

FCC Test Report

(PART 27)

Report No.: RF150326E02D

FCC ID: 2AD8UFZPFWIE01

Test Model: FWIE

Received Date: Mar. 26, 2015

Test Date: Apr. 01 to 07, 2015

Issued Date: July 27, 2015

Applicant: Nokia Solutions and Networks

Address: 1455 West Shure Drive, Arlington Heights, IL 60004, USA

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin
Chu Hsien 307, Taiwan R.O.C.

Test Location (1): No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin
Chu Hsien 307, Taiwan R.O.C.

Test Location (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin
Chu Hsien 307, Taiwan R.O.C.



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A D T

Release Control Record

Issue No.	Description	Date Issued
RF150326E02D	Original release.	July 27, 2015



A D T

1 Certificate of Conformity

Product: Flexi Zone Indoor Pico BTS
Brand: Nokia
Test Model: FWIE
Sample Status: ENGINEERING SAMPLE
Applicant: Nokia Solutions and Networks
Test Date: Apr. 01 to 07, 2015
Standards: FCC Part 27
FCC Part 2

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :

midoli Peng
(Midoli Peng, Specialist)

' Date:

July 27, 2015

Approved by :

May Chen
(May Chen, Manager)

' Date:

July 27, 2015

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 27.50(d)(4)	Equivalent Isotropically radiated power	PASS	Meet the requirement of limit.
2.1055 27.54	Frequency Stability Stay with the authorized bands of operation	PASS	Meet the requirement of limit.
2.1049 27.53(h)	Occupied Bandwidth	PASS	Meet the requirement of limit.
27.53(h)	Band Edge Measurements	PASS	Meet the requirement of limit.
---	Peak To Average Ratio	PASS	Meet the requirement of limit.
2.1051 27.53(h)	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
2.1053 27.53(h)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -15.44dB at 19192.5MHz.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.43 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.72 dB
	6GHz ~ 18GHz	4.00 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Test Site and Instruments

For radiated spurious emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Aug. 11, 2014	Aug. 10, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 06, 2015	Feb. 05, 2016
RF Cable	NA	CHHCAB_001	Oct. 05, 2014	Oct. 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Aug. 26, 2014	Aug. 25, 2015
Pre-Amplifier Agilent	8449B	300801923	Oct. 28, 2014	Oct. 27, 2015
RF Cable	NA	131206 131213 131215 SNMY23685/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Dec. 12, 2014	Dec. 11, 2015
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	329751/4 RF104-204	Dec. 11, 2014	Dec. 10, 2015
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
5. The CANADA Site Registration No. is IC 7450H-3.
6. Tested Date: Apr. 07, 2015

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100037	Oct. 30, 2014	Oct. 29, 2015
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 18, 2014	Dec. 17, 2015
AC Power Source EXTECH Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 08, 2014	Dec. 07, 2015
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Apr. 28, 2014	Apr. 27, 2015
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010004	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/ 005 506 602 UK6 UNJ	Dec. 05, 2014	Dec. 04, 2015
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
Power meter Anritsu	ML2495A	0824006	May 22, 2014	May 21, 2015
Power sensor Anritsu	MA2411B	0738172	May 22, 2014	May 21, 2015
Software	Total Power Measurement Tools V7.1	NA	NA	NA
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA

- NOTE:**
1. The test was performed in Oven room A.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Apr. 01, 2015

3 General Information

3.1 General Description of EUT

Product	Flexi Zone Indoor Pico BTS	
Brand	Nokia	
Test Model	FWIE	
Test Sample S/N	EA150610120	
Hardware Version	473151A.X33 (Confirmation that the hardware version 473151A.X33 is fully identical with 473151A.101)	
Software Version	Operating SW: FB_FZM_PS_LFS_OS_2014_05_59-0-g927a301 WiFi module SW: 9.8.1.0.14302702	
Status of EUT	ENGINEERING SAMPLE	
Power Supply Rating	12Vdc from power adapter or 55Vdc from POE	
Modulation Type	QPSK, 16QAM, 64QAM	
Modulation Technology	FHSS / DSSS	
Transfer Rate	Uplink : 75Mbps , Downlink : 300Mbps	
Operating Frequency	Channel Bandwidth: 5MHz	2112.5MHz ~2152.5MHz
	Channel Bandwidth: 10MHz	2115MHz ~2150MHz
	Channel Bandwidth: 15MHz	2117.5MHz ~2147.5MHz
	Channel Bandwidth: 20MHz	2120MHz ~2145MHz
Number of Channel	Channel Bandwidth: 5MHz	401
	Channel Bandwidth: 10MHz	351
	Channel Bandwidth: 15MHz	301
	Channel Bandwidth: 20MHz	251
Max. EIRP Power	Channel Bandwidth: 5MHz	1120.2mW (QPSK)
	Channel Bandwidth: 10MHz	1146.3mW (QPSK)
	Channel Bandwidth: 15MHz	1183.9mW (QPSK)
	Channel Bandwidth: 20MHz	1154.3mW (QPSK)
Emission Designator	Channel Bandwidth: 5MHz	QPSK: 4M52G7D
		16QAM: 4M52W7D
		64QAM: 4M52W7D
	Channel Bandwidth: 10MHz	QPSK: 9M00G7D
		16QAM: 9M00W7D
		64QAM: 9M00W7D
	Channel Bandwidth: 15MHz	QPSK: 13M7G7D
		16QAM: 13M7W7D
		64QAM: 13M7W7D
	Channel Bandwidth: 20MHz	QPSK: 18M1G7D
		16QAM: 18M1W7D
		64QAM: 18M1W7D

Antenna Type	Refer to note as below
Antenna Connector	Refer to user's manual
Accessory Device	Adapter x1
Data Cable Supplied	NA

Note:

1. There are BT, LTE and GPS technology used for the EUT.
2. The EUT incorporates a MIMO function for LTE mode

Channel Bandwidth	Modulation	TX & RX configuration	
5MHz	QPSK, 16QAM, 64QAM	2TX	2RX
10MHz	QPSK, 16QAM, 64QAM	2TX	2RX
15MHz	QPSK, 16QAM, 64QAM	2TX	2RX
20MHz	QPSK, 16QAM, 64QAM	2TX	2RX

3. The EUT's spec. as below table:

Model name	LTE		BT	GPS	
	Freq.(MHz)	Band			
FWIE	DL	BW 5MHz : 2112.5~2152.5	4 (AWS)	✓	✓
		BW 10MHz : 2115~2150			
		BW 15MHz : 2117.5~2174.5			
		BW 20MHz : 2120~2145			

4. The emission of the simultaneous operation (BT & LTE) has been evaluated and no non-compliance was found.
5. The EUT must be supplied with a POE(option) or power adapter as following table:

Brand	Model No.	Spec.
DVE	DSA-60PFE-12 1 120500	Input: 100-240V, 2.0A, 50/60Hz AC input cable(1.8m, unshielded) Output: 12V, 5A DC output cable(1.2m, unshielded, with one core)

6. The EUT was pre-tested under following test modes :

Test Mode	Description
Mode A	With POE
Mode B	With adapter

For the above modes, the worst radiated emission (above 1GHz) test was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

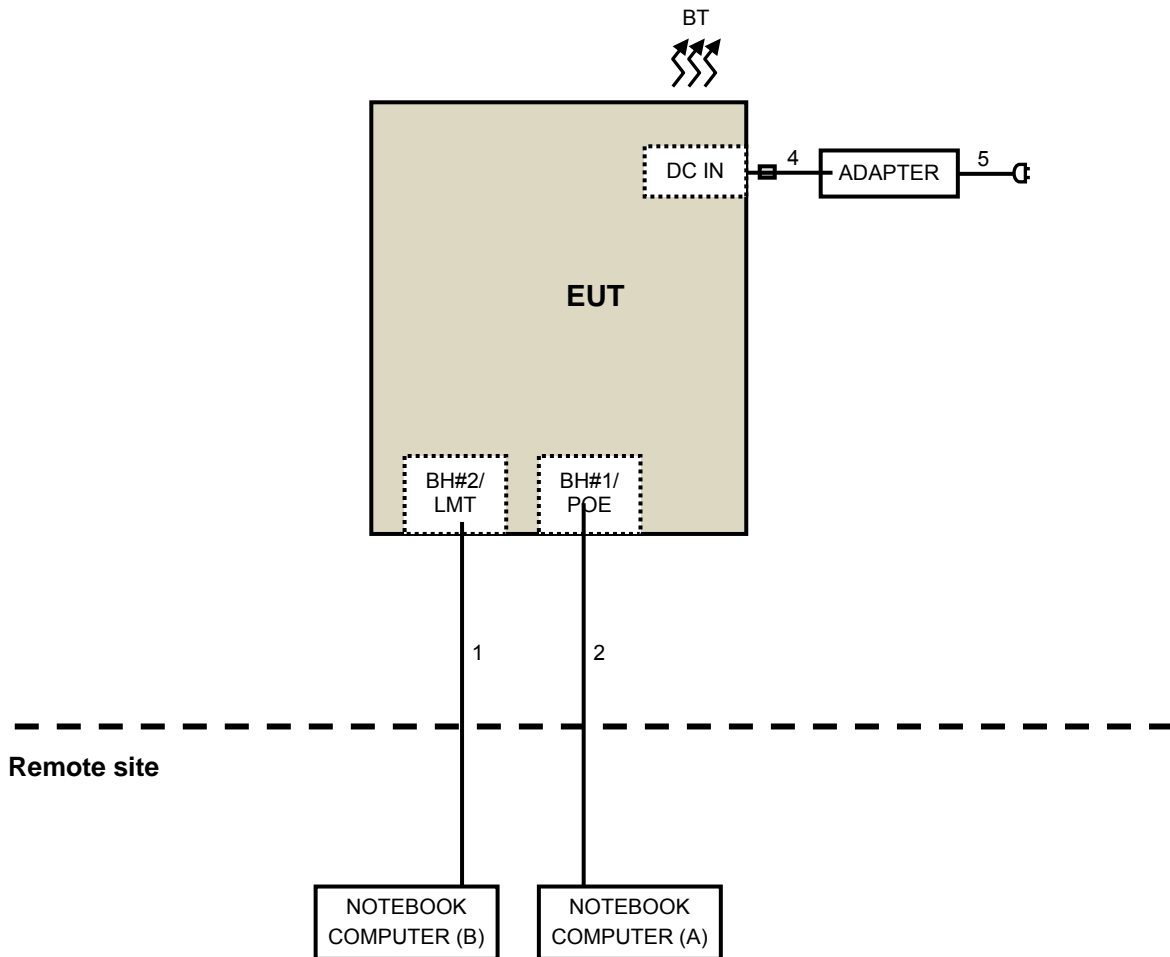
7. The antennas provided to the EUT, please refer to the following table:

LTE Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
External LTE Ant (Main & Aux)	Pulse	DASLTE500NFMI MO-1405P	1/4 Wave monopoles on ground plane	N-Female/1/4" low loss, low PIM, plenum rated cable	5	500	1710~2170 (Band 4)
GPS Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
External GPS Ant	TongDa	T-543-8141037-9	ElecPatch	SMA Male	4.0	9140 ± 100	GPS : 1575.42 ± 3 MHz Glonass : 1602 ± 8 MHz
BT Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
Internal BT Ant	INPAQ	Fz PICO	Chip	NA	-1.22	NA	2400~2500

