

BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:

FCC Part 15 Subpart C, Section 15.247 Intentional Radiator

ARRIS Model Spectrum 110A Set Top Box
FCC ID: ACQ-SPECTRUM110

REPORT BEC-1839-05

TEST DATES: 10/03/2017 – 11/15/2017

CUSTOMER:

ARRIS Group Incorporated
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Horsham, PA 19044

PREPARED BY:


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Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	11/27/2017



1.0 Administrative Information

1.1 Project Details

Project Number	BEC-1893
Set Top Box Manufacturer	ARRIS Group Incorporated
Set Top Box Model Number	Spectrum 110A
Set Top Box Serial Number	CA0SBJ3NC9WN
Set Top Box Sample Number	1839-01 (Modified With SMA Ports to the BT Antenna)
Set Top Box Serial Number	CA0TBJLD72NH
Set Top Box Sample Number	1825-05 (Unmodified Antennas)
FCC ID	ACQ-SPECTRUM110
Bluetooth Chip Manufacturer	Cypress Semiconductor Corporation
Bluetooth Chip Model Number	CYW20704 Single Chip Blue Tooth Transceiver
Frequency of Operation	2400 - 2483.5 MHz
FCC Classification	DSS for Frequency Hopper
Test Laboratory Location	BEC Incorporated 970 East High Street Pottstown, PA 19464
Test Personnel	Paul Banker / Steve Fanella / JR Fanella
Test Performed For	ARRIS Group Incorporated 101 Tournament Drive Horsham, PA 19044
Customer Technical Contact	Tom Piacentino
Date Received	09/30/2017
Condition Received	Suitable for test
Sample Type	Production unit
EUT Description	Cable Set Top Box with wireless capability supporting Bluetooth
Applicable FCC Rule Part	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System



1.2 Preface

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures, and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

1.3 Test Result Summary Table

The ARRIS Model Spectrum 110A Set Top Box was tested to the following standards:

FCC Part 15, Subpart C Intentional Radiators	Test Description	Result
15.31(m)	Number of Operating Frequencies	PASS
15.203	Antenna Restrictions	PASS
15.204	Antenna Identification	PASS
15.205	Restricted Bands of Operation	PASS
15.207(b)	Conducted Emissions Power Leads 150 kHz to 30 MHz	PASS
15.209(a)	Spurious Radiated Emissions, 30 MHz to 25 GHz	PASS
15.247(a)(1)	Carrier Frequency Separation	PASS
15.247(a)(1)(iii)	Number of Hopping Frequencies	PASS
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	PASS
FCC DA 009705, ANSI C63.10 (6.9.2)	20 dB Bandwidth	PASS
15.247(b)(1)	Maximum Peak Power Output	PASS
15.247(d)	Band Edge Measurement	PASS
15.247(f)	Antenna Port, Power Spectral Density	PASS

Interpretation of Test Results: Where required, the EUT was tested in three modulation schemes; GFSK, QPSK and 8PSK. Also, each modulation scheme was tested at low, middle and high channel frequencies. The resultant data is presented by showing the worst case levels for each modulation type and/or frequency. All recorded results are maintained at BEC Inc.



1.4 Measurement Uncertainty

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Conducted Disturbance	N/A	150 kHz – 30 MHz	FCC Section 15.207	3.43
Radiated Disturbance	3 Meter	30 MHz – 1 GHz	FCC Section 15.209	4.50

No adjustments to measured data presented in this report are required because all values of uncertainty are less than the CISPR 16-4-2:2011 recommendations. These uncertainties have a coverage factor of $k = 2$, which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.

FCC Registered Test Site Number: US1118

1.5 Condition of Received Sample

An evaluation of the EUT was conducted in order to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damage was noted. The test item condition was deemed acceptable for the performance of the requested test services.

1.6 Climatic Environment

Unless noted elsewhere in this report, the following were the ambient conditions in the laboratory during testing:

Temperature: $22^{\circ} \pm 5^{\circ}$

Humidity: $50\% \pm 20\%$

Barometric Pressure: $1000\text{mb} \pm 20\%$

1.7 Test Equipment

All test equipment is checked to manufacturer's specifications and, when applicable, have current N.I.S.T. traceable, ISO 9002 conforming certificates of calibration. Test equipment used for the tests described herein is listed in Appendix A.



2.0 Equipment Under Test

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

2.1 EUT Description

The Spectrum product line includes the Spectrum 110A and Spectrum 210A. Both products are video home set tops with a wideband QAM tuner capable of up to 4 tunes. Video display capability is max 1080P60. Both products have fully compliant DOCSIS 3.0 embedded cable modems. The Spectrum 110A is capable of pause/live TV with internal SD card. The Spectrum 210A is capable of up to 4 DVR recordings with included HDD. Both products have capsense menu keys with Bluetooth and RF4CE wireless technologies.

2.2 Product Category

FCC Part 15, Subpart C (Section 15.247)

2.3 Product Classification

Intentional Radiator Testing Requirements DSS for Frequency Hopper Operation within the band of 2400 - 2483.5 MHz.

2.4 Test Configuration

The antenna within the ARRIS Spectrum 110A Set Top Box was controlled by software which allowed selection of frequency hopping (BR-Basic Rata of 1 Mbps or EDR-Enhanced Data Rate of 2 Mbps). When selecting specific transmission frequencies the software allows the technician to select Modulated or Un-modulated signals with choices of QPSK, GFSK or 8PSK Modulation Signatures. Output power was controlled as 1-Low, 2-Medium or 3-Maximum Output Power. Maximum Output was selected for all testing.

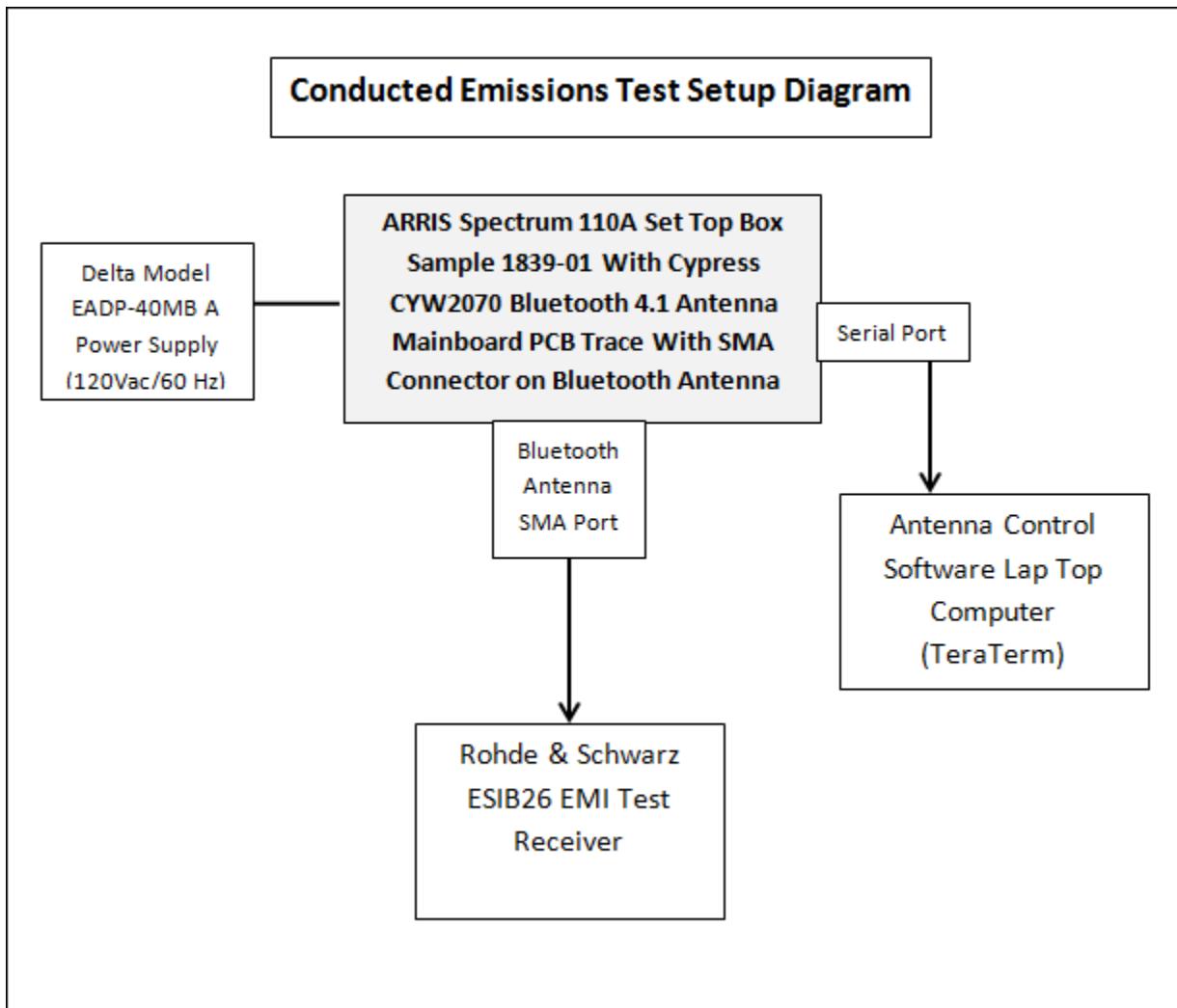
2.5 Test Configuration Rationale

The tested configuration of the EUT was required so that the test technician could view the characteristics of the antenna at specific frequencies and allow the technician to record the required measurements.



2.6 Test Configuration Diagram (Transmitter Conducted Measurements)

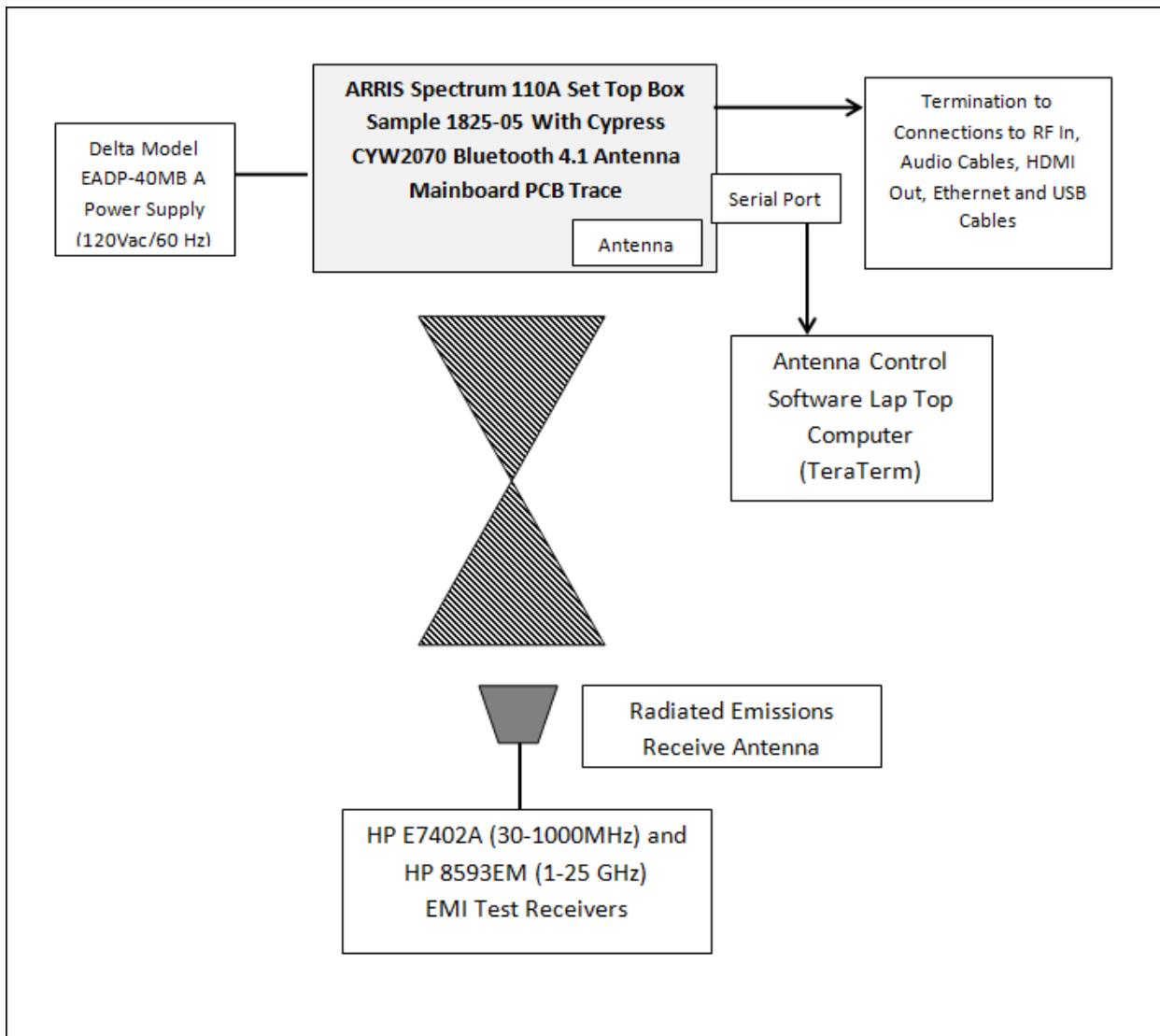
A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.





2.7 Test Configuration Diagram (Radiated/Conducted Measurements)

A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.





2.8 EUT Information, Interconnection Cabling and Support Equipment

EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Set Top Box (Modified BT Antenna with SMA Connector)	ARRIS	Spectrum 110A	CA0SBJ3NC9WN	1839-01
Set Top Box (Unmodified Antennas)	ARRIS	Spectrum 110A	CA0TBJLD72NH	1825-05

Interconnection Cable List (Conducted Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Workhorse	WHU18-3636-036	High Frequency RF Cable 1 to 40 GHz	Double Braid	1 Meter	Measurement Cable from the Antenna SMA Connector to the Rohde and Schwarz ESIB26 Receiver. Asset # BEC-814

Interconnection Cable List (Radiated Test Setup)

Type	Mfr/Part#	Shielding	Length	Description
Audio	Acoustic Research/PR161	95% braid w/100% aluminum Mylar foil	6 Feet	Audio Out Ports
HDMI	Monoprice/HH-28F-04E	Double Copper Braid	4 Feet	HDMI Port (Emissions)
75-Ohm Coax	Belden-T 9114 Duobond	Double Braid	1 Meter	RF In and RF Out
Ethernet CAT5	Siemon Co. / MC5-8-T-07-20	Mylar foil	7 Feet	Ethernet Port
USB	Hannstar/E52534-D	Braid over foil	2 Meters	USB Port

Support Equipment

Description	Manufacturer	Model	Serial Number
Ethernet Broadband Router	D-Link	DI-604	B25I16B000726
Lap Top Computer	Dell	Latitude C640	HB00X21
AC/DC Power Convertor for Spectrum 110A Set Top Box	Delta	EADP-40MB A	DTDG0140300274151009035



2.9 Test Signals and Test Modulation

The following table lists the individual hopping frequencies for the transmitter. The EUT can provide GFSK, QPSK or 8PSK modulation. The frequency hopping could be enabled and modulated by selection. The transmitter also could be programmed to control the output at Low, Medium and Maximum Output levels.

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
	GHz		GHz		GHz		GHz
1	2.402	21	2.422	41	2.442	61	2.462
2	2.403	22	2.423	42	2.443	62	2.463
3	2.404	23	2.424	43	2.444	63	2.464
4	2.405	24	2.425	44	2.445	64	2.465
5	2.406	25	2.426	45	2.446	65	2.466
6	2.407	26	2.427	46	2.447	66	2.467
7	2.408	27	2.428	47	2.448	67	2.468
8	2.409	28	2.429	48	2.449	68	2.469
9	2.410	29	2.430	49	2.450	69	2.470
10	2.411	30	2.431	50	2.451	70	2.471
11	2.412	31	2.432	51	2.452	71	2.472
12	2.413	32	2.433	52	2.453	72	2.473
13	2.414	33	2.434	53	2.454	73	2.474
14	2.415	34	2.435	54	2.455	74	2.475
15	2.416	35	2.436	55	2.456	75	2.476
16	2.417	36	2.437	56	2.457	76	2.477
17	2.418	37	2.438	57	2.458	77	2.478
18	2.419	38	2.439	58	2.459	78	2.479
19	2.420	39	2.440	59	2.460	79	2.480
20	2.421	40	2.441	60	2.461		

2.10 Grounding

Direct grounding of the test sample was accomplished through the coaxial cable connected to the RF input port of the EUT.

2.11 EUT Modifications

Except for the attachment of a SMA connector directly to the antenna output on the main board of the ARRIS Spectrum 110A Sample 1839-01 for conducted testing, no modifications were made to the units under test.



