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NEDAC ISO/IEC 17025

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Ericsson AB Klaes Holm PDU HW 164 80 Stockholm

# Class II permissive change on AIR 21 B4A B2P 1700/2100 MHz radio equipment with FCC ID: TA8AKRC118046-1 and IC: 287AB-AS1180461

(6 appendices)

**Test object** 

Product name: AIR 21 B4A B2P Product number: KRC 118 046/1, R3B

#### Summary

See appendix 1 for general information and appendix 6 for external photos.

Standard	Compliant	Appendix	
FCC CFR 47 / IC RSS-139 Issue 2			
2.1046 / RSS-139 6.4	RF power output conducted	Yes	2
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	3
2.1051 / RSS-139 6.5	Band edge	Yes	4
2.1051 / RSS-139 6.5	Spurious emission at antenna terminals	Yes	5

Note: Above RSS-139 items are given as cross-reference only. Measurements were performed according to ANSI procedures referenced by FCC and covered by SP's accreditation.

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Occupied bandwidth	Appendix 3
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Appendix 1

# Description of the test object

Equipment:	Product name: AIR 21 B4A B2P Product number: KRC 118 046/1, R3B FCC ID TA8AKRC118046-1 IC 287AB-AS1180461 IC MODEL NO: AS1180461	
Tested configuration:	WCDMA single RAT	
Frequency bands:	TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz	
Antenna ports:	2 TX/RX ports, (internally connected to integrated Cross- Polarized antenna elements)	
RF configurations:	Single carrier, multi carrier and MIMO 2x2	
Nominal RF output power per antenna port:	Single carrier: 1x 44.8 dBm (1x 30W) Multi carrier: 2x 41.8 dBm (2x 15W) 4x 38.8 dBm (4x 7.5W)	
Antenna type:	Cross- polarized antenna	
Antenna gain:	18 dBi	
Modulations:	QPSK, 16QAM and 64QAM	
Channel bandwidths:	4.2 to 5 MHz (configurable in steps of 100/200 kHz)	
Channel spacing:	4.4 to 5 MHz (configurable in steps of 100/200 kHz)	
Nominal supply voltage:	-48VDC	



## **Operation mode during measurements**

Measurements were performed with the test object transmitting the Test model 1 which are defined in 3GPP TS 25.141. Test model 1 (TM1) represent QPSK modulation. Test model 5 (TM5) includes the 16QAM modulation and Test model 6 (TM6) includes the 64QAM modulation.

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

single carrier, MIMO mode TM5: 8 HS-PDSCH at 240 ksps + 30 DPCH:s at 30 ksps (SF=128)

multi carrier(2 carriers), MIMO mode TM5: 8 HS-PDSCH at 240 ksps +30 DPCH:s at 30 ksps (SF=128)

Channel bandwidth 5 MHz

#### **Conducted measurements**

The conducted measurements were performed on AIR 21 B4A B12P B8P with product number KRC 118 056/1 including the radio unit ARUS B4 1/KRC 118 046 which is identical for AIR 21 B4 B2P and is representative for conducted TX performance measurements.

The test object was pole mounted and powered with -48 VDC by an external power supply. All TX parameters were measured at port RF A with port RF B terminated into 50 ohm. Complete measurements were made on RF A with additional measurements on RF B to verify that the ports are identical.

#### **Purpose of test**

The purpose of test is to justify a Class II Permissive Change of the test object with hardware update and to include the use of MIMO mode, by verifying compliance to the performance characteristics specified in applicable parts of FCC CFR 47, IC RSS-139 and IC RSS-Gen.

#### References

Measurements were done according to relevant parts of the following standards: ANSI 63.4-2009 ANSI/TIA/EIA-603-C-2004 3GPP TS 25.141, version 11.4.0 CFR 47 part 2, October 1<sup>st</sup>, 2012 CFR 47 part 27, October 1<sup>st</sup>, 2012 RSS-Gen Issue 3 RSS-139 Issue 2



# Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "SP-QD 10885". The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).

Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

### Reservation

The test results in this report apply only to the particular test object as declared in the report.

### **Delivery of test object**

The test object was delivered 2013-10-18.

### Manufacturer's representative

Christer Gustavsson, Ericsson AB.

#### **Test engineers**

Andreas Johnson, Tomas Isbring, Hyder Khalaf, Kexin Chen, Tomas Lennhager Jörgen Wassholm and Rolf Kühn, SP

## **Test participant**

None



Appendix 1

# Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2014-07	503 738
R&S ESU 26	2014-05	901 553
R&S FSQ 40	2014-03	504 143
Control computer with	-	503 899
R&S software EMC32 version 8.52.0		
High pass filter	2014-07	901 501
High pass filter	2014-07	901 502
High pass filter	2014-07	504 199
High pass filter	2014-09	901 373
High pass filter	2014-09	503 739
High pass filter	2014-07	503 740
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
RF attenuator	2014-07	900 691
RF attenuator	2014-07	901 384
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2015-09	502 175
Std.gain horn FLANN model 20240-20	2014-03	503 674
μComp Nordic, Low Noise Amplifier	2014-04	901 545
Schwarzbeck preamplifier BBV 9742	2014-03	504 085
Miteq Low Noise Amplifier	2014-09	503 285
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188
Temperature Chamber	2013-11	501 031
Multimeter Fluke 87	2014-08	502 190



Appendix 1

#### Test frequencies during measurements

TX test frequencies Frequency Symbolic Comment UARFCN Downlink [MHz] name 1537 2112.4 Single carrier TX bottom frequency В 1537 2112.4 **B**2 2 carrier TX band bottom constellation 2117.4 1562 2 carrier TX band bottom constellation 2112.4 **B**3 1537 1587 2122.4 B4 4 carrier TX band bottom constellation 2112.4 1537 1562 2117.4 2122.4 1587 2127.4 1612 2132.6 Single carrier TX band mid frequency 1638 Μ 2 carrier TX band mid constellation 1625 2130.0 M2 1650 2135.0 4 carrier TX band midconstellation 2125.0 M4 1600 1625 2130.0 1650 2135.0 1675 2140.0 1738 2152.6 Т Single carrier TX top frequency T2 2 carrier TX band top constellation 1713 2147.6 1738 2152.6 T3 1688 2142.6 2 carrier TX band top constellation 1738 2152.6 T4 4 carrier TX band top constellation 1663 2137.6 1688 2142.6 1713 2147.6 1738 2152.6

All RX frequencies were configured 400 MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.



Appendix 1

#### Test set-up conducted measurements



## Test object:

1.	AIR 21 B4A B12P B8P, KRC 118 056/1, revision R1A, S/N: CQ30112763
	with software: CXP 901 3268/6, Rev. R51NE
	1-2. Transceiver, ARUS B4 1/KRC 118 046, revision R1C

#### **Functional test equipment**

2. 2	
2.	DUW 30 01, KDU 127 161/3, revision R4F, s/n: TU8XB20713
3.	PDU 02 01, BMG 980 336/4, revision R2A, s/n: BJ31528316
4	RBS 6201 cabinet, BAMS – 1000778792
5.	Controlling laptop HP Elitebook 8560w, BAMS 1001236856
	running software MOSHELL V9.0z
6.	Fast Ethernet switch, Netgear FS726T
7.	ERNC Sim 130, BAMS – 100066091
8.	Symmetricon 8040 reference, BAMS – 1000714189
9.	Terminator, 50 ohm
10.	Attenuator, according respective appendix
11.	SP Test Instrumentation according to measurement equipment list
12.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K474887
13.	GPS Active Antenna, KRE 101 2082/1





Appendix 1

Interfaces:	Type of port:
Power: -48 VDC	DC Power
Antenna port (A), (passive antenna), 7/16-connector	Antenna
Antenna port (B), (passive antenna), 7/16-connector	Antenna
Data 1, Optical Interface Link, single mode opto fibre	Signal
Data 2, Optical Interface Link, single mode opto fibre	Signal
Ground wire	Ground

