

Test Report

FCC ID: 2APBP-CS10

Date of issue: Apr. 10, 2018

Report Number:	MTi180416E037
Sample Description:	Smart POS Payment Terminal
Model(s):	CS10, CS10A, CS10B, CS10C, CS10D, CS10E, CS10F, CS11, CS12, CS13
Applicant:	Ciontek Technology Corp.
Address:	B501, Chanxueyan Building Wuhan University, No.6 Of Yuexing 2nd Road, Nanshan District, Shenzhen
Date of Test:	Mar. 23, 2018 to Apr. 10, 2018

Shenzhen Microtest Co., Ltd.
<http://www.mtitest.com>

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Test Result Certification

Applicant's name: Ciontek Technology Corp.

Address: B501, Chanxueyan Building Wuhan University, No.6 Of Yuexing 2nd Road, Nanshan District, Shenzhen

Manufacture's Name: Ciontek Technology Corp.

Address: B501, Chanxueyan Building Wuhan University, No.6 Of Yuexing 2nd Road, Nanshan District, Shenzhen

Product name: Smart POS Payment Terminal

Trademark: Ciontek

Model name: CS10, CS10A, CS10B, CS10C, CS10D, CS10E, CS10F, CS11, CS12, CS13

Standards: FCC Part 15.247

Test Procedure: ANSI C63.10-2013
DA 00-705

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:



Demi Mu

Apr. 10, 2018

Reviewed by:



Blue Zheng

Apr. 10, 2018

Approved by:



Smith Chen

Apr. 10, 2018

1 General Information

1.1 Description of EUT

Product name	Smart POS Payment Terminal
Model name	CS10
Serial Model	CS10A, CS10B, CS10C, CS10D, CS10E, CS10F, CS11, CS12, CS13
Model Difference	All the models above are identical in interior structure, electrical circuits and components; just the color. fingerprint module and scanner module is different. The model CS10 has been tested for the worst case.
Operation Frequency	TX 2402-2480MHz RX 2402-2480MHz
Modulation Type:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Bit Rate of Transmitter	1 Mbps, 2 Mbps, 3 Mbps
Antenna Type	Integrated antenna
Antenna Gain	-0.39dBi
Max. Output Power	2.175 dBm
Hardware Version:	CS10_V3.0
Software Version:	A26_V3.17_171103US
Software Version:	A26_V3.17_171103US
Power Supply:	DC 5V From adapter
Adapter information:	Model: GKYPG0200050 US2 Input: 100-240V 50/60Hz 0.5A Output: 5V 2A

1.2 Operation channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464

09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454	--	--
26	2428	53	2455	--	--

1.3 Test channel list

Channel	Channel	Frequency (MHz)
Low	00	2402
Middle	39	2441
High	79	2480

1.4 Ancillary equipment list

Equipment	Model	S/N	Manufacturer	Certificate type
/	/	/	/	/

1.5 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	Series No.	Note
/	/	/	/	/	/
/	/	/	/	/	/

Note:

(1)The support equipment was authorized by Declaration of Confirmation.

(2)For detachable type I/O cable should be specified the length in cm in 『Length』 column.

2 Summary of Test Results

Test procedures according to the technical standards:

No.	Standard Section	Test Item	Result	Remark
1	15.203/15.247(c)	Antenna requirement	Pass	
2	15.247(b)(1)	Peak output power	Pass	
3	15.207	Conducted emission	Pass	
4	15.247(d)	Band edge	Pass	
5	15.205/15.209	Spurious emission	Pass	
6	15.247(a)(1)	20dB occupied bandwidth	Pass	
7	15.247(a)(1)	Carrier Frequencies Separation	Pass	
8	15.247(a)(1)	Hopping channel number	Pass	
9	15.247(a)(1)	Dwell time	Pass	

3 Test Facilities and Accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd.
Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573

3.2 Environmental conditions

Temperature:	20°C~30°C
Humidity	30%~70%
Atmospheric pressure	98kPa~101kPa

3.3 Measurement uncertainty

The reported uncertainty of measurement $y \pm U$ where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$ providing a level of confidence of approximately 95 %

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 1.38\text{dB}$
2	RF power, conducted	$\pm 0.16\text{dB}$
3	Spurious emissions, conducted	$\pm 0.21\text{dB}$
4	All emissions, radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

3.4 Test software

Software Name	Manufacturer	Model	Version
RF Test System	Farad	LZ-RF	Lz_Rf 3A3

4 Equipment List

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E001	Spectrum Analyzer	Agilent	E4407B	MY41441082	2017/09/18	2018/09/17
MTI-E002	CMU 200 universal radio communication tester	Rohde&schwarz	CMU 200	114587	2017/09/18	2018/09/17
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI	1000314	2017/09/18	2018/09/17
MTI-E006	Broadband antenna	schwarabeck	VULB9163	872	2017/09/18	2018/09/17
MTI-E007	Horn antenna	schwarabeck	BBHA9120D	1201	2017/09/18	2018/09/17
MTI-E014	amplifier	America	8447D	3113A06150	2017/09/18	2018/09/17
MTI-E015	Conduction Immunity Signal Generator	Schloder	CDG6000	126A1343/2015	2017/09/18	2018/09/17
MTI-E016	Coupled decoupling network	Schloder	CDA M2/M3	A2210332/2015	2017/09/18	2018/09/17
MTI-E032	Comprehensive test instrument	Rohde&schwarz	CMW500	124192	2017/09/13	2018/09/12
MTI-E034	amplifier	Agilent	8449B	3008A02400	2017/08/22	2018/08/21
MTI-E040	Spectrum analyzer	Agilent	N9020A	MY49100060	2017/09/05	2018/09/04
MTI-E041	Signal generator	Agilent	N5182A	MY49060455	2017/09/23	2018/09/22
MTI-E042	Analog signal generator	Agilent	E4421B	GB40051240	2017/09/23	2018/09/22
MTI-E043	Power probe	Dare Instruments	RPR3006W	16100054SN016	2017/09/29	2018/09/28
MTI-E047	10dB attenuator	Mini-Circuits	UNAT-10+	15542	2017/09/24	2018/09/23
MTI-E049	spectrum analyzer	Rohde&schwarz	FSP-38	100019	2017/09/18	2018/09/17
MTI-E050	PSG Signal generator	Agilent	E8257D	MY46520873	2017/09/24	2018/09/23
MTI-E051	Active Loop Antenna 9kHz - 30MHz	Schwarzbeek	FMZB 1519 B	00044	2017/09/26	2018/09/25
MTI-E052	18-40GHz amplifier	Chengdu step Micro Technology	ZLNA-18-40G-21	1608001	2017/09/18	2018/09/17
MTI-E053	15-40G Antenna	Schwarzbeek	BBHA9170	BBHA9170582	2017/09/18	2018/09/17
Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).						

5 Test Result

5.1 Antenna requirement

5.1.1 Standard requirement

15.203 requirement: For intentional device, 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

5.1.2 EUT Antenna

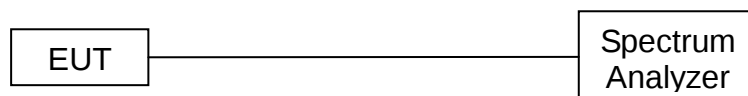
The antenna is an integrated antenna, which was permanently affixed to the device and un-replaced, complies with 15.203. In addition, the maximum antenna gain is -0.39dBi.

5.2 Peak output power

5.2.1 Limit

FCC Part15 Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247(b)(3)	Peak output power	Hopping Channels>75 Power<1W(30dBm)	2400-2483.5

5.2.2 Test setup



5.2.3 Test procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW ≤1 MHz)
RBW=3MHz, VBW=10MHz, Detector=Peak (If 20dB BW > 1 MHz)
- (3) The EUT was set to continuously transmitting in the max power during the test.

5.2.4 Test results

Test data

EUT :	Smart POS Payment Terminal	Model Name :	CS10
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V by battery

GFSK

Test Channel	Frequency (MHz)	Maximum Peak Output Power(dBm)	Limit (dBm)
CH00	2402	1.550	30
CH39	2441	1.768	30
CH78	2480	2.175	30

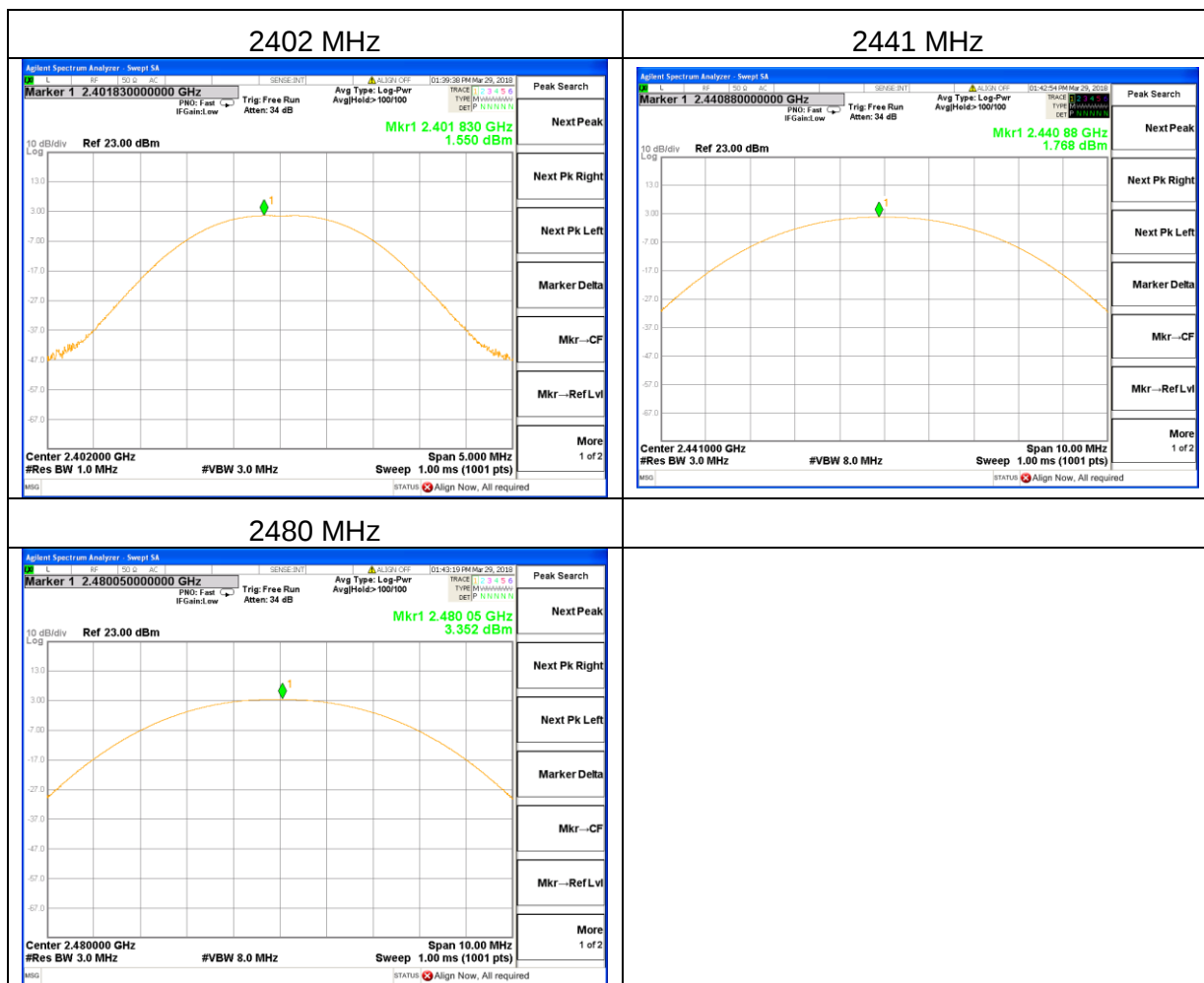
$\pi/4$ -DQPSK

Test Channel	Frequency (MHz)	Maximum Peak Output Power(dBm)	Limit (dBm)
CH00	2402	0.444	20.96
CH39	2441	0.783	20.96
CH78	2480	2.175	20.96

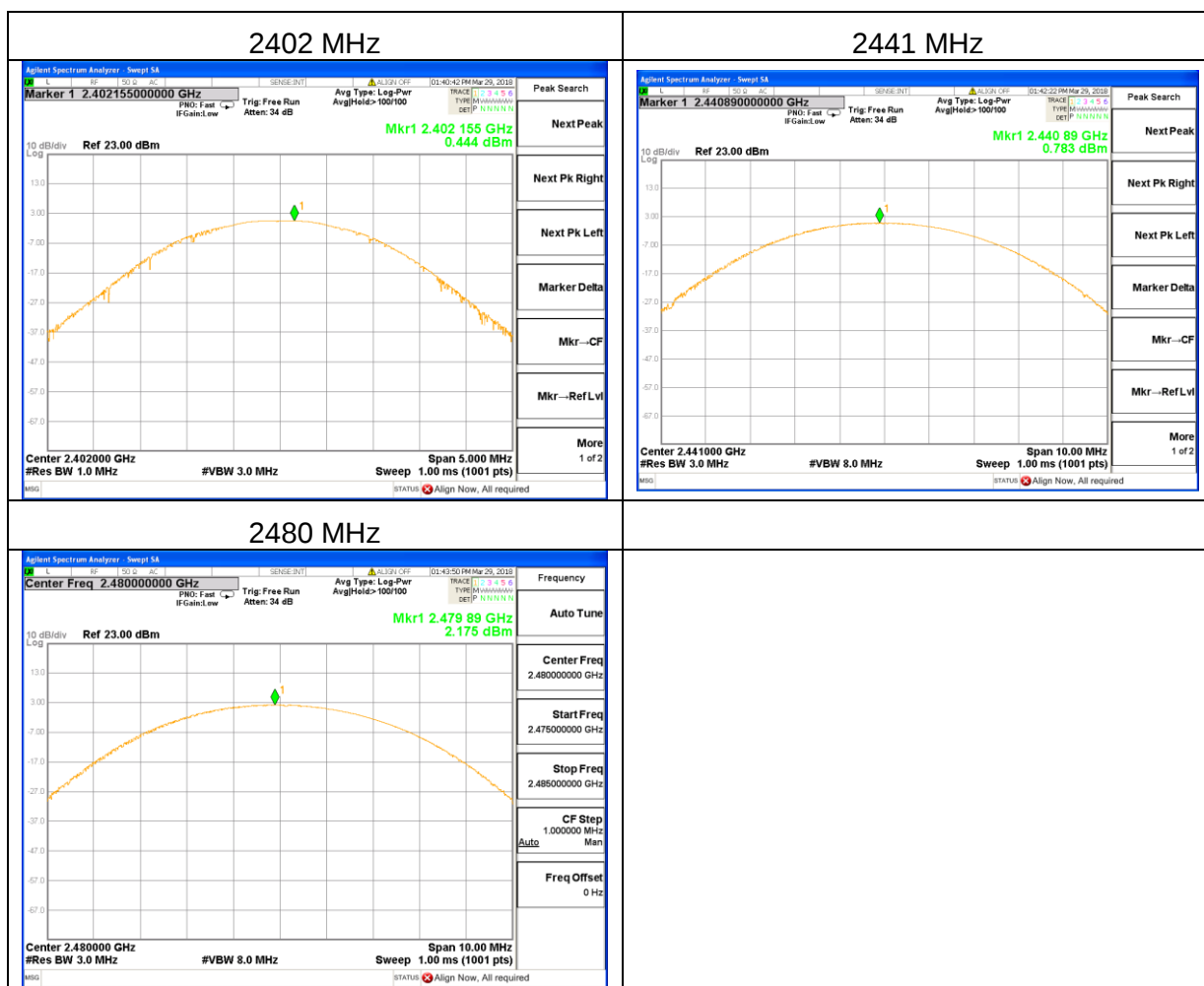
8DPSK

Test Channel	Frequency (MHz)	Maximum Peak Output Power(dBm)	Limit (dBm)
CH00	2402	0.714	20.96
CH39	2441	0.746	20.96
CH78	2480	2.137	20.96