2.12 EUT Pictures ARRIS Model Spectrum 110A With Bluetooth Antenna Connection Conducted Testing Sample 1839-01

ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 FRONT SIDE

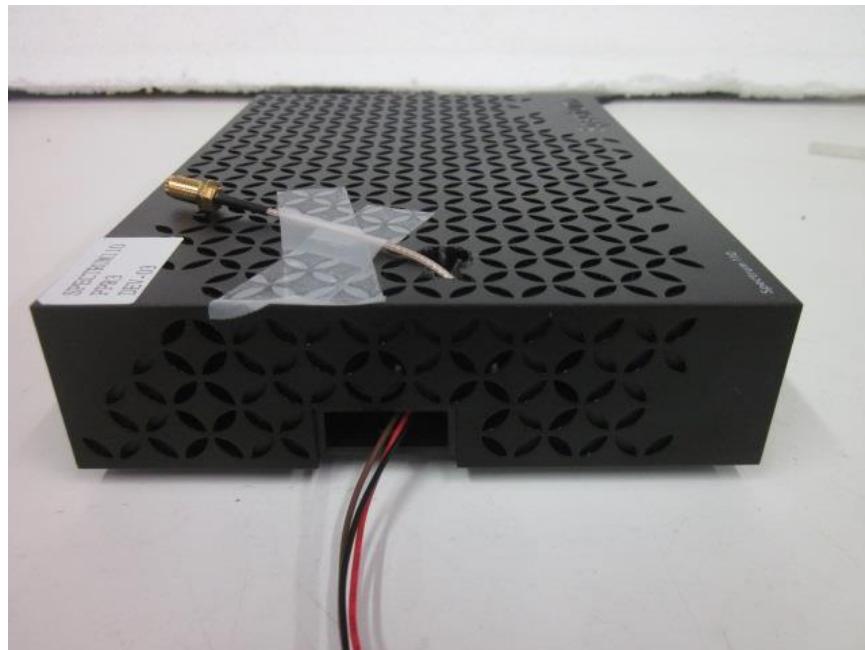


ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 REAR SIDE

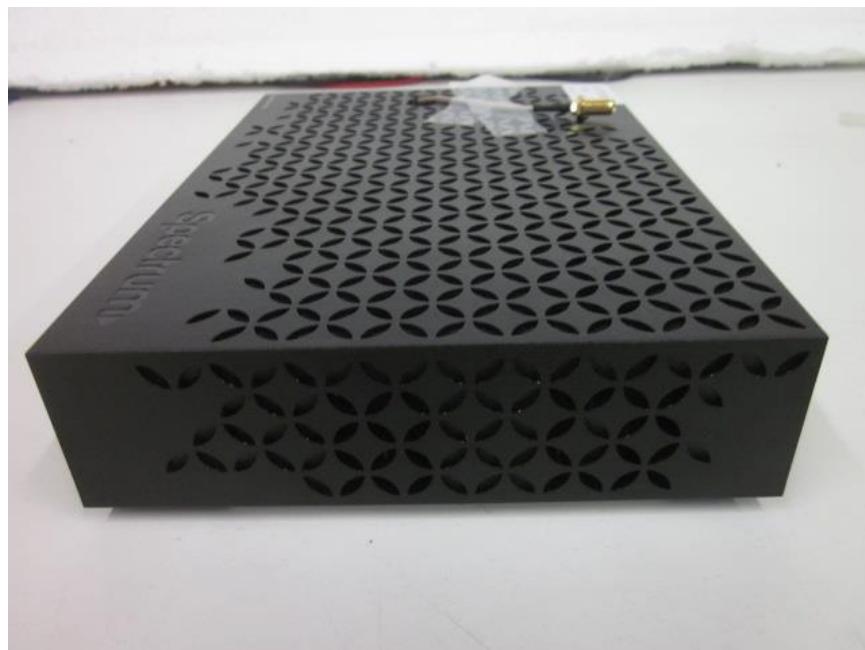




ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 LEFT SIDE

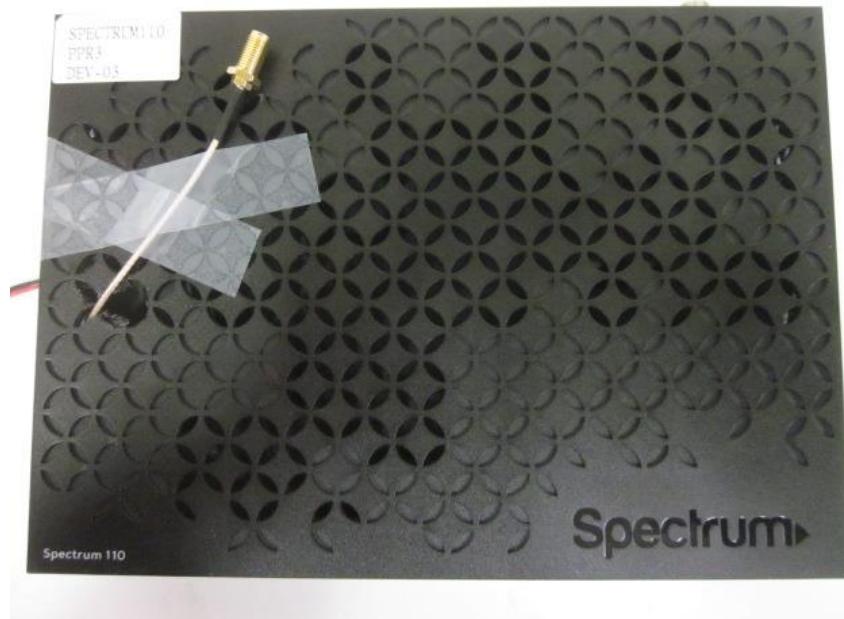


ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 RIGHT SIDE





ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 TOP SIDE

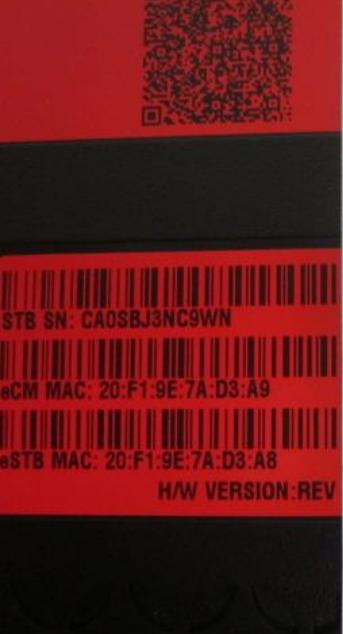


ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 BOTTOM SIDE





ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1839-01 SAMPLE TAG

	<p>Compliance Test Lab</p> <p><input checked="" type="checkbox"/> Test Item <input type="checkbox"/> Support Item</p> <p>Project/Sample #: <u>1839 - 01</u></p> <p>Customer: <u>ARRIS</u></p> <p>Model #: <u>SPECTRUM 110A FPR3</u></p> <p>Serial #: <u>CA0SBJ3NC9WN</u></p> <p>Item Received Date: <u>10/3/17</u></p> <p>Notes: <u>BT - CONDUCTED</u> <u>RF/CE - RADIATED</u></p> <p>BEC-F010002</p>
------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



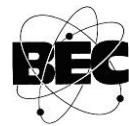
2.15 EUT Pictures ARRIS Model Spectrum 110A No Antenna Modifications Radiated Testing Sample 1825-05

ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1825-05 FRONT SIDE

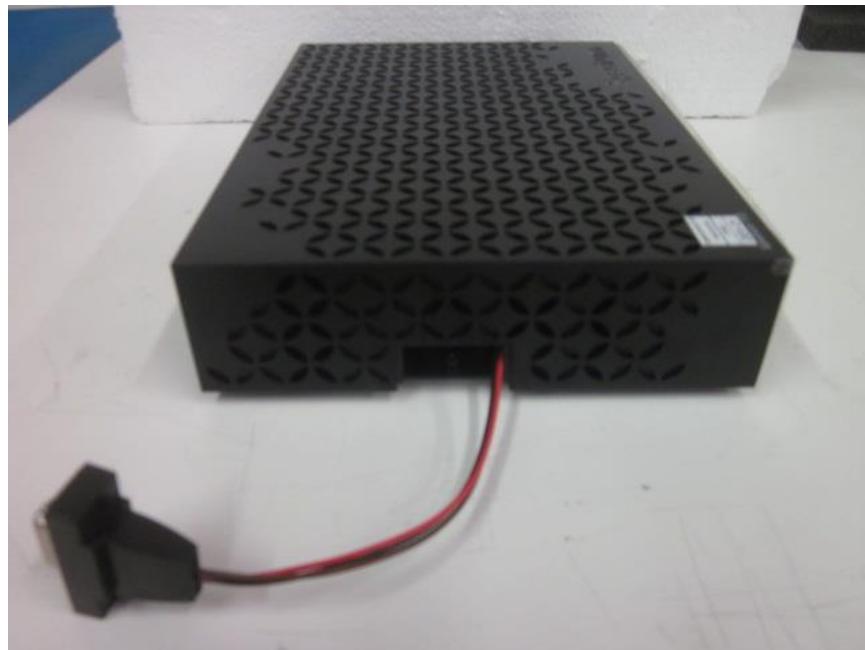


ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1825-05 REAR SIDE

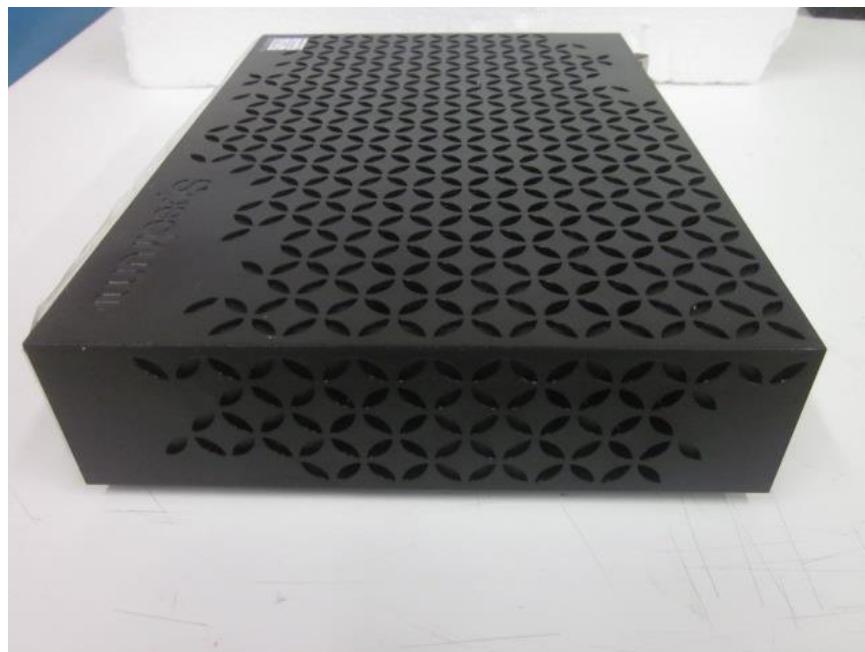




ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1825-05 LEFT SIDE



ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1825-05 RIGHT SIDE





ARRIS MODEL SPECTRUM 110A SET TOP BOX SAMPLE 1825-05 BOTTOM SIDE





3.0 Applicable Requirements, Methods, and Procedures

3.1 Applicable Requirements

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirements at the discretion of the customer, regulatory agencies, or other entities.

3.1.1 FCC Requirements

USA

Code of Federal Regulations:

Title 47 – Telecommunication

Chapter I - Federal Communications Commission

Sub-chapter A – General

Part 15 – Radio Frequency Devices

Subpart C - Intentional Radiators

3.1.2 Basic Test Methods and Test Procedures

ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

FCC Public Notice FCC DA 00-705, Released March 30, 2000, “Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.”

3.2 Deviations or Exclusions from the Requirements

No deviations or exclusions were made.



4.0 Test Results

4.1 Number of Operating Frequencies (47 CFR 15.31(m))

4.1.1 Hopping Frequency List

The table below details the 79 hopping frequencies contained in the 2.402 – 2.480 GHz band.

Channel	Frequency GHz	Channel	Frequency GHz	Channel	Frequency GHz	Channel	Frequency GHz
1	2.402	21	2.422	41	2.442	61	2.462
2	2.403	22	2.423	42	2.443	62	2.463
3	2.404	23	2.424	43	2.444	63	2.464
4	2.405	24	2.425	44	2.445	64	2.465
5	2.406	25	2.426	45	2.446	65	2.466
6	2.407	26	2.427	46	2.447	66	2.467
7	2.408	27	2.428	47	2.448	67	2.468
8	2.409	28	2.429	48	2.449	68	2.469
9	2.410	29	2.430	49	2.450	69	2.470
10	2.411	30	2.431	50	2.451	70	2.471
11	2.412	31	2.432	51	2.452	71	2.472
12	2.413	32	2.433	52	2.453	72	2.473
13	2.414	33	2.434	53	2.454	73	2.474
14	2.415	34	2.435	54	2.455	74	2.475
15	2.416	35	2.436	55	2.456	75	2.476
16	2.417	36	2.437	56	2.457	76	2.477
17	2.418	37	2.438	57	2.458	77	2.478
18	2.419	38	2.439	58	2.459	78	2.479
19	2.420	39	2.440	59	2.460	79	2.480
20	2.421	40	2.441	60	2.461		

Demonstration of compliance of intentional radiators that operate in a frequency range greater than 10 MHz shall test three frequencies, 1 near top, 1 near middle and 1 near bottom of range. The frequencies of 2.402, 2.440 and 2.480 GHz were selected for testing of the ARRIS Spectrum 110A.



4.2 Antenna Requirement (47 CFR 15.203)

The antenna used by the ARRIS Spectrum 110A is a short trace on the main PCB of the EUT. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

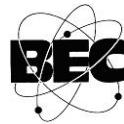
4.3 External RF power amplifiers and antenna modifications (47 CFR 15.204)

There are no RF power amplifier kits available to be used with the ARRIS Spectrum 110A. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.4 Restricted Bands of Operation 30 MHz - 25 GHz (47 CFR 15.205)

The emissions from the ARRIS Spectrum 110A, which fall in the restricted bands of operation, detailed in this section, comply with the limits of 15.209. The combinations of frequency and modulation that produced the highest emissions are shown. The EUT operated at maximum RF output at Low Frequency (LF) 2.402 MHz, Middle Frequency (MF) 2.440 GHz and High Frequency (HF) 2.480 GHz. GFSK (Gaussian Frequency Shift Keying), QPSK (Quadrature Phase Shift Keying) and 8PSK (Eight Phase Shift Keying) modulation methods were examined at each frequency.

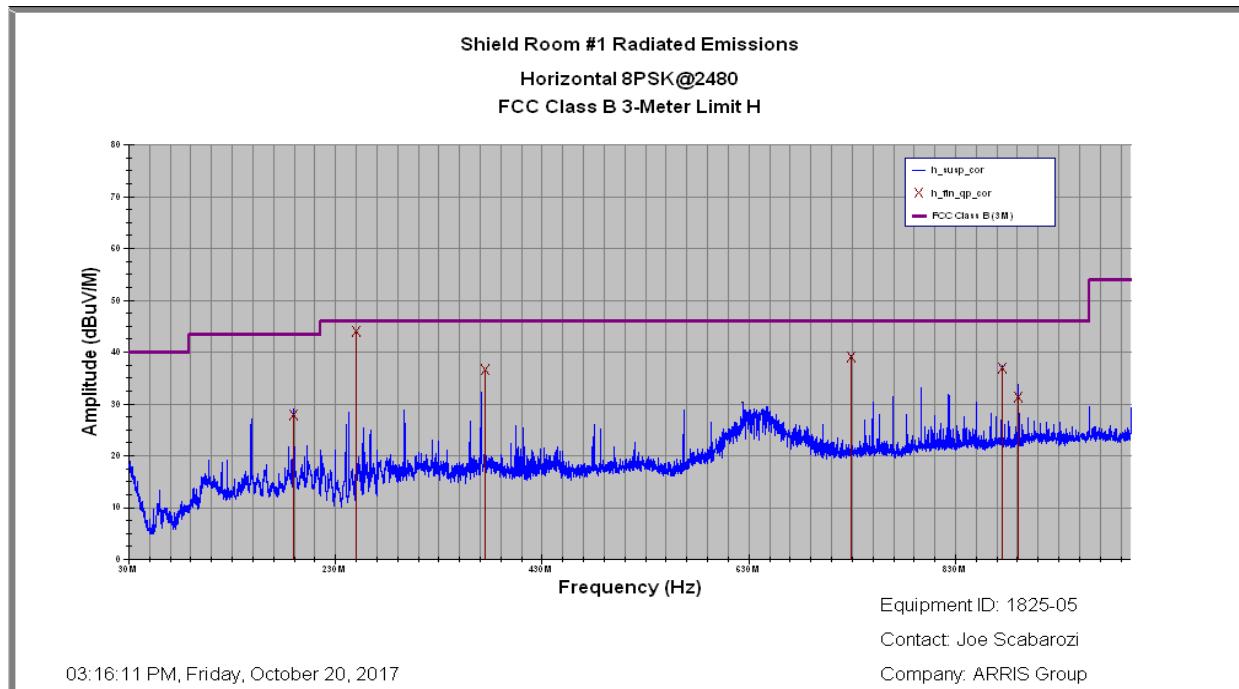
Measurement of the signals was performed with the EUT on a turntable and a variable height antenna mast at 3 meters distance. The signals residing in restricted bands of operation were the second harmonic of the carrier. The table below shows the highest emission measured among the nine combinations of frequency and modulation.



4.4.1 Restricted Bands of Operation (47 CFR 15.205) 30 MHz – 1000 MHz

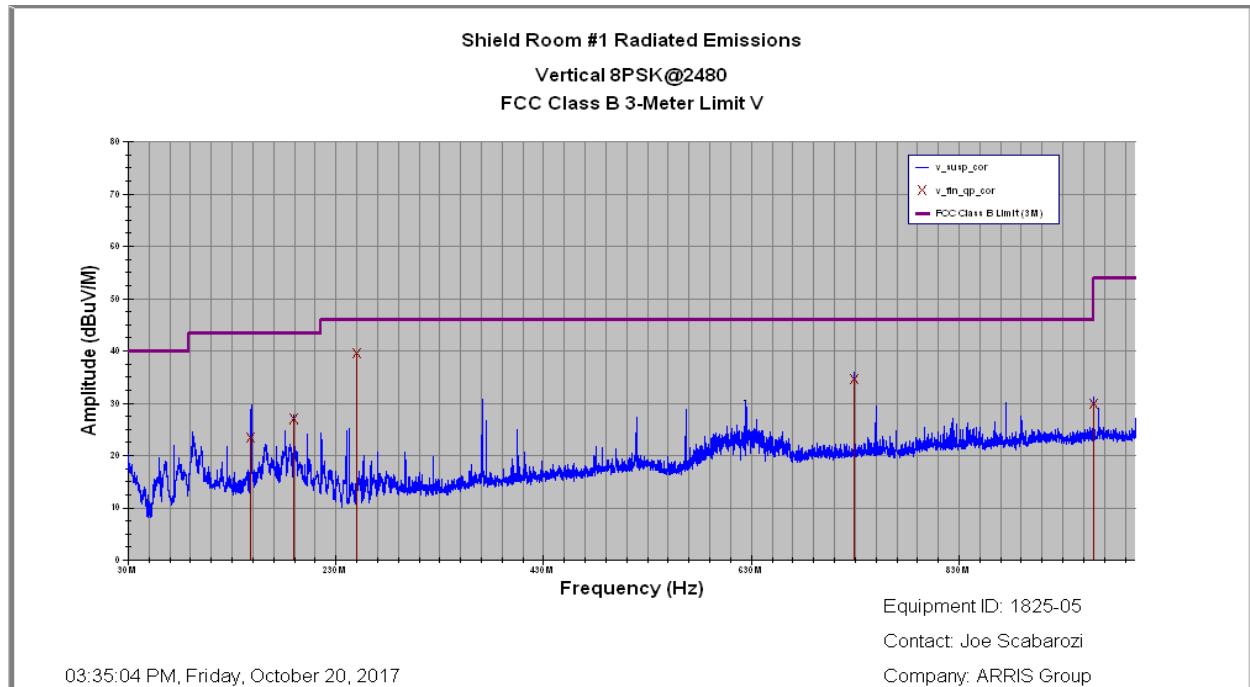
The table below shows the radiated emissions between 30 MHz and 1 GHz of the ARRIS Spectrum 110A measured at a distance of 3 meters. The emissions were measured for each of the high, middle and low transmitter frequencies and with each of the three modulation types. From the total of the nine possible tables, the transmitter frequency of 2.480 GHz with 8PSK modulation showed the highest emissions.

