TEST REPORT

REPORT NUMBER: I12GL0960-FCC-RF_2

ON

Type of Equipment: LTE PCI-e Module
Type of Designation: LP15
Manufacturer: Asia Telco Technologies Co.

ACCORDING TO
FCC CFR Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS; e-CFR
PART 90—PRIVATE LAND MOBILE RADIO SERVICES e-CFR, January 13, 2014;
971168 D01 Power Meas License Digital Systems v02r01 —Measurement Guidance for Certification of Licensed Digital Transmitters;

China Telecommunication Technology Labs.

Month date, year
Feb, 19, 2014

Signature

He Guili
Director

FCC ID:	J26-4859300114
Report Date:	2014-12-19
Test Firm Name:	China Telecommunication Technology Labs
Registration Number:	840587

Statement

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2 and 90. The sample tested was found to comply with the requirements defined in the applied rules.

CTL Test Report

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1 General Information

1.1 Notes

All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2, 90.

The test results of this test report relate exclusively to the item(s) tested as specified in section 2.

The following deviation from, additions to, or exclusions from the test specifications have been made. See Annex C.

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CTTL Test Report

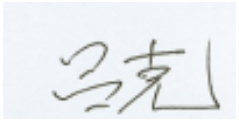
1.2 Testers

Name: Lv Ke

Position: Engineer

Department: Department of EMC test

Duration of the test: From 2012-11-08 to 2014-01-24

Signature: 

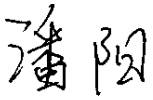
Editor of this test report:

Name: Pan Yang

Position: Engineer

Department: Department of EMC test

Date: 2014-01-24

Signature: 

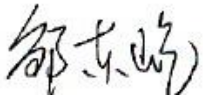
Technical responsibility for area of testing:

Name: Zou Dongyi

Position: Manager

Department: Department of EMC test

Date: 2014-01-24

Signature: 

CTTL EMC Test Report

1.3 Testing Laboratory information

1.3.1 Location

Name:	China Telecommunication Technology Labs.
Address:	No. 11, Yue Tan Nan Jie, Xi Cheng District BEIJING P. R. CHINA, 100083
Tel:	+86 10 68094053
Fax:	+86 10 68011404
Email:	emc@chinattl.com

1.3.2 Details of accreditation status

Accredited by:	China National Accreditation for Laboratory (CNAL)
Registration number:	CNAL Registration No.L0570
Standard:	ISO/IEC 17025

1.3.3 Test location, where different from section 1.3.1

Name:	------
Street:	------
City:	------
Country:	------
Telephone:	------
Fax:	------
Postcode:	------

CTTL Test Report

1.4 Details of applicant or manufacturer

1.4.1 Applicant

Name:	CalAmp Wireless Networks
Address:	299 Johnson Avenue, Suite 110 , Waseca MN, 56093-0833, USA
Country:	USA
Telephone:	001-507-833-6709
Fax:	001-507-833-6758
Contact:	Allen Frederick
Telephone:	001-507-833-6709
Email:	--

1.4.2 Manufacturer (if different from applicant in section 1.4.1)

Name:	Asia Telco Technologies Co.
Address:	#289 Bisheng Road,Buiding-8,3F,Zhangjiang Hi-Tech Park,Pudong,Shanghai 201204,China

1.4.3 Manufactory (if different from applicant in section 1.4.1)

Name:	--
Address:	--

CTL Test Report

2 Test Item

2.1 General Information

Manufacturer: LTE PCI-e Module
Model Name: LP15
Product Name PCI e-Module

Serial Number: --
Production Status: Product
Receipt date of test item: 2012-10-17

2.2 Outline of EUT

EUT is a PCI e-Module. It supports LTE mode, with the frequency range of 788 MHz to 798 MHz for LTE Band 14. Its modulation type is QPSK and 16QAM.

2.3 Modifications Incorporated in EUT

The EUT has not been modified from what is described by the brand name and unique type identification stated above.

2.4 Equipment Configuration

Equipment configuration list:

Item	Generic Description	Manufacturer	Type	Serial No.	Remarks
A	LTE PCI-e Module	Asia Telco Technologies Co.	LP15	--	None
B	Battery	--	--	--	None
D	Earphone	--	--	--	None
E	Antenna	AEON Technology(Shanghai) CO., Ltd.	C6466-510003PA	--	None

2.5 Other Information

Version of hardware and software:

HW Version: --

SW Version: --

2.6 EUT Photographs

See Annex A and B for the external and internal photo

3 Summary of Test Results

A brief summary of the tests carried out is shown as following.

Specification Clause	Name of Test	Result
2.1051, 90.543	Radiated Spurious Emission	Pass
2.1046, 90.542	Radiated RF Power Output	Pass
2.1049	Occupied Bandwidth	*Note 1
2.1055	Frequency Stability over Temperature Variation	Pass
2.1055, 90.213	Frequency Stability over Voltage Variation	Pass
2.1046, 90.542	Conducted RF Power Output	Pass
2.1057, 90.543	Conducted spurious emissions	Pass
2.1051, 90.543	Band-edge (conducted)	Pass
Note 1: No applicable performance criteria.		

Test equipment Used:

Asset Number	Description	Manufacturer	Model Number	Serial Number	Cal Due	State
7805	EMI Test Receiver	R/S	ESI26	100211	2015-01-09	Normal
7330	Ultra Broadband Antenna	R/S	VULB 9160	vulb9160－3252	2014-09-04	Normal
7330	Double-Ridged Horn Antenna	R/S	HF906	100037	2015-01-22	Normal
713	Fully-Anechoic Chamber	ETS	11.8m×6.5m×6.3m	--	2014-11-15	Normal
7330-2	Radio Communications Analyzer	Anritsu	MT8820B	6200772659	2015-01-25	Normal
---	Power spliter	Jie sai	---	1000132	2014-12-30	Normal
7353-2	DC power	Agilent.	66319B	MY43000149	2014-03-01	Normal
02	Power meter	NVRD	---	102257	2014-08-31	Normal

CTTL Test Report

4 Test Results

4.1 Radiated Spurious Emission

Specifications:	2.1051,90.543
Date of Tests	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

Limit Level Construction:
Part 90:
Section 90.543 Emission limitations.
(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz. so the limit level is:
P(dBm) – (43 + 10 log(P)) dB= -13dBm
(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the 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, in accordance with the following:
(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations. So the limit level is:
P(dBm) – (76 + 10 log(P)) dB=-46
(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations. So the limit level is:
P(dBm) – (65 + 10 log(P)) dB=-35
(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB. So the limit level is:
P(dBm) – (43 + 10 log(P)) dB=-13
(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.
(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and

adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Setup:

The EUT was placed in an anechoic chamber. The Wireless Communications Test Set was used to set the TX channel and power level and modulate the TX signal with different modes.

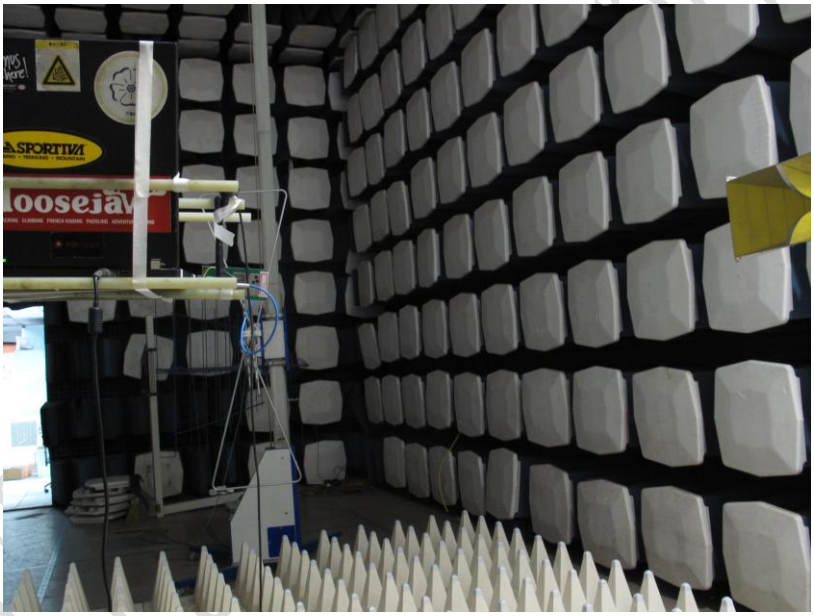
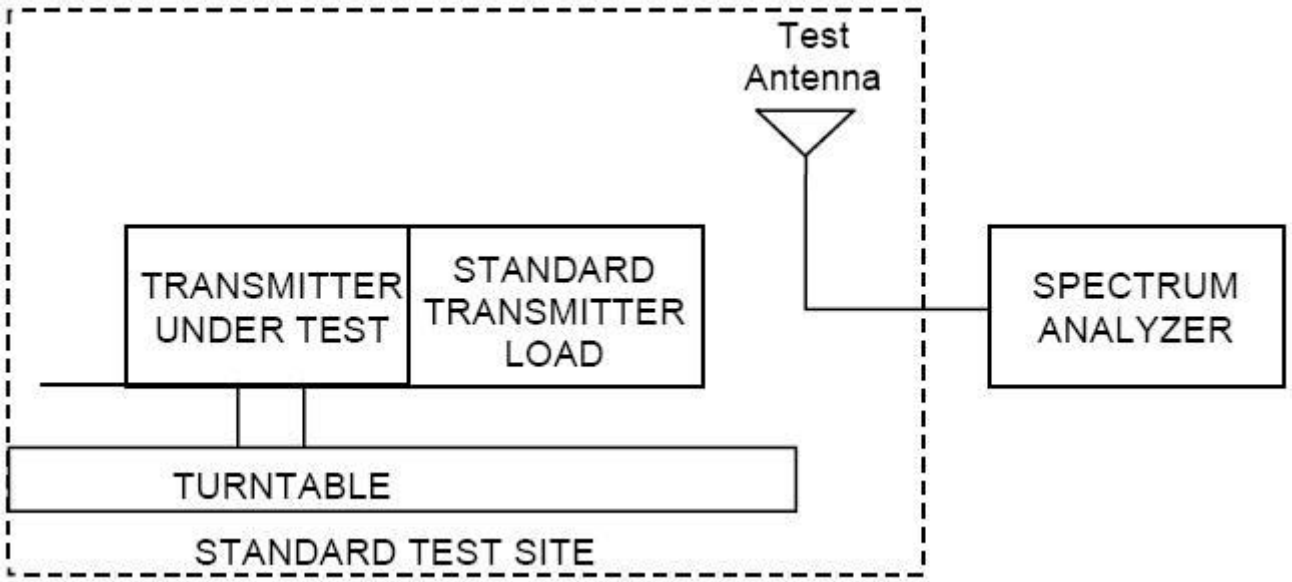


Figure SP

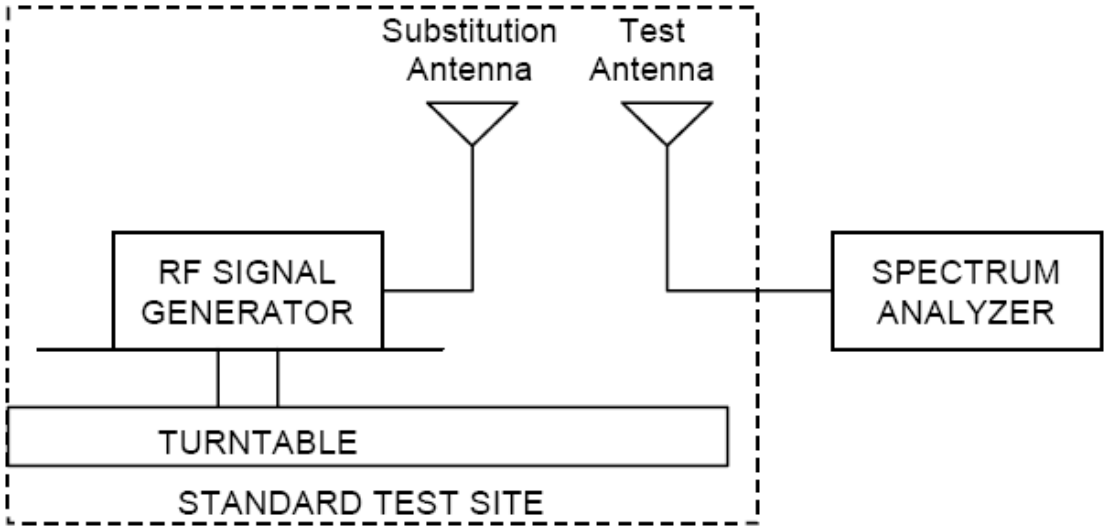
Test Method:

The measurement method is substitution method accordance with section 2.2.12 of ANSI/TIA-603-C: *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*.

(a) Connect the equipment as illustrated and measure the spurious emissions as the method as above.



(b) Reconnect the equipment as illustrated.



(c) Remove the transmitter and replace it with a substitution antenna. The center of the substitution antenna should be approximately at the same location as the center of the transmitter.

(d) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

(e) Repeat step d) with both antennas vertically polarized for each spurious frequency.
(f) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps d) and e) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

$$P_d\text{(dBm)} = P_g\text{(dBm)} - \textit{cable loss}\ \text{(dB)} + \textit{antenna gain}\ \text{(dB)}$$

where:
P_d is the dipole equivalent power and
P_g is the generator output power into the substitution antenna.

Test Data

（LTE channel 23305 BW 5MHz, QPSK）

Frequency [GHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1581	-53.5	6.9	8.6	-51.8	V
2371.5	-52.3	8.7	10	-51.0	V
3162	-60.2	10.5	9.9	-60.8	V
3952.5	-54.3	12.1	9.8	-56.6	V
4743	-55.1	13.5	11.2	-57.4	V
5533.5	-57.4	15	10.9	-61.5	V
1581	-55.4	6.9	8.6	-53.7	H
2371.5	-55.8	8.7	10	-54.5	H
3162	-63.7	10.5	9.9	-64.3	H
3952.5	-60.2	12.1	9.8	-62.5	H
4743	-57.9	13.5	11.2	-60.2	H
5533.5	-57.8	15	10.9	-61.9	H

Test Data

（LTE channel 23330 BW 5MHz, 16QAM）

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1581	-51.5	6.9	8.6	-49.8	V
2371.5	-51.9	8.7	10	-50.6	V
3162	-65.9	10.5	9.9	-61.5	V
3952.5	-58.2	12.1	9.8	-58.2	V

4743	-57.9	13.5	11.2	-60.3	V
5533.5	-57	15	10.9	-61.1	V
1581	-53.4	6.9	8.6	-51.7	H
2371.5	-54.8	8.7	10	-53.5	H
3162	-66.7	10.5	9.9	-62.3	H
3952.5	-61.8	12.1	9.8	-62.5	H
4743	-56.1	13.5	11.2	-58.4	H
5533.5	-31.5	15	10.9	-62.7	H

Test Data

（LTE channel 23355 BW 5MHz, QPSK）

Frequency [GHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1591	-55.3	6.9	8.6	-53.6	V
2386.5	-51.1	8.7	10	-49.8	V
3182	-65.2	10.5	9.9	-60.8	V
3977.5	-55.9	12.1	9.8	-56.6	V
4773	-55.1	13.5	11.2	-57.4	V
5568.5	-57.4	15	10.9	-61.5	V
1591	-55.9	6.9	8.6	-54.2	H
2386.5	-57	8.7	10	-55.7	H
3182	-68.7	10.5	9.9	-64.3	H
3977.5	-61.8	12.1	9.8	-62.5	H
4773	-57.9	13.5	11.2	-60.2	H
5568.5	-57.8	15	10.9	-61.9	H

Test Data

（LTE channel 23355 BW 5MHz, 16QAM）

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1591	-52.6	6.9	8.6	-50.9	V
2386.5	-53.5	8.7	10	-52.2	V
3182	-66.2	10.5	9.9	-61.8	V
3977.5	-57.9	12.1	9.8	-58.6	V
4773	-57.8	13.5	11.2	-60.1	V
5568.5	-57.4	15	10.9	-61.5	V

1591	-54	6.9	8.6	-52.3	H
2386.5	-52.6	8.7	10	-51.3	H
3182	-66.7	10.5	9.9	-62.3	H
3977.5	-62.1	12.1	9.8	-62.8	H
4773	-56	13.5	11.2	-58.3	H
5568.5	-58	15	10.9	-62.1	H

Test Data

（LTE channel 23330 BW 10MHz, QPSK）

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1575	-53.3	6.9	8.6	-51.6	V
2368.8	-44.7	8.7	10	-43.4	V
3151.8	-56.5	10.5	9.9	-57.1	V
3940.2	-55.5	12.1	9.8	-57.8	V
4728.6	-55.9	13.5	11.2	-58.2	V
5516.4	-54.7	15	10.9	-58.8	V
6308.8	-53.8	6.9	8.6	-52.1	V
7091.2	-53.8	8.7	10	-52.5	V
7898.4	-52.8	10.5	9.9	-53.4	H
8656	-53.4	12.1	9.8	-55.7	V
9452	-52.6	13.5	11.2	-54.9	V
1575	-53.3	6.9	8.6	-51.6	V

Test Data

（LTE channel 23330 BW 10MHz, 16QAM）

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dBi]	Spurious Emission Power (P_d) [dBm]	Antenna Polarization [H/V]
1576.8	-53.9	6.9	8.6	-52.2	V
2370.6	-44.8	8.7	10	-43.5	V
3154.8	-57.1	10.5	9.9	-57.7	H
3936.6	-55.8	12.1	9.8	-58.1	V
4731.6	-55.5	13.5	11.2	-57.8	V
5520	-54.6	15	10.9	-58.7	H
6300	-53.5	6.9	8.6	-51.8	V
7080	-53.7	8.7	10	-52.4	H
7877.6	-53	10.5	9.9	-53.6	V
8664	-53.1	12.1	9.8	-55.4	H
9448	-52.8	13.5	11.2	-55.1	H

Band-edge

KDB971168 CLAUSE 5.8.3:

It is often more convenient to measure the field strength in a radiated measurement and then mathematically convert the measured level to an equivalent power level for comparison to the applicable limit. Alternatively, the power limit can be mathematically converted to an equivalent field strength limit. The following relationships can be used to facilitate using radiated measurement data to demonstrate compliance to the relevant conducted output power limits:

a) E (dBμV/m) = Measured amplitude level (dBμV) + Cable Loss (dB) + Antenna Factor (dB/m)

b) E (dBμV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m).

c) E (dBμV/m) = EIRP (dBm) – 20log(D) + 104.8; where D is the measurement distance in meters.

d) EIRP(dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance in meters.

e) ERP = EIRP – 2.15; where ERP and EIRP are expressed in consistent units.

f) EIRP = ERP + 2.15; ERP and EIRP are expressed in consistent units

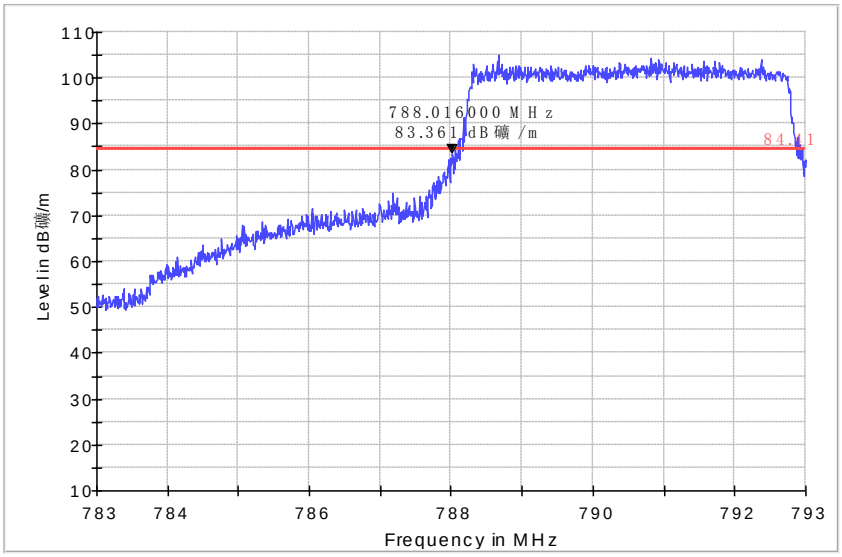
Note that the antenna factor is typically only provided for standard measurement distances (e.g., 1 and/or 3 meters), and thus may be a determinant factor in choosing what measurement distance to use.

