


	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

Compliance Test Report		FCC PART 90		
Test Lab Information	Name	CELLTECH LABS INC.		
	Address	21-364 Lougheed Road, Kelowna, British Columbia V1X 7R8 Canada		
Test Site Registration No.(s)	FCC	Accredited Site (ISO 17025:2005 - A2LA Test Lab Certificate No. 2470.01)		
	IC	3874A-1		
Applicant Information	Name	4RF Limited		
	Address	PO Box 13-506 Wellington 6032 New Zealand		
Standard(s) & Procedure(s)	FCC	47 CFR Part 2; Part 90		
	ANSI	TIA/EIA-603-D-2010, C63.4-2009		
Device Classification(s)	FCC	Private Land Mobile Radio Services (TNB)		
Application Type(s)	FCC/IC	New Certification		
Device Identifier(s)	FCC ID:	UIPSQ135M150		
Device Under Test (DUT)	Aprisa SR+ 15/ 30 kHz channels; QPSK,16QAM & 64QAM modulations, Digital Radio Model # SQ135M150			
This wireless device has demonstrated compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in FCC 47 CFR Rule Parts 2 and Part 90, ANSI TIA/EIA-603-D-2010 and ANSI C63.4-2009.				
I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.				
The results and statements contained in this report pertain only to the device(s) evaluated. This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Labs Inc.				
Test Report Approved By		Art Voss	28 January 2016	Celltech Labs Inc.

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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GENERAL REMARKS

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SUMMARY



The device under test (DUT) fulfills the general approval requirements as identified in this test report.

REVISION LOG

Revision	Description	Implemented By	Implementation Date
1.0	1st Release	Bruce Balston	7 January 2016
1.1	2 nd Release – Corrections per TCB	Art Voss	19 January 2016
1.2	3 rd Release- Corrections per TCB	Art Voss	28 January 2016

Test Report Prepared By	Date	QA Review By	Date
Ben Hewson	1/28/2016	Art Voss	7 January 2016

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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SCOPE

This report outlines the results collected during RF radiated and conducted measurements of the 4RF Aprisa SQ135M150 point-to-multipoint radio. The measurement results were applied against the applicable requirements and limits outlined in the technical rules and regulations set forth in the Federal Communication’s Commission Code of Federal Regulations Title 47 Part 2 and Part 90; and Industry Canada Radio Standards Specification RSS-119 and RSS-Gen.

1.0 REFERENCES

1.1 Normative References


ANSI/ISO 17025:2005	General Requirements for competence of testing and calibration laboratories
IEEE/ANSI C63.4:2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/TIA/EIA-603-D:2010	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
CFR Title 47 Part 2	Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR Title 47 Part 90	Code of Federal Regulations Title 47: Telecommunication Part 90: Private Land Mobile Radio Services



2.0 PASS/FAIL CRITERIA

Unless otherwise noted in the Appendices, the pass/fail criteria are the limit set forth in the reference standards. The DUT is considered to have passed the requirements if the data collected during the described measurement procedure is no greater than the specified limits as defined. The pass/fail statements made in this report only apply to the unit tested.

3.0 FACILITIES AND ACCREDITATIONS

The facilities used in collecting the test results outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC as an accredited test facility and Industry Canada under File Number IC 3874A-1.

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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4.0 GENERAL INFORMATION

DUT Description & Specifications

Device Description	Aprisa SR+,SQ135M150, 15 / 30 kHz channels, kHz Point-to-Multipoint Digital Radio	
Test Sample Serial No.	T/A Sample - Identical Prototype	
Device Identifier(s)	FCC ID:	UIPSQ135M150
Model Number(s)	SQ135M150	
FCC Frequency Band (MHz):	150.8 - 156.2475 / 157.1875 - 161.575 / 161.775 – 161.9625 / 162.0375 – 173.4	
Transmit Frequency Range DUT (MHz):	150.8 - 156.2475 / 157.1875 - 161.575 / 161.775 – 161.9625 / 162.0375 – 173.4 (15 / 30 KHz Channels)	
Rated TX Power and Modulation	QPSK: +37.0 dBm 16QAM: +35.0 dBm 64QAM: +34.0 dBm	
Spectral Efficiency	Min. = 7,500 bits per second / 30 kHz or 6,667 bits per second / 15 kHz	
Antenna	Maximum antenna gain = 15dBi	
Emission Designator	30.0 KHz Ch. QPSK = 19K1G1D 30.0 KHz Ch. 16QAM & 64QAM = 19K0D1D 15.0 KHz Ch. QPSK = 10K7G1D 15.0 KHz Ch. 16QAM & 64QAM = 10K6D1D	
DUT Power Source	10-30 Vdc	
Type of Equipment	Fixed Licensed Non-Broadcast Station Transmitter (TNB)	
Deviation(s) from standard/procedure	None	
Modification of DUT	None	
Test Exercise	The DUT was placed in continuous transmit mode and CW mode	
Applicable Standards	FCC Part 90	

DUT Function & Test Statements

Spectrum Efficiency - Part 90.203(j)(5).


15kHz Channel Bandwidth, Gross Data Rate = 18,000bps = 7,500bps per 6.25kHz Channel BW



30kHz Channel Bandwidth, Gross Data Rate = 32,000bps = 6,667bps per 6.25kHz Channel BW

This device complies with the spectrum efficiency requirement of this rule part.


A manufacturer's attestation exhibit has been submitted with this filing.



This device has no voice frequency capability. It uses digital modulation only. Therefore no voice frequency test requirements have been reported.

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
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<u>Section</u>	<u>Description of Test</u>	<u>Procedure Reference</u>	<u>Limit Reference</u>	<u>Result</u>
5	RF Output Power	ANSI/TIA/EIA-603-D	§2.1046, §90.205	Pass
6	Occupied Bandwidth and Emission Mask	ANSI/TIA/EIA-603-D	§2.1049, §90.210	Pass
7	Spurious Emissions at the antenna terminals (Conducted)	ANSI/TIA/EIA-603-D	§2.1051, §90.210	Pass
8	Radiated Spurious Emissions	ANSI C63.4-2009	§2.1053, §90.210	Pass
9	Frequency Stability	ANSI/TIA/EIA-603-D	§2.1055, §90.213	Pass
10	Transient Frequency Response	ANSI/TIA/EIA-603-D	§90.214	Pass

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
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5.0 RF OUTPUT POWER MEASUREMENT


References	
Normative Reference Standard	FCC CFR 47 §2.1046, §90.205; IC RSS-119, 5.4
Procedure Reference	The RF output power measurements were performed in accordance with ANSI TIA/EIA Standard 603.



Limits	
FCC CFR 47 §90.279	ERP relative to Effective Antenna Height (EAH), 90.279.

Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

Asset number	Manufacturer	Model	Description	Last cal / Cal due
00110	Gigatronics	8652A	Power Meter	17-Feb-14 /17-Feb-16
00248	Gigatronics	80334A	Power Sensor	17-Feb-14 /17-Feb-16

Setup drawing		
DUT	Attenuator	Power Meter

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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Conducted Power Measurement

Method of Measurement: The RF power is measured with a 50 ohm resistive watt-meter connected at the EUT's RF output connector.
Nomimnal DC power of 15.0VDC is applied.


Measured Conducted Power (155MHz)			Rated Power	
Modulation	15kHz EBW (dBm)	30kHz EBW (dBm)	15kHz EBW (dBm)	30kHz EBW (dBm)
QPSK	35.7	36.0	37.0	37.0
16QAM	33.3	33.4	35.0	35.0
64QAM	32.3	32.3	34.0	34.0
Result:			Complies	



Sign-Off

I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.



Art Voss
Sr. Engineer

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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			IC Test Site No.:	IC 3874A-1	

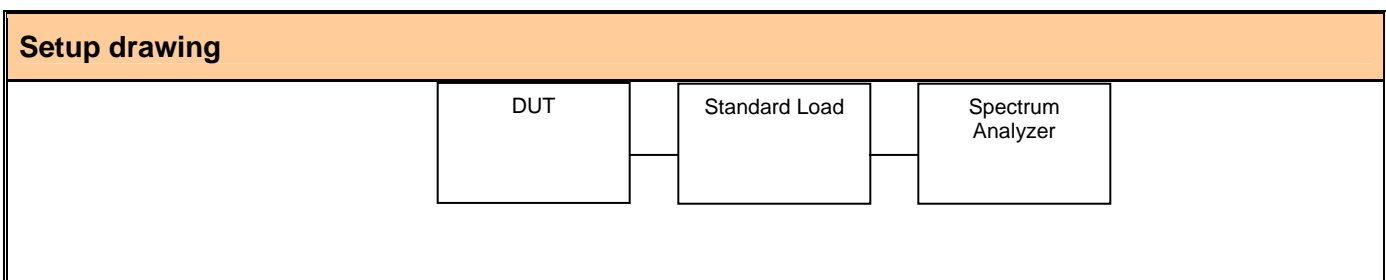
6.0 OCCUPIED BANDWIDTH AND EMISSION MASK


References	
Normative Reference Standard	FCC CFR 47 §2.1049, §90.210
Procedure Reference / Description	Occupied bandwidth was performed by connecting the output of the DUT to the input of a spectrum analyzer.

Limits	
§90.210	Mask C /30 KHz CH. Mask D /15 KHz CH.

Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
00241	R&S	FSP40	Spectrum Analyzer	23 Apr 15 / 23 Apr 17



Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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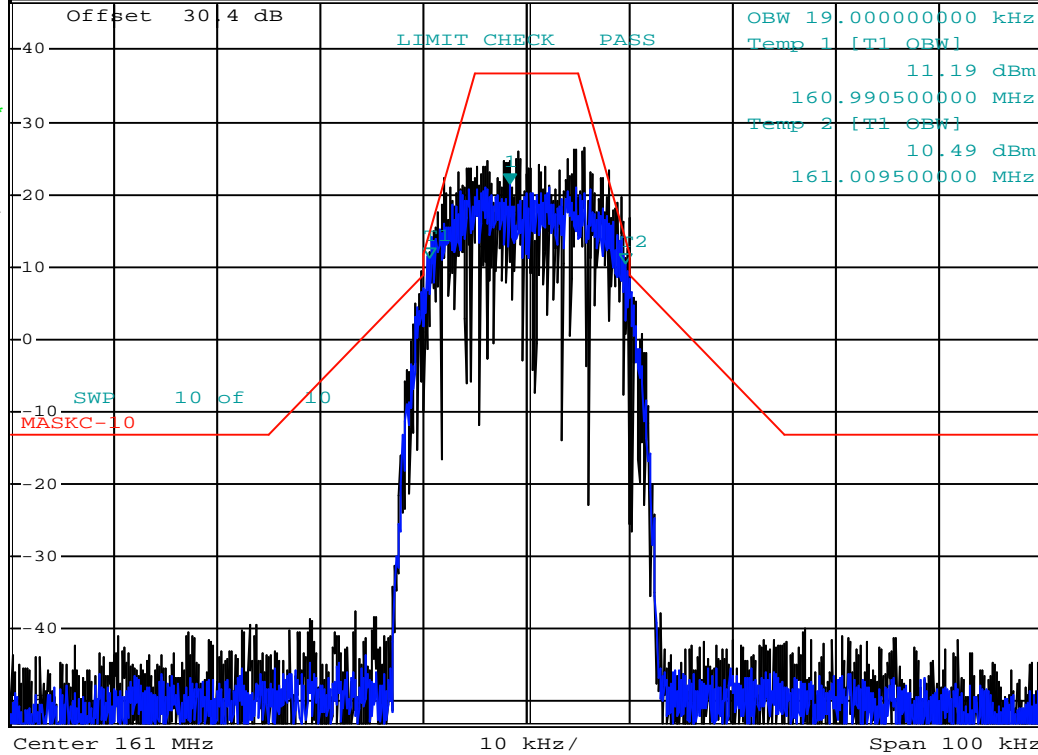
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 21.41 dBm
 *VBW 1 kHz
 *SWT 2 s 160.998450000 MHz

