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Report On

FCC and Industry Canada Testing of the
Ericsson AB
RBS 6401 1.0 B2 LTE / KRD 901 040/6

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FCC ID: TA8AKRD901040
IC ID: 287AB-AS901040

Document 75923959 Report 02 Issue 3

October 2013



Product Service

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Document 75923959 Report 02 Issue 3

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PREPARED FOR

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90590 Oulu
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PREPARED BY


R Small
Test Engineer

APPROVED BY


N Forsyth
Authorised Signatory

DATED

28 October 2013

This report has been up-issued to Issue 3 to amend the Manufacturer's Declaration.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate compliance with FCC CFR 47: Part 24 and Industry Canada RSS-133. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);



R Small





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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Ericsson AB
RBS 6401 1.0 B2 LTE / KRD 901 040/6



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Ericsson AB RBS 6401 1.0 B2 LTE / KRD 901 040/6 to the requirements of FCC CFR 47 Part 24 and Industry Canada RSS-133.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of RBS 6401 1.0 B2 LTE / KRD 901 040/6.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Ericsson AB
Product Name	RBS 6401 1.0 B2 LTE
Part Number	KRD 901 040/6
IC Model Name	AS901040
Serial Number(s)	C827268550
Software Version	LTE Arago 82 Prod build 2013-08-13
Hardware Version	R1B/A
Number of Samples Tested	1
Non Test Variants	KRD 901 040/5 KRD 901 040/4 KRD 901 040/3 KRD 901 040/2 KRD 901 040/1
Test Specification/Issue/Date	FCC CFR 47 Part 24: 2012 Industry Canada RSS-133 Issue 6: 2013
Order Number	9201663674
Date	20 August 2013
Start of Test	30 August 2013
Finish of Test	03 September 2013
Name of Engineer(s)	R Small
Related Document(s)	ANSI C63.4: 2009 FCC CFR 47 Part 2: 2012 Industry Canada RSS-GEN Issue 3: 2010



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 24 and Industry Canada RSS-133, is shown below.

Configuration 1 – Base Station							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2 and 24	RSS-133 and RSS-GEN					
	24.232 (a)	6.4	Effective Radiated Power	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)		N/A	No integral antenna.
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)		N/A	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)		N/A	
2.1	2.1046, 24.232 (a)	6.4	Maximum Peak Output Power - Conducted	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.2	24.232 (d)	6.4	Peak – Average Ratio	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.3	2.1047 (d)	6.2	Modulation Characteristics	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.4	2.1049, 24.238 (b)	RSS-Gen 4.6.1	Occupied Bandwidth and Emission Bandwidth	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.5	2.1051, 24.238 (b)	6.5	Spurious Emissions at Antenna Terminals (± 1 MHz)	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	



Configuration 1 – Base Station							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2 and 24	RSS-133 and RSS-GEN					
	2.1053, 24.238 (a)	6.5	Radiated Spurious Emissions	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Note 1	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Note 1	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Note 1	
2.6	2.1051, 24.238 (a)	6.5	Conducted Spurious Emissions	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.7	2.1055, 24.235	6.3	Frequency Stability Under Temperature Variations	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.8	2.1055, 24.235	6.3	Frequency Stability Under Voltage Variations	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	Pass	-
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	Pass	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	Pass	
2.9	-	6.6	Receiver Spurious Emissions	1932.5MHz (5MHz OBW) / 1935.0MHz (10MHz OBW) / 1940.0MHz (20MHz OBW)	0	N/A	Both antenna ports are duplex ports. Outside 30 to 960 MHz range.
				1960.0MHz (5MHz, 10MHz, 20MHz OBW)	0	N/A	
				1987.5MHz (5MHz OBW) / 1985.0MHz (10MHz OBW) / 1980.0MHz (20MHz OBW)	0	N/A	

N/A – Not Applicable

Note 1 – Not tested at this time, results to be presented in a separate report.



1.3 MANUFACTURER'S DECLARATION

Manufacturer	Ericsson AB		
Model number(s)	RBS 6401		
Identification/Type(s)	KRD 901 040/*		
Cabinet type(s)	Indoor		
Cabinet identification(s)	N/A		
Number of sectors	1		
Number of carriers	1		
Base station class	Medium Range		
Maximum rated output power(s)	2 x 1W		
Duplex Mode	FDD		
Frequency Band	1900 MHz Band 2		
Modulation type(s)	QPSK 16 QAM 64 QAM		
Channel Bandwidth(s)	WCDMA : 5MHz LTE: 5MHz, 10MHz, 20MHz		
Transmit diversity	Yes ¹		
Receive diversity	Yes ²		
MIMO	LTE 2x2 MIMO DL		
ITU designation or class of emission	WCDMA:4M18F9W LTE: 4M48G7D, 8M93G7D, 17M9G7D, 4M48W7D, 8M93W7D, 17M9W7D		
Environment temperature range(s)	Minimum 0 C		Maximum +50 C
AC Power source	Yes Voltage Range(s) Minimum VAC 100 Nominal VAC 230 Maximum VAC 250		
DC Power source	N/A Voltage Range(s) Minimum VDC Nominal VDC Maximum VDC		
Options	Type CPE V4 (VDSL2 module) WiFi AP 01 ETSI WiFi AP 01 FCC		Model KDU 127 184/1 KRC 161 393/1 KRC 161 393/2

(The * in the model number KRD 901 040/* denotes 0 – 6 depending on different HW and SW configurations)

¹ Each transmitter path is declared to be equivalent.

² Each receiver path is declared to be equivalent.

I hereby declare that I am entitled to sign on behalf of the manufacturer and that the information supplied is correct and complete.

Signature :

Name : Mika Savilakso

Position held : Verification Engineer, Regulatory Approvals

Date : 22.10.2013



1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) RBS 6401 1.0 B2 LTE / KRD 901 040/6 is an Ericsson AB Radio Equipment working in the public mobile service 1900MHz band which provides communication connections to LTE1900 network. The RBS 6401 1.0 B2 LTE / KRD 901 040/6 operates from a 120V AC, 60Hz supply.

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturers documentation.



Equipment Under Test



1.4.2 Test Configuration

Configuration 1: Base Station

The EUT was configured in accordance with FCC CFR 47 Part 24 and Industry Canada RSS-133.

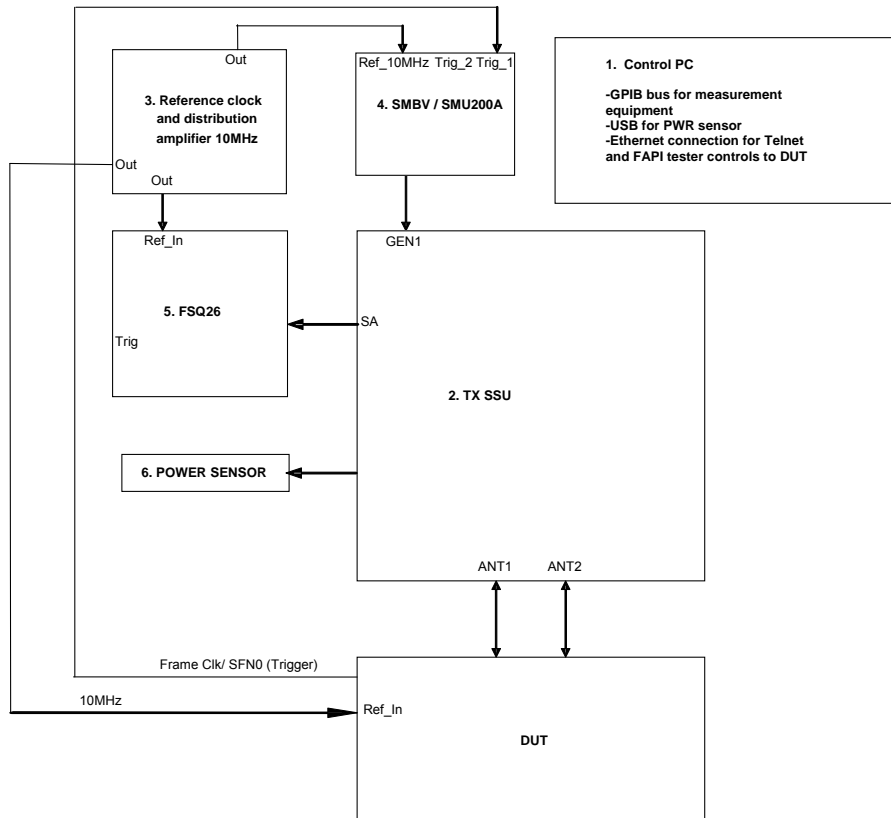
The RBS 6401 1.0 B2 LTE / KRD 901 040/6 supports Test Models E-TM1.1, E-TM3.2 and E-TM3.1 at 1900MHz defined in 3GPP TS 36.141. Test Model E-TM1.1 was used to represent QPSK modulation only, Test Model E-TM3.2 was used to represent 16QAM modulation and Test Model E-TM3.1 was used to represent 64QAM modulation.

The settings below were found to be representative for all traffic scenarios when several settings with the different modulations and channel bandwidths were tested to find the worst case setting. These settings were used for all measurements if not otherwise noted:

Single carrier:

Test Model E-TM1.1 with channel bandwidths 5 MHz, 10 MHz and 20 MHz

The EUT can be configured to transmit with 1900MHz single carrier at the RF output connector. There are three options that can be fitted to an RBS 6401 base station, (i) a VDSL module (a Very-high-bit-rate Digital Subscriber Line, non-RF data transmission device), (ii) a WiFi module FCC ID: RAR 40025002 and IC ID: 4674A-40025002), and (iii) an External Antenna Kit. All Tx Testing was performed on the combined Tx / Rx output connector ANT A of the EUT. The complete testing was performed with the EUT transmitting at maximum RF power unless otherwise stated, VDSL enabled and WiFi enabled at 2.4GHz and 5 GHz. The EUT was powered by a 120V AC, 60Hz power supply unless otherwise stated.

**Test Setup, Conducted Measurement:**

Test Object	Part Number	Version	Serial Number
Radio Part	RBS 6401 1.0 B2 LTE / KRD 901 040/6	R1B/A	C827268550

No.	Auxiliary Equipment	Part Number / Model Type	Version	Serial Number
1	Computer	Dell Optiplex 790	--	10150652924
2	Switching Unit (TX)	TDD Filter SSU	--	SSU-0711-1316
3	Rubidium Frequency Standard	Symmetricon 8040	--	123630105006
4	Vector Signal Generator	Rohde & Schwarz SMBV 100A	--	258387
5	Signal Analyser	Rohde & Schwarz FSQ 26	--	101154
7	Thermal Power Sensor	Rohde & Schwarz NRP-Z21	--	101290



1.4.3 Modes of Operation

Modes of operation of each EUT during testing were as follows:

Bottom Channel :

Mode 1 - 5 : EARFCN 625: 1932.5MHz (5.0MHz Bandwidth)

Mode 1 - 10 : EARFCN 650: 1935.0MHz (10.0MHz Bandwidth)

Mode 1 - 20 : EARFCN 700: 1940.0MHz (20.0MHz Bandwidth)

Middle Channel :

Mode 2 : EARFCN 900: 1960.0MHz

Top Channel :

Mode 3 - 5 : EARFCN 1175: 1987.5MHz (5.0MHz Bandwidth)

Mode 3 - 10 : EARFCN 1150: 1985.0MHz (10.0MHz Bandwidth)

Mode 3 - 20 : EARFCN 1100: 1980.0MHz (20.0MHz Bandwidth)

Information on the specific test modes utilised are detailed in the test procedure for each individual test.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

The EUT was powered from a 120V AC, 60Hz supply.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.



Product Service

1.8 ALTERNATIVE TEST SITE

Radiated emissions testing has been performed at :

Intertek Semko AB, Torshamnsgatan 43, P.O. Box 1103, SE-164 22 Kista

under the following site registrations:

Intertek Semko AB is a FCC listed test site with site registration number 90913

Intertek Semko AB is a Industry Canada listed test facility with IC assigned code 2042G



Product Service

SECTION 2

TEST DETAILS

FCC and Industry Canada Testing of the
Ericsson AB
RBS 6401 1.0 B2 LTE / KRD 901 040/6



Product Service

2.1 MAXIMUM PEAK OUTPUT POWER - CONDUCTED

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 24, Clause 24.232 (a)
Industry Canada RSS-133, Clause 6.4

2.1.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.1.3 Date of Test and Modification State

30 August 2013 – Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133.

Using a thermal power sensor and attenuator(s), the output power of the EUT was measured at the antenna terminal. The carrier power was measured with E-TM1.1, E-TM3.2 and E-TM3.1 test models.

