EMC
TEST REPORT

Report No.: TS12100112-EME
Model No.: 3100, 3000, 1200, 806
Issued Date: Dec. 18, 2012

Applicant:	**Gao Jin Industrial Co., Ltd.** **No. 18, Lane 1020, Ta-Wan Rd., Yung-Kang District, Tainan City, Taiwan**
Test Method/ Standard:	**FCC Part 15 Subpart C Section §15.205, §15.207, §15.209, §15.247, DA 00-705 and ANSI C63.4/2003.**
Test By:	**Intertek Testing Services Taiwan Ltd.** **No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan**

Testing Laboratory
0597

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The test report was reviewed by: Jimmy Yang

Name Jimmy Yang
Title Engineer

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Summary of Tests

Test Item	Reference	Results
20dB Bandwidth test	15.247(a)(1)	Pass
Carrier Frequency Separation test	15.247(a)(1)	Pass
Number of hopping frequencies test	15.247(a)(1)	Pass
Time of Occupancy (dwell time) test	15.247(a)(1)	Pass
Maximum Output Power test	15.247(b)	Pass
RF Antenna Conducted Spurious test	15.247(d)	Pass
Radiated Spurious Emission test	15.205, 15.209	Pass
Emission on the Band Edge test	15.247(d)	Pass
AC Power Line Conducted Emission test	15.207	Pass

1. General information

1.1 Identification of the EUT

Product:	Bluetooth Helmet
Model No.:	3000
FCC ID.:	Y6EZLINK20
Frequency Range:	2402 MHz ~ 2480 MHz
Channel Number:	79 channels
Frequency of Each Channel:	2402 + k MHz; k = 0~78
Type of Modulation:	GFSK, π/4-DPSK, 8-DPSK
Rated Power:	1. DC 5 V from adapter 2. DC 3.7 V from battery
Power Cord:	N/A
Sample Received:	Oct. 23, 2012
Test Date(s):	Dec. 05, 2012 ~ Dec. 11, 2012
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is Bluetooth Helmet, and was defined as information technology equipment.

The customer confirmed 3100, 1200 and 806 are series models to 3000 (EUT), the model is identical in hardware aspect, and the differences are in external style, color and lining only.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”.

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2.7dBi
Antenna Type : PCB Dipole
Connector Type : Fixed Type Antenna

1.4 Charge Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Charge Adapter	N/A	TEKA006-0501000UK	I/P: AC 100-240V, 50/60Hz, 0.2A O/P: DC 5V, 1A

1.5 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data Cable
Notebook PC	DELL	Latitude D610	4YWZK1S	USB shielded cable 1 meter× 1

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.205, §15.207, §15.209, §15.247, DA 00-705 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band was all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT is supplied with DC 5 V from adapter (Test voltage: 120Vac, 60Hz) or DC 3.7 V from battery, and pretested TX mode and adapter charging mode.

The worst case is found when the EUT executes TX mode by “CSR bluetest 3” software during all the tests except for conducted emission test and radiated emission below 1GHz; the EUT is tested under “charging mode” in conducted emission and radiated emission below 1GHz.test.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

2.3 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2012/11/30	2013/11/29
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2012/6/25	2013/6/25
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2012/2/6	2013/2/5
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/9/3	2014/9/3
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2012/9/5	2014/9/5
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2011/7/26	2013/7/25
Pre-Amplifier	MITEQ	AFS44-00102650--42-10P-44	1495287	2011/10/27	2013/10/26
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2012/9/18	2014/9/18
Power Meter	Anritsu	ML2495A	0844001	2012/10/9	2013/10/9
Power Senor	Anritsu	MA2411B	0738452	2012/10/9	2013/10/9
Temperature & Humidity Test Chamber	TERCHY	MHU-225LRU (SA)	950838	2012/6/15	2013/6/15
Two-Line V-Network	Rohde&schwarz	ESH3-Z5	838979/014	2012/10/29	2013/10/29

Note: The above equipments are within the valid calibration period.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

3.2 Test setup & procedure

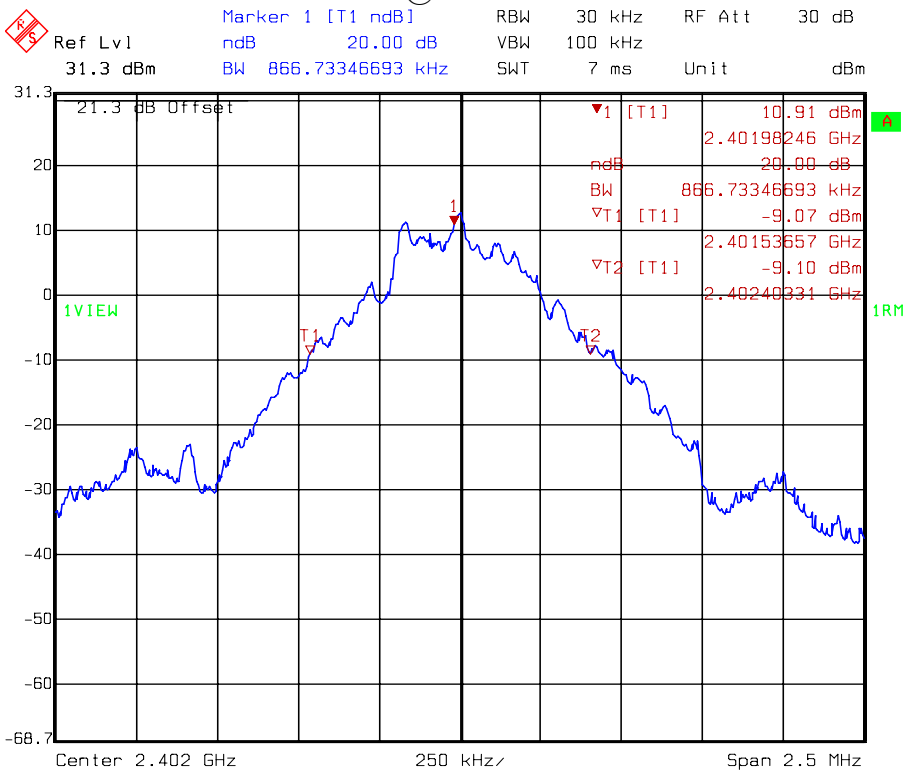
The test procedure was according to FCC measurement guidelines DA 00-705.
The 20dB bandwidth per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set≧1% of the Span, the video bandwidth≧RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

3.3 Measured data of modulated bandwidth test results

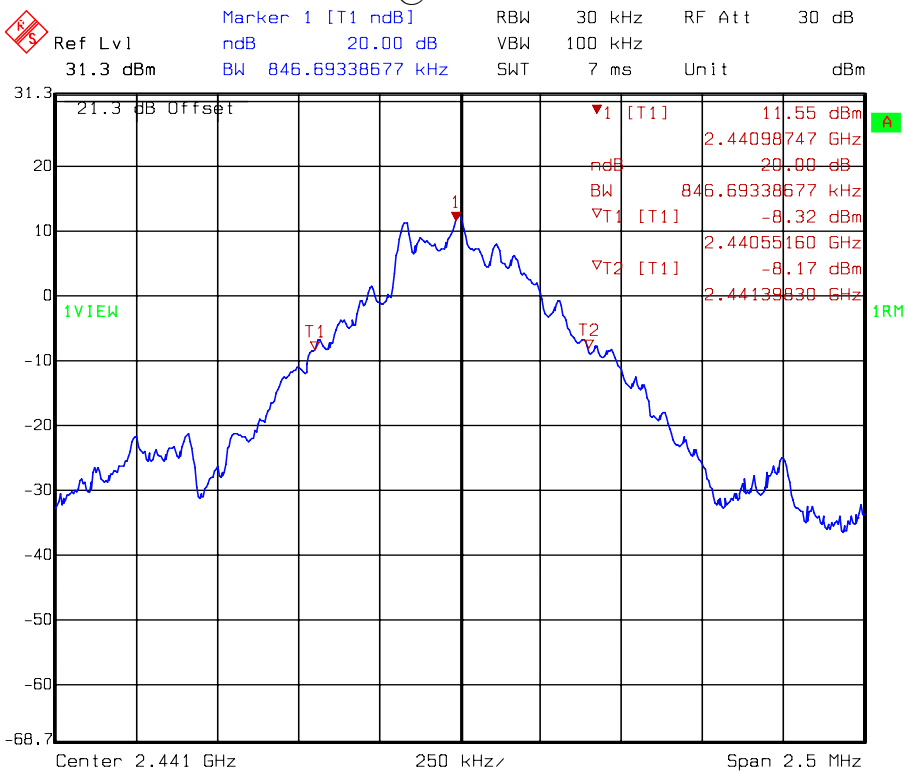
Mode	Channel	Frequency (MHz)	20dB Bandwidth (MHz)
GFSK	0	2402	0.867
	39	2441	0.847
	78	2480	0.767
π/4-DPSK	0	2402	1.222
	39	2441	1.217
	78	2480	1.217
8-DPSK	0	2402	1.293
	39	2441	1.197
	78	2480	1.217

Please see the plot below.

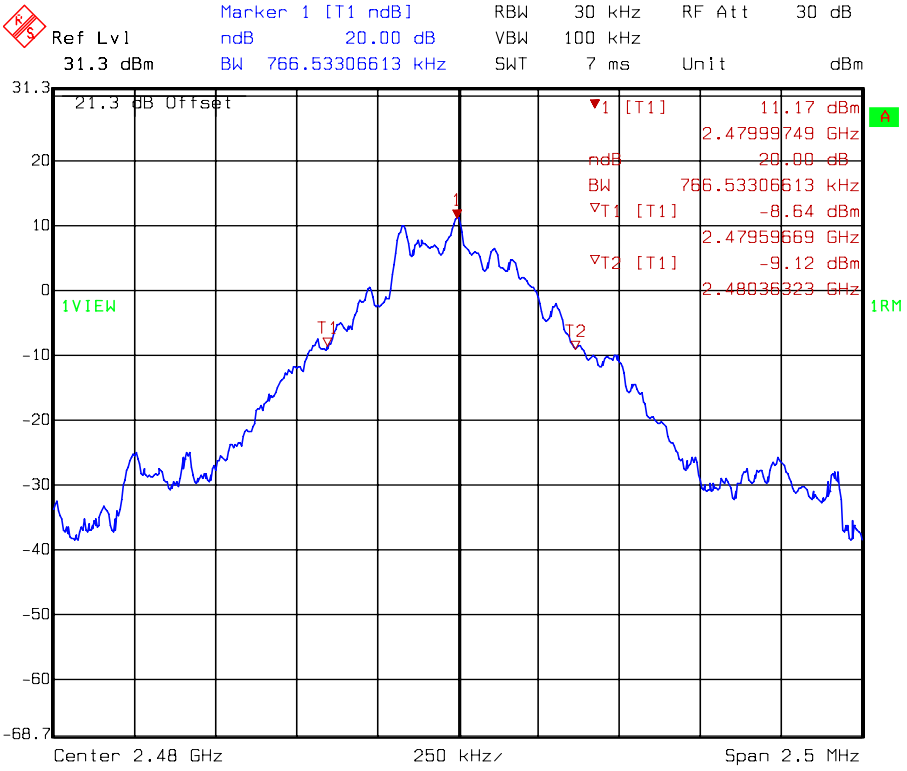
20 dB Bandwidth @ GFSK mode Channel 0



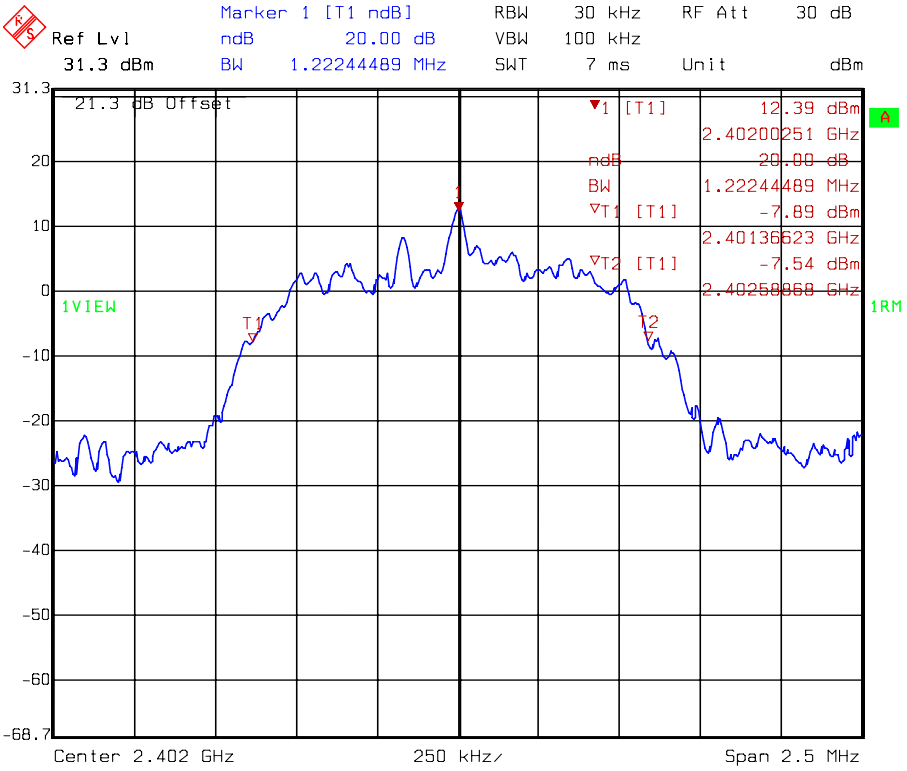
20 dB Bandwidth @ GFSK mode Channel 39



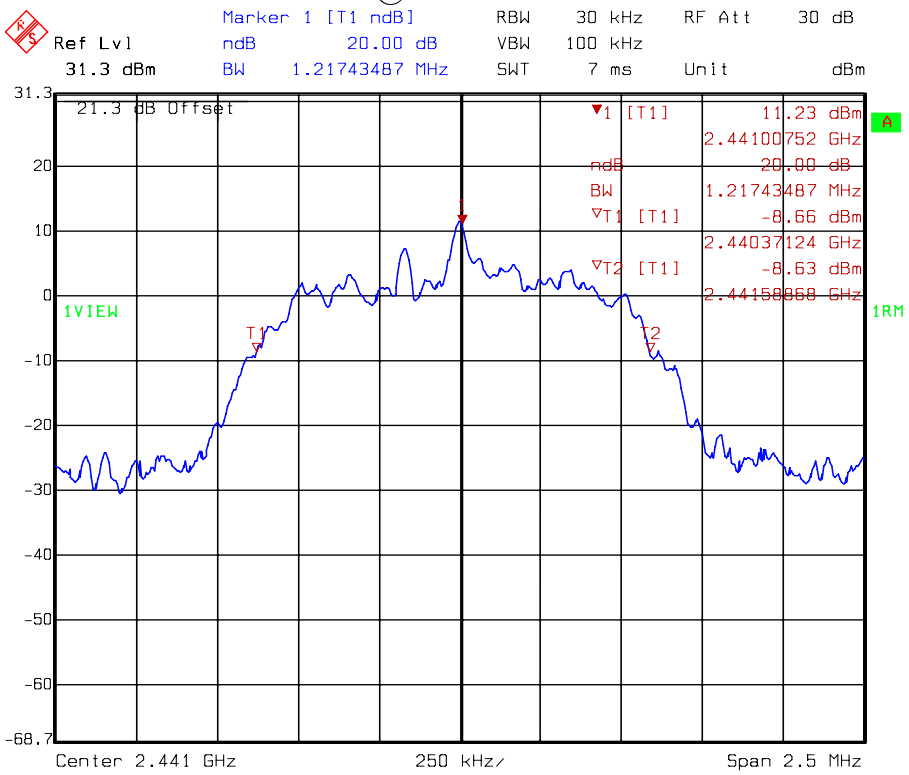
20 dB Bandwidth @ GFSK mode Channel 78



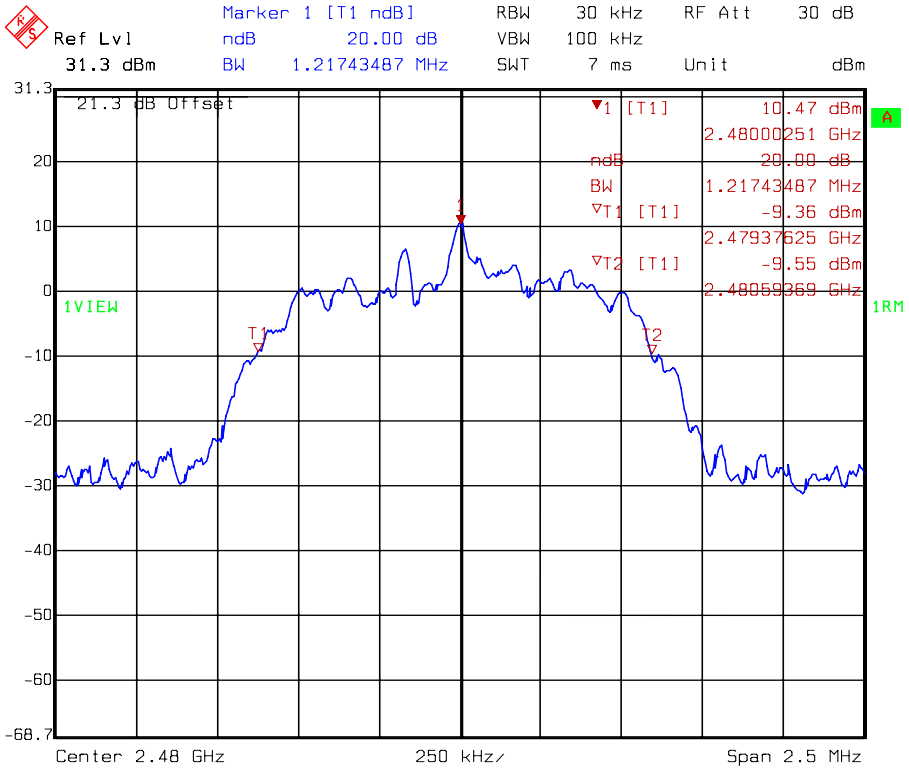
20 dB Bandwidth @ π/4-DPSK mode Channel 0



