TEST REPORT

No. I17N00290-LTE

for

CK TELECOM LTD.

LTE phone

Model Name: DSB-0090

FCC ID: WS5DSB0090

with

Hardware Version: 1011

Software Version: FRANK01A-S10A_DSB0090_201_USER_170503

Issued Date: 2017-04-26

Test Laboratory:

FCC 2.948 Listed: No. 342690

CTTL,Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I17N00290-LTE	Rev.0	1st edition	2017-04-26

CONTENTS

1. Test Laboratory

1.1. Testing Location

Company Name:	CTTL ShenZhen,Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT
Address:	TCL International E city No. 1001 Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong, China
Postal Code:	518048
Telephone:	+86(755)33322000
Fax:	+86(755)33322000

1.2. Testing Environment

Normal Temperature:	15-35℃
Relative Humidity:	20-75%
Air pressure	980 - 1040 hPa

The climatic requirements above are general exclude the special requirements for dedicated test environments listed in section 5 and some specific test cases in other parts of this report.

1.3. Project data

Testing Start Date:	2017-03-17
Testing End Date:	2017-04-26

1.4. Signature

Lai Minghua
(Prepared this test report)

Yang Zi'an
(Reviewed this test report)

Zhang Bojun
Deputy Director of the laboratory
(Approved this test report)

2. Client Information

2.1. Applicant Information

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Contact Person:	Per Carlenhag
Contact Email	per.carlenhag@doro.com
Telephone:	+46 46 280 5000
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2.2. Manufacturer Information

Company Name:	CK TELECOM LTD.
Address /Post:	Technology Road.High-Tech Development Zone. Heyuan, Guangdong, P.R.China
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Contact Email	xin.li@ck-telecom.com
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	LTE phone
Model Name	DSB-0090
FCC ID	WS5DSB0090
Antenna	Integrated
Output power	26.06dBm maximum EIRP measured for LTE Band 7
Extreme vol. Limits	3.6VDC to 4.2VDC (nominal: 3.8VDC)
Extreme temp. Tolerance	-30°C to +50°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL, Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Sample Arrival Date
S01	355115080009167	1011	FRANK01A-S10A_DSB0090_201_USER_170503	2017-03-17
S02	355115080009142	1011	FRANK01A-S10A_DSB0090_201_USER_170503	2017-03-17

*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
AE1	Battery
AE2	Charger1
AE3	Charger2

AE1

Model	DBN-2920A
Manufacturer	Coslight Technology International Group Co., Ltd.
Capacitance	2920mAh

AE2

Model	A2-3762-501000
Manufacturer	Dongguan Aohai Power Techonolgy Co.,LTD

AE3

Model	A806A-050100U-UK1
Manufacturer	Dongguan Aohai Power Techonolgy Co.,LTD

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

3.4. General Description

The Equipment Under Test (EUT) is a model LTE mobile phone with integrated antenna. It consists of normal options: charger. Manual and specifications of the EUT were provided to fulfil the test.

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 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-15 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-15 Edition
ANSI/TIA-603-D	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2010
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	Power Meas License Digital Systems	v02r02

5. LABORATORY ENVIRONMENT

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

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. =20 %, Max. = 80 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber 2 (8.6 meters×6.1 meters×3.85 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C**,** Max. = 30 ˚C
Relative humidity	Min. = 35 %**,** Max. = 60 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 1 Ω
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 4000 MHz

Semi-anechoic chamber 2 / Fully-anechoic chamber 3 (10 meters×6.7 meters×6.15 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C**,** Max. = 30 ˚C
Relative humidity	Min. = 35 %**,** Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 0.5 Ω
Normalised site attenuation (NSA)	**<** ±3.5 dB, 3 m distance
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

6. SUMMARY OF TEST RESULTS

6.1. Summary of test results

Abbreviations used in this clause:		
Verdict Column	P	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured
Location Column	A/B/C/D	The test is performed in test location A, B, C or D which are described in section 1.1 of this report

LTE Band 7

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

6.2. Statements

The test cases listed in section 6.1 of this report for the EUT specified in section 3 were performed by CTTL according to the standards or reference documents in section 4.1

The EUT met all applicable requirements of the standards or reference documents in section 4.1.

This report only deals with the LTE functions among the features described in section 3.

7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Test Receiver	ESR7	R&S	101675	2017-07-21
2	BiLog Antenna	VULB9163	Schwarzbeck	9163 329	2020-02-17
3	Horn Antenna	3117	ETS-Lindgren	00066585	2019-03-05
4	Antenna	SBA 9113	814	Schwarzbeck	/
5	Antenna	SBA 9112	302	Schwarzbeck	/
6	Antenna	3160-09	LM4750/00118388	ETS-Lindgren	2018.07.14
7	preamplifier	83017A	MY39501110	Agilent	/
8	Signal Generator	SMR40	R&S	100541	2017-06-27
9	Fully Anechoic Chamber	FACT5-2.0	ETS-Lindgren	4166	2018-05-13
10	Spectrum Analyzer	FSP40	R&S	100378	2017-12-15
11	Universal Radio Communication Tester	CMU200	R&S	114544	2017-09-09
12	Universal Radio Communication Tester	CMW500	R&S	158344	2017-07-21
13	Spectrum Analyzer	FSU	R&S	200679	2017-12-25
14	Temperature Chamber	SH-241	ESPECs	92007516	2017-11-29
15	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2017-11-22

Test software

Item	Name	Vesion
Radiated	EMC32	Version 10.01.00

ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 27.50(h)(2).

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.

This result contains peak output power and ERP/EIRP measurements for the EUT.

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 7

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2567.5	21.71	21.00
		2535.0	21.61	20.85
		2502.5	21.43	20.61
	1 RB low	2567.5	21.69	20.97
		2535.0	21.58	20.80
		2502.5	21.43	20.59
	50% RB mid	2567.5	20.79	19.80
		2535.0	20.65	19.61
		2502.5	20.47	19.42
	100% RB	2567.5	20.77	19.76
		2535.0	20.64	19.57
		2502.5	20.45	19.39
10MHz	1 RB high	2565.0	21.80	21.09
		2535.0	21.70	20.95
		2505.0	21.53	20.72
	1 RB low	2565.0	21.66	20.89
		2535.0	21.55	20.80
		2505.0	21.42	20.61
	50% RB mid	2565.0	20.75	19.74
		2535.0	20.64	19.60
		2505.0	20.48	19.43

