TEST REPORT

No. I20Z61600-WMD01

for

TCL Communication Ltd.

Neo – the smart kids watch

Model Name: VKW001

FCC ID: 2ACCJB134

with

Hardware Version: V4.0

Software Version: MT45_ZZ_00.01_01

Issued Date: 2020-11-04

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 CTTL.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I20Z61600-WMD01	Rev.0	1st edition	2020-10-28
I20Z61600-WMD01	Rev.1	2nd edition Updated the results in page 17 to 20.	2020-11-04

Note: the latest revision of the test report supersedes all previous version.

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CONTENTS

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1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0 and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Location 1: CTTL (huayuan North Road)

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

Location 2: CTTL (Shouxiang)

Address: No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China 100191

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1.3. Testing Environment

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

1.4. Project Data

Testing Start Date: 2020-10-12

Testing End Date: 2020-11-04

1.5. Signature

Dong Yuan

(Prepared this test report)

Zhou Yu

(Reviewed this test report)

Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	TCL Communication Ltd.
Address /Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact:	Gong Zhizhou
Email:	zhizhou.gong@tcl.com
Telephone:	0086-755-36611722
Fax:	0086-755-36612000-81722

2.2. Manufacturer Information

Company Name:	TCL Communication Ltd.
Address /Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact:	Gong Zhizhou
Email:	zhizhou.gong@tcl.com
Telephone:	0086-755-36611722
Fax:	0086-755-36612000-81722

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

3.1. About EUT

Description	Neo – the smart kids watch
Model Name	VKW001
FCC ID	2ACCJB134
Antenna	Embedded
Output power	20.89dBm maximum EIRP measured for LTE Band 7
Extreme vol. Limits	3.6VDC to 4.3VDC (nominal: 3.8VDC)
Extreme temp. Tolerance	0°C to +55°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Date of receipt
UT58a	355810970203082	V4.0	MT45_ZZ_00.01_01	2020-10-12
UT29a	355810970201367	V4.0	MT45_ZZ_00.01_01	2020-10-09

*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

AE1

Model	TLp004D1
Manufacturer	Shenzhen BYD Lithium Battery Company Limited
Capacitance	470mAh

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

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4. Reference Documents

4.1. Documents supplied by applicant

EUT parameters, referring to Annex A for detailed information, is supplied by the client or manufacturer, which is the basis of testing.

4.2. 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	10-1-19 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services	2015
KDB 971168 D01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS	v03r01

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5. Laboratory Environment

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 6000 MHz

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6. Summary Of Test Result

LTE Band 7

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50	P
2	Emission Limit	27.53	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	27.53	P
6	Band Edge Compliance	27.53	P
7	Conducted Spurious Emission	27.53	P
8	Peak-to-Average Power Ratio	27.50	P

LTE Band 12

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50	P
2	Emission Limit	27.53	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	27.53	P
6	Band Edge Compliance	27.53	P
7	Conducted Spurious Emission	27.53	P
8	Peak-to-Average Power Ratio	27.50	P

Terms used in Verdict column

P	Pass. The EUT complies with the essential requirements in the standard.
NP	Not Performed. The test was not performed by CTTL.
NA	Not Applicable.The test was not applicable.
BR	Re-use test data from basic model report.
F	Fail. The EUT does not comply with the essential requirements in the standard.

Explanation of worst-case configuration

The worst-case scenario for all measurements is based on the conducted output power measurement investigation results. Output power was measured on QPSK,16QAM modulations. It was found that QPSK was the worst case. All testing was performed using QPSK modulations to represent the worst case unless otherwise stated. The test results shown in the following sections represent the worst case emission.

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7. Test Equipment Utilized

Description	Type	Series Number	Manufacture	Cal Due Date	Calibration Interval
Wideband Radio Communication Tester	CMW500	159082	R&S	2020-12-24	1 year
Spectrum Analyzer	FSU	200030	R&S	2021-06-01	1 year
Climate Chamber	SH-242	93008556	ESPEC	2020-12-21	3 years
EMI Antenna	VULB9163	9163-235	Schwarzbeck	2020-11-24	1 year
EMI Antenna	3117	00058889	ETS-Lindgren	2020-11-18	1 year
EMI Antenna	3117	00119024	ETS-Lindgren	2021-05-08	1 year
Signal Generator	SMF100A	101295	R&S	2021-08-01	1 year
Test Receiver	E4440A	MY48250642	Agilent	2020-12-27	1 year
Universal Radio Communication Tester	CMW500	143008	R&S	2020-11-26	1 year

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Annex A: Measurement Results

A.1 Output Power

A.1.1 Summary

During the process of testing, the EUT was controlled via communication tester 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 7

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)	
			QPSK	16QAM
5MHz	1 RB high	2567.5	22.18	21.04
		2535.0	22.34	20.95
		2502.5	21.99	20.83
	1 RB low	2567.5	22.41	21.04
		2535.0	22.50	21.17
		2502.5	22.01	20.99
	50% RB mid	2567.5	21.56	20.39
		2535.0	21.42	20.19
		2502.5	21.40	20.59
	100% RB	2567.5	21.50	20.74
		2535.0	21.37	20.46
		2502.5	21.35	20.48
10MHz	1 RB high	2565.0	22.37	21.50
		2535.0	22.45	21.56
		2505.0	22.26	21.89
	1 RB low	2565.0	22.30	21.27
		2535.0	22.12	21.53
		2505.0	22.02	21.36
	50% RB mid	2565.0	21.60	20.91
		2535.0	21.42	20.77
		2505.0	21.40	20.36
	100% RB	2565.0	21.66	20.73
		2535.0	21.37	20.49

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		2505.0	21.29	20.21
15MHz	1 RB high	2562.5	22.78	21.82
		2535.0	22.53	21.88
		2507.5	22.41	21.81
	1 RB low	2562.5	22.81	21.85
		2535.0	22.39	21.85
		2507.5	22.36	21.43
	50% RB mid	2562.5	21.50	20.60
		2535.0	21.44	20.23
		2507.5	21.35	20.26
	100% RB	2562.5	21.67	20.51
		2535.0	21.55	20.37
		2507.5	21.38	20.45
20MHz	1 RB high	2560.0	22.81	21.35
		2535.0	21.96	21.43
		2510.0	22.44	21.55
	1 RB low	2560.0	22.33	21.31
		2535.0	21.94	21.49
		2510.0	21.81	20.88
	50% RB mid	2560.0	21.52	20.89
		2535.0	21.58	20.59
		2510.0	21.81	20.50
	100% RB	2560.0	21.59	20.42
		2535.0	21.51	20.77
		2510.0	21.12	20.59

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LTE band 12

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	715.3	21.70	20.63
		707.5	21.58	20.47
		699.7	21.24	20.50
	1 RB low	715.3	21.68	20.50
		707.5	21.54	20.40
		699.7	21.29	20.82
	50% RB mid	715.3	21.76	20.91
		707.5	21.60	20.58
		699.7	21.44	20.29
	100% RB	715.3	20.42	19.61
		707.5	20.40	19.31
		699.7	20.39	19.05
3MHz	1 RB high	714.5	21.68	20.63
		707.5	21.33	20.39
		700.5	21.34	20.26
	1 RB low	714.5	21.54	20.76
		707.5	21.48	20.78
		700.5	21.38	20.73
	50% RB mid	714.5	20.34	19.58
		707.5	20.34	19.19
		700.5	20.25	19.03
	100% RB	714.5	20.33	19.47
		707.5	20.42	19.33
		700.5	20.31	19.30
5MHz	1 RB high	713.5	21.74	20.25
		707.5	21.87	20.20
		701.5	21.67	20.03
	1 RB low	713.5	21.62	20.20
		707.5	22.04	20.05
		701.5	21.14	20.29
	50% RB mid	713.5	20.94	19.02
		707.5	20.96	19.20
		701.5	20.84	19.17
	100% RB	713.5	20.87	19.30
		707.5	20.91	19.39
		701.5	20.78	19.43
10MHz	1 RB high	711.0	21.61	20.77
		707.5	21.71	20.52

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		704.0	21.47	20.41
	1 RB low	711.0	21.58	20.14
		707.5	21.63	20.90
		704.0	21.95	20.46
	50% RB mid	711.0	20.66	19.49
		707.5	20.44	19.44
		704.0	20.53	19.31
	100% RB	711.0	20.52	19.58
		707.5	20.65	19.57
		704.0	20.62	19.41

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A.1.3.1 Description

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

FDD Band 7: Part 27.50(h) specifies "Mobile stations are limited to 2.0 watts EIRP".

FDD Band 12: Part 27.50(c) specifies "Portable stations (hand-held devices) in the 600 MHz uplink band and the 698–746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP".

A.1.3.2 Method of Measurement

According to KDB 412172 D01 and ANSI C63.26 the relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

ERP or EIRP = $P_T + G_T – L_C$, ERP = EIRP -2.15, where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively
(expressed in the same units as P_{Mea} , e.g., dBm or dBW)

P_T = transmitter output power in dBm;

G_T = gain of the transimitting antenna, in dBd(ERP) or dBi(EIRP);

L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

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A.1.3.3 Measurement result

LTE Band 7-EIRP

Limits: ≤33 dBm (2W)

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)		EIRP(dBm) ($G_T - L_C$ = -3.6)	
			QPSK	16QAM	QPSK	16QAM
5MHz	1 RB high	2567.5	22.18	21.04	18.58	17.44
		2535	22.34	20.95	18.74	17.35
		2502.5	21.99	20.83	18.39	17.23
	1 RB low	2567.5	22.41	21.04	18.81	17.44
		2535	22.50	21.17	18.90	17.57
		2502.5	22.01	20.99	18.41	17.39
	50% RB mid	2567.5	21.56	20.39	17.96	16.79
		2535	21.42	20.19	17.82	16.59
		2502.5	21.40	20.59	17.80	16.99
	100% RB	2567.5	21.50	20.74	17.90	17.14
		2535	21.37	20.46	17.77	16.86
		2502.5	21.35	20.48	17.75	16.88
10MHz	1 RB high	2565	22.37	21.50	18.77	17.90
		2535	22.45	21.56	18.85	17.96
		2505	22.26	21.89	18.66	18.29
	1 RB low	2565	22.30	21.27	18.70	17.67
		2535	22.12	21.53	18.52	17.93
		2505	22.02	21.36	18.42	17.76
	50% RB mid	2565	21.60	20.91	18.00	17.31
		2535	21.42	20.77	17.82	17.17
		2505	21.40	20.36	17.80	16.76
	100% RB	2565	21.66	20.73	18.06	17.13
		2535	21.37	20.49	17.77	16.89
		2505	21.29	20.21	17.69	16.61
15MHz	1 RB high	2562.5	22.78	21.82	19.18	18.22
		2535	22.53	21.88	18.93	18.28
		2507.5	22.41	21.81	18.81	18.21
	1 RB low	2562.5	22.81	21.85	19.21	18.25
		2535	22.39	21.85	18.79	18.25
		2507.5	22.36	21.43	18.76	17.83
	50% RB mid	2562.5	21.50	20.60	17.90	17.00
		2535	21.44	20.23	17.84	16.63
		2507.5	21.35	20.26	17.75	16.66
	100% RB	2562.5	21.67	20.51	18.07	16.91
		2535	21.55	20.37	17.95	16.77
		2507.5	21.38	20.45	17.78	16.85

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20MHz	1 RB high	2560	22.81	21.35	19.21	17.75
		2535	21.96	21.43	18.36	17.83
		2510	22.44	21.55	18.84	17.95
	1 RB low	2560	22.33	21.31	18.73	17.71
		2535	21.94	21.49	18.34	17.89
		2510	21.81	20.88	18.21	17.28
	50% RB mid	2560	21.52	20.89	17.92	17.29
		2535	21.58	20.59	17.98	16.99
		2510	21.81	20.50	18.21	16.90
	100% RB	2560	21.59	20.42	17.99	16.82
		2535	21.51	20.77	17.91	17.17
		2510	21.12	20.59	17.52	16.99

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LTE Band 12 -ERP

Limits: ≤34.77dBm (3W)