Ref 46.8 dBm *Att 40 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 10:46:55

Channel Frequency [30kHz Ch BW, QPSK]:	161MHz
Measured Occupied Bandwidth:	19.0kHz
Authorized Bandwidth §90.209:	20.0kHz
Result:	Complies

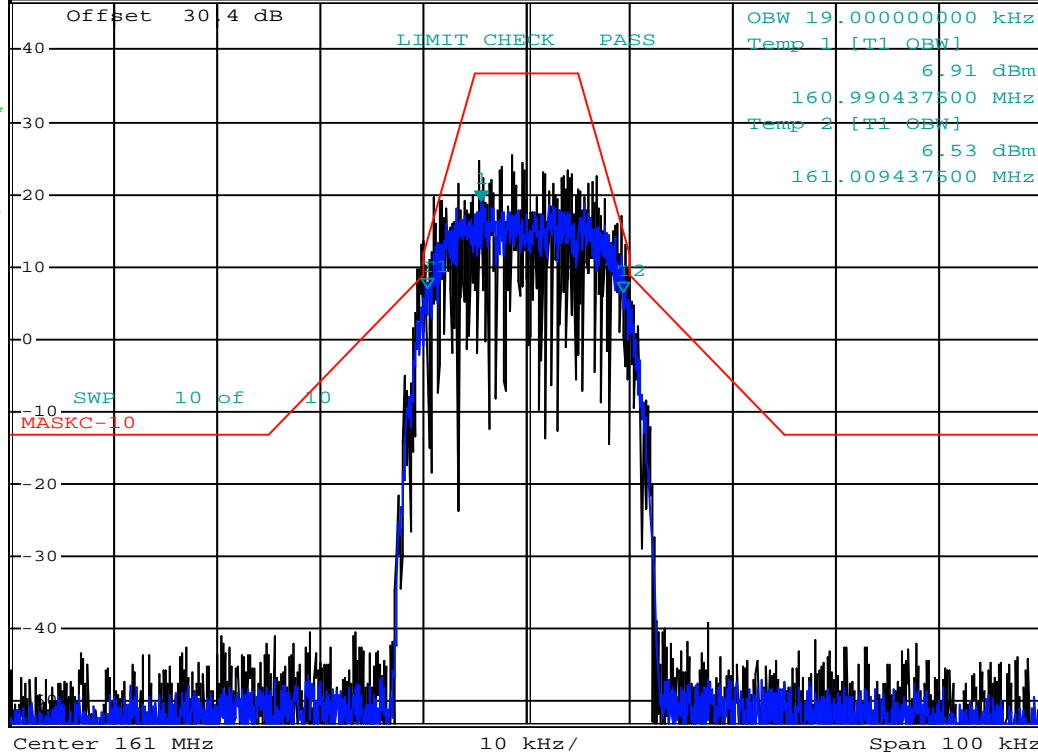
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 19.06 dBm
 *VBW 1 kHz
 *SWT 2 s 160.995662500 MHz

Ref 46.8 dBm *Att 40 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 10:49:12

Channel Frequency [30kHz Ch BW, 16QAM]:	161MHz
Measured Occupied Bandwidth:	19.0kHz
Authorized Bandwidth §90.209:	20.0kHz
Result:	Complies

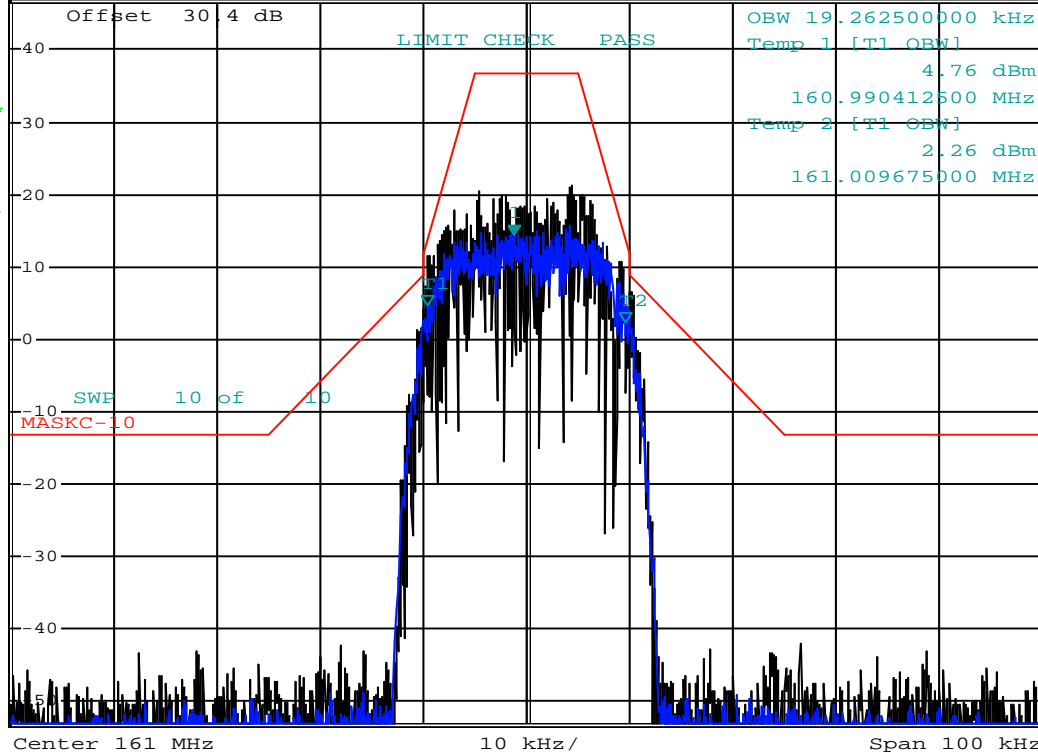
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 14.39 dBm
 *VBW 1 kHz
 *SWT 2 s 160.998712500 MHz

Ref 46.8 dBm *Att 40 dB Offset 30.4 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 10:50:50

Channel Frequency [30kHz Ch BW, 64 QAM]:	161MHz
Measured Occupied Bandwidth:	19.3kHz
Authorized Bandwidth §90.209:	20.0kHz
Result:	Complies



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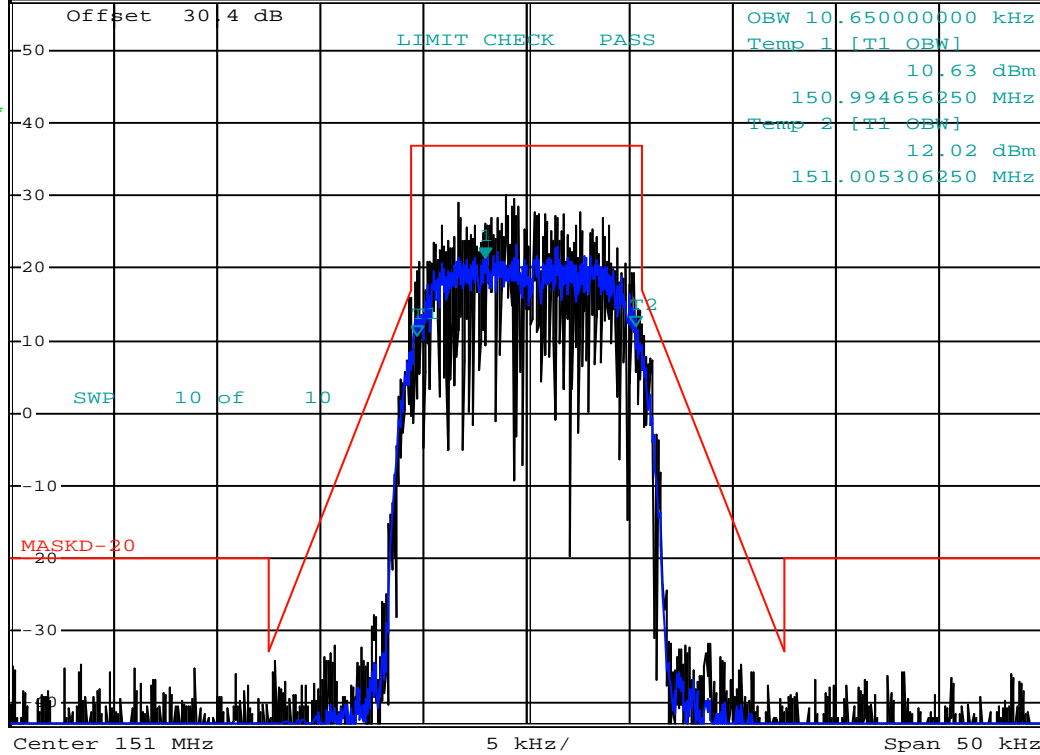
Test Lab Certificate No. 2470.01

Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 21.54 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 150.998000000 MHz

Ref 57 dBm



Date: 20.JAN.2016 09:33:10

Channel Frequency [15kHz Ch BW, QPSK]:	151MHz
Measured Occupied Bandwidth:	10.7kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

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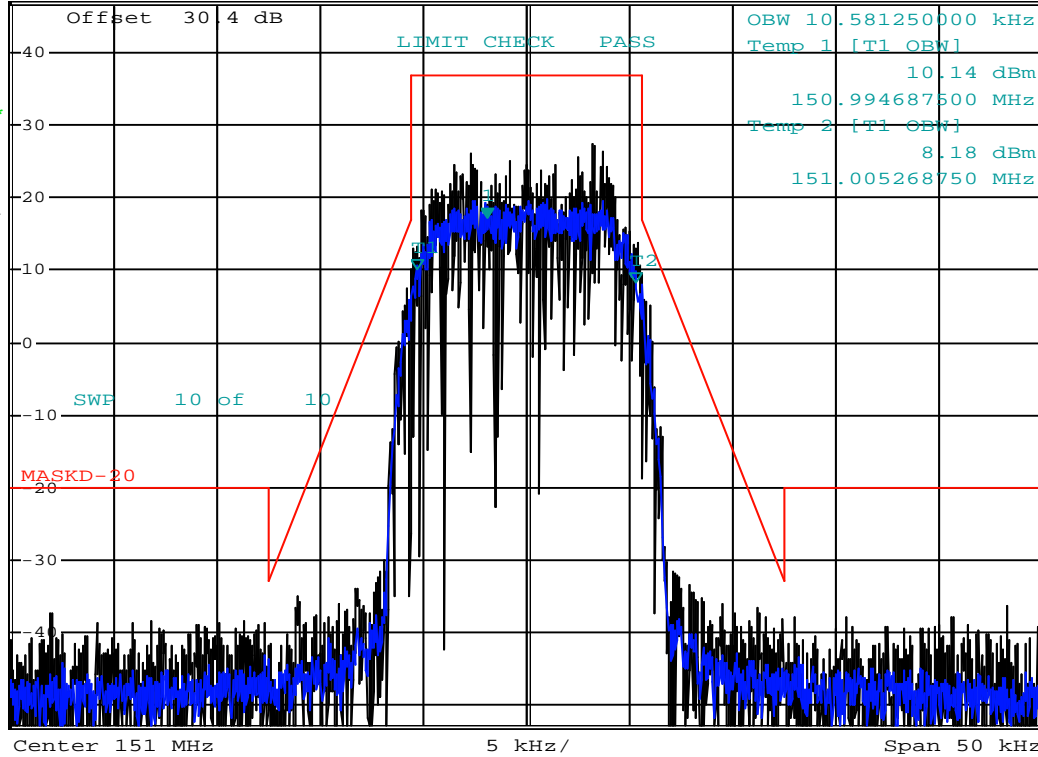
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 17.15 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 150.998131250 MHz

Ref 57 dBm Offset 30.4 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:47:59

