TEST REPORT

Report No.:	BCTC2104347687E
Applicant:	Shenzhen Z.S.F Technology Co., LTD.
Product Name:	Electric Scooter
Model/Type Ref.:	L9 Pro+ L9 Pro, L9
Tested Date:	2021-04-22 to 2021-05-22
Issued Date:	2021-05-22

Shenzhen BCTC Testing Co., Ltd.

FCC ID: 2AZ3Z-ZSF9

Product Name:	Electric Scooter
Trademark:	N/A
Model/Type Ref.:	L9 Pro+ L9 Pro, L9
Prepared For:	Shenzhen Z.S.F Technology Co., LTD
Address:	No.4, LongShan 4 Rd. 3rd Luotian industrial distrct, SongGang Town, BaoAn district, Shenzhen, GuangDong, China, 518105
Manufacturer:	Shenzhen Z.S.F Technology Co., LTD.
Address:	No.4, LongShan 4 Rd. 3rd Luotian industrial distrct, SongGang Town, BaoAn district, Shenzhen, GuangDong, China, 518105
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Sample Received Date:	2021-04-22
Sample tested Date:	2021-04-22 to 2021-05-22
Issue Date:	2021-05-22
Report No.:	BCTC2104347687E
Test Standards	FCC Part15.247 ANSI C63.10-2013
Test Results	PASS
Remark:	This is Bluetooth BLE radio test report.

Tested by:

Willem Wang

Willem Wang/Project Handler

Approved by:

Zero Zhou/Reviewer

The test report is effective only with both signature and specialized stamp.This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full.The tested sample(s) and the sample information are provided by the client.

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(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
BCTC2104347687E	2021-05-22	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

No.	Test Parameter	Clause No	Results
1	Conducted Emission	15.207	PASS
2	6dB Bandwidth	15.247 (a)(2)	PASS
3	Peak Output Power	15.247 (b)	PASS
4	Radiated Spurious Emission	15.247 (d), 15.205	PASS
5	Power Spectral Density	15.247 (e)	PASS
6	Restricted Band of Operation	15.205	PASS
7	Band Edge (Out of Band Emissions)	15.247(d)	PASS
8	Antenna Requirement	15.203	PASS

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Uncertainty
1	3m camber Radiated spurious emission(9kHz-30MHz)	U=3.7dB
2	3m camber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
3	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
4	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
5	Conducted Adjacent channel power	U=1.38dB
6	Conducted output power uncertainty Above 1G	U=1.576dB
7	Conducted output power uncertainty below 1G	U=1.28dB
8	humidity uncertainty	U=5.3%
9	Temperature uncertainty	U=0.59℃

4. PRODUCT INFORMATION AND TEST SETUP

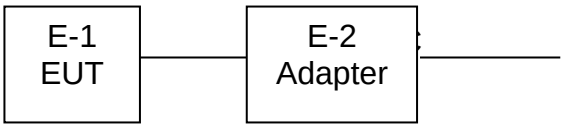
4.1 Product Information

Model/Type Ref.:	L9 Pro+
Model differences:	L9 Pro, L9 All the model are the same circuit and RF module, except model names and color.
Bluetooth Version:	BT 5.0
Hardware Version:	V3.1.2x
Software Version:	V1.1
Operation Frequency:	Bluetooth: 2402MHz-2480MHz
Type of Modulation:	Bluetooth: GFSK
Number Of Channel	40CH
Antenna installation:	Bluetooth: PCB antenna
Antenna Gain:	Bluetooth: 0dBi
Ratings:	DC 42V from Adapter DC 36V from Battery
Adapter Information:	Model: JY-420200 Input: AC 100-240V 50/60Hz 2A Output: DC 42V 2A Max

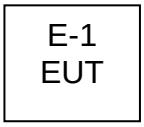
4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.

Conducted Emission:



Radiated Spurious Emission



4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
E-1	Electric Sco oter	N/A	L9 Pro+	L9 Pro, L9	EUT	E-1
E-2	Adapter	N/A	JY-420200	N/A	EUT	E-2

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	11	2422	21	2442
02	2404	12	2424	22	2444
03	2406	13	2426	23	2446
~	~	~	~	~	~
09	2418	19	2438	39	2478
10	2420	20	2440	40	2480

4.5 Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

For All Mode	Description	Modulation Type
Mode 1	CH01	GFSK(1Mbps)
Mode 2	CH20	
Mode 3	CH40	
Mode 4	CH01	GFSK(2Mbps)
Mode 5	CH20	
Mode 6	CH40	
Mode 7	Charging (Conducted emission)	
Mode 8	Link mode (Radiated emission)	

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) Fully-charged battery is used during the test (except in charging mode)

4.6 table of parameters of text software setting

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters

Test software Version	CMD		
Frequency	2402 MHz	2440 MHz	2480 MHz
Parameters	DEF	DEF	DEF

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address:1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

FCC Test Firm Registration Number: 712850

IC Registered No.: 23583

5.2 Test Instrument Used

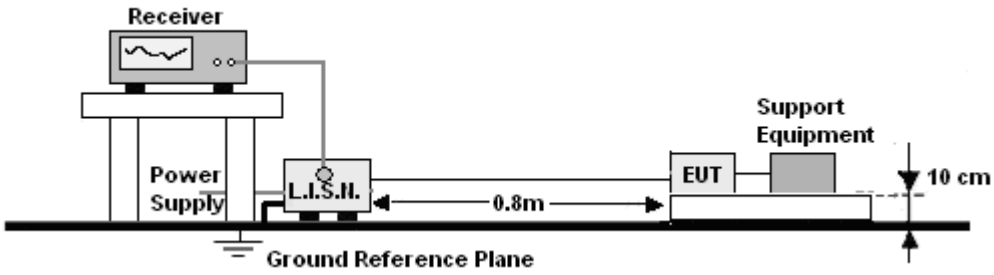
Conducted emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Receiver	R&S	ESR3	102075	Jun. 08, 2020	Jun. 07, 2021
LISN	R&S	ENV216	101375	Jun. 04, 2020	Jun. 03, 2021
ISN	HPX	ISN T800	S1509001	Jun. 04, 2020	Jun. 03, 2021
Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

RF conducted test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Power Metter	Keysight	E4419B	\	Jun. 08, 2020	Jun. 07, 2021
Power Sensor (AV)	Keysight	E9 300A	\	Jun. 08, 2020	Jun. 07, 2021
Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	Jun. 04, 2020	Jun. 03, 2021
Spectrum Analyzer 9kHz-40GHz	Agilent	FSP40	100363	Jun. 13, 2020	Jun. 12, 2021

Radiated emissions Test (966 chamber)					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023
Receiver	R&S	ESR3	102075	Jun. 08, 2020	Jun. 07, 2021
Receiver	R&S	ESRP	101154	Jun. 08, 2020	Jun. 07, 2021
Amplifier	Schwarzbeck	BBV9718	9718-309	Jun. 04, 2020	Jun. 03, 2021
Amplifier	Schwarzbeck	BBV9744	9744-0037	Jun. 04, 2020	Jun. 03, 2021
TRILOG Broadband Antenna	schwarzbeck	VULB 9163	VULB9163 -942	Jun. 08, 2020	Jun. 07, 2021
Horn Antenna	SCHWARZBECK	BBHA9120 D	1541	Jun. 10, 2020	Jun. 09, 2021
Horn Antenna (18GHz-40 GHz)	SCHWARZBECK	BBHA9170	822	Jun. 10, 2020	Jun. 09, 2021
Amplifier (18GHz-40 GHz)	MITEQ	TTA1840-35-HG	2034381	Jun. 08, 2020	Jun. 07, 2021
Loop Antenna (9KHz-30MHz)	SCHWARZBECK	FMZB1519 B	014	Jun. 08, 2020	Jun. 07, 2021
RF cables1 (9kHz-30MHz)	Huber+Suhnar	9kHz-30MHz	B1702988-0008	Jun. 08, 2020	Jun. 07, 2021
RF cables2 (30MHz-1GHz)	Huber+Suhnar	30MHz-1GHz	1486150	Jun. 08, 2020	Jun. 07, 2021
RF cables3 (1GHz-40GHz)	Huber+Suhnar	1GHz-40GHz	1607106	Jun. 08, 2020	Jun. 07, 2021
Power Metter	Keysight	E4419B	\	Jun. 08, 2020	Jun. 07, 2021
Power Sensor (AV)	Keysight	E9 300A	\	Jun. 08, 2020	Jun. 07, 2021
Signal Analyzer 20kHz-26.5 GHz	KEYSIGHT	N9020A	MY49100060	Jun. 04, 2020	Jun. 03, 2021
Spectrum Analyzer 9kHz-40GHz	Agilent	FSP40	100363	Jun. 08, 2020	Jun. 07, 2021
Software	Frad	EZ-EMC	FA-03A2 RE	\	\

6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



6.2 Limit

FREQUENCY (MHz)	Limit (dBuV)	
	Quas-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

Notes:
1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

6.3 Test procedure

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

a. The Product was placed on a nonconductive table 0.1 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).

b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.

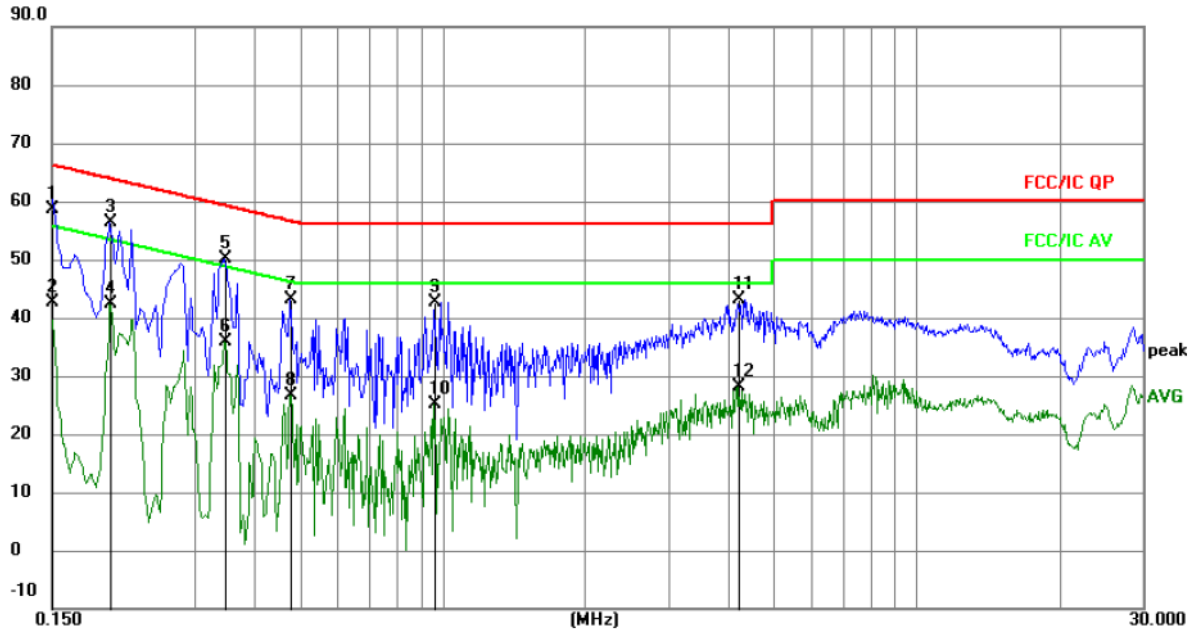
c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 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.

