

Appendix

Bluetooth BLE

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1 Equipment List

Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2018/4/2	2019/4/1
				2019/4/1	2020/3/31
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2018/7/12	2019/7/11
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2019/2/11	2020/2/10
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019/3/2	2020/3/1
RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/1/13	2020/1/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

2 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	RF power density, conducted	±2.84dB
3	Spurious emissions, conducted	±0.75dB
4	Conduct emission test	±3.12 dB (9KHz- 30MHz)

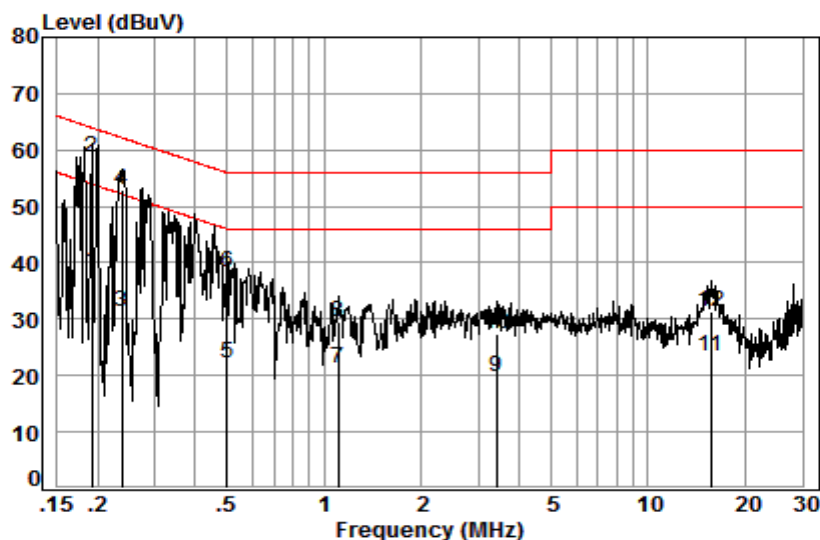
3 AC Power Line Conducted Emissions

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

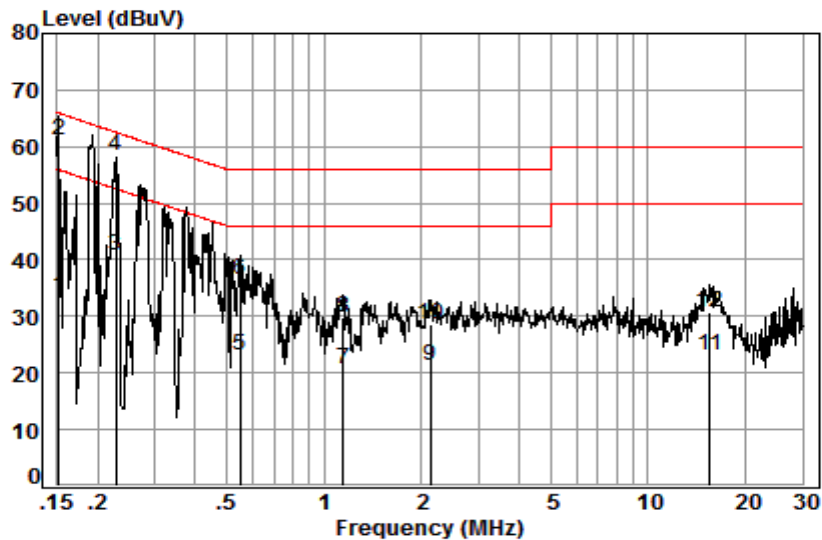
Live line:



Site : Shielding Room
 Condition: Line
 Job No. : 11707CR
 Test mode: c

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.19	0.02	9.66	28.79	38.47	53.98	-15.51	Average
2	0.19	0.02	9.66	49.13	58.81	63.98	-5.17	QP
3	0.24	0.03	9.67	21.77	31.47	52.17	-20.70	Average
4	0.24	0.03	9.67	43.13	52.83	62.17	-9.34	QP
5	0.50	0.06	9.67	12.34	22.07	46.00	-23.93	Average
6	0.50	0.06	9.67	28.50	38.23	56.00	-17.77	QP
7	1.11	0.10	9.73	11.32	21.15	46.00	-24.85	Average
8	1.11	0.10	9.73	19.72	29.55	56.00	-26.45	QP
9	3.40	0.16	9.71	9.79	19.66	46.00	-26.34	Average
10	3.40	0.16	9.71	17.45	27.32	56.00	-28.68	QP
11	15.63	0.21	10.31	12.99	23.51	50.00	-26.49	Average
12	15.63	0.21	10.31	20.67	31.19	60.00	-28.81	QP

Neutral line:



Site : Shielding Room
Condition: Neutral
Job No. : 11707CR
Test mode: c

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.15	0.01	9.63	23.89	33.53	55.91	-22.38	Average
2	0.15	0.01	9.63	51.37	61.01	65.91	-4.90	QP
3	0.23	0.03	9.64	31.00	40.67	52.52	-11.85	Average
4	0.23	0.03	9.64	48.80	58.47	62.52	-4.05	QP
5	0.55	0.06	9.64	13.36	23.06	46.00	-22.94	Average
6	0.55	0.06	9.64	26.70	36.40	56.00	-19.60	QP
7	1.15	0.10	9.70	10.94	20.74	46.00	-25.26	Average
8	1.15	0.10	9.70	20.02	29.82	56.00	-26.18	QP
9	2.13	0.16	9.69	11.43	21.28	46.00	-24.72	Average
10	2.13	0.16	9.69	18.72	28.57	56.00	-27.43	QP
11	15.55	0.21	10.34	12.69	23.24	50.00	-26.76	Average
12	15.55	0.21	10.34	20.12	30.67	60.00	-29.33	QP

