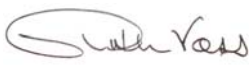


	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
			Report Revision No.:	Revision 1.2	
	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	
					Test Lab Certificate No. 2470.01

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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	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	

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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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	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	

<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				
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz		
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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	

Art Voss
Sr. Engineer

	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
			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	
					Test Lab Certificate No. 2470.01

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.

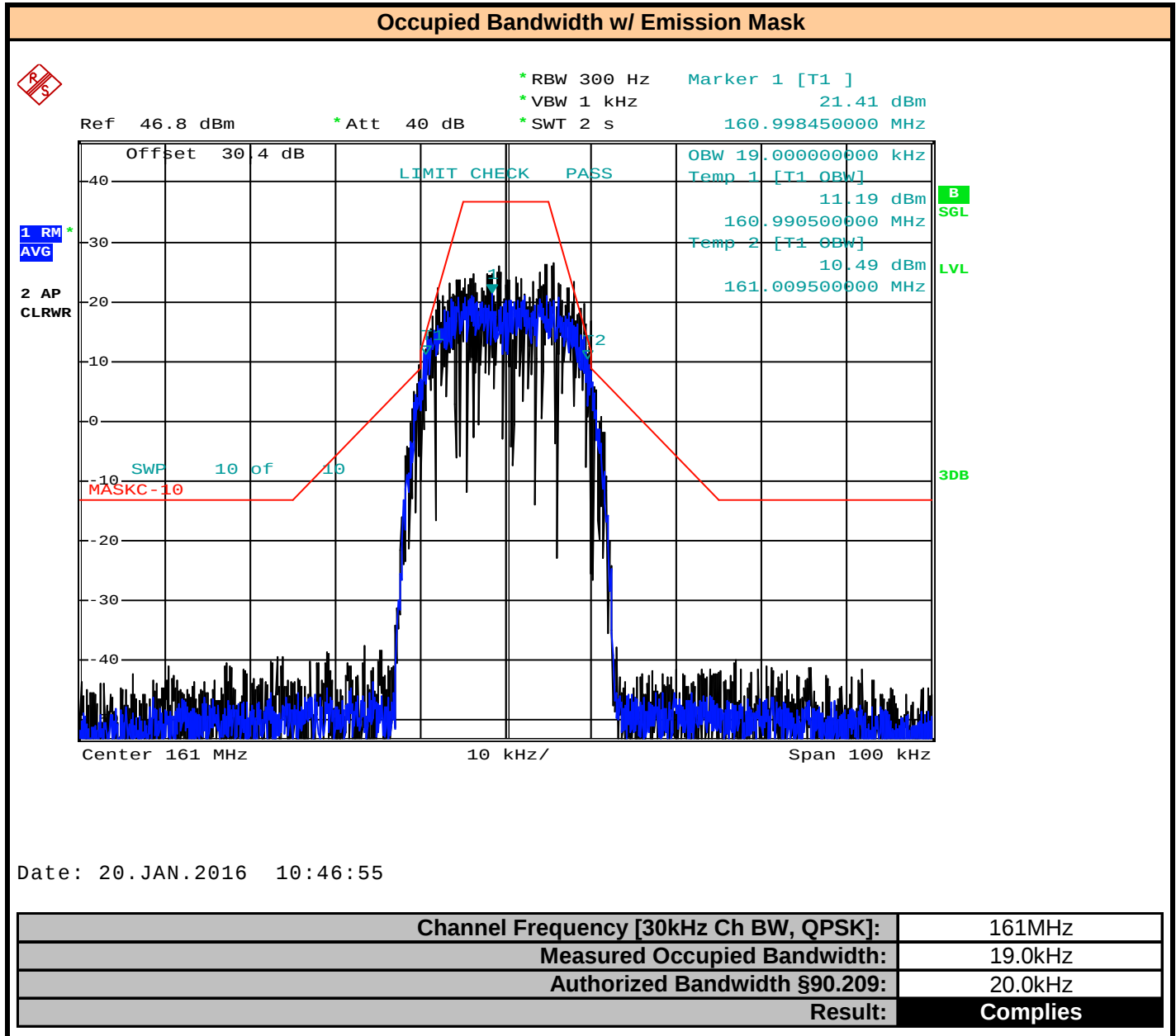
Limits	
§90.210	Mask C /30 KHz CH. Mask D /15 KHz CH.

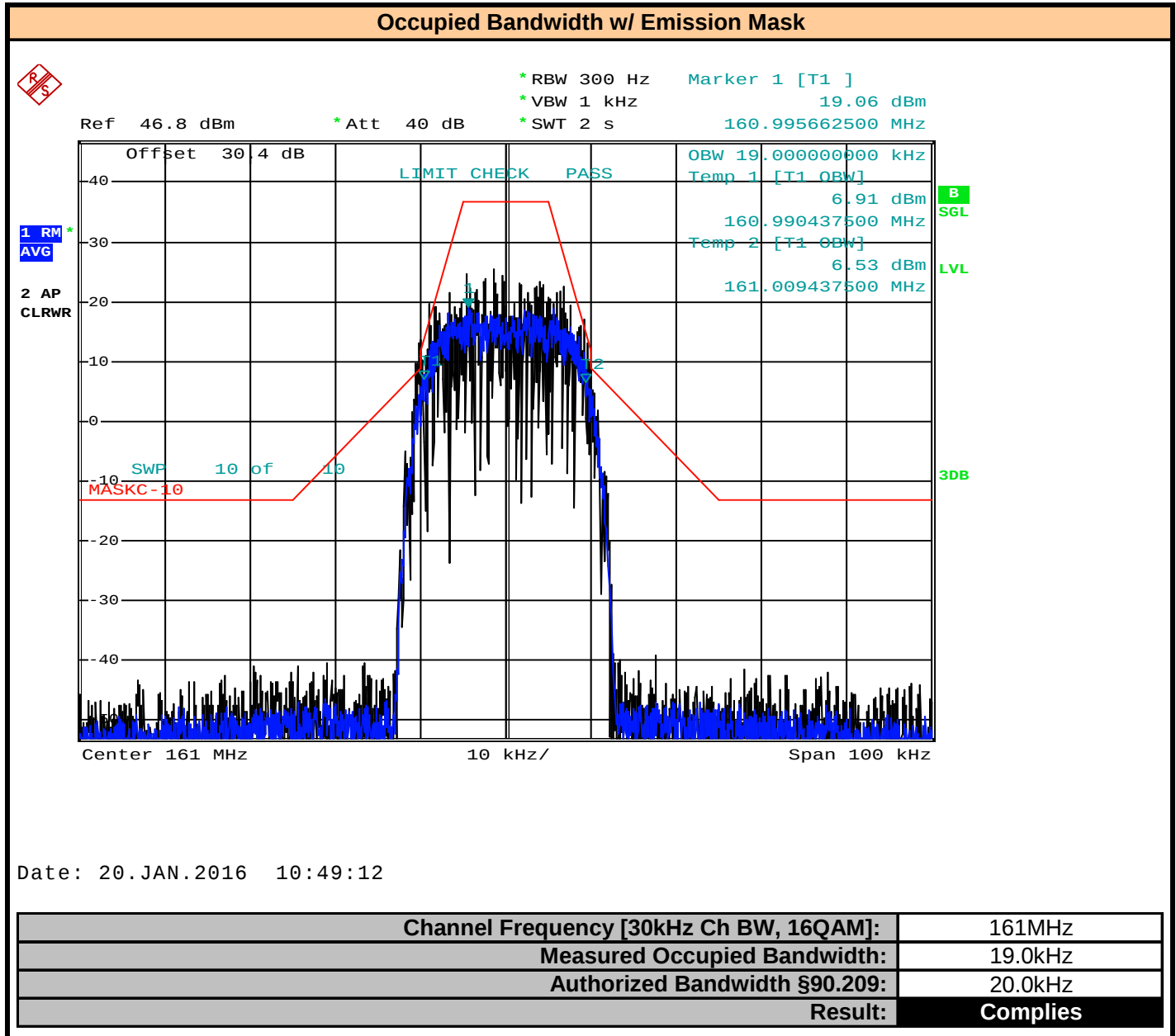
Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

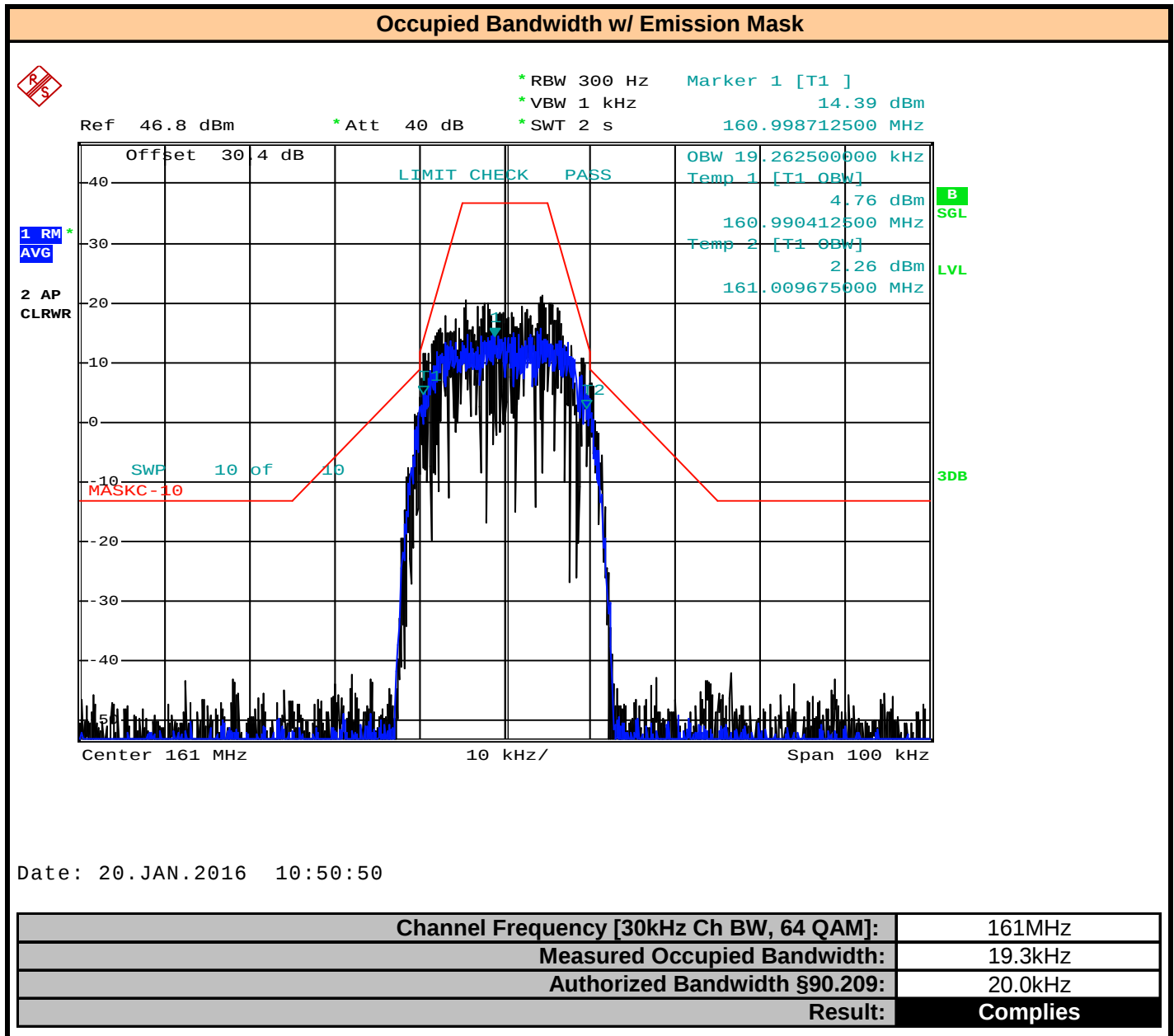
Equipment List				
Asset number	Manufacturer	Model	Description	Last cal / Cal due
00241	R&S	FSP40	Spectrum Analyzer	23 Apr 15 / 23 Apr 17