	100% RB	2565.0	20.77	19.74
		2535.0	20.64	19.59
		2505.0	20.49	19.43
15MHz	1 RB high	2562.5	21.65	20.90
		2535.0	21.59	20.83
		2507.5	21.45	20.63
	1 RB low	2562.5	21.72	20.96
		2535.0	21.64	20.88
		2507.5	21.53	20.71
	50% RB mid	2562.5	21.73	20.71
		2535.0	21.64	20.61
		2507.5	21.52	20.48
	100% RB	2562.5	20.75	19.73
		2535.0	20.67	19.61
		2507.5	20.54	19.47
20MHz	1 RB high	2560.0	21.86	21.16
		2535.0	21.80	21.05
		2510.0	21.70	20.91
	1 RB low	2560.0	21.77	21.02
		2535.0	21.71	20.92
		2510.0	21.61	20.80
	50% RB mid	2560.0	20.71	19.70
		2535.0	20.66	19.63
		2510.0	20.56	19.51
	100% RB	2560.0	20.72	19.69
		2535.0	20.69	19.64
		2510.0	20.57	19.52

A.1.3 Radiated

A.1.3.1 Description

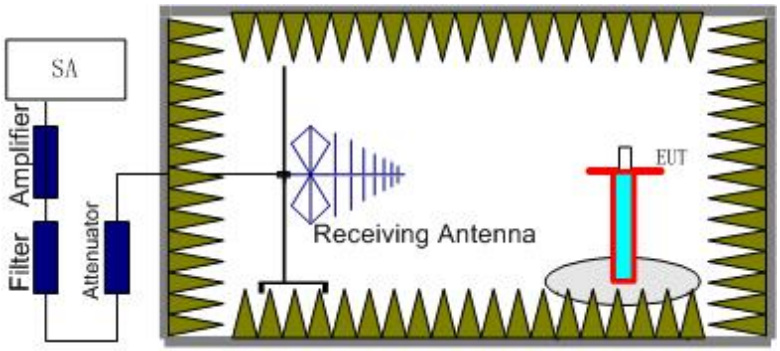
This is the test for the maximum radiated power from the EUT.

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

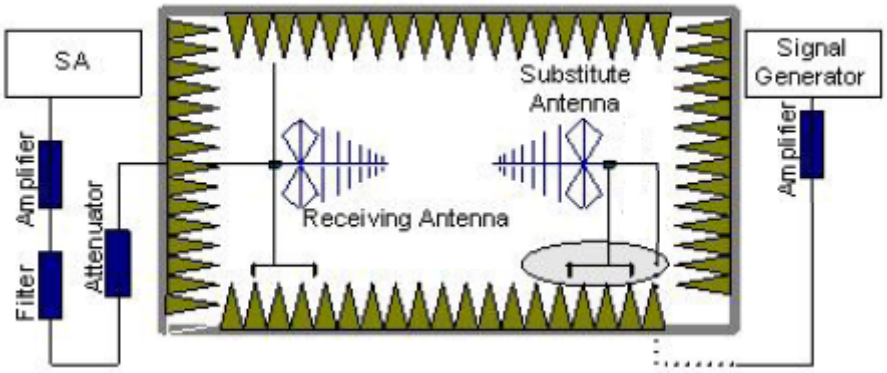
A.1.3.2 Method of Measurement

The measurements procedures in TIA-603-D-2010 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 7- EIRP 27.50(h)(2)

Limits: ≤33 dBm (2W)

LTE Band 7_5MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2502.50	-3.50	-28.70	0.59	25.79	33.00	V
2535.00	-4.87	-28.60	0.45	24.18	33.00	V
2567.50	-3.85	-28.60	0.38	25.13	33.00	V

LTE Band 7_10MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2505.00	-4.31	-28.70	0.59	24.98	33.00	V
2535.00	-5.36	-28.60	0.45	23.69	33.00	V
2565.00	-4.84	-28.60	0.38	24.14	33.00	V

LTE Band 7_15MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2507.50	-3.38	-28.70	0.59	25.91	33.00	V
2535.00	-5.18	-28.60	0.45	23.87	33.00	V
2562.50	-4.86	-28.60	0.38	24.12	33.00	V

LTE Band 7_20MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2510.00	-4.62	-28.70	0.59	24.67	33.00	V
2535.00	-6.62	-28.60	0.45	22.43	33.00	V
2560.00	-6.78	-28.60	0.38	22.20	33.00	V

LTE Band 7_5MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2502.50	**-3.23**	**-28.70**	**0.59**	**26.06**	**33.00**	**V**
2535.00	-4.52	-28.60	0.45	24.53	33.00	V
2567.50	-4.14	-28.60	0.38	24.84	33.00	V

LTE Band 7_10MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2505.00	-4.12	-28.70	0.59	25.17	33.00	V
2535.00	-5.31	-28.60	0.45	23.74	33.00	V
2565.00	-5.39	-28.60	0.38	23.59	33.00	V

LTE Band 7_15MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2507.50	-4.42	-28.70	0.59	24.88	33.00	V
2535.00	-6.44	-28.60	0.45	22.61	33.00	V
2562.50	-6.08	-28.60	0.38	22.90	33.00	V

LTE Band 7_20MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Polarization
2510.00	-4.54	-28.70	0.59	24.75	33.00	V
2535.00	-5.93	-28.60	0.45	23.12	33.00	V
2560.00	-5.55	-28.60	0.38	23.43	33.00	V

Peak EIRP (dBm)=P_{Mea}(-3.23dBm)-（P_{cl}+P_{Ag}）(-28.70dB)+G_a(0.59dB)=26.06dBm

ANALYZER SETTINGS:

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

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

Note: Expanded measurement uncertainty is U = 0.96 dB, k = 2.

A.2 EMISSION LIMIT

Reference

FCC: CFR Part 2.1051, 27.53(m).

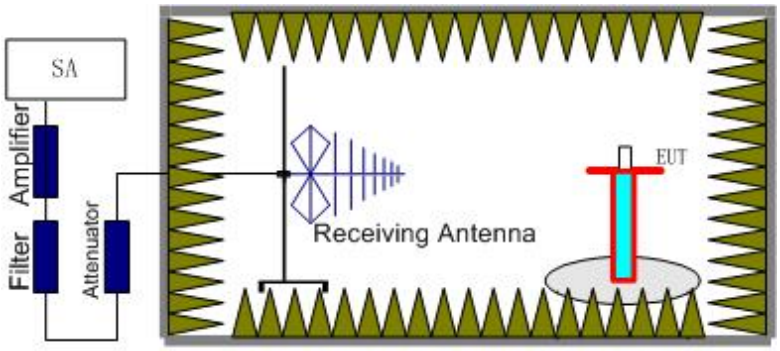
A.2.1 Measurement Method

The measurements procedures in TIA-603-D-2010 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

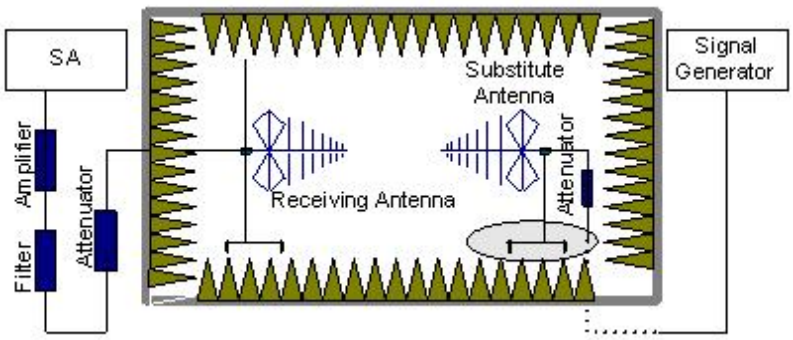
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Band 7.