6.5 Test Result

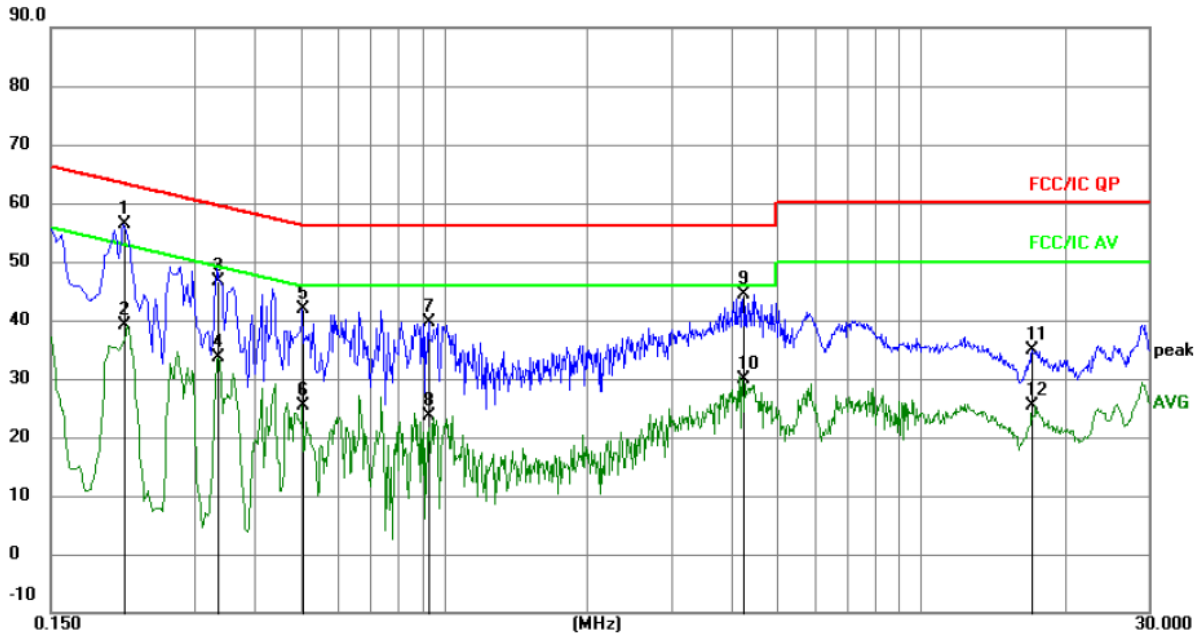
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Phase：	L
Test Voltage ：	AC 120V/60Hz	Test Mode：	Mode 7



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz		dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1500	49.21	9.52	58.73	66.00	-7.27	QP	
2		0.1500	33.19	9.52	42.71	56.00	-13.29	AVG	
3		0.1995	46.84	9.46	56.30	63.63	-7.33	QP	
4		0.1995	32.94	9.46	42.40	53.63	-11.23	AVG	
5		0.3480	40.63	9.54	50.17	59.01	-8.84	QP	
6		0.3480	26.38	9.54	35.92	49.01	-13.09	AVG	
7		0.4785	33.61	9.57	43.18	56.37	-13.19	QP	
8		0.4785	17.13	9.57	26.70	46.37	-19.67	AVG	
9		0.9600	33.03	9.58	42.61	56.00	-13.39	QP	
10		0.9600	15.43	9.58	25.01	46.00	-20.99	AVG	
11		4.2045	33.33	9.74	43.07	56.00	-12.93	QP	
12		4.2045	18.37	9.74	28.11	46.00	-17.89	AVG	

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Phase：	N
Test Voltage ：	AC 120V/60Hz	Test Mode：	Mode 7



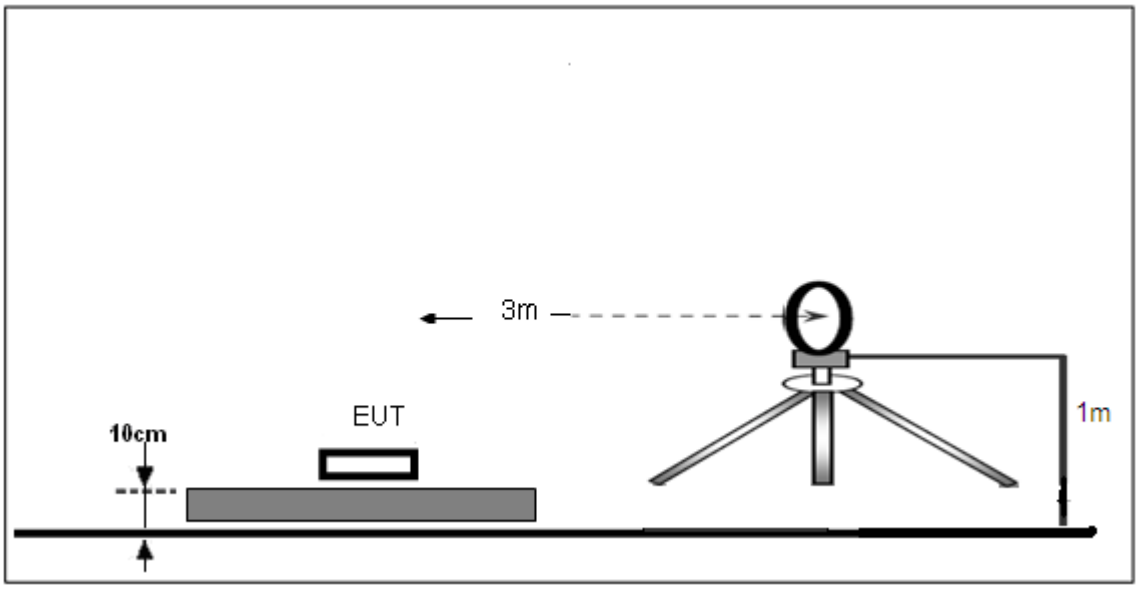
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz		dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.2128	46.90	9.48	56.38	63.10	-6.72	QP	
2		0.2128	29.61	9.48	39.09	53.10	-14.01	AVG	
3		0.3373	37.18	9.55	46.73	59.27	-12.54	QP	
4		0.3373	24.04	9.55	33.59	49.27	-15.68	AVG	
5		0.5047	32.18	9.61	41.79	56.00	-14.21	QP	
6		0.5047	15.72	9.61	25.33	46.00	-20.67	AVG	
7		0.9282	30.04	9.59	39.63	56.00	-16.37	QP	
8		0.9282	14.14	9.59	23.73	46.00	-22.27	AVG	
9		4.2242	34.73	9.75	44.48	56.00	-11.52	QP	
10		4.2242	20.21	9.75	29.96	46.00	-16.04	AVG	
11		17.1084	25.06	9.74	34.80	60.00	-25.20	QP	
12		17.1084	15.72	9.74	25.46	50.00	-24.54	AVG	

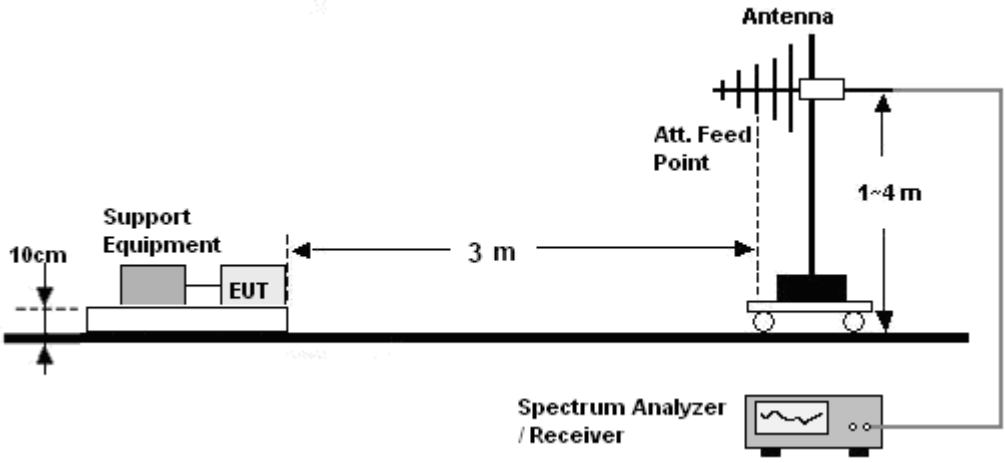
7. RADIATED EMISSIONS

7.1 Block Diagram Of Test Setup

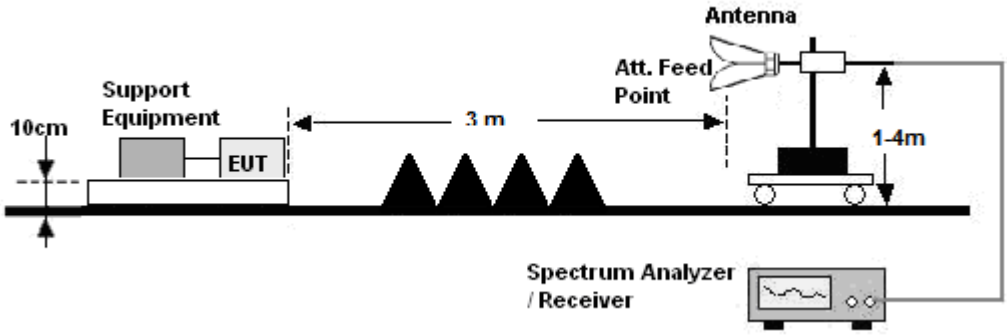
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



7.2 Limit

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	Field Strength	Distance	Field Strength Limit at 3m Distance	
(MHz)	uV/m	(m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:
(1)The limit for radiated test was performed according to FCC PART 15C.
(2)The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT
(a) For an intentional radiator
the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
(4) If the intentional radiator operates at or above 95 GHz: To the third harmonic of the highest fundamental frequency or to 750 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
(5) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the

intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a) (1)through (4) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

7.3 Test procedure

Receiver Parameter	Setting
Attenuation	Auto
9kHz~150kHz	RBW 200Hz for QP
150kHz~30MHz	RBW 9kHz for QP
30MHz~1000MHz	RBW 120kHz for QP

Spectrum Parameter	Setting
1-25GHz	RBW 1 MHz /VBW 1 MHz for Peak, RBW 1 MHz / VBW 10Hz for Average

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

a.The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g.Test the EUT in the lowest channel, the middle channel, the Highest channel.