The path loss was measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1 – 5, Mode 1 – 10, Mode 1 – 20
- Mode 2 (5MHz, 10MHz, 20MHz)
- Mode 3 - 5, Mode 3 – 10, Mode 3 – 20

2.1.6 Environmental Conditions

30 August 2013

Ambient Temperature 25.9°C

Relative Humidity 33.4%



2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133 for Maximum Peak Output Power.

The test results are shown below

E-TM1.1: 5.0MHz Bandwidth

Configuration 1 - Mode 1 – 5, Mode 2 and Mode 3 - 5

EARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
625 (Bottom)	1932.5	23.8	30.00	1.000
900 (Middle)	1960.0	23.8	30.19	1.045
1175 (Top)	1987.5	23.8	30.29	1.069

E-TM1.1: 10.0MHz Bandwidth

Configuration 1 - Mode 1 – 10, Mode 2 and Mode 3 - 10

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
650 (Bottom)	1935.0	23.8	30.00	1.000
900 (Middle)	1960.0	23.8	30.09	1.021
1150 (Top)	1985.0	23.8	30.16	1.038

E-TM1.1: 20.0MHz Bandwidth

Configuration 1 - Mode 1 – 20, Mode 2 and Mode 3 - 20

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
700 (Bottom)	1940.0	23.8	30.02	1.005
900 (Middle)	1960.0	23.8	30.04	1.009
1100 (Top)	1980.0	23.8	30.09	1.021

**E-TM3.2: 5.0MHz Bandwidth****Configuration 1 - Mode 1 – 5, Mode 2 and Mode 3 - 5**

EARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
625 (Bottom)	1932.5	23.8	30.02	1.005
900 (Middle)	1960.0	23.8	30.11	1.026
1175 (Top)	1987.5	23.8	30.17	1.040

E-TM3.2: 10.0MHz Bandwidth**Configuration 1 - Mode 1 – 10, Mode 2 and Mode 3 - 10**

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
650 (Bottom)	1935.0	23.8	30.01	1.002
900 (Middle)	1960.0	23.8	30.08	1.019
1150 (Top)	1985.0	23.8	30.14	1.033

E-TM3.2: 20.0MHz Bandwidth**Configuration 1 - Mode 1 – 20, Mode 2 and Mode 3 - 20**

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
700 (Bottom)	1940.0	23.8	30.01	1.002
900 (Middle)	1960.0	23.8	30.04	1.009
1100 (Top)	1980.0	23.8	30.09	1.021

**E-TM3.1: 5.0MHz Bandwidth****Configuration 1 - Mode 1 – 5, Mode 2 and Mode 3 - 5**

EARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
625 (Bottom)	1932.5	23.8	29.96	0.991
900 (Middle)	1960.0	23.8	30.10	1.023
1175 (Top)	1987.5	23.8	30.19	1.045

E-TM3.1: 10.0MHz Bandwidth**Configuration 1 - Mode 1 – 10, Mode 2 and Mode 3 - 10**

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
650 (Bottom)	1935.0	23.8	30.02	1.005
900 (Middle)	1960.0	23.8	30.09	1.021
1150 (Top)	1985.0	23.8	30.15	1.035

E-TM3.1: 20.0MHz Bandwidth**Configuration 1 - Mode 1 – 20, Mode 2 and Mode 3 - 20**

UARFCN	Frequency (MHz)	Path Loss (dB)	Result (dBm) RMS	Result (W) RMS
700 (Bottom)	1940.0	23.8	30.00	1.000
900 (Middle)	1960.0	23.8	29.99	0.998
1100 (Top)	1980.0	23.8	30.04	1.009

Limit	$\leq 100W$ or $\leq +50dBm$
-------	------------------------------

Remarks

The EUT does not exceed 100W or 50dBm at the measured frequencies.



Product Service

2.2 PEAK – AVERAGE RATIO

2.2.1 Specification Reference

FCC CFR 47 Part 24, Clause 24.232 (d)

2.2.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.2.3 Date of Test and Modification State

02 September 2013 – Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24.

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyser's Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percentage of time the signal spends at or above the level defines the probability for that particular power level.

The spectrum analyser measurement bandwidth was set to 5MHz when testing 5MHz OBW, 10MHz when testing 10MHz OBW and 12MHz when testing 20MHz OBW. The path loss was measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1 – 5, Mode 1 – 20
- Mode 2 (5MHz, 10MHz, 20MHz OBW)
- Mode 3 – 5, Mode 3 - 20

2.2.6 Environmental Conditions

02 September 2013

Ambient Temperature 26.2°C

Relative Humidity 36.5%



2.2.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24 and Industry Canada RSS- 133 - Peak to Average Ratio.

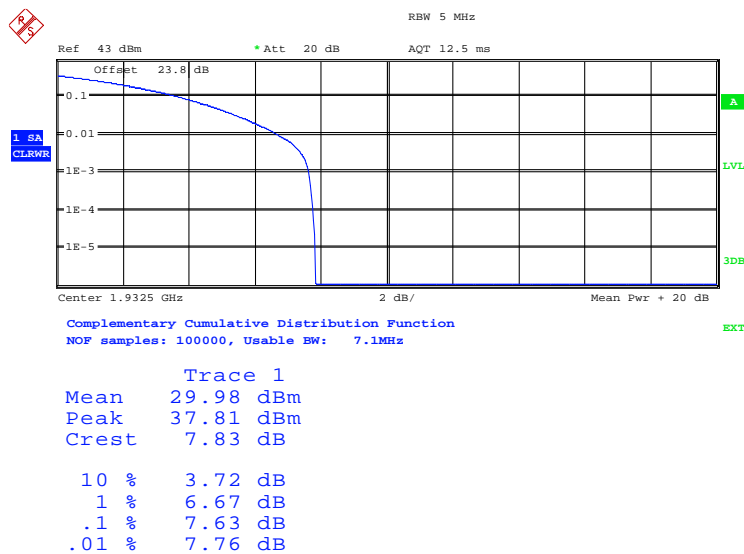
The test results are shown below

E-TM1.1: 5.0MHz Bandwidth

Configuration 1 - Mode 1 – 5, Mode 2 and Mode 3 - 5

Test Model	Occupied Bandwidth (MHz)	EARFCN	Frequency (MHz)	PAR (dB)
E-TM1.1	5.0	625 (Bottom)	1932.5	7.83
		900 (Middle)	1960.0	7.81
		1175 (Top)	1987.5	7.85

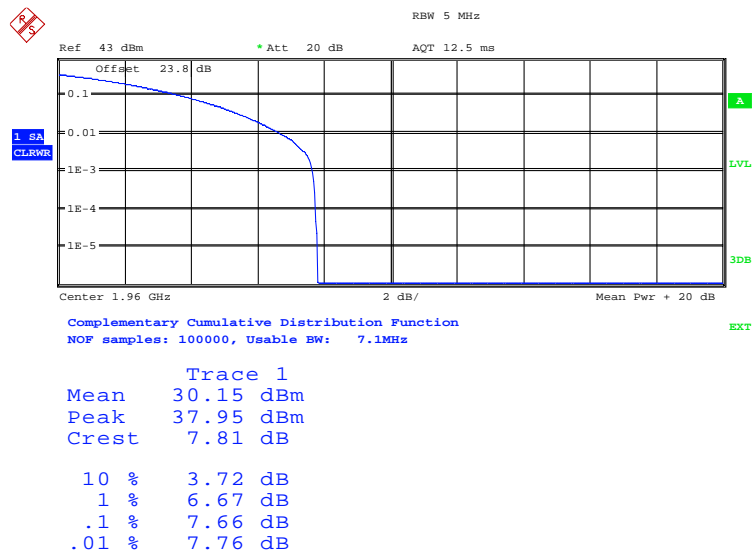
Configuration 1 - Mode 1 - 5



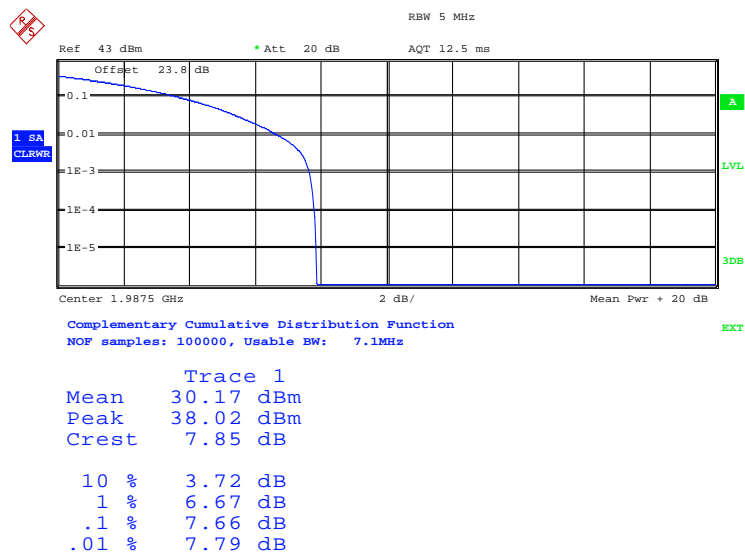
Date: 2.SEP.2013 09:24:34



Product Service

Configuration 1 - Mode 2 - 5

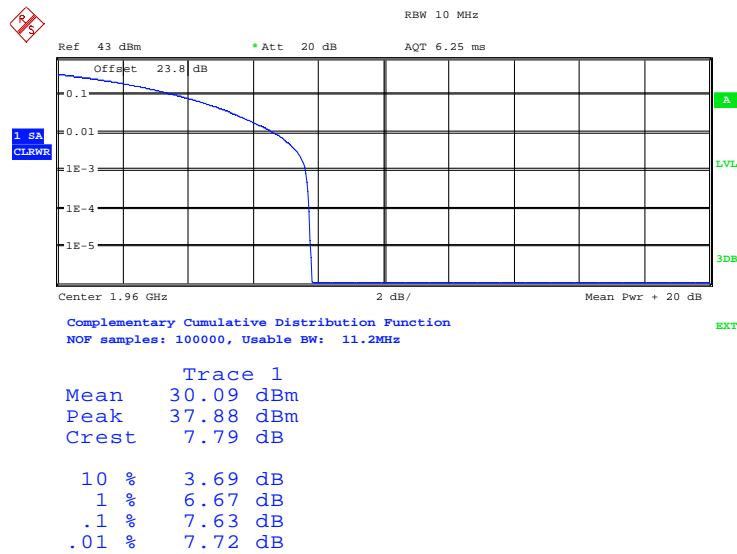
Date: 2.SEP.2013 09:23:39

Configuration 1 - Mode 3 - 5

Date: 2.SEP.2013 09:25:50

**E-TM1.1: 10.0MHz Bandwidth****Configuration 1 - Mode 2 - 10**

Test Model	Occupied Bandwidth (MHz)	EARFCN	Frequency (MHz)	PAR (dB)
E-TM1.1	10.0	900 (Middle)	1960.0	7.79

Configuration 1 - Mode 2 - 10

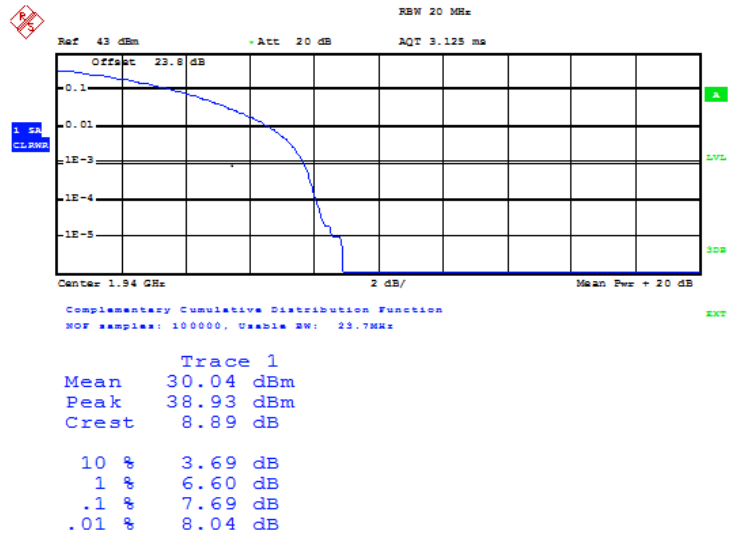
Date: 2.SEP.2013 09:49:09

E-TM1.1: 20.0MHz Bandwidth**Configuration 1 - Mode 1 – 20, Mode 2 and Mode 3 - 20**

