FCC Test Report (Part 90S)

Report No.:	RF160802E01
FCC ID:	2AD8UFW2CA01
Test Model:	FW2CA
Received Date:	Aug. 02, 2016
Test Date:	Aug. 31 to Oct. 11, 2016
Issued Date:	Oct. 17, 2016
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:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, 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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Release Control Record

Issue No.	Description	Date Issued
RF160802E01	Original release	Oct. 17, 2016

1 Certificate of Conformity

Product:	Mini Macro Outdoor Pico BTS
Brand:	Nokia
Test Model:	FW2CA
Sample Status:	MASS-PRODUCTION
Applicant:	Nokia Solutions and Networks
Test Date:	Aug. 31 to Oct. 11, 2016
Standards:	FCC Part 90, Subpart S 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 : _____ , **Date:** Oct. 17, 2016

Claire Kuan / Specialist

Approved by : _____ , **Date:** Oct. 17, 2016

May Chen / Manager

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 90.635 (b)	EffectiveRadiated Power Limit: max. 1kilowatt e.r.p power	PASS	Meet the requirement of limit.
2.1055 90.213	Frequency Stability	PASS	Meet the requirement of limit.
2.1049 90.209	Occupied Bandwidth	PASS	Meet the requirement of limit.
2.1051 90.691	Emission Mask	PASS	Meet the requirement of limit.
---	Peak To Average Ratio	PASS	Meet the requirement of limit.
2.1051 90.691	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
2.1053 90.691	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -34.15dB at 36.68MHz.

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	Expended Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.31 dB
	200MHz ~1000MHz	3.40 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	3.73 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Test Site and Instruments

For Spurious Emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated _V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 test was performed in 966 Chamber No. 3.
3. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Loop antenna was used for all emissions below 30 MHz
6. Tested Date: Aug. 31 to Oct. 11, 2016

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 27, 2016	Jan. 26, 2017
Spectrum Analyzer Keysight	N9030A	MY54490570	July 06, 2016	July 05, 2017
AC Power Source Extech Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 03, 2015	Dec. 02, 2016
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	Y45094468/005 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2015	Nov. 09, 2016
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53052647	July 25, 2016	July 24, 2017
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_01	Nov. 23, 2015	Nov. 22, 2016
Switch Box Agilent	PS-X10-100	PS-X10-100_01	NA	NA
Test Receiver Agilent	N9038A	MY54450088	July 20, 2016	July 19, 2017

NOTE: 1. The test was performed in Oven room 1.
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: Aug. 31 to Oct. 11, 2016

3 General Information

3.1 General Description of EUT

Product	Mini Macro Outdoor Pico BTS		
Brand	Nokia		
Test Model	FW2CA		
Test Sample S/N	MS162900006		
Hardware Version	X22		
Status of EUT	MASS-PRODUCTION		
Power Supply Rating	90 - 264Vac		
Modulation Type	QPSK, 16QAM, 64QAM		
Operating Frequency	LTE Band 26	Channel Bandwidth 5MHz	TX: 865.1, 865.8, 866.5 MHz
			RX: 820.1, 820.8, 821.5 MHz
Max. ERP Power	LTE Band 26	Channel Bandwidth 5MHz	406946.4mW
Emission Designator	LTE Band 26	Channel Bandwidth 5MHz	QPSK: 4M50G7D
			16QAM: 4M48D7W
			64QAM: 4M51D7W
Antenna Type	Refer to note as below		
Antenna Connector	Refer to note as below		
Accessory Device	NA		
Data Cable Supplied	NA		

Note:

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

Antenna Spec.						
Set	Antenna Condition	Brand	Model	Antenna Type	Gain(dBi)	Frequency (MHz)
1	LTE 1	Alpha Wireless	AW3439	PANEL Type	12.5	LTE B26 806-896
	LTE 2	Alpha Wireless	AW3439	PANEL Type	12.5	LTE B26 806-896
2	LTE 1	Alpha Wireless	AW3176	Omni Type	6	LTE B26 790-890
	LTE 2	Alpha Wireless	AW3176	Omni Type	6	LTE B26 790-890
3	LTE 1	Alpha Wireless	AW3543	Omni Type	4.5	LTE B26 806-896
	LTE 2	Alpha Wireless	AW3543	Omni Type	4.5	LTE B26 806-896

2. The EUT uses following internal power supply.

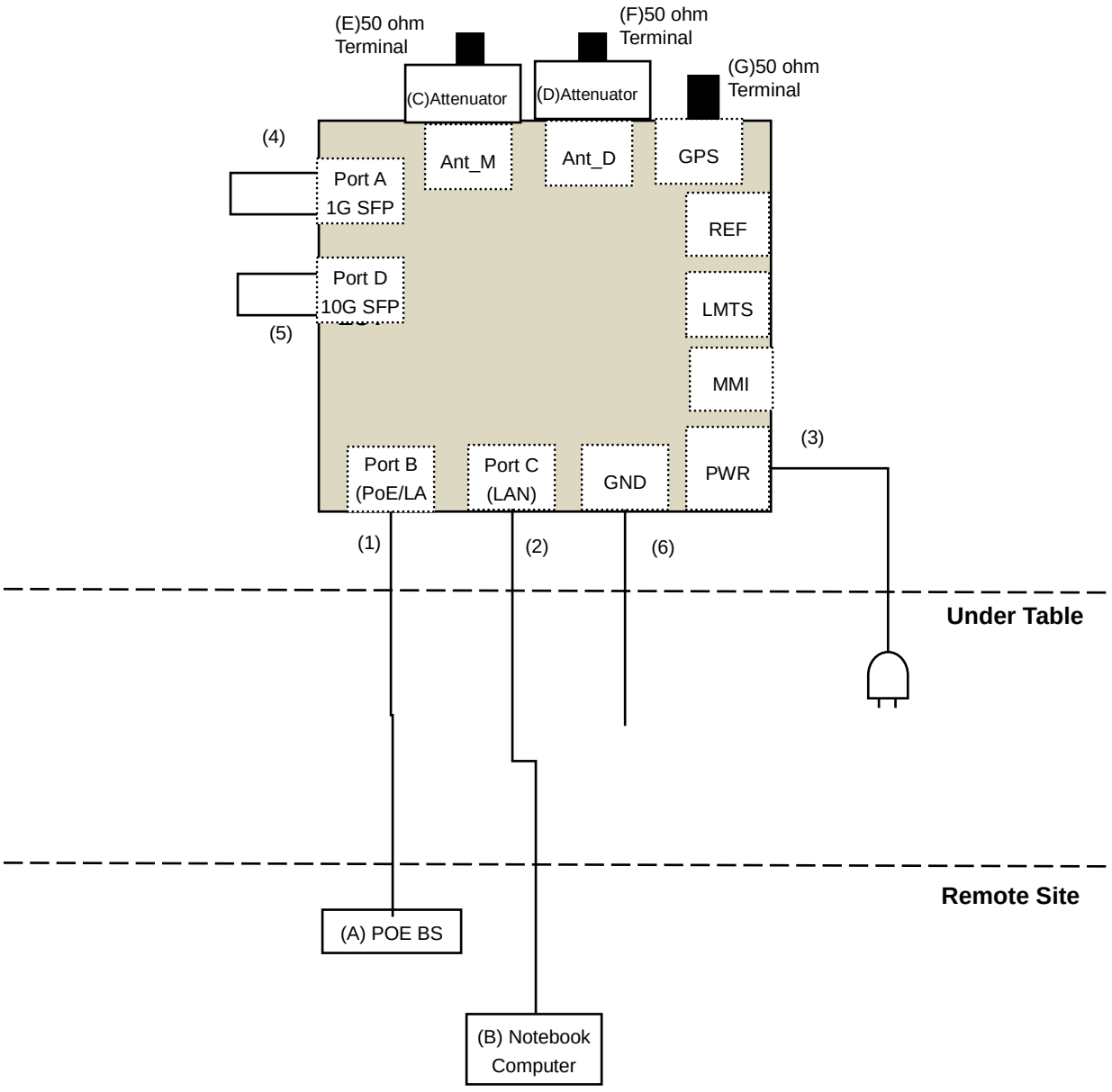
Brand	GE
Model	CLP0412
Input Power	90 - 264Vac
Output Power	12Vdc

3. The EUT must be inserted with one module as following table:

Product Name	Brand	Model No.	FCC ID
BT module	Nokia	NBTM01	2AD8UNBTM01

4. 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



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	PoE BS	Nokia	NA	NA	AN	Supplied by client
B	Notebook Computer	DELL	E6420	482T3R1	FCC DoC	Provided by Lab
C	Attenuator	NA	NA	NA	AN	Supplied by client
D	Attenuator	NA	NA	NA	AN	Supplied by client
E	50 ohm Terminal	NA	NA	NA	AN	Provided by Lab
F	50 ohm Terminal	NA	NA	NA	AN	Provided by Lab
G	50 ohm Terminal	NA	NA	NA	AN	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 Cable	1	10	No	0	Provided by Lab
2	RJ-45 Cable	1	3	No	0	Provided by Lab
3	AC Cable	1	10	No	0	Supplied by client
4	Fiber Cable	1	5	No	0	Supplied by client
5	Fiber Cable	1	3	No	0	Supplied by client
6	Cable	1	3	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. Following channel(s) was (were) selected for the final test as listed below:

Test Item	Available Frequency (MHz)	Tested Frequency (MHz)	Channel Bandwidth	Modulation
Output Power	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK
Frequency Stability	865.1~ 866.5	866.5	5MHz	QPSK
Emission Bandwidth	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK, 16QAM, 64QAM
Emission Mask	865.1~ 866.5	865.1/ 866.5	5MHz	QPSK
Peak To Average Ratio	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK, 16QAM, 64QAM
Conducted Emission	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK
Radiated Emission Below 1GHz	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK
Radiated Emission Above 1GHz	865.1~ 866.5	865.1/ 865.8/ 866.5	5MHz	QPSK

NOTE:
All supported modulation types were evaluated.The Worst case emaission of QPSK was selected. Therefore, the Output power, Frequency Stability, Emission Mask, 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	Gary Cheng
Frequency Stability	25deg. C, 63%RH	120Vac, 60Hz	Gary Cheng
Emission Bandwidth	25deg. C, 63%RH	120Vac, 60Hz	Gary Cheng
Emission Mask	25deg. C, 63%RH	120Vac, 60Hz	Gary Cheng
Peak To Average Ratio	25deg. C, 63%RH	120Vac, 60Hz	Gary Cheng
Conducted Emission	25deg. C, 63%RH	120Vac, 60Hz	Gary Cheng
Radiated Emission	20deg. C, 62%RH 24deg. C, 64%RH	120Vac, 60Hz	JyunChun Lin
	20deg. C, 62%RH 24deg. C, 64%RH	120Vac, 60Hz	JyunChun Lin

3.4 EUT Operating Conditions

The software (telnet pasted command.txt) provided by client to enable the 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 90

KDB 971168 D01 Power Meas License Digital Systems v02r02

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI/TIA/EIA-603-D 2010

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 and Antenna Height

The effective radaited power shall be according to the specific rule Part 90.635 that “The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m.(1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.”.

Antenna height (ATT) meters (feet)	Effective radiated power (watts)
Above 1,372 (4,500)	65
Above 1,220 (4,000) to 1,372 (4,500)	70
Above 1,067 (3,500) to 1,220 (4,000)	75
Above 915 (3,000) to 1,067 (3,500)	100
Above 763 (2,500) to 915 (3,000)	140
Above 610 (2,000) to 763 (2,500)	200
Above 458 (1,500) to 610 (2,000)	350
Above 305 (1,000) to 458 (1,500)	600
Up to 305 (1,000)	1,000

4.1.2 Test Procedures

EIRP / ERP Measurement:

a. The EUT was set up for the maximum power with LTE link data modulation. The power was measured with power meter. All measurements were done at low, middle and high operational frequency range.

b. The average power meter was used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum outputpower level applies. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), then the gated average power meter was used to perform the measurement if the gating parameters can be adjusted such that the power is measured only during active transmission bursts at maximum output power levels.

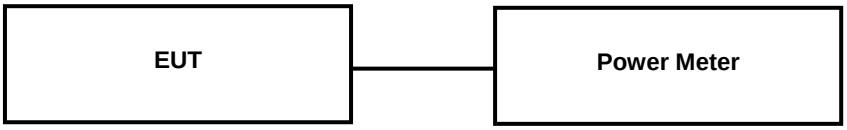
c. Relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

ERP or EIRP = PMeas + GT

Where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as PMeas, e.g., dBm or dBW)
PMeas measured transmitter output power, in dBm or dBW
GT gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

4.1.3 Test Setup



4.1.4 Test Results

ERP Power

Channel Bandwidth: 5MHz

Chan.	Freq (MHz)	Conducted Power (dBm)		Antenna Gain (dBi)		ERP				Total Power	
						dBm		mW		dBm	mW
		Chain (0)	Chain (1)	Chain (0)	Chain (1)	Chain (0)	Chain (1)	Chain (0)	Chain (1)		
8751	865.1	42.77	42.68	12.50	12.50	53.12	53.03	205116.2	200909.3	56.09	406025.5
8758	865.8	42.76	42.71	12.50	12.50	53.11	53.06	204644.5	202301.9	56.10	406946.4
8765	866.5	42.21	41.86	12.50	12.50	52.56	52.21	180301.8	166341.3	55.40	346643.1

Note: ERP = EIPR - 2.15dB = Conducted power (dBm) + Antenna gain (dBi) - 2.15dB

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stabiliity Measurement

1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

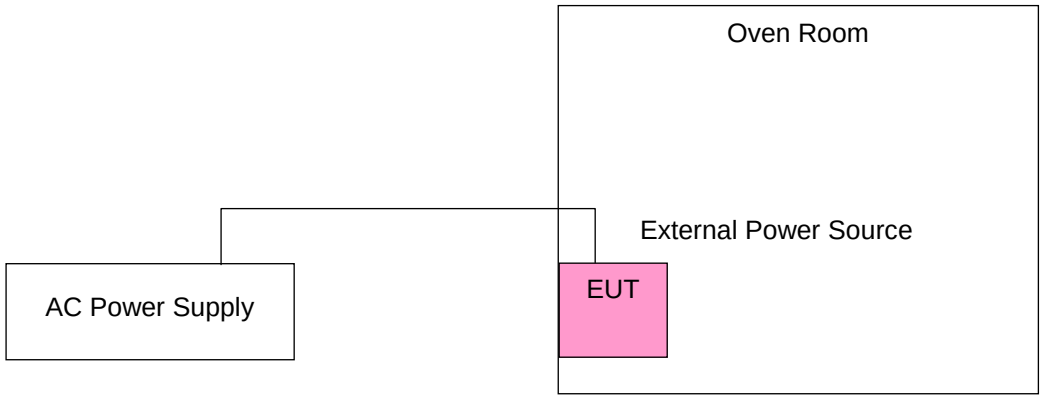
4.2.2 Test Procedure

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. EUT is connected the external power supply to control the AC input power. 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 ±0.5 ℃ 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.

