FCC Test Report

(Part 27)

Report No.: RF160617D01-1

FCC ID: P27LC4RT

Test Model: LC4R-T

Received Date: Jun. 17, 2016

Test Date: Jun. 29 ~ 30, 2016

Issued Date: Jul. 7, 2016

Applicant: Sercomm Corp.

Address: 8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan, R.O.C.

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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.

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Table of Contents

Release Control Record **3**

1 Certificate of Conformity **4**

2 Summary of Test Results **5**

2.1 Measurement Uncertainty 5
2.2 Test Site and Instruments 6

3 General Information **7**

3.1 General Description of EUT 7
3.2 Configuration of System Under Test 8
3.2.1 Description of Support Units 8
3.3 Test Mode Applicability and Tested Channel Detail 9
3.4 EUT Operating Conditions 10
3.5 General Description of Applied Standards 10

4 Test Types and Results **11**

4.1 Output Power Measurement 11
4.1.1 Limits of Output Power Measurement 11
4.1.2 Test Procedures 11
4.1.3 Test Setup 12
4.1.4 Test Results 13
4.2 Frequency Stability Measurement 18
4.2.1 Limits of Frequency Stabiliity Measurement 18
4.2.2 Test Procedure 18
4.2.3 Test Setup 18
4.2.4 Test Results 19
4.3 Emission Bandwidth Measurement 21
4.3.1 Limits of Emission Bandwidth Measurement 21
4.3.2 Test Procedure 21
4.3.3 Test Setup 21
4.3.4 Test Result 22
4.4 Channel Edge Measurement 23
4.4.1 Limits of Band Edge Measurement 23
4.4.2 Test Setup 23
4.4.3 Test Procedures 23
4.4.4 Test Results 24
4.5 Peak To Average Ratio 30
4.5.1 Limits of Peak To Average Ratio Measurement 30
4.5.2 Test Setup 30
4.5.3 Test Procedures 30
4.5.4 Test Results 31
4.6 Conducted Spurious Emissions 32
4.6.1 Limits of Conducted Spurious Emissions Measurement 32
4.6.2 Test Setup 32
4.6.3 Test Procedure 32
4.6.4 Test Results 33
4.7 Radiated Emission Measurement 45
4.7.1 Limits of Radiated Emission Measurement 45
4.7.2 Test Procedure 45
4.7.3 Deviation from Test Standard 45
4.7.4 Test Setup 46
4.7.5 Test Results 47

5 Pictures of Test Arrangements **52**

Appendix – Information on the Testing Laboratories **53**

Release Control Record

Issue No.	Description	Date Issued
RF160617D01-1	Original release.	Jul. 7, 2016

1 Certificate of Conformity

Product: Ninja LTE module

Brand: Sercomm

Test Model: LC4R-T

Sample Status: Engineering sample

Applicant: Sercomm Corp.

Test Date: Jun. 29 ~ 30, 2016

Standards: FCC Part 27, Subpart H, M

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:** Jul. 7, 2016

Celia Chen / Supervisor

Approved by : _____ , **Date:** Jul. 7, 2016

Rex Lai / Assistant Manager

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2			
FCC Clause LTE Band 41	Test Item	Result	Remarks
2.1046 27.50(h)	Equivalent Isotropically Radiated Power	Pass	Meet the requirement of limit.
----	Peak To Average Ratio	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(m)(6)	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(m)	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 27.53(h)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(m)(4)(6)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -6.29 dB at 5359.79MHz.

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 ~ 1000MHz	4.00 dB
Radiated Emissions above 1 GHz	1GHz ~ 40GHz	3.36 dB

2.2 Test Site and Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 26, 2016	Feb. 25, 2017
HP Preamplifier	8449B	3008A01201	Feb. 26, 2016	Feb. 25, 2017
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Mar. 01, 2016	Feb. 28, 2017
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 02, 2016	Feb. 01, 2017
Schwarzbeck Antenna	VULB 9168	139	Jan. 04, 2016	Jan. 03, 2017
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2015	May 28, 2017
Schwarzbeck Horn Antenna	BBHA-9170	212	Jan. 08, 2016	Jan. 07, 2017
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Jan. 21, 2016	Jan. 20, 2017
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.4	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 15, 2015	Aug. 14, 2016
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 15, 2015	Aug. 14, 2016
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	May 25, 2016	May 24, 2017
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Jul. 14, 2015	Jul. 13, 2016
EMCO Horn Antenna	3115	00028257	Jan. 19, 2016	Jan. 18, 2017
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 23, 2015	Sep. 22, 2016
Anritsu Power Sensor	MA2411B	0738404	Apr. 28, 2016	Apr. 27, 2017
Anritsu Power Meter	ML2495A	0842014	Apr. 28, 2016	Apr. 27, 2017

NOTE:
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

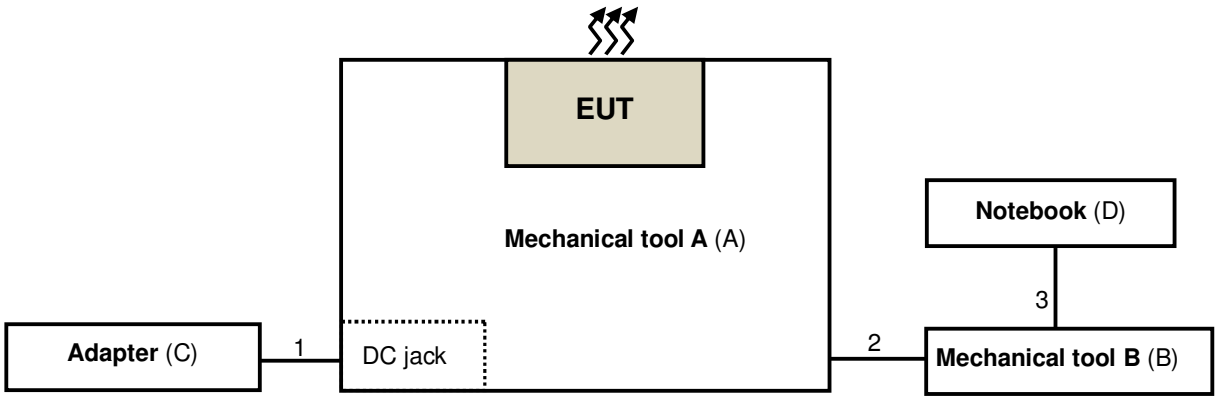
3 General Information

3.1 General Description of EUT

Product	Ninja LTE module	
Brand	Sercomm	
Test Model	LC4R-T	
Status of EUT	Engineering sample	
Power Supply Rating	3.3Vdc	
Modulation Type	QPSK, 16QAM, 64QAM	
Operating Frequency	LTE Band 41 (Channel Bandwidth 20MHz)	2510MHz ~ 2560MHz, 2630MHz ~ 2680MHz
Max. EIRP Power	LTE Band 41 (Channel Bandwidth 20MHz)	2510MHz ~ 2560MHz: 187.499mW (22.73dBm) 2630MHz ~ 2680MHz: 228.034mW (23.58dBm)
Antenna Type	LTE Band 41	Dipole antenna with 2.7dBi gain
Antenna Connector	I-PEX	
Accessory Device	N/A	
Data Cable Supplied	N/A	

Note: The EUT is a Ninja LTE module.

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.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Mechanical tool A	N/A	N/A	N/A	N/A	Supplied by client
B.	Mechanical tool B	N/A	N/A	N/A	N/A	Supplied by client
C.	Adapter	FAIRWAY	WT10A-050U	N/A	N/A	Supplied by client
D.	Notebook	DELL	PP27L	8SNZ12S	FCC DoC Approved	Provided by Lab

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	3.0	N	0	Supplied by client
2.	Data cable	1	0.2	N	0	Supplied by client
3.	USB cable	1	1.0	Y	0	Supplied by client

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, XYZ axis and antenna ports.

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

LTE Band 41

Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
EIRP	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK	100 RB / 0 RB Offset
Frequency Stability	39790 to 40290, 40990 to 41490	40040, 41240	20MHz	QPSK	100 RB / 0 RB Offset
Emission Bandwidth	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK / 16QAM / 64QAM	100 RB / 0 RB Offset
Band Edge	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK / 16QAM / 64QAM	100 RB / 0 RB Offset
Peak to Average Ratio	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK / 16QAM / 64QAM	100 RB / 0 RB Offset
Condcudeted Emission	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK	100 RB / 0 RB Offset
Radiated Emission Below 1GHz	39790 to 40290, 40990 to 41490	39790, 40990	20MHz	QPSK	100 RB / 0 RB Offset
Radiated Emission Above 1GHz	39790 to 40290, 40990 to 41490	39790, 40040, 40290, 40990, 41240, 41490	20MHz	QPSK	100 RB / 0 RB Offset

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	26deg. C, 65%RH	3.3Vdc	Aaron You
Frequency Stability	26deg. C, 65%RH	3.3Vdc	Aaron You
Occupied Bandwidth	26deg. C, 65%RH	3.3Vdc	Aaron You
Band Edge	26deg. C, 65%RH	3.3Vdc	Aaron You
Peak To Average Ratio	26deg. C, 65%RH	3.3Vdc	Aaron You
Conducted Emission	26deg. C, 65%RH	3.3Vdc	Aaron You
Radiated Emission	26deg. C, 65%RH	3.3Vdc	Aaron You

3.4 EUT Operating Conditions

The software 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 27

KDB 971168 D01 Power Meas License Digital Systems v02r02

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI/TIA/EIA-603-D 2010

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

Mobile / Portable station are limited to 2 watts e.i.r.p for LTE Band 41

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 5MHz for LTE Mode.

b. Substitution method is used for E.I.R.P 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

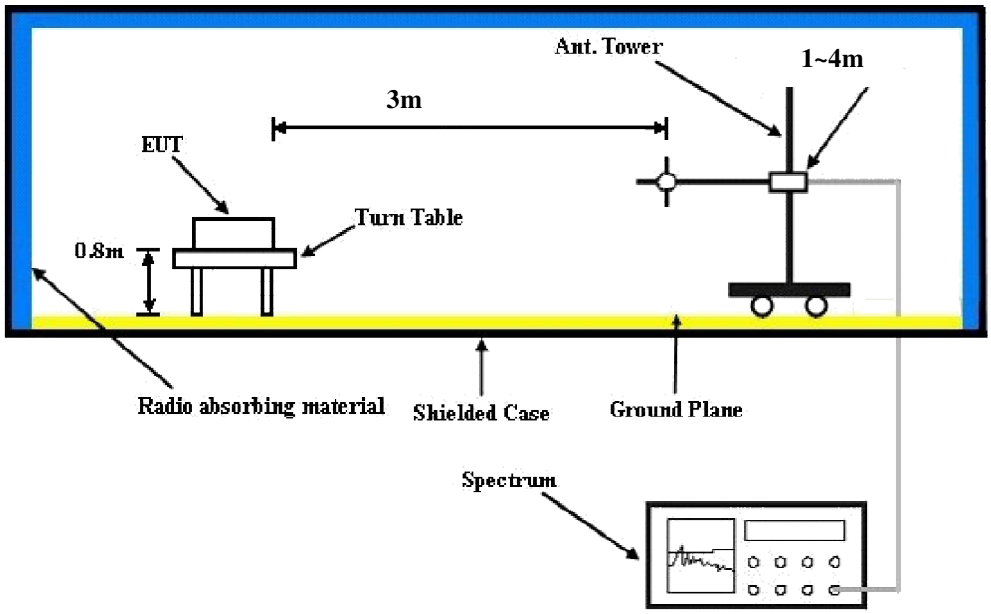
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.R.P power - 2.15dBi.