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

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Band 7. 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 Band 7 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.

LTE Band 7, 5 MHz, QPSK, Channel 20775

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16816.78	-34.75	2.90	-0.26	-37.91	-13.00	H
17143.59	-34.05	2.90	-0.79	-37.74	-13.00	H
17216.44	-32.76	2.90	-1.01	-36.67	-13.00	H
17444.16	-32.25	3.20	-1.08	-36.53	-13.00	H
17621.34	-33.37	3.20	-1.01	-37.58	-13.00	H
17784.09	-32.99	3.20	-0.75	-36.94	-13.00	H

LTE Band 7, 5 MHz, QPSK, Channel 21100

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16873.22	-33.75	2.90	-0.26	-36.91	-13.00	H
17196.75	-33.31	2.90	-0.79	-37.00	-13.00	H
17295.19	-33.20	2.90	-1.01	-37.11	-13.00	H
17434.97	-32.73	3.20	-1.08	-37.01	-13.00	H
17623.97	-32.59	3.20	-1.01	-36.80	-13.00	H
17704.03	-32.67	3.20	-0.75	-36.62	-13.00	H

LTE Band 7, 5 MHz, QPSK, Channel 21425

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16757.06	-34.97	2.90	-0.26	-38.13	-13.00	V
16891.59	-34.87	2.90	-0.26	-38.03	-13.00	H
17274.84	-33.41	2.90	-1.01	-37.32	-13.00	H
17436.28	-33.07	3.20	-1.08	-37.35	-13.00	H
17601.66	-33.84	3.20	-1.01	-38.05	-13.00	H
17773.59	-33.45	3.20	-0.75	-37.40	-13.00	H

LTE Band 7, 5 MHz, 16QAM, Channel 20775

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16845.66	-35.60	2.90	-0.26	-38.76	-13.00	H
17190.19	-34.77	2.90	-0.79	-38.46	-13.00	H
17269.59	-35.35	2.90	-1.01	-39.26	-13.00	H
17442.19	-34.01	3.20	-1.08	-38.29	-13.00	H
17767.03	-34.49	3.20	-0.75	-38.44	-13.00	H
17925.84	-31.69	3.20	-0.64	-35.53	-13.00	H

LTE Band 7, 5 MHz, 16QAM, Channel 21100

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16881.09	-35.37	2.90	-0.26	-38.53	-13.00	H
17205.28	-34.43	2.90	-1.01	-38.34	-13.00	H
17425.13	-33.44	3.20	-1.08	-37.72	-13.00	H
17609.53	-34.33	3.20	-1.01	-38.54	-13.00	H
17805.75	-34.20	3.20	-0.84	-38.24	-13.00	H
17917.97	-33.29	3.20	-0.64	-37.13	-13.00	H

LTE Band 7, 5 MHz, 16QAM, Channel 21425

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit（dBm）	Polarization
16816.13	-35.81	2.90	-0.26	-38.97	-13.00	H
17199.38	-34.90	2.90	-0.79	-38.59	-13.00	H
17335.88	-34.34	2.90	-0.98	-38.22	-13.00	H
17440.22	-33.91	3.20	-1.08	-38.19	-13.00	H
17793.28	-34.36	3.20	-0.75	-38.31	-13.00	H
17928.47	-33.34	3.20	-0.64	-37.18	-13.00	H

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

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, 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 ℃ increments 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 3.6VDC and 4.2VDC, with a nominal voltage of 3.8VDC. 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. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

A.4.3 Measurement results

LTE Band 7, 10MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.6	11	-9	0.004	0.004
3.8	21	-18	0.008	0.007
4.2	9	35	0.004	0.014

Frequency Error vs Temperature

Temperature (℃)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30°	33	36	0.013	0.014
-20°	25	29	0.010	0.011
-10°	14	41	0.006	0.016
0°	8	16	0.003	0.006
10°	15	18	0.006	0.007
20°	11	22	0.004	0.009
30°	24	27	0.009	0.011
40°	36	38	0.014	0.015
50°	8	49	0.003	0.019

A.4 OCCUPIED 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 4.2:

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.

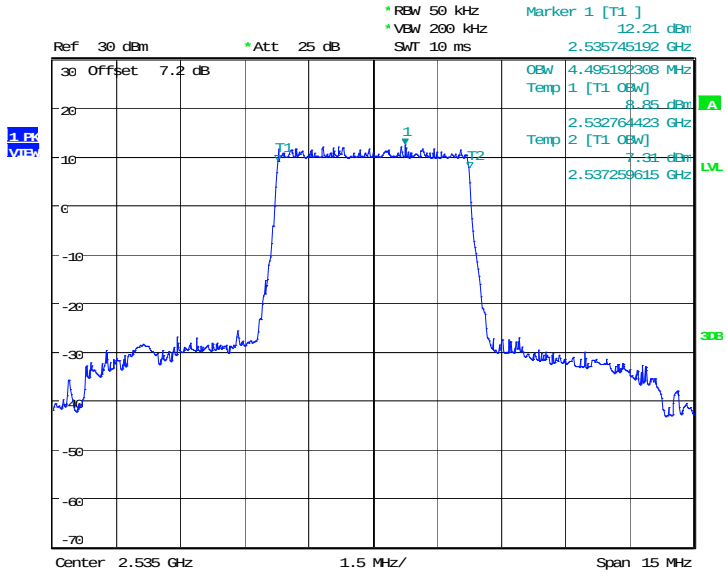
d) Set the detection mode to peak, and the trace mode to max hold.