#### **RBS** software:

Software	Revision
CXP 902 1719	R4F/5



# RF power output measurements according to CFR 47 §27.50 / IC RSS-139 6.4, conducted

Date	Temperature	Humidity
2013-11-08	$23^{\circ}C \pm 3^{\circ}C$	31 % ± 5 %
2013-11-10	$23^{\circ}C \pm 3^{\circ}C$	31 % ± 5 %

#### Test set-up and procedure

The test object was connected to a signal analyzer measuring peak and RMS output power in CDF mode. A resolution bandwidth of 50 MHz was used.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

#### Measurement uncertainty: 1.1 dB

#### Results

MIMO mode, single carrier

Rated output power 1 x 44.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]			
	Port RF A Port RF B Total power <sup>1)</sup>			
В	44.88/ 7.24	44.72/ 7.24	47.81	
М	44.86/ 7.24	44.76/ 7.24	47.82	
Т	44.86/ 7.24	44.71/7.24	47.80	

<sup>1)</sup>: summed output power according to FCC KDB662911 Multiple transmitter output v02r01

Note: The PAR value is the 0.1 % Peak to Average Ratio.



MIMO mode, 2-Carrier

Rated output power 2 x 41.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]		
	Port RF A	Port RF B	Total power <sup>1)</sup>
B2	44.72/ 7.24	44.70/ 7.26	47.72
M2	44.81/7.24	44.71/ 7.21	47.77
T2	44.79/ 7.24	44.78/ 7.19	47.80

MIMO mode, 4-Carrier

Rated output power 4 x 38.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]		
	Port RF A Port RF B Total power <sup>1)</sup>		
B4	44.93/ 7.31	44.93/ 7.31	47.94
M4	45.01/7.19	44.84/ 7.19	47.94
T4	44.90/ 7.38	44.93/ 7.38	47.93

<sup>1)</sup>: 2 outputs summed power according to FCC KDB662911 Multiple transmitter output v02r01 Note: The PAR value is the 0.1 % Peak to Average Ratio.





## MIMO mode, single carrier

Measured output power per 1 MHz.

Symbolic	[RMS dBm]		Total power <sup>1)</sup>
name	Port RF A	Port RF B	[RMS dBm]
В	38.99	39.61	42.61
М	39.94	39.67	42.94
Т	40.00	39.59	43.00

 <sup>1)</sup>: Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). "Measure and add 10 log(N<sub>Ant</sub>)".

#### Limits

- \$27.50: The maximum output power may not exceed 1640 W (EIRP)/ MHz. The Peak to Average Ratio (PAR) may not exceed 13 dB.
- RSS-139 6.4: The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-513 apply, resulting in a maximum EIRP of 1640 W/ MHz for the scope of this report. The peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes







## Occupied bandwidth measurements according to 47 CFR 2.1049 / RSS-Gen 4.6.1

Date	Temperature	Humidity
2013-11-07	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %
2013-11-08	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %

#### Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a signal analyzer with the RMS detector activated. The signal analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

#### Results

MIMO mode, single carrier,

Diagram	BW configuration	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
1	5 MHz	В	RF A	4.16
2	5 MHz	М	RF A	4.17
3	5 MHz	М	RF B	4.17
4	5 MHz	Т	RF A	4.17



Appendix 3

#### Diagram 1:



Date: 11.NOV.2013 09:50:58

#### Diagram 2:



Date: 11.NOV.2013 09:35:31



Appendix 3

#### Diagram 3:



Date: 11.NOV.2013 15:19:08

#### Diagram 4:



Date: 11.NOV.2013 10:03:05



## Band edge measurements according to CFR 47 §27.53(h) / IC RSS-139 6.5

Date	Temperature	Humidity
2013-11-07	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %
2013-11-08	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %

#### Test set-up and procedure

The measurements were made per definition in §27.53(h). The test object was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

A resolution bandwidth of 20 kHz was used up to 1 MHz away from the band edges. 20 kHz is <1% of the Emission BW (4.37 MHz between the 26 dB points for 5 MHz nominal BW setting). To compensate for the reduced resolution bandwidth, the limit was adjusted with 3.4 dB to -16.4 dBm.

A resolution bandwidth of 200 kHz was used 1 MHz to 6 MHz away from the band edges, to compensate for the reduced resolution bandwidth the limit was adjusted by 7 dB to -20 dBm.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), (iii) "measure and add 10 log( $N_{ANT}$ )" of FCC KDB662911 D01 Multiple Transmitter Output v01r02

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB



Appendix 4

#### Results

#### MIMO mode, single carrier

Diagram	BW configuration	Symbolic name	Tested Port
1 a-c	5 MHz	В	RF A
2 a-c	5 MHz	В	RF B
3 a-c	5 MHz	Т	RF A
4 a-c	5 MHz	Т	RF B

#### MIMO mode, 2-carriers

Diagram	BW configuration	Symbolic name	Tested Port
5 a-c	5 MHz	B2	RF A
6 a-c	5 MHz	T2	RF A

#### MIMO mode, 4-carriers

Diagram	BW configuration	Symbolic name	Tested Port
7 a-c	5 MHz	B4	RF A
8 a-c	5 MHz	T4	RF A

#### Limits

CFR 47 §27.53(h) and RSS-139 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P) dB$ , resulting in a limit of -13 dBm.

Complies?	Yes



Appendix 4

Diagram 1 a:

 
 MultiView
 Spectrum

 Ref Level 48.94 dbm
 • RBW 20 kHz

 • Att
 10 dB • SWT 10 s
 VBW 200 kHz

 TDF
 1705
 VBW 200 kHz
 ~ 1Rm Max M1[1] -24.88 dBm 2.110000000 GHz 40 dBr 30 dBr 20 de 10 df -10 dBr 1 -16.400 de -20 dBm -30 dBm -40 dBm -50 dBn 60 dBr Stop 2.111 GHz 11.11.2013 09:53:53 3001 pt 200.0 kHz/ Start 2.109 GH Measuring.. 

Date: 11.NOV.2013 09:53:53

#### Diagram 1 b:

MultiView	Spectrum								~
Ref Level 48.5	94 dBm 10 dB = SWT	<ul> <li>RBW 2</li> <li>10 s VBW</li> </ul>	00 kHz 2 MHz Mode	Auto Sween					
TDF	10 00 - 0111	10.5	2 PARE MODE	Addo officep					
1 Frequency Sv	weep					M1[1]			1Rm Max -22,49,48
						milij		2.	10898876 GHz
40 dBm									
30 dBm									
30 0011									
20 dBm-									
10 dBm-									
0 dBm									
-10 dBm									
-20 dBm	H1 -20.000 dBm								
-30 dBm-									M
10.40.0								-	
-in dam-									
-50 dBm									
-60 dBm									
Start 2.104 GH	z		2001 pt	ts	50	0.0 kHz/		s	top 2.109 GHz
	1						Measuring		11.11.2013 09:54:53

Date: 11.NOV.2013 09:54:53





Appendix 4

Diagram 1 c

ultiView 🖽 Spectrum	1		~
Ref Level 48.94 dBm	RBW 1 MHz		
Att 10 dB - SWT 10 s	VBW 10 MHz Mode Auto Sweep		
			a (D M
requency sweep		M1[1]	-34-50 dB
			2.10398751 G
dBm			
dBm			
dBm-			
d8m-			
8m			
) dBm			
H1 -13.000 dBm			
dBm			
40.00			
GBIN			
dBm			
dBm-			
) dBm			
art 2.094 GHz	2001 pts	1.0 MHz/	Stop 2.104 G
	2001 pta	110 11112/	