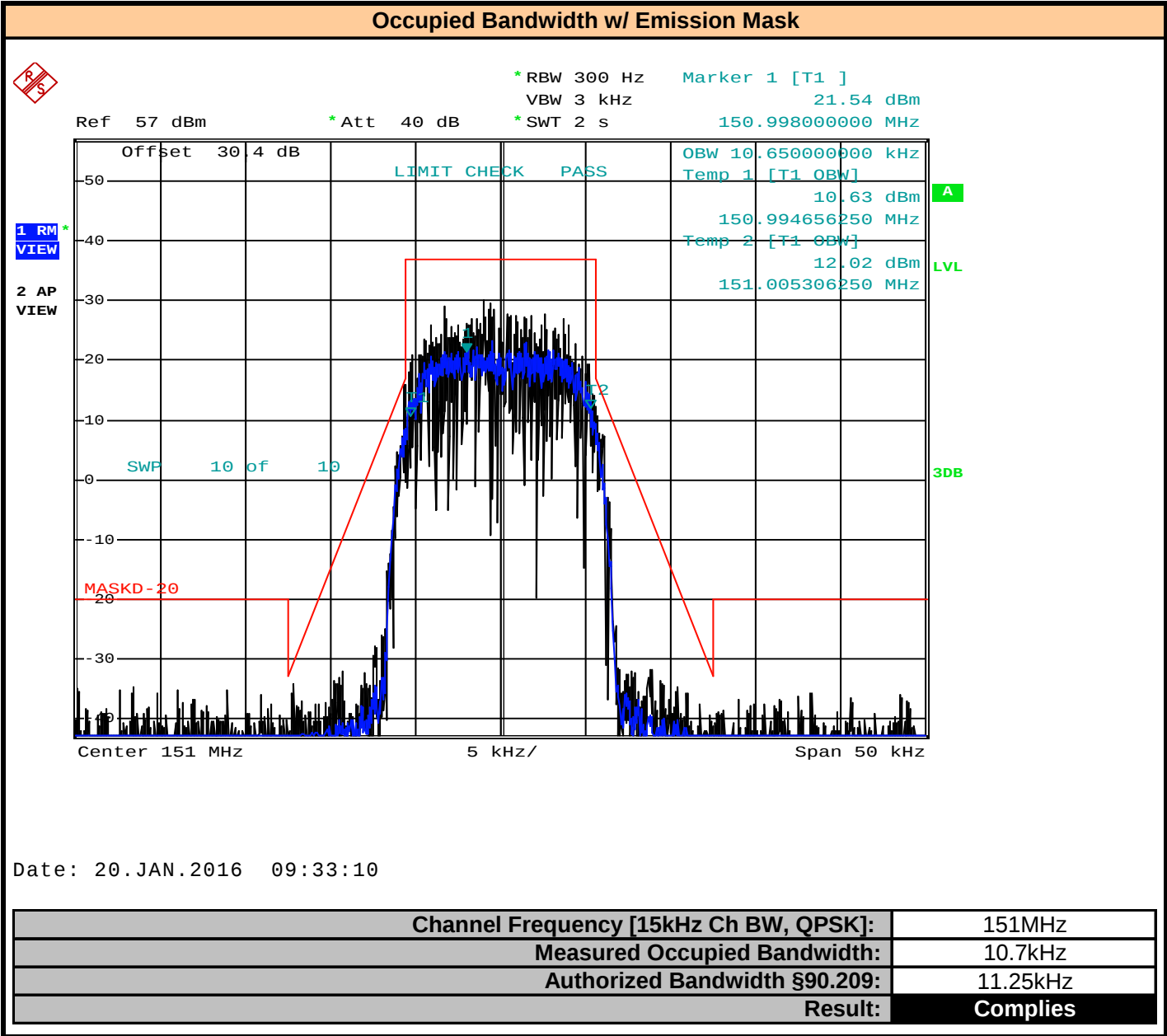
Setup drawing			
	DUT	Standard Load	Spectrum Analyzer

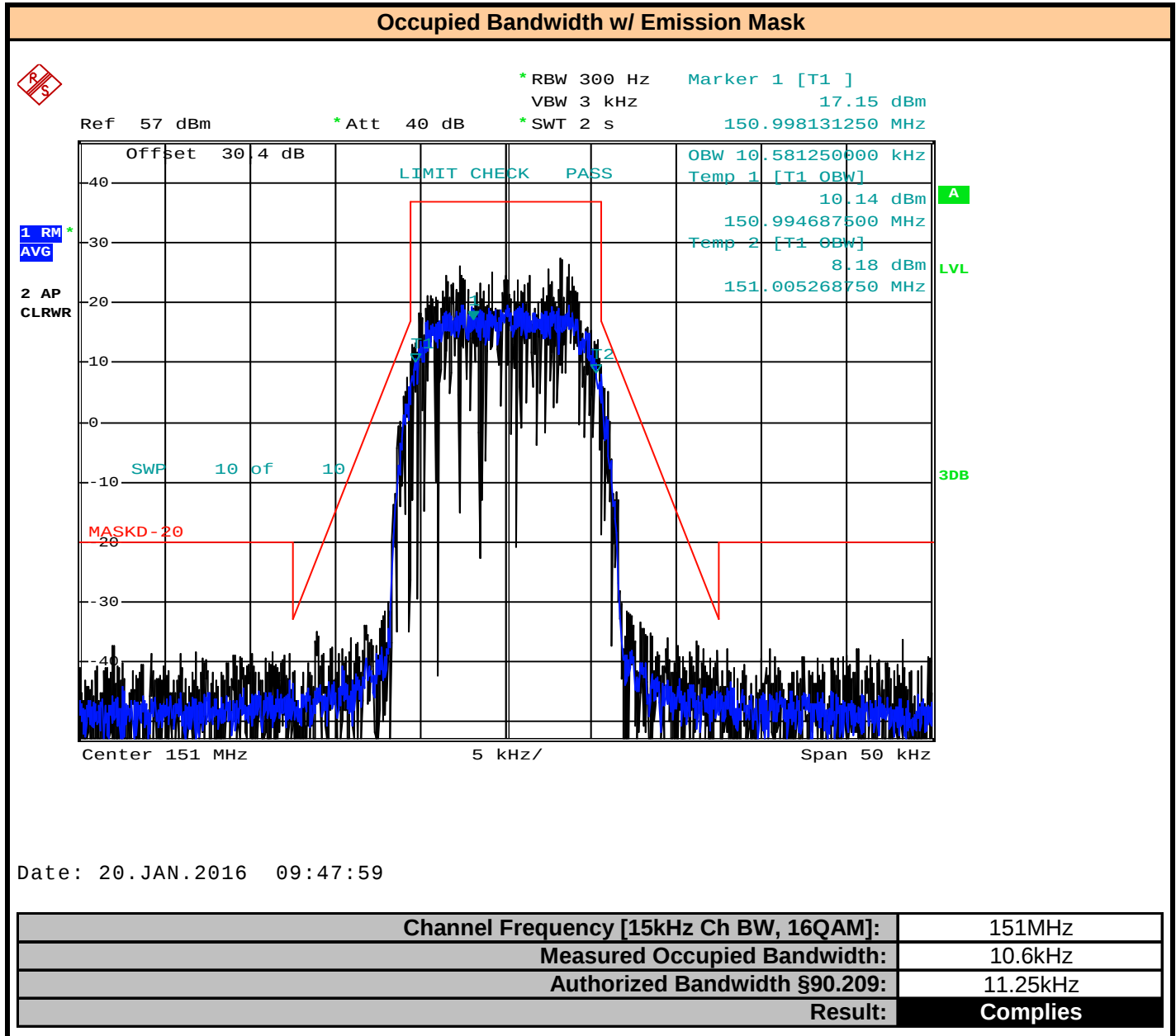
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio		DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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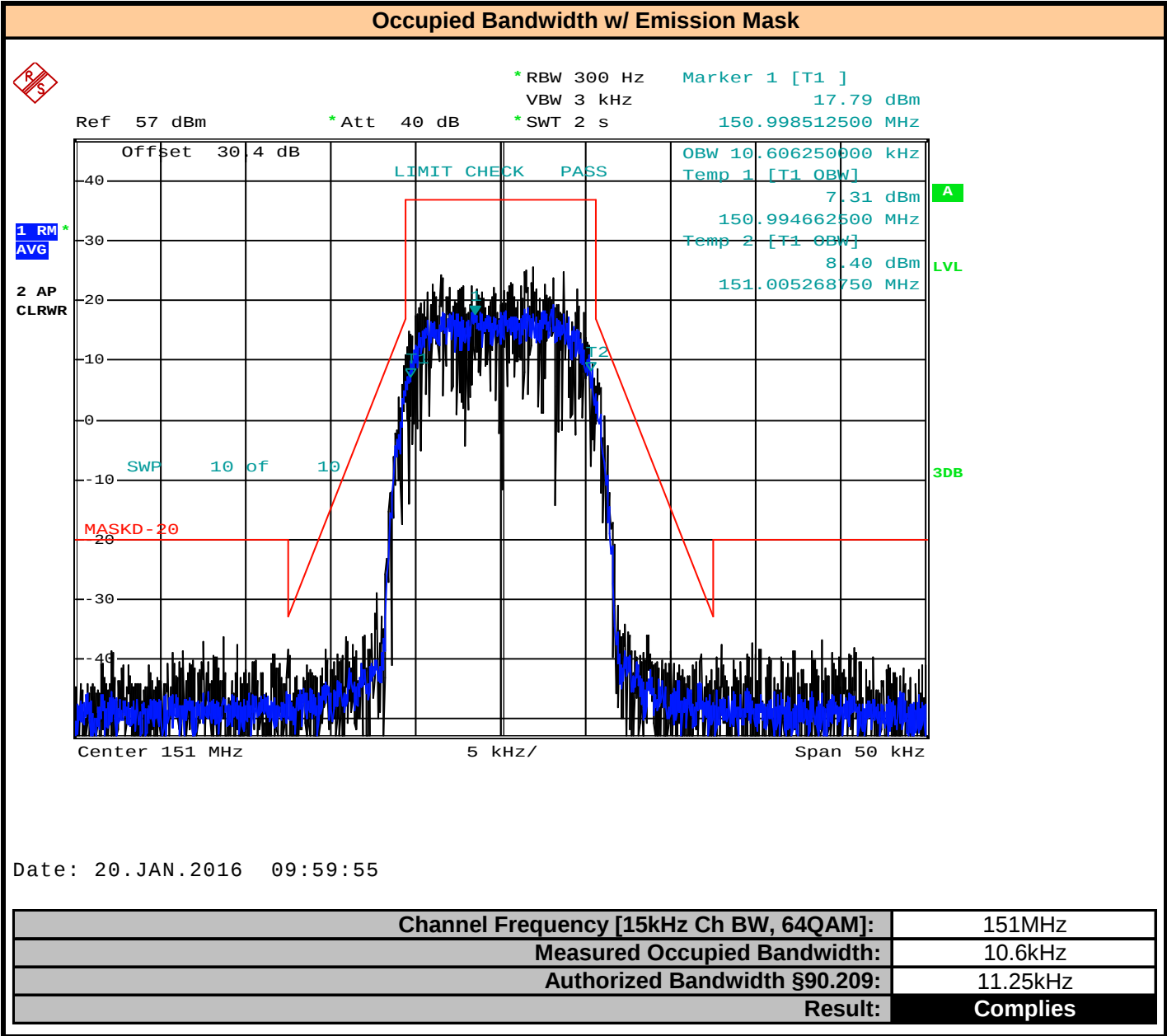