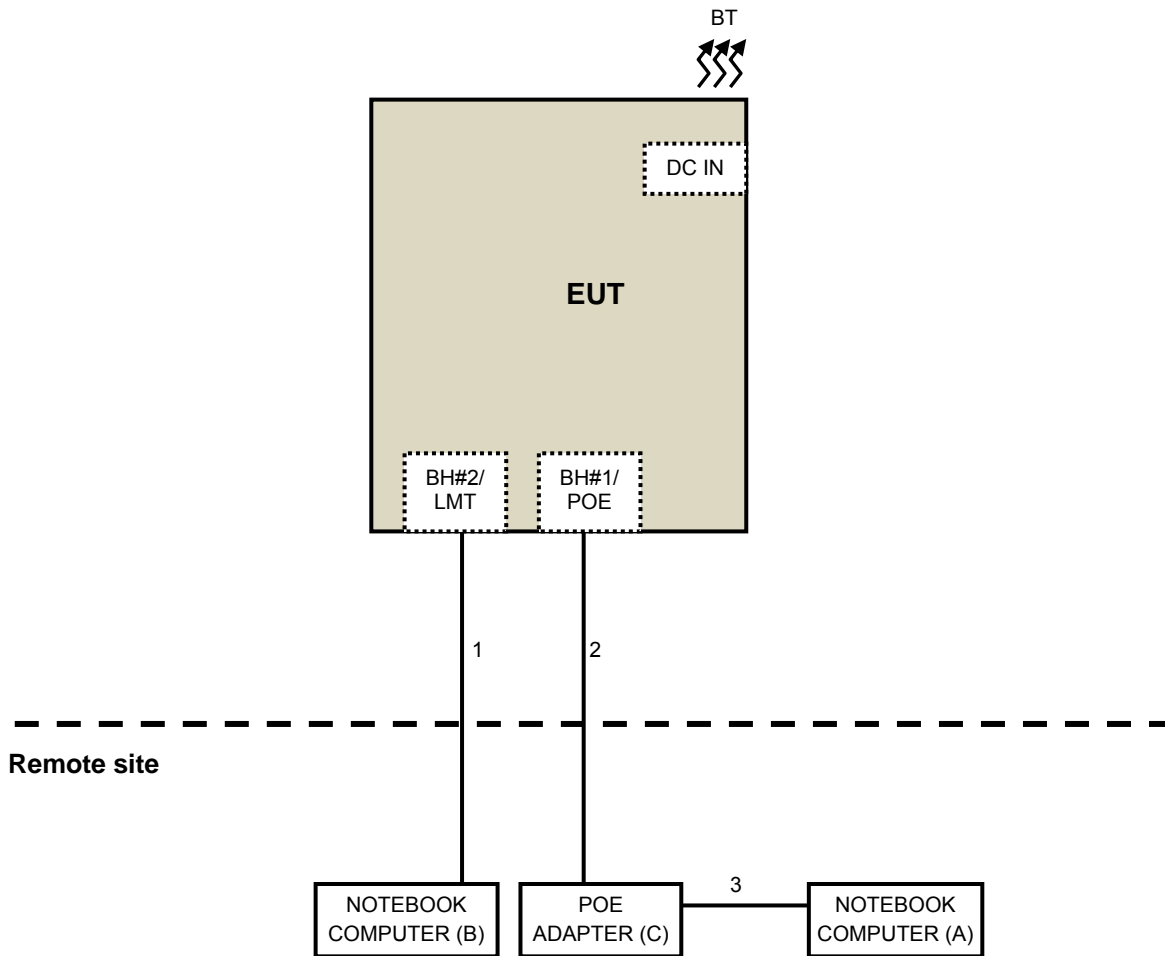
8. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Configuration of System under Test

For Adapter mode:



For POE mode:



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B	NOTEBOOK COMPUTER	DELL	E6420	H62T3R1	FCC DoC	Provided by Lab
C	POE ADAPTER	NA	PD-7001G	D11326441001235A01	FCC DoC	Provided by Lab

NOTE:

1. All power cords of the above support units are non-shielded (1.8 m).

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	RJ-45	1	10	No	0	Provided by Lab
2	RJ-45	1	10	No	0	Provided by Lab
3	RJ-45	1	1.5	No	0	Provided by Lab

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XY axis and antenna ports

The worst case was found when positioned on Y-plane. Following channel(s) was (were) selected for the final test as listed below:

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
Output Power	1975 to 2375	1975, 2175, 2375	5MHz	QPSK
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK
Frequency Stability	1975 to 2375	2175	5MHz	QPSK
	2000 to 2350	2175	10MHz	QPSK
	2025 to 2325	2175	15MHz	QPSK
	2050 to 2300	2175	20MHz	QPSK
Emission Bandwidth	1975 to 2375	1975, 2175, 2375	5MHz	QPSK, 16QAM, 64QAM
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK, 16QAM, 64QAM
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK, 16QAM, 64QAM
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK, 16QAM, 64QAM
Channel Edge	1975 to 2375	1975, 2375	5MHz	QPSK
	2000 to 2350	2000, 2350	10MHz	QPSK
	2025 to 2325	2025, 2325	15MHz	QPSK
	2050 to 2300	2050, 2300	20MHz	QPSK
Peak To Average Ratio	1975 to 2375	1975, 2175, 2375	5MHz	QPSK, 16QAM, 64QAM
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK, 16QAM, 64QAM
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK, 16QAM, 64QAM
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK, 16QAM, 64QAM
Condcudeted Emission	1975 to 2375	1975, 2175, 2375	5MHz	QPSK
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK
Radiated Emission Below 1GHz	1975 to 2375	1975, 2175, 2375	5MHz	QPSK
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK
Radiated Emission Above 1GHz	1975 to 2375	1975, 2175, 2375	5MHz	QPSK
	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2025 to 2325	2025, 2175, 2325	15MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK

NOTE:

1. For radiated emission, the low, mid and high channels were pre-tested in chamber. The mid channel was the worst case and chosen for final test.
2. All supported modulation types were evaluated. The Worst case emaisson of QPSK was selected. Therefore, the EIRP power, Frequency Stability, Channel Edge, Condcudeted Emission and Radiated Emission were presented under QPSK mode only.



Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Output Power	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Frequency Stability	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Emission Bandwidth	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Band Edge	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Peak To Average Ratio	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Conducuted Emission	25deg. C, 63%RH	120Vac, 60Hz	James Chan
Radiated Emission	24deg. C, 62%RH	120Vac, 60Hz	Tim Ho

3.4 EUT Operating Conditions

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 27

KDB 971168 D01 Power Meas License Digital Systems v02r01

ANSI/TIA/EIA-603-C 2004

NOTE: All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

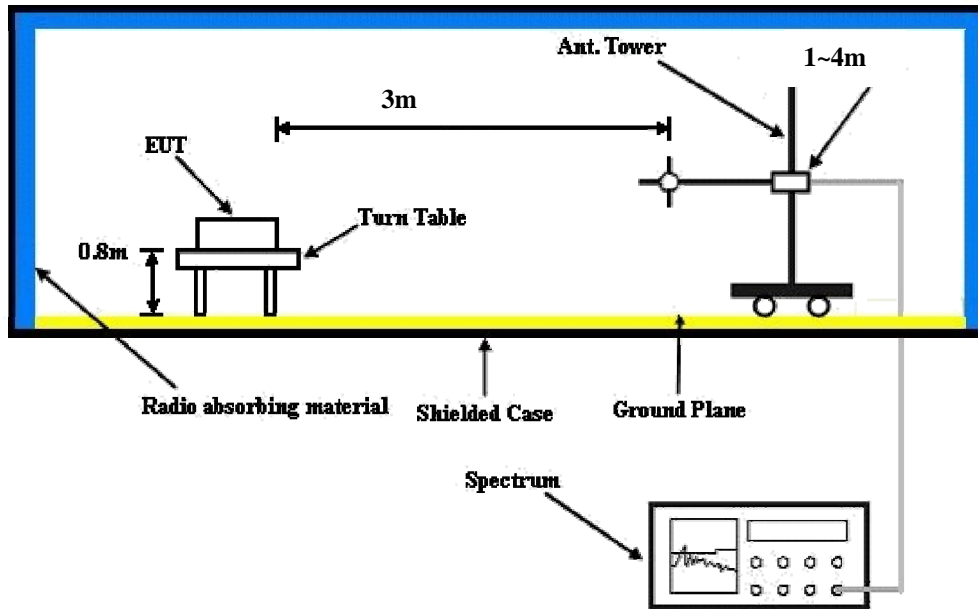
The radiated peak output power shall be according to the specific rule Part 27.50(d)(2) that are limited to EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

4.1.2 Test Procedures

EIRP / ERP Measurement:

- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 10MHz for LTE mode.
- b. Substitution method is used for EIRP measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G
- d. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$

4.1.3 Test Setup EIRP / ERP MEASUREMENT:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.4 Test Results

EIRP Power (dBm)

LTE Band 4					
Channel Bandwidth: 5MHz / QPSK					
Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)
1975	2112.5	24.0	6.4	30.4	1094.7
2175	2132.5	24.1	6.4	30.5	1120.2
2375	2152.5	23.9	6.4	30.3	1082.2

LTE Band 4					
Channel Bandwidth: 10MHz / QPSK					
Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)
2000	2115	24.1	6.4	30.5	1130.6
2175	2132.5	24.2	6.4	30.6	1146.3
2350	2150	24.0	6.4	30.5	1110.0

LTE Band 4					
Channel Bandwidth: 15MHz / QPSK					
Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)
2025	2117.5	24.2	6.4	30.6	1154.3
2175	2132.5	24.3	6.4	30.7	1183.9
2325	2147.5	24.2	6.4	30.6	1156.9

LTE Band 4					
Channel Bandwidth: 20MHz / QPSK					
Channel	Frequency (MHz)	LVL (dBm)	Correction Factor(dB)	EIRP(dBm)	EIRP(mW)
2050	2120	24.0	6.4	30.4	1102.3
2175	2132.5	24.2	6.4	30.6	1154.3
2300	2145	24.1	6.4	30.5	1130.6

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

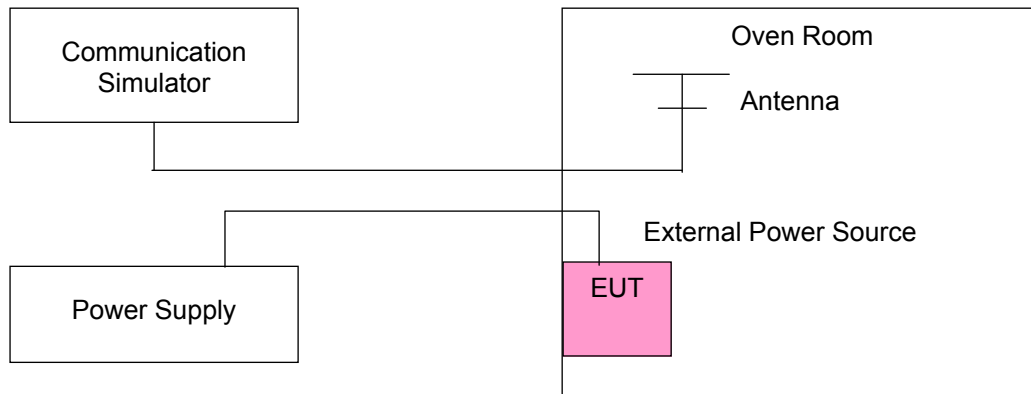
According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT $-30^{\circ}\text{C} \sim 50^{\circ}\text{C}$.