Date: 11.NOV.2013 09:55:31



Appendix 4

Diagram 2 a:

 
 Ref Level 48.94 dbm
 RBW 20 kHz

 Att
 10 dB • SWT 10 s
 VBW 200 kHz
 Mode Auto Sweep
 ♥ TDF 1 Frequency Sweep 1Rm Max M1[1] -24.83 dBm 2.11000000 GHz 40 di 30 dBn 20 dB 10 48 10 d 1 -16.400 dBr -20 dBr -30 dBr 40 dBr -50 dBn -60 dB Start 2.109 GF 3001 pts 200.0 kHz .111 GHz 1.11.2013 16:06:22 Measuring... Date: 11.NOV.2013 16:06:22

# Diagram 2 b:

MultiView	Spectrum								~
Ref Level 48.9	4 dBm	RBW	200 kHz						
Att	10 dB 🖷 SWT	10 s VBW	2 MHz Mode	Auto Sweep					
Frequency Sv	/eep								1Rm Max
						M1[1]		. 2	-33.92 dBm .10898880 GHz
+0 dBm									
30 dBm									
20 dBm									
10 dBm-									
0 d8m									
10 dBm									
-10 dBm									
-20 dBm	11 -20.000 dBm								
30 dBm-									P.
40.dBm									
-50 dBm									
-60 dßm									
Start 2.104 GH	z		2001 pt	s	50	0.0 kHz/			Stop 2.109 GHz
							Measuring		11.11.2013 16:07:02

Date: 11.NOV.2013 16:07:02





Appendix 4

Diagram 2 c:

MultiView 🗄	Spectrum										♥ .
Ref Level 48.9	94 dBm	•	RBW	1 MHz							
Att	10 dB 🖷 SWT	10 s	VBW 1	0 MHz	Mode A	uto Sweep					
Frequency Sv	veep									• 1	Rm Max
								M1[1]		-34 2.10398	4.41 dBm 3750 GH;
0 dBm											
0 dBm							 			 	
0 dBm-							 			 	
0.40-											
n gew-											
dBm				-							
.0 dBm	41 -12 000 dam-										
0 dBm	12.000.000						 			 	
0 dBm							 			 	1
0 dBm										 	
0 dBm							 			 	
0 dBm											
tart 2.094 GH	z			+ 2	2001 pt	s	1.	0 MHz/	-	 Stop 2.	104 GHz
									Measuring	 <b>#</b> 11.11 16:	.2013

Date: 11.NOV.2013 16:07:29



Appendix 4

Diagram 3 a:

 
 MultiView
 Spectrum

 Ref Level 48.94 dbm
 • RBW 20 kHz

 • Att
 10 dB • SWT 10 s
 VBW 200 kHz

 TDF
 1705
 VBW 200 kHz
 ~ 1Rm Max M1[1] -25.38 dBm 2.155000000 GHz 40 dBr 30 dBr 20 dB -10 dBr 1 -16.400 d -20 dBn -30 dBr -40 dBr -50 dB 60 dB Stop 2.156 GHz 11.11.2013 10:04:46 Start 2.154 GH 3001 pt 200.0 kHz/ Measuring. COLUMN 2 1 Date: 11.NOV.2013 10:04:46

#### Diagram 3 b:

MultiView	Spectrum								♥
Ref Level 48.	94 dBm	RBW	200 kHz 2 MHz Mode	Auto Sween					
TDF	10 00 0 0111	10.5 10.0	2 Mile Mode	Auto oncep					
1 Frequency Sy	weep			,					IRm Max
						M1[1]		2	-34.45 dBm .15600875 GHz
40 dBm-									
30 dBm									
20 dBm									
10 dBm									
0 d8m									
-10 dBm									
-20 dBm	H1 -20.000 dBm								
-30 dBm									
L									
-40 dBm-								· · · · · · · · · · · · · · · · · · ·	
-50 dBm									
-60 dBm									
Start 2.156 GH	z		2001 p	ts	50	00.0 kHz/			Stop 2.161 GHz
	Л						Measuring		11.11.2013 10:05:19

Date: 11.NOV.2013 10:05:19





Appendix 4

Diagram 3 c:

lultiView 🕀	Spectrum										V
Ref Level 48.94	4 dBm	•	RBW	1 MHz							
Att	10 dB 🖷 SWT	10 s	VBW 1	0 MHz I	Mode A	luto Sweep					
JF Frequency Sw	een										1Rm Max
								M1[1]		2,1610	33.30 dBr
dBm											
dBm							 				
dBm							 				
dBm											
Gom											
l8m											
) dBm	1 -13.000 dBm						 				
) dBm							 		_		
dem											
- dolin							 		 		
J dBm											
) dBm							 				
dBm							 				
art 2,161 GHz				2	2001 pt	s	1.0 N	4Hz/		Stop 2	2.171 GH

Date: 11.NOV.2013 10:05:46



Appendix 4

Diagram 4 a:

 
 MultiView
 Spectrum

 Ref Level 48.94 dbm
 • RBW 20 kHz

 • Att
 10 dB • SWT 10 s
 VBW 200 kHz

 TDF
 • Frequency Sweep
 ~ 1Rm Max M1[1] -25.56 dBm 2.155000000 GHz 30 dt 20 dBm lo de -10 dBr -20 dBn -30 dBm -40 dBm -50 dB 60 dBr Span 2.0 MHz 11.11.2013 16:12:35 3001 pt 200.0 kHz/ CF 2.155 GHz Measuring 

Date: 11.NOV.2013 16:12:35

#### Diagram 4 b:

MultiView	Spectrum								~
Ref Level 48.	.94 dBm	RBW	200 kHz	A					
TDF	10 00 - 5471	10.5 4044	2 Mode	Auto Sweep					
1 Frequency S	weep					M1(1)			<ul> <li>1Rm Max</li> </ul>
						MILI		2	-34.22 0Bm
40 dBm									1
20.48									
30 dBm-									
20 dBm									
10 dBm									
0 d8m									
-10 dBm									
-20 dbm	H1 -20 000 dBm								
-20 00	12 -20.000 00.0								
130 dBm									
£									
-40 dBm						······································	Contraction in the International Advances in the		
-50 dBm-									1
-60 dBm									
Start 2.156 GH	iz		2001 p	ts	50	00.0 kHz/			stop 2.161 GHz
	Л						Measuring		16:13:05

Date: 11.NOV.2013 16:13:05





Appendix 4

Diagram 4 c:

lultiView 🕀	Spectrum								~
Ref Level 48.9	i4 dBm	RB	W 1 MHz						
DE	10 dB • SWT	10 s VB	W 10 MHz Mo	de Auto Sweep					
Frequency Sw	/eep								1Rm Max
						M1[1]		-	33.45 dBn
) dBm								2,1611	7740 GH
dBro									
dBm									
dBm-									
18m									
) dBm									
1	(1 -13.000 dem								
) dbm									
dBm									
dBm-									
) dBm-									
dBm									
art 2.161 GHz	7		200	11 nts	_	1.0 MHz/		Stop 2	2.171 GH

Date: 11.NOV.2013 16:13:37



Appendix 4

Diagram 5 a:

♥ TDF 1 Frequency Sweep 1Rm Max M1[1] -28.06 dBm 2.110000000 GHz 30 dBr in de 10 d 1 -16.400 dB -20 dB -30 dBr 40 dBn -50 dBm -60 dB Start 2.109 GF 3001 pts 200.0 kHz 111 GHz 1.11.2013 10:43:14 Measuring... Date: 11.NOV.2013 10:43:14