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)		ERP(dBm) (G_T – L_C = -9.9)	
			QPSK	16QAM	QPSK	16QAM
1.4MHz	1 RB high	715.3	21.70	20.63	9.65	8.58
		707.5	21.58	20.47	9.53	8.42
		699.7	21.24	20.50	9.19	8.45
	1 RB low	715.3	21.68	20.50	9.63	8.45
		707.5	21.54	20.40	9.49	8.35
		699.7	21.29	20.82	9.24	8.77
	50% RB mid	715.3	21.76	20.91	9.71	8.86
		707.5	21.60	20.58	9.55	8.53
		699.7	21.44	20.29	9.39	8.24
	100% RB	715.3	20.42	19.61	8.37	7.56
		707.5	20.40	19.31	8.35	7.26
		699.7	20.39	19.05	8.34	7.00
3MHz	1 RB high	714.5	21.68	20.63	9.63	8.58
		707.5	21.33	20.39	9.28	8.34
		700.5	21.34	20.26	9.29	8.21
	1 RB low	714.5	21.54	20.76	9.49	8.71
		707.5	21.48	20.78	9.43	8.73
		700.5	21.38	20.73	9.33	8.68
	50% RB mid	714.5	20.34	19.58	8.29	7.53
		707.5	20.34	19.19	8.29	7.14
		700.5	20.25	19.03	8.20	6.98
	100% RB	714.5	20.33	19.47	8.28	7.42
		707.5	20.42	19.33	8.37	7.28
		700.5	20.31	19.30	8.26	7.25
5MHz	1 RB high	713.5	21.74	20.25	9.69	8.20
		707.5	21.87	20.20	9.82	8.15
		701.5	21.67	20.03	9.62	7.98
	1 RB low	713.5	21.62	20.20	9.57	8.15
		707.5	22.04	20.05	9.99	8.00
		701.5	21.14	20.29	9.09	8.24
	50% RB mid	713.5	20.94	19.02	8.89	6.97
		707.5	20.96	19.20	8.91	7.15
		701.5	20.84	19.17	8.79	7.12
	100% RB	713.5	20.87	19.30	8.82	7.25
		707.5	20.91	19.39	8.86	7.34
		701.5	20.78	19.43	8.73	7.38

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10MHz	1 RB high	711	21.61	20.77	9.56	8.72
		707.5	21.71	20.52	9.66	8.47
		704	21.47	20.41	9.42	8.36
	1 RB low	711	21.58	20.14	9.53	8.09
		707.5	21.63	20.90	9.58	8.85
		704	21.95	20.46	9.90	8.41
	50% RB mid	711	20.66	19.49	8.61	7.44
		707.5	20.44	19.44	8.39	7.39
		704	20.53	19.31	8.48	7.26
	100% RB	711	20.52	19.58	8.47	7.53
		707.5	20.65	19.57	8.60	7.52
		704	20.62	19.41	8.57	7.36

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A.2 Emission Limit

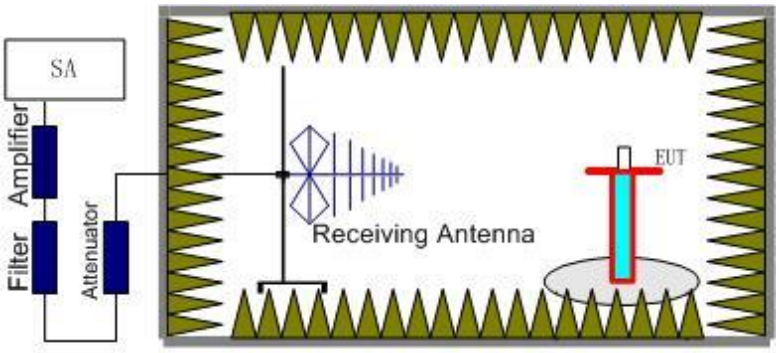
A.2.1 Measurement Method

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

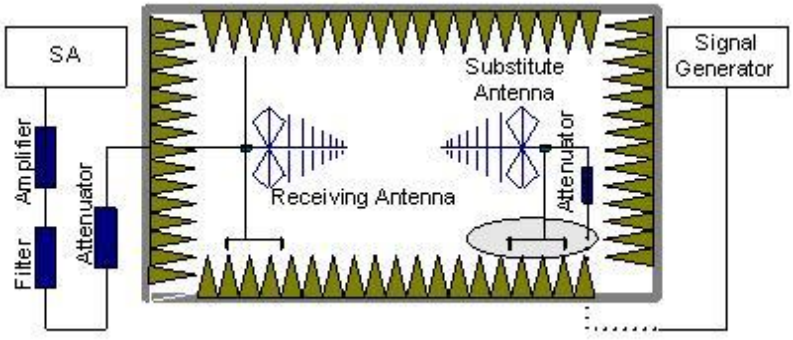
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and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

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, 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

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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(h) specifies 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.

Part 27.53(m) 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.

Part 27.53(g) states for operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee’s frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee’s frequency block, a resolution bandwidth of at least 30 kHz may be employed.

A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of each LTE Band. 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 each LTE Band into any of the other blocks. The equipment must still,

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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 range of evaluated frequency is from 30MHz to 26GHz.

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LTE Band 7, 5 MHz, QPSK, Channel 20775

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
4985.02	-54.98	6.63	9.89	-51.72	-25.00	26.72	V
7514.01	-49.64	8.34	12.21	-45.77	-25.00	20.77	V
10017.01	-51.99	9.23	12.91	-48.31	-25.00	23.31	H
12502.01	-48.77	10.18	13.20	-45.75	-25.00	20.75	V
15002.00	-46.50	11.22	14.00	-43.72	-25.00	18.72	H
17503.00	-44.72	12.74	14.90	-42.56	-25.00	17.56	H

LTE Band 7, 5 MHz, QPSK, Channel 21100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5075.02	-55.33	6.70	10.01	-52.02	-25.00	27.02	H
7607.01	-47.53	8.00	12.29	-43.24	-25.00	18.24	H
10155.01	-52.35	9.37	12.96	-48.76	-25.00	23.76	V
12669.01	-48.52	10.35	13.30	-45.57	-25.00	20.57	V
15210.00	-44.88	11.39	13.87	-42.40	-25.00	17.40	H
17728.00	-44.93	12.34	15.22	-42.05	-25.00	17.05	V

LTE Band 7, 5 MHz, QPSK, Channel 21425

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
5138.02	-55.22	6.86	10.09	-51.99	-25.00	26.99	H
7704.01	-41.37	8.42	12.36	-37.43	-25.00	12.43	H
10277.01	-51.33	9.56	13.01	-47.88	-25.00	22.88	V
12839.01	-47.88	10.67	13.40	-45.15	-25.00	20.15	V
15418.00	-44.95	11.42	13.75	-42.62	-25.00	17.62	H
17982.00	-44.47	12.90	15.57	-41.80	-25.00	16.80	H

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LTE Band 12, 1.4MHz, QPSK, Channel 23017

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1400.01	-44.05	3.24	4.98	2.15	-44.46	-13.00	31.46	H
2104.00	-54.74	4.20	4.91	2.15	-56.18	-13.00	43.18	V
2794.00	-53.01	4.90	6.63	2.15	-53.43	-13.00	40.43	H
3493.02	-54.87	5.51	8.18	2.15	-54.35	-13.00	41.35	H
4199.02	-53.90	6.20	9.10	2.15	-53.15	-13.00	40.15	V
4898.01	-53.75	6.73	9.80	2.15	-52.83	-13.00	39.83	V

LTE Band 12, 1.4MHz, QPSK, Channel 23095

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1415.01	-41.81	3.25	5.06	2.15	-42.15	-13.00	29.15	V
2135.00	-55.91	4.23	5.01	2.15	-57.28	-13.00	44.28	H
2823.00	-52.57	4.95	6.68	2.15	-52.99	-13.00	39.99	H
3533.02	-56.83	5.65	8.25	2.15	-56.38	-13.00	43.38	H
4232.02	-55.51	6.26	9.13	2.15	-54.79	-13.00	41.79	H
4957.01	-57.18	6.68	9.86	2.15	-56.15	-13.00	43.15	V

LTE Band 12, 1.4MHz, QPSK, Channel 23173

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1431.01	-43.09	3.28	5.14	2.15	-43.38	-13.00	30.38	H
2158.00	-56.00	4.26	5.07	2.15	-57.34	-13.00	44.34	V
2870.00	-51.65	4.97	6.77	2.15	-52.00	-13.00	39.00	V
3586.02	-53.82	6.19	8.32	2.15	-53.84	-13.00	40.84	V
4304.02	-53.84	6.19	9.20	2.15	-52.98	-13.00	39.98	V
5012.01	-53.69	6.58	9.92	2.15	-52.50	-13.00	39.50	H

Note: The maximum value of expanded measurement uncertainty for this test item is U = 5.16 dB, k = 2.

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A.3 Frequency Stability

A.3.1 Method of Measurement

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage. Two reference points are established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation shall be identified as F_L and F_H respectively.

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 CMW500.

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 each LTE band, 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 center 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 -30℃ to +50℃. 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.

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 the lower, higher and nominal voltage. 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.

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A.3.2 Measurement results

LTE Band 7, 20MHz bandwidth QPSK (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	2500.929	2569.071	-67.66	0.0267
50				-60.95	0.0240
40				4.35	0.0017
30				-63.71	0.0251
10				-65.62	0.0259
0				-63.44	0.0250
-10				-45.86	0.0181
-20				-63.96	0.0252
-30					

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
3.6	20	2500.929	2569.071	-64.69	0.0255
4.3				-64.03	0.0253

LTE Band 12, 10MHz bandwidth QPSK (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	699.465	715.503	7.30	0.0103
50				5.97	0.0084
40				6.15	0.0087
30				7.00	0.0099
10				6.64	0.0094
0				6.81	0.0096
-10				6.95	0.0098
-20				7.04	0.0100
-30					

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
3.6	20	699.465	715.503	6.17	0.0087
4.3				0.11	0.0002

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A.4 Occupied Bandwidth

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies frequency. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.
The measurement method is from ANSI C63.26:
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.
b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
d) Set the detection mode to peak, and the trace mode to max-hold.

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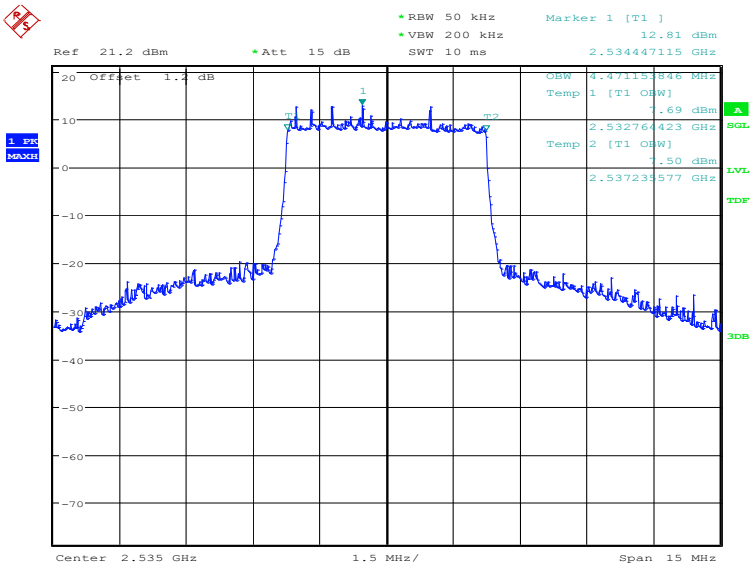
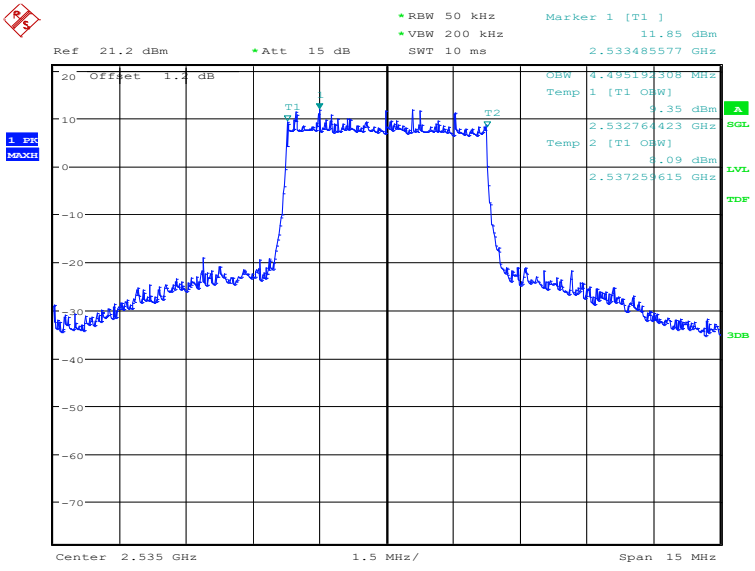
LTE band 7, 5MHz (99%)

