

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS 247 CLASS II & IV PC REPORT

OF

Applicant: Qualcomm Atheros, Inc.
1700 Technology Drive, San Jose, CA 95110

Product Name: 802.11a/b/g/n/ac + BT4.1 M.2 2230 Type Card

Brand Name: Qualcomm Atheros

Model No.: QCNFA344A

Model Difference: N/A

Report Number: E2/2020/10010

FCC Rule Part: §15.247, Cat: DSS

IC RSS: RSS-247 issue 2 Feb 2017

Issue Date: Mar. 10, 2020

Date of Test: Jan. 14, 2020 ~ Mar. 04, 2020

Date of EUT Received: Jan. 14, 2020

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.

Approved By:

CHUN-CHIEH, CHEN

Chun Chieh Chen / Supervisor



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Revision History

Report Number	Revision	Description	Issue Date	Remark
E2/2020/10010	Rev.00	Original.	Mar. 10, 2020	Revised By: Susan Lin

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1 GENERAL INFORMATION

1.1 Product description

Product Name of Host:	Notebook Computer	
Brand Name of Host:		
Marketing Name of Host:	SF314-42	
Model No. of Host:	N19C4	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Model No. of BT/WLAN Module:	QCNFA344A	
Scope:	The test report covers the radiated emissions requirements of the standards referenced in the report to allow system level approval of the module in this specific host.	
Class II & Class IV Permissive change:	802.11a/b/g/n/ac + BT4.1 M.2 2230 Type Card INSTALLED IN Notebook Computer	
Power Supply:	11.25Vdc from Rechargeable Li-ion Battery Pack or 19V by AC/DC Power Adapter	
	Battery:	Model No.: AP18C8K, Supplier: acer
	Adapter:	Model No.: A18-065N3A, Supplier: Chicony

Radio Technology:	Bluetooth BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + π/4DQPSK + 8DPSK
Antenna Designation:	PIFA Antenna, Supplier: Wistron Neweb Corporation, Part No.: 81EABA15.GA3 (DC33002EG20) (Aux) Peak Gain: -2.26dBi
Rated Power (Peak) / EIRP:	7.01dBm 5.86dBm (EIRP)
Type of Emission:	1M23F1D
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	≤ 0.4s

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
KDB 558074 D01 v05r02 DSS Meas. Guidance
RSS-247 issue 2 Feb. 2017
RSS-Gen. issue 5, Amendment 1, March 2019
ANSI C63.10:2013

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory (TAF code 0513)
No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: TW0002

ISED CAB identifier: TW0513

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.

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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 placed on a table which is 0.8 m above ground plane. 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. The two LISNs provide 50uH/50 ohm 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 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. 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 transmitter (EUT) was rotated through three orthogonal axes 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.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission



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

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.247(b)(1)	RSS-247 §5.4 b	Peak Output Power	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10	Radiated Band Edge and Spurious Emission	Compliant
§15.203	N/A	Antenna Requirement	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 d	Time of Occupancy	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2402 MHz	21	2422 MHz	41	2442 MHz	71	2462 MHz
2	2403 MHz	22	2423 MHz	42	2443 MHz	72	2463 MHz
3	2404 MHz	23	2424 MHz	43	2444 MHz	73	2464 MHz
4	2405 MHz	24	2425 MHz	44	2445 MHz	74	2465 MHz
5	2406 MHz	25	2426 MHz	45	2446 MHz	75	2466 MHz
6	2407 MHz	26	2427 MHz	46	2447 MHz	76	2467 MHz
7	2408 MHz	27	2428 MHz	47	2448 MHz	77	2468 MHz
8	2409 MHz	28	2429 MHz	48	2449 MHz	78	2469 MHz
9	2410 MHz	29	2430 MHz	49	2450 MHz	79	2470 MHz
10	2411 MHz	30	2431 MHz	50	2451 MHz	70	2471 MHz
11	2412 MHz	31	2432 MHz	51	2452 MHz	71	2472 MHz
12	2413 MHz	32	2433 MHz	52	2453 MHz	72	2473 MHz
13	2414 MHz	33	2434 MHz	53	2454 MHz	73	2474 MHz
14	2415 MHz	34	2435 MHz	54	2455 MHz	74	2475 MHz
15	2416 MHz	35	2436 MHz	55	2456 MHz	75	2476 MHz
16	2417 MHz	36	2437 MHz	56	2457 MHz	76	2477 MHz
17	2418 MHz	37	2438 MHz	57	2458 MHz	77	2478 MHz
18	2419 MHz	38	2439 MHz	58	2459 MHz	78	2479 MHz
19	2420 MHz	39	2440 MHz	59	2460 MHz	79	2480 MHz
20	2421 MHz	40	2441 MHz	60	2461 MHz		

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4.2 The Worst Test Modes and Channel Details

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

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	PACKET TYPE
RADIATED EMISSION TEST (ABOVE 1 GHz)				
Bluetooth	2402 to 2480	2402, 2441, 2480	GFSK	DH5

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				
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	PACKET TYPE
Peak Output Power,				
Bluetooth	2402 to 2480	2402, 2441, 2480	GFSK, $\pi/4$ -DQPSK, 8-DQPK	DH1/DH3/DH5
Time of Occupancy (Dwell time)				
Bluetooth	2402 to 2480	2402, 2441, 2480	GFSK, $\pi/4$ -DQPSK, 8-DQPK	DH1/DH3/DH5

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5 MEASUREMENT UNCERTAINTY

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 Measurement Uncertainty	
Polarization: Vertical	9kHz~30MHz: +/- 2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +/- 2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 PEAK OUTPUT POWER MEASUREMENT

6.1 Standard Applicable

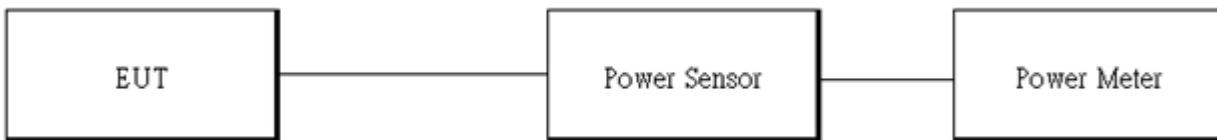
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

The e.i.r.p. shall not exceed 4 W.

