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Measurements on RUS 01 B4 1700/2100 MHz radio equipment with FCC ID: TA8BKRC11859-1 and IC: 287AB-BS118591 (9 appendices)

Test object

RUS 01 B4, (1P)KRC 118 59/1 Rev. (21P)R3A

Summary

Appendix 1 describes the test object and set-ups during test.
Appendix 9 presents photos of the test object.

Standard	Compliant	Appendix	Remarks
FCC CFR 47 / IC RSS-139 Issue 2			
2.1046 / RSS-139 6.4 RF power output	Yes	2	-
2.1049 / RSS-139 6.5 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	-
2.1053 / RSS-139 6.5 Field strength of spurious radiation	Yes	6	-
2.1055 / RSS-139 6.3 Frequency stability	Yes	7	-
FCC CFR 47 / IC RSS-Gen Issue2			
15.111 / RSS-Gen 4.10 Receiver spurious emissions	Yes	8	

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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FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Table of contents

Description of the test object	Appendix 1
Operation mode during measurements	Appendix 1
Purpose of test	Appendix 1
Test setups	Appendix 1
RF power output	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Spurious emission at antenna terminals	Appendix 5
Field strength of spurious radiation	Appendix 6
Frequency stability	Appendix 7
Receiver spurious emissions	Appendix 8
External photos	Appendix 9

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Description of test object

Equipment: Radio equipment RUS 1700/2100 MHz running in WCDMA mode supporting single carrier and multi carrier.

Frequency bands: TX: 2110 – 2155 MHz
RX: 1710 – 1755 MHz

Channel bandwidth: 4.2 to 5 MHz (configurable in steps of 100/200 kHz)

Channel spacing: 4.4 to 5MHz (configurable in steps of 100/200 kHz)

Modulations: QPSK, 16QAM and 64QAM

Maximum rated output power: Single carrier 1x 47.8 dBm (1x60 W)
Multi carrier 2x44.8 dBm (2x30W)

Number of antenna ports: TX/RX: 1 RX: 1

Nominal power voltage: -48 VDC

Tested channels

Channel	Downlink		Uplink	
	Frequency*	UARFCN	Frequency*	UARFCN
B	2112.4	1537	1712.4	1312
B+5	2117.4	1562	1717.4	1337
B+10	2122.4	1587	1722.4	1362
M	2132.6	1638	1732.6	1413
T-10	2142.6	1688	1742.6	1463
T-5	2147.6	1713	1747.6	1488
T	2152.6	1738	1752.6	1513

* Frequency in MHz

Note: UARFCN are derived according 3GPP TS 25.141.



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Operation mode during measurements

Measurements were performed with the test object transmitting the Test models which are defined in 3GPP TS 25.141. Test model 1 (TM1) uses the QPSK modulation only, 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 and channel bandwidths were tested to find the worst case setting. These settings were used for all measurements if not otherwise noted.

Single carrier TM1: 64 DPCH:s at 30 ksps (SF=128)
Multi carrier TM1: 32 DPCH:s at 30 ksps (SF=128) in each carrier
Channel bandwidth 5 MHz

Conducted measurements

The test object was powered with -48 VDC. All RF conducted measurements were performed with the test object configured for maximum transmit power. All TX measurements were done at the RF A connector and the RX measurements were done at the RF B connector.

Radiated measurements

The test object was powered with -48 VDC. All radiated measurements were performed with the test object configured for maximum transmit power installed in a wooden rack without EMC shielding. This configuration represents worst case for radiated spurious emission measurements.

The RF output power port was via a RF attenuator connected to functional test equipment for supervision.

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-139.

References

Measurements were done according to relevant parts of the following standards:
ANSI 63.4-2003
ANSI/TIA/EIA-603-B-2002
3GPP TS 25.141
RSS-Gen Issue 2
RSS-139 Issue 2

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "EL-QD 8.2". The uncertainties are calculated with a coverage factor $k=2$ (95% level of confidence).

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Measurement equipment

Measurement equipment	Calibration Due	SP number
Test site Tesla	2010-10	503 881
R&S FSIQ 40	2010-07-30	503 738
R&S FSQ 40	2010-07-30	504 143
High pass filter	2011-03	504 200
RF attenuator	2011-07	504 159
RF attenuator	2011-07	900 229
RF step attenuator	2011-07	503 096
Boonton RF Peak power meter/analyzer	2010-09	503 144
Boonton Power sensor 56518-S/4	2012-02	503 146
Chase Bilog antenna CBL 6111A	2011-11	502 181
EMCO Horn Antenna 3115	2011-01	502 175
Standard gain antenna 20240-20	-	503 674
MITEQ Low Noise Amplifier	2010-08	503 285
Climate chamber 2	2010-11	501 031
Rotronic temperature and humidity meter	2010-11	502 946
Multimeter Fluke 87	2011-03	502 190
Testo 635 temperature and humidity meter	2011-03	504 203
Testo 625 temperature and humidity meter	2011-04	504 117

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: 2010-07-01.

Manufacturer's representative

Anders Johansson, Ericsson AB

Test engineers

Jörgen Wassholm, Tomas Lennhager, and Jonas Bremholt

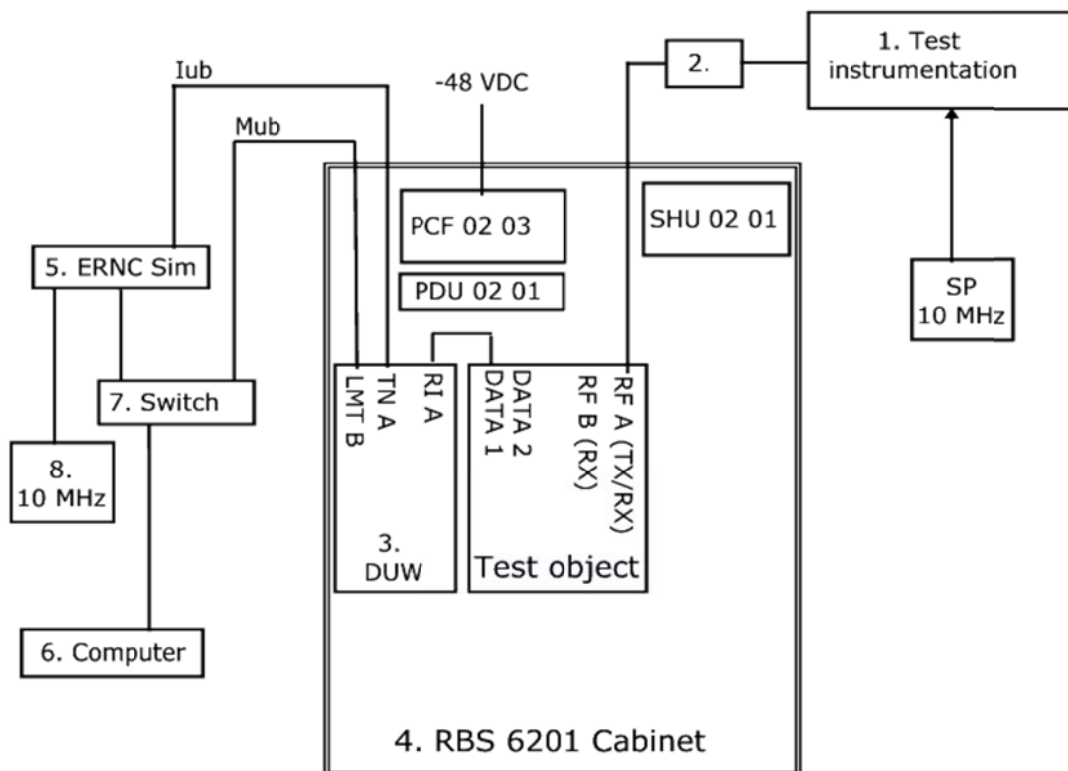
Test participants

Reja Mohammed, Ericsson AB

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Test set-up conducted TX measurements at port RF A



Test object

RUS 01 B4, KRC 118 59/1 Rev. R3A, S/N (S)C823555257
FCC ID: TA8BKRC11859-1 and IC: 287AB-BS118591
with software Basic package CXP 901 6243 Rev. R7A01 and Upgrade package CXP 901 6114/1 Rev R7G01

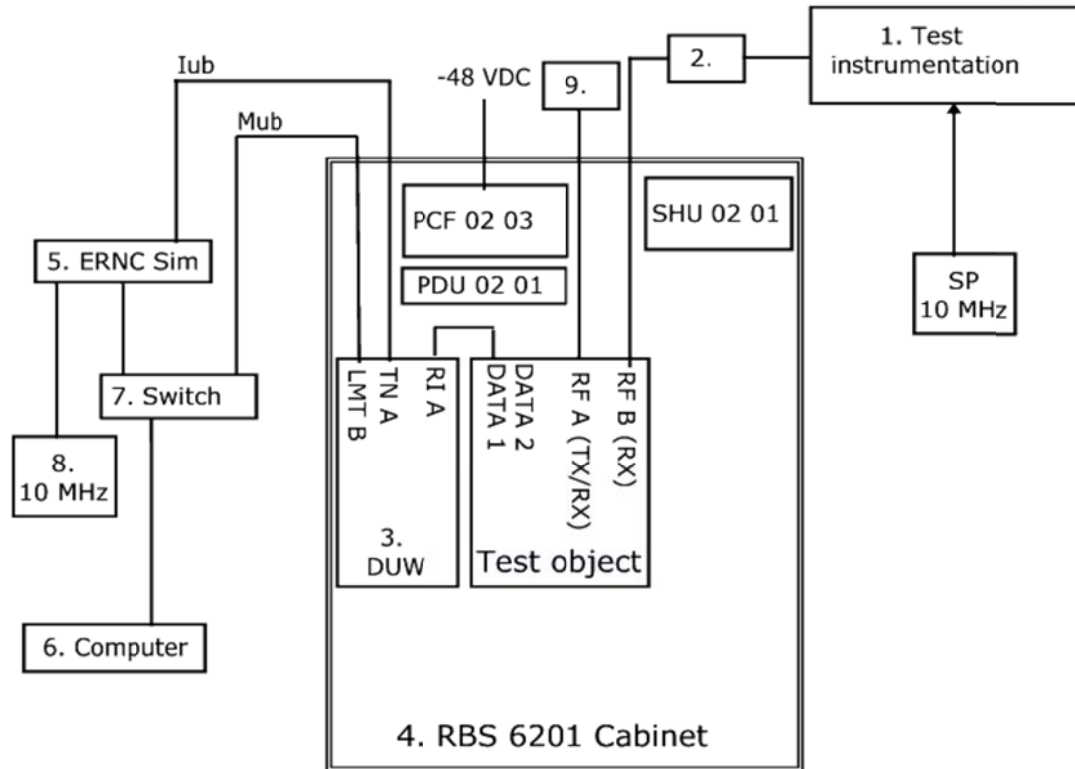
Functional test equipment

1. SP test instrument according equipment list
2. Attenuator SP 900 229
3. DUW KDU 127 161/3 Rev R2B S/N (S)C823486740
4. RBS 6201 cabinet
5. ERNC Sim 131
6. Computer, SunBlade 2500, BAMS-0000015231
7. Switch, Netgear FS726T
8. Symmetricom 8040 10 MHz reference, BAMS-1000714190

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Test set-up conducted RX measurements at port RF B



Test object

RUS 01 B4, KRC 118 59/1 Rev. R3A, S/N (S)C823555257
FCC ID: TA8BKRC11859-1 and IC: 287AB-BS118591
with software Basic package CXP 901 6243 Rev. R7A01 and Upgrade package CXP 901 6114/1 Rev R7G01