4.2.3 Test Setup



4.2.4 Test Results

Frequency Error vs. Voltage		
866.5 MHz		
Voltage (Volts)	Frequency Error (ppm)	Limit (ppm)
	LTE	
	5MHz	
102	0.039	1.5
138	0.040	1.5

Frequency Error vs. Temperature.		
866.5 MHz		
TEMP. (℃)	Frequency Error (ppm)	Limit (ppm)
	LTE	
	5MHz	
75	0.046	1.5
70	0.045	1.5
60	0.045	1.5
50	0.030	1.5
40	0.037	1.5
30	0.036	1.5
20	0.030	1.5
10	0.031	1.5
0	0.033	1.5
-10	0.039	1.5
-20	0.042	1.5
-30	0.050	1.5

4.3 Occupied Bandwidth Measurement

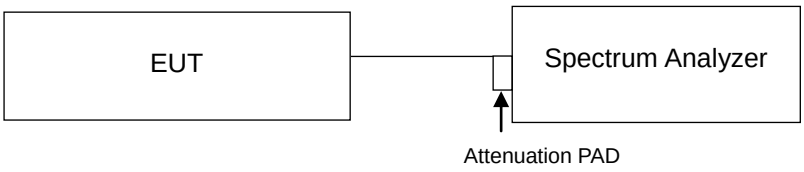
4.3.1 Limits of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 %of the total mean power of a given emission.

4.3.2 Test Procedure

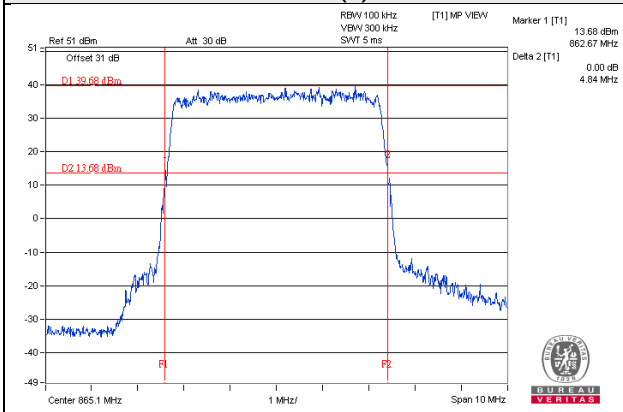
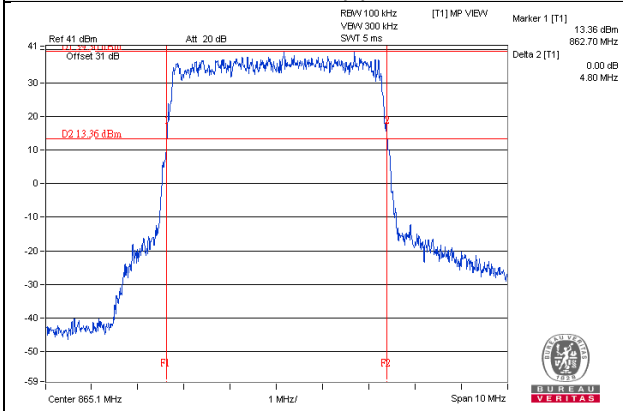
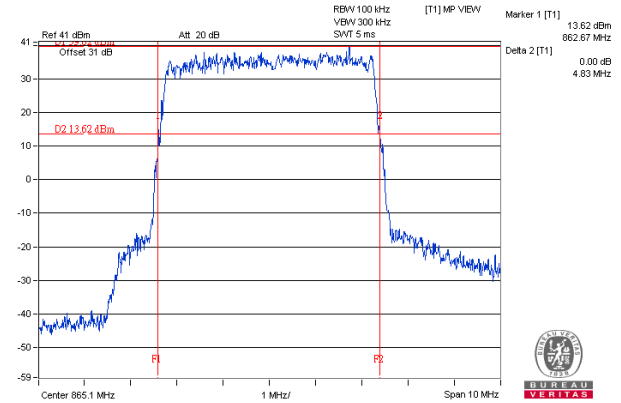
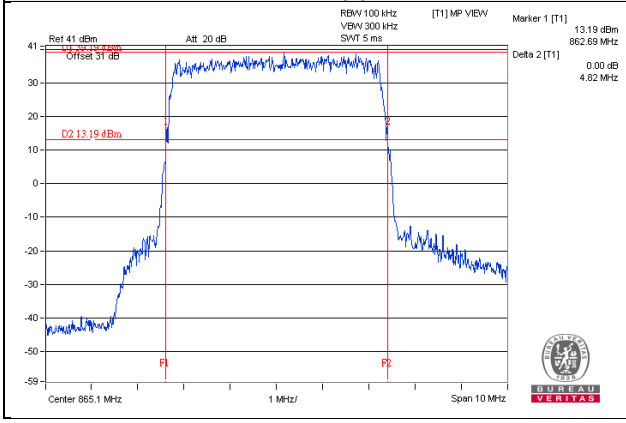
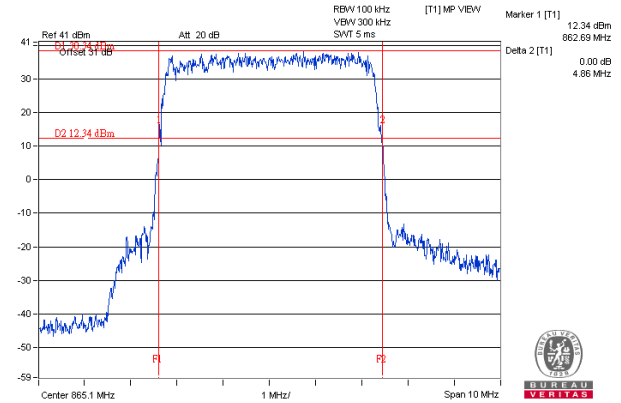
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range, RB of the spectrum is 1% of occupied bnadwidth and VB of the spectrum is 3 times RBW. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

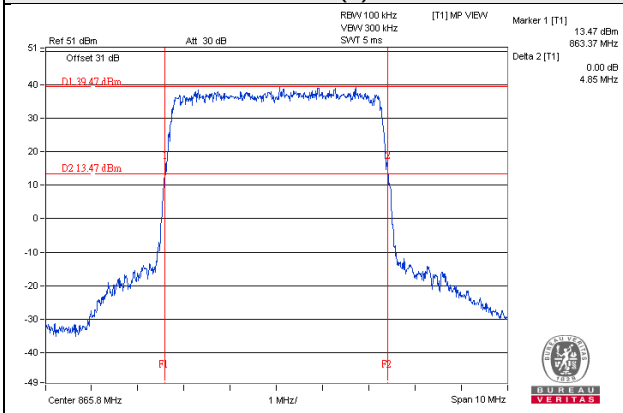
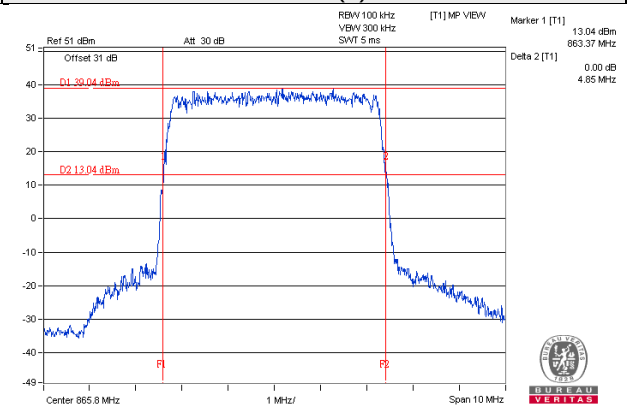
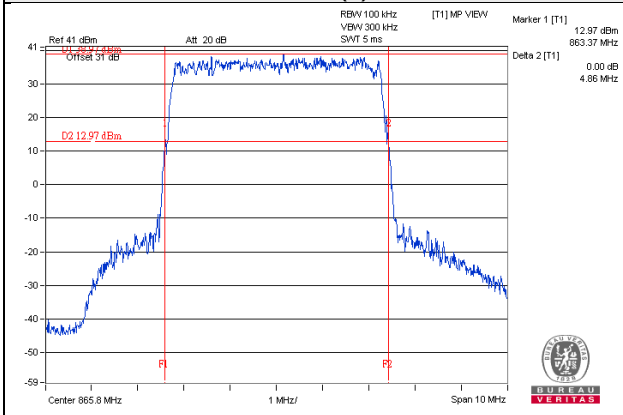
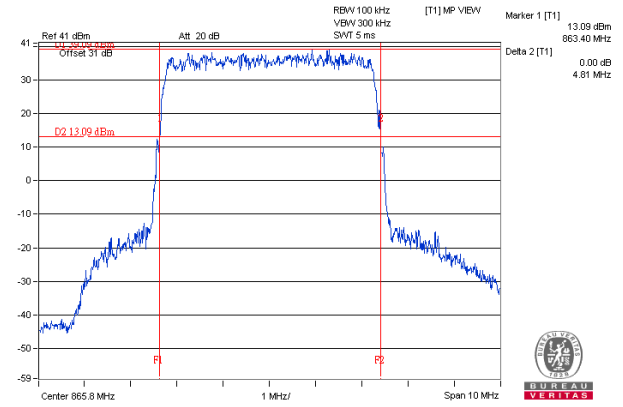
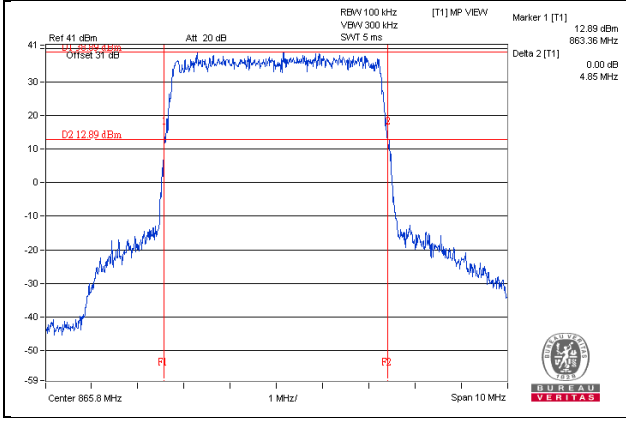
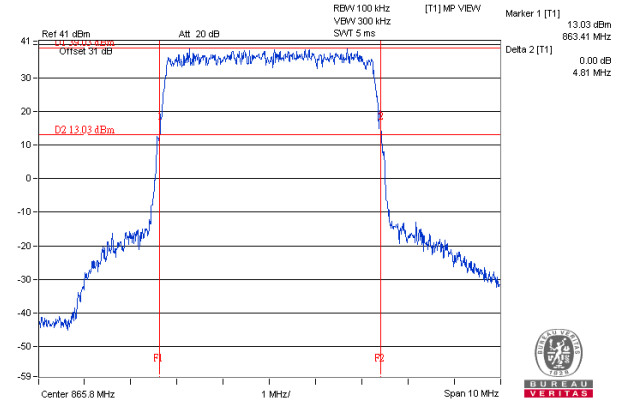
4.3.3 Test Setup

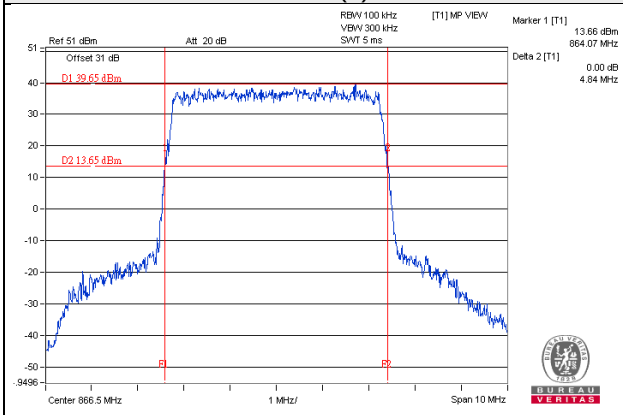
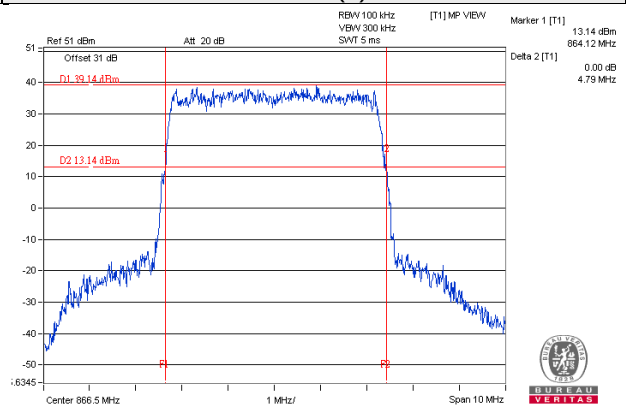
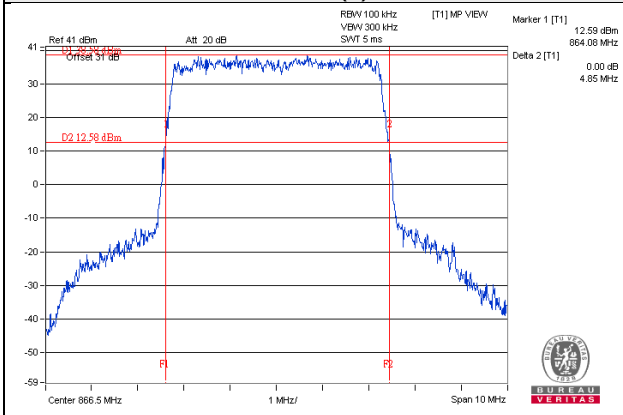
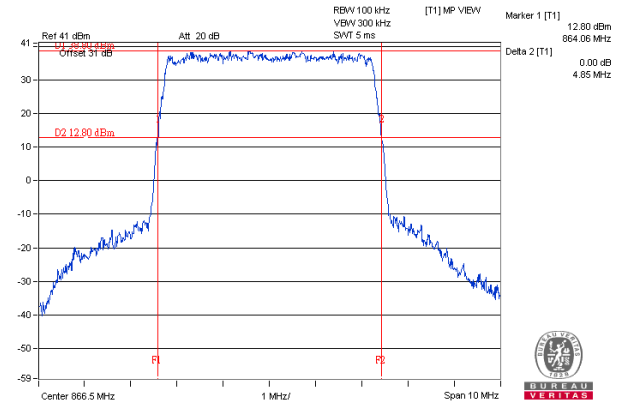
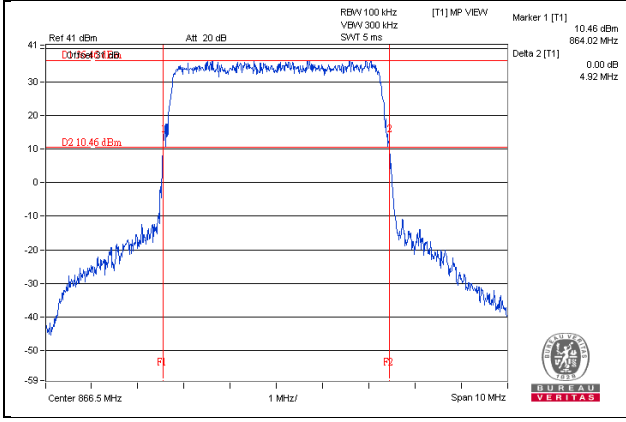
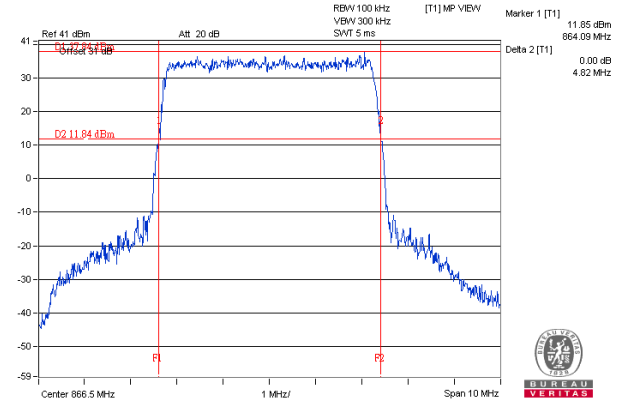