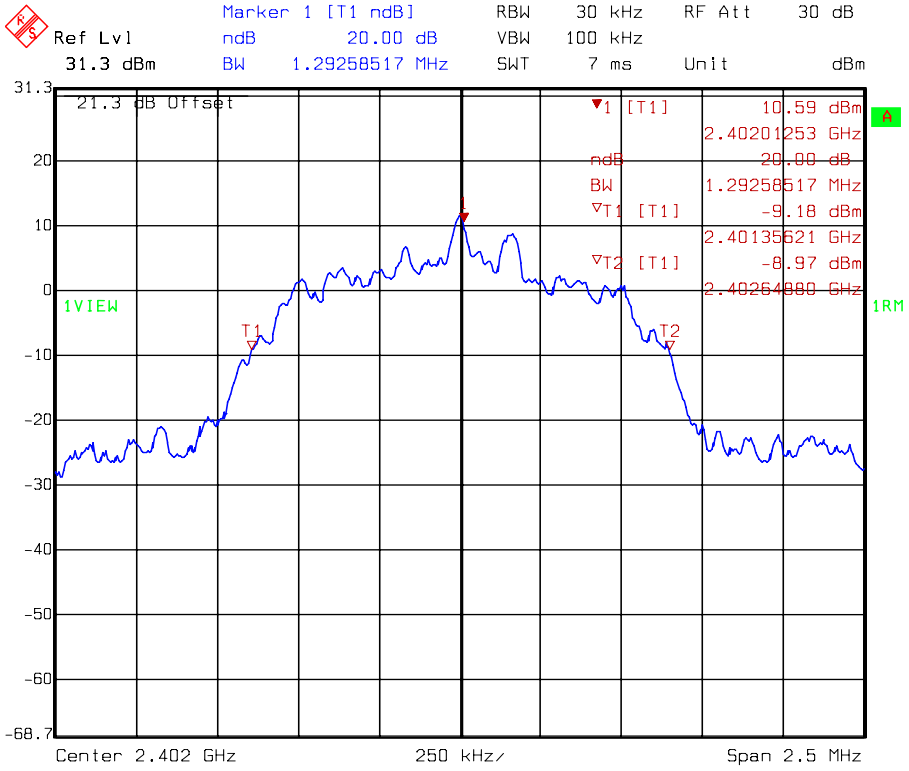
20 dB Bandwidth @ π/4-DPSK mode channel 39



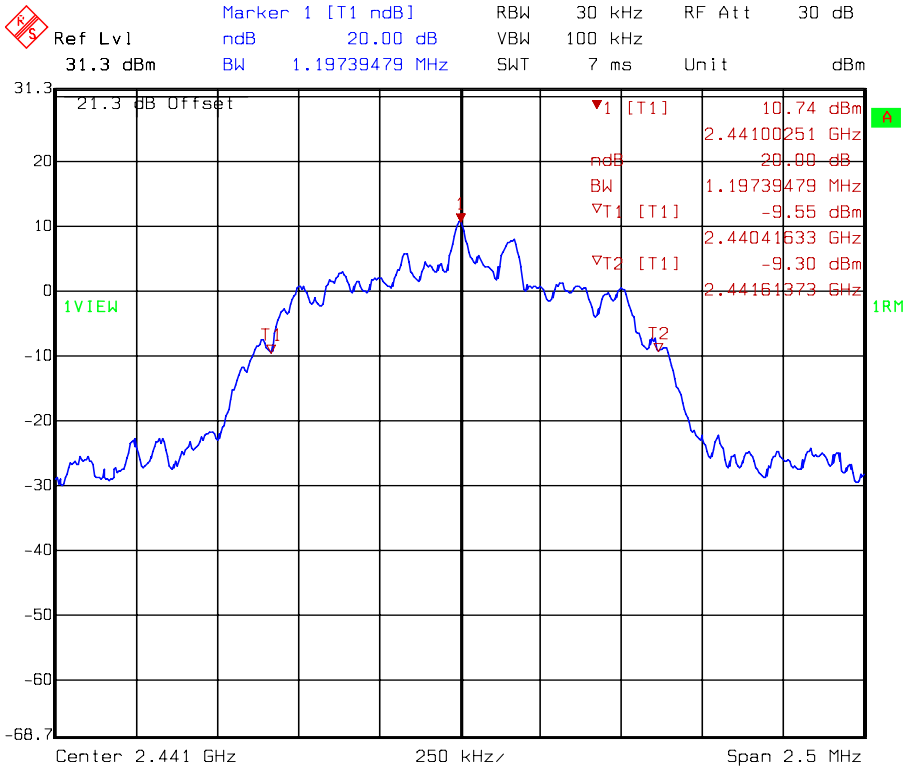
20 dB Bandwidth @ π/4-DPSK mode Channel 78



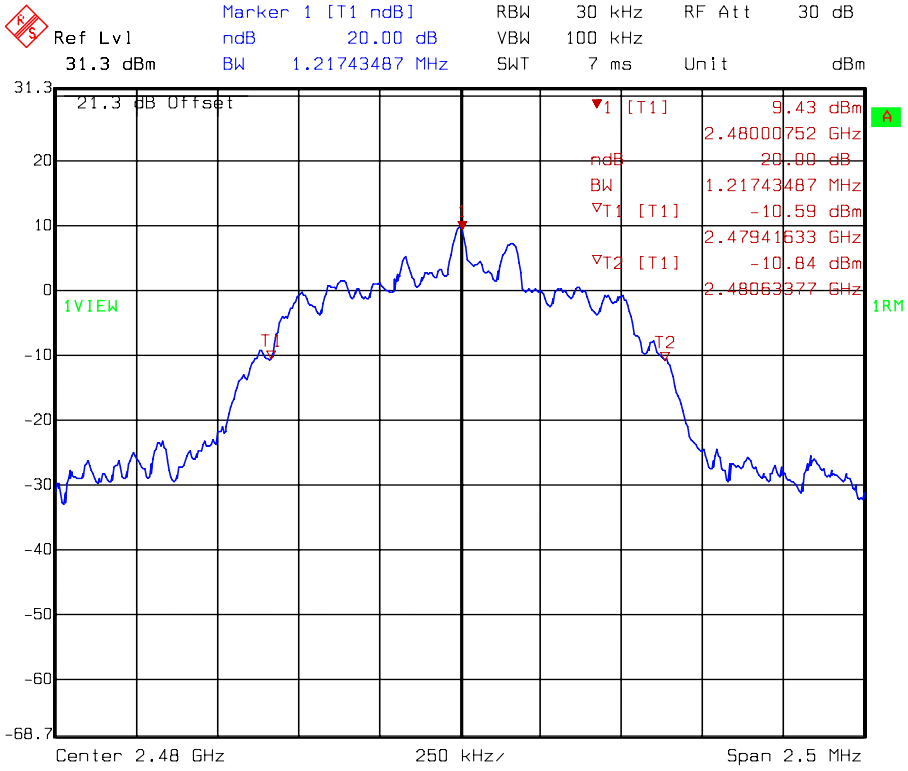
20 dB Bandwidth @ 8-DPSK mode Channel 0



20 dB Bandwidth @ 8-DPSK mode channel 39



20 dB Bandwidth @ 8-DPSK mode Channel 78



4. Carrier Frequency Separation test

4.1 Operating environment

Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

4.2 Test setup & procedure

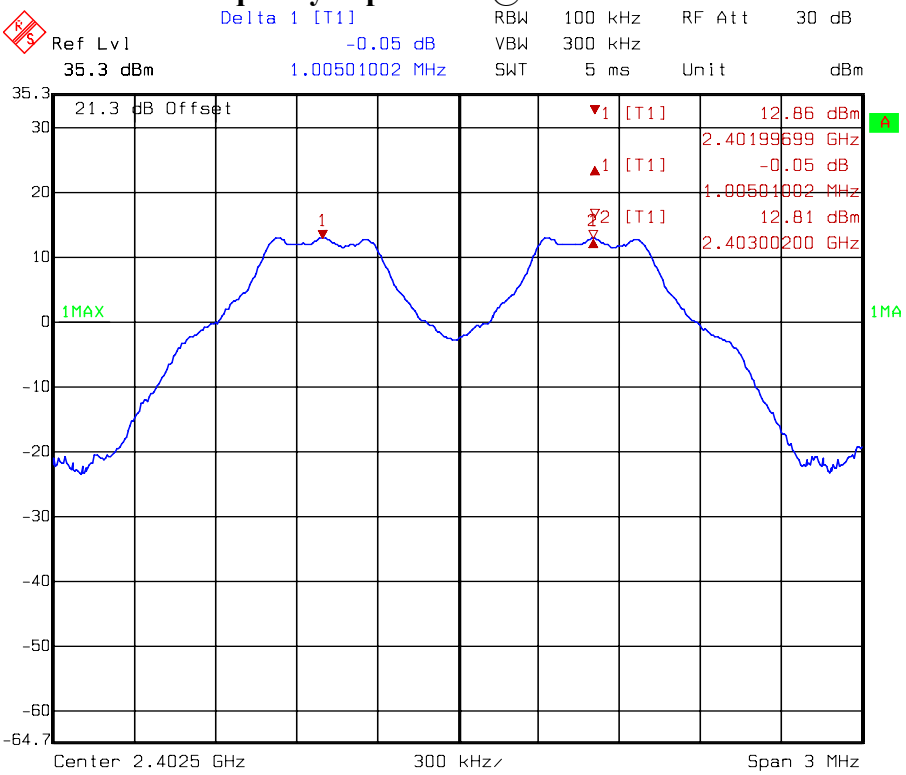
The test procedure was according to FCC measurement guidelines DA 00-705.
The carrier frequency separation per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was wide enough to capture the peaks of two adjacent channels. The carrier frequency separation result is in the following Table.

4.3 Measured data of Carrier Frequency Separation test result

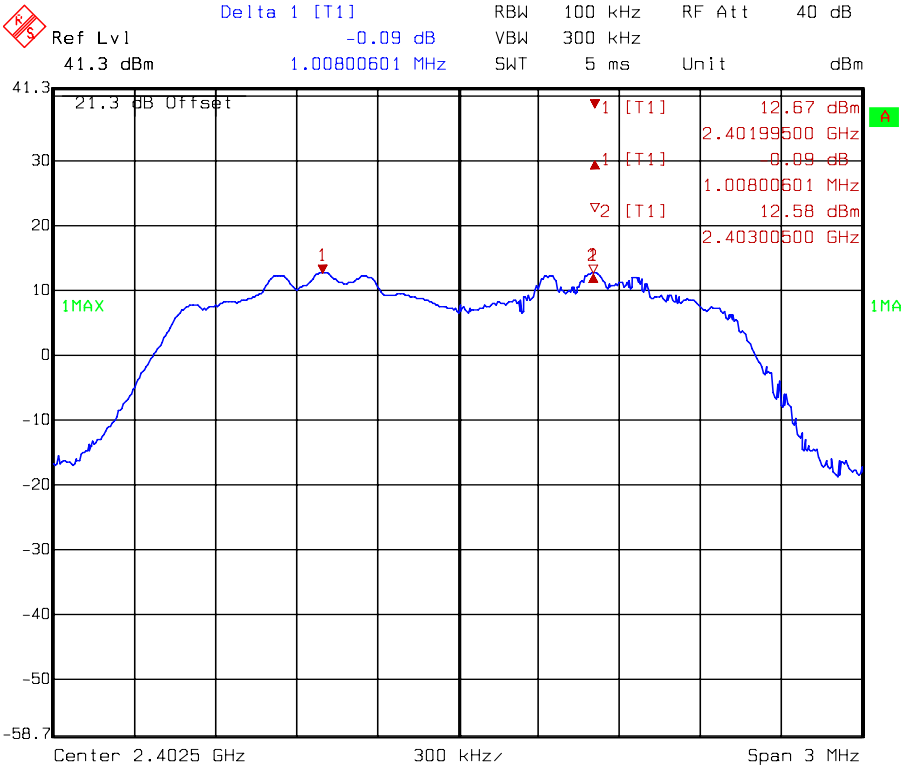
Mode	Channel	Frequency (MHz)	Carrier freq. Separation (MHz)	Limit 20dB BW*2/3(kHz)
GFSK	0	2402	1.005	578.00
π/4-DPSK	0	2402	1.008	814.67
8-DPSK	0	2402	1.004	862.00

Please see the plot below.

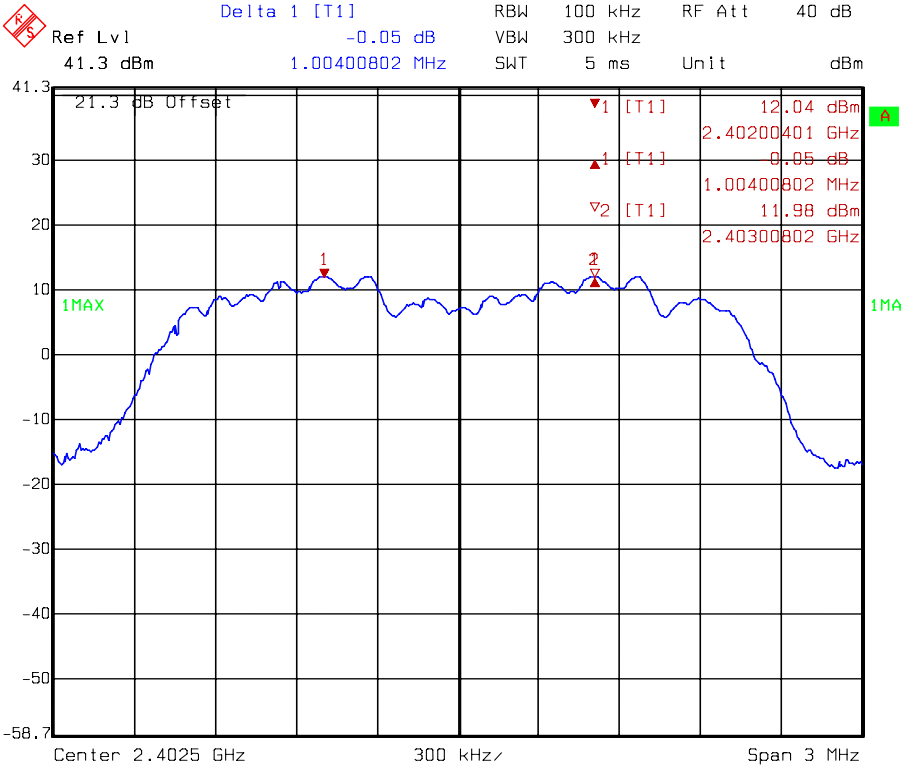
Carrier Frequency Separation @ GFSK mode Channel 0



Carrier Frequency Separation @ π/4-DPSK mode Channel 0



Carrier Frequency Separation @ 8-DPSK mode Channel 0



5. Number of hopping frequencies test

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

5.2 Test setup & procedure

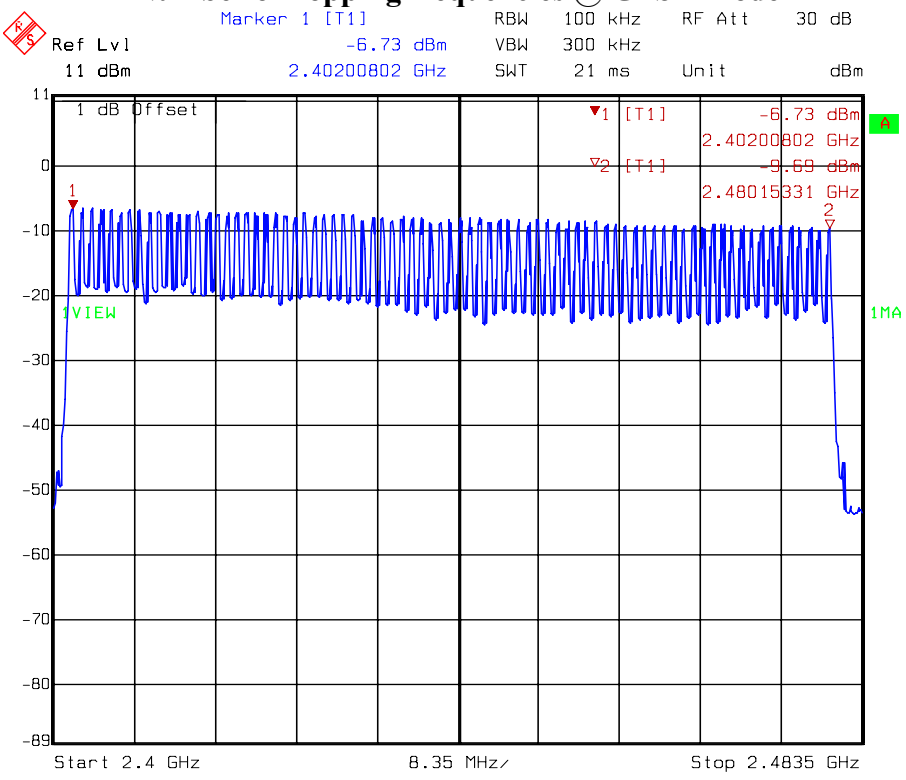
The test procedure was according to FCC measurement guidelines DA 00-705.
The number of hopping frequencies per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was the frequency band of operation. The carrier frequency separation result is in the following Table.