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

7.4 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.

7.5 Test Result

Below 30MHz

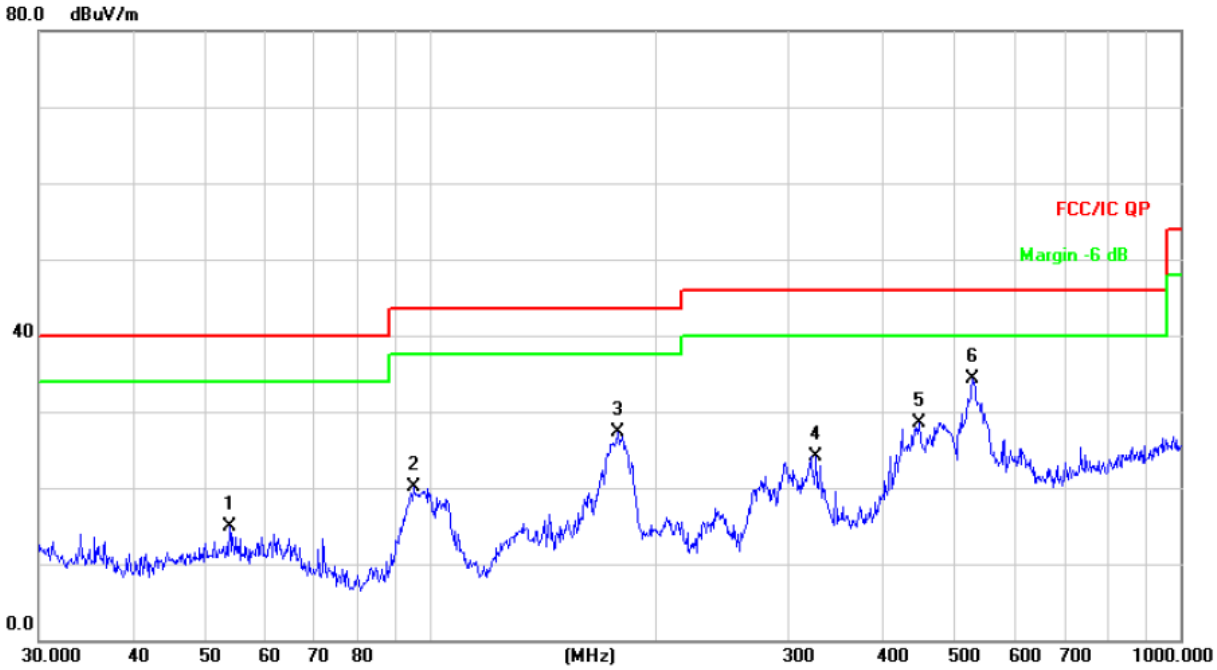
Temperature:	26℃	Relative Humidtity:	24%
Pressure:	101 kPa	Test Voltage :	DC 36V
Test Mode :	Mode 8	Polarization :	--

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 (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

Between 30MHz – 1GHz

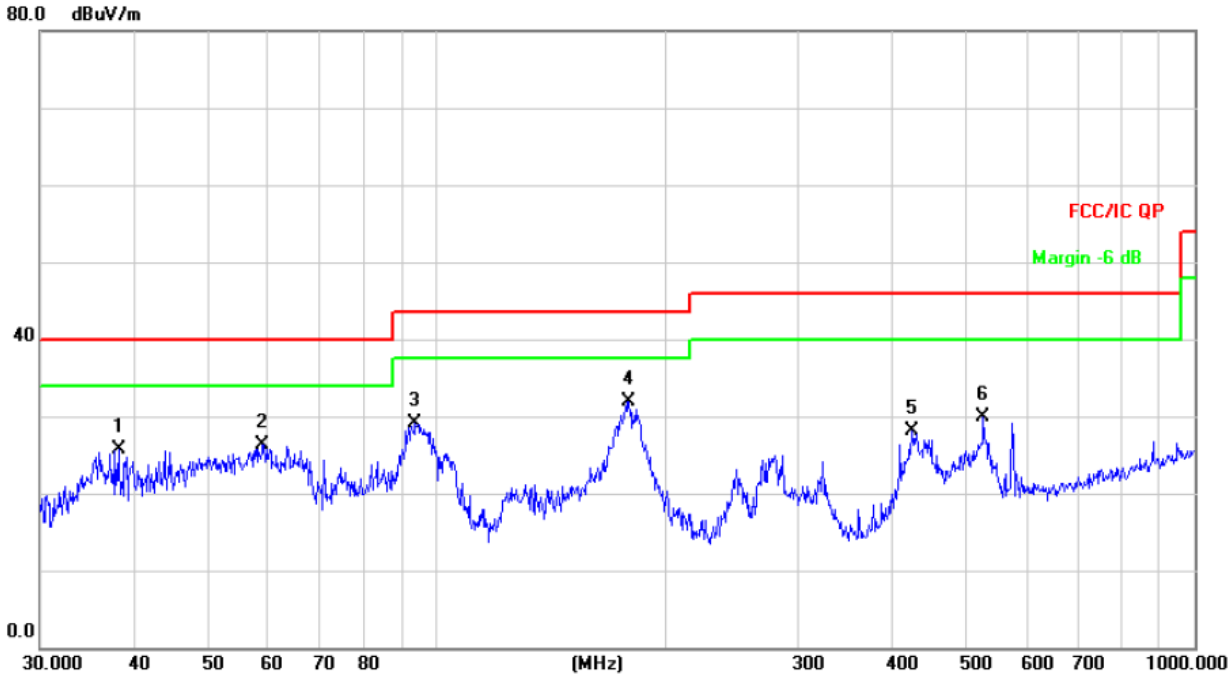
Temperature:	26℃	Relative Humidtity:	54%
Pressure:	101 kPa	Test Voltage :	DC 36V
Test Mode :	Mode 8	Polarization :	Horizontal



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		53.8818	26.20	-11.35	14.85	40.00	-25.15	QP
2		94.7601	33.68	-13.52	20.16	43.50	-23.34	QP
3		177.5092	37.00	-9.77	27.23	43.50	-16.27	QP
4		326.7395	31.27	-7.10	24.17	46.00	-21.83	QP
5		447.9822	31.44	-2.95	28.49	46.00	-17.51	QP
6	*	528.2458	35.84	-1.50	34.34	46.00	-11.66	QP

Temperature:	26℃	Relative Humidtity:	54%
Pressure:	101 kpa	Test Voltage :	DC 36V
Test Mode :	Mode 8	Polarization :	Vertical



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		38.0783	35.81	-10.17	25.64	40.00	-14.36	QP
2		59.0251	37.67	-11.33	26.34	40.00	-13.66	QP
3		93.7685	42.73	-13.57	29.16	43.50	-14.34	QP
4	*	179.3863	41.89	-9.95	31.94	43.50	-11.56	QP
5		423.5403	32.09	-3.92	28.17	46.00	-17.83	QP
6		526.3967	31.42	-1.54	29.88	46.00	-16.12	QP

Between 1GHz – 25GHz

GFSK1Mbps

GFSK							
Polar (H/V)	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Measure-ment (dBuV/m)	Limits (dBuV/m)	Over (dB)	Detector Type
Low channel							
V	4804.00	54.50	-0.43	54.07	74.00	-19.93	PK
V	4804.00	44.52	-0.43	44.09	54.00	-9.91	AV
V	7206.00	47.28	8.31	55.59	74.00	-18.41	PK
V	7206.00	38.09	8.31	46.40	54.00	-7.60	AV
H	4804.00	50.62	-0.43	50.19	74.00	-23.81	PK
H	4804.00	41.05	-0.43	40.62	54.00	-13.38	AV
H	7206.00	45.51	8.31	53.82	74.00	-20.18	PK
H	7206.00	36.87	8.31	45.18	54.00	-8.82	AV
Middle channel							
V	4880.00	52.32	-0.38	51.94	74.00	-22.06	PK
V	4880.00	43.60	-0.38	43.22	54.00	-10.78	AV
V	7320.00	43.59	8.83	52.42	74.00	-21.58	PK
V	7320.00	33.82	8.83	42.65	54.00	-11.35	AV
H	4880.00	50.15	-0.38	49.77	74.00	-24.23	PK
H	4880.00	40.00	-0.38	39.62	54.00	-14.38	AV
H	7320.00	40.62	8.83	49.45	74.00	-24.55	PK
H	7320.00	32.79	8.83	41.62	54.00	-12.38	AV
High channel							
V	4960.00	54.62	-0.32	54.30	74.00	-19.70	PK
V	4960.00	45.48	-0.32	45.16	54.00	-8.84	AV
V	7440.00	46.60	9.35	55.95	74.00	-18.05	PK
V	7440.00	37.39	9.35	46.74	54.00	-7.26	AV
H	4960.00	53.58	-0.32	53.26	74.00	-20.74	PK
H	4960.00	43.79	-0.32	43.47	54.00	-10.53	AV
H	7440.00	45.52	9.35	54.87	74.00	-19.13	PK
H	7440.00	37.66	9.35	47.01	54.00	-6.99	AV

Remark:
1.Emission Level = Meter Reading + Factor,
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Over= Emission Level - Limit
2.If peak below the average limit, the average emission was no test.
3. In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

GFSK 2Mbps

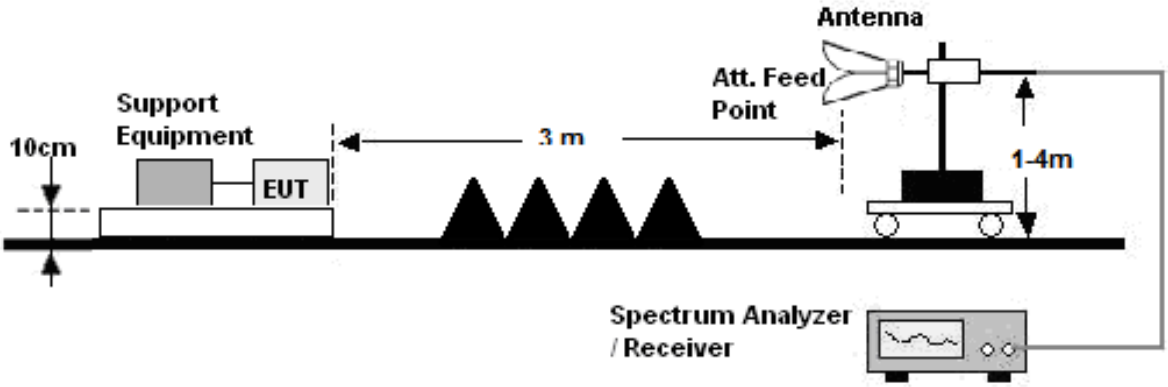
GFSK							
Polar (H/V)	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Measure-ment (dBuV/m)	Limits (dBuV/m)	Over (dB)	Detector Type
Low channel							
V	4804.00	54.56	-0.43	54.13	74.00	-19.87	PK
V	4804.00	45.15	-0.43	44.72	54.00	-9.28	AV
V	7206.00	44.42	8.31	52.73	74.00	-21.27	PK
V	7206.00	35.22	8.31	43.53	54.00	-10.47	AV
H	4804.00	51.56	-0.43	51.13	74.00	-22.87	PK
H	4804.00	40.89	-0.43	40.46	54.00	-13.54	AV
H	7206.00	41.61	8.31	49.92	74.00	-24.08	PK
H	7206.00	33.22	8.31	41.53	54.00	-12.47	AV
Middle channel							
V	4880.00	51.39	-0.38	51.01	74.00	-22.99	PK
V	4880.00	43.86	-0.38	43.48	54.00	-10.52	AV
V	7320.00	43.61	8.83	52.44	74.00	-21.56	PK
V	7320.00	35.28	8.83	44.11	54.00	-9.89	AV
H	4880.00	46.78	-0.38	46.40	74.00	-27.60	PK
H	4880.00	36.11	-0.38	35.73	54.00	-18.27	AV
H	7320.00	42.18	8.83	51.01	74.00	-22.99	PK
H	7320.00	33.45	8.83	42.28	54.00	-11.72	AV
High channel							
V	4960.00	52.72	-0.32	52.40	74.00	-21.60	PK
V	4960.00	41.96	-0.32	41.64	54.00	-12.36	AV
V	7440.00	46.69	9.35	56.04	74.00	-17.96	PK
V	7440.00	37.08	9.35	46.43	54.00	-7.57	AV
H	4960.00	50.59	-0.32	50.27	74.00	-23.73	PK
H	4960.00	40.08	-0.32	39.76	54.00	-14.24	AV
H	7440.00	43.77	9.35	53.12	74.00	-20.88	PK
H	7440.00	35.53	9.35	44.88	54.00	-9.12	AV

Remark:
1.Emission Level = Meter Reading + Factor,
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Over= Emission Level - Limit
2.If peak below the average limit, the average emission was no test.
3. In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

8. RADIATED BAND EMISSION MEASUREMENT AND RESTRICTED BANDS OF OPERATION

8.1 Block Diagram Of Test Setup

Radiated Emission Test-Up Frequency Above 1GHz



8.2 Limit

FCC Part15 C Section 15.209 and 15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:
(1)The limit for radiated test was performed according to FCC PART 15C.
(2)The tighter limit applies at the band edges.
(3)Emission level (dBuV/m)=20log Emission level (uV/m).

8.3 Test procedure

Receiver Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Above 1GHz test procedure as below:

a.The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g.Test the EUT in the lowest channel,the Highest channel.

Note:

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

8.4 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.

8.5 Test Result

	Polar (H/V)	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Measure-ment (dBuV/m)	Limits (dBuV/m)		Result
					PK	PK	AV	
GFSK (1Mbps)	Low Channel 2402MHz							
	H	2390.00	57.56	-6.70	50.86	74.00	54.00	PASS
	H	2400.00	48.71	-6.71	42.00	74.00	54.00	PASS
	V	2390.00	58.39	-6.70	51.69	74.00	54.00	PASS
	V	2400.00	50.03	-6.71	43.32	74.00	54.00	PASS
	High Channel 2480MHz							
	H	2483.50	57.11	-6.79	50.32	74.00	54.00	PASS
	H	2485.00	49.79	-6.81	42.98	74.00	54.00	PASS
	V	2483.50	57.59	-6.79	50.80	74.00	54.00	PASS
	V	2485.00	49.67	-6.81	42.86	74.00	54.00	PASS

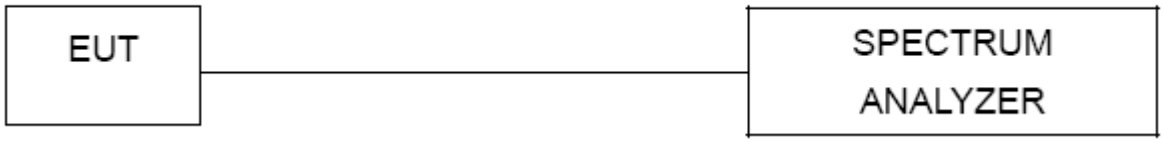
Remark:
1. Emission Level = Meter Reading + Factor,
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Over= Emission Level - Limit
2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
3 In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
5. This report only shows the worst case test data.

	Polar (H/V)	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Measure-ment (dBuV/m)	Limits (dBuV/m)		Result
					PK	PK	AV	
GFSK (2Mbps)	Low Channel 2402MHz							
	H	2390.00	57.67	-6.70	50.97	74.00	54.00	PASS
	H	2400.00	50.31	-6.71	43.60	74.00	54.00	PASS
	V	2390.00	56.87	-6.70	50.17	74.00	54.00	PASS
	V	2400.00	49.17	-6.71	42.46	74.00	54.00	PASS
	High Channel 2480MHz							
	H	2483.50	56.82	-6.79	50.03	74.00	54.00	PASS
	H	2485.00	49.58	-6.81	42.77	74.00	54.00	PASS
	V	2483.50	55.66	-6.79	48.87	74.00	54.00	PASS
	V	2485.00	47.62	-6.81	40.81	74.00	54.00	PASS

Remark:
1. Emission Level = Meter Reading + Factor,
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Over= Emission Level - Limit
2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
3 In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
5. This report only shows the worst case test data.

9. POWER SPECTRAL DENSITY TEST

9.1 Block Diagram Of Test Setup



9.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

9.3 Test procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

.

9.4 EUT operating Conditions

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

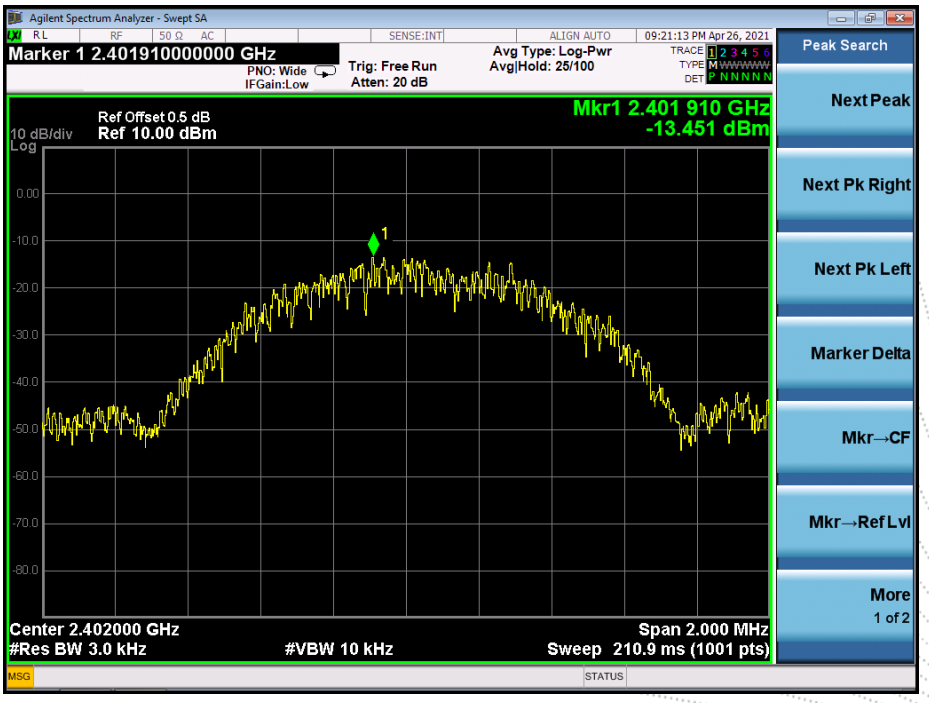
Note: Power Spectral Density(dBm)=Reading+Cable Loss

