



## FCC Part 15.247

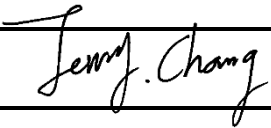
## TEST REPORT

For

### AirTies Wireless Networks

Mithat Uluönlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey

**FCC ID: Z3WAIR7430**

Report Type	Original Report
Product Type:	UHD Wireless Set-Top Box
Report Number :	RLK1810008-00B
Report Date :	2019/02/25
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*Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Taiwan)*

### Revision History

Revision	Report Number	Issue Date	Description	Author/Revised by
1.0	RLK1810008-00B	2019/02/25	Original Report	Himiko Chen

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## 1 General Information

### 1.1 Product Description for Equipment under Test (EUT)

<b>Applicant</b>	<b>AirTies Wireless Networks</b> Mithat Uluünlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey
<b>Manufacturer</b>	<b>XAVi Technologies Corp.</b> 3F-1, No. 27, Puding Rd., Hsinchu City 300, Taiwan
<b>Brand(Trade) Name</b>	<b>AirTies</b>
<b>Product (Equipment)</b>	<b>UHD Wireless Set-Top Box</b>
<b>Model Name</b>	<b>Air7430</b>
<b>EUT Function</b>	BT: BR+EDR
<b>Frequency Range</b>	2402 MHz ~ 2480 MHz
<b>Number of Channels</b>	79 Channels
<b>Output Power</b>	BT BR-1Mbps (GFSK) Mode: 10.46 dBm (0.0111W) BT EDR-2Mbps ( $\pi/4$ -DQPSK) Mode: 8.83 dBm(0.0076W) BT EDR-3Mbps (8-DPSK) Mode: 8.89 dBm (0.0077W)
<b>Received Date</b>	Oct. 26, 2018.
<b>Date of Test</b>	Nov. 15, 2018 ~ Dec. 07, 2018
<b>Modulation Type</b>	BR-1Mbps Mode: GFSK EDR-2Mbps Mode: $\pi/4$ -DQPSK EDR-3Mbps Mode: 8-DPSK
<b>Related Submittal(s)/Grant(s)</b>	<b>FCC Part 15.247 DTS with FCC ID : Z3WAIR7430</b> <b>FCC Part 15.407 NII with FCC ID : Z3WAIR7430</b>

\*All measurement and test data in this report was gathered from production sample serial number: 1810008 (Assigned by BACL, Taiwan).

### 1.2 Operation Condition of EUT

<b>Power Operation (Voltage Range)</b>	<input checked="" type="checkbox"/> AC 120V/60Hz <input checked="" type="checkbox"/> Adapter <i>Brand Name: MOSO</i> <i>Model: MSA-C2000IS12.0-24Y-US</i> <i>I/P: 100-240Vac,0.7A</i> <i>O/P: 12Vdc,2A</i> <input type="checkbox"/> By Power Core
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### 1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the AirTies Wireless Networks Appliance (Model: Air7430) to the requirements of the following Standards:

-Part 2, Subpart J, Part 15, Subparts A and C, section 15.247 of the Federal Communication Commission's rules.

- ANSI C63.10-2013 of the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

### 1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power with Power Meter	± 0.55 dB
Occupied Channel Bandwidth	± 4.45 %
RF Conducted test with Spectrum	± 1.45 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	± 3.57 dB
Radiated Above 1G-18G	± 4.29 dB
Radiated Above 18G-40G	± 4.67 dB

### 1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on

70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 974454. Designation No.: TW3180

## 2 System Test Configuration

### 2.1 Description of Test Configuration

The system was configured for testing in testing mode which was provided by manufacturer.

No special accessory, No modification was made to the EUT and No special equipment used during test.

**For BT (BR/EDR), there are totally 79 channels.**

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441
1	2403	--	--
2	2404	--	--
3	2405	76	2478
--	--	77	2479
38	2440	78	2480

For BLE: Channel 0, 39 and 78 were tested.

Radiated below 1G were tested worst output power mode.

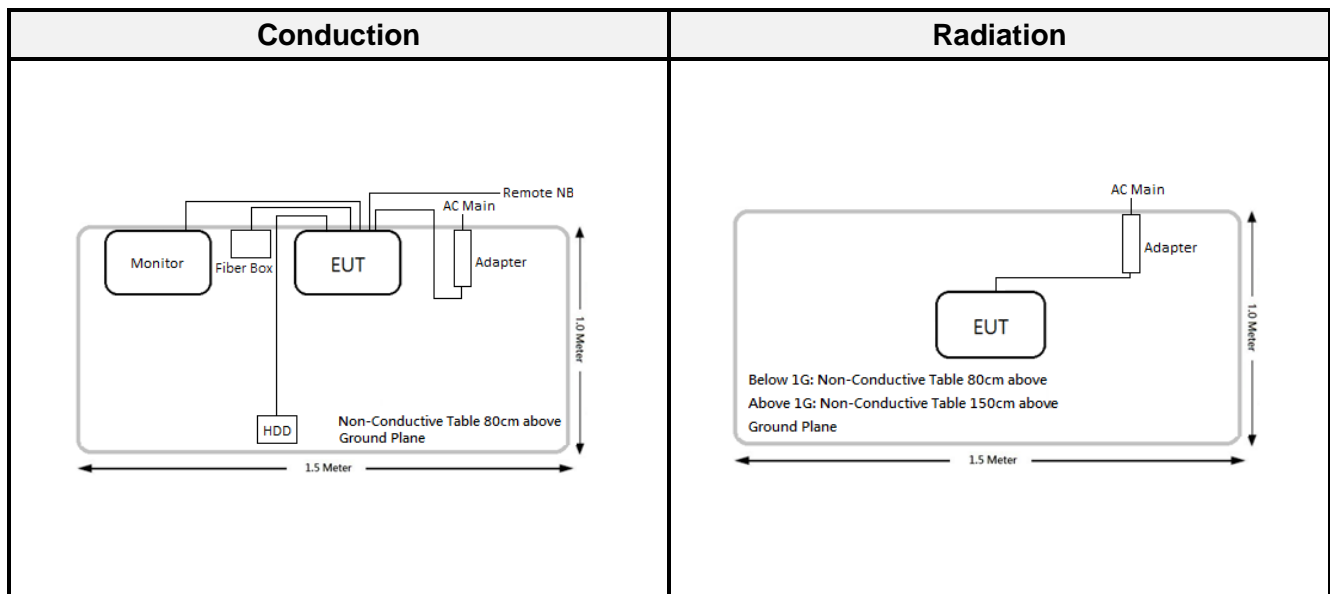
Worst Case of Power Setting				
EUT Exercise Software		accessMtool		
Configuration	NTX	Low CH	Mid CH	High CH
BR-1Mbps (GFSK) mode	1	0x09	0x09	0x09
EDR-2Mbps ( $\pi/4$ -DQPSK) mode	1	0x09	0x09	0x09
EDR-3Mbps (8DPSK) mode	1	0x09	0x09	0x09

## 2.2 Support Equipment List and Details

No.	Description	Manufacturer	Model Number	BSMI	FCC ID / DoC
A	Monitor	DELL	PP27LA	R33038	DoC
B	HDD	WD	WESNWDBUZG0014BBK	D33015	DoC
C	Fiber BOX	SPDIF	2RCA	NA	NA
D	Notebook PC	DELL	Latitude E5470	R33002	DoC

No.	Cable Description	Shielding Type	Length (m)	From	To
1	HDMI Cable	Shielded	1.8	EUT	Monitor
2	USB Cable	Shielded	1	EUT	HDD
3	Fiber Cable	Non- Shielded	0.6	EUT	Fiber BOX
4	LAN Cable	Non- Shielded	10	EUT	NB

## 2.3 Block Diagram of Test Setup





### 3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1310, §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance

## 4 FCC §15.247(i), § 1.1310, § 2.1091 – Maximum Permissible Exposure (MPE)

### 4.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

#### Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

**Calculated Formulary:** Predication of MPE limit at a given distance

S = PG/4πR<sup>2</sup> = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

## 4.2 RF Exposure Evaluation Result

### MPE Evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi 2.4G	2412-2462	3.60	2.291	27.00	501.187	25	0.1463	1
BLE	2402-2480	-4.30	0.372	8.00	6.310	25	0.0003	1
BR+EDR	2402-2480	-4.30	0.372	11.00	12.589	25	0.0006	1
Wi-Fi 5G UNII-1	5150-5250	9.44	8.790	23.00	199.526	25	0.2234	1
Wi-Fi 5G UNII-2a	5250-5350	9.44	8.790	21.00	158.489	25	0.1409	1
Wi-Fi 5G UNII-2c	5470-5725	9.78	9.506	19.00	79.433	25	0.0961	1
Wi-Fi 5G UNII-3	5745-5850	9.03	7.999	27.00	501.187	25	0.5107	1

The Wi-Fi 2.4G, BT and Wi-Fi 5G can transmit simultaneously:

$$= S_{2.4G}/S_{\text{limit-2.4G}} + S_{\text{BR+EDR}}/S_{\text{limit-BR+EDR}} + S_{5G \text{ UNII-3}}/S_{\text{limit-5G UNII-3}}$$

$$= 0.1463/1 + 0.0006/1 + 0.5107/1 = 0.6576 < 1.0$$

**Result:** MPE evaluation meet 25 cm the requirement of standard.

## 5 FCC §15.203 – Antenna Requirements

### 5.1 Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6dBi

### 5.2 Antenna List and Details

Brand	Model	Antenna Type	Antenna Gain	Result
AirTies	BT Ant-1	PCB Antenna	-4.30 dBi	Compliance

*The EUT has an internal antenna arrangement, which was permanently attached, fulfill the requirement of this section.*

## 6 FCC §15.207 - AC Line Conducted Emissions

### 6.1 Applicable Standard

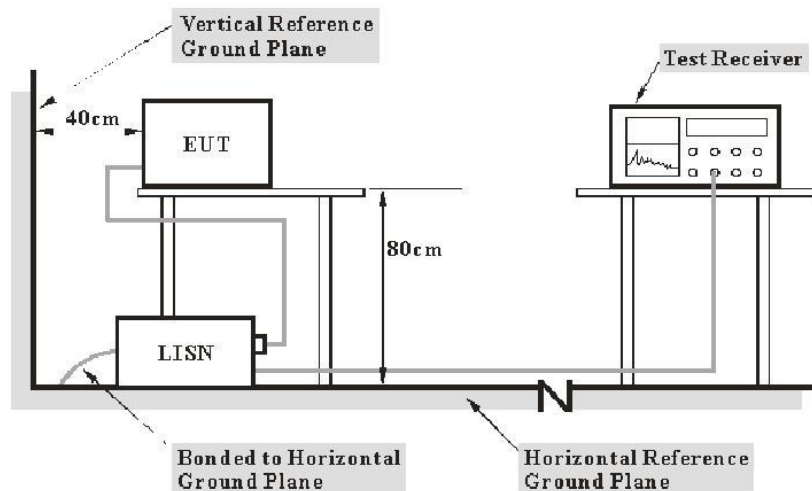
According to FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Channel	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 <sup>Note 1</sup>	56 to 46 <sup>Note 2</sup>
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency. Note 2: A linear average detector is required

### 6.2 EUT Setup and Test Procedure



- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	Receiver RBW
150 kHz - 30 MHz	9 kHz

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

### 6.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conduction Room</b>					
LISN	Rohde & Schwarz	ENV216	101612	2018/02/22	2019/02/21
LISN	Rohde & Schwarz	ENV216	101248	2018/06/27	2019/06/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2018/08/03	2019/08/02
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	e3	V9.150826k	N.C.R	N.C.R

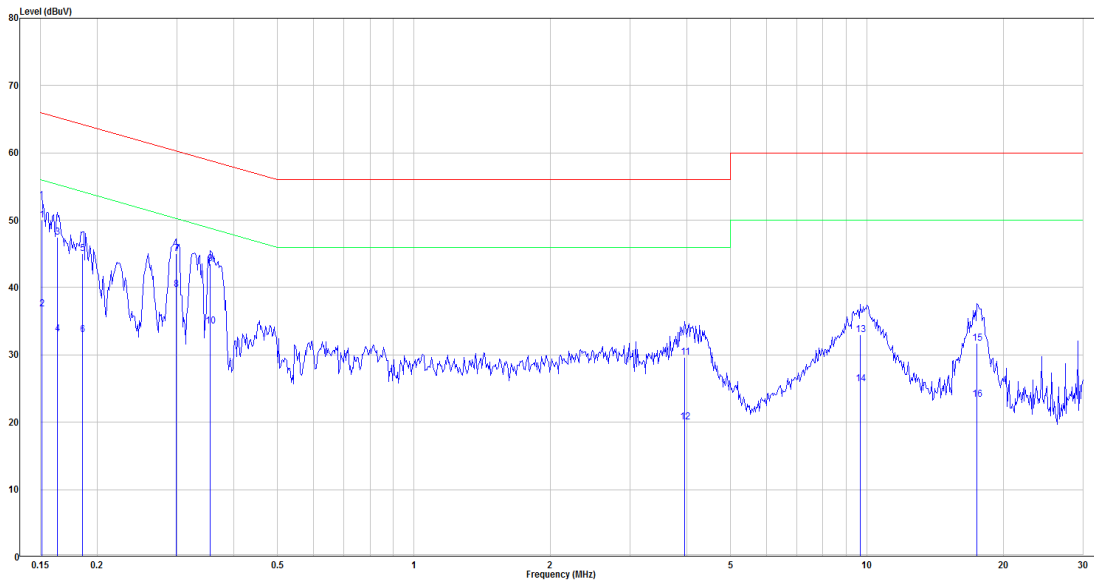
**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 6.4 Test Environmental Conditions