So the limits:

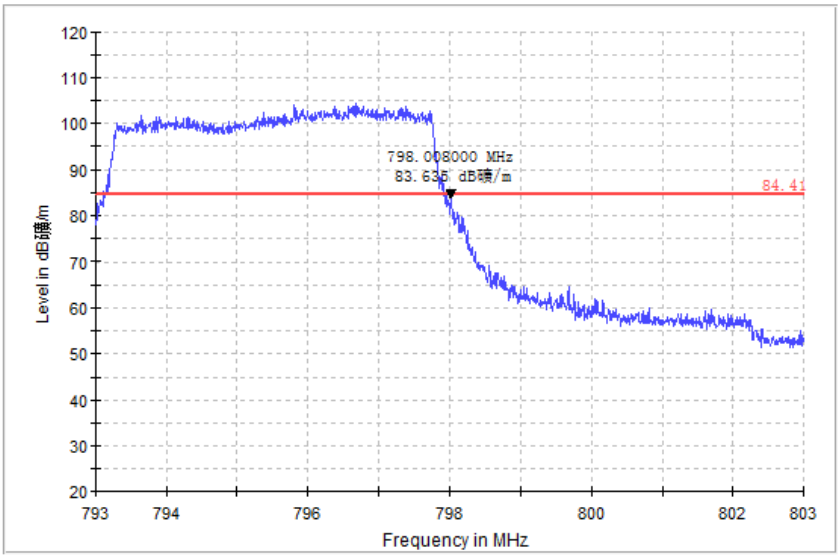
E (dBμV/m) = EIRP (dBm) – 20log(D) + 104.8=-13-20log(3dBm)+104.8

=84.41 dBμV/m

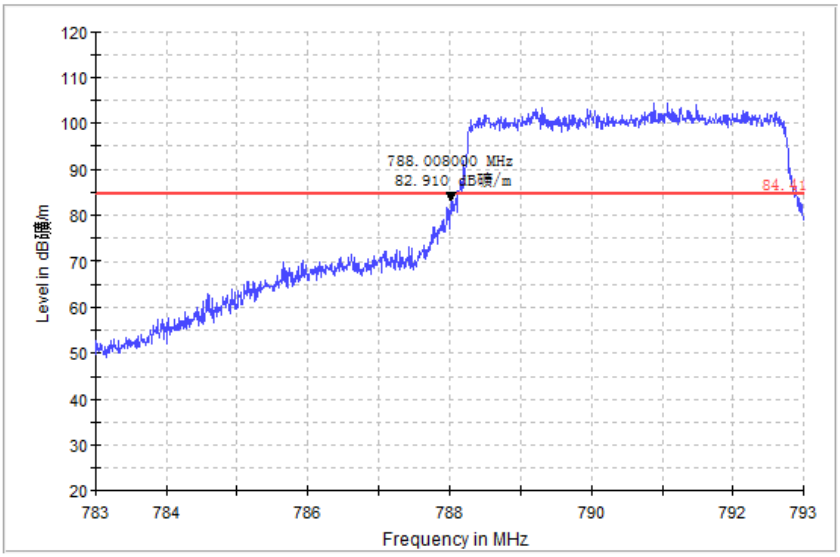
LTE band 14 BW 5MHz



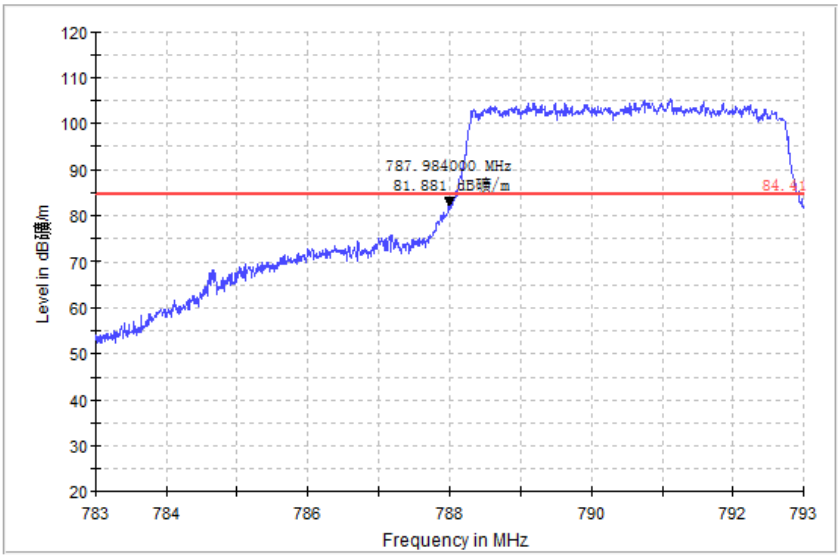
Ch23305 Left band edge QPSK



Ch23355 Right band edge QPSK

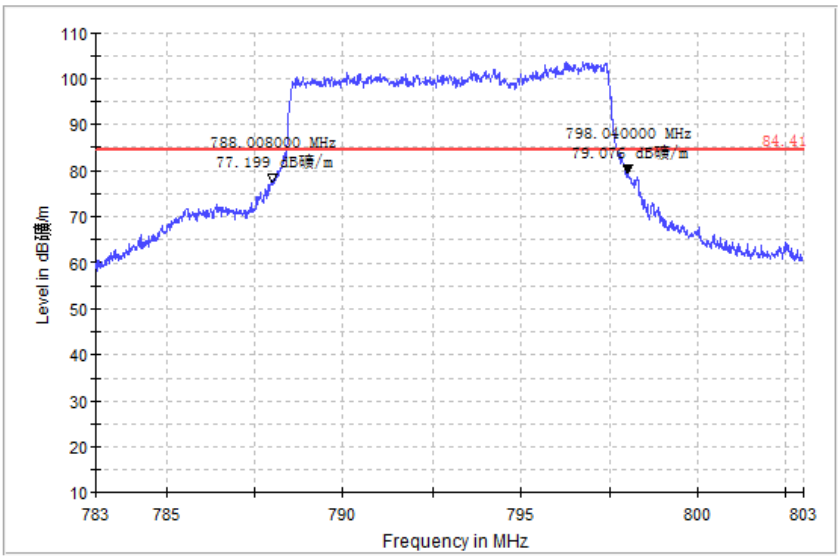


Ch23305 Left band edge 16QAM

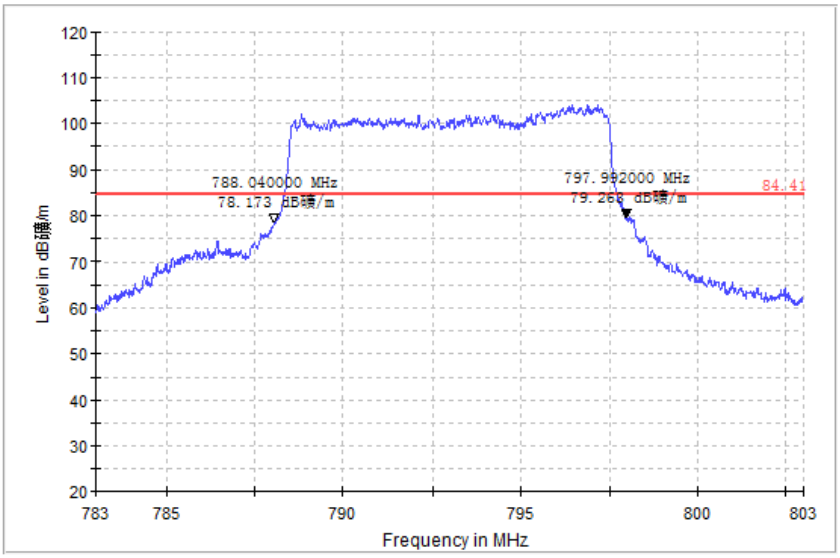


Ch23355 Right band edge 16QAM

LTE band 14 BW 10MHz



Ch23330 band edge QPSK



Ch23330 band edge 16QAM

4.2 Radiated RF Power Output

Specifications:	2.1046 ,90.542
Date of Tests	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

Limit Level Construction:
Part 90:
Secion 90.542 Broadband transmitting power limits.
(a) The following power limits apply to the 758–768/788–798 MHz band:
(6) Control stations and mobile stations transmitting in the 758–768 MHz band and the 793–798 MHz band are limited to **30 watts ERP**.
(7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to **3 watts ERP**.
The maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage.

Limits for Radiated RF Power Output (ERP)

Frequency range	Limit Level (ERP)
TX channel	30W

Test Setup:

The EUT was set in an anechoic chamber, which is connected to the Wireless Communications Test Set located outside the chamber. The test was done using an automated test system, where all test equipments were controlled by a computer. The test distance separation from the receive antenna is 3 meters.

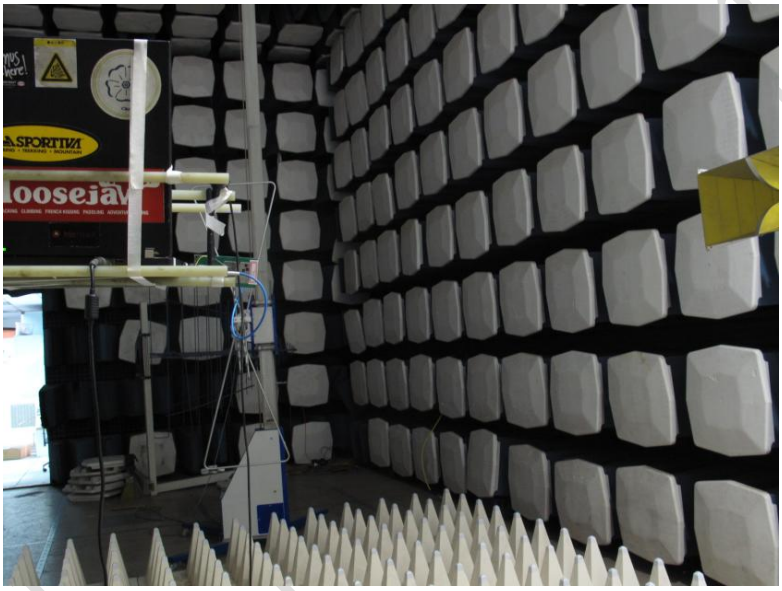
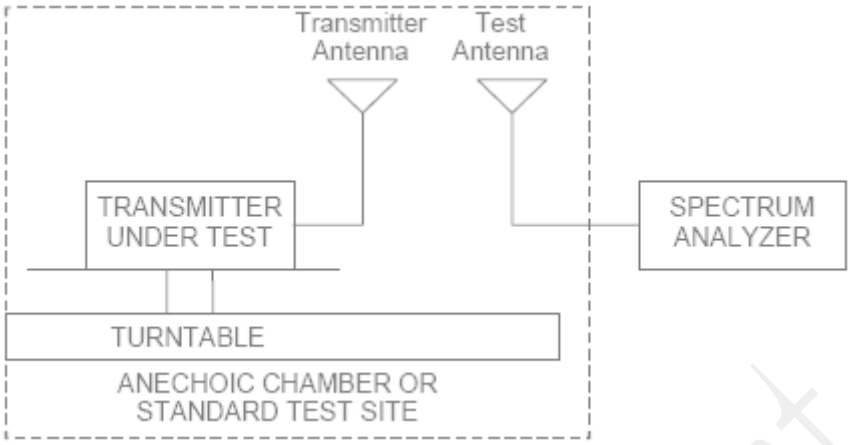


Figure ERP

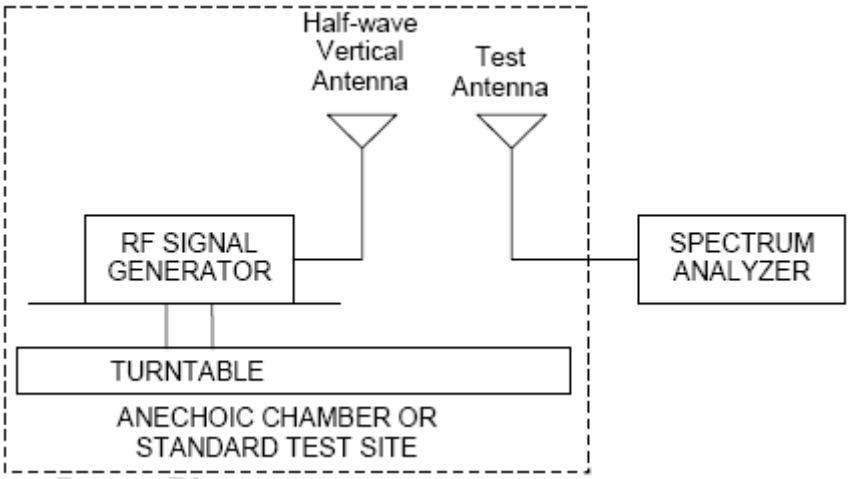
Test Method

The measurement was performed accordance with section 2.2.17 of ANSI/TIA-603-C: *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*.

a) Connect the equipment as illustrated. Mount the equipment in a vertical orientation on a multi-axis plastic holder in a RF anechoic chamber.



b) Key the transmitter on, then rotate the EUT 360 degree azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks.
c) Replace the transmitter under test with a vertically polarized half-wave dipole, or an antenna whose gain is known relative to an ideal half-wave dipole, illustrated as following. The center of the antenna should be at the same location as the center of the antenna under test.



d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS.

LOSS = Generator Output Power (dBm) – Analyzer reading (dBm)

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:

ERP (dBm) = LVL (dBm) + LOSS (dB)

f) The maximum ERP is the maximum value determined in the preceding step.

Method of Calculation

ERP can then be calculated as follows:

P_d (dBm) = P_g (dBm) - Losses (dB) + Antenna Gain (dBd)

where:

dBd refers to gain relative to an ideal dipole.

Test Data:

LTE band 14 BW 5MHz, QPSK mode:

Channel	Output power (Pg) [dBm]	Loss [dB]	Antenna Gain [dBd]	ERP (P_d) [dBm]	Antenna Polarization [H/V]
23330 (793.0MHz)	22.36	5.1	3.95	21.21	V
23355 (795.5MHz)	22.13	5.1	3.95	20.98	V

LTE band 14 BW 5MHz, 16QAM mode:

Channel	Output power (Pg) [dBm]	Loss [dB]	Antenna Gain [dBd]	ERP (P_d) [dBm]	Antenna Polarization [H/V]
23330 (793.0MHz)	22.70	5.1	3.95	21.55	V
23355 (795.5MHz)	22.42	5.1	3.95	21.27	V

LTE band 14 BW 10MHz, QPSK mode:

Channel	Output power (Pg) [dBm]	Loss [dB]	Antenna Gain [dBd]	ERP (P_d) [dBm]	Antenna Polarization [H/V]
23330 (793.0MHz)	21.18	3.05	3.11	21.24	V

LTE band 14 BW 10MHz, 16QAM mode:

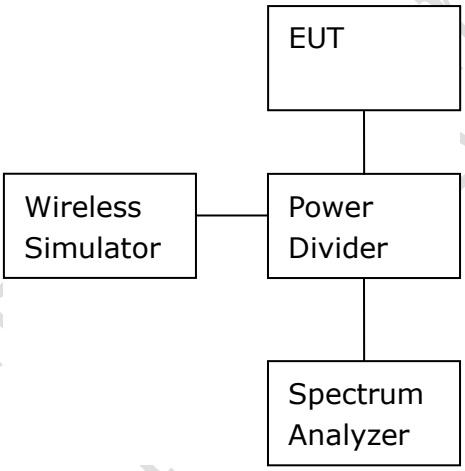
Channel	Output power (Pg) [dBm]	Loss [dB]	Antenna Gain [dBd]	ERP (P_d) [dBm]	Antenna Polarization [H/V]
23330 (793.0MHz)	22.52	3.05	3.11	22.58	V

4.3 Occupied bandwidth

Specifications:	2.1049
Date of Test	2012.12.07
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

Test Setup

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method

The 99% occupied bandwidth was calculated from the spectrum analyzer. Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power band. The RBW is not less then and near 1% 26 dBc bandwidth.

KDB971168 CLAUSE 4.2:

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

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

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

d) NOTE—Steps a) through c) may require iteration to adjust within the specified tolerances.
e) Set the detection mode to peak, and the trace mode to max hold..
f) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
g) If the instrument does not have a 99 % power bandwidth function, the trace data points are to be recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % power bandwidth is the difference between these two frequencies.
h) The OBW shall be reported by providing plot(s) of the measuring instrument display. The frequency and amplitude axes and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).
FSQ Signal Analyzer setting:
LTE Band 14, 5MHz bandwidth

	RBW(KHz)	VBW(KHz)
26dBc BW	100	300
99% OBW	100	300

LTE Band 14, 10MHz bandwidth

	RBW(KHz)	VBW(KHz)
26dBc BW	100	300
99% OBW	120	300

Note:

None

Test Data:

LTE Band 14, 5MHz bandwidth, QPSK:

UARFCN	26dBc BW (MHz)	RBW(≥1% 26dBcBW)	99% Occupied Bandwidth (MHz)
23305	5.271	100 kHz	4.529
23355	5.150	100 kHz	4.569

LTE Band 14, 5MHz bandwidth, 16QAM:

UARFCN	26dBc BW (MHz)	RBW(≥1% 26dBcBW)	99% Occupied Bandwidth
23305	5.471	100 kHz	4.529
23355	5.351	100 kHz	4.549

LTE Band 14, 10MHz bandwidth, QPSK:

UARFCN	26dBc BW (MHz)	RBW(≥1% 26dBcBW)	99% Occupied Bandwidth (MHz)
23330	10.38	120 kHz	8.94

LTE Band 14, 10MHz bandwidth, 16QAM:

UARFCN	26dBc BW (MHz)	RBW(≥1% 26dBcBW)	99% Occupied Bandwidth
23330	10.42	120 kHz	8.97

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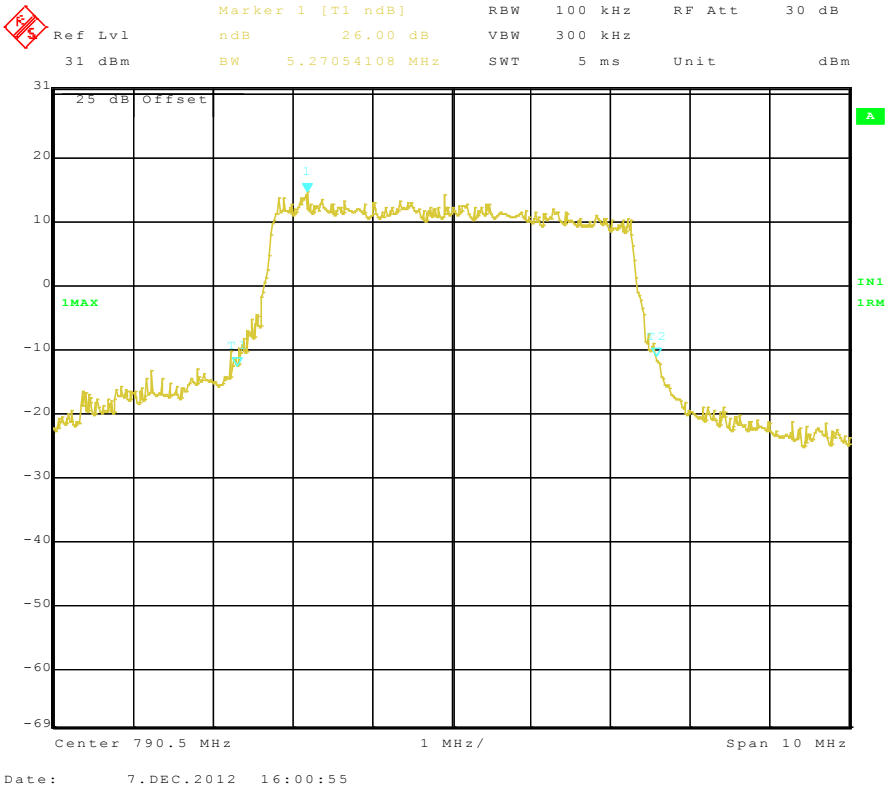
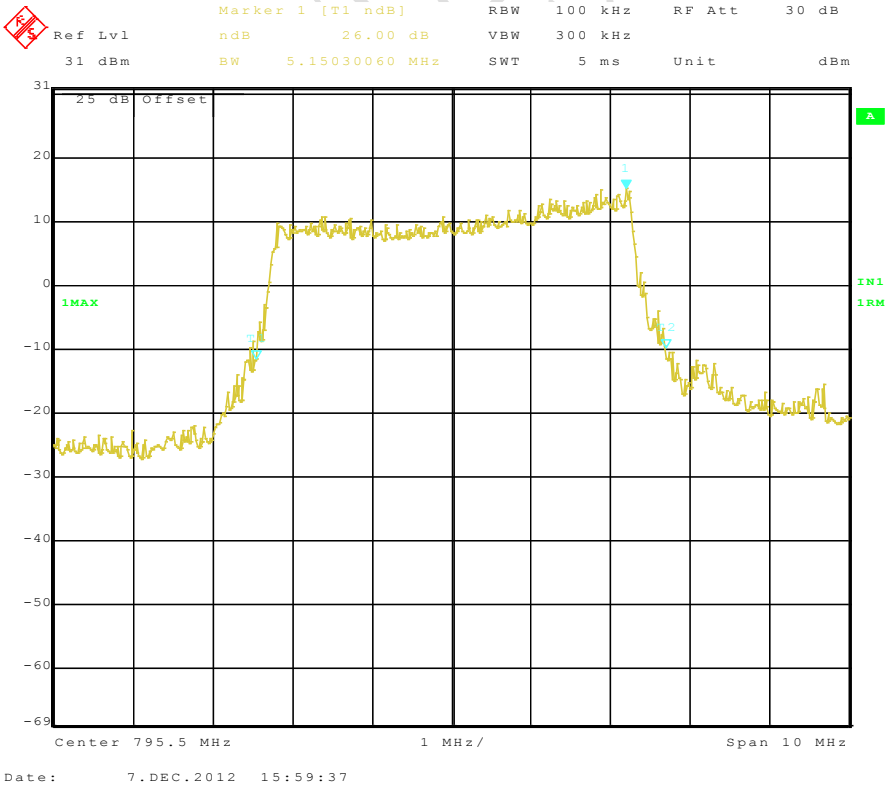
Graphical results for LTE BC14, 5 MHz Bandwidth:

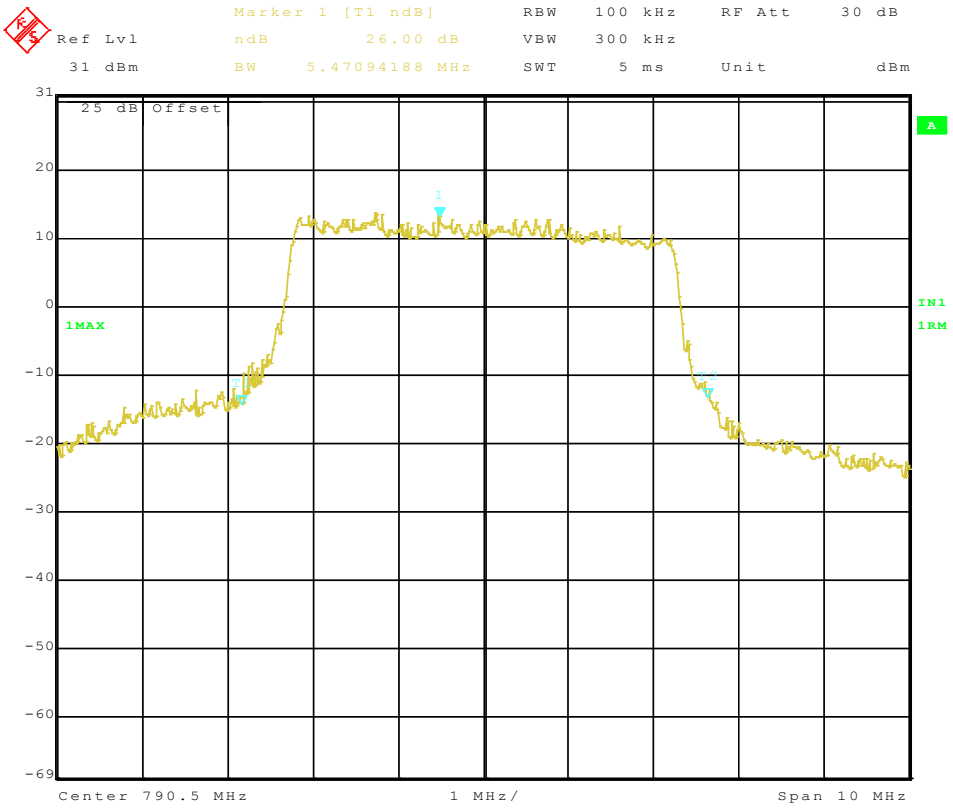
UARFCN=23305，26 dBc BW, QPSK



UARFCN=23355，26 dBc BW, QPSK

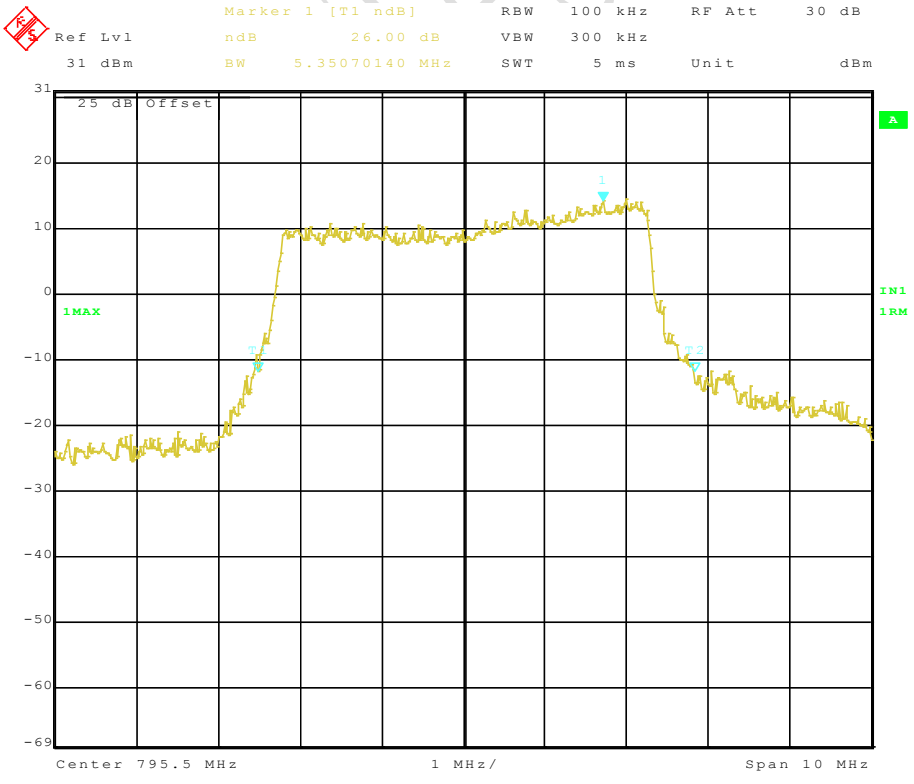


UARFCN=23305，26 dBc BW, 16QAM



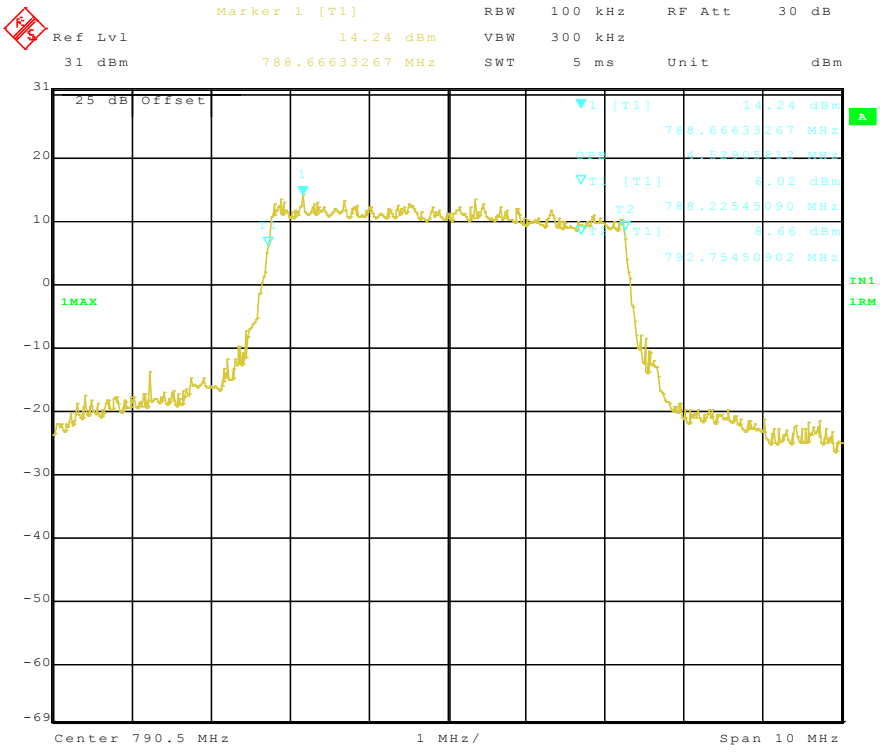
Date: 7.DEC.2012 16:01:53

UARFCN=23355，26 dBc BW, 16QAM



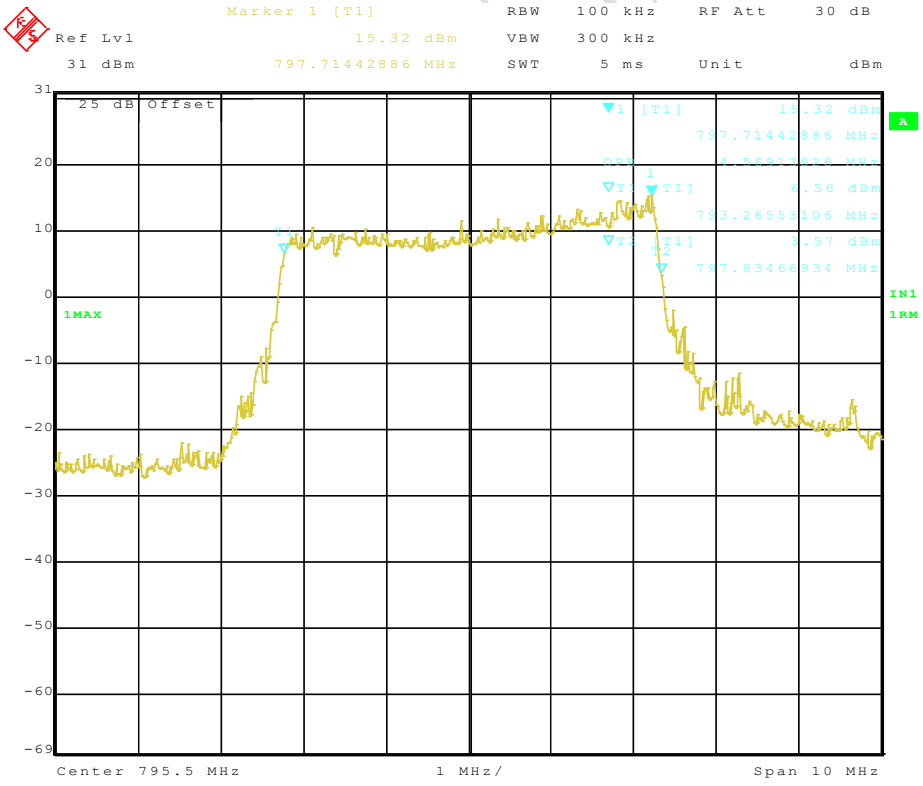
Date: 7.DEC.2012 15:58:37

UARFCN=23305，99% BW, QPSK



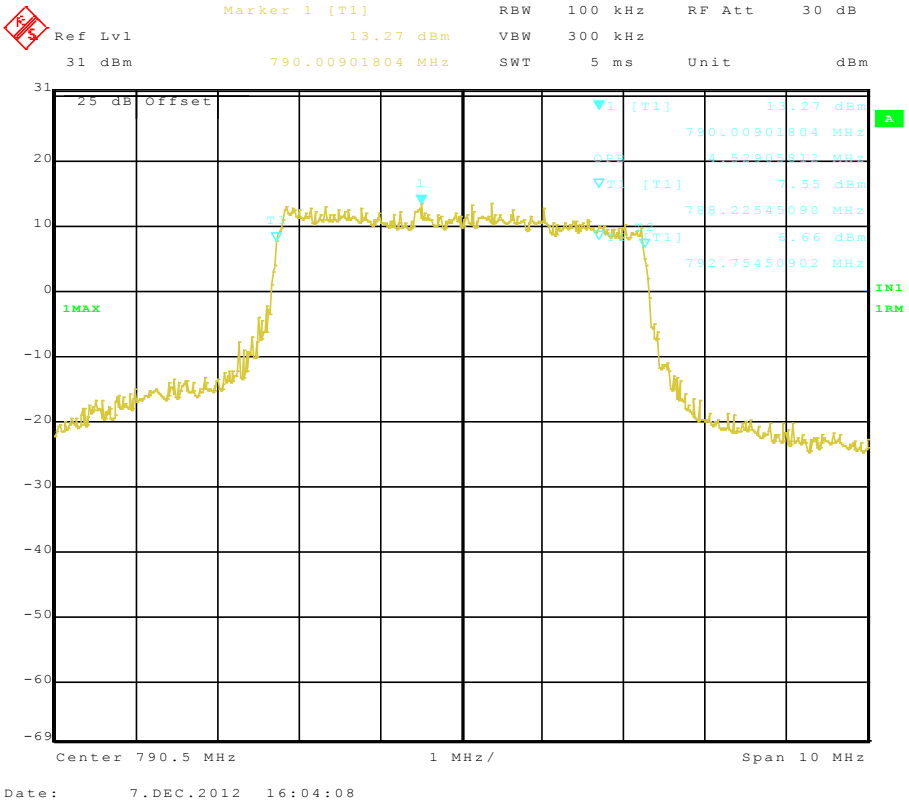
Date: 7.DEC.2012 16:05:30

UARFCN=23355，99% BW, QPSK

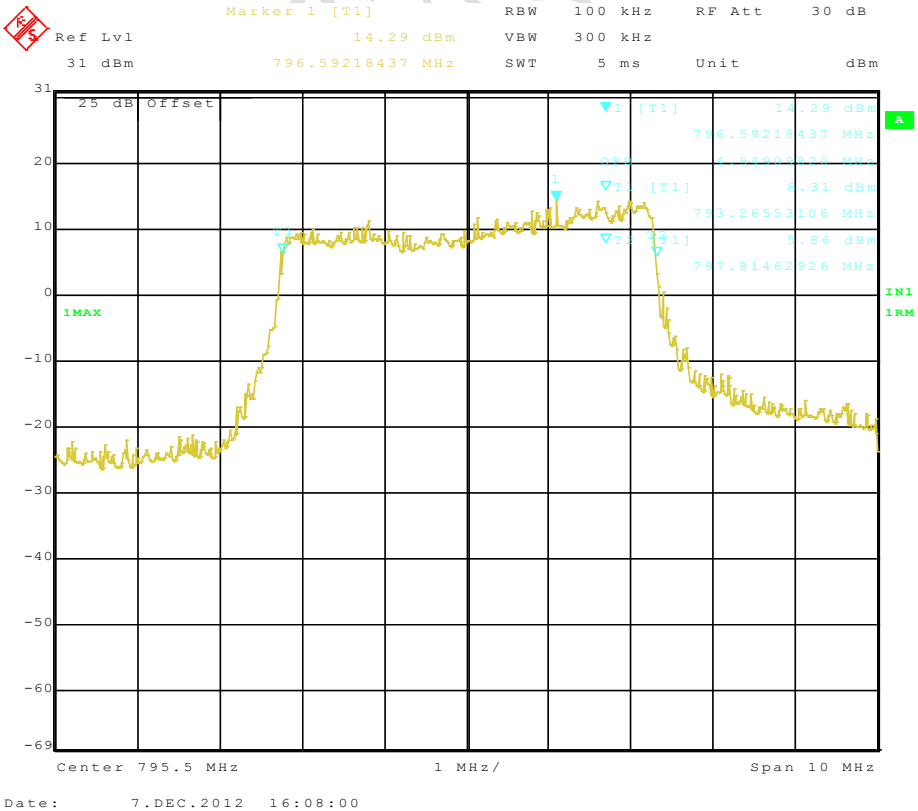


Date: 7.DEC.2012 16:06:52

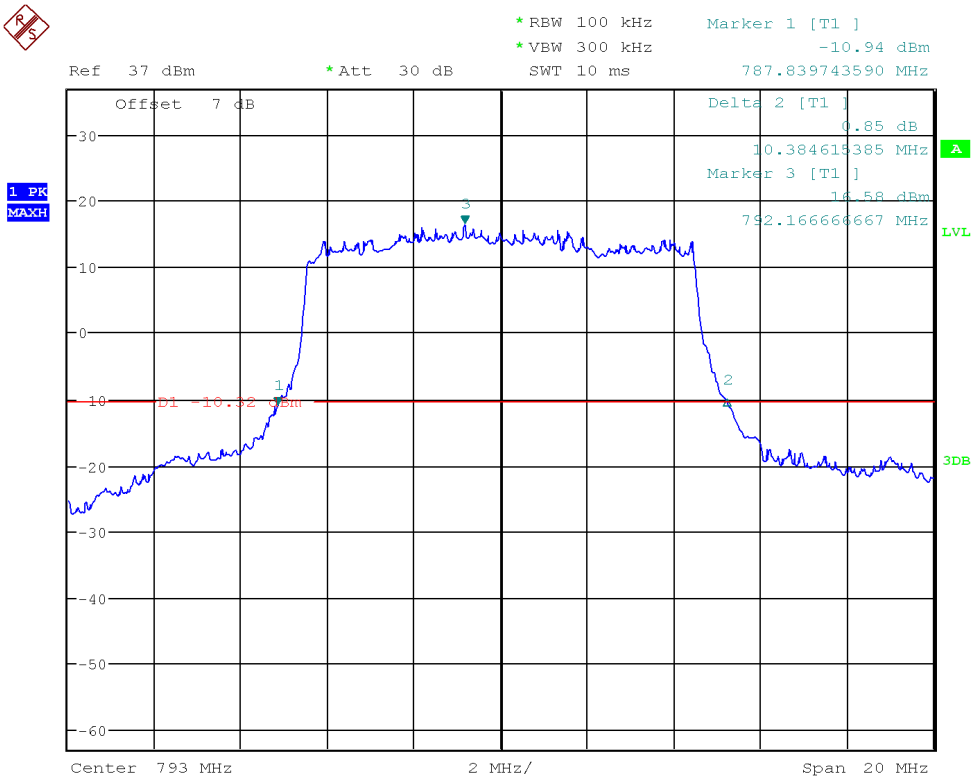
UARFCN=23305，99% BW, 16QAM



UARFCN=23355，99% BW, 16QAM

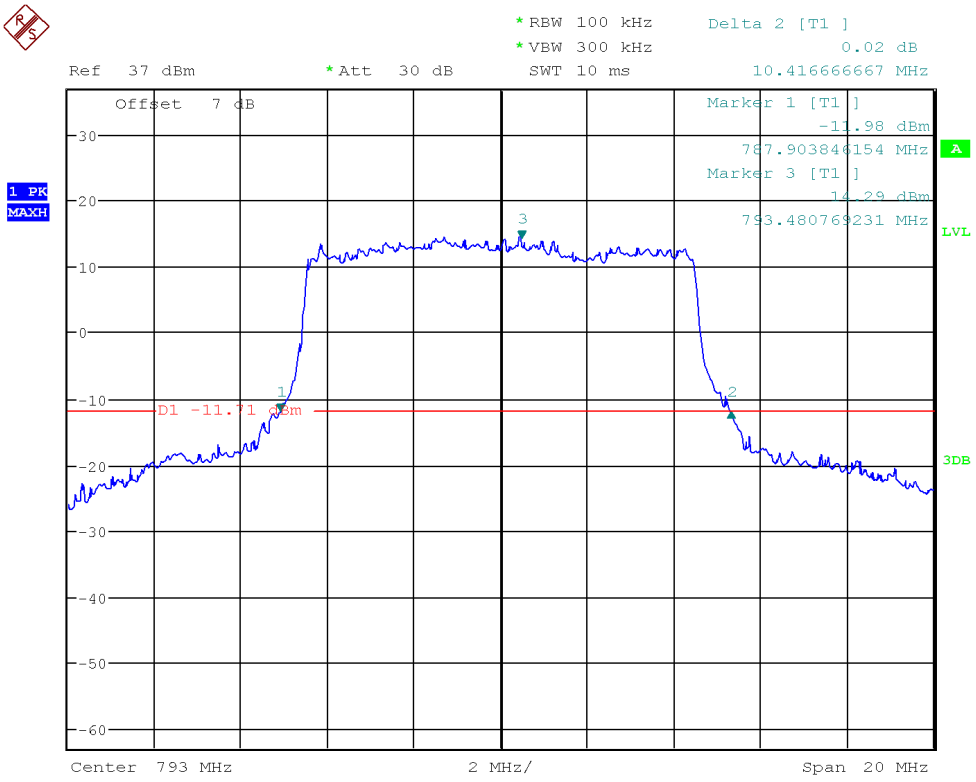


Graphical results for LTE BC14, 10 MHz Bandwidth: UARFCN=23330，26 dBc BW, QPSK



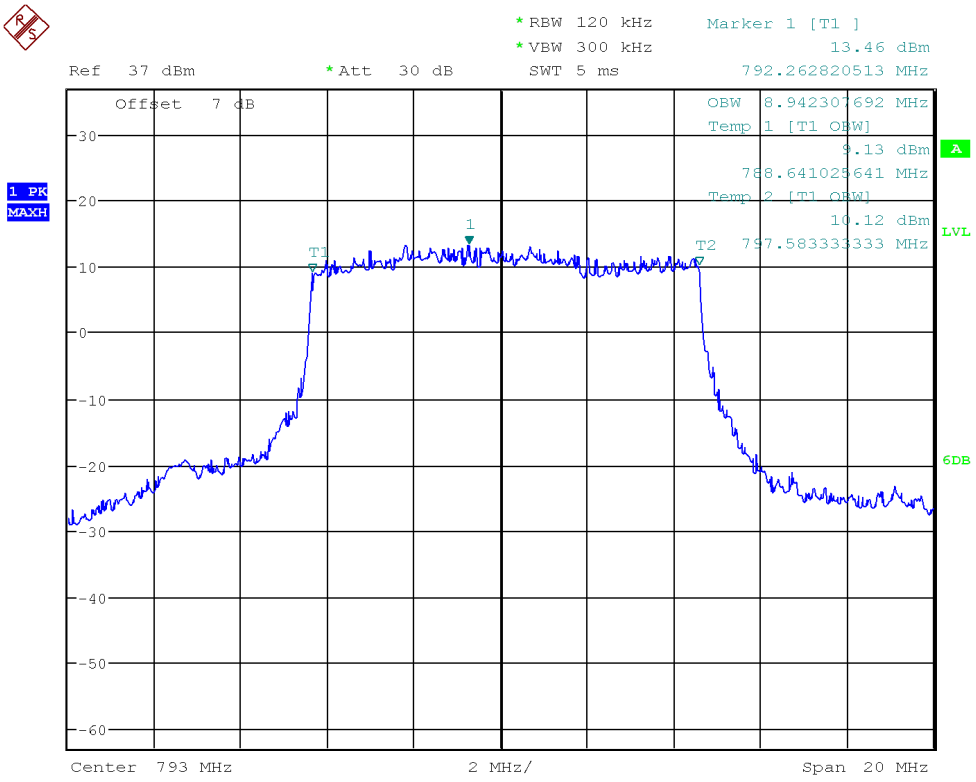
Date: 15.JAN.2014 18:59:54

UARFCN=23330，26 dBc BW, 16QAM



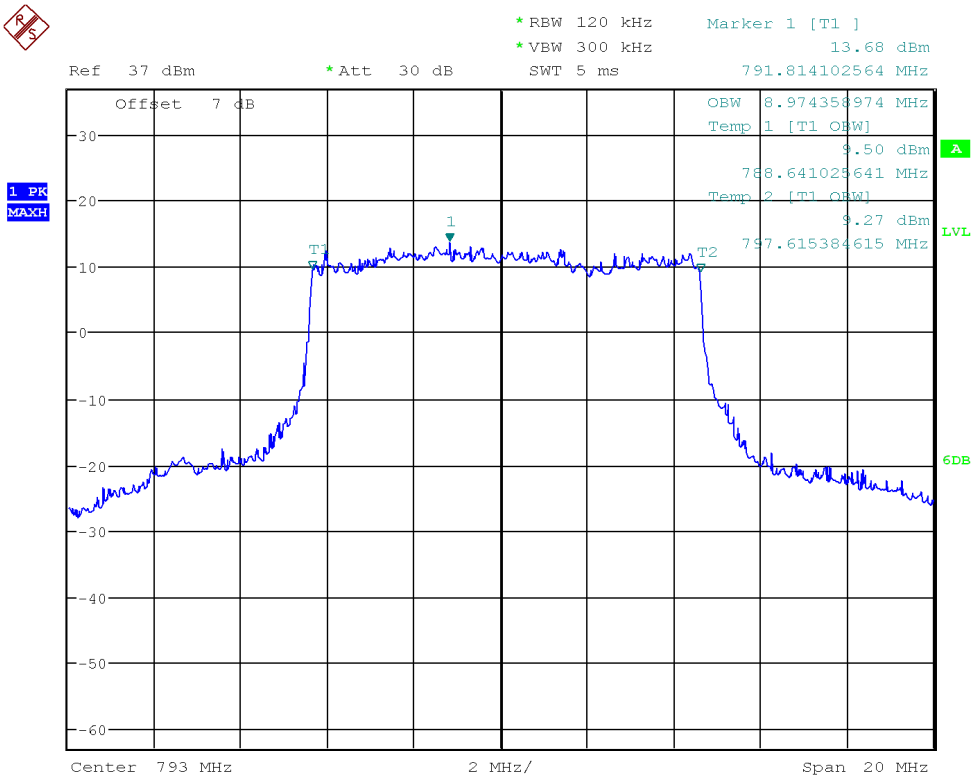
Date: 15.JAN.2014 19:01:28

UARFCN=23330，99% BW, QPSK



Date: 15.JAN.2014 19:03:09

UARFCN=23330，99% BW, 16QAM



Date: 15.JAN.2014 19:02:31

4.4 Frequency Stability over Temperature Variation

Specifications:	2.1055, 90.213
Date of Test	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:-30℃-50℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass
Limit	
Frequency deviation [ppm]	±2.5

Note: For frequency stability, "sufficient" is the requirement in the FCC rules, so ±2.5 ppm is applied upon the experiences.

Test Setup

The EUT was placed in a temperature chamber, demonstrated as figure T. The CMU 200 was used to set the TX channel and power level, modulate the TX signal with different bit patterns and measure the frequency of TX. A dummy battery powered by a DC power supply is used to provide a constant power source.

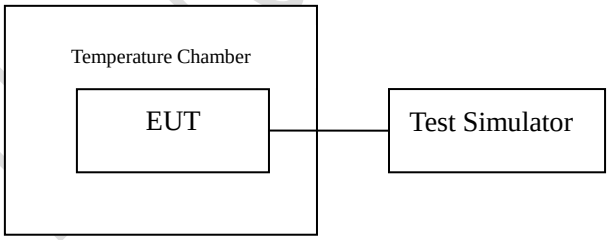


Figure T: setup for measurement of frequency stability over temperature variation

Test Method

1. The EUT was turned off and placed in the temperature chamber.
2. The temperature of the chamber was set to -30℃ and allowed to stabilize.
3. The EUT temperature was allowed to stabilize for 45 minutes.
4. The EUT was turned on and set to transmit with Wireless Telecommunications Test Set.
5. The maximum transmit frequency deviation during one minute period was measured by Wireless Communications Test Set.
6. The steps 3-5 were repeated for -20℃, -10℃, 0℃, 10℃, 20℃, 30℃, 40℃

and 50℃.

Test data:

LTE Band 14, 5MHz bandwidth, channel 23305, QPSK
Compliance windows: ±1976.25 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	19	Pass
-20	18	Pass
-10	15	Pass
0	14	Pass
10	17	Pass
20	16	Pass
30	17	Pass
40	19	Pass
50	18	Pass

LTE Band 14, 5MHz bandwidth, channel 23355, QPSK
Compliance windows: ±1988.75 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	23	Pass
-20	19	Pass
-10	20	Pass
0	16	Pass
10	19	Pass
20	22	Pass
30	19	Pass
40	21	Pass
50	23	Pass

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LTE Band 14, 5MHz bandwidth, channel 23305, 16QAM
Compliance windows: ±1976.25 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	23	Pass
-20	19	Pass
-10	14	Pass
0	17	Pass
10	15	Pass
20	16	Pass
30	18	Pass
40	19	Pass
50	18	Pass

LTE Band 14, 5MHz bandwidth, channel 23355, 16QAM
Compliance windows: ±1988.75 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	22	Pass
-20	21	Pass
-10	19	Pass
0	18	Pass
10	17	Pass
20	16	Pass
30	19	Pass
40	19	Pass
50	18	Pass

LTE Band 14, 10MHz bandwidth, channel 23330, QPSK
Compliance windows: ±1982.5 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	25	Pass
-20	26	Pass
-10	23	Pass
0	20	Pass
10	18	Pass
20	19	Pass
30	22	Pass
40	27	Pass
50	26	Pass

LTE Band 14, 10MHz bandwidth, channel 23330, 16QAM
Compliance windows: ±1982.5 Hz

Temperature[℃]	Deviation[Hz]	Remarks
-30	29	Pass
-20	25	Pass
-10	27	Pass
0	24	Pass
10	23	Pass
20	19	Pass
30	24	Pass
40	28	Pass
50	31	Pass

CTTL Test Report

4.5 Frequency Stability over Voltage Variation

Specifications:	2.1055, 90.213
Date of Test	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:-30℃-50℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass
Limit	
Frequency deviation [ppm]	±2.5

Note: For frequency stability, "sufficient" is the requirement in the FCC rules, so ±2.5 ppm is applied upon the experiences.

Test Setup

The EUT was placed in a shielding chamber and powered by the dummy battery which is connected to a DC power source, demonstrated as figure V. The wireless communications test set was used to set the TX channel and power level, modulate the TX signal with different bit patterns and measure the frequency of TX.

