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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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IC ID: 287AB-BS1612542

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February 2014



Product Service

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Ericsson RRUS 11 B4 / KRC 161 254/2

Document 75924767 Report 02 Issue1

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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



0141



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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 WCDMA 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
Product Number	KRC 161 254/2
IC Model Number	BS1612542
Serial Number(s)	CF81442849
WCDMA Software	CXP9021719 Rev R1CB18
PIS Software	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	24 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: 2012 Industry Canada RSS-GEN Issue 3: 2010 Industry Canada SRSP513 Issue 2: 2009



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	2112.4MHz		N/A	No integral antenna.
				2132.4MHz		N/A	
				2152.6MHz		N/A	
				2112.4MHz + 2127.4MHz		N/A	
				2124.8MHz + 2139.8MHz		N/A	
				2137.6MHz + 2152.6MHz		N/A	
				2112.4MHz + 2117.4MHz + 2122.4MHz + 2127.4MHz		N/A	
				2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz		N/A	
2137.6MHz + 2142.6MHz + 2147.6MHz + 2152.6MHz		N/A					
2.1	2.1046, 27.50 (d)	6.4	RF Output Power - Conducted	2112.4MHz	0	Pass	-
				2132.4MHz	0	Pass	
				2152.6MHz	0	Pass	
				2112.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2139.8MHz	0	Pass	
				2137.6MHz + 2152.6MHz	0	Pass	
				2112.4MHz + 2117.4MHz + 2122.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz	0	Pass	
2137.6MHz + 2142.6MHz + 2147.6MHz + 2152.6MHz	0	Pass					
2.2	27.50 (i)	6.4	Peak – Average Ratio	2112.4MHz	0	Pass	-
				2132.4MHz	0	Pass	
				2152.6MHz	0	Pass	
				2112.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2139.8MHz	0	Pass	
				2137.6MHz + 2152.6MHz	0	Pass	
				2112.4MHz + 2117.4MHz + 2122.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz	0	Pass	
2137.6MHz + 2142.6MHz + 2147.6MHz + 2152.6MHz	0	Pass					



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					
2.3	-	6.2	Modulation Characteristics	2132.4MHz	0	Pass	-
2.4	2.1049, 27.53 (h)	RSS-Gen 4.6.1	Occupied Bandwidth	2112.4MHz	0	Pass	-
				2132.4MHz	0	Pass	
				2152.6MHz	0	Pass	
				2112.4MHz + 2127.4MHz		N/A	
				2124.8MHz + 2139.8MHz		N/A	
				2137.6MHz + 2152.6MHz		N/A	
				2112.4MHz + 2117.4MHz + 2122.4MHz + 2127.4MHz		N/A	
				2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz		N/A	
2.5	2.1051, 27.53 (h)	6.5	Spurious Emissions at Antenna Terminals (±1MHz)	2112.4MHz	0	Pass	-
				2132.4MHz		N/A	
				2152.6MHz	0	Pass	
				2112.4MHz + 2117.4MHz	0	Pass	
				2124.8MHz + 2139.8MHz		N/A	
				2147.6MHz + 2152.6MHz	0	Pass	
2.6	2.1053, 27.53 (h)	6.5	Radiated Spurious Emissions	2132.4MHz	0	Pass	-
				2112.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2139.8MHz	0	Pass	
				2137.6MHz + 2152.6MHz	0	Pass	
				2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz	0	Pass	
2.7	2.1051, 27.53 (h)	6.5	Conducted Spurious Emissions	2112.4MHz	0	Pass	-
				2132.4MHz	0	Pass	
				2152.6MHz	0	Pass	
				2112.4MHz + 2127.4MHz	0	Pass	
				2124.8MHz + 2139.8MHz	0	Pass	
				2137.6MHz + 2152.6MHz	0	Pass	
2.8	2.1055, 27.54	6.3	Frequency Stability Under Temperature Variations	2132.4MHz	0	Pass	-
2.9	2.1055, 27.54	6.3	Frequency Stability Under Voltage Variations	2132.4MHz	0	Pass	-

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
PRODUCT NUMBER	KRC 161 254/2
IC Model Number	BS1612542
SERIAL NUMBER(s)	CF81442849
HARDWARE VERSION	R2B
WCDMA SOFTWARE	CXP9021719 Rev R1CB18
PIS SOFTWARE	CXP9017316/1 Rev R39UL
TRANSMITTER OPERATING RANGE	TX: 2110MHz - 2155MHz RX: 1710MHz - 1755MHz
MODULATIONS	QPSK, 16QAM, 64QAM
NUMBER OF CARRIERS	Maximum 4 carriers
ITU DESIGNATION OF EMISSION	5M00F9W
OUTPUT POWER (RMS) (W or dBm)	Single Carrier: 1 x 46.0dBm per port (1 x 40W per port) Multi Carrier (x 2): 2 x 43.0dBm per port (2 x 20W per port) Multi Carrier (x 4): 4 x 40.0dBm per port (4 x 10W per port)
OUTPUT POWER TOLERANCE	± 2.0dB
INSTANTANEOUS BANDWIDTH	20MHz
CHANNEL BANDWIDTH	4.2 MHz to 5MHz (configurable in steps of 100/200kHz)
ANTENNA	No dedicated antenna, handled during licensing
NUMBER OF ANTENNA PORTS	2 TX/RX ports
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 WCDMA Base Station.

Signature

Date

15 November 2013

D of B S Serial No

75924767/02

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 provides communication connections to WCDMA network. 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



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 TM1, TM5 and TM6 at 2100MHz defined in 3GPP TS 25.141. Test Model 1 (TM1) uses the QPSK modulation only, Test Model 5 (TM5) includes 16QAM modulation and Test Model 6 (TM6) includes 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. RX testing was performed on the antenna connector RF B of the EUT.

The settings below were found to be representative for all modes when several settings with the different modulations and different number of carriers were tested to find the worst case setting. The settings were used for all measurements if not otherwise noted:

Single carrier:

Test Model 1 (TM1): 64 DPCHs at 30 ksps (SF=128)

Multi carrier (1x2):

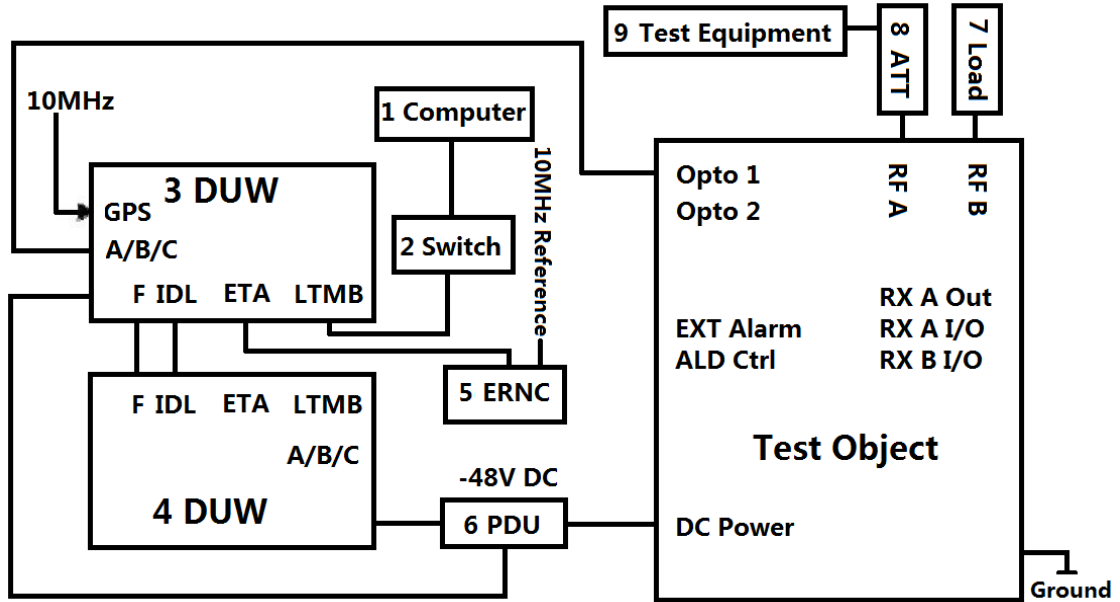
Test model 1 (TM1): 32 DPCHs at 30 ksps (SF=128)

Channel bandwidth 5MHz

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



Test Setup, Conducted Measurement:

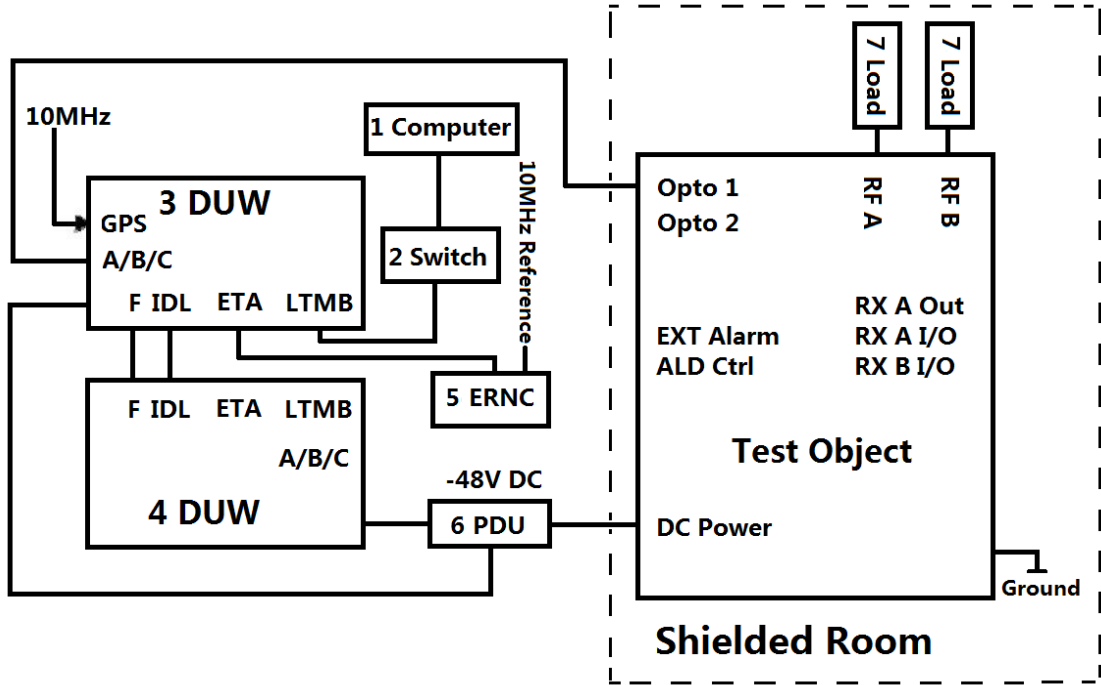


Product Name	Product Number	Version	Serial Number
RRUS 11 B4	KRC 161 254/2	R2B	CF81442849

No.	Auxiliary Equipment	Part Number / Model Type	Version	Serial Number
1	Work Station	Sun A70-XHZB1-9AG-2GDT	--	0826TFC1V9
2	Switch	TL-HP8MU	--	05300902892
3	RBS 6601	BFL 901 009/1	--	--
	DUW 30 01	KDU 127 161/3	R4F	TU8X960893
	SUP 6601	1/BFL 901 009/1	R3B	BR80908065
4	RBS 6601	BFL 901 009/1	--	--
	DUW 30 01	KDU 127 161/3	R4F	TU8X960894
	SUP 6601	1/BFL 901 009/1	R3B	BR80993658
5	ERNC SIM	FAB 102 614	--	ETC/L167
6	Power Supply	DH1716-5D	--	2008040041
	Power Supply	DH1716-5D	--	2008040050
7	Load	TF100	--	09121648
8	40dB Attenuator	48-40-43-LIM	--	BR5020
9	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	Work Station	Sun A70-XHZB1-9AG-2GDT	--	0826TFC1V9
2	Switch	TL-HP8MU	--	05300902892
3	RBS 6601	BFL 901 009/1	--	--
	DUW 30 01	KDU 127 161/3	R4F	TU8X960893
	SUP 6601	1/BFL 901 009/1	R3B	BR80908065
4	RBS 6601	BFL 901 009/1	--	--
	DUW 30 01	KDU 127 161/3	R4F	TU8X960894
	SUP 6601	1/BFL 901 009/1	R3B	BR80993658
5	ERNC SIM	FAB 102 614	--	ETC/L167
6	Power Supply	DH1716-5D	--	2008040041
	Power Supply	DH1716-5D	--	2008040050
7	Load	TF100	--	09121648
	Load	TF100	--	09121605

1.4.3 Modes of Operation

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

Mode 1 - UARFCN 1537: 2112.4MHz (Bottom Channel)

Mode 2 - UARFCN 1637: 2132.4MHz (Middle Channel)

Mode 3 - UARFCN 1738: 2152.6MHz (Top Channel)

Mode 4 - UARFCN 1537 + 1612: 2112.4MHz + 2127.4MHz (B and B+15MHz)

Mode 5 - UARFCN 1599 + 1674: 2124.8MHz + 2139.8MHz (M-7.6MHz and M+7.6MHz)

Mode 6 - UARFCN 1663 + 1738: 2137.6MHz + 2152.6MHz (T-15MHz and T)

Mode 7 - UARFCN 1537 + 1562: 2112.4MHz + 2117.4MHz (B and B+5MHz)

Mode 8 - UARFCN 1713 + 1738: 2147.6MHz + 2152.6MHz (T-5MHz and T)

Mode 9 - UARFCN 1537 + 1562 + 1587 + 1612:
2112.4MHz + 2117.4MHz + 2122.4MHz + 2127.4MHz (B, B+5MHz, B+10MHz and B+15MHz)

Mode 10 - UARFCN 1599 + 1624 + 1649 + 1674:
2124.8MHz + 2129.8MHz + 2134.8MHz + 2139.8MHz (M-7.6MHz, M-2.6MHz, M+2.4MHz and M+7.6MHz)

Mode 11 - UARFCN 1663 + 1688 + 1713 + 1738:
2137.6MHz + 2142.6MHz + 2147.6MHz + 2152.6MHz (T-15MHz, T-10MHz, T-5MHz and T)

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

Mod 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 (± 1 MHz)
- Conducted Spurious Emissions
- Frequency Stability

Only Radiated Spurious Emission 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.



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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

24, 25 and 31 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 TM1, TM5 and TM6 test models. Since the EUT transmits on two antennas simultaneously in the same frequency range, i.e., MIMO, using the Measure-and-Sum approach, the output power at both antennas RF A and RF B were tested, and the total output power was then summed mathematically in linear power units.

The path loss was measured and entered to the power meter as a reference level offset to get the output power value directly.

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

Configuration 1 - Mode 1
- Mode 2
- Mode 3
- Mode 4
- Mode 5
- Mode 6
- Mode 9
- Mode 10
- Mode 11



Product Service

2.1.6 Environmental Conditions

	24 October 2013	25 October 2013	31 October 2013
Ambient Temperature	22.5°C	23.0°C	23.0°C
Relative Humidity	35.0%	39.0%	48.0%

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

Configuration 1 - Mode 1, 2 and 3

TM1

UARFCN	Frequency (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		Antenna A			Antenna B				
		dBm	dBm/MHz ¹	W	dBm	dBm/MHz ¹	W		
1537 (Bottom)	2112.4	45.45	39.24	35.08	45.46	39.25	35.16	48.47	70.24
1637 (Middle)	2132.4	45.84	39.63	38.37	45.86	39.65	38.55	48.86	76.92
1738 (Top)	2152.6	45.84	39.63	38.37	45.83	39.62	38.28	48.85	76.65

Note 1:
 1 MHz Power for 5MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(4.18) =Output Power - 6.21

TM5

UARFCN	Frequency (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		Antenna A			Antenna B				
		dBm	dBm/MHz ¹	W	dBm	dBm/MHz ¹	W		
1537 (Bottom)	2112.4	45.37	39.16	34.43	45.39	39.18	34.59	48.39	69.02
1637 (Middle)	2132.4	45.82	39.61	38.19	45.86	39.65	38.55	48.85	76.74
1738 (Top)	2152.6	45.81	39.60	38.11	45.86	39.65	38.55	48.85	76.66

Note 1:
 1 MHz Power for 5MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(4.18) =Output Power - 6.21



TM6

UARFCN	Frequency (MHz)	Result (RMS)						*Total (dBm) RMS	*Total (W) RMS
		Antenna A			Antenna B				
		dBm	dBm/MHz ¹	W	dBm	dBm/MHz ¹	W		
1537 (Bottom)	2112.4	45.26	39.05	33.57	45.24	39.03	33.42	48.26	66.99
1637 (Middle)	2132.4	45.64	39.43	36.64	45.66	39.45	36.81	48.66	73.45
1738 (Top)	2152.6	45.62	39.41	36.48	45.67	39.46	36.90	48.66	73.38

Note 1:
 1 MHz Power for 5MHz BW=Output Power - 10lg(OBW/1)=Output Power - 10lg(4.18) =Output Power - 6.21

Multi Carrier (1x2)

Configuration 1 - Mode 4, 5 and 6

TM1

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1612	2112.4 & 2127.4	45.56	35.97	45.61	36.39	48.59	72.36
1599 & 1674	2124.8 & 2139.8	45.85	38.46	45.87	38.64	48.87	77.10
1663 & 1738	2137.6 & 2152.6	45.80	38.02	45.75	37.58	48.79	75.60

TM5

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1612	2112.4 & 2127.4	45.59	36.22	45.64	36.64	48.62	72.86
1599 & 1674	2124.8 & 2139.8	45.83	38.28	45.85	38.46	48.85	76.74
1663 & 1738	2137.6 & 2152.6	45.80	38.02	45.76	37.67	48.79	75.69

TM6

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1612	2112.4 & 2127.4	45.33	34.12	45.48	35.32	48.42	69.44
1599 & 1674	2124.8 & 2139.8	45.74	37.50	45.70	37.15	48.73	74.65
1663 & 1738	2137.6 & 2152.6	45.68	36.98	45.67	36.90	48.69	73.88

**Multi Carrier (1x4)**Configuration 1 - Mode 9, 10 and 11TM1

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1562 & 1587 & 1612	2112.4 & 2117.4 & 2122.4 & 2127.4	45.60	36.31	45.65	36.73	48.64	73.04
1599 & 1624 & 1649 & 1674	2124.8 & 2129.8 & 2134.8 & 2139.8	45.89	38.82	45.89	38.82	48.90	77.64
1663 & 1688 & 1713 & 1738	2137.6 & 2142.6 & 2147.6 & 2152.6	45.79	37.93	45.84	38.37	48.83	76.30

TM5

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1562 & 1587 & 1612	2112.4 & 2117.4 & 2122.4 & 2127.4	45.61	36.39	45.67	36.90	48.65	73.29
1599 & 1624 & 1649 & 1674	2124.8 & 2129.8 & 2134.8 & 2139.8	45.82	38.19	45.84	38.37	48.84	76.56
1663 & 1688 & 1713 & 1738	2137.6 & 2142.6 & 2147.6 & 2152.6	45.82	38.19	45.80	38.02	48.82	76.21

TM6

UARFCN	Frequency(MHz)	Antenna A		Antenna B		*Total (dBm) RMS	*Total (W) RMS
		Result (dBm) RMS	Result (W) RMS	Result (dBm) RMS	Result (W) RMS		
1537 & 1562 & 1587 & 1612	2112.4 & 2117.4 & 2122.4 & 2127.4	45.12	32.51	45.15	32.73	48.15	65.24
1599 & 1624 & 1649 & 1674	2124.8 & 2129.8 & 2134.8 & 2139.8	45.40	34.67	45.41	34.75	48.41	69.42
1663 & 1688 & 1713 & 1738	2137.6 & 2142.6 & 2147.6 & 2152.6	45.32	34.04	45.31	33.96	48.33	68.00

Note *:

Two transmitters output power were summed up according to FCC KDB662911 D01 Multiple Transmitter Output v02r01 for 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.



Product Service

Limit	$\leq 1640\text{W/MHz}$ or $\leq +62.1\text{dBm/MHz}$
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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

24, 25 and 31 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 measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

The Peak to Average was measured with QPSK, 16QAM, 64QAM using the test models described.

The measurements were performed on the combined output connector RF A. Limited complementary measurements were done at output connector RF B to verify identical performance for both transmitter chains in MIMO mode, but only the results of RF A as representative 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
- Mode 2
- Mode 3
- Mode 4
- Mode 5
- Mode 6
- Mode 9
- Mode 10
- Mode 11



Product Service

2.2.6 Environmental Conditions

	24 October 2013	25 October 2013	31 October 2013
Ambient Temperature	22.5°C	23.0°C	23.0°C
Relative Humidity	35.0%	39.0%	48.0%

2.2.7 Test Results

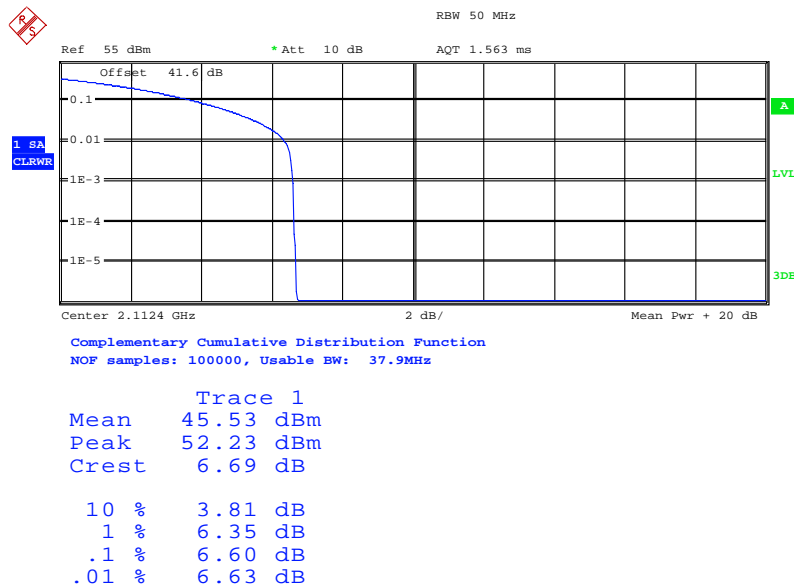
For the period of test the EUT met the requirements of FCC CFR 47 Part 27 and Industry Canada RSS-139 for Peak – Average Ratio.