# Diagram 5 b:

MultiView 🖯	Spectrum						~
Ref Level 48.	94 dBm	RBW	1 MHz				
Att	10 dB 😐 SWT	10 s VBW	10 MHz Mode	Auto Sweep			
Frequency Sv	weep						1Rm Max
					M1[1]		 -33.25 dBn 2.10398750 GH
HO dBm							
30 dBm							
20 dBm							
10 dBm-							
0 d8m							
-10 dBm	H1 -13.000 dBm						
20 dBm							
30 dBm-							
10.40.0					 		
40 dBm							
50 dBm							-
60 dBm							
Start 2.094 GH	z		2001 p	ts	1.0 MHz/		Stop 2,104 GH
	1					Measuring	 11.11.2013

Date: 11.NOV.2013 10:44:46





Appendix 4

Diagram 5 c:

 
 MultiView
 Spectrum

 Ref Level
 48.94 dbm
 @ RBW
 1 MHz

 e Att
 10 dB
 @ WT 10 s
 VBW 10 MHz
 Mode Auto Sweep
 ♥ TDF 1 Frequency Sweep • 1Rm Max M1[1] -33.25 dBm 2.10398750 GHz 40 dB 30 dBr 20 dB 10 dB -10 dB H1 -13.000 dBm -20 dBm -30 dBr -40 dBm -50 dB -60 dB 1.0 MHz/ o 2.104 GHz 2001 pts Start 2.094 GF 1.11.2013 10:45:15 Measuring... 🚺 🗰 🗰

Date: 11.NOV.2013 10:45:14



Appendix 4

Diagram 6 a:



# Diagram 6 b:

IultiView 🗄	Spectrum								~
Ref Level 48.9	94 dBm	- P	BW 200 kH;	:					
Att	10 dB 🖷 SWT	10 s V	BW 2 MH:	Mode	Auto Sweep				
Frequency Sv	veep								1Rm Max
							M1[1]		-34.50 dBr 2.15600875 GH
) dBm									
dBm									 
dBm									 
dBm									
38m									
0 dBm									
) dBm	H1 -20.000 dBm		_						
) dBm									
40 m				~					 
J dBm									
) dBm			_						+
) dBm									
art 2.156 GH	z			2001 pt	s	5	00.0 kHz/		Stop 2.161 GF
								Measuring	 11.11.2013

Date: 11.NOV.2013 11:31:56





Appendix 4

Diagram 6 c:

MultiView 🖽 S	pectrum	)				_ ▽
Ref Level 48.94 dB	m entre e	RBW 1 MHz				
TDF 107	ab 🖷 5101 10 s	VBW 10 MHz	Mode Auto Sweep			
Frequency Sweep					M1[1]	<ul> <li>1Rm Max</li> <li>-35.54 dBm</li> </ul>
0 dBm						2.10398751 GHz
0 dBm						
0 dBm						
1.0011						
) dBm-						
d8m						
0 dBm	2 000 49/0					
0 dBm						
0 dBm						
						ħ
J dBm						
0 dBm						
0 dBm						
avt 2 004 CHz		,	2001 ptr	1.01	4477	Stop 2 104 CH
art 2.094 GHZ			out pts	1.0 P	//////	Stop 2.104 GH2

Date: 11.NOV.2013 11:33:09



Appendix 4

Diagram 7 a:

 
 MultiView
 Spectrum

 Ref Level 48.94 dbm
 • RBW 20 kHz

 • Att
 10 dB • SWT 10 s
 VBW 200 kHz

 TDF
 1705
 VBW 200 kHz
 ~ 1Rm Max M1[1] -30.59 dBm 2.110000000 GHz 40 dBr 30 dBr 20 de -10 dBn -20 dBr -30 dBn -40 dBm -50 dBm 60 dBr Stop 2.111 GHz 11.11.2013 14:15:34 3001 pt 200.0 kHz/ Start 2.109 GH Measuring.. Date: 11.NOV.2013 14:15:34

#### Diagram 7 b:

Ref Level 48, 54, dbm          • REW 200 kHz          Att       10 db • SWT 10 s         TP          • IAm Max          IFrequency Sveep          • IAm Max          40 dsn          • II[1]          30 d8n          • IAm          20 d8n          • IAm          10 d8n          • IAm          20 d8n          • IAm          20 d8n          • IAm          20 d8n          • IAm          10 d8n          • IAm          20 d8n          • IAm          20 d8n          • IAm          10 d8n          • IAm          10 d8n          • IAm          -30 d8n          • IAm          -30 d8n          • IAm          -30 d8n          • IAm          -30 d8n          • IAm          -40 d8n         -50 d8n         -10 d8n         -30 d8n	MultiView	B) Spectrum								~
DF         11 Producincy Sweep         11 Pr	Ref Level 48.	.94 dBm 10 dB = SWT	RBW	200 kHz 2 MHz Mode	Auto Sween					
I Frequency Sweep         If m Ms: -33.66 dBm           40 dBm         M1[1]           2.10898880 GHz           20 dBm           20 dBm           10 dBm           -10 dBm           -10 dBm           -20 dBm           -33.66 dBm           -30 dBm <th>TDF</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	TDF									
Mility     2.1089880 GHz       40 dsm     2.1089880 GHz       30 dsm     20 dsm       20 dsm     20 dsm       10 dsm     20 dsm       10 dsm     20 dsm       -0 dsm     20 dsm       -10 ds	1 Frequency S	weep								1Rm Max
40 dBm							MILIJ		2	-33.66 dBm 10898880 GHz
30 dem     10 dem <td>40 dBm</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td></td>	40 dBm							1		
30 dBm										
20 dBm	30 dBm-									
20 dBm 10 dBm 10 dBm 10 dBm 10 dBm 11 -20.000 dBm 11 -20.000 dBm -20 dBm -30 dBm -50	00 d0-									
10 dBm 0 dBm0 dBm0 dBm0 d	20 dbm									
0 d8m	10 dBm									
0 d8m										
-10 d8m +11 -20.000 d8m +11 -20.0000 d8m +11 -20.00000 d8m +11 -20.0000 d8m +11 -20.0000 d8m +11 -20.0000	0 d8m									
-10 dBm +11 -20.000 dBm +11 -2										
-20 dBm +11 -20.000 dBm	-10 dBm									
-20 dbm H1 -20 000 dbm										
-30 dBm	-20 dBm	H1 -20.000 dBm							_	
-30 dbm										
-40 dbm -50 dbm -60 dbm -60 dbm -61 db	-30 dBm									M
-50 dBm	-40 dBm									
-50 dBm	-40 0011									
-40 dBm	-50 dBm									
-60 dBm Start 2.104 GHz 2001 pts 500.0 kHz/ Stop 2.109 GHz 11.11.2013										
Start 2.104 GHz 2001 pts 500.0 kHz/ Stop 2.109 GHz 11.11.2013	-60 dBm									
Start 2.104 GHz 2001 pts 500.0 kHz/ Stop 2.109 GHz 11.11.2013										
Stor 2 200 pts 3000 Kitz/ Stor 2 300 pt 109 Git	Start 2, 104 GF	17		2001 m	uts.	50	0.0 kHz/			top 2,109 GHz
	51011211040	Ĩ		2001	1.0	5.	10.0 Ki 12/	Measuring		11.11.2013

Date: 11.NOV.2013 14:17:12





Appendix 4

Diagram 7 c

 
 MultiView
 Spectrum

 Ref Level
 48.94 dbm
 e
 RBW
 1 MHz

 e
 Att
 10 dB
 e WT
 10 s
 VBW
 10 MHz
 Mode
 Auto Sweep
 ~ TDF 1 Frequency Sweep м1[1] -31.67 dBm 2.10398750 GHz 30 de 20 dB 10 dB 10 d H1 -13.000 dB 20 de -30 dB 40 dBr 2001 pt 1.0 MHz 104 GHz 11.11.2013 14:18:05 ...... Measuring... Date: 11.NOV.2013 14:18:05

