Genesys Aerosystems

REVISED EMC TEST REPORT TO 103888-5

Genesys Digital Radio
Model: GDR-2556U

Tested to The Following Standards:

FCC Part 2 / 87 Subpart D
(118.000MHz TO 136.975MHz)

Report No.: 103888-5A

Date of issue: July 23, 2020

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.01

Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Genesys Aerosystems
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Mineral Wells, TX 76067

Representative: B. Delong

REPORT PREPARED BY:

Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103888

DATE OF EQUIPMENT RECEIPT: June 1, 2020
DATE(S) OF TESTING: June 1-2, and 11, 2020
July 14, 2020

Revision History

Original: Testing of the Genesys Digital Radio, Model: GDR-2556U to FCC Part 2 / 87 Subpart D.
Revision A: To update EUT Configuration 1 in Equipment under Test Section. Replaced Data sheet, Test Data Summary table and photos for Section 2.1053 / 87.139(a) Field Strength of Spurious Radiation. Update Limit in Test Data Summary table of Section 2.1049 / 87.135 Occupied bandwidth.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

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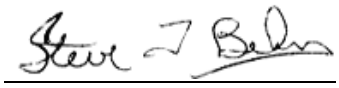


Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part(s) 2 / 87 Subpart D

Test Procedure	Description	Modifications	Results
2.1046 / 87.131	Output power (conducted)	NA	Pass
2.1051 / 87.139(a)	Spurious emissions at antenna terminal	MOD1	Pass
2.1053 / 87.139(a)	Field strength of spurious radiation	MOD1	Pass
2.1049 / 87.139(a)	Emission mask	NA	Pass
2.1049 / 87.135	Occupied bandwidth	NA	Pass
2.1047 / 87.141	Modulation limiting	MOD1	Pass
2.1047	Audio low-pass filter response	MOD1	Pass
2.1055 / 87.133(a)	Frequency Stability	NA	Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
MOD1: A voltage multiplier circuit was added to increase the available back bias voltage for the PIN diode transmit/receive switch. This increased the PIN diode back bias to 70 Vdc.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Genesys Digital Radio	Genesys Aerosystems	GDR-2556U	66-019044

Support Equipment:

Device	Manufacturer	Model #	S/N
DC Power Supply	Kepco	ATE 36-15M	F28979
GDR Radio Test Panel	Genesys Aerosystems		11
Laptop Computer	Dell	Latitude E5550	5CTGH72

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Genesys Digital Radio	Genesys Aerosystems	GDR-2556U	66-019044

Support Equipment:

Device	Manufacturer	Model #	S/N
DC Power Supply	Kepco	ATE 36-15M	F28979
GDR Radio Test Panel	Genesys Aerosystems		11
Laptop Computer	Dell	Latitude E5550	5CTGH72
Arbitrary waveform generator	HP	33120A	36023090

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
Genesys Digital Radio	Genesys Aerosystems	GDR-2556U	66-019044

Support Equipment:

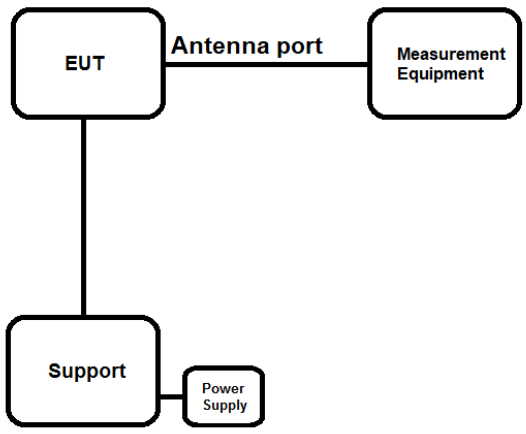
Device	Manufacturer	Model #	S/N
DC Power Supply	Kepco	ATE 36-15M	F28979
GDR Radio Test Panel	Genesys Aerosystems		11
Laptop Computer	Dell	Latitude E5550	5CTGH72
Termination	Narda	370 BNM	NA
Attenuator	Weinschel Corp	49-30-43	KW075
Arbitrary waveform generator	HP	33120A	36023090

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Transmission System:	Analog Voice telephony communication, Air traffic control
Operating Frequency Range(s):	118 to 136.975 MHz
Modulation Type(s):	AM
Maximum Duty Cycle:	20 %, continuous with forced airflow
Number of TX Chains:	One
Antenna Type(s) and Gain:	Mono pole, 3 dBi
Beamforming Type:	None
Antenna Connection Type:	External Connector
Nominal Input Voltage:	27.5Vdc
Firmware / Software used for Test:	3.05E

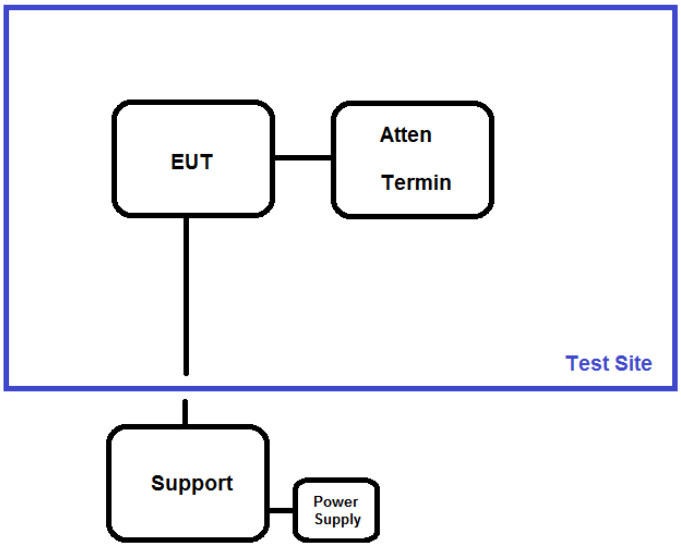
Block Diagram(s) of Test Setup

Test Setup Block Diagram



Conducted

Test Setup Block Diagram



Radiated

EUT Photos

Front View

Back View

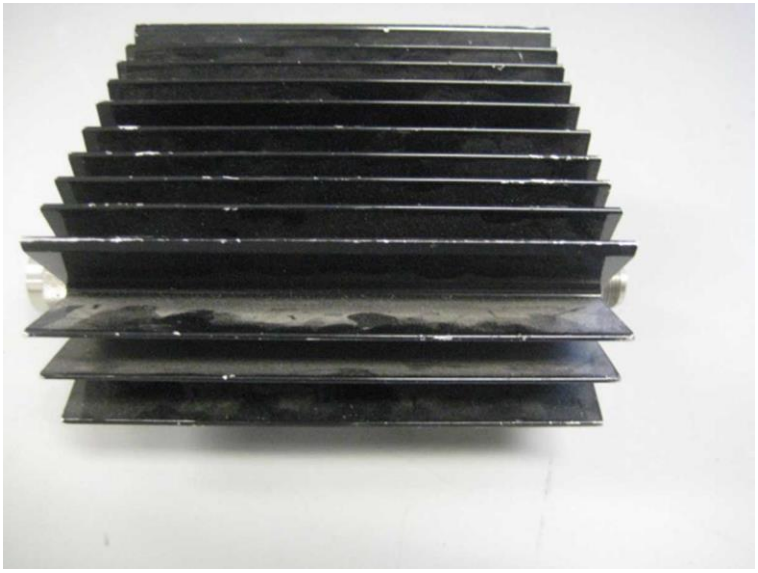
Left View

Side View

Top View

Bottom View

Accessory Photos



Attenuator

Laptop

Power Supply

Termination

Test Panel

Waveform Generator

FCC PART(S) 2 / PART 87 SUBPART D

2.1046 / 87.131 Output Power (Conducted)