4.3.4 Test Result (-26dB Bandwidth)

LTE Band 26							
Channel Bandwidth 5MHz							
Channel	Frequency (MHz)	-26dB Occupied Bandwidth (MHz)					
		Chain (0)			Chain (1)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
8751	865.1	4.84	4.80	4.82	4.81	4.83	4.86
8758	865.8	4.85	4.86	4.85	4.85	4.81	4.81
8765	866.5	4.84	4.85	4.92	4.79	4.85	4.82

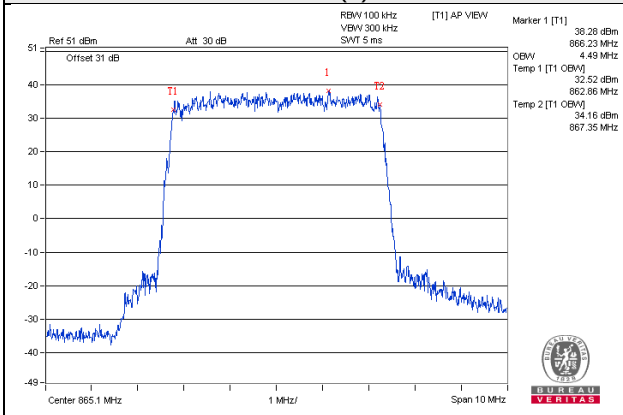
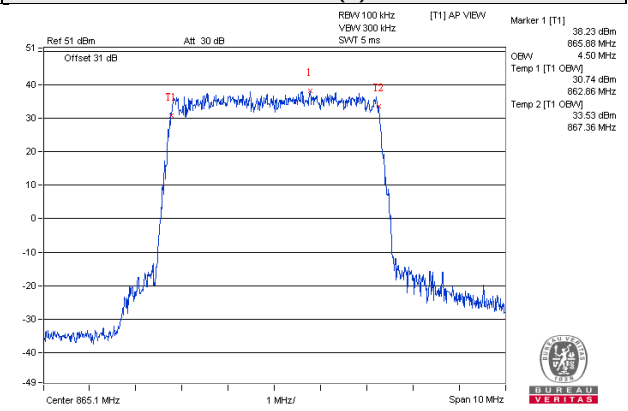
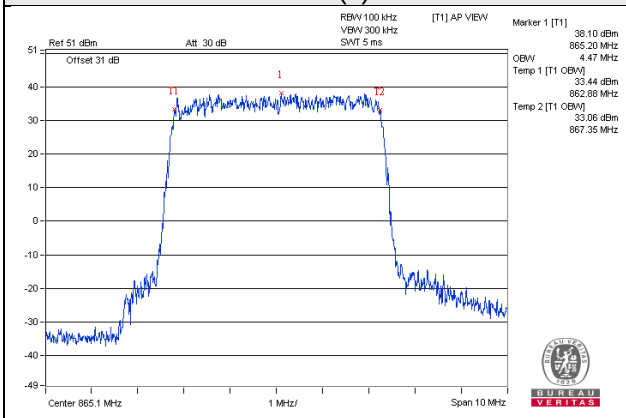
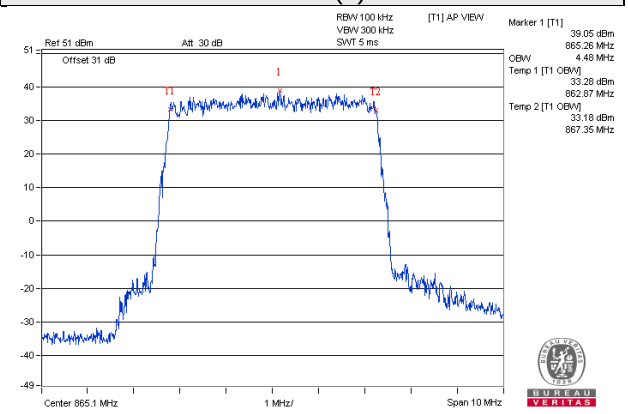
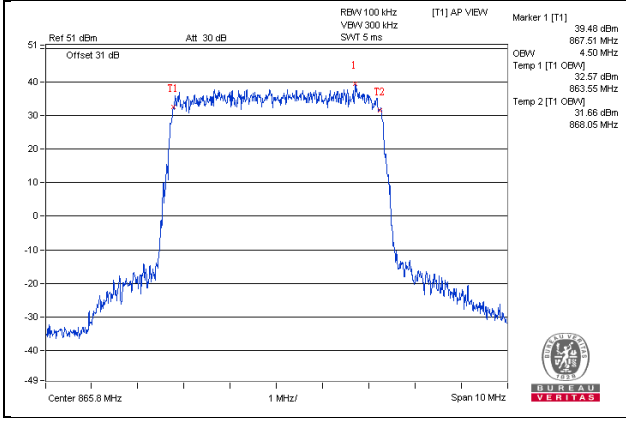
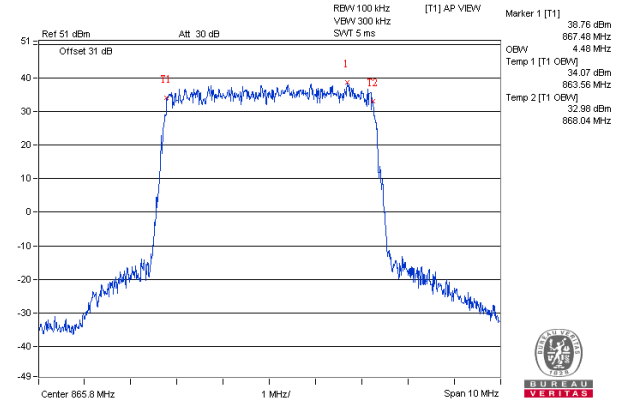
Spectrum Plot Of Worst Value	
Channel 8751	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

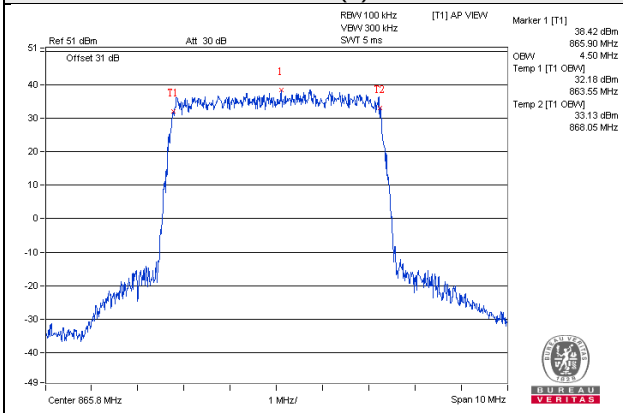
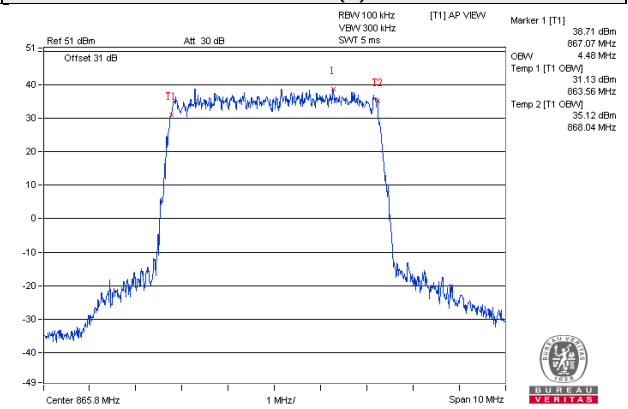
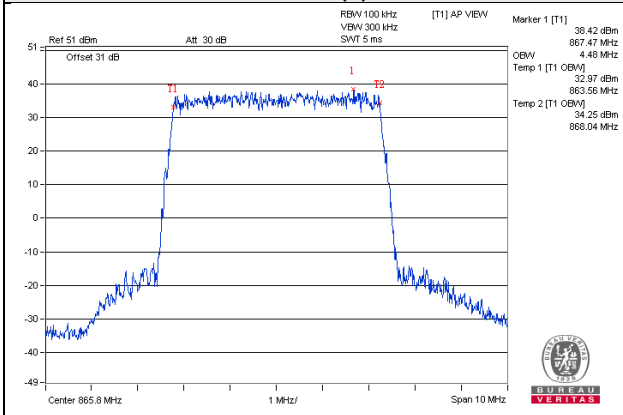
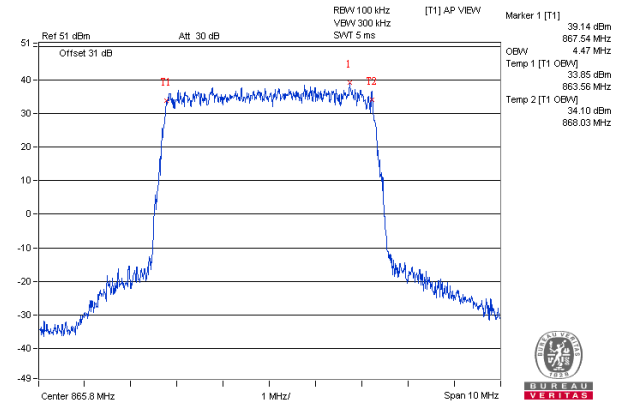
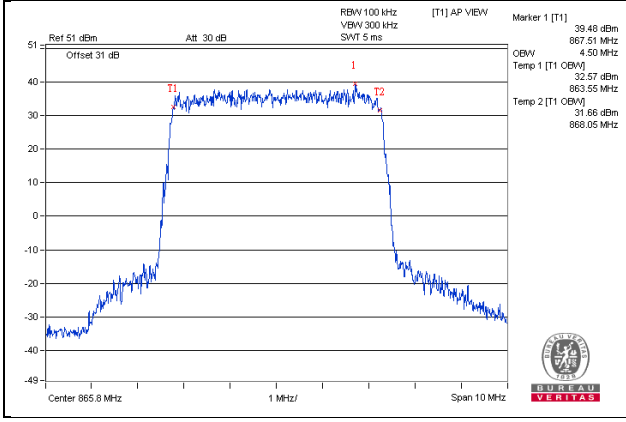
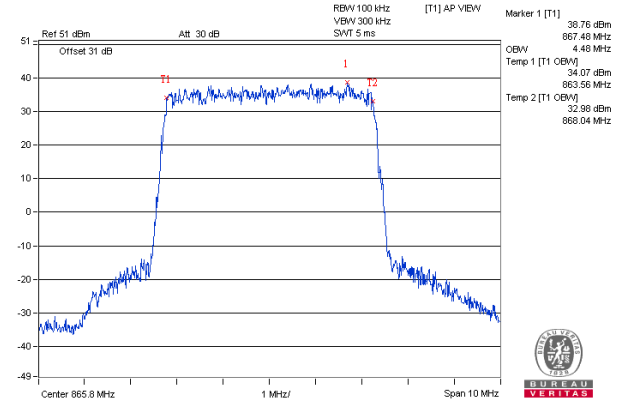
Spectrum Plot Of Worst Value	
Channel 8758	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

