

FCC 15.247 & RSS-247 2.4 GHz Test Report

for

LG Electronics Inc.

**222, LG-ro Jinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do,
451-713, Korea**

Product Name : Notebook Computer
Model Name : 14Z980
Brand : LG
FCC ID : BEJNT-14Z980
IC : 2703H-14Z980

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



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APPENDIX A TEST DATA AND PLOTS

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TEST REPORT CERTIFICATION

Applicant : LG Electronics Inc.
Factory : LG Electronics Nanjing New Technology Co., Ltd.
EUT Description
(1) Product : Notebook Computer
(2) Model : 14Z980
(3) Brand : LG
(4) Power Supply: DC 19V, 2.53A

Applicable Standards:

47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 4), November 2014
RSS-247 (Issue 2), February 2017
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: 2017. 12. 07

Reviewed by:



(Sabrina Wang/Administrator)

Approved by:



(Ben Cheng/Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2017. 12. 07	Original Report	EM-F170742

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	PASS
15.247(d)/15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(1)	RSS-247 §5.1(2)	20dB Bandwidth	PASS
15.247(a)(1)	RSS-247 §5.1(2)	Carrier Frequency Separation	PASS
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Time of Occupancy	PASS
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Number of Hopping Channels	PASS
15.247(b)(1)	RSS-247 §5.1(2)	Maximum Peak Output Power	PASS
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	PASS
15.203	---	Antenna Requirement	Compliance

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-ro Jinwi-myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Factory	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Product	Notebook Computer
Model	14Z980
Brand	LG

3.2. Description of EUT

Test Model	14Z980	
Serial Number	N/A	
Power Rating	DC 19V, 2.53A	
RF Features	WLAN: 802.11 a/b/g/n/ac Bluetooth: BT and BLE	
Transmit Type	2.4 GHz	
	802.11b	1T1R
	802.11g	1T1R
	802.11n-HT20	2T2R
	802.11n-HT40	2T2R
	BT/BLE	1T1R
	UNII Bands	
	802.11a	1T1R
	802.11n-HT20/ 802.11ac-VHT20	2T2R
	802.11n-HT40/ 802.11ac-VHT40	2T2R
	802.11ac-VHT80	2T2R
Sample Status	Production	
Date of Receipt	2017. 11. 21	
Date of Test	2017. 11. 23 ~ 12. 07	
Interface Ports of EUT	• One Micro SD Card Slot • One Earphone Port • Two USB 3.0 Ports • One USB Type C Port • One HDMI Port • One DC Input Port	
Accessories Supplied	• AC Adapter	

3.3. Antenna Information

2.4G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	WA-F-LBLB-04-058 (Main)	INPAQ	FPCB	2400	1.94
				2450	2.72
				2500	1.20
2	WA-F-LBLB-04-058 (AUX)	INPAQ	FPCB	2400	2.79
				2450	2.29
				2500	1.90

5G Antenna					
No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	WA-F-LBLB-04-058 (Main)	INPAQ	FPCB	5100	1.35
				5400	3.06
				5800	2.10
2	WA-F-LBLB-04-058 (AUX)	INPAQ	FPCB	5100	2.82
				5400	1.12
				5800	0.58

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

3.5.1. For the All Component Lists

Item	Supplier	Model / Type	Character
System	Microsoft	Win10 Home	---
Main Board	LG	14/15Z980 Main B/D PCB	(without Thunderbolt) Manufacturer: (1) Elec & Eltek Company (MCO) Limited (2) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (3) LG Innotek Co., Ltd.
	LG	14/15Z980 Main B/D PCB	(with Thunderbolt) Manufacturer: (1) Elec & Eltek Company (MCO) Limited (2) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (3) LG Innotek Co., Ltd.
SUB Board	LG	14Z980 WLAN SUB B/D	(without Finger Print) Manufacturer: (1) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (2) HYUNWOO
	LG	14Z980 WLAN SUB B/D	(with Finger Print) Manufacturer: (1) Hannstar Board Tech(Jiang Yin) Corp.,Ltd. (2) HYUNWOO
CPU (Socket: BGA1356)	Intel	i7-8550U	1.8GHz, up to 4.0GHz
	Intel	i5-8250U	1.6GHz, up to 3.4GHz
14" LCD Panel	LG Display	LP140WF5-SPG2	Resolution: 1920 x 1080, 60Hz FHD IPSW/ Touch (AIT Including touch)
	LG Display	LP140WF7-SPG1	Resolution: 1920 x 1080, 60Hz FHD IPS (Normal Non touch)
Storage (SSD)	SK hynix	HFS256G39TND-N210A BB	256GB (SATA)
	SK hynix	HFS512G39TND-N210A BB	512GB (SATA)
	Samsung	MZNLN256MHQ	256GB (SATA)
	Samsung	MZNLN512HMP	512GB (SATA)
Memory (RAM) (On Board)	Samsung	K4A8G165WB-BCRC	8Gbit DDR4 2400MHz (On Board) *4ea
	SK hynix	H5ANAG6NAMA UHC	4Gbit DDR4 2400MHz (On Board) *4ea
Memory (RAM)	Samsung	M471A5244CB0-CRC	4Gbit DDR4 2400MHz (On Card)
Battery Pack	LG	LBS1224E	DC 7.7V, 72Wh, Typ 9450mAh

Item	Supplier	Model / Type	Character
WLAN Combo Card	Intel	8265D2W	802.11a/b/g/n/ac 2.4GHz/5GHz + BT 4.2 BLE
WLAN Combo Antenna	LG (INPAQ)	WA-F-LBLB-04-058	FPCB Type Main: Black, Aux: Gray
Keyboard	LG	SN3871	Black: BL, White: BL 1
Finger Print	SUNTEL	SFPC-L0016A(White)	---
		SFPC-L0016B(Black)	---
		Above model have the same circuit and hardware. The model SFPC-L0016B(Black) is tested in this report.	
Web Camera	Lite-On	7BF109N2	With two MIC
LAN Gender (Type C to LAN)	LG	80-5946-111 (White)	10/100 Megabit Ethernet
		80-5946-101 (Black)	Manufacturer: SUZHOU MEC ELECTRONICS
		Above model have the same circuit and hardware. The model 80-5946-101 (Black) is tested in this report.	
	LG	GD-08MF-36-WH-LP05 (White)	10/100 Megabit Ethernet
		GD-08MF-36-BK-LP06 (Black)	Manufacturer: ARIN TECH CO. LTD
		Above model have the same circuit and hardware. The model GD-08MF-36-BK-LP06 (Black) is tested in this report.	
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter (65W)	LG (Lite-on)	PA-1650-43	I/P: AC 100-240V, 50/60Hz, 1.6A, O/P: DC 19V, 3.42A
	DC Power Cord: Non-Shielded, Undetached, 1.8m, Bonded a ferrite core AC Power Cord: Non-Shielded, Detached, 1.0m (3C)		

Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

3.5.2. The EUT collocates with following worst components, which are used to establish a basic configuration of system during test:

SKU		#1
Main Board	LG, 14/15Z980 Main B/D PCB (with Thunderbolt)	V
SUB Board	LG, 14Z980 WLAN SUB B/D (with Finger Print)	V
CPU	Intel, i7-8550U	V
14" LCD Panel	LG Display, LP140WF5-SPG2/(AIT Including touch)	V
Storage (SSD)	512GB	V
Memory (RAM)	8Gbit (On Board)	V
Battery Pack	LG, LBS1224E	V
WLAN Combo Card	Intel, 8265D2W	V
WLAN Combo Antenna	LG (INPAQ), WA-F-LBLB-04-058	V
Keyboard	LG, SN3871	V
Finger Print	SUNTEL, SFPC-L0016B(Black)	V
Web Camera	Lite-On, 7BF109N2	V
AC Adapter	LG (Lite-on), PA-1650-43	V
LAN Gender (Type C to LAN)	LG, GD-08MF-36-BK-LP06 (Black), 100Mbps	V

3.6. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
BT	N/A	2.880	N/A

AC Conduction	
Test Case	Normal operation

Item		Modulation	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	GFSK	1Mbps	00/78
		8-DPSK	3Mbps	00/78
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

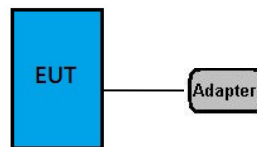
No.	Product	Brand	Model No.	Serial No.	Approval
1.	LCD Monitor	ASUS	VE228	N/A	FCC By DoC
2.	USB Mouse	Lenovo	45J4886	N/A	FCC By DoC
3.	Earphone	APPLE	N/A	N/A	FCC By DoC

3.7.2. Cable Lists

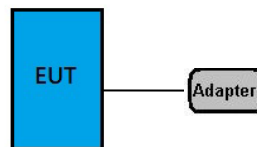
No.	Cable Description Of The Above Support Units
1.	HDMI Cable: Shielded, Detachable, 1.8m AC Power Cord: Unshielded, Detachable, 1.8m
2.	USB Cable: Unshielded, Undetachable, 1.8m
3.	Earphone Cable: Unshielded, Undetachable, 2.0m

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 “DRTU” is used for enabling EUT BT function under continues transmitting and choosing data rate/ 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 (3) FCC OET Designation No. TW1004 & TW1090 & TW1724
Test Facilities	(1) No. 7 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. Due
1.	Test Receiver	R&S	ESCI	101276	2017. 03. 23	1 Year
2.	A.M.N.	R&S	ESH2-Z5	100366	2017. 07. 20	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-881-13	2016. 12. 28	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	101495	2017. 01. 16	1 Year
5.	Test Software	Audix	e3	V.120619C	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2017. 09. 13	1 Year
2.	Spectrum Analyzer	Agilent	N9010A-526	MY52220368	2016. 12. 01	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2017. 06. 19	1 Year
4.	Amplifier	HP	8447D	2944A06305	2017. 02. 16	1 Year
5.	Amplifier	Sonoma	310N	187161	2017. 06. 08	1 Year
6.	Bilog Antenna	CHASE	CBL6112D	33821	2017. 01. 21	1 Year
7.	Loop Antenna	R&S	HFH2-Z2	891847/27	2016. 12. 23	1 Year
8.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2017. 03. 08	1 Year
9.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-00	1	2017. 07. 26	1 Year
10.	3GHz Notch Filter	Microwave	H3G018G1	484798	2017. 08. 25	1 Year
11.	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
2.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2017. 04. 18	1 Year

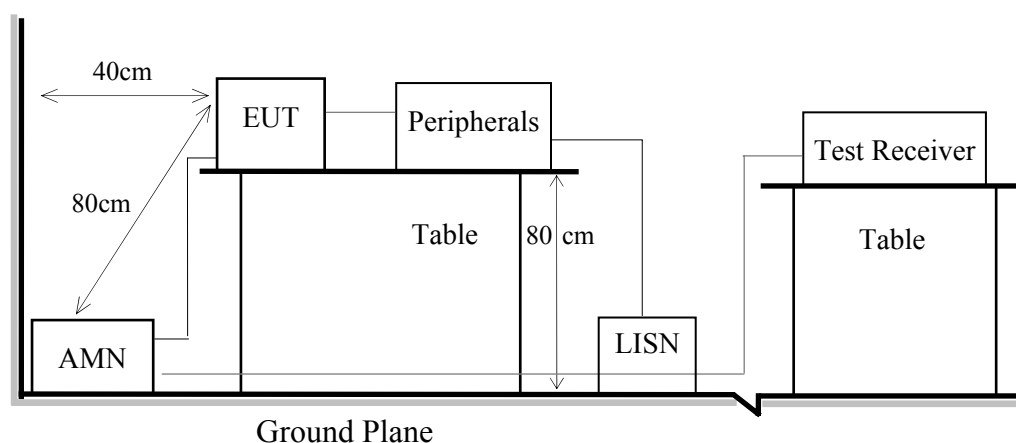
5. CONDUCTED EMISSION

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. Checking 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.

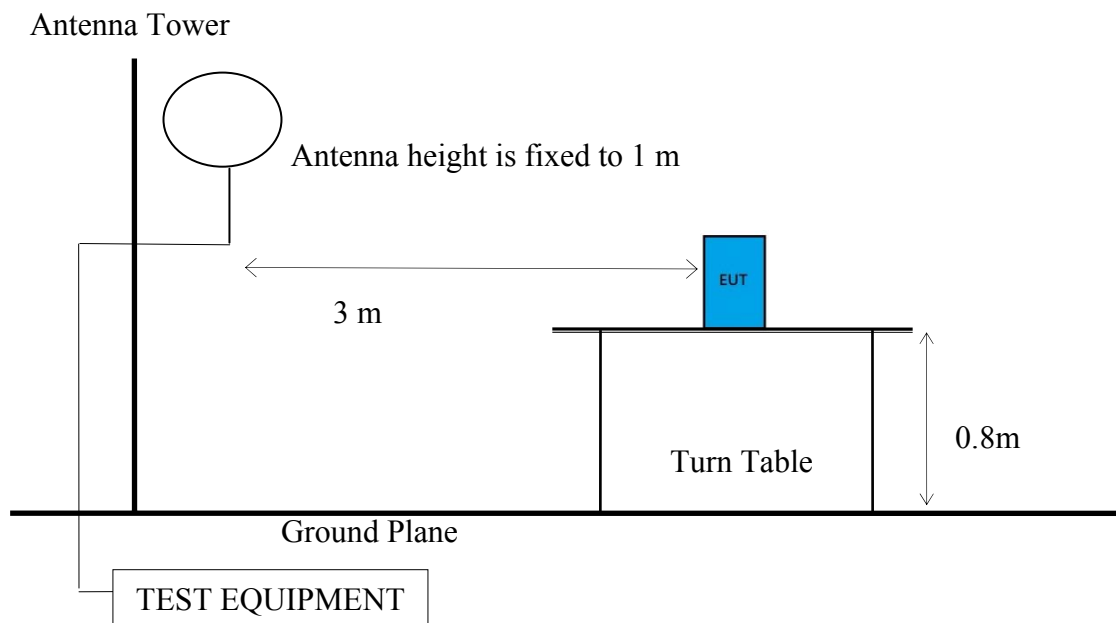
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