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

LTE band 7, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	4495.19	4471.15

LTE band 7, 5MHz Bandwidth, QPSK (99% BW)



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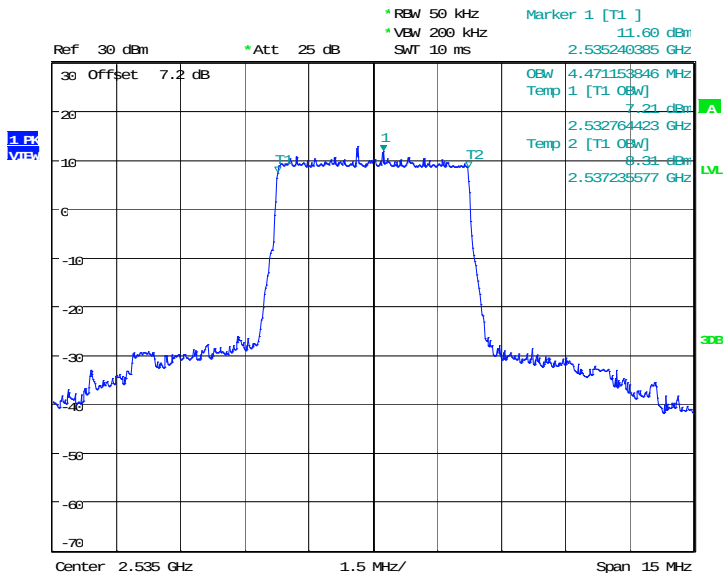
LTE band 7, 5MHz Bandwidth,16QAM (99% BW)

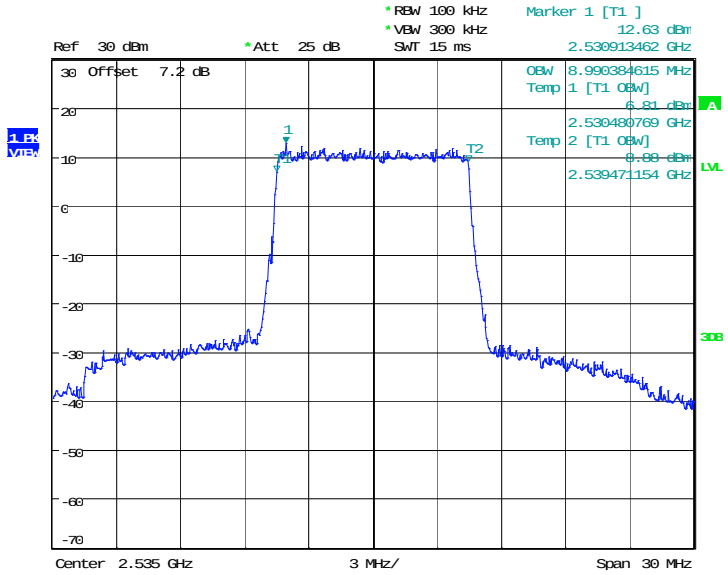


Date: 2.APR.2017 06:17:05

LTE band 7, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	8990.38	8942.31

LTE band 7, 10MHz Bandwidth, QPSK (99% BW)



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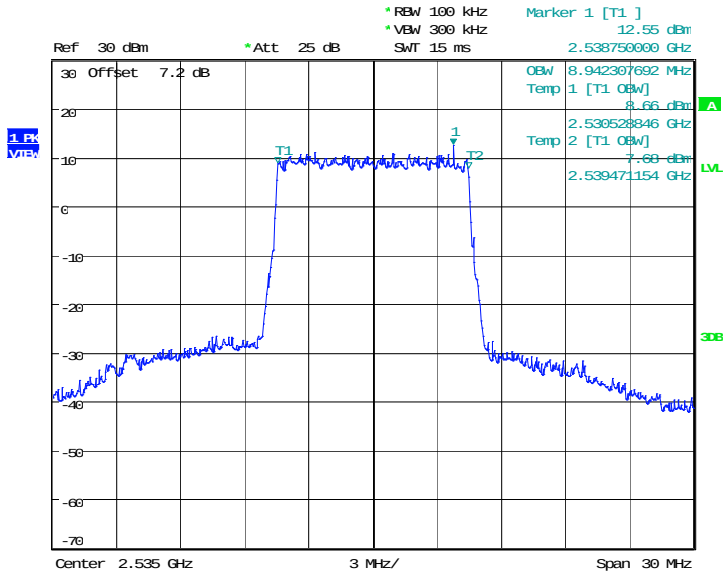
LTE band 7, 10MHz Bandwidth, 16QAM (99% BW)

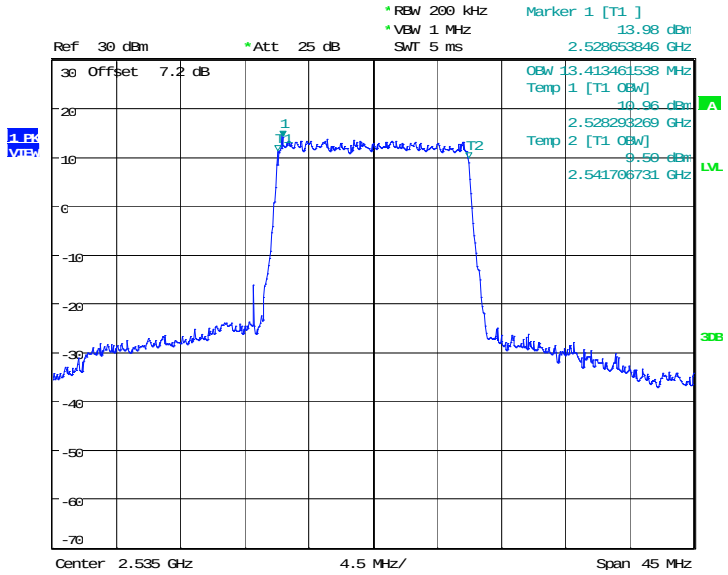


Date: 2.APR.2017 06:19:46

LTE band 7, 15MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	13413.46	13485.58

LTE band 7, 15MHz Bandwidth, QPSK (99% BW)



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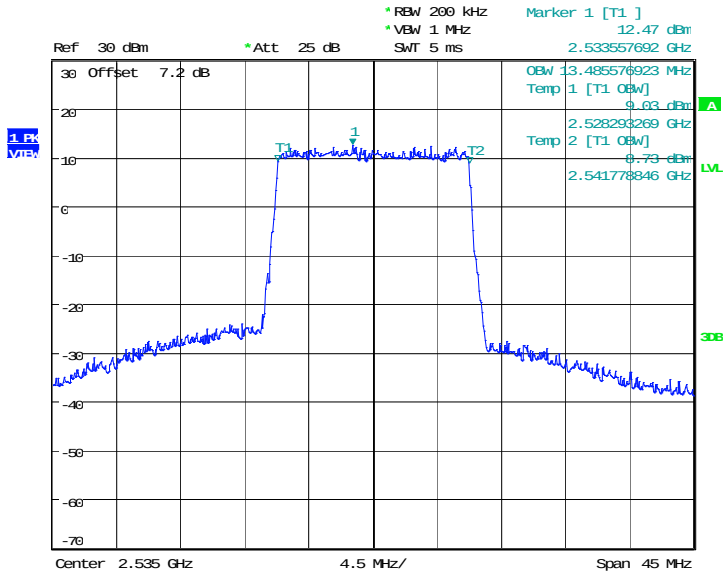
LTE band 7, 15MHz Bandwidth, 16QAM (99% BW)