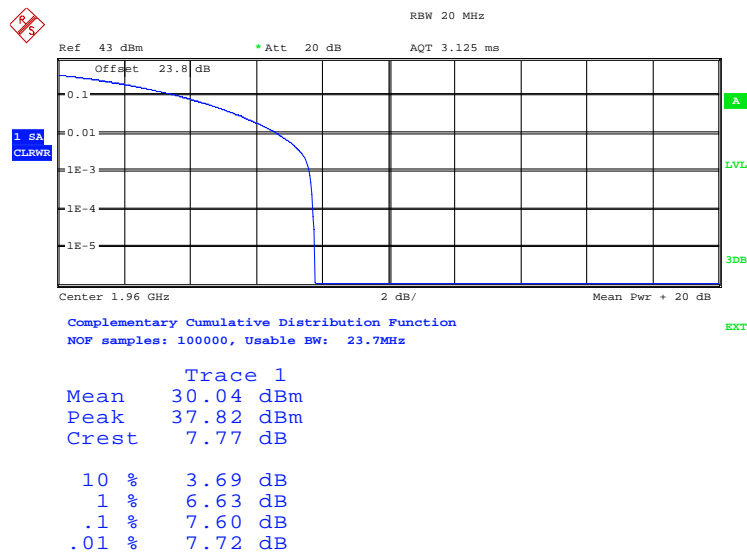
Test Model	Occupied Bandwidth (MHz)	EARFCN	Frequency (MHz)	PAR (dB)
E-TM1.1	20.0	700 (Bottom)	1940.0	8.89
		900 (Middle)	1960.0	7.77
		1100 (Top)	1980.0	8.08



Product Service

Configuration 1 - Mode 1 - 20

Date: 2.SEP.2013 09:38:38

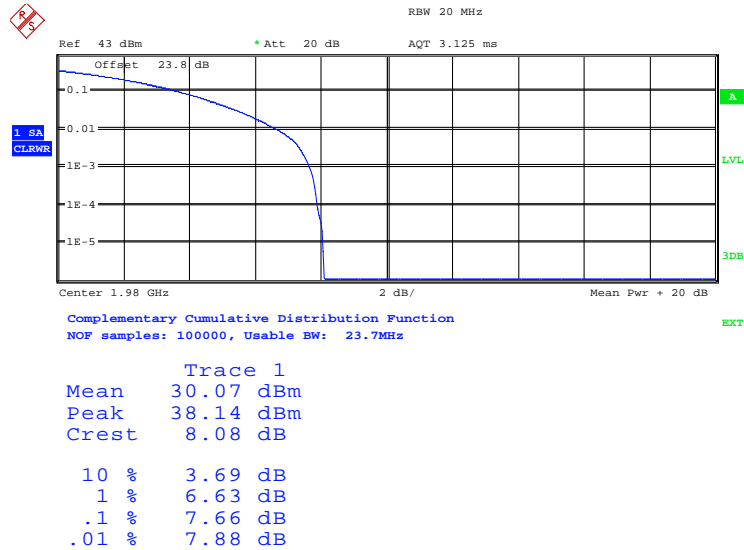
Configuration 1 - Mode 2 - 20

Date: 2.SEP.2013 09:35:58



Product Service

Configuration 1 - Mode 3 - 20



Date: 2.SEP.2013 09:41:18

Limit	13dB
-------	------

Remarks

The Peak – Average ratio does not exceed 13dB at the measured frequencies.



Product Service

2.3 MODULATION CHARACTERISTICS

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047 (d)
Industry Canada RSS-133 Clause 6.2

2.3.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.3.3 Date of Test and Modification State

02 September 2013 – Modification State 0

2.3.4 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Industry Canada RSS-133.

The RF output port ANT A was connected to a spectrum analyser with an attenuator. All other ports were connected to match loads. The EUT was set to transmit at maximum power. The Code Domain Power and the constellation of the EUT was measured and recorded by the spectrum analyser.

The EUT supports QPSK, 16QAM and 64QAM modulations and was tested in 5.0MHz Bandwidth.

The test was performed with the EUT in the following configuration and mode of operation:

Configuration 1 - Mode 2 (5MHz OBW)

2.3.5 Environmental Conditions

02 September 2013

Ambient Temperature 26.2°C

Relative Humidity 36.5%



2.3.6 Test Result

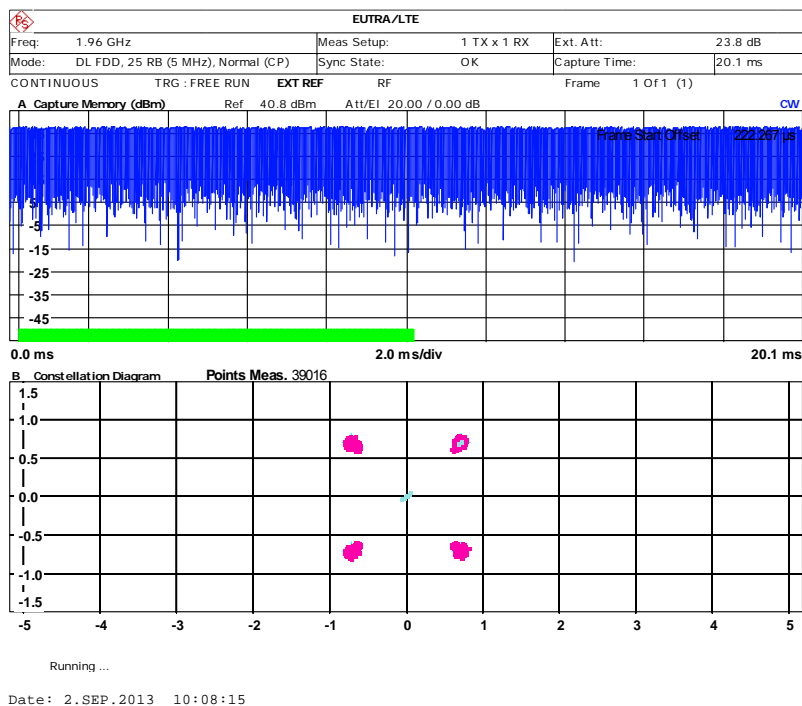
Plots are shown on the following page showing the EUT transmitting with all of the modulations:

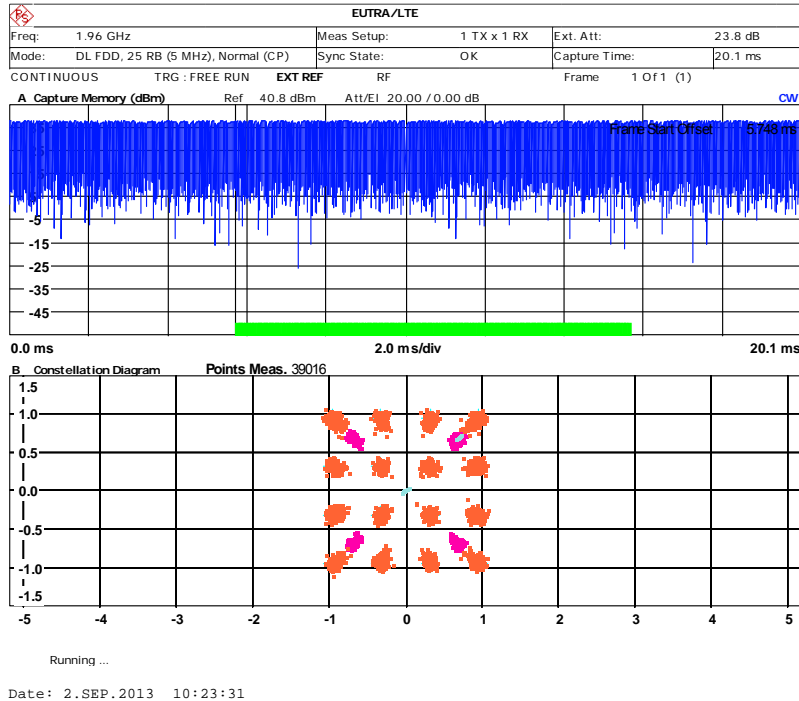
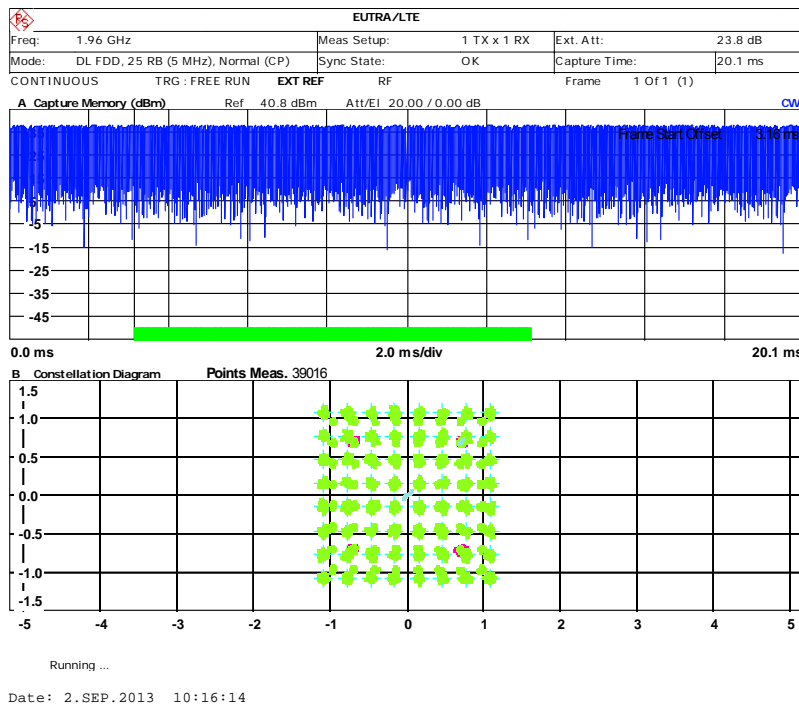
The test results are shown below

Configuration 1 - Mode 2

5MHz Bandwidth

E-TM1.1: EUT transmitting with QPSK modulation:



E-TM3.2: EUT transmitting with 16QAM modulation:E-TM3.1: EUT transmitting with 64QAM modulation:



Product Service

2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049 (h)
FCC CFR 47 Part 24, Clause 24.238 (b)
Industry Canada RSS-GEN, Clause 4.6.1

2.4.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.4.3 Date of Test and Modification State

02 September 2013 – Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-GEN.

The EUT was transmitting at maximum power, modulated using the test model described. The spectrum analyser measurement bandwidth was set to 50kHz when testing 5MHz OBW, 100kHz when testing 10MHz OBW and 200kHz when testing 20MHz OBW, the video bandwidth was set to 10 times the measurement bandwidth. The path loss was measured and entered as a reference level offset.

Measurement was made of the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. The -26dBc points were also established and the emission bandwidth determined.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1 – 5, Mode 1 – 20
 - Mode 2 (5MHz, 10MHz, 20MHz OBW)
 - Mode 3 – 5, Mode 3 - 20

2.4.6 Environmental Conditions

	02 September 2013
Ambient Temperature	24.1°C
Relative Humidity	40.2%



2.4.7 Test Results

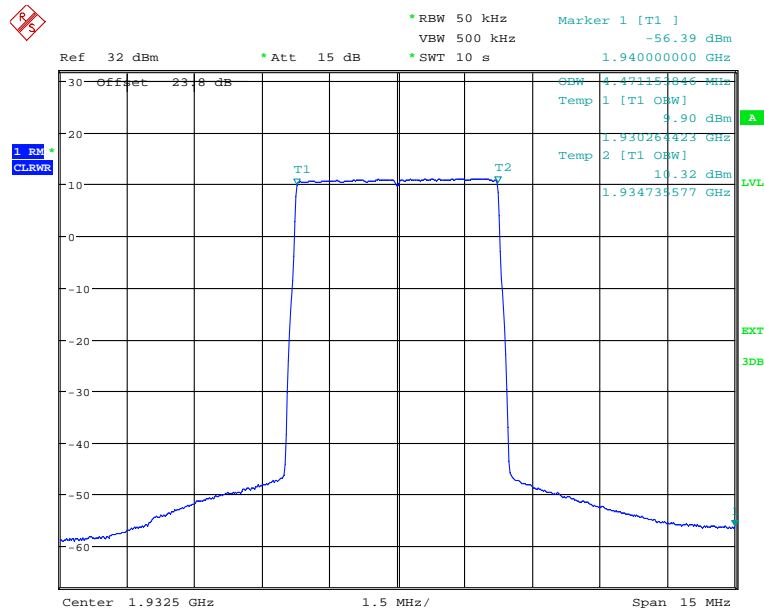
For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-GEN for Occupied Bandwidth.