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/06/2019	03/05/2020
Power Meter	Anritsu	ML2496A	1326001	08/05/2019	08/04/2020
DC Block	PASTERNACK	PE8210	RF256	11/20/2019	11/19/2020
Coaxial Cables	Woken	00100A1F1A185C	RF230	11/20/2019	11/19/2020

6.3 Test Set-up:



6.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 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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6.5 Peak & Average Power Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.38	3.451	125
Mid	2441	5.35	3.428	125
High	2480	5.98	3.963	125

1M BR mode (Average):

CH	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.30	3.385	125
Mid	2441	5.27	3.361	125
High	2480	5.86	3.850	125

2M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6.35	4.315	125
Mid	2441	6.84	4.831	125
High	2480	7.01	5.023	125

2M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	4.86	3.059	125
Mid	2441	5.05	3.195	125
High	2480	5.09	3.225	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6.45	4.416	125
Mid	2441	6.91	4.909	125
High	2480	6.97	4.977	125

3M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	4.70	2.948	125
Mid	2441	5.05	3.195	125
High	2480	5.01	3.166	125

NOTE: cable loss as 0dB that offsets in the spectrum

*Note: Max. Output include tune up tolerance Power measured by using average detector.

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6.6 EIRP Measurement Result

1M BR mode EIRP

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	5.30	-2.26	2.011	4000
Mid	2441	5.27	-2.26	1.998	4000
High	2480	5.86	-2.26	2.288	4000

2M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	4.86	-2.26	1.818	4000
Mid	2441	5.05	-2.26	1.899	4000
High	2480	5.09	-2.26	1.917	4000

3M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	4.70	-2.26	1.752	4000
Mid	2441	5.05	-2.26	1.899	4000
High	2480	5.01	-2.26	1.882	4000

* Note: EIRP = Average Power + Gain

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7 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

7.1 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 μ V/m) = 20 log Emission level (dB μ V/m)

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7.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	11/04/2019	11/03/2020
Horn Antenna	Schwarzbeck	BBHA9170	185	08/07/2019	08/06/2020
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/12/2019	06/11/2020
Loop Antenna	ETS.LINDGREN	6502	143303	04/25/2019	04/24/2020
3m Site NSA	SGS	966 chamber D	N/A	07/12/2019	07/11/2020
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
Pre-Amplifier	EMC Instruments	EMC184045B	980135	11/20/2019	11/19/2020
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/20/2019	11/19/2020
Pre-Amplifier	EMC Instruments	EMC12630SE	980271	11/20/2019	11/19/2020
Attenuator	Woken	WATT-218FS-10	RF25	11/20/2019	11/19/2020
High Pass Filter	R&S	F13 HPF 3GHz	RF64	11/20/2019	11/19/2020
Low Pass Filter	EWT	EWT-56-0019	RF46	11/20/2019	11/19/2020
Notch Filter	EWT	EWT-54-0038	RF55	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/20/2019	11/19/2020

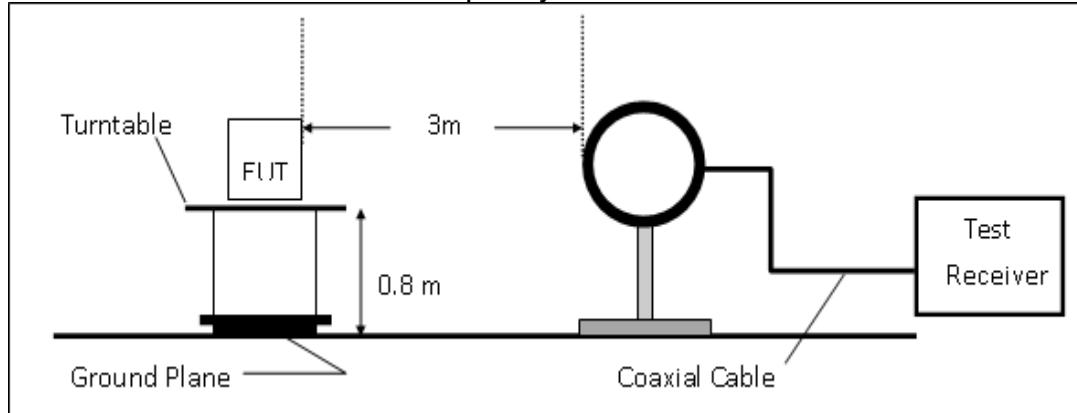
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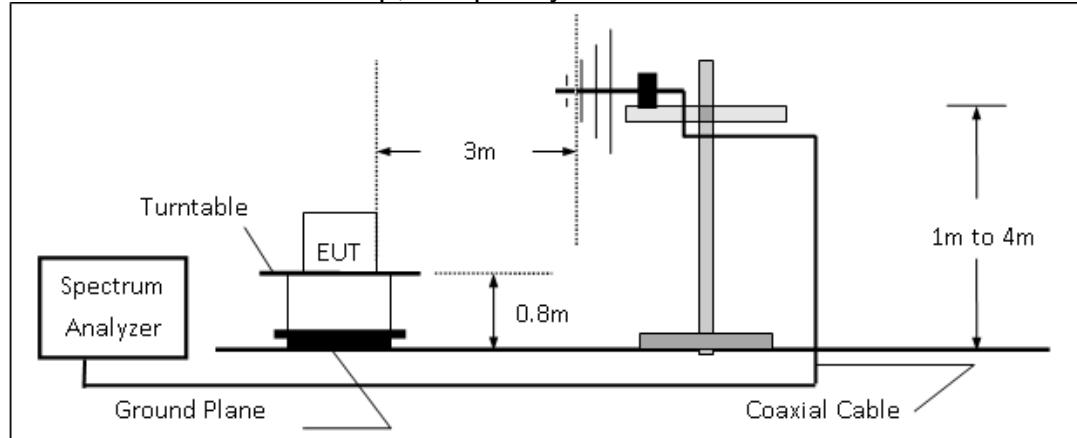
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7.3 Test SET-UP

