



TEST REPORT

No. 2013TAR873

for

Sony Mobile Communications AB

GSM/WCDMA/LTE Mobile Phone

Type: PM-0762-BV

FCC ID: PY7PM-0762

with

Hardware Version: AP1

Software Version: 19.0.A.0.250

Issued Date: Jan. 15th, 2014

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 TMC Beijing.

Test Laboratory:

DAkks accreditation (DIN EN ISO/IEC 17025): No. 12123-01-01

FCC 2.948 Listed: No.733176

IC O.A.T.S listed: No.6629A-1

TMC Beijing, Telecommunication Metrology Center of Ministry of Industry and Information Technology

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

Tel:+86(0) 10-62304633-2561, Fax:+86(0)10-62304633-2504 Email:welcome@emcite.com. www.emcite.com

CONTENTS

1. TEST LABORATORY	3
1.1. TESTING LOCATION	3
1.2. TESTING ENVIRONMENT	3
1.3. PROJECT DATA.....	3
1.4. SIGNATURE	3
2. CLIENT INFORMATION	4
2.1. APPLICANT INFORMATION.....	4
2.2. MANUFACTURER INFORMATION.....	4
3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	5
3.1. ABOUT EUT	5
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	5
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST.....	5
3.4. GENERAL DESCRIPTION	6
3.5. EUT SET-UPS	6
4. REFERENCE DOCUMENTS	7
4.1. REFERENCE DOCUMENTS FOR TESTING	7
5. LABORATORY ENVIRONMENT	8
6. SUMMARY OF TEST RESULTS.....	9
6.1. SUMMARY OF TEST RESULTS	9
6.2. STATEMENTS	9
7. TEST EQUIPMENTS UTILIZED.....	10
ANNEX A: MEASUREMENT RESULTS	11
A.1 OUTPUT POWER.....	11
A.2 EMISSION LIMIT	20
A.3 CONDUCTED EMISSION.....	25
A.4 FREQUENCY STABILITY	28
A.5 OCCUPIED BANDWIDTH	30
A.6 EMISSION BANDWIDTH.....	39
A.7 BAND EDGE COMPLIANCE	48
A.8 CONDUCTED SPURIOUS EMISSION	65
ANNEX B: TEST LAYOUT	77
ANNEX C: EUT PHOTOGRAPH.....	78

1. Test Laboratory

1.1. Testing Location

Location A

Company Name: TMC Beijing, Telecommunication Metrology Center of MIIT
Address: No 52, Huayuan Bei Road, Haidian District, Beijing, P.R. China
Postal Code: 100191

Location B

Company Name: TMC Beijing, Telecommunication Metrology Center of MIIT
Address: Building Shouxiang, No.51, Xueyuan Road, Haidian District, Beijing, China
Postal Code: 100191

1.2. Testing Environment

Normal Temperature: 15-35°C
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

Receipt of Sample Dec. 24th, 2013
Testing Start Date: Dec. 30th, 2013
Testing End Date: Jan. 10th, 2014

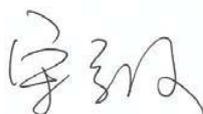
1.4. Signature



Qu Pengfei
(Prepared this test report)



Sun Xiangqian
(Reviewed this test report)



Song Chongwen
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name: Sony Mobile Communications (China) Co. Ltd
Address /Post: Sony Mobile R&D Center, No. 16, Guangshun South Street,
Chaoyang District
City: Beijing
Postal Code: 100102
Country: China
Contact Person: Ma, Gang
Telephone: +86-10-58656312
Fax: +86-10-58659049

2.2. Manufacturer Information

Company Name: Sony Mobile Communications AB
Address /Post: Mobilvägen, 22188 Lund, Sweden
City: Lund
Postal Code: 22188
Country: Sweden
Contact Person: Nilsson, Mikael
Telephone: +46 703 227503
Fax: +46 706 127385

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

3.1. About EUT

Description	GSM 850/900/1800/1900 quad bands, GPRS, EDGE, WCDMA FDD bands 1/5/8, HSDPA, HSUPA, LTE FDD bands 1/3/5/7/8/20, Bluetooth (EDR and 4.0), ANT+, WLAN (802.11 a/b/g/n), NFC, FM, GPS mobile phone
Type	PM-0762-BV
FCC ID	PY7PM-0762
GSM Frequency Band	GSM 850/900/1800/1900
UMTS Frequency Band	FDD Band 1 / FDD Band 5 / FDD Band 8
LTE Frequency Band	FDD Band 1 / FDD Band 3 / FDD Band 5 / FDD Band 7/ FDD Band 8 / FDD Band 20
Antenna	Internal
Power supply	Battery (charged by travel adapter or vehicle charger)
Extreme vol. Limits	3.5VDC to 4.1VDC (nominal: 3.7VDC)
Extreme temp. Tolerance	-20°C to +55°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Telecommunication Metrology Center of MIIT of People's Republic of China.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN	IMEI	HW Version	SW Version
EUT2	CB512686S7	004402451819522	AP1	19.0.A.0.250
EUT8	CB512686S6	004402451819506	AP1	19.0.A.0.250

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

3.3. Internal Identification of AE used during the test

AE ID*	Description	SN	Revision
AE1	Travel Charger	4413W 18 511285	1
AE3	USB Cable	131307D20BE8904	1
AE4	Embedded Battery	/	1C

AE1

Commercial name	EP880
Type	AC-0400-EU
Manufacturer	SALCOMP
Length of cable	98.5 cm (length of USB cable)

AE3

Commercial name	EC801
Type	AI-0401
Manufacturer	Sony Mobile
Length of cable	98.5 cm

AE4

Model name	1277-4767
Manufacturer	Sony Mobile
Minimum Capacitance	3000mAh
Nominal Voltage	3.8V

*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 of GSM/WCDMA/LTE Mobile Phone with integrated antenna and embedded battery.

The EUT supports GSM 850/900/1800/1900MHz bands, WCDMA FDD bands 1/5/8 and LTE FDD bands 1/3/5/7/8/20. It supports GPRS service with multi-slots class 33 and EGPRS service with multi-slots class 33. The HSDPA and HSUPA (Cat 6) features are also supported.

It has MP3, camera, USB memory, Mobile High-Definition Link (MHL), FM radio, GPS receiver, NFC, Bluetooth (EDR and Bluetooth 4.0), ANT+, WLAN (802.11 a/b/g/n) and Wi-Fi hotspot functions. For WLAN 802.11n, it supports 20MHz and 40MHz bandwidths on both 2.4GHz band and 5GHz/5.8GHz band.

It consists of normal options: USB cable and travel charger.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

3.5. EUT set-ups

EUT Set-up No.	Combination of EUT and AE	Remarks
Set.3	EUT2 + AE1 + AE3 + AE4	Tests with travel charger
Set.4	EUT2 + AE4	ERP/EIRP/RSE tests
Set.5	EUT8 + AE4	Conducted RF tests

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 15	Radio frequency devices	10-1-12 Edition
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-13 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-13 Edition
ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2004
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	2009
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v02r01

5. LABORATORY ENVIRONMENT

Semi-anechoic chamber SAC-1 (23 meters×17meters×10meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3m/10m distance, from 30 to 1000 MHz
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

Fully-anechoic chamber FAC-3 (9 meters×6.5 meters×4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 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

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

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

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 5

Items	Test Name	Clause in FCC rules	Section in this report	Verdict	Test Location
1	Output Power	22.913(a)	A.1	P	B
2	Emission Limit	22.917, 2.1051	A.2	P	B
3	Conducted Emission	15.107/207	A.3	P	A
4	Frequency Stability	22.355, 2.1055	A.4	P	B
5	Occupied Bandwidth	2.1049(h)(i)	A.5	P	B
6	Emission Bandwidth	22.917(b)	A.6	P	B
7	Band Edge Compliance	22.917(b)	A.7	P	B
8	Conducted Spurious Emission	22.917, 2.1057	A.8	P	B

LTE Band 7

Items	Test Name	Clause in FCC rules	Section in this report	Verdict	Test Location
1	Output Power	27.50(h)(2)	A.1	P	B
2	Emission Limit	27.53(m), 2.1051	A.2	P	B
3	Conducted Emission	15.107/15.207	A.3	P	A
4	Frequency Stability	27.54, 2.1055	A.4	P	B
5	Occupied Bandwidth	2.1049(h)(i)	A.5	P	B
6	Emission Bandwidth	27.53(m)	A.6	P	B
7	Band Edge Compliance	27.53(m)	A.7	P	B
8	Conducted Spurious Emission	27.53(m), 2.1057	A.8	P	B

6.2. Statements

The test cases listed in section 6.1 of this report for the EUT specified in section 3 were performed by TMC 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	SERIES NUMBER	MANUFACTURE	CAL DUE DATE
1.	Test Receiver	ESCI	100344	R&S	2014-03-28
2.	Spectrum Analyzer	E4440A	MY48250642	Agilent	2014-03-04
3.	LISN	ESH2-Z5	829991/012	R&S	2014-04-14
4.	EMI Antenna	VULB 9163	9163-482	Schwarzbeck	2014-02-17
5.	EMI Antenna	3117	00119024	ETS-Lindgren	2014-02-02
6.	EMI Antenna	3117	00058889	ETS-Lindgren	2014-02-02
7.	EMI Antenna	VUBA 9117	167	Schwarzbeck	2014-04-01
8.	Signal Generator	N5183A	MY49060052	Agilent	2014-03-19
9.	Power Amplifier	5S1G4	0341863	AR	2016-03-01
10.	Climatic chamber	SH-241	92003546	ESPEC	2014-05-11
11.	Universal Radio Communication Tester	CMW500	116588	R&S	2014-11-04

ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 22.913(a), 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.

The power was measured with spectrum analyzer's RMS detector.

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 5

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	824.7	23.69	22.84
		836.5	23.89	23.00
		848.3	23.77	22.87
	1 RB low	824.7	23.68	22.80
		836.5	23.77	22.88
		848.3	23.76	22.86
	50% RB mid	824.7	23.68	22.60
		836.5	23.83	22.73
		848.3	23.75	22.61
	100% RB	824.7	22.73	21.80
		836.5	22.82	21.96
		848.3	22.74	21.76

(continued)

3MHz	1 RB high	825.5	23.70	23.04
		836.5	23.77	23.08
		847.5	23.54	22.90
	1 RB low	825.5	23.73	23.03
		836.5	23.62	23.04
		847.5	23.66	22.98
	50% RB mid	825.5	22.64	21.79
		836.5	22.82	21.95
		847.5	22.69	21.77
	100% RB	825.5	22.69	21.78
		836.5	22.75	21.86
		847.5	22.77	21.82
5MHz	1 RB high	826.5	23.70	22.74
		836.5	23.79	22.80
		846.5	23.63	22.69
	1 RB low	826.5	23.77	22.78
		836.5	23.65	22.67
		846.5	23.61	22.63
	50% RB mid	826.5	22.73	21.81
		836.5	22.91	21.95
		846.5	22.72	21.84
	100% RB	826.5	22.71	21.87
		836.5	22.78	21.92
		846.5	22.75	21.86
10MHz	1 RB high	829.0	23.72	23.11
		836.5	23.81	23.08
		844.0	23.61	22.99
	1 RB low	829.0	23.74	23.03
		836.5	23.66	23.03
		844.0	23.56	22.93
	50% RB mid	829.0	22.72	21.80
		836.5	22.80	21.86
		844.0	22.75	21.76
	100% RB	829.0	22.71	21.83
		836.5	22.77	21.88
		844.0	22.79	21.84

LTE band 7

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2502.5	22.33	21.31
		2535	22.44	21.46
		2567.5	22.50	21.49
	1 RB low	2502.5	22.36	21.36
		2535	22.33	21.30
		2567.5	22.22	21.21
	50% RB mid	2502.5	21.27	20.29
		2535	21.46	20.39
		2567.5	21.33	20.28
	100% RB	2502.5	21.27	20.29
		2535	21.47	20.50
		2567.5	21.35	20.34
10MHz	1 RB high	2505	22.34	21.42
		2535	22.49	21.47
		2565	22.40	21.50
	1 RB low	2505	22.44	21.47
		2535	22.23	21.20
		2565	22.14	21.43
	50% RB mid	2505	21.44	20.43
		2535	21.47	20.37
		2565	21.38	20.38
	100% RB	2505	21.48	20.45
		2535	21.49	20.38
		2565	21.45	20.37
15MHz	1 RB high	2507.5	22.30	21.37
		2535	22.48	21.50
		2562.5	22.39	21.42
	1 RB low	2507.5	22.42	21.50
		2535	22.30	21.41
		2562.5	22.14	21.18
	50% RB mid	2507.5	21.40	20.47
		2535	21.26	20.48
		2562.5	21.44	20.50
	100% RB	2507.5	21.43	20.40
		2535	21.46	20.40
		2562.5	21.42	20.35

(continued)

20MHz	1 RB high	2510	22.42	21.46
		2535	22.48	21.50
		2560	22.39	21.41
	1 RB low	2510	22.39	21.49
		2535	22.40	21.38
		2560	22.17	21.23
	50% RB mid	2510	21.43	20.45
		2535	21.47	20.46
		2560	21.37	20.36
	100% RB	2510	21.43	20.45
		2535	21.43	20.36
		2560	21.39	20.40

Note: Expanded measurement uncertainty is $U = 0.83$ dB, $k = 2$.

A.1.3 Radiated

A.1.3.1 Description

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

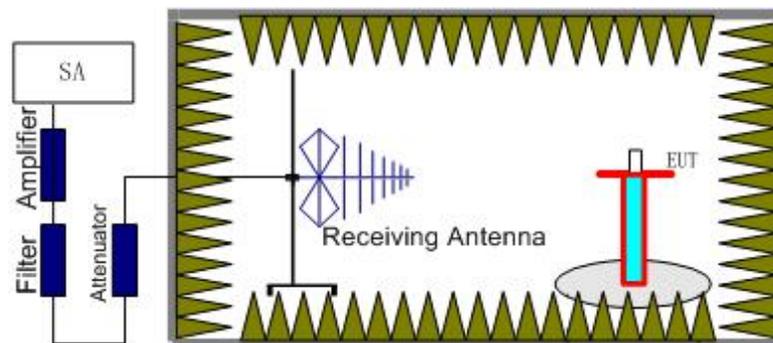
Rule Part 22.913(a) specifies "Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

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

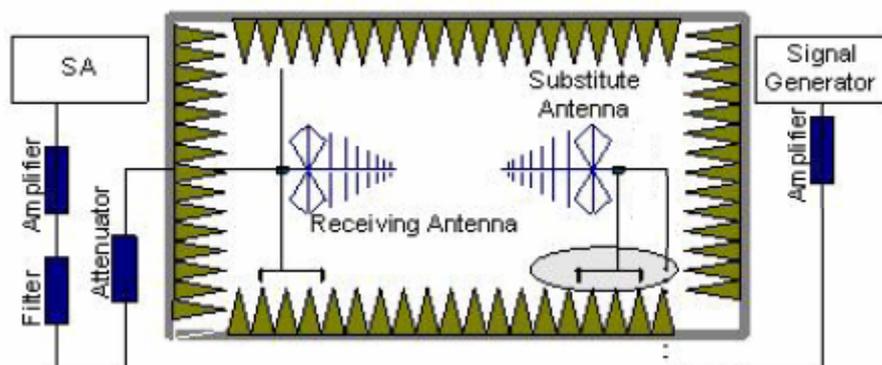
A.1.3.2 Method of Measurement

The measurements procedures in TIA-603C-2004 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.

- 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:

$$\text{Power (EIRP)} = P_{Mea} - P_{Ag} - P_{cl} - G_a$$

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

For test layout photo, please refer to Pic.1 in Annex B.

A.1.3.3 Measurement result

LTE Band 5- ERP 22.913(a)

Limits: $\leq 38.45\text{dBm}$ (7W)

LTE Band 5_1.4MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	Cable Loss (dB)	P_{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
824.70	-24.82	2.07	-53.00	0.84	2.15	23.12	Vertical
836.50	-24.79	2.08	-53.00	0.90	2.15	23.08	Vertical
848.30	-25.55	2.09	-53.00	0.95	2.15	22.26	Vertical

LTE Band 5_3MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	Cable Loss (dB)	P_{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
825.50	-24.78	2.07	-53.00	0.85	2.15	23.15	Vertical
836.50	-24.67	2.08	-53.00	0.90	2.15	23.20	Vertical
847.50	-25.60	2.09	-53.00	0.94	2.15	22.22	Vertical

LTE Band 5_5MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	Cable Loss (dB)	P_{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
826.50	-25.11	2.07	-53.00	0.85	2.15	22.82	Vertical
836.50	-24.90	2.08	-53.00	0.90	2.15	22.97	Vertical
846.50	-25.33	2.09	-53.00	0.94	2.15	22.49	Vertical

LTE Band 5_10MHz_QPSK

Frequency (MHz)	P_{Mea} (dBm)	Cable Loss (dB)	P_{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
829.00	-25.59	2.08	-53.00	0.86	2.15	22.32	Vertical
836.50	-24.87	2.08	-53.00	0.90	2.15	23.00	Vertical
844.00	-24.97	2.09	-53.00	0.93	2.15	22.86	Vertical

LTE Band 5_1.4MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
824.70	-24.81	2.07	-53.00	0.84	2.15	23.13	Vertical
836.50	-24.77	2.08	-53.00	0.90	2.15	23.10	Vertical
848.30	-25.55	2.09	-53.00	0.95	2.15	22.26	Vertical

LTE Band 5_3MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
825.50	-24.93	2.07	-53.00	0.85	2.15	23.00	Vertical
836.50	-24.82	2.08	-53.00	0.90	2.15	23.05	Vertical
847.50	-25.75	2.09	-53.00	0.94	2.15	22.07	Vertical

LTE Band 5_5MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
826.50	-25.04	2.07	-53.00	0.85	2.15	22.89	Vertical
836.50	-24.78	2.08	-53.00	0.90	2.15	23.09	Vertical
846.50	-25.82	2.09	-53.00	0.94	2.15	22.00	Vertical

LTE Band 5_10MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	Correction (dB)	RMS ERP (dBm)	Polarization
829.00	-25.79	2.08	-53.00	0.86	2.15	22.12	Vertical
836.50	-24.98	2.08	-53.00	0.90	2.15	22.89	Vertical
844.00	-25.02	2.09	-53.00	0.93	2.15	22.81	Vertical

Sample calculation: LTE Band 5, 3 MHz bandwidth, frequency 836.50 MHz, QPSK

$$\begin{aligned} \text{Peak ERP(dBm)} &= P_{\text{Mea}}(-24.67 \text{ dBm}) - G_a (0.90 \text{ dBi}) - P_{\text{Ag}} (-53.00 \text{ dB}) - P_{\text{cl}} (2.08 \text{ dB}) - 2.15 \text{ dB} \\ &= 23.20 \text{ dBm} \end{aligned}$$

LTE Band 7_5MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2502.50	-30.38	3.59	-50.00	-5.41	21.44	Horizontal
2535.00	-30.00	3.62	-50.00	-5.49	21.87	Horizontal
2567.50	-31.17	3.65	-50.00	-5.58	20.76	Horizontal

LTE Band 7_10MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2505.00	-30.96	3.59	-50.00	-5.41	20.86	Horizontal
2535.00	-29.94	3.62	-50.00	-5.49	21.93	Horizontal
2565.00	-31.40	3.65	-50.00	-5.57	20.52	Horizontal

LTE Band 7_15MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2507.50	-31.51	3.59	-50.00	-5.42	20.32	Horizontal
2535.00	-29.99	3.62	-50.00	-5.49	21.88	Horizontal
2562.50	-31.76	3.64	-50.00	-5.56	20.16	Horizontal

LTE Band 7_20MHz_QPSK

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2510.00	-32.89	3.59	-50.00	-5.43	18.95	Horizontal
2535.00	-29.93	3.62	-50.00	-5.49	21.94	Horizontal
2560.00	-33.07	3.64	-50.00	-5.56	18.85	Horizontal

LTE Band 7_5MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2502.50	-30.62	3.59	-50.00	-5.41	21.20	Horizontal
2535.00	-29.95	3.62	-50.00	-5.49	21.92	Horizontal
2567.50	-31.55	3.65	-50.00	-5.58	20.38	Horizontal

LTE Band 7_10MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2505.00	-31.15	3.59	-50.00	-5.41	20.67	Horizontal
2535.00	-30.02	3.62	-50.00	-5.49	21.85	Horizontal
2565.00	-31.44	3.65	-50.00	-5.57	20.48	Horizontal

LTE Band 7_15MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2507.50	-31.57	3.59	-50.00	-5.42	20.26	Horizontal
2535.00	-30.03	3.62	-50.00	-5.49	21.84	Horizontal
2562.50	-32.50	3.64	-50.00	-5.56	19.42	Horizontal

LTE Band 7_20MHz_16QAM

Frequency (MHz)	P _{Mea} (dBm)	Cable Loss (dB)	P _{Ag} (dB)	Antenna Gain(dBi)	RMS EIRP(dBm)	Polarization
2510.00	-32.90	3.59	-50.00	-5.43	18.94	Horizontal
2535.00	-30.00	3.62	-50.00	-5.49	21.87	Horizontal
2560.00	-33.22	3.64	-50.00	-5.56	18.70	Horizontal

Sample calculation: LTE Band 7, 20 MHz bandwidth, frequency 2535 MHz, QPSK

$$\begin{aligned} \text{Peak EIRP(dBm)} &= P_{\text{Mea}}(-29.93 \text{ dBm}) - G_a (-5.49 \text{ dBi}) - P_{\text{Ag}} (-50.00 \text{ dB}) - P_{\text{cl}} (3.62 \text{ dB}) \\ &= 21.94 \text{ dBm} \end{aligned}$$

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 $U = 0.96 \text{ dB}$, $k = 2$.