#### Diagram 8 a:



Date: 11.NOV.2013 14:31:27

Diagram 8 b:





Page 17 (18)

nuitiview	Spectrum				~
Ref Level 4	18.94 dBm	RBW 200 kHz			
DF	10 dB 😐 SWT 10 s	VBW 2 MHz Moe	de Auto Sweep		
Frequency	Sweep			MILLI	• 1Rm Max
				wili	2.15600870 GF
0 dBm					
) d8m					
0 dBm					
dBro					
- upin					
d8m					
0 dBm-					
0 dBm	H1 -20.000 dBm				
0 dBm					
in dam					
io abm					
50 dBm					
50 dBm					
	Di la	2001	nte	500.0 kHz/	Stop 2.161 GH
tart 2.156 ( te: 11.NOV.2 1ultiView	013 14:32:18	2001	213	Meas	uring 11.11.2013 14:32:19
tart 2.156 ( tte: 11.NOV.2 <b>1ultiView</b> Ref Level 4 Att	013 14:32:18 Spectrum 18:94 dBm 10 dB • SWT 10 s	• RBW 1 MHz • VBW 10 MHz Mod	e Auto Sweep	Meas	uring 11.11.2013 14:32:19
tert 2.156 ( te: 11.NOV.2 fultiView Ref Level 4 Att DF	013 14:32:18 Spectrum 10.48 • SWT 10 s Sweep	• RBW 1 MHz • VBW 10 MHz Mod	le Auto Sweep	Meas	uring 11.1.2013 14:32:19
te: 11.NOV.2 te: 11.NOV.2 fultiView Ref Level 4 Att DF	013 14:32:18 Spectrum 18:94 dbm 10 dB = SWT 10 s Sweep	• RBW 1 MHz • VBW 10 MHz Mod	le Auto Sweep	Meas MI[1]	uring 11.12.013 14:32:19 v 16:00250.024 (6) 2 16:00250.024 (6) 2 10:00250.024 (6)
te: 11.NOV.2 tultiView Ref Level 4 Att DF Frequency o dBm-	Spectrum 10 dB = SWT 10 s Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring 11.1.2013 14:32:19 v 14:19 v 14:10 v 14:10 v 14:10 v 14:10 v 14:10 v 14:10 v 11 v 14:10
te: 11.NOV.2 te: 11.NOV.2 fultiView Ref Level 4 Att DF F Frequency	Spectrum 14:32:18 Spectrum 10:48 • SWT 10:5 Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ↓ 1.1.1.2013 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19 ↓ 14:32:19
te: 11.NOV.2 tultiView Ref Level 4 Att DF Frequency 0 dBm	Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 1.1.1.2013 14:32:19 ▼ ■ 18/m MBy -30.24 48 2.16100750 G
te: 11.NOV.2 <b>fultiView</b> Ref Level 4 Att DF Frequency 0 d8m	14:32:18     Spectrum     10:48 e SWT 10:5     Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ▼ 14:32:19 ■ 18/m Max - 30.24 dB 2.16 100750 GH
te: 11.NOV.2 fultiView Ref Level 4 Att DF Frequency 0 dBm	Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ▼ 14:32:19 ■ 18/m Map - 30.24 dB 2.16 100750 GH
tart 2.156 ( 	Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ▼ 14:32:19 ▼ 19/17 M29 -30.24 dB 2.16100750 GF
tart 2.156 (	Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Mi[1]	uring ■ 11.1.2013 14:32:19 ▼ 14:32:19 ▼ 14:32:19 ▼ 11:12:013 14:32:19 ▼ 11:12:013 14:32:19
tart 2.156 (	Spectrum 18:94 dbm 10 db e SWT 10 s Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Mi[1]	uring ■ 11.1.2013 14:32:19 ▼ 14:32:19 ▼ 14:32:19 ▼ 14:32:19
tart 2.156 (	Spectrum     Section	RBW 1 MHz     RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 16:70 MBP -30.24 dB 2.16100750 GP
tart 2.156 (	Spectrum     Source     Sector     Sect	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 14:32:19 ■ 14:32:19
tart 2.156 (	Spectrum 18:94 dBm 10 dB = SWT 10 s Sweep 411 -12.000 dBm	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 16m M88 -30.24 dB 2.16100750 GF
tert 2.156 (  tert 2.156 (  tert 11.NOV 2  tultiView Ref Level < Att D  dBm  0	Spectrum 18:94 dBm 10 dB = SWT 10 s Sweep 10 dB = SWT 10 s Sweep 11 -13.000 dBm	RBW 1 MHz     WBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 12m M2 - 30.24 dB 2.16100750 Gł 
te: 11.NOV 2 te: 1	Spectrum 14:32:18 Spectrum 10:48 e SWT 10:5 Sweep H1 -12.000 dbm H1 -12.000 dbm	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 11:00 ■ 14:32:19 ■ 14:32:19
tert 2.156 (  tert 2.156 (  tert 11.NOV 2  fulliView Ref Level < Att D  dBm  0	In 2	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	MI[1]	uring ■ 11.1.2013 14:32:19 ■ 14:32:19 ■ 14:32:19
Lart 2, 156 (           te: 11.NOV 2           fulliView           Ref Level            Att           DF           Frequence           0 dBm	H2 Spectrum 18:94 dbm 10 db e SWT 10 s Sweep H1 -13.000 dbm	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Mi[1]	uring ■ 11.1.2013 14:32:19 ■ 1F/m MSX 
tart 2, 156 (           te: 11.NOV 2           fulliView           Ref Level 4           Att           DF           Frequency           0 dBm	Spectrum Spectrum Sequence Sweep	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Mi[1]	uring ■ 11.1.2013 14:32:19 ■ 1F/m M3x -30.24 dBi 2.16100750 GF
tart 2, 156 ( te: 11, NOV 2 tultiView Ref Level 4 Att DF FFequency 0 d8m	Spectrum Spectrum Sector Sweep	RBW 1 MHz     RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19
tart 2, 156 (  te: 11, NOV 2  4ultiView Ref Level 4  tip Frequency dBm	Spectrum Spectrum 10 dB = SWT 10 s Sweep H1 -12.000 dBm H1 -12.000 dBm	RBW 1 MHz     VBW 10 MHz Mod	le Auto Sweep	Meas	uring ■ 11.1.2013 14:32:19 ■ 14:32:19 ■ 14:32:19

Date: 11.NOV.2013 14:33:11





Appendix 4

Diagram 8 c

MultiView 🕀 Spe	ctrum							~
Ref Level 48.94 dBm Att 10 dB	• SWT 10 s VBW	1 MHz 10 MHz Mode Aut	o Sweep					
Frequency Sweep					M1[1]			• 1Rm Max -30.24 dBm
10 dBm							2	.16100750 GH2
10 dBm								
0 dBm								
10 dBm								
) d8m								
10 dBm	DD dam							
20 dBm								
30 dBm								
40 dBm								
50 dBm								
60 dBm								
Start 2.161 GHz		2001 pts		1.	0 MHz/		5	top 2.171 GHz
						Measuring		14:33:10

Date: 11.NOV.2013 14:33:11



# Conducted spurious emission measurements according to CFR 47 §27.53(h)/ IC RSS-139 6.5

Date	Temperature	Humidity
2013-11-07	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %
2013-11-08	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31 % ± 5 %

#### Test set-up and procedure

The measurements were made per definition in §27.53(h). The output was connected to a spectrum analyzer with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), (iii) "measure and add 10 log( $N_{ANT}$ )" of FCC KDB662911 D01 Multiple Transmitter Output v01r02

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	902 282
High pass filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

#### Results

MIMO mode, single carrier

Diagram	Symbolic name	Tested Port
1 a+b+c+d	В	RF A
2 a+b+c+d	М	RF A
3 a+b+c+d	М	RF B
4 a+b+c+d	Т	RF A

#### MIMO mode, 2-carriers

Diagram	Symbolic name	Tested Port
5 a+b+c+d	В3	RF A
6 a+b+c+d	T3	RF A

#### MIMO mode, 4-carriers

Diagram	BW configuration	Symbolic name	Tested Port
7 a+b+c+d	5 MHz	M4	RF A



### Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 2.155 GHz. The measurements were made up to 22 GHz (10x2.155 GHz = 21.55 GHz).