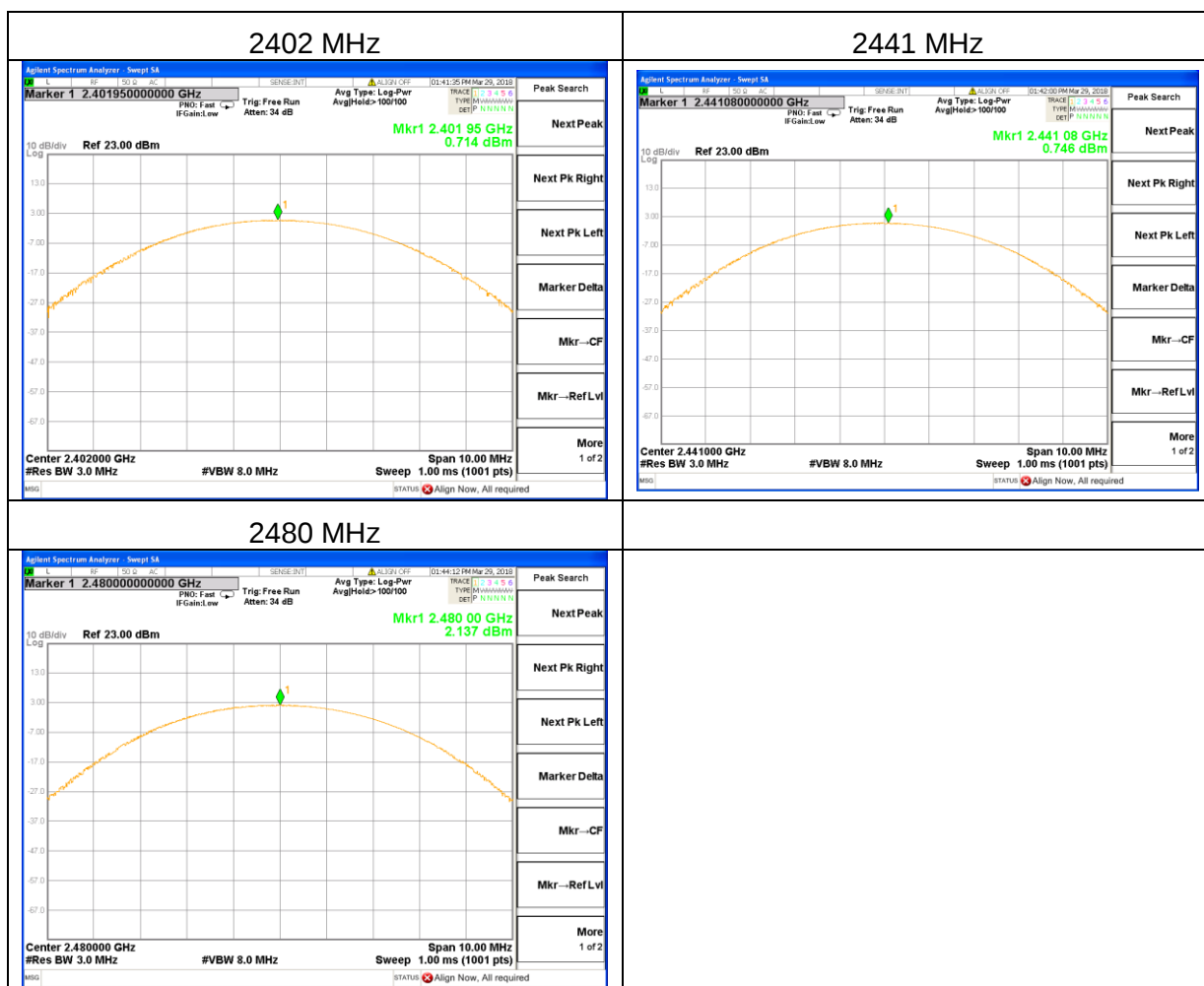
Test plots
GFSK



$\pi/4$ -DQPSK



8DPSK



5.3 Conducted emission

5.3.1 Limits

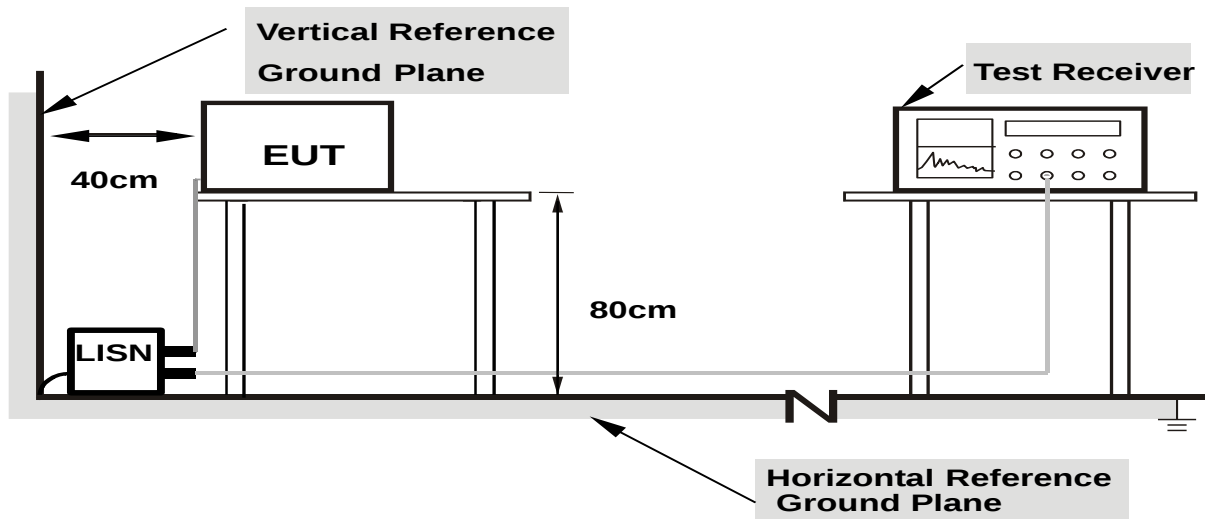
FREQUENCY (MHz)	Class B (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note

(1)The tighter limit applies at the band edges.

(2)The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

5.3.2 Test setup



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

5.3.3 Test procedure

a. EUT Operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

b. The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

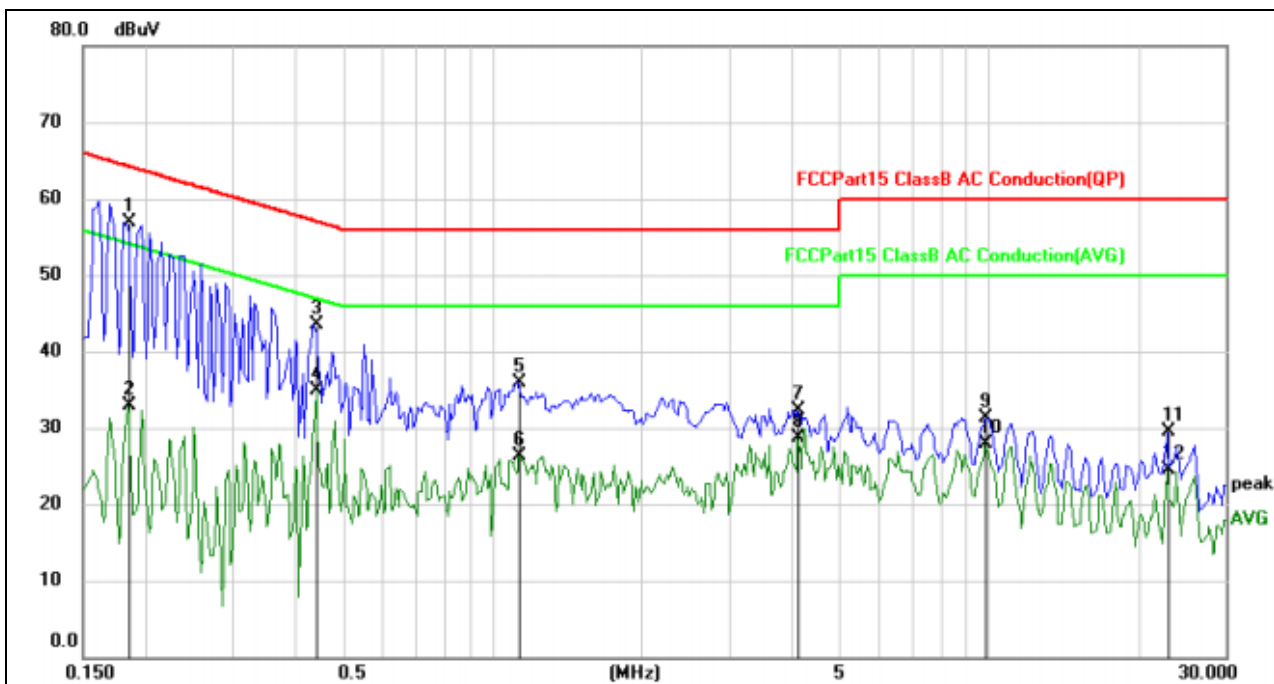
- c. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- d. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- e. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- f. LISN at least 80 cm from nearest part of EUT chassis.

For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.3.4 Test results

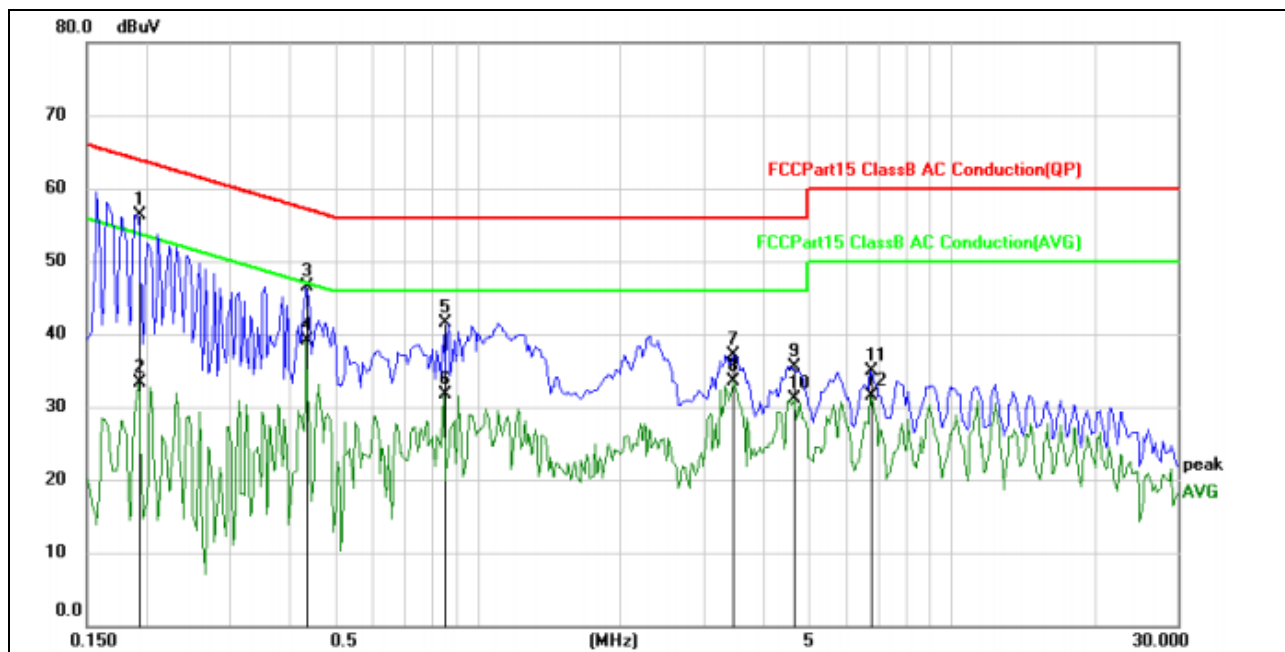
Test data

EUT :	Smart POS Payment Terminal	Model Name. :	CS10
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 5V from adapter AC 120V/60Hz	Test Mode :	Normal working



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1852	56.86	-0.03	56.83	64.25	-7.42	QP	
2		0.1852	32.87	-0.03	32.84	54.25	-21.41	AVG	
3		0.4430	43.62	-0.03	43.59	57.01	-13.42	QP	
4		0.4430	34.93	-0.03	34.90	47.01	-12.11	AVG	
5		1.1305	35.90	-0.04	35.86	56.00	-20.14	QP	
6		1.1305	26.43	-0.04	26.39	46.00	-19.61	AVG	
7		4.1211	32.40	-0.05	32.35	56.00	-23.65	QP	
8		4.1211	28.79	-0.05	28.74	46.00	-17.26	AVG	
9		9.8397	31.48	-0.09	31.39	60.00	-28.61	QP	
10		9.8397	27.93	-0.09	27.84	50.00	-22.16	AVG	
11		22.9336	29.76	-0.29	29.47	60.00	-30.53	QP	
12		22.9336	24.84	-0.29	24.55	50.00	-25.45	AVG	

EUT :	Smart POS Payment Terminal	Model Name. :	CS10
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 5V from adapter AC 120V/60Hz	Test Mode :	Normal working



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1930	56.40	-0.03	56.37	63.91	-7.54	QP	
2		0.1930	33.32	-0.03	33.29	53.91	-20.62	AVG	
3		0.4352	46.51	-0.03	46.48	57.15	-10.67	QP	
4		0.4352	39.06	-0.03	39.03	47.15	-8.12	AVG	
5		0.8492	41.48	-0.03	41.45	56.00	-14.55	QP	
6		0.8492	31.80	-0.03	31.77	46.00	-14.23	AVG	
7		3.4648	37.22	-0.04	37.18	56.00	-18.82	QP	
8		3.4648	33.52	-0.04	33.48	46.00	-12.52	AVG	
9		4.6680	35.52	-0.06	35.46	56.00	-20.54	QP	
10		4.6680	31.22	-0.06	31.16	46.00	-14.84	AVG	
11		6.7422	35.05	-0.05	35.00	60.00	-25.00	QP	
12		6.7422	31.57	-0.05	31.52	50.00	-18.48	AVG	

5.4 Radiated spurious emission

5.4.1 Limits

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

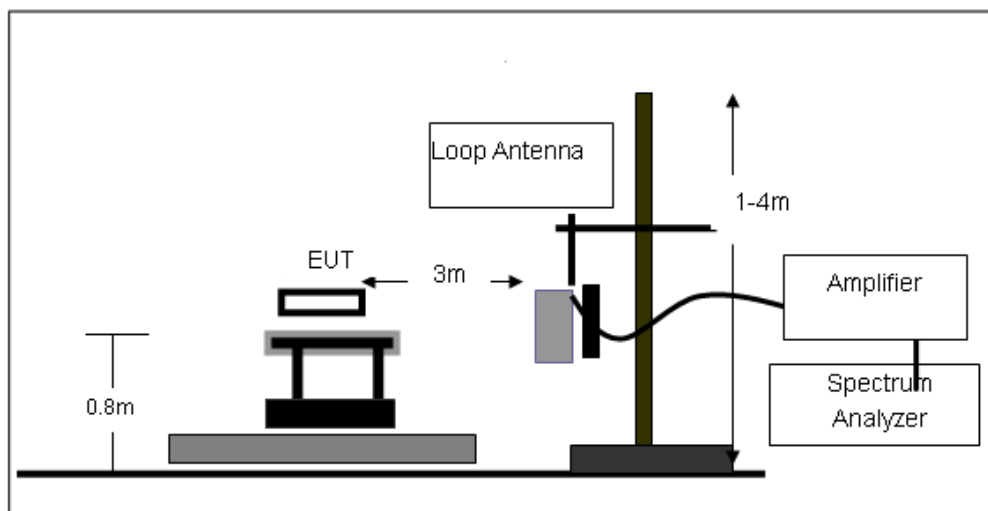
Frequency (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

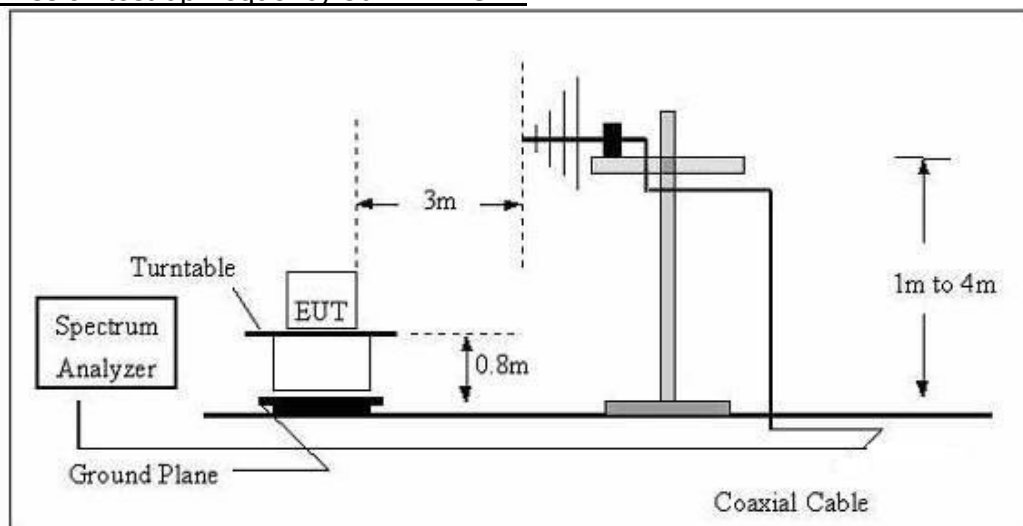
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

