



TESTING LABORATORY
CERTIFICATE#4323.01



FCC PART 15.247 TEST REPORT

For

Shanghai Sunmi Technology Co.,Ltd.

Room 605, Block 7, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai 200433
China

FCC ID: 2AH25T2SW

Report Type: Original Report	Product Type: POS System
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Report Number:	RKSA200804002-00B
Report Date:	2020-10-15
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Shanghai Sunmi Technology Co.,Ltd.
Product Type:	POS System
Tested Model:	L1563, L1573
Series Model:	L1562, L1561, L1572, L1571
Model Difference	See Declaration of Similarity
Power Supply:	DC 24.0V from Adapter
RF Function:	Classic BT
Operating Band/Frequency:	2402-2480 MHz
Channel Number:	79
Channel Separation:	1 MHz
Modulation Type:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Type:	L1563: PCB Antenna; L1573: PCB Antenna
*Maximum Antenna Gain:	L1563:2.19 dBi; L1573:1.14 dBi

Adapter1 information (L1563/L1562/L1561) : *Adapter2 information (L1573/L1572/L1571) :*
Model: CYSE65-240250 *Model: CYZS36-240150*
Input: AC 100V-240V, 50/60Hz, 1.7A *Input: AC 100V-240V, 50/60Hz, 1.5A*
Output: DC 24.0V, 2.5A, 60.0W *Output: DC 24.0V, 1.5A*

Note1: The Maximum Antenna Gain was declared by the manufacturer.

Note2: According to product differences, choose model L1563 and L1573 for full test.

**All measurement and test data in this report was gathered from production sample serial number: 20200804002. (Assigned by the BACL. The EUT supplied by the applicant was received on 2020-08-04)*

Objective

This test report is prepared on behalf of *Shanghai Sunmi Technology Co.,Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine Compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AH25T2SW
 FCC Part 15.407 NII submissions with FCC ID: 2AH25T2SW
 FCC Part 15B JAB submissions with FCC ID: 2AH25T2SW

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01), the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	...	...
...	...	...	...
...	...	78	2480
39	2441	/	/

EUT was tested with Channel 0, 39 and 78.

For Conducted Test:

Based on the same RF electrical parameters of all models, the model of L1563 was selected for testing.

For Radiated Test:

Based on the same RF electrical parameters except for antennas gains, the models of L1563 and L1573 were selected for testing.

EUT Exercise Software

RF test software: QRCT3

GFSK, $\pi/4$ -DQPSK, 8DPSK Power level: 9.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

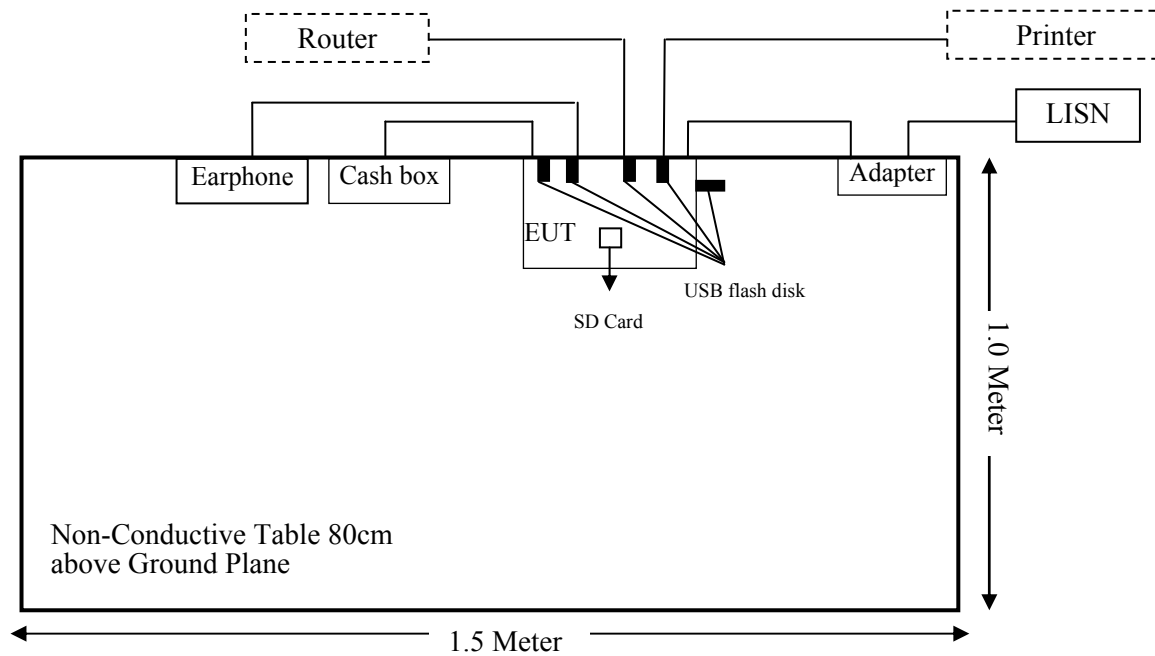
Manufacturer	Description	Model	Serial Number
Shanghai Sunmi Technology Co.,Ltd.	Cash Box	/	/
TP-LINK	Router	EC26CA652860	1153150000000
/	Printer	/	/
/	Earphone	/	/
Sandisk	USB flash disk	/	/
Sandisk	SD card	SDSQUNC-032G-ZN6MA	/

External I/O Cable

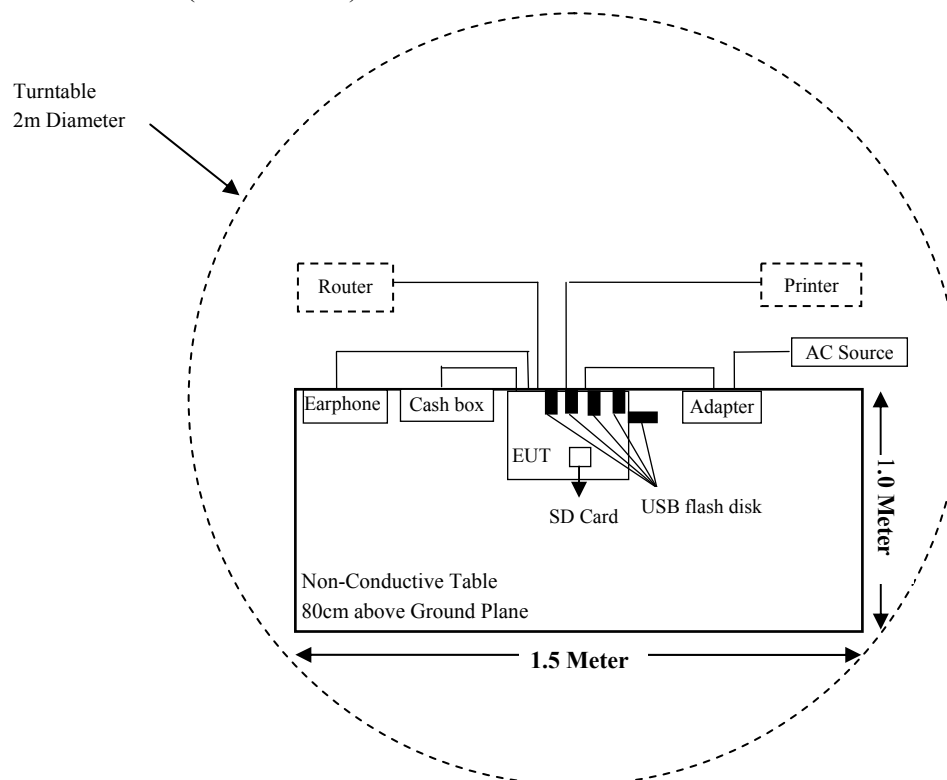
Cable Description	Shielding Type	Length (m)	From Port	To
RJ11 Cable	Un-shielding	0.5	EUT	Cash Box
USB Cable	Un-shielding	1.0	EUT	Adapter
Power Cable	Un-shielding	1.0	Adapter	LISN/AC Source
Audio Cable	Un-shielding	1.0	EUT	Earphone
Data Cable	Un-shielding	10	EUT	Printer
RJ45 Cable	Un-shielding	1.0	EUT	Router

Block Diagram of Test Setup**For model: L1563**

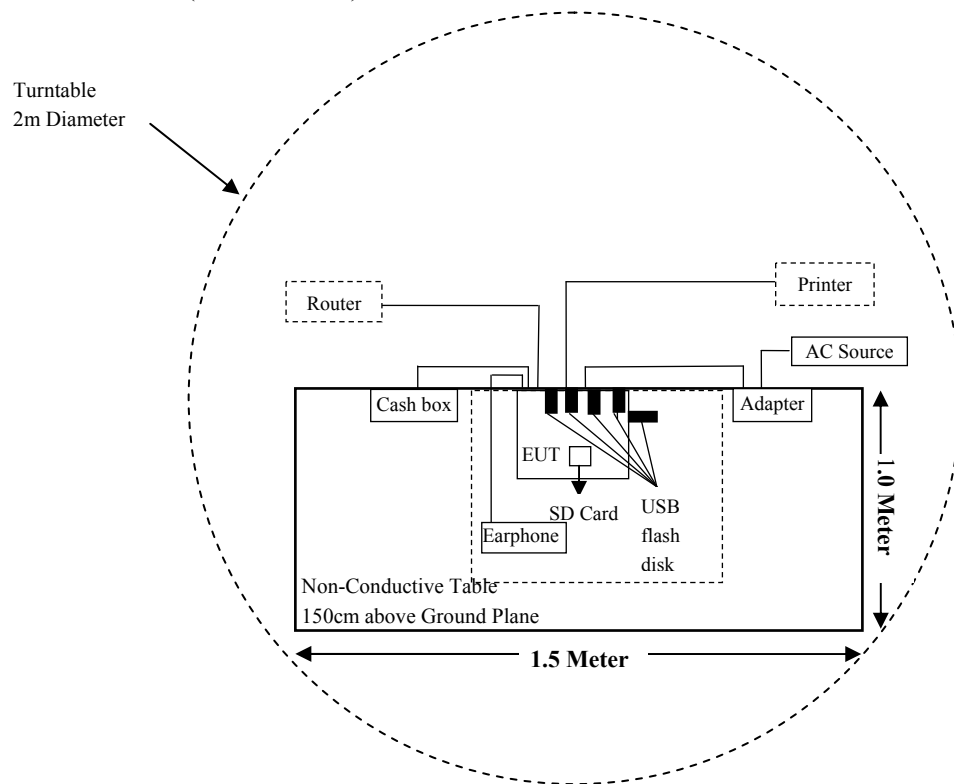
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):

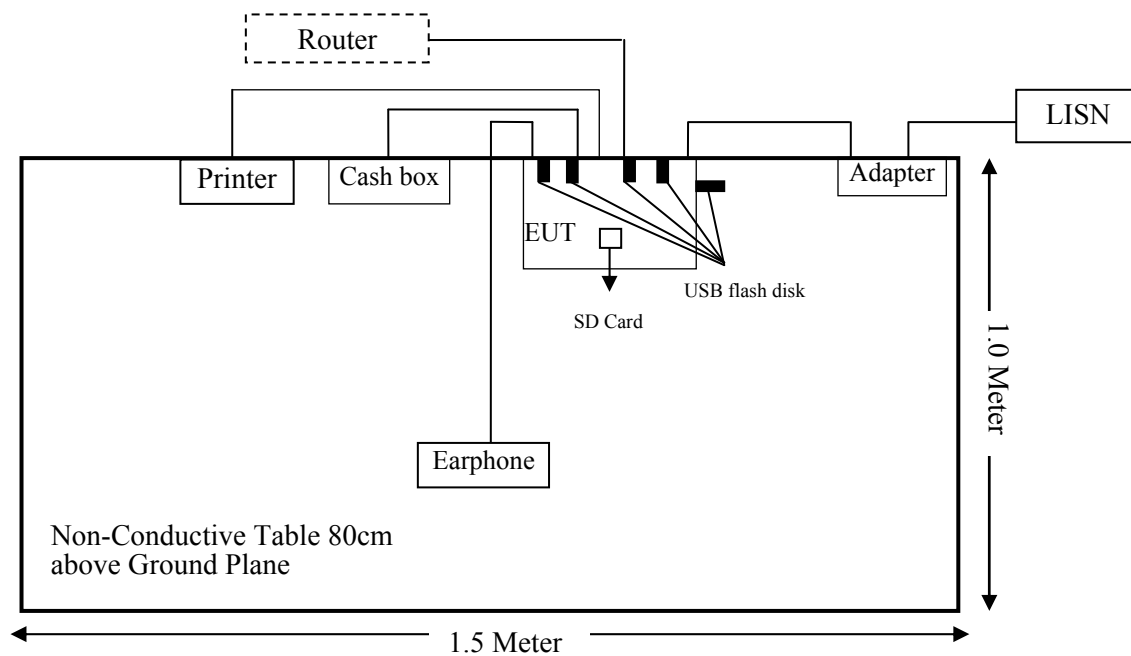


For Radiated Emissions (Above 1GHz):

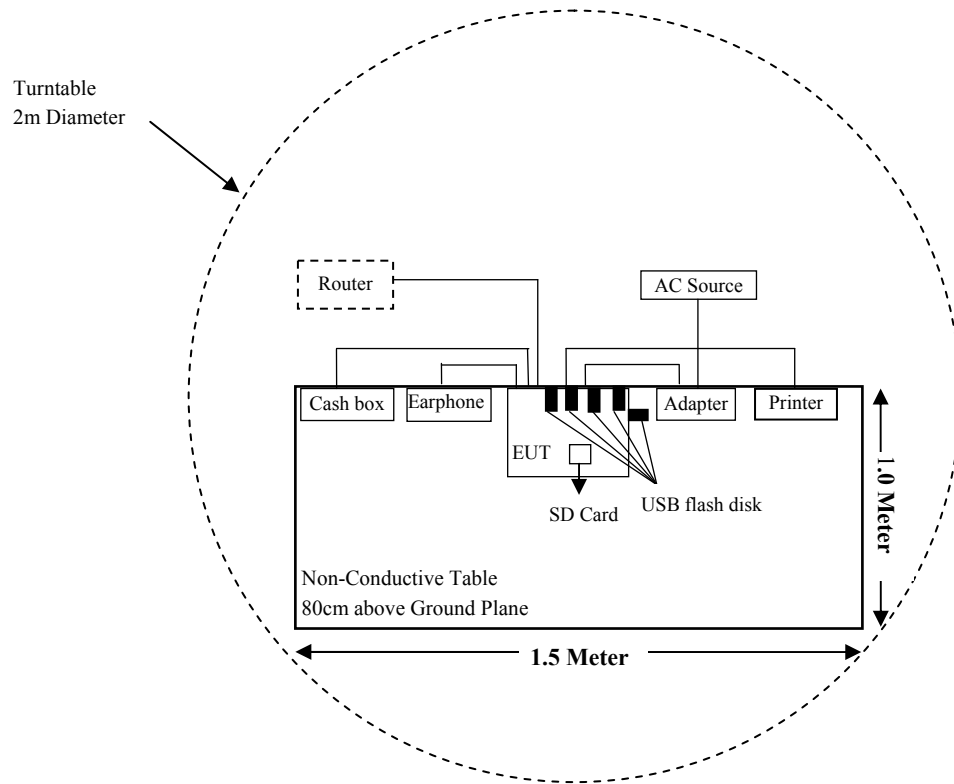


For model: L1573

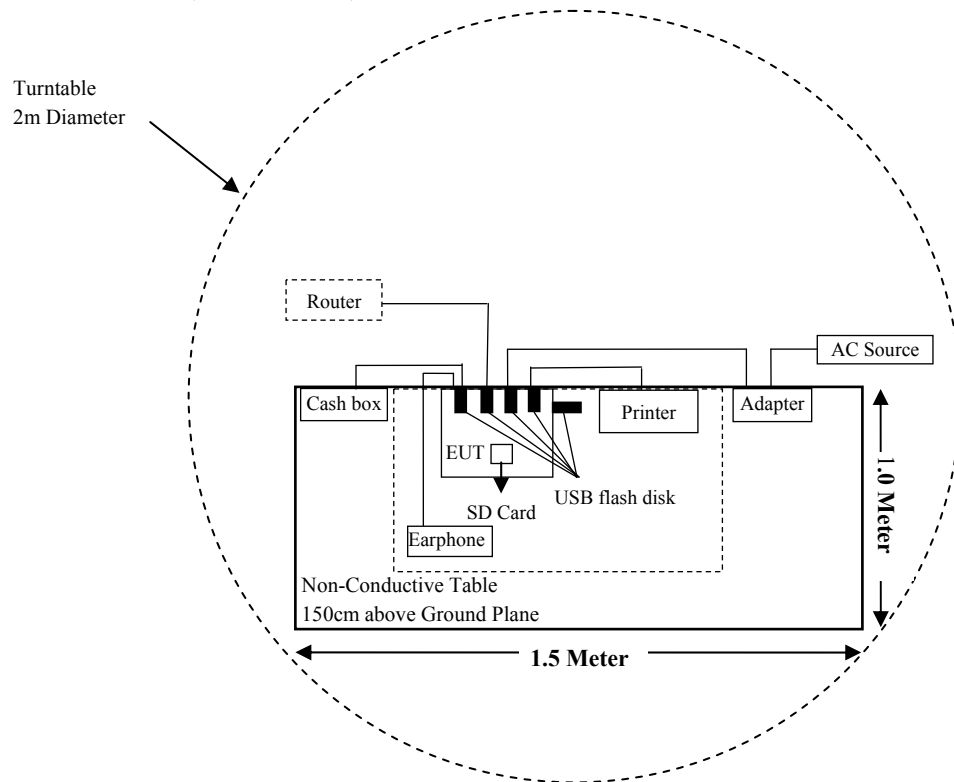
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (I), §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Emissions & Restricted Bands Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-12-14	2020-12-13
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2017-12-26	2020-12-25
Sonoma Instrument	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2020-04-01	2021-03-31
ETS-LINDGREN	Horn Antenna	3115	6229	2020-01-10	2023-01-09
ETS-LINDGREN	Horn Antenna	3116	00084159	2019-10-18	2022-10-17
A.H.Systems,inc	Amplifier	PAM-0118P	512	2020-02-20	2021-02-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2020-03-22	2021-03-21
MICRO-TRONICS	Band Reject Filter	BRM50702	G024	2020-08-05	2021-08-04
Narda	Attenuator	10dB	010	2020-08-15	2021-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-12-12	2020-12-11
MICRO-COAX	Coaxial Cable	Cable-11	011	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2020-08-15	2021-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2019-12-14	2020-12-13
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2020-08-05	2021-08-04
Rohde & Schwarz	EMI Test Receiver	ESIB26	100146	2019-12-14	2020-12-13
Narda	Attenuator	10dB	010	2020-08-15	2021-08-14
Sunmi	RF Cable	Sunmi 01	C01	Each Time	/
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2020-08-05	2021-08-04
Rohde & Schwarz	LISN	ENV216	3560655016	2019-11-30	2020-11-29
Audix	Test Software	e3	V9	--	--
Rohde & Schwarz	Pulse limiter	ESH3-Z2	0357.8810.54	2020-08-10	2021-08-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2020-08-15	2021-08-14

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	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

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

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);

Calculated Data (worst case):**Model: L1563****2.4G Wi-Fi/BLE/BT:**

Mode	Frequency Range (MHz)	Maximum Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412-2462	2.19	1.66	23.00	199.53	20	0.0659	1.0
802.11g		2.19	1.66	24.00	251.19	20	0.0829	1.0
802.11n-HT20		2.19	1.66	24.00	251.19	20	0.0829	1.0
802.11n-HT40	2422-2452	2.19	1.66	23.50	223.87	20	0.0739	1.0
BLE (1Mbps)	2402-2480	2.19	1.66	0.50	1.12	20	0.0004	1.0
BLE (2Mbps)	2402-2480	2.19	1.66	1.00	1.26	20	0.0004	1.0
BT	2402-2480	2.19	1.66	9.50	8.91	20	0.0029	1.0

5G Wi-Fi:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
802.11a	5150~5250	0.05	1.01	18.50	70.79	20	0.0142	1.0
	5725~5850	0.05	1.01	21.00	125.89	20	0.0253	1.0
802.11ac20	5150~5250	0.05	1.01	20.50	112.20	20	0.0225	1.0
	5725~5850	0.05	1.01	23.00	199.53	20	0.0401	1.0
802.11n20	5150~5250	0.05	1.01	20.50	112.20	20	0.0225	1.0
	5725~5850	0.05	1.01	23.00	199.53	20	0.0401	1.0
802.11ac40	5150~5250	0.05	1.01	16.00	39.81	20	0.0080	1.0
	5725~5850	0.05	1.01	22.50	177.83	20	0.0357	1.0
802.11n40	5150~5250	0.05	1.01	16.00	39.81	20	0.0080	1.0
	5725~5850	0.05	1.01	22.50	177.83	20	0.0357	1.0
802.11ac80	5150~5250	0.05	1.01	10.50	11.22	20	0.0023	1.0
	5725~5850	0.05	1.01	23.00	199.53	20	0.0401	1.0

Note: 1. The tune up power were declared by the manufacturer.

2. Wi-Fi and BT/BLE can't transmit simultaneously.

3. For 802.11b, 802.11g, 802.11a, the tune-up power is base on SISO mode
For 802.11ac20/n20/n40/ac40/ac80, the tune-up power is base on MIMO mode**Result:** The device meet FCC MPE at 20 cm distance.

Model: L1573**2.4G Wi-Fi/BLE/BT:**

Mode	Frequency Range (MHz)	Maximum Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412-2462	1.14	1.30	23.00	199.53	20	0.0516	1.0
802.11g		1.14	1.30	24.00	251.19	20	0.0650	1.0
802.11n-HT20		1.14	1.30	24.00	251.19	20	0.0650	1.0
802.11n-HT40	2422-2452	1.14	1.30	23.50	223.87	20	0.0579	1.0
BLE (1Mbps)	2402-2480	1.14	1.30	0.50	1.12	20	0.0003	1.0
BLE (2Mbps)	2402-2480	1.14	1.30	1.00	1.26	20	0.0003	1.0
BT	2402-2480	1.14	1.30	9.50	8.91	20	0.0023	1.0

5G Wi-Fi:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
802.11a	5150~5250	1.57	1.44	18.50	70.79	20	0.0203	1.0
	5725~5850	1.57	1.44	21.00	125.89	20	0.0361	1.0
802.11ac20	5150~5250	1.57	1.44	20.50	112.20	20	0.0321	1.0
	5725~5850	1.57	1.44	23.00	199.53	20	0.0570	1.0
802.11n20	5150~5250	1.57	1.44	20.50	112.20	20	0.0321	1.0
	5725~5850	1.57	1.44	23.00	199.53	20	0.0570	1.0
802.11ac40	5150~5250	1.57	1.44	16.00	39.81	20	0.0114	1.0
	5725~5850	1.57	1.44	22.50	177.83	20	0.0509	1.0
802.11n40	5150~5250	1.57	1.44	16.00	39.81	20	0.0114	1.0
	5725~5850	1.57	1.44	22.50	177.83	20	0.0509	1.0
802.11ac80	5150~5250	1.57	1.44	10.50	11.22	20	0.0032	1.0
	5725~5850	1.57	1.44	23.00	199.53	20	0.0570	1.0

- Note:** 1. The tune up power were declared by the manufacturer.
 2. Wi-Fi and BT/BLE can't transmit simultaneously.
 3. For 802.11b, 802.11g, 802.11a, the tune-up power is base on SISO mode
 For 802.11ac20/n20/n40/ac40/ac80, the tune-up power is base on MIMO mode

Result: The device meet FCC MPE at 20 cm distance.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT (model: L1563) has an internal PCB antenna for Bluetooth, which the antenna gain is 2.19 dBi, fulfill the requirement of this section; The EUT (model: L1573) has an internal PCB antenna for Bluetooth, which the antenna gain is 1.14 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

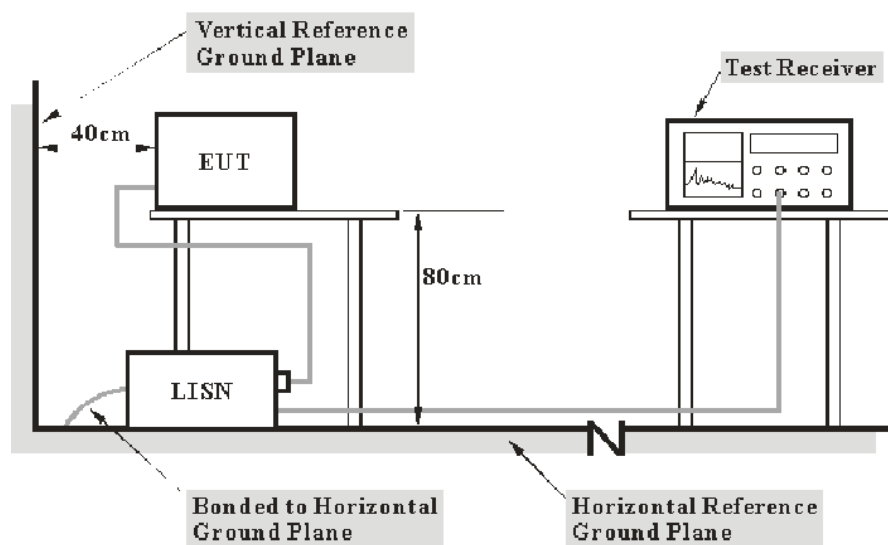
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



- 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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

EMI Test Receiver Setup

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	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

ANSI C63.10-2013 clause 6.2

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.

Factor & Margin Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation (dB). The basic equation is as follows:

$$\text{Factor (dB)} = \text{LISN VDF (dB)} + \text{Cable Loss (dB)} + \text{Transient Limiter Attenuation (dB)}$$

The “**Over Limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over Limit of 7dB means the emission is 7 dB above the limit. The equation for over Limit calculation is as follows:

$$\text{Over Limit (dB)} = \text{Read level (dB}\mu\text{V)} + \text{Factor (dB)} - \text{Limit (dB}\mu\text{V)}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

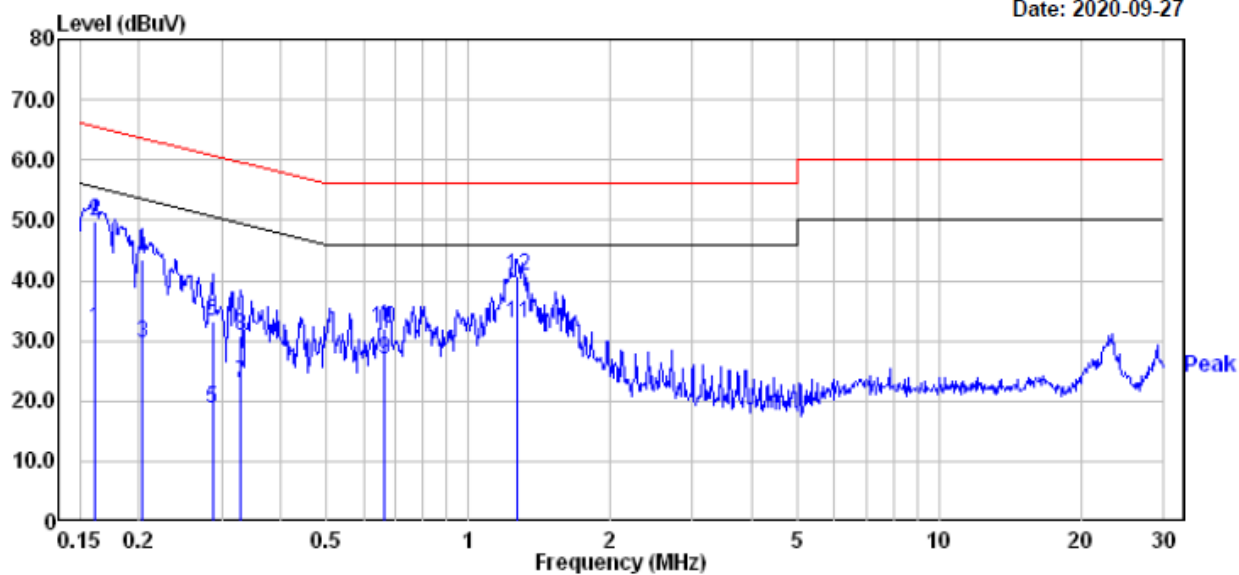
Temperature:	24.6-25.2 °C
Relative Humidity:	46-50 %
ATM Pressure:	101.3-101.6 kPa

The testing was performed by CK Huang from 2020-09-03 to 2020-09-27.

EUT operation mode: Transmitting in low channel of GFSK mode (Worst case)

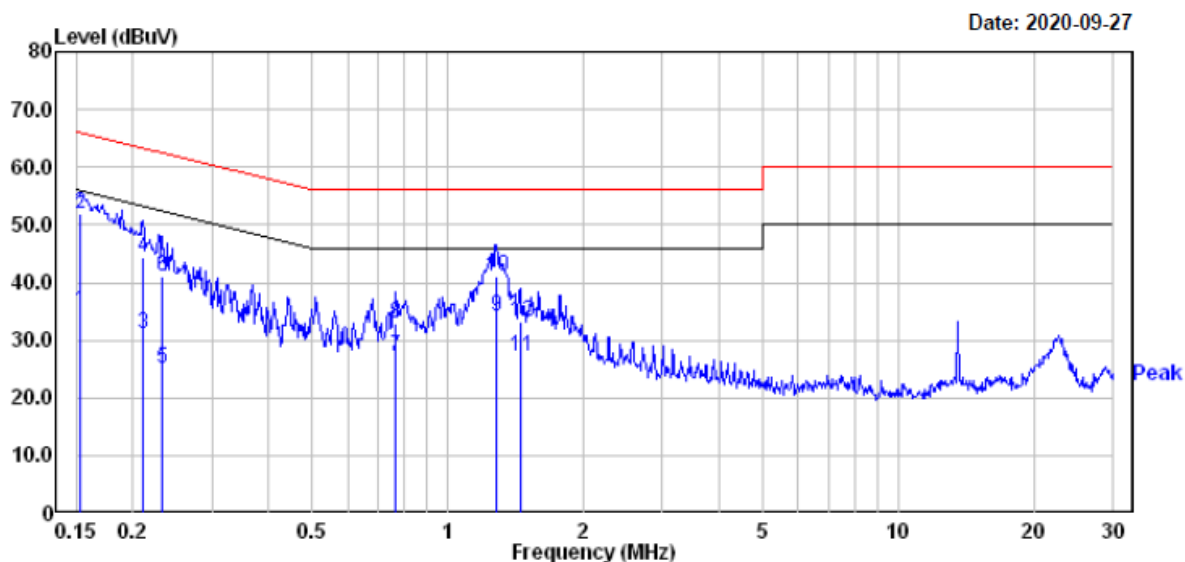
Model: L1563**AC 120V/60 Hz, Line**

Date: 2020-09-27

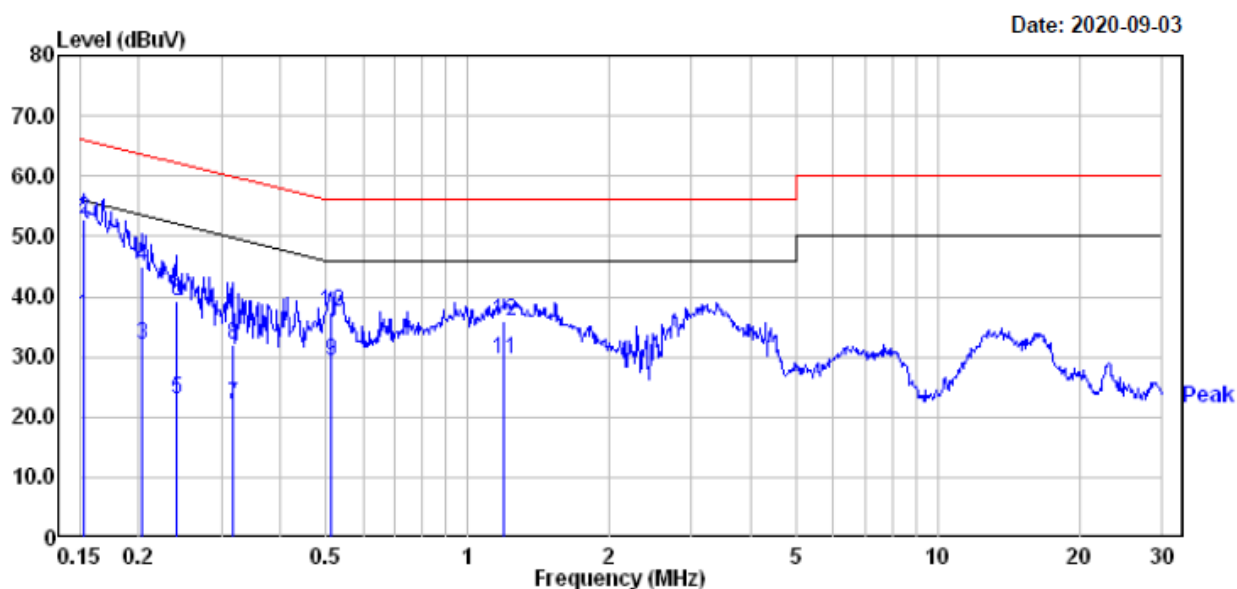


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.162	12.10	19.83	31.93	55.38	-23.45	Average
2	0.162	29.90	19.83	49.73	65.38	-15.65	QP
3	0.203	9.70	19.82	29.52	53.49	-23.97	Average
4	0.203	23.80	19.82	43.62	63.49	-19.87	QP
5	0.286	-1.00	19.82	18.82	50.63	-31.81	Average
6	0.286	13.40	19.82	33.22	60.63	-27.41	QP
7	0.329	2.99	19.82	22.81	49.49	-26.68	Average
8	0.329	10.89	19.82	30.71	59.49	-28.78	QP
9	0.661	7.10	19.75	26.85	46.00	-19.15	Average
10	0.661	12.20	19.75	31.95	56.00	-24.05	QP
11	1.269	13.10	19.82	32.92	46.00	-13.08	Average
12	1.269	21.00	19.82	40.82	56.00	-15.18	QP

AC 120V/60 Hz, Neutral

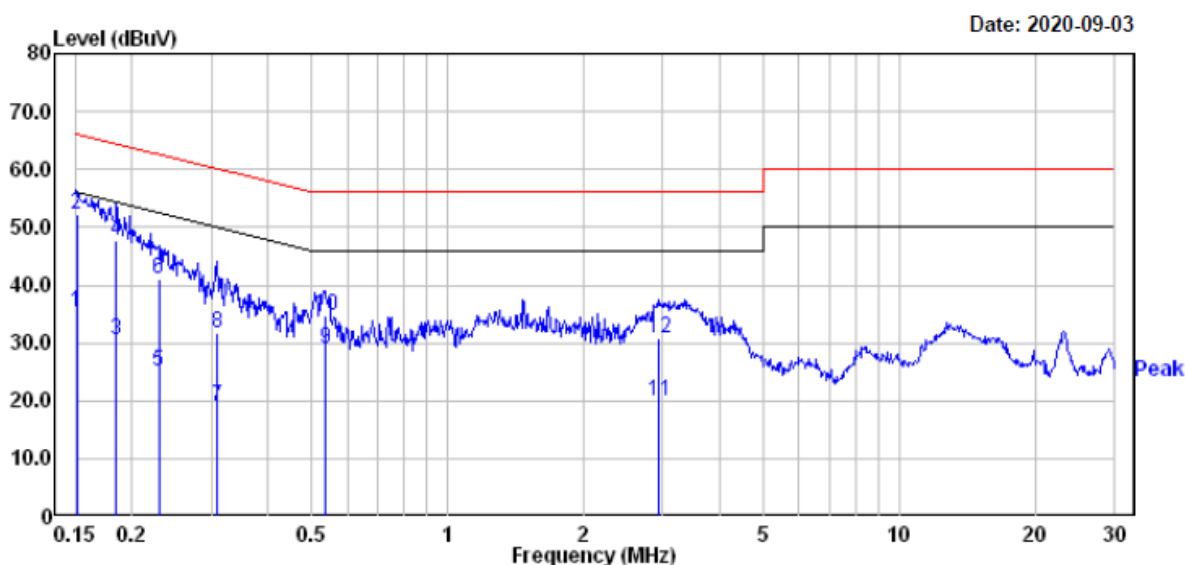


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.152	15.10	19.82	34.92	55.87	-20.95	Average
2	0.152	32.20	19.82	52.02	65.87	-13.85	QP
3	0.211	11.40	19.82	31.22	53.18	-21.96	Average
4	0.211	24.70	19.82	44.52	63.18	-18.66	QP
5	0.233	5.30	19.82	25.12	52.35	-27.23	Average
6	0.233	21.30	19.82	41.12	62.35	-21.23	QP
7	0.767	7.40	19.72	27.12	46.00	-18.88	Average
8	0.767	13.20	19.72	32.92	56.00	-23.08	QP
9	1.282	14.20	19.82	34.02	46.00	-11.98	Average
10	1.282	21.20	19.82	41.02	56.00	-14.98	QP
11	1.449	7.40	19.84	27.24	46.00	-18.76	Average
12	1.449	13.50	19.84	33.34	56.00	-22.66	QP

Model: L1573**AC 120V/60 Hz, Line**

		Read			Limit	Over	
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.152	17.10	19.82	36.92	55.87	-18.95	Average
2	0.152	32.90	19.82	52.72	65.87	-13.15	QP
3	0.203	12.10	19.82	31.92	53.49	-21.57	Average
4	0.203	25.20	19.82	45.02	63.49	-18.47	QP
5	0.240	3.20	19.82	23.02	52.08	-29.06	Average
6	0.240	19.50	19.82	39.32	62.08	-22.76	QP
7	0.318	2.20	19.82	22.02	49.75	-27.73	Average
8	0.318	12.10	19.82	31.92	59.75	-27.83	QP
9	0.513	9.60	19.76	29.36	46.00	-16.64	Average
10	0.513	17.80	19.76	37.56	56.00	-18.44	QP
11	1.197	9.90	19.81	29.71	46.00	-16.29	Average
12	1.197	16.20	19.81	36.01	56.00	-19.99	QP

AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.151	15.50	19.82	35.32	55.96	-20.64	Average
2	0.151	32.50	19.82	52.32	65.96	-13.64	QP
3	0.184	10.61	19.82	30.43	54.28	-23.85	Average
4	0.184	27.81	19.82	47.63	64.28	-16.65	QP
5	0.229	5.20	19.82	25.02	52.48	-27.46	Average
6	0.229	21.10	19.82	40.92	62.48	-21.56	QP
7	0.310	-0.71	19.83	19.12	49.97	-30.85	Average
8	0.310	11.79	19.83	31.62	59.97	-28.35	QP
9	0.535	9.31	19.75	29.06	46.00	-16.94	Average
10	0.535	15.01	19.75	34.76	56.00	-21.24	QP
11	2.946	0.60	19.46	20.06	46.00	-25.94	Average
12	2.946	11.20	19.46	30.66	56.00	-25.34	QP

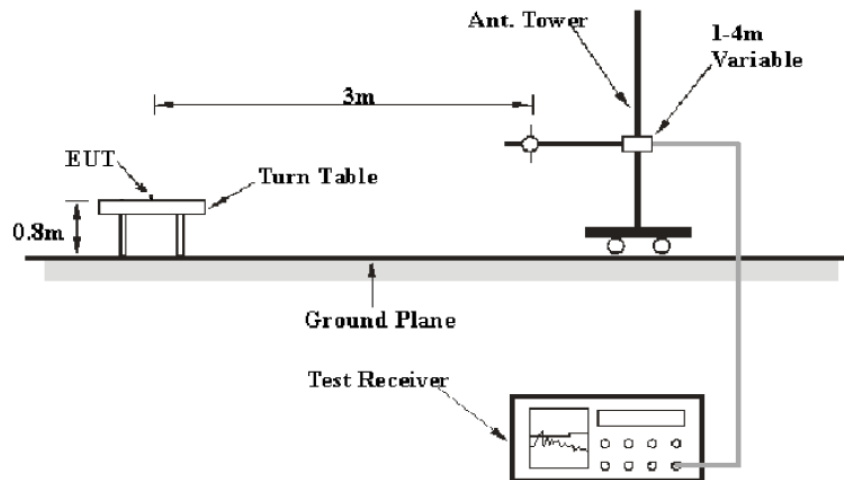
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

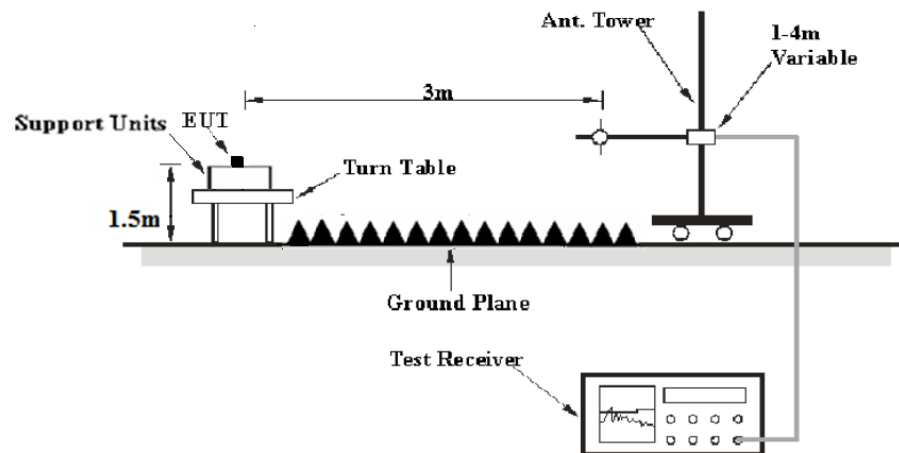
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dB μ V /m) = Meter Reading (dB μ V) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The “**Margin**” column of the following data tables indicates the degree of Compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V /m)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

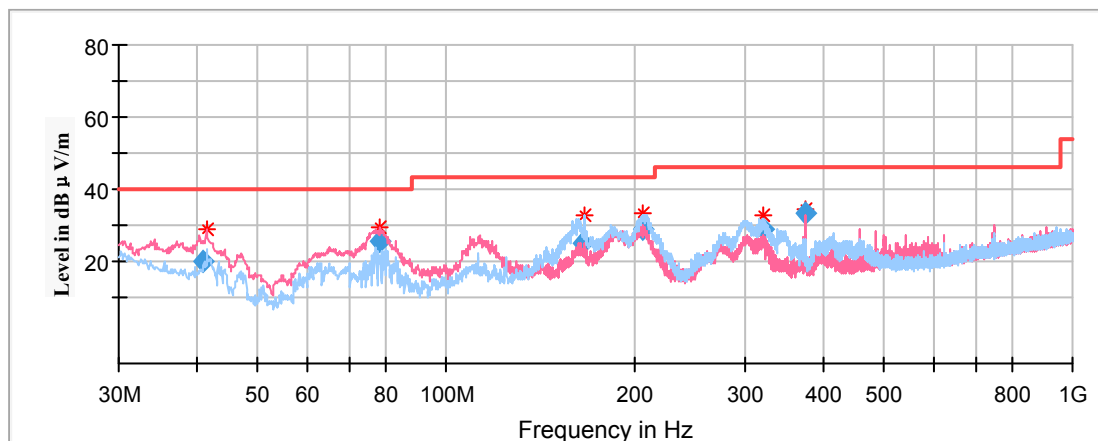
Temperature:	24.8~25 °C
Relative Humidity:	49 ~50 %
ATM Pressure:	101.1 ~101.2 kPa

The testing was performed by CK Huang from 2020-09-02 to 2020-10-11.

EUT operation mode: Transmitting

Model: L1563**Spurious Emission Test:****30MHz-1GHz:**

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case low channel of GFSK Mode in Z-axis of orientation was recorded



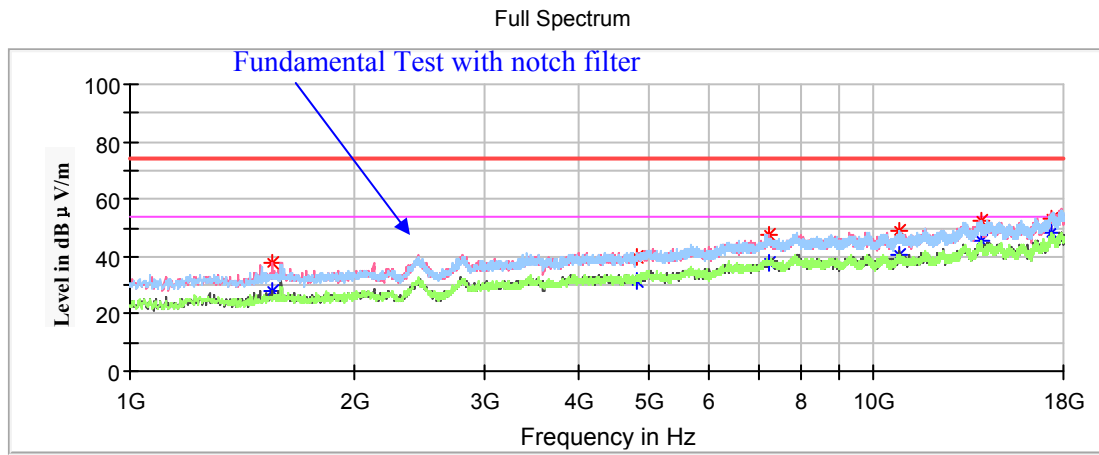
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	Quasi-peak (dBμV/m)	Height (cm)	Polar (H/V)				
41.009800	20.44	100.0	V	87.0	-18.6	40.00	19.56
78.090800	25.67	100.0	V	250.0	-23.9	40.00	14.33
165.648100	25.18	200.0	H	103.0	-19.0	43.50	18.32
206.585250	28.94	200.0	H	135.0	-18.1	43.50	14.56
320.750750	28.95	100.0	H	169.0	-16.5	46.00	17.05
374.280050	33.46	100.0	V	180.0	-15.2	46.00	12.54

1GHz-18GHz:

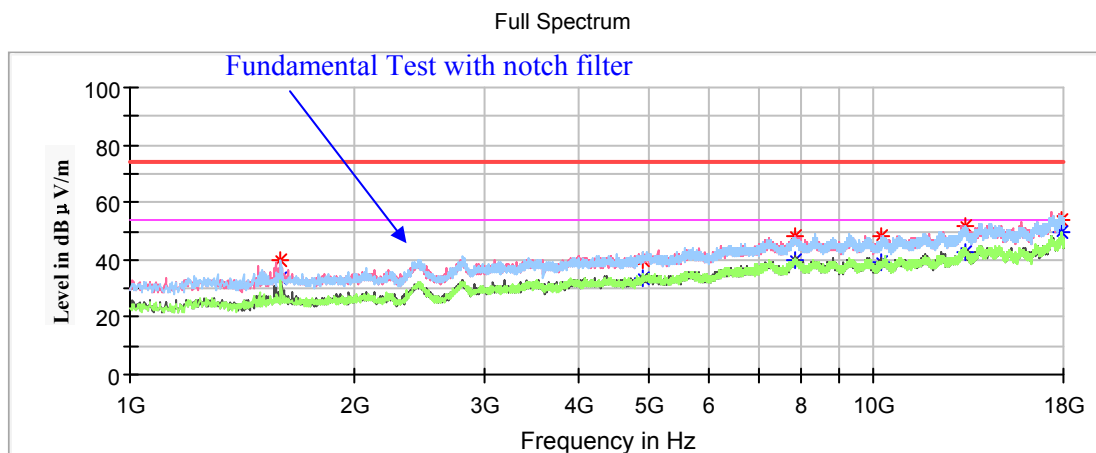
*Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case **GFSK Mode in Z-axis of orientation** was recorded*

Note:

1. This test was performed with the 2.4-2.5 GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
 Corrected Amplitude (dB μ V/m) = Corrected Factor (dB/m) + Reading (dB μ V)
 Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V/m)

Low Channel: 2402MHz

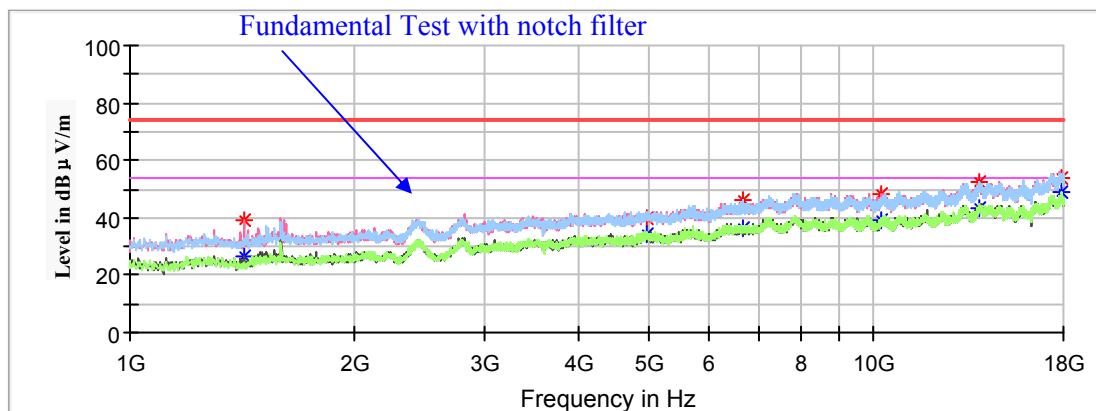
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1554.200000	---	27.87	200.0	V	51.0	-16.2	54.00	26.13
1554.200000	37.85	---	200.0	V	51.0	-16.2	74.00	36.15
4804.000000	---	31.79	200.0	V	354.0	-5.6	54.00	22.21
4804.000000	39.94	---	200.0	V	354.0	-5.6	74.00	34.06
7206.000000	---	37.84	150.0	V	25.0	0.5	54.00	16.16
7206.000000	47.62	---	150.0	V	25.0	0.5	74.00	26.38
10820.900000	---	40.37	200.0	H	63.0	2.7	54.00	13.63
10820.900000	49.17	---	200.0	H	63.0	2.7	74.00	24.83
13918.300000	---	45.47	150.0	H	37.0	6.1	54.00	8.53
13918.300000	52.68	---	150.0	H	37.0	6.1	74.00	21.32
17374.400000	53.20	---	200.0	V	281.0	8.5	74.00	20.80
17374.400000	---	48.44	200.0	V	281.0	8.5	54.00	5.56

Middle Channel: 2441MHz

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1596.700000	---	33.89	200.0	V	245.0	-16.0	54.00	20.11
1596.700000	39.72	---	200.0	V	245.0	-16.0	74.00	34.28
4882.000000	---	33.30	200.0	H	257.0	-5.4	54.00	20.70
4882.000000	39.67	---	200.0	H	257.0	-5.4	74.00	34.33
7837.400000	---	40.17	200.0	H	141.0	1.6	54.00	13.83
7837.400000	48.39	---	200.0	H	141.0	1.6	74.00	25.61
10231.000000	---	39.47	200.0	H	244.0	2.1	54.00	14.53
10231.000000	48.22	---	200.0	H	244.0	2.1	74.00	25.78
13241.700000	---	42.64	150.0	V	186.0	5.4	54.00	11.36
13241.700000	51.96	---	150.0	V	186.0	5.4	74.00	22.04
17898.000000	53.87	---	200.0	H	97.0	8.8	74.00	20.13
17898.000000	---	49.34	200.0	H	97.0	8.8	54.00	4.66

High Channel: 2480MHz

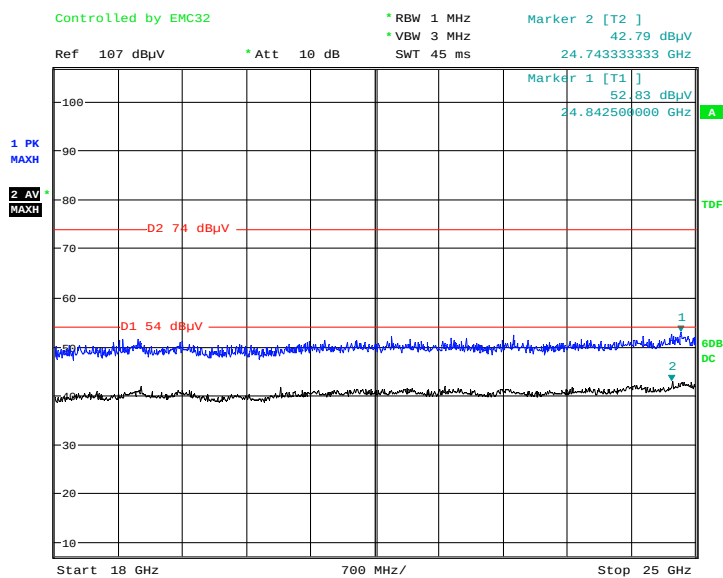
Full Spectrum



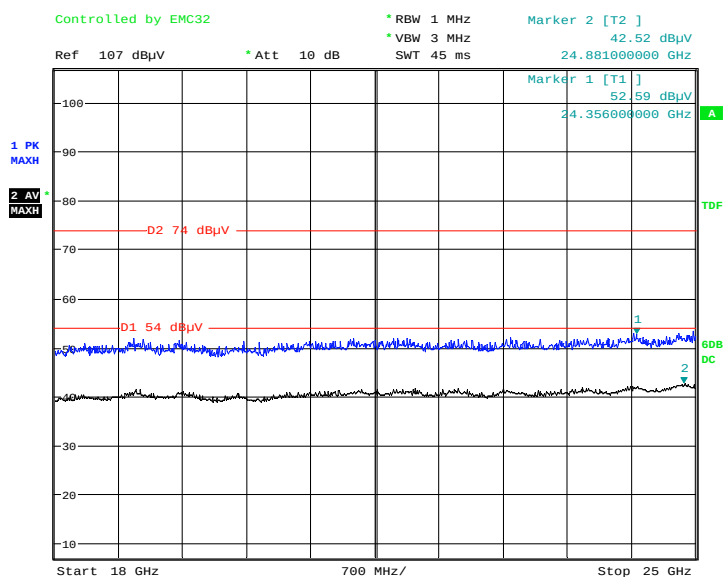
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1423.300000	---	26.80	200.0	V	250.0	-16.8	54.00	27.20
1423.300000	39.12	---	200.0	V	250.0	-16.8	74.00	34.88
4960.000000	---	33.96	200.0	V	350.0	-5.3	54.00	20.04
4960.000000	40.20	---	200.0	V	350.0	-5.3	74.00	33.80
6678.000000	---	36.37	150.0	V	76.0	-0.8	54.00	17.63
6678.000000	46.12	---	150.0	V	76.0	-0.8	74.00	27.88
10239.500000	---	38.95	200.0	V	289.0	2.1	54.00	15.05
10239.500000	48.37	---	200.0	V	289.0	2.1	74.00	25.63
13906.400000	---	43.01	200.0	H	51.0	6.1	54.00	10.99
13906.400000	52.25	---	200.0	H	51.0	6.1	74.00	21.75
17918.400000	53.93	---	150.0	H	6.0	8.8	74.00	20.07
17918.400000	---	48.79	150.0	H	6.0	8.8	54.00	5.21

18GHz-25GHz:

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case low channel of GFSK Mode in Z-axis of orientation was recorded

Horizontal

Date: 27.SEP.2020 20:54:20

Vertical

Date: 27.SEP.2020 20:05:00

Fundamental Test & Restricted Bands Emissions:

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case GFSK Mode in Z-axis of orientation was recorded

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)

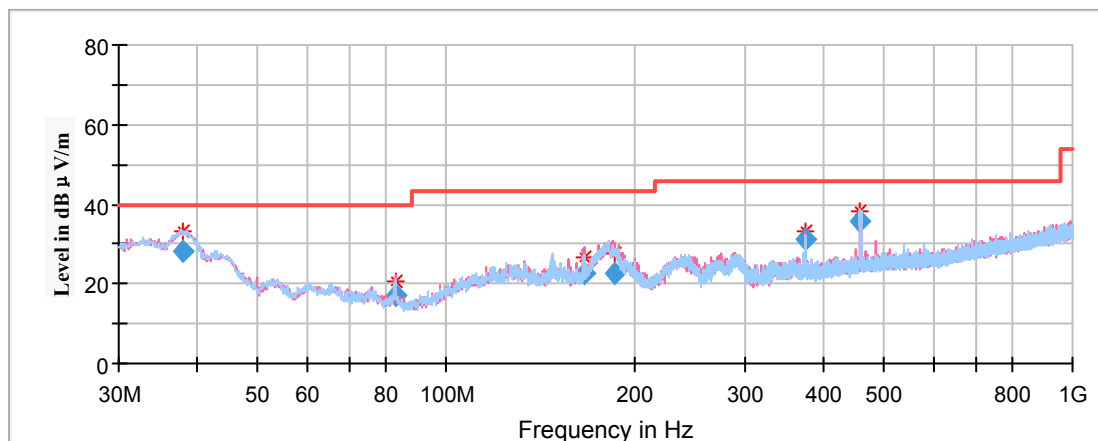
Corrected Amplitude (dB μ V /m) = Corrected Factor (dB/m) + Reading (dB μ V)

Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2390.00	55.42	---	200.0	V	53.0	-2.9	74.00	18.58
2390.00	---	50.18	200.0	V	53.0	-2.9	54.00	3.82
High Channel: 2480MHz								
2483.50	55.30	---	200.0	V	63.0	-2.5	74.00	18.70
2483.50	---	48.37	200.0	V	63.0	-2.5	54.00	5.63

Model: L1573**Spurious Emission Test:****30MHz-1GHz:**

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case low channel of GFSK Mode in Z-axis of orientation was recorded



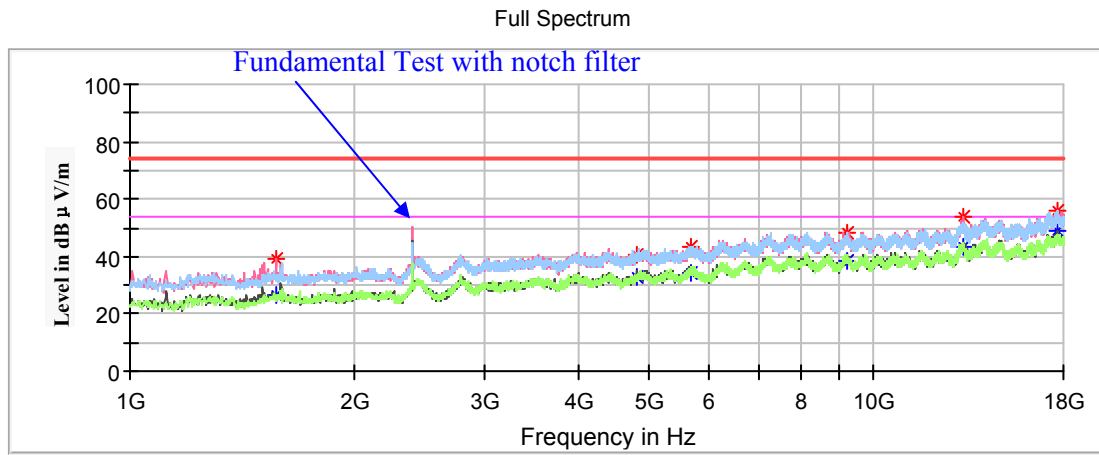
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	Quasi-peak (dBμV/m)	Height (cm)	Polar (H/V)				
37.869500	28.28	200.0	H	307.0	-9.7	40.00	11.72
82.848600	16.86	100.0	V	146.0	-18.1	40.00	23.14
165.714400	22.68	100.0	V	237.0	-13.5	43.50	20.82
185.392600	22.88	100.0	V	243.0	-13.7	43.50	20.62
374.261750	31.39	100.0	V	0.0	-9.2	46.00	14.61
457.450700	35.52	100.0	H	20.0	-7.2	46.00	10.48

1GHz-18GHz:

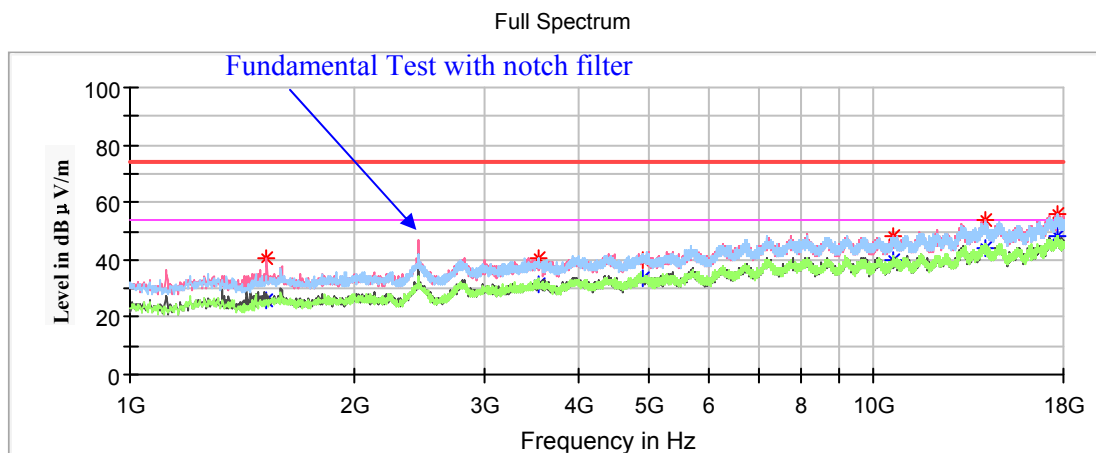
*Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case **GFSK Mode in Z-axis of orientation** was recorded*

Note:

1. This test was performed with the 2.4-2.5 GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
 Corrected Amplitude (dB μ V/m) = Corrected Factor (dB/m) + Reading (dB μ V)
 Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V/m)

Low Channel: 2402MHz

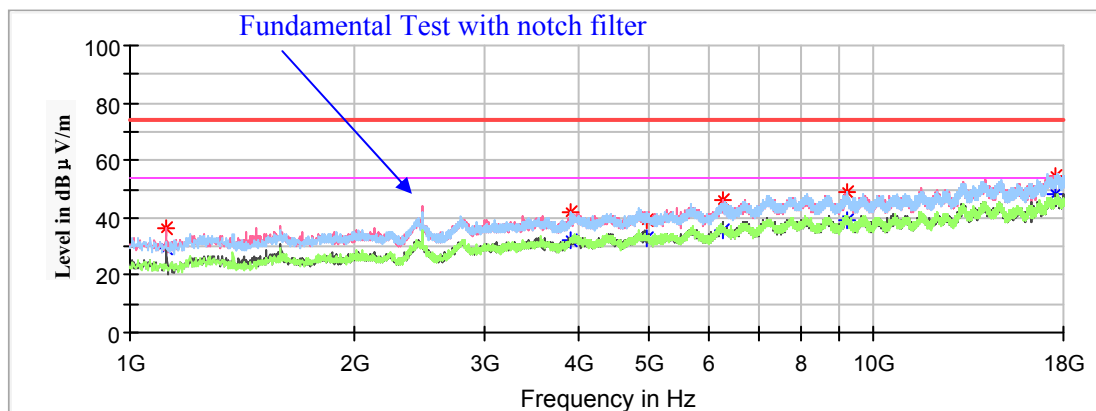
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1574.600000	---	26.89	150.0	V	151.0	-16.1	54.00	27.11
1574.600000	39.01	---	150.0	V	151.0	-16.1	74.00	34.99
4804.000000	---	32.55	150.0	V	88.0	-5.6	54.00	21.45
4804.000000	40.29	---	150.0	V	88.0	-5.6	74.00	33.71
5675.000000	---	33.99	150.0	V	9.0	-3.6	54.00	20.01
5675.000000	43.66	---	150.0	V	9.0	-3.6	74.00	30.34
9199.100000	---	38.31	150.0	V	139.0	2.0	54.00	15.69
9199.100000	48.48	---	150.0	V	139.0	2.0	74.00	25.52
13195.800000	---	43.24	150.0	V	296.0	5.4	54.00	10.76
13195.800000	53.57	---	150.0	V	296.0	5.4	74.00	20.43
17626.000000	55.65	---	150.0	H	357.0	8.9	74.00	18.35
17626.000000	---	48.69	150.0	H	357.0	8.9	54.00	5.31

Middle Channel: 2441MHz

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1528.700000	---	25.84	150.0	V	98.0	-16.3	54.00	28.16
1528.700000	40.42	---	150.0	V	98.0	-16.3	74.00	33.58
3541.500000	---	31.52	150.0	V	22.0	-8.7	54.00	22.48
3541.500000	40.62	---	150.0	V	22.0	-8.7	74.00	33.38
4882.000000	---	33.85	150.0	H	198.0	-5.4	54.00	20.15
4882.000000	39.62	---	150.0	H	198.0	-5.4	74.00	34.38
10640.700000	---	39.69	150.0	V	231.0	2.5	54.00	14.31
10640.700000	48.21	---	150.0	V	231.0	2.5	74.00	25.79
14100.200000	---	43.80	150.0	V	98.0	6.2	54.00	10.20
14100.200000	53.53	---	150.0	V	98.0	6.2	74.00	20.47
17660.000000	---	48.34	150.0	H	287.0	8.9	54.00	5.66
17660.000000	55.73	---	150.0	H	287.0	8.9	74.00	18.27

High Channel: 2480MHz

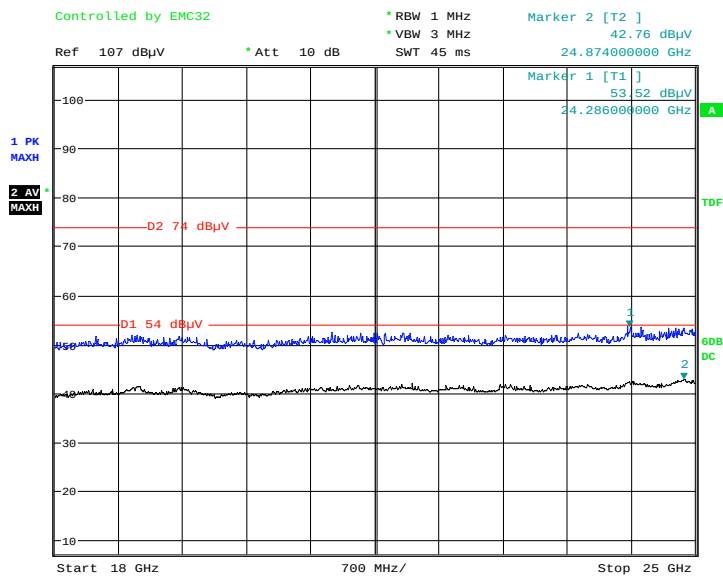
Full Spectrum



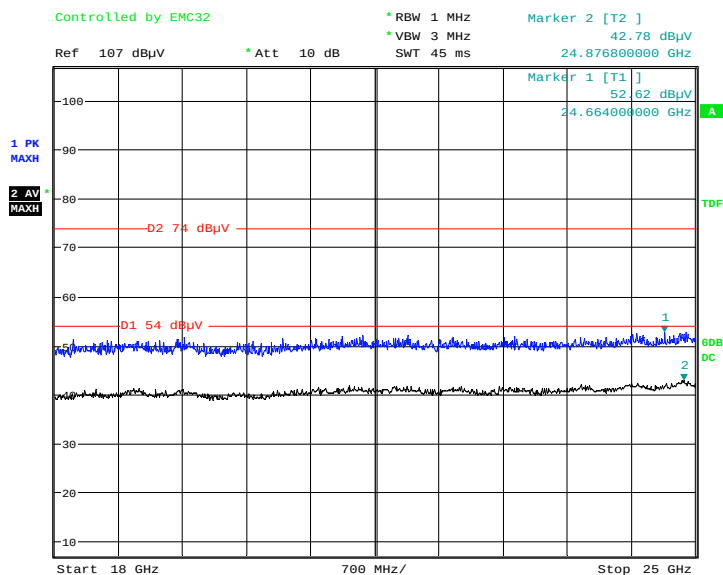
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Height (cm)	Polar (H/V)				
1117.300000	---	29.20	150.0	V	4.0	-18.4	54.00	24.80
1117.300000	36.04	---	150.0	V	4.0	-18.4	74.00	37.96
3918.900000	---	32.50	150.0	H	340.0	-7.3	54.00	21.50
3918.900000	41.89	---	150.0	H	340.0	-7.3	74.00	32.11
4960.000000	---	32.60	150.0	H	304.0	-5.3	54.00	21.40
4960.000000	39.17	---	150.0	H	304.0	-5.3	74.00	34.83
6256.400000	---	35.85	150.0	V	353.0	-2.1	54.00	18.15
6256.400000	45.81	---	150.0	V	353.0	-2.1	74.00	28.19
9190.600000	---	38.94	150.0	V	249.0	2.0	54.00	15.06
9190.600000	49.21	---	150.0	V	249.0	2.0	74.00	24.79
17581.800000	---	48.33	150.0	V	300.0	8.9	54.00	5.67
17581.800000	54.74	---	150.0	V	300.0	8.9	74.00	19.26

18GHz-25GHz:

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case low channel of GFSK Mode in Z-axis of orientation was recorded

Horizontal

Date: 5.OCT.2020 18:00:59

Vertical

Date: 5.OCT.2020 17:42:08

Fundamental Test & Restricted Bands Emissions:

Pre-Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case GFSK Mode in Z-axis of orientation was recorded

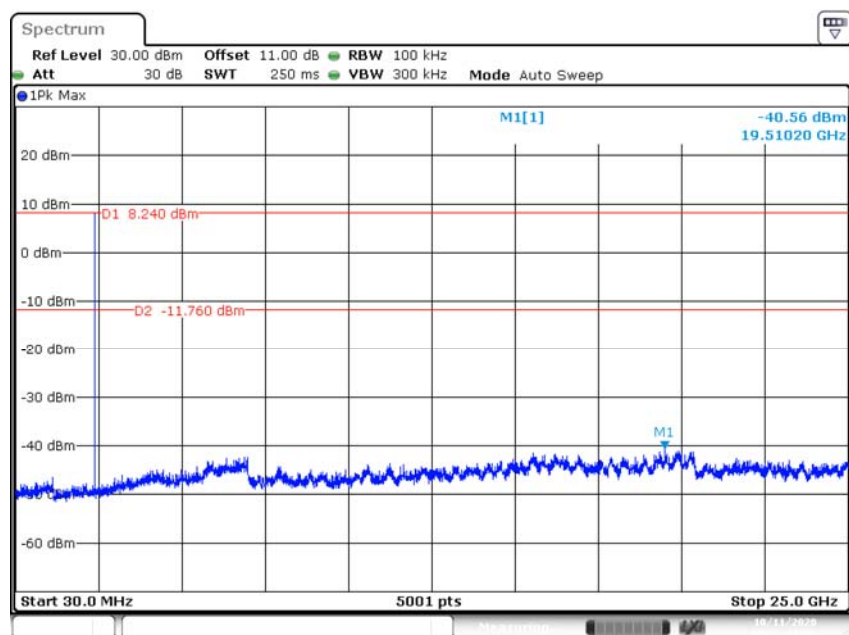
Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)

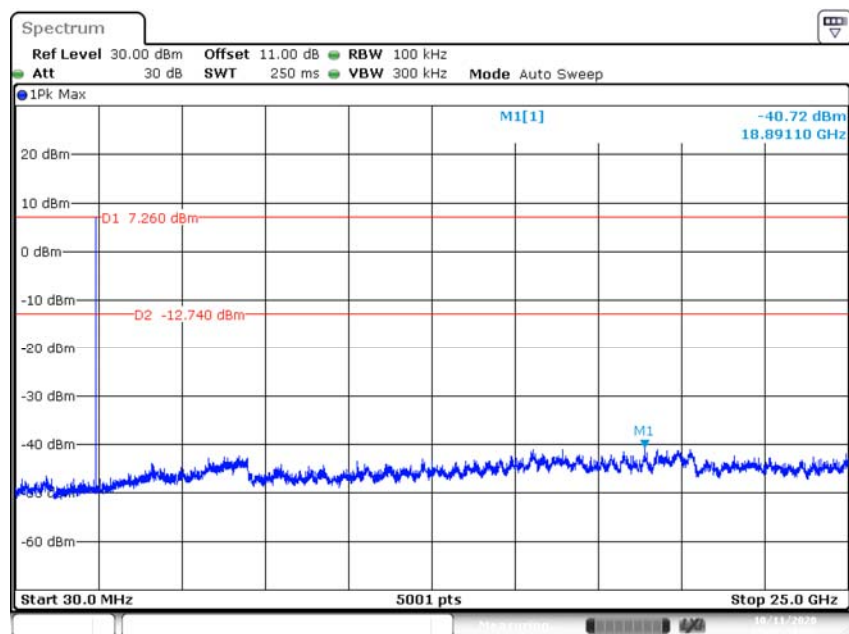
Corrected Amplitude (dB μ V /m) = Corrected Factor (dB/m) + Reading (dB μ V)

Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V /m)

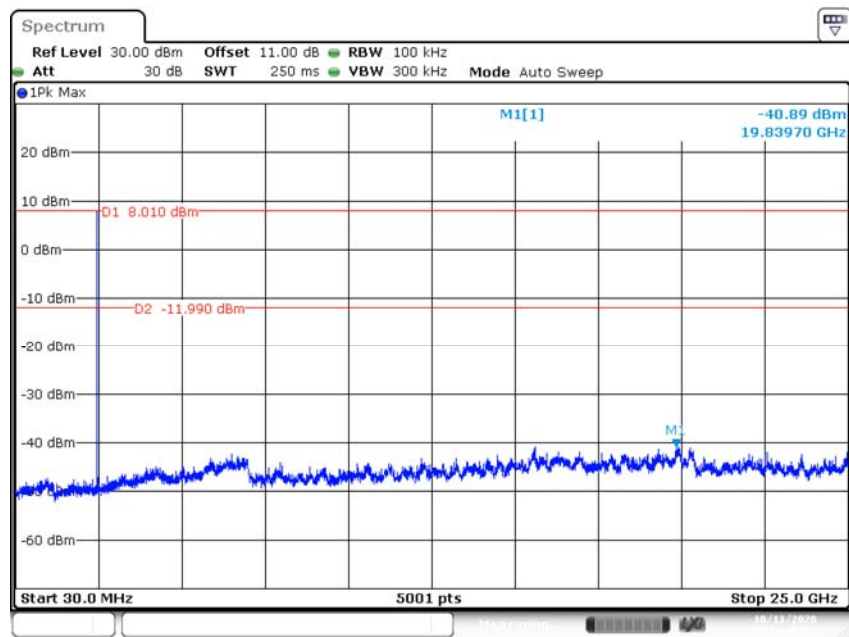
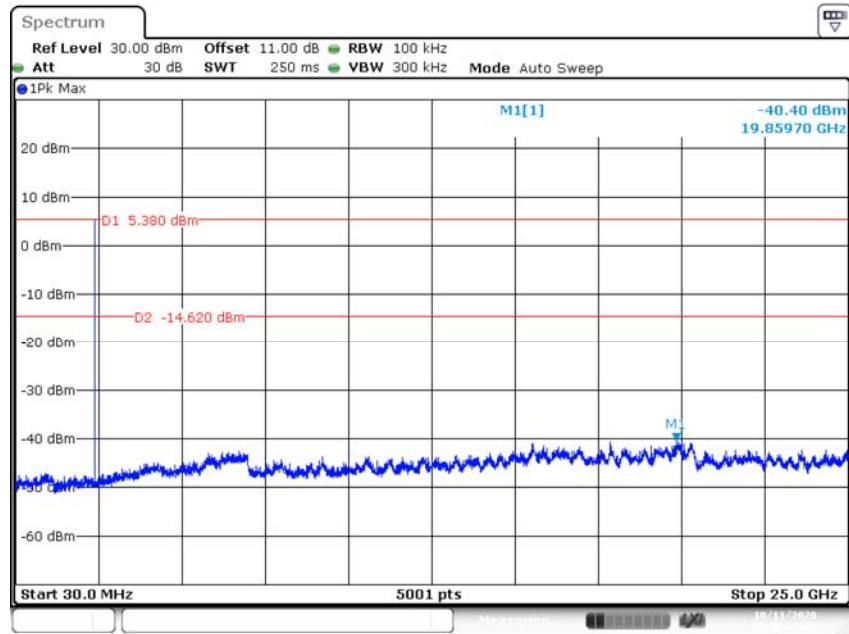
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2390.00	---	39.69	150.0	V	61.0	-2.9	54.00	14.31
2390.00	48.21	---	150.0	V	61.0	-2.9	74.00	25.79
High Channel: 2480MHz								
2483.50	---	40.17	150.0	V	86.0	-2.5	54.00	13.83
2483.50	49.99	---	150.0	V	86.0	-2.5	74.00	24.01

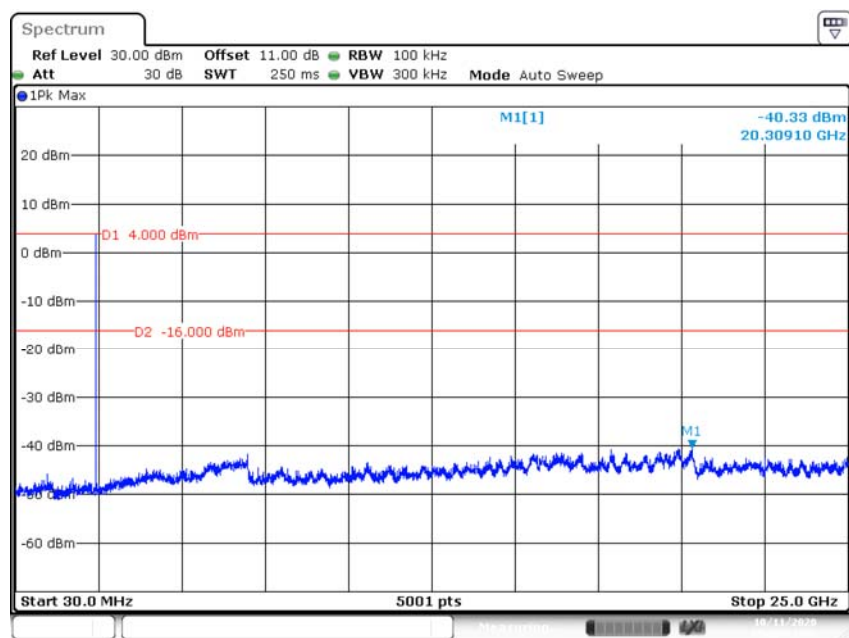
Conducted Spurious Emissions at Antenna Port**BDR (GFSK): Low Channel**

Date: 11.OCT.2020 17:23:44

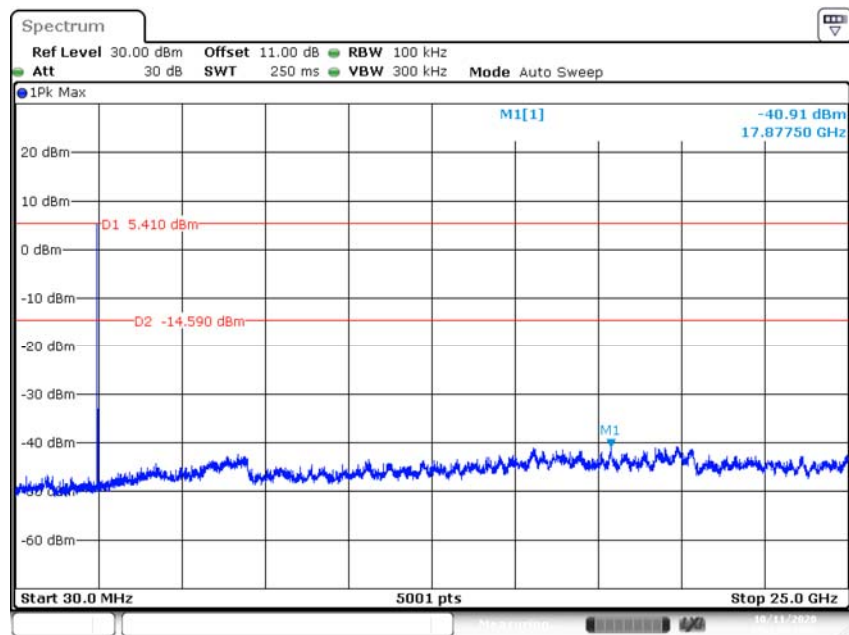
BDR (GFSK): Middle Channel

Date: 11.OCT.2020 17:22:37

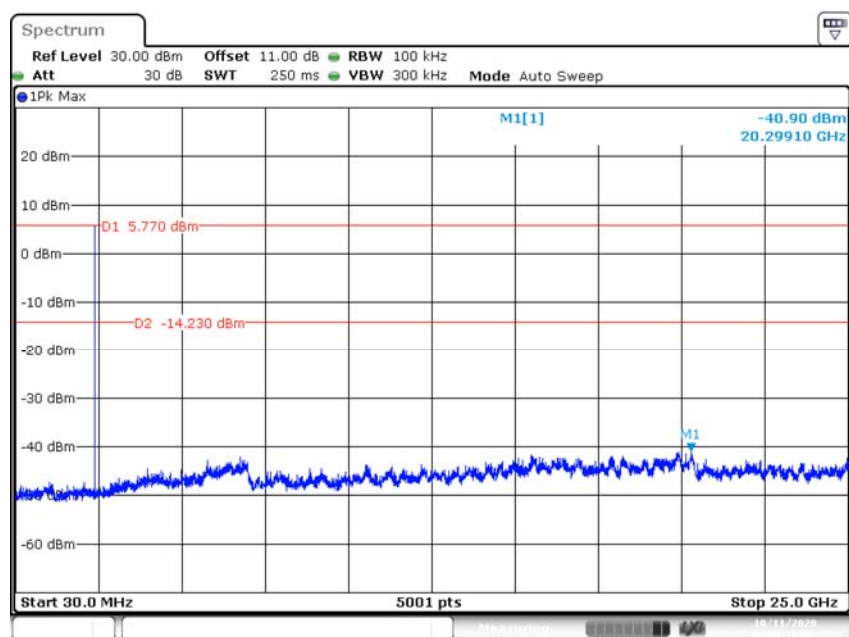
BDR (GFSK): High Channel**EDR ($\pi/4$ -DQPSK): Low Channel**

EDR ($\pi/4$ -DQPSK): Middle Channel

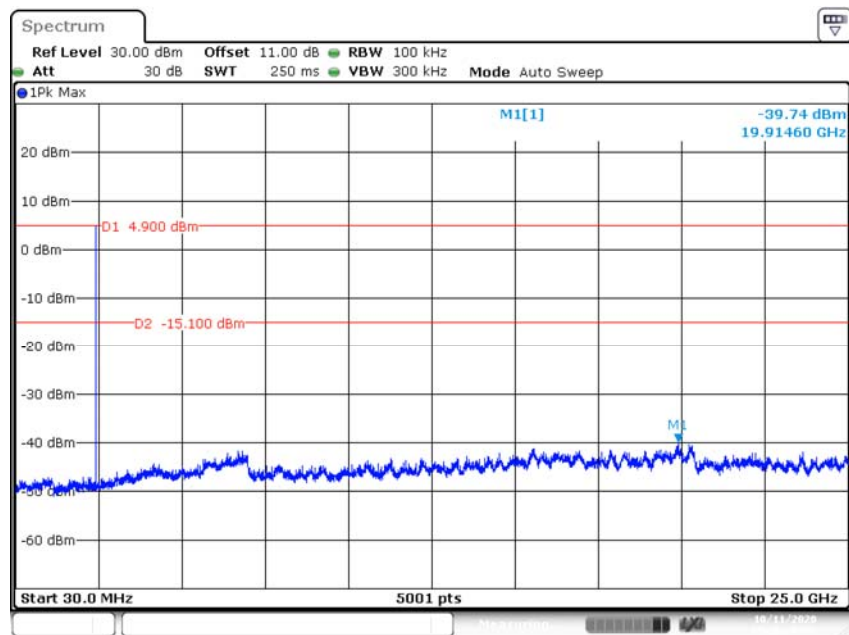
Date: 11.OCT.2020 17:20:52

EDR ($\pi/4$ -DQPSK): High Channel

Date: 11.OCT.2020 17:13:51

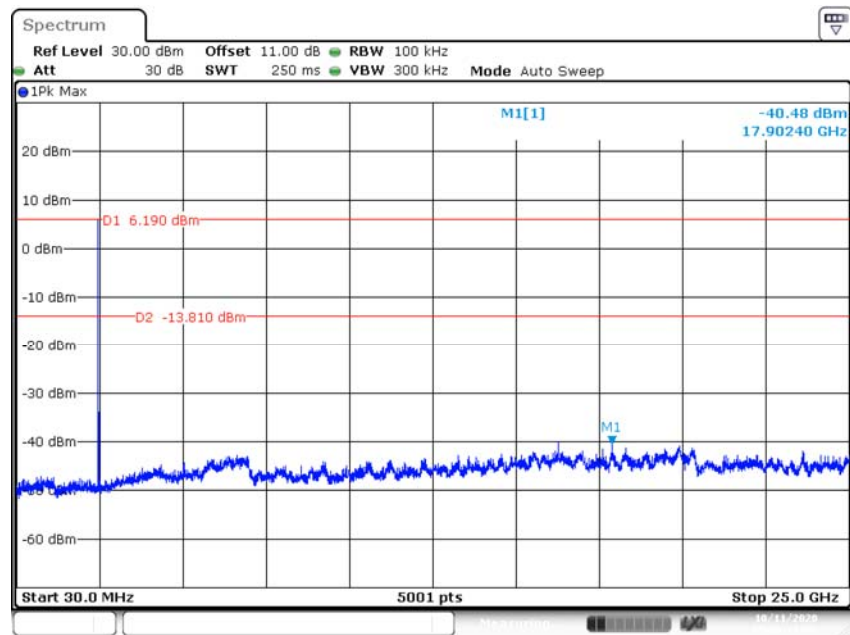
EDR (8DPSK): Low Channel

Date: 11.OCT.2020 17:27:15

EDR (8DPSK): Middle Channel

Date: 11.OCT.2020 17:18:28

EDR (8DPSK): High Channel



Date: 11.OCT.2020 17:15:13

FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

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.

Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a. Span: Wide enough to capture the peaks of two adjacent channels.
- b. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- c. Video (or average) bandwidth (VBW) $\geq$ RBW.
- d. Sweep: Auto.
- e. Detector function: Peak.
- f. Trace: Max hold.
- g. Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Test Data

Environmental Conditions

Temperature:	24.5 °C
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

The testing was performed by CK Huang on 2020-10-11.

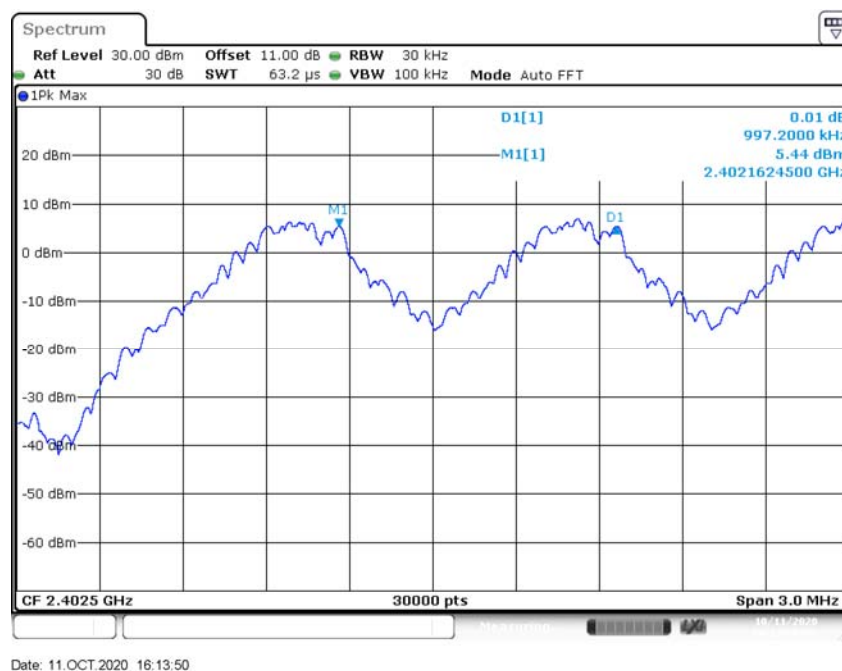
EUT operation mode: Transmitting

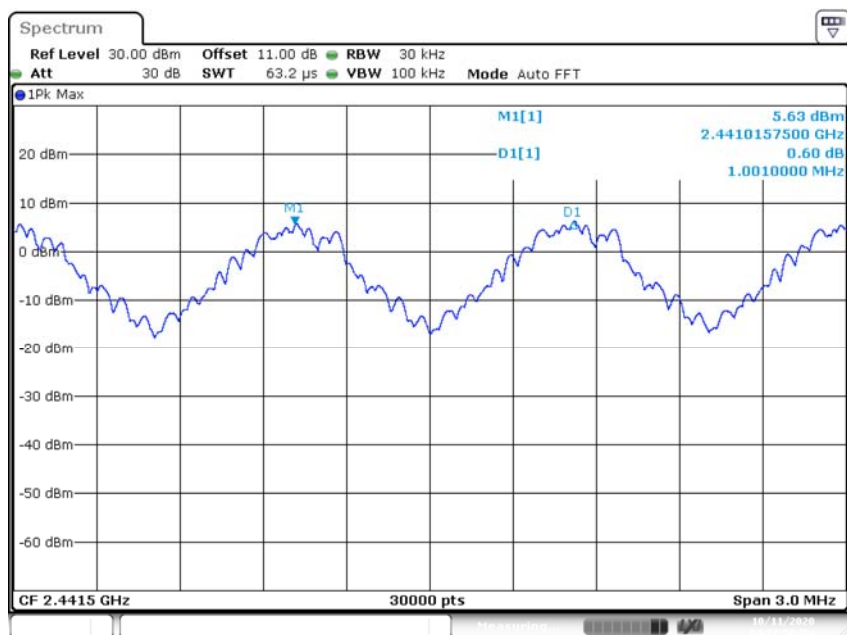
Test Result: Compliant.

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
BDR (GFSK)	Low	2402	0.997	0.944	Pass
	Adjacent	2403			
	Middle	2441	1.001	0.944	Pass
	Adjacent	2442			
	High	2480	0.998	0.944	Pass
	Adjacent	2479			
EDR ($\pi/4$ -DQPSK)	Low	2402	1.002	0.866	Pass
	Adjacent	2403			
	Middle	2441	1.005	0.866	Pass
	Adjacent	2442			
	High	2480	0.998	0.870	Pass
	Adjacent	2479			
EDR (8DPSK)	Low	2402	1.008	0.870	Pass
	Adjacent	2403			
	Middle	2441	1.001	0.870	Pass
	Adjacent	2442			
	High	2480	1.007	0.870	Pass
	Adjacent	2479			

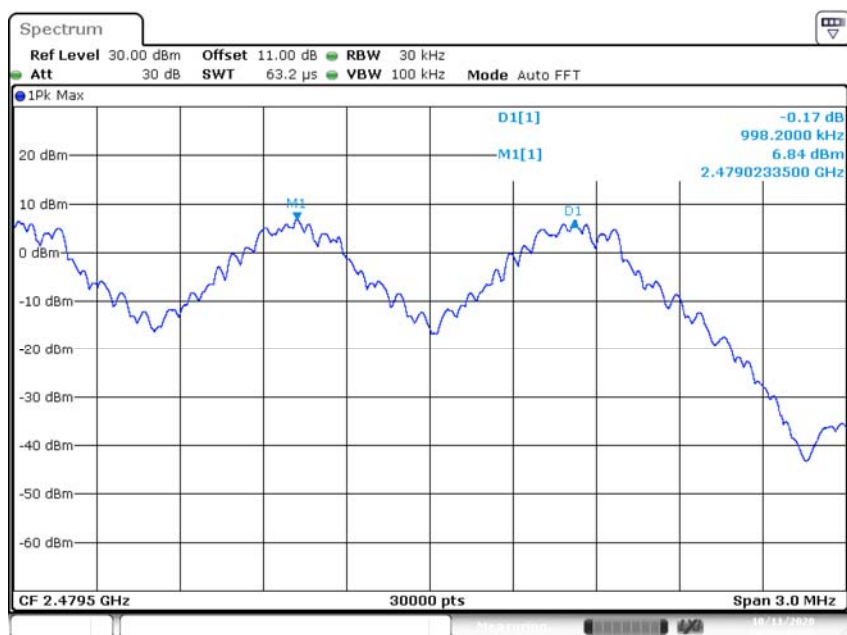
Note: For BDR mode, Limit = 20 dB bandwidth; For EDR mode, Limit = 20 dB bandwidth*2/3.

BDR (GFSK): Low Channel

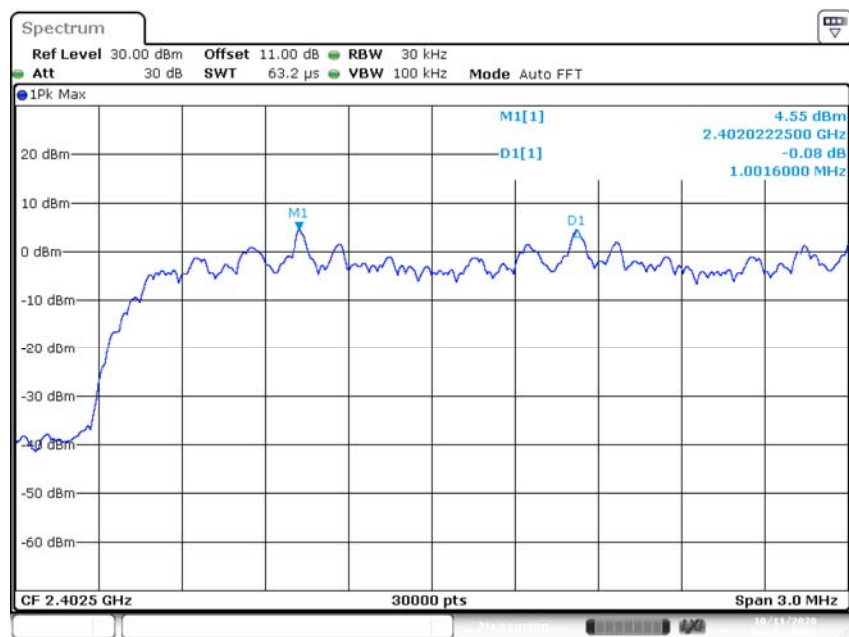


BDR (GFSK): Middle Channel

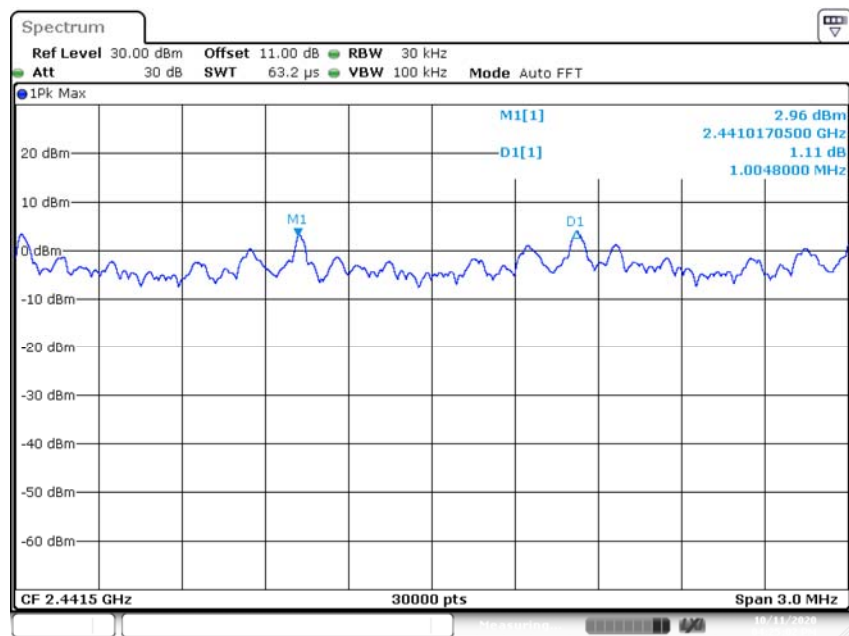
Date: 11.OCT.2020 16:27:50

BDR (GFSK): High Channel

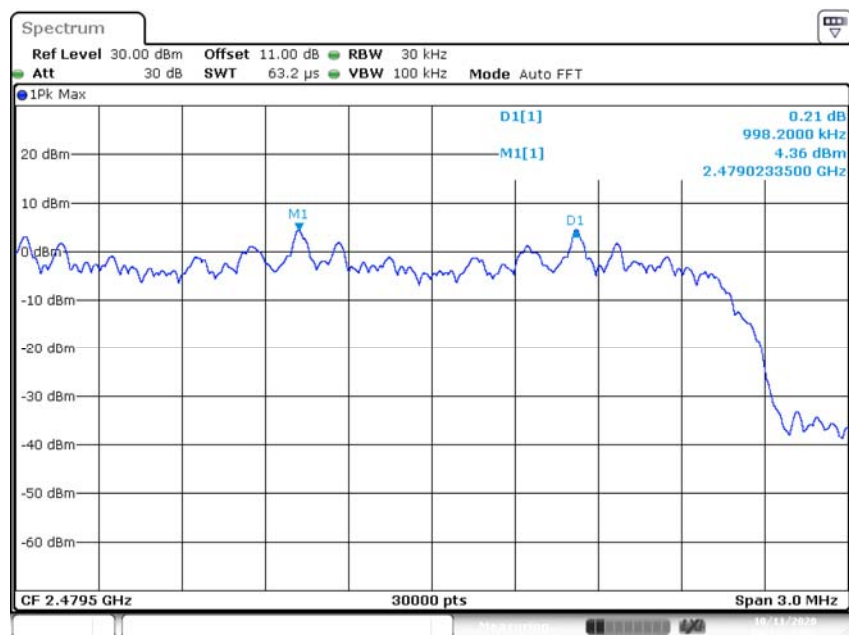
Date: 11.OCT.2020 16:29:40

EDR ($\pi/4$ -DQPSK): Low Channel

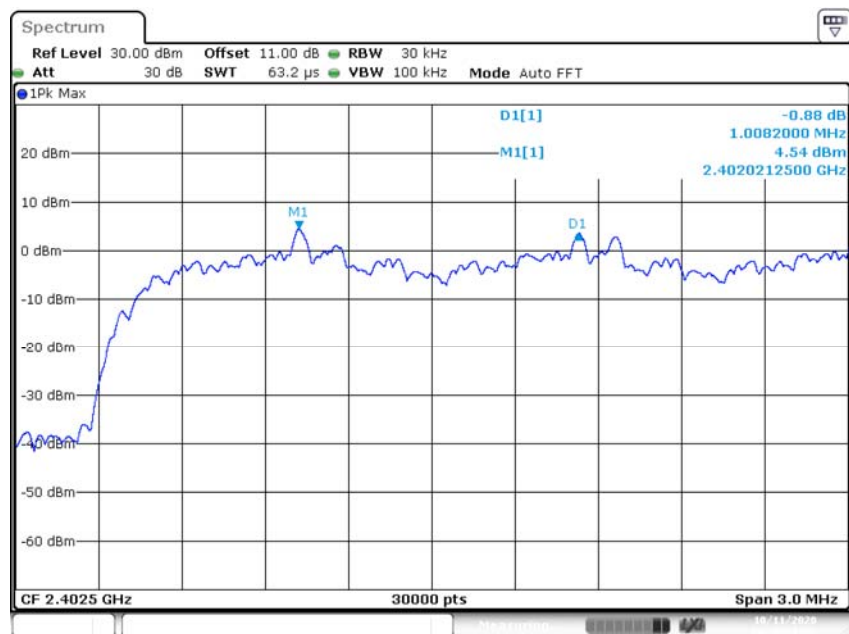
Date: 11.OCT.2020 16:16:29

EDR ($\pi/4$ -DQPSK): Middle Channel

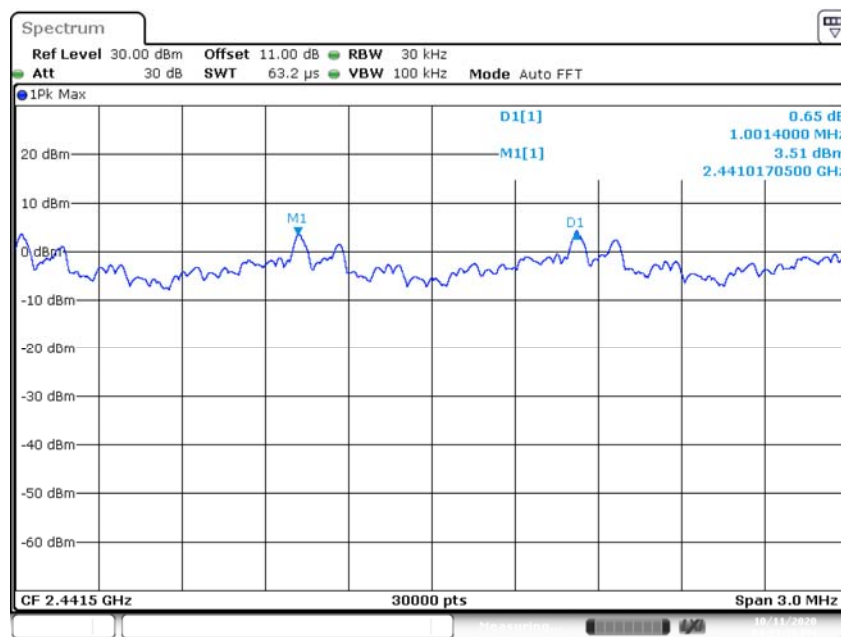
Date: 11.OCT.2020 16:25:03

EDR ($\pi/4$ -DQPSK): High Channel

Date: 11.OCT.2020 16:31:22

EDR (8DPSK): Low Channel

Date: 11.OCT.2020 16:19:00

EDR (8DPSK): Middle Channel

Date: 11.OCT.2020 16:23:36

EDR (8DPSK): High Channel

Date: 11.OCT.2020 16:33:09

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH

Applicable Standard

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.

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.

Test Data**Environmental Conditions**

Temperature:	24.7 °C
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

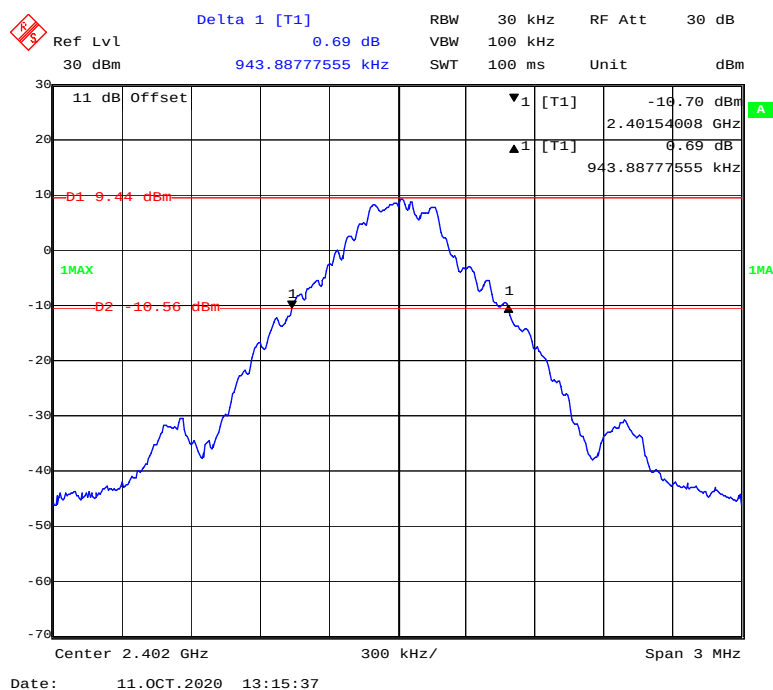
The testing was performed by CK Huang on 2020-10-11.

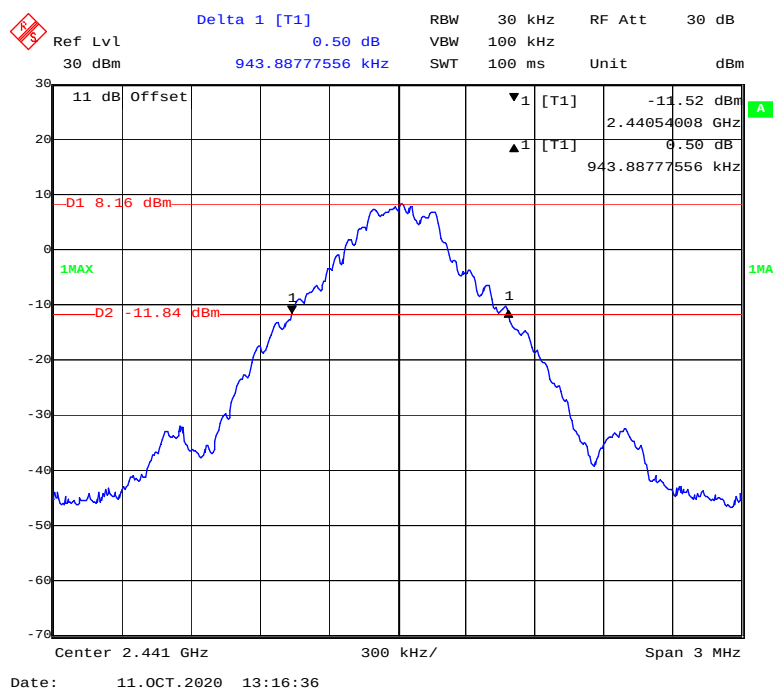
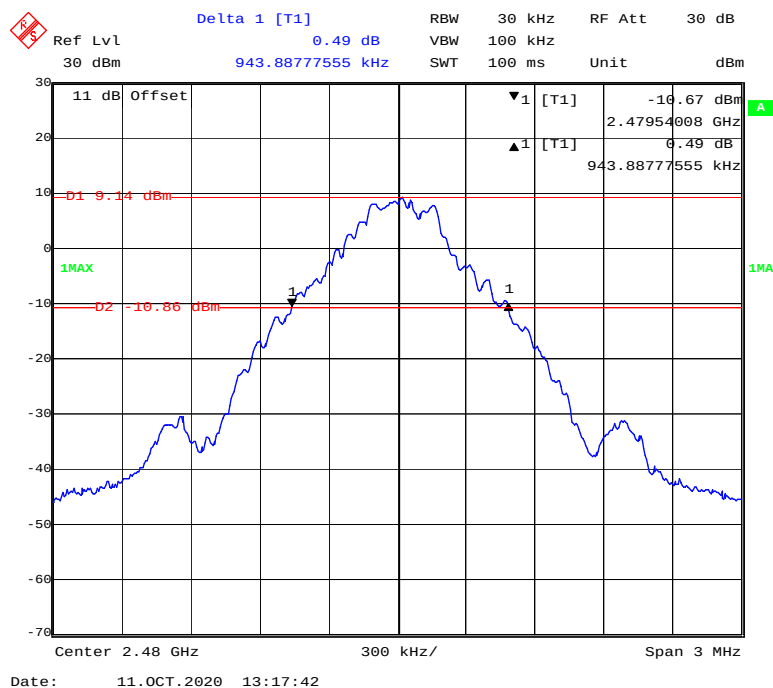
EUT operation mode: Transmitting

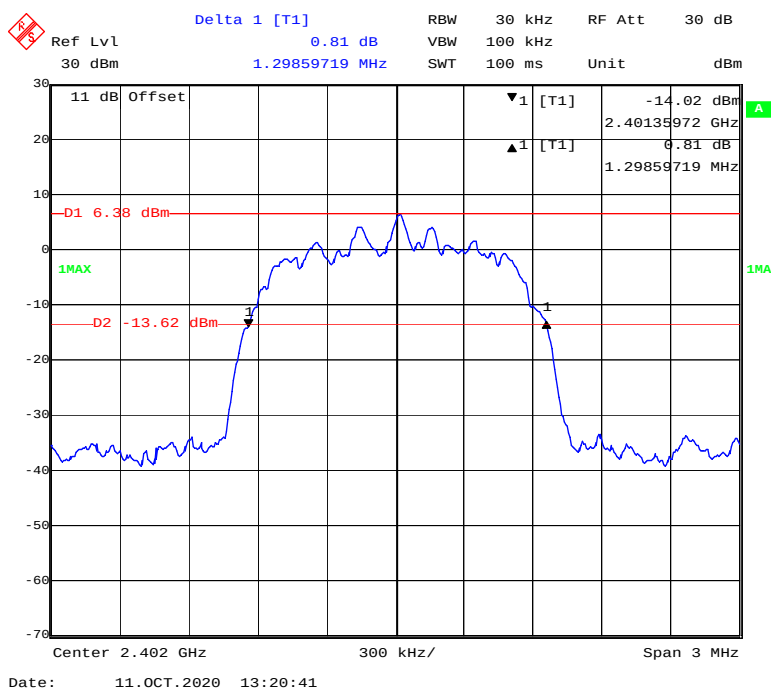
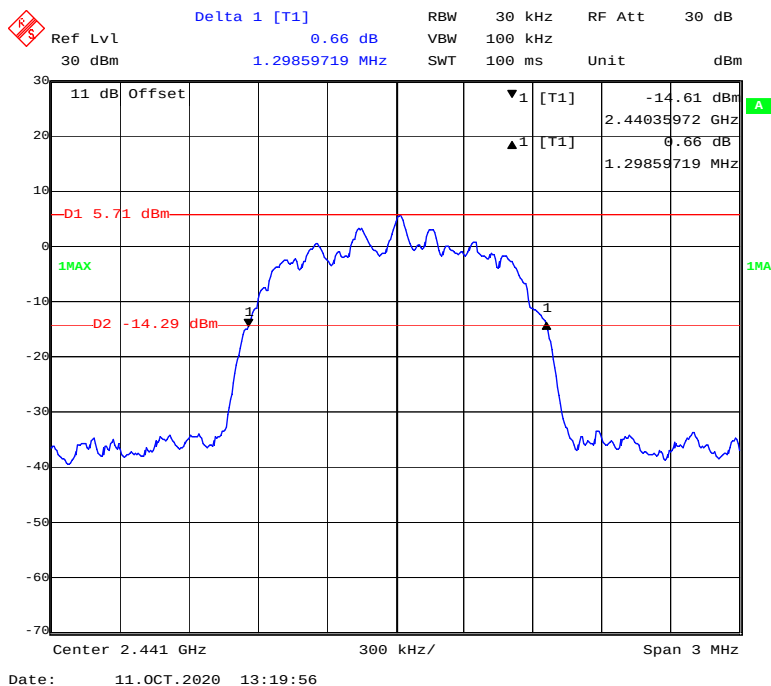
Test Result: Compliant.

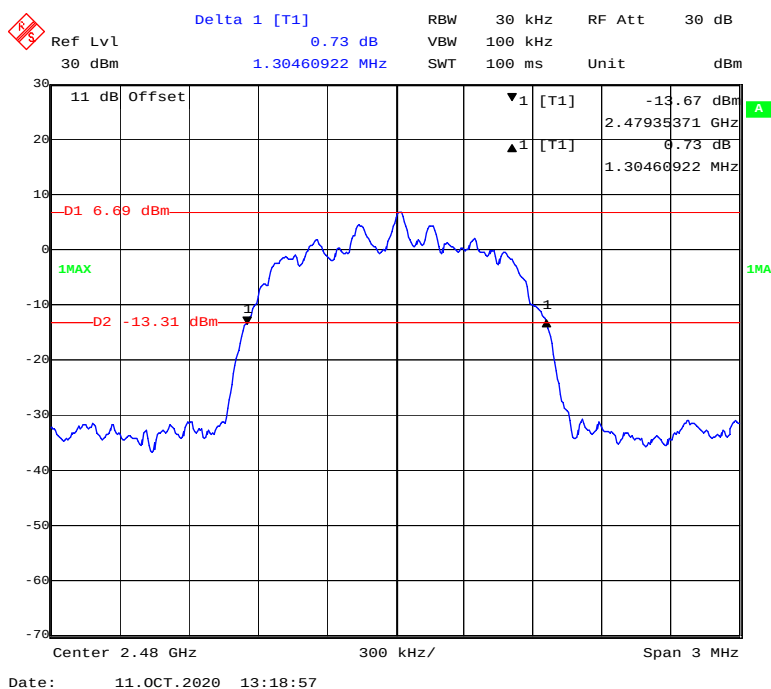
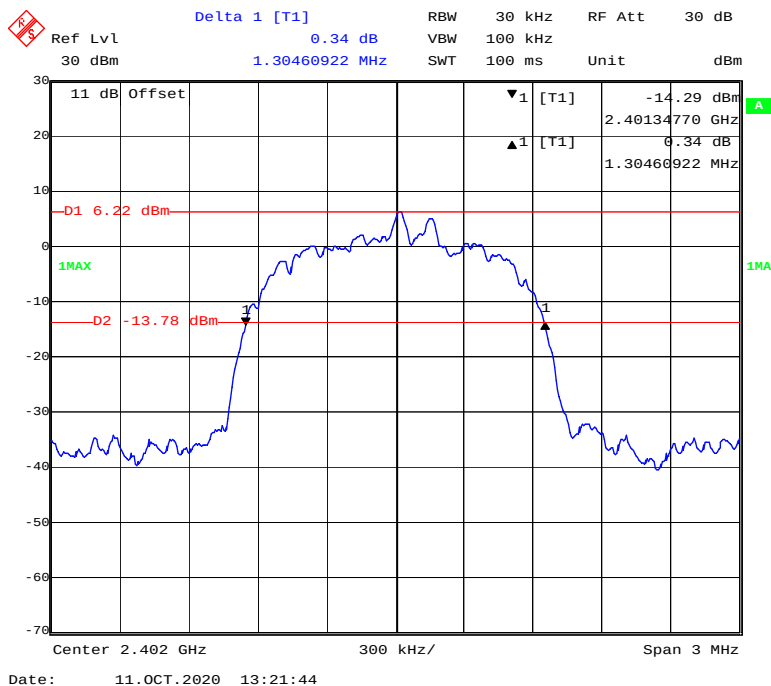
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.944
	Middle	2441	0.944
	High	2480	0.944
EDR ($\pi/4$ -DQPSK)	Low	2402	1.299
	Middle	2441	1.299
	High	2480	1.305
EDR (8DPSK)	Low	2402	1.305
	Middle	2441	1.305
	High	2480	1.305

BDR (GFSK): Low Channel

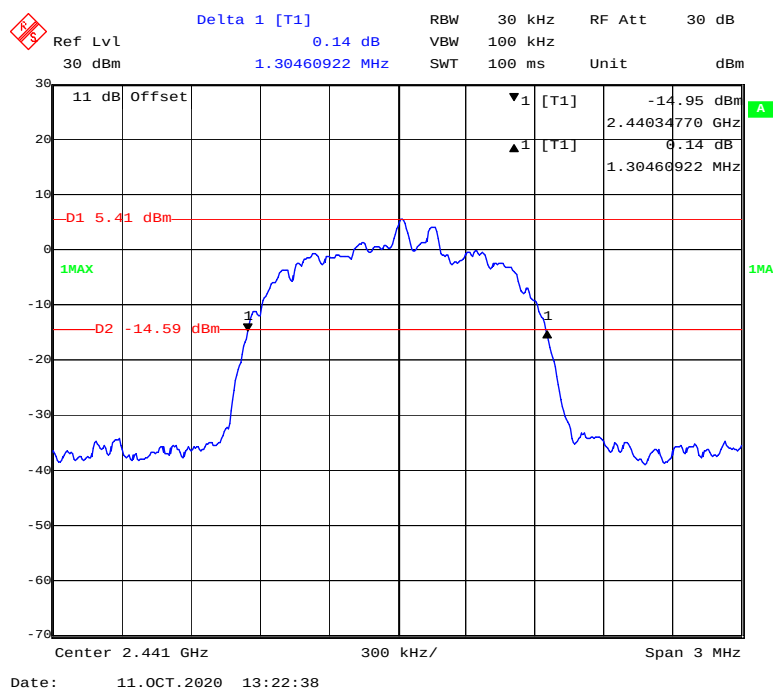


BDR (GFSK): Middle Channel**BDR (GFSK): High Channel**

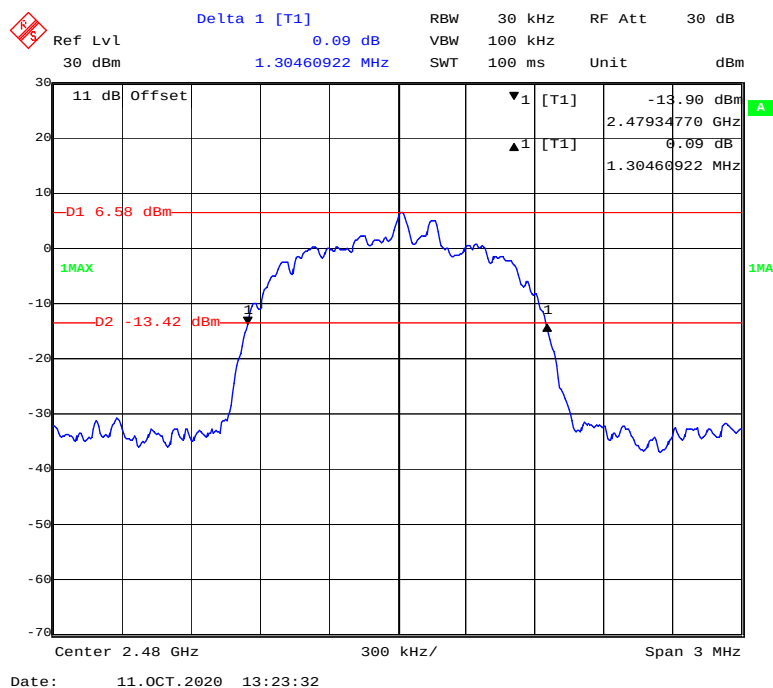
EDR ($\pi/4$ -DQPSK): Low ChannelEDR($\pi/4$ -DQPSK): Middle Channel

EDR ($\pi/4$ -DQPSK): High Channel**EDR (8DPSK): Low Channel**

EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

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.

Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c. VBW $\geq$ RBW.
- d. Sweep: Auto.
- e. Detector function: Peak.
- f. Trace: Max hold.
- g. Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies.

Test Data

Environmental Conditions

Temperature:	24.6 °C
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

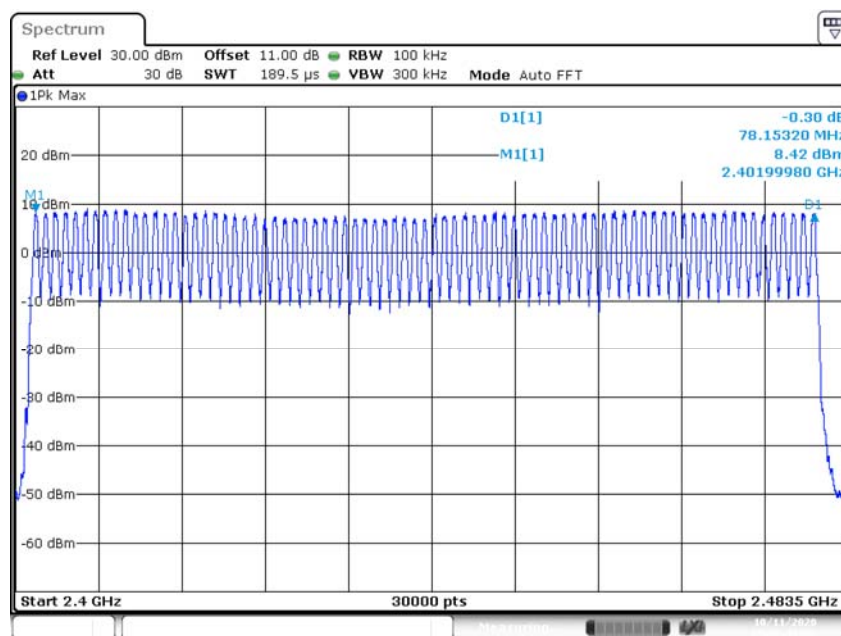
The testing was performed by CK Huang on 2020-10-11.

EUT operation mode: Hopping

Test Result: Compliant.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



Date: 11.OCT.2020 17:02:41

Spectrum

Ref Level 30.00 dBm Offset 11.00 dB RBW 100 kHz
 Att 30 dB SWT 189.5 μ s VBW 300 kHz Mode Auto FFT

1Pk Max

M1[1] 5.86 dBm
 D1[1] 2.40199700 GHz
 -0.66 dB
 78.15600 MHz

20 dBm
 10 dBm
 0 dBm
 -10 dBm
 -20 dBm
 -30 dBm
 -40 dBm
 -50 dBm
 -60 dBm

Start 2.4 GHz 30000 pts Stop 2.4835 GHz

Spectrum

Ref Level 30.00 dBm Offset 11.00 dB RBW 100 kHz
 Att 30 dB SWT 189.5 μ s VBW 300 kHz Mode Auto FFT

1Pk Max

D1[1] 0.68 dB
 M1[1] 78.13090 MHz
 5.63 dBm
 2.40202770 GHz

20 dBm
 10 dBm
 0 dBm
 -10 dBm
 -20 dBm
 -30 dBm
 -40 dBm
 -50 dBm
 -60 dBm

Start 2.4 GHz 30000 pts Stop 2.4835 GHz

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FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)**Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz 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.

Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

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

Test Data**Environmental Conditions**

Temperature:	24.6 °C
Relative Humidity:	49 %
ATM Pressure:	101.1 kPa

The testing was performed by CK Huang on 2020-10-11.

EUT operation mode: Hopping

Mode		Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
BDR (GFSK)	DH1	Low	0.413	0.132	0.4	Pass
		Middle	0.417	0.133	0.4	Pass
		High	0.419	0.134	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH3	Low	1.681	0.269	0.4	Pass
		Middle	1.699	0.272	0.4	Pass
		High	1.681	0.269	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH5	Low	2.942	0.314	0.4	Pass
		Middle	2.958	0.316	0.4	Pass
		High	2.966	0.316	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR ($\pi/4$ -DQPSK)	2DH1	Low	0.417	0.133	0.4	Pass
		Middle	0.417	0.133	0.4	Pass
		High	0.421	0.135	0.4	Pass
		Note: 2DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	2DH3	Low	1.681	0.269	0.4	Pass
		Middle	1.687	0.270	0.4	Pass
		High	1.675	0.268	0.4	Pass
		Note: 2DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	2DH5	Low	2.974	0.317	0.4	Pass
		Middle	2.958	0.316	0.4	Pass
		High	2.942	0.314	0.4	Pass
		Note: 2DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8DPSK)	3DH1	Low	0.421	0.135	0.4	Pass
		Middle	0.423	0.135	0.4	Pass
		High	0.419	0.134	0.4	Pass
		Note: 3 DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	3DH3	Low	1.675	0.268	0.4	Pass
		Middle	1.681	0.269	0.4	Pass
		High	1.693	0.271	0.4	Pass
		Note: 3DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	3DH5	Low	2.942	0.314	0.4	Pass
		Middle	2.958	0.316	0.4	Pass
		High	2.950	0.315	0.4	Pass
		Note: 3DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

Delta 1 [T1]

Ref Lvl -0.68 dB

30 dBm 412.745491 μ s

RBW 500 kHz

VBW 2 MHz

SWT 1 ms

RF Att 30 dB

Unit dBm

11 dB Offset

▼1 [T1] -51.77 dBm

▲1 [T1] -19.338677 μ s

-0.68 dB

412.745491 μ s

TR

Center 2.402 GHz

100 μ s/

Date: 11.OCT.2020 14:16:24

Delta 1 [T1] 2.38 dB
 416.753507 μ s

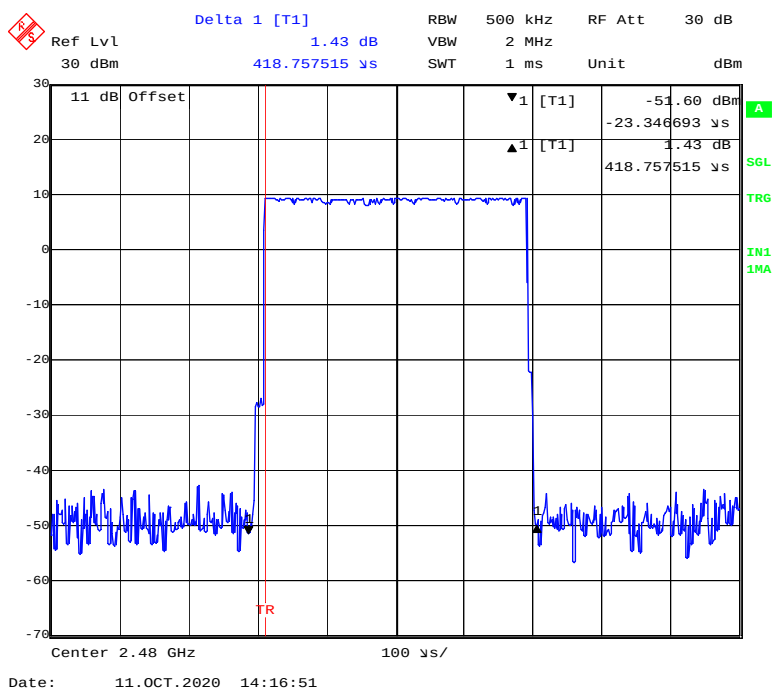
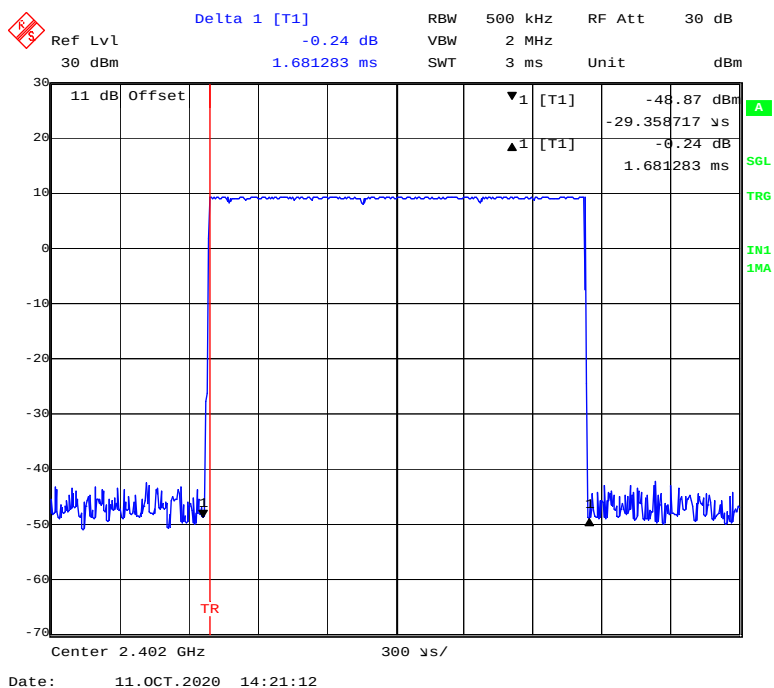
Ref Lvl 30 dBm
 RBW 500 kHz
 VBW 2 MHz
 SWT 1 ms
 RF Att 30 dB
 Unit dBm

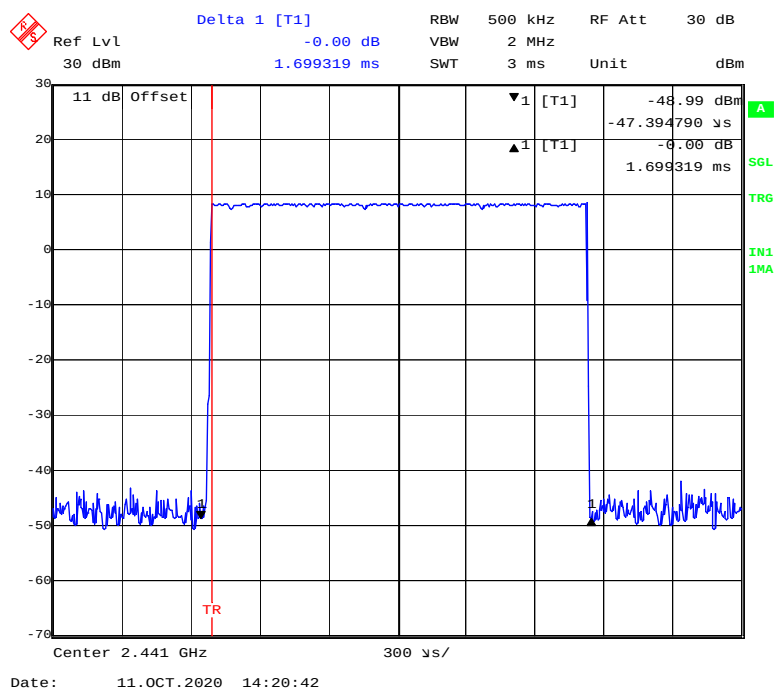
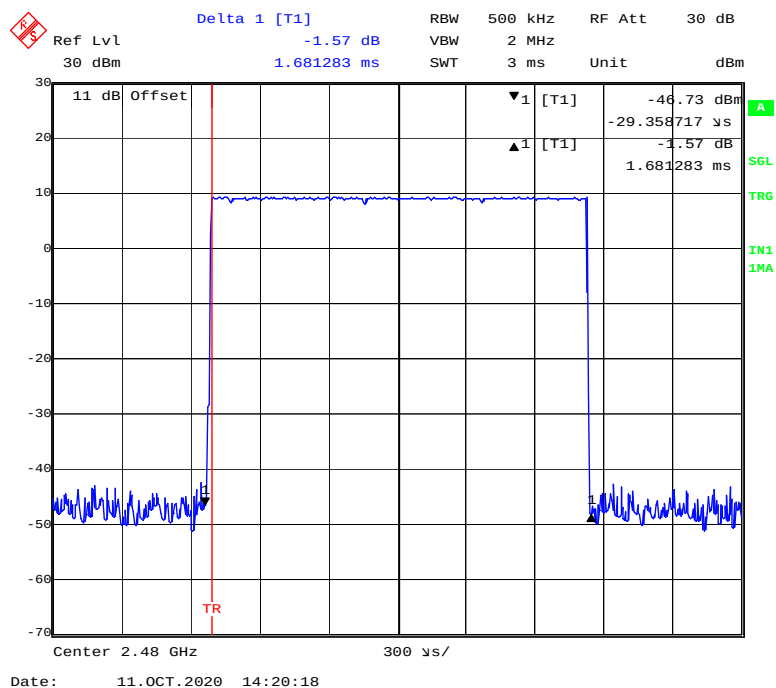
▼1 [T1]	-52.97 dBm
-23.346693 μ s	
▲1 [T1]	2.38 dB
416.753507 μ s	

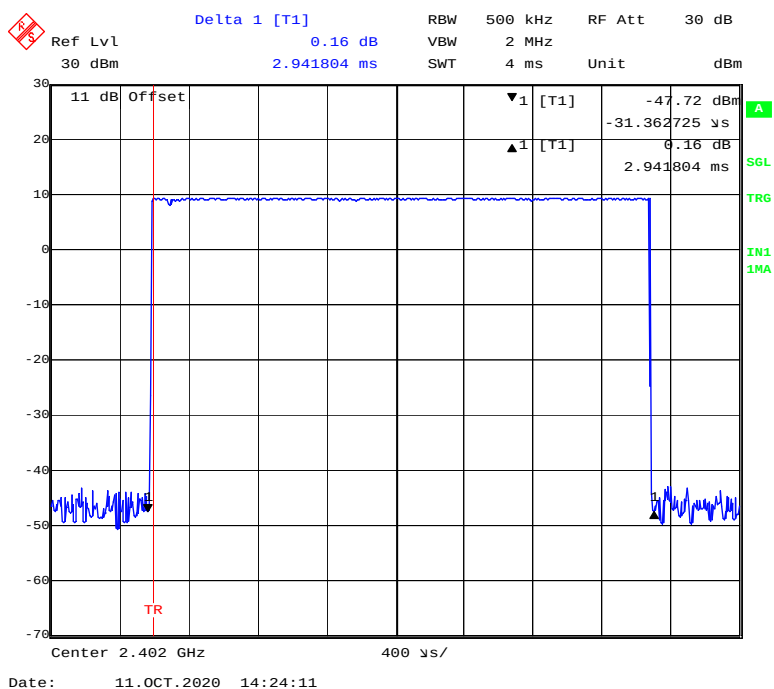
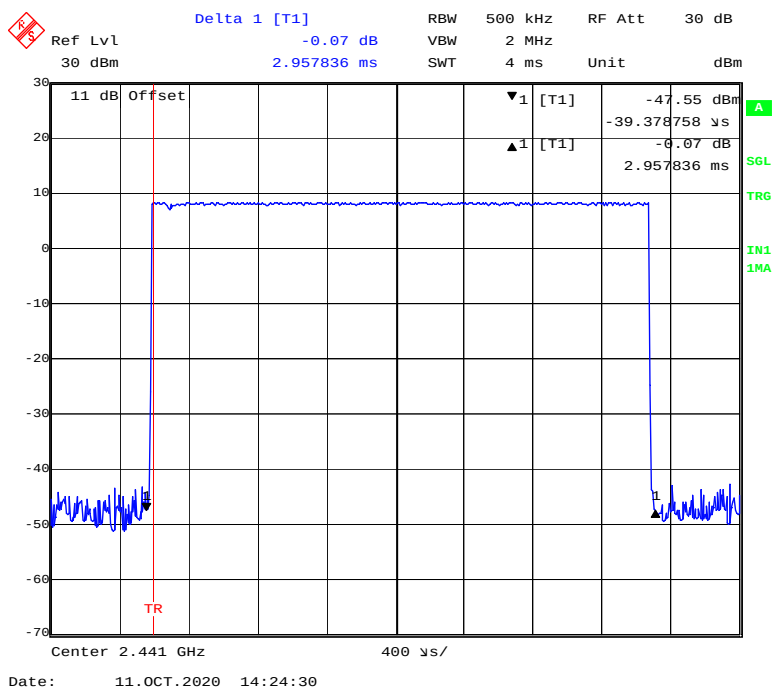
11 dB Offset
 TR

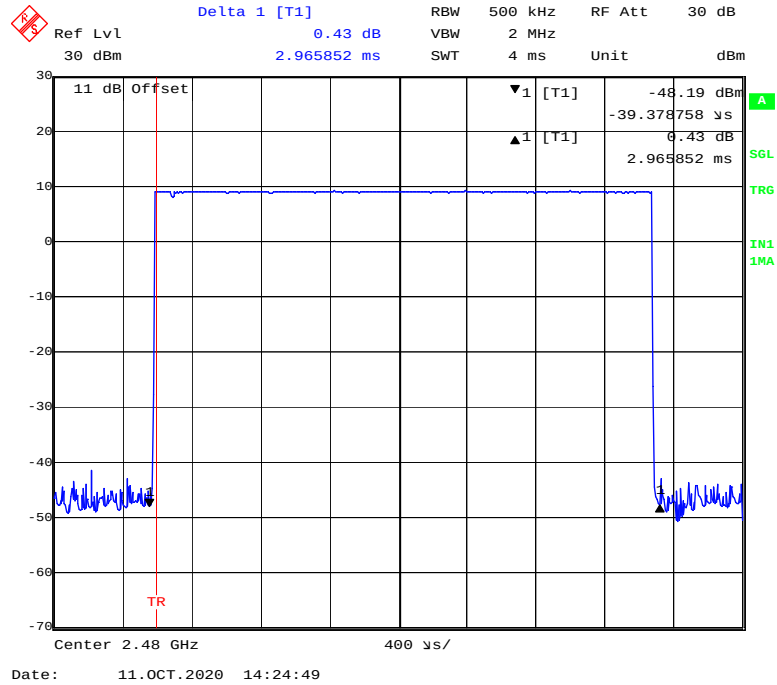
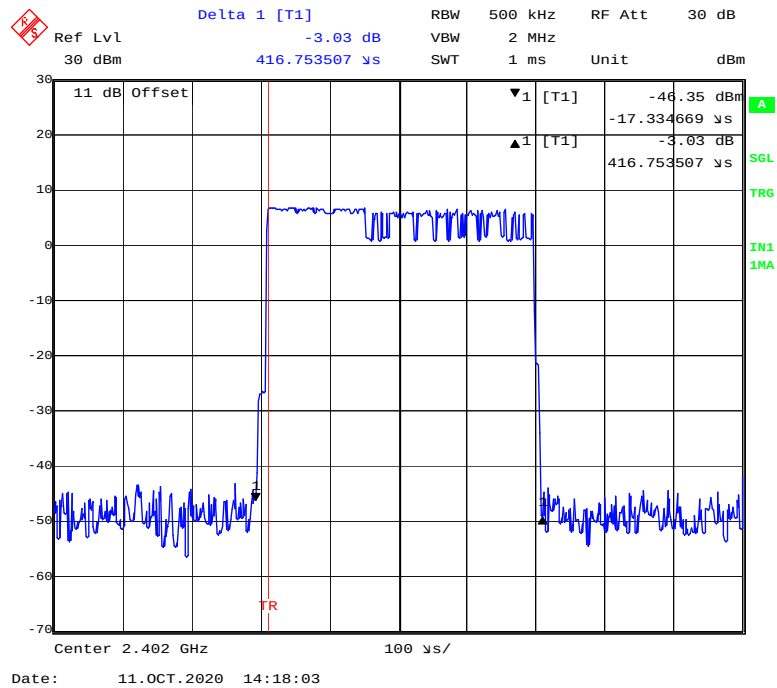
Center 2.441 GHz
 100 μ s/

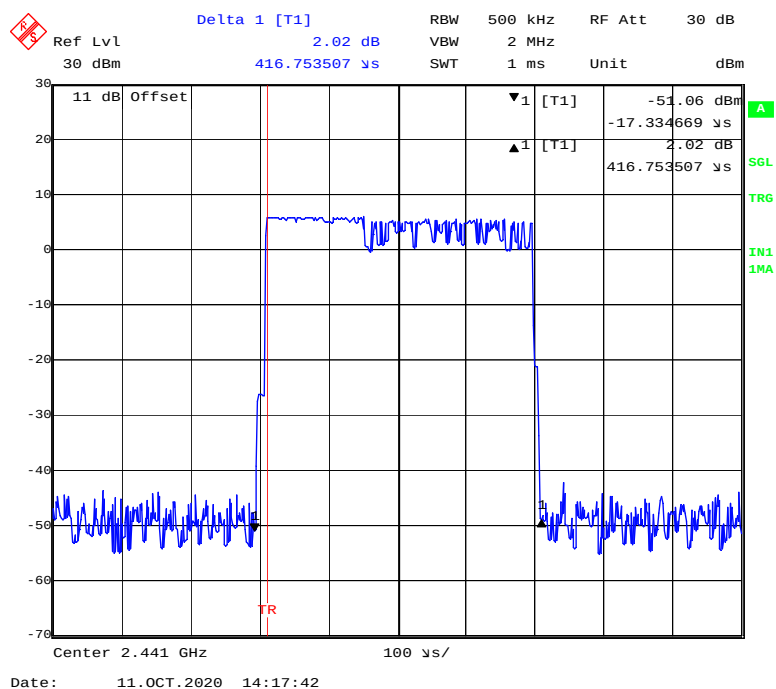
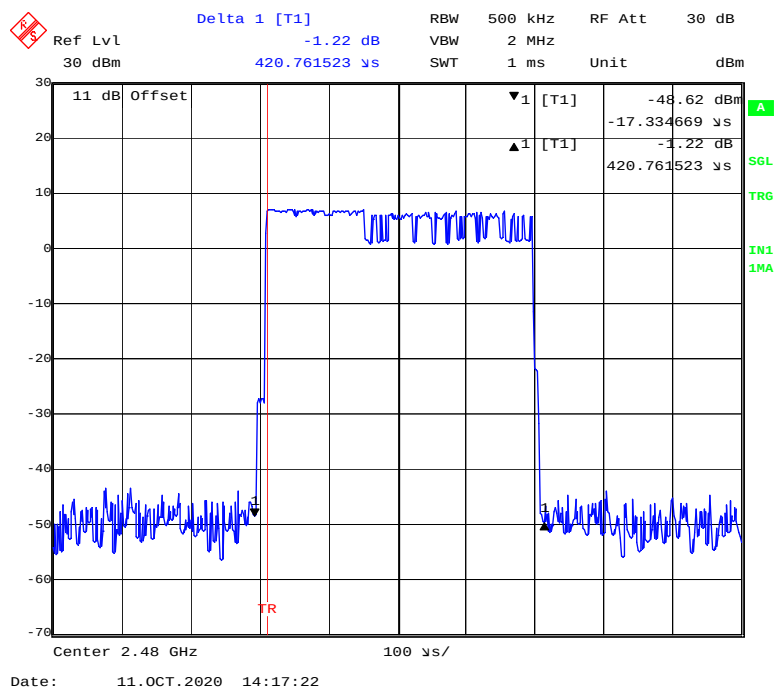
Date: 11.OCT.2020 14:15:54

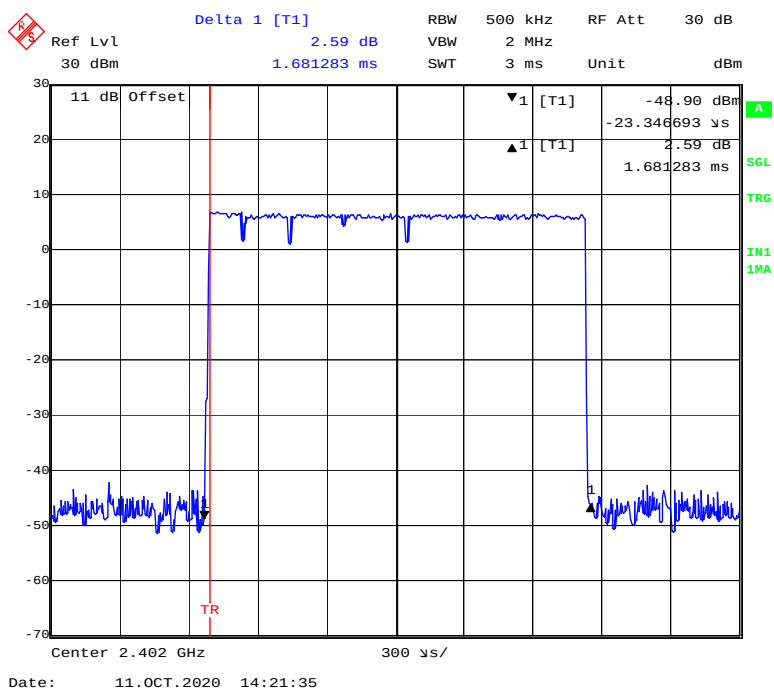
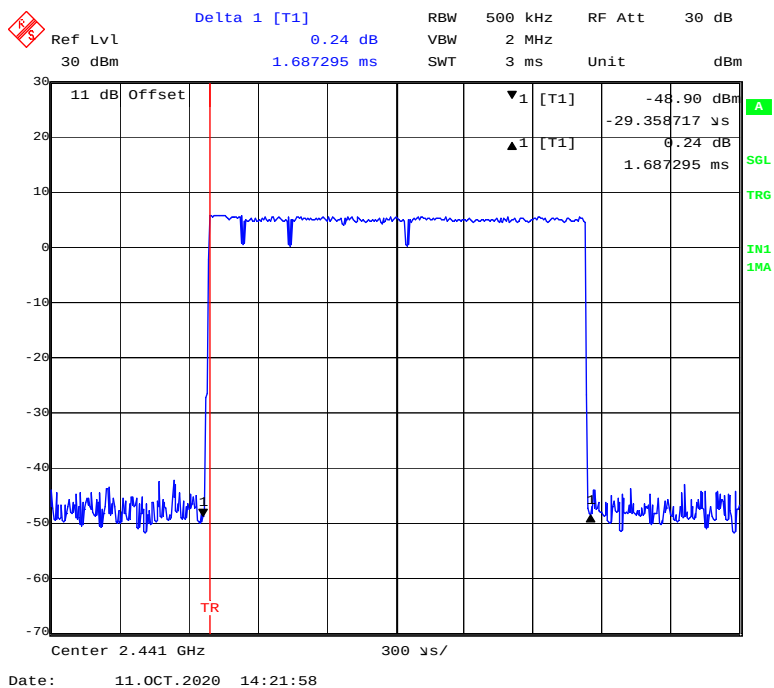
BDR (GFSK): Pulse time, High Channel, DH1**BDR (GFSK): Pulse time, Low Channel, DH3**

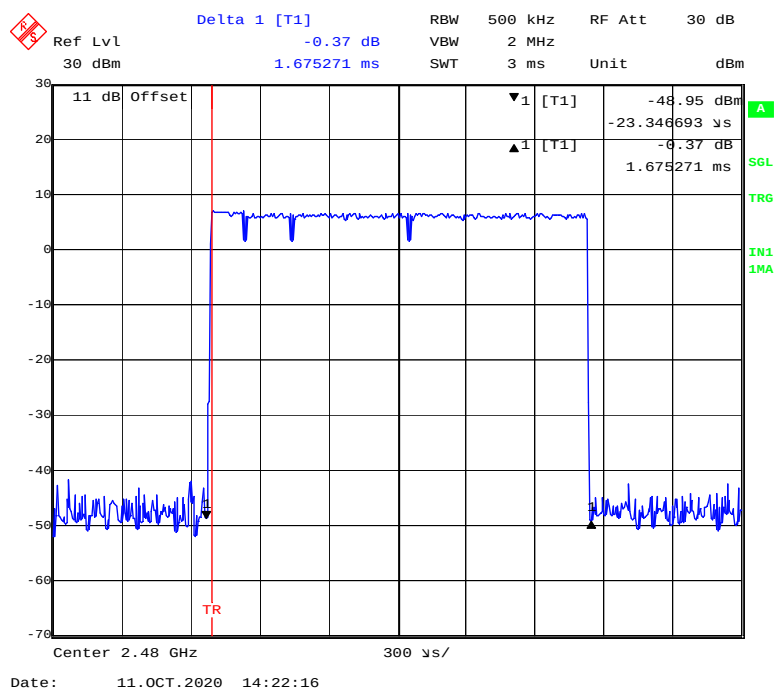
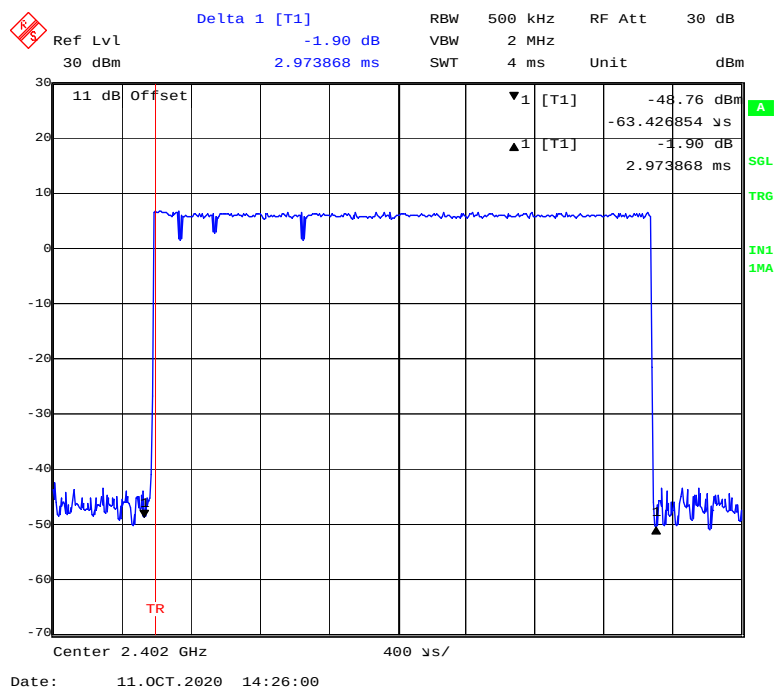
BDR (GFSK): Pulse time, Middle Channel, DH3**BDR (GFSK): Pulse time, High Channel, DH3**

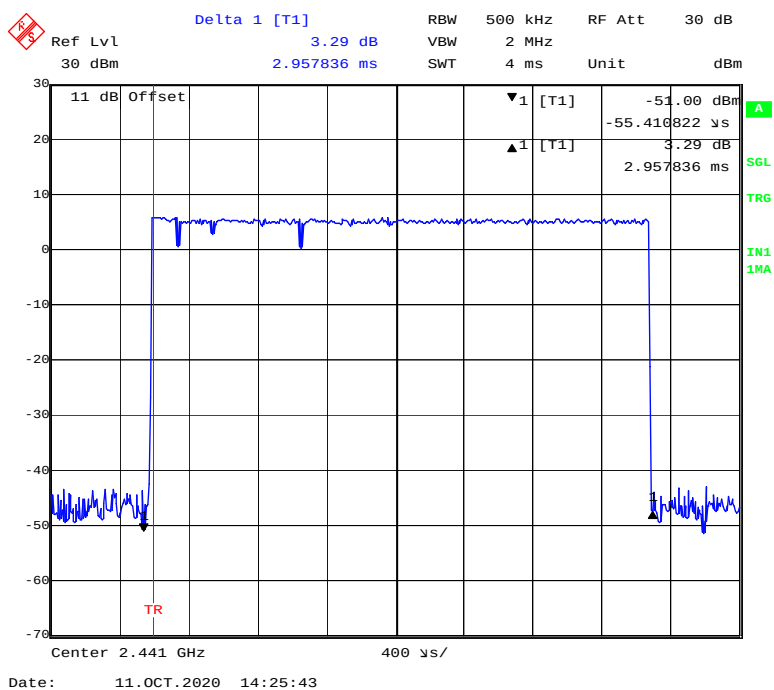
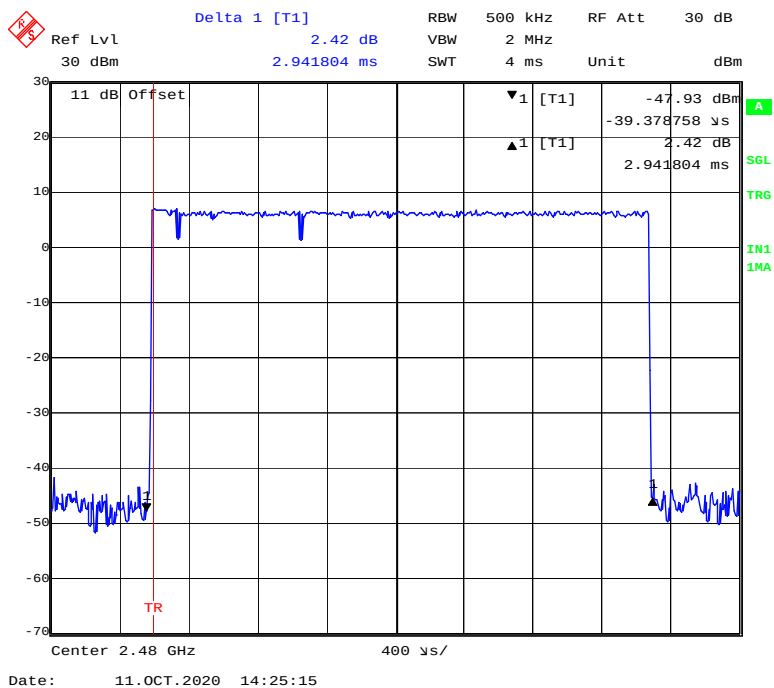
BDR (GFSK): Pulse time, Low Channel, DH5**BDR (GFSK): Pulse time, Middle Channel, DH5**

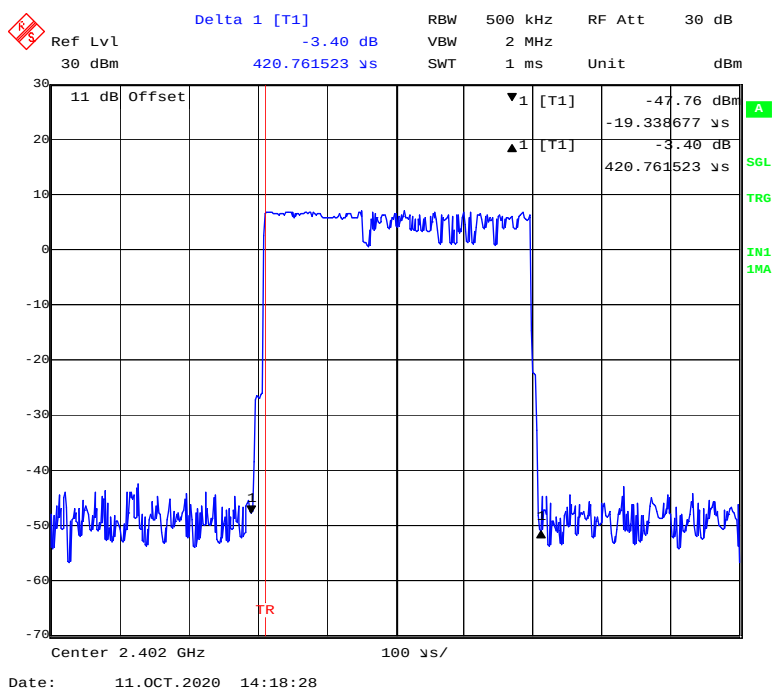
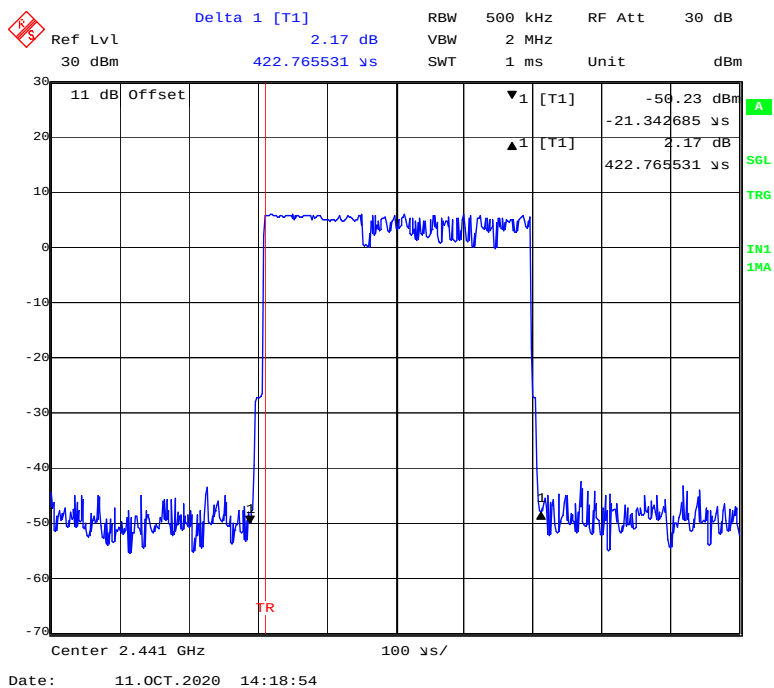
BDR (GFSK): Pulse time, High Channel, DH5**EDR ($\pi/4$ -DQPSK): Pulse time, Low Channel, 2DH1**