#### Limits

§27.53(h) and RSS-139 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P) dB$ , resulting in a limit of -13 dBm per 1 MHz RBW.

Complies? Yes	
---------------	--





Appendix 5

Diagram 1 a:

 
 MultiView
 Spectrum

 Ref Level 50.00 dbm
 e RBW 1 MHz

 e Att
 10 dB e SWT 30 s
 VBW 10 MHz
 ♥ TDF 1 Frequency Sweep 1Rm Max 39.60 dBm 2.1124000 GHz -31.81 dBm 2.9825162 GHz M1[1] M1 M2[1] 40 dP 30 di 10 dB 10 dB H1 -13.000 dBi 20 dBr O de 50 dB 60 d 300.0 MHz/ Start 9.0 kHz 32001 pts Stop 3.0 GHz 11.11.2013 09:49:20 Measuring... Date: 11.NOV.2013 09:49:20

# Diagram 1 b:

MultiView	Spectrum							~
RefLevel 1: Att TDF	3.94 dBm Offse 10 dB = SWT	et 1.50 dB <b>e</b> R 10 s V	BW 1 MHz BW 10 MHz Mo	de Auto Sweep				
1 Frequency 10 dBm	Sweep					M1[1]		<ul> <li>1Rm Max</li> <li>-28.76 dBm</li> <li>5.193880 GHz</li> </ul>
0 d8m								
-10 dBm	H1 -13.000 dBm							
-20 dBm			MI					
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
Start 3.0 GHz	 '''		32001 p	ts	70	00.0 MHz/		Stop 10.0 GHz
							Measuring	 09:47:19

Date: 11.NOV.2013 09:47:19



Appendix 5

Diagram 1 c:

MultiView 🕀	Spectrum								~
Ref Level 13.9	4 dBm Offse	t 0.70 dB 🖷 R	BW 1 MHz						
TDF	5 00 <b>e 5</b> 17 I	10 S V	BW 10 MHZ M	ode Auto Swee	p				
Frequency Sw	eep								1Rm Max
0 dBm						M1[1]	1	1	-30.57 dBr 13.827410 GH
dBm									
.0 dBm	1 12 000 484								
0 dBm	1 -15.000 08/1								
10 dBm						M1			
					+				
0 dBm									
0 dBm									
0 dBm									
0 dBm									
0 dBm									
0 dBm									
00 dBm									
tart 10.0 GHz			32001 p	ots	6	00.0 MHz/			Stop 16.0 GH
							Measuring		11.11.2013 09:46:24

# Diagram 1 d:

MultiView	Spectrum							~
Ref Level 13 Att TDF	5 dB e SWT	et 0.70 dB <b>e</b> Ri 10 s Vi	3W 1 MHz 3W 10 MHz Mo	de Auto Sweep				
1 Frequency S 10 dBm	weep					M1[1]		<ul> <li>1Rm Max</li> <li>-20.91 dBm</li> <li>21.971410 GHz</li> </ul>
0 dBm								
-10 dBm	H1 -13.000 dBm							
-20 dBm								 MI
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
Start 16.0 GH	z		32001 p	ts	60	0.0 MHz/		Stop 22.0 GHz
	ا						Measuring	 09:45:53

Date: 11.NOV.2013 09:45:53



Appendix 5

Diagram 2 a:

 
 MultiView
 Spectrum

 Ref Level 50.00 dbm
 e RBW 1 MHz

 e Att
 10 dB e SWT 30 s
 VBW 10 MHz
 ♥ TDF 1 Frequency Sweep 1Rm Max 39.39 dBm 2.1326000 GHz -31.83 dBm 2.9825162 GHz M1[1] M2[1] 40 dP 30 di 10 dB 10 dB H1 -13.000 dB 20 dBr 0 d 10 dBr 50 dB 60 de 300.0 MHz/ Start 9.0 kHz 32001 pts Stop 3.0 GHz 11.11.2013 09:38:04 Measuring.... COLUMN 2 1 Date: 11.NOV.2013 09:38:04

# Diagram 2 b:

MultiView 🗄 Spectrum			▽ _
Ref Level         13.94 dBm         Offset         1.50 dB         R           • Att         10 dB         • SWT         10 s         V           TDF         10 dB         • SWT         10 s         V	BW 1 MHz BW 10 MHz Mode Auto Sweep		
1 Frequency Sweep		M1[1]	<ul> <li>1Rm Max</li> <li>-28.99 dBm</li> <li>5.193885 GHz</li> </ul>
0 d9m			
-10 dBm			
-20 dBm	M1		
-40 d8m-			
-50 dBm			
-60 dBm			
-70 dBm			
-80 dBm			
-100 dBm			
Start 3.0 GHz	32001 pts	700.0 MHz/	Stop 10.0 GHz

Date: 11.NOV.2013 09:39:42



Appendix 5

Diagram 2 c:

MultiView 🕀	Spectrum								~
Ref Level 13.9	4 dBm Offse	t 0.70 dB - R	BW 1 MHz	de Auto Susser					
DF	5 UD 🖷 5 W I	10.5 ¥	244 10 MHZ MM	de Auto Sweet	,				
Frequency Sw	/eep								1Rm Max
D dBm						MILIJ		1	13.827412 GH
d8m									
0 dBm									
+	11 -13.000 dBm								
0 dBm									
0 dBm						MI			
0 dBm	**************************************								
0 dBm									
0 dBm									
0 dBm									
0 dBm-									
0 dBm									
00 dBm									
tart 10.0 GHz			32001 p	ts	6	00.0 MHz/			Stop 16.0 GH
							Measuring		11.11.2013 09:40:24

# Diagram 2 d:

MultiView	Spectrum								~
Ref Level 13.9 Att	94 dBm Offse 5 dB e SWT	et 0.70 dB e RI 10 s VB	3W 1 MHz 3W 10 MHz Me	ode Auto Sweep					
1 Frequency Sv	weep					M1[1]			<ul> <li>1Rm Max</li> <li>-21.09 dBm</li> </ul>
10 dsm-							I	1	21.962410 GHz
0 d8m									
-10 dBm	H1 -13.000 dBm								
-20 dBm									ML
- autor									
40 dBm									
10 0011									
-50 dBm									
-60 dBm									
-70 dBm									
-80 dBm									
-90 dBm									
-100 dBm									
Start 16.0 GHz	,		32001 n	ts	60	0.0 MHz/			Stop 22.0 GHz
	[		52001 p				Measuring		11.11.2013 09:41:09

Date: 11.NOV.2013 09:41:09





Appendix 5

Diagram 3 a:

 
 MultiView
 Spectrum

 Ref Level 50.00 dbm
 e RBW 1 MHz

 e Att
 10 dB e SWT 30 s
 VBW 10 MHz
 ♥ TDF 1 Frequency Sweep 1Rm Max -31.68 dBm 2.9968590 GHz 39.41 dBm 2.1326000 GHz M2[1] M1[1] 40 dP 30 di 10 dB 10 dB H1 -13.000 dB 20 dBr 30 d 10 dBr i0 dB 60 de 300.0 MHz/ Start 9.0 kHz 32001 pts Stop 3.0 GHz 11.11.2013 15:23:31 Measuring... Date: 11.NOV.2013 15:23:31