<b>Temperature:</b>	25 °C	<b>Relative Humidity:</b>	45 %
<b>ATM Pressure:</b>	1010 hPa	<b>Test Engineer:</b>	Ray Huang
<b>Test Date:</b>	2018-12-07		

### 6.5 AC Line Conducted Emission Test Plot and Data

Mode: AC 120V/60 Hz, BT mode, Line



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Over limit (dB)	Remark
1	0.151	30.55	19.45	50.00	65.96	-15.96	QP
2	0.151	17.32	19.45	36.77	55.96	-19.18	Average
3	0.163	28.01	19.45	47.46	65.30	-17.84	QP
4	0.163	13.66	19.45	33.11	55.30	-22.19	Average
5	0.186	25.52	19.46	44.98	64.22	-19.24	QP
6	0.186	13.49	19.46	32.95	54.22	-21.27	Average
7	0.298	25.62	19.47	45.09	60.29	-15.20	QP
8	0.298	20.19	19.47	39.65	50.29	-10.63	Average
9	0.355	24.02	19.47	43.49	58.84	-15.35	QP
10	0.355	14.77	19.47	34.24	48.84	-14.60	Average
11	3.965	10.09	19.58	29.67	56.00	-26.33	QP
12	3.965	0.43	19.58	20.01	46.00	-25.99	Average
13	9.677	13.30	19.71	33.01	60.00	-26.99	QP
14	9.677	6.04	19.71	25.75	50.00	-24.25	Average
15	17.512	12.00	19.78	31.78	60.00	-28.22	QP
16	17.512	3.59	19.78	23.37	50.00	-26.63	Average

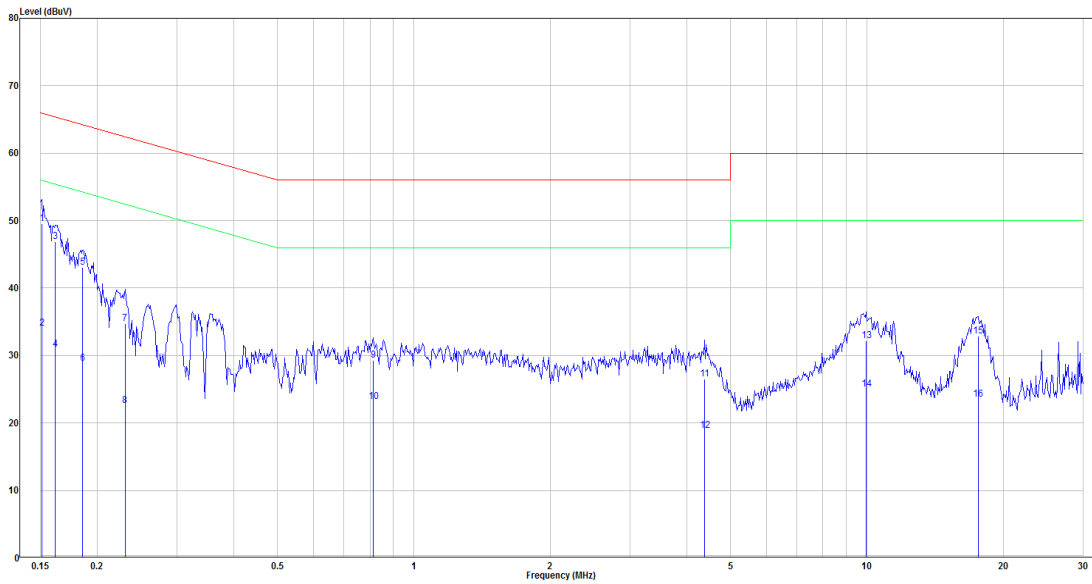
Note:

$Level = Read\ Level + Factor$

$Over\ Limit\ (Margin) = Level - Limit\ Line$

$Factor = (LISN, ISN, PLC\ or\ current\ probe)\ Factor + Cable\ Loss + Attenuator$

**Mode: AC 120V/60 Hz, BT mode, Neutral**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Over limit (dB)	Remark
1	0.151	30.16	19.44	49.60	65.96	-16.36	QP
2	0.151	14.59	19.44	34.03	55.96	-21.93	Average
3	0.162	27.50	19.45	46.94	65.38	-18.44	QP
4	0.162	11.46	19.45	30.91	55.38	-24.47	Average
5	0.186	23.58	19.45	43.03	64.22	-21.19	QP
6	0.186	9.34	19.45	28.79	54.22	-25.43	Average
7	0.230	15.28	19.46	34.74	62.44	-27.70	QP
8	0.230	3.15	19.46	22.61	52.44	-29.83	Average
9	0.813	9.86	19.48	29.34	56.00	-26.66	QP
10	0.813	3.66	19.48	23.14	46.00	-22.86	Average
11	4.381	6.92	19.58	26.50	56.00	-29.50	QP
12	4.381	-0.67	19.58	18.91	46.00	-27.09	Average
13	9.971	12.52	19.71	32.23	60.00	-27.77	QP
14	9.971	5.25	19.71	24.96	50.00	-25.04	Average
15	17.600	13.05	19.81	32.85	60.00	-27.15	QP
16	17.600	3.68	19.81	23.49	50.00	-26.51	Average

Note:

$Level = Read\ Level + Factor$

$Over\ Limit\ (Margin) = Level - Limit\ Line$

$Factor = (LISN, ISN, PLC\ or\ current\ probe)\ Factor + Cable\ Loss + Attenuator$



## 7 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

### 7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6

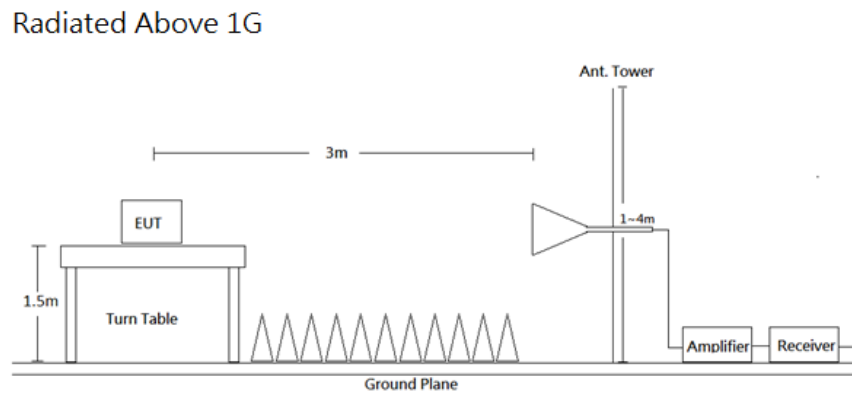
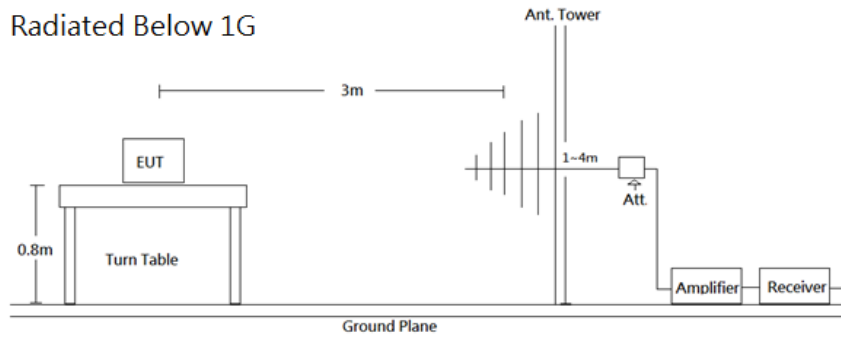
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

## 7.2 EUT Setup and Test Procedure



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

The system was investigated from 30 MHz to 10 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Detector	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	QP	-	QP
Above 1 GHz	1 MHz	3 MHz	PK	-	PK
	1 MHz	3 MHz	RMS	>98%	Ave
	1 MHz	1/T	PK	<98%	Ave

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

### 7.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>966A Room</b>					
Active Loop Antenna	ETS-Lindgren	6502	00035796	2018/03/13	2019/03/12
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2017/12/20	2018/12/19
Horn Antenna	EMCO	3115	9311-4158	2018/04/20	2019/04/19
Horn Antenna	ETS-Lindgren	3116	62638	2018/08/29	2019/08/28
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2017/12/14	2018/12/13
Microwave Preamplifier	EM Electronics Corporation	EM18G40G	060656	2018/01/15	2019/01/14
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Spectrum Analyzer	Spectrum Analyzer	FSV40	101435	2018/02/12	2019/02/13
Micro flex Cable	UTIFLEX	FSCM 64639 / (2M)	93D0127	2018/07/31	2019/07/30
Micro flex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-002	2018/11/16	2019/11/15
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2018/03/05	2019/03/04
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2018/01/17	2019/01/16
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	60772	N.C.R	N.C.R
Software	AUDIX	e3	E3LK-01	N.C.R	N.C.R
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/21	2019/11/20
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

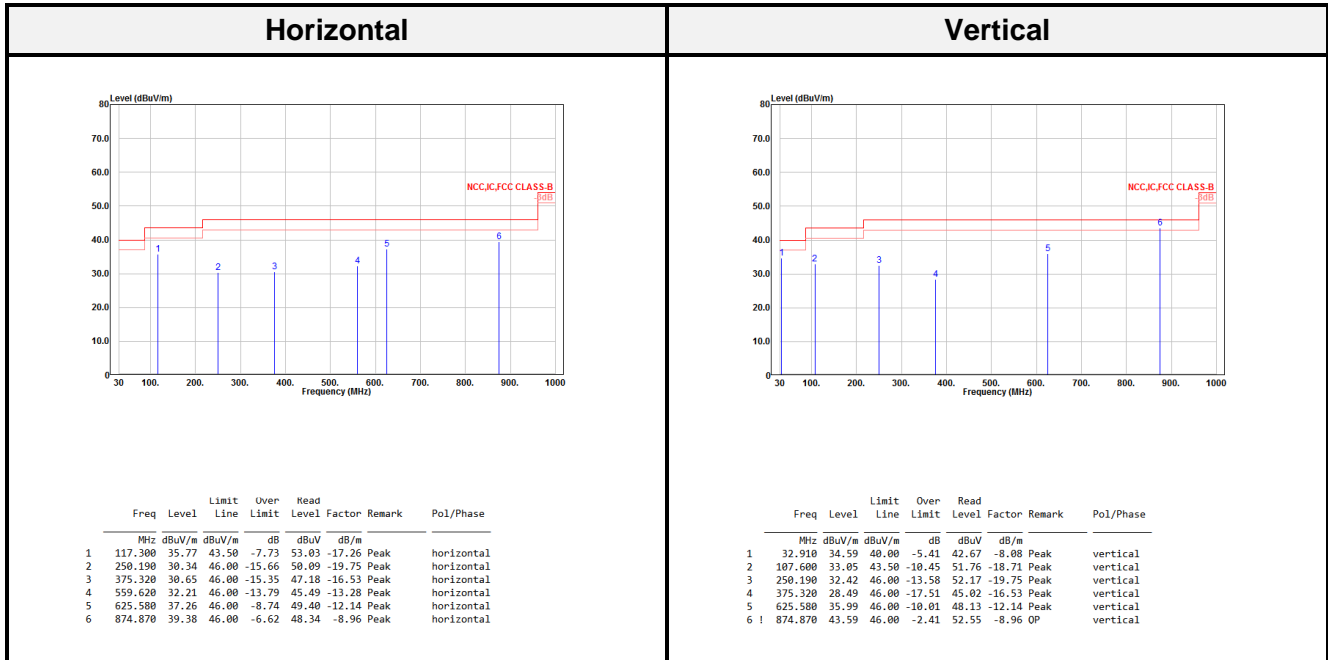
### 7.4 Test Environmental Conditions

<b>Temperature:</b>	25 °C	<b>Relative Humidity:</b>	45 %
<b>ATM Pressure:</b>	1014hPa	<b>Test Engineer:</b>	Leo Chang
<b>Conducted Test Date:</b>	2018-11-21	<b>Radiated Test Date:</b>	2018-12-05