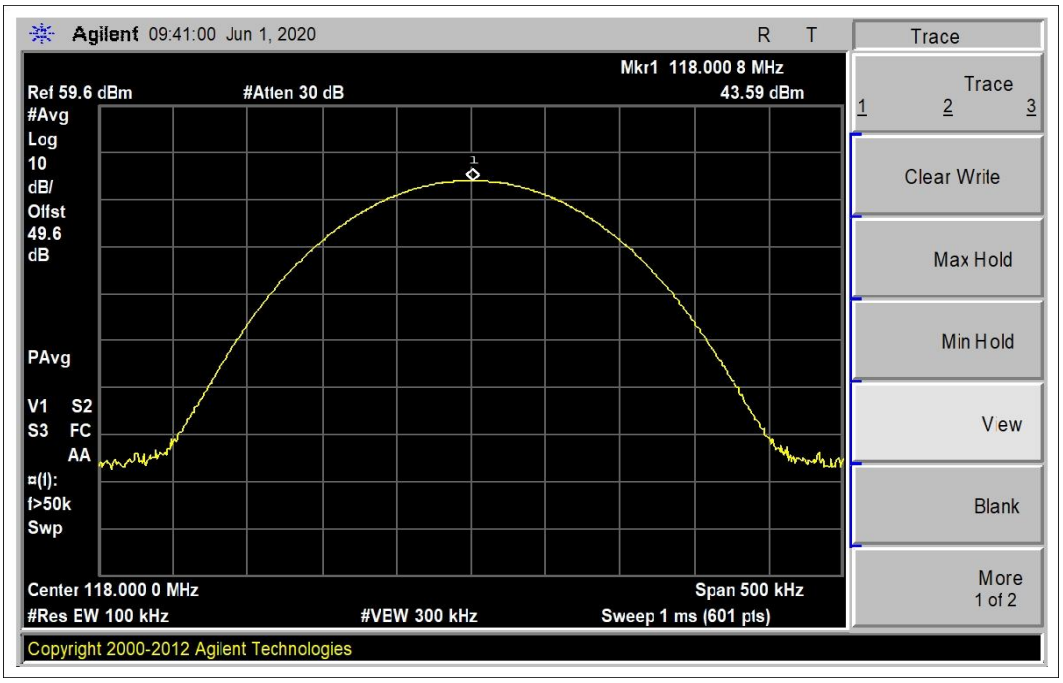
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/1/2020
Configuration:	1		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit at its rated power. The EUT is tested in its low (118.0MHz), middle (127.5MHz), and high (136.975MHz) channels. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	54

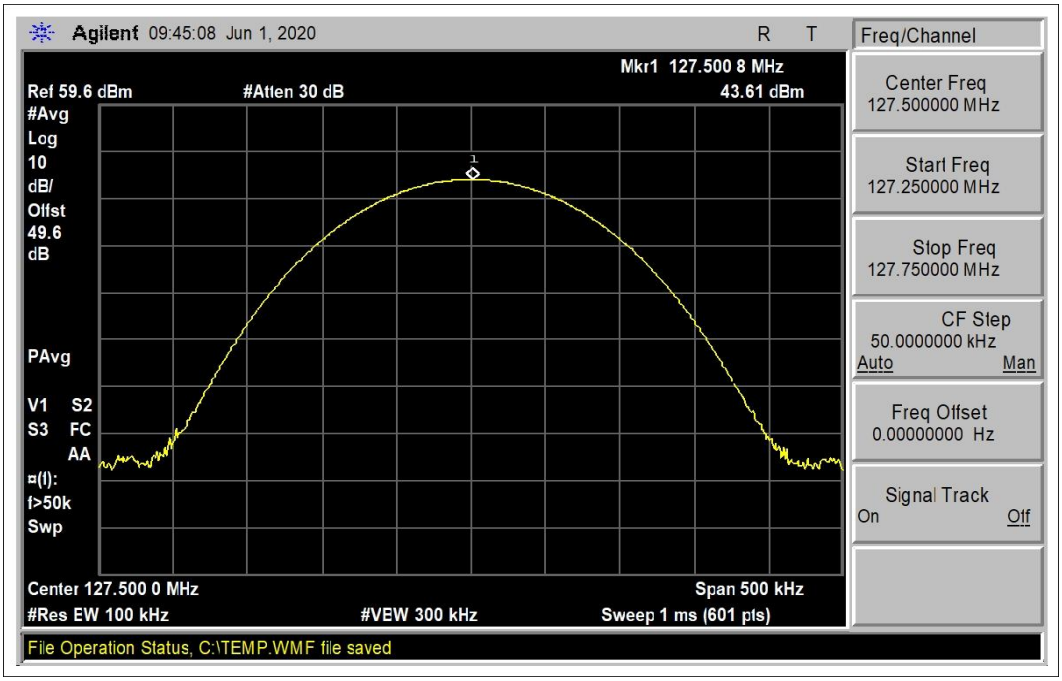
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P05954	Cable	Pasternack	RG-214/U	3/31/2020	3/31/2022
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022

Test Data Summary - RF Conducted Measurement						
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured RF Output Power (dBm)	EIRP (dBm)	ERP Limit (dBm)	Results
118.0	NA	Monopole / 3	43.59	46.59	46.99	Pass
127.5	NA	Monopole / 3	43.62	46.62	46.99	Pass
136.975	NA	Monopole / 3	43.60	46.60	46.99	Pass