5.4.2 Test setup

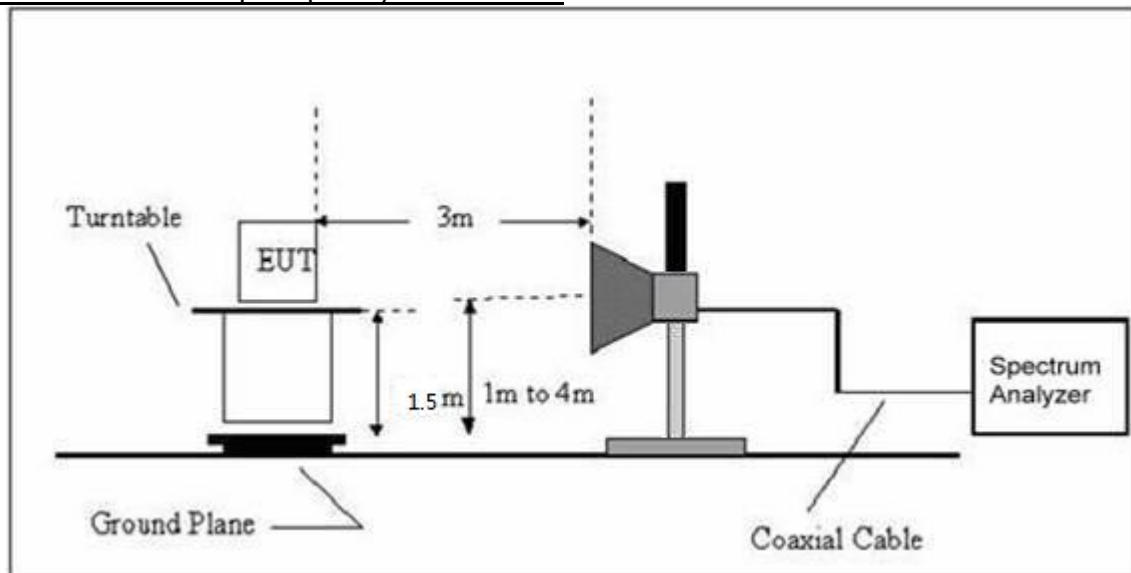
Radiated emission test-up frequency below 30MHz



Radiated emission test-up frequency 30MHz~1GHz



Radiated emission test-up frequency above 1GHz



5.4.3 Test procedure

- a. EUT operating conditions. The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.
- b. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- c. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- f. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- g. For the actual test configuration, please refer to the related Item –EUT Test photos.

Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

5.4.4 Test results

5.4.4.1 Radiation emission

Below 30MHz

EUT:	Smart POS Payment Terminal	Model Name:	CS10
Temperature:	20 °C	Relative Humidity:	48%
Pressure:	1010 hPa	Test Voltage:	DC 5V from adapter AC 120V/60Hz
Test Mode:	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	Pass
--	--	--	--	Pass

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

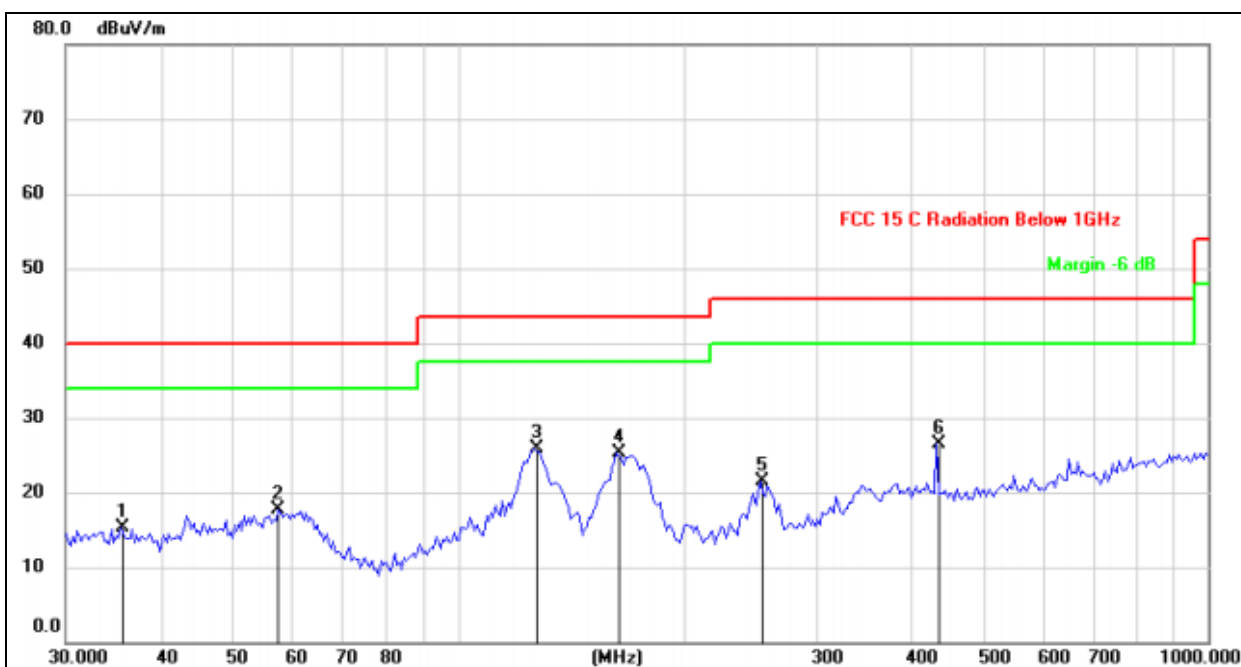
Limit line = specific limits(dBuV) + distance extrapolation factor.

Between 30MHz – 1GHz

Note1 : Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.

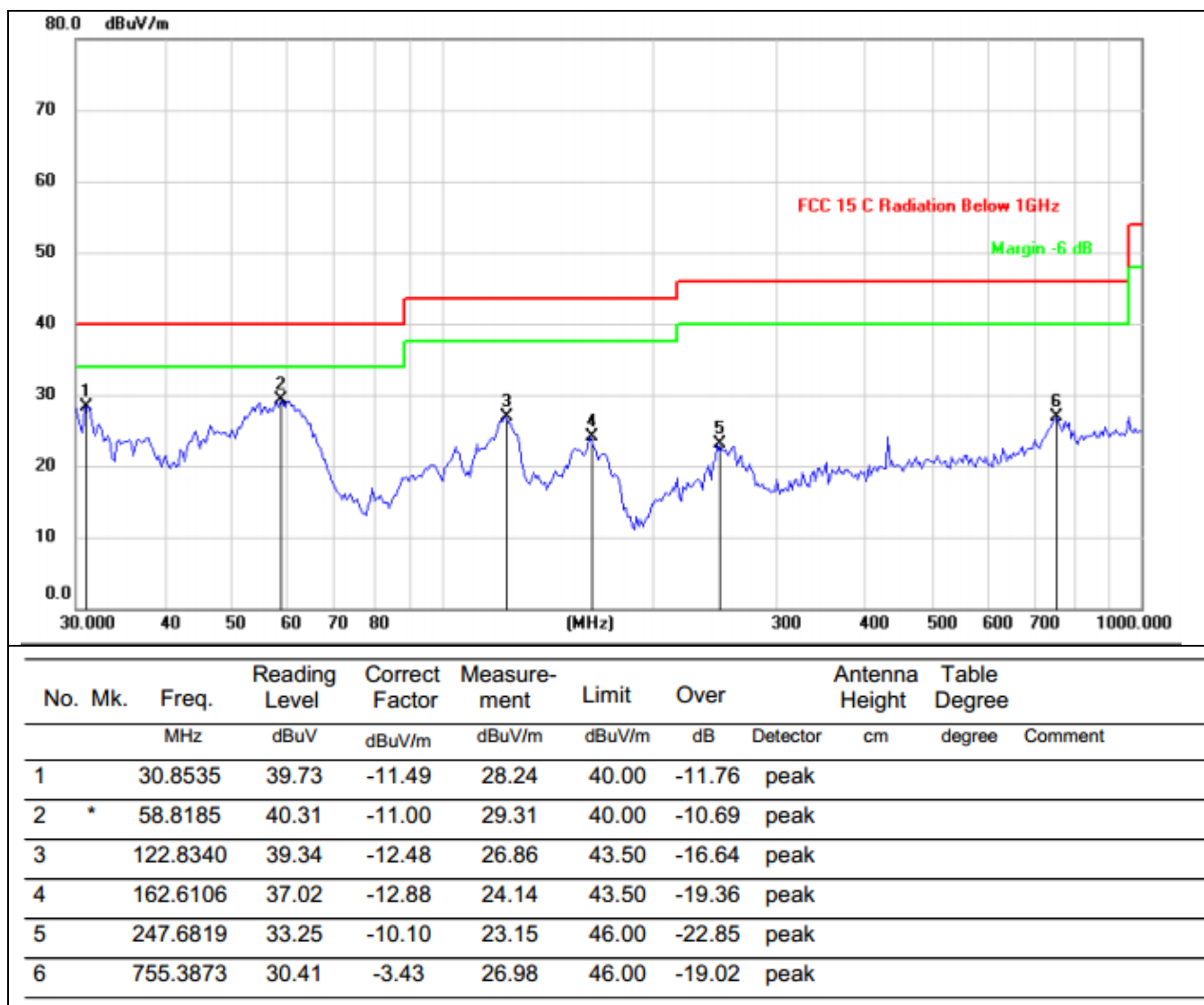
Note2 :The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.

EUT :	Smart POS Payment Terminal	Model Name :	CS10
Relative Humidity:	52%	Phase:	H
Pressure:	1010 hPa	Test Voltage :	DC 5V from adapter AC 120V/60Hz
Test Mode :	Normal working		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		35.4993	25.58	-10.32	15.26	40.00	-24.74	peak		
2		57.5939	28.59	-10.81	17.78	40.00	-22.22	peak		
3	*	126.3286	39.87	-13.96	25.91	43.50	-17.59	peak		
4		162.6106	39.52	-14.15	25.37	43.50	-18.13	peak		
5		252.9482	31.50	-9.94	21.56	46.00	-24.44	peak		
6		434.0651	32.61	-6.05	26.56	46.00	-19.44	peak		

EUT :	Smart POS Payment Terminal	Model Name :	CS10
Relative Humidity:	52%	Phase:	V
Pressure:	1010 hPa	Test Voltage :	DC 5V from adapter AC 120V/60Hz
Test Mode :	Normal working		



1G-25GHz

Note1 : Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Note2 :The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.

For GFSK

Low Channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6110.220	51.29	-7.20	44.09	74.00	-29.91	Horizontal
2	9619.238	50.02	-1.04	48.98	74.00	-25.02	Horizontal
3	10675.351	50.85	0.25	51.10	74.00	-22.90	Horizontal
4	11901.804	51.52	0.28	51.80	74.00	-22.20	Horizontal
5	12787.575	50.12	1.23	51.35	74.00	-22.65	Horizontal
6	14150.301	46.02	5.62	51.64	74.00	-22.36	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6246.493	50.37	-5.07	45.30	74.00	-28.70	Vertical
2	8290.581	49.21	-1.93	47.28	74.00	-26.72	Vertical
3	9619.238	49.07	0.72	49.79	74.00	-24.21	Vertical
4	10368.737	48.65	2.16	50.81	74.00	-23.19	Vertical
5	12719.439	49.53	3.01	52.54	74.00	-21.46	Vertical
6	14082.164	44.91	6.06	50.97	74.00	-23.03	Vertical

Middle channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6587.174	50.94	-5.70	45.24	74.00	-28.76	Horizontal
2	7949.900	50.54	-3.72	46.82	74.00	-27.18	Horizontal
3	10368.737	50.77	0.10	50.87	74.00	-23.13	Horizontal
4	11731.463	50.91	0.33	51.24	74.00	-22.76	Horizontal
5	12787.575	50.36	1.23	51.59	74.00	-22.41	Horizontal
6	13945.892	45.48	5.61	51.09	74.00	-22.91	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	3963.928	50.78	-2.76	48.02	74.00	-25.98	Vertical
2	6655.311	50.05	-3.96	46.09	74.00	-27.91	Vertical
3	9551.102	48.22	0.51	48.73	74.00	-25.27	Vertical
4	11867.736	48.65	2.45	51.10	74.00	-22.90	Vertical
5	12583.166	49.14	2.98	52.12	74.00	-21.88	Vertical
6	14116.233	45.52	5.97	51.49	74.00	-22.51	Vertical

High channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6484.970	52.34	-5.95	46.39	74.00	-27.61	Horizontal
2	7983.968	50.73	-3.67	47.06	74.00	-26.94	Horizontal
3	10470.942	50.44	0.19	50.63	74.00	-23.37	Horizontal
4	11492.986	51.61	0.40	52.01	74.00	-21.99	Horizontal
5	12617.235	50.96	1.10	52.06	74.00	-21.94	Horizontal
6	13094.188	49.83	1.77	51.60	74.00	-22.40	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	7268.537	49.19	-2.79	46.40	74.00	-27.60	Vertical
2	8052.104	49.59	-1.87	47.72	74.00	-26.28	Vertical
3	9993.988	47.72	1.87	49.59	74.00	-24.41	Vertical
4	11118.237	48.95	2.36	51.31	74.00	-22.69	Vertical
5	12753.507	48.88	3.03	51.91	74.00	-22.09	Vertical
6	13945.892	45.31	6.08	51.39	74.00	-22.61	Vertical

For 8DPSK

Low Channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6110.220	51.29	-7.20	44.09	74.00	-29.91	Horizontal
2	9619.238	50.02	-1.04	48.98	74.00	-25.02	Horizontal
3	10675.351	50.85	0.25	51.10	74.00	-22.90	Horizontal
4	11901.804	51.52	0.28	51.80	74.00	-22.20	Horizontal
5	12787.575	50.12	1.23	51.35	74.00	-22.65	Horizontal
6	14150.301	46.02	5.62	51.64	74.00	-22.36	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	3997.996	50.03	-2.63	47.40	74.00	-26.60	Vertical
2	6553.106	50.32	-4.29	46.03	74.00	-27.97	Vertical
3	8290.581	48.57	-1.93	46.64	74.00	-27.36	Vertical
4	10573.146	49.17	2.28	51.45	74.00	-22.55	Vertical
5	12344.689	48.30	2.80	51.10	74.00	-22.90	Vertical
6	12991.984	48.01	3.08	51.09	74.00	-22.91	Vertical

Middle channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	9006.012	49.48	-2.07	47.41	74.00	-26.59	Horizontal
2	10505.010	50.90	0.22	51.12	74.00	-22.88	Horizontal
3	12072.144	50.36	0.36	50.72	74.00	-23.28	Horizontal
4	12344.689	49.98	0.77	50.75	74.00	-23.25	Horizontal
5	13945.892	45.82	5.61	51.43	74.00	-22.57	Horizontal
6	16160.321	46.68	3.08	49.76	74.00	-24.24	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	5769.539	50.12	-6.56	43.56	74.00	-30.44	Vertical
2	8188.377	49.38	-1.90	47.48	74.00	-26.52	Vertical
3	9517.034	48.40	0.41	48.81	74.00	-25.19	Vertical
4	10232.465	49.13	2.06	51.19	74.00	-22.81	Vertical
5	12038.076	49.45	2.48	51.93	74.00	-22.07	Vertical
6	12855.711	49.33	3.05	52.38	74.00	-21.62	Vertical

High channel

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6519.038	52.84	-5.86	46.98	74.00	-27.02	Horizontal
2	7949.900	51.27	-3.72	47.55	74.00	-26.45	Horizontal
3	9176.353	50.07	-1.79	48.28	74.00	-25.72	Horizontal
4	10368.737	51.03	0.10	51.13	74.00	-22.87	Horizontal
5	12038.076	51.01	0.30	51.31	74.00	-22.69	Horizontal
6	12923.848	52.13	1.32	53.45	74.00	-20.55	Horizontal

No.	Frequency (MHz)	Meter Reading (dBuV)	Factor dB	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Polar (H/V)
1	6621.243	49.90	-4.07	45.83	74.00	-28.17	Vertical
2	7915.832	50.13	-2.01	48.12	74.00	-25.88	Vertical
3	9619.238	48.80	0.72	49.52	74.00	-24.48	Vertical
4	10845.691	48.58	2.30	50.88	74.00	-23.12	Vertical
5	12310.621	48.61	2.77	51.38	74.00	-22.62	Vertical
6	13468.938	46.71	4.45	51.16	74.00	-22.84	Vertical

5.4.4.2 Band edge – radiated

Note1 : Absolute Level = Reading Level+ Factor, Margin= Absolute Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Note2 :The peak value is less than the AV value, AV value is not required Factor added by measurement software automatically.