9.5 Test Result

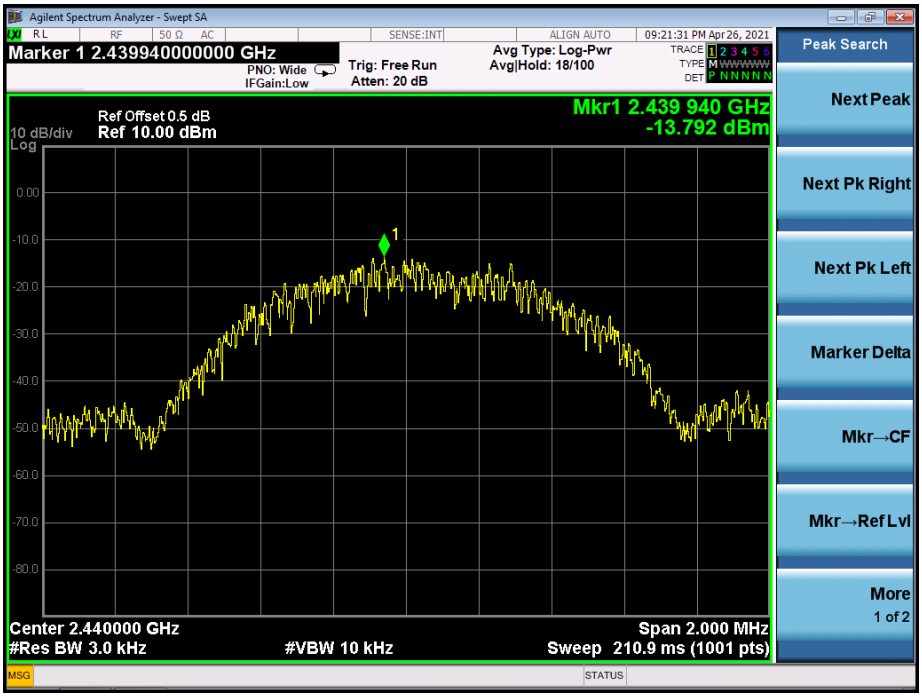
Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK 1Mbps	Test Voltage ：	DC 36V

Frequency	Power Spectral Density(dBm/3kHz)	Limit (dBm/3kHz)	Result
2402 MHz	-13.451	8	PASS
2440 MHz	-13.792	8	PASS
2480 MHz	-13.076	8	PASS

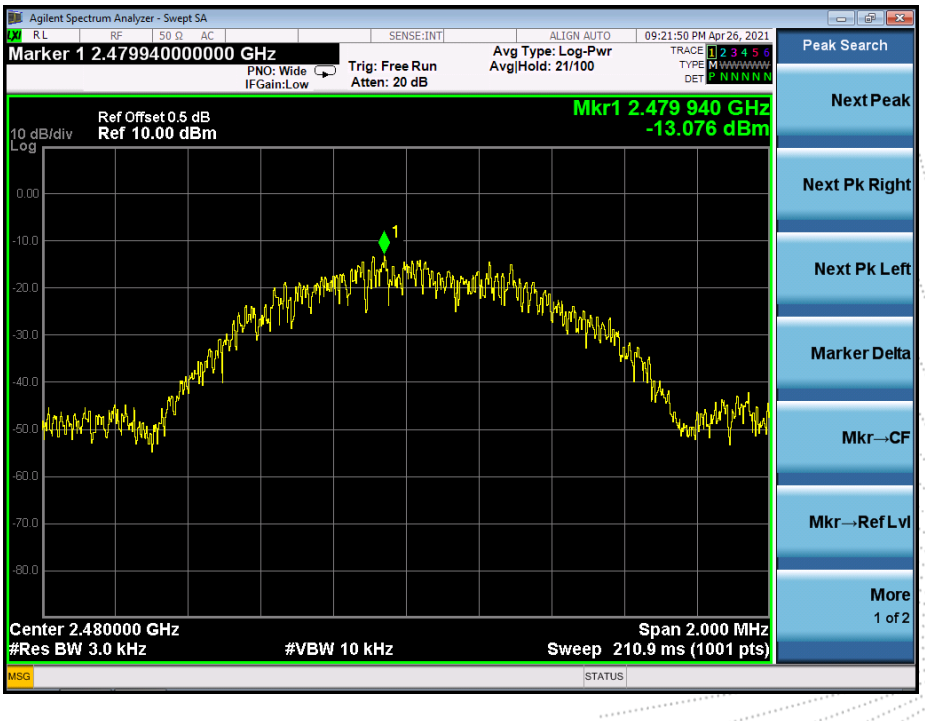
CH01



CH20


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.439940000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 18/100
09:21:31 PM Apr 26, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.439 940 GHz
-13.792 dBm
Center 2.440000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
Sweep 210.9 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

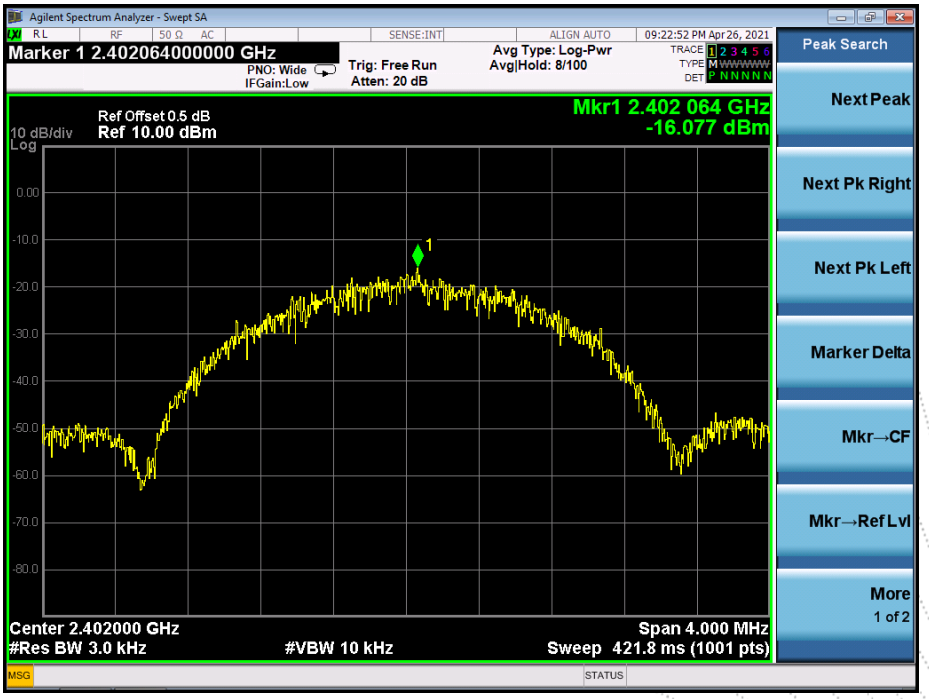
CH40


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.479940000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 21/100
09:21:50 PM Apr 26, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.479 940 GHz
-13.076 dBm
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
Sweep 210.9 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

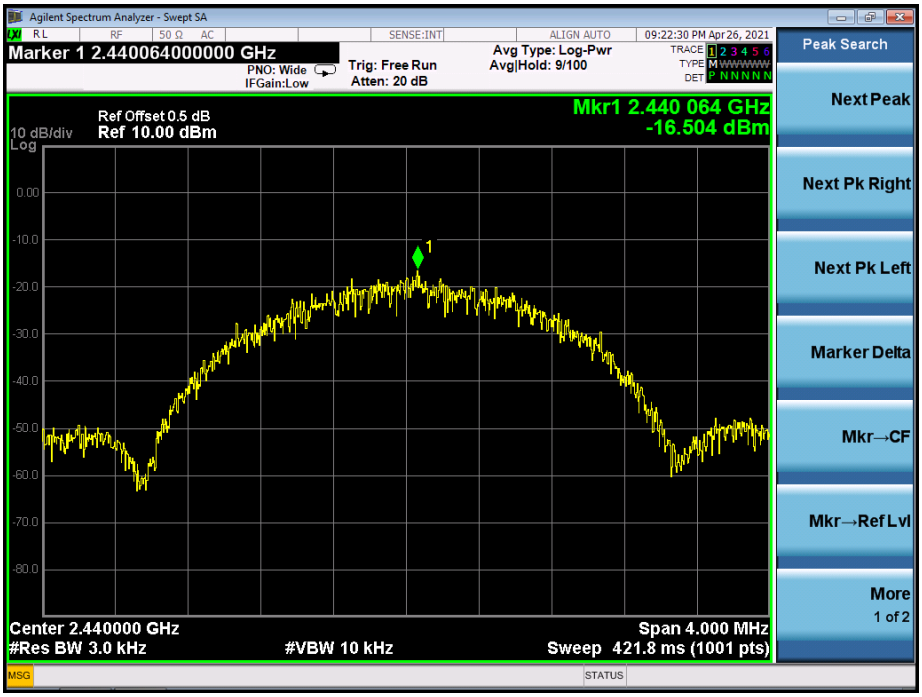
Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK 2Mbps	Test Voltage ：	DC 36V

Frequency	Power Spectral Density(dBm/3kHz)	Limit (dBm/3kHz)	Result
2402 MHz	-16.077	8	PASS
2440 MHz	-16.504	8	PASS
2480 MHz	-16.414	8	PASS

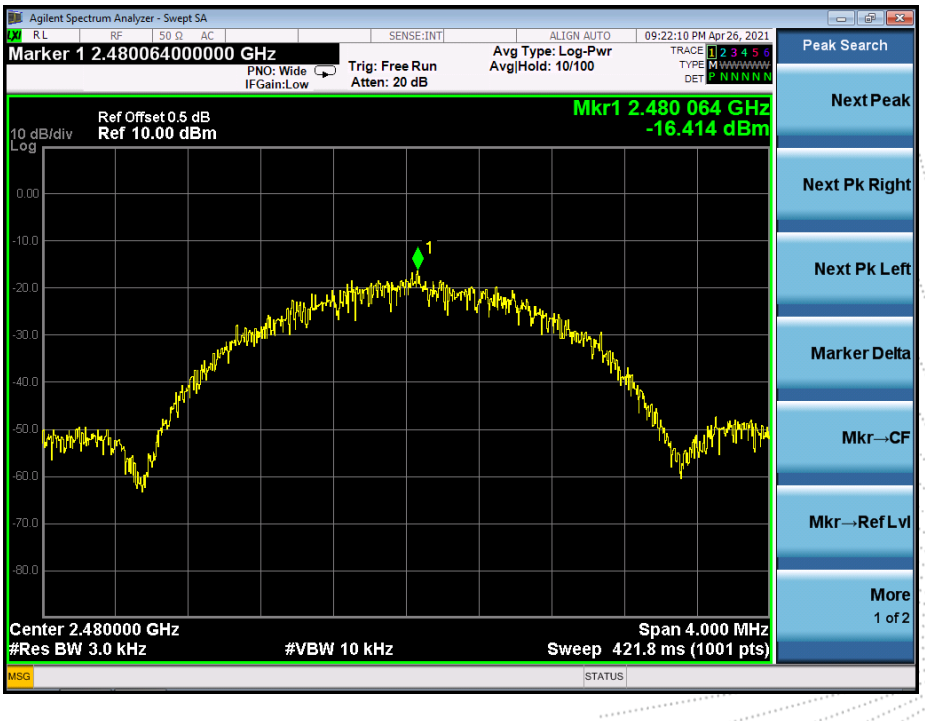
CH01



CH20


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.440064000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 9/100
09:22:30 PM Apr 26, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.440 064 GHz
-16.504 dBm
Center 2.440000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 4.000 MHz
Sweep 421.8 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

CH40


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.480064000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/100
09:22:10 PM Apr 26, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.480 064 GHz
-16.414 dBm
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 4.000 MHz
Sweep 421.8 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

10. BANDWIDTH TEST

10.1 Block Diagram Of Test Setup

10.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

10.3 Test procedure

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. .

