ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS 210 CLASS II PC REPORT

OF

Product Name:	**PCIE 802.11a/b/g/n 2.4GHz/5GHz +USB BT 4.0card**
Brand Name:	**Qualcomm Atheros**
Model No.:	**QCNFA222**
Model Difference:	**N/A**
FCC ID:	**PPD-QCNFA222**
IC:	**4104A-QCNFA222**
Report No.:	**E2/2014/90018**
Issue Date:	**Dec. 09, 2014**
FCC Rule Part:	**§15.247, Cat: DSS**
IC Rule Part:	**RSS-210 issue 8 :2010, Annex 8**
Prepared for:	**Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110**
Prepared by:	**SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333**

Testing Laboratory
0513

VERIFICATION OF COMPLIANCE

Applicant:	Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110
Product Name:	PCIE 802.11a/b/g/n 2.4GHz/5GHz +USB BT 4.0card
Brand Name:	Qualcomm Atheros
Model No.:	QCNFA222
Model Difference:	N/A
FCC ID:	PPD-QCNFA222
IC:	4104A-QCNFA222
File Number:	E2/2014/90018
Date of test:	Sep. 15, 2014 ~ Dec. 09, 2014
Date of EUT Received:	Dec. 09, 2014

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 C63.4:2009 and RSS-Gen. issue 3 the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247 and IC RSS 210 issue 8: 2010 Annex 8.
The test results of this report relate only to the tested sample identified in this report.

Test By:	Jazz Huang	***Date:***	Dec. 09, 2014
	Jazz Huang / Sr. Engineer		
Prepared By:	Tiffany Kao	***Date:***	Dec. 09, 2014
	Tiffany Kao / Clerk		
Approved By:	Jim Chang	***Date:***	Dec. 09, 2014
	Jim Chang / Supervisor		

Version

Version No.	Date	Description
00	Dec. 09, 2014	Initial creation of document

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1. GENERAL INFORMATION

1.1. Product description

General Information of Notebook:

Product Name:	Notebook
Brand Name:	acer
Model No.:	MS2398
Model Difference:	N/A
Hardware Version:	ENG phase
Software Version:	N/A
Model No. for BT/WLAN Module:	QCNFA222
Module FCC ID:	PPD-QCNFA222
Module IC:	4104A-QCNFA222
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 Permissive change:	PCIE 802.11a/b/g/n 2.4GHz/5GHz +USB BT 4.0card (QCNFA222) INSTALLED IN AN Tablet Computer
Power Supply:	11.4Vdc Rechargeable Li-polymer battery pack or 19Vdc from AC/DC adapter
	Battery: Model No.: AC14C8I, Supplier: acer
	Adapter: Model No.: A13-045N2A, Supplier: CHICONY

Bluetooth:

Bluetooth Version	V3.0+HS
Frequency Range	2402 – 2480MHz
Channel number	79 channels max.
Rated Power	6.21dBm (Peak)
Modulation type	GFSK + π/4DQPSK + 8DPSK
Antenna Designation:	PIFA Antenna, Antenna Main: 2.36dBi
Type of Emission:	1M23F1D

The EUT is compliance with Bluetooth V3.0+HS standard.

This test report applies for Bluetooth function.

1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: PPD-QCNFA222** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and **IC: 4104A-QCNFA222** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8. The composite system (digital device) is compliance with FCC part 15; Subpart B is authorized under the doc procedure.

1.3. Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2009. Radiated testing was performed at an antenna to EUT distance 3 meters. Tested in accordance with FCC Public Notice DA 00-705 – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333 which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. FCC Registration Number is: 990257. Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

1.5. Special Accessories

There is no special accessory used while test was conducted.

1.6. Equipment Modifications

There was no modification incorporated into the EUT.

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

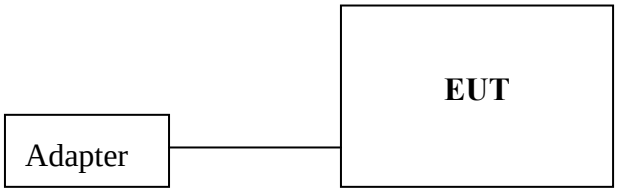
The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. 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 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 according to the requirements in Section 8 and 13 and of ANSI C63.4:2009 and DA 00-705.

2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration



Remote Side

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 Test Set	Anritsu	MT8852B	6k00006107	N/A	N/A

3. SUMMARY OF TEST RESULTS

FCC/IC Rules	Description Of Test	Result
§15.247(b)(1) RSS-210 issue 8,§A8.4(2)	Peak Output Power	Compliant
$15.247(d) §15.209(a) (f) RSS-Gen §7.2.5 RSS-210 issue 8,§A8.5	Spurious Emission	Compliant
§15.203, RSS- Gen issue §7.1.2	Antenna Requirement	Compliant

4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel Low, Mid and High with highest rated data rate were chosen as worst case for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case E2 position was reported.

Channel Low: channel 1 at 2402MHz
Channel Mid: channel 39 at 2441MHz
Channel High: channel 78 at 2480MHz

In comparison with BR and EDR mode, emission carried out by EDR is chosen as the most representative measurement to perform measurement of radiated spurious emission pursuant to Part 15C of 2480MHz. Modulation, EDR, is selected to be performed for 100 kHz Bandwidth Band Edge, due to its characteristics of wider bandwidth.

Data type being used to conduct the measurement:
DH1/DH3/DH5 (GFSK) with 1Mbps
2DH1/2DH3/2DH5 (Π/4 DQPSK) with 2Mbps
3DH1/3DH3/3DH5 (8DPSK) with 3Mbps

5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55 dB
20dB Bandwidth & 99% Power Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

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

Measurement uncertainty (Polarization : **Horizontal**)	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.