Frequency	Peak Measurement	QP Measurement	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC Class B Limit	Margin	Results
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
189.005	28.89	28	H	219	122	-14.25	43.52	-15.52	PASS
249.984	44.8	44.1	H	148	134	-13.3	46.02	-1.92	PASS
374.974	37.29	36.52	H	189	191	-9.99	46.02	-9.5	PASS
728.981	39.77	39.17	H	146	115	-4.57	46.02	-6.85	PASS
874.99	36.08	36.87	H	127	155	-2.35	46.02	-9.15	PASS
890.99	32.21	31.35	H	101	107	-2.16	46.02	-14.67	PASS





Frequency	Peak Measurement	QP Measurement	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC Class B Limit	Margin	Results
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
148.326	25.05	23.45	V	277	237	-13.3	43.52	-20.07	PASS
188.987	28.53	27.07	V	345	107	-14.25	43.52	-16.45	PASS
249.989	40.47	39.54	V	161	109	-13.3	46.02	-6.48	PASS
728.981	35.52	34.71	V	282	119	-4.57	46.02	-11.31	PASS
959.995	30.99	29.92	V	204	147	-1.31	46.02	-16.1	PASS
959.998	30.84	29.84	V	181	110	-1.31	46.02	-16.18	PASS



Test Results: The ARRIS Spectrum 110A complies with the requirements of 47 CFR Part 15.205 for restricted bands of operation.



4.4.2 Restricted Bands of Operation (47 CFR 15.205) 1 – 18 GHz

EUT Setting: GFSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.591E+09	38.61	28.27	H	234	164.3	-0.31	53.98	-25.713	73.98	-35.368	PASS
4.804E+09	47.23	41.28	H	49	101.9	2.26	53.98	-12.699	73.98	-26.754	PASS
4.845E+09	44.62	39.1	H	50	101.6	2.41	53.98	-14.884	73.98	-29.359	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.583E+09	38.47	28.09	V	191	156	-0.33	53.98	-25.887	73.98	-35.514	PASS
4.804E+09	55.75	52.88	V	191	110	2.25	53.98	-1.099	73.98	-18.226	PASS

EUT Setting: QPSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.594E+09	41.55	28.46	H	228	137.8	-0.3	53.98	-25.517	73.98	-32.43	PASS
4.845E+09	44.36	38.99	H	354	100	2.41	53.98	-14.995	73.98	-29.62	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.592E+09	39.61	28.13	V	134	111	-0.31	53.98	-25.848	73.98	-34.366	PASS
4.796E+09	38.96	29.52	V	189	184	2.22	53.98	-24.464	73.98	-35.017	PASS

EUT Setting: 8PSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.596E+09	37.52	28.15	H	259	172.3	-0.29	53.98	-25.831	73.98	-36.464	PASS
4.845E+09	42.99	37.33	H	315	137.8	2.41	53.98	-16.651	73.98	-30.989	PASS
1.51E+10	53.18	45.4	H	272	200.5	9.45	53.98	-8.585	73.98	-20.802	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.586E+09	40.21	28.23	V	217	128	-0.32	53.98	-25.747	73.98	-33.774	PASS
4.804E+09	47.7	40.65	V	181	179	2.26	53.98	-13.332	73.98	-26.285	PASS


EUT Setting: GFSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.588E+09	37.81	28.08	H	261	101.4	-0.32	53.98	-25.9	73.98	-36.17	PASS
4.845E+09	43.73	39.07	H	360	132.3	2.41	53.98	-14.914	73.98	-30.249	PASS
4.88E+09	48.74	41.6	H	317	99.1	2.54	53.98	-12.375	73.98	-25.235	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.582E+09	36.23	28.06	V	168	181	-0.34	53.98	-25.918	73.98	-37.748	PASS
4.88E+09	52.84	49.81	V	27	100	2.54	53.98	-4.168	73.98	-21.135	PASS

EUT Setting: QPSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.597E+09	36.85	27.93	H	215	152.3	-0.29	53.98	-26.046	73.98	-37.128	PASS
4.845E+09	44.85	41.09	H	28	98.9	2.41	53.98	-12.894	73.98	-29.129	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.595E+09	39.95	28.5	V	214	128	-0.3	53.98	-25.484	73.98	-34.027	PASS
4.869E+09	38.54	29.59	V	221	209	2.5	53.98	-24.394	73.98	-35.439	PASS

EUT Setting: 8PSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.591E+09	37.35	27.98	H	73	111.2	-0.31	53.98	-26.001	73.98	-36.628	PASS
4.845E+09	44.58	40.57	H	30	101.7	2.41	53.98	-13.412	73.98	-29.4	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.588E+09	37.85	28.29	V	331	133	-0.32	53.98	-25.692	73.98	-36.13	PASS
4.845E+09	45.95	42.04	V	96	112	2.41	53.98	-11.941	73.98	-28.029	PASS
4.88E+09	48.83	42.15	V	191	149	2.54	53.98	-11.831	73.98	-25.146	PASS


EUT Setting: GFSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	34.15	31.62	H	318	100.3	-5.18	53.98	-22.36	73.98	-39.83	PASS
3.581E+09	38.79	27.84	H	71	129.7	-0.34	53.98	-26.135	73.98	-35.19	PASS
4.837E+09	37.74	29.42	H	106	132.7	2.38	53.98	-24.557	73.98	-36.239	PASS
4.96E+09	51.21	47.95	H	317	101.4	2.85	53.98	-6.034	73.98	-22.771	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	32.06	30.05	V	182	101	-5.18	53.98	-23.926	73.98	-41.921	PASS
3.579E+09	38.73	28.25	V	333	197	-0.35	53.98	-25.725	73.98	-35.248	PASS
4.956E+09	37.13	29.61	V	270	199	2.83	53.98	-24.368	73.98	-36.846	PASS

EUT Setting: QPSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	31.88	27.07	H	220	101.4	-5.18	53.98	-26.907	73.98	-42.1	PASS
3.588E+09	37.46	27.75	H	145	113.6	-0.32	53.98	-26.226	73.98	-36.518	PASS
4.845E+09	45.53	40.97	H	30	103.5	2.41	53.98	-13.007	73.98	-28.449	PASS
1.514E+10	54.15	45.27	H	313	192	9.38	53.98	-8.707	73.98	-19.829	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	33.04	27.52	V	181	146	-5.18	53.98	-26.462	73.98	-40.939	PASS
3.593E+09	38.25	28.66	V	169	108	-0.3	53.98	-25.317	73.98	-35.732	PASS
4.845E+09	42.8	38.41	V	352	110	2.41	53.98	-15.574	73.98	-31.179	PASS
4.96E+09	49.42	43.91	V	194	130	2.85	53.98	-10.073	73.98	-24.561	PASS

EUT Setting: 8PSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	30.43	25.32	H	85	139.9	-5.18	53.98	-28.662	73.98	-43.549	PASS
3.593E+09	35.77	27.92	H	125	102.8	-0.3	53.98	-26.058	73.98	-38.211	PASS
4.842E+09	38.23	28.95	H	336	123.6	2.4	53.98	-25.029	73.98	-35.752	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	29.95	24.6	V	179	105	-5.18	53.98	-29.378	73.98	-44.03	PASS
3.595E+09	41.37	28.48	V	215	121	-0.3	53.98	-25.502	73.98	-32.607	PASS
4.845E+09	43.19	39.33	V	176	146	2.41	53.98	-14.654	73.98	-30.789	PASS
4.96E+09	44.93	36.76	V	183	152	2.85	53.98	-17.223	73.98	-29.053	PASS

Test Results: The ARRIS Spectrum 110A complies with the requirements of 47 CFR Part 15.205 and 47 CFR Part 15.209.

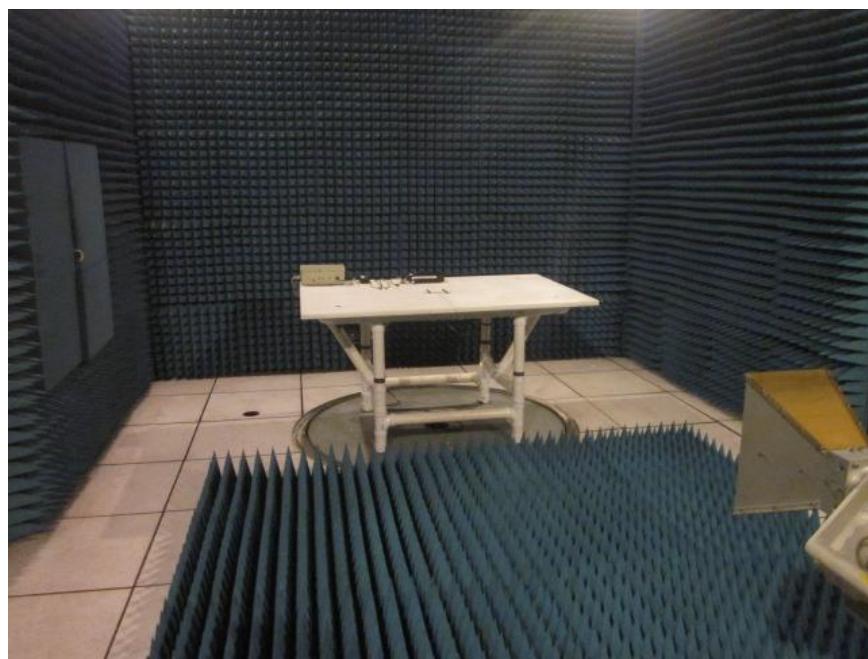


4.4.3 Restricted Bands of Operation and Spurious Emissions (47 CFR 15.205 and 47 CFR 15.205) Test Setup Pictures

30 – 1000 MHz



1 – 18 GHz





4.5 Conducted Emissions AC power leads (47 CFR 15.207(b))

AC Power Line

Conducted emissions at the power line input of the EUT were measured with an EMI receiver set to the appropriate detector and CISPR bandwidth, which was connected to the RF output of a 50 Ω , 50 μ H Line Impedance Stabilization Network (LISN) installed in each power line. Measurements were made over the frequency range of 150 kHz to 30 MHz while the EUT was operating as described in the EUT section of this report. The significant amplitudes of emissions measured on the AC power lines of the EUT were recorded as follows:

Emission (dB μ V) = Meter Reading (dB μ V) + Cable Loss (dB) + LISN Factor (dB) + Limiter Loss (dB)

4.5.1 Conducted Emissions AC power leads (47 CFR 15.207(b)) EUT Test Configuration Description

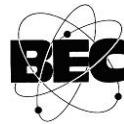
The ARRIS Spectrum 110A Set Top Box Sample 1825-05 was tested with the 3 Different Modulation Schemes testing each at a Low (2402 MHz), Medium (2440 MHz) and High (2480 MHz) Frequency.

4.5.2 Conducted Emissions AC power leads (47 CFR 15.207(b)) EUT Test Results Summary For Delta Model ADP-36KR A Power Supply Sample 1825-05 (10/20/2017)

The summary table below shows the highest average and quasi-peak detected signals for each of nine configurations tested. Detailed tabular results for the worst case levels follow.

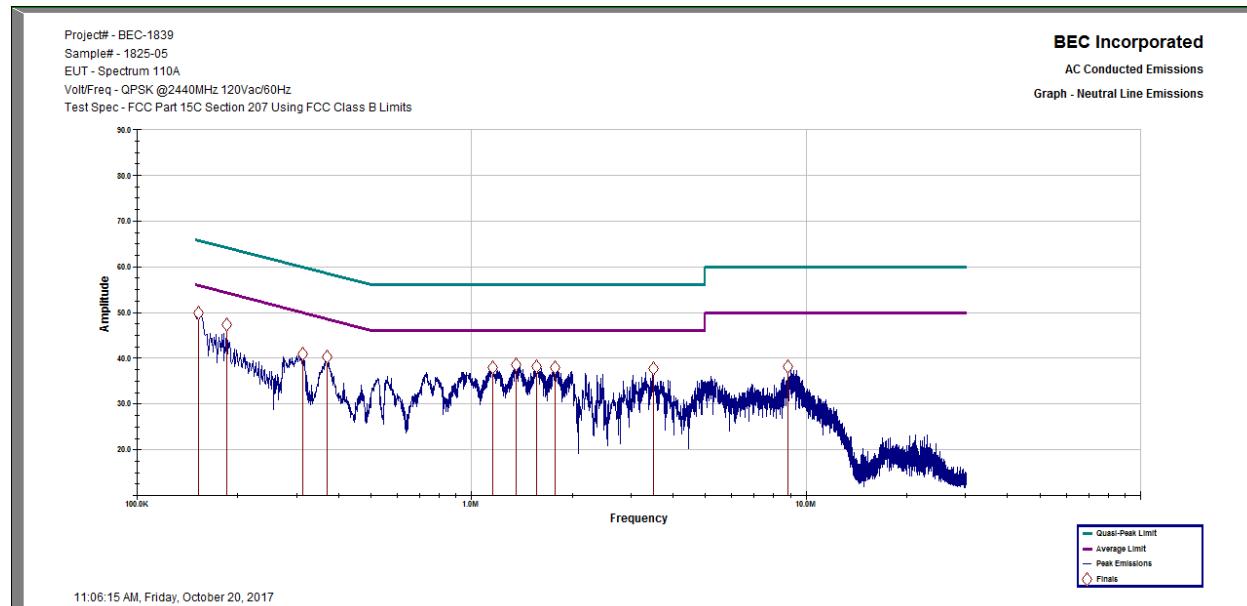
Summary Table Modulation Schemes

GFSK	Closest Average Margin	Closest QP Margin
Channel 01 (2402 MHz)	-16.07	-18.69
Channel 39 (2440 MHz)	-16.24	-18.05
Channel 79 (2480 MHz)	-15.4	-17.97
QPSK		
Channel 01 (2402 MHz)	-16.18	-17.96
Channel 39 (2440 MHz)	-15.37	-17.67
Channel 79 (2480 MHz)	-16.15	-17.71
8PSK		
Channel 01 (2402 MHz)	-15.5	-17.76
Channel 39 (2440 MHz)	-16.02	-17.78
Channel 79 (2480 MHz)	-15.94	-17.55



4.5.3 Conducted Emissions, AC power line, 47 CFR 15.207(b)

BEC Incorporated Neutral Line Conducted Emissions 11:10:50 AM, Friday, October 20, 2017							
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
152.539 KHz	35.50	55.93	-20.43	48.18	65.93	-17.75	10.030
185.995 KHz	33.76	54.97	-21.22	40.45	64.97	-24.52	10.030
309.695 KHz	24.48	51.44	-26.96	38.37	61.44	-23.07	10.049
365.126 KHz	30.86	49.85	-18.99	37.76	59.85	-22.09	10.130
1.153 MHz	28.50	46.00	-17.50	35.93	56.00	-20.07	10.240
1.370 MHz	24.57	46.00	-21.43	34.50	56.00	-21.50	10.240
1.561 MHz	27.40	46.00	-18.60	35.51	56.00	-20.49	10.240
1.774 MHz	25.22	46.00	-20.78	33.70	56.00	-22.30	10.250
3.466 MHz	26.25	46.00	-19.75	32.81	56.00	-23.19	10.360
8.907 MHz	25.81	50.00	-24.19	33.18	60.00	-26.82	10.390
Project# - BEC-1839							
Sample# - 1825-05							
EUT - Spectrum 110A							
Volt/Freq - QPSK @2440MHz 120Vac/60Hz							
Test Spec - FCC Part 15C Section 207 Using FCC Class B Limits							



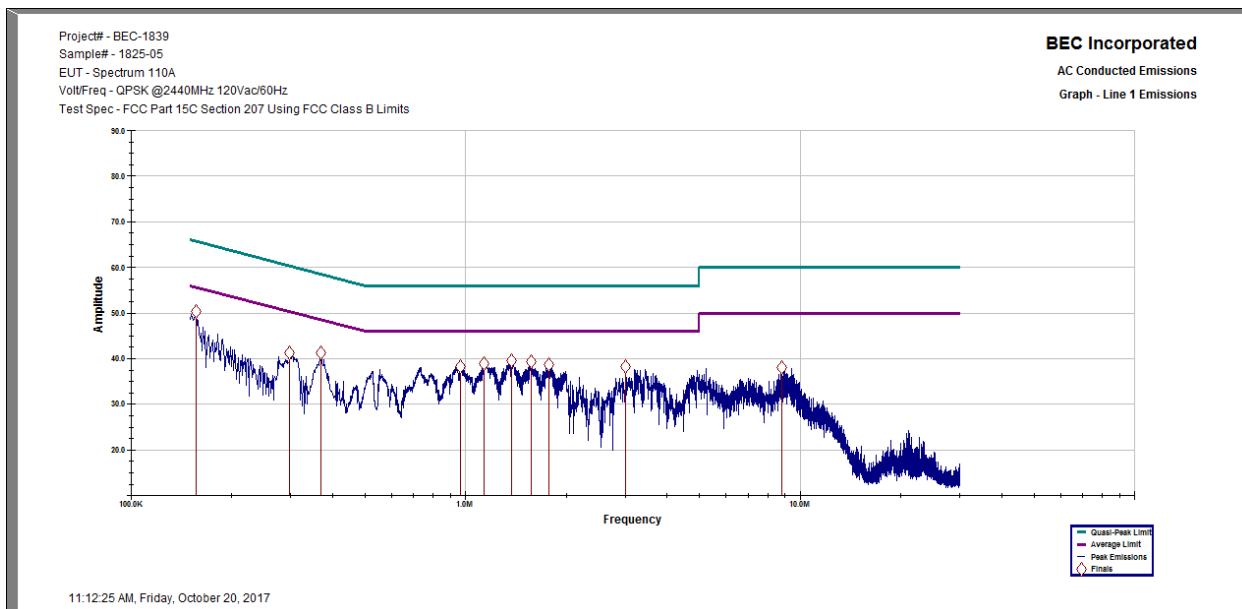


BEC Incorporated

Line 1 Conducted Emissions

11:16:41 AM, Friday, October 20, 2017

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
154.916 KHz	36.010	55.860	-19.850	48.190	65.860	-17.670	10.050
294.200 KHz	19.685	51.880	-32.195	36.510	61.880	-25.370	10.040
370.054 KHz	34.342	49.713	-15.370	38.820	59.713	-20.893	10.140
959.320 KHz	24.145	46.000	-21.855	35.310	56.000	-20.690	10.260
1.149 MHz	29.280	46.000	-16.720	37.280	56.000	-18.720	10.260
1.357 MHz	26.128	46.000	-19.872	36.060	56.000	-19.940	10.260
1.567 MHz	28.783	46.000	-17.217	36.440	56.000	-19.560	10.260
1.784 MHz	25.991	46.000	-20.009	34.628	56.000	-21.372	10.268
3.008 MHz	24.103	46.000	-21.897	31.780	56.000	-24.220	10.380
8.853 MHz	26.032	50.000	-23.968	33.430	60.000	-26.570	10.390
Project# - BEC-1839							
Sample# - 1825-05							
EUT - Spectrum 110A							
Volt/Freq - QPSK @2440MHz 120Vac/60Hz							
Test Spec - FCC Part 15C Section 207 Using FCC Class B Limits							

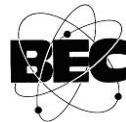


Test Results: The ARRIS Spectrum 110A complies with the requirements of 47 CFR Part 15.205 and 47 CFR Part 15.207(b).