The test results are shown below.

Single Carrier

Configuration 1 - Mode 1

TM1

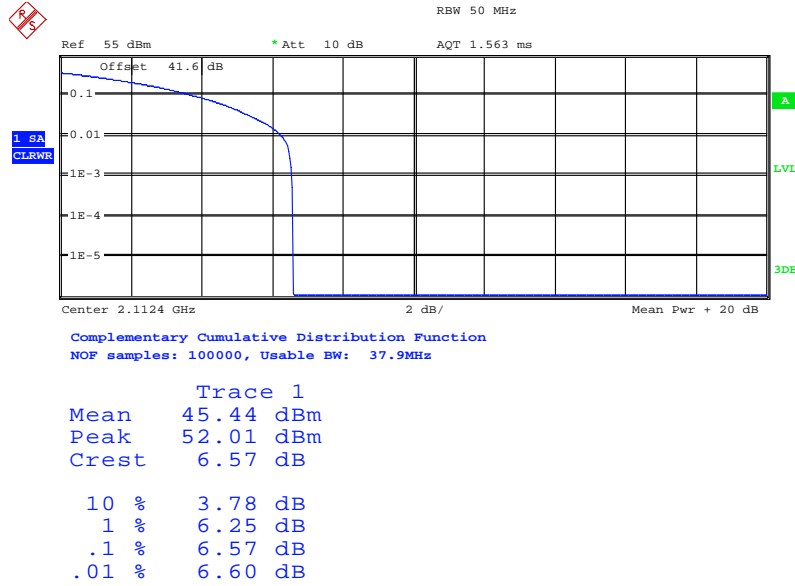


Date: 24.OCT.2013 10:04:51



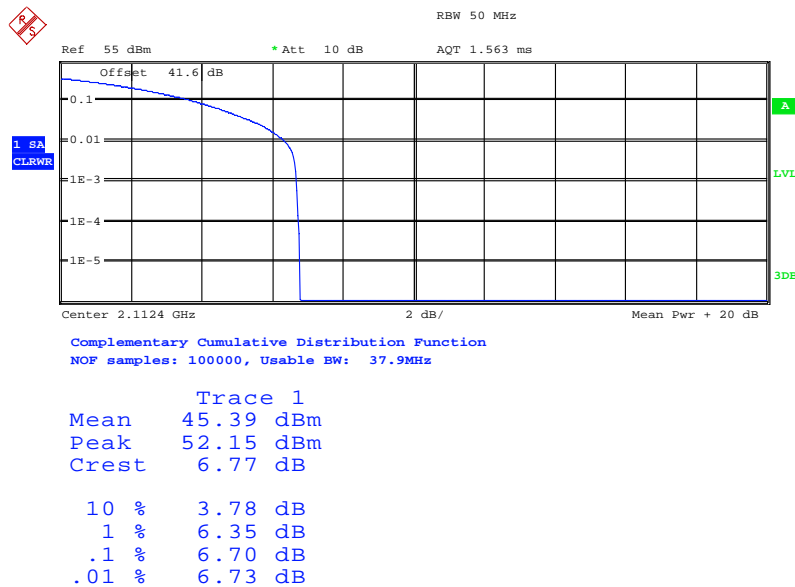
Product Service

TM5



Date: 24.OCT.2013 13:45:54

TM6



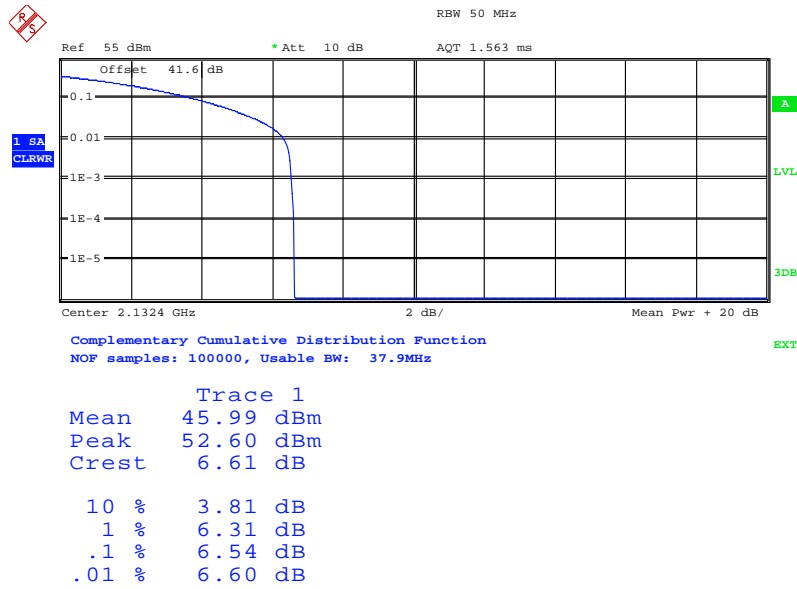
Date: 24.OCT.2013 13:14:33



Product Service

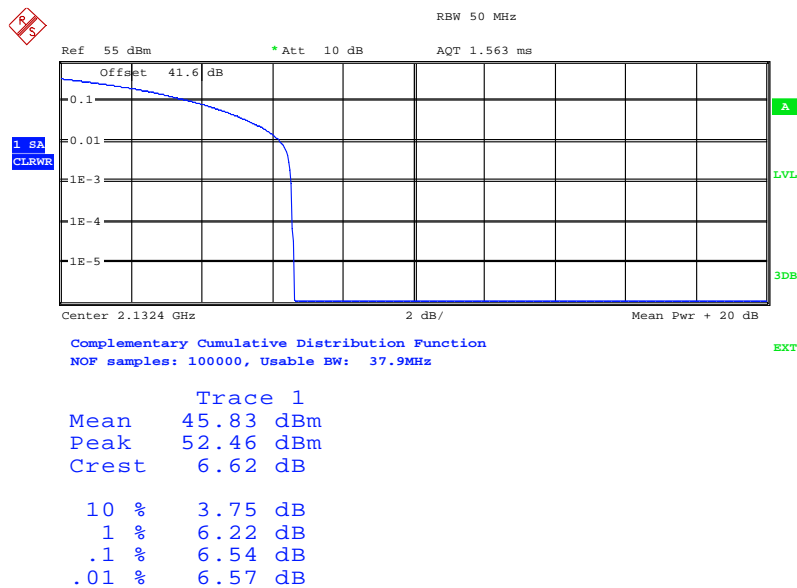
Configuration 1 - Mode 2

TM1



Date: 24.OCT.2013 14:37:51

TM5

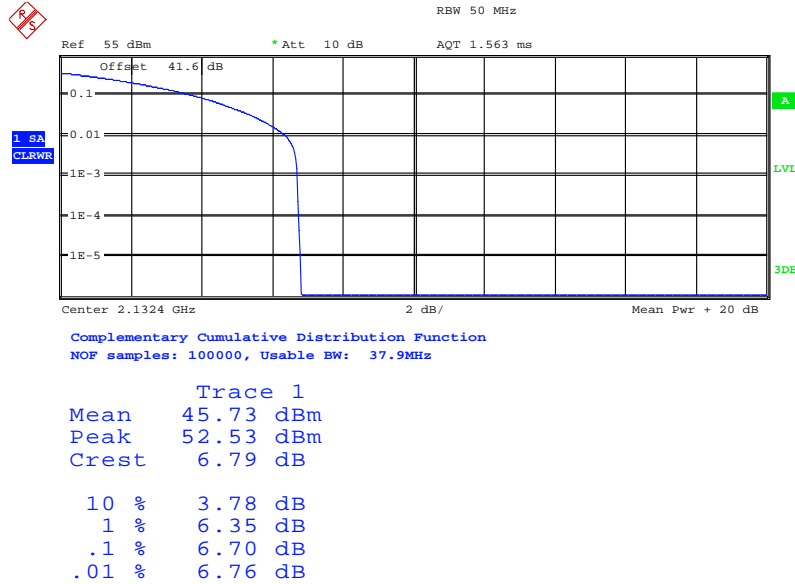


Date: 24.OCT.2013 15:33:26



Product Service

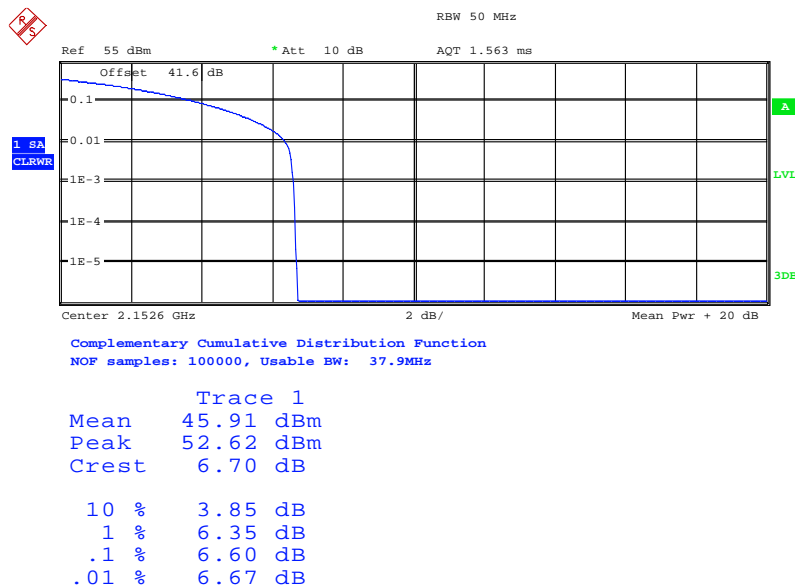
TM6



Date: 24.OCT.2013 15:53:02

Configuration 1 - Mode 3

TM1

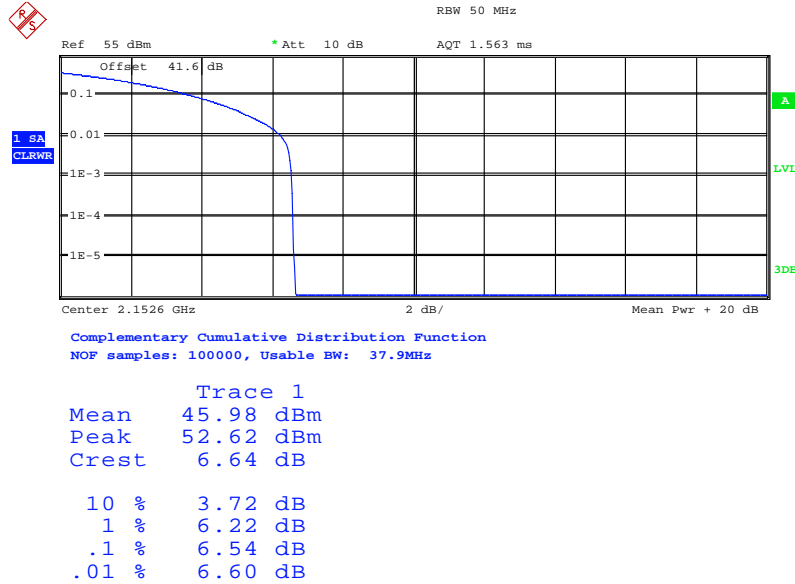


Date: 24.OCT.2013 16:20:01



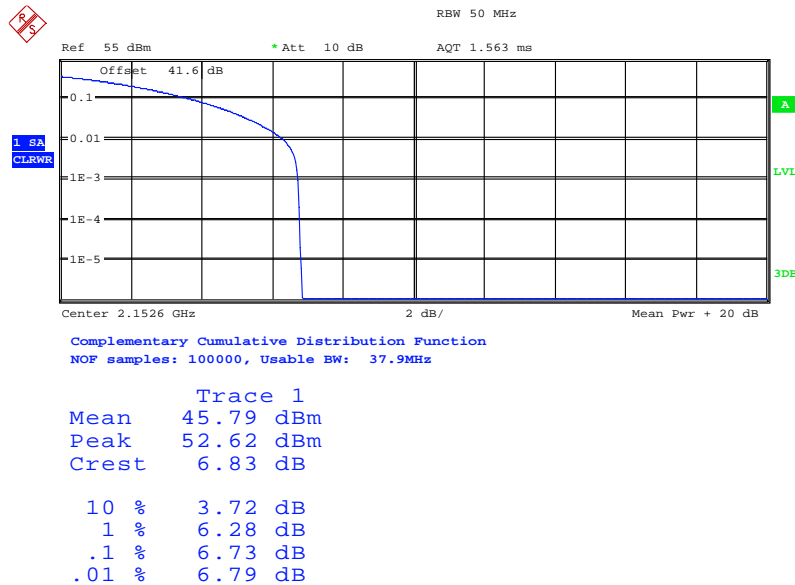
Product Service

TM5



Date: 24.OCT.2013 16:34:47

TM6



Date: 24.OCT.2013 17:07:57

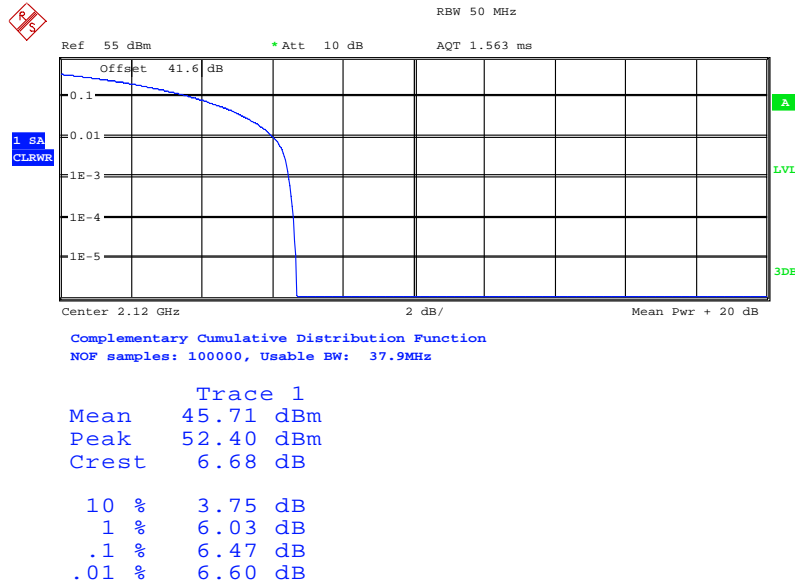


Product Service

Multi Carrier (1x2)