Conducted Power Measurement:

A power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

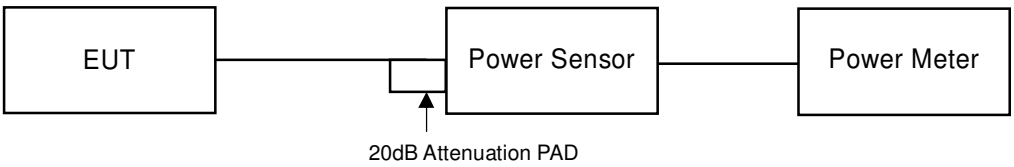
4.1.3 Test Setup

EIRP / ERP MEASUREMENT:



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

CONDUCTED POWER MEASUREMENT:



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

4.1.4 Test Results

CONDUCTED OUTPUT POWER (dBm)

Band / BW	RB Size	RB Offset	QPSK								
			Low CH			Mid CH			High CH		
			39790			40040			40290		
			2510 MHz			2535 MHz			2560 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	21.92	22.74	25.36	22.09	21.53	24.83	21.81	22.48	25.17
	1	50	21.74	22.83	25.33	22.05	21.48	24.78	22.11	22.39	25.26
	1	99	21.88	22.96	25.46	21.99	21.56	24.79	22.08	22.42	25.26
	50	0	21.90	22.89	25.43	21.98	21.51	24.76	22.19	22.50	25.36
	50	25	21.94	22.94	25.48	22.02	21.63	24.84	22.17	22.37	25.28
	50	50	21.81	22.98	25.44	22.06	21.59	24.84	22.15	22.46	25.32
	100	0	22.08	23.17	25.67	22.14	21.76	24.96	22.27	22.90	25.61

Band / BW	RB Size	RB Offset	QPSK								
			Low CH			Mid CH			High CH		
			40990			41240			41490		
			2630 MHz			2655 MHz			2680 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	22.16	23.02	25.62	21.62	21.53	24.59	22.14	21.89	25.03
	1	50	24.93	22.04	26.73	21.87	21.14	24.53	22.12	21.53	24.85
	1	99	24.31	22.08	26.35	21.96	21.09	24.56	22.05	21.32	24.71
	50	0	24.36	22.31	26.47	21.63	21.48	24.57	22.16	21.75	24.97
	50	25	24.21	21.76	26.17	21.54	21.39	24.48	22.07	21.78	24.94
	50	50	24.19	21.71	26.13	21.53	21.42	24.49	22.08	21.83	24.97
	100	0	24.96	22.15	26.79	21.72	21.58	24.66	22.21	21.96	25.10

Band / BW	RB Size	RB Offset	16QAM								
			Low CH			Mid CH			High CH		
			39790			40040			40290		
			2510 MHz			2535 MHz			2560 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	21.84	22.62	25.26	21.96	21.44	24.72	21.76	22.38	25.09
	1	50	21.69	22.71	25.24	21.92	21.39	24.67	22.02	22.20	25.12
	1	99	21.80	22.85	25.37	21.88	21.50	24.70	21.95	22.29	25.13
	50	0	21.79	22.80	25.33	21.90	21.41	24.67	22.04	22.30	25.18
	50	25	21.82	22.89	25.40	21.95	21.55	24.76	22.02	22.27	25.16
	50	50	21.73	22.91	25.37	21.99	21.48	24.75	22.00	22.31	25.17
	100	0	21.96	23.02	25.53	22.05	21.68	24.88	22.13	22.76	25.47

Band / BW	RB Size	RB Offset	16QAM								
			Low CH			Mid CH			High CH		
			40990			41240			41490		
			2630 MHz			2655 MHz			2680 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	22.09	22.93	25.54	21.56	21.52	24.55	22.08	21.84	24.97
	1	50	24.88	21.94	26.66	21.81	21.07	24.47	22.05	21.46	24.78
	1	99	24.29	22.01	26.31	21.87	21.02	24.48	21.97	21.27	24.64
	50	0	24.32	22.27	26.43	21.58	21.41	24.51	22.09	21.61	24.87
	50	25	24.08	21.94	26.15	21.49	21.37	24.44	21.94	21.70	24.83
	50	50	24.11	21.89	26.15	21.51	21.38	24.46	22.01	21.79	24.91
	100	0	24.92	22.08	26.74	21.65	21.52	24.60	22.17	21.88	25.04

Band / BW	RB Size	RB Offset	64QAM								
			Low CH			Mid CH			High CH		
			39790			40040			40290		
			2510 MHz			2535 MHz			2560 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	21.88	22.64	25.29	21.93	21.28	24.63	21.74	22.34	25.06
	1	50	21.62	22.73	25.22	21.90	21.45	24.69	22.03	22.32	25.19
	1	99	21.79	22.81	25.34	21.82	21.37	24.61	22.00	22.29	25.16
	50	0	21.81	22.75	25.32	21.81	21.42	24.63	22.06	22.41	25.25
	50	25	21.74	22.82	25.32	21.79	21.54	24.68	22.05	22.25	25.16
	50	50	21.75	22.90	25.37	21.94	21.51	24.74	22.08	22.31	25.21
	100	0	21.99	22.97	25.52	22.01	21.65	24.84	22.16	22.80	25.50

Band / BW	RB Size	RB Offset	64QAM								
			Low CH			Mid CH			High CH		
			40990			41240			41490		
			2630 MHz			2655 MHz			2680 MHz		
			Chain0	Chain1	Total	Chain0	Chain1	Total	Chain0	Chain1	Total
41 / 20M	1	0	22.08	22.91	25.53	21.55	21.40	24.49	22.08	21.83	24.97
	1	50	24.85	21.79	26.59	21.74	21.09	24.44	22.06	21.42	24.76
	1	99	24.25	21.97	26.27	21.91	21.02	24.50	21.98	21.20	24.62
	50	0	24.30	21.29	26.06	21.51	21.33	24.43	22.09	21.64	24.88
	50	25	24.09	21.62	26.04	21.39	21.27	24.34	21.95	21.68	24.83
	50	50	24.02	21.64	26.00	21.46	21.30	24.39	21.98	21.77	24.89
	100	0	24.82	21.93	26.62	21.63	21.51	24.58	22.19	21.92	25.07

EIRP Power (dBm)

LTE Band 41

Channel Bandwidth: 20MHz

MODE		TX channel 39790					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2510.00	8.12	-2.16	14.11	11.95	33.00	-21.05
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2510.00	19.11	8.62	14.11	**22.73**	33.00	-10.27

MODE		TX channel 40040					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2535.00	7.63	-2.71	14.19	11.48	33.00	-21.52
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2535.00	18.64	8.16	14.19	22.35	33.00	-10.65

MODE		TX channel 40290					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2560.00	7.52	-2.86	14.25	11.39	33.00	-21.61
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2560.00	18.52	8.06	14.25	22.31	33.00	-10.69

MODE	TX channel 40990						
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2630.00	9.17	-1.34	14.45	13.11	33.00	-19.89
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2630.00	19.70	9.13	14.45	**23.58**	33.00	-9.42

MODE	TX channel 41240						
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2655.00	9.00	-1.56	14.53	12.97	33.00	-20.03
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2655.00	19.17	8.49	14.53	23.02	33.00	-9.98

MODE	TX channel 41490						
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2680.00	8.99	-1.60	14.59	12.99	33.00	-20.01
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	2680.00	19.29	8.52	14.59	23.11	33.00	-9.89

Note: EIRP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stabiliity Measurement

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

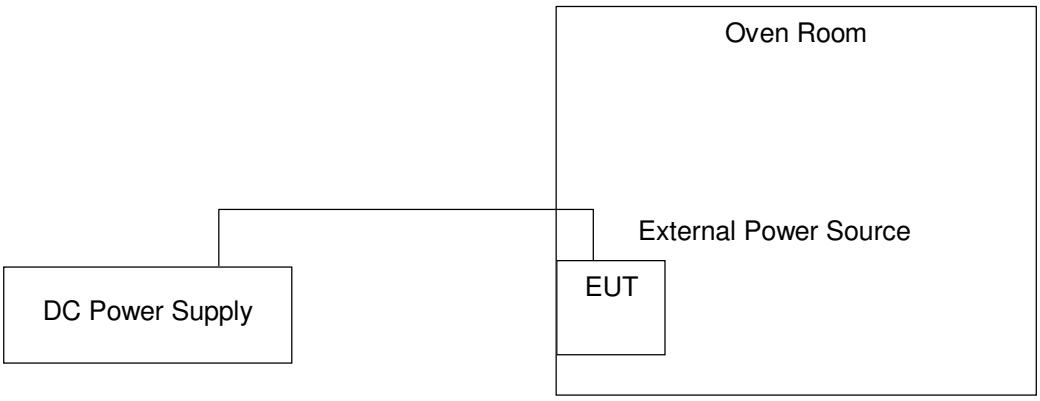
4.2.2 Test Procedure

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 DC 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

TX channel 40040

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)		Limit (ppm)
	LTE Band 41		
	20MHz		
	Chain 0	Chain 1	
3.465	0.0067061144	0.0063116371	2.5
3.3	0.0063116371	0.0055226824	2.5
3.135	0.0055226824	0.0051282051	2.5

Note: The applicant defined the normal working voltage is from 3.135Vdc to 3.465Vdc.

Frequency Error vs. Temperature

Voltage (Volts)	Frequency Error (ppm)		Limit (ppm)
	LTE Band 41		
	20MHz		
	Chain 0	Chain 1	
50	0.0071005917	0.0067061144	2.5
40	0.0067061144	0.0059171598	2.5
30	0.0059171598	0.0055226824	2.5
20	0.0055226824	0.0047337278	2.5
10	0.0047337278	0.0039447732	2.5
0	0.0043392505	0.0035502959	2.5

TX channel 41240

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)		Limit (ppm)
	LTE Band 41		
	20MHz		
	Chain 0	Chain 1	
3.465	0.0071563089	0.0067796610	2.5
3.3	0.0064030132	0.0060263653	2.5
3.135	0.0060263653	0.0056497175	2.5

Note: The applicant defined the normal working voltage is from 3.135Vdc to 3.465Vdc.

Frequency Error vs. Temperature

Voltage (Volts)	Frequency Error (ppm)		Limit (ppm)
	LTE Band 41		
	20MHz		
	Chain 0	Chain 1	
50	0.0060263653	0.0064030132	2.5
40	0.0056497175	0.0060263653	2.5
30	0.0048964218	0.0056497175	2.5
20	0.0045197740	0.0041431262	2.5
10	0.0037664783	0.0037664783	2.5
0	0.0030131827	0.0033898305	2.5

4.3 Emission Bandwidth Measurement

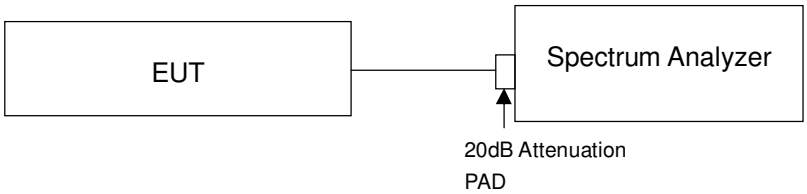
4.3.1 Limits of Emission Bandwidth Measurement

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 = 430kHz and VBW = 1.2MHz (Channel Bandwidth: 20MHz). The 26dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 26dB.

4.3.3 Test Setup

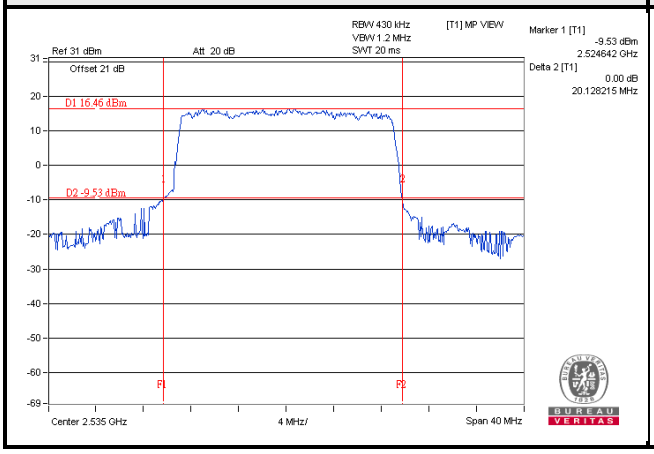


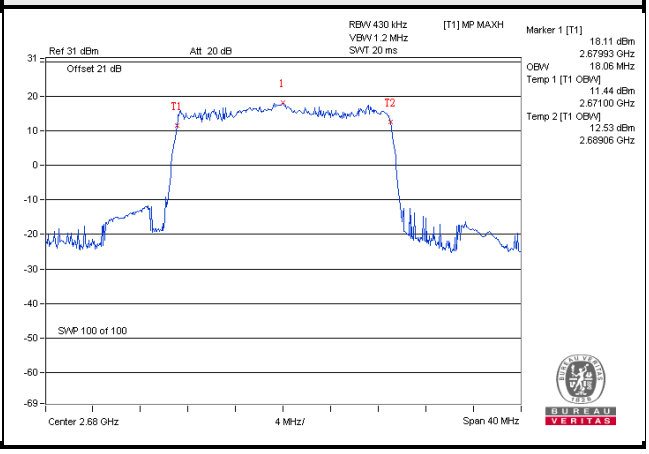
4.3.4 Test Result

LTE Band 41							
Channel Bandwidth: 20MHz							
Channel	Frequency (MHz)	-26dBc Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
39790	2510	19.73	19.78	19.55	19.67	19.70	19.62
40040	2535	19.94	19.92	19.96	20.00	20.13	19.98
40290	2560	19.57	19.58	19.57	19.63	19.56	19.62
40990	2630	19.50	19.56	19.48	19.53	19.49	19.54
41240	2655	19.73	19.64	19.57	19.45	19.60	19.60
41490	2680	19.44	19.56	19.47	19.48	19.59	19.55

LTE Band 41							
Channel Bandwidth: 20MHz							
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
39790	2510	17.93	17.86	17.93	17.93	17.80	17.93
40040	2535	17.93	18.00	17.93	17.86	17.93	18.00
40290	2560	17.86	18.00	17.86	17.86	17.86	17.80
40990	2630	17.93	18.00	17.80	18.00	17.93	18.06
41240	2655	17.86	18.00	17.93	17.80	17.93	17.80
41490	2680	18.06	18.00	18.00	17.93	18.00	17.93

-26dBc Bandwidth	Occupied Bandwidth
Spectrum Plot Of Worst Value	
20MHz / 64QAM	20MHz / QPSK





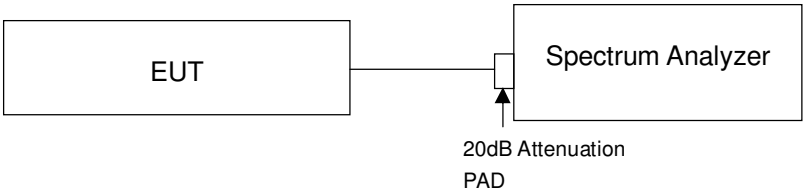
4.4 Channel Edge Measurement

4.4.1 Limits of Band Edge Measurement

For LTE Band 41
According to FCC 27.53(m)(4) specified that power of any emission outside of the channel edge must be attenuated below the transmitting power (P) by a factor shall be not less than 43 + 10 log (P) dB at the channel edge, the limit of emission equal to –13dBm. And 55 + 10 log (P) dB at 5.5 MHz from the channel edges, the limit of emission equal to –25dBm.In the 1MHz 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: The results for each of the transmit chains shall be individually compared with the limits after these limits have been added by 10 x log (N) (number of active transmit chains).

