# **TEST REPORT**

# **Dt&C**

### DT&C Co., Ltd.

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1.	Report No :	DRTFCC1804-0099(2)
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- 2. Customer
  - Name : LG Electronics MobileComm USA, Inc.
  - Address : 1000 Sylvan Ave., Englewood Cliffs, New Jersey, United States, 07632
- 3. Use of Report : FCC Original Grant
- Product Name / Model Name : Mobile Phone / LM-Q710EM
   FCC ID : ZNFQ710EM
- 5. Test Method Used : KDB558074 D01v04

Test Specification : FCC Part 15.247

- 6. Date of Test : 2018.03.20 ~ 2018.04.10, 2018.04.27 ~ 2018.04.28
- 7. Testing Environment : See appended test report.
- 8. Test Result : Refer to the attached test result.



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.

2018.05.04.

### DT&C Co., Ltd.

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

## **Test Report Version**

Test Report No.	Date	Description
DRTFCC1804-0099	Apr. 25, 2018	Initial issue
DRTFCC1804-0099(1)	Apr. 30, 2018	Updated the Section 8.5 and APPENDIX II
DRTFCC1804-0099(2)	May. 04, 2018	Removed Channel 12,13



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### **1. EUT DESCRIPTION**

FCC Equipment Class	Digital Transmission System(DTS)
Product	Mobile Phone
Model Name	LM-Q710EM
Add Model Name	LMQ710EM, Q710EM
Power Supply	DC 3.85 V
Frequency Range	• 802.11b/g/n(20 MHz) : 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band • 802.11b : 20.88 dBm • 802.11g : 24.06 dBm • 802.11n (HT20) : 22.88 dBm
Modulation Type	• 802.11b: CCK, DSSS • 802.11g/n: OFDM
Antenna Specification	Antenna type: LMA Antenna Antenna gain: -4.17 dBi

### 2. INFORMATION ABOUT TESTING

#### 2.1 Test mode

Test mode	Worst case data rate	Tested Frequency(MHz)				
		Lowest	Middle	Highest		
TM 1	802.11b 1 Mbps	2412	2437	2462		
TM 2	802.11g 12 Mbps	2412	2437	2462		
ТМ 3	802.11n(HT20) MCS 7	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	Equipment Model No.		Manufacturer	Note	
-	-	-	-	-	
-	-	-	-	-	

#### 2.3 Tested environment

Temperature	: 21 ~ 25 °C
Relative humidity content	: 40 ~ 45 %
Details of power supply	: DC 3.85 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 Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.247(a)	6 dB Bandwidth	> 500 kHz		С
15.247(b)	Transmitter Output Power	< 1 Watt		С
15.247(d)	Out of Band Emissions / Band Edge	20 dBc in any 100 kHz BW	Conducted	с
15.247(e)	Transmitter Power Spectral Density	< 8 dBm/3 kHz		С
-	RSS-Gen [6.6]	Occupied Bandwidth (99 %)		NA
15.247(d) 15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	FCC 15.209 limits	Radiated	<b>C</b> Note 2, 3
15.207	AC Line Conducted Emissions	FCC 15.207 limits	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: 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.

Note 4: This test report includes the test data for FCC ID: ZNFQ710FA.

The spot-check measurement was performed for FCC ID: ZNFQ710EM and the RF characteristics of the two products was similar.

(FCC ID: ZNFQ710EM is same the printed circuit board and SW with FCC ID: ZNFQ710FA.)



### 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

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 attached on the device by means of unique coupling method (Spring Tension). 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]		
	2412	9.553		
TM 1	2437	10.024		
	2462	10.042		
	2412	16.340		
TM 2	2437	16.015		
	2462	15.962		
	2412	17.753		
TM 3	2437	17.646		
	2462	17.751		



#### RESULT PLOTS







#### 6 dB Bandwidth



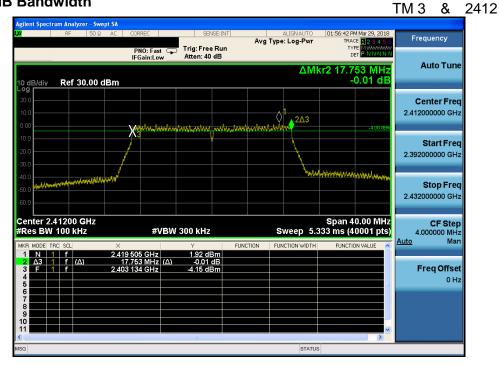
#### 6 dB Bandwidth

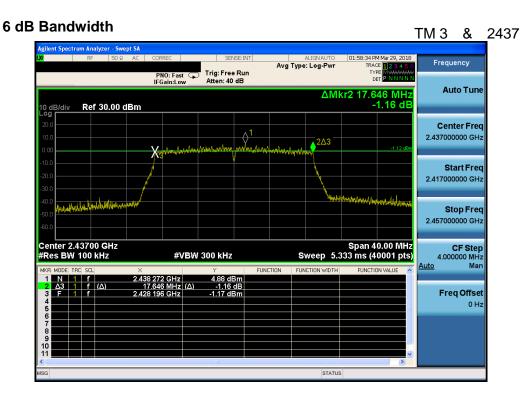
TM 2 & 2437

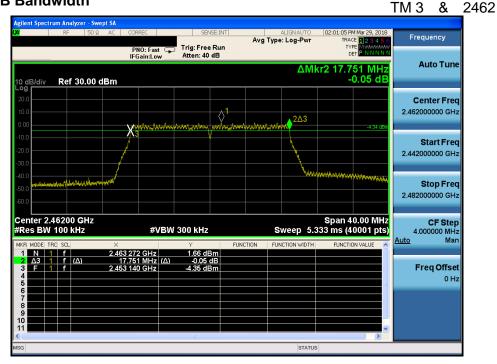










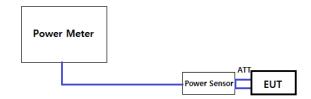


#### 8.2 Maximum peak conducted output power

#### 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.

Note: The measure-and-sum technique is used for test mode with multiple transmitting.



#### Test Results: Comply

Free		Maximum Peak Conducted Output Power (dBm) for <u>802.11b</u>							
Freq. (MHz)	Det.	Data Rate [Mbps]							
		1	2	5.5	11	-	-	-	-
2412	PK	20.70	20.53	20.54	20.33	-	-	-	-
2412	AV	18.35	18.42	18.40	18.10	-	-	-	-
2437	PK	20.88	20.77	20.65	20.70	-	-	-	-
2437	AV	18.63	18.49	18.51	18.46	-	-	-	-
2462	PK	20.39	20.17	20.26	20.32	-	-	-	-
2402	AV	18.14	18.22	18.24	18.13	-	-	-	-

<b>F</b>			Maxim	um Peak Co	onducted Ou	tput Power	(dBm) for <u>80</u>	02.11g					
Freq. (MHz)	Det.	Data Rate [Mbps]											
		6	9	12	18	24	36	48	54				
0440	PK	21.48	21.87	22.85	22.46	21.54	22.03	21.70	22.18				
2412	AV	14.10	14.02	14.04	13.92	13.94	13.97	13.33	13.41				
2437	PK	22.81	22.96	24.06	23.89	22.92	22.91	23.68	23.42				
2437	AV	16.80	16.66	16.95	16.65	16.58	16.86	16.77	16.37				
2462	PK	20.59	20.23	21.82	21.79	20.23	20.26	21.48	21.21				
2462	AV	13.61	13.64	13.93	13.67	13.43	13.48	13.34	13.56				

<b>F</b> ree at		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	20.45	20.28	20.62	20.54	20.46	20.74	20.79	20.79				
2412	AV	13.38	13.44	13.45	13.36	13.37	12.34	12.43	12.50				
2437	PK	22.54	22.39	22.35	22.22	22.15	22.74	22.49	22.88				
2437	AV	15.43	15.32	15.41	15.31	15.34	14.81	14.61	14.88				
2462	PK	20.07	19.71	19.70	20.05	19.98	20.48	20.38	20.64				
2462	AV	13.25	13.23	13.11	13.34	13.35	12.68	12.77	12.74				



#### 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 :  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- 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.