6. PEAK OUTPUT POWER MEASUREMENT

6.1. Standard Applicable

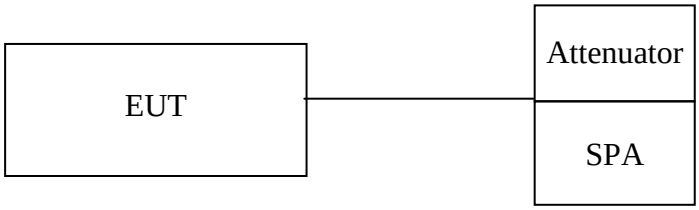
According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts.

According to RSS-210 issue 8,§A8.4(2), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

6.2. Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	Agilent	N9010A	MY53400256	2014/10/15	2015/10/14
Power Meter	Anritsu	ML2496A	1326001	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315048	2014/06/20	2015/06/19
Power Sensor	Anritsu	MA2411B	1315049	2014/06/20	2015/06/19
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	2	2014/01/06	2015/01/05
DC Block	Mini-Circuits	BLK-18-S+	4	2014/01/06	2015/01/05
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-019	2014/01/06	2015/01/05
Attenuator	WOKEN	218FS-10	7	2014/01/06	2015/01/05
Bluetooth Test Set	Anritsu	8852B	1329002	2014/07/16	2015/07/15

6.3. Test Set-up:



6.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. 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)
3. Record the max. reading.
4. Repeat above procedures until all default test channel is completed.

NOTE: cable loss as 5.4dB that offsets in the spectrum.

6.5. Measurement Result

BR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	2.48	0.00177	0.125
2441.00	2.94	0.00197	0.125
2480.00	3.10	0.00204	0.125

EDR mode (π/4DQPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	4.95	0.00313	0.125
2441.00	5.48	0.00353	0.125
2480.00	5.75	0.00376	0.125

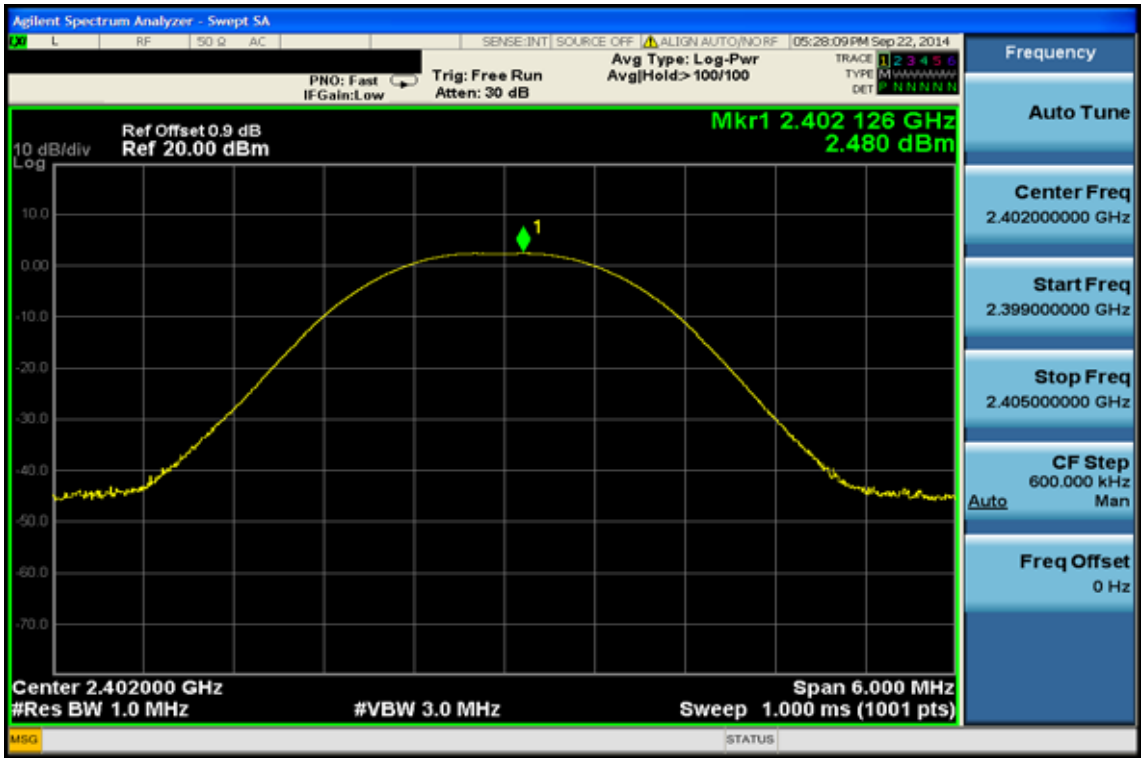
EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	5.39	0.00346	0.125
2441.00	5.94	0.00393	0.125
2480.00	**6.21**	0.00418	0.125