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

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



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



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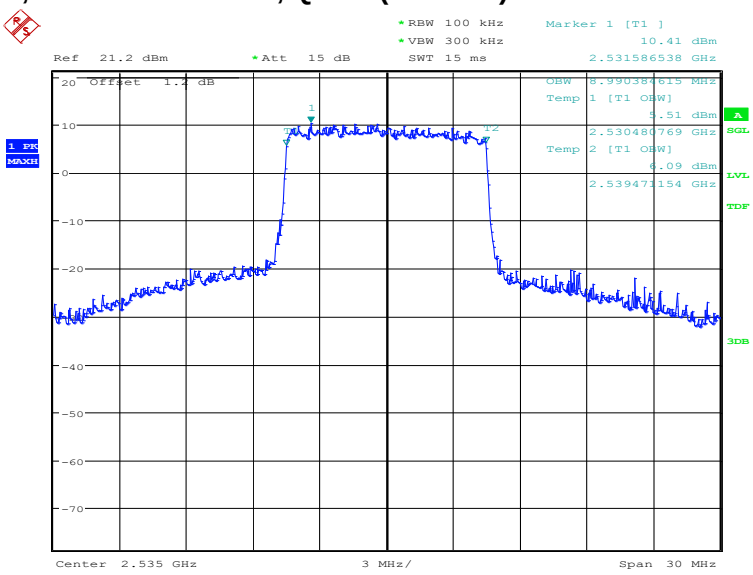
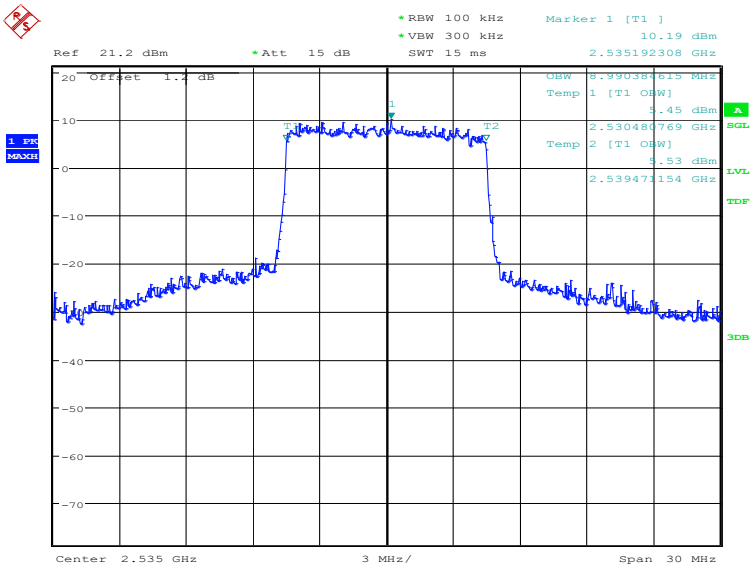
LTE band 7, 10MHz (99%)

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

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



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



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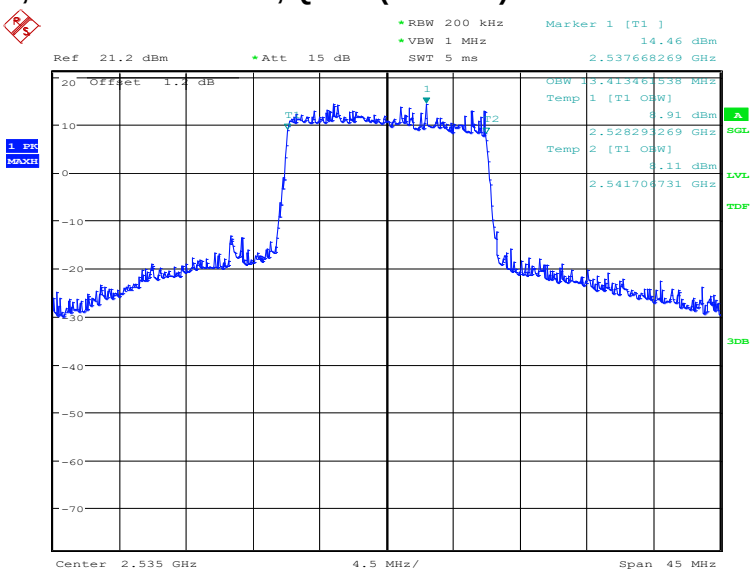
LTE band 7, 15MHz (99%)

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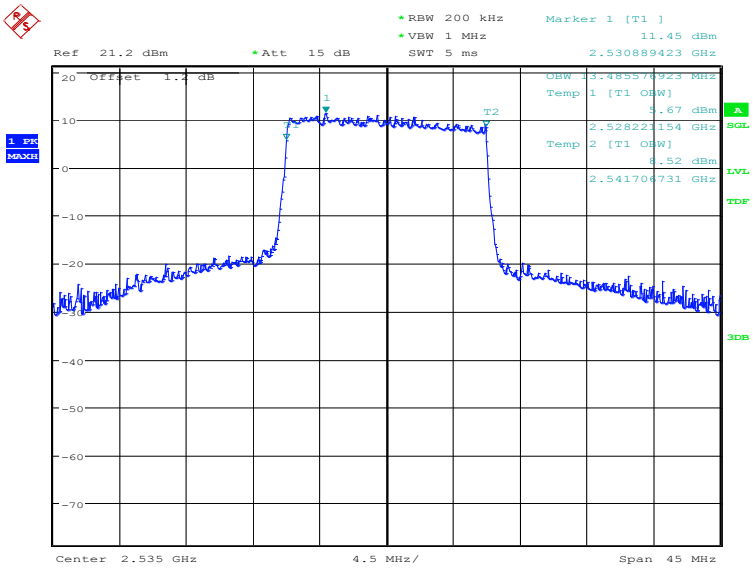
LTE band 7, 15MHz Bandwidth, 16QAM (99% BW)



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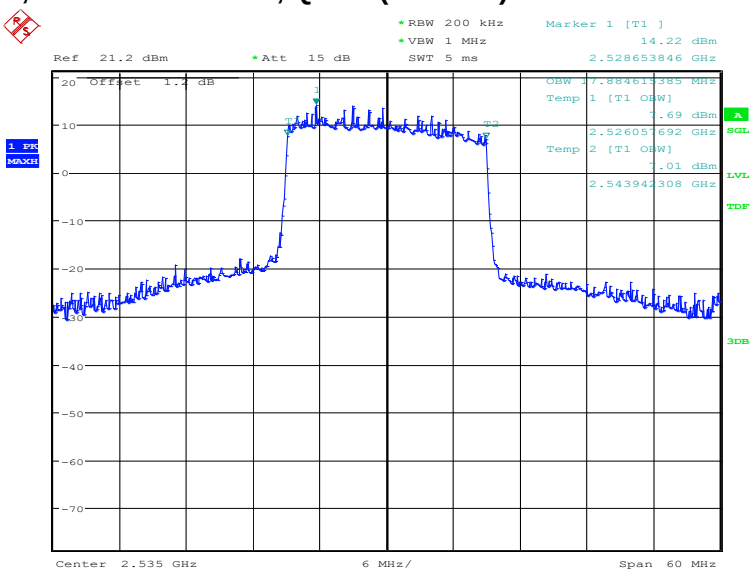
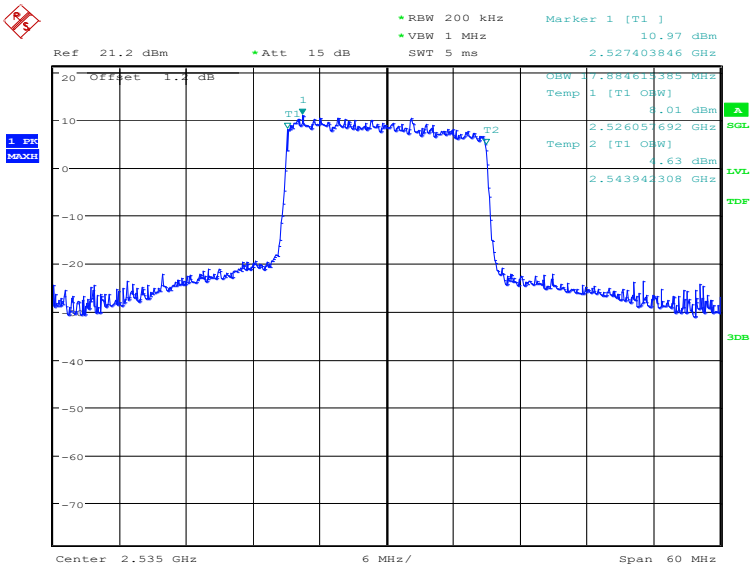
LTE band 7, 20MHz (99%)

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

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



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



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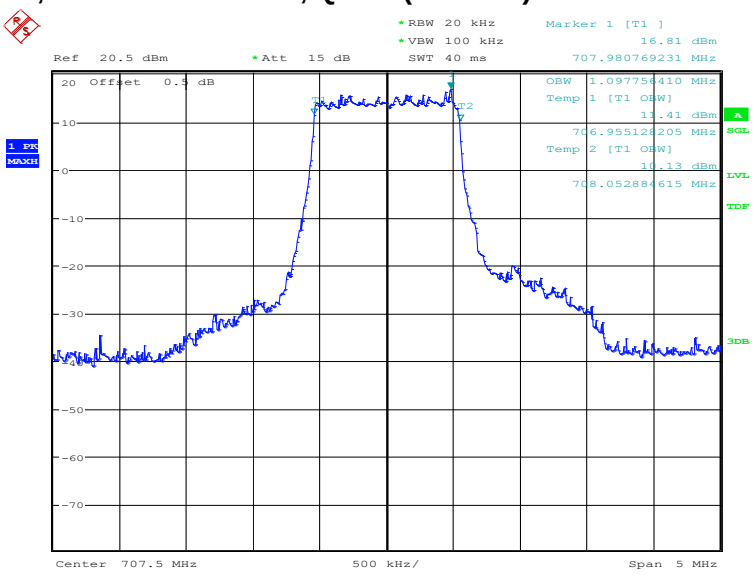
LTE band 12, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%) (kHz)	
707.5	QPSK	16QAM
	1097.76	1089.74

LTE band 12, 1.4MHz Bandwidth, QPSK (99% BW)



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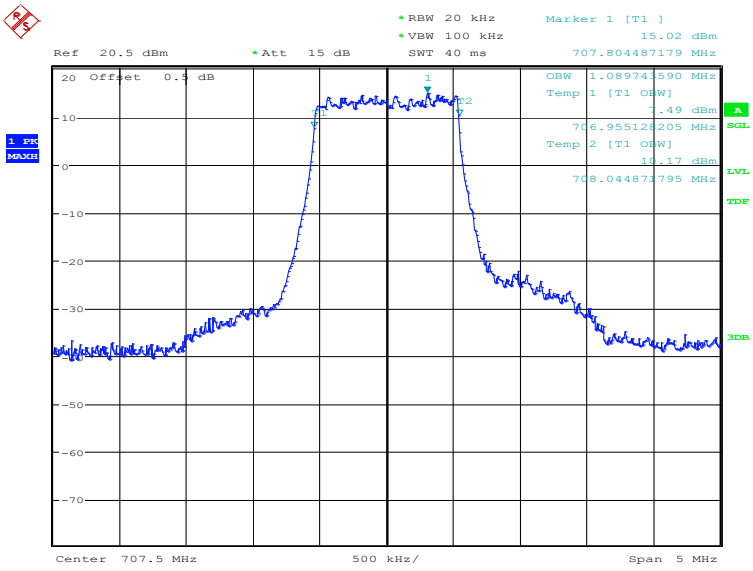
LTE band 12, 1.4MHz Bandwidth, 16QAM (99% BW)



