



	•			•							
Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	2388.14	V	Х	PK	50.93	2.69	N/A	N/A	53.62	74.00	20.38
Lowoot	2388.06	V	Х	AV	42.07	2.69	N/A	N/A	44.76	54.00	9.24
Lowest	4823.93	н	Х	PK	50.69	1.49	N/A	N/A	52.18	74.00	21.82
	4823.92	н	х	AV	40.70	1.49	N/A	N/A	42.19	54.00	11.81
Middle	4873.51	н	Y	PK	50.15	1.62	N/A	N/A	51.77	74.00	22.23
Middle	4873.97	н	Y	AV	40.65	1.62	N/A	N/A	42.27	54.00	11.73
	2483.82	V	Х	PK	50.39	3.10	N/A	N/A	53.49	74.00	20.51
	2483.86	V	х	AV	41.06	3.10	N/A	N/A	44.16	54.00	9.84
Highest	4923.69	н	Y	PK	50.31	1.78	N/A	N/A	52.09	74.00	21.91
	4924.01	Н	Y	AV	41.12	1.78	N/A	N/A	42.90	54.00	11.10

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : TM 1

Note.

1. The radiated emissions were investigated 9kHz to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL - AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

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

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



Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	2389.67	V	Z	PK	55.98	2.70	N/A	N/A	58.68	74.00	15.32
L anna a t	2389.82	V	Z	AV	45.21	2.70	0.13	N/A	48.04	54.00	5.96
Lowest	4824.41	Н	Y	PK	50.42	1.49	N/A	N/A	51.91	74.00	22.09
	4823.26	Н	Y	AV	39.09	1.49	0.13	N/A	40.71	54.00	13.29
N 4: -1 -11 -	4874.12	Н	Y	PK	50.34	1.62	N/A	N/A	51.96	74.00	22.04
Middle	4873.43	Н	Y	AV	39.17	1.62	0.13	N/A	40.92	54.00	13.08
	2483.89	V	Z	PK	51.78	3.10	N/A	N/A	54.88	74.00	19.12
Highest	2483.98	V	Z	AV	41.90	3.10	0.13	N/A	45.13	54.00	8.87
	4923.10	Н	Y	PK	49.86	1.78	N/A	N/A	51.64	74.00	22.36
	4923.92	Н	Y	AV	38.75	1.78	0.13	N/A	40.66	54.00	13.34

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : TM 2

Note.

1. The radiated emissions were investigated 9kHz to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL - AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

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

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



Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	2389.30	V	Z	PK	57.15	2.70	N/A	N/A	59.85	74.00	14.15
1	2389.63	V	Z	AV	46.29	2.70	0.13	N/A	49.12	54.00	4.88
Lowest	4824.35	н	Y	PK	51.00	1.49	N/A	N/A	52.49	74.00	21.51
	4824.16	Н	Y	AV	39.06	1.49	0.13	N/A	40.68	54.00	13.32
NA: -I -II -	4873.94	Н	Y	PK	50.64	1.62	N/A	N/A	52.26	74.00	21.74
Middle	4874.85	Н	Y	AV	39.29	1.62	0.13	N/A	41.04	54.00	12.96
	2484.88	V	Z	PK	52.54	3.10	N/A	N/A	55.64	74.00	18.36
	2483.50	V	Z	AV	42.21	3.10	0.13	N/A	45.44	54.00	8.56
Highest	4923.12	Н	Y	PK	49.62	1.78	N/A	N/A	51.40	74.00	22.60
	4924.23	Н	Y	AV	38.76	1.78	0.13	N/A	40.67	54.00	13.33

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : TM 3

Note.

1. The radiated emissions were investigated 9kHz to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + DCCF + DCF / T.F = AF + CL – AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCE = Duty Cycle Correction Factor = DCE = Distance Correction Factor

DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

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

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



8.6 Power-line conducted emissions

Test Requirements and limit, §15.207

For an intentional radiator which 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 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range	Conducted Limit (dBuV)				
(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.