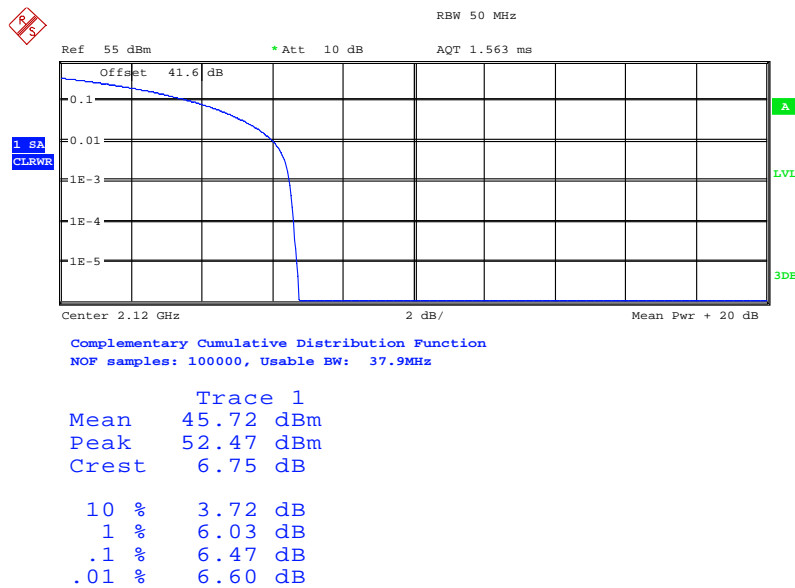
Configuration 1 - Mode 4

TM1



Date: 25.OCT.2013 15:31:21

TM5

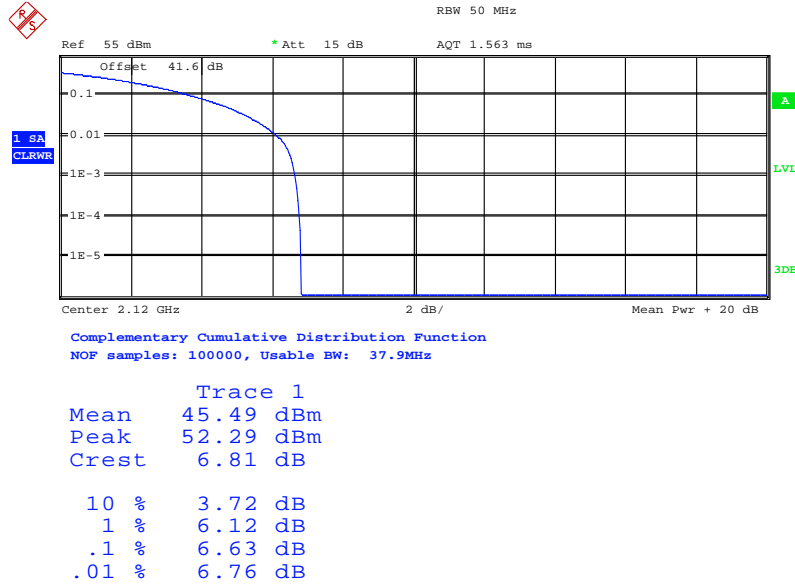


Date: 25.OCT.2013 15:01:49



Product Service

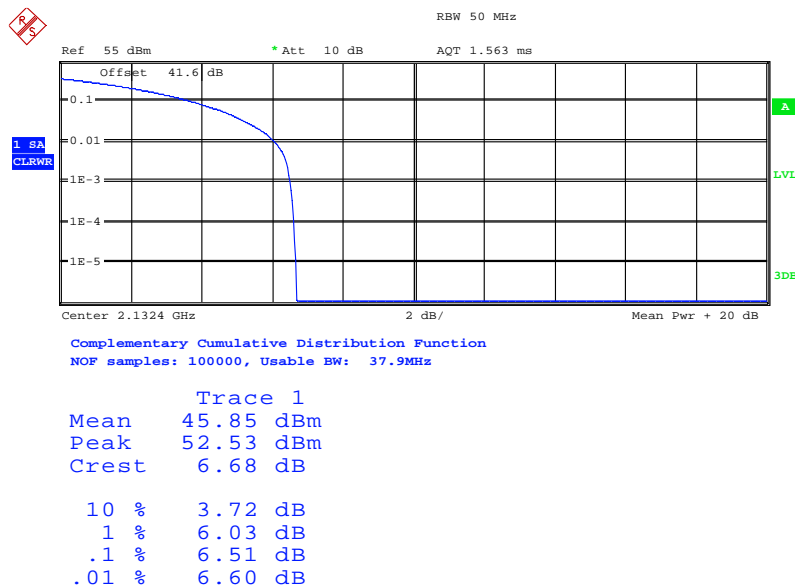
TM6



Date: 25.OCT.2013 14:30:27

Configuration 1 - Mode 5

TM1

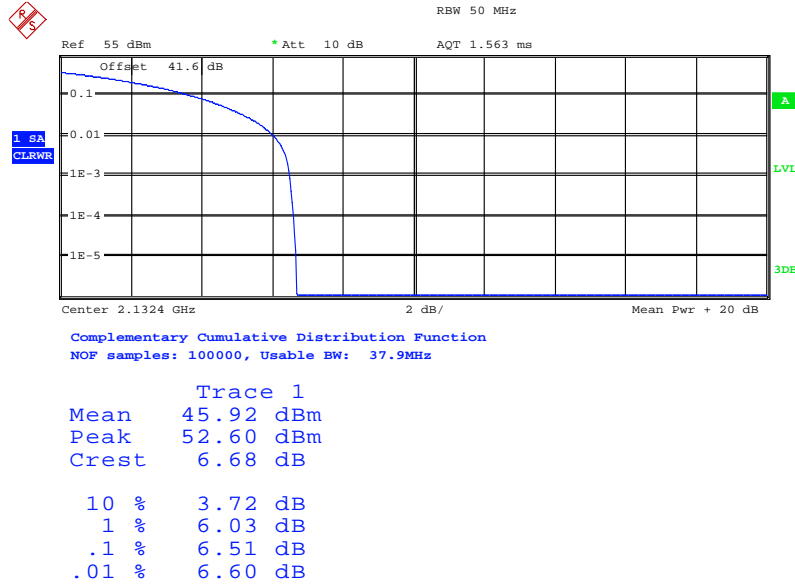


Date: 25.OCT.2013 10:32:54



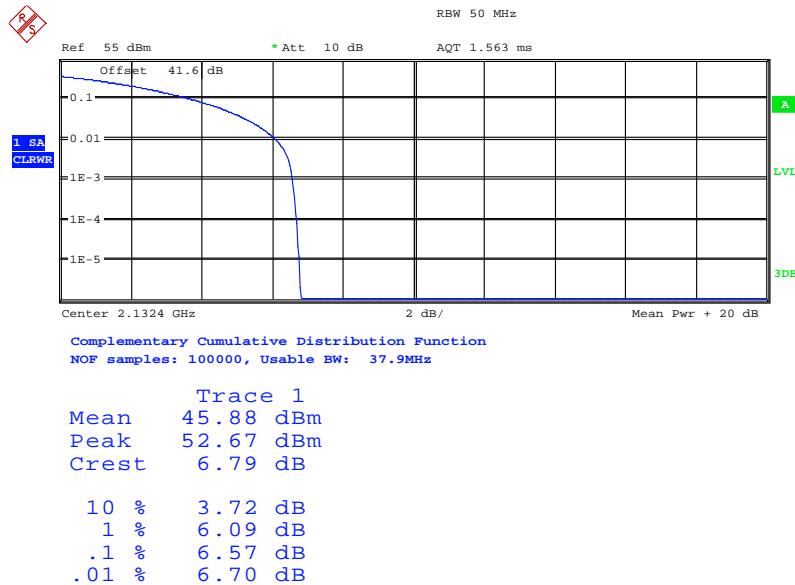
Product Service

TM5



Date: 25.OCT.2013 11:03:35

TM6



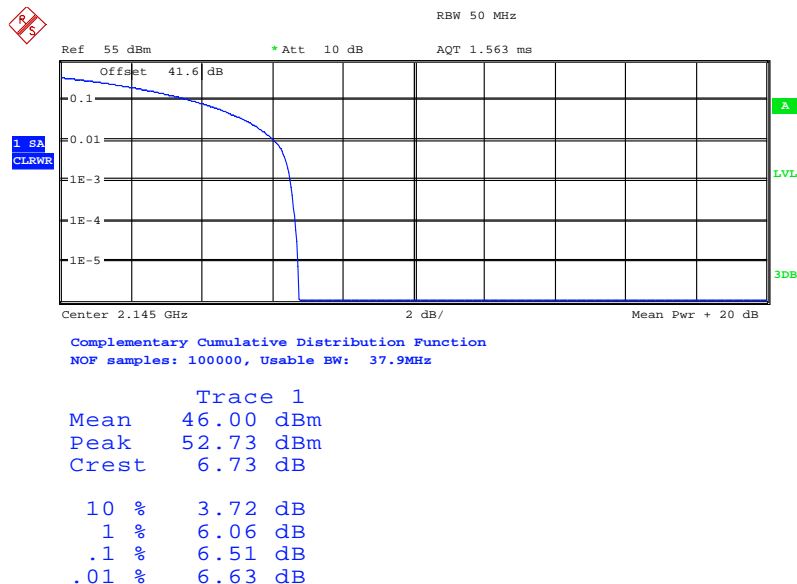
Date: 25.OCT.2013 11:25:45



Product Service

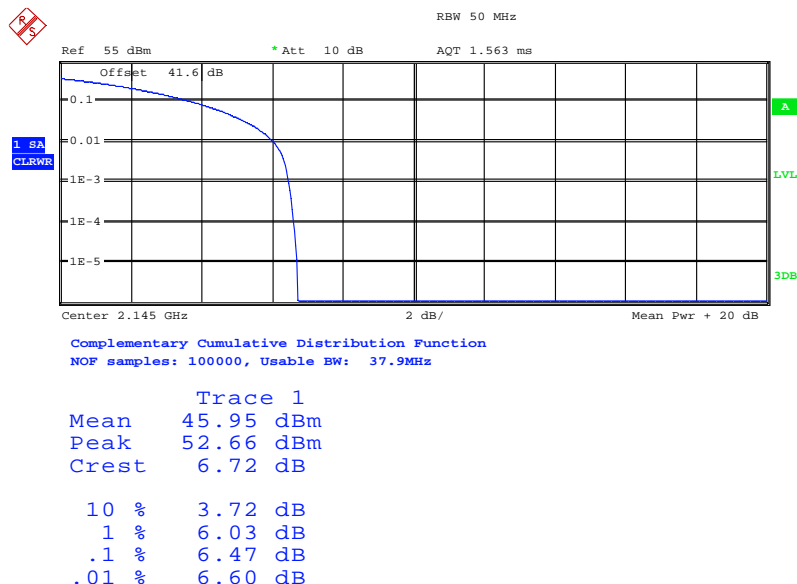
Configuration 1 - Mode 6

TM1



Date: 25.OCT.2013 16:14:43

TM5

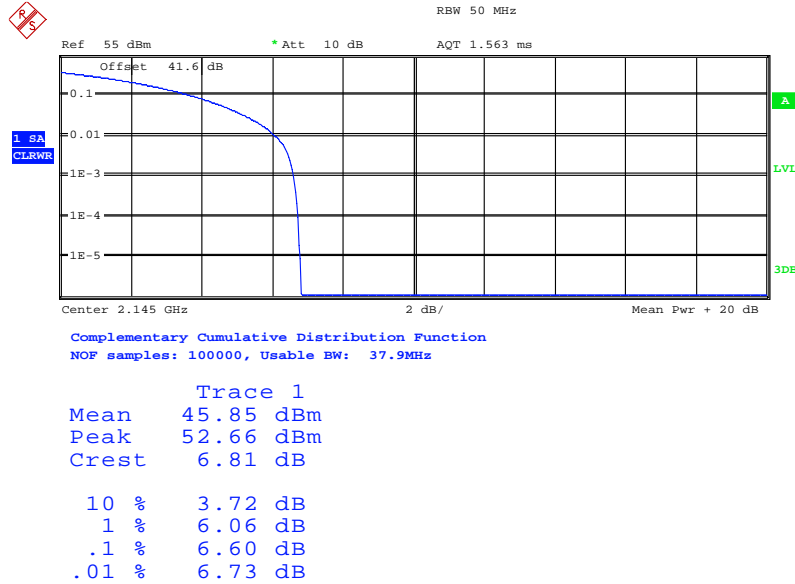


Date: 25.OCT.2013 17:02:08



Product Service

TM6

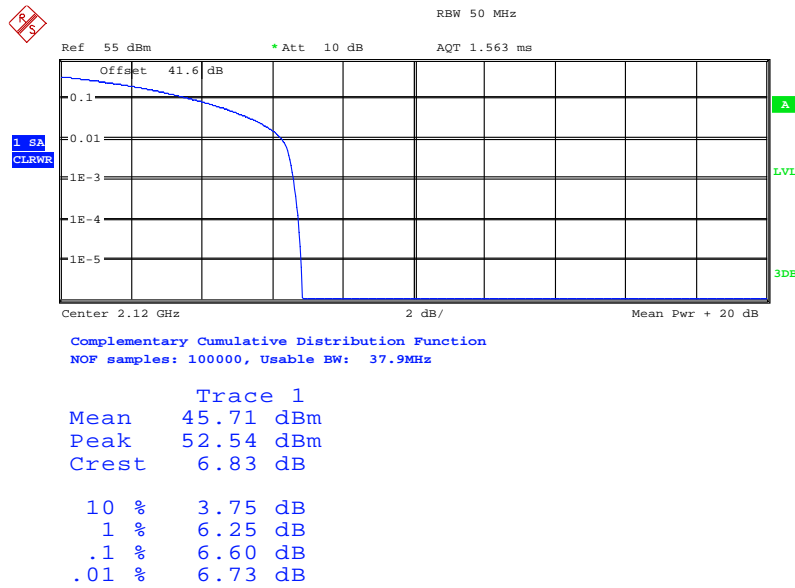


Date: 31.OCT.2013 08:39:26

Multi Carrier (1x4)

Configuration 1 - Mode 9

TM1 - Mode 9

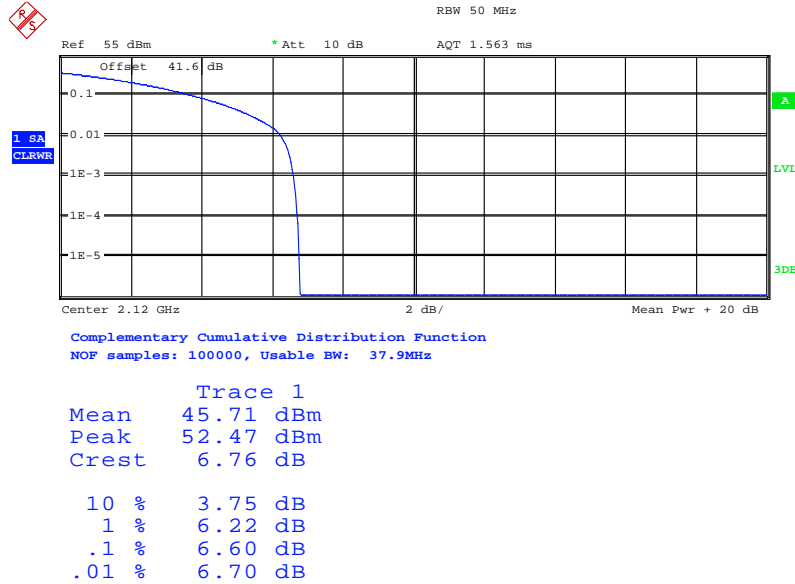


Date: 31.OCT.2013 09:45:54



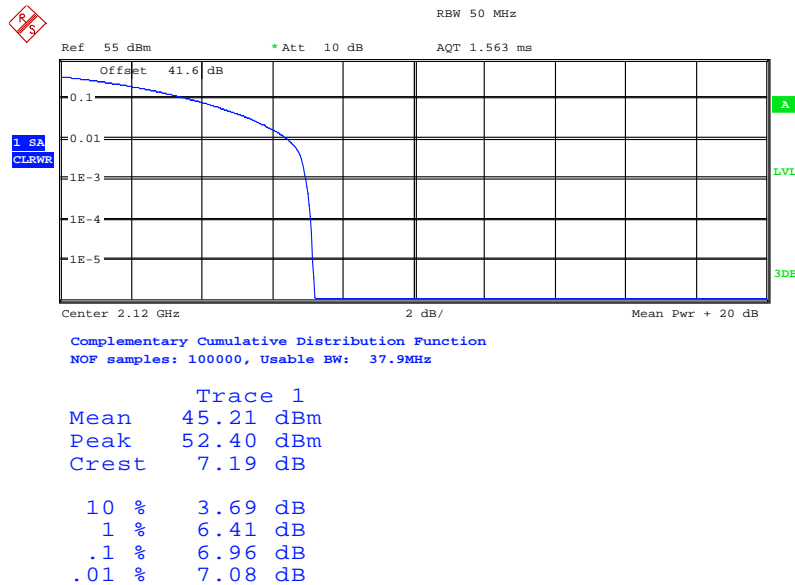
Product Service

TM5



Date: 31.OCT.2013 10:12:33

TM6



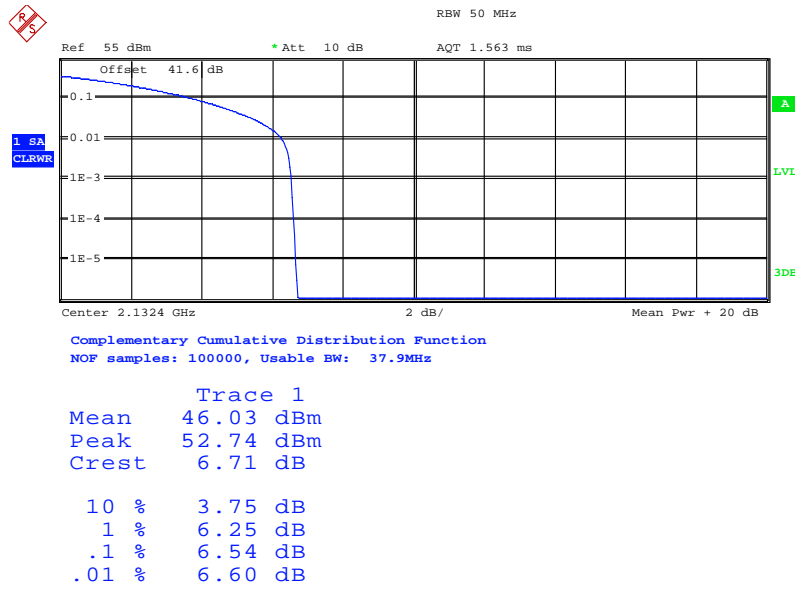
Date: 31.OCT.2013 12:12:05



Product Service

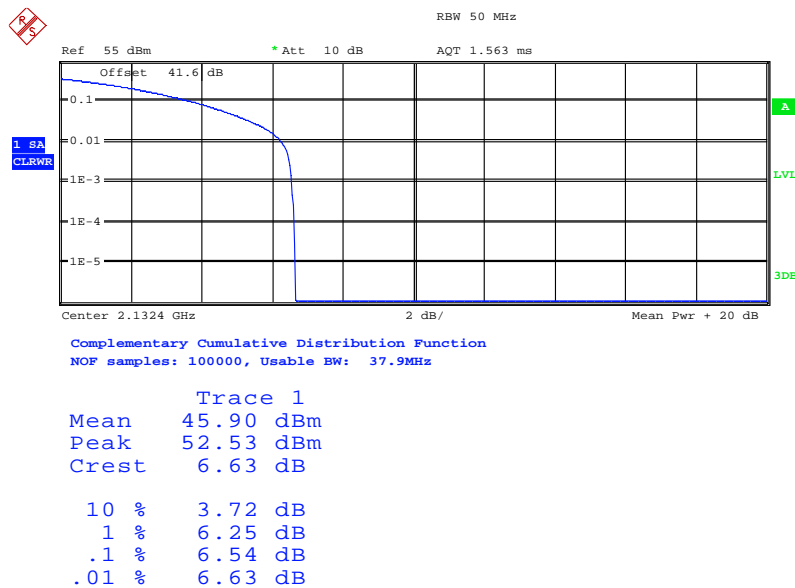
Configuration 1 - Mode 10

TM1



Date: 31.OCT.2013 13:29:58

TM5

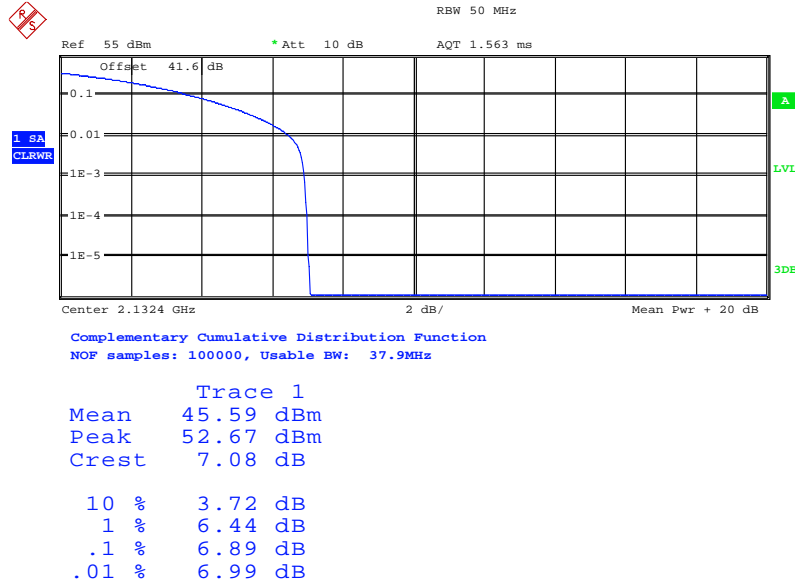


Date: 31.OCT.2013 13:09:30



Product Service

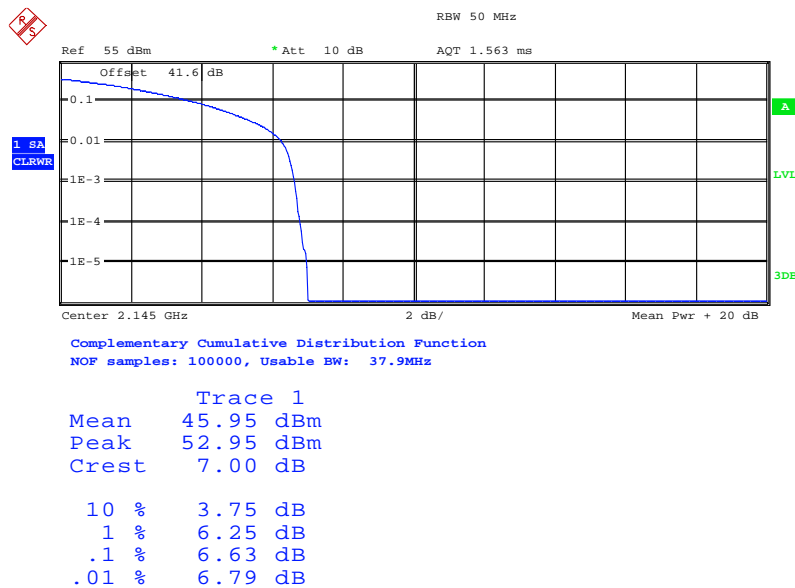
TM6



Date: 31.OCT.2013 12:46:00

Configuration 1 - Mode 11

TM1

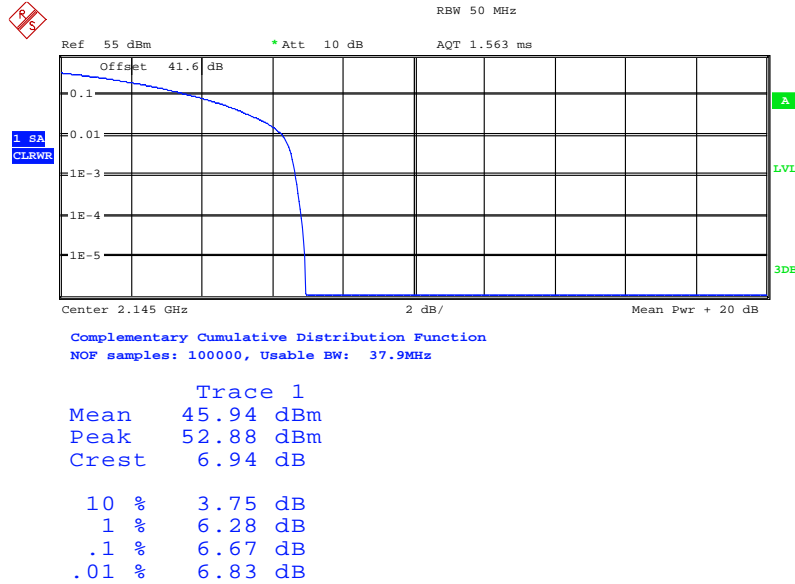


Date: 31.OCT.2013 14:03:24



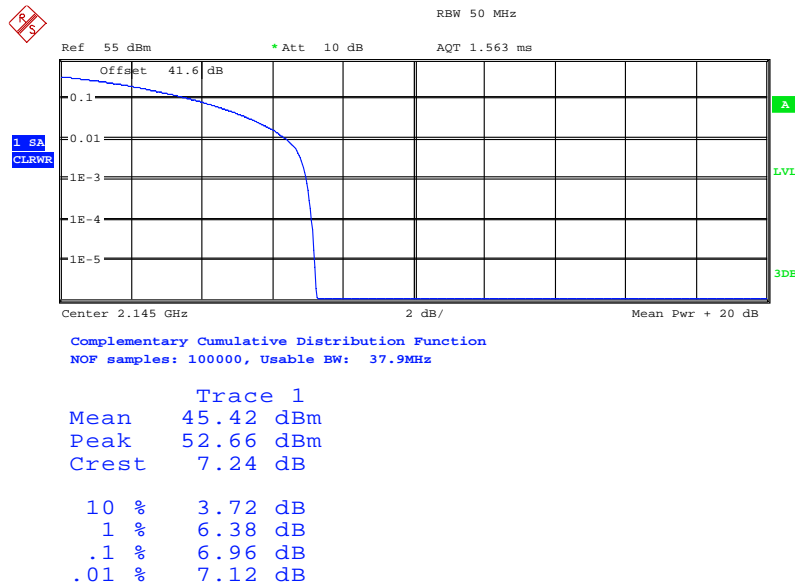
Product Service

TM5



Date: 31.OCT.2013 14:25:36

TM6



Date: 31.OCT.2013 14:50:09



Product Service

Limit	13dB
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Remarks

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



Product Service

2.3 MODULATION CHARACTERISTICS

2.3.1 Specification Reference

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

24 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.

Connect the TX output connector RF A to a spectrum analyzer with an attenuator. The other connector RF B was connected to match load. The EUT was set to transmit maximum power. The constellation was measured and recorded using a Vector Signal 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

	24 October 2013
Ambient Temperature	22.5°C
Relative Humidity	35.0%



2.3.6 Test Result

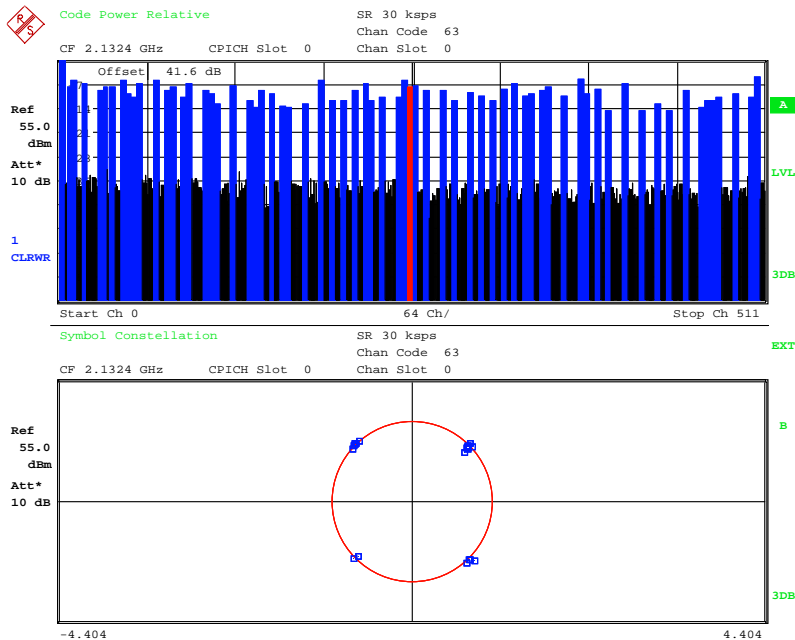
For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and Industry Canada RSS-139 for Modulation Characteristics.