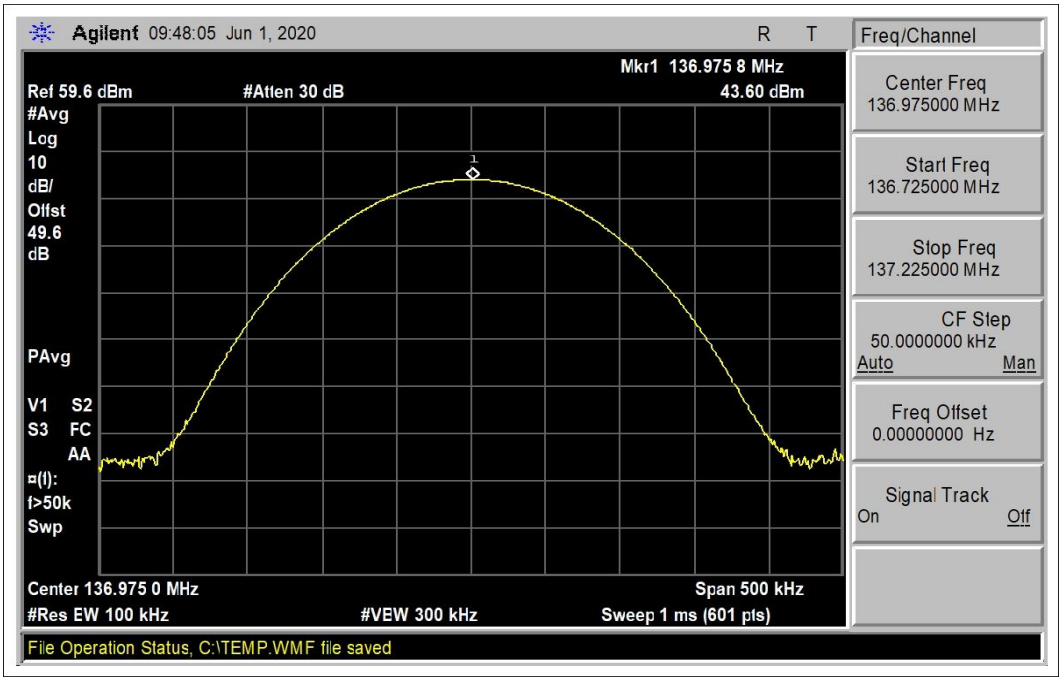
Test Data



Low Channel

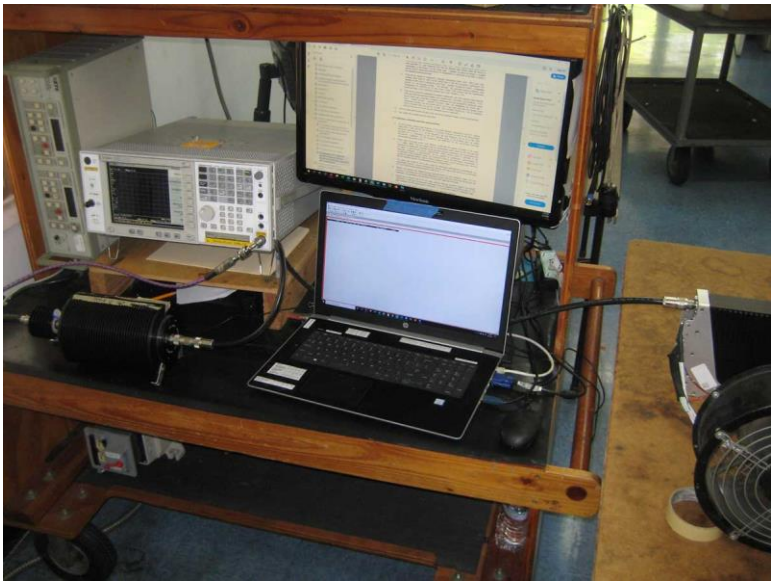


Middle Channel



High Channel

Test Setup Photo(s)



2.1051 / 87.139(a) Spurious Emissions at Antenna Terminal

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/11/2020
Configuration:	2		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit a modulated signal at its rated power. The EUT is tested in its low (118.0MHz), middle (127.5MHz), and high (136.975MHz) channels. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel. Modification 1 was in place during testing.		

Environmental Conditions			
Temperature (ºC)	22	Relative Humidity (%):	44

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/13/2019	3/13/2021
P01578	Attenuator	Bird	25-A-MFN-30	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P06978	Cable	Huber & Suhner Inc.	Sucoflex 104A	3/26/2020	3/26/2022

Test Data Summary					
Frequency (MHz)	**Polarity**	**Pk / Ave**	**Measured (dBm)**	**Limit (dBm)**	**Results**
273.941	Antenna Port	Pk	-15.3	-13	Pass
236.002	Antenna Port	Pk	-16.9	-13	Pass
254.992	Antenna Port	Pk	-17.0	-13	Pass
547.893	Antenna Port	Pk	-19.9	-13	Pass

Limit line for Conducted Spurious Emission

REQUIRED ATTENUATION = 43+10 LOG P DB

Limit	=	Power - Required Attenuation
	=	10 Log P – (43 +10Log P)
	=	~~10Log P~~ – 43 – ~~10Log P~~
	=	-43 dBW
	=	0.00005W (0.05mW)
	=	10 Log 0.00005/0.001
	=	-13dBm (94dBuV) at any power level.

Test Setup Photo(s)

2.1053 / 87.139(a) Field Strength of Spurious Radiation

Test Data Summary					
Frequency (MHz)	**Polarity**	**Pk / Ave**	**Measured (dBm)**	**Limit (dBm)**	**Results**
589.999	Vertical	Pk	-16.3	-13	Pass
382.500	Horizontal	Pk	-18.9	-13	Pass
943.998	Vertical	Pk	-19.4	-13	Pass
943.998	Horizontal	Pk	-20.2	-13	Pass
353.998	Vertical	Pk	-20.6	-13	Pass
637.500	Horizontal	Pk	-21.9	-13	Pass

Limit for Radiated Spurious Emission

REQUIRED ATTENUATION = 43+10 LOG P DB

Limit = Power - Required Attenuation
= 10 Log P – (43 +10Log P)
= ~~10Log P~~ – 43 – ~~10Log P~~
= -43 dBW
= 0.00005W (0.05mW)
= 10 Log 0.00005/0.001
= -13dBm at any power level.

ANSI 63.26 (2015) clause 5.2.7

E (dBµV/m) = EIRP (dBm) − 20log(D) + 104.8

where D is the measurement distance (in the far field region) in m.

Radiated Emission limit @ 3 meter = -13dBm-20Log (3) +104.8

= 82.23 dBuV/m (-24.8dBm/m) at any power level

Test Setup / Conditions / Data

Test Location:	CKC Laboratories Inc • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Genesys Aerosystems**		
Specification:	**47 CFR §87.139(a) Spurious Emissions**		
Work Order #:	**103888**	Date:	7/14/2020
Test Type:	**Maximized Emissions**	Time:	11:48:57
Tested By:	S. Yamamoto	Sequence#:	1
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

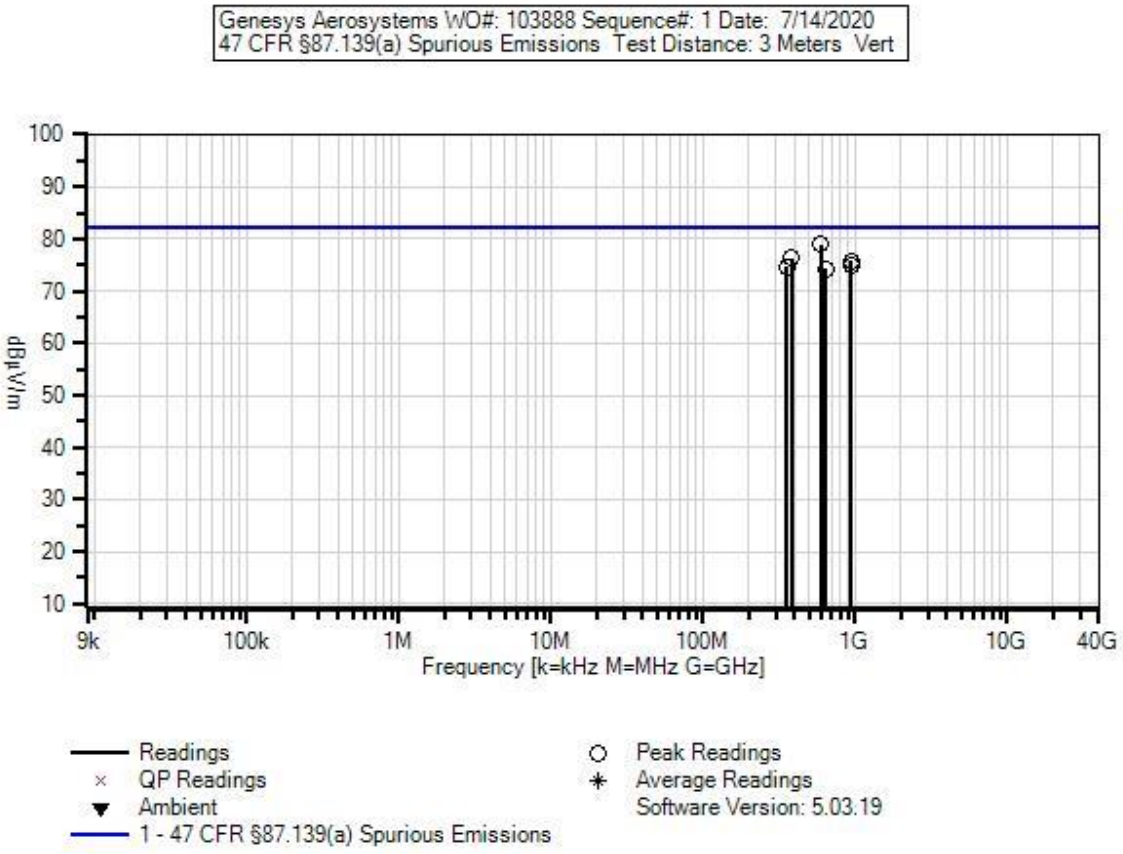
Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