Test Procedure

- 1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
- 2. The EUT is connected via LISN to the test power supply.
- 3. The measurement results are obtained as described below:
- 4. Detectors Quasi Peak and Average Detector.

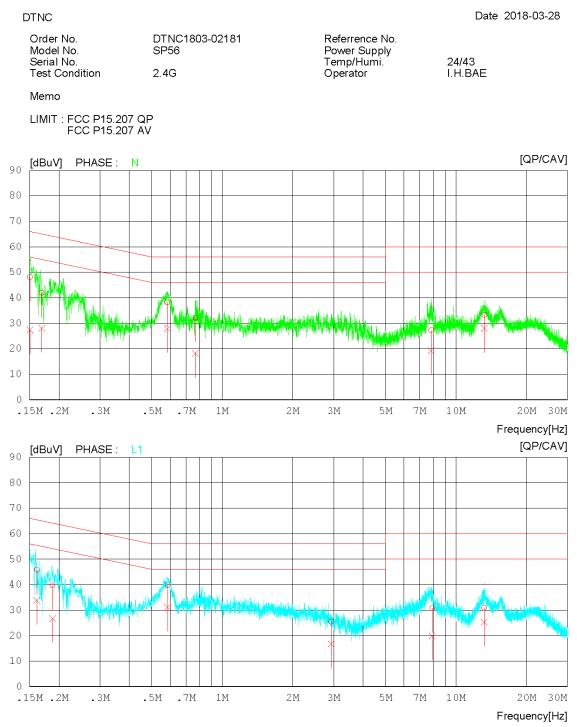
Test Results: Comply(Refer to next page.)

The worst data was reported.

RESULT PLOTS AC Line Conducted Emissions (Graph)

Test Mode: TM2 & 2462 MHz

Results of Conducted Emission



AC Line Conducted Emissions (List)

Test Mode: TM2 & 2462 MHz

Results of Conducted Emission

Referrence No. Power Supply

Temp/Humi.

Operator

Date 2018-03-28

24/43

I.H.BAE

Order No.	DTNC1803-02181
Model No.	SP56
Serial No. Test Condition	2.4G

Memo

DTNC

LIMIT : FCC P15.207 QP FCC P15.207 AV

N) FREQ	READING QP CAV [dBuV] [dBuV]	C.FACTOR [dB]	RESULT QP CAV [dBuV] [dBuV]	LIMIT QP CA [dBuV] [dB	~	PHASE
1	0.15043	38.14 17.41	9.99	48.13 27.40	65.98 55.	98 17.8528.58	N
2	0.16915	31.9918.20	9.97	41.9628.17	65.00 55.	00 23.04 26.83	N
3	0.58326	28.17 17.97	9.98	38.15 27.95	56.00 46.	00 17.8518.05	N
4	0.76921	22.24 8.25	9.96	32.20 18.21	56.00 46.	00 23.80 27.79	Ν
5	7.83260	17.12 9.11	10.17	27.29 19.28	60.00 50.	00 32.71 30.72	N
6	13.24820	23.0017.78	10.27	33.27 28.05	60.00 50.	00 26.7321.95	N
7	0.16092	35.7323.90	9.98	45.71 33.88	65.42 55.	42 19.7121.54	L1
8	0.18815	29.6516.77	9.95	39.60 26.72	64.12 54.1	12 24.5227.40	L1
9	0.58403	29.7121.13	9.98	39.6931.11	56.00 46.	00 16.31 14.89	L1
10	2.92240	15.37 6.59	10.05	25.42 16.64	56.00 46.	00 30.5829.36	L1
11	7.92180	20.55 9.65	10.17	30.72 19.82	60.00 50.	00 29.2830.18	L1
12	13.20560	20.5514.97	10.27	30.82 25.24	60.00 50.	00 29.1824.76	L1

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.

TEST CONFIGURATION

Refer to the APPENDIX I.