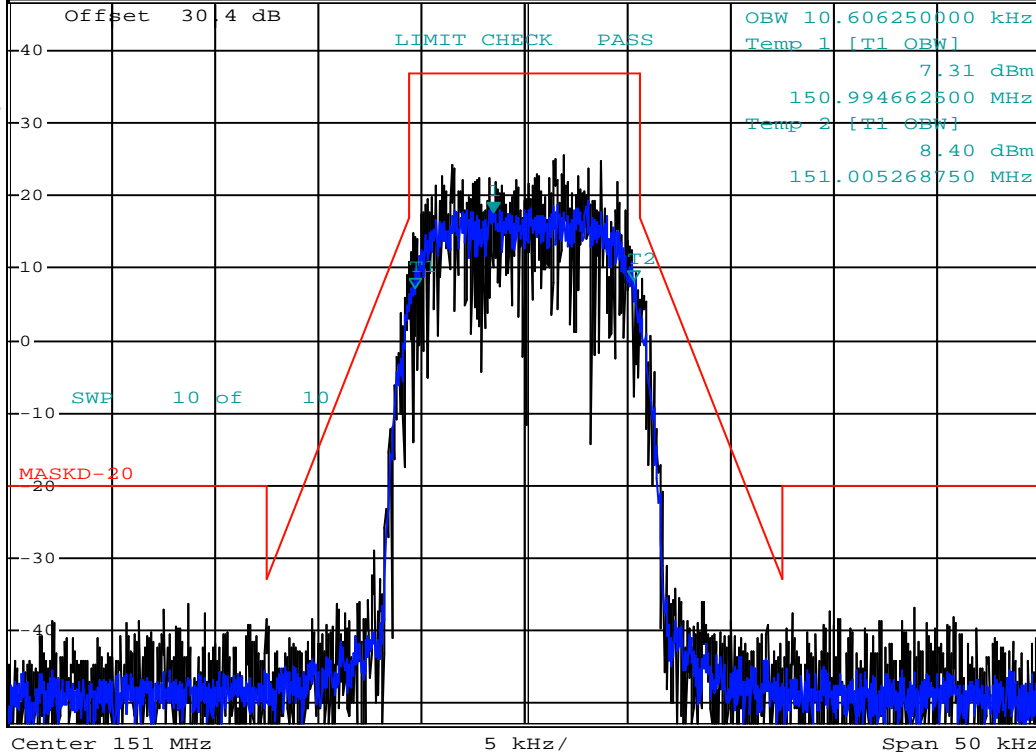
Channel Frequency [15kHz Ch BW, 16QAM]:	151MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 17.79 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 150.998512500 MHz

Ref 57 dBm



Date: 20.JAN.2016 09:59:55

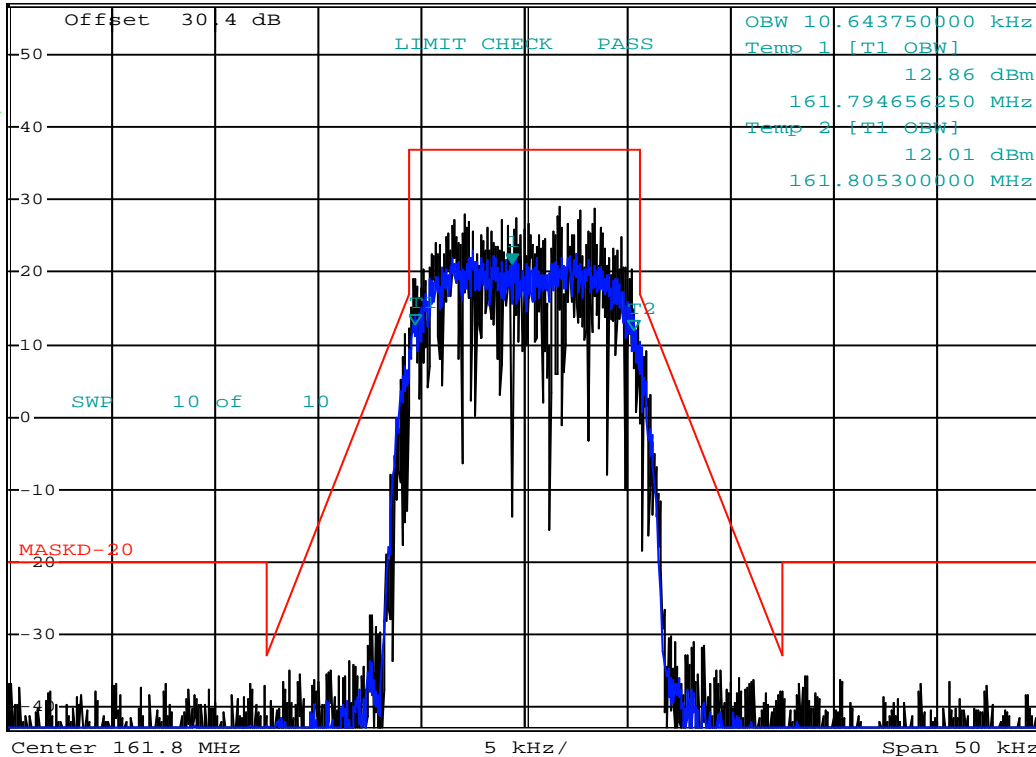
Channel Frequency [15kHz Ch BW, 64QAM]:	151MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 21.21 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 161.799356250 MHz

Ref 57 dBm



Date: 20.JAN.2016 09:40:07

Channel Frequency [15kHz Ch BW, QPSK]:	161MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies



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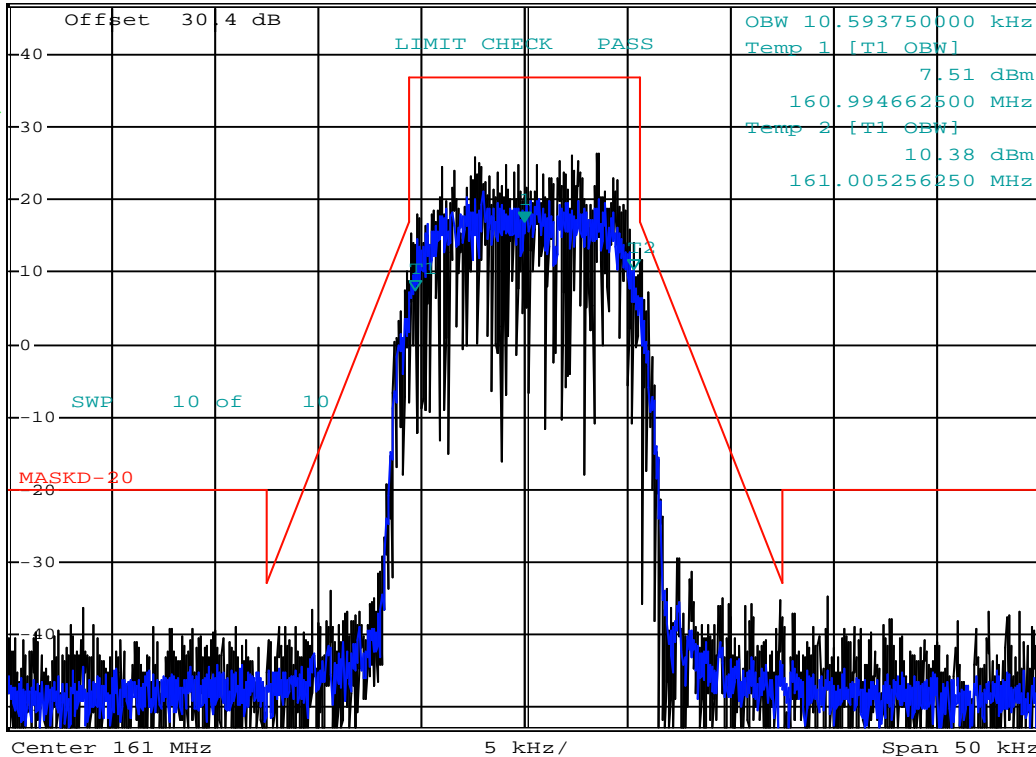
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 16.85 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 160.999975000 MHz

Ref 57 dBm Offset 30.4 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:45:44

Channel Frequency [15kHz Ch BW, 16QAM]:	161MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

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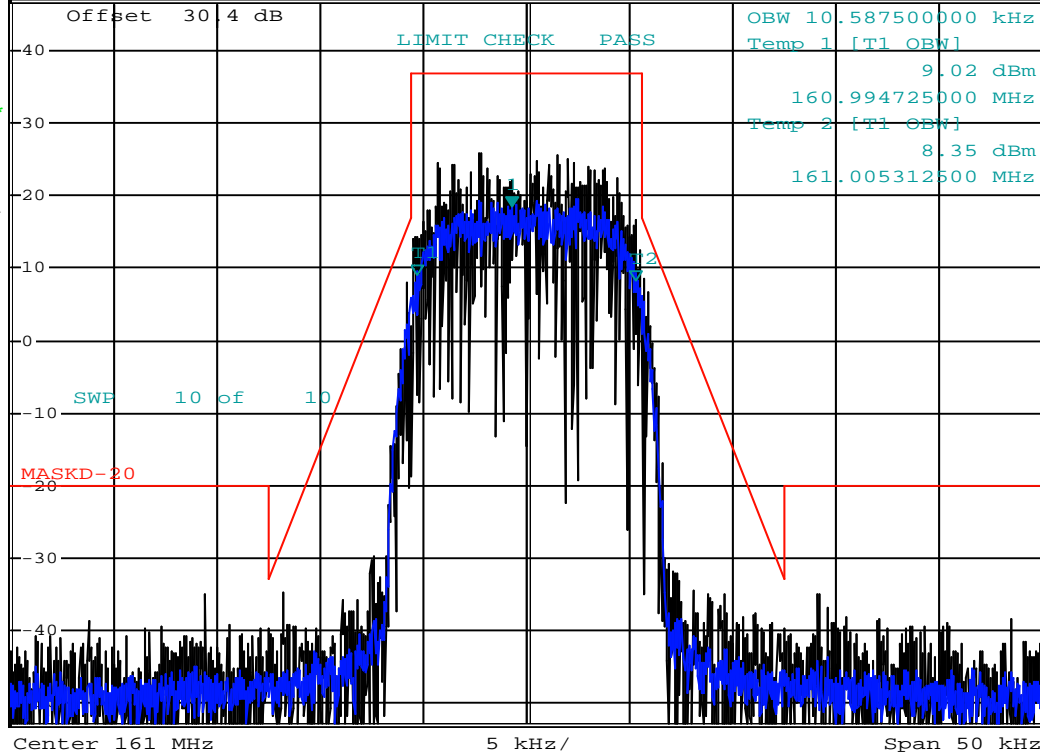
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 18.50 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 160.999306250 MHz

Ref 57 dBm

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:54:55

Channel Frequency [15kHz Ch BW, 64QAM]:	161MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

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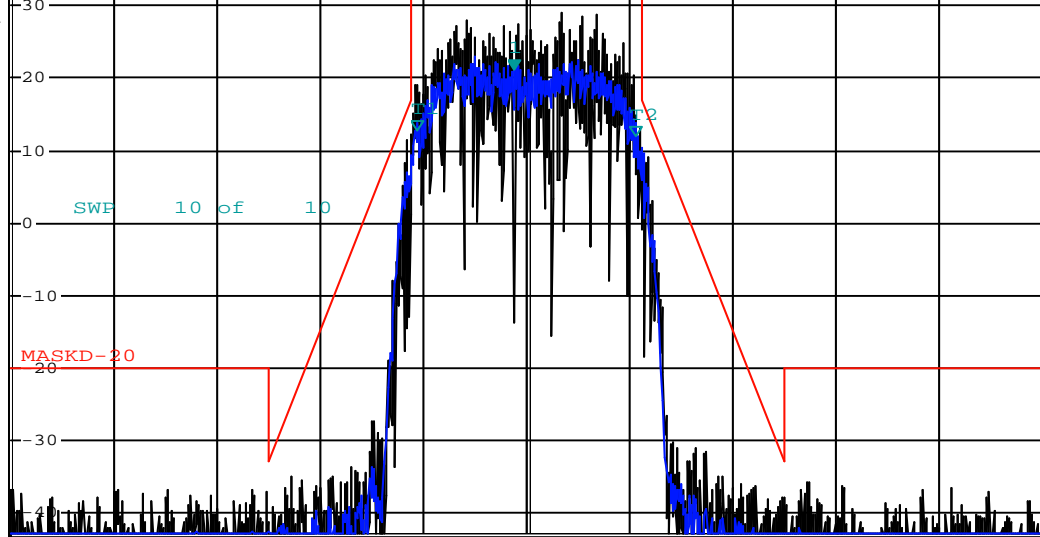
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 21.21 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 161.799356250 MHz