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

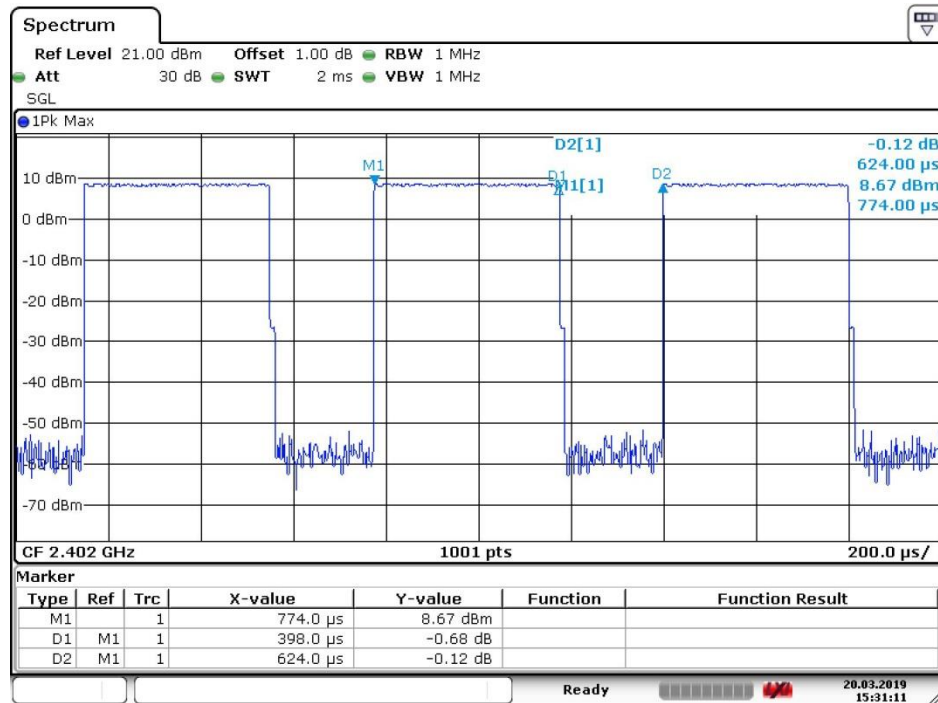
4 Duty Cycle

4.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
BLE	CH0	63.78

4.2 Test Plots

BLE



Date: 20.MAR.2019 15:31:12

5 Conducted Output Power

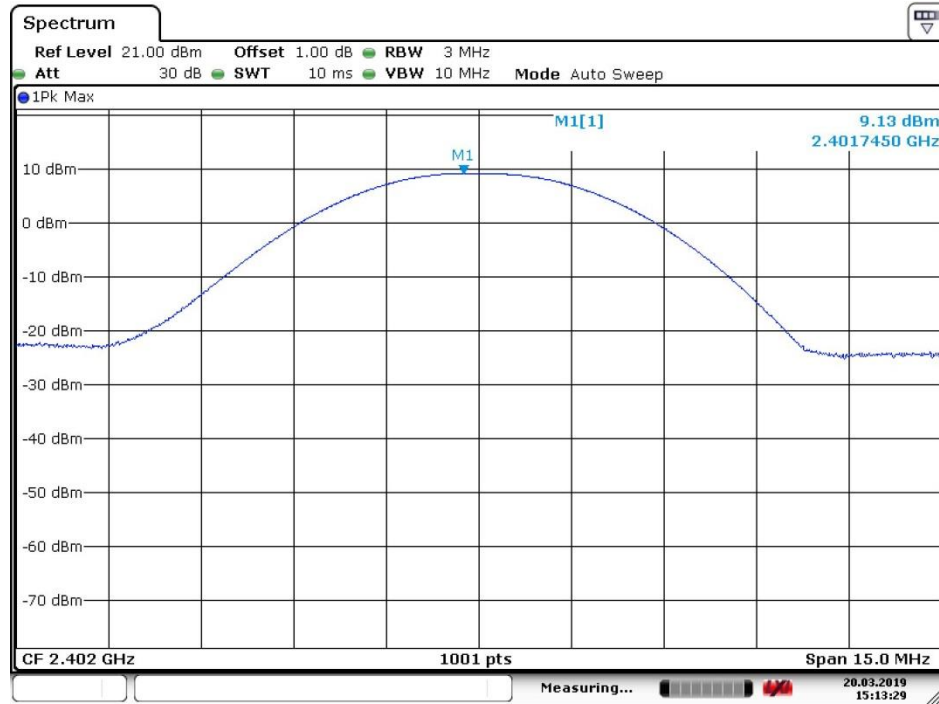
5.1 Test Results

Measurement Data of Peak Power :

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	9.13	30.00	Pass
Middle	8.89	30.00	Pass
Highest	8.45	30.00	Pass