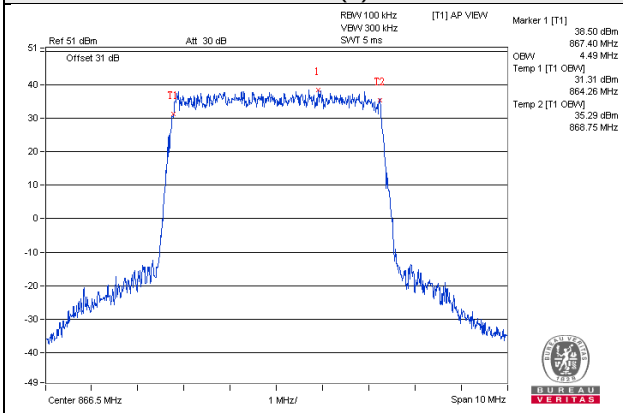
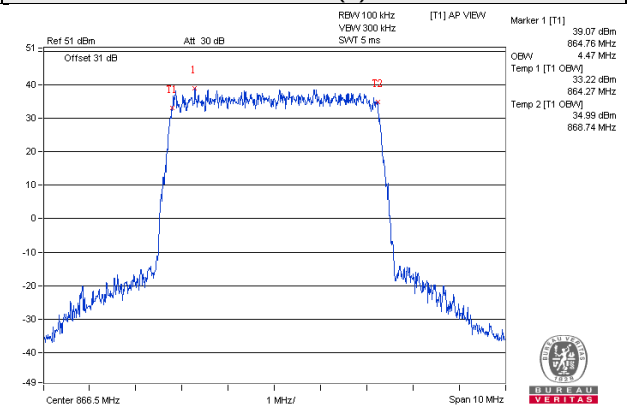
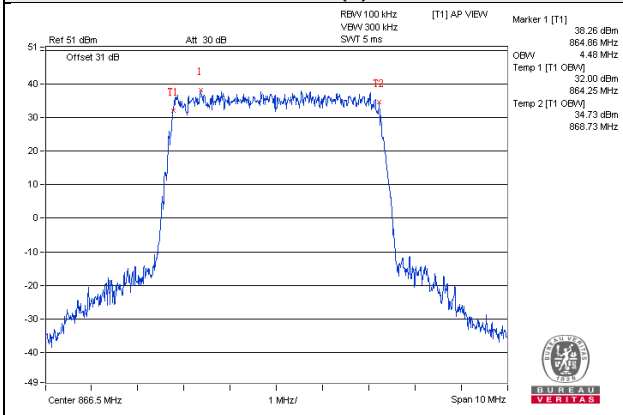
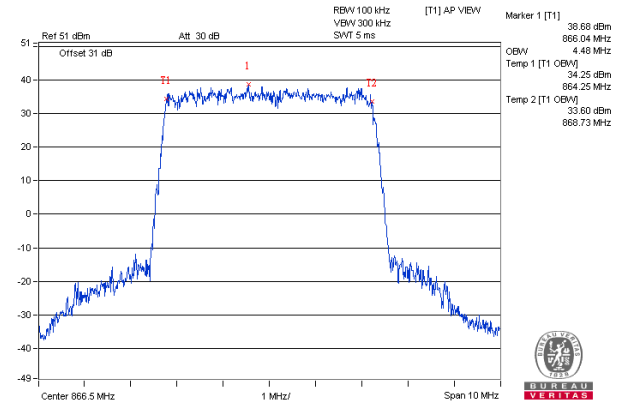
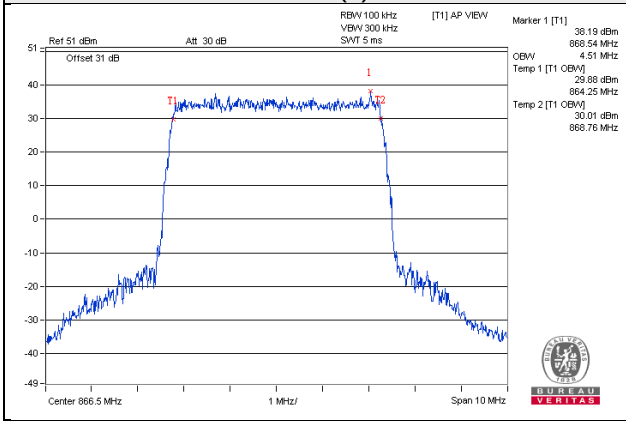
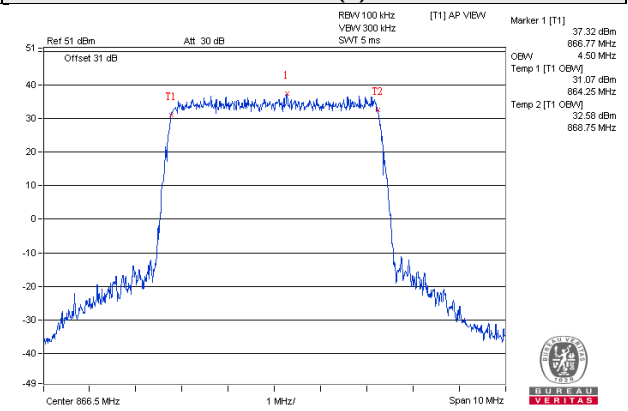
Spectrum Plot Of Worst Value	
Channel 8765	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

4.3.5 Test Result (Occupied Bandwidth)

LTE Band 26							
Channel Bandwidth 5MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)					
		Chain (0)			Chain (1)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
8751	865.1	4.49	4.47	4.49	4.50	4.48	4.48
8758	865.8	4.50	4.48	4.50	4.48	4.47	4.48
8765	866.5	4.49	4.48	4.51	4.47	4.48	4.50

Spectrum Plot Of Worst Value	
Channel 8751	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

Spectrum Plot Of Worst Value	
Channel 8758	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

Spectrum Plot Of Worst Value	
Channel 8765	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

4.4 Emission Mask Measurement

4.4.1 Limits of Emission Mask Measurement

Per 90.210, equipment used in 809-824/854-869 MHz licensed band to EA or non-EA systems shall comply with the emission mask provisions of §90.691.

Per 90.691, Emission mask requirements
(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:
(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.
(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

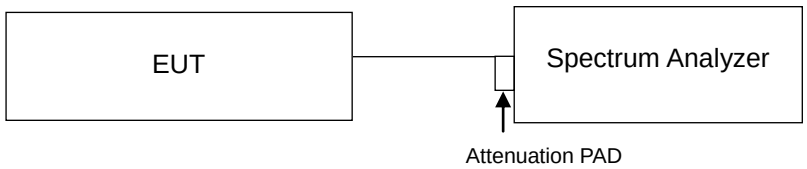
Note:

This device can be impelement MIMO function, so the limit of spurious emissions needs to be reduced by $10\log(Numbers_{Ant})$ according to FCC KDB 662911 D01 guidance.
{The limit is adjusted to -13dBm – 10*log(2) = -16.01dBm and -20dBm-10*log(2)=-23.01dBm.}

4.4.2 Test Procedures

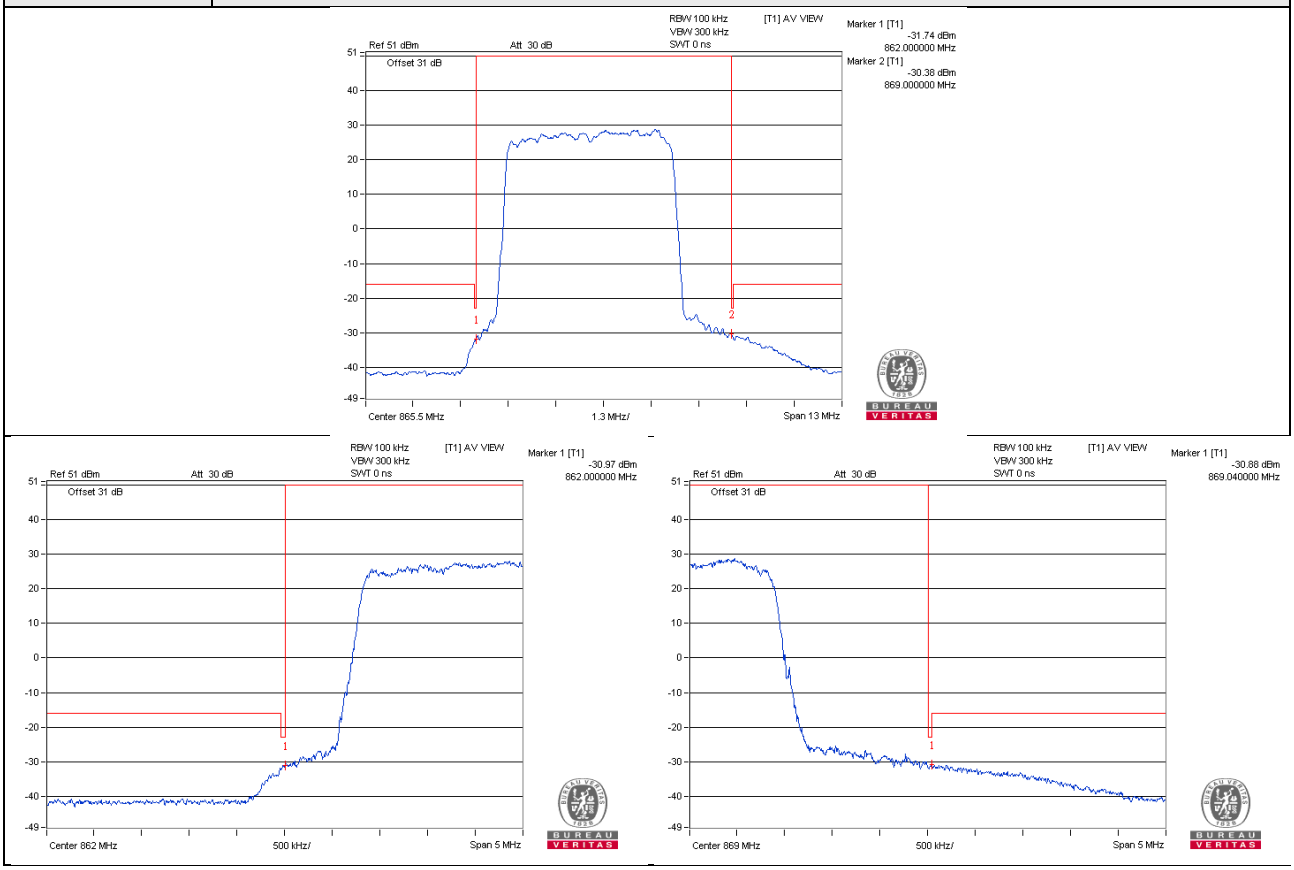
1. The power was measured with Spectrum Analyzer. All measurements were done at 1 channel.
2. The measurement used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.
3. Record the test plot.