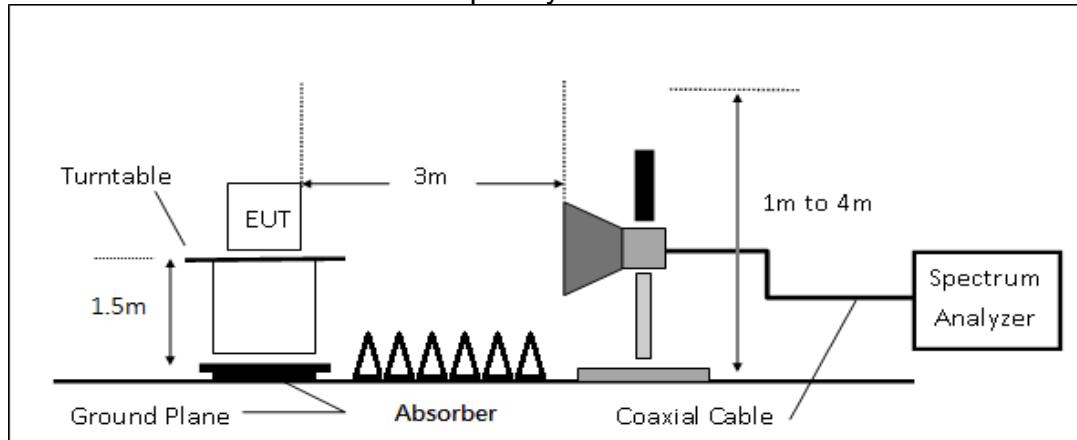
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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7.4 Measurement Procedure

7.4.1 Radiated Emission

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m 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. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW \geq 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. 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.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

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7.5 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 $dB\mu V/m$, which converts $20 * \log(\mu V/m)$

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

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

7.6 Test Results of Radiated Spurious Emissions from 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) & RSS-GEN §6.13.2 was not reported.

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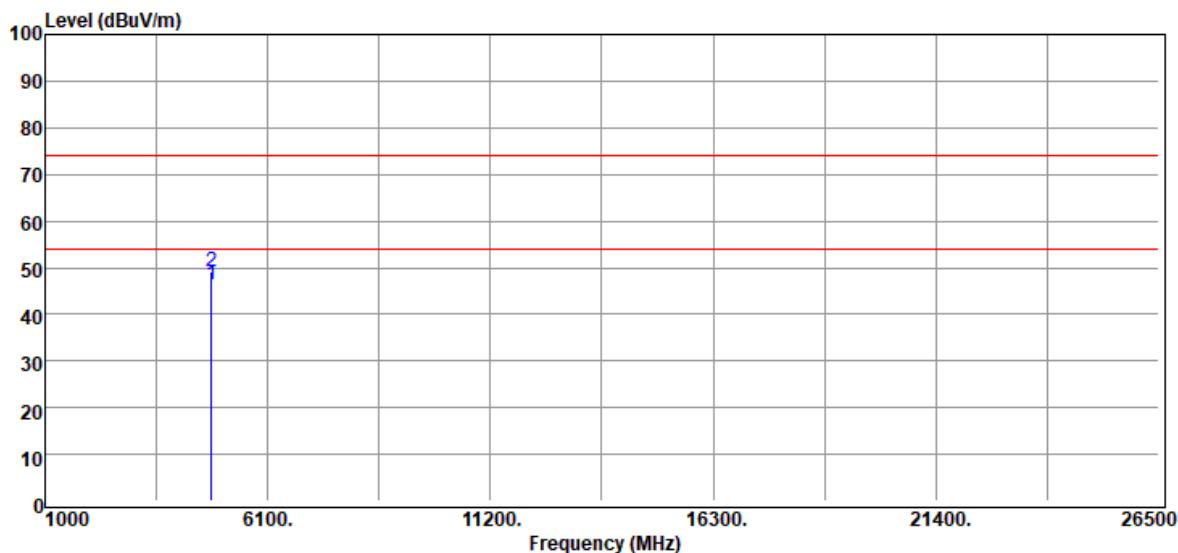
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7.7 Measurement Result:

7.7.1 Radiated Spurious Emission above 1 GHz:

Report Number	:E2/2020/10010	Test Date	:2020-01-14
Operation Mode	:BT BR	Temp./Humi.	:20.4/63
Test Channel	:2402 MHz	Antenna Pol.	:VERTICAL
Test Mode	:TX CH LOW	Engineer	:Kailin
EUT Pol	:E2 Plan		



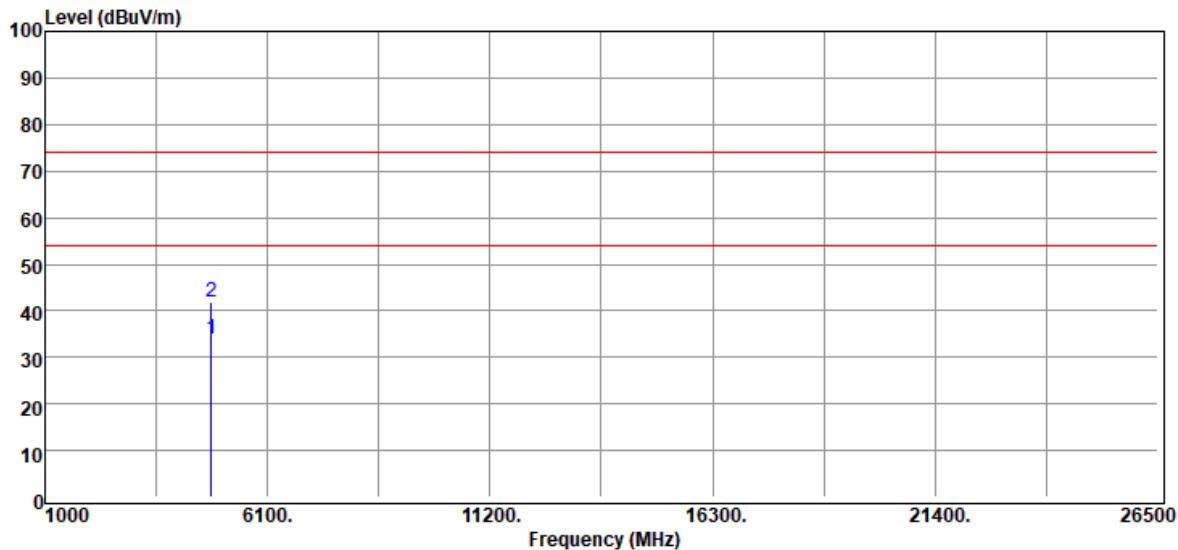
Freq. MHz	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit	Margin dB
				FS dB μ V/m	@3m dB μ V/m	
4804.00	Average	46.65	-0.35	46.30	54.00	-7.70
4804.00	Peak	49.42	-0.35	49.07	74.00	-24.93

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Report Number :E2/2020/10010 Test Date :2020-01-14
 Operation Mode :BT BR Temp./Humi. :20.4/63
 Test Channel :2402 MHz Antenna Pol. :HORIZONTAL
 Test Mode :TX CH LOW Engineer :Kailin
 EUT Pol :E2 Plan