4.4.2 Test Setup



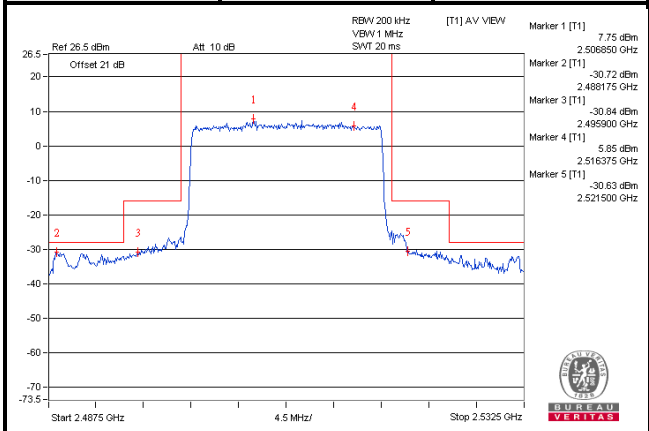
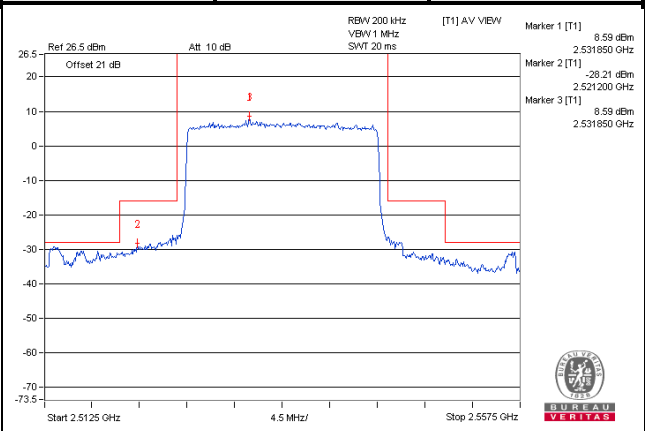
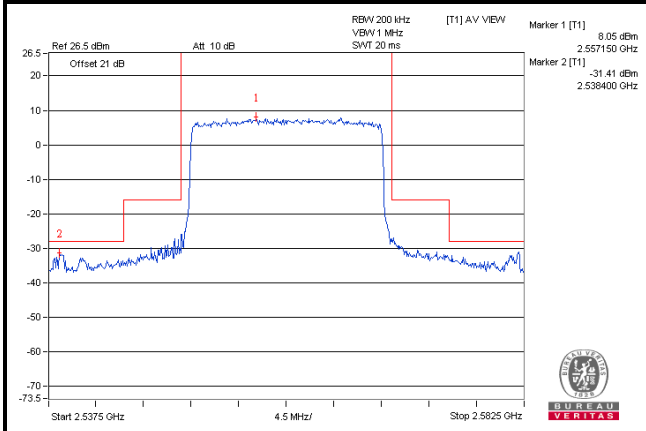
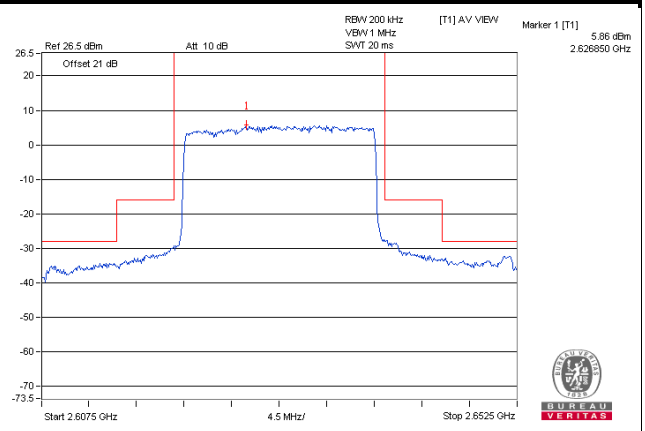
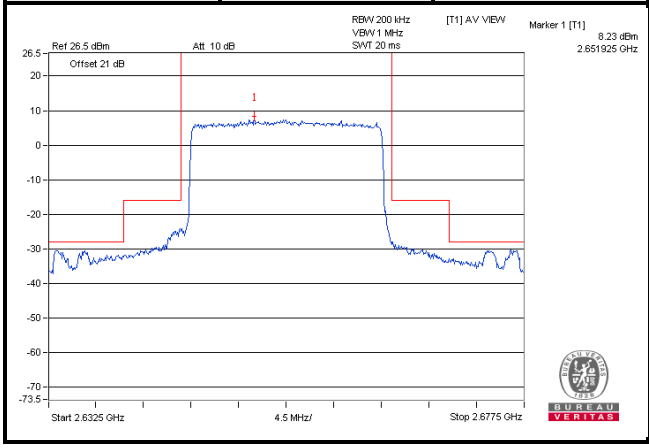
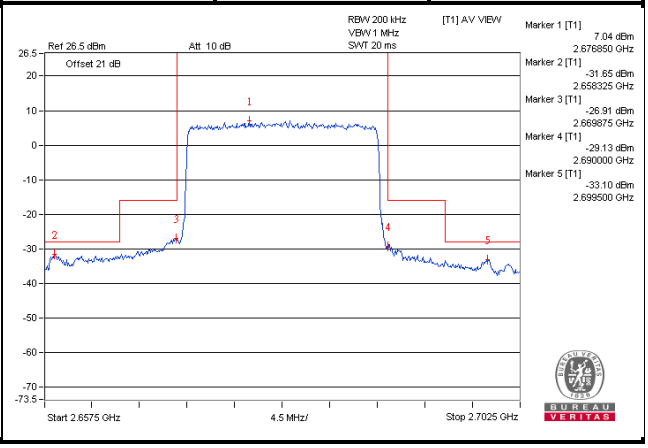
4.4.3 Test Procedures

a. The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. For LTE Band 41 measurements were done at 6 channels: low, middle and high operational frequency range.

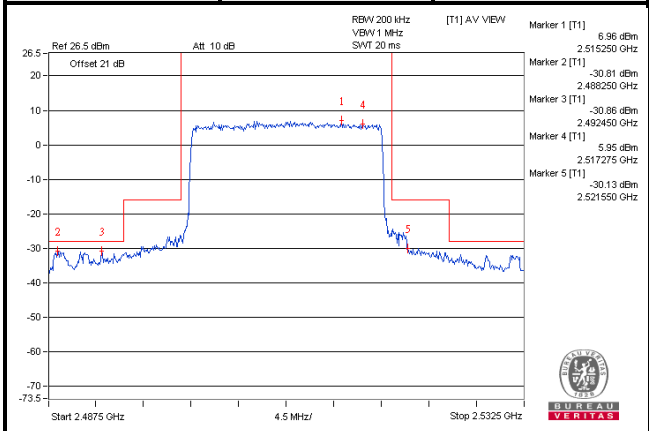
b. The center frequency of spectrum is the band edge frequency and span is 1.5MHz. RBW = 200kHz and VBW = 1MHz (Channel Bandwidth: 20MHz).

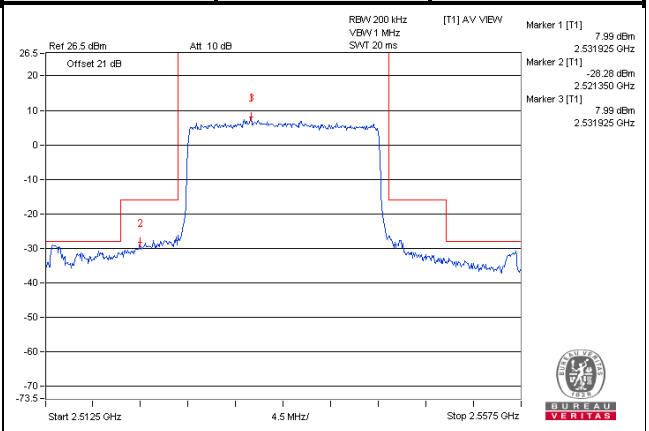
c. Record the max trace plot into the test report.

4.4.4 Test Results

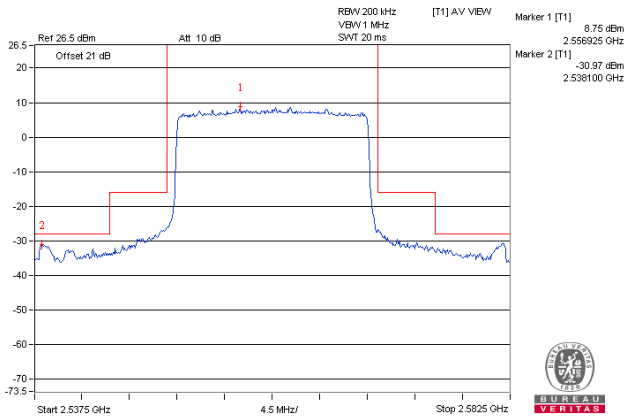
LTE Band 41 / QPSK					
Channel Bandwidth 20MHz					
Chain 0					
Channel	39790	100 RB	Channel	40040	100 RB
					
Channel	40290	100 RB	Channel	40990	100 RB
					
Channel	41240	100 RB	Channel	41490	100 RB
					

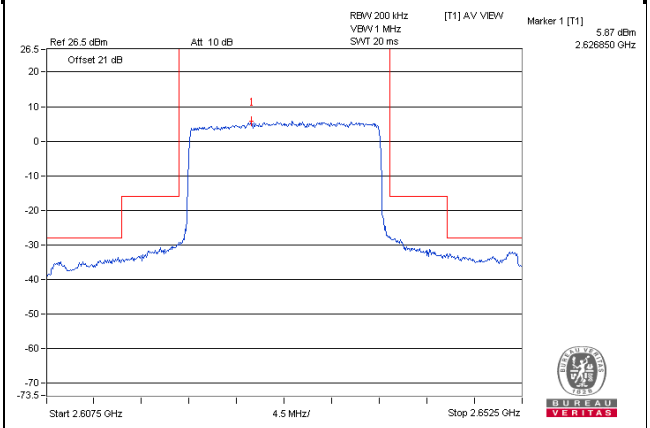
LTE Band 41 / 16QAM					
Channel Bandwidth 20MHz					
Chain 0					
Channel	39790	100 RB	Channel	40040	100 RB