Ref 57 dBm

Offset 30.4 dB LIMIT CHECK PASS OBW 10.643750000 kHz
 Temp 1 [T1 OBW] 12.86 dBm A
 1 RM * 161.794656250 MHz
 AVG Temp 2 [T1 OBW] 12.01 dBm LVL
 2 AP 161.805300000 MHz
 CLRWR



Center 161.8 MHz 5 kHz/ Span 50 kHz

Date: 20.JAN.2016 09:40:07

Channel Frequency [15kHz Ch BW, QPSK]:	161.8MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

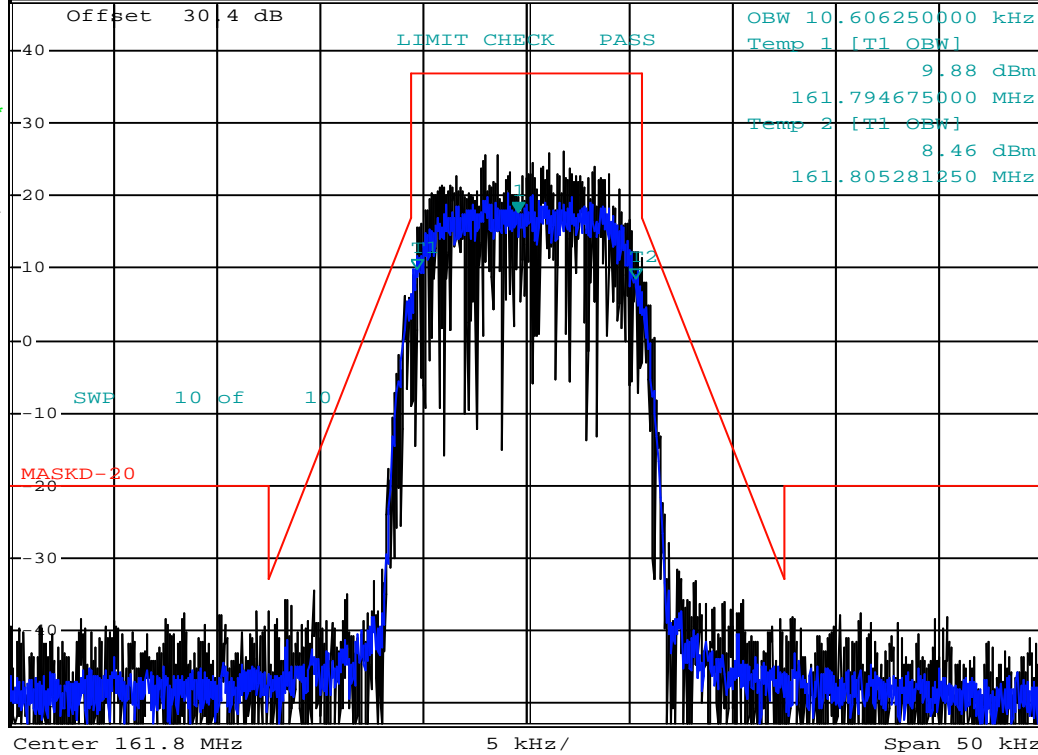
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 17.82 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 161.799550000 MHz

Ref 57 dBm Offset 30.4 dB

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:43:05

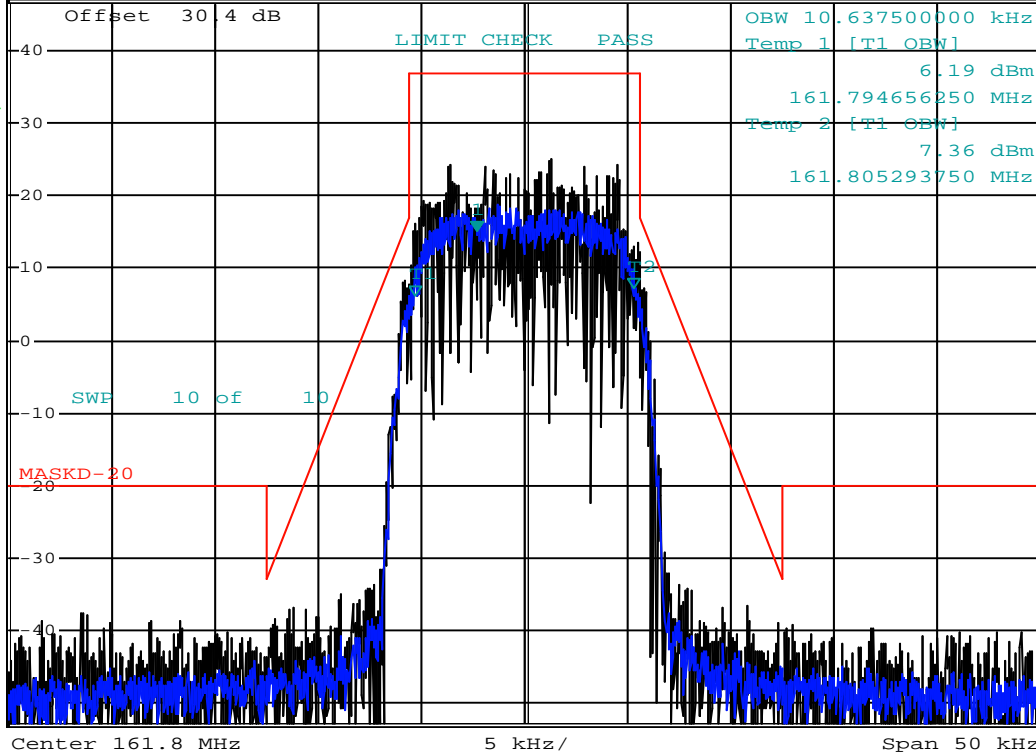
Channel Frequency [15kHz Ch BW, 16QAM]:	161.8MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 14.98 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 161.797731250 MHz

Ref 57 dBm



Date: 20.JAN.2016 09:57:40

Channel Frequency [15kHz Ch BW, 64QAM]:	161.8MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

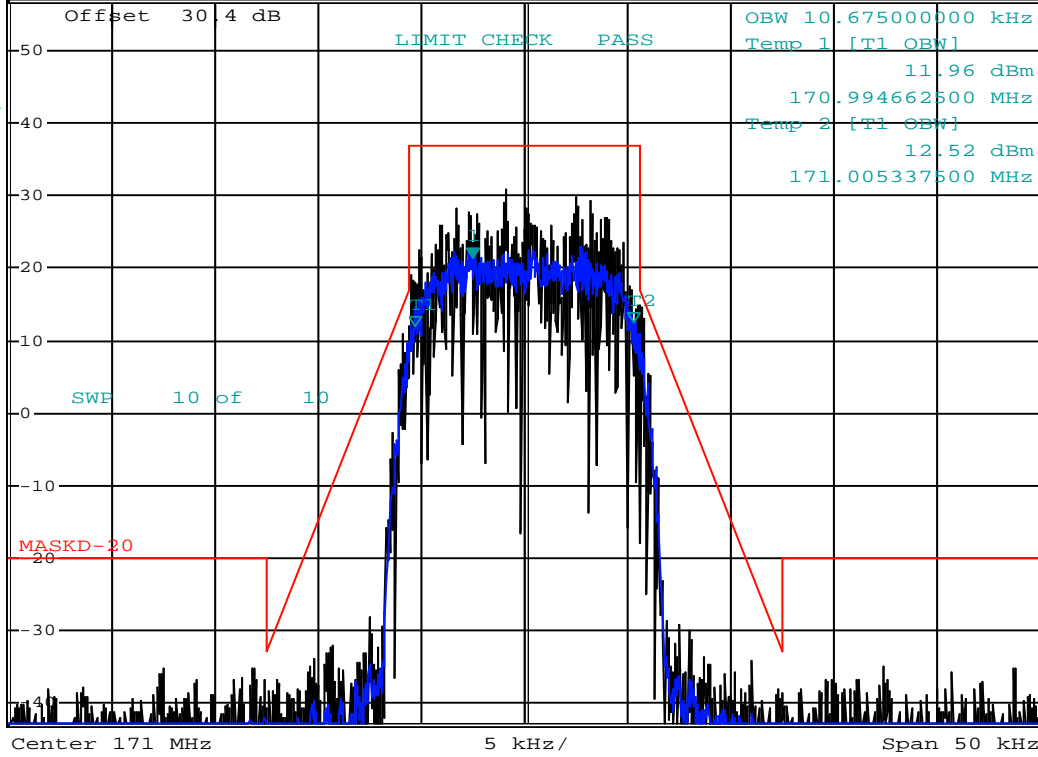
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1]
 VBW 3 kHz 21.33 dBm
 *Att 40 dB *SWT 2 s 170.997475000 MHz

Ref 57 dBm Offset 30.4 dB LIMIT CHECK PASS OBW 10.675000000 kHz

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:38:00

Channel Frequency [15kHz Ch BW, QPSK]:	171MHz
Measured Occupied Bandwidth:	10.7kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

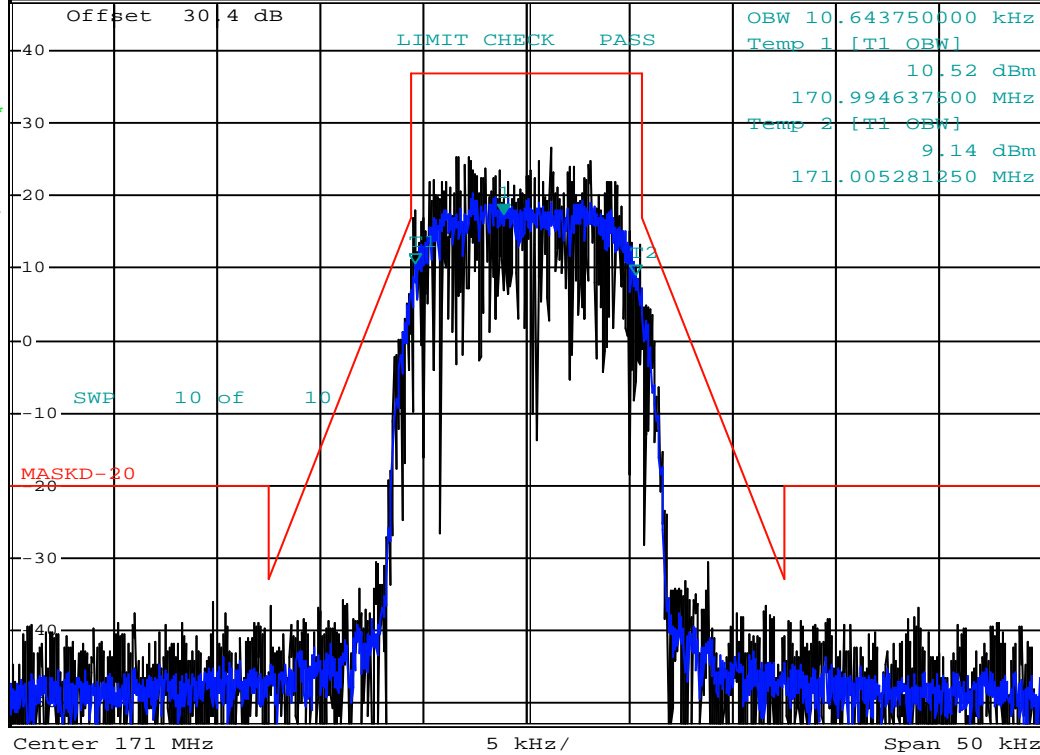
Occupied Bandwidth w/ Emission Mask



*RBW 300 Hz Marker 1 [T1] 17.41 dBm
 VBW 3 kHz
 *Att 40 dB *SWT 2 s 170.998900000 MHz

