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Report On

FCC and Industry Canada Testing of the
Ericsson RRUS 11 B4 / KRC 161 254/2

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FCC ID: TA8BKRC161254-2
IC ID: 287AB-BS1612542

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REPORT ON

FCC and Industry Canada Testing of the
Ericsson RRUS 11 B4 / KRC 161 254/2

Document 75924767 Report 01 Issue 1

February 2014

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DATED

18 February 2014

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 27 and Industry Canada RSS-139. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Zhao X Zhang

Product Service

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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Ericsson RRUS 11 B4 / KRC 161 254/2

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Ericsson RRUS 11 B4 / KRC 161 254/2 to the requirements of FCC CFR 47 Part 27 and Industry Canada RSS-139.

Testing was carried out in support of an application for Grant of RRUS 11 B4 / KRC 161 254/2 in LTE mode.

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	RRUS 11 B4
Part Number	KRC 161 254/2
IC Model Number	BS1612542
Serial Number(s)	CF81442849
LTE Software Version	CXP102051/16 Rev R32BD
PIS Software Version	CXP9017316/1 Rev R39UL
Hardware Version	R2B
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 27: 2013 Industry Canada RSS-139 Issue 2: 2009
Incoming Release Date	Declaration of Build Status 21 October 2013
Order Number Date	PTP 19 October 2013
Start of Test	21 October 2013
Finish of Test	08 January 2014
Name of Engineer(s)	G Zhao X Zhang
Related Document(s)	ANSI C63.4: 2009 FCC CFR 47 Part 2: 2013 Industry Canada RSS-GEN Issue 3: 2010

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 27 and Industry Canada RSS-139, is shown below.

Configuration 1 – Remote Radio Equipment							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2 and 27	RSS-139 and RSS-GEN					
	27.50 (d)	6.4	Effective Radiated Power	2110.7MHz (1.4MHz OBW) / 2120.0MHz (20.0MHz OBW)		N/A	No integral antenna.
				2132.5MHz (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)		N/A	
				2154.3MHz (1.4MHz OBW) / 2145.0MHz (20.0MHz OBW)		N/A	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)		N/A	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)		N/A	
2.1	2.1046, 27.50 (d)	6.4	RF Output Power - Conducted	2110.7MHz (1.4MHz OBW) / 2120.0MHz (20.0MHz OBW)	0	Pass	-
				2132.5MHz (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)	0	Pass	
				2154.3MHz (1.4MHz OBW) / 2145.0MHz (20.0MHz OBW)	0	Pass	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)	0	Pass	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2124.0MHz + 2141.0MHz (3.0MHz OBW) / 2125.0MHz + 2140.0MHz (5.0MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)	0	Pass	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)	0	Pass	

Product Service

Configuration 1 – Remote Radio Equipment							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2 and 27	RSS-139 and RSS-GEN					
2.2	27.50 (i)	6.4	Peak – Average Ratio	2110.7MHz (1.4MHz OBW) / 2120.0MHz (20.0MHz OBW)	0	Pass	-
				2132.5MHz (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)	0	Pass	
				2154.3MHz (1.4MHz OBW) / 2145.0MHz (20.0MHz OBW)	0	Pass	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)	0	Pass	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2124.0MHz + 2141.0MHz (3.0MHz OBW) / 2125.0MHz + 2140.0MHz (5.0MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)	0	Pass	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)	0	Pass	
2.3	2.1047 (d)	6.2	Modulation Characteristics	2112.5MHz (5.0MHz OBW)		N/A	-
				2132.5MHz (5.0MHz OBW)	0	Pass	
				2152.5MHz (5.0MHz OBW)		N/A	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)		N/A	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)		N/A	
2.4	2.1049, 27.53 (h)	RSS-Gen 4.6.1	Occupied Bandwidth	2110.7MHz (1.4MHz OBW) / 2120.0MHz (20.0MHz OBW)	0	Pass	-
				2132.5MHz (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)	0	Pass	
				2154.3MHz (1.4MHz OBW) / 2145.0MHz (20.0MHz OBW)	0	Pass	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)		N/A	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)		N/A	

Product Service

Configuration 1 – Remote Radio Equipment							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2 and 27	RSS-139 and RSS-GEN					
2.5	2.1051, 27.53 (h)	6.5	Spurious Emissions at Antenna Terminals (±1MHz)	2110.7MHz (1.4MHz OBW) / 2111.5MHz (3.0MHz OBW) 2112.5MHz (5.0MHz OBW) / 2115.0MHz (10.0MHz OBW) 2117.5MHz (15.0MHz OBW) / 2120.0MHz (20.0MHz OBW)	0	Pass	
				2132.5MHz		N/A	
				2154.3MHz (1.4MHz OBW) / 2153.5MHz (3.0MHz OBW) 2152.5MHz (5.0MHz OBW) / 2150.0MHz (10.0MHz OBW) 2147.5MHz (15.0MHz OBW) / 2145.0MHz (20.0MHz OBW)	0	Pass	
				2110.7MHz + 2112.1MHz (1.4MHz OBW) / 2111.5MHz + 2114.5MHz (3MHz OBW) / 2112.5MHz + 2117.5MHz (5MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)	0	Pass	-
				-		N/A	
				2152.9MHz + 2154.3MHz (1.4MHz OBW) / 2150.5MHz + 2153.5MHz (3MHz OBW) / 2147.5MHz + 2152.5MHz (5MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)	0	Pass	
2.6	2.1053, 27.53 (h)	6.5	Radiated Spurious Emissions	2110.7MHz (1.4MHz OBW)	0	Pass	
				2132.5MHz (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)	0	Pass	
				2154.3MHz (1.4MHz OBW)	0	Pass	-
				2110.7MHz + 2129.3MHz (1.4MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW)	0	Pass	
				2135.7MHz + 2154.3MHz (1.4MHz OBW)		N/A	
2.7	2.1051, 27.53 (h)	6.5	Conducted Spurious Emissions	2110.7MHz (1.4MHz OBW) / 2120.0MHz (20.0MHz OBW)	0	Pass	
				2132.5MHz (1.4MHz, 20.0MHz OBW)	0	Pass	
				2154.3MHz (1.4MHz OBW) / 2145.0MHz (20.0MHz OBW)	0	Pass	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)	0	Pass	-
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)	0	Pass	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)	0	Pass	

Product Service

Configuration 1 – Remote Radio Equipment							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 2and 22	RSS-139 and RSS-GEN					
2.8	2.1055, 27.54	6.3	Frequency Stability Under Temperature Variations	2111.5MHz (3.0MHz OBW)		N/A	-
				2132.5MHz (3.0MHz OBW)	0	Pass	
				2153.5MHz (3.0MHz OBW)		N/A	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)		N/A	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)		N/A	
2.9	2.1055, 27.54	6.3	Frequency Stability Under Voltage Variations	2111.5MHz (3.0MHz OBW)		N/A	-
				2132.5MHz (3.0MHz OBW)	0	Pass	
				2153.5MHz (3.0MHz OBW)		N/A	
				2110.7MHz + 2129.3MHz (1.4MHz OBW) / 2115.0MHz + 2125.0MHz (10MHz OBW)		N/A	
				2123.2MHz + 2141.8MHz (1.4MHz OBW) / 2127.5MHz + 2137.5MHz (10MHz OBW)		N/A	
				2135.7MHz + 2154.3MHz (1.4MHz OBW) / 2140.0MHz + 2150.0MHz (10MHz OBW)		N/A	

N/A – Not Applicable

Product Service

1.3 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	Remote Radio Equipment
MANUFACTURER	Ericsson AB
PRODUCT NAME	RRUS 11 B4
PART NUMBER	KRC 161 254/2
IC Model Number	BS1612542
SERIAL NUMBER	CF81442849
HARDWARE VERSION	R2B
LTE SOFTWARE	CXP102051/16 Rev R32BD
PIS SOFTWARE	CXP9017316/1 Rev R39UL
TRANSMITTER OPERATING RANGE	TX: 2110MHz - 2155MHz RX: 1710MHz - 1755MHz
MODULATIONS	QPSK, 16QAM, 64QAM
NUMBER OF CARRIERS	Maximum 2 carriers
ITU DESIGNATION OF EMISSION	1M40F9W, 3M00F9W, 5M00F9W, 10M0F9W, 15M0F9W, 20M0F9W
OUTPUT POWER (RMS) (W or dBm)	Single Carrier: 1x 46dBm per port (1 x 40W per port) Multi Carrier(x 2): 2 x 43dBm per port (2 x 20W per port)
OUTPUT POWER TOLERANCE	± 2.0dB
INSTANTANEOUS BANDWIDTH	20MHz
CHANNEL BANDWIDTH	Single carrier supports 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz Multi carrier supports1.4MHz, 3MHz, 5MHz and 10MHz according to 3GPP TS 36.141
ANTENNA	No dedicated antenna, handled during licensing
NUMBER OF ANTENNA PORTS	2 TX/RX ports
SUPPORTED CONFIGURATION	Dual Single carrier or Multi Carrier. Both RF chains are identical.
FCC ID	TA8BKRC161254-2
IC ID	287AB-BS1612542
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The equipment is the Radio Part of LTE Base Station.

Signature 

Date 15 November 2013

D of B S Serial No 75924767/01

No responsibility will be accepted by TÜV SÜD Product Service as to the accuracy of the information declared in this document by the manufacturer.

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) RRUS 11 B4 / KRC 161 254/2 is an Ericsson Remote Radio Equipment working in the public mobile service 2100MHz band which operates in LTE mode. The RRUS 11 B4 / KRC 161 254/2 operates from a -48V DC 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

Product Service

1.4.2 Test Configuration

Configuration 1: Remote Radio Equipment

The EUT was configured in accordance with FCC CFR 47 Part 27 and Industry Canada RSS-139.

The RRUS 11 B4 / KRC 161 254/2 supports Test Models E-TM1.1, E-TM3.2 and E-TM3.1 at 2100MHz defined in 3GPP TS 36.141. Test Model E-TM1.1 is used to represent QPSK modulation only, Test Model E-TM3.2 is used to represent 16QAM modulation, and Test Model E-TM3.1 is used to represent 64QAM modulation.

The EUT includes two TX/RX ports and it can be configured to transmit in MIMO mode, and MIMO mode was used for measurements as the worst configuration.

The Maximum Output Power was tested on both TX/RX output connectors RF A and RF B, all other TX measurements were performed on the combined TX/RX output connector RF A of the EUT as the representative port.

The complete testing was performed with the EUT transmitting at maximum RF power unless otherwise stated.

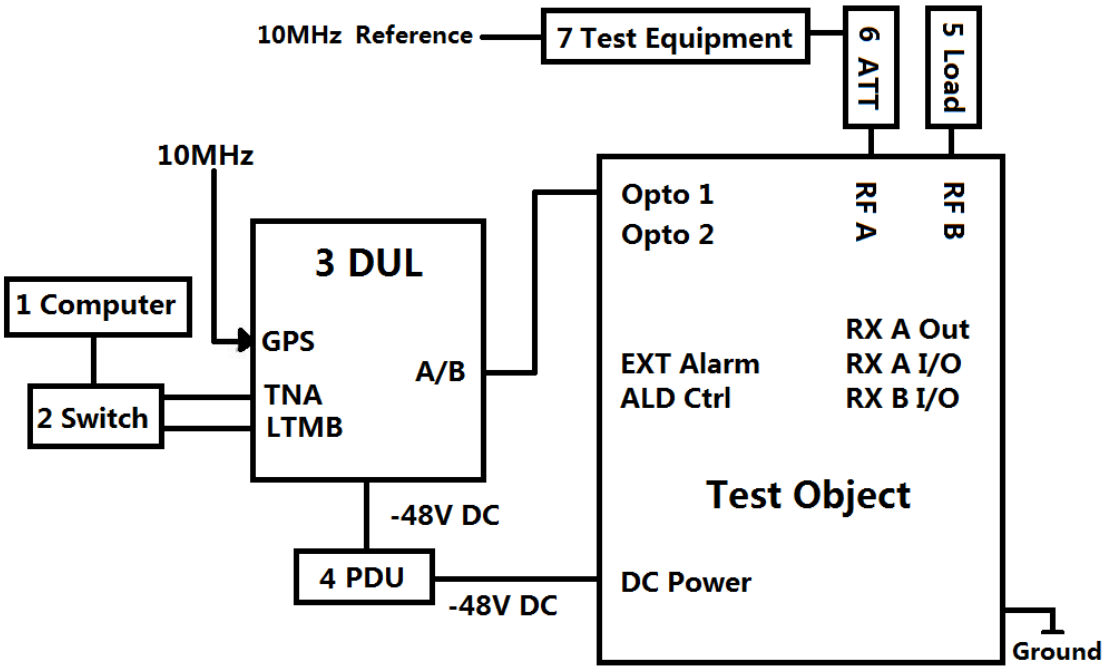
The settings below were found to be representative for all traffic scenarios when several settings with the different modulations, channel bandwidths were tested to find the worst case setting. These settings were used for all measurements if not otherwise noted:

- Single Carrier: Test Model E-TM1.1 in channel bandwidth 1.4MHz and 20MHz.
- Multi Carrier (x2): Test Model E-TM1.1 in channel bandwidth 1.4MHz and 10MHz.

The EUT was powered by a -48V DC Power supply.

Product Service

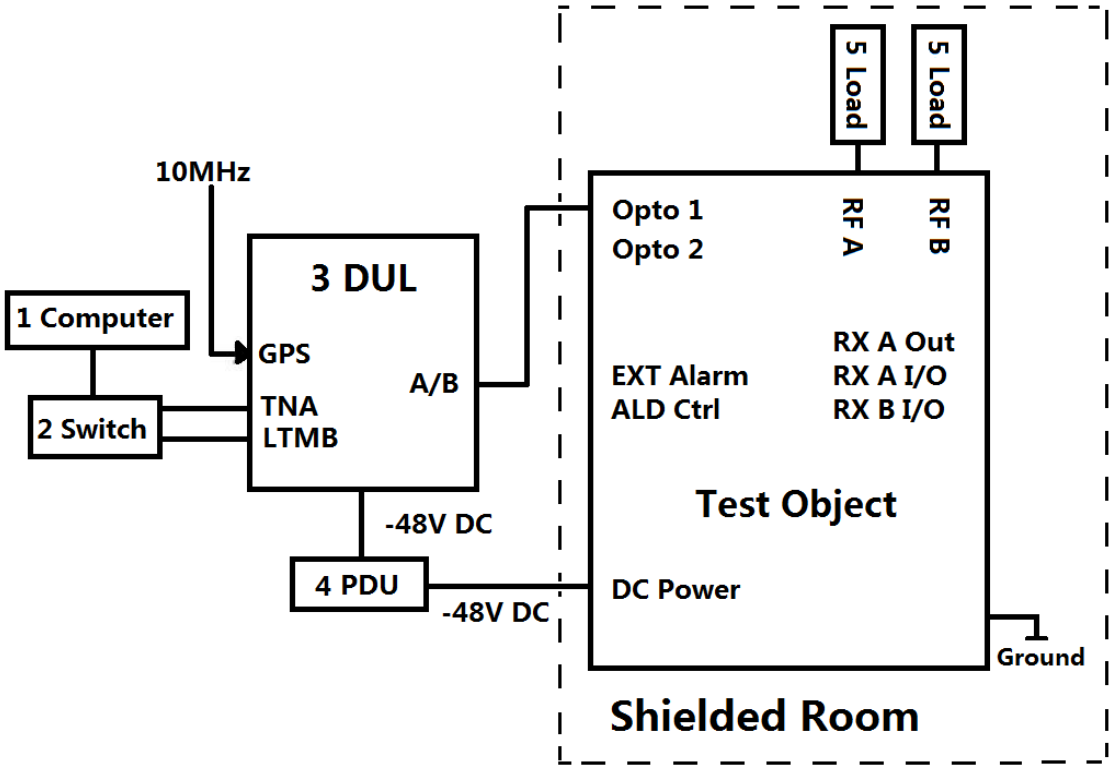
Test Setup, Conducted Measurement:



Product Name	Product Number	Version	Serial Number
RRUS 11 B4	KRC 161 254/2	R2B	CF81442849

No.	Auxiliary Equipment	Part Number / Model Type	Version	Serial Number
1	Computer	HP EliteBook 8460p	--	AP523464
2	Switch	TL-SF1008+	--	11936826484
3	RBS 6601	BFL 901 009/1	--	--
	DUL 20 01	KDU 137 533/4	R1C	CB4H365213
	SUP 6601	1/BFL 901 009/1	R3B	BR81262578
4	Power Supply	DH1716-5D	--	2008040041
	Power Supply	DH1716-5D	--	2008040050
5	Load	TF100	--	09121648
6	40dB Attenuator	48-40-43-LIM	--	BR5020
7	Power Meter	Rohde & Schwarz NRP2	--	101593
	Power Sensor	Rohde & Schwarz NRP-Z51	--	102123
	Spectrum Analyzer	FSQ26	--	100253

Test Setup, Radiated Measurement:



Product Name	Product Number	Version	Serial Number
RRUS 11 B4	KRC 161 254/2	R2B	CF81442849

No.	Auxiliary Equipment	Part Number / Model Type	Version	Serial Number
1	Computer	HP EliteBook 8460p	--	AP523464
2	Switch	TL-SF1008+	--	11936826484
3	RBS 6601	BFL 901 009/1	--	--
	DUL 20 01	KDU 137 533/4	R1C	CB4H365213
	SUP 6601	1/BFL 901 009/1	R3B	BR81262578
4	Power Supply	DH1716-5D	--	2008040041
	Power Supply	DH1716-5D	--	2008040050
5	Load	TF100	--	09121648
	Load	TF100	--	09121605

Product Service

1.4.3 Modes of Operation

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

Single Carrier :

Bottom Channel :

Mode 1 - 1.4 : EARFCN 1957: 2110.7MHz (1.4MHz Bandwidth)

Mode 1 - 3 : EARFCN 1965: 2111.5MHz (3.0MHz Bandwidth)

Mode 1 - 5 : EARFCN 1975: 2112.5MHz (5.0MHz Bandwidth)

Mode 1 - 10 : EARFCN 2000: 2115.0MHz (10.0MHz Bandwidth)

Mode 1 - 15 : EARFCN 2025: 2117.5MHz (15.0MHz Bandwidth)

Mode 1 - 20 : EARFCN 2050: 2120.0MHz (20.0MHz Bandwidth)

Middle Channel :

Mode 2 : EARFCN 2175: 2132.5MHz

Top Channel :

Mode 3 - 1.4 : EARFCN 2393: 2154.3MHz (1.4MHz Bandwidth)

Mode 3 - 3 : EARFCN 2385: 2153.5MHz (3.0MHz Bandwidth)

Mode 3 - 5 : EARFCN 2375: 2152.5MHz (5.0MHz Bandwidth)

Mode 3 - 10 : EARFCN 2350: 2150.0MHz (10.0MHz Bandwidth)

Mode 3 - 15 : EARFCN 2325: 2147.5MHz (15.0MHz Bandwidth)

Mode 3 - 20 : EARFCN 2300: 2145.0MHz (20.0MHz Bandwidth)

Multi Carrier (x2):

Bottom Channel :

Mode 4 - 1.4 : EARFCN 1957 + 2143: 2110.7MHz + 2129.3MHz (1.4MHz Bandwidth)

Mode 4 - 3 : EARFCN 1965 + 2135: 2111.5MHz + 2128.5MHz (3.0MHz Bandwidth)

Mode 4 - 5 : EARFCN 1975 + 2125: 2112.5MHz + 2127.5MHz (5.0MHz Bandwidth)

Mode 4 - 10 : EARFCN 2000 + 2100: 2115.0MHz + 2125.0MHz (10.0MHz Bandwidth)

Mode 4’ - 1.4 : EARFCN 1957 + 1971: 2110.7MHz + 2112.1MHz (1.4MHz Bandwidth)

Mode 4’ - 3 : EARFCN 1965 + 1995: 2111.5MHz + 2114.5MHz (3.0MHz Bandwidth)

Mode 4’ - 5 : EARFCN 1975 + 2025: 2112.5MHz + 2117.5MHz (5.0MHz Bandwidth)

Middle Channel :

Mode 5 - 1.4 : EARFCN 2082 + 2268: 2123.2MHz + 2141.8MHz (1.4MHz Bandwidth)

Mode 5 - 3 : EARFCN 2090 + 2260: 2124.0MHz + 2141.0MHz (3.0MHz Bandwidth)

Mode 5 - 5 : EARFCN 2100 + 2250: 2125.0MHz + 2140.0MHz (5.0MHz Bandwidth)

Mode 5 - 10 : EARFCN 2125 + 2225: 2127.5MHz + 2137.5MHz (10.0MHz Bandwidth)

Top Channel :

Mode 6 - 1.4 : EARFCN 2207 + 2393: 2135.7MHz + 2154.3MHz (1.4MHz Bandwidth)

Mode 6 - 3 : EARFCN 2215 + 2385: 2136.5MHz + 2153.5MHz (3.0MHz Bandwidth)

Mode 6 - 5 : EARFCN 2225 + 2375: 2137.5MHz + 2152.5MHz (5.0MHz Bandwidth)

Mode 6 - 10 : EARFCN 2250 + 2350: 2140.0MHz + 2150.0MHz (10.0MHz Bandwidth)

Mode 6’ - 1.4 : EARFCN 2379 + 2393: 2152.9MHz + 2154.3MHz (1.4MHz Bandwidth)

Mode 6’ - 3 : EARFCN 2355 + 2385: 2150.5MHz + 2153.5MHz (3.0MHz Bandwidth)

Mode 6’ - 5 : EARFCN 2325 + 2375: 2147.5MHz + 2152.5MHz (5.0MHz 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 -48V DC 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

Mode State 0 - No modifications were made to the EUT during testing.

1.8 ALTERNATIVE TEST SITE

Under our group UKAS Accreditation, TÜV SÜD Product Service conducted the following tests at Ericsson in Beijing, China:

- RF Output Power – Conducted
- Peak - Average Ratio
- Modulation Characteristics
- Occupied Bandwidth
- Spurious Emissions at Antenna Terminals (±1MHz)
- Conducted Spurious Emissions
- Frequency Stability

Only Radiated Spurious Emissions testing has been performed under the following site registrations:

FCC Accreditation 910917:
The State Radio Monitoring Centre, No.80 Beilishi Road Xicheng District Beijing, China.

Industry Canada Accreditation 7308A-1:
The State Radio Monitoring Centre, No.80 Beilishi Road Xicheng District Beijing, China.

Product Service

SECTION 2

TEST DETAILS

FCC and Industry Canada Testing of the
Ericsson RRUS 11 B4 / KRC 161 254/2

2.1 RF OUTPUT POWER - CONDUCTED

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 27, Clause 27.50 (d)
Industry Canada RSS-139, Clause 6.4

2.1.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.1.3 Date of Test and Modification State

21, 22 and 23 October 2013 – Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

Using a power meter 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 to the power meter as a reference level offset to get the output power value directly.

When working in MIMO mode, the EUT transmits on two antennas simutaneoulsy in the same frequency range, the output power at both antennas RF A and RF B was measured. The combined power from both RF ports was determined using the measure and sum approach described in FCC KDB662911 Multiple Transmitter Output v02 + 01.

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

Configuration 1
- Mode 1 - 1.4, Mode 1 - 20
- Mode 2 (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)
- Mode 3 - 1.4, Mode 3 - 20
- Mode 4 - 1.4, Mode 4 - 10
- Mode 5 - 1.4, Mode 5 - 3, Mode 5 - 5, Mode 5 - 10
- Mode 6 - 1.4, Mode 6 - 10

2.1.6 Environmental Conditions

	21 October 2013	22 October 2013	23 October 2013
Ambient Temperature	23.0°C	23.0°C	23.5°C
Relative Humidity	30.0%	36.0%	34.0%

Product Service

2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139 for RF Output Power.

The test results are shown below

Single Carrier

Declarative Maximum Output power:

1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz: 46.00dBm per port

E-TM1.1: 1.4MHz Bandwidth

Configuration 1 - Mode 1 - 1.4, Mode 2 and Mode 3 - 1.4

EARFCN	Frequency (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		RF A			RF B				
		dBm	dBm/MHz[1]	W	dBm	dBm/MHz[1]	W		
1957 (Bottom)	2110.7	45.21	44.84	33.19	45.20	44.83	33.11	48.22	66.30
2175 (Middle)	2132.5	45.68	45.31	36.98	45.70	45.33	37.15	48.70	74.13
2393 (Top)	2154.3	45.67	45.30	36.90	45.70	45.33	37.15	48.70	74.05

Note 1:
1 MHz Power for 1.4MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(1.09) =Output Power - 0.37

E-TM1.1: 20.0MHz Bandwidth

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

EARFCN	Frequency (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		RF A			RF B				
		dBm	dBm/MHz[1]	W	dBm	dBm/MHz[1]	W		
2050 (Bottom)	2120.0	45.50	32.96	35.48	45.56	33.02	35.97	48.54	71.45
2175 (Middle)	2132.5	45.79	33.27	37.93	45.83	33.31	38.28	48.82	76.21
2300 (Top)	2145.0	45.72	33.18	37.33	45.74	33.20	37.50	48.74	74.83

Note 1:
For Bottom and Top Channel:
1 MHz Power for 20MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(17.95) =Output Power - 12.54

For Middle Channel:
1 MHz Power for 20MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(17.87) =Output Power - 12.52

Product Service

E-TM1.1: 3.0MHz, 5.0MHz, 10.0MHz and 15.0MHz Bandwidth

Configuration 1 - Mode 2

EARFCN	BW Config (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		RF A			RF B				
		dBm	dBm/MHz[1]	W	dBm	dBm/MHz[1]	W		
2175 (Middle) / 2132.5	3.0	45.74	41.46	37.50	45.74	41.46	37.50	48.75	75.00
	5.0	45.74	39.24	37.50	45.76	39.26	37.67	48.76	75.17
	10.0	45.75	36.22	37.58	45.78	36.25	37.84	48.77	75.42
	15.0	45.70	34.41	37.15	45.73	34.44	37.41	48.73	74.56

Note 1:
1 MHz Power for 3MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(2.68) =Output Power - 4.28
1 MHz Power for 5MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(4.47) =Output Power - 6.50
1 MHz Power for 10MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(8.97) =Output Power - 9.53
1 MHz Power for 15MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(13.46) =Output Power - 11.29

E-TM3.2 and E-TM3.1: 1.4MHz Bandwidth

Configuration 1 - Mode 2

EARFCN / Frequency (MHz)	Test Model	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		RF A			RF B				
		dBm	dBm/MHz[1]	W	dBm	dBm/MHz[1]	W		
2175 (Middle) / 2132.5	E-TM3.2	45.67	45.26	36.90	45.70	45.29	37.15	48.70	74.05
	E-TM3.1	45.63	45.26	36.56	45.69	45.32	37.07	48.67	73.63

Note 1:
For E-TM3.2 Test Model:
1 MHz Power for 1.4MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(1.10) =Output Power - 0.41

For E-TM3.1 Test Model:
1 MHz Power for 1.4MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(1.09) =Output Power - 0.37

E-TM3.2 and E-TM3.1: 20.0MHz Bandwidth

Configuration 1 - Mode 2

EARFCN / Frequency (MHz)	Test Model	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		RF A			RF B				
		dBm	dBm/MHz[1]	W	dBm	dBm/MHz[1]	W		
2175 (Middle) / 2132.5	E-TM3.2	45.72	33.20	37.33	45.76	33.24	37.67	48.75	75.00
	E-TM3.1	45.75	33.23	37.58	45.75	33.23	37.58	48.76	75.16

Note 1:
1 MHz Power for 20MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(17.87) =Output Power - 12.52

Multi Carrier (x2)

Declarative Maximum Output power:

1.4MHz, 3MHz, 5MHz: 45.50dBm per port
10MHz :46.00dBm per port

E-TM1.1: 1.4MHz Bandwidth

Configuration 1 - Mode 4 - 1.4, Mode 5 - 1.4 and Mode 6 - 1.4

EARFCN	Frequency (MHz)	RF A		RF B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1957 + 2143 (Bottom)	2110.7 + 2129.3	44.84	30.48	44.93	31.12	47.90	61.60
2082 + 2268 (Middle)	2123.2 + 2141.8	45.21	33.19	45.21	33.19	48.22	66.38
2393 + 2207 (Top)	2154.3 + 2135.7	45.10	32.36	45.12	32.51	48.12	64.87

E-TM1.1: 10.0MHz Bandwidth

Configuration 1 - Mode 4 - 10, Mode 5 - 10 and Mode 6 - 10

EARFCN	Frequency (MHz)	RF A		RF B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
2000 + 2100 (Bottom)	2115.0 + 2125.0	45.46	35.16	45.54	35.81	48.51	70.97
2125 + 2225 (Middle)	2127.5 + 2137.5	45.77	37.76	45.80	38.02	48.80	75.78
2350 + 2250 (Top)	2150.0 + 2140.0	45.67	36.90	45.73	37.41	48.71	74.31

E-TM1.1: 3.0MHz and 5.0MHz Bandwidth

Configuration 1 - Mode 5 - 3 and Mode 5 - 5

EARFCN / Frequency (MHz)	BW Config (MHz)	RF A		RF B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
2090+ 2260 / 2124.0 + 2141.0 (Middle)	3.0	45.28	33.73	45.33	34.12	48.32	67.85
2100 + 2250 / 2125.0 + 2140.0 (Middle)	5.0	45.29	33.81	45.28	33.73	48.30	67.54

E-TM3.2: 1.4MHz and 10.0MHz Bandwidth

Configuration 1 - Mode 5 – 1.4 and Mode 5 - 10

EARFCN / Frequency (MHz)	BW Config (MHz)	RF A		RF B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
2082+ 2268 / 2123.2+ 2141.8 (Middle)	1.4	45.23	33.34	45.17	32.89	48.21	66.23
2125+ 2225 / 2127.5 + 2137.5 (Middle)	10.0	45.74	37.50	45.78	37.84	48.77	75.34

E-TM3.1: 1.4MHz and 10.0MHz Bandwidth

Configuration 1 - Mode 5 – 1.4 and Mode 5 - 10

EARFCN / Frequency (MHz)	BW Config (MHz)	RF A		RF B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
2082+ 2268 / 2123.2 + 2141.8 (Middle)	1.4	45.18	32.96	45.14	32.66	48.17	65.62
2125 + 2225 / 2127.5 + 2137.5 (Middle)	10.0	45.74	37.50	45.77	37.76	48.77	75.26

Note *:

Two transmitters output power were summed up according to FCC KDB662911 D01 Multiple Transmitter Output v02r01for MIMO mode.

This unit is tested without antenna. ERP/EIRP compliance is addressed at the time of licensing, as required by the responsible FCC/IC Bureau(s).Licensees are required to take into account maximum allowed antenna gain used in combination with above power settings to prevent the radiated output power to exceed the limits.

Limit	≤1640W/MHz or ≤+62.1dBm/MHz

Remarks

The EUT does not exceed 1640W/MHz or 62.1dBm/MHz at the measured frequencies.

2.2 PEAK – AVERAGE RATIO

2.2.1 Specification Reference

FCC CFR 47 Part 27, Clause 27.50 (d)(5)
Industry Canada RSS-139, Clause 6.4

2.2.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.2.3 Date of Test and Modification State

21, 22 and 23 October 2013 – Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

A peak to average ratio measurment is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determined 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 percent of time the signal spends at or above the level defines the probability for that particular power level.

The measurements were performed on the combined output connector RF A. Limited complementary measurements were done at the output connector RF B to verify identical performance for both transmitter chains in MIMO mode, but only the results of RF A as the reprentative were shown as below.