5.3 Measured data of number of hopping frequencies test result

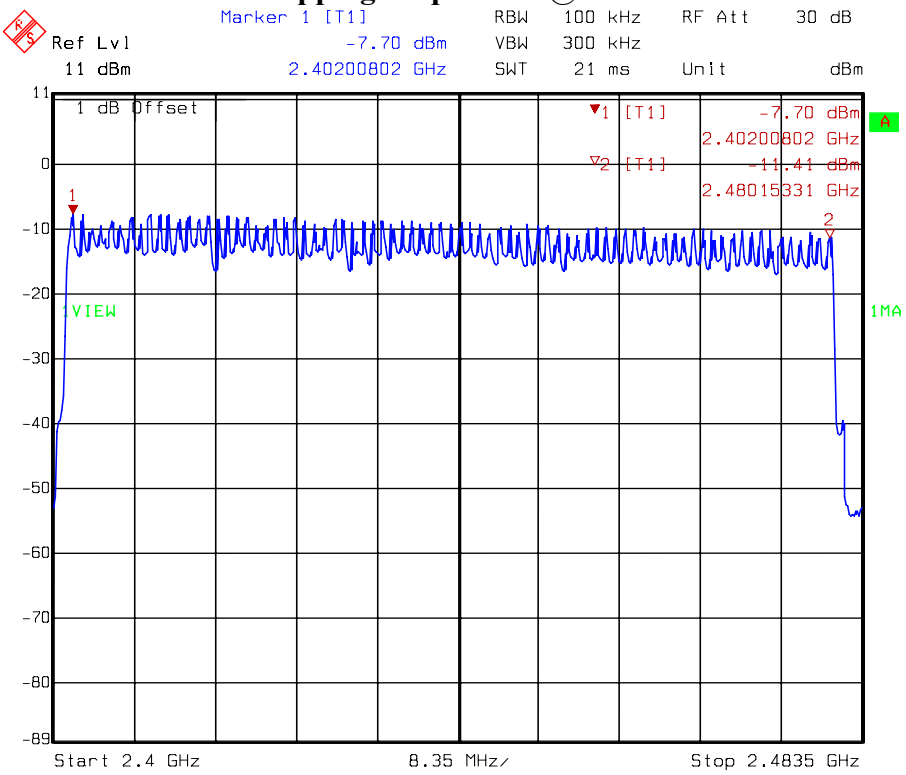
Frequency Range (MHz)	Total hopping channels
2400 ~ 2483.5	79

Please see the plot below.

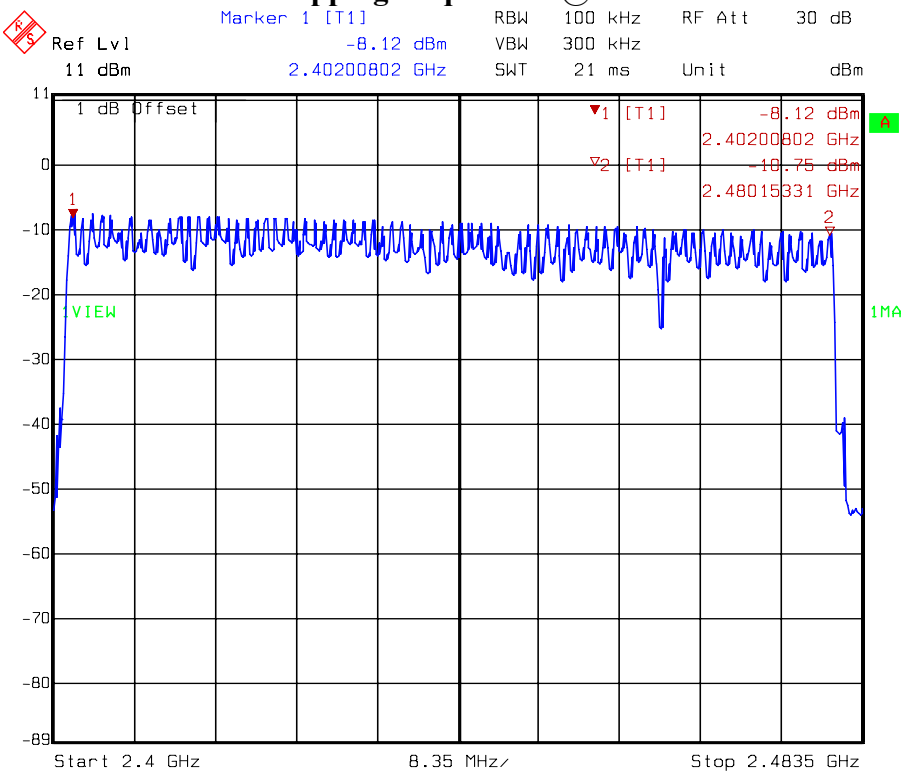
Number of hopping frequencies @ GFSK mode



Number of hopping frequencies @ π/4-DPSK mode



Number of hopping frequencies @ 8-DPSK mode



6. Time of Occupancy (dwell time) & Duty Cycle Correction Factor test

6.1 Operating environment

Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

6.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.
The time of occupancy (dwell time) per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth≧RBW, and the zero span function of spectrum analyzer was enable. The EUT has its hopping function enable.

The system makes worst case 1600 hops per second or 1 time slot has a length of 625μs with 79 channels.

The total sweep time is 0.4(79) =31.6 seconds
Due to the number of hops in the 31.6s sweep we determined to reduce the sweep time to 3.16s, count the number of hops and multiply by 10. The total number of hops will be multiplied by the measured time of one pulse.

Time of occupancy (dwell time) for DH1:
Number of Hops in 3.16s=32, Total Number of Hops in 31.6s = 32(10) =320
Single Pulse Width = 0.0004048096 sec
Dwell time = Pulse Width * 320= 129.5 ms

Time of occupancy (dwell time) for DH3:
Number of Hops in 3.16s=16, Total Number of Hops in 31.6s = 16(10) =160
Single Pulse Width = 0.001659319 sec
Dwell time = Pulse Width * 160= 265.5 ms

Time of occupancy (dwell time) for DH5:
Number of Hops in 3.16s=11, Total Number of Hops in 31.6s = 11(10) =110
Single Pulse Width = 0.002901804 sec
Dwell time = Pulse Width * 110= 319.2 ms

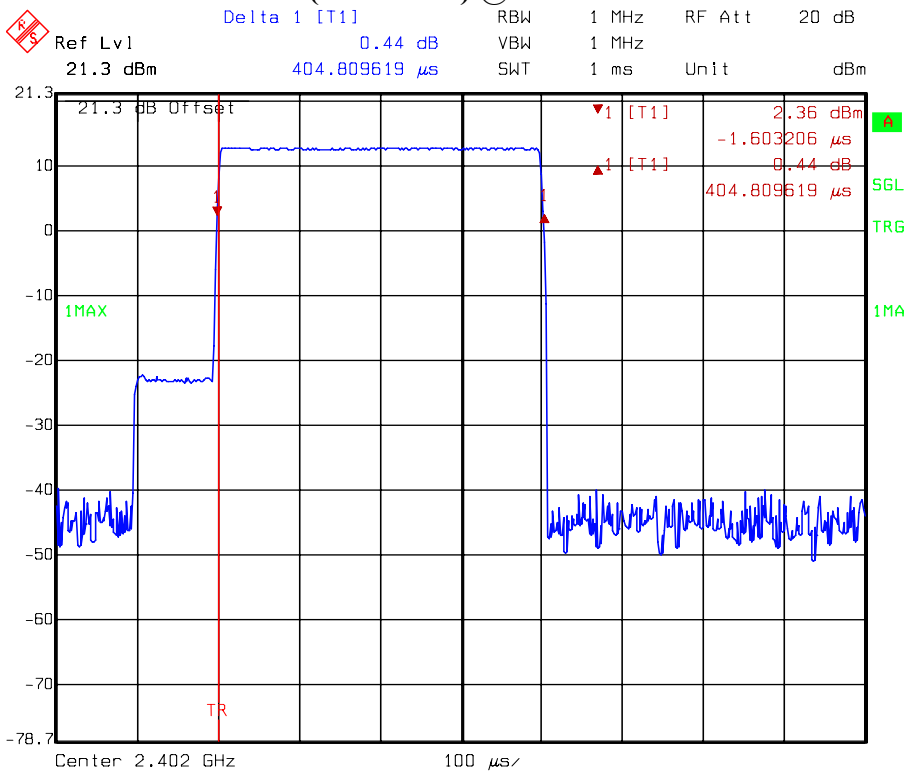
Mode	Packet type	Pulse duration (ms)	Number of pulse	Measure time (s)	Dwell time (s)	Limit (s)
GFSK	DH1	0.4048	32	3.2	0.1295	0.4
	DH3	1.6593	16	3.2	0.2655	0.4
	DH5	2.9018	11	3.2	0.3192	0.4
π/4-DPSK	DH1	0.4088	33	3.2	0.1349	0.4
	DH3	1.6673	16	3.2	0.2668	0.4
	DH5	2.9068	11	3.2	0.3197	0.4
8-DPSK	DH1	0.4018	32	3.2	0.1286	0.4
	DH3	1.6643	16	3.2	0.2663	0.4
	DH5	2.9068	11	3.2	0.3197	0.4

Mode	Packet type	Pulse time (ms)	Number of pulse during time period	Time period (ms)	Duty cycle %	Duty cycle correction factor
GFSK	DH1	0.4048	2	98.84	0.4096	-47.75
	DH3	1.6593	1	100	1.6593	-35.60
	DH5	2.9018	1	100	2.9018	-30.75
π/4-DPSK	DH1	0.4088	2	99.12	0.4124	-47.69
	DH3	1.6673	1	100	1.6673	-35.56
	DH5	2.9068	1	100	2.9068	-30.73
8-DPSK	DH1	0.4018	2	98.79	0.4067	-47.81
	DH3	1.6643	1	100	1.6643	-35.58
	DH5	2.9068	1	100	2.9068	-30.73

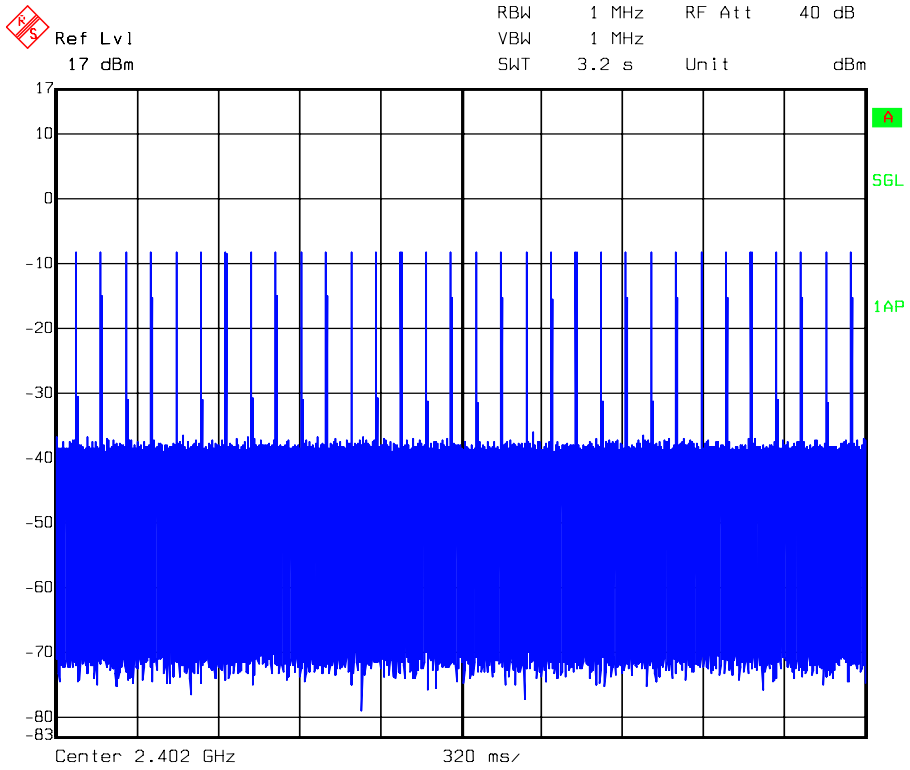
Remark:
1. The time period over which the duty cycle is measured in 100 ms or the repetition cycle, whichever is a shorter time frame.
2. Duty Cycle = (Pulse time)/(Time period)*100%
3. Duty Cycle Correction Factor = 20 log (Duty cycle)
4. The worst case of GFSK mode is -30.75
   The worse case of π/4-DPSK mode is –30.73
   The worse case of 8-DPSK mode is –30.73

Please see the plot below.

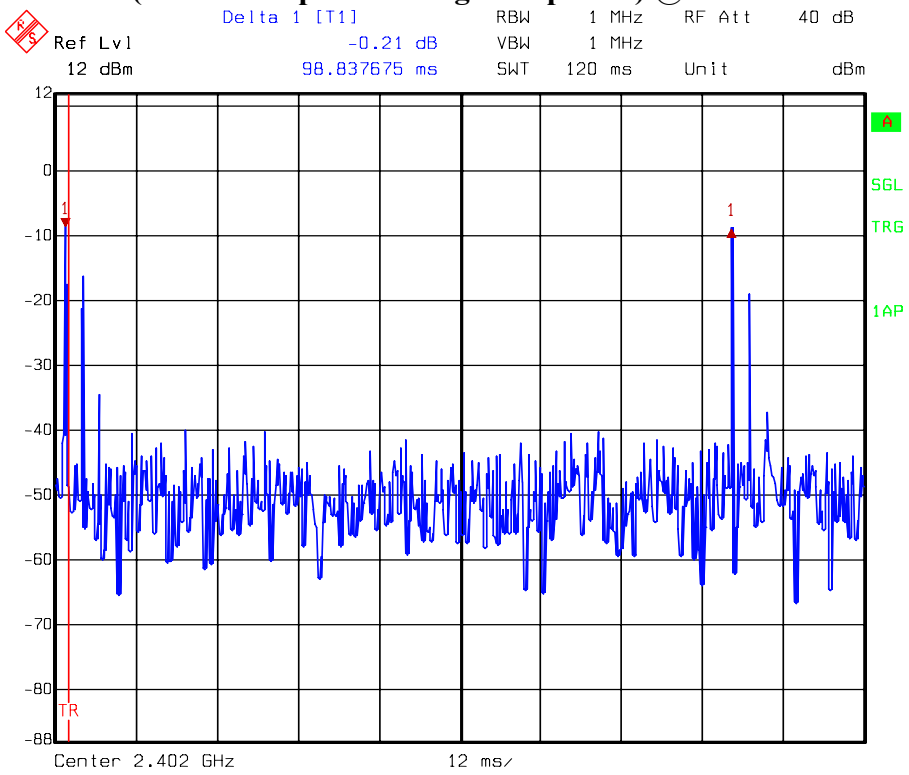
Dwell time (Pulse time) @ GFSK mode DH 1