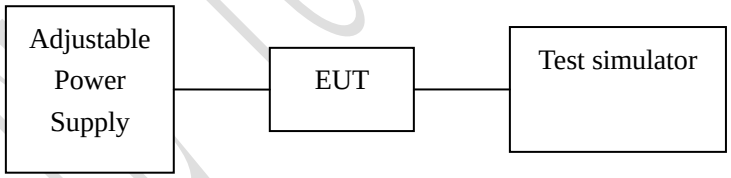


Figure V: test setup for measurement of frequency stability over voltage variation

LTE Band 14, 5MHz bandwidth：EARFCN=23305, QPSK
Compliance windows: ±1976.25Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	14
Cut-off point	3.9	18

LTE Band 14, 5MHz bandwidth：EARFCN=23305, 16QAM
Compliance windows: ±1976.25Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	18
Cut-off point	3.9	18

Limit：2.5ppm
LTE Band 14, 5MHz bandwidth：EARFCN=23355, QPSK
Compliance windows: ±1988.75Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	21
Cut-off point	3.9	19

LTE Band 14, 5MHz bandwidth：EARFCN=23355, 16QAM
Compliance windows: ±1988.75Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	23
Cut-off point	3.9	28

LTE Band 14, 10MHz bandwidth：EARFCN=23330, QPSK
Compliance windows: ±1982.5Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	26
Cut-off point	3.9	21

LTE Band 14, 10MHz bandwidth：EARFCN=23330, 16QAM
Compliance windows: ±1982.5Hz

Level	Voltage[V]	Deviation[Hz]
Nominal	5.0	22
Cut-off point	3.9	19

CTTL Test Report

4.6 Conducted RF Power Output

Specifications:	2.1046, 90.542
Date of Tests	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

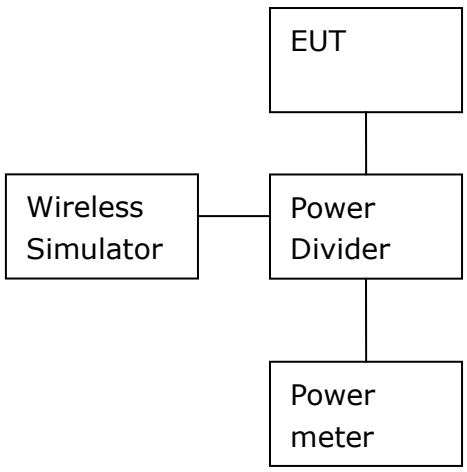
Limit Level Construction:
Part 90:
Secion 90.542 Broadband transmitting power limits.
(a) The following power limits apply to the 758–768/788–798 MHz band:
(6) Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to **30 watts ERP.**
(7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to **3 watts ERP**.
The maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage.

Limits for ERP

Frequency range	Limit Level (ERP)
TX channel	30W

Test Setup:

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by power meter.



Test Method

1) The EUT was coupled to the power meter and the base station simulator through a power divider. The lost of the cables the test system is calibrated to correct the readings.
KDB971168 CLAUSE 5.1.2:
The total peak output power may be measured using a broadband peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the emission bandwidth and utilize a fast-responding diode detector. Consult the operator's manual for specific operating details for the particular power meter to be used.VBW>10MHz.

Note:

None

Test Results:

LTE Band 14, 5MHz bandwidth, QPSK:

EARFCN	Conducted Power (dBm)
23305	22.57
23355	22.25

LTE Band 14, 5MHz bandwidth, 16QAM:

EARFCN	Conducted Power (dBm)
23305	22.88
23355	22.59

LTE Band 14, 10MHz bandwidth, QPSK:

EARFCN	Conducted Power (dBm)
23330	22.12

LTE Band 14, 10MHz bandwidth, 16QAM:

EARFCN	Conducted Power (dBm)
23330	22.46

CTTL Test Report

4.7 Conducted Spurious Emission

Specifications:	2.1051, 90.543
Date of Tests	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

Limit Level Construction:

Part 90:

Section 90.543 Emission limitations.

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz. so the limit level is:

P(dBm) – (43 + 10 log(P)) dB= -13dBm

(e) For operations in the 763–768 MHz and the 793–798 MHz bands, the power of any emission outside the 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, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations. so the limit level is:

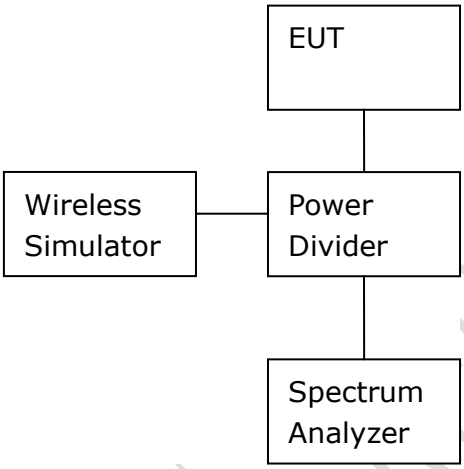
P(dBm) – (65 + 10 log(P)) dB= -35dBm

(3) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 763–775 MHz and 793–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation. The wideband signals limits are applicable in this report, which is **-40 dBm/MHz.**

Test Setup:

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method

The measurement was performed accordance with section 2.2.13 of ANSI/TIA-603-C: *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*.
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.

Note:

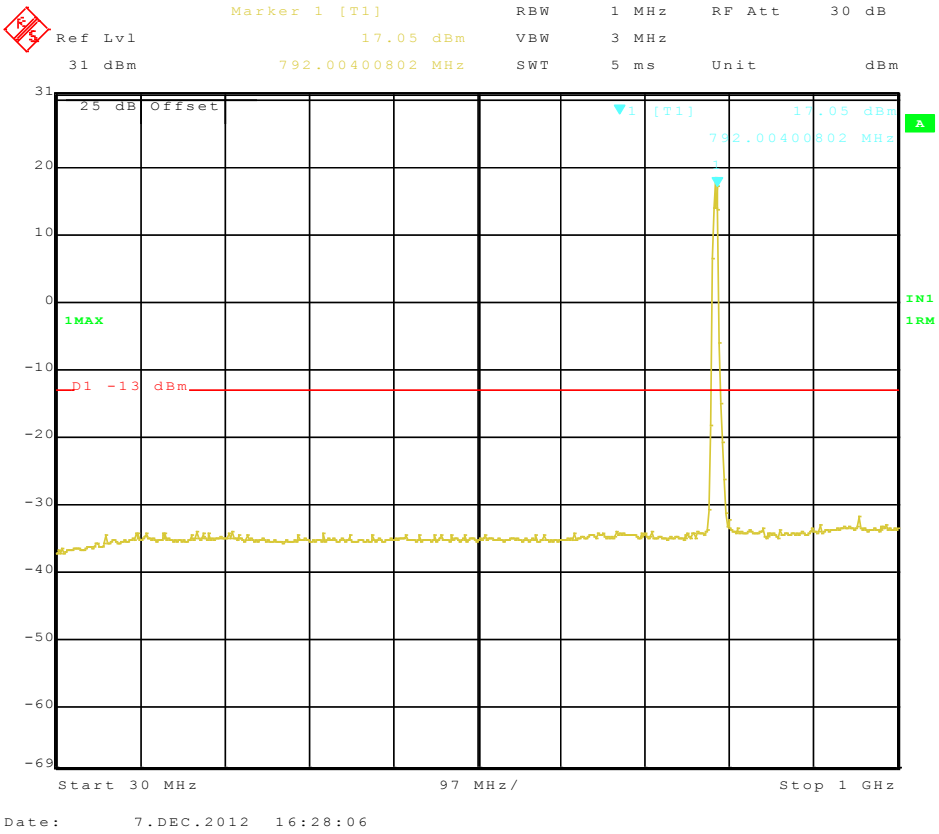
None
Test Data:
LTE Band 14, 5MHz bandwidth, QPSK, EARFCN: 23305

Freq range	RBW/VBW	Limit (dBm)	Picture
30M-1GHz	1M/3M,	-13	LQPSK1
1G-8GHz	1M/3M	-13	LQPSK2
775-788MHz	30k/100k	-13	LQPSK3
-758MHz	100k/300k	-13	LQPSK4
805M-	100k/300k	-13	LQPSK5

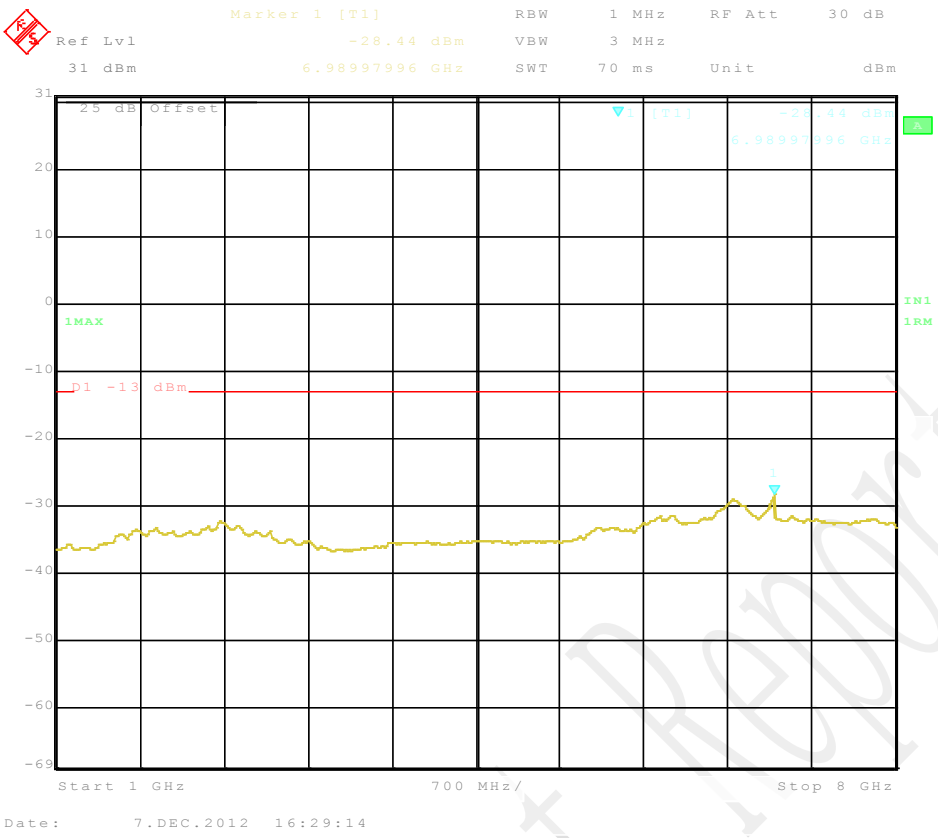
769-775	10k/1M	-35	LQPSK6
799-805	10k/1M	-35	LQPSK7
1559M-1610MHz	1M/3M	-40	LQPSK8

Note: all spurious emission values are much less then the limits.

