

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

	OF			
Product Name:	Smart Phone			
Brand Name:	Nokia			
Model No.:	TA-1023			
Model Difference:	N/A			
FCC ID:	2AJOTTA-1023			
Report No.:	ER/2017/60091			
Issue Date:	Jul. 17, 2017			
FCC Rule Part:	§15.247, Cat: DSS			
Prepared for:	HMD Global Oy Karaportti 2, 02610 Espoo, Finland SGS Taiwan Ltd.			
Prepared by:	Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803			
TAF BC MRA Teting Laboratory 0513	<b>Note:</b> This report shall not be reproduced except in full, without the written approval of SGS Taiwan Ltd. This document may be altered or revised by SGS Taiwan Ltd. Personnel only, and shall be noted in the revision section of the document.			

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# VERIFICATION OF COMPLIANCE

Applicant:	HMD Global Oy Karaportti 2, 02610 Espoo, Finland
Product Name:	Smart Phone
Brand Name:	Nokia
Model No.:	TA-1023
Model Difference:	N/A
FCC ID:	2AJOTTA-1023
Report Number:	ER/2017/60091
Date of test:	Jun. 24, 2017 ~ Jul. 07, 2017
Date of EUT Received:	Jun. 24, 2017

### We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Test By:	Ton L.	Date:	Jul. 17, 2017	
Prepared By:	Tin Lin/Engineer Karen Huang	Date:	Jul. 17, 2017	
Approved By:	0.00	ng Date:	Jul. 17, 2017	
	Jim Chang / Asst. Manag	<i>jer</i>		

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# **Revision History**

Report Number	Revision	Description	Issue Date
ER/2017/60091	Rev.00	Initial creation of document	Jul. 17, 2017

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No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134 號 SGS Taiwan Ltd.



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#### **GENERAL INFORMATION** 1

### **1.1 Product Description**

#### General:

Product Name:	Smart Pho	Smart Phone			
Brand Name:	Nokia				
Model No.:	TA-1023				
Model Difference:	N/A				
Hardware Version:	890				
Software Version:	V0.140				
USB Cable:	Model No.: CUBB01M-FA010-DH, Supplier: Nokia				
Headset:	Model No.	Model No.: WH-108, Supplier: Nokia			
	3.85Vdc from Rechargeable Li-ion Polymer Battery or 5V from AC/DC Adapter				
Power Supply:	Battery:	Model No.: HE338, Supplier: Nokia			
	Adapter: Model No.: FC0102, Supplier: Nokia				

#### Bluetooth BR+EDR:

Frequency Range:	2.402GHz – 2.480GHz	
Bluetooth Version	BT V4.1 (dual mode)	
Channel number:	79 channels	
Modulation type:	GFSK + π/4DQPSK + 8DPSK	
Transmit Power:	12.46dBm (Peak)	
Antenna Designation:	PIFA Antenna, Gain: -1.84dBi	

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#### **1.2 Test Methodology of Applied Standards**

FCC Part 15, Subpart C §15.247

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

#### **1.3 Test Facility**

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Numbers are: 509634

#### **1.4 Special Accessories**

There is no special accessory used while test was conducted.

#### **1.5 Equipment Modifications**

There was no modification incorporated into the EUT.

#### 1.6 Referencing test data across separate equipment authorization

The test data in DSS test report (ER/2017/ 60079) under original FCC ID: 2AJOTTA-1035 are fully referred for the FCC ID: 2AJOTTA-1023 in this test report.

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### 2 SYSTEM TEST CONFIGURATION

#### 2.1 EUT Configuration

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

#### 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

#### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plan. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m 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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through one orthogonal axe and measurement procedures for electric field radiated

emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

#### 2.4 Measurement Results Explanation Example

#### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

#### Note:

The spectrum analyzer offset is derived from RF cable loss 4.2dB.

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#### 2.5 Configuration of Tested System

#### Fig. 2-1 Radiated Emission

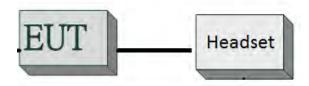
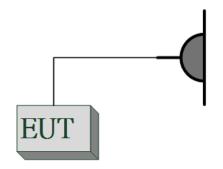


Fig. 2-2 AC Power Line Conducted Emission Configuration



#### Fig. 2-3 Conducted (Antenna Port) Configuration

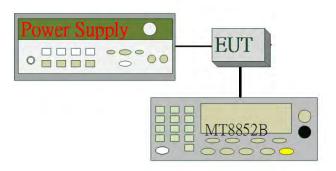


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Bluetooth Tester	Anritsu	MT8852B	6k00006107	N/A	N/A
3.	DC Power Supply	Agilent	E3640A	KR93300208	N/A	Un-shield
4.	Headset	Nokia	WH-108	N/A	N/A	N/A

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#### SUMMARY OF TEST RESULTS 3

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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#### **DESCRIPTION OF TEST MODES** 4

### 4.1 Operated in 2400 ~ 2483.5MHz Band

#### 79 channels are provided for Bluetooth

СН	FREQUENCY	СН	FREQUENCY	СН	FREQUENCY	СН	FREQUENCY
0	2402 MHz	20	2422 MHz	40	2442 MHz	70	2462 MHz
1	2403 MHz	21	2423 MHz	41	2443 MHz	71	2463 MHz
2	2404 MHz	22	2424 MHz	42	2444 MHz	72	2464 MHz
3	2405 MHz	23	2425 MHz	43	2445 MHz	73	2465 MHz
4	2406 MHz	24	2426 MHz	44	2446 MHz	74	2466 MHz
5	2407 MHz	25	2427 MHz	45	2447 MHz	75	2467 MHz
6	2408 MHz	26	2428 MHz	46	2448 MHz	76	2468 MHz
7	2409 MHz	27	2429 MHz	47	2449 MHz	77	2469 MHz
8	2410 MHz	28	2430 MHz	48	2450 MHz	78	2470 MHz
9	2411 MHz	29	2431 MHz	49	2451 MHz	79	2471 MHz
10	2412 MHz	30	2432 MHz	50	2452 MHz	70	2472 MHz
11	2413 MHz	31	2433 MHz	51	2453 MHz	71	2473 MHz
12	2414 MHz	32	2434 MHz	52	2454 MHz	72	2474 MHz
13	2415 MHz	33	2435 MHz	53	2455 MHz	73	2475 MHz
14	2416 MHz	34	2436 MHz	54	2456 MHz	74	2476 MHz
15	2417 MHz	35	2437 MHz	55	2457 MHz	75	2477 MHz
16	2418 MHz	36	2438 MHz	56	2458 MHz	76	2478 MHz
17	2419 MHz	37	2439 MHz	57	2459 MHz	77	2479 MHz
18	2420 MHz	38	2440 MHz	58	2460 MHz	78	2480 MHz
19	2421 MHz	39	2441 MHz	59	2461 MHz		

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#### 4.2 The Worst Test Modes and Channel Details

- 1 The EUT has been tested under operating condition.
- Test program used to control the EUT for staying in continuous transmitting and receiving 2 mode is programmed.
- 3 Investigation has been done on all the possible configurations for searching the worst case.

RADIATED TEST						
	Radiated	Emission Test	(BELOW 1 GHz) (Wo	orst case)		
MODE	AVAILABLE	TESTED MODULATION	PACKET			
MODE	CHANNEL	CHANNEL	WODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	8-DPSK	3DH5		
	Radiated Emission Test (ABOVE 1 GHz) (Worst case)					
MODE	AVAILABLE	TESTED	MODULATION	PACKET		
MODE	CHANNEL	CHANNEL	WODULATION	TYPE		
Bluetooth	0 to 78	0,39,78	8-DPSK	3DH5		
Band Edge						
Bluetooth	0 to 78	0,78	GFSK	DH5		
Bluetooth	0 to 78	0,78	8-DPSK	3DH5		

Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth BR+EDR Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

ANTENNA PORT CONDUCTED TEST							
	Peak Output Power, 20dB Band Width						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE			
	0 to 78	0,39,78	GFSK	DH5			
Bluetooth	0 to 78	0,39,78	π/4-DQPSK	2DH5			
	0 to 78	0,39,78	8-DPSK	3DH5			
		Band Edge & C	onducted Emission	1			
Bluetooth	0 to 78	0,78	GFSK	DH5			
Bluetooth	0 to 78	0,78	8-DPSK	3DH5			
		Frequen	cy Separation				
Bluetooth	Bluetooth 0 to 78 0,39,78 8-DPSK 3DH5		3DH5				
		Number of h	opping frequency				
Bluetooth	0 to 78	0 to 78	8-DPSK	3DH5			
Time of Occupancy (Dwell time)							
Bluetooth	0 to 78	0,39,78	GFSK	DH1/DH3/DH5			
Bluetooth	0 to 78	39	π/4-DQPSK	DH1/DH3/DH5			
Bluetooth	0 to 78	39	8-DPSK	DH1/DH3/DH5			

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#### **ASUREMENT UNCERTAINTY** 5

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
Measurement uncertainty	180MHz -417MHz: +/- 3.19dB
(Polarization : Vertical)	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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#### CONDUCTED EMISSION TEST 6

### 6.1 Standard Applicable

Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range	Lin dB(	nits ′uV)			
MHz	Quasi-peak	Average			
0.15 to 0.50	66 to 56	56 to 46			
0.50 to 5	56	46			
5 to 30	60	50			
Note					

1. The lower limit shall apply at the transition frequencies

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz

#### 6.2 Measurement Equipment Used

Conducted Emission Test Site						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
TYPE		NUMBER	NUMBER	CAL.		
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018	
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018	
LISN	MESS TEC	FCC-LISN-50/250- 25-2-01	4034	03/19/2017	03/18/2018	
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017	

### 6.3 EUT Setup

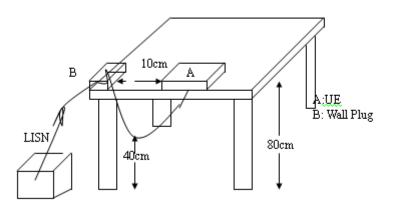
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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### 6.4 Test SET-UP (Block Diagram of Configuration)



#### 6.5 Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plan.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

#### 6.6 Measurement Result

Note: Refer to next page for measurement data and plots. Note2: The \* reveals the worst-case results that closet to the limit