### 7.5 Radiated Emission Test Plot and Data

**Transmitting mode** (Pre-scan with three orthogonal axis, and worse case as X axis)

**Below 1G (30 MHz-1 GHz) test the output power worst mode: BR-1Mbps mode (GFSK) Middle Channel.**



*Level = Read Level + Factor*

*Over Limit = Level – Limit*

*Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain*

*Spurious emissions more than 20 dB below the limit were not reported*

**Above 1G (1 GHz-26.5 GHz)**

**BR-1Mbps mode (GFSK):**

Low CH													
Horizontal							Vertical						
Freq	Level	Limit	Over	Read			Freq	Level	Limit	Over	Read		
		Line	Limit	Level	Factor	Remark			Line	Limit	Level	Factor	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.600	36.14	54.00	-17.86	44.83	-8.69	Average	2374.600	35.32	54.00	-18.68	43.98	-8.66	Average
2389.600	57.54	74.00	-16.46	66.23	-8.69	Peak	2374.600	49.93	74.00	-24.07	58.59	-8.66	Peak
2401.900	86.16			94.88	-8.72	Average	2401.900	78.10			86.82	-8.72	Average
2401.900	100.62			109.34	-8.72	Peak	2401.900	90.08			98.80	-8.72	Peak
4804.000	36.54	54.00	-17.46	37.65	-1.11	Average	4804.000	33.41	54.00	-20.59	34.51	-1.10	Average
4804.000	47.55	74.00	-26.45	48.66	-1.11	Peak	4804.000	43.17	74.00	-30.83	44.27	-1.10	Peak
7206.000	38.63	54.00	-15.37	35.42	3.21	Average	6906.600	46.18	54.00	-7.82	43.47	2.71	Average
7206.000	48.89	74.00	-25.11	45.68	3.21	Peak	6906.600	50.37	74.00	-23.63	47.66	2.71	Peak
							7206.000	41.61	54.00	-12.39	38.40	3.21	Average
							7206.000	49.77	74.00	-24.23	46.56	3.21	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit	Over	Read			Freq	Level	Limit	Over	Read		
		Line	Limit	Level	Factor	Remark			Line	Limit	Level	Factor	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2364.720	35.79	54.00	-18.21	44.43	-8.64	Average	2375.520	35.99	54.00	-18.01	44.65	-8.66	Average
2364.720	49.70	74.00	-24.30	58.34	-8.64	Peak	2375.520	49.11	74.00	-24.89	57.77	-8.66	Peak
2441.280	85.67			94.43	-8.76	Average	2441.280	76.98			85.74	-8.76	Average
2441.280	99.82			108.58	-8.76	Peak	2441.280	88.80			97.56	-8.76	Peak
2529.360	36.30	54.00	-17.70	45.05	-8.75	Average	2547.120	35.53	54.00	-18.47	44.25	-8.72	Average
2529.360	49.35	74.00	-24.65	58.10	-8.75	Peak	2547.120	49.70	74.00	-24.30	58.42	-8.72	Peak
4882.000	31.10	54.00	-22.90	31.98	-0.88	Average	4882.000	30.75	54.00	-23.25	31.61	-0.86	Average
4882.000	43.17	74.00	-30.83	44.05	-0.88	Peak	4882.000	42.67	74.00	-31.33	43.53	-0.86	Peak
7323.000	40.38	54.00	-13.62	36.83	3.55	Average	6906.600	46.24	54.00	-7.76	43.53	2.71	Average
7323.000	50.39	74.00	-23.61	46.84	3.55	Peak	6906.600	51.35	74.00	-22.65	48.64	2.71	Peak
							7323.000	43.66	54.00	-10.34	40.11	3.55	Average
							7323.000	51.41	74.00	-22.59	47.86	3.55	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit	Over	Read			Freq	Level	Limit	Over	Read		
		Line	Limit	Level	Factor	Remark			Line	Limit	Level	Factor	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2480.160	85.48			94.26	-8.78	Average	2479.840	76.22			85.00	-8.78	Average
2480.160	99.47			108.25	-8.78	Peak	2479.840	87.75			96.53	-8.78	Peak
2494.800	35.70	54.00	-18.30	44.50	-8.80	Average	2531.760	35.36	54.00	-18.64	44.11	-8.75	Average
2494.800	50.60	74.00	-23.40	59.40	-8.80	Peak	2531.760	50.42	74.00	-23.58	59.17	-8.75	Peak
4960.000	43.77	54.00	-10.23	44.51	-0.74	Average	4960.000	36.00	54.00	-18.00	36.74	-0.74	Average
4960.000	49.80	74.00	-24.20	50.54	-0.74	Peak	4960.000	45.97	74.00	-28.03	46.71	-0.74	Peak
7440.000	38.96	54.00	-15.04	34.99	3.97	Average	6906.600	46.46	54.00	-7.54	43.75	2.71	Average
7440.000	48.04	74.00	-25.96	44.07	3.97	Peak	6906.600	51.34	74.00	-22.66	48.63	2.71	Peak
							7440.000	41.87	54.00	-12.13	37.90	3.97	Average
							7440.000	47.58	74.00	-26.42	43.61	3.97	Peak

**EDR-2Mbps mode ( $\pi/4$ -DQPSK):**

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.600	35.94	54.00	-18.06	44.63	-8.69	Average	2360.900	35.68	54.00	-18.32	44.31	-8.63	Average
2389.600	56.48	74.00	-17.52	65.17	-8.69	Peak	2360.900	49.26	74.00	-24.74	57.89	-8.63	Peak
2401.900	83.69			92.41	-8.72	Average	2402.200	75.08			83.80	-8.72	Average
2401.900	100.18			108.90	-8.72	Peak	2402.200	89.98			98.70	-8.72	Peak
4804.000	35.49	54.00	-18.51	36.60	-1.11	Average	4804.000	37.74	54.00	-16.26	38.84	-1.10	Average
4804.000	46.12	74.00	-27.88	47.23	-1.11	Peak	4804.000	48.00	74.00	-26.00	49.10	-1.10	Peak
7206.000	33.62	54.00	-20.38	30.41	3.21	Average	6906.600	46.74	54.00	-7.26	44.06	2.68	Average
7206.000	45.47	74.00	-28.53	42.26	3.21	Peak	6906.600	52.68	74.00	-21.32	50.00	2.68	Peak
							7206.000	38.85	54.00	-15.15	35.64	3.21	Average
							7206.000	47.82	74.00	-26.18	44.61	3.21	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2364.480	35.21	54.00	-18.79	43.85	-8.64	Average	2375.520	35.99	54.00	-18.01	44.65	-8.66	Average
2364.480	49.33	74.00	-24.67	57.97	-8.64	Peak	2375.520	49.11	74.00	-24.89	57.77	-8.66	Peak
2441.280	82.89			91.65	-8.76	Average	2441.280	76.98			85.74	-8.76	Average
2441.280	99.41			108.17	-8.76	Peak	2441.280	88.80			97.56	-8.76	Peak
2529.360	36.76	54.00	-17.24	45.51	-8.75	Average	2547.120	35.53	54.00	-18.47	44.25	-8.72	Average
2529.360	49.14	74.00	-24.86	57.89	-8.75	Peak	2547.120	49.70	74.00	-24.30	58.42	-8.72	Peak
4882.000	34.03	54.00	-19.97	34.91	-0.88	Average	4882.000	30.75	54.00	-23.25	31.61	-0.86	Average
4882.000	46.05	74.00	-27.95	46.93	-0.88	Peak	4882.000	42.67	74.00	-31.33	43.53	-0.86	Peak
7323.000	36.35	54.00	-17.65	32.80	3.55	Average	6906.600	46.24	54.00	-7.76	43.53	2.71	Average
7323.000	46.47	74.00	-27.53	42.92	3.55	Peak	6906.600	51.35	74.00	-22.65	48.64	2.71	Peak
							7323.000	43.66	54.00	-10.34	40.11	3.55	Average
							7323.000	51.41	74.00	-22.59	47.86	3.55	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2480.160	85.48			94.26	-8.78	Average	2479.840	76.22			85.00	-8.78	Average
2480.160	99.47			108.25	-8.78	Peak	2479.840	87.75			96.53	-8.78	Peak
2494.800	35.70	54.00	-18.30	44.50	-8.80	Average	2531.760	35.36	54.00	-18.64	44.11	-8.75	Average
2494.800	50.60	74.00	-23.40	59.40	-8.80	Peak	2531.760	50.42	74.00	-23.58	59.17	-8.75	Peak
4960.000	43.77	54.00	-10.23	44.51	-0.74	Average	4960.000	36.00	54.00	-18.00	36.74	-0.74	Average
4960.000	49.80	74.00	-24.20	50.54	-0.74	Peak	4960.000	45.97	74.00	-28.03	46.71	-0.74	Peak
7440.000	38.96	54.00	-15.04	34.99	3.97	Average	6906.600	46.46	54.00	-7.54	43.75	2.71	Average
7440.000	48.04	74.00	-25.96	44.07	3.97	Peak	6906.600	51.34	74.00	-22.66	48.63	2.71	Peak
							7440.000	41.87	54.00	-12.13	37.90	3.97	Average
							7440.000	47.58	74.00	-26.42	43.61	3.97	Peak

**EDR-3Mbps mode (8-DPSK):**

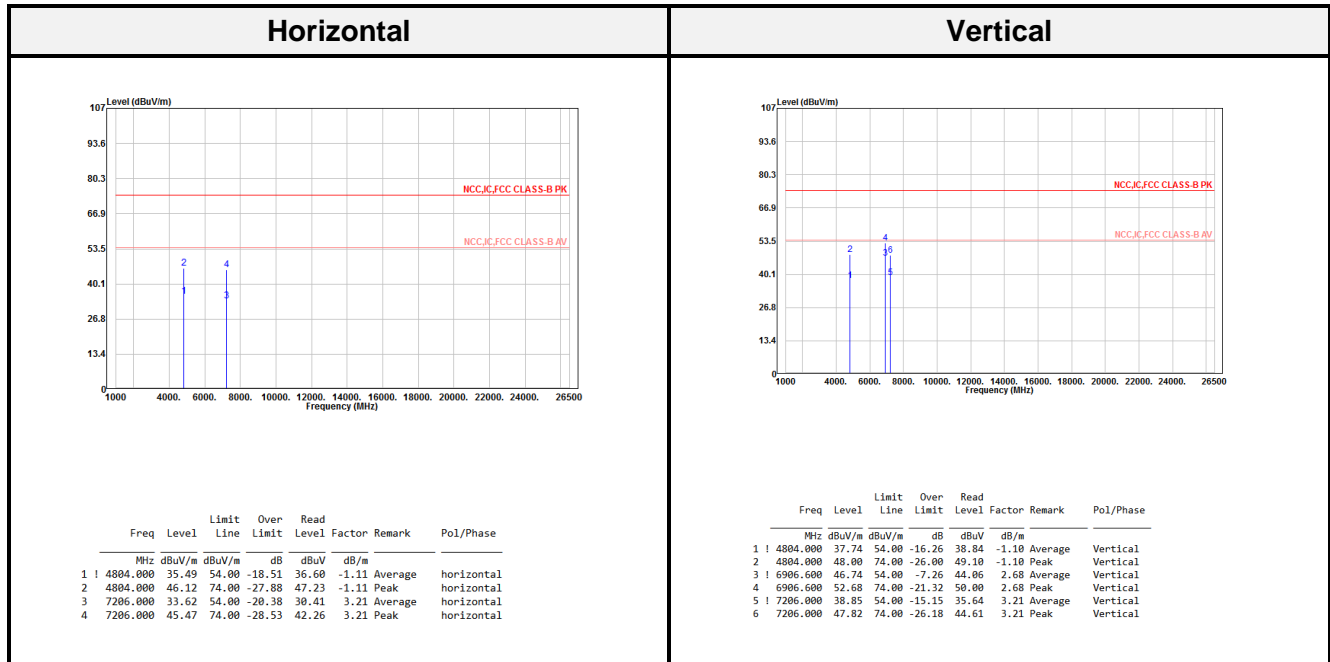
Low CH													
Horizontal						Vertical							
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.600	35.69	54.00	-18.31	44.38	-8.69	Average	2381.800	35.47	54.00	-18.53	44.15	-8.68	Average
2389.600	56.56	74.00	-17.44	65.25	-8.69	Peak	2381.800	50.14	74.00	-23.86	58.82	-8.68	Peak
2402.100	83.11			91.83	-8.72	Average	2402.100	74.90			83.62	-8.72	Average
2402.100	100.11			108.83	-8.72	Peak	2402.100	89.95			98.67	-8.72	Peak
4804.000	35.55	54.00	-18.45	36.66	-1.11	Average	4804.000	31.31	54.00	-22.69	32.41	-1.10	Average
4804.000	45.04	74.00	-28.96	46.15	-1.11	Peak	4804.000	44.48	74.00	-29.52	45.58	-1.10	Peak
7206.000	33.72	54.00	-20.28	30.51	3.21	Average	6906.600	46.29	54.00	-7.71	43.58	2.71	Average
7206.000	45.87	74.00	-28.13	42.66	3.21	Peak	6906.600	51.29	74.00	-22.71	48.58	2.71	Peak
							7206.000	35.81	54.00	-18.19	32.60	3.21	Average
							7206.000	48.02	74.00	-25.98	44.81	3.21	Peak

Middle CH													
Horizontal						Vertical							
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2343.600	35.63	54.00	-18.37	44.22	-8.59	Average	2340.240	36.02	54.00	-17.98	44.60	-8.58	Average
2343.600	49.07	74.00	-24.93	57.66	-8.59	Peak	2340.240	48.70	74.00	-25.30	57.28	-8.58	Peak
2441.280	82.82			91.58	-8.76	Average	2441.040	74.14			82.90	-8.76	Average
2441.280	99.57			108.33	-8.76	Peak	2441.040	88.04			96.80	-8.76	Peak
2543.040	36.38	54.00	-17.62	45.11	-8.73	Average	2501.760	35.19	54.00	-18.81	44.00	-8.81	Average
2543.040	50.48	74.00	-23.52	59.21	-8.73	Peak	2501.760	48.90	74.00	-25.10	57.71	-8.81	Peak
4882.000	31.12	54.00	-22.88	32.00	-0.88	Average	4882.000	31.09	54.00	-22.91	31.95	-0.86	Average
4882.000	42.52	74.00	-31.48	43.40	-0.88	Peak	4882.000	42.72	74.00	-31.28	43.58	-0.86	Peak
7323.000	35.38	54.00	-18.62	31.83	3.55	Average	6906.600	46.26	54.00	-7.74	43.55	2.71	Average
7323.000	47.75	74.00	-26.25	44.20	3.55	Peak	6906.600	50.32	74.00	-23.68	47.61	2.71	Peak
							7323.000	36.19	54.00	-17.81	32.64	3.55	Average
							7323.000	46.15	74.00	-27.85	42.60	3.55	Peak