The test results are shown below

Single Carrier

Configuration 1 - Mode 2

TM1: EUT transmitting with QPSK modulation:

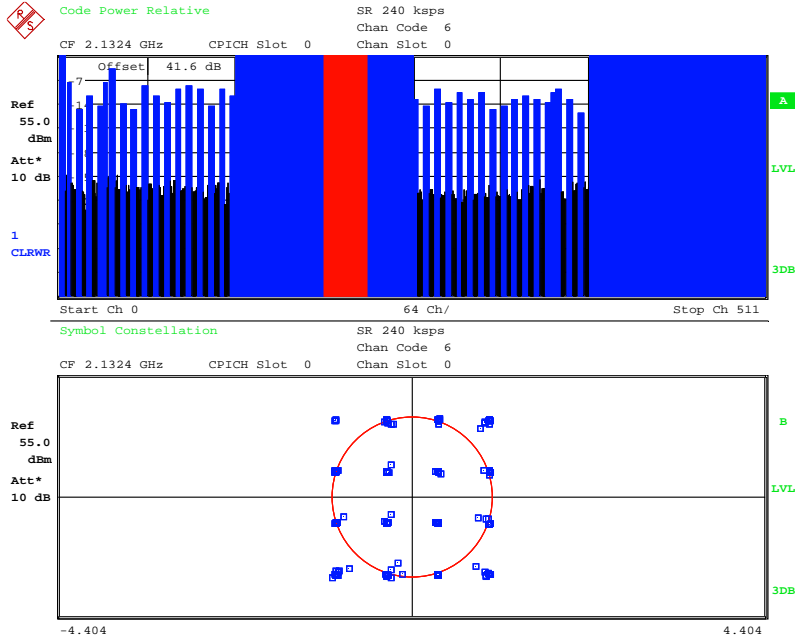


Date: 24.OCT.2013 14:36:53



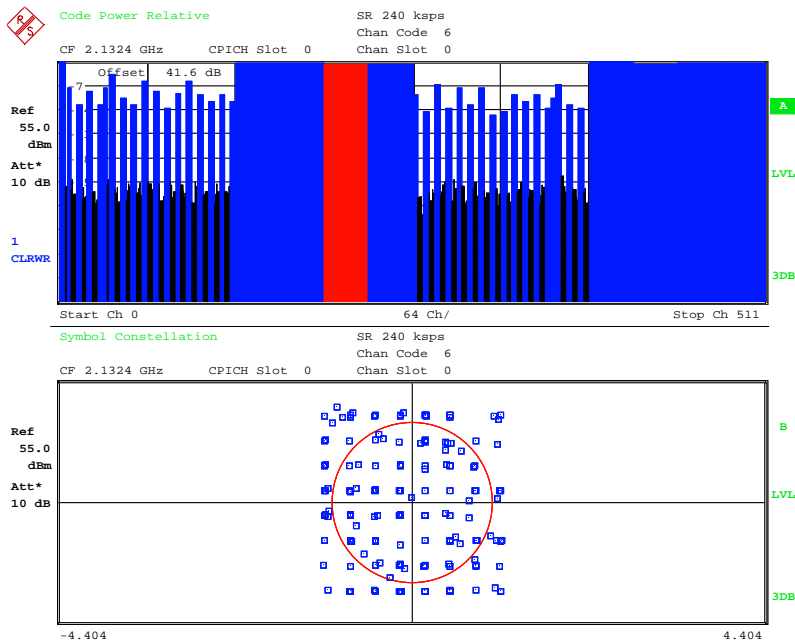
Product Service

TM5: EUT transmitting with 16QAM modulation:



Date: 24.OCT.2013 15:45:45

TM6: EUT transmitting with 64QAM modulation:



Date: 24.OCT.2013 15:51:54



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

24, 25 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 TM1, TM5 and TM6 described. A resolution bandwidth of 50kHz and a video bandwidth of 500kHz were used for test.

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
 - Mode 2
 - Mode 3

2.4.6 Environmental Conditions

	24 October 2013	25 October 2013	08 January 2014
Ambient Temperature	22.5°C	23.0°C	24.5°C
Relative Humidity	35.0%	39.0%	30.0%