A.2 EMISSION LIMIT

Reference

FCC: CFR 2.1051, Part 22.917(a), 27.53(m).

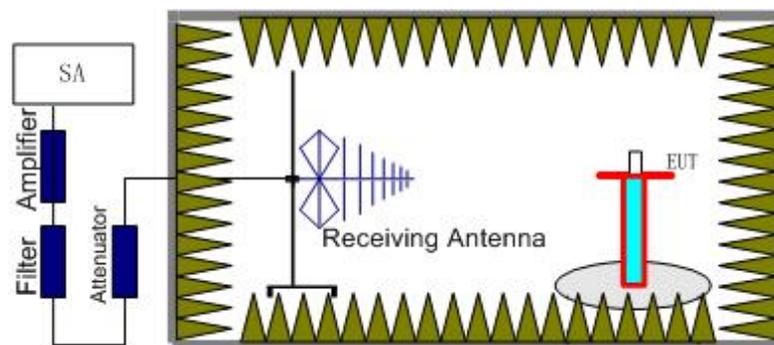
A.2.1 Measurement Method

The measurements procedures in TIA-603C-2004 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

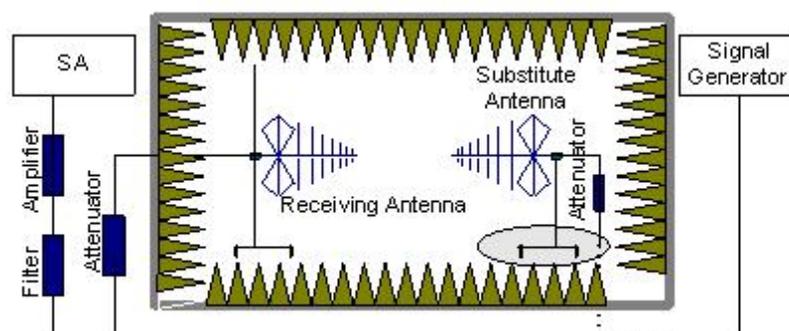
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917 and Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 5 and 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:

$$\text{Power (EIRP)} = P_{Mea} + P_{pl} + G_a$$

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 22.917(a) and 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 Bands 5 and 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 Bands 5 and 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 5, 1.4MHz, QPSK, Channel 20407

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
2654.28	-50.77	3.70	-5.80	2.15	-50.82	-13.00	Vertical
4003.93	-61.83	4.62	-8.50	2.15	-60.10	-13.00	Vertical
4825.39	-61.99	5.14	-9.39	2.15	-59.89	-13.00	Vertical
5685.59	-61.27	5.51	-10.07	2.15	-58.86	-13.00	Horizontal
6383.91	-61.15	5.82	-10.51	2.15	-58.61	-13.00	Horizontal
7149.74	-61.07	6.37	-11.19	2.15	-58.40	-13.00	Horizontal

LTE Band 5, 1.4MHz, QPSK, Channel 20525

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1671.95	-53.03	2.98	-5.34	2.15	-52.82	-13.00	Horizontal
3622.56	-64.31	4.38	-8.05	2.15	-62.79	-13.00	Horizontal
5321.94	-63.47	5.40	-9.89	2.15	-61.13	-13.00	Vertical
6204.99	-61.59	5.78	-10.36	2.15	-59.16	-13.00	Vertical
7176.60	-62.39	6.37	-11.21	2.15	-59.70	-13.00	Vertical
7930.84	-62.08	6.97	-11.83	2.15	-59.37	-13.00	Vertical

LTE Band 5, 1.4MHz, QPSK, Channel 20643

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
3637.74	-63.04	4.38	-8.07	2.15	-61.50	-13.00	Horizontal
4446.84	-62.93	4.81	-8.77	2.15	-61.12	-13.00	Vertical
5324.21	-60.55	5.40	-9.89	2.15	-58.21	-13.00	Horizontal
6257.79	-62.20	5.82	-10.41	2.15	-59.76	-13.00	Horizontal
6921.47	-62.51	6.08	-11.02	2.15	-59.72	-13.00	Horizontal
7899.95	-61.27	6.94	-11.80	2.15	-58.56	-13.00	Vertical

LTE Band 5, 1.4MHz, 16QAM, Channel 20407

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
2474.93	-51.59	3.56	-5.32	2.15	-51.98	-13.00	Horizontal
3461.46	-63.95	4.24	-7.81	2.15	-62.53	-13.00	Vertical
4712.95	-60.88	4.96	-9.18	2.15	-58.81	-13.00	Vertical
5826.89	-62.00	5.75	-10.13	2.15	-59.77	-13.00	Vertical
6822.06	-62.23	6.17	-10.92	2.15	-59.63	-13.00	Vertical
8071.88	-61.22	6.92	-11.94	2.15	-58.35	-13.00	Horizontal

LTE Band 5, 1.4MHz, 16QAM, Channel 20525

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1671.80	-53.96	2.98	-5.34	2.15	-53.75	-13.00	Horizontal
2507.86	-46.69	3.59	-5.42	2.15	-47.01	-13.00	Horizontal
3321.58	-63.09	4.15	-7.47	2.15	-61.92	-13.00	Vertical
4027.70	-61.95	4.69	-8.52	2.15	-60.27	-13.00	Horizontal
4906.43	-63.73	5.13	-9.53	2.15	-61.48	-13.00	Horizontal
6879.34	-63.36	6.07	-10.98	2.15	-60.60	-13.00	Horizontal

LTE Band 5, 1.4MHz, 16QAM, Channel 20643

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
2543.24	-49.37	3.63	-5.51	2.15	-49.64	-13.00	Horizontal
3382.95	-62.03	4.23	-7.62	2.15	-60.79	-13.00	Horizontal
5278.38	-62.59	5.34	-9.87	2.15	-60.21	-13.00	Vertical
6150.23	-61.29	5.85	-10.32	2.15	-58.97	-13.00	Horizontal
6984.46	-61.32	6.23	-11.08	2.15	-58.62	-13.00	Horizontal
7819.09	-61.76	6.91	-11.72	2.15	-59.10	-13.00	Horizontal

LTE Band 7, 5 MHz, QPSK, Channel 20775

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5000.76	-57.62	5.17	-9.70	-53.09	-13.00	Vertical
7500.97	-49.26	6.61	-11.40	-44.47	-13.00	Horizontal
10001.38	-50.43	7.99	-12.40	-46.02	-13.00	Horizontal
12637.41	-58.15	8.75	-12.86	-54.04	-13.00	Horizontal
15076.39	-55.44	9.77	-13.48	-51.73	-13.00	Horizontal
17581.80	-53.92	10.73	-13.35	-51.30	-13.00	Horizontal

LTE Band 7, 5 MHz, QPSK, Channel 21100

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5342.52	-60.59	5.41	-9.91	-56.09	-13.00	Vertical
7598.65	-48.67	6.88	-11.50	-44.05	-13.00	Vertical
10131.12	-50.81	7.97	-12.43	-46.35	-13.00	Horizontal
12197.72	-55.29	8.91	-12.58	-51.62	-13.00	Vertical
15213.98	-55.49	9.81	-13.46	-51.84	-13.00	Horizontal
17074.94	-53.31	10.59	-12.53	-51.37	-13.00	Horizontal

LTE Band 7, 5 MHz, QPSK, Channel 21425

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5334.35	-61.50	5.41	-9.90	-57.01	-13.00	Vertical
7696.03	-50.72	6.56	-11.60	-45.68	-13.00	Horizontal
10261.55	-48.63	7.55	-12.45	-43.73	-13.00	Horizontal
12826.96	-47.16	9.06	-13.09	-43.13	-13.00	Vertical
15071.14	-53.58	9.75	-13.49	-49.84	-13.00	Vertical
17626.42	-51.85	10.64	-13.38	-49.11	-13.00	Horizontal

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

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5341.02	-62.30	5.41	-9.90	-57.81	-13.00	Vertical
7501.04	-50.03	6.61	-11.40	-45.24	-13.00	Horizontal
10001.44	-53.08	7.99	-12.40	-48.67	-13.00	Horizontal
12485.62	-56.59	8.74	-12.69	-52.64	-13.00	Horizontal
14947.77	-55.31	9.52	-13.51	-51.32	-13.00	Horizontal
17700.29	-53.22	10.63	-13.42	-50.43	-13.00	Vertical

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

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5025.92	-63.74	5.16	-9.72	-59.18	-13.00	Horizontal
7598.32	-49.41	6.88	-11.50	-44.79	-13.00	Vertical
10131.21	-50.28	7.97	-12.43	-45.82	-13.00	Horizontal
12456.21	-56.39	8.75	-12.68	-52.46	-13.00	Horizontal
14882.84	-55.14	9.62	-13.52	-51.24	-13.00	Horizontal
17683.92	-53.84	10.60	-13.41	-51.03	-13.00	Horizontal

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

Frequency (MHz)	P _{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit (dBm)	Polarization
5130.66	-47.95	5.25	-9.78	-43.42	-13.00	Horizontal
7696.09	-52.33	6.56	-11.60	-47.29	-13.00	Horizontal
10261.39	-47.91	7.55	-12.45	-43.01	-13.00	Horizontal
12761.58	-58.44	9.02	-13.01	-54.45	-13.00	Horizontal
15021.16	-57.41	9.68	-13.50	-53.59	-13.00	Horizontal
17610.02	-54.58	10.70	-13.37	-51.91	-13.00	Vertical

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

A.3 CONDUCTED EMISSION

Reference

FCC: CFR Part 15.107/207

The measurement procedure in ANSI C63.4-2009 is used. Conducted emission is measured with travel charger. The EUT is working under LTE FDD bands 5/7 traffic mode which is the worst case of conducted emission measurement.

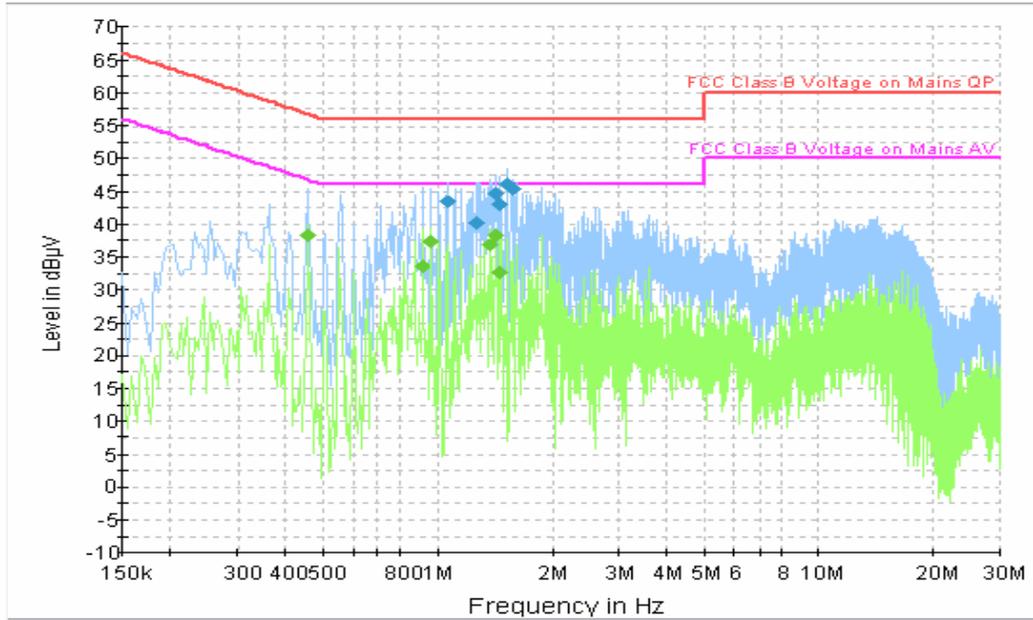
For test layout photo, please refer to Pic.2 in Annex B.

A.3.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi -Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with logarithm of the frequency

A.3.2 Measurement result
LTE Band 5, 1.4 MHz bandwidth



IF bandwidth 9 kHz

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

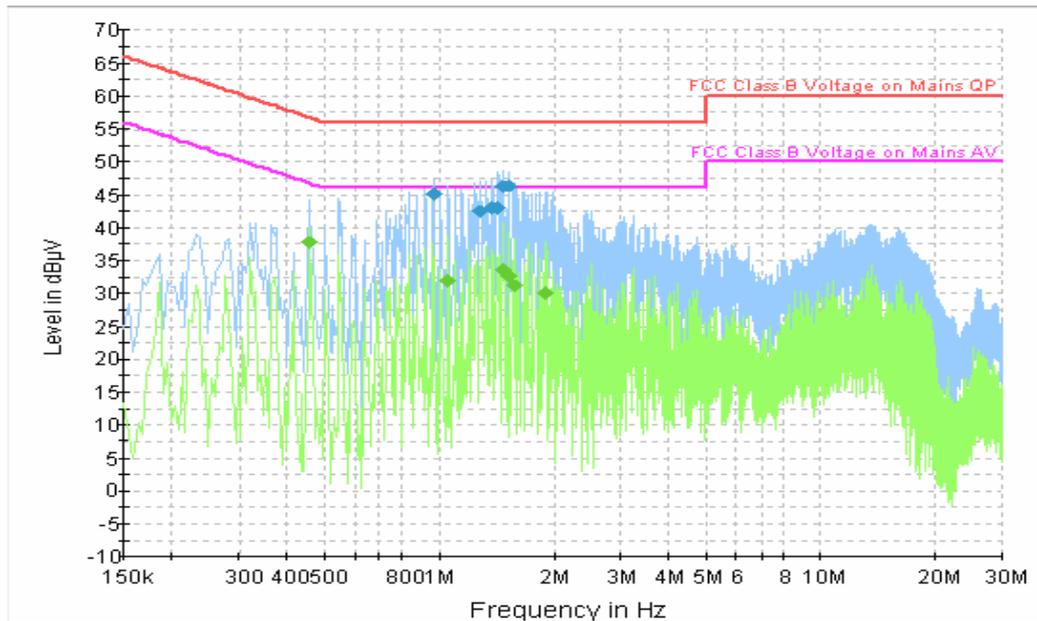
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.068000	43.4	GND	L1	9.7	12.6	56.0
1.270500	40.2	GND	L1	9.7	15.8	56.0
1.423500	44.8	GND	L1	9.7	11.2	56.0
1.468500	43.1	GND	L1	9.7	12.9	56.0
1.527000	46.0	GND	L1	9.7	10.0	56.0
1.572000	45.3	GND	L1	9.7	10.7	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.460500	38.3	GND	L1	9.8	8.4	46.7
0.915000	33.6	GND	L1	9.7	12.4	46.0
0.969000	37.3	GND	L1	9.7	8.7	46.0
1.378500	36.8	GND	L1	9.7	9.2	46.0
1.428000	38.4	GND	L1	9.7	7.6	46.0
1.468500	32.6	GND	L1	9.7	13.4	46.0

LTE Band 7, 5 MHz bandwidth



IF bandwidth 9 kHz

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.973500	45.1	GND	L1	9.7	10.9	56.0
1.284000	42.5	GND	L1	9.7	13.5	56.0
1.378500	43.0	GND	L1	9.7	13.0	56.0
1.419000	43.1	GND	L1	9.7	12.9	56.0
1.482000	46.2	GND	L1	9.7	9.8	56.0
1.527000	46.4	GND	L1	9.7	9.6	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.460500	37.7	GND	L1	9.8	9.0	46.7
1.054500	31.9	GND	L1	9.7	14.1	46.0
1.482000	33.7	GND	L1	9.7	12.3	46.0
1.527000	32.6	GND	L1	9.7	13.4	46.0
1.572000	31.1	GND	L1	9.7	14.9	46.0
1.896000	30.0	GND	L1	9.7	16.0	46.0

Note: The maximum value of expanded measurement uncertainty for this test item is $U=2.9$ dB, $k = 2$.

A.4 FREQUENCY STABILITY

Reference

FCC: CFR Part 2.1055, 22.355, 27.54.

A.4.1 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°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE bands 5/7, 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°C increments from -30°C to +50°C. 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°C.
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 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

A.4.2 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. 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 3.5VDC and 4.1VDC, with a nominal voltage of 3.7VDC. 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

Room Temperature: 24 °C

LTE Band 5, 1.4 MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.7	-2	17	0.002	0.021
4.1	-4	20	0.005	0.024
3.5	-5	19	0.006	0.023

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	0	15	0.000	0.018
40°	-4	15	0.004	0.018
30°	-3	15	0.004	0.018
20°	-3	15	0.003	0.018
10°	-2	13	0.002	0.015
0°	-1	14	0.001	0.016
- 10°	-4	13	0.004	0.016
- 20°	-3	15	0.004	0.018
- 30°	-3	15	0.004	0.018

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

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.7	7	1	0.003	0.001
4.1	-5	-10	0.002	0.004
3.5	-4	-16	0.001	0.007

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-6	-13	0.002	0.005
40°	-5	-5	0.002	0.002
30°	-10	-5	0.004	0.002
20°	-9	-16	0.004	0.006
10°	-3	-9	0.001	0.003
0°	8	-8	0.003	0.003
- 10°	-1	0	0.000	0.000
- 20°	3	-10	0.001	0.004
- 30°	6	-10	0.003	0.004

Expanded measurement uncertainty for this test item is 10 Hz, $k = 2$.

