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Test Report

Prepared for: Bird Technologies

Model: DDR1-M1-ANW-C

Description: Public Safety Fiber DAS remote

Serial Number: 20030

FCC ID: EZZDDR406

To

FCC Part 90

Date of Issue: May 25, 2020

On the behalf of the applicant:

Bird Technologies
30303 Aurora Road
Solon, OH 44139

Attention of:

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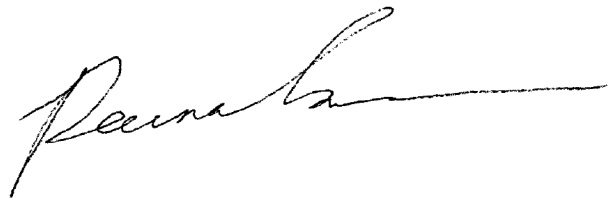

Poona Saber
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	May 25, 2020	Poona Saber	Original Document

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

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#2152.01

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The Applicant has been cautioned as to the following:

15.21: **Information to the User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): **Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations Part 90.219, KDB 935210 D05 Booster, and FCC Part 2, where appropriate.

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI/TIA 603C, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
24.7 – 27.9	44.9 – 51.5	963.5 – 970.4

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description

Model: DDR1-M1-ANW-C
Description: Public Safety Fiber DAS remote
Firmware: N/A
Software: N/A
Serial Number: 20030

Additional Information:

System under test is a Fiber-Das system consists of three segments:

-Gateway: acts as a firewall ensuring internal traffic remains internal and allowing a web interface for monitoring and supervision.
-Headend: Serves as the interface with the operator's base station, housing the units required to transmit and receive communications between the operator's base station and the remote units of the Fiber-DAS.
-Remote unit: is located near the distributed antennas and house the equipment necessary to transmit and receive the communications between the antenna and the headend

Remote unit is tested for down link. RF input is injected into DL input on the FOI unit where it gets converted and transferred through fiber optics to remote unit. It converts back fiber to RF output on the Remote unit which is measured with spectrum analyzer for testing below.

The Uplink is connected to a base station with no antenna or amplifier inline hence, it does not radiate, and it is considered as a non-transmitting host unit.

AGC Threshold
Several tests reference the AGC Threshold level.
The AGC Threshold was measured as follows:

- Connect a signal generator to the input of the EUT.
- Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- Use a CW signal.
- While monitoring the output of the EUT, increase the input level until the output stops increasing or drops a few 10th's of a dB.
- This is the AGC threshold level of the EUT.
- When the procedure calls out to set the RF Input to just below the AGC Threshold, The AGC Threshold is measured using the procedure listed above, and then the RF Input is backed off 0.2 dB below this threshold level.

Band	RF path	Frequency Range (MHz)	Emission Designators
UHF	Downlink	406-411	16K0F3E 11K0F3E 8k30F1W
UHF	Uplink	415-420	16K0F3E 11K0F3E 8k30F1W

Antenna that is approved for this filing is an Omni Antenna with maximum gain of 3.5 dBi.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Network Switch	HP	JE006A	NA
1	Master Frame Unit	Deltanode	FOI/BIU/PSu	NA
1	Base station Gateway	SuperMicro	NA	CSE-513

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	RF Cable	<1	N	N	N/A

Modifications:

None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210 D05	AGC Threshold	Pass	
KDB 935210-D05	Out of Band Rejection	Pass	
2.1046	Output Power (Conducted)	Pass	
90.210 2.1049	Occupied Bandwidth (Emission Masks)	Pass	
2.1051	Spurious Emissions (Transmitter Conducted)	Pass	
2.1053	Radiated Spurious Emissions	Pass	
KDB 935210-D05	Intermodulation	Pass	
90.219(e)(2)	Noise Figure	Pass	
90.213	Frequency Stability (Temperature Variation)	N/A	
90.213	Frequency Stability (Voltage Variation)	N/A	

AGC Threshold

Engineer: Poona Saber

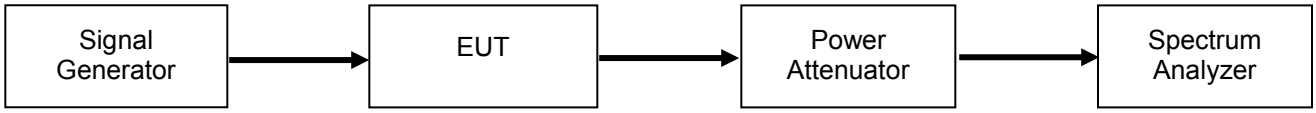
Test Date: 5/28/2020

Test Procedure

A signal generator producing a CW signal was connected to the input of the EUT. A spectrum analyzer was connected to the EUT in order to monitor the output power levels. The input power level was increase in 1 dB increments until the power no longer increased. The input levels were recorded in the table below.