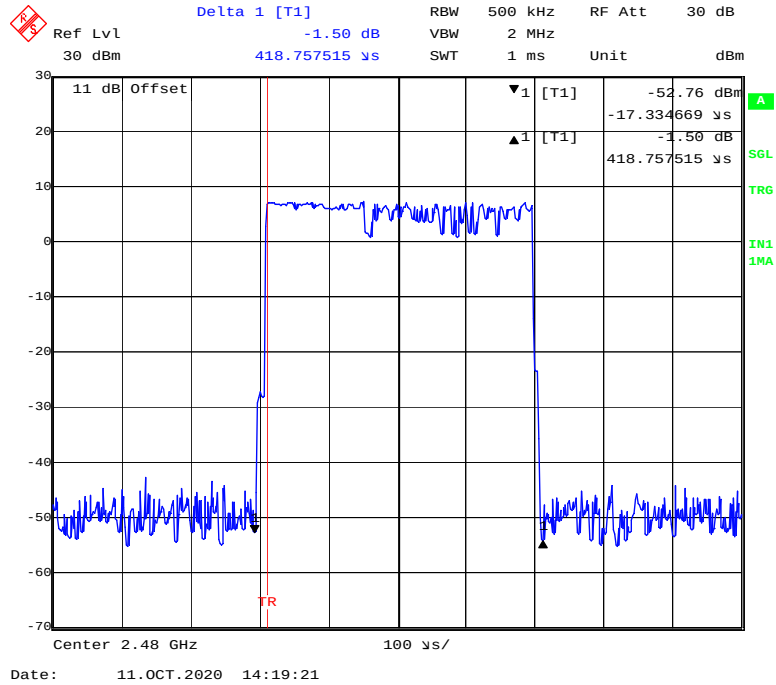
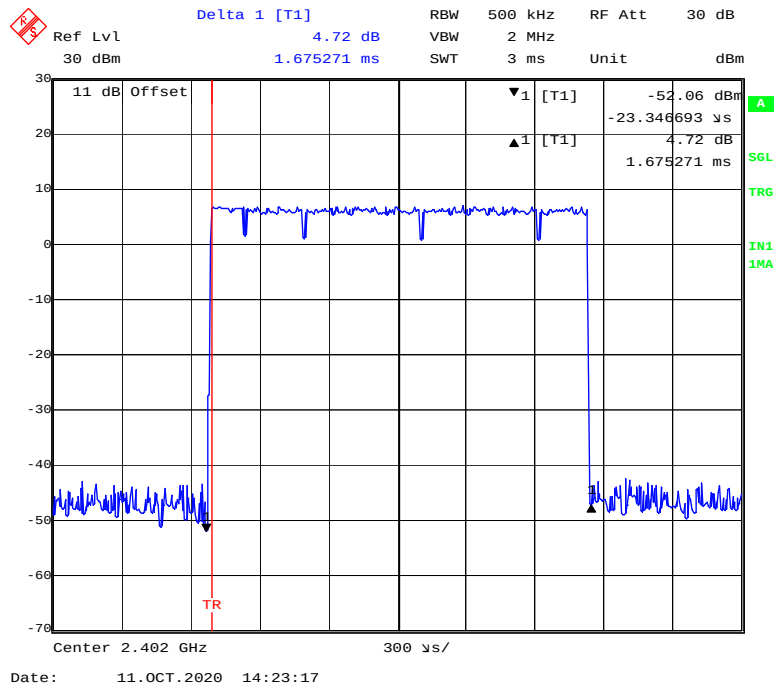
EDR ($\pi/4$ -DQPSK):Pulse time, Middle Channel, 2DH1**EDR ($\pi/4$ -DQPSK):Pulse time, High Channel, 2DH1**

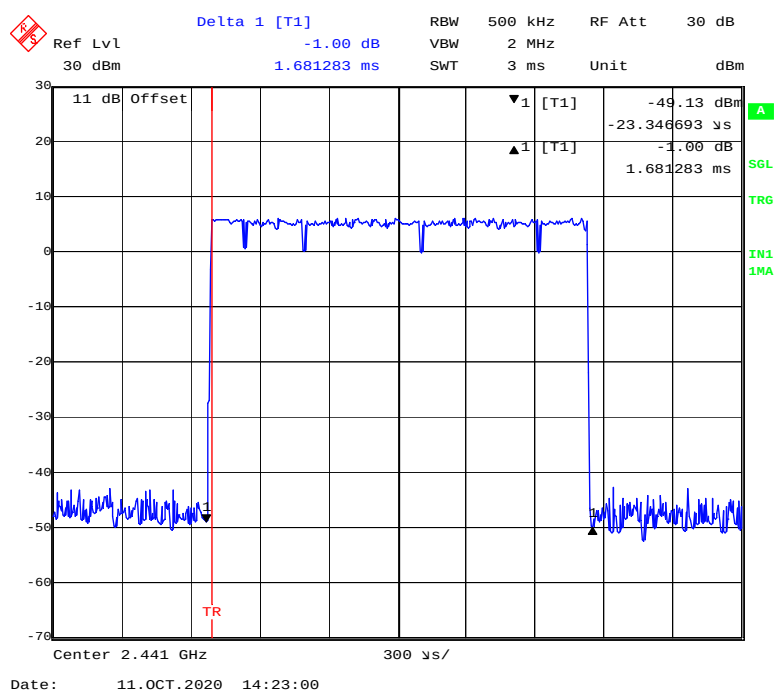
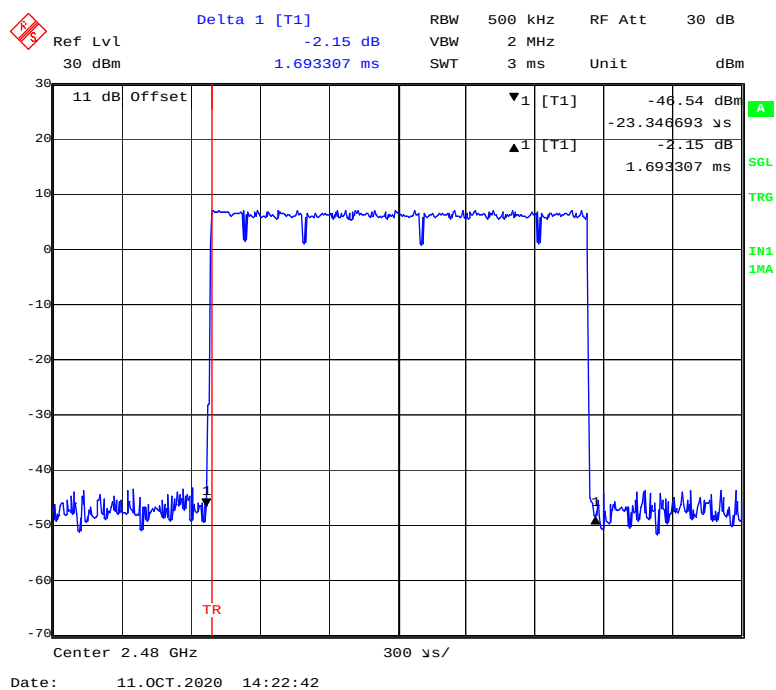
EDR ($\pi/4$ -DQPSK):Pulse time, Low Channel, 2DH3EDR ($\pi/4$ -DQPSK):Pulse time, Middle Channel, 2DH3

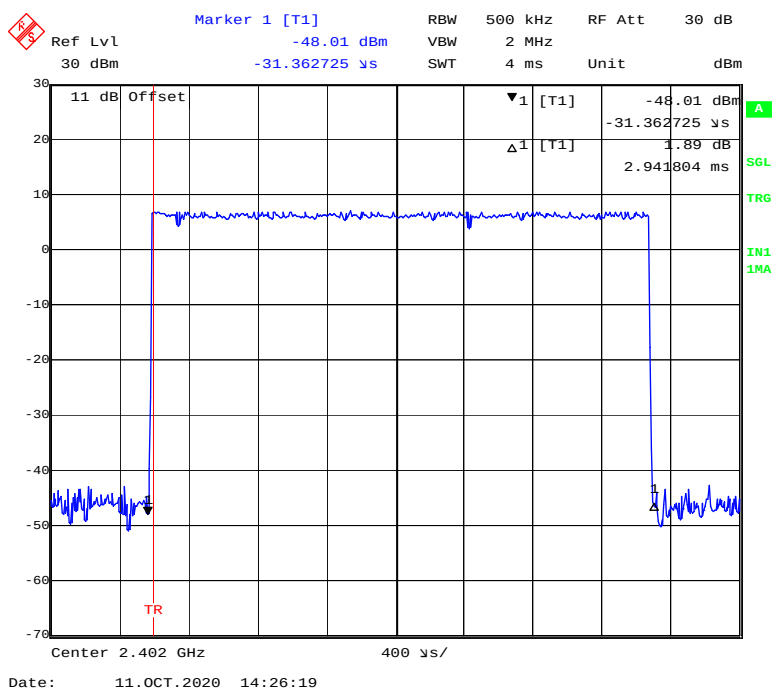
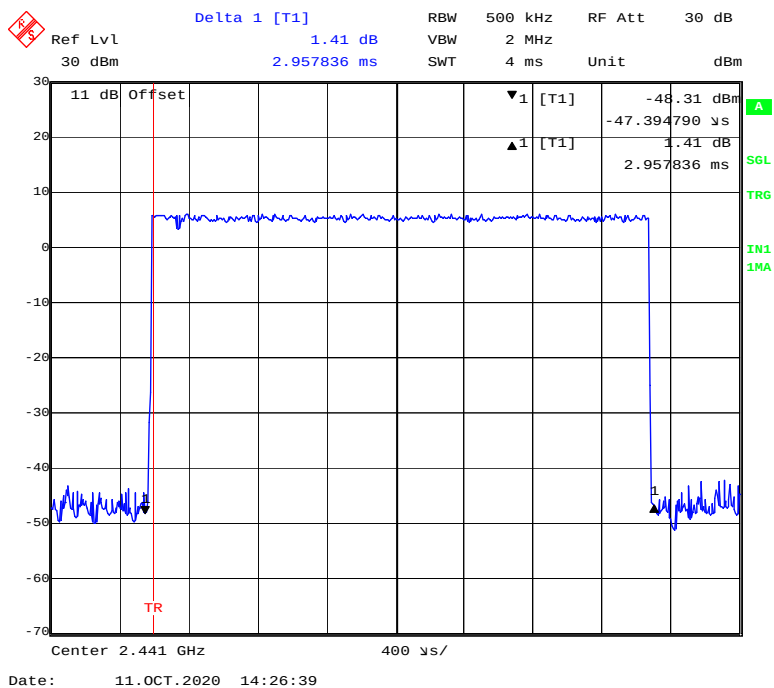
EDR ($\pi/4$ -DQPSK):Pulse time, High Channel, 2DH3**EDR ($\pi/4$ -DQPSK):Pulse time, Low Channel, 2DH5**

EDR ($\pi/4$ -DQPSK):Pulse time, Middle Channel, 2DH5**EDR ($\pi/4$ -DQPSK):Pulse time, High Channel, 2DH5**

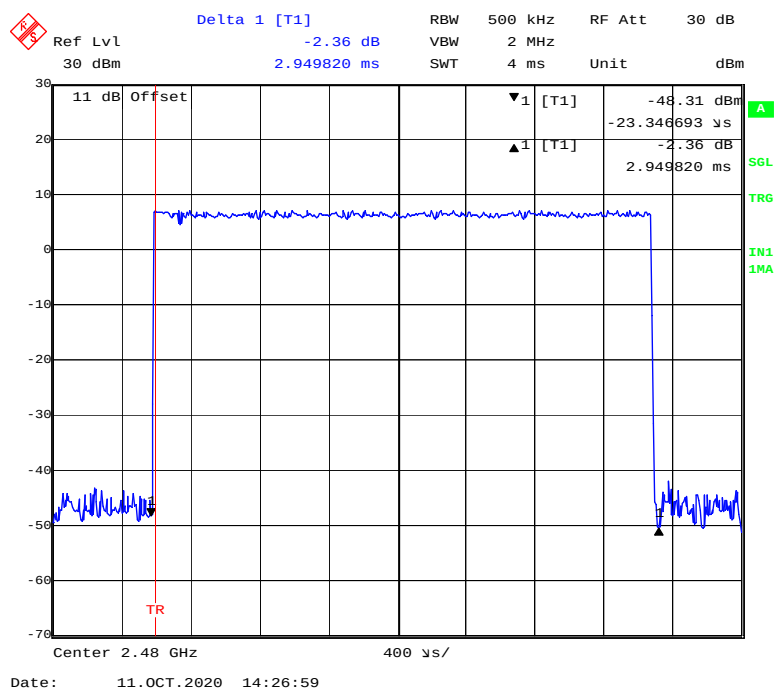
EDR (8DPSK): Pulse time, Low Channel, 3DH1**EDR (8DPSK): Pulse time, Middle Channel, 3DH1**

EDR (8DPSK): Pulse time, High Channel, 3DH1**EDR (8DPSK): Pulse time, Low Channel, 3DH3**

EDR (8DPSK): Pulse time, Middle Channel, 3DH3**EDR (8DPSK): Pulse time, High Channel, 3DH3**

EDR (8DPSK): Pulse time, Low Channel, 3DH5**EDR (8DPSK): Pulse time, Middle Channel, 3DH5**

EDR (8DPSK): Pulse time, High Channel, 3DH5



FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

- a. Use the following spectrum analyzer settings:
 - 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
 - 2) RBW > 20 dB bandwidth of the emission being measured.
 - 3) VBW $\geq$ RBW.
 - 4) Sweep: Auto.
 - 5) Detector function: Peak.
 - 6) Trace: Max hold.
- b. Allow trace to stabilize.
- c. Use the marker-to-peak function to set the marker to the peak of the emission.
- d. The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e. A plot of the test results and setup description shall be included in the test report.

Test Data

Environmental Conditions

Temperature:	21.7 °C
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

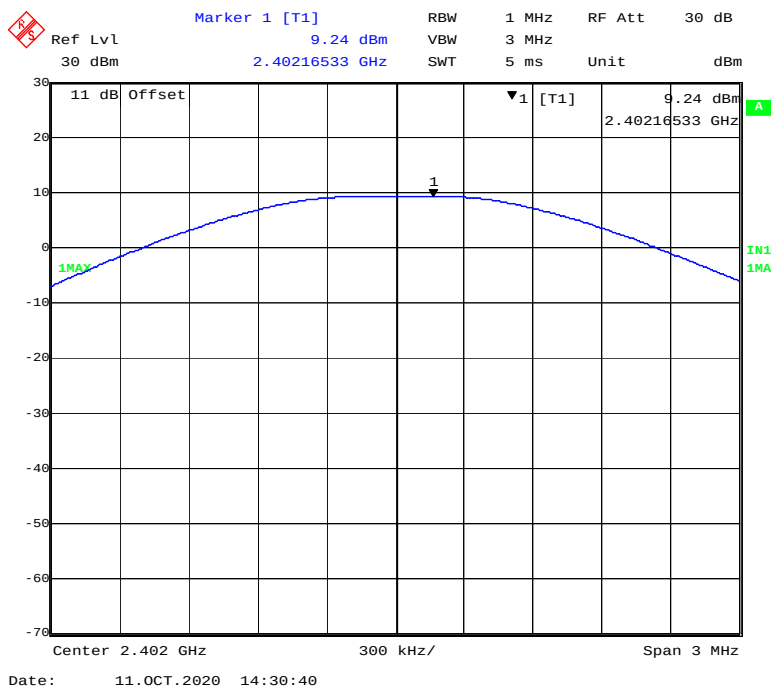
The testing was performed by CK Huang on 2020-10-11.

EUT operation mode: Transmitting

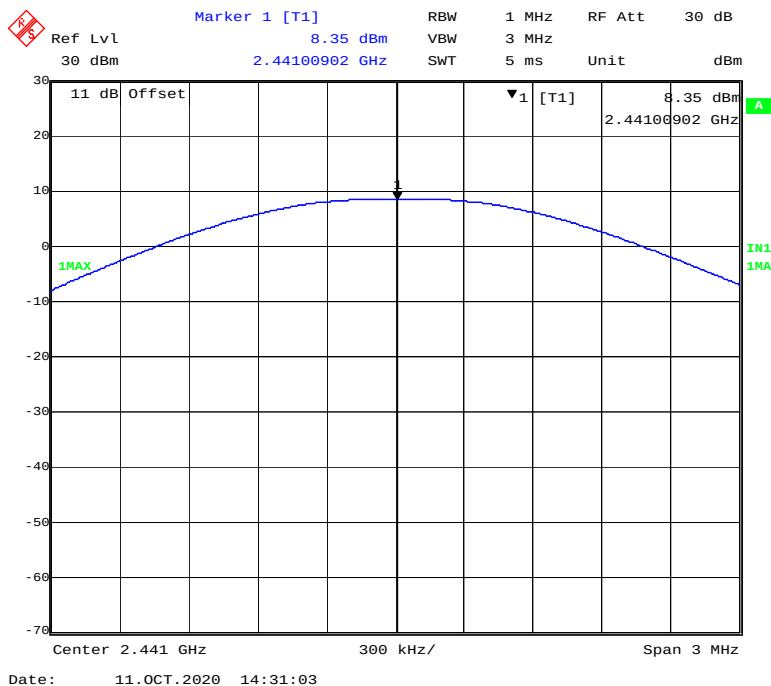
Test Result: Compliant.

Mode	Frequency (MHz)	Output Power		Limit (mW)
		(dBm)	(mW)	
BDR (GFSK)	2402	9.24	8.39	1000
	2441	8.35	6.84	1000
	2480	9.12	8.17	1000
EDR ($\pi/4$-DQPSK)	2402	8.49	7.06	125
	2441	7.40	5.50	125
	2480	8.37	6.87	125
EDR (8DPSK)	2402	8.71	7.43	125
	2441	7.91	6.18	125
	2480	8.71	7.43	125

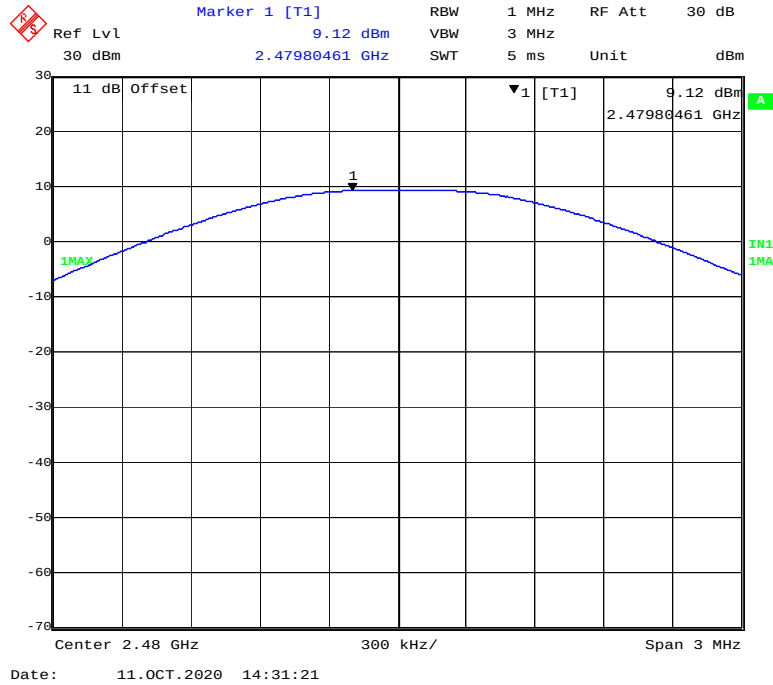
BDR (GFSK): 2402MHz



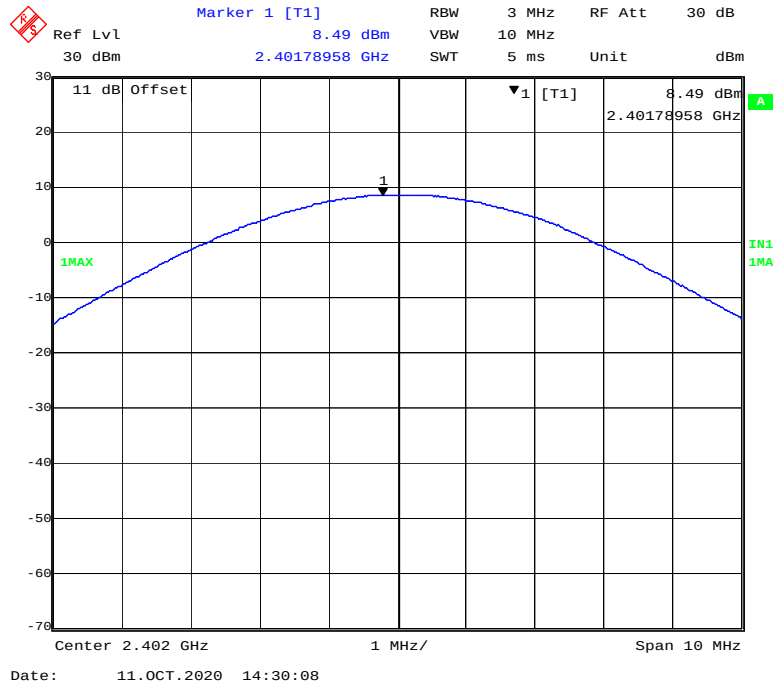
BDR (GFSK): 2441MHz



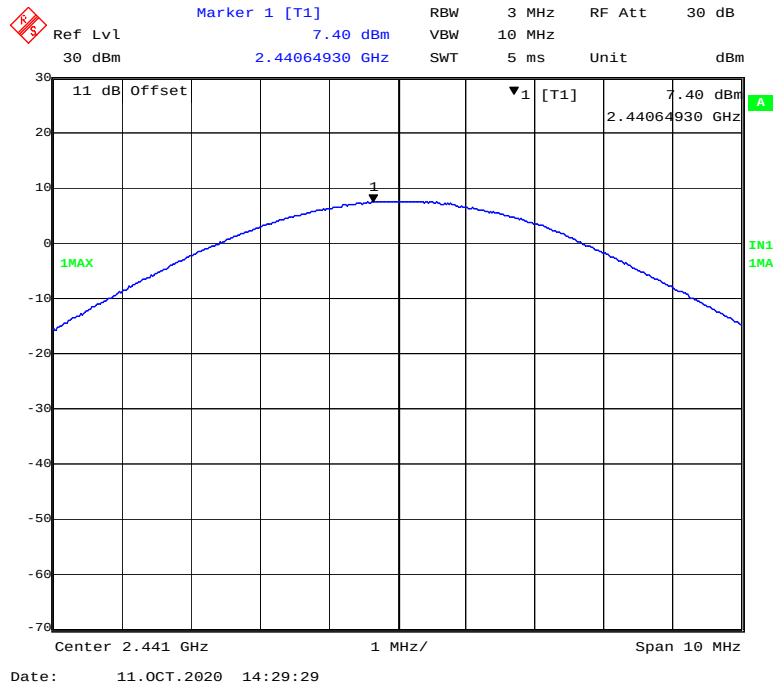
BDR (GFSK): 2480MHz



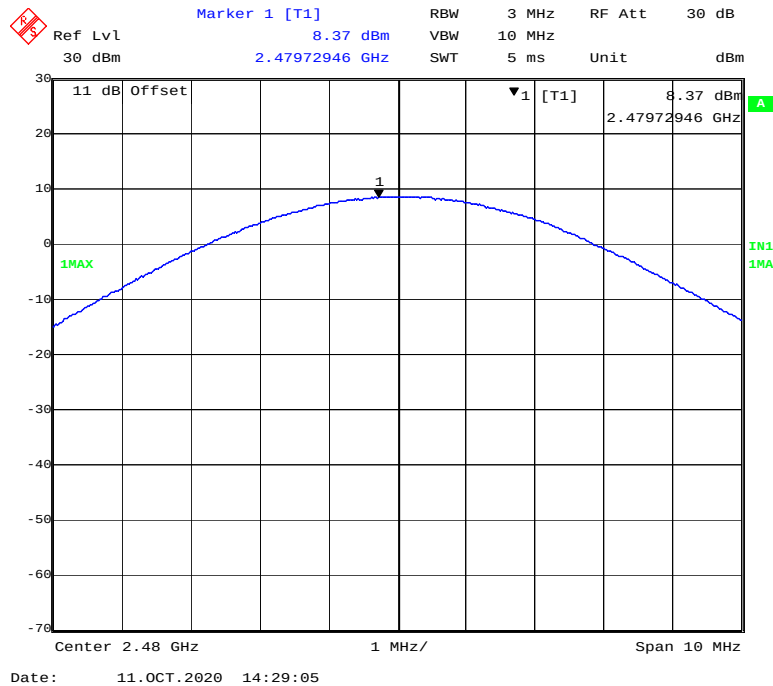
EDR($\pi/4$ -DQPSK): 2402MHz



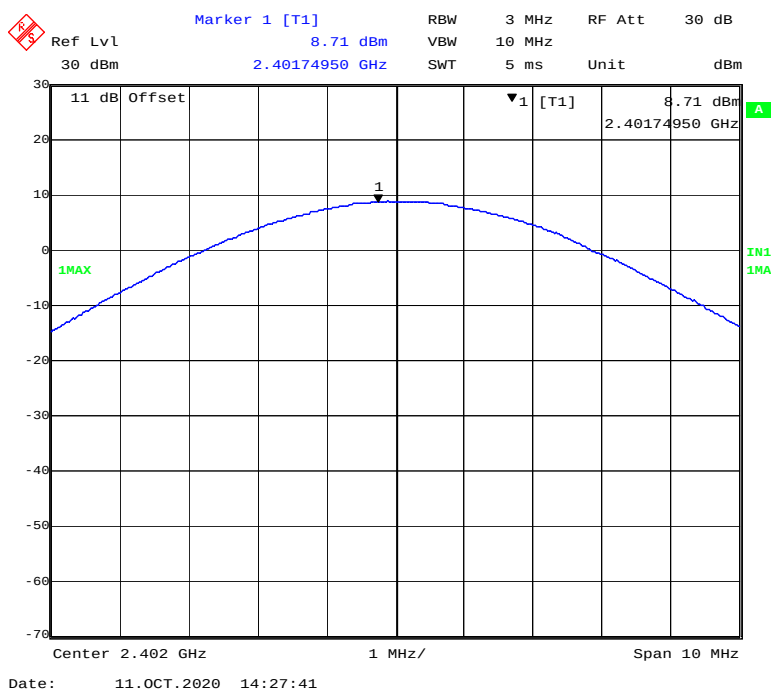
EDR($\pi/4$ -DQPSK): 2441MHz



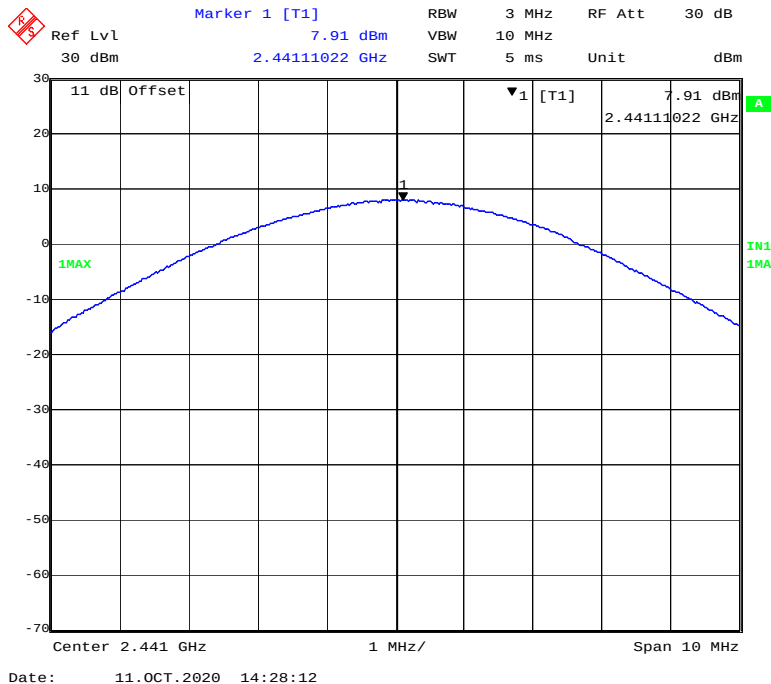
EDR($\pi/4$ -DQPSK): 2480MHz



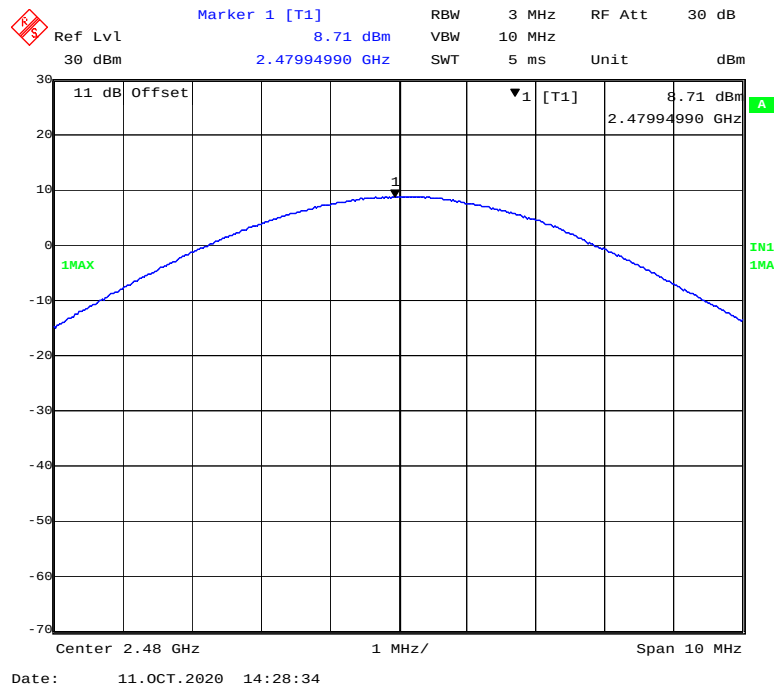
EDR(8DPSK): 2402MHz



EDR(8DPSK): 2441MHz



EDR(8DPSK): 2480MHz



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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 20 dB. 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)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