The equipment under test (EUT) and support equipment are located together on the table top. The RF output of the EUT is connected to a high power attenuator and termination. The EUT is tested in its low (118.0MHz), middle (127.5MHz), and high (136.975MHz) channels. The EUT is set to continuously transmit a modulated signal at its rated power.The EUT is tested in each of the three axis system. The EUT VOR ILS receive port is populated with coaxial cable and fifty ohm termination. The EUT Marker receive port is populated with coaxial cable and fifty ohm termination. Voltage to the EUT is 27.5Vdc.

Environmental Conditions:
Temperature: 25°C
Humidity: 52%
Pressure: 99kPa.

Frequency range of data sheet is 9kHz to 9000MHz.
9kHz to 150kHz RBW=200Hz, VBW=600Hz
150kHz to 30MHz RBW=9kHz, VBW=30kHz
30MHz to 1000MHz, RBW=120kHz, VBW=1.2MHz
1000MHz to 9000MHz, RBW=1MHz, VBW=3MHz



Test Equipment:

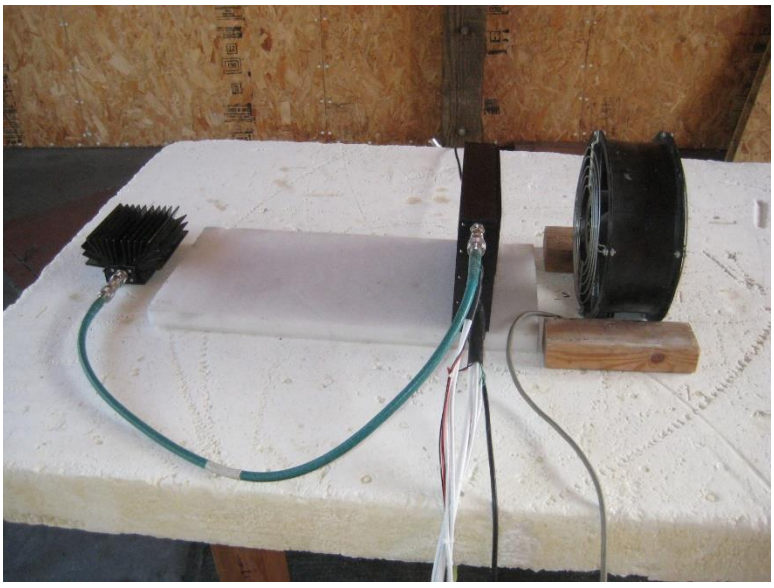
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	3/13/2019	3/13/2021
T1	ANP06978	Cable	Sucoflex 104A	3/26/2020	3/26/2022
T2	AN00010	Preamp	8447D	1/2/2020	1/2/2022
T3	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022
T4	ANP05569	Cable-Amplitude +15C to +45C (dB)	RG-214/U	12/24/2018	12/24/2020
T5	ANP05283	Attenuator	ATT-0218-06-NNN-02	3/26/2020	3/26/2022
T6	AN01994	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN00787	Preamp	83017A	5/31/2019	5/31/2021
	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022
	ANP07138	Cable	ANDL1-PNMNM-60	3/4/2019	3/4/2021
	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	589.999M	75.7	+0.2 +5.8	-28.0 +19.6	+2.8	+2.8	+0.0	78.9	82.2	-3.3	Vert
2	382.500M	77.7	+0.2 +5.9	-27.1 +15.2	+2.2	+2.2	+0.0	76.3	82.2	-5.9	Horiz
3	943.998M	66.3	+0.3 +5.9	-27.4 +23.4	+3.5	+3.8	+0.0	75.8	82.2	-6.4	Vert
4	943.998M	65.5	+0.3 +5.9	-27.4 +23.4	+3.5	+3.8	+0.0	75.0	82.2	-7.2	Horiz
5	353.998M	76.6	+0.2 +5.9	-26.8 +14.5	+2.1	+2.1	+0.0	74.6	82.2	-7.6	Vert
6	637.500M	70.3	+0.2 +5.9	-28.0 +20.0	+2.9	+3.0	+0.0	74.3	82.2	-7.9	Horiz

Test Setup Photo(s)

Below 1GHz



Below 1GHz

Above 1GHz

2.1049 / 87.139(a) Emissions Mask

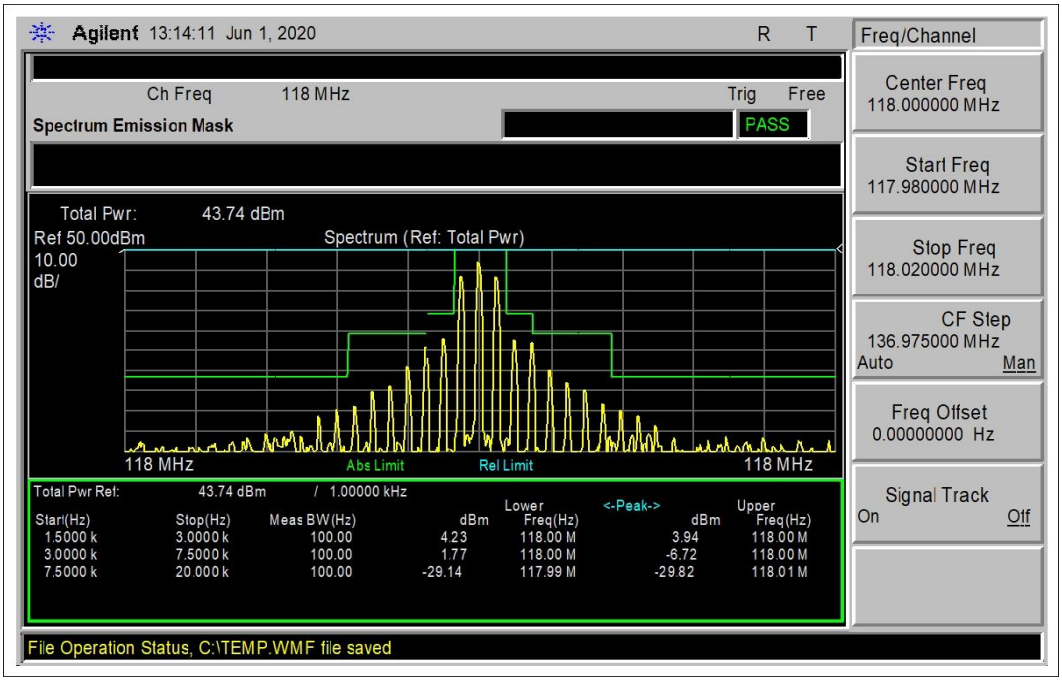
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/1/2020
Configuration:	2		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit a modulated signal at its rated power. The EUT is tested in its low (118.0MHz), middle (127.5MHz), and high (136.975MHz) channels. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	54