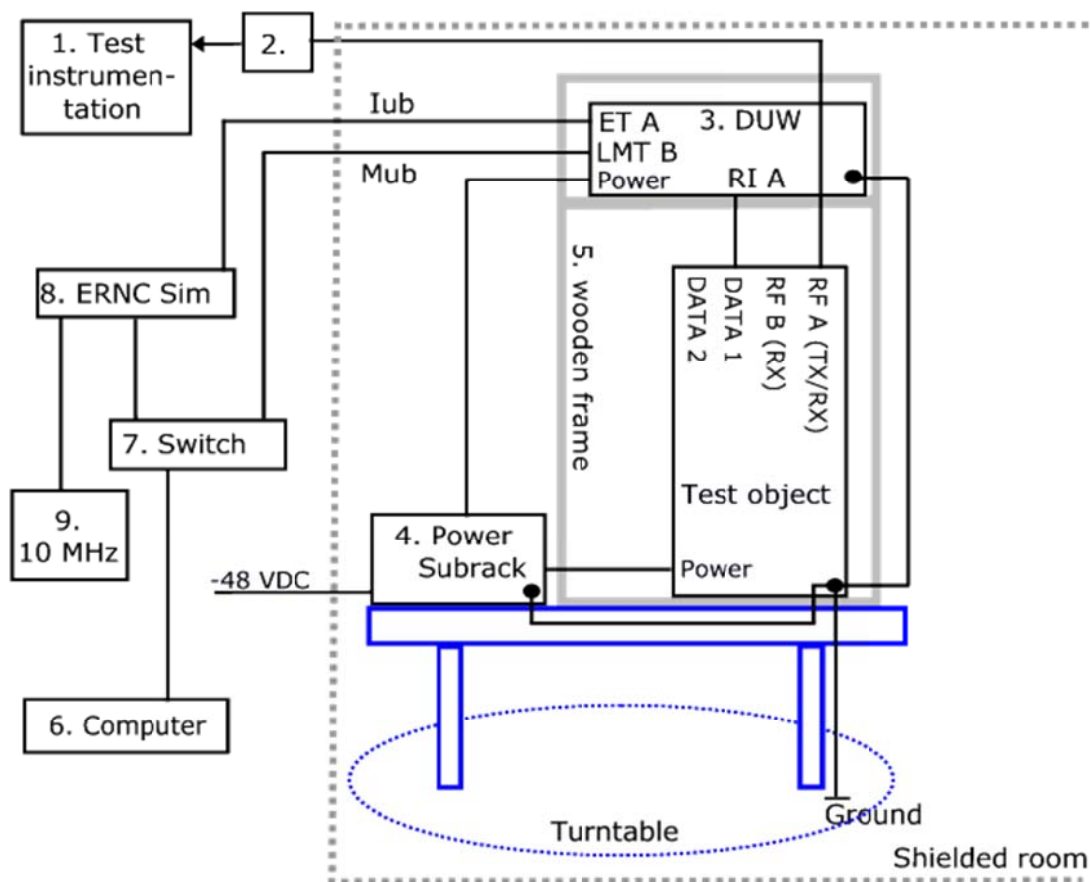
Functional test equipment

1. SP test instrument according equipment list
2. RF Attenuator SP 503096 (10 dB)
3. DUW KDU 127 161/3 Rev R2B S/N (S)C823486740
4. RBS 6201 Cabinet
5. ERNC Sim 131
6. Computer, SunBlade 2500, BAMS-0000015231
7. Switch, Netgear FS726T
8. Symmetricom 8040 10 MHz reference, BAMS-1000714190
9. Attenuator SP900229& termination 50 ohm

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Test set-up, radiated measurements



Test object

RUS 01 B4, KRC 118 59/1 Rev. R3A, S/N (S)C823555247
FCC ID: TA8AKRC11859-1 and IC: 287AB-AS118591
with software Basic package CXP 901 6243 Rev. R7A01 and Upgrade package CXP 901 6114/1 Rev R7G01

Functional test equipment

1. CMU 300, BAMS 1000306761 (for supervision only)
2. Attenuator
3. DUW 30 01, KDU 127 161/3 Rev. R2B, S/N (S)C823474489
4. Power Subrack, SXK 109 8115/1, Rev. R2A
individual components see section 'Components of Power Subrack' below
5. Wooden frame
6. Computer, Sun Blade 2500 BAMS-0000015235
7. Switch, Netgear FS726T
8. ERNC Sim 130
9. Symmetricom 8040 10 MHz Reference BAMS-1000714189

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 1

Test object ports

Interface:	Type of port:
Ground connection	Ground
Supply power -48 VDC	DC Power
Antenna port 1 "RF A", 7/16 connector, female, combined TX/RX	Antenna
Antenna port 2 "RF B", 7/16 connector, female, RX only	Antenna
"DATA 1", data connection to AE for O&M	Signal
"DATA 2", unconnected	Signal
RXA I/O: RXA cross connector output 17 dB / external input. Connector QMA. Not used	Signal
RXB I/O: RXB cross connector input / co-site output 18 dB. Connector QMA. Not used	Signal
RXA OUT: RXA co-site output 18dB. Connector QMA. Not used	Signal

Components of Power Subrack

Position	Product name	Product number	R-state	Serial number	Comment
	Power Subrack	SXK 109 8115/1	R2A	-	
1	PDU 01 01	BMG 980 336/2	R4F	(s)BJ31532384	
2	PDU 01 01	BMG 980 336/2	R4F	(s)BJ31532382	
3	SHU 01 01	BMG 980 336/2	R3C	(s)BJ31446269	
4	DUMMY	SXK 109 8257/1	R1F	-	
5	DUMMY	SXK 109 8257/1	R1F	-	
6	DUMMY	SXK 109 8257/1	R1F	-	
7	DUMMY	SXK 109 8257/1	R1F	-	
8	DUMMY	SXK 109 8257/1	R1F	-	
9	PCF 02 01	KFE 101 1157/1	R1C	(s)BW95301450	

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 2

RF power output measurements according to 47 CFR 2.1046 / IC RSS-139 6.4

Date	Temperature	Humidity
2010-07-06	24 °C ± 3 °C	36 % ± 5 %
2010-07-07	24 °C ± 3 °C	42 % ± 5 %

Test set-up and procedure

The test object was connected to a power analyzer measuring peak and RMS output power.

Measurement equipment	SP number
Boonton RF Peak power meter/analyzer	503 144
Boonton Power sensor 56518-S/4	503 146
RF attenuator	900 229
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 0.7 dB

Results

Single carrier: Output power level at RF A connector (maximum):

Transmitter power (dBm/ dB) RMS/ PAR		
B	M	T
47.5/ 6.6	47.5/ 6.5	47.5/ 6.6

Multi carrier: Output power level at RF A connector (maximum):

Transmitter combined power (dBm/ dB) RMS/ PAR		
B and (B+10)	M and (T-10)	T and (T-10)
47.5/ 6.1	47.4/ 6.1	47.4/ 6.1

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 2

Limit

From amendment to CFR 47, part 27.50 Power and antenna height limits:

The power of each fixed or base station transmitting in the 2110–2155 MHz band and located in any county with population density of 100 or fewer persons per square mile, is limited to an EIRP of 3280 watts/MHz. The power of each fixed or base station transmitting in the 2110–2155 MHz band and situated in any other geographic location is limited to an EIRP of 1640 watts/MHz. In measuring transmissions using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

From IC RSS-139, section 6.4:

The transmitter output power shall be within ± 1 dB of the manufacturer's rated power. In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

From IC SRSP-513, Issue 2, section 5.1.1 2110-2155 MHz sub-band:

For fixed or base stations operating in this sub-band with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz.

Complies?	Yes
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FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 3

Occupied bandwidth measurements according to 47 CFR 2.1049 / IC RSS-139 6.5

Date	Temperature	Humidity
2010-07-06	24 °C ± 3 °C	36 % ± 5 %
2010-07-07	24 °C ± 3 °C	42 % ± 5 %

Test set-up and procedure

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

All measurements were performed at maximum RF output power and were iterated over the supported channel bandwidth configurations, payload modulations and carrier configurations as documented in the results below.

Measurement equipment	SP number
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	900 229
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 3.1

Channel Bandwidth 5.0 MHz

	Channel	OBW
Diagram 1	B	4.18 MHz
Diagram 2	M	4.18 MHz
Diagram 3	T	4.18 MHz

Channel Bandwidth 4.2 MHz

	Channel	OBW
Diagram 4	B	3.85 MHz
Diagram 5	M	3.85 MHz
Diagram 6	T	3.85 MHz



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 3.1

Diagram 1:

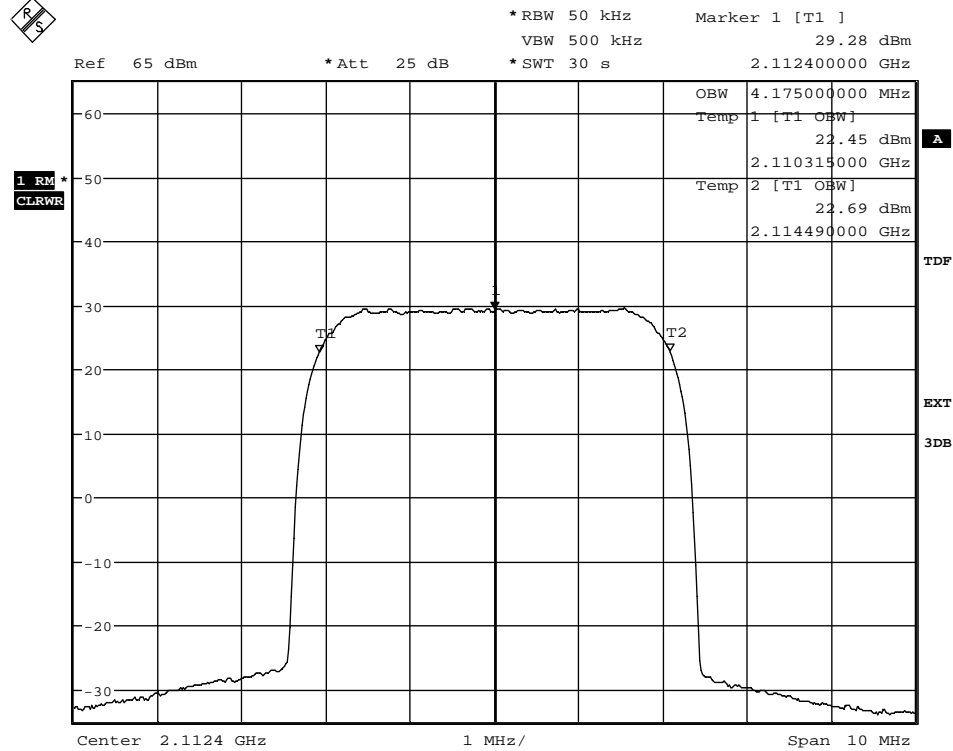
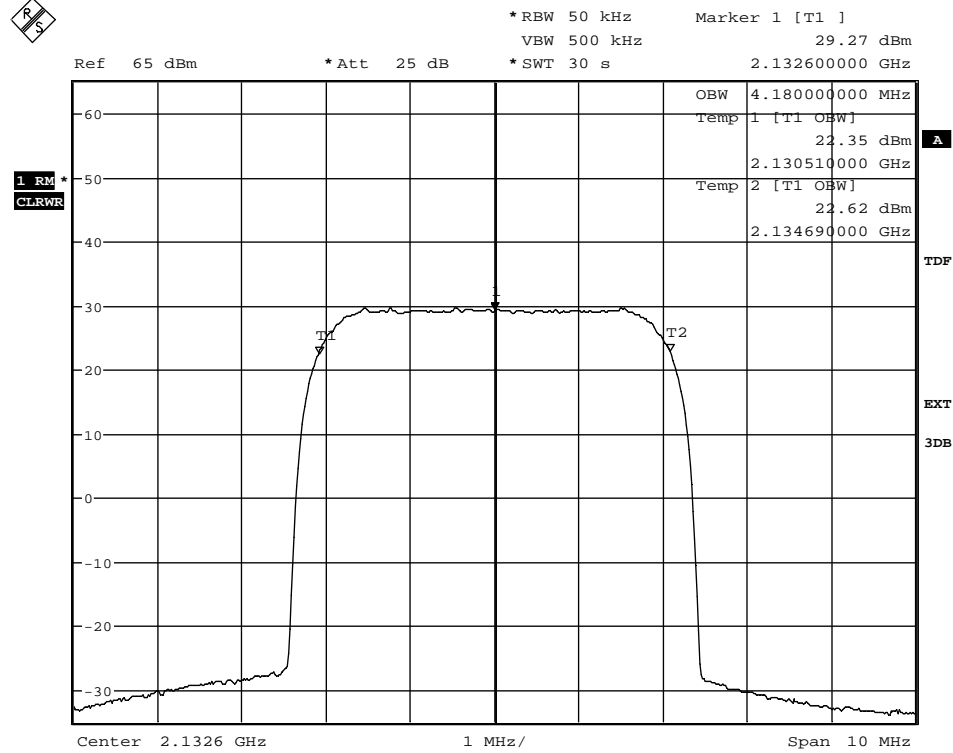