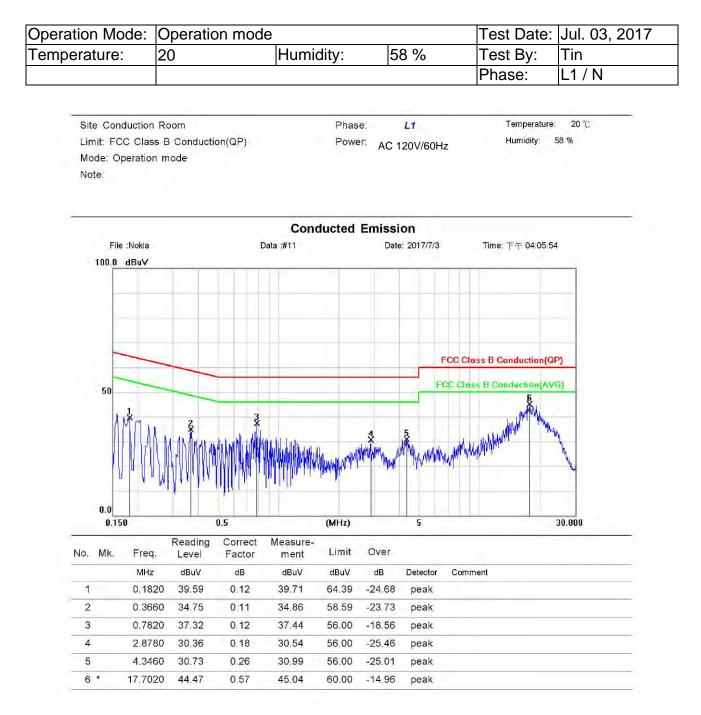
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### AC POWER LINE CONDUCTED EMISSION TEST DATA



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6 \*

18.5620

42.01

0.48

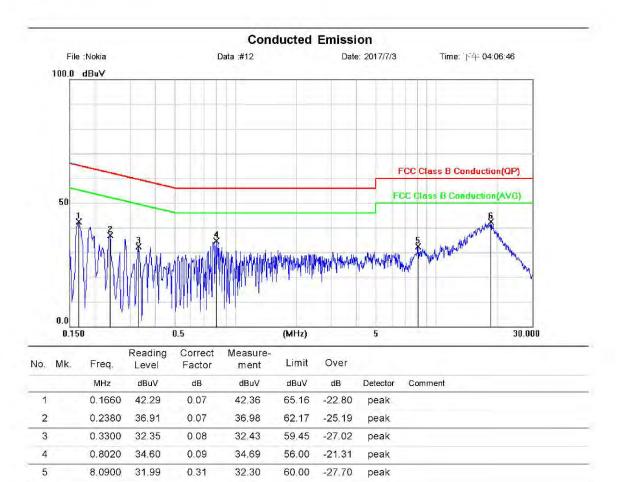
42.49

60.00

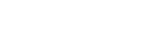
-17.51

peak

Temperature: 20 °C Site Conduction Room Phase: N Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 58 % Mode: Operation mode Note:



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# 7 PEAK OUTPUT POWER MEASUREMENT

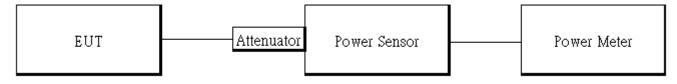
# 7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

### 7.2 Measurement Equipment Used

SGS Conducted Room						
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.	
TYPE		NUMBER	NUMBER	CAL.		
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017	
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017	
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018	
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018	
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018	
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018	
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018	
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017	
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018	

### 7.3 Test Set-up:



## 7.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
- 4. Record the max. reading.
- 5. Repeat above procedures until all default test channel is completed.

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#### 7.5 Measurement Result

1M BR mode (Peak):

СН	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	9.17	8.260	125
39	2441	11.19	13.152	125
78	2480	8.71	7.430	125

1M BR mode (Average):

СН	Freq. (MHz)	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	8.02	6.339	125
39	2441	9.91	9.795	125
78	2480	7.38	5.470	125

2M EDR mode (Peak):

СН	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	10.13	10.304	125
39	2441	12.11	16.255	125
78	2480	9.60	9.120	125

2M EDR mode (Average):

СН	Freq. (MHz)	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	6.45	4.416	125
39	2441	8.52	7.112	125
78	2480	5.94	3.926	125

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#### 3M EDR mode (Peak):

СН	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	10.49	11.194	125
39	2441	12.46	17.620	125
78	2480	9.93	9.840	125

#### 3M EDR mode (Average):

СН	Freq. (MHz)	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	6.44	4.406	125
39	2441	8.45	6.998	125
78	2480	5.96	3.945	125

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### 8 20DB BANDWIDTH MEASUREMENT

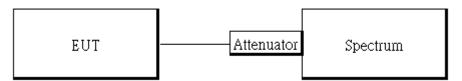
#### 8.1 Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

#### 8.2 Measurement Equipment Used

SGS Conducted Room							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017		
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018		
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018		
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018		
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018		
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017		
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018		

#### 8.3 Test Set-up



#### 8.4 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 5. Mark the peak frequency and -20dB (upper and lower) frequency
- 6. Repeat above procedures until all test default channel is completed

### NOTE:

1. For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark.

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#### 8.5 Measurement Result

#### GFSK

СН	20 dB BW (MHz)	2/3 BW (MHz)	
Low	1.8814	1.25	
Mid	0.9255	0.62	
High	0.9263	0.62	

#### π/4-DQPSK

	20 dB	2/3 BW	
СН	BW		
	(MHz)	(MHz)	
Low	1.315	0.88	
Mid	1.317	0.88	
High	1.318	0.88	

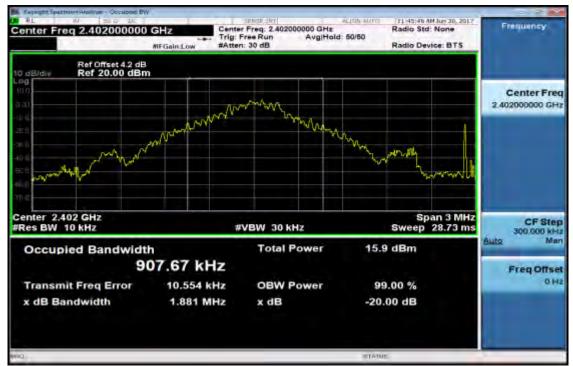
#### 8-DPSK

	20 dB 2/3		
СН	BW	BW	
	(MHz)	(MHz)	
Low	1.271	0.85	
Mid	1.270	0.85	
High	1.269	0.85	

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## 20dB Band Width Test Data CH-Low (GFSK mode)



## 20dB Band Width Test Data CH-Mid (GFSK mode)



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## 20dB Band Width Test Data CH-High (GFSK mode)



### 20dB Band Width Test Data CH-Low (π/4-DQPSK mode)



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### 20dB Band Width Test Data CH-Mid (π/4-DQPSK mode)

RI 12:34:22 PM Jun 30, 2013 Radio Std: None Center Freq: 2.441000000 GHz Trig: Free Run Avg|Hol #Atten: 30 dB Center Freq 2.441000000 GHz Frequency MFGain:Low Avg|Hold: 50/50 Radio Device: BTS Ref Offset 4.2 dB Ref 20.00 dBm 0 dE Center Fred 2 441000000 GHz Span 3 MHz Sweep 12.73 ms Center 2.441 GHz #Res BW 15 kHz **CF** Step #VBW 47 kHz 300.000 kH Auto **Occupied Bandwidth Total Power** 17.3 dBm 1.1695 MHz Freq Offset OH Transmit Freq Error -2.540 kHz **OBW Power** 99.00 % x dB Bandwidth 1.316 MHz x dB -20.00 dB

## 20dB Band Width Test Data CH-High (π/4-DQPSK mode)



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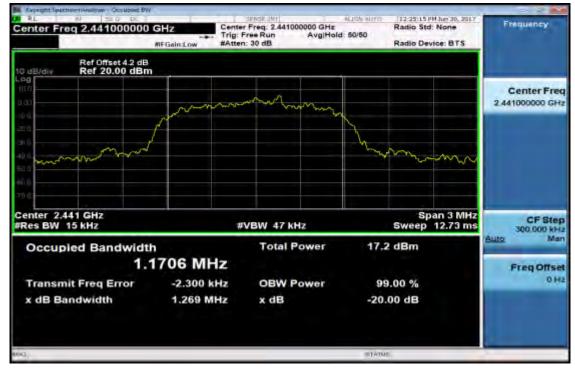
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## 20dB Band Width Test Data CH-Low (8-DPSK mode)



## 20dB Band Width Test Data CH-Mid (8-DPSK mode)



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## 20dB Band Width Test Data CH-High (8-DPSK mode)



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### 9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

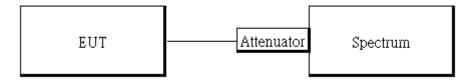
#### 9.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

SGS Conducted Room							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017		
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018		
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018		
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018		
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018		
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017		
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018		

#### 9.2 Measurement Equipment Used

#### 9.3 Test SET-UP



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#### 9.4 Measurement Procedure

#### **Conducted Band Edge:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
- 6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
- 7. Repeat above procedures until all frequency measured were complete.

### **Conducted Spurious Emission:**

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Set RBW = 100 kHz & VBW = 300 kHz, Detector =Peak, Sweep = Auto
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- 6. Repeat above procedures until all default test channel measured were complete.

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

### FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

#### 9.5 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

- 1. Cable loss as 4.2dB that offsets in the spectrum
- 2. The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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#### Avg Type: Log-Pwr Center Freq 2.365000000 GHz Frequency Trig: Free Run #Atten: 30 dB PNO: Fast C Auto Tune Mkr3 2.390 00 GHz -56.59 dBm Ref Offset 4.2 dB Ref 20.00 dBm O dB Center Freq 2 365000000 GHz IT WINDOW IN THE Start Freq 2 310000000 GH 1 Stop Freq 2 42000000 GH Start 2.31000 GHz #Res BW 100 kHz Stop 2.42000 GHz Sweep 10.53 ms (1001 pts) CF Step 11.000000 MH #VBW 300 kHz 0.50 dBm 6.59 dBm Freq Offset 0 HI

## Band Edges Test Data CH-Low (Hopping mode) (GFSK mode)

## Band Edges Test Data CH-High



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## Band Edges Test Data CH-Low (Non-Hopping mode) (GFSK mode)

Avg Type: Log-Pwr Center Freq 2.365000000 GHz Frequency Trig: Free Run #Atten: 30 dB PNO: Fast C Auto Tune Mkr3 2.390 00 GHz Ref Offset 4.2 dB Ref 20.00 dBm -58.11 dBm O dB Center Freq 2 365000000 GHz Start Freq 2 310000000 GH 02 Stop Freq 2 42000000 GH Start 2.31000 GHz #Res BW 100 kHz Stop 2.42000 GHz Sweep 10.53 ms (1001 pts) CF Step 11.000000 MH #VBW 300 kHz 9.31 dBm 48.64 dBm 68.11 dBm Freq Offset 0 HI

## Band Edges Test Data CH-High



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#### Avg Type: Log-Pwr Center Freq 2.365000000 GHz Frequency Trig: Free Run #Atten: 30 dB PNO: Fast C Auto Tune Mkr3 2.390 00 GHz Ref Offset 4.2 dB Ref 20.00 dBm -57.20 dBm O dB Why ent Center Freq 2 365000000 GHz Start Freq 2 310000000 GH Stop Freq 2 42000000 GH Start 2.31000 GHz #Res BW 100 kHz Stop 2.42000 GHz Sweep 10.53 ms (1001 pts) CF Step 11.000000 MH #VBW 300 kHz 8.35 dBm -54.94 dBm -57.20 dBm Freq Offset 0 HI

