Full

TEST REPORT

No. I18D00189-SRD06

For

Client :	**Shanghai Sunmi Technology Co.,Ltd.**
Production :	**POS System**
Model Name :	**L1321/L1323**
Brand Name :	**SUNMI**
FCC ID :	**2AH25T2MININFC**
Hardware Version:	**V1.03**
Software Version:	**MST2MINI_EQ000_2EE0.123BBE2.9530762_180824_100_V01_T15**
Issued date:	**2018-12-25**

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of ECIT Shanghai.

The standards accredited by A2LA except ANSI/TIA-603-E and KDB 971168 D01.

Test Laboratory:

ECIT Shanghai, East China Institute of Telecommunications

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Revision Version

Report Number	Revision	Date	Memo
I18D00189-SRD06	00	2018-12-13	Initial creation of test report
I18D00189-SRD06	01	2018-12-24	Second creation of test report
I18D00189-SRD06	02	2018-12-25	Third creation of test report

CONTENTS

1. Test Laboratory

1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area, No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301
FCC registration No	958356

1.2. Testing Environment

Normal Temperature:	15-35℃
Extreme Temperature:	-30/+50℃
Relative Humidity:	25-75%

1.3. Project data

Project Leader:	Zhou Yan
Testing Start Date:	2018-09-18
Testing End Date:	2018-10-19

1.4. Signature

Yang Dejun
(Prepared this test report)

Shi Hongqi
(Reviewed this test report)

Zheng Zhongbin
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	Shanghai Sunmi Technology Co.,Ltd.
Address:	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone:	8618721763396
Postcode:	200433

2.2. Manufacturer Information

Company Name:	Shanghai Sunmi Technology Co.,Ltd.
Address:	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone:	8618721763396
Postcode:	200433

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

EUT Description	POS System
Model name	L1321/L1323
FCC ID	2AH25T2MININFC
GSM Frequency Band	GSM 850/GSM 1900
UMTS Frequency Band	Band 2/5
CDMA Frequency Band	BC 0
LTE Frequency Band	Band 38/41
Additional Communication Function	BT/BLE/2.4G WLAN b/g/n20/n40/NFC
Extreme Temperature	-30/+50℃
Nominal Voltage	24V
Extreme High Voltage	25V
Extreme Low Voltage	23V

Note: Photographs of EUT are shown in ANNEX A of this test report.

3.2. Internal Identification of EUT used during the test

EUT ID*	Model Name	SN or IMEI	HW Version	SW Version	Date of receipt
N07	L1321	/	V1.03	MST2MINI_EQ000_2EE0.123BBE2.9530762_180824_100_V01_T15	2018-09-07
N08	L1321	/	V1.03	MST2MINI_EQ000_2EE0.123BBE2.9530762_180824_100_V01_T15	2018-09-07
N01	L1323	/	V1.03	MST2MINI_EQ000_2EE0.123BBE2.9530762_180824_100_V01_T15	2018-09-07

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description	SN
AE1	RF cable	---

*AE ID: is used to identify the test sample in the lab internally.

3.4. Statements

The L1321/L1323, supporting GPRS/EDGE/WCDMA/CDMA/LTE/BT/WLAN/BLE/NFC, manufactured by Shanghai Sunmi Technology Co.,Ltd., which is a new product for testing.

Note: The project has two prototypes, L1321 and L1323. The L1321 we tested all the test items. The other one we only tested worse case of RSE.

ECIT has verified that the compliance of the tested device specified in section 5 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 5 of this test report.

4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2017/10/01
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2017/10/01
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.4	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2014
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03

5. SUMMARY OF TEST RESULTS

Band 41

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	27.50(h)(2)	A.1	P
2	Emission Limit	27.53(m), 2.1051	A.2	P
3	Frequency Stability	27.54, 2.1055	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	A.4	P
5	Emission Bandwidth	27.53(m)	A.5	P
6	Band Edge Compliance	27.53(m)	A.6	P
7	Conducted Spurious Emission	27.53(m), 2.1057	A.7	P
8	Peak to Average Power Ratio	27.50(a)	A.8	P

Receiver Radiated Emission

Items	Test Name	Section in this report	Verdict
9	Receiver Radiated Emissions	A.9	P

6. Test Equipment Utilized

Climate chamber

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Climate chamber	SH-641	92012011	ESPEC	2017-12-25	2 Year

Radiated emission test system

The test equipment and ancillaries used are as follows.

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Universal Radio Communication Tester	CMW500	104178	R&S	2018-05-11	1 Year
2	Test Receiver	ESU40	100307	R&S	2018-05-11	1 Year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2017-02-25	3 Year
4	Double Ridged Guide Antenna	ETS-3117	135890	ETS	2017-01-11	3 Year
5	2-Line V-Network	ENV216	101380	R&S	2018-05-11	1 Year
6	Substitution Antenna	ETS-3117	00135890	ETS	2017-01-11	3 Year
7	RF Signal Generator	SMF100A	102314	R&S	2018-05-11	1 Year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2017-11-18	3 Year
9	Amplifier	SCU08	10146	R&S	2018-05-11	1 Year

Conducted test system

No.	Name	Type	SN	Manufacture	Calibration date	Cal.interval
1	Vector Signal Analyser	FSQ40	200063	Rohde&Schwarz	2017-12-17	1 Year
2	Wireless communication comprehensive tester	CMW500	148904	Rohde&Schwarz	2017-08-21	1 Year
3	DC Power Supply	ZUP60-14	LOC-220Z006-0007	TDL-Lambda	2018-05-11	1 Year
4	MAX Signal Analyzer	N9020A	MY51240233	Agilent Technologies	2018-05-11	1 Year

Software

Name	Version
Eagle FCC LTE auto test system	V3.0
EMC32	V9.15

7. Test Environment

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20%, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =25 %, Max. =75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

8. Test Environment

Measurement uncertainty for all the testing in this report are within the limit specified in ECIT documents. The detailed measurement uncertainty to see the column, k=2

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	±0.88db
EBW and VBW	30MHz-3600MHz	95%	±0.031MHz
Transmitter Spurious Emission-Conducted	9KHz-10000MHz	95%	±4.56db
Transmitter Spurious Emission-Conducted	10000 MHz -40000MHz	95%	±5.34db
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	±5.66db
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	±4.98db
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	±5.06db
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	±5.20db
Frequency stability	1MHz-16GHz	95%	10KHz

ANNEX A. MEASUREMENT RESULTS

ANNEX A.1. OUTPUT POWER

A.1.1. Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation.
In all cases, output power is within the specified limits.