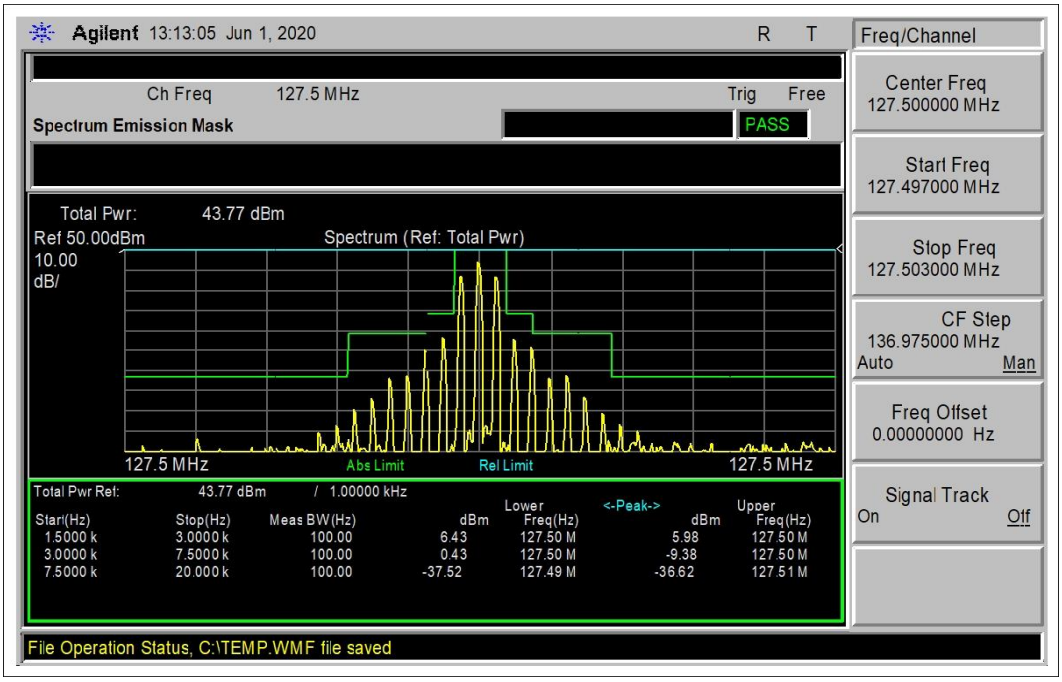
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P05954	Cable	Pasternack	RG-214/U	3/31/2020	3/31/2022
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022

Frequency (MHz)	Band Edge	SA Reading (dBm)	Total Band Edge (dBc/dBm)	RBW (Hz)	Limit (dBc/dBm)	Results
Low Frequency						
117.9985	Low	4.23	39.51dBc	100	25dBc	Pass
117.997	Low	1.77	41.97dBc	100	35dBc	Pass
117.9925	Low	-29.14	-29.14dBm	100	-13dBm	Pass
118.0015	High	3.94	39.8dBc	100	25dBc	Pass
118.003	High	-6.72	50.46dBc	100	35dBc	Pass
118.0075	High	-29.82	-29.82dBm	100	-13dBm	Pass
Middle Frequency						
127.4985	Low	6.43	37.34dBc	100	25dBc	Pass
127.497	Low	0.43	43.34dBc	100	35dBc	Pass
127.4925	Low	-37.52	-37.52dBm	100	-13dBm	Pass
127.5015	High	5.98	37.79dBc	100	25dBc	Pass
127.503	High	-9.38	53.15dBc	100	35dBc	Pass
127.5075	High	-36.62	-36.62dBm	100	-13dBm	Pass
High Frequency						
136.9735	Low	10.29	33.5dBc	100	25dBc	Pass
136.972	Low	3.52	40.27dBc	100	35dBc	Pass
136.9675	Low	-39.5	-39.5dBm	100	-13dBm	Pass
136.972	High	9.92	33.87dBc	100	25dBc	Pass
136.9735	High	-11.44	55.23dBc	100	35dBc	Pass
136.978	High	-38.27	-38.27dBm	100	-13dBm	Pass

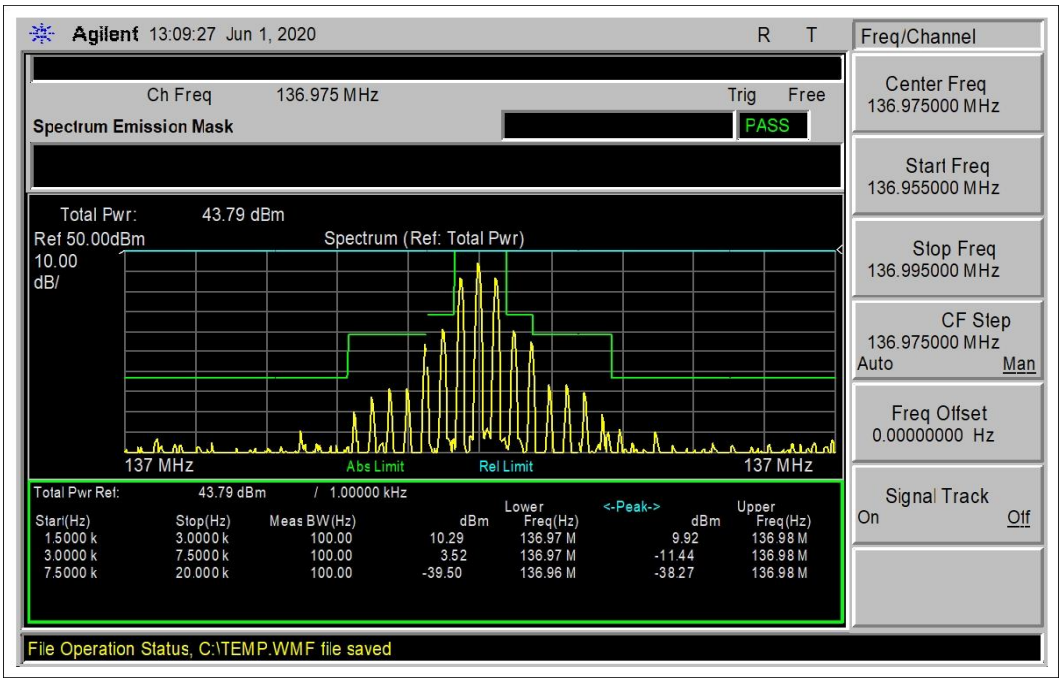
Emissions Mask



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)