### Band Edges Test Data CH-Low (Hopping mode) (8-DPSK mode)

## Band Edges Test Data CH-High



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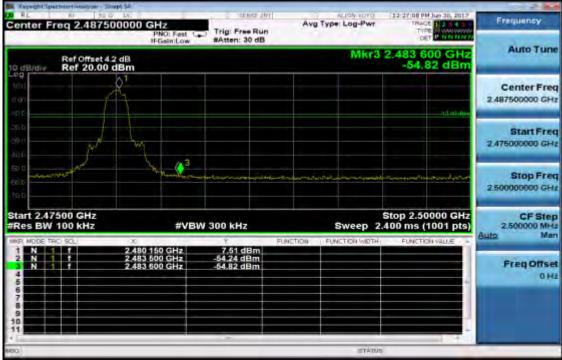
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# Band Edges Test Data CH-Low (Non-Hopping mode) (8-DPSK mode)

Avg Type: Log-Pwr Center Freq 2.365000000 GHz Frequency Trig: Free Run #Atten: 30 dB PNO: Fast C Auto Tune Mkr3 2.390 00 GHz -57.53 dBm Ref Offset 4.2 dB Ref 20.00 dBm Eb 0 ٥ Center Freq 2 365000000 GHz Start Freq 2 310000000 GH 12 Stop Freq 2 42000000 GH Start 2.31000 GHz #Res BW 100 kHz Stop 2.42000 GHz Sweep 10.53 ms (1001 pts) CF Step 11.000000 MH #VBW 300 kHz 8.17 dBm 49.46 dBm 57.53 dBm Freq Offset 0 HI

## Band Edges Test Data CH-High



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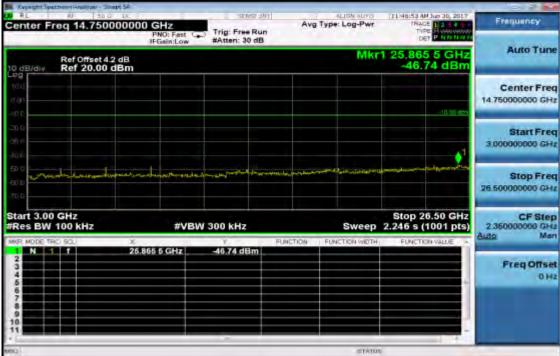
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### **Conducted Spurious Emission Measurement Result (GFSK mode)** Ch Low 30MHz - 3GHz

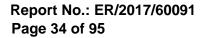
31:40:36 AM Frequency Center Freq 1.515000000 GHz Avg Type: Log-Pwr PNO: Fast () Trig: Free Run #Atten: 30 dB Auto Tune Mkr1 2.403 0 GHz 9,04 dBm Ref Offset 4.2 dB Ref 20.00 dBm 00 Center Freq 1.515000000 GHz Start Freq 30.000000 MH Stop Freq 3.000000000 GH Start 30 MHz Stop 3.000 GHz CF Step #Res BW 100 kHz #VBW 300 kHz Sweep 283.9 ms (1001 pts) 297.000000 MH Ma 2.403 0 GHz 9.04 dBn Freq Offset OH

### Ch Low 3GHz – 26.5GHz



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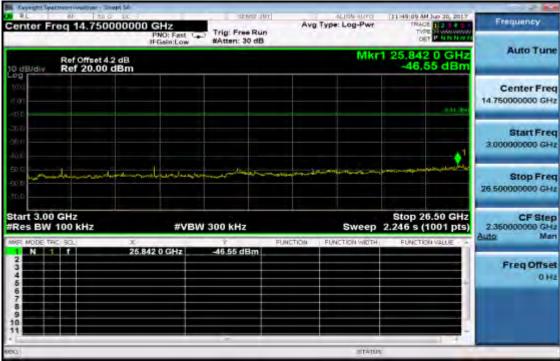




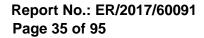
### Ch Mid 30MHz – 3GHz

Keynight Spectratin Analyzer - Skrept SA					2 2 2 M
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300 300 400					Start Freq 30,000000 MHz
in it	anipality my base	le-p-1910-910-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	مېرىغىلىيە بىچەر ۋە ئەلەردە بەر بىرە بىرىمەن بەر بىرە تەر	a manage from a galar	Stop Freq 3.000000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBV	V 300 kHz		Stop 3.000 GHz 283.9 ms (1001 pts)	CF Step 297.000000 MHz Auto Man
WRR MODE TRC: SCL X:	2.441 6 GHz	10.55 dBm	FLANCTION : FUNCTION WETH	FUNCTION VALUE	Freq Offset 0 Hz
			STATE	5	

### Ch Mid 3GHz – 26.5GHz



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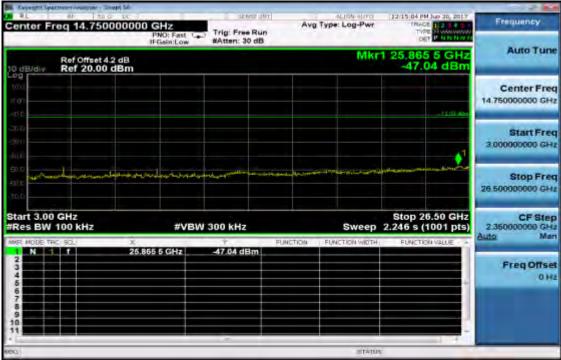




### Ch High 30MHz – 3GHz

RL N/ Successful State		use and	ALION AUTO	11-51:44 AM Jup 30, 2517	
Center Freq 1.5150000		Av Run	g Type: Log-Pwr	TRACE 1 2 4 4 1 TYPE Noncommunity DET P N W MUCH	Frequency
Ref Offset 4.2 dB	T COUNTE ON THE OWNER	of up	Mkr	1 2.480 3 GHz 7.91 dBm	Auto Tune
-eg 1001 man				1	Center Freq 1.515000000 GHz
400					Start Freq 30,000000 MHz
50.0 60.0 مىلايىتى ئىرىكى ئېرىكى 70.0	den kanne keinden mennen interskelteren.	يەدەن ئەرەنىيە بەرەن بەرەن بەرە رولىرىنى بەرەن	مرا «مرورة» «النفاية مراجعة» م	after de la deservation	Stop Freq 3.00000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBW 300 kH			Stop 3.000 GHz 3.9 ms (1001 pts)	CF Step 297.000000 MHz Auto Man
1 N 1 1	× 7.91 0	Bm	FUNCTION WETH	FUNCTION VALUE .	CARLS - CONT
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9 9 10					
*			STÁTUS	1 1	

### Ch High 3GHz – 26.5GHz



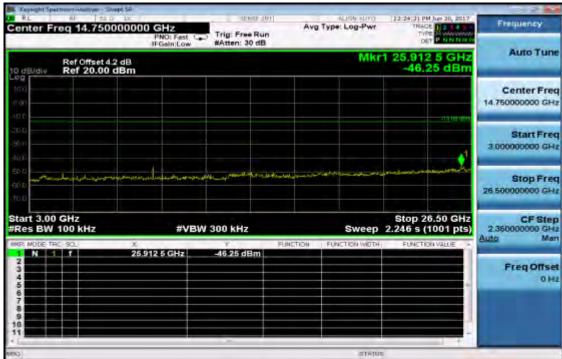
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### **Conducted Spurious Emission Measurement Result (8DPSK mode)** Ch Low 30MHz - 3GHz

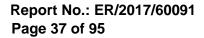
RL RL BI 15000000 GHz Center Freq 1.515000000 GHz PNG: Feat IFGain:Low Frequency Avg Type: Log-Pwr Trig: Free Run #Atten: 30 dB Auto Tune Mkr1 Ref Offset 4.2 dB Ref 20.00 dBm 6.31 dBm **Center Freq** 1.515000000 GHz Start Freq 30.000000 MH Stop Freq 3.000000000 GH Stop 3.000 GHz Sweep 283.9 ms (1001 pts) CF Step Start 30 MHz 297.000000 MH #Res BW 100 kHz #VBW 300 kHz Auto 2.403 0 GHz 6.31 dB Freq Offset 0 H

### Ch Low 3GHz - 26.5GHz



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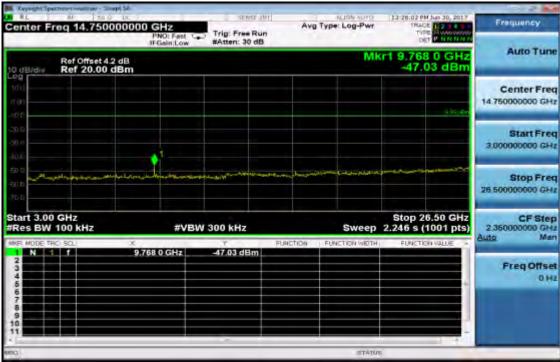




## Ch Mid 30MHz - 3GHz

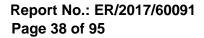
Keynight Spectromy-Analyzer - Skrept SA	a			
Center Freq 1.5150000		Avg Type: Log-Pwr	12-25:34 PM 3up 30, 2517 TRACE 1 2 3 4 3 1 TYPE NUMBER OF PINN 1000	Frequency
Ref Offset 4.2 dB		Mk	r1 2,441 6 GHz 10.05 dBm	Auto Tune
			) 1 - Altourie	Center Freq 1.515000000 GHz
90 00				Start Freq 30,000000 MHz
o o C	ابط والمحافث المستجد ومستجه يعاون والمحافظ	an a	l somerne for spinning der	Stop Freq 3,00000000 GHz
tart 30 MHz Res BW 100 kHz	#VBW 300 kHz	Sweep 2	Stop 3.000 GHz 33.9 ms (1001 pts)	CF Step 297.000000 MHz Auto Man
1 N 1 f 2 3 4 5 6	2.441 6 GHz 10.05 dBm			Freq Offset 0 Hz
7 8 9 10 11				
28		STATUS		

# Ch Mid 3GHz – 26.5GHz



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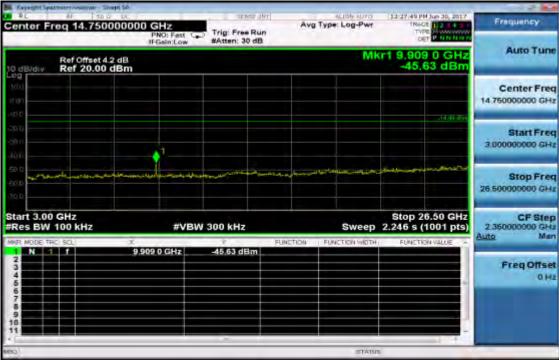