4.5.4 Conducted Emissions AC power leads (47 CFR 15.207(b)) Test Setup Picture





4.6 Spurious Radiated Emissions 1 – 25 GHz (47 CFR 15.209(a))

SR#1

The Semi-Anechoic Shielded Room (SR#1) is an ferrite and absorber lined chamber which houses a 5-foot diameter turntable capable of rotating equipment 360 degrees and antenna mast for Horizontal and Vertical polarity measurements. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This 3 meter shielded enclosure has a raised computer floor with metal tile bottoms providing a continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel outside the chamber. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

The test site complies with the attenuation measurements specified in ANSI C63.4:2014

Radiated Emissions 1 – 40 GHz

The EMI receiver was set to quasi-peak mode for frequencies from 30MHz to 1GHz and the appropriate CISPR bandwidths were employed. The receiver was set to average mode for frequencies above 1GHz with the appropriate CISPR bandwidths were employed. Significant emissions found during the preliminary scans were maximized by rotating the turntable and varying the antenna height. Both horizontal and vertical antenna polarities were also investigated for suspect emissions. The signals are maximized and measured using the in house generated RADE or off the shelf TILE software. The support equipment and test item(s) were powered off in turn to determine the source of the emissions where appropriate.

Field strengths were calculated as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{Meter Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)}$$

4.6.1 Spurious Radiated Emissions 1 – 25 GHz Measurement

The spurious signal measurements made above 1 GHz are the same measurements made for 47 CFR Part 15.205. The detected signals were the second and third harmonics of the radio transmitter frequency. The levels were measured at low, middle and high frequencies utilizing GFSK, QPSK and 8PSK modulation. Data for 1 to 18 GHz measurements are shown in section 4.6.2. There were no measurable signal from 18 to 25 GHz but all scans are on record at BEC as proof of measurements made for all modulation schemes at low, middle and high frequencies. Data is deliverable upon request.



4.6.2 Restricted Bands of Operation (47 CFR 15.209(a)) 1 – 18 GHz

EUT Setting: GFSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.591E+09	38.61	28.27	H	234	164.3	-0.31	53.98	-25.713	73.98	-35.368	PASS
4.804E+09	47.23	41.28	H	49	101.9	2.26	53.98	-12.699	73.98	-26.754	PASS
4.845E+09	44.62	39.1	H	50	101.6	2.41	53.98	-14.884	73.98	-29.359	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.583E+09	38.47	28.09	V	191	156	-0.33	53.98	-25.887	73.98	-35.514	PASS
4.804E+09	55.75	52.88	V	191	110	2.25	53.98	-1.099	73.98	-18.226	PASS

EUT Setting: QPSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.594E+09	41.55	28.46	H	228	137.8	-0.3	53.98	-25.517	73.98	-32.43	PASS
4.845E+09	44.36	38.99	H	354	100	2.41	53.98	-14.995	73.98	-29.62	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.592E+09	39.61	28.13	V	134	111	-0.31	53.98	-25.848	73.98	-34.366	PASS
4.796E+09	38.96	29.52	V	189	184	2.22	53.98	-24.464	73.98	-35.017	PASS

EUT Setting: 8PSK @ 2402 MHz											
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.596E+09	37.52	28.15	H	259	172.3	-0.29	53.98	-25.831	73.98	-36.464	PASS
4.845E+09	42.99	37.33	H	315	137.8	2.41	53.98	-16.651	73.98	-30.989	PASS
1.51E+10	53.18	45.4	H	272	200.5	9.45	53.98	-8.585	73.98	-20.802	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.586E+09	40.21	28.23	V	217	128	-0.32	53.98	-25.747	73.98	-33.774	PASS
4.804E+09	47.7	40.65	V	181	179	2.26	53.98	-13.332	73.98	-26.285	PASS


EUT Setting: GFSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.588E+09	37.81	28.08	H	261	101.4	-0.32	53.98	-25.9	73.98	-36.17	PASS
4.845E+09	43.73	39.07	H	360	132.3	2.41	53.98	-14.914	73.98	-30.249	PASS
4.88E+09	48.74	41.6	H	317	99.1	2.54	53.98	-12.375	73.98	-25.235	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.582E+09	36.23	28.06	V	168	181	-0.34	53.98	-25.918	73.98	-37.748	PASS
4.88E+09	52.84	49.81	V	27	100	2.54	53.98	-4.168	73.98	-21.135	PASS

EUT Setting: QPSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.597E+09	36.85	27.93	H	215	152.3	-0.29	53.98	-26.046	73.98	-37.128	PASS
4.845E+09	44.85	41.09	H	28	98.9	2.41	53.98	-12.894	73.98	-29.129	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.595E+09	39.95	28.5	V	214	128	-0.3	53.98	-25.484	73.98	-34.027	PASS
4.869E+09	38.54	29.59	V	221	209	2.5	53.98	-24.394	73.98	-35.439	PASS

EUT Setting: 8PSK @ 2440 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.591E+09	37.35	27.98	H	73	111.2	-0.31	53.98	-26.001	73.98	-36.628	PASS
4.845E+09	44.58	40.57	H	30	101.7	2.41	53.98	-13.412	73.98	-29.4	PASS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.588E+09	37.85	28.29	V	331	133	-0.32	53.98	-25.692	73.98	-36.13	PASS
4.845E+09	45.95	42.04	V	96	112	2.41	53.98	-11.941	73.98	-28.029	PASS
4.88E+09	48.83	42.15	V	191	149	2.54	53.98	-11.831	73.98	-25.146	PASS


EUT Setting: GFSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	34.15	31.62	H	318	100.3	-5.18	53.98	-22.36	73.98	-39.83	PASS
3.581E+09	38.79	27.84	H	71	129.7	-0.34	53.98	-26.135	73.98	-35.19	PASS
4.837E+09	37.74	29.42	H	106	132.7	2.38	53.98	-24.557	73.98	-36.239	PASS
4.96E+09	51.21	47.95	H	317	101.4	2.85	53.98	-6.034	73.98	-22.771	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	32.06	30.05	V	182	101	-5.18	53.98	-23.926	73.98	-41.921	PASS
3.579E+09	38.73	28.25	V	333	197	-0.35	53.98	-25.725	73.98	-35.248	PASS
4.956E+09	37.13	29.61	V	270	199	2.83	53.98	-24.368	73.98	-36.846	PASS

EUT Setting: QPSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	31.88	27.07	H	220	101.4	-5.18	53.98	-26.907	73.98	-42.1	PASS
3.588E+09	37.46	27.75	H	145	113.6	-0.32	53.98	-26.226	73.98	-36.518	PASS
4.845E+09	45.53	40.97	H	30	103.5	2.41	53.98	-13.007	73.98	-28.449	PASS
1.514E+10	54.15	45.27	H	313	192	9.38	53.98	-8.707	73.98	-19.829	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	33.04	27.52	V	181	146	-5.18	53.98	-26.462	73.98	-40.939	PASS
3.593E+09	38.25	28.66	V	169	108	-0.3	53.98	-25.317	73.98	-35.732	PASS
4.845E+09	42.8	38.41	V	352	110	2.41	53.98	-15.574	73.98	-31.179	PASS
4.96E+09	49.42	43.91	V	194	130	2.85	53.98	-10.073	73.98	-24.561	PASS

EUT Setting: 8PSK @ 2480 MHz

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	30.43	25.32	H	85	139.9	-5.18	53.98	-28.662	73.98	-43.549	PASS
3.593E+09	35.77	27.92	H	125	102.8	-0.3	53.98	-26.058	73.98	-38.211	PASS
4.842E+09	38.23	28.95	H	336	123.6	2.4	53.98	-25.029	73.98	-35.752	PASS
Frequency	Peak Level	Average Level	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC B Average Limit	FCC B Average Margin	FCC B Peak Limit	FCC B Peak Margin	Results
GHz	dBuV/m	dBuV/m	H/V	Degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.48E+09	29.95	24.6	V	179	105	-5.18	53.98	-29.378	73.98	-44.03	PASS
3.595E+09	41.37	28.48	V	215	121	-0.3	53.98	-25.502	73.98	-32.607	PASS
4.845E+09	43.19	39.33	V	176	146	2.41	53.98	-14.654	73.98	-30.789	PASS
4.96E+09	44.93	36.76	V	183	152	2.85	53.98	-17.223	73.98	-29.053	PASS

Test Results: The ARRIS Spectrum 110A complies with the requirements of 47 CFR Part 15.205 and 47 CFR Part 15.209.

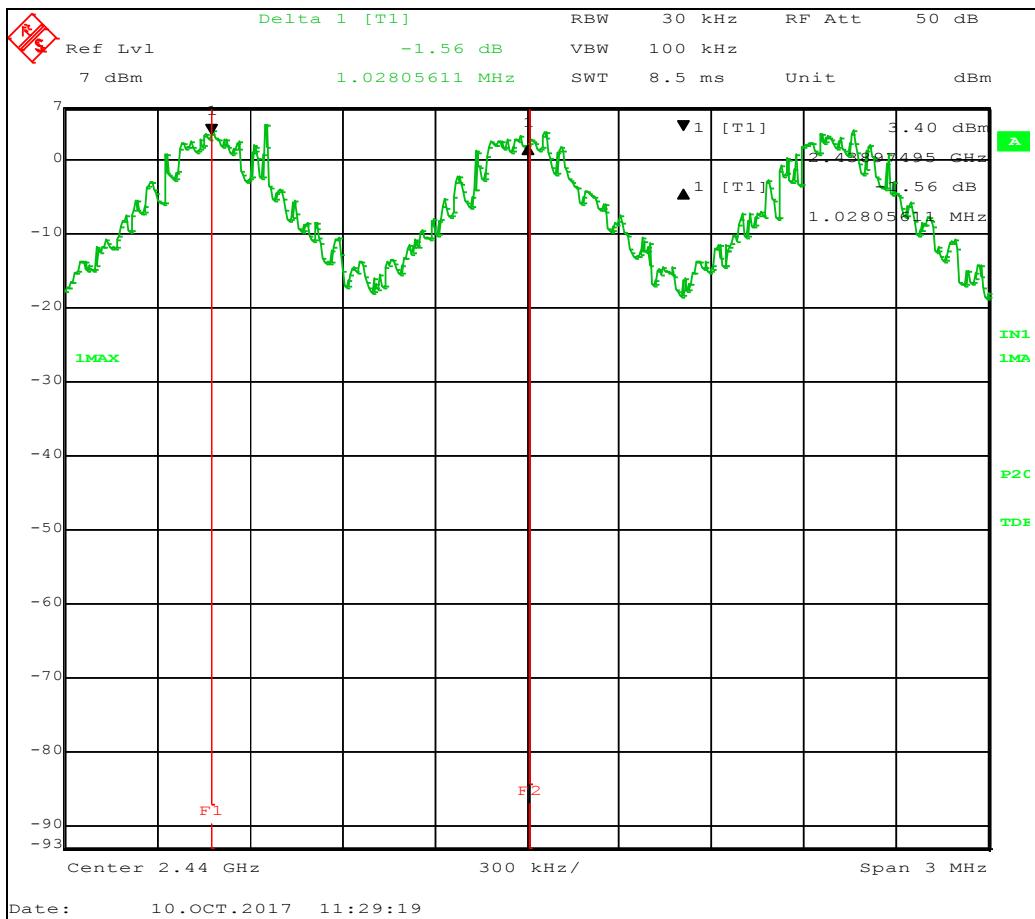


4.7 Carrier Frequency Separation (47 CFR 15.247(a)(1)) (10/10/2017)

Hopping Channels must be separated by a minimum of 25 kHz or 2/3 of the 20 dB bandwidth whichever is greater. The first table shows the 2/3 value of the 20 dB bandwidths of each low, middle and high frequencies with the three types of modulation from Section 4.10. Basic Data Rate (BDR) speed is 1 Mbps (Megabits per second) and uses GFSK modulation. Enhanced Data Rate (EDR) is 2 Mbps. The measured channel separation is shown on the screen graph and table depicted below.

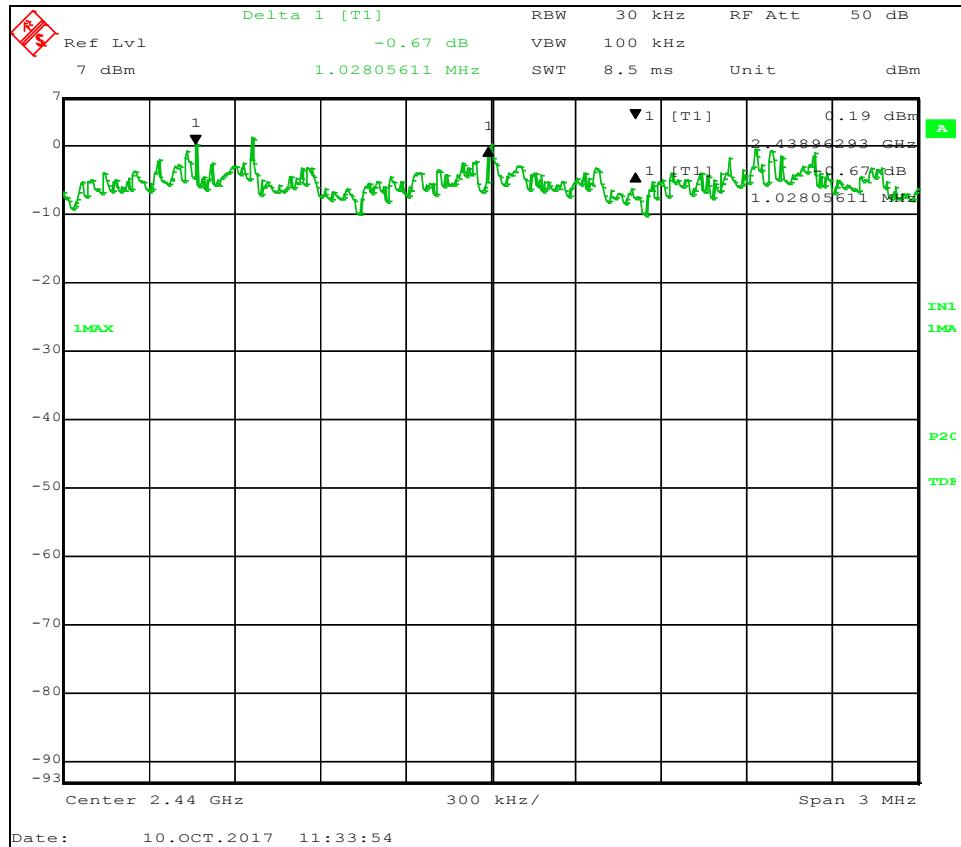
2/3 of 20 dB Bandwidth			
Frequency	GFSK Modulation	QPSK Modulation	8-DPSK Modulation
GHz	kHz	MHz	MHz
2.402	637.27	0.93	0.92
2.440	685.44	0.93	0.92
2.480	641.28	0.93	0.92

BDR (Basic Data Rate) 1 Mbps





EDR (Enhanced Data Rate) 2 Mbps



Highest 2/3 value of 20 dB Bandwidth (QPSK Modulation)	Measured Hopping Channel Separation	
	BDS	EDS
(MHz)	(MHz)	(MHz)
0.930	1.0280	1.0280

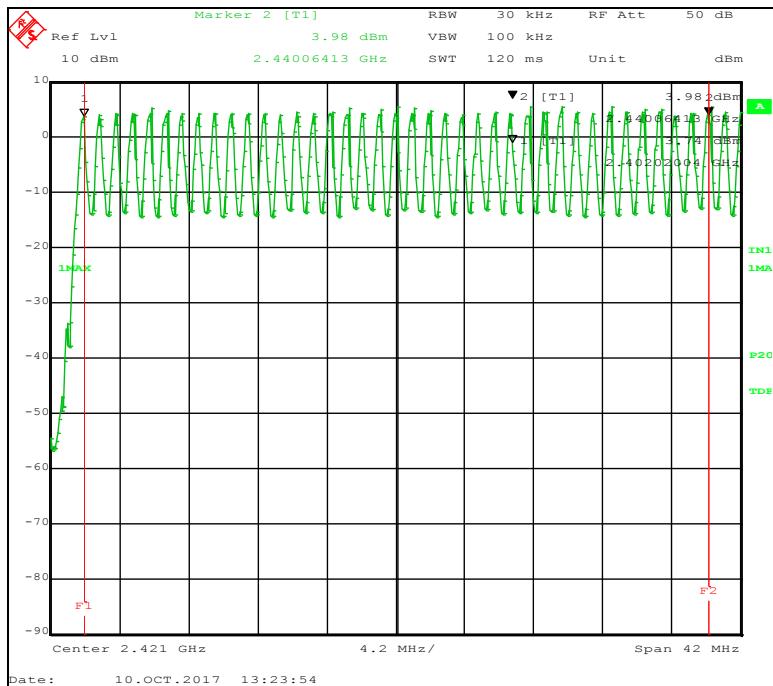
Test Results: The Channel spacing for BDR and EDR Modes are 1.0280 MHz respectively. These values are greater than the minimum 2/3 value of the 20 dB bandwidth required by 47 CFR Part 15.246 (a)(1).