Spectrum Analyzer settings
Power Channel integration
RBW = 1-5% of EBW
Video BW = 3x RBW

Test Setup



Downlink

406-411 MHz

Tuned Frequency (MHz)	AGC Threshold Pin (dBm)	AGC Threshold Pout (dBm)
408.5	-45.58	32.74

Out of Band Rejection

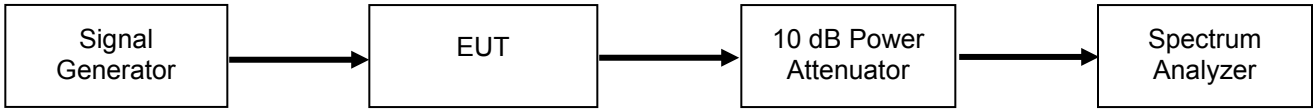
Engineer: Poona Saber

Test Date: 5/28/2020

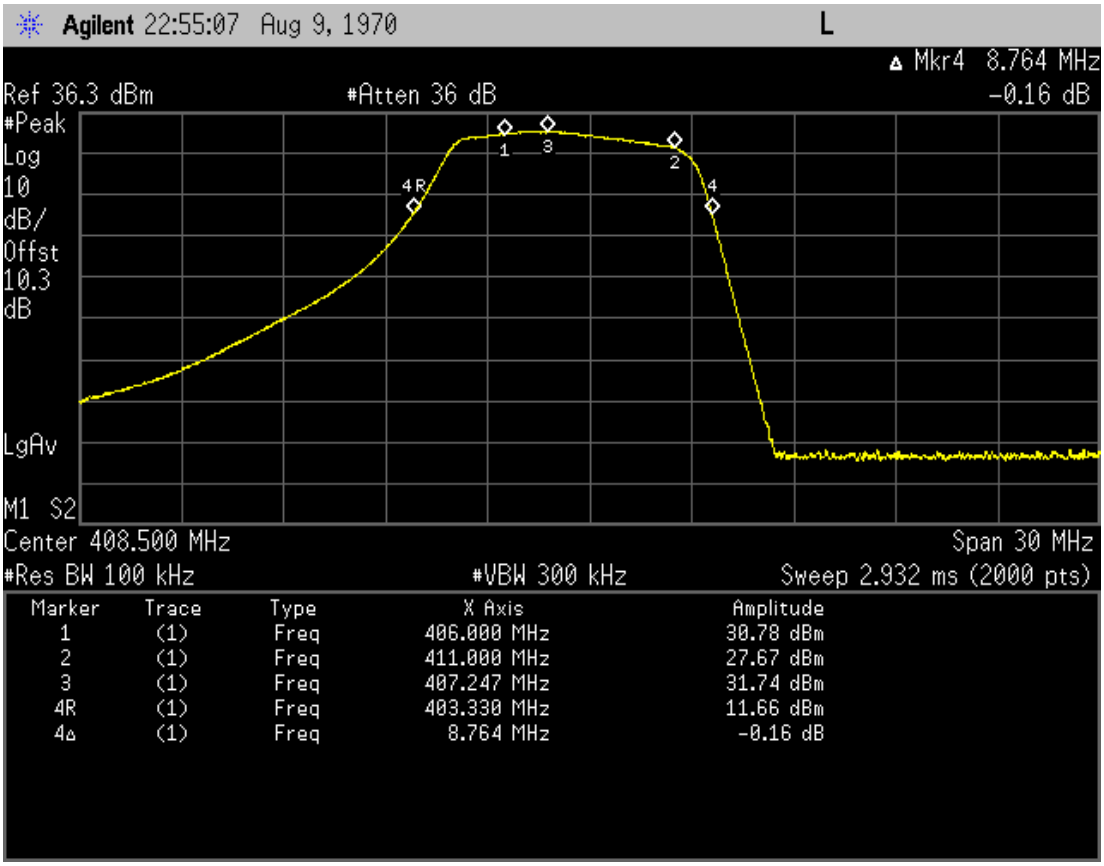
Test Procedure

The EUT was connected to a spectrum analyzer through a 10 dB power attenuator. A signal generator was utilized to produce a swept CW signal with the RF input level set to 3 dB below the AGC Threshold level. The Uplink and Downlink filter response and the -20 dB bandwidth were measured. The marker table function of the spectrum analyzer was used to show the peak amplitude in the passband and the -20 dB bandwidth of the pass band filter.
RBW = 100 KHz
Video BW = 3x RBW