## Ch High 30MHz – 3GHz

Keynight Spectroler - Shipt SA				13. 2 M
Center Freq 1.515000000	PNO: Fest C #Atten: 30 dB	Avg Type: Log-Pwr	12-27:30 PM Sub 30, 2517 TRACE 1 2 3 4 9 1 TYPE PLOAD AND AND A	Frequency
Ref Offset 4.2 dB	Position writer, or up	Mk	1 2,480 3 GHz 5,01 dBm	Auto Tune
101 101			<b>†</b> <sup>1</sup>	Center Freq 1.515000000 GHz
400			addiaa	Start Freq 30,000000 MHz
400 50 U 60 D 70 D	ling and and group of the place of the place of the second second second second second second second second sec	المعادر والمعادلة المحافظ والمعادية والمعادية والمعادية والمعادلين والمعادية والمعادية والمعادية والمعادية والم	and a second	Stop Freq 3.00000000 GHz
Start 30 MHz #Res BW 100 kHz	#VBW 300 kHz		Stop 3.000 GHz 33.9 ms (1001 pts)	CF Step 297.000000 MHz Auto Man
2 3 4 5	2.480 3 GHz 5.01 dBm	PLNETION FUNCTION WETH	FUNCTION VALUE	Freq Offset 0 Hz
6 7 8 9 10 11				
* CB		erátus	1.1	

# Ch High 3GHz – 26.5GHz



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# **10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT**

## **10.1 Standard Applicable**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level ( $dB\mu V/m$ ) = 20 log Emission level ( $dB\mu V/m$ )

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### **10.2 Measurement Equipment Used**

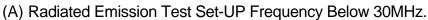
SGS SAC-III								
Name of Equipment	Manufacturer	Model	Serial Num- ber	Calibra- tion Date	Calibra- tion Due			
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018			
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018			
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2016	09/19/2017			
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017			
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017			
Pre-Amplifier	Agilent	8447D	2944A07676	01/05/2017	01/04/2018			
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/05/2017	01/04/2018			
Turn Table	HD	DT420	N/A	N.C.R	N.C.R			
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R			
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R			
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018			
3m Site NSA	SGS	966 chamber	N/A	07/01/2016	06/30/2017			
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018			
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017			
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018			

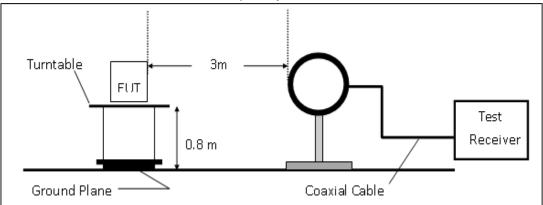
Note: N.C.R refers to Not Calibrated Required.

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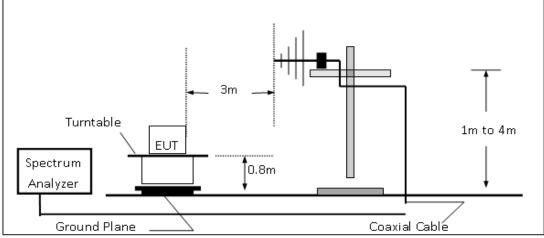


#### 10.3 Test SET-UP

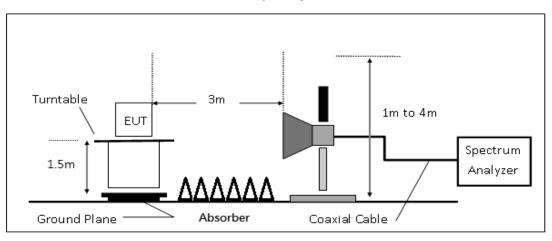




### (B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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## **10.4 Measurement Procedure**

### **Radiated Emission**

- 1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m for frequency> 1GHz above ground plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. Use the follow spectrum analyzer setting:
  - (1) Span = wide enough to fully capture the emission being measured
  - (2) RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz, VBW  $\ge$  RBW, Sweep = auto, Detector function = peak, Trace = max hold
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c) Duty Cycle = On time/100 milliseconds

On time = N1\*L1=N2\*L2+...+N(n-1)\*LN(n-1)+N(n)\*L(n)

Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20\*log (duty Cycle)

- 6. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 8. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 9. Repeat above procedures until all frequency of the interest measured were complete.

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#### 10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

#### FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

The limit of the emission level is expressed in dBuV/m, which converts 20\*log(uV/m)

Actual FS( $dB\mu V/m$ ) = SPA. Reading level( $dB\mu V$ ) + Factor(dB)

 $Factor(dB) = Antenna Factor(dB\mu V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)$ 

#### Note :

"F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

### 10.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

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

#### **10.7 Measurement Result**

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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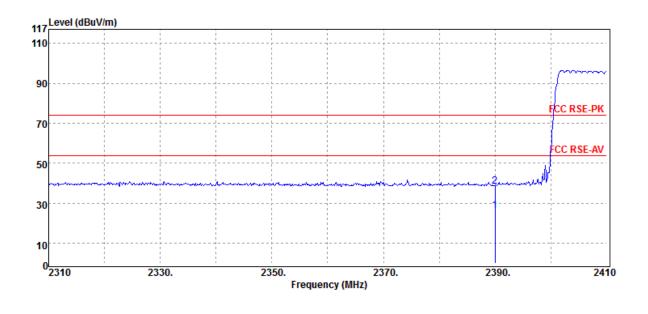


#### Radiated Band Edge Measurement Result: (Hopping Mode)

**Operation Band Fundamental Frequency Operation Mode** EUT Pol.

:BR Hopping :2402 MHz :Bandedge CH LOW :E2 Plane

:2017-06-29 Test Date Temp./Humi. :23 deg C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.16	-1.74	26.42	54.00	-27.58
2390.00	Е	Peak	40.33	-1.74	38.59	74.00	-35.41

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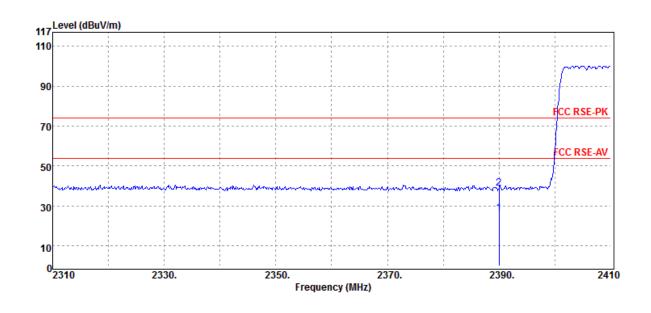


**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:BR Hopping :2402 MHz :Bandedge CH LOW :E2 Plane

Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.

:2017-06-29 :23 deg\_C / 62 RH :HORIZONTAL



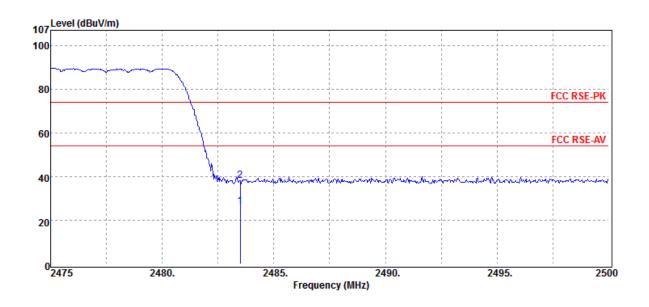
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.18	-1.74	26.44	54.00	-27.56
2390.00	Е	Peak	40.58	-1.74	38.84	74.00	-35.16

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**Operation Band** :BR Hopping Fundamental Frequency :2480 MHz **Operation Mode** :Bandedge CH HIGH EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	27.93	-1.62	26.31	54.00	-27.69
2483.50	Е	Peak	39.59	-1.62	37.97	74.00	-36.03

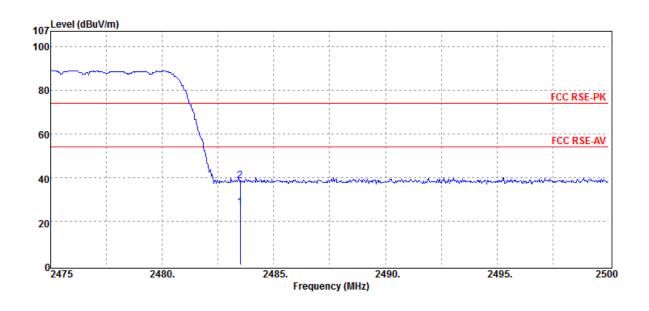
Report No.: ER/2017/60091 Page 47 of 95



**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol. :E2 Plane

:BR Hopping :2480 MHz :Bandedge CH HIGH Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.

:2017-06-29 :23 deg\_C / 62 RH :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	27.92	-1.62	26.30	54.00	-27.70
2483.50	Е	Peak	40.23	-1.62	38.61	74.00	-35.39

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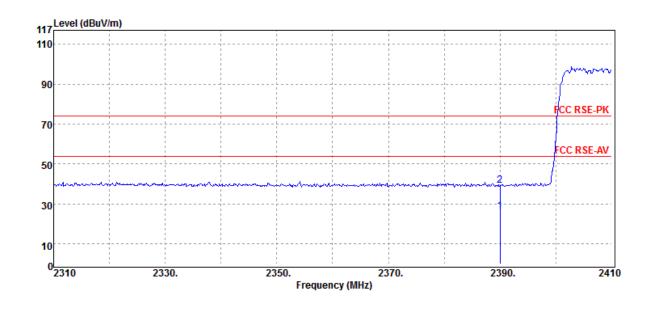
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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:EDR Hopping :2402 MHz :Bandedge CH LOW :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.16	-1.74	26.42	54.00	-27.58
2390.00	Е	Peak	41.04	-1.74	39.30	74.00	-34.70

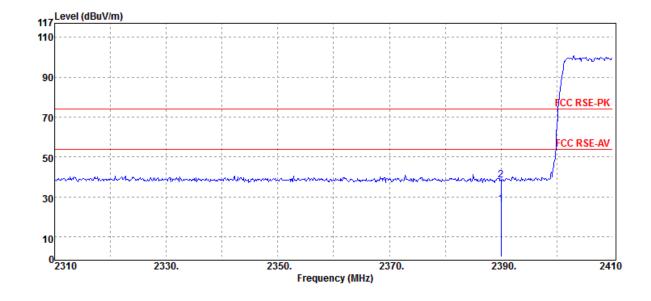
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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:EDR Hopping :2402 MHz :Bandedge CH LOW :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.26	-1.74	26.52	54.00	-27.48
2390.00	Е	Peak	40.02	-1.74	38.28	74.00	-35.72

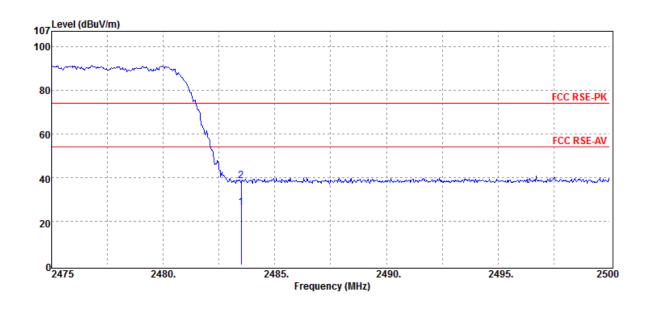
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**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:EDR Hopping :2480 MHz :Bandedge CH HIGH :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	27.89	-1.62	26.27	54.00	-27.73
2483.50	Е	Peak	40.13	-1.62	38.51	74.00	-35.49

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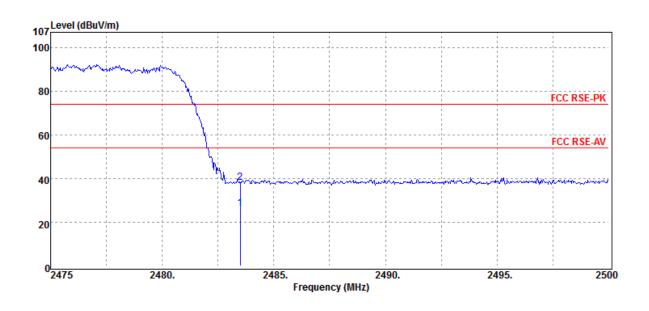


**Operation Band** Fundamental Frequency **Operation Mode** EUT Pol.

:EDR Hopping :2480 MHz :Bandedge CH HIGH :E2 Plane

Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.