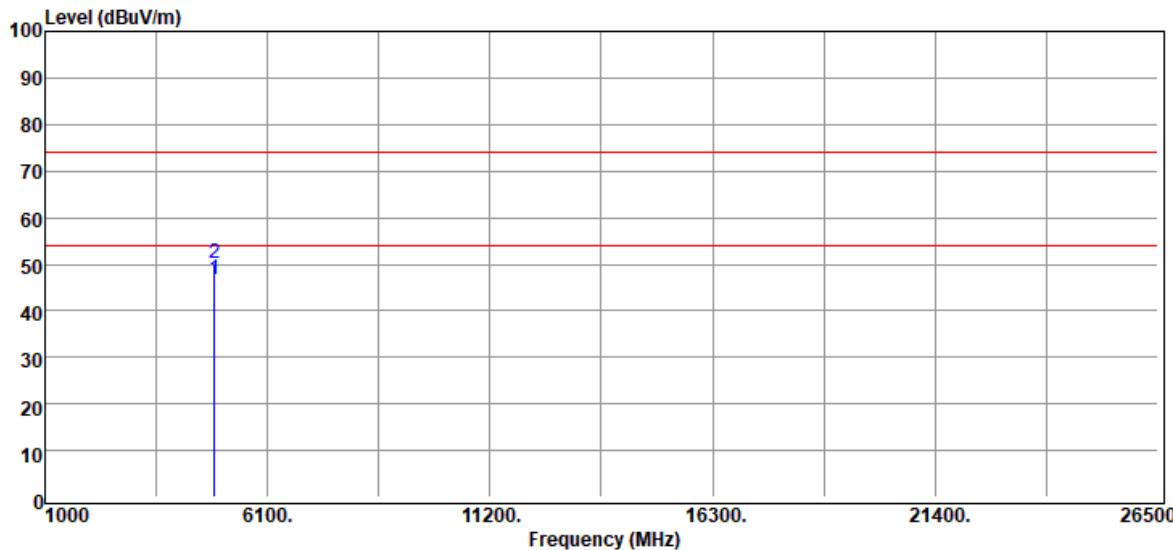
Freq. MHz	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
		dB μ V		FS dB μ V/m	@3m dB μ V/m	dB
4804.00	Average	34.39	-0.35	34.04	54.00	-19.96
4804.00	Peak	42.07	-0.35	41.72	74.00	-32.28

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Report Number :E2/2020/10010 Test Date :2020-01-14
 Operation Mode :BT BR Temp./Humi. :20.4/63
 Test Channel :2441 MHz Antenna Pol. :VERTICAL
 Test Mode :TX CH MID Engineer :Kailin
 EUT Pol :E2 Plan



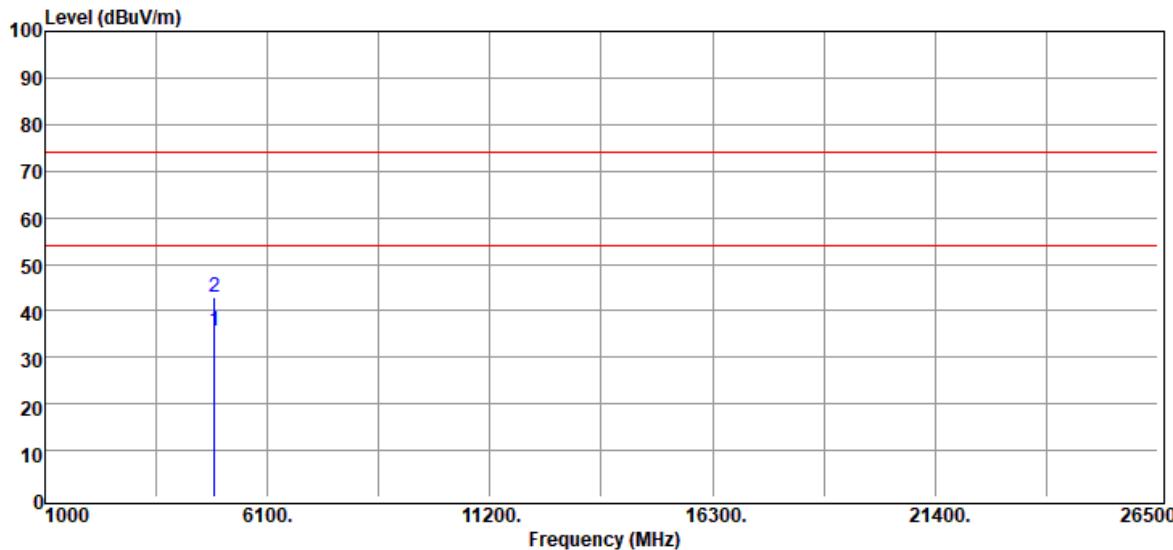
Freq. MHz	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
		dB μ V		FS dB μ V/m	@3m dB μ V/m	dB
4882.00	Average	47.19	-0.44	46.75	54.00	-7.25
4882.00	Peak	50.45	-0.44	50.01	74.00	-23.99

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Report Number :E2/2020/10010 Test Date :2020-01-14
 Operation Mode :BT BR Temp./Humi. :20.4/63
 Test Channel :2441 MHz Antenna Pol. :HORIZONTAL
 Test Mode :TX CH MID Engineer :Kailin
 EUT Pol :E2 Plan