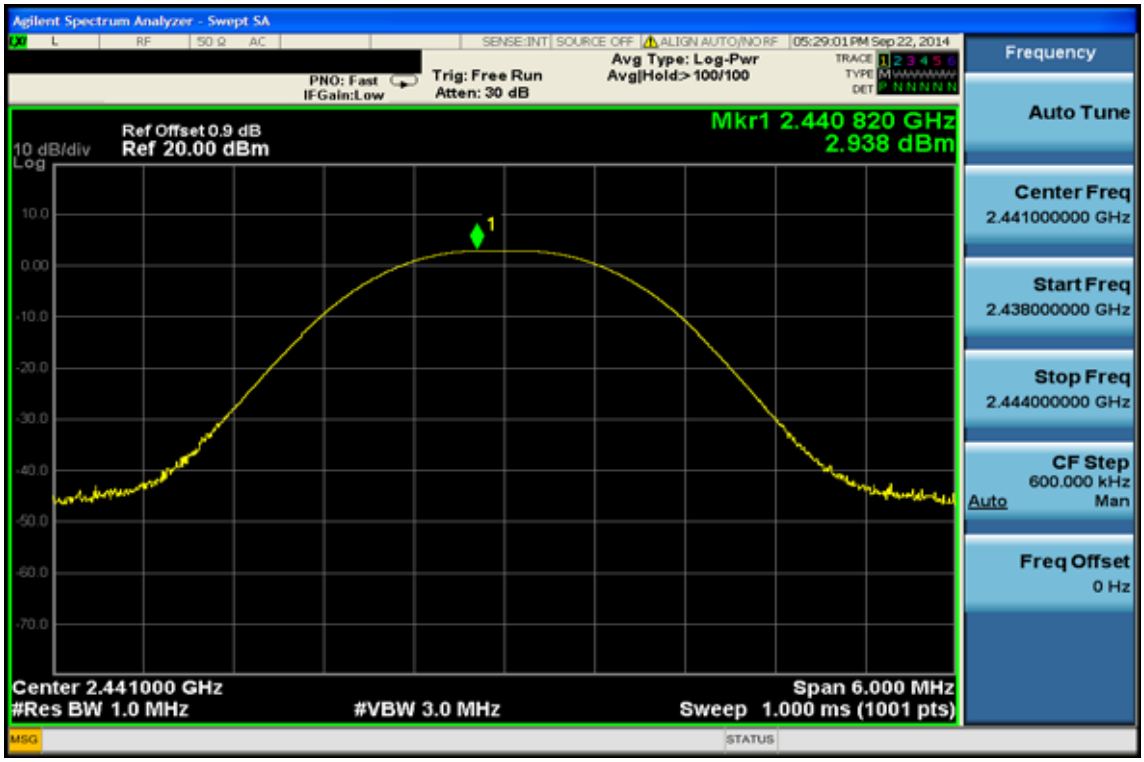
**Note: offset 0.9dB.*

**Note: Refer to next page for plots.*

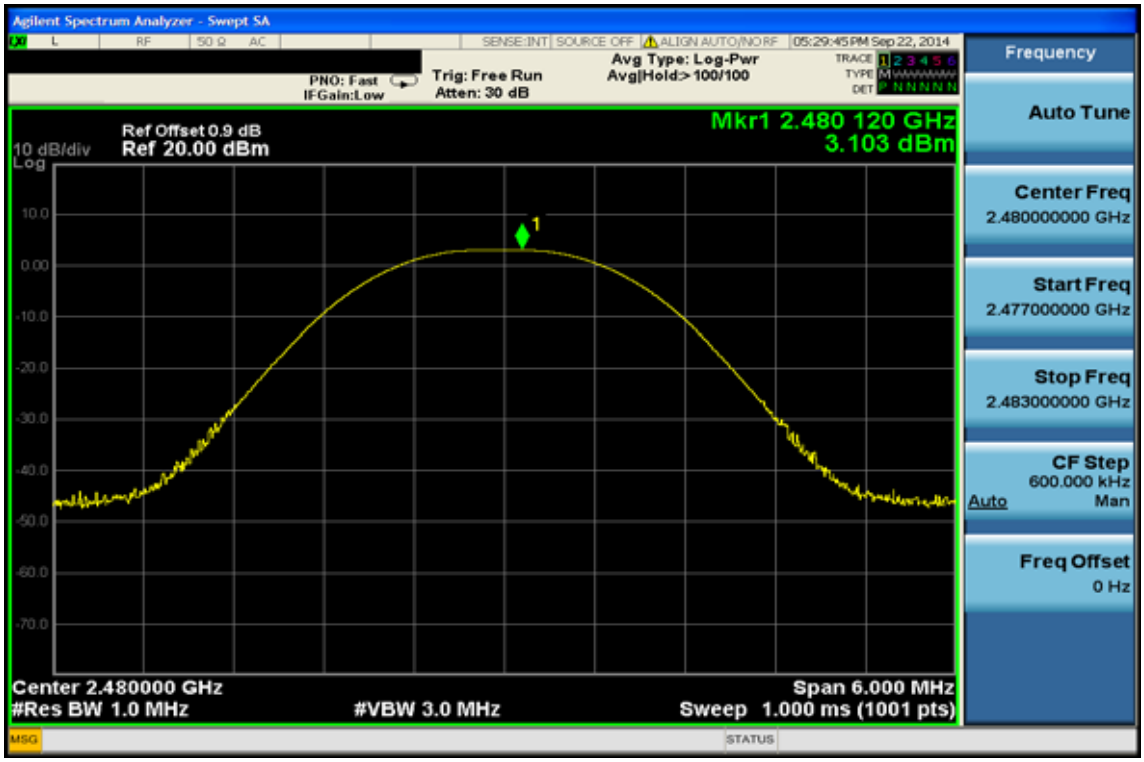
Peak Power Output Data Plot (CH Low) (BR mode GFSK)