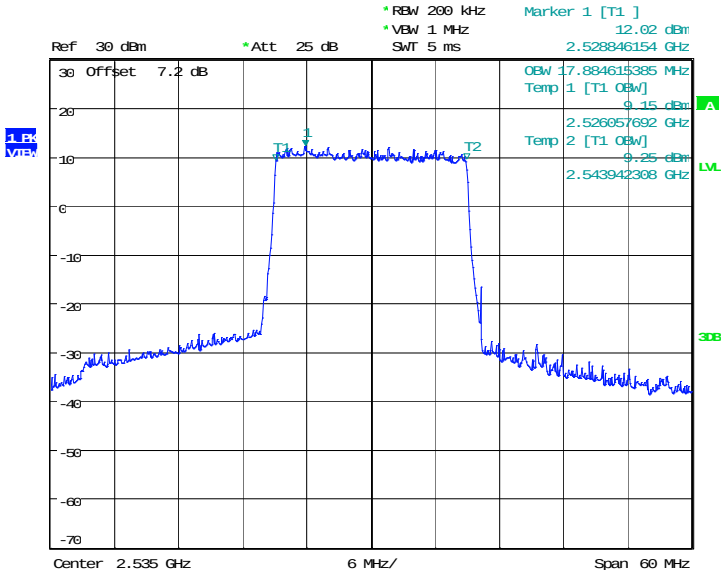


Date: 2.APR.2017 06:22:33

LTE band 7, 20MHz (99%)

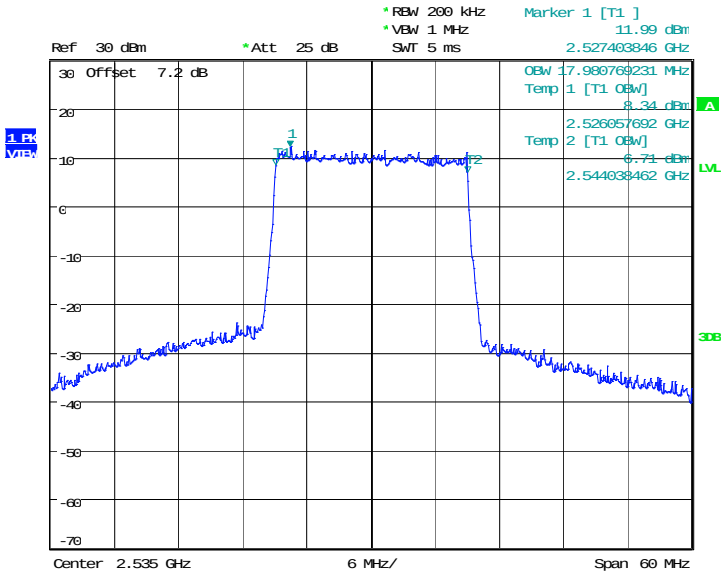
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	17884.62	17980.77

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



Date: 2.APR.2017 06:25:48

LTE band 7, 20MHz Bandwidth, 16QAM (99% BW)



Date: 2.APR.2017 06:25:03

A.5 EMISSION BANDWIDTH

Reference

FCC: CFR Part 27.53(h)

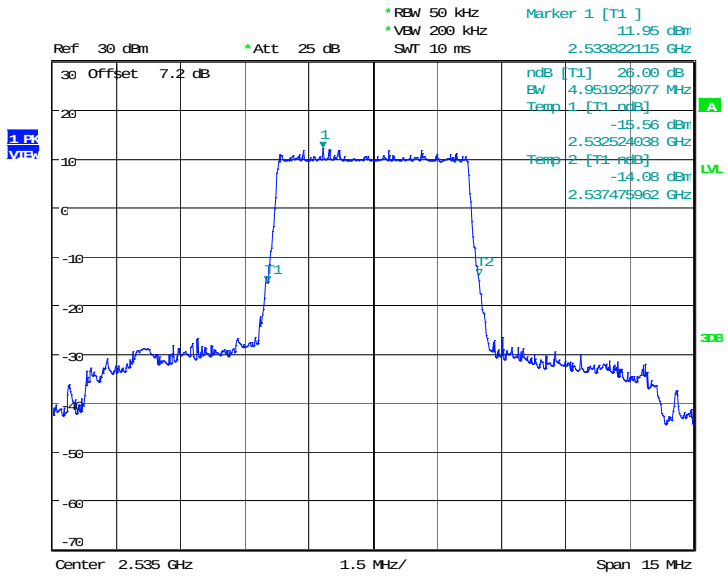
A.5.1Emission Bandwidth Results

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 7, 5MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	4951.92	4951.92

LTE band 7, 5MHz Bandwidth, QPSK (-26dBc BW)



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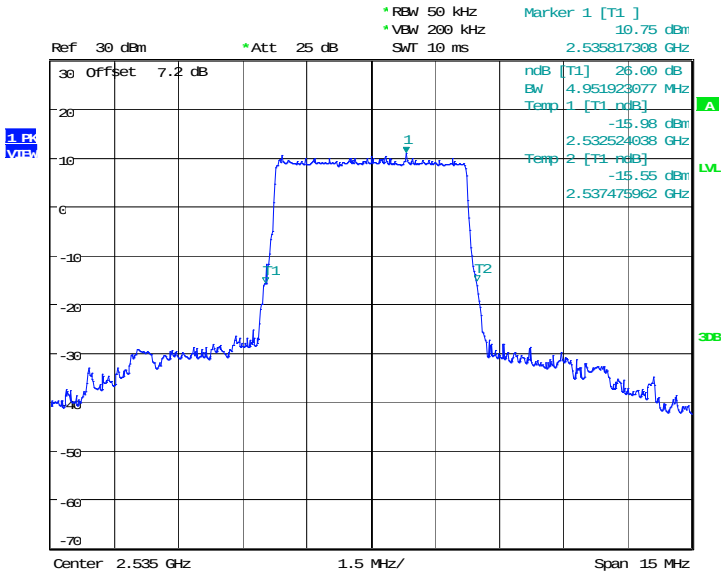
LTE band 7, 5MHz Bandwidth,16QAM (-26dBc BW)