The test results are shown below

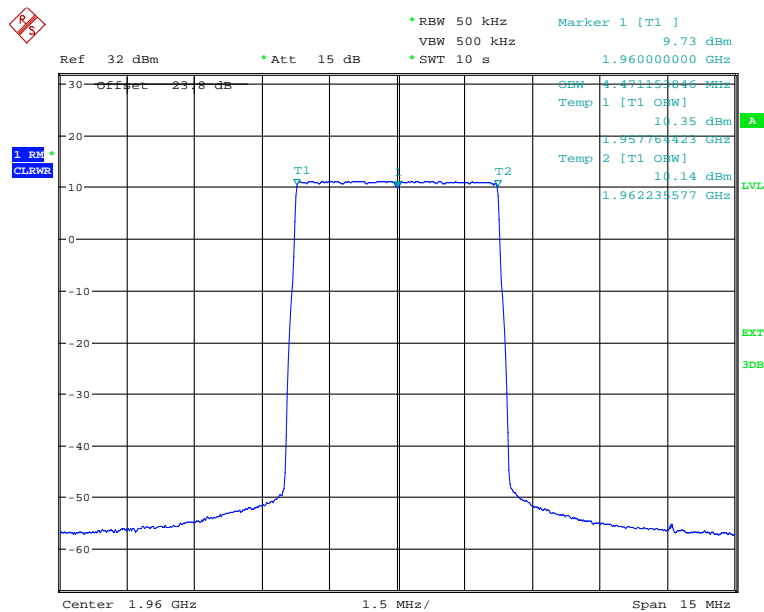
Test Model	BW configuration (MHz)	Frequency (MHz) / Channel	Occupied Bandwidth (MHz)
E-TM1.1	99% Occupied Bandwidth		
	5.0	1932.5 (Bottom)	4.47
	20.0	1940.0 (Bottom)	17.87
	5.0	1960.0 (Middle)	4.47
	10.0	1960.0 (Middle)	8.97
	20.0	1960.0 (Middle)	17.95
	5.0	1987.5 (Top)	4.47
	20.0	1980.0 (Top)	17.95
	-26dBc Emission Bandwidth		
	5.0	1960.0 (Middle)	4.81
	10.0	1960.0 (Middle)	9.46
	20.0	1960.0 (Middle)	18.91



Product Service

E-TM1.1: 5.0MHz Bandwidth**Configuration 1 - Mode 1 - 5**

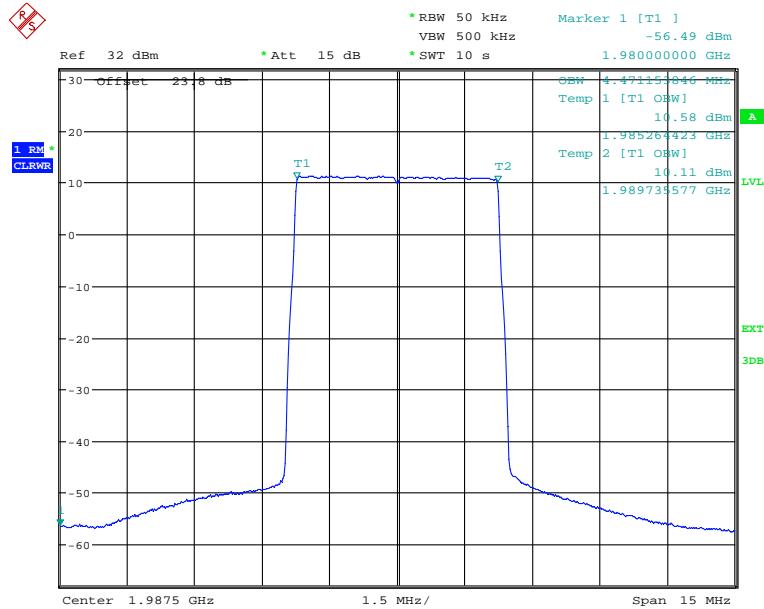
Date: 2.SEP.2013 11:38:40

Configuration 1 - Mode 2 - 5

Date: 2.SEP.2013 11:36:44



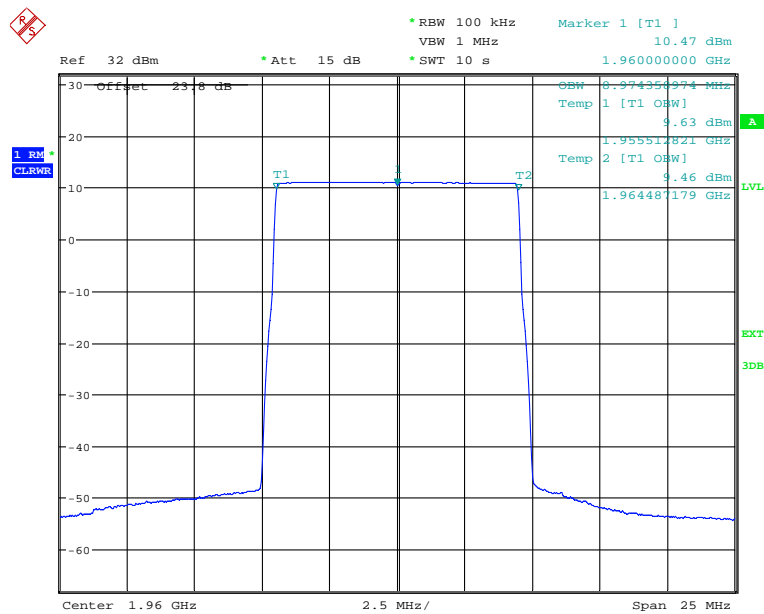
Configuration 1 - Mode 3 - 5



Date: 2.SEP.2013 11:40:03

E-TM1.1: 10.0MHz Bandwidth

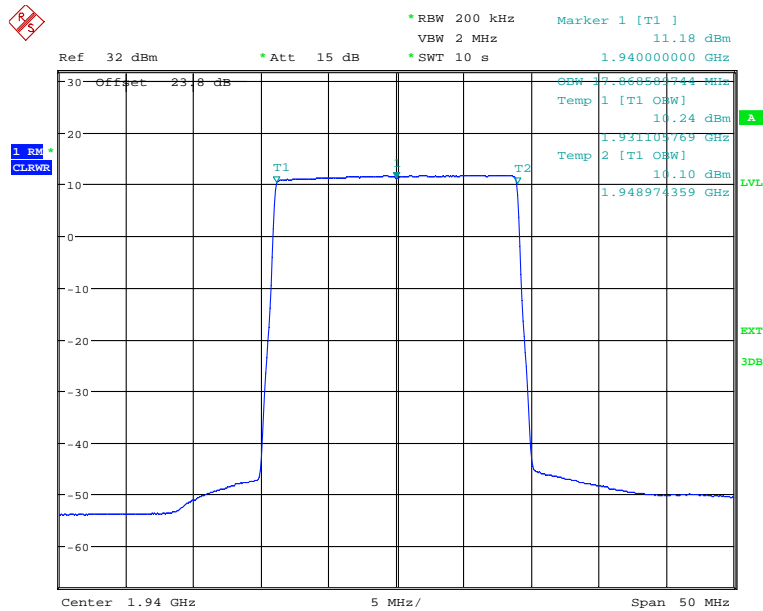
Configuration 1 - Mode 2 - 10



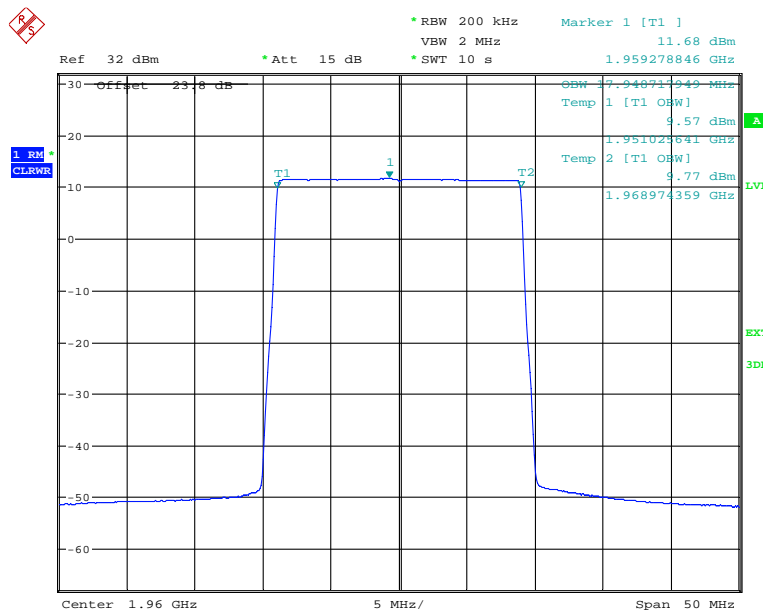
Date: 2.SEP.2013 12:07:14



Product Service

E-TM1.1: 20.0MHz Bandwidth**Configuration 1 - Mode 1 - 20**

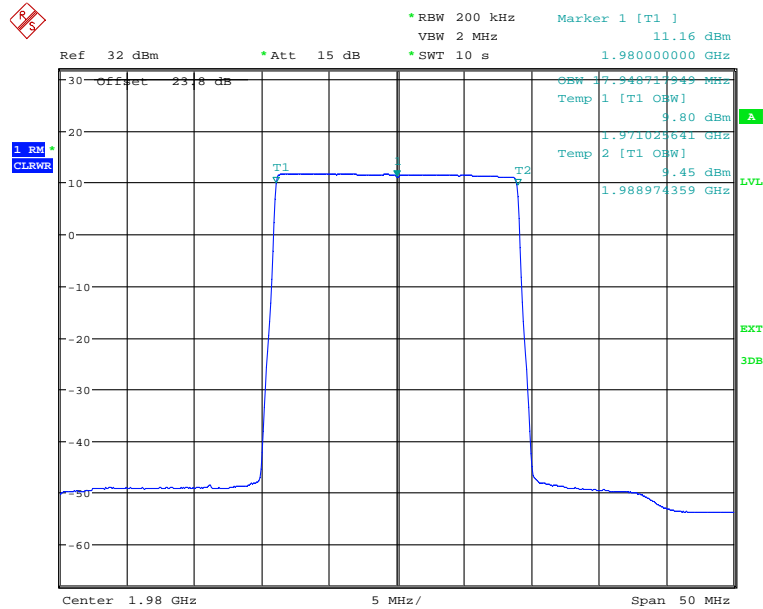
Date: 2.SEP.2013 11:56:10

Configuration 1 - Mode 2 - 20

Date: 2.SEP.2013 11:53:36



Configuration 1 - Mode 3 - 20

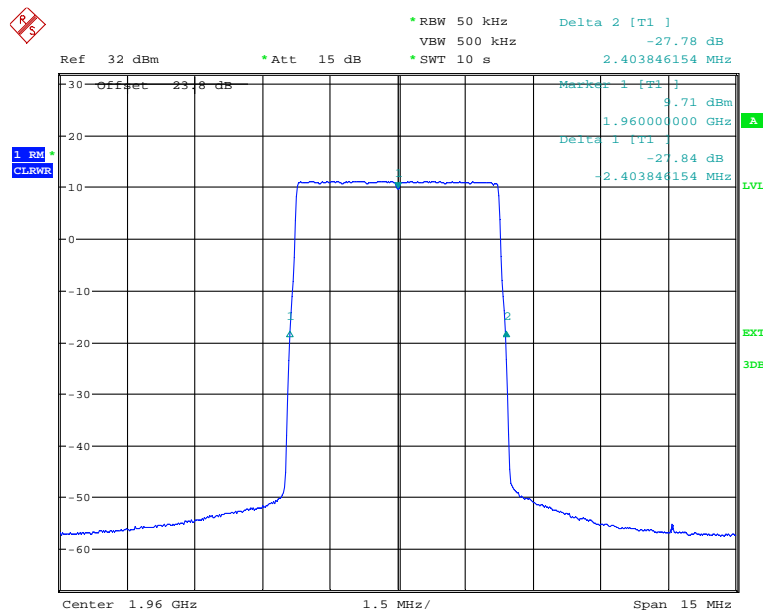


Date: 2.SEP.2013 11:57:34

-26dBc Bandwidth

E-TM1.1: 5.0MHz Bandwidth

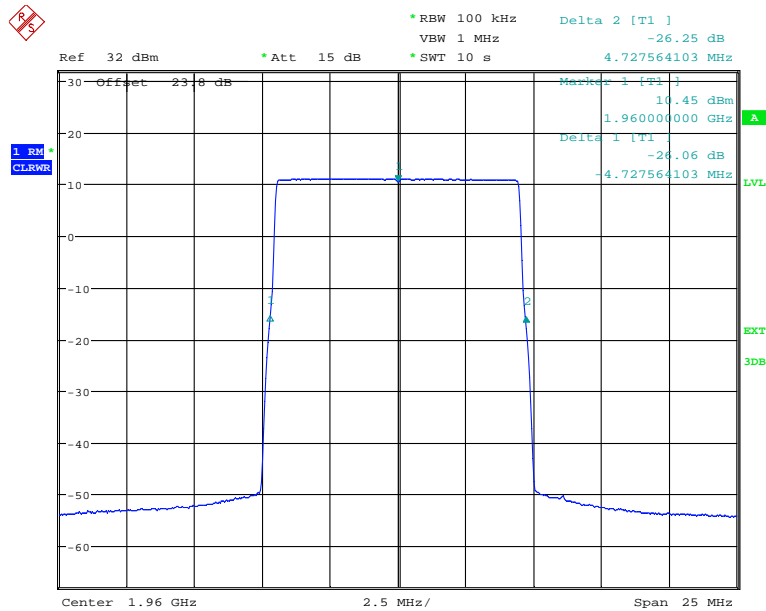
Configuration 1 - Mode 2 - 5 -26dBc Bandwidth