Diagram 2





FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 3.1

Diagram 3

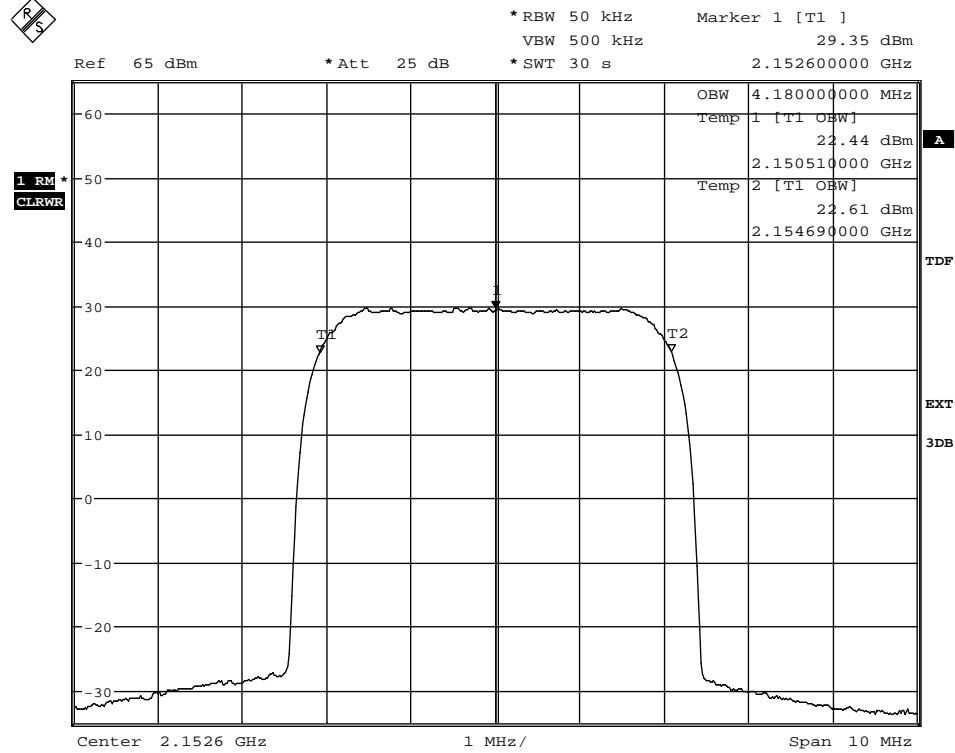
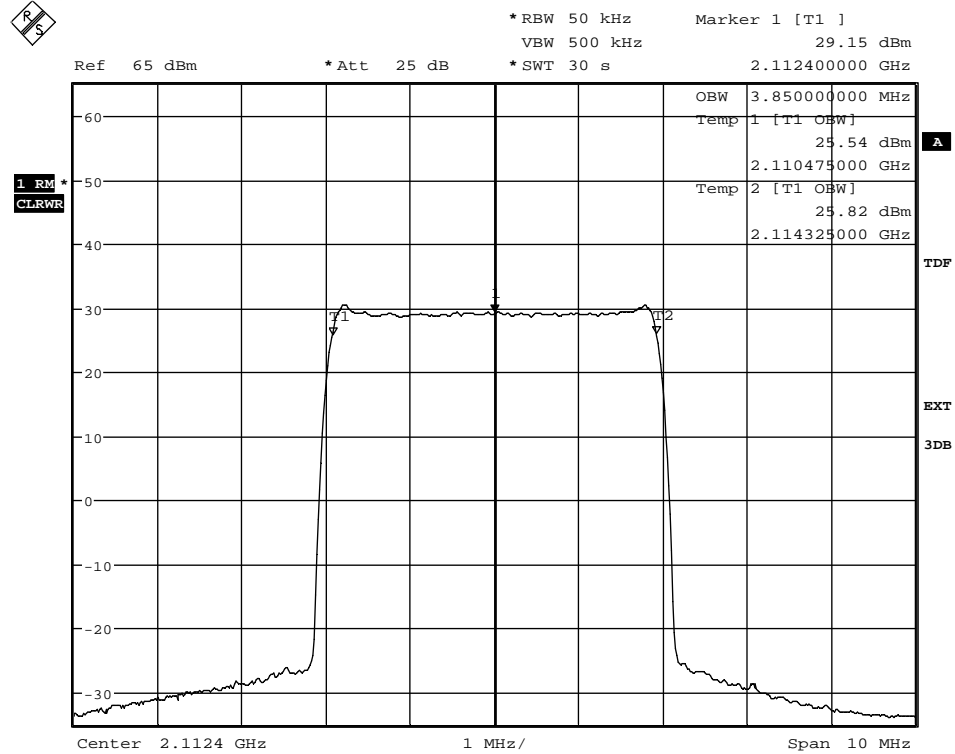


Diagram 4





FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 3.1

Diagram 5

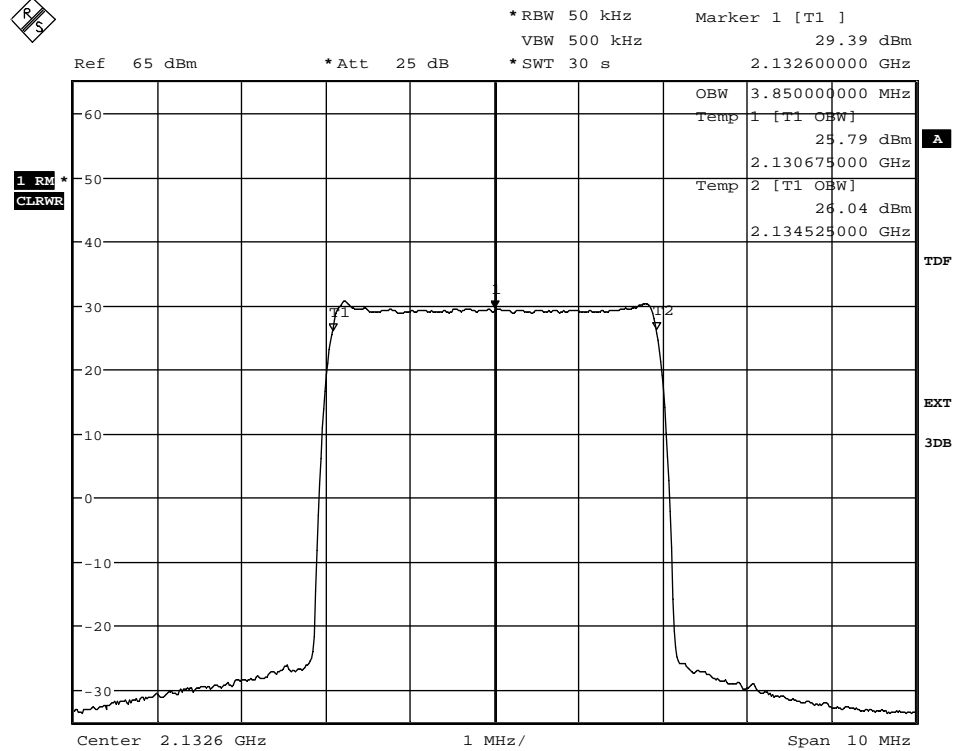
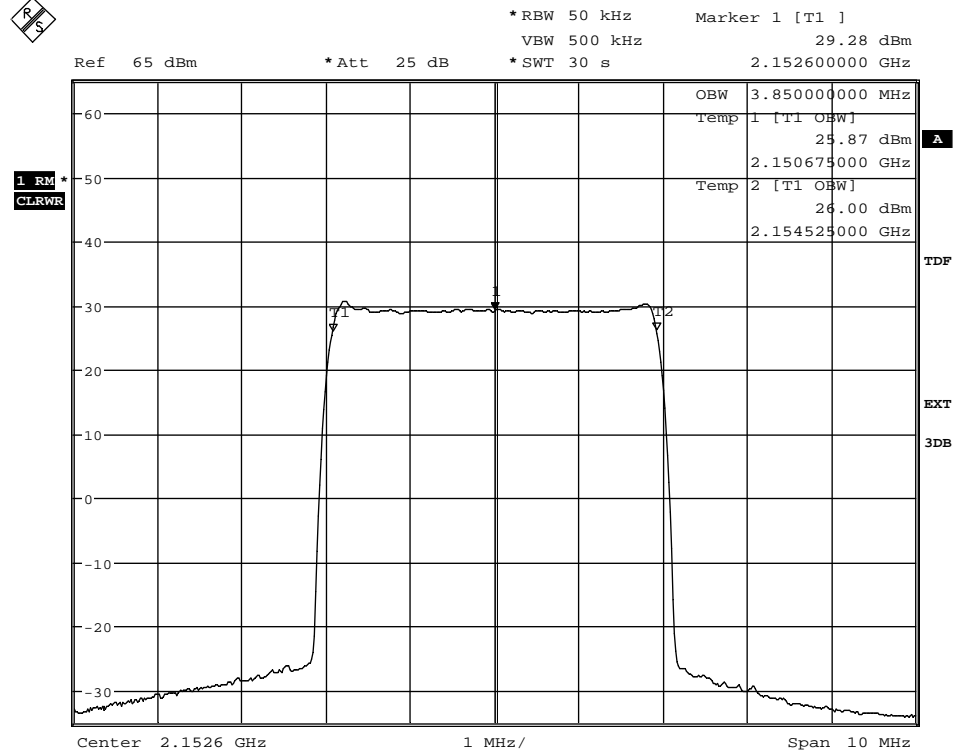


Diagram 6



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 4

Band edge measurements according to 47 CFR 2.1051 / IC RSS-139 6.5

Date	Temperature	Humidity
2010-07-06	24 °C ± 3 °C	36 % ± 5 %
2010-07-07	24 °C ± 3 °C	42 % ± 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 30 kHz was used up to 5 MHz away from the band edges. 30 kHz is <1% of the Emission BW(4.25 MHz between the 26 dB points). To compensate for the reduced measurement bandwidth, the limit was adjusted with 1.5 dB to -14.5 dBm up to 1 MHz away from the band edges and with 15.2 dB to -28.2 dBm in the frequency range 1 MHz to 5 MHz away from the band edges.

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	900 229
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 4.1

Single carrier:

Diagram 1: B

Diagram 2: T

Multi carrier:

Diagram 3: B and (B+5)

Diagram 4: T and (T-5)

Limits

From CRF 47 §27.53 (h): For operations in the 2110–2155 MHz band, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

Resulting in an absolute limit of -13 dBm within the specified measurement bandwidth.