A.1.2. Conducted

A.1.2.1. Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.
These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

A.1.2.2 Measurement result

LTE band 41

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2557.5	21.8	20.52
		2593.0	21.5	20.29
		2652.5	21.56	20.22
	1 RB low	2557.5	21.66	20.57
		2593.0	21.67	21
		2652.5	21.43	20.9
	50% RB mid	2557.5	21.93	20.49
		2593.0	21.61	20.31
		2652.5	21.68	20.91
	100% RB	2557.5	20.75	19.8
		2593.0	20.51	19.88
		2652.5	20.53	19.49
10MHz	1 RB high	2560.0	21.92	20.77
		2593.0	21.52	20.67
		2650.0	21.83	20.95
	1 RB low	2560.0	21.82	20.8
		2593.0	21.58	20.67
		2650.0	21.73	21.03
	50% RB mid	2560.0	22.03	21.2
		2593.0	21.74	21
		2650.0	21.8	20.97
	100% RB	2560.0	20.99	19.78
		2593.0	20.72	19.79
		2650.0	20.65	19.55
15MHz	1 RB high	2562.5	21.75	21.1
		2593.0	21.77	20.68
		2647.5	21.81	20.98
	1 RB low	2562.5	21.82	21.41
		2593.0	21.63	20.78
		2647.5	21.68	20.87
	50% RB mid	2562.5	21.86	21.21
		2593.0	22	20.7
		2647.5	21.48	20.53
	100% RB	2562.5	20.75	19.79
		2593.0	20.52	19.63
		2647.5	20.56	19.6

20MHz	1 RB high	2565.0	21.71	20.24
		2593.0	21.35	20.65
		2645.0	21.7	20.98
	1 RB low	2565.0	21.81	20.94
		2593.0	21.35	20.62
		2645.0	21.73	21.12
	50% RB mid	2565.0	22.18	20.51
		2593.0	21.87	21.26
		2645.0	21.68	21.34
	100% RB	2565.0	20.54	19.57
		2593.0	20.74	19.64
		2645.0	20.69	19.58

A.1.3 Radiated

A.1.3.1 Description

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 27.50(d) specifies “Fixed, mobile, and portable (handheld) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”.

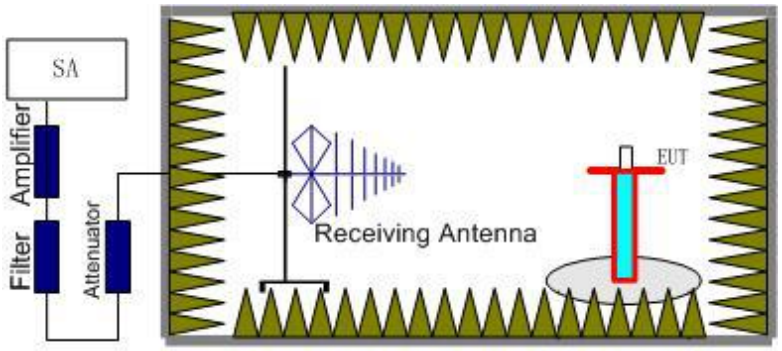
Rule Part 27.50(h)(2) specifies “Mobile stations are limited to 2.0 watts EIRP.”.

Rule Part 27.50(c) specifies “Portable stations (hand-held de-vices) are limited to 3 watts ERP.”.

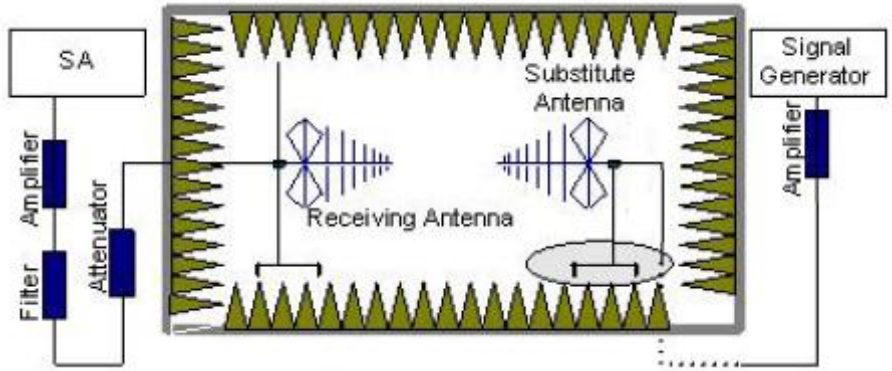
A.1.3.2 Method of Measurement

The measurements procedures in TIA-603E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, a substitution antenna for the frequency band of interest is placed at the

reference point of the chamber. An RF signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.
   The cable loss (P_{cl}), the substitution antenna Gain (G_a) and the amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power (EIRP) = P_{Mea} + P_{Ag} - P_{cl} + G_a
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15.

A.1.3.3 Measurement result

LTE Band 41- EIRP Part 27.50(h)(2)

Limits: ≤33dBm (2W)

LTE Band 41_5MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2557.5	-9.82	5.4	34.8	3.8	23.38	33.0	9.62	H
2593.0	-8.44	5.5	34.8	3.8	24.66	33.0	8.34	H
2652.5	-10.37	5.5	34.9	3.9	22.93	33.0	10.07	H

LTE Band 41_10MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2560.0	-7.3	5.4	34.8	3.8	25.9	33.0	7.1	H
2593.0	-6.7	5.5	34.8	3.8	26.4	33.0	6.6	H
2650.0	-9.02	5.5	34.9	3.9	24.28	33.0	8.72	H

LTE Band 41_15MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2562.5	-7.34	5.4	34.8	3.8	25.86	33.0	7.14	H
2593.0	-6.38	5.5	34.8	3.8	26.72	33.0	6.28	H
2647.5	-9.3	5.5	34.9	3.9	24	33.0	9	H

LTE Band 41_20MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2565.0	-8.98	5.4	34.8	3.8	24.22	33.0	8.78	H
2593.0	-8.39	5.5	34.8	3.8	24.71	33.0	8.29	H

2645.0	-10.08	5.5	34.9	3.9	23.22	33.0	9.78	H

LTE Band 41_5MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2557.5	-9.63	5.4	34.8	3.8	23.57	33.0	9.43	H
2593.0	-8.15	5.5	34.8	3.8	24.95	33.0	8.05	H
2652.5	-10.12	5.5	34.9	3.9	23.18	33.0	9.82	H

LTE Band 41_10MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2560.0	-7.54	5.4	34.8	3.8	25.66	33.0	7.34	H
2593.0	-6.81	5.5	34.8	3.8	26.29	33.0	6.71	H
2650.0	-9.19	5.5	34.9	3.9	24.11	33.0	8.89	H

LTE Band 41_15MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2562.5	-7.55	5.4	34.8	3.8	25.65	33.0	7.35	H
2593.0	-6.35	5.5	34.8	3.8	26.75	33.0	6.25	H
2647.5	-8.77	5.5	34.9	3.9	24.53	33.0	8.47	H

LTE Band 41_20MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2565.0	-9.2	5.4	34.8	3.8	24	33.0	9	H
2593.0	-8.53	5.5	34.8	3.8	24.57	33.0	8.43	H
2645.0	-10.07	5.5	34.9	3.9	23.23	33.0	9.77	H

Peak EIRP(dBm) = P_{Mea}(-10.07dBm) - G_a (3.9dBi) - P_{Ag} (34.9dB) - P_{cl} (5.5dB) =23.23dBm

ANALYZER SETTINGS:

RBW = VBW = 8MHz for occupied bandwdiths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

ANNEX A.2. EMISSION LIMT

Reference

FCC: CFR 2.1051, 27.53(m).