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 on the following pages

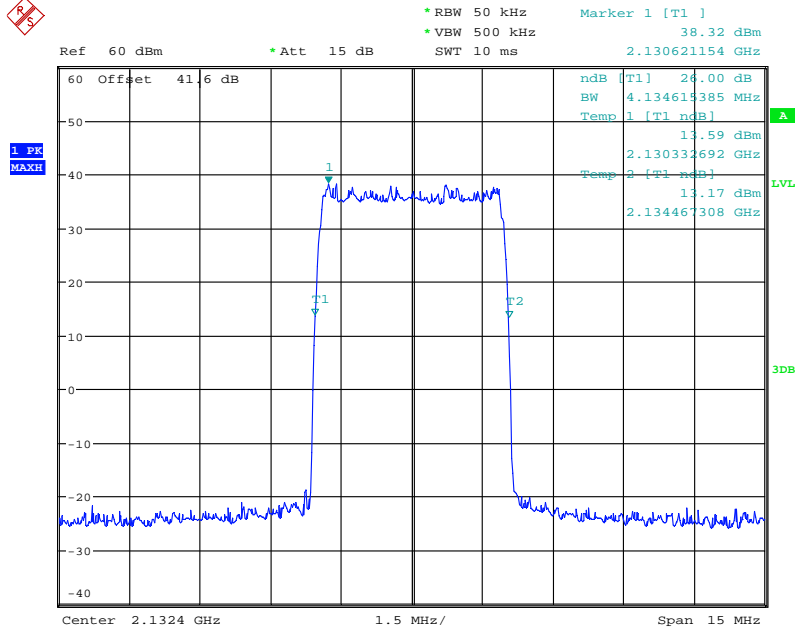


Single Carrier: 4.2MHz Bandwidth

Configuration 1 - Mode 2

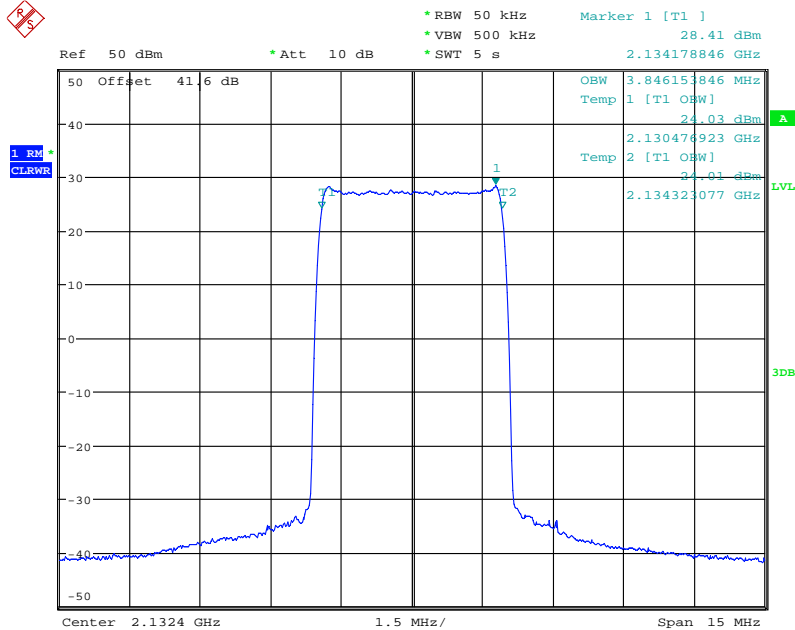
TM1

-26dB Occupied Bandwidth



Date: 8.JAN.2014 15:05:33

99% Occupied Bandwidth

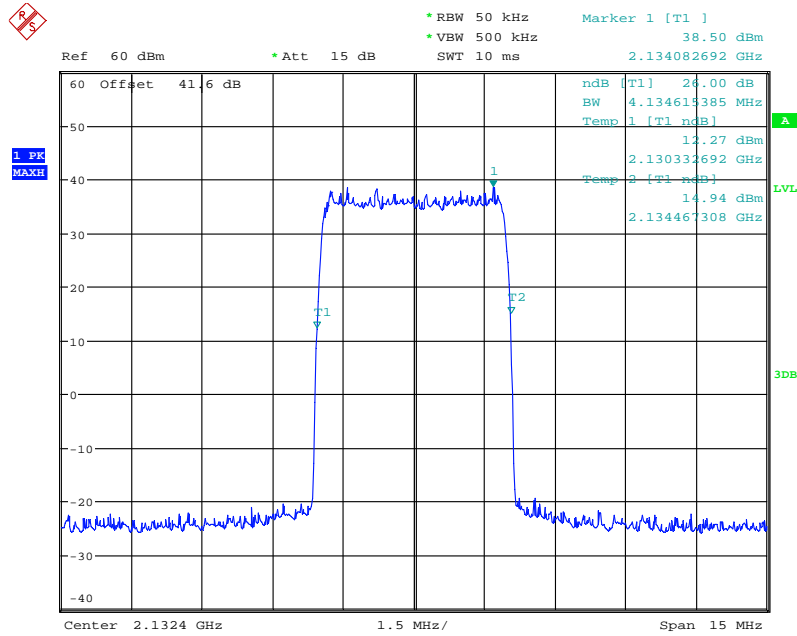


Date: 25.OCT.2013 09:52:22



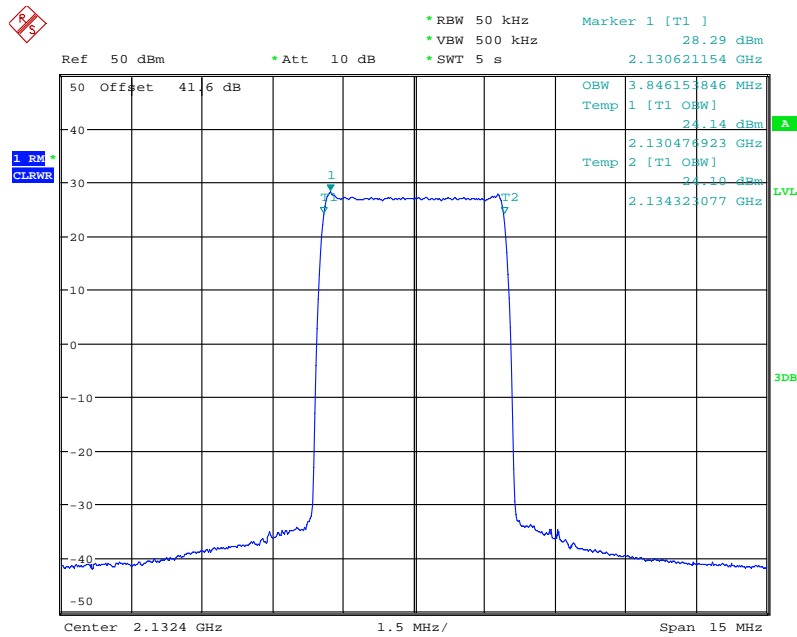
TM5

-26dB Occupied Bandwidth



Date: 8.JAN.2014 15:11:26

99% Occupied Bandwidth

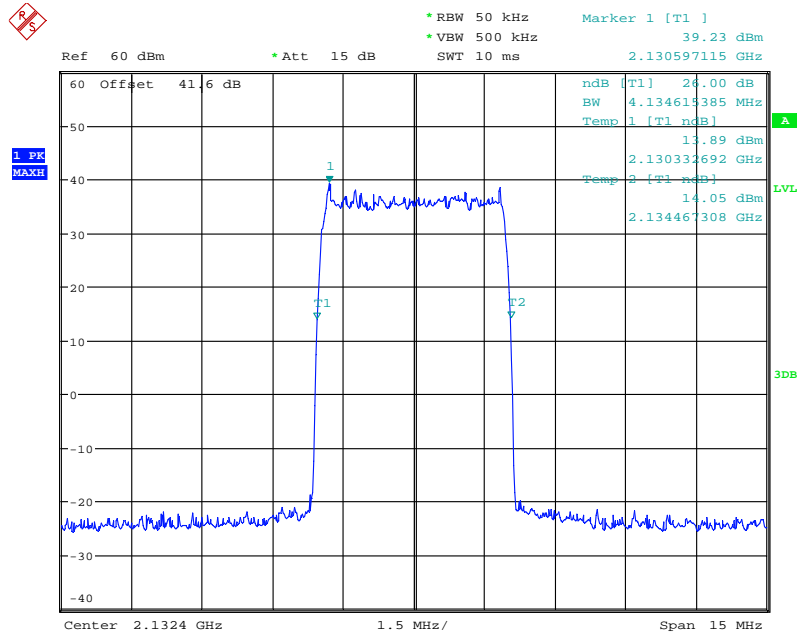


Date: 25.OCT.2013 10:00:01



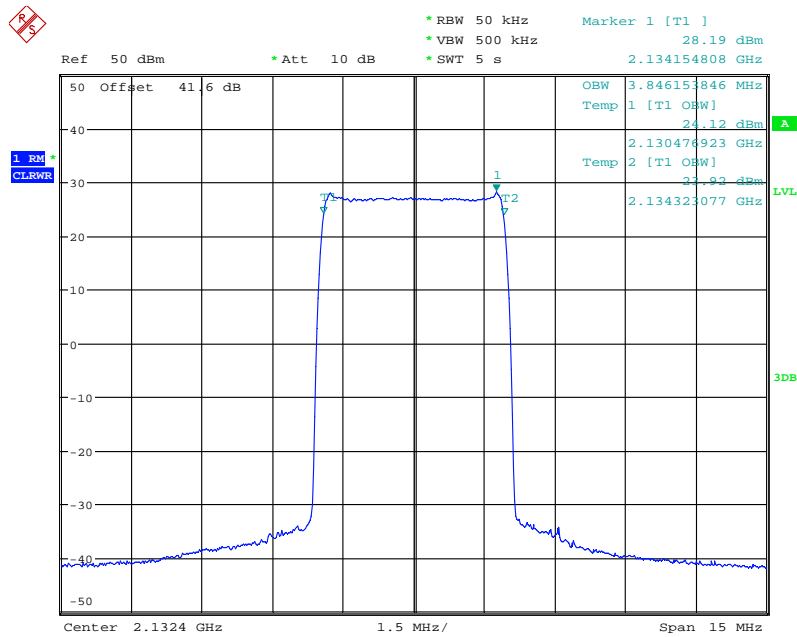
TM6

-26dB Occupied Bandwidth



Date: 8.JAN.2014 15:18:25

99% Occupied Bandwidth



Date: 25.OCT.2013 10:16:07

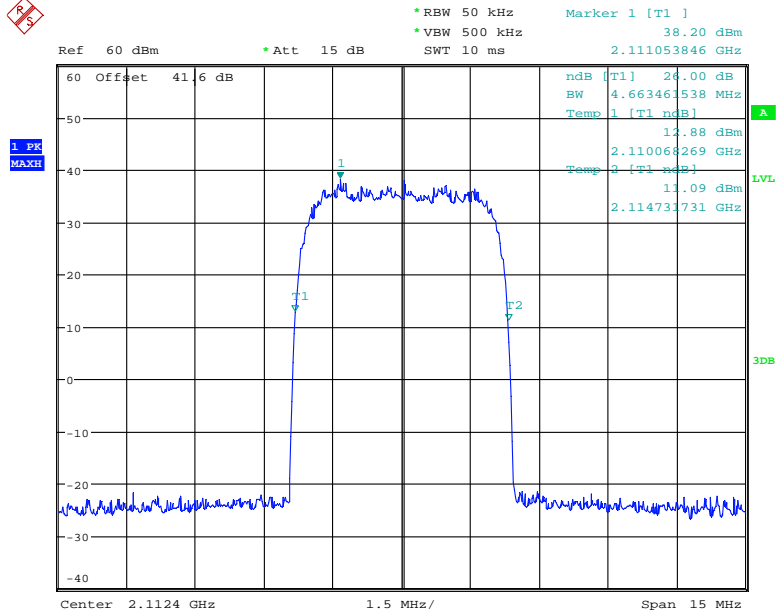


Single Carrier: 5MHz Bandwidth

Configuration 1 - Mode 1

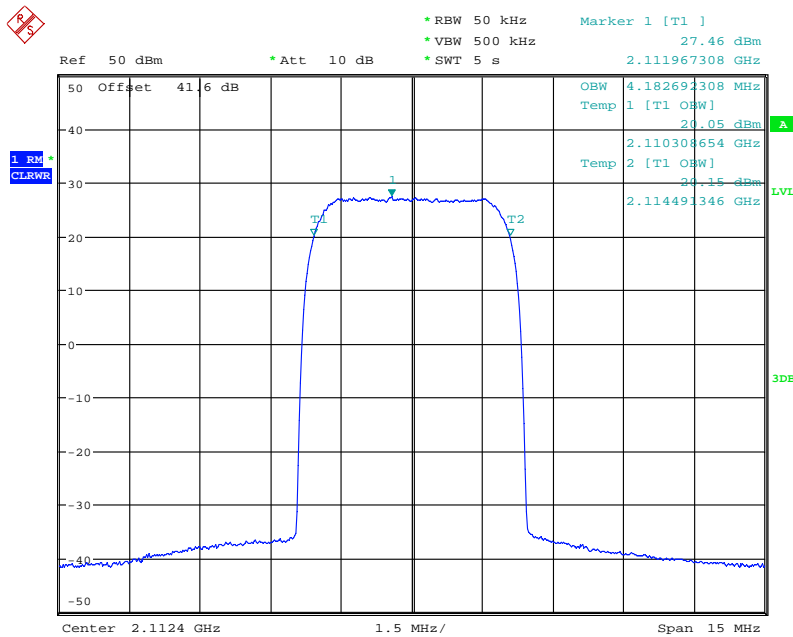
TM1

-26dB Occupied Bandwidth



Date: 8.JAN.2014 14:50:08

99% Occupied Bandwidth

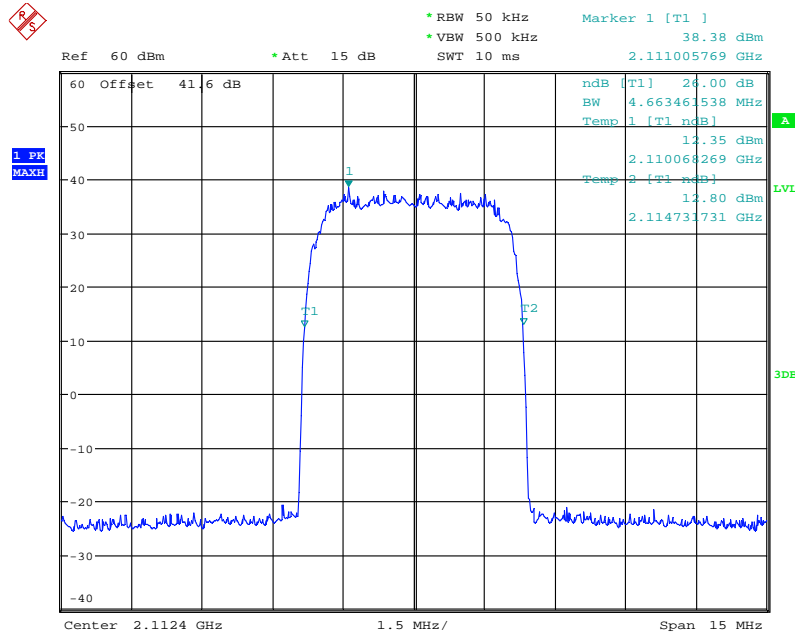


Date: 24.OCT.2013 10:13:47



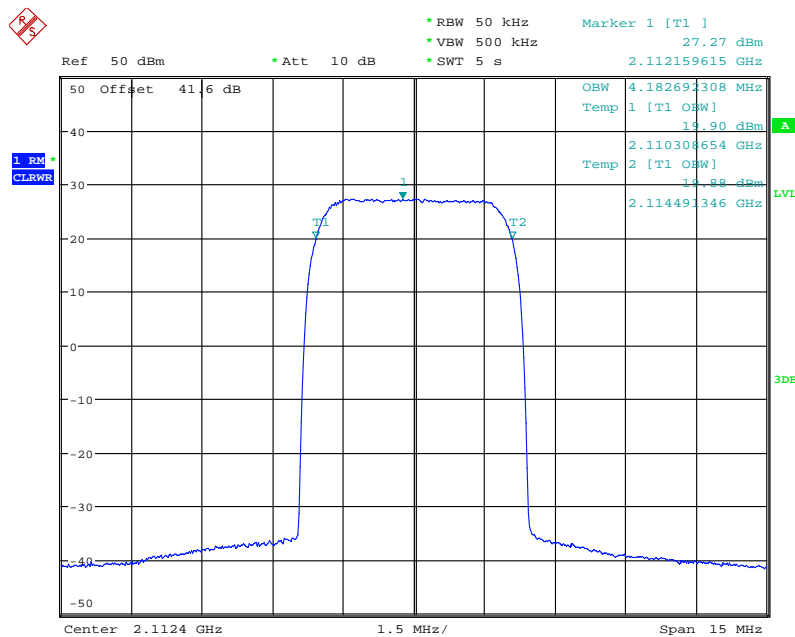
TM5

-26dB Occupied Bandwidth



Date: 8.JAN.2014 13:46:14

99% Occupied Bandwidth

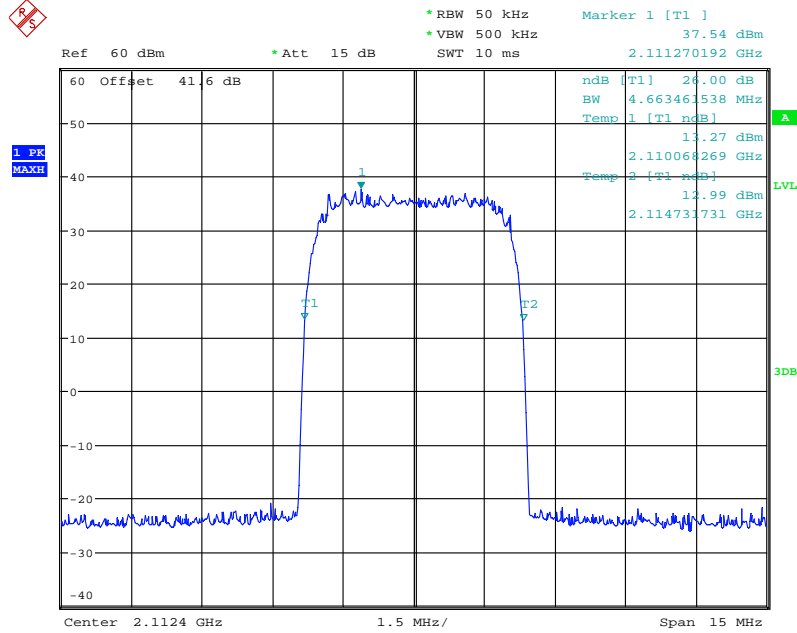


Date: 24.OCT.2013 11:12:36



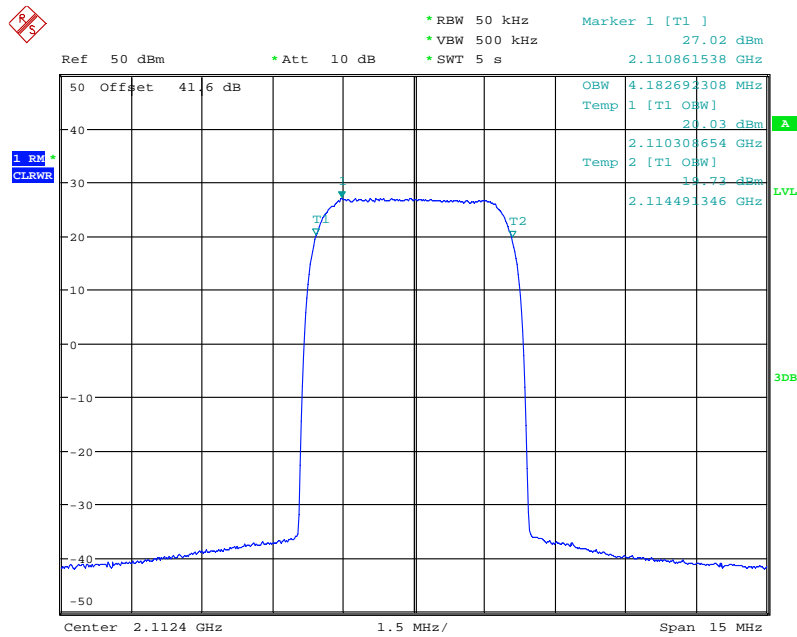
TM6

-26dB Occupied Bandwidth



Date: 8.JAN.2014 13:53:51

99% Occupied Bandwidth



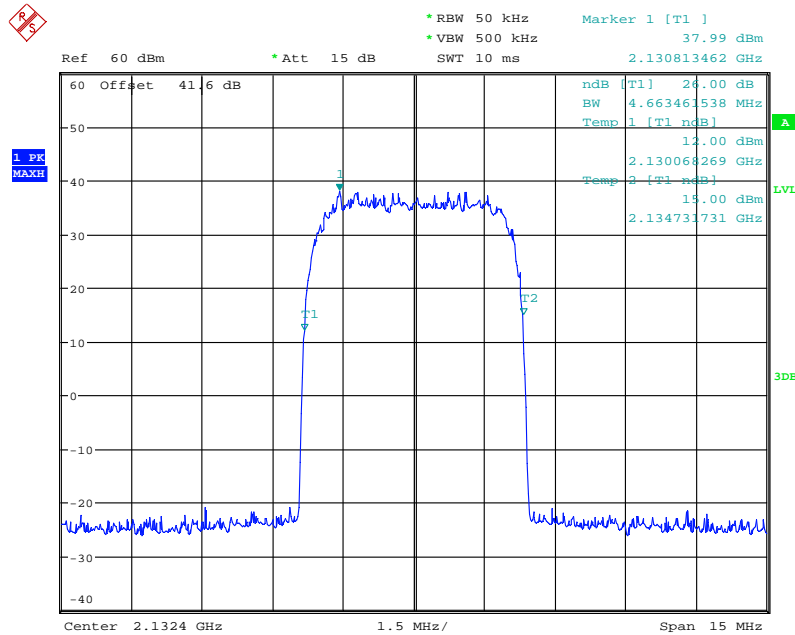
Date: 24.OCT.2013 13:13:25



Configuration 1 - Mode 2

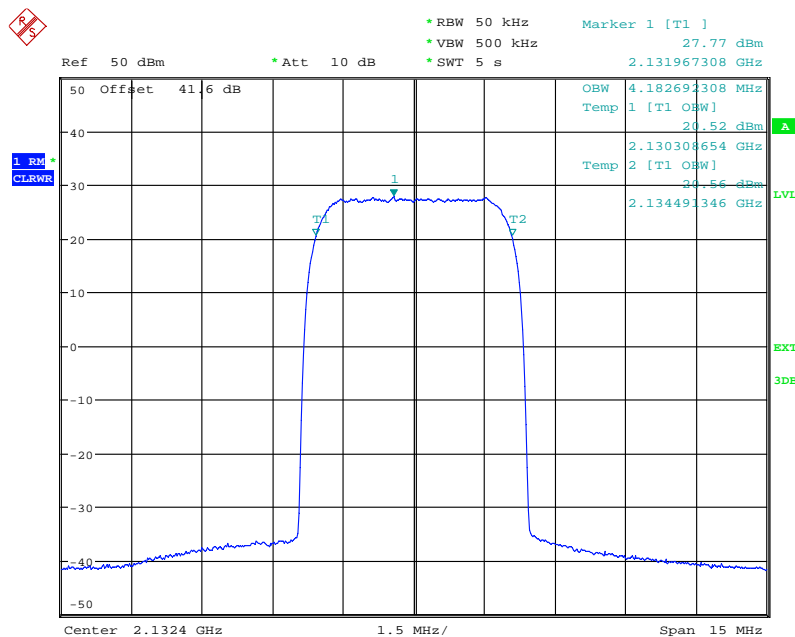
TM1

-26dB Occupied Bandwidth



Date: 8.JAN.2014 14:56:14

99% Occupied Bandwidth

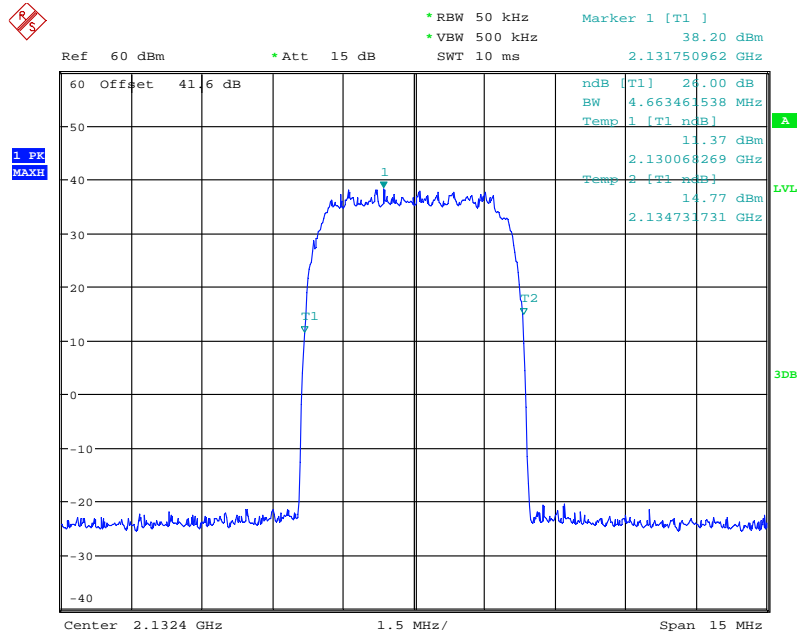


Date: 24.OCT.2013 14:39:00



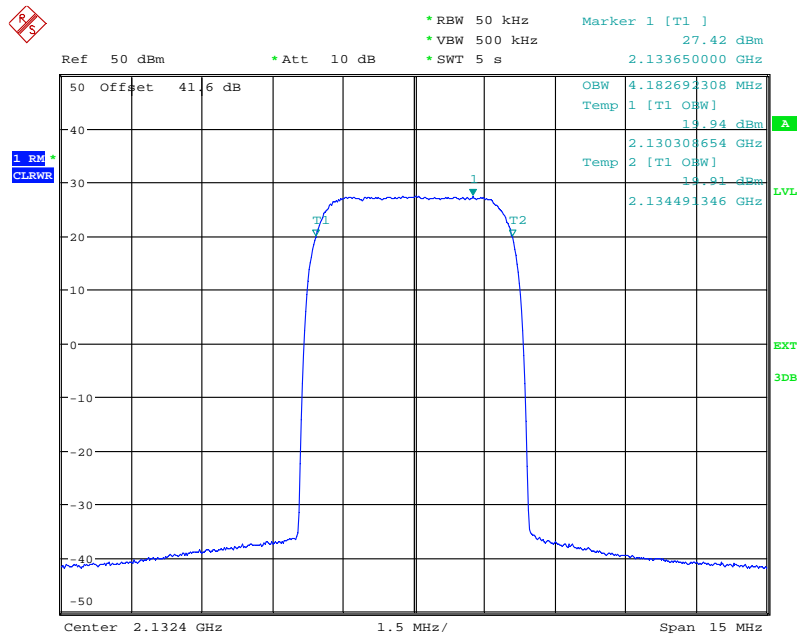
TM5

-26dB Occupied Bandwidth



Date: 8.JAN.2014 13:40:00

99% Occupied Bandwidth

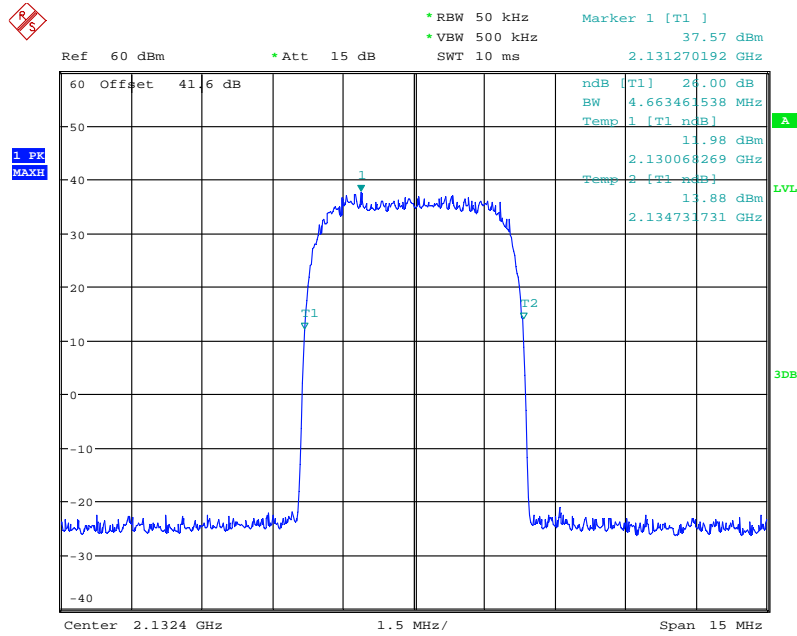


Date: 24.OCT.2013 15:33:03



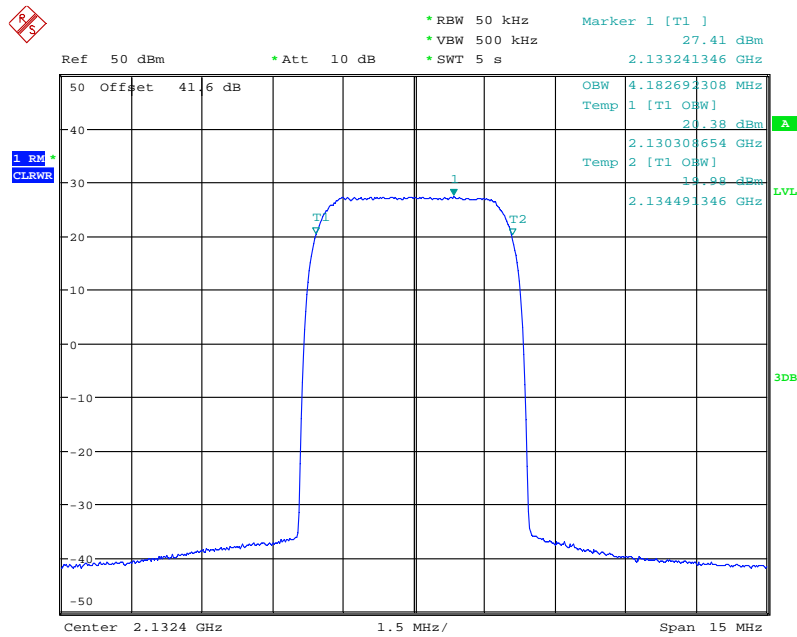
TM6

-26dB Occupied Bandwidth



Date: 8.JAN.2014 14:02:48

99% Occupied Bandwidth



Date: 24.OCT.2013 15:54:31

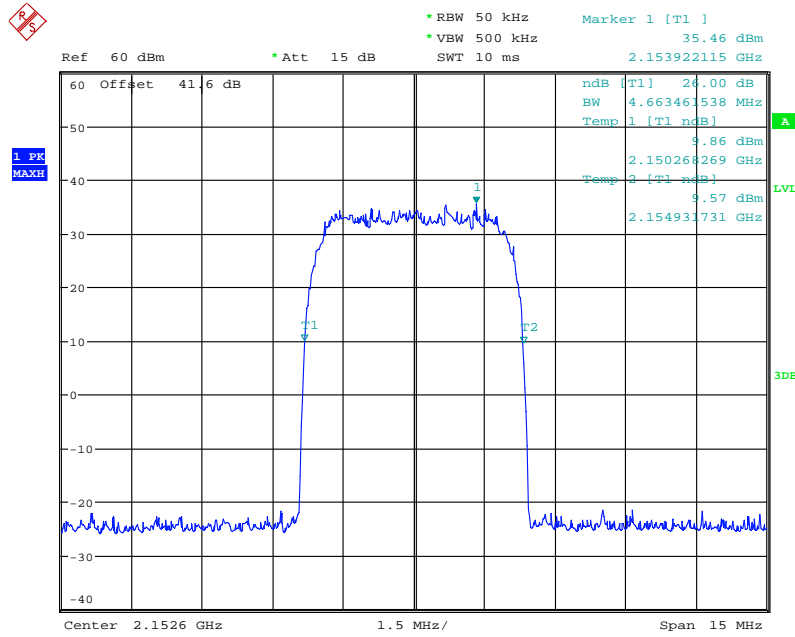


Product Service

Configuration 1 - Mode 3

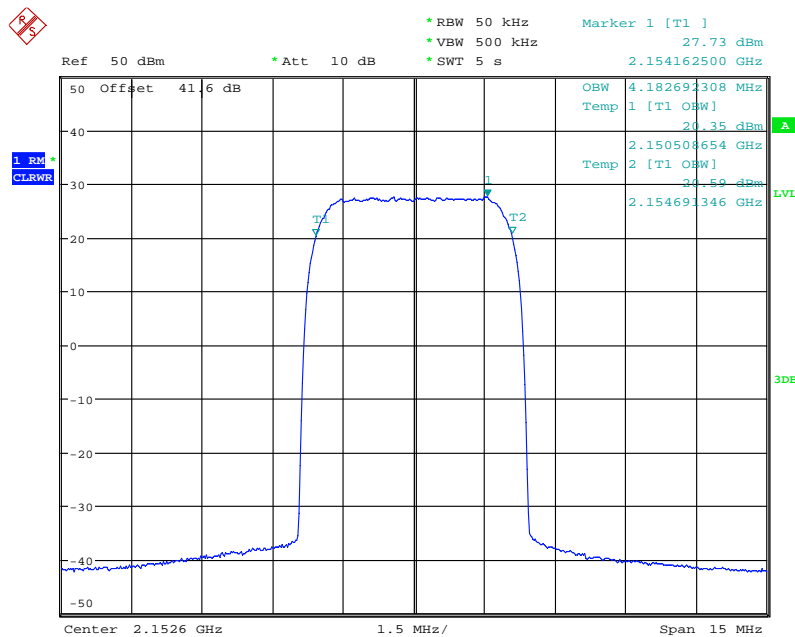
TM1

-26dB Occupied Bandwidth



Date: 8.JAN.2014 14:18:09

99% Occupied Bandwidth



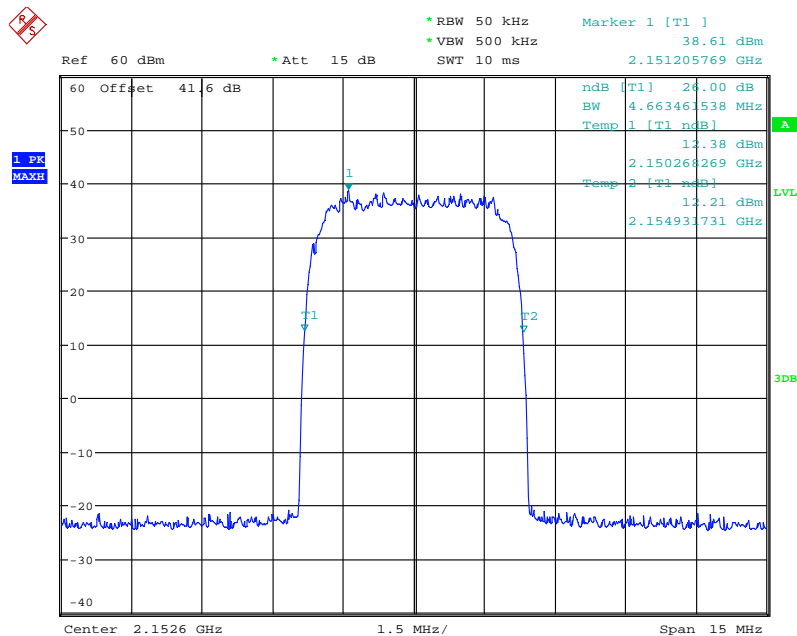
Date: 24.OCT.2013 16:21:02



Product Service

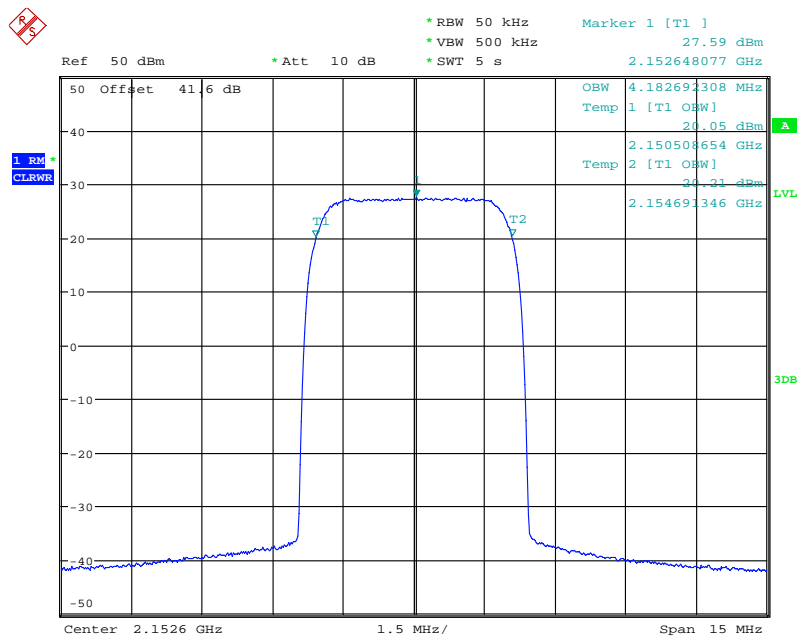
TM5

-26dB Occupied Bandwidth



Date: 8.JAN.2014 13:29:03

99% Occupied Bandwidth

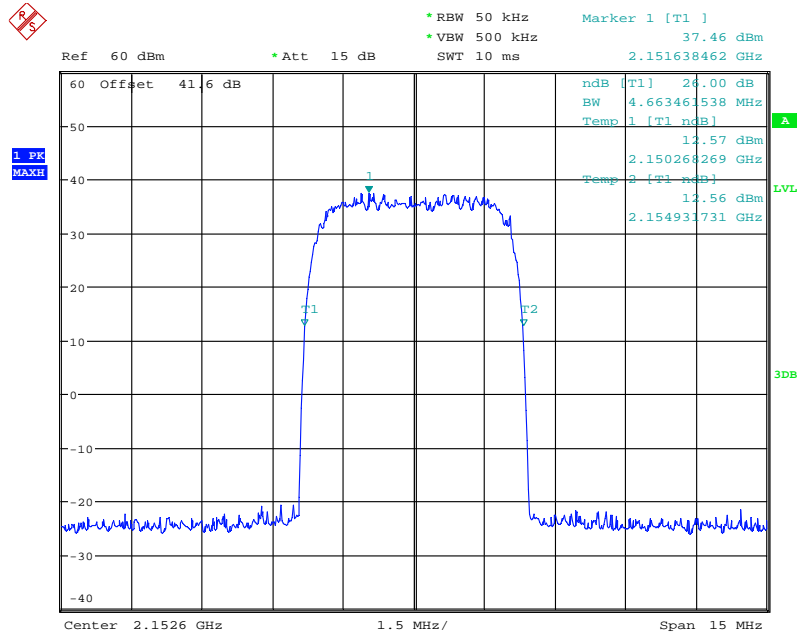


Date: 24.OCT.2013 16:40:22



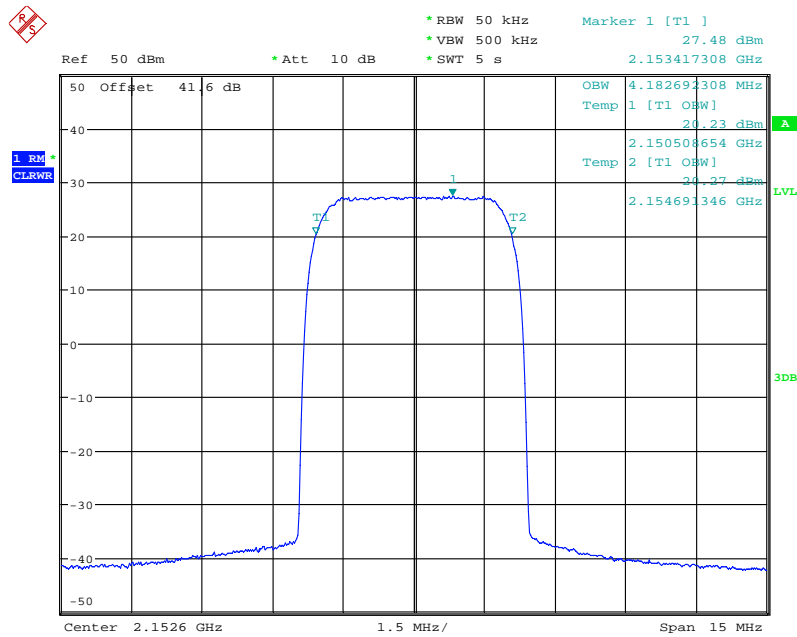
TM6

-26dB Occupied Bandwidth



Date: 8.JAN.2014 14:10:36

99% Occupied Bandwidth



Date: 24.OCT.2013 17:05:21



2.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (± 1 MHz)

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 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

24 and 25 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 27.53(h)(1), at least 1% of the emission bandwidth should be used for the frequencies offset up to 1MHz away from the block edge. A resolution bandwidth of 30kHz was used for single carrier and multi carriers (x2) up to 1MHz away from the band edges. 30kHz is <1% of the Emission Bandwidth (5MHz nominal Bandwidth setting). To compensate for the reduced measurement bandwidth, at the frequency range up to 1MHz away from the band edges, the limit was adjusted from -13dBm to -15.2dBm. According to the FCC rules, a RBW of 1MHz was used for measurements of emissions > 1MHz away from the band edges. 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 representative were shown as below.