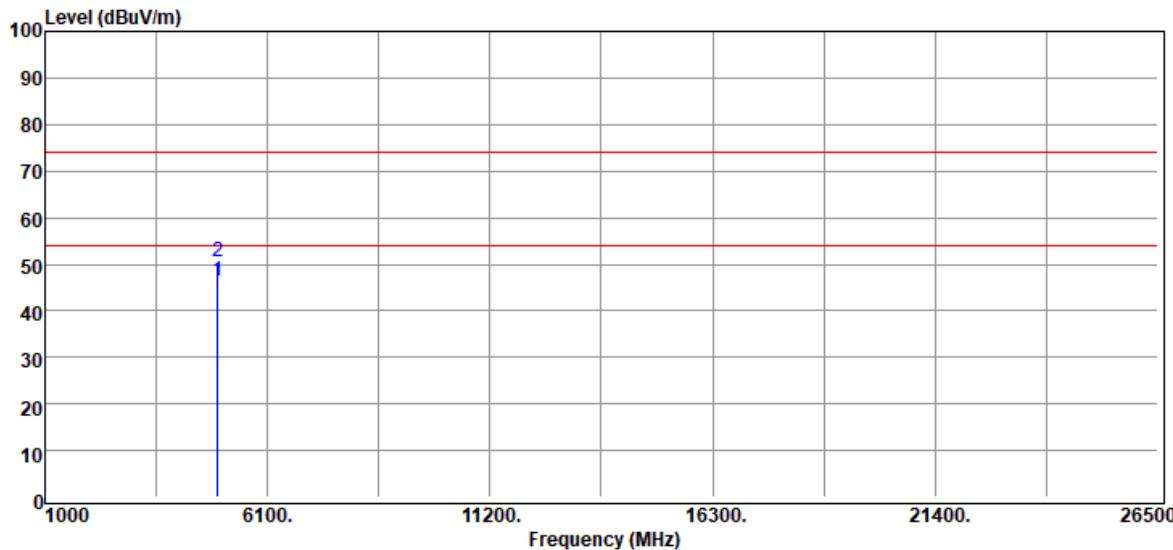
Freq. MHz	Detector Mode	Spectrum Reading	Factor dB	Actual FS	Limit @3m	Margin
		PK/QP/AV		dB μ V	dB μ V/m	dB
4882.00	Average	36.23	-0.44	35.79	54.00	-18.21
4882.00	Peak	43.45	-0.44	43.01	74.00	-30.99

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Report Number :E2/2020/10010
 Operation Mode :BT BR
 Test Channel :2480 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plan
 Test Date :2020-01-14
 Temp./Humi. :20.4/63
 Antenna Pol. :VERTICAL
 Engineer :Kailin

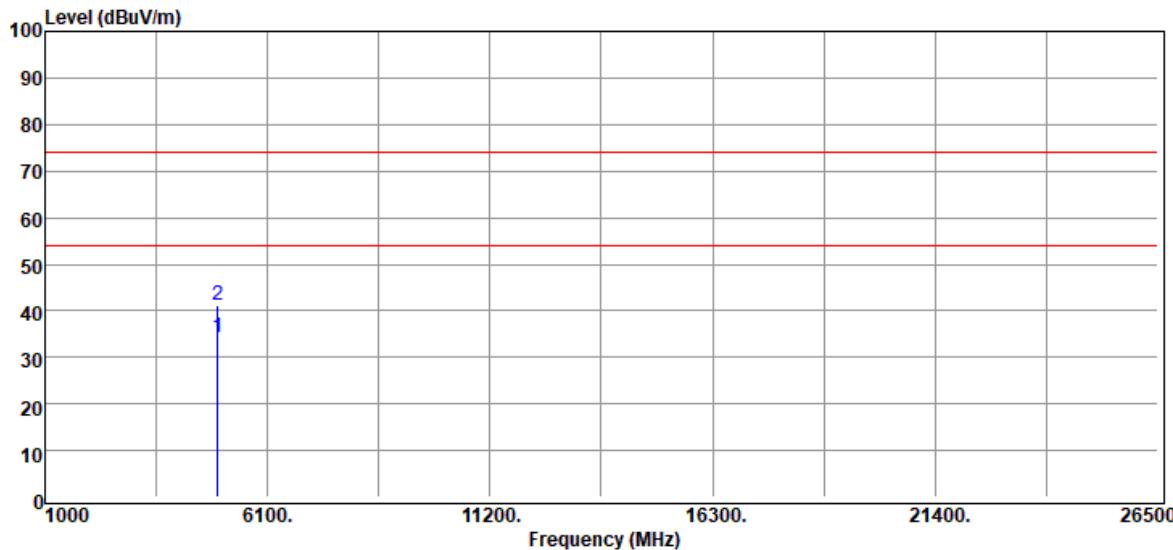


Freq. MHz	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
		PK/QP/AV		FS dB μ V/m	@3m dB μ V/m	dB
4960.00	Average	47.26	-0.75	46.51	54.00	-7.49
4960.00	Peak	51.20	-0.75	50.45	74.00	-23.55

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Report Number :E2/2020/10010 Test Date :2020-01-14
 Operation Mode :BT BR Temp./Humi. :20.4/63
 Test Channel :2480 MHz Antenna Pol. :HORIZONTAL
 Test Mode :TX CH HIGH Engineer :Kailin
 EUT Pol :E2 Plan



Freq. MHz	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
		dB μ V		FS dB μ V/m	@3m dB μ V/m	dB
4960.00	Average	35.03	-0.75	34.28	54.00	-19.72
4960.00	Peak	41.95	-0.75	41.20	74.00	-32.80

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8 TIME OF OCCUPANCY (DWELL TIME)

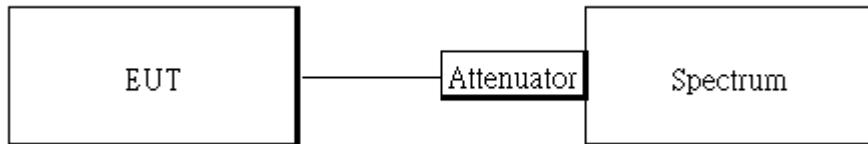
8.1 Standard Applicable

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.

8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/06/2019	03/05/2020
Power Meter	Anritsu	ML2496A	1326001	08/05/2019	08/04/2020
DC Block	PASTERNAK	PE8210	RF256	11/20/2019	11/19/2020
Coaxial Cables	Woken	00100A1F1A185C	RF230	11/20/2019	11/19/2020

8.3 Test Set-up



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8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C6310:2015.
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.