A.2.1 Measurement Method

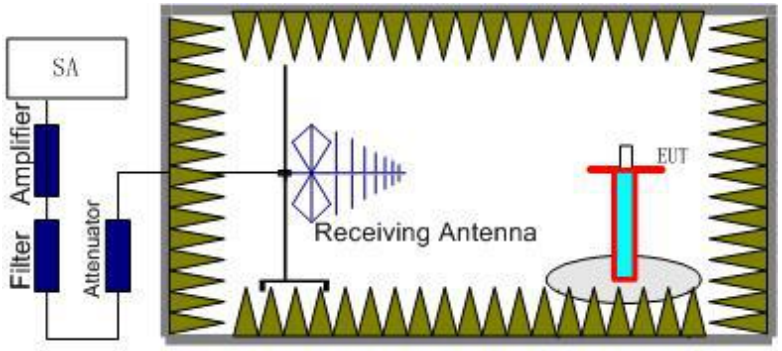
The measurements procedures in TIA-603E-2016 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as

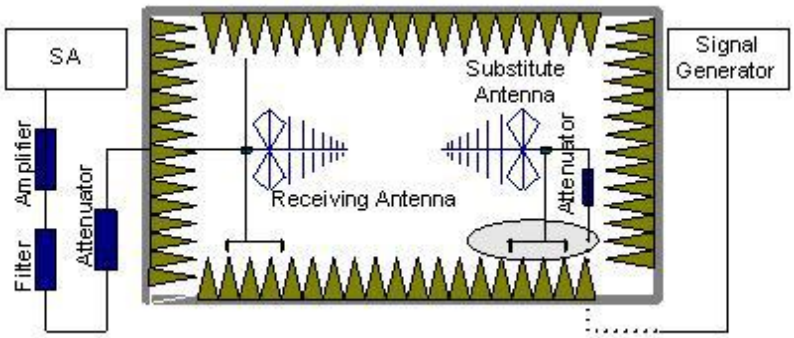
outlined in Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 40/41.

The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.

An amplifier should be connected in for the test.
The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier.
The measurement results are obtained as described below:
Power (EIRP)=P_{Mea}- P_{pl} + G_a

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

A.2.2 Measurement Limit

Part 27.53(m) all specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

A.2.3 Measurement Results

7. Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 41. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE Bands 41. into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this. The evaluated frequency range is from 30MHz to 26GHz.

L1321

LTE Band 41, 5MHz, QPSK, Channel 40265

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3582.0	-47.93	6.5	4.7	-49.73	-13	H
4468.8	-47.81	7.3	7.3	-47.81	-13	V
6058.0	-48.18	8.6	10.4	-46.38	-13	V
7884.8	-50.26	9.9	16.6	-43.56	-13	V
10761.6	-42.98	11.7	17.3	-37.38	-13	V
13320.5	-40.63	13.6	21.8	-32.43	-13	H

LTE Band 41, 5MHz, QPSK, Channel 40620

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3582.8	-47.32	6.5	4.7	-49.12	-13	H
5177.2	-46.1	8.0	8.7	-45.4	-13	H
6920.4	-48.77	9.3	12.9	-45.17	-13	H
9134.8	-48.63	10.5	18.5	-40.63	-13	V
11847.0	-41.79	12.5	17.6	-36.69	-13	V
15660.2	-37	14.5	22.2	-29.3	-13	H

LTE Band 41, 5MHz, QPSK, Channel 41215

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3569.2	-47.89	6.4	4.7	-49.59	-13	H
4524.4	-46.93	7.3	7.3	-46.93	-13	H
6414.8	-47.5	8.9	11.5	-44.9	-13	H
8891.2	-50.33	10.4	18.3	-42.43	-13	V
10831.2	-42.77	11.7	17.3	-37.17	-13	H
12930.2	-39.93	13.0	20.2	-32.73	-13	H

Note: The maximum value of expanded measurement uncertainty for this test item is U = 4.2 dB, k = 2.

L1323

LTE Band 41, 5MHz, QPSK, Channel 40265

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3815.2	-50.26	6.7	7.7	-49.26	-13	H
4864.4	-46.57	7.6	7.9	-46.27	-13	V
6328.4	-47.54	8.8	10.8	-45.54	-13	H
7950.8	-45.87	9.8	16.6	-39.07	-13	H
10806.0	-42.74	11.7	17.3	-37.14	-13	H
17763.8	-30.9	15.8	20.6	-26.1	-13	H

LTE Band 41, 5MHz, QPSK, Channel 40620

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3944.8	-49.95	6.8	7.7	-49.05	-13	H
4970.8	-48.26	7.7	9.0	-46.96	-13	H
6701.2	-48.27	9.1	12.3	-45.07	-13	V
8024.8	-49.34	9.9	16.6	-42.64	-13	H
10075.2	-46.57	11.3	17.6	-40.27	-13	V
12214.5	-40.21	12.6	17.5	-35.31	-13	V

LTE Band 41, 5MHz, QPSK, Channel 41215

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3997.6	-51.04	6.9	7.7	-50.24	-13	V
5251.6	-48.65	8.0	8.7	-47.95	-13	V
6949.2	-47.98	9.3	12.9	-44.38	-13	V
9924.4	-45.51	11.0	17.6	-38.91	-13	V
13269.8	-40.87	13.0	21.8	-32.07	-13	V
17823.2	-30.87	16.0	20.6	-26.27	-13	H

Note: The maximum value of expanded measurement uncertainty for this test item is U = 4.2 dB, k = 2.

ANNEX A.3. FREQUENCY STABILITY

Reference

FCC: CFR Part 2.1055, 27.54.

A.3.1 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 40/41, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃ decrements from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

A.3.2 Measurement Limit

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 23VDC and 25VDC, with a nominal voltage of 24VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. For the purposes of measuring frequency stability these voltage limits are to be used.

A.3.3 Measurement results

LTE Band 41, 5MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
23	14.59	-22	0.01	0.01
24	15.51	-18.91	0.01	0.01
25	18.14	-21.6	0.01	0.01

Frequency Error vs Temperature

Temperature (℃)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	16.69	34.46	0.01	0.01
40°	14.46	-28.71	0.01	0.01
30°	19.38	-21.44	0.01	0.01
20°	16.09	-17.15	0.01	0.01
10°	14.58	-20.53	0.01	0.01
0°	12.69	-22.64	0.01	0.01
- 10°	17.74	-21.72	0.01	0.01
- 20°	14.86	-21.31	0.01	0.01
- 30°	14.16	-25.55	0.01	0.01

ANNEX A.4. EMISSION BANDWIDTH

Reference

FCC: CFR Part 2.1049(h)(i)

A.4.1 Occupied Bandwidth Results

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

The measurement method is from KDB 971168 4:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

LTE band 41, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
2593.0	QPSK	16QAM
	4.471	4.495

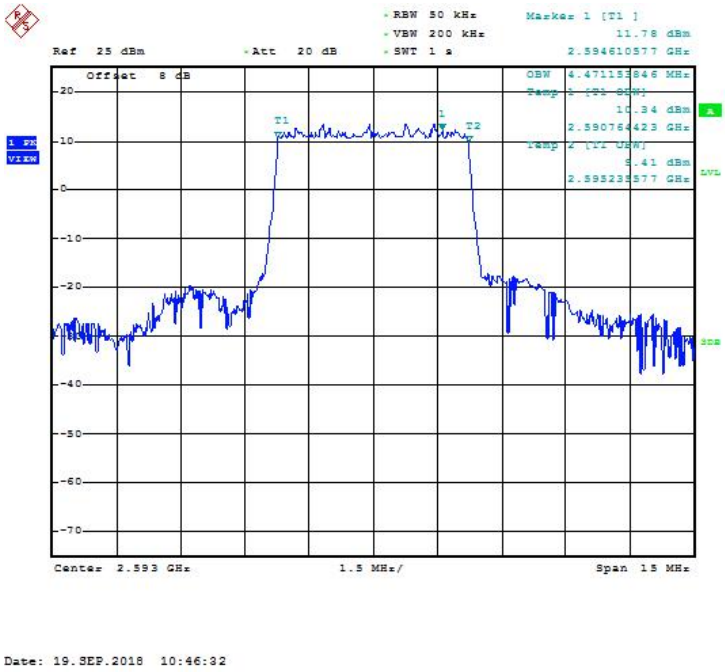


Fig.1 LTE band 41, 5MHz Bandwidth, QPSK (99% BW)