The EUT was tested at its maximum power level. The path loss was measured and entered as a reference level offset.

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

Configuration 1 - Mode 1
- Mode 3
- Mode 7
- Mode 8



2.5.6 Environmental Conditions

	24 October 2013	25 October 2013
Ambient Temperature	22.5°C	23.0°C
Relative Humidity	35.0%	39.0%

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.

TM1

Single Carrier

Configuration 1 - Mode 1 and 3

Band Edge Frequency	Edge Test with QPSK modulation Channel No./Frequencies	RBW / VBW (kHz)	Limit (dB)
Bottom 2110 MHz	Channel: 1537 Frequency: 2112.4 MHz	30 / 300	-18.2
Top 2155 MHz	Channel: 1738 Frequency: 2152.6 MHz	30 / 300	-18.2

Multi Carrier (1x2)

Configuration 1 - Mode 7 and 8

Band Edge Frequency	Edge Test with QPSK modulation Channel No./Frequencies	RBW / VBW (kHz)	Limit (dB)
Bottom 2110 MHz	Channel: 1537 & 1562 Frequency: 2112.4 & 2117.4 MHz	30 / 300	-18.2
Top 2155 MHz	Channel: 1713 & 1738 Frequency: 2147.6 & 2152.6 MHz	30 / 300	-18.2

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.

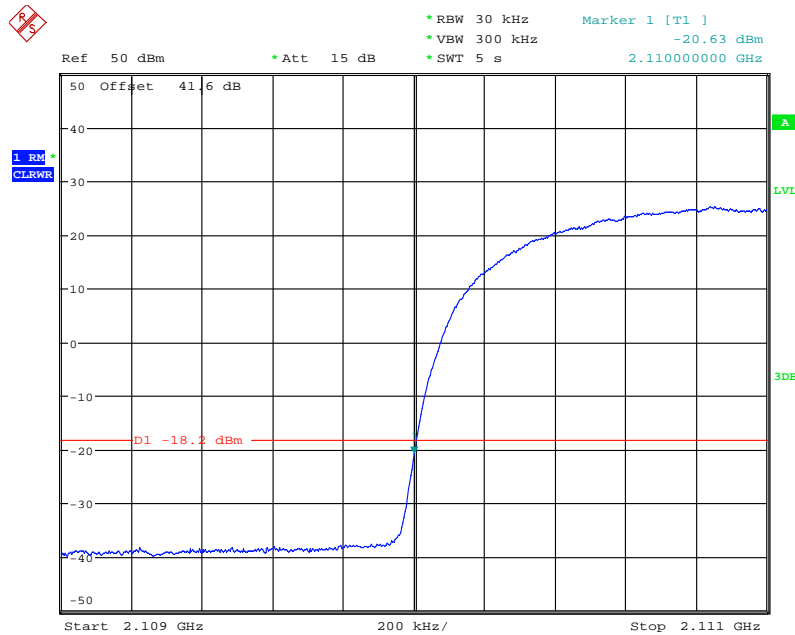


The test results are shown below

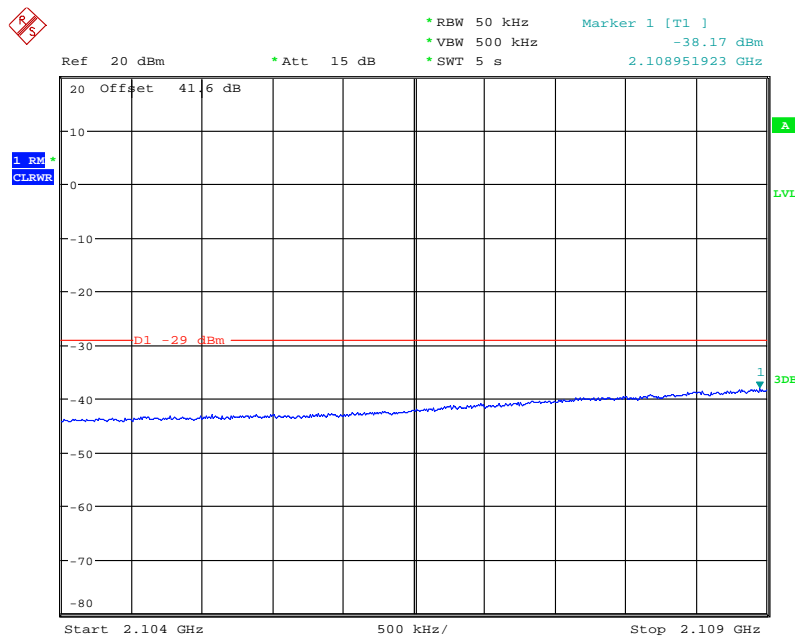
TM1

Single Carrier

Configuration 1 - Mode 1



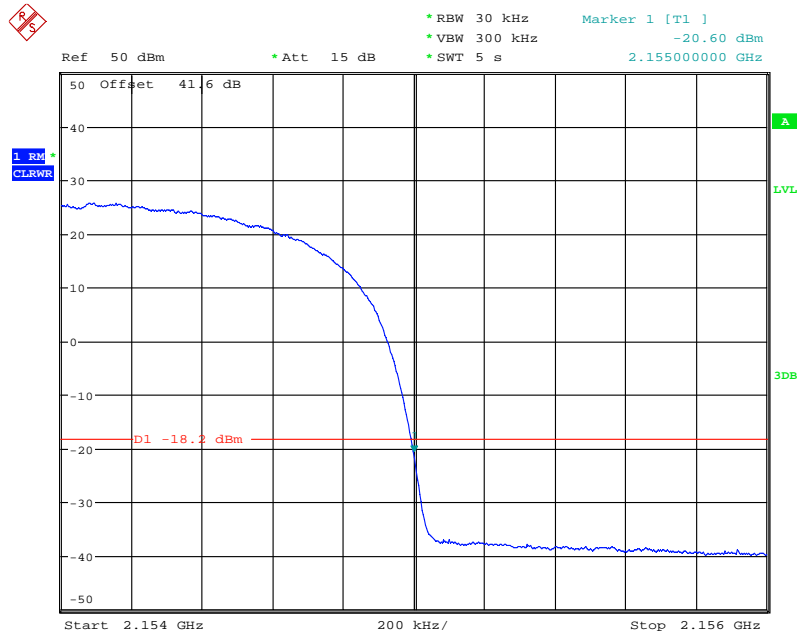
Date: 24.OCT.2013 10:18:42



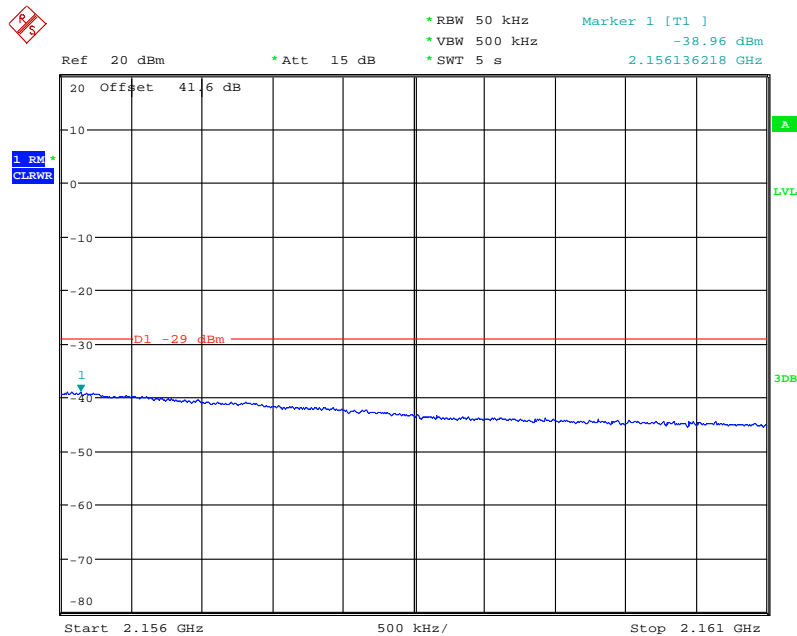
Date: 24.OCT.2013 10:22:00



Configuration 1 - Mode 3



Date: 24.OCT.2013 16:16:13



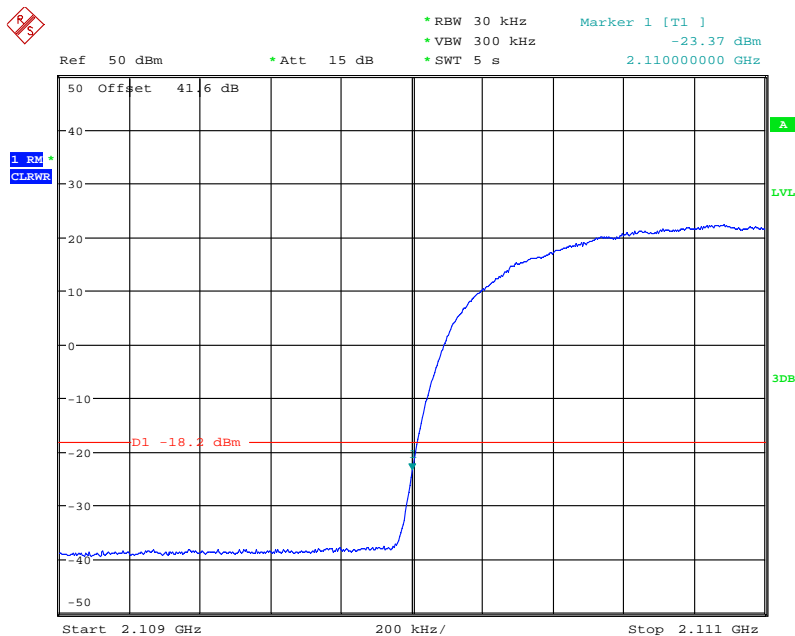
Date: 24.OCT.2013 16:17:29



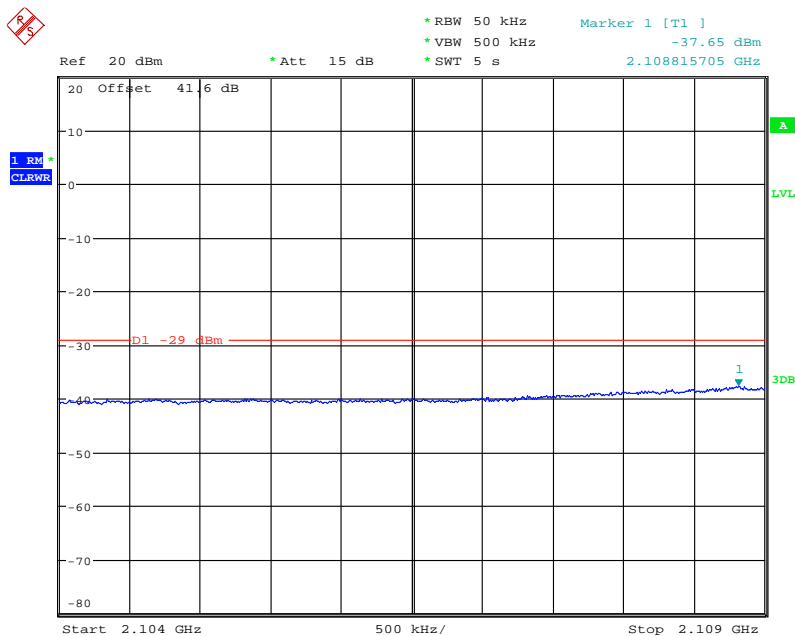
Product Service

Multi Carrier (1x2)

Configuration 1 - Mode 7



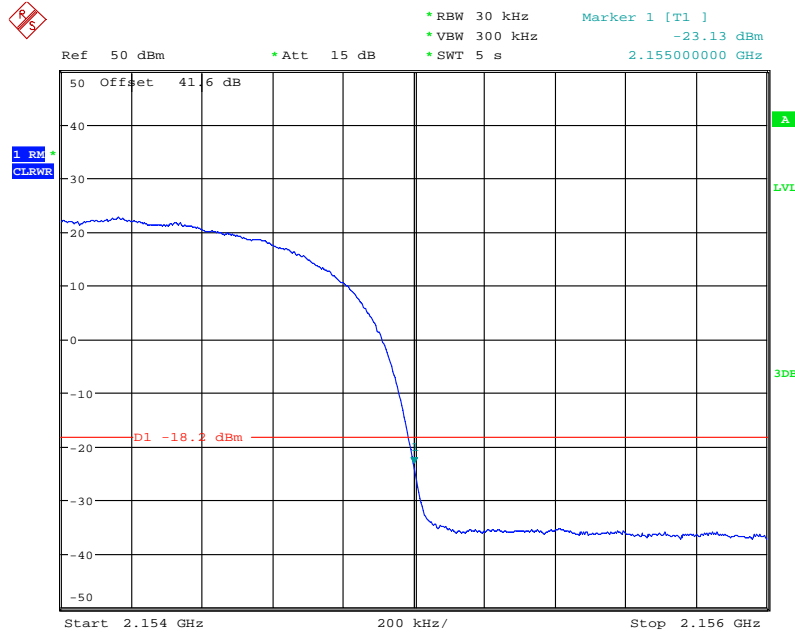
Date: 25.OCT.2013 15:34:50



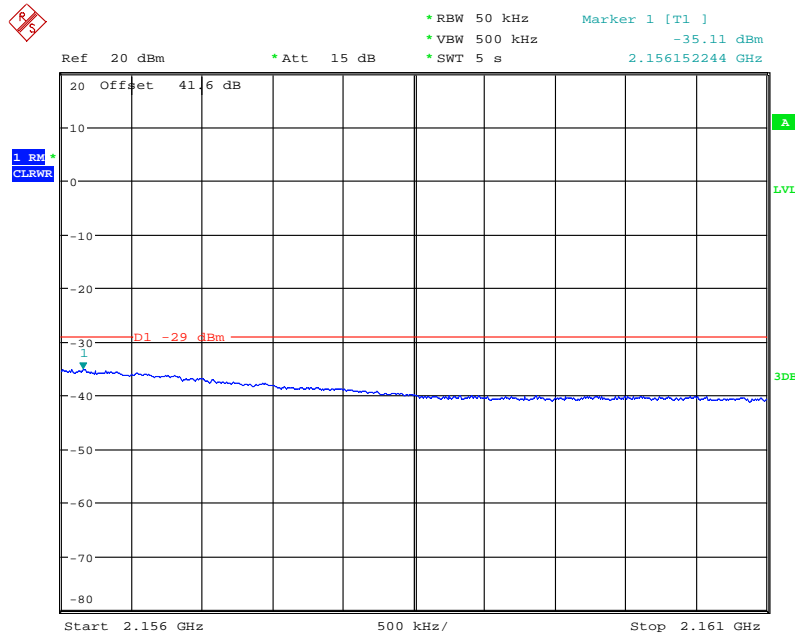
Date: 25.OCT.2013 15:32:38



Configuration 1 - Mode 8



Date: 25.OCT.2013 16:13:06



Date: 25.OCT.2013 16:14:01

Limit

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



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

11 and 13 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.

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 - $(43 + 10\text{Log}(P))$ dB

Where:

Field Strength is measured in dB μ V/m

P is measured Transmitter Power in Watts



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 dipole 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 meters.

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

$$E_{(v/m)} = (30 \times 1.64 \times 65.24)^{0.5} / 3 = 18.89V/m = 145.52dB\mu V/m$$

As per 27.53(h) the spurious emission must be attenuated by $43 + 10\log(P_o)$ dB this gives:

$$43 + 10\log(65.24) = 61.15dB$$

Therefore the limit at 3m measurement distance is:

$$145.52 - 61.15 = 84.4 \text{ dB}\mu V/m$$

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 in the following configurations and modes of operation:

- Configuration 1 - Mode 2
 - Mode 4
 - Mode 5
 - Mode 6
 - Mode 10

2.6.6 Environmental Conditions

	11 November 2013	13 November 2013
Ambient Temperature	26.0°C	25.0°C
Relative Humidity	35.0%	33.0%



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 all of the emissions are greater than 20dB below the limit. A set of plots have been included to show the measurement system noise floor

Single Carrier:

TM1, TM5 and TM6

Configuration 1 - Mode 2

No emissions were detected within 20dB of the limit.

Multi Carrier(x2):

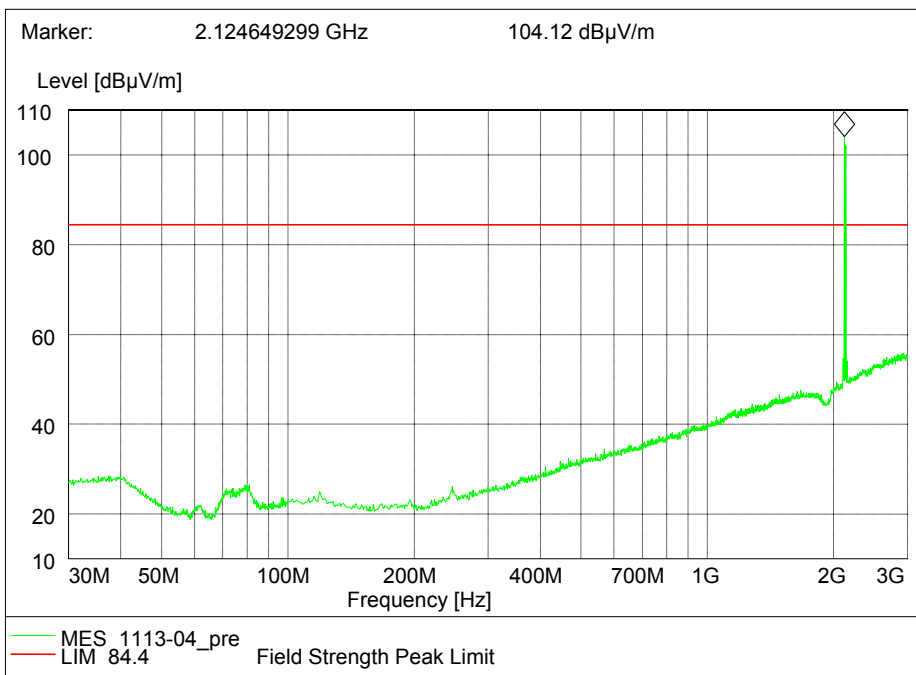
TM6

Configuration 1 - Mode 4

No emissions were detected within 20dB of the limit.

Configuration 1 - Mode 5

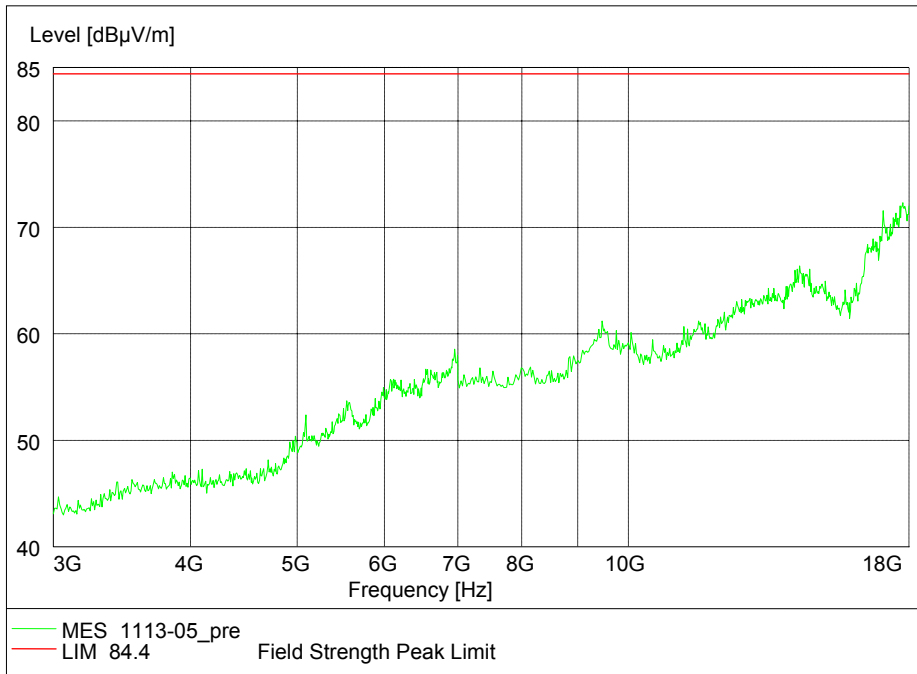
30MHz to 3GHz



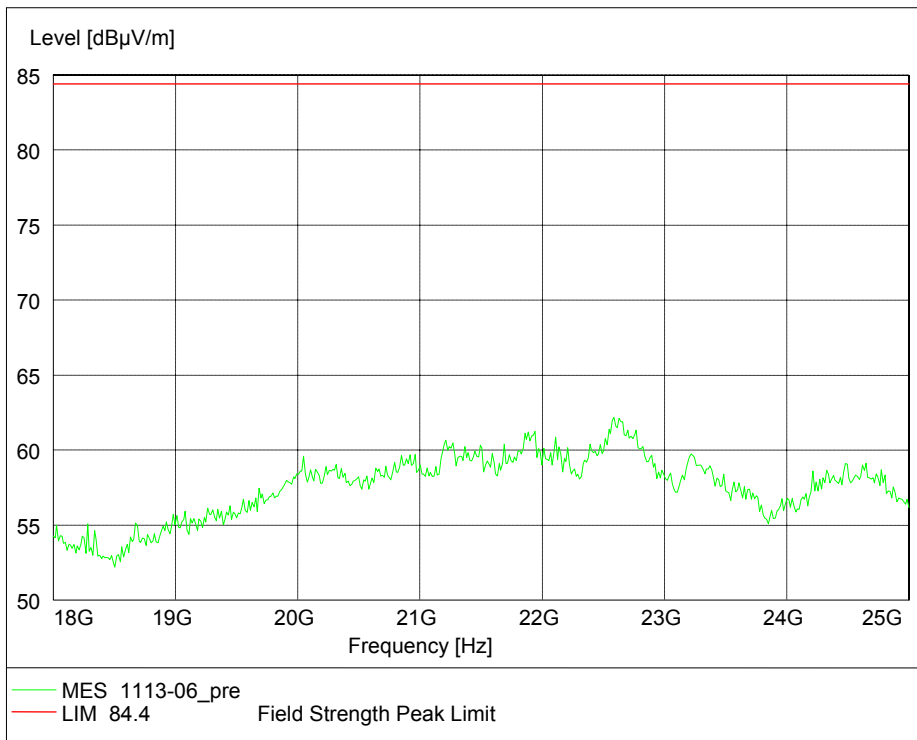
Note: The emission marked is the operating frequency.