4.2.2 Test Procedure

- a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- b. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

4.2.3 Test Setup



4.2.4 Test Results (With POE)

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)				Limit (ppm)
	5MHz	10MHz	15MHz	20MHz	
102	0.001	0.002	0.002	0.002	2.5
138	0.002	0.002	0.002	0.002	2.5

TEMP. (°C)	Frequency Error (ppm)				Limit (ppm)
	5MHz	10MHz	15MHz	20MHz	
75	0.002	0.002	0.002	0.002	2.5
70	0.002	0.002	0.002	0.002	2.5
60	0.002	0.002	0.001	0.002	2.5
50	0.001	0.001	0.002	0.002	2.5
40	0.001	0.001	0.002	0.002	2.5
30	0.001	0.001	0.001	0.002	2.5
20	0.002	0.002	0.002	0.002	2.5
10	0.002	0.002	0.002	0.002	2.5
0	0.002	0.002	0.002	0.001	2.5
-10	0.002	0.002	0.002	0.002	2.5
-20	0.002	0.002	0.002	0.002	2.5
-30	0.002	0.002	0.001	0.001	2.5

4.2.5 Test Results (With Adapter)

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)				Limit (ppm)
	5MHz	10MHz	15MHz	20MHz	
102	0.002	0.002	0.002	0.002	2.5
138	0.001	0.002	0.002	0.001	2.5

TEMP. (°C)	Frequency Error (ppm)				Limit (ppm)
	5MHz	10MHz	15MHz	20MHz	
75	0.002	0.001	0.001	0.001	2.5
70	0.002	0.002	0.002	0.002	2.5
60	0.001	0.002	0.002	0.002	2.5
50	0.002	0.002	0.002	0.002	2.5
40	0.002	0.002	0.001	0.001	2.5
30	0.001	0.002	0.002	0.001	2.5
20	0.002	0.001	0.001	0.002	2.5
10	0.002	0.002	0.001	0.001	2.5
0	0.002	0.001	0.002	0.002	2.5
-10	0.002	0.002	0.001	0.002	2.5
-20	0.002	0.002	0.001	0.002	2.5
-30	0.002	0.001	0.002	0.002	2.5

4.3 Emission Bandwidth Measurement

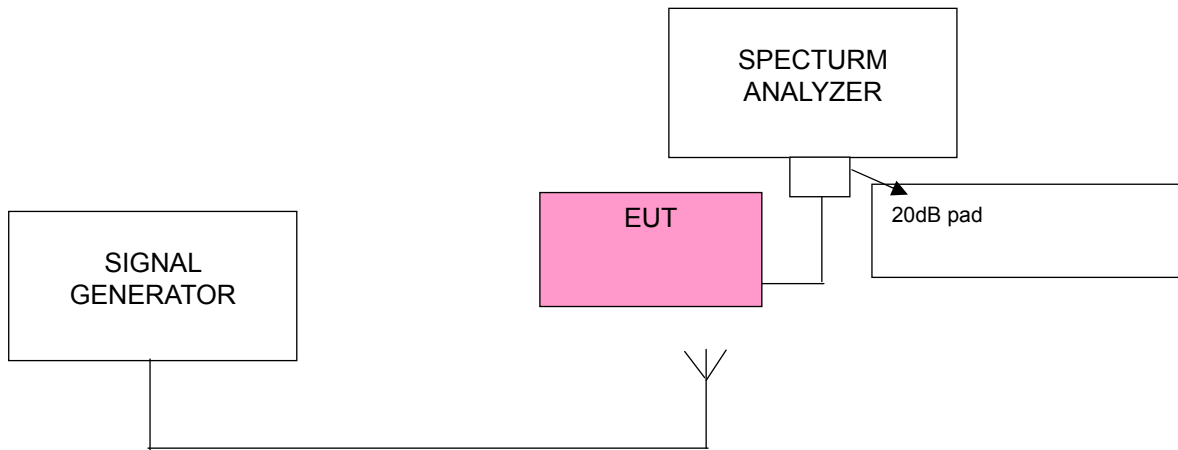
4.3.1 Limits of Emission Bandwidth Measurement

According to FCC 27.53(m)(6) specified that emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

4.3.2 Test Procedure

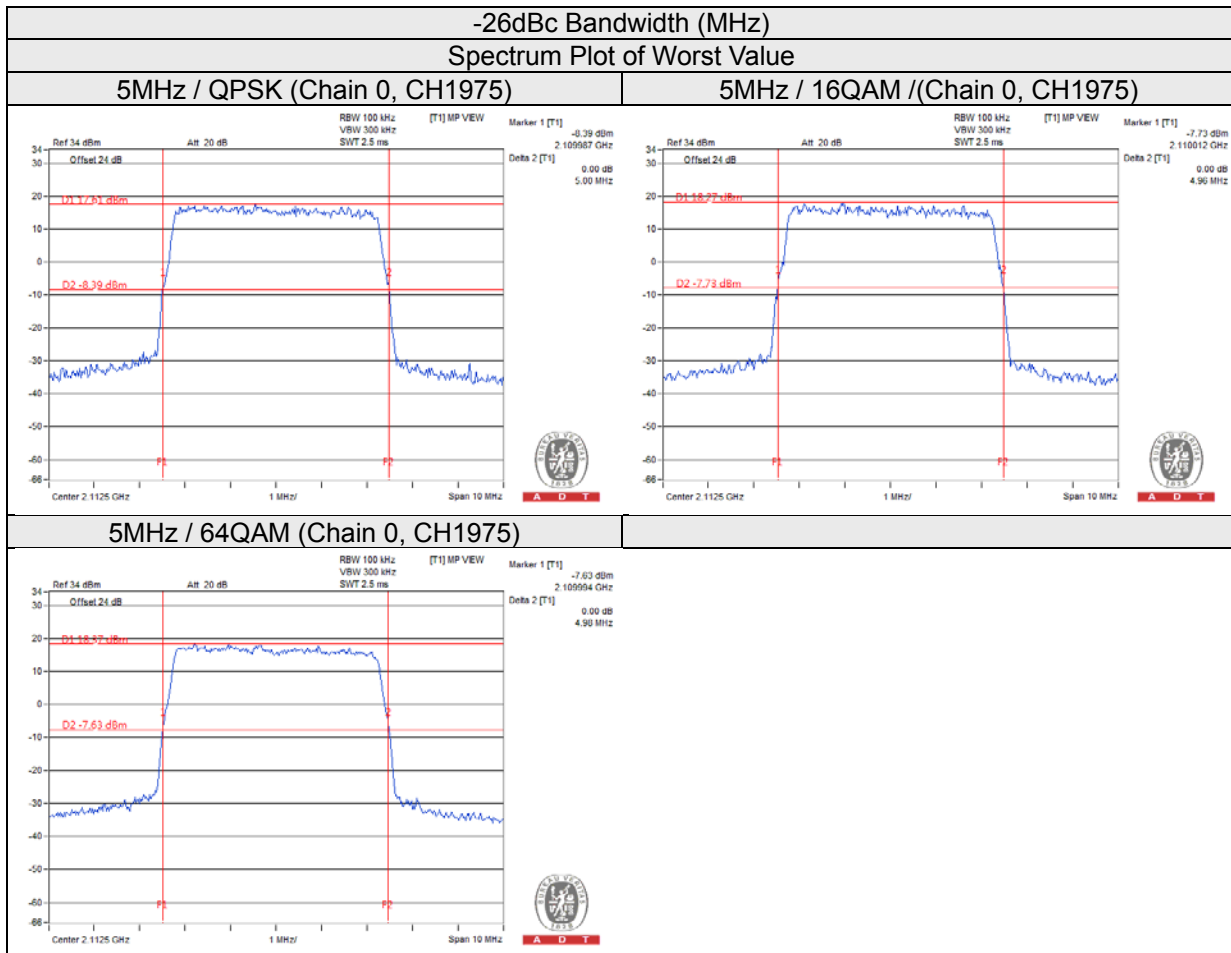
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW = 100kHz and VBW = 300kHz (Channel Bandwidth: 5MHz), RBW = 200kHz and VBW = 620kHz (Channel Bandwidth: 10MHz), RBW = 510kHz and VBW = 1.5MHz (Channel Bandwidth: 15MHz and 20MHz).

4.3.3 Test Setup



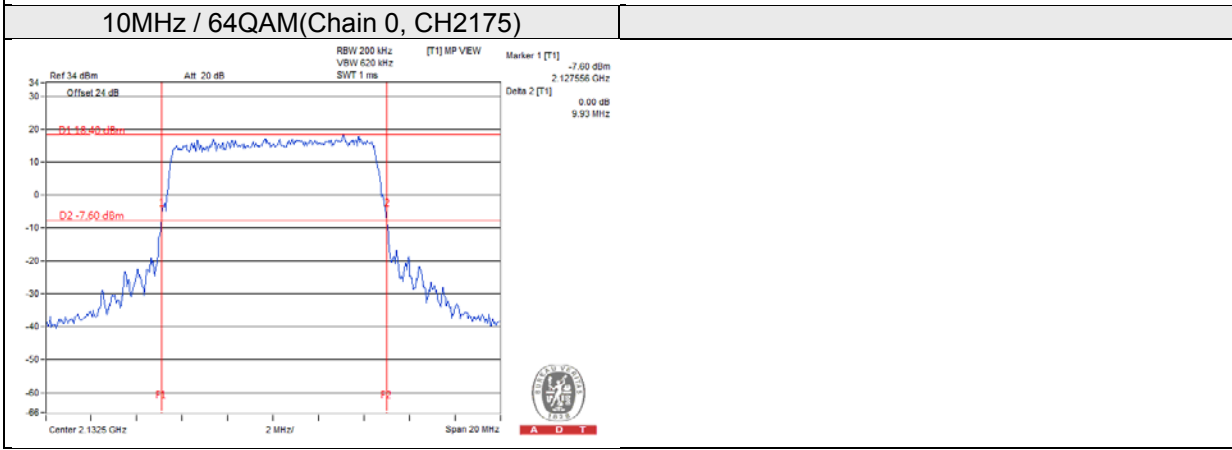
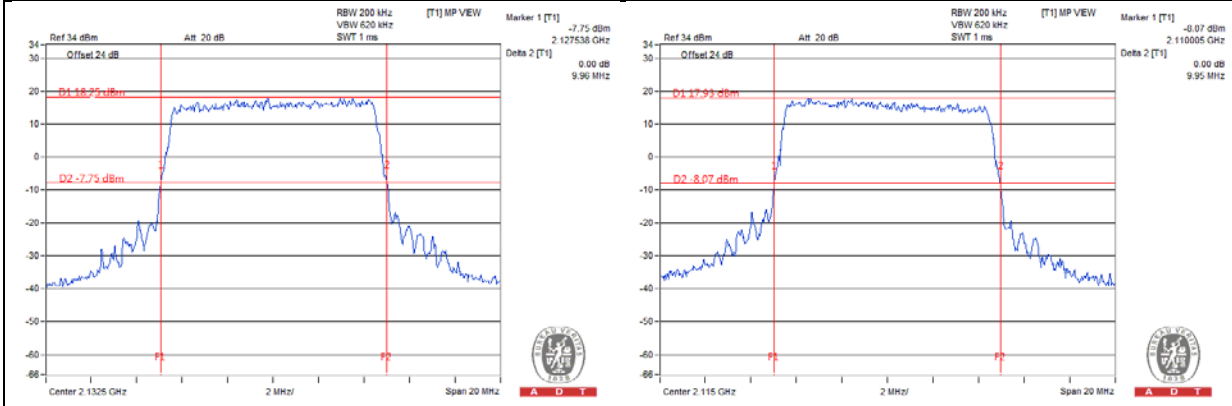
4.3.4 Test Results (-26dBc Bandwidth)