The spectrum analyzer Measurement bandwidth was set 50MHz for single and multi carrier, and the path loss measured was 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 - 1.4, Mode 1 - 20
- Mode 2 (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)
- Mode 3 - 1.4, Mode 3 - 20
- Mode 4 - 1.4, Mode 4 - 10
- Mode 5 - 1.4, Mode 5 - 3, Mode 5 - 5, Mode 5 - 10
- Mode 6 - 1.4, Mode 6 - 10

Product Service

2.2.6 Environmental Conditions

	21 October 2013	22 October 2013	23 October 2013
Ambient Temperature	23.0°C	23.0°C	23.5°C
Relative Humidity	30.0%	36.0%	34.0%

2.2.7 Test Results

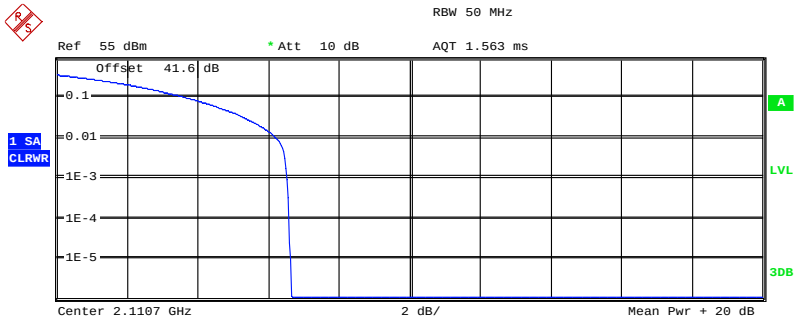
For the period of test the EUT met the requirements of FCC CFR 47 Part 27 and Industry Canada RSS-139 for Peak – Average Ratio.

The test results are shown below.

Single Carrier

Configuration 1 - Mode 1 - 1.4

E-TM1.1: 1.4MHz Bandwidth



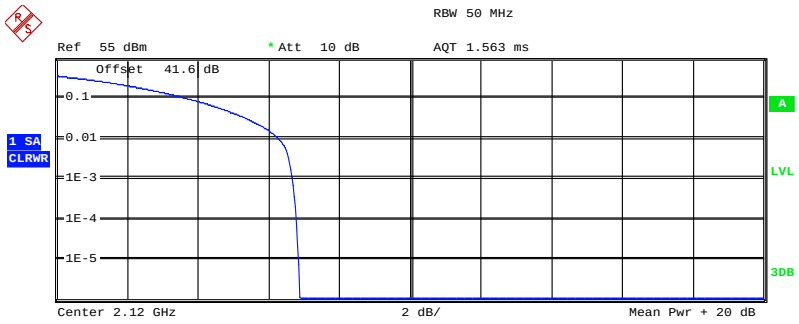
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.34 dBm
Peak	51.98 dBm
Crest	6.65 dB
10 %	3.72 dB
1 %	6.22 dB
.1 %	6.54 dB
.01 %	6.60 dB

Date: 22.OCT.2013 14:24:14

Configuration 1 - Mode 1 - 20

E-TM1.1: 20.0MHz Bandwidth



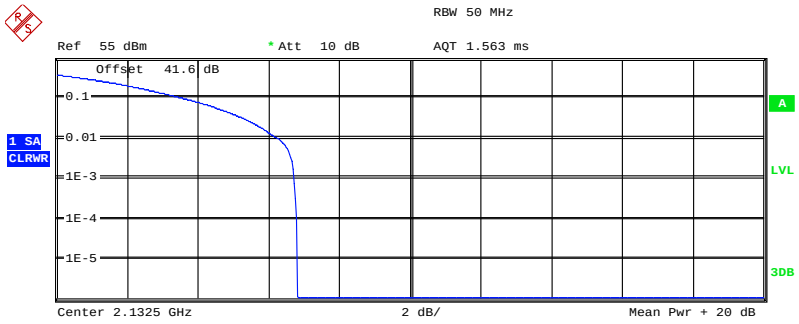
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.55 dBm
Peak	52.42 dBm
Crest	6.87 dB
10 %	3.72 dB
1 %	6.28 dB
.1 %	6.67 dB
.01 %	6.79 dB

Date: 22.OCT.2013 14:21:06

Configuration 1 - Mode 2

E-TM1.1: 1.4MHz Bandwidth

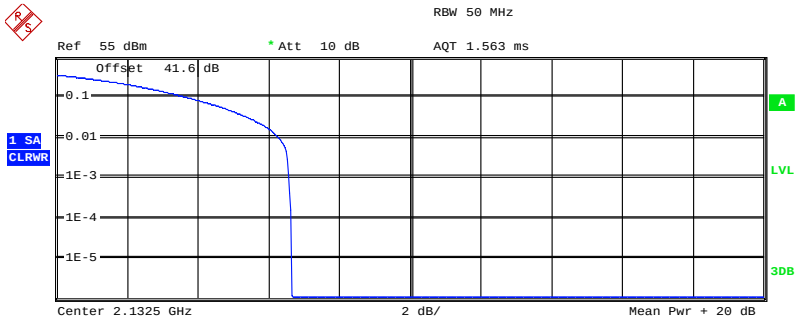


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.56 dBm
Peak	52.36 dBm
Crest	6.80 dB
10 %	3.59 dB
1 %	6.25 dB
.1 %	6.73 dB
.01 %	6.79 dB

Date: 21.OCT.2013 07:53:57

E-TM1.1: 3.0MHz Bandwidth

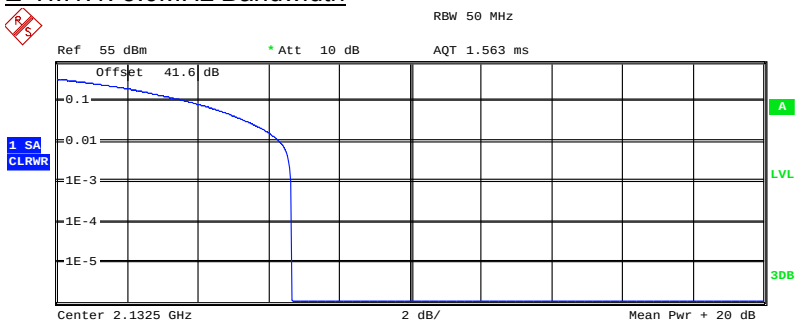


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.78 dBm
Peak	52.43 dBm
Crest	6.64 dB
10 %	3.72 dB
1 %	6.28 dB
.1 %	6.57 dB
.01 %	6.63 dB

Date: 21.OCT.2013 09:11:15

E-TM1.1: 5.0MHz Bandwidth

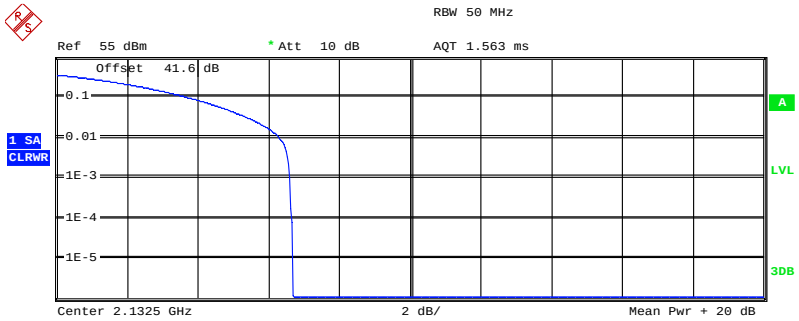


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.70 dBm
Peak	52.36 dBm
Crest	6.65 dB
10 %	3.75 dB
1 %	6.31 dB
.1 %	6.63 dB
.01 %	6.67 dB

Date: 21.OCT.2013 09:39:05

E-TM1.1: 10.0MHz Bandwidth

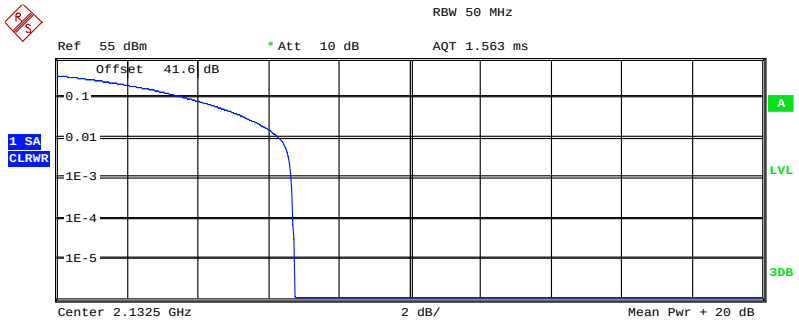


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.81 dBm
Peak	52.50 dBm
Crest	6.68 dB
10 %	3.72 dB
1 %	6.28 dB
.1 %	6.60 dB
.01 %	6.67 dB

Date: 21.OCT.2013 10:10:37

E-TM1.1: 15.0MHz Bandwidth

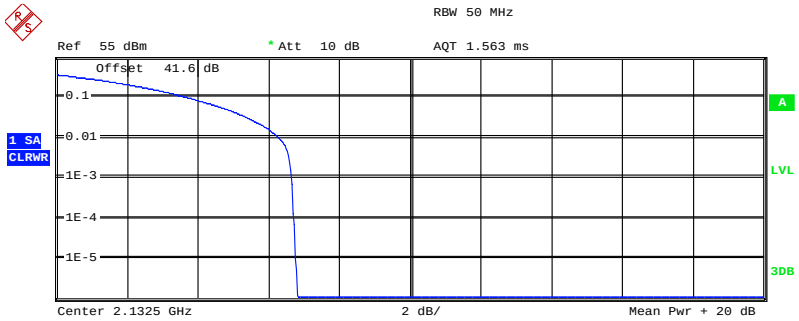


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.61 dBm
Peak	52.36 dBm
Crest	6.74 dB
10 %	3.72 dB
1 %	6.31 dB
.1 %	6.63 dB
.01 %	6.70 dB

Date: 21.OCT.2013 10:33:40

E-TM1.1: 20.0MHz Bandwidth



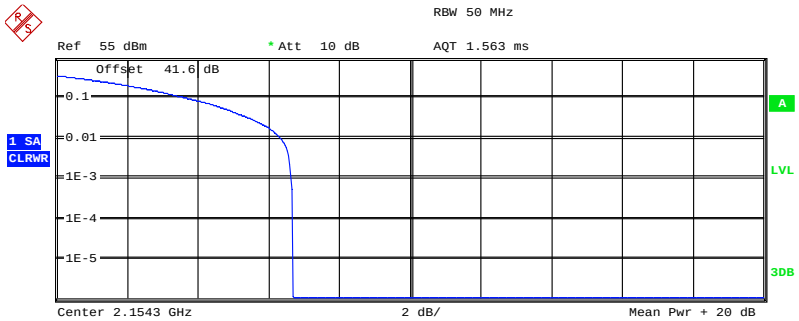
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.82 dBm
Peak	52.64 dBm
Crest	6.82 dB
10 %	3.72 dB
1 %	6.28 dB
.1 %	6.67 dB
.01 %	6.70 dB

Date: 21.OCT.2013 09:04:52

Configuration 1 - Mode 3 - 1.4

E-TM1.1: 1.4MHz Bandwidth



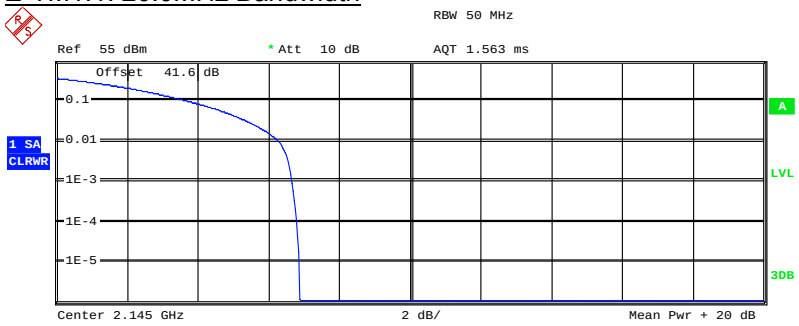
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.71 dBm
Peak	52.39 dBm
Crest	6.68 dB
10 %	3.72 dB
1 %	6.35 dB
.1 %	6.63 dB
.01 %	6.70 dB

Date: 22.OCT.2013 14:37:49

Configuration 1 - Mode 3 - 20

E-TM1.1: 20.0MHz Bandwidth



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

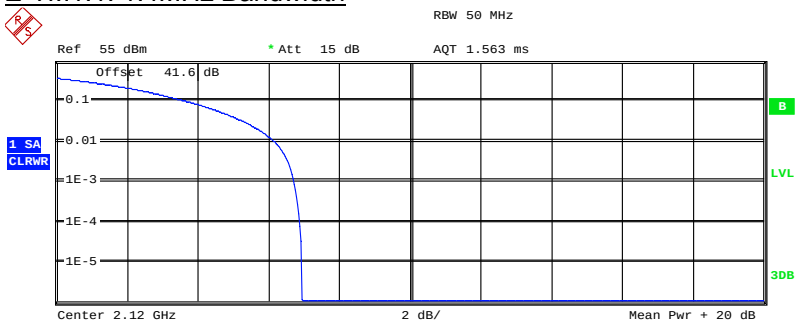
	Trace 1
Mean	45.67 dBm
Peak	52.54 dBm
Crest	6.87 dB
10 %	3.72 dB
1 %	6.25 dB
.1 %	6.67 dB
.01 %	6.79 dB

Date: 22.OCT.2013 13:53:36

Multi Carrier (x2)

Configuration 1 - Mode 4 - 1.4

E-TM1.1: 1.4MHz Bandwidth



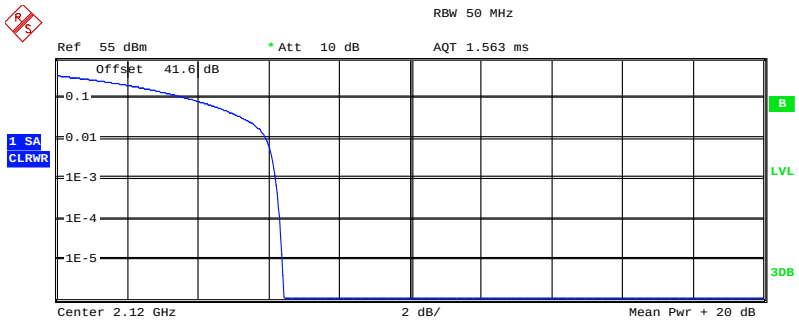
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.00 dBm
Peak	51.94 dBm
Crest	6.94 dB
10 %	3.69 dB
1 %	6.15 dB
.1 %	6.70 dB
.01 %	6.89 dB

Date: 23.OCT.2013 14:28:54

Configuration 1 - Mode 4 - 10

E-TM1.1: 10MHz Bandwidth



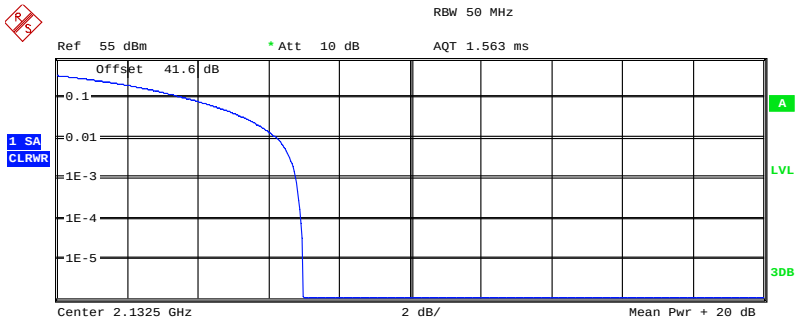
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.63 dBm
Peak	52.05 dBm
Crest	6.41 dB
10 %	3.75 dB
1 %	5.93 dB
.1 %	6.19 dB
.01 %	6.31 dB

Date: 23.OCT.2013 14:12:26

Configuration 1 - Mode 5 - 1.4

E-TM1.1: 1.4MHz Bandwidth



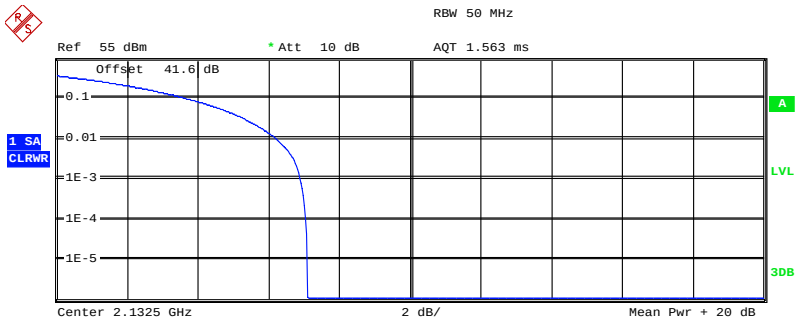
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.20 dBm
Peak	52.17 dBm
Crest	6.97 dB
10 %	3.69 dB
1 %	6.22 dB
.1 %	6.76 dB
.01 %	6.92 dB

Date: 23.OCT.2013 11:28:13

Configuration 1 - Mode 5 - 3

E-TM1.1: 3MHz Bandwidth



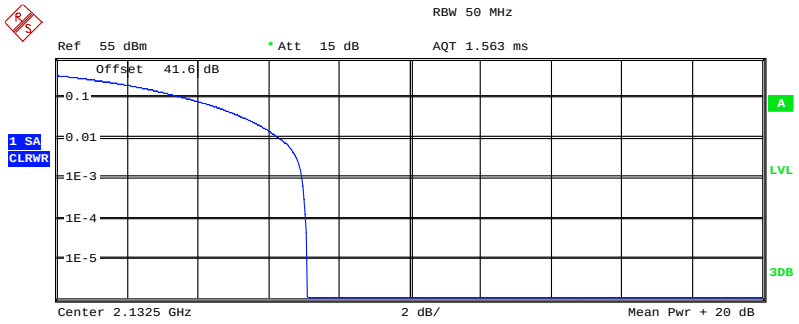
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.36 dBm
Peak	52.46 dBm
Crest	7.09 dB
10 %	3.72 dB
1 %	6.22 dB
.1 %	6.89 dB
.01 %	7.05 dB

Date: 23.OCT.2013 11:14:26

Configuration 1 - Mode 5 - 5

E-TM1.1: 5MHz Bandwidth



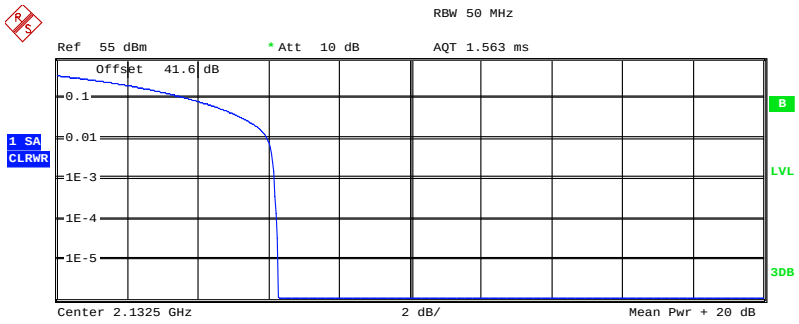
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.27 dBm
Peak	52.36 dBm
Crest	7.09 dB
10 %	3.69 dB
1 %	6.31 dB
.1 %	6.96 dB
.01 %	7.05 dB

Date: 23.OCT.2013 10:41:13

Configuration 1 - Mode 5 - 10

E-TM1.1: 10MHz Bandwidth



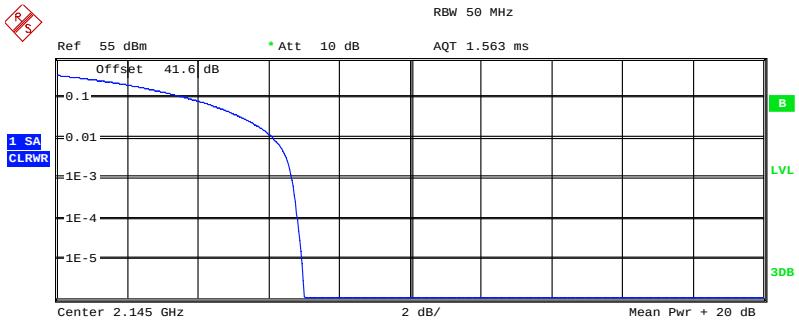
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.85 dBm
Peak	52.10 dBm
Crest	6.25 dB
10 %	3.75 dB
1 %	5.96 dB
.1 %	6.15 dB
.01 %	6.22 dB

Date: 23.OCT.2013 13:26:27

Configuration 1 - Mode 6 - 1.4

E-TM1.1: 1.4MHz Bandwidth



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

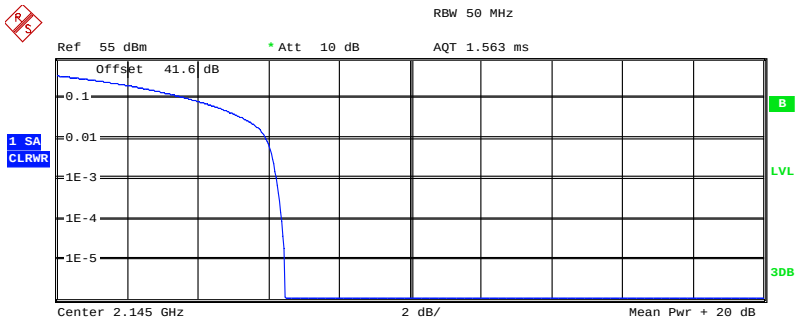
	Trace 1
Mean	45.32 dBm
Peak	52.31 dBm
Crest	6.99 dB
10 %	3.75 dB
1 %	6.12 dB
.1 %	6.67 dB
.01 %	6.83 dB

Date: 23.OCT.2013 15:00:00

Product Service

Configuration 1 - Mode 6 - 10

E-TM1.1: 10MHz Bandwidth



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 37.9MHz

	Trace 1
Mean	45.78 dBm
Peak	52.24 dBm
Crest	6.46 dB
10 %	3.75 dB
1 %	5.93 dB
.1 %	6.22 dB
.01 %	6.38 dB

Date: 23.OCT.2013 13:49:33

Limit	13dB

Remarks

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

2.3 MODULATION CHARACTERISTICS

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047 (d)
Industry Canada RSS-139, Clause 6.2

2.3.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.3.3 Date of Test and Modification State

22 October 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-139.

During testing only RF port A was measured and RF port B was terminated with a matched load. The EUT was configured to transmit with maximum power. The transmissions from RF port A were measured via an attenuator, using a Modulation measurement function on a 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 (5.0MHz OBW)

2.3.5 Environmental Conditions

	22 October 2013
Ambient Temperature	23.0°C
Relative Humidity	36.0%

Product Service

2.3.6 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Industry Canada RSS-139 for Modulation Characteristics.

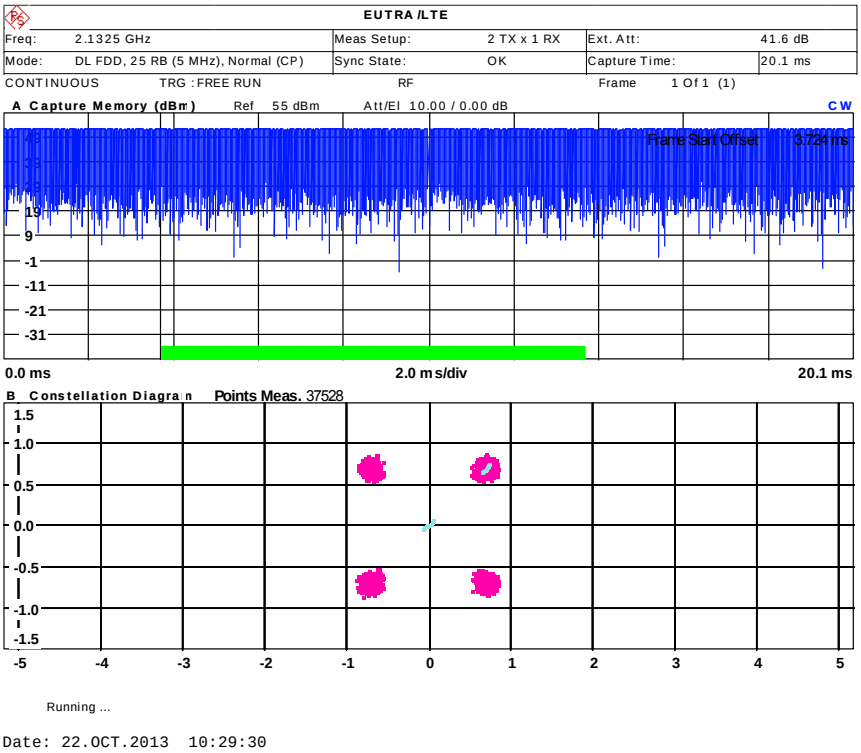
The test results are shown below

Single Carrier

Configuration 1 - Mode 2

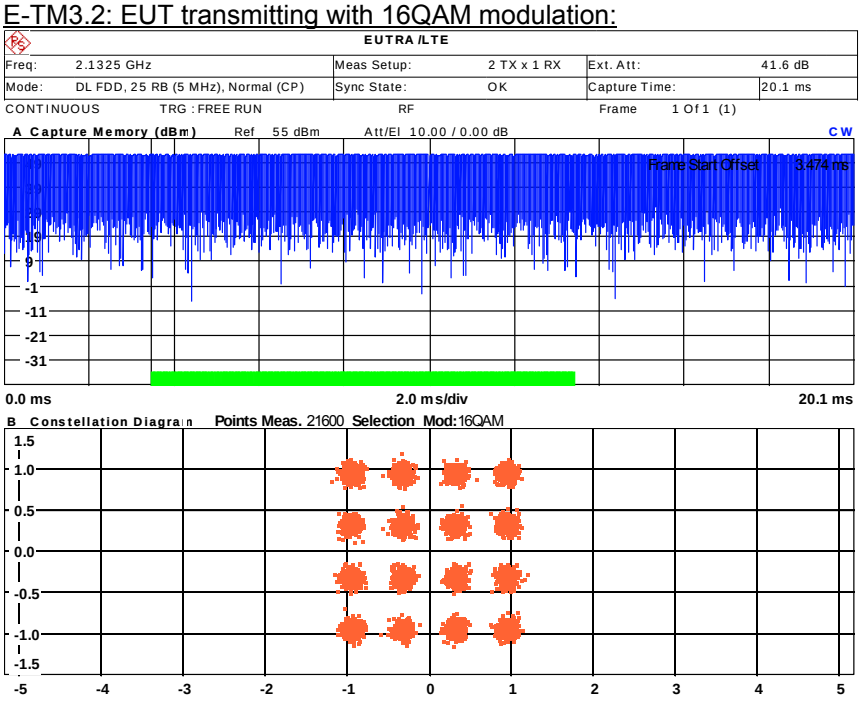
5.0MHz Bandwidth

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



Product Service

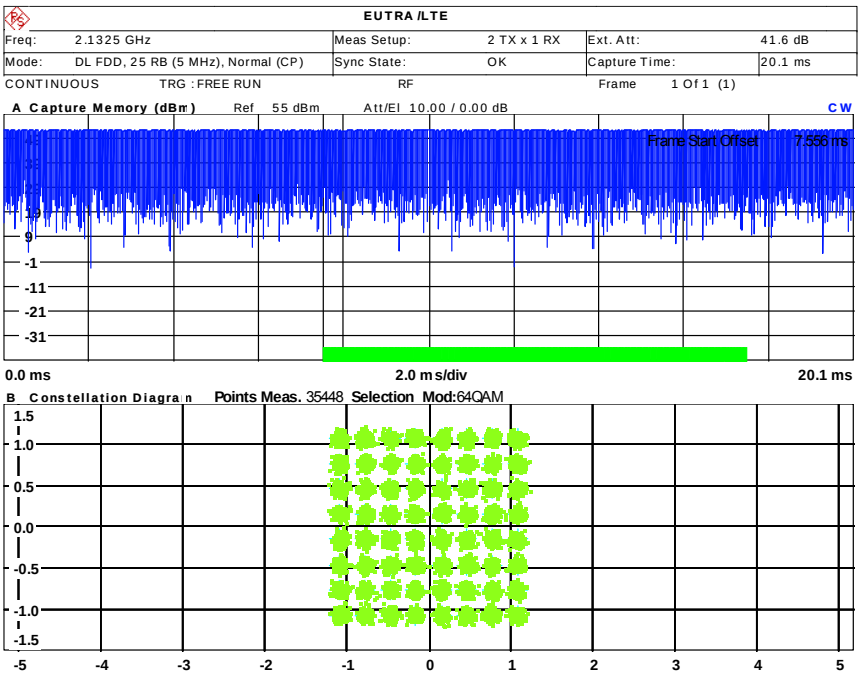
E-TM3.2: EUT transmitting with 16QAM modulation:



Running ...

Date: 22.OCT.2013 10:35:20

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



Running ...

Date: 22.OCT.2013 10:37:46

2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-GEN, Clause 4.6.1

2.4.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.4.3 Date of Test and Modification State

21, 22 October 2013 and 08 January 2014 – Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-GEN.

The EUT was transmitting at maximum power, modulated using the test models described. The EUT was tested in the 6 bandwidths. At least 1% of the emission bandwidth were used for the resolution bandwidth.

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

Configuration 1 - Mode 1 - 1.4, Mode 1 - 20
- Mode 2(1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)
- Mode 3 - 1.4, Mode 3 - 20

2.4.6 Environmental Conditions

	21 October 2013	22 October 2013	08 January 2014
Ambient Temperature	23.0°C	23.0°C	24.5°C
Relative Humidity	30.0%	36.0%	30.0%

Product Service

2.4.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-GEN for Occupied Bandwidth.