4.4.3 Test Setup

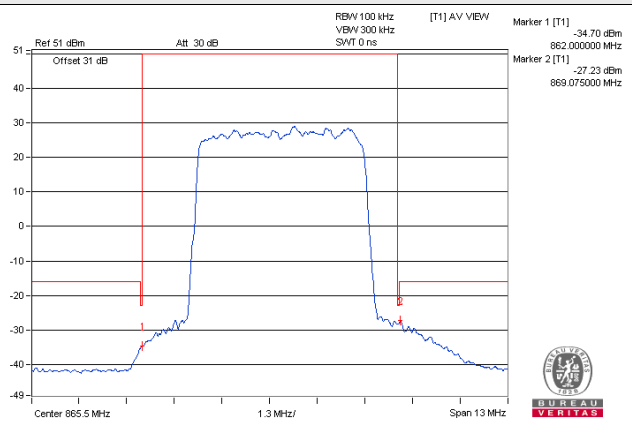


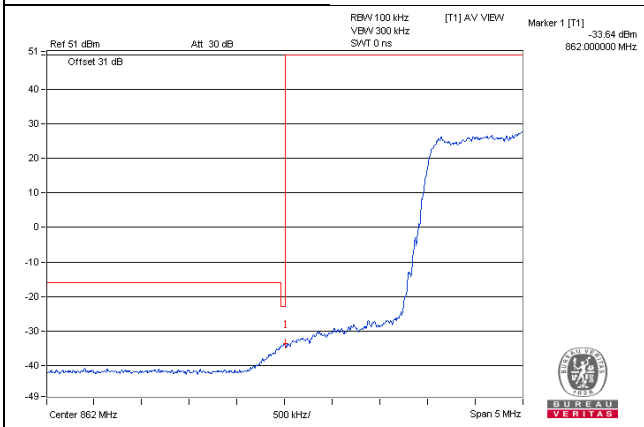
4.4.4 Test Results

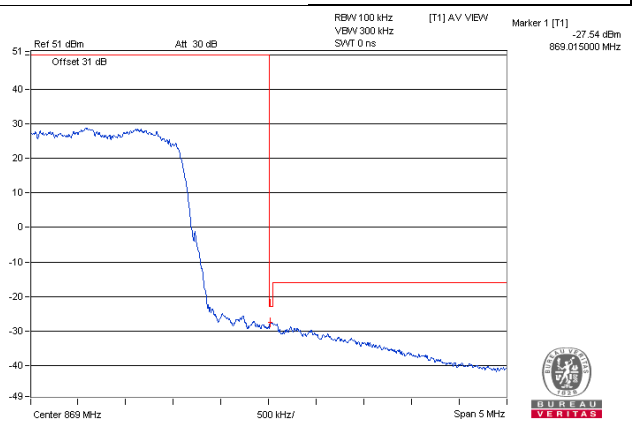
LTE Band 26	
Chain (0)	
Channel	8751



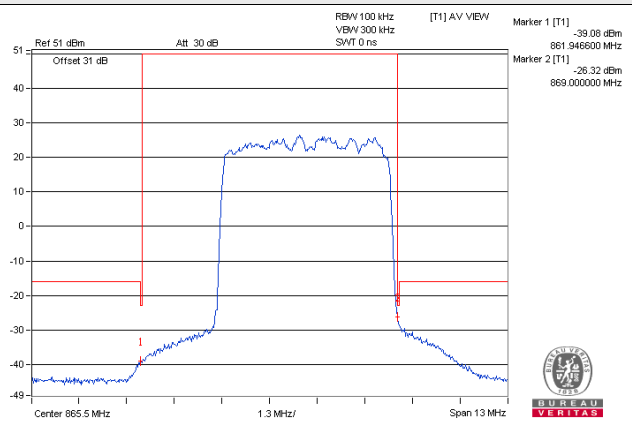
Channel	8758

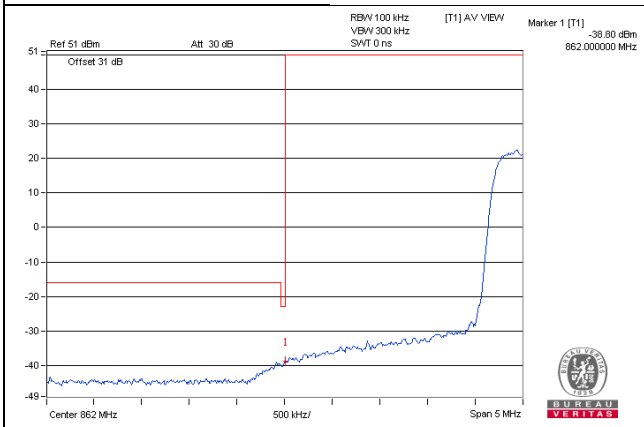


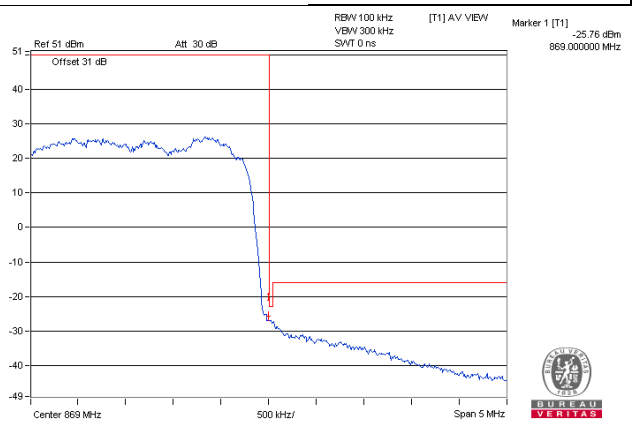




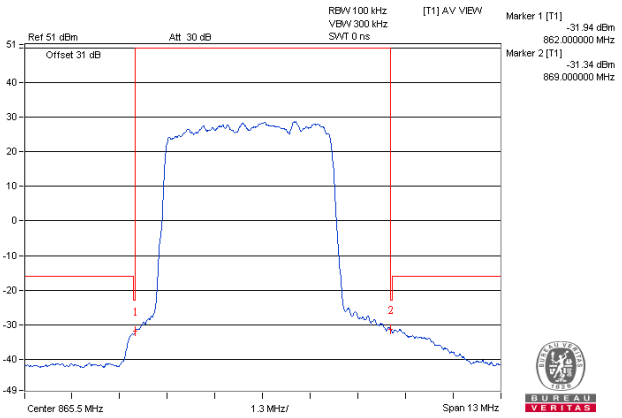
Channel	8765

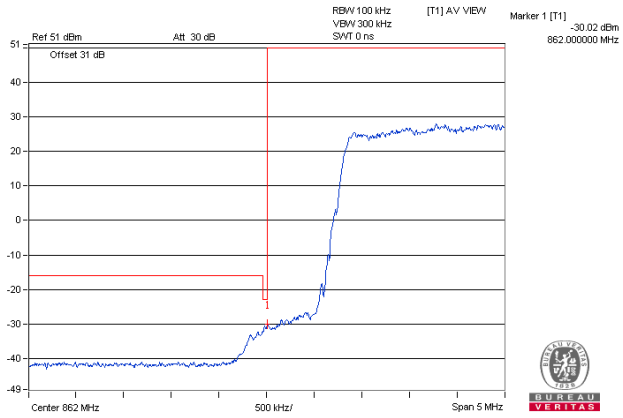


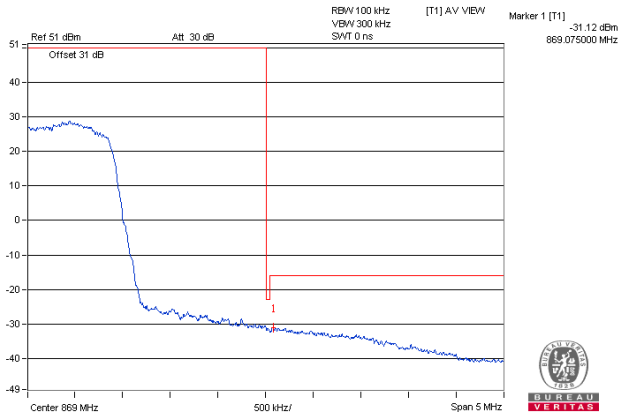




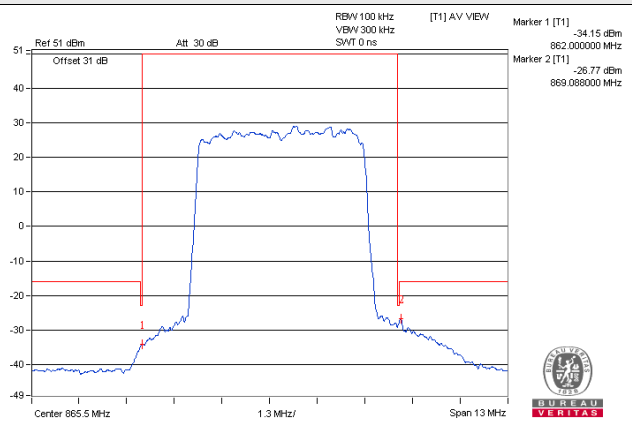
Chain (1)	
Channel	8751

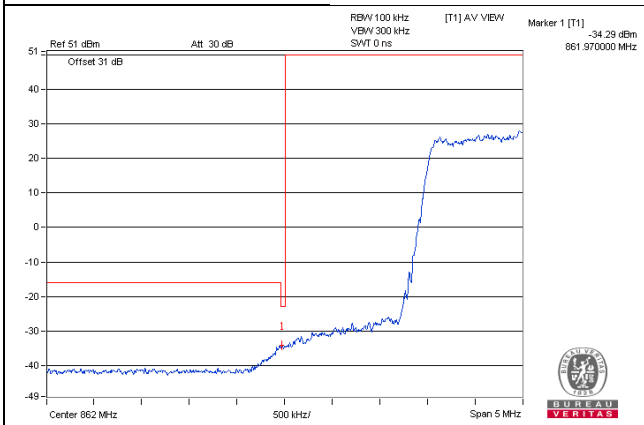


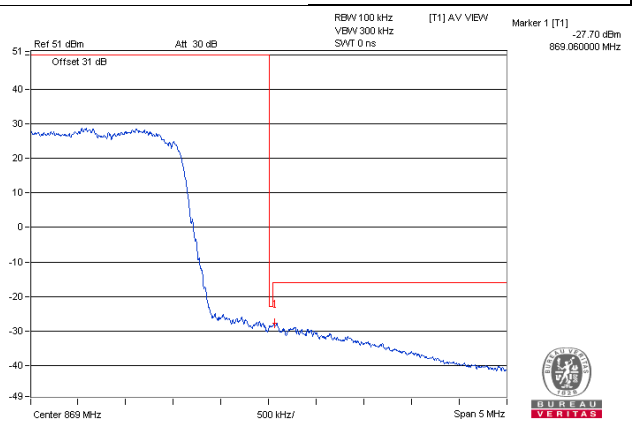




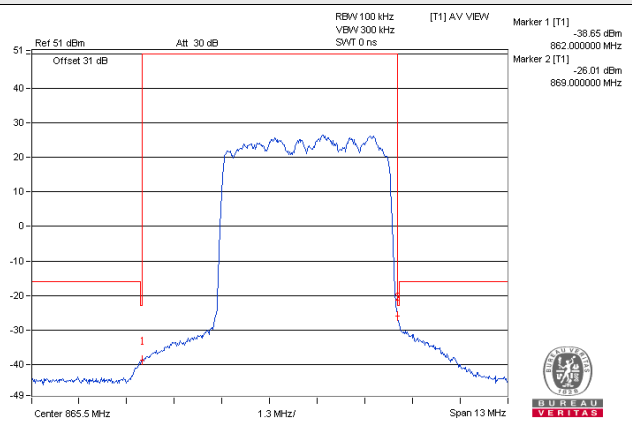
Channel	8758

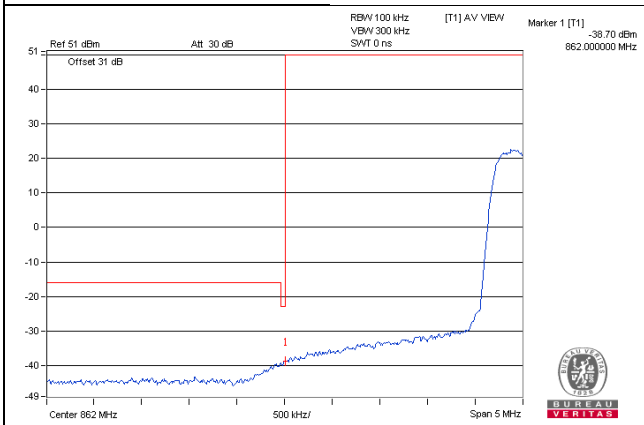


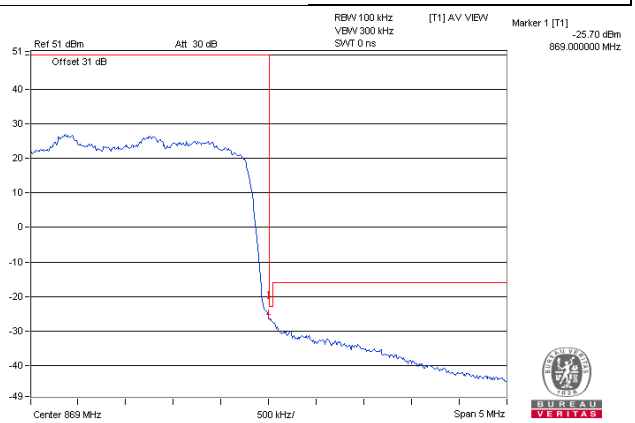




Channel	8765





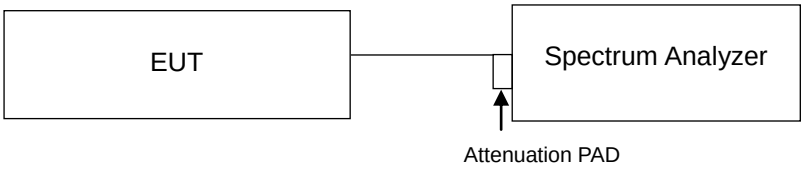


4.5 Peak to Average Ratio

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

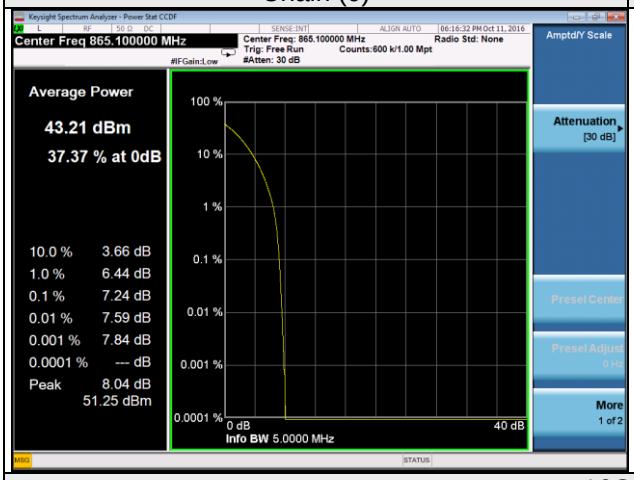
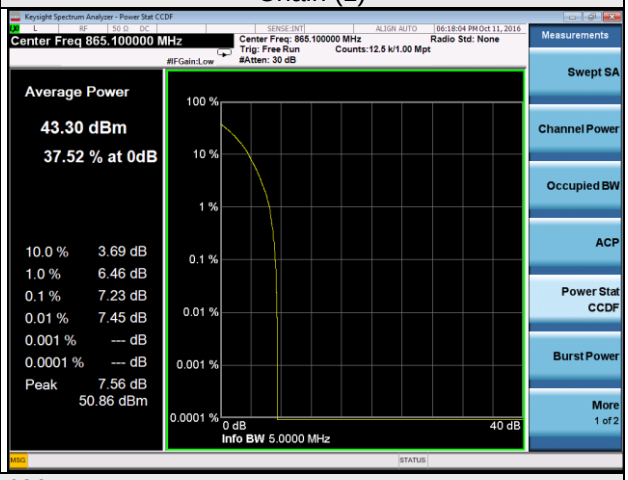
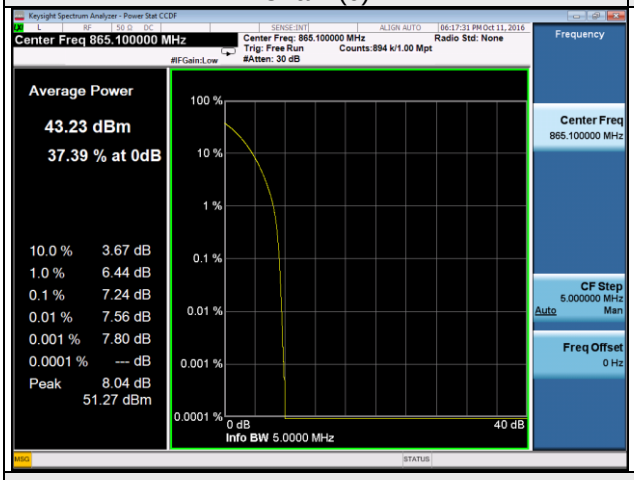
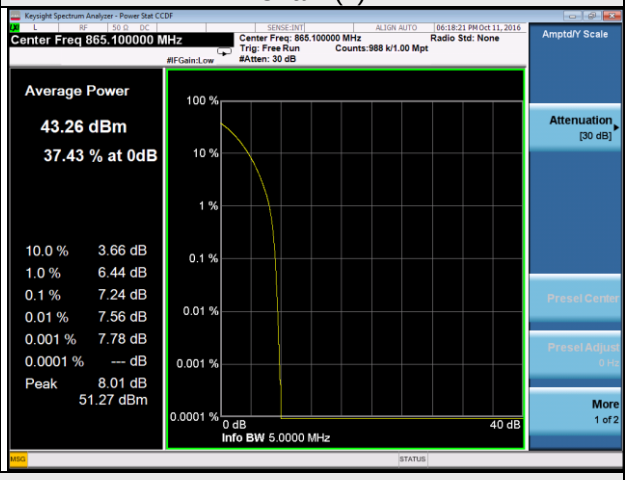
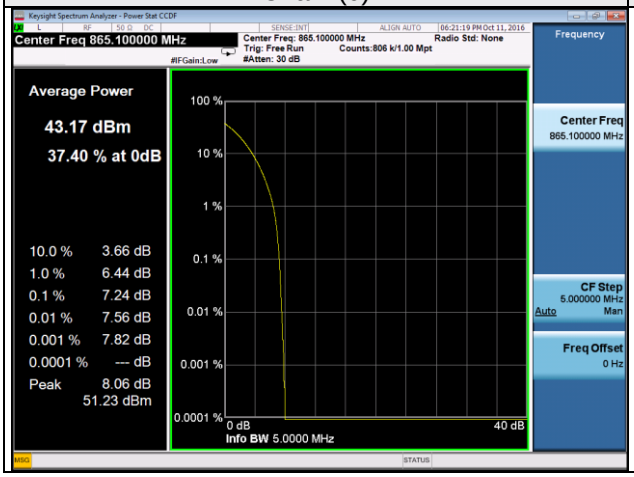
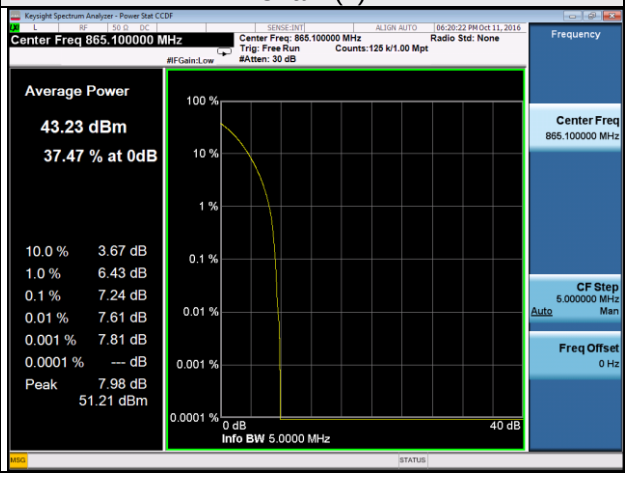
a. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