Channel Bandwidth: 5MHz							
Channel	Frequency (MHz)	-26dBc Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
1975	2112.5	5	4.96	4.98	4.94	4.92	4.98
2175	2132.5	4.93	4.96	4.97	4.92	4.94	4.91
2375	2152.5	4.99	4.95	4.95	4.99	4.95	4.96



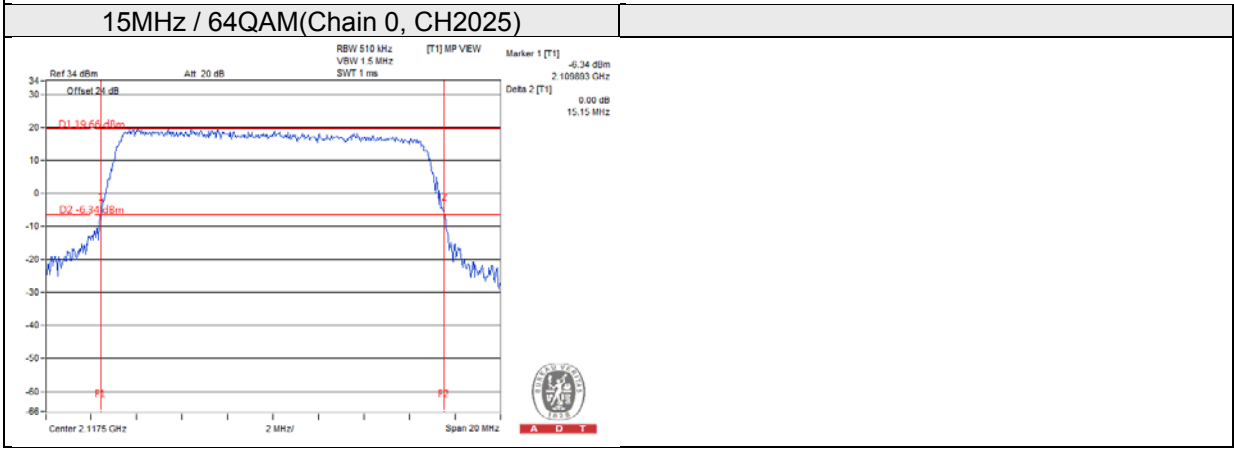
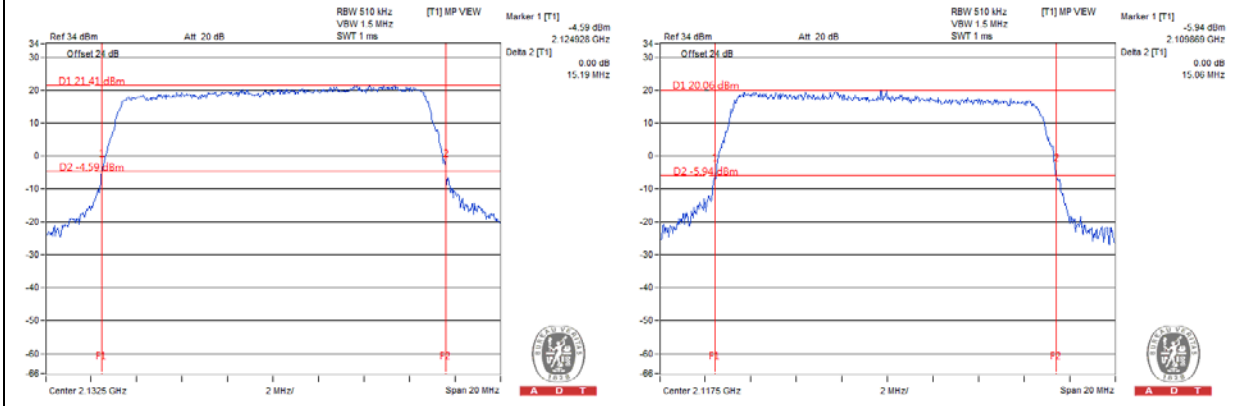
Channel Bandwidth: 10MHz							
Channel	Frequency (MHz)	-26dBc Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2000	2115	9.87	9.95	9.91	9.89	9.94	9.93
2175	2132.5	9.87	9.93	9.93	9.96	9.89	9.87
2350	2150	9.92	9.92	9.8	9.88	9.86	9.86

-26dBc Bandwidth (MHz)
Spectrum Plot of Worst Value



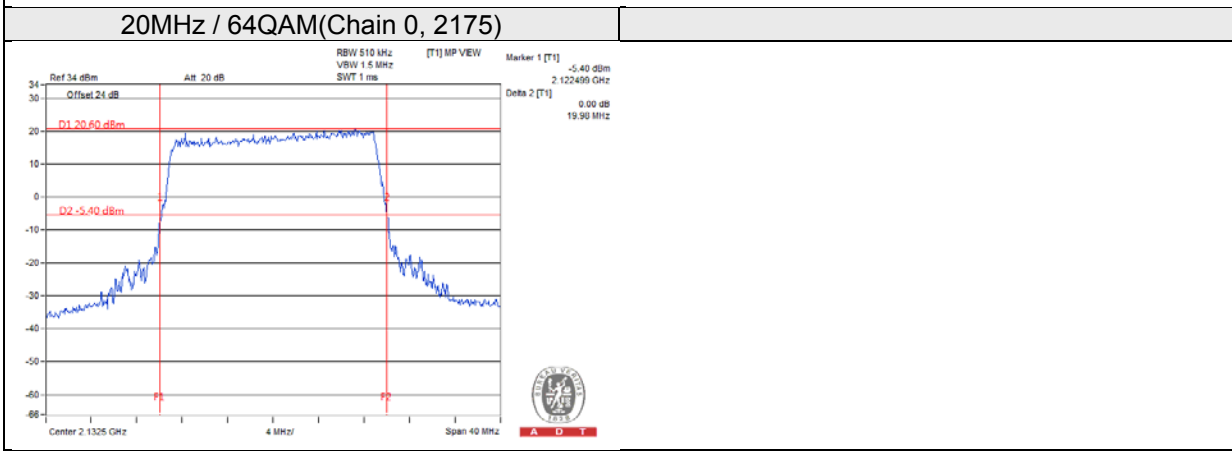
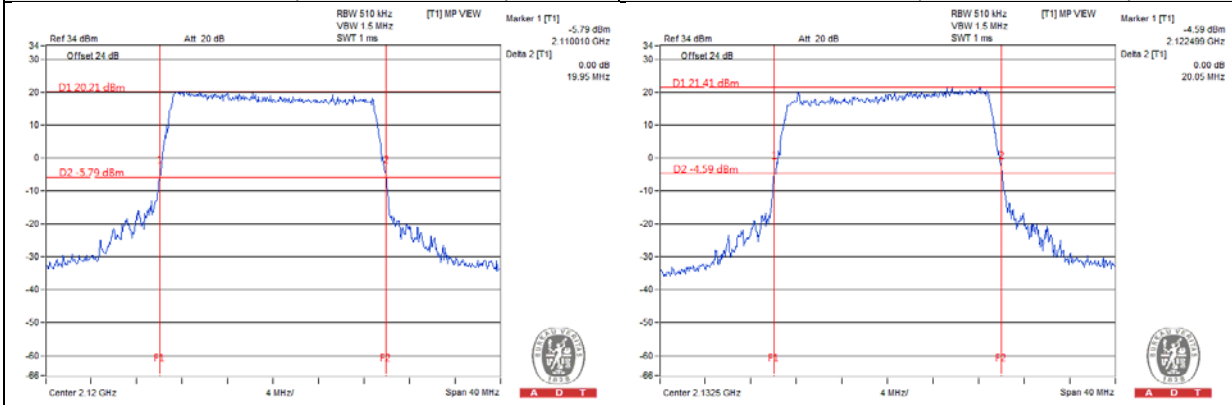
Channel Bandwidth: 15MHz							
Channel	Frequency (MHz)	-26dBc Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2025	2117.5	15.13	15.02	15.15	15.12	15.06	15.05
2175	2132.5	15.19	15.05	14.86	15.09	15.06	15.09
2325	2147.5	14.92	14.91	15	15.01	14.95	14.8

-26dBc Bandwidth (MHz)
Spectrum Plot of Worst Value



Channel Bandwidth: 20MHz							
Channel	Frequency (MHz)	-26dBc Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2050	2120	19.95	20.03	19.97	19.9	19.92	19.87
2175	2132.5	19.9	19.77	19.98	19.94	20.05	19.87
2300	2145	19.76	19.67	19.81	19.73	19.5	19.62

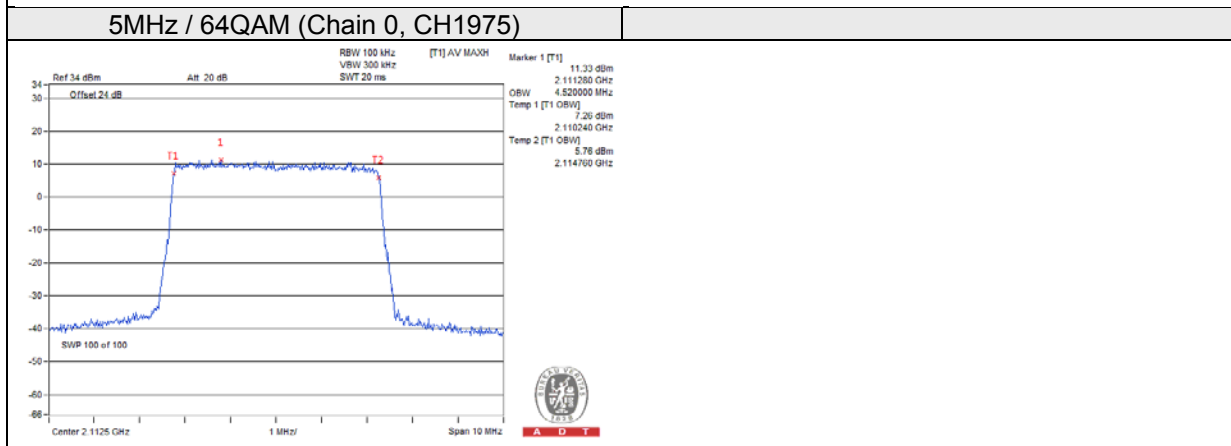
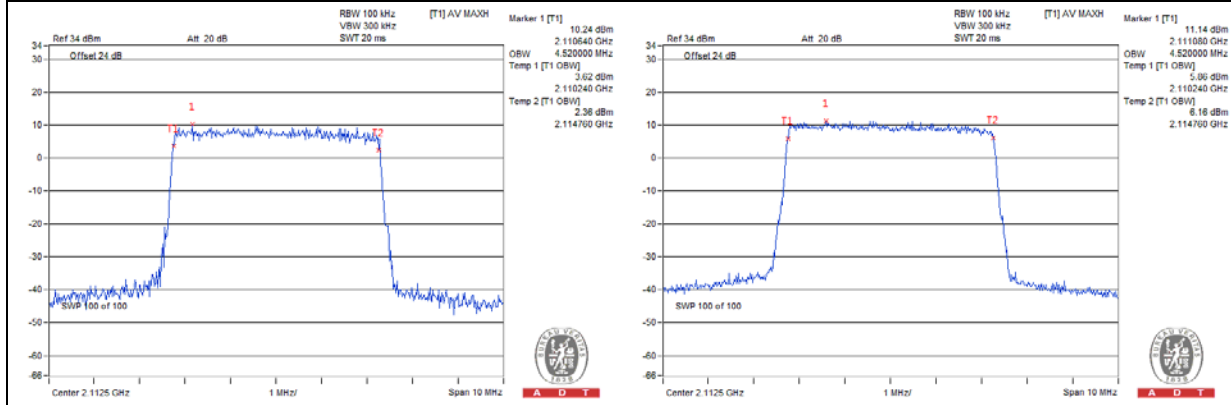
-26dBc Bandwidth (MHz)
Spectrum Plot of Worst Value