The test results are shown below

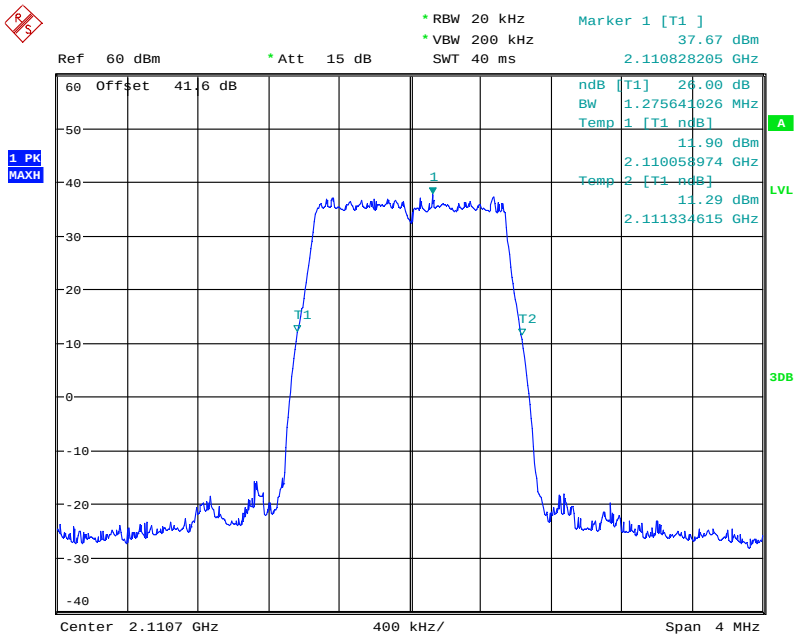
Test Model	BW configuration (MHz)	Frequency (MHz) / Channel	-26dB Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
E-TM1.1	1.4	2110.7 (Bottom)	1.28	1.09
	20.0	2120.0 (Bottom)	18.75	17.95
	1.4	2132.5 (Middle)	1.28	1.09
	3.0	2132.5 (Middle)	2.91	2.68
	5.0	2132.5 (Middle)	4.81	4.47
	10.0	2132.5 (Middle)	9.42	8.97
	15.0	2132.5 (Middle)	14.18	13.46
	20.0	2132.5 (Middle)	18.75	17.87
	1.4	2154.3 (Top)	1.28	1.09
	20.0	2145.0 (Top)	18.75	17.95
E-TM3.2	1.4	2132.5 (Middle)	1.28	1.10
	20.0	2132.5 (Middle)	18.75	17.87
E-TM3.1	1.4	2132.5 (Middle)	1.26	1.09
	20.0	2132.5 (Middle)	18.75	17.87

Product Service

E-TM1.1

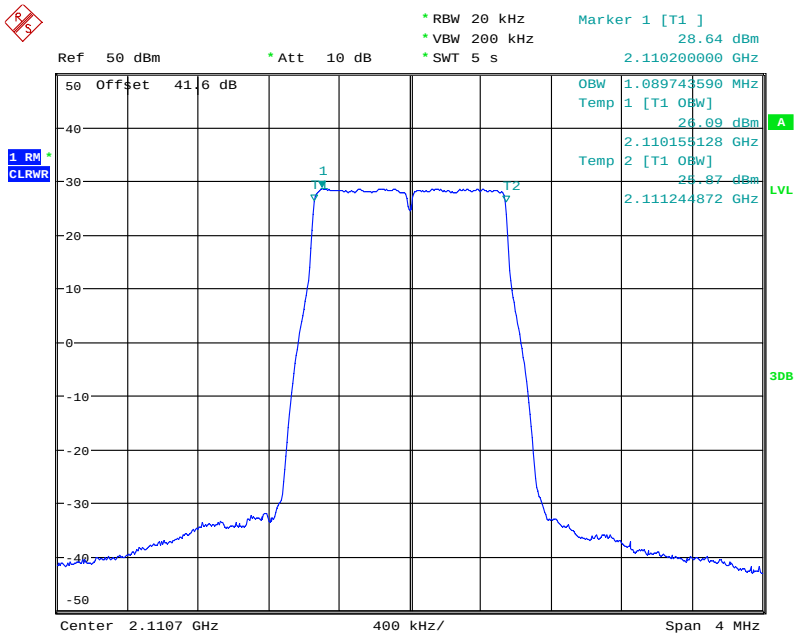
Configuration 1 - Mode 1 - 1.4

-26dB Occupied Bandwidth of 1.4MHz Bandwidth



Date: 8.JAN.2014 16:27:56

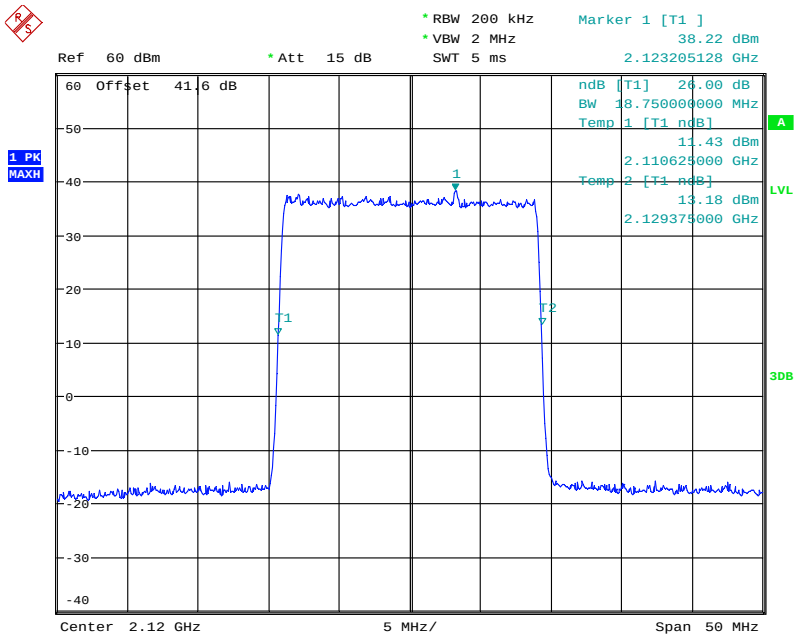
99% Occupied Bandwidth of 1.4MHz Bandwidth



Date: 22.OCT.2013 14:25:35

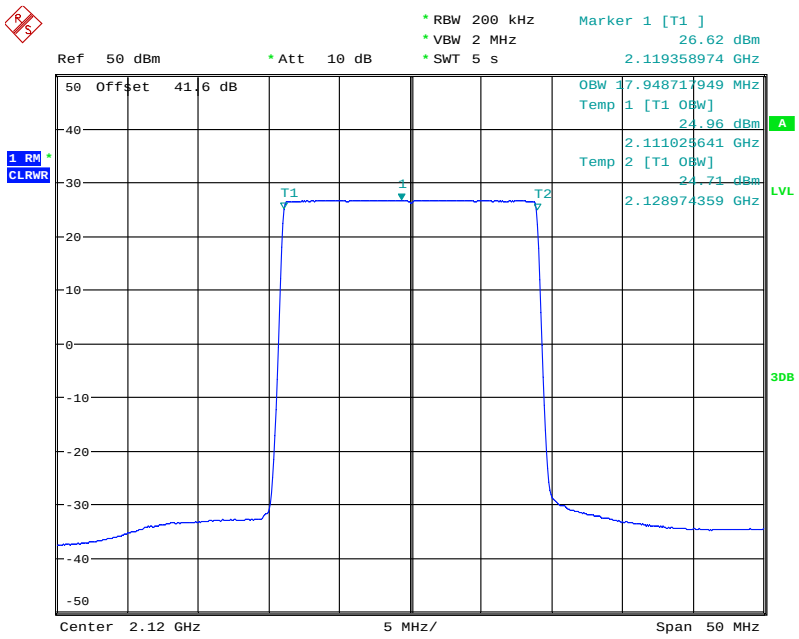
Configuration 1 - Mode 1 - 20

-26dB Occupied Bandwidth of 20.0MHz Bandwidth



Date: 8.JAN.2014 16:40:27

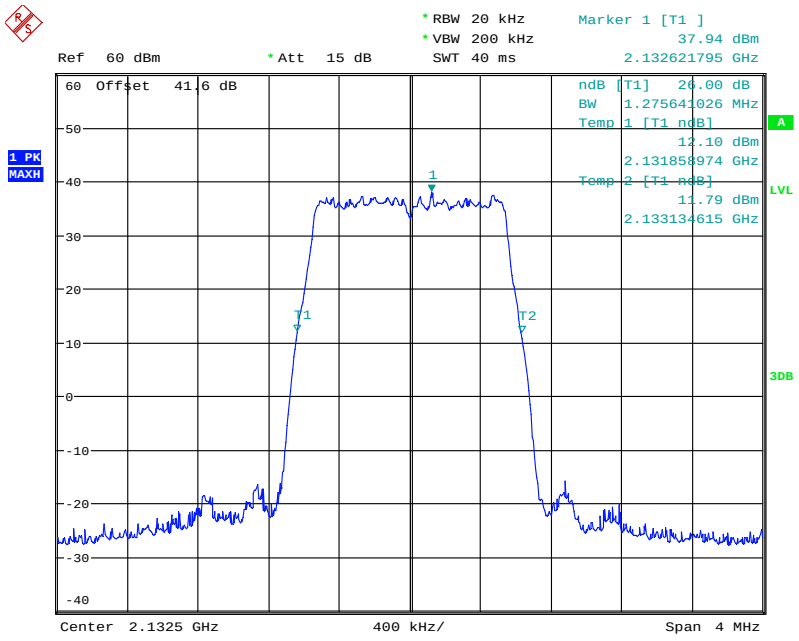
99% Occupied Bandwidth of 20.0MHz Bandwidth



Date: 22.OCT.2013 14:20:05

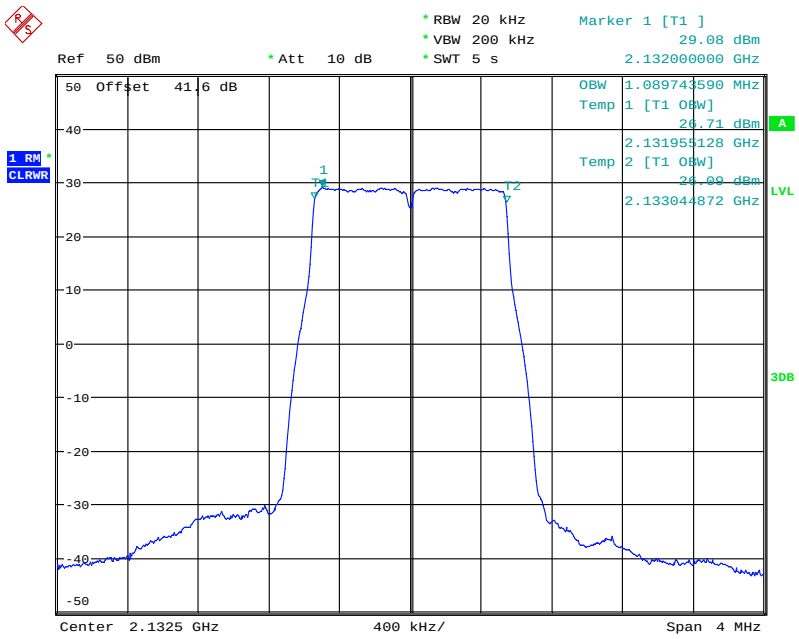
Configuration 1 - Mode 2

-26dB Occupied Bandwidth of 1.4MHz Bandwidth



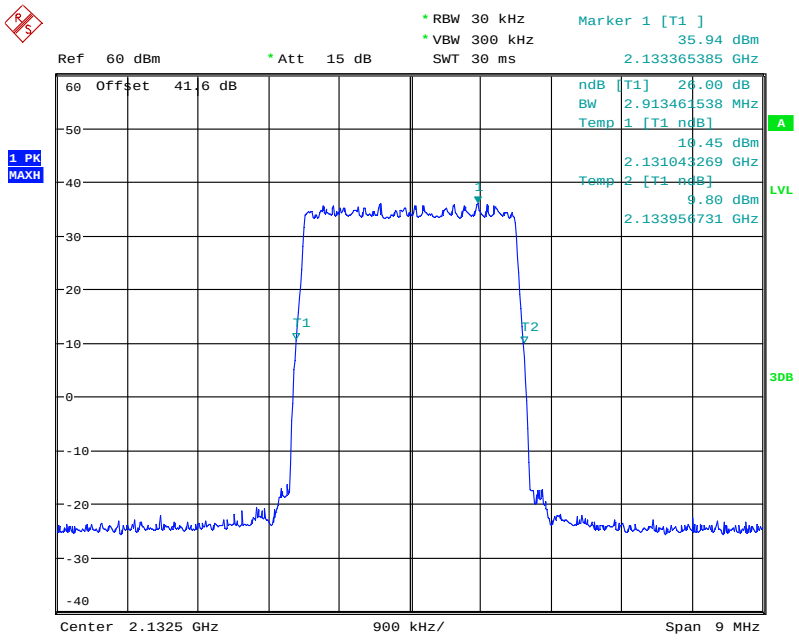
Date: 8.JAN.2014 15:35:45

99% Occupied Bandwidth of 1.4MHz Bandwidth



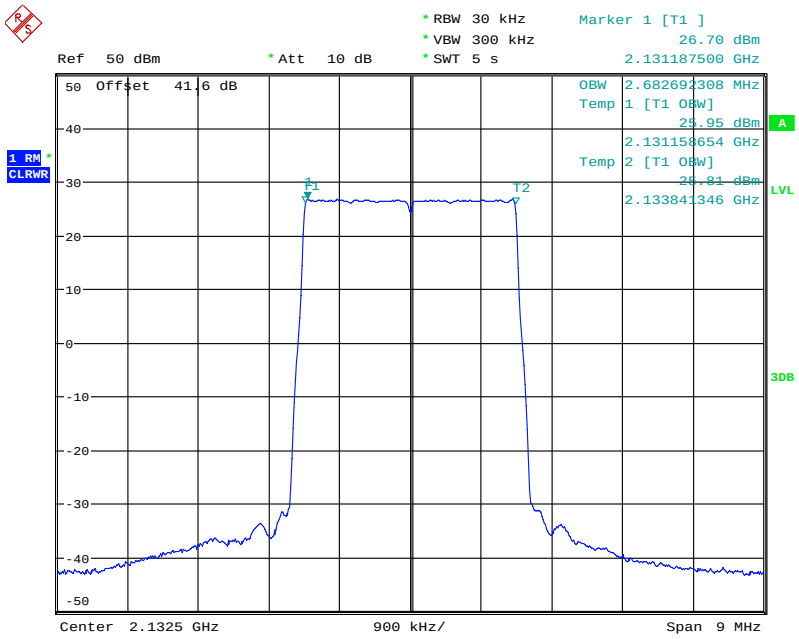
Date: 21.OCT.2013 08:00:07

-26dB Occupied Bandwidth of 3.0MHz Bandwidth



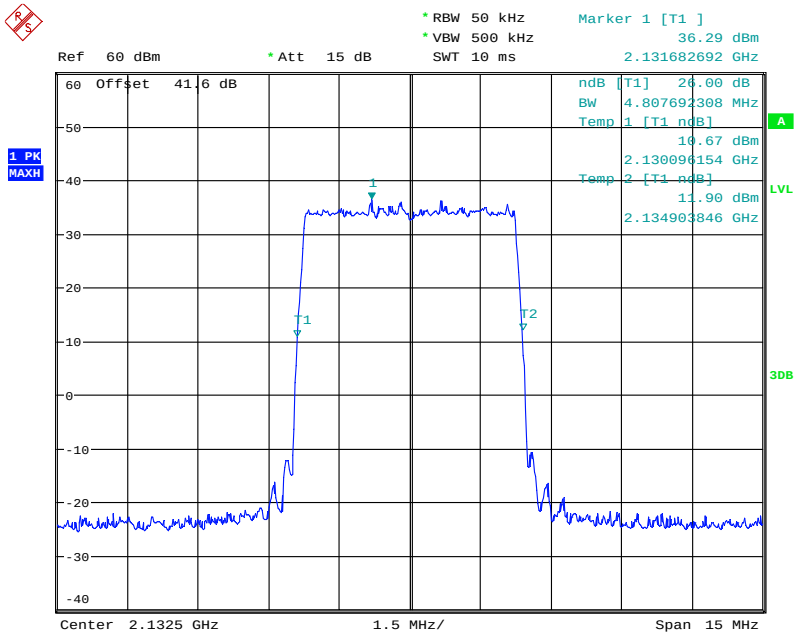
Date: 8.JAN.2014 16:07:14

99% Occupied Bandwidth of 3.0MHz Bandwidth



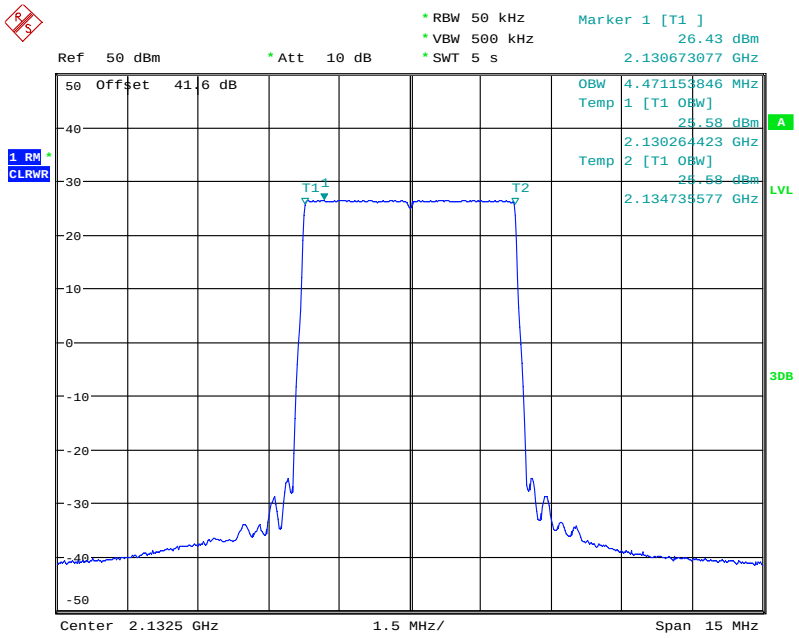
Date: 21.OCT.2013 09:13:36

-26dB Occupied Bandwidth of 5.0MHz Bandwidth



Date: 8.JAN.2014 16:14:16

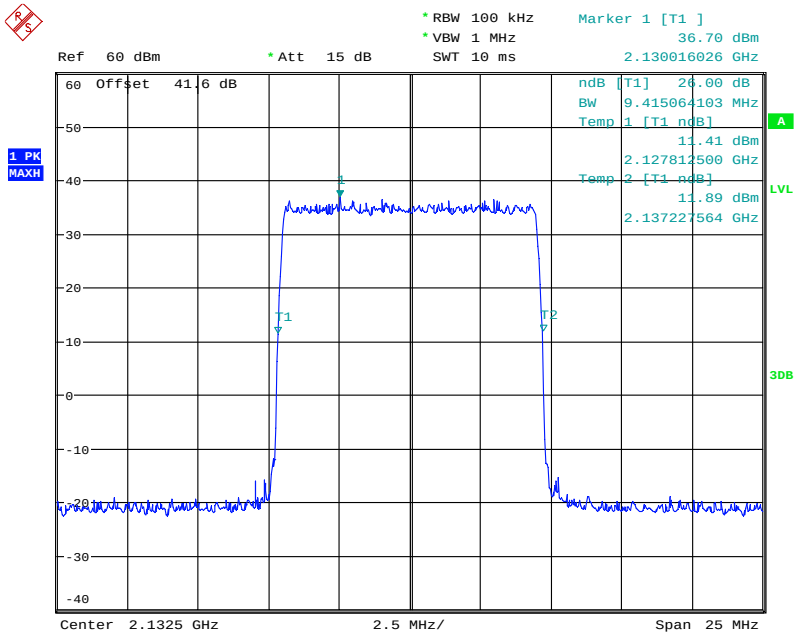
99% Occupied Bandwidth of 5.0MHz Bandwidth



Date: 21.OCT.2013 09:40:31

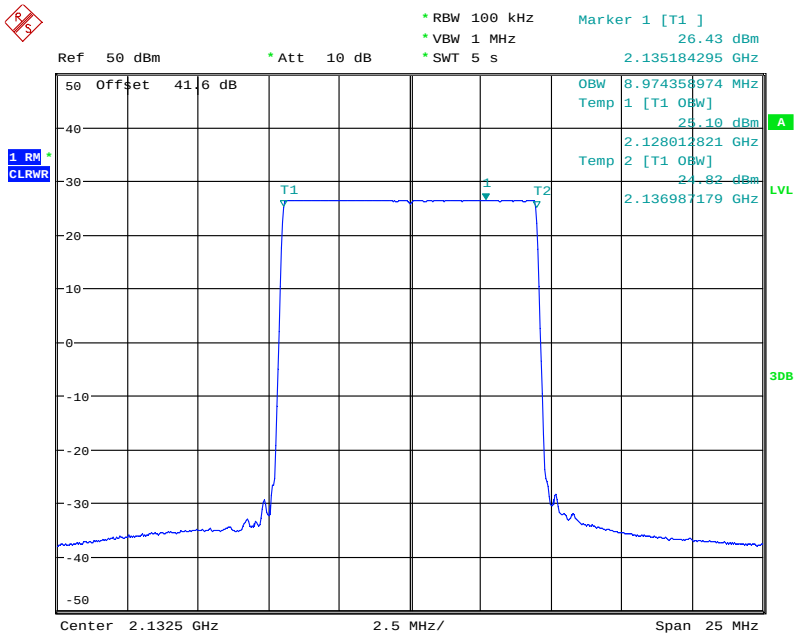
Product Service

-26dB Occupied Bandwidth of 10.0MHz Bandwidth



Date: 8.JAN.2014 16:18:52

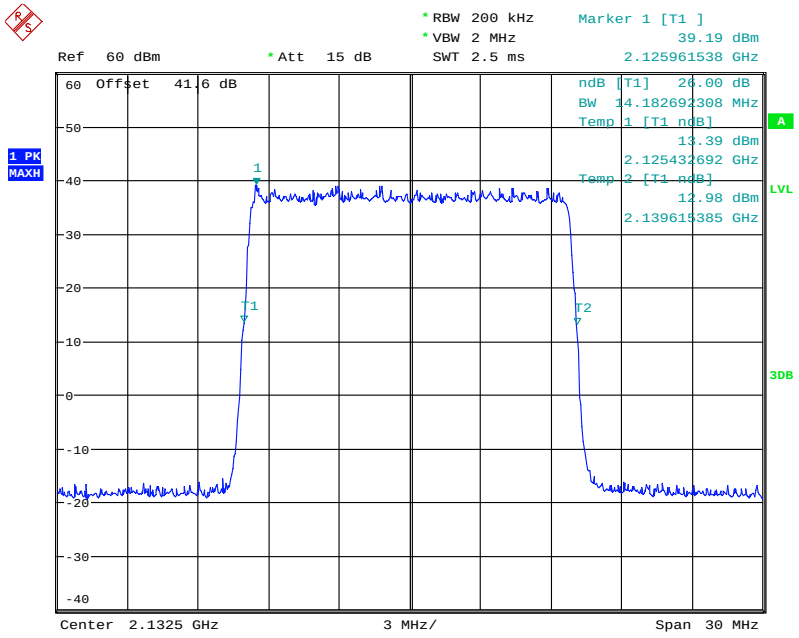
99% Occupied Bandwidth of 10.0MHz Bandwidth



Date: 21.OCT.2013 10:08:37

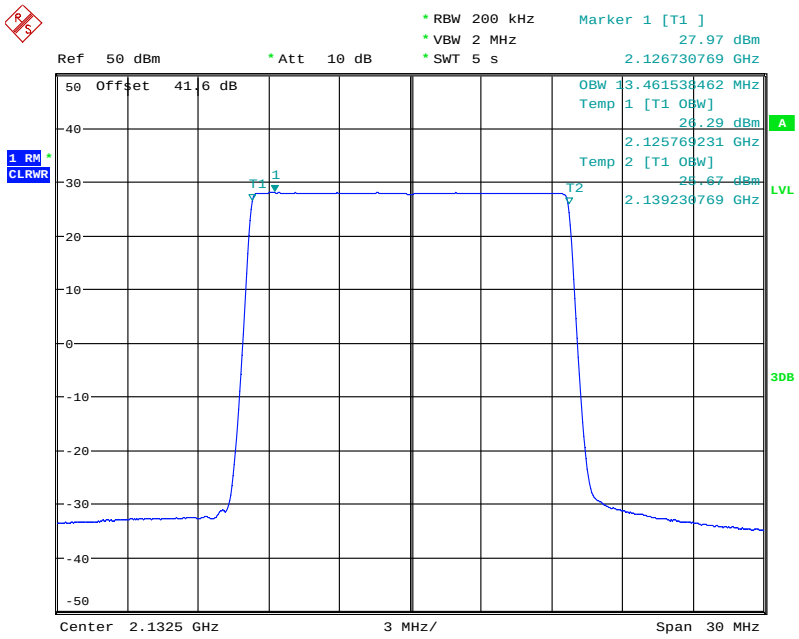
Product Service

-26dB Occupied Bandwidth of 15.0MHz Bandwidth



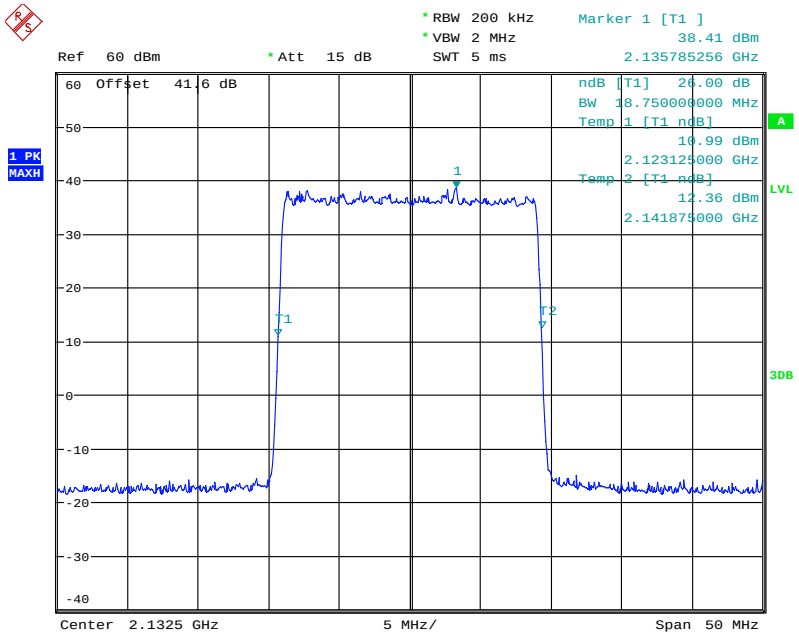
Date: 8.JAN.2014 16:25:38

99% Occupied Bandwidth of 15.0MHz Bandwidth



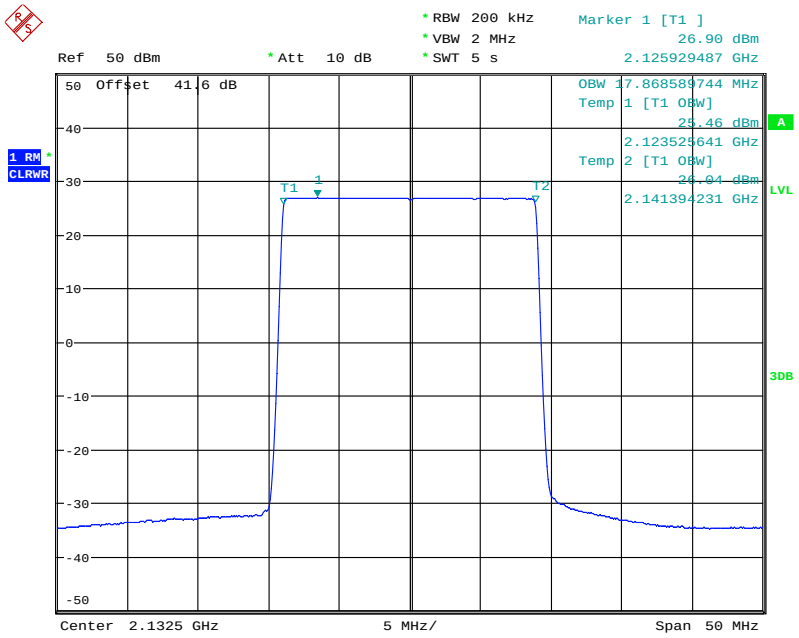
Date: 21.OCT.2013 10:35:44

-26dB Occupied Bandwidth of 20.0MHz Bandwidth



Date: 8.JAN.2014 15:53:57

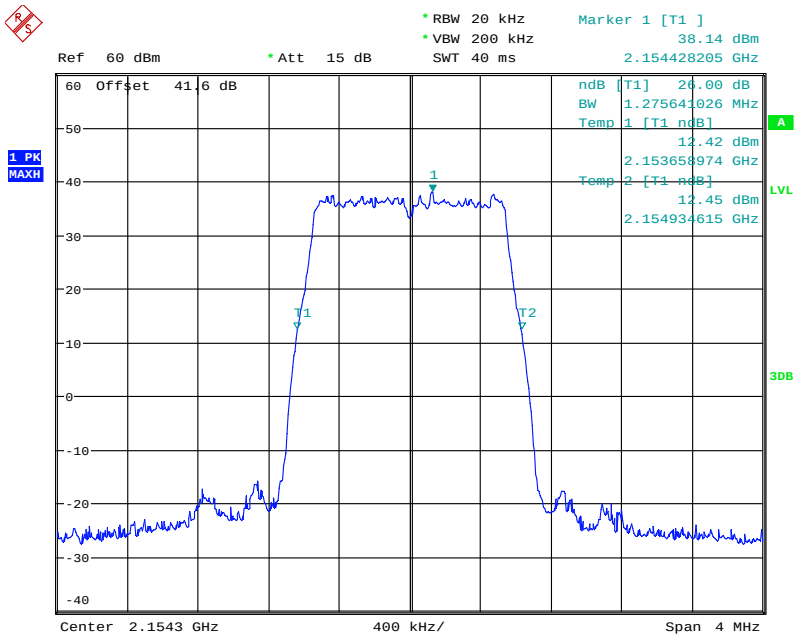
99% Occupied Bandwidth of 20.0MHz Bandwidth



Date: 21.OCT.2013 09:25:29

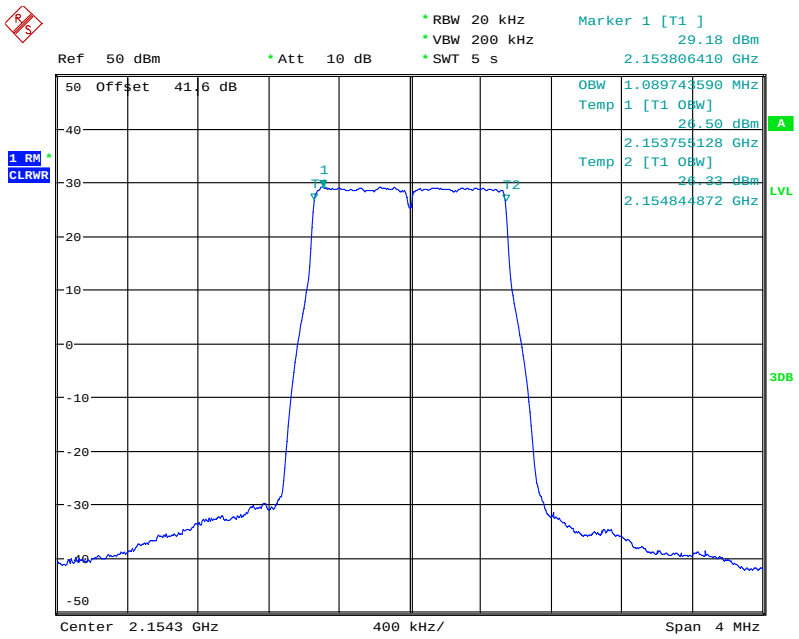
Configuration 1 - Mode 3 - 1.4

-26dB Occupied Bandwidth of 1.4MHz Bandwidth



Date: 8.JAN.2014 16:34:28

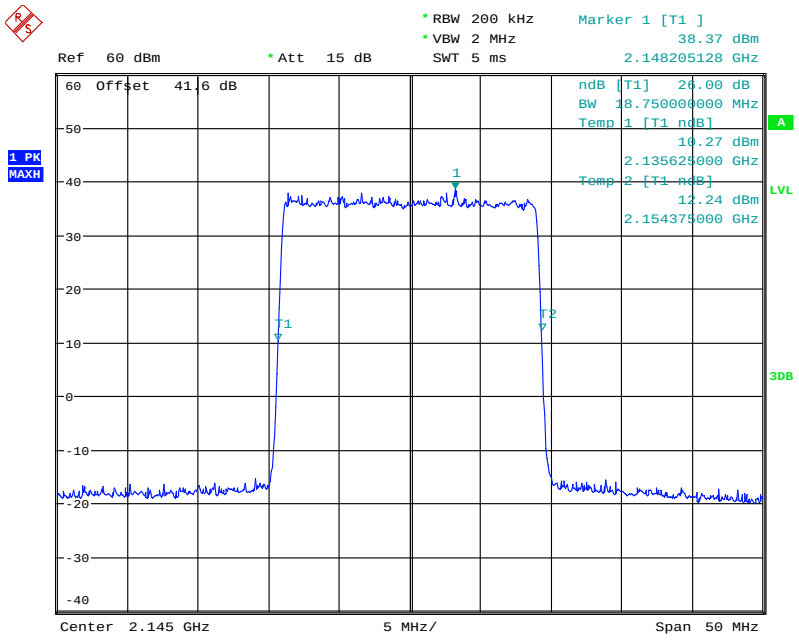
99% Occupied Bandwidth of 1.4MHz Bandwidth