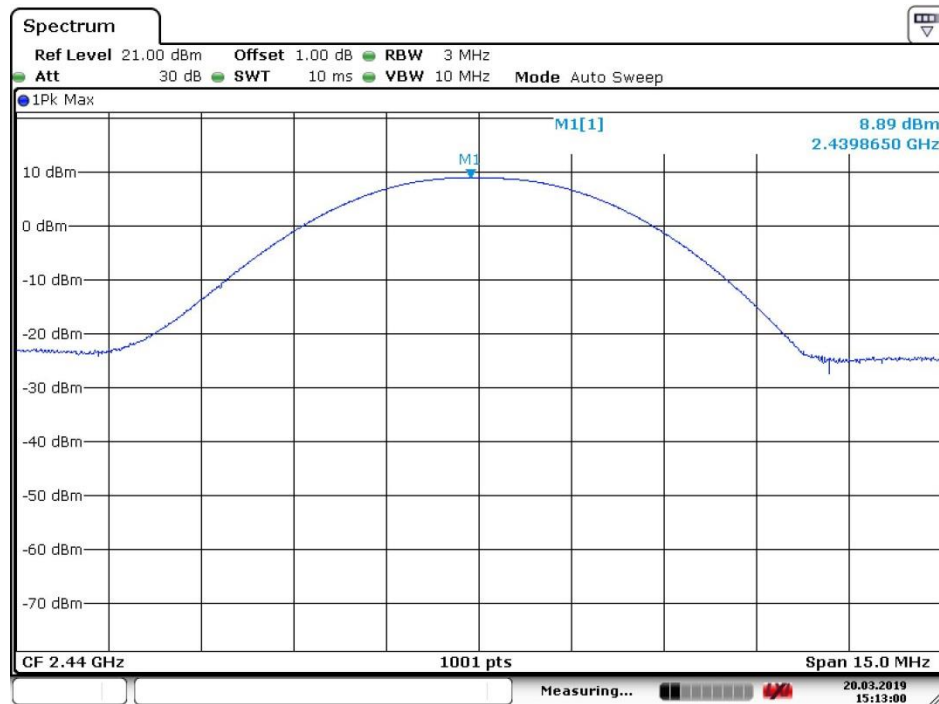
5.2 Test plots:

GFSK _Lowest Channel



Date: 20.MAR.2019 15:13:30

GFSK _Middle Channel



Date: 20.MAR.2019 15:13:01

GFSK _Highest Channel



Date: 20.MAR.2019 15:12:27

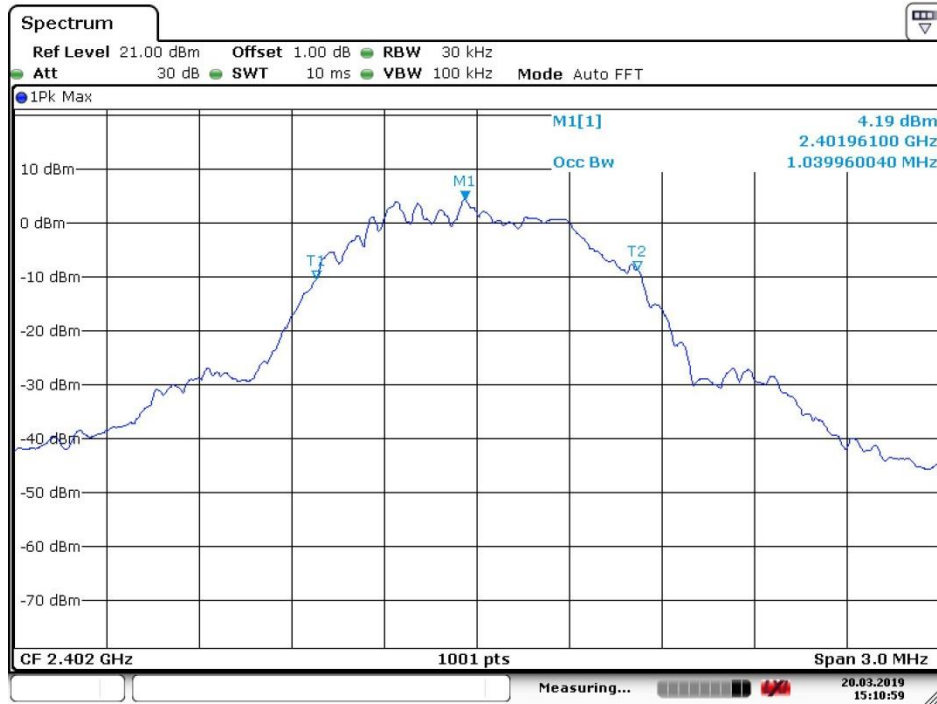
6 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

6.1 Test Results

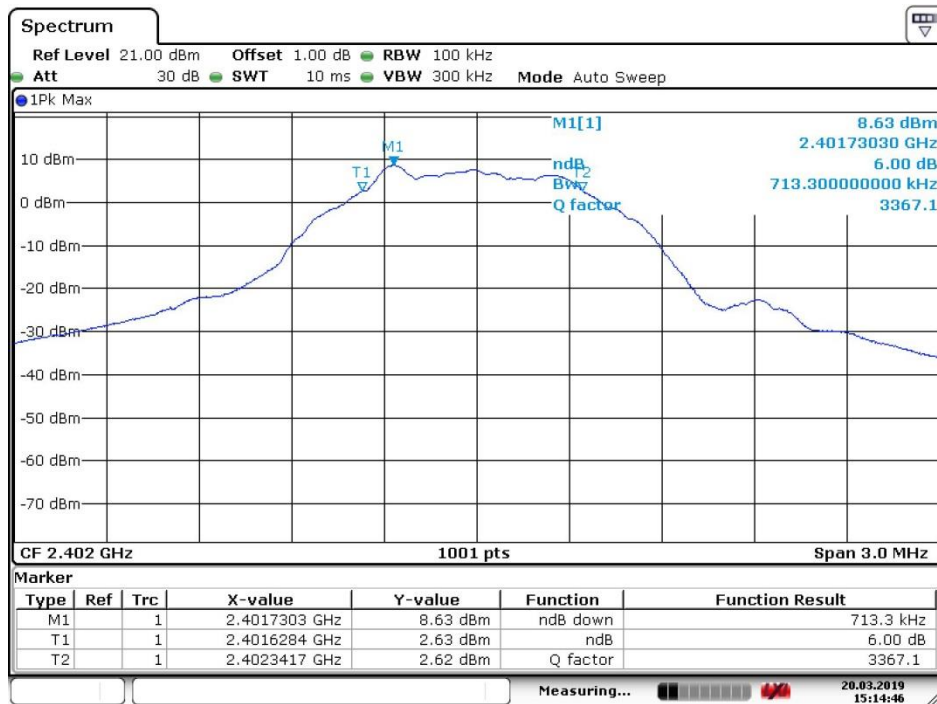
Mode	Test Channel	99% Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
GFSK	Lowest	4.19	0.71	≥500	Pass
	Middle	3.90	0.70	≥500	Pass
	Highest	3.41	0.72	≥500	Pass