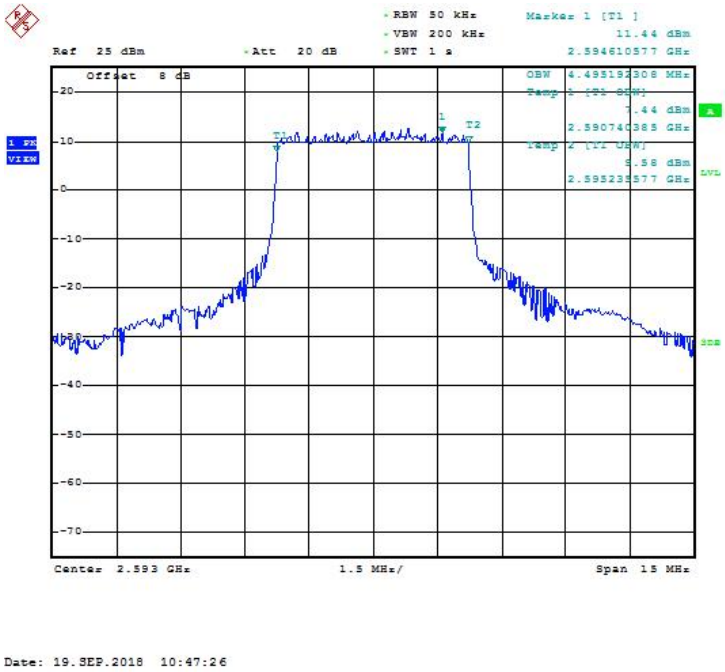


Fig.2 LTE band 41, 5MHz Bandwidth, 16QAM (99% BW)

LTE band 41, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
2593.0	QPSK	16QAM
	8.99	8.99

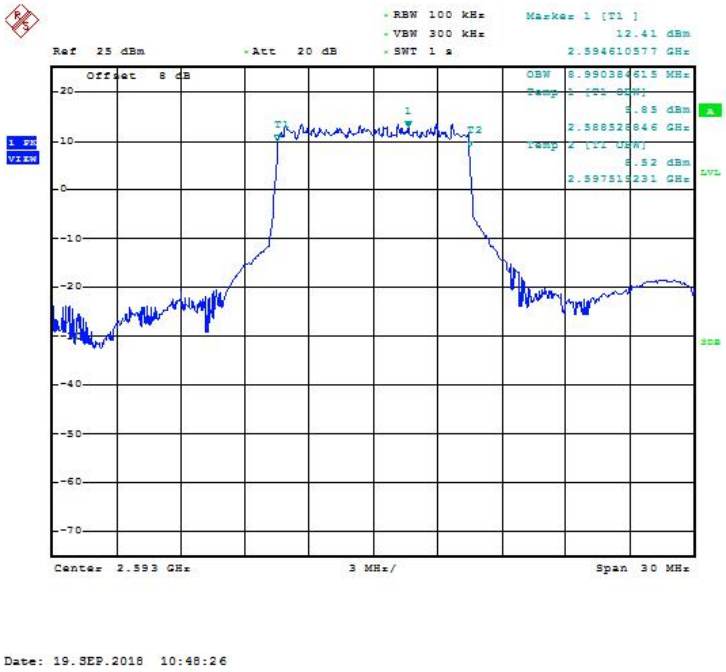


Fig.3 LTE band 41, 10MHz Bandwidth, QPSK (99% BW)

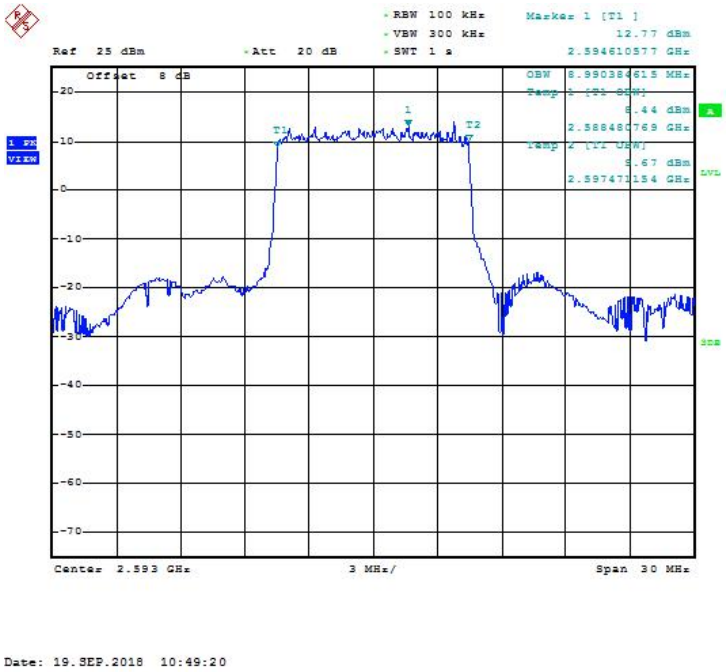


Fig.4 LTE band 41, 10MHz Bandwidth, 16QAM (99% BW)

LTE band 41, 15MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
2593.0	QPSK	16QAM
	13.526	13.59

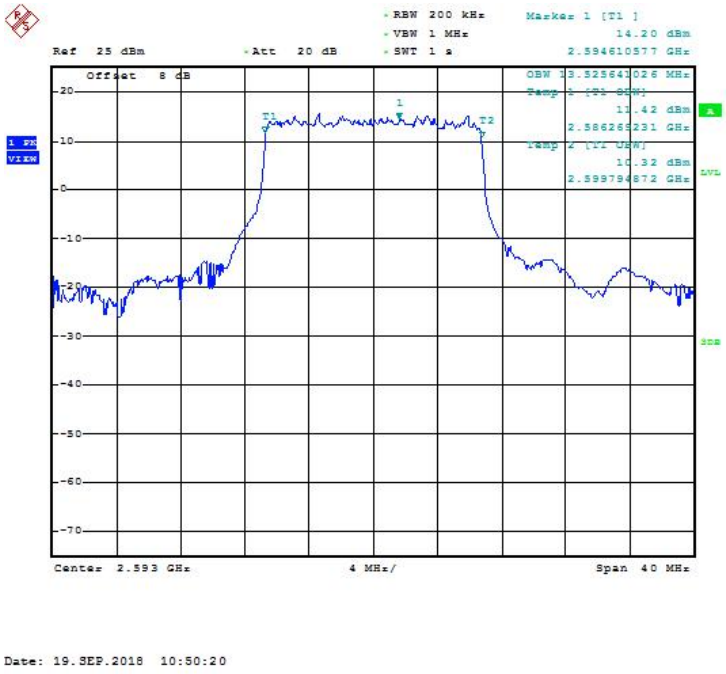


Fig.5 LTE band 41, 15MHz Bandwidth, QPSK (99% BW)