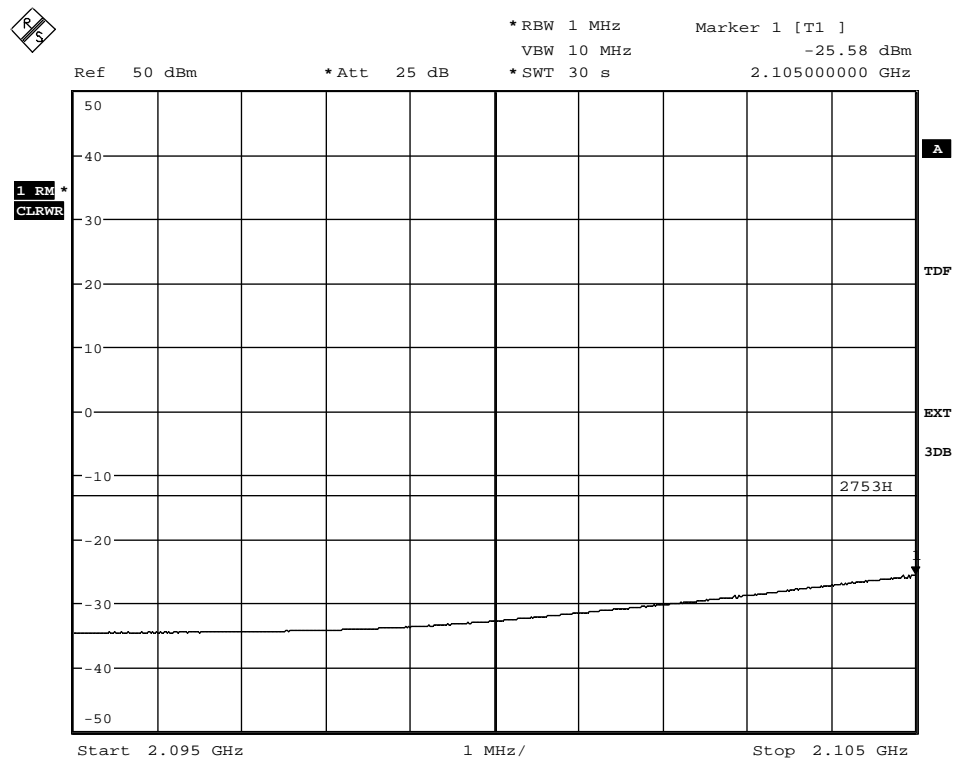
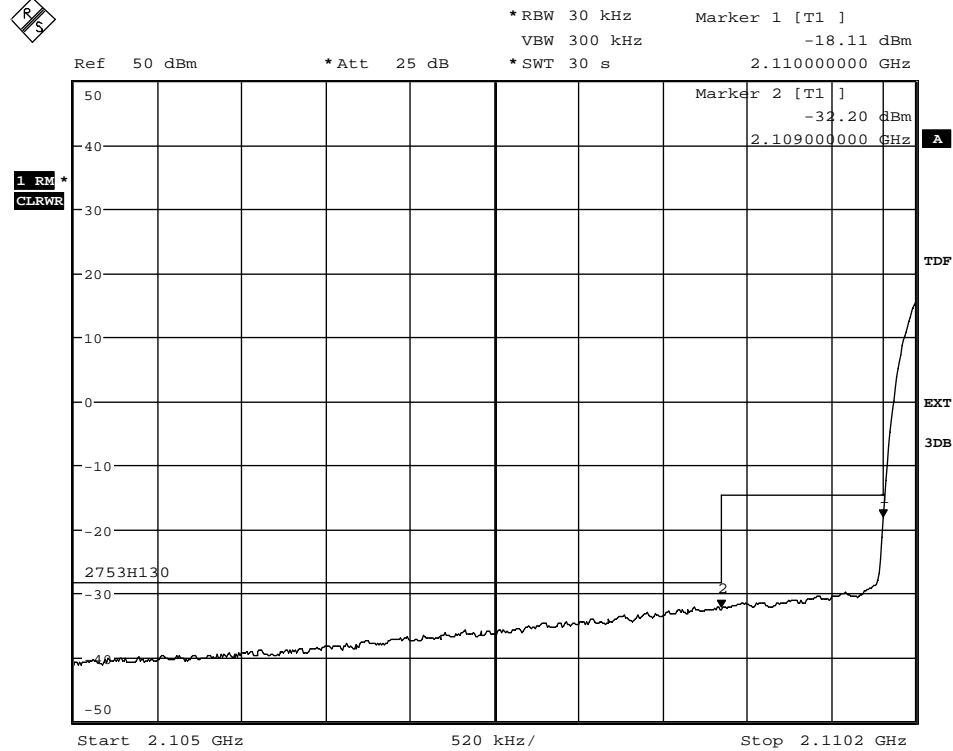
Complies?	Yes
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IC: 287AB-BS118591

Appendix 4.1

Diagram 1





REPORT

Date
2010-08-14

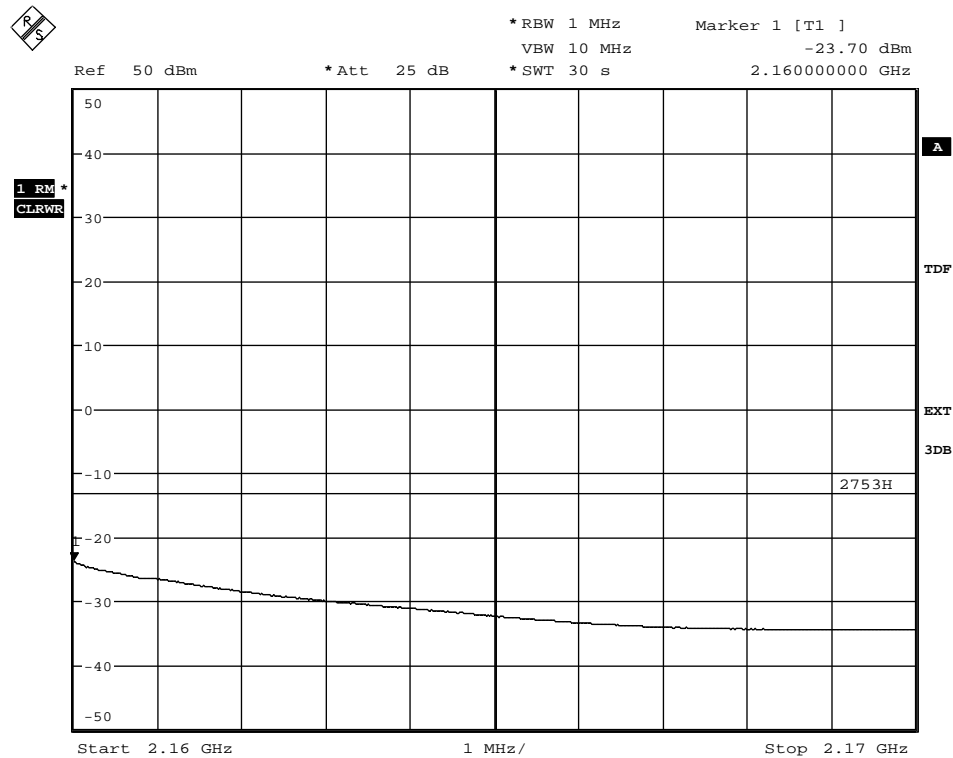
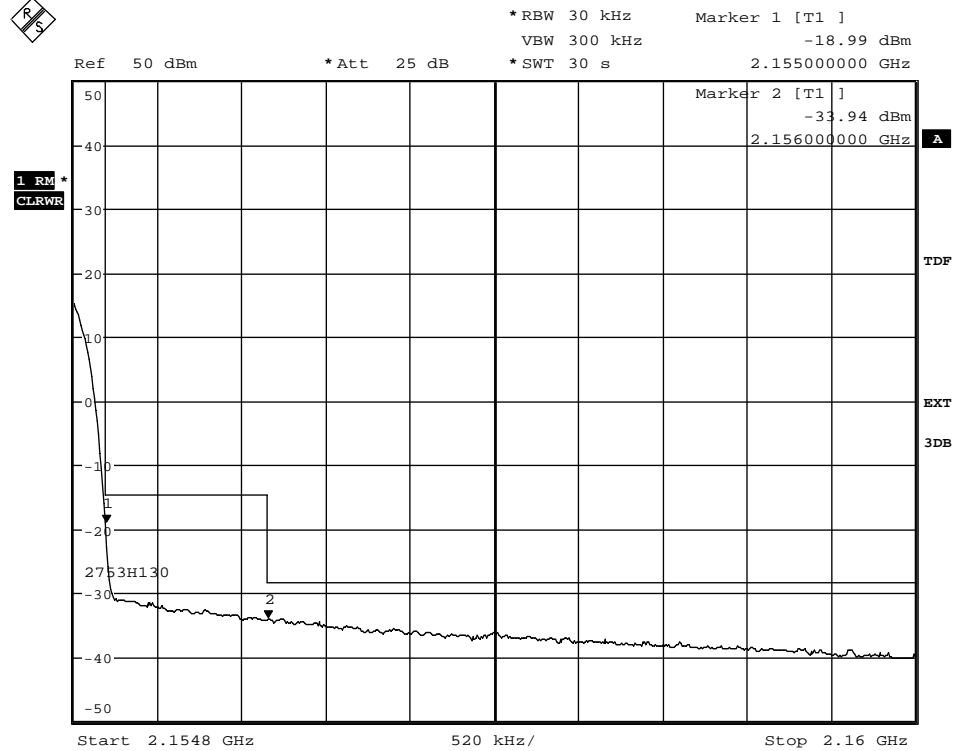
Reference
FX012084-F27

Page
2 (4)