6.2 Test plots

GFSK_Lowest Channel

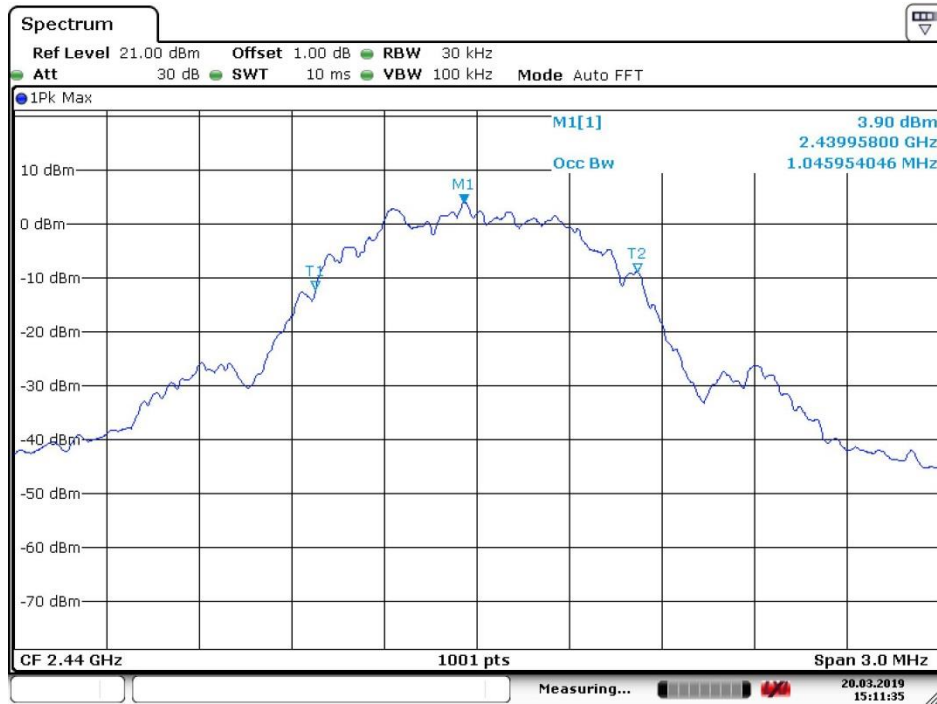


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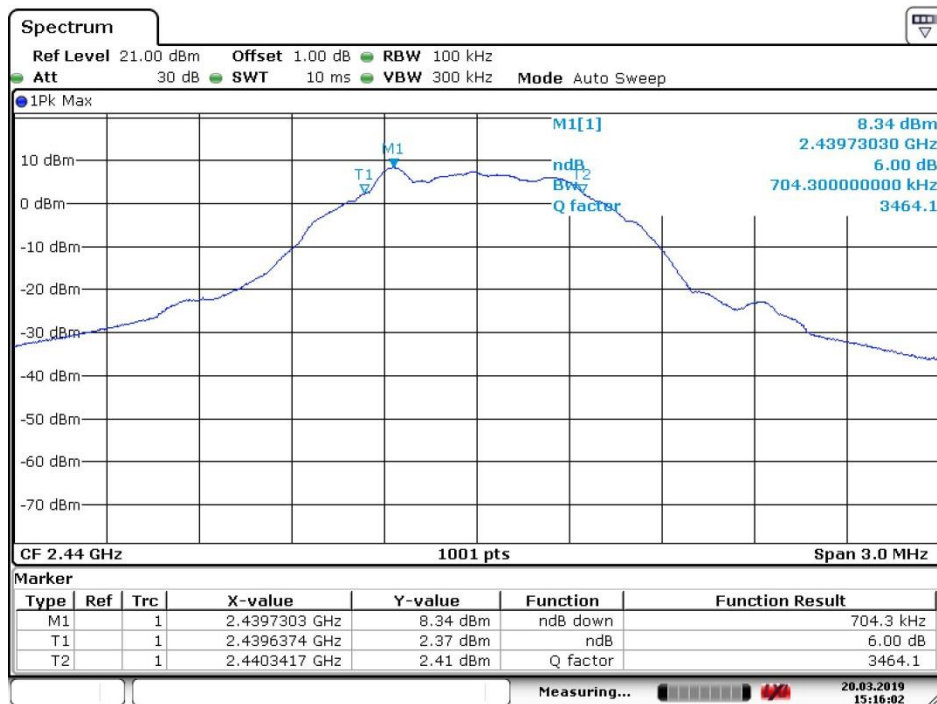