Ref 57 dBm

1 RM*
 AVG
 2 AP
 CLRWR



Date: 20.JAN.2016 09:50:43

Channel Frequency [15kHz Ch BW, 16QAM]:	171MHz
Measured Occupied Bandwidth:	10.6kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies

Occupied Bandwidth w/ Emission Mask



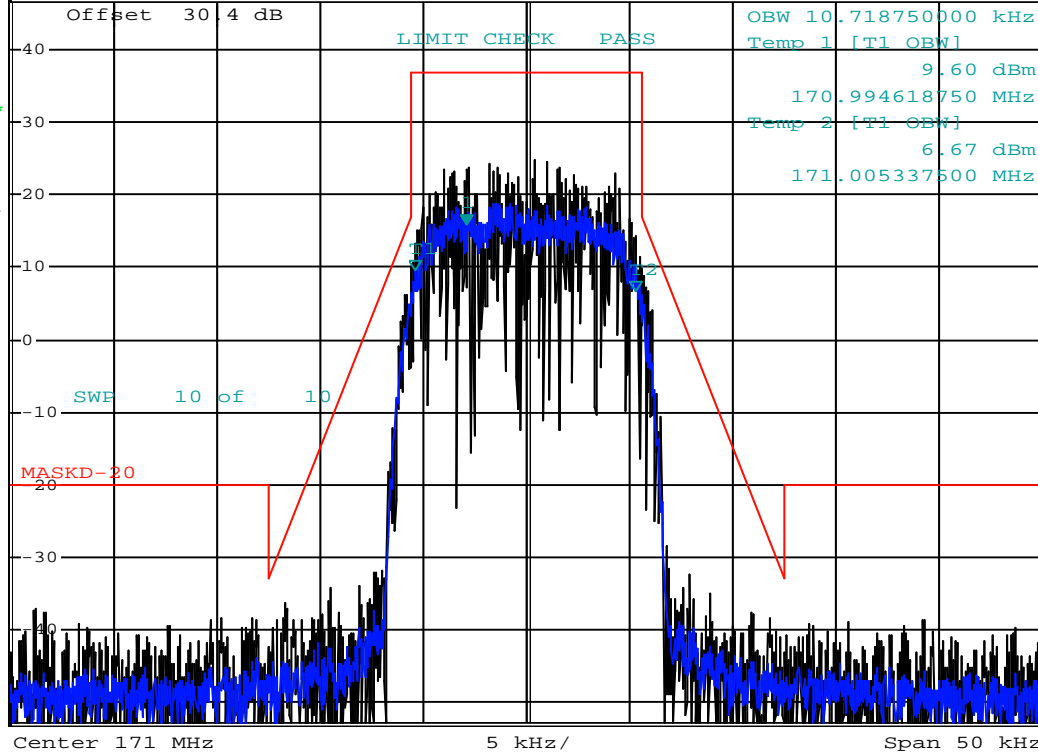
*RBW 300 Hz Marker 1 [T1]
 VBW 3 kHz 15.83 dBm
 *Att 40 dB 170.997106250 MHz

Ref 57 dBm

*Att 40 dB



*SWT 2 s

170.997106250 MHz



Date: 20.JAN.2016 09:52:40

Channel Frequency [15kHz Ch BW, 64QAM]:	171MHz
Measured Occupied Bandwidth:	10.7kHz
Authorized Bandwidth §90.209:	11.25kHz
Result:	Complies


	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	



Sign-Off

I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.



Art Voss
Sr. Engineer

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
			Report Revision No.:	Revision 1.2	
	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

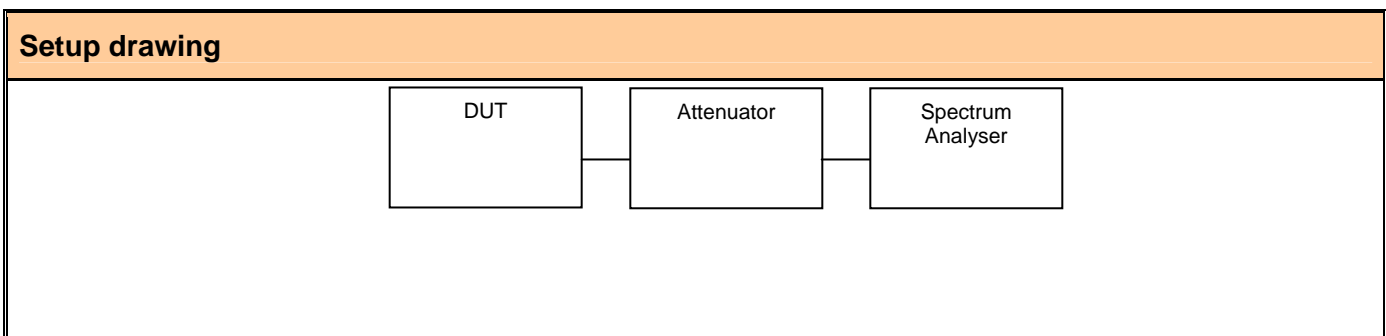
7.0 SPURIOUS EMISSIONS AT THE ANTENNA TERMINAL


References	
Normative Reference Standard	FCC CFR 47 §2.1051, §90.210
Procedure Reference	<p>The spurious emissions measurements at the antenna terminal were performed in accordance with ANSI TIA/EIA Standard 603.</p> <p>The emission search was performed across all required ranges. The worst case performance has been presented.</p>

Limits	
FCC CFR 47 §90.210	30.0 KHz Ch.= Mask C
FCC CFR 47 §90.210	15.0 KHz CH. = Mask D

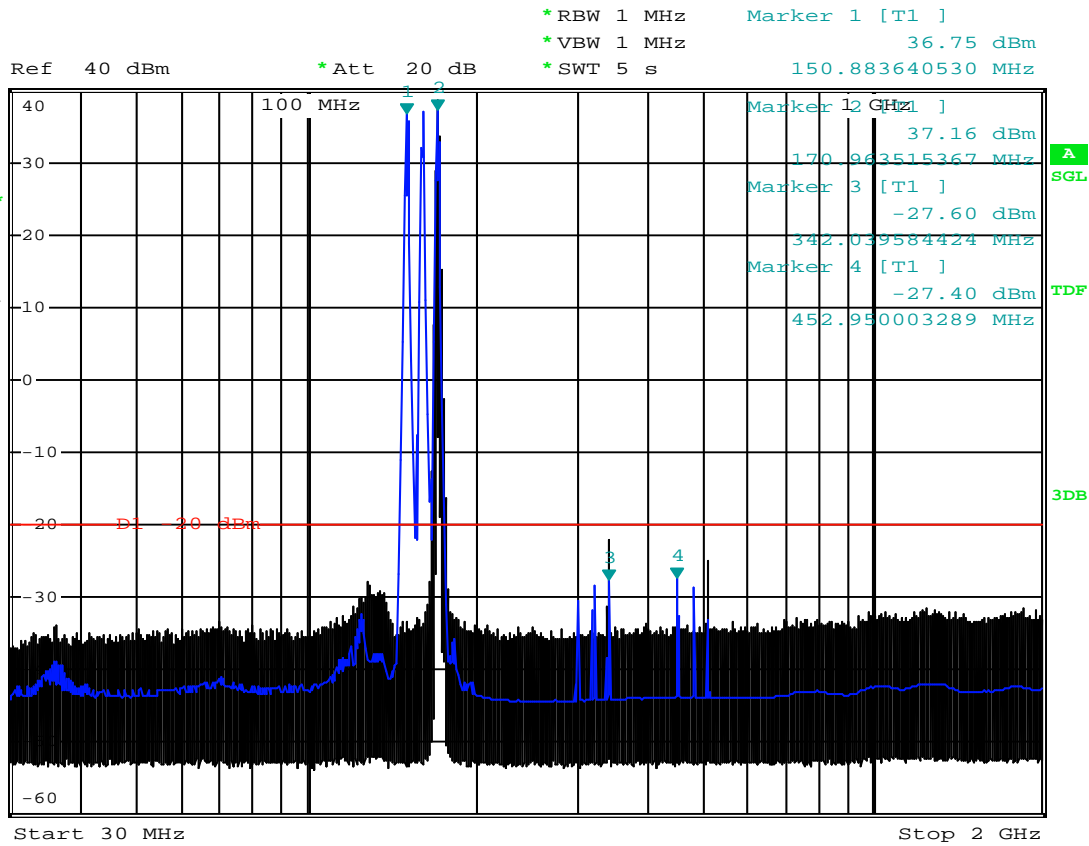
Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
00241	R&S	FSP40	Spectrum Analyzer	23 Apr 15 / 23 Apr 17



Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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Conducted Spurious Emissions



Date: 20.JAN.2016 10:15:55

Plot For Reference Only

Frequency Span:	2.0GHz
Channel:	15kHz
Minimum Attenuation §90.210):	27.6
Result:	Complies

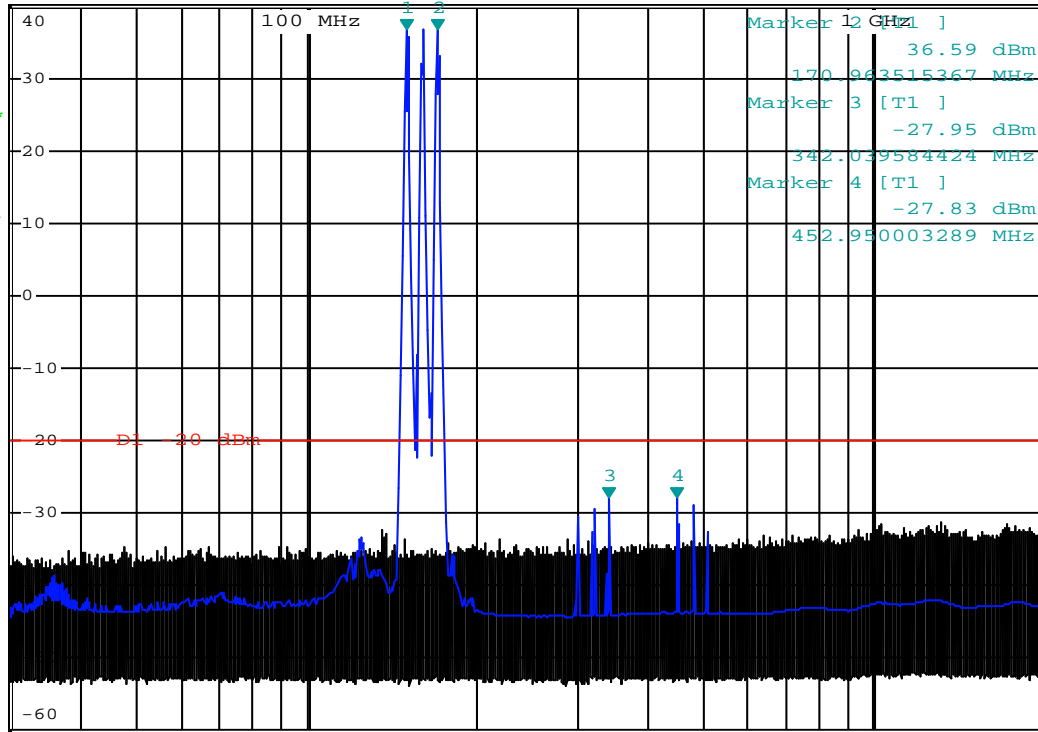
Conducted Spurious Emissions



*RBW 1 MHz Marker 1 [T1]
 *VBW 1 MHz 36.59 dBm
 *SWT 5 s 150.883640530 MHz

Ref 40 dBm *Att 20 dB

1 RM *
 MAXH
 2 AP
 CLRWR





Start 30 MHz Stop 2 GHz

Date: 20.JAN.2016 10:26:23


Plot For Reference Only


Frequency Span:	2.0GHz
Channel:	30kHz
Minimum Attenuation §90.210):	27.2
Result:	Complies



	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

Conducted Spurious Emissions Zoom Data				
Fundamental Output Power (dBm):				37.0
Modulation	Frequency (MHz)	Measured Spur (dBm)	Limit (dBm)	Margin (dB)
QPSK15	342	-27.6	-20.0	7.6
QPSK15	452	-27.7	-20.0	7.7
QPSK30	342	-27.1	-13.0	14.4
QPSK30	452	-27.2	-13.0	14.2

Margin = Limit - Measured

Sign-Off
I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.