#### Test Results: Comply

Test Mode	Frequency	RBW	PKPSD [dBm]		
	2412	3 kHz	-3.08		
TM 1	2437	3 kHz	-4.14		
	2462	3 kHz	-4.04		
	2412	3 kHz	-9.99		
TM 2	2437	3 kHz	-6.11		
	2462	3 kHz	-9.97		
	2412	3 kHz	-10.85		
ТМ 3	2437	3 kHz	-9.71		
	2462	3 kHz	-11.87		

#### RESULT PLOTS





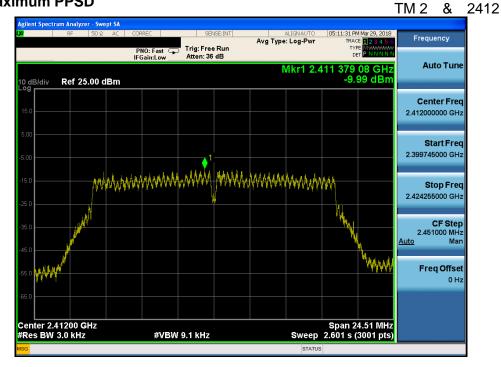
TRF-RF-236(04)170516

## **T**Dt&C





#### **Maximum PPSD**

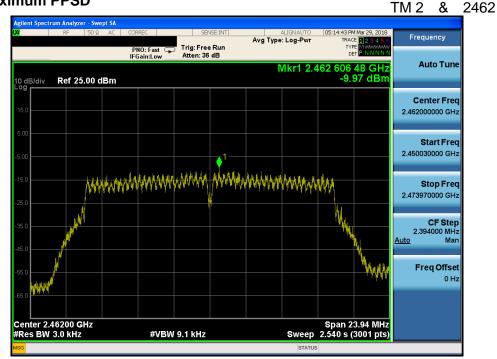




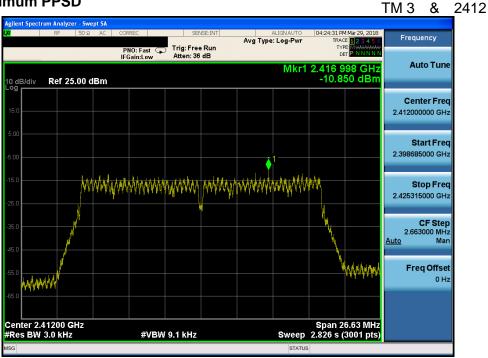
TM 2 & 2437



## **T**Dt&C



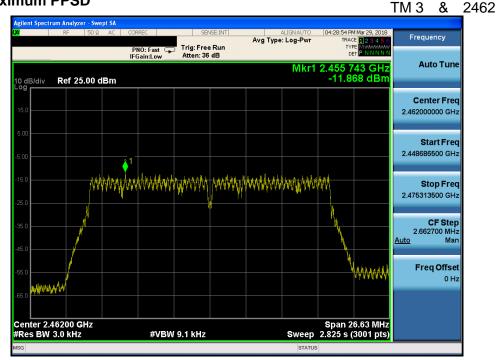
#### **Maximum PPSD**







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#### 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

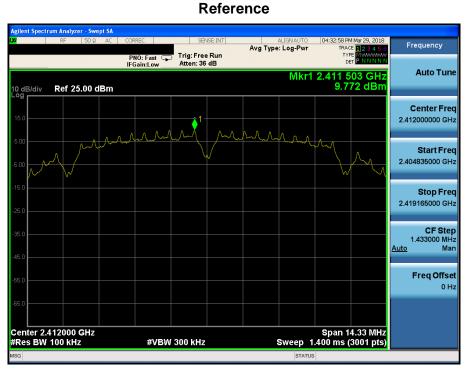
Frequency range: 30 MHz ~ 10 GHz, 10 GHz ~25 GHz RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

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.

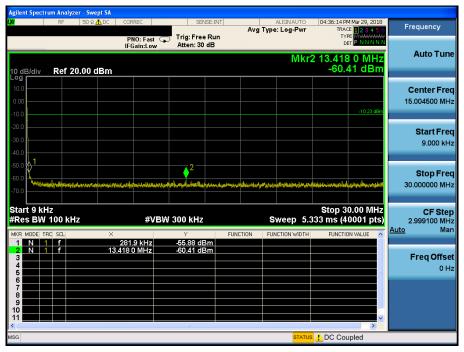
#### RESULT PLOTS

TM 1 & 2412



Low Band-edge





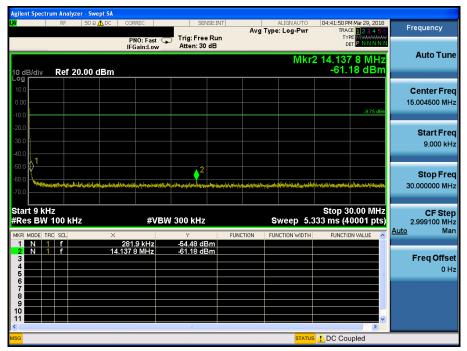
Agilent Spectrum Analyzer - Swe					
<b>χμ</b> RF 50 Ω	AC CORREC	Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	04:37:34 PM Mar 29, 2018 TRACE 1 2 3 4 5 6 TYPE MMMMMM DET P N N N N N	Frequency
10 dB/div Ref 20.00 c	IFGain:Low	Atten: 30 dB	Mkr	4 9.693 17 GHz -45.07 dBm	Auto Tune
10.0 0.00 -10.0				-10.23 dBm	Center Freq 5.015000000 GHz
-20.0				4	Start Free 30.000000 MH;
-50.0 -70.0					Stop Fred 10.000000000 GH:
Start 30 MHz #Res BW 1.0 MHz	#VBV	/ 3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MH Auto Mar
MKR         MODE         TRC         SCL           1         N         1         f           2         N         1         f           3         N         1         f           4         N         1         f           5         -         -         -	× 2.413 58 GHz 4.824 57 GHz 5.545 15 GHz 9.693 17 GHz	Y FUN 13.22 dBm -42.37 dBm -44.18 dBm -45.07 dBm -45.07 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse 0 H:
6 7 8 9 9 9 10 11 11 11 11 11 11 11 11 11 11 11 11				~	
ISG			STATUS		

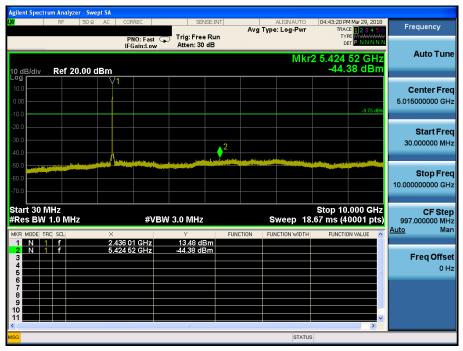


#### TM 1 & 2437

#### Reference







Agilent Spectrum Analyzer - Swe					
<b>LXI</b> RF 50 Ω	AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:44:54 PM Mar 29, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast G IFGain:Low	Trig: Free Run Atten: 30 dB		DET P N N N N N	
	II Galil.Edw		Mkr	4 17.005 5 GHz	Auto Tune
10 dB/div Ref 20.00 d	Bm		IVI KI-	-38.29 dBm	
Log					Center Freq
0.00					18.25000000 GHz
-10.0				-9.75 dBm	
-20.0				.1.2	Start Freq
-30.0		4			5tart Freq 10.000000000 GHz
-40.0					
-50.0					Oton Eron
-60.0					Stop Freq 26.50000000 GHz
-70.0					
Start 10.000 GHz				Stop 26.500 GHz	CF Step
#Res BW 1.0 MHz	#VBV	V 3.0 MHz	Sweep 42	.67 ms (40001 pts)	1.650000000 GHz
MKR MODE TRC SCL	× 24.187 5 GHz	∨ -31.79 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f	24.795 1 GHz	-31.97 dBm			<b>F</b> === 0 <b>(f</b> == 1)
3 N 1 f 4 N 1 f	21.447 7 GHz 17.005 5 GHz	-35.33 dBm -38.29 dBm			Freq Offset 0 Hz
5 6					0112
7 8					
9					
11				×	
MSG			STATUS		