Date: 22.OCT.2013 14:37:12

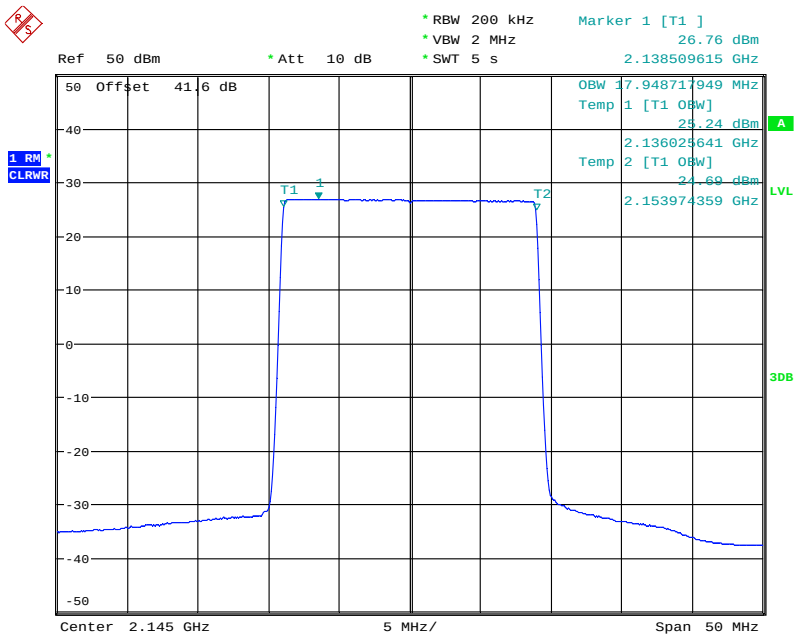
Configuration 1 - Mode 3 - 20

-26dB Occupied Bandwidth of 20.0MHz Bandwidth



Date: 8.JAN.2014 16:37:35

99% Occupied Bandwidth of 20.0MHz Bandwidth



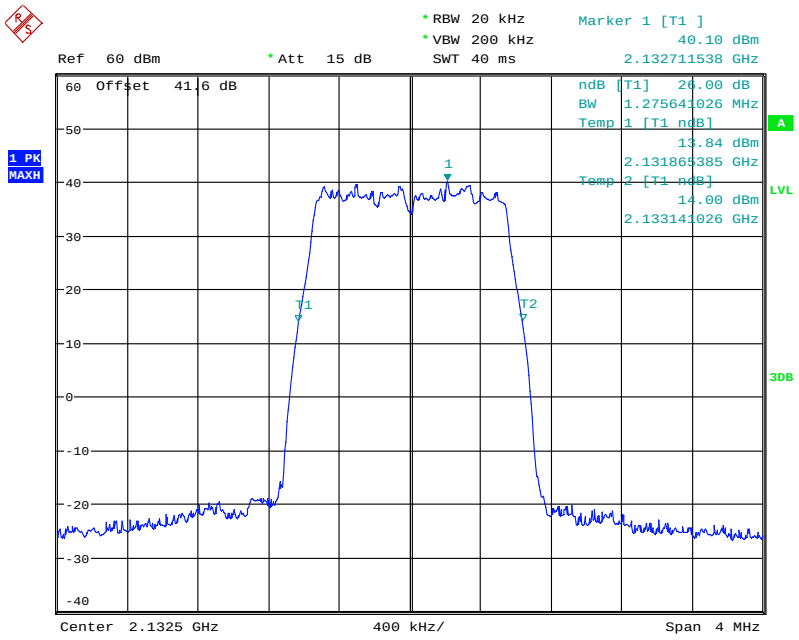
Date: 22.OCT.2013 13:55:37

Product Service

E-TM3.2

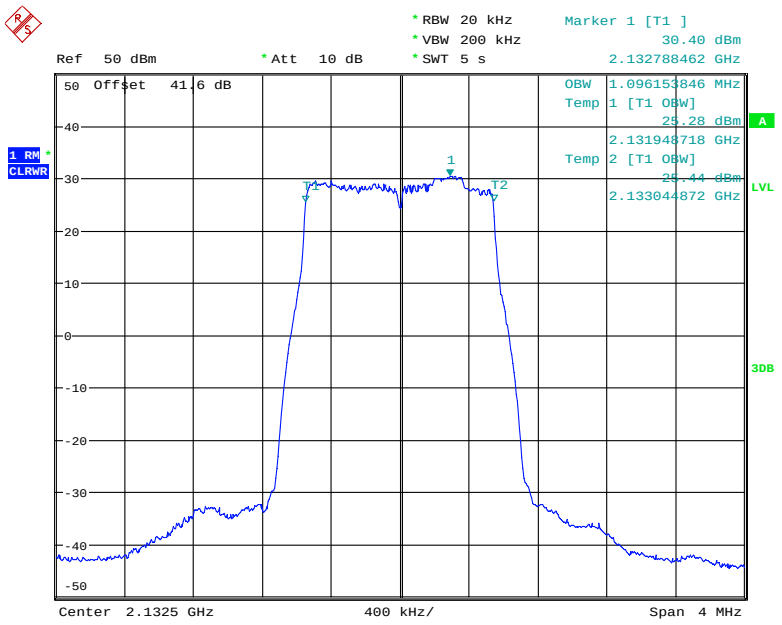
Configuration 1 - Mode 2

-26dB Occupied Bandwidth of 1.4MHz Bandwidth



Date: 8.JAN.2014 15:40:45

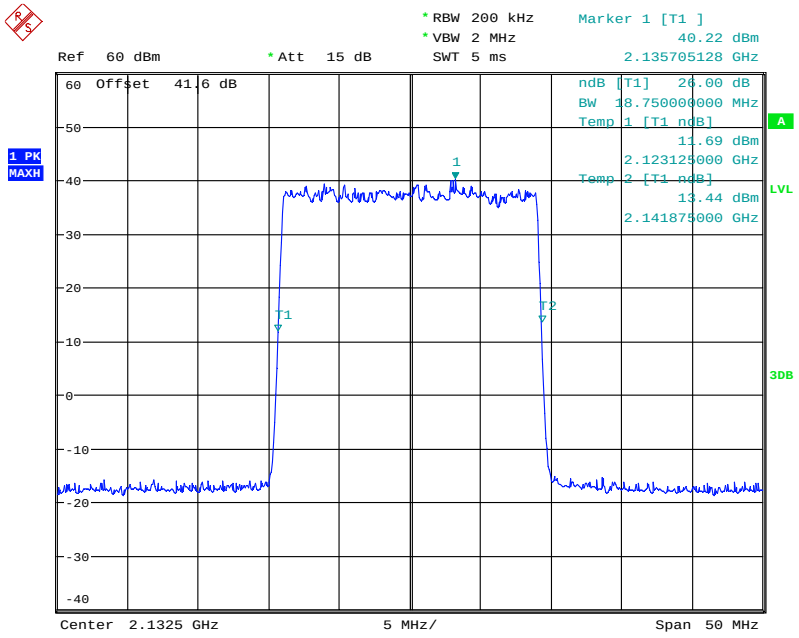
99% Occupied Bandwidth of 1.4MHz Bandwidth



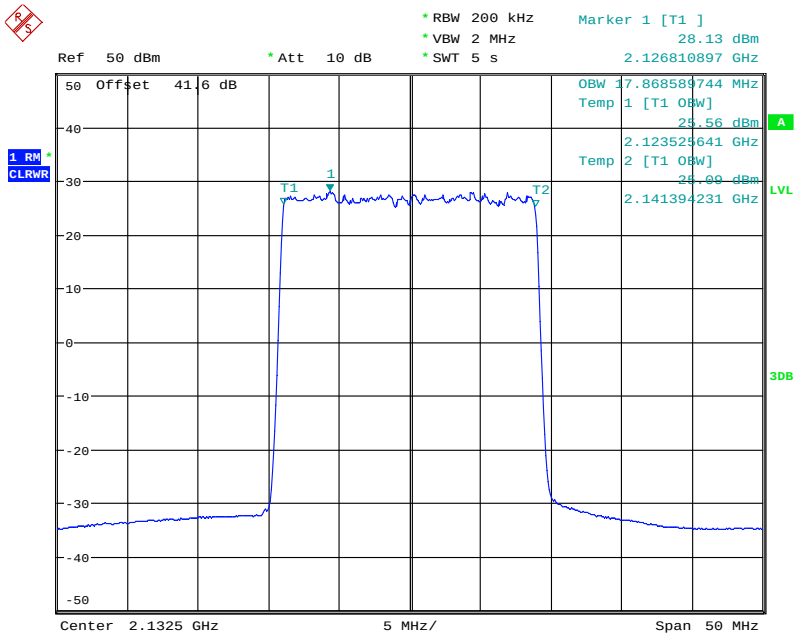
Date: 21.OCT.2013 11:10:48

Product Service

-26dB Occupied Bandwidth of 20.0MHz Bandwidth



99% Occupied Bandwidth of 20.0MHz Bandwidth

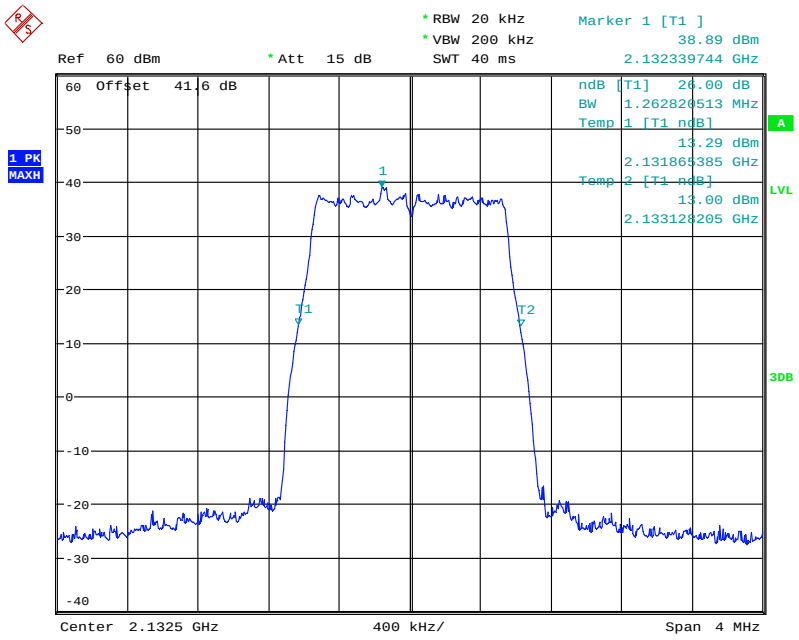


Product Service

E-TM3.1

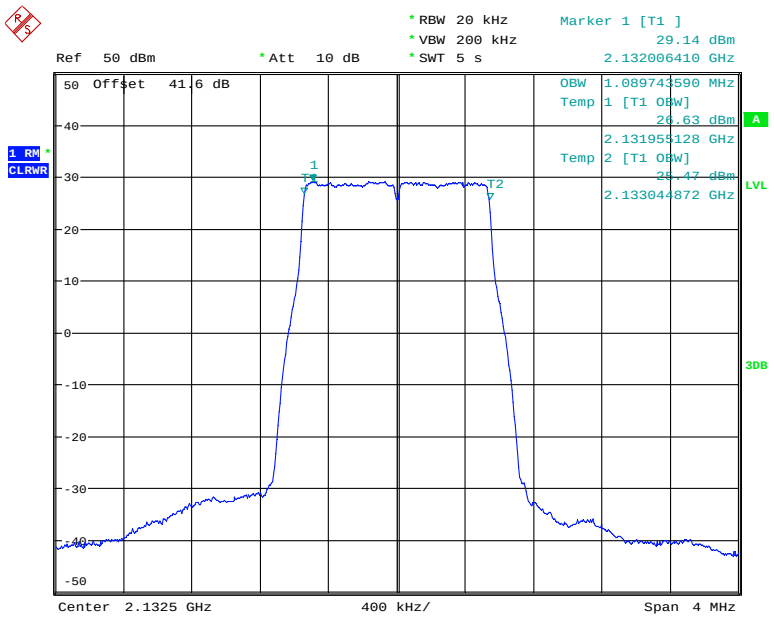
Configuration 1 - Mode 2

-26dB Occupied Bandwidth of 1.4MHz Bandwidth



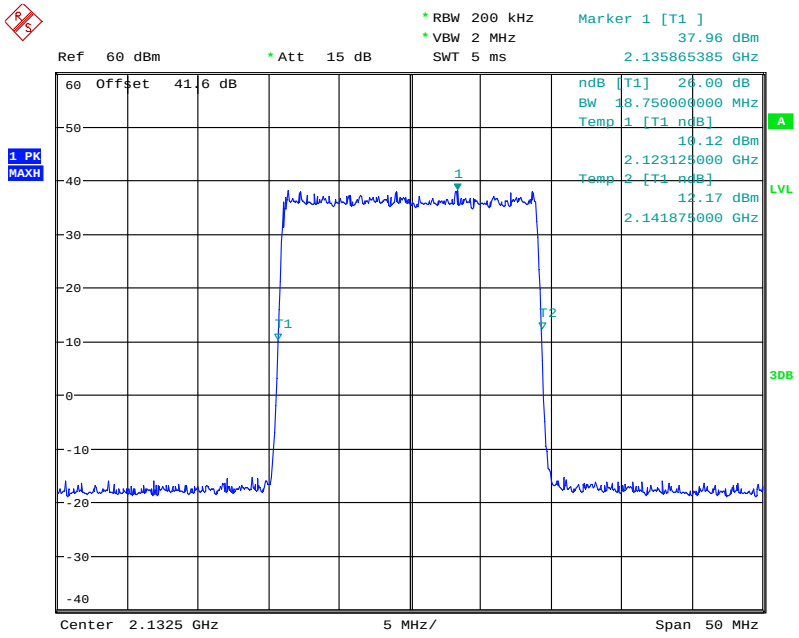
Date: 8.JAN.2014 15:48:15

99% Occupied Bandwidth of 1.4MHz Bandwidth



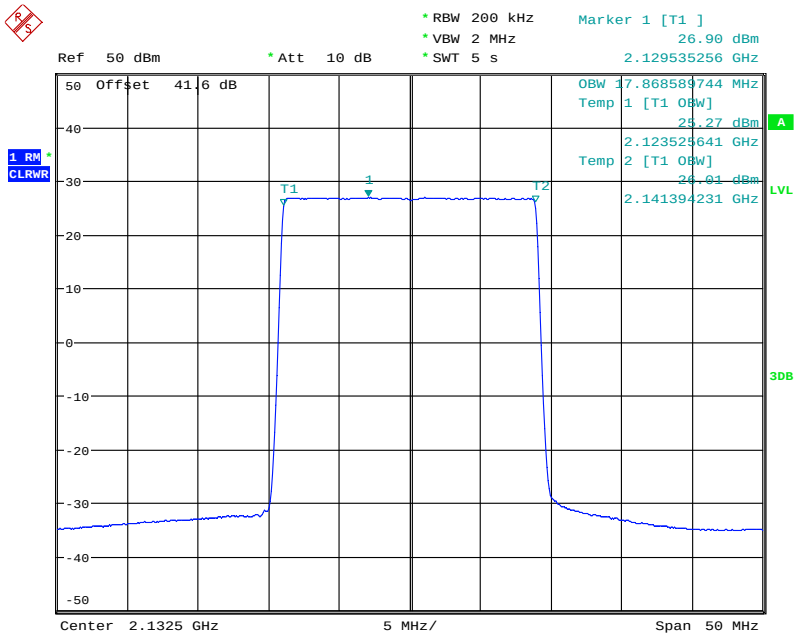
Date: 21.OCT.2013 11:14:24

-26dB Occupied Bandwidth of 20.0MHz Bandwidth



Date: 8.JAN.2014 16:03:16

99% Occupied Bandwidth of 20.0MHz Bandwidth



Date: 21.OCT.2013 10:57:54

2.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (±1MHz)

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.5.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.5.3 Date of Test and Modification State

22 and 23 October 2013 – Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

In accordance with FCC Part 27.53(h)(1), at least 1% of the emission bandwith should be used for the frequencies offset up to 1MHz away from the block edge, and a RBW of 1MHz for measurements of emissions > 1MHz away from the band edges. A resolution bandwidth of 50kHz was used for measurements of emissions > 1MHz away from the band edges. To compensate for the reduced measurement bandwidth, at the frequency range > 1MHz away from the band edges, the limit was adjusted from -13dBm to -26dBm. Spectrum analyser detector was set as RMS.

The limit was adjusted with a correction of -3dB [10Log(2)] by using the Measure and Add 10Log(N) dB technique according to FCC KDB662911 D01 Multiple Transmitter Output v02r01 accounting for simultaneous transmission from antenna ports RF A and RF B.

The measurements were performed on the combined output connector RF A. Limited complementary measurement were done at the output connector RF B to verify identical performance for both transmitter chains, but only the results of RF A as reprentative were shown as below.

The EUT was tested at it's maximum power level.The path loss 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 - 1.4, Mode 1 - 3, Mode 1 - 5, Mode 1 - 10, Mode 1 - 15, Mode 1 - 20
- Mode 3 - 1.4, Mode 3 - 3, Mode 3 - 5, Mode 3 - 10, Mode 3 - 15, Mode 3 - 20
- Mode 4' - 1.4, Mode 4' - 3, Mode 4' - 5, Mode 4 - 10
- Mode 6' - 1.4, Mode 6' - 3, Mode 6' - 5, Mode 6 - 10

Product Service

2.5.6 Environmental Conditions

	22 October 2013	23 October 2013
Ambient Temperature	23.0°C	23.5°C
Relative Humidity	36.0%	34.0%

2.5.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139 for Spurious Emissions Antenna Terminals (±1MHz)

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

Single Carrier

ETM1.1

Bandwidth: 1.4MHz

Configuration 1 - Mode 1 -1.4 and Mode 3 - 1.4

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 1.4MHz Bandwidth Channel No./Frequencies	Channel: 1957 Frequency: 2110.7 MHz	Channel: 2393 Frequency: 2154.3 MHz	20k / 200k	-16.0

Bandwidth: 3.0MHz

Configuration 1 - Mode 1 - 3 and Mode 3 - 3

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 3.0MHz Bandwidth Channel No./Frequencies	Channel: 1965 Frequency: 2111.5 MHz	Channel: 2385 Frequency: 2153.5MHz	30k / 300k	-16.0

Bandwidth: 5.0MHz

Configuration 1 - Mode 1 - 5 and Mode 3 - 5

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 5.0MHz Bandwidth Channel No./Frequencies	Channel: 1975 Frequency: 2112.5 MHz	Channel: 2375 Frequency: 2152.5 MHz	50k / 500k	-16.0

Bandwidth: 10.0MHz

Configuration 1 - Mode 1 - 10 and Mode 3 - 10

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 10.0MHz Bandwidth Channel No./Frequencies	Channel: 2000 Frequency: 2115.0 MHz	Channel: 2350 Frequency: 2150.0 MHz	100k / 1M	-16.0

Bandwidth: 15.0MHz

Configuration 1 - Mode 1 - 15 and Mode 3 - 15

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 15.0MHz Bandwidth Channel No./Frequencies	Channel: 2025 Frequency: 2117.5 MHz	Channel: 2325 Frequency: 2147.5 MHz	200k / 2M	-16.0

Bandwidth: 20.0MHz

Configuration 1 - Mode 1 - 20 and Mode 3 - 20

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 20.0MHz Bandwidth Channel No./Frequencies	Channel: 2050 Frequency: 2120.0 MHz	Channel: 2300 Frequency: 2145.0 MHz	200k / 2M	-16.0

Multi Carrier (x2)

ETM1.1

Bandwidth: 1.4MHz

Configuration 1 - Mode 4' - 1.4 and Mode 6' - 1.4

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 1.4MHz Bandwidth Channel No./Frequencies	Channel: 1957+ 1971 Frequency: 2110.7MHz + 2112.1 MHz	Channel: 2379 + 2393 Frequency: 2152.9 MHz + 2154.3MHz	20k / 200k	-16.0

Bandwidth: 3.0MHz

Configuration 1 - Mode 4' - 3 and Mode 6' - 3

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 3.0MHz Bandwidth Channel No./Frequencies	Channel: 1965+ 1995 Frequency: 2111.5MHz + 2114.5 MHz	Channel: 2355 + 2385 Frequency: 2150.5MHz + 2153.5MHz	30k / 300k	-16.0

Bandwidth: 5.0MHz

Configuration 1 - Mode 4' - 5 and Mode 6' - 5

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 5.0MHz Bandwidth Channel No./Frequencies	Channel: 1975 + 2025 Frequency: 2112.5 MHz + 2117.5 MHz	Channel: 2325 + 2375 Frequency: 2147.5MHz + 2152.5MHz	50k / 500k	-16.0

Bandwidth: 10MHz

Configuration 1 - Mode4 - 10 and Mode 6 - 10

Band Edge Frequency	Bottom 2110 MHz	Top 2155 MHz	RBW / VBW (Hz)	Limit (dBm)
Edge Test with 10.0MHz Bandwidth Channel No./Frequencies	Channel: 2000 + 2100 Frequency: 2115.0 MHz + 2125.0 MHz	Channel: 2250 + 2350 Frequency: 2140.0MHz + 2150.0MHz	100k / 1M	-16.0

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. Channels used outside of those stated and power levels used beyond those stated in the table exceed the specification limits, thus they cannot be used.

The channels outside of those shown in the table above were not tested at lower power levels to determine a level at which compliance would be achieved. Therefore, to maintain compliance, only the channels shown in the table above shall be used.