<hr/> Art Voss Sr. Engineer

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
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	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

8.0 RADIATED SPURIOUS EMISSIONS – TX (SIGNAL SUBSTITUTION)


References	
Normative Reference Standard	FCC CFR 47 §2.1053; 90.210
Measurement Reporting	<ul style="list-style-type: none"> The transmitter spurious emissions were measured in accordance with ANSI/TIA-603-D. The spectrum was searched from the lowest frequency generated in the DUT up to the 10th harmonic of the fundamental frequency. The DUT was characterized on 3 orthogonal axis. Detected emissions are reported.



Limits	
§90.210	Emissions must be at least $50 + 10 \log_{10}(P)$ dB below the mean power output of the transmitter.

Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
00072	EMCO	2075	Mini-mast	CNR
00073	EMCO	2080	Turn Table	CNR
00071	EMCO	2090	Multi-Device Controller	CNR
00241	R&S	FSU40	Spectrum Analyzer	23 Apr 15 / 23 Apr 17
00050	Chase	CBL-6111A	Bilog Antenna	25-Apr-2014 / 25-Apr-2016
00054	EMCO	3121C	Dipole Antenna	(first cal cycle) / 30-Apr-16
00051	HP	8566B	Spectrum Analyzer RF Section	30-Apr-14 / 30-Apr-16
00049	HP	85650A	Quasi-peak Adapter	30-Apr-14 / 30-Apr-16
00047	HP	85685A	RF Preselector	30-Apr-14 / 30-Apr-16
00006	R & S	SMR 20	Signal Generator (10MHz-40GHz)	08-May-14 / 08-May-16
00239	Mini-Ccts	ZFL-1000VH	Amplifier 10MHz-1GHz	Cal on use
00110	Gigatronics	8652A	Power Meter	17-Feb-14 / 17-Feb-16
00248	Gigatronics	80701A	Power Sensor	18-Feb-14 / 18-Feb-16

Note: COU = cal on use.

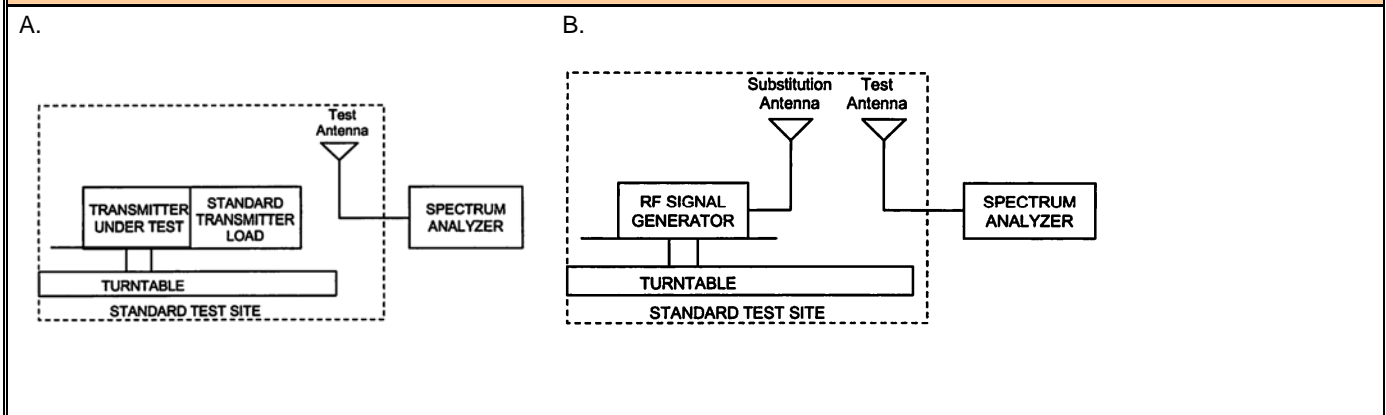
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	



Measurement equipment setup

MEASUREMENT EQUIPMENT CONNECTIONS	For the field strength measurements, the measurement equipment was connected as shown below. For the final substitutions, the DUT was replaced with the appropriate antenna and fed from a CW signal source sufficient to replicate the received field strength of the emission being investigated. Worst case performance is presented.		
	Frequency Range	RX Antenna	TX Antenna
	30 MHz - 1GHz	Bilog	Dipole
	1 GHz - 18 GHz	ETS 3115 Horn	ETS 3115 Horn
MEASUREMENT EQUIPMENT SETTINGS	Measurement Settings.		
	RBW	VBW	Detector
	MHz	MHz	
	100 kHz < 1GHz 1 MHz >1 GHz	300 kHz < 1 GHz 3 MHz > 1 GHz	Peak

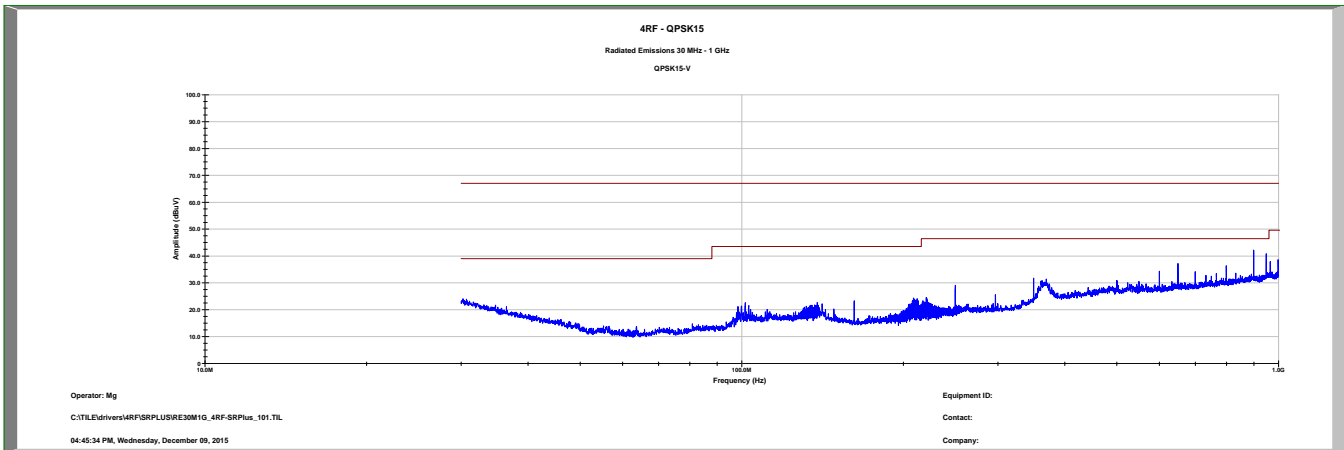
Setup drawing(s)



Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	Test Lab Certificate No. 2470.01

Radiated Spurious Emissions (Tx)



For Reference Only

Result: Complies

Notes


No Emissions Within 20dB of Limit Were Detected



Worst-case emissions shown

The device was searched to the 10th harmonic of the fundamental on both 15kHz and 30kHz BW Channels on all Tx Modes

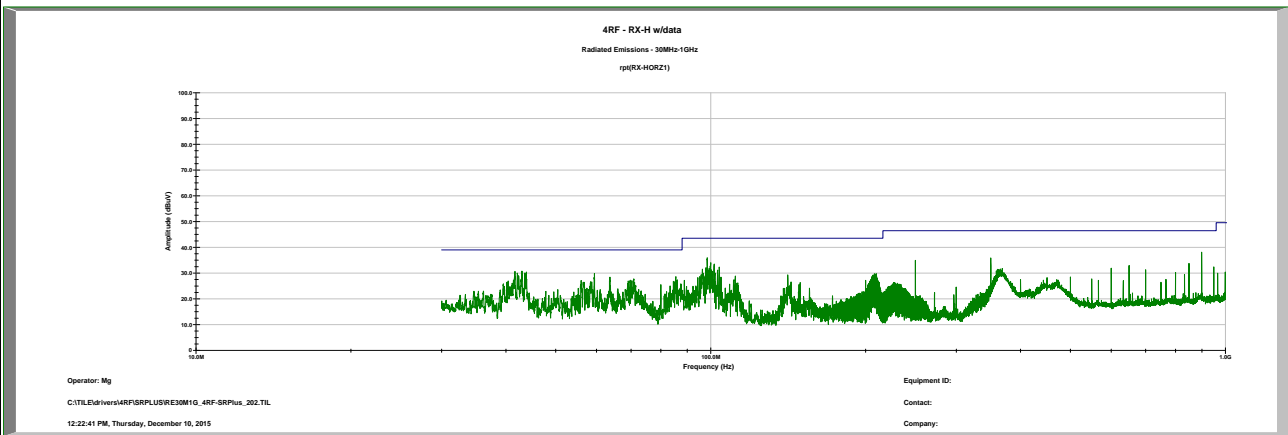
Data presented may use a peak detector and compared to quasi-peak limit

All detected emissions have been reported

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	Test Lab Certificate No. 2470.01

Radiated Spurious Emissions (Rx)



For Reference Only

Result: Complies

*No emissions found, noise floor measurement

Notes


- Worst-case emissions shown
- The device was searched to the 10th harmonic of the fundamental
- Data presented may use a peak detector and compared to quasi-peak limit
- All detected emissions have been reported



Sign-Off

I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.



Art Voss
Sr. Engineer

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
			Report Revision No.:	Revision 1.2	
	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

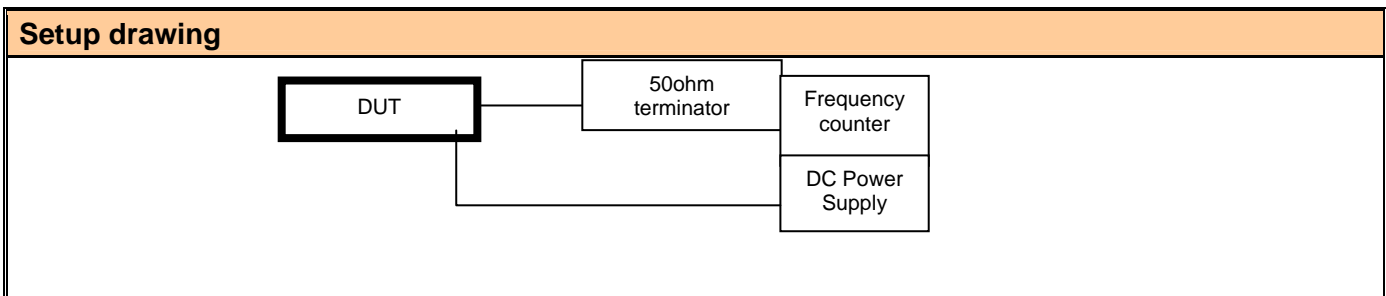
9.0 FREQUENCY STABILITY


References	
Normative Reference Standard	FCC CFR 47 §2.1055, §90.213
Procedure Reference / Description	§2.1055(a)(2) The frequency stability shall be measured with variation of ambient temperature as follows: (1) From -40° to +70° centigrade.