:2017-06-29 :23 deg\_C / 62 RH :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	27.91	-1.62	26.29	54.00	-27.71
2483.50	Е	Peak	39.69	-1.62	38.07	74.00	-35.93



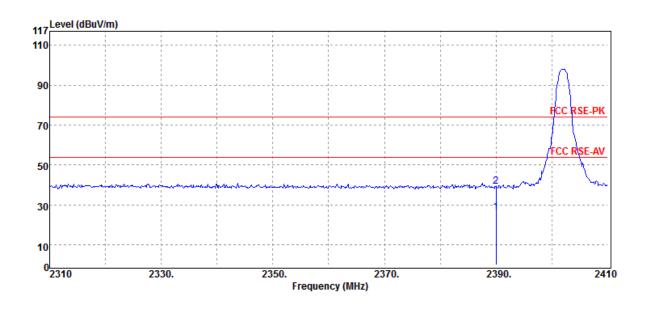
#### Radiated Band Edge Measurement Result: (Non-Hopping Mode)

Operation Band	:BR
Fundamental Frequency	:240
Operation Mode	:Ba
EUT Pol.	:E2

R(1M) 02 MHz indedge CH LOW Plane

Test Date Temp./Humi. Engineer Measurement Antenna Pol.

:2017-06-29 :23 deg\_C / 62 RH :Mike :VERTICAL



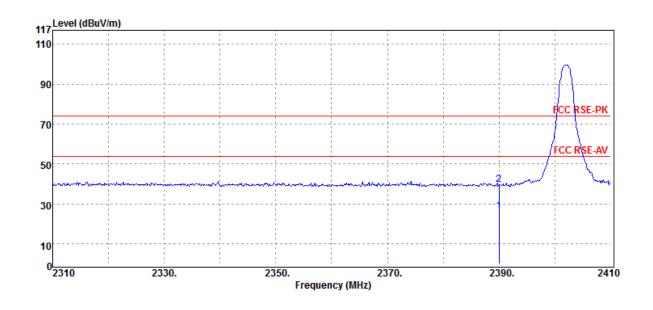
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.19	-1.74	26.45	54.00	-27.55
2390.00	Е	Peak	41.00	-1.74	39.26	74.00	-34.74

Report No.: ER/2017/60091 Page 53 of 95



**Operation Band** :BR(1M) Fundamental Frequency :2402 MHz **Operation Mode** :Bandedge CH LOW EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :HORIZONTAL Measurement Antenna Pol.



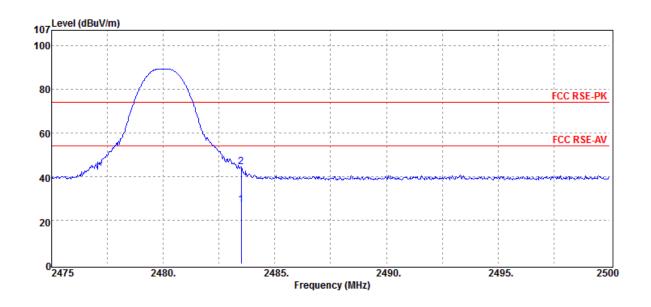
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.20	-1.74	26.46	54.00	-27.54
2390.00	Е	Peak	41.62	-1.74	39.88	74.00	-34.12

Report No.: ER/2017/60091 Page 54 of 95



**Operation Band** :BR(1M) Fundamental Frequency :2480 MHz **Operation Mode** :Bandedge CH HIGH EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	28.59	-1.62	26.97	54.00	-27.03
2483.50	Е	Peak	45.89	-1.62	44.27	74.00	-29.73

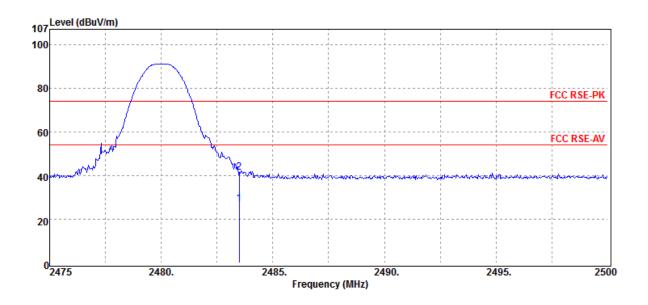
Report No.: ER/2017/60091 Page 55 of 95



**Operation Band** :BR(1M) Fundamental Frequency :2480 MHz **Operation Mode** :Bandedge CH HIGH EUT Pol. :E2 Plane

Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.





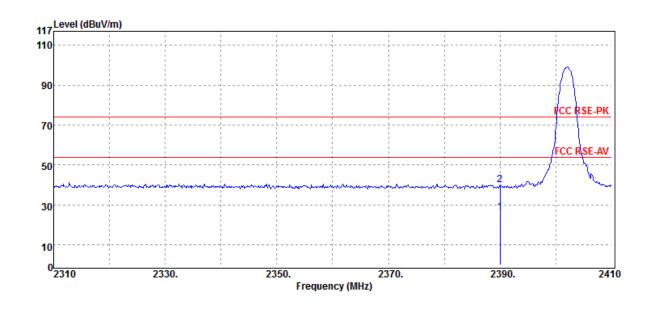
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	28.48	-1.62	26.86	54.00	-27.14
2483.50	Е	Peak	42.94	-1.62	41.32	74.00	-32.68

Report No.: ER/2017/60091 Page 56 of 95



**Operation Band** :EDR(3M) Fundamental Frequency :2402 MHz **Operation Mode** :Bandedge CH LOW EUT Pol. :E2 Plane

:2017-06-29 Test Date Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



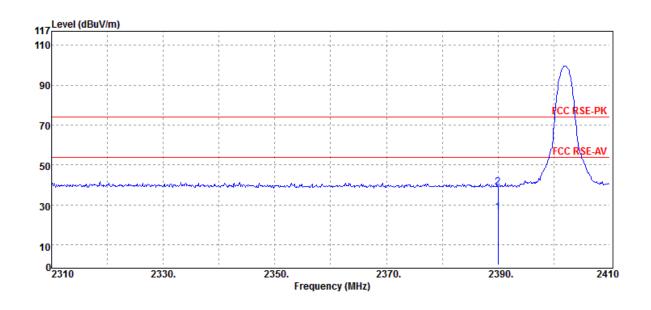
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.15	-1.74	26.41	54.00	-27.59
2390.00	Е	Peak	41.80	-1.74	40.06	74.00	-33.94

Report No.: ER/2017/60091 Page 57 of 95



**Operation Band** :EDR(3M) Fundamental Frequency :2402 MHz **Operation Mode** :Bandedge CH LOW EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :HORIZONTAL Measurement Antenna Pol.



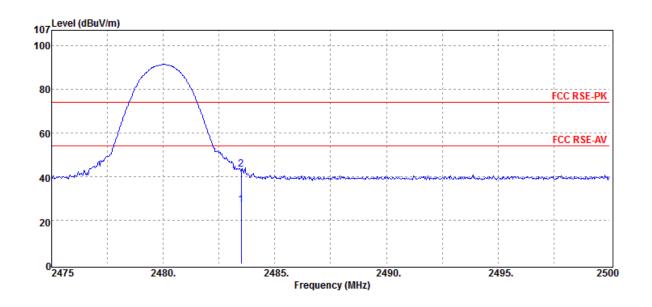
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Е	Average	28.26	-1.74	26.52	54.00	-27.48
2390.00	Е	Peak	40.76	-1.74	39.02	74.00	-34.98

Report No.: ER/2017/60091 Page 58 of 95



**Operation Band** :EDR(3M) Fundamental Frequency :2480 MHz **Operation Mode** :Bandedge CH HIGH EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



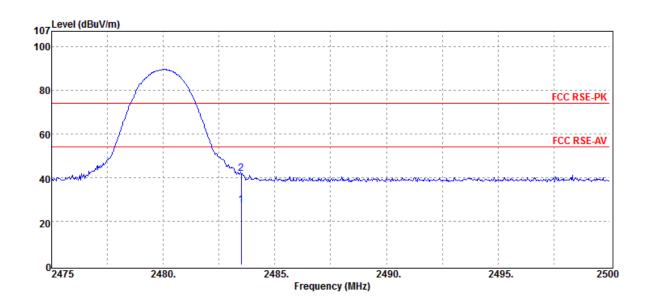
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	28.59	-1.62	26.97	54.00	-27.03
2483.50	Е	Peak	44.88	-1.62	43.26	74.00	-30.74

Report No.: ER/2017/60091 Page 59 of 95



**Operation Band** :EDR(3M) Fundamental Frequency :2480 MHz **Operation Mode** :Bandedge CH HIGH EUT Pol. :E2 Plane

Test Date :2017-06-29 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :HORIZONTAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Е	Average	28.84	-1.62	27.22	54.00	-26.78
2483.50	Е	Peak	43.53	-1.62	41.91	74.00	-32.09



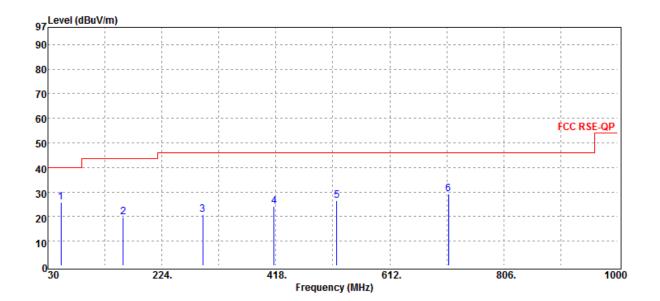
#### Radiated Spurious Emission Measurement Result: (Worst Case)

#### For Frequency form 30MHz to 1000MHz

**Operation Band** Fundamental Frequency Operation Mode EUT Pol.

:EDR(3M) :2402 MHz :Tx CH LOW :E2 Plane

Test Date :2017-06-30 Temp./Humi. :23 deg\_C / 62 RH Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
52.31	S	Peak	33.64	-7.76	25.88	40.00	-14.12
158.04	S	Peak	27.09	-7.45	19.64	43.50	-23.86
293.84	S	Peak	26.71	-6.04	20.67	46.00	-25.33
415.09	S	Peak	27.46	-3.21	24.25	46.00	-21.75
521.79	S	Peak	28.10	-1.61	26.49	46.00	-19.51
711.91	S	Peak	27.92	1.31	29.23	46.00	-16.77

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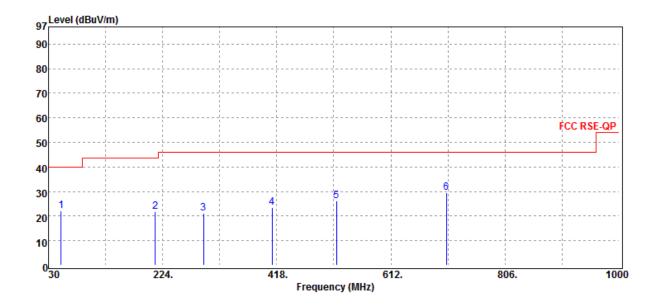
SGS Taiwan Ltd. No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134號



Operation Band	:EDR(3M)
Fundamental Frequency	:2402 MHz
Operation Mode	:Tx CH LOW
EUT Pol.	:E2 Plane

Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.