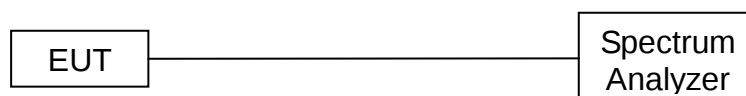
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
GFSK							
2390	52.64	-10.42	42.23	74	-31.77	peak	Vertical
2390	52.69	-9.54	42.3	74	-31.7	peak	Horizontal
2400	53.46	-10.31	43.3	74	-30.7	peak	Vertical
2400	53.73	-9.43	44.45	74	-29.55	peak	Horizontal
2483.5	55.23	-9.73	45.5	74	-28.5	peak	Vertical
2483.5	55.98	-8.66	47.32	74	-26.68	peak	Horizontal
π/4-DQPSK							
2390	52.14	-10.42	41.73	74	-32.27	peak	Vertical
2390	52.25	-9.54	41.86	74	-32.14	peak	Horizontal
2400	53.43	-10.31	43.27	74	-30.73	peak	Vertical
2400	53.61	-9.43	44.33	74	-29.67	peak	Horizontal
2483.5	55.25	-9.73	45.52	74	-28.48	peak	Vertical
2483.5	55.62	-8.66	46.96	74	-27.04	peak	Horizontal
8DPSK							
2390	52.65	-10.42	42.24	74	-31.76	peak	Vertical
2390	52.78	-9.54	42.39	74	-31.61	peak	Horizontal
2400	53.01	-10.31	42.85	74	-31.15	peak	Vertical
2400	53.95	-9.43	44.67	74	-29.33	peak	Horizontal
2483.5	54.32	-9.73	44.59	74	-29.41	peak	Vertical
2483.5	56.84	-8.66	48.18	74	-25.82	peak	Horizontal

5.5 20dB occupied channel bandwidth

5.5.1 Limit

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247a(1)	20dB bandwidth	/	2400-2483.5

5.5.2 Test setup



5.5.3 Test procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
Bandwidth: RBW=30 kHz, VBW=100 kHz, detector= Peak

5.5.4 Test results

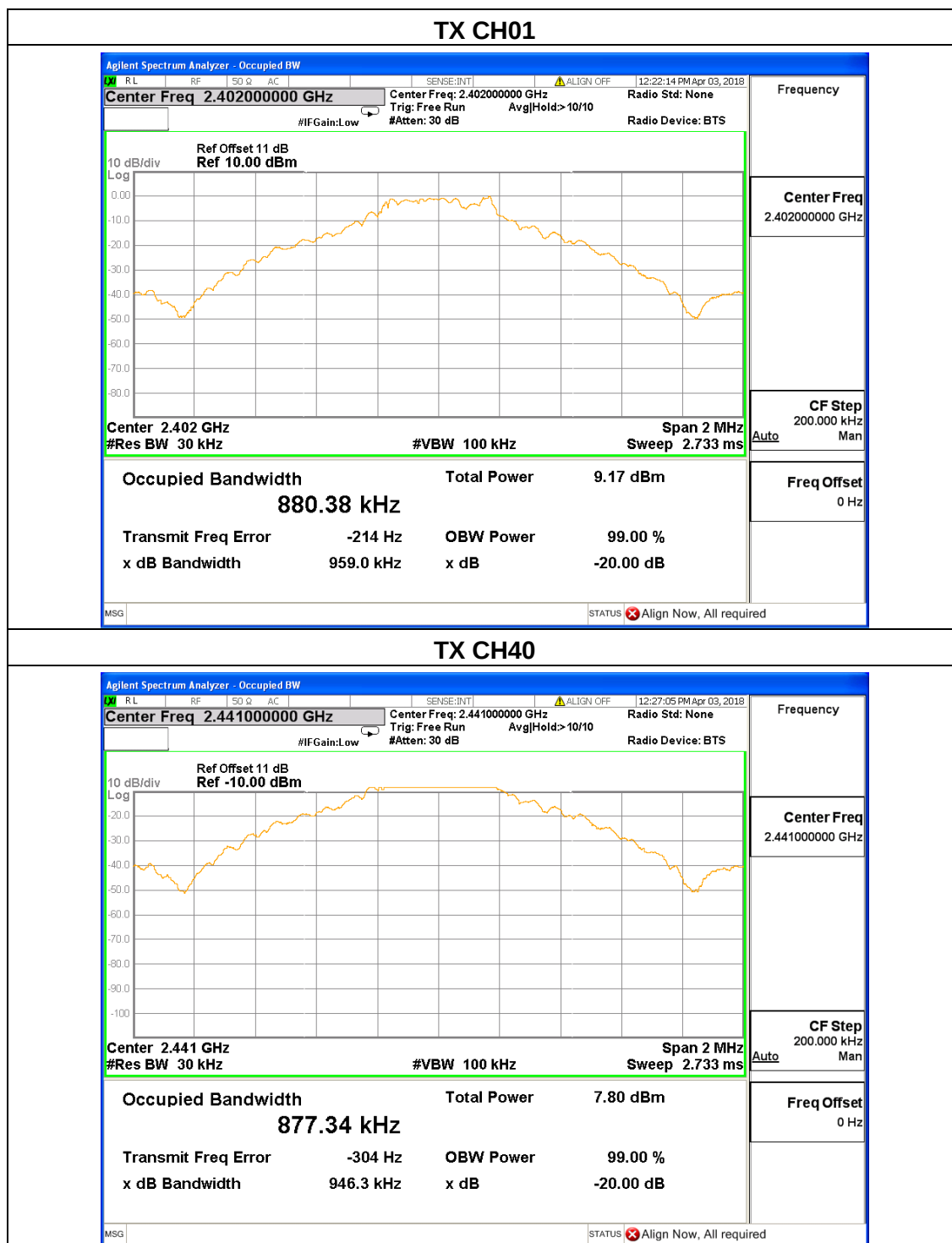
Test data

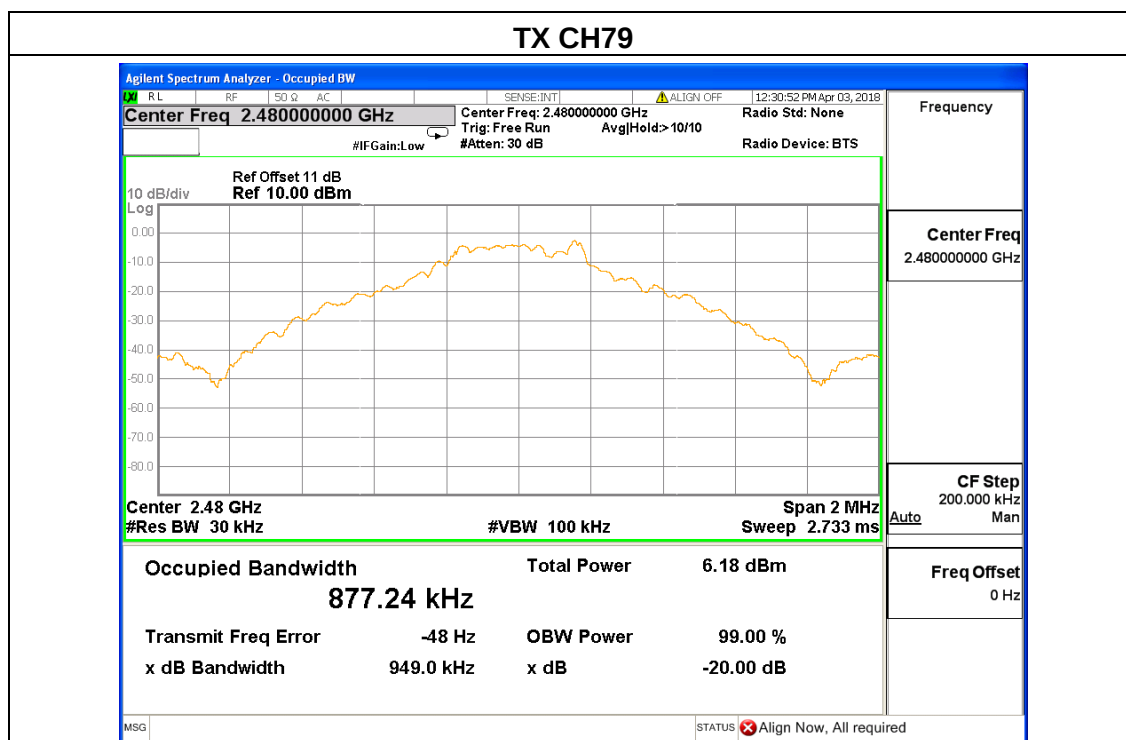
EUT :	Smart POS Payment Terminal	Model Name :	CS10
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V by battery

Mode	Frequency (MHz)	20dB Bandwidth (MHz)	Limit (kHz)	Result
GFSK	2402	0.959	/	Pass
	2441	0.946	/	Pass
	2480	0.949	/	Pass
π /4-DQPSK	2402	1.279	/	Pass
	2441	1.279	/	Pass
	2480	1.269	/	Pass
8DPSK	2402	1.273	/	Pass
	2441	1.160	/	Pass
	2480	1.266	/	Pass