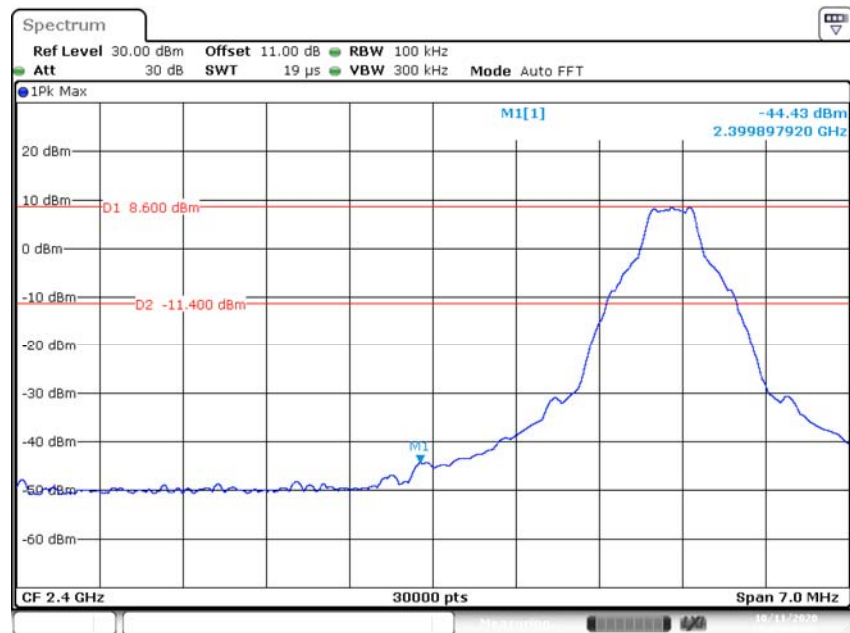
Environmental Conditions

Temperature:	24.8℃
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

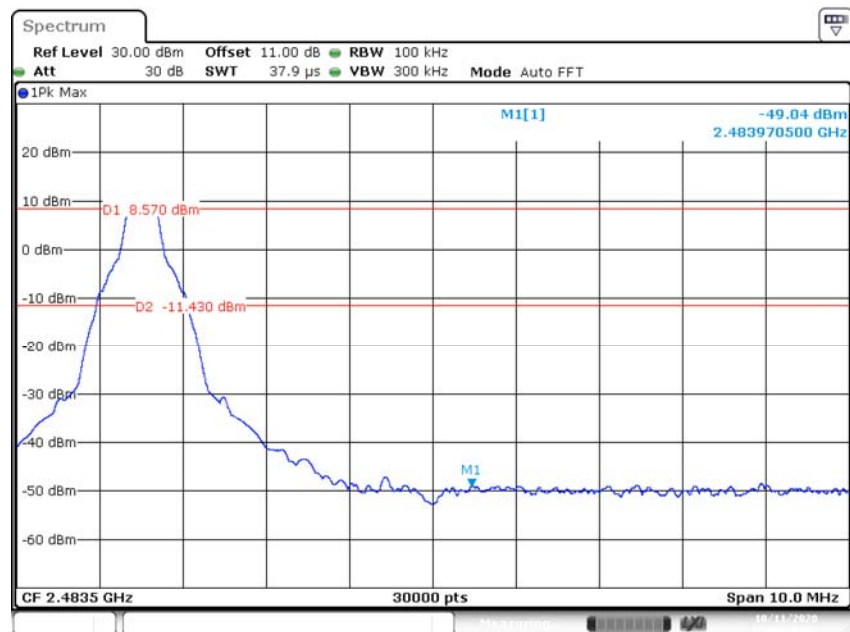
The testing was performed by CK Huang on 2020-10-11.

EUT operation mode: Transmitting & Hopping

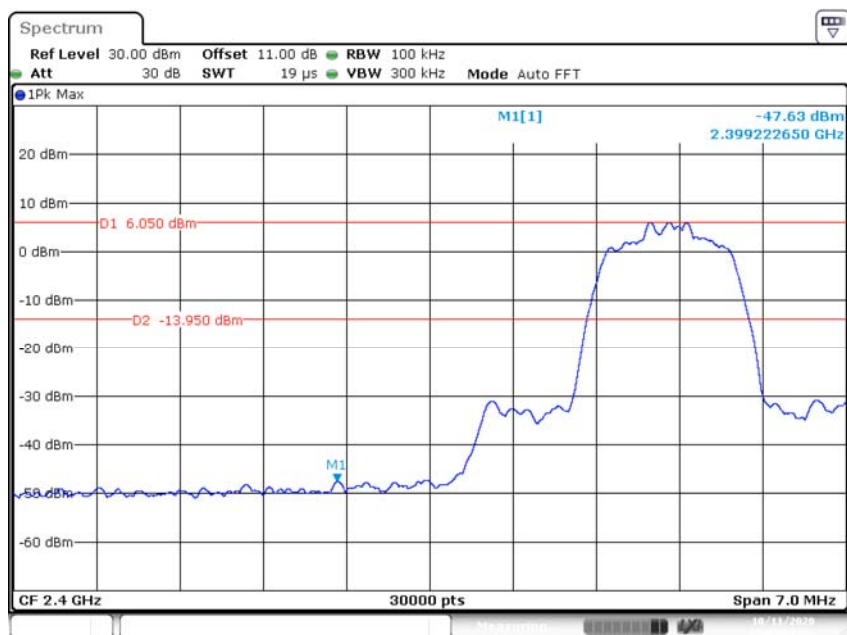
Test Result: Compliant.

Band Edge**BDR (GFSK): Left Side - Transmitting**

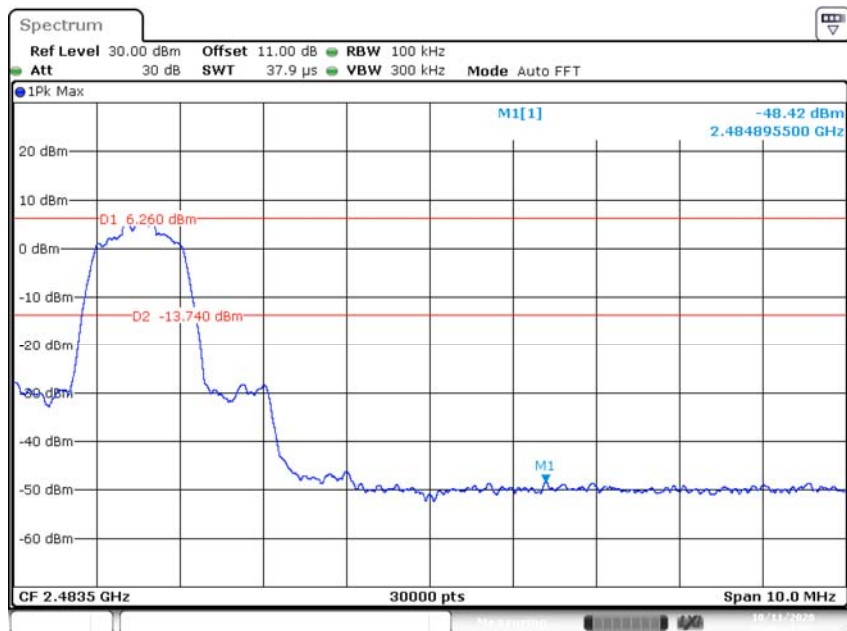
Date: 11.OCT.2020 17:03:58

BDR (GFSK): Right Side - Transmitting

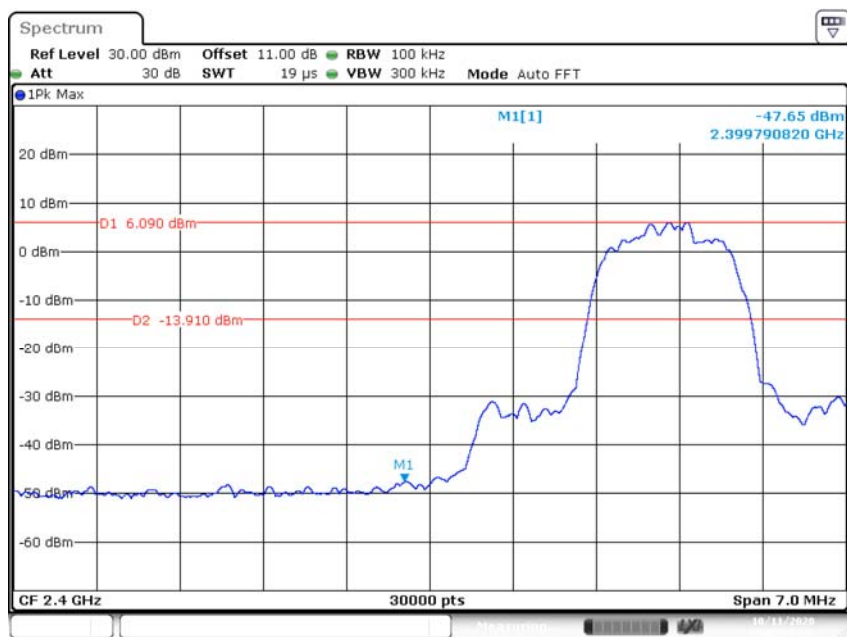
Date: 11.OCT.2020 17:09:28

EDR ($\pi/4$ -DQPSK): Left Side - Transmitting

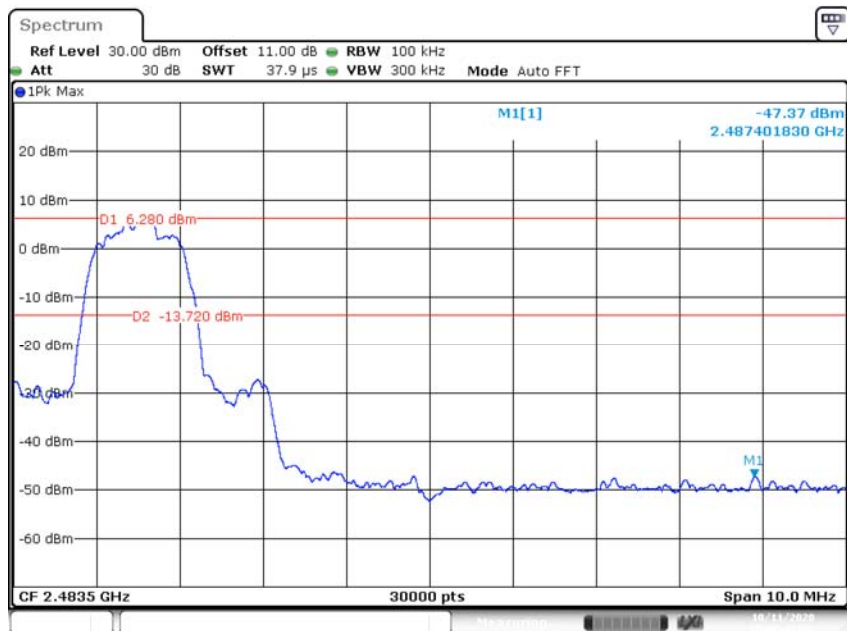
Date: 11.OCT.2020 17:05:08

EDR ($\pi/4$ -DQPSK): Right Side - Transmitting

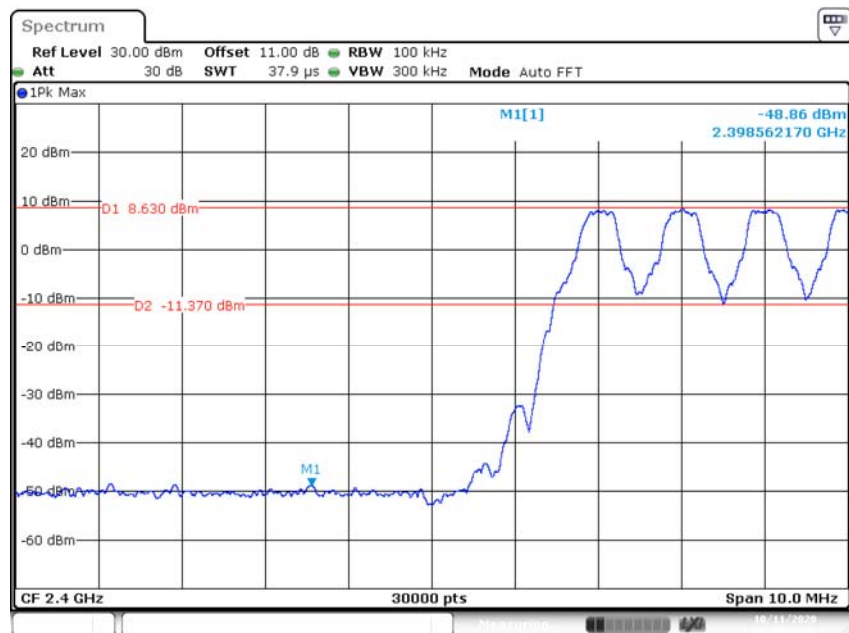
Date: 11.OCT.2020 17:08:40

EDR (8DPSK): Left Side - Transmitting

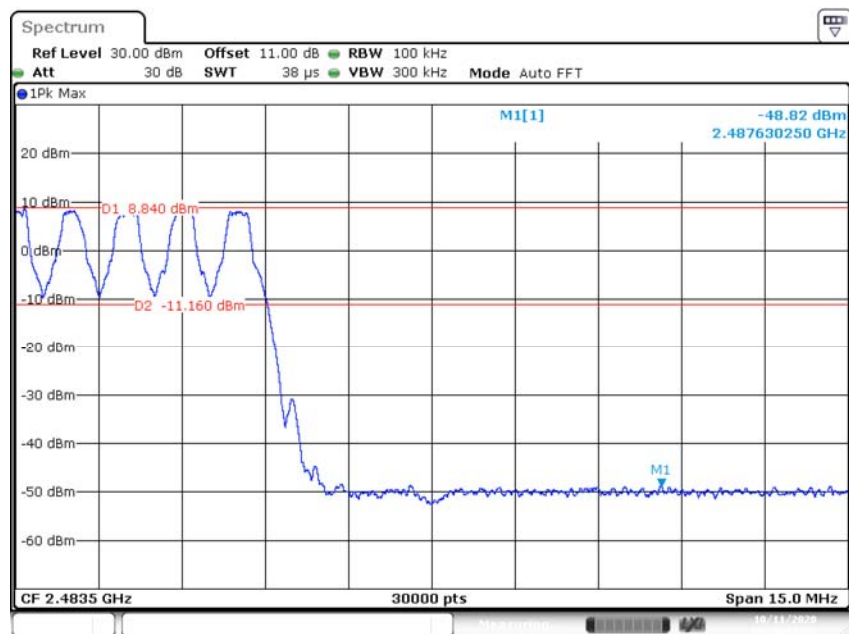
Date: 11.OCT.2020 17:05:50

EDR (8DPSK): Right Side - Transmitting

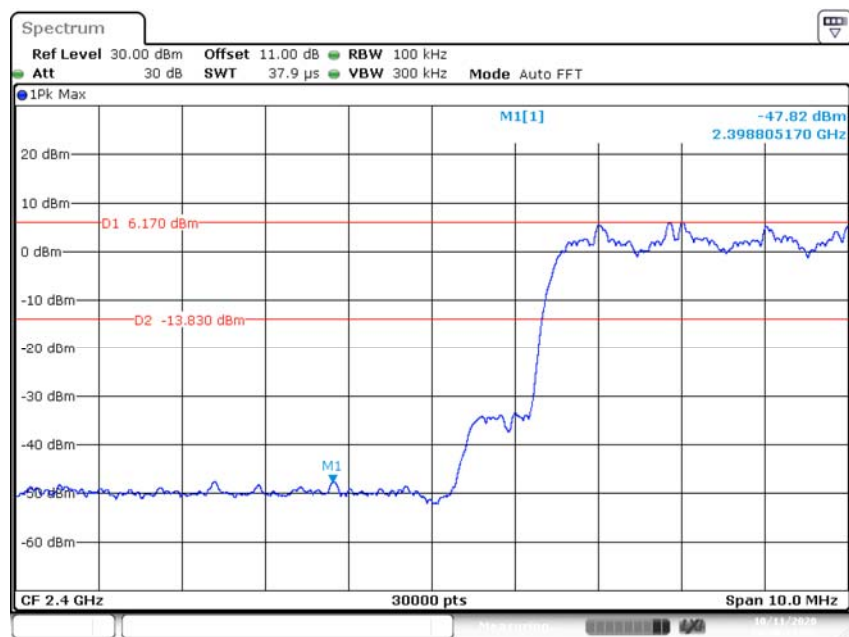
Date: 11.OCT.2020 17:07:47

BDR (GFSK): Left Side - Hopping

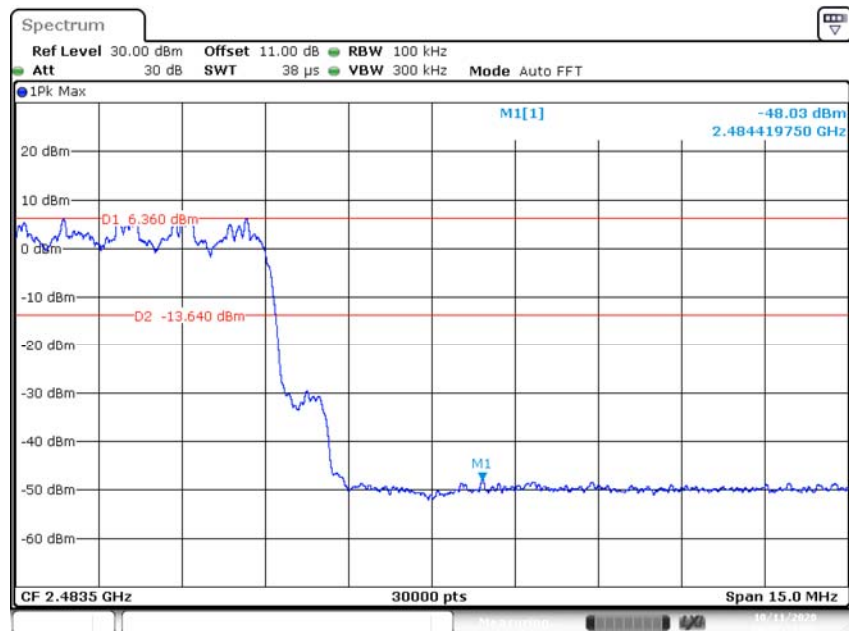
Date: 11.OCT.2020 16:38:55

BDR (GFSK): Right Side- Hopping

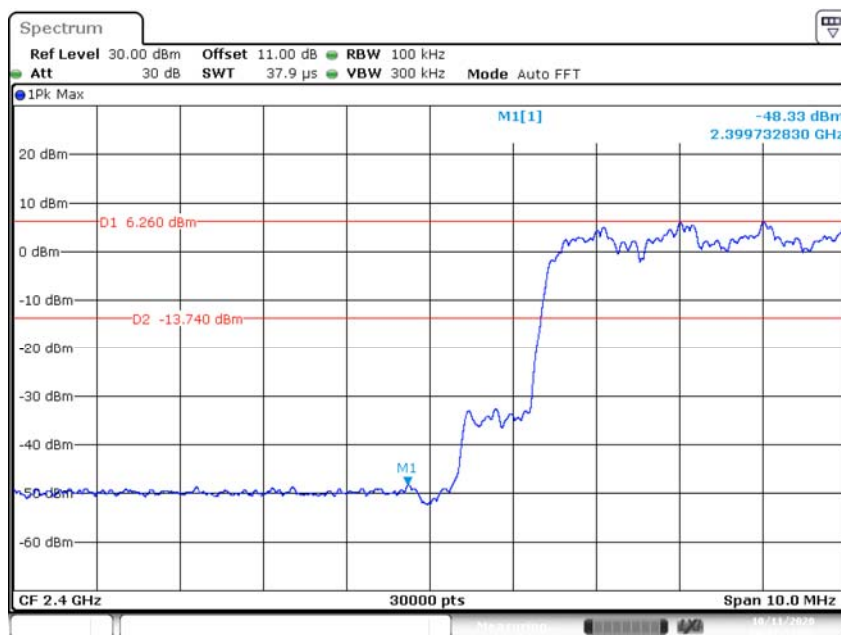
Date: 11.OCT.2020 16:38:04

EDR ($\pi/4$ -DQPSK): Left Side- Hopping

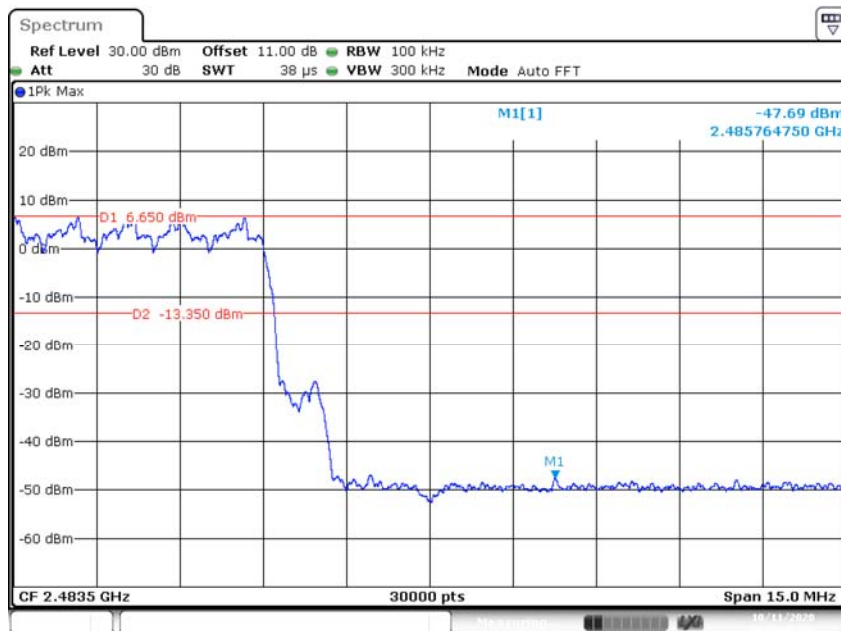
Date: 11.OCT.2020 16:40:13

EDR ($\pi/4$ -DQPSK): Right Side- Hopping

Date: 11.OCT.2020 16:37:14

EDR (8DPSK): Left Side- Hopping

Date: 11.OCT.2020 16:41:53

EDR (8DPSK): Right Side- Hopping

Date: 11.OCT.2020 16:35:49

Declarations

- 1: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
- 2: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
- 3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
- 4: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.
- 5: This report cannot be reproduced except in full, without prior written approval of the Company.
- 6: This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

******* END OF REPORT *******