:2017-06-30 :23 deg\_C / 62 RH :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
51.34	S	Peak	29.93	-7.75	22.18	40.00	-17.82
211.39	S	Peak	31.47	-9.70	21.77	43.50	-21.73
293.84	S	Peak	27.10	-6.04	21.06	46.00	-24.94
410.24	S	Peak	27.08	-3.62	23.46	46.00	-22.54
519.85	S	Peak	27.84	-1.62	26.22	46.00	-19.78
706.09	S	Peak	28.36	1.33	29.69	46.00	-16.31

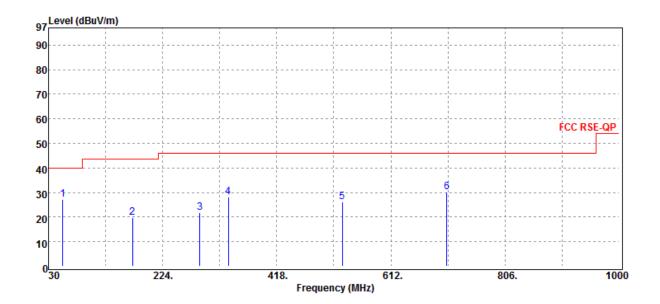
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Operation Band	:EDR(3M)	Test
Fundamental Frequency Operation Mode	:2441 MHz :Tx CH MID	Temp Engi
EUT Pol.	:E2 Plane	Meas

Date :2017-06-30 p./Humi. :23 deg\_C / 62 RH ineer :Mike :VERTICAL surement Antenna Pol.



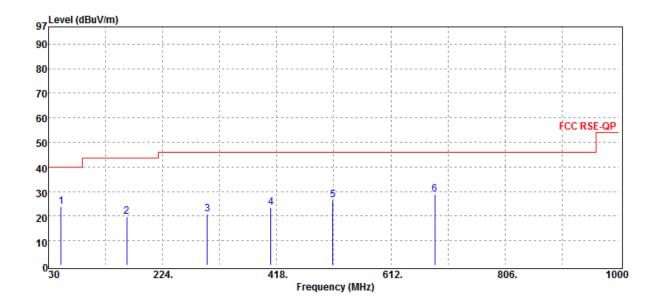
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
54.25	S	Peak	35.07	-7.82	27.25	40.00	-12.75
172.59	S	Peak	27.73	-7.86	19.87	43.50	-23.63
287.05	S	Peak	28.07	-6.19	21.88	46.00	-24.12
335.55	S	Peak	33.41	-5.32	28.09	46.00	-17.91
529.55	S	Peak	27.49	-1.25	26.24	46.00	-19.76
707.06	S	Peak	28.67	1.40	30.07	46.00	-15.93

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Operation Band	:EDR(3M)	Test Date	:2017-06-30
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
51.34	S	Peak	31.75	-7.75	24.00	40.00	-16.00
162.89	S	Peak	27.15	-7.48	19.67	43.50	-23.83
299.66	S	Peak	26.69	-5.93	20.76	46.00	-25.24
408.30	S	Peak	27.08	-3.53	23.55	46.00	-22.45
513.06	S	Peak	28.51	-1.89	26.62	46.00	-19.38
686.69	S	Peak	27.81	1.21	29.02	46.00	-16.98

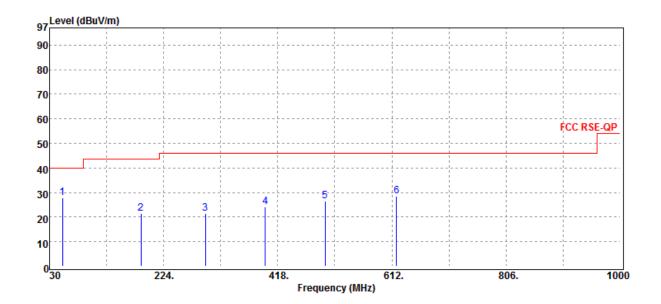
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**Operation Band** :EDR(3M) Fundamental Frequency :2480 MHz **Operation Mode** :Tx CH HIGH EUT Pol. :E2 Plane

Test Date :2017-06-30 :23 deg\_C / 62 RH Temp./Humi. Engineer :Mike :VERTICAL Measurement Antenna Pol.



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
52.31	S	Peak	35.49	-7.76	27.73	40.00	-12.27
185.20	S	Peak	30.59	-9.06	21.53	43.50	-21.97
294.81	S	Peak	27.48	-6.02	21.46	46.00	-24.54
396.66	S	Peak	28.41	-4.11	24.30	46.00	-21.70
498.51	S	Peak	28.91	-2.52	26.39	46.00	-19.61
619.76	S	Peak	28.60	0.02	28.62	46.00	-17.38

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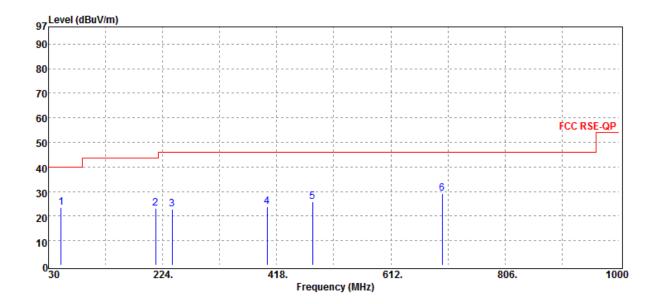
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**Operation Band** :EDR(3M) Fundamental Frequency :2480 MHz **Operation Mode** :Tx CH HIGH EUT Pol. :E2 Plane

Test Date Temp./Humi. Engineer :Mike Measurement Antenna Pol.

:2017-06-30 :23 deg\_C / 62 RH :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
51.34	S	Peak	31.25	-7.75	23.50	40.00	-16.50
212.36	S	Peak	32.88	-9.65	23.23	43.50	-20.27
240.49	S	Peak	30.78	-8.04	22.74	46.00	-23.26
401.51	S	Peak	27.88	-3.95	23.93	46.00	-22.07
479.11	S	Peak	28.38	-2.39	25.99	46.00	-20.01
699.30	S	Peak	27.73	1.44	29.17	46.00	-16.83

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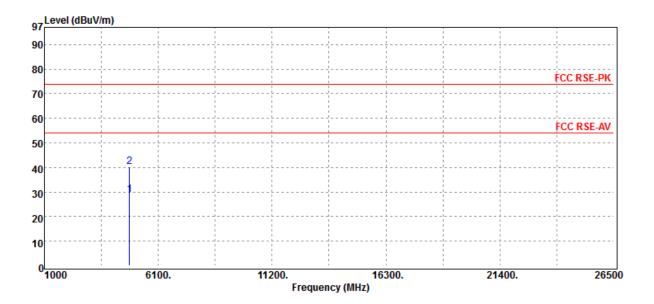
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#### **Radiated Spurious Emission Measurement Result:**

#### For Frequency above 1 GHz

i ol i loquolloj uboro			
Operation Band	:EDR(3M)	Test Date	:2017-06-29
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Н	Average	24.09	4.92	29.01	54.00	-24.99
4804.00	Н	Peak	35.25	4.92	40.17	74.00	-33.83



4804.00

Н

Н

Operation Fundamer Operation EUT Pol.	ntal Frequency	:EDR(3M) :2402 MHz :Tx CH LOV :E2 Plane	V	Test Date Temp./Humi. Engineer Measurement Antenna Pol.		:Mike	16-29 C / 62 RH CONTAL
97 <mark>-</mark>	evel (dBuV/m)						_
90							
80						FCC RSE-PI	
70							
60						FCC DCC M	
<b>50</b>						FCC RSE-A	
40	2						
30							
20							
10							
0 <u></u> 1(	000 6	100.	11200. Frequency (I	16300. MHz)	21400.	26	500
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB

24.03

36.54

Average

Peak

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4.92

4.92

28.95

41.46

54.00

74.00

-25.05

-32.54



Н

Operation Ba Fundamental Operation Mc EUT Pol.	Frequency	:EDR(3M) :2441 MHz :Tx CH MID :E2 Plane	)	Test Date Temp./Humi. Engineer Measurement Antenna Po		:23 deg :Mike	:2017-06-29 :23 deg_C / 62 RH :Mike :VERTICAL	
97	(dBuV/m)							
90 90		-						
80						FCC DCF D		
70						FCC RSE-PI	<u>_</u>	
<b>60</b>						FCC RSE-A		
50					· · · · · · · · · · · · · · · · · · ·			
40	2							
30								
20							- ·	
10								
0 <mark></mark> 1000	0 <mark></mark>			16300. NHz)	21400.	26	500	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe	
		Mode	Reading Level		FS	@3m	Margin	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4882.00	н	Average	24.16	5.18	29.34	54.00	-24.66	

Peak

35.39

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5.18

40.57

74.00

-33.43



Н

Operation Ba Fundamental Operation Mc EUT Pol.	Frequency	:EDR(3M) :2441 MHz :Tx CH MID :E2 Plane	)	Test Date Temp./Humi. Engineer Measurement Antenna Pol.		:Mike	06-29 g_C / 62 RH ZONTAL	
97	(dBuV/m)							
90						·		
80						FCC RSE-F	ж	
70	 							
60						FCC RSE-	AV	
50								
40	2					·		
30								
20								
10								
0 <mark>.</mark> 1000	00							
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe	
		Mode	Reading Level		FS	@3m	Margin	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4882.00	н	Average	24.19	5.18	29.37	54.00	-24.63	