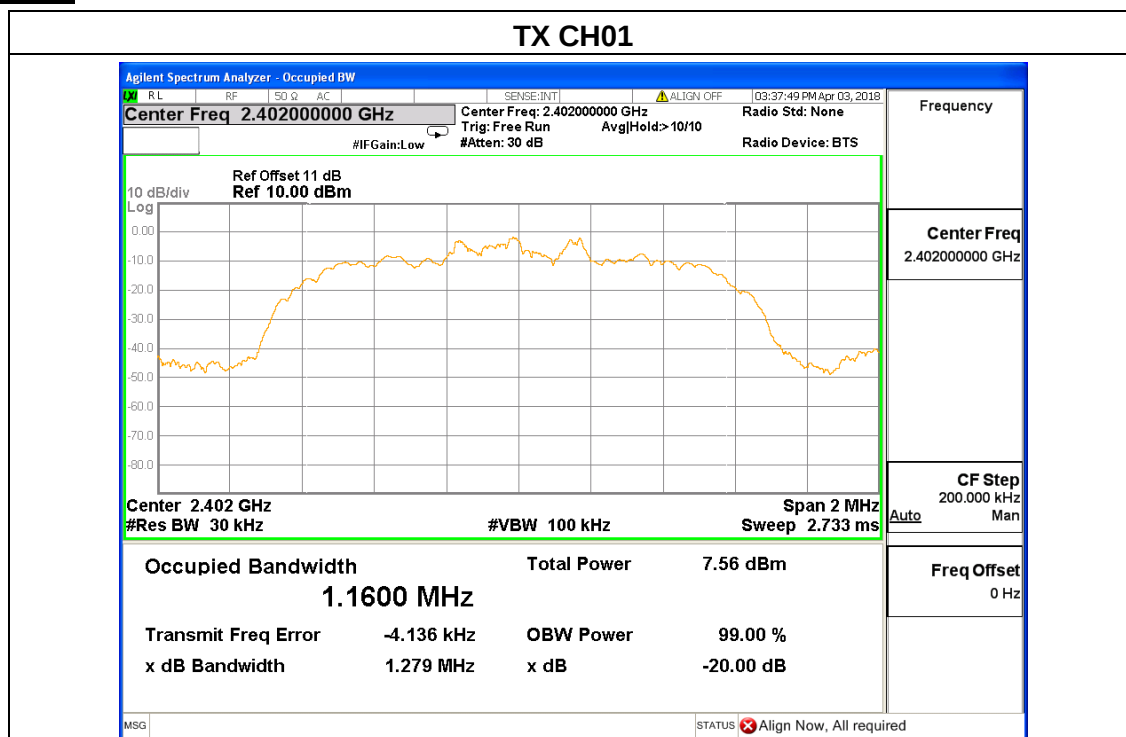
Test plots

GFSK mode

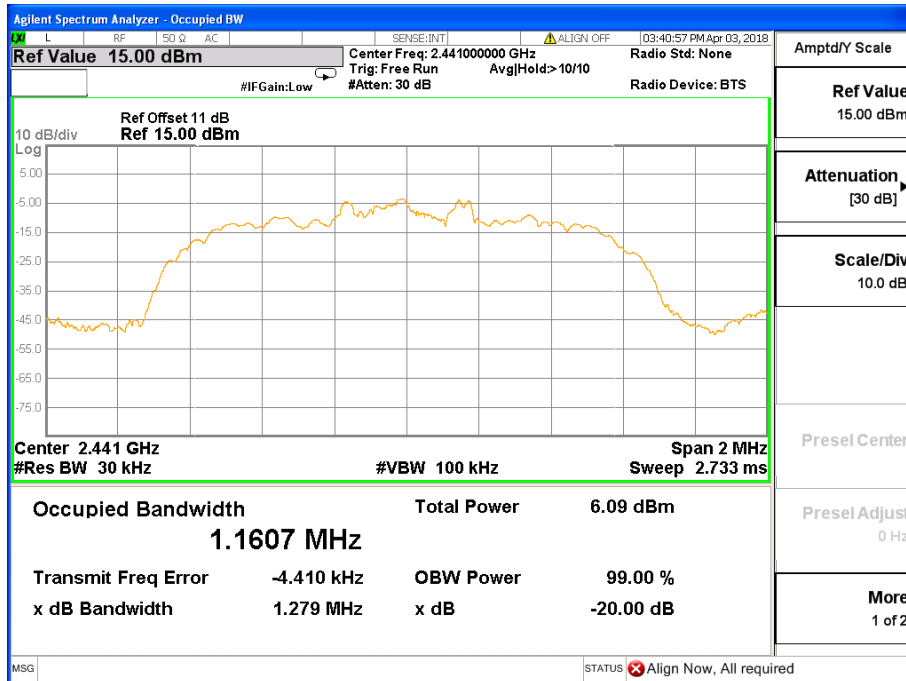




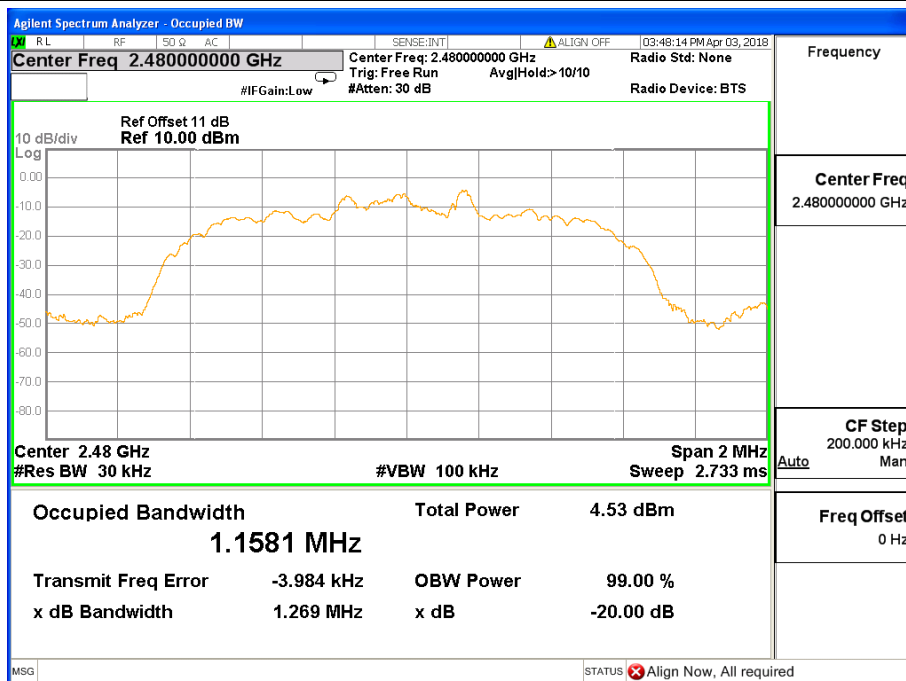
$\pi/4$ -DQPSK



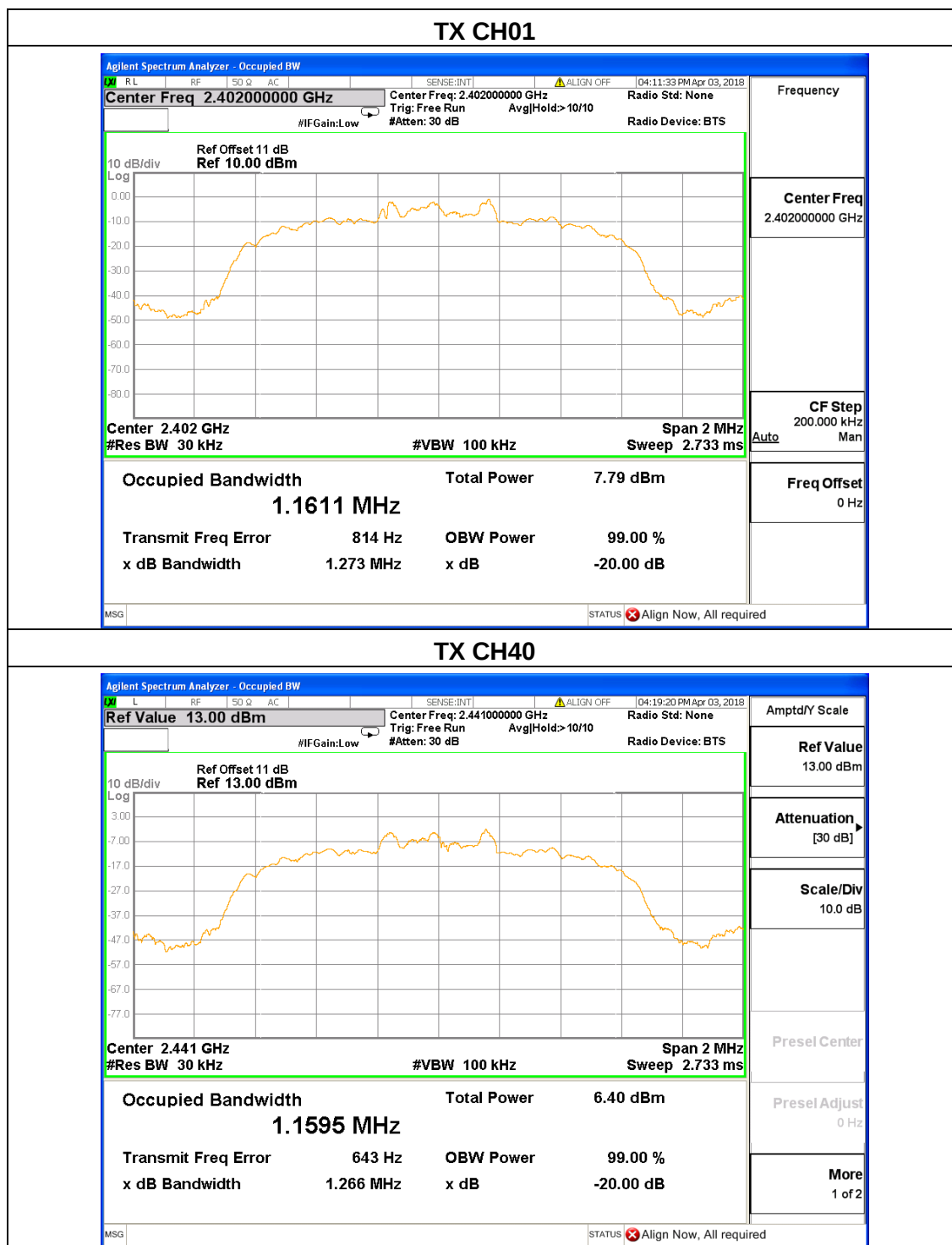
TX CH40

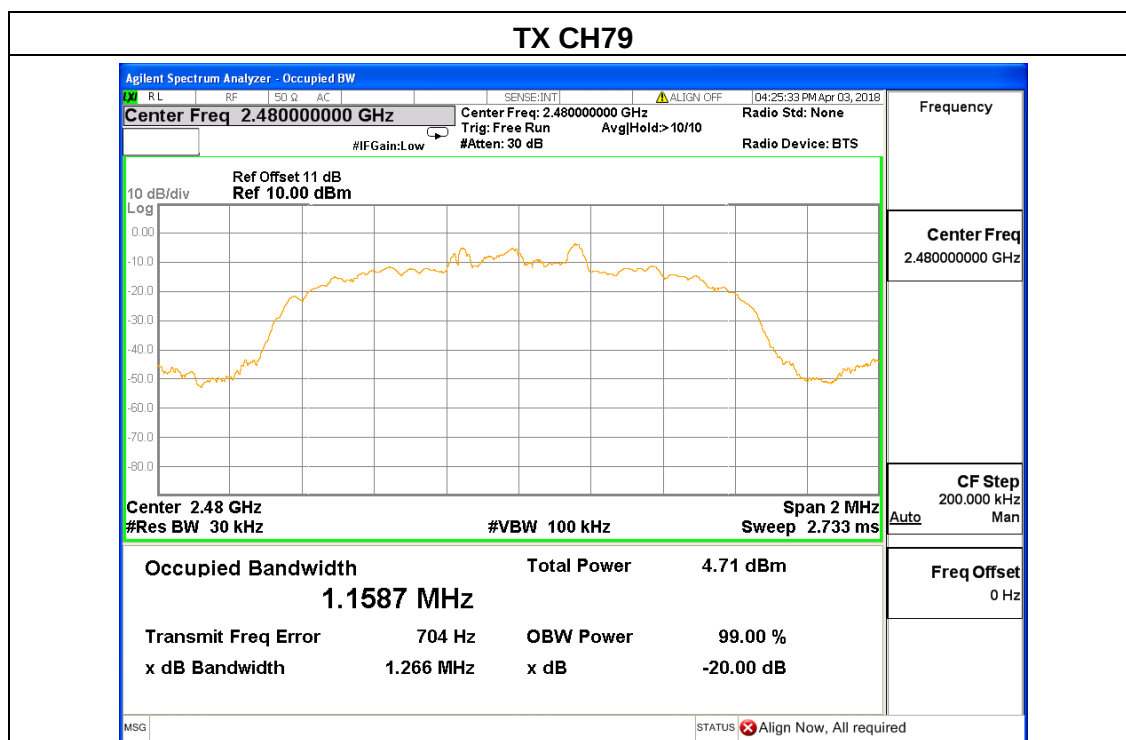


TX CH79



8DPSK mode



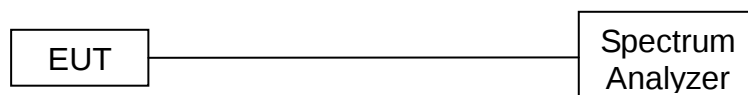


5.6 Carrier frequency separation

5.6.1 Limit

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247(a)(1)	Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth (Which is greater)	2400-2483.5

5.6.2 Test setup



5.6.3 Test procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
RBW=30 kHz, VBW=100 kHz, detector= Peak, Sweep Time =auto.
- (3) The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Test.

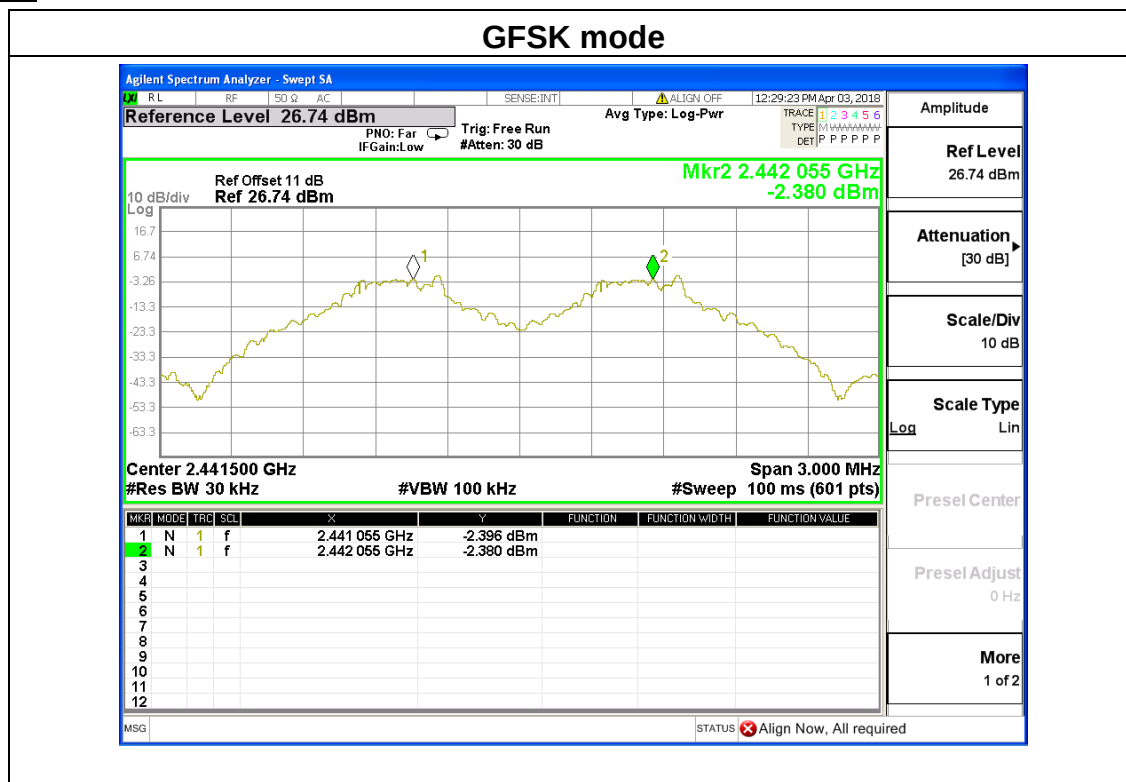
5.6.4 Test results

Test data

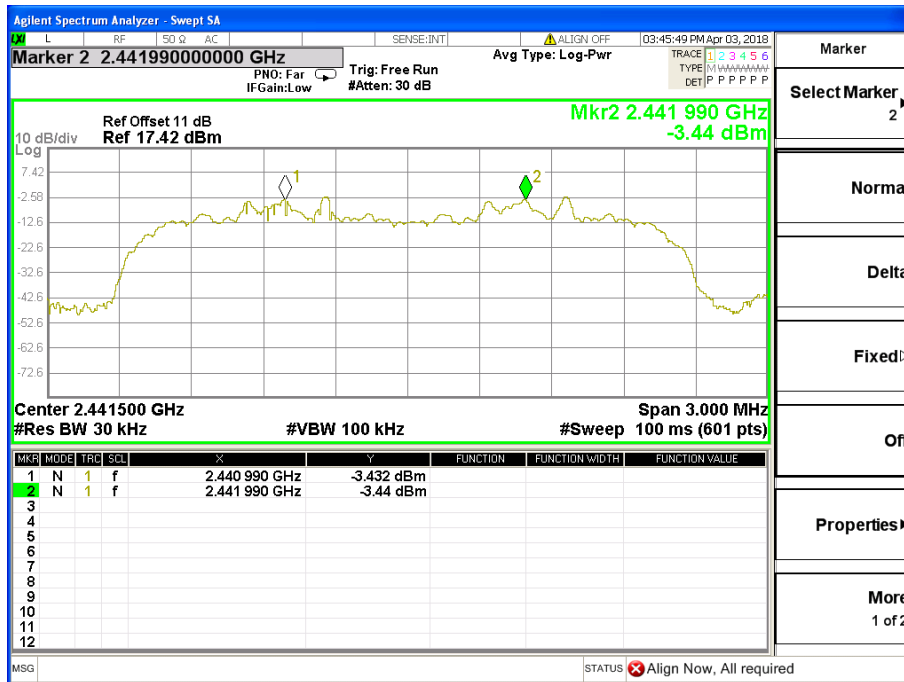
EUT :	Bluetooth audio transmitter	Model Name :	KCDBT181
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V by battery
Test Mode :	GFSK Mode /CH00, CH39, CH78		

Mode	Channel	Frequency (MHz)	Test Result (KHz)	Limit (kHz)	Result
GFSK	Middle	2441	1000	0.63	Pass
$\pi/4$ -DQPSK	Middle	2441	1000	0.85	Pass
8DPSK	Middle	2441	1000	0.85	Pass