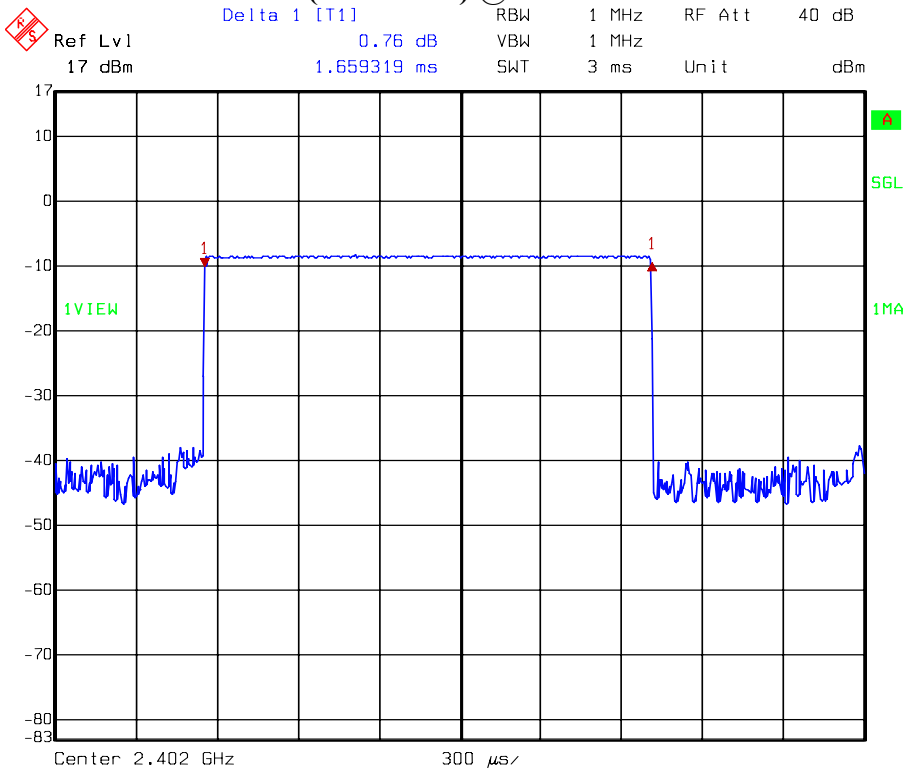
Dwell time (Number of Pulses) @ GFSK mode DH 1



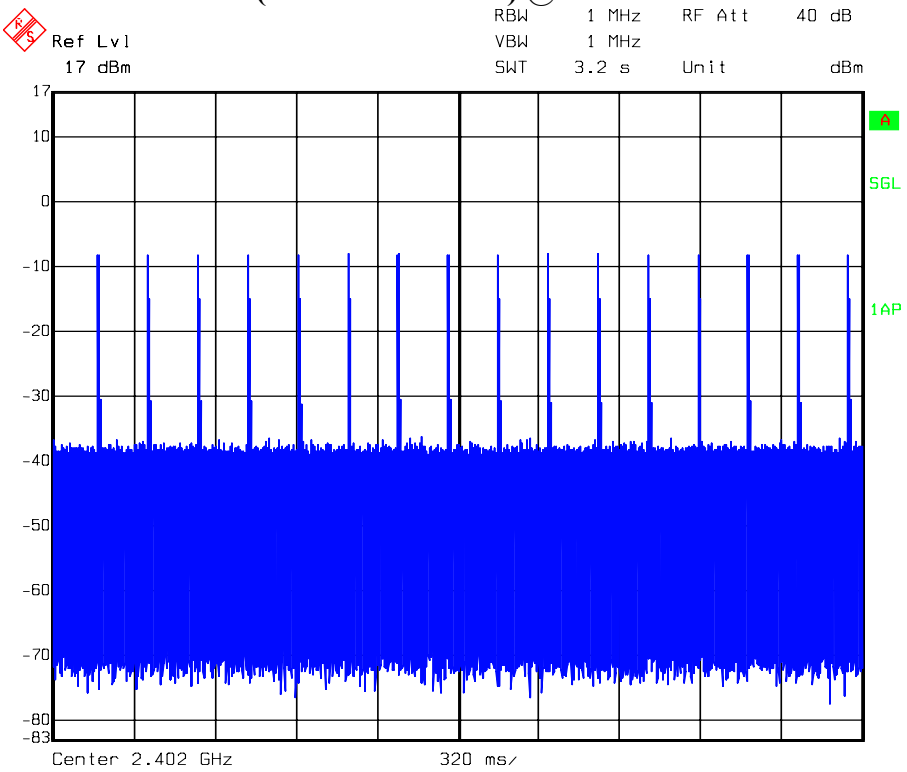
Dwell time (Number of pulse during time period) @ GFSK mode DH 1



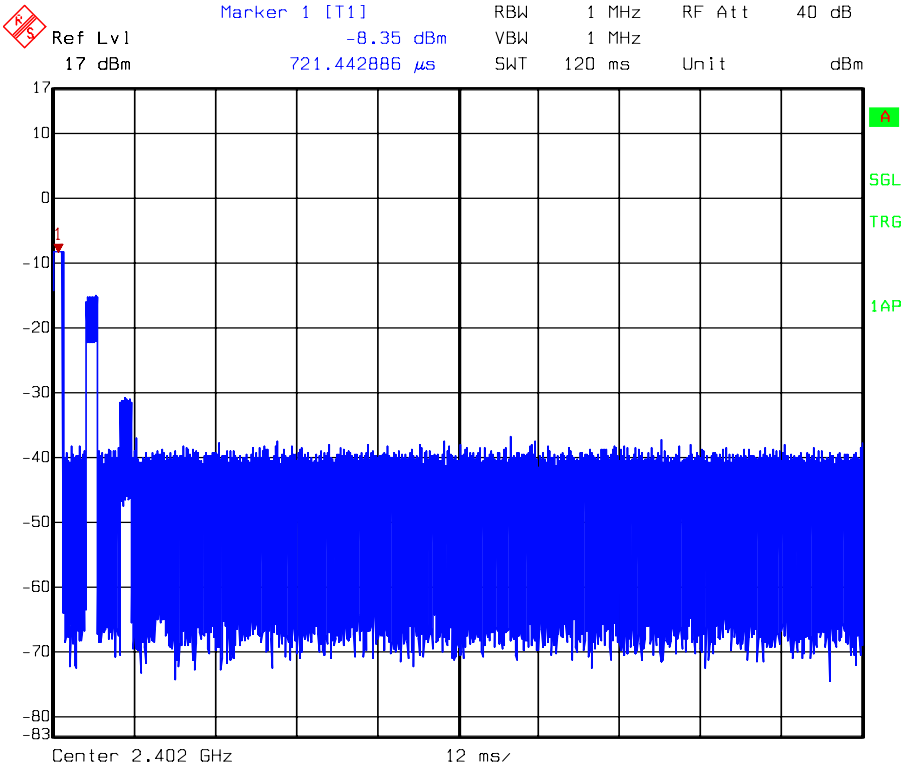
Dwell time (Pulse time) @ GFSK mode DH 3



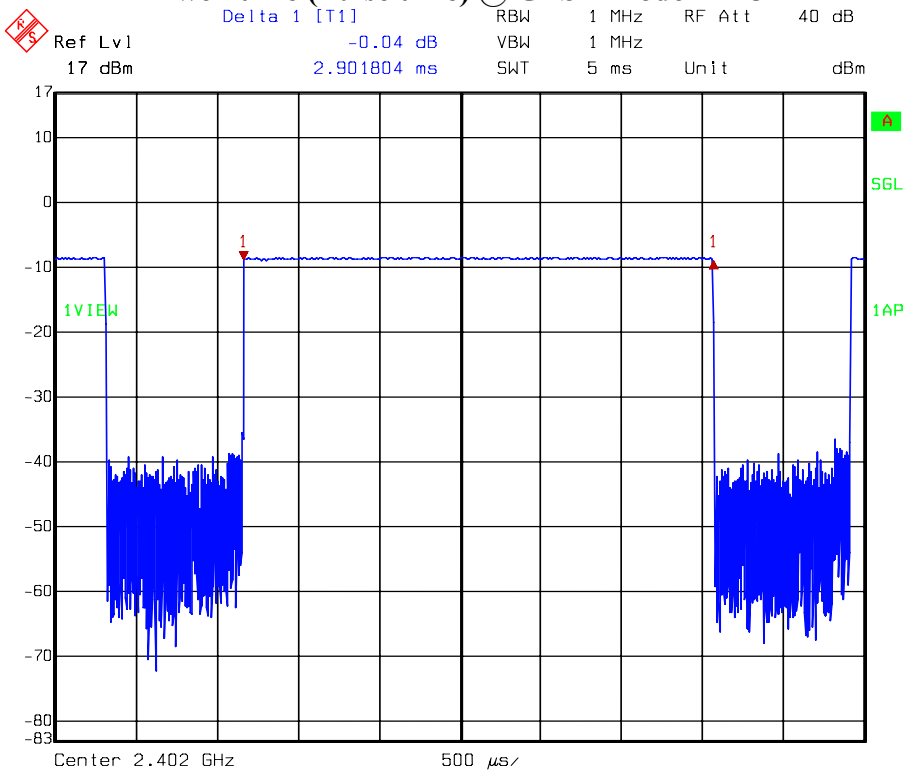
Dwell time (Number of Pulses) @ GFSK mode DH 3



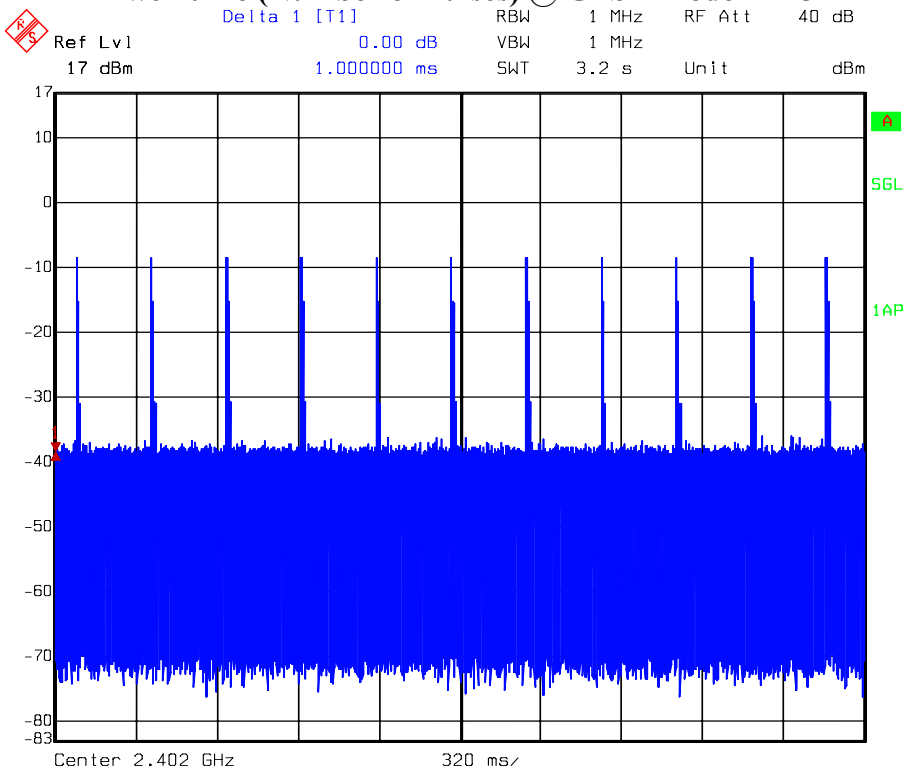
Dwell time (Number of pulse during time period) @ GFSK mode DH 3



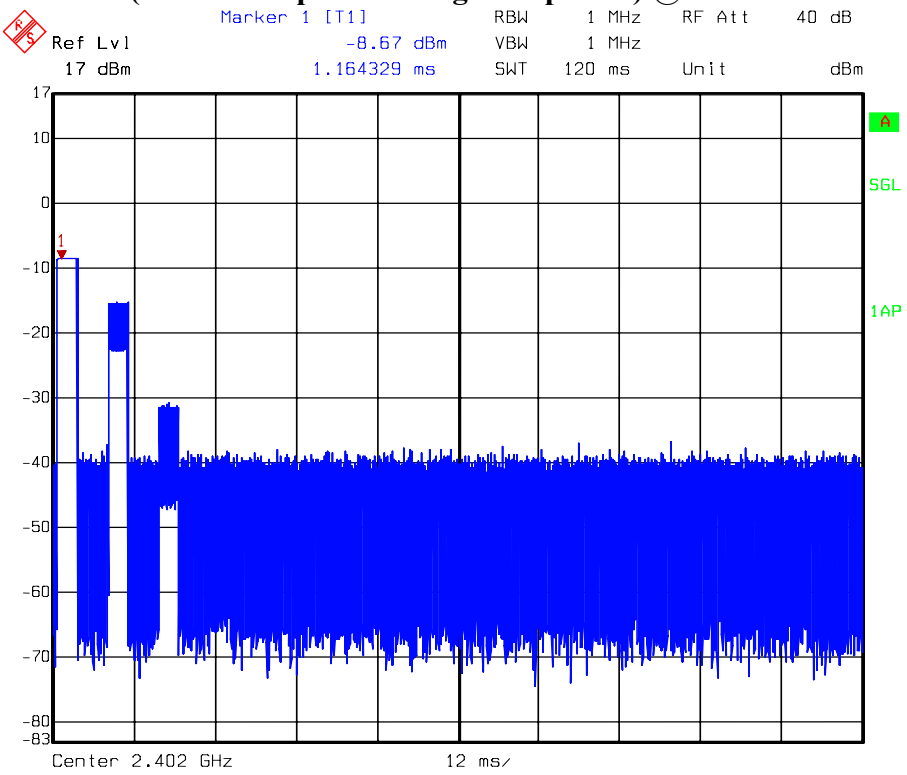
Dwell time (Pulse time) @ GFSK mode DH 5



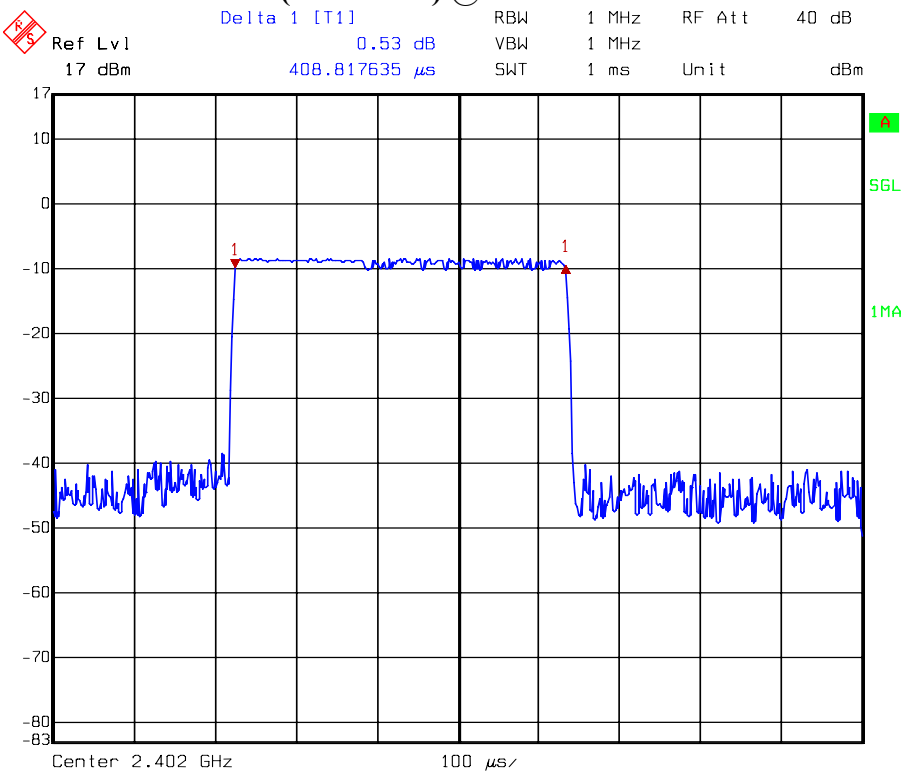
Dwell time (Number of Pulses) @ GFSK mode DH 5



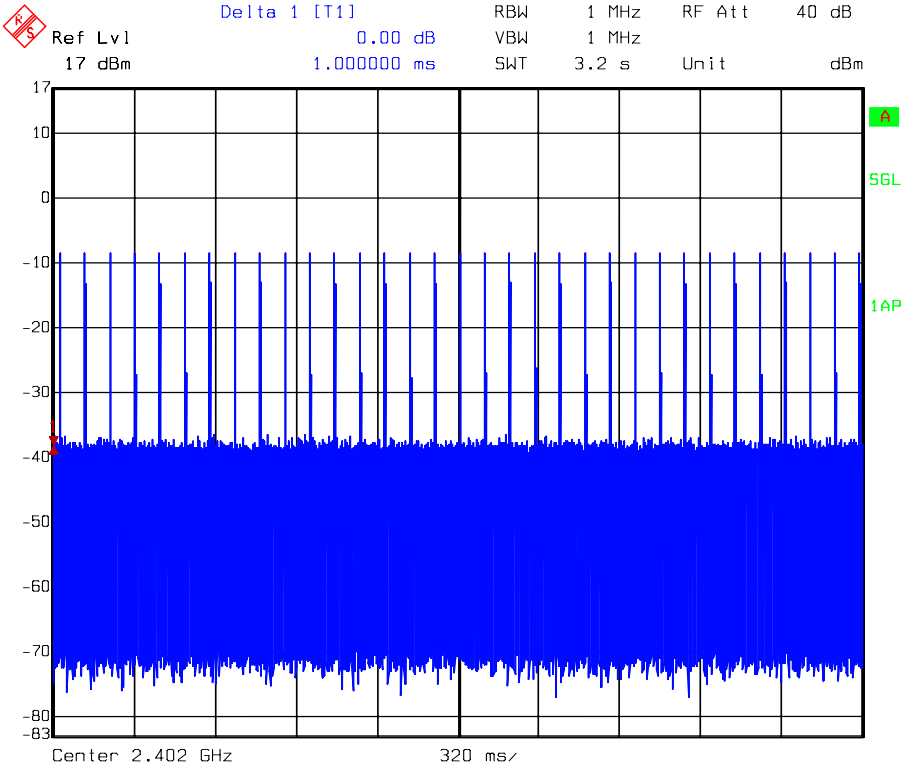
Dwell time (Number of pulse during time period) @ GFSK mode DH 5