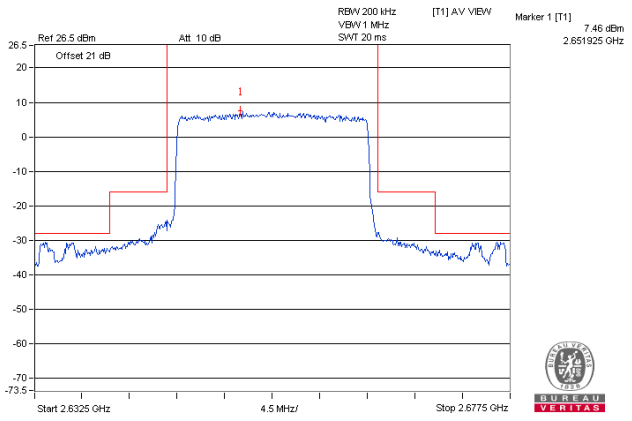


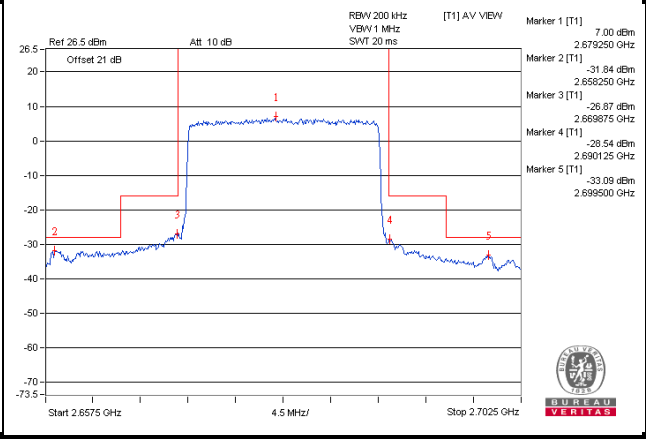
Channel	40290	100 RB	Channel	40990	100 RB





Channel	41240	100 RB	Channel	41490	100 RB



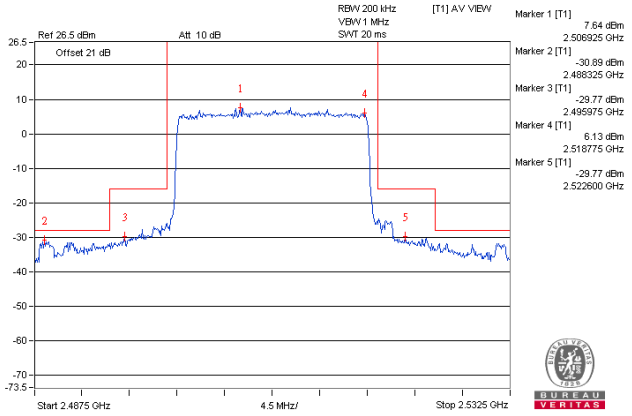


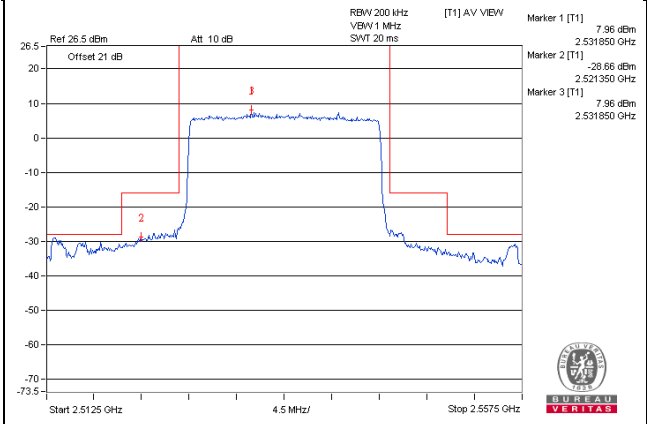
LTE Band 41 / 64QAM

Channel Bandwidth 20MHz

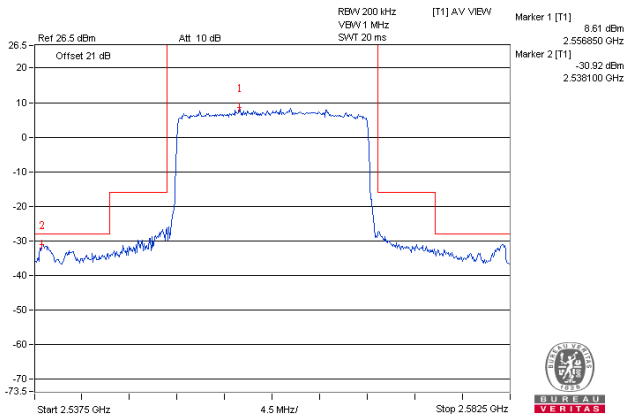
Chain 0

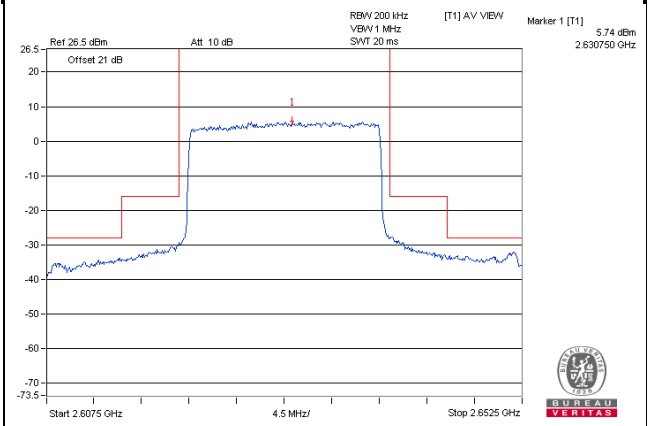
Channel	39790	100 RB	Channel	40040	100 RB



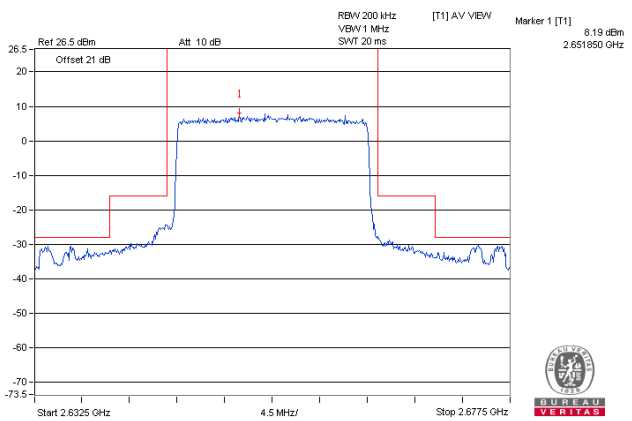


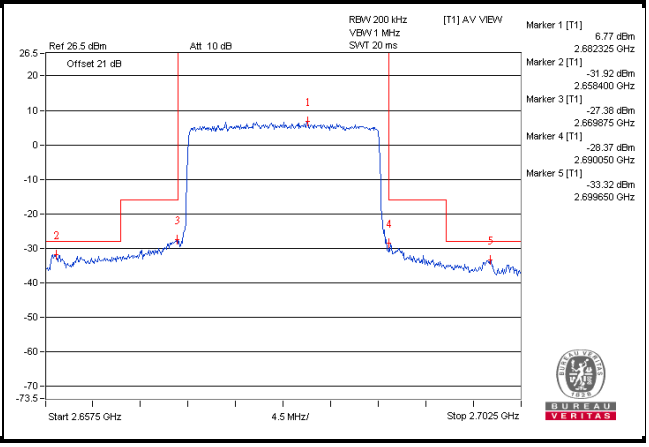
Channel	40290	100 RB	Channel	40990	100 RB



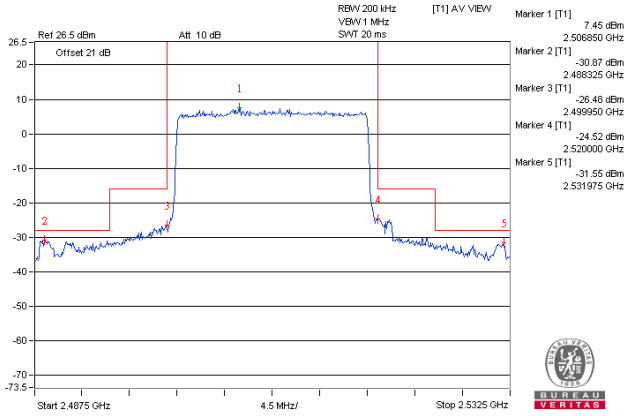


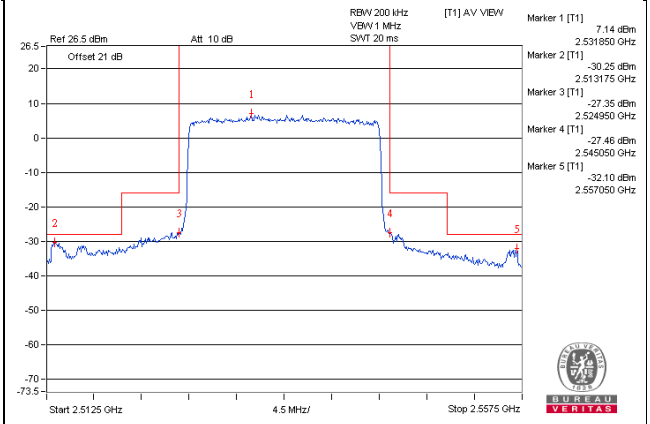
Channel	41240	100 RB	Channel	41490	100 RB



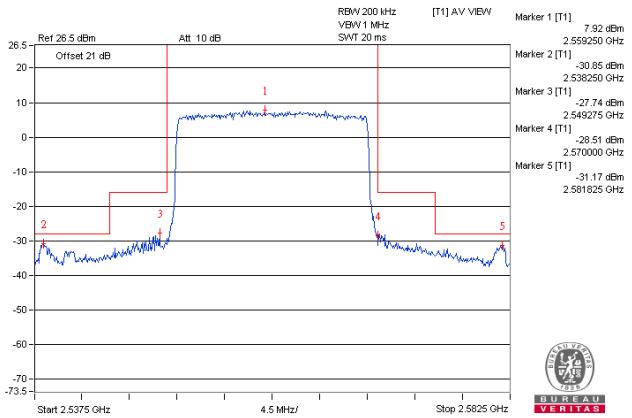


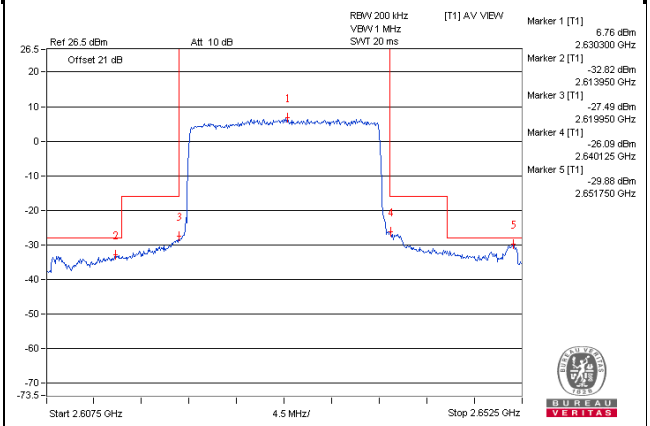
LTE Band 41 / QPSK					
Channel Bandwidth 20MHz					
Chain 1					
Channel	39790	100 RB	Channel	40040	100 RB



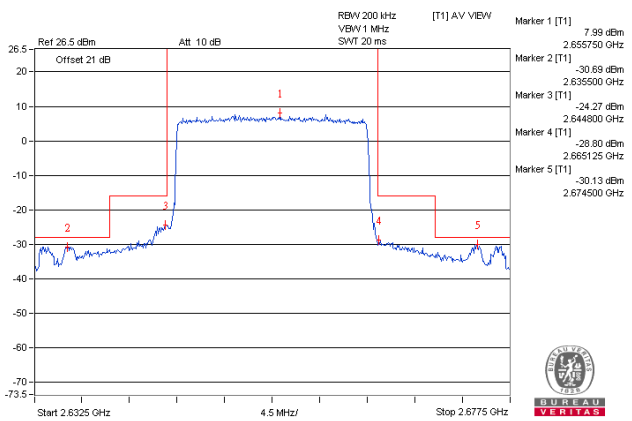


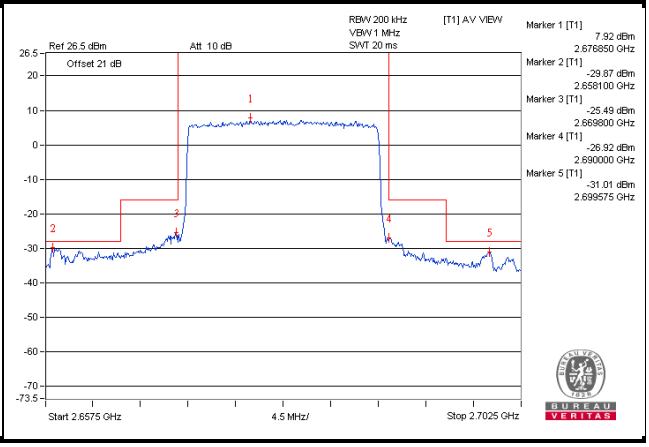
Channel	40290	100 RB	Channel	40990	100 RB