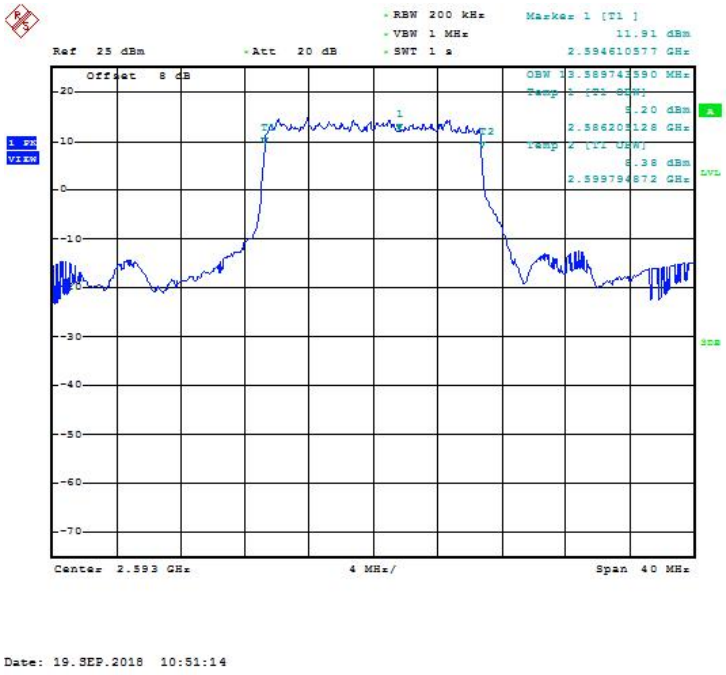


Fig.6 LTE band 41, 15MHz Bandwidth, 16QAM (99% BW)

LTE band 41, 20MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
2593.0	QPSK	16QAM
	17.885	17.885

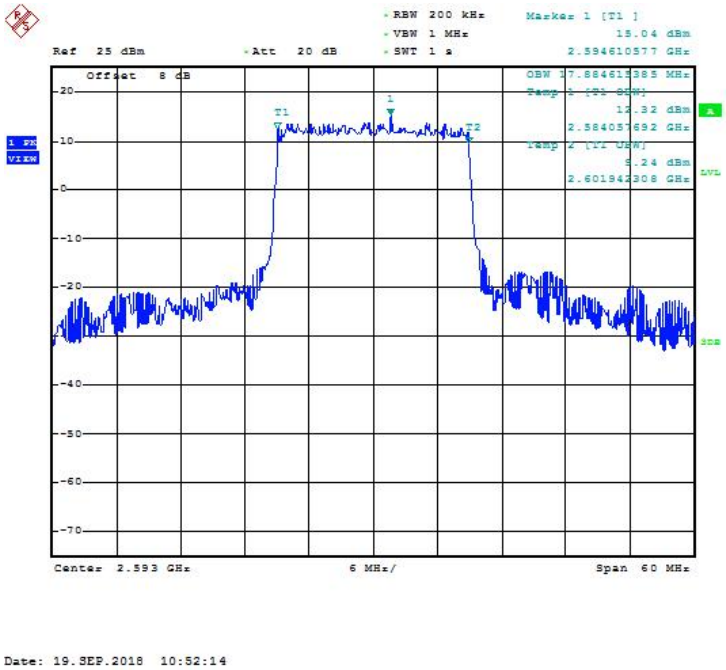


Fig.7 LTE band 41, 20MHz Bandwidth, QPSK (99% BW)

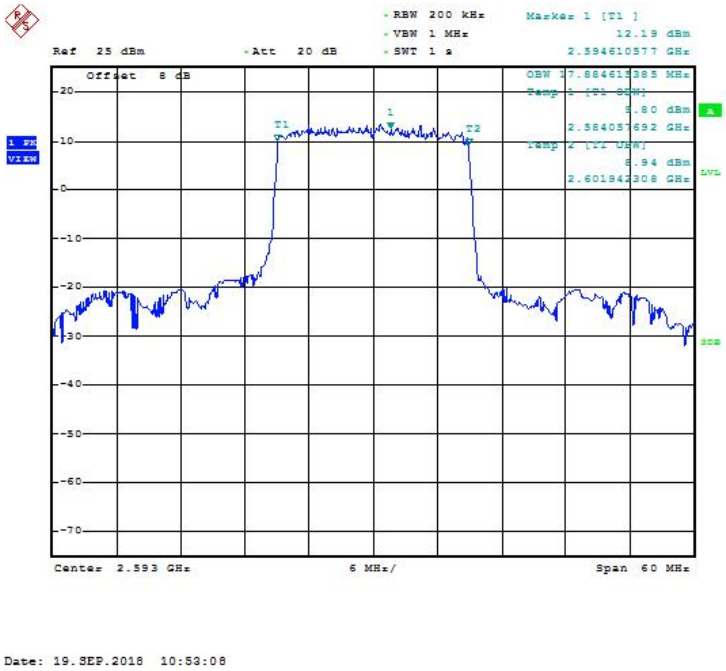


Fig.8 LTE band 41, 20MHz Bandwidth, 16QAM (99% BW)

ANNEX A.5. EMISSION BANDWIDTH

Reference

FCC: CFR Part 27.53(m)

A.5.1Emission Bandwidth Results

The 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 26 dB below the transmitter power. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

LTE band 41, 5MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
2593.0	QPSK	16QAM
	4.952	5.024

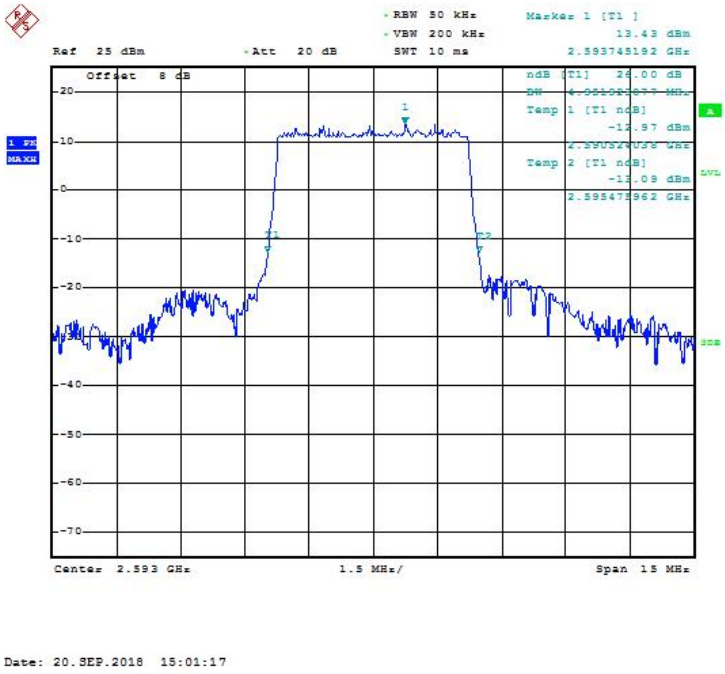


Fig.9 LTE band 41, 5MHz Bandwidth, QPSK (-26dBc BW)