# Diagram 3 b:

MultiView	Spectrum							~
Ref Level 13.9 Att TDF	94 dBm Offse 10 dB - SWT	et 1.50 dB • RE 10 s VB	W 1 MHz W 10 MHz Mo	de Auto Sweep				
1 Frequency Sv 10 dBm	weep					M1[1]	1	<ul> <li>1Rm Max</li> <li>-28.67 dBm</li> <li>5.199350 GHz</li> </ul>
0 d8m								
-10 dBm	H1 -13.000 dBm							
-20 dBm			M1					
-30 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
-100 dBm			32001 n	re c	70	0.0 MHz/		Stop 10.0 CHz
	1		32001 p	13		0.0 MH2/	Measuring	 11.11.2013 15:25:07

Date: 11.NOV.2013 15:25:07



Appendix 5

Diagram 3 c:

MultiView 🗄	Spectrum								~
Ref Level 13.9	4 dBm Offse	et 0.70 dB 🖷 R	BW 1 MHz						
Att	5 dB 😐 SWT	10 s <b>V</b>	BW 10 MHz Mo	de Auto Sweep					
Frequency Sw	/eep								1Rm Max
0 dBm						M1[1]		1	-29.75 dBr 13.827040 GH
d8m-									
LO dBm-	41 -13 000 dBm								
0 dBm	12 -10.000 00.00								
10 dBm						M1			
i0 dBm									
iū dBm									
i0 dBm									
o dbiir									
0 dBm-									
.0 dBm									
0 dBm									
00 dBm									
tart 10.0 GHz		1	32001 pt	ts	60	00.0 MHz/			Stop 16.0 GH
te: 11 NOV 2013	15:26:28						Measuring		11.11.2013 15:26:28

# Diagram 3 d:

MultiView	Spectrum							~
RefLevel 13. Att	94 dBm Offse 5 dB • SWT	et 0.70 dB = RB 10 s VB	3W 1 MHz 3W 10 MHz Mo	ode Auto Sweep				
1 Frequency Sy	weep							1Rm Max
10 dBm						M1[1]		-20.98 dBm 21.931470 GHz
0 dBm-								
-10 dBm								
-20 dBm	H1 -13.000 dBm							M1
STO GOIL								
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
100 10-1								
Start 16 0 CHz			32001 p	te	60			Stop 22.0 GHz
540 C 10/0 GH2	N		52001 p	<i>La</i>	00	///////////////////////////////////////	Measuring	 11.11.2013 15:27:46

Date: 11.NOV.2013 15:27:45



Appendix 5

Diagram 4 a:

 
 MultiView
 Spectrum

 Ref Level 50.00 dbm
 e RBW 1 MHz

 e Att
 10 dB e SWT 30 s
 VBW 10 MHz
 ♥ TDF 1 Frequency Sweep 1Rm Max 39.22 dBm 2.1526000 GHz -31.75 dBm 2.9825162 GHz M1[1] M2[1] 40 dP 30 df 10 dt 10 dB H1 -13.000 dB 20 dBr 0 d 10 dBr i0 dB 60 de 300.0 MHz/ Start 9.0 kHz 32001 pts Stop 3.0 GHz 11.11.2013 10:08:03 Measuring.... COLUMN 2 1 Date: 11.NOV.2013 10:08:02

# Diagram 4 b:

MultiView 🗄 Spectrum			(	V
Ref Level 13.94 dBm Offset Att 10 dB SWT TDF	1.50 dB • RBW 1 MHz 10 s VBW 10 MHz Mode Auto 3	Sweep		
1 Frequency Sweep 10 dBm		M1[1]	• 18m   -28.97 5.193885	Max ' dBm 5 GHz
0 dBm				
-10 dBm				
-20 dBm	ML			
-30 dBm				
-40 dBm-				
-50 dBm-				
-70 dBm				
-80 dBm				
-90 dBm				
-100 dBm				
Start 3.0 GHz	32001 pts	700.0 MHz/	Stop 10.0	GHz 3

Date: 11.NOV.2013 10:09:19



Appendix 5

Diagram 4 c:

lultiView	Spectrum							~
Ref Level 13.9 Att	94 dBm Offset 5 dB e SWT	0.70 dB • R 10 s V	BW 1 MHz BW 10 MHz M	lode Auto Swee	0			
Frequency Sv	weep							1Rm Max
) dBm						M1[1]		-30.33 dBr 13.827412 GH
d8m-								
0 dBm								
0 dBm	H1 -13.000 dBm							
0.40						MI		
J dem								 
J dBm								
0 dBm								
0 dBm-								
0 dBm-								
0 dBm								 
0 dBm								
00 dBm								
art 10.0 GHz			32001	pts	6	00.0 MHz/		Stop 16.0 GH
	1						Measuring	 11.11.2013

# Diagram 4 d:

MultiView	Spectrum							~
RefLevel 13. Att TDE	94 dBm Offse 5 dB • SWT	et 0.70 dB = RE 10 s VE	W 1 MHz W 10 MHz Mo	ode Auto Sweep				
1 Frequency S 10 dBm	weep					M1[1]		<ul> <li>1Rm Max</li> <li>-21.15 dBm</li> <li>21.973090 GHz</li> </ul>
0 d9m								<u> </u>
-10 dBm	H1 -13.000 dBm							
-20 dBm								 ME
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
-100 dBm Start 16.0 GHz	:		32001 p	ts	60	0.0 MHz/		Stop 22.0 GHz
	)[]						Measuring	 11.11.2013 10:10:22

Date: 11.NOV.2013 10:10:22



Appendix 5

Diagram 5 a:

♥ TDF 1 Frequency Sweep • 1Rm Ma M1[1] 36.42 df 2.1124000 G 36.48 df 2.1224000 G 40 dB M2[1] l0 de 20 dBr n d 60 dB Start 9.0 kHz 2 Marker Table Type | Ref | Trc | M1 1 32001 pts 300.0 MHz/ Stop 3.0 GHz Stimulus 2.1124 GHz 2.1224 GHz 2.155 GHz Response 36.42 dBm 36.48 dBm -29.25 dBm Function Function Result 1 M2 M3 Measuring... 🚺 🗰 11.11.2013 10:54:20

Date: 11.NOV.2013 10:54:20

#### Diagram 5 b:

Mile         Mile         Mile           -00 dBm         Mile         Mile         Mile	IRm Məx 19.68 dBm 13885 GHz
I Frequency Sweep         MI[1]         5.1'           10 dm         MI         5.1'           0 dm         MI         MI           -10 dm         MI         MI           -20 dBm         MI         MI           -30 dBm         MI         MI	1Rm Max 29.68 dBm 3885 GHz
10 dem	3885 GHz
0 dBm I	
-10 dBm     Image: state sta	
-20 dBm -30 dBm -40	
-20 dBm	
-40 dBm-	
-40 dBm-	
-50 dBm:	
-60 dBm	
-70 dBm-	
-00 /4m	
-90 dBm-	
-100 dBm-	
Start 3.0 GHz 32001 pts 700.0 MHz/ Stop	10.0 GHz

Date: 11.NOV.2013 10:55:49



Appendix 5

Diagram 5 c:

AultiView	Spectrum								~
Ref Level 13.9	4 dBm Offset	0.70 dB . R	SW 1 MHz	- d 0					
DF	5 db 🖷 5 W I	10.5 46	W 10 MHZ M	ode Auto Sweet	>				
Frequency Sv	veep								1Rm Max
0 dBm						M1[1]		1	-30.58 dBr 13.827412 GH
d8m-									
0 dBm	11 12 000 48/								
0 dBm	11 -13.000 08//								
0 dBm						M1			
0 dBm-									
0 dBm									
0 dBm									
0 dBm									
0 dBm									
0 dBm									
00 dBm									
art 10.0 GHz			32001 p	ots	6	00.0 MHz/			Stop 16.0 GH
							Measuring		11.11.2013 10:56:21