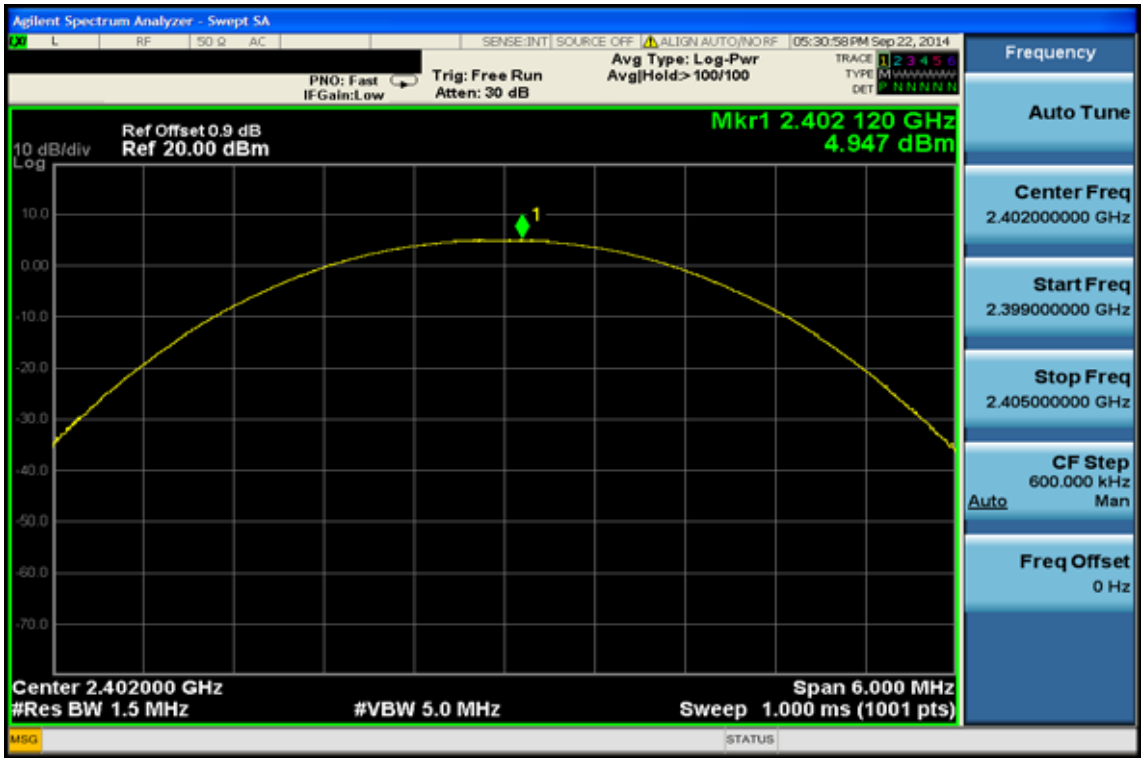
Peak Power Output Data Plot (CH Mid) (BR mode GFSK)



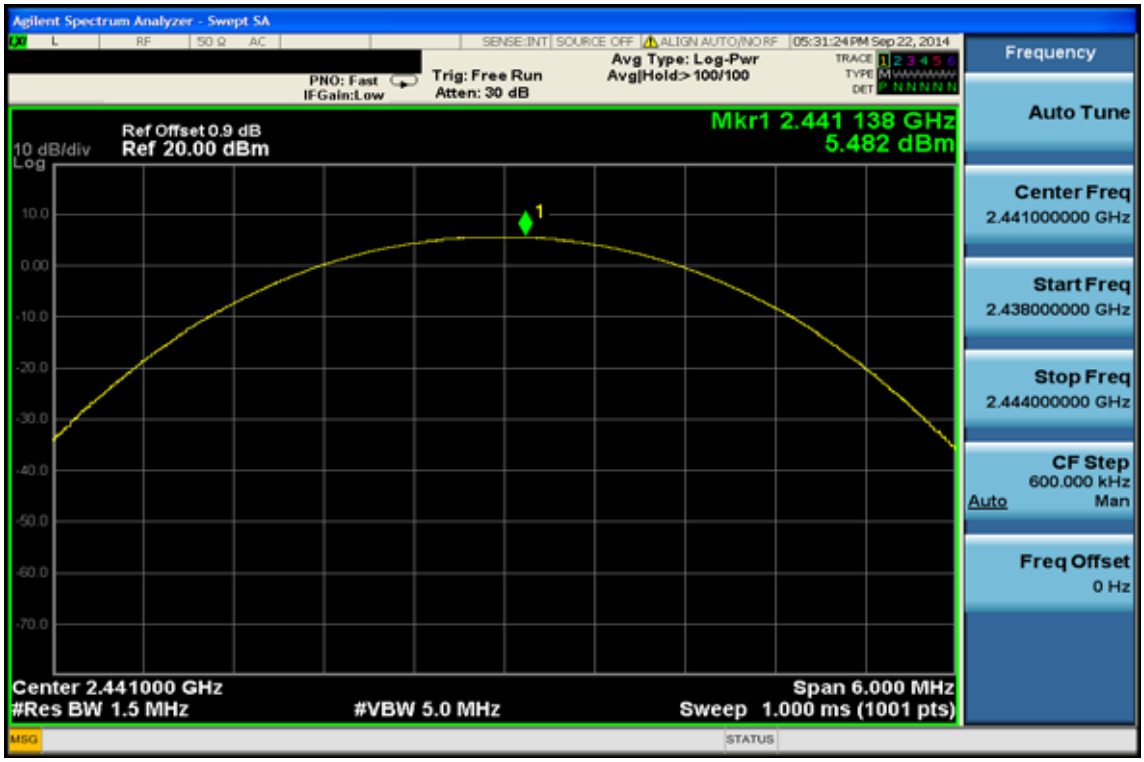
Peak Power Output Data Plot (CH High) (BR mode GFSK)