Date: 20.MAR.2019 15:14:46

GFSK_Middle Channel

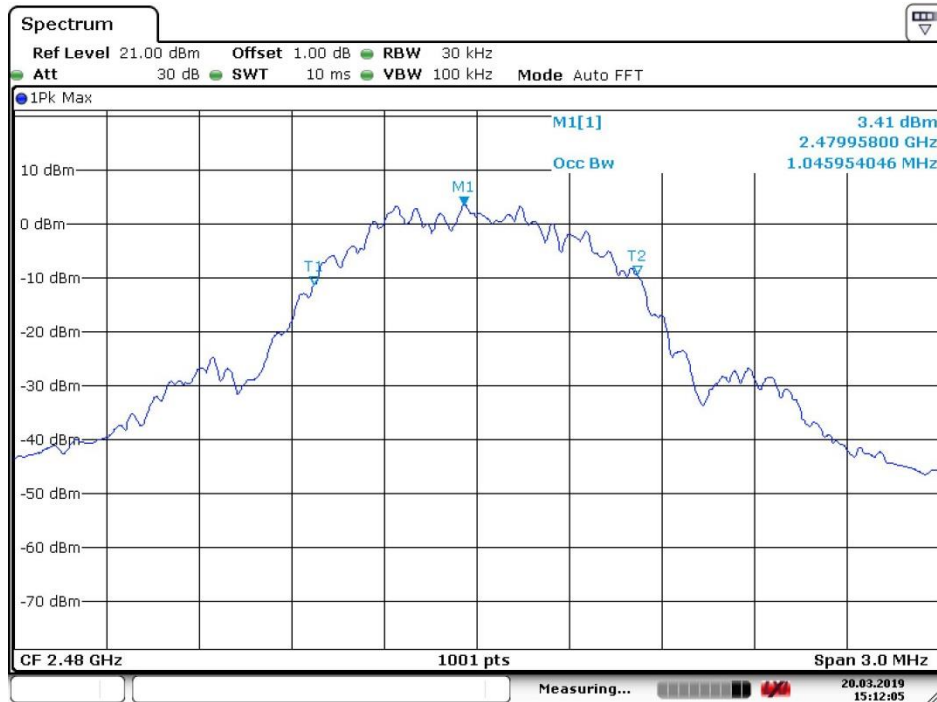


Date: 20.MAR.2019 15:11:36

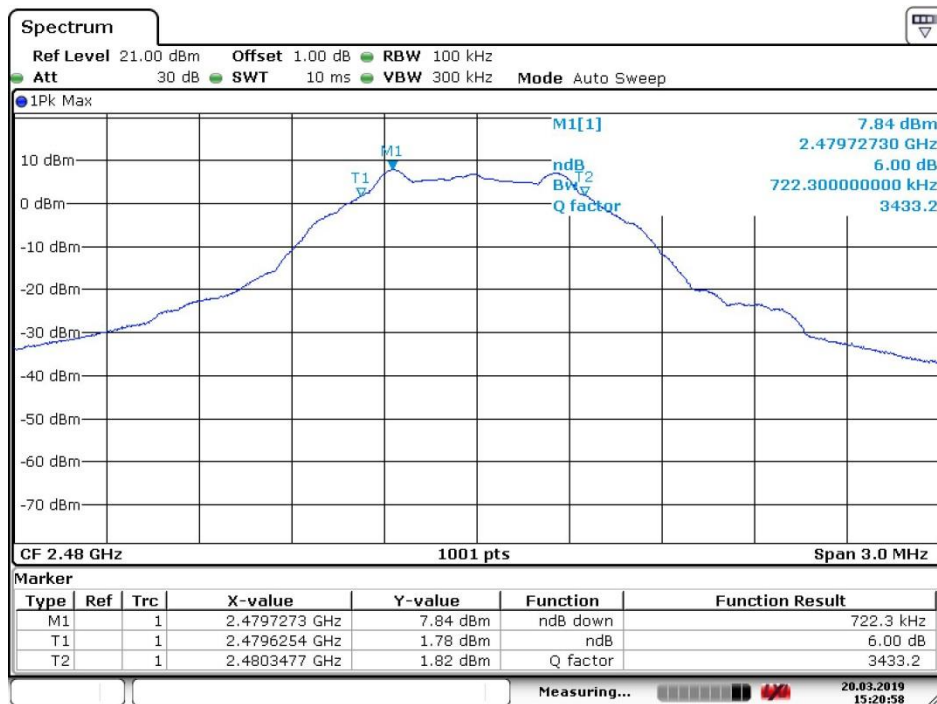


Date: 20.MAR.2019 15:16:02

GFSK_Highest Channel



Date: 20.MAR.2019 15:12:05



Date: 20.MAR.2019 15:20:58

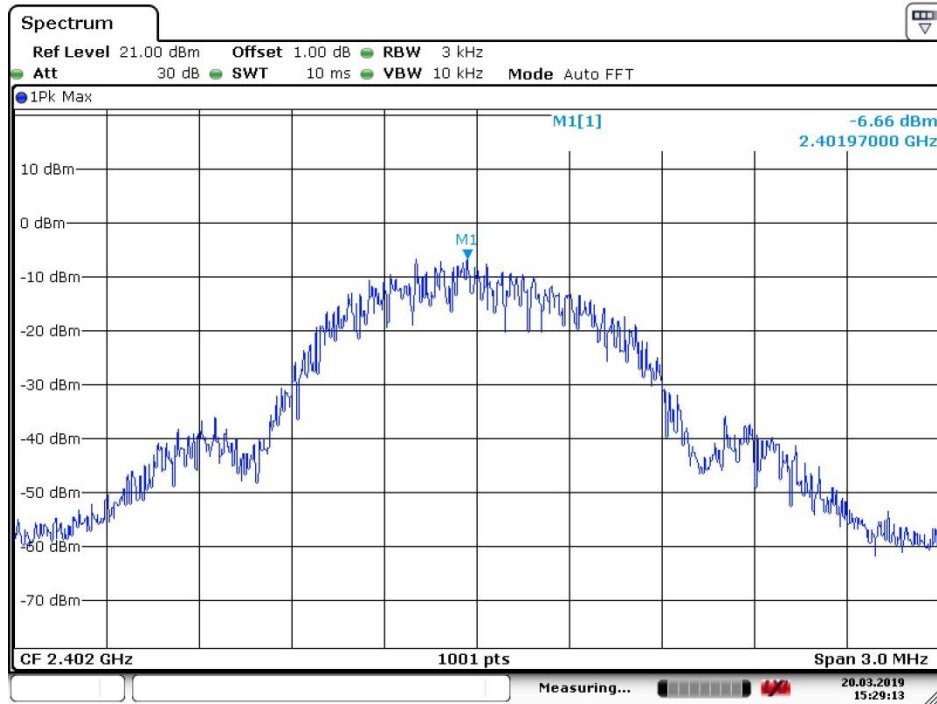
7 Power Spectral Density

7.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK	Lowest	-6.66	≤8.00	Pass
	Middle	-6.99	≤8.00	Pass
	Highest	-7.79	≤8.00	Pass