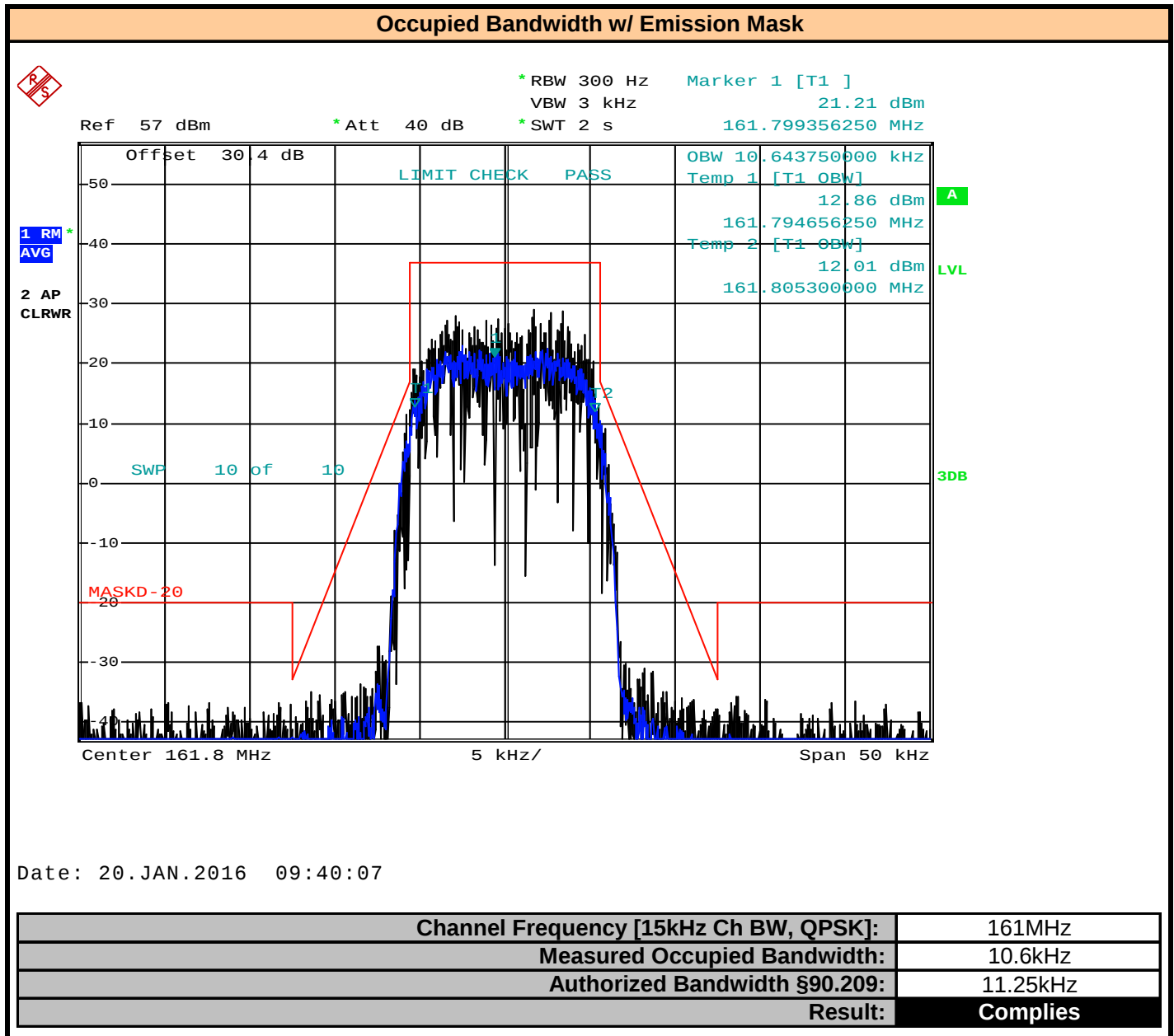


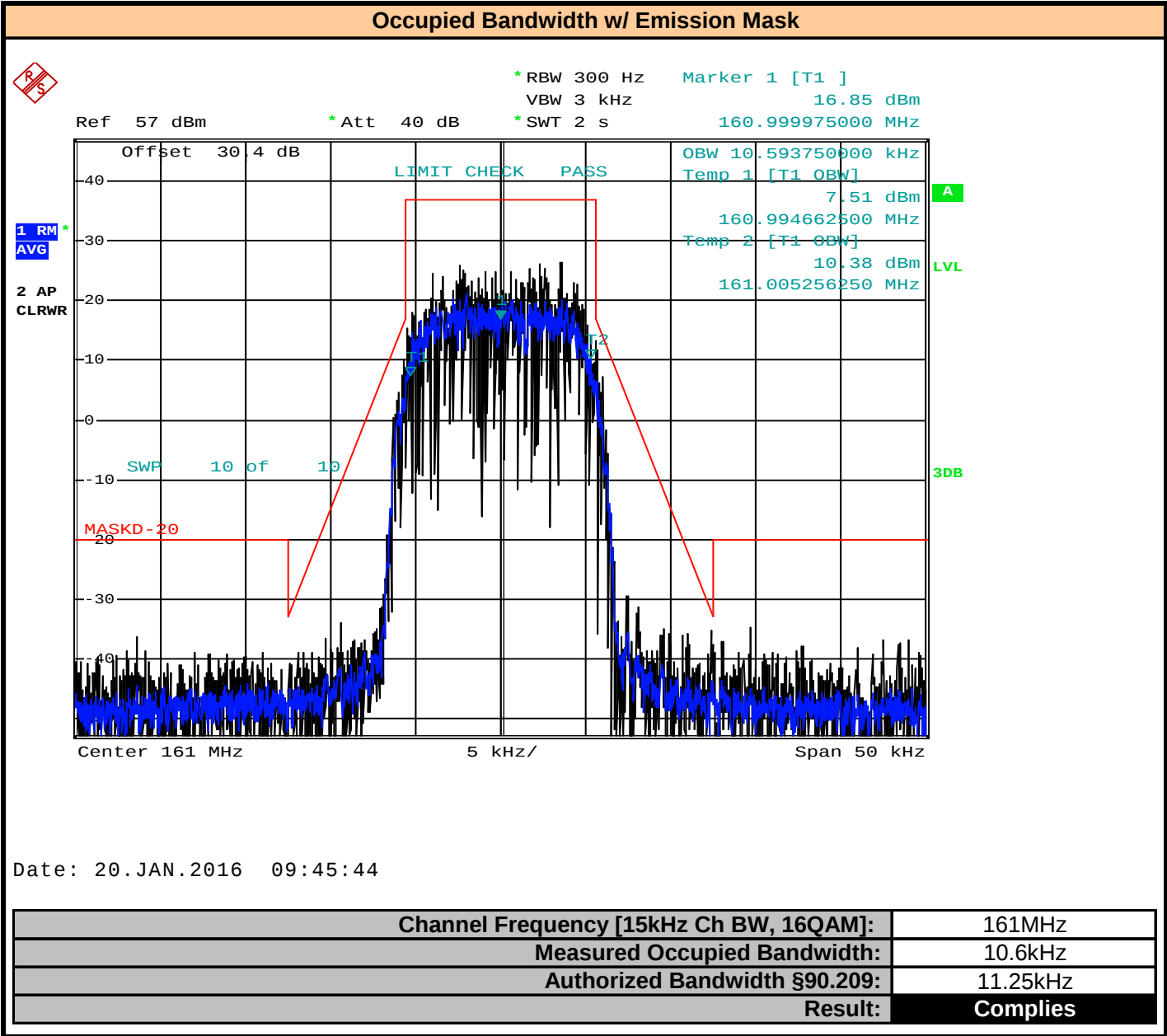


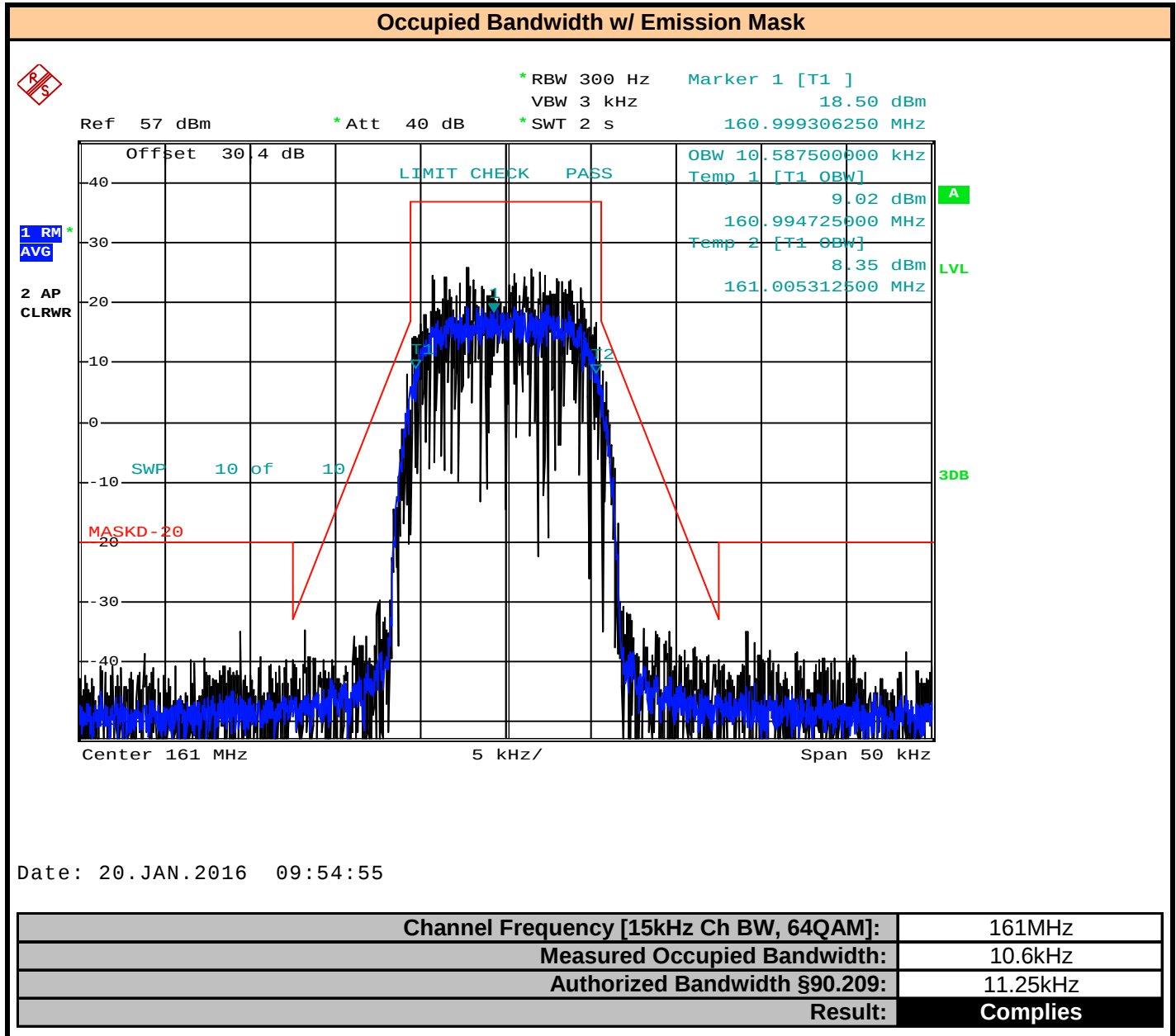


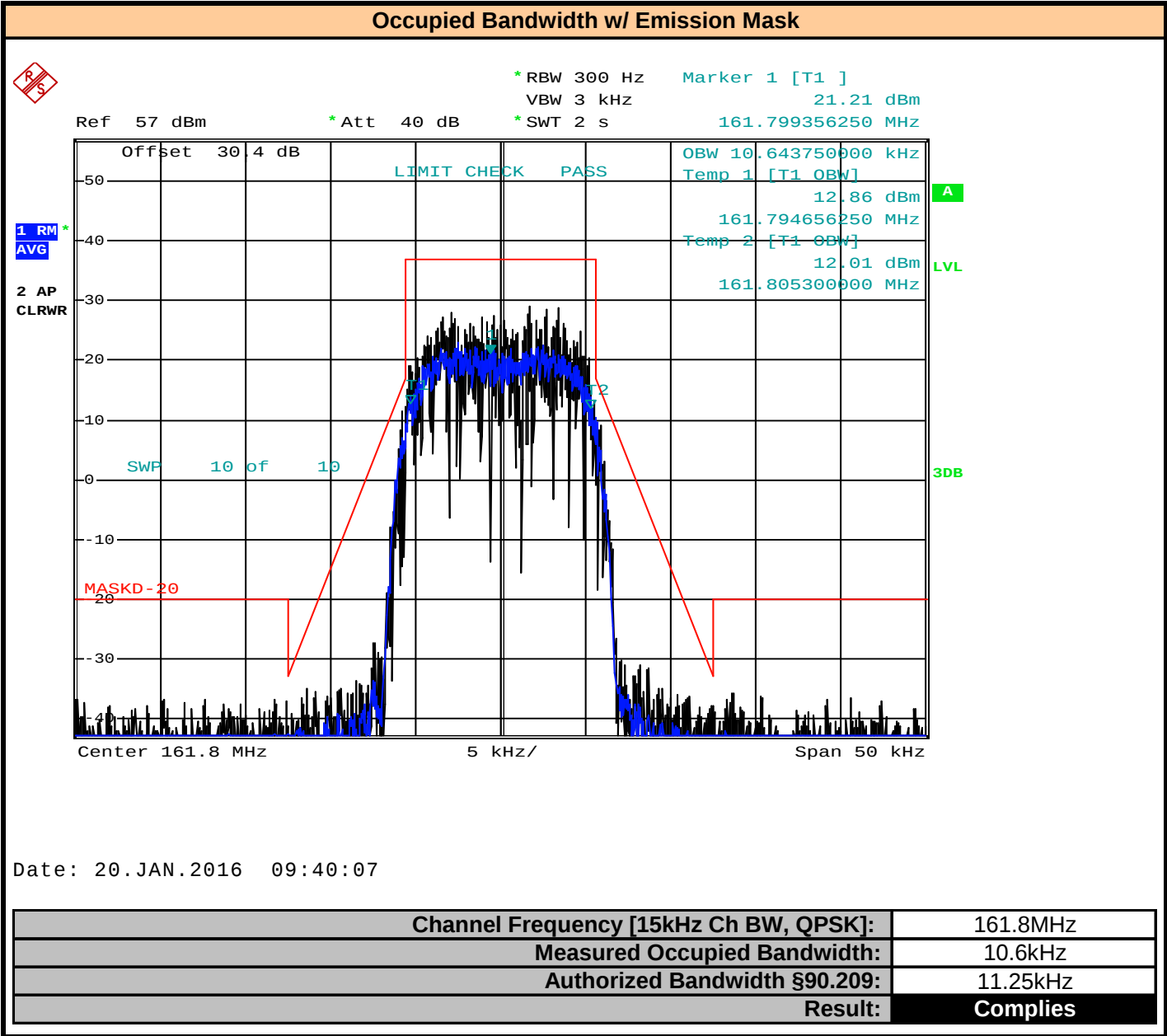


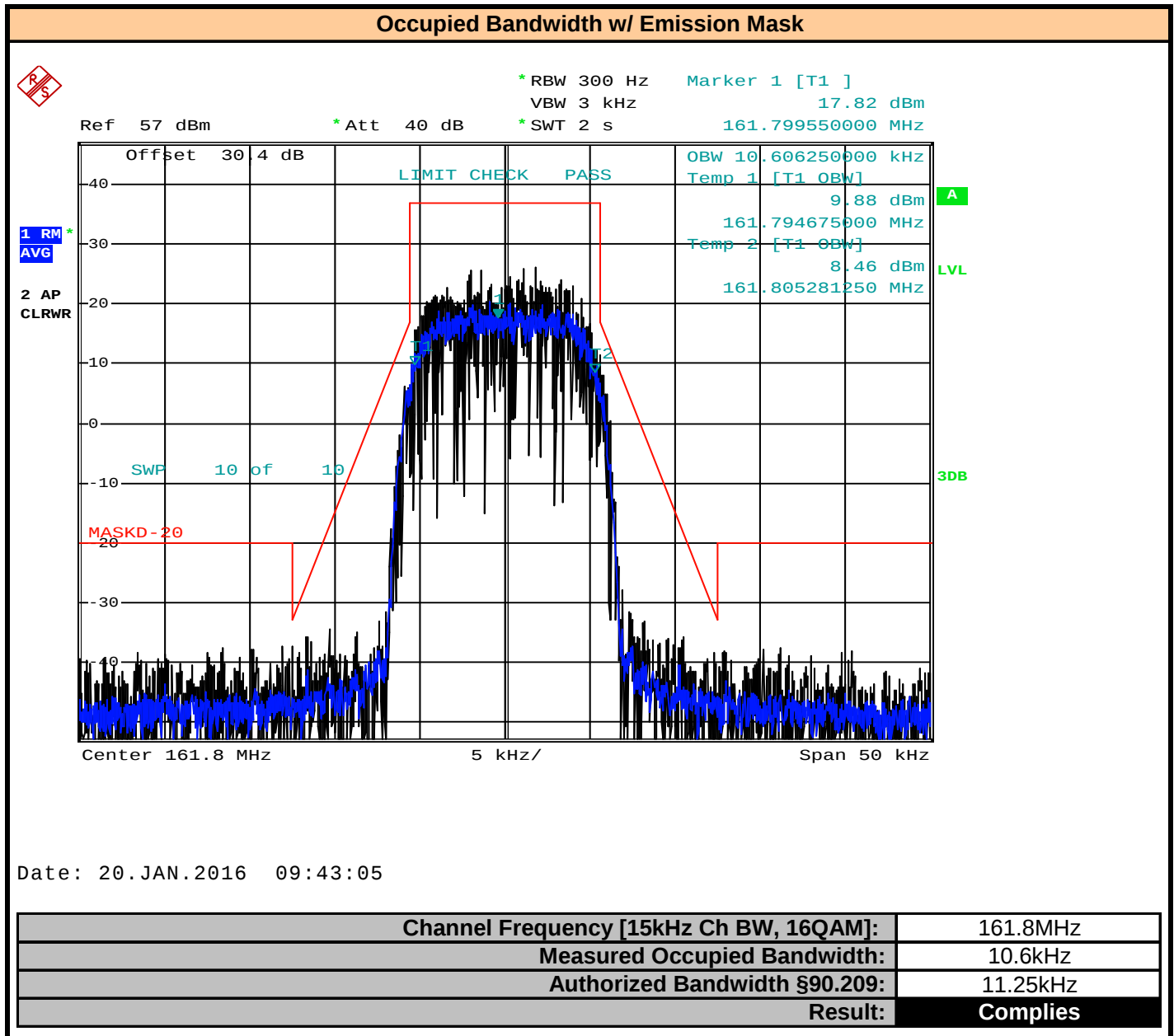






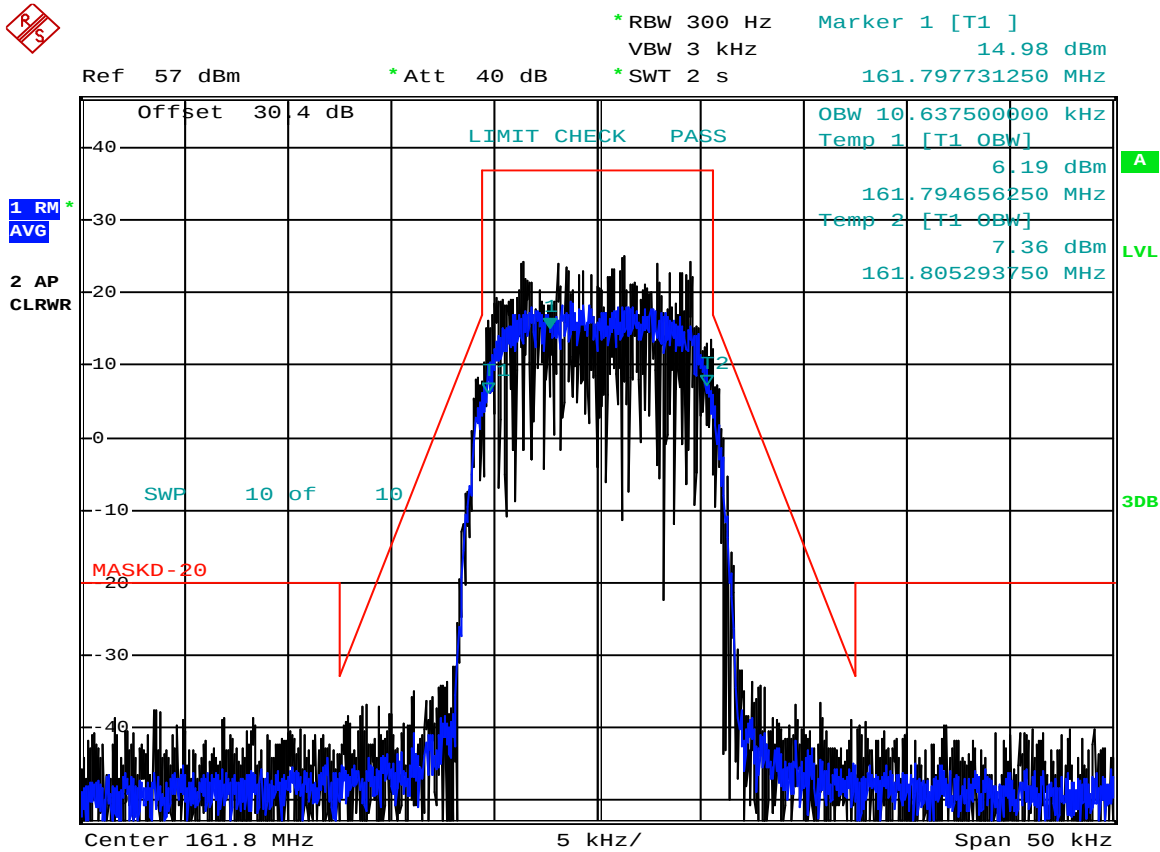






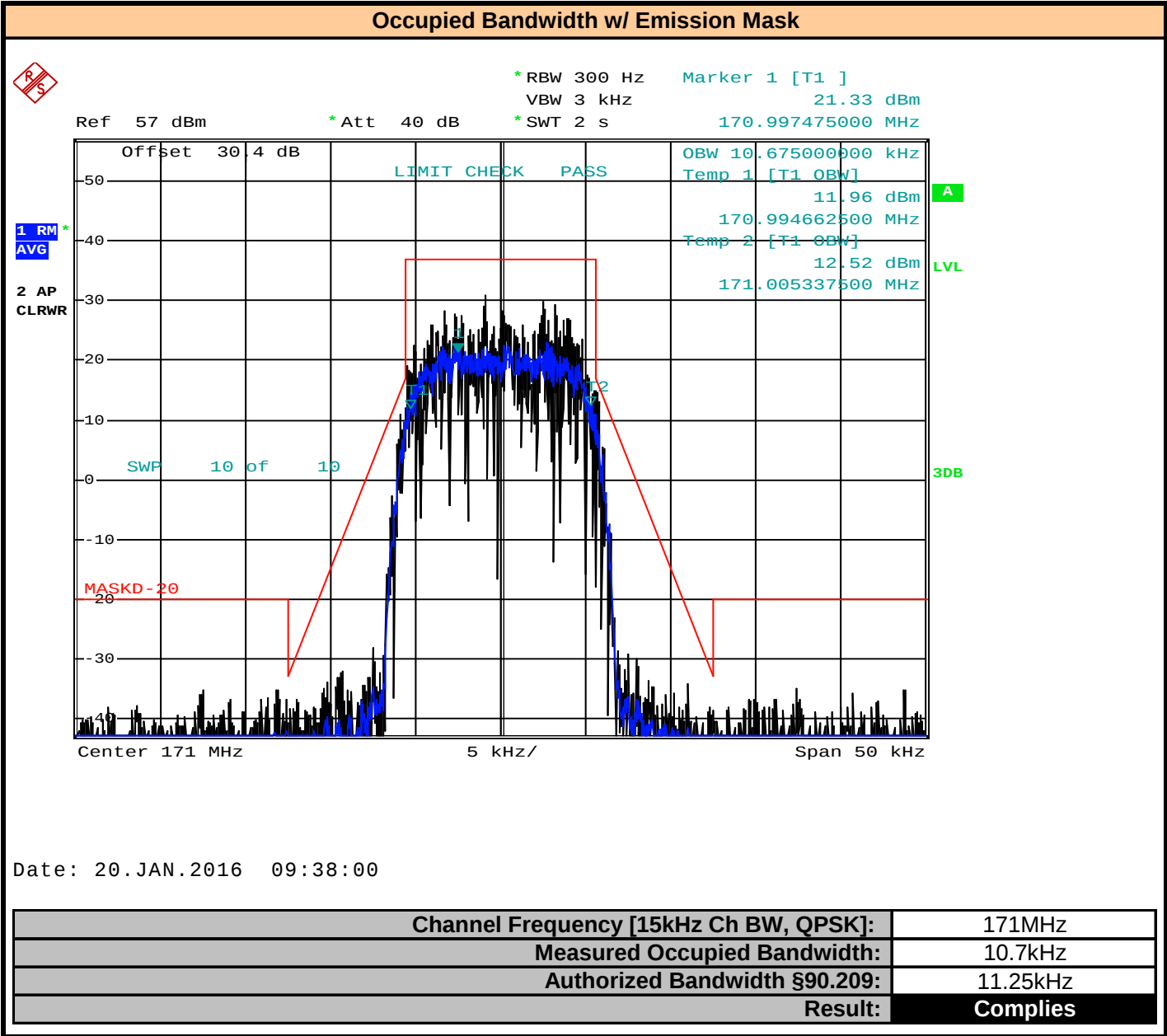