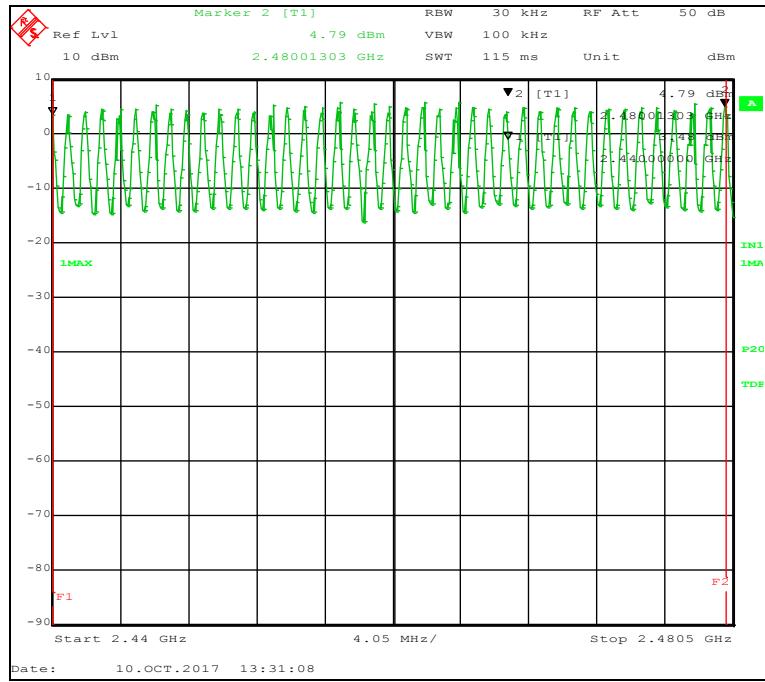
4.8 Number of Hopping Frequencies (47 CFR 15.247(a)(1)(iii)) (10/10/2017)

The hopping frequencies utilized by the ARRIS Spectrum 110A were measured directly from the transmitter output of the EUT for BDR and EDR. The displays captured from the Spectrum Analyzer show the range of 2.402 to 2.480 using two separate scans for each transmission rate.

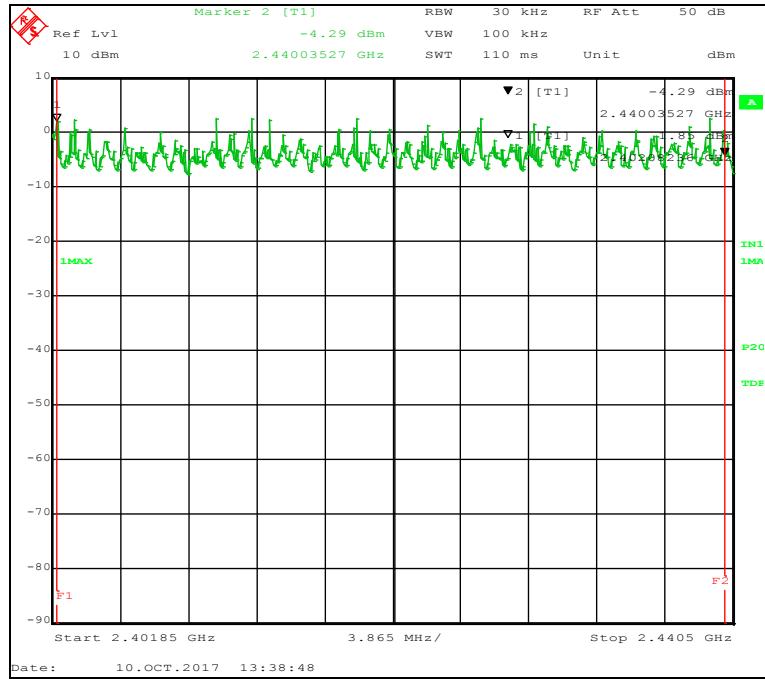
BDR (Basic Data Rate) 1 Mbps 2402 to 2440 MHz



BDR (Basic Data Rate) 1 Mbps 2440 to 2480 MHz

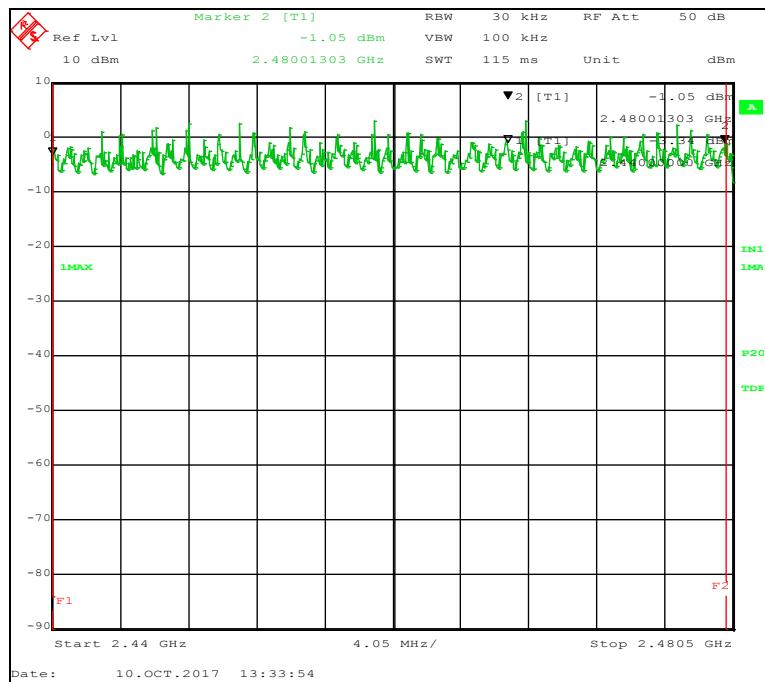


EDR (Enhanced Data Rate) 2 Mbps 2402 to 2440 MHz





EDR (Enhanced Data Rate) 2 Mbps 2440 to 2480 MHz



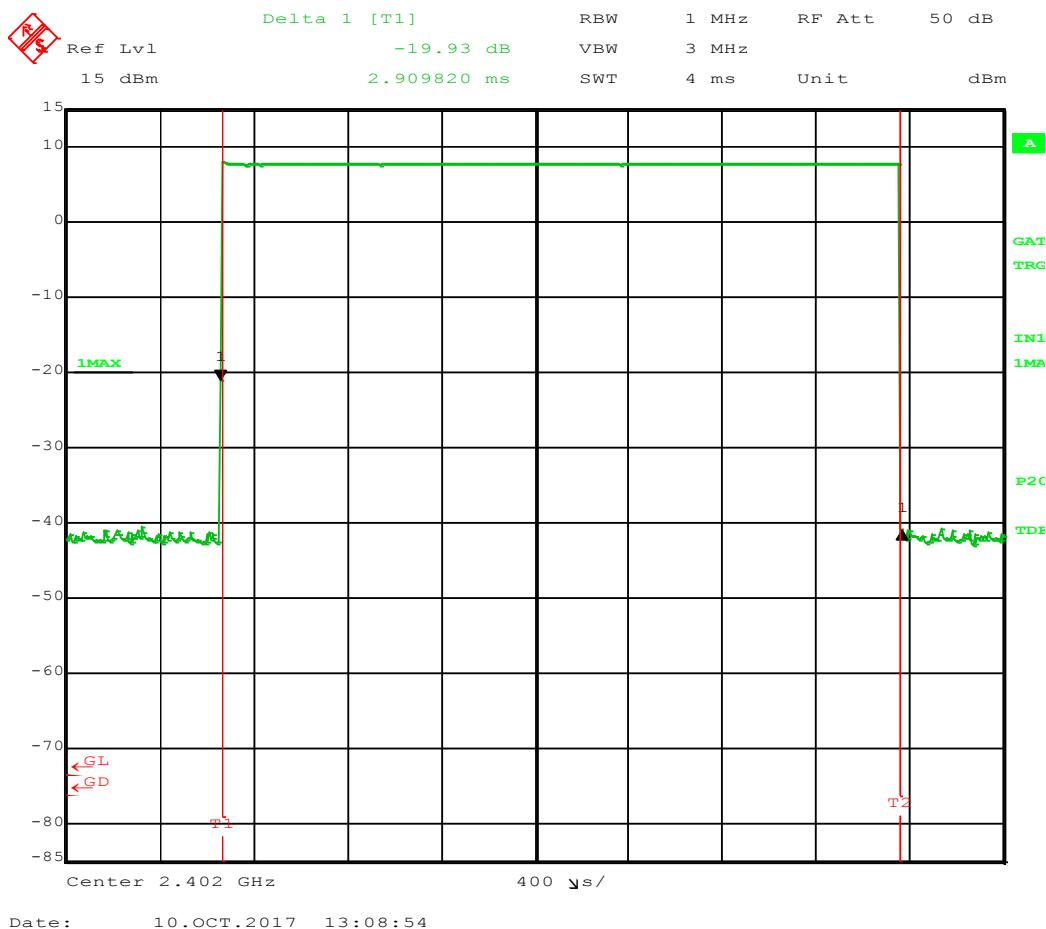
Test Results: The number of hopping frequencies is 79 for both BDR and EDR modes. This complies with the requirements of 47 CFR 15.247(a)(1)(iii).



4.9 Time of Occupancy (Dwell Time) (47 CFR 15.247(a)(1)(iii)) (10/10/2017)

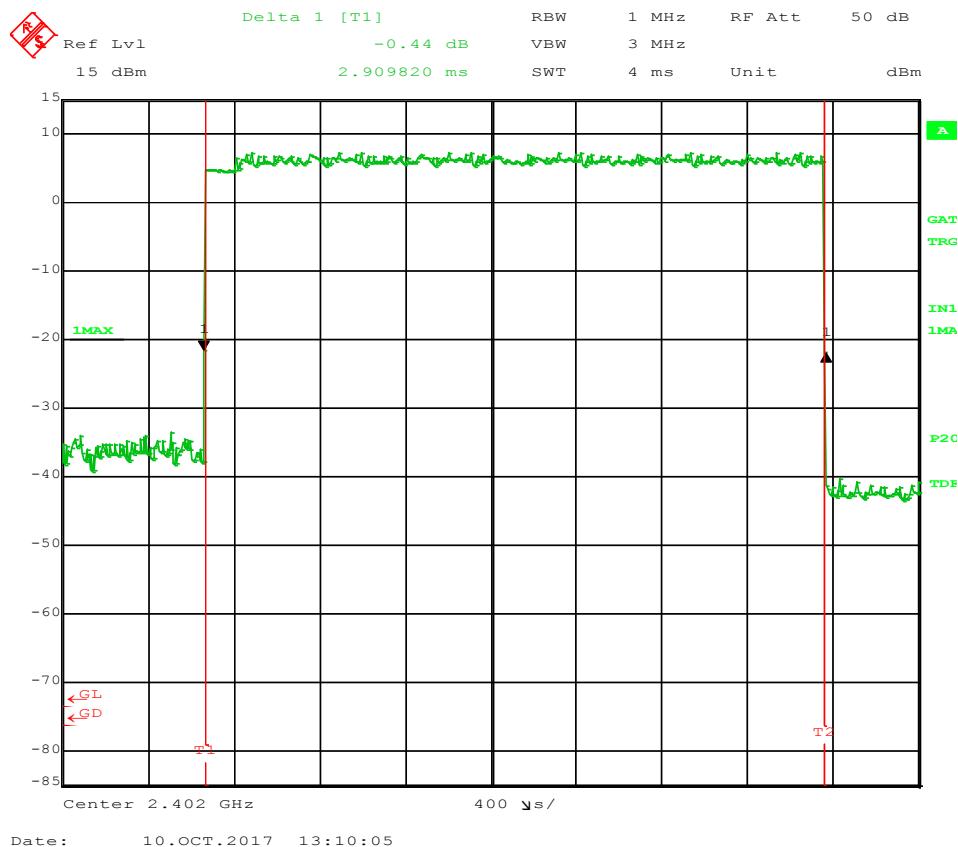
Section (a)(1)(iii) of 15.247 requires the average occupancy time of the hopping frequency system shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed (79 channels). The following displays show the measured occupancy time for both data rates.

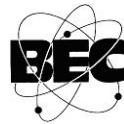
BDR (Basic Data Rate) 1 Mbps (2.9098 ms)





EDR (Enhanced Data Rate) 2 Mbps (2.9098 ms)





4.9.1 Time of Occupancy (Dwell Time) (47 CFR 15.247(a)(1)(iii)) Summary Table

The calculation to determine occupancy time:

79 Hopping Channels X .4 seconds = 31.6 maximum transmission time. DH5 packet utilizes 5 time slots. The hopping rate is 1600 hops/second. Maximum dwell is $5/1600 = 3.125$ ms. DH5 maximum hops per second is 1600 hops/second, 79 channels, 6 time slots (5Tx, 1Rx); $1600/79/6 = 3.37$ hops/second in each channel. Dwell time: hops/sec each channel (3.37 ms) X maximum transmission time (31.6) = 106.6.

Modulation	Frequency	Measured Transmission Time	# of transmissions in band	Dwell Time	Limit	Result
	(MHz)	msec		seconds	seconds	
BDR	2.402 GHz	2.91	106.6	0.31	0.40	PASS
EDR	2.402 GHz	2.91	106.6	0.31	0.40	PASS

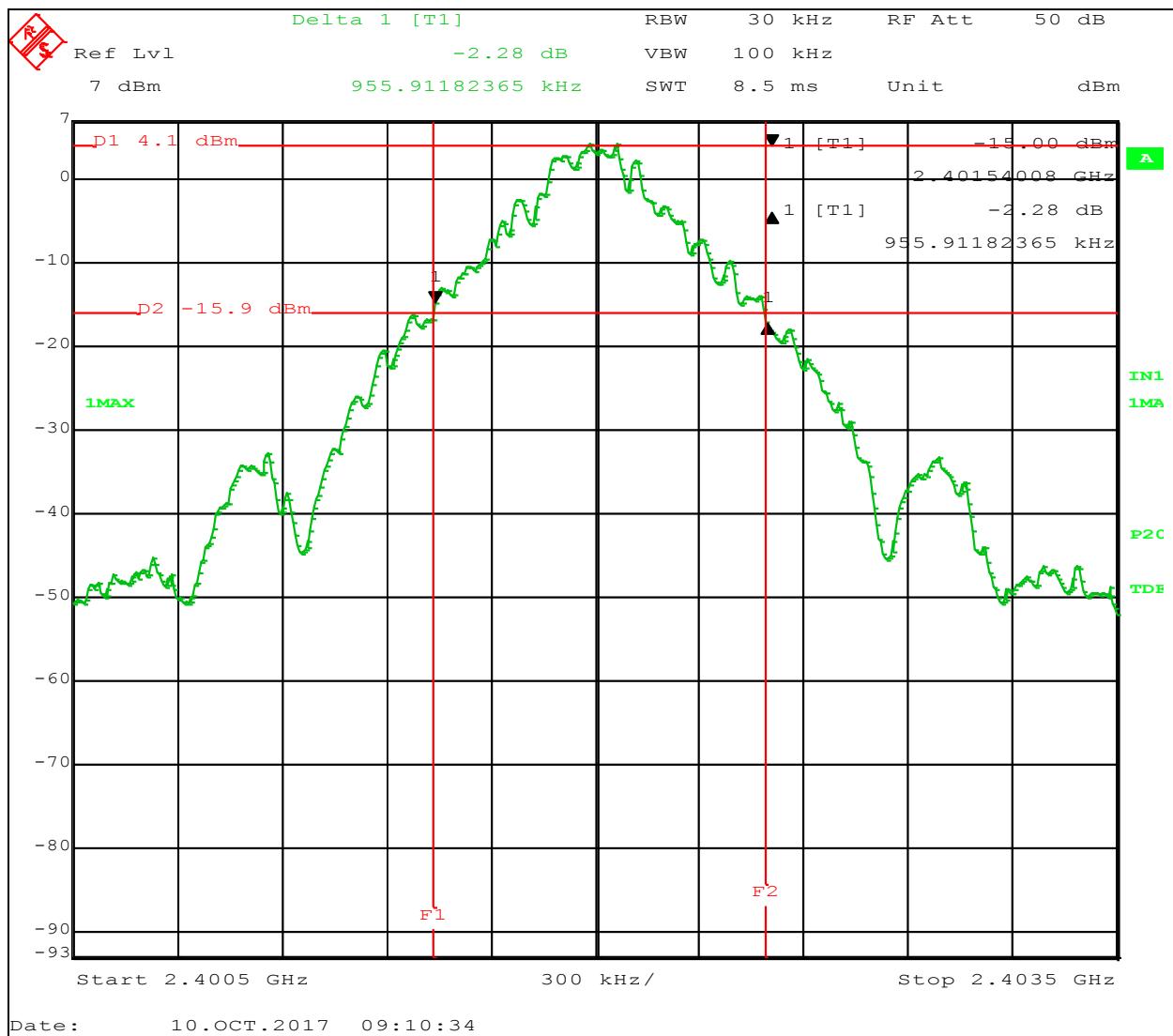
4.10 20 dB Bandwidth, 47 CFR 15.247(a)(1)(i), FCC DA 00-705, ANSI C63.10, (6.9.2). (10/10/2017)

The following table contains the 20 dB bandwidth measured for each of the modulation schemes and low, middle and high frequency channels. The displays show the highest of each of the modulation schemes.