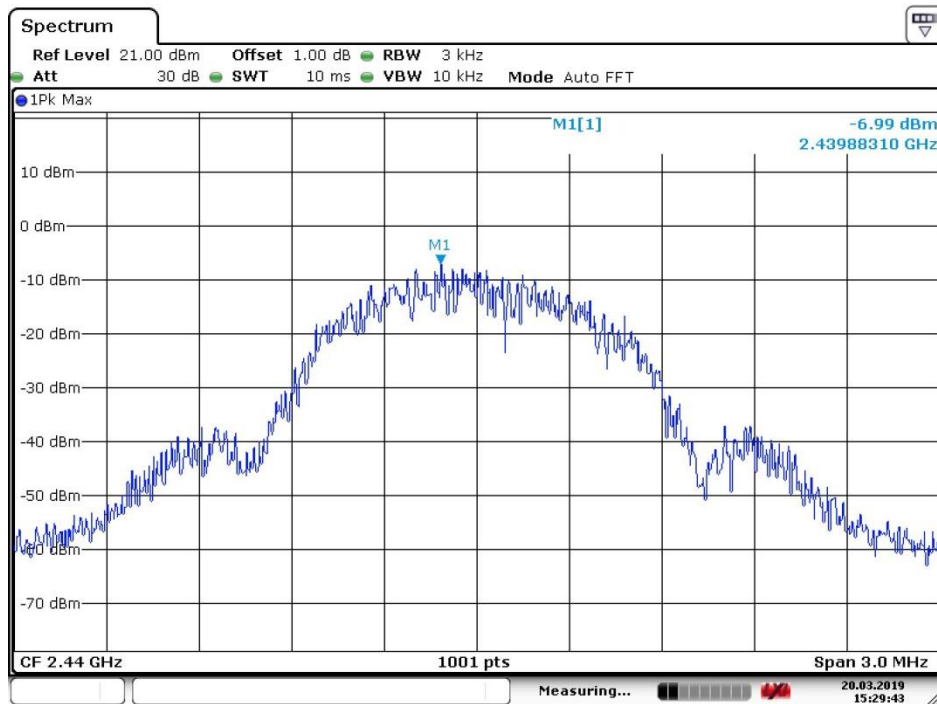
7.2 Test plots

GFSK _Lowest Channel



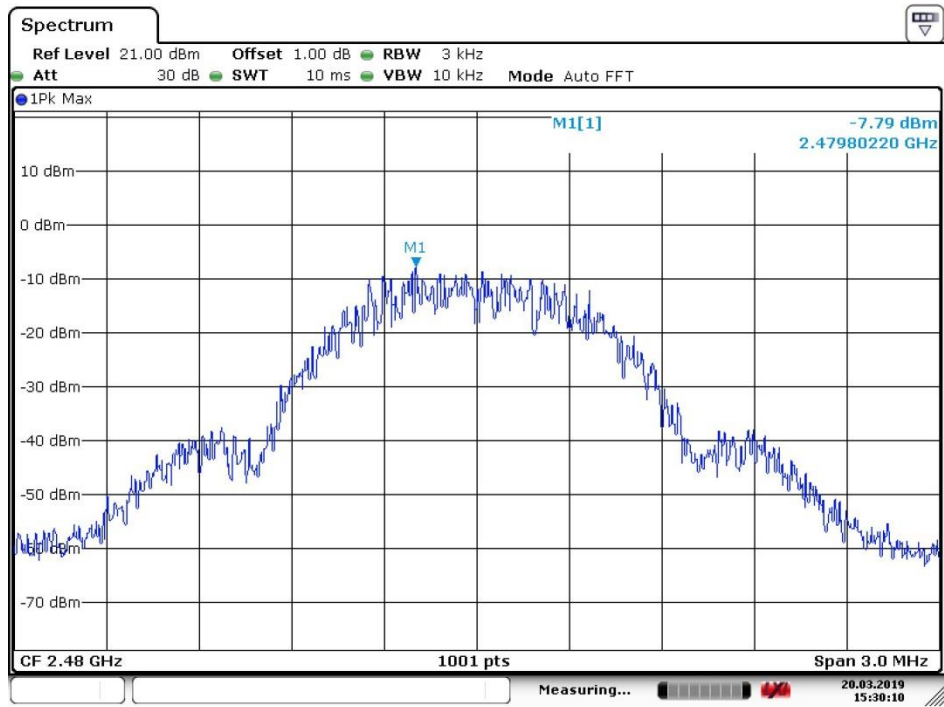
Date: 20.MAR.2019 15:29:13

GFSK _Middle Channel



Date: 20.MAR.2019 15:29:44

GFSK _Highest Channel

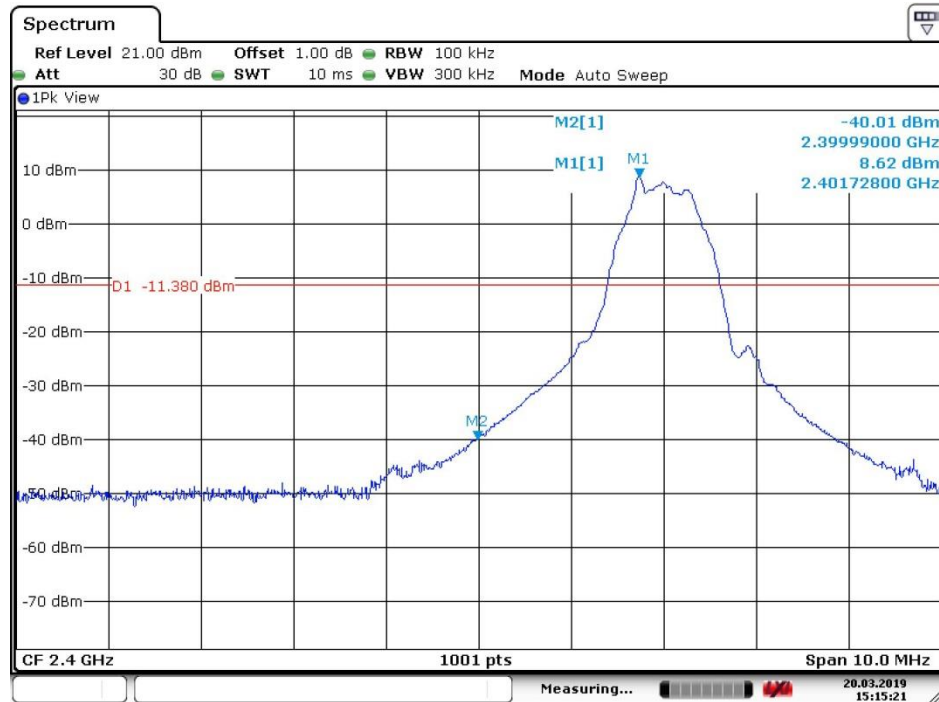


Date: 20.MAR.2019 15:30:10