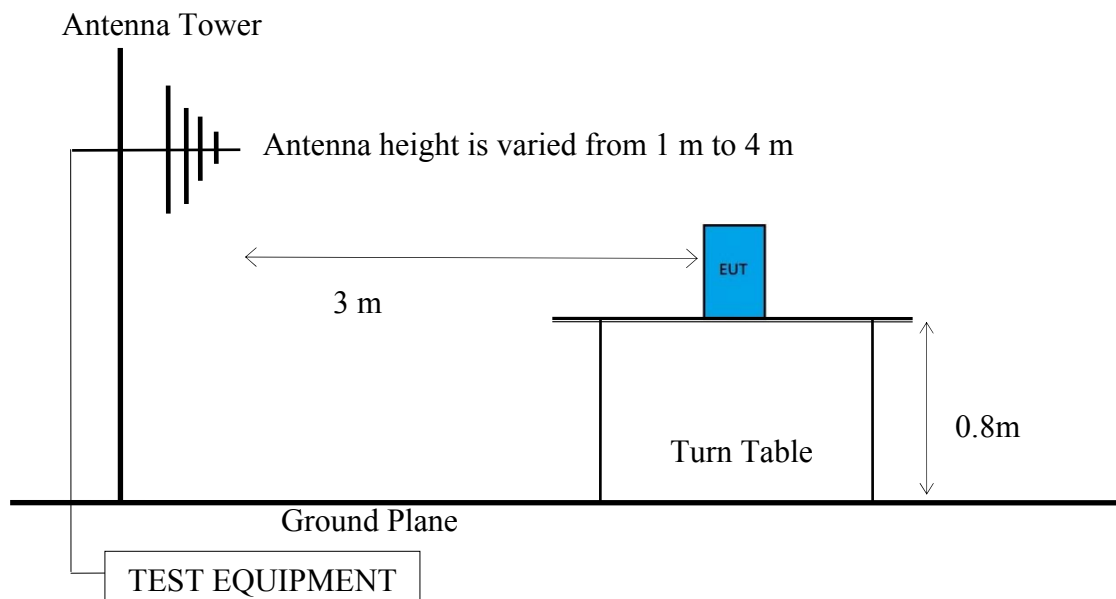
6.1.1. Block Diagram of EUT

Indicated as section 3.8

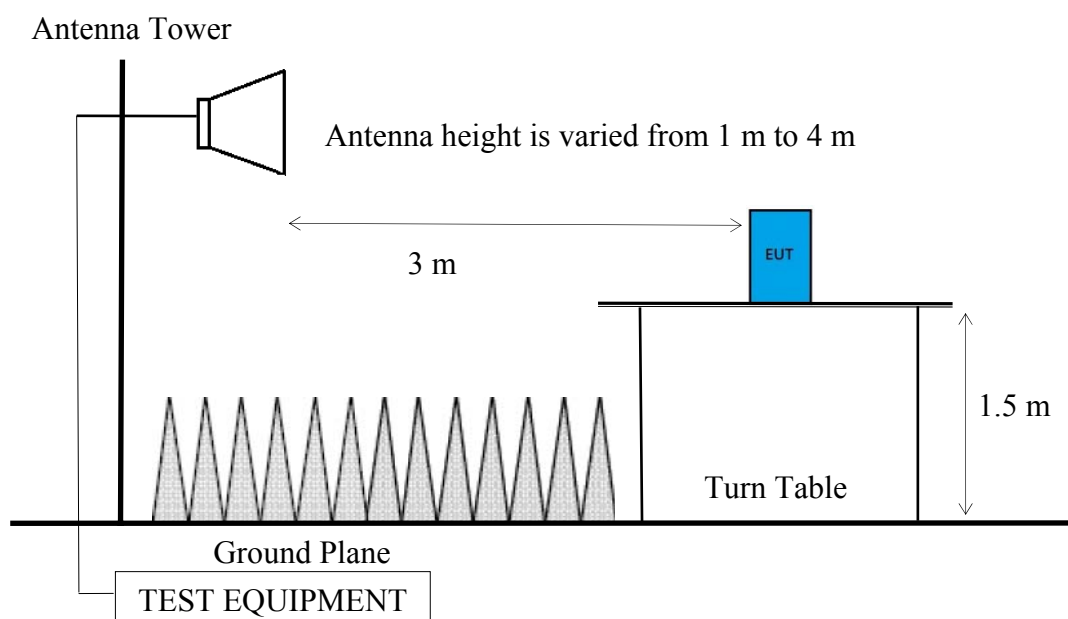
6.1.2. Setup Diagram for 9kHz-30MHz



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/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dB μ V/m	μ V/m
0.009 - 0.490	300	67.6	2400/kHz
0.490 - 1.705	30	87.6	24000/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 dB μ V/m (Peak) 54.0 dB μ V/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 find 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 finally 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 finally 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

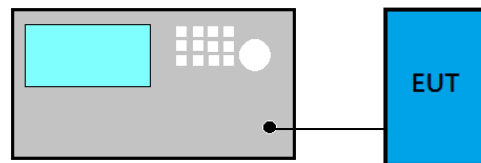
□ ERP = Peak Emission Level - 95.2dB - 2.14dB

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:

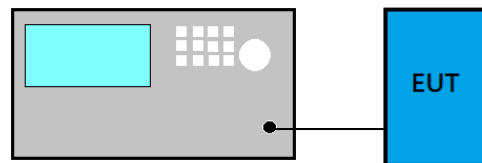
- (1) Set RBW close to 1% to 5% of OBW.
- (2) Set $VBW \geq 3RBW$.
- (3) Detector = Peak.
- (4) Trace mode = Max hold.
- (5) Sweep = Auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

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:

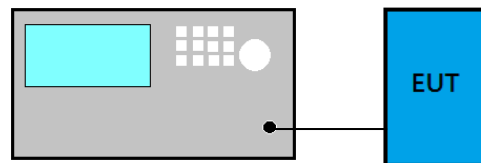
- (1) Span = Wide enough to capture the peaks of two adjacent channels
- (2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- (3) VBW = RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace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

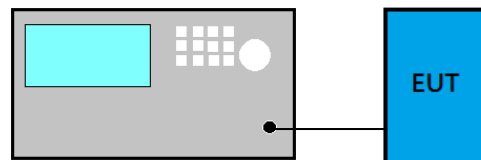
- (1) Span: Zero span, centered on a hopping channel.
- (2) RBW shall be $\leq$ channel spacing and where possible RBW should be set $> 1/T$, where T is the expected dwell time per channel.
- (3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger 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:

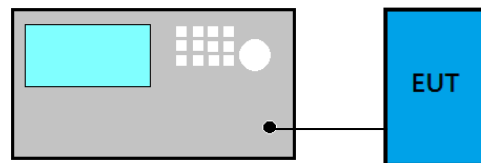
- (1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- (2) RBW: To identify clearly the individual channels, set 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:

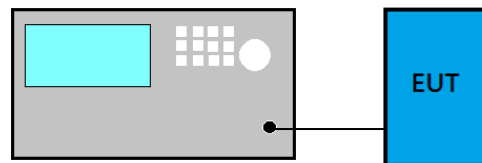
- (1) Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- (2) RBW $\geq$ 1% of the span
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = Max hold

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】



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APPENDIX A

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APPDNDIX A

TEST DATA AND PLOTS

(Model: 14Z980)

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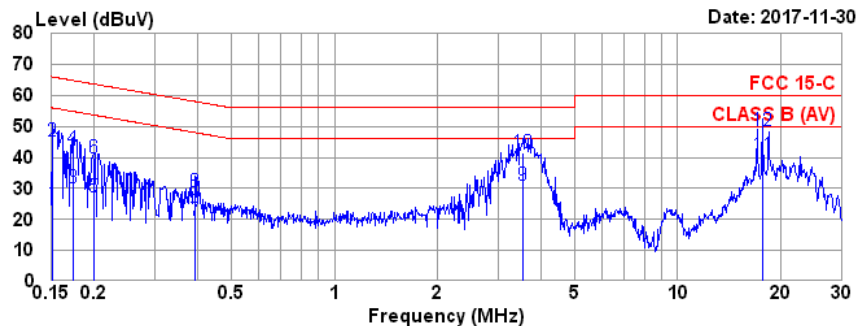
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A.1 CONDUCTED EMISSION

Test Date	2017/11/30	Temp./Hum.	24°C/57%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.7 Shielded Room Data no. : 2
Condition : ESH2-Z5 366(ADAPTER) Phase : NEUTRAL
Limit : FCC 15-C
Env. / Ins. : 24°C / 57% ESCI(1276) Engineer : Nick Du
EUT : 14Z980
Power Rating : 120Vac/60Hz
Test Mode : Operating

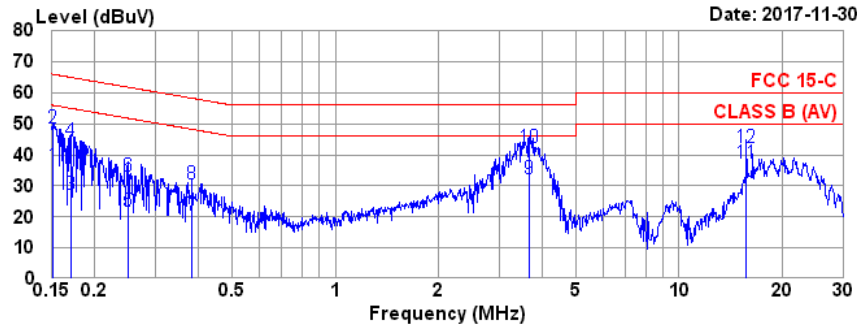
	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.152	0.19	0.03	9.86	15.27	25.35	55.91	30.56	Average
2	0.152	0.19	0.03	9.86	35.21	45.29	65.91	20.62	QP
3	0.174	0.18	0.04	9.86	20.25	30.33	54.77	24.44	Average
4	0.174	0.18	0.04	9.86	32.57	42.65	64.77	22.12	QP
5	0.199	0.17	0.04	9.86	17.31	27.38	53.67	26.29	Average
6	0.199	0.17	0.04	9.86	29.75	39.82	63.67	23.85	QP
7	0.393	0.19	0.04	9.86	9.70	19.79	47.99	28.20	Average
8	0.393	0.19	0.04	9.86	18.93	29.02	57.99	28.97	QP
9	3.547	0.31	0.16	9.87	20.85	31.19	46.00	14.81	Average
10	3.547	0.31	0.16	9.87	31.35	41.69	56.00	14.31	QP
11	17.661	0.91	0.29	9.93	29.60	40.73	50.00	9.27	Average
12	17.661	0.91	0.29	9.93	37.33	48.46	60.00	11.54	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

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Test Date	2017/11/30	Temp./Hum.	24°C/57%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.7 Shielded Room Data no. : 1
Condition : ESH2-Z5 366(ADAPTER) Phase : LINE
Limit : FCC 15-C
Env. / Ins. : 24°C / 57% ESCI(1276) Engineer : Nick Du
EUT : 14Z980
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.151	0.18	0.03	9.86	26.55	36.62	55.96	19.34	Average
2	0.151	0.18	0.03	9.86	38.34	48.41	65.96	17.55	QP
3	0.171	0.17	0.03	9.86	17.22	27.28	54.90	27.62	Average
4	0.171	0.17	0.03	9.86	34.28	44.34	64.90	20.56	QP
5	0.249	0.17	0.04	9.86	11.61	21.68	51.78	30.10	Average
6	0.249	0.17	0.04	9.86	23.03	33.10	61.78	28.68	QP
7	0.383	0.18	0.04	9.86	10.36	20.44	48.21	27.77	Average
8	0.383	0.18	0.04	9.86	20.32	30.40	58.21	27.81	QP
9	3.661	0.32	0.16	9.87	21.82	32.17	46.00	13.83	Average
10	3.661	0.32	0.16	9.87	31.95	42.30	56.00	13.70	QP
11	15.718	0.93	0.28	9.92	26.02	37.15	50.00	12.85	Average
12	15.718	0.93	0.28	9.92	31.32	42.45	60.00	17.55	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

A.2 RADIATED EMISSION

Test Date	2017/11/29	Temp./Hum.	24°C/51%
Test Voltage	AC 120V, 60Hz (via AC 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	GFSK	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
82.38	14.30	2.04	17.84	34.18	40.00	5.82	Peak
144.46	17.47	2.77	21.95	42.19	43.50	1.31	Peak
216.24	16.92	3.50	20.32	40.74	46.00	5.26	Peak
303.54	19.58	4.36	15.74	39.68	46.00	6.32	Peak
489.78	23.04	6.34	14.48	43.86	46.00	2.14	Peak
802.12	25.94	7.62	7.75	41.31	46.00	4.69	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
53.28	13.98	1.63	22.33	37.94	40.00	2.06	Peak
279.29	19.36	4.11	19.69	43.16	46.00	2.84	Peak
359.80	21.09	5.09	16.73	42.91	46.00	3.09	Peak
488.81	23.04	6.34	13.90	43.28	46.00	2.72	Peak
647.89	24.75	6.91	11.46	43.12	46.00	2.88	Peak
720.64	25.12	7.20	9.98	42.30	46.00	3.70	Peak

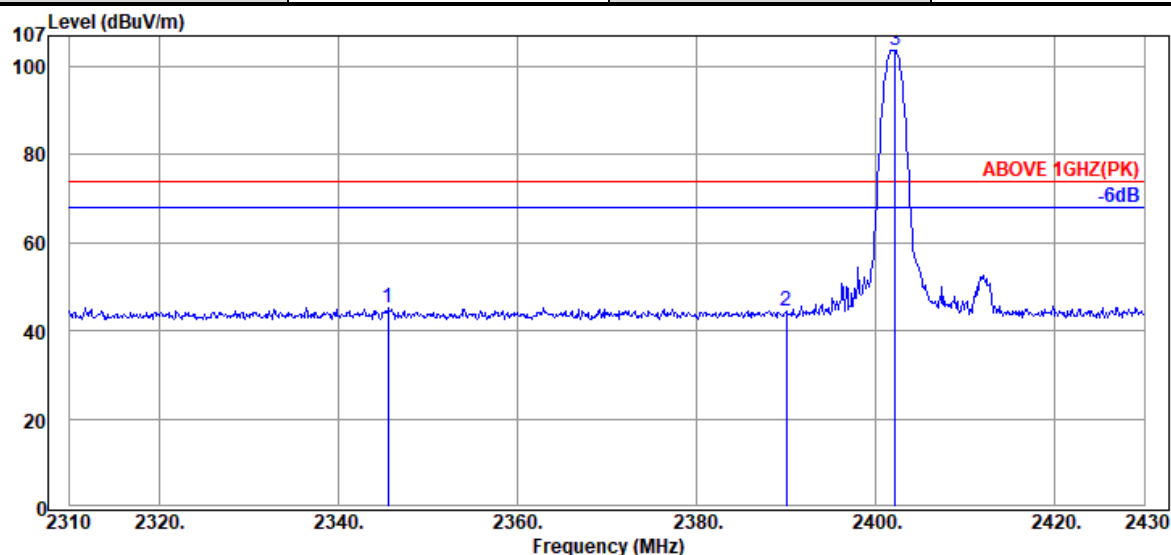
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A.2.1.3 Frequency Above 1 GHz to 10th harmonics