The test results are shown below

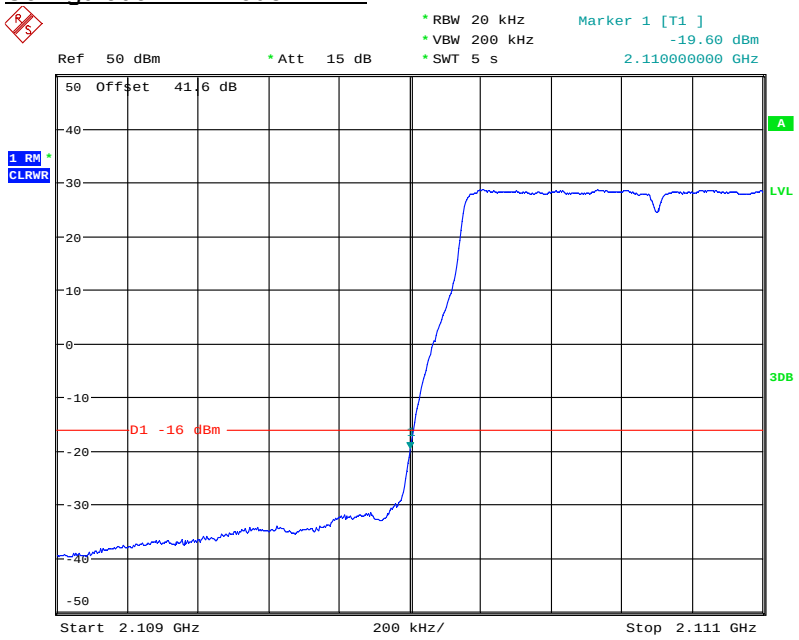
Product Service

Single Carrier

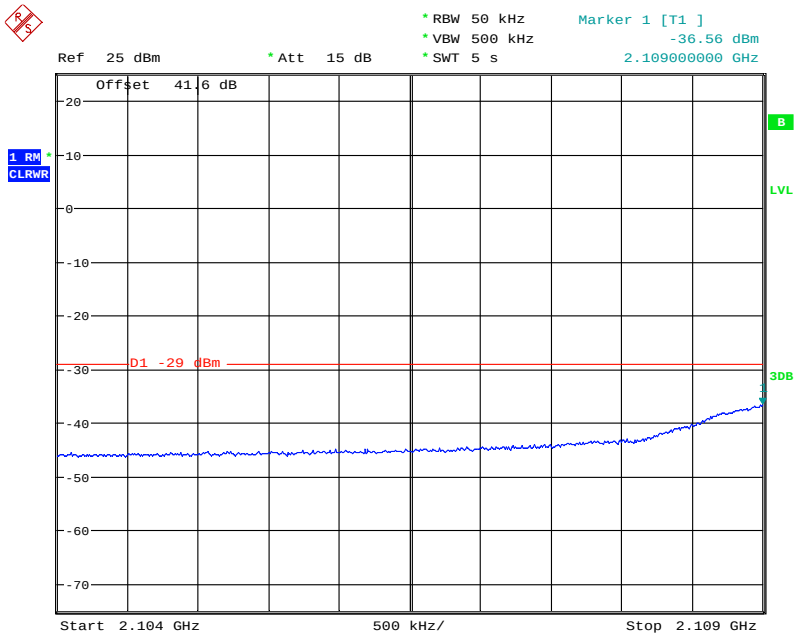
E-TM1.1

1.4MHz Bandwidth

Configuration 1 - Mode 1 - 1.4



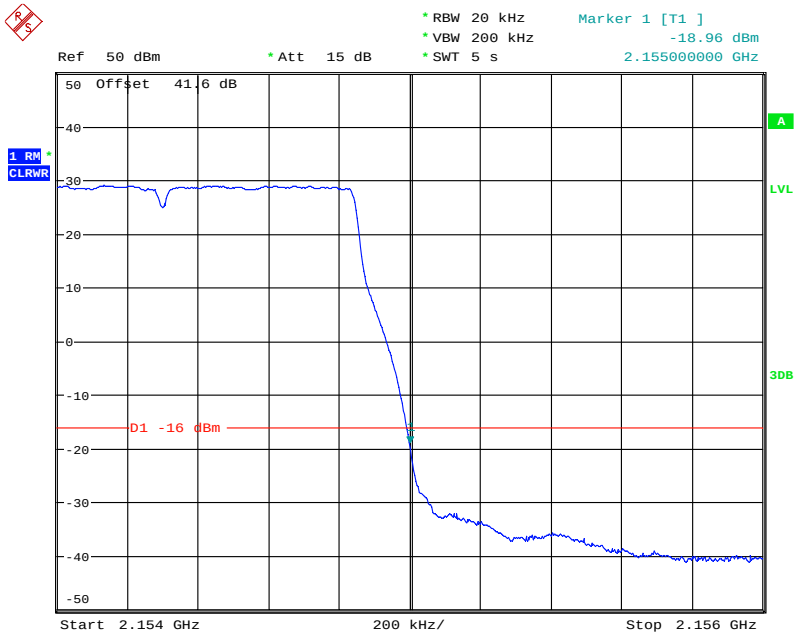
Date: 22.OCT.2013 10:54:33



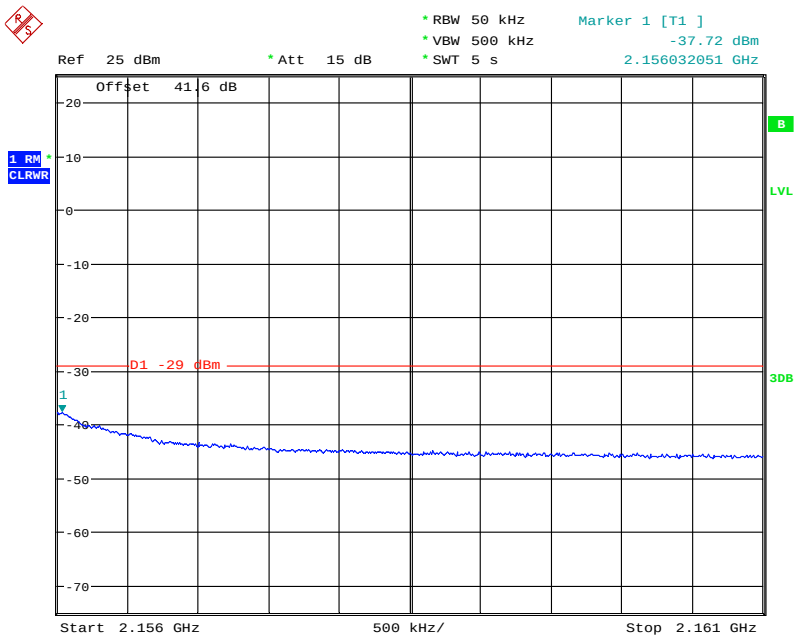
Date: 22.OCT.2013 10:59:27

Product Service

Configuration 1 - Mode 3 - 1.4



Date: 22.OCT.2013 13:19:42

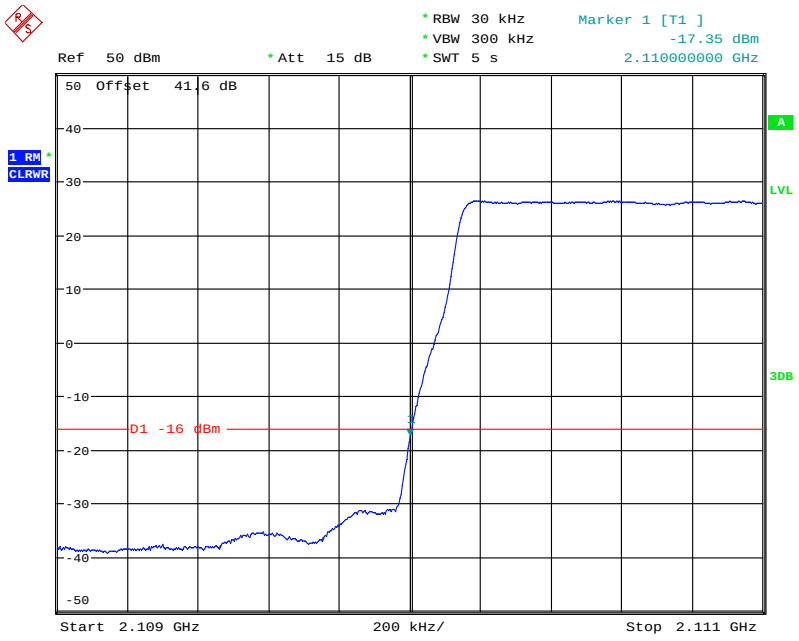


Date: 22.OCT.2013 13:20:27

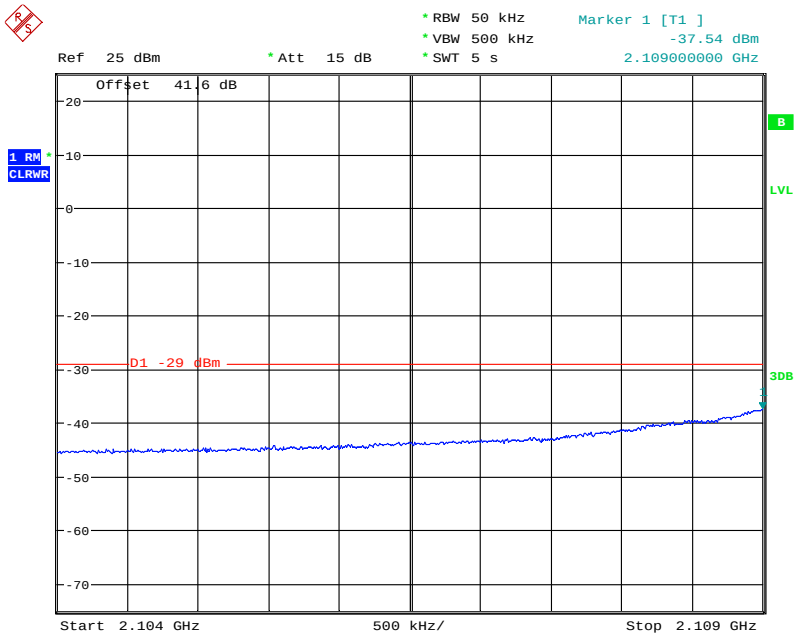
Product Service

3.0MHz Bandwidth

Configuration 1 - Mode 1 - 3



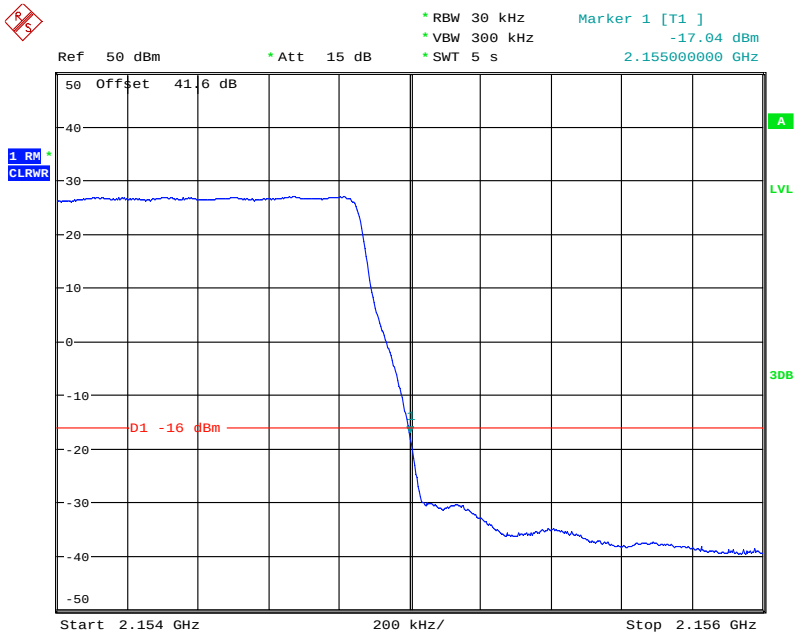
Date: 22.OCT.2013 11:02:23



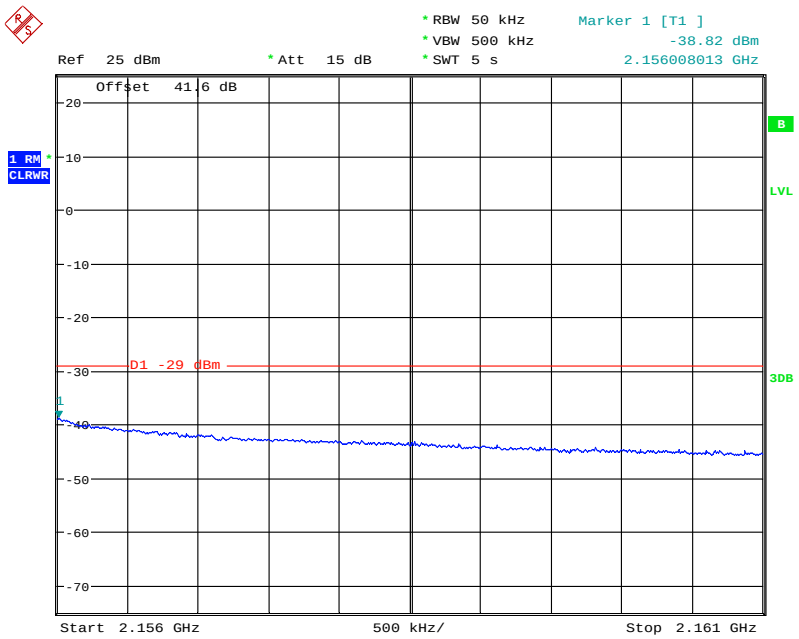
Date: 22.OCT.2013 11:05:40

Product Service

Configuration 1 - Mode 3 - 3



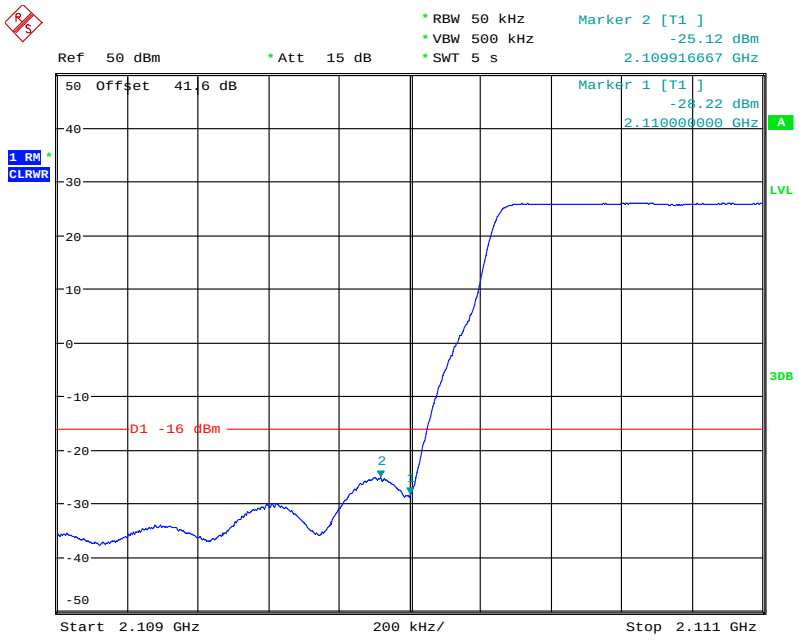
Date: 22.OCT.2013 13:13:10



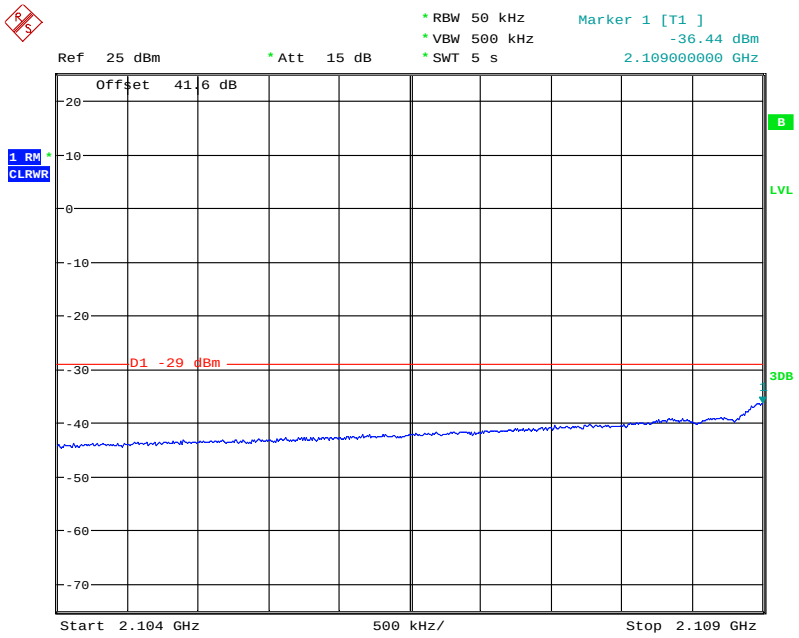
Date: 22.OCT.2013 13:15:52

5.0MHz Bandwidth

Configuration 1 - Mode 1 - 5



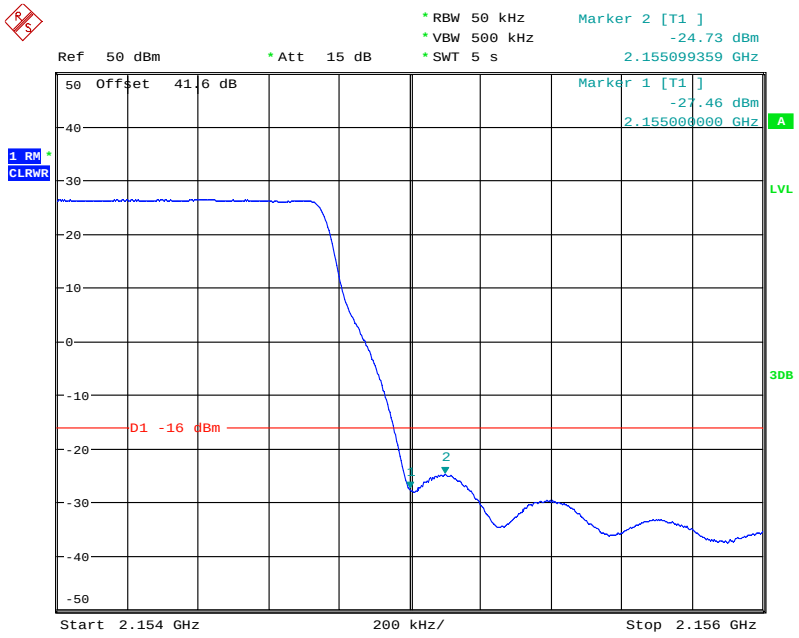
Date: 22.OCT.2013 11:21:58



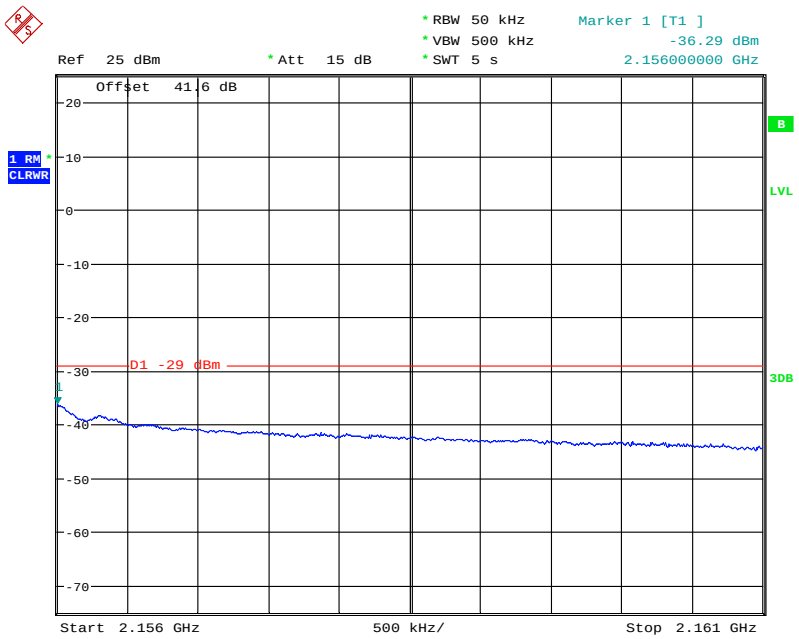
Date: 22.OCT.2013 11:22:57

Product Service

Configuration 1 - Mode 3 - 5



Date: 22.OCT.2013 13:32:57

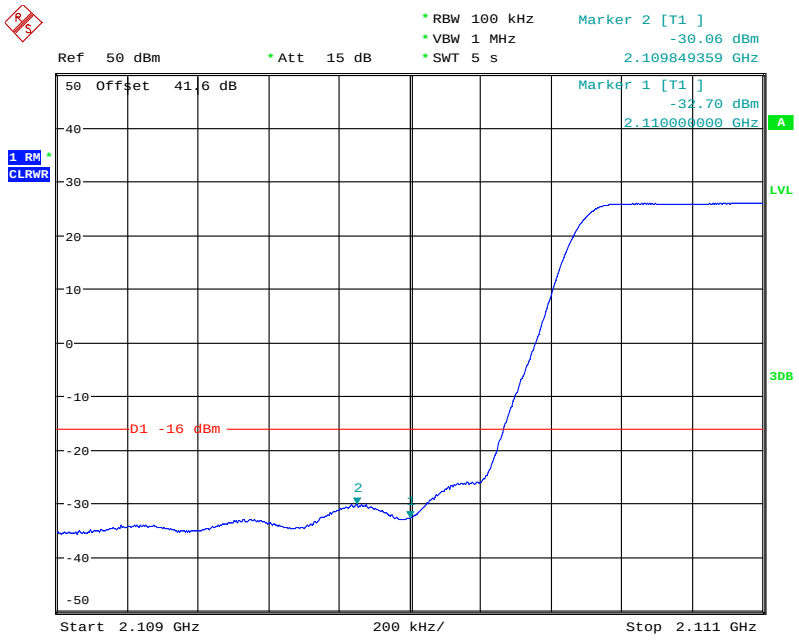


Date: 22.OCT.2013 13:33:47

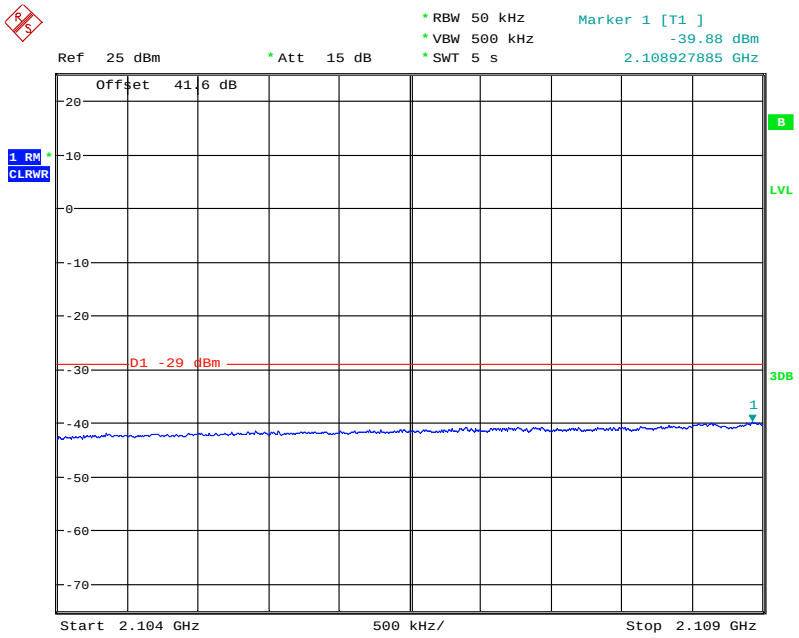
Product Service

10.0MHz Bandwidth

Configuration 1 - Mode 1 - 10



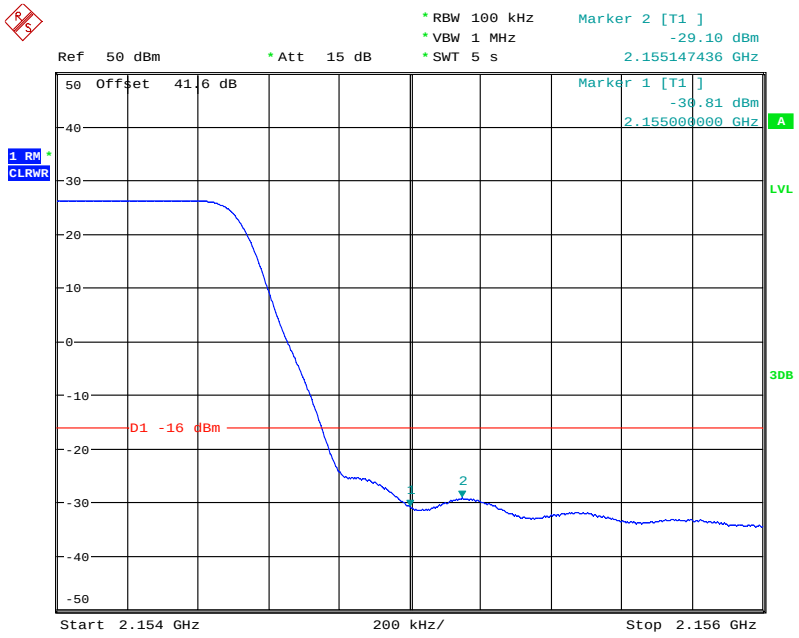
Date: 22.OCT.2013 11:29:05



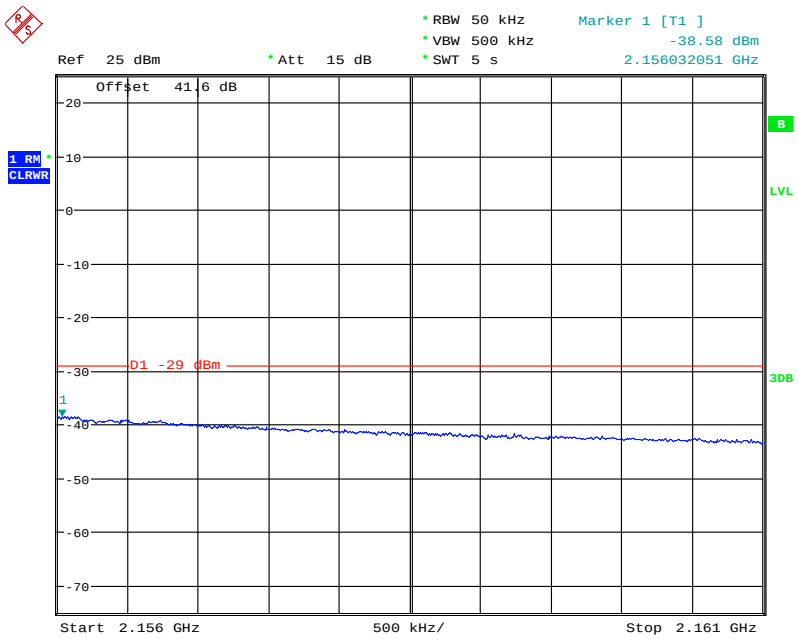
Date: 22.OCT.2013 11:26:36

Product Service

Configuration 1 - Mode 3 - 10



Date: 22.OCT.2013 13:39:45

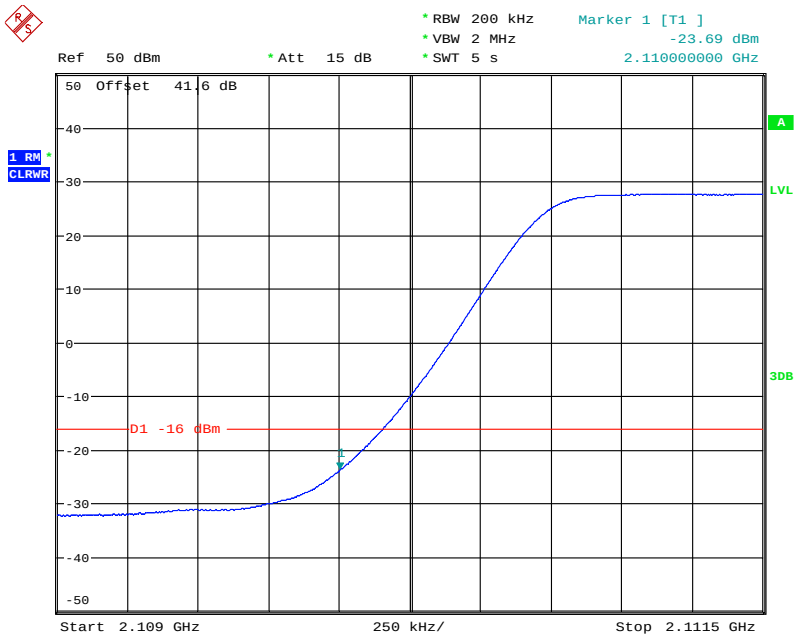


Date: 22.OCT.2013 13:40:30

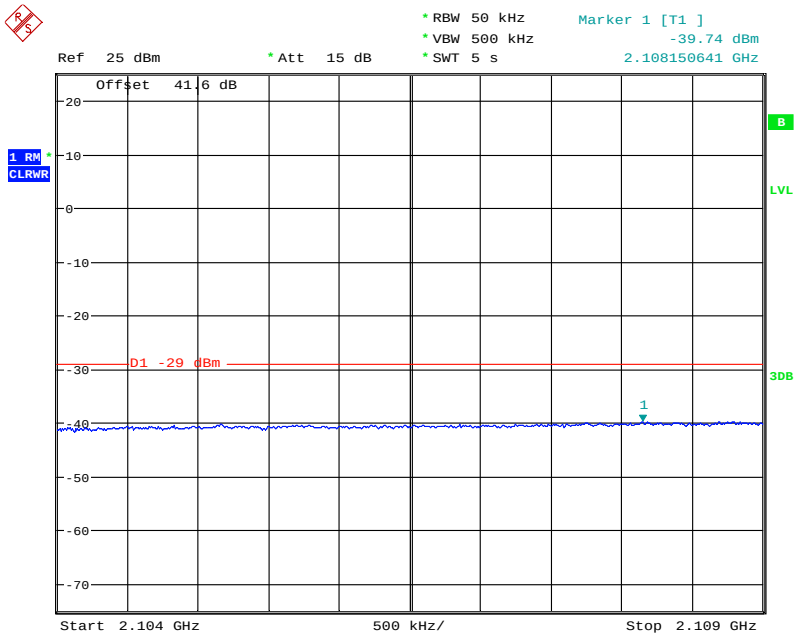
Product Service

15MHz Bandwidth

Configuration 1 - Mode 1 - 15



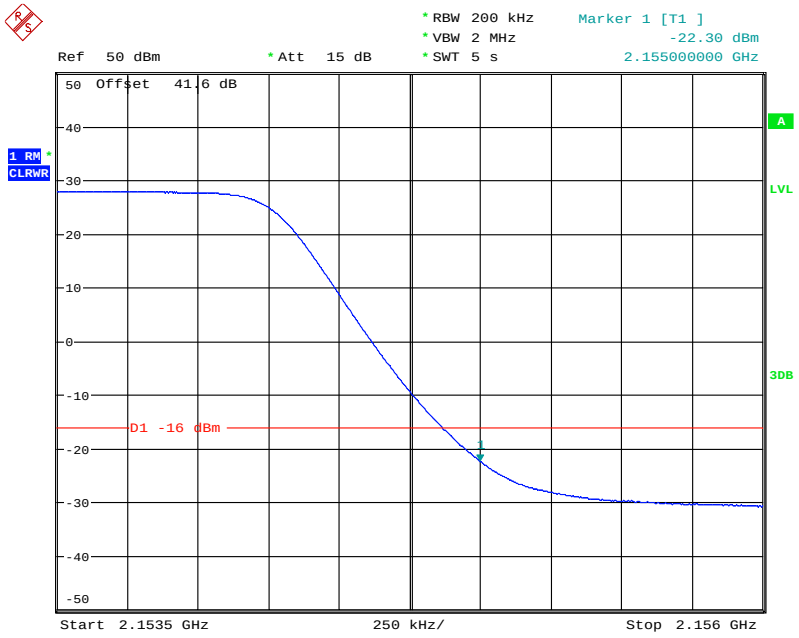
Date: 22.OCT.2013 11:31:44



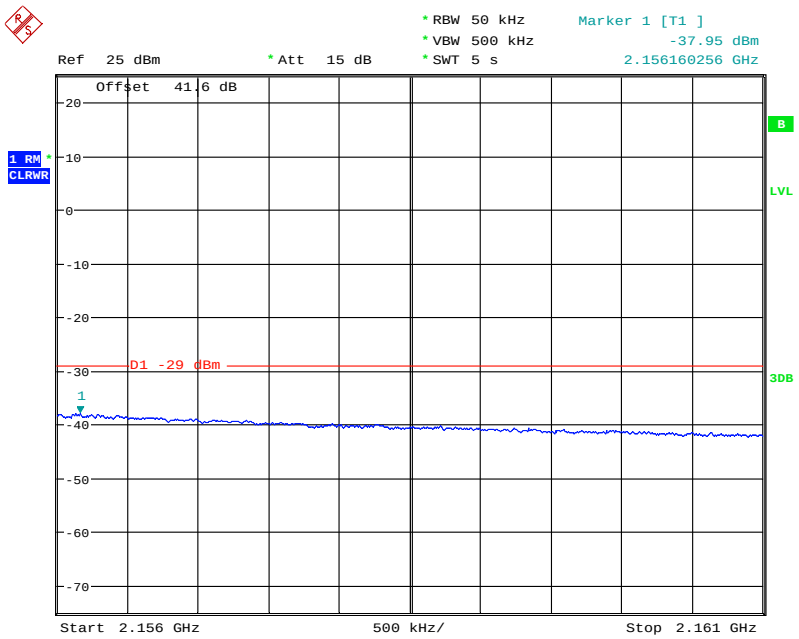
Date: 22.OCT.2013 11:32:51

Product Service

Configuration 1 - Mode 3 - 15



Date: 22.OCT.2013 13:46:13

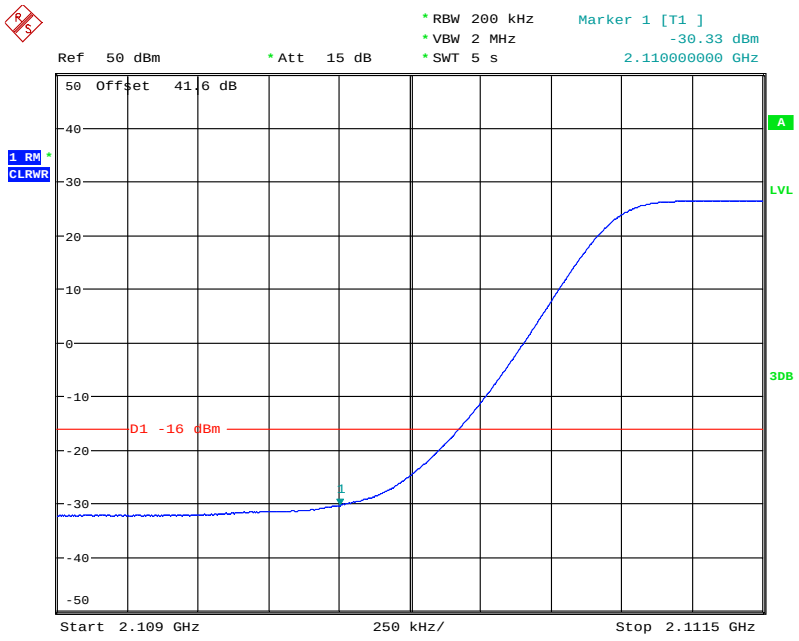


Date: 22.OCT.2013 13:46:40

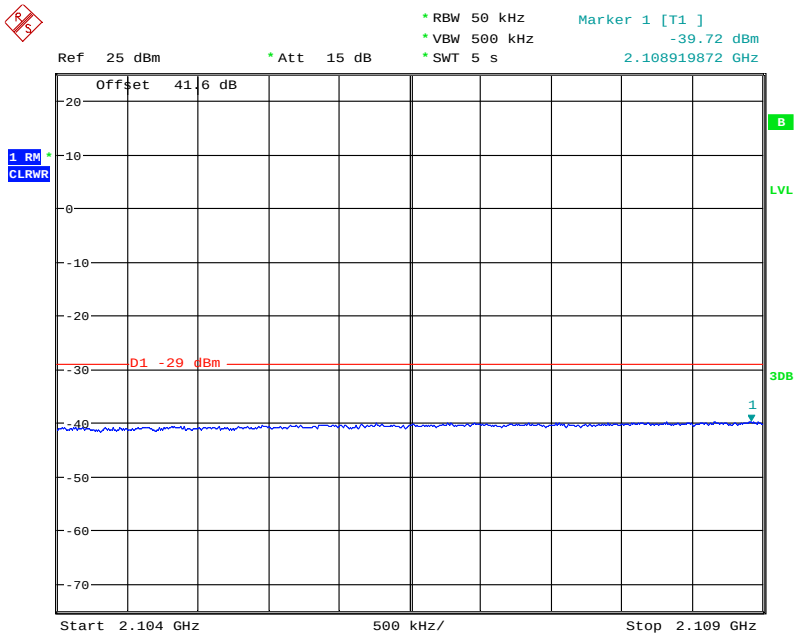
Product Service

20MHz Bandwidth

Configuration 1 - Mode 1 - 20



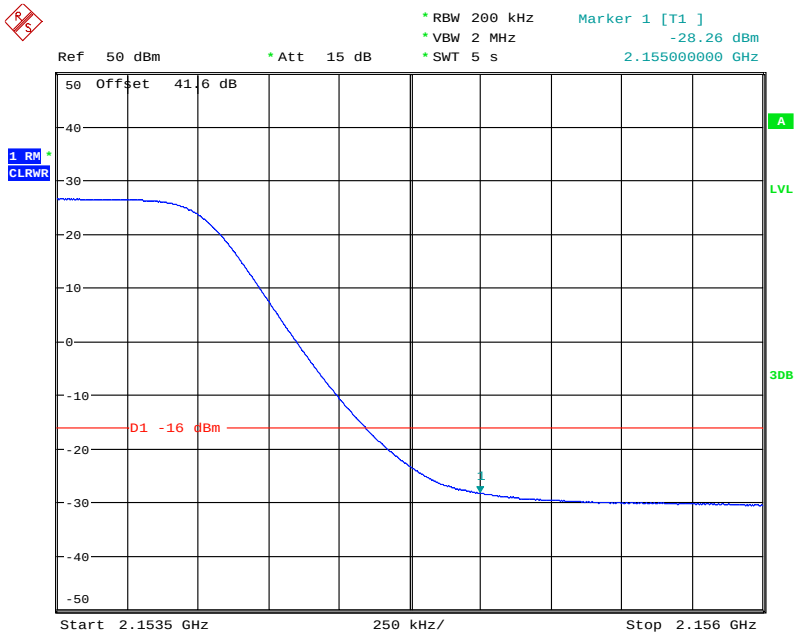
Date: 22.OCT.2013 11:37:25



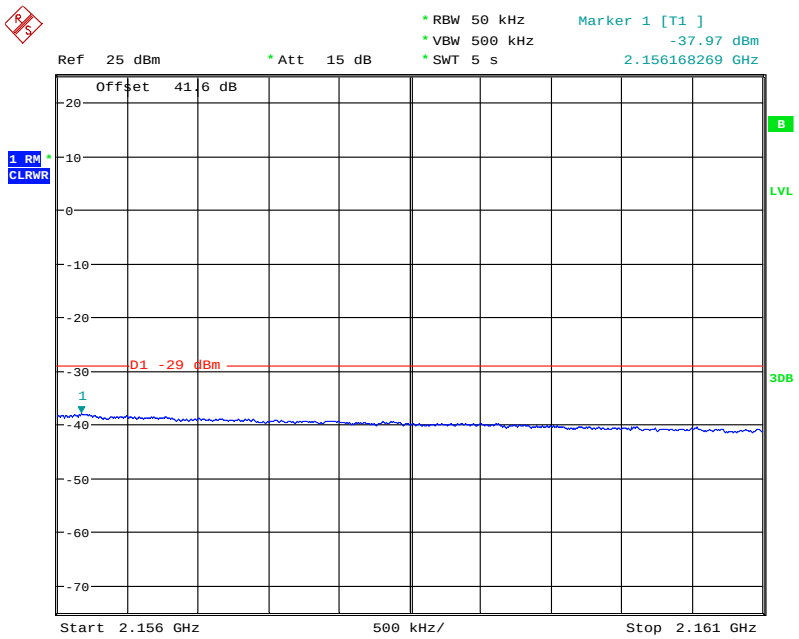
Date: 22.OCT.2013 11:37:01

Product Service

Configuration 1 - Mode 3 - 20



Date: 22.OCT.2013 13:51:33



Date: 22.OCT.2013 13:49:30

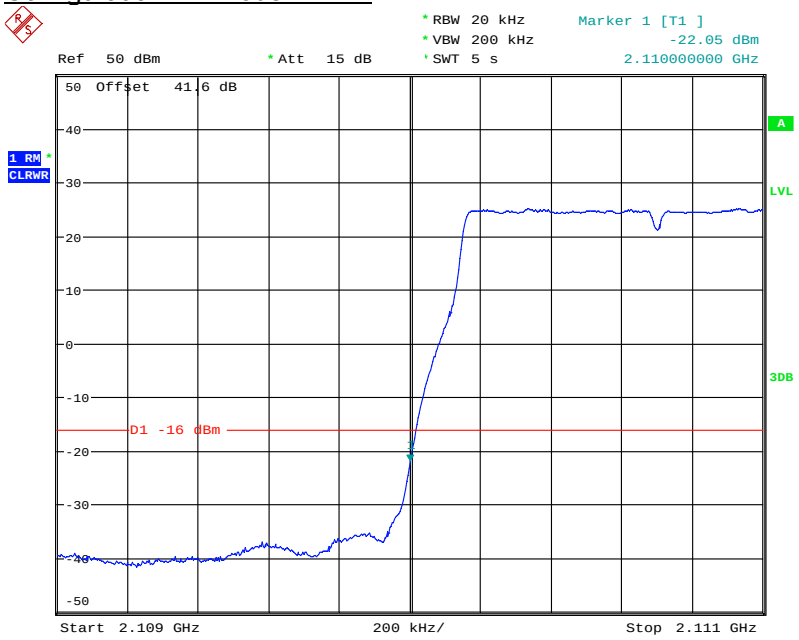
Product Service

Multi Carrier (x2)