A.5 OCCUPIED BANDWIDTH

Reference

FCC: CFR Part 2.1049(h)(i)

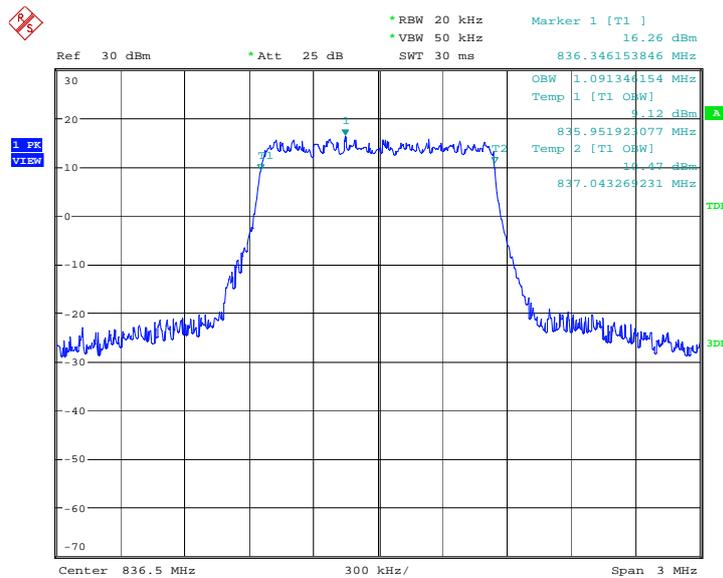
A.5.1 Occupied Bandwidth Measurement Results

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 of the LTE bands 5 and 7. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

LTE band 5, 1.4 MHz (99% BW)

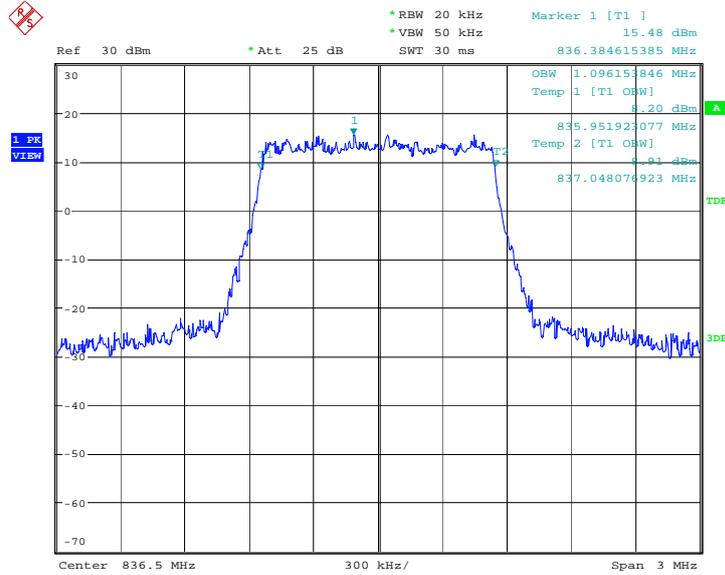
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
836.5MHz	1091.346	1096.154

LTE band 5, 1.4 MHz Bandwidth, QPSK (99% BW)



Date: 31.DEC.2013 08:43:50

LTE band 5, 1.4 MHz Bandwidth, 16QAM (99% BW)

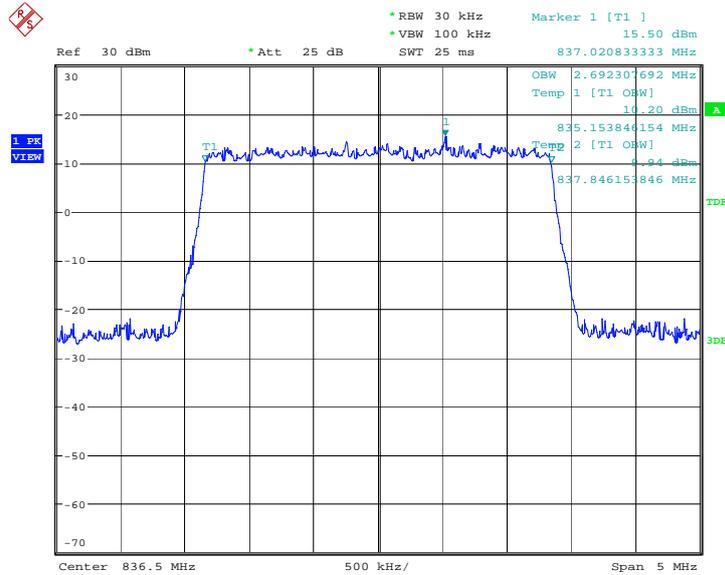


Date: 31.DEC.2013 08:44:03

LTE band 5, 3 MHz (99% BW)

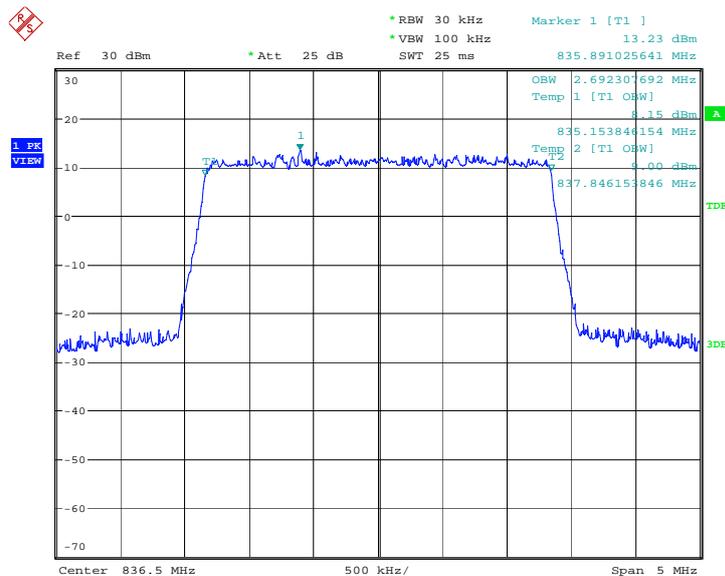
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
836.5MHz	2692.308	2692.308

LTE band 5, 3 MHz Bandwidth, QPSK (99% BW)



Date: 31.DEC.2013 09:07:43

LTE band 5, 3 MHz Bandwidth,16QAM (99% BW)

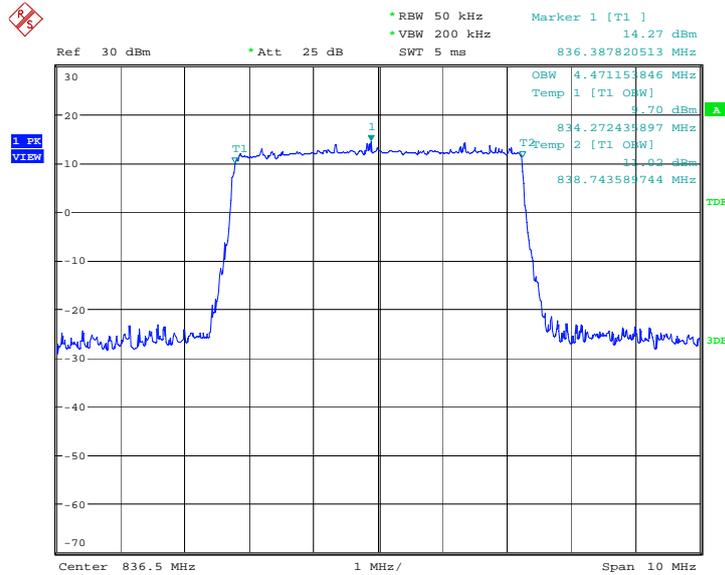


Date: 31.DEC.2013 09:07:57

LTE band 5, 5MHz (99% BW)

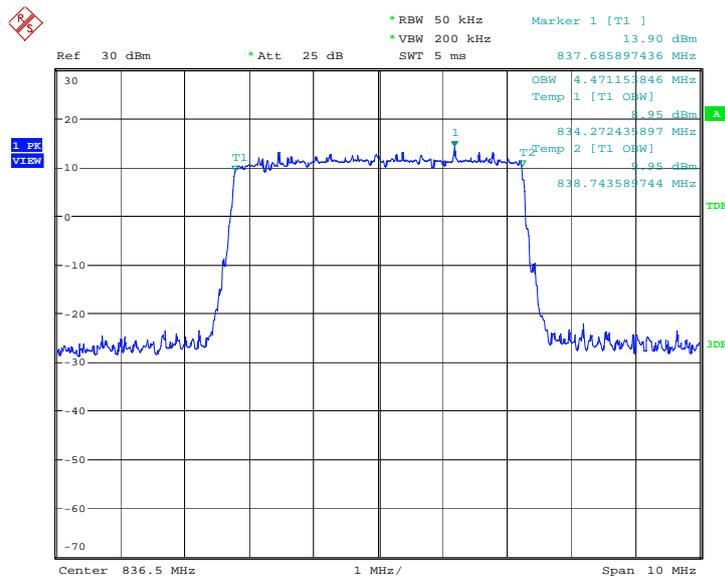
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
836.5MHz	4471.154	4471.154

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



Date: 31.DEC.2013 09:30:35

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

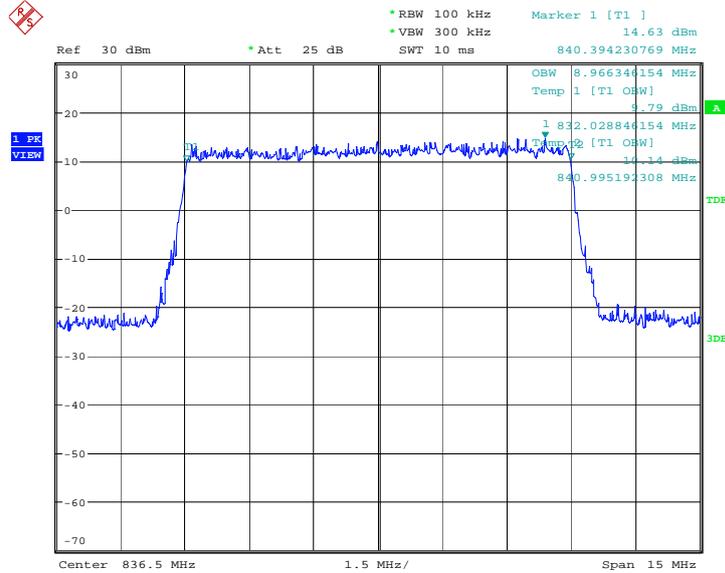


Date: 31.DEC.2013 09:30:48

LTE band 5, 10MHz (99% BW)

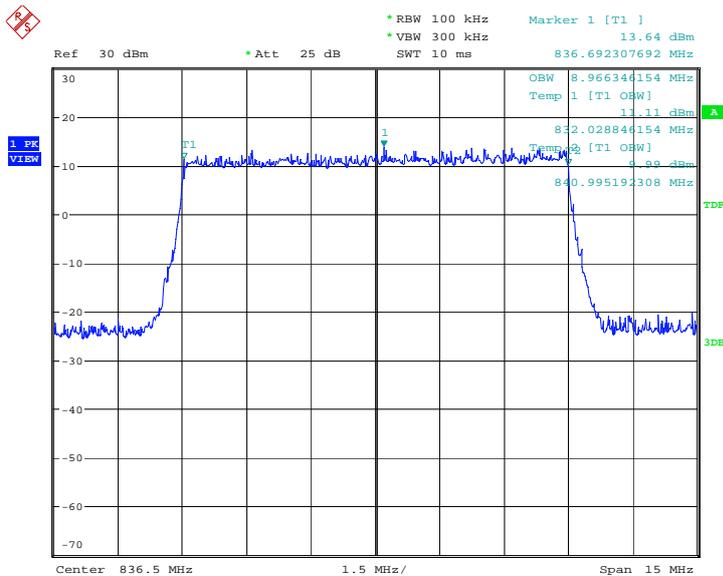
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
836.5MHz	8966.346	8966.346

LTE band 5, 10MHz Bandwidth, QPSK (99% BW)



Date: 31.DEC.2013 09:53:30

LTE band 5, 10MHz Bandwidth, 16QAM (99% BW)

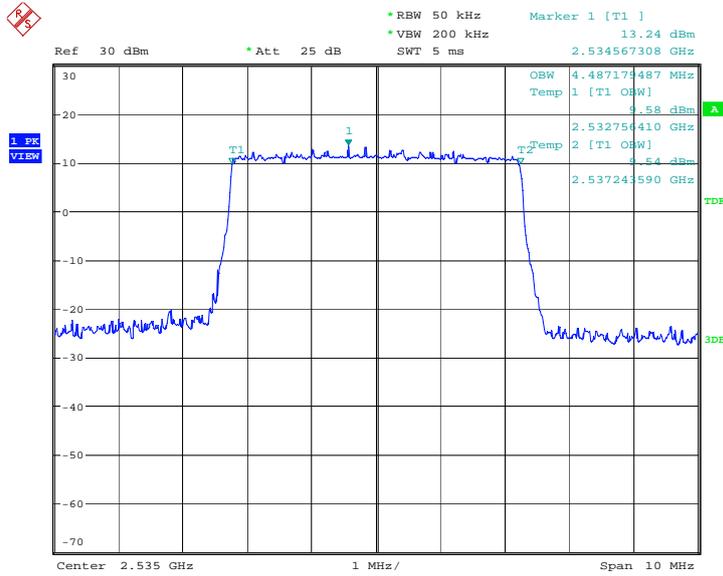


Date: 31.DEC.2013 09:53:43

LTE band 7, 5MHz (99% BW)

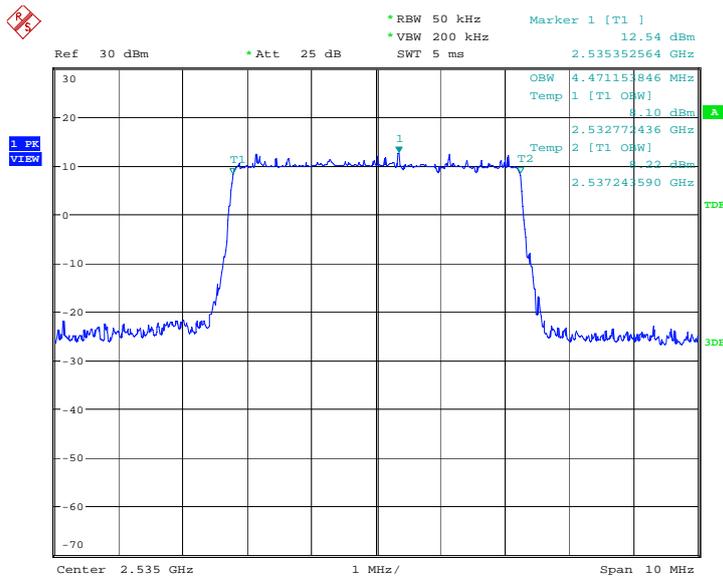
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
2535	4487.179	4471.154

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



Date: 7.JAN.2014 10:16:35

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

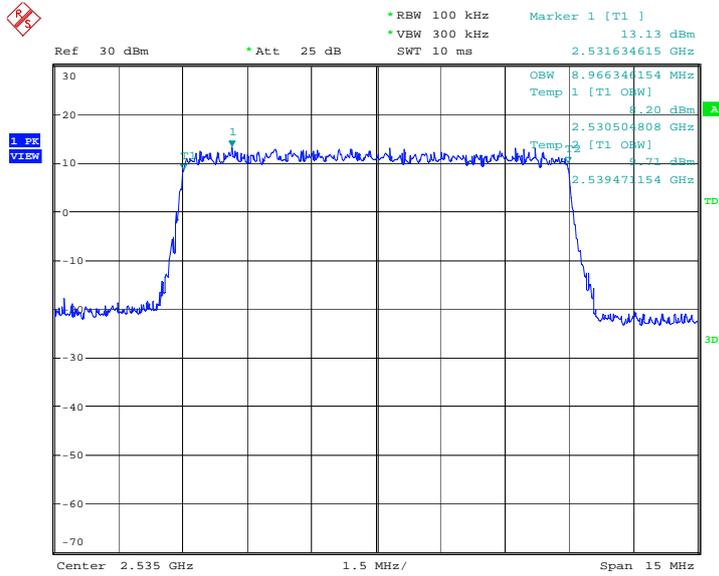


Date: 7.JAN.2014 10:16:49

LTE band 7, 10MHz (99% BW)

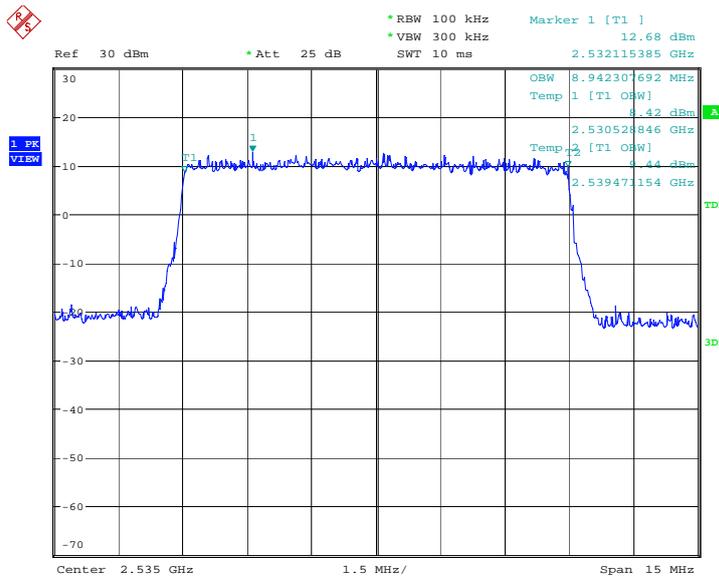
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
2535	8966.346	8942.308

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



Date: 7.JAN.2014 10:17:40

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

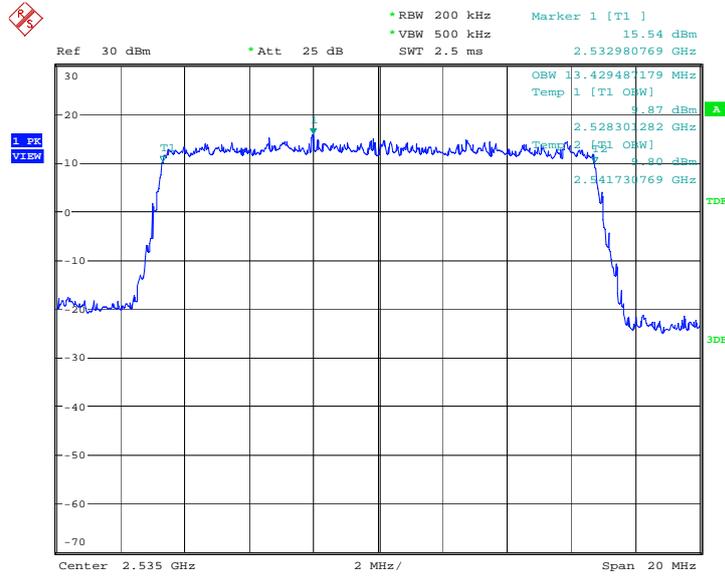


Date: 7.JAN.2014 10:17:54

LTE band 7, 15MHz (99% BW)

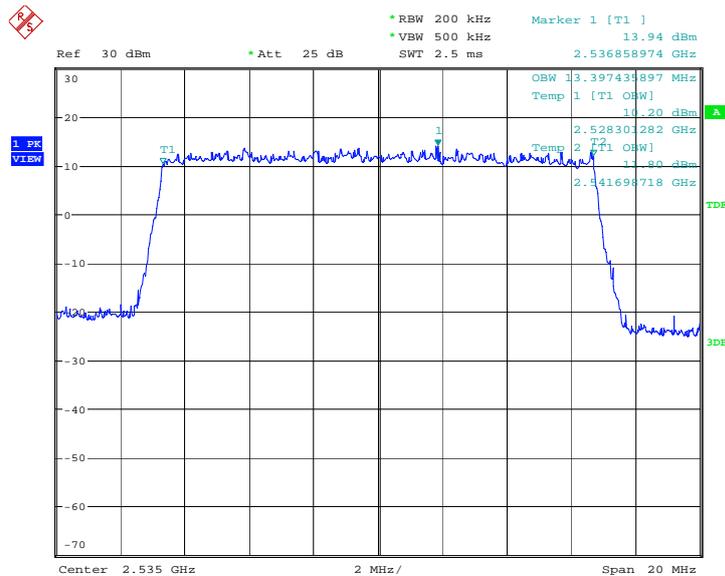
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
2535	13429.487	13397.436

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



Date: 7.JAN.2014 10:18:45

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

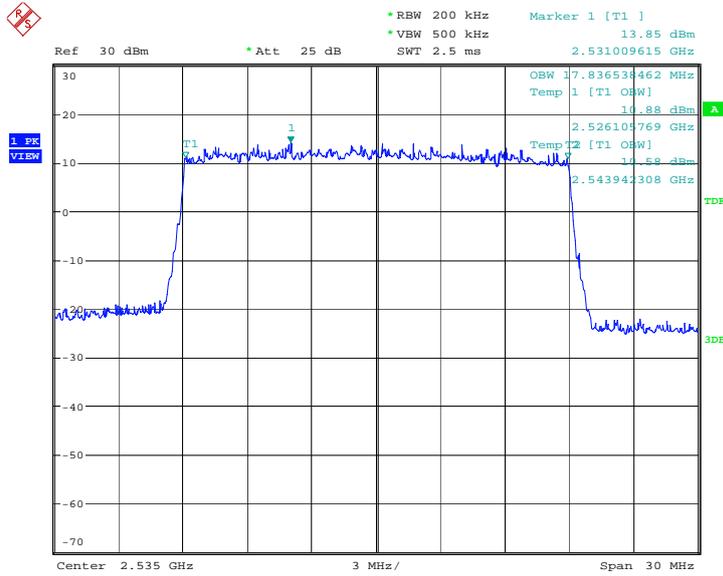


Date: 7.JAN.2014 10:18:59

LTE band 7, 20MHz (99% BW)

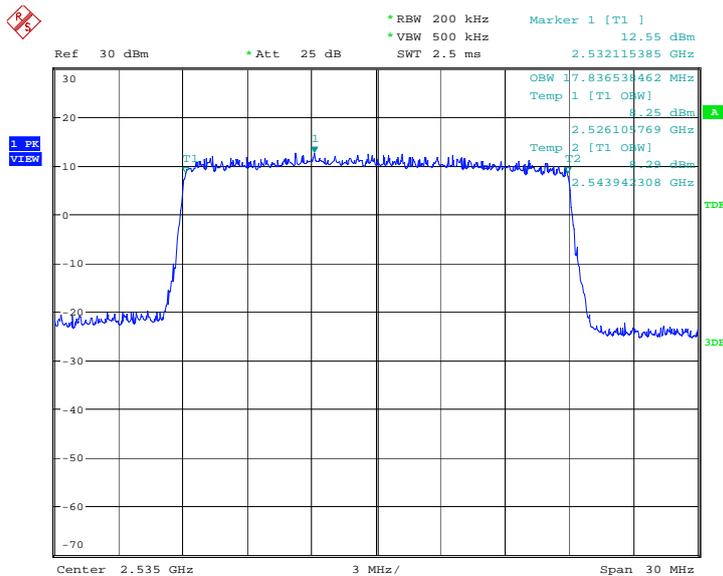
Frequency (MHz)	Occupied Bandwidth (99% BW)(kHz)	
	QPSK	16QAM
2535	17836.538	17836.538

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



Date: 7.JAN.2014 10:19:50

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



Date: 7.JAN.2014 10:20:04

A.6 EMISSION BANDWIDTH

Reference

FCC: CFR Part 22.917(b), 27.53(m)

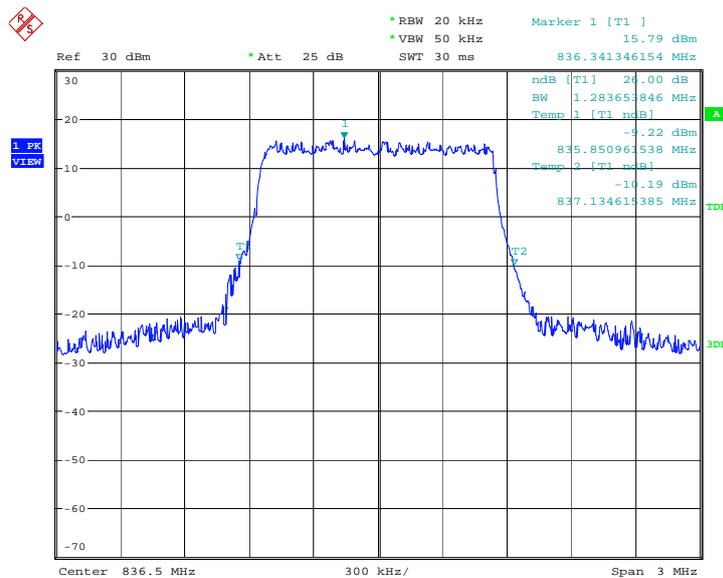
A.6.1 Emission Bandwidth Measurement Results

Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE bands 5 and 7. Table below lists the measured 100% BW. Spectrum analyzer plots are included on the following pages.