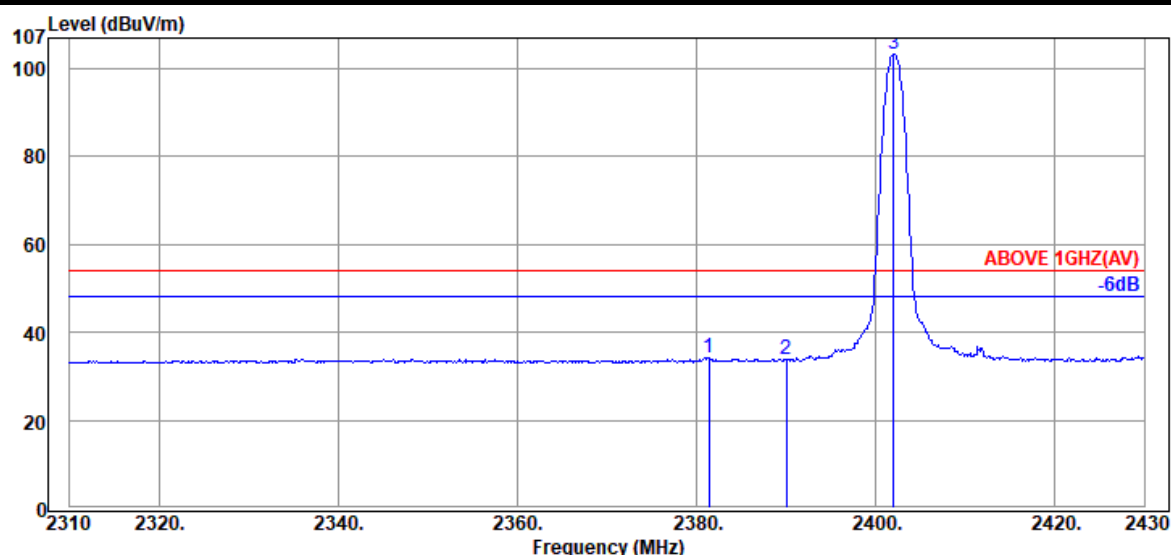
Band Edge:

Mode	GFSK	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
2345.52	32.08	6.51	6.70	45.29	74.00	28.71	Peak
2390.04	32.16	6.57	5.69	44.42	74.00	29.58	Peak
2402.16	32.16	6.57	64.98	103.71	---	---	Peak



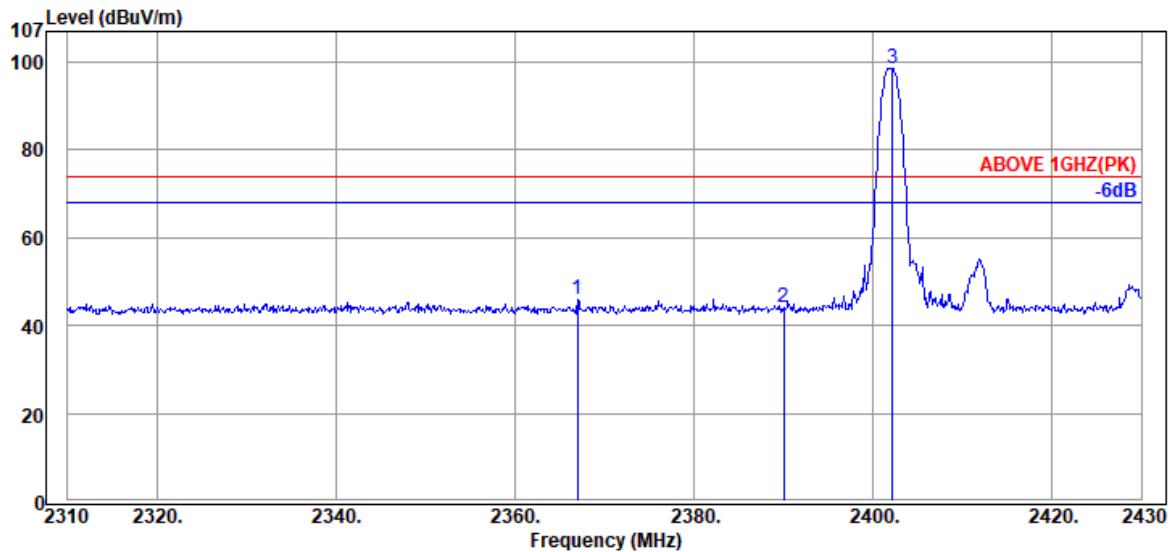
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2381.40	32.13	6.55	-4.52	34.16	54.00	19.84	Average
2390.04	32.16	6.57	-4.97	33.76	54.00	20.24	Average
2402.04	32.16	6.57	64.75	103.48	---	---	Average

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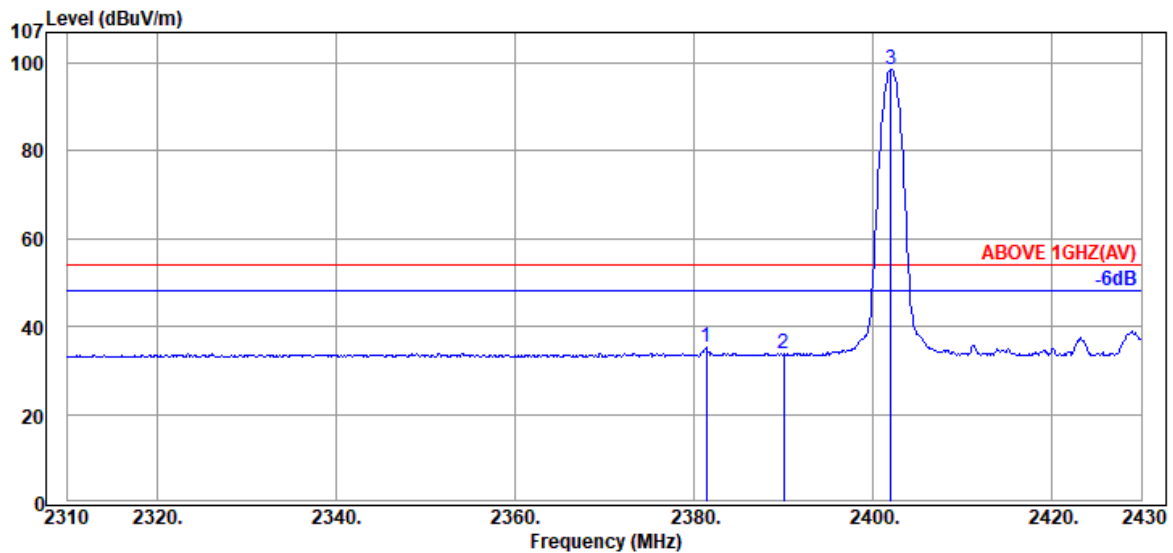
Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	GFSK	Frequency	TX 2402MHz
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Antenna at Vertical Polarization

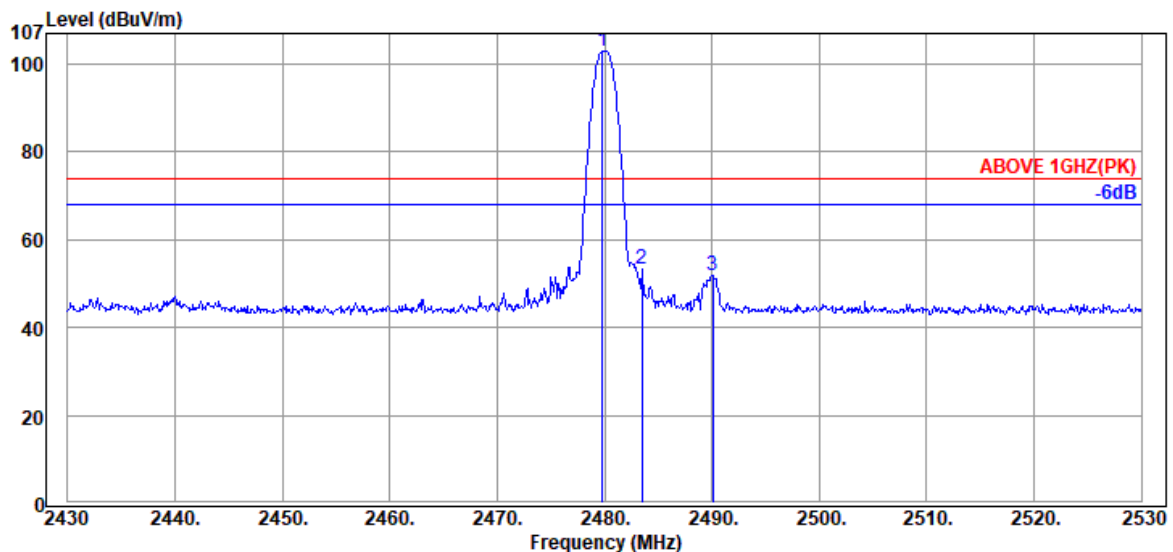
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2367.00	32.11	6.53	7.50	46.14	74.00	27.86	Peak
2390.04	32.16	6.57	5.34	44.07	74.00	29.93	Peak
2402.16	32.16	6.57	59.99	98.72	---	---	Peak



Antenna at Vertical Polarization

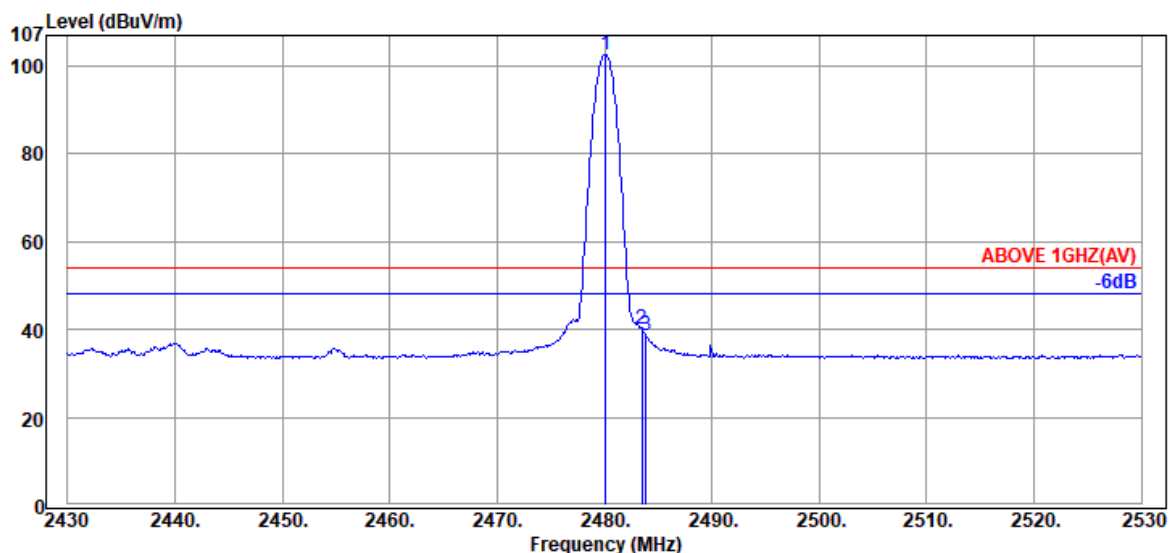
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2381.40	32.13	6.55	-3.50	35.18	54.00	18.82	Average
2390.04	32.16	6.57	-4.92	33.81	54.00	20.19	Average
2402.04	32.16	6.57	59.81	98.54	---	---	Average

Mode	GFSK	Frequency	TX 2480MHz
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Antenna at Horizontal Polarization

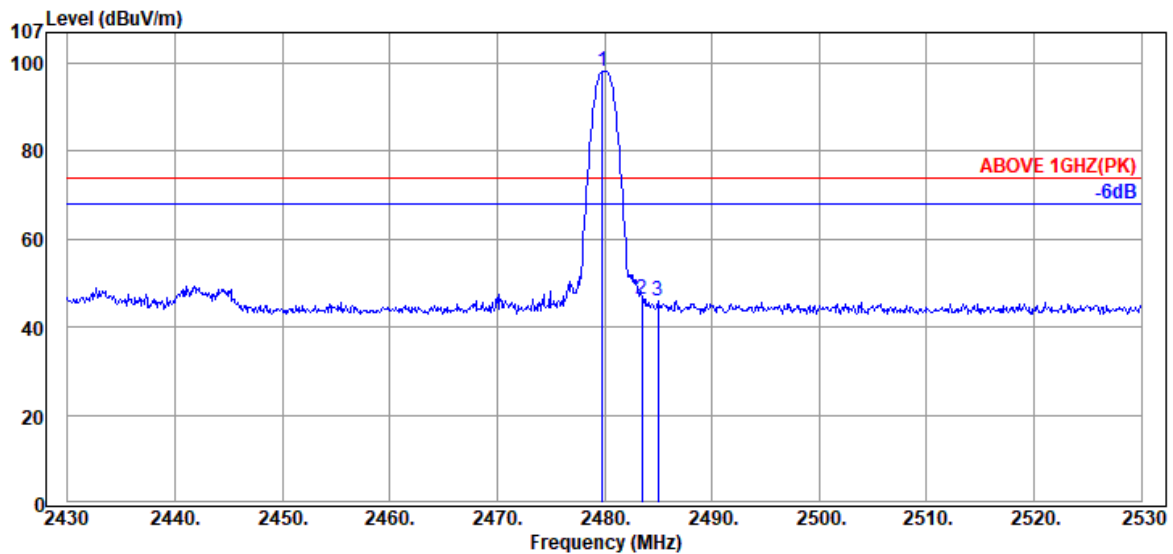
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.80	32.28	6.67	64.08	103.03	---	---	Peak
2483.50	32.28	6.67	14.33	53.28	74.00	20.72	Peak
2490.10	32.30	6.69	12.90	51.89	74.00	22.11	Peak