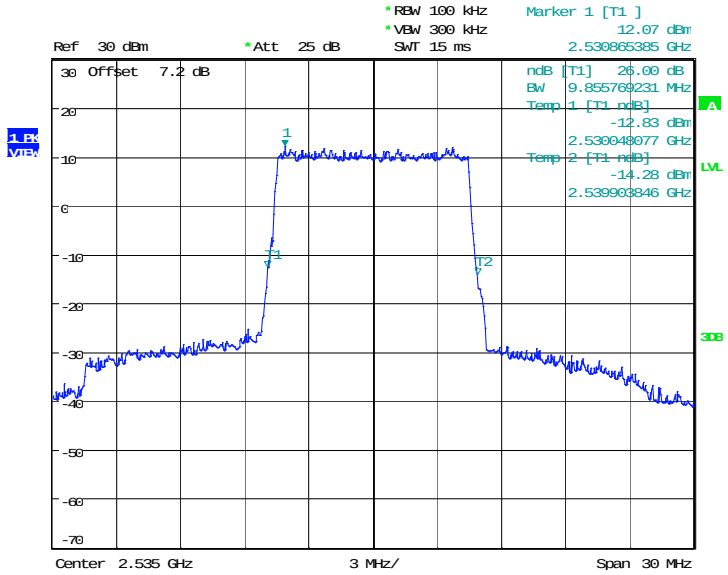


Date: 2.APR.2017 06:17:37

LTE band 7, 10MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	9855.77	9711.54

LTE band 7, 10MHz Bandwidth, QPSK (-26dBc BW)



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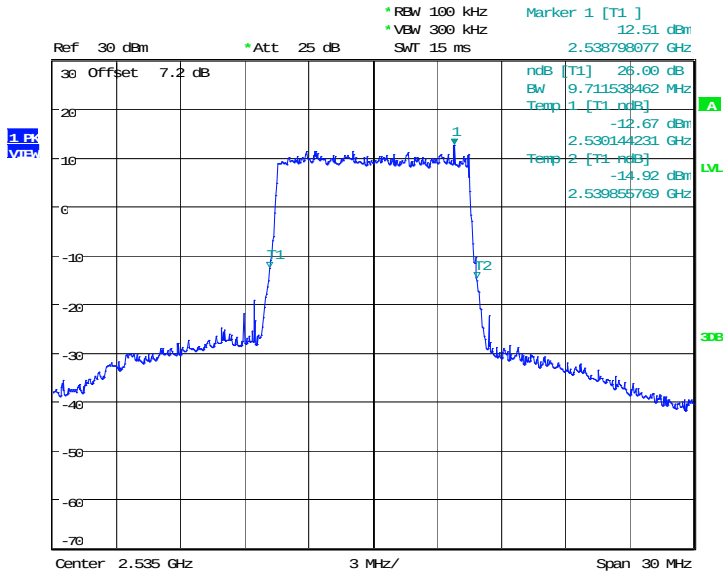
LTE band 7, 10MHz Bandwidth, 16QAM (-26dBc BW)

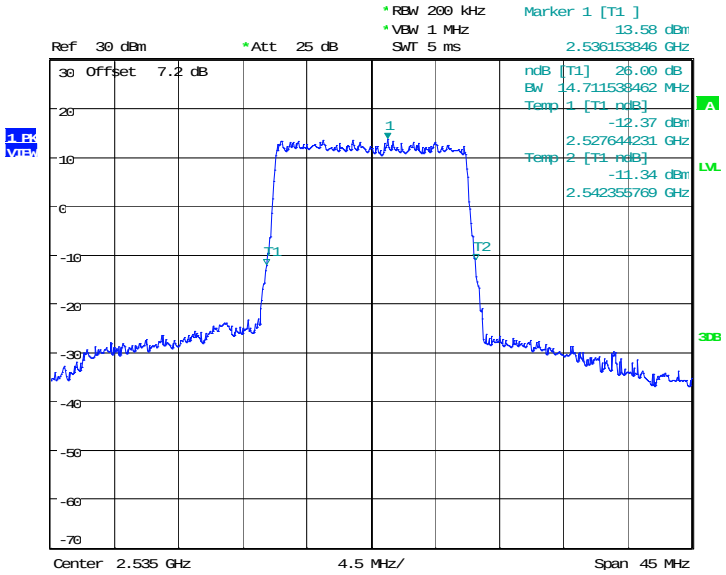


Date: 2.APR.2017 06:19:24

LTE band 7, 15MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	14711.54	14783.65

LTE band 7, 15MHz Bandwidth, QPSK (-26dBc BW)



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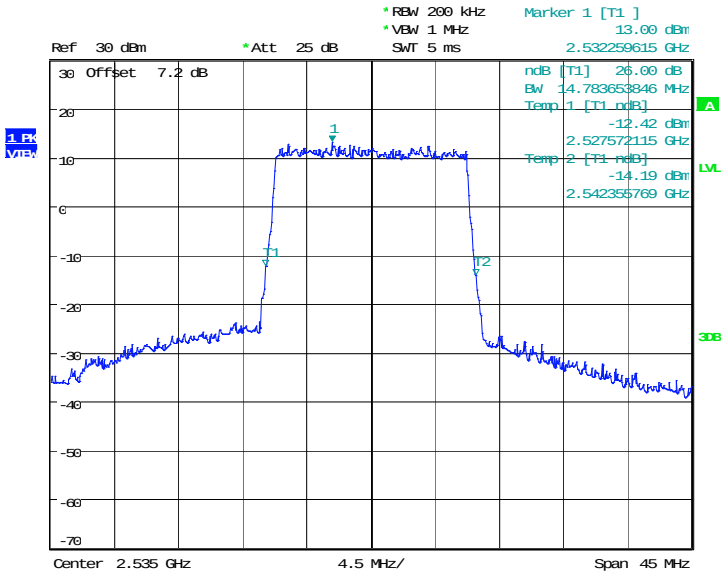
LTE band 7, 15MHz Bandwidth, 16QAM (-26dBc BW)