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 4.1

Diagram 2

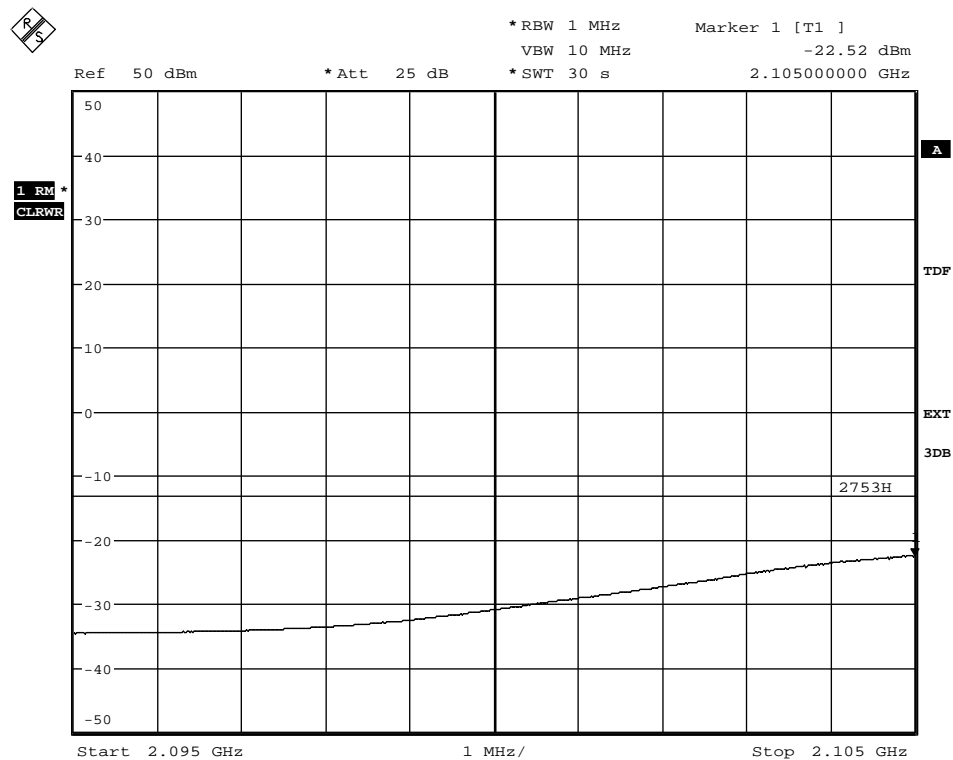




FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 4.1

Diagram 3

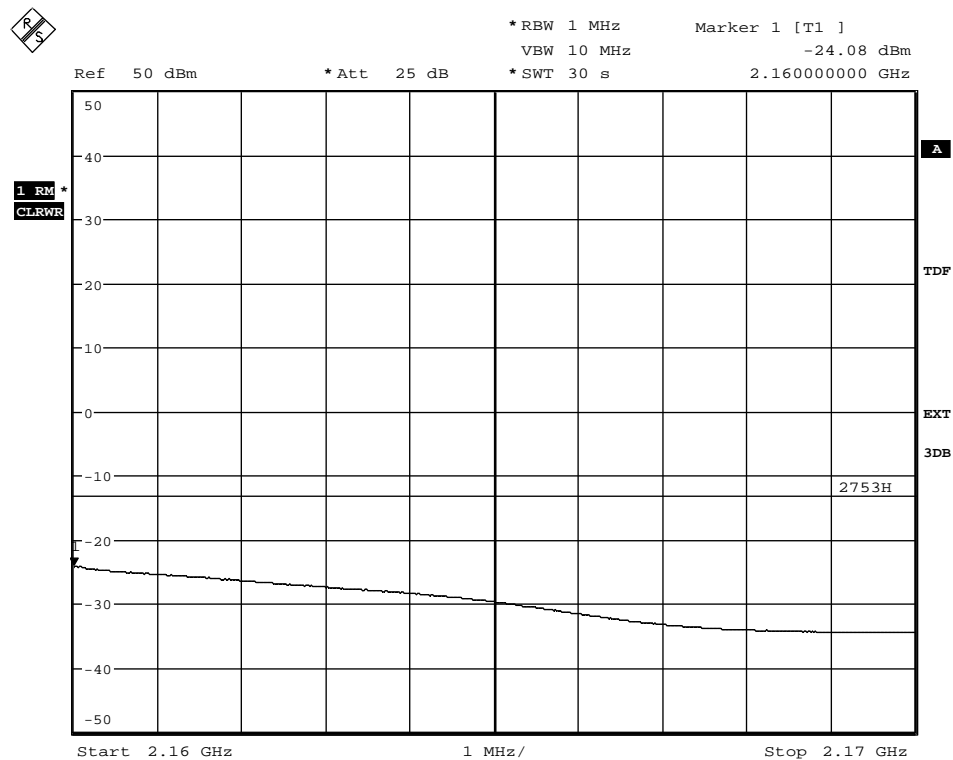
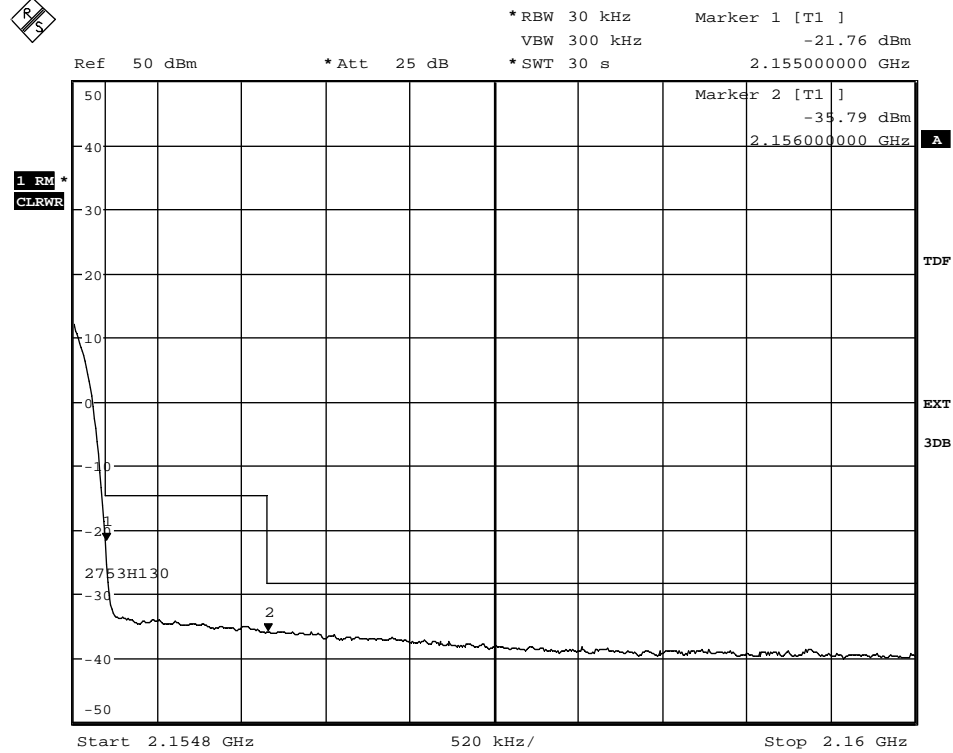




FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 4.1

Diagram 4



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5

Conducted spurious emission measurements according to 47 CFR 2.1051 / IC RSS-139 6.5

Date	Temperature	Humidity
2010-07-06	24 °C ± 3 °C	36 % ± 5 %
2010-07-07	24 °C ± 3 °C	42 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. A pre-measurement was performed with the PEAK detector activated. Emission close to or above the limit with the PEAK detector is measured with the RMS detector activated and the level of the emission is determined with the substitution method.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	900 229
High pass filter	504 200
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 5.1

Single carrier:

Diagram 1: B

Diagram 2: M

Diagram 3: T

Multi carrier:

Diagram 4: B and (B+10)

Diagram 5: T and (T-10)

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.

Limits

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

Resulting in an absolute limit of -13 dBm within the specified measurement bandwidth.

Complies?	Yes
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REPORT

Date
2010-08-14

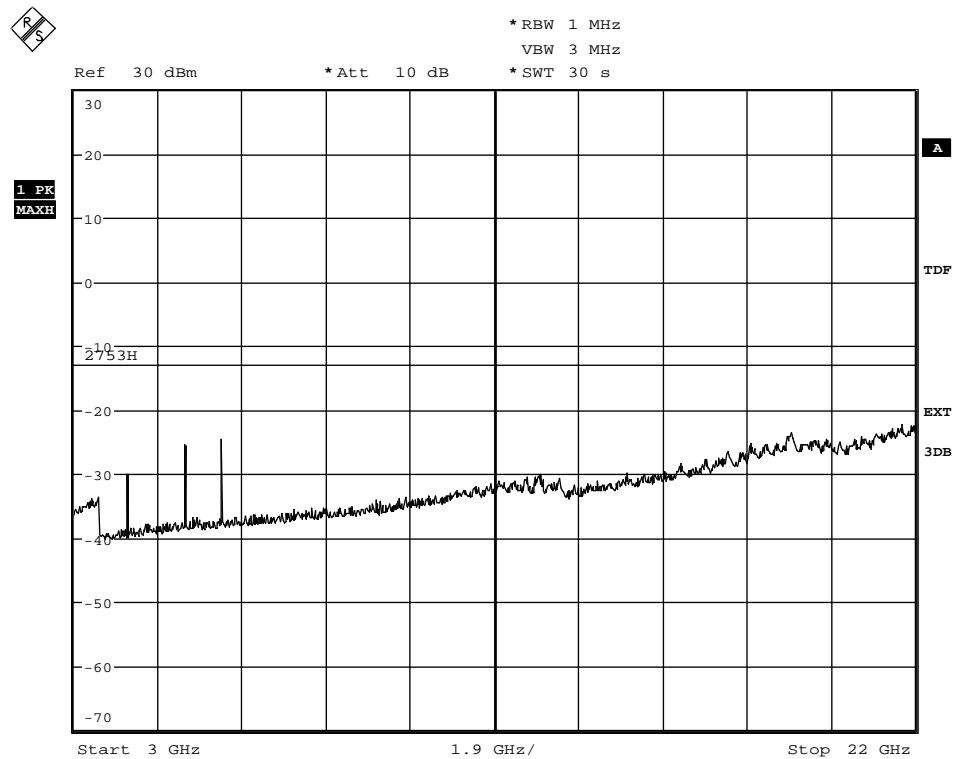
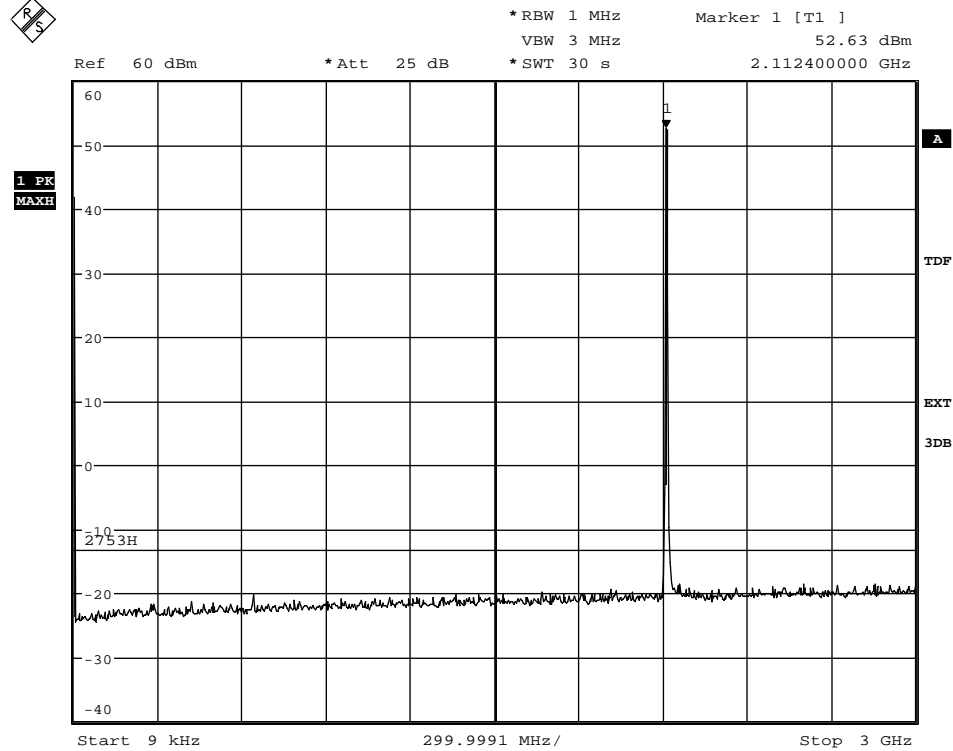
Reference
FX012084-F27

Page
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FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5.1

Diagram 1:

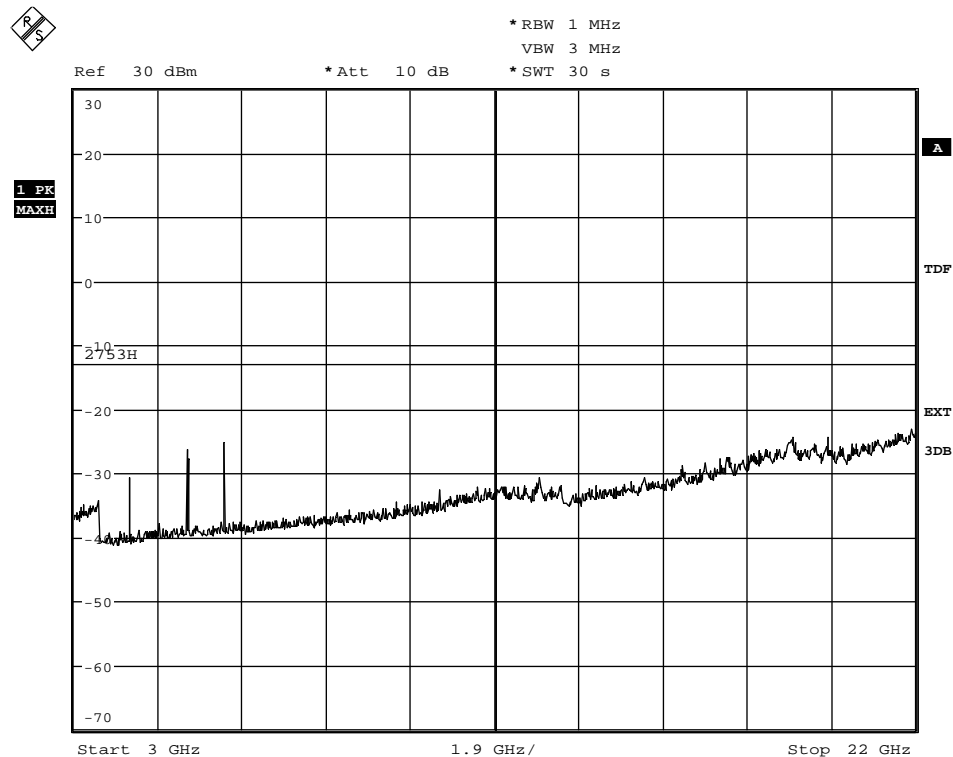
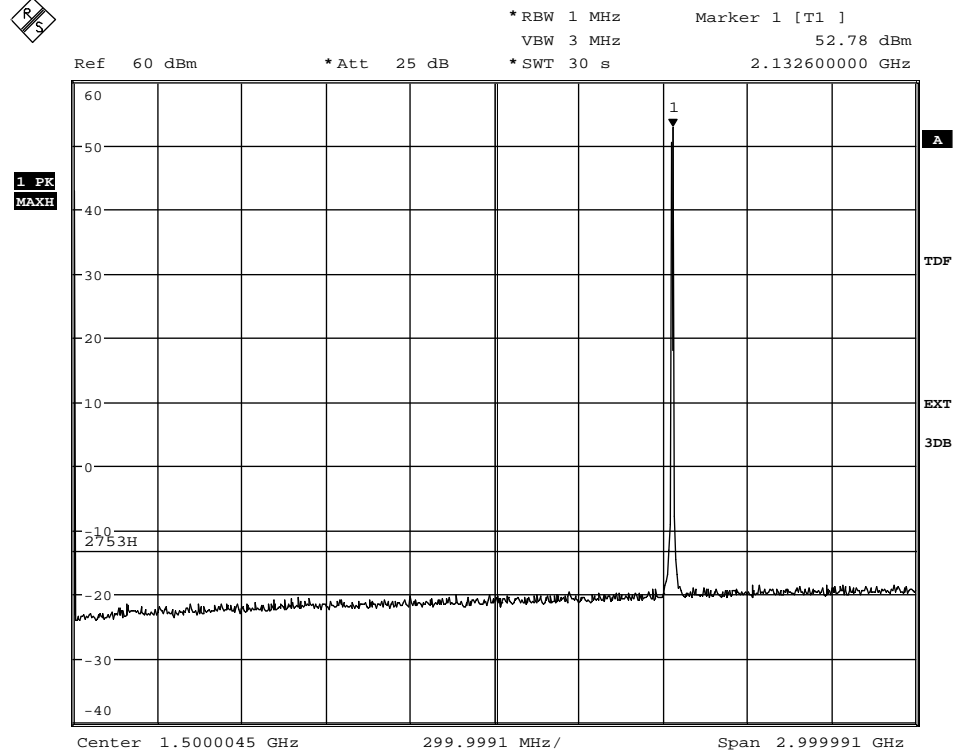




FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5.1

Diagram 2:





REPORT

Date
2010-08-14

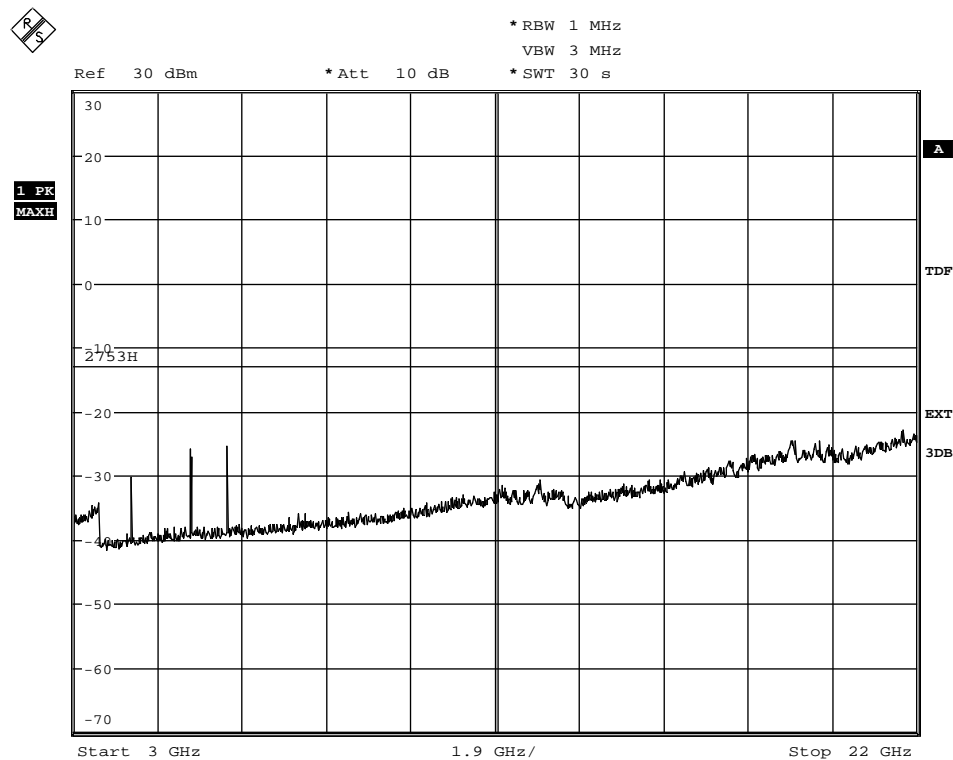
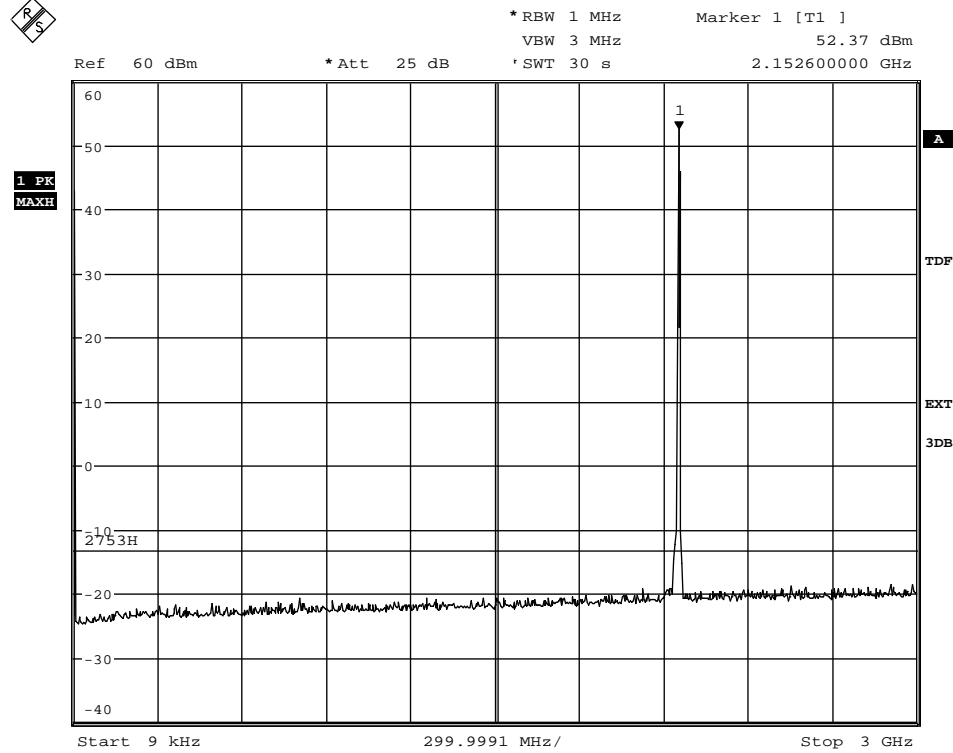
Reference
FX012084-F27

Page
3 (5)

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5.1

Diagram 3:

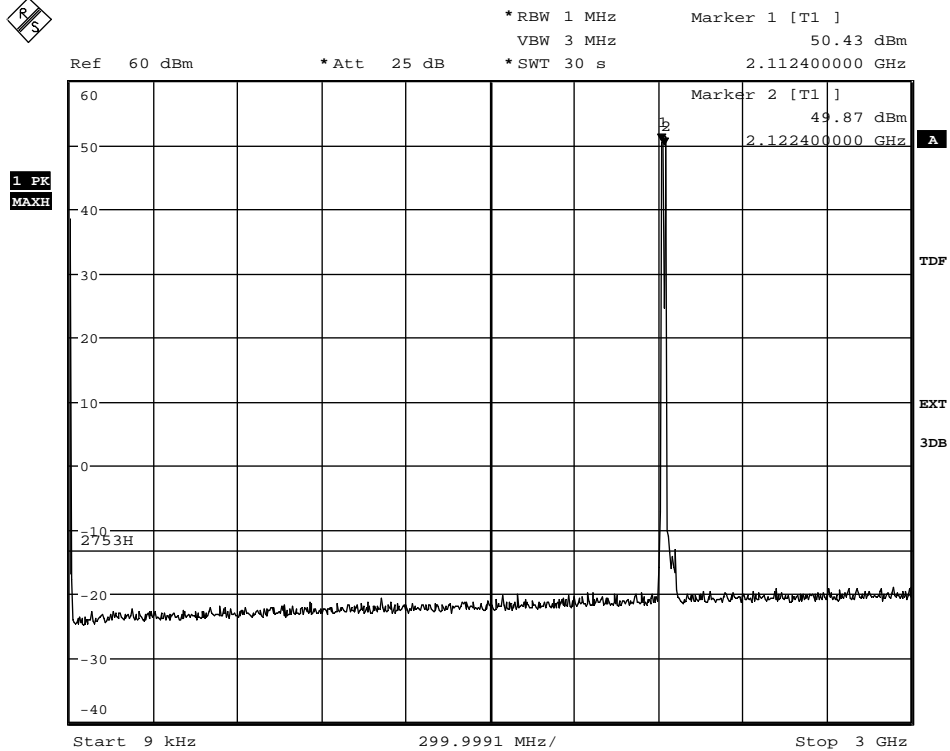




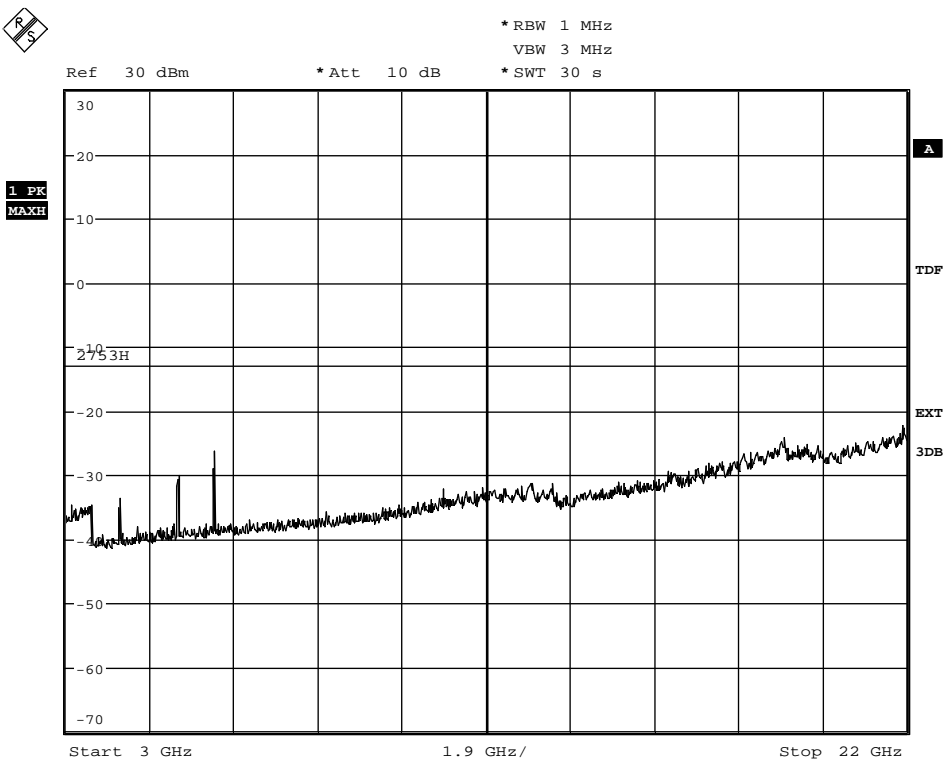
FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5.1

Diagram 4:



The spurious close to the limit at 2170 MHz was >15 dB below limit when measured with the RMS detector.