Antenna at Horizontal Polarization

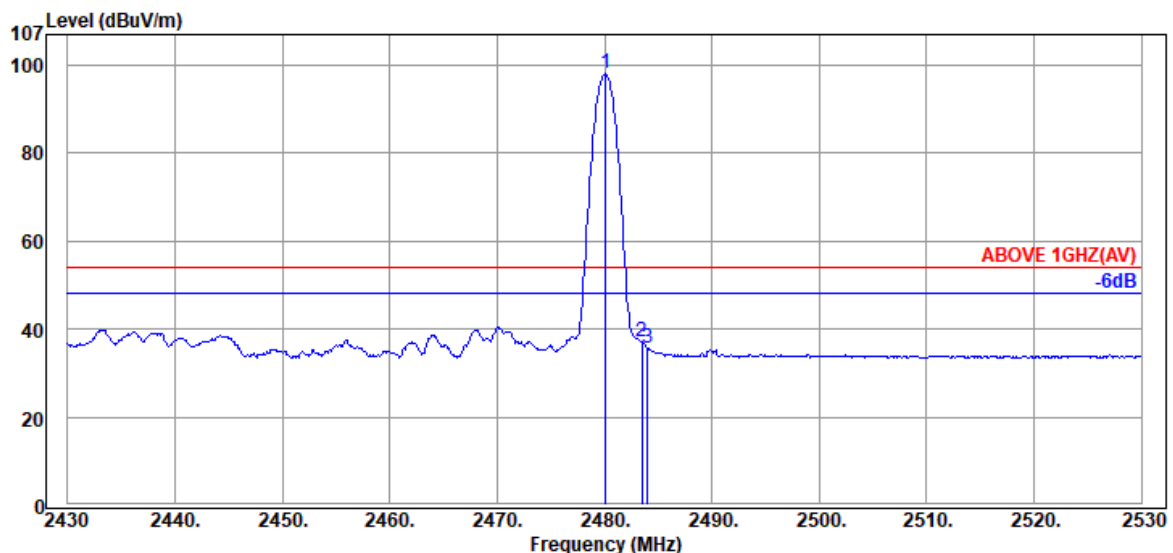
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.10	32.28	6.67	63.82	102.77	---	---	Average
2483.50	32.28	6.67	1.13	40.08	54.00	13.92	Average
2483.90	32.28	6.67	-0.45	38.50	54.00	15.50	Average

Mode	GFSK	Frequency	TX 2480MHz
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Antenna at Vertical Polarization

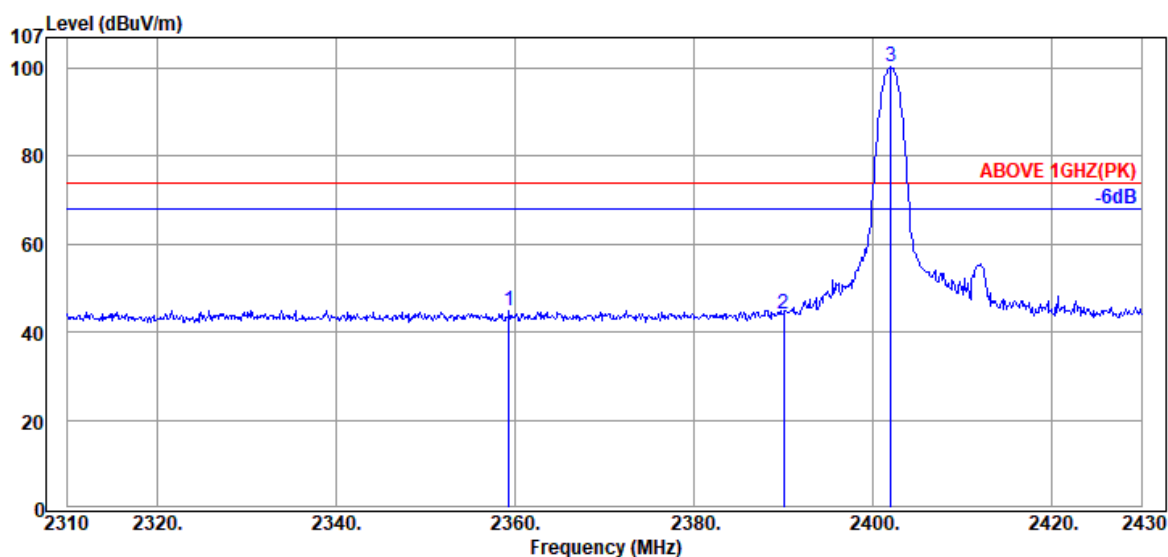
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.80	32.28	6.67	59.30	98.25	---	---	Peak
2483.50	32.28	6.67	7.29	46.24	74.00	27.76	Peak
2485.00	32.28	6.67	6.93	45.88	74.00	28.12	Peak



Antenna at Vertical Polarization

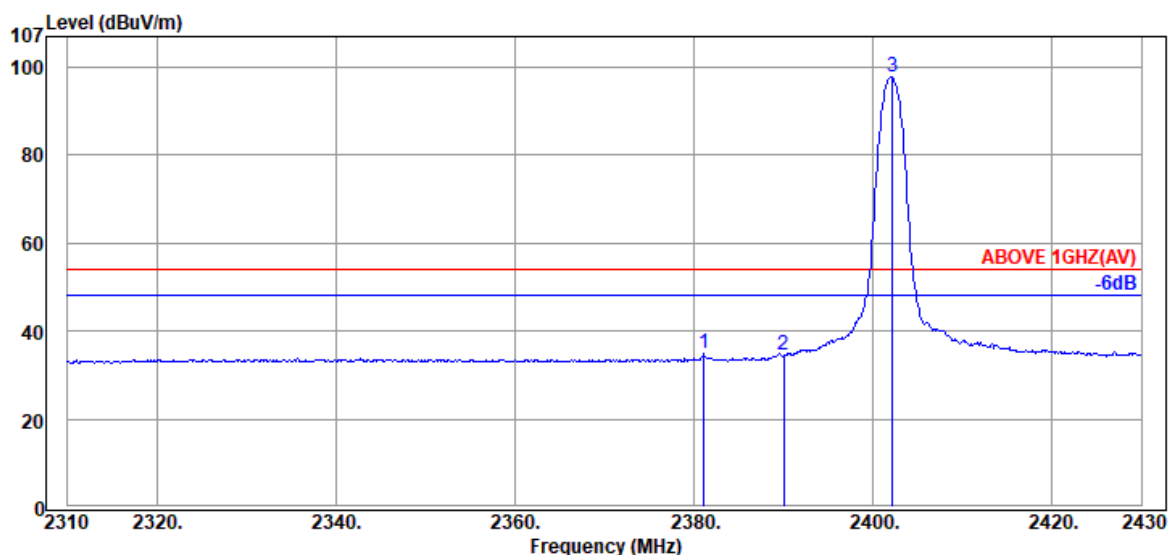
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.10	32.28	6.67	59.12	98.07	---	---	Average
2483.50	32.28	6.67	-1.72	37.23	54.00	16.77	Average
2484.00	32.28	6.67	-3.27	35.68	54.00	18.32	Average

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

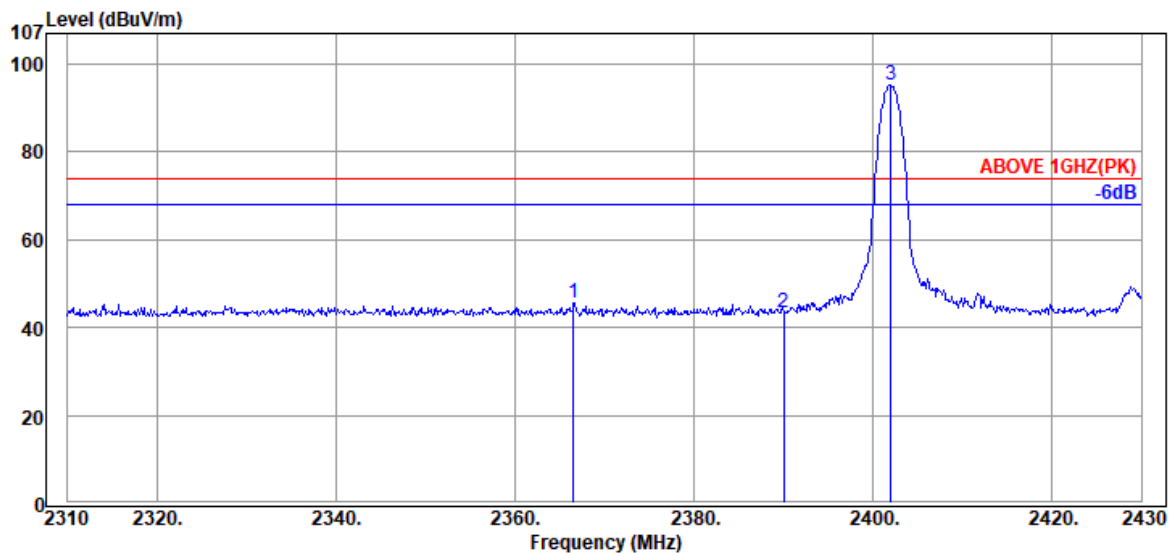
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2359.32	32.11	6.53	6.33	44.97	74.00	29.03	Peak
2390.04	32.16	6.57	5.57	44.30	74.00	29.70	Peak
2402.04	32.16	6.57	61.47	100.20	---	---	Peak



Antenna at Horizontal Polarization

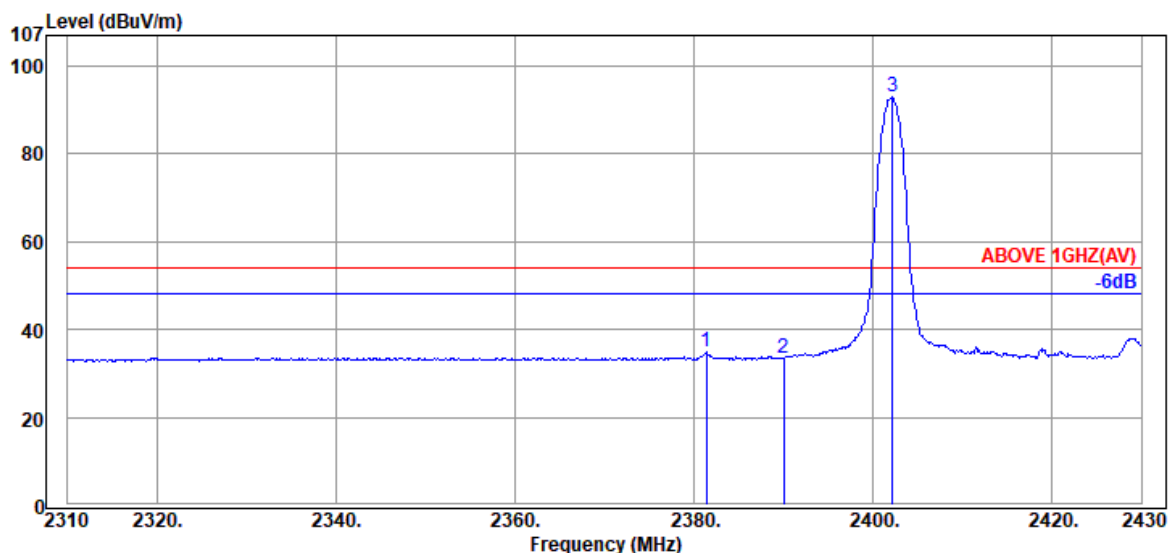
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2381.16	32.13	6.55	-3.92	34.76	54.00	19.24	Average
2390.04	32.16	6.57	-4.19	34.54	54.00	19.46	Average
2402.16	32.16	6.57	59.04	97.77	---	---	Average

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

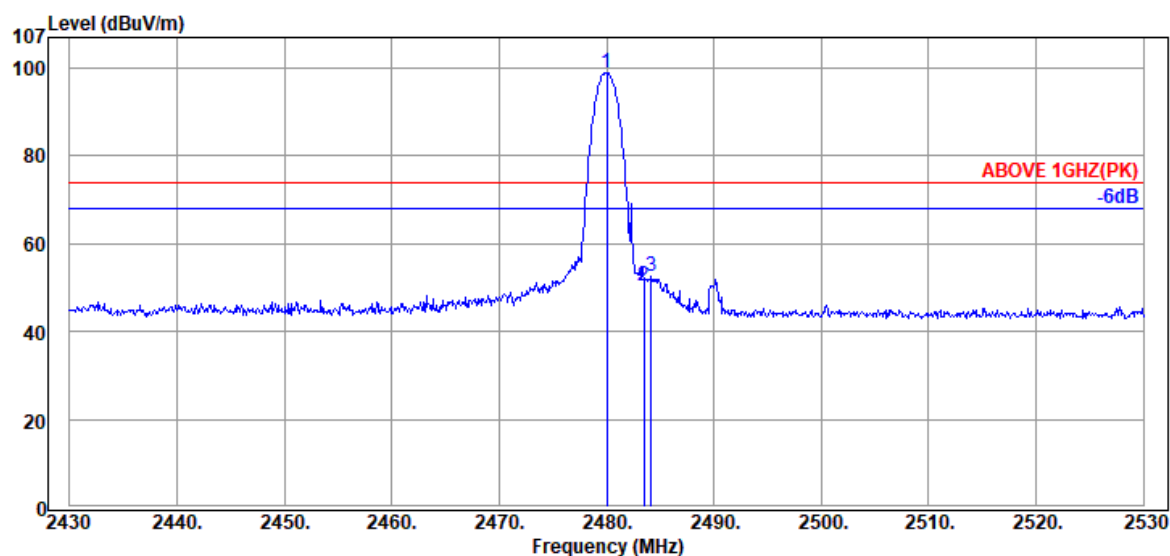
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2366.52	32.11	6.53	6.97	45.61	74.00	28.39	Peak
2390.04	32.16	6.57	4.78	43.51	74.00	30.49	Peak
2402.04	32.16	6.57	56.49	95.22	---	---	Peak



Antenna at Vertical Polarization

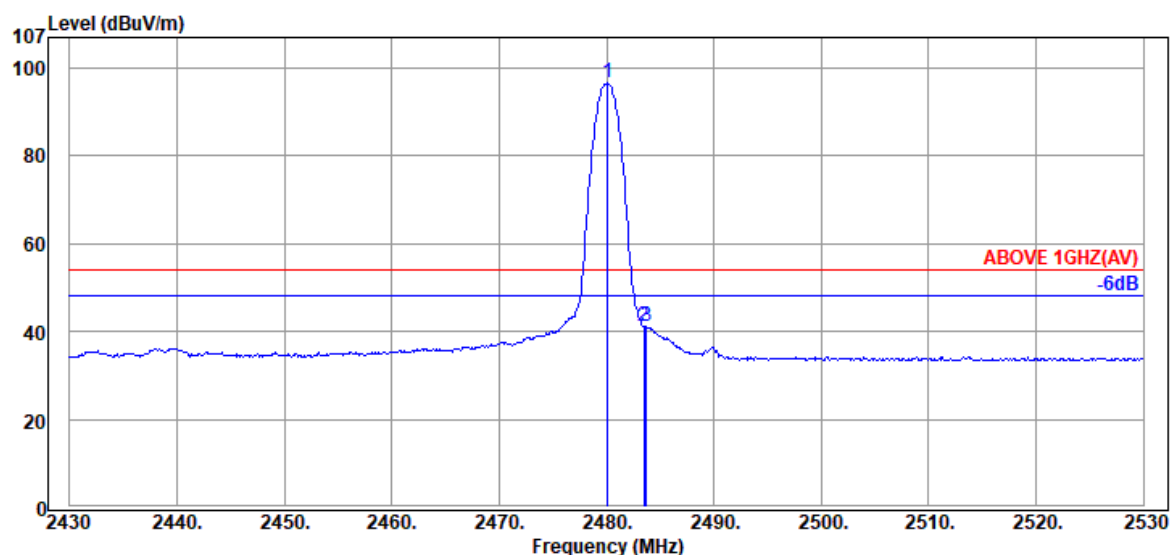
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2381.40	32.13	6.55	-3.91	34.77	54.00	19.23	Average
2390.04	32.16	6.57	-5.18	33.55	54.00	20.45	Average
2402.16	32.16	6.57	54.12	92.85	---	---	Average