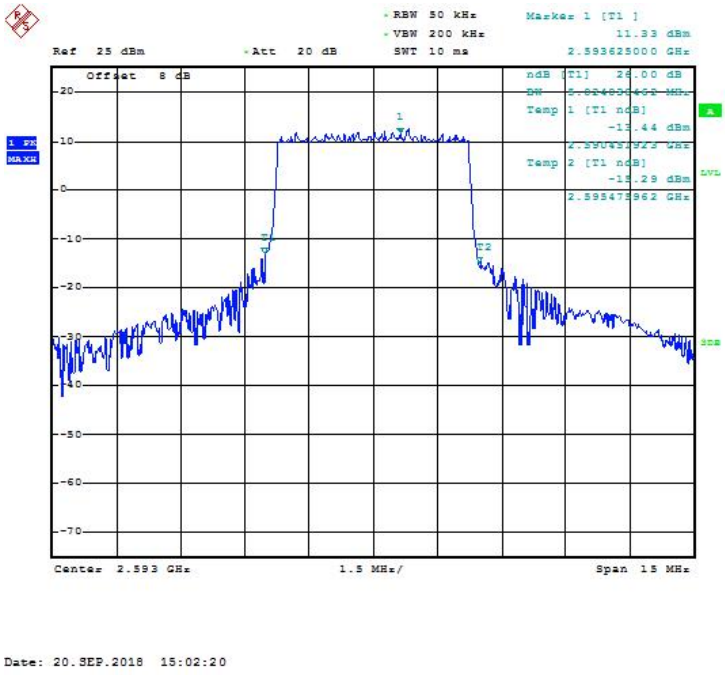


Fig.10 LTE band 41, 5MHz Bandwidth, 16QAM (-26dBc BW)

LTE band 41, 10MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
2593.0	QPSK	16QAM
	10.817	9.76

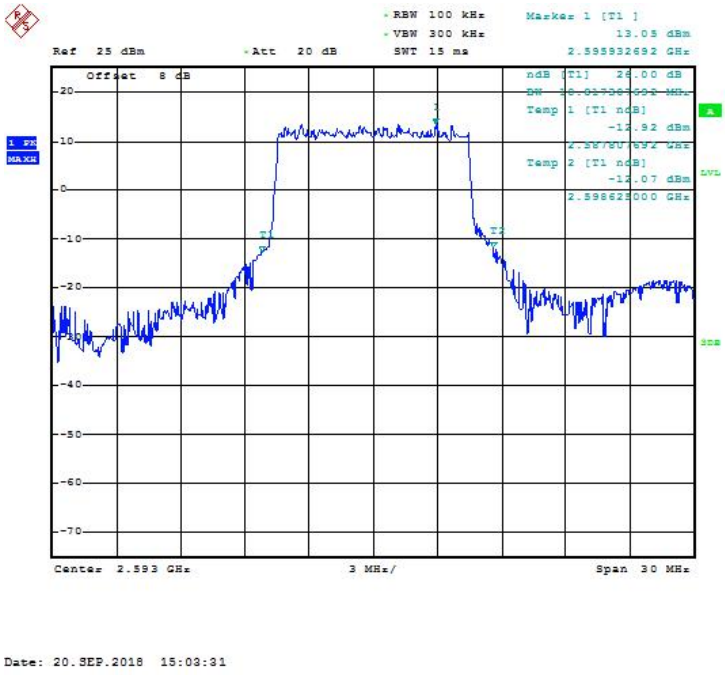


Fig.11 LTE band 41, 10MHz Bandwidth, QPSK (-26dBc BW)

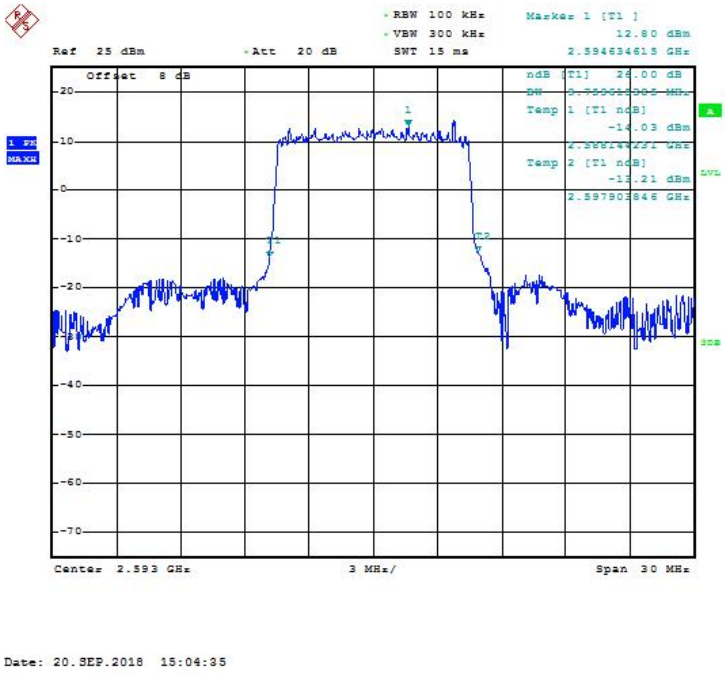


Fig.12 LTE band 41, 10MHz Bandwidth, 16QAM (-26dBc BW)

LTE band 41, 15MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
2593.0	QPSK	16QAM
	15.072	15.361

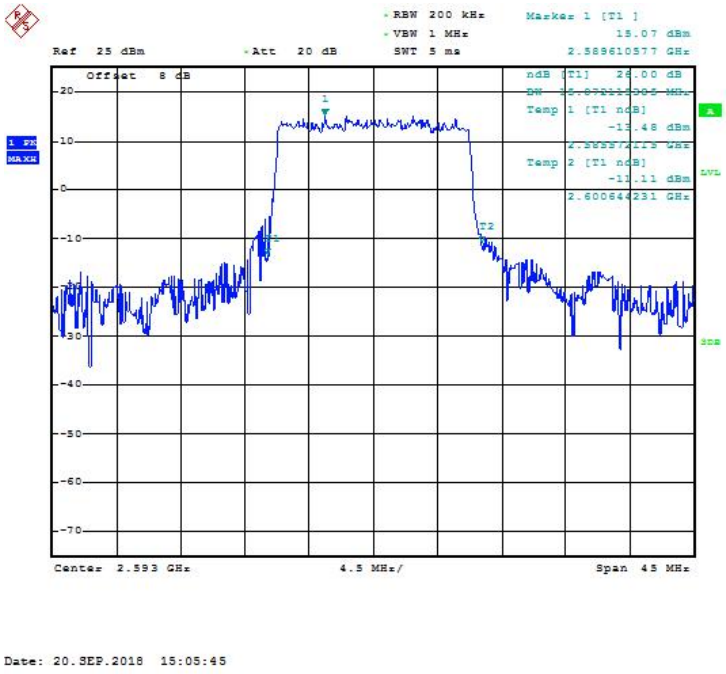


Fig.13 LTE band 41, 15MHz Bandwidth, QPSK (-26dBc BW)