Limits	
§90.213	90.213 - 421-512 MHz, 2.5ppm / 30.0 KHz CH.
	90.213 - 421-512 MHz, 1.5ppm / 15.0 KHz CH.

Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

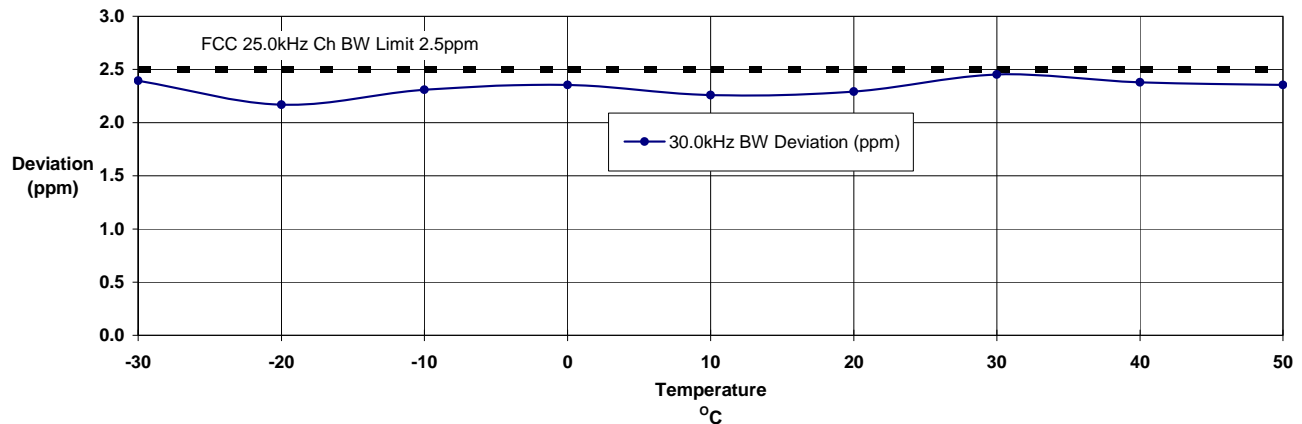
Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
n/a	ESPEC	ECT-2	Heater/Refrigerator	n/a
00003	HP	53181A	Frequency Counter	28-Apr-14 / 28-Apr-16
n/a	HP	E3611A	DC Power Supply	Cal on use
00234	VWR	61161-378	Temperature Humidity Monitor	New / 08-May-2016



Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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Frequency Stability


Nominal Frequency (MHz):	155.0
Nominal Channel BW (KHz):	30.0
Nominal Voltage (VDC):	13.8
Nominal Temperature (°C):	25





Frequency Stability Measurements (Temperature)					Frequency Stability Measurements (Voltage)				
Temp (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Deviation (Hz)	Deviation (ppm)	Voltage (VDC)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Deviation (Hz)	Deviation (ppm)
-30	155.000000	154.999629	371	2.39	15.9 (115%)	155.000000	154.999646	354	2.28
-20	155.000000	154.999664	336	2.17	13.8 (100%)	155.000000	154.999645	355	2.29
-10	155.000000	154.999642	358	2.31	11.7 (85%)	155.000000	154.999643	357	2.30
0	155.000000	154.999635	365	2.35	Maximum Deviation:				2.30
10	155.000000	154.999650	350	2.26	Maximum Limit:				2.50
20	155.000000	154.999645	355	2.29	Result:				Complies
30	155.000000	154.999620	380	2.45					
40	155.000000	154.999631	369	2.38					
50	155.000000	154.999635	365	2.35					
Maximum Deviation:				2.45					
Maximum Limit:				2.50					
Result:				Complies					

Sign-Off

I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.



Art Voss
Sr. Engineer

	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
			Report Revision No.:	Revision 1.2	
	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	


10.0 TRANSIENT FREQUENCY RESPONSE



References	
Normative Reference Standard	FCC CFR 47 §2.1055, §90.214
Procedure Reference / Description	§90.214 . Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

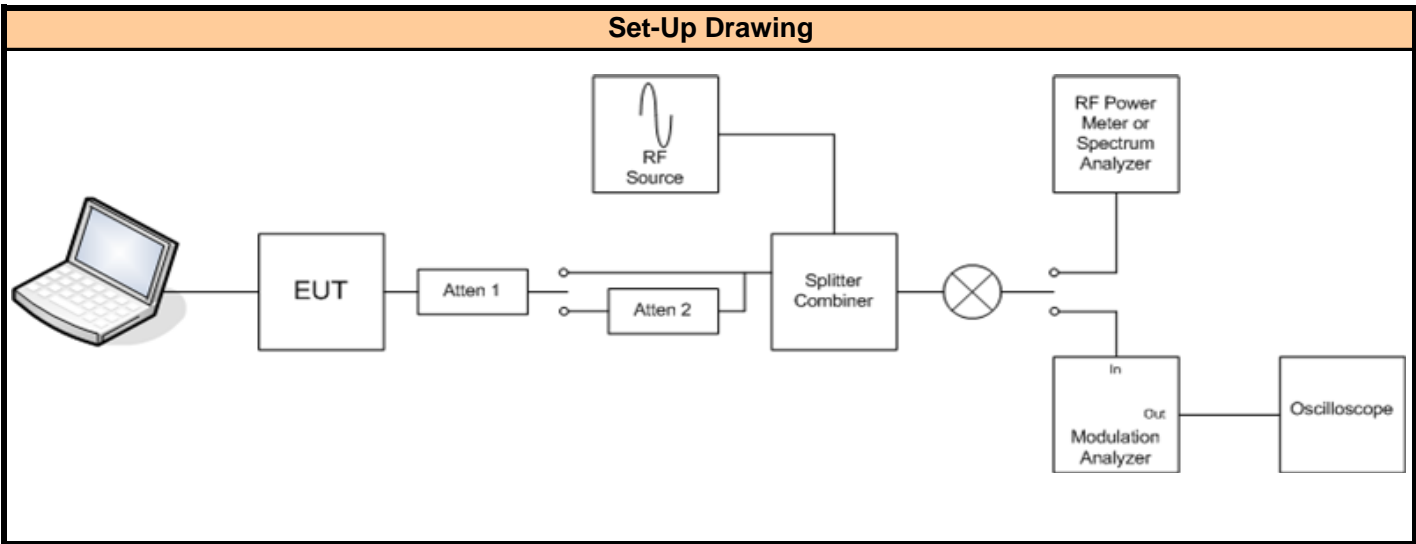
Limits	
§90.214	150-174kHz, t1: 5.0ms, t2: 20.0ms, t3: 5.0ms
	150-174kHz, 25kHz Channel, Max Deviation: +/-25.0kHz
	150-174kHz, 12.5kHz Channel, Max Deviation: +/-12.5kHz


Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
00110	Gigatronics	8652A	Power Meter	17-Feb-14 / 17-Feb-16
00248	Gigatronics	80701A	Power Sensor	18-Feb-14 / 18-Feb-16
00028	HP	8901A	Modulation Analyzer	22-Dec-14 / 22-Dec-16
00254	LeCory	WM8600A	Oscilloscope	17 Sep 14 / 17 Sep 16
00005	HP	8648D	Signal Generator	29 Apr 14 / 29 Apr 16

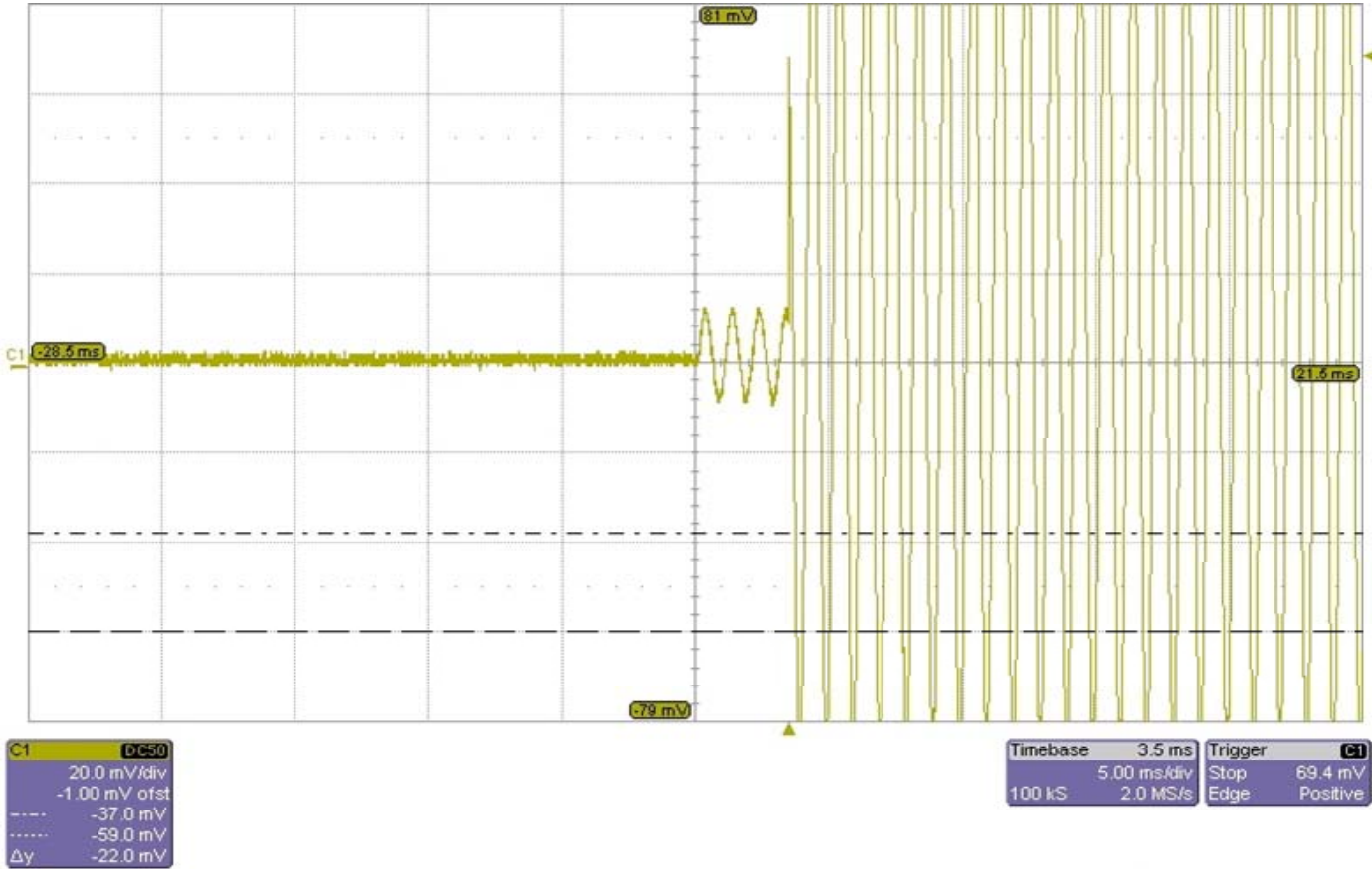
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	