2.1049 / 87.135 Occupied Bandwidth

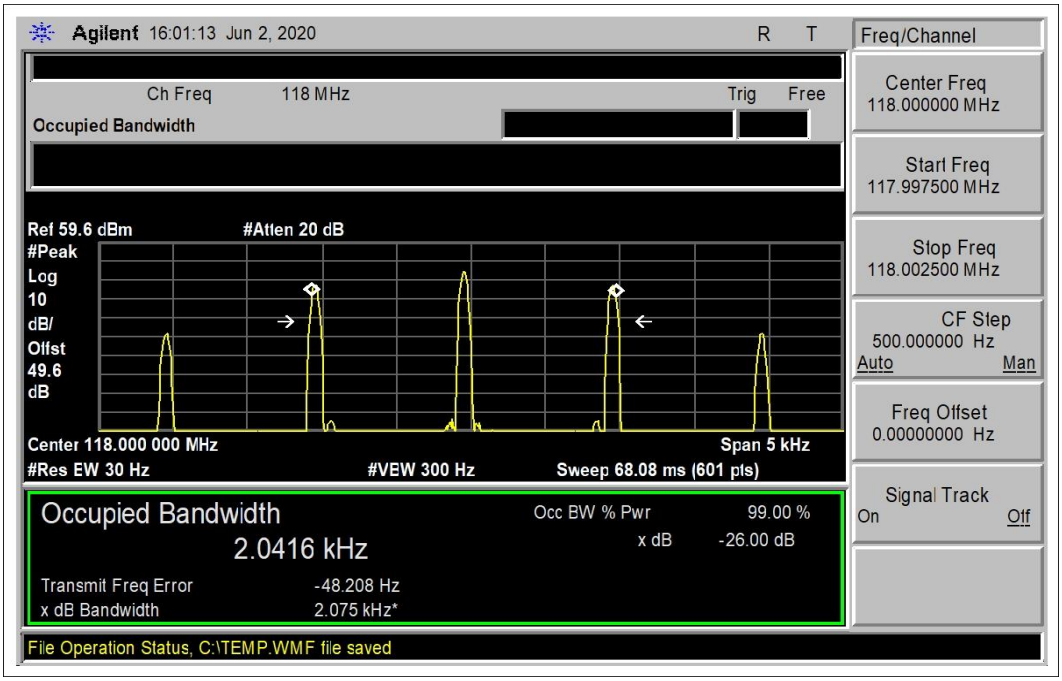
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/1/2020
Configuration:	2		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit a modulated signal at its rated power. The EUT is tested in its low (118.0MHz), middle (127.5MHz), and high (136.975MHz) channels. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	54

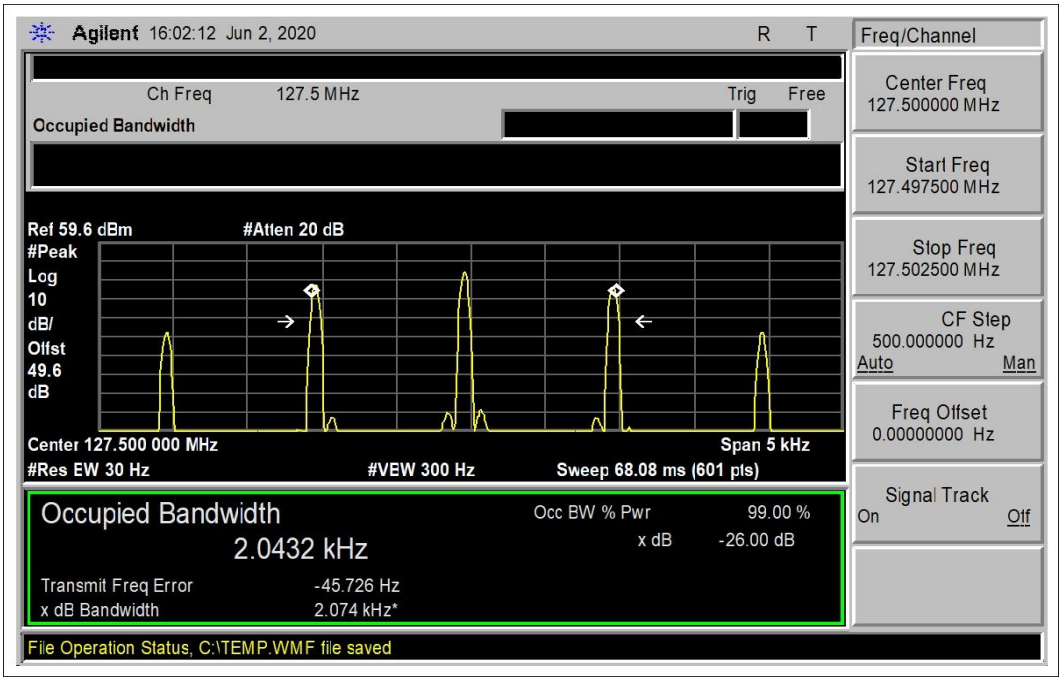
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P05954	Cable	Pasternack	RG-214/U	3/31/2020	3/31/2022
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022

99% Occupied Bandwidth Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (MHz)**	**Limit (MHz)**	**Results**
118	1	1kHz sinewave 85% AM	0.0020	0.025	Pass
127.5	1	1kHz sinewave 85% AM	0.0020	0.025	Pass
136.975	1	1kHz sinewave 85% AM	0.0020	0.025	Pass

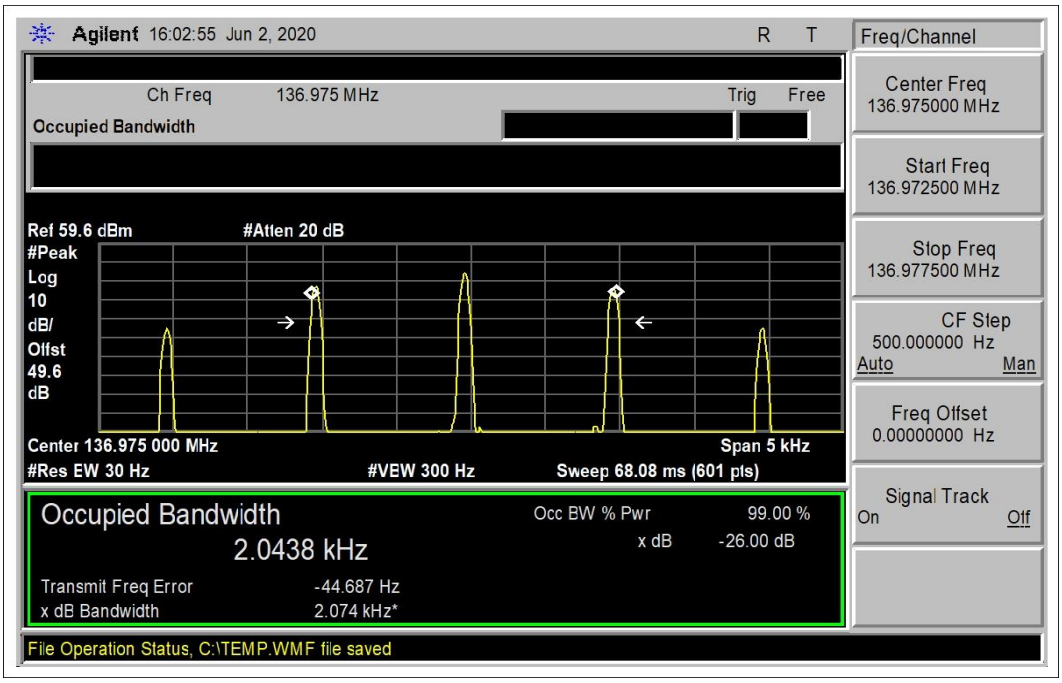
Plots



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)