Date: 20.JAN.2016 09:43:05

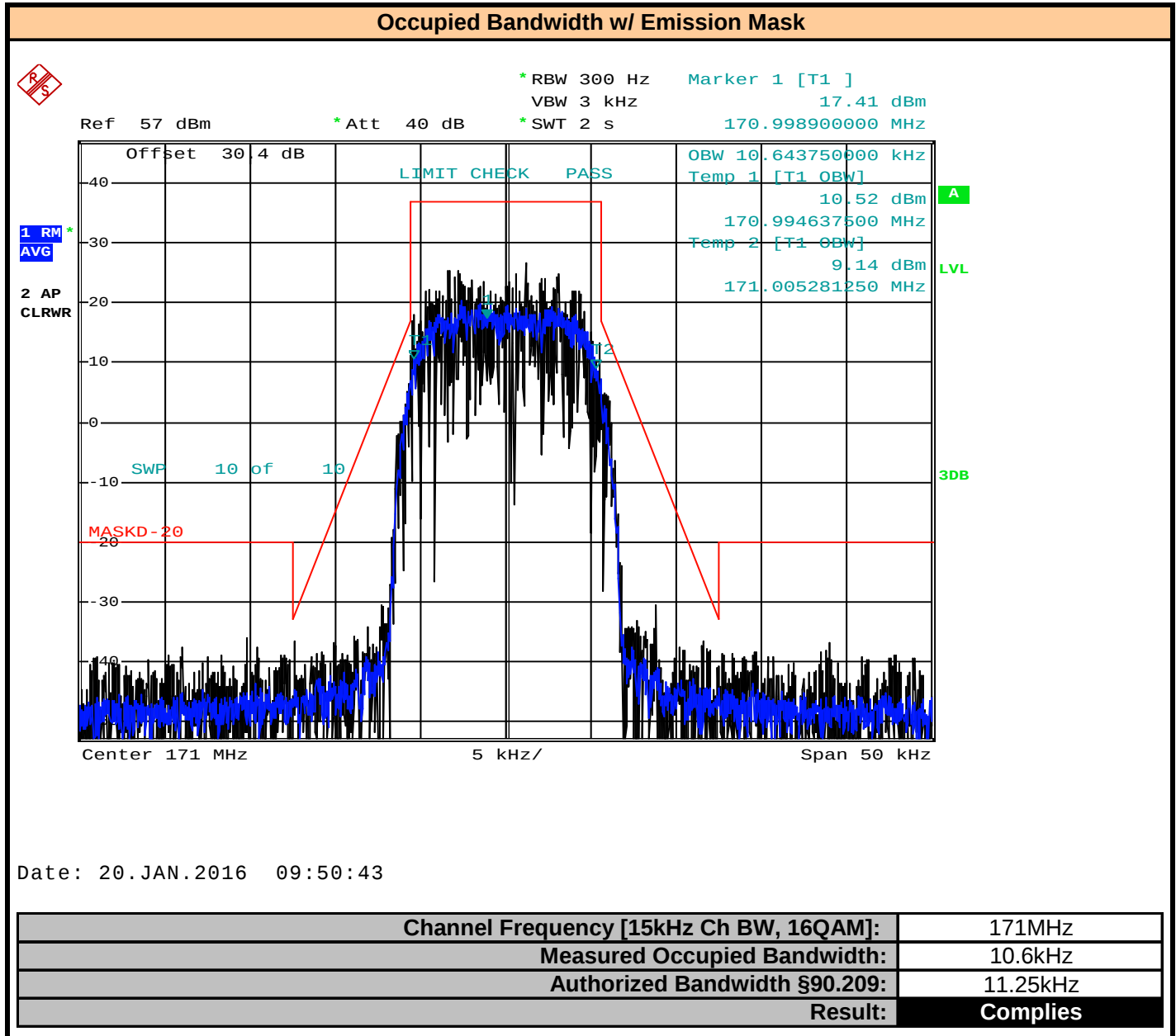
Occupied Bandwidth w/ Emission Mask



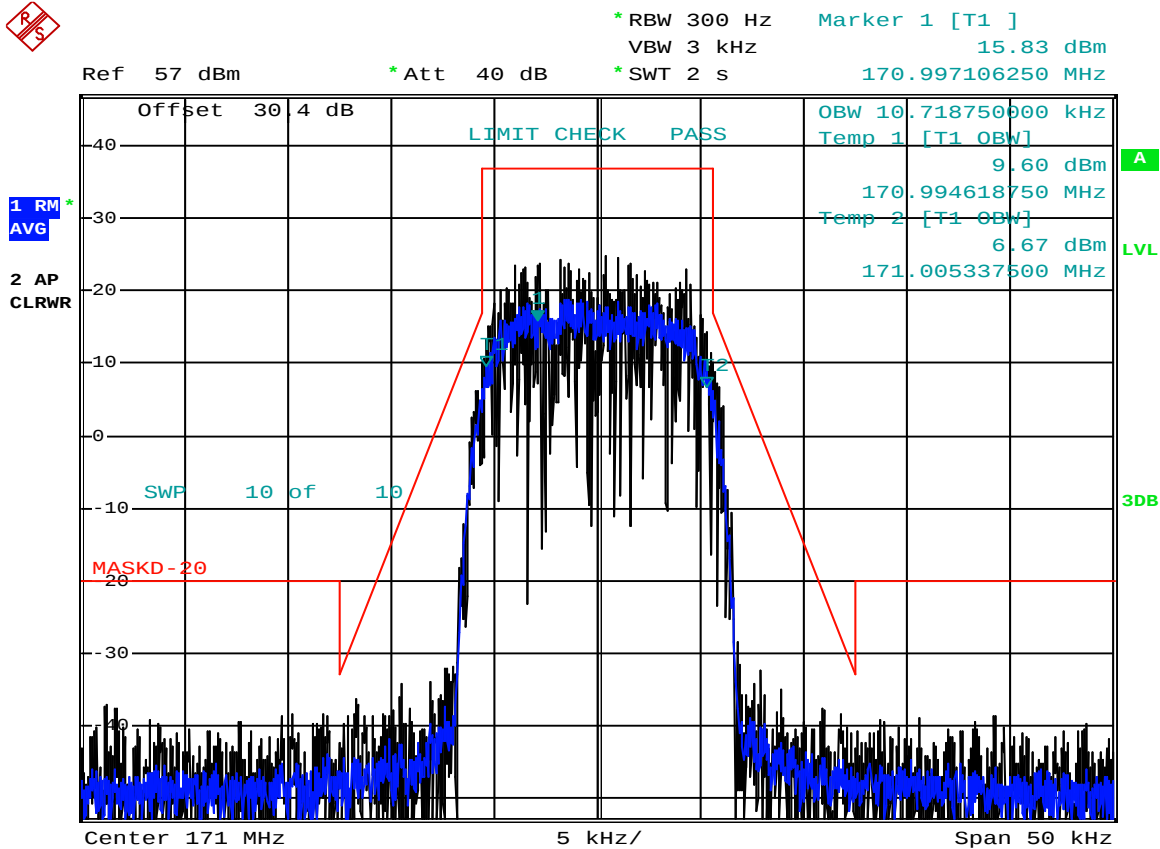
Date: 20.JAN.2016 09:57:40

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



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	
			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	
					Test Lab Certificate No. 2470.01

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	
			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	
					Test Lab Certificate No. 2470.01

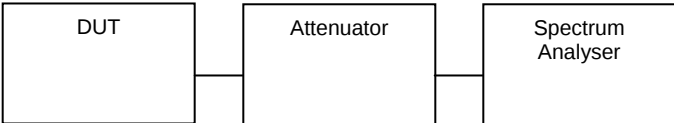
7.0 SPURIOUS EMISSIONS AT THE ANTENNA TERMINAL