# Diagram 5 d:

MultiView	B Spectrum								~
Ref Level 1 Att	13.94 dBm Offset 5 dB • SWT	10 s VB	W 1 MHz W 10 MHz Mo	de Auto Sweep					
TDF 1 Erequency	Sween								1 Rm May
10 dBm	Jacop					M1[1]			-21.17 dBm 21.925280 GHz
0 d8m									
-10 dBm-	H1 -13.000 dBm								
-20 dBm									M1
-20 dbm									
-40 dBm									
-50 dBm-									<u> </u>
-60 dBm									
-70 dBm									
00.40-									
-60 0610									
-90 dBm									
-100 dBm									
Start 16.0 G	Hz		32001 p	ts	60	0.0 MHz/	1	1	Stop 22.0 GHz
							Measuring		10:56:55

Date: 11.NOV.2013 10:56:55



Appendix 5

Diagram 6 a:

♥ TDF 1 Frequency Sweep Rm Ma M1[1] 36.47 c 2.1426000 36.31 c 2.1526000 40 dB M2[1] 10 dt 20 dBr n d 60 dB Start 9.0 kHz 2 Marker Table Type | Ref | Trc | M1 1 32001 pts 300.0 MHz/ Stop 3.0 GHz Stimulus 2.1426 GHz 2.1526 GHz 2.994516 GHz Response 36.47 dBm 36.31 dBm -31.84 dBm Function Result 1 Function M2 M3 Measuring... 🚺 💷 🚧 11.11.2013 11:21:23

Date: 11.NOV.2013 11:21:23

#### Diagram 6 b:

MultiView	Spectrum							
Ref Level 13.9 Att TDF	4 dBm Offse 10 dB • SWT	et 1.50 dB RE 10 s VE	W 1 MHz W 10 MHz Mo	de Auto Sweep				
1 Frequency Sw	/eep							1Rm Max
10 dBm						M1[1]		-28.64 dBm 5.191480 GHz
0 d8m								
-10 dBm								
+	11 -13.000 dBm							
-20 dBm			MI					
-30 dBm					and the second second second second			 
-40 dBm			-					
-50 dBm-								
60 dB-1								
-60 dBm-								
-70 dBm								+
-80 dBm								
-90 dBm								
-100 dBm								
Start 3.0 GHz			32001 p	s	70	0.0 MHz/		Stop 10.0 GHz
			STOOL b			]	Measuring	 11.11.2013 11:16:04

Date: 11.NOV.2013 11:16:04



Appendix 5

Diagram 6 c:

AultiView 🕀	Spectrum							~
Ref Level 13.9	4 dBm Offse	t 0.70 dB R	BW 1 MHz					
DF	5 06 <b>e 5</b> WT	10 s <b>V</b>	BW 10 MHZ MA	ode Auto Sweep				
Frequency Sw	/eep							• 1Rm Max
0 dBm						MILI		13.778290 GF
d8m-								
0 dBm								
н	1 -13.000 dBm							
.0 dBm								
i0 dBm						M1		 
40 dBm								
IU dBm								
0 dBm								
'0 dBm								 
10 dBm								
0 dam								
O UBIII								
100 dBm								
tart 10.0 GHz			32001 p	ts	6	00.0 MHz/		 Stop 16.0 GH
]							Measuring	 11.11.2013 11:14:53

# Diagram 6 d:

MultiView	Spectrum							~
Ref Level 1 Att	3.94 dBm Offse 5 dB • SWT	t 0.70 dB e RI 10 s VI	3W 1 MHz 3W 10 MHz Mo	de Auto Sweep				
TDF								
1 Frequency	Sweep					M1[1]		IRm Max 20.01 dBm
10 dBm						MILI		21.992780 GHz
0 d8m								
-10 dBm								
-10 0011	H1 -13.000 dBm							
-20 dBm								 
- 30 GBm								 
-40 dBm								
-10 0011								
-50 dBm								
-60 dBm								
-70 dBm-								
-70 0811								
-80 dBm								
-90 dBm								
-100 dBm								
-100 0011								
Start 16.0 Gł	Hz		32001 p	ts	60	0.0 MHz/		Stop 22.0 GHz
							Measuring	 11:13:47

Date: 11.NOV.2013 11:13:48



Appendix 5

Diagram 7 a:

♥ TDF 1 Frequency Sweep ●1Rm Max -31.58 dBm 2.9990160 GHz 33.54 dBm 2.1250000 GHz M5[1] 40 dBn M1[1] 30 dBm 20 dBm 10 dBm d8n -10 dBr -13.00 20 dBr 30 dB 10 dB 0 dB -60 dBr Start 9.0 kHz 32001 pts 300.0 MHz/ Stop 3.0 GHz 
 Start 9.0 kHz

 2 Marker Table

 Type
 Ref
 Trc

 M1
 1

 M2
 1

 M3
 1

 M4
 1
 Response 33.54 dBm 33.64 dBm 33.65 dBm 33.63 dBm -31.58 dBm Stimulus 2.125 GHz 2.13 GHz 2.135 GHz 2.14 GHz 2.999016 GHz Function Function Result Measuring... 📲 11.11.2013 13:59:54

Date: 11.NOV.2013 13:59:54

#### Diagram 7 b:

MultiView	Spectrum							▽ _
Ref Level 13.9 Att TDF	94 dBm Offse 10 dB = SWT	et 1.50 dB 🖷 RE 10 s VB	W 1 MHz W 10 MHz Mo	de Auto Sweep				
1 Frequency Sv 10 dBm	weep					M1[1]		<ul> <li>1Rm Max</li> <li>-28.50 dBm</li> <li>5 198700 GHz</li> </ul>
0 d8m								
-10 dBm	41 -12 000 dBm							
-20 dBm	11 -13.000 000							
-30 dBm			M1					 
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
-100 dBm Start 3.0 GHz			32001 p	ts	70	0.0 MHz/		 Stop 10.0 GHz
							Measuring	 11.11.2013 14:01:51

Date: 11.NOV.2013 14:01:52



Appendix 5

Diagram 7 c:

								~
Ref Level 13.94	4 dBm Offse	t 0.70 dB 🖷 RI	BW 1 MHz					
Att	5 dB 😐 SWT	10 s VI	3W 10 MHz N	lode Auto Swee	2p			
DF Frequency Swi	een							1 Pm May
diam	66 <b>9</b>					M1[1]		-29.64 dB
dom								13.825910 GH
40 m								
2011								
0 dBm								
H	1 -13.000 dBm							
0 dBm							 	
						141		
0 dBm						Y		
								T
0 dBm								+
0 dBm				+			 	+
3 dBm								
n gew-								
0.48m								
J GDII								
0 dBm								
00 dBm							 	+
10.0.01			00000			00.0101-(		01
art 10.0 GHz			32001	pts	6	00.0 MHz/		Stop 16.0 GH

# Diagram 7 d:

MultiView 🖽	Spectrum							▽
Ref Level 13.94 Att	4 dBm Offse 5 dB = SWT	t 0.70 dB • RE 10 s VB	3W 1 MHz 3W 10 MHz Mo	ode Auto Sweep				
1 Frequency Swe	eep							1Rm Max
10 dBm						M1[1]	-20.98 dBm 21.917410 GHz	
0 d8m								
-10 dBm								
-20 dBm	1 -13.000 dBm							M1
doin a								
-40 dBm-								
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
100.40								
-100 dBm			22001 p		60	0.0 MHz/		Stop 22.0 GHz
Start 10.0 GHZ			32001 p	13	60	NO WINZ/	Measuring	 11.11.2013

Date: 11.NOV.2013 14:04:09



Appendix 6

1

11

Rear side

External photos

Front side





Appendix 6

Left side







Appendix 6

Top side

Bottom side