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8.5 Tabular Result of the Measurement

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Low	DH1	121.92	400ms	2.625	3.00
	DH3	262.08	400ms	0.611	1.00
	DH5	307.20	400ms	0.347	1.00
Mid	DH1	121.86	400ms	2.626	3.00
	DH3	261.12	400ms	0.613	1.00
	DH5	307.20	400ms	0.347	1.00
High	DH1	120.83	400ms	2.648	3.00
	DH3	261.12	400ms	0.613	1.00
	DH5	307.20	400ms	0.003	1.00

$\pi/4$ DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Mid	2DH1	123.84	400ms	2.584	3.00
	2DH3	262.08	400ms	0.611	1.00
	2DH5	307.20	400ms	0.347	1.00

8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Mid	3DH1	122.88	400ms	2.604	3.00
	3DH3	262.08	400ms	0.611	1.00
	3DH5	308.27	400ms	0.346	1.00

NOTE: cable loss as 0dB that offsets in the spectrum

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GFSK (1Mbps):

CH Low	DH1 time slot	=	0.381	*	(1600/2/79)	*	31.6	=	121.92	(ms)
	DH3 time slot	=	1.638	*	(1600/4/79)	*	31.6	=	262.08	(ms)
	DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)
CH Mid	DH1 time slot	=	0.381	*	(1600/2/79)	*	31.6	=	121.86	(ms)
	DH3 time slot	=	1.632	*	(1600/4/79)	*	31.6	=	261.12	(ms)
	DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)
CH High	DH1 time slot	=	0.378	*	(1600/2/79)	*	31.6	=	120.83	(ms)
	DH3 time slot	=	1.632	*	(1600/4/79)	*	31.6	=	261.12	(ms)
	DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)

$\pi/4$ -DQPSK (2Mbps):

CH Mid	2DH1 time slot	=	0.387	*	(1600/2/79)	*	31.6	=	123.84	(ms)
	2DH3 time slot	=	1.638	*	(1600/4/79)	*	31.6	=	262.08	(ms)
	2DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)

8-DPSK (3Mbps):

CH Mid	3DH1 time slot	=	0.384	*	(1600/2/79)	*	31.6	=	122.88	(ms)
	3DH3 time slot	=	1.638	*	(1600/4/79)	*	31.6	=	262.08	(ms)
	3DH5 time slot	=	2.890	*	(1600/6/79)	*	31.6	=	308.27	(ms)

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

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GFSK (1Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	DH5	153.60	400ms
$\pi/4$ DQPSK (2Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	2DH5	153.60	400ms
8-DPSK (3Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	3DH5	154.13	400ms

8.6 Measurement Result

Note: Refer to next page for plots.

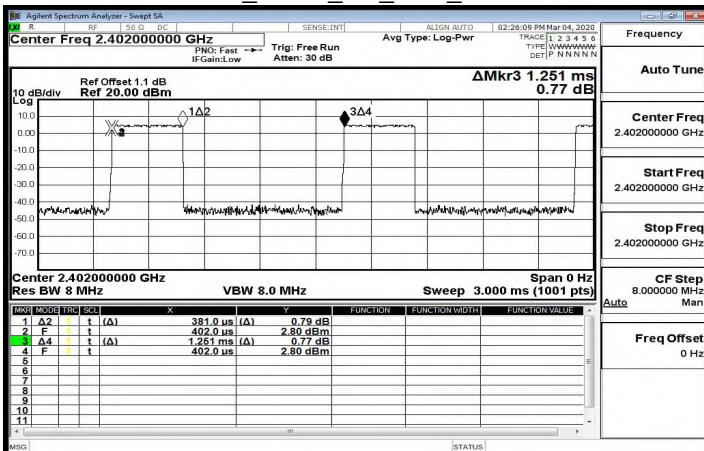
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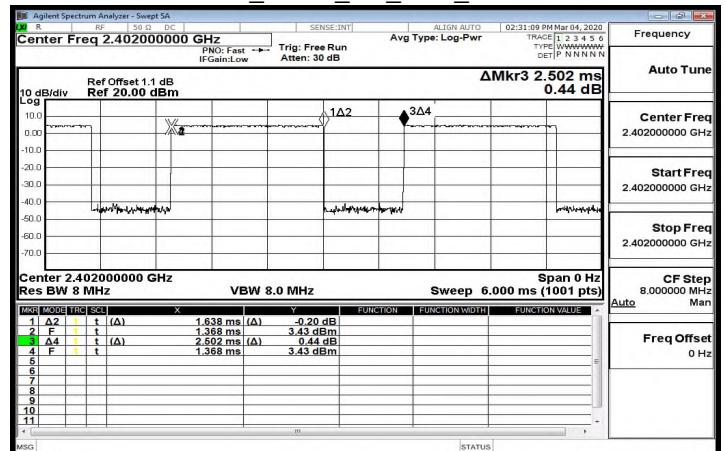
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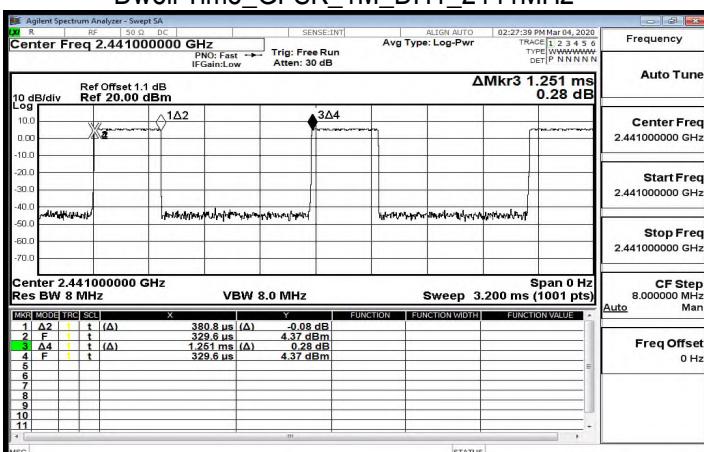
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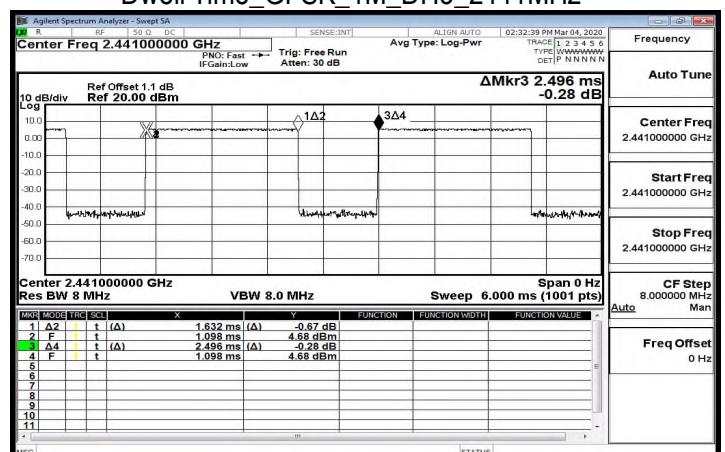
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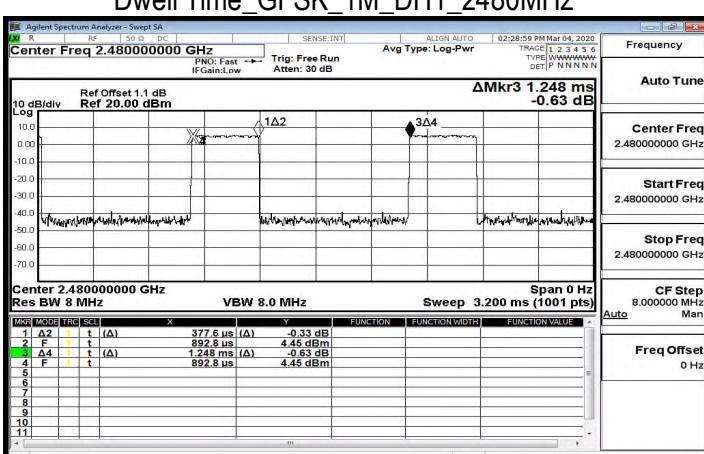
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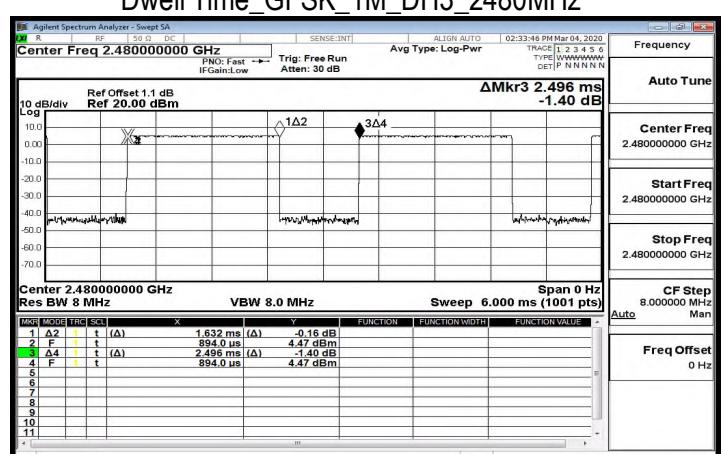
Dwell Time_GFSK_1M_DH3_2441MHz