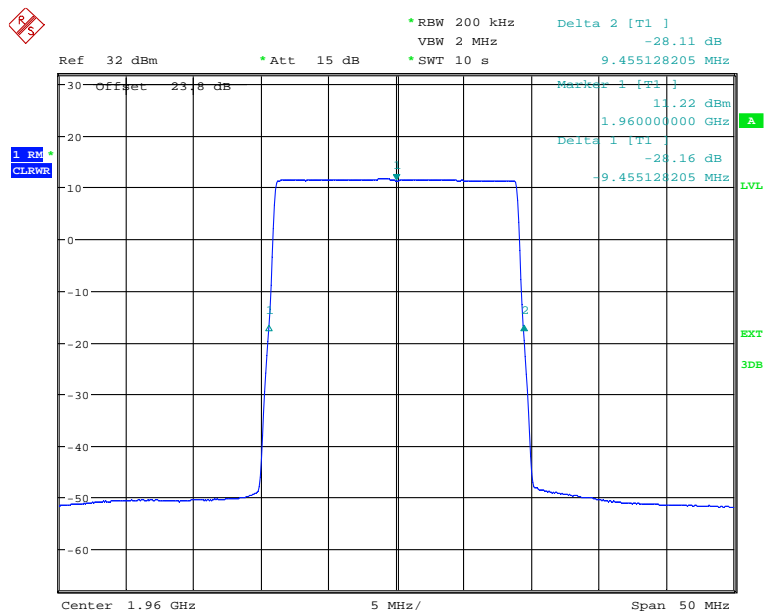
Date: 2.SEP.2013 11:42:57



Product Service

E-TM1.1: 10.0MHz Bandwidth**Configuration 1 - Mode 2 – 10****-26dBc Bandwidth**

Date: 2.SEP.2013 12:08:14

E-TM1.1: 20.0MHz Bandwidth**Configuration 1 - Mode 2 – 20****-26dBc Bandwidth**

Date: 2.SEP.2013 11:52:26



Product Service

2.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (± 1 MHz)

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, Clause 24.238 (a)
Industry Canada RSS-133 Clause 6.5

2.5.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.5.3 Date of Test and Modification State

02 September 2013 – Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133.

In accordance with 24.238(a), at least 1% of the 26dB bandwidth was used for the resolution and video bandwidths up to 1MHz away from the block edge. A resolution bandwidth of 50kHz was used up to 1MHz away from the band edges when measuring 5MHz Occupied Bandwidth, 100kHz when measuring 10MHz Occupied Bandwidth and 200kHz when measuring 20MHz Occupied Bandwidth. In all cases, the setting of the resolution bandwidth was $>1\%$ of the Emission Bandwidth (4.81MHz between the 26dB points for 5MHz nominal BW setting, 8.97MHz between the 26dB points for 10MHz nominal BW setting and 17.95MHz between the 26dB points for 20MHz nominal BW setting), therefore the limit was not required to be adjusted. A resolution bandwidth of 50kHz was used between 1MHz to 5MHz away from the band edge. As the FCC rules specify a RBW of 1MHz for measurements of emissions > 1 MHz away from the band edges, the limit was adjusted by -13dB to -26dBm to compensate for the reduced measurement bandwidth. The Spectrum analyser detector was set to RMS.

The path loss was measured and entered as a reference level offset.

The EUT was tested at its maximum power level.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1 – 5, Mode 1 – 10, Mode 1 – 20
- Mode 3 – 5, Mode 3 – 10, Mode 3 – 20



2.5.6 Environmental Conditions

02 September 2013

Ambient Temperature 24.1°C

Relative Humidity 40.2%

2.5.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133 for Spurious Emissions Antenna Terminals (± 1 MHz)

Below are the Frequencies the EUT was tested against along with the tested channels.

5.0MHz Bandwidth

Configuration 1 - Mode 1 - 5 and 3 - 5

Band Edge Frequency	Edge Test with 5.0MHz Bandwidth Channel No./Frequencies	RBW / VBW (Hz)
Bottom 1930 MHz	Channel: 625 Frequency: 1932.5 MHz	50k / 500k
Top 1990MHz	Channel: 1175 Frequency: 1987.5 MHz	

10.0MHz Bandwidth

Configuration 1 - Mode 1 - 10 and 3 - 10

Band Edge Frequency	Edge Test with 10.0MHz Bandwidth Channel No./Frequencies	RBW / VBW (Hz)
Bottom 1930 MHz	Channel: 650 Frequency: 1935.0 MHz	100k / 1M
Top 1990MHz	Channel: 1150 Frequency: 1985.0 MHz	

20.0MHz Bandwidth

Configuration 1 - Mode 1 - 20 and 3 - 20

Band Edge Frequency	Edge Test with 20.0MHz Bandwidth Channel No./Frequencies	RBW / VBW (Hz)
Bottom 1930 MHz	Channel: 700 Frequency: 1940.0 MHz	200k / 2M
Top 1990MHz	Channel: 1100 Frequency: 1980.0 MHz	

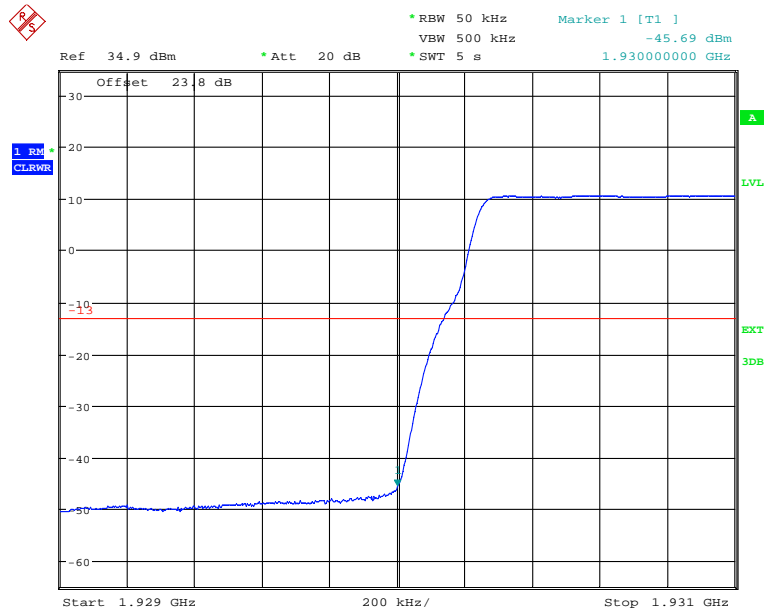
The channels shown in the table above are the minimum and maximum channels that can be used in the authorised frequency ranges to maintain compliance.