Mode	8-DPSK	Frequency	TX 2480MHz
------	--------	-----------	------------



Antenna at Horizontal Polarization

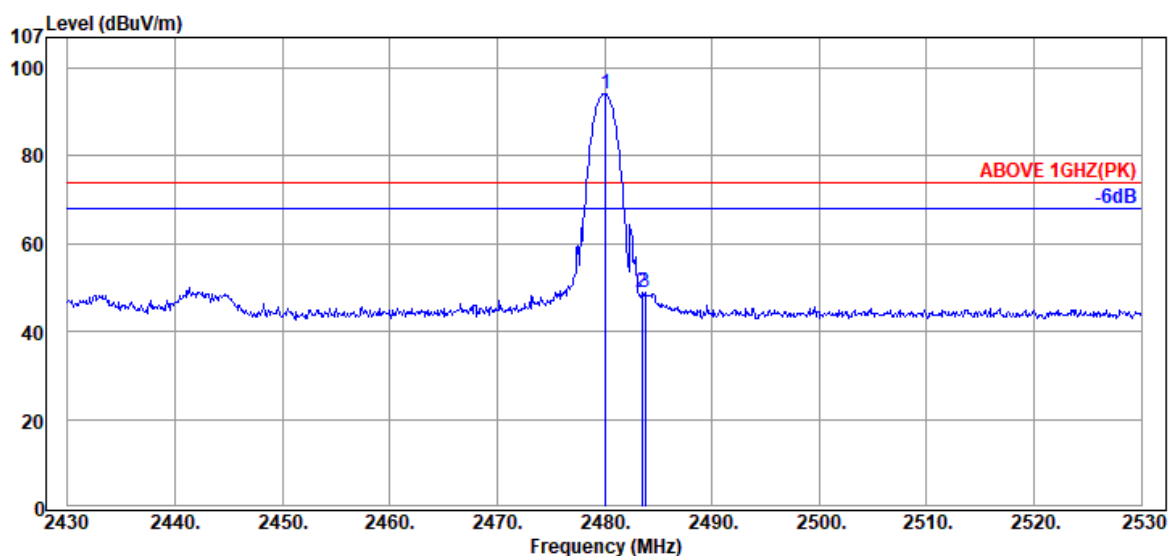
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	6.67	60.08	99.03	---	---	Peak
2483.50	32.28	6.67	11.48	50.43	74.00	23.57	Peak
2484.20	32.28	6.67	13.67	52.62	74.00	21.38	Peak



Antenna at Horizontal Polarization

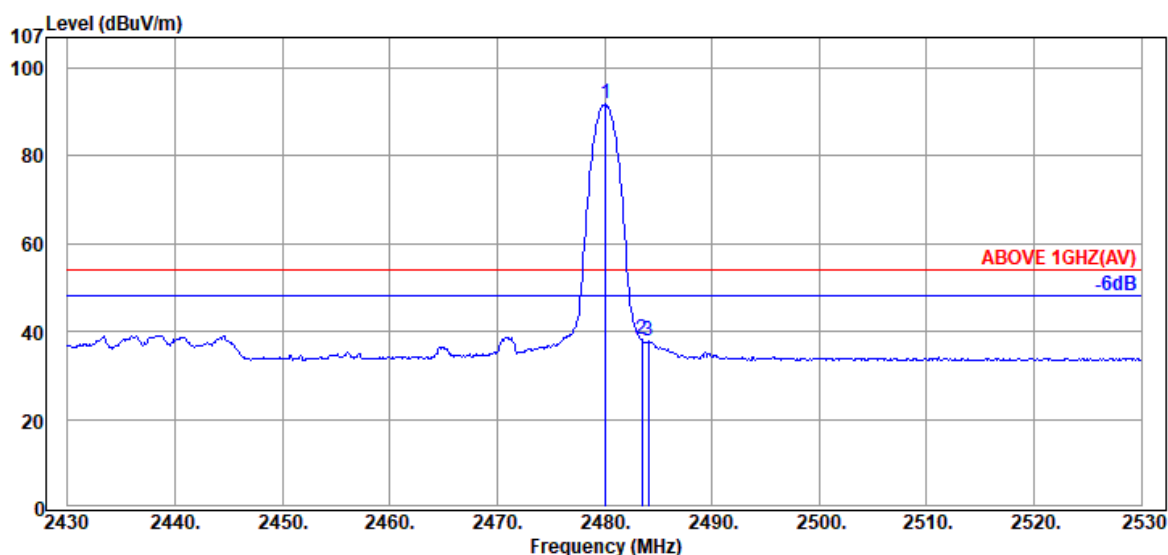
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.10	32.28	6.67	57.65	96.60	---	---	Average
2483.50	32.28	6.67	2.15	41.10	54.00	12.90	Average
2483.70	32.28	6.67	2.19	41.14	54.00	12.86	Average

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
2480.10	32.28	6.67	55.18	94.13	---	---	Peak
2483.50	32.28	6.67	9.81	48.76	74.00	25.24	Peak
2483.80	32.28	6.67	10.03	48.98	74.00	25.02	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
2480.10	32.28	6.67	52.90	91.85	---	---	Average
2483.50	32.28	6.67	-0.83	38.12	54.00	15.88	Average
2484.10	32.28	6.67	-1.06	37.89	54.00	16.11	Average

A.2.2 Emissions outside the frequency band:

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

Mode	GFSK	Frequency	TX 2402MHz
------	------	-----------	------------

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	-1.27	42.49	54.00	11.51	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	-2.34	41.42	54.00	12.58	Peak

Mode	GFSK	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	-0.72	43.09	54.00	10.91	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	0.52	44.33	54.00	9.67	Peak

Mode	GFSK	Frequency	TX 2480MHz
------	------	-----------	------------

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
4960.00	34.29	9.60	-2.25	41.64	54.00	12.36	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
4960.00	34.29	9.60	-3.30	40.59	54.00	13.41	Peak

A.2.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the 15.209 general radiated emissions limits is not required.

A.3 20dB BANDWIDTH

Test Date	2017/12/07	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.3.1 6dB Bandwidth Result

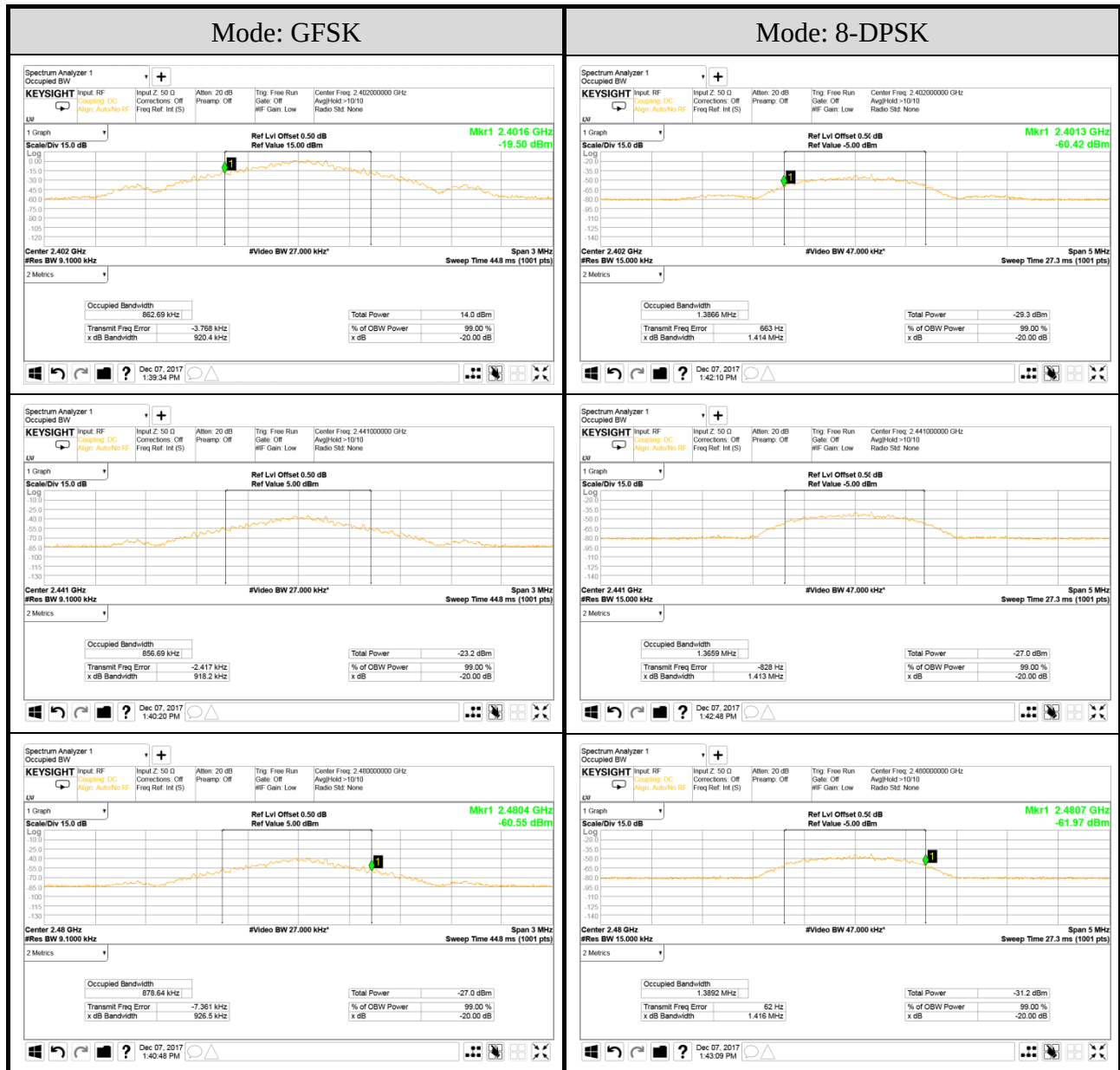
Mode	Centre Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz) (Reference only)	2/3 (20dB Bandwidth)
GFSK	2402	0.9204	0.86269	0.614
	2441	0.9182	0.85669	0.612
	2480	0.9265	0.87864	0.618
8-DPSK	2402	1.414	1.3866	0.943
	2441	1.413	1.3659	0.942
	2480	1.416	1.3892	0.944