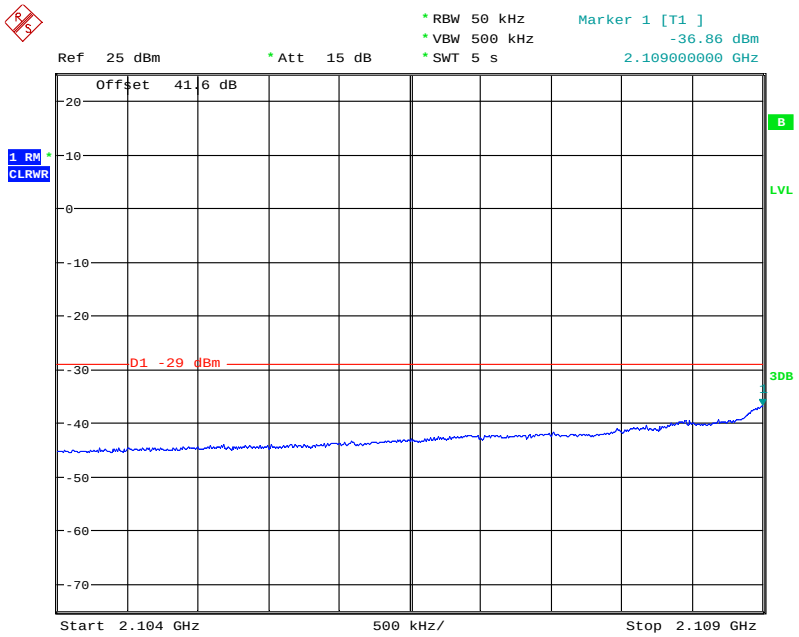
E-TM1.1

1.4MHz Bandwidth

Configuration 1 - Mode 4' - 1.4



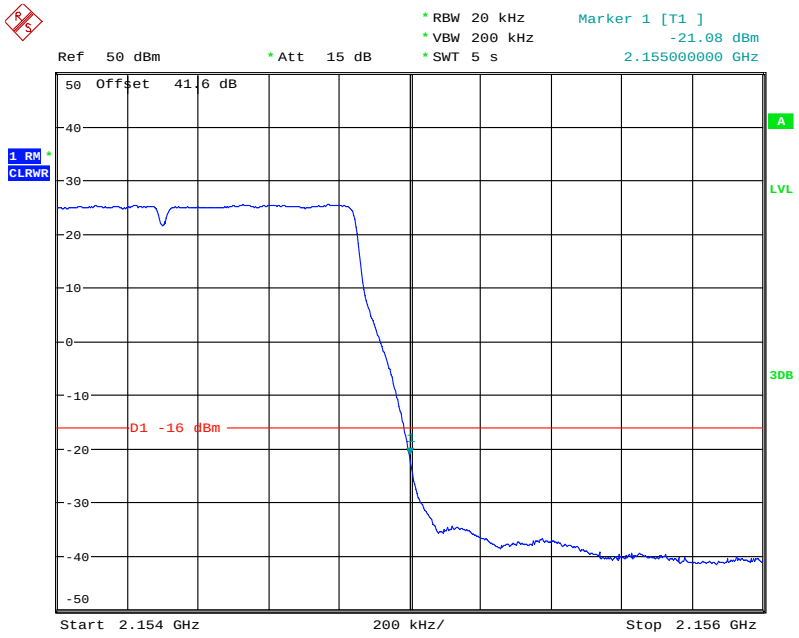
Date: 22.OCT.2013 15:53:25



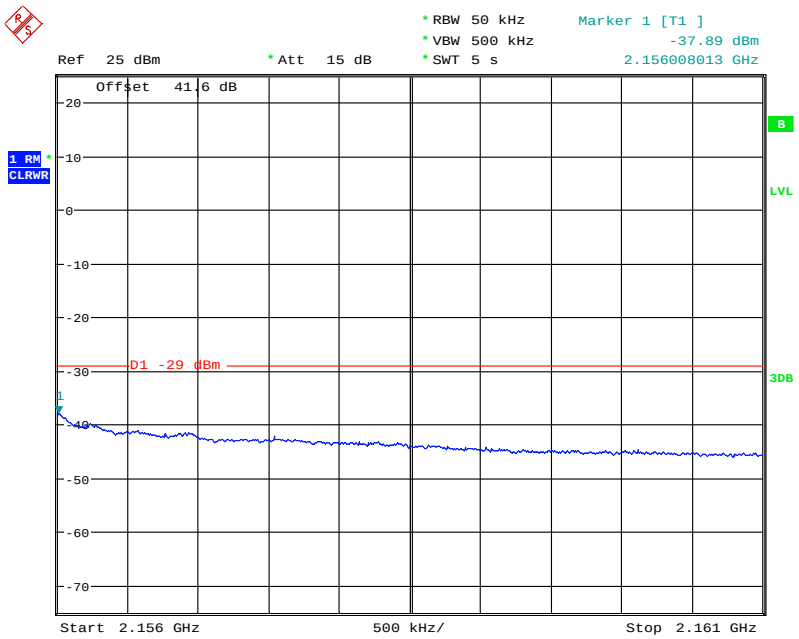
Date: 22.OCT.2013 15:55:13

Product Service

Configuration 1 - Mode 6' - 1.4



Date: 22.OCT.2013 16:27:48

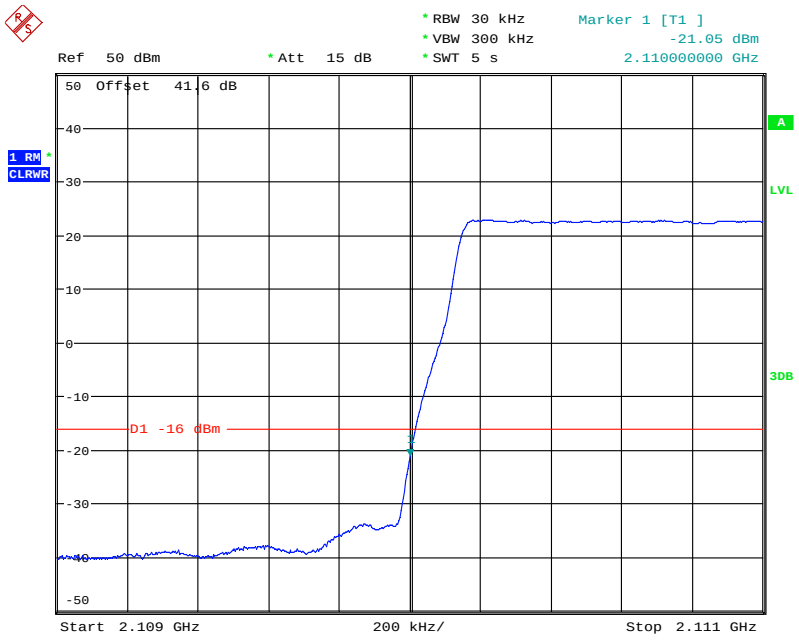


Date: 22.OCT.2013 16:30:10

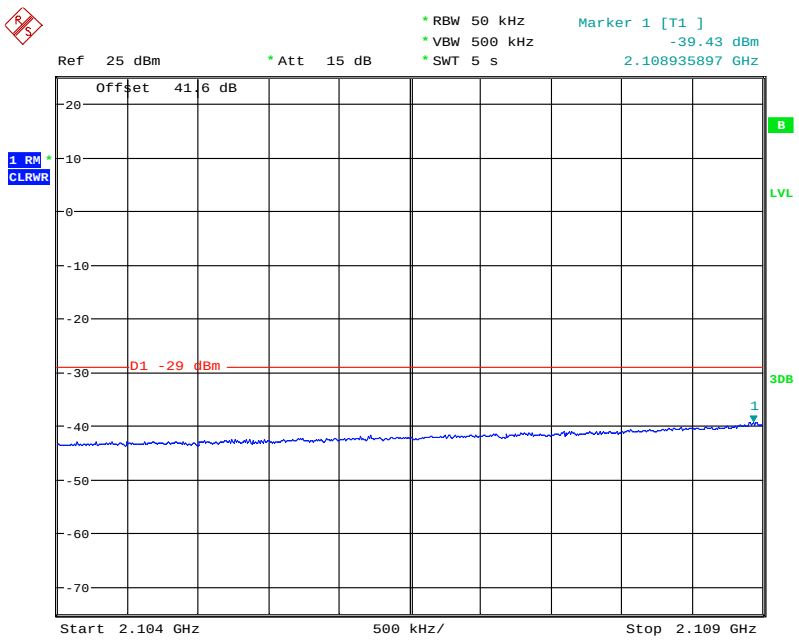
Product Service

3.0MHz Bandwidth

Configuration 1 - Mode 4' - 3



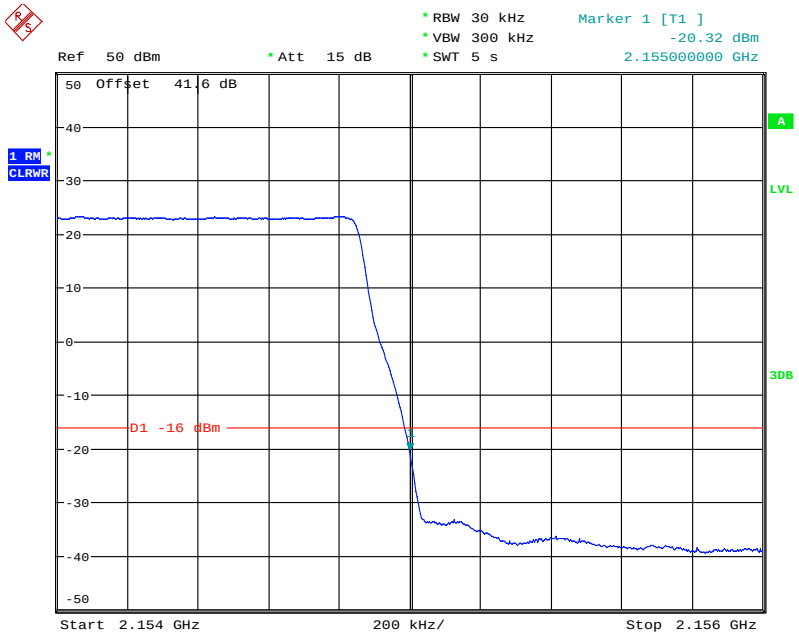
Date: 22.OCT.2013 16:59:08



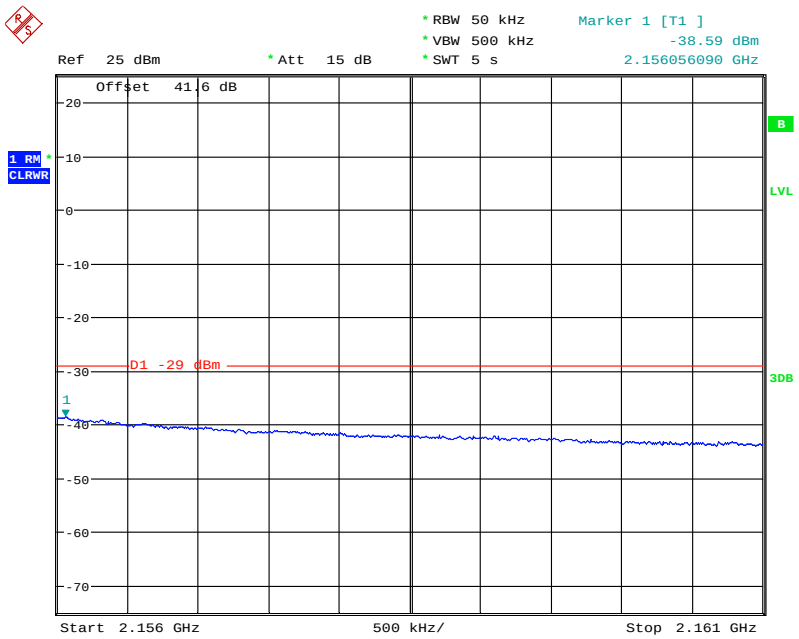
Date: 22.OCT.2013 16:59:42

Product Service

Configuration 1 - Mode 6' - 3



Date: 22.OCT.2013 16:36:19

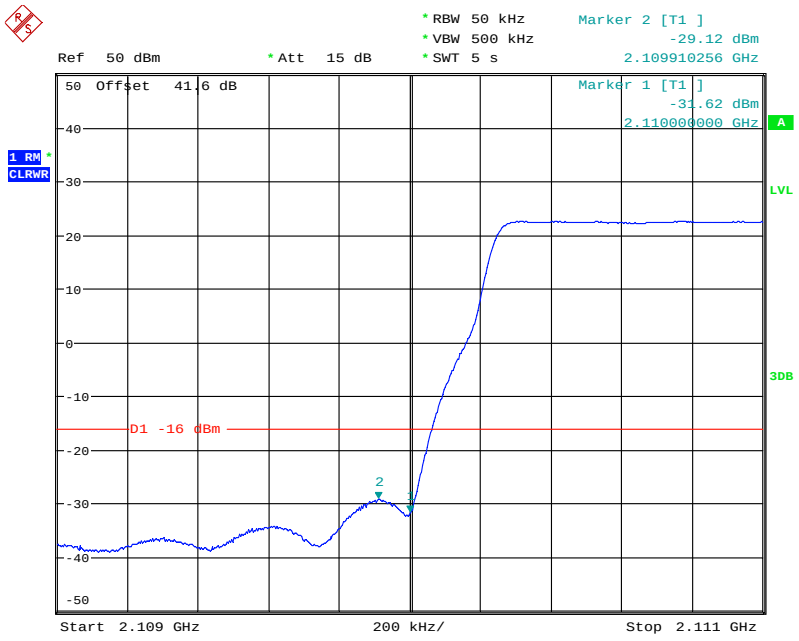


Date: 22.OCT.2013 16:40:35

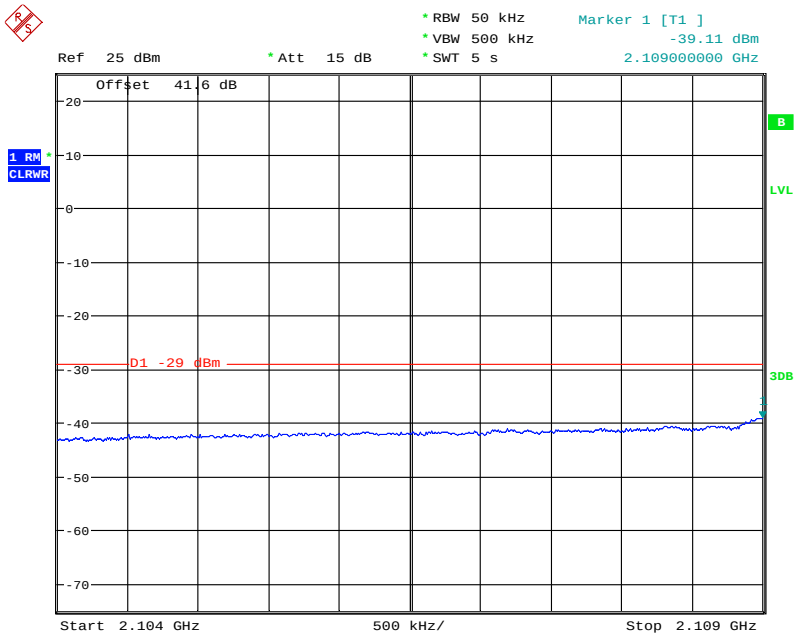
Product Service

5.0MHz Bandwidth

Configuration 1 - Mode 4' - 5



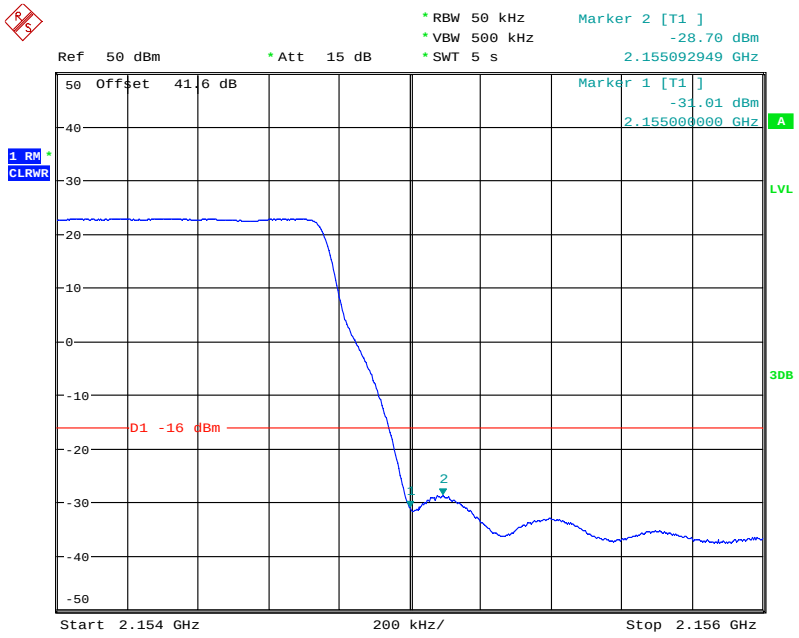
Date: 23.OCT.2013 10:14:10



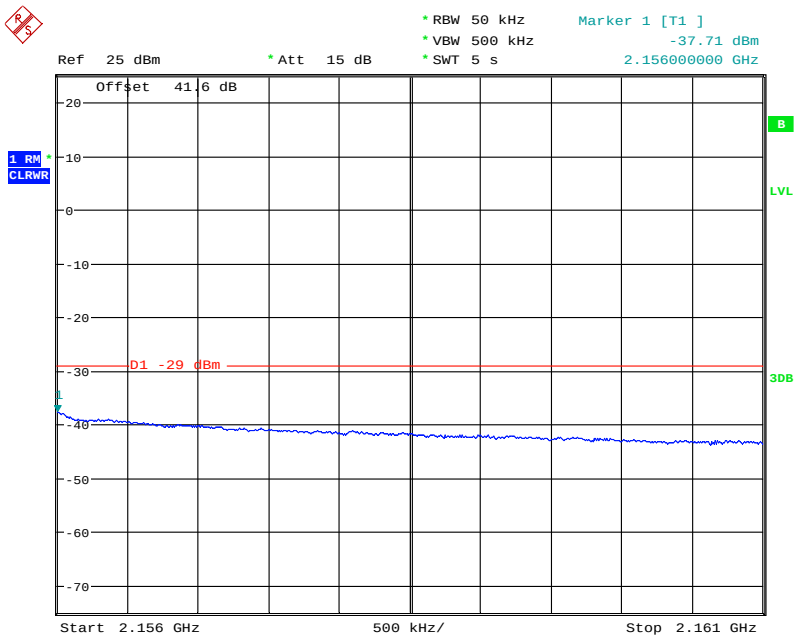
Date: 23.OCT.2013 10:15:31

Product Service

Configuration 1 - Mode 6' - 5



Date: 23.OCT.2013 10:35:19

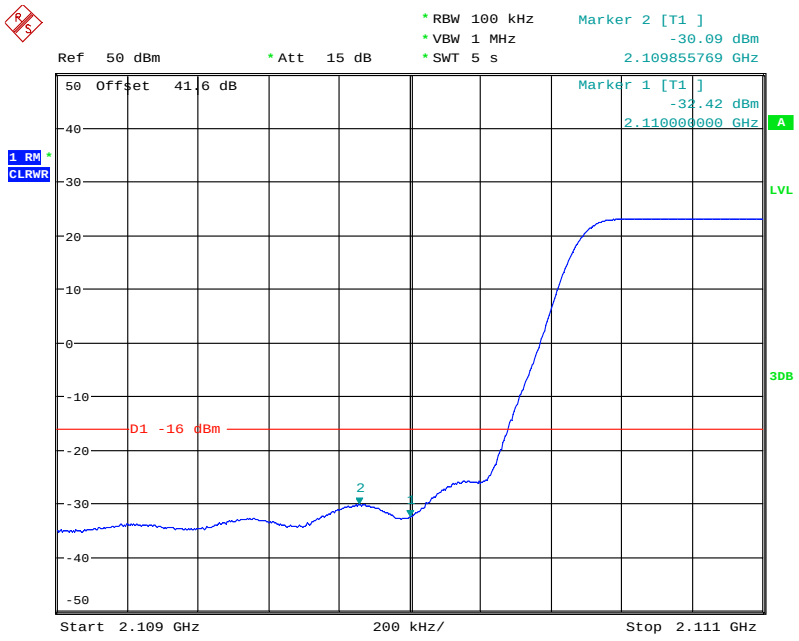


Date: 23.OCT.2013 10:35:45

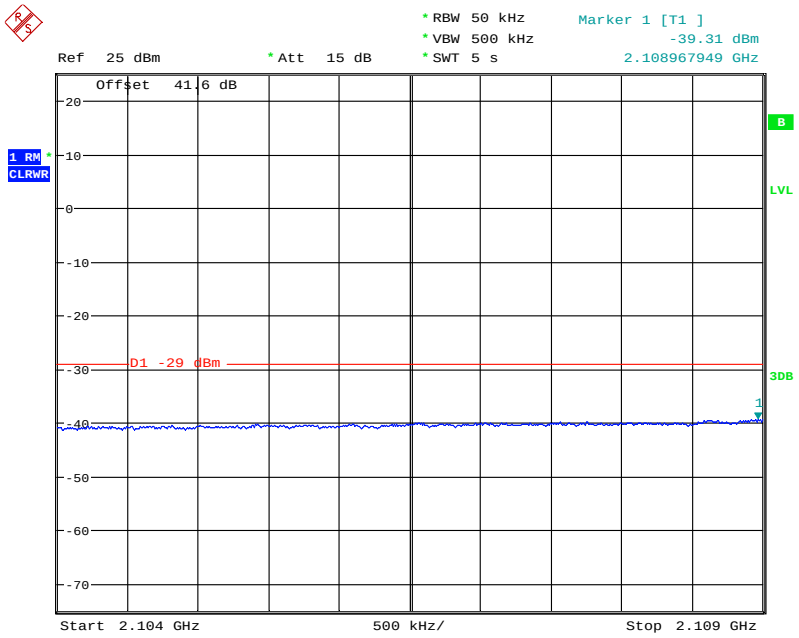
Product Service

10.0MHz Bandwidth

Configuration 1 - Mode 4 - 10



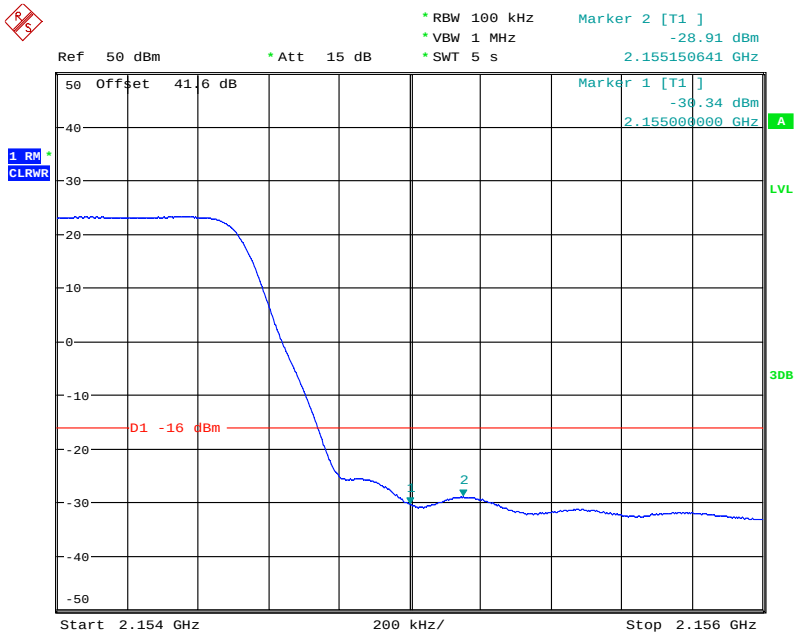
Date: 23.OCT.2013 10:24:11



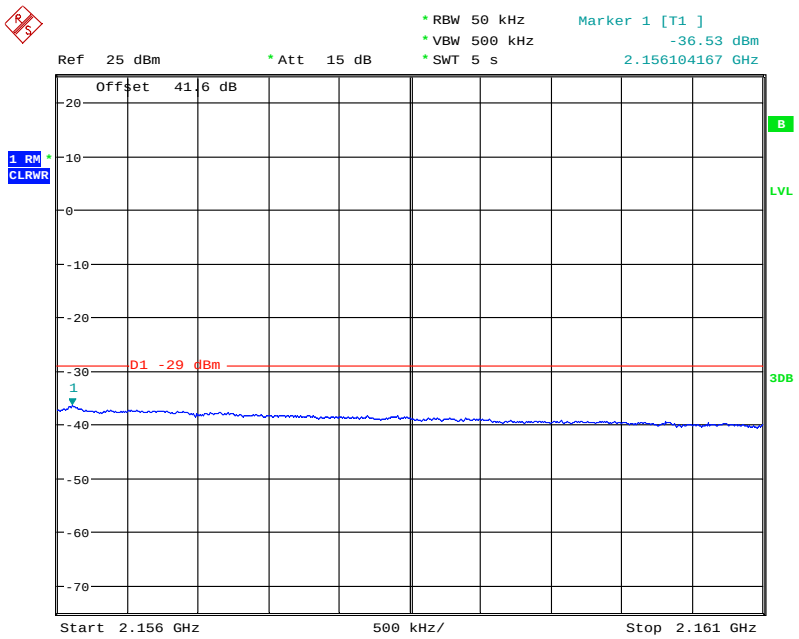
Date: 23.OCT.2013 10:25:21

Product Service

Configuration 1 - Mode 6 - 10



Date: 23.OCT.2013 10:28:12



Date: 23.OCT.2013 10:29:12

Limit

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

2.6 RADIATED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1053
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.6.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.6.3 Date of Test and Modification State

15, 19 and 22 November 2013 – Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within the chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations.

Emissions identified within the range 30MHz – 25GHz were then formally measured using a Peak detector as the worst case.

In the frequency Range 30MHz – 25GHz, the measurement was performed with a resolution bandwidth of 1MHz as the worst case.

The measurements were performed at a 3m distance unless otherwise stated.

The limits for Spurious Emissions have been calculated, as shown below using the following formula:

Field Strength of Carrier - (43 + 10Log (P)) dB

Where:
Field Strength is measured in dBµV/m
P is measured Transmitter Power in Watts

Product Service

Determination of Spurious Emission Limit

As the EUT does not have an integral antenna, the field strength of the carrier has been calculated assuming that the power is to be fed to a half-wave tuned dipoles as per 2.1053 (a).

$E_{(v/m)}=(30 \times G_i \times P_o)^{0.5} / d$

Where G_i is the antenna gain of ideal half-wave dipoles,
P_o is the power out of the transceiver in W,
d is the measurement distance in meter.

Therefore at 3m measurement distance the field strength using the lowest transceiver output power would be:

$E_{(v/m)}=(30 \times 1.64 \times 61.60)^{0.5} / 3 = 18.35V/m = 145.27dB\mu V/m$

As per 22.917(a) the spurious emission must be attenuated by 43 + 10log (P_o) dB this gives:

43 + 10log(61.60) = 60.90dB

Therefore the limit at 3m measurement distance is:

145.27 – 60.90 = 84.4 dBµV/m

This limit has been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

The test was performed with the EUT operating on all modes in section 1.4.3 and record the result of the following configurations and modes of operation for worst case:

Configuration 1 - Mode 1 - 1.4
- Mode 2 (1.4MHz, 3.0MHz, 5.0MHz, 10.0MHz, 15.0MHz, 20.0MHz OBW)
- Mode 3 - 1.4
- Mode 5 - 1.4

2.6.6 Environmental Conditions

	15 November 2013	19 November 2013	22 November 2013
Ambient Temperature	25.5°C	25.0°C	24.5°C
Relative Humidity	38.0%	35.0%	44.0%

Product Service

2.6.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 & Part 27 and Industry Canada RSS-139 for Radiated Spurious Emissions.

The test results are shown below

Note: Only the worst case results plots have been included as other emissions are greater than 20dB below the limit. A set of plots have been included to show the measurement system noise floor.

Single Carrier

E-TM1.1

1.4MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

3.0MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

5.0MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

10.0MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

15.0MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

20.0MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

E-TM3.2

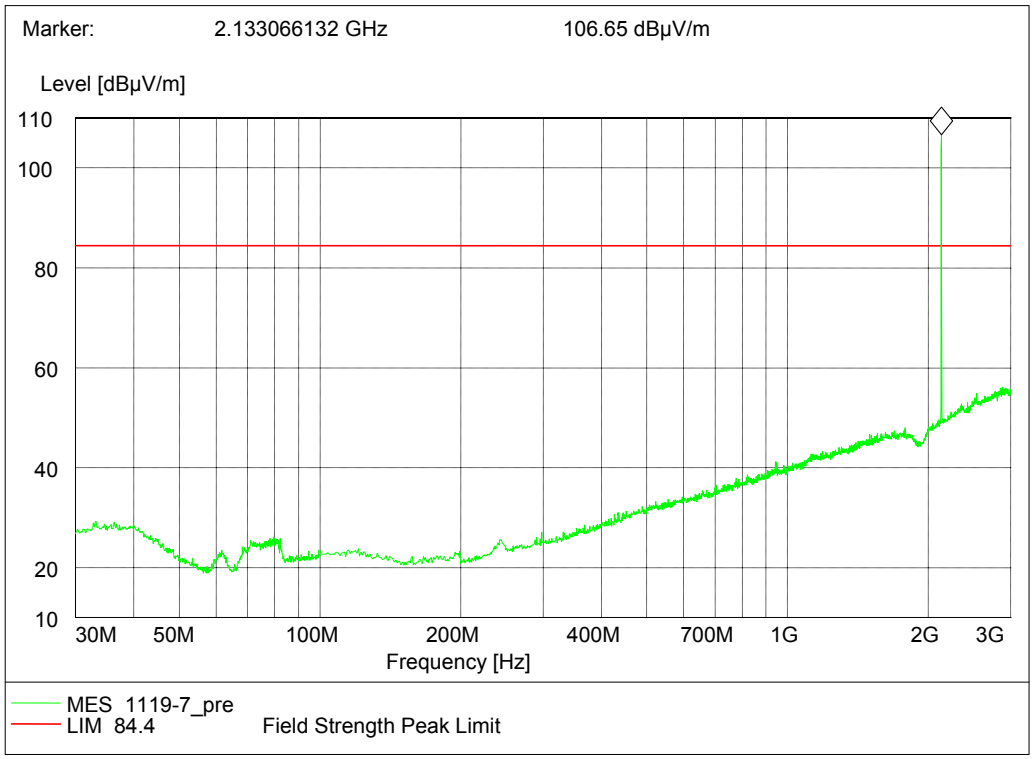
1.4MHz Bandwidth

Configuration 1 - Mode 1

No emissions were detected within 20dB of the limit.

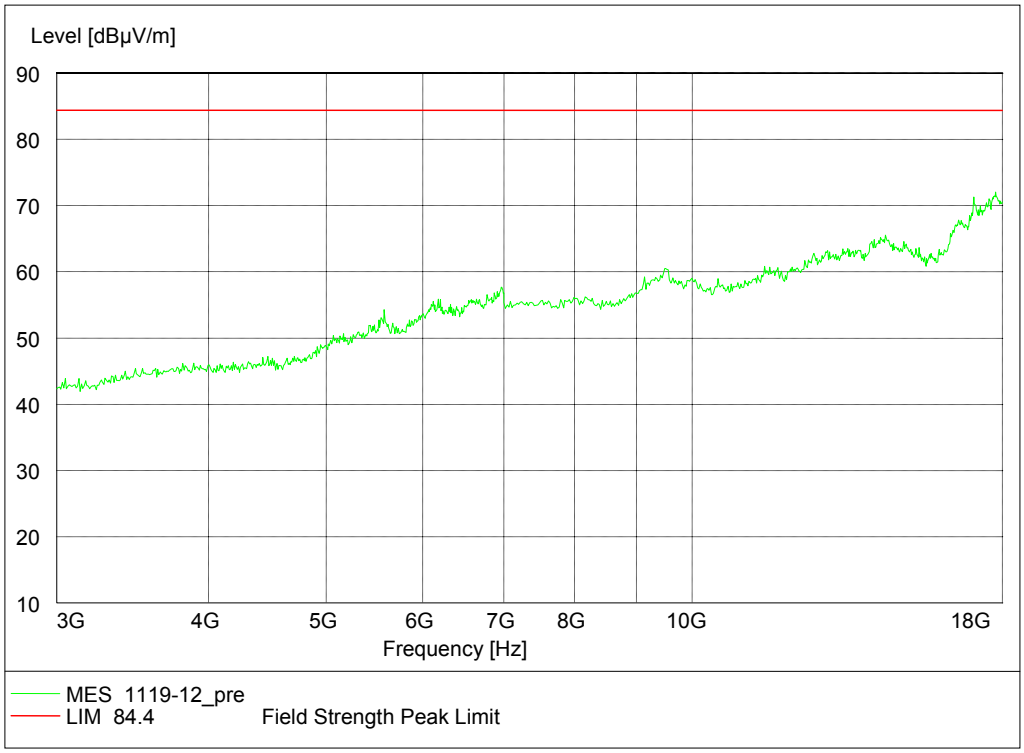
Configuration 1 - Mode 2

30MHz – 1GHz

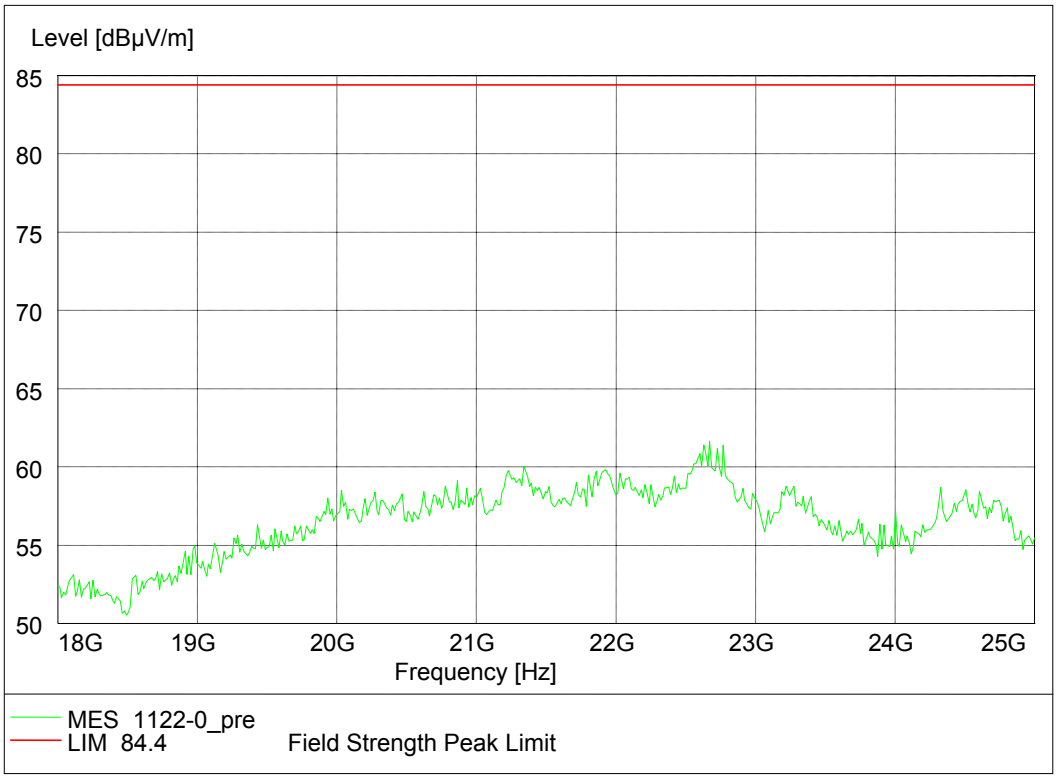


Note: The emission beyond the limit is the operating frequency.