3GHz to 18GHz



18GHz to 25GHz



Configuration 1 - Mode 6

No emissions were detected within 20dB of the limit.



Product Service

Multi Carrier(x4):**TM6**Configuration 1 – Mode10

No emissions were detected within 20dB of the limit.

Limit	-13dBm / 84.4dB μ V/m
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Remarks

The EUT does not exceed -13dBm / 84.4dB μ V/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

24 and 25 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 Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 9kHz to 22GHz. The EUT was set to transmit on maximum power. 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.

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 10th harmonic of the highest carrier frequency.

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

Configuration 1 - Mode 1
 - Mode 2
 - Mode 3
 - Mode 4
 - Mode 5
 - Mode 6



Product Service

2.7.6 Environmental Conditions

	24 October 2013	25 October 2013
Ambient Temperature	22.5°C	23.0°C
Relative Humidity	35.0%	39.0%

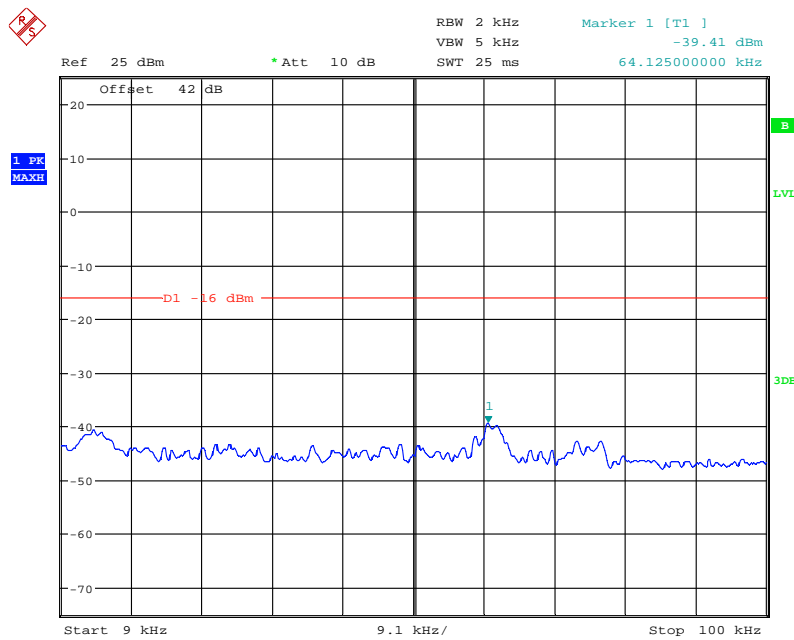
2.7.7 Test Results

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 measurement with a smaller span showed that it was related to the LO feedthrough



Date: 24.OCT.2013 10:24:52



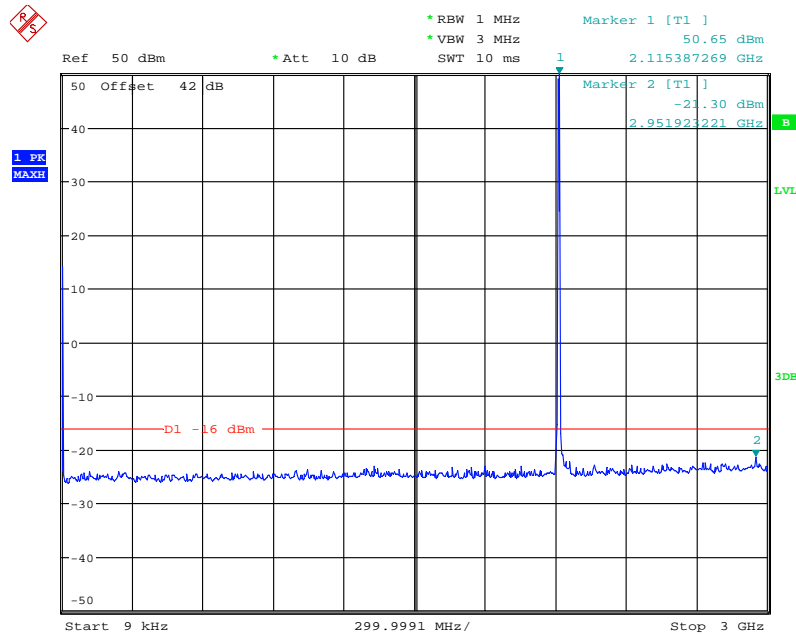
Product Service

TM1

Single Carrier

Configuration - Mode 1

9kHz to 3GHz

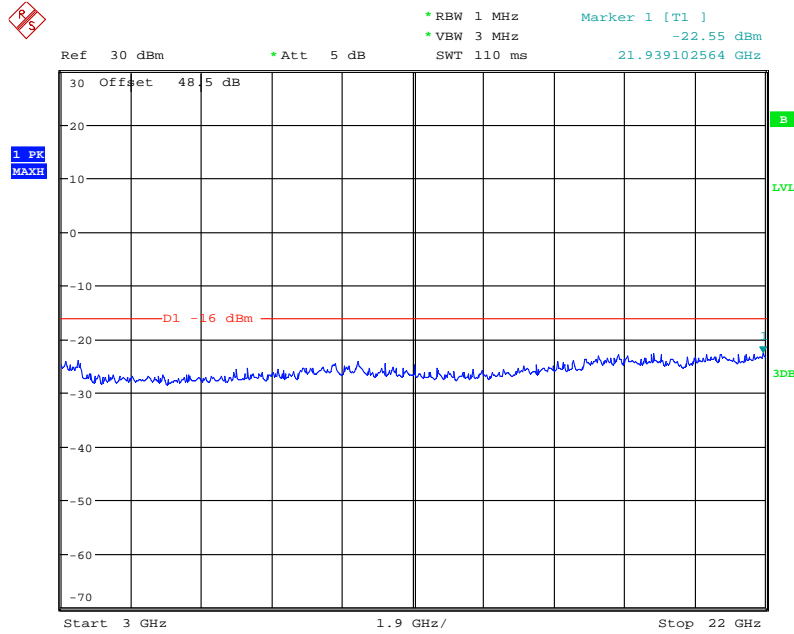


Date: 24.OCT.2013 10:26:19

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



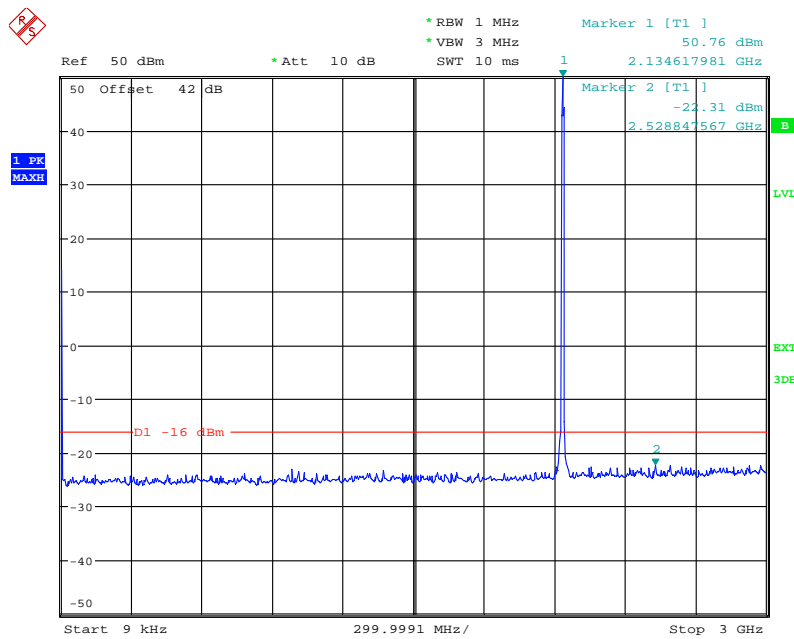
3GHz to 22GHz



Date: 24.OCT.2013 10:34:00

Configuration 1 - Mode 2

9kHz to 3GHz

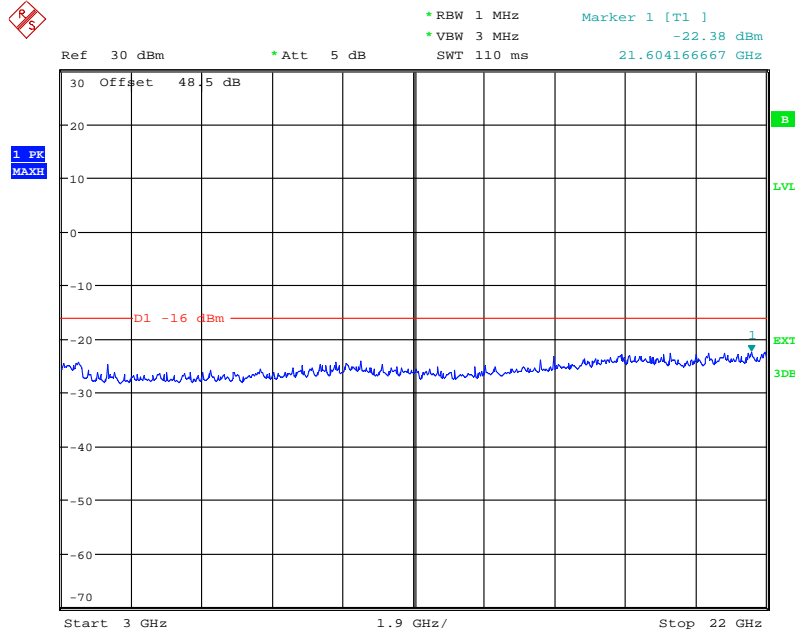


Date: 24.OCT.2013 14:41:52

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



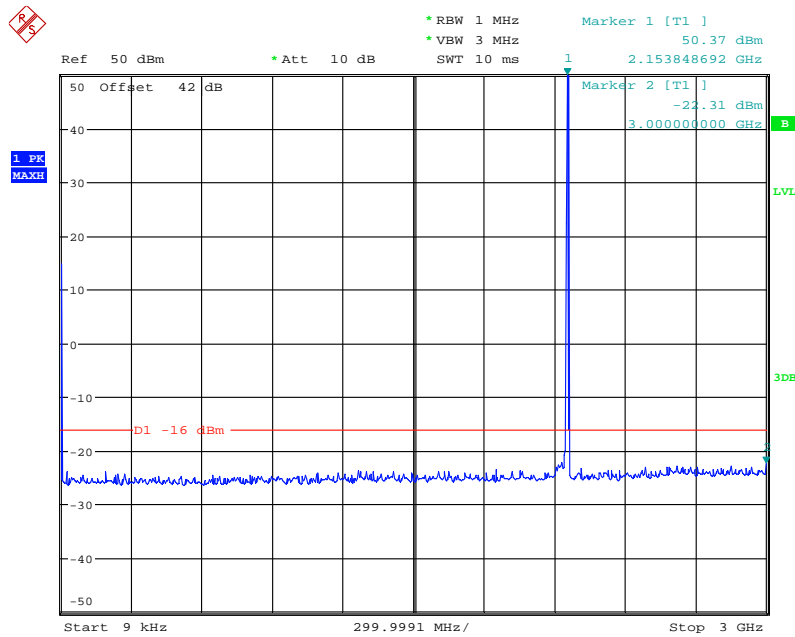
3GHz to 22GHz



Date: 24.OCT.2013 14:44:13

Configuration 1 - Mode 3

9kHz to 3GHz

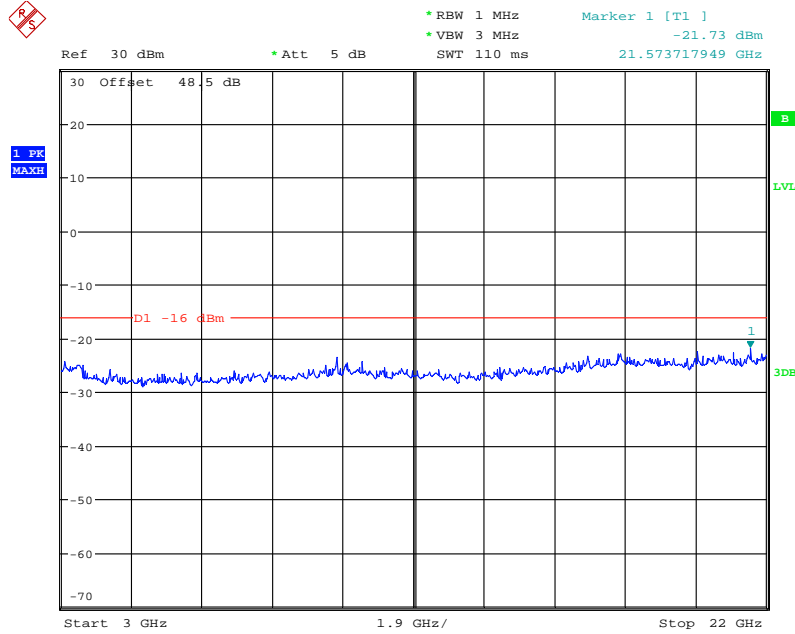


Date: 24.OCT.2013 16:25:46

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



3GHz to 22GHz

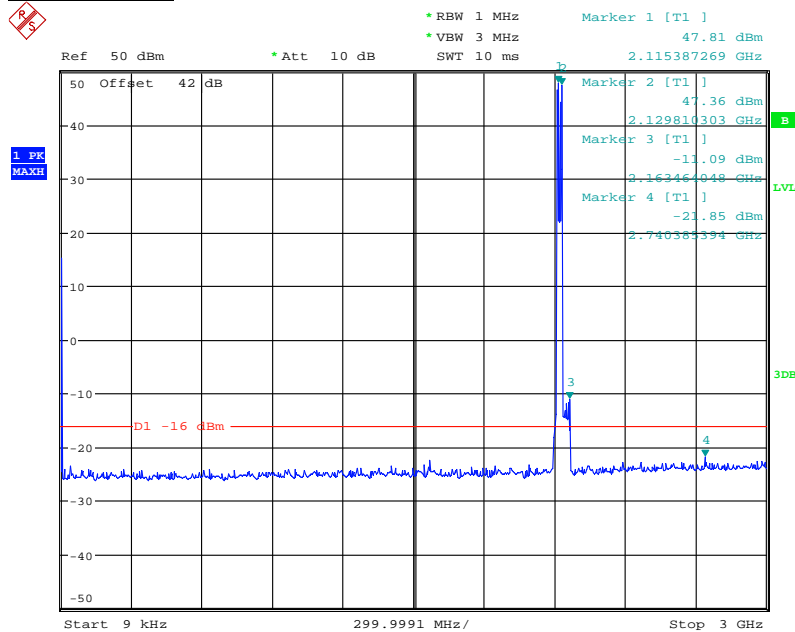


Date: 24.OCT.2013 16:21:45

Multi Carrier (1x2)

Configuration 1 - Mode 4

9kHz to 3GHz

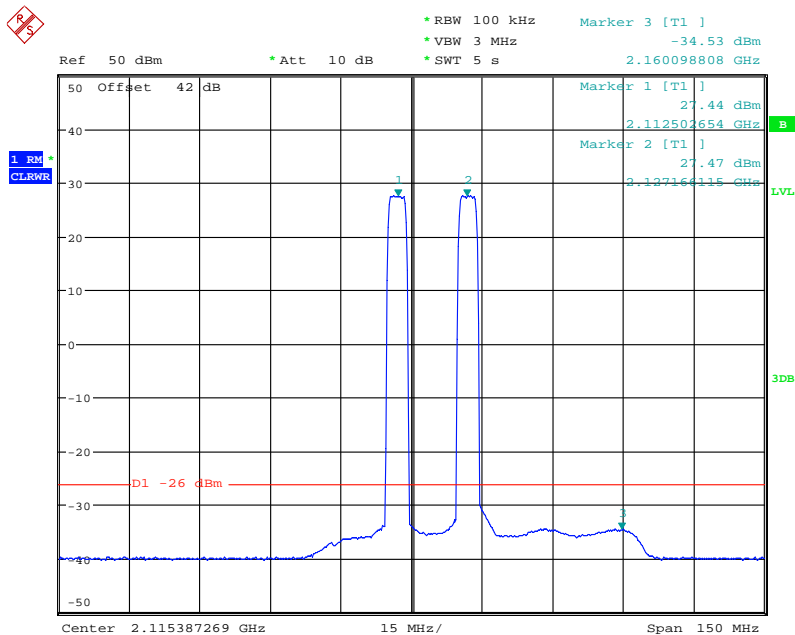


Date: 25.OCT.2013 15:37:55

Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot on page 69 of 87.



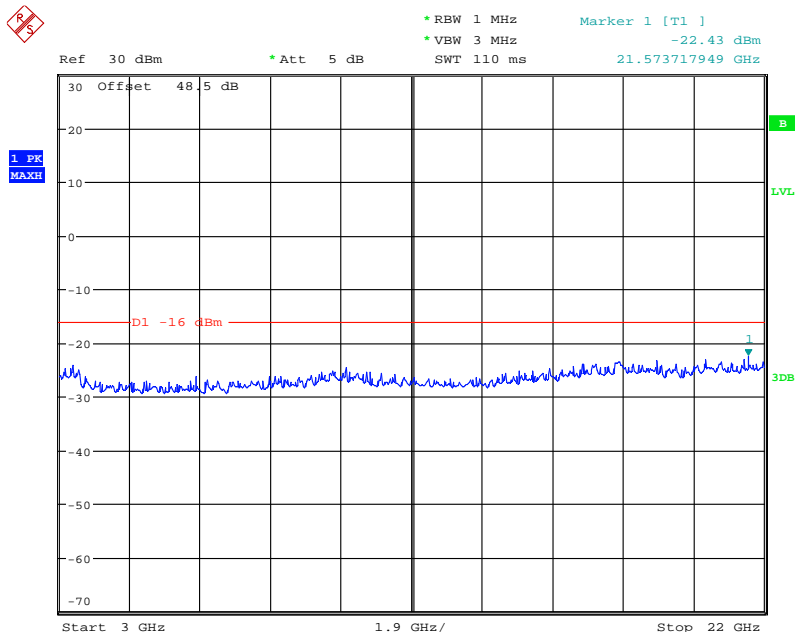
Product Service



Date: 25.OCT.2013 15:39:00

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

3GHz to 22GHz

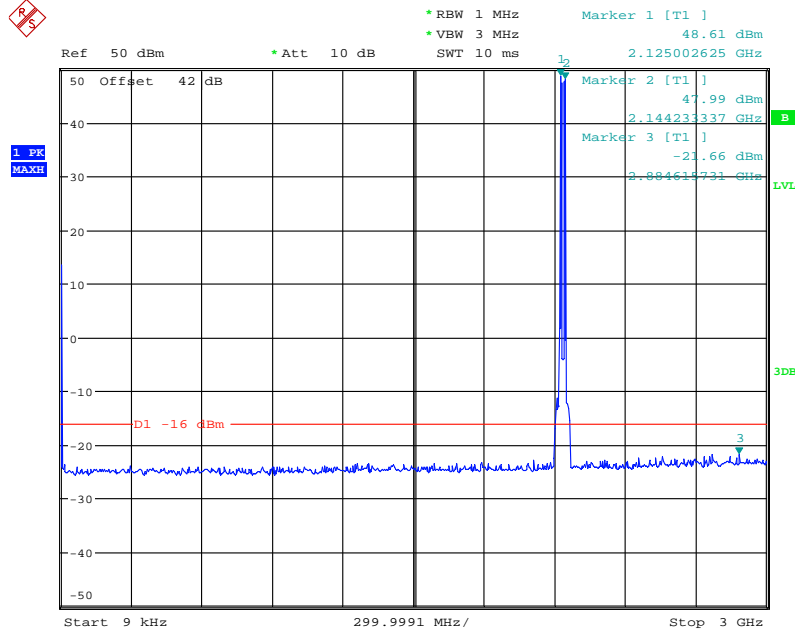


Date: 25.OCT.2013 15:35:59



Configuration 1 - Mode 5

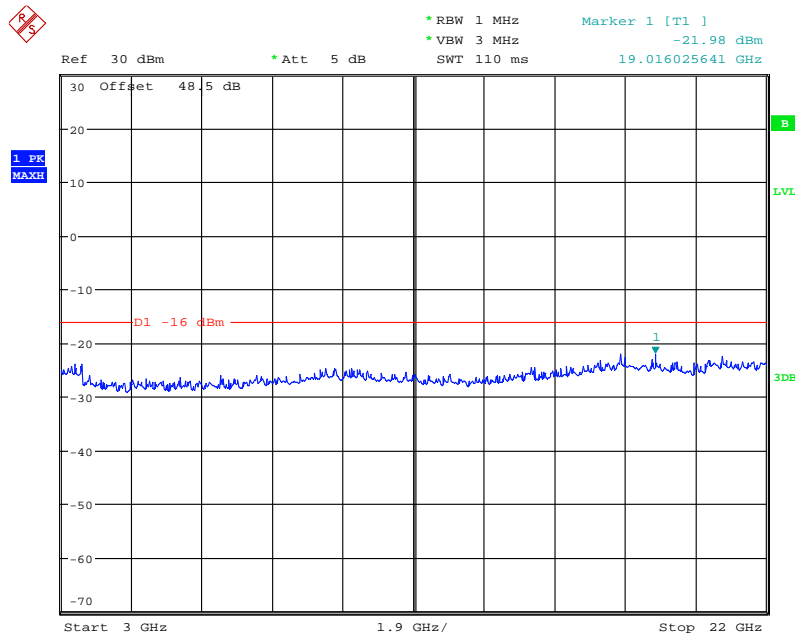
9kHz to 3GHz



Date: 25.OCT.2013 10:38:19

Note: The emissions beyond the limit are the operating frequencies.