4.3.5 Test Results (Occupied Bandwidth)

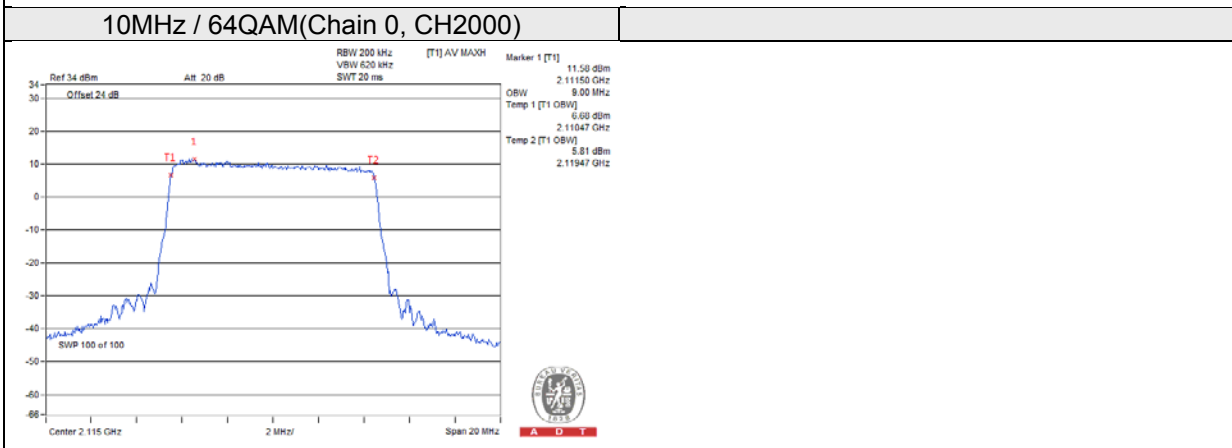
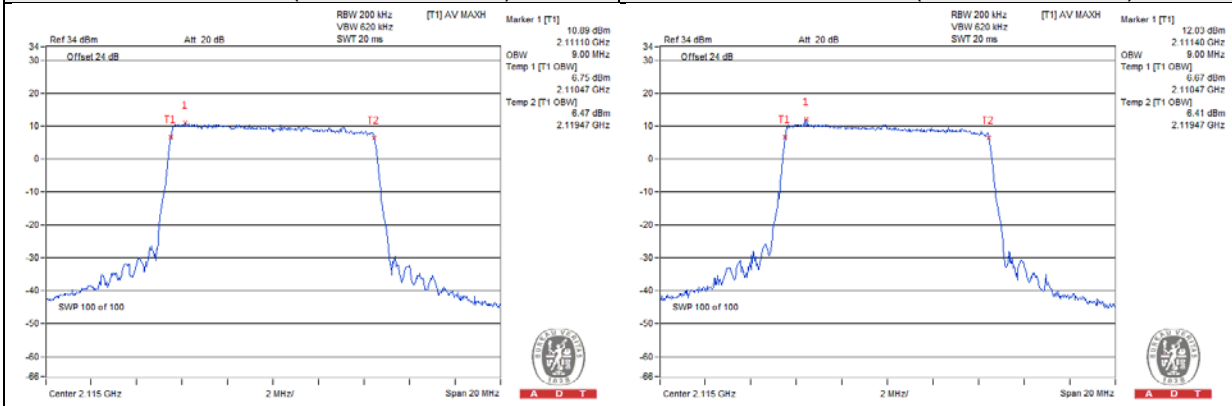
Channel Bandwidth: 5MHz							
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
1975	2112.5	4.52	4.52	4.52	4.50	4.52	4.52
2175	2132.5	4.52	4.52	4.50	4.52	4.52	4.52
2375	2152.5	4.50	4.50	4.50	4.50	4.50	4.50

Occupied Bandwidth Spectrum Plot of Worst Value



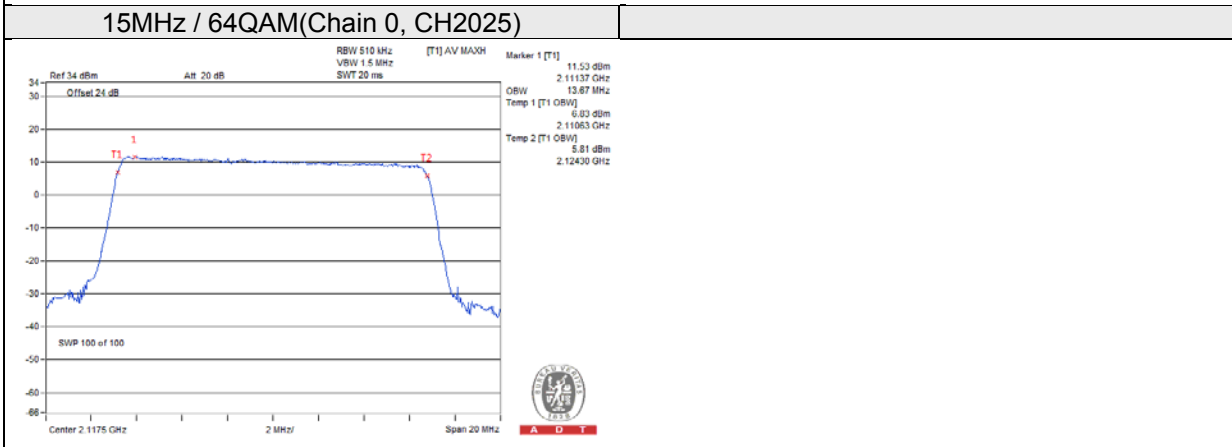
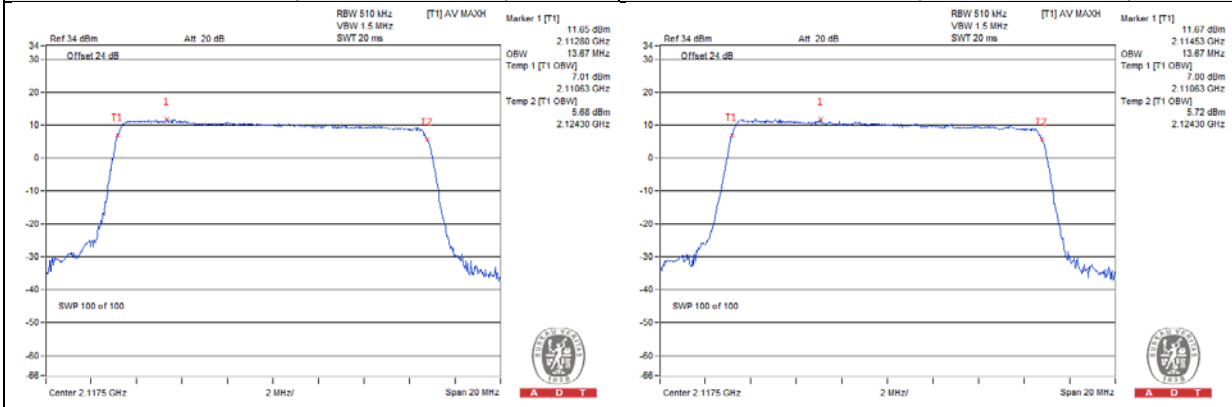
Channel Bandwidth: 10MHz							
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2000	2115	8.97	8.97	9.00	9.00	9.00	9.00
2175	2132.5	8.97	8.97	8.97	8.97	8.97	8.97
2350	2150	8.97	8.97	8.97	8.97	8.97	8.97

Occupied Bandwidth
Spectrum Plot of Worst Value



Channel Bandwidth: 15MHz							
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2025	2117.5	13.67	13.67	13.67	13.67	13.63	13.67
2175	2132.5	13.60	13.63	13.63	13.63	13.63	13.63
2325	2147.5	13.57	13.57	13.60	13.53	13.57	13.60

Occupied Bandwidth
Spectrum Plot of Worst Value



Channel Bandwidth: 20MHz

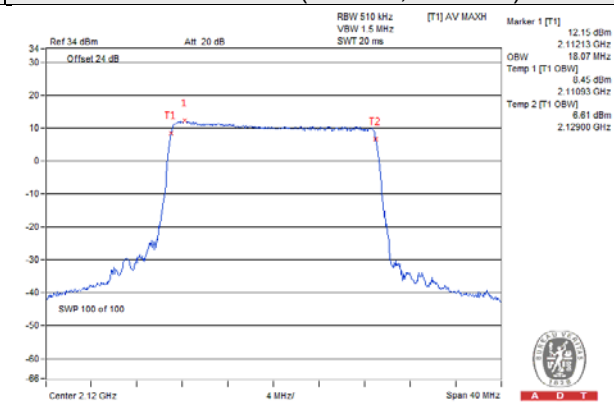
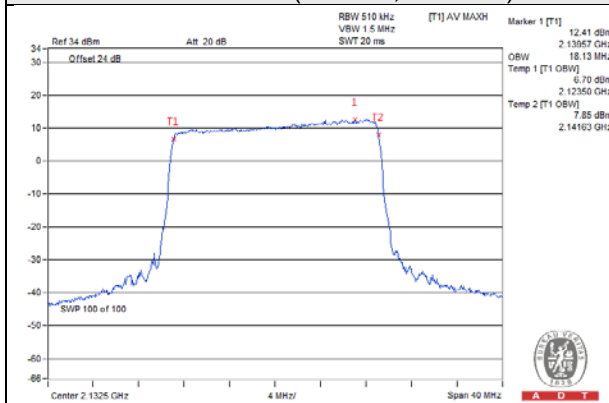
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2050	2120	18.07	18.07	18.07	18.07	18.07	18.07
2175	2132.5	18.13	18.07	18.07	18.07	18.07	18.07
2300	2145	17.87	17.87	17.87	17.87	17.87	17.87

Occupied Bandwidth

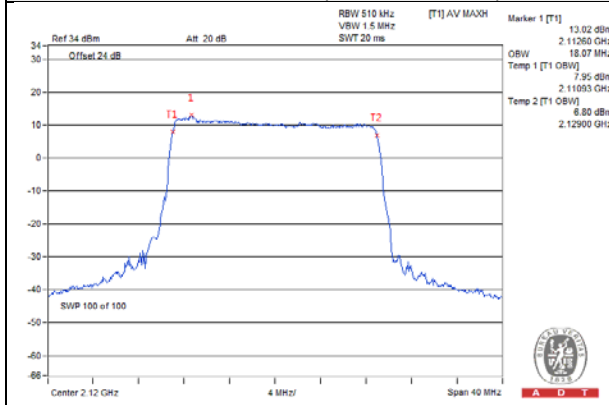
Spectrum Plot of Worst Value

20MHz / QPSK(Chain 0, CH2175)

20MHz / 16QAM(Chain 0, CH2050)



20MHz / 64QAM(Chain 0, 2050)