The test results are shown below

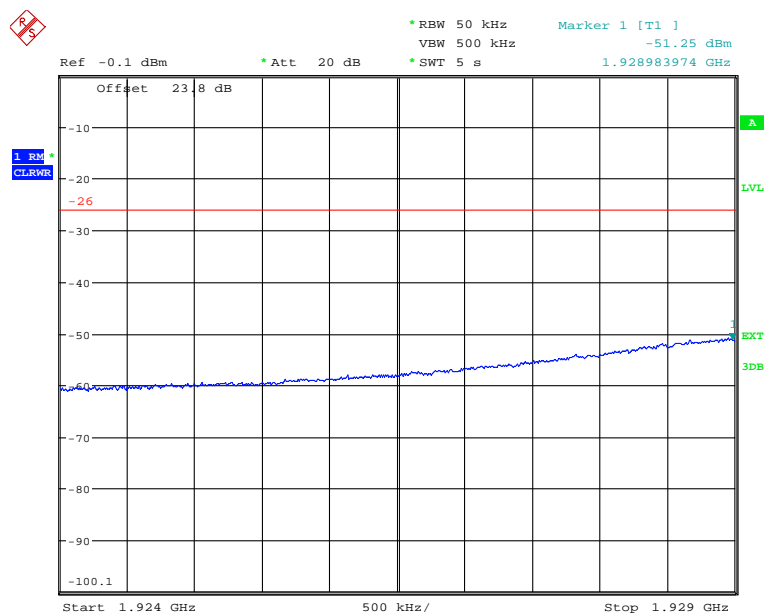
E-TM1.1

5.0MHz Bandwidth

Configuration 1 - Mode 1 – 5



Date: 2.SEP.2013 13:06:13

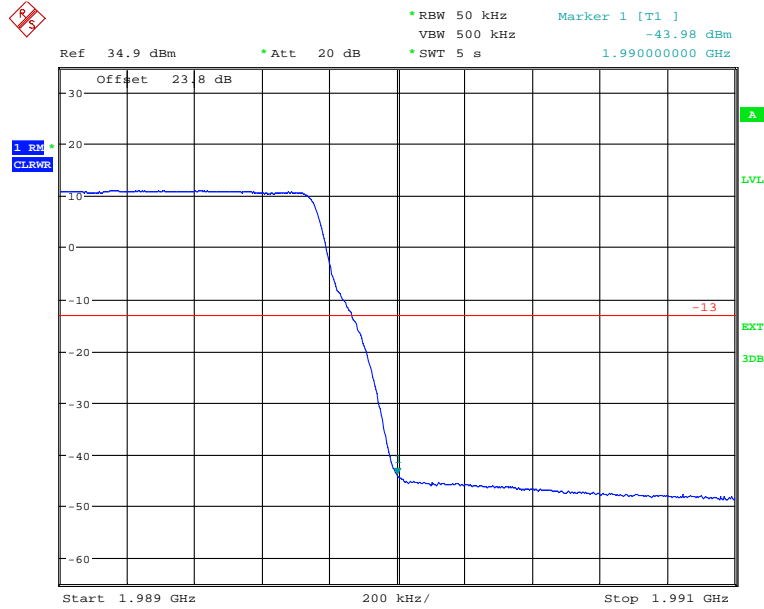


Date: 2.SEP.2013 13:04:36

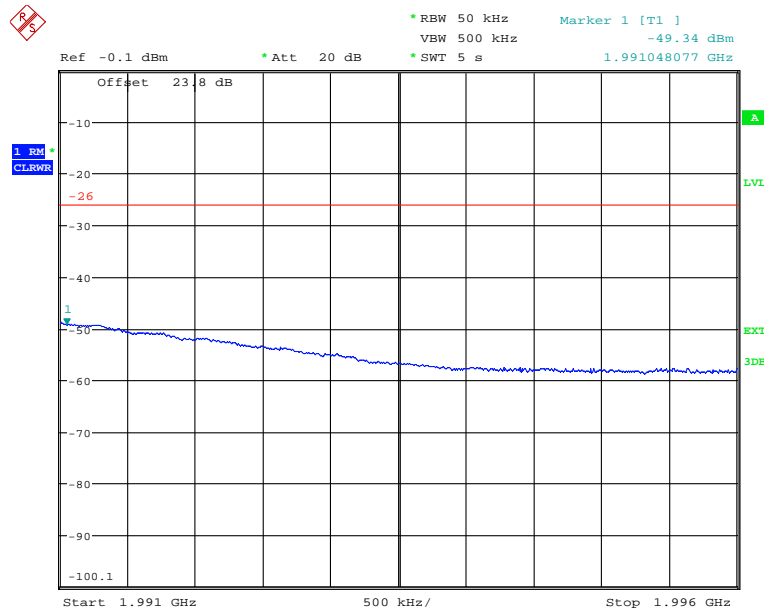


Product Service

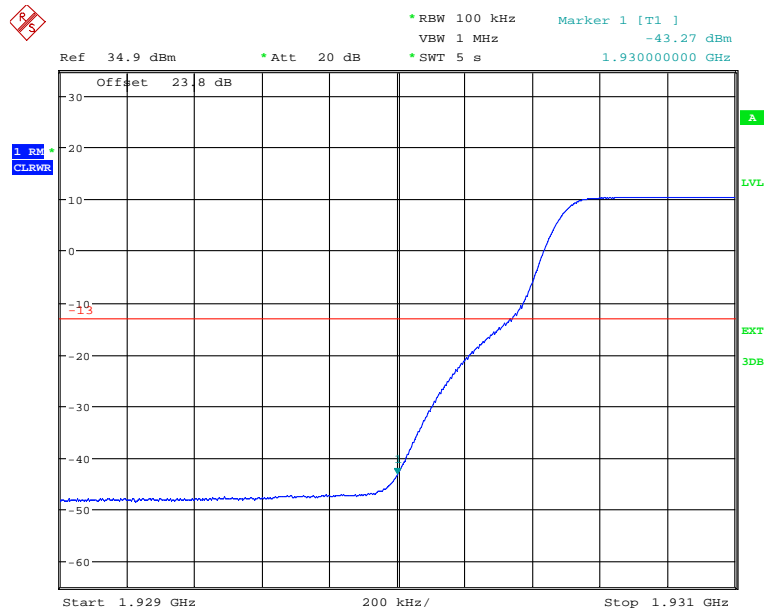
Configuration 1 - Mode 1 – 5



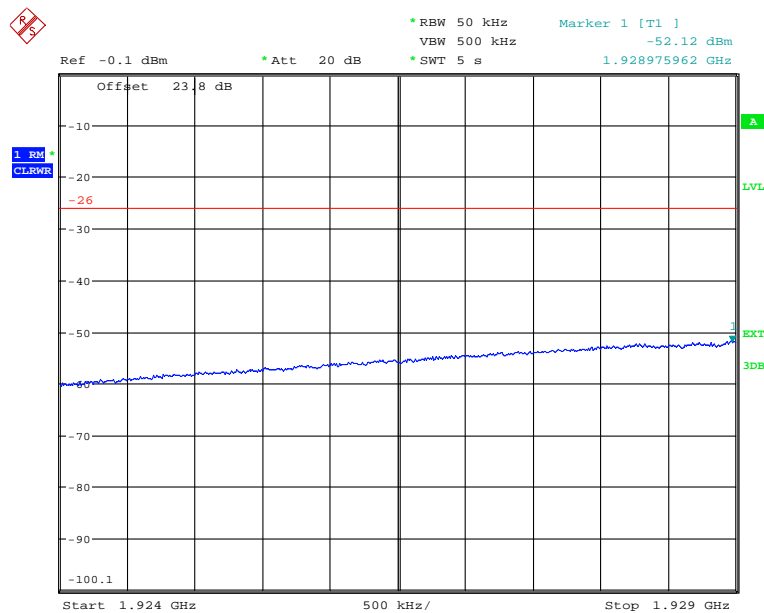
Date: 2.SEP.2013 13:01:38



Date: 2.SEP.2013 13:02:49

**10.0MHz Bandwidth****Configuration 1 - Mode 1 – 10**

Date: 2.SEP.2013 12:20:10

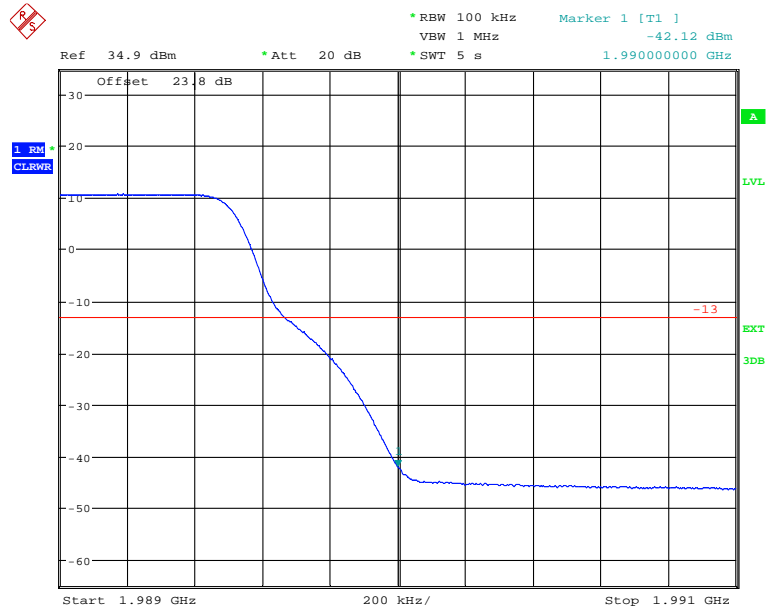


Date: 2.SEP.2013 12:23:28

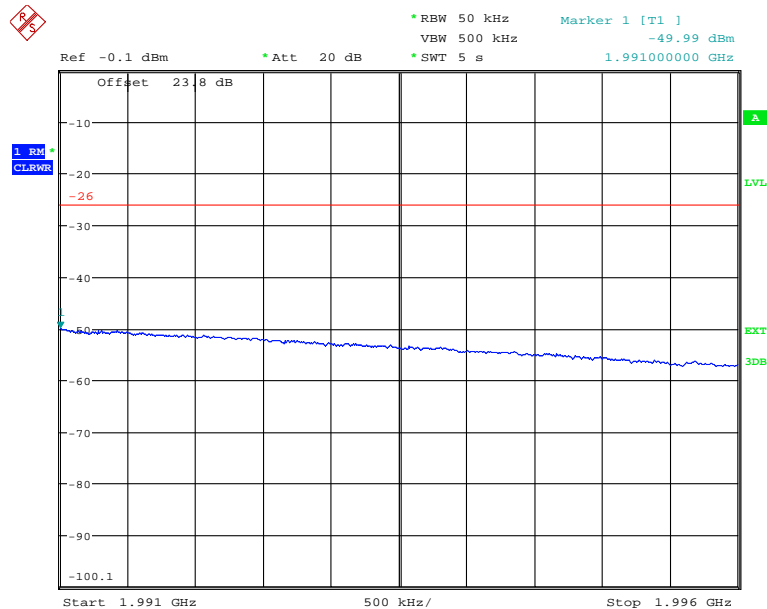


Product Service

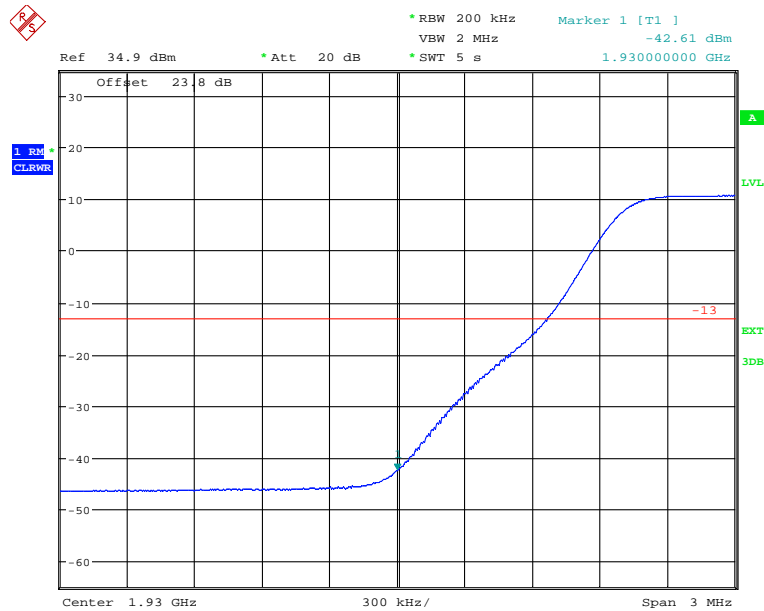
Configuration 1 - Mode 3 – 10



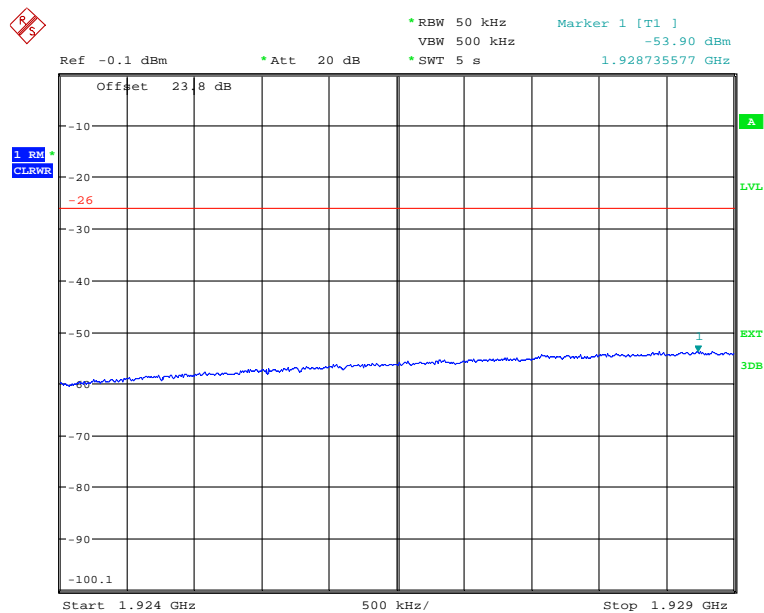
Date: 2.SEP.2013 12:28:38



Date: 2.SEP.2013 12:26:39

**20.0MHz Bandwidth****Configuration 1 - Mode 1 – 20**

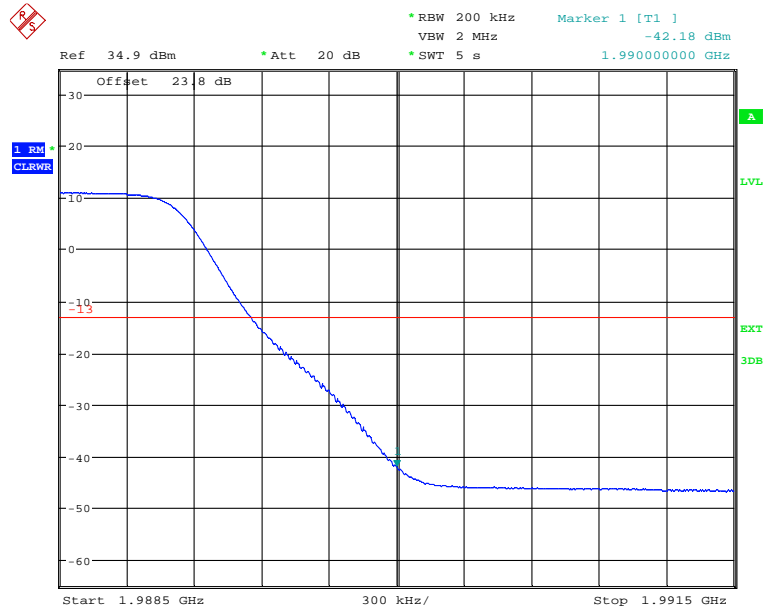
Date: 2.SEP.2013 13:28:36



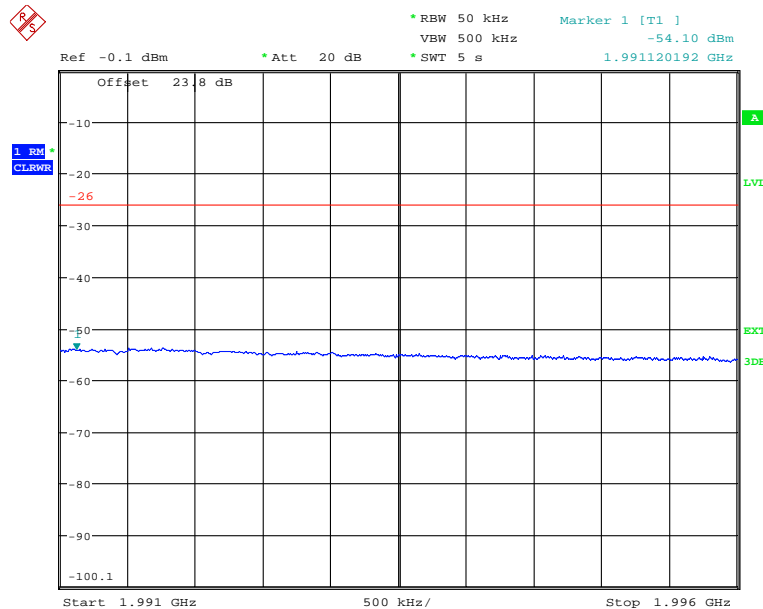
Date: 2.SEP.2013 13:29:54



Configuration 1 - Mode 3 – 20



Date: 2.SEP.2013 13:34:16



Date: 2.SEP.2013 13:32:33

Limit

The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10\log P$ dB.



Product Service

2.6 CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, 24.238 (a)
Industry Canada RSS-133, Clause 6.5

2.6.2 Equipment Under Test

RBS 6401 1.0 B2 LTE / KRD 901 040/6, S/N: C827268550

2.6.3 Date of Test and Modification State

03 September 2013 – Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133.

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 9kHz to 20GHz. The EUT was set to transmit on maximum power. The EUT was tested on Bottom, Middle and Top channels for E-TM1.1 test model in 5.0MHz and 20MHz bandwidth configurations as the representative modes. The resolution bandwidth was set to 1MHz for 9kHz to 20GHz thus meeting the requirements of Part 24.53(h). The spectrum analyser detector was set to peak and trace was kept on Max Hold.