20 dB Bandwidth			
Frequency	GFSK Modulation	QPSK Modulation	8-DPSK Modulation
GHz	kHz	MHz	MHz
2.402	955.91	1.39	1.38
2.440	1028.16	1.40	1.38
2.480	961.92	1.39	1.38

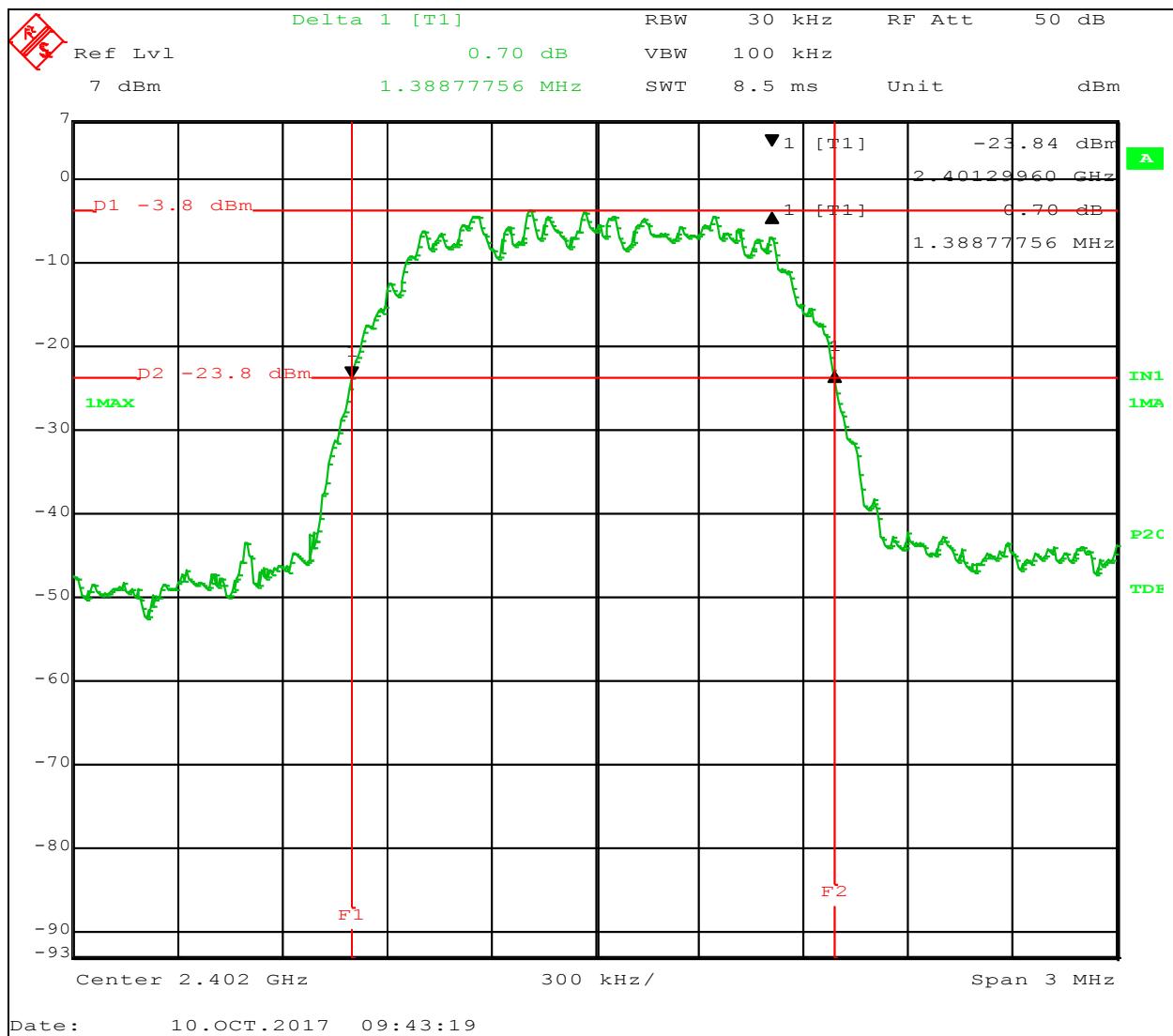


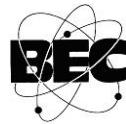
GFSK Modulation



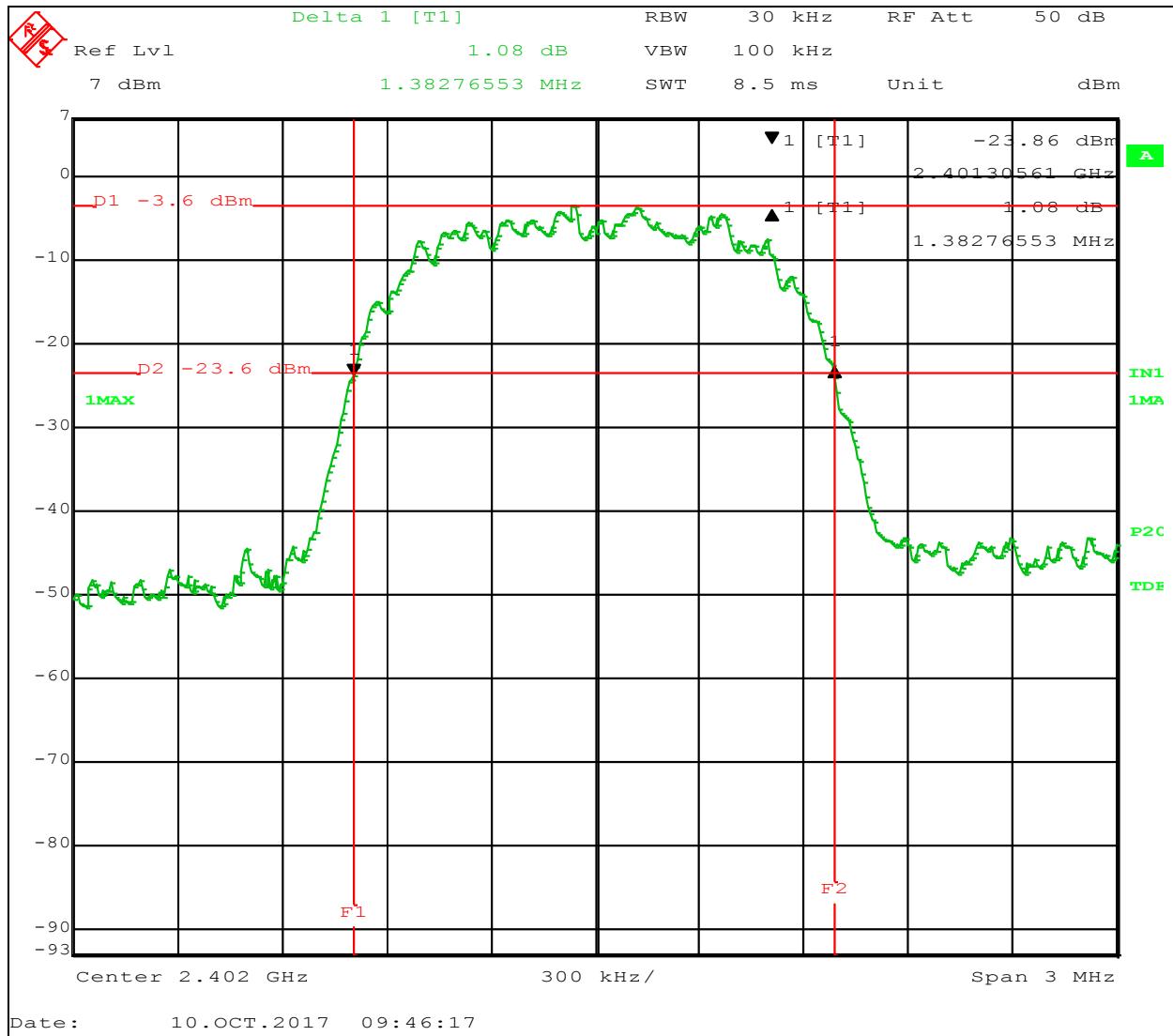


QPSK Modulation





8-DPSK Modulation



Test Results: The ARRIS Model Spectrum 110A is measured for its 20 dB bandwidth in each of the modulation configurations and is then used to calculate the channel separation in section 4.7. The above screen captures show each modulation configuration when tested at 2402 MHz. The other Frequencies of 2440 MHz and 2480 MHz were measured and screen captures are on file with BEC Incorporated.



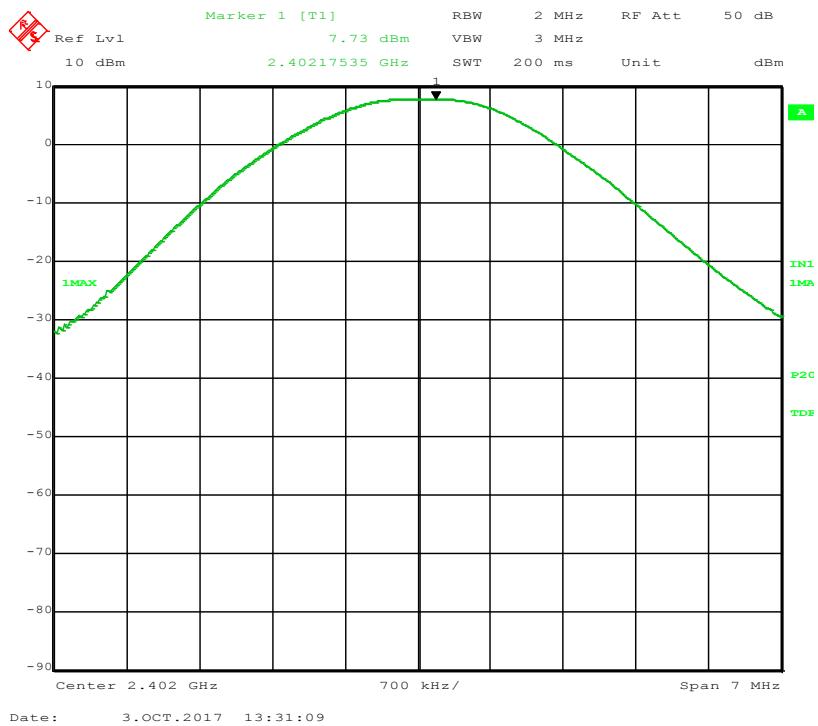
4.11 Maximum Peak Power Output, 47 CFR 15.247(b)(1)

Measurement of the Maximum Peak Power Output of the ARRIS Model Spectrum 110A was made with the spectrum analyzer connected directly to the transmitter output in place of the antenna. The table contains the power levels of each of the modulation schemes at low, middle and high frequency channels in constant transmit mode, non-hopping.

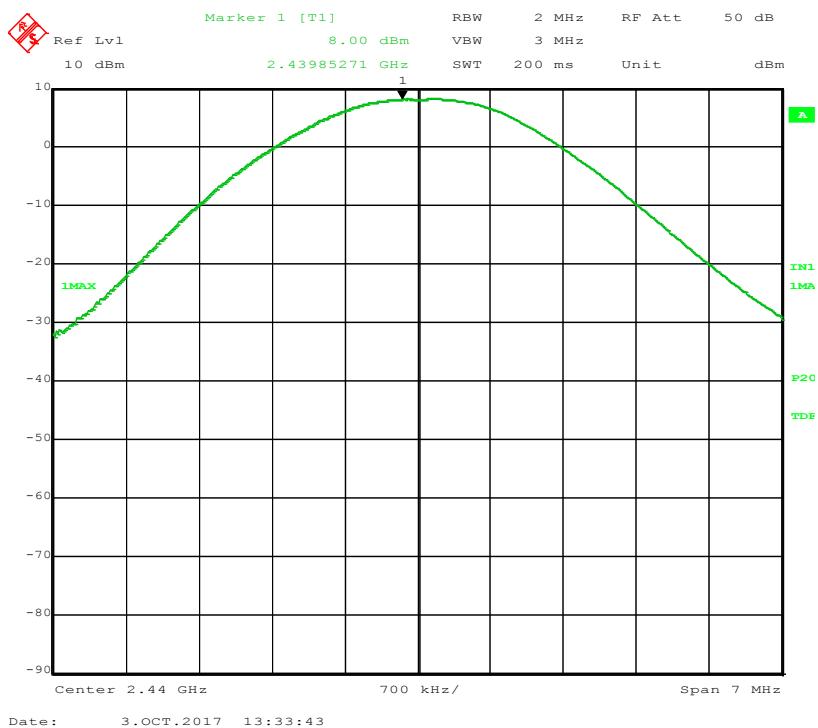
Modulation Scheme	Frequency (GHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Total		Limit		Margin	
				dBm	Watts	dBm	Watts	dBm	Watts
GFSK	2.402	7.73	0.62	8.35	0.007	30.00	1.000	-21.65	-0.993
	2.440	8.00	0.63	8.63	0.007	30.00	1.000	-21.37	-0.993
	2.480	8.21	0.63	8.84	0.008	30.00	1.000	-21.16	-0.992
QPSK	2.402	5.80	0.62	6.42	0.004	30.00	1.000	-23.58	-0.996
	2.440	6.31	0.63	6.94	0.005	30.00	1.000	-23.06	-0.995
	2.480	6.63	0.63	7.26	0.005	30.00	1.000	-22.74	-0.995
8-DPSK	2.402	6.11	0.62	6.73	0.005	30.00	1.000	-23.27	-0.995
	2.440	6.47	0.63	7.10	0.005	30.00	1.000	-22.90	-0.995
	2.480	6.70	0.63	7.33	0.005	30.00	1.000	-22.67	-0.995