Test Setup



Test Plot



Conducted Output Power and Amplifier Gain

Engineer: Poona Saber

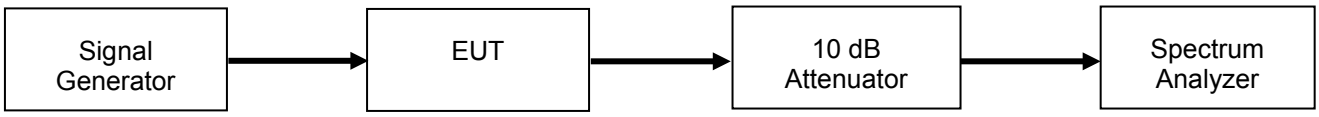
Test Date: 5/28/2020

Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 10 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained.
A CW signal was utilized, set to the frequency of the peak amplitude measured in the Out of Band Rejection test.
The RF input signal level was set to 0.2 dB below the AGC Threshold and also 3 dB above AGC Threshold.
RBW = 100 kHz
Video BW = 3x RBW
The Input and Output power levels were recorded, and the gain was calculated using the following formula:

Gain (dB) = Output Power (dBm) – Input Power (dBm)

Test Setup



Output Power and Gain Test Results

0.2 Below AGC Threshold

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
407.247	-45.31	32.85	78.16

3 dB above AGC threshold

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
407.247	-42.34	32.90	75.24

Conducted Spurious Emissions

Engineer: Poona Saber

Test Date: 5/21/2020

Test Procedure

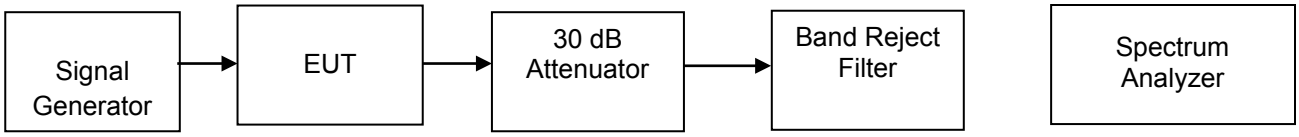
The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings were obtained.
A CW signal was utilized, set to the center frequency of the passband.
The RF input signal level was set to 0.2 dB below the AGC Threshold.
The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.

The frequency range from 30 MHz to the 10th harmonic of the passband frequency was observed and plotted.

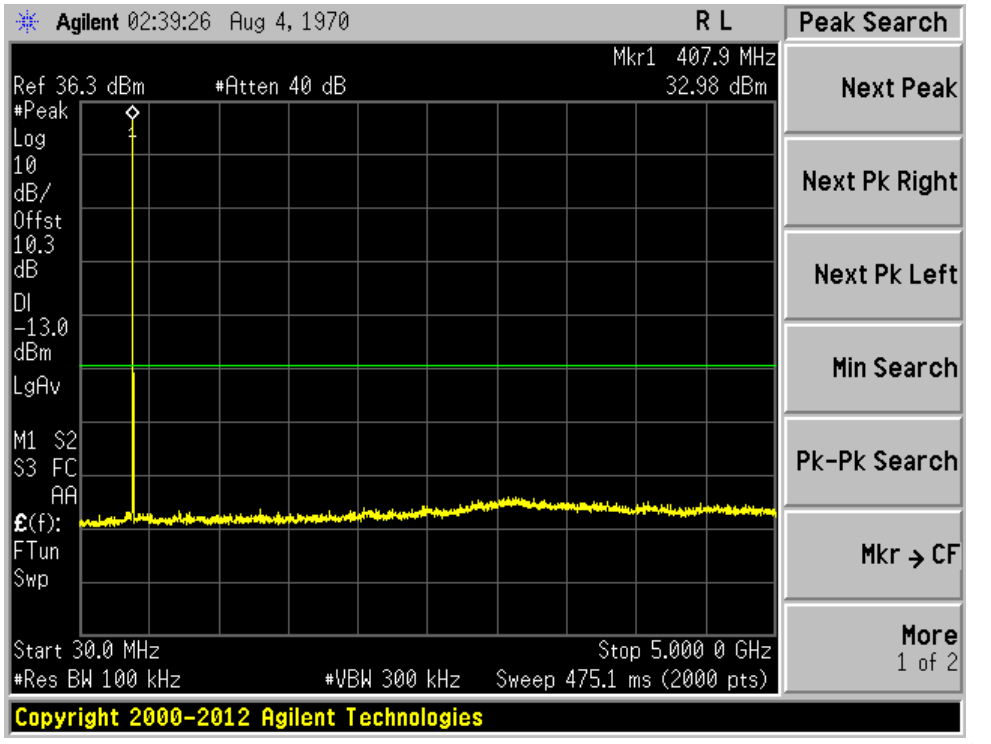
The following formula was used for calculating the limits.