10.4 EUT operating Conditions

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

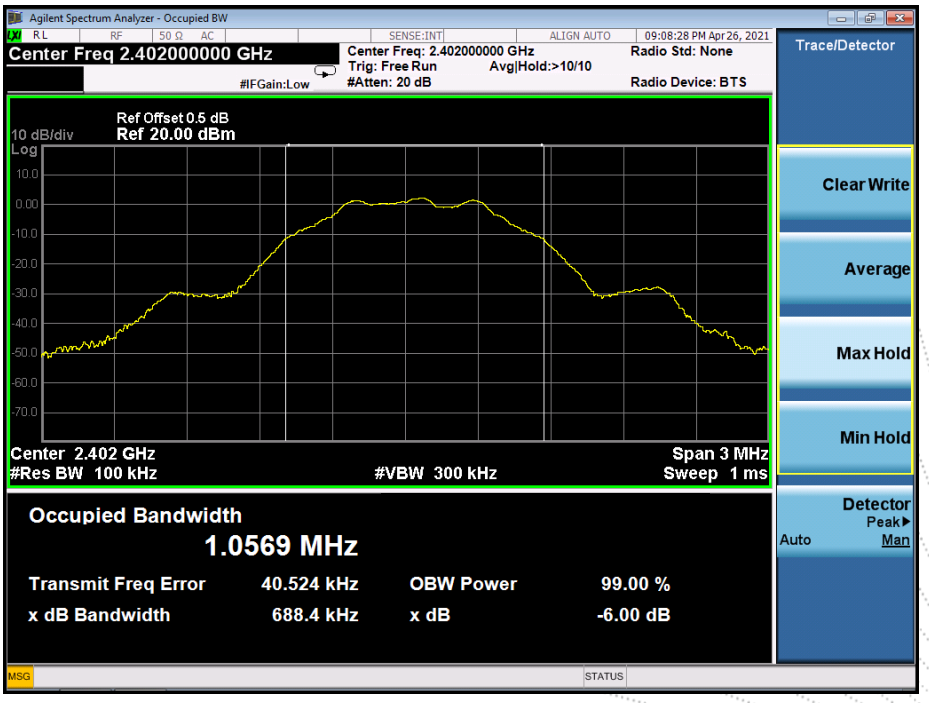
Note: Power Spectral Density(dBm)=Reading+Cable Loss

10.5 Test Result

Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK 1Mbps	Test Voltage ：	DC 36V

Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
2402	0.688	500	Pass
2440	0.696	500	Pass
2480	0.702	500	Pass

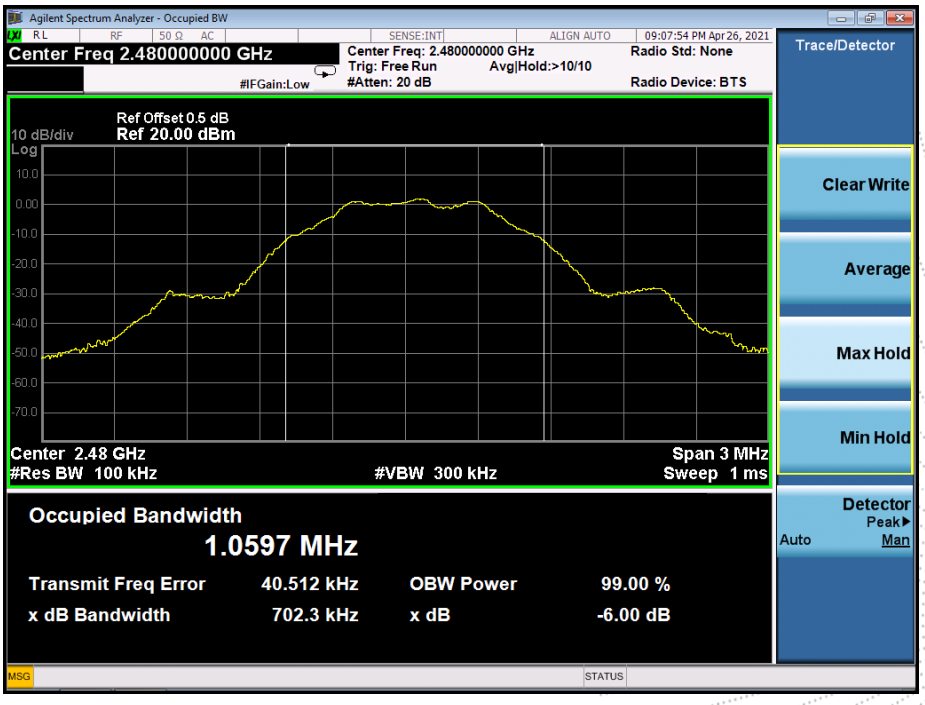
CH 01



CH 20

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
09:08:13 PM Apr 26, 2021
Trace/Detector
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
Log
Clear Write
Average
Max Hold
Min Hold
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0646 MHz
Transmit Freq Error 41.781 kHz
OBW Power 99.00 %
x dB Bandwidth 695.8 kHz
x dB -6.00 dB
Detector
Peak
Auto
Man
MSG
STATUS

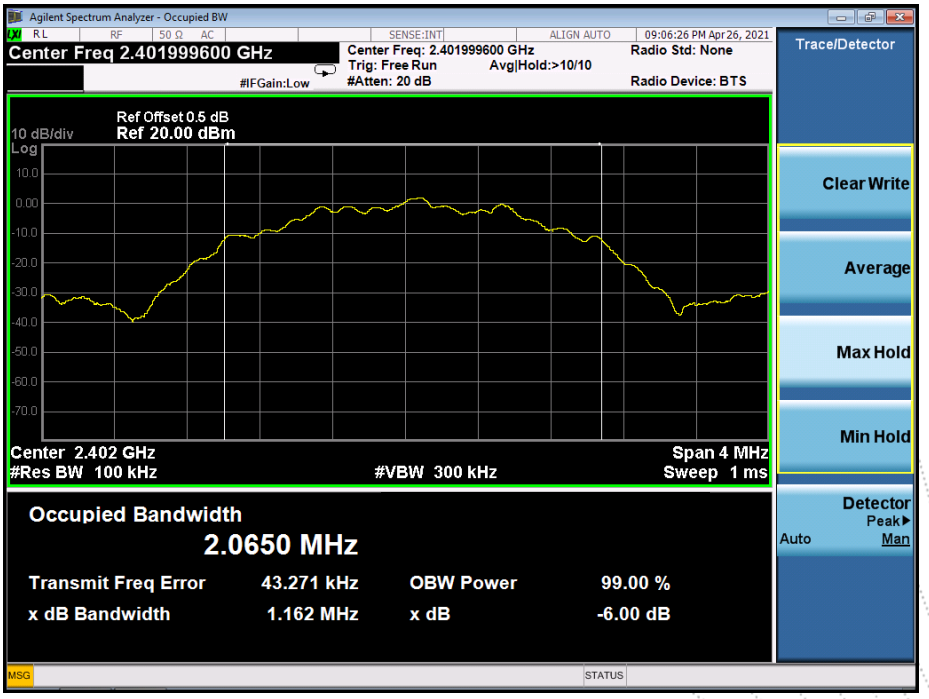
CH 40


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
09:07:54 PM Apr 26, 2021
Trace/Detector
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
Log
Clear Write
Average
Max Hold
Min Hold
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0597 MHz
Transmit Freq Error 40.512 kHz
OBW Power 99.00 %
x dB Bandwidth 702.3 kHz
x dB -6.00 dB
Detector
Peak
Auto
Man
MSG
STATUS

Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK 2Mbps	Test Voltage ：	DC 36V

Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
2402	1.162	500	Pass
2440	1.147	500	Pass
2480	1.149	500	Pass

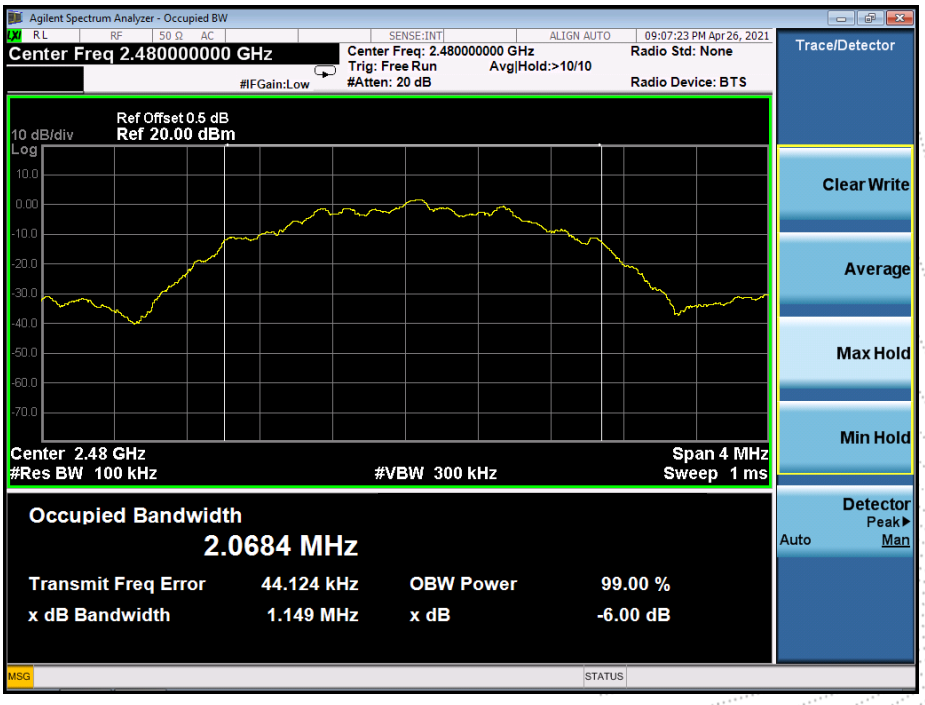
CH 01



CH 20

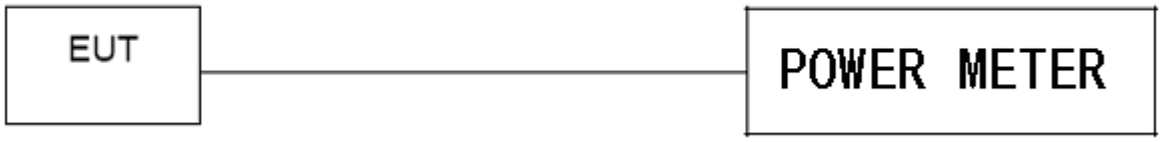
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
09:07:04 PM Apr 26, 2021
Trace/Detector
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
Log
Clear Write
Average
Max Hold
Min Hold
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 1 ms
Occupied Bandwidth
2.0664 MHz
Transmit Freq Error 43.391 kHz
OBW Power 99.00 %
x dB Bandwidth 1.147 MHz
x dB -6.00 dB
Detector
Peak
Auto
Man
MSG
STATUS