High CH													
Horizontal						Vertical							
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2480.000	84.61			93.39	-8.78	Average	2480.000	72.98			81.76	-8.78	Average
2480.000	99.08			107.86	-8.78	Peak	2480.000	86.87			95.65	-8.78	Peak
2485.280	35.54	54.00	-18.46	44.33	-8.79	Average	2487.120	35.31	54.00	-18.69	44.10	-8.79	Average
2485.280	50.01	74.00	-23.99	58.80	-8.79	Peak	2487.120	50.07	74.00	-23.93	58.86	-8.79	Peak
4960.000	39.77	54.00	-14.23	40.51	-0.74	Average	4960.000	33.94	54.00	-20.06	34.68	-0.74	Average
4960.000	48.62	74.00	-25.38	49.36	-0.74	Peak	4960.000	44.98	74.00	-29.02	45.72	-0.74	Peak
7440.000	35.38	54.00	-18.62	31.41	3.97	Average	6906.600	46.66	54.00	-7.34	43.95	2.71	Average
7440.000	46.44	74.00	-27.56	42.47	3.97	Peak	6906.600	51.90	74.00	-22.10	49.19	2.71	Peak
							7440.000	37.52	54.00	-16.48	33.55	3.97	Average
							7440.000	48.27	74.00	-25.73	44.30	3.97	Peak



**Above 1G (1 GHz-26.5 GHz): The worst mode: EDR-2Mbps mode (GFSK) Low Channel.**



*Level = Read Level + Factor*

*Over Limit = Level - Limit*

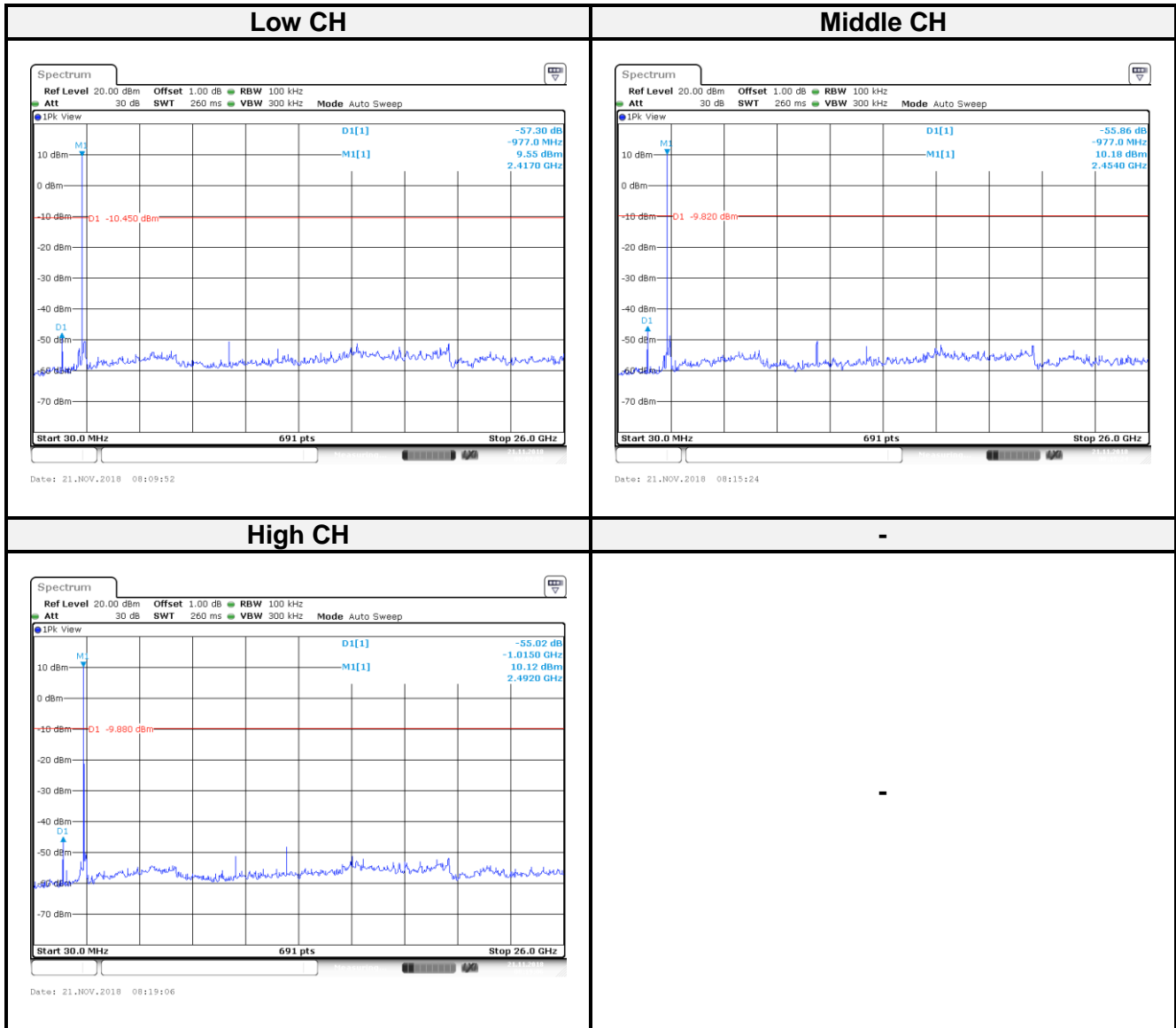
*Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain*

*Spurious emissions more than 20 dB below the limit were not reported*

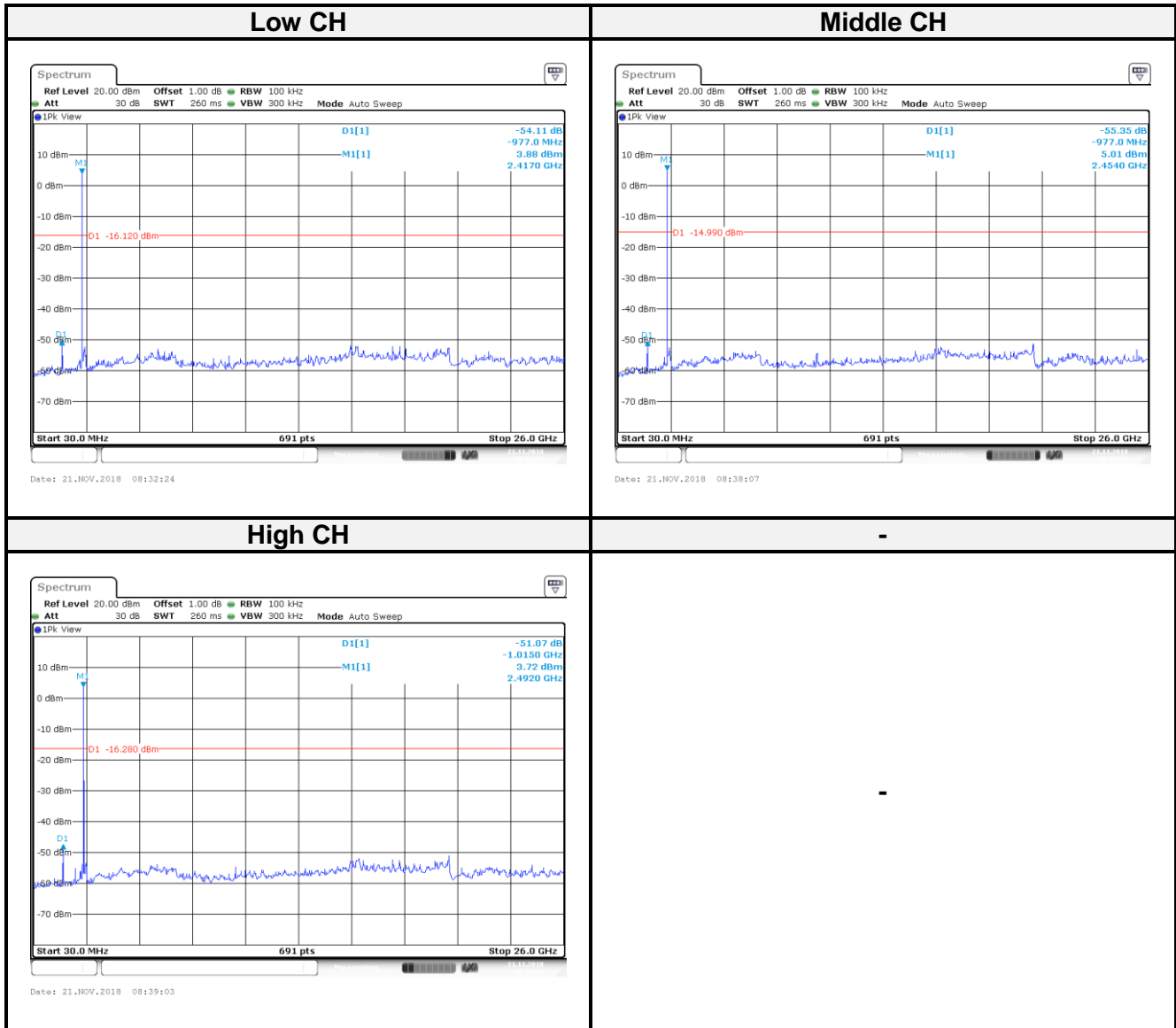
**Conducted Spurious Emissions:**

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
<b>BR-1Mbps mode (GFSK)</b>				
Low	2402	57.30	≥ 20	Compliance
Mid	2441	55.86	≥ 20	Compliance
High	2480	55.02	≥ 20	Compliance
<b>EDR-2Mbps mode (<math>\pi/4</math>-DQPSK)</b>				
Low	2402	54.11	≥ 20	Compliance
Mid	2441	55.35	≥ 20	Compliance
High	2480	51.07	≥ 20	Compliance
<b>EDR-3Mbps mode (8DPSK)</b>				
Low	2402	57.58	≥ 20	Compliance
Mid	2441	55.06	≥ 20	Compliance
High	2480	51.51	≥ 20	Compliance

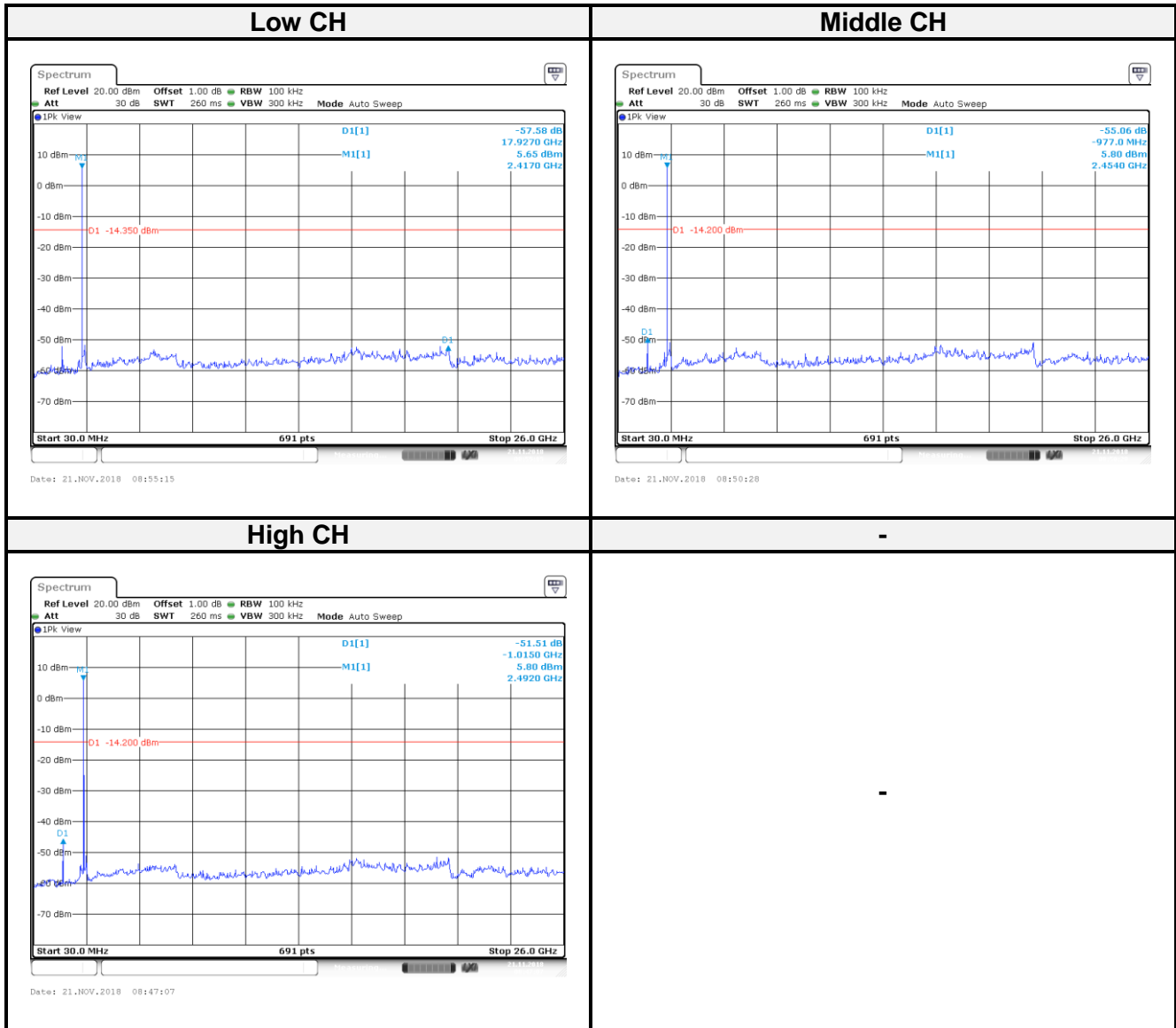
### BR-1Mbps mode (GFSK):



**EDR-2Mbps mode ( $\pi/4$ -DQPSK):**



### EDR-3Mbps mode (8DPSK):



## 8 FCC §15.247(a)(1) – 20 dB Emission Bandwidth

### 8.1 Applicable Standard

According to FCC §15.247(a) (1) the maximum 20 dB bandwidth of the hopping channel shall be presented.

### 8.2 Test Procedure

- (1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- (2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- (3) Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- (4) Repeat above procedures until all frequencies measured were complete.