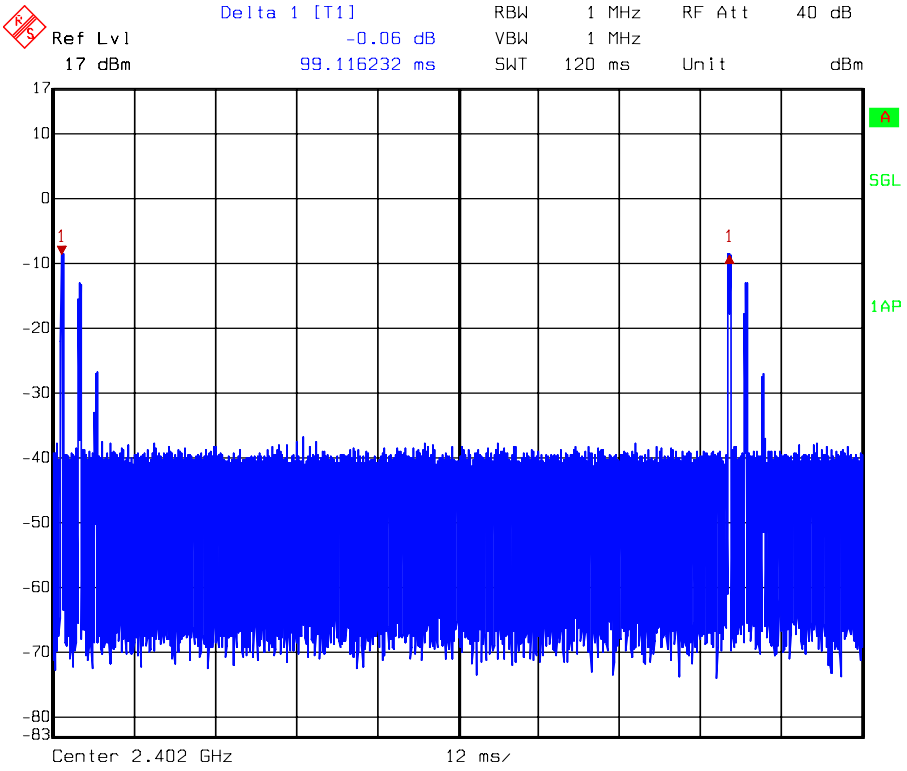
Dwell time (Pulse time) @ π/4-DPSK mode DH 1



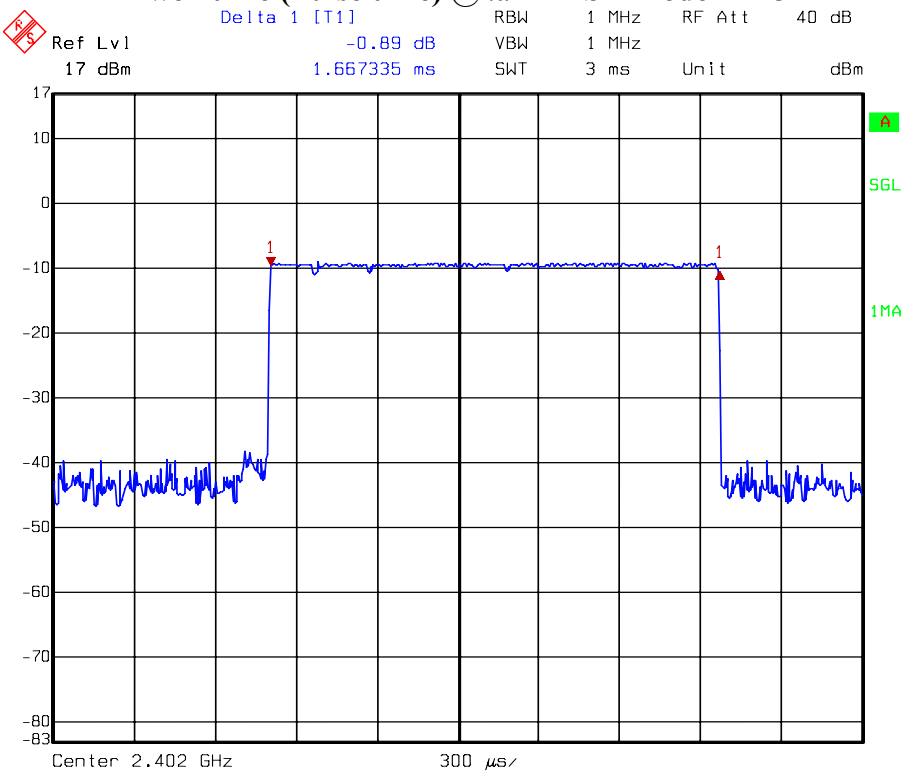
Dwell time (Number of Pulses) @ π/4-DPSK mode DH 1



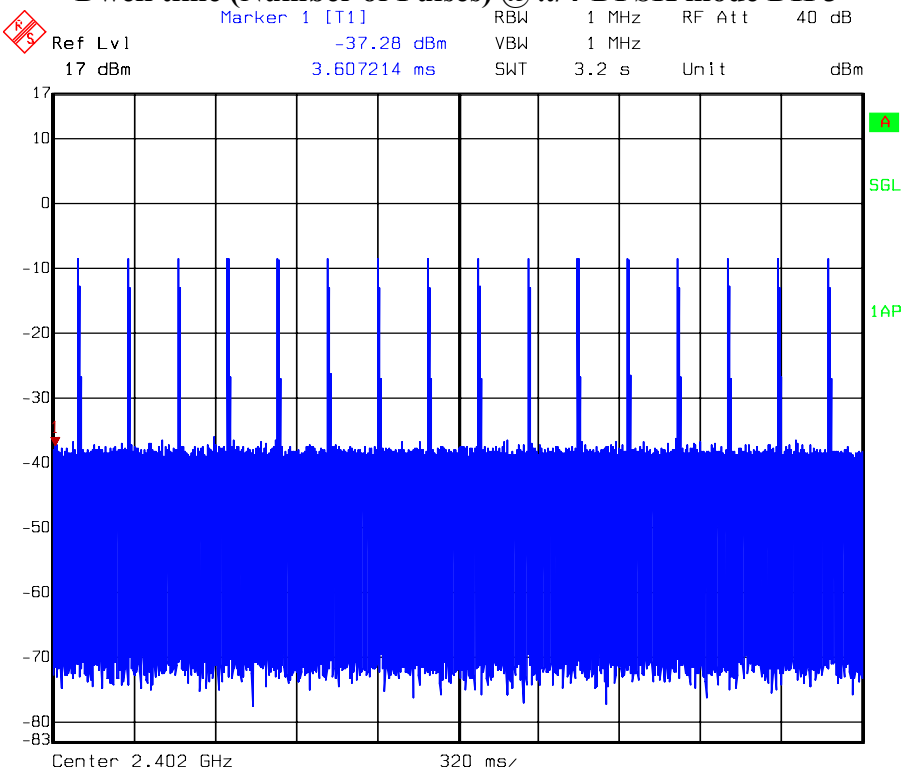
Dwell time (Number of pulse during time period) @ π/4-DPSK mode DH 1



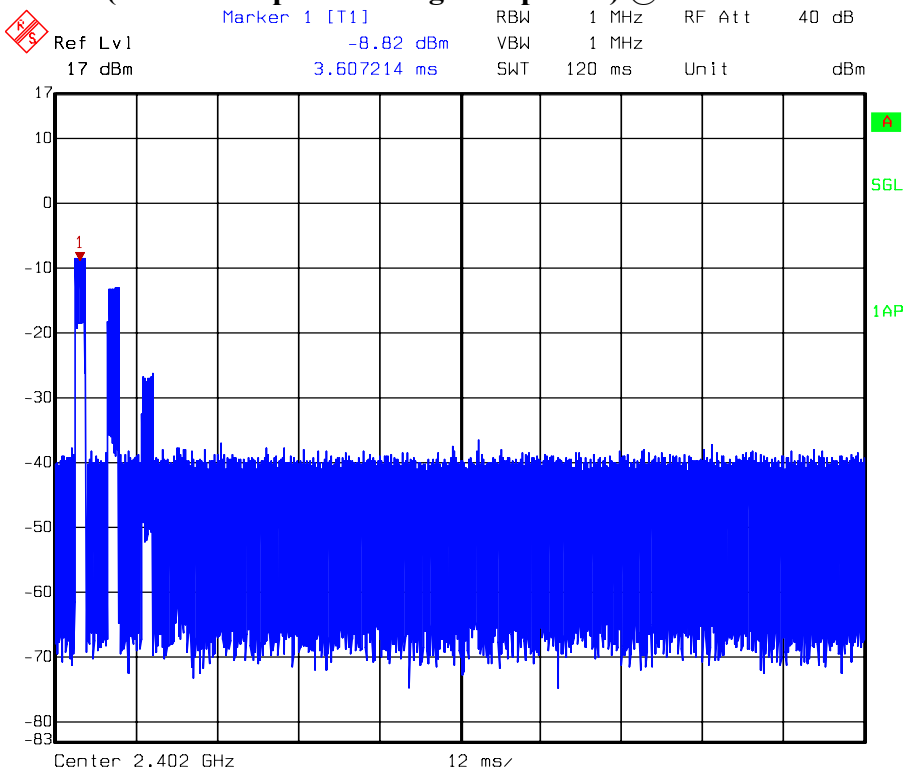
Dwell time (Pulse time) @ π/4-DPSK mode DH 3



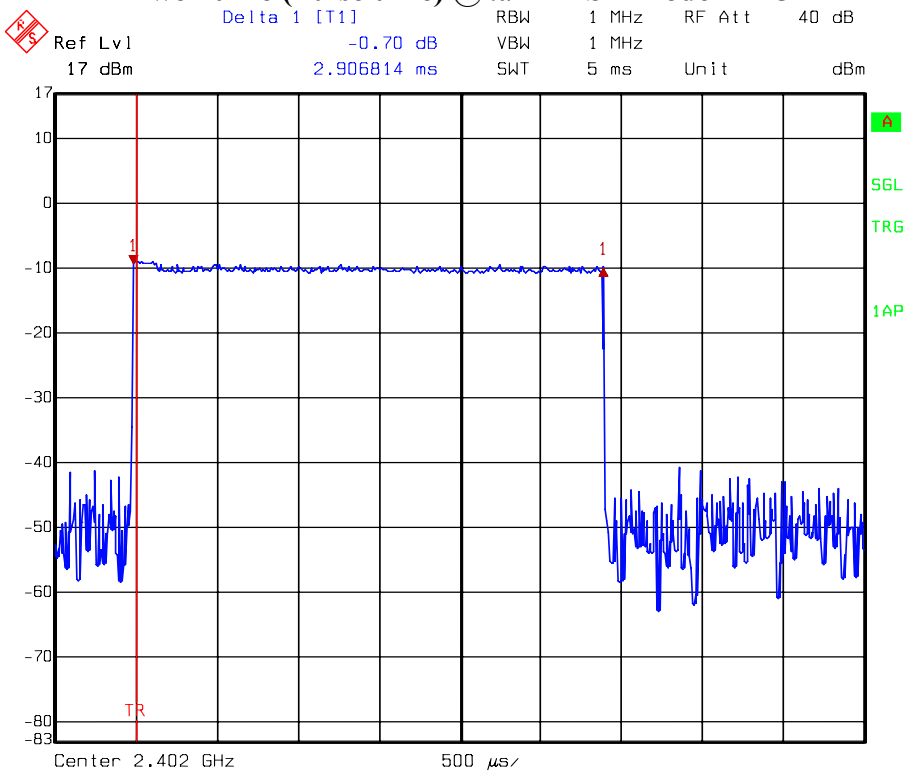
Dwell time (Number of Pulses) @ π/4-DPSK mode DH 3



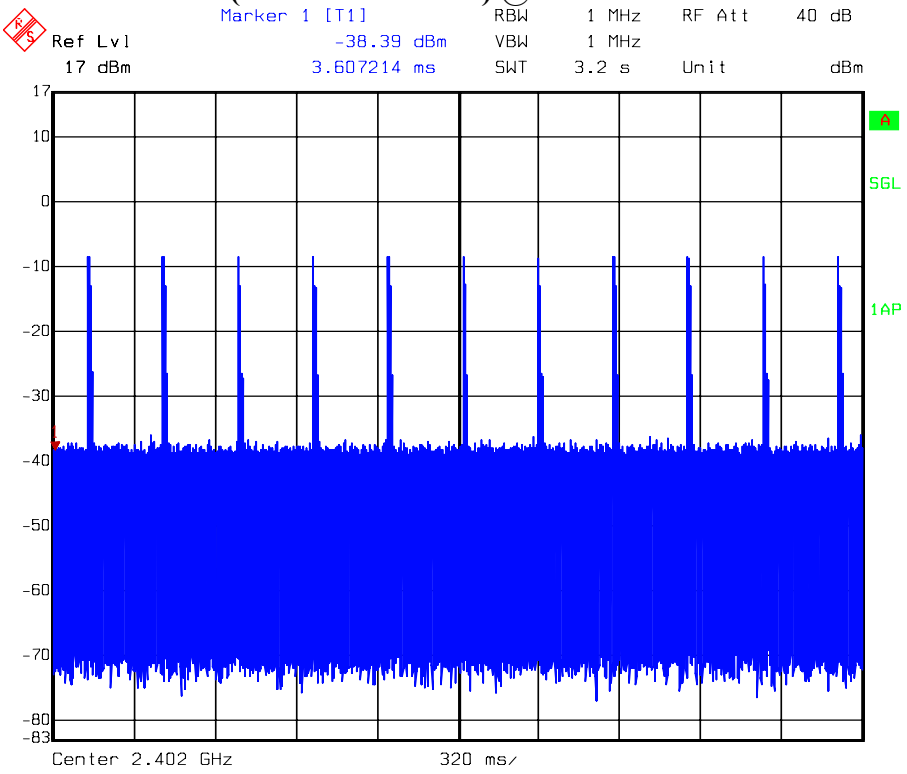
Dwell time (Number of pulse during time period) @ π/4-DPSK mode DH 3



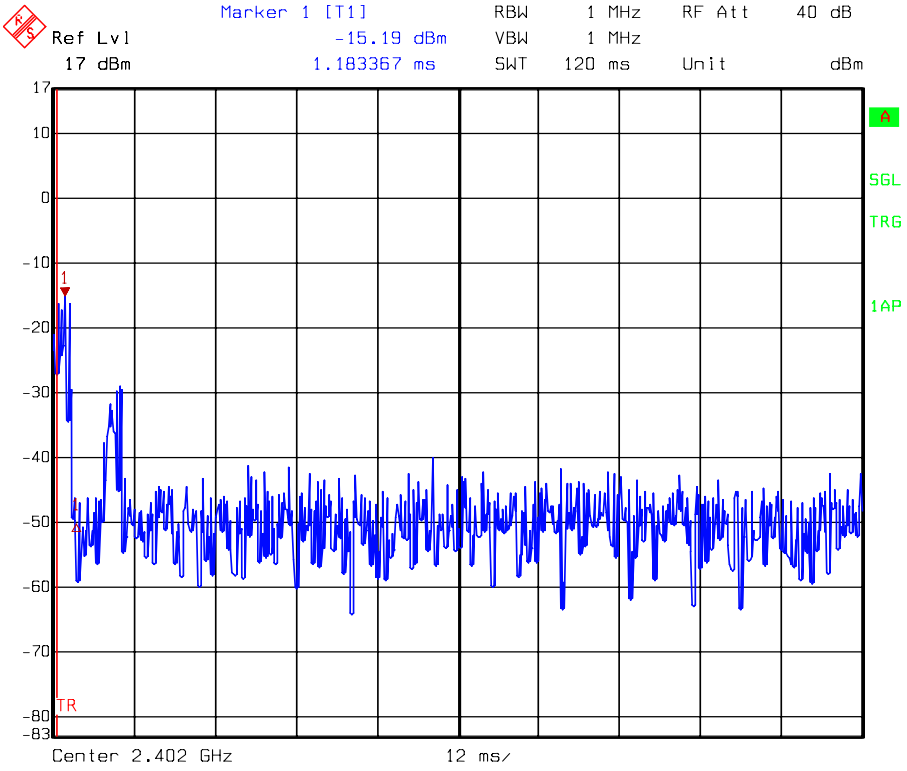
Dwell time (Pulse time) @ π/4-DPSK mode DH 5



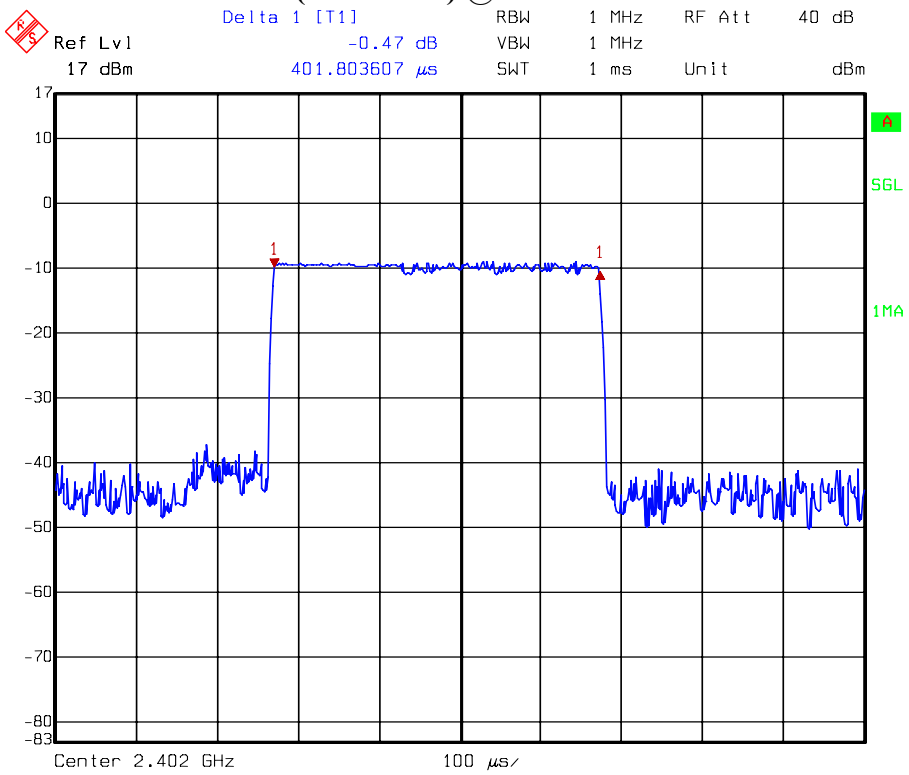
Dwell time (Number of Pulses) @ π/4-DPSK mode DH 5



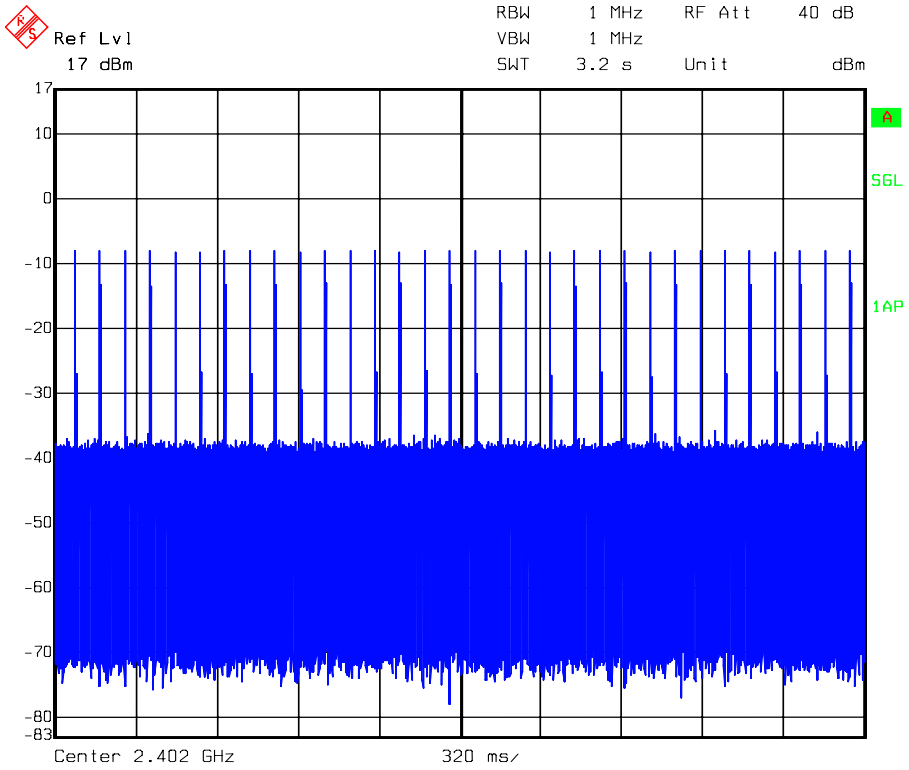
Dwell time (Number of pulse during time period) @ π/4-DPSK mode DH 5



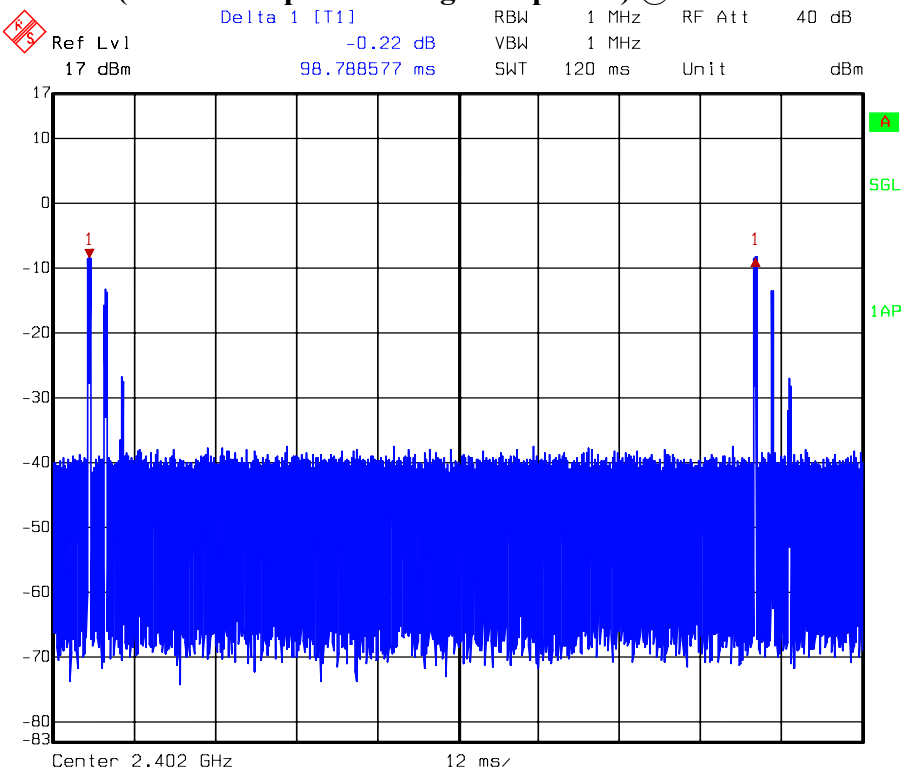
Dwell time (Pulse time) @ 8-DPSK mode DH 1



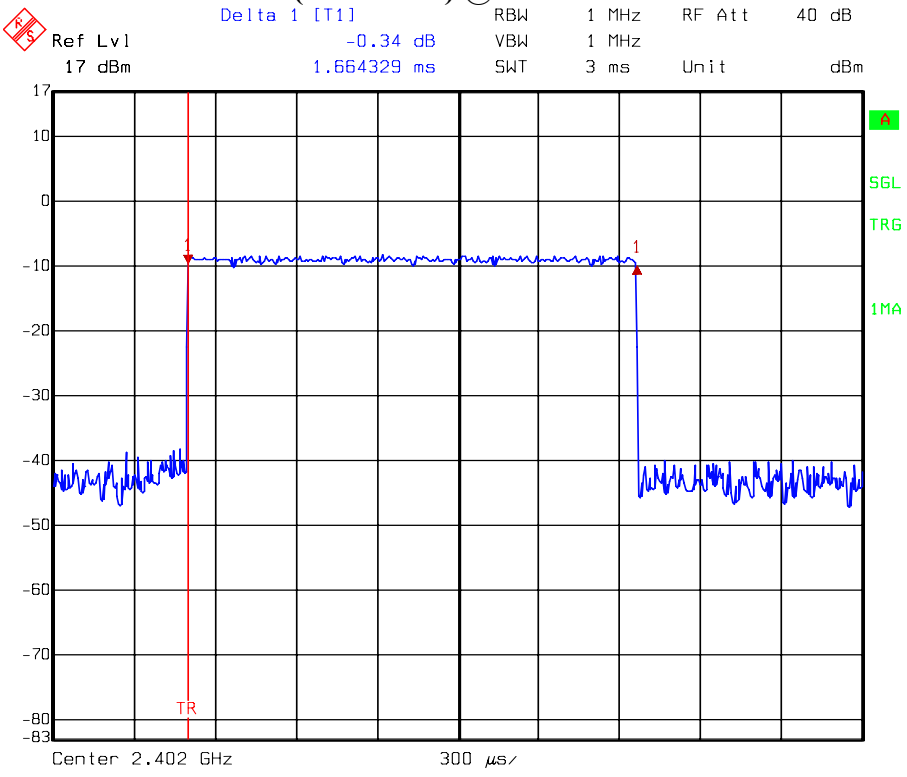
Dwell time (Number of Pulses) @ 8-DPSK mode DH 1



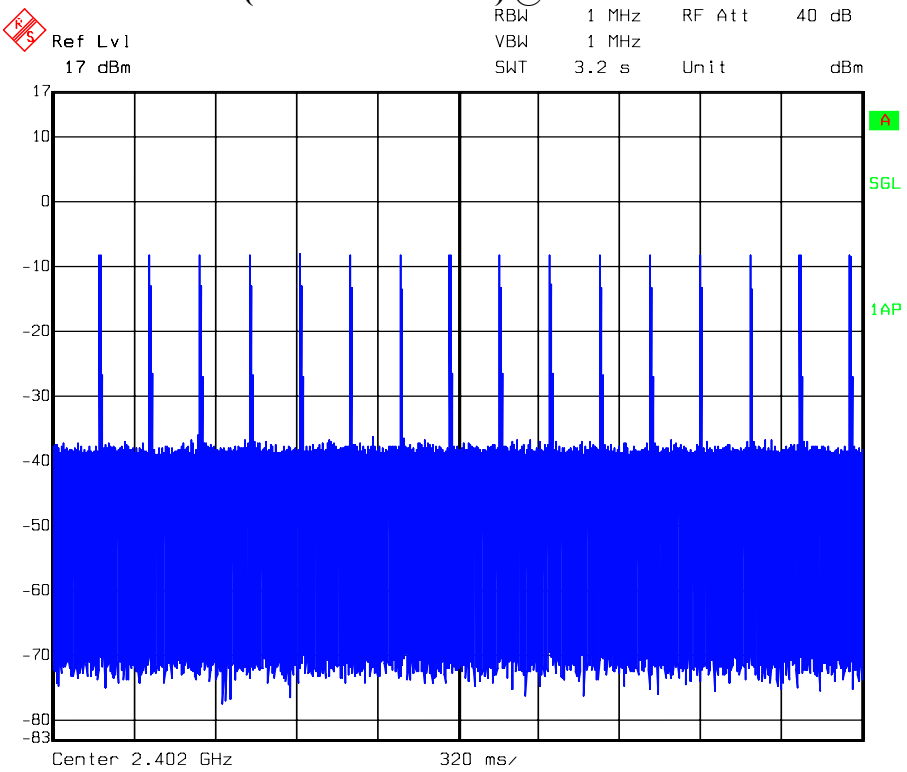
Dwell time (Number of pulse during time period) @ 8-DPSK mode DH 1



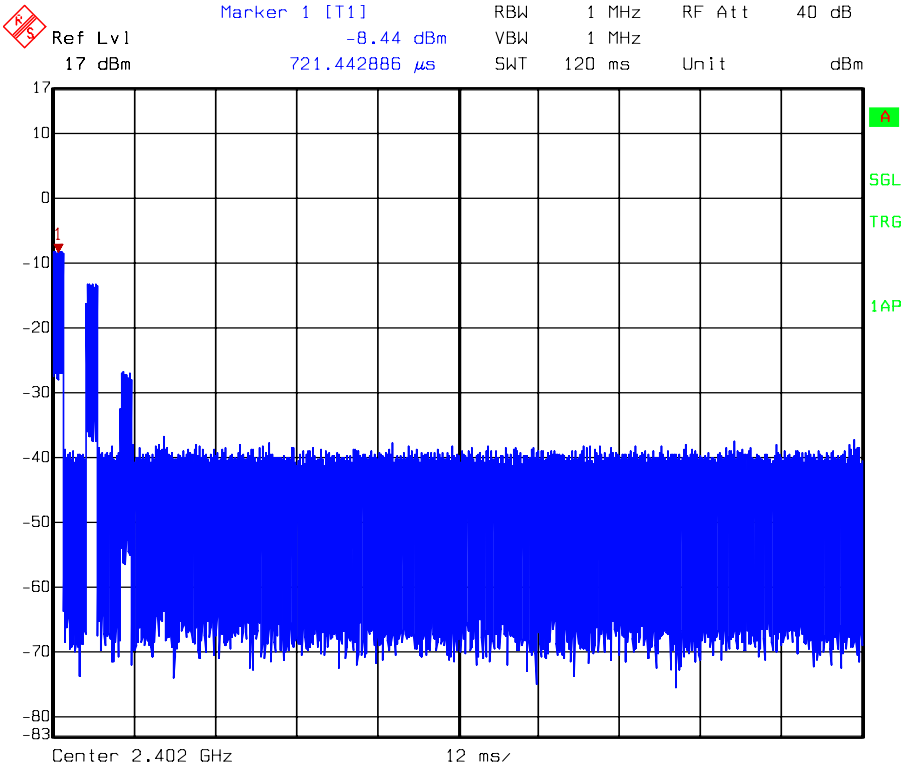
Dwell time (Pulse time) @ 8-DPSK mode DH 3



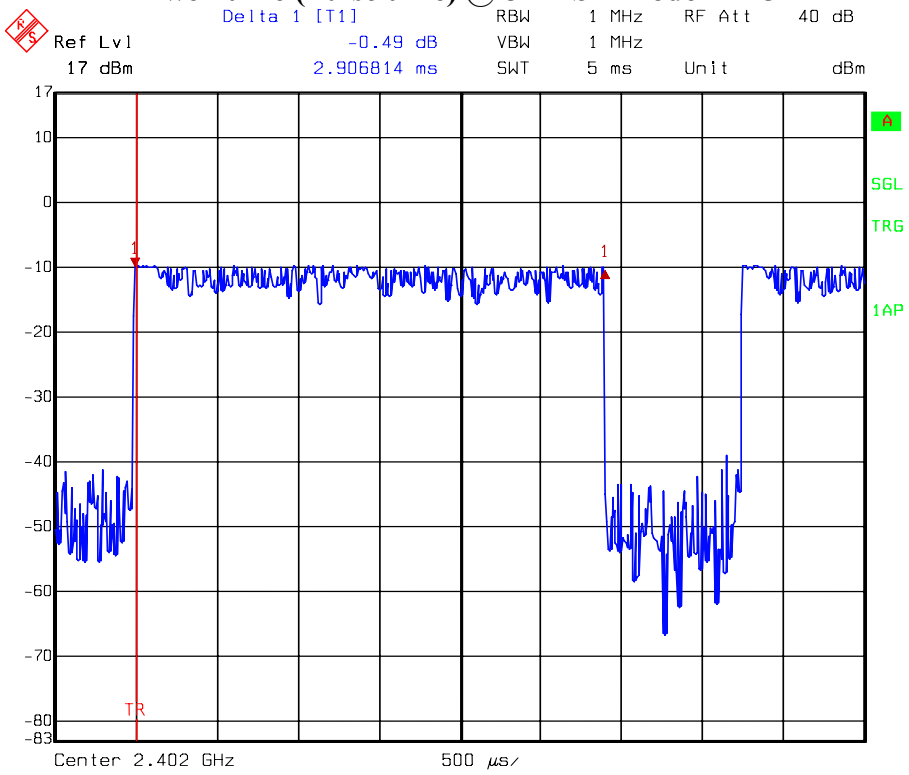
Dwell time (Number of Pulses) @ 8-DPSK mode DH 3



