FCC Part 15.247

TEST REPORT

For

IONE ELECTRONIC TECHNOLOGY CO., LTD. TAIWAN BRANCH

8F-2, #75, sec 1, Hsin Tai Wu Rd., Hsi Chih District, New Taipei City, Taiwan, R.O.C.(Far East World Center-Bldg. A)

FCC ID: 2APDTTS-A05BT-ANC

Report Type	**Original Report**
Product Name:	**TUNE IN - Streaming**
Model Name:	**TS-A05BT-ANC**
Report Number :	**RXZ190624003-00B**
Report Date :	**2019/10/21**
Reviewed By :	**Zeus Chen** Zeus Chen
Prepared By: **Bay Area Compliance Laboratories Corp.(Linkou Laboratory)** **No. 6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.)** **Tel: +886 (3)3961072; Fax: +886 (3) 3961027** **www.bacl.com.tw**	

Revision History

Revision	Report Number	Issue Date	Description
1.0	RXZ190624003-00B	2019/10/21	Original Report

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**IONE ELECTRONIC TECHNOLOGY CO., LTD. TAIWAN BRANCH** 8F-2, #75, sec 1, Hsin Tai Wu Rd., Hsi Chih District, New Taipei City, Taiwan, R.O.C.(Far East World Center-Bldg. A)
Manufacturer	**IONE ELECTRONIC TECHNOLOGY CO., LTD. TAIWAN BRANCH** 8F-2, #75, sec 1, Hsin Tai Wu Rd., Hsi Chih District, New Taipei City, Taiwan, R.O.C.(Far East World Center-Bldg. A)
Product (Equipment)	**TUNE IN - Streaming**
Model Name	**TS-A05BT-ANC**
Frequency Range	2402 - 2480 MHz
Number of Channels	79 Channels
Output Power	BR-1Mbps: -2.09 dBm (0.0006 W) EDR-2Mbps: -1.88 dBm (0.0006 W) EDR-3Mbps:: -1.71 dBm (0.0007 W)
Modulation Type	BR-1Mbps: GFSK EDR-2Mbps: π/4-DQPSK EDR-3Mbps: 8-DPSK
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DSS with FCC ID : 2APDTTS-A05BT-ANC**
Received Date	Jun. 24, 2019
Date of Test	July. 12, 2019 ~ Oct 21, 2019

**All measurement and test data in this report was gathered from production sample serial number: 190624003(Assigned by BACL, LinKou).*

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☐ AC 120 V/60 Hz ☐ Adapter ☐ By Power Cord.
	☐ DC Type ☐ DC Power Supply: 5Vdc to connector port ☐ Battery ☒ External from USB Cable 5Vdc ☐ External DC Adapter
	☐ Host System

1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the IONE ELECTRONIC TECHNOLOGY CO., LTD. TAIWAN BRANCH. Appliance (Model: TS-A05BT-ANC) 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 t American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

-KDB 558074 D01 15.247 Meas Guidance v05r02.

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power with Power Meter	± 0.55 dB
Occupied Channel Bandwidth	± 4.54 Hz
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. (Linkou) to collect test data is located on

☒ No.6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, 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.: 0027578244. Designation No.: TW3546. The Test Firm Registration No.: 181430.

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.

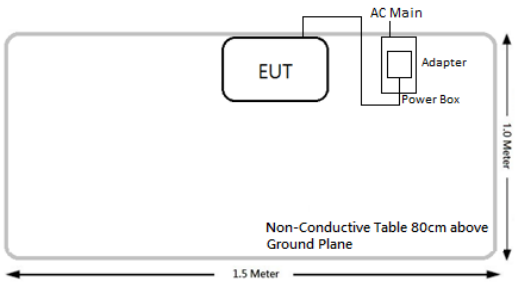
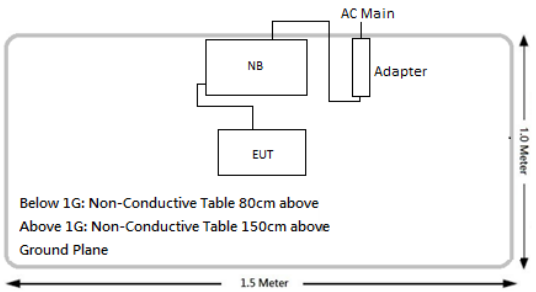
Worst Case of Power Setting				
EUT Exercise Software		QRCT3		
Configuration	**NTX**	**Low CH**	**Mid CH**	**High CH**
BR-1Mbps (GFSK) mode	1	Default	Default	Default
EDR-2Mbps (π/4-DQPSK) mode	1	Default	Default	Default
EDR-3Mbps (8DPSK) mode	1	Default	Default	Default

2.2 Support Equipment List and Details

No.	Description	Manufacturer	Model Number
A	Notebook PC	DELL	Latitude E6410
B	Adapter	MI	A1718 (Apple)

No.	Cable Description	Shielding Type	Length (m)	From	To
1	USB Cable	Non-Shielded	1.0	EUT	Adapter
2	USB Cable	Non-Shielded	1.0	EUT	NB

2.3 Block Diagram of Test Setup

Conduction	Radiation
	

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1307, § 2.1093	RF Exposure	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), § 1.1307, § 2.1093 – RF Exposure

4.1 Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·

[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is $\leqslant$ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

4.2 RF Exposure Evaluation Result

RF Exposure Evaluation:

Frequency (MHz)	Tunp-up Power		Evaluation Distrance (mm)	SAR Excluion Result	Extremity SAR Exclusion Limit (1g SAR)
	(dBm)	(mW)			
2402-2480	0	1.000	5	0.3183	7.5

Result: SAR evaluation is not necessary.

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	Antenna Type	Antenna Gain	Result
YAGEO	Chip Antenna	1.69 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

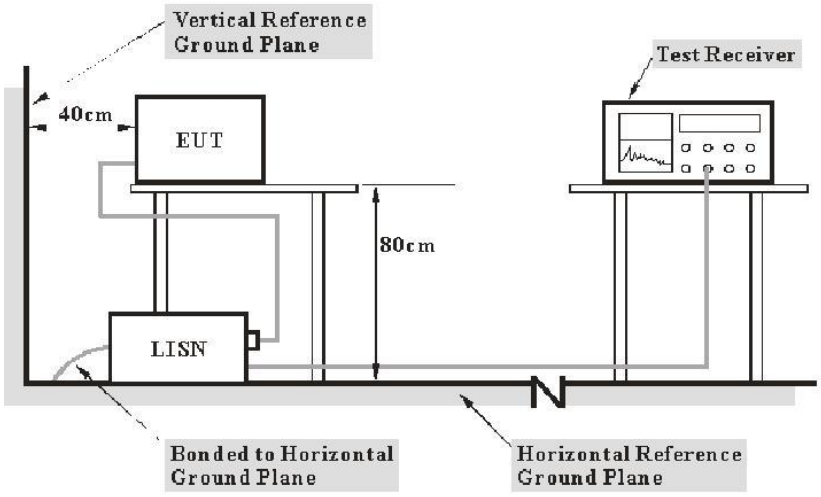
According to FCC §15.207,

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 µH/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.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
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.
Conduction Room					
LISN	Rohde & Schwarz	ENV216	100010	2019/09/02	2020/09/01
EMI Test Receiver	Rohde & Schwarz	ESR3	102430	2019/03/27	2020/03/26
Pulse Limiter	SCHWARZBECK	VSTD 9561-F	00432	2019/08/28	2020/08/27
RF Cable	EMCI	EMCCFD300-BM-BM-8000	180526	2019/08/08	2020/08/07
Software	Audix	e3 v9	E3LK-03	N.C.R	N.C.R

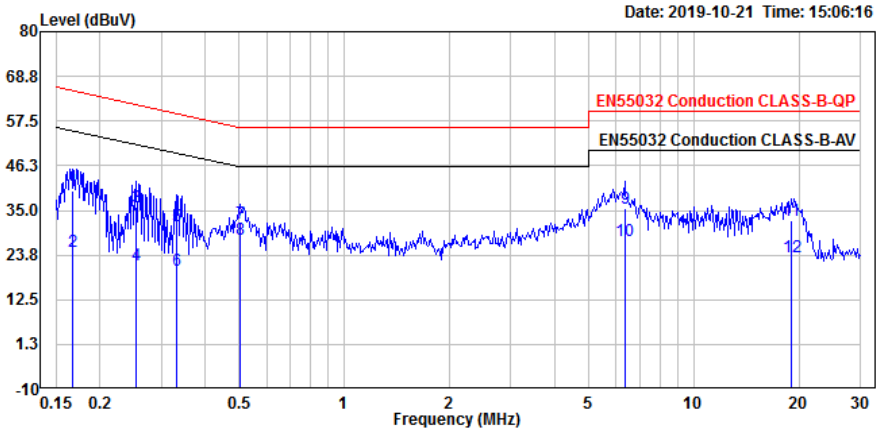
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

6.4 Test Environmental Conditions

Temperature:	25 ℃	**Relative Humidity:**	50 %
ATM Pressure:	1010 hPa	**Test Engineer:**	David Hsu
Test Date:	2019-10-21		

6.5 Test Data and Test Plot

Mode: 120V/60Hz, Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.168	19.91	39.85	19.94	65.07	-25.22	QP
2	0.168	4.76	24.70	19.94	55.07	-30.37	Average
3	0.254	15.93	35.87	19.94	61.63	-25.76	QP
4	0.254	1.41	21.35	19.94	51.63	-30.28	Average
5	0.333	11.19	31.13	19.94	59.38	-28.25	QP
6	0.333	0.03	19.97	19.94	49.38	-29.41	Average
7	0.504	11.87	31.83	19.96	56.00	-24.17	QP
8	0.504	7.61	27.57	19.96	46.00	-18.43	Average
9	6.344	15.33	35.39	20.06	60.00	-24.61	QP
10	6.344	7.30	27.36	20.06	50.00	-22.64	Average
11	19.050	12.34	32.51	20.17	60.00	-27.49	QP
12	19.050	3.04	23.21	20.17	50.00	-26.79	Average