4.4 Channel Edge Measurement

4.4.1 Limits of Channel Edge Measurement

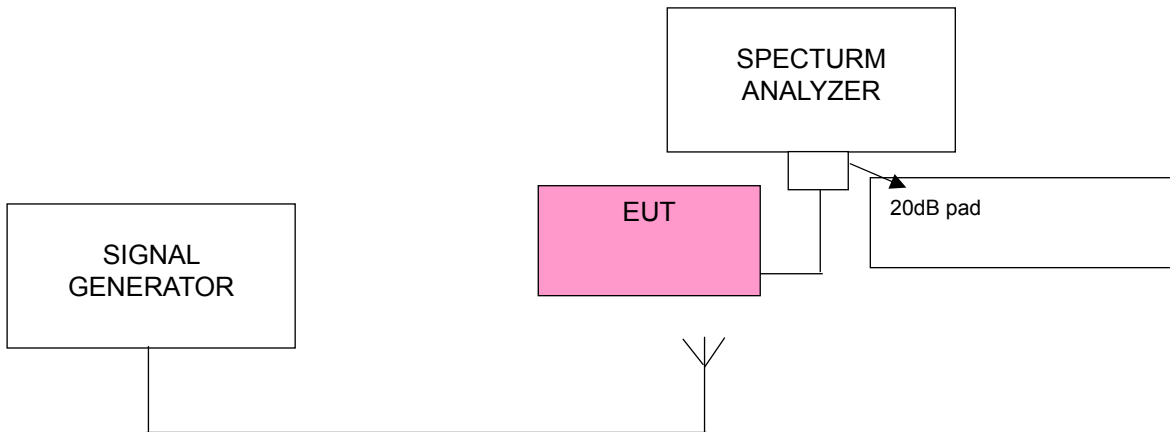
According to FCC 27.53(h) specified the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Note:

This device can be implement MIMO function, so the limit of spurious emissions needs to be reduced by $10 \log(\text{Numbers}_{\text{Ant}})$ according to FCC KDB 662911 D01 guidance.

{The limit is adjusted to $-13\text{dBm} - 10 \cdot \log(2) = -16.01\text{dBm}$.}

4.4.2 Test Setup



4.4.3 Test Procedures

- The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels: low, middle and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 15MHz. RBW of the spectrum is 100kHz (Channel Bandwidth: 5MHz & 10MHz) / 150kHz (Channel Bandwidth: 15MHz) / 200kHz (Channel Bandwidth: 20MHz).
- Record the max trace plot into the test report.

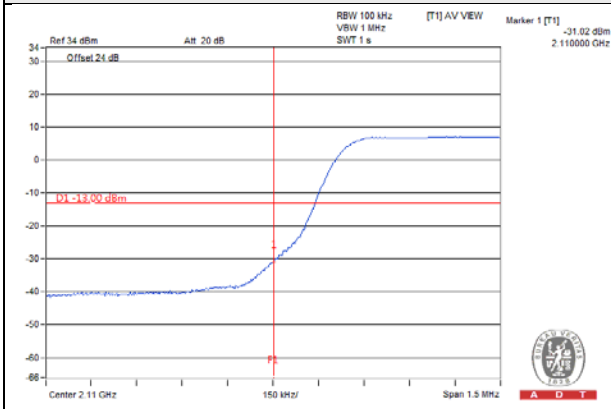
4.4.4 Test Results

Chain 0

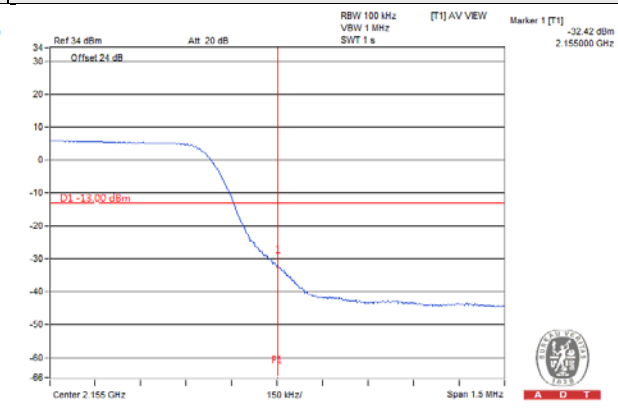
QPSK / Channel Bandwidth: 5MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-31.02	-16.01	-15.01	Pass
2155	-32.42	-16.01	-16.41	Pass

Ch1975



Ch2375

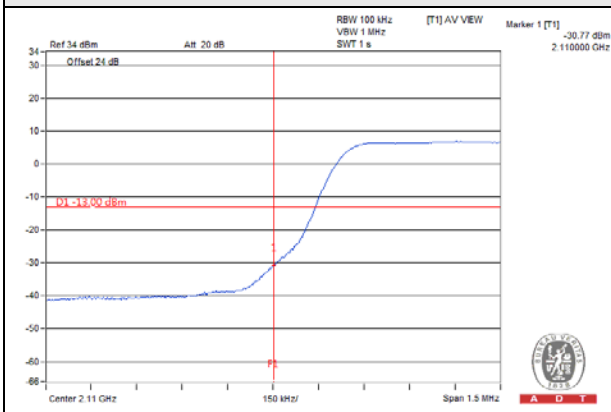


Chain 1

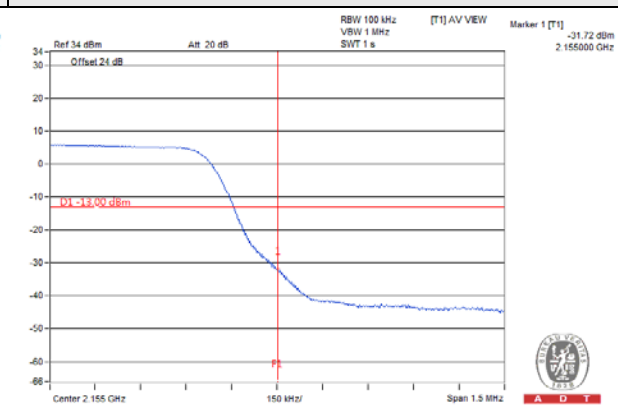
QPSK / Channel Bandwidth: 5MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-30.77	-16.01	-14.76	Pass
2155	-31.72	-16.01	-15.71	Pass

Ch1975



Ch2375



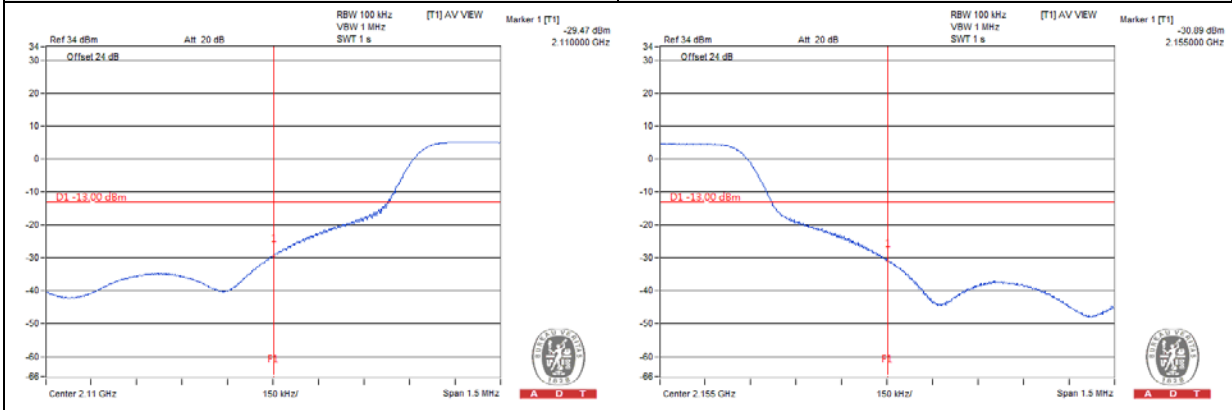
Chain 0

QPSK / Channel Bandwidth: 10MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-29.47	-16.01	-13.46	Pass
2155	-30.89	-16.01	-14.88	Pass

Ch2000

Ch2350



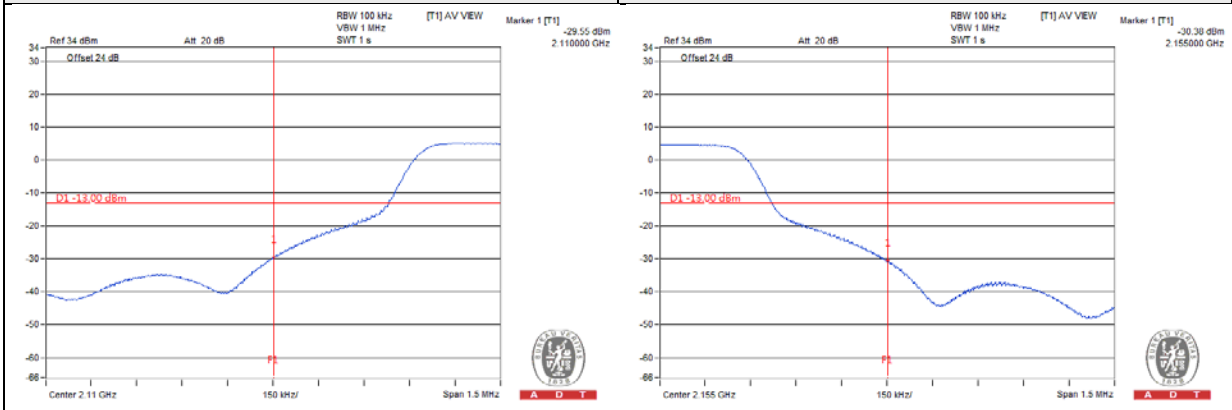
Chain 1

QPSK / Channel Bandwidth: 10MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-29.55	-16.01	-13.54	Pass
2155	-30.38	-16.01	-14.37	Pass

Ch2000

Ch2350



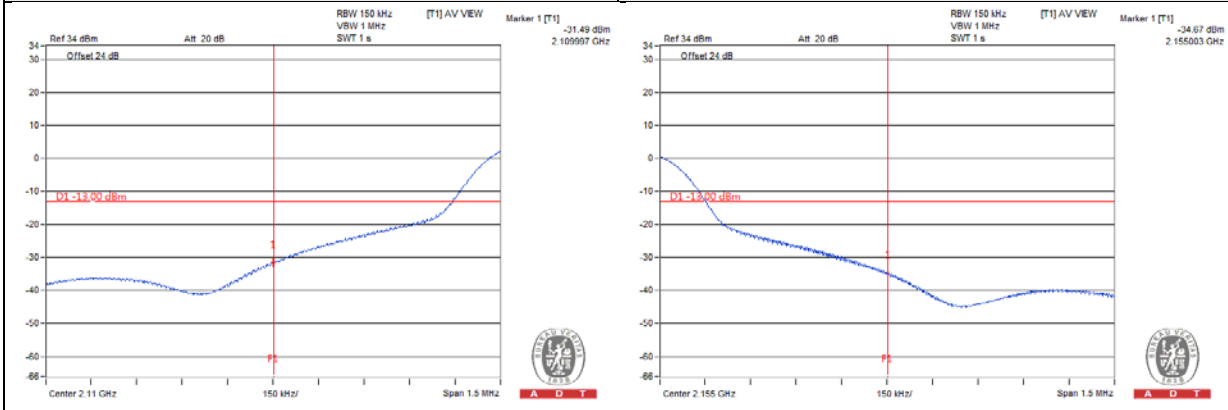
Chain 0

QPSK / Channel Bandwidth: 15MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-31.49	-16.01	-15.48	Pass
2155	-34.67	-16.01	-18.66	Pass