LTE band 5, 1.4 MHz (100% BW)

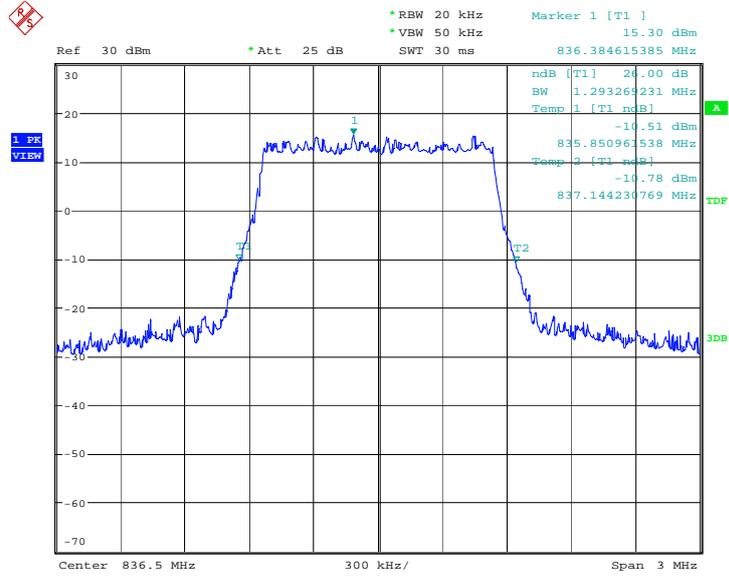
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
836.5	1283.654	1293.269

LTE band 5, 1.4 MHz Bandwidth, QPSK (100% BW)



Date: 31.DEC.2013 08:48:12

LTE band 5, 1.4 MHz Bandwidth, 16QAM (100% BW)

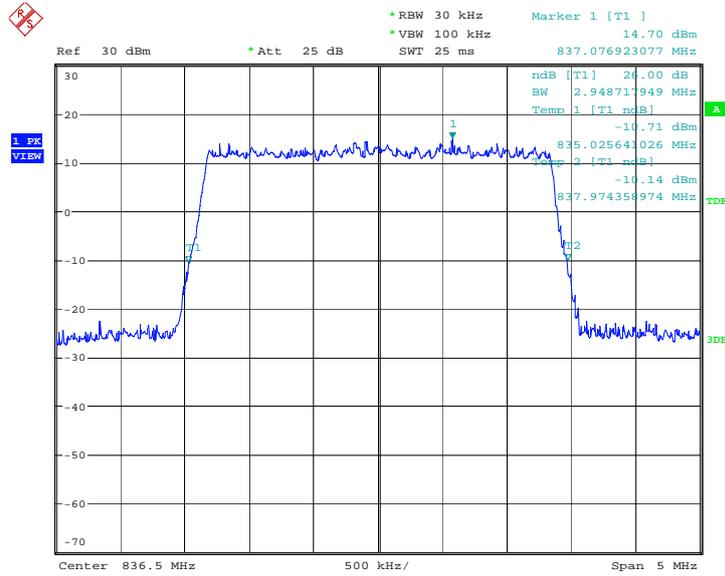


Date: 31.DEC.2013 08:48:27

LTE band 5, 3 MHz (100% BW)

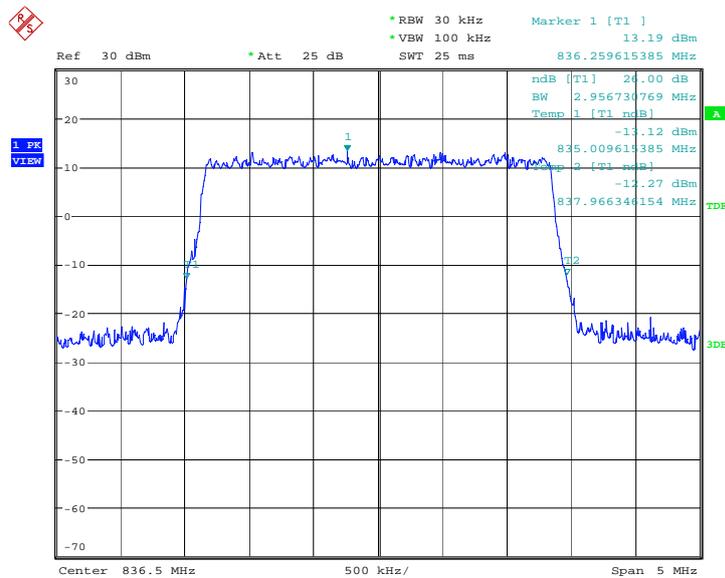
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
836.5	2948.718	2956.731

LTE band 5, 3 MHz Bandwidth, QPSK (100% BW)



Date: 31.DEC.2013 09:11:56

LTE band 5, 3 MHz Bandwidth,16QAM (100% BW)

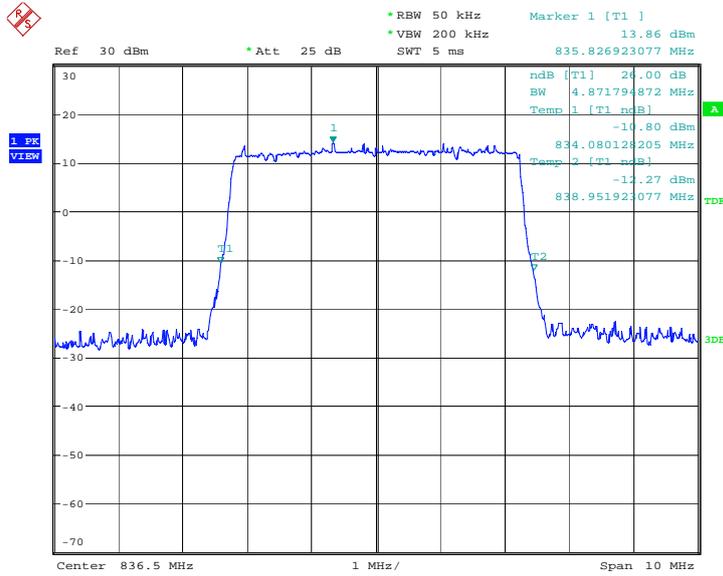


Date: 31.DEC.2013 09:12:11

LTE band 5, 5 MHz (100% BW)

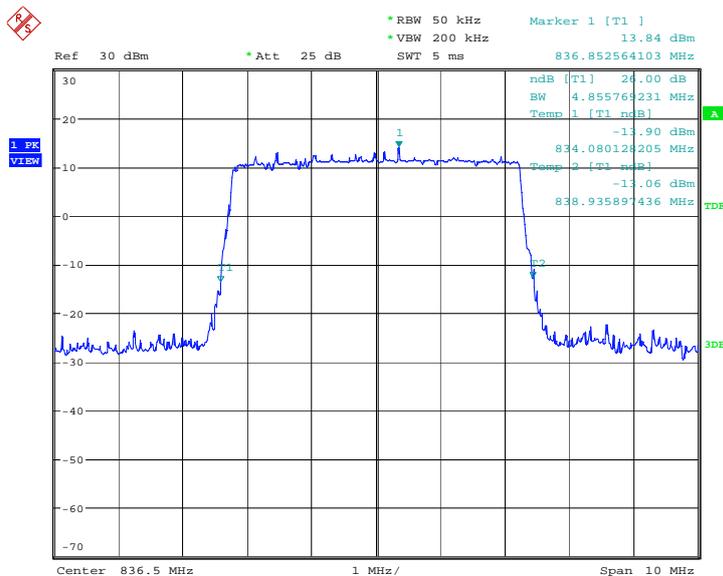
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
836.5	4871.795	4855.769

LTE band 5, 5 MHz Bandwidth, QPSK (100% BW)



Date: 31.DEC.2013 09:34:48

LTE band 5, 5 MHz Bandwidth, 16QAM (100% BW)

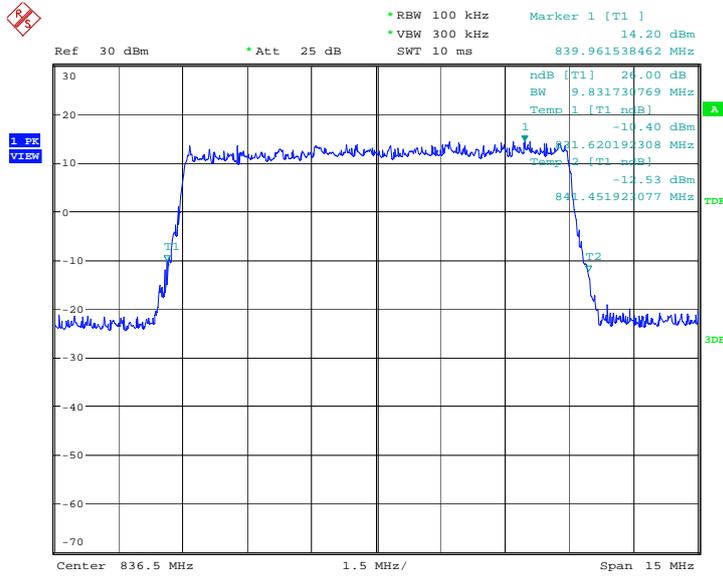


Date: 31.DEC.2013 09:35:03

LTE band 5, 10 MHz (100% BW)

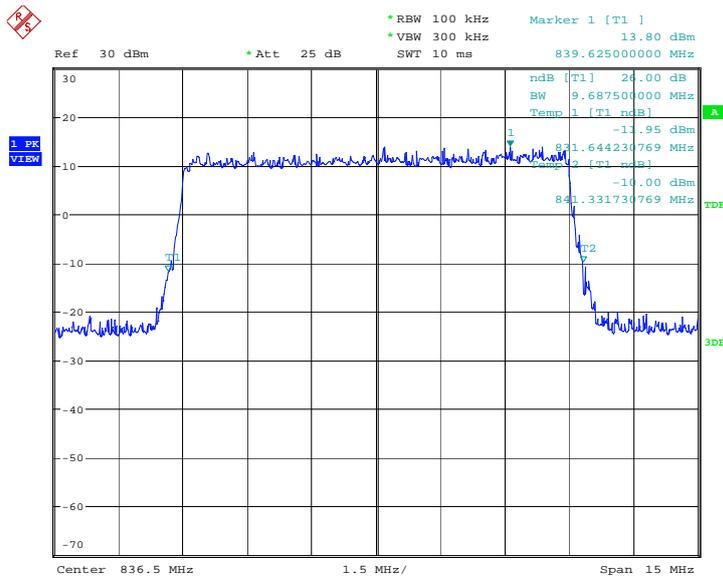
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
836.5	9831.731	9687.500

LTE band 5, 10 MHz Bandwidth, QPSK (100% BW)



Date: 31.DEC.2013 09:57:43

LTE band 5, 10 MHz Bandwidth, 16QAM (100% BW)

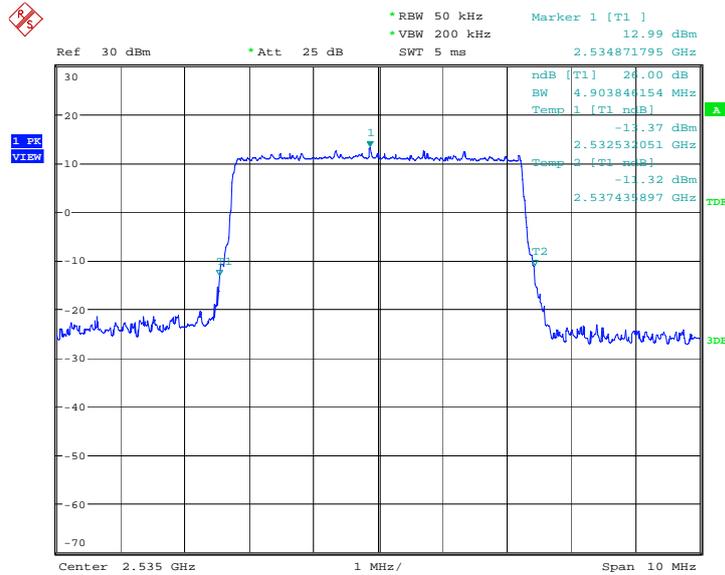


Date: 31.DEC.2013 09:57:58

LTE band 7, 5MHz (100% BW)

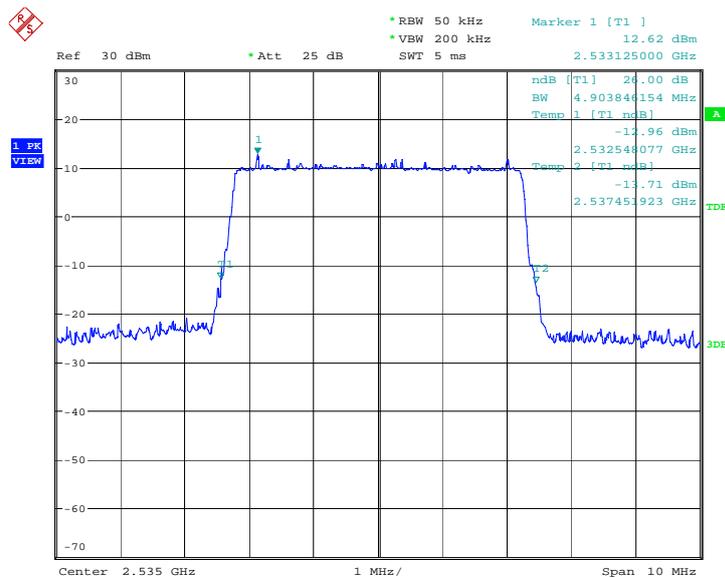
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
2535	4903.846	4903.846

LTE band 7, 5MHz Bandwidth, QPSK (100% BW)



Date: 7.JAN.2014 09:25:47

LTE band 7, 5MHz Bandwidth,16QAM (100% BW)

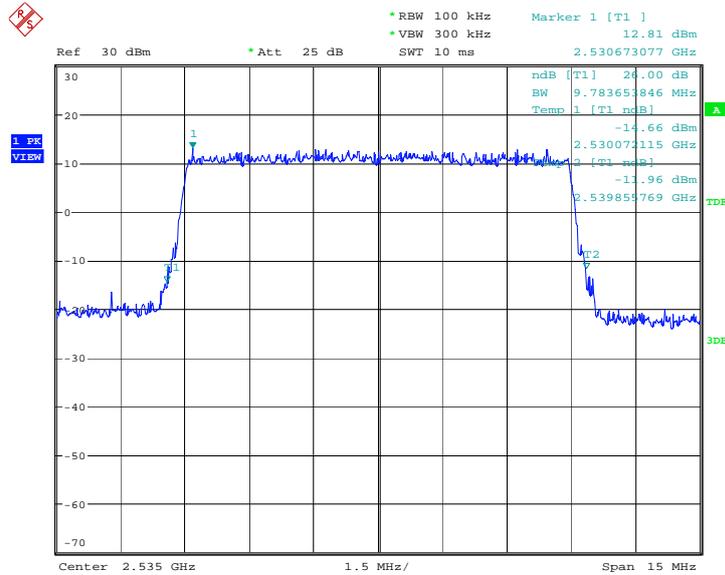


Date: 7.JAN.2014 09:26:03

LTE band 7, 10MHz (100% BW)

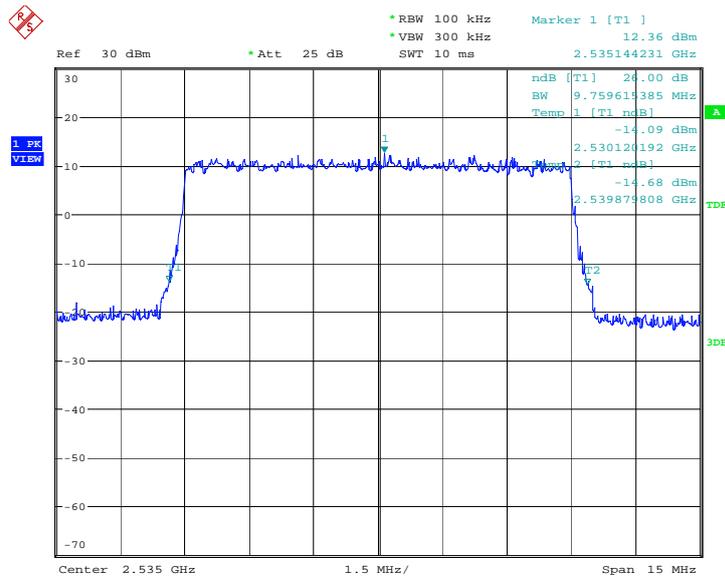
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
2535	9783.654	9759.615

LTE band 7, 10MHz Bandwidth, QPSK (100% BW)



Date: 7.JAN.2014 09:34:42

LTE band 7, 10MHz Bandwidth, 16QAM (100% BW)

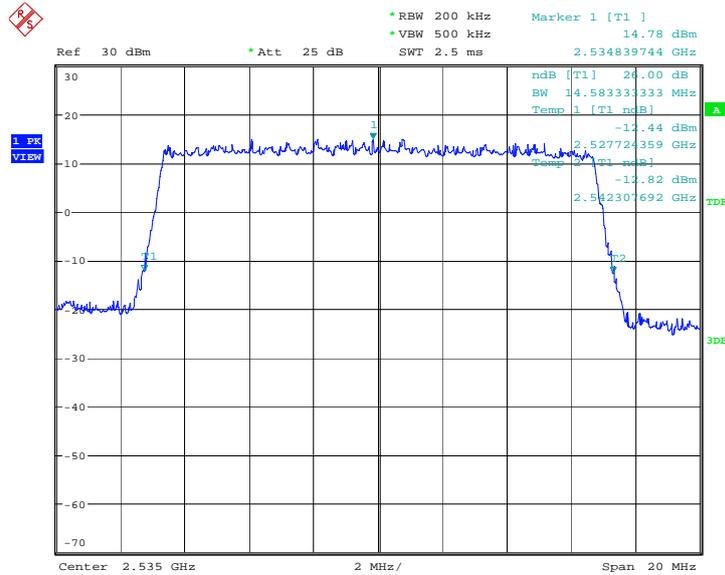


Date: 7.JAN.2014 09:34:58

LTE band 7, 15MHz (100% BW)