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

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

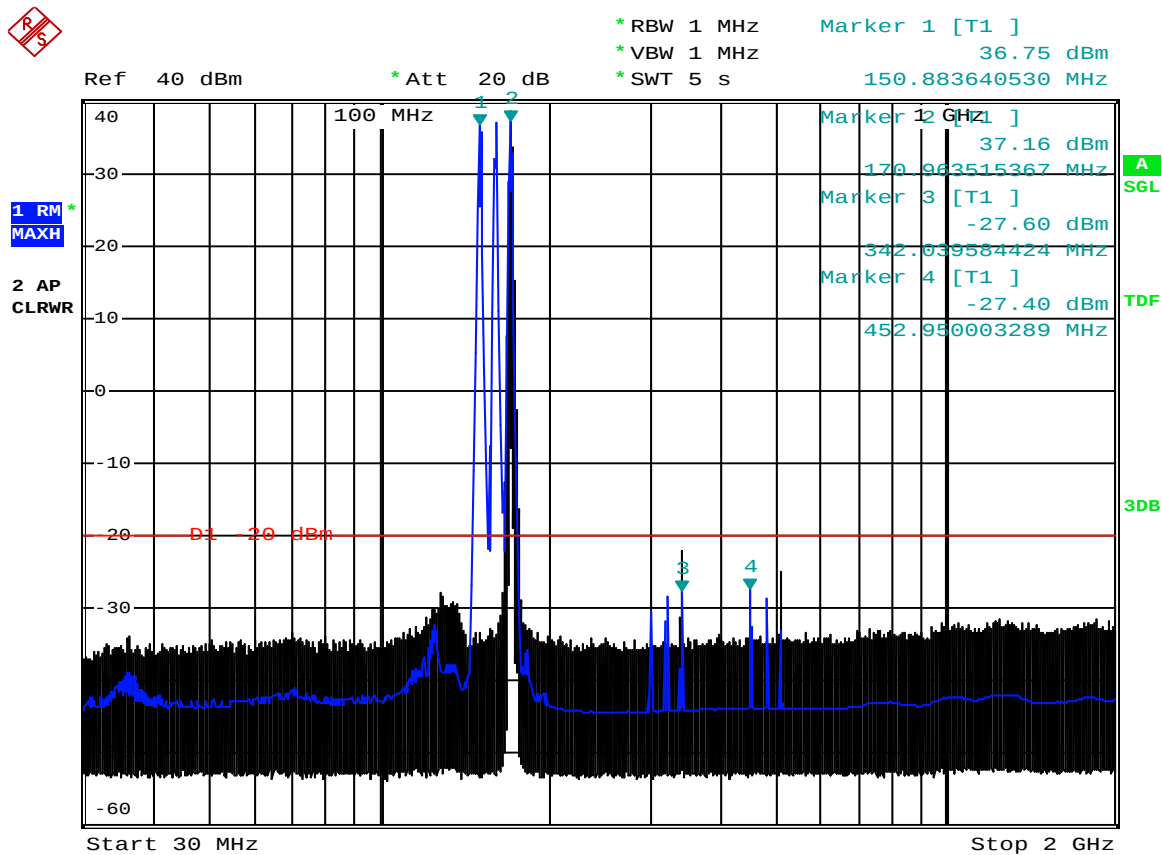
Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

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

Setup drawing	
 <pre> graph LR DUT[DUT] --- Attenuator[Attenuator] --- SpectrumAnalyser[Spectrum Analyser] </pre>	

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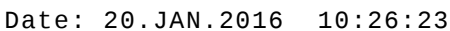
Conducted Spurious Emissions



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



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	
			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	
					Test Lab Certificate No. 2470.01

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.

_____ 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	

8.0 RADIATED SPURIOUS EMISSIONS – TX (SIGNAL SUBSTITUTION)

References	
Normative Reference Standard	FCC CFR 47 §2.1053; 90.210
Measurement Reporting	- 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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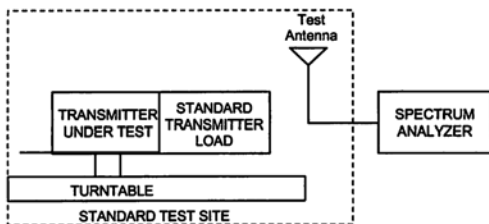
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			Report Revision No.:	Revision 1.2	
	FCC Rule Part(s):	47 CFR §2, §90	FCC Test Firm Reg. No.:	Accredited	
			IC Test Site No.:	IC 3874A-1	
					Test Lab Certificate No. 2470.01

Measurement equipment setup

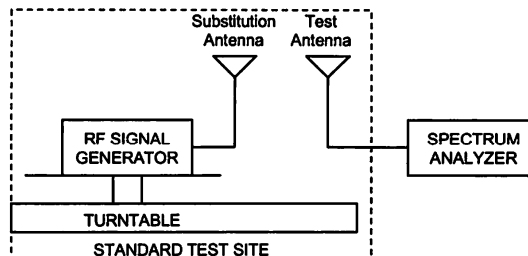
MEASUREMENT EQUIPMENT CONNECTIONS	For the field strength measurements, the measurement equipment was connected as shown below. For the final substitutions, the DUT was replaced with the appropriate antenna and fed from a CW signal source sufficient to replicate the received field strength of the emission 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)

A.

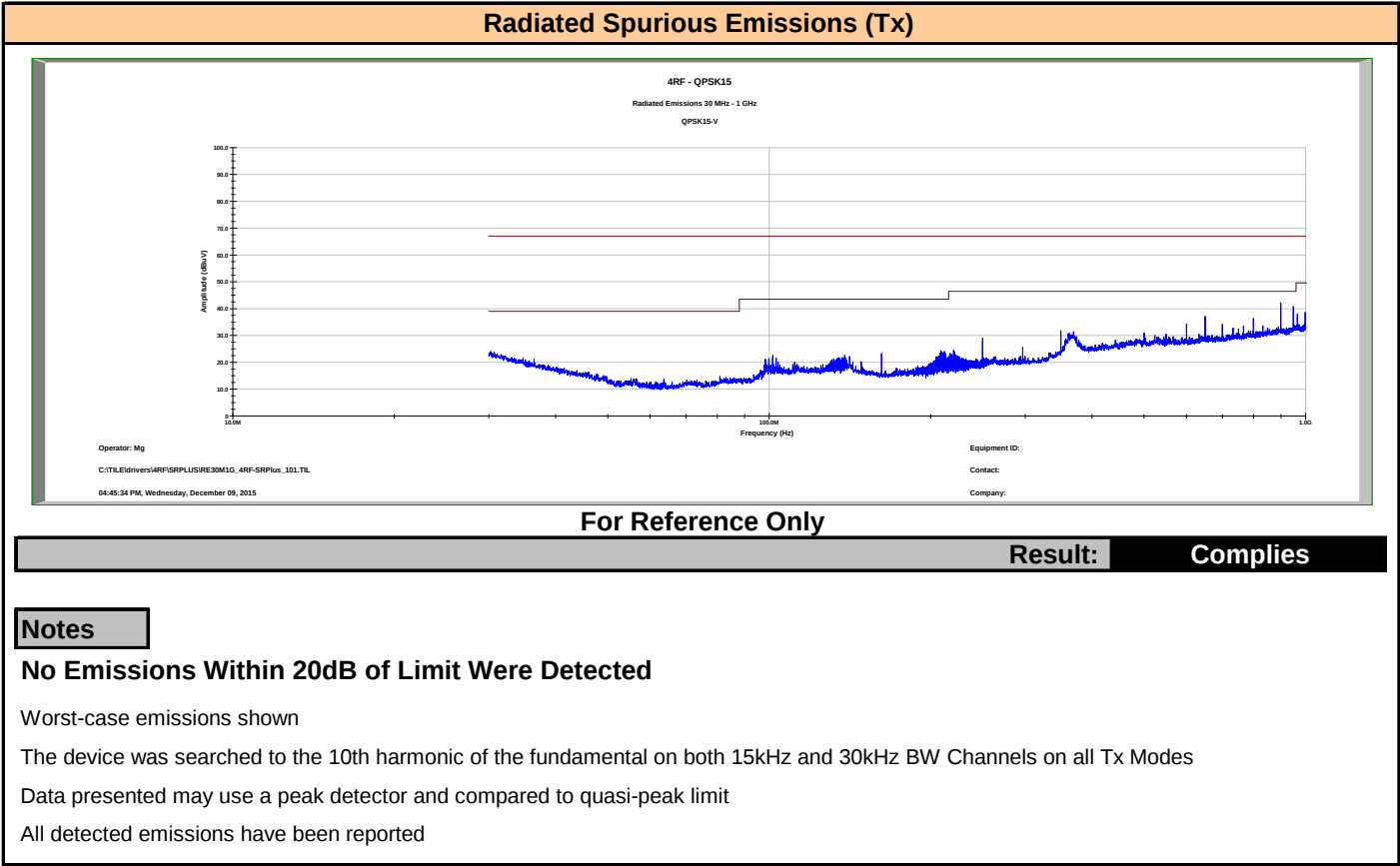


B.



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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281215-T1339-E-900

1/28/2016

Revision 1.2

47 CFR §2, §90

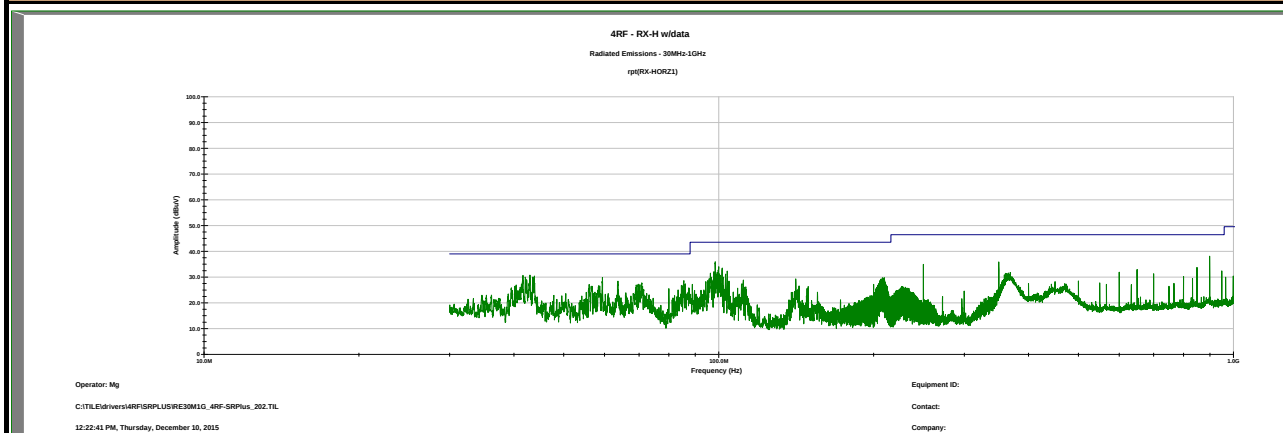
Accredited

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.

— Ruth Voss

Art Voss
Sr. Engineer

	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
			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	
					Test Lab Certificate No. 2470.01

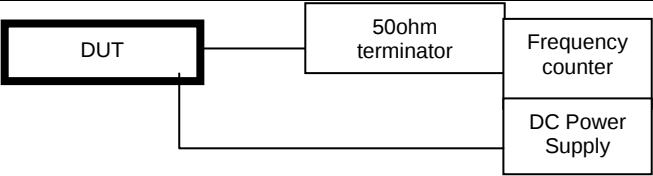
9.0 FREQUENCY STABILITY

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.