## TDt&C

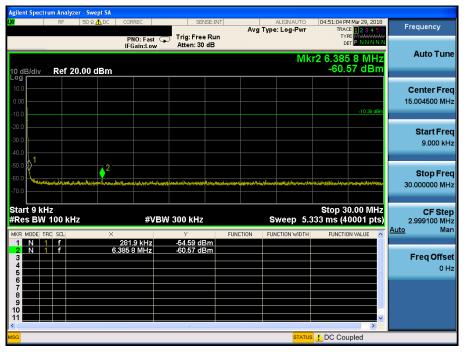
#### TM 1 & 2462

#### Reference



#### **High Band-edge**



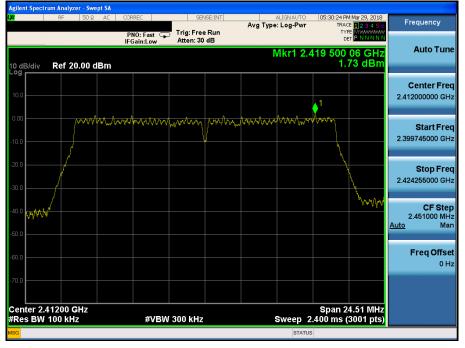


Agilent Spectrum Ana								
<b>LXI</b> RF	50 Ω AI	C CORREC	SEN	SE:INT AV	ALIGNAUTO	04:52:18 PM I TRACE	123456	Frequency
		PNO: Fas IFGain:Lo	t 🖵 Trig:Free w Atten:30			TYPE DET	M WWWWW P N N N N N	
		IF Galil.LU		40	Mkr	5 5.864 9	4 GHZ	Auto Tune
10 dB/div Ref	f 20.00 dBr	n			IVIKI	-44.5	8 dBm	
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-10.0							-10.36 dBm	
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-60.0								Stop Freq 10.00000000 GHz
-70.0								10.00000000000000
Start 30 MHz						Stop 10.0	000 GHz	CF Step
#Res BW 1.0 M	٧Hz	#\	/BW 3.0 MHz		Sweep 18	.67 ms (40	001 pts)	997.000000 MHz
MKR MODE TRC SCL		×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION	VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f		2.460 94 GHz 4.924 27 GHz	-43.07 dB	m				
3 N 1 f 4 N 1 f		6.505 27 GHz 6.912 29 GHz	-44.44 dB	m				Freq Offset 0 Hz
5 N 1 f		5.864 94 GHz	-44.58 dB	m			=	0 112
7								
9								
11							~	
K MSG					STATU	2		
mod					STATU	,		



#### TM 2 & 2412

#### Reference

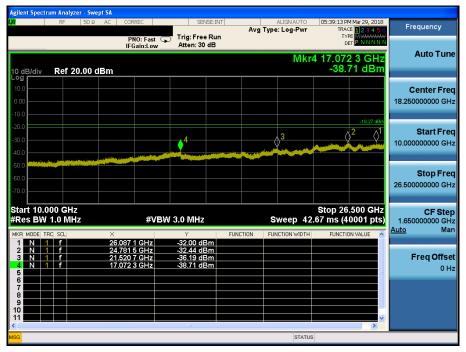


#### Low Band-edge



	Spec			yzer - Sw													
LXI			RF	50 Ω	🛕 DC	COP	REC		SEN	ISE:INT	Ave		ALIGNAUTO		M Mar 29, 2018 CE <mark>1 2 3 4 5</mark> (		Frequency
							NO: Fast Gain:Lov		Trig: Free Atten: 30		,	, , , , , , , , ,		TY			
10 dE Log	3/div	F	Ref	20.00	dBm								Mkr	2 29.13 -60.3	18 MHz 84 dBm		Auto Tune
10.0 0.00 -10.0																	Center Freq 15.004500 MHz
-20.0 -30.0 -40.0	x 1														-18.27 dBm		Start Freq 9.000 kHz
-50.0 -60.0 -70.0	() (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	let, rej		a.M.	era tipika	idens à Mirro	a of the party of	liquoted	heta an the splay to	naturiational	دىلىد <del>ا</del> يرلىستايدۇستار	ik Norma	امانېريولو،ار دومې	ytotolennistlerint	2 6/1/1/2010/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/		Stop Freq 30.000000 MHz
Stari #Res	s BW	V 10		Hz			#V	/BW	300 kHz			S	weep 5.:	333 ms (4	0.00 MHz 0001 pts;	Au	CF Step 2.999100 MHz to Man
MKR N 1 2	N	1	SCL f		¢		.4 kHz		-53.57 dE -60.84 dE	3m	UNCTION	FUN	ICTION WIDTH	FUNCTIO	DN VALUE		
3 4 5 6						.9.101	5 14112		-00.04 00								<b>Freq Offset</b> 0 Hz
7 8 9 10																	
11															>		
MSG													STATUS	L DC Cou	upled		

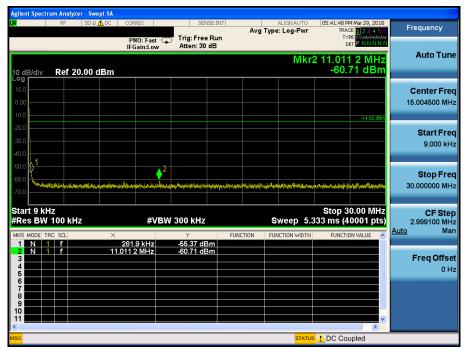
Agilent Spectrum Analyz						
LXI RF	50Ω AC COP	RREC S	ENSE:INT	ALIGNAUTO	05:38:02 PM Mar 29, 2018 TRACE 1 2 3 4 5 6	Frequency
	P	NO: Fast 😱 Trig: Fro Gain:Low Atten: 3		0 // 0	TYPE MWAAAAAAAAA DET P N N N N N	
	IF	Gain:Low Atten: C		Biller		Auto Tune
10 dB/div Ref 2	0.00 dBm			IVIKE	3 9.708 63 GHz -44.55 dBm	
Log 10.0						Contor From
0.00						Center Freq 5.015000000 GHz
-10.0						5.01500000 GH2
-10.0					-18.27 dBm	
						Start Freq
-30.0			2		_3	30.000000 MHz
-40.0		فسير والمراجع والملاقع	hand the state of	and the second se		
-50.0				and the set of the set		Stop Freq
-60.0						10.00000000 GHz
-70.0						
Start 30 MHz					Stop 10.000 GHz	CF Step
#Res BW 1.0 MH	IZ	#VBW 3.0 MH	z	Sweep 18.	.67 ms (40001 pts)	997.000000 MHz
MKR MODE TRC SCL	×	Y	FUNCTIO	N FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f	2.415 5 5.624 6		lBm IBm			
3 N 1 f	9.708 6					Freq Offset
4 5					=	0 Hz
6						
8						
9						
11					~	
MSG				STATUS		
				514105		