Band-edge for RF Conducted Emissions

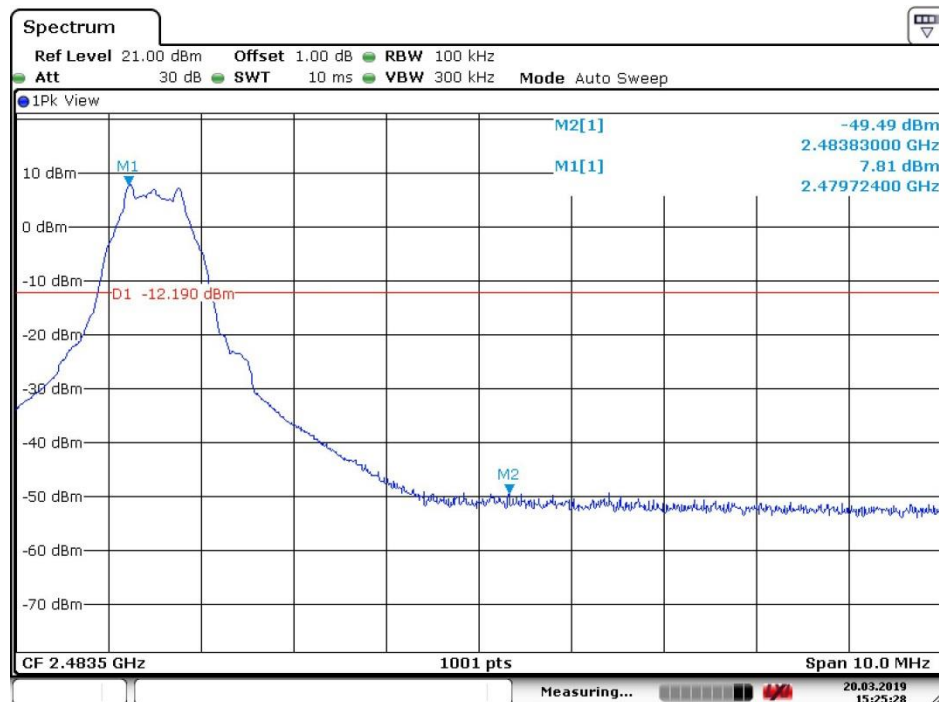
8.1 Test plots

GFSK _Lowest Channel



Date: 20.MAR.2019 15:15:22

GFSK _Highest Channel

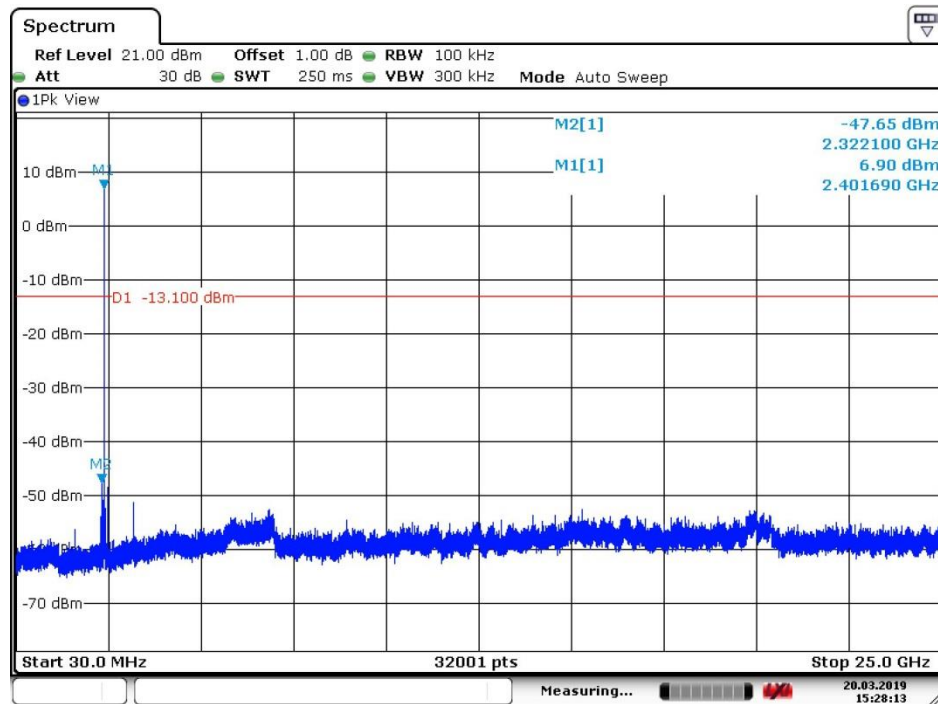


Date: 20.MAR.2019 15:25:29

9 Spurious RF Conducted Emissions

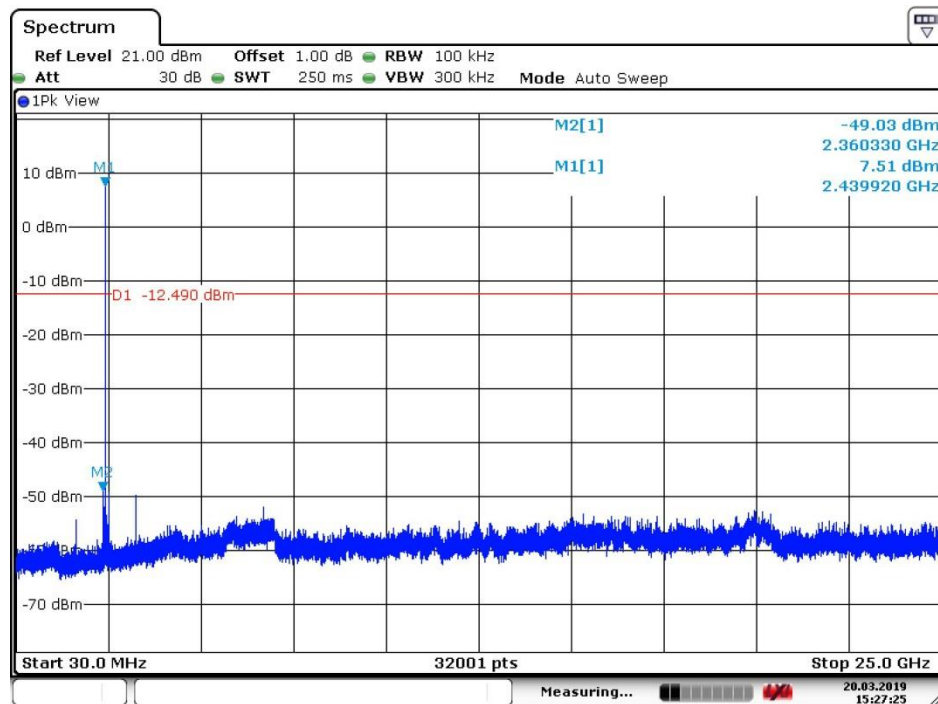