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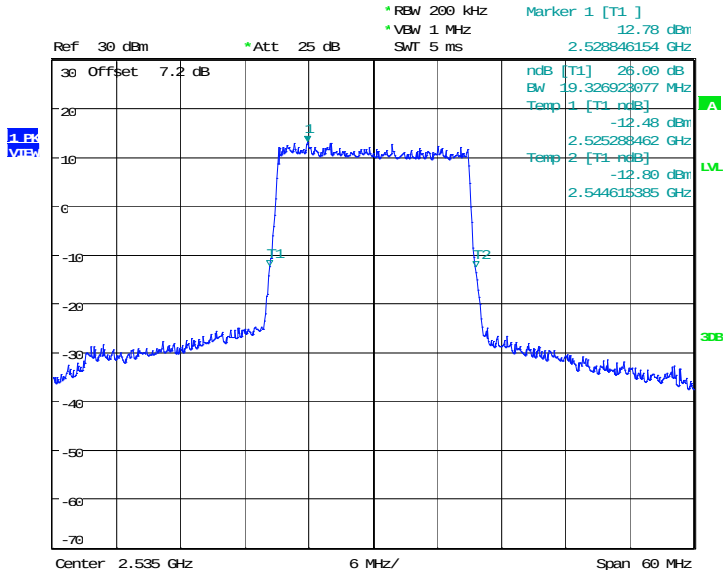
LTE band 7, 20MHz (-26dBc)

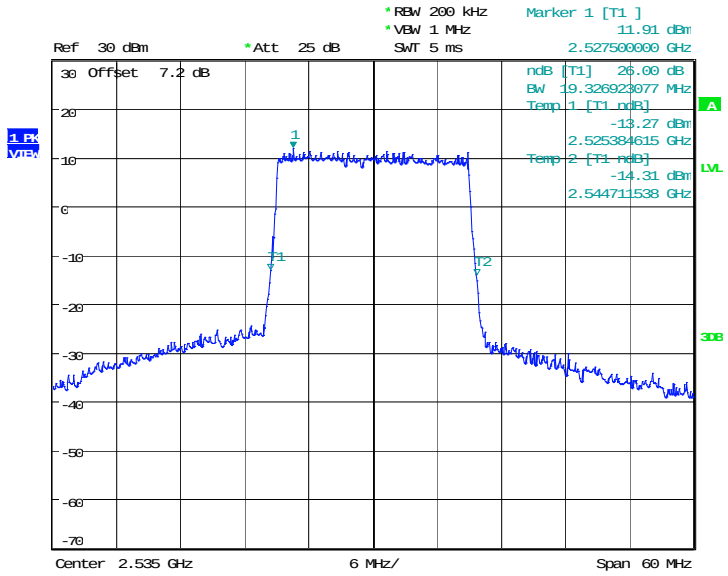
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	19326.92	19326.92

LTE band 7, 20MHz Bandwidth, QPSK (-26dBc BW)



Date: 2.APR.2017 06:24:02

LTE band 7, 20MHz Bandwidth, 16QAM (-26dBc BW)



Date: 2.APR.2017 06:24:37

A.6 BAND EDGE COMPLIANCE

Reference

FCC: CFR Part 27.53(h).

A.6.1 Measurement limit

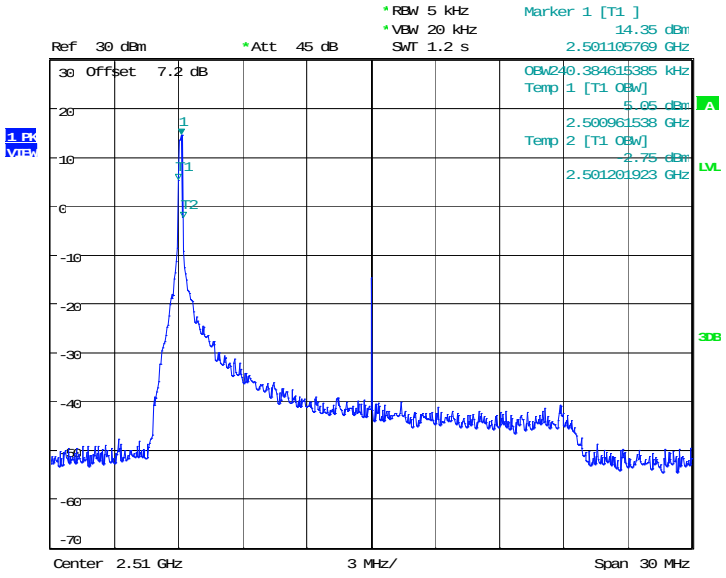
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log (P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. According to KDB 971168 6.0, 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.