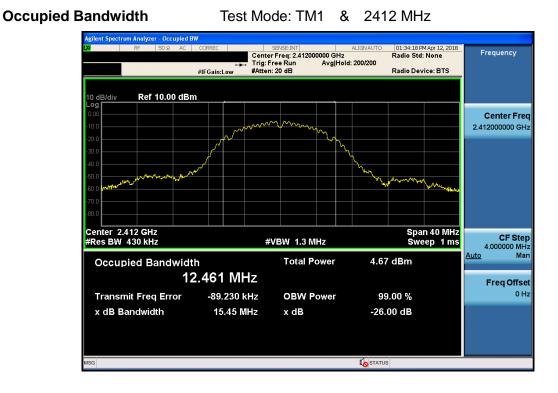
TEST PROCEDURE

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- 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 3x RBW.

TEST RESULTS: Comply

Test Mode	Frequency	Test Results[MHz]		
	Lowest	12.461		
TM 1	Middle	12.466		
	Highest	12.562		
	Lowest	16.548		
TM 2	Middle	16.537		
	Highest	16.610		
	Lowest	17.533		
ТМ 3	Middle	17.547		
	Highest	17.556		

RESULT PLOTS



Occupied Bandwidth

Test Mode: TM1 & 2437 MHz



Test Mode: TM1 & 2462 MHz



Test Mode: TM2 & 2412 MHz



Occupied Bandwidth

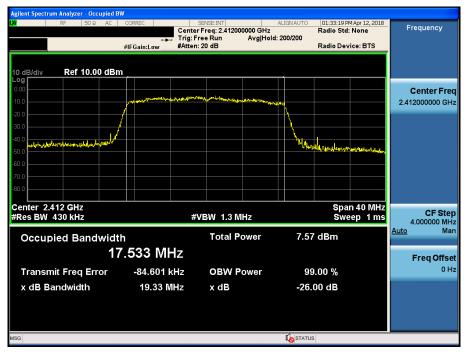
Test Mode: TM2 & 2437 MHz



Test Mode: TM2 & & 2462 MHz



Test Mode: TM3 & 2412 MHz



Occupied Bandwidth

Test Mode: TM3 & 2437 MHz



Test Mode: TM3 & 2462 MHz



9. LIST OF TEST EQUIPMENT

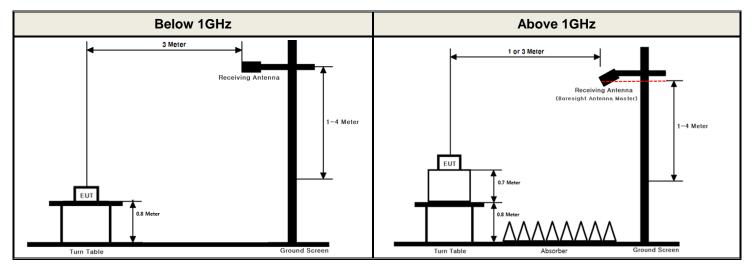
Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	17/07/17	18/07/17	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	18/01/03	19/01/03	MY48011700
DC Power Supply	Agilent Technologies	66332A	17/09/05	18/09/05	MY43000211
DC Power Supply	SM techno	SDP30-5D	17/12/26	18/12/26	305DKA013
Multimeter	FLUKE	17B	17/12/26	18/12/26	26030065WS
Signal Generator	Rohde Schwarz	SMBV100A	17/12/27	18/12/27	255571
Signal Generator	Rohde Schwarz	SMF100A	17/12/27	18/12/27	102341
Thermohygrometer	BODYCOM	BJ5478	17/09/11	18/09/11	N/A