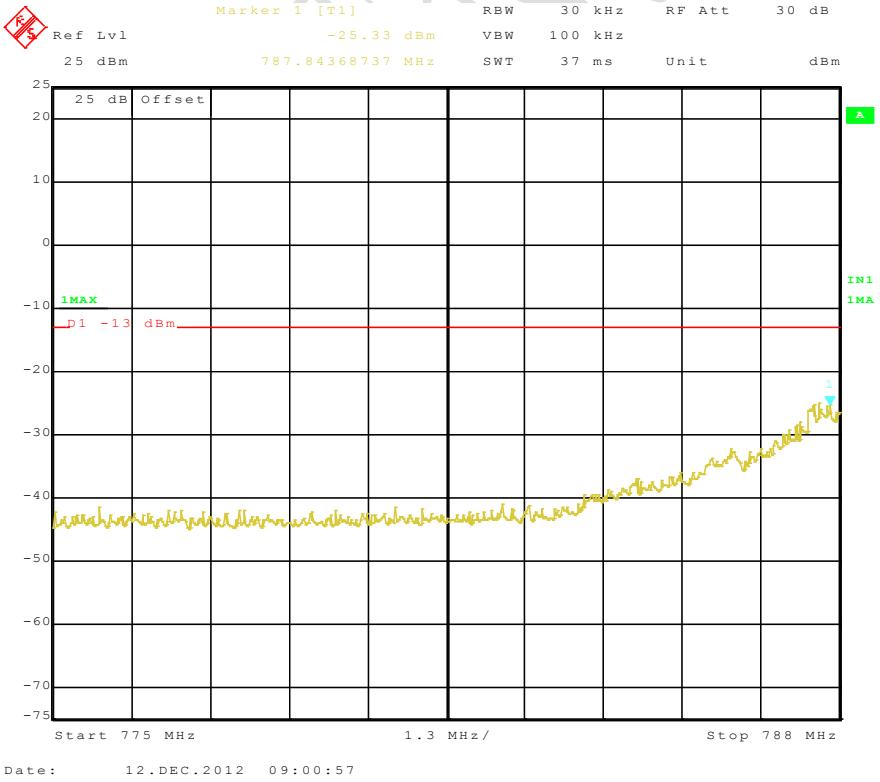
LQPSK1



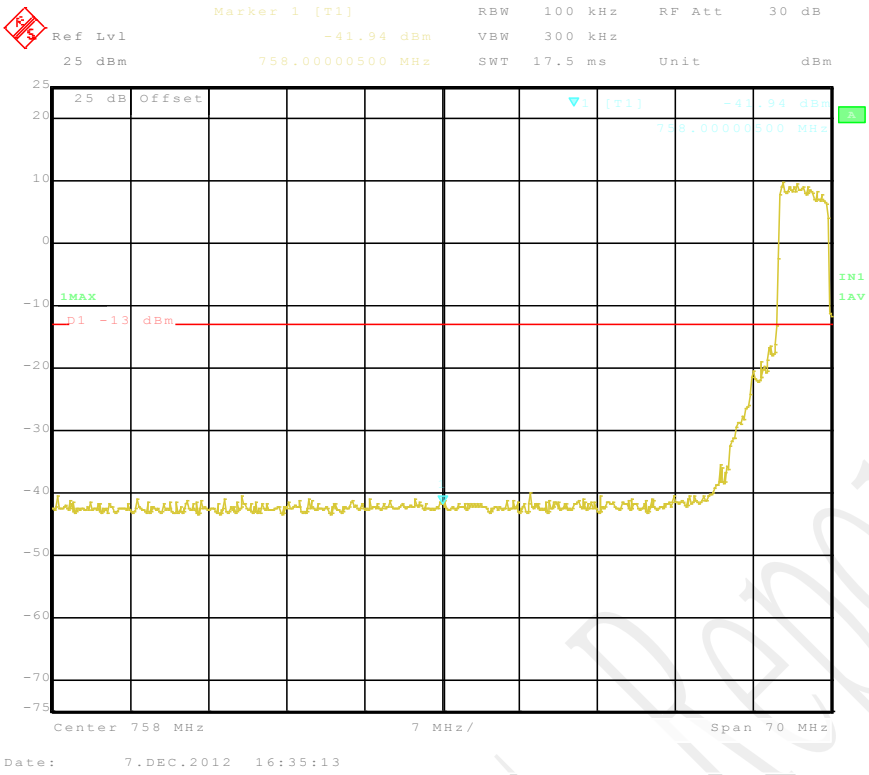
LQPSK2



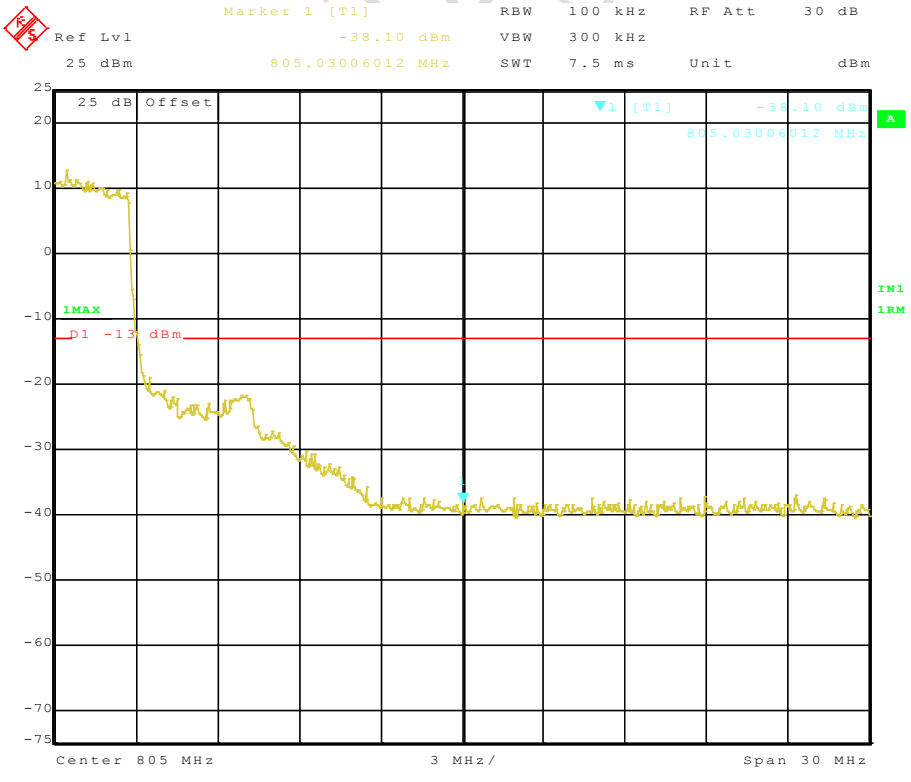
LQPSK3



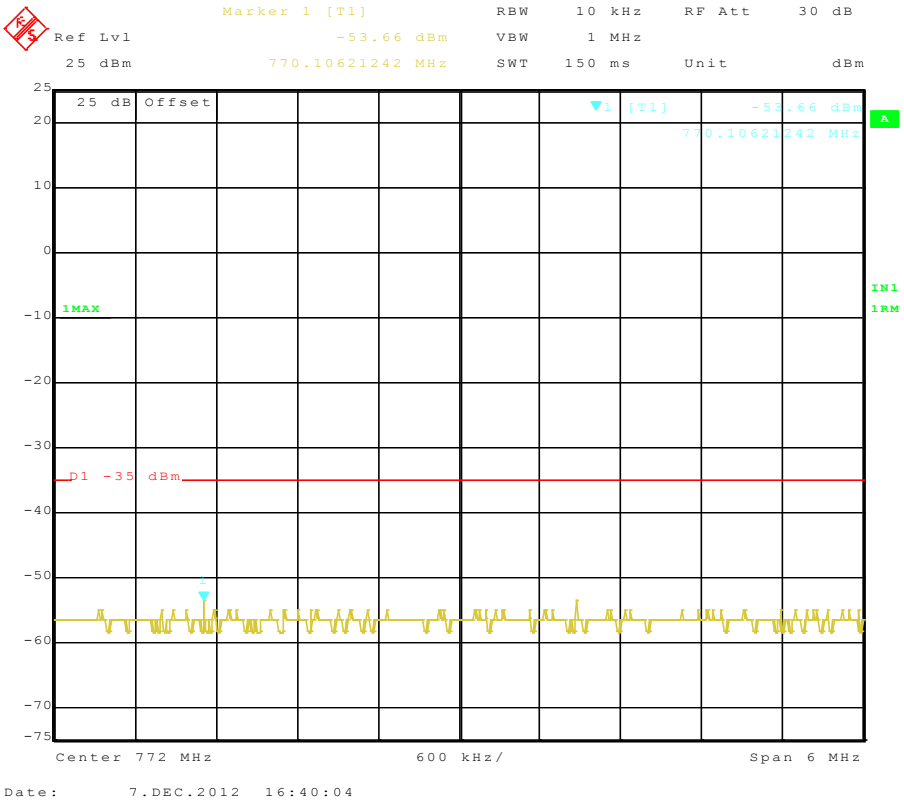
LQPSK4


Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-41.94 dBm
VBW 300 kHz
25 dBm
758.00000500 MHz
SWT 17.5 ms
Unit dBm
25 dB Offset
▼1 [T1] -41.94 dBm
758.00000500 MHz
A
1MAX
D1 -13 dBm
IN1
1AV
Center 758 MHz
7 MHz/
Span 70 MHz
Date: 7.DEC.2012 16:35:13

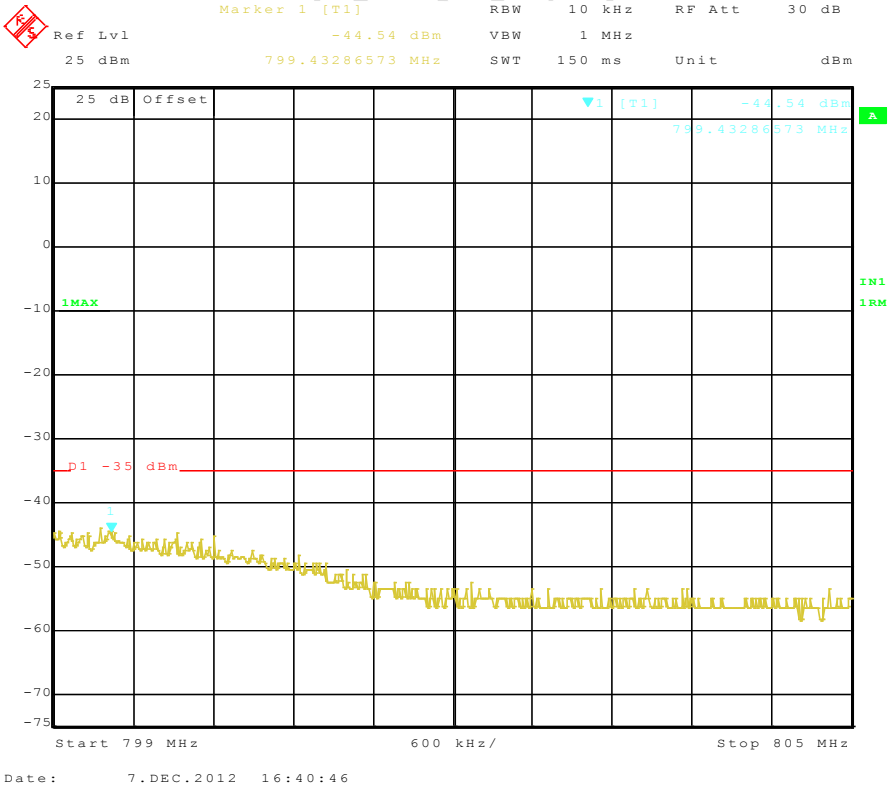
LQPSK5


Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-38.10 dBm
VBW 300 kHz
25 dBm
805.03006012 MHz
SWT 7.5 ms
Unit dBm
25 dB Offset
▼1 [T1] -38.10 dBm
805.03006012 MHz
A
1MAX
D1 -13 dBm
IN1
1RM
Center 805 MHz
3 MHz/
Span 30 MHz
Date: 7.DEC.2012 16:36:55

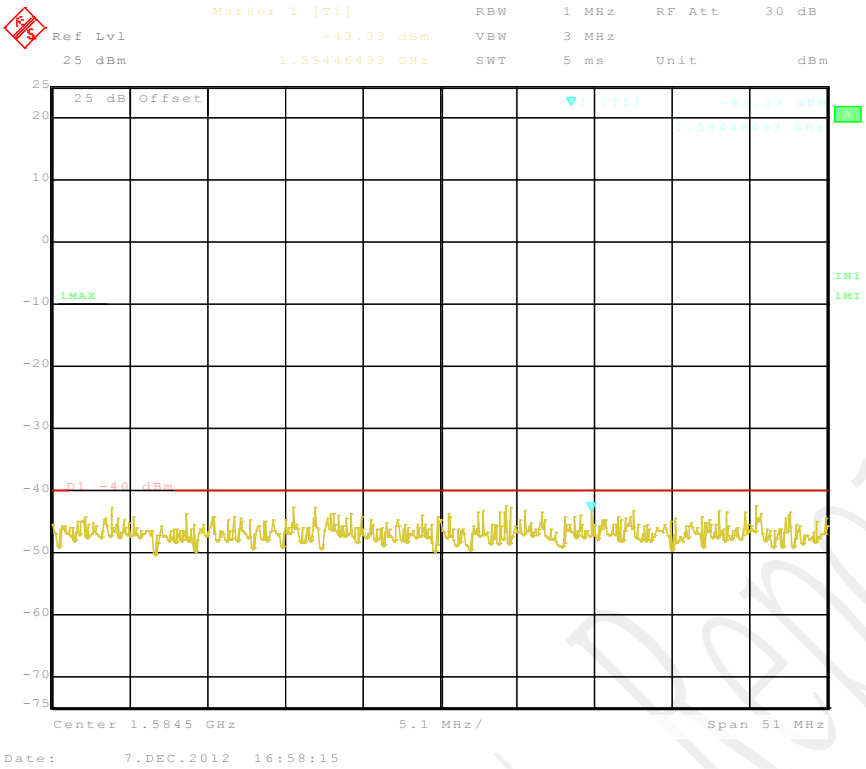
LQPSK6



LQPSK7



LQPSK8



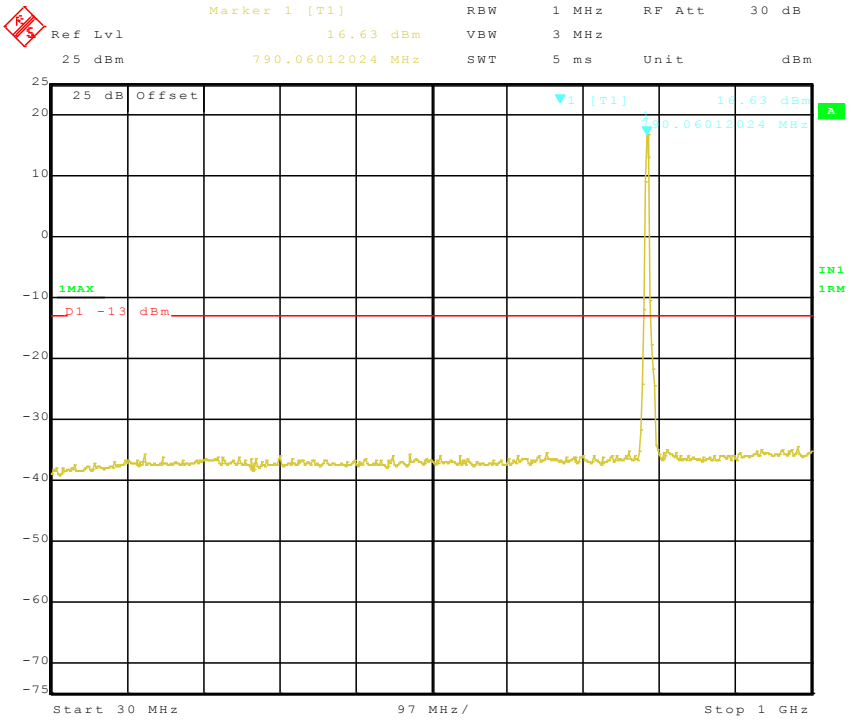
LTE Band 14, 5MHz bandwidth, 16QAM, EARFCN: 23305

Freq range	RBW/VBW	Limit (dBm)	Picture
30M-1GHz	1M/3M,	-13	LQAM1
1G-8GHz	1M/3M	-13	LQAM2
775-788MHz	30k/100k	-13	LQAM3
-758MHz	100k/300k	-13	LQAM4
805M-	100k/300k	-13	LQAM5
769-775	10k/1M	-35	LQAM6
799-805	10k/1M	-35	LQAM7
1559M-1610MHz	1M/3M,	-40	LQAM8

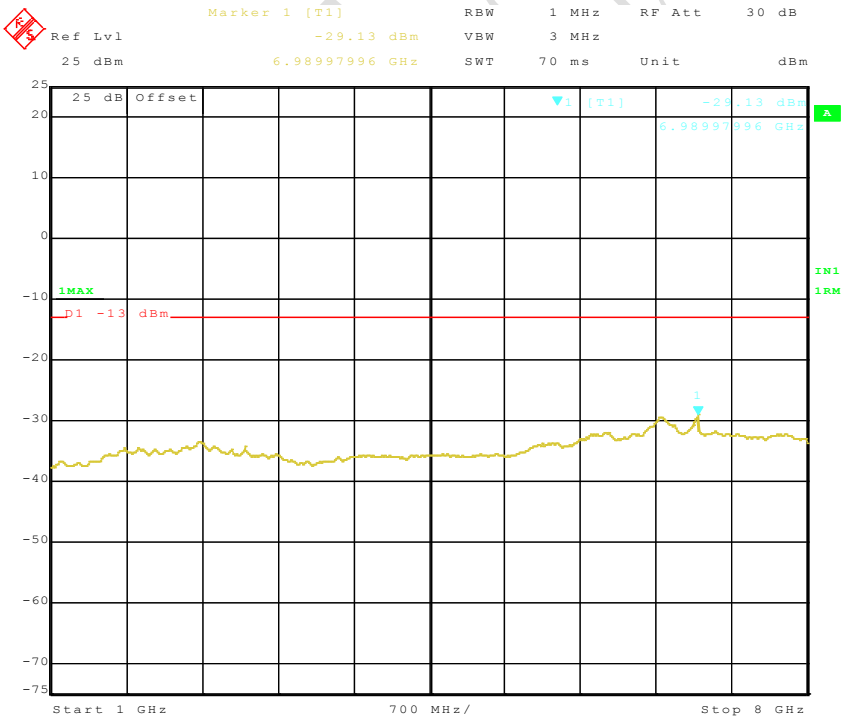
Note: all spurious emission values are much less then the limits.

CTTL Test Report

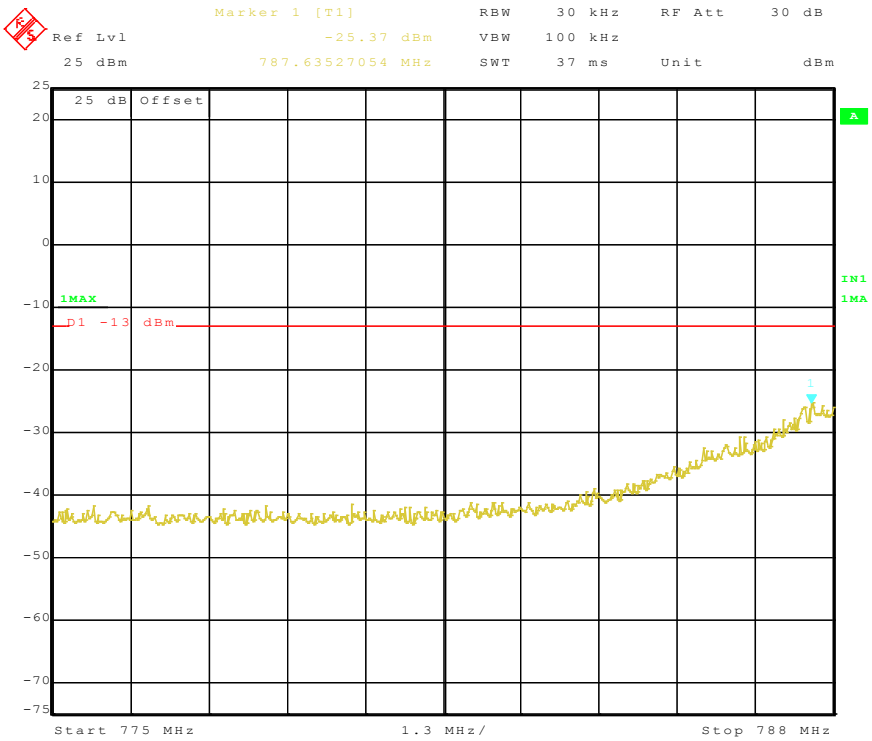
LQAM1


Marker 1 [T1]
Ref Lvl
25 dBm
RBW 1 MHz
VBW 3 MHz
SWT 5 ms
RF Att 30 dB
Unit dBm
16.63 dBm
790.06012024 MHz
25 dB Offset
1MAX
D1 -13 dBm
IN1
1RM
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 7.DEC.2012 16:49:03