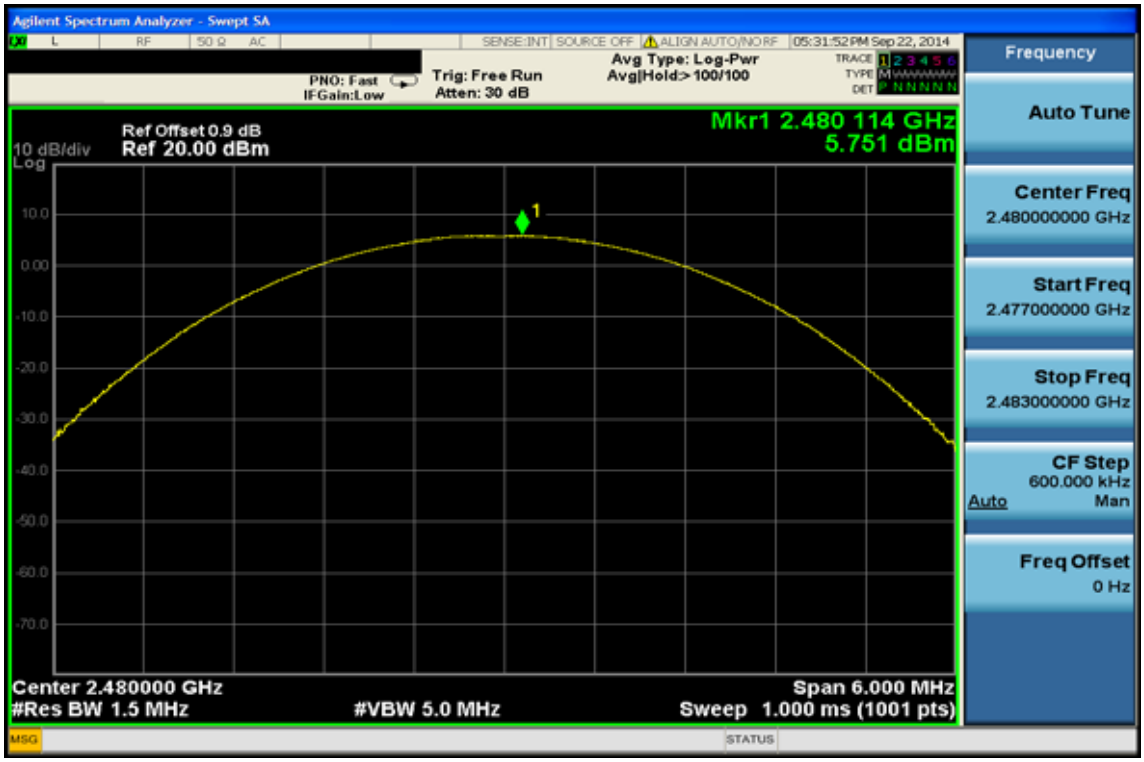
Peak Power Output Data Plot (CH Low) (EDR mode π/4DQPSK)



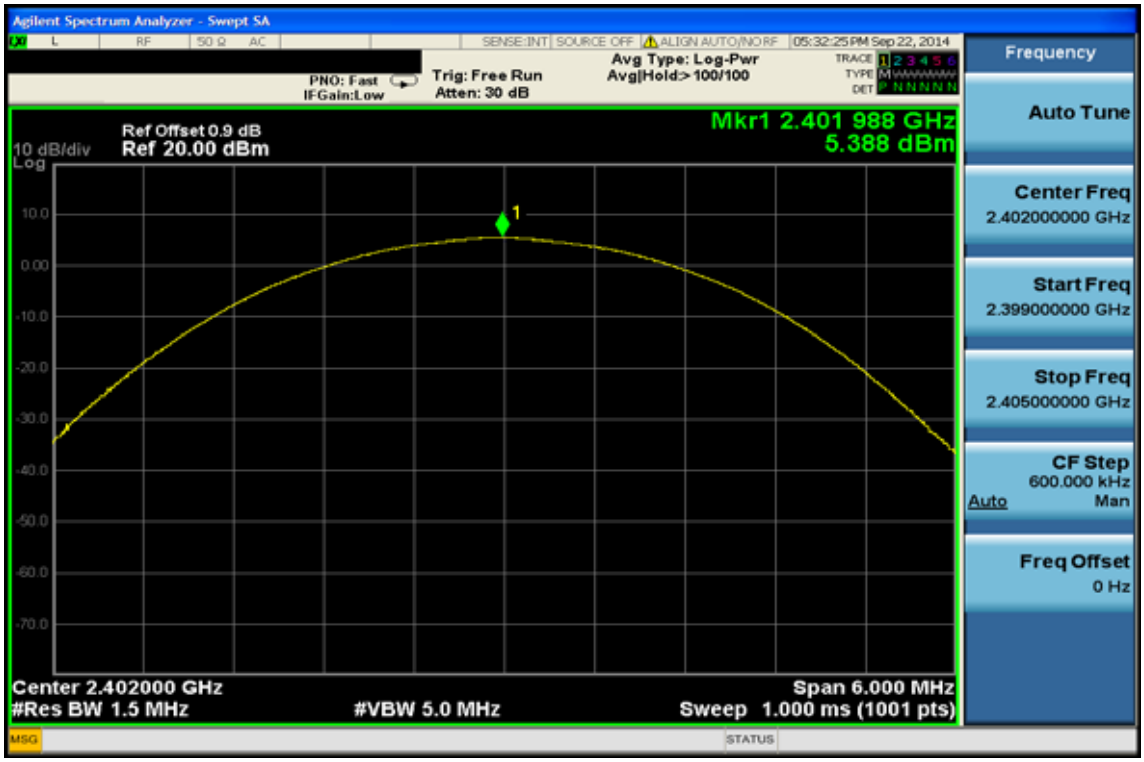
Peak Power Output Data Plot (CH Mid) (EDR mode π/4DQPSK)