Dwell Time_GFSK_1M_DH1_2480MHz



Dwell Time_GFSK_1M_DH3_2480MHz



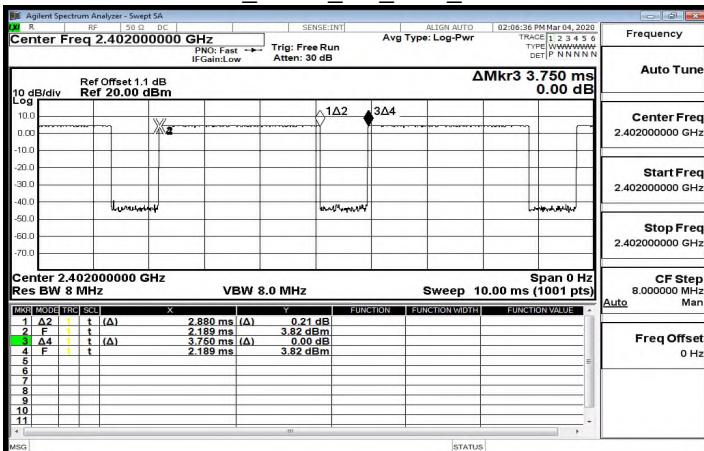
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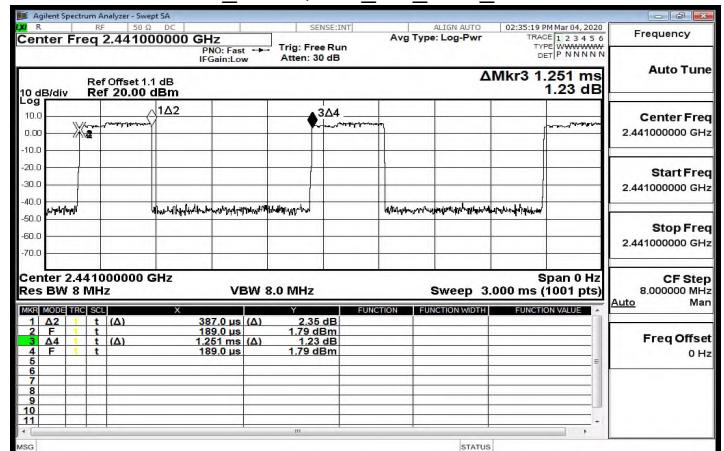
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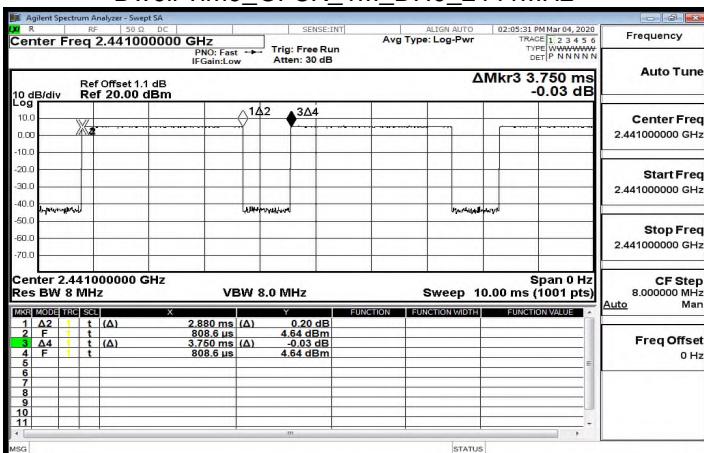
Dwell Time_GFSK_1M_DH5_2402MHz