GFSK Modulation, Channel 1

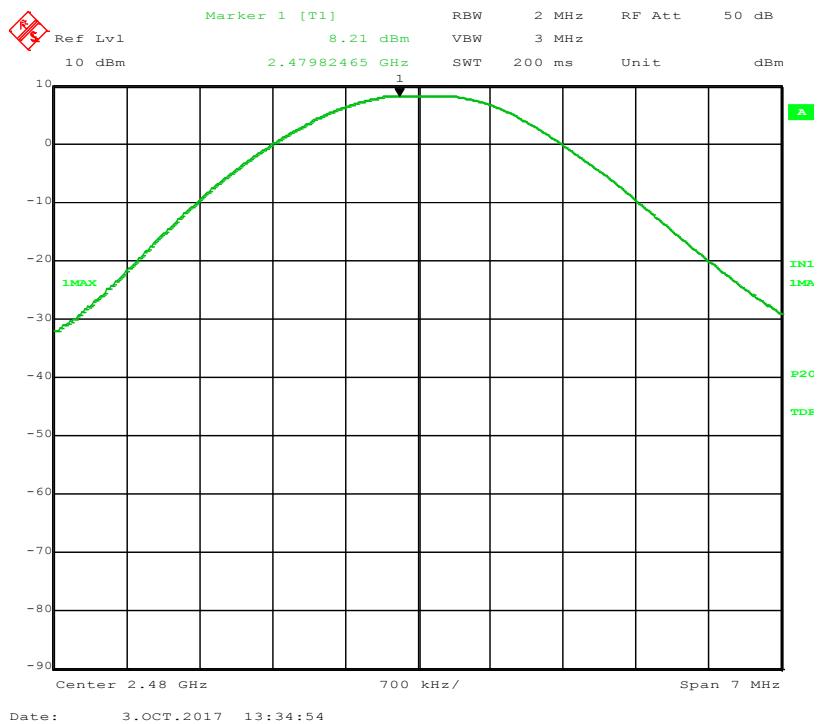


GFSK Modulation, Channel 40

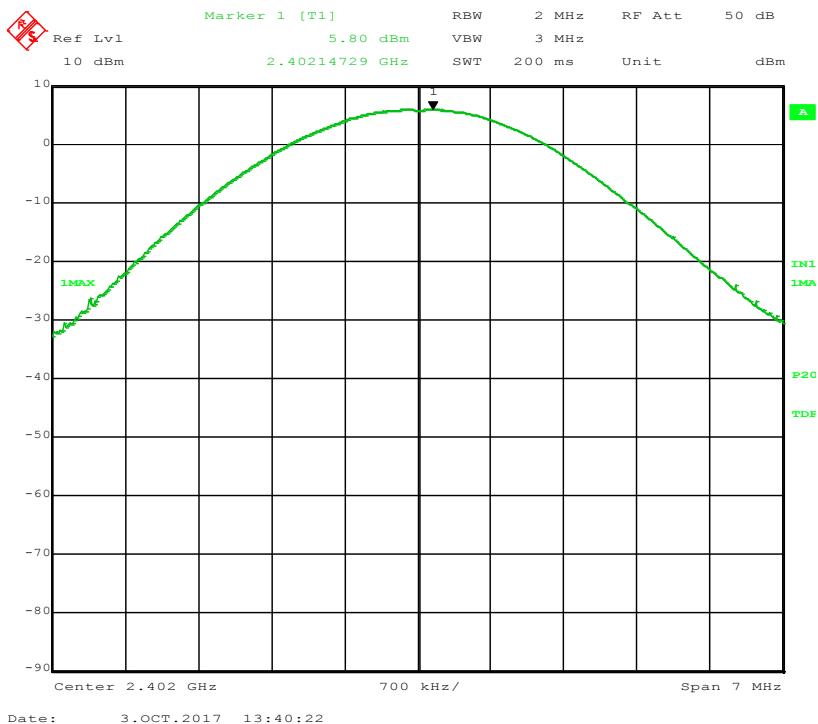




GFSK Modulation, Channel 79

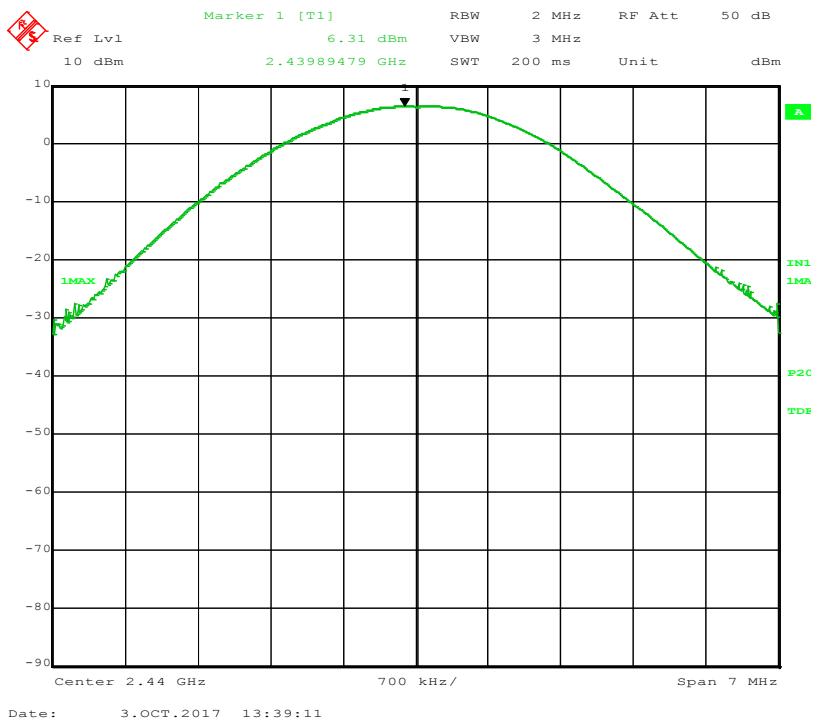


QPSK Modulation, Channel 1

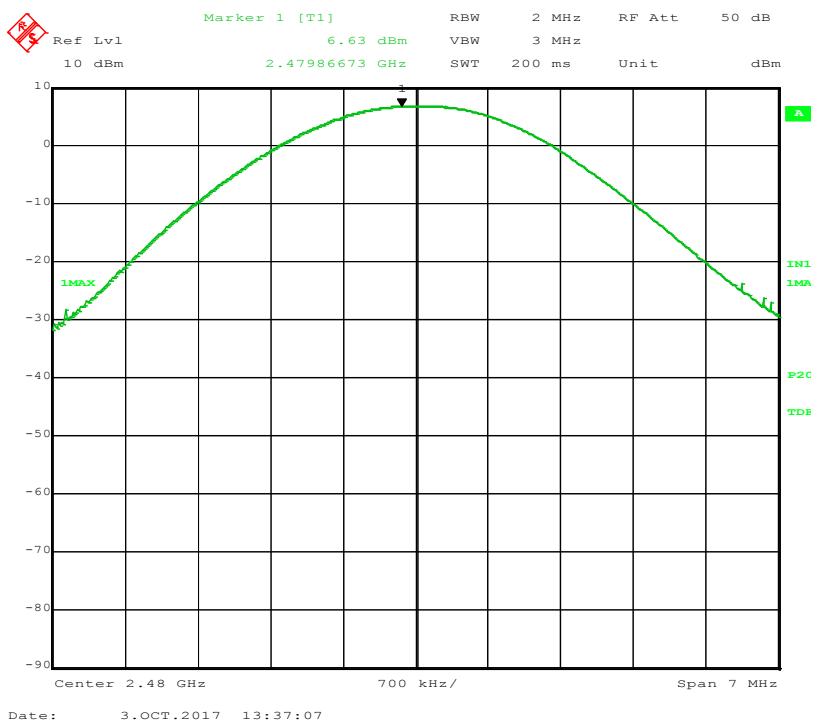




QPSK Modulation, Channel 40



QPSK Modulation, Channel 79

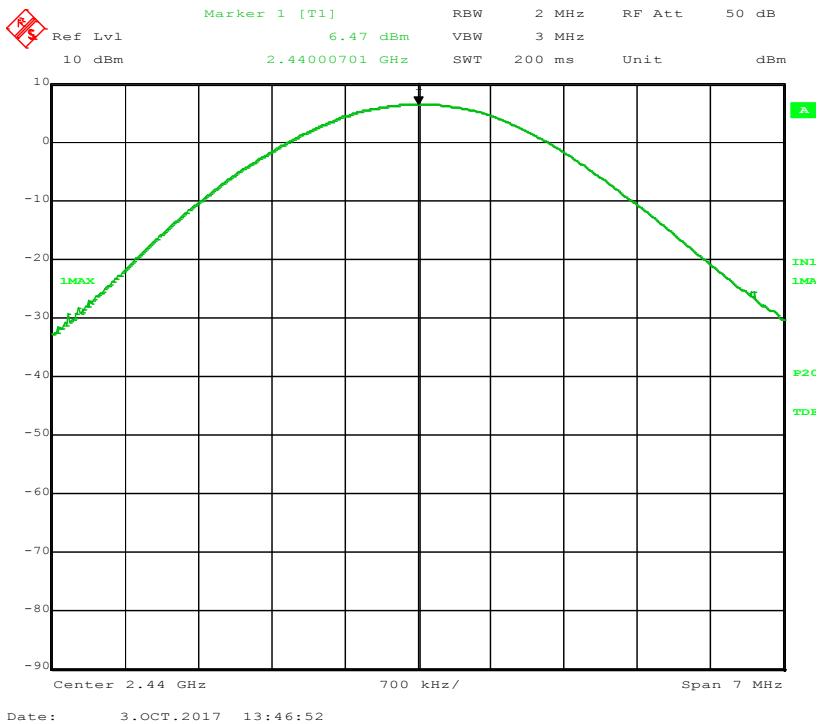




8-DPSK Modulation, Channel 1

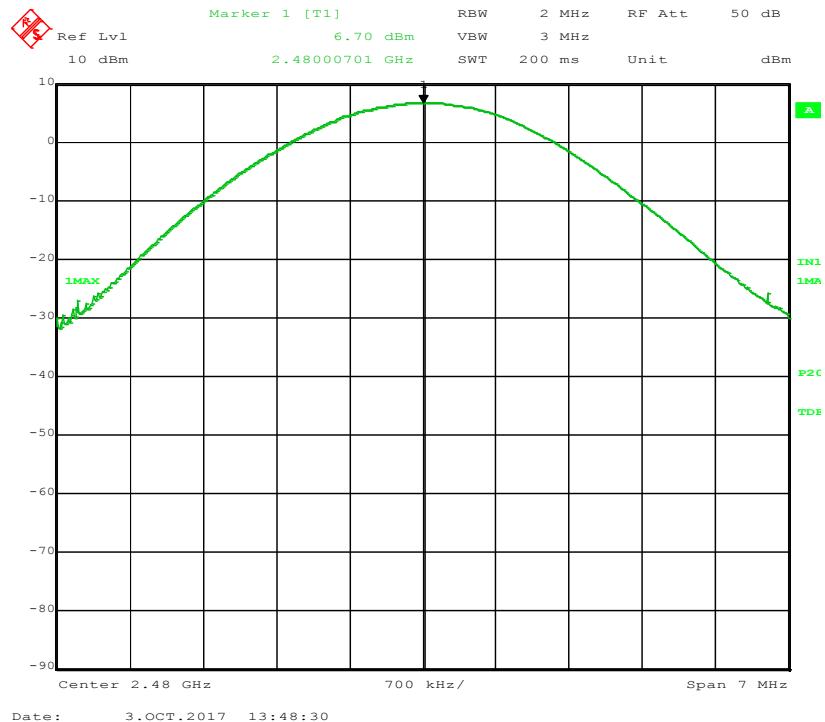


8-DPSK Modulation, Channel 40





8-DPSK Modulation, Channel 79

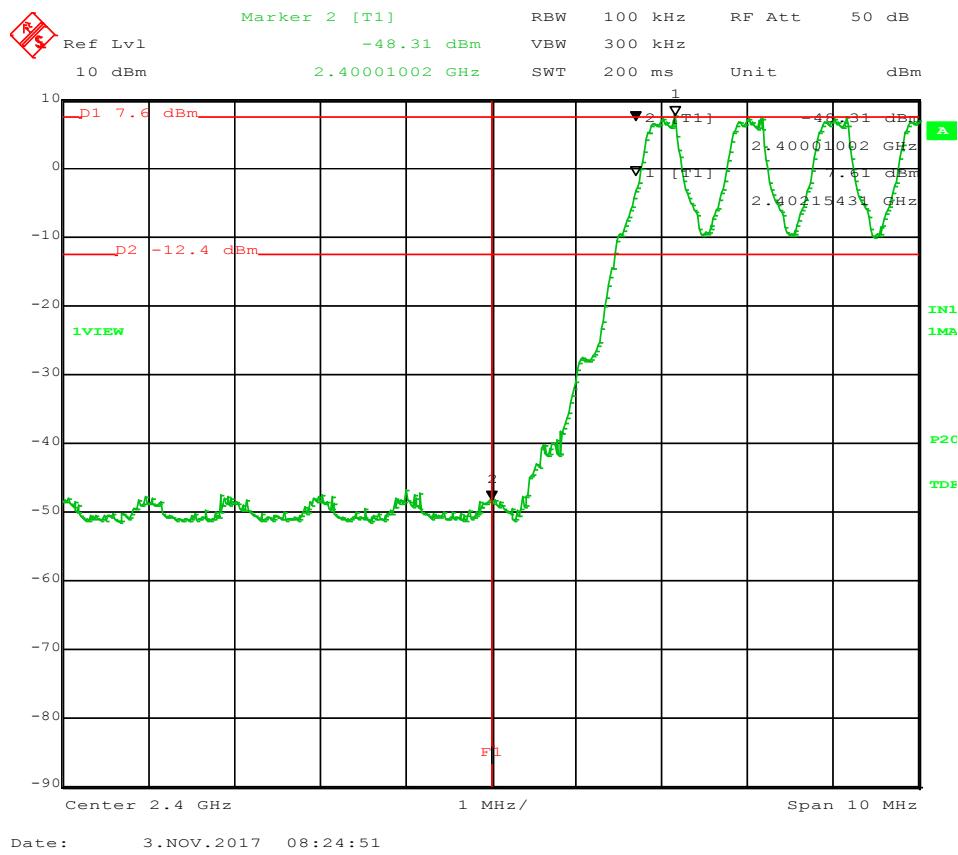


Test Results: The peak output power of the ARRIS Model Spectrum 110A varied slightly with modulation type. The highest levels consistently occurred at the highest channel frequency (2.480 GHz). The maximum peak power output level was compliant to the 1 Watt limit imposed by 47 CFR Part 15.247 (b)(1).

4.12 Band Edge Measurement (47 CFR 15.247(d))

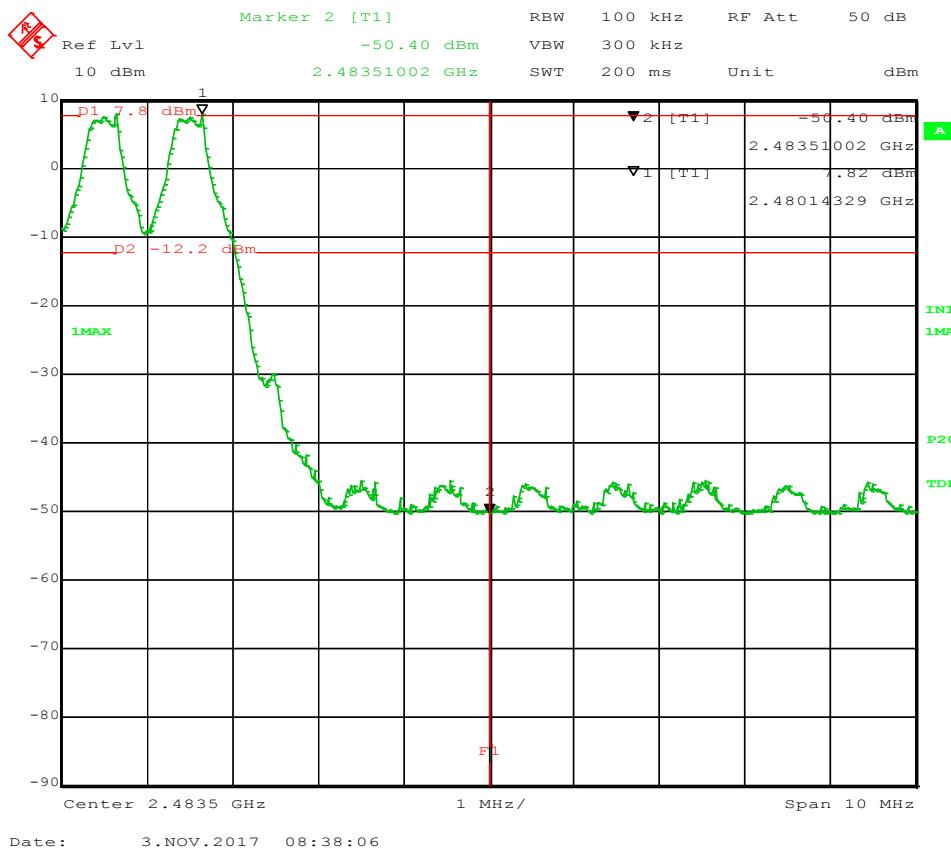
The demonstration of band-edge compliance is shown by two spectrum analyzer screens. The SA bandwidth is 100 kHz. One screen shows the peak emission within the operating range of the ARRIS Model Spectrum 110A 2.4 – 2.4835 GHz. The second screen shows the peak level of all other emissions in the 30 MHz to 25 GHz span using the 100 kHz bandwidth and the limit set to 20 dB below the maximum in-band peak level. Measurements were taken with and without frequency hopping. Both BDR (Basic Data Rate) and EDR (Enhanced Data Rate) modes were tested.