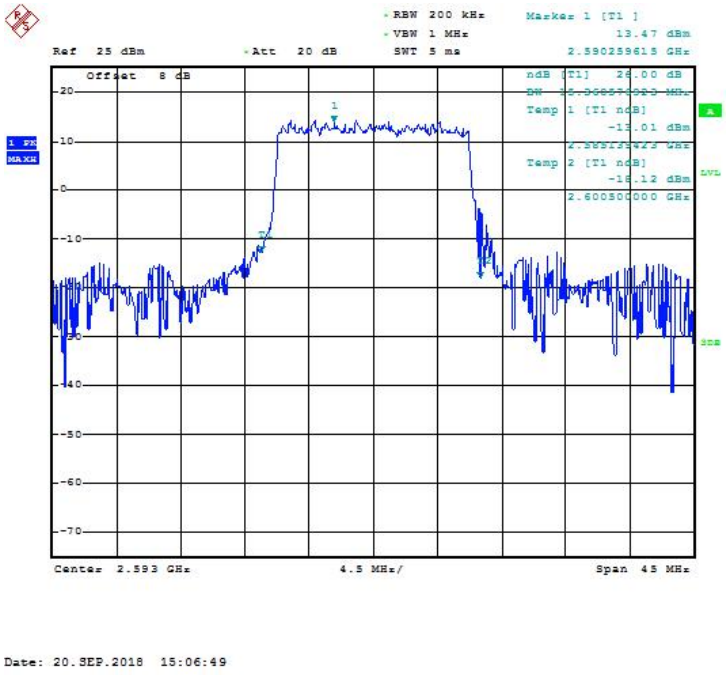


Fig.14 LTE band 41, 15MHz Bandwidth, 16QAM (-26dBc BW)

LTE band 41, 20MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
2593.0	QPSK	16QAM
	19.231	19.519

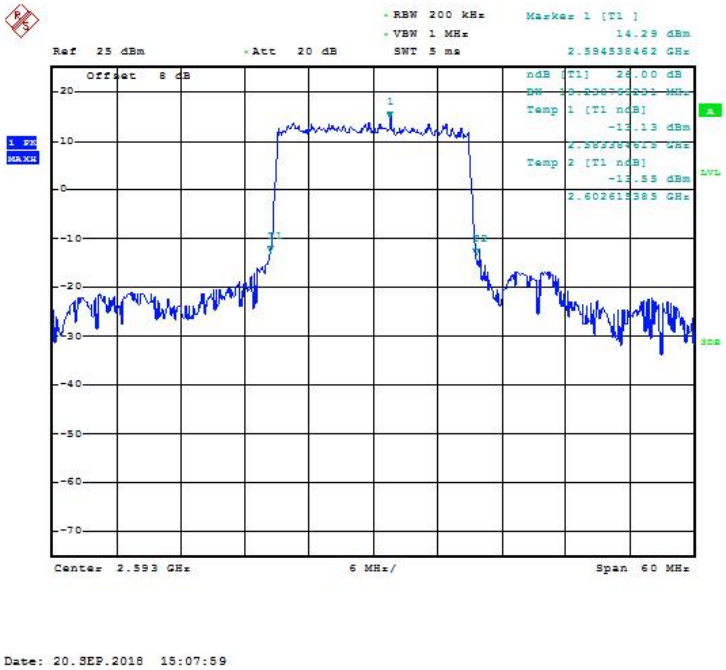


Fig.15 LTE band 41, 20MHz Bandwidth, QPSK (-26dBc BW)

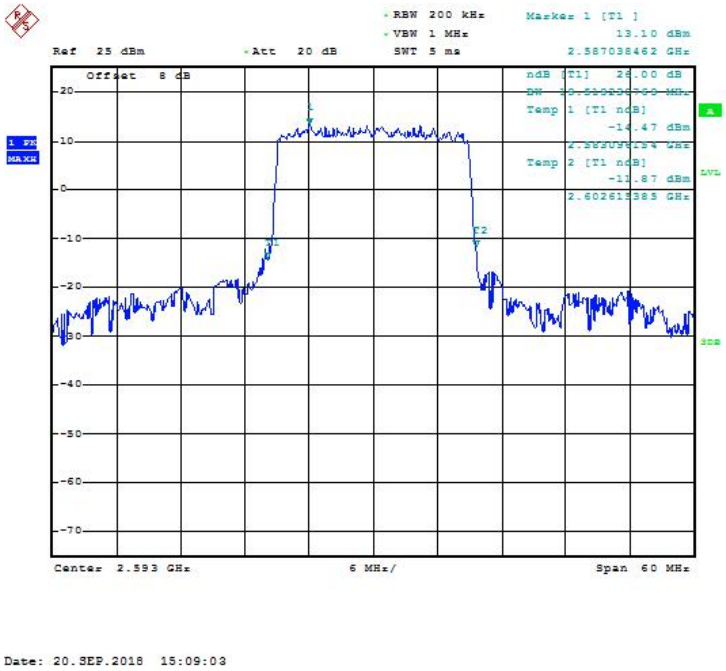


Fig.16 LTE band 41, 20MHz Bandwidth, 16QAM (-26dBc BW)

ANNEX A.6. BAND EDGE COMPLIANCE

Reference

FCC: CFR Part 27.53(m)

A.6.1 Measurement limit

27.53(m) state that on any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log (P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

According to KDB 971168 6, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

Part 27.53(m) states that for mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