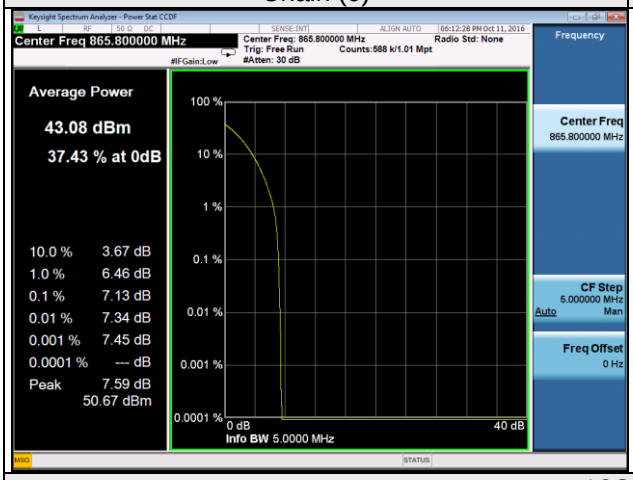
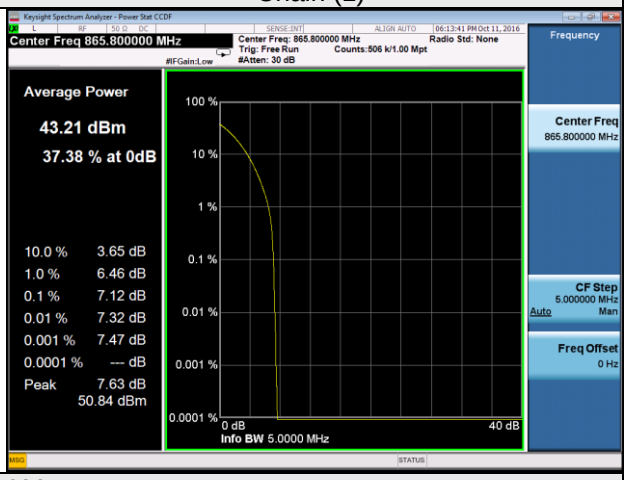
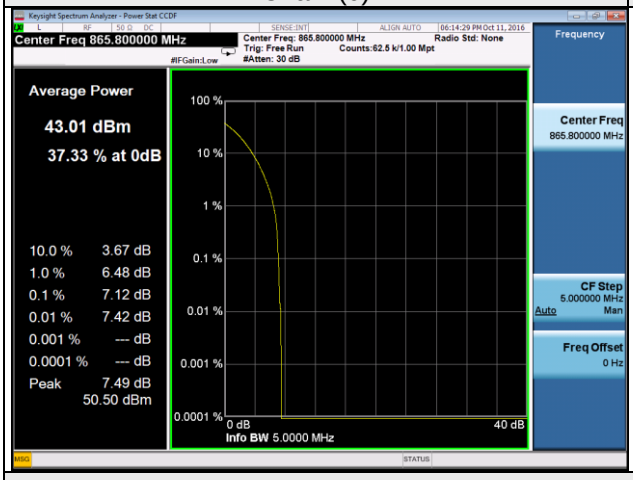
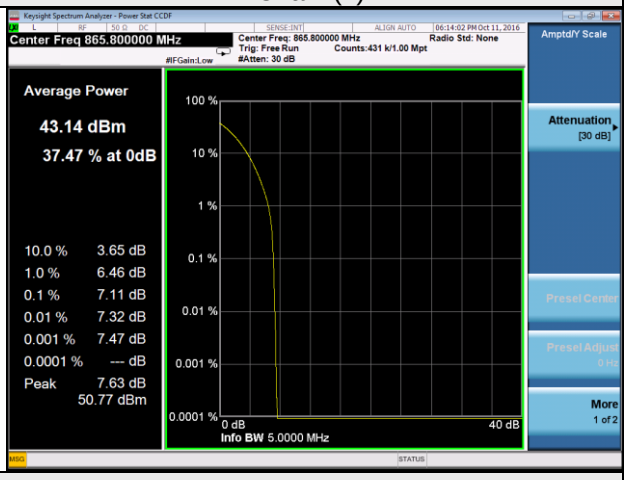
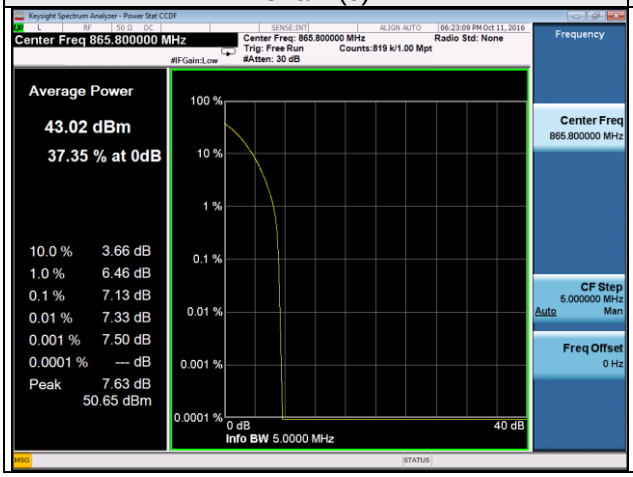
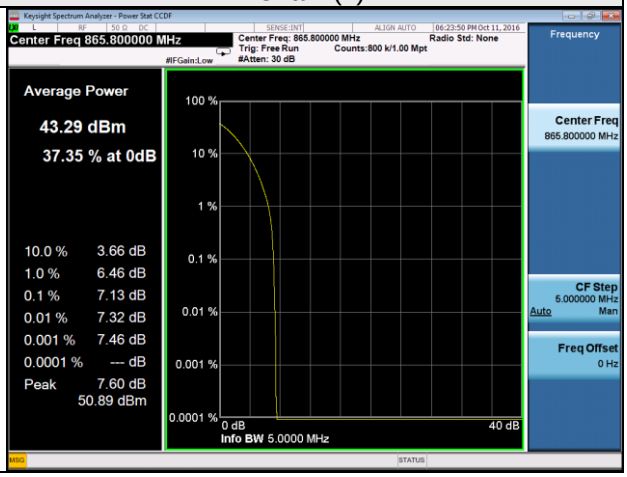
b. Set the number of counts to a value that stabilizes the measured CCDF curve;

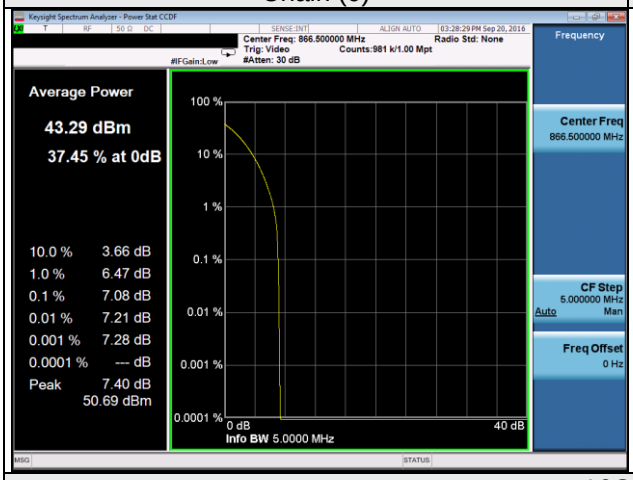
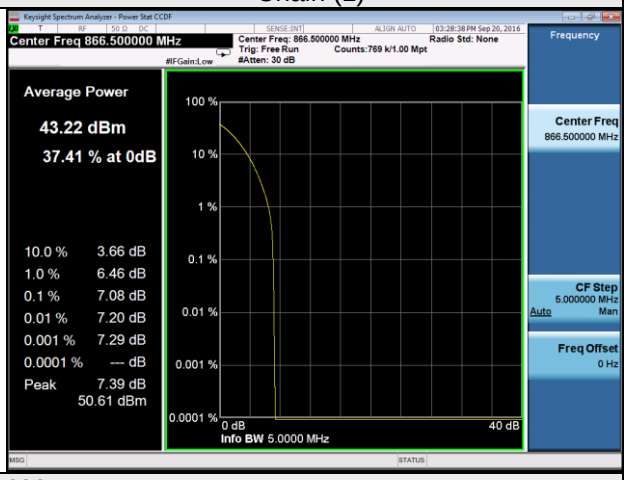
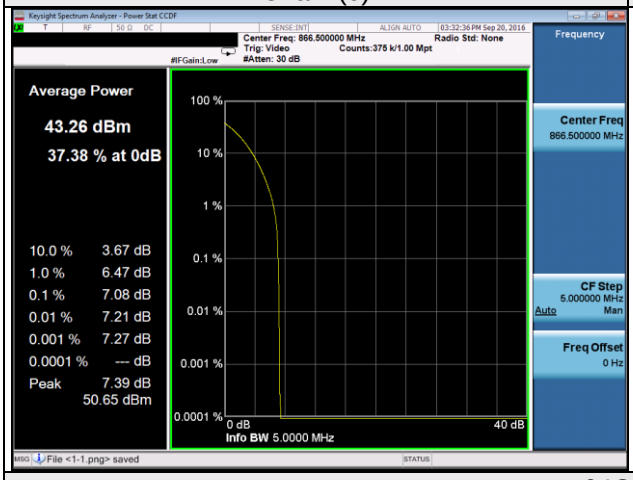
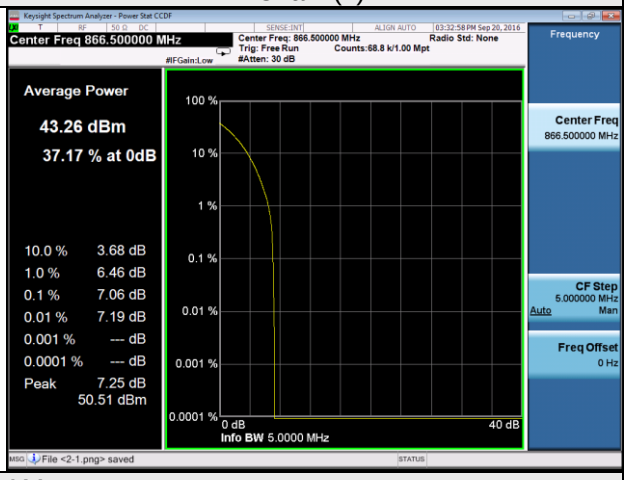
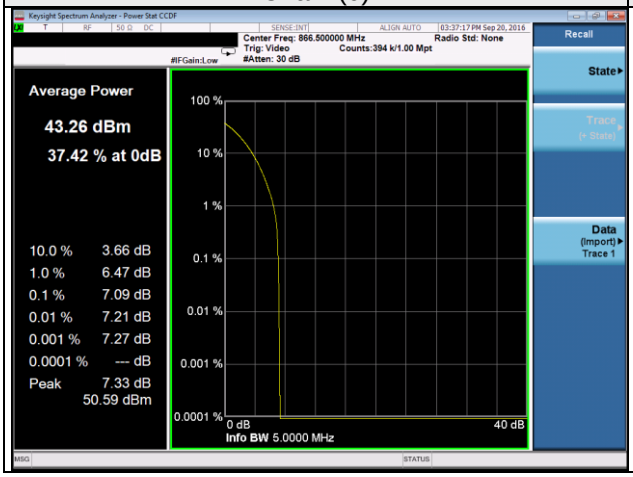
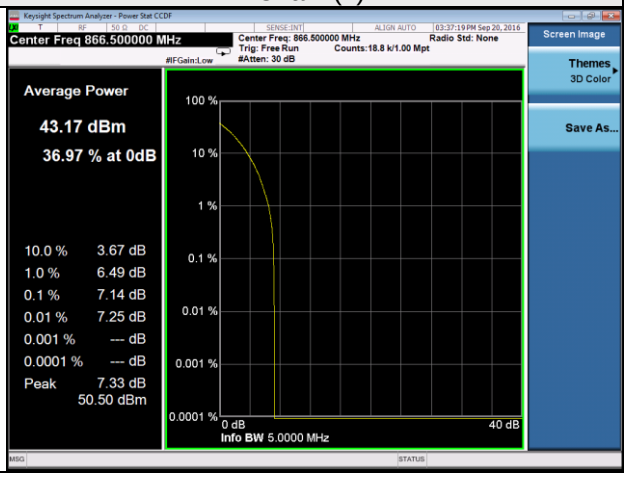
c. Record the maximum PAPR level associated with a probability of 0.1%.