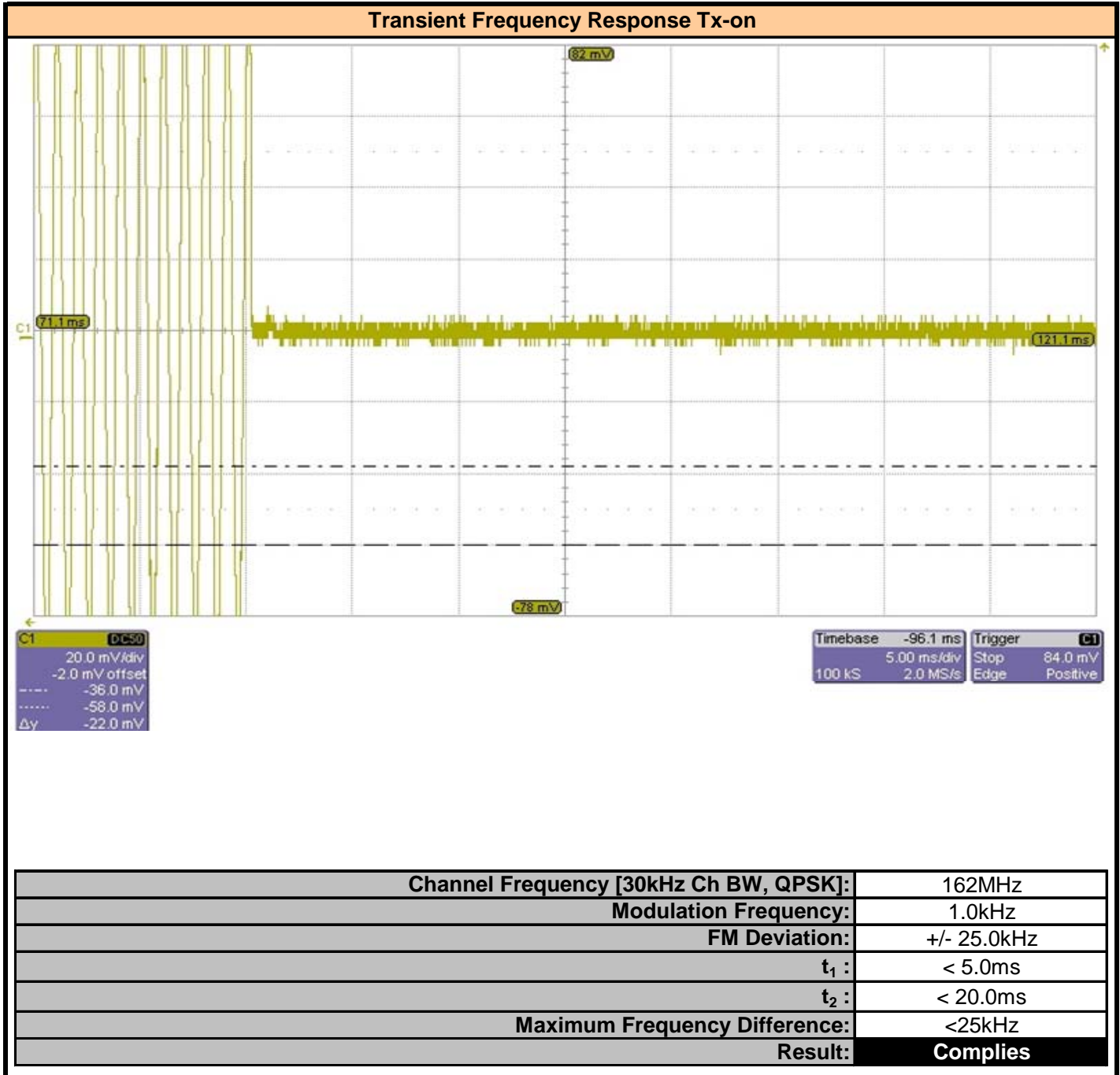
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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Transient Frequency Response Tx-off



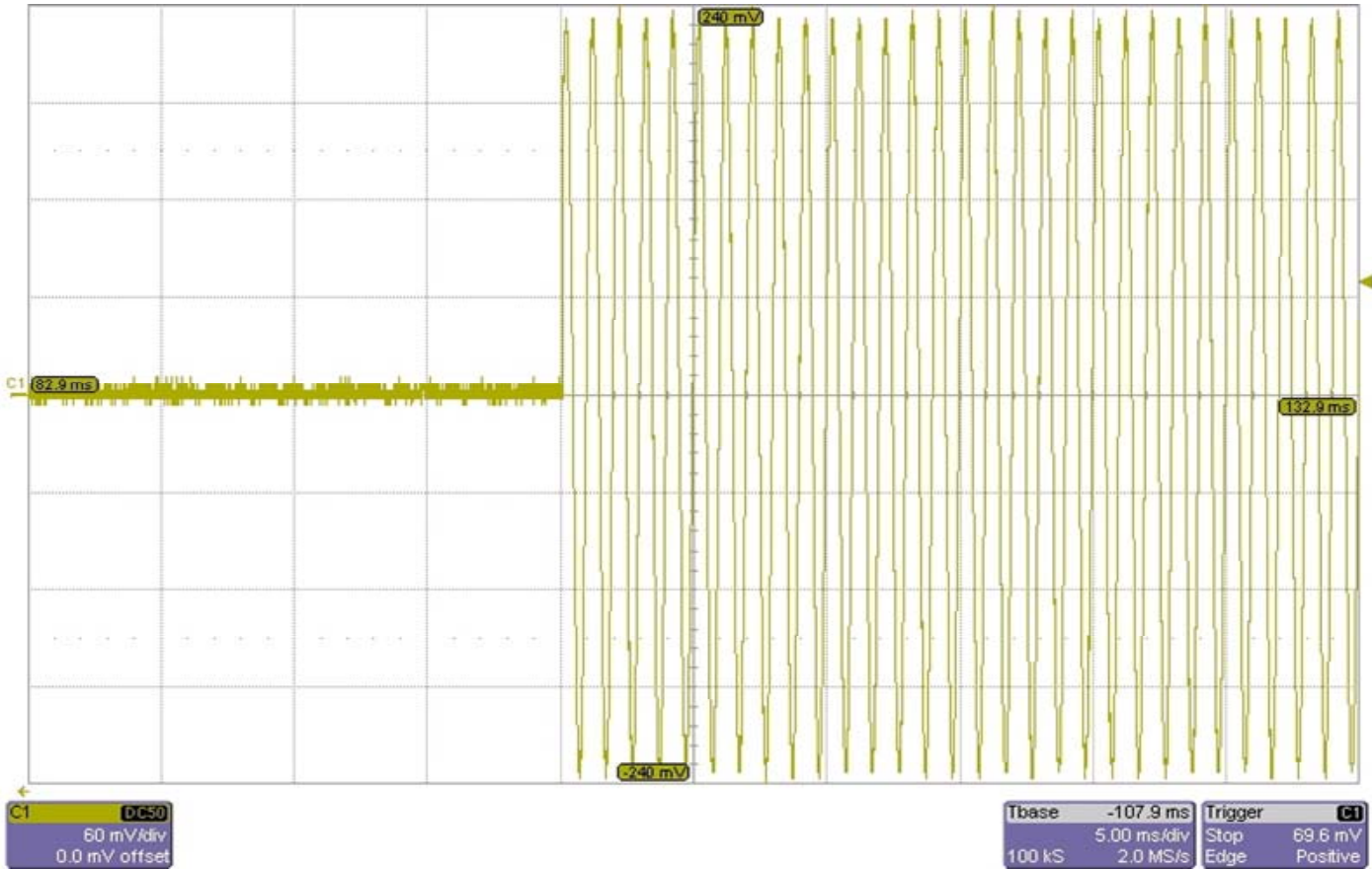
Channel Frequency [30kHz Ch BW, QPSK]:	162MHz
Modulation Frequency:	1.0kHz
FM Deviation:	+/- 25kHz
t₃ :	< 5.0ms
Maximum Frequency Difference:	<25kHz
Result:	Complies

	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	
					Test Lab Certificate No. 2470.01



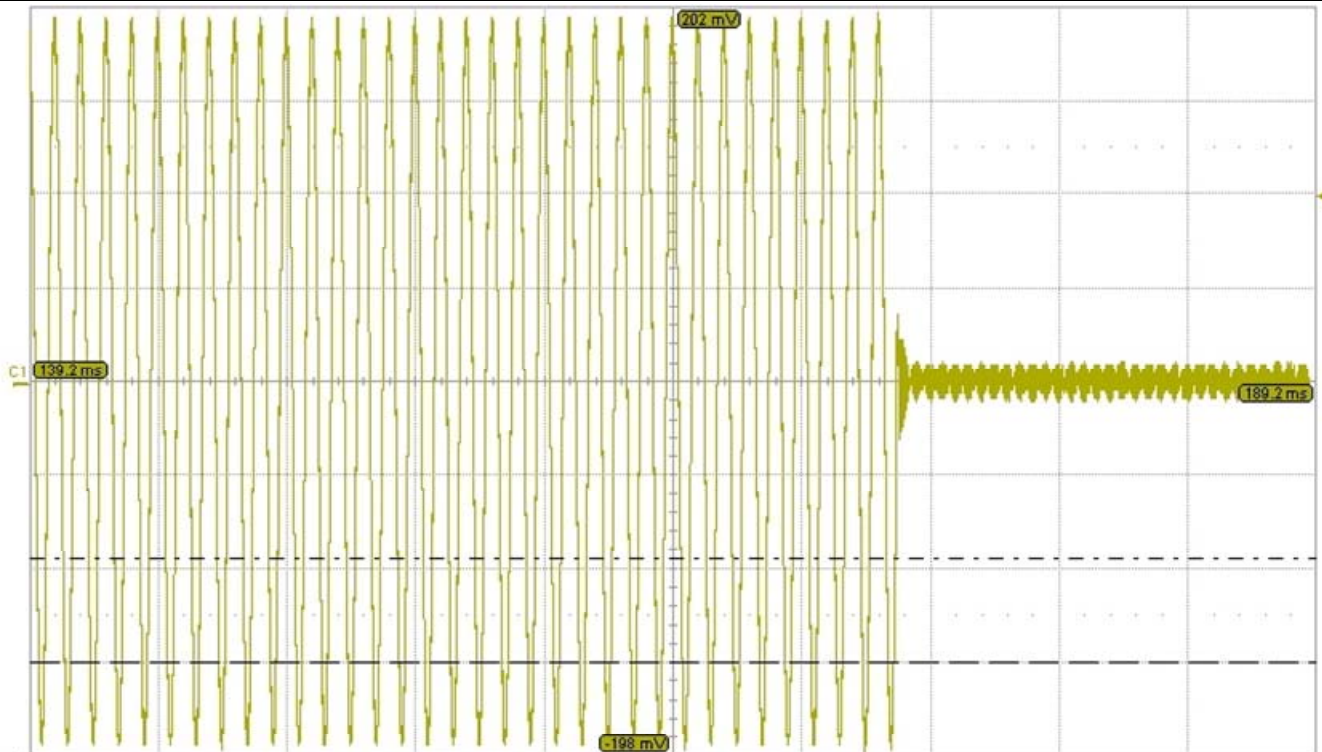
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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Transient Frequency Response Tx-off



Channel Frequency [15kHz Ch BW, QPSK]:	162MHz
Modulation Frequency:	1.0kHz
FM Deviation:	+/- 12.5kHz
t₁ :	< 5.0ms
t₂ :	< 20.0ms
Maximum Frequency Difference:	<12.5kHz
Result:	Complies



Transient Frequency Response Tx-on



C1 DC50
 50.0 mV/div
 -2.0 mV offset
 ---- -93.0 mV
 -148.0 mV
 Δy -55.0 mV

Tbase -164.2 ms
 5.00 ms/div
 100 kS 2.0 MS/s
 Trigger Stop 100.0 mV
 Edge Positive

Channel Frequency [15kHz Ch BW, QPSK]:	162MHz
Modulation Frequency:	1.0kHz
FM Deviation:	+/- 12.5kHz
t₁ :	< 5.0ms
t₂ :	< 20.0ms
Maximum Frequency Difference:	<12.5kHz
Result:	Complies


	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	 Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	



Sign-Off

I attest to the accuracy of the data. All measurements reported herein were performed by me and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements.




Art Voss
Sr. Engineer

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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	FCC Rule Part(s):	47 CFR §2, §90	Report Revision No.:	Revision 1.2	
			FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	

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Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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