Peak

35.82

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5.18

41.00

74.00

-33.00



4960.00

Н

Н

Operation Band Fundamental Frequency Operation Mode EUT Pol.		:EDR(3M) :2480 MHz :Tx CH HIGH :E2 Plane		Test Date Temp./Hu Engineer Measure	ımi.	:23 deg :Mike	:2017-06-29 :23 deg_C / 62 RH :Mike :VERTICAL	
97	el (dBuV/m)						_	
90								
80						FCC RSE-P	<u>K</u>	
70								
60						FCC RSE-A	N	
50	2							
40	Ē					 		
30								
20								
10						       		
0	0 6	100	11200.	16300.	21400	26	500	
<sup>6</sup> 1000 6100. 11200. 16300. 21400. 26500 Frequency (MHz)						1500		
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe	
		Mode	Reading Level		FS	@3m	Margin	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	

24.79

36.76

Average

Peak

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5.29

5.29

30.08

42.05

-23.92

-31.95

54.00

74.00



4960.00

Н

Н

Operation Band Fundamental Frequency Operation Mode EUT Pol.		:EDR(3M) :2480 MHz :Tx CH HIGH :E2 Plane		Test Date Temp./Hu Engineer Measurer	umi.	:23 deg_ :Mike	:2017-06-29 :23 deg_C / 62 RH :Mike :HORIZONTAL	
97	vel (dBuV/m)						7	
90								
80						FCC RSE-PK		
70								
60						FCC RSE-AV		
<b>50</b>	2			     				
40								
30								
20						·		
10								
0	00 6	100.	11200.	16300.	21400.	265		
Frequency (MHz)								
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe	
		Mode	Reading Level		FS	@3m	Margin	
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	

24.78

36.53

Average

Peak

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5.29

5.29

30.07

41.82

-23.93

-32.18

54.00

74.00



# **11 FREQUENCY SEPARATION**

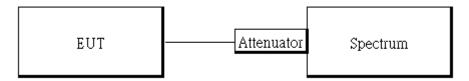
## 11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

## **11.2 Measurement Equipment Used**

SGS Conducted Room							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017		
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018		
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018		
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018		
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018		
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017		
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018		

### 11.3 Test Set-up



### **11.4 Measurement Procedure**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = middle of hopping channel.
- 5. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
- 6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

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#### **11.5 Measurement Result**

Channel separation (MHz)	Limit	Result
1	>=25 kHz or 2/3 times 20dB bandwidth	PASS

# **Frequency Separation Test Data**



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# **12 NUMBER OF HOPPING FREQUENCY**

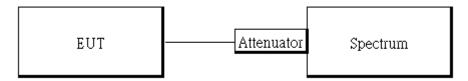
# 12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

## 12.2 Measurement Equipment Used

SGS Conducted Room							
EQUIPMENT	MFR MODEL		SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017		
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018		
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018		
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018		
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018		
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017		
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018		

#### 12.3 Test Set-up



#### **12.4 Measurement Procedure**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- 5. Set the spectrum analyzer as RBW=430 kHz, VBW=1.5MHz., Detector = Peak
- 6. Max hold, view and count how many channel in the band.

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#### **12.5 Measurement Result**

**Tabular Data of Total Channel Number** 

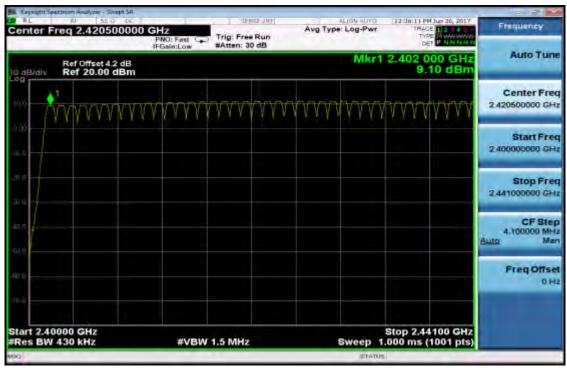
	Channel Number	Limit
2.4 GHz – 2.441GHz	40	
2.441 GHz – 2.4835GHz	39	>15
2.4GHz ~2.4835GHz	(40+39) = 79	

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# **Channel Number**



#### 2.4 GHz – 2.441GHz

#### 2.441 GHz – 2.4835GHz



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# **13 TIME OF OCCUPANCY (DWELL TIME)**

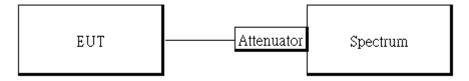
## **13.1 Standard Applicable**

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

#### **13.2 Measurement Equipment Used**

SGS Conducted Room							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.		
TYPE		NUMBER	NUMBER	CAL.			
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017		
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017		
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018		
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018		
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018		
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018		
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018		
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017		
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018		

#### 13.3 Test Set-up



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#### **13.4 Measurement Procedure**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~8ms.
- 6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 \* 20 ) (S), Hop Over Occupancy Time comes to (800 / 6 / 20 )\*(0.4 \*20 ) =53.33

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only

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#### **13.5 Tabular Result of the Measurement**

#### GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	DH1	117.12	400ms
0	DH3	256.32	400ms
	DH5	302.61	400ms
	DH1	116.80	400ms
39	DH3	255.68	400ms
	DH5	302.61	400ms
78	DH1	117.12	400ms
	DH3	257.60	400ms
	DH5	302.61	400ms

#### π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	
	DH1	118.40	400ms	
39	DH3	257.60	400ms	
	DH5	302.61	400ms	

#### 8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	DH1	118.72	400ms
39	DH3	255.68	400ms
	DH5	302.61	400ms



#### A period time = 0.4 (s) \* 79 = 31.6 (s)

#### GFSK (1Mbps):

CH Low	DH1 time slot =	0.366 *	(1600/2/79) *	31.6 =	117.12 (ms)
	DH3 time slot =	1.602 *	(1600/4/79) *	31.6 =	256.32 (ms)
	DH5 time slot =	2.837 *	(1600/6/79) *	31.6 =	302.61 (ms)
CH Mid	DH1 time slot =	0.365 *	(1600/2/79) *	31.6 =	116.80 (ms)
	DH3 time slot =	1.598 *	(1600/4/79) *	31.6 =	255.68 (ms)
	DH5 time slot =	2.837 *	(1600/6/79) *	31.6 =	302.61 (ms)
CH High	DH1 time slot =	0.366 *	(1600/2/79) *	31.6 =	117.12 (ms)
	DH3 time slot =	1.610 *	(1600/4/79) *	31.6 =	257.60 (ms)
	DH5 time slot =	2.837 *	(1600/6/79) *	31.6 =	302.61 (ms)

#### π/4 -DQPSK (2Mbps):

CH Mid	2DH1 time slot=	0.370 *	(1600/2/79) *	31.6 =	118.40 (ms)
	2DH3 time slot=	1.610 *	(1600/4/79) *	31.6 =	257.60 (ms)
	2DH5 time slot=	2.837 *	(1600/6/79) *	31.6 =	302.61 (ms)

#### 8-DPSK (3Mbps):

CH Mid	3DH1 time slot=	0.371 *	(1600/2/79) *	31.6 =	118.72 (ms)
	3DH3 time slot=	1.598 *	(1600/4/79) *	31.6 =	255.68 (ms)
	3DH5 time slot=	2.837 *	(1600/6/79) *	31.6 =	302.61 (ms)



GFSK (1Mbps) for AFH Mode					
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)		
20	DH5	151.31	400ms		
	π/4 DQPSK (2Mbps) for Mode				
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)		
20	DH5	151.31	400ms		
8-DPSK (3Mbps) for AFH Mode					
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)		
20	DH5	151.31	400ms		

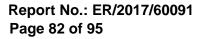
#### GFSK (1Mbps):

DH5 time sl =	2.837	(ms)	*	(800/6/20)	* 8 =	151.31	(ms)
π/4 -DQPSK (2Mbps							
2DH5 time :=	2.837	(ms)	*	(800/6/20)	* 8 =	151.31	(ms)
8-DPSK (3Mbps):							
3DH5 time :=	2.837	(ms)	*	(800/6/20)	* 8 =	151.31	(ms)

#### **13.6 Measurement Result**

Note: Refer to next page for plots.

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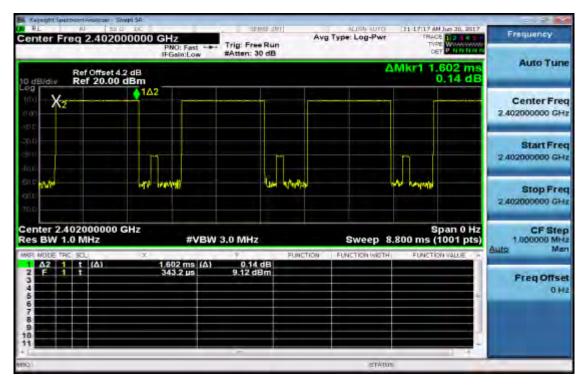




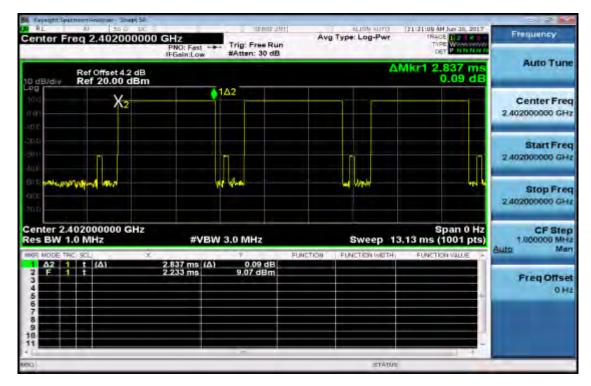
# CH-Low DH1

enter Fre	eq 2.4020000	00 GHz PNO: Fast IFGain:Low		Ava Type: Log-Pwr 1	5 AM Jun 3D, 2017 NAGE 1 2 3 4 3 TYPE WARMAN	Frequency				
dB/div	Ref Offset 4.2 dB 0.54 dB 0.54 dB									
X2	1Δ2					Center Fre 2.402000000 GH				
						Start Fre 2.402000000 GH				
	without large	-wayyaya	bandal hadmoudand	ปละพุม จะและพุมษกม	Hand	Stop Fre 2.402000000 GH				
es BW 1.			BW 3.0 MHz	Sweep 4.467 m		CF Ste 1.000000 Mit Auto Mi				
R MODE TRIC A2 1 2 F 1 3 4 5 6	t (A)	× 366.3 µs ( 80.40 µs		NUCTION FUNCTION WOTH FUN	CTION VALUE	Freq Offs 01				