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

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A.3.2 Measurement Plots

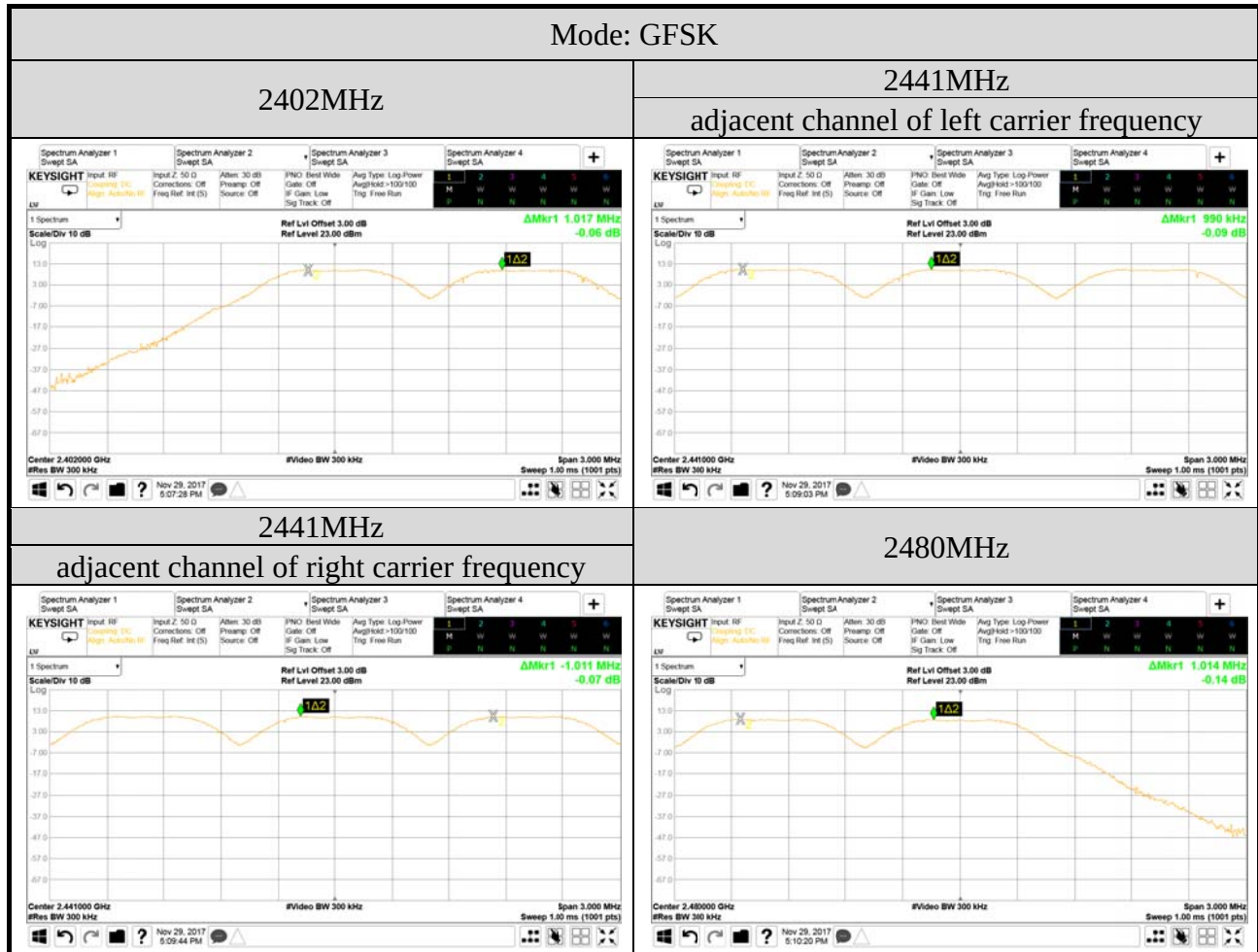


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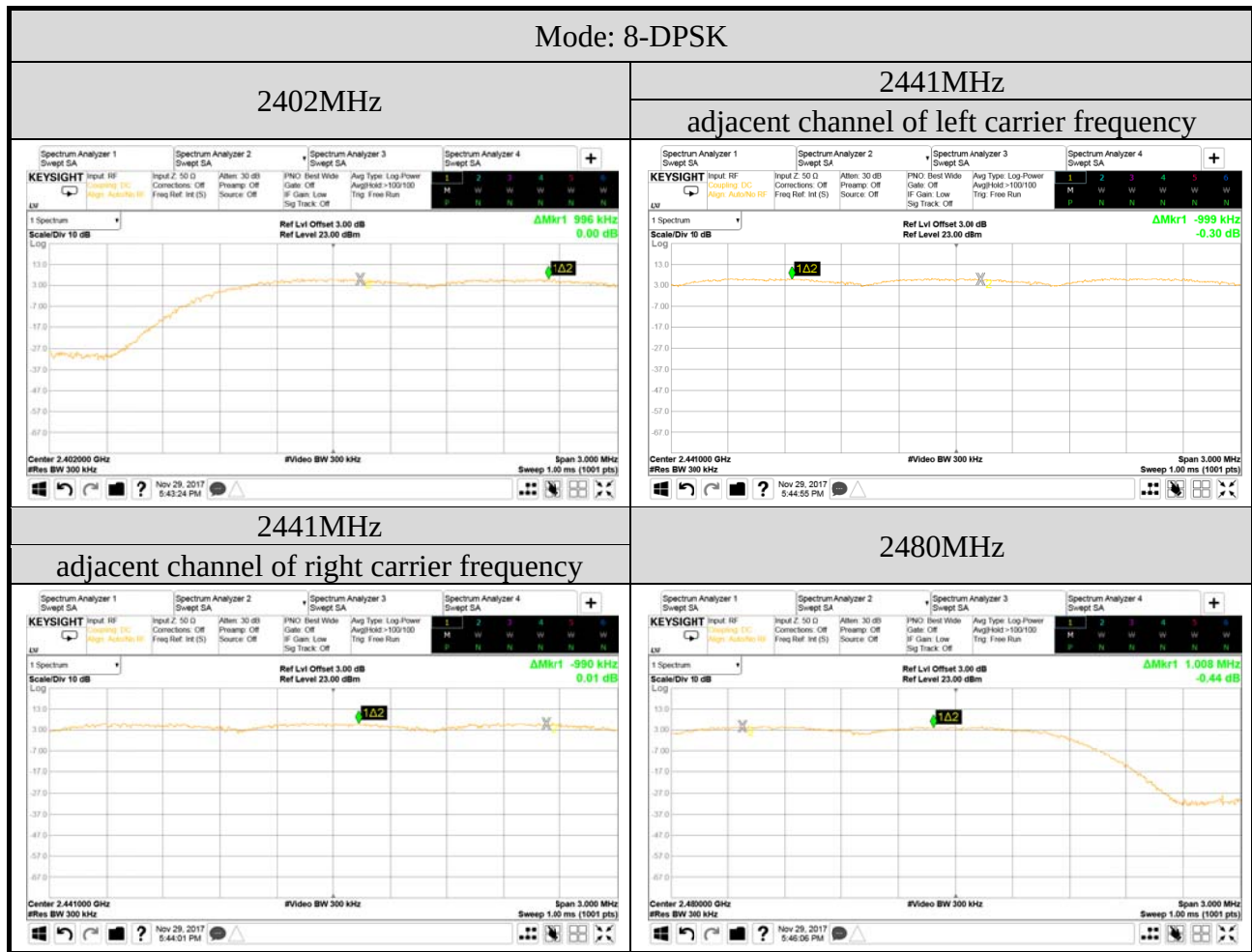
A.4 CARRIER FREQUENCY SEPARATION

Test Date	2017/11/29	Temp./Hum.	23°C/58%
Cable Loss	3.0dBm	Test Voltage	AC 120V, 60Hz (via AC Adapter)



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A.5 TIME OF OCCUPANCY

Test Date	2017/11/29	Temp./Hum.	23°C/58%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.5.1 Time of Occupancy

Mode	Centre Frequency (MHz)	Mode	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
GFSK	2402	DH1	0.360	113.760	<400
		DH3	1.620	358.344	
		DH5	2.860	271.128	
	2441	DH1	0.360	113.760	
		DH3	1.620	307.152	
		DH5	2.860	271.128	
	2480	DH1	0.370	116.920	
		DH3	1.620	307.152	
		DH5	2.876	271.645	

Observation Period: 79 channels*0.4 seconds = 31.6 seconds

Centre Frequency: 2402MHz

DH1: For each second of 10 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.360 \text{ ms} = 113.760 \text{ ms}$$

DH3: For each second of 7 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$7 \text{ channels} * 31.6 \text{ seconds} * 1.620 \text{ ms} = 358.344 \text{ ms}$$

DH5: For each second of 3 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$3 \text{ channels} * 31.6 \text{ seconds} * 2.860 \text{ ms} = 271.128 \text{ ms}$$

Centre Frequency: 2441MHz

DH1: For each second of 10 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.360 \text{ ms} = 113.760 \text{ ms}$$

DH3: For each second of 6 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$6 \text{ channels} * 31.6 \text{ seconds} * 1.620 \text{ ms} = 307.152 \text{ ms}$$

DH5: For each second of 3 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$3 \text{ channels} * 31.6 \text{ seconds} * 2.860 \text{ ms} = 271.128 \text{ ms}$$

Centre Frequency: 2480MHz

DH1: For each second of 10 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.370 \text{ ms} = 116.920 \text{ ms}$$

DH3: For each second of 6 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$6 \text{ channels} * 31.6 \text{ seconds} * 1.620 \text{ ms} = 307.152 \text{ ms}$$

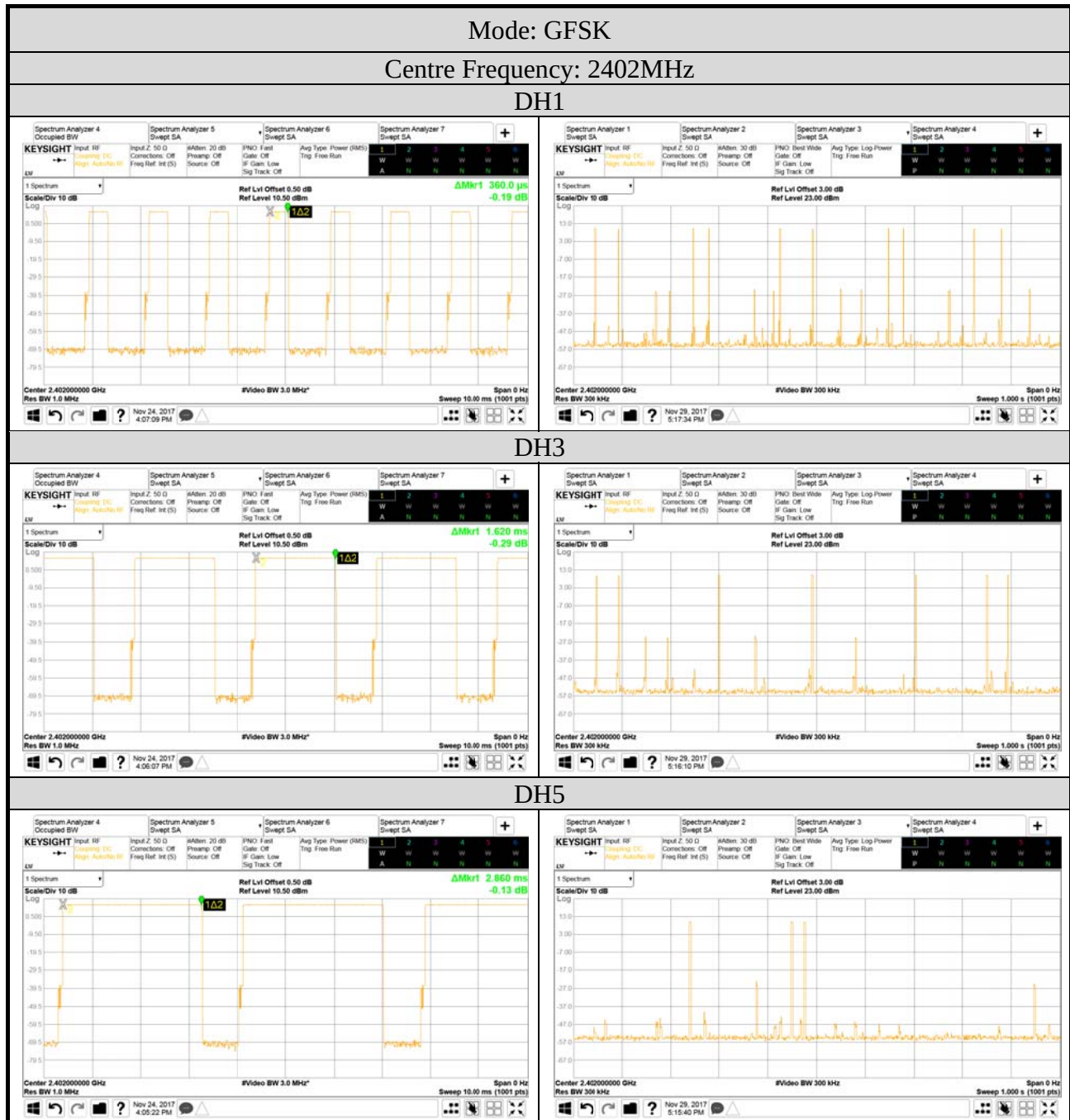
DH5: For each second of 3 channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$3 \text{ channels} * 31.6 \text{ seconds} * 2.876 \text{ ms} = 272.645 \text{ ms}$$

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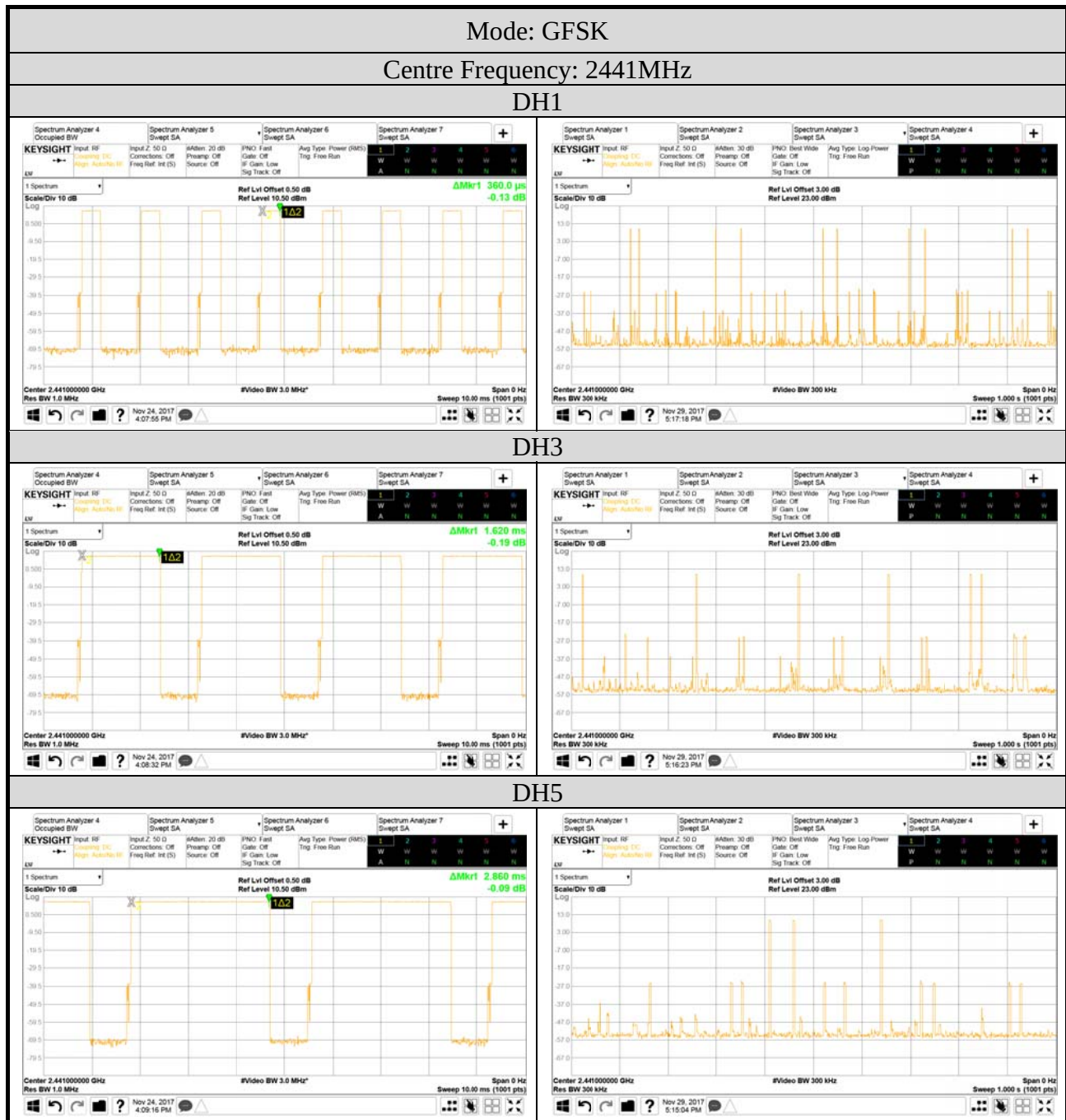
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● Measurement Plots



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Mode: GFSK

Centre Frequency: 2480MHz

DH1



DH3



DH5



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Mode	Centre Frequency (MHz)	Mode	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
8-DPSK	2402	3DH1	0.370	116.920	<400
		3DH3	1.600	252.800	
		3DH5	2.880	182.016	
	2441	3DH1	0.370	116.920	
		3DH3	1.610	254.380	
		3DH5	2.870	181.384	
	2480	3DH1	0.370	116.920	
		3DH3	1.630	257.540	
		3DH5	2.870	181.384	

Observation Period: 79 channels*0.4 seconds = 31.6 seconds

Centre Frequency: 2402MHz

3DH1: For each second of **10** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.370 \text{ ms} = 116.920 \text{ ms}$$

3DH3: For each second of **5** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$5 \text{ channels} * 31.6 \text{ seconds} * 1.600 \text{ ms} = 252.800 \text{ ms}$$

3DH5: For each second of **2** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$2 \text{ channels} * 31.6 \text{ seconds} * 2.880 \text{ ms} = 182.016 \text{ ms}$$