Conducted Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13 dBm
P1 = power in dBm
P2 = power in Watts

Test Setup



Test Results



Radiated Spurious Emissions

Engineer: Poona Saber

Test Date: 5/27/2020

Test Procedure

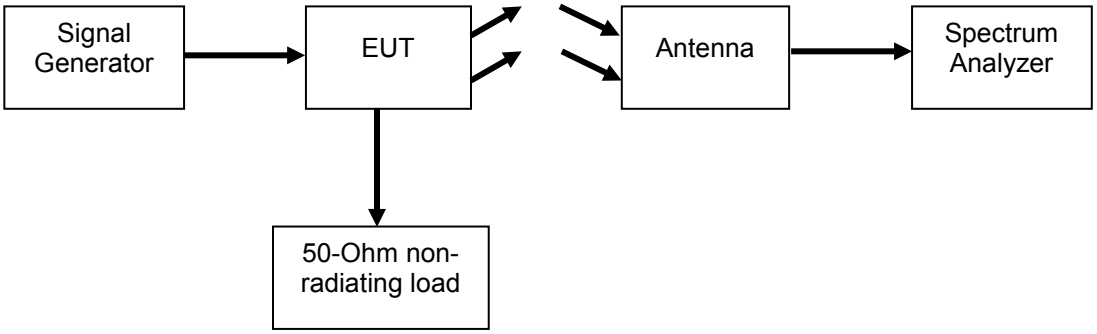
The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm. A signal generator was used to provide a CW signal. The EUT output was terminated into a 50 Ohm non-radiating load.

The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.

The following formula was used for calculating the limits:

Radiated Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13dBm
P1 = power in dBm
P2 = power in Watts

Test Setup



Test Results

Refer to Annex A for the Radiated Spurious Emissions Plots

Input versus Output signal comparison (Emission Masks)

Engineer: Poona Saber

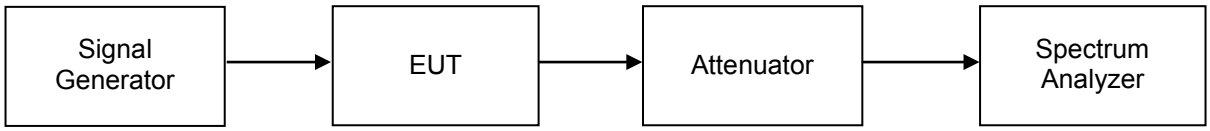
Test Date: 5/28/2021

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask.
A reference level plot is provided to verify that the peak power was established prior to testing the mask.
The EUT is a booster amplifier that does not contain a transmitter; representative emission designators used in the industry were used for the emission masks and are listed in Table 1.
The output signal was tested to the required mask.
The input signal was recorded and compared to the output signal.
The input and output was tested at 0.2 dB below the AGC Threshold and +3 dB above the AGC Threshold.

Emission Designator	Emission Mask	Type of Modulation	Occupied Bandwidth (kHz)	Channel Spacing (kHz)	Audio Frequency (kHz)	Deviation (kHz)	RBW (Hz)
16K0F3E	B	FM	16.0	25	1.0	5.0	300
11K3F3E	B	FM	11.3	12.5	1.0	2.5	100
8k30F1W	B	C4FM	-	-	-	-	100

Test Setup



Refer to Annex B for Emission Mask plots

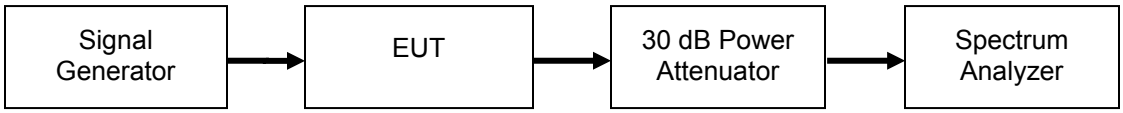
Intermodulation

Engineer: Poona Saber
Test Date: 5/22/2020

Test Procedure

The EUT was connected to a spectrum analyzer through a 30 dB power attenuator.
A signal generator with two tones were utilized to produce a two tone signal with the 25 KHz and 12.5 KHz channel spacing set so the intermodulation products fell within the operational band. Frequency at the maximum power from out of band rejection was utilized.
The Test was performed on both the uplink and downlink.
The RF input signal level was set to 0.2 dB below the AGC Threshold.
RBW = 300 Hz
Video BW = 3x RBW