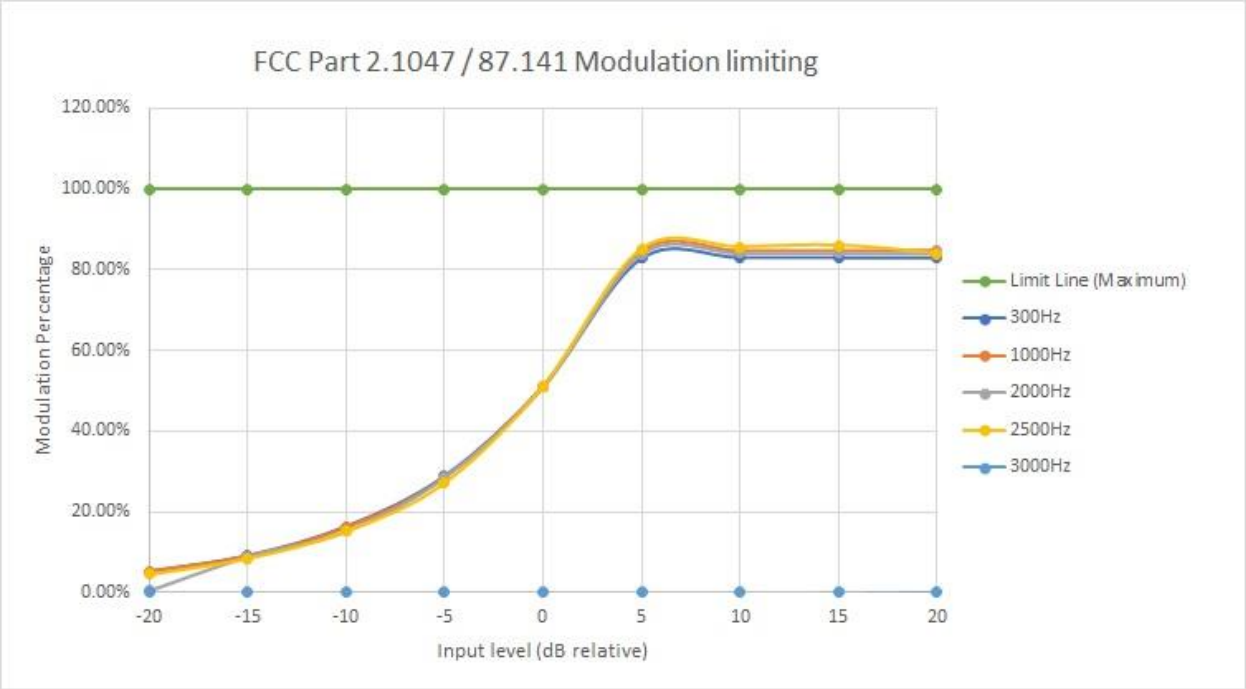
2.1047 / 87.141 Modulation Limiting

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/11/2020
Configuration:	1		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit a modulated signal at its rated power. The modulation source was either the characteristic analyzer or arbitrary waveform generator. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel. Modification 1 was in place during testing.		

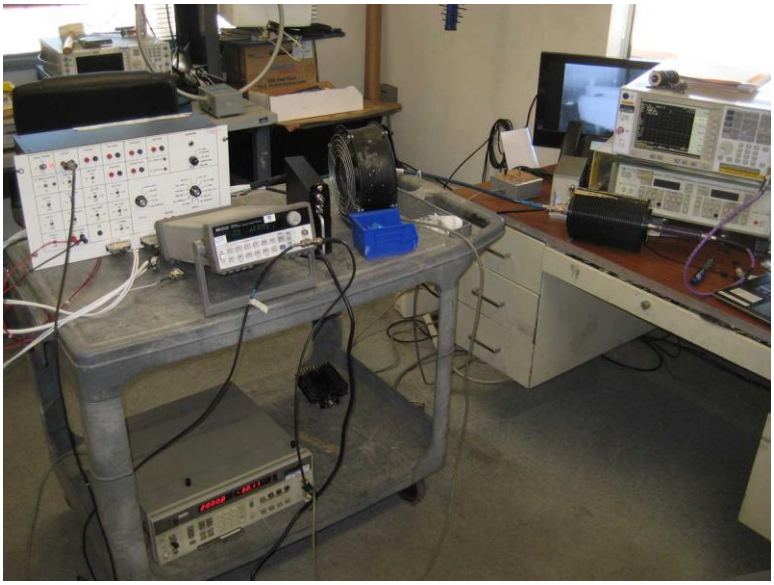
Environmental Conditions			
Temperature (ºC)	22	Relative Humidity (%):	44

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/13/2019	3/13/2021
P01578	Attenuator	Bird	25-A-MFN-30	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P06978	Cable	Huber & Suhner Inc.	Sucoflex 104A	3/26/2020	3/26/2022
02338	RF Characteristics Analyzer	HP	8903B	8/21/2018	8/21/2020
00838	Arbitrary Waveform Generator	HP	33120A	1/24/2019	1/24/2021

Test Data



Test Setup Photo(s)