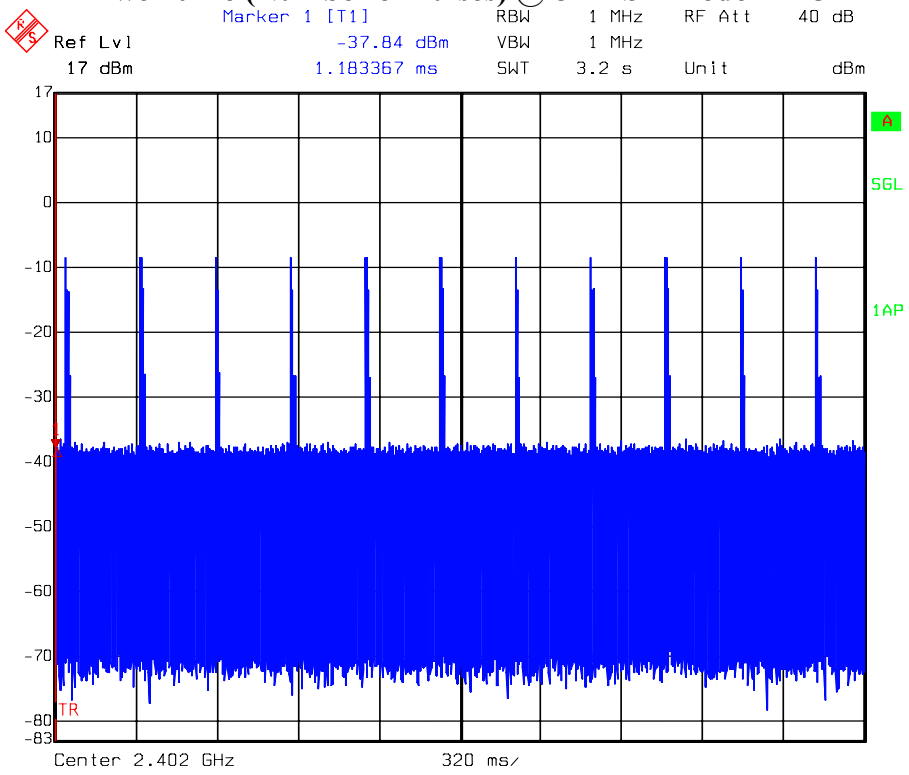
Dwell time (Number of pulse during time period) @ 8-DPSK mode DH 3



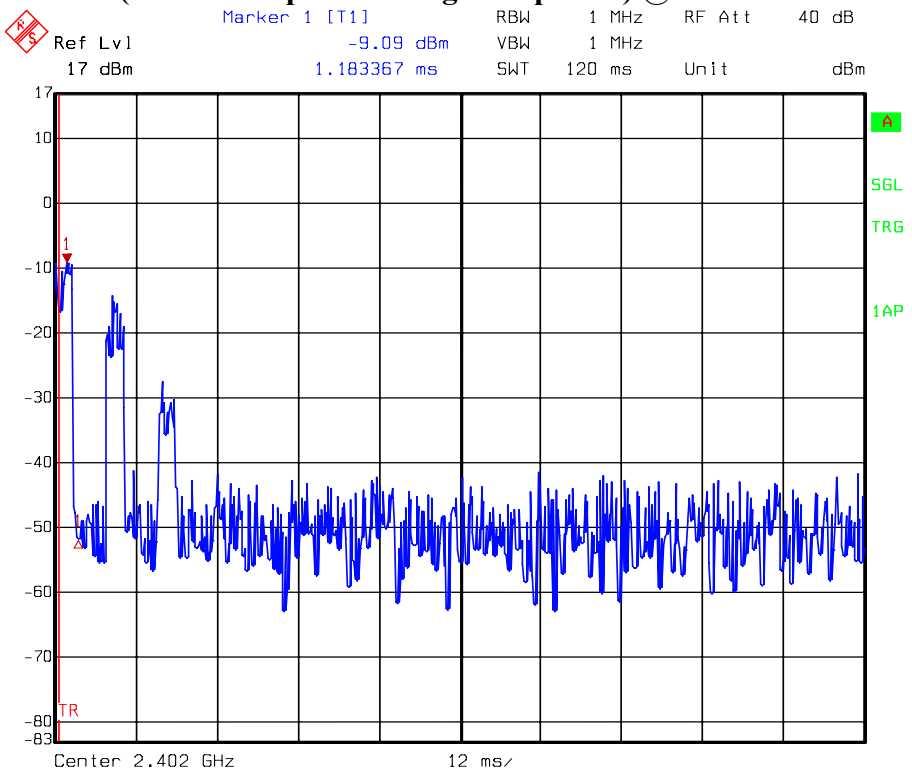
Dwell time (Pulse time) @ 8-DPSK mode DH 5



Dwell time (Number of Pulses) @ 8-DPSK mode DH 5



Dwell time (Number of pulse during time period) @ 8-DPSK mode DH 5



7. Maximum Output Power test

7.1 Operating environment

Temperature: 24 ℃
Relative Humidity: 55 %
Atmospheric Pressure: 1008 hPa

7.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.
The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (2 dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

7.3 Measured data of Maximum Output Power test results

Mode	Channel	Frequency	Output Power (dBm)		Total Power (mW)	Limit	Margin
		(MHz)	(PK)	(AV)	(PK)	(dBm)	(dB)
GFSK	0	2402	13.03	12.83	20.09	30	-16.97
	39	2441	13.12	12.87	20.51	30	-16.88
	78	2480	12.62	12.08	18.28	30	-17.38
π/4-DPSK	0	2402	12.61	12.22	18.24	30	-17.39
	39	2441	13.17	11.48	20.75	30	-16.83
	78	2480	12.75	10.85	18.84	30	-17.25
8-DPSK	0	2402	13.20	11.16	20.89	30	-16.80
	39	2441	12.66	10.45	18.45	30	-17.34
	78	2480	12.22	10.37	16.67	30	-17.78

8. RF Antenna Conducted Spurious test

8.1 Operating environment

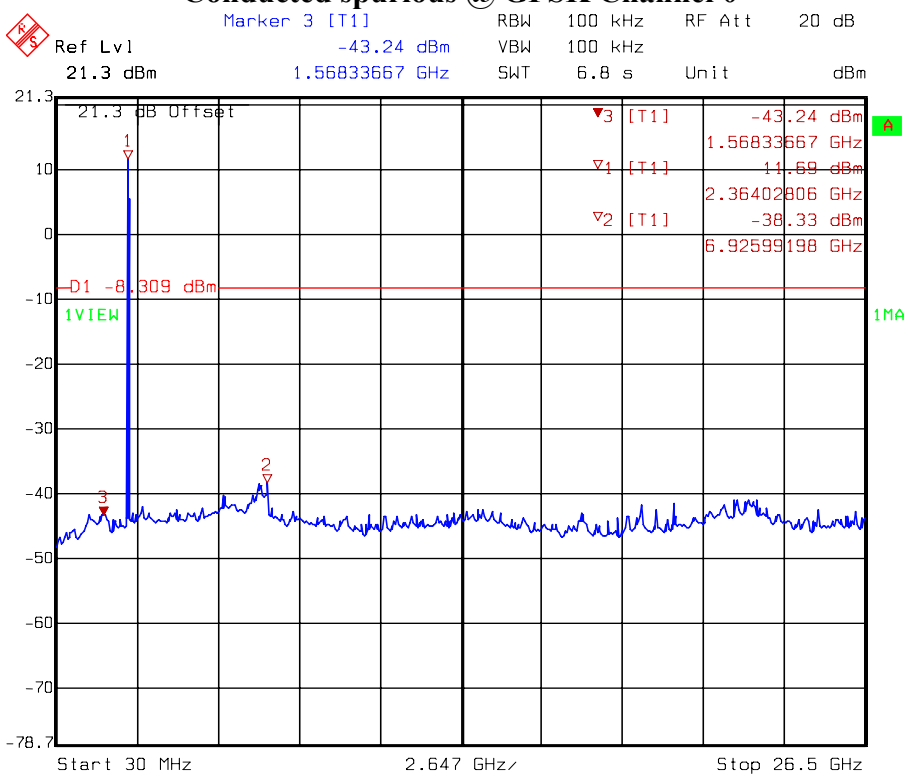
Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

8.2 Test setup & procedure

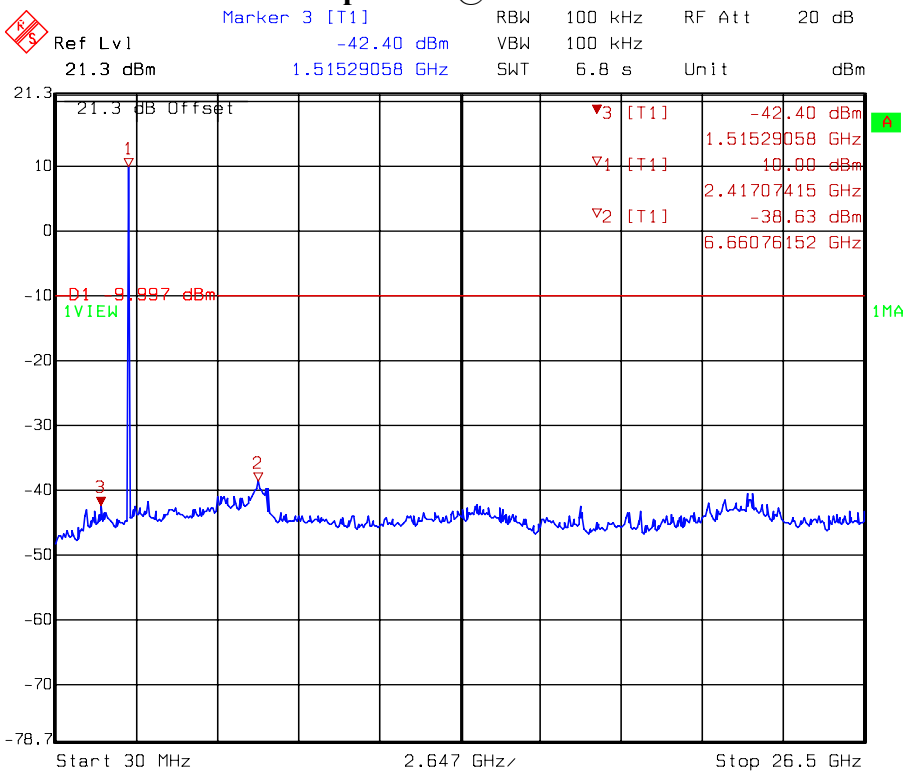
The test procedure was according to FCC measurement guidelines DA 00-705.
The measurements were performed from 30MHz to 25GHz RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz.
Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