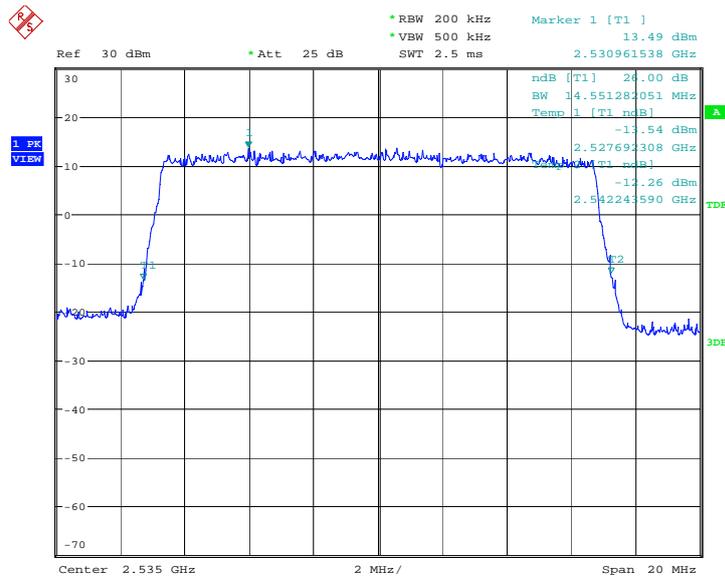
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
2535	14583.333	14551.282

LTE band 7, 15MHz Bandwidth, QPSK (100% BW)



Date: 7.JAN.2014 09:43:42

LTE band 7, 15MHz Bandwidth, 16QAM (100% BW)

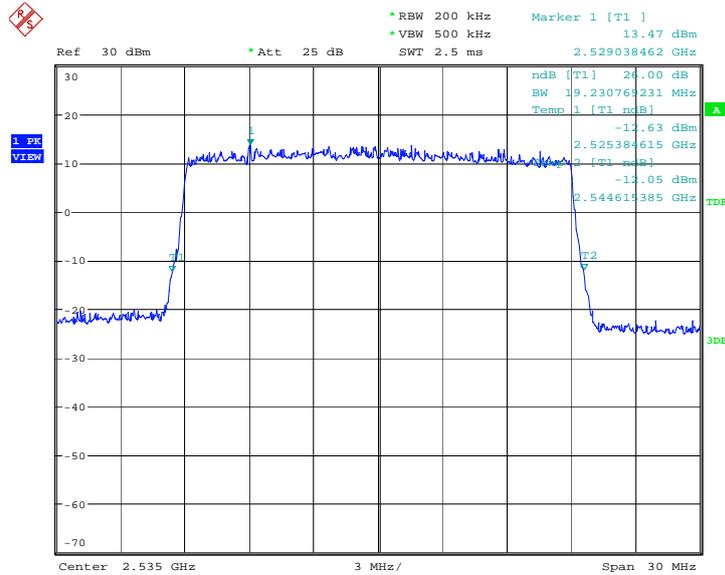


Date: 7.JAN.2014 09:43:57

LTE band 7, 20MHz (100% BW)

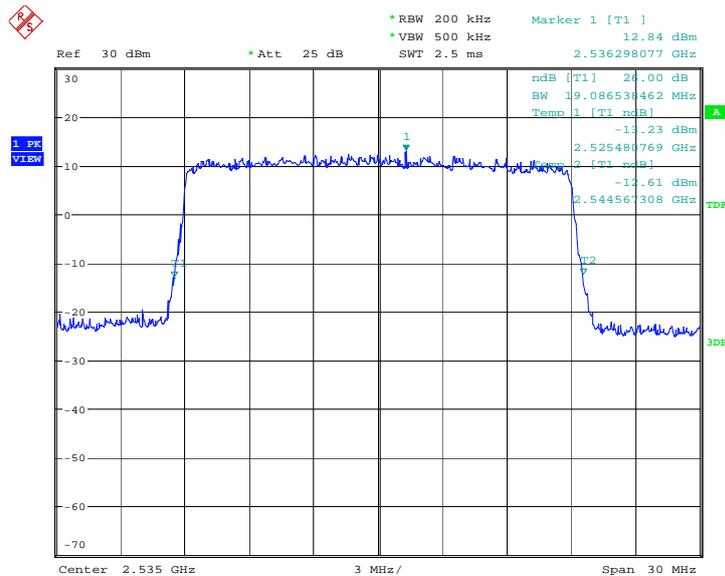
Frequency (MHz)	Occupied Bandwidth (100% BW)(kHz)	
	QPSK	16QAM
2535	19230.769	19086.538

LTE band 7, 20MHz Bandwidth, QPSK (100% BW)



Date: 7.JAN.2014 09:52:45

LTE band 7, 20MHz Bandwidth, 16QAM (100% BW)



Date: 7.JAN.2014 09:53:01

A.7 BAND EDGE COMPLIANCE

Reference

FCC: CFR Part 22.917(b), 27.53(m).

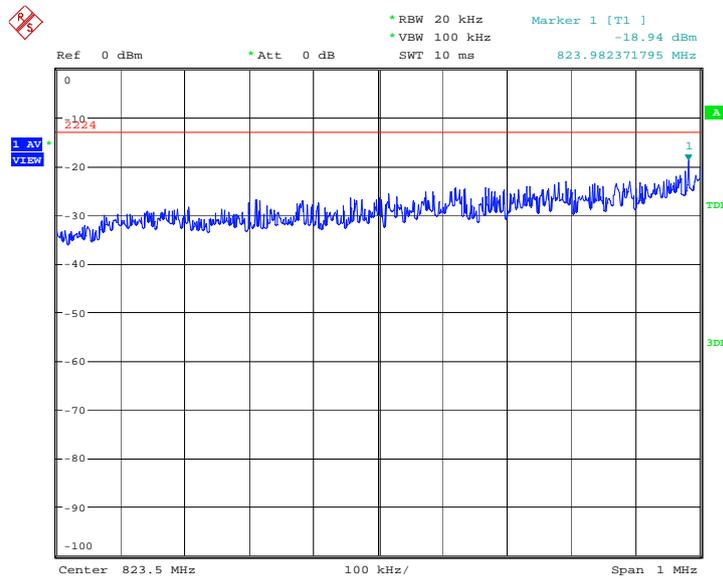
A.7.1 Measurement limit

On any frequency outside frequency band of the LTE FDD bands 5 and 7 spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least $43+10\log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