The maximum path loss across each of the measurement bands was used as the reference level offset to ensure worst case.

In addition, measurements were made up to the 10th harmonic of the fundamental.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1 – 5, Mode 1 – 20
 - Mode 2 (5MHz, 20MHz OBW)
 - Mode 3 – 5, Mode 3 - 20



Product Service

2.6.6 Environmental Conditions

03 September 2013

Ambient Temperature 23.8°C

Relative Humidity 42.6%

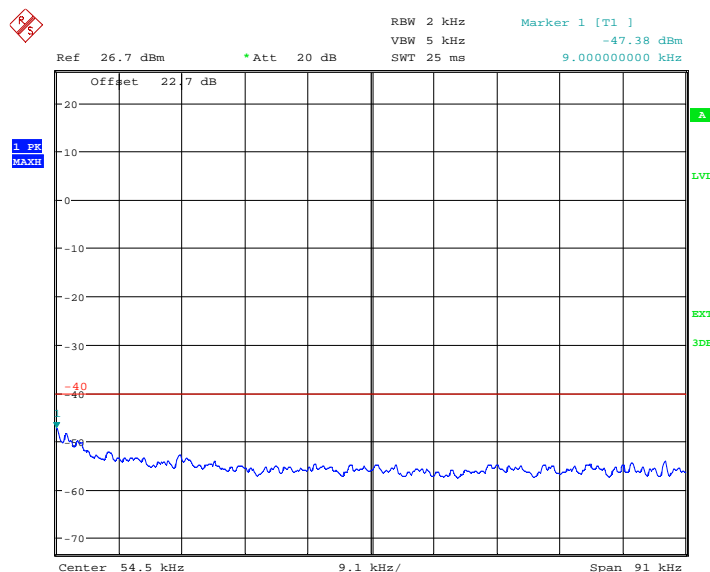
2.6.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133 for Conducted Spurious Emissions.

The test results are shown below

Remark:

The emissions at 9kHz on the plots were not generated by the test object. An additional measurement with a smaller span (reproduced in the plot below) showed that it was related to the LO feedthrough. The resolution bandwidth was set to 2kHz. As the FCC rules specify a RBW of 1MHz for measurements of emissions > 1MHz away from the band edges and to show a direct comparison with the 9kHz to 3GHz measurements, the limit was adjusted by -27dB to -40dBm to compensate for the reduced measurement bandwidth.



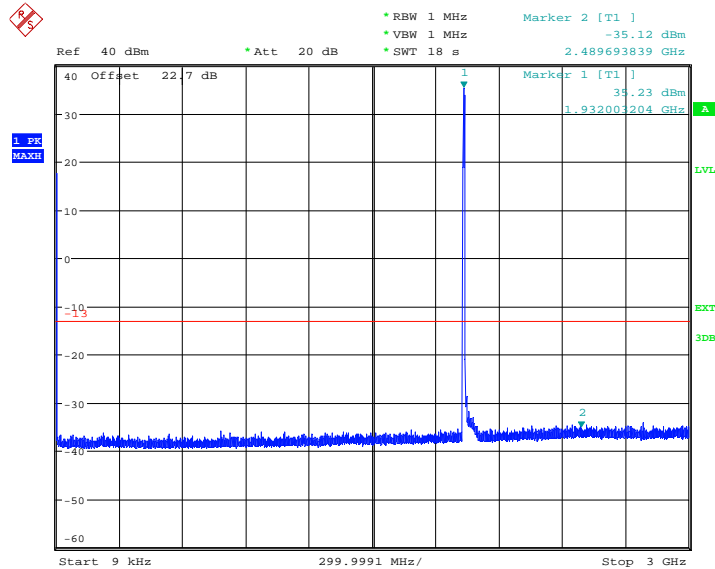
Date: 3.SEP.2013 12:30:13



Product Service

E-TM1.1 5.0MHz Bandwidth

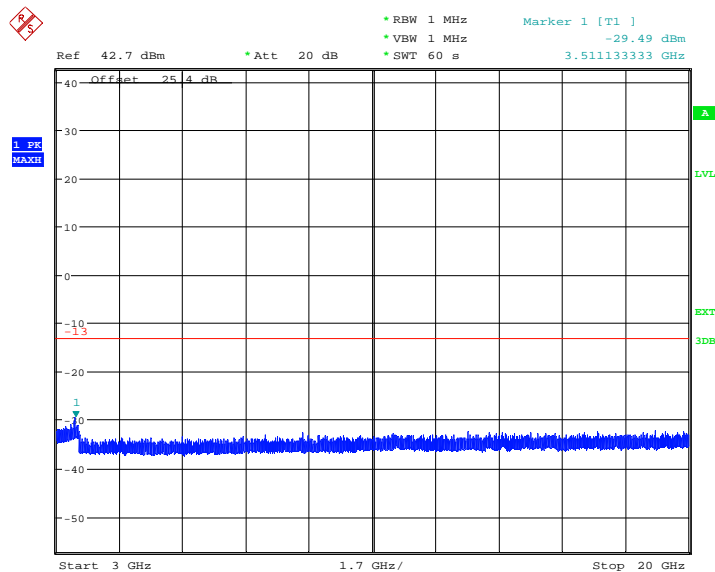
Configuration 1 - Mode 1 - 5 9kHz to 3GHz



Date: 3.SEP.2013 12:44:59

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz

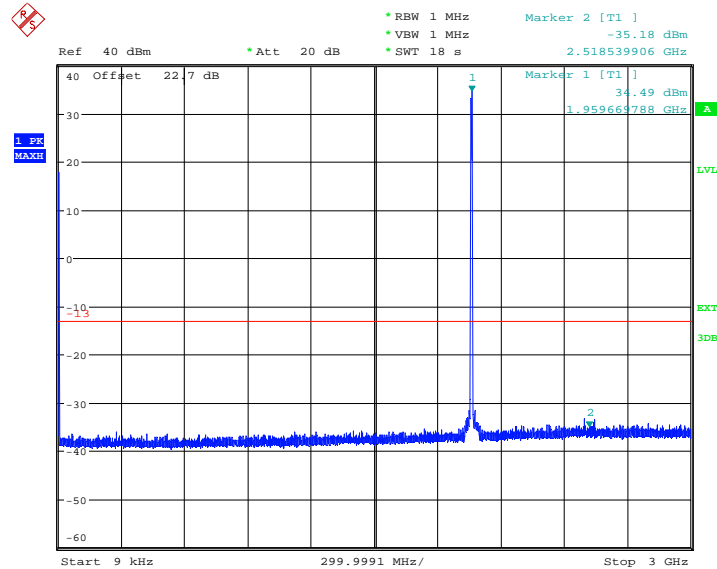


Date: 3.SEP.2013 12:58:59



Product Service

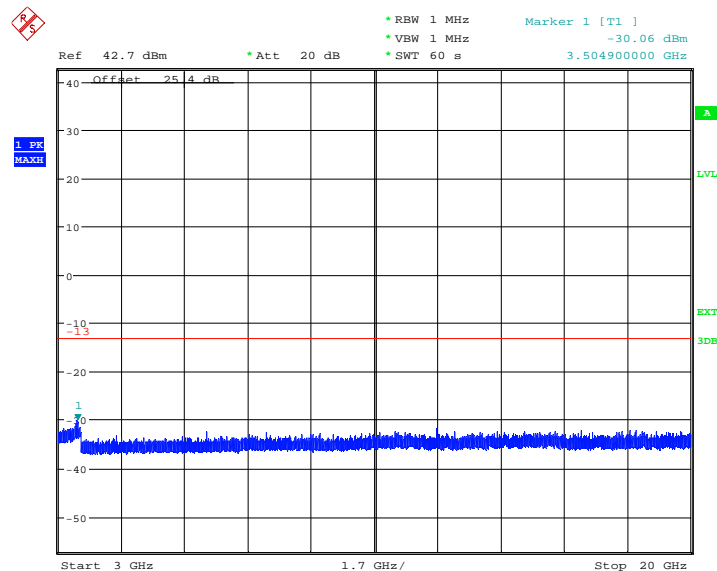
Configuration 1 - Mode 2 - 5 9kHz to 3GHz



Date: 3.SEP.2013 12:34:03

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz

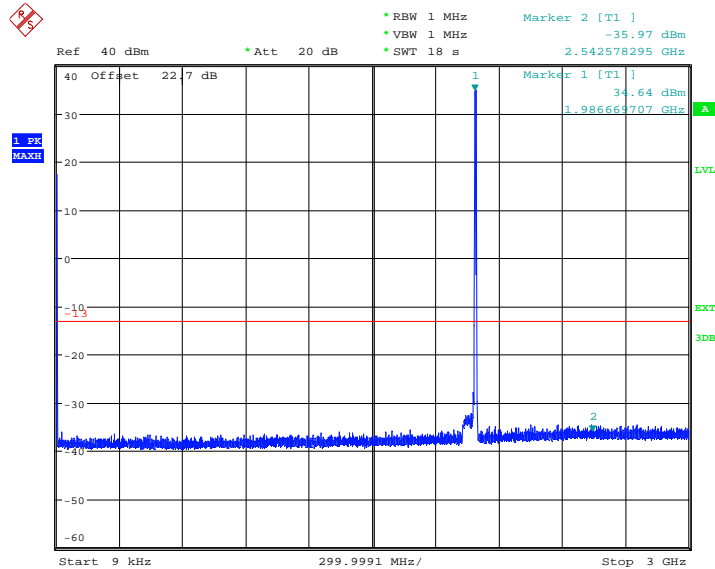


Date: 3.SEP.2013 13:01:34



Product Service

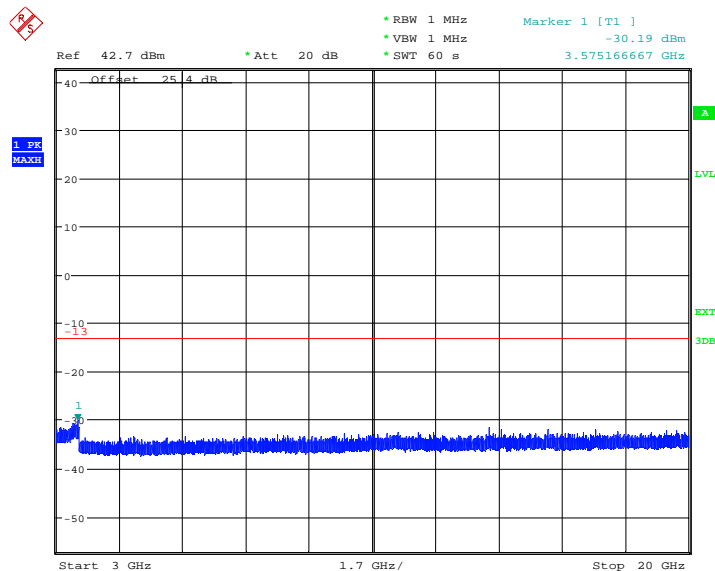
Configuration 1 - Mode 3 - 5 9kHz to 3GHz



Date: 3.SEP.2013 12:50:15

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz



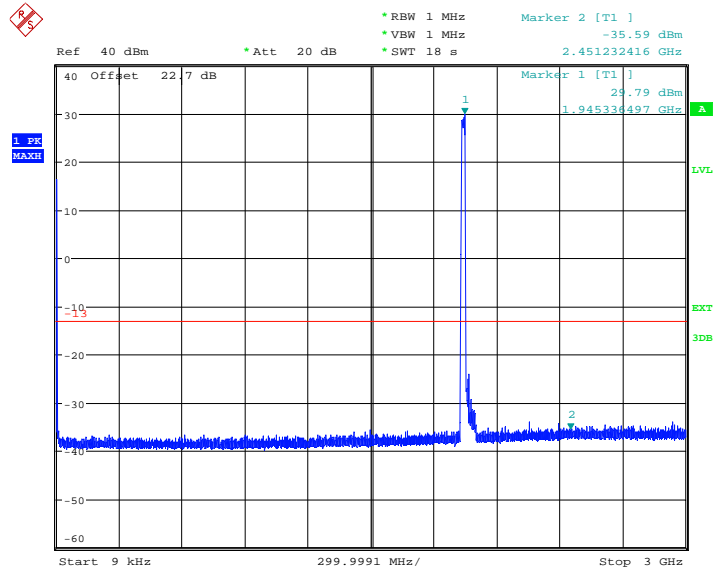
Date: 3.SEP.2013 12:54:46



Product Service

E-TM1.1 20.0MHz Bandwidth

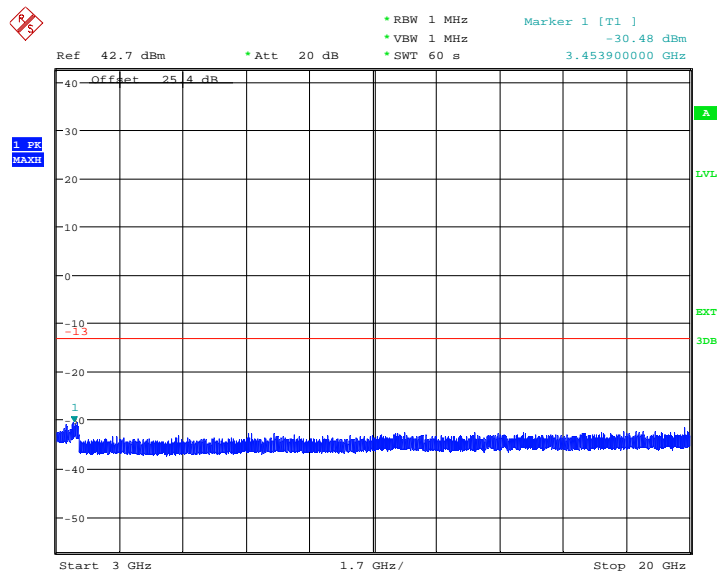
Configuration 1 - Mode 1 - 20 9kHz to 3GHz



Date: 3.SEP.2013 13:47:17

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz

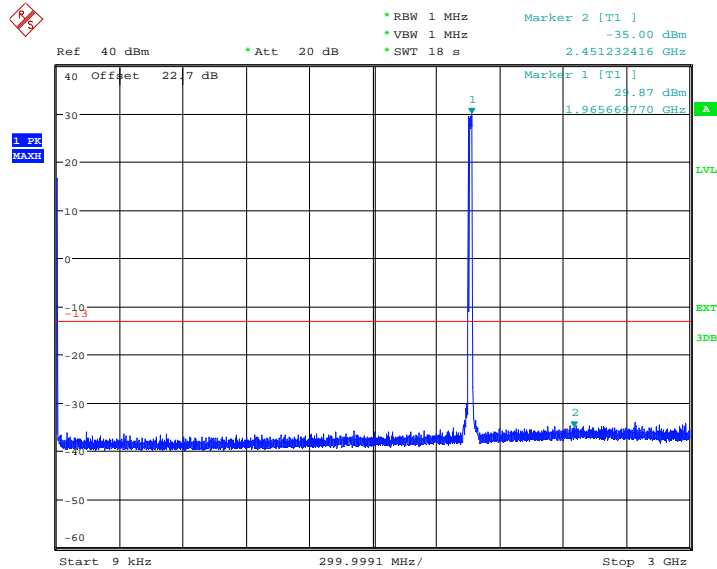


Date: 3.SEP.2013 13:39:18



Product Service

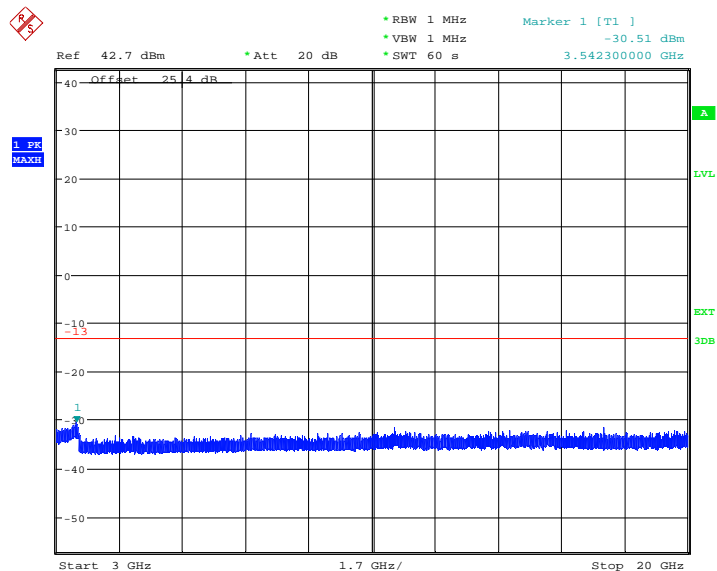
Configuration 1 - Mode 2 - 20
9kHz to 3GHz



Date: 3.SEP.2013 13:48:35

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz

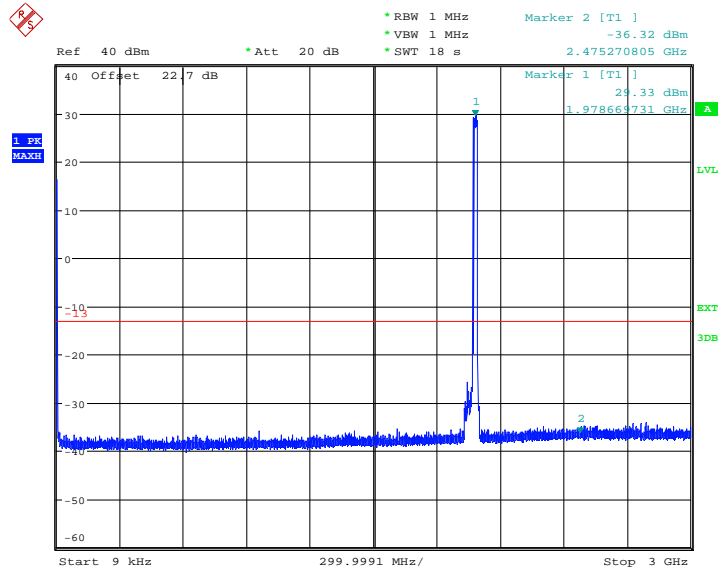


Date: 3.SEP.2013 13:36:57



Product Service

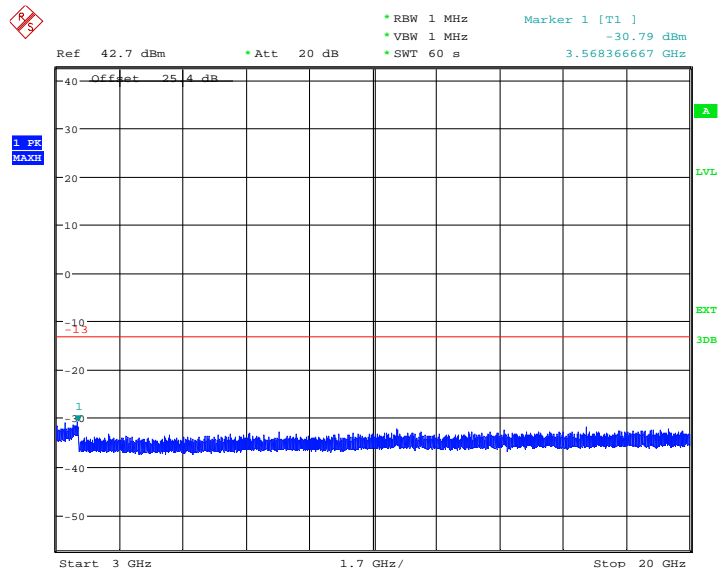
Configuration 1 - Mode 3 - 20 9kHz to 3GHz



Date: 3.SEP.2013 13:45:59

Note: The emission beyond the limit is the operating frequency.

3GHz to 20GHz



Date: 3.SEP.2013 13:41:34

Limit	-13dBm
-------	--------

Remarks

The EUT does not exceed -13dBm at the frequency range of 9kHz to 20GHz.



Product Service

2.7 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.7.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
 FCC CFR 47 Part 24, Clause 24.235
 Industry Canada RSS-133, Clause 6.3

2.7.2 Equipment Under Test

RRUS 01 B2, S/N: C827268550

2.7.3 Date of Test and Modification State

02 and 03 September 2013 – Modification State 0

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133. The EUT is designed for indoor use with a temperature range of -30°C to +50°C.

The EUT was set to transmit on maximum power. A Spectrum Analyser was used to measure the frequency error. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2 (5MHz OBW)

2.7.6 Environmental Conditions

	02 September 2013	03 September 2013
Ambient Temperature	24.1°C	26.0°C
Relative Humidity	40.2%	32.6%



2.7.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133 for Frequency Stability Under Temperature Variations.

The test results are shown below

Power Supply: 120V AC, 60Hz

E-TM1.1

5.0MHz Bandwidth

Configuration 1 - Mode 2 - 5

Temperature Interval (°C)	Deviation (Hz)
-30	+1.25
-20	+3.14
-10	+1.68
0	+2.44
+10	+2.82
+20	+4.60
+30	+3.80
+40	+4.49
+50	+3.61

Limit	± 1.0 ppm or ± 1.96 kHz
-------	---------------------------------

Remarks

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval across the measured range.



Product Service

2.8 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

2.8.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 24, Clause 24.235
Industry Canada RSS-133, Clause 6.3

2.8.2 Equipment Under Test

RRUS 01 B2, S/N: C827268550

2.8.3 Date of Test and Modification State

02 September 2013 – Modification State 0

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133.

The EUT was set to transmit on maximum power. A Spectrum Analyser was used to measure the frequency error. The supplied voltage was varied from 85 to 115 percent of the nominal value.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2 (5MHz OBW)

2.8.6 Environmental Conditions

02 September 2013

Ambient Temperature 24.1°C

Relative Humidity 40.2%



2.8.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 24 and Industry Canada RSS-133 for Frequency Stability Under Voltage Variations.

The test results are shown below

Temperature: 20°C

E-TM1.1

5.0MHz Bandwidth

Configuration 1 - Mode 2 - 5

AC Voltage (V)	Deviation (Hz)
102	+5.12
120	+4.41
138	+2.92

Limit	± 1.0 ppm or ± 1.96 kHz
-------	---------------------------------

Remarks

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges under voltage variations across the measured range.



Product Service

SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	Serial No.	Calibration Due
Section 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 – Maximum Conducted Output Power, Peak – Average Ratio, Modulation Characteristics, Occupied Bandwidth, Spurious Emissions at Antenna Terminals (± 1MHz), Conducted Spurious Emissions and Receiver Spurious Emissions.				
Digital Multimeter	Fluke	79III	69621983	16-Aug-2014
Thermo-hygrometer	Rotronic	Hygropalm	31845 015	22-Mar-2014
Thermal Power Sensor	Rohde & Schwarz	NRP-Z21	101290	20-Sep-2013
Spectrum Analyser	Rohde & Schwarz	FSQ26	101154	09-Aug-2014
20dB Attenuator	Generic	50HF-020-50/18	Not serialised	O/P MON
Power Supply	Agilent	6812B	MY41001954	O/P MON
Switching Unit (Tx)	Orbis	TDD Filter SSU (Tx)	SSU-0711-1316	O/P MON
Frequency Standard	Symmetricon	8040	123630105006	09-Nov-2013
RF Signal Generator	Rohde & Schwarz	SMF 100A	104229	03-Apr-2014
Vector Signal Generator	Rohde & Schwarz	SMU 200A	104988	O/P MON
Vector Signal Generator	Rohde & Schwarz	SMBV 100A	258387	12-Aug-2014
Section 2.7 and 2.8 – Frequency Stability Under Temperature and Voltage Variations				
Digital Multimeter	Fluke	79III	69621983	16-Aug-2014
Thermo-hygrometer	Rotronic	Hygropalm	31845 015	22-Mar-2014
Digital Thermometer	Fluke	51 K/J	73860001	06-Aug-2014
Climatic Chamber	Vötsch	VT7010	56602714	O/P MON
Thermal Power Sensor	Rohde & Schwarz	NRP-Z21	101290	20-Sep-2013
Spectrum Analyser	Rohde & Schwarz	FSQ26	101154	09-Aug-2014
20dB Attenuator	Generic	50HF-020-50/18	Not serialised	O/P MON
Power Supply	Agilent	6812B	MY41001954	O/P MON
Switching Unit (Tx)	Orbis	TDD Filter SSU (Tx)	SSU-0711-1316	O/P MON
Frequency Standard	Symmetricon	8040	123630105006	09-Nov-2013
RF Signal Generator	Rohde & Schwarz	SMF 100A	104229	03-Apr-2014
Vector Signal Generator	Rohde & Schwarz	SMU 200A	104988	O/P MON
Vector Signal Generator	Rohde & Schwarz	SMBV 100A	258387	12-Aug-2014
Climatic Chamber	Vötsch	VT4018	56606541	O/P MON

O/P MON Output monitored with calibration equipment



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Conducted Maximum Peak Output Power	30MHz to 10GHz Amplitude	0.2dB
Conducted Emissions	30MHz to 20GHz Amplitude	1.7dB*
Frequency Stability	30MHz to 2GHz Amplitude	$<1 \times 10^{-7}$
Worst case error for both Time and Frequency measurement 12 parts in 10^6		

* In accordance with CISPR 16-4



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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