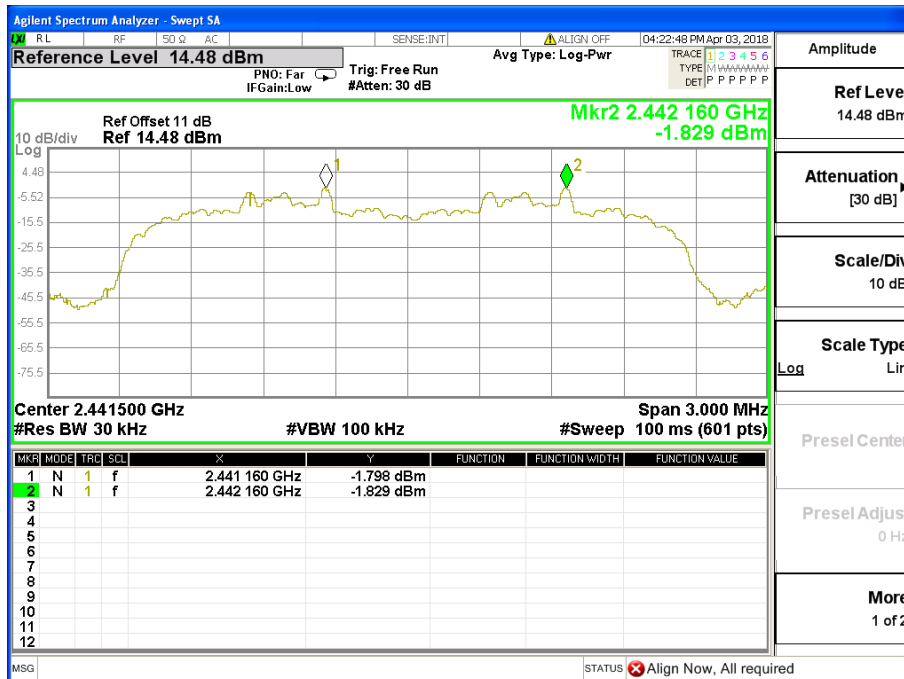
Test plots



$\pi/4$ -DQPSK mode



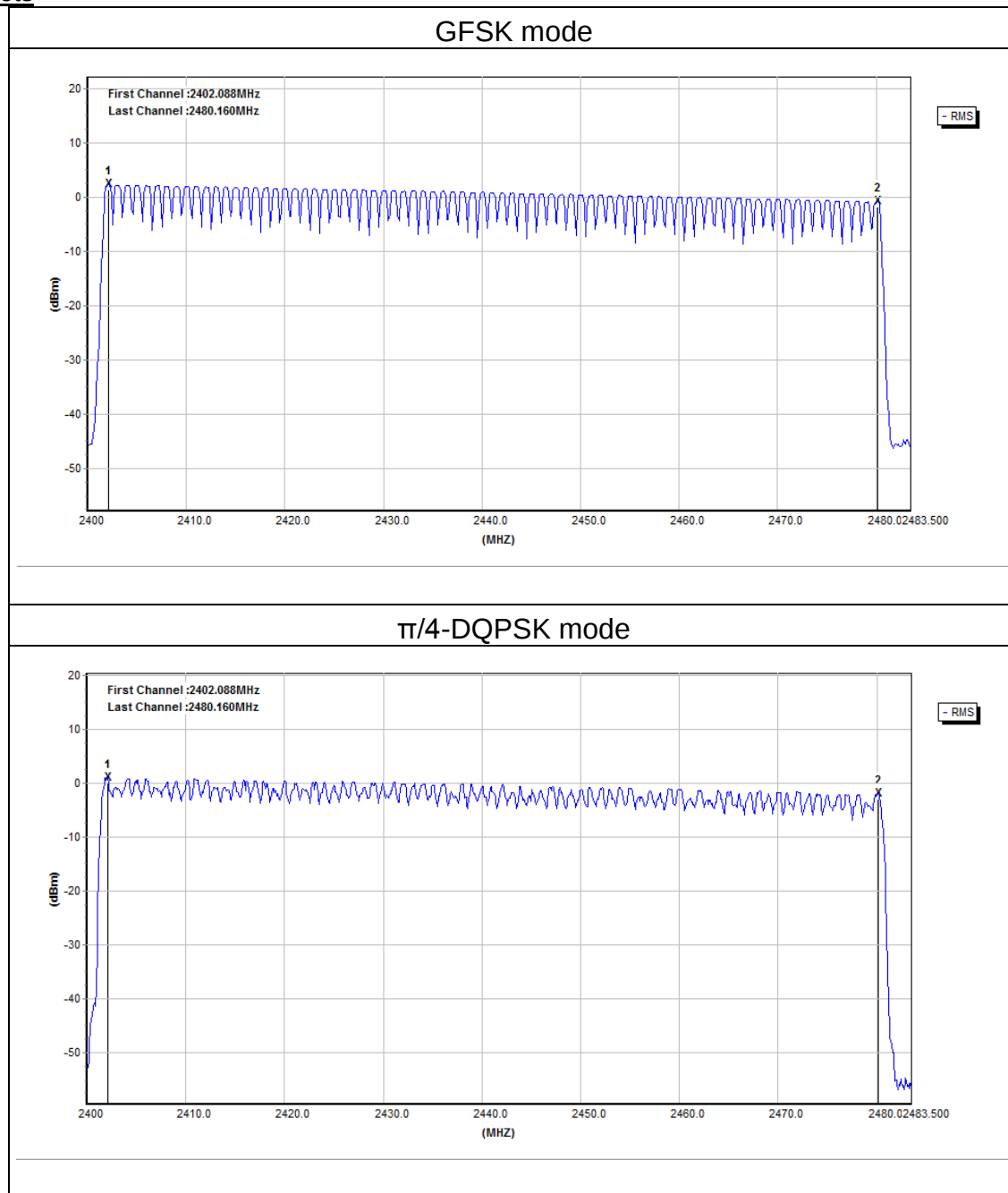
8DPSK mode

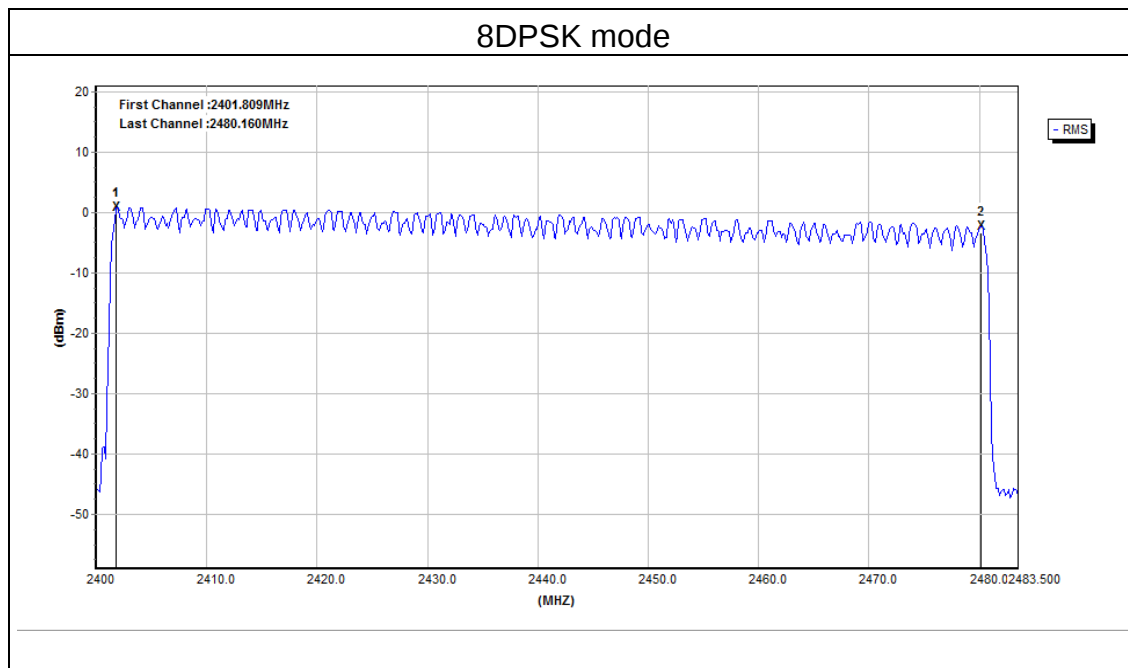


HOPPING CHANNEL

Mode	Quantity of Hopping Channel	Limit	Results
GFSK, $\pi/4$ -DQPSK, 8DPSK	79	>15	Pass

Test plots



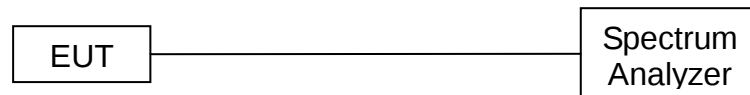


5.7 Dwell time

5.7.1 Limit

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
15.247(a)(a)	Dwell time	0.4 sec	2400-2483.5

5.7.2 Test setup



5.7.3 Test procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
- (3) Use video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for packet transmitting.
- (8) Measure the maximum time duration of one single pulse.
- (9) The EUT was set to the Hopping Mode for Dwell Time Test

5.7.4 Test results

Test data

EUT :	Bluetooth audio transmitter	Model Name :	KCDBT181
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V by battery
Test Mode :	GFSK, $\pi/4$ -DQPSK, 8DPSK / CH00, CH39, CH78		

Mode	Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit(s)	Conclusion
GFSK	DH1	2441	0.37	118.40	<0.4	Pass
	DH3	2441	1.64	262.40	<0.4	Pass
	DH5	2441	2.89	308.27	<0.4	Pass
$\pi/4$ DQPSK	2DH1	2441	0.38	121.60	<0.4	Pass
	2DH3	2441	1.64	262.40	<0.4	Pass
	2DH5	2441	2.89	308.27	<0.4	Pass
8DPSK	3DH1	2441	0.39	124.80	<0.4	Pass
	3DH3	2441	1.64	262.40	<0.4	Pass
	3DH5	2441	2.89	308.27	<0.4	Pass

Note1: A period time = 0.4 (s) * 79 = 31.6(s)

Note2:

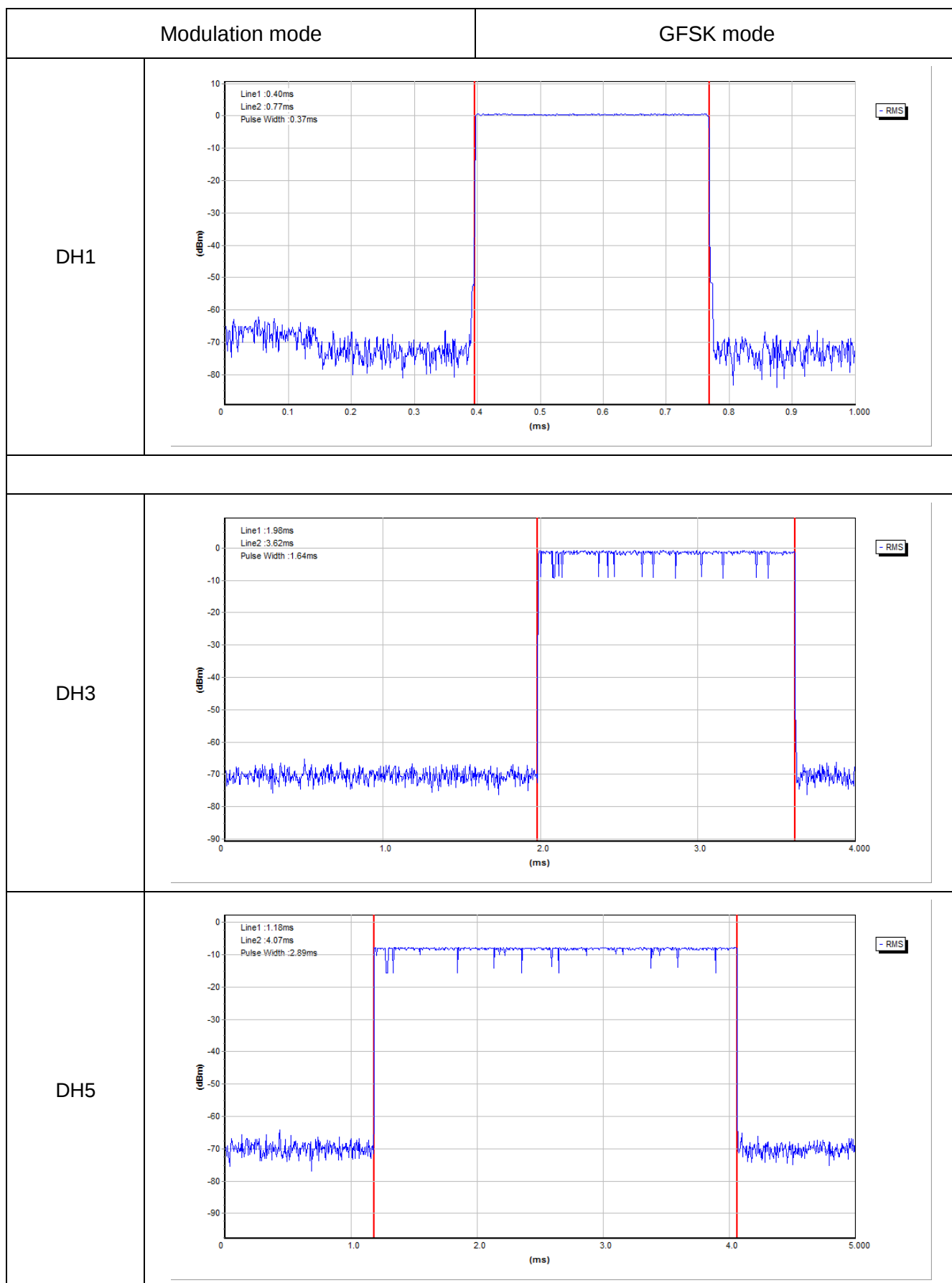
DH1 time slot = Pulse Duration * (1600/(2*79)) * A period time

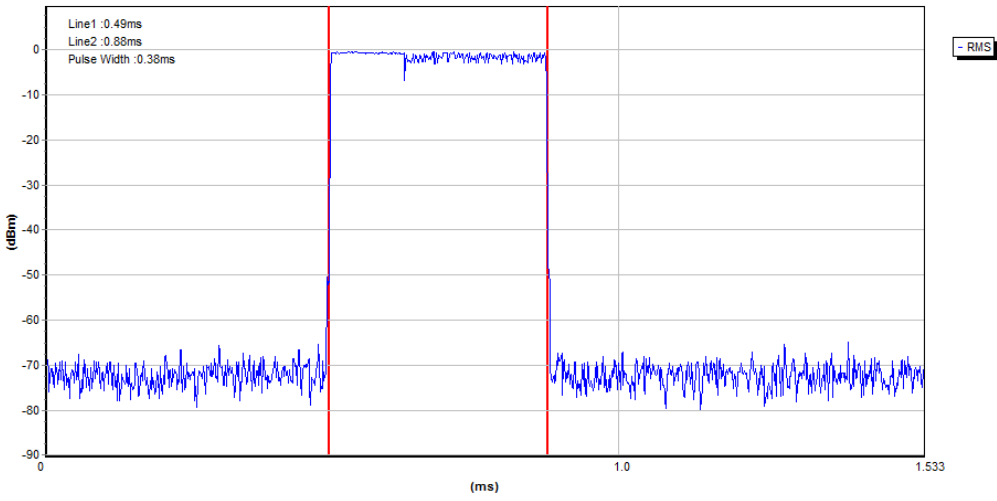
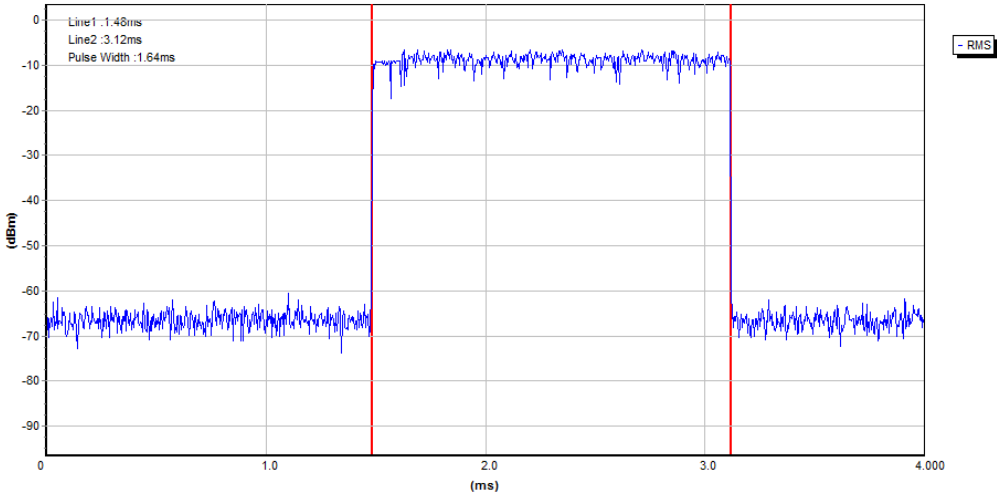
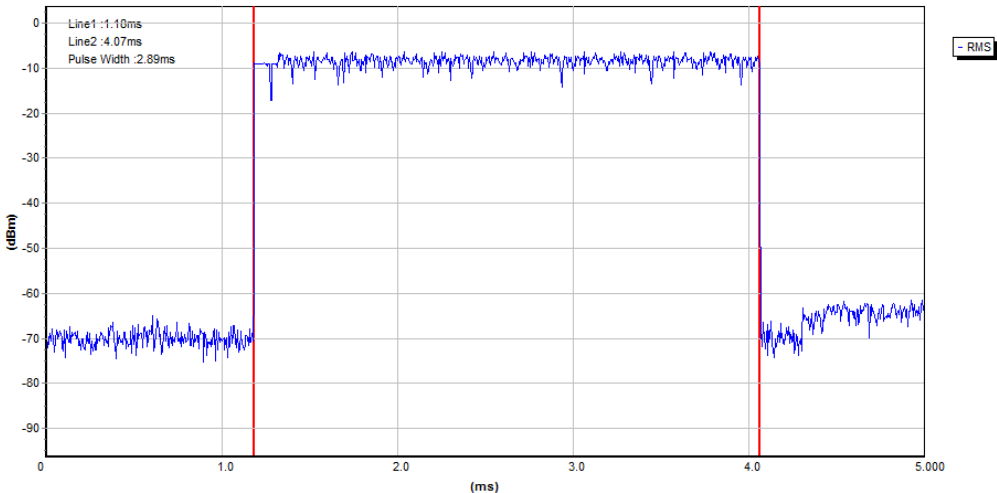
DH3 time slot = Pulse Duration * (1600/(4*79)) * A period time