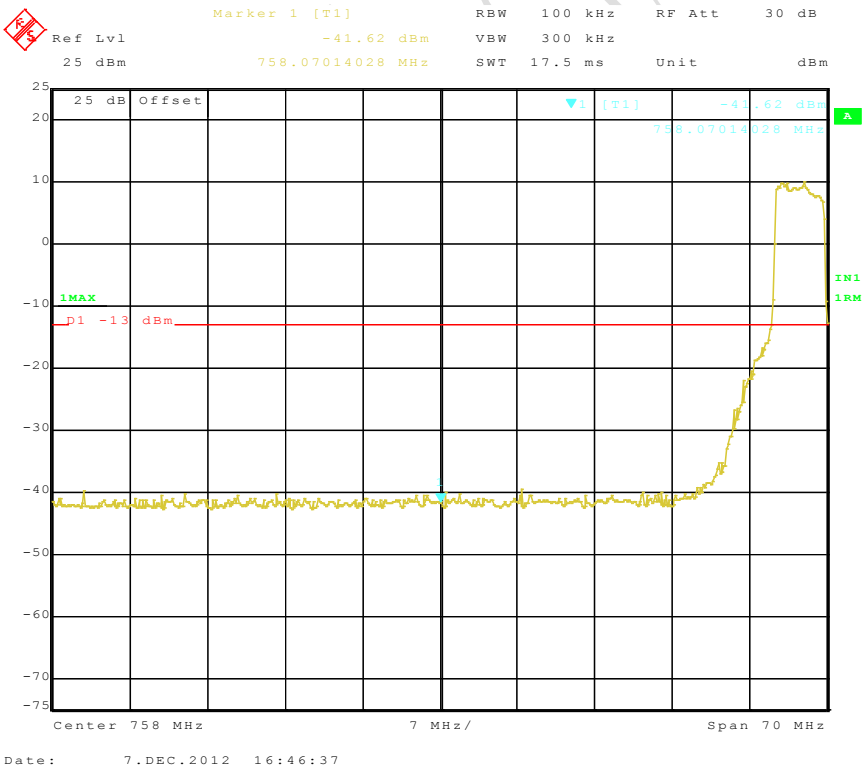
LQAM2


Marker 1 [T1]
Ref Lvl
25 dBm
RBW 1 MHz
VBW 3 MHz
SWT 70 ms
RF Att 30 dB
Unit dBm
-29.13 dBm
6.98997996 GHz
25 dB Offset
1MAX
D1 -13 dBm
IN1
1RM
Start 1 GHz
700 MHz/
Stop 8 GHz
Date: 7.DEC.2012 16:48:30

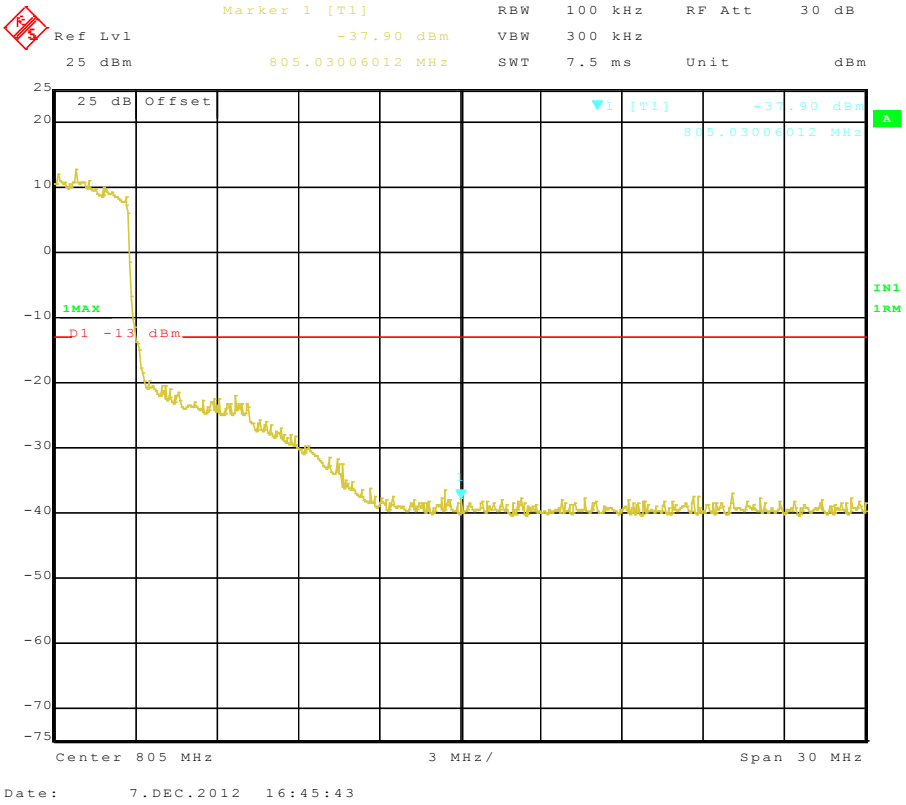
LQAM3


Marker 1 [T1]
Ref Lvl
25 dBm
-25.37 dBm
787.63527054 MHz
RBW 30 kHz
VBW 100 kHz
SWT 37 ms
RF Att 30 dB
Unit dBm
25 dB Offset
1MAX
D1 -13 dBm
Start 775 MHz
1.3 MHz/
Stop 788 MHz
Date: 12.DEC.2012 09:02:59

LQAM4

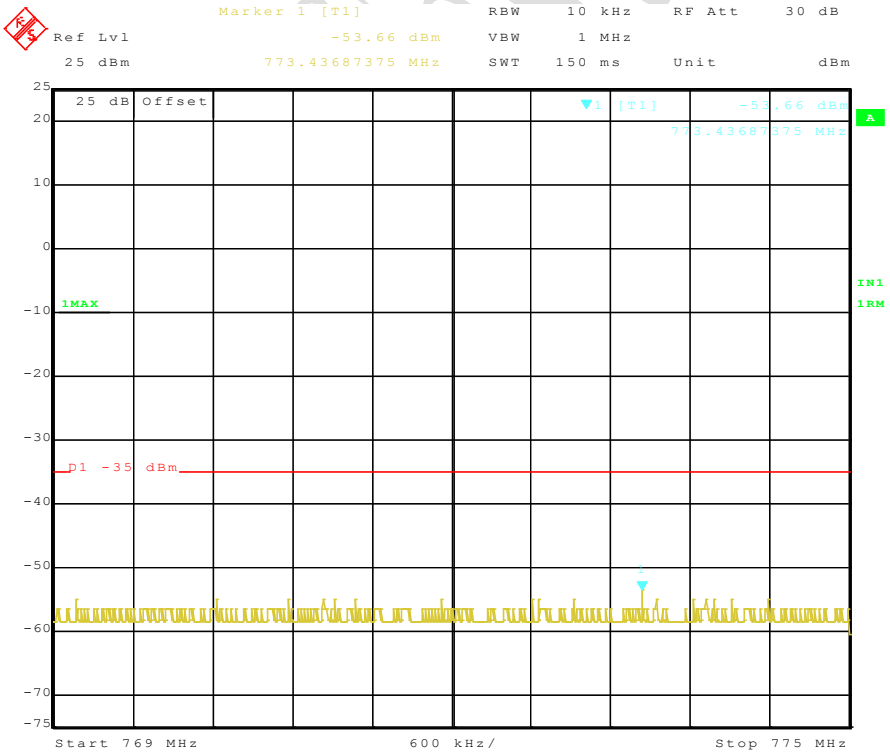

Marker 1 [T1]
Ref Lvl
25 dBm
-41.62 dBm
758.07014028 MHz
RBW 100 kHz
VBW 300 kHz
SWT 17.5 ms
RF Att 30 dB
Unit dBm
25 dB Offset
1MAX
D1 -13 dBm
Center 758 MHz
7 MHz/
Span 70 MHz
Date: 7.DEC.2012 16:46:37

LQAM5



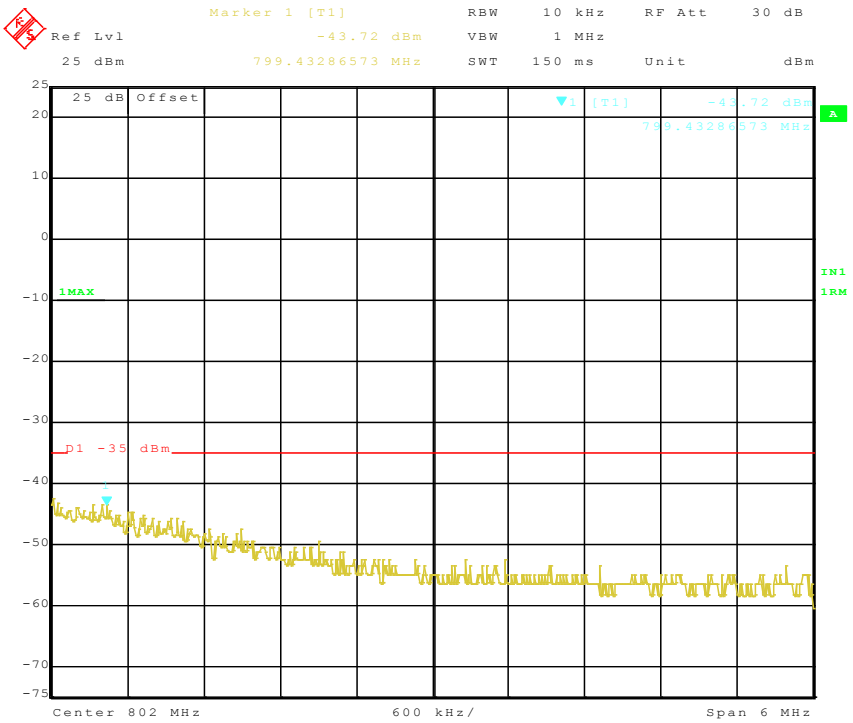
Date: 7.DEC.2012 16:45:43

LQAM6

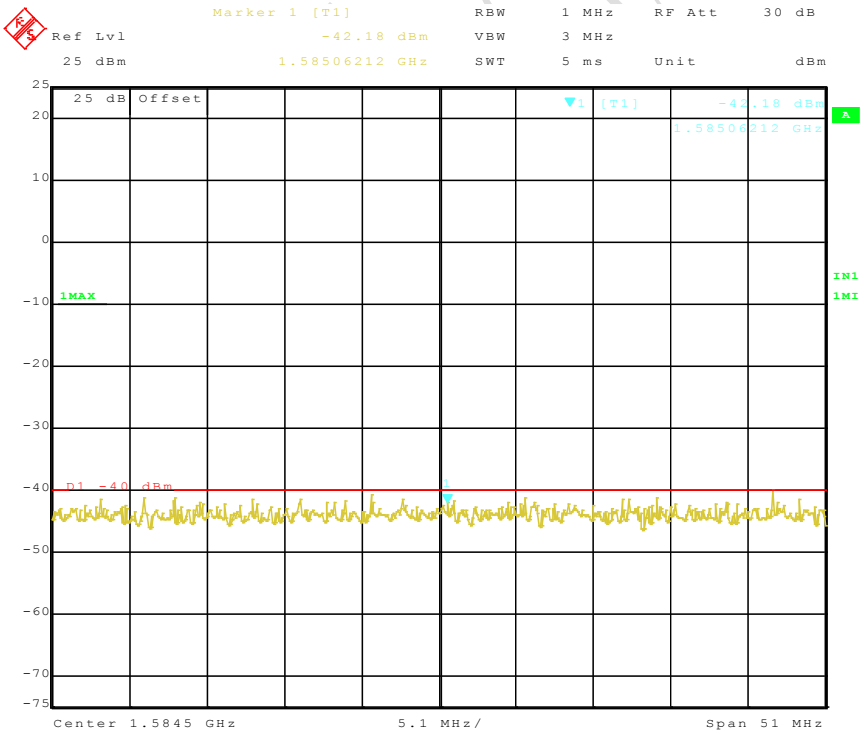


Date: 7.DEC.2012 16:43:42

LQAM7


Marker 1 [T1]
RBW 10 kHz
RF Att 30 dB
Ref Lvl
-43.72 dBm
VBW 1 MHz
25 dBm
799.43286573 MHz
SWT 150 ms
Unit dBm
25 dB Offset
▼1 [T1]
-43.72 dBm
799.43286573 MHz
1MAX
D1 -35 dBm
Center 802 MHz
600 kHz/
Span 6 MHz
Date: 7.DEC.2012 16:42:39

LQAM8

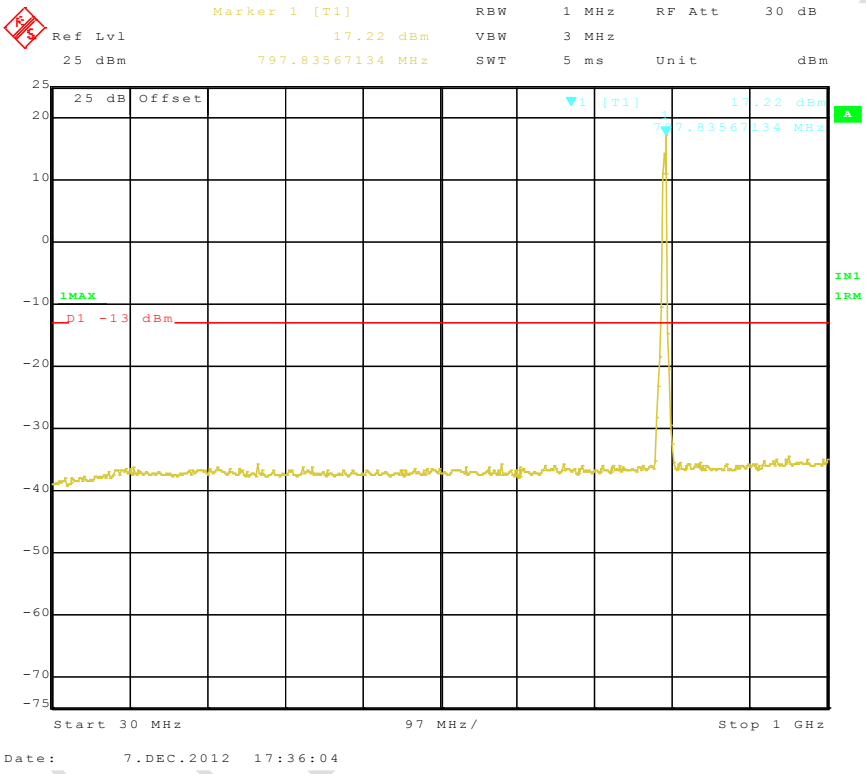

Marker 1 [T1]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
-42.18 dBm
VBW 3 MHz
25 dBm
1.58506212 GHz
SWT 5 ms
Unit dBm
25 dB Offset
▼1 [T1]
-42.18 dBm
1.58506212 GHz
1MAX
D1 -40 dBm
Center 1.5845 GHz
5.1 MHz/
Span 51 MHz
Date: 7.DEC.2012 16:57:47

LTE Band 14, 5MHz bandwidth, QPSK, EARFCN: 23355

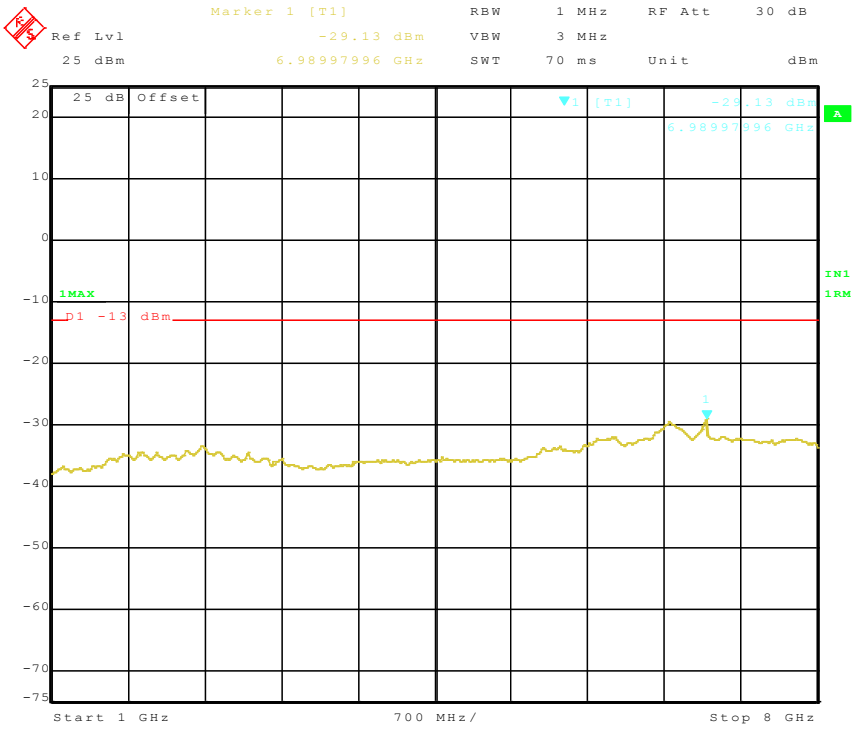
Freq range	RBW/VBW	Limit (dBm)	Picture
30M-1GHz	1M/3M,	-13	HQPSK1
1G-8GHz	1M/3M	-13	HQPSK2
769-775MHz	10k/1M	-35	HQPSK3
799-805MHz	10k/1M	-35	HQPSK4
1559M-1610MHz	1M/3M,	-40	HQPSK5

Note: all spurious emission values are much less then the limits.