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	16/08/05	18/08/05	9160-3362
Horn Antenna	ETS-Lindgren	3115	17/01/13	19/01/13	9202-3820
Horn Antenna	Schwarzbeck	BBHA 9120C	17/12/04	19/12/04	9120C-561
HORN ANT	A.H.Systems	SAS-574	17/07/31	19/07/31	155
PreAmplifier	tsj	MLA-0118-J01-45	18/02/08	19/02/08	17138
PreAmplifier	TSJ	MLA-010K01-B01-27	18/03/05	19/03/05	1844539
EMI Test Receiver	Rohde Schwarz	ESR7	18/02/13	19/02/13	101061
Attenuator	SMAJK	SMAJK-2-3	17/09/06	18/09/06	3
Attenuator	Aeroflex/Weinschel	20515	17/12/27	18/12/27	Y2370
Attenuator	SRTechnology	F01-B0606-01	17/09/07	18/09/07	13092403
Attenuator	Hefei Shunze	SS5T2.92-10-40	17/12/27	18/12/27	16012202
Attenuator	SMAJK	SMAJK-50-10	17/09/06	18/09/06	3-50-10
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	17/12/26	18/12/26	3
High Pass Filter	Wainwright Instruments	WHKX12-935-1000- 15000-40SS	17/09/05	18/09/05	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300- 18000-60SS	17/09/06	08/09/06	1
Power Meter & Wide	Anritsu	ML2495A	17/12/27	18/12/27	1306007
Bandwidth Sensor		MA2490A	17/12/27	18/12/27	1249001
EMI TEST RECEIVER	Rohde Schwarz	ESCI7	18/02/12	19/02/12	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	17/09/29	18/09/29	101333
LISN	SCHWARZBECK	NNLK 8121	18/03/20	19/03/20	6183
Cable	DT&C	CABLE	N/A	N/A	RF-82
Cable	DT&C	CABLE	N/A	N/A	RF-68
Cable	DT&C	CABLE	N/A	N/A	P-IN
Cable	DT&C	CABLE	N/A	N/A	RF-71