### 8.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

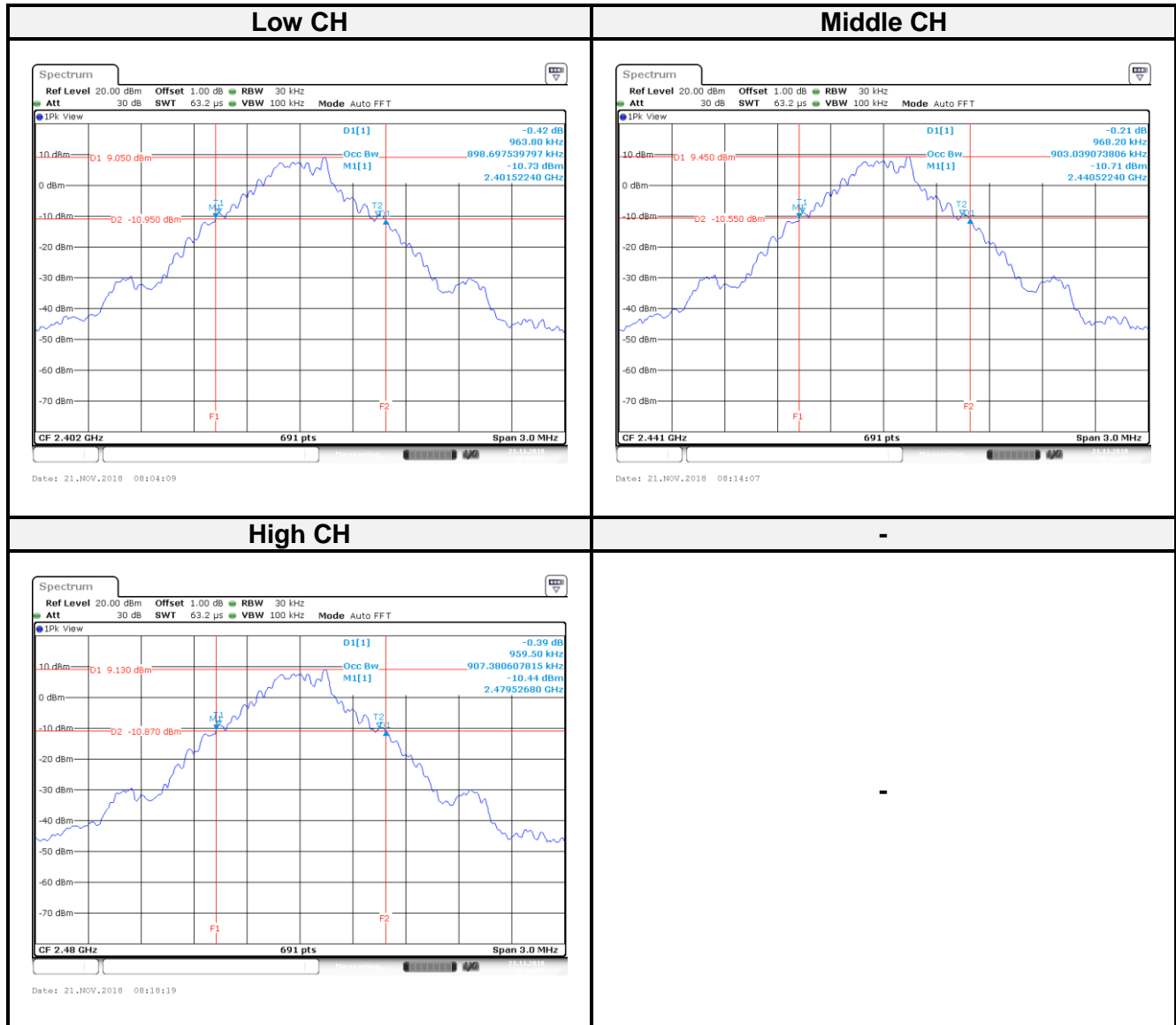
### 8.4 Test Environmental Conditions

<b>Temperature:</b>	25 °C	<b>Relative Humidity:</b>	45 %
<b>ATM Pressure:</b>	1015hPa	<b>Test Engineer:</b>	Leo Chang
<b>Conducted Test Date:</b>	2018-11-21	-	-

## 8.5 Test Results

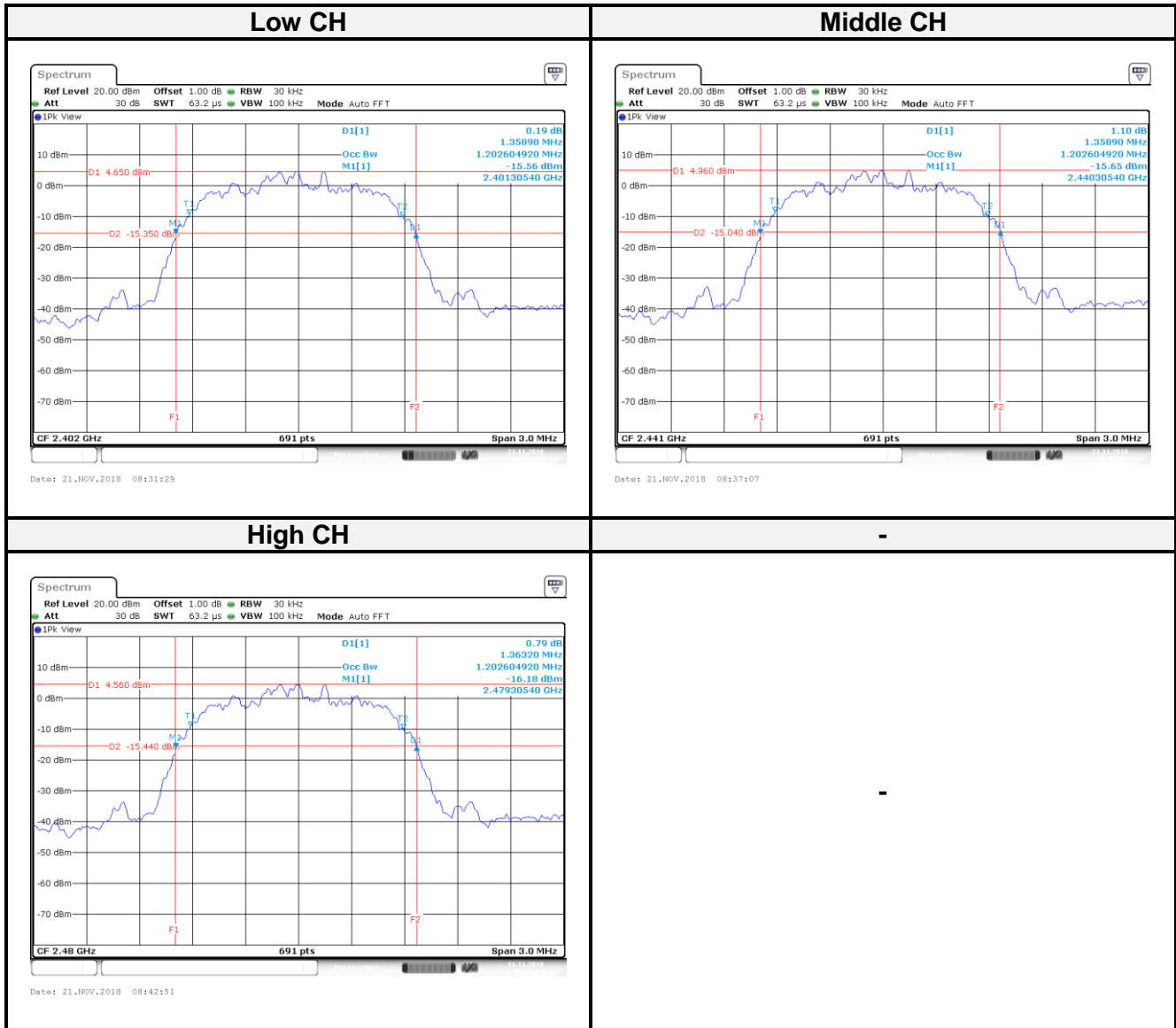
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
<b>BR-1Mbps Mode (GFSK)</b>		
Low	2402	0.9638
Middle	2441	0.9682
High	2480	0.9595
<b>EDR-2Mbps Mode (<math>\pi/4</math>-DQPSK)</b>		
Low	2402	1.3589
Middle	2441	1.3589
High	2480	1.3632
<b>EDR-3Mbps Mode (8DPSK)</b>		
Low	2402	1.3242
Middle	2441	1.3198
High	2480	1.3242

### BR-1Mbps mode (GFSK):

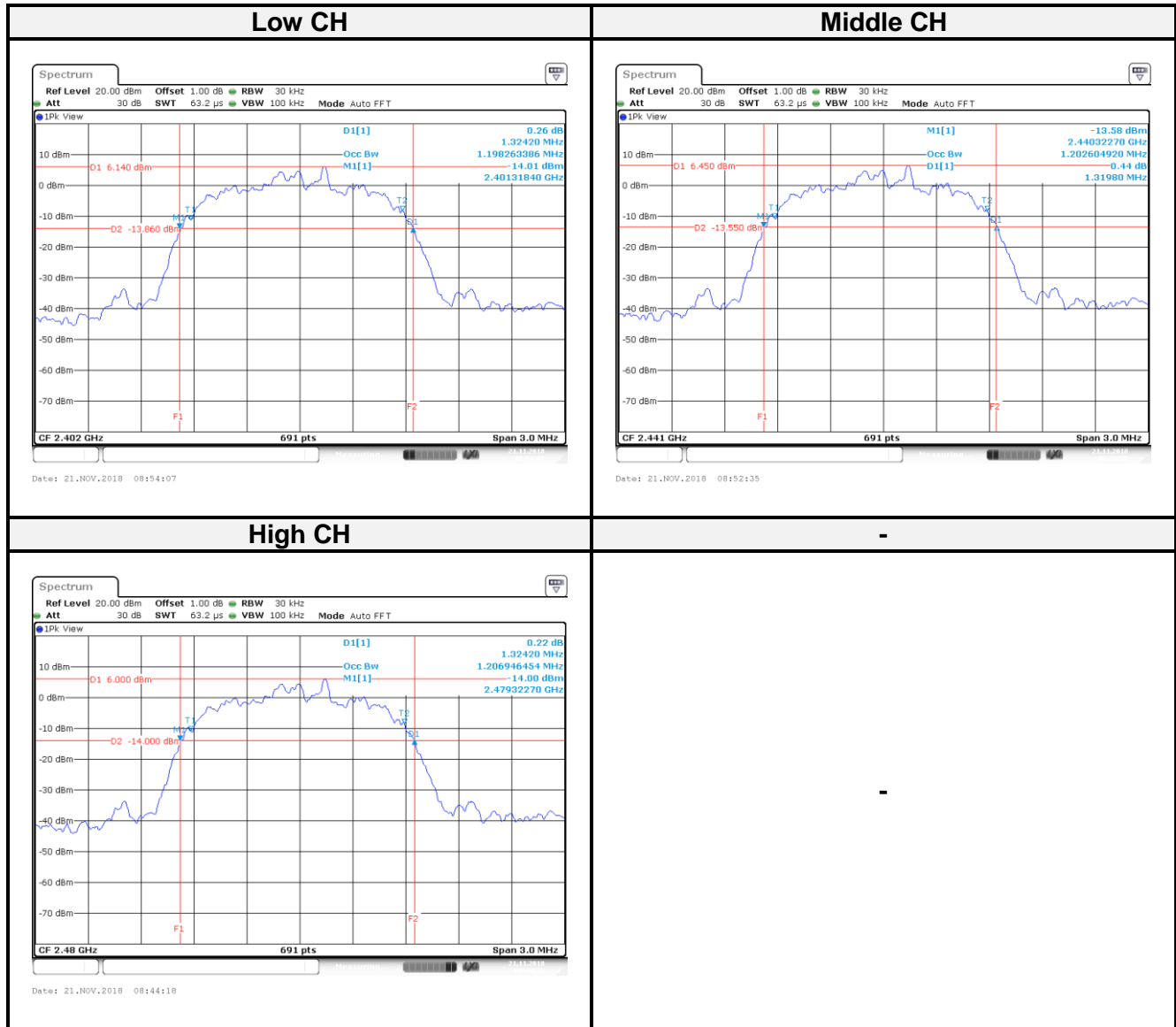




**EDR-2Mbps Mode ( $\pi/4$ -DQPSK):**



**EDR-3Mbps Mode (8DPSK):**



## 9 FCC §15.247(a)(1) – Channel Separation Test

### 9.1 Applicable Standard

According to FCC §15.247(a) (1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### 9.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel. Video (or Average) Bandwidth (VBW) ≥RBW. Sweep = auto