Ch2025

Ch2325



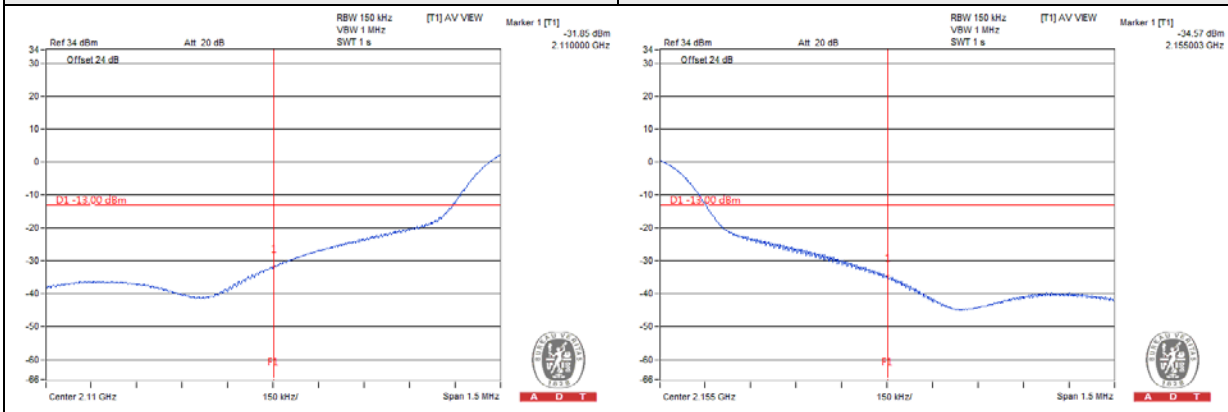
Chain 1

QPSK / Channel Bandwidth: 15MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-31.85	-16.01	-15.84	Pass
2155.01	-34.57	-16.01	-18.56	Pass

Ch2025

Ch2325



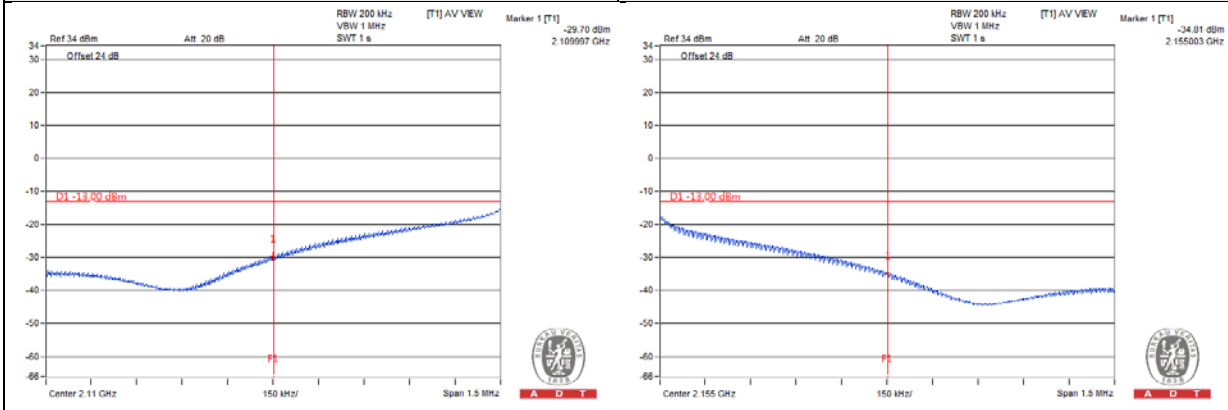
Chain 0

QPSK / Channel Bandwidth: 20MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2109.99	-29.7	-16.01	-13.69	Pass
2155	-34.81	-16.01	-18.8	Pass

Ch2050

Ch2300



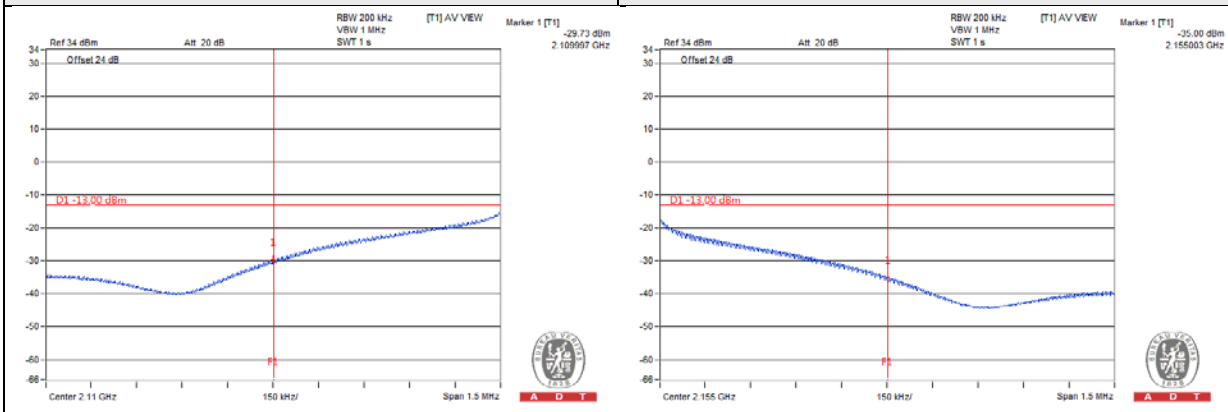
Chain 1

QPSK / Channel Bandwidth: 20MHz

Frequency(MHz)	Measurement Value	Limit	Margin	Result
2110	-29.73	-16.01	-13.72	Pass
2155.01	-35	-16.01	-18.99	Pass

Ch2050

Ch2300

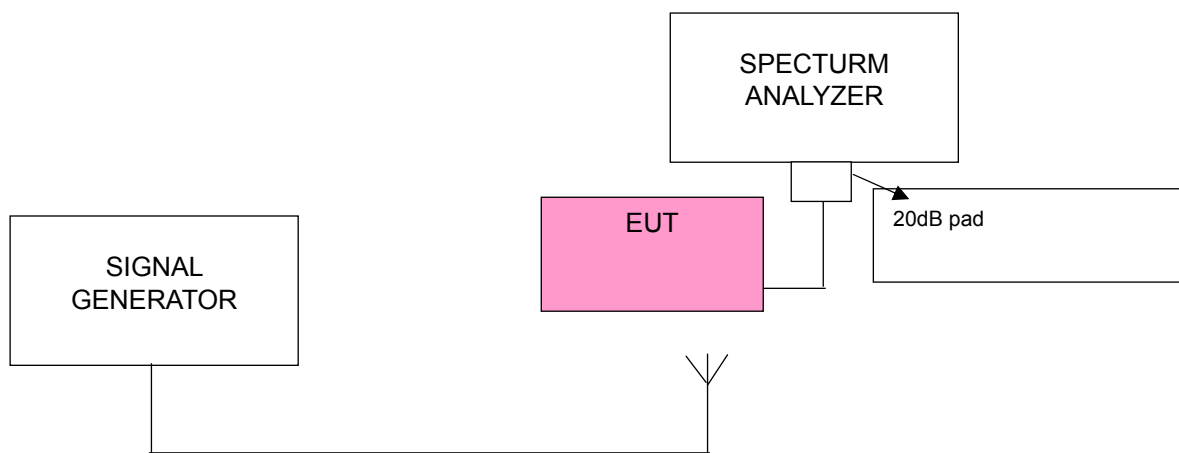


4.5 Peak to Average Ratio

4.5.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.5.2 Test Setup

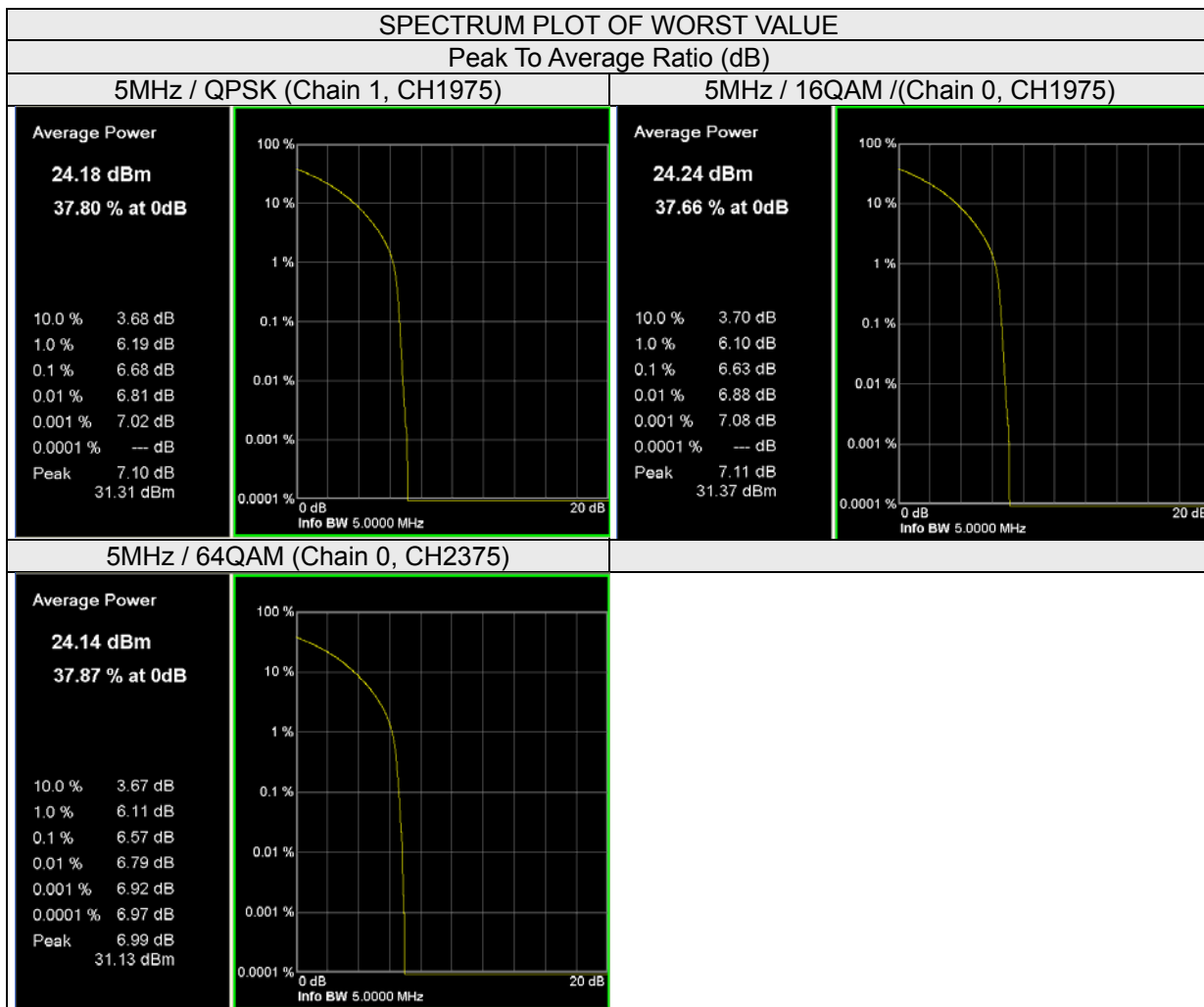


4.5.3 Test Procedures

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

4.5.4 Test Results

Channel Bandwidth: 5MHz							
Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
1975	2112.5	6.62	6.59	6.5	6.68	6.63	6.66
2175	2132.5	6.54	6.62	6.56	6.54	6.52	6.56
2375	2152.5	6.58	6.52	6.57	6.62	6.57	6.56