HQPSK1

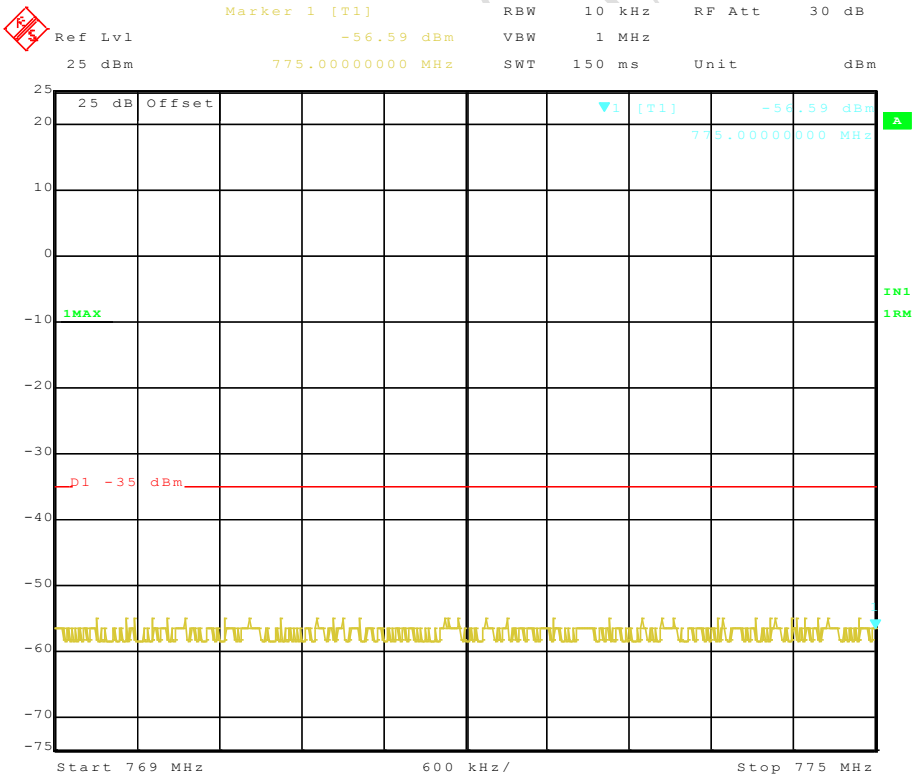


HQPSK2



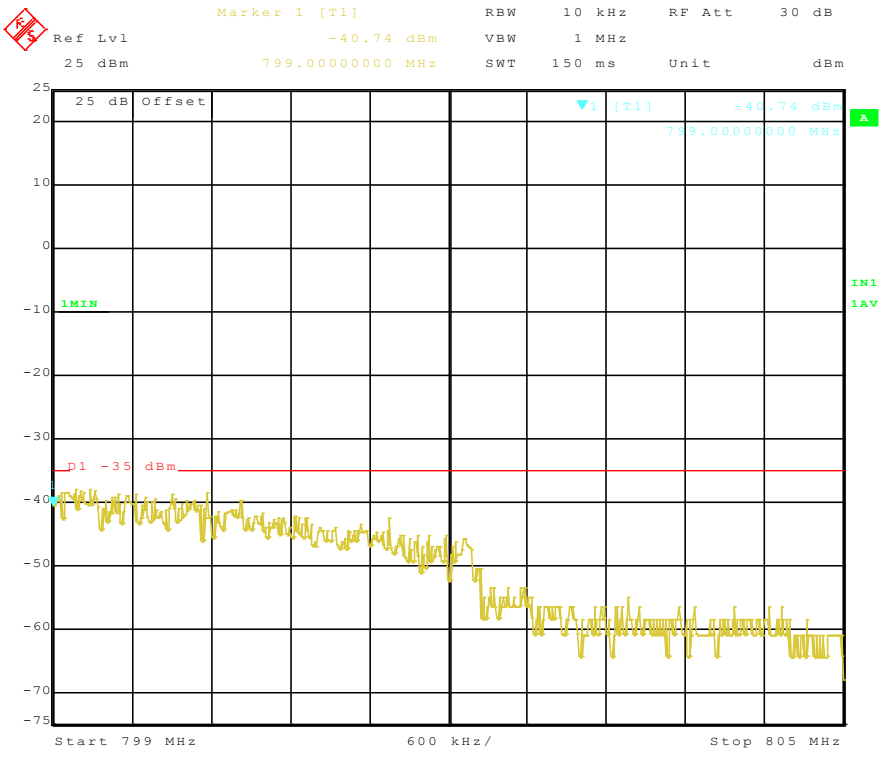
Date: 7.DEC.2012 17:36:34

HQPSK3

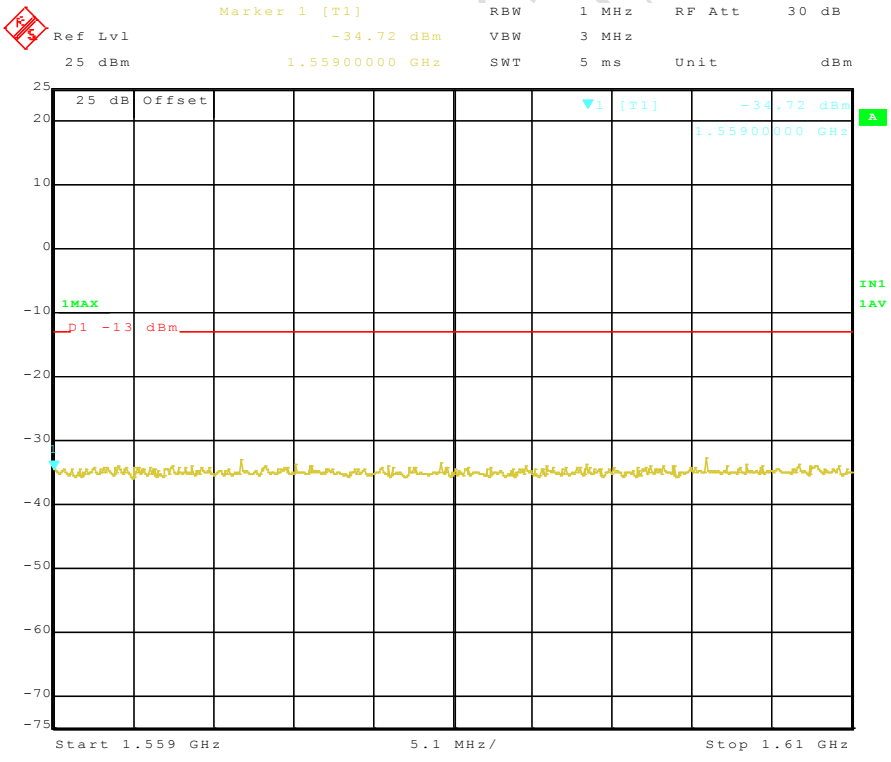


Date: 7.DEC.2012 17:38:01

HQPSK4



HQPSK5

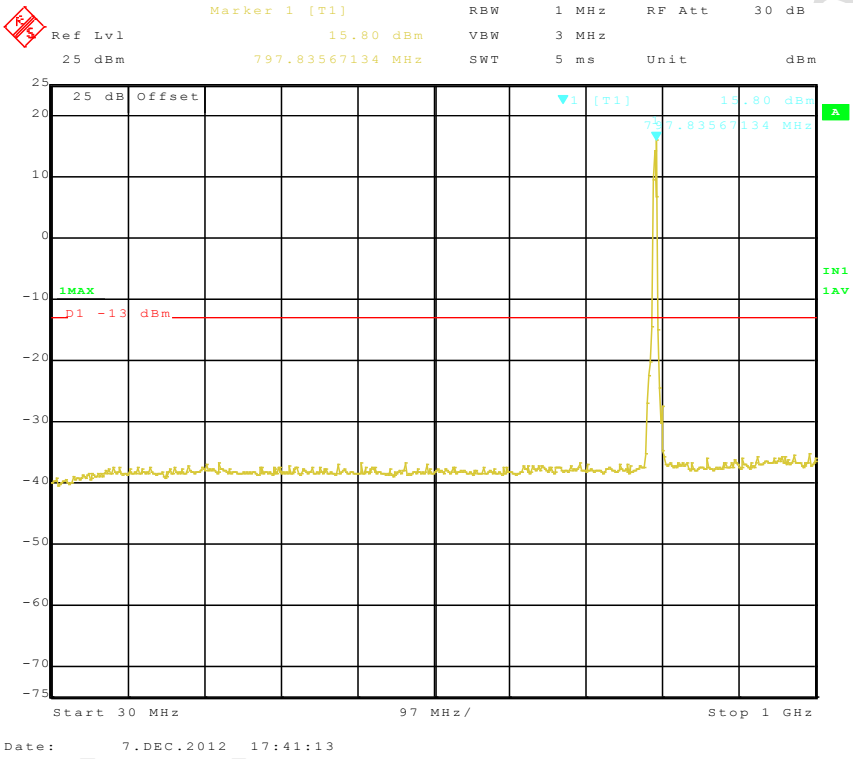


LTE Band 14, 5MHz bandwidth, 16QAM, EARFCN: 23355

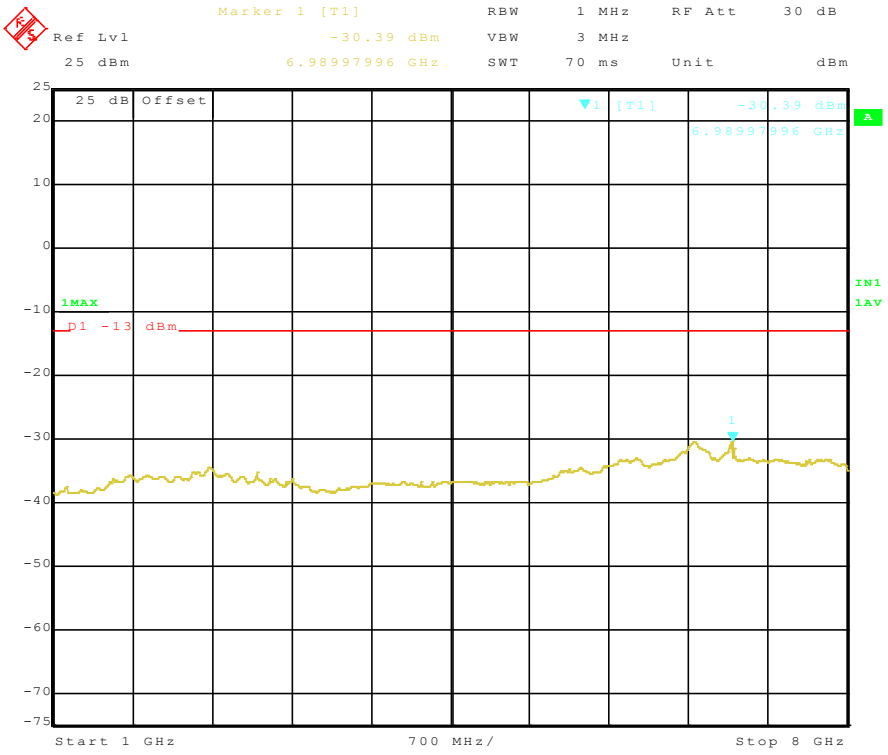
Freq range	RBW/VBW	Limit (dBm)	Picture
30M-1GHz	1M/3M,	-13	HQAM1
1G-8GHz	1M/3M	-13	HQAM2
769-775MHz	10k/1M	-35	HQAM3
799-805MHz	10k/1M	-35	HQAM4
1559M-1610MHz	1M/3M,	-40	HQAM5

Note: all spurious emission values are much less then the limits.

HQAM1

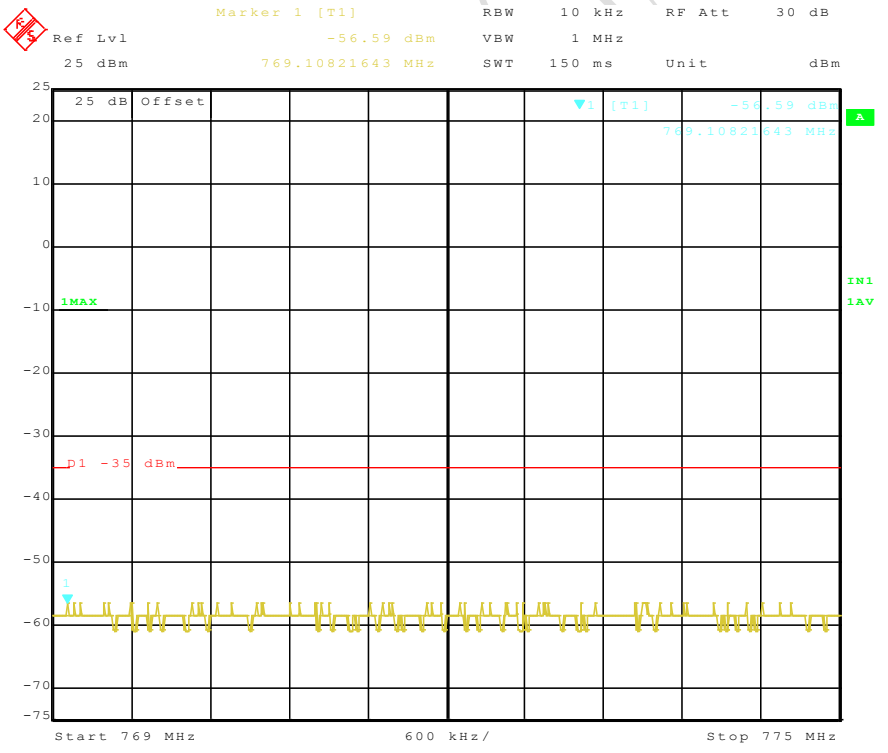


HQAM2



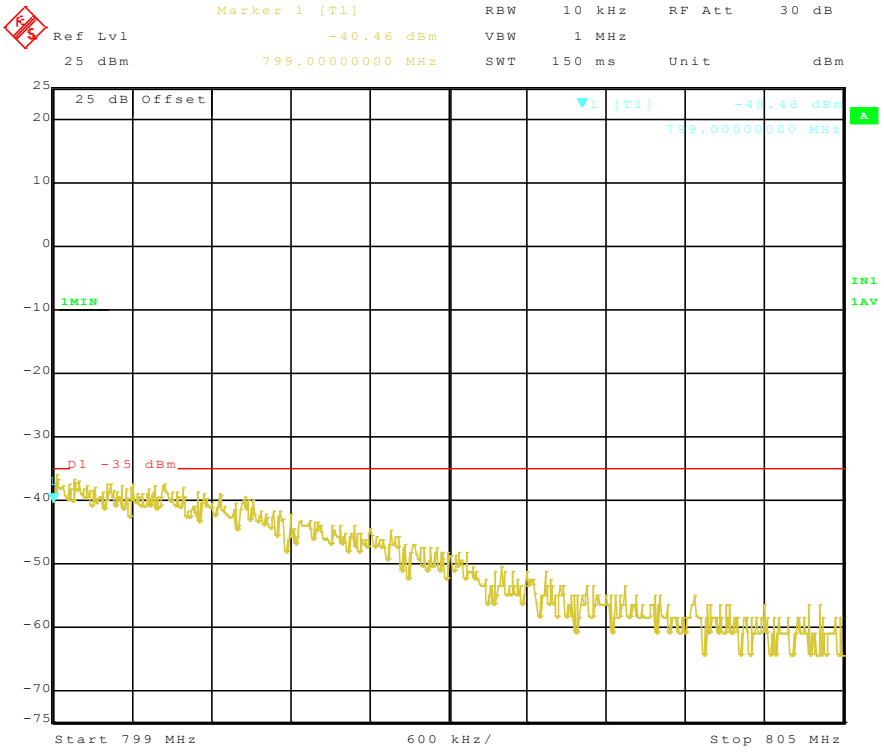
Date: 7.DEC.2012 17:40:40

HQAM3

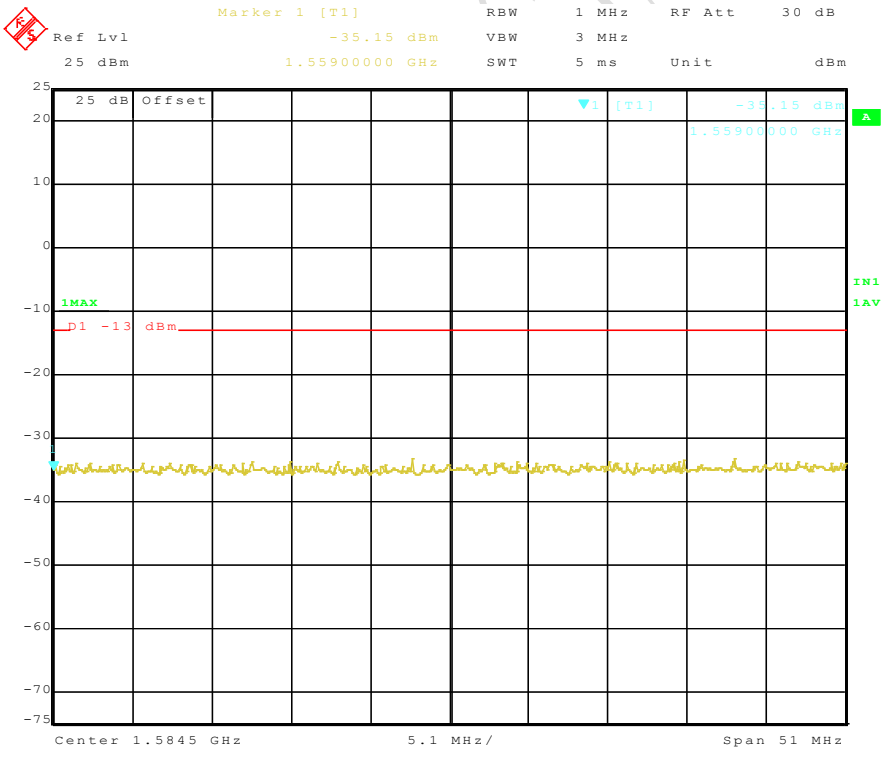


Date: 7.DEC.2012 17:41:56

HQAM4



HQAM5

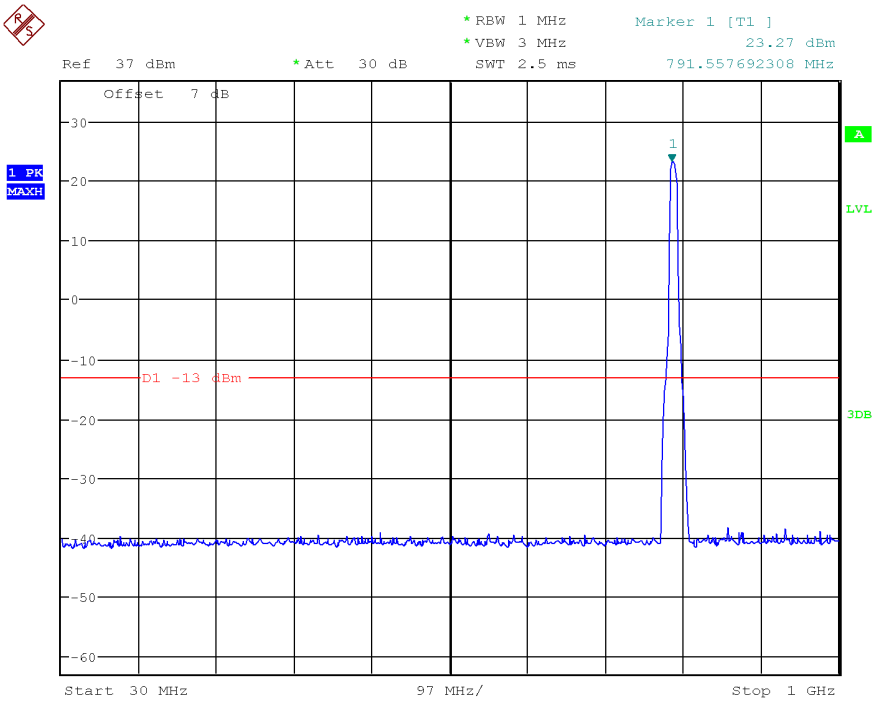


LTE Band 14, 10MHz bandwidth, 16QAM, EARFCN: 23330

Freq range	RBW/VBW	Limit (dBm)	Picture
30M-1GHz	1M/3M,	-13	MQAM1
1G-8GHz	1M/3M	-13	MQAM2
775-788MHz	30k/100k	-13	MQAM3
769-775MHz	10k/1M	-35	MQAM4
799-805MHz	10k/1M	-35	MQAM5
1559M-1610MHz	1M/3M,	-40	MQAM6

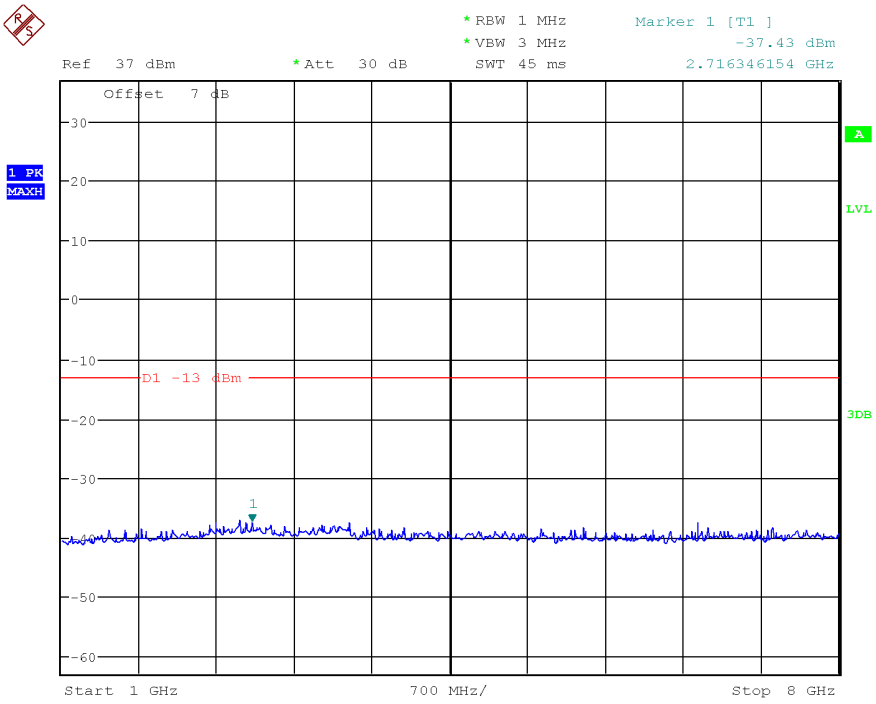
Note: all spurious emission values are much less than the limits.