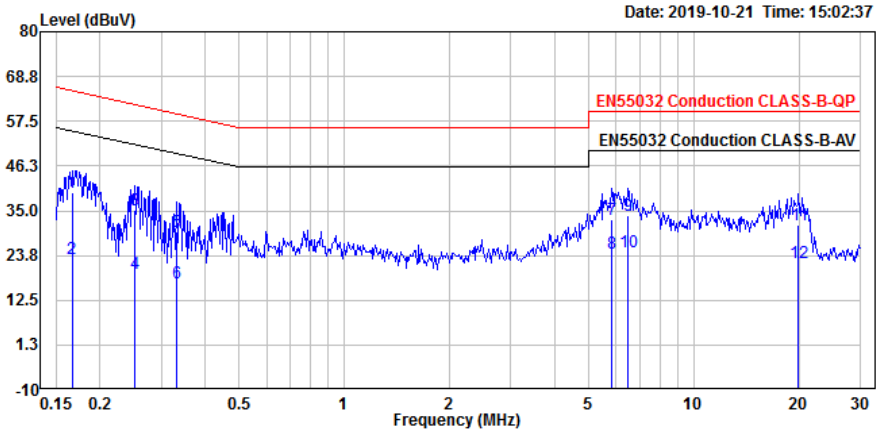
Note:

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, Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.166	19.57	39.52	19.95	65.14	-25.62	QP
2	0.166	3.11	23.06	19.95	55.14	-32.08	Average
3	0.252	15.06	35.00	19.94	61.70	-26.70	QP
4	0.252	-0.73	19.21	19.94	51.70	-32.49	Average
5	0.333	9.79	29.74	19.95	59.38	-29.64	QP
6	0.333	-3.10	16.85	19.95	49.38	-32.53	Average
7	5.812	12.75	32.83	20.08	60.00	-27.17	QP
8	5.812	4.16	24.24	20.08	50.00	-25.76	Average
9	6.498	13.70	33.80	20.10	60.00	-26.20	QP
10	6.498	4.60	24.70	20.10	50.00	-25.30	Average
11	19.983	11.16	31.47	20.31	60.00	-28.53	QP
12	19.983	1.71	22.02	20.31	50.00	-27.98	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

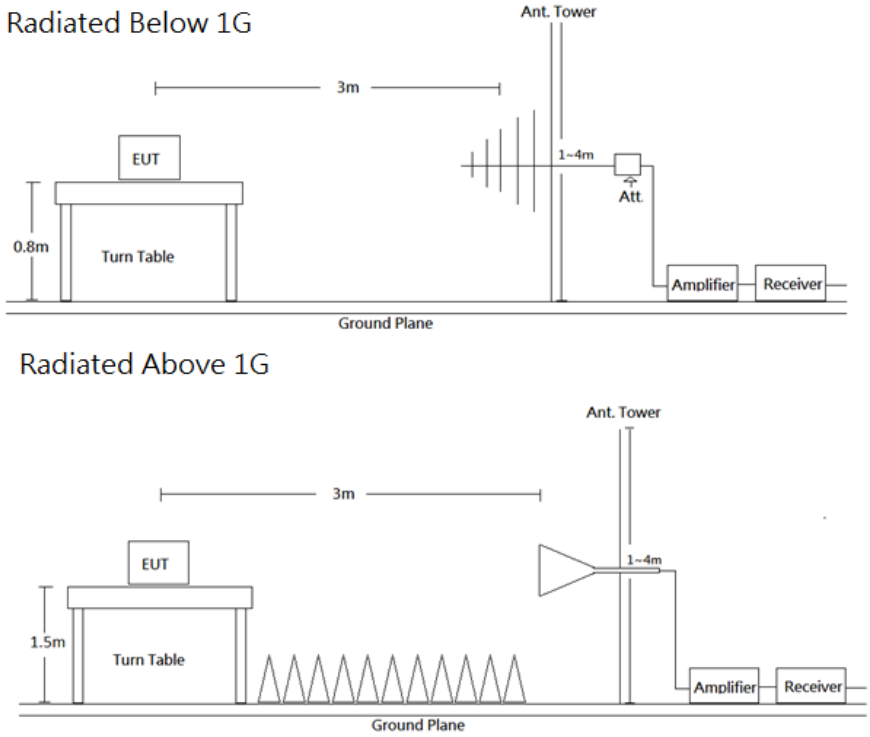
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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 26.5 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.
966A Room					
Bilog Antenna/6 dB Attenuator	SUNOL SCIENCES & EMEC /EMCI	JB3/N-6-06	A111513/AT-N0668	2019/03/29	2020/03/28
Horn Antenna	ETS-Lindgren	3115	00109141	2019/07/05	2020/07/04
Horn Antenna	ETS-Lindgren	3160-09	00123852	2019/07/11	2020/07/10
Preamplifier	A.H. Systems	PAM-0118P	478	2019/03/28	2020/03/27
Preamplifier	A.H. Systems	PAM-1840VH	174	2019/02/18	2020/02/17
Signal and Spectrum Analyzer	Rohde & Schwarzr	FSV40	101434	2019/04/17	2020/04/16
Microflex Cable (1m)	EMCI	EMC106-SM-SM-2000	93D0127	2019/05/05	2020/05/04
Microflex Cable (2m)	MTJ	H0919	MFR64639 226389-002	2019/05/05	2020/05/04
Microflex Cable (8m)	UTIFLEX	UFA210A-1-3149-300300	160309-1	2019/05/05	2020/05/04
Turn Table	Chaintek	T-200-S-1	003501	N.C.R	N.C.R
Antenna Tower	Chaintek	MBD-400-1	003504	N.C.R	N.C.R
Controller	Chaintek	3000-1	003507	N.C.R	N.C.R
Software	Audix	e3 v9	E3LK-01	N.C.R	N.C.R
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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).*

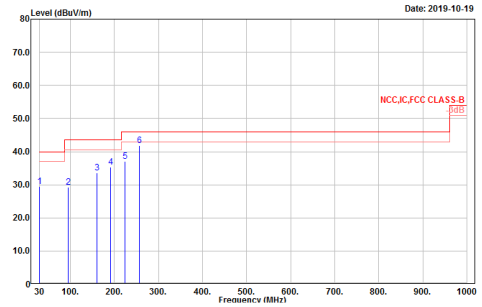
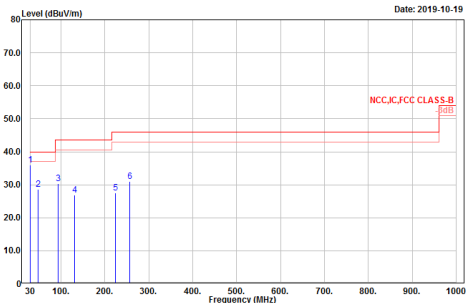
7.4 Test Environmental Conditions

Temperature:	25.6 ℃	**Relative Humidity:**	46 %
ATM Pressure:	1014hPa	**Test Engineer:**	Boris Kao / Boris Kao
Radiated Test Date:	2019-10-18 to 2019-10-19	**Conducted Test Date:**	2019-07-12

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

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	29.49	40.00	-10.51	35.32	-5.83	Peak	horizontal
2	95.960	29.18	43.50	-14.32	50.64	-21.46	Peak	horizontal
3	159.980	33.54	43.50	-9.96	51.92	-18.38	Peak	horizontal
4	191.990	35.35	43.50	-8.15	55.01	-19.66	Peak	horizontal
5	224.000	37.00	46.00	-9.00	56.89	-19.89	Peak	horizontal
6	256.010	41.75	46.00	-4.25	60.95	-19.20	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	36.01	40.00	-3.99	41.84	-5.83	Peak	vertical
2	47.460	28.63	40.00	-11.37	48.27	-19.64	Peak	vertical
3	93.050	30.36	43.50	-13.14	52.51	-22.15	Peak	vertical
4	131.850	26.81	43.50	-16.69	43.56	-16.75	Peak	vertical
5	224.000	27.61	46.00	-18.39	47.50	-19.89	Peak	vertical
6	256.010	30.98	46.00	-15.02	50.18	-19.20	Peak	vertical

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

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	24.34	54.00	-29.66	31.97	-7.63	Average
2390.000	36.28	74.00	-37.72	43.91	-7.63	Peak
2401.902	79.27			86.89	-7.62	Average
2401.902	93.53			101.15	-7.62	Peak
4804.000	47.06	54.00	-6.94	46.44	0.62	Average
4804.000	53.83	74.00	-20.17	53.21	0.62	Peak
7206.000	46.03	54.00	-7.97	40.78	5.25	Average
7206.000	51.86	74.00	-22.14	46.61	5.25	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	23.11	54.00	-30.89	30.74	-7.63	Average
2390.000	36.08	74.00	-37.92	43.71	-7.63	Peak
2401.902	74.54			82.16	-7.62	Average
2401.902	87.51			95.13	-7.62	Peak
4804.000	39.77	54.00	-14.23	39.15	0.62	Average
4804.000	42.67	74.00	-31.33	42.05	0.62	Peak
7206.000	42.56	54.00	-11.44	37.31	5.25	Average
7206.000	47.33	74.00	-26.67	42.08	5.25	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	24.30	54.00	-29.70	31.93	-7.63	Average
2390.000	35.89	74.00	-38.11	43.52	-7.63	Peak
2441.100	79.86			87.38	-7.52	Average
2441.100	94.16			101.68	-7.52	Peak
2483.500	25.19	54.00	-28.81	32.53	-7.34	Average
2483.500	37.56	74.00	-36.44	44.90	-7.34	Peak
4882.000	47.69	54.00	-6.31	46.87	0.82	Average
4882.000	52.53	74.00	-21.47	51.71	0.82	Peak
7323.000	46.47	54.00	-7.53	40.75	5.72	Average
7323.000	52.92	74.00	-21.08	47.20	5.72	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	30.00	54.00	-24.00	37.63	-7.63	Average
2390.000	35.38	74.00	-38.62	43.01	-7.63	Peak
2441.100	75.32			82.84	-7.52	Average
2441.100	88.49			96.01	-7.52	Peak
2483.500	23.42	54.00	-30.58	30.76	-7.34	Average
2483.500	35.63	74.00	-38.37	42.97	-7.34	Peak
4882.000	40.13	54.00	-13.87	39.31	0.82	Average
4882.000	45.92	74.00	-28.08	45.10	0.82	Peak
7323.000	41.36	54.00	-12.64	35.64	5.72	Average
7323.000	49.62	74.00	-24.38	43.90	5.72	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2479.840	80.17			87.52	-7.35	Average
2479.840	94.44			101.79	-7.35	Peak
2483.500	26.74	54.00	-27.26	34.08	-7.34	Average
2483.500	39.14	74.00	-34.86	46.48	-7.34	Peak
4960.000	44.06	54.00	-9.94	43.25	0.81	Average
4960.000	48.52	74.00	-25.48	47.71	0.81	Peak
7440.000	42.39	54.00	-11.61	36.33	6.06	Average
7440.000	49.73	74.00	-24.27	43.67	6.06	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2479.840	76.58			83.93	-7.35	Average
2479.840	89.93			97.28	-7.35	Peak
2483.500	24.76	54.00	-29.24	32.10	-7.34	Average
2483.500	37.72	74.00	-36.28	45.06	-7.34	Peak
4960.000	38.39	54.00	-15.61	37.58	0.81	Average
4960.000	44.68	74.00	-29.32	43.87	0.81	Peak
7440.000	40.29	54.00	-13.71	34.23	6.06	Average
7440.000	48.29	74.00	-25.71	42.23	6.06	Peak

EDR-2Mbps mode (π/4-DQPSK):

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	24.13	54.00	-29.87	31.76	-7.63	Average
2390.000	35.47	74.00	-38.53	43.10	-7.63	Peak
2401.902	74.92			82.54	-7.62	Average
2401.902	90.32			97.94	-7.62	Peak
4804.000	44.19	54.00	-9.81	43.57	0.62	Average
4804.000	54.42	74.00	-19.58	53.80	0.62	Peak
7206.000	42.96	54.00	-11.04	37.71	5.25	Average
7206.000	52.54	74.00	-21.46	47.29	5.25	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	23.12	54.00	-30.88	30.75	-7.63	Average
2390.000	36.53	74.00	-37.47	44.16	-7.63	Peak
2401.902	71.79			79.41	-7.62	Average
2401.902	86.37			93.99	-7.62	Peak
4804.000	35.62	54.00	-18.38	35.00	0.62	Average
4804.000	44.69	74.00	-29.31	44.07	0.62	Peak
7206.000	40.76	54.00	-13.24	35.51	5.25	Average
7206.000	50.22	74.00	-23.78	44.97	5.25	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	23.37	54.00	-30.63	31.00	-7.63	Average
2390.000	35.00	74.00	-39.00	42.63	-7.63	Peak
2440.910	74.72			82.24	-7.52	Average
2440.910	89.96			97.48	-7.52	Peak
2483.500	23.45	54.00	-30.55	30.79	-7.34	Average
2483.500	34.80	74.00	-39.20	42.14	-7.34	Peak
4882.000	43.51	54.00	-10.49	42.69	0.82	Average
4882.000	51.27	74.00	-22.73	50.45	0.82	Peak
7323.000	46.22	54.00	-7.78	40.50	5.72	Average
7323.000	53.86	74.00	-20.14	48.14	5.72	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	23.14	54.00	-30.86	30.77	-7.63	Average
2390.000	35.16	74.00	-38.84	42.79	-7.63	Peak
2440.910	72.80			80.32	-7.52	Average
2440.910	87.52			95.04	-7.52	Peak
2483.500	23.53	54.00	-30.47	30.87	-7.34	Average
2483.500	34.89	74.00	-39.11	42.23	-7.34	Peak
4882.000	36.56	54.00	-17.44	35.74	0.82	Average
4882.000	45.64	74.00	-28.36	44.82	0.82	Peak
7323.000	37.73	54.00	-16.27	32.01	5.72	Average
7323.000	48.21	74.00	-25.79	42.49	5.72	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2479.840	77.65			85.00	-7.35	Average
2479.840	93.60			100.95	-7.35	Peak
2483.500	26.29	54.00	-27.71	33.63	-7.34	Average
2483.500	39.10	74.00	-34.90	46.44	-7.34	Peak
4960.000	40.91	54.00	-13.09	40.10	0.81	Average
4960.000	49.10	74.00	-24.90	48.29	0.81	Peak
7440.000	39.89	54.00	-14.11	33.83	6.06	Average
7440.000	49.96	74.00	-24.04	43.90	6.06	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2479.840	73.00			80.35	-7.35	Average
2479.840	87.76			95.11	-7.35	Peak
2483.500	24.17	54.00	-29.83	31.51	-7.34	Average
2483.500	35.75	74.00	-38.25	43.09	-7.34	Peak
4960.000	35.35	54.00	-18.65	34.54	0.81	Average
4960.000	44.39	74.00	-29.61	43.58	0.81	Peak
7440.000	34.13	54.00	-19.87	28.07	6.06	Average
7440.000	44.86	74.00	-29.14	38.80	6.06	Peak

EDR-3Mbps mode (8-DPSK):

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2349.576	23.84	54.00	-30.16	31.57	-7.73	Average
2349.576	36.49	74.00	-37.51	44.22	-7.73	Peak
2402.106	76.67			84.29	-7.62	Average
2402.106	92.72			100.34	-7.62	Peak
4804.000	41.28	54.00	-12.72	40.66	0.62	Average
4804.000	51.72	74.00	-22.28	51.10	0.62	Peak
7206.000	42.34	54.00	-11.66	37.09	5.25	Average
7206.000	52.88	74.00	-21.12	47.63	5.25	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2317.548	22.86	54.00	-31.14	30.67	-7.81	Average
2317.548	36.14	74.00	-37.86	43.95	-7.81	Peak
2402.106	70.98			78.60	-7.62	Average
2402.106	85.56			93.18	-7.62	Peak
4804.000	33.62	54.00	-20.38	33.00	0.62	Average
4804.000	45.12	74.00	-28.88	44.50	0.62	Peak
7206.000	39.46	54.00	-14.54	34.21	5.25	Average
7206.000	50.05	74.00	-23.95	44.80	5.25	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2362.250	23.55	54.00	-30.45	31.25	-7.70	Average
2362.250	35.22	74.00	-38.78	42.92	-7.70	Peak
2441.100	76.35			83.87	-7.52	Average
2441.100	92.16			99.68	-7.52	Peak
2484.990	25.14	54.00	-28.86	32.48	-7.34	Average
2484.990	35.31	74.00	-38.69	42.65	-7.34	Peak
4882.000	42.74	54.00	-11.26	41.92	0.82	Average
4882.000	51.74	74.00	-22.26	50.92	0.82	Peak
7323.000	42.49	54.00	-11.51	36.77	5.72	Average
7323.000	52.06	74.00	-21.94	46.34	5.72	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2346.480	30.12	54.00	-23.88	37.87	-7.75	Average
2346.480	35.10	74.00	-38.90	42.85	-7.75	Peak
2441.100	73.33			80.85	-7.52	Average
2441.100	88.29			95.81	-7.52	Peak
2485.560	24.45	54.00	-29.55	31.79	-7.34	Average
2485.560	35.50	74.00	-38.50	42.84	-7.34	Peak
4882.000	36.53	54.00	-17.47	35.71	0.82	Average
4882.000	46.86	74.00	-27.14	46.04	0.82	Peak
7323.000	36.43	54.00	-17.57	30.71	5.72	Average
7323.000	47.14	74.00	-26.86	41.42	5.72	Peak

High CH

Horizontal

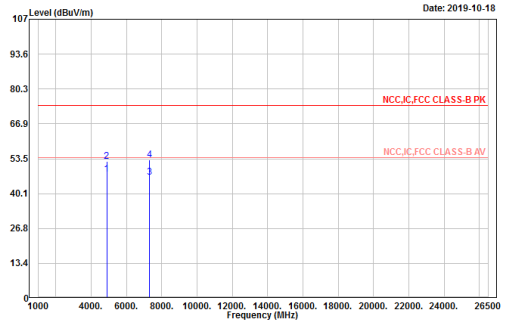
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2480.020	77.71			85.06	-7.35	Average
2480.020	93.87			101.22	-7.35	Peak
2483.560	25.67	54.00	-28.33	33.01	-7.34	Average
2483.560	38.44	74.00	-35.56	45.78	-7.34	Peak
4960.000	35.61	54.00	-18.39	34.80	0.81	Average
4960.000	45.57	74.00	-28.43	44.76	0.81	Peak
7440.000	34.97	54.00	-19.03	28.91	6.06	Average
7440.000	45.83	74.00	-28.17	39.77	6.06	Peak

Vertical

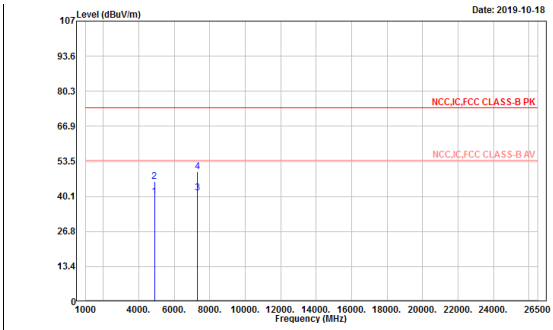
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2479.990	73.33			80.68	-7.35	Average
2479.990	88.43			95.78	-7.35	Peak
2484.100	23.25	54.00	-30.75	30.59	-7.34	Average
2484.100	37.04	74.00	-36.96	44.38	-7.34	Peak
4960.000	31.82	54.00	-22.18	31.01	0.81	Average
4960.000	42.98	74.00	-31.02	42.17	0.81	Peak
7440.000	30.75	54.00	-23.25	24.69	6.06	Average
7440.000	44.78	74.00	-29.22	38.72	6.06	Peak

Above 1G (1 GHz-26.5 GHz): The worst mode

Horizontal	Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	4882.000	47.69	54.00	-6.31	46.87	0.82	Average	horizontal
2	4882.000	52.53	74.00	-21.47	51.71	0.82	Peak	horizontal
3 !	7323.000	46.47	54.00	-7.53	40.75	5.72	Average	horizontal
4	7323.000	52.92	74.00	-21.08	47.20	5.72	Peak	horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	4882.000	40.13	54.00	-13.87	39.31	0.82	Average	vertical
2	4882.000	45.92	74.00	-28.08	45.10	0.82	Peak	vertical
3 !	7323.000	41.36	54.00	-12.64	35.64	5.72	Average	vertical
4	7323.000	49.62	74.00	-24.38	43.90	5.72	Peak	vertical

Level = Read Level + Factor

Over Limit = Level – Limit

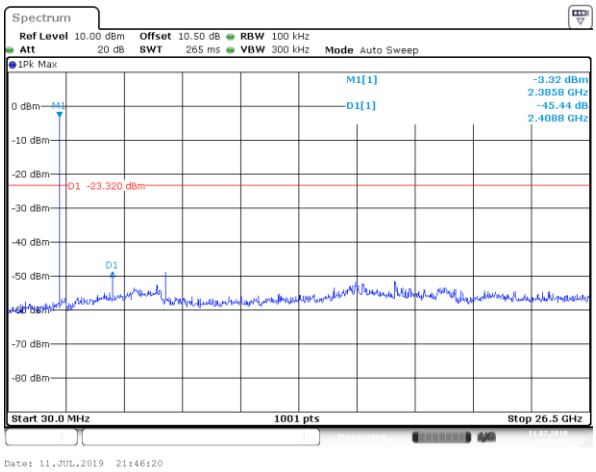
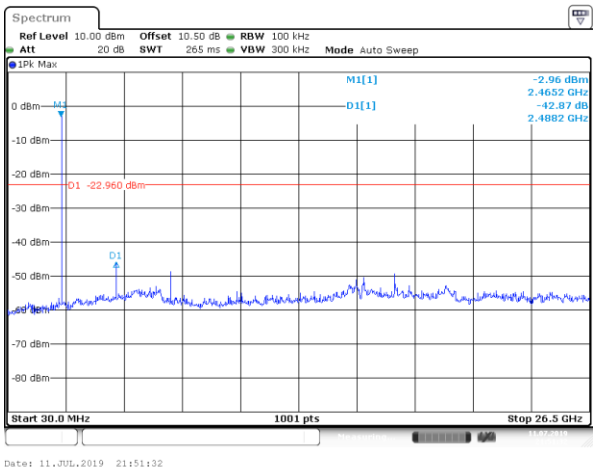
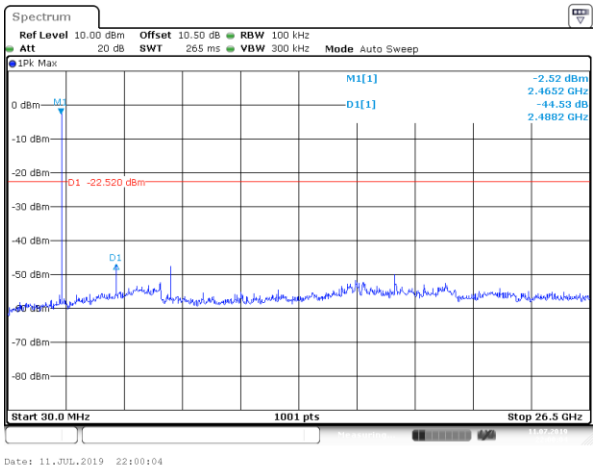
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

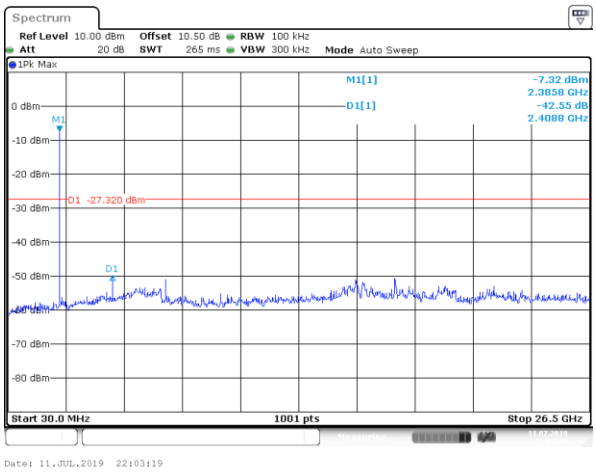
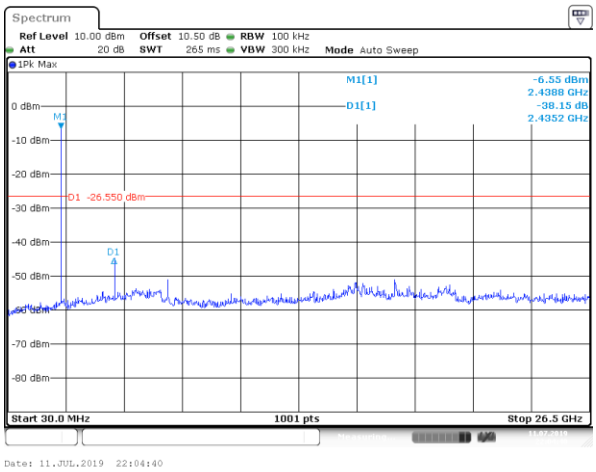
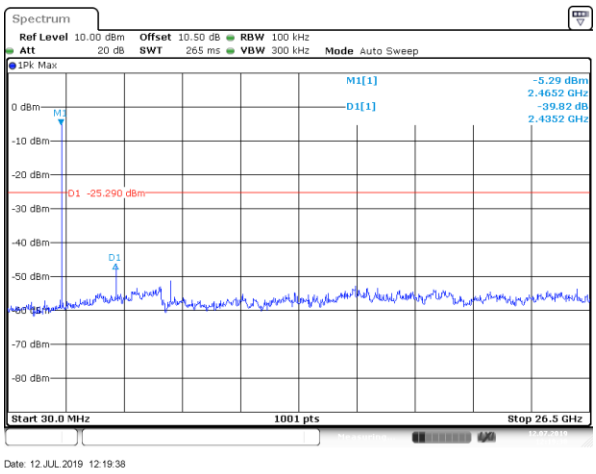
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR-1Mbps mode (GFSK)				
Low	2402	45.44	≥ 20	Compliance
Mid	2441	42.87	≥ 20	Compliance
High	2480	44.53	≥ 20	Compliance
EDR-2Mbps mode (π/4-DQPSK)				
Low	2402	42.55	≥ 20	Compliance
Mid	2441	38.15	≥ 20	Compliance
High	2480	29.83	≥ 20	Compliance
EDR-3Mbps mode (8DPSK)				
Low	2402	44.04	≥ 20	Compliance
Mid	2441	45.08	≥ 20	Compliance
High	2480	41.57	≥ 20	Compliance

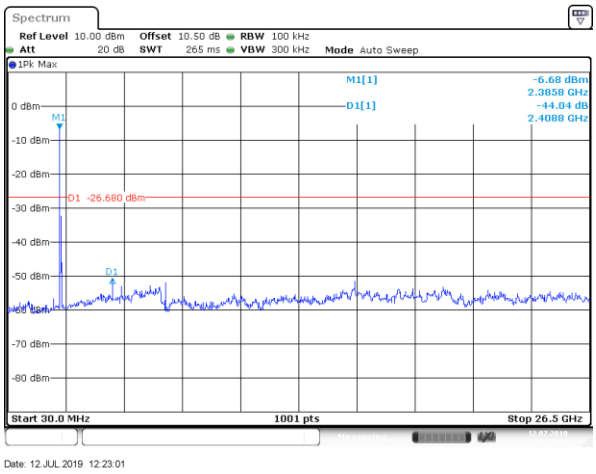
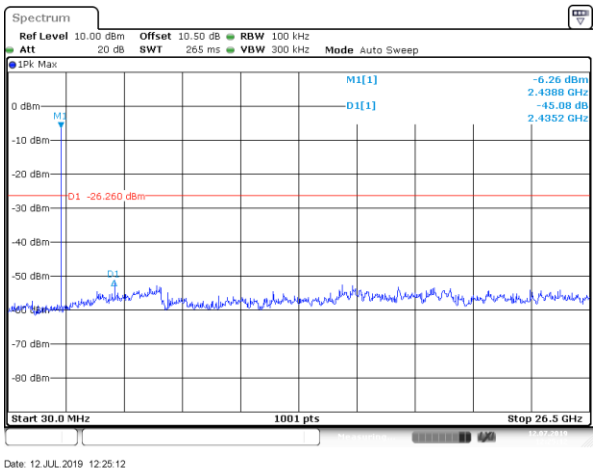
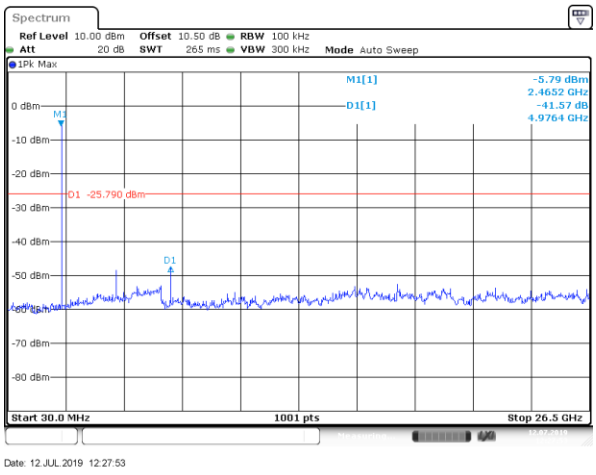
BR-1Mbps mode (GFSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-2Mbps mode (π/4-DQPSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-3Mbps mode (8DPSK):

Low CH	Middle CH
	
High CH	**-**
	-

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.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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).*

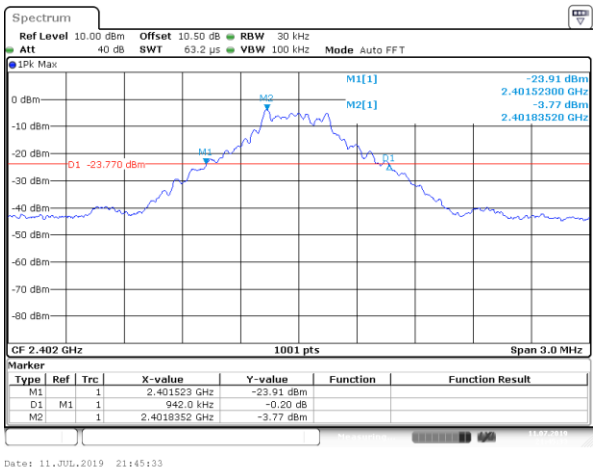
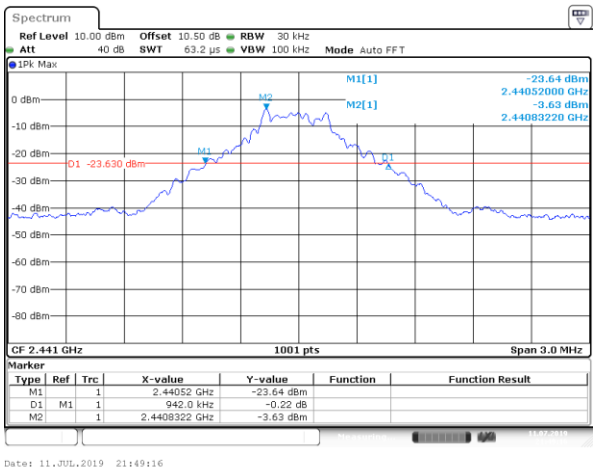
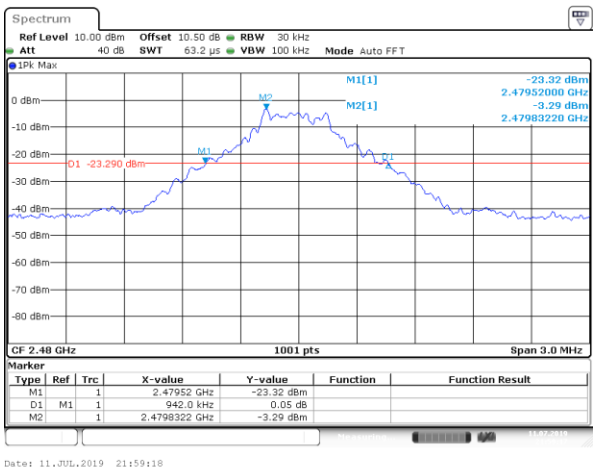
8.4 Test Environmental Conditions

Temperature:	25.6 ℃	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-12	-	-

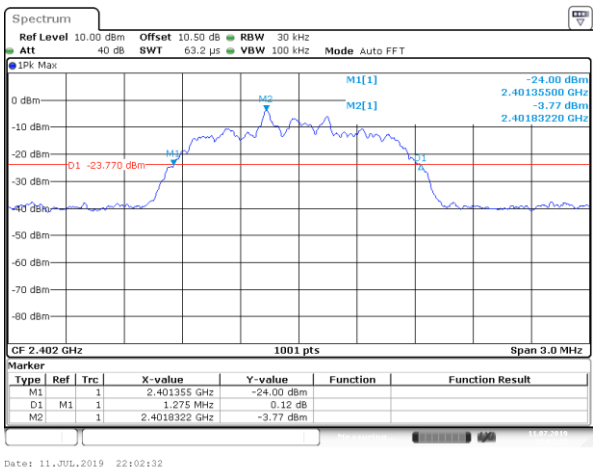
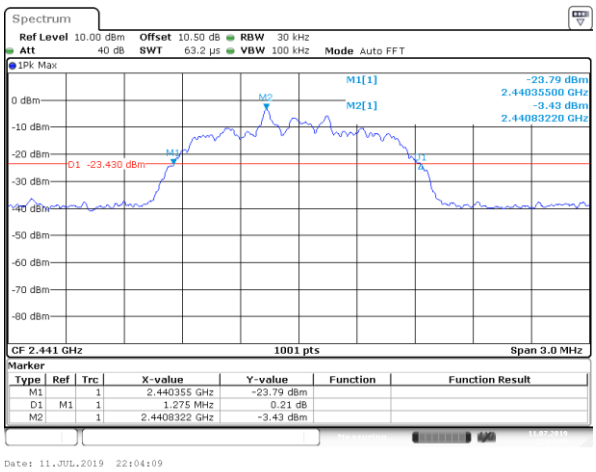
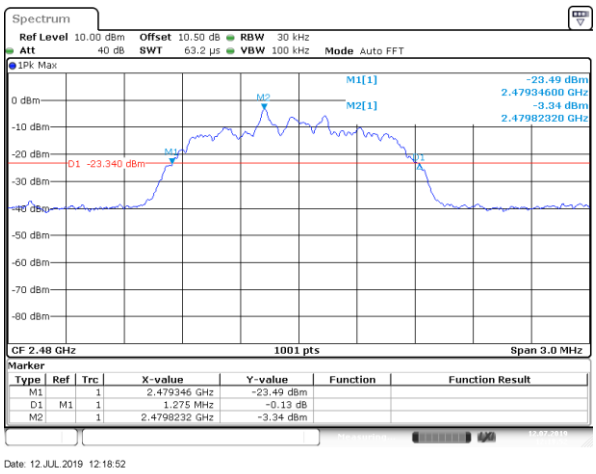
8.5 Test Results

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BR-1Mbps Mode (GFSK)		
Low	2402	0.9420
Middle	2441	0.9420
High	2480	0.9420
EDR-2Mbps Mode (π/4-DQPSK)		
Low	2402	1.2750
Middle	2441	1.2750
High	2480	1.2750
EDR-3Mbps Mode (8DPSK)		
Low	2402	1.2810
Middle	2441	1.2870
High	2480	1.2870

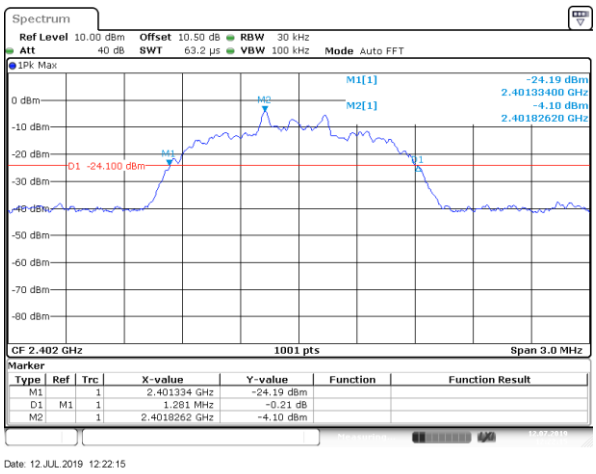
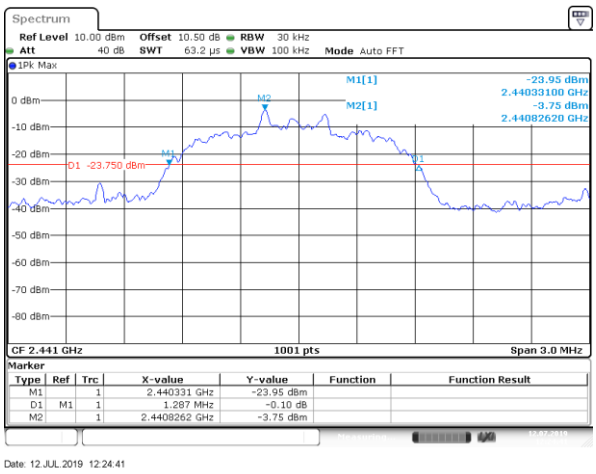
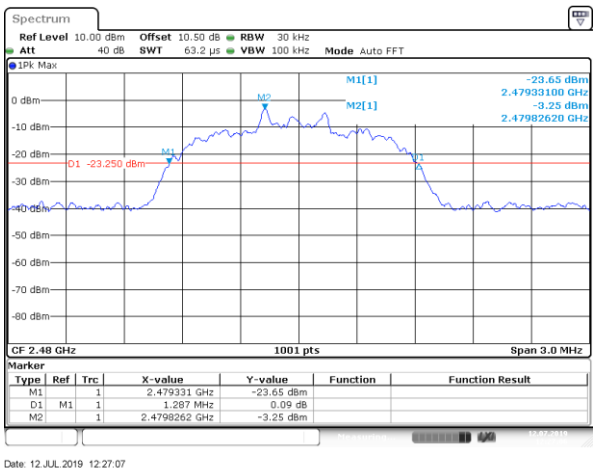
BR-1Mbps mode (GFSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-2Mbps Mode (π/4-DQPSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-3Mbps Mode (8DPSK):

Low CH	Middle CH
	
High CH	**-**
	-

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.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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).*

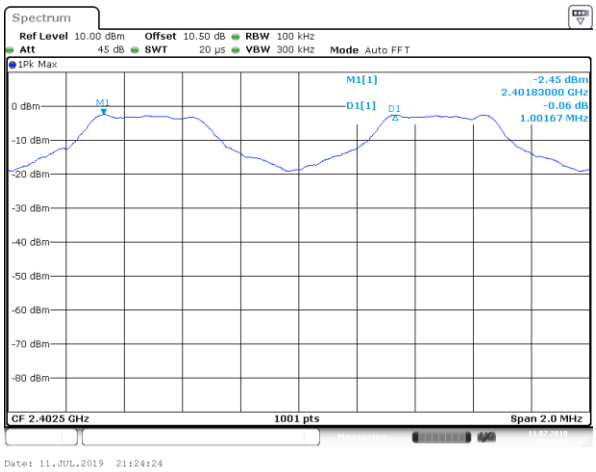
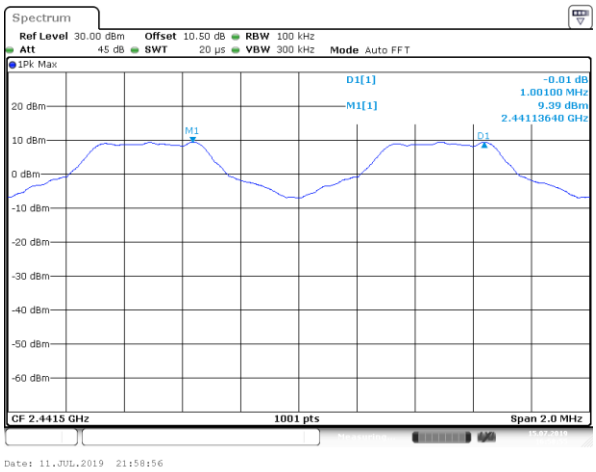
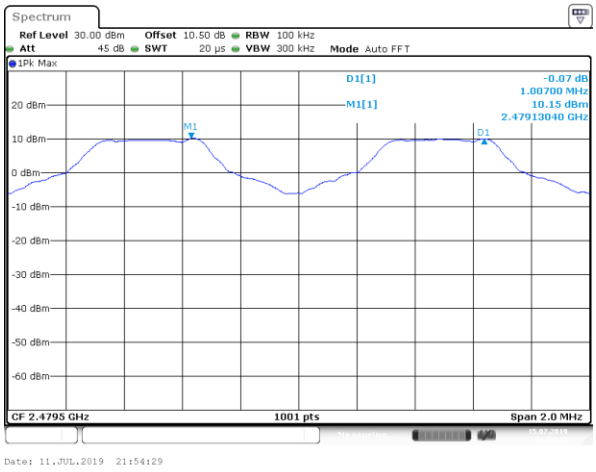
9.4 Test Environmental Conditions

Temperature:	25.6°C	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-11	-	-

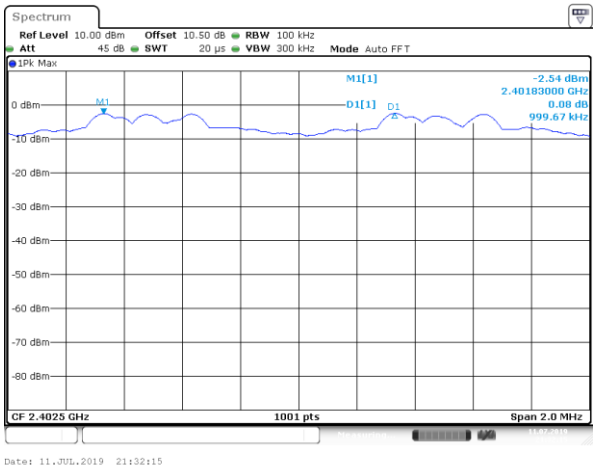
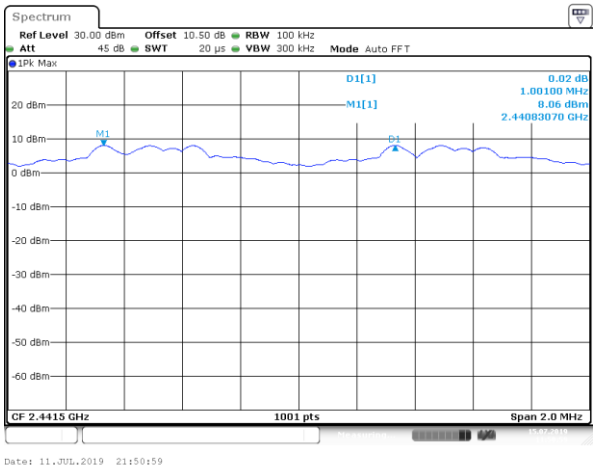
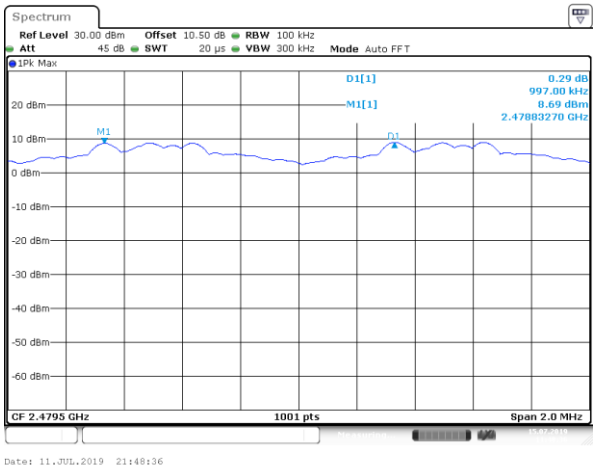
9.5 Test Results

Channel	Frequency (MHz)	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Limit (dBm)	Result
BR-1Mbps mode (GFSK)						
Low	2402	1.00167	0.9420	0.627	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.00100	0.9420	0.627		Compliance
High	2480	1.00700	0.9420	0.627		Compliance
EDR-2Mbps mode (π/4-DQPSK)						
Low	2402	0.99967	1.2750	0.853	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.00100	1.2750	0.853		Compliance
High	2480	0.99700	1.2750	0.853		Compliance
EDR-3Mbps mode (8DPSK)						
Low	2402	0.99967	1.2810	0.853	>two-thirds of the 20 dB bandwidth	Compliance
Middle	2441	1.00100	1.2870	0.860		Compliance
High	2480	0.99900	1.2870	0.860		Compliance

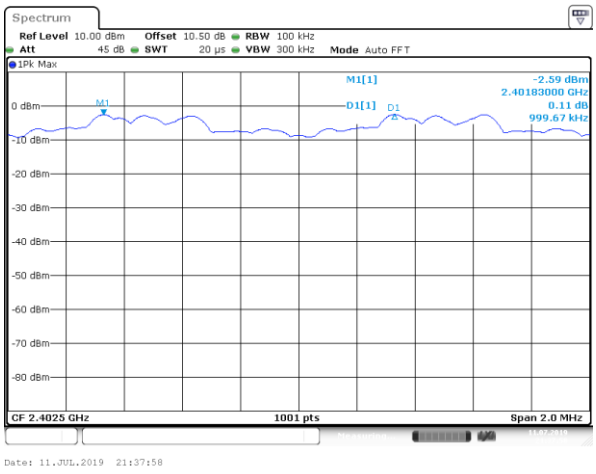
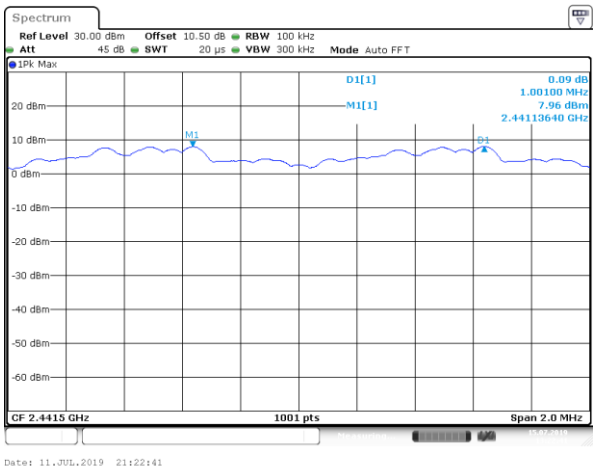
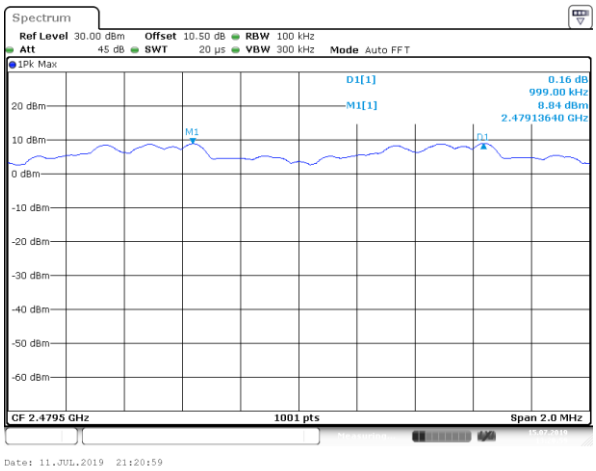
BR-1Mbps mode (GFSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-2Mbps mode (π/4-DQPSK):

Low CH	Middle CH
	
High CH	**-**
	-

EDR-3Mbps mode (8-DPSK):

Low CH	Middle CH
	
High CH	**-**
	-

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 ≤ channel spacing and where possible RBW should be set >> 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.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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

Temperature:	25.6°C	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-12	-	-

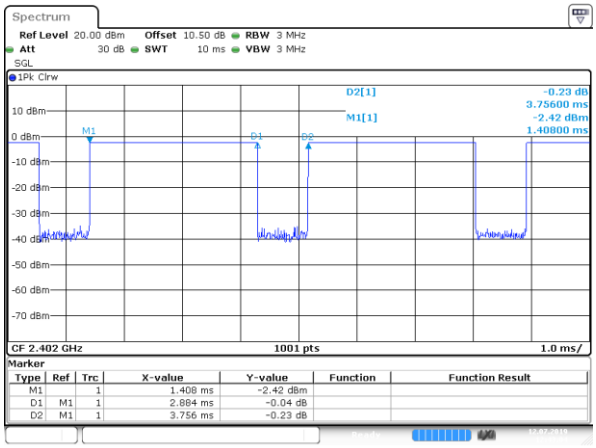
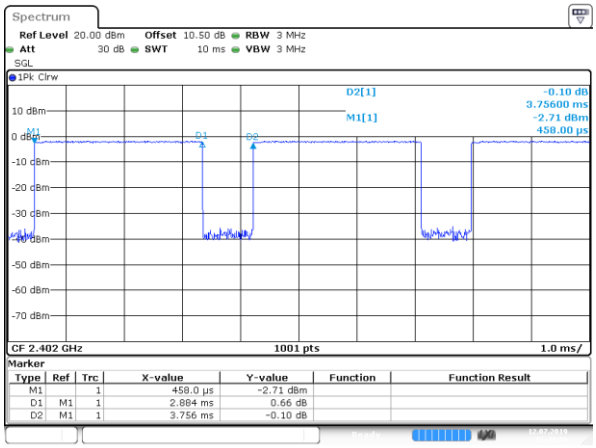
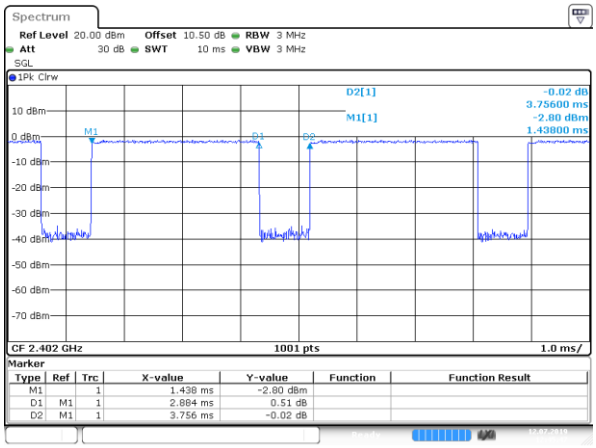
10.5 Test Results

Time of Occupancy (Dwell Time) Result				
Modulation Mode	**Pulse Time per Hop (ms)**	**Number of Pulse in [0.4 x N sec] (s)**	**Dwell Time in [0.4 x N sec] (s)**	**Dwell Time Limits (s)**
BR-1Mbps mode (GFSK)	2.884	106.7	0.308	0.4
EDR-2Mbps mode (π/4-DQPSK)	2.884	106.7	0.308	0.4
EDR-3Mbps mode (8DPSK)	2.884	106.7	0.308	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.*

DH5	2-DH5
	
3-DH5	**-**
	-

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.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

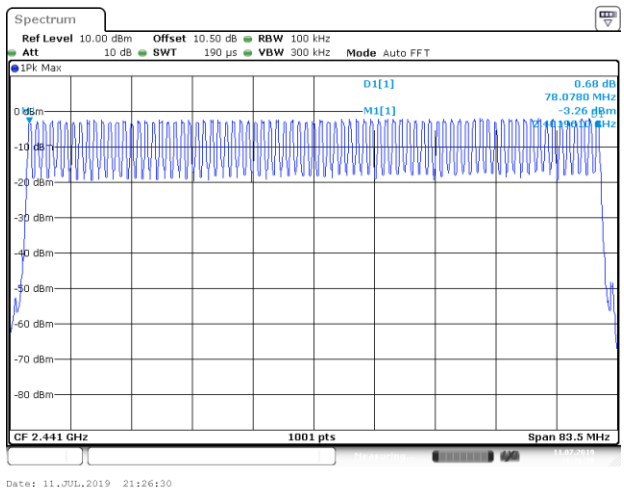
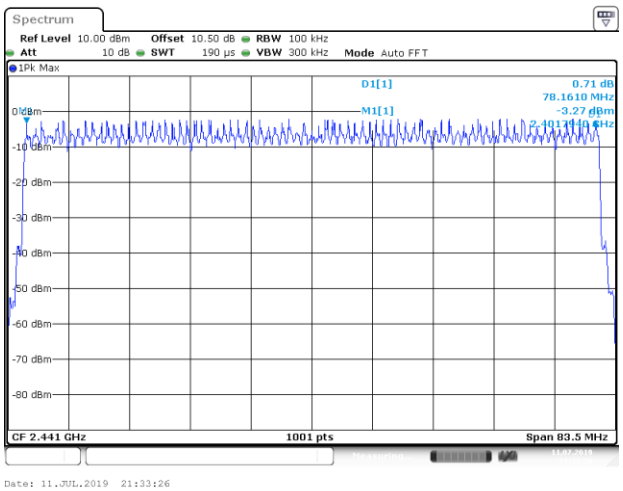
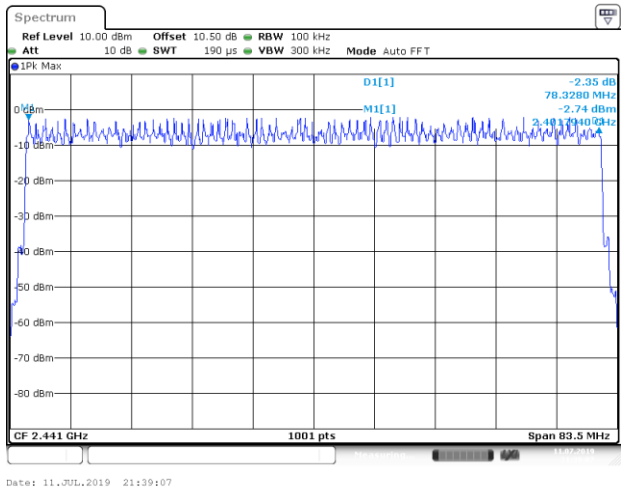
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

11.4 Test Environmental Conditions

Temperature:	25.6°C	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-11	-	-

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 (π/4-DQPSK)	2402-2480	79	>15	Compliance
EDR-3Mbps mode (8DPSK)	2402-2480	79	>15	Compliance

BR-1Mbps mode (GFSK)	**EDR-2Mbps mode (π/4-DQPSK)**
	
EDR-3Mbps mode (8DPSK)	**-**
	-

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.
Conducted Room					
Power Sensor	Agilent	U2021XA	MY54250014	2018/11/12	2019/11/11
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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

Temperature:	25.6°C	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-11	-	-

12.5 Test Results

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (W)	Limit (dBm)	Result
BR-1Mbps mode (GFSK)					
Low	2402	-2.09	0.0006	21	Compliance
Middle	2441	-2.61	0.0005	21	Compliance
High	2480	-2.42	0.0006	21	Compliance
EDR-2Mbps mode (π/4-DQPSK)					
Low	2402	-2.01	0.0006	21	Compliance
Middle	2441	-1.88	0.0006	21	Compliance
High	2480	-2.01	0.0006	21	Compliance
EDR-3Mbps mode (8DPSK)					
Low	2402	-1.71	0.0007	21	Compliance
Middle	2441	-1.72	0.0007	21	Compliance
High	2480	-1.82	0.0007	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.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	102248	2019/09/11	2020/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/27

***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).*

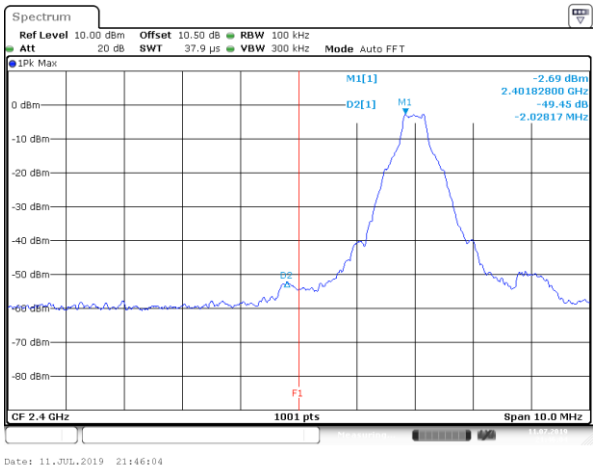
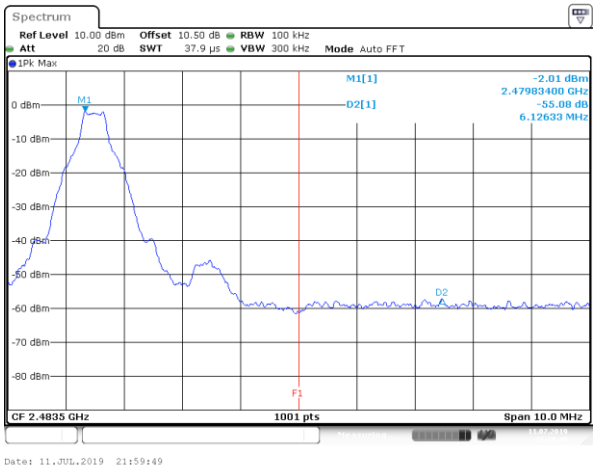
13.4 Test Environmental Conditions

Temperature:	25.6°C	**Relative Humidity:**	46 %
ATM Pressure:	1010hPa	**Test Engineer:**	Boris Kao
Conducted Test Date:	2019-07-11 – 2019-07-12	-	-