#### DH3

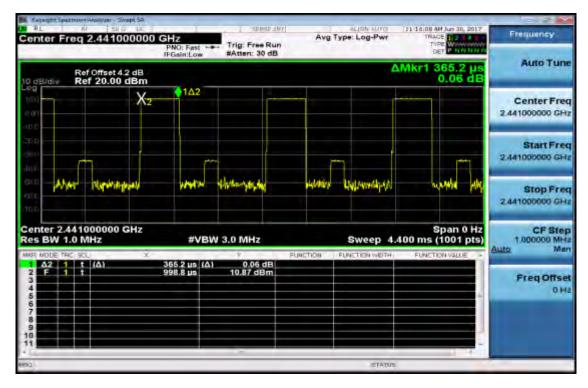




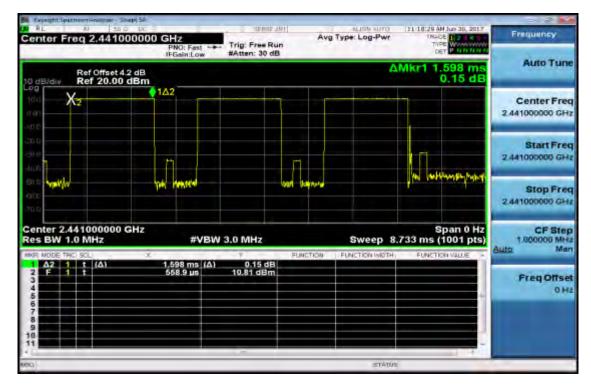


# CH-Mid

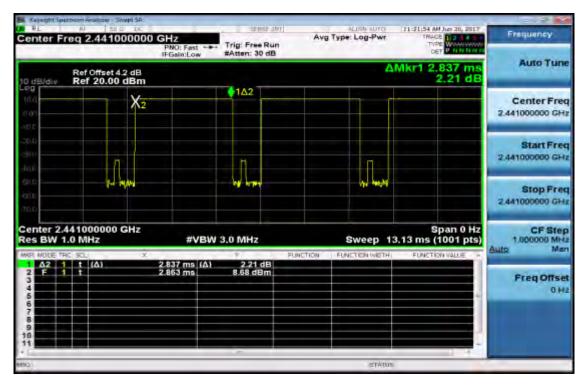
DH1







#### DH5

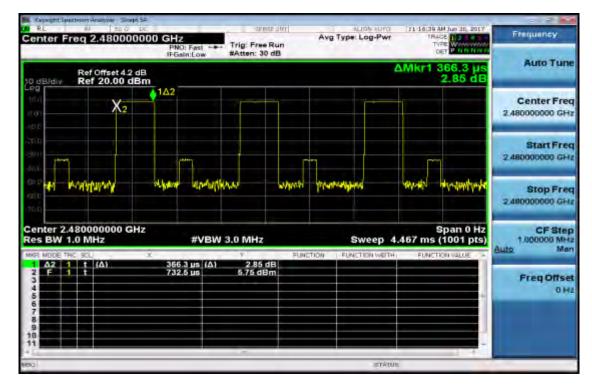


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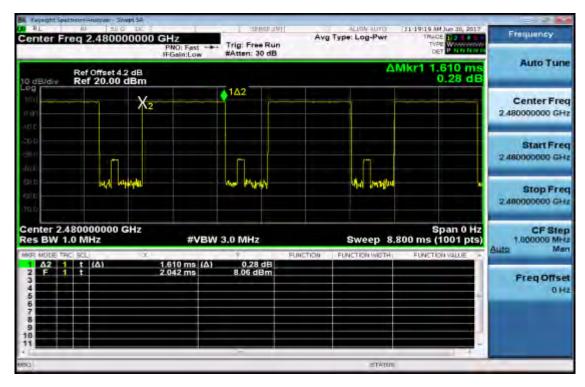
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# CH-High DH1



#### DH3





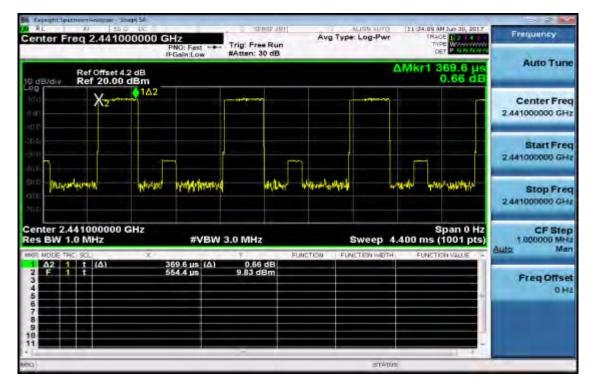
R Russepht Span	atesters - Strapt S					312 1			
11.00	eq 2.480000		Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr	11:22:37 AM Jue 30, 2017 TRACE 1, 2, 3, 4, 5, 7 TYPE WOMMANN OFT P. N.N. 1411 N	Frequency			
10 dB/div	Ref Offset 4.2 dB ΔMkr1 2.837 ms								
	X <sub>2</sub>		142			Center Fre 2.480000000 GH			
-20-0 -20-0 -30-0 -40-0	n		n	n		Start Free 2.480000000 GH			
E0.0 e0.0 70.0	tal lunue		hal have	- d boy		Stop Fre 2.480000000 GH			
Res BW 1		#VBW	3.0 MHz		Span 0 Hz 3.13 ms (1001 pts)	CF Step 1.000000 MH			
2 F 1 34 56 7	t (A)	2.837 ms (Δ) 2.548 ms	0.50 dB 7.92 dBm	ALETYDA I FLIVETKON WETH,	FUNCTION VALUE	Freq Offse 0 H			
8 9 10 11			-	erátus					

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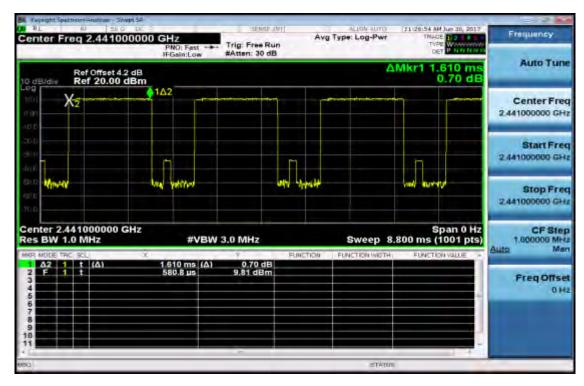
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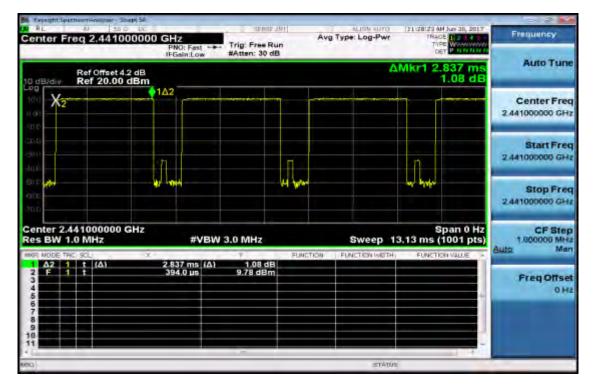
# CH-Mid 2DH1



## 2DH3





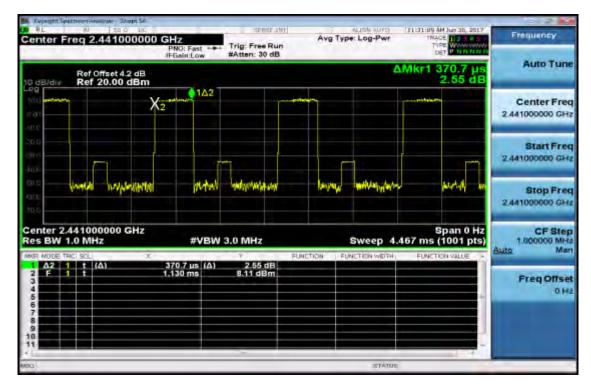


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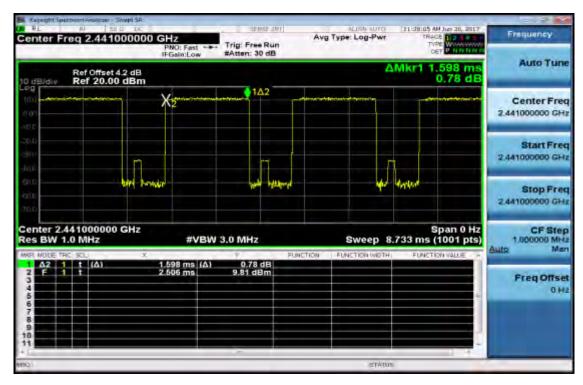
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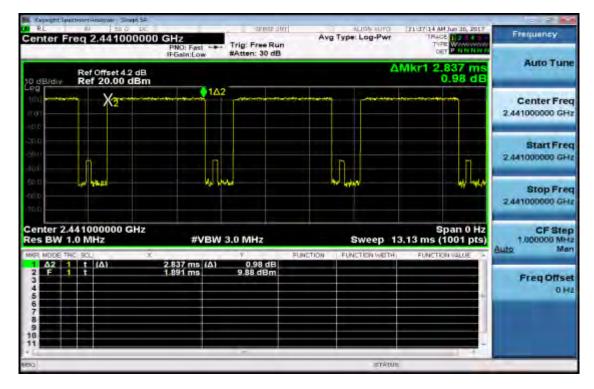
# CH-Mid **3DH1**



## 3DH3







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# **14 ANTENNA REQUIREMENT**

#### 14.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

#### 14.2 Antenna Connected Construction

An embedded-in antenna design is used.

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

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# PHOTOGRAPHS OF SET UP Radiated Emission Set up Photos (Below 1GHz)





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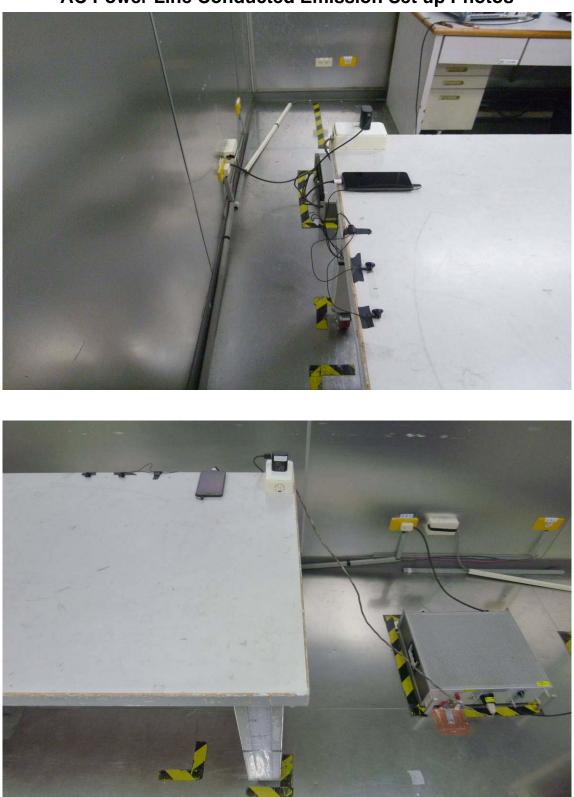
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# Radiated Emission Set up Photos (Above 1GHz)





#### **AC Power Line Conducted Emission Set up Photos**

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# **Conducted Setup Photo (Measurement at Antenna Port)**

# PHOTOGRAPHS OF EUT

Please refer to the attached file(EUT Photo)

~ End of Report ~