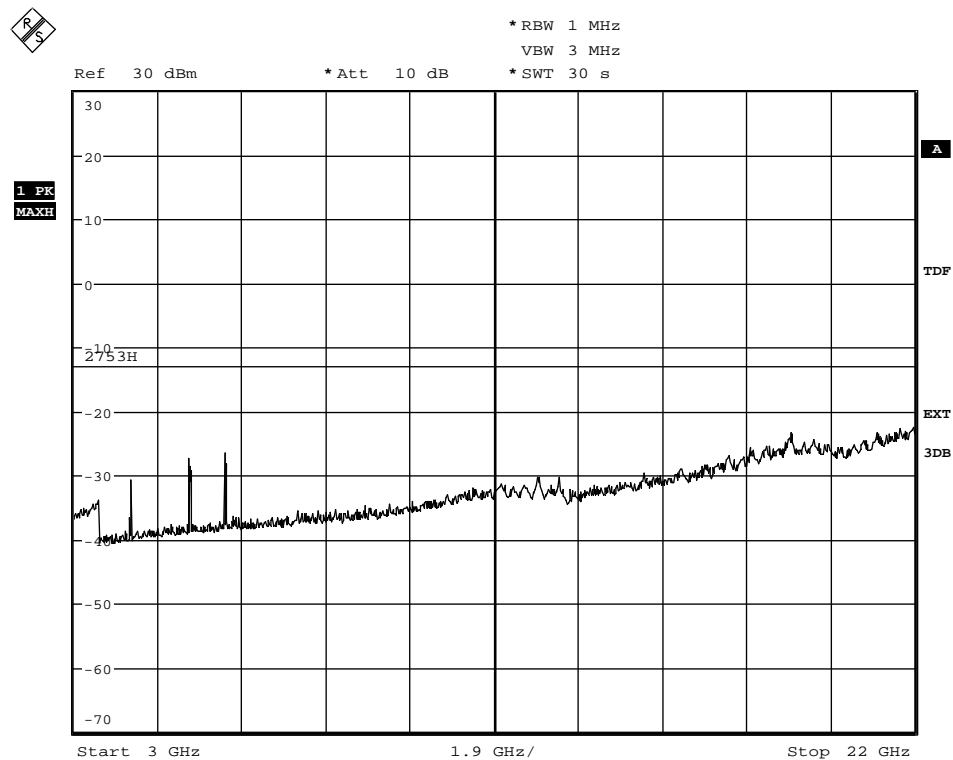
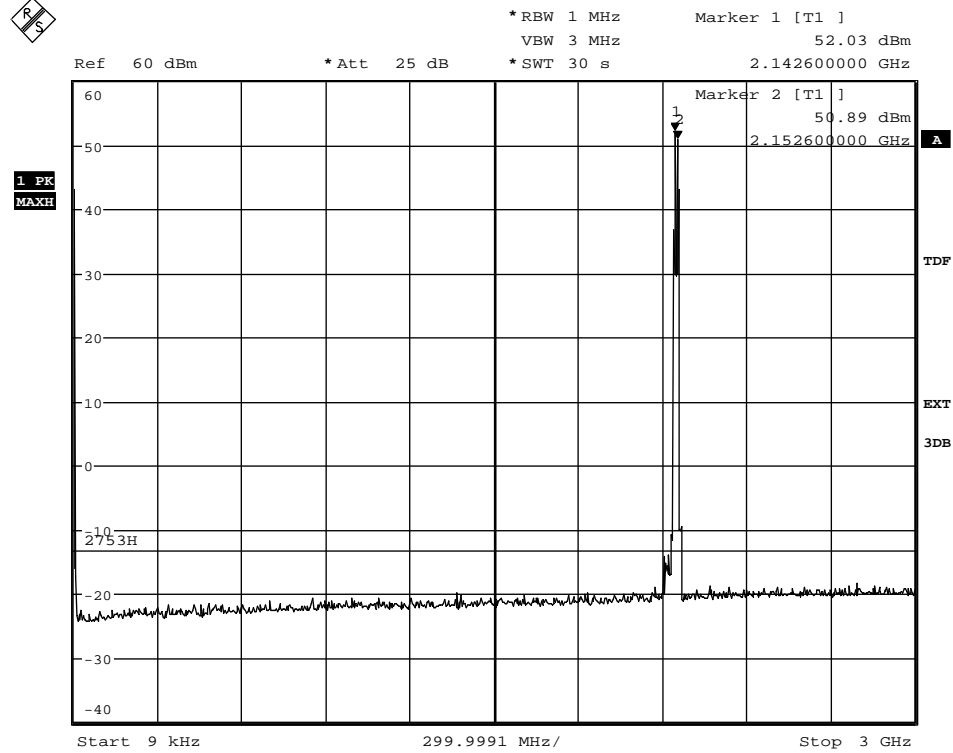




FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 5.1

Diagram 5:



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IC: 287AB-BS118591

Appendix 6

Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-139 6.5

Date 2010-07-02 to 2010-07-07	Temperature 23 °C ± 3 °C	Humidity 41 to 52 % ± 5 %
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Test set-up and procedure

The test site is listed at FCC, Columbia with registration number: 93866. The test site comply with RSS-Gen, Issue 2, Industry Canada file no.:IC 3482A-1.

The measurements were performed with both horizontal and vertical polarisation of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18-22 GHz.

A pre-measurement was first performed:

In the frequency range 30 MHz-22 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was,

$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

The measurement procedure was as the following:

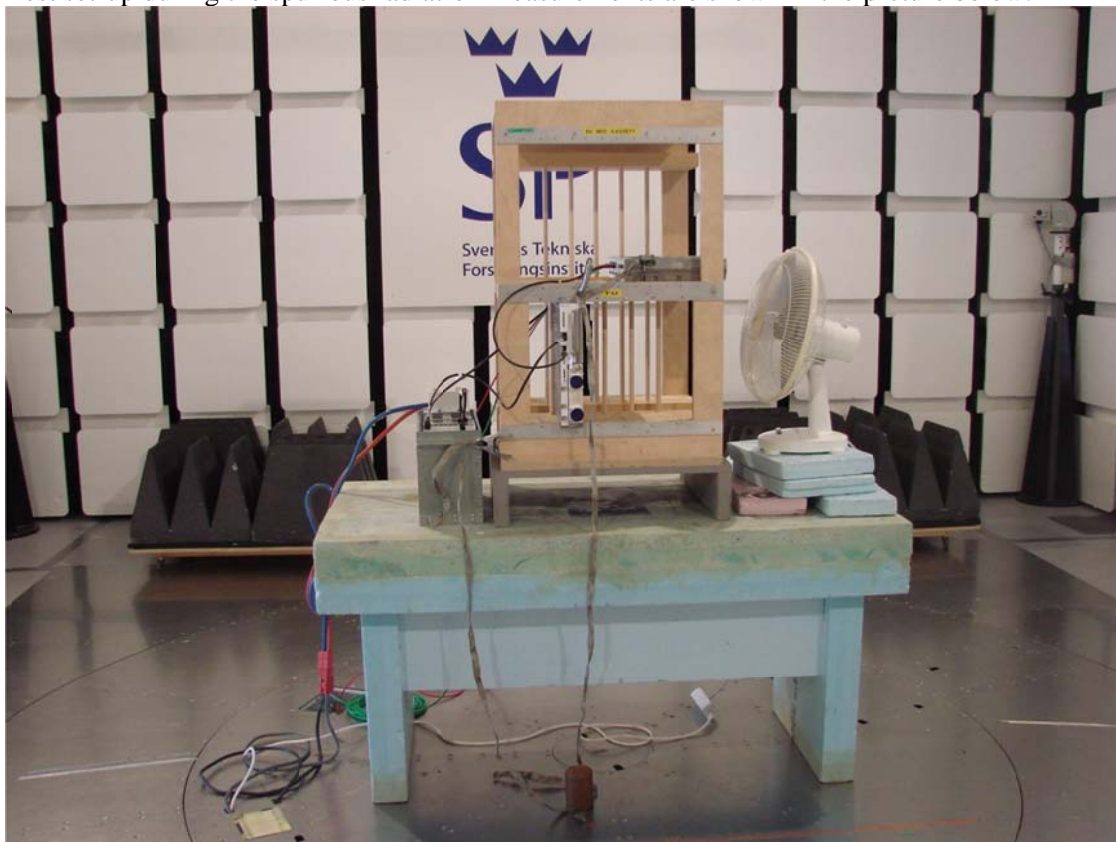
1. The pre-measurement was first performed with peak detector. The EUT was measured in eight directions and with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. Spurious radiation on frequencies closer than 20 dB to the limit is scanned 0-360 degrees and the antenna is scanned 1-4 m for maximum response. The emission is then measured with the average detector and the average value is reported, frequencies closer than 10 dB to the limit measured with the average detector was measured with the substitution method according to the standard.

Measurement equipment	SP number
Test site Tesla	503 881
Test site Tesla (measurements 18-22 GHz)	503 881
R&S ESI 26	503 292
Control computer	503 479
Software: R&S EMC32, ver. 8.20.1	-
Chase Bilog antenna CBL 6111A	502 182
EMCO Horn Antenna 3115	502 175
MITEQ Low Noise Amplifier	503 285
Standard gain antenna 20240-20	503 674
Testo 625 temperature and humidity meter	504 117

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 6

Test set-up during the spurious radiation measurements are shown in the picture below:



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 6

The measurements were performed with the test object allocated to the following channels:

Single Carrier:

Cell	1	1	1
Channel	B	M	T

Multi Carrier:

Cell	1	2	1	2
Channel	B	B+10	T	T-10

Results

Single carrier

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty		4.7 dB

Multi carrier

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty		4.7 dB

Limits

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

Complies?	Yes
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FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 7

Frequency stability measurements according to 47 CFR 2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2010-07-02 to 2010-07-04	22 to 24 °C ± 3 °C	32 to 36 % ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
Climate chamber 2	503 546
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	504 159
Testo 635, Temperature and humidity meter	504 203
Rotronic temperature and humidity meter	502 946
Multimeter Fluke 87	502 190

FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 7

Results

Nominal transmitter frequency was 2132.6 MHz.

Supply voltage DC (V)	T (°C)	Frequency error (Hz)
-48.0	+20	-11
-55.2	+20	-13
-40.8	+20	-12
-48.0	+30	-22
-48.0	+40	-18
-48.0	+50	-12
-48.0	+10	-11
-48.0	0	-15
-48.0	-10	+15
-48.0	-20	TX disabled (Note 1)
-48.0	-30	N.T.
Maximum freq. error (Hz)		22
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Note 1: This temperature caused an unacceptable error “TemperatureExceptionallyLow” and it was not possible to enable the transmitter.

Limits (according to 3GPP TS 25.141)The frequency Error shall be within $\pm(0.05 \text{ PPM} + 12 \text{ Hz})$ ($\pm 118.63 \text{ Hz}$).

Complies?	Yes
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FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

Appendix 8

Receiver spurious emissions measurements according to 47 CFR 15.111 and RSS-GEN Issue 2

Date 2010-07-09	Temperature 24 °C ± 3 °C	Humidity 51 % ± 5 %
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Test set-up and procedure

The measurements were performed according to ANSI C63.4.

Measurements were performed on port “RF B”. The measurement was first performed with peak detector. Emission on frequencies close to or above the limit was re-measured with quasi-peak detector below 1 GHz and with average detector above 1GHz.

During the measurement at the receiver port “RF B” the combined TX/RX port “RF A” was terminated into 50 ohm. The TX was active at maximum power at the TX band center frequency 2132.6 MHz.

Measurement equipment	SP number
R&S FSQ40	504 143
RF attenuator	900 229
High pass filter	504 199
Testo 635 Temperature and humidity meter	504 203

Result

The results are shown in appendix 8.1:

The nominal RX frequency was 1732.5 MHz.

	Tested port, frequency range
Diagram 1a	RX B, 9 KHz – 1 GHz
Diagram 1b	RX B, 1 GHz – 11 GHz

Remarks

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

It was deemed sufficient to measure RX conducted emissions with only the worst case TX configuration. The upper frequency bound 11 GHz was chosen to cover 5x the upper edge of the TX band as the client declared highest internal generated frequency.

Limit

The power of any spurious output signals appearing at the antenna terminals must not exceed -57 dBm (2 nanowatt).