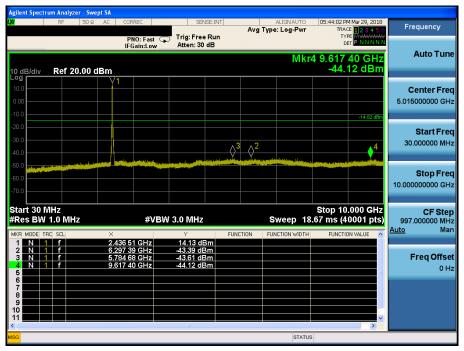


#### TM 2 & 2437

#### Reference







Agilent Spectrum Analyzer - Swept SA					
<b>LX</b> RF 50 Ω AC	CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	05:45:33 PM Mar 29, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB		DET P N N N N	
			Mkr	3 16.942 4 GHz	Auto Tune
10 dB/div Ref 20.00 dBm				-39.23 dBm	
10.0					Center Freq
0.00					18.250000000 GHz
-10.0				-14.82 dBm	
-20.0			A 2	(1	Start Freq
-30.0		¢ <sup>3</sup>			10.00000000 GHz
-40.0					
-60.0					Stop Freq
-70.0					26.50000000 GHz
Start 10.000 GHz				Stop 26.500 GHz	CF Step
#Res BW 1.0 MHz	#VBW 3	3.0 MHz	Sweep 42	.67 ms (40001 pts)	1.65000000 GHz
MKR MODE TRC SCL X			NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f 2'	.810 8 GHz .451 4 GHz	-31.96 dBm -35.80 dBm			En a Offerst
4	5.942 4 GHz	-39.23 dBm			Freq Offset 0 Hz
5 6					
8					
9					
11 <				×	
MSG			STATUS		

# **Dt&C**

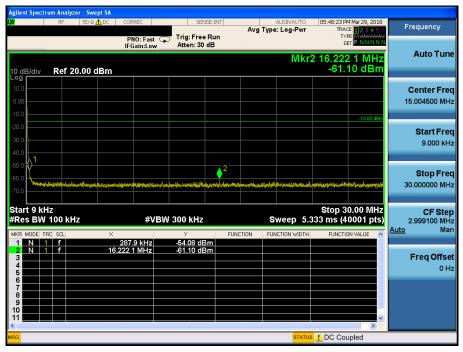
#### TM 2 & 2462

#### Reference



#### **High Band-edge**





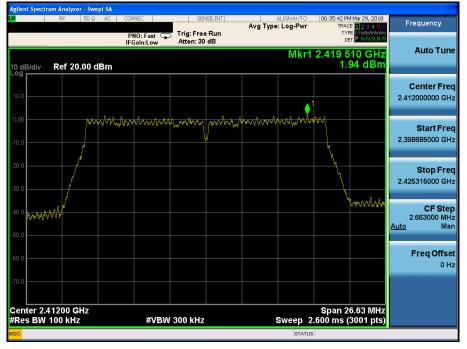
Agilent Spectrum Analyzer - Swe					
<b>LXI</b> RF 50 Ω	AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	05:49:45 PM Mar 29, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast ( IFGain:Low	Trig: Free Run Atten: 30 dB		TYPE M WAAMAAAAA DET P N N N N N	
	IFGain:Low	Atten: 30 dB	Mkr	4 9.734 05 GHz	Auto Tune
10 dB/div Ref 20.00 d	dBm		IVIKI	-44.58 dBm	
Log					
0.00					Center Freq 5.015000000 GHz
-10.0					5.015000000 GHz
-20.0				-15.82 dBm	
-30.0					Start Freq
-40.0			2 3	4	30.000000 MHz
	and the second second		A CONTRACT OF A		
-60.0					Stop Freq
-70.0					10.00000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#\ <b>/</b> D	W 3.0 MHz	0	Stop 10.000 GHz .67 ms (40001 pts)	CF Step
			· · · · ·		997.000000 MHz Auto Man
MKR MODE TRC SCL	× 2.463 43 GHz	Y FUN 11.40 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	
2 N 1 f 3 N 1 f	5.774 71 GHz 6.985 82 GHz	-43.96 dBm -44.13 dBm			Freq Offset
4 N 1 f	9.734 05 GHz	-44.58 dBm			0 Hz
5 6					
7 8					
9					
11				~	
		110		<b>)</b>	
MSG			STATUS		



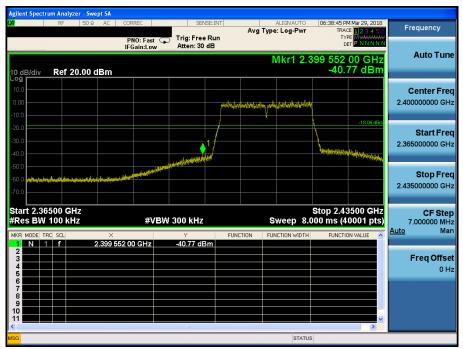
## **Dt&C**

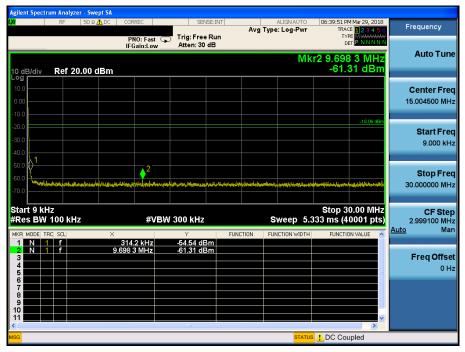
#### TM 3 & 2412

#### Reference

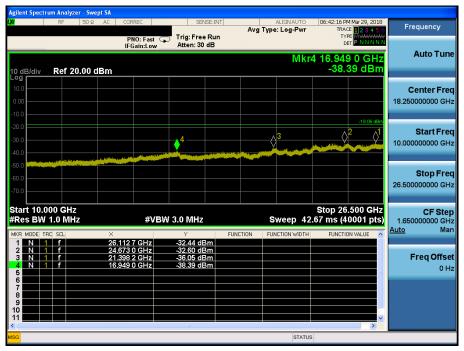


#### Low Band-edge





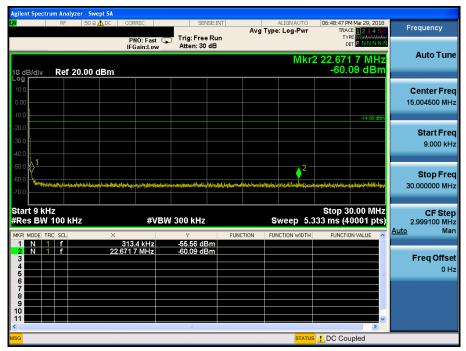
Agilent Spectrum Analyzer - Swept					
<b>ιχύ</b> RF 50.Ω A	AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	06:41:10 PM Mar 29, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB		TYPE MWWWWWW DET P NNNNN	
			Mkr	5 3.056 39 GHz	Auto Tune
10 dB/div Ref 20.00 dB				-45.25 dBm	
10.0	<u> </u>				Center Freq
0.00					5.015000000 GHz
-10.0				-18.06 dBm	
-20.0	<b>↓</b> <sup>2</sup>			-10.06 0811	Start Freq
-30.0	1 15		3		30.000000 MHz
-40.0				and the second state of th	
-50.0					Stop Freq
-70.0					10.00000000 GHz
				04	
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	X		TION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f	2.418 06 GHz 2.399 12 GHz	9.83 dBm -27.25 dBm			
3 N 1 f 4 N 1 f	6.412 79 GHz 5.755 77 GHz	-44.01 dBm -44.26 dBm			Freq Offset 0 Hz
5 N 1 f	3.056 39 GHz	-45.25 dBm			0 Hz
7					
9					
11				×	
MSG			STATUS		