A.7.2 Measurement result

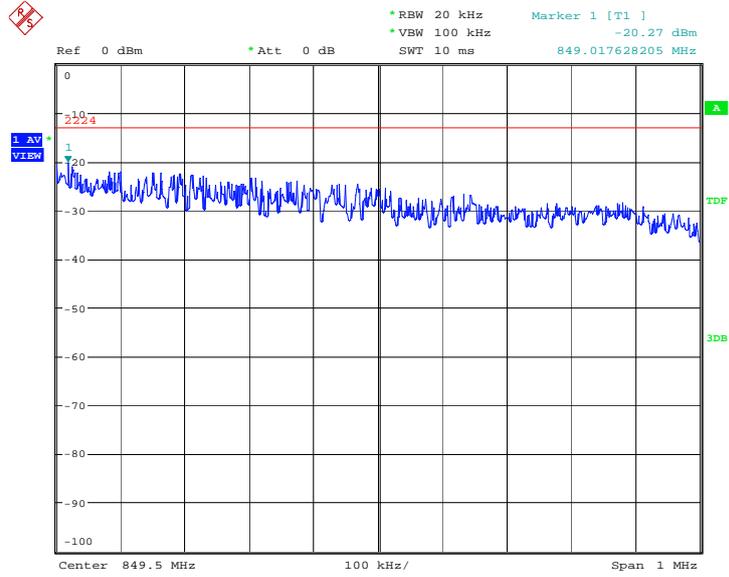
LTE band 5, 1.4MHz

LOW BAND EDGE BLOCK-QPSK



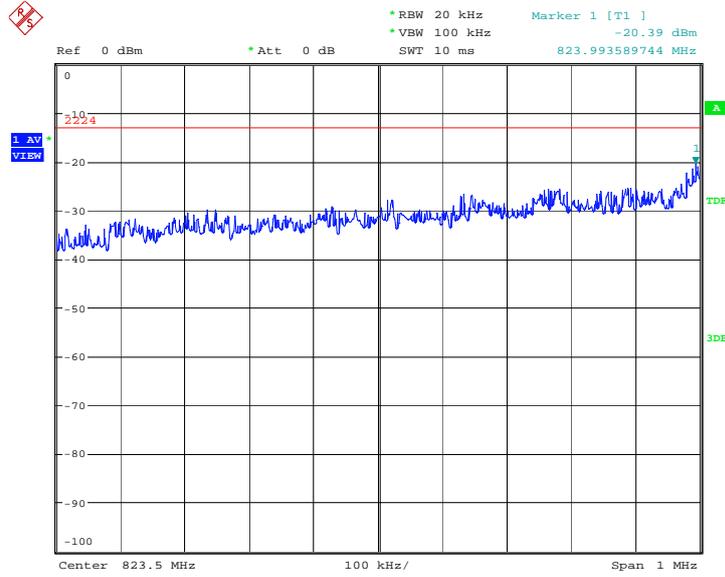
Date: 31,DEC,2013 08:47:06

HIGH BAND EDGE BLOCK-QPSK



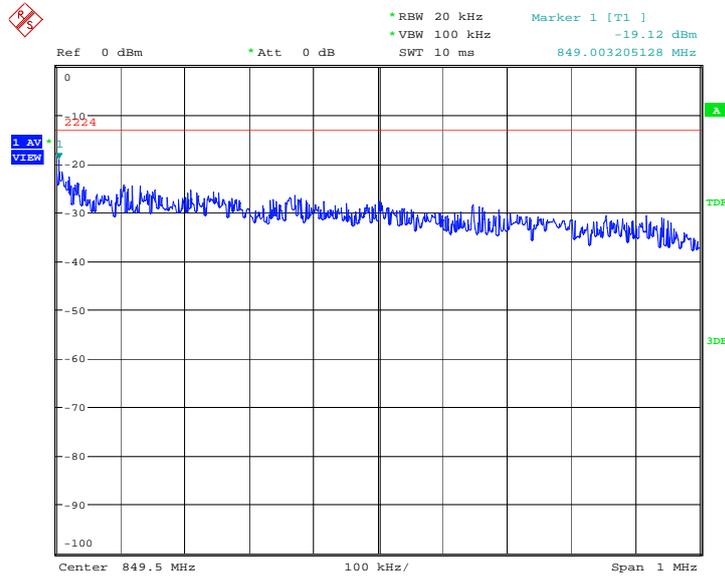
Date: 31.DEC.2013 08:50:27

LOW BAND EDGE BLOCK-16QAM



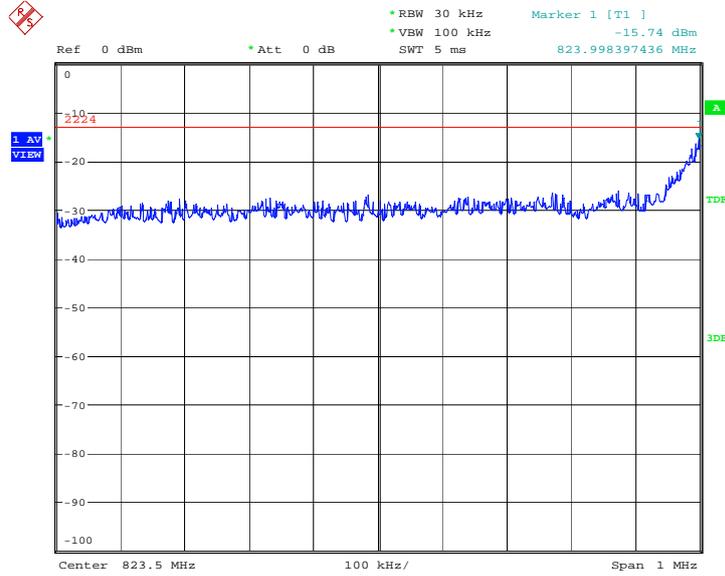
Date: 31.DEC.2013 08:47:16

HIGH BAND EDGE BLOCK-16QAM



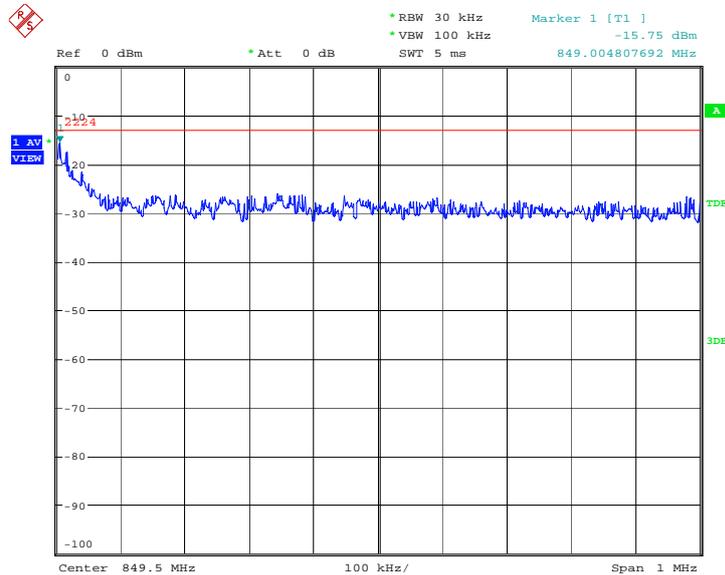
Date: 31.DEC.2013 08:50:37

**LTE band 5, 3MHz
LOW BAND EDGE BLOCK-QPSK**



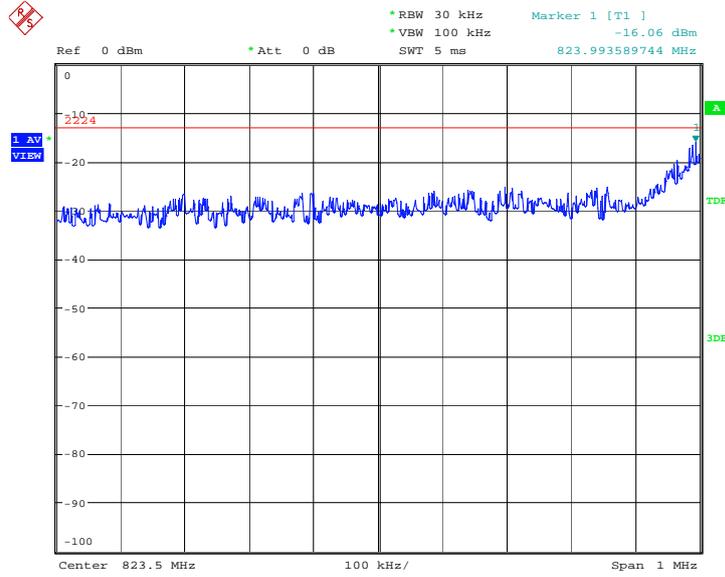
Date: 31.DEC.2013 09:10:53

HIGH BAND EDGE BLOCK-QPSK



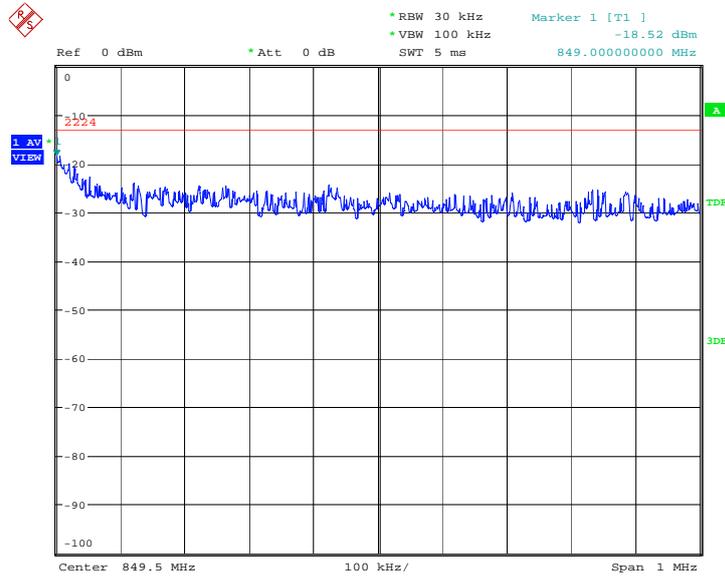
Date: 31.DEC.2013 09:14:07

LOW BAND EDGE BLOCK-16QAM



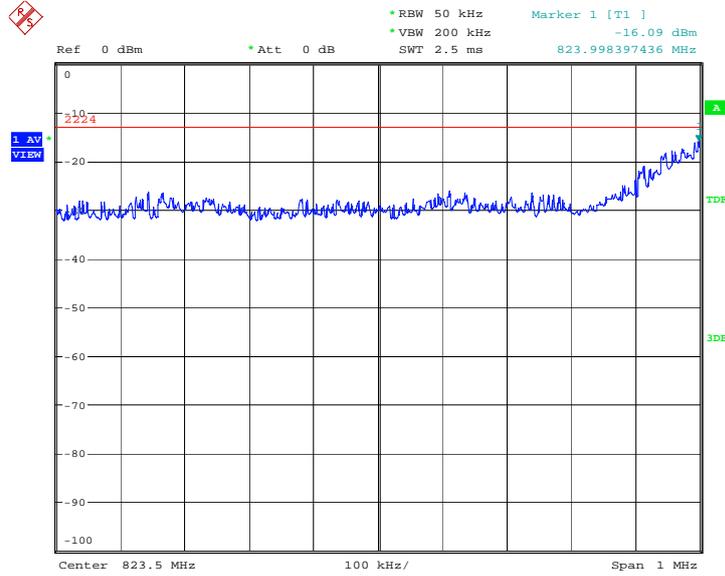
Date: 31.DEC.2013 09:11:02

HIGH BAND EDGE BLOCK-16QAM



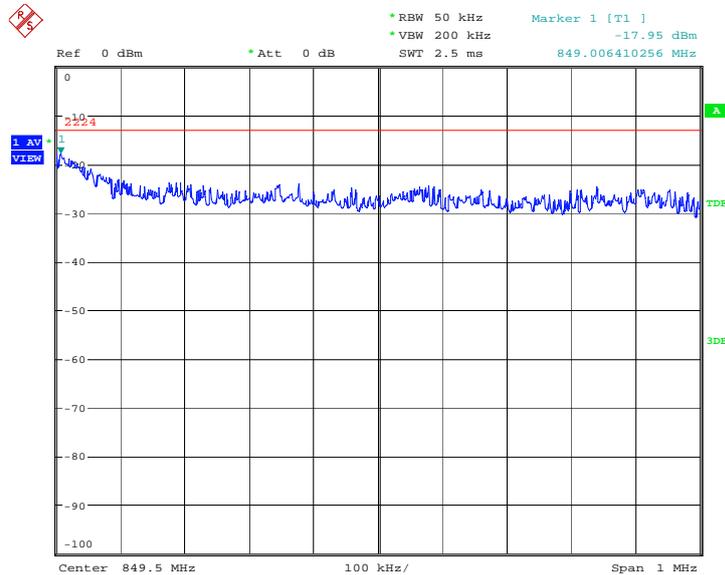
Date: 31.DEC.2013 09:14:16

LTE band 5, 5MHz
LOW BAND EDGE BLOCK-QPSK



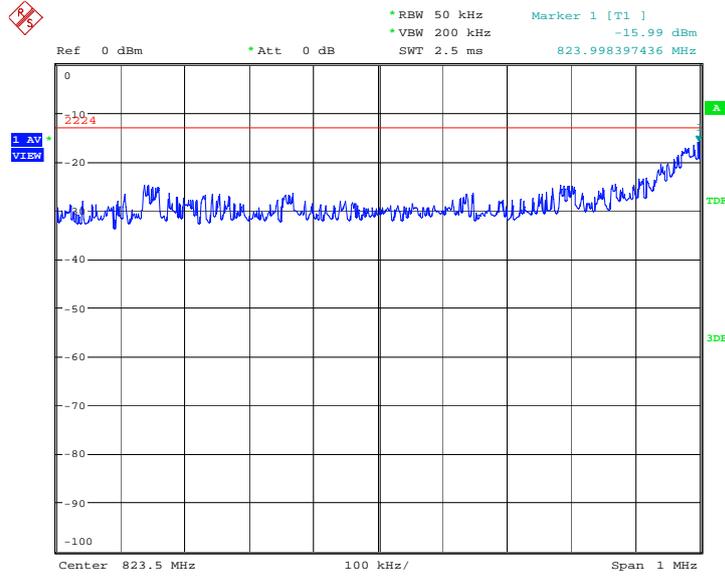
Date: 31.DEC.2013 09:33:45

HIGH BAND EDGE BLOCK-QPSK



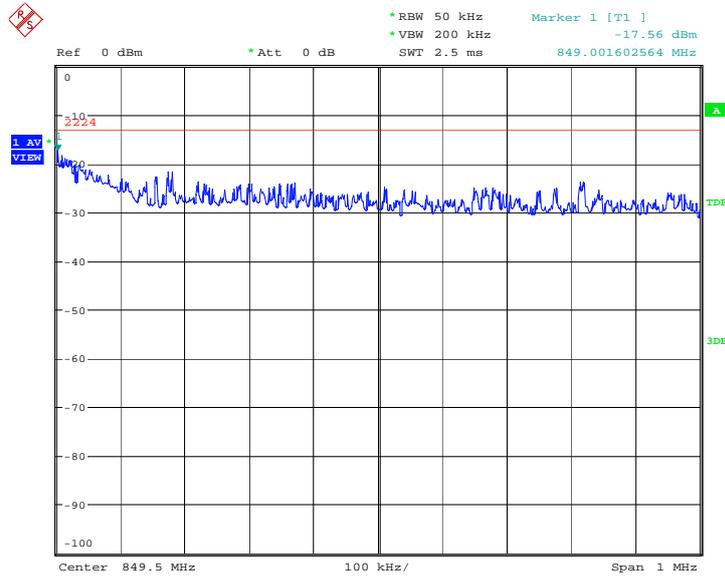
Date: 31.DEC.2013 09:36:59

LOW BAND EDGE BLOCK-16QAM



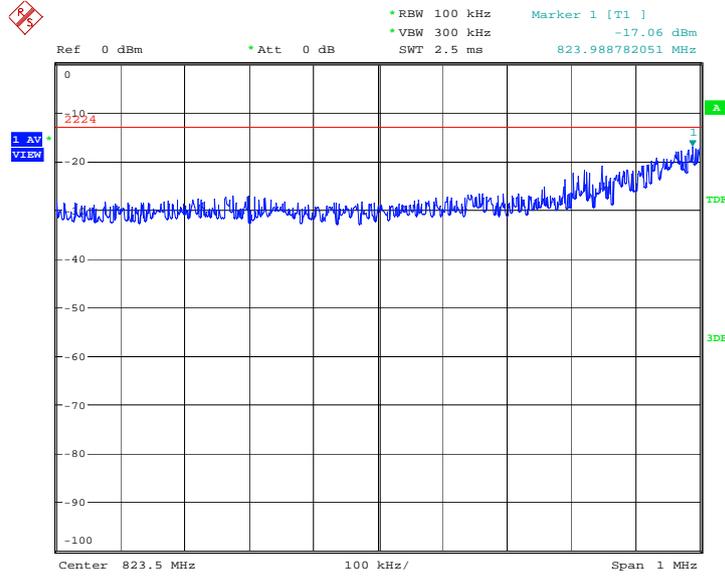
Date: 31.DEC.2013 09:33:54

HIGH BAND EDGE BLOCK-16QAM



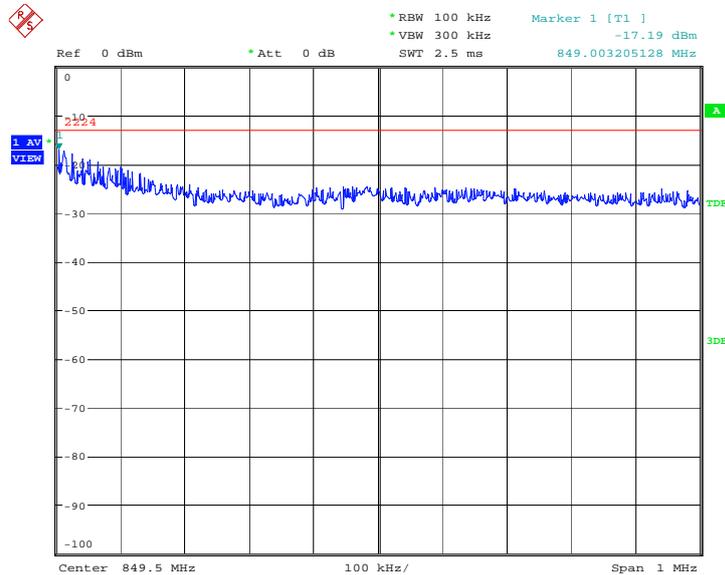
Date: 31.DEC.2013 09:37:08

**LTE band 5, 10MHz
LOW BAND EDGE BLOCK-QPSK**



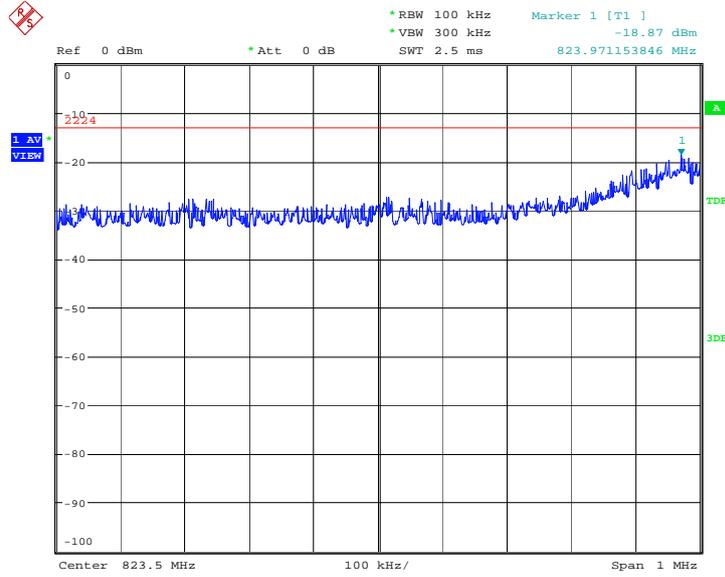
Date: 31.DEC.2013 09:56:40

HIGH BAND EDGE BLOCK-QPSK



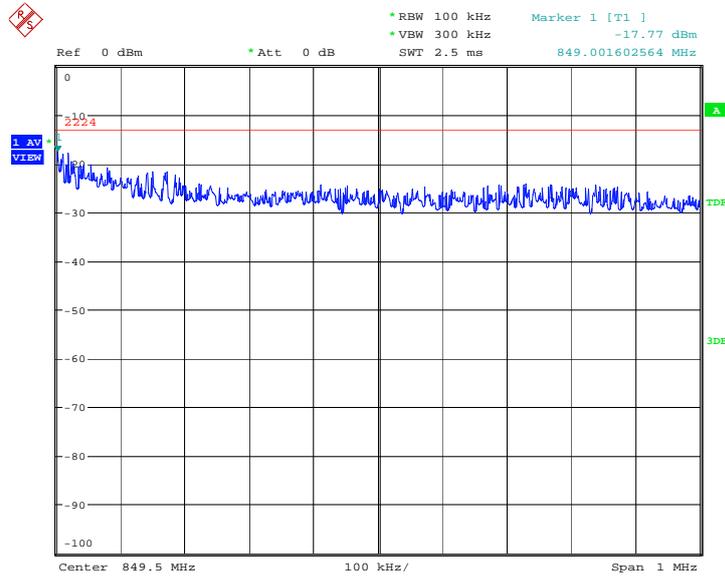
Date: 31.DEC.2013 09:59:54

LOW BAND EDGE BLOCK-16QAM



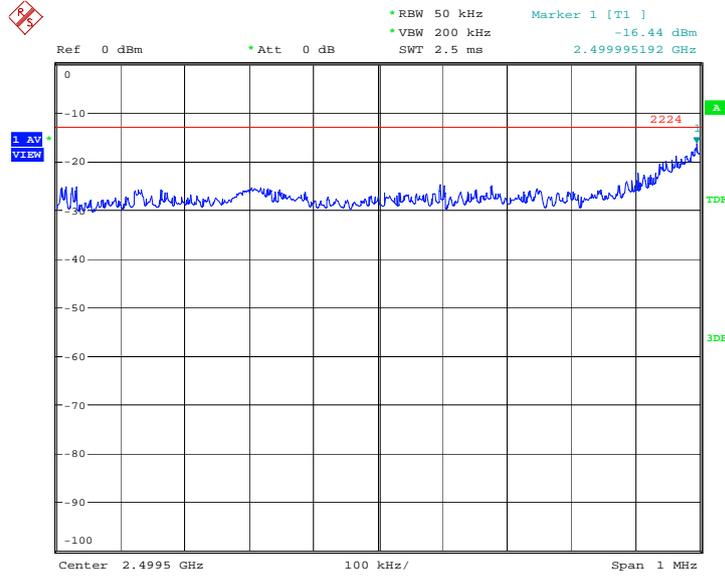
Date: 31.DEC.2013 09:56:49

HIGH BAND EDGE BLOCK-16QAM



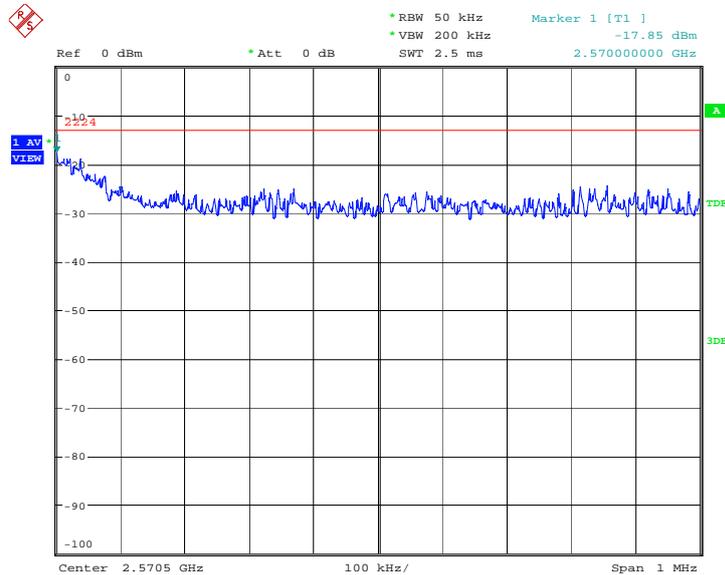
Date: 31.DEC.2013 10:00:03

LTE band 7, 5MHz
LOW BAND EDGE BLOCK-QPSK



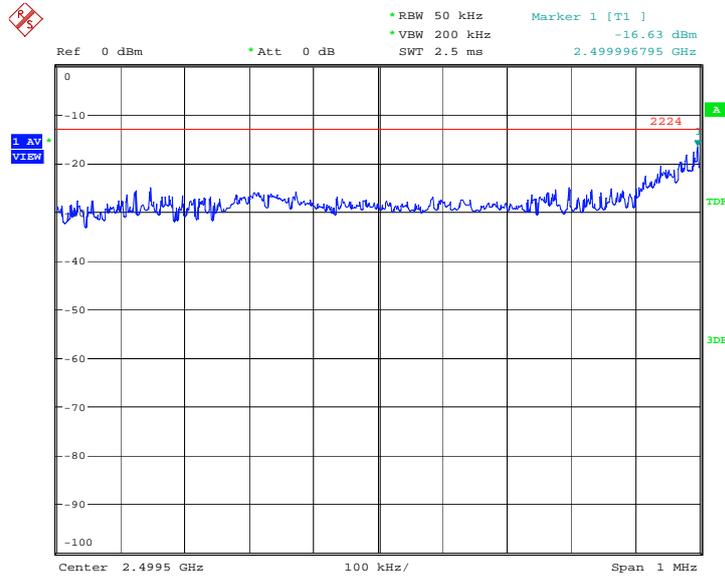
Date: 7.JAN.2014 09:24:42

HIGH BAND EDGE BLOCK-QPSK



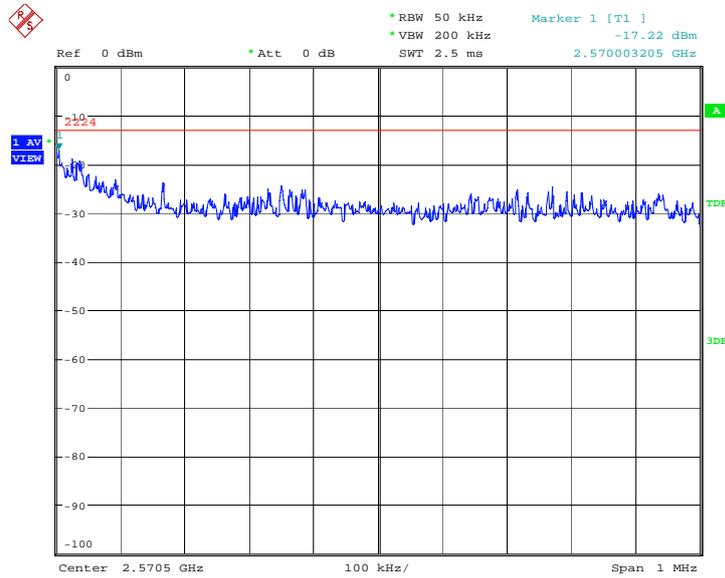
Date: 7.JAN.2014 09:28:03

LOW BAND EDGE BLOCK-16QAM



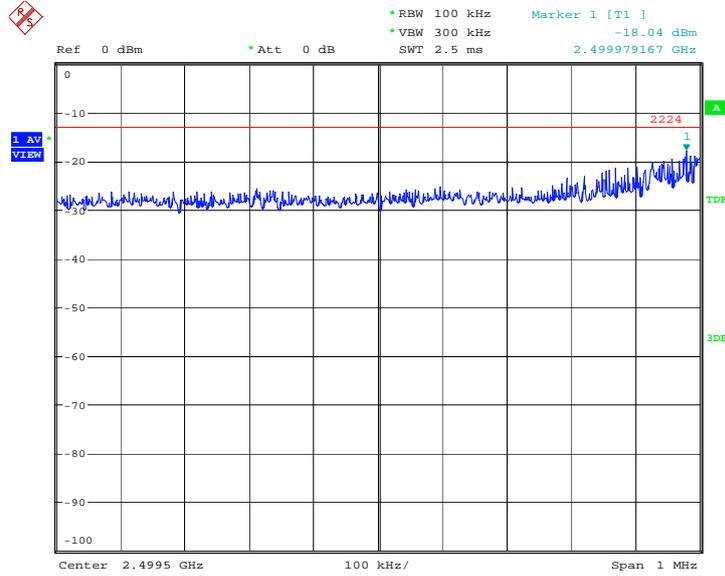
Date: 7.JAN.2014 09:24:52

HIGH BAND EDGE BLOCK-16QAM



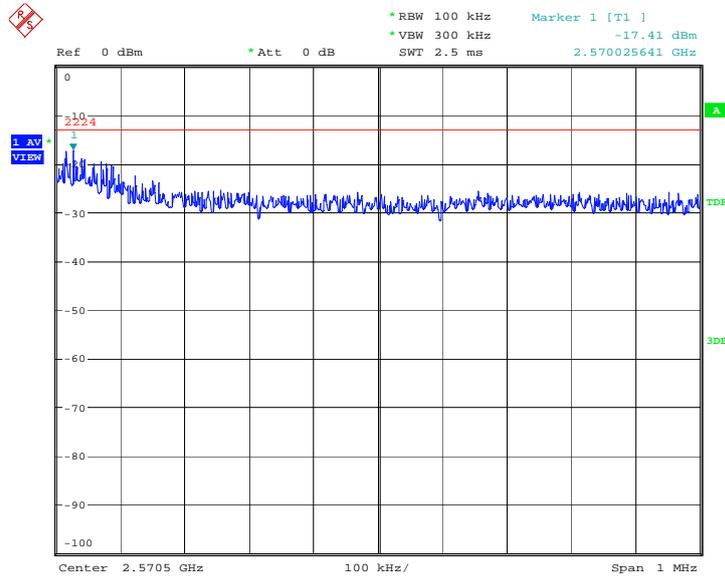
Date: 7.JAN.2014 09:28:13

**LTE band 7, 10MHz
LOW BAND EDGE BLOCK-QPSK**



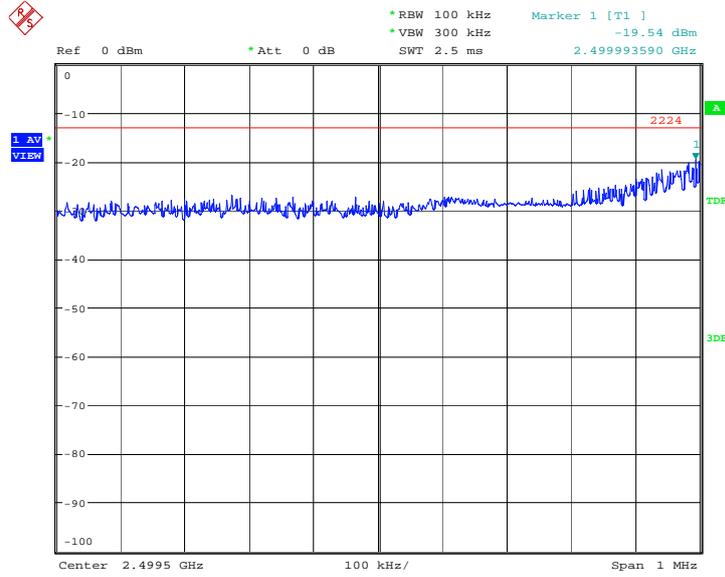
Date: 7.JAN.2014 09:33:37

HIGH BAND EDGE BLOCK-QPSK