Channel	41240	100 RB	Channel	41490	100 RB



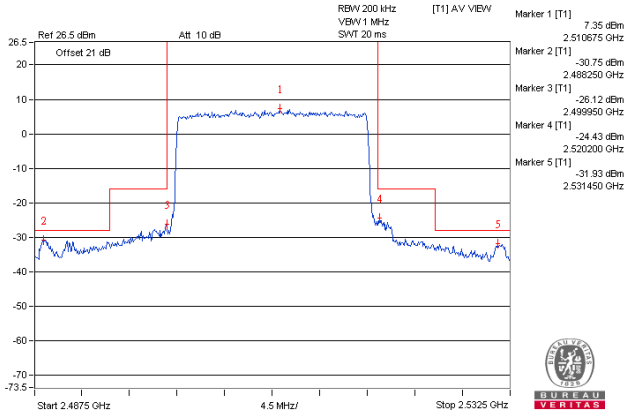


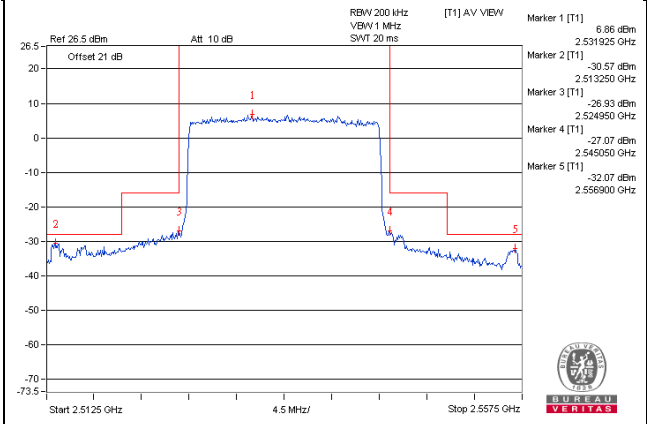
LTE Band 41 / 16QAM

Channel Bandwidth 20MHz

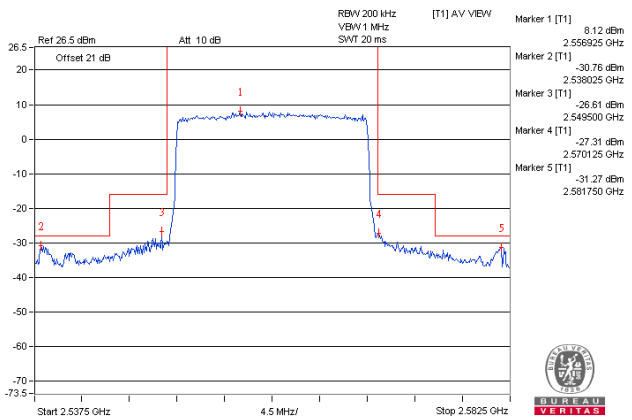
Chain 1

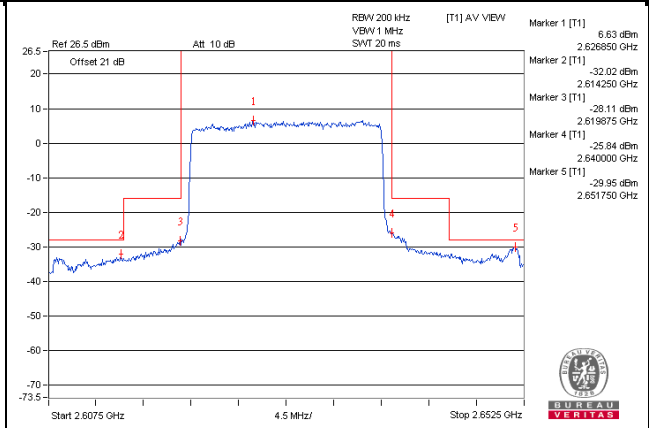
Channel	39790	100 RB	Channel	40040	100 RB



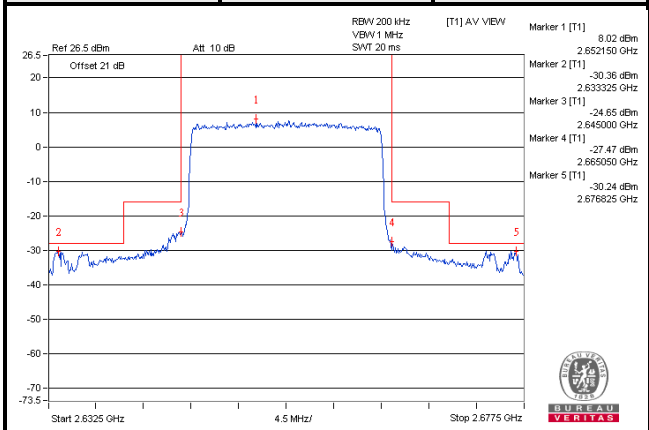


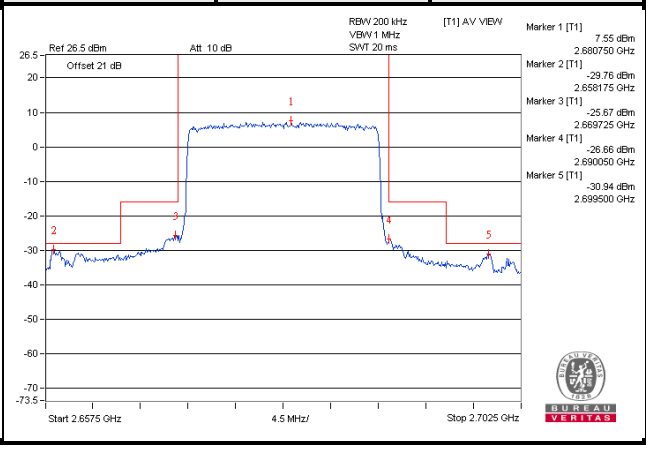
Channel	40290	100 RB	Channel	40990	100 RB





Channel	41240	100 RB	Channel	41490	100 RB



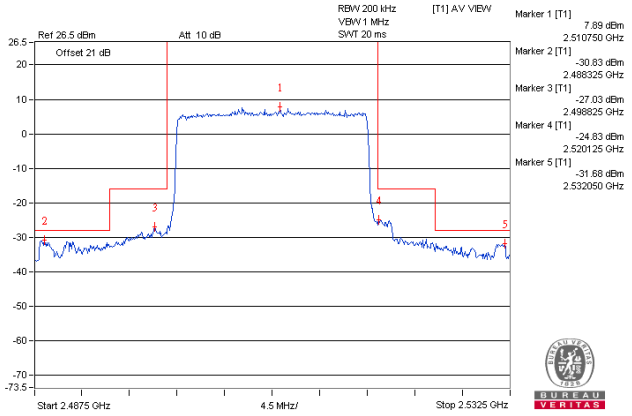


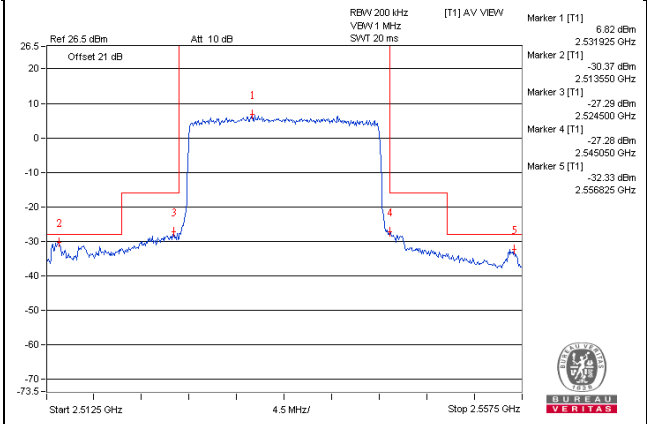
LTE Band 41 / 64QAM

Channel Bandwidth 20MHz

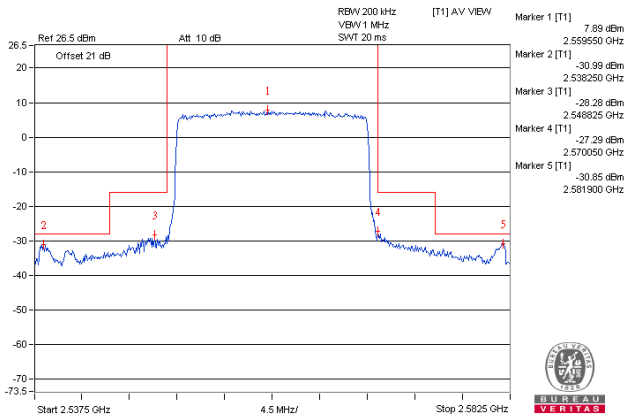
Chain 1

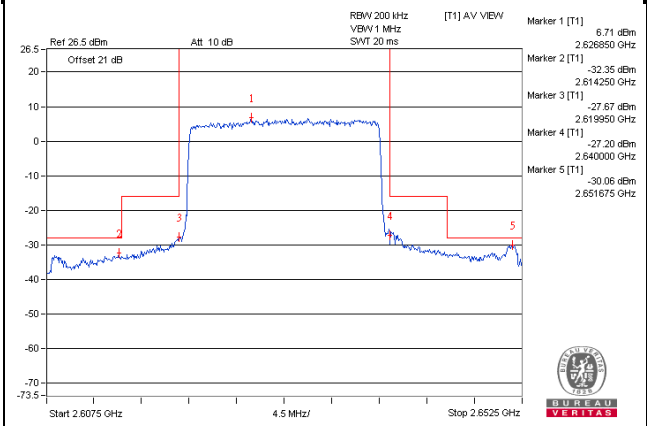
Channel	39790	100 RB	Channel	40040	100 RB



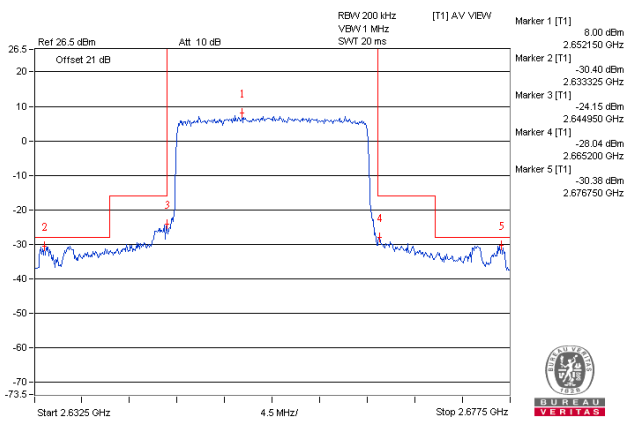


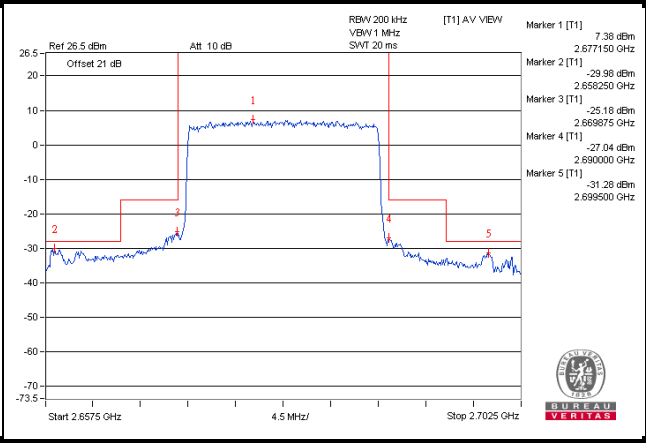
Channel	40290	100 RB	Channel	40990	100 RB





Channel	41240	100 RB	Channel	41490	100 RB



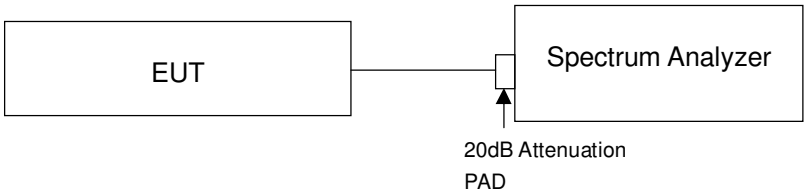


4.5 Peak To Average Ratio

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;

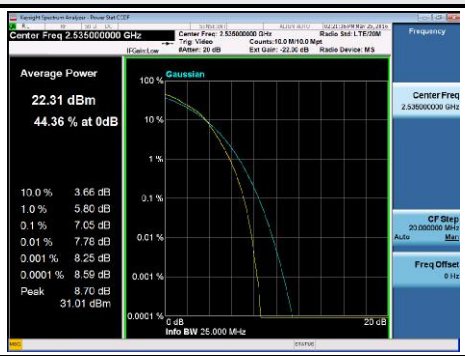
b. Set the number of counts to a value that stabilizes the measured CCDF curve;

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

4.5.4 Test Results

LTE Band 41							
Channel Bandwidth 20MHz							
Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
39790	2510	5.89	5.51	6.65	6.60	6.90	6.28
40040	2535	5.83	6.14	6.50	6.88	6.42	7.05
40290	2560	5.78	5.77	5.63	5.94	5.61	5.72
40990	2630	6.02	6.06	6.32	6.22	6.75	6.94
41240	2655	5.38	5.34	5.96	5.91	6.27	6.11
41490	2680	5.87	6.30	6.24	6.36	6.46	6.37

Spectrum Plot Of Worst Value
20MHz / 64QAM

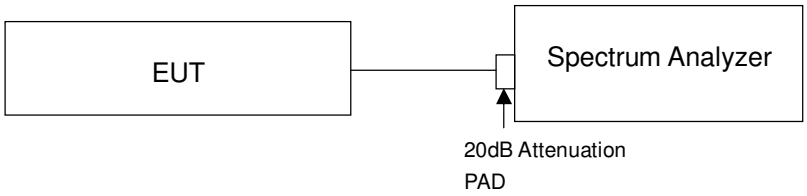


4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

For LTE Band 41
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 55 + 10 log (P) dB. The emission limit equal to –25dBm.