Centre Frequency: 2441MHz

3DH1: For each second of **10** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.370 \text{ ms} = 116.920 \text{ ms}$$

3DH3: For each second of **5** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$5 \text{ channels} * 31.6 \text{ seconds} * 1.610 \text{ ms} = 254.380 \text{ ms}$$

3DH5: For each second of **2** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$2 \text{ channels} * 31.6 \text{ seconds} * 2.870 \text{ ms} = 181.384 \text{ ms}$$

Centre Frequency: 2480MHz

3DH1: For each second of **10** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$10 \text{ channels} * 31.6 \text{ seconds} * 0.370 \text{ ms} = 116.920 \text{ ms}$$

3DH3: For each second of **5** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$5 \text{ channels} * 31.6 \text{ seconds} * 1.630 \text{ ms} = 257.540 \text{ ms}$$

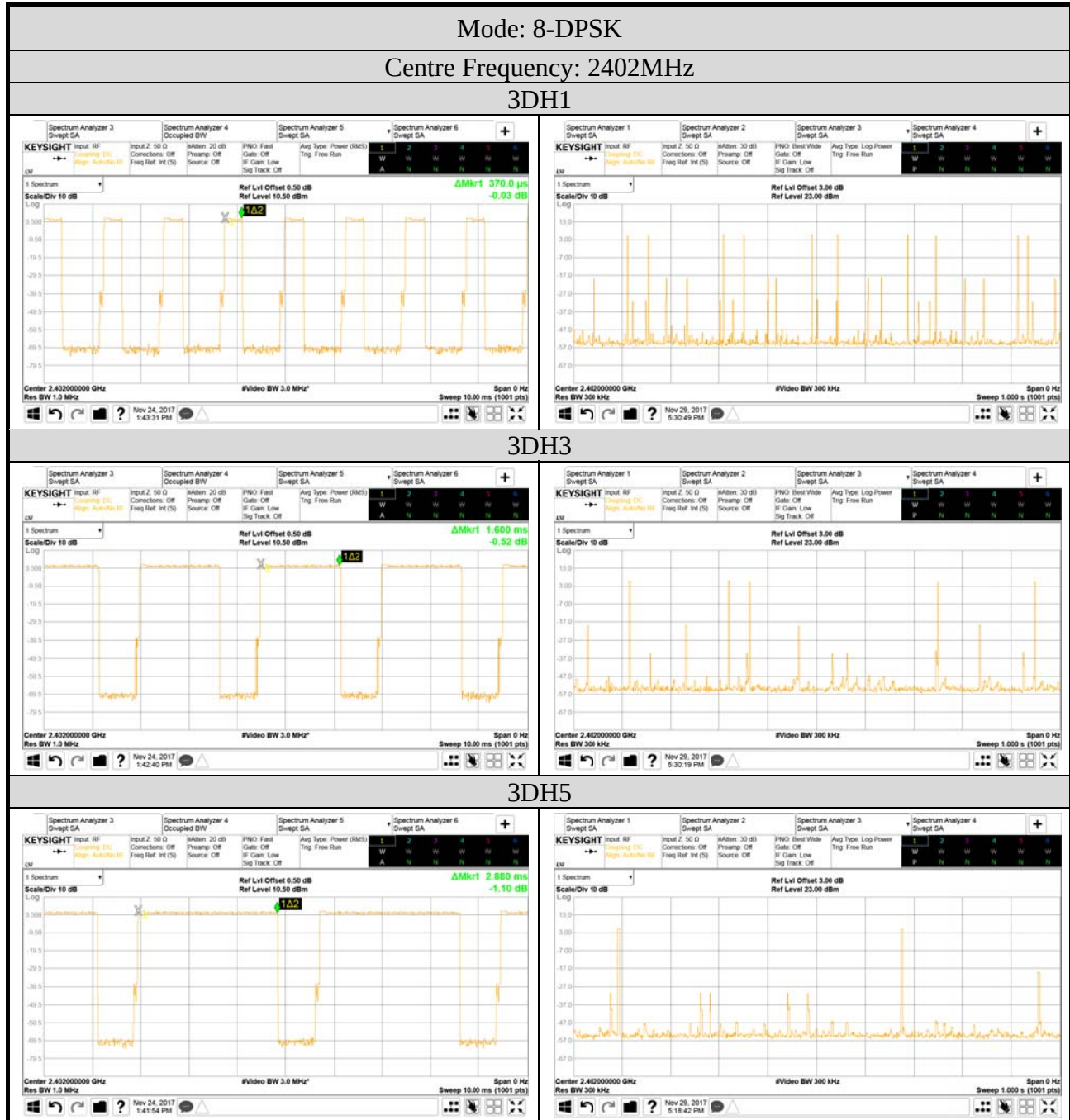
3DH5: For each second of **2** channel appearance, the longest time of occupancy for each of 31.6 seconds is:

$$2 \text{ channels} * 31.6 \text{ seconds} * 2.870 \text{ ms} = 181.384 \text{ ms}$$

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● Measurement Plots



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Mode: 8-DPSK

Centre Frequency: 2441MHz

3DH1



3DH3



3DH5



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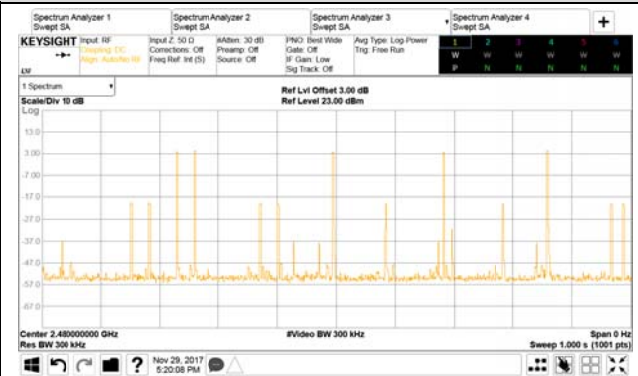
Mode: 8-DPSK

Centre Frequency: 2480MHz

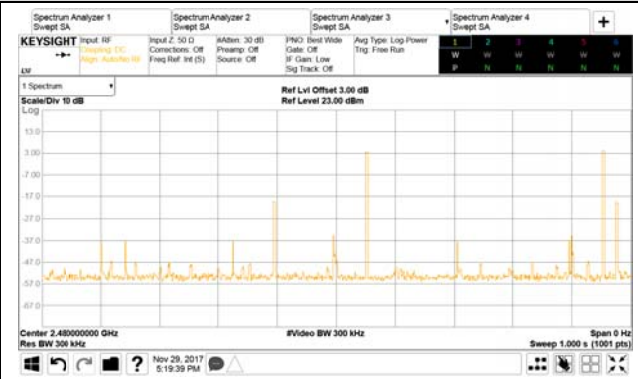
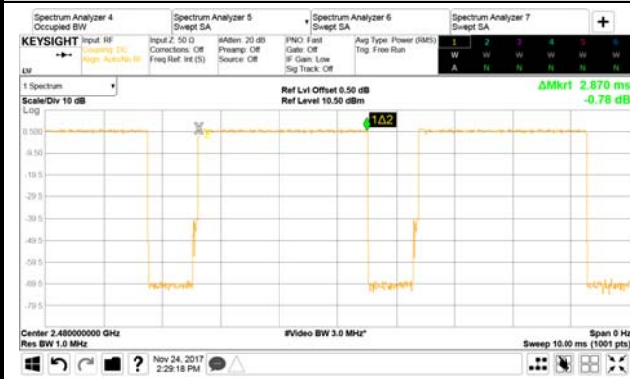
3DH1



3DH3

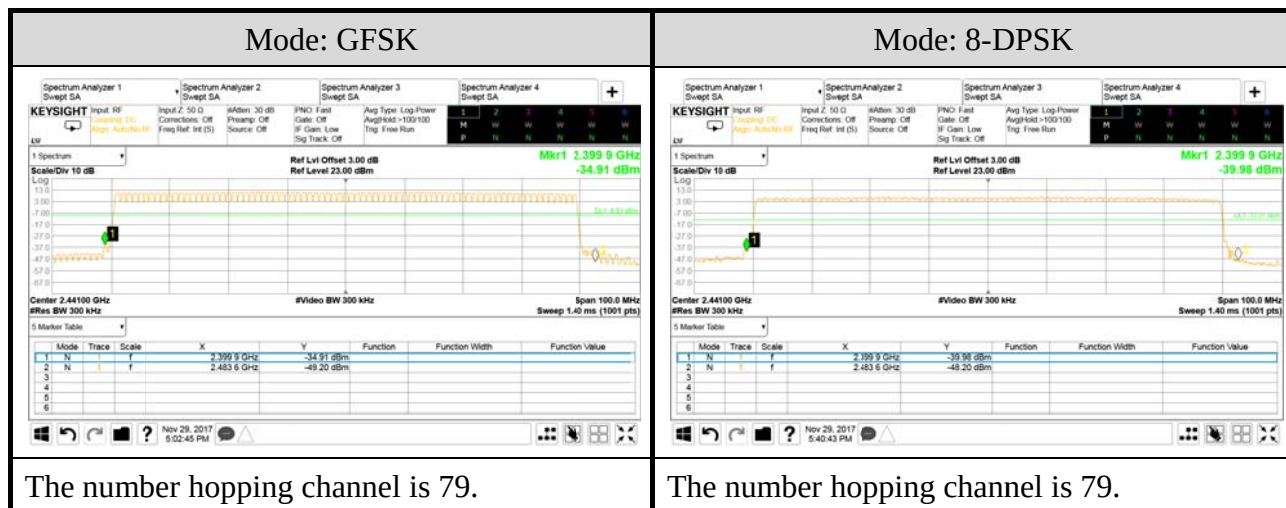


3DH5



A.6 NUMBER OF HOPPING CHANNELS

Test Date	2017/11/29	Temp./Hum.	23°C/58%
Cable Loss	3.0dBm	Test Voltage	AC 120V, 60Hz (via AC Adapter)



A.7 MAXIMUM PEAK OUTPUT POWER

Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.7.1 Maximum Peak Output Power

Modulation	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
GFSK	2402	7.33	0.005	21dBm (0.125W)
	2441	7.98	0.006	
	2480	6.49	0.004	
8-DPSK	2402	4.63	0.003	
	2441	5.29	0.003	
	2480	3.75	0.002	

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A.7.2 Measurement Plots



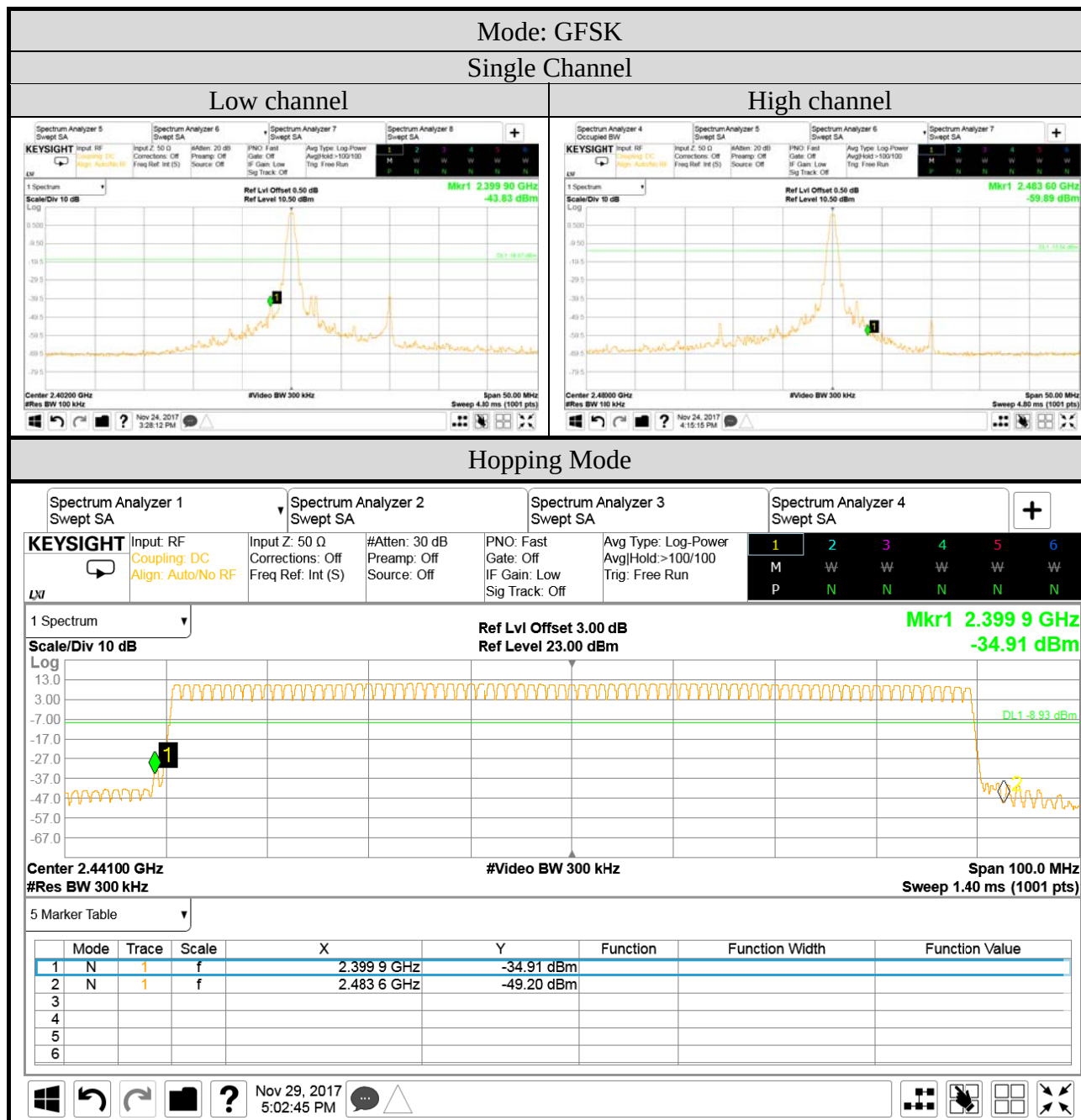
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A.8 EMISSION LIMITATIONS MEASUREMENT