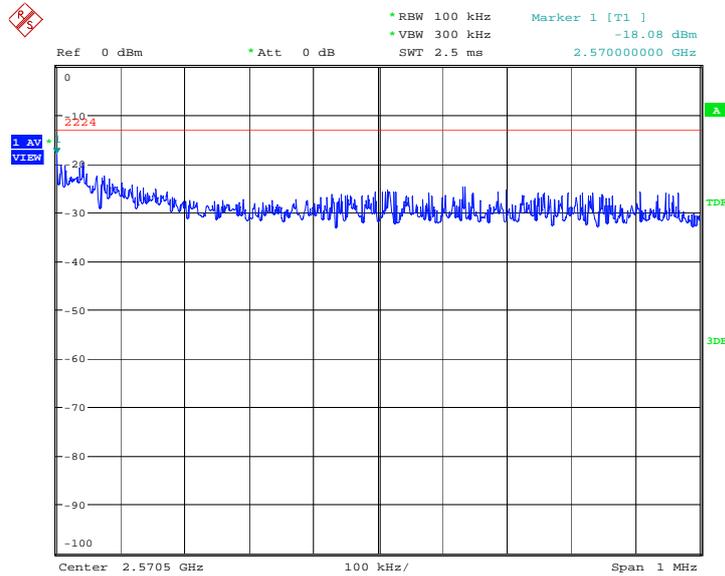
Date: 7.JAN.2014 09:36:57

LOW BAND EDGE BLOCK-16QAM



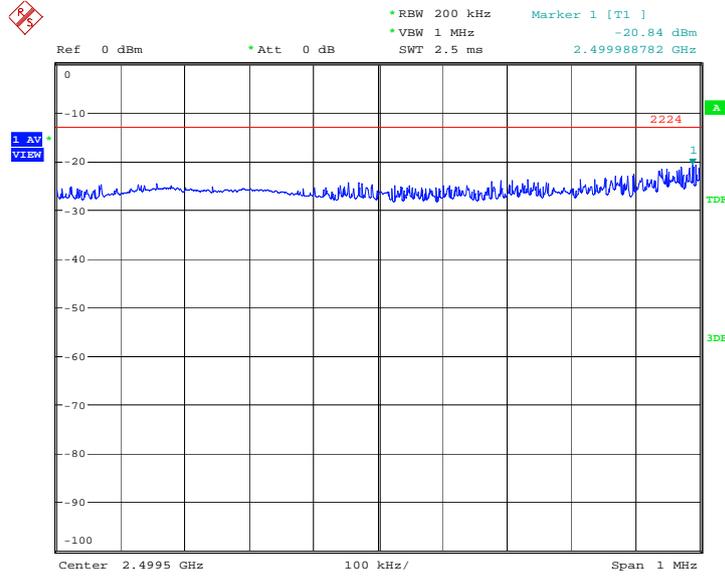
Date: 7.JAN.2014 09:33:47

HIGH BAND EDGE BLOCK-16QAM



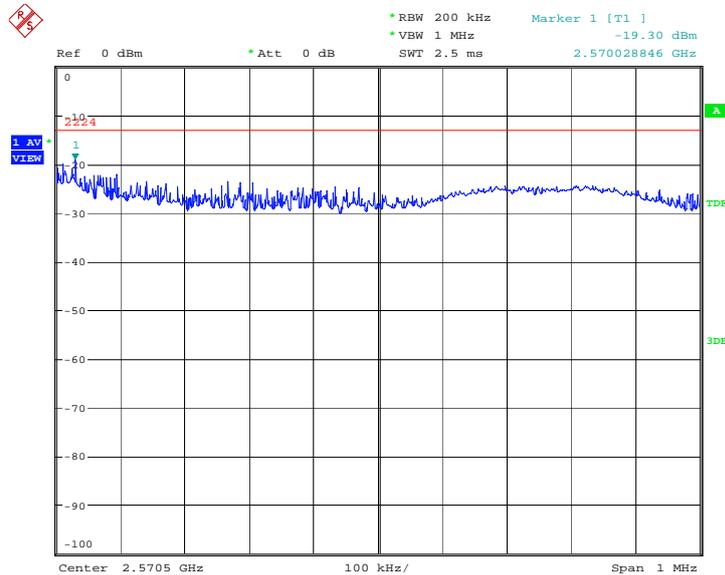
Date: 7.JAN.2014 09:37:07

LTE band 7, 15MHz
LOW BAND EDGE BLOCK-QPSK



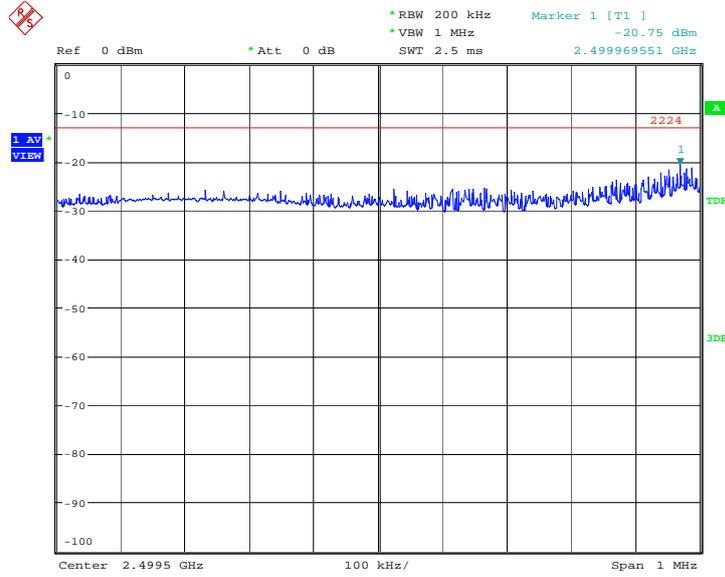
Date: 7.JAN.2014 09:42:36

HIGH BAND EDGE BLOCK-QPSK



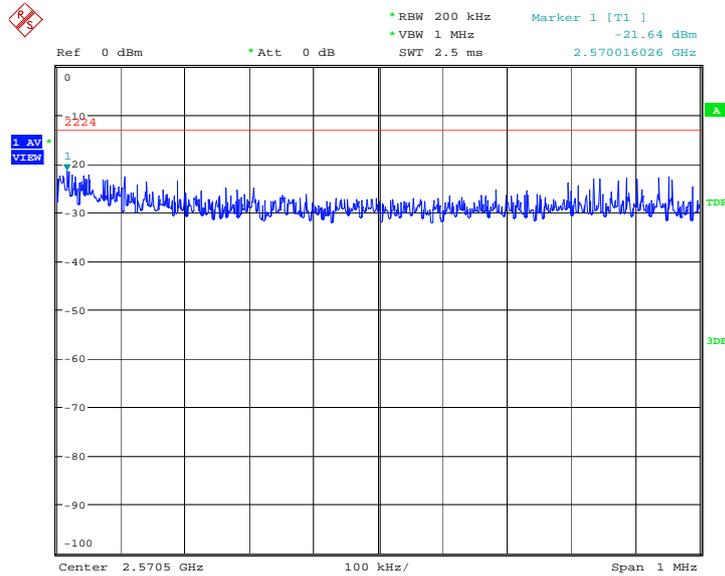
Date: 7.JAN.2014 09:45:57

LOW BAND EDGE BLOCK-16QAM



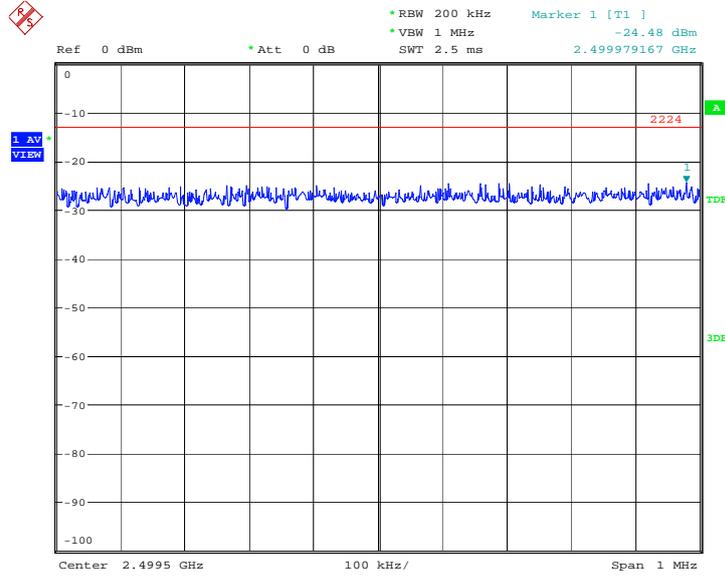
Date: 7.JAN.2014 09:42:47

HIGH BAND EDGE BLOCK-16QAM



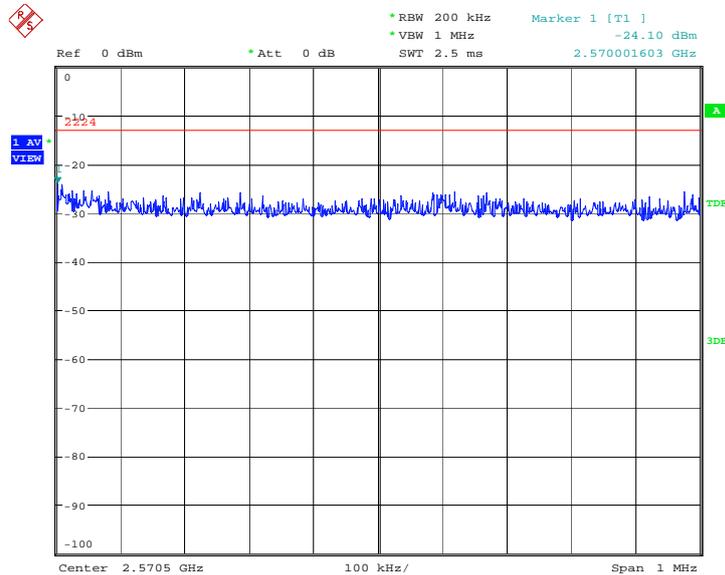
Date: 7.JAN.2014 09:46:07

**LTE band 7, 20MHz
LOW BAND EDGE BLOCK-QPSK**



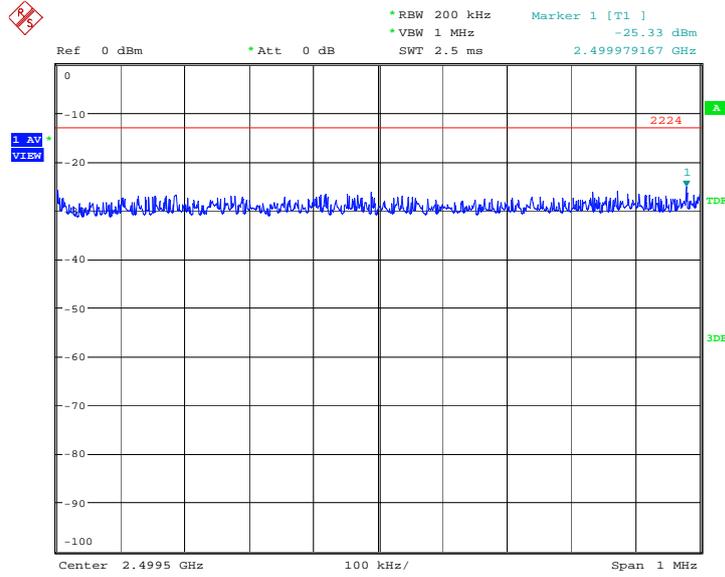
Date: 7.JAN.2014 09:51:40

HIGH BAND EDGE BLOCK-QPSK



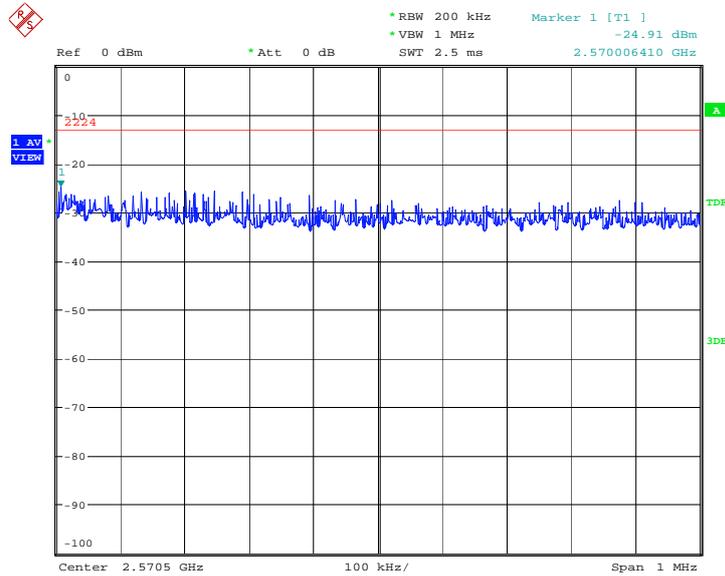
Date: 7.JAN.2014 09:55:00

LOW BAND EDGE BLOCK-16QAM



Date: 7.JAN.2014 09:51:50

HIGH BAND EDGE BLOCK-16QAM



Date: 7.JAN.2014 09:55:11

A.8 CONDUCTED SPURIOUS EMISSION

Reference

FCC: CFR Part 2.1057, 22.917, 27.53(m).

A.8.1 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.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

A. 8.2 Measurement Limit

Part 22.917 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.

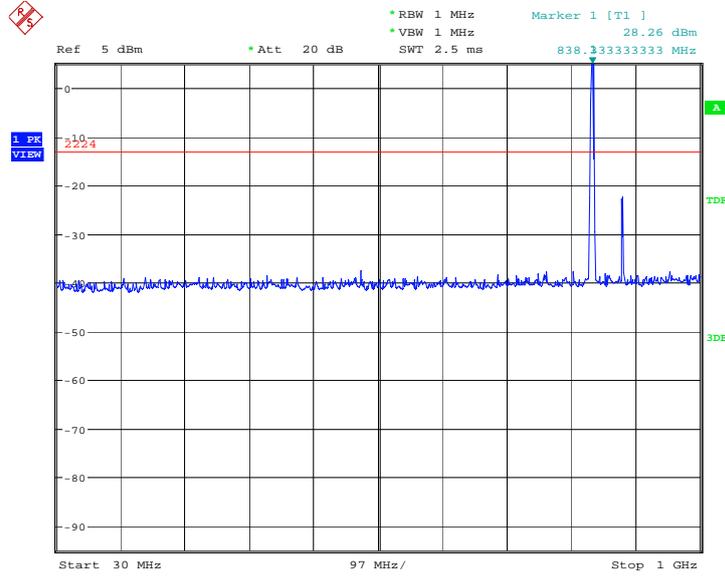
A. 8.3 Measurement result

Measurement Uncertainty: 0.3dB

LTE band 5, 1.4MHz bandwidth

QPSK: 30MHz – 1GHz

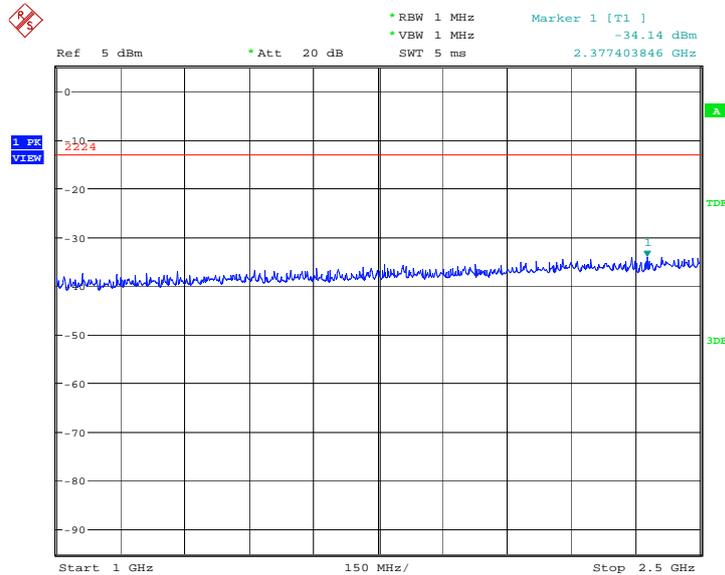
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:54:25

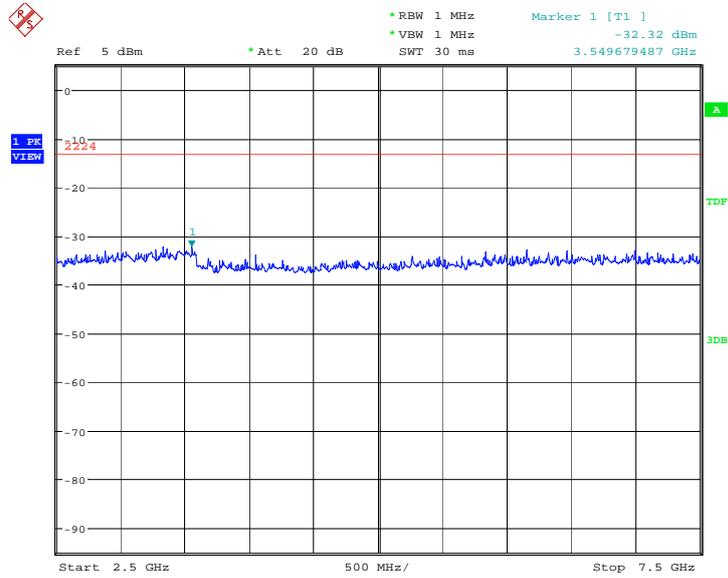
QPSK: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



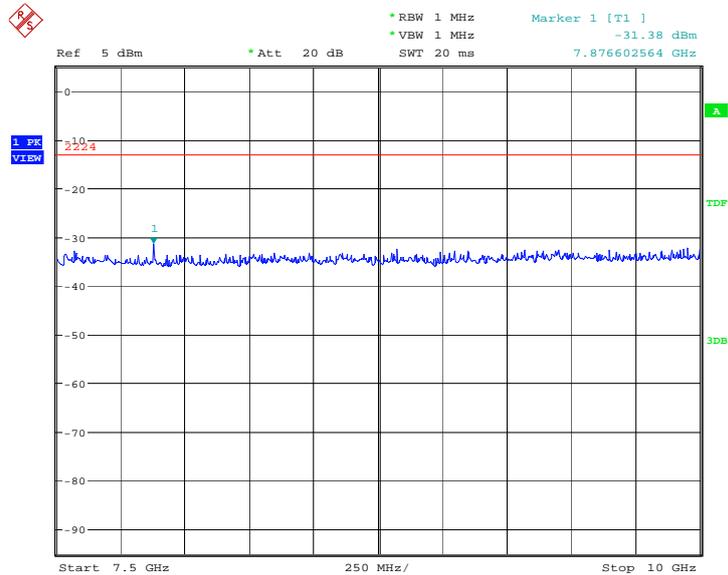
Date: 31.DEC.2013 08:54:33

QPSK: 2.5GHz – 7.5GHz
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:54:41

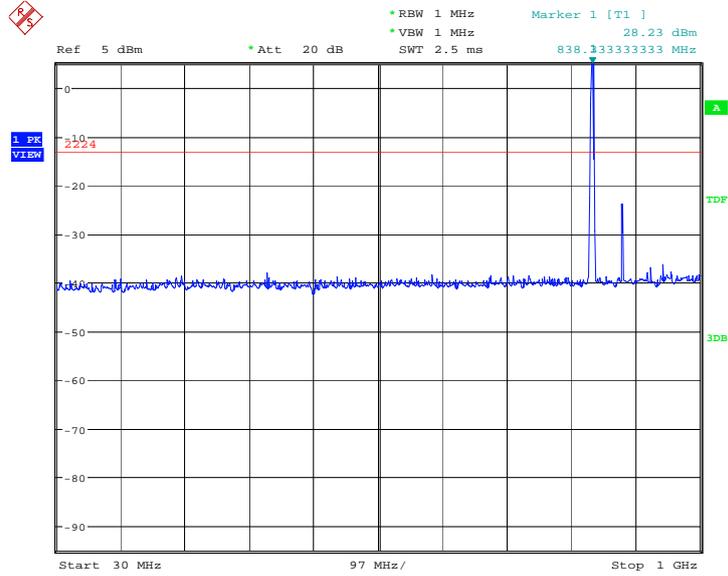
QPSK: 7.5GHz – 10GHz
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:54:50

16QAM: 30MHz – 1GHz

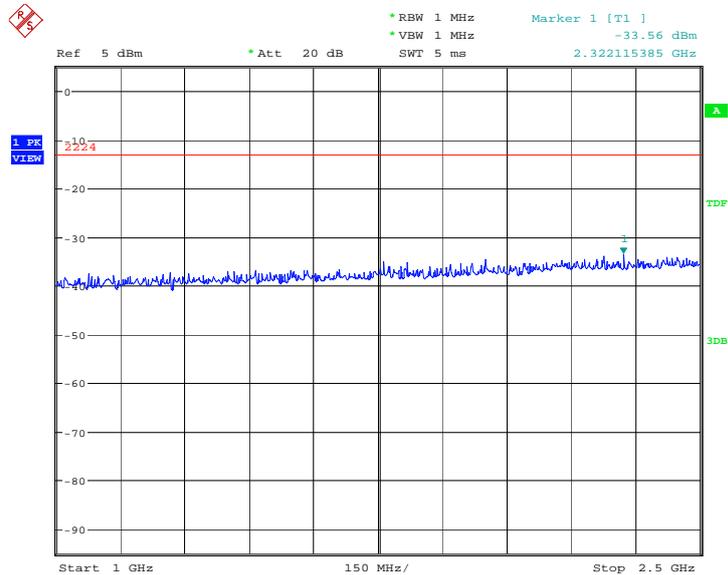
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:55:35

16QAM: 1GHz – 2.5GHz

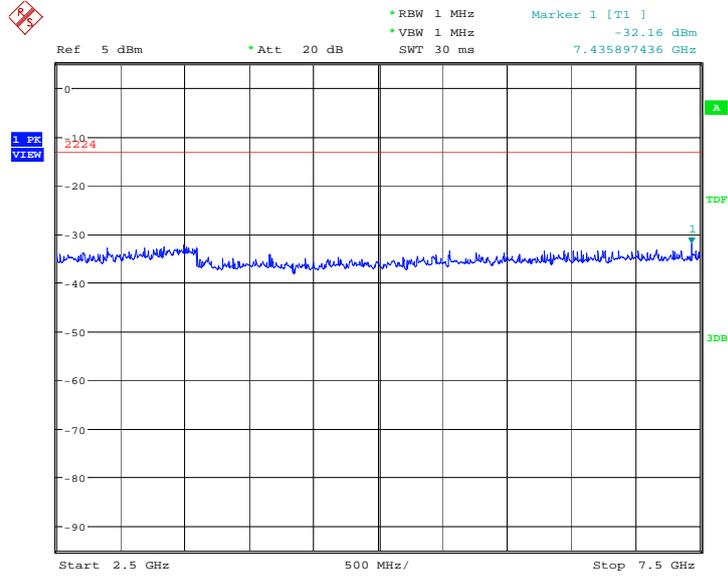
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:55:42

16QAM: 2.5GHz – 7.5GHz

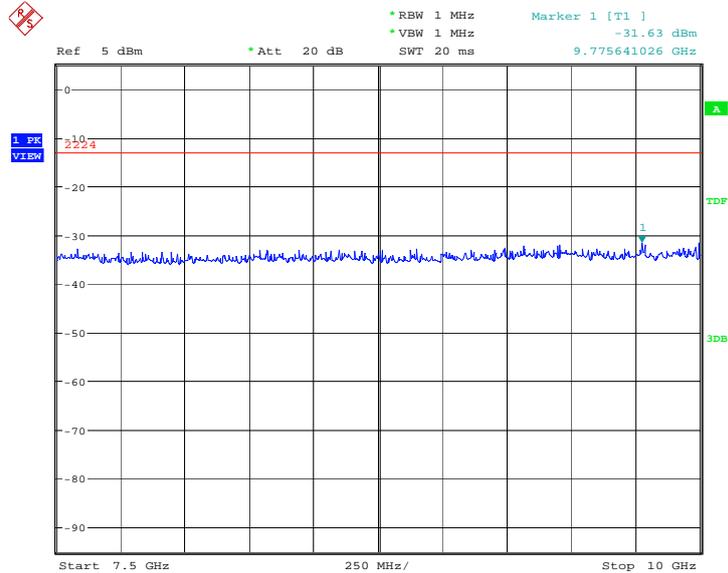
Spurious emission limit –13dBm.