A.6.2 Measurement result

Only worst case result is given below

LTE band 41

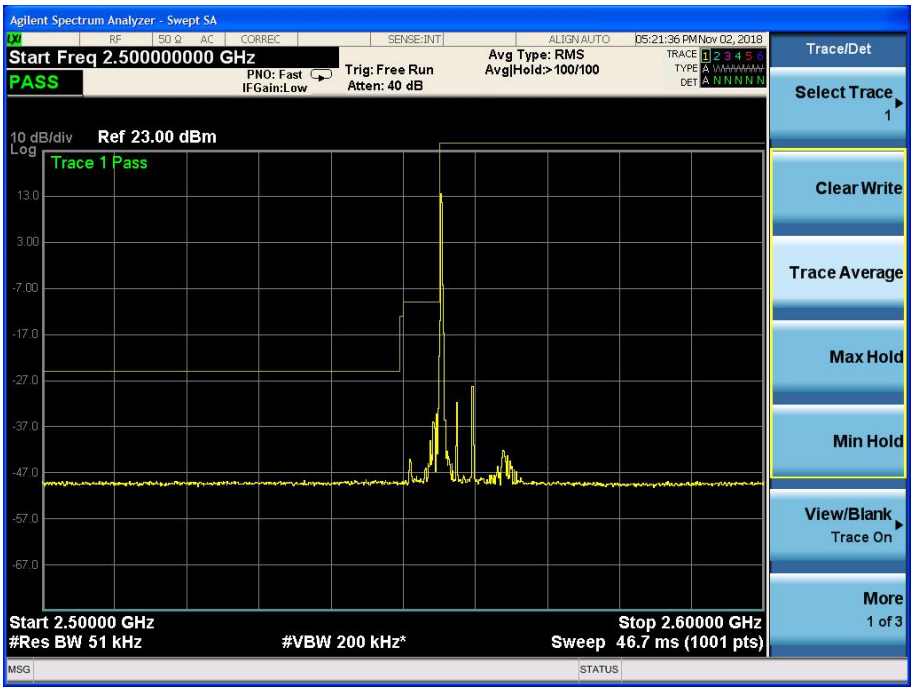


Fig.17 LOW BAND EDGE BLOCK-1RB-low_offset

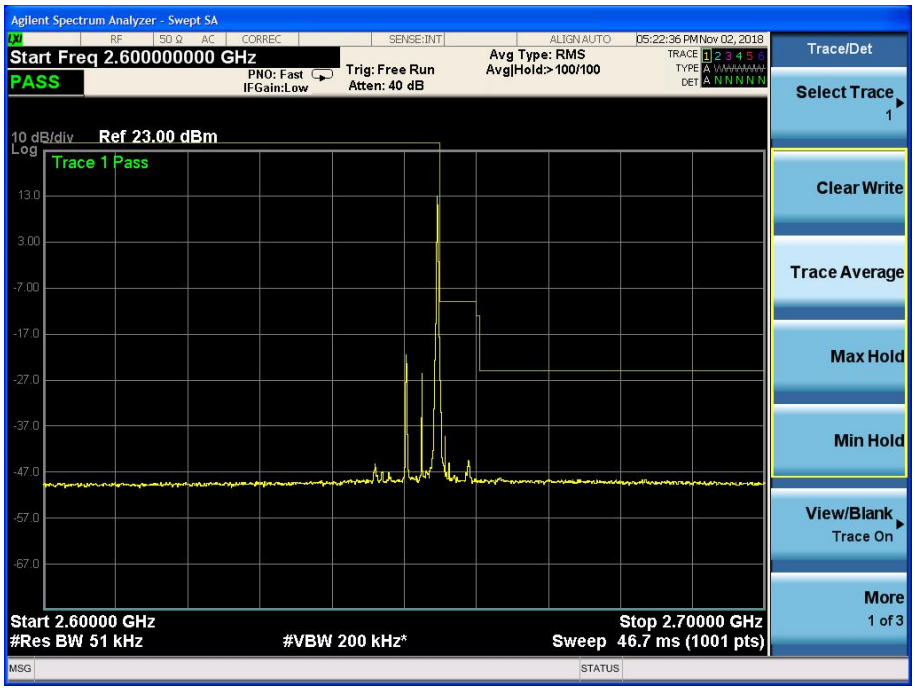


Fig.18 HIGH BAND EDGE BLOCK-1RB-high_offset

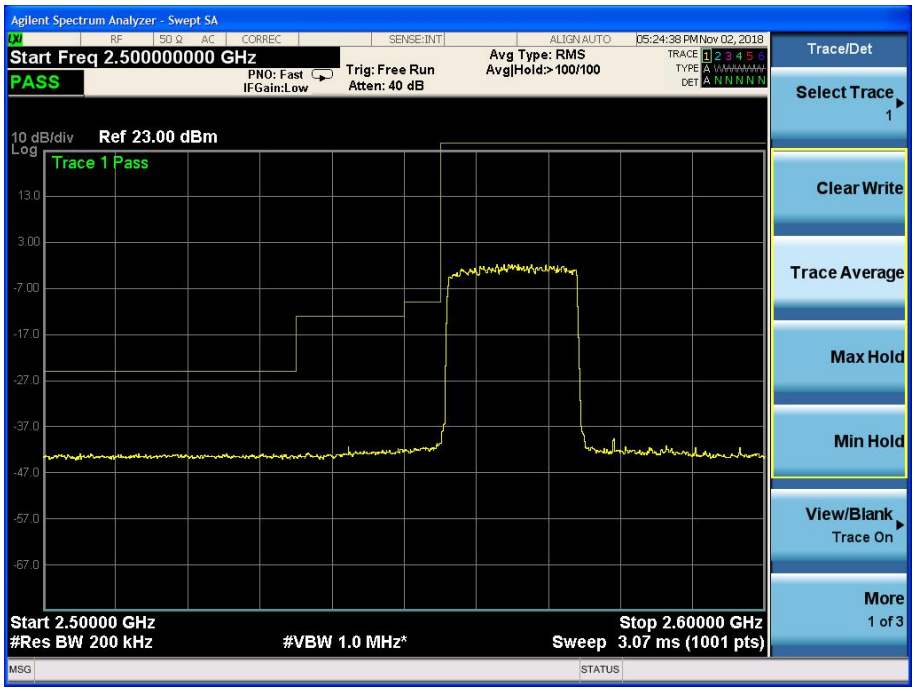


Fig.19 LOW BAND EDGE BLOCK-10MHz-100%RB

Fig.20 HIGH BAND EDGE BLOCK-10MHz-100%RB

ANNEX A.7. CONDUCTED SPURIOUS EMISSION

Reference

FCC: CFR Part 2.1057, 27.53(m)

A.7.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

A. 7.2 Measurement Limit

Part 27.53(m), 2.1057 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Part 27.53(m)(4) specifies for mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

A. 7.3 Measurement result

Only worst case result is given below

LTE band 41: Spurious emission limit –13dBm.

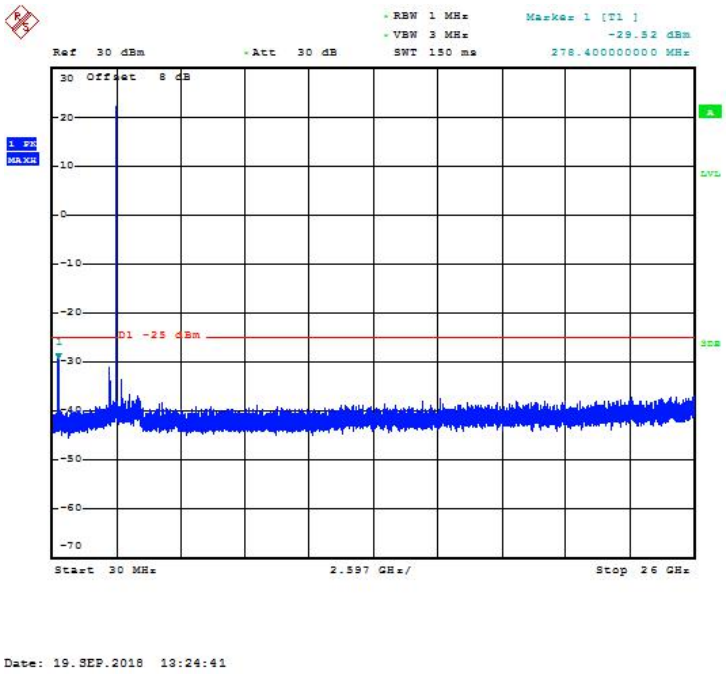


Fig.21 LTE band 41: 30MHz – 26GHz

ANNEX A.8. PEAK-TO-AVERAGE POWER RATIO

Reference

FCC: CFR Part 27.50(a)

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

According to KDB 971168 5.7:

a)Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;

b) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

c) Set the number of counts to a value that stabilizes the measured CCDF curve;

d) Set the measurement interval to 1 ms

e)Record the maximum PAPR level associated with a probability of 0.1%

A.8.1 Measurement limit

not exceed 13 dB

A.8.2 Measurement results

LTE band 41, 20MHz

Frequency(MHz)	PAPR(dB)	
2593.0	QPSK	16QAM
	8.65	10.80

ANNEX A. Deviations from Prescribed Test Methods

No deviation from Prescribed Test Methods.

ANNEX B. Accreditation Certificate

Accredited Laboratory

A2LA has accredited

EAST CHINA INSTITUTE OF TELECOMMUNICATIONS

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 15th day of March 2017.

President and CEO
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

************END OF REPORT************