9.1 Test plots:

GFSK _Lowest Channel



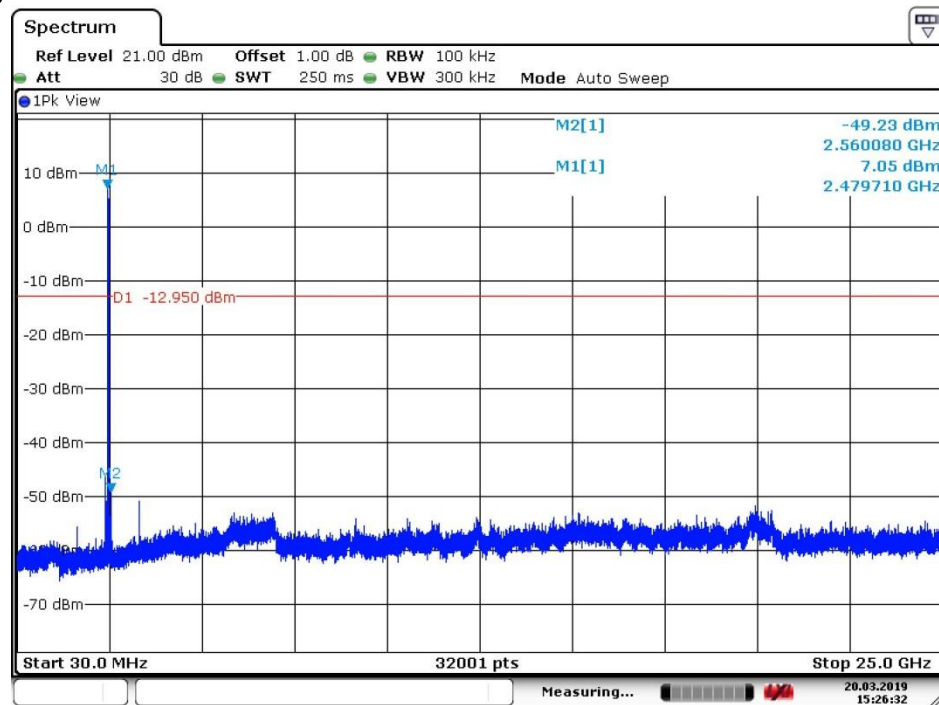
Date: 20.MAR.2019 15:28:13

GFSK _Middle Channel



Date: 20.MAR.2019 15:27:25

GFSK _Highest Channel



Date: 20.MAR.2019 15:26:32

Remark:

Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

The End