Note: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

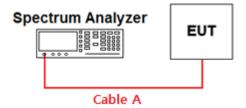
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.44	15	3.32
1	0.74	20	4.13
2.412 & 2.437 & 2.462	1.34	25	4.62
5	1.87	-	-
10	2.48	-	-

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

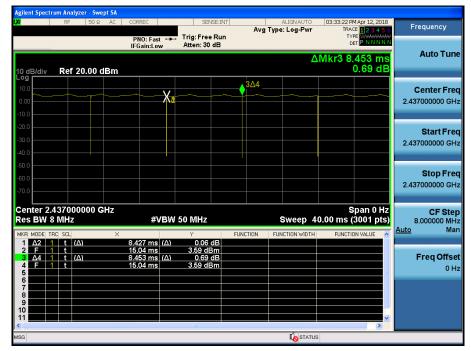
Duty Cycle was measured using section 6.0 b) of KDB558074 D01V04 :

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

TM 1 & Middle

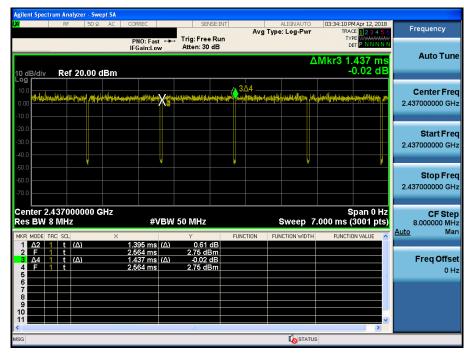


TDt&C

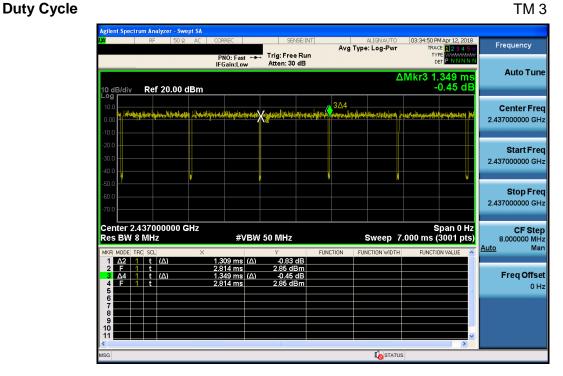
TM 2 & M

Middle

Duty Cycle

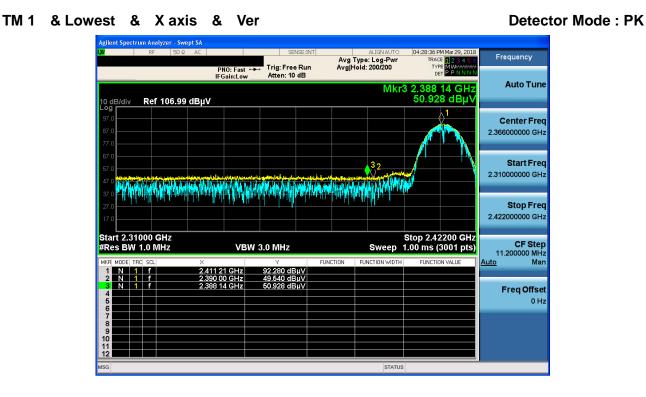


& Middle



APPENDIX III

Unwanted Emissions (Radiated) Test Plot



TM 1 & Lowest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB TYPE DE1 PNO: Fast IFGain:Low Auto Tune Mkr3 2.388 06 GHz 42.072 dBµ∖ Ref 106.99 dBµV 0 dB/div **Center Freq** 2.366000000 GHz Start Freq 2.310000000 GHz 32 Stop Freq 2.422000000 GHz Stop 2.42200 GHz Sweep 1.00 ms (3001 pts) Start 2.31000 GHz #Res BW 1.0 MHz **CF Step** 11.200000 MHz <u>o</u> Man VBW 3.0 MHz* Auto <u>41.681 dBμ\</u> 42.072 dBμ\ Freq Offset 0 Hz STATUS



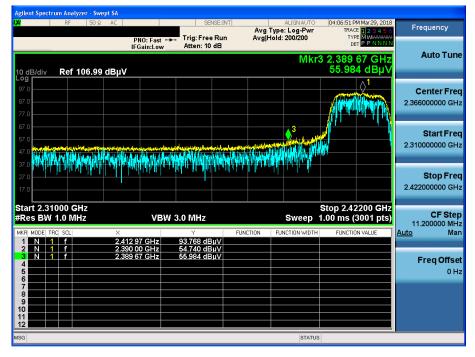
TM 1 & Highest & X axis & Ver



TM 1 & Highest & X axis & Ver

Avg Type: RMS Avg|Hold: 200/200 Frequency Trig: Free Run Atten: 10 dB TYPE DE1 PNO: Fast IFGain:Low A UNANA A P N N Auto Tune Mkr3 2.483 856 GH 41.057 dBµ Ref 106.99 dBµV **Center Freq** 2.476000000 GHz Start Freq 2.452000000 GHz ()3 Stop Freq 2.500000000 GHz Start 2.45200 GHz #Res BW 1.0 MHz Stop 2.50000 GHz 1.00 ms (3001 pts) CF Step 4.800000 MHz Man #VBW 3.0 MHz* Sweep Auto FUNCTION 84.910 dBµV 40.826 dBµV 41.057 dBµV 2.483 500 GHz 2.483 856 GHz Freq Offset 0 Hz 11 12 STATUS