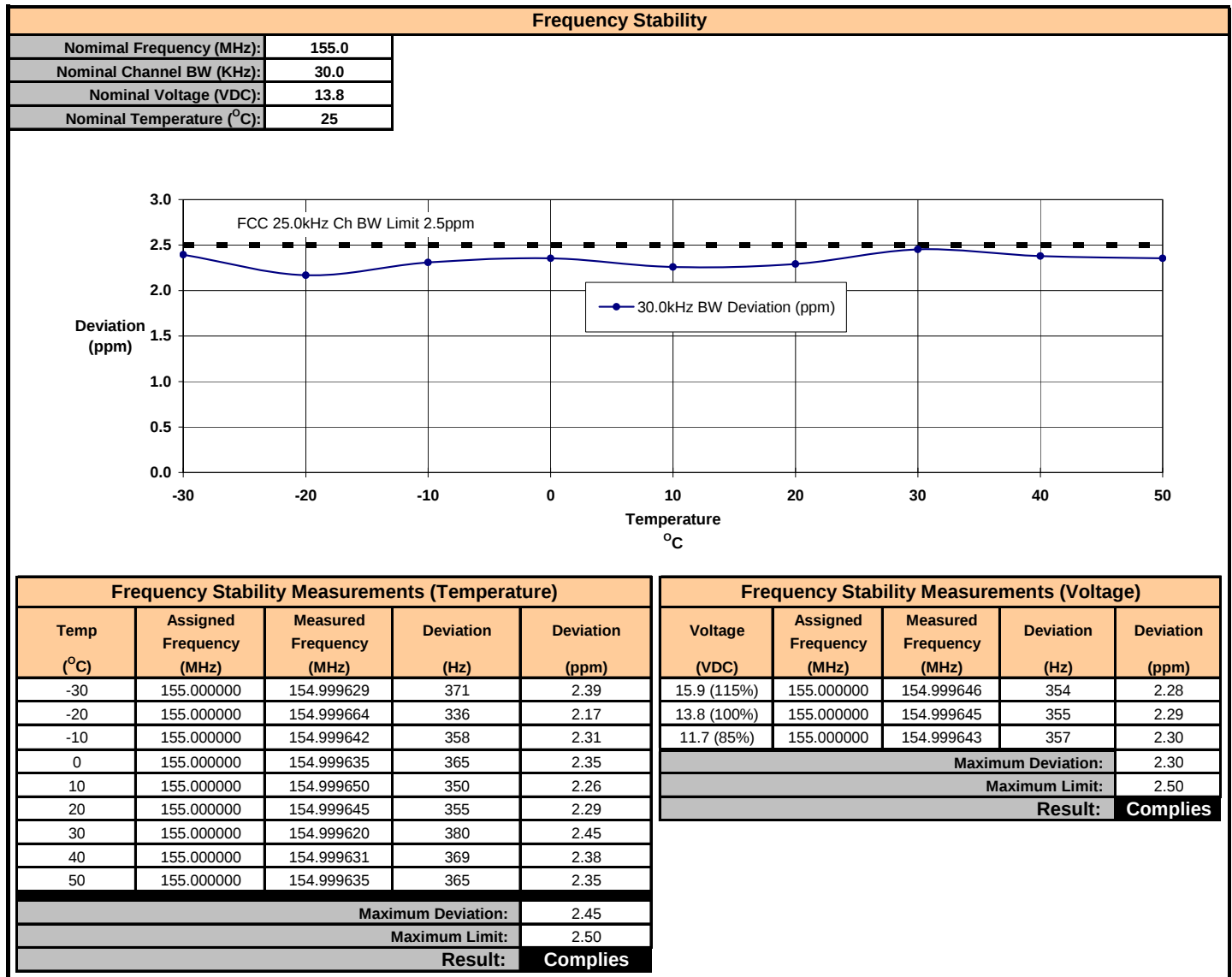
Limits	
§90.213	90.213 - 421-512 MHz, 2.5ppm / 30.0 KHz CH.
	90.213 - 421-512 MHz, 1.5ppm / 15.0 KHz CH.

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

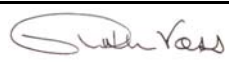
Setup drawing
 <pre> graph LR DUT[DUT] --- Terminator[50ohm terminator] Terminator --- FC[Frequency counter] Terminator --- DPS[DC Power Supply] </pre>

Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio		DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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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	
			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	
					Test Lab Certificate No. 2470.01

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

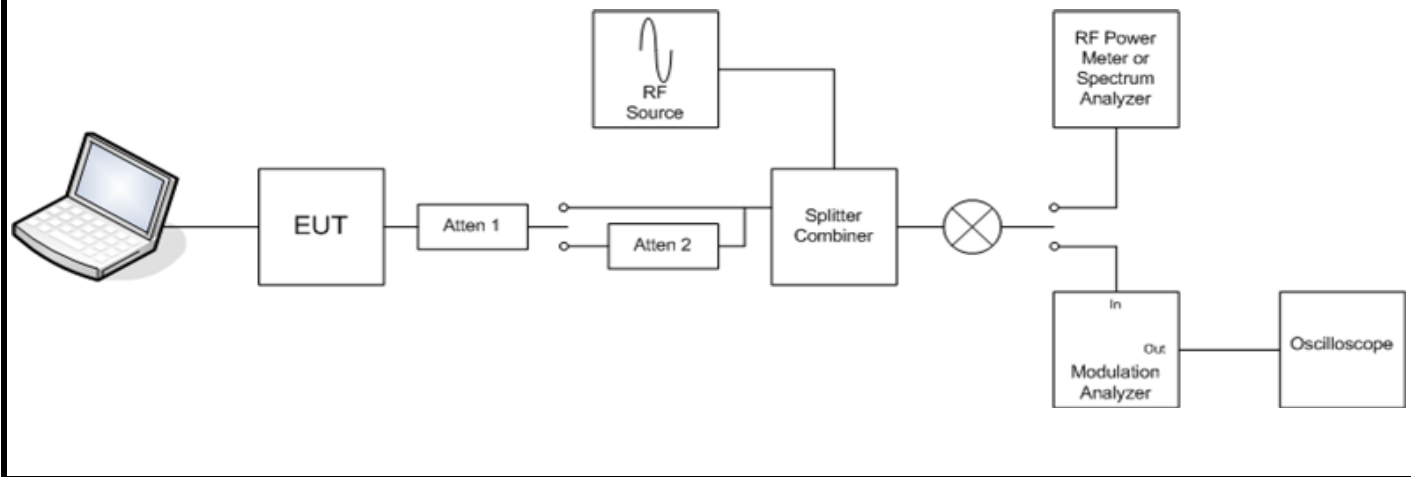
Environmental conditions	
Temperature	25 +/- 5 °C
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

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

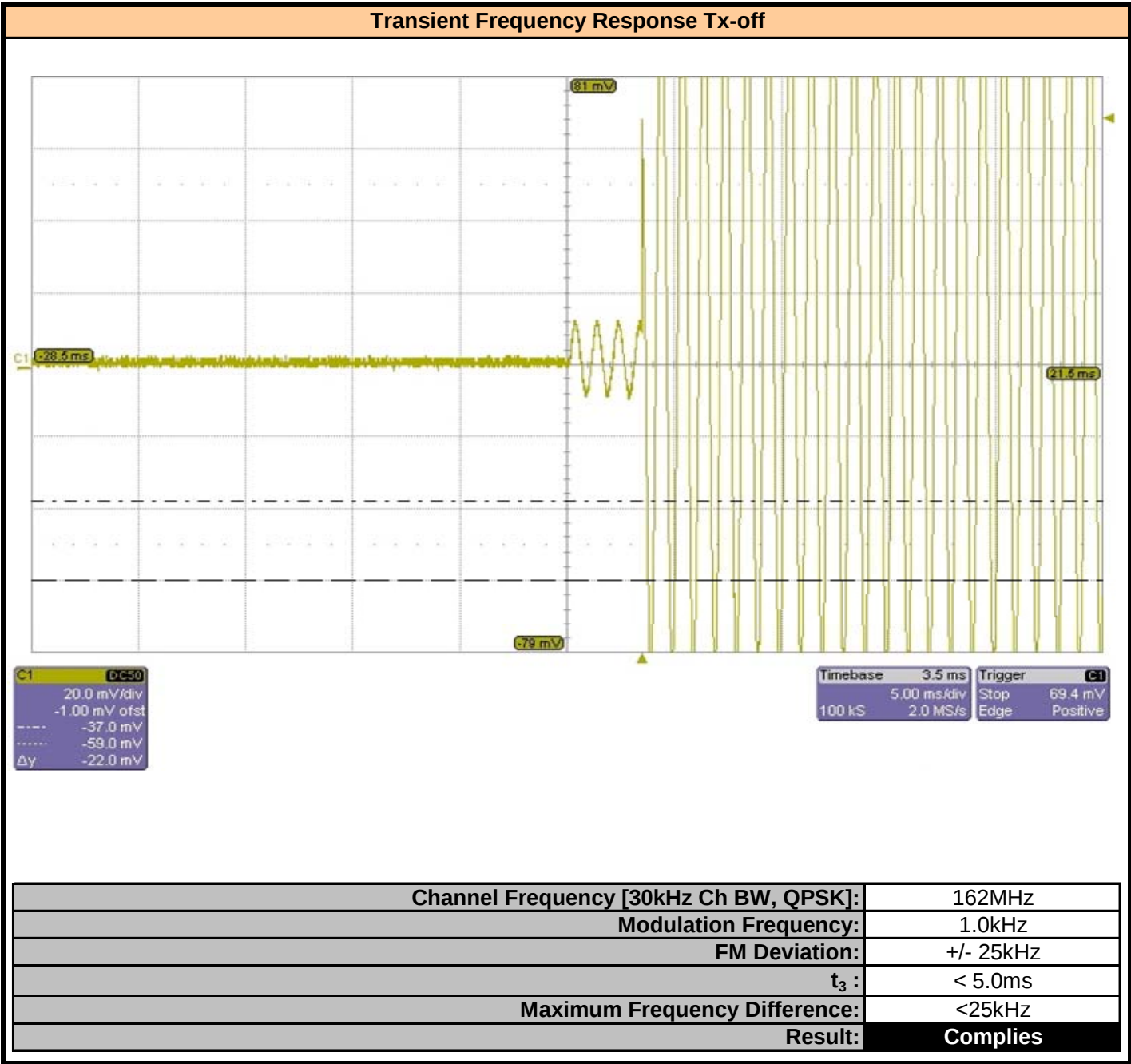
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150			
DUT Type:	Digital Radio	DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	  Test Lab Certificate No. 2470.01
	FCC Rule Part(s):	47 CFR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