Detector function = peak Trace = max hold

### 9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

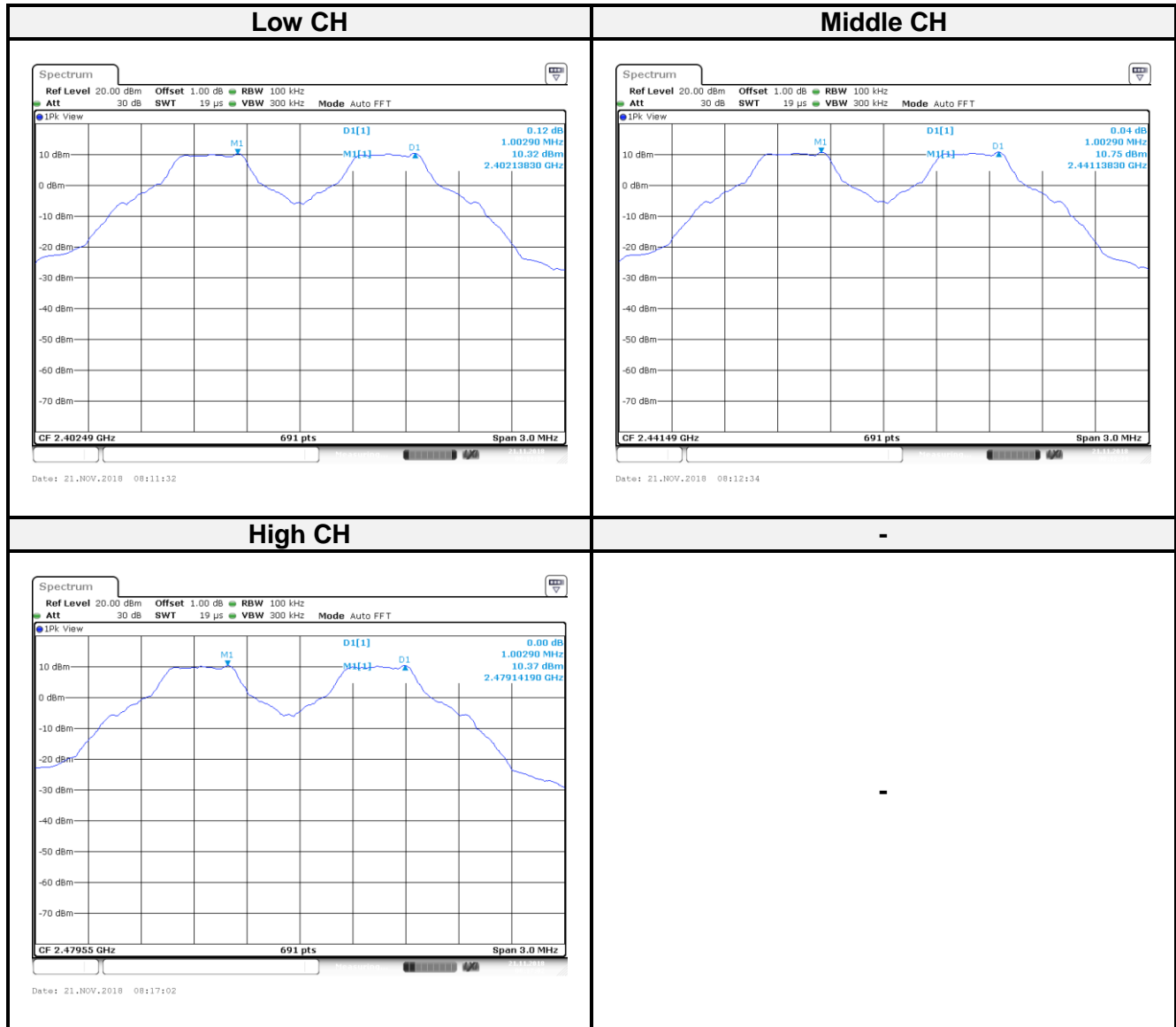
### 9.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Conducted Test Date:	2018-11-21	-	-

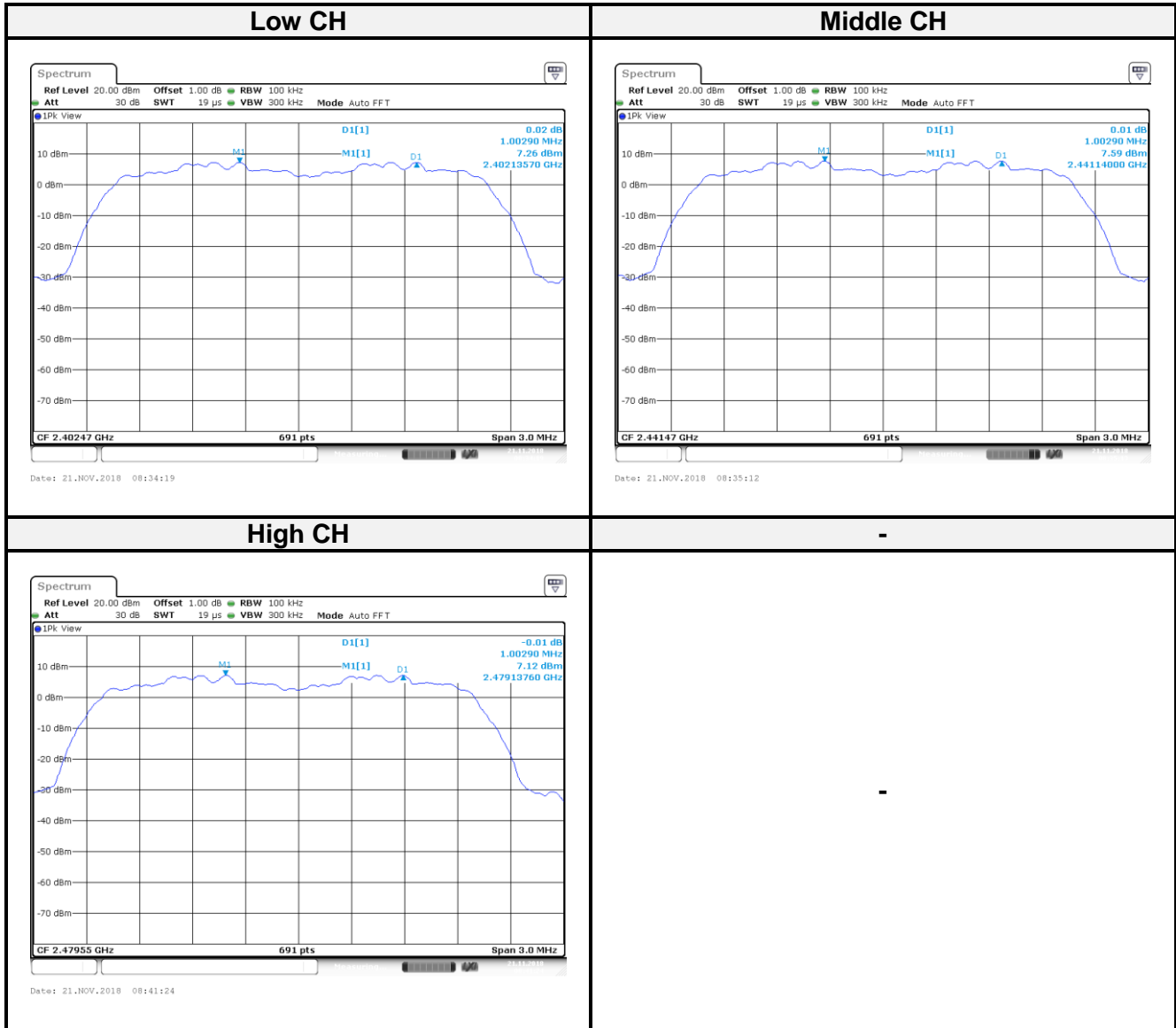
### 9.5 Test Results

Channel	Frequency (MHz)	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Limit (dBm)	Result
<b>BR-1Mbps mode (GFSK)</b>						
Low	2402	1.0029	0.9638	0.643	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.0029	0.9682	0.645		Compliance
High	2480	1.0029	0.9595	0.640		Compliance
<b>EDR-2Mbps mode (<math>\pi/4</math>-DQPSK)</b>						
Low	2402	1.0029	1.3589	0.906	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.0029	1.3589	0.906		Compliance
High	2480	1.0029	1.3632	0.909		Compliance
<b>EDR-3Mbps mode (8DPSK)</b>						
Low	2402	1.0029	1.3242	0.883	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.0029	1.3198	0.880		Compliance
High	2480	1.0029	1.3242	0.883		Compliance

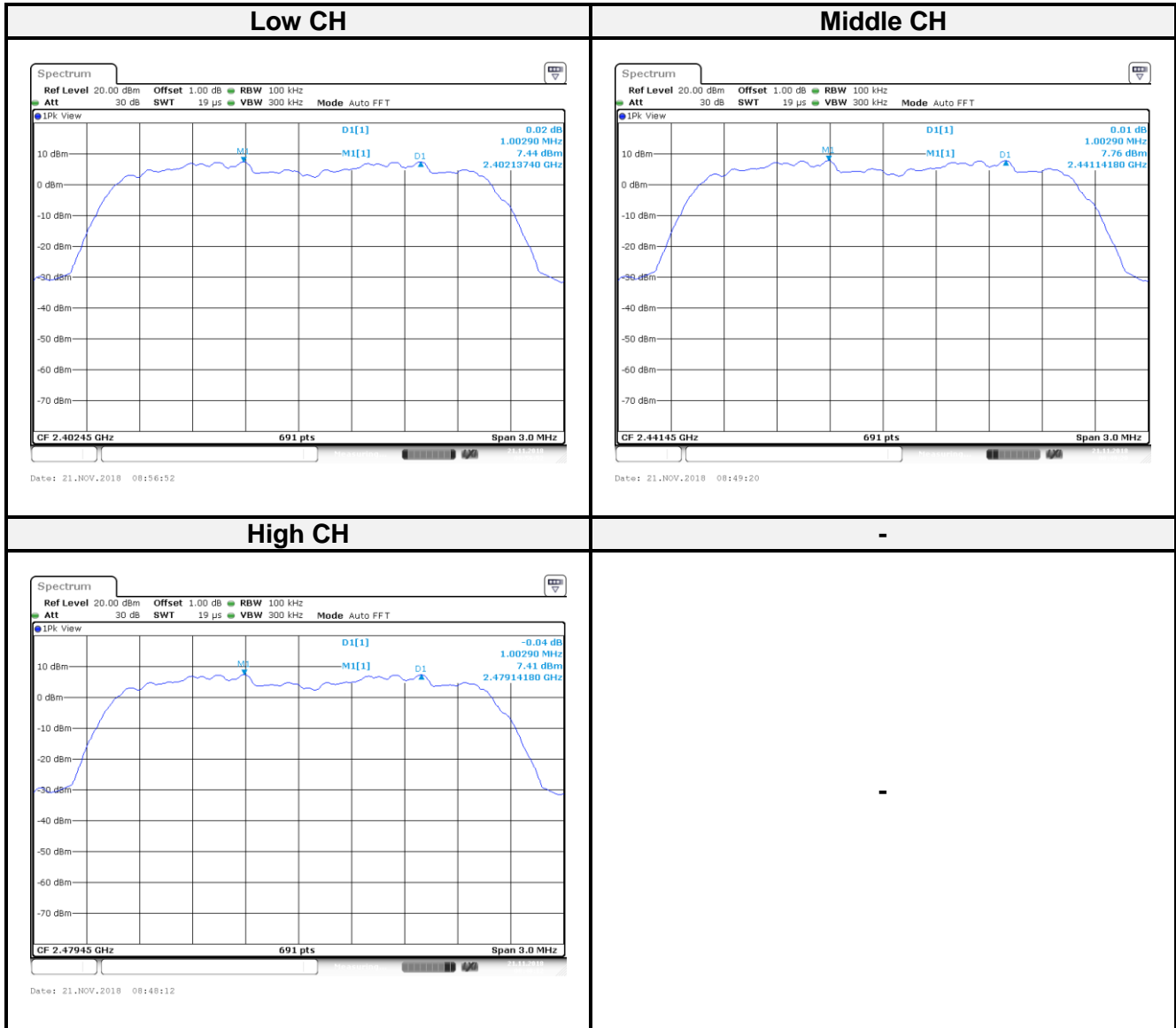
**BR-1Mbps mode (GFSK):**



### EDR-2Mbps mode ( $\pi/4$ -DQPSK):



### EDR-3Mbps mode (8-DPSK):



## 10 FCC §15.247(a)(1)(iii) – Time of Occupancy (Dwell Time)

### 10.1 Applicable Standard

According to FCC §15.247(a)(1)(iii),

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 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 the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 10.2 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel

RBW  $\leq$  channel spacing and where possible RBW should be set  $\gg 1/T$ , where T is the expected dwell time per channel

Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak

Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.

Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.



### 10.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 10.4 Test Environmental Conditions

<b>Temperature:</b>	25 °C	<b>Relative Humidity:</b>	45 %
<b>ATM Pressure:</b>	1015hPa	<b>Test Engineer:</b>	Leo Chang
<b>Conducted Test Date:</b>	2018-11-21	-	-