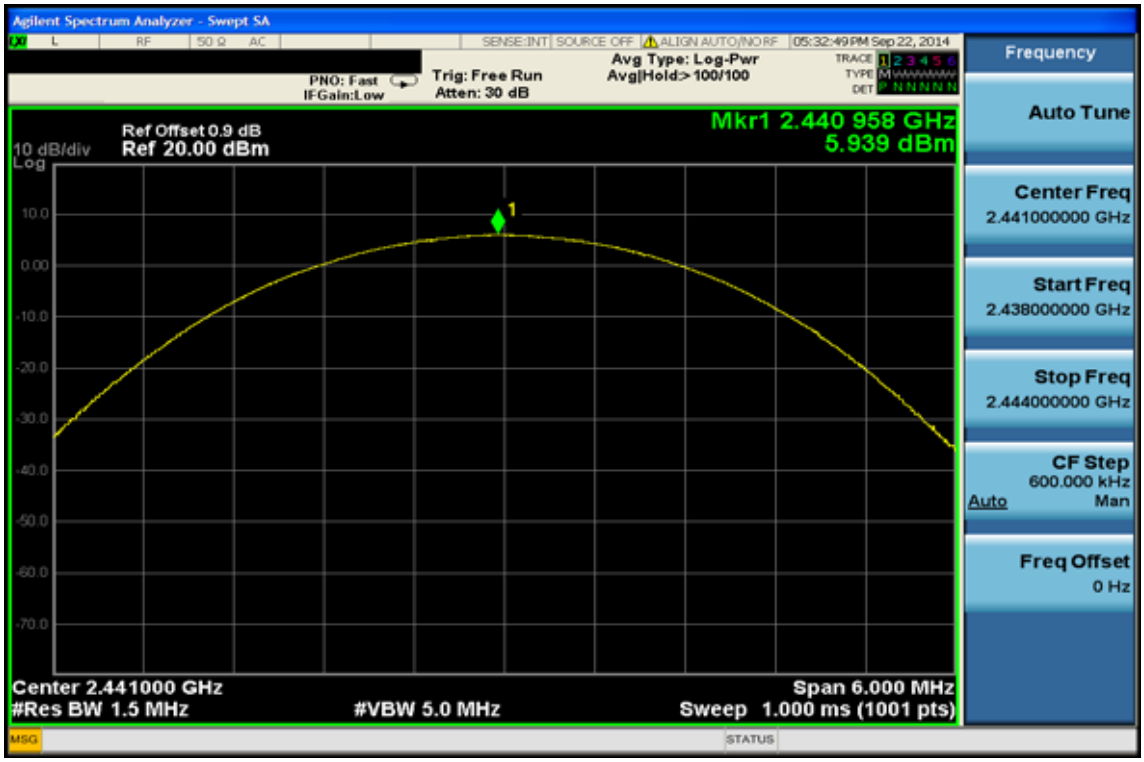
Peak Power Output Data Plot (CH High) (EDR mode π/4DQPSK)



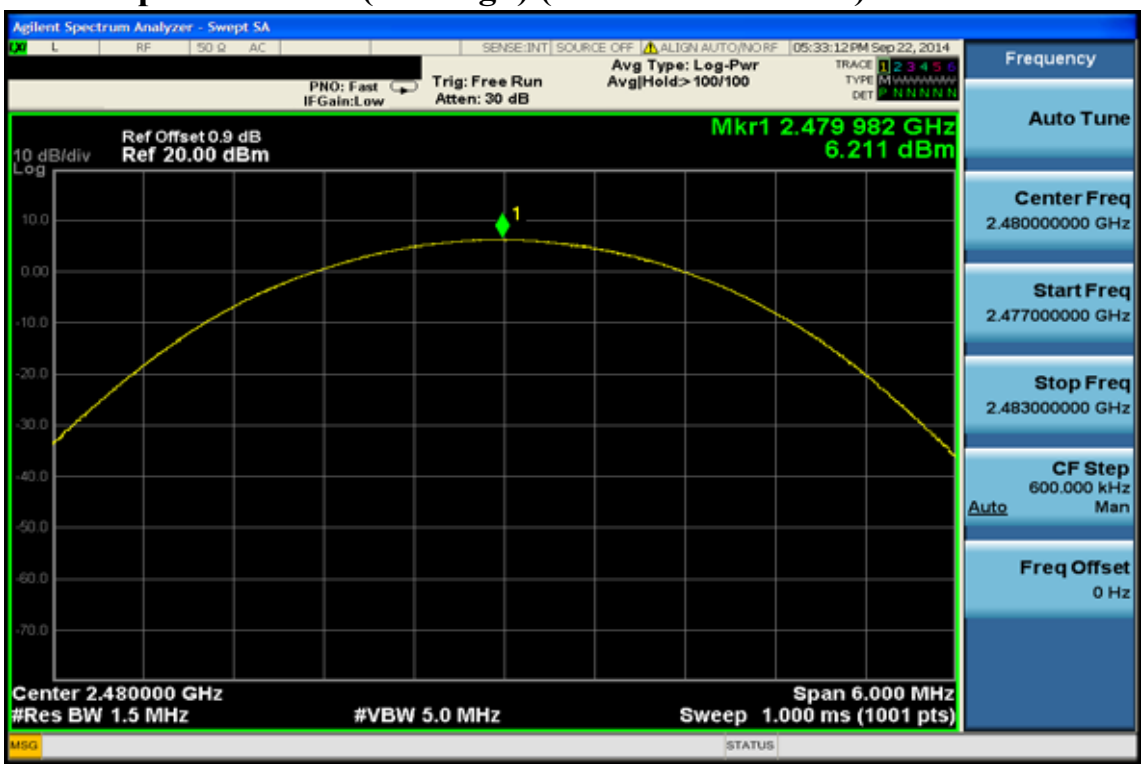
Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



Peak Power Output Data Plot (CH Mid) (EDR mode 8DPSK)



Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



7. SPURIOUS RADIATED EMISSION TEST

7.1. Standard Applicable

According to §15.247(d),

Emission at antenna port:

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. 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) (see § 15.205(c)).