3GHz – 18GHz



18GHz – 25GHz



Configuration 1 - Mode 3

No emissions were detected within 20dB of the limit.

E-TM3.1

1.4MHz Bandwidth

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

Multi Carrier (x2)

E-TM1.1

1.4MHz Bandwidth

Configuration 1 - Mode 5

No emissions were detected within 20dB of the limit.

Limit	-13dBm / 84.4dBµV/m

Remarks

The EUT does not exceed -13dBm / 84.4dBµV/m at the measured frequencies.

2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.7.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.7.3 Date of Test and Modification State

21, 22 and 23 October 2013 – Modification State 0

2.7.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

In accordance with FCC Part 2.1051, the spurious emissions from the antenna terminal were measured. The measurements were performed on the output connector RF A. Limited complementary measurement were done at output connector RF B to verify identical performance for both transmitter chains. The EUT was set to transmit on maximum power. The transmitter output was attenuated using an attenuator and the frequency spectrum investigated from 9kHz to 22GHz. The EUT was tested on Bottom, Middle and Top channels for E-TM1.1 test model, just 1.4MHz and 20MHz bandwidth for single carrier and 1.4MHz and 10MHz bandwidth for multi carrier configurations were selected as the representative modes. The resolution was set to 1MHz for 9kHz to 22GHz thus meeting the requirements of FCC CFR 47 Part 27, Clause 27.53 (h) and Industry Canada RSS-139, Clause 6.5. The spectrum analyser detector was set to peak and trace was kept on Max Hold as worst case in all cases, unless otherwise stated.

The limit was adjusted with a correction of -3dB [10Log(2)] by using the Measure and Add 10Log(N) dB technique according to FCC KDB662911 D01 Multiple Transmitter Output v02r01 accounting for simultaneous transmission from antenna ports RF A and RF B.

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

Measurements were made up to the 10^{th} harmonic of the highest carrier frequency at least.

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

Configuration 1
- Mode 1 - 1.4, Mode 1 - 20
- Mode 2 (1.4MHz, 20.0MHz OBW)
- Mode 3 - 1.4, Mode 3 - 20
- Mode 4 - 1.4, Mode 4 - 10
- Mode 5 - 1.4, Mode 5 - 10
- Mode 6 - 1.4, Mode 6 - 10

2.7.6 Environmental Conditions

	21 October 2013	22 October 2013	23 October 2013
Ambient Temperature	23.0°C	23.0°C	23.5°C
Relative Humidity	30.0%	36.0%	34.0%

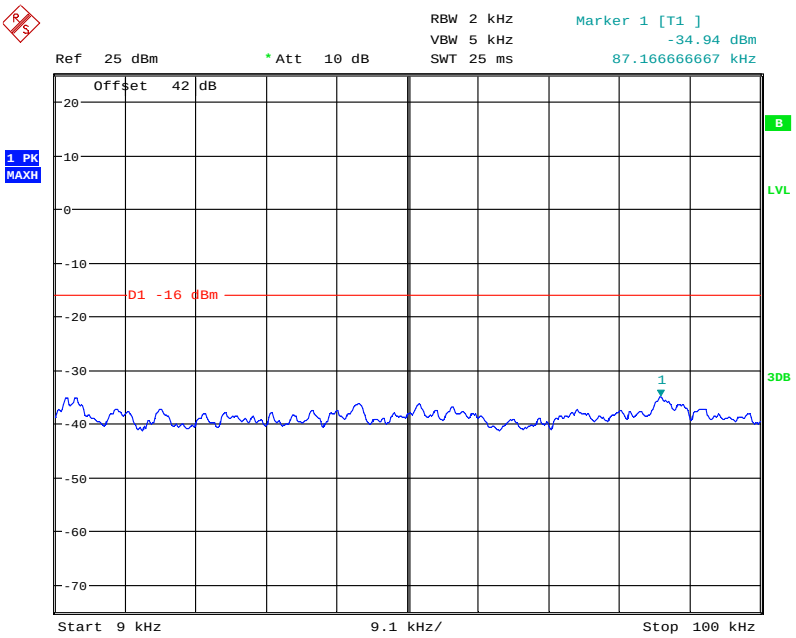
2.7.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139 for Conducted Spurious Emissions.

The test results are shown below

Remark:

The emissions at 9kHz on the plots was not generated by the test object. A complementary measruement with a smaller Span showed that it was related to the LO feedthrough.



Date: 21.OCT.2013 08:13:06

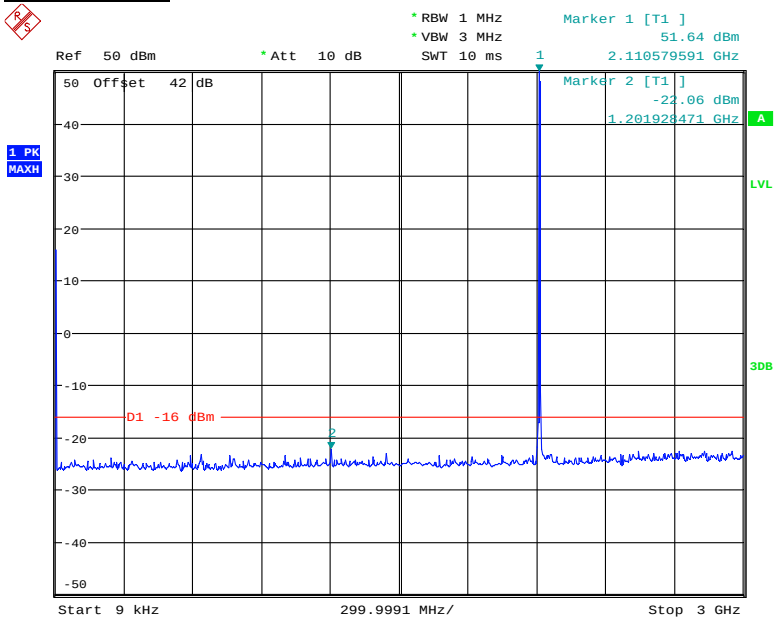
Product Service

Single Carrier

E-TM1.1 - 1.4MHz Bandwidth

Configuration 1 - Mode 1 - 1.4

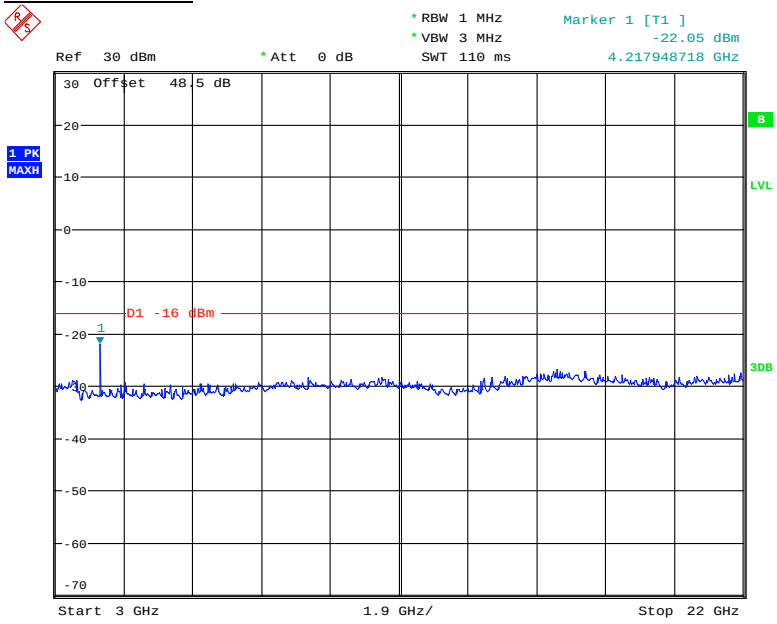
9kHz to 3GHz



Date: 23.OCT.2013 16:46:13

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

3GHz to 22GHz

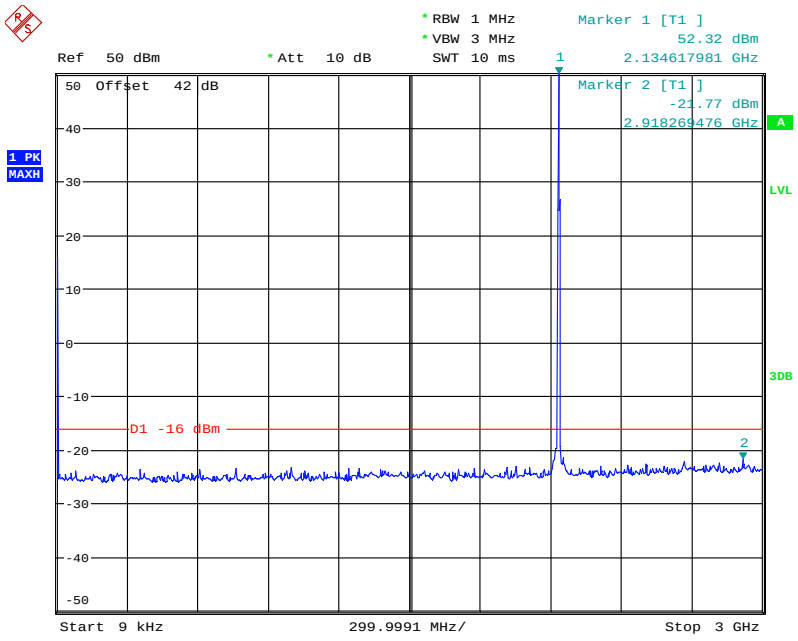


Date: 22.OCT.2013 14:30:55

Product Service

Configuration 1 - Mode 2 - 1.4

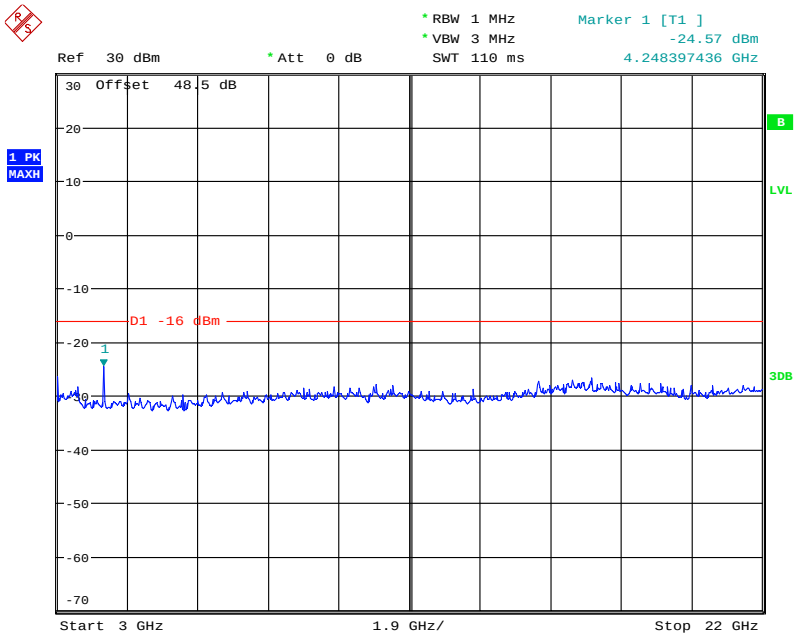
9kHz to 3GHz



Date: 23.OCT.2013 15:46:11

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

3GHz to 22GHz

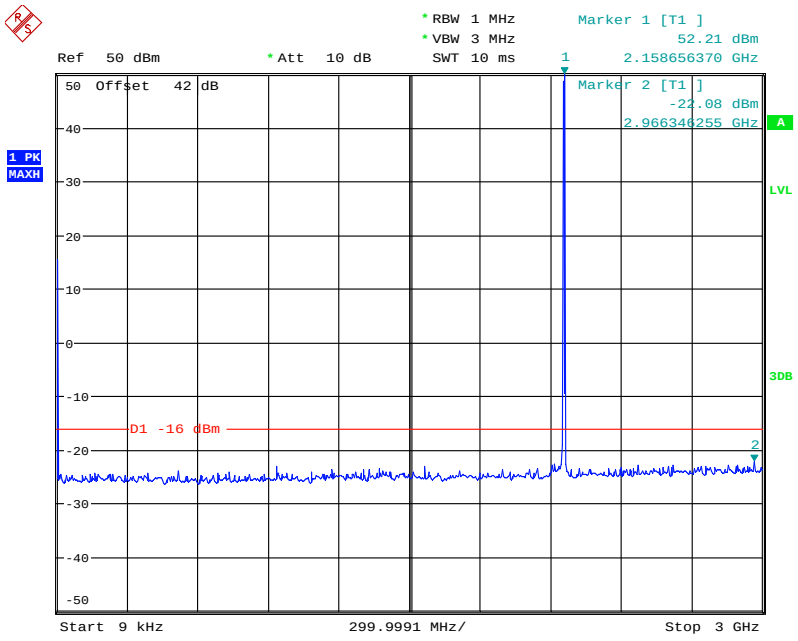


Date: 21.OCT.2013 08:24:05

Product Service

Configuration 1 - Mode 3 - 1.4

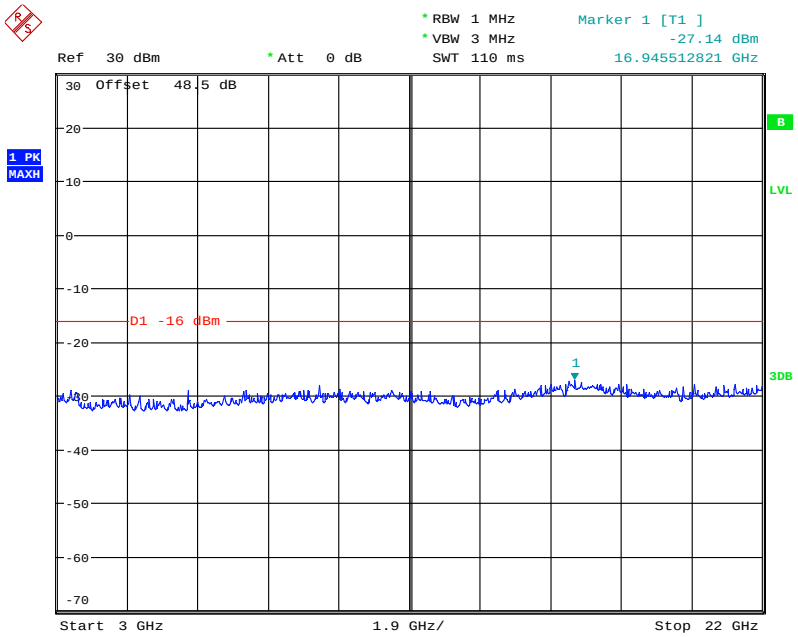
9kHz to 3GHz



Date: 23.OCT.2013 16:47:52

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

3GHz to 22GHz

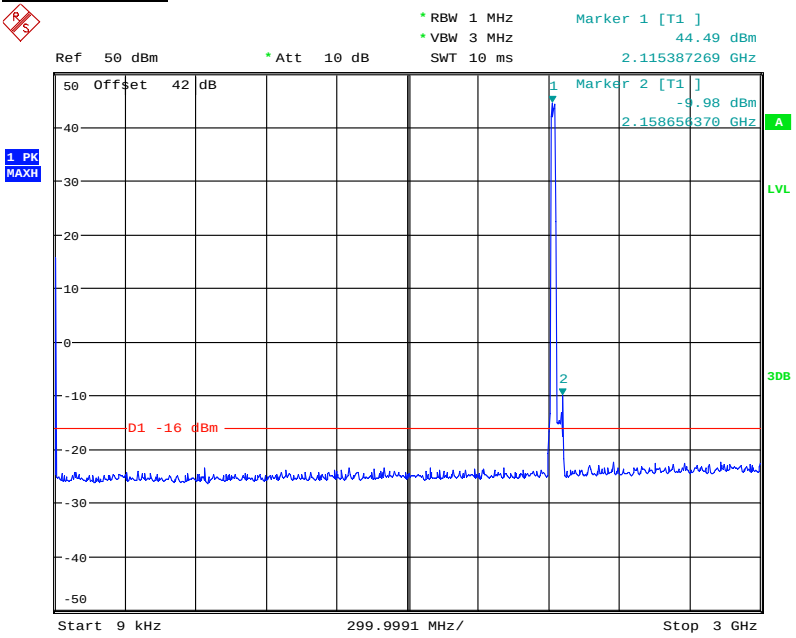


Date: 22.OCT.2013 14:32:44

E-TM1.1 - 20MHz Bandwidth

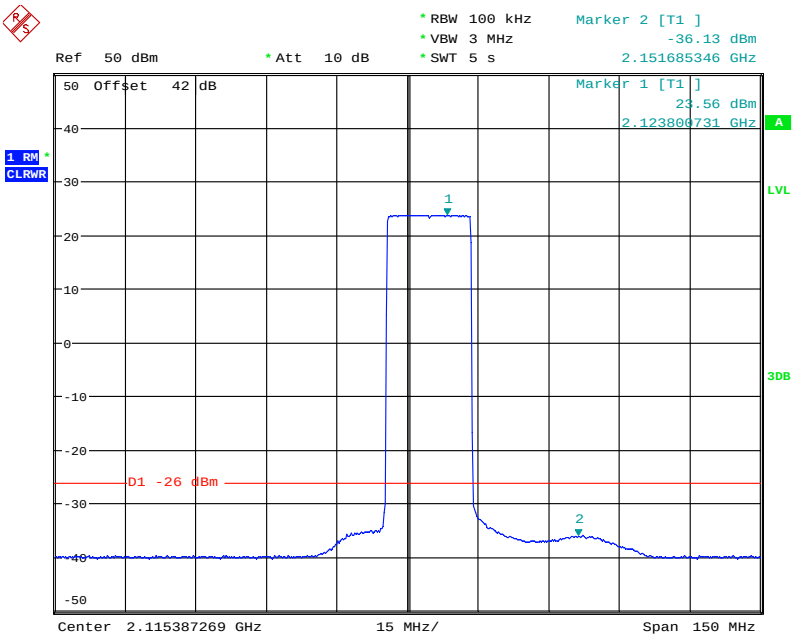
Configuration 1 - Mode 1 - 20

9kHz to 3GHz



Date: 23.OCT.2013 16:49:50

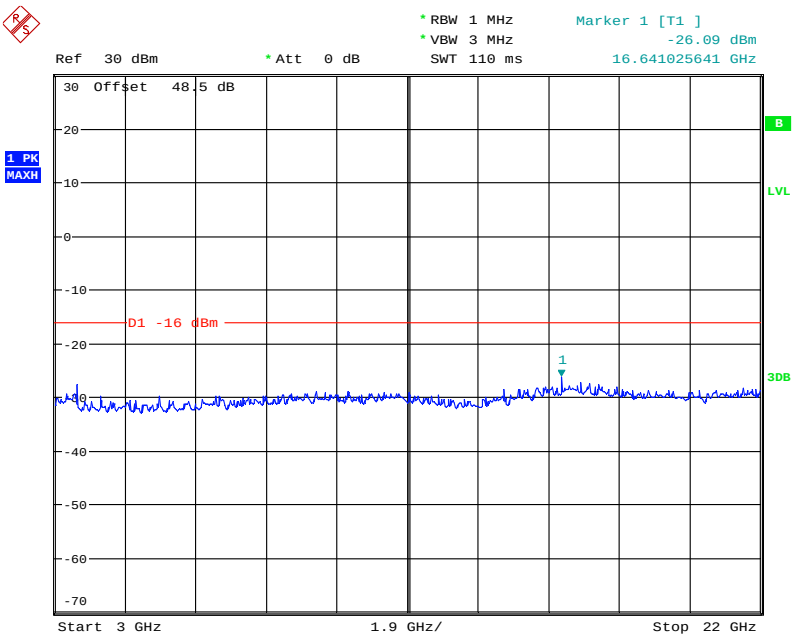
Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot below.



Date: 23.OCT.2013 16:51:34

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth. Marker 1 indicates the Fundamental transmission. Marker 2 indicates the greatest emission in exception to the Fundamental transmission.

3GHz to 22GHz

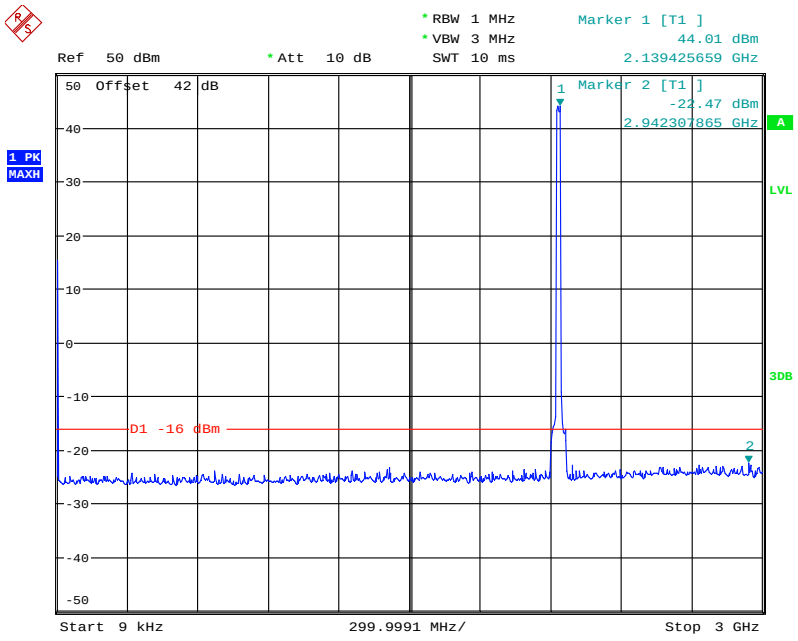


Date: 22.OCT.2013 14:06:49

Product Service

Configuration 1 - Mode 2 - 20

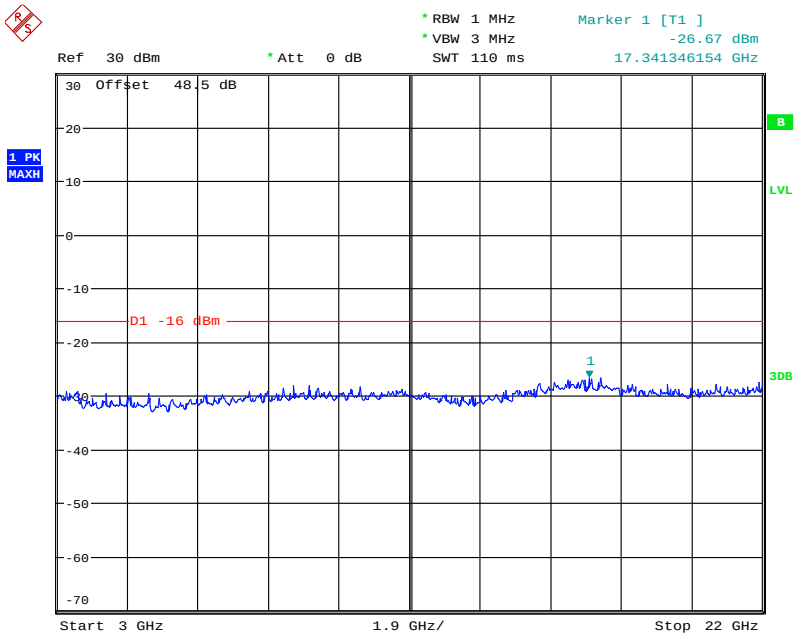
9kHz to 3GHz



Date: 23.OCT.2013 16:18:06

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

3GHz to 22GHz

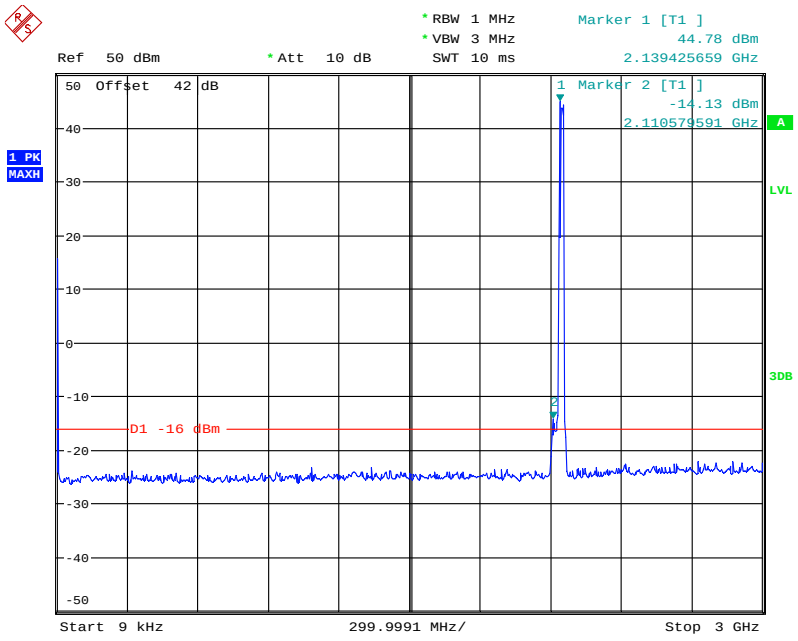


Date: 21.OCT.2013 08:57:34

Product Service

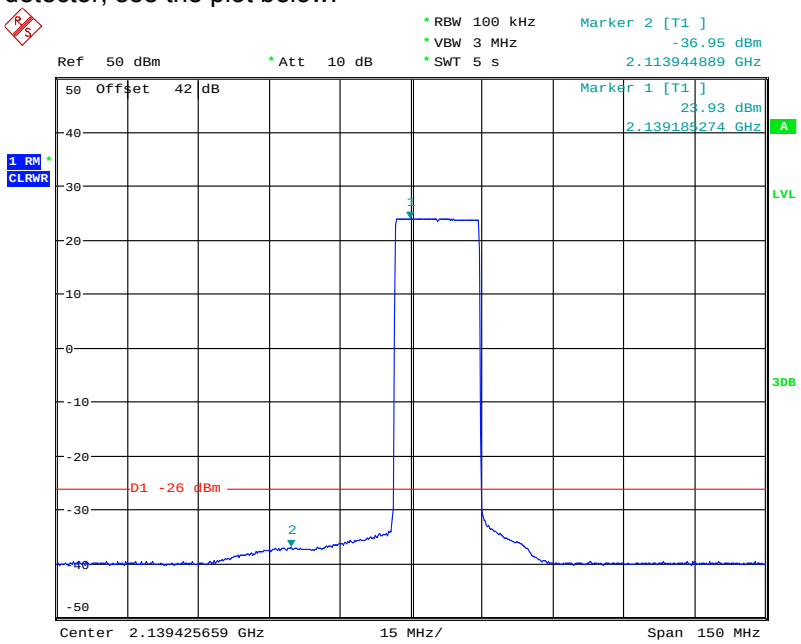
Configuration 1 - Mode 3 - 20

9kHz to 3GHz



Date: 23.OCT.2013 16:53:33

Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot below.

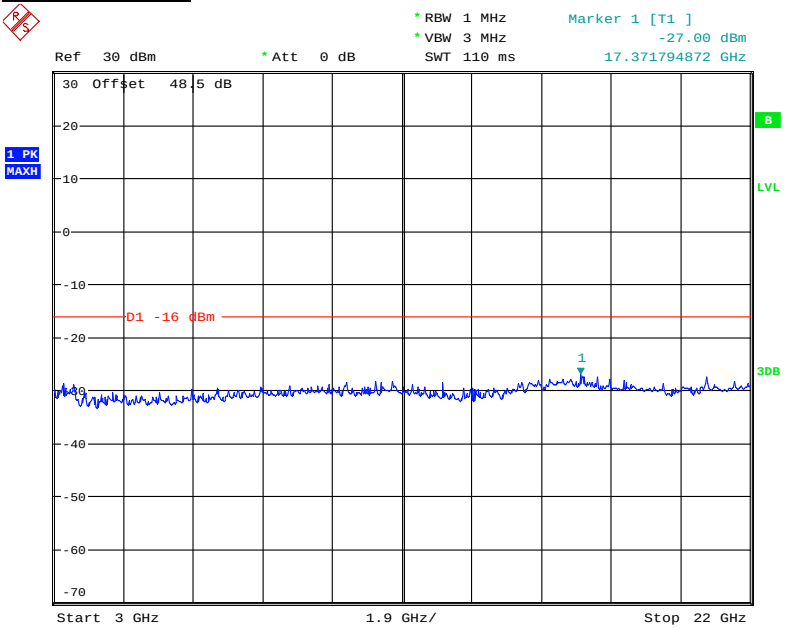


Date: 23.OCT.2013 16:54:36

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth.