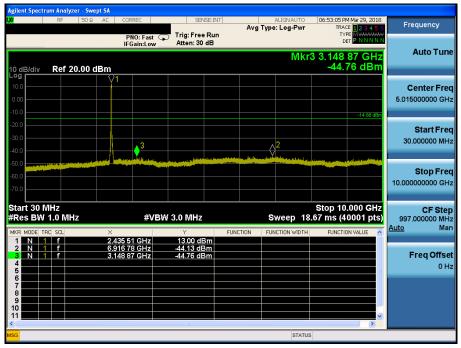
#### TM 3 & 2437

#### Reference







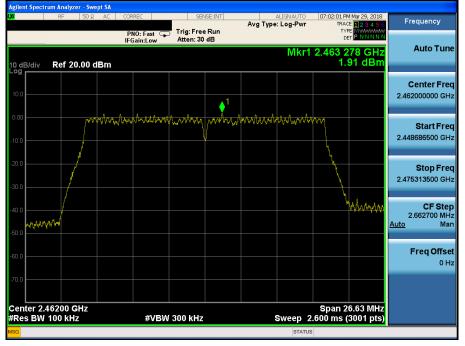


су
Tune
r Frea
0 GHz
t Freq
0 GHz
Freq
0 GHz
Step
0 GHz Man
wan
Offset
0 Hz

# **Dt&C**

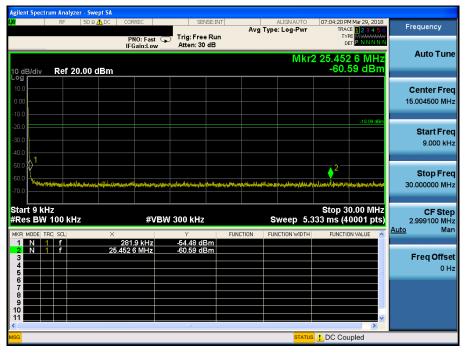
#### TM 3 & 2462

#### Reference

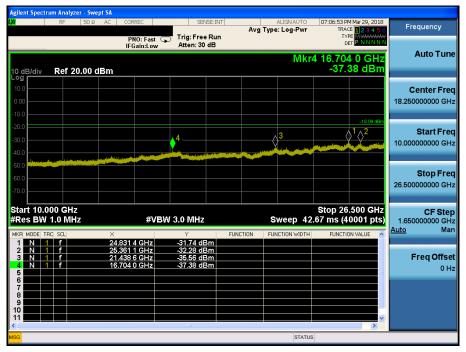


#### High Band-edge





Agilent Spectrum Analy									
L <mark>XI</mark> RF	50 Ω AC	CORREC	SENSE	EINT		ALIGNAUTO : Log-Pwr		4 Mar 29, 2018 E <mark>1 2 3 4 5 6</mark>	Frequency
		PNO: Fast 🔾	Trig: Free F Atten: 30 d				TYP		
		IFGain:Low	Atten: 30 d	B					Auto Tune
						IVIKI	4 7.536	16 GHZ 70 dBm	
10 dB/div Ref 2	20.00 dBm						-44.	TU UBIII	
10.0	<u>Y'</u>								Center Freq
0.00									5.015000000 GHz
-10.0									
-20.0								-18.09 dBm	
-30.0									Start Freq
-40.0				(3		∧ <sup>2</sup> ∧4			30.000000 MHz
F0.0	In the second second second	and a state of the	And the second	Y	the survey see the	Marthan Ballenson and	والمراجل والمراجع		
-60.0									Stop Freq
									10.00000000 GHz
-70.0									
Start 30 MHz		I					Stop 10	.000 GHz	CF Step
#Res BW 1.0 M	Hz	#VBV	V 3.0 MHz		s	weep 18	.67 ms (4	0001 pts)	997.000000 MHz
MKR MODE TRC SCL	×		Y	FUNC	TION FUN	ICTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u> Man
1 N 1 f 2 N 1 f		4 70 GHz 2 16 GHz	9.79 dBn -44.37 dBn						
3 N 1 f	5.63	0 90 GHz	-44.53 dBn	n					Freq Offset
4 N 1 f	7.53	6 16 GHz	-44.70 dBn	n					0 Hz
6									
8									
9									
11								~	
<									
MSG						STATUS			





#### 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

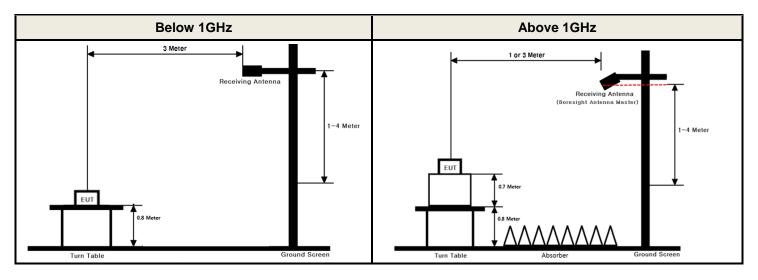
\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

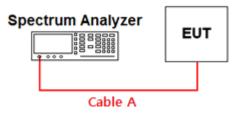
#### Test Configuration



#### 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.

#### Conducted Measurement



#### Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.28	15	3.05
1	1.01	20	3.25
2.412 & 2.437 & 2.462 & 2.472	1.71	25	3.47
5	2.34	-	-
10	2.73	-	-

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)



#### 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  $\geq$  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  $\geq$  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.

#### **Duty Cycle Correction factor**

Test Mode	Date rate	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
TM 1	1 Mbps	99.75	-
TM 2	12 Mbps	97.47	0.11
TM 3	MCS 7	88.61	0.53

#### Test Results: Comply

Please refer to next page for data table and the appendix I 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)
	2386.87	Н	Х	PK	53.70	2.68	N/A	N/A	56.38	74.00	17.62
0440	2387.25	Н	Х	AV	43.23	2.69	N/A	N/A	45.92	54.00	8.08
2412	4824.00	V	Х	PK	53.04	1.49	N/A	N/A	54.53	74.00	19.47
	4824.07	V	Х	AV	46.93	1.49	N/A	N/A	48.42	54.00	5.58
0407	4874.14	V	Х	PK	50.67	1.62	N/A	N/A	52.29	74.00	21.71
2437	4874.11	V	Х	AV	41.62	1.62	N/A	N/A	43.24	54.00	10.76
	2486.46	Н	Х	PK	53.77	3.10	N/A	N/A	56.87	74.00	17.13
0400	2489.73	Н	Х	AV	43.20	3.10	N/A	N/A	46.30	54.00	7.70
2462	4924.10	V	Х	PK	50.33	1.78	N/A	N/A	52.11	74.00	21.89
	4924.06	V	Х	AV	42.49	1.78	N/A	N/A	44.27	54.00	9.73

### Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : Test Mode 1(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

Margin

(dB)

17.50

6.88

22.17

12.84

22.65

12.85

9.33

3.58

22.60

13.06

Limit

(dBuV/m)

74.00

54.00

74.00

54.00

74.00

54.00

74.00

54.00

74.00

54.00

Result

(dBuV/m)

56.50 47.12

51.83

41.16

51.35

41.15

64.67

50.42

51.40

40.94

N/A

N/A

N/A

N/A

N/A

N/A

N/A

N/A



4822.00

4825.35

4876.55

4872.91

2485.32

2483.55

4926.60

4925.85

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : <u>Test Mode 2(TM 2)</u>								
Tested Frequency	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)
	2389.93	Н	Х	PK	53.80	2.70	N/A	N/A
	2389.93	Н	Х	AV	44.31	2.70	0.11	N/A