Date: 31.DEC.2013 08:55:50

16QAM: 7.5GHz – 10GHz

Spurious emission limit –13dBm.

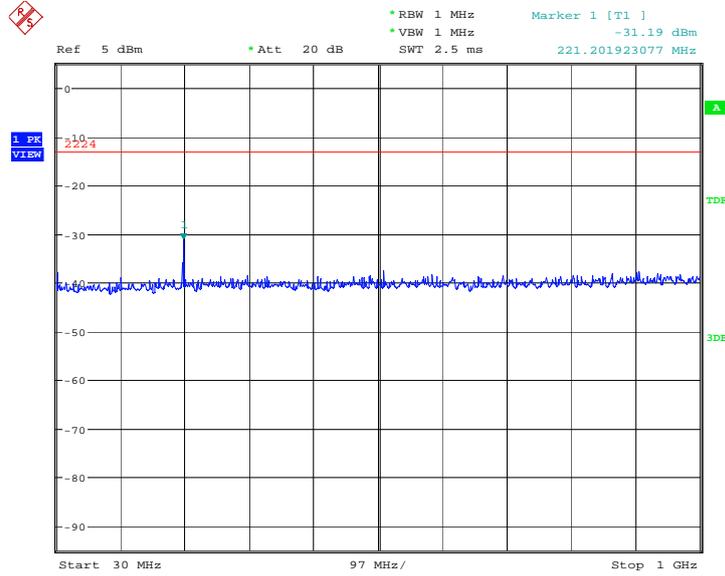


Date: 31.DEC.2013 08:55:58

LTE band 7, 5MHz bandwidth

QPSK: 30MHz – 1GHz

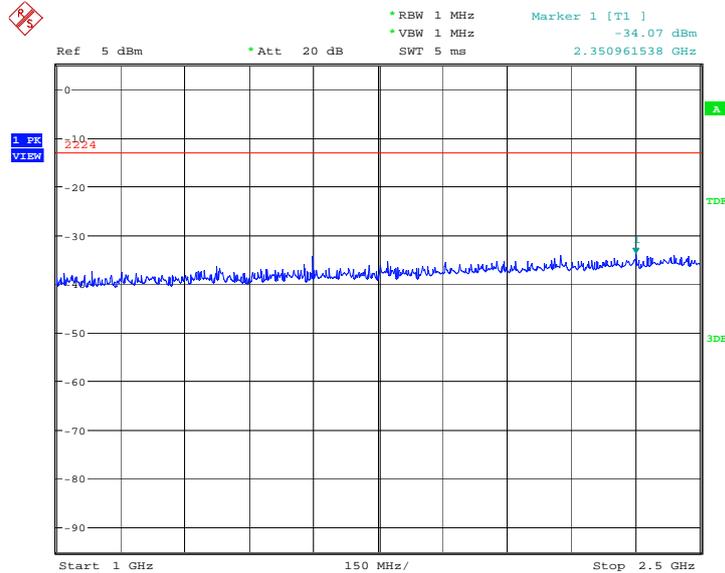
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:25:25

QPSK: 1GHz – 2.5GHz

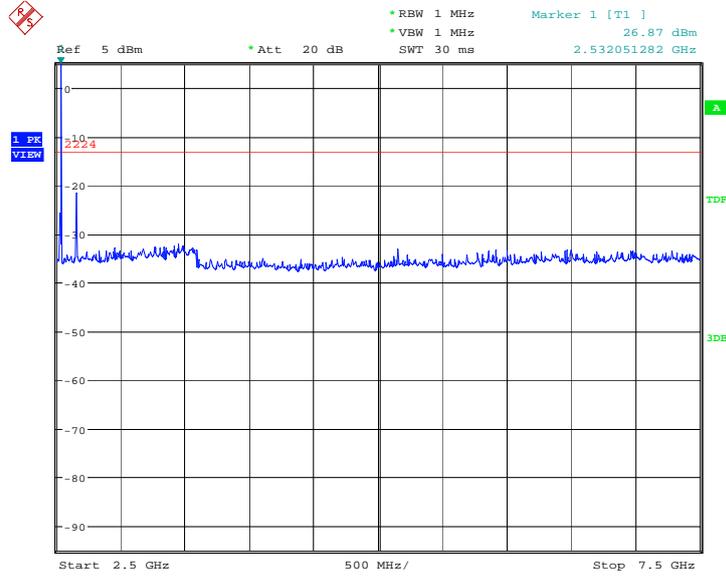
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:25:33

QPSK: 2.5GHz – 7.5GHz

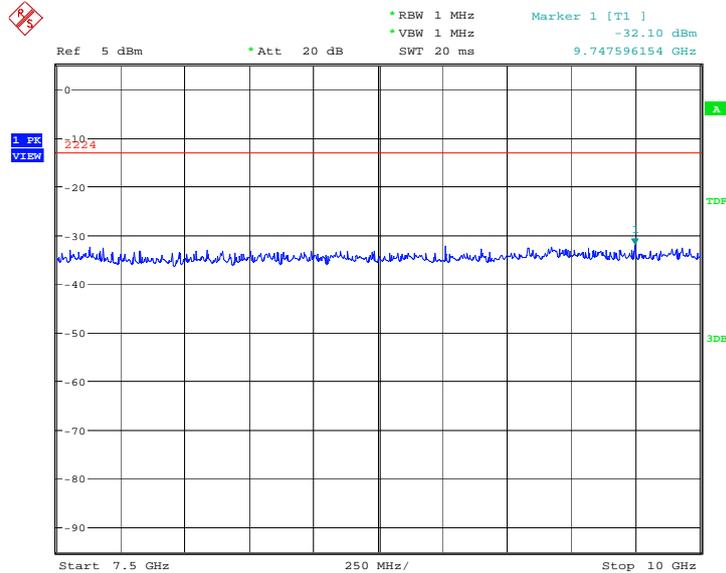
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:25:41

QPSK: 7.5GHz –10GHz

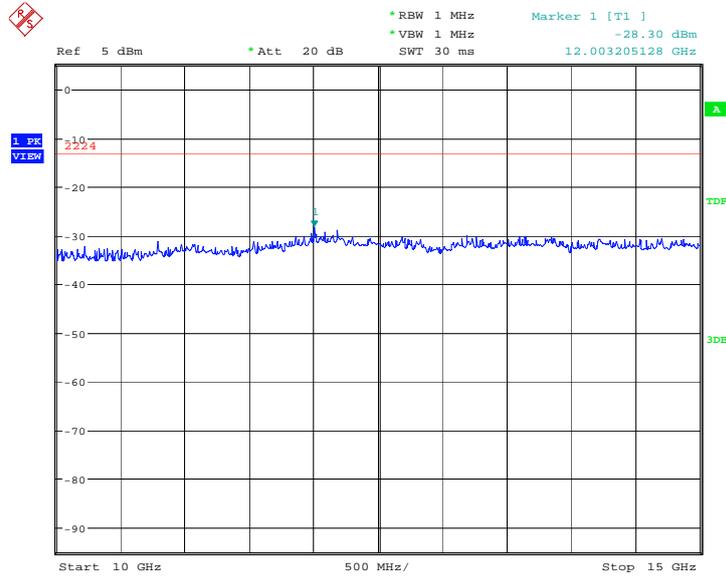
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:25:49

QPSK: 10GHz –15GHz

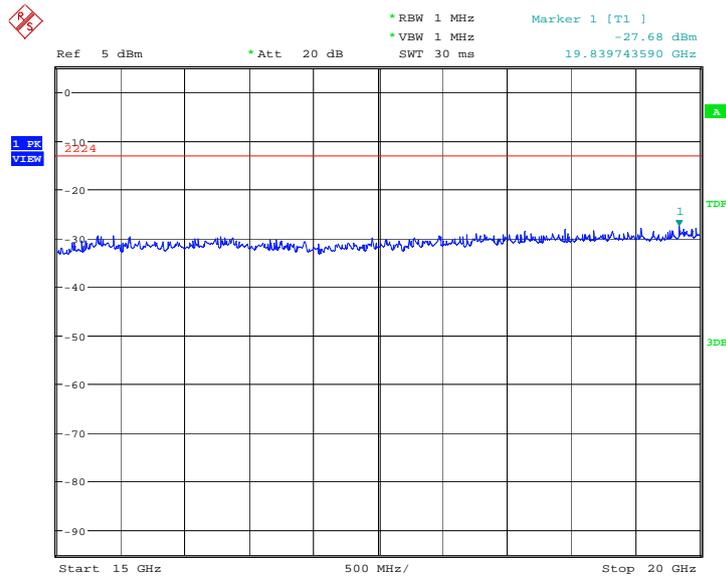
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:25:57

QPSK: 15GHz –20GHz

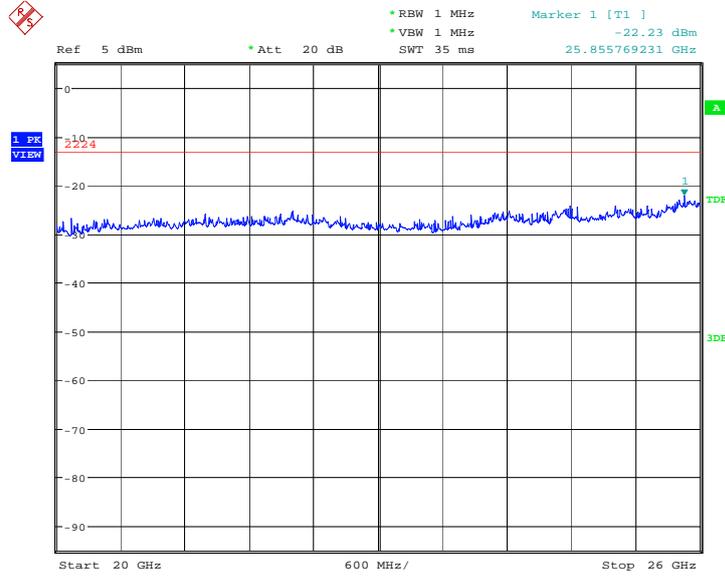
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:26:05

QPSK: 20GHz –26GHz

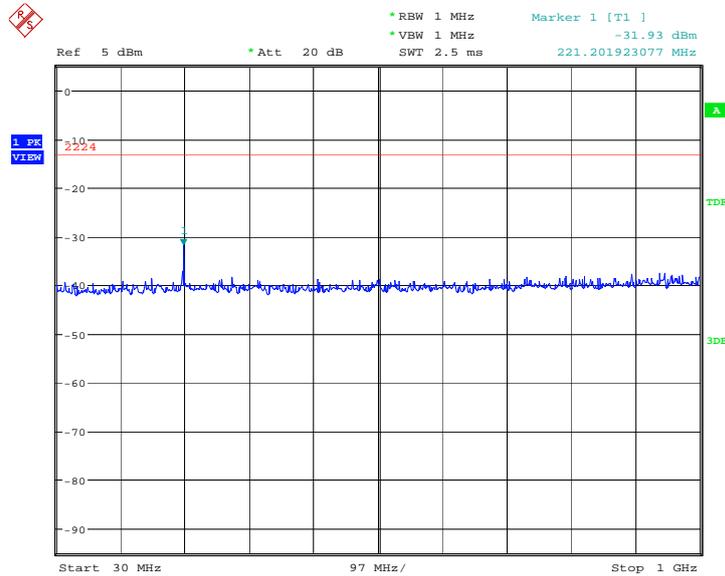
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:26:13

16QAM: 30MHz – 1GHz

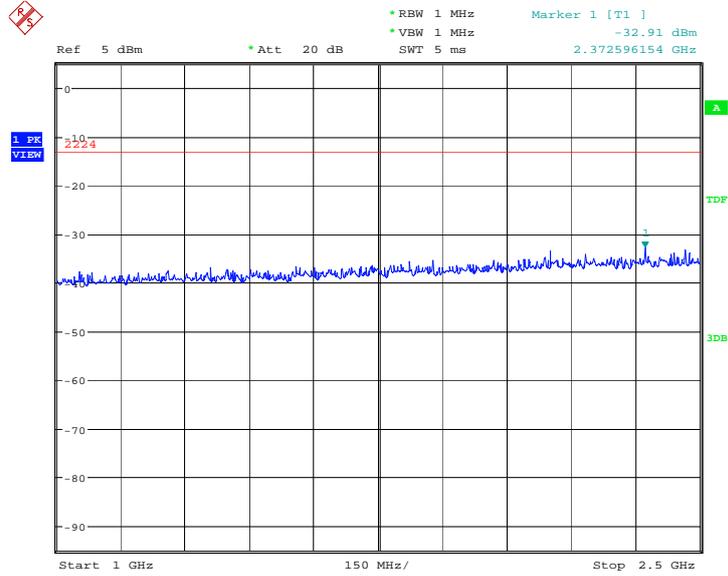
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:26:23

16QAM: 1GHz – 2.5GHz

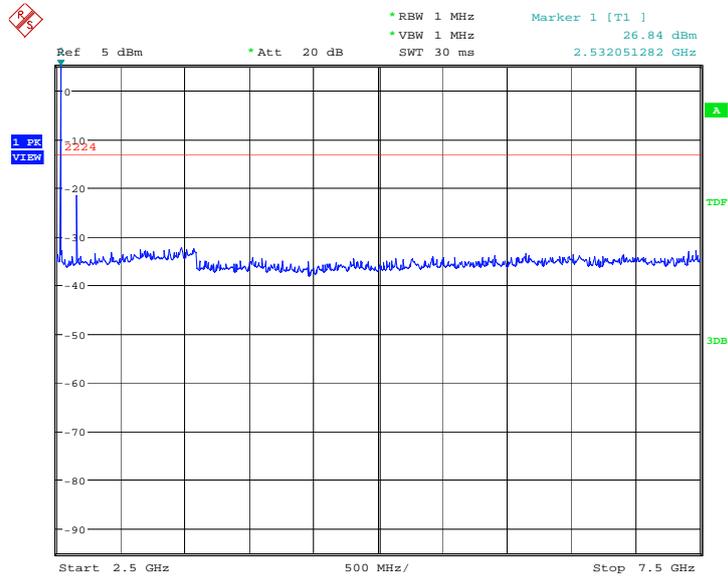
Spurious emission limit -13dBm.



Date: 7.JAN.2014 10:26:31

16QAM: 2.5GHz – 7.5GHz

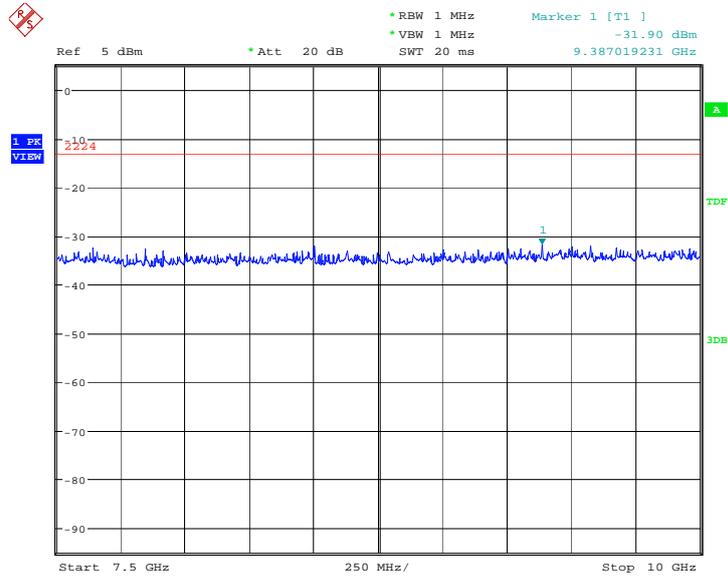
Spurious emission limit -13dBm.



Date: 7.JAN.2014 10:26:39

16QAM: 7.5GHz –10GHz

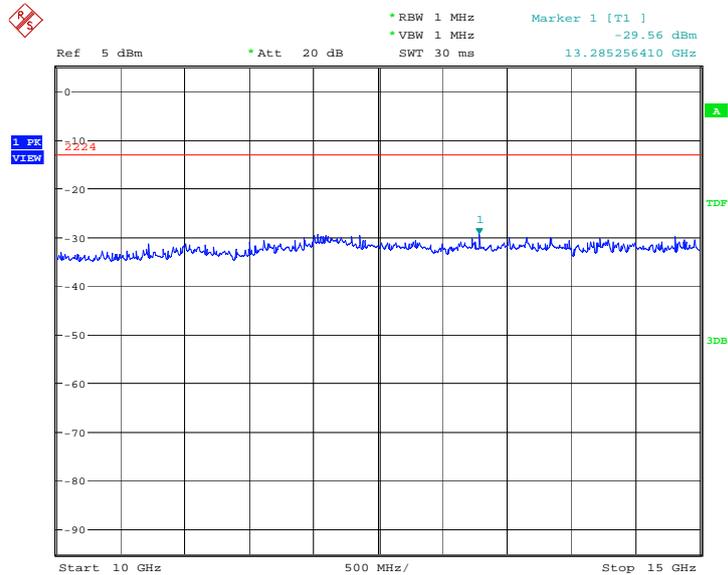
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:26:47

16QAM: 10GHz –15GHz

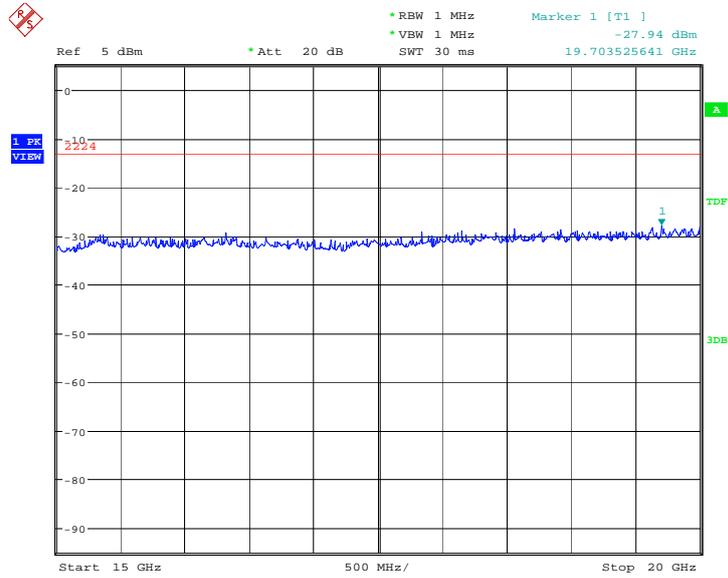
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:26:55

16QAM: 15GHz –20GHz

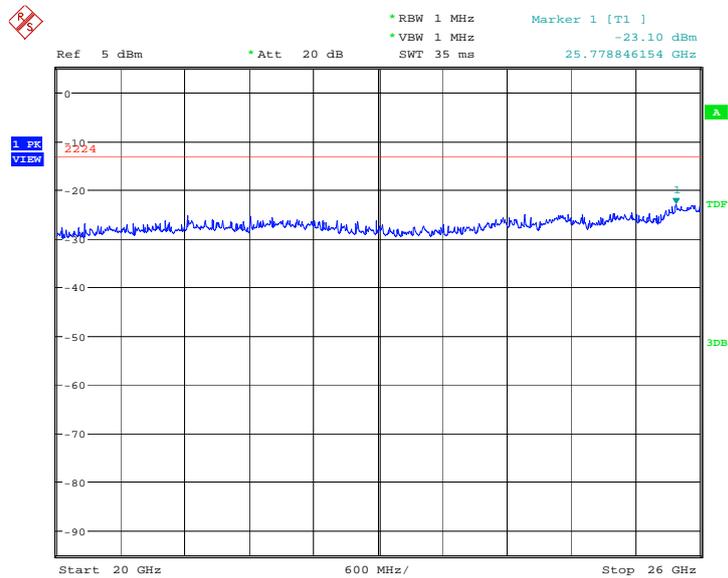
Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:27:03

16QAM: 20GHz –26GHz

Spurious emission limit –13dBm.



Date: 7.JAN.2014 10:27:11