Product Service

3GHz to 22GHz



Date: 22.OCT.2013 14:03:53

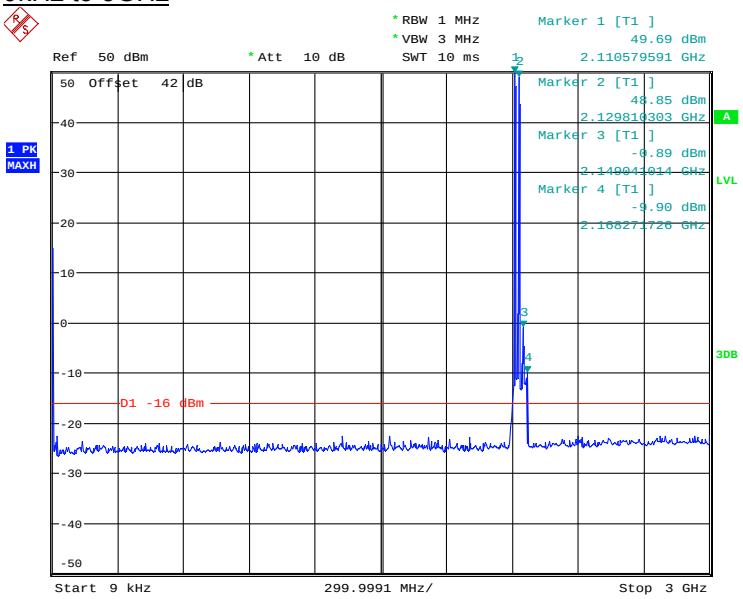
Product Service

Multi Carrier (x2)

E-TM1.1 - 1.4MHz Bandwidth

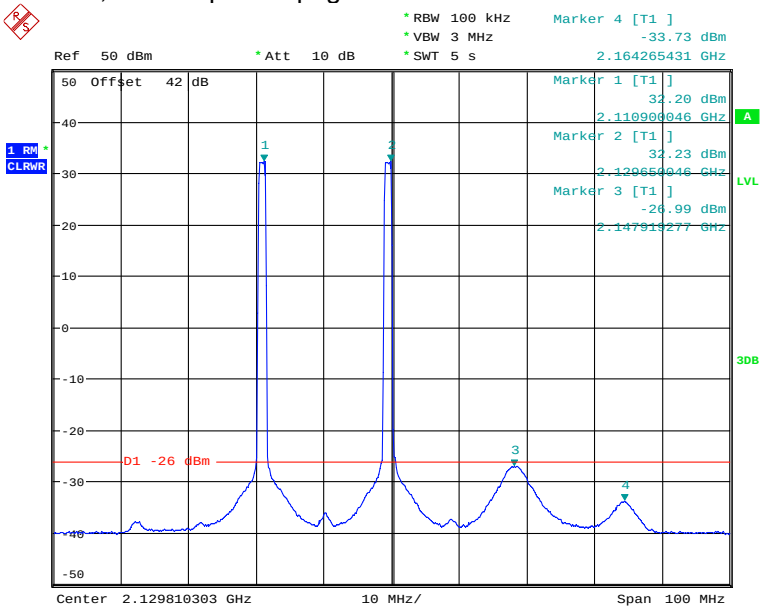
Configuration 1 - Mode 4 - 1.4

9kHz to 3GHz



Date: 23.OCT.2013 14:45:09

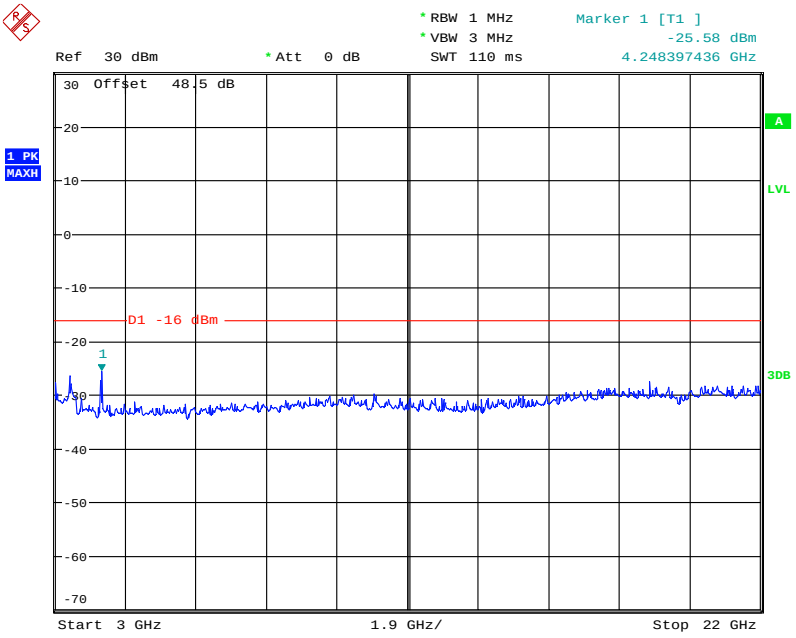
Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot on page 92 of 109.



Date: 23.OCT.2013 14:47:20

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth.

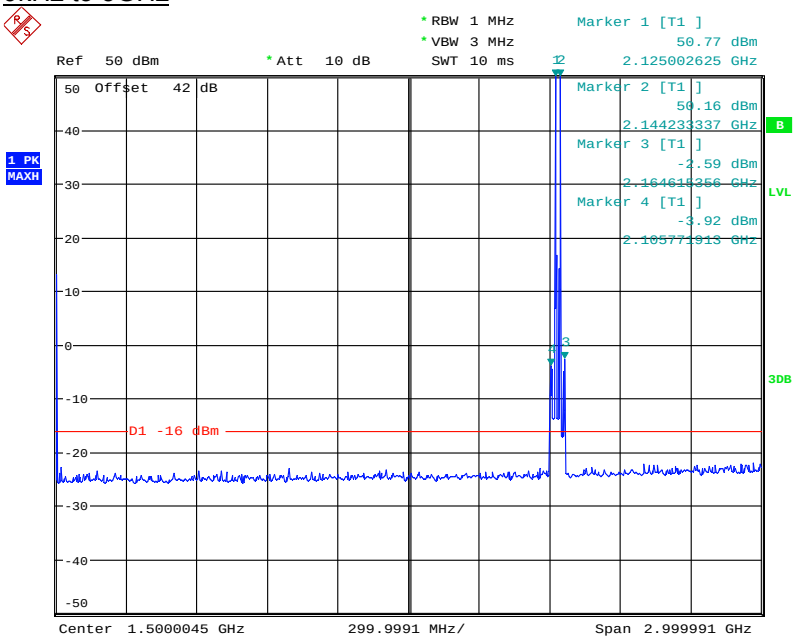
3GHz to 22GHz



Date: 23.OCT.2013 14:48:24

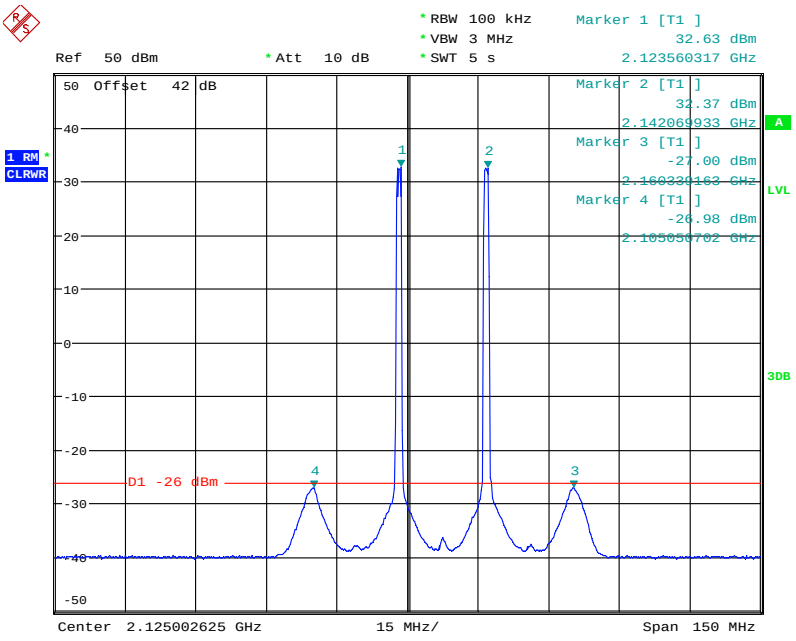
Configuration 1 - Mode 5 - 1.4

9kHz to 3GHz



Date: 23.OCT.2013 11:37:29

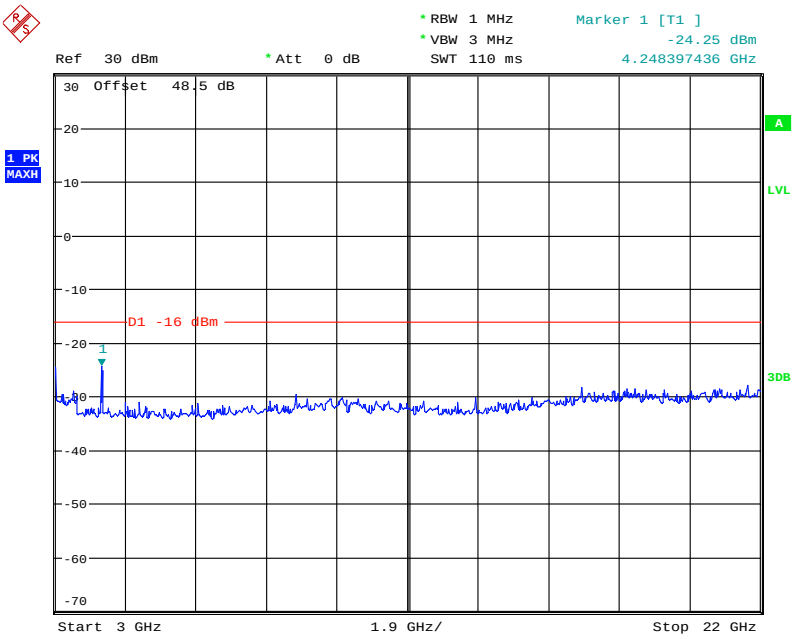
Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot below.



Date: 23.OCT.2013 11:43:06

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth.

3GHz to 22GHz

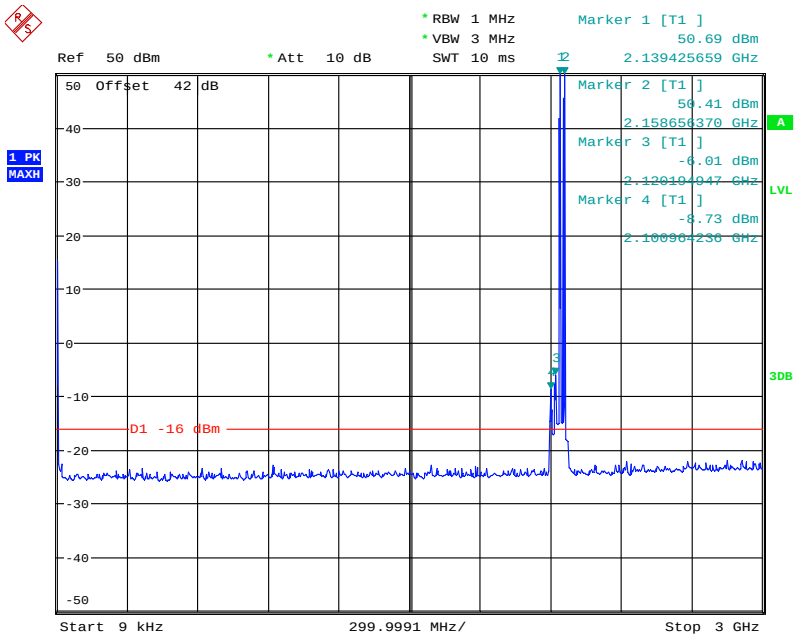


Date: 23.OCT.2013 11:45:34

Product Service

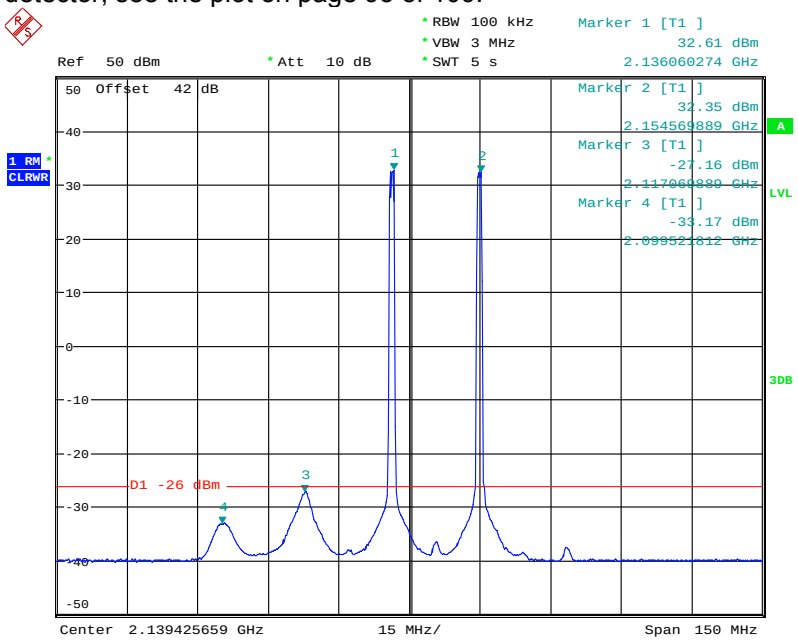
Configuration 1 - Mode 6 - 1.4

9kHz to 3GHz



Date: 23.OCT.2013 14:56:50

Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot on page 95 of 109.

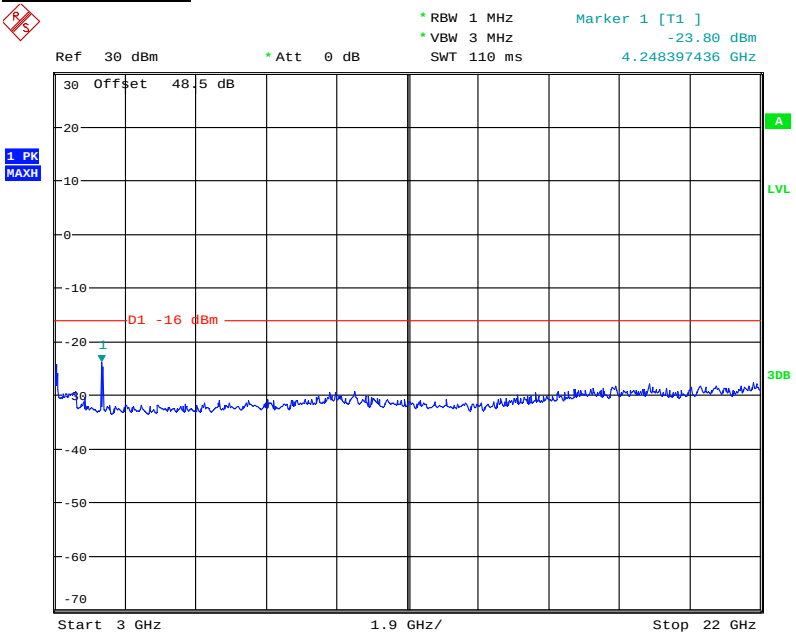


Date: 23.OCT.2013 14:58:23

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth.

Product Service

3GHz to 22GHz



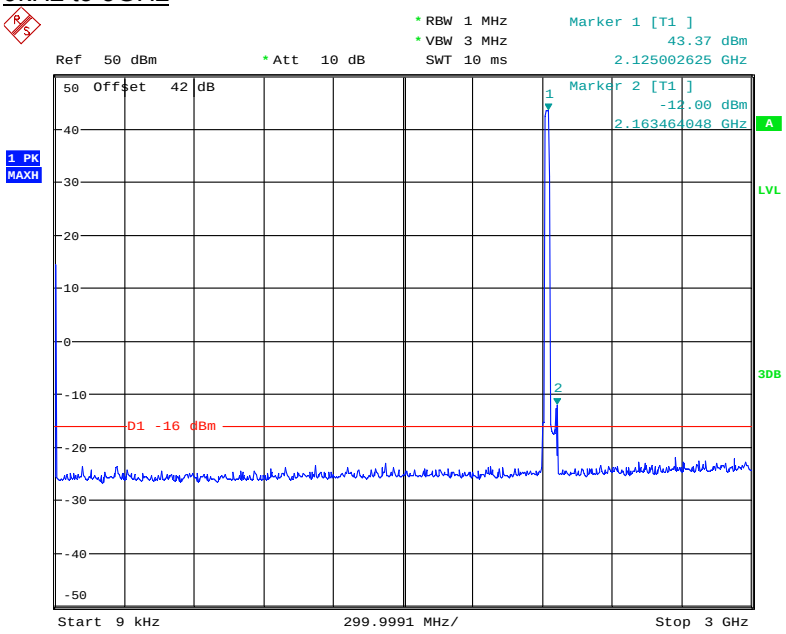
Date: 23.OCT.2013 14:53:26

Product Service

E-TM1.1 - 10MHz Bandwidth

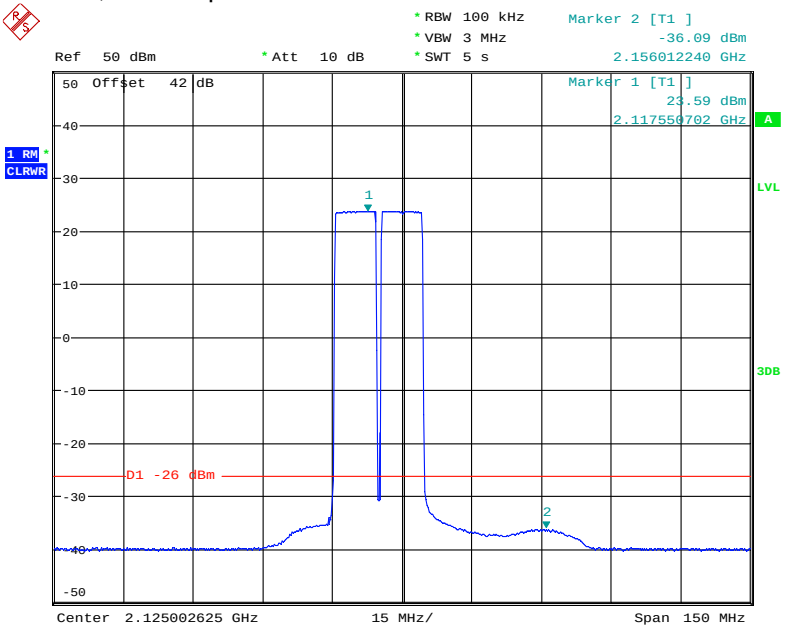
Configuration 1 - Mode 4 – 10

9kHz to 3GHz



Date: 23.OCT.2013 14:06:24

Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot below.

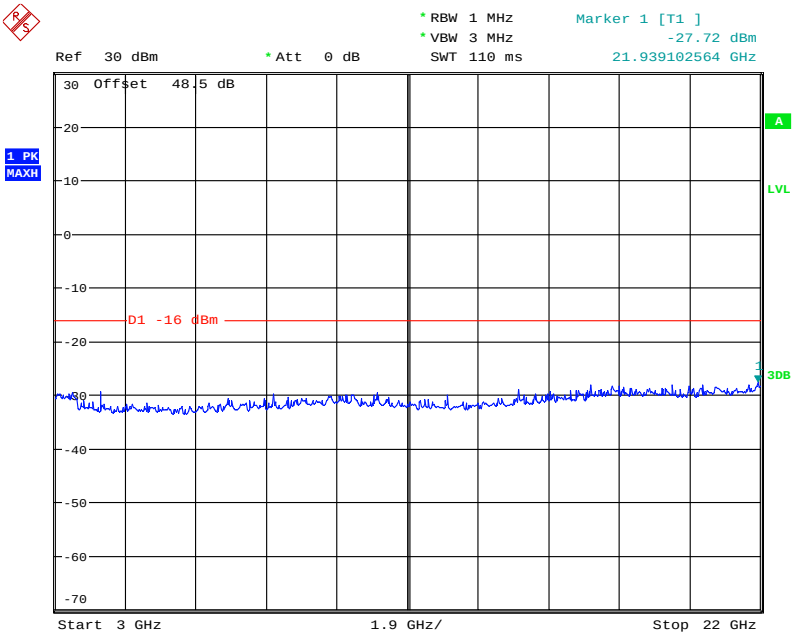


Date: 23.OCT.2013 14:10:53

Note: The limit has been reduced by 10dB to account for the reduction in measurement bandwidth.

Product Service

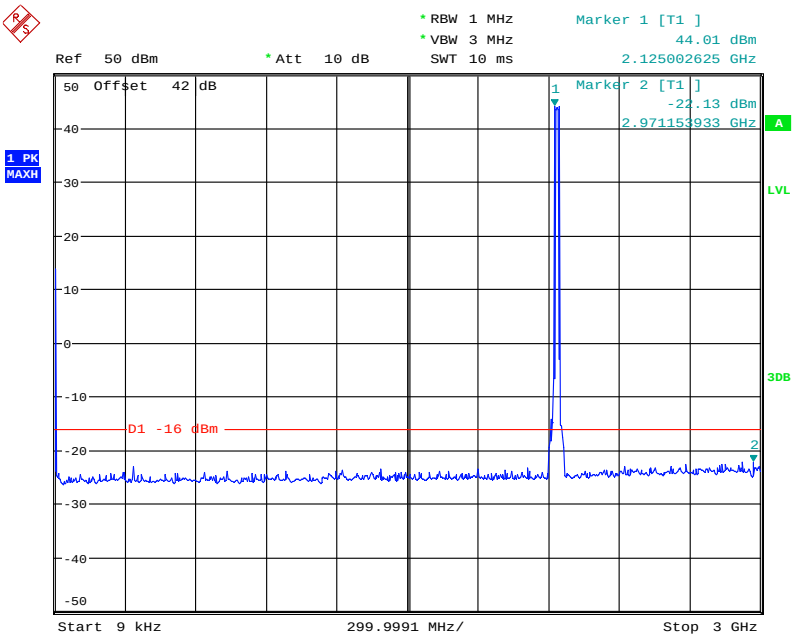
3GHz to 22GHz



Date: 23.OCT.2013 13:58:40

Configuration 1 - Mode 5 - 10

9kHz to 3GHz

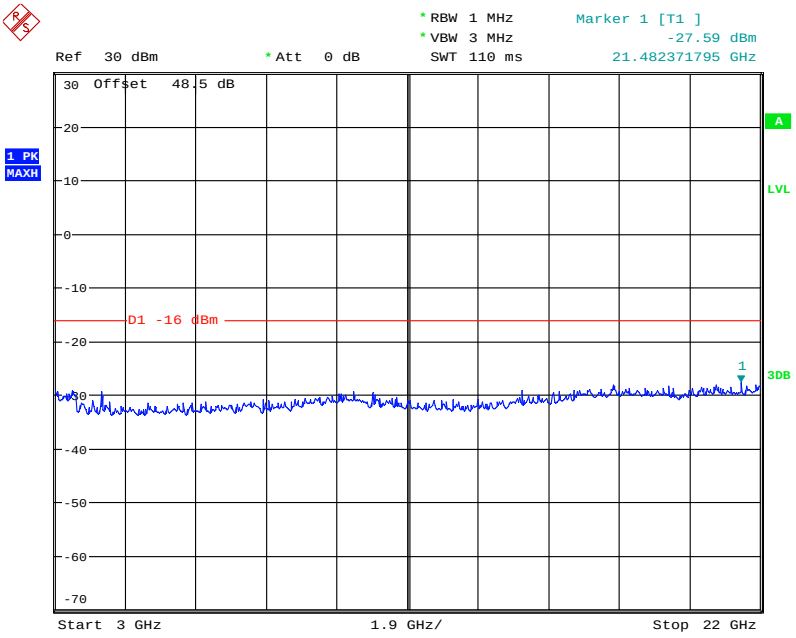


Date: 23.OCT.2013 13:28:08

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

Product Service

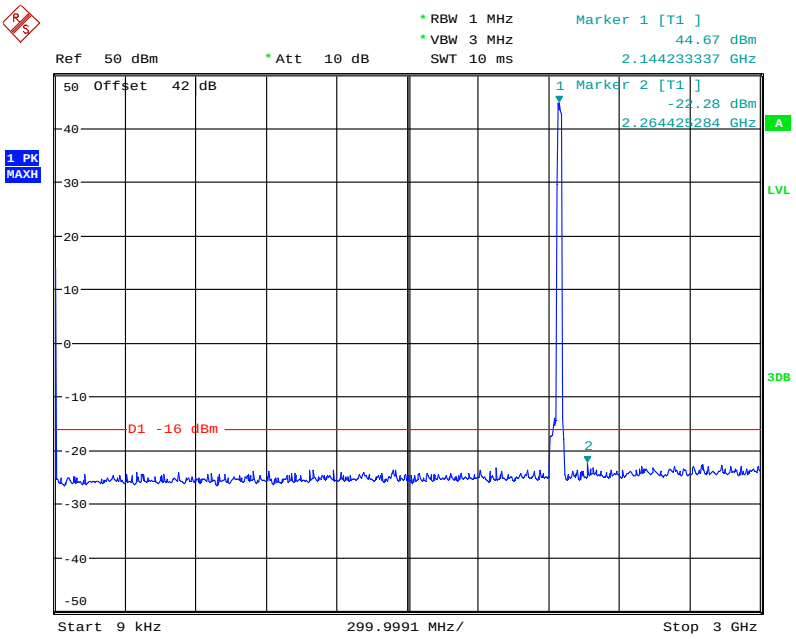
3GHz to 22GHz



Date: 23.OCT.2013 13:29:20

Configuration 1 - Mode 6 - 10

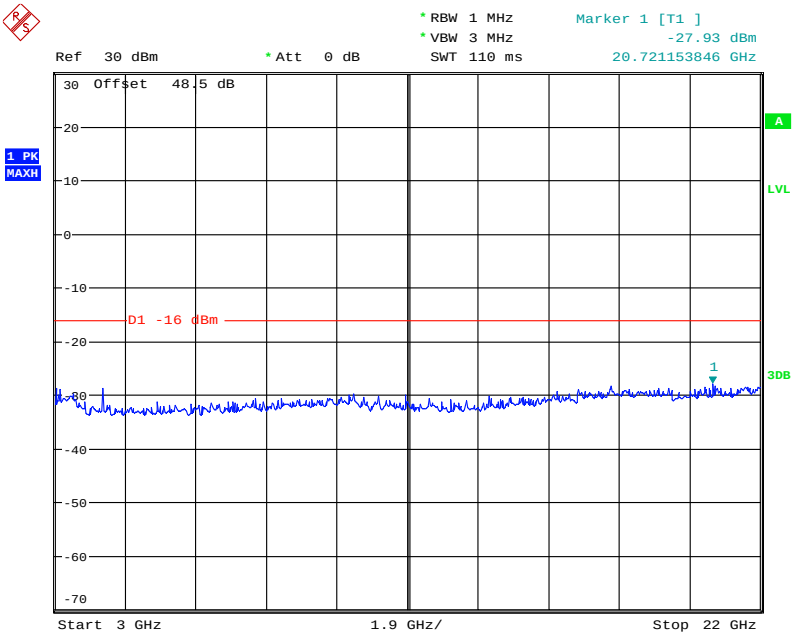
9kHz to 3GHz



Date: 23.OCT.2013 13:52:52

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

3GHz to 22GHz



Date: 23.OCT.2013 13:50:00

Limit

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

Remarks

The EUT does not exceed -16dBm at the frequency range of 9kHz to 22GHz.

Product Service

2.8 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.8.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 27, Clause 27.54
Industry Canada RSS-139, Clause 6.3

2.8.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.8.3 Date of Test and Modification State

9, 10 and 11 December 2013 – Modification State 0

2.8.4 Test Equipment Used

The major items of test equipment used for the below 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 27 and Industry Canada RSS-139.

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

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

Configuration 1 - Mode 2 (3.0MHz OBW)

2.8.6 Environmental Conditions

	9 December 2013	10 December 2013	11 December 2013
Ambient Temperature	24.5°C	24.5°C	24.5°C
Relative Humidity	46.0%	46.0%	48.0%

Product Service

2.8.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139 for Frequency Stability Under Temperature Variations.

The test results are shown below

Power Supply: -48V DC

Single Carrier

E-TM1.1 - 3.0MHz

Configuration 1 - Mode 2

Temperature Interval (ºC)	Deviation (Hz)
-30	-14.17
-20	-13.58
-10	-15.90
0	-13.03
+10	-13.56
+20	**-12.52**
+30	-13.91
+40	-14.31
+50	-12.96

Limit	± (0.05 ppm + 12 Hz) or ± 118.62 Hz*

Remarks

* Limit according to 3GPP TS 36.141 V11.4.0.

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

2.9 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

2.9.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 27, Clause 27.54
Industry Canada RSS-139, Clause 6.3

2.9.2 Equipment Under Test

RRUS 11 B4 / KRC 161 254/2, S/N: CF81442849

2.9.3 Date of Test and Modification State

10 December 2013 – Modification State 0

2.9.4 Test Equipment Used

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

2.9.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139.

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 configuration and mode of operation:

Configuration 1 - Mode 2 (3.0MHz OBW)

2.9.6 Environmental Conditions

	10 December 2013
Ambient Temperature	24.5°C
Relative Humidity	46.0%

Product Service

2.9.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Part 27 and Industry Canada RSS-139 for Frequency Stability Under Voltage Variations.

The test results are shown below

Temperature: 20°C

Single Carrier

E-TM1.1 - 3.0MHz

Configuration 1 - Mode 2

DC Voltage (V)	Deviation (Hz)
-40.8	-14.73
-48.0	**-12.52**
-55.2	-12.42

Limit	± (0.05 ppm + 12 Hz) or ± 118.62 Hz*

Remarks

* Limit according to 3GPP TS 36.141 V11.4.0.

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

Product Service

3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.1, 2.2, 2.3, 2.4, 2.5, 2.7 – Maximum Conducted Output Power, Peak – Average Ratio, Modulation Characteristics, Occupied Bandwidth, Spurious Emissions at Antenna Terminals (±1MHz), Conducted Spurious Emissions.					
Spectrum Analyser	Rohde & Schwarz	FSQ26	100253	12	04-Aug-2014
Power Meter	Rohde & Schwarz	NRP2	101593	12	04-Aug-2014
Power Sensor	Rohde & Schwarz	NRP-Z51	102123	12	04-Aug-2014
Network Analyzer	Agilent	8720D	US36140166	12	26-Sep-2014
40dB Attenuator	Aeroflex / Weinschel	48-40-43-LIM	BR5020	-	O/P MON
Pass Filter	K&L	ULK 904 098/2	16	-	O/P MON
Load	Shanghai Huaxiang	TF100	09121648	-	O/P MON
Power Supply	Dahua	DH1716-5D	2008040041	-	O/P MON
Power Supply	Dahua	DH1716-5D	2008040050	-	O/P MON
Digital Multimeter	FLUKE	179	91820401	12	24-Dec-2014
Thermo-hygrometer	AZ Instruments	8705	9151665	12	12-Dec-2014
Digital Multimeter	FLUKE	179	91820401	12	24-Dec-2014
Thermo-hygrometer	AZ Instruments	8705	9151665	12	12-Dec-2014
Section 2.6 – Radiated Spurious Emissions					
Load	Shanghai Huaxiang	TF100	09121648	-	O/P MON
Load	Shanghai Huaxiang	TF100	09121605	-	O/P MON
EMI Receiver	Rohde & Schwarz	ESI 40	100015	12	19-Aug-2014
Ultra log test antenna	Rohde & Schwarz	HL562	100167	12	19-Aug-2014
Double-Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF 906	100029	12	19-Aug-2014
Pyramidal Horn Antenna	EMCO	3160-09	-	-	-
Antenna master	Frankonia	MA 260	-	12	19-Aug-2014
Relay Switch Unit	Rohde & Schwarz	331.1601.31	338965002	-	TU
Semi Anechoic Chamber	Frankonia	23.18m×16.88 m×9.60m	-	12	19-Aug-2014
Power Supply	Dahua	DH1716-5D	2008040041	-	O/P MON
Power Supply	Dahua	DH1716-5D	2008040050	-	O/P MON
Digital Multimeter	FLUKE	179	91820401	12	24-Dec-2014
Thermo-hygrometer	AZ Instruments	8705	9151665	12	12-Dec-2014

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.8 and 2.9 – Frequency Stability Under Temperature and Voltage Variations					
Spectrum Analyser	Rohde & Schwarz	FSQ26	100253	12	04-Aug-2014
40dB Attenuator	Aeroflex / Weinschel	48-40-43-LIM	BR5020	-	O/P MON
Temperature Chamber	ZUNDAR	ZT1000	10080064	-	O/P MON
Power Supply	Dahua	DH1716-5D	2008040041	-	O/P MON
Power Supply	Dahua	DH1716-5D	2008040050	-	O/P MON
Digital Multimeter	FLUKE	179	91820401	12	24-Dec-2014
Thermo-hygrometer	AZ Instruments	8705	9151665	12	12-Dec-2014

O/P MON Output monitored with calibration equipment
TU Traceability Unscheduled

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
Conducted RF Output Power	30MHz to 10GHz Amplitude	0.5dB*
Conducted Emissions	30MHz to 40GHz Amplitude	3.0dB*
Frequency Stability		$<1x10^{-7}$
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
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

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 (Not UKAS Accredited).