4.6.2 Test Setup

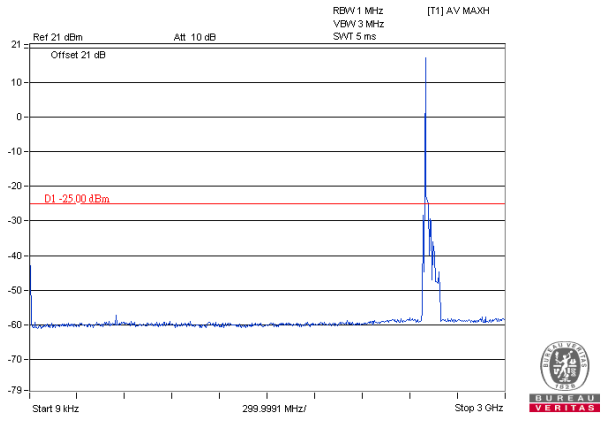
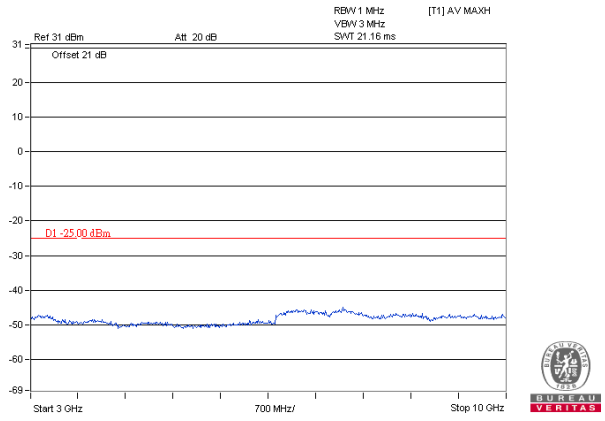
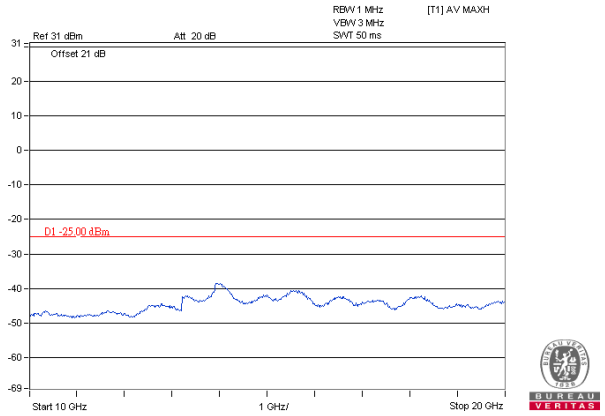


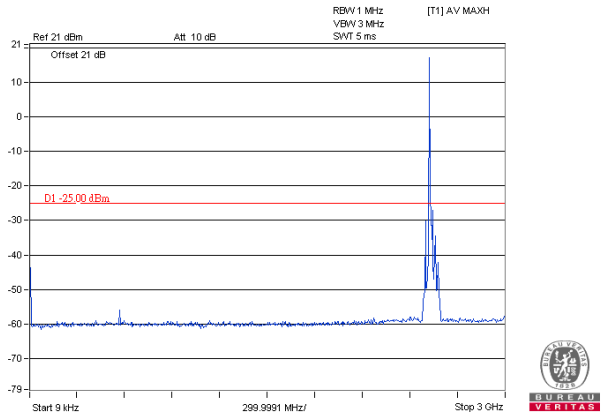
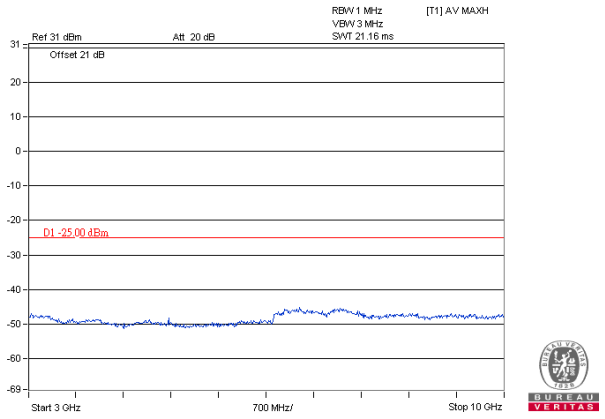
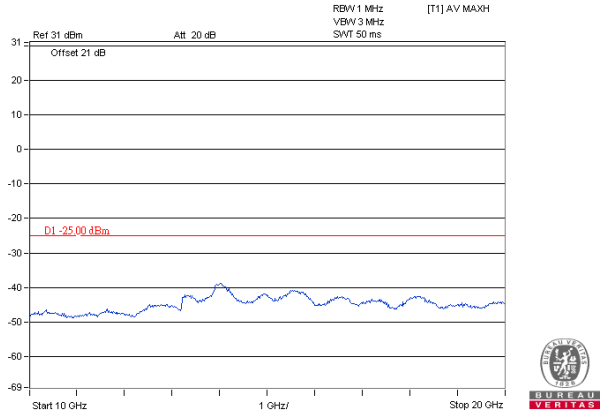
4.6.3 Test Procedure

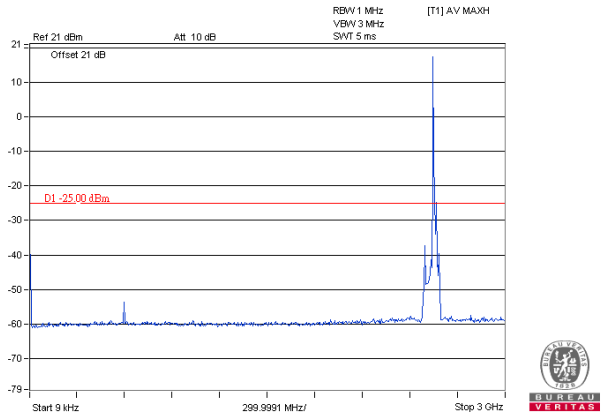
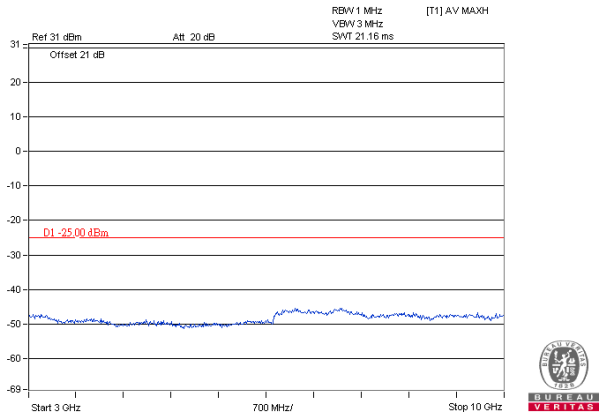
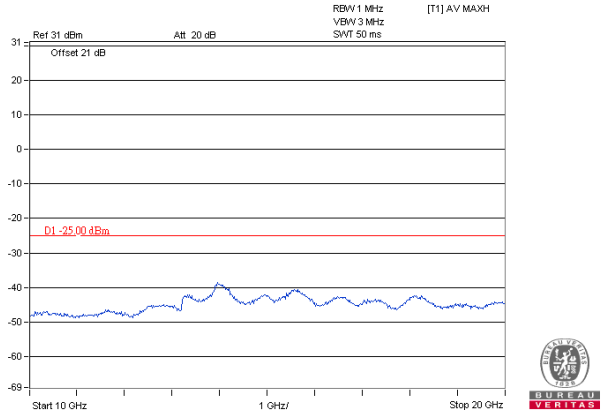
a. For LTE band LTE Band 41 measurements were done at 6 channels: low, middle and high operational frequency range.

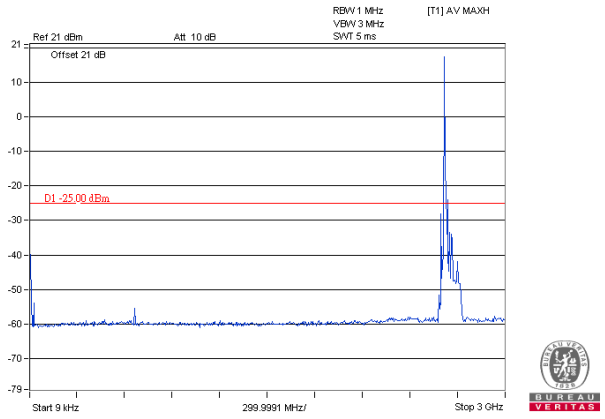
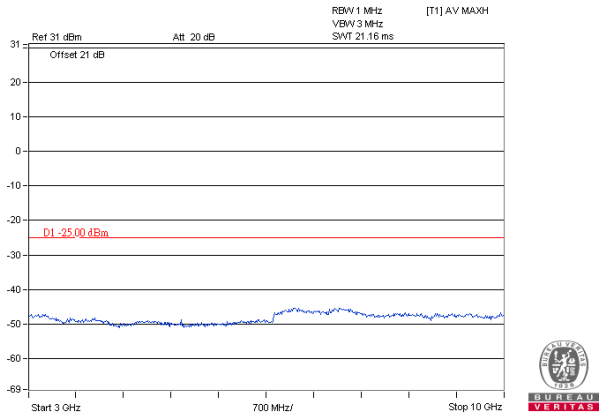
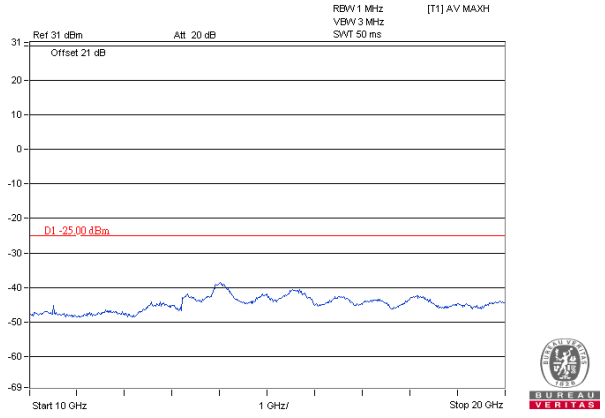
b. When the spectrum scanned from 9kHz to 20GHz, it shall be connected to the 20dB pad attenuated the carried frequency. The spectrum set RB = 1MHz, VB = 3MHz for LTE Band 41.