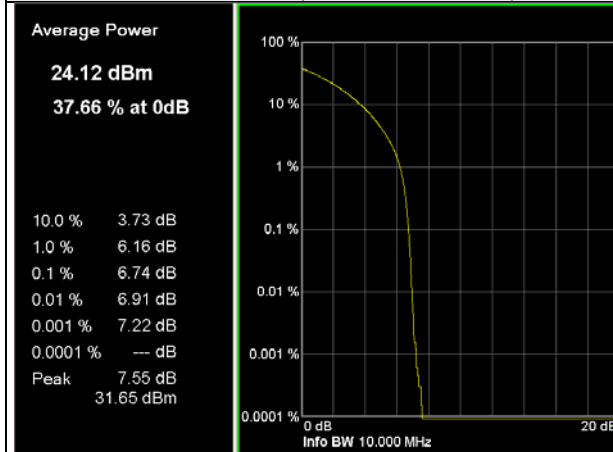
Channel Bandwidth: 10MHz

Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2000	2115	6.66	6.71	6.71	6.74	6.71	6.79
2175	2132.5	6.66	6.64	6.68	6.56	6.66	6.66
2350	2150	6.67	6.66	6.68	6.67	6.66	6.66

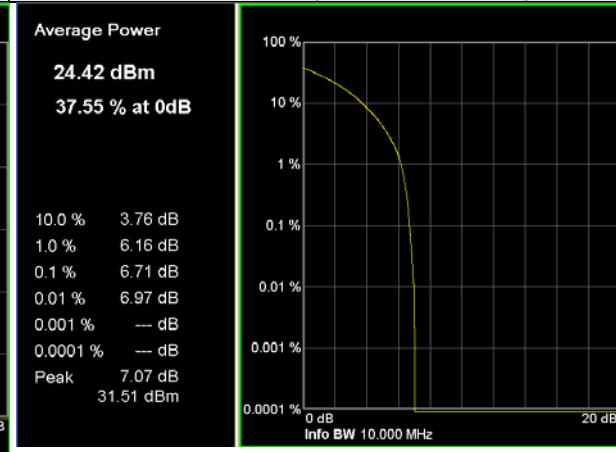
SPECTRUM PLOT OF WORST VALUE

Peak To Average Ratio (dB)

10MHz / QPSK (Chain 1, CH2000)



10MHz / 16QAM /(Chain 0, CH2000)



10MHz / 64QAM (Chain 1, CH2000)



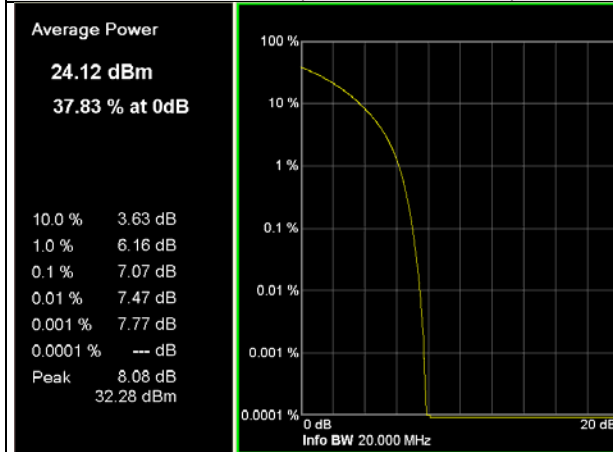
Channel Bandwidth: 15MHz

Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2025	2117.5	7.07	7.07	7.07	7.07	7.07	7.05
2175	2132.5	6.96	6.96	6.96	6.96	6.96	6.96
2325	2147.5	6.96	6.96	6.96	6.95	6.96	6.86

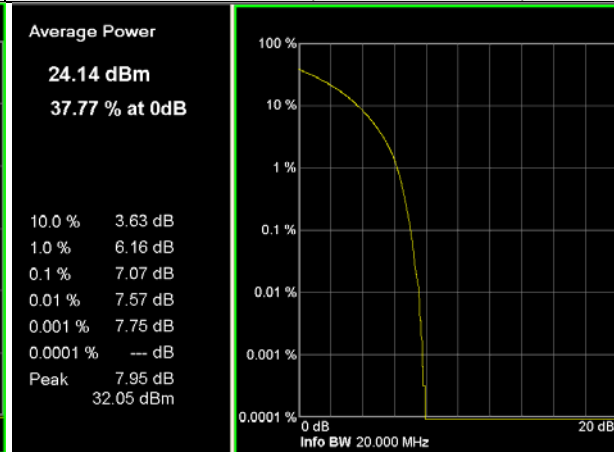
SPECTRUM PLOT OF WORST VALUE

Peak To Average Ratio (dB)

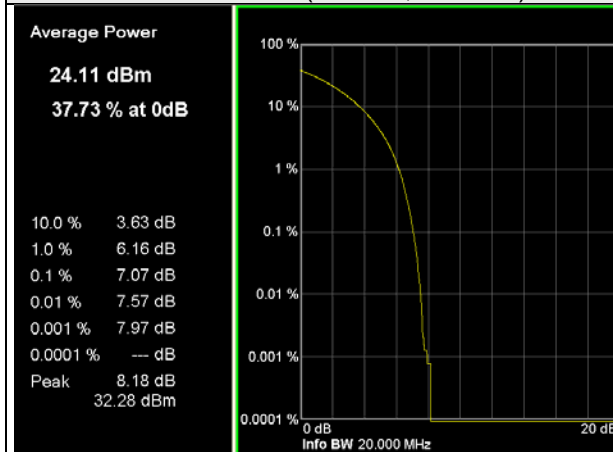
15MHz / QPSK (Chain 0, CH2025)



15MHz / 16QAM /(Chain 0, CH2025)



15MHz / 64QAM (Chain 0, CH2025)



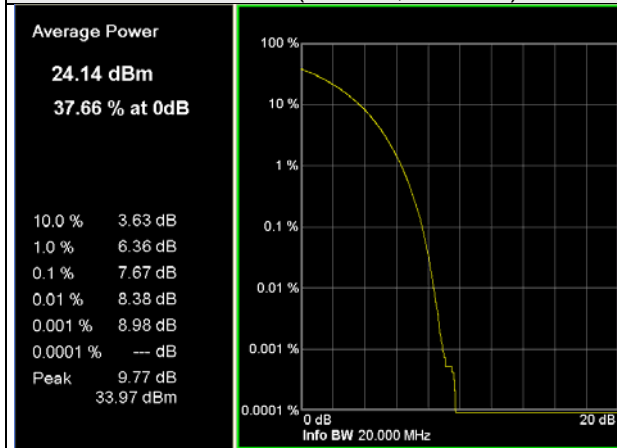
Channel Bandwidth: 20MHz

Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2050	2120	7.67	7.67	7.64	7.67	7.67	7.62
2175	2132.5	7.57	7.67	7.58	7.55	7.57	7.68
2300	2145	7.57	7.62	7.64	7.57	7.58	7.68

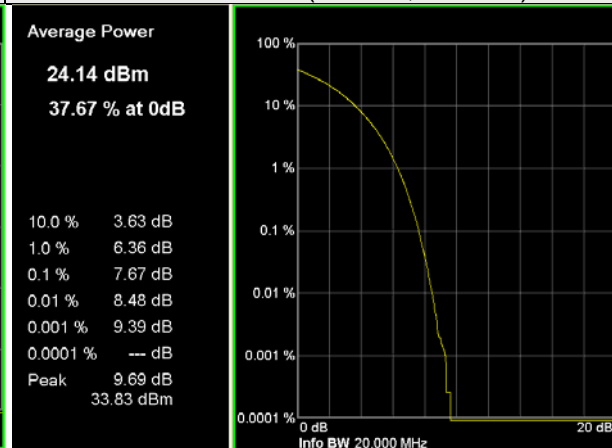
SPECTRUM PLOT OF WORST VALUE

Peak To Average Ratio (dB)

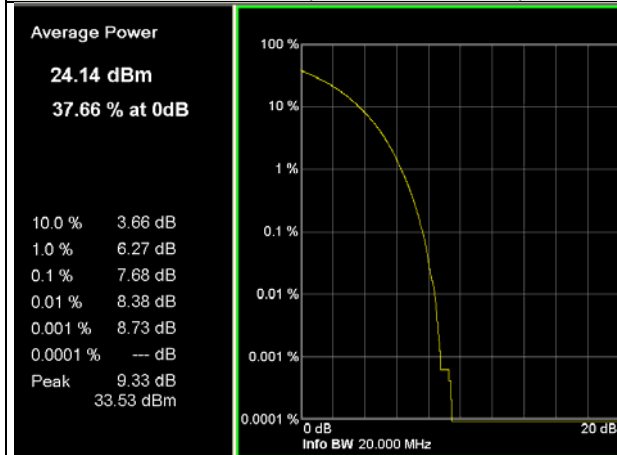
20MHz / QPSK (Chain 1, CH2025)



20MHz / 16QAM (Chain 0, CH2050)



20MHz / 64QAM (Chain 1, CH2175)



4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

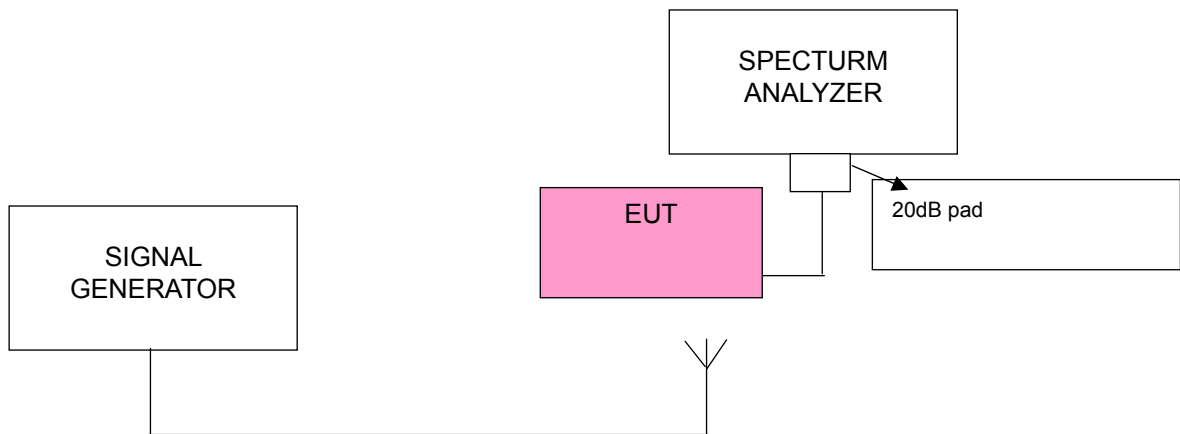
In the FCC 27.53(h), On any frequency outside a licensee's frequency block, The power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB, the emission limit equal to -13dBm .

Note:

This device can be implemet MIMO function, so the limit of spurious emissions needs to be reduced by $10\log(\text{Numbers}_{\text{Ant}})$ according to FCC KDB 662911 D01 guidance.

{The limit is adjusted to $-13\text{dBm} - 10*\log(2) = -16.01\text{dBm}$.}

4.6.2 Test Setup



4.6.3 Test Procedure

- All measurements were done at 3 channels: low, middle and high operational frequency range.
- When the spectrum scanned from 9kHz to 26.5GHz, it shall be connected to the 20dB pad attenuated the carried frequency.