4.5.4 Test Results

LTE Band 26								
Channel Bandwidth 5MHz								
Channel	Frequency (MHz)	Peak To Average Ratio (dB)						Limit (dB)
		Chain (0)			Chain (1)			
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM	
8751	865.1	7.24	7.24	7.24	7.23	7.24	7.24	13
8758	865.8	7.12	7.12	7.13	7.12	7.11	7.13	13
8765	866.5	7.08	7.08	7.09	7.08	7.06	7.14	13

Spectrum Plot Of Worst Value	
Channel 8751	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

Spectrum Plot Of Worst Value	
Channel 8758	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

Spectrum Plot Of Worst Value	
Channel 8765	
QPSK	
Chain (0)	Chain (1)
	
16QAM	
Chain (0)	Chain (1)
	
64QAM	
Chain (0)	Chain (1)
	

4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

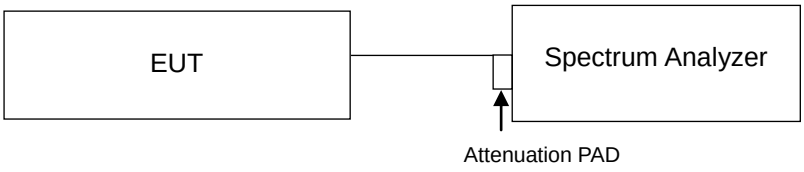
The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission equal to –13dBm.

Note:

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

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

4.6.2 Test Setup



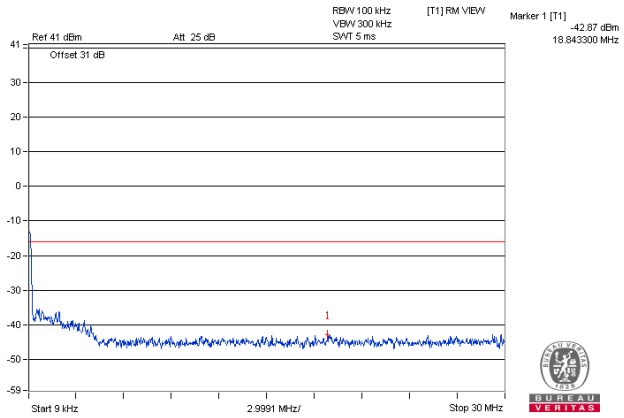
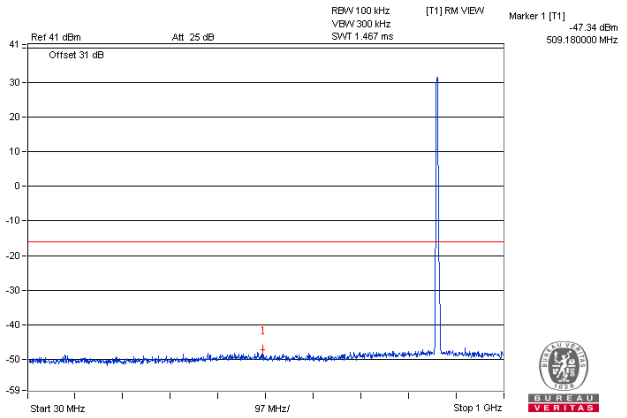
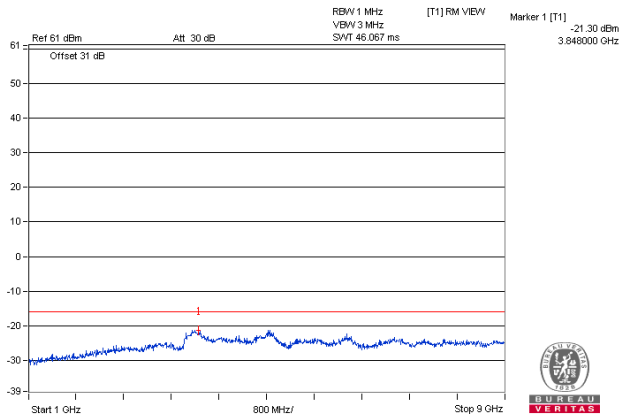
4.6.3 Test Procedure

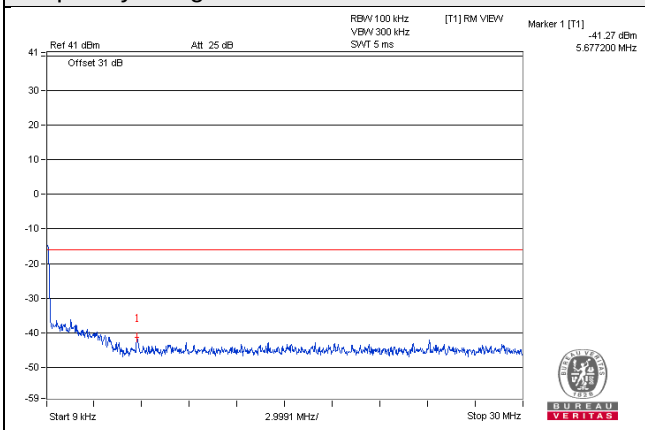
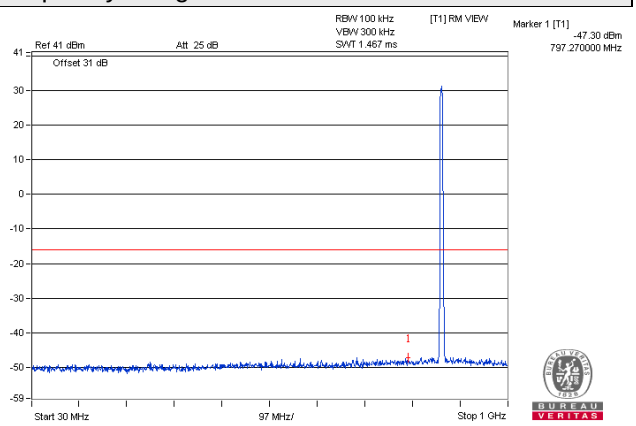
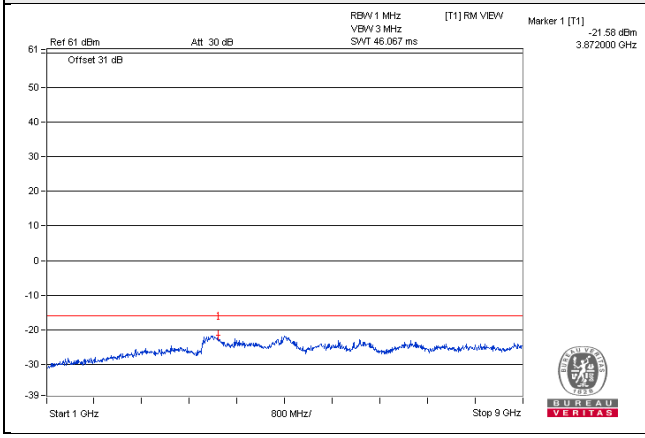
a. The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with Spectrum Analyzer.

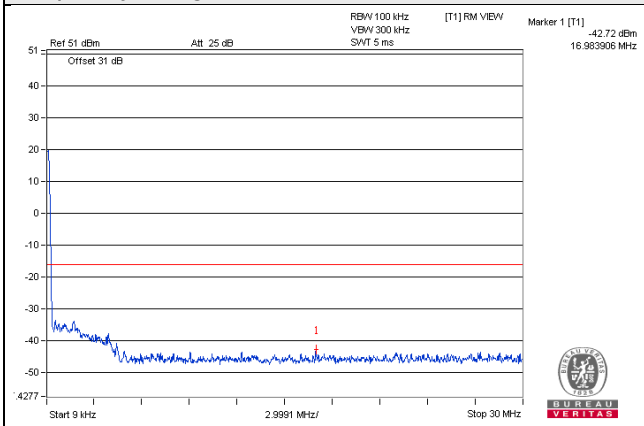
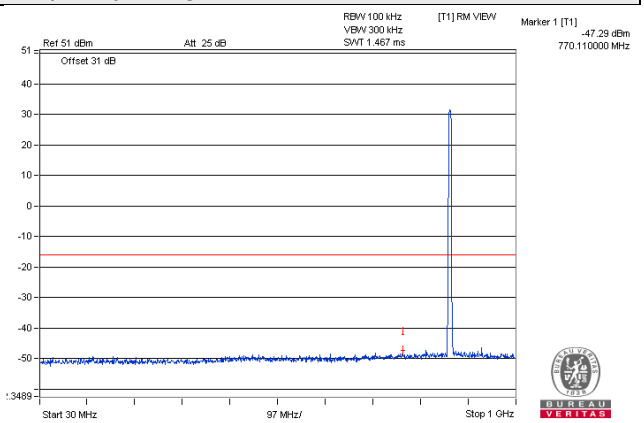
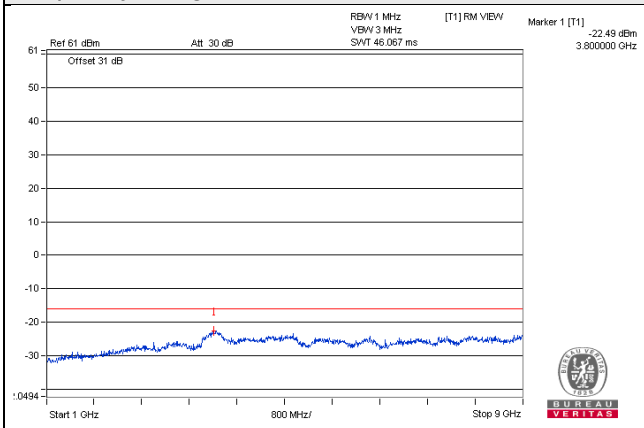
b. The conducted spurious emission used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.

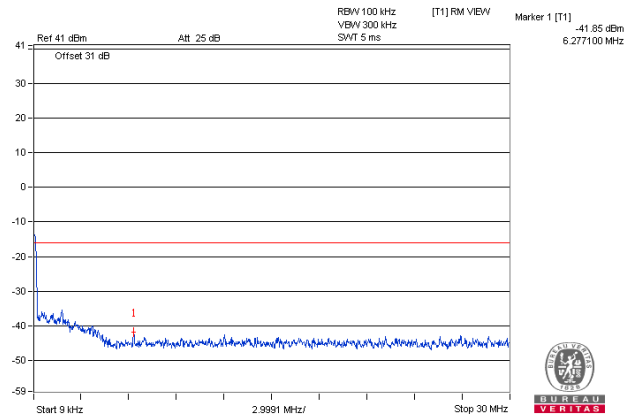
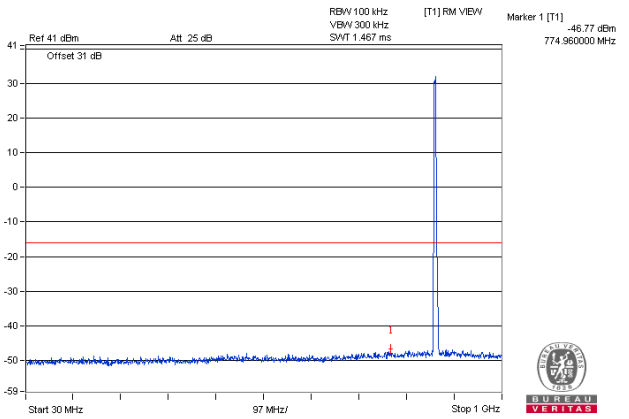
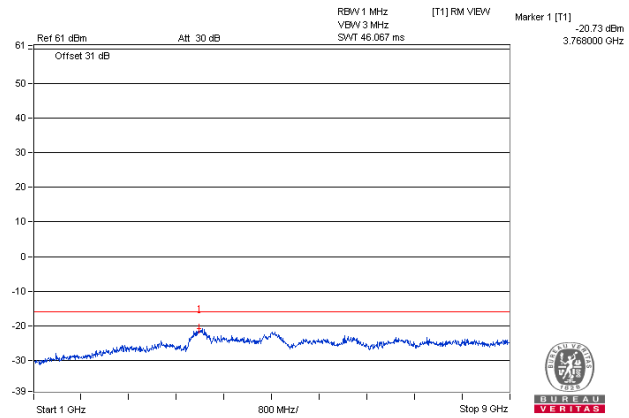
c. When the spectrum scanned from 9kHz to 9GHz, it shall be connected to the band reject filter attenuated the carried frequency. The spectrum set RB=100kHz, VB=300kHz for below 1GHz and RB=1MHz, VB=3MHz for above 1GHz test.

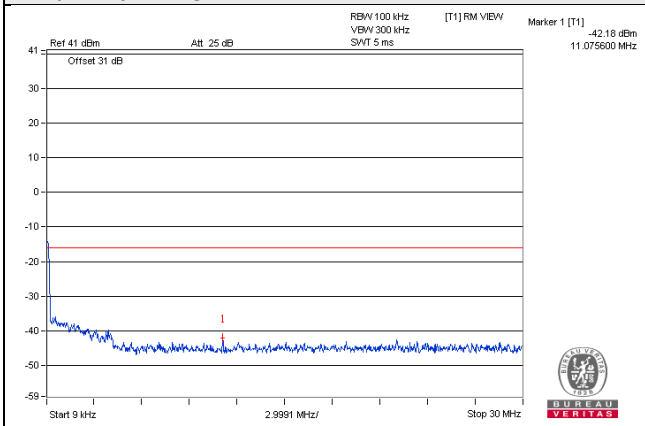
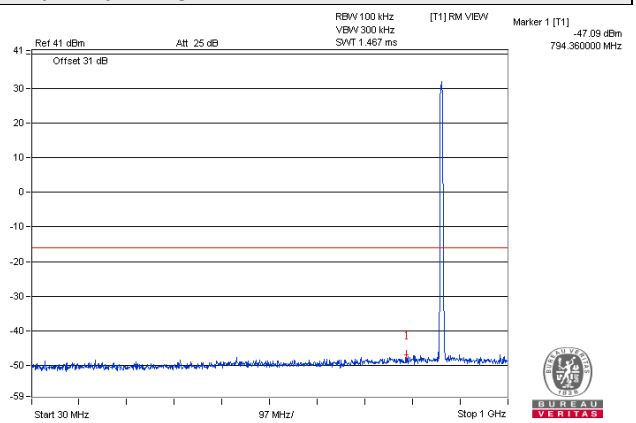
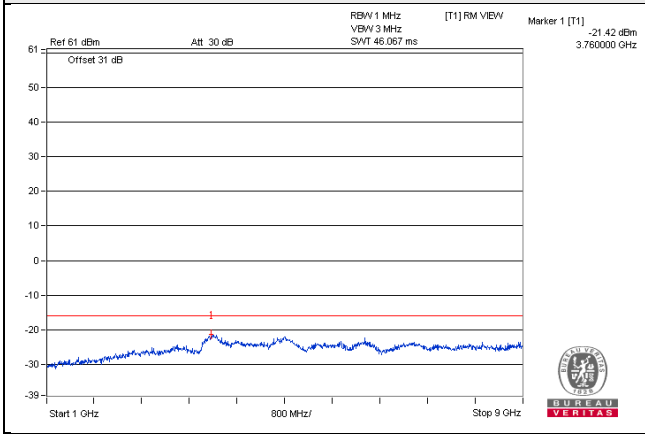
4.6.4 Test Results