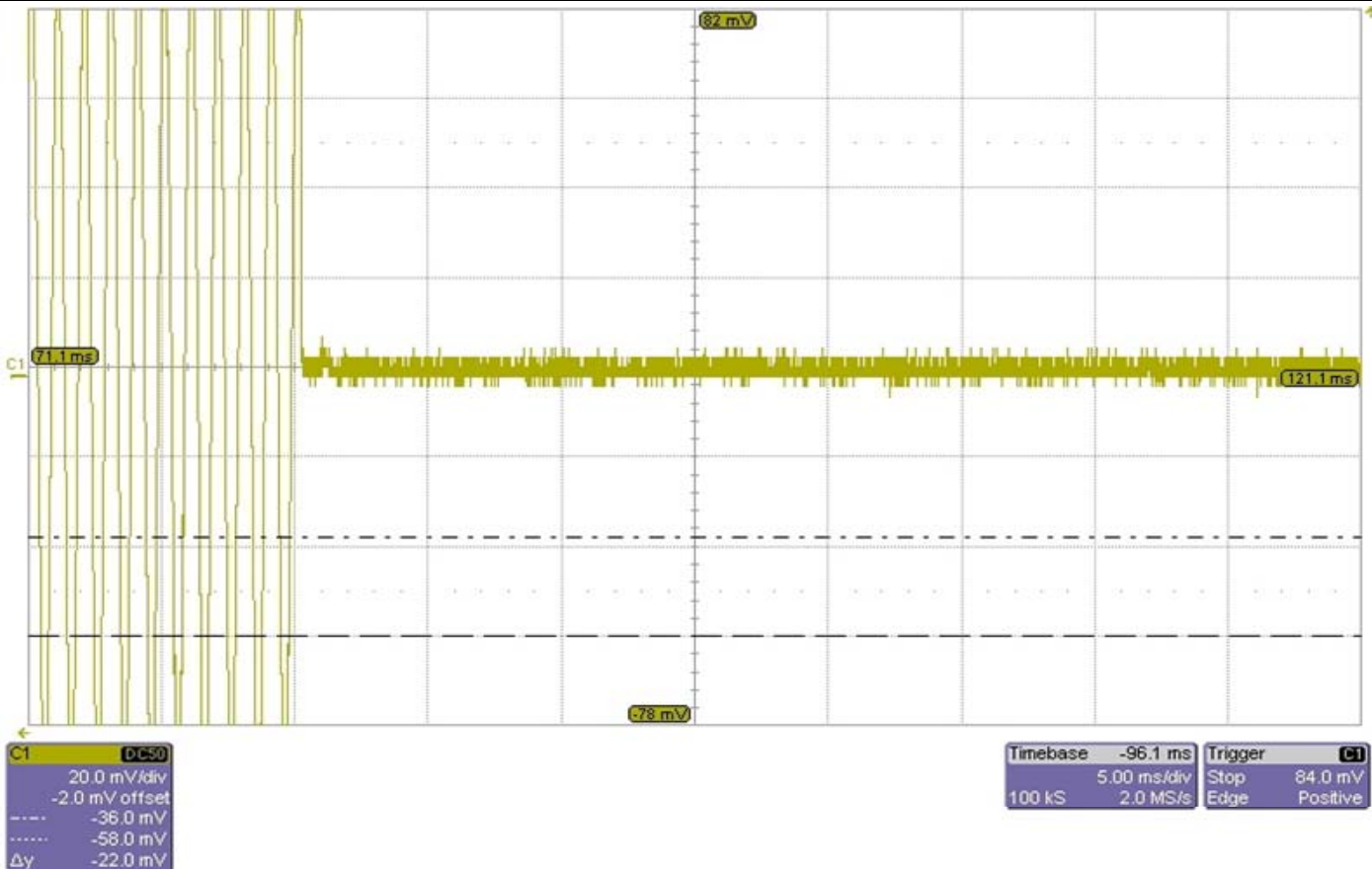
Set-Up Drawing



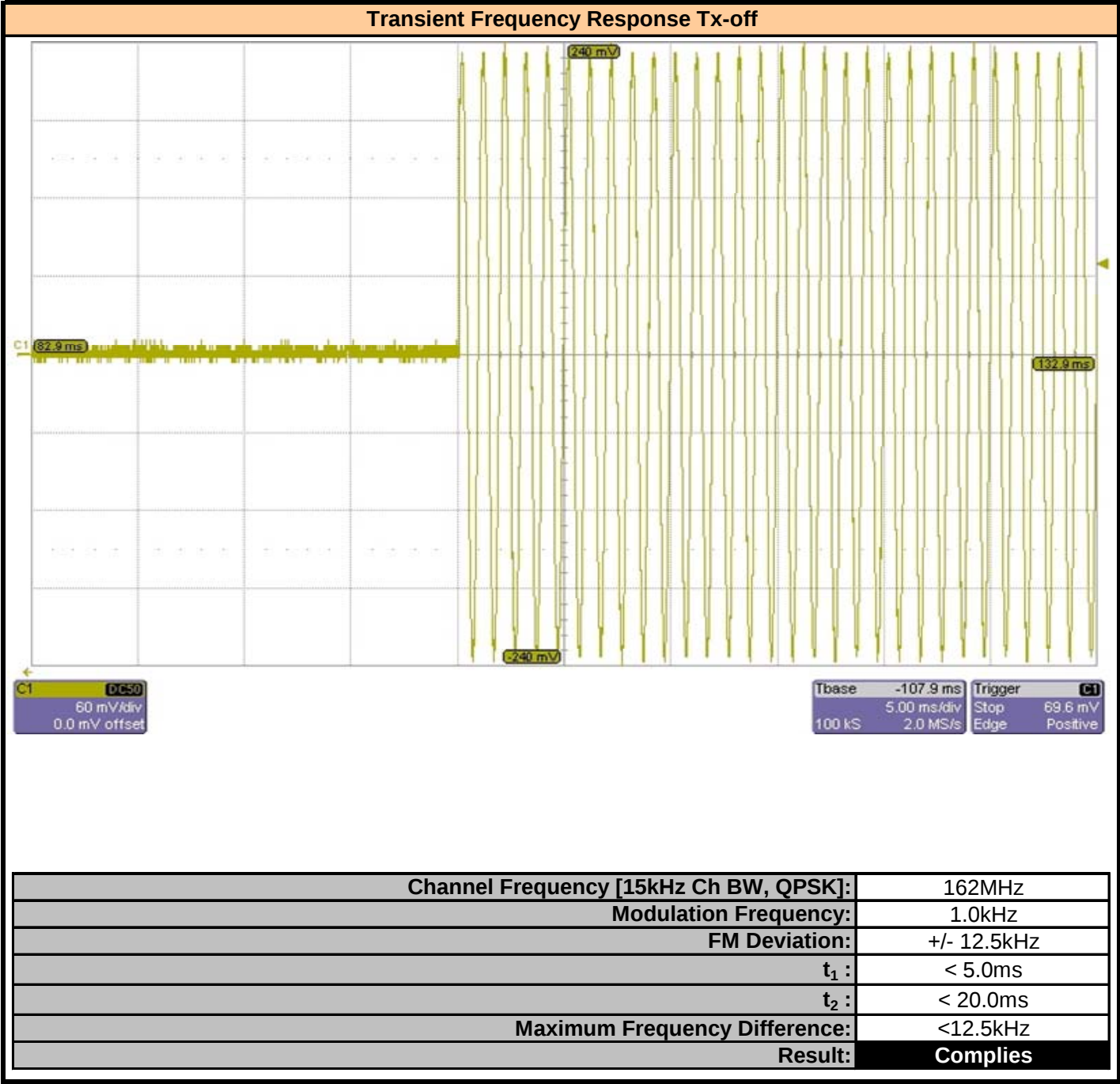
Applicant:	4RF Limited	FCC ID:	UIPSQ135M150				
DUT Type:	Digital Radio		DUT	Aprisa SR+ 135M150	Freq.:	150-174 MHz	
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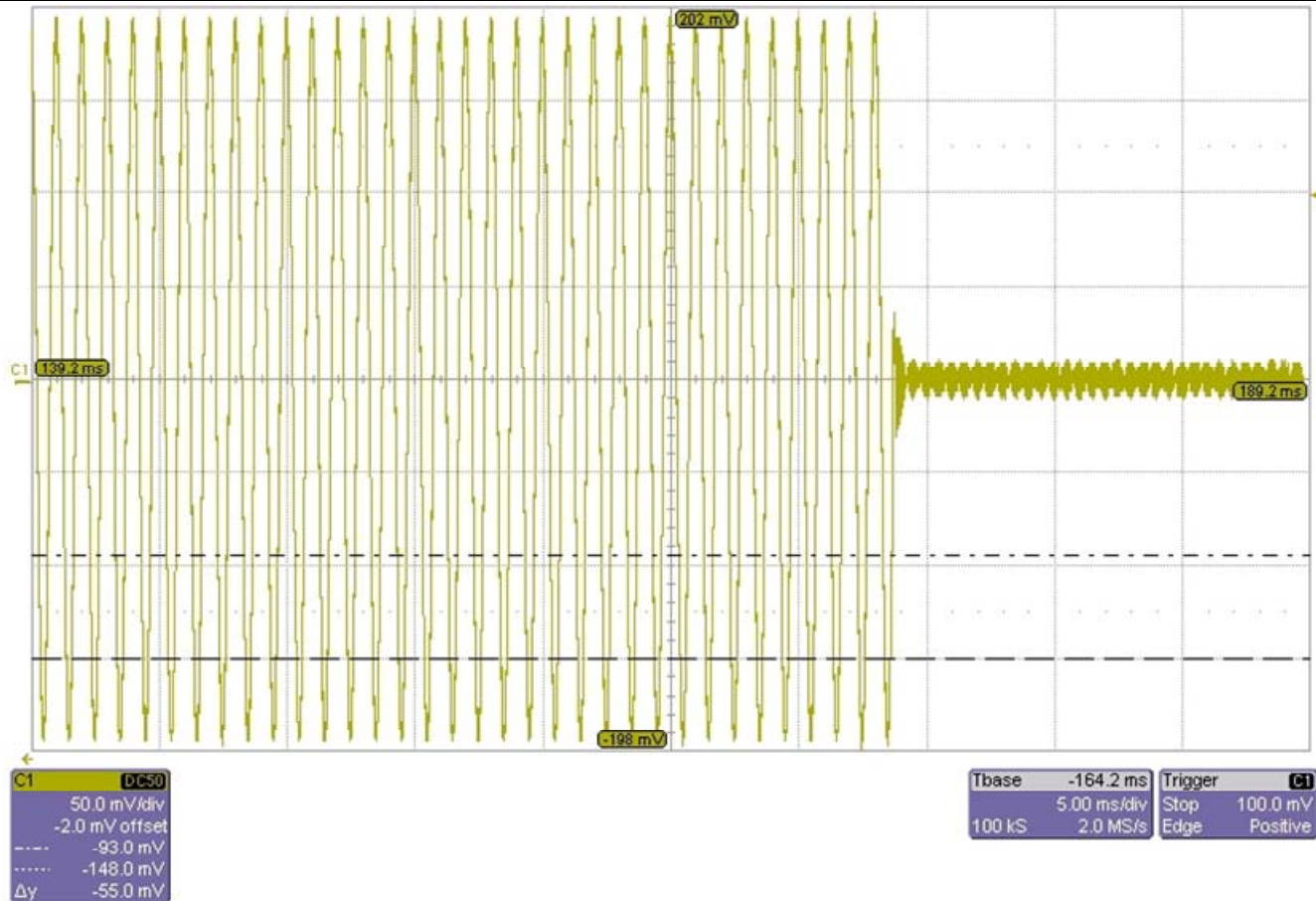
Transient Frequency Response Tx-on



Channel Frequency [30kHz Ch BW, QPSK]:	162MHz
Modulation Frequency:	1.0kHz
FM Deviation:	+/- 25.0kHz
t ₁ :	< 5.0ms
t ₂ :	< 20.0ms
Maximum Frequency Difference:	<25kHz
Result:	Complies



Transient Frequency Response Tx-on



Channel Frequency [15kHz Ch BW, QPSK]:	162MHz
Modulation Frequency:	1.0kHz
FM Deviation:	+/- 12.5kHz
t ₁ :	< 5.0ms
t ₂ :	< 20.0ms
Maximum Frequency Difference:	<12.5kHz
Result:	Complies

	Test Report Serial No.:	281215-T1339-E-900	Report Issue Date:	1/28/2016	
			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	
					Test Lab Certificate No. 2470.01

END OF DOCUMENT

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