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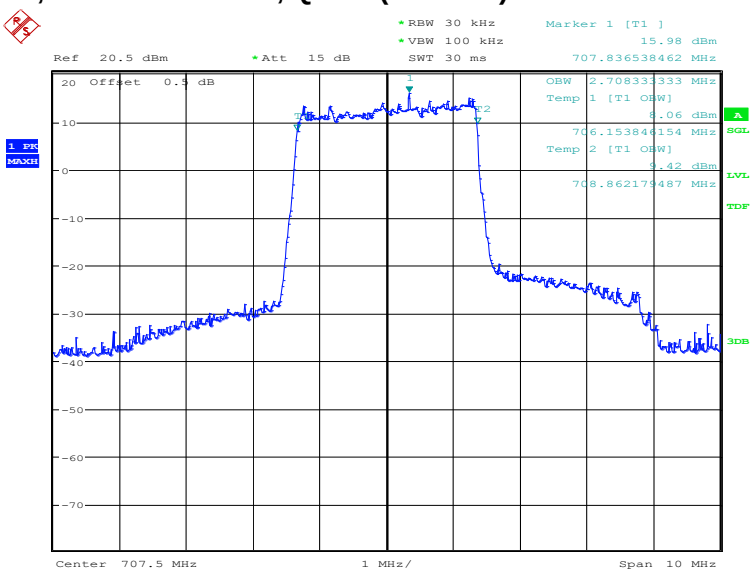
LTE band 12, 3MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%) (kHz)	
707.5	QPSK	16QAM
	2708.33	2692.31

LTE band 12, 3MHz Bandwidth, QPSK (99% BW)



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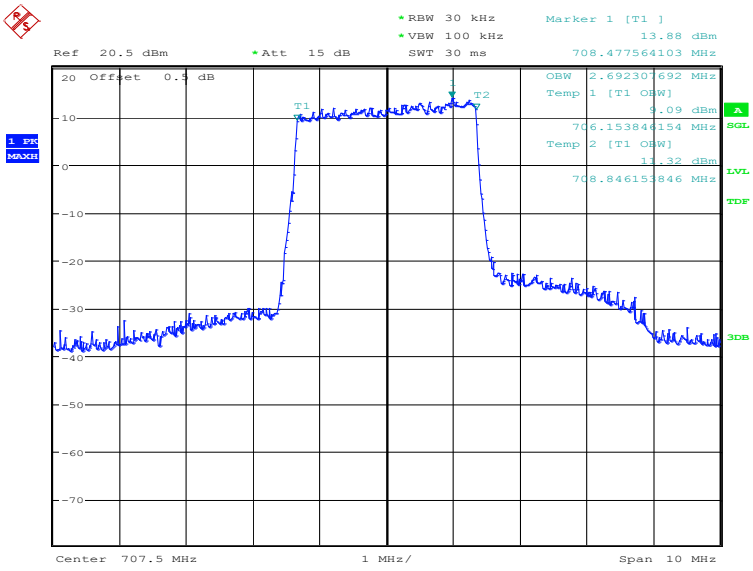
LTE band 12, 3MHz Bandwidth, 16QAM (99% BW)



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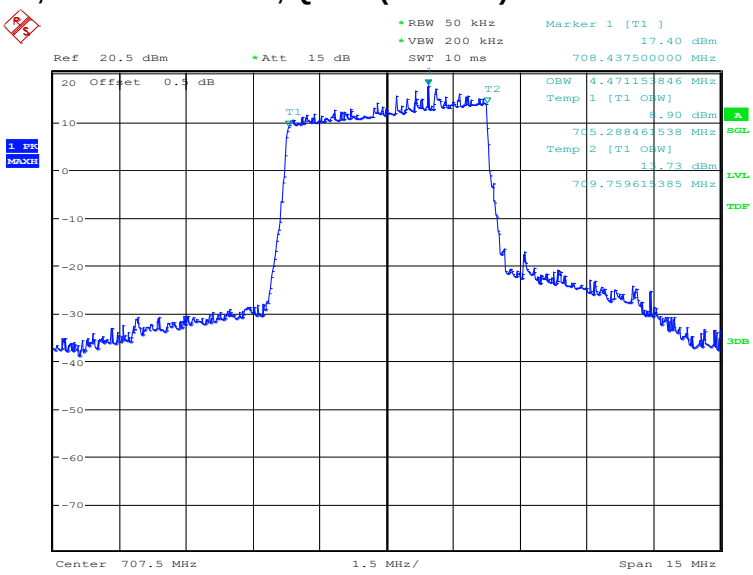
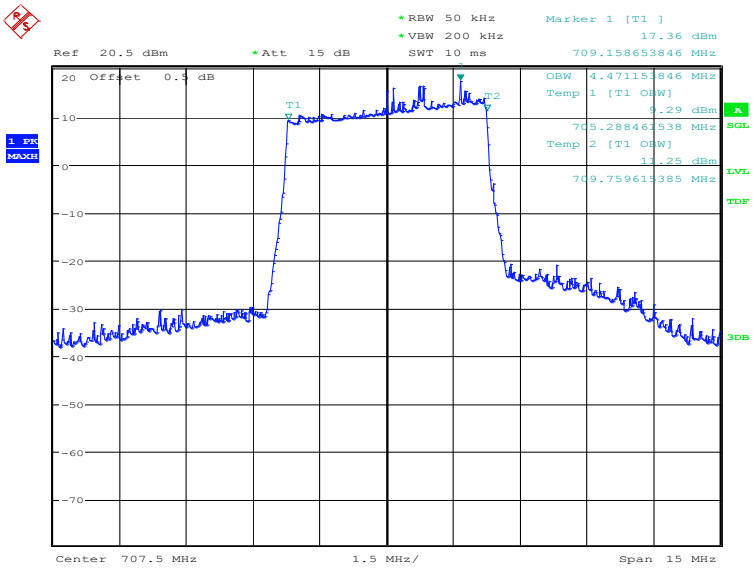
LTE band 12, 5MHz (99%)

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

LTE band 12, 5MHz Bandwidth, QPSK (99% BW)



LTE band 12, 5MHz Bandwidth, 16QAM (99% BW)



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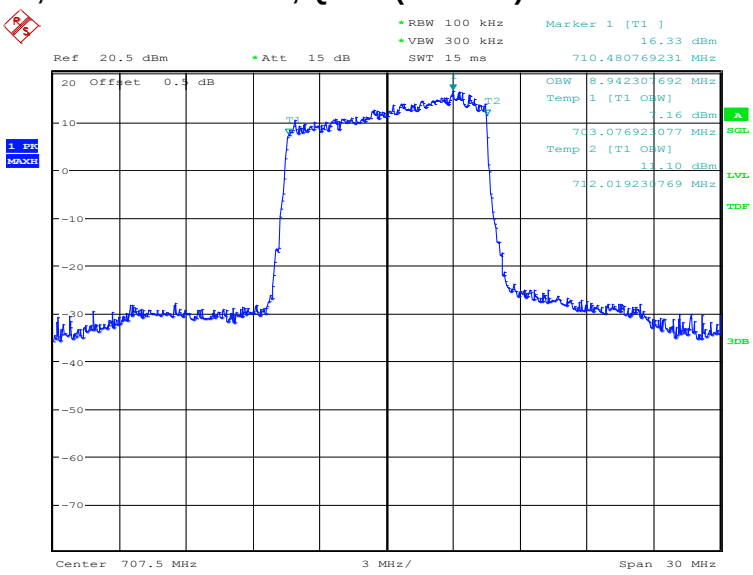
LTE band 12, 10MHz (99%)

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

LTE band 12, 10MHz Bandwidth, QPSK (99% BW)



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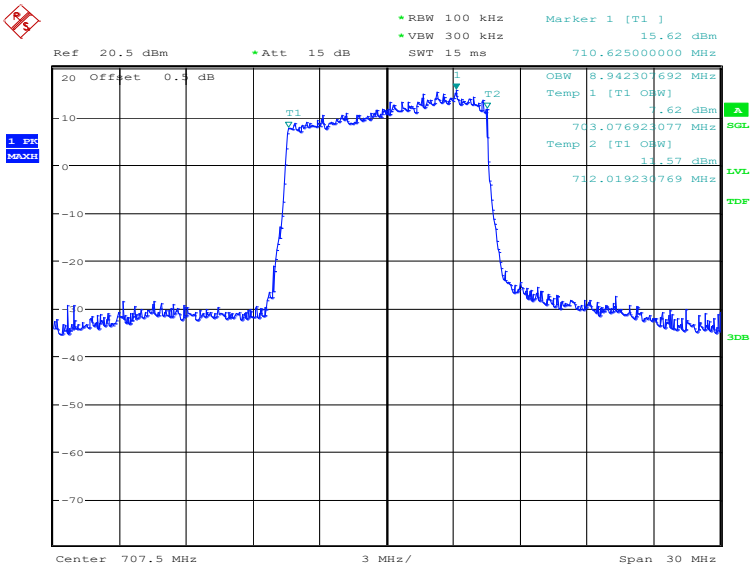
LTE band 12, 10MHz Bandwidth, 16QAM (99% BW)



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A.5 Emission Bandwidth

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.
The measurement method is from ANSI C63.26:
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “−X dB” requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

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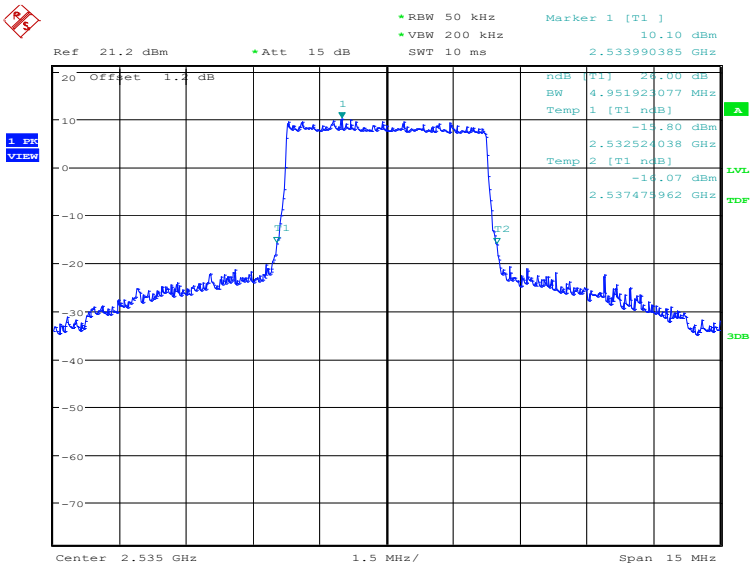
LTE band 7, 5MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
	QPSK	16QAM
2535.0	4951.92	5000.00

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



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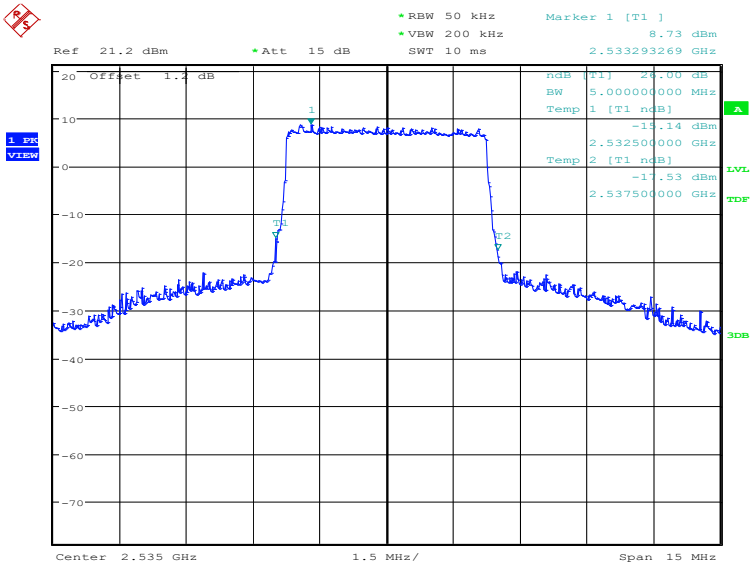
LTE band 7, 5MHz Bandwidth,16QAM (-26dBc BW)



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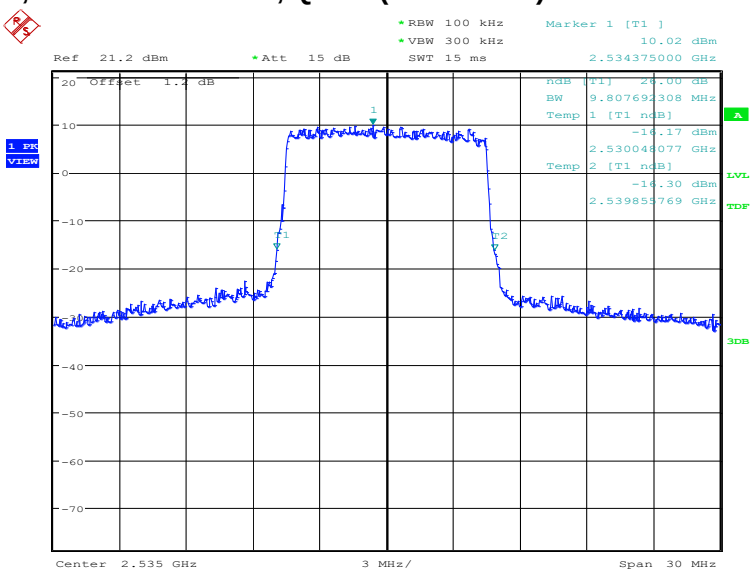
LTE band 7, 10MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
2535.0	QPSK	16QAM
	9807.69	9807.69