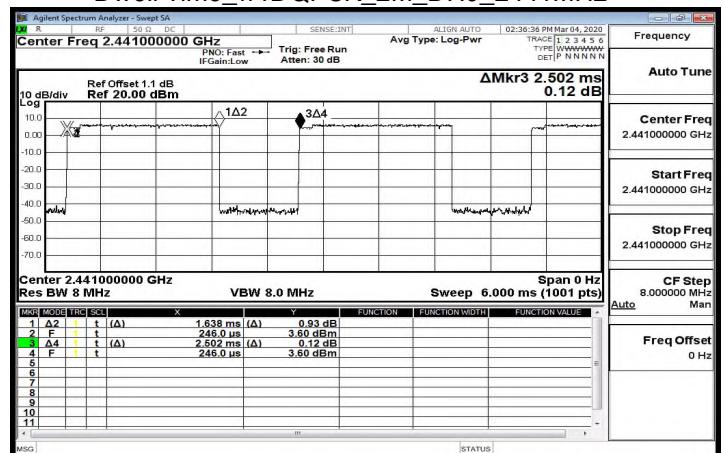
Dwell Time_π4DQPSK_2M_DH1_2441MHz



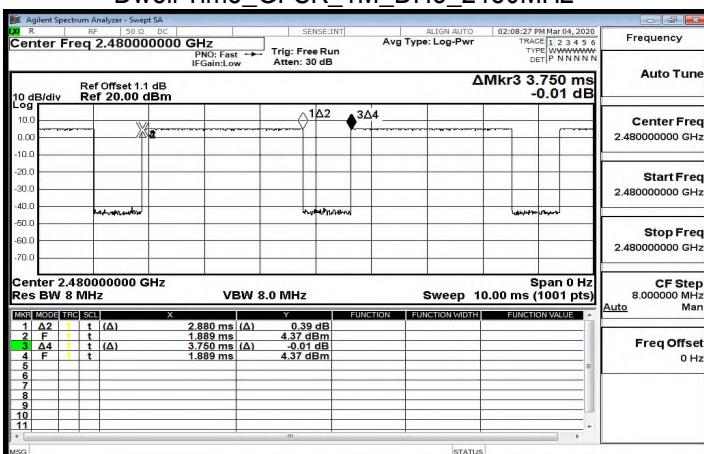
Dwell Time_GFSK_1M_DH5_2441MHz



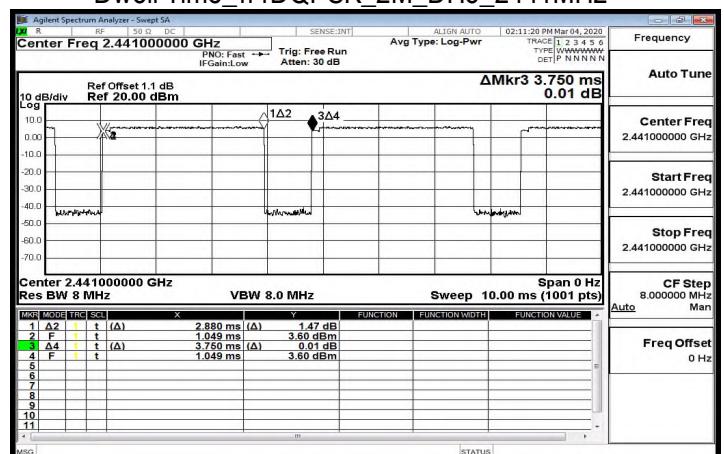
Dwell Time_π4DQPSK_2M_DH3_2441MHz



Dwell Time_GFSK_1M_DH5_2480MHz



Dwell Time_π4DQPSK_2M_DH5_2441MHz

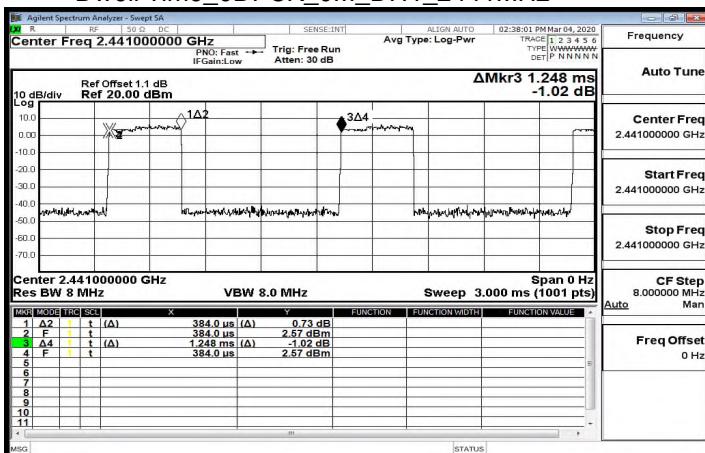


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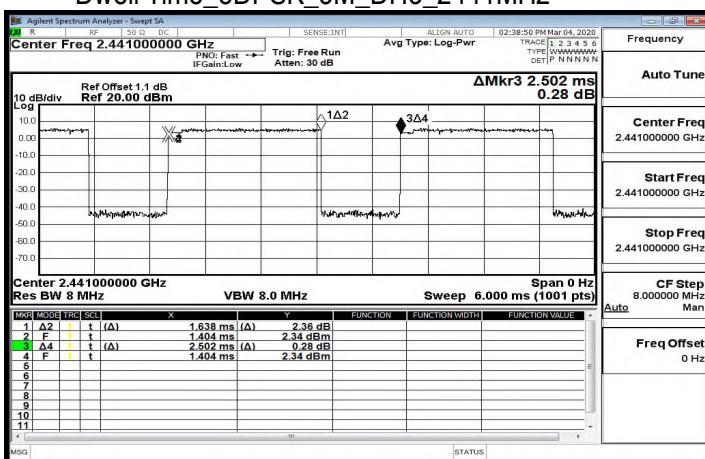
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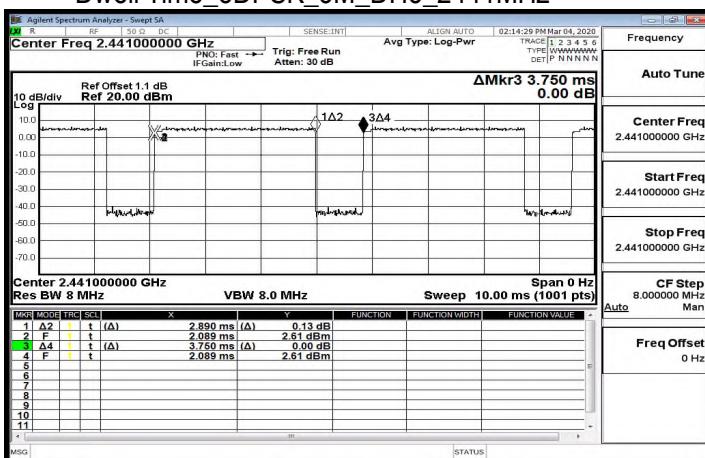
Dwell Time_8DPSK_3M_DH1_2441MHz



Dwell Time_8DPSK_3M_DH3_2441MHz



Dwell Time_8DPSK_3M_DH5_2441MHz



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9 ANTENNA REQUIREMENT

9.1 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.

9.2 Antenna Connected Construction

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

~ End of Report ~

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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