MQAM1:



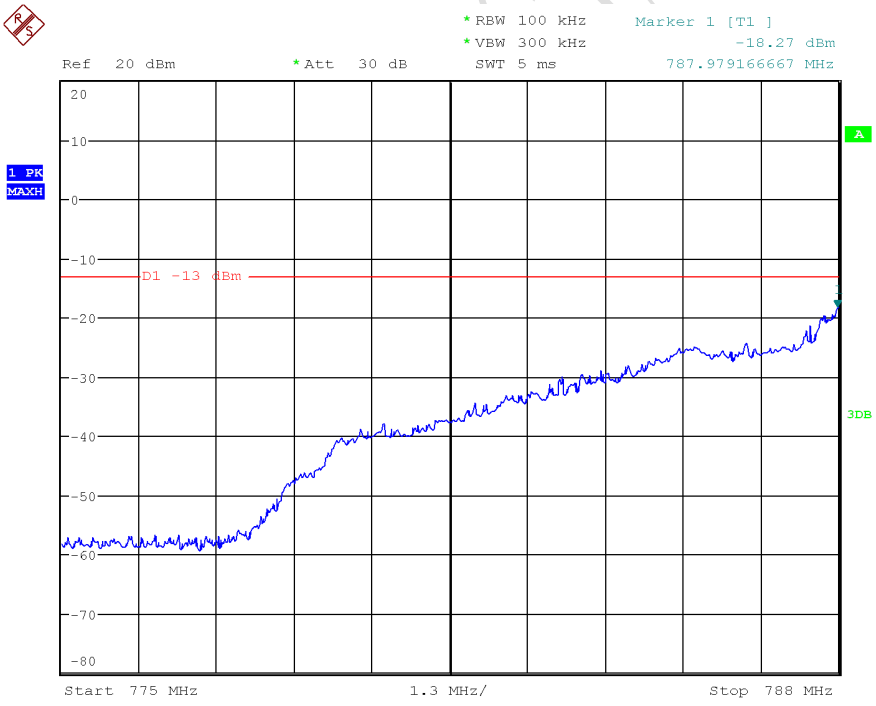
Date: 15.JAN.2014 19:09:54

MQAM2:



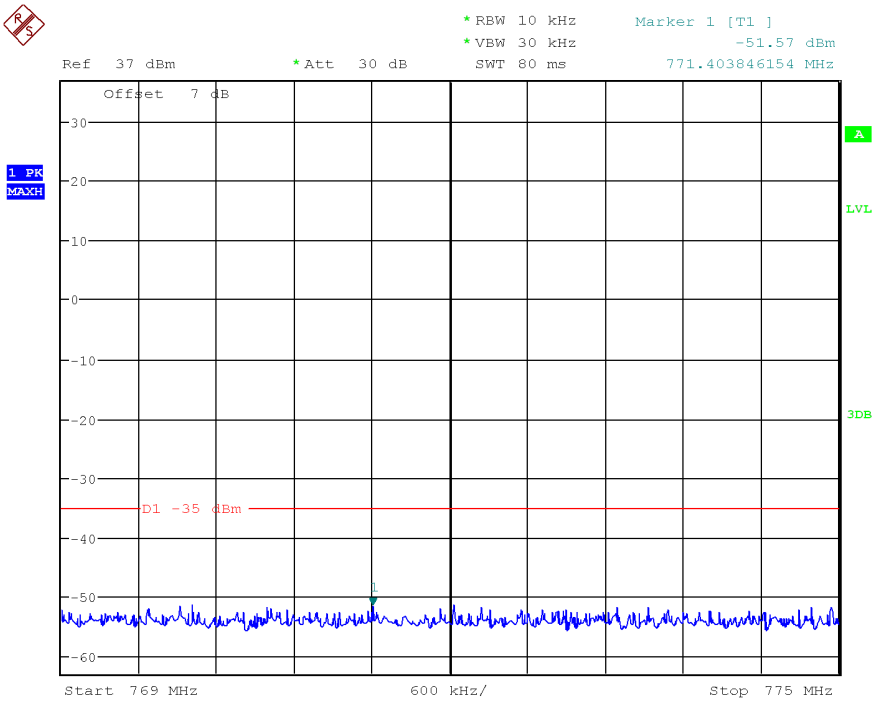
Date: 15.JAN.2014 19:10:17

MQAM3:



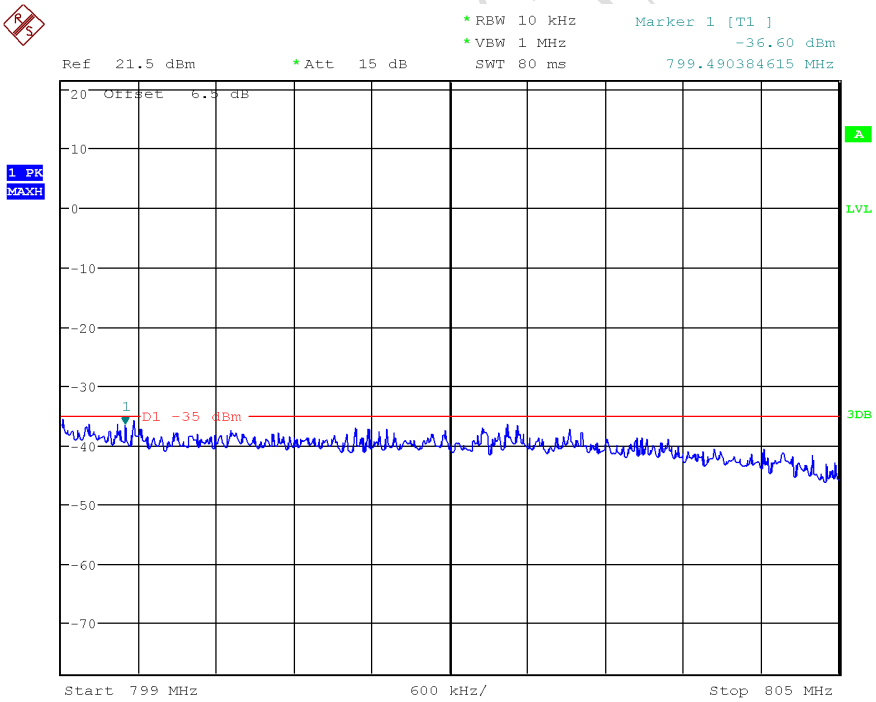
Date: 15.JAN.2014 20:02:05

MQAM4:



Date: 15.JAN.2014 19:34:25

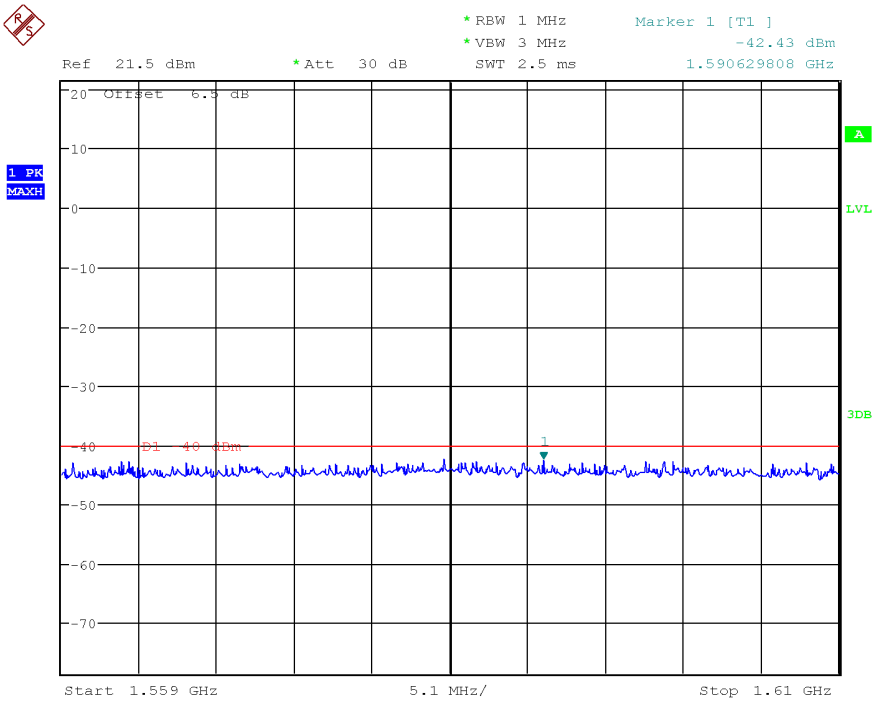
MQAM5:



Date: 21.JAN.2014 17:32:08

MQAM6:

FCC Parts 2, 90
Equipment: LP15 **REPORT NO.: I12GL9630-FCC-RF_2**



Date: 21.JAN.2014 17:33:42

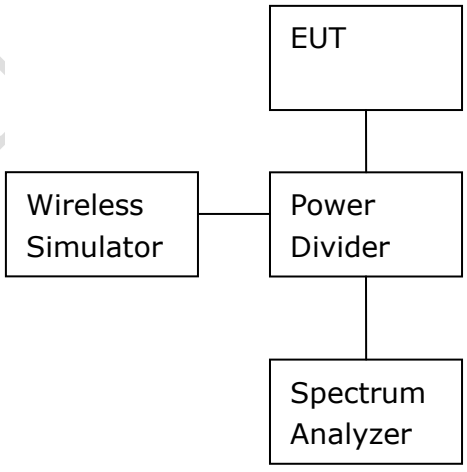
4.8 Band-edge (conducted)

Specifications:	2.1051, 90.543
Date of Tests	2012-12-07~2014-01-23
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Operation Mode	LTE mode, TX on, channel 23305 and 23355, 5 MHz Bandwidth, modulation type QPSK and 16QAM. RB size = 25, RB offset = 0
Test Results:	Pass

Limit Level Construction:
Part 90：
Section 90.543 Emission limitations.
(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz. so the limit level is:
P(dBm) – (43 + 10 log(P)) dB= -13dBm

Test Setup:

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method

1) The EUT was coupled to the EMI test receiver analyzer mode and the base station simulator through a power divider. The lost of the cables the test system is calibrated to correct the readings.

2) The spectrum analyzer was set to RMS Detector function and Maximum hold mode.
3) The resolution bandwidth of the spectrum analyzer was a little greater than 1% of the 26dB emission bandwidth.

Note: --

Test Results:

LTE Band 14, 5MHz bandwidth, QPSK:

	Frequency[MHz]	Power level [dBm]
Ch23305 Left band edge	787.930	-16.04
Ch23355 Right band edge	798.035	-22.95

LTE Band 14, 5MHz bandwidth, 16QAM:

	Frequency[MHz]	Power level [dBm]
Ch23305 Left band edge	788.030	-13.59
Ch23355 Right band edge	798.035	-23.01

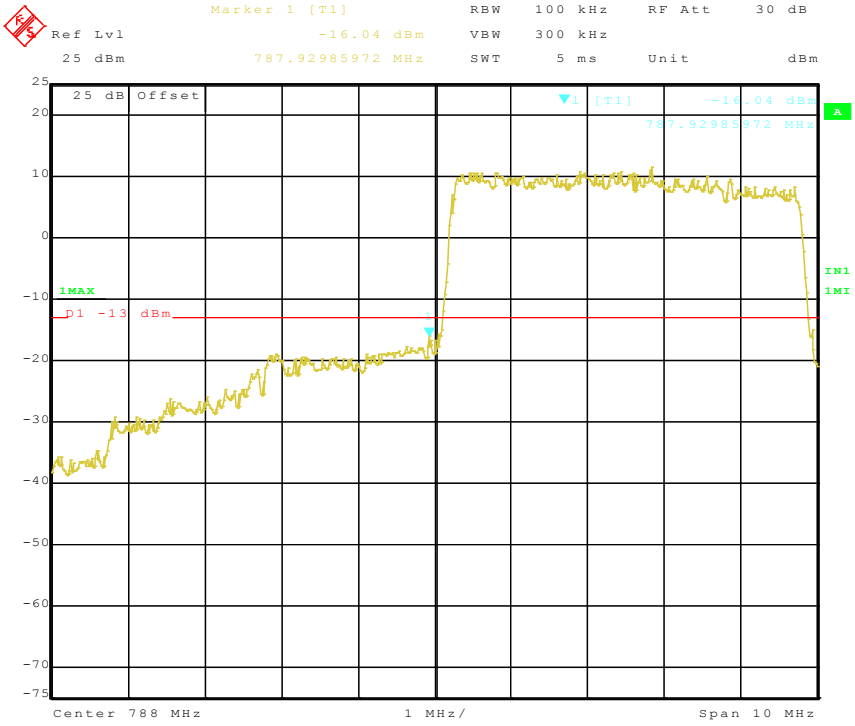
LTE Band 14, 10MHz bandwidth, QPSK:

	Frequency[MHz]	Power level [dBm]
Ch 23330 Left band edge	788.016	-13.26
Ch 23330 Right band edge	798.032	-14.17

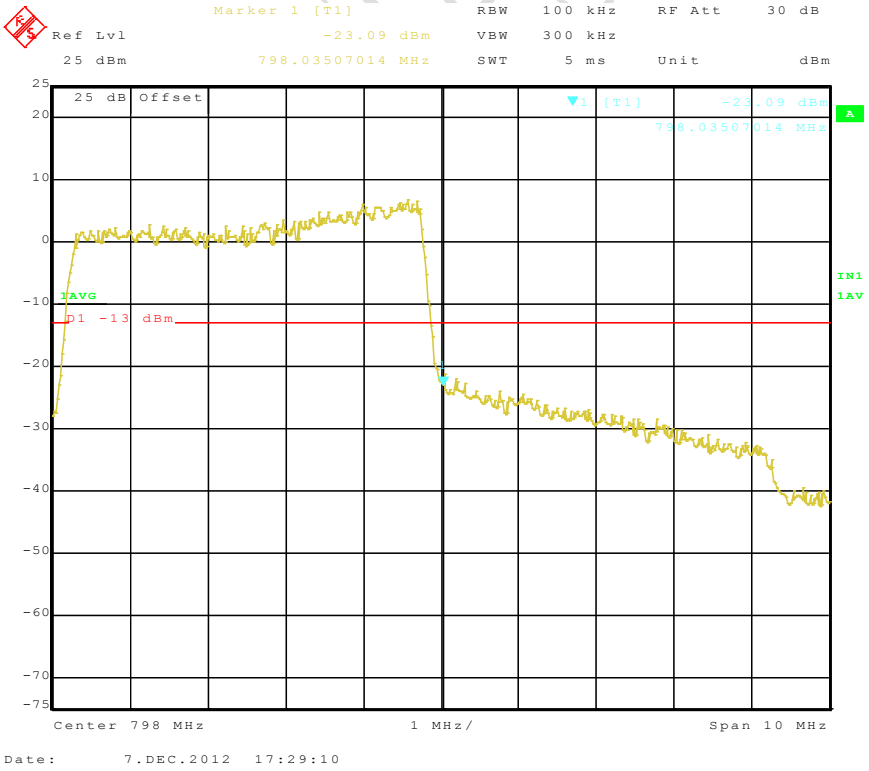
CTTL Test Report

Graphical results for QPSK mode:

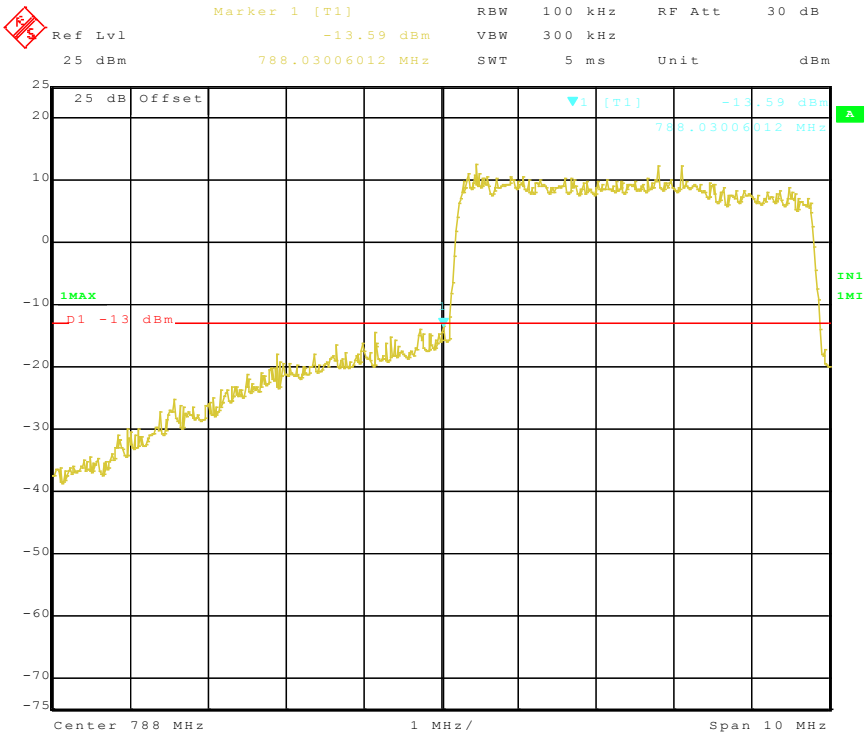
Ch23305 Left band edge QPSK



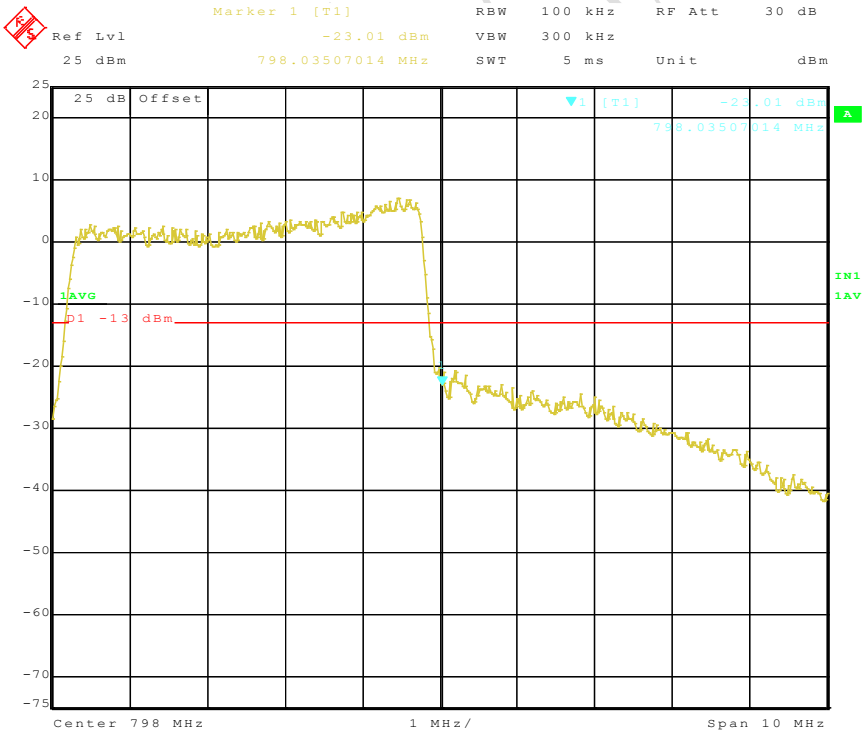
Ch23355 Right band edge QPSK



Ch23305 Left band edge 16QAM



Ch23355 Right band edge 16QAM



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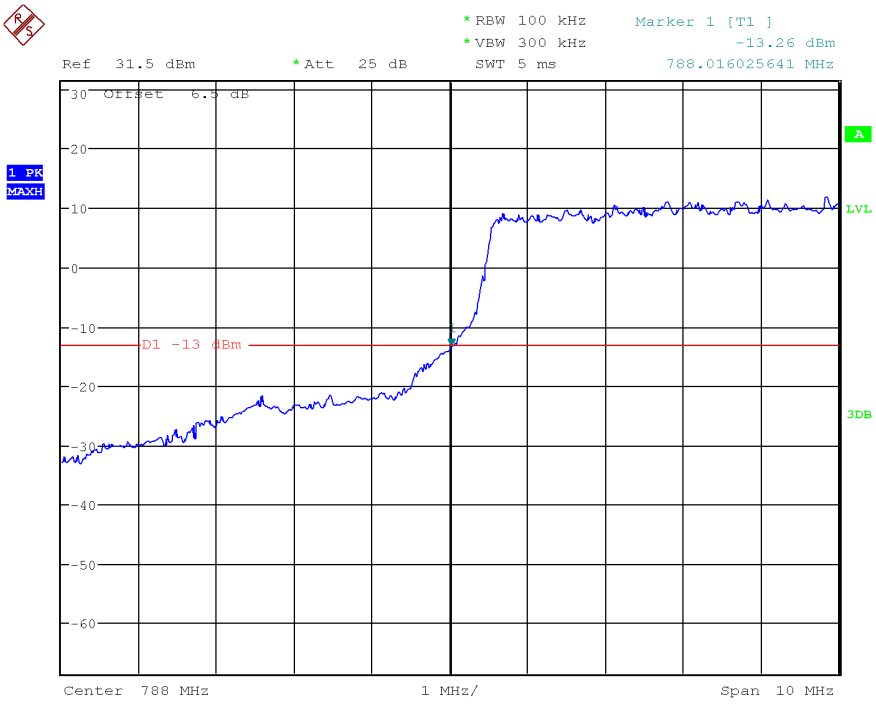

Date: 24.JAN.2014 12:57:09

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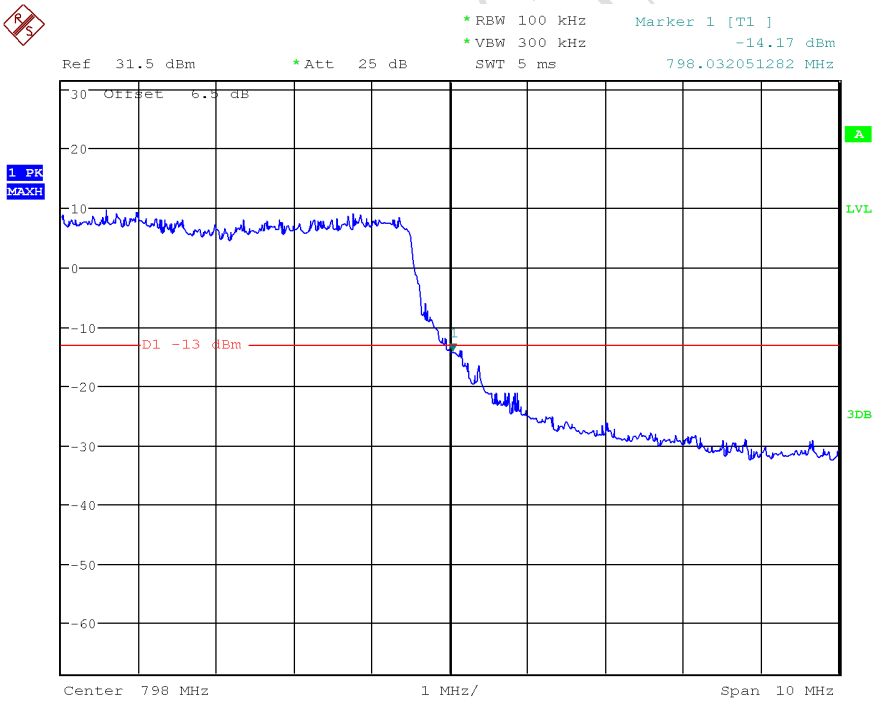

Date: 24.JAN.2014 13:06:23

ANNEX C Deviations from Prescribed Test Methods

No deviation from Prescribed Test Methods.

The End of this Report

CTTL Test Report