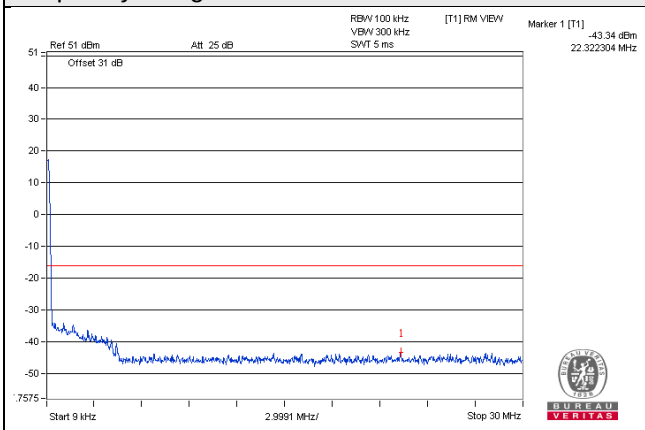
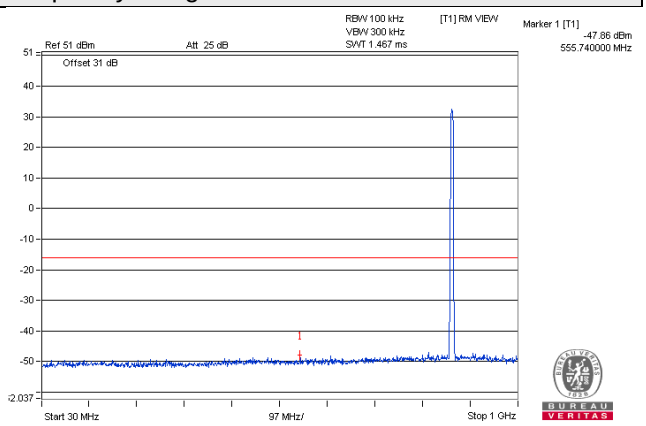
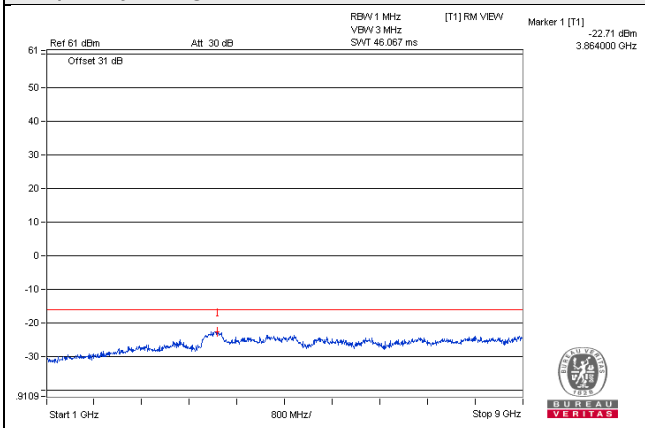
Chain (0)	
Channel 8751	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

Channel 8758	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

Channel 8765	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

Chain (1)	
Channel 8751	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

Channel 8758	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

Channel 8765	
Frequency Range : 9kHz~30MHz	Frequency Range : 30MHz~1GHz
	
Frequency Range : 1GHz~9GHz	
	

4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measuremen

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission equal to –13dBm

4.7.2 Test Procedure

a. 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.

b. The substitution 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 a. Record the power level of S.G

c. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna.

d. ERP power can be calculated form EIRP power by subtracting the gain of dipole, ERP power = EIRP power - 2.15dBi.

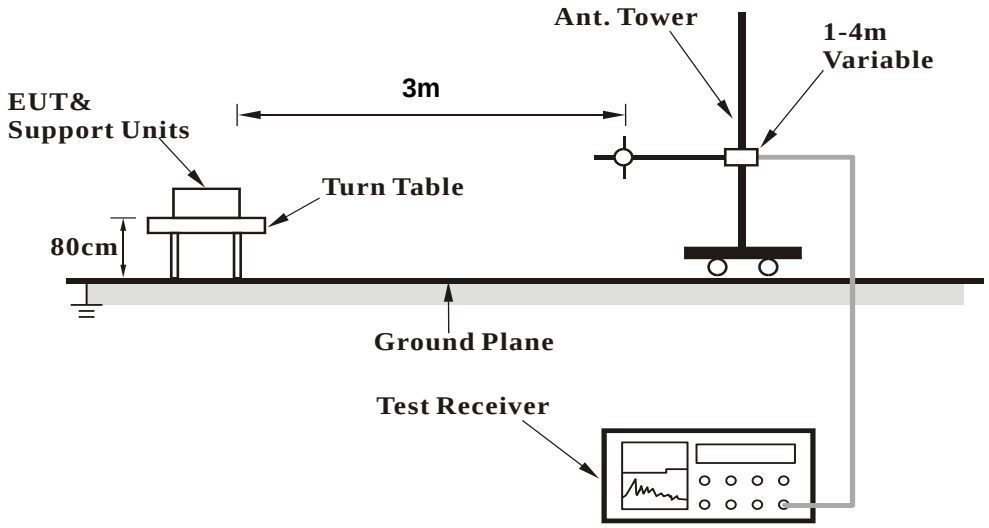
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.7.3 Deviation from Test Standard

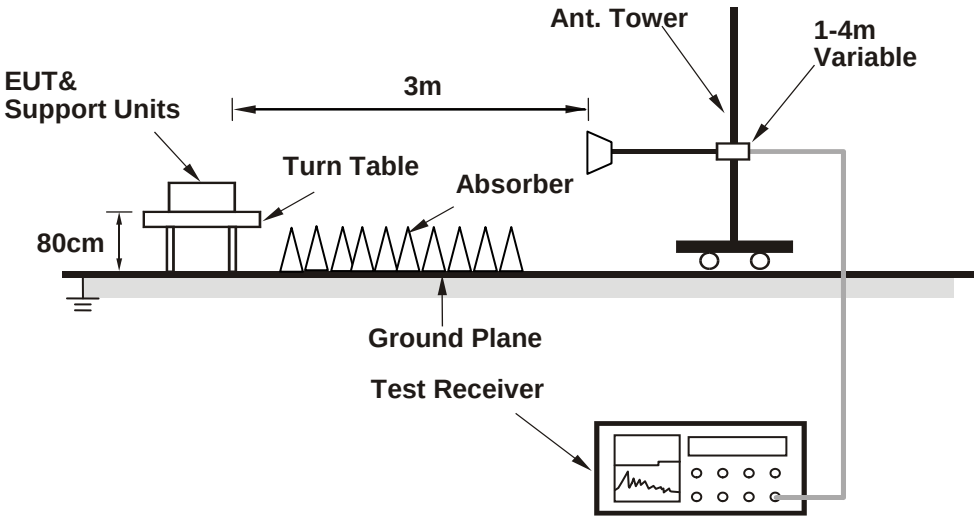
No deviation.

4.7.4 Test Setup

For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.7.5 Test Results

Test was done with 50ohm terminator on antenna port.

Below 1GHz

Mode	TX channel 8751	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	100.93	31.46	-59.20	-0.63	-59.83	-13	-46.83
2	203.33	34.66	-60.82	4.29	-56.53	-13	-43.53
3	499.28	38.56	-56.96	2.89	-54.07	-13	-41.07
4	700.37	36.49	-59.85	1.62	-58.23	-13	-45.23
5	799.48	45.57	-53.15	1.55	-51.60	-13	-38.60
6	925.89	36.64	-61.81	0.42	-61.39	-13	-48.39
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	37.52	38.44	-35.24	-13.27	-48.51	-13	-35.51
2	490.96	36.03	-59.59	2.95	-56.64	-13	-43.64
3	799.58	48.48	-50.24	1.55	-48.69	-13	-35.69
4	874.3	37.97	-61.04	0.57	-60.47	-13	-47.47
5	925.78	39.09	-59.36	0.42	-58.94	-13	-45.94
6	960.01	38.15	-59.68	0.39	-59.29	-13	-46.29

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 8758	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	99.86	31.75	-58.91	-0.63	-59.54	-13	-46.54
2	202.91	34.52	-60.96	4.29	-56.67	-13	-43.67
3	499.88	38.15	-57.37	2.89	-54.48	-13	-41.48
4	699.13	37.03	-59.31	1.62	-57.69	-13	-44.69
5	800.71	45.33	-53.39	1.55	-51.84	-13	-38.84
6	924.94	36.55	-61.90	0.42	-61.48	-13	-48.48
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	36.51	39.33	-34.35	-13.27	-47.62	-13	-34.62
2	492.49	35.70	-59.92	2.95	-56.97	-13	-43.97
3	799.93	49.03	-49.69	1.55	-48.14	-13	-35.14
4	875.8	39.00	-60.01	0.57	-59.44	-13	-46.44
5	925.42	39.45	-59.00	0.42	-58.58	-13	-45.58
6	960.44	37.39	-60.44	0.39	-60.05	-13	-47.05

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 8765	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	100.23	32.10	-58.56	-0.63	-59.19	-13	-46.19
2	203.65	35.20	-60.28	4.29	-55.99	-13	-42.99
3	500.01	38.60	-56.92	2.89	-54.03	-13	-41.03
4	700.03	37.90	-58.44	1.62	-56.82	-13	-43.82
5	800.04	46.70	-52.02	1.55	-50.47	-13	-37.47
6	925.07	37.10	-61.35	0.42	-60.93	-13	-47.93
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	**36.68**	**39.80**	**-33.88**	**-13.27**	**-47.15**	**-13**	**-34.15**
2	491.53	36.40	-59.22	2.95	-56.27	-13	-43.27
3	800.03	49.20	-49.52	1.55	-47.97	-13	-34.97
4	875.04	39.20	-59.81	0.57	-59.24	-13	-46.24
5	925.07	39.80	-58.65	0.42	-58.23	-13	-45.23
6	959.99	38.70	-59.13	0.39	-58.74	-13	-45.74

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Above 1GHz

Mode	TX channel 8751	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1730.2	33.08	-69.25	6.42	-62.83	-13	-49.83
2	2595.3	35.94	-63.33	6.75	-56.58	-13	-43.58
3	3460.4	36.24	-66.92	7.80	-59.12	-13	-46.12
4	4325.5	37.84	-66.85	7.38	-59.47	-13	-46.47
5	5190.6	39.47	-65.06	7.05	-58.01	-13	-45.01
6	6055.7	41.14	-63.00	6.66	-56.34	-13	-43.34
7	6920.8	43.93	-58.38	5.10	-53.28	-13	-40.28
8	7785.9	44.99	-57.63	4.29	-53.34	-13	-40.34
9	8651	45.7	-57.01	4.23	-52.78	-13	-39.78
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1730.2	37.05	-65.28	6.42	-58.86	-13	-45.86
2	2595.3	36.31	-62.96	6.75	-56.21	-13	-43.21
3	3460.4	37.52	-65.64	7.80	-57.84	-13	-44.84
4	4325.5	37.85	-66.84	7.38	-59.46	-13	-46.46
5	5190.6	39.14	-65.39	7.05	-58.34	-13	-45.34
6	6055.7	40.02	-64.12	6.66	-57.46	-13	-44.46
7	6920.8	42.57	-59.74	5.10	-54.64	-13	-41.64
8	7785.9	45.89	-56.73	4.29	-52.44	-13	-39.44
9	8651	44.6	-58.11	4.23	-53.88	-13	-40.88

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 8758	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1731.6	33.29	-69.04	6.42	-62.62	-13	-49.62
2	2597.4	35.66	-63.61	6.75	-56.86	-13	-43.86
3	3463.2	36.93	-66.23	7.80	-58.43	-13	-45.43
4	4329	39.14	-65.55	7.38	-58.17	-13	-45.17
5	5194.8	38.49	-66.04	7.05	-58.99	-13	-45.99
6	6060.6	40.11	-64.03	6.66	-57.37	-13	-44.37
7	6926.4	42.65	-59.66	5.10	-54.56	-13	-41.56
8	7792.2	44.43	-58.19	4.29	-53.90	-13	-40.90
9	8658	45.2	-57.51	4.23	-53.28	-13	-40.28
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1731.6	37.61	-64.72	6.42	-58.30	-13	-45.30
2	2597.4	36.48	-62.79	6.75	-56.04	-13	-43.04
3	3463.2	37.67	-65.49	7.80	-57.69	-13	-44.69
4	4329	38.85	-65.84	7.38	-58.46	-13	-45.46
5	5194.8	38.82	-65.71	7.05	-58.66	-13	-45.66
6	6060.6	39.97	-64.17	6.66	-57.51	-13	-44.51
7	6926.4	43.81	-58.50	5.10	-53.40	-13	-40.40
8	7792.2	45.18	-57.44	4.29	-53.15	-13	-40.15
9	8658	45.81	-56.90	4.23	-52.67	-13	-39.67

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 8765	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1733	33.40	-68.93	6.42	-62.51	-13	-49.51
2	2599.5	35.40	-63.87	6.75	-57.12	-13	-44.12
3	3466	36.50	-66.66	7.80	-58.86	-13	-45.86
4	4332.5	38.2	-66.49	7.38	-59.11	-13	-46.11
5	5199	39.4	-65.13	7.05	-58.08	-13	-45.08
6	6065.5	40.6	-63.54	6.66	-56.88	-13	-43.88
7	6932	43.2	-59.11	5.10	-54.01	-13	-41.01
8	7798.5	45	-57.62	4.29	-53.33	-13	-40.33
9	8665	45.4	-57.31	4.23	-53.08	-13	-40.08
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1733	37.7	-64.63	6.42	-58.21	-13	-45.21
2	2599.5	35.8	-63.47	6.75	-56.72	-13	-43.72
3	3466	36.7	-66.46	7.80	-58.66	-13	-45.66
4	4332.5	38.4	-66.29	7.38	-58.91	-13	-45.91
5	5199	39.4	-65.13	7.05	-58.08	-13	-45.08
6	6065.5	40.8	-63.34	6.66	-56.68	-13	-43.68
7	6932	43.4	-58.91	5.10	-53.81	-13	-40.81
8	7798.5	45.3	-57.32	4.29	-53.03	-13	-40.03
9	8665	45.5	-57.21	4.23	-52.98	-13	-39.98

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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