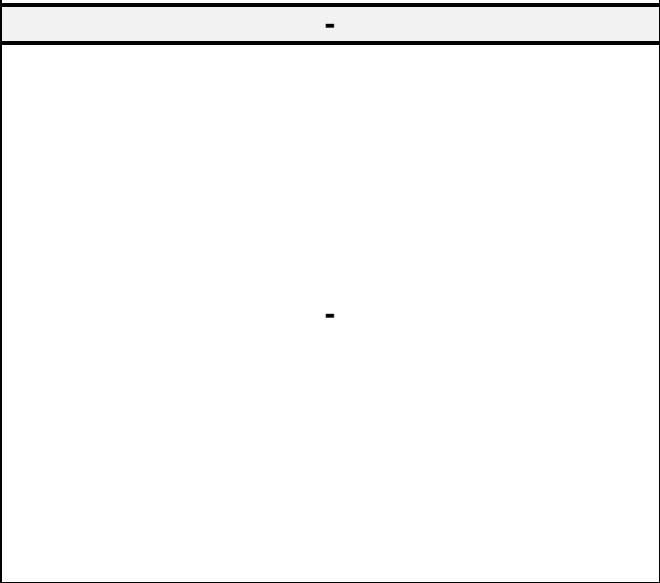
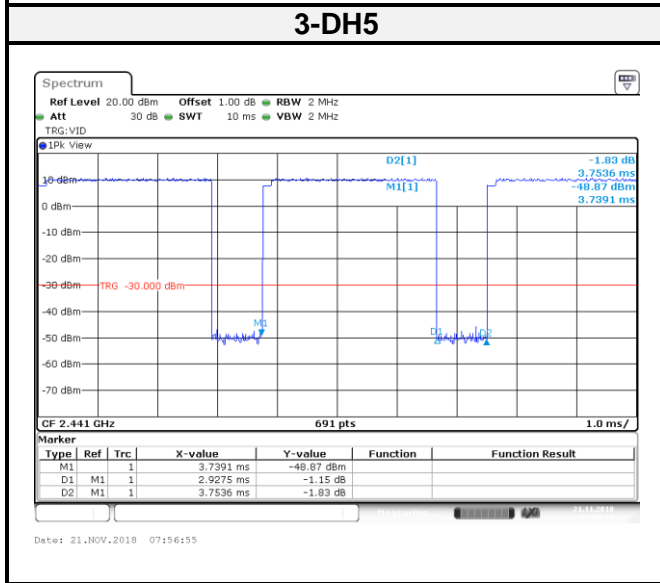
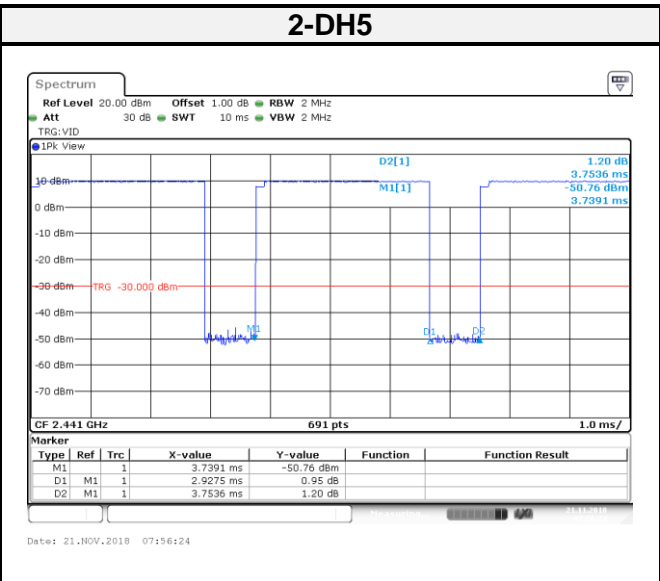
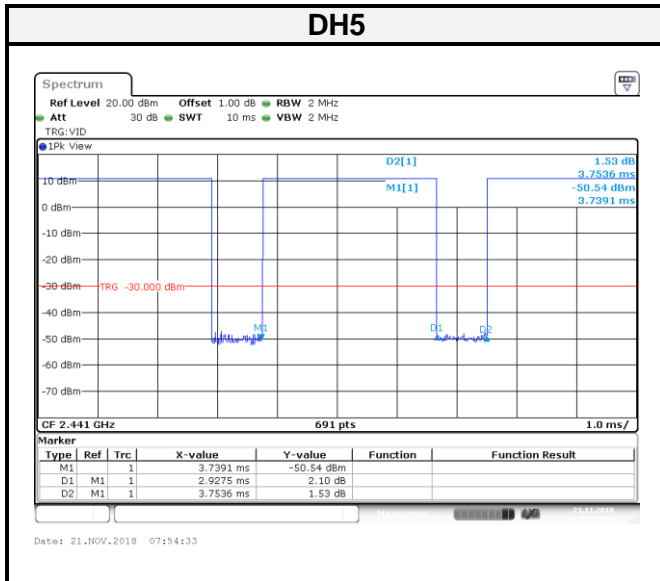
### 10.5 Test Results

Time of Occupancy (Dwell Time) Result				
Modulation Mode	Pulse Time per Hop (ms)	Number of Pulse in [0.4 x N sec]	Dwell Time in [0.4 x N sec]	Dwell Time Limits (s)
		(s)	(s)	
BR-1Mbps mode (GFSK)	2.92	106.7	0.311	0.4
EDR-2Mbps mode ( $\pi/4$ -DQPSK)	2.92	106.7	0.311	0.4
EDR-3Mbps mode (8DPSK)	2.92	106.7	0.311	0.4

\*Number of Pulse in [0.4 x N sec] = 1600/79/6\*(0.4\*79)

\*Dwell Time in [0.4 x N sec] = (Pulse Time \* Number of Pulse in [0.4 x N sec])/1000

\* Bluetooth ACL packets can be 1, 3, or 5 time slots. The DH1 packet can cover a single time slot. The DH3 packet can cover up to 3 time slots. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.



## 11 FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

### 11.1 Applicable Standard

According to FCC §15.247(a)(1)(iii),

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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 the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 11.2 Test Procedure

Span = the frequency band of operation.

RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller VBW ≥ RBW.

Sweep = auto. Detector function = peak Trace = max hold.

### 11.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

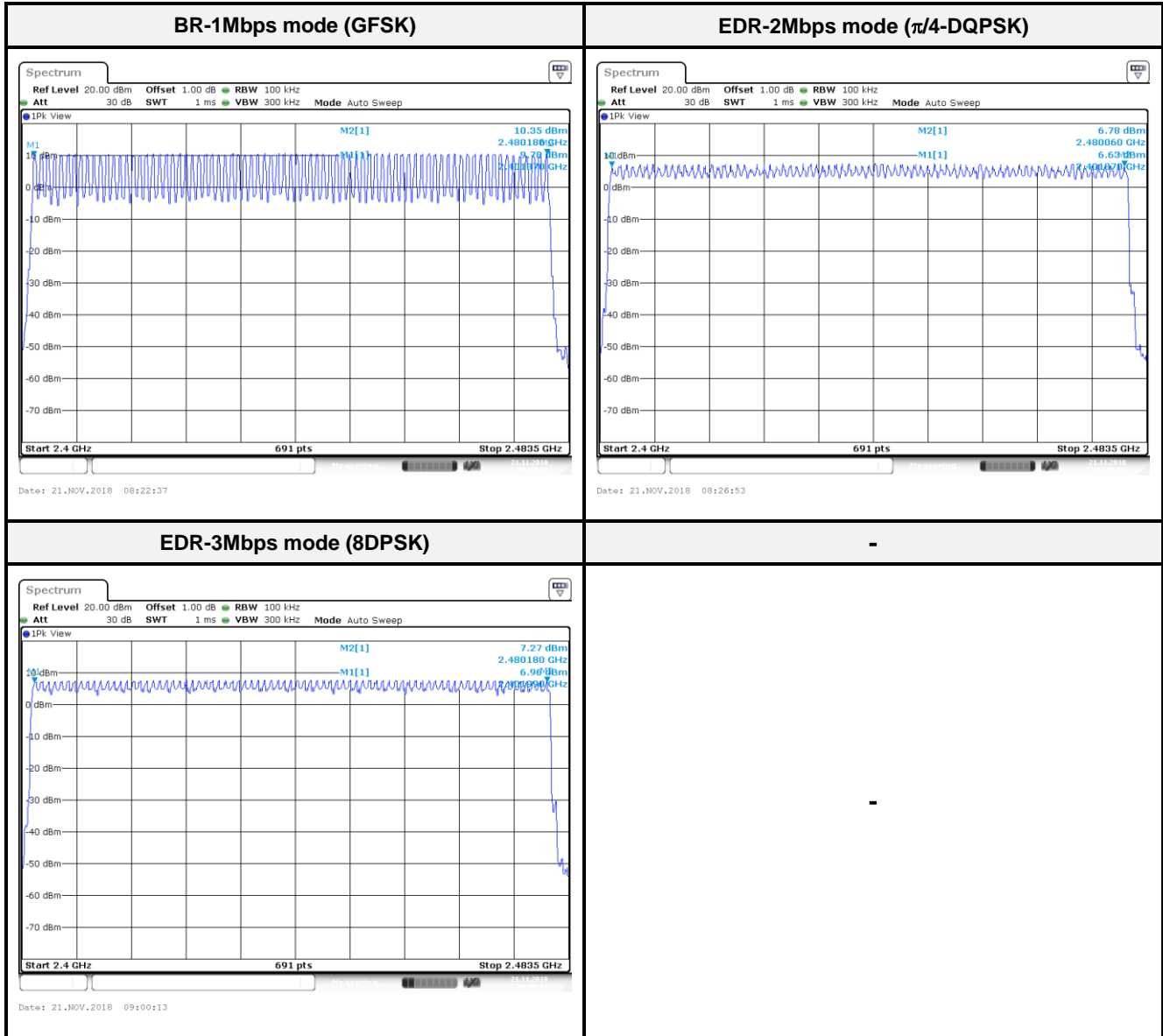
**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 11.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Conducted Test Date:	2018-11-21	-	-

### 11.5 Test Results

Mode	Frequency Range (MHz)	Number of Hopping Channel	Limit (CH)	Result
BR-1Mbps mode (GFSK)	2402-2480	79	>15	Compliance
EDR-2Mbps mode ( $\pi/4$ -DQPSK)	2402-2480	79	>15	Compliance
EDR-3Mbps mode (8DPSK)	2402-2480	79	>15	Compliance



## 12 FCC §15.247(b)(1) – Maximum Output Power

### 12.1 Applicable Standard

According to FCC §15.247(b) (1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

### 12.2 Test Procedure

Place the EUT on a bench and set it in transmitting mode.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Power sensor.

### 12.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2018/03/07	2019/03/06
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

*\*Statement of Traceability: The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

### 12.4 Test Environmental Conditions

<b>Temperature:</b>	25 °C	<b>Relative Humidity:</b>	45 %
<b>ATM Pressure:</b>	1015hPa	<b>Test Engineer:</b>	Leo Chang
<b>Conducted Test Date:</b>	2018-11-21	-	-

**12.5 Test Results**

Channel	Frequency (MHz)	Maximum peak Output Power (dBm)	Maximum peak Output Power (W)	Limit (dBm)	Result
<b>BR-1Mbps mode (GFSK)</b>					
Low	2402	10.21	0.0105	21	Compliance
Middle	2441	<b>10.46</b>	<b>0.0111</b>	21	Compliance
High	2480	9.96	0.0099	21	Compliance
<b>EDR-2Mbps mode (<math>\pi/4</math>-DQPSK)</b>					
Low	2402	8.61	0.0073	21	Compliance
Middle	2441	8.83	0.0076	21	Compliance
High	2480	8.31	0.0068	21	Compliance
<b>EDR-3Mbps mode (8DPSK)</b>					
Low	2402	8.74	0.0075	21	Compliance
Middle	2441	8.89	0.0077	21	Compliance
High	2480	8.32	0.0068	21	Compliance

### 13 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

#### 13.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c)

#### 13.2 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz VBW = 300 kHz.

Sweep = coupled. Detector function = peak Trace = max hold.

#### 13.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room</b>					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

#### 13.4 Test Environmental Conditions

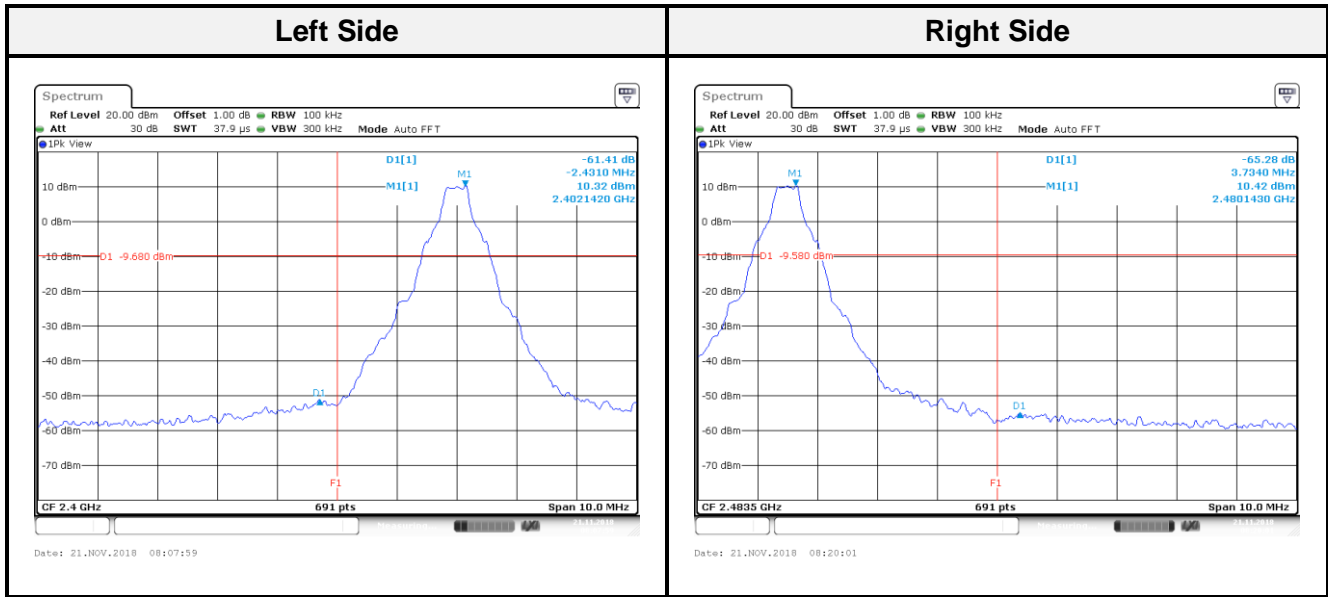
Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Conducted Test Date:	2018-11-21	-	-