ΡK

AV

ΡK

AV

ΡK

AV

ΡK

AV

50.35

39.56

49.73

39.42

61.57

47.21

49.62

39.05

Х

Х

Х

Х

Х

Х

Х

Х

Н

Н

н

Н

Н

н

Н

Н

#### Note.

2412

2437

2462

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

1.48

1.49

1.62

1.62

3.10

3.10

1.78

1.78

N/A

0.11

N/A

0.11

N/A

0.11

N/A

0.11

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

41.38

54.00

Margin (dB)

15.35 6.65 22.49 12.90 22.35 12.54 8.48 4.93 23.15

12.62



Radiated	-													
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)				
	2389.35	Н	Х	PK	55.95	2.70	N/A	N/A	58.65	74.00	ſ			
2412	2389.35	Н	Х	AV	44.12	2.70	0.53	N/A	47.35	54.00	ſ			
	4824.31	Н	Х	PK	50.02	1.49	N/A	N/A	51.51	74.00	ſ			
	4822.28	Н	Х	AV	39.08	1.49	0.53	N/A	41.10	54.00	ſ			
2437	4876.99	Н	Х	PK	50.03	1.62	N/A	N/A	51.65	74.00				
2437	4874.85	Н	Х	AV	39.31	1.62	0.53	N/A	41.46	54.00	ſ			
	2484.43	Н	Х	PK	62.42	3.10	N/A	N/A	65.52	74.00	ſ			
2462	2483.80	Н	Х	AV	45.44	3.10	0.53	N/A	49.07	54.00				
2402	4922.99	Н	Х	PK	49.07	1.78	N/A	N/A	50.85	74.00	ſ			

#### diated Spurious Emissions date/0 LU-OF OULS . Teat Meda 2/TM 2)

#### Note.

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

1.78

0.53

N/A

2. Sample Calculation.

4923.25

Н

Х

AV

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

39.07

#### 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.)

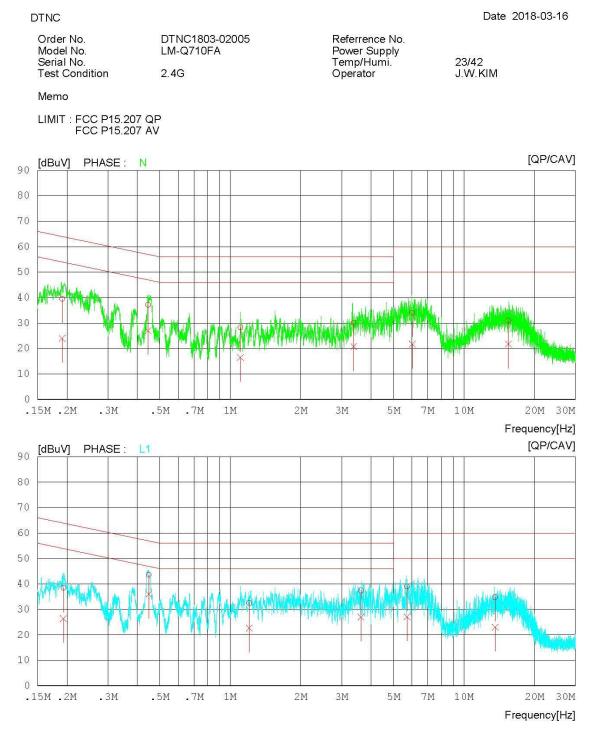
The worst data was reported.



## RESULT PLOTS TM1 & 2437MHz

#### AC Line Conducted Emissions (Graph)

## **Results of Conducted Emission**



#### AC Line Conducted Emissions (List)

## **Results of Conducted Emission**

Date 2018-03-16

Order No.	DTNC1803-02005	Referrence No.	
Model No.	LM-Q710FA	Power Supply	
Serial No.		Temp/Humi.	23/42
Test Condition	2.4G	Operator	J.W.KIM

#### Memo

DTNC

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

	NO	2000 AND	READING QP CAV	C.FACTOR	RESULT QP CAV	LIM] QP	CAV	MAR0 QP	CAV	PHASE
		[MHz]	[dBuV] [dBuV]	[dB]	[dBuV] [dBuV	] [dBuV]	[dBuV]	[dBuV]	[dBuV]	
	1	0.19109	29.5614.01	9.95	39.51 23.96	63.99 5	3.99	24.4830	0.03	N
	2	0.44536	27.1317.08	9.98	37.11 27.06	56.96 4	6.96	19.85 19	9.90	Ν
	3	1.10700	18.29 6.48	10.00	28.29 16.48	56.00 4	6.00	27.71 29	.52	Ν
	4	3.37440	20.0710.63	10.06	30.13 20.69	56.00 4	6.00	25.87 25	5.31	Ν
	5	6.01280	24.03 11.63	10.11	34.14 21.74	60.00 5	0.00	25.8628	3.26	Ν
	6	15.50500	20.7011.43	10.32	31.02 21.75	60.00 5	0.00	28.9828	3.25	N
	7	0.19317	28.50 16.45	9.95	38.45 26.40	63.90 5	3.90	25.45 27	7.50	L1
	8	0.44805	33.64 26.10	9.98	43.62 36.08	56.91 4	6.91	13.2910	).83	L1
	9	1.20680	22.4812.60	10.00	32.48 22.60	56.00 4	6.00	23.52.23	3.40	L1
ļ.	10	3.62360	27.2716.86	10.06	37.33 26.92	56.00 4	6.00	18.67 19	9.08	L1
1	11	5.70620	28.8217.03	10.10	38.92 27.13	60.00 5	0.00	21.08 22	2.87	L1
1	12	13.61320	24.4812.67	10.28	34.76 22.95	60.00 5	0.00	25.24 27	7.05	L1

## 9. LIST OF TEST EQUIPMENT

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9020A	17/07/12	18/07/12	US50410399
Spectrum Analyzer	Agilent	N9020A	18/01/03	19/01/03	MY48011700
Multimeter	FLUKE	17B	17/12/26	18/12/26	26030065WS
DC Power Supply	Agilent	66332A	17/09/05	18/09/05	MY43000394
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	18/01/13	19/01/13	120612-1
Thermohygrometer	BODYCOM	BJ5478	17/09/11	18/09/11	N/A
Attenuator	SMAJK	SMAJK-50-10	17/09/06	18/09/06	2-50-10
Loop Antenna	ETS	6502	17/03/24	19/03/24	3471
BILOG ANTENNA	Schwarzbeck	VULB 9160	17/04/14	19/04/14	9160-3339
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 Antenna	A.H.Systems Inc.	SAS-574	17/07/31	19/07/31	155
PreAmplifier	tsj	MLA-100K01-B01- 26	18/02/19	19/02/19	1252741
PreAmplifier	tsj	MLA-0118-J01-45	18/02/08	19/02/08	17138
PreAmplifier	tsj	MLA-1840-J02-45	17/10/26	18/10/26	16966-10728
EMI Test Receiver	Rohde Schwarz	ESR7	17/07/06	18/07/06	100469
Attenuator	SMAJK	SMAJK-2-3	17/09/06	18/09/06	3
Attenuator	Aeroflex/Weinschel	56-3	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
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	18/09/06	1
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A MA2411B	17/12/27	18/12/27	1338004 1306053
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	06183
Cable	DT&C	CABLE	N/A	N/A	RF-56
Cable	DT&C	CABLE	N/A	N/A	RF-68
Cable	DT&C	CABLE	N/A	N/A	RF-71
Cable	DT&C	CABLE	N/A	N/A	P-IN
Cable	DT&C	CABLE	N/A	N/A	RF-82
Cable	JUNFLON	MWX315	N/A	N/A	J12J101978-00
Cable	Fairview Microwave	FM-F141	N/A	N/A	17050010
Cable	Fairview Microwave	FM-F141	N/A	N/A	17050011
Cable	Fairview Microwave	FM-F141	N/A	N/A	17050012
Cable	Radiall	TESTPRO3	N/A	N/A	RF-74
Cable	Radiall	TESTPRO3	N/A	N/A	RF-66