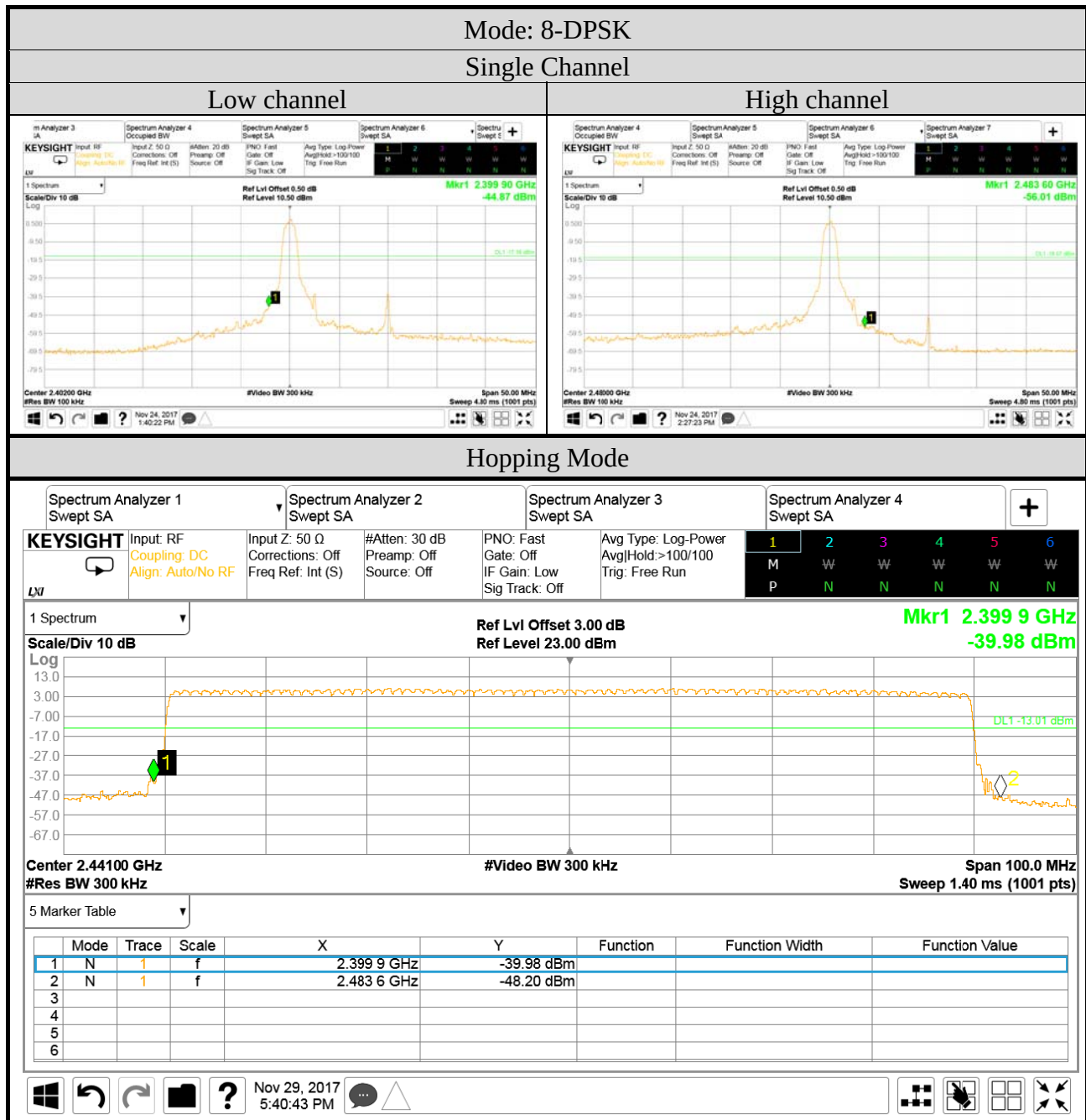
Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)

A.8.1 Band Edge



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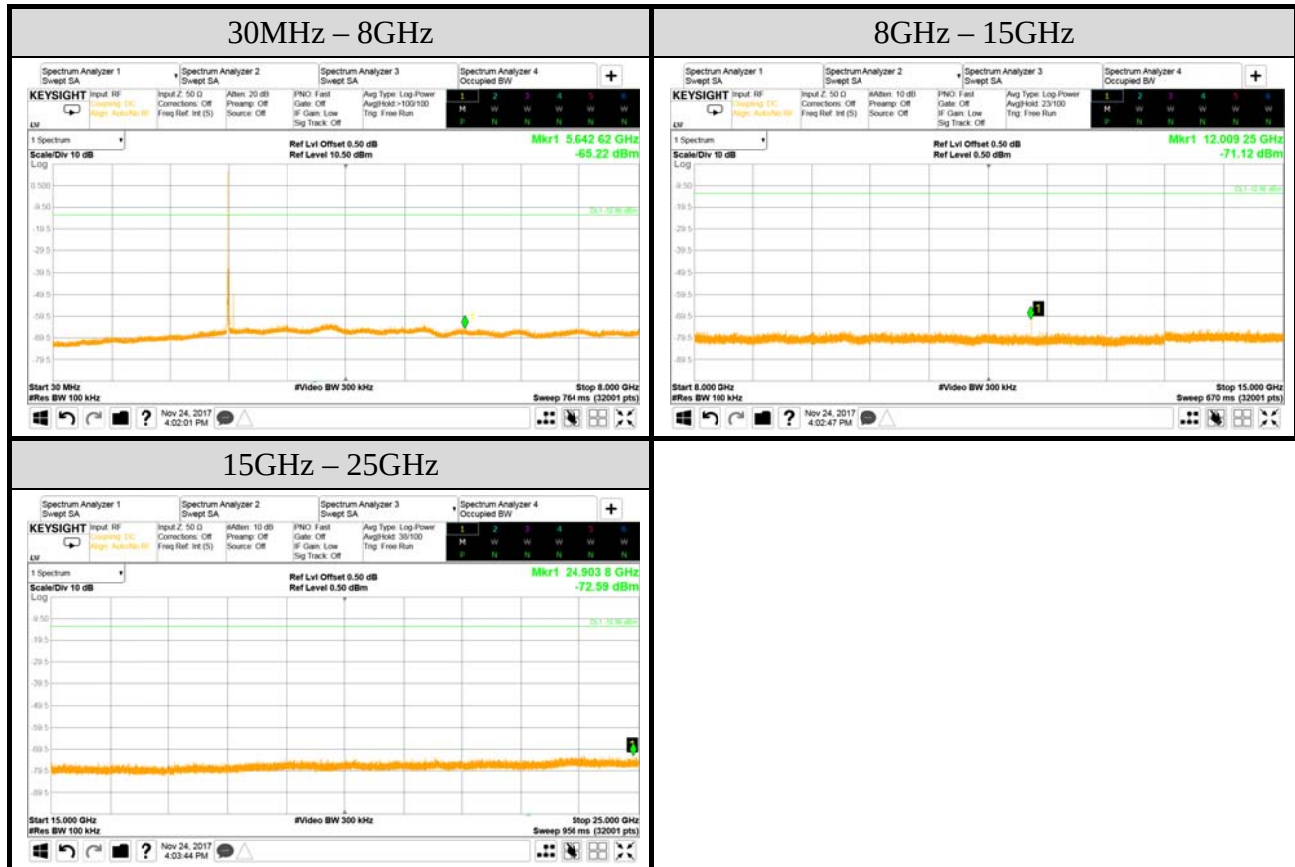


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A.8.2 Spurious Emission

Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2402MHz



Note: All results have been included cable loss.

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Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2441MHz

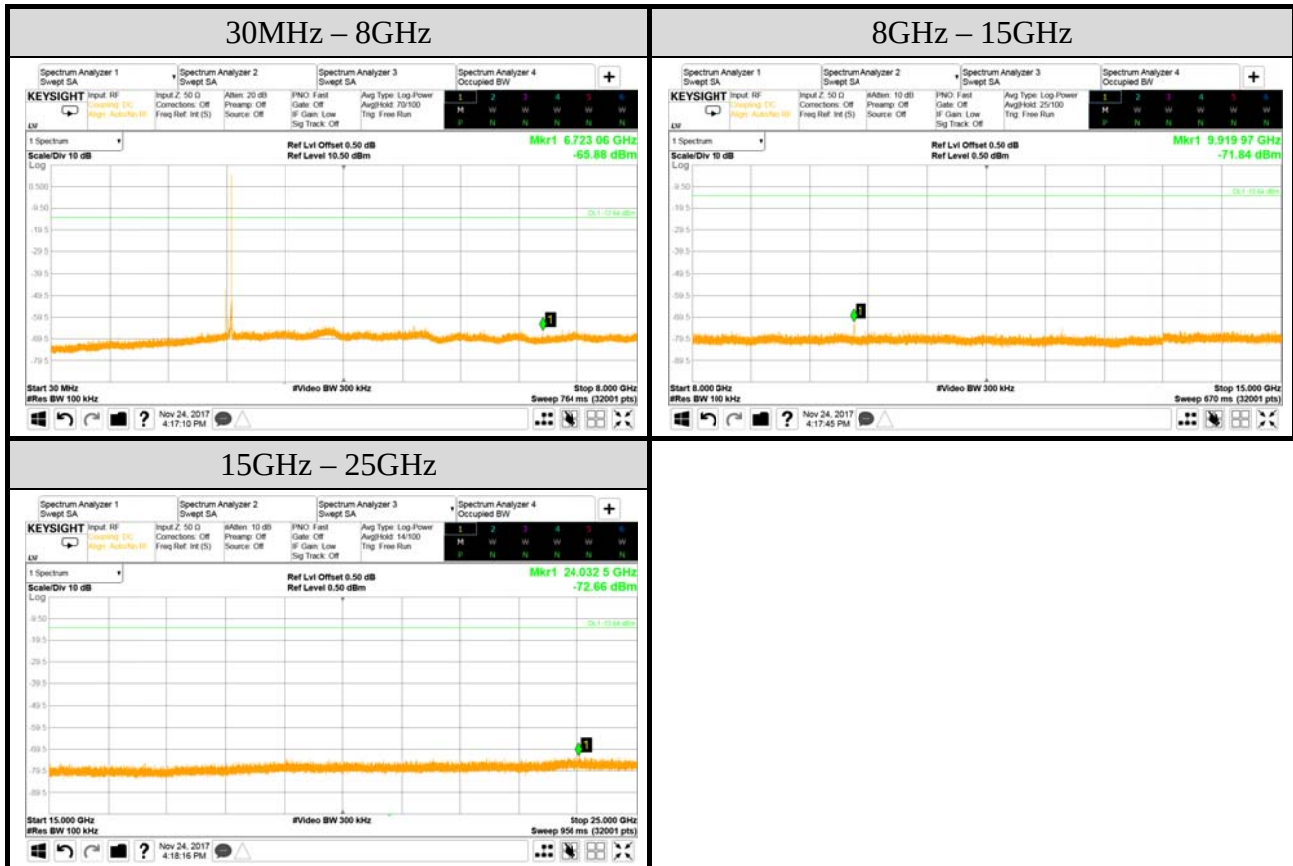


Note: All results have been included cable loss.

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Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	GFSK	Frequency	2480MHz



Note: All results have been included cable loss.

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Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2402MHz



Note: All results have been included cable loss.

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Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2441MHz

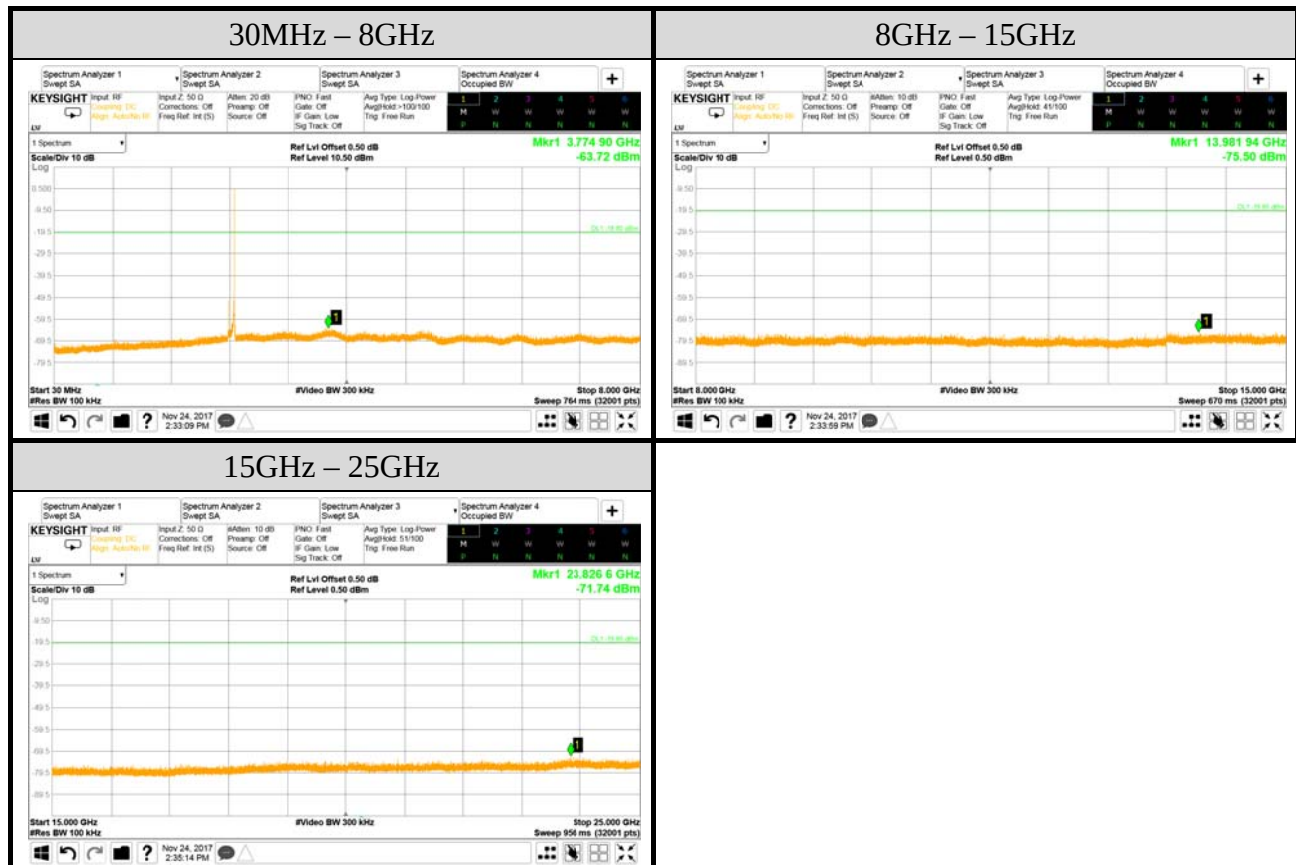


Note: All results have been included cable loss.

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Test Date	2017/11/24	Temp./Hum.	23°C/55%
Cable Loss	0.5dB	Test Voltage	AC 120V, 60Hz (via AC Adapter)
Mode	8-DPSK	Frequency	2480MHz



Note: All results have been included cable loss.



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APPENDIX B

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: 14Z980)