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



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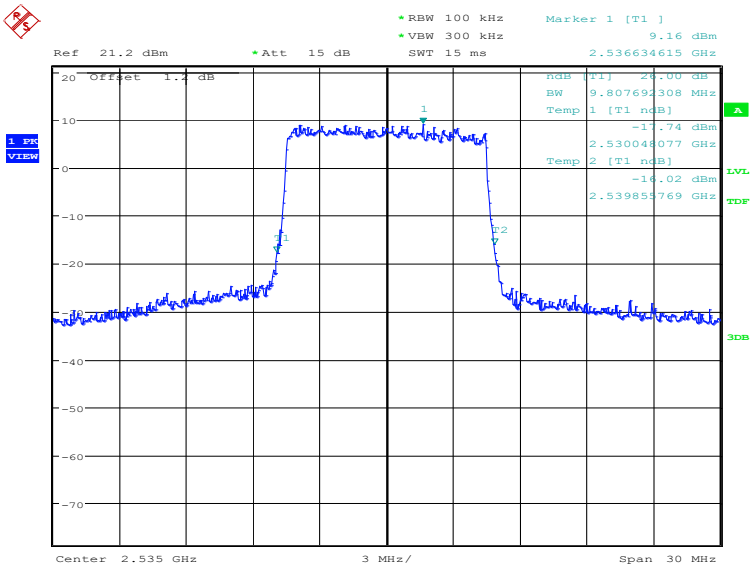
LTE band 7, 10MHz Bandwidth,16QAM (-26dBc BW)



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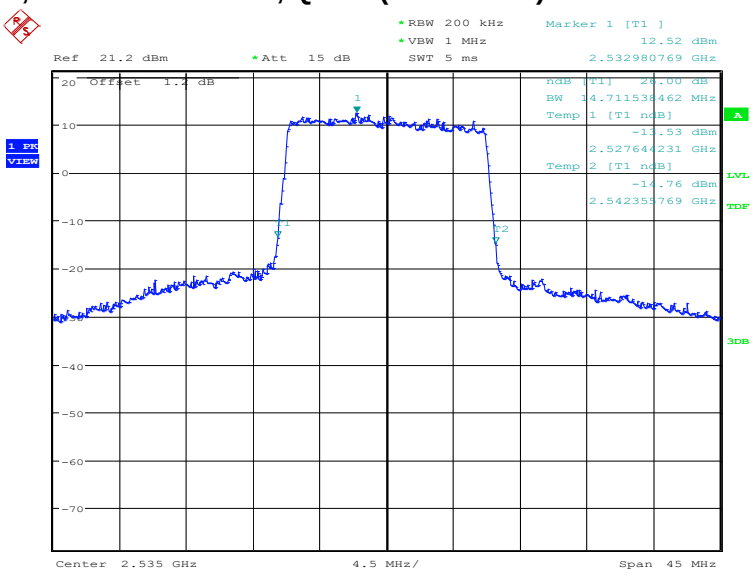
LTE band 7, 15MHz (-26dBc)

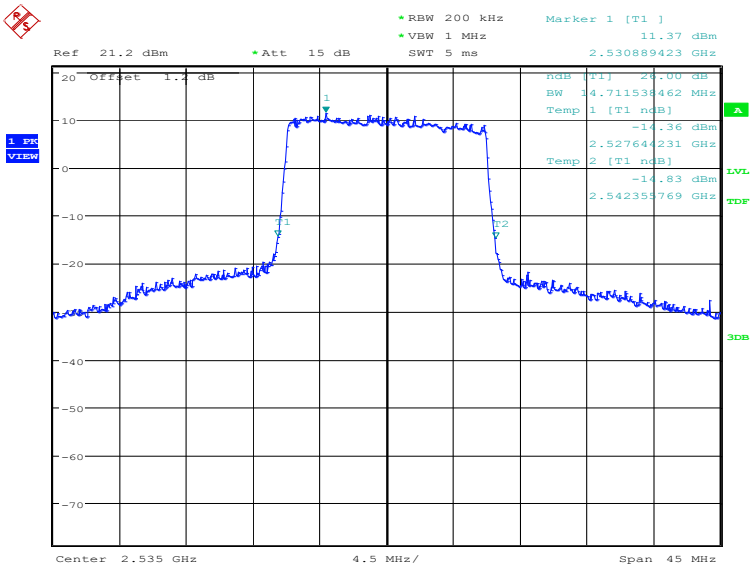
Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
2535.0	QPSK	16QAM
	14711.54	14711.54

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



Date: 13.OCT.2020 07:58:03

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



Date: 13.OCT.2020 07:58:42

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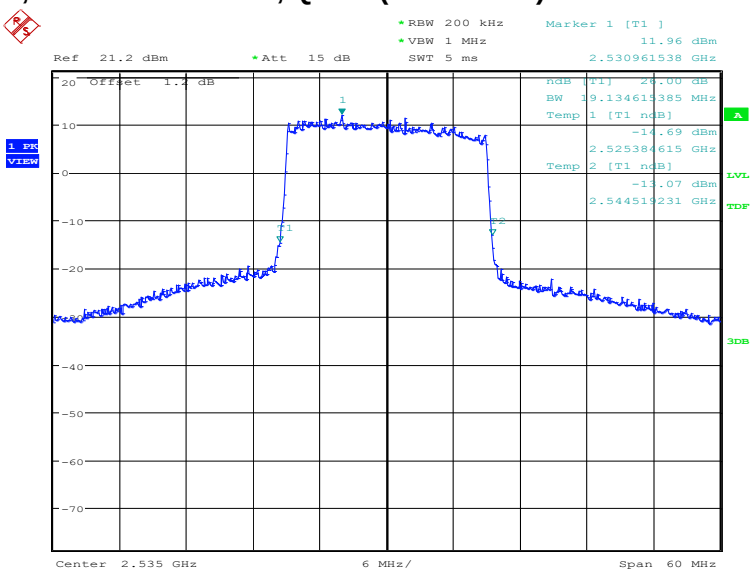
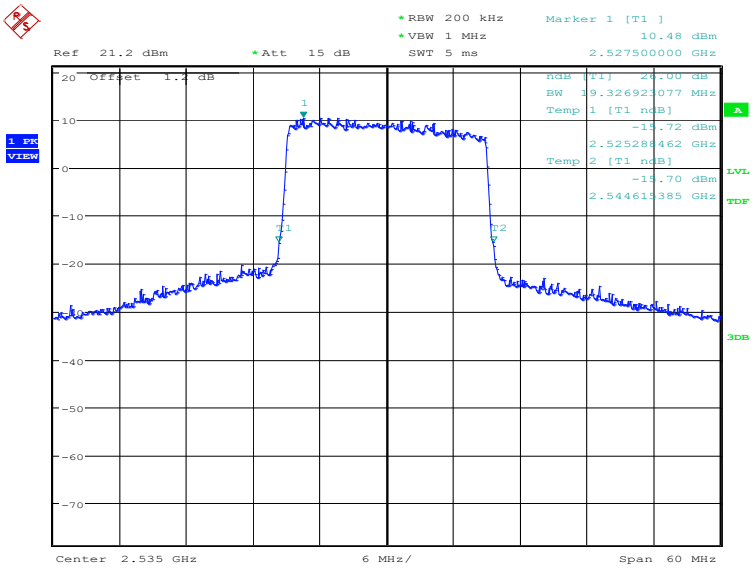
LTE band 7, 20MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
2535.0	QPSK	16QAM
	19134.62	19326.92

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



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



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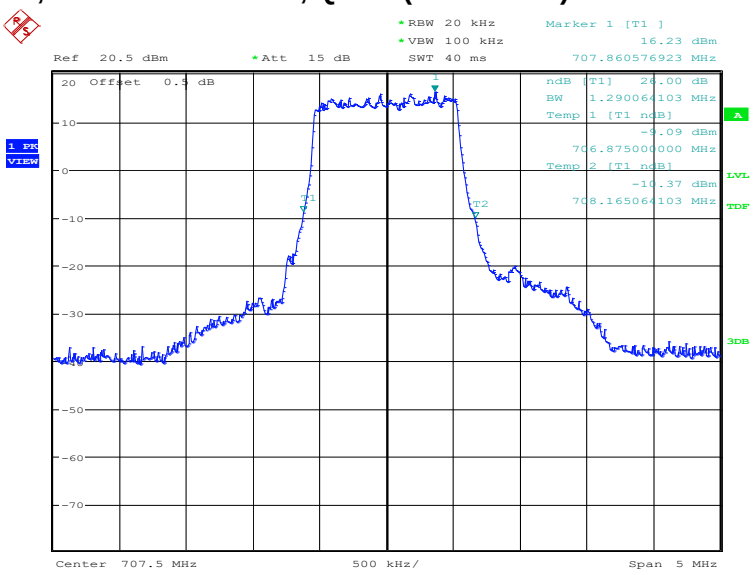
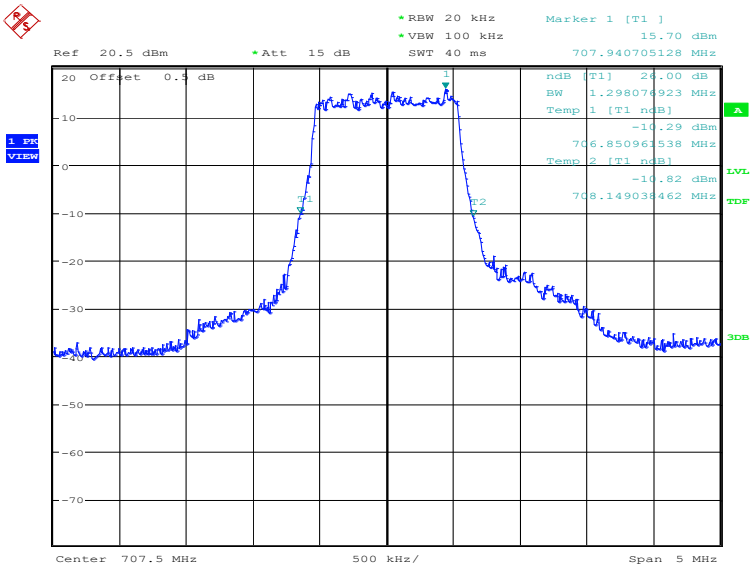
LTE band 12, 1.4MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
707.5	QPSK	16QAM
	1290.06	1298.08

LTE band 12, 1.4MHz Bandwidth, QPSK (-26dBc BW)



LTE band 12, 1.4MHz Bandwidth, 16QAM (-26dBc BW)



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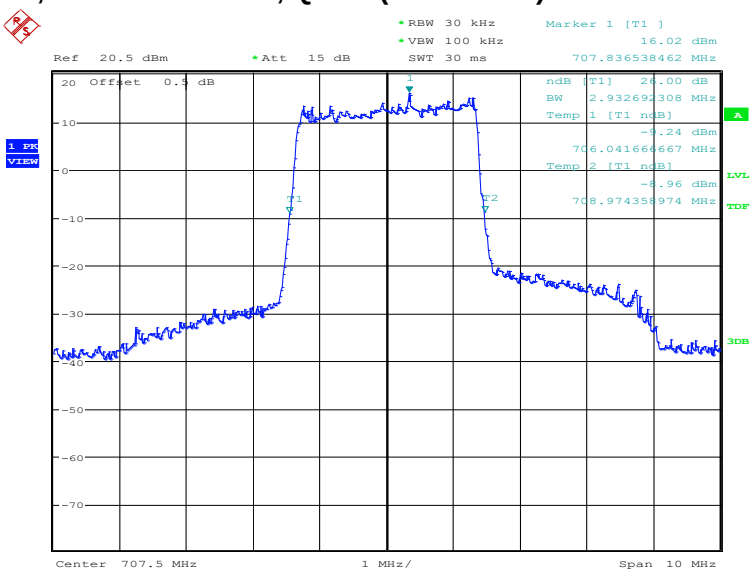
LTE band 12, 3MHz (-26dBc)