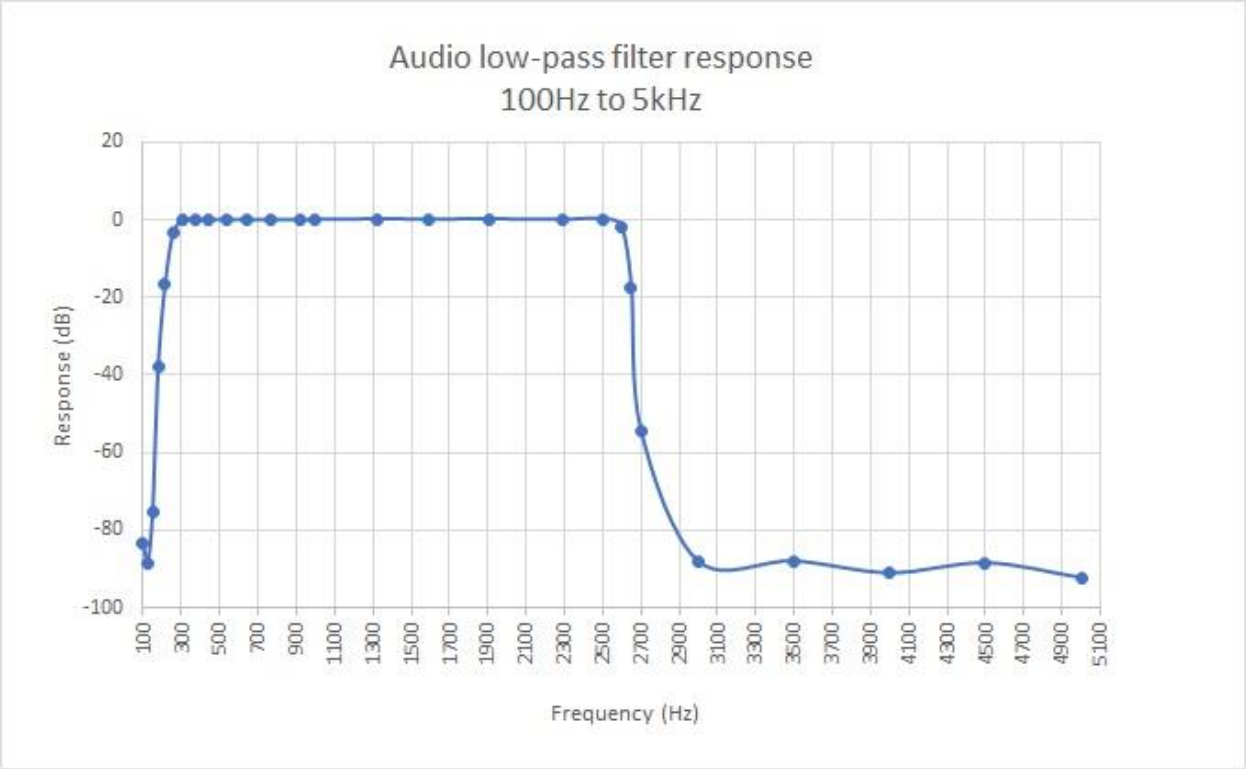
2.1047 Audio Low-Pass Filter Response

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/11/2020
Configuration:	1		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit a modulated signal at its rated power. The modulation source was the arbitrary waveform generator. Voltage to the EUT is 27.5Vdc. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel. Modification 1 was in place during testing.		

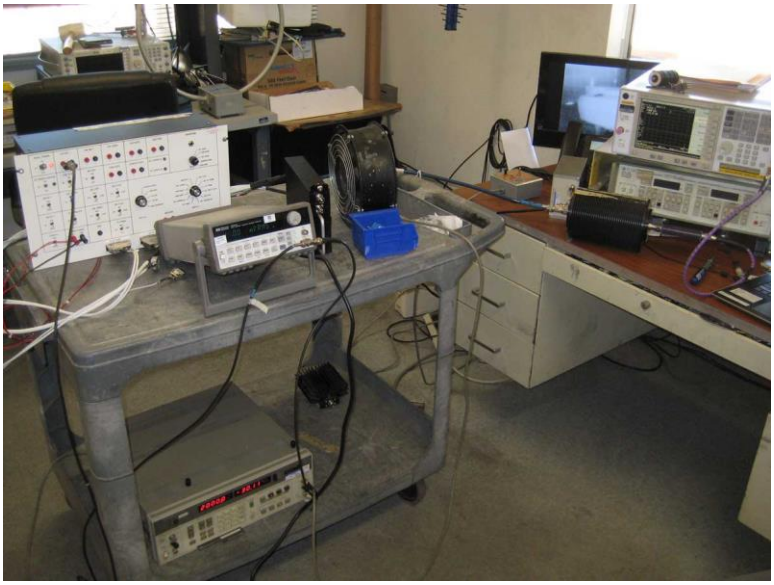
Environmental Conditions			
Temperature (ºC)	22	Relative Humidity (%):	44

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/13/2019	3/13/2021
P01578	Attenuator	Bird	25-A-MFN-30	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P06978	Cable	Huber & Suhner Inc.	Sucoflex 104A	3/26/2020	3/26/2022
00838	Arbitrary Waveform Generator	HP	33120A	1/24/2019	1/24/2021

Test Data



Test Setup Photo(s)



2.1055 / 87.133(a) Frequency Stability

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.26 (2015)	Test Date(s):	6/2/2020
Configuration:	1		
Test Setup:	The RF output of the EUT is connected to the spectrum analyzer via high power attenuators and coaxial cables. The EUT is set to continuously transmit at its rated power. The support external DC power supply is providing the required voltage to the back side of the GDR Radio Test Panel. The Radio Power port on the front side of the Test Panel connects to the EUT via unshielded wires. The TO UUT (COM) port and TO UUT (NAV) port connect to the EUT via shielded cables. The laptop computer is used to set the EUT frequency/channel. Modification 1 was in place during testing.		

Environmental Conditions			
Temperature (ºC)	22	Relative Humidity (%):	48

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P05161	Attenuator	JFW	50FHAO-020-200N	3/18/2019	3/18/2021
P05954	Cable	Pasternack	RG-214/U	3/31/2020	3/31/2022
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
01878	Temperature Chamber	Thermotron Corp.	S 1.2 Mini-Max	3/26/2019	3/26/2021
P05947	Thermometer	Fluke	51	4/28/2020	4/28/2022
P07164	Multimeter	Fluke	8845A/G	7/30/2019	7/30/2021

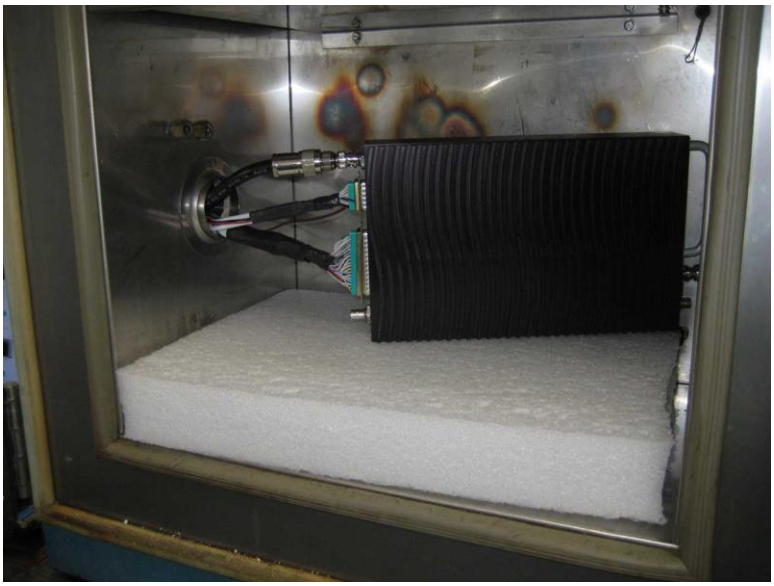
Test Data Summary				
Temp (ºC)	**Voltage** ($V_{nominal}$ except as noted)	**Low Channel Deviation (PPM)**	**Specification Channel Deviation (PPM)**	**Results**
-30		0.66	20	Pass
-20		0.66	20	
-10		0.23	20	
0		0.32	20	
10		0.22	20	
20	$V_{Minimum}$	0.03	20	
20		0.03	20	
20	$V_{Maximum}$	0.03	20	
30		0.02	20	
40		0.07	20	
50		0.14	20	
Maximum Deviation		0.66		

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
$V_{Nominal}$:	27.5Vdc
$V_{Minimum}$:	23.375Vdc
$V_{Maximum}$:	31.625Vdc

Test Setup Photo



SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.