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

### **APPENDIX I**

#### 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(1Mbps) & 2437

	RF	50 Ω AC	CORREC	SENS	E:INT	ALIGN AU*		M Mar 29, 2018	Frequency
			PNO: Fast IFGain:Low		Run	vg Type: Log-Pi	TY	CE 123456 PE WAAAAAAA ET P N N N N N	Frequency
0 dB/div	Dof 3	0.00 dBm					ΔMkr3 1	2.23 ms 0.42 dB	Auto Tur
		0.00 0011		V		•	3∆4		
20.0				<u>— Ха</u>					Center Fre
10.0									2.437000000 GI
0.00									
10.0									Start Fr
20.0									2.437000000 G
30.0									2.407000000 0
40.0									
50.0									Stop Fr
50.0									2.437000000 G
	437000	000 GHz				_	S	pan 0 Hz	CF Ste
			#V	BW 50 MHz		Sweep	40.00 ms (	3001 pts)	
KR MODE T	8 MHZ	×	(	Y	FUNCTION	FUNCTION WIL			
Res BW A			12.20 ms	Υ (Δ) 0.37 d	в				
KR MODE T 1 A2 2 F 3 A4	8 MHz 1 t (A) 1 t (A) 1 t (A)	)	12.20 ms 18.05 ms 12.23 ms	γ (Δ) 0.37 d 21.84 dBr (Δ) 0.42 d	B m B				Auto M Freq Offs
KR MODE T 1 A2 2 F 3 A4	8 MHz (RC SCL) 1 t (Δ) 1 t	)	12.20 ms 18.05 ms	∨ (∆) 0.37 d 21.84 dBr	B m B				Auto M Freq Offs
Kes         BW         B	8 MHz 1 t (A) 1 t (A) 1 t (A)	)	12.20 ms 18.05 ms 12.23 ms	γ (Δ) 0.37 d 21.84 dBr (Δ) 0.42 d	B m B				Auto M Freq Offs
KES         BW         K           1         A2         7           2         F         7           3         A4         7           4         F         7           5         6         6           7         8         8	8 MHz 1 t (A) 1 t (A) 1 t (A)	)	12.20 ms 18.05 ms 12.23 ms	γ (Δ) 0.37 d 21.84 dBr (Δ) 0.42 d	B m B				Auto M Freq Offs
KR         MODE         T           1         Δ2         2           2         F         2           3         Δ4         7           4         F         2           5         6         6           7         8         9	8 MHz 1 t (A) 1 t (A) 1 t (A)	)	12.20 ms 18.05 ms 12.23 ms	γ (Δ) 0.37 d 21.84 dBr (Δ) 0.42 d	B m B				Auto M Freq Offs
KES         BW         K           1         A2         7           2         F         7           3         A4         7           4         F         7           5         6         6           7         8         8	8 MHz 1 t (A) 1 t (A) 1 t (A)	)	12.20 ms 18.05 ms 12.23 ms	γ (Δ) 0.37 d 21.84 dBr (Δ) 0.42 d	B m B				

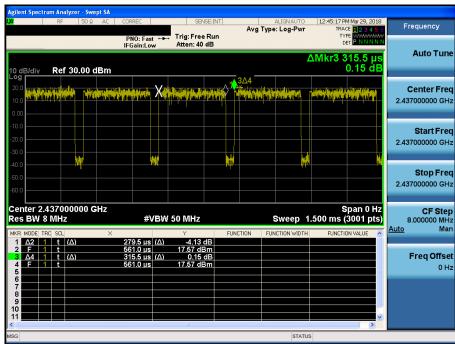
# **Dt&C**

#### TM 2(12Mbps) & 2437

#### **Duty Cycle**

jilent Spectrum Analyzer - Swej					
RF 50 Ω	AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	05:06:59 PM Mar 29, 2018 TRACE 2 3 4 5 6 TYPE WWWWWW DET P N N N N N	Frequency
0 dB/div Ref 30.00 d	IFGain:Low	Atten: 40 dB	Δ	Mkr3 1.424 ms 0.50 dB	Auto Tun
<b>90</b> 0.0 <del>4/466664/000000000000000000000000000000</del>	systy oferstors lighting from		14.19:19:304 14.19:19:30 14.19:19:19:19:19:19:19:19:19:19:19:19:19:1	islaad, sidtettipeteisegebeet, politeete	Center Fre 2.437000000 GH
0.0 0.0 0.0					Start Fre 2.437000000 G⊦
0.0		n 			Stop Fre 2.437000000 G⊦
enter 2.437000000 G es BW 8 MHz		50 MHz	Sweep 6	Span 0 Hz .000 ms (3001 pts)	CF Ste 8.000000 M⊢ <u>Auto</u> Ma
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.388 ms (Δ) 2.850 ms 1.424 ms (Δ) 2.850 ms	-0.74 dB 19.67 dBm 0.50 dB 19.67 dBm			Freq Offso 0 ⊦
6 7 8 9 10 11					
s <mark>g</mark>			STATUS	3	

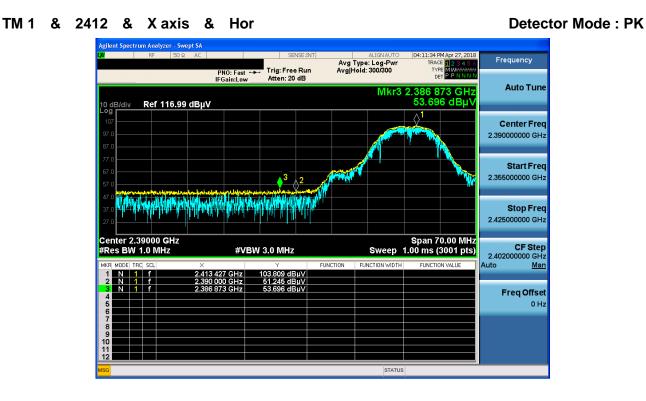
#### TM 3(MCS7) & 2437



#### **Duty Cycle**

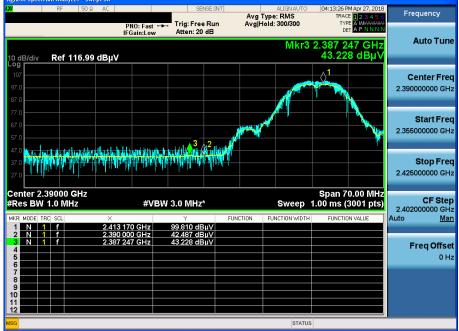
### APPENDIX II

## **Unwanted Emissions (Radiated) Test Plot**



#### TM 1 & 2412 & X axis & Hor

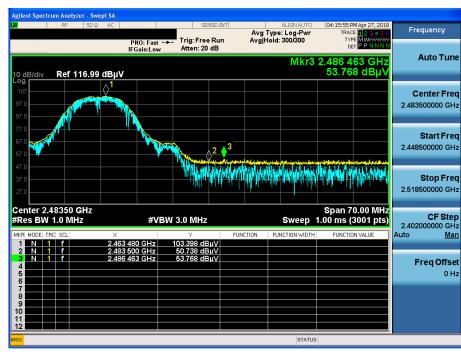
#### PMAyr 27, 2018 CE 11 2 3 4 5 5 FF A WMMW FF A P NNNN