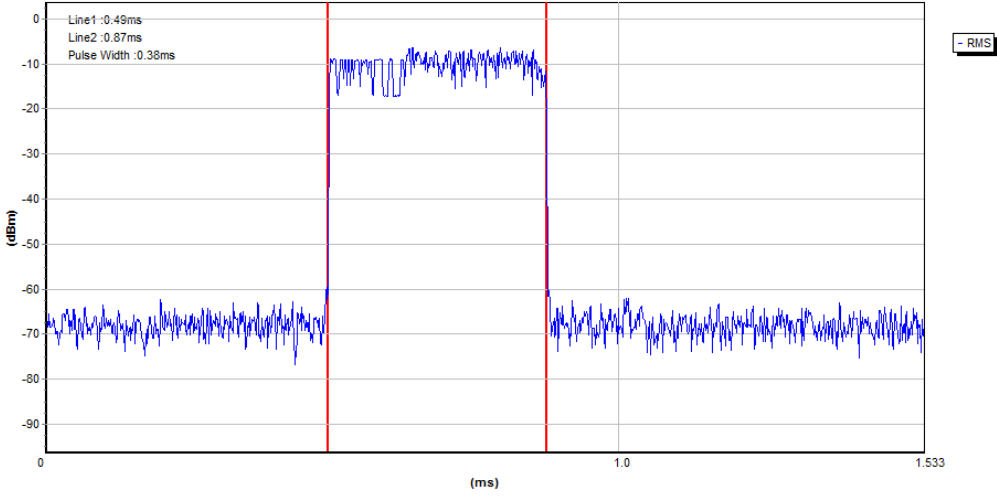
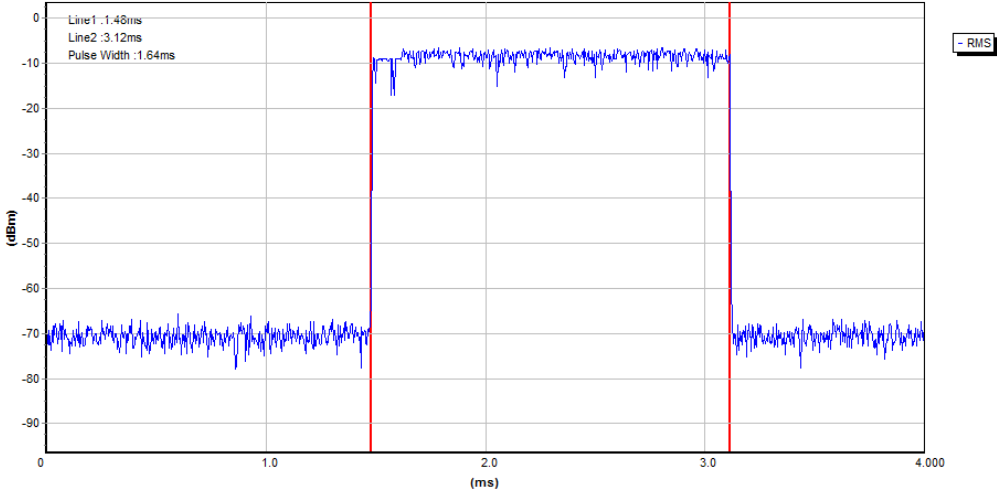
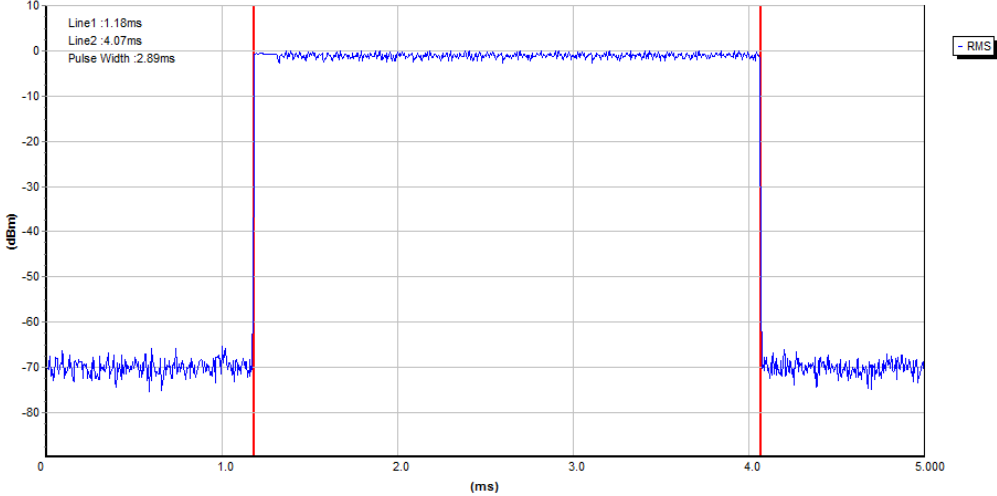
DH5 time slot = Pulse Duration * (1600/(6*79)) * A period time

Note3: For GFSK, $\pi/4$ -DQPSK and 8DPSK: The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test plots



Modulation mode	$\pi/4$ -DQPSK
2-DH1	
2-DH3	
2-DH5	

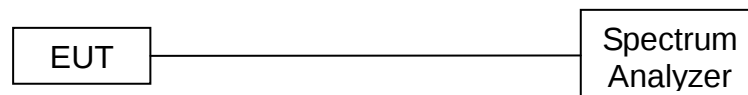
Modulation mode	GFSK mode
3-DH1	
3-DH3	
3-DH5	

5.8 Conducted spurious emission and bandedge

5.8.1 Limit

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)).

5.8.2 Test setup



5.8.3 Test procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) 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.
- e) Repeat above procedures until all measured frequencies were complete.

5.8.4 Test results

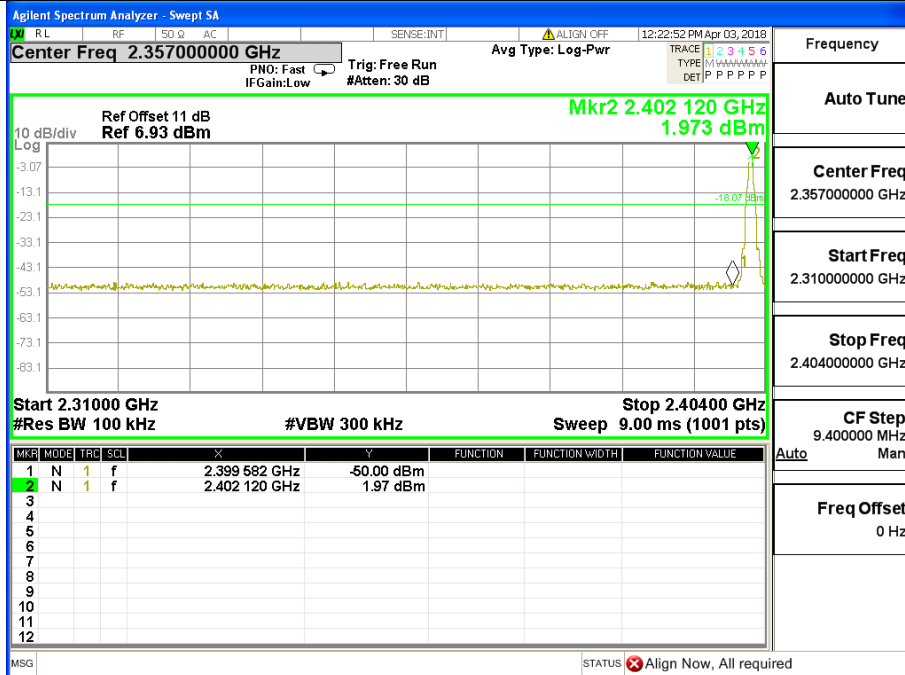
Test data

EUT :	Bluetooth audio transmitter	Model Name :	CS10
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V by battery

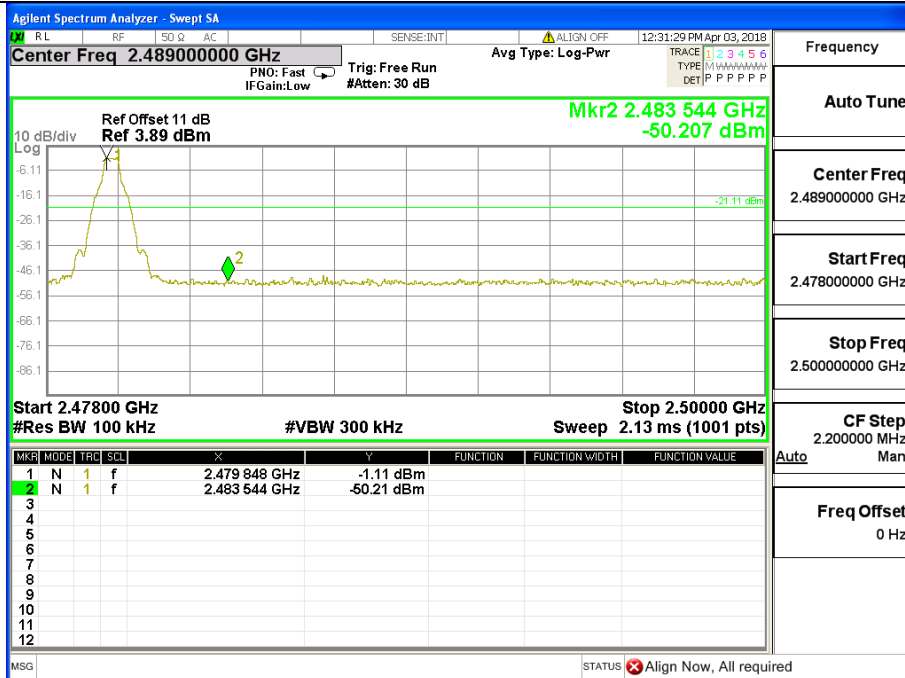
Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK mode			
Left-band	51.97	20	Pass
Right-band	49.10	20	Pass
$\pi/4$ -DQPSK mode			
Left-band	50.33	20	Pass
Right-band	48.41	20	Pass
8DPSK mode			
Left-band	48.55	20	Pass
Right-band	47.64	20	Pass

Test plots

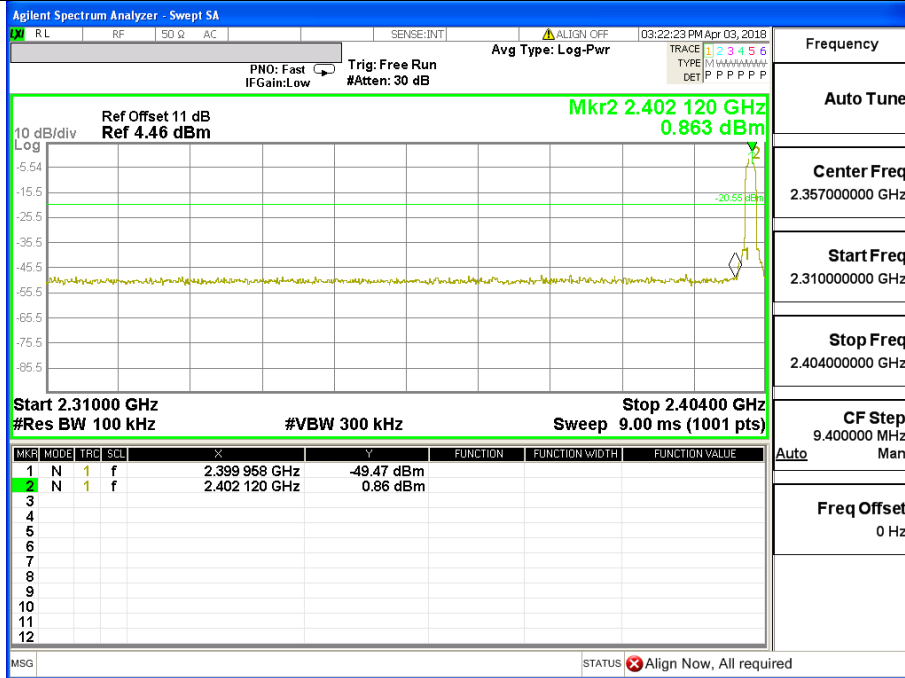
GFSK: Band Edge, Left Side



GFSK: Band Edge, Right Side

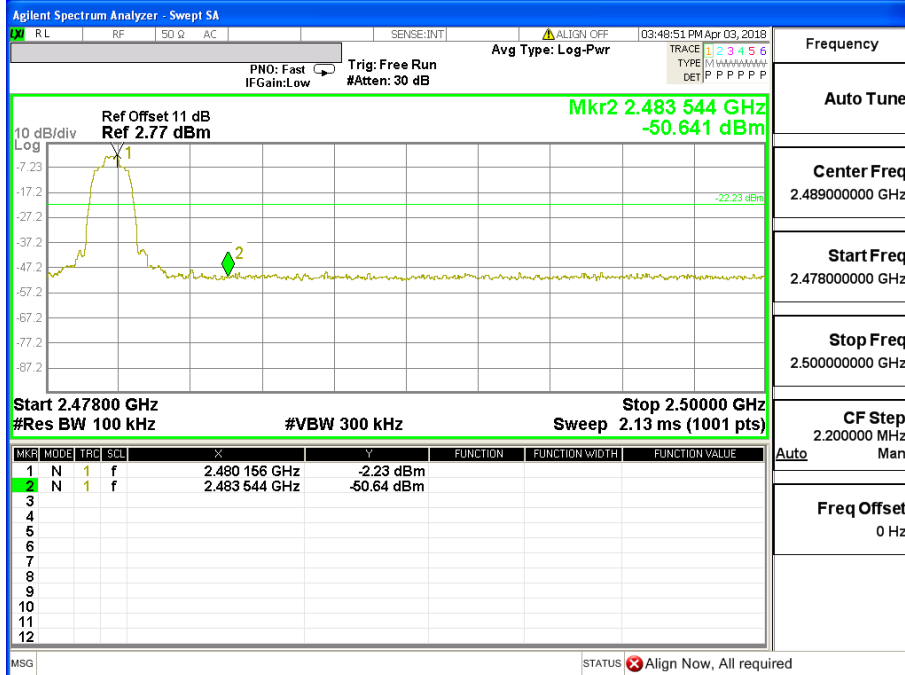


$\pi/4$ -DQPSK: Band Edge, Left Side



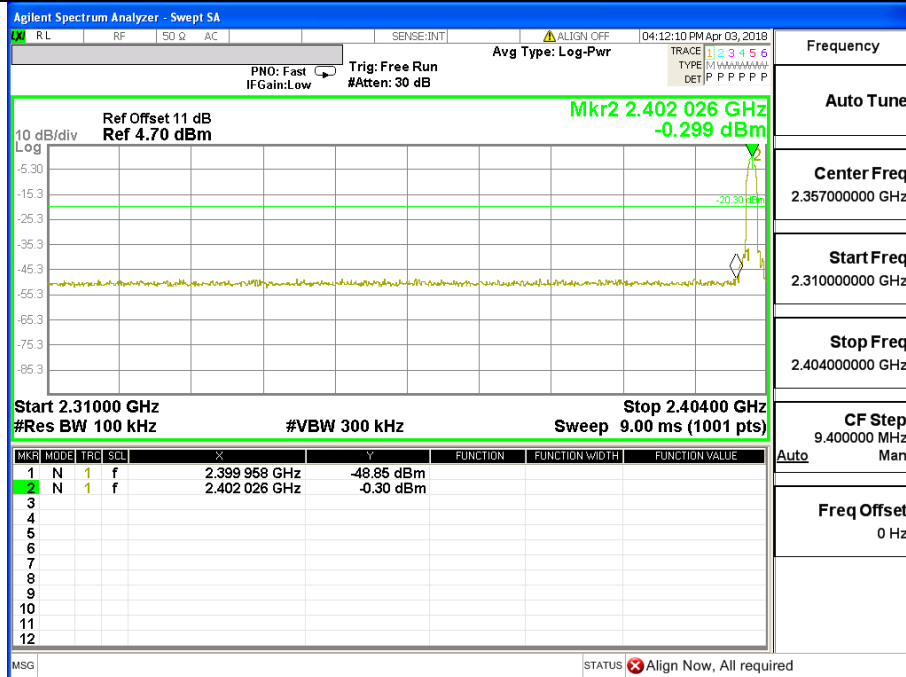
Frequency
Auto Tune
Center Freq 2.357000000 GHz
Start Freq 2.310000000 GHz
Stop Freq 2.404000000 GHz
CF Step 9.400000 MHz
Auto
Freq Offset 0 Hz

$\pi/4$ -DQPSK: Band Edge, Right Side



Frequency
Auto Tune
Center Freq 2.489000000 GHz
Start Freq 2.478000000 GHz
Stop Freq 2.500000000 GHz
CF Step 2.200000 MHz
Auto
Freq Offset 0 Hz