3GHz to 22GHz

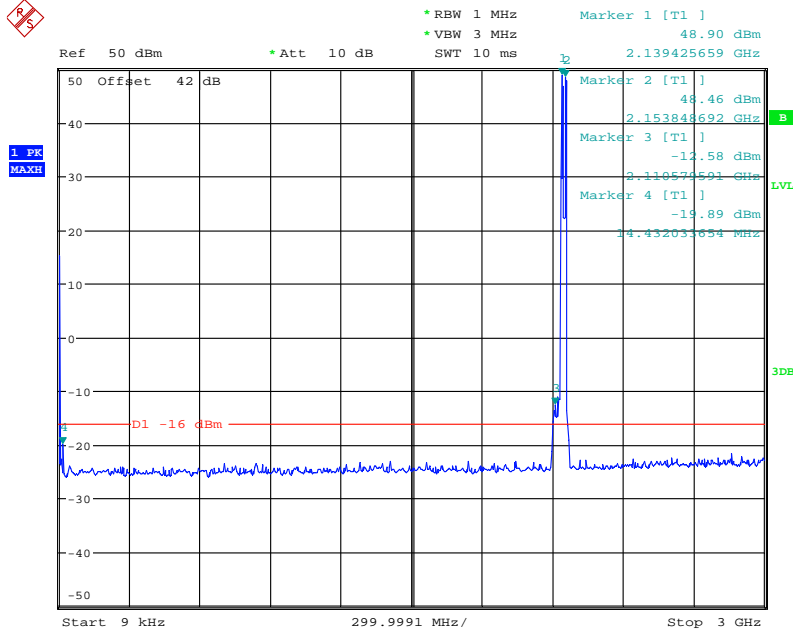


Date: 25.OCT.2013 10:42:13



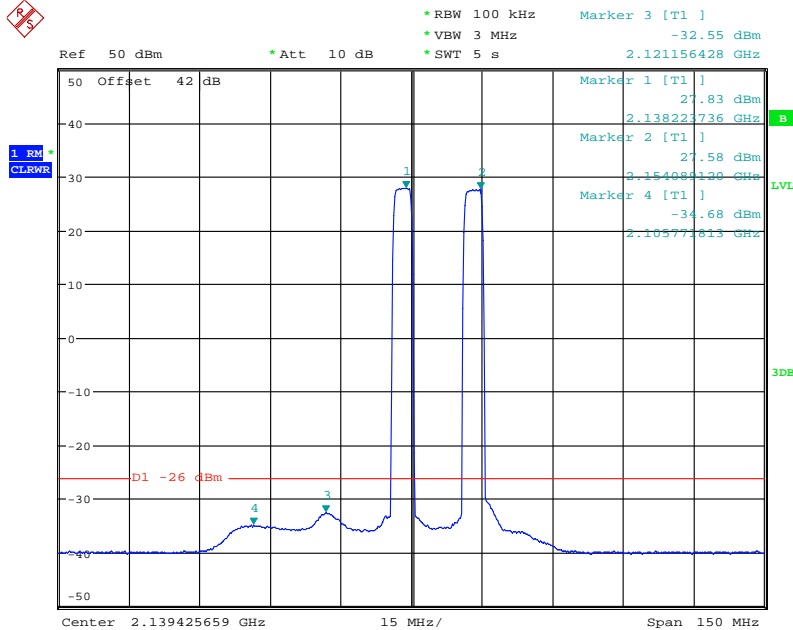
Configuration 1 - Mode 6

9kHz to 3GHz



Date: 25.OCT.2013 16:06:37

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



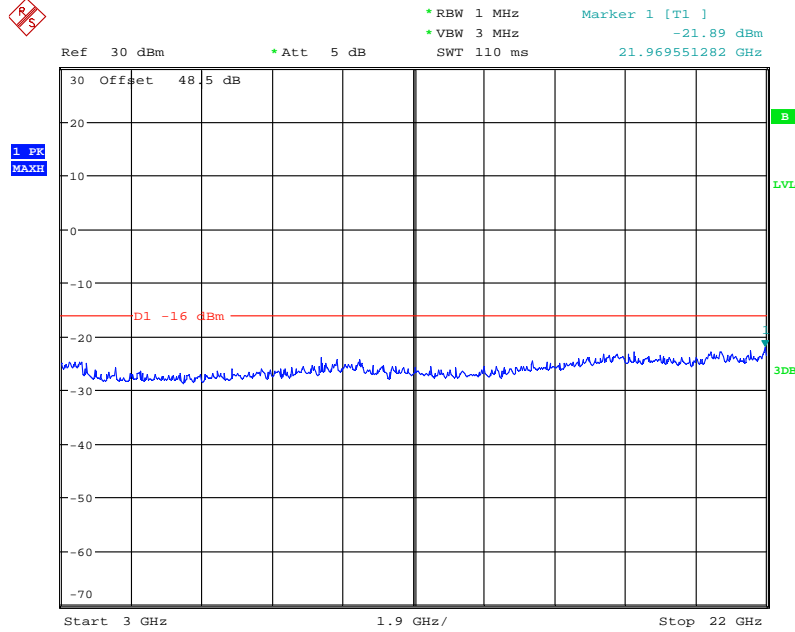
Date: 25.OCT.2013 16:08:06

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



Product Service

3GHz to 22GHz



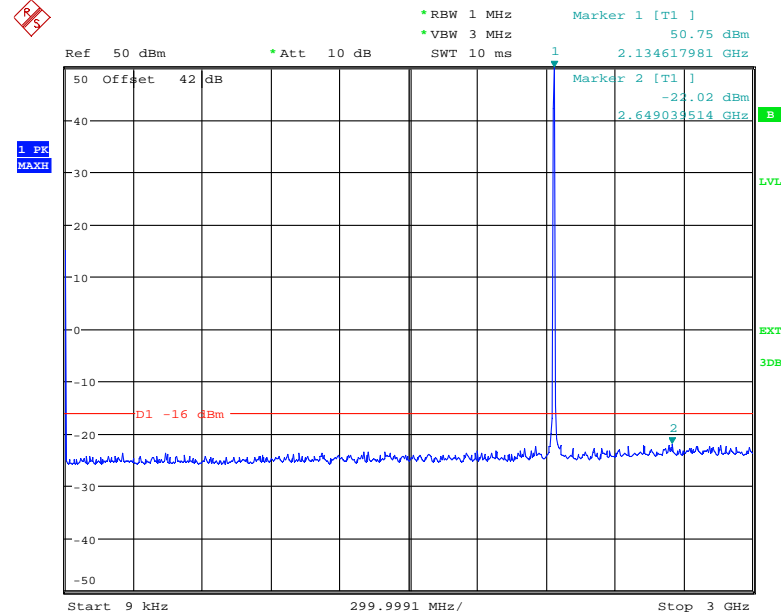
Date: 25.OCT.2013 16:12:15

TM5

Single Carrier

Configuration – Mode2

9kHz to 3GHz



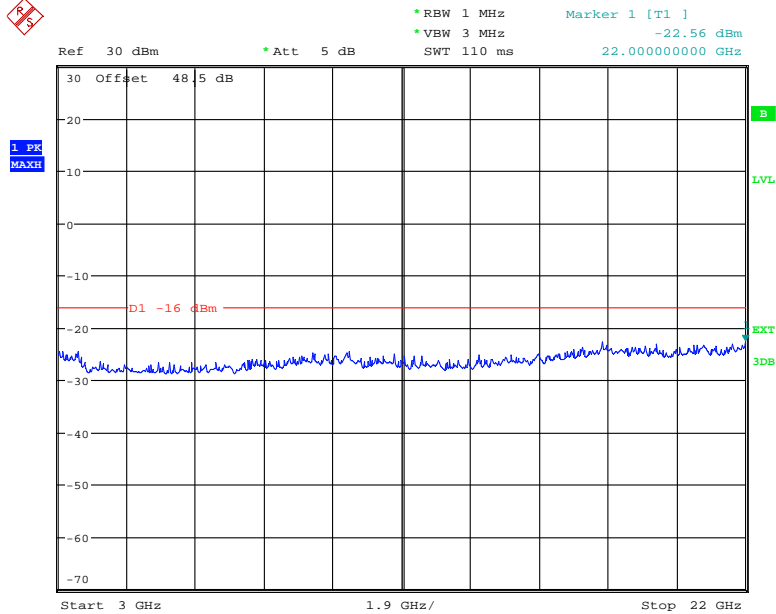
Date: 24.OCT.2013 15:37:04

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



Product Service

3GHz to 22GHz

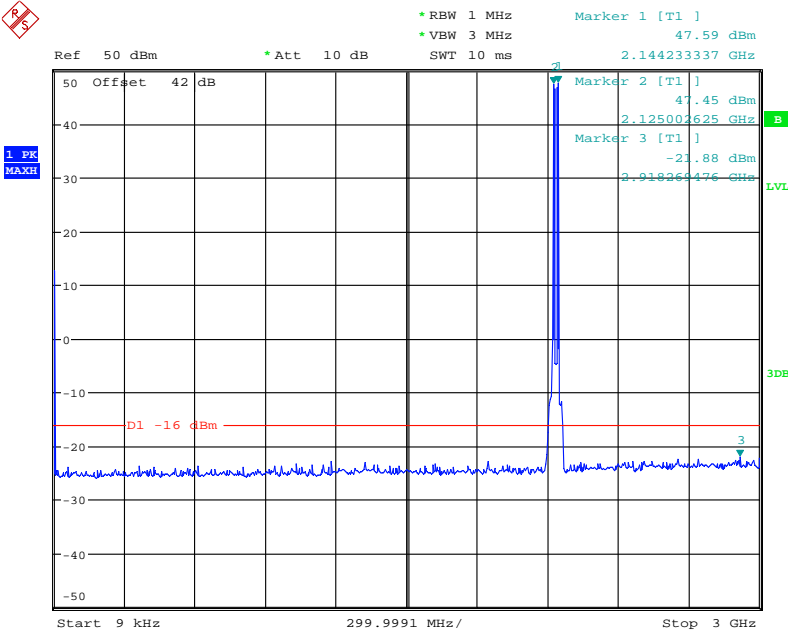


Date: 24.OCT.2013 15:34:11

Multi Carrier (1x2)

Configuration 1 - Mode 5

9kHz to 3GHz

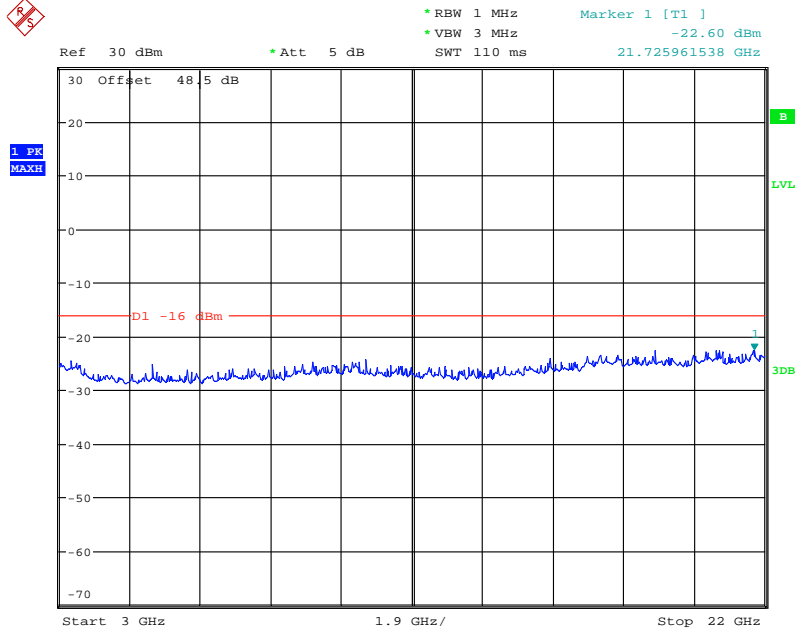


Date: 25.OCT.2013 11:07:37

Note: The emissions beyond the limit are the operating frequencies.



3GHz to 22GHz



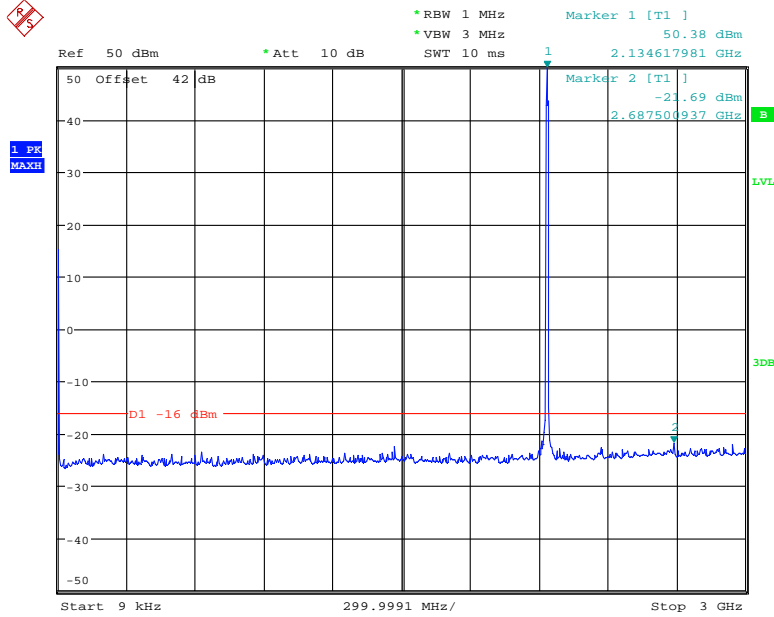
Date: 25.OCT.2013 11:04:05

TM6

Single Carrier

Configuration – Mode2

9kHz to 3GHz



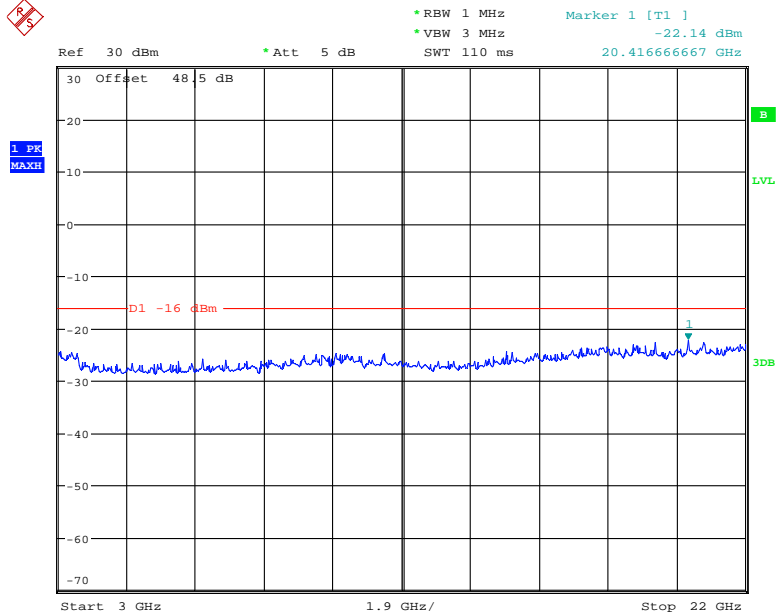
Date: 24.OCT.2013 15:56:19

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



Product Service

3GHz to 22GHz

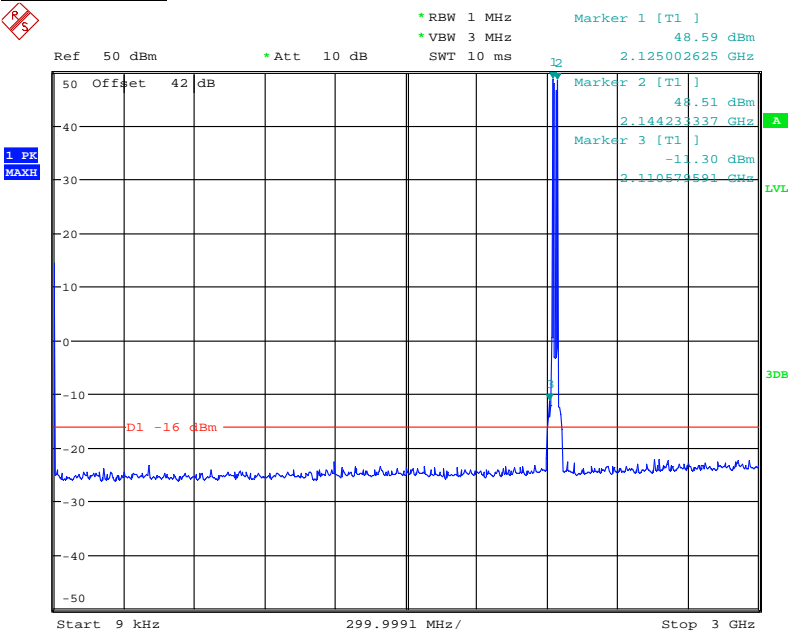


Date: 24.OCT.2013 15:59:07

Multi Carrier (1x2)

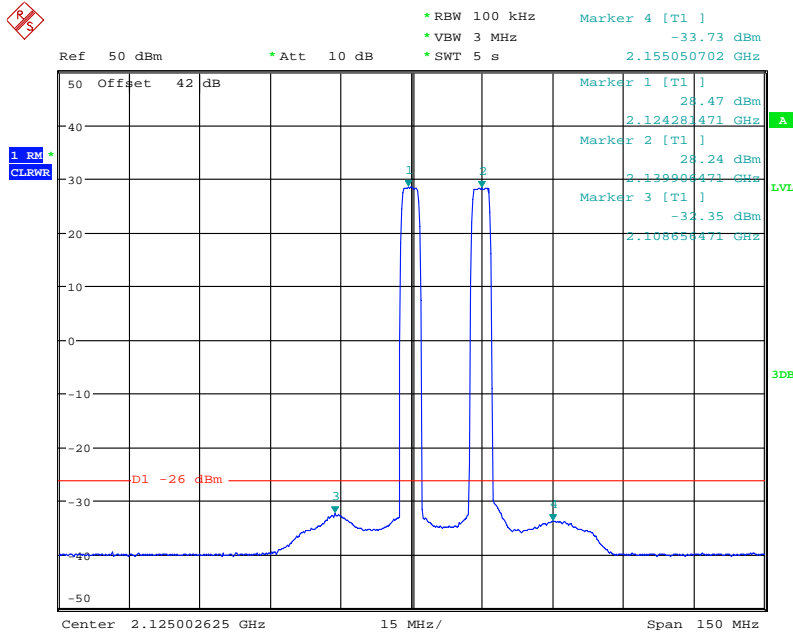
Configuration 1 - Mode 5

9kHz to 3GHz



Date: 25.OCT.2013 10:43:32

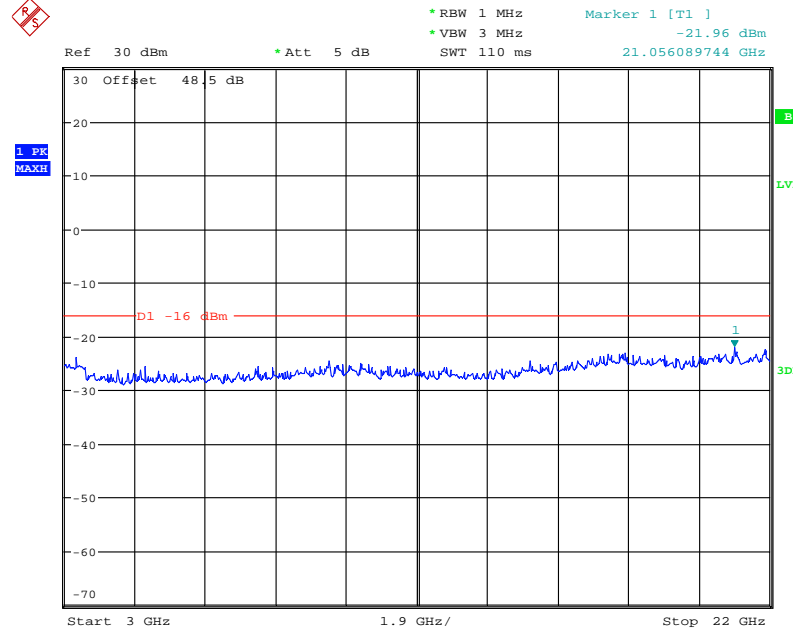
Note: The emissions above the limit are measured in a smaller bandwidth and using a RMS detector, see the plot on page 76 of 87.



Date: 25.OCT.2013 10:46:30

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

3GHz to 22GHz



Date: 25.OCT.2013 11:25:09



Product Service

Limit

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

Remarks

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



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

11 and 12 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 -30°C and +50°C in 10° steps as per 2.1055.

The EUT was tested at it’s maximum power level, modulation using QPSK as the representative test modulation. The path loss measured and entered as a reference level offset.

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

Configuration 1 - Mode 2

2.8.6 Environmental Conditions

	11 December 2013	12 December 2013
Ambient Temperature	24.5°C	24.5°C
Relative Humidity	46.0%	48.0%



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

TM1

Configuration 1 - Mode 2

Temperature Interval (°C)	Deviation (Hz)
-30	+29.94
-20	+33.16
-10	+27.22
0	+32.83
+10	+32.89
+20	+31.16
+30	+32.78
+40	+32.96
+50	-29.69

Limit	$\pm (0.05 \text{ ppm} + 12 \text{ Hz})$ or $\pm 118.62 \text{ Hz}^*$
-------	---

Remarks

* Limit according to 3GPP TS 25.141 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

12 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 EUT was tested at its maximum power level, modulation using QPSK as the representative test modulation. The path loss measured and entered as a reference level offset.

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

Configuration 1 - Mode 2

2.9.6 Environmental Conditions

	12 December 2013
Ambient Temperature	24.5°C
Relative Humidity	48.0%



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

TM1

Configuration 1 - Mode 2

DC Voltage (V)	Deviation (Hz)
-40.8	+29.45
-48.0	+31.16
-55.2	+33.78

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

Remarks

* Limit according to 3GPP TS 25.141 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

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) and 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	13-Dec-2013
Thermo-hygrometer	AZ Instruments	8705	9151665	12	16-Dec-2013
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	13-Dec-2013
Thermo-hygrometer	AZ Instruments	8705	9151665	12	16-Dec-2013



Product Service

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	13-Dec-2013
Thermo-hygrometer	AZ Instruments	8705	9151665	12	16-Dec-2013

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



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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		$<1 \times 10^{-7}$
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



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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).

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