A.6.2 Measurement result

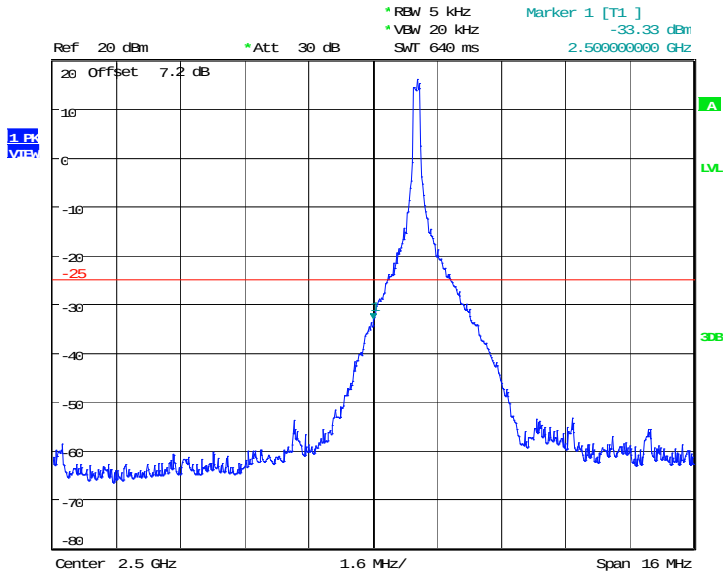
Only worst case result is given below

LTE band 7

OBW: 1RB-low_offset

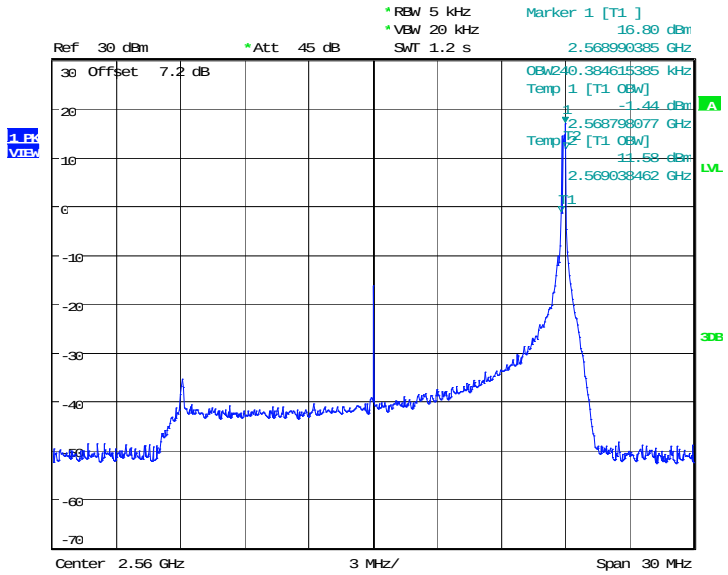


LOW BAND EDGE BLOCK-1RB-low_offset



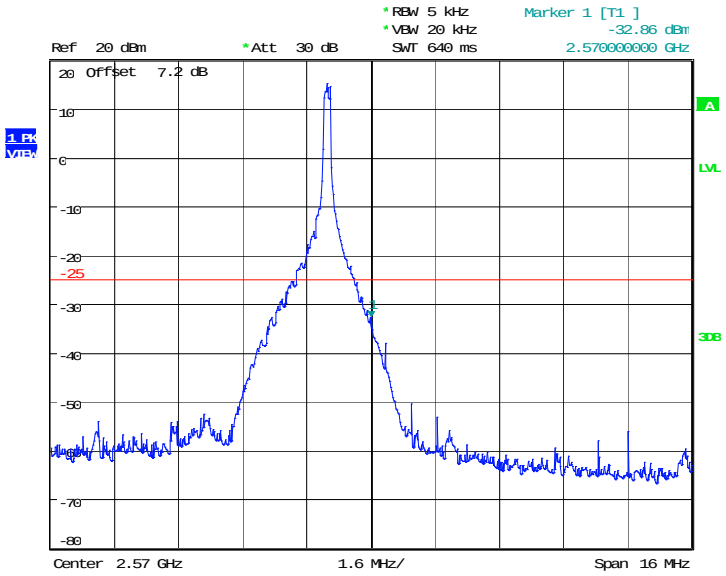
Date: 7.APR.2017 20:42:02

BW: 1RB-high_offset



Date: 7.MAR.2017 19:07:06

HIGH BAND EDGE BLOCK-1RB-high_offset



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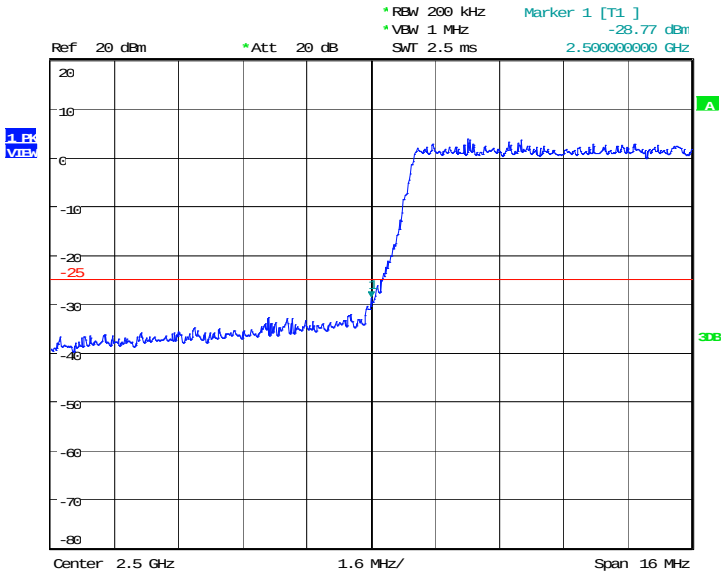
LOW BAND EDGE BLOCK-20MHz-100%RB



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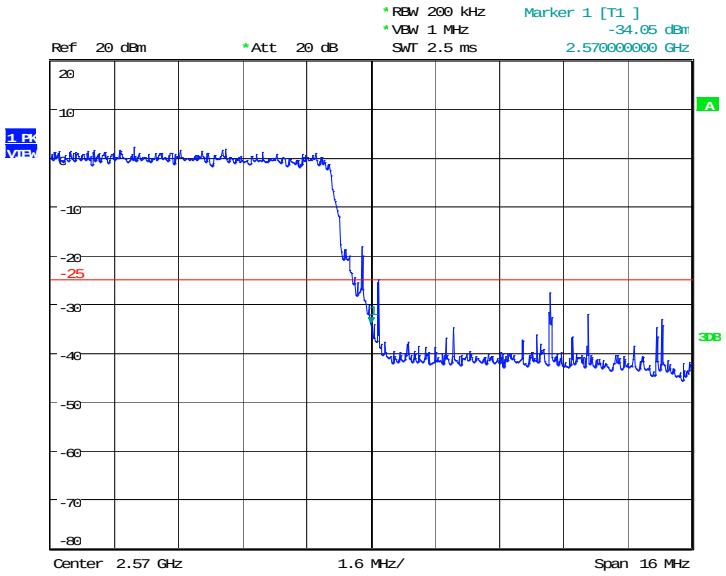
HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 7.APR.2017 20:54:27

A.7 CONDUCTED SPURIOUS EMISSION

Reference

FCC: CFR Part 2.1057, 22.917, 24.238, 27.53(h).

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.

A. 7.2 Measurement Limit

Part 22.917, Part 24.238 and Part 27.53 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.

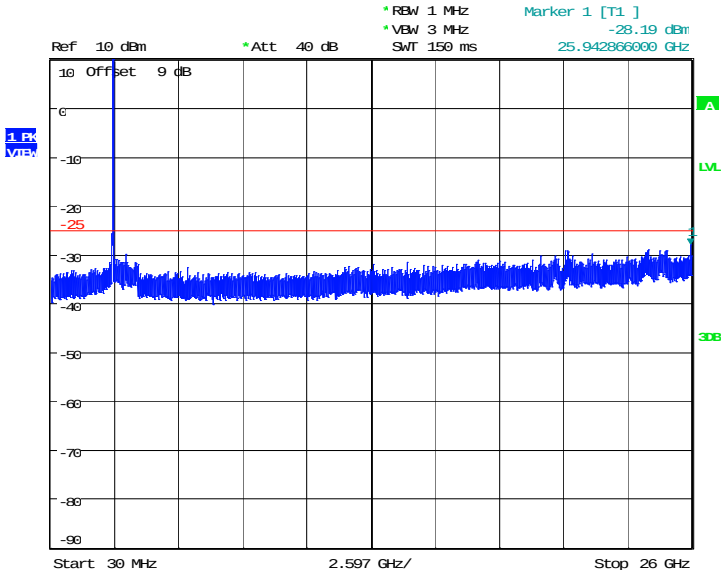
The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. 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. 7.3 Measurement result

Only worst case result is given below

LTE band 7: 30MHz – 26GHz

Spurious emission limit –13dBm.



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A.8 PEAK-TO-AVERAGE POWER RATIO

Reference

FCC: CFR Part 24.232 (d), 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 5.7.1:

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 7, 20MHz

Frequency(MHz)	PAPR(dB)	
2510.0	QPSK	16QAM
	6.63	7.59

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