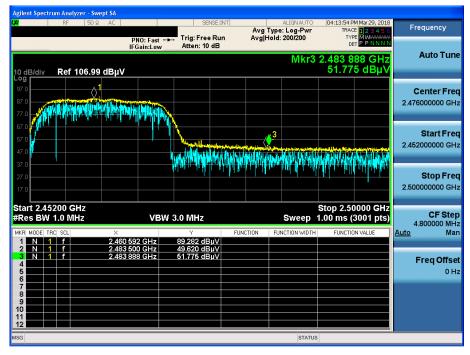
TM 2 & Lowest & Zaxis & Ver



TM 2 & Lowest & Zaxis & Ver

Avg Type: RMS Avg|Hold: 200/200 Frequency Trig: Free Run Atten: 10 dB TYPE DE1 PNO: Fast IFGain:Low A P N Auto Tune Mkr3 2.389 82 GH 45.207 dBµ Ref 106.99 dBµV Center Freq \Diamond 2.366000000 GHz Start Freq ▲3 2.31000000 GHz Stop Freq 2.422000000 GHz Start 2.31000 GHz #Res BW 1.0 MHz Stop 2.42200 GHz 1.00 ms (3001 pts) **CF Step** 11.200000 MHz <u>o</u> Man VBW 3.0 MHz* Sweep Auto FUNCTION 85.965 dBµV 45.409 dBµV 45.207 dBµV Freq Offset 0 Hz 11 12 STATUS

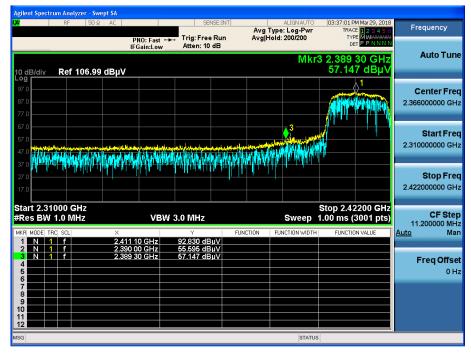
TM 2 & Highest & Zaxis & Ver



TM 2 & Highest & Zaxis & Ver

Avg Type: RMS Avg|Hold: 200/200 Frequency Trig: Free Run Atten: 10 dB PNO: Fast IFGain:Low A P N Auto Tune Mkr3 2.483 984 GH 41.896 dBµ Ref 106.99 dBµV **Center Freq** Δ 2.476000000 GHz Start Freq 2.452000000 GHz **()**3 Stop Freq 2.500000000 GHz Start 2.45200 GHz #Res BW 1.0 MHz Stop 2.50000 GHz 1.00 ms (3001 pts) CF Step 4.800000 MHz Man VBW 3.0 MHz* Sweep Auto 81.961 dBµ\ 41.652 dBµ\ 41.896 dBµ\ 2.483 500 GHz 2.483 984 GHz Freq Offset 0 Hz 11 12 STATUS

TM 3 & Lowest & Zaxis & Ver



TM 3 & Lowest & Zaxis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB TYPE DE1 PNO: Fast IFGain:Low A P N Auto Tune Mkr3 2.389 63 GH 46.289 dBµ Ref 106.99 dBµV **Center Freq** 2.366000000 GHz Start Freq <mark>~</mark>3 2.31000000 GHz Stop Freq 2.422000000 GHz Start 2.31000 GHz #Res BW 1.0 MHz Stop 2.42200 GHz 1.00 ms (3001 pts) **CF Step** 11.200000 MHz <u>o</u> Man VBW 3.0 MHz* Sweep Auto FUNCTION 86.962 dBµ\ 46.412 dBµ\ 46.289 dBµ\ Freq Offset 0 Hz 11 12 STATUS

TM 3 & Highest & Zaxis & Ver



TM 3 & Highest & Zaxis & Ver



Detector Mode : AV

TM 1 & Highest & Yaxis & Hor



TM 2 & Middle & Yaxis & Hor

er - Swept SA Frequency TYPE A UNATAL Avg Type: RMS Avg|Hold: 200/200 PNO: Fast +++ Trig: Free Run IFGain:High #Atten: 0 dB Mkr1 4.873 433 GHz 39.173 dBµV Auto Tune Ref 76.99 dBµV 5 dB/div Log **Center Freq** 4.874000000 GHz Start Freq 4.869000000 GHz Stop Freq 4.879000000 GHz **CF Step** 2.437000000 GHz Auto <u>Man</u> <mark>أ</mark> Freq Offset 0 Hz Center 4.874000 GHz #Res BW 1.0 MHz Span 10.00 MHz Sweep 1.00 ms (3001 pts) #VBW 3.0 MHz*

TM 3 & Middle & Yaxis & Hor