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.

According to RSS-Gen §7.2.5 and RSS-210 issue 8,§A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6 of RSS-GEN.

7.2. Measurement Equipment Used:

7.2.1. Radiated emission:

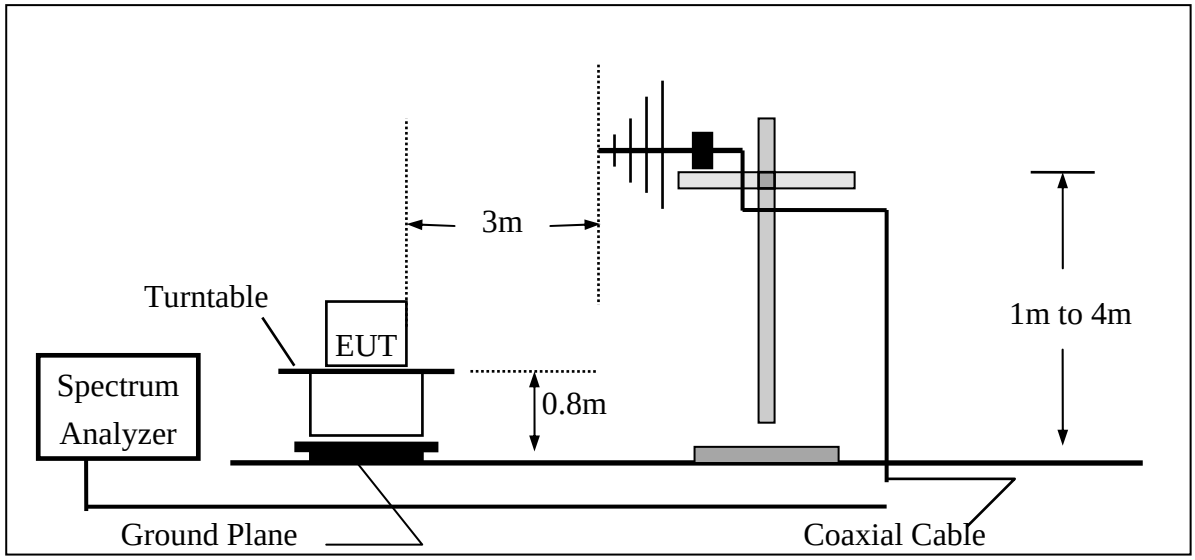
966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESU 40	100363	2014/04/12	2015/04/11
Loop Antenna	ETS-Lindgren	6502	00143303	2014/01/16	2015/01/15
Broadband Antenna	TESEQ	CBL 6112D	35240	2014/01/17	2015/01/16
Horn Antenna	ETS-Lindgren	3117	00143272	2014/01/27	2015/01/26
Horn Antenna	ETS-Lindgren	3160-09	00117911	2014/01/22	2015/01/21
Pre Amplifier	R&S	SCU-18	10204	2014/03/26	2015/03/25
Pre Amplifier	R&S	SCU-26	100780	2014/03/26	2015/03/25
Pre Amplifier	EMC Instruments	EMC330	980096	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	RG 214/U	W21.03	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	RG 214/U	W22.03	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17413/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17404/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17394/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17386/4	2014/03/26	2015/03/25
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17388/4	2014/03/26	2015/03/25
Attenuator	WOKEN	218FS-10	HY-151	2014/01/06	2015/01/05
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Site NSA	SGS	966 Chamber C	SAC-C	2014/03/05	2015/03/04
Site VSWR	SGS	966 Chamber C	SAC-C	2014/04/10	2015/04/09
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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

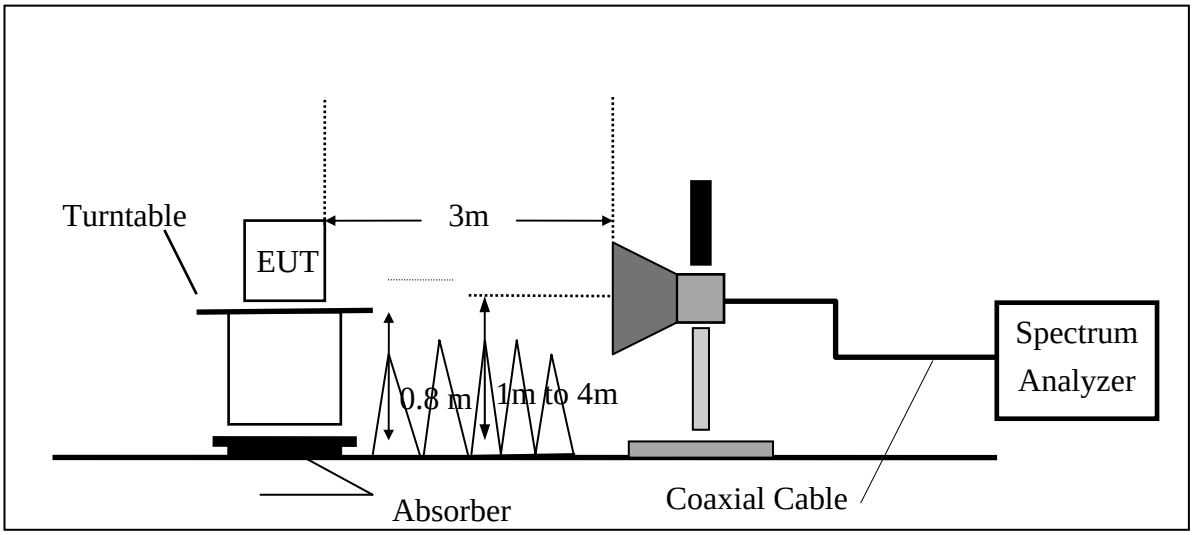
7.3. Test SET-UP:

7.3.1. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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



7.4. Measurement Procedure:

Radiated Emission:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. 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.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency of the interest measured were complete.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

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	

Remark:

1. The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)
2. Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

7.6. Measurement Result:

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

Note: For the tabular table as presents below, “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency. “E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor

7.6.1 Radiated Emission – Band Edge: (Worst: EDR mode) Hopping mode

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2402 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge LOW	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	E	43.12	3.14	46.26	74.00	-27.74
2390.00	Average	E	32.79	3.14	35.93	54.00	-18.07

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2402 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge LOW	Engineer	:Jerry
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Peak	E	49.15	3.14	52.29	74.00	-21.71
2390.00	Average	E	33.19	3.14	36.33	54.00	-17.67

Actual FS(dBµV/m) = SPA. Reading level(dBµV) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/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.
"---" : denotes Noise Floor.
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	E	44.00	3.35	47.36	74.00	-26.64
2483.50	Average	E	33.22	3.35	36.57	54.00	-17.43

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	E	52.22	3.35	55.57	74.00	-18.43
2483.50	Average	E	36.30	3.35	39.65	54.00	-14.35

Actual FS(dBµV/m) = SPA. Reading level(dBµV) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/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.
"---" : denotes Noise Floor.
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Band Edge: (Worst: EDR mode) Non-Hopping mode

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2402 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge LOW	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2321.80	Peak	S	48.28	2.92	51.20	74.00	-22.80
2321.80	Average	S	38.32	2.92	41.24	54.00	-12.76
2390.00	Peak	E	42.65	3.14	45.79	74.00	-28.21
2390.00	Average	E	31.92	3.14	35.06	54.00	-18.94

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2402 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge LOW	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2321.80	Peak	S	50.43	2.92	53.35	74.00	-20.65
2321.80	Average	S	41.06	2.92	43.98	54.00	-10.02
2390.00	Peak	E	42.91	3.14	46.05	74.00	-27.95
2390.00	Average	E	33.23	3.14	36.37	54.00	-17.63

Actual FS(dBµV/m) = SPA. Reading level(dBµV) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/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.
"---" : denotes Noise Floor.
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	E	46.57	3.35	49.93	74.00	-24.07
2483.50	Average	E	38.15	3.35	41.50	54.00	-12.50

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:Bandedge HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	Peak	E	54.05	3.35	57.41	74.00	-16.59
2483.50	Average	E	44.25	3.35	47.60	54.00	-6.40

Actual FS(dBµV/m) = SPA. Reading level(dBµV) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/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.
"---" : denotes Noise Floor.
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

7.6.2 Radiated Spurious Emission Measurement Result (worst case EDR mode)

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:TX HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/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.
"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2992.00	Peak	S	45.34	4.97	50.31	74.00	-23.69
2992.00	Average	S	30.67	4.97	35.64	54.00	-18.36
3982.00	Peak	S	53.70	-1.15	52.55	74.00	-21.45
3982.00	Average	S	30.82	-1.15	29.67	54.00	-24.33
4960.00	Peak	H	41.31	0.61	41.92	74.00	-32.08
4960.00	Average	H	30.23	0.61	30.84	54.00	-23.16
4983.00	Peak	S	52.33	0.69	53.02	74.00	-20.98
4983.00	Average	S	30.55	0.69	31.24	54.00	-22.76
7251.00	Peak	S	45.33	4.73	50.06	74.00	-23.94
7251.00	Average	S	30.13	4.73	34.86	54.00	-19.14
7440.00	Peak	H	---				
9920.00	Peak	H	---				
12400.00	Peak	H	---				
14880.00	Peak	H	---				
17360.00	Peak	H	---				
19840.00	Peak	H	---				
22320.00	Peak	H	---				
24800.00	Peak	H	---				

Operation Band	:EDR	Test Date	:2014-11-26
Fundamental Frequency	:2480 MHz	Temp./Humi.	:25.4 deg_C / 57 RH
Operation Mode	:TX HIGH	Engineer	:Tai
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/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.
"---" : denotes Noise Floor.

Freq.	Detector Mode	Note	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV / m	dBμV / m	dB
2994.00	Peak	S	44.06	4.01	48.07	74.00	-25.93
2994.00	Average	S	30.65	4.01	34.66	54.00	-19.34
3989.00	Peak	S	54.03	-1.12	52.91	74.00	-21.09
3989.00	Average	S	30.63	-1.12	29.51	54.00	-24.49
4960.00	Peak	H	41.69	0.61	42.30	74.00	-31.70
4960.00	Average	H	30.25	0.61	30.86	54.00	-23.14
4983.00	Peak	S	46.38	0.69	47.07	74.00	-26.93
4983.00	Average	S	30.71	0.69	31.40	54.00	-22.60
7440.00	Peak	H	---				
9920.00	Peak	H	---				
12400.00	Peak	H	---				
14880.00	Peak	H	---				
17360.00	Peak	H	---				
19840.00	Peak	H	---				
22320.00	Peak	H	---				
24800.00	Peak	H	---				

8. ANTENNA REQUIREMENT

8.1. 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.

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

8.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2.36dBi, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.