Emission below limit?	Yes
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IC: 287AB-BS118591

Appendix 8.1

Diagram 1a:

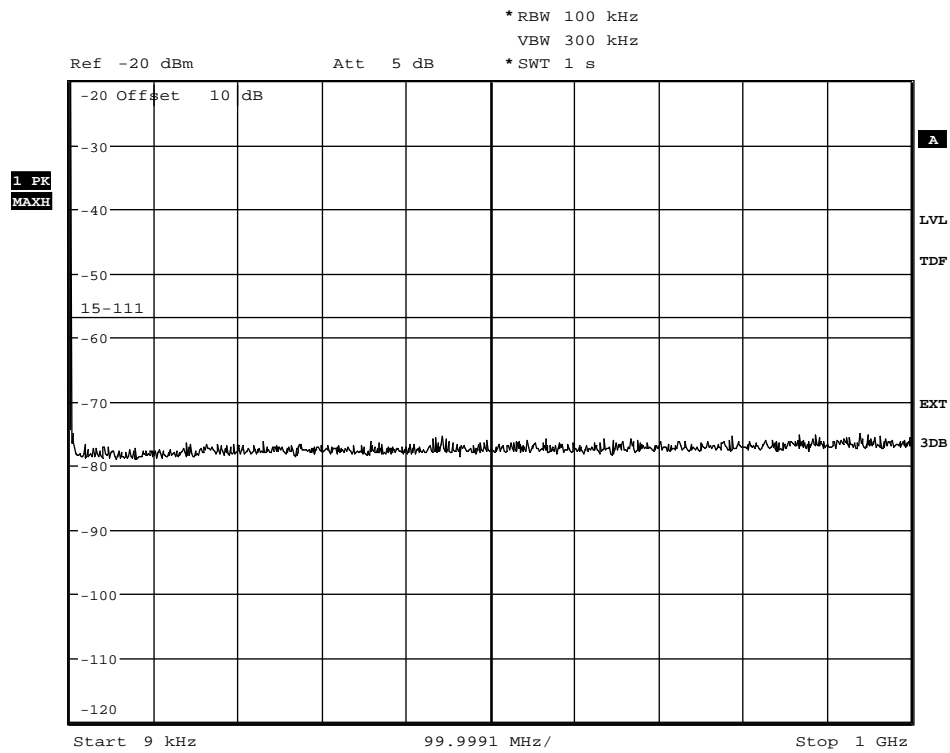
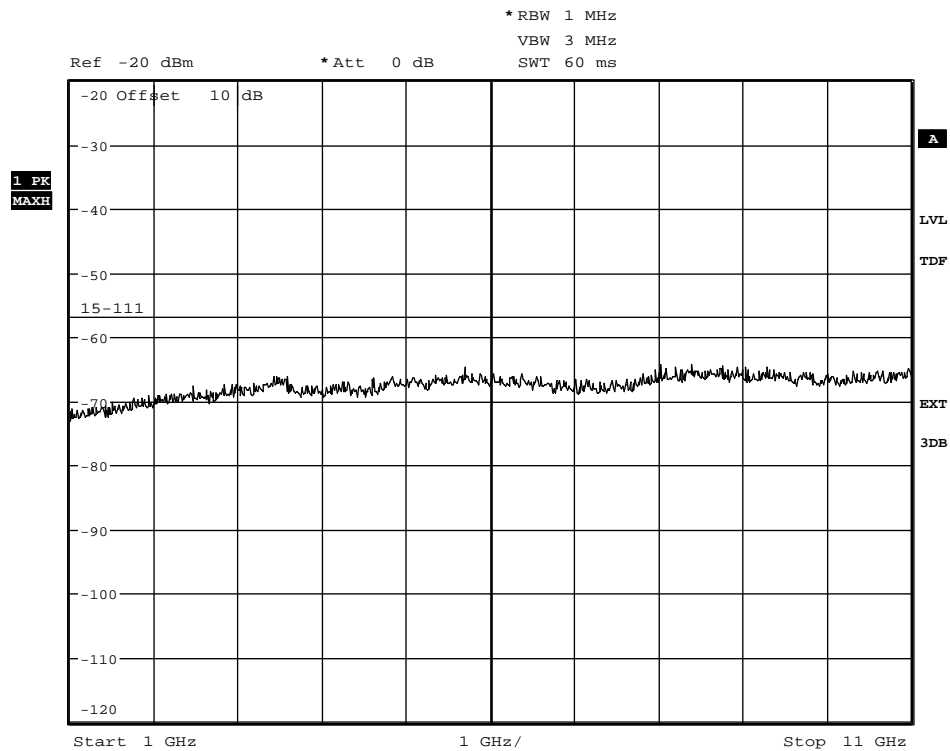


Diagram 1b:



FCC ID: TA8BKRC11859-1
IC: 287AB-BS118591

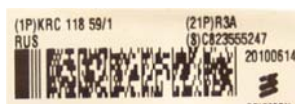
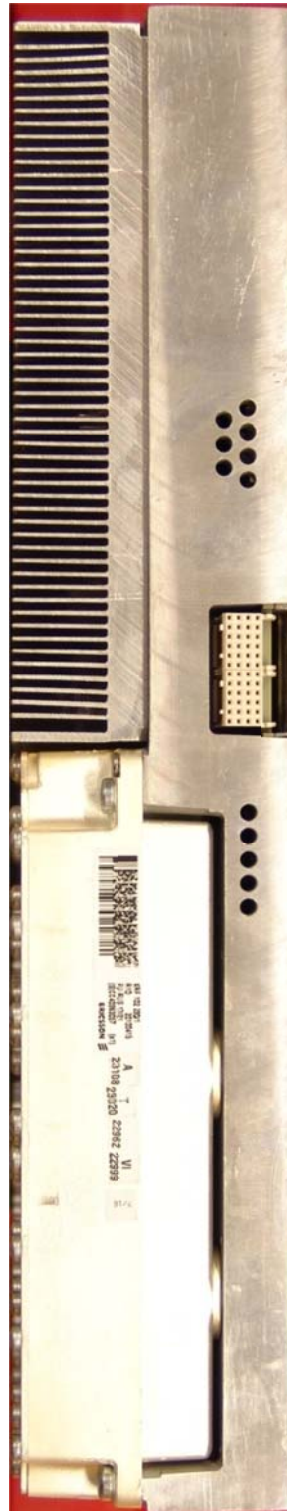
Appendix 9

Photos

Front



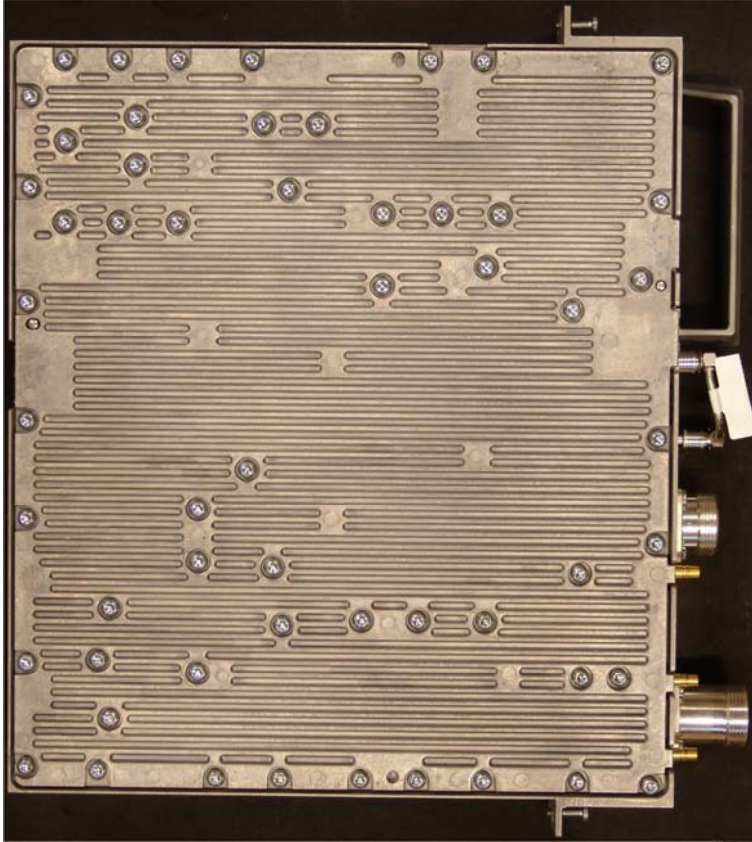
Back



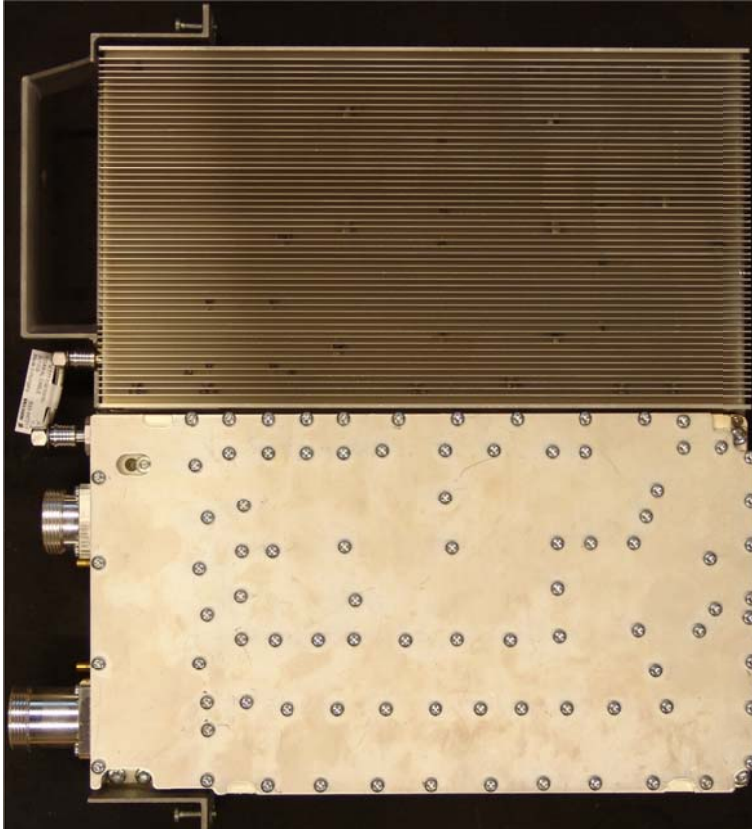
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IC: 287AB-BS118591

Appendix 9

Right side



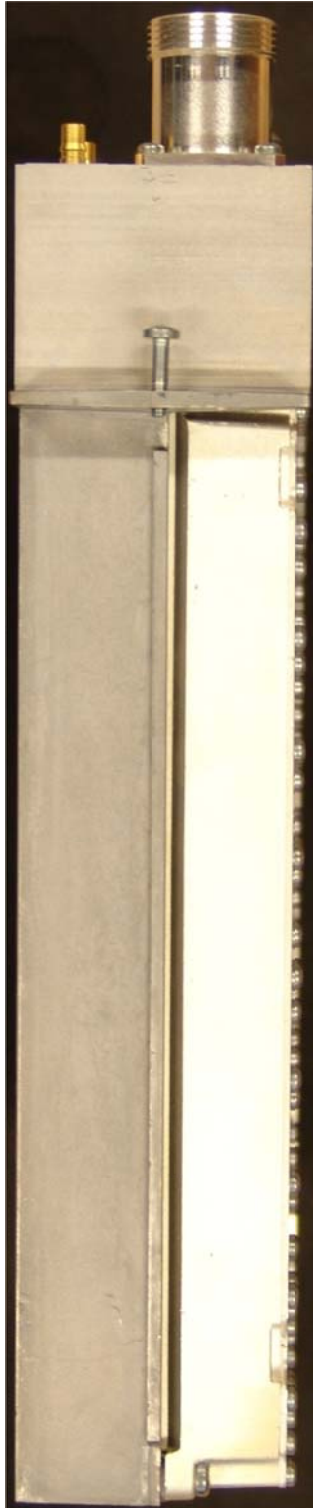
Left side



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IC: 287AB-BS118591

Appendix 9

Bottom side



Top side