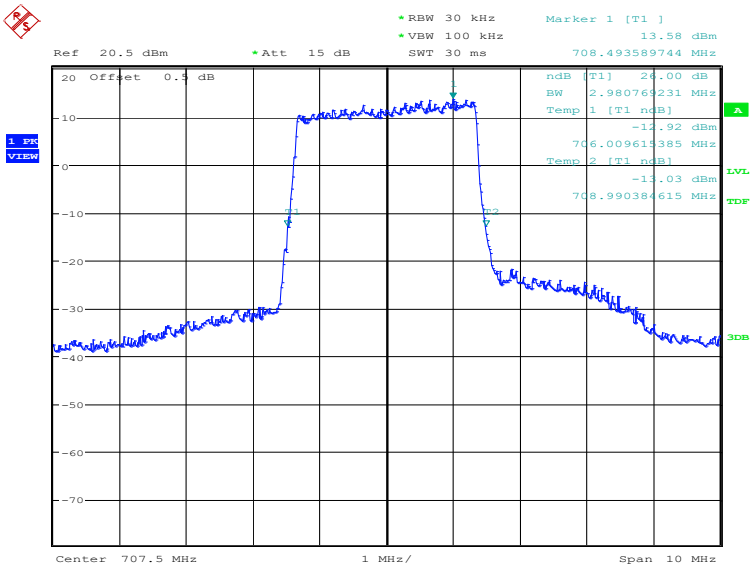
Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
707.5	QPSK	16QAM
	2932.69	2980.77

LTE band 12, 3MHz Bandwidth, QPSK (-26dBc BW)



Date: 13.OCT.2020 08:21:23

LTE band 12, 3MHz Bandwidth, 16QAM (-26dBc BW)



Date: 13.OCT.2020 08:22:01

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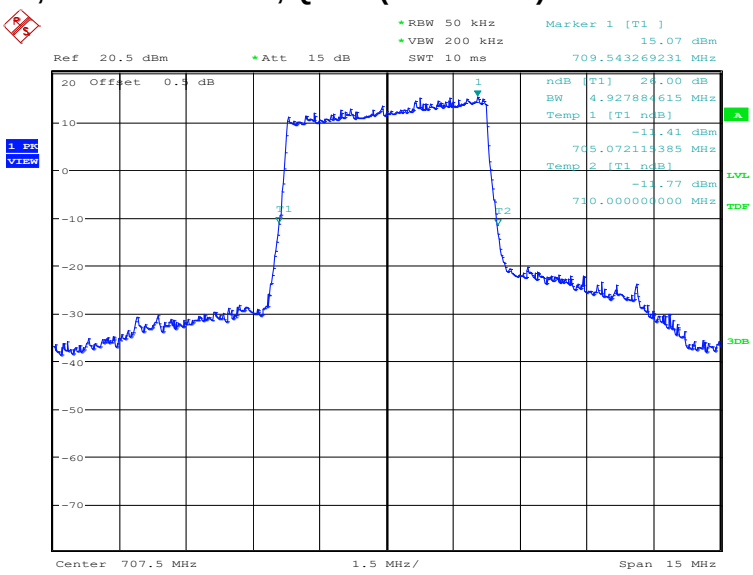
LTE band 12, 5MHz (-26dBc)

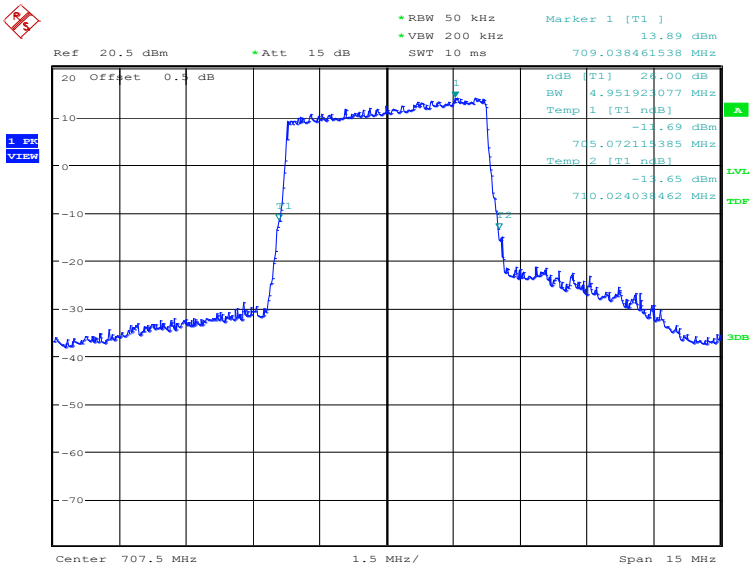
Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
707.5	QPSK	16QAM
	4927.88	4951.92

LTE band 12, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 13.OCT.2020 08:22:42

LTE band 12, 5MHz Bandwidth, 16QAM (-26dBc BW)



Date: 13.OCT.2020 08:23:20

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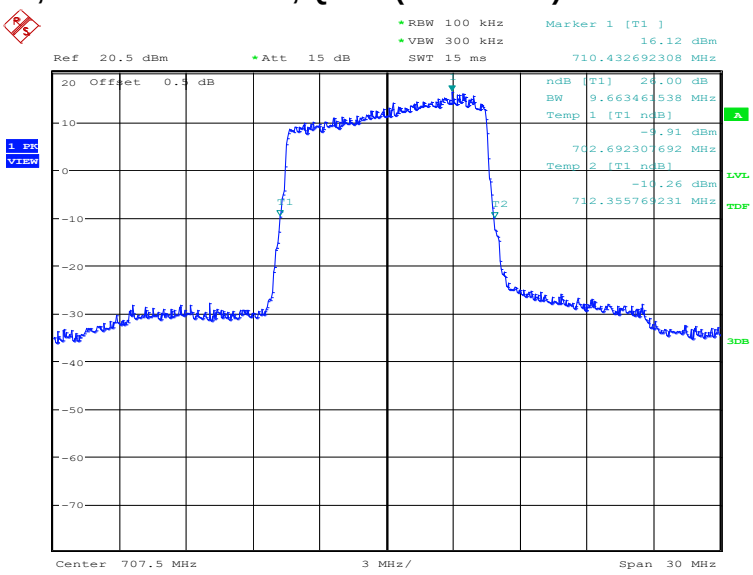
LTE band 12, 10MHz (-26dBc)

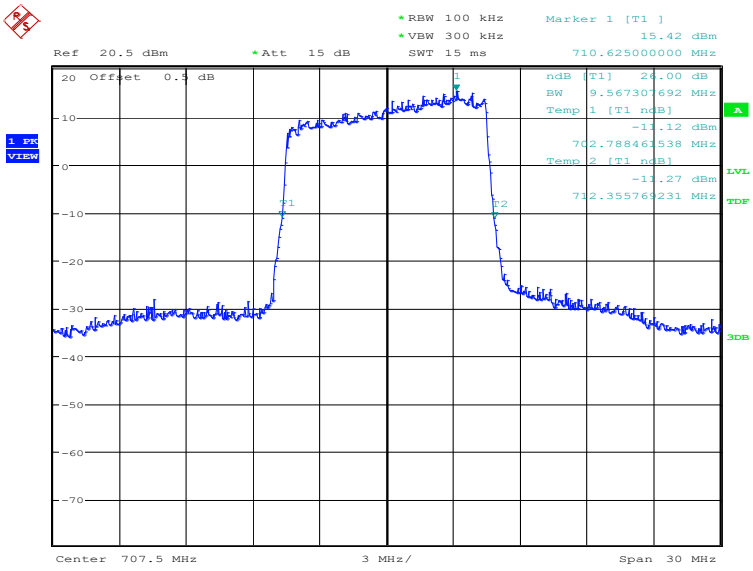
Frequency(MHz)	Occupied Bandwidth (-26dBc) (kHz)	
707.5	QPSK	16QAM
	9663.46	9567.31

LTE band 12, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 13.OCT.2020 08:24:01

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



Date: 13.OCT.2020 08:24:39

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A.6 Band Edge Compliance

A.6.1 Measurement limit

Part 27.53(m) 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.

Part 27.53(g) states for operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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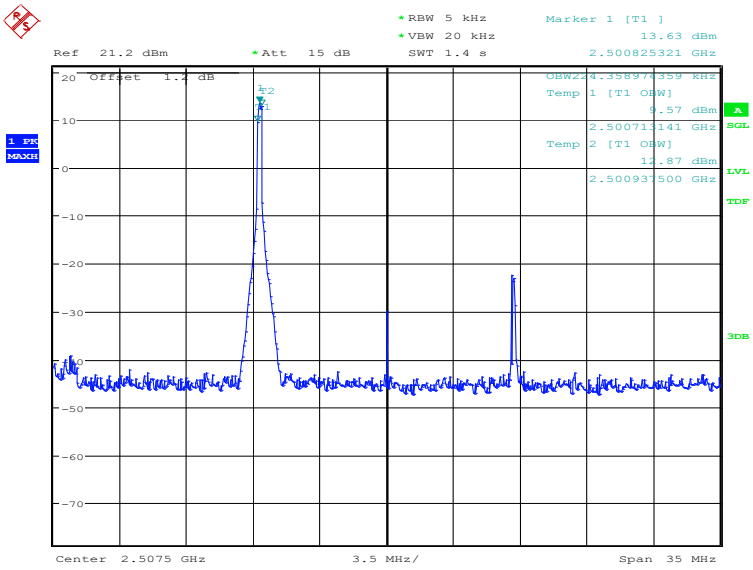
A.6.2 Measurement result

Only the worst case result is given below

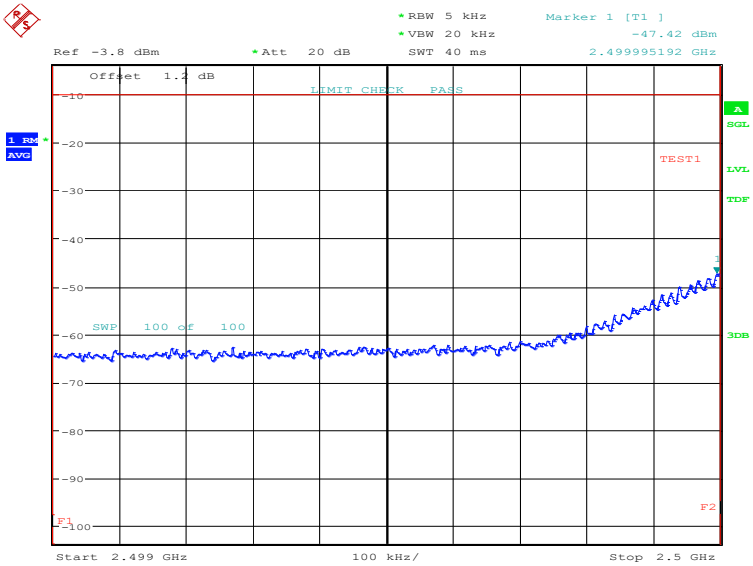
LTE band 7

OBW: 1RB-low_offset



Date: 22.OCT.2020 09:40:19

LOW BAND EDGE BLOCK-1RB-low_offset



Date: 22.OCT.2020 09:41:38

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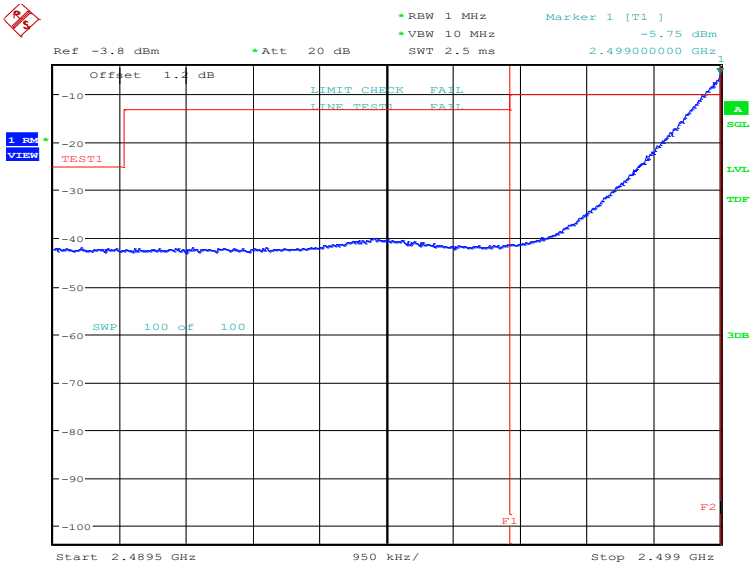
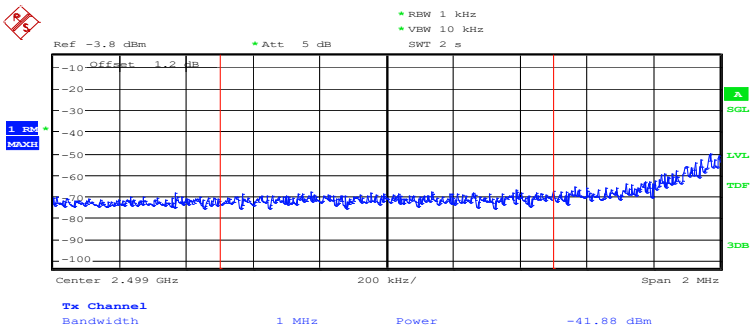