Test Setup



Refer to Annex C for Intermodulation plots

Noise Figure Test

Engineer: Poona Saber

Test Date: 5/28/2020

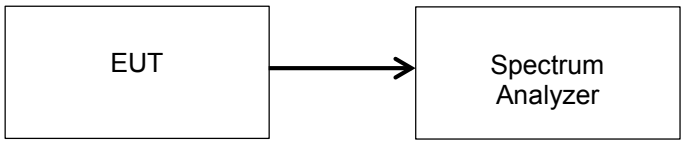
Test Procedure

The test equipment was connected as shown in the test set-up below.

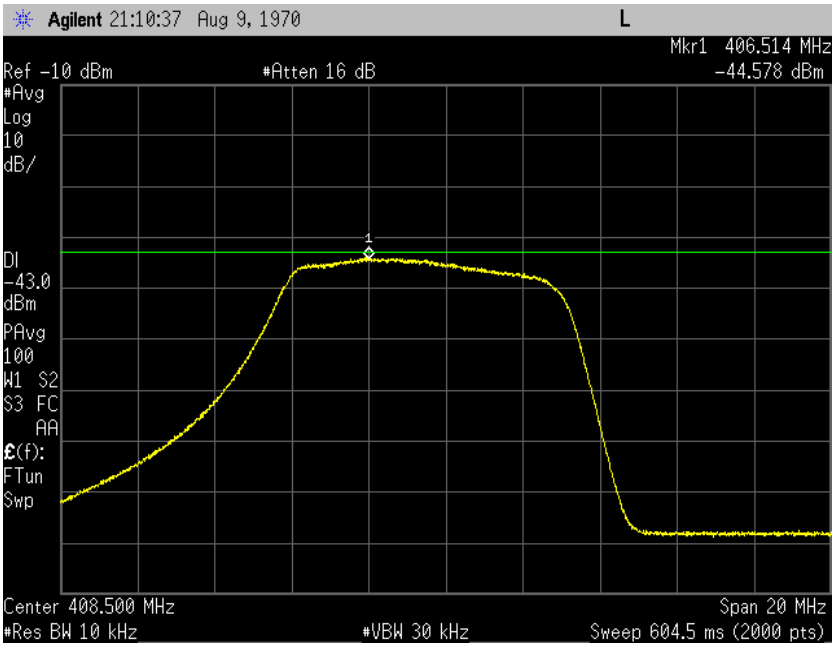
Note: The allowance per KDB 935210 D02 Signal Boosters Certification v03 was used to demonstrate compliance for Noise Figure.

"For the remote unit of a conventional fiber-connected host/remote DAS booster system, it is acceptable to submit compliance information and test data consistent with 90.219(d)(6)(ii) (i.e., ERP of noise ≤ −43 dBm in 10 kHz RBW) for the downlink path only, in place of 90.219(e)(2) noise figure test data (i.e., NF ≤ 9 dB for both UL and DL). Test reports must provide explicit details about instrumentation and procedure used for 90.219(d)(6)(ii) testing."

Test Setup



Test Results



Frequency (MHz)	Noise Figure (dBm)	Antenna Gain (dBm)	Noise Figure ERP(dBm)	Limit ERP (dBm)	Margin (dB)
408.5	-44.578	3.5 dBi	-43.228	-43	0.228

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/18	6/16/20
Bi-Log antenna	Chase	CBL6111C	i00267	3/8/18	3/8/20
Spectrum Analyzer	Agilent	E4407B	i00331	12/18/19	12/18/20
Signal Generator	Keysight/Agilent	E4438C	i00457	1/3/2020	1/3/2021
Signal Generator	Rohde & Schwarz	SMU200A	I00405	7/24/2019	7/24/2020
Spectrum Analyzer	Agilent	E4445A	I00471	12/11/2019	12/11/2020
DC Power Supply	Agilent	E3610A	I00569	Functional Verification	Functional Verification
Ultra Wideband LNA 10MHz-45GHz	RF-Lambda USA	RLNA00M45GA	I00555	Functional Verification	Functional Verification

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT