

FCC 15.247 2.4 GHz Test Report

for

Amino Communications Ltd.

**Buckingway Business Park, Anderson Road
Swaveasy Cambridgeshire CB24 4UQ, United Kingdom**

Product Name : IPTV STB/PVR
Model Name : Kamai XXXXXXXXXXXXX
Brand : amino
FCC ID : XVG500144BCBT

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

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APPENDIX A TEST DATA AND PLOTS

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TEST REPORT CERTIFICATION

Applicant : Amino Communications Ltd.

Manufacturer : Xavi Technologies Corp.

EUT Description

(1) Product : IPTV STB/PVR

(2) Model : Kamai XXXXXXXXXXXXX

(3) Brand : amino

(4) Power Rating : DC 12V

Applicable Standards:

47 CFR FCC Part 15 Subpart C

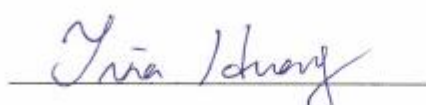
ANSI C63.10:2013

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2019. 04. 15

Reviewed by:



(Tina Huang/Administrator)

Approved by:



(Ben Cheng/Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2019. 04. 15	Original Report	EM-F180126

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	PASS
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(1)	20dB Bandwidth	PASS
15.247(a)(1)	Carrier Frequency Separation	PASS
15.247(a)(1)(iii)	Time of Occupancy	PASS
15.247(a)(1)(iii)	Number of Hopping Channels	PASS
15.247(b)(1)	Maximum Peak Output Power	PASS
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	PASS
15.203	Antenna Requirement	Compliance

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	Amino Communications Ltd. Buckingway Business Park, Anderson Road Swaveasy Cambridgeshire CB24 4UQ, United Kingdom
Manufacturer	Xavi Technologies Corp. No. 468, Gu tang Road, Wu jiang city, Jiangsu province
Product	IPTV STB/PVR
Model	Kamai XXXXXXXXXXXXX (Where "X" can be 6, 7, 8 or blank; "XXXXXXXXXXXX" can be any combination of 0~9, A~Z, -, /, or blank; for marketing purpose only)
Brand	amino

3.2. Description of EUT

Test Model	Kamai 7B																			
Serial Number	N/A																			
Power Rating	DC 12V																			
RF Features	WLAN:802.11 a/n/ac Bluetooth: BT and BLE																			
Transmit Type	<table><tr><td colspan="2">2.4 GHz</td></tr><tr><td>BT/BLE</td><td>1T1R</td></tr></table>			2.4 GHz		BT/BLE	1T1R													
	2.4 GHz																			
	BT/BLE	1T1R																		
	<table><tr><th rowspan="2">UNII Bands</th><th colspan="2">Mode</th></tr><tr><th>CDD</th><th>SDM</th></tr><tr><td>802.11a</td><td>4T4R</td><td>--</td></tr><tr><td>802.11n-HT20/ 802.11ac-VHT20</td><td>4T4R</td><td>4T4R</td></tr><tr><td>802.11n-HT40/ 802.11ac-VHT40</td><td>4T4R</td><td>4T4R</td></tr><tr><td>802.11ac-VHT80</td><td>4T4R</td><td>4T4R</td></tr></table>			UNII Bands	Mode		CDD	SDM	802.11a	4T4R	--	802.11n-HT20/ 802.11ac-VHT20	4T4R	4T4R	802.11n-HT40/ 802.11ac-VHT40	4T4R	4T4R	802.11ac-VHT80	4T4R	4T4R
	UNII Bands	Mode																		
		CDD	SDM																	
	802.11a	4T4R	--																	
	802.11n-HT20/ 802.11ac-VHT20	4T4R	4T4R																	
	802.11n-HT40/ 802.11ac-VHT40	4T4R	4T4R																	
	802.11ac-VHT80	4T4R	4T4R																	
This device not support beamforming mode.																				
Sample Status	Production																			
Date of Receipt	2018. 03. 05																			
Date of Test	2018. 03. 20 ~ 04. 13																			
Interface Ports of EUT	● DC power In Port x1 ● S/PDIF optical output Port x1 ● USB 3.0 Port x1 ● HDMI Port x1 ● Ethernet Port x1 ● Analogue A/V Output Port x1																			
Accessories Supplied	● AC/DC Adapter ● Remote Control ● 3.5mm jack to 3x RCA Cable ● HDMI Cable																			

3.3. Antenna Information

WLAN Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	Ant 5G-1	Waisin Technology Corporation	PCB Antenna	5150-5850	2.36
2	Ant 5G-2				2.31
3	Ant 5G-3				2.13
4	Ant 5G-4				2.35

BT/BLE Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	---	---	PCB Antenna	2400-2500	1.4

3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
Bluetooth	2402-2480	79	FHSS (GFSK, $\pi/4$ DQPSK, 8-DPSK)	1/2/3

Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

3.5. Description of Key Components

Item	Supplier	Model/Type	Description
AC/DC Adapter	MOSO	MSA-C2000IS 12.0-24Y-DE	Input: 100-240V~, 50/60Hz, 0.7A max. Output: DC 12V, 2A
Remote Control	N/A	N/A	N/A

3.6. Test Configuration

Mode	Duty Cycle (x)	T (ms)
BT	N/A	2.890

AC Conduction	
Test Case	Normal operation

Item		Modulation	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	8-DPSK	3Mbps	00/78
	Radiated Spurious Emission ^{Note1}	8-DPSK	3Mbps	00/39/78
Conducted Test Case ^{Note2}	20dB Bandwidth	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Carrier Frequency Separation	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Time of Occupancy	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Number of Hopping Channels	GFSK	1Mbps	39
		8-DPSK	3Mbps	39
	Maximum Peak Output Power	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Band Edges	GFSK	1Mbps	00/78
		8-DPSK	3Mbps	00/78
	Spurious Emission	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78

Note 1:  Mobile Device

☐ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☐ Lie ☐ Side ☐ Stand

Note 2: We performed testing of the highest and lowest data rate.

3.7. Tested Supporting System List

3.7.1. Support Peripheral Unit

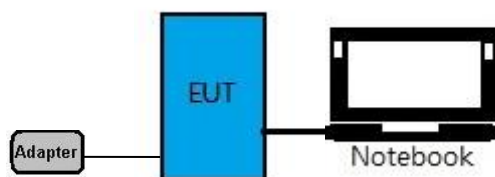
No.	Product	Brand	Model No.	Serial No.	Approval
1.	Notebook PC	acer	N16Q2	N/A	Contains FCC ID: PPD-QCNFA435 Contains IC: 4104A-QCNFA435

3.7.2. Cable Lists

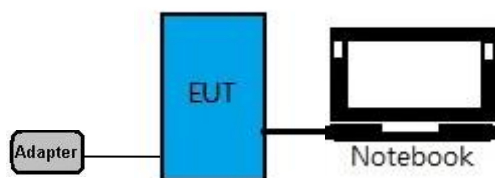
No.	Cable Description Of The Above Support Units
1.	USB Cable : Unshielded, Detachable, 2.0m Adapter: Chicony, M/N A11-065N1A DC Cord : Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord : Unshielded, Detachable, 1.0m

3.8. Setup Configuration

3.8.1. EUT Configuration for Power Line & Radiated Emission



3.8.2. EUT Configuration for RF Conducted Test Items



3.9. Operating Condition of EUT

Test program “Tera term” is used for enabling EUT RF function under continues transmitting and choosing channel.

3.10. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 (1) No. 8 Shielding Room (2) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (3) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

3.11. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.50dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	±0.2kHz
Carrier Frequency Separation	±0.2kHz
Time of Occupancy	±0.03sec
Maximum peak Output power	± 0.52dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR	101774	2018. 01. 24	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2017. 11. 12	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2017. 12. 14	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2018. 01. 16	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2017. 04. 21	1 Year
6.	Test Software	Audix	e3	V.6.120424	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2017. 09. 13	1 Year
2.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2018. 01. 04	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2017. 06. 19	1 Year
4.	Amplifier	HP	8447D	2944A06305	2018. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2018. 03. 06	1 Year
6.	Bilog Antenna	CHASE	CBL6112D	33821	2018. 01. 21	1 Year
7.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017. 12. 18	1 Year
8.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2018. 03. 08	1 Year
9.	Horn Antenna	EMCO	3116	2653	2017. 12. 19	1 Year
10.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-00	1	2017. 07. 26	1 Year
11.	3GHz Notch Filter	Microwave	H3G018G1	484798	2017. 08. 25	1 Year
12.	Digital Thermo-Hygro Meter	IMax	HTC-1	No.1 3m A/C	2017. 04. 21	1 Year
13.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2017. 04. 21	1 Year
14.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2017. 04. 18	1 Year
2.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2017. 04. 21	1 Year

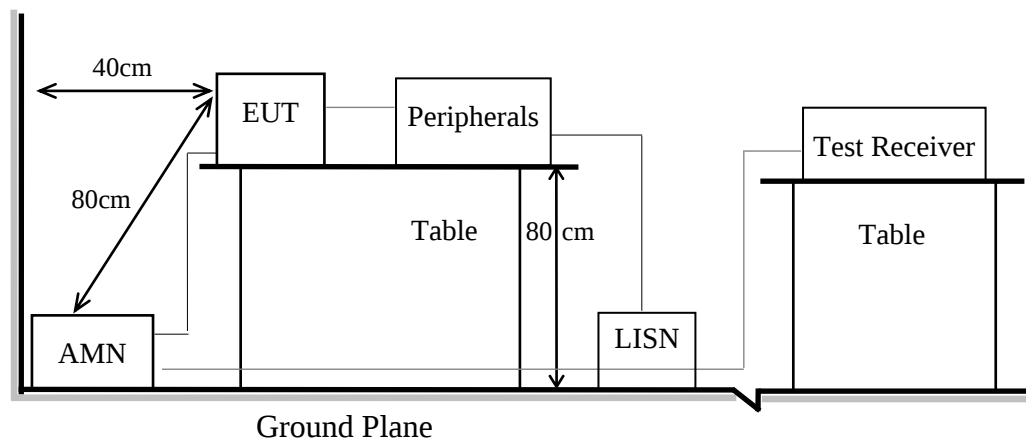
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.8

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. To Check frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

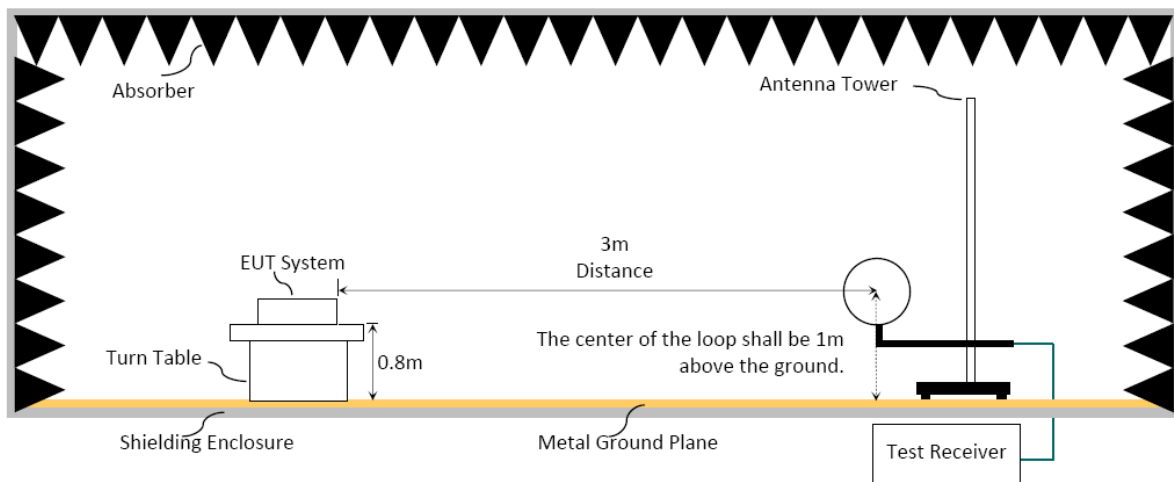
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

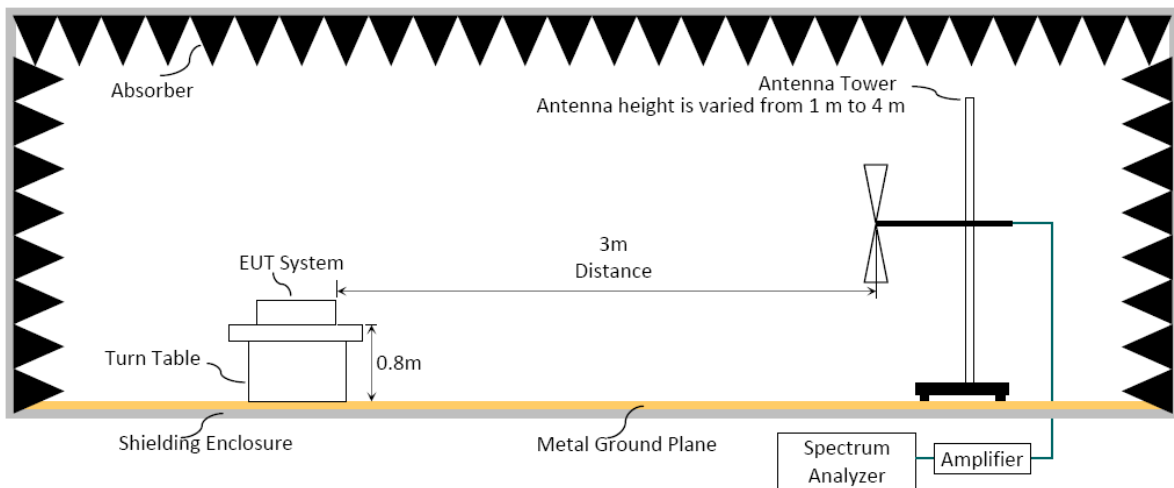
6.1.1. Block Diagram of EUT

Indicated as section 3.8

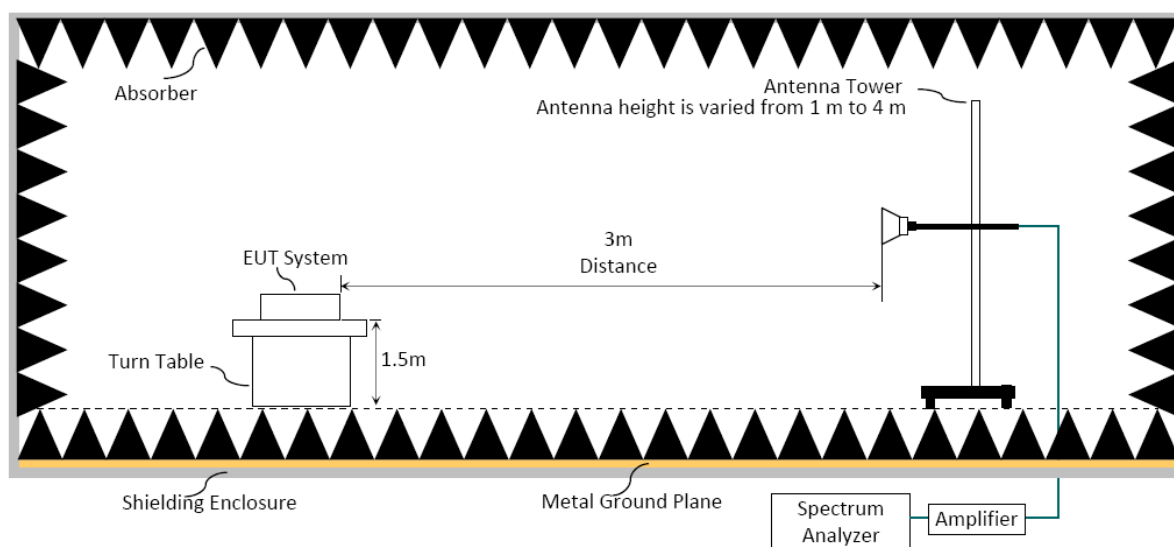
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000 MHz



6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 25GHz:

The EUT setup on the turn table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Frequency above 1GHz to 10th harmonic (up to 25 GHz):

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:☒ **Option 1:**

- (1) RBW = 1MHz
- (2) VBW $\geq 1/T$.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

☐ **Option 2:**

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading

☒ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

☐ Average Emission Level = Peak Emission Level + DCCF

Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.6

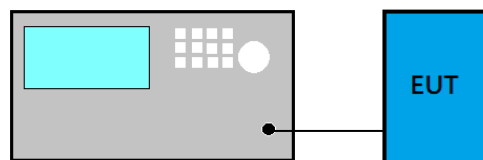
☐ ERP = Peak Emission Level - 95.2dB - 2.14dB

6.5. Test Results

Please refer to Appendix A.

7. 20dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

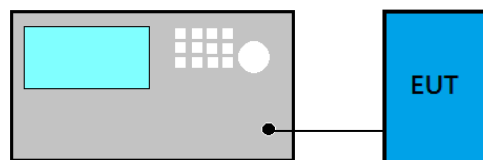
- (1) Set RBW close to 1% to 5% of OBW.
- (2) Set $VBW \geq 3RBW$.
- (3) Detector = Peak.
- (4) Trace mode = Max hold.
- (5) Sweep = Auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. CARRIER FREQUENCY SEPARATION

8.1. Block Diagram of Test Setup



8.2. Specification Limits

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output no greater than 125mW.

8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

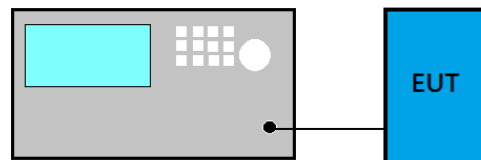
- (1) Span = Wide enough to capture the peaks of two adjacent channels
- (2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = Max hold
- (7) Allow the trace to stabilize.

8.4. Test Results

Please refer to Appendix A

9. TIME OF OCCUPANCY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency hopping systems in the 2400-2483.5MHz shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by number of hopping channels employed.

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

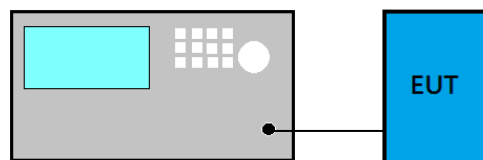
- (1) Span: Zero span, centered on a hopping channel.
- (2) RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
- (3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- (4) Detector function = Peak
- (5) Trace = Max hold

9.4. Test Results

Please refer to Appendix A

10. NUMBER OF HOPPING CHANNELS

10.1. Block Diagram of Test Setup



10.2. Specification Limits

Frequency hopping systems which use fewer than 20 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

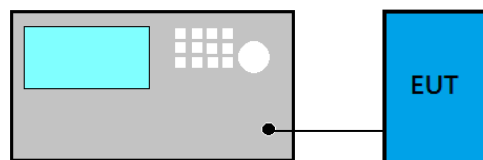
- (1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- (2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = m=Max hold
- (7) Allow the trace to stabilize.

10.4. Test Results

Please refer to Appendix A

11. MAXIMUM PEAK OUTPUT POWER

11.1. Block Diagram of Test Setup



11.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

11.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

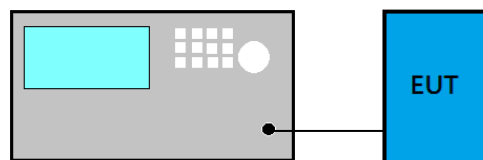
- (a) Use the following spectrum analyzer settings
 - (1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
 - (2) RBW > 20 dB bandwidth of the emission being measured.
 - (3) VBW $\geq$ RBW
 - (4) Sweep: Auto
 - (5) Detector function: Peak
 - (6) Trace: Max hold
- (b) Allow trace to stabilize.
- (c) Use the marker-to-peak function to set the marker to the peak of the emission.

11.4. Test Results

Please refer to Appendix A

12.EMISSION LIMITATIONS

12.1.Block Diagram of Test Setup



12.2.Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).

12.3.Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

- (1) Set span wide enough to capture the peak level of the in-band emission and all spurious emissions; up to 10th harmonic.
- (2) RBW = 100 kHz
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = Max hold

12.4.Test Results

Please refer to Appendix A

13.DEVIATION TO TEST SPECIFICATIONS

【NONE】



Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

APPENDIX A

TEST DATA AND PLOTS

(Model: Kamai 7B)

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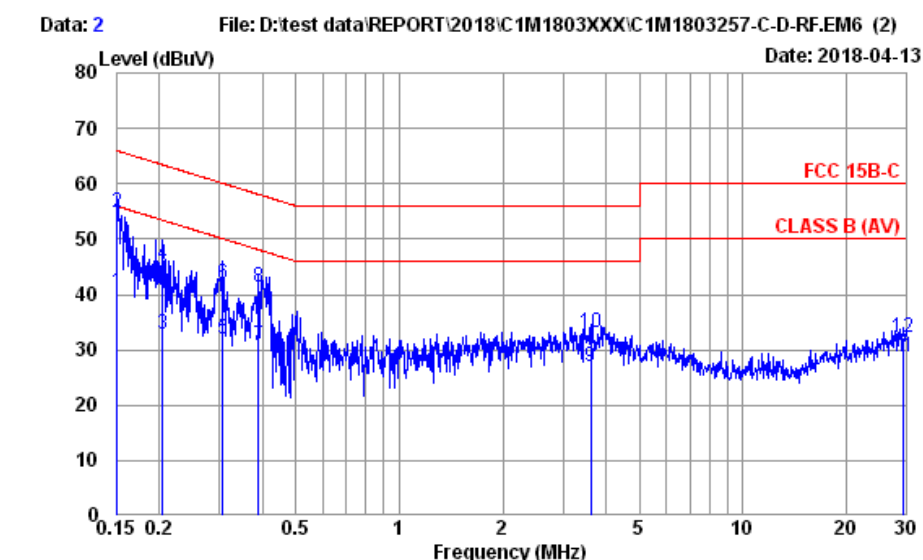
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AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.1 CONDUCTED EMISSION

Test Date	2018/04/13	Temp./Hum.	25°C/56%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.8 Shielded Room Data no. : 2
Condition : ENV4200 100169 LISN Phase : NEUTRAL
Limit : FCC 15B-C
Env. / Ins. : 25°C / 56% ESR3(1774) Engineer : Nick Du
EUT : Kamai 7B
Power Rating : 120Vac/60Hz
Test Mode : Operating

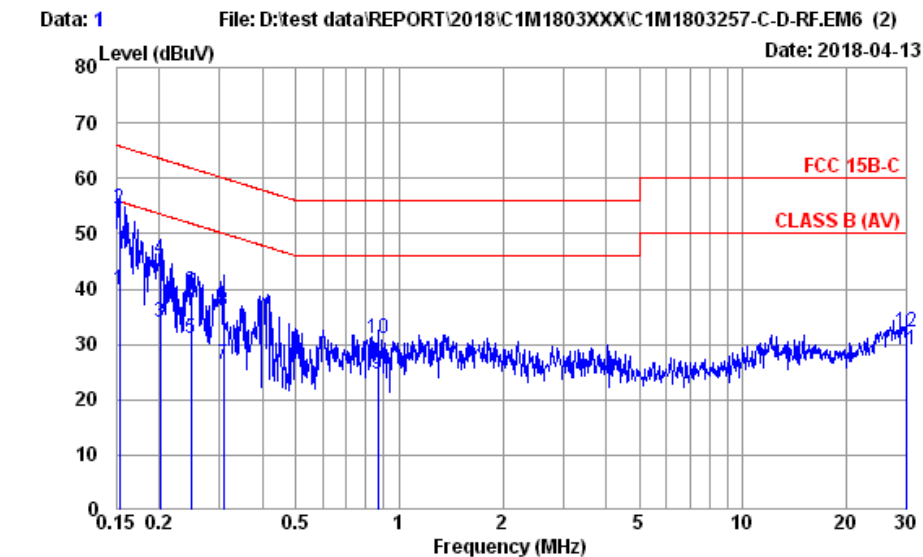
	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.57	0.03	9.86	20.09	40.55	55.96	15.41	Average
2	0.151	10.57	0.03	9.86	34.25	54.71	65.96	11.25	QP
3	0.205	10.52	0.03	9.86	12.43	32.84	53.40	20.56	Average
4	0.205	10.52	0.03	9.86	25.12	45.53	63.40	17.87	QP
5	0.307	10.46	0.04	9.86	11.46	31.82	50.06	18.24	Average
6	0.307	10.46	0.04	9.86	21.68	42.04	60.06	18.02	QP
7	0.389	10.43	0.04	9.86	10.46	30.79	48.08	17.29	Average
8	0.389	10.43	0.04	9.86	20.89	41.22	58.08	16.86	QP
9	3.603	10.57	0.11	9.87	6.55	27.10	46.00	18.90	Average
10	3.603	10.57	0.11	9.87	12.57	33.12	56.00	22.88	QP
11	29.371	16.12	0.33	10.00	2.28	28.73	50.00	21.27	Average
12	29.371	16.12	0.33	10.00	5.92	32.37	60.00	27.63	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/04/13	Temp./Hum.	25°C/56%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.8 Shielded Room Data no. : 1
Condition : ENV4200 100169 LISN Phase : LINE
Limit : FCC 15B-C
Env. / Ins. : 25°C / 56% ESR3(1774) Engineer : Nick Du
EUT : Kamai 7B
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.153	10.62	0.03	9.86	19.48	39.99	55.82	15.83	Average
2	0.153	10.62	0.03	9.86	33.88	54.39	65.82	11.43	QP
3	0.202	10.56	0.03	9.86	13.56	34.01	53.54	19.53	Average
4	0.202	10.56	0.03	9.86	24.91	45.36	63.54	18.18	QP
5	0.248	10.53	0.03	9.86	10.61	31.03	51.82	20.79	Average
6	0.248	10.53	0.03	9.86	19.28	39.70	61.82	22.12	QP
7	0.308	10.49	0.04	9.86	5.90	26.29	50.02	23.73	Average
8	0.308	10.49	0.04	9.86	15.58	35.97	60.02	24.05	QP
9	0.866	10.44	0.06	9.86	4.19	24.55	46.00	21.45	Average
10	0.866	10.44	0.06	9.86	10.73	31.09	56.00	24.91	QP
11	29.841	16.31	0.34	10.01	2.26	28.92	50.00	21.08	Average
12	29.841	16.31	0.34	10.01	5.62	32.28	60.00	27.72	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

A.2 RADIATED EMISSION

Test Date	2018/04/10	Temp./Hum.	24°C/53%
Test Voltage	AC 120V, 60Hz (via AC/DC Adapter)		

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1 GHz

Mode	8-DPSK	Frequency	TX 2441MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
35.82	21.82	1.33	1.12	24.27	40.00	15.73	Peak
127.97	18.39	2.60	7.94	28.93	43.50	14.57	Peak
291.90	19.44	4.23	10.73	34.40	46.00	11.60	Peak
638.19	24.73	6.88	2.96	34.57	46.00	11.43	Peak
874.87	26.60	8.04	3.59	38.23	46.00	7.77	Peak
975.75	27.59	8.68	1.25	37.52	54.00	16.48	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
31.94	23.76	1.25	7.75	32.76	40.00	7.24	Peak
107.60	18.02	2.36	14.57	34.95	43.50	8.55	Peak
296.75	19.47	4.28	8.92	32.67	46.00	13.33	Peak
647.89	24.75	6.91	4.55	36.21	46.00	9.79	Peak
747.80	25.39	7.34	2.59	35.32	46.00	10.68	Peak
991.27	27.73	8.76	1.50	37.99	54.00	16.01	Peak

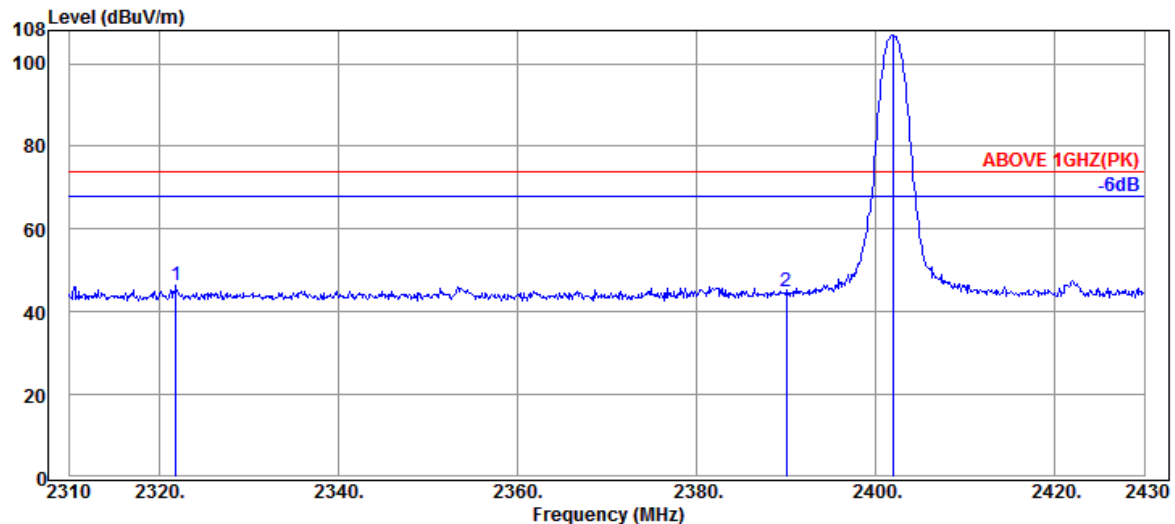
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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.2.1.3 Frequency Above 1 GHz to 10th harmonics

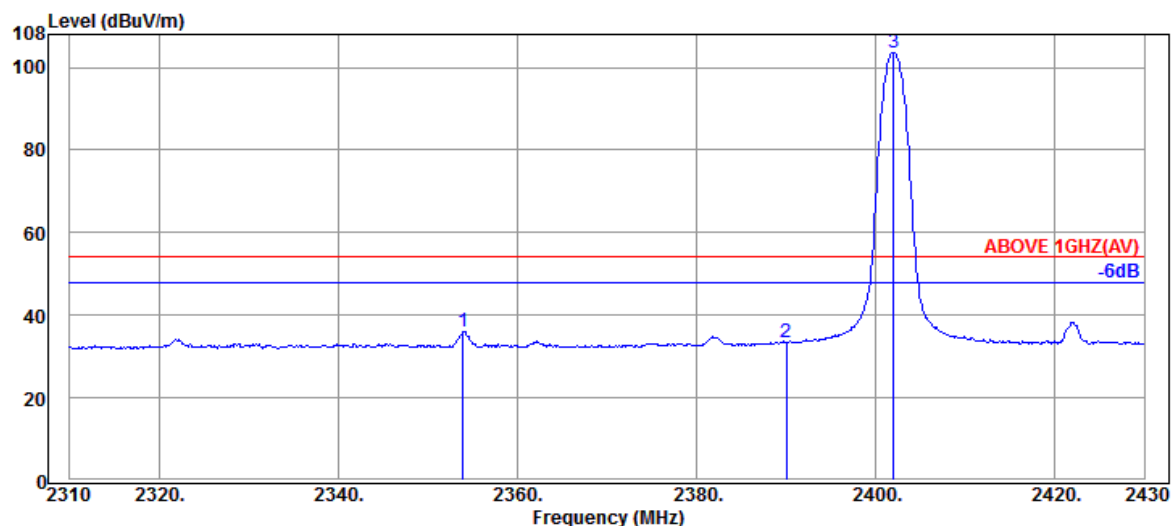
Band Edge:

Mode	8-DPSK	Frequency	TX 2402MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2321.88	32.06	6.49	7.67	46.22	74.00	27.78	Peak
2390.04	32.16	6.57	6.10	44.83	74.00	29.17	Peak
2401.92	32.16	6.57	68.12	106.85	---	---	Peak



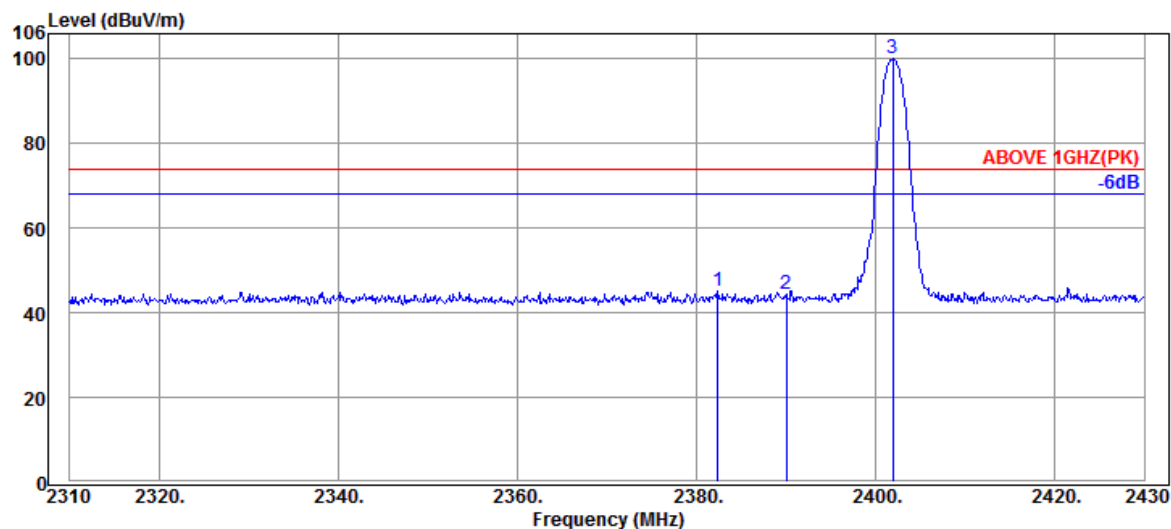
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2353.92	32.11	6.53	-2.74	35.90	54.00	18.10	Average
2390.04	32.16	6.57	-5.46	33.27	54.00	20.73	Average
2402.04	32.16	6.57	64.84	103.57	---	---	Average

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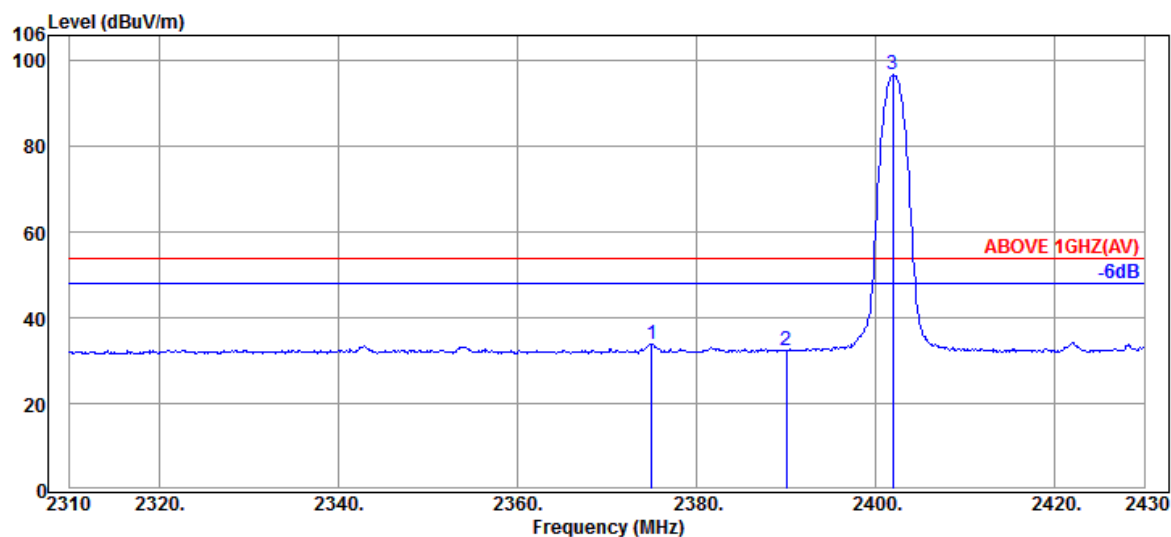
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Mode	8-DPSK	Frequency	TX 2402MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2382.36	32.13	6.55	6.50	45.18	74.00	28.82	Peak
2390.04	32.16	6.57	5.73	44.46	74.00	29.54	Peak
2401.92	32.16	6.57	61.33	100.06	---	---	Peak



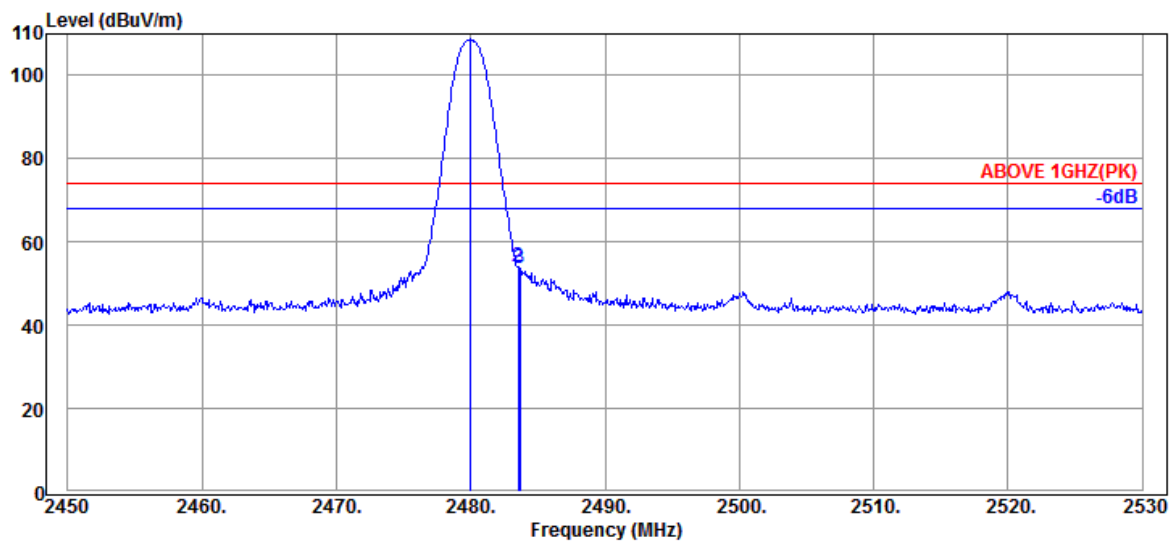
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2375.04	32.13	6.55	-4.73	33.95	54.00	20.05	Average
2390.04	32.16	6.57	-6.19	32.54	54.00	21.46	Average
2401.92	32.16	6.57	58.03	96.76	---	---	Average

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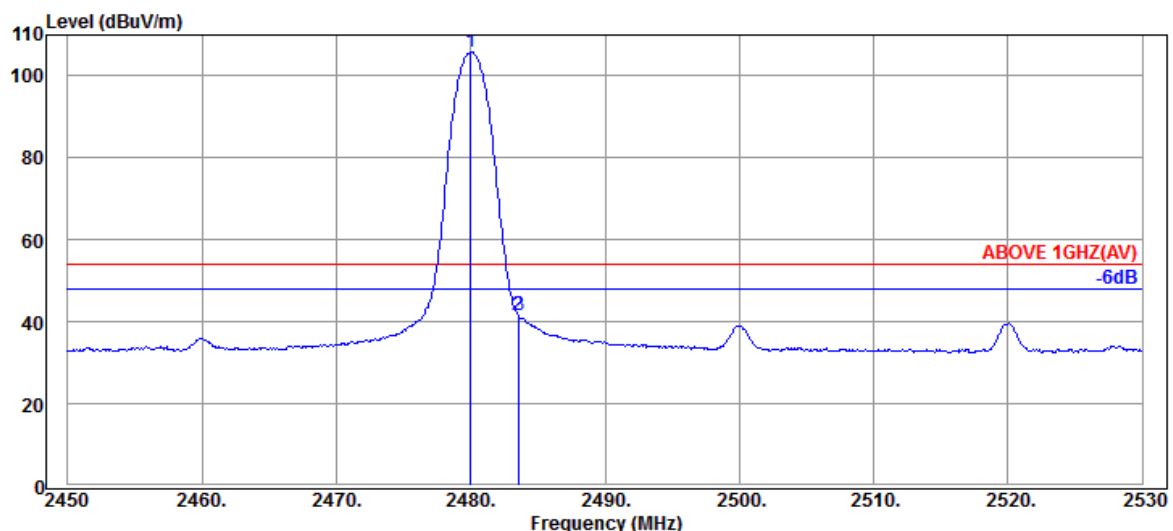
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Fax: +886 2 26099303

Mode	8-DPSK	Frequency	TX 2480MHz
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Antenna at Horizontal Polarization

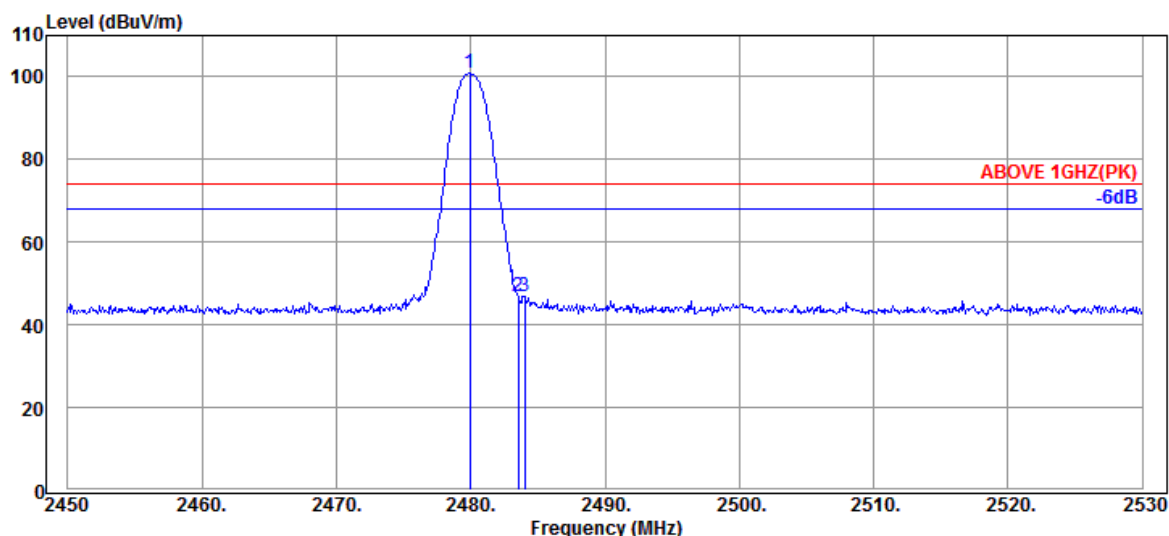
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.67	69.78	108.73	---	---	Peak
2483.52	32.28	6.67	14.99	53.94	74.00	20.06	Peak
2483.68	32.28	6.67	14.69	53.64	74.00	20.36	Peak



Antenna at Horizontal Polarization

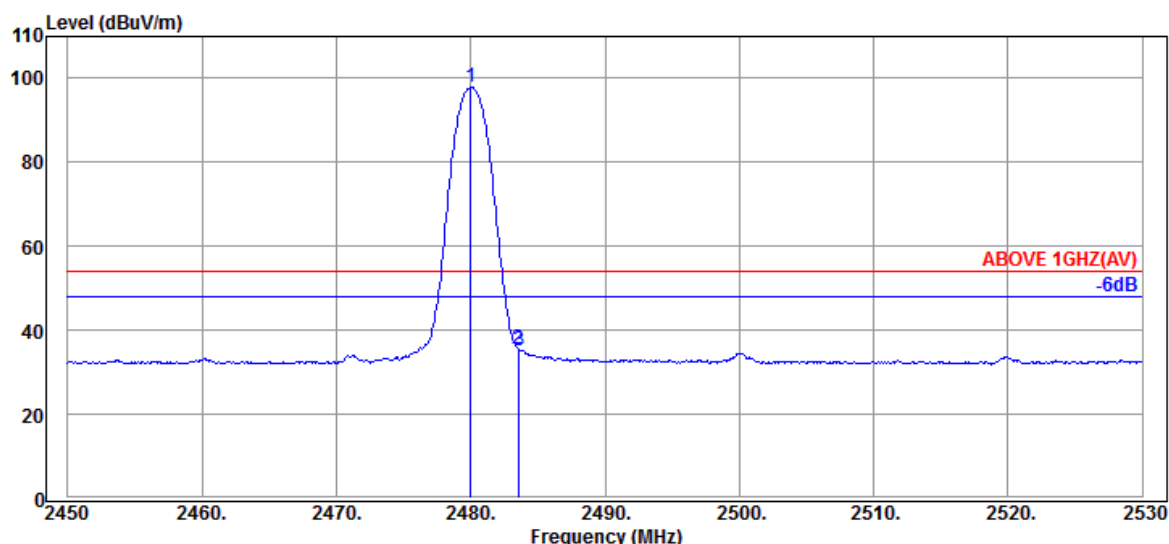
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.67	66.82	105.77	---	---	Average
2483.52	32.28	6.67	2.67	41.62	54.00	12.38	Average
2483.60	32.28	6.67	2.49	41.44	54.00	12.56	Average

Mode	8-DPSK	Frequency	TX 2480MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.92	32.28	6.67	61.90	100.85	---	---	Peak
2483.52	32.28	6.67	7.87	46.82	74.00	27.18	Peak
2484.00	32.28	6.67	7.96	46.91	74.00	27.09	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.67	58.90	97.85	---	---	Average
2483.52	32.28	6.67	-3.41	35.54	54.00	18.46	Average
2483.60	32.28	6.67	-3.67	35.28	54.00	18.72	Average

AUDIX Technology Corp.

No. 53-11, Dingfu, Linkou, Dist.,

New Taipei City244, Taiwan

Tel: +886 2 26099301**Fax: +886 2 26099303****A.2.2 Emissions outside the frequency band:**

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	8-DPSK	Frequency	TX 2402MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4805.00	34.22	9.54	-1.90	41.86	54.00	12.14	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4805.00	34.22	9.54	-1.47	42.29	54.00	11.71	Peak

Mode	8-DPSK	Frequency	TX 2441MHz
------	--------	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.25	9.56	-0.80	43.01	54.00	10.99	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.25	9.56	-1.97	41.84	54.00	12.16	Peak

Mode	8-DPSK	Frequency	TX 2480MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
4960.00	34.29	9.60	-0.68	43.21	54.00	10.79	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
4960.00	34.29	9.60	-1.81	42.08	54.00	11.92	Peak

A.2.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a) general radiated emissions limits is not required.

A.3 20dB BANDWIDTH

Test Date	2018/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.3.1 6dB Bandwidth Result

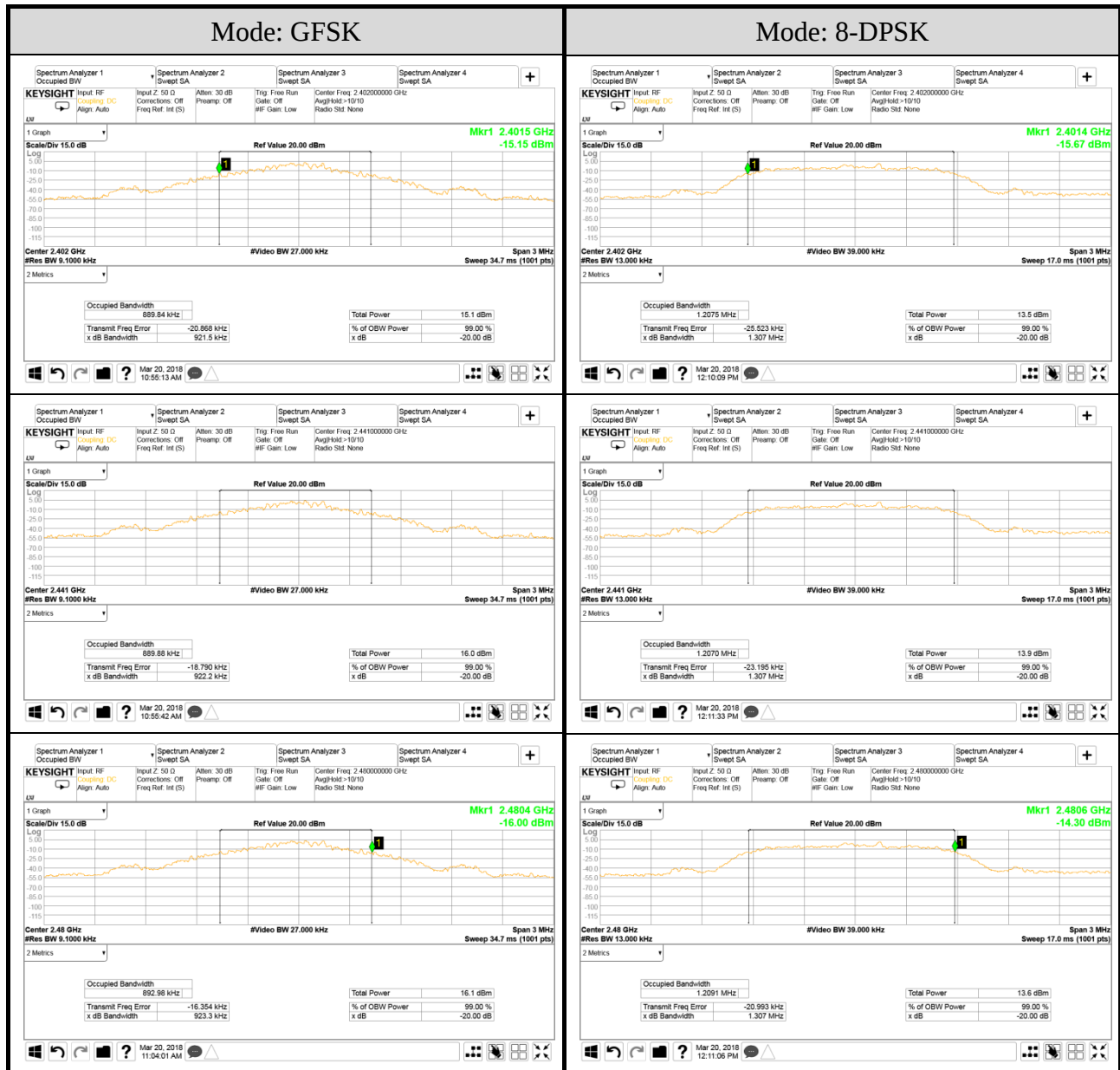
Mode	Centre Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz) (Reference only)	2/3 (20dB Bandwidth)
GFSK	2402	0.9215	0.88984	0.614
	2441	0.9222	0.88988	0.615
	2480	0.9233	0.89298	0.616
8-DPSK	2402	1.307	1.2075	0.871
	2441	1.307	1.2070	0.871
	2480	1.307	1.2091	0.871

Remark: The maximum two-thirds of the 20dB bandwidth is the limit for carrier frequency separation presented.

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.3.2 Measurement Plots

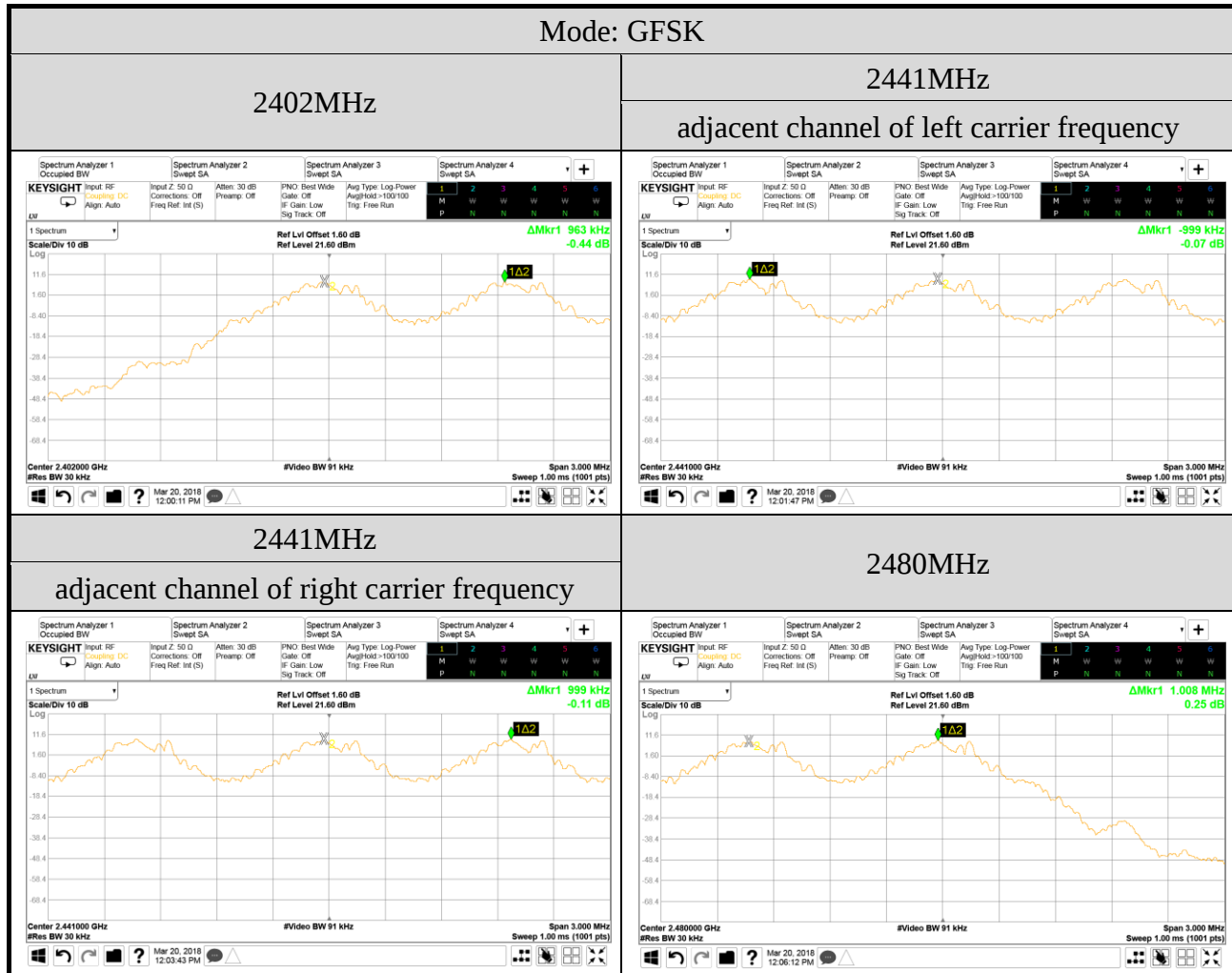


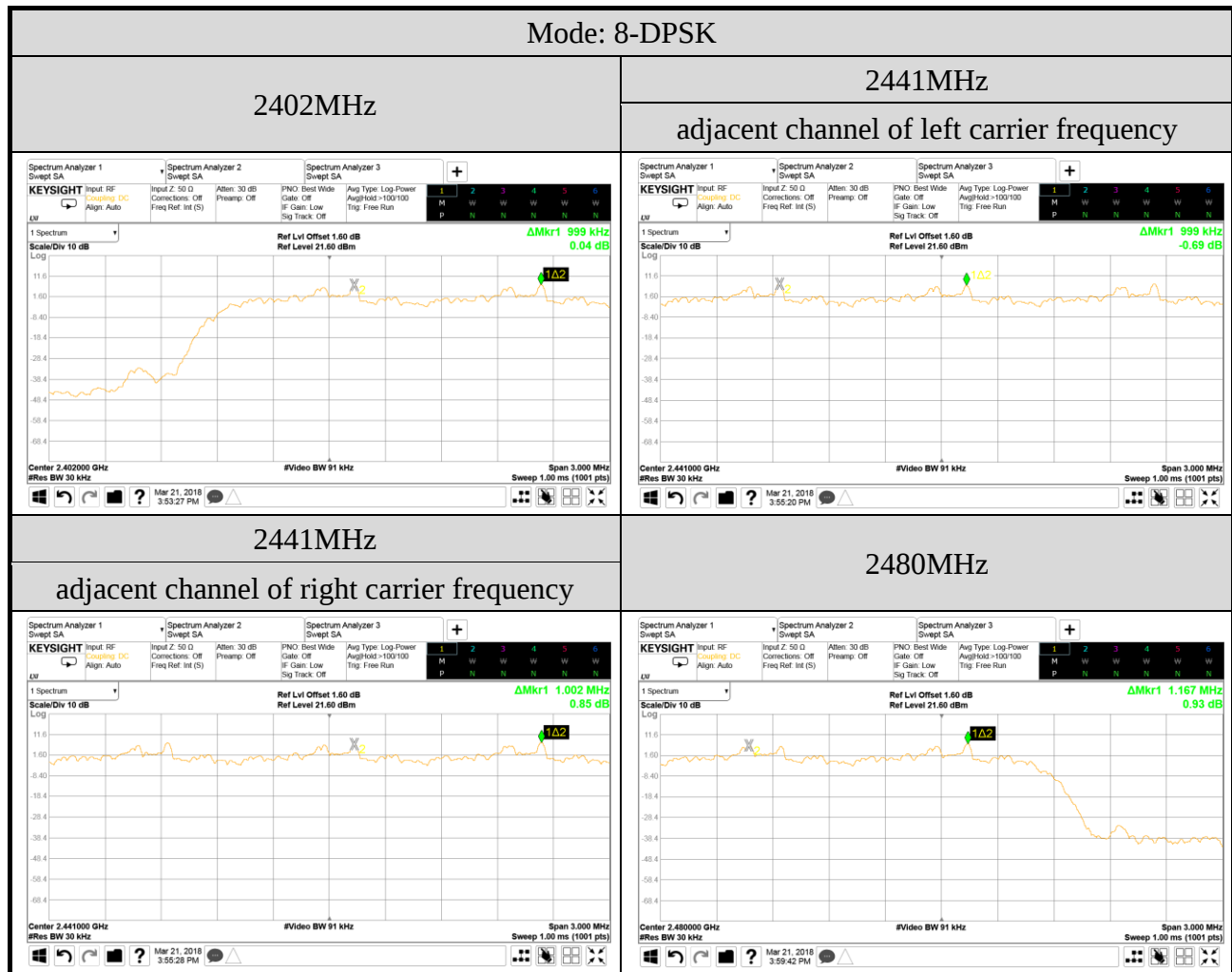
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New Taipei City 244, Taiwan

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Fax: +886 2 26099303

A.4 CARRIER FREQUENCY SEPARATION

Test Date	2017/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)





A.5 TIME OF OCCUPANCY

Test Date	2017/03/20~22	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.5.1 Time of Occupancy

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2402	DH1	10	0.380	120.080	<400
		DH3	5	1.640	259.120	<400
		DH5	3	2.890	273.972	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds

DH1 Mode

For each second of 10 transmission appearance,the longest time of occupancy is
10 transmission* 31.6 seconds* 0.380 ms= 120.080 ms (<400ms)

DH3 Mode

For each second of 5 transmission appearance,the longest time of occupancy is
5 transmission* 31.6 seconds* 1.640 ms= 259.120 ms (<400ms)

DH5 Mode

For each second of 3 transmission appearance,the longest time of occupancy is
3 transmission* 31.6 seconds* 2.890 ms= 273.972 ms (<400ms)

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2440	DH1	10	0.380	120.080	<400
		DH3	5	1.640	259.120	<400
		DH5	3	2.880	273.024	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds

DH1 Mode

For each second of 10 transmission appearance,the longest time of occupancy is
10 transmission* 31.6 seconds* 0.380 ms= 120.080 ms (<400ms)

DH3 Mode

For each second of 5 transmission appearance,the longest time of occupancy is
5 transmission* 31.6 seconds* 1.640 ms= 259.120 ms (<400ms)

DH5 Mode

For each second of 3 transmission appearance,the longest time of occupancy is
3 transmission* 31.6 seconds* 2.880 ms= 273.024 ms (<400ms)

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2480	DH1	10	0.380	120.080	<400
		DH3	5	1.640	259.120	<400
		DH5	3	2.890	273.972	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds

DH1 Mode

For each second of 10 transmission appearance, the longest time of occupancy is

10 transmission* 31.6 seconds* 0.380 ms= 120.080 ms (<400ms)

DH3 Mode

For each second of 5 transmission appearance, the longest time of occupancy is

5 transmission* 31.6 seconds* 1.640 ms= 259.120 ms (<400ms)

DH5 Mode

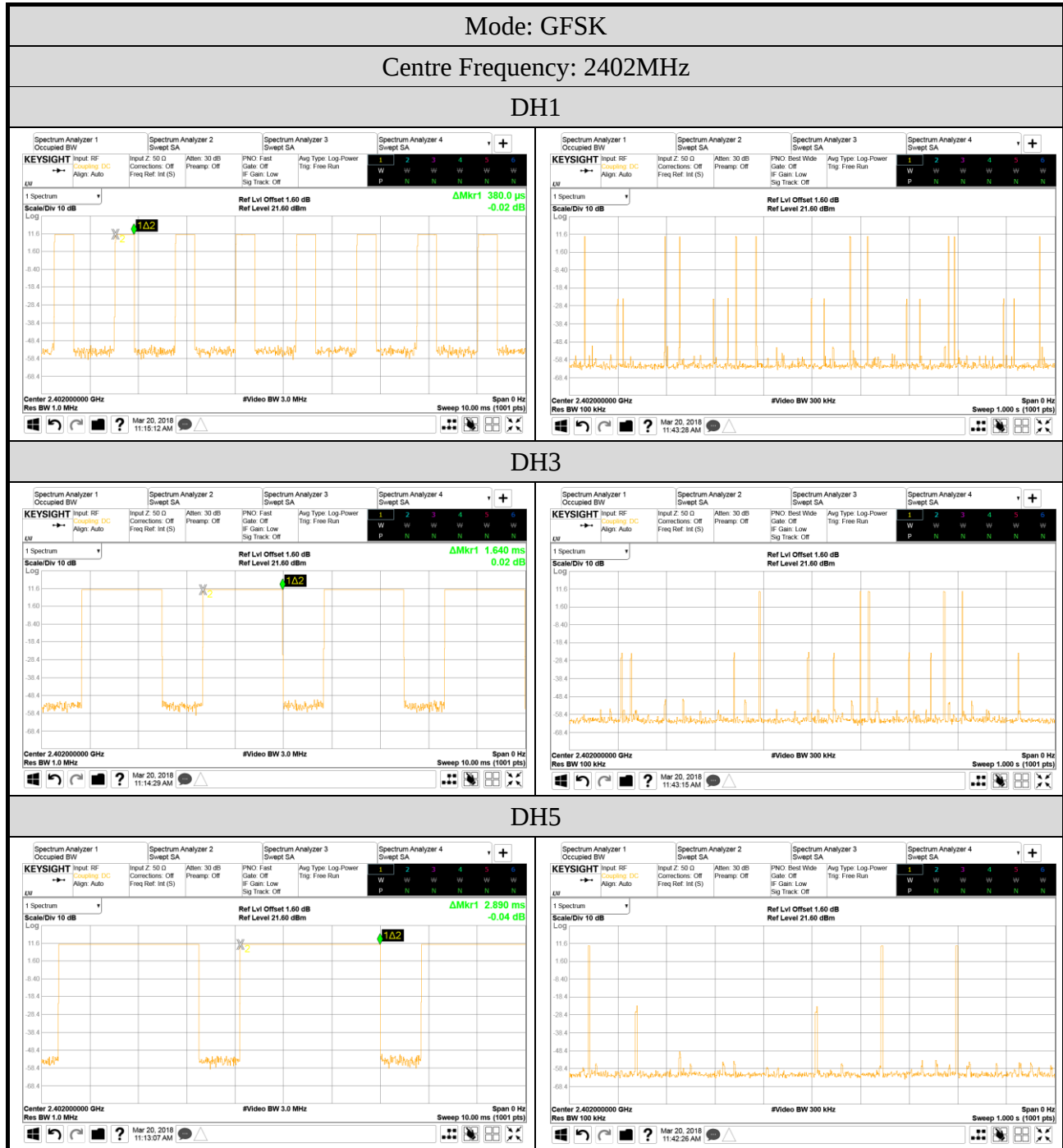
For each second of 3 transmission appearance, the longest time of occupancy is

3 transmission* 31.6 seconds* 2.890 ms= 273.972 ms (<400ms)

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

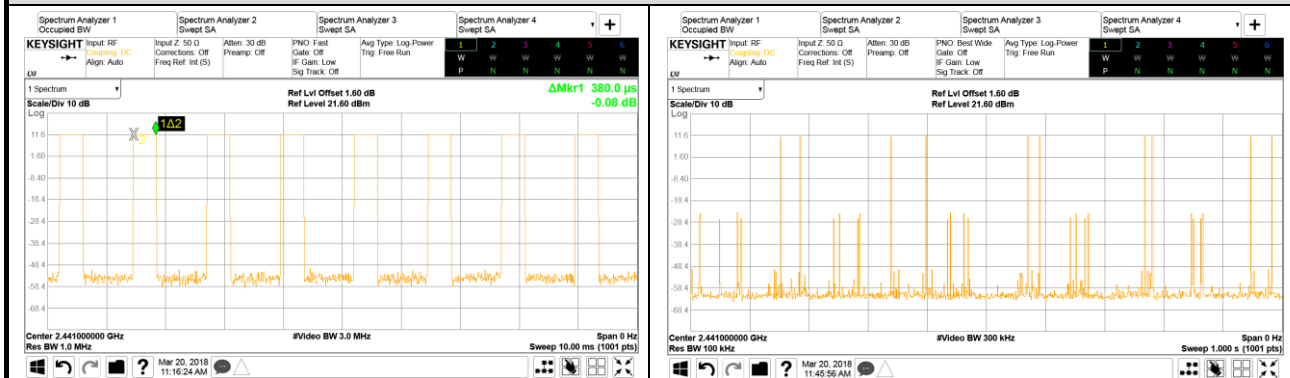
● Measurement Plots



Mode: GFSK

Centre Frequency: 2441MHz

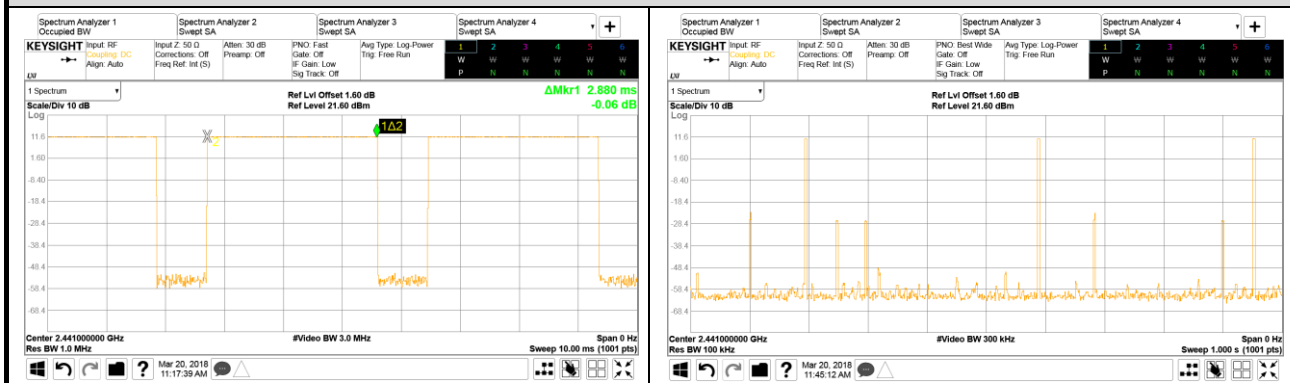
DH1



DH3



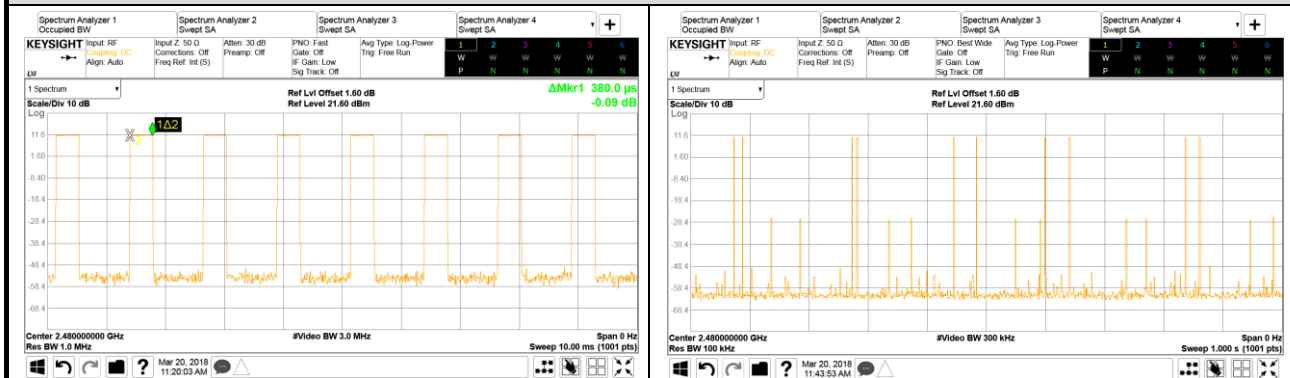
DH5



Mode: GFSK

Centre Frequency: 2480MHz

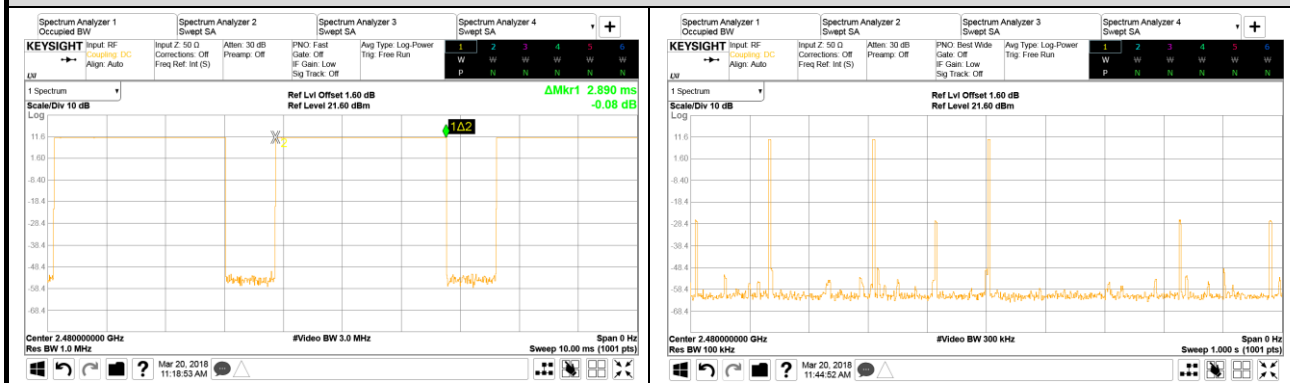
DH1



DH3



DH5



Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2402	3DH1	10	0.350	110.600	<400
		3DH3	5	1.640	259.120	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds**3DH1 Mode**For each second of **10** transmission appearance,the longest time of occupancy is**10 transmission* 31.6 seconds* 0.350 ms= 110.600 ms (<400ms)****3DH3 Mode**For each second of **5** transmission appearance,the longest time of occupancy is**5 transmission* 31.6 seconds* 1.640 ms= 259.120 ms (<400ms)****3DH5 Mode**For each second of **3** transmission appearance,the longest time of occupancy is**3 transmission* 31.6 seconds* 2.890 ms= 273.972 ms (<400ms)**

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2441	3DH1	10	0.390	123.240	<400
		3DH3	5	1.630	257.540	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds**3DH1 Mode**For each second of **10** transmission appearance,the longest time of occupancy is**10 transmission* 31.6 seconds* 0.390 ms= 123.240 ms (<400ms)****3DH3 Mode**For each second of **5** transmission appearance,the longest time of occupancy is**5 transmission* 31.6 seconds* 1.630 ms= 257.540 ms (<400ms)****3DH5 Mode**For each second of **3** transmission appearance,the longest time of occupancy is**3 transmission* 31.6 seconds* 2.890 ms= 273.972 ms (<400ms)**

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	Centre Frequency (MHz)	Mode	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2480	3DH1	10	0.390	123.240	<400
		3DH3	5	1.640	259.120	<400
		3DH5	3	2.890	273.972	<400

Observation Period:

79 channels* 0.4 seconds= 31.6 seconds

3DH1 Mode

For each second of **10** transmission appearance,the longest time of occupancy is
10 transmission* **31.6** seconds* **0.390** ms= **123.240** ms (<400ms)

3DH3 Mode

For each second of **5** transmission appearance,the longest time of occupancy is
5 transmission* **31.6** seconds* **1.640** ms= **259.120** ms (<400ms)

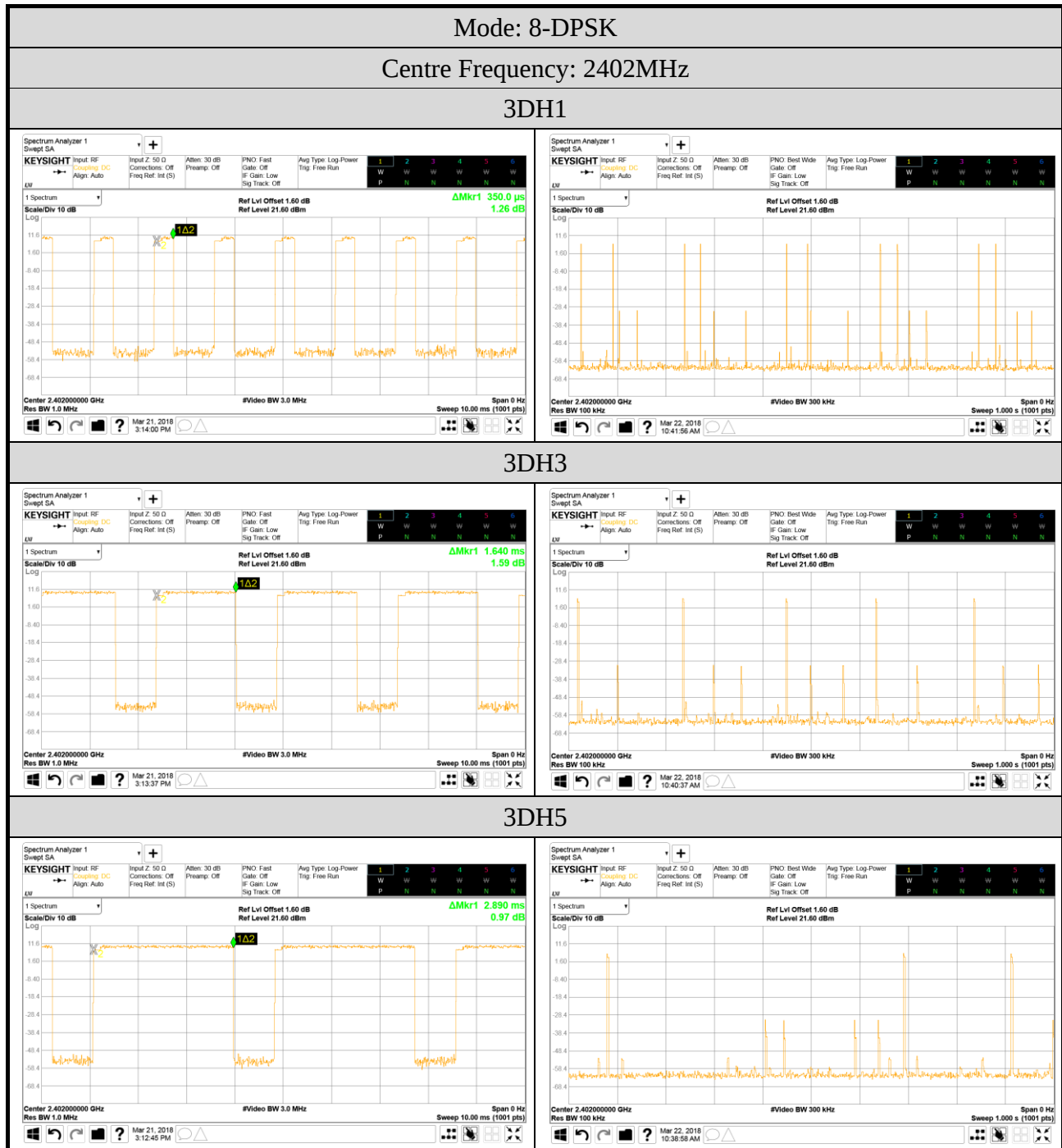
3DH5 Mode

For each second of **3** transmission appearance,the longest time of occupancy is
3 transmission* **31.6** seconds* **2.890** ms= **273.972** ms (<400ms)

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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

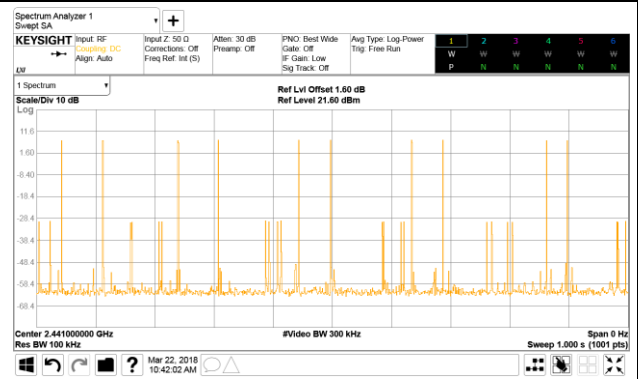
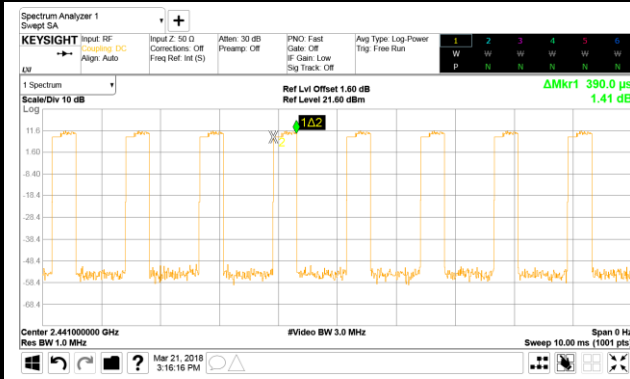
● Measurement Plots



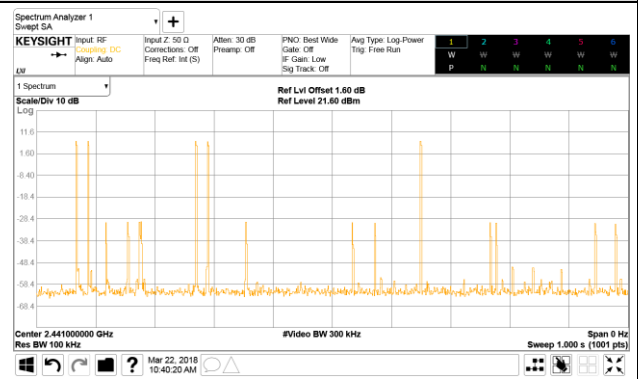
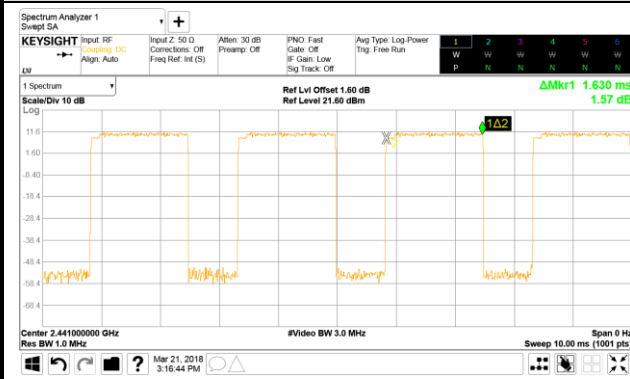
Mode: 8-DPSK

Centre Frequency: 2441MHz

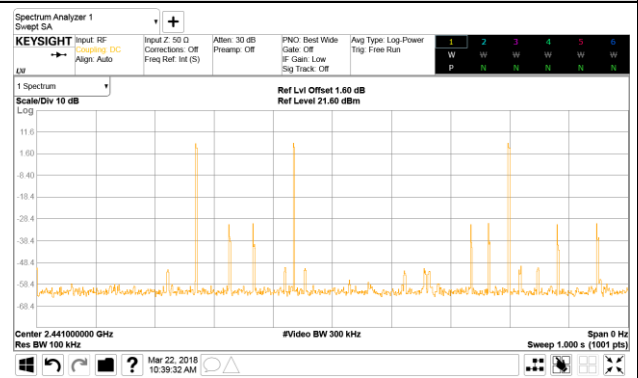
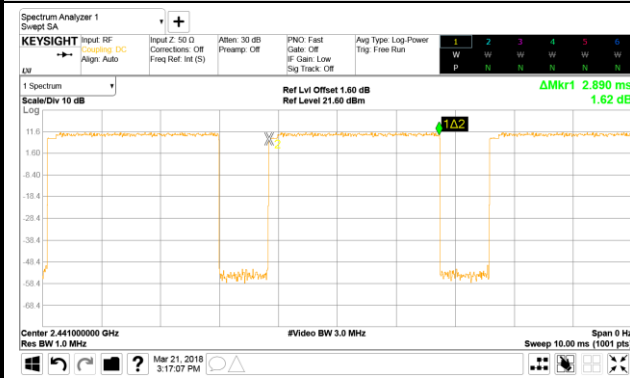
3DH1

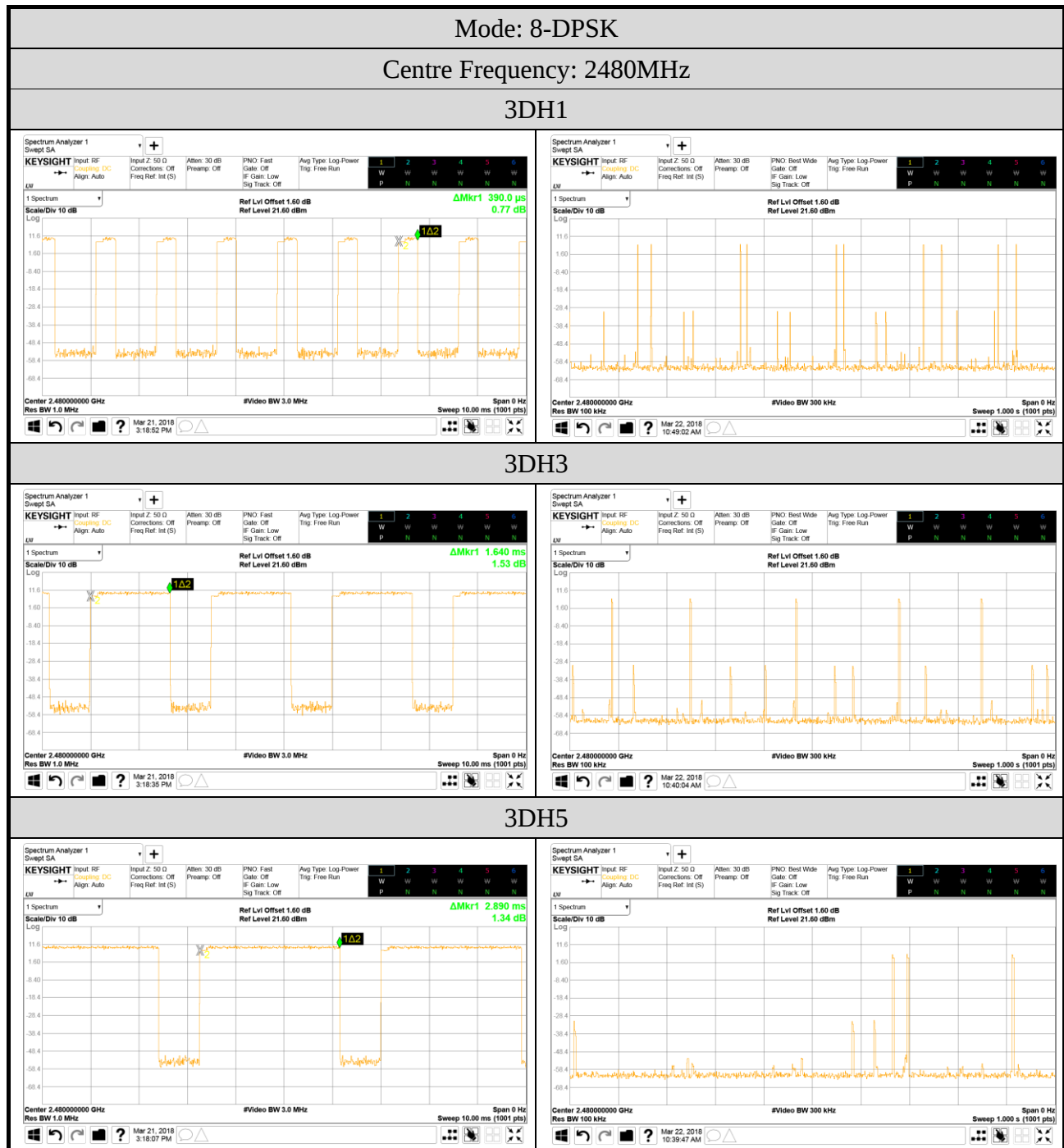


3DH3



3DH5



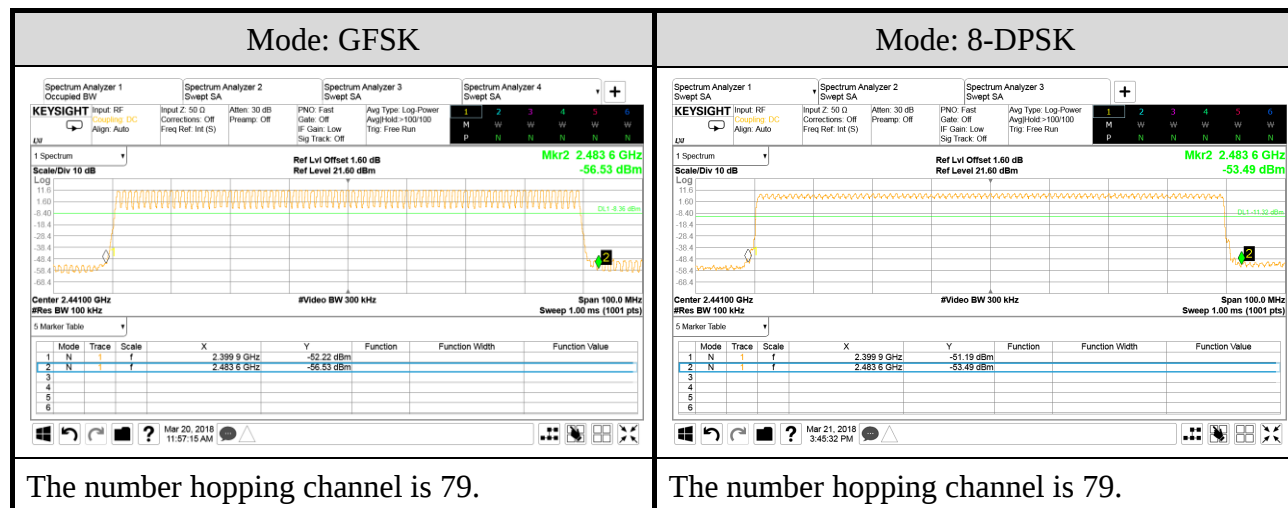


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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.6 NUMBER OF HOPPING CHANNELS

Test Date	2018/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)



A.7 MAXIMUM PEAK OUTPUT POWER

Test Date	2018/04/10	Temp./Hum.	24°C/54%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.7.1 Maximum Peak Output Power

Mode	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
GFSK	2402	10.16	0.0104	21dBm (0.125W)
	2441	10.39	0.0109	
	2480	10.44	0.0111	
8-DPSK	2402	10.15	0.0104	
	2441	10.51	0.0112	
	2480	10.21	0.0105	

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.7.2 Measurement Plots



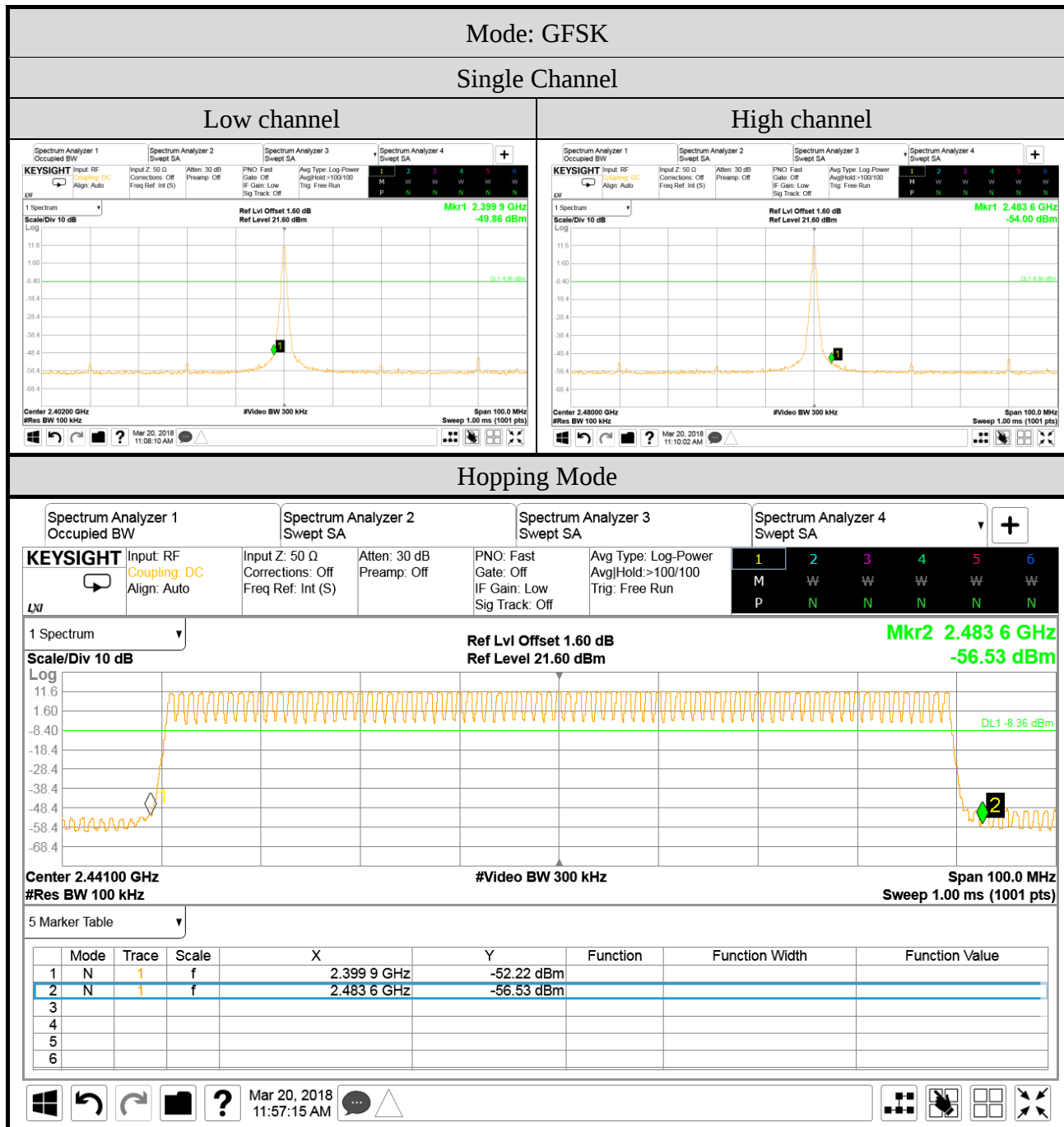
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Fax: +886 2 26099303

A.8 EMISSION LIMITATIONS MEASUREMENT

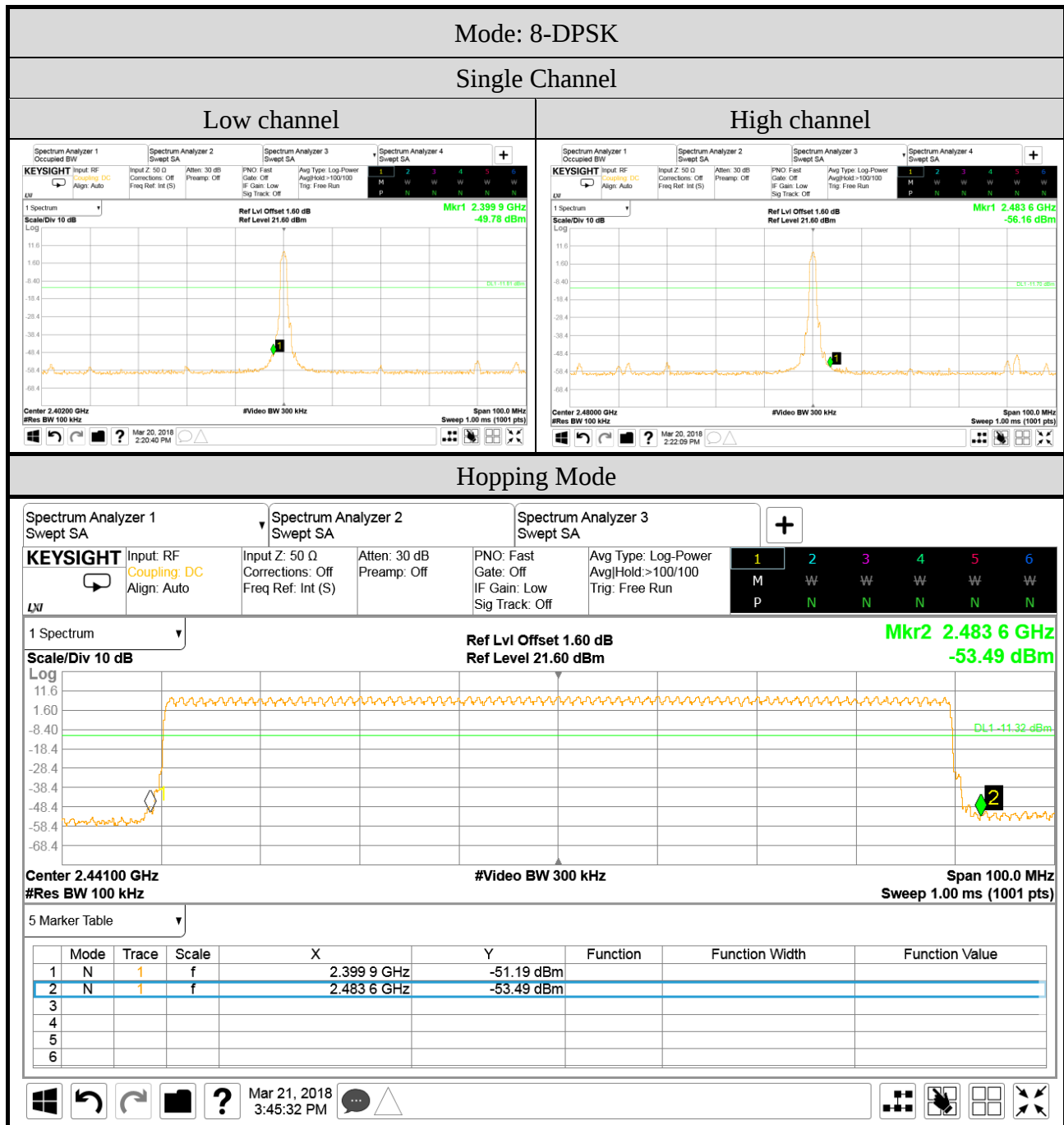
Test Date	2018/03/20~21	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.8.1 Band Edge



AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303



AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.8.2 Spurious Emission

Test Date	2018/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2402MHz



Note: All results have been included cable loss.

Test Date	2018/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2441MHz



Note: All results have been included cable loss.

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/03/20	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2480MHz

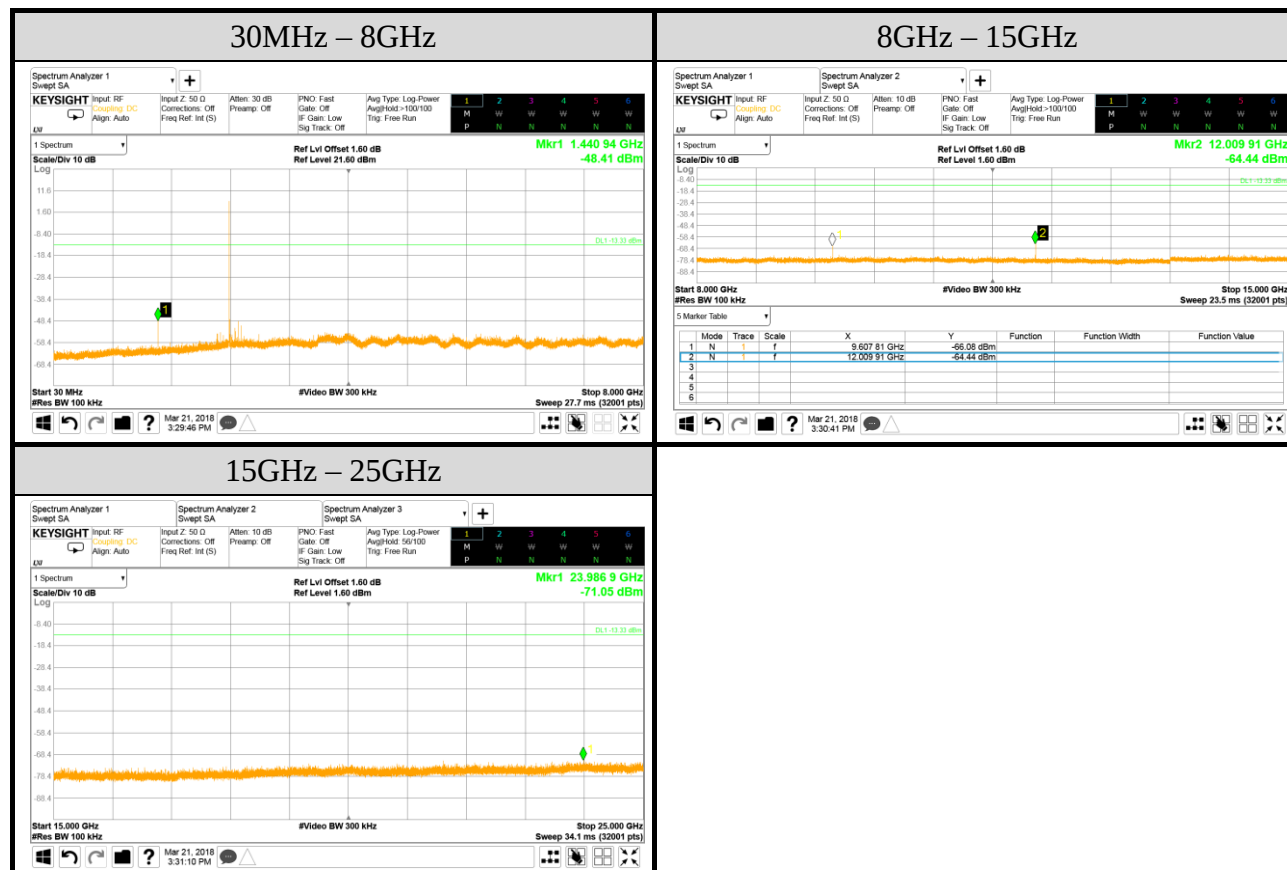


Note: All results have been included cable loss.

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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/03/21	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2402MHz



Note: All results have been included cable loss.

AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/03/21	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2441MHz



Note: All results have been included cable loss.

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No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/03/21	Temp./Hum.	23°C/55%
Cable Loss	1.6dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2480MHz



Note: All results have been included cable loss.



Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

APPENDIX B

Tel: +886 2 26099301
Fax: +886 2 26099303

APPENDIX B

TEST PHOTOGRAPHS

(Model: Kamai 7B)