Date: 22.OCT.2020 09:42:00



Date: 22.OCT.2020 09:42:11

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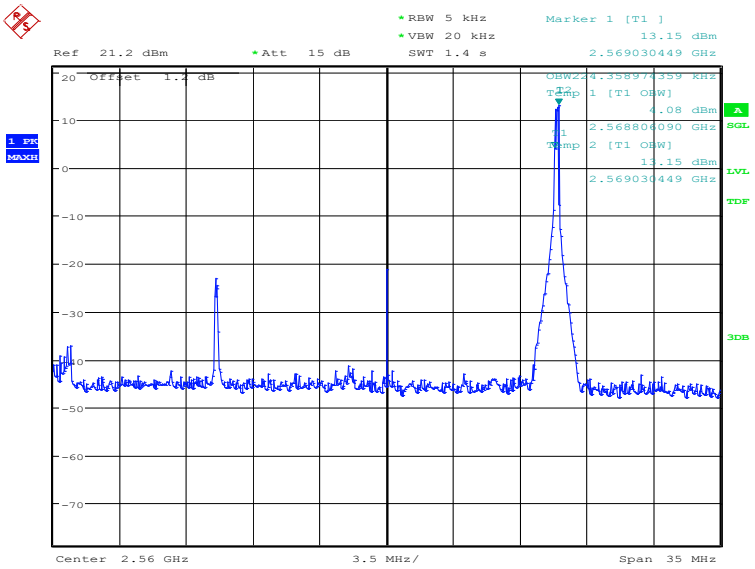
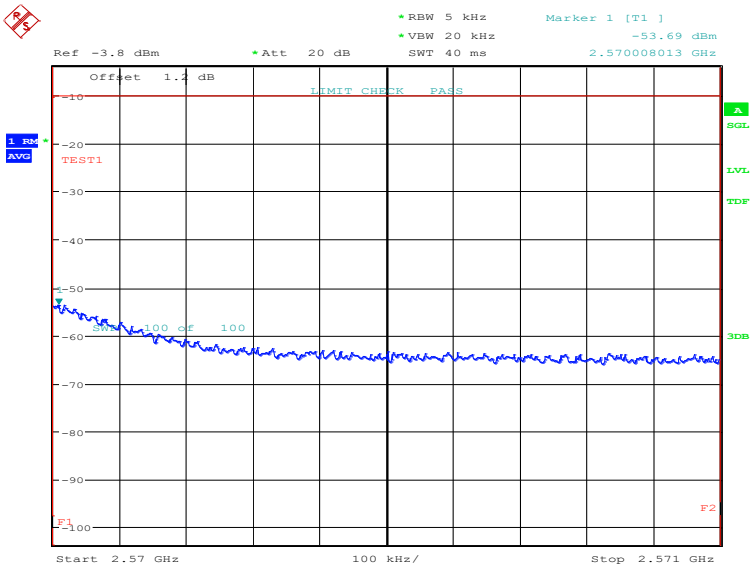
OBW: 1RB-high_offset



Date: 22.OCT.2020 09:42:46

HIGH BAND EDGE BLOCK-1RB-high_offset



Date: 22.OCT.2020 09:44:06

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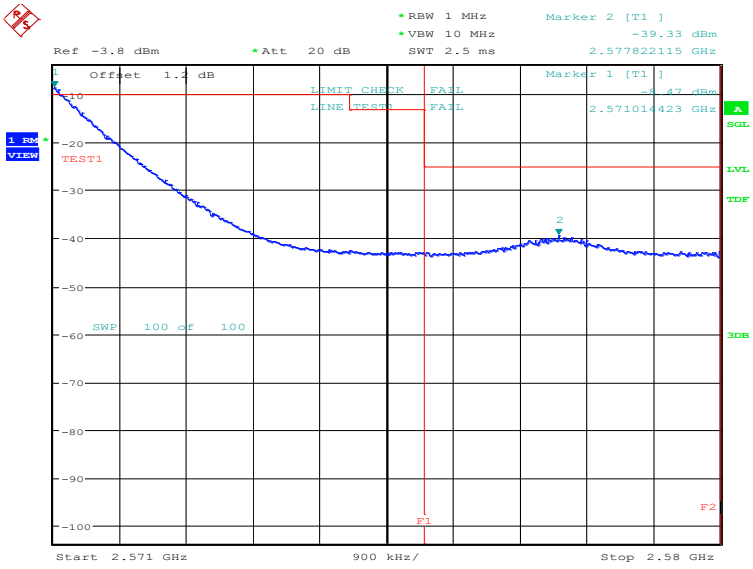
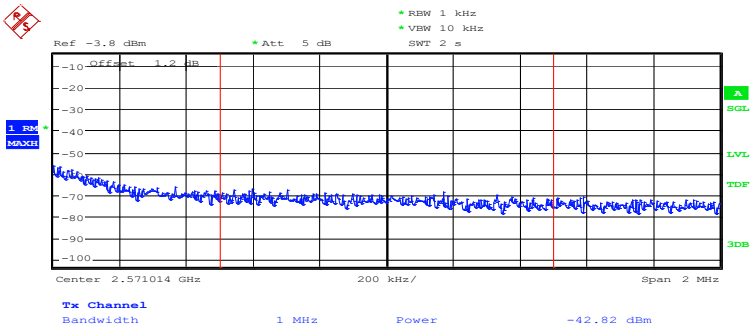


Date: 22.OCT.2020 09:44:28



Date: 22.OCT.2020 09:44:39

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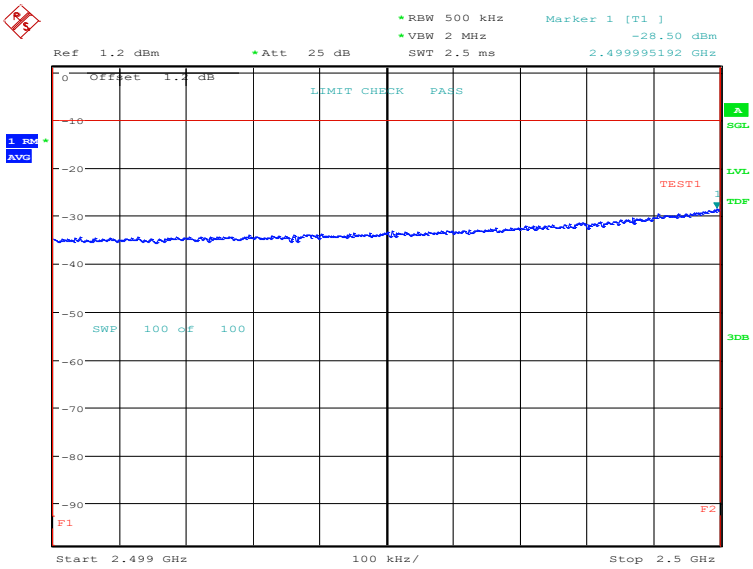
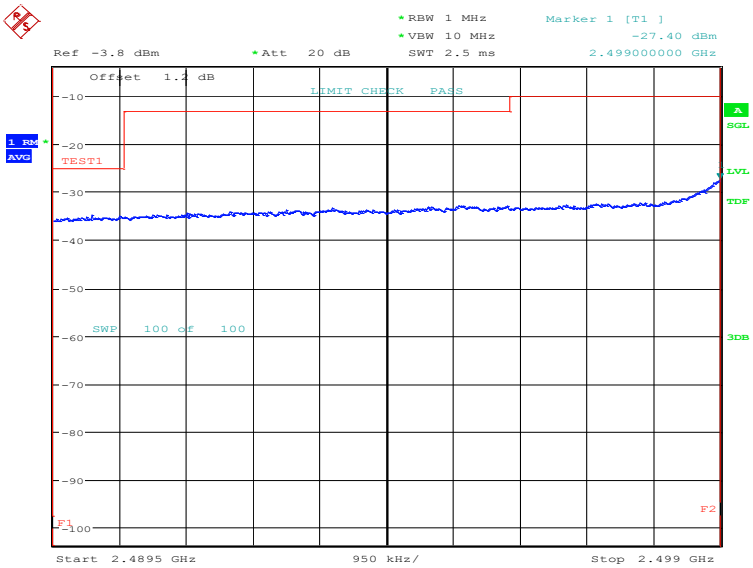
LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 13.OCT.2020 08:01:06



Date: 13.OCT.2020 08:01:19

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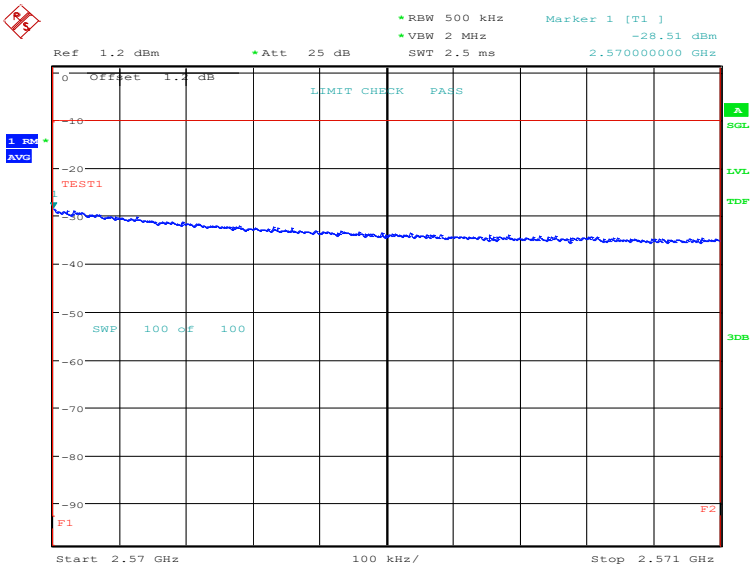
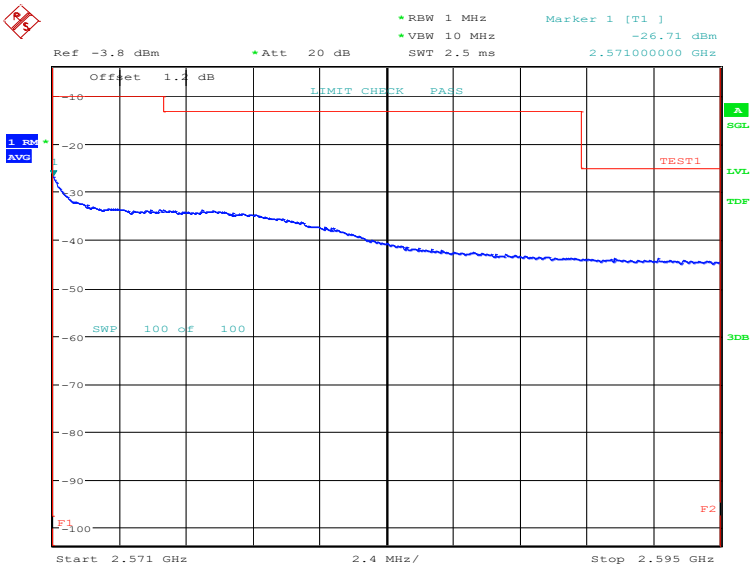
HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 13.OCT.2020 08:02:44