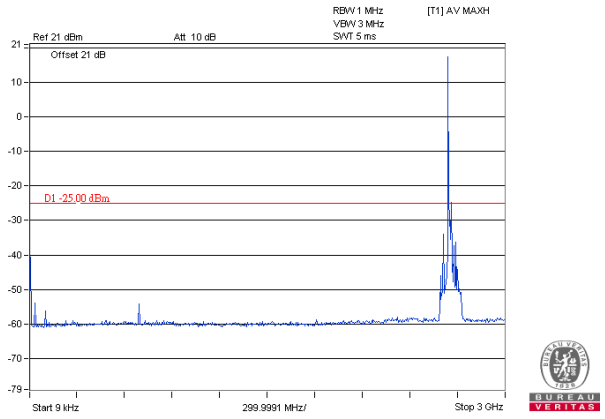
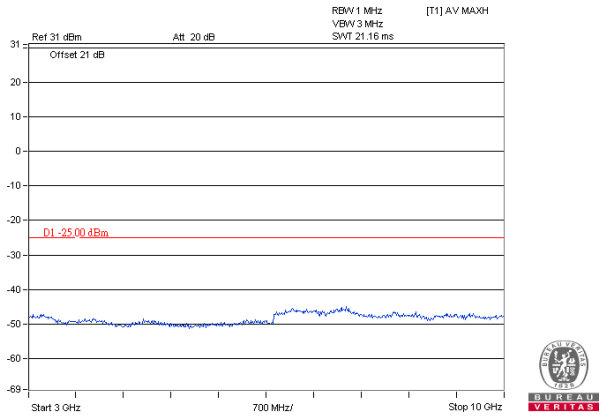
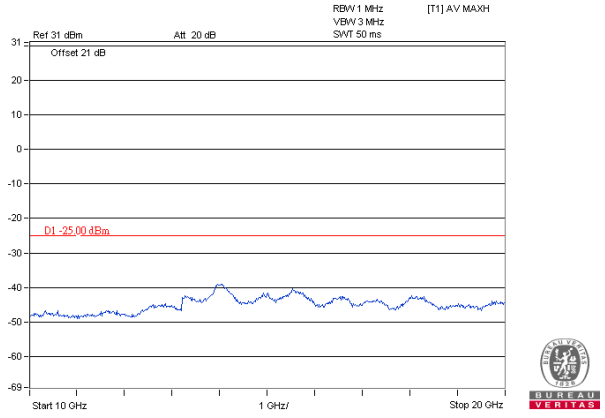
4.6.4 Test Results

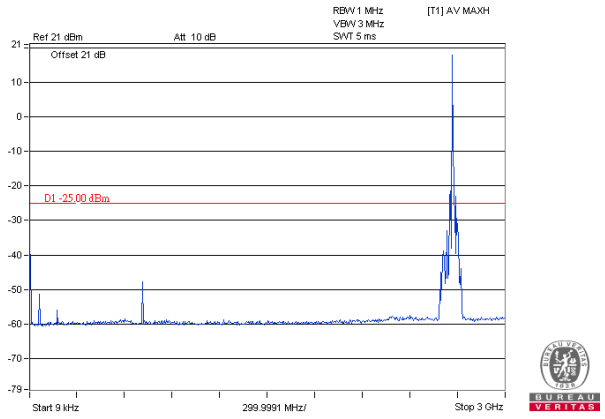
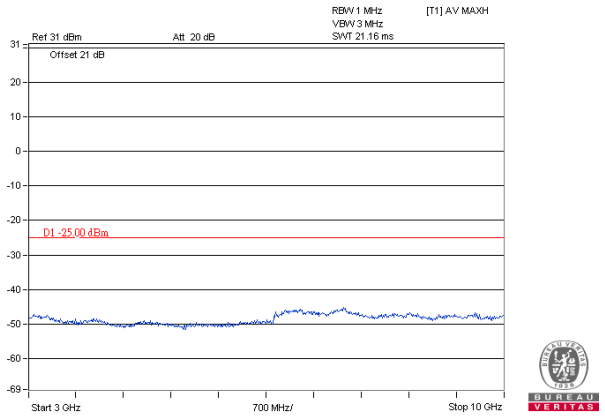
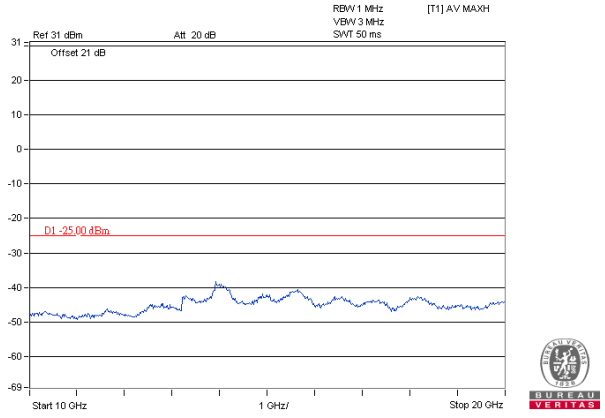
LTE Band 41 Channel Band width: 20MHz	
Channel 39790	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

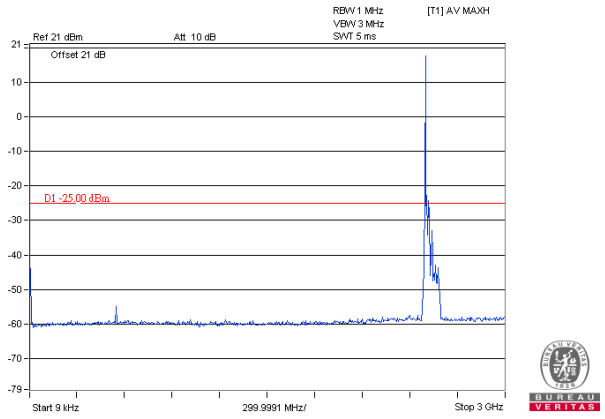
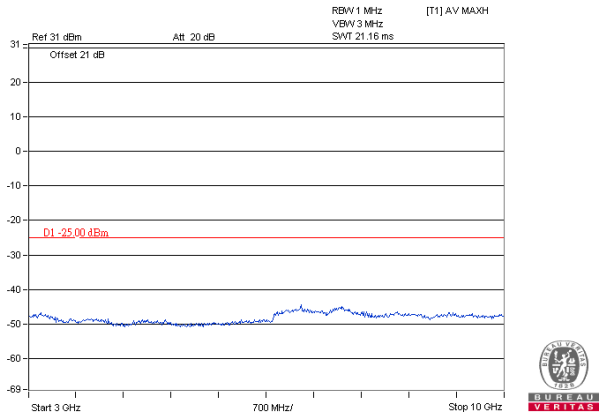
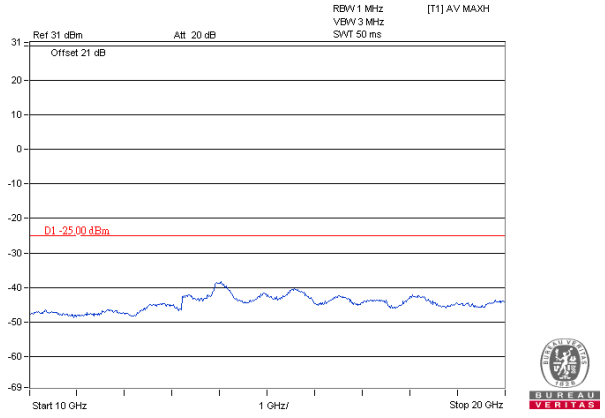
LTE Band 41 Channel Band width: 20MHz	
Channel 40040	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

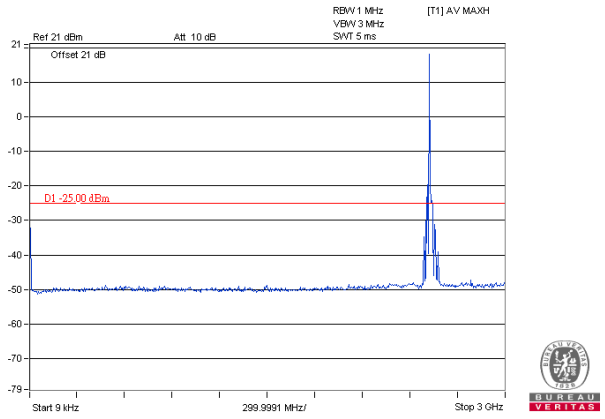
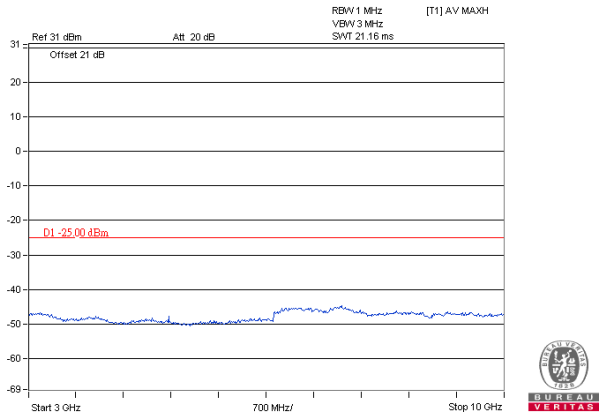
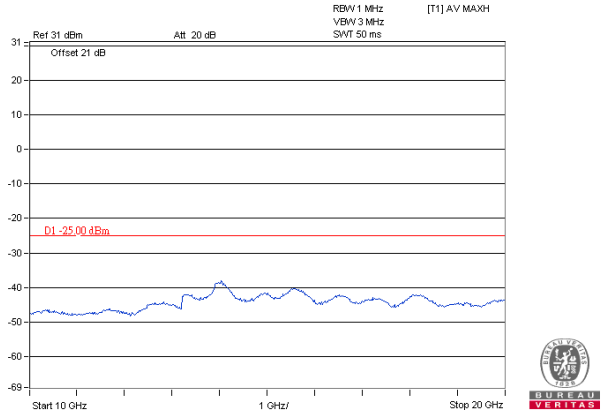
LTE Band 41 Channel Band width: 20MHz	
Channel 40290	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

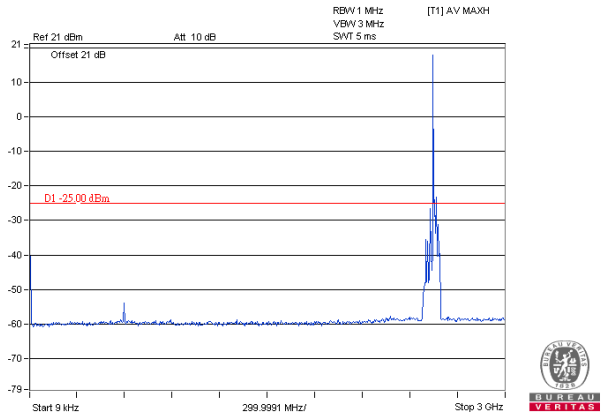
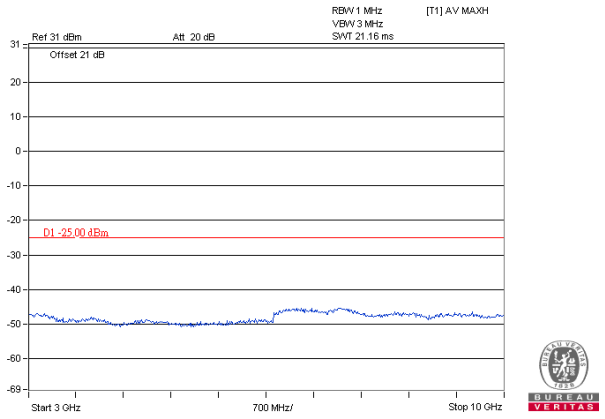
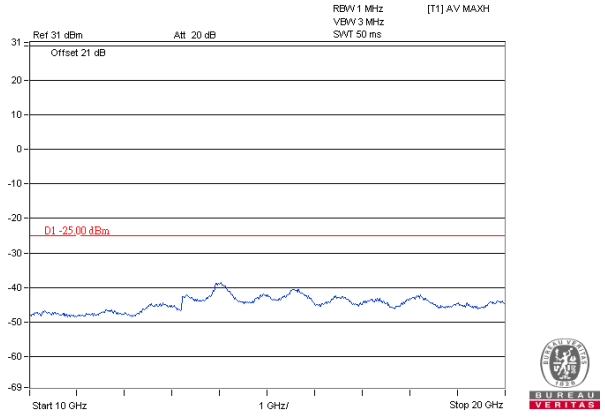
LTE Band 41 Channel Band width: 20MHz	
Channel 40990	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

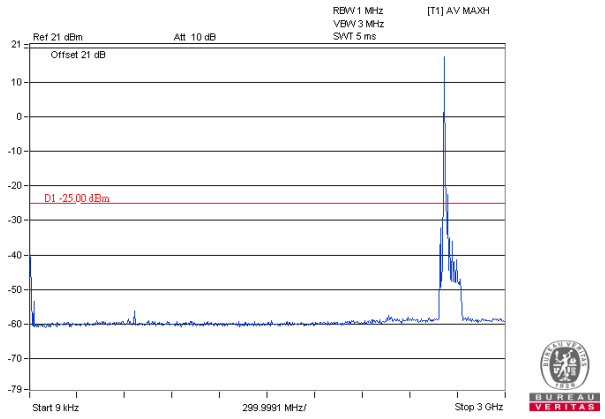
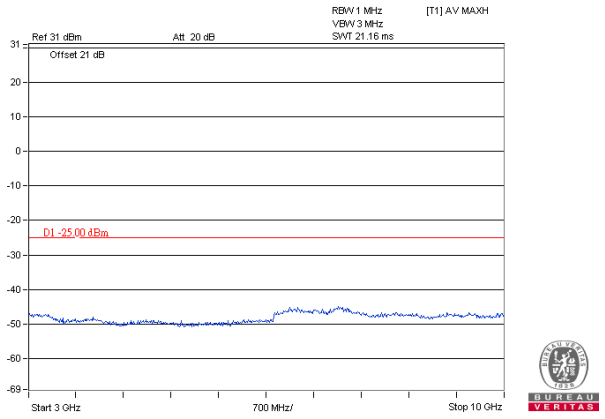
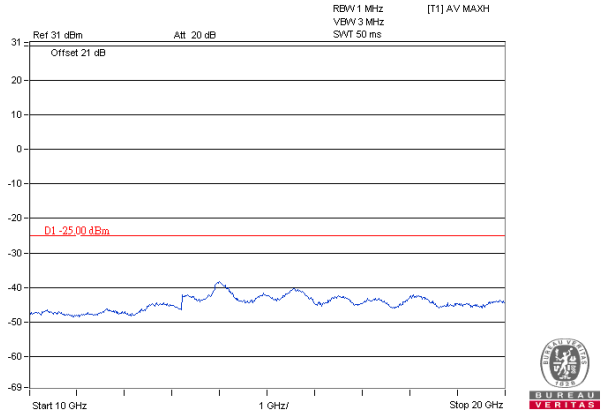
LTE Band 41 Channel Band width: 20MHz	
Channel 41240	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