#### TM 1 & 2462 & X axis & Hor



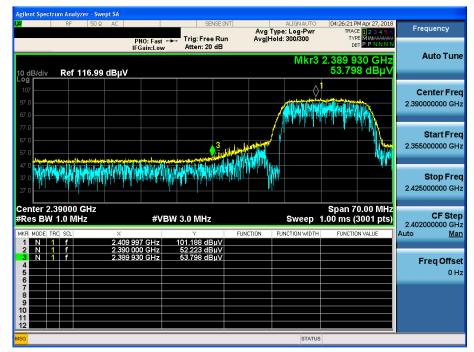


#### TM 1 & 2462 & X axis & Hor

Avg Type: RMS Avg|Hold: 300/300 Frequency Trig: Free Run Atten: 20 dB TYPE DE1 A WARA PNO: Fast IFGain:Low Auto Tune Mkr3 2.489 730 GH 43.198 dBµ Ref 116.99 dBµV **Center Freq** 2.483500000 GHz Start Freq 2.448500000 GHz Stop Freq 2.518500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 70.00 MHz 1.00 ms (3001 pts) CF Step 2.40200000 GHz #VBW 3.0 MHz\* Sweep Auto Man FUNCTION 00.060 dBµ\ 42.551 dBµ\ 43.198 dBµ\ 2.483 500 GHz 2.489 730 GHz Freq Offset 0 Hz STATUS



#### TM 2 & 2412 & X axis & Hor

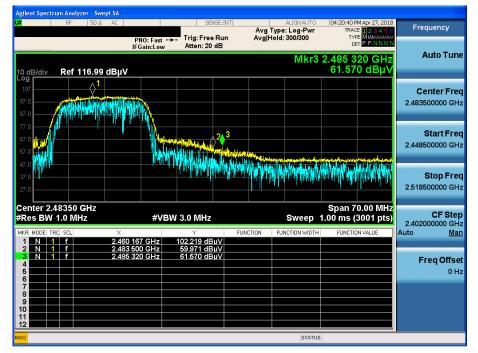


#### TM 2 & 2412 & X axis & Hor

#### er - Swept SA Frequency Avg Type: RMS Avg|Hold: 300/300 DET A P N N N Trig: Free Run Atten: 20 dB PNO: Fast IFGain:Low Mkr3 2.389 930 GHz 44.307 dBµ\ Auto Tune Ref 116.99 dBµV l0 dB/div .og **Center Freq** 2.390000000 GHz Start Freq 2.355000000 GHz Stop Freq 2.425000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 70.00 MHz 1.00 ms (3001 pts) **CF Step** 2.402000000 GHz uto <u>Man</u> #VBW 3.0 MHz\* Sweep **Auto** 92.760 dBµV 43.691 dBµV 44.307 dBµV Ň 2 389 930 GHz Freq Offset 0 Hz STATUS

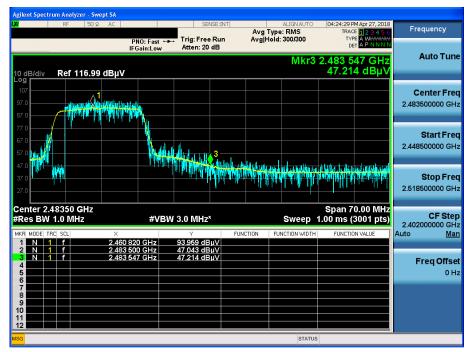


#### TM 2 & 2462 & X axis & Hor



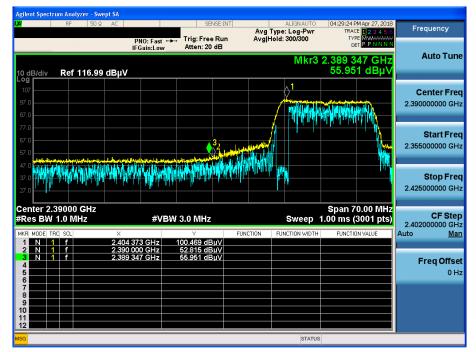
#### Detector Mode : AV

#### TM 2 & 2462 & X axis & Hor

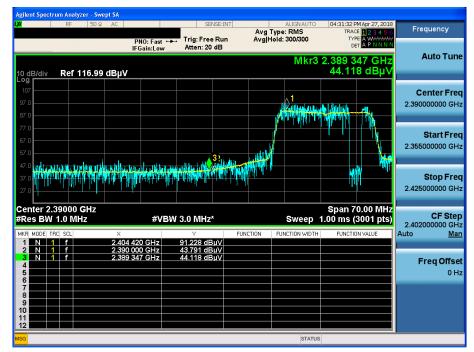




#### TM 3 & 2412 & X axis & Hor

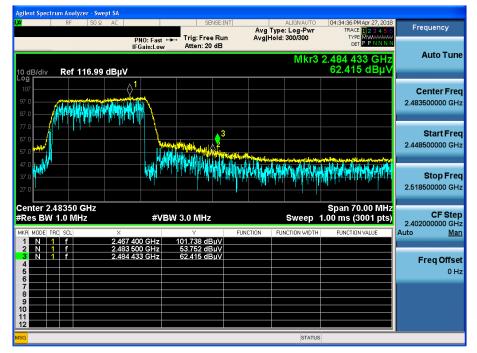


#### TM 3 & 2412 & X axis & Hor





#### TM 3 & 2462 & X axis & Hor



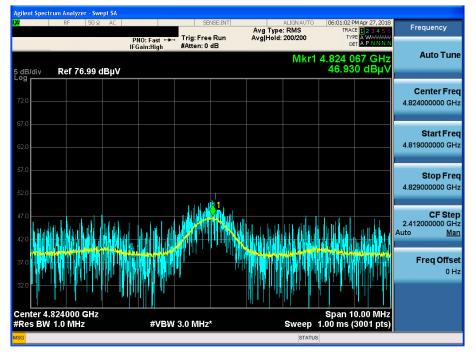
#### TM 3 & 2462 & X axis & Hor

#### zer - Swept SA Frequency Avg Type: RMS Avg|Hold: 300/300 DET A P N N Trig: Free Run Atten: 20 dB PNO: Fast +++ IFGain:Low Mkr3 2.483 803 GH: 45.436 dBµ Auto Tune Ref 116.99 dBµV 0 dB/div **Center Freq** 2.483500000 GHz . Nota di Alle Aller Start Freq 2.448500000 GHz Stop Freq 2.518500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 70.00 MHz 1.00 ms (3001 pts) **CF Step** 2.402000000 GHz uto <u>Man</u> #VBW 3.0 MHz\* Sweep Auto 91.826 dBµ 45.140 dBµ 45.436 dBµ 2.483 500 GHz 2.483 803 GHz Ň Freq Offset 0 Hz

**Detector Mode : AV** 



#### TM 1 & 2412 & X axis & Ver



#### TM 2 & 2412 & X axis & Hor

#### yzer - Swept SA Frequency Avg Type: RMS Avg|Hold: 200/200 PNO: Fast +++ Trig: Free Run IFGain:High #Atten: 0 dB TYP! DE A WHH Auto Tune Mkr1 .825 347 GHz 39.562 dBµ\ Ref 76.99 dBµV 5 dB/div Log **Center Freq** 4.824000000 GHz Start Freq 4.80400000 GHz Stop Freq 4.844000000 GHz **CF Step** 2.412000000 GHz Auto <u>Man</u> **Freq Offset** 0 Hz Center 4.82400 GHz #Res BW 1.0 MHz Span 40.00 MHz #VBW 3.0 MHz\* Sweep 1.00 ms (3001 pts)



#### TM 3 & 2437 & X axis & Hor