Date: 13.OCT.2020 08:02:58

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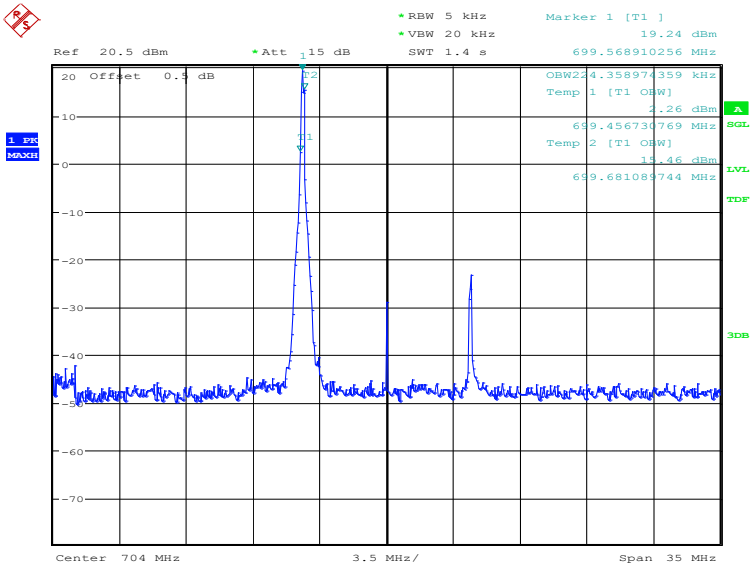
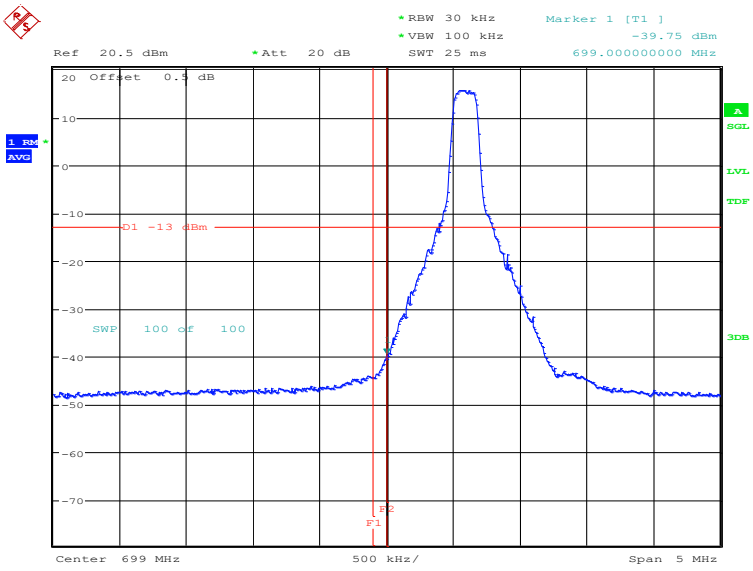
LTE band 12

OBW: 1RB-low_offset



Date: 22.OCT.2020 09:47:49

LOW BAND EDGE BLOCK-1RB-low_offset



Date: 22.OCT.2020 09:48:02

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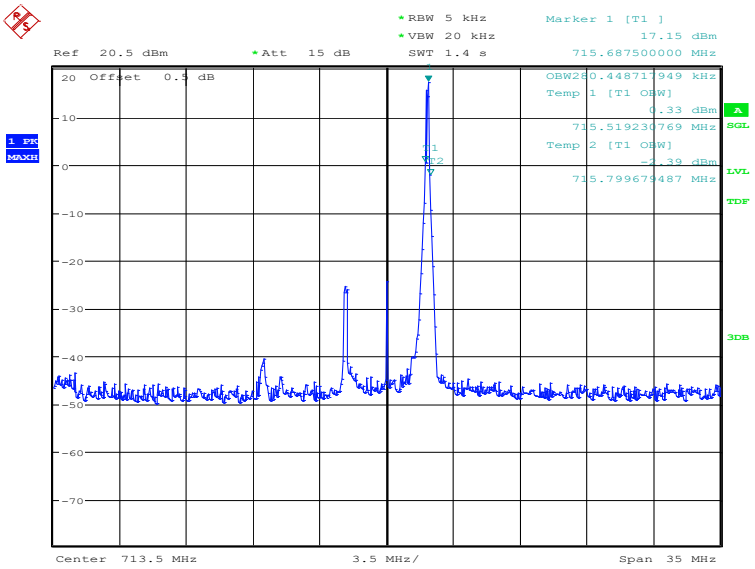
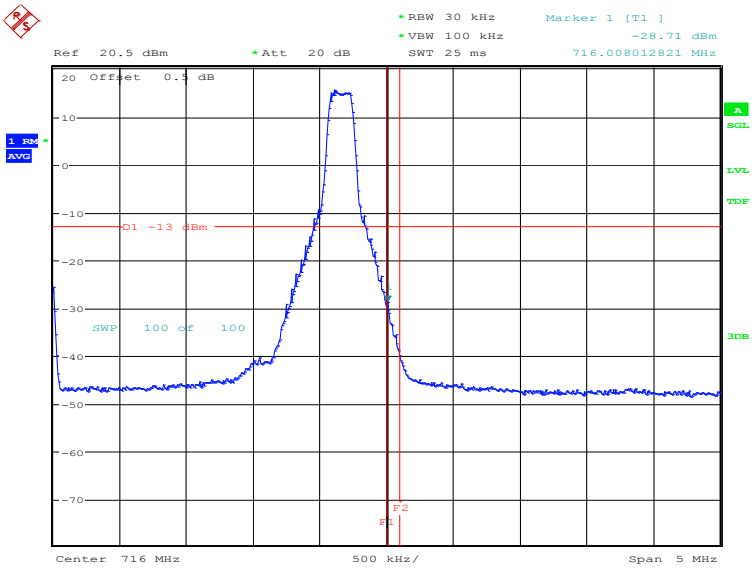
OBW: 1RB-high_offset



Date: 22.OCT.2020 09:49:30

HIGH BAND EDGE BLOCK-1RB-high_offset



Date: 22.OCT.2020 09:49:43

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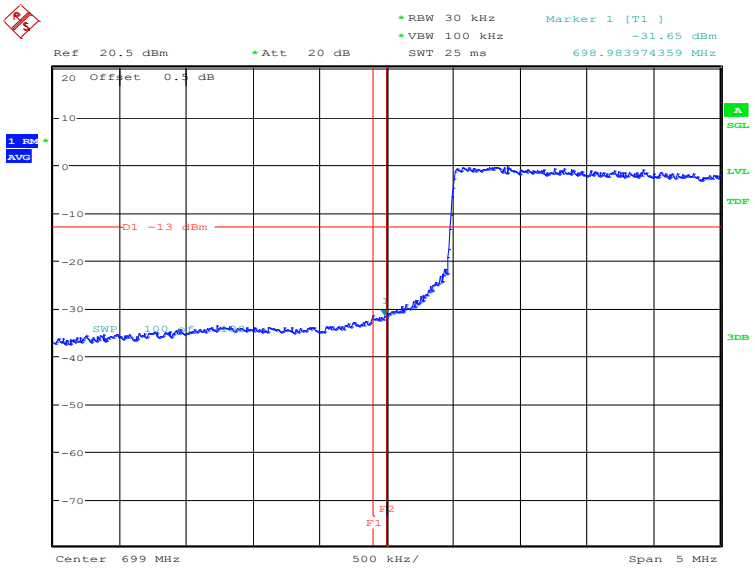
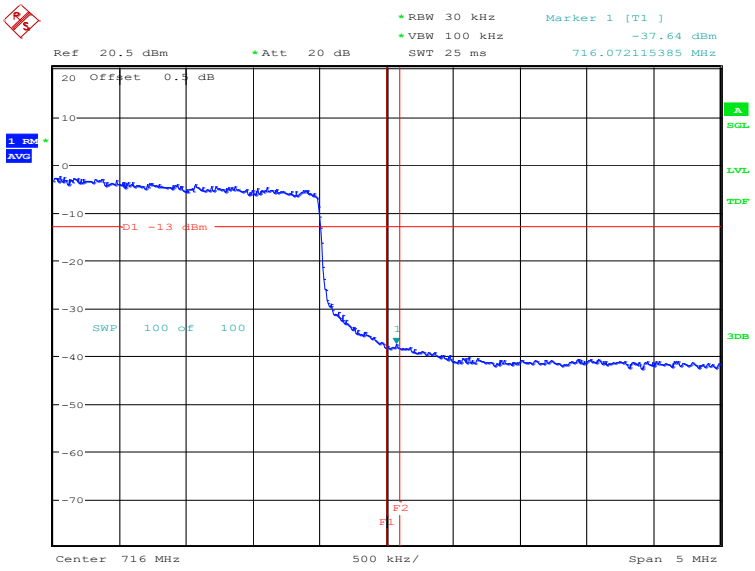
LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 22.OCT.2020 10:44:37

HIGH BAND EDGE BLOCK-10MHz-100%RB



Date: 22.OCT.2020 10:45:56

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A.7 Conducted Spurious Emission

A.7.1 Measurement Method

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

1. In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:
   (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
   (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
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) 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.

Part 27.53(g) states for operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee’s frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee’s frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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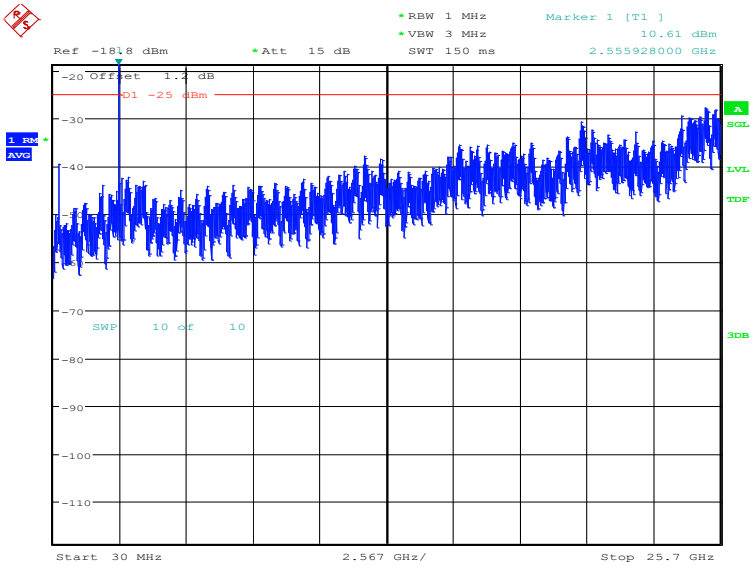
A. 7.3 Measurement result

Only the worst case result is given below

LTE band 7: 30MHz – 25.7GHz

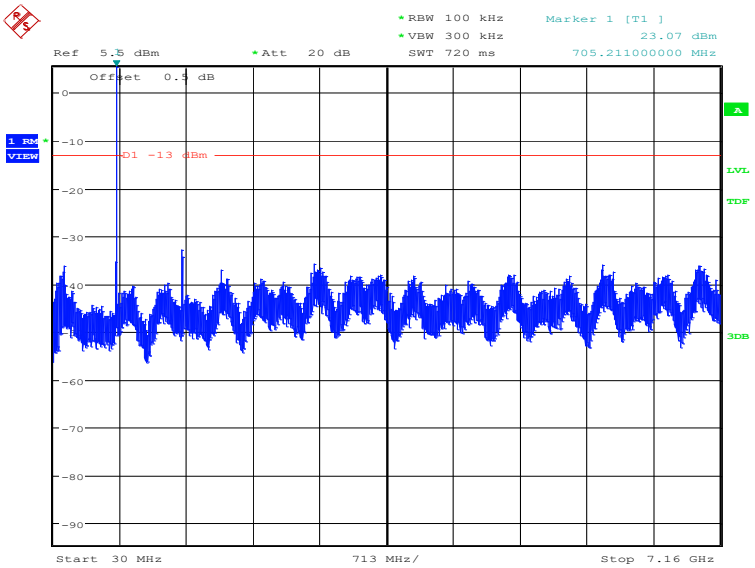
NOTE: peak above the limit line is the carrier frequency.



Date: 22.OCT.2020 09:51:19

LTE band 12: 30MHz – 7.16GHz

NOTE: peak above the limit line is the carrier frequency.



Date: 22.OCT.2020 09:52:31

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A.8 Peak-to-Average Power Ratio

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

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

LTE band 7, 20MHz

Frequency(MHz)	PAPR(dB)	
2535.0	QPSK	16QAM
	7.05	7.47

LTE band 12,10MHz

Frequency(MHz)	PAPR(dB)	
707.5	QPSK	16QAM
	5.87	6.54

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Annex B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2020-09-29 through 2021-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

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

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