Frequency Hopping: BDR (Basic Data Rate) 1 Mbps –Lower Band Edge



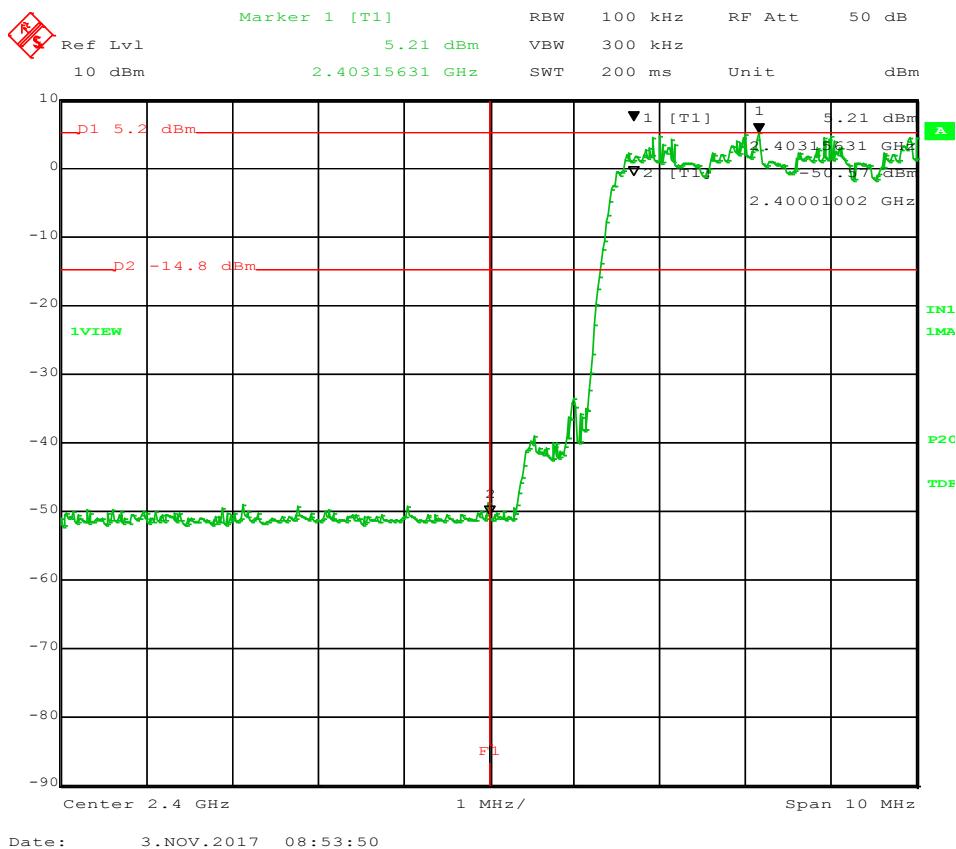


Frequency Hopping: BDR (Basic Data Rate) 1 Mbps –Upper Band Edge



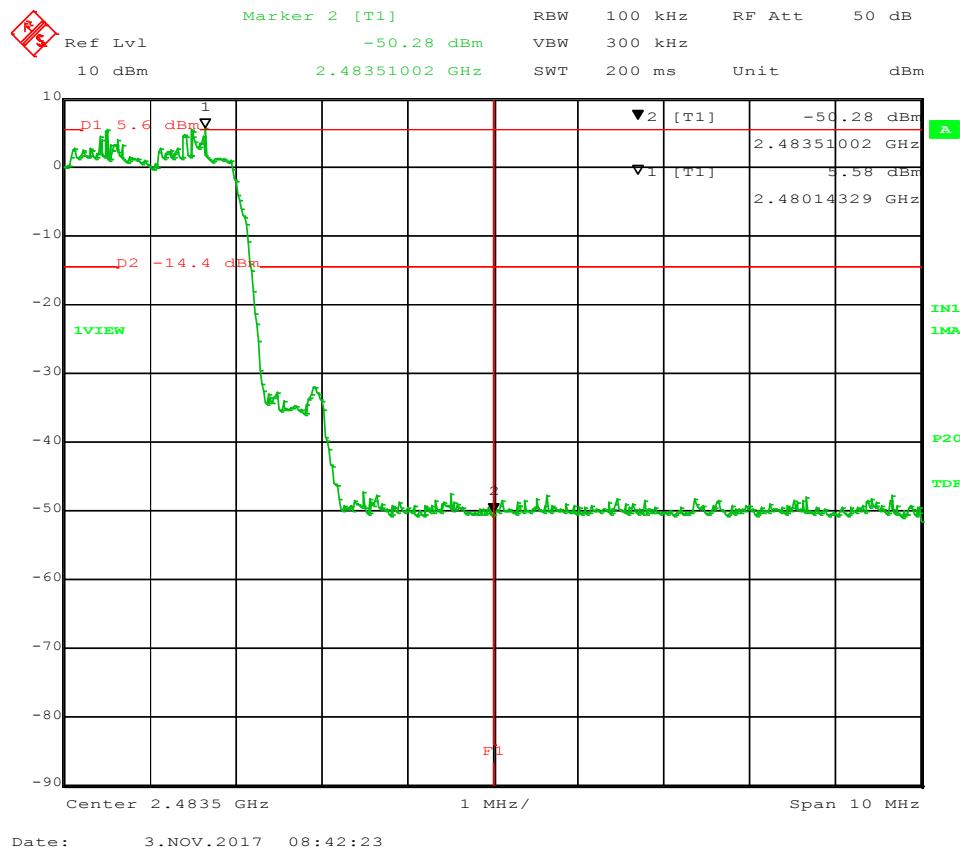


Frequency Hopping: EDR (Enhanced Data Rate) 2 Mbps –Lower Band Edge





Frequency Hopping: EDR (Enhanced Data Rate) 2 Mbps –Upper Band Edge



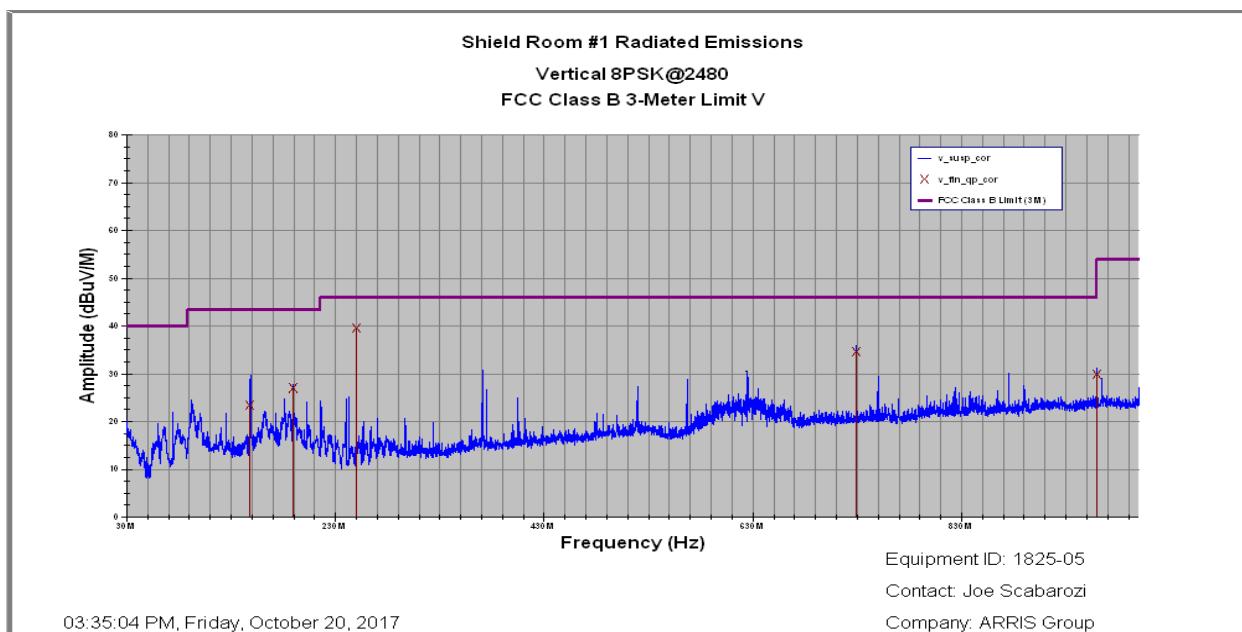
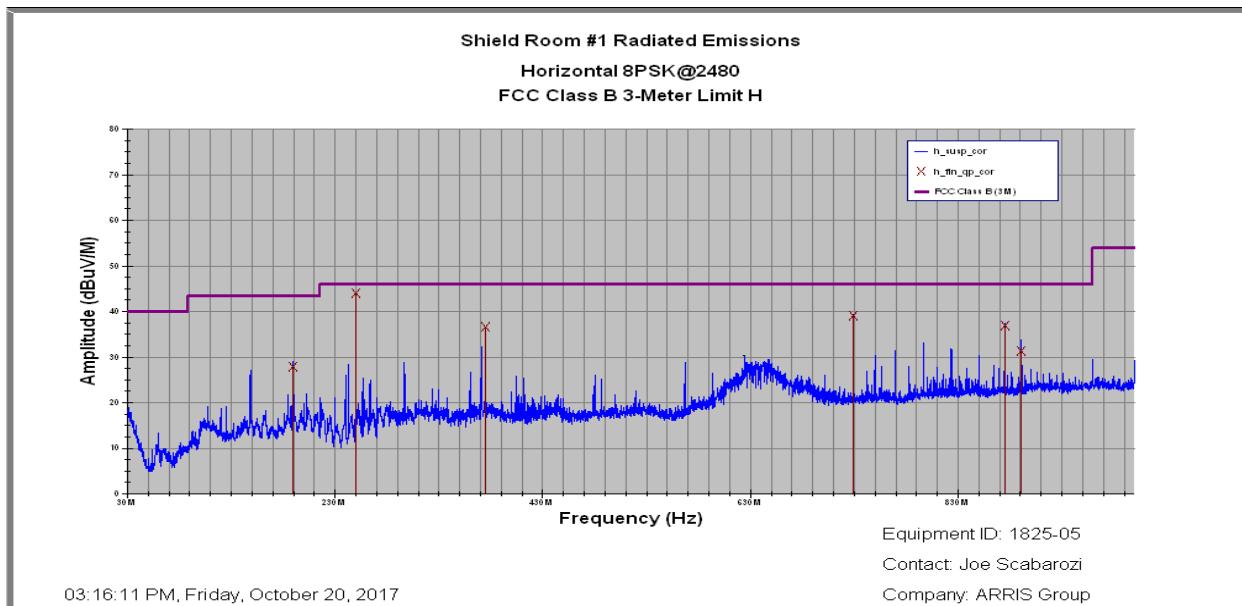
Test Results: The ARRIS Model Spectrum 110A demonstrates that all emissions in a 100 kHz band, outside the operating band are more than 20 dB below the 100 kHz bandwidth emission inside the operating band. This complies with the requirements of 47 CFR Part 15.247(d).



4.12.1 Radiated Emissions (47 CFR 15.247(d)) (10/18/2017 to 10/20/2017)

Additionally radiated emissions which fall in the restricted bands of section 15.205(a) must comply with the radiated emission limits specified in 15.209(a).

The ARRIS Model Spectrum 110A was tested for compliance to the limits of 15.209(a). The modulation schemes were tested at each of the low, middle and high channel frequencies. The highest emissions were noted with 8PSK with the transmitter at 2.480 GHz. There was little variation in signal quantity or amplitude among the various combinations of frequency and modulation. The tables and graphs below shows the highest emissions.





Sample 1825-05
ARRIS Model Spectrum 110A
Bluetooth Set to 8PSK at 2480 MHz

Frequency	Peak Measurement	QP Measurement	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC Class B Limit	Margin	Results
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
189.005	28.89	28	H	219	122	-14.25	43.52	-15.52	PASS
249.984	44.8	44.1	H	148	134	-13.3	46.02	-1.92	PASS
374.974	37.29	36.52	H	189	191	-9.99	46.02	-9.5	PASS
728.981	39.77	39.17	H	146	115	-4.57	46.02	-6.85	PASS
874.99	36.08	36.87	H	127	155	-2.35	46.02	-9.15	PASS
890.99	32.21	31.35	H	101	107	-2.16	46.02	-14.67	PASS

Frequency	Peak Measurement	QP Measurement	Antenna Polarity	Turntable	Antenna Height	Correction Factor	FCC Class B Limit	Margin	Results
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
148.326	25.05	23.45	V	277	237	-13.3	43.52	-20.07	PASS
188.987	28.53	27.07	V	345	107	-14.25	43.52	-16.45	PASS
249.989	40.47	39.54	V	161	109	-13.3	46.02	-6.48	PASS
728.981	35.52	34.71	V	282	119	-4.57	46.02	-11.31	PASS
959.995	30.99	29.92	V	204	147	-1.31	46.02	-16.1	PASS
959.998	30.84	29.84	V	181	110	-1.31	46.02	-16.18	PASS

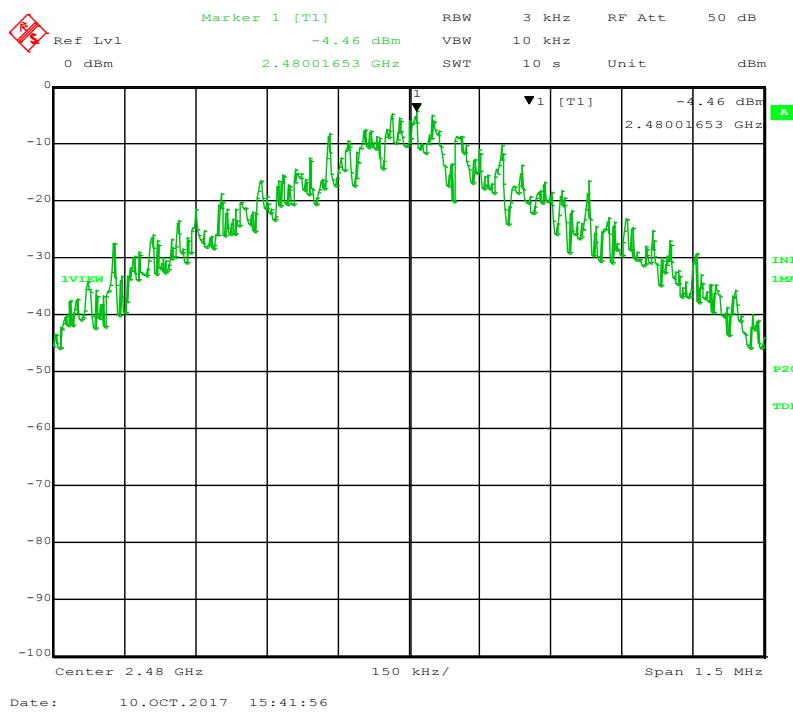
Test Results: Signals measured from the ARRIS Model Spectrum 110A complied with the requirements of CFR Part 15.247(d) with a margin of 1.92 dB.

4.13 Antenna Port, Power Spectral Density (47 CFR 15.247(f)) (10/10/2017)

The ARRIS Model Spectrum 110A employs a combination of both frequency hopping and digital modulation techniques. Therefore, the power spectral density, conducted from the transmitter to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off shall not be greater than 8 dBm in any 3 kHz band during continuous transmission.

Modulation	Channel	Freq (GHz)	Measured Power Spectral Density (dBm)	Cable Loss (dB)	Total Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Pass/Fail
GFSK	CH.1	2.402	-5.23	0.62	-4.61	8.00	PASS
	CH.39	2.440	-4.64	0.63	-4.01	8.00	PASS
	CH.79	2.480	-4.46	0.63	-3.83	8.00	PASS
QPSK	CH.1	2.402	-12.36	0.62	-11.74	8.00	PASS
	CH.39	2.440	-12.68	0.63	-12.05	8.00	PASS
	CH.79	2.480	-12.53	0.63	-11.9	8.00	PASS
8PSK	CH.1	2.402	-14.04	0.62	-13.42	8.00	PASS
	CH.39	2.440	-13.74	0.63	-13.11	8.00	PASS
	CH.79	2.480	-12.81	0.63	-12.18	8.00	PASS

GFSK Modulation @ 2.480 GHz



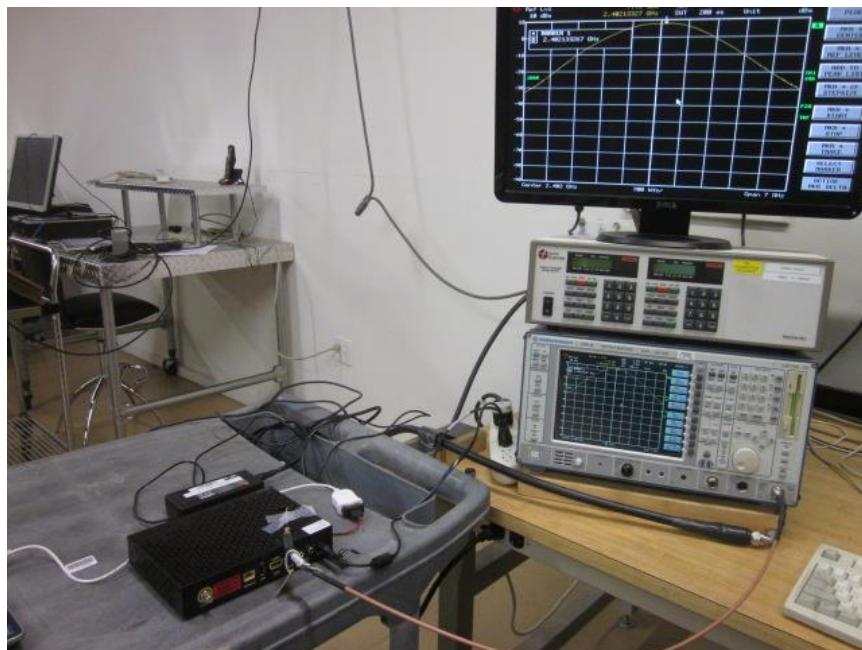
Test Results: Power Spectral Density of the ARRIS Model Spectrum 110A complied with the requirements of CFR Part 15.247(f) with a margin of 3.83 dB.

5.0 Test Setup Pictures

5.1 Conducted Emissions Power Line Test Setup Picture

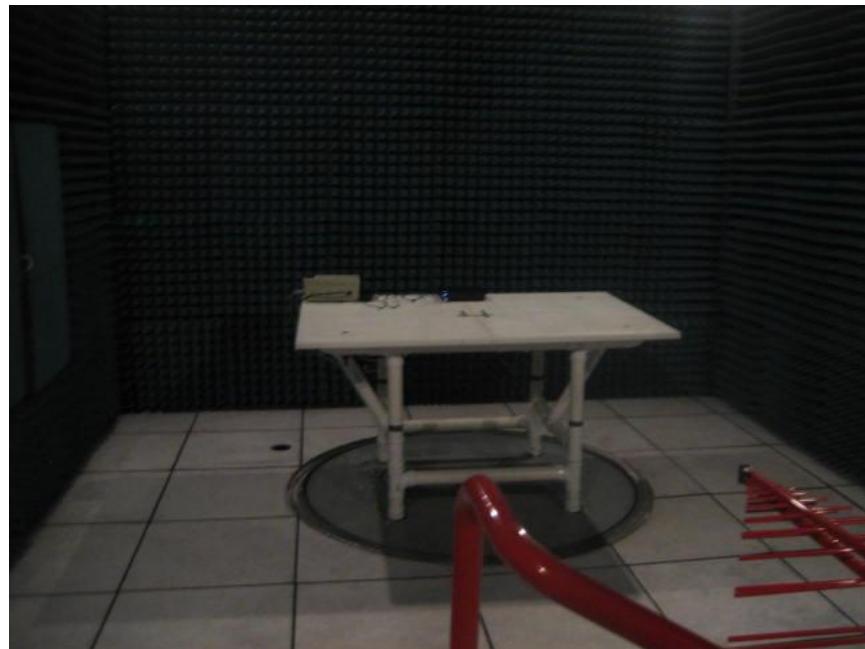


5.2 Conducted Emissions Antenna Test Setup Picture

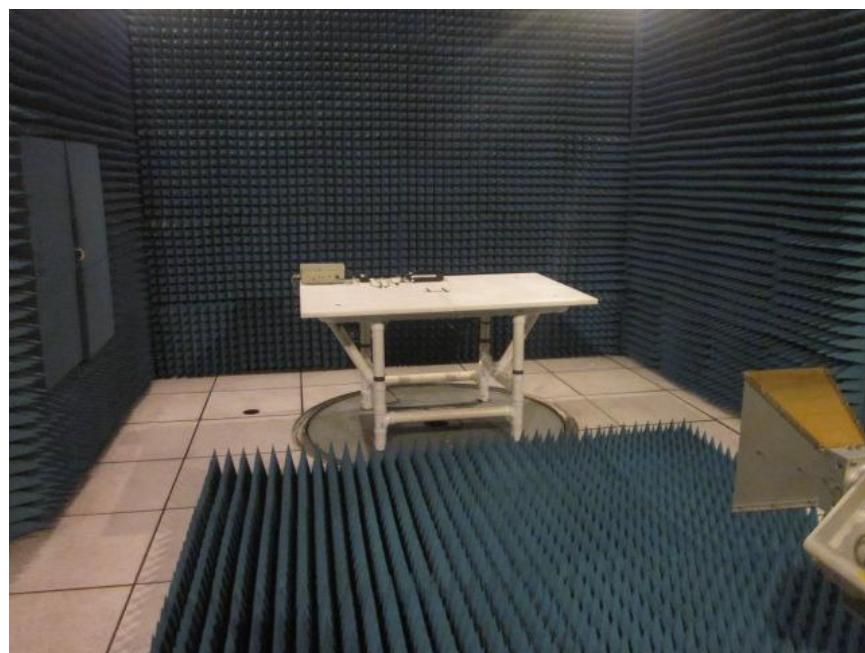




5.3 Radiated Emissions 30 – 1000 MHz Test Setup Picture



5.4 Radiated Emissions 1 – 25 GHz Test Setup Picture





Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	07/01/16	2 Years	07/01/18
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	04/01/16	2 Years	04/01/18
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	02/16/16	2 Years	02/16/18
Amplifier (.1 – 1300 MHz)	Hewlett Packard	8447F	2805A02896	1003	No Cal. Required	No Cal. Required	No Cal. Required
EMC Analyzer (9 kHz - 1.8 GHz)	Hewlett Packard	8591EM	3536A00746	821	11/15/17	3 Years	11/15/20
GTEM (30 MHz – 1 GHz)	ETS Lindgren	5317	1014	1001	No Cal. Required	No Cal. Required	No Cal. Required
Spectrum Analyzer (9 kHz - 40 GHz)	Hewlett Packard	8564E	3410A00129	769	12/29/15	3 Years	12/29/18
EMC Analyzer (9 kHz - 26.5 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/02/17	2 Years	03/02/19
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	10/03/16	2 Year	10/03/18
Double Ridged Horn Antenna (1 - 18 GHz)	EMCO	3115	9705-5225	1028	10/19/16	2 Years	10/19/18



Antenna (18 - 26.5 GHz)	Hewlett Packard	84125-80008	N/A	1056	10/19/16	2 Years	10/19/18
EMI Receiver (9 kHz - 6.5 GHz)	Hewlett Packard	8546A	3325A00158	761	12/13/16	3 Years	12/13/19
Four Line V-LISN	Teseq	NNB 52	253551	950	06/15/17	1 Year	06/15/18
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	12/16/15	2 Years	12/16/17
Intentional Radiator Testing High Frequency RF Test Cable	Workhorse	WHU18-3636-036	N/A	814	12/04/16	2 Years	12/04/18
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	05/16/17	1 Year	05/16/18
Temp/Humidity Meter	Control Company	4096	170522942	780	07/14/17	2 Years	07/14/19
Software (Tile Instrument Control System)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required
Radiated Emissions Test Software	BEC	RADE	2.2	N/A	No Cal. Required	No Cal. Required	No Cal. Required