**13.5 Test Results**

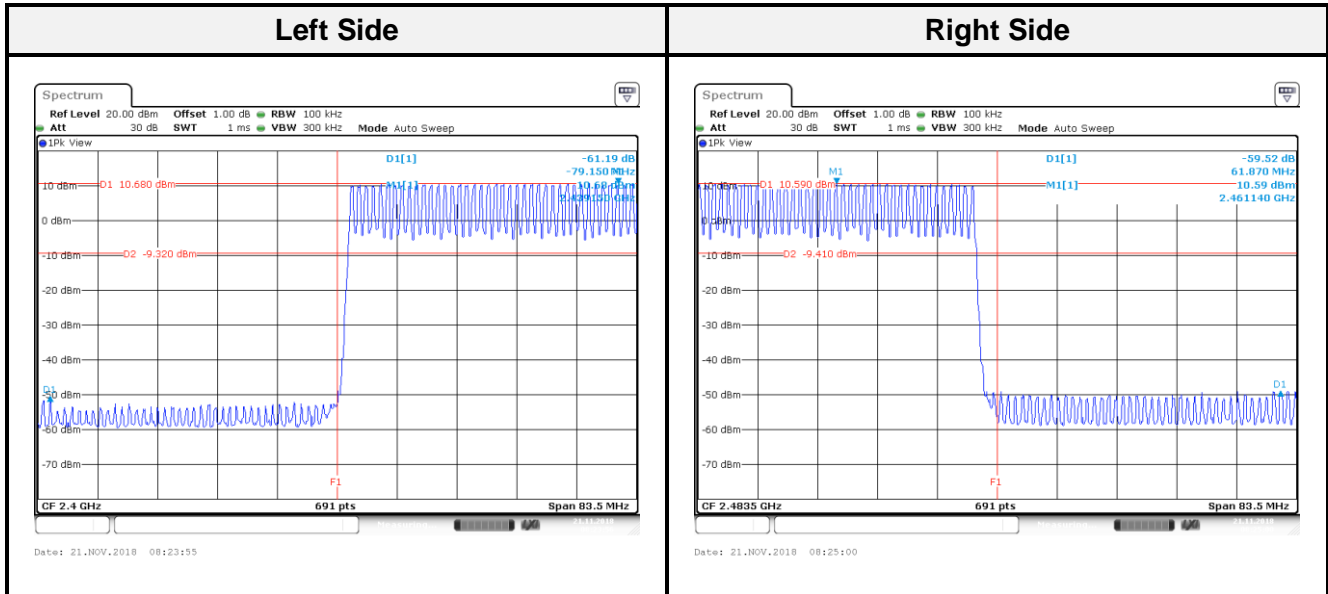
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
<b>BR-1Mbps mode (GFSK)</b>				
Low	2402	61.41	≥ 20	Compliance
High	2480	65.28	≥ 20	Compliance
<b>BR-1Mbps Hopping mode (GFSK)</b>				
Low	2402	61.19	≥ 20	Compliance
High	2480	59.52	≥ 20	Compliance
<b>EDR-2Mbps mode (<math>\pi/4</math>-DQPSK)</b>				
Low	2402	57.43	≥ 20	Compliance
High	2480	60.91	≥ 20	Compliance
<b>EDR-2Mbps Hopping mode (<math>\pi/4</math>-DQPSK)</b>				
Low	2402	58.63	≥ 20	Compliance
High	2480	57.11	≥ 20	Compliance
<b>EDR-3Mbps mode (8DPSK)</b>				
Low	2402	56.44	≥ 20	Compliance
High	2480	62.80	≥ 20	Compliance
<b>EDR-3Mbps Hopping mode (8DPSK)</b>				
Low	2402	57.15	≥ 20	Compliance
High	2480	56.89	≥ 20	Compliance



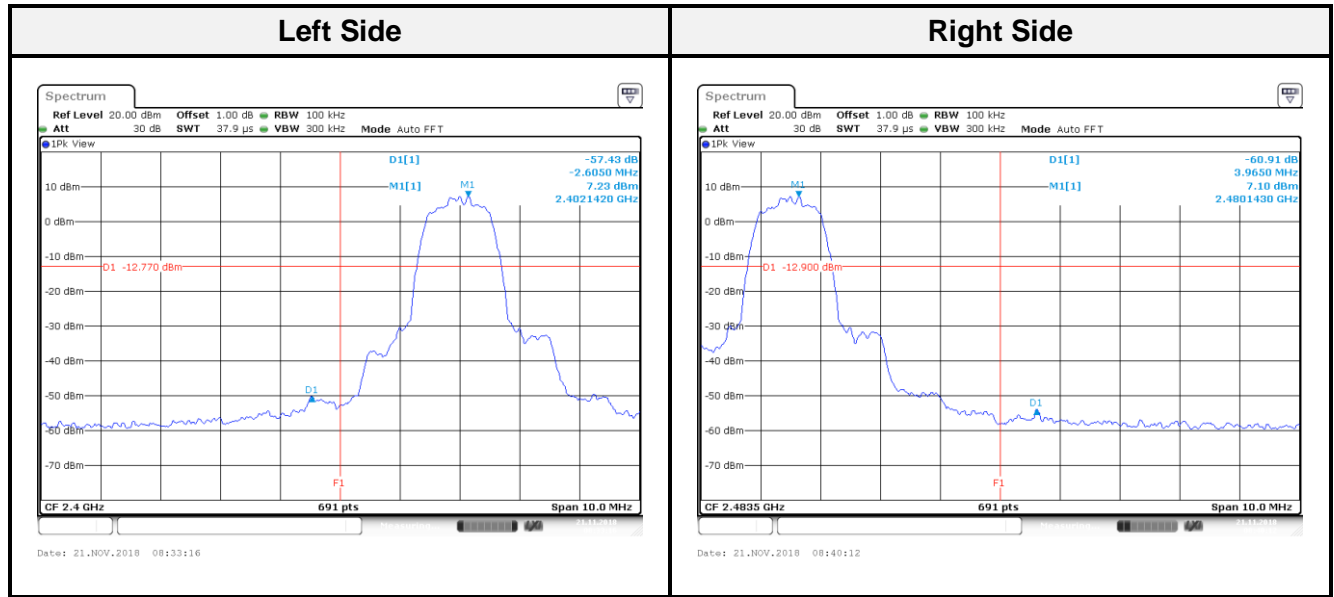
**BR-1Mbps mode (GFSK):**



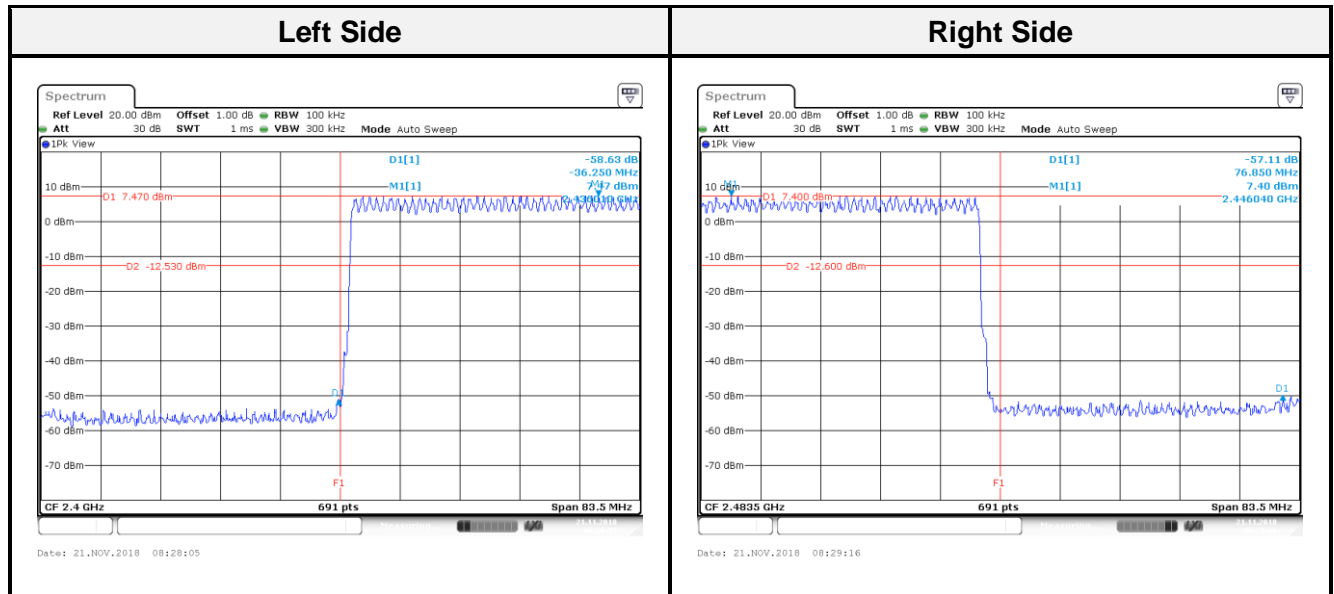
**BR-1Mbps Hopping mode (GFSK):**



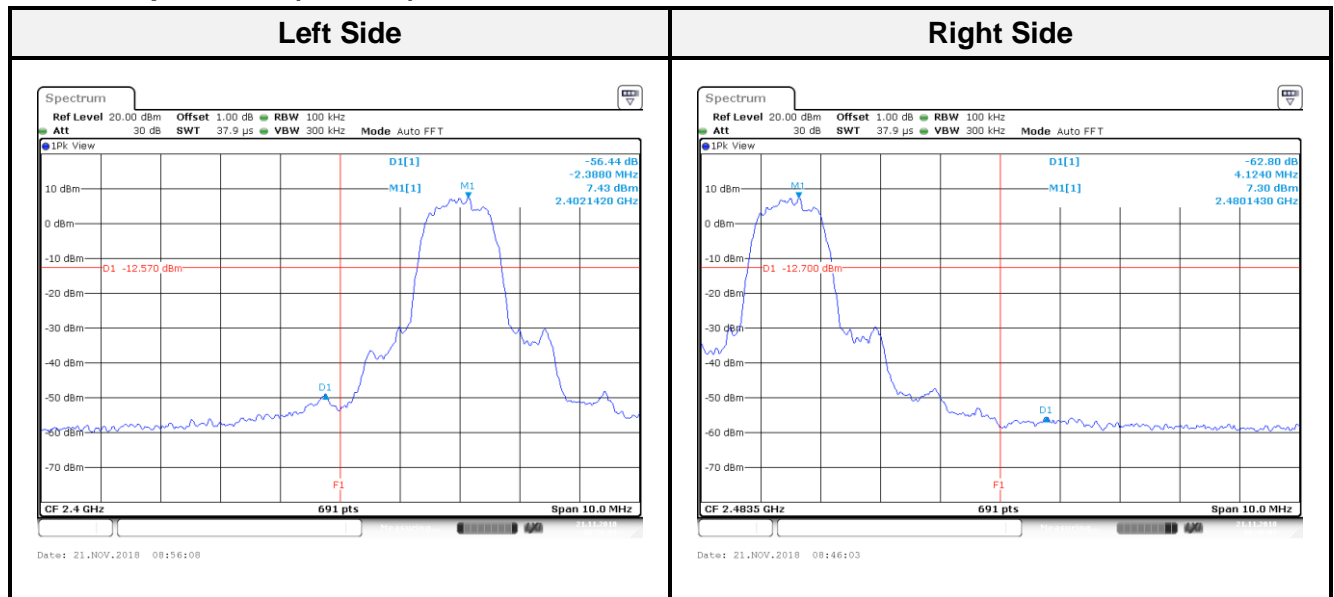
**EDR-2Mbps mode ( $\pi/4$ -DQPSK):**



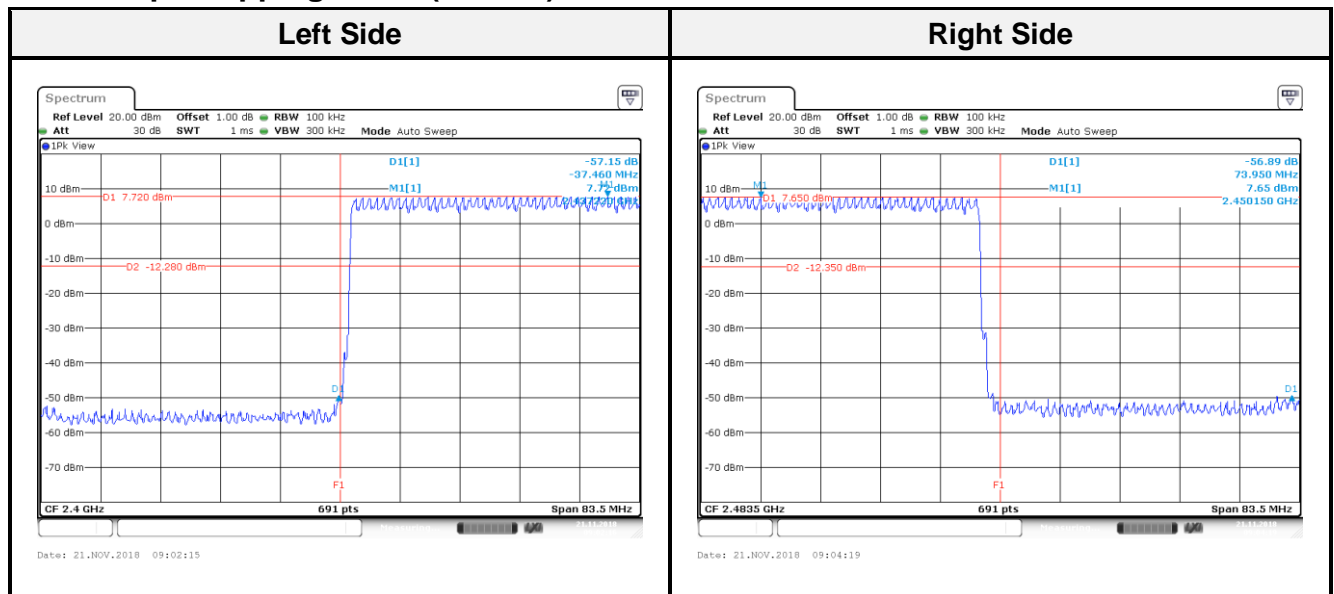
**EDR-2Mbps Hopping mode ( $\pi/4$ -DQPSK):**



### EDR-3Mbps mode (8DPSK):



### EDR-3Mbps Hopping mode (8DPSK):



----- END OF REPORT -----