8DPSK: Band Edge, Left Side



Frequency

Auto Tune

Center Freq
2.357000000 GHz

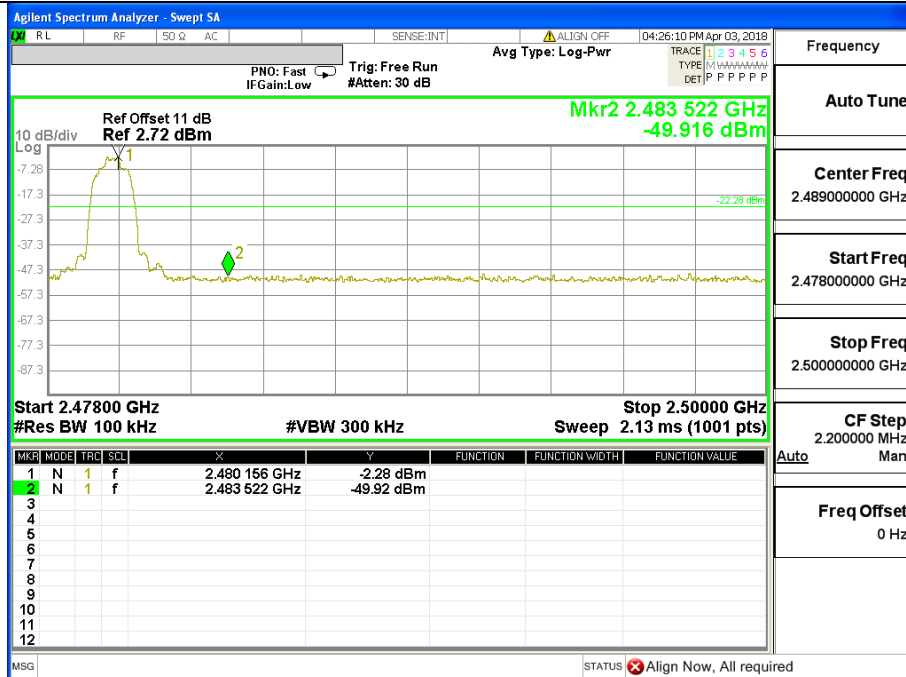
Start Freq
2.310000000 GHz

Stop Freq
2.404000000 GHz

CF Step
9.400000 MHz
Auto Man

Freq Offset
0 Hz

8DPSK: Band Edge, Right Side



Frequency

Auto Tune

Center Freq
2.489000000 GHz

Start Freq
2.478000000 GHz

Stop Freq
2.500000000 GHz

CF Step
2.200000 MHz
Auto Man

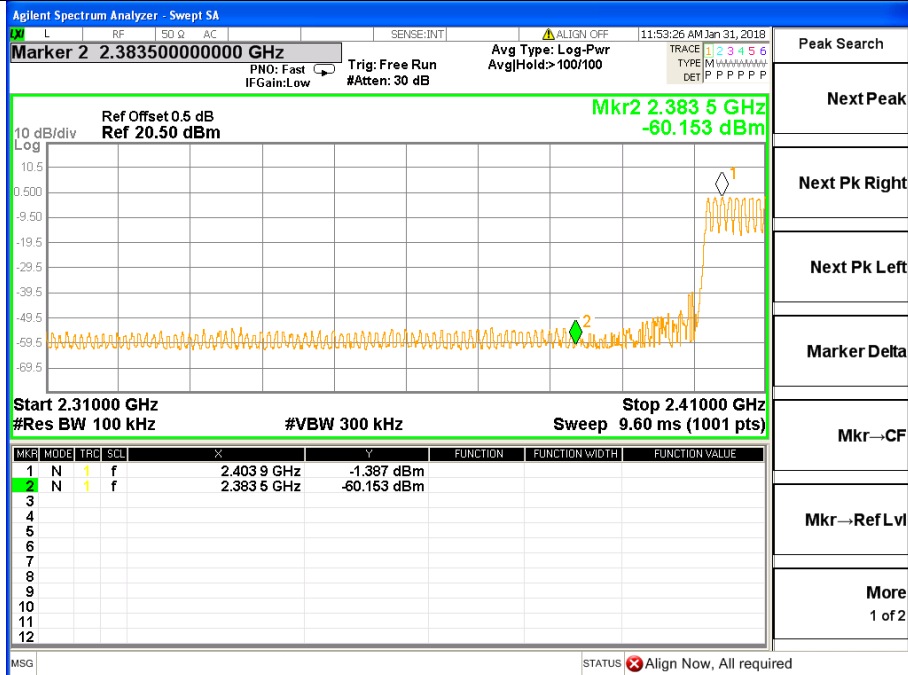
Freq Offset
0 Hz

Hopping Mode

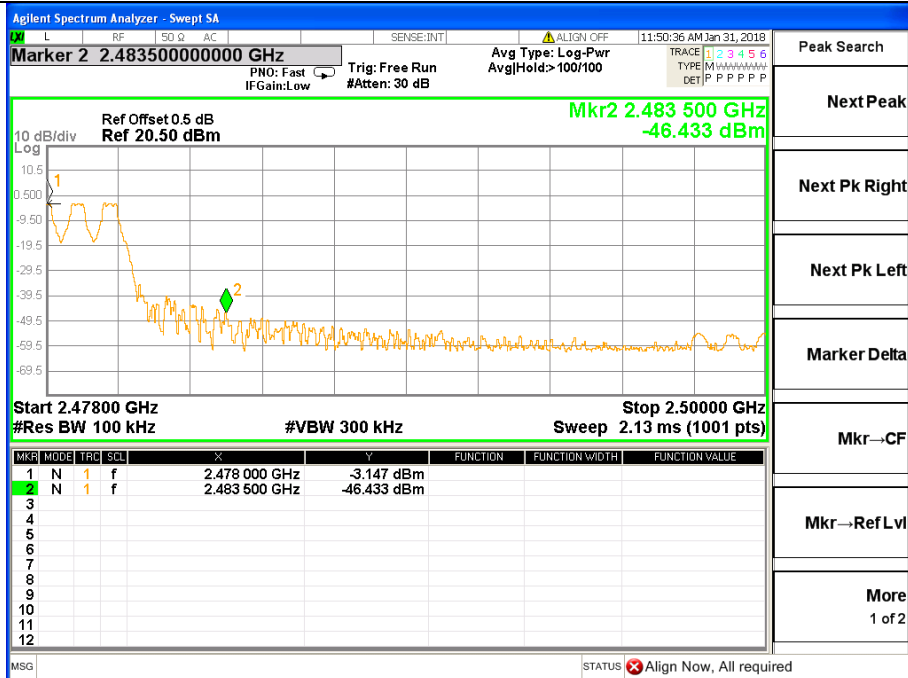
Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK mode			
Left-band	58.766	20	Pass
Right-band	43.286	20	Pass
$\pi/4$ -DQPSK mode			
Left-band	49.582	20	Pass
Right-band	54.436	20	Pass
8DPSK mode			
Left-band	49.582	20	Pass
Right-band	43.286	20	Pass

Test plots

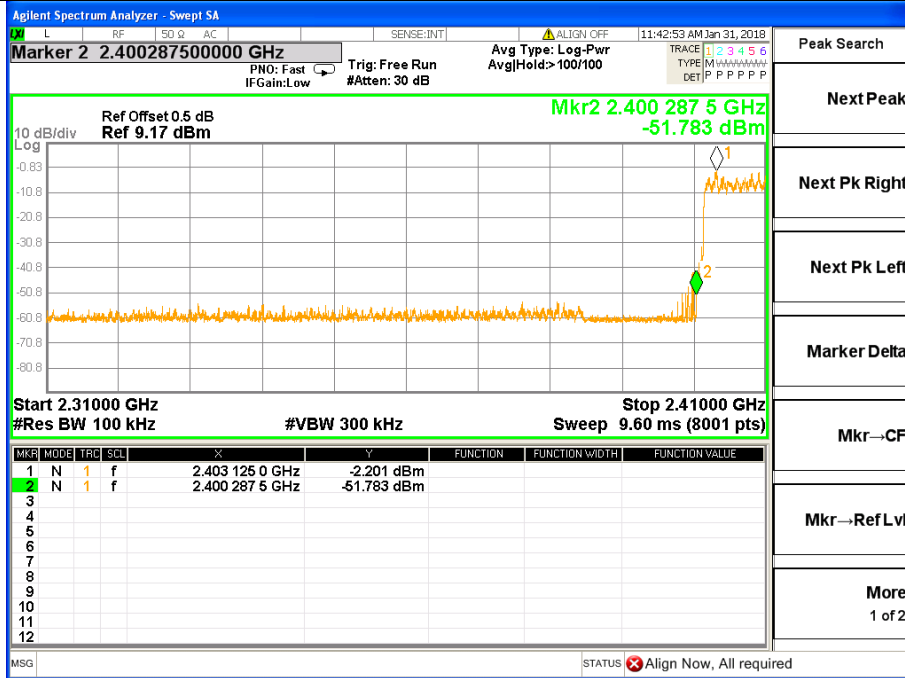
GFSK: Band Edge, Left Side



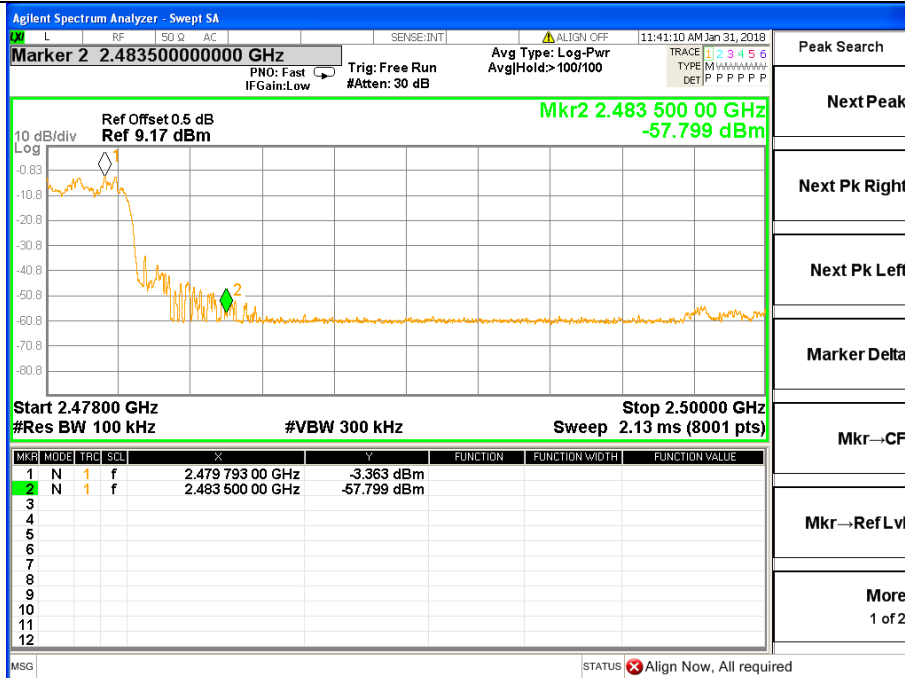
GFSK: Band Edge, Right Side



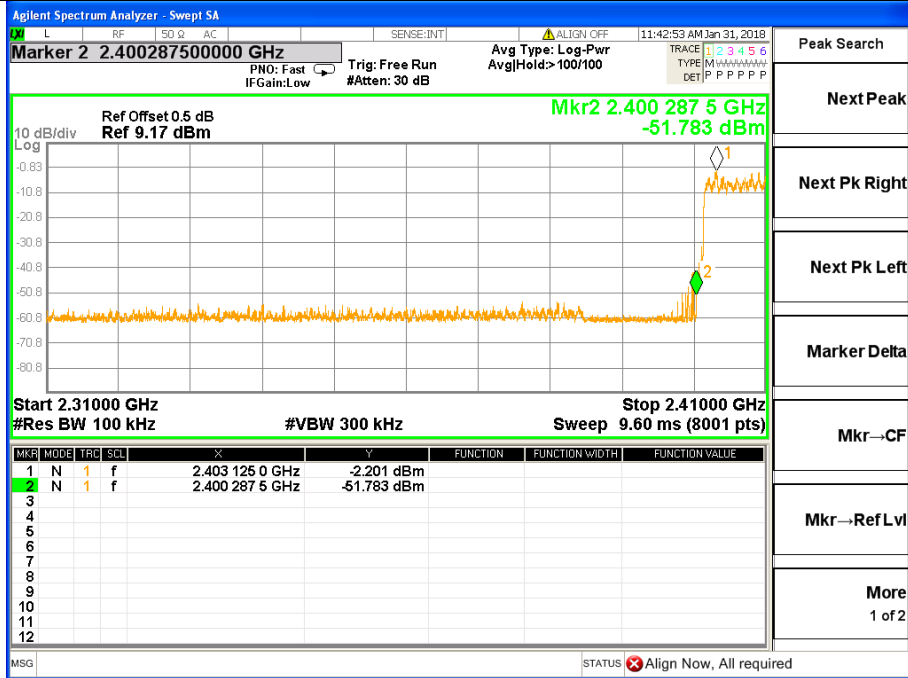
$\pi/4$ -DQPSK: Band Edge, Left Side



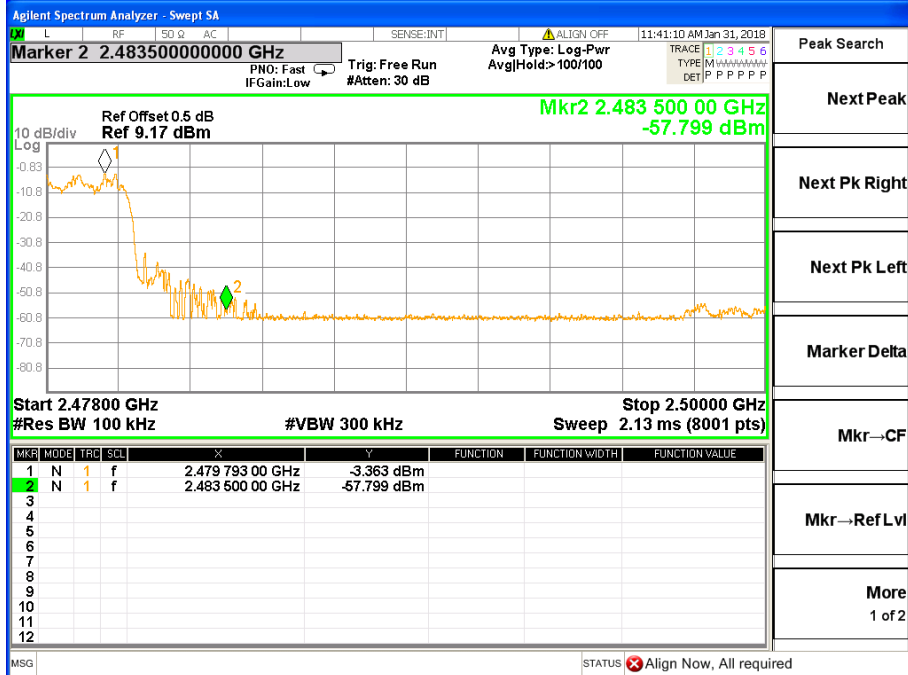
$\pi/4$ -DQPSK Band Edge, Right Side



8DPSK: Band Edge, Left Side

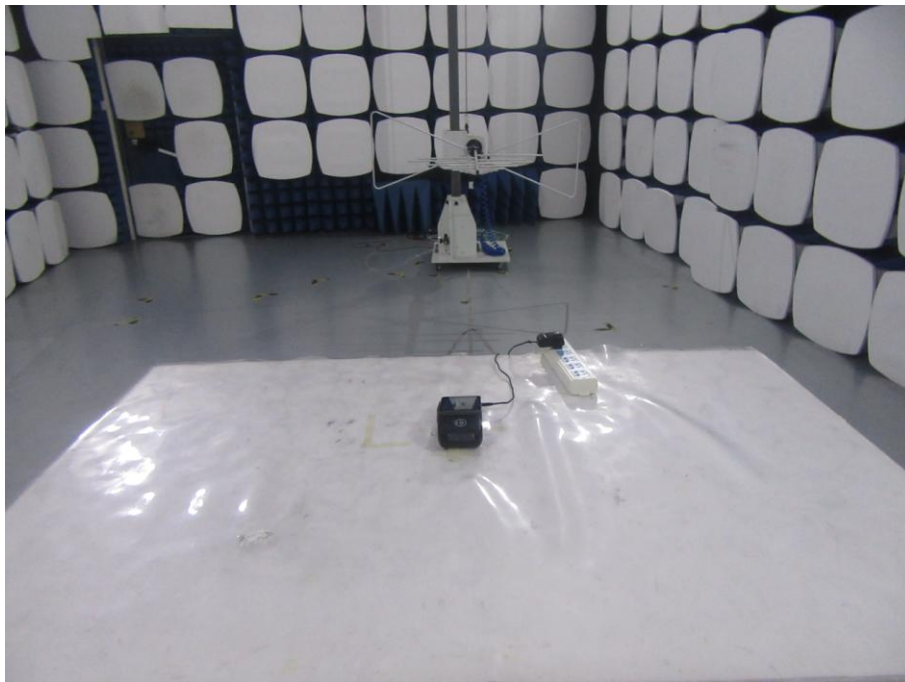


8DPSK Band Edge, Right Side



Photographs of the Test Setup

Radiated emission



Conducted emission



---END OF REPORT---