CH 40


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
09:07:23 PM Apr 26, 2021
Trace/Detector
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
Log
Clear Write
Average
Max Hold
Min Hold
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 1 ms
Occupied Bandwidth
2.0684 MHz
Transmit Freq Error 44.124 kHz
OBW Power 99.00 %
x dB Bandwidth 1.149 MHz
x dB -6.00 dB
Detector
Peak
Auto
Man
MSG
STATUS

11. PEAK OUTPUT POWER TEST

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

11.3 Test procedure

a. The EUT was directly connected to the Power meter

11.4 EUT operating Conditions

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

Note: Power Spectral Density(dBm)=Reading+Cable Loss

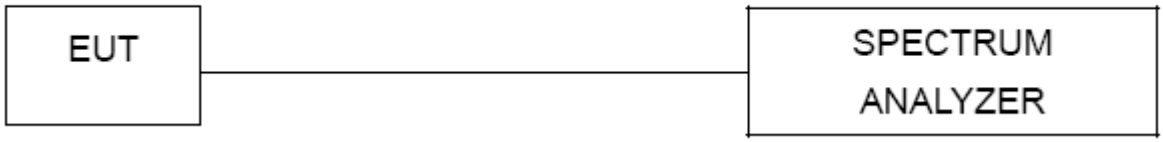
11.5 Test Result

Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK	Test Voltage ：	DC 36V

	Frequency	Maximum Conducted Output Power(PK)	Conducted Output Power Limit
	(MHz)	(dBm)	dBm
GFSK 1Mbps	2402	2.378	30
	2440	1.875	30
	2480	2.010	30
GFSK 2Mbps	2402	2.371	30
	2440	1.887	30
	2480	2.024	30

12. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

12.1 Block Diagram Of Test Setup



12.2 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

12.3 Test procedure

Using the following spectrum analyzer setting:

a) Set the RBW = 100KHz.

b) Set the VBW = 300KHz.

c) Sweep time = auto couple.

d) Detector function = peak.

e) Trace mode = max hold.

f) Allow trace to fully stabilize..

12.4 EUT operating Conditions

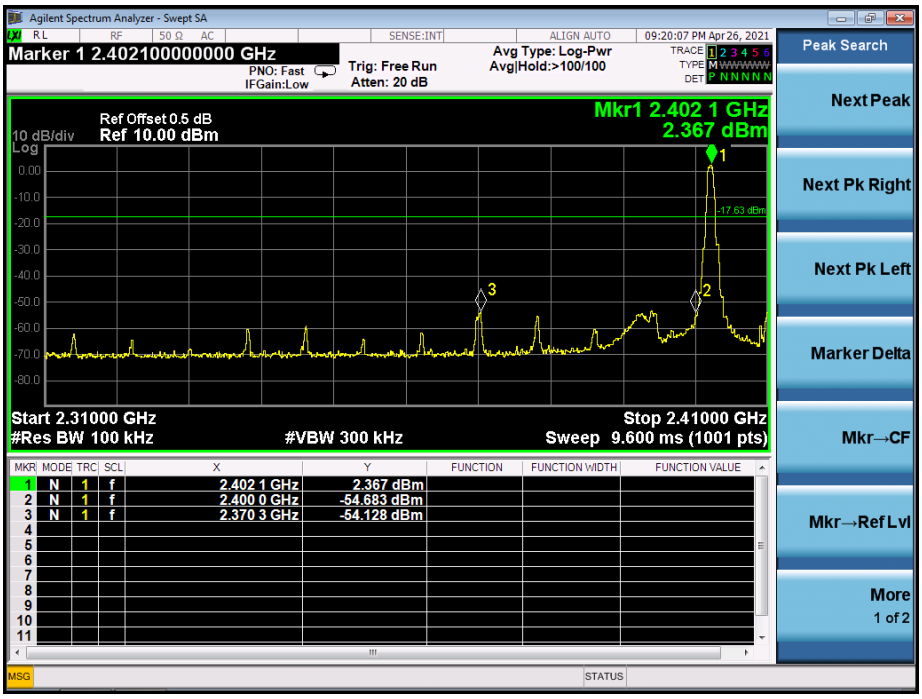
The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