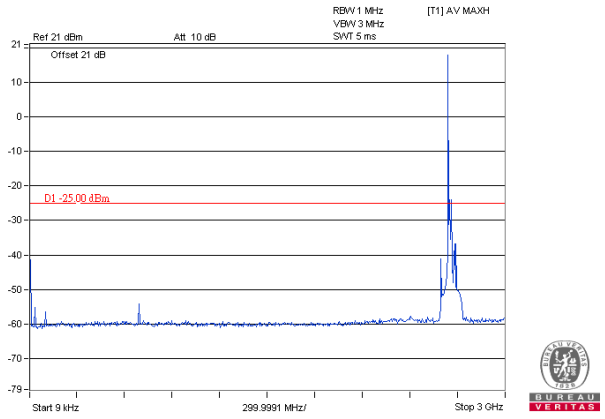
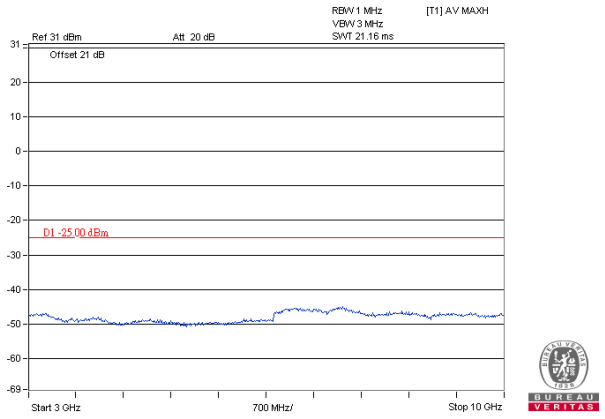
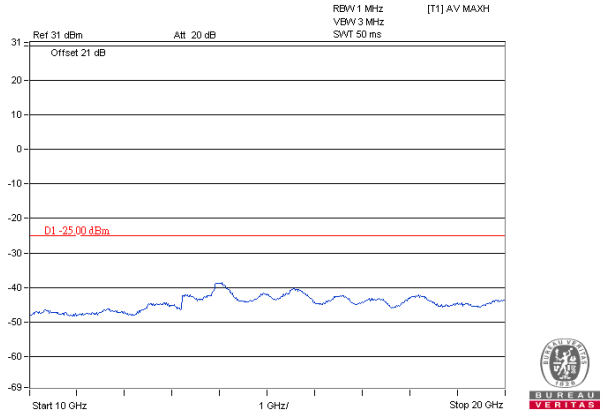
LTE Band 41 Channel Band width: 20MHz	
Channel 41490	
Chain 0	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

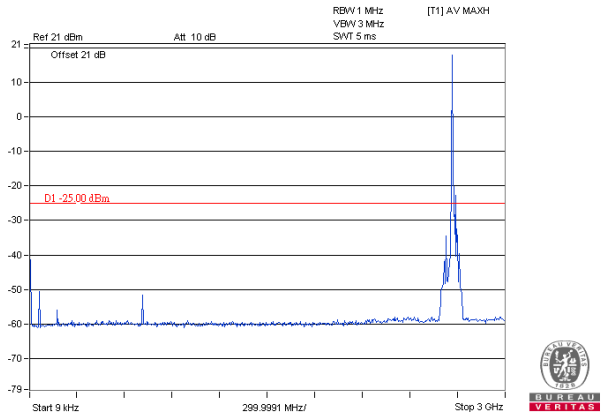
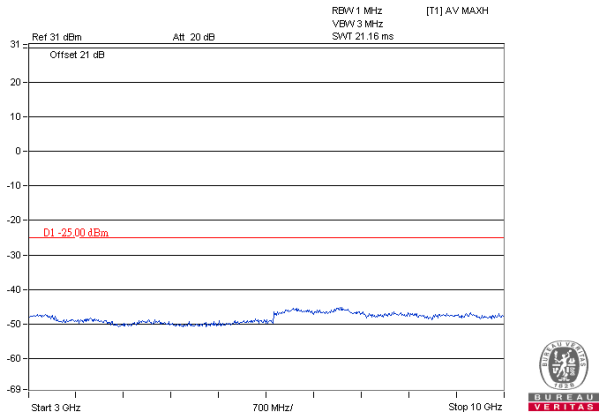
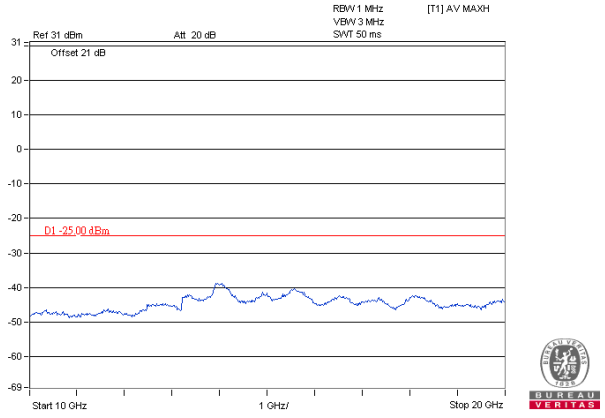
LTE Band 41 Channel Band width: 20MHz	
Channel 39790	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

LTE Band 41 Channel Band width: 20MHz	
Channel 40040	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

LTE Band 41 Channel Band width: 20MHz	
Channel 40290	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

LTE Band 41 Channel Band width: 20MHz	
Channel 40990	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

LTE Band 41 Channel Band width: 20MHz	
Channel 41240	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

LTE Band 41 Channel Band width: 20MHz	
Channel 41490	
Chain 1	
Frequency Range : 9kHz~3GHz	Frequency Range : 3GHz~10GHz
	
Frequency Range : 10GHz~20GHz	
	

4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

For LTE Band 41
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 55 + 10 log (P) dB. The emission limit equal to –25dBm.

4.7.2 Test Procedure

a. The power was measured with R&S Spectrum Analyzer. For LTE Band 41 measurements were done at 6 channels (low, middle and high channel of operational frequency range.)

b. Substitution method is used for E.I.R.P 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 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

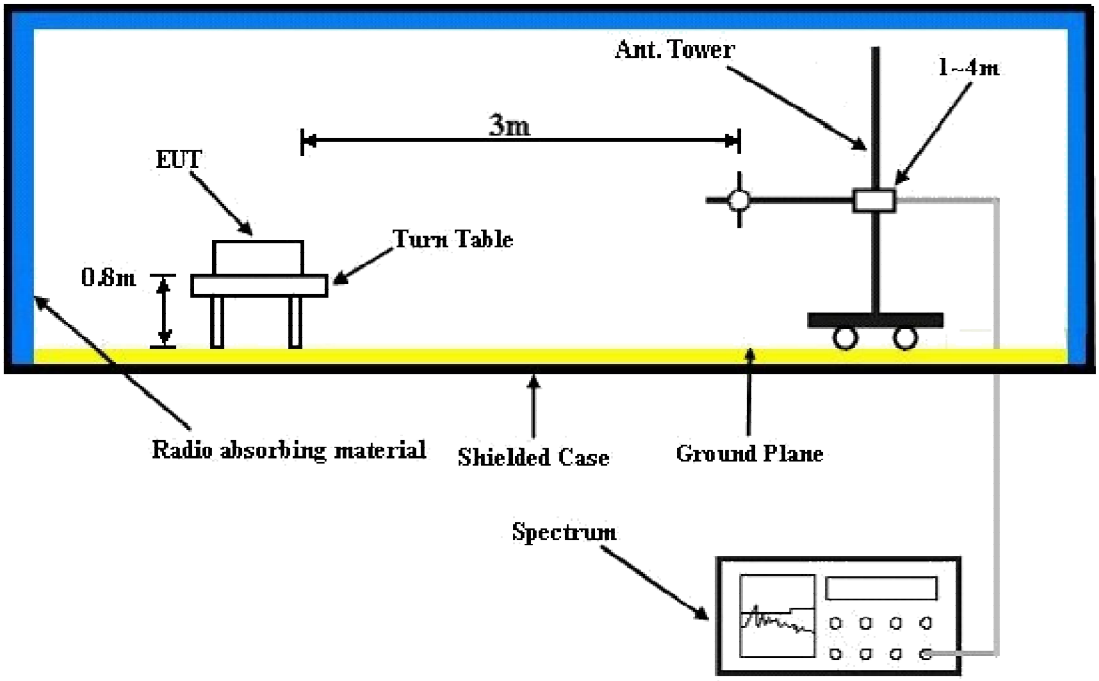
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna.

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

4.7.5 Test Results

Below 1GHz

LTE Band 41

Channel Bandwidth: 20MHz

Mode	TX channel 39790	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	112.69	-66.55	-81.64	12.00	-69.64	-25.00	-44.64
2	164.71	-60.56	-75.51	14.71	-60.80	-25.00	-35.80
3	216.72	-56.71	-73.35	12.19	-61.16	-25.00	-36.16
4	329.37	-65.39	-83.10	17.01	-66.09	-25.00	-41.09
5	528.70	-69.51	-89.27	21.87	-67.40	-25.00	-42.40
6	615.64	-75.91	-95.79	24.14	-71.65	-25.00	-46.65
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	44.67	-70.90	-82.80	14.16	-68.64	-25.00	-43.64
2	173.32	-61.43	-76.84	14.06	-62.78	-25.00	-37.78
3	268.62	-65.82	-82.12	15.07	-67.05	-25.00	-42.05
4	329.37	-64.45	-82.25	17.01	-65.24	-25.00	-40.24
5	559.01	-72.58	-92.08	22.44	-69.64	-25.00	-44.64
6	746.83	-71.24	-92.28	26.20	-66.08	-25.00	-41.08

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 40990	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	121.30	-65.70	-80.92	12.83	-68.09	-25.00	-43.09
2	164.71	-61.54	-76.49	14.71	-61.78	-25.00	-36.78
3	260.01	-56.25	-73.70	14.65	-59.05	-25.00	-34.05
4	329.37	-63.04	-80.75	17.01	-63.74	-25.00	-38.74
5	559.01	-68.53	-88.43	22.44	-65.99	-25.00	-40.99
6	746.95	-71.88	-92.25	26.20	-66.05	-25.00	-41.05
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	57.52	-66.87	-82.56	14.25	-68.31	-25.00	-43.31
2	190.66	-57.17	-74.25	12.51	-61.74	-25.00	-36.74
3	225.33	-58.77	-75.22	12.17	-63.05	-25.00	-38.05
4	329.37	-65.83	-83.63	17.01	-66.62	-25.00	-41.62
5	532.95	-70.59	-90.15	21.90	-68.25	-25.00	-43.25
6	731.07	-69.71	-90.19	25.66	-64.53	-25.00	-39.53

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

Above 1GHz

LTE Band 41

Channel Bandwidth: 20MHz

Mode	TX channel 39790	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5029.16	-43.62	-57.39	21.06	-36.33	-25.00	-11.33
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5028.89	-38.91	-52.38	21.06	-31.32	-25.00	-6.32

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

Mode	TX channel 40040	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5070.21	-40.58	-54.29	21.15	-33.14	-25.00	-8.14
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5070.43	-41.08	-54.54	21.15	-33.39	-25.00	-8.39

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

Mode	TX channel 40290	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5120.04	-41.69	-55.36	21.30	-34.06	-25.00	-9.06
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5120.11	-42.64	-56.12	21.30	-34.82	-25.00	-9.82

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

Mode	TX channel 40990	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5260.07	-42.50	-56.11	21.76	-34.35	-25.00	-9.35
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5259.74	-40.02	-53.59	21.76	-31.83	-25.00	-6.83

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

Mode	TX channel 41240	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5309.77	-42.73	-56.30	21.90	-34.40	-25.00	-9.40
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5310.12	-40.02	-53.60	21.90	-31.70	-25.00	-6.70

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

Mode	TX channel 41490	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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	5360.01	-41.86	-55.40	22.06	-33.34	-25.00	-8.34
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	**5359.79**	**-39.74**	**-53.35**	**22.06**	**-31.29**	**-25.00**	**-6.29**

Remarks:
1. Output Power (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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