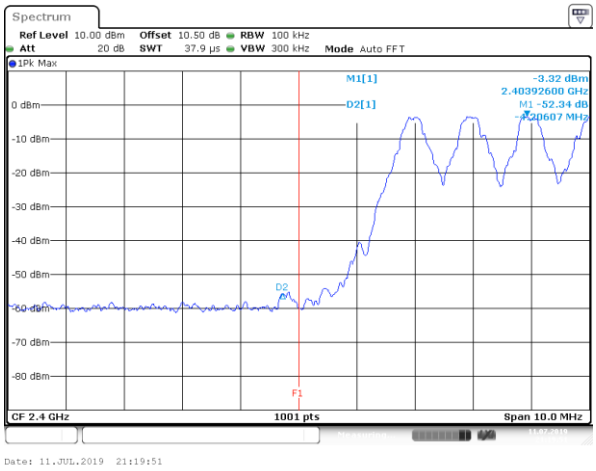
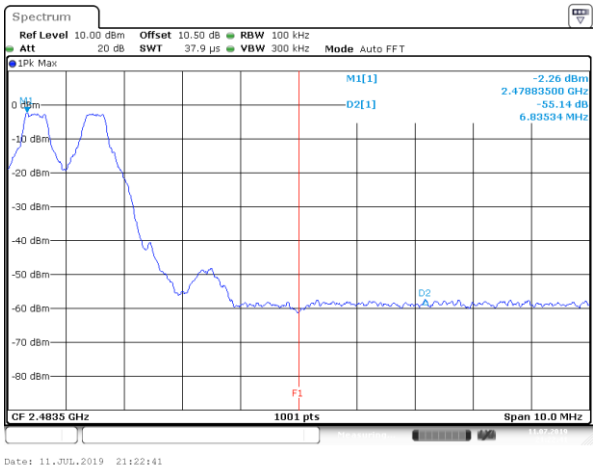
13.5 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR-1Mbps mode (GFSK)				
Low	2402	49.45	≥ 20	Compliance
High	2480	55.08	≥ 20	Compliance
BR-1Mbps Hopping mode (GFSK)				
Low	2402	52.34	≥ 20	Compliance
High	2480	55.14	≥ 20	Compliance
EDR-2Mbps mode (π/4-DQPSK)				
Low	2402	47.68	≥ 20	Compliance
High	2480	56.39	≥ 20	Compliance
EDR-2Mbps Hopping mode (π/4-DQPSK)				
Low	2402	48.62	≥ 20	Compliance
High	2480	55.03	≥ 20	Compliance
EDR-3Mbps mode (8DPSK)				
Low	2402	50.43	≥ 20	Compliance
High	2480	56.28	≥ 20	Compliance
EDR-3Mbps Hopping mode (8DPSK)				
Low	2402	49.17	≥ 20	Compliance
High	2480	55.08	≥ 20	Compliance

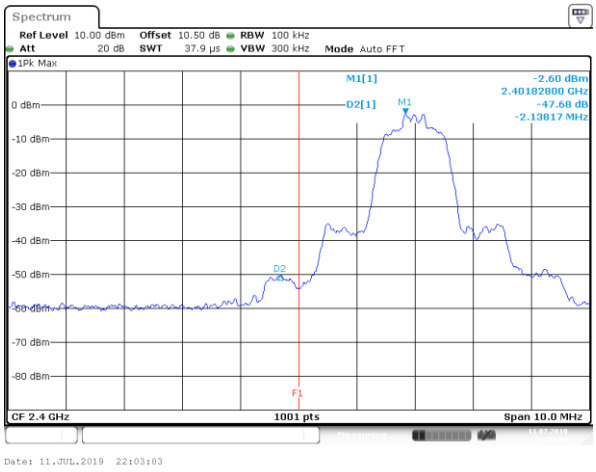
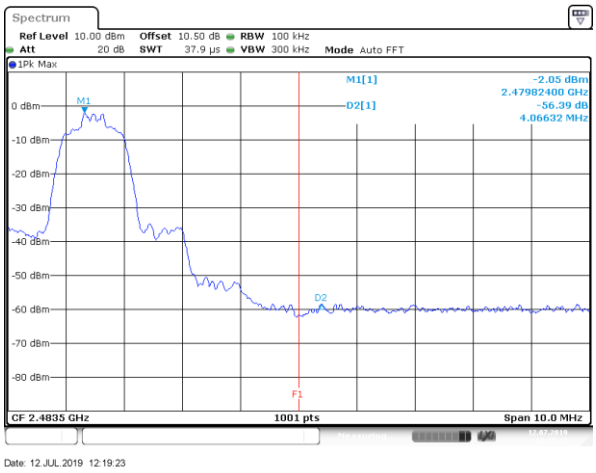
BR-1Mpbs mode (GFSK):

Left Side	Right Side
	

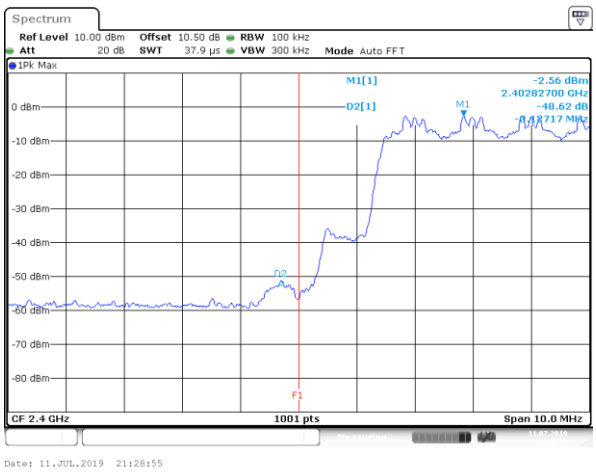
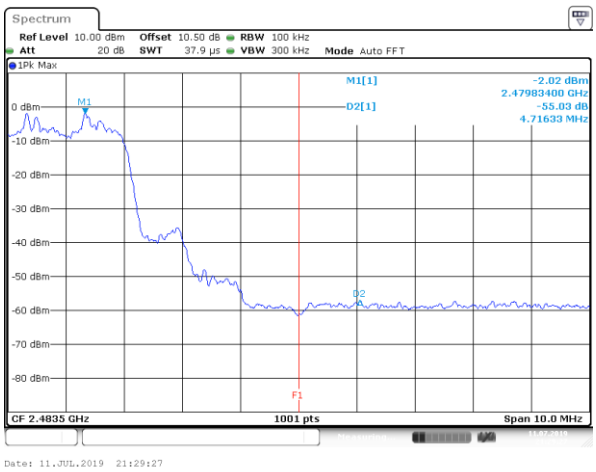
BR-1Mpbs Hopping mode (GFSK):

Left Side	Right Side
	

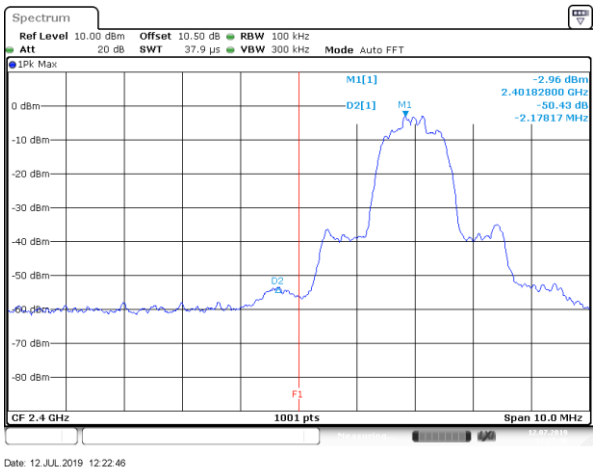
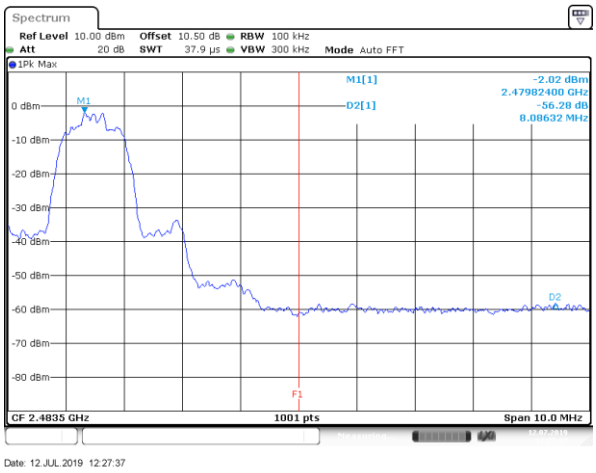
EDR-2Mbps mode (π/4-DQPSK):

Left Side	Right Side
	

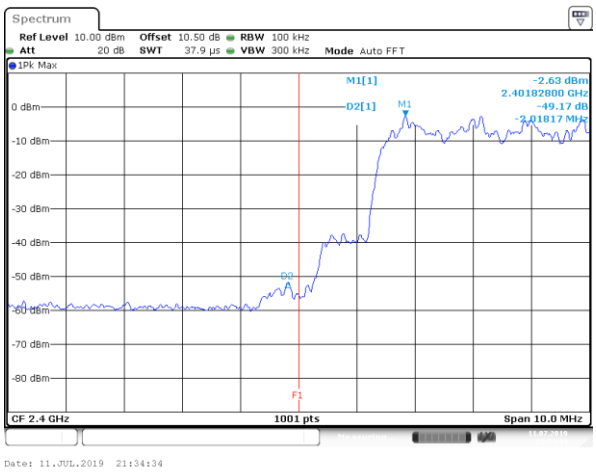
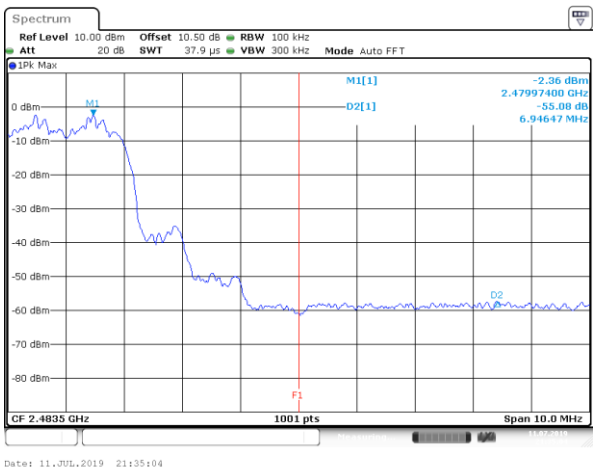
EDR-2Mbps Hopping mode (π/4-DQPSK):

Left Side	Right Side
	

EDR-3Mbps mode (8DPSK):

Left Side	Right Side
	

EDR-3Mbps Hopping mode (8DPSK):

Left Side	Right Side
	

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