Note: Power Spectral Density(dBm)=Reading+Cable Loss

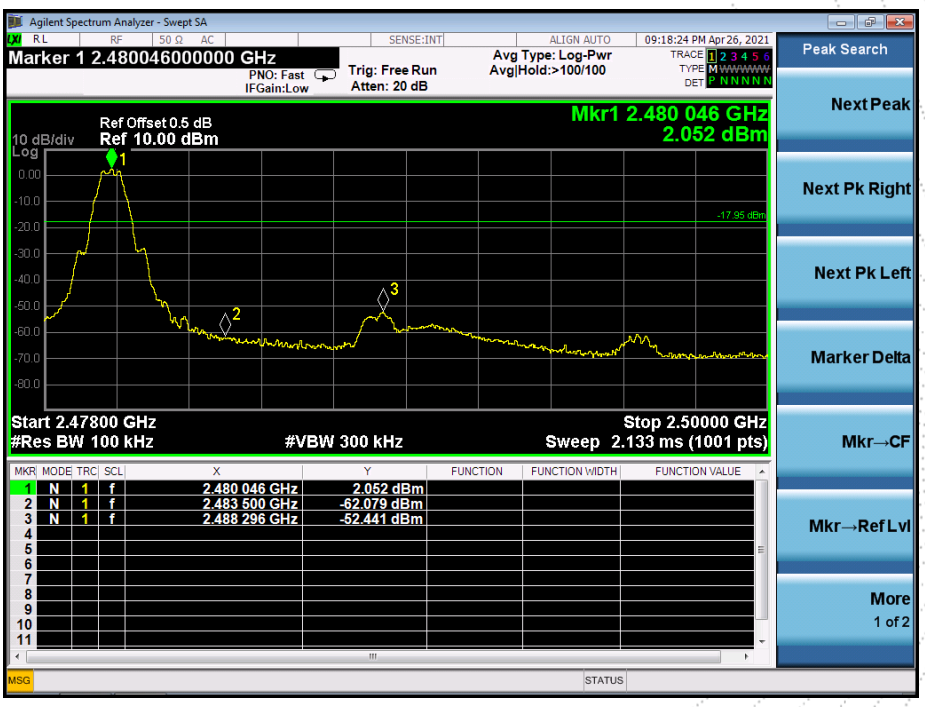
12.5 Test Result

Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK	Test Voltage ：	DC 36V

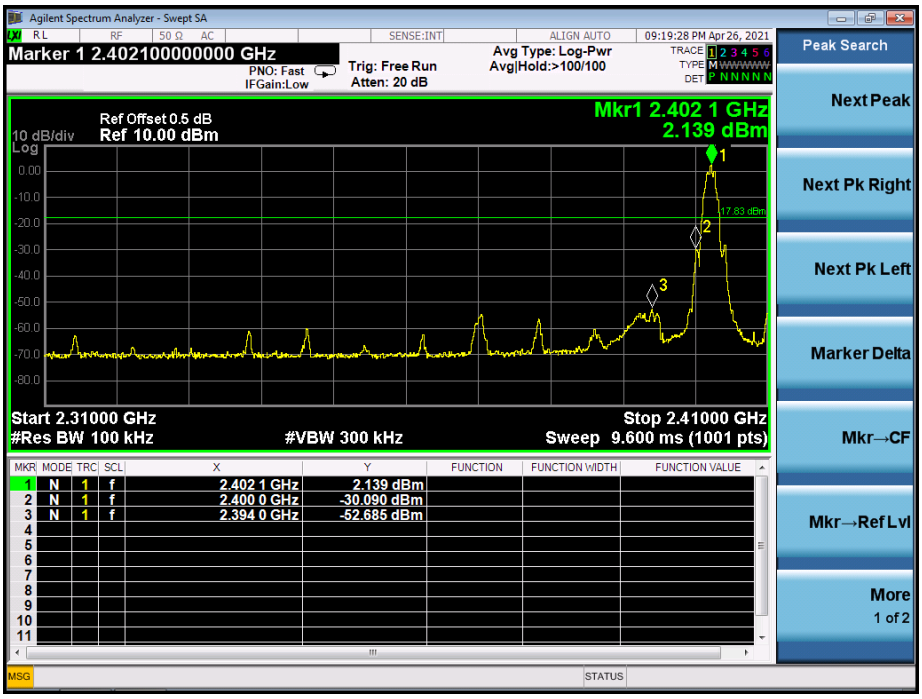
GFSK 1Mbps: Band Edge, Left Side



GFSK 1Mbps: Band Edge, Right Side



GFSK 2Mbps: Band Edge, Left Side

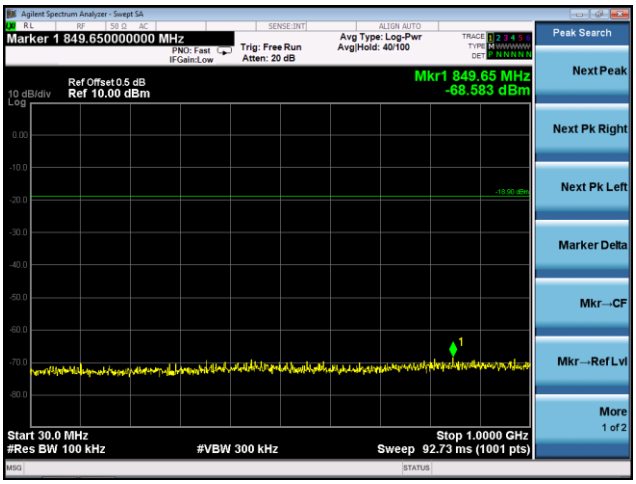


GFSK 2Mbps: Band Edge, Right Side

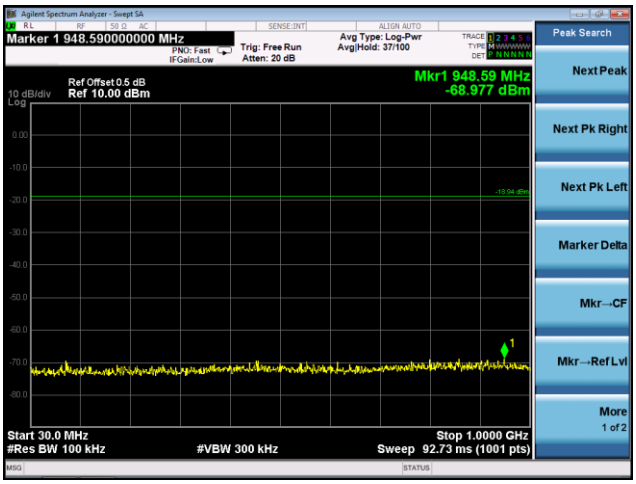
CONDUCTED EMISSION MEASUREMENT

GFSK 1Mbps

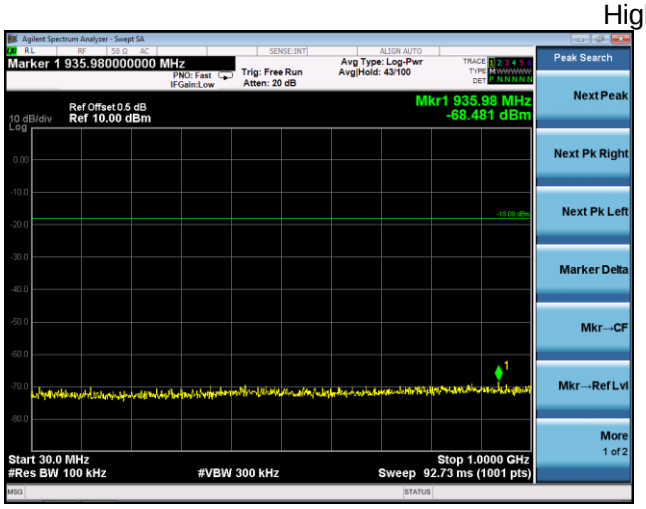
Low Channel 2402MHz

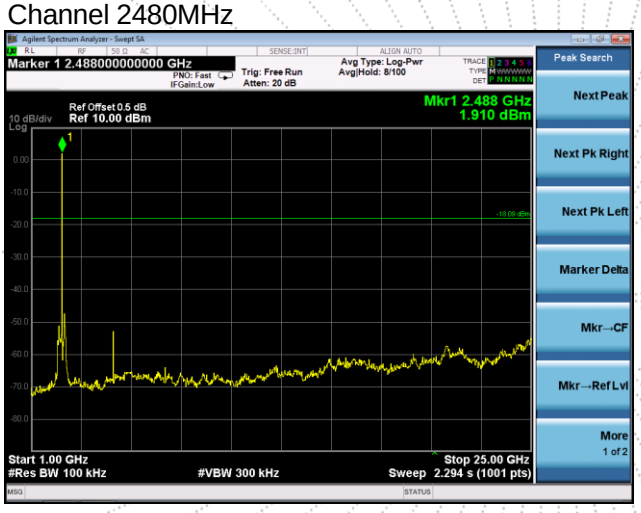


Middle Channel 2440MHz



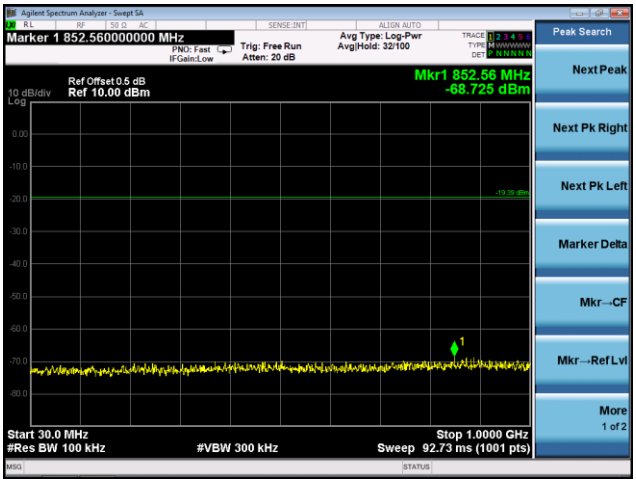
High Channel 2480MHz



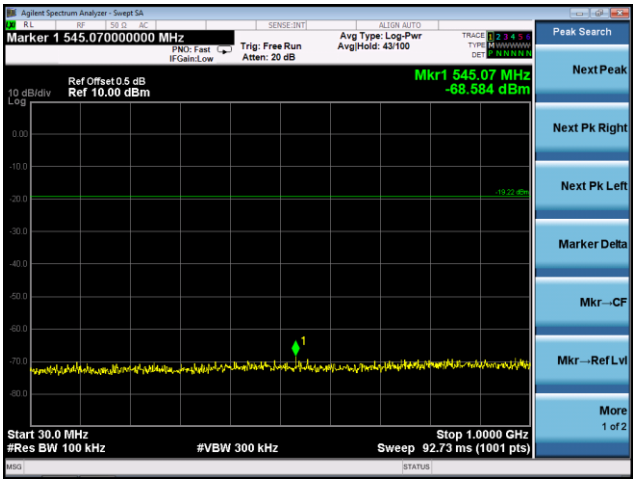


GFSK 2Mbps

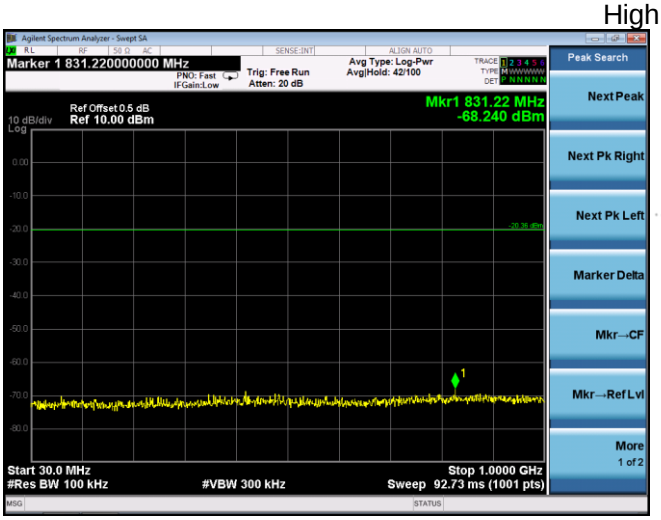
Low Channel 2402MHz



Middle Channel 2440MHz



High Channel 2480MHz



13. DUTY CYCLE OF TEST SIGNAL

13.1 STANDARD REQUIREMENT

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.
All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

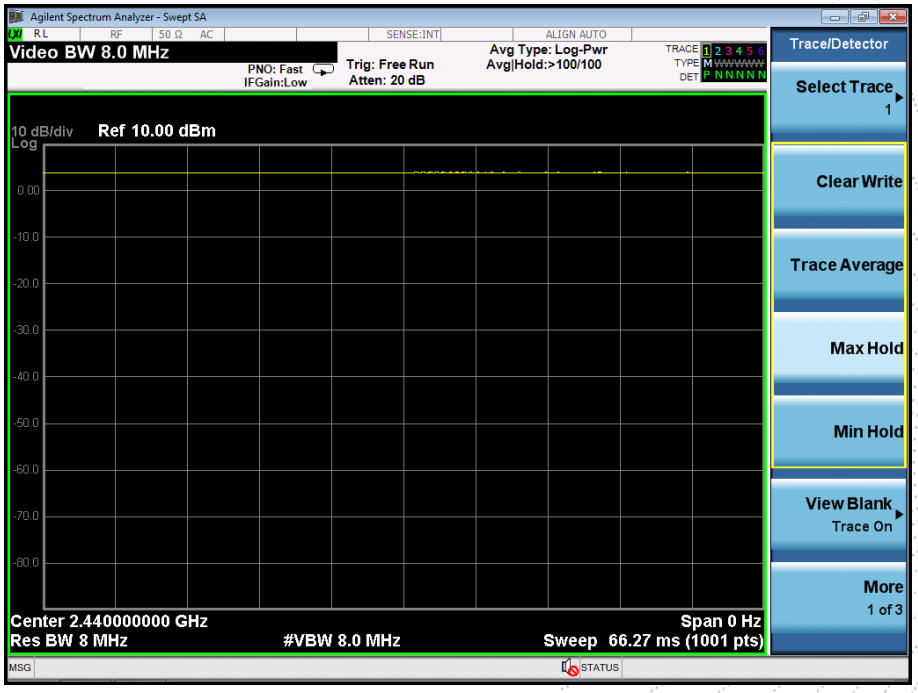
13.2 Formula:

Duty Cycle = Ton / (Ton+Toff)

Measurement Procedure:
1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

	Duty Cycle	Duty Fator (dB)
GFSK	1	0



14. ANTENNA REQUIREMENT

14.1 Limit

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.

14.2 Test Result

The EUT antenna is PCB antenna, The antenna gain is 0dBi, fulfill the requirement of this section.

15. EUT PHOTOGRAPHS

EUT Photo 1

EUT Photo 2

EUT Photo 3

EUT Photo 4

16. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions

Radiated Measurement Photos

BCTC
倍 测 检 测

STATEMENT

1.The equipment lists are traceable to the national reference standards.

2.The test report can not be partially copied unless prior written approval is issued from our lab.

3.The test report is invalid without stamp of laboratory.

4.The test report is invalid without signature of person(s) testing and authorizing.

5.The test process and test result is only related to the Unit Under Test.

6.The quality system of our laboratory is in accordance with ISO/IEC17025.

7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

Address:
1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL：400-788-9558

P.C.: 518103

FAX：0755-33229357

Website：http://www.chnbctc.com

E-Mail：bctc@bctc-lab.com.cn

※※※※※ **END** ※※※※※