8.3 Measured data of the highest RF Antenna Conducted Spurious test result

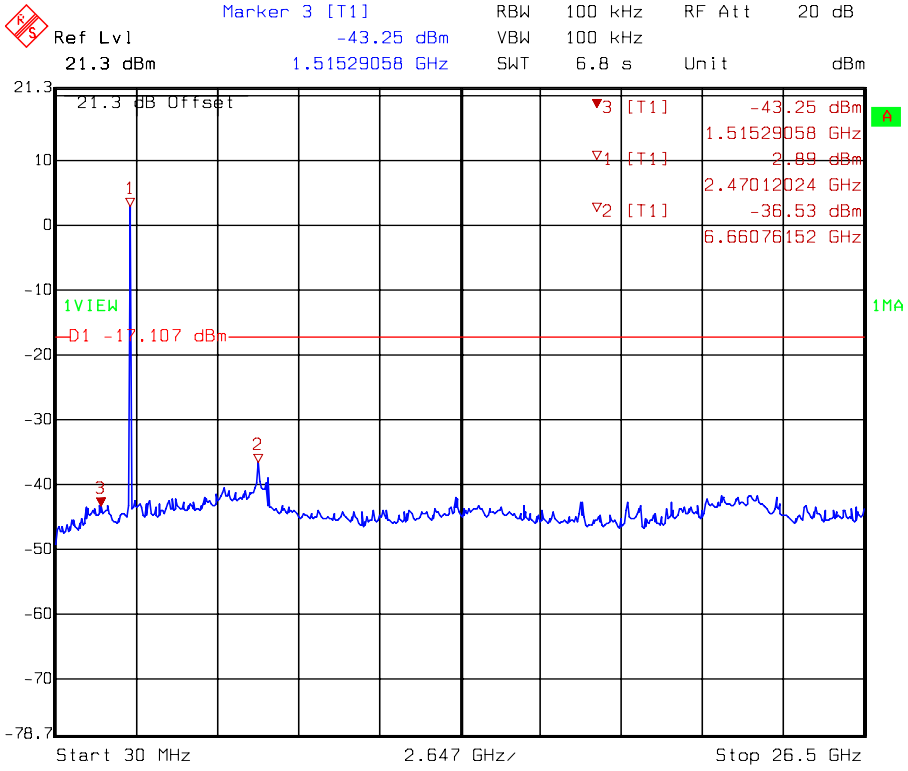
Conducted spurious @ GFSK Channel 0



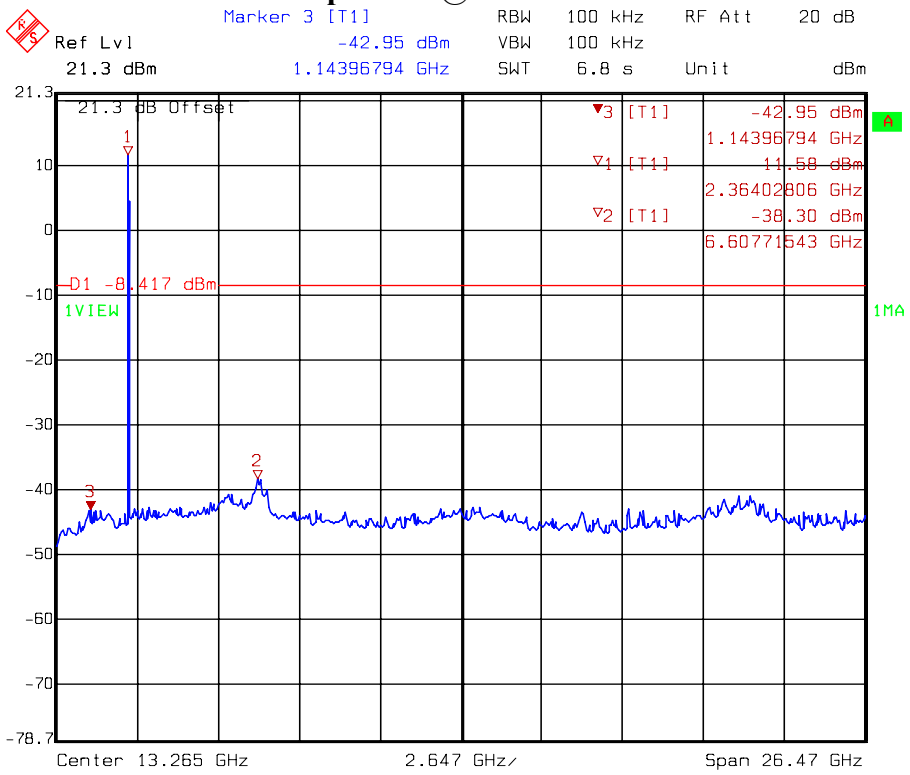
Conducted spurious @ GFSK Channel 39



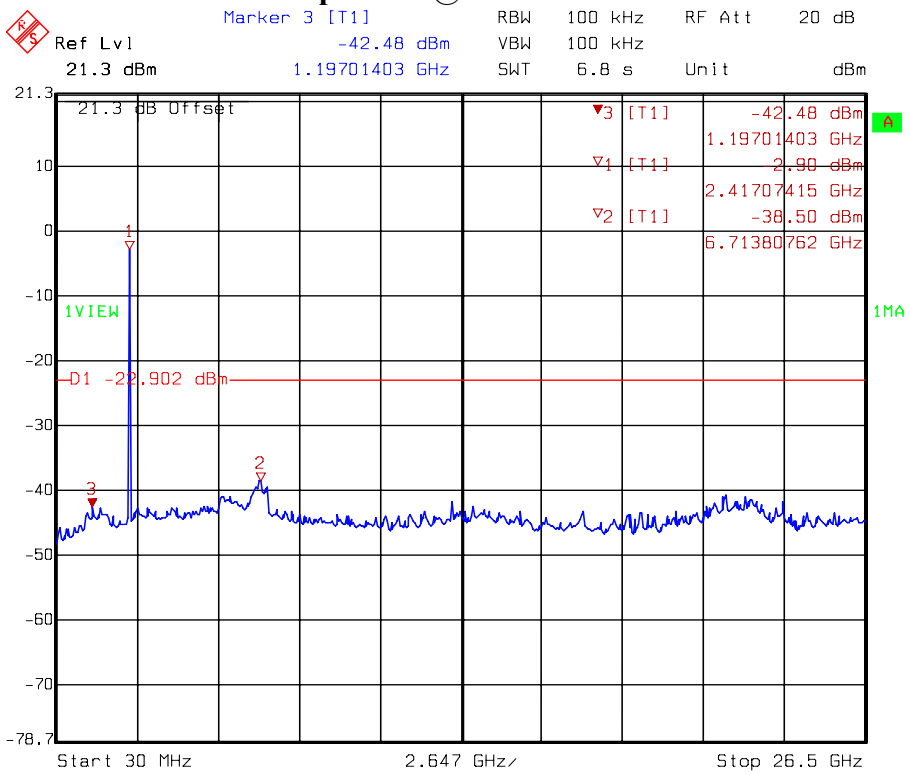
Conducted spurious @ GFSK Channel 78



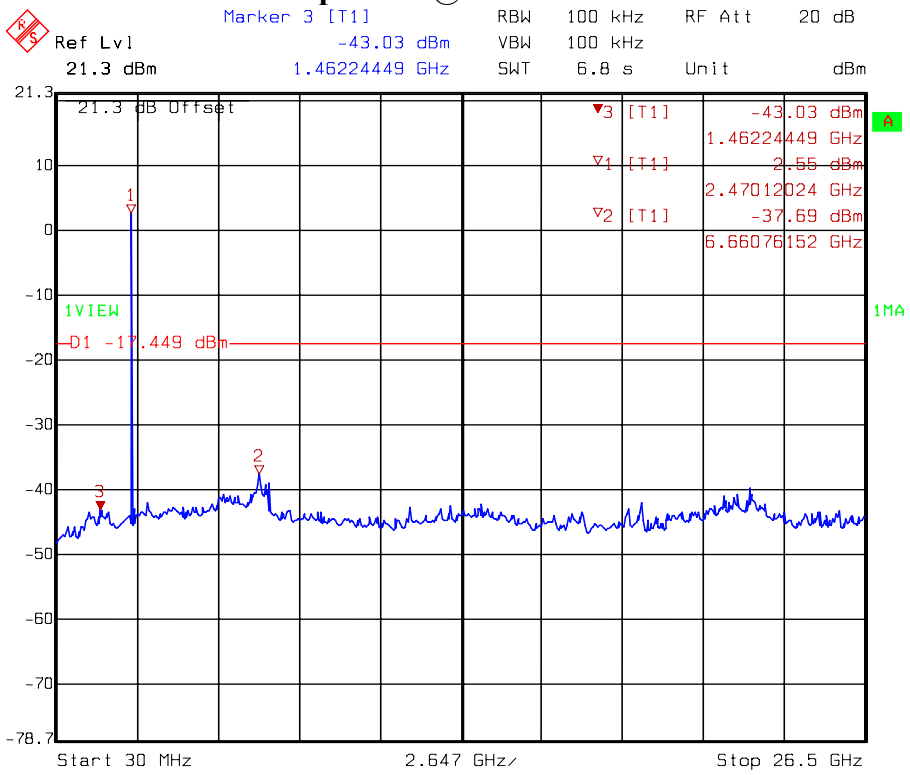
Conducted spurious @ π/4-DPSK Channel 0



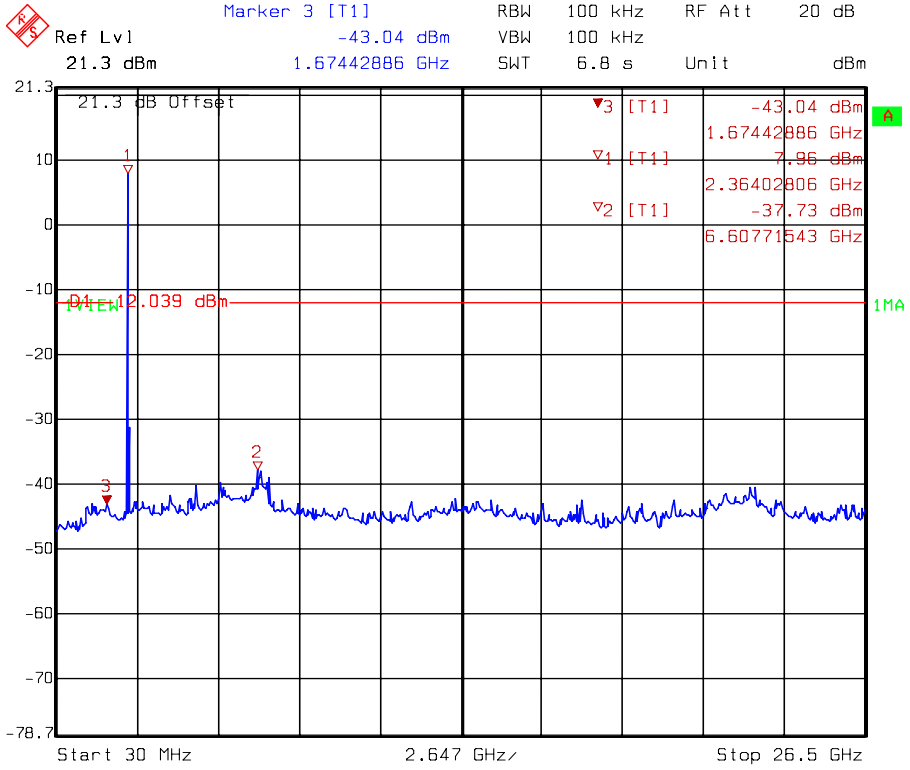
Conducted spurious @ π/4-DPSK Channel 39



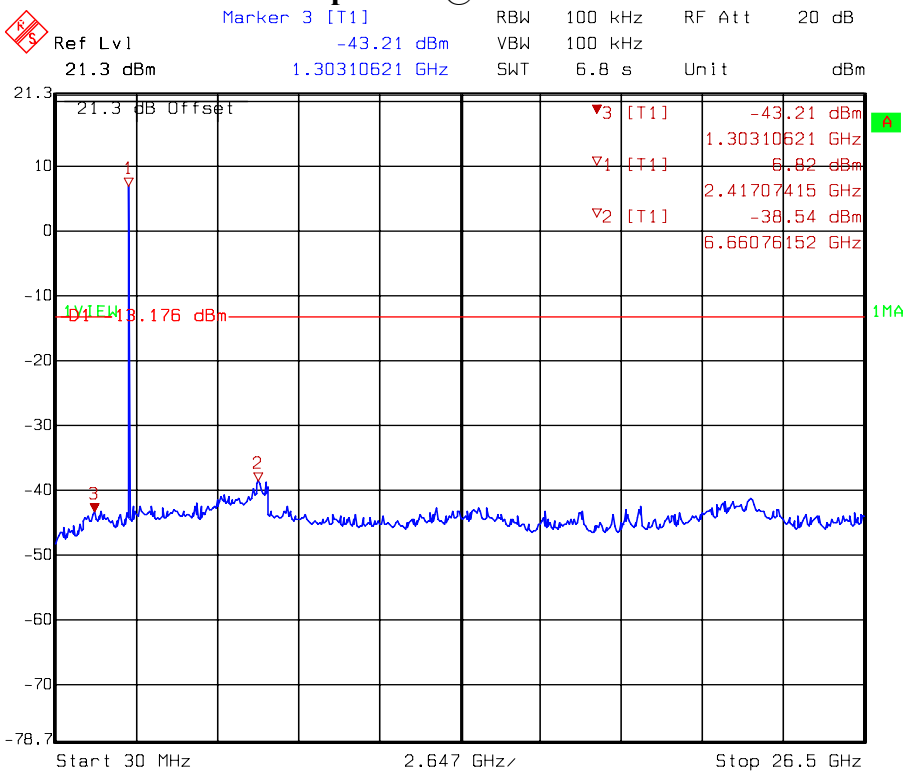
Conducted spurious @ π/4-DPSK Channel 78



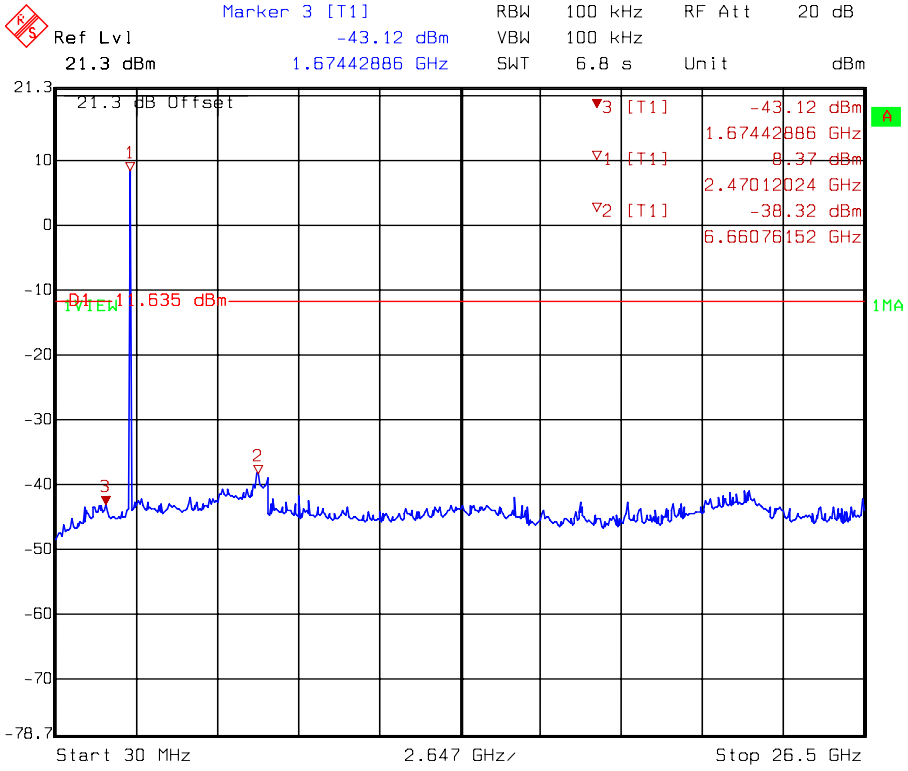
Conducted spurious @ 8-DPSK Channel 0



Conducted spurious @ 8-DPSK Channel 39



Conducted spurious @ 8-DPSK Channel 78



9. Radiated Emission test

9.1 Operating environment

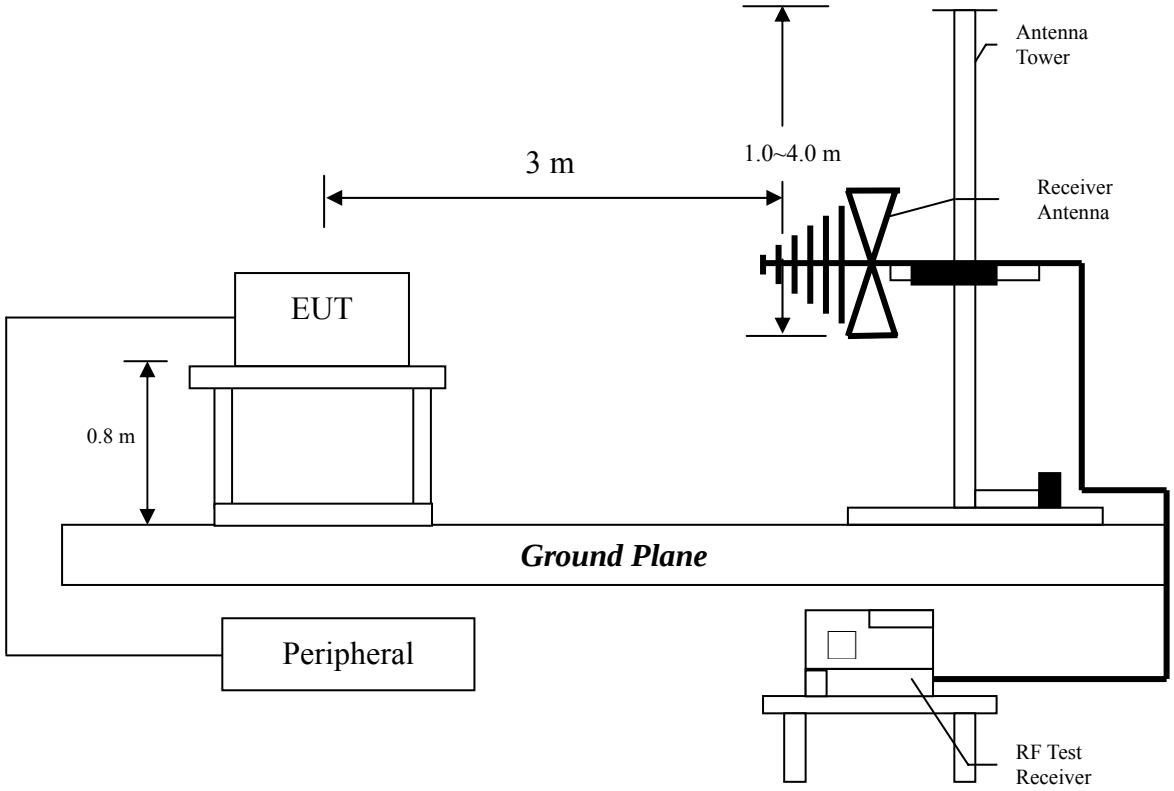
Temperature:	23	℃
Relative Humidity:	53	%
Atmospheric Pressure:	1008	hPa

9.2 Test setup & procedure

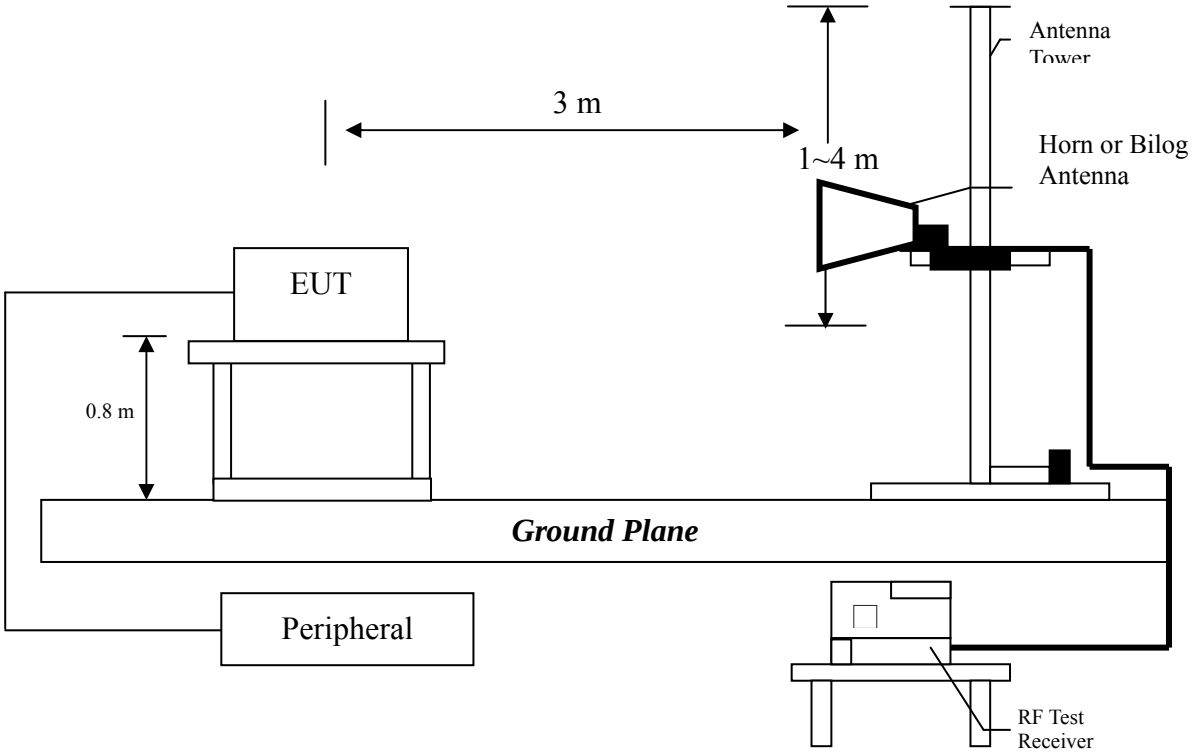
The test procedure was according to FCC measurement guidelines DA 00-705 and ANSI C63.4/2003.

The Diagram below shows the test setup, which is utilized to make these measurements.

The frequency spectrum from 30MHz to 1000MHz was investigated.



The frequency spectrum from over 1GHz was investigated.



The signal is maximized through rotation and placement in the three orthogonal axes.
Radiated emission measurements were performed from 26 MHz to 25 GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1 GHz, 1MHz – for frequencies above 1 GHz.
The EUT for testing is arranged on a fiberglass turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

9.3 Emission limits

The spurious Emission shall test through the 10th harmonic. 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).

Frequency (MHz)	Limits (dBμV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and theclosed point of any part of the device or system

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	±5.056 dB

9.4 Radiated spurious emission test data

9.4.1 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under GFSK, π/4-DPSK and 8-DPSK mode. The worst case occurred at GFSK mode at Channel 39.

EUT : 3000
Worst Case : GFSK mode at Channel 39

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	179.38	QP	14.96	25.45	40.40	43.50	-3.10
V	295.78	QP	13.95	19.73	33.68	46.00	-12.32
V	402.48	QP	16.47	18.66	35.13	46.00	-10.87
V	474.26	QP	17.68	19.60	37.28	46.00	-8.72
V	495.60	QP	18.43	17.67	36.09	46.00	-9.91
V	635.28	QP	21.53	17.63	39.16	46.00	-6.84
H	179.38	QP	13.48	25.15	38.62	43.50	-4.88
H	297.72	QP	14.17	22.09	36.25	46.00	-9.75
H	328.76	QP	14.40	18.16	32.55	46.00	-13.45
H	365.62	QP	15.48	19.20	34.67	46.00	-11.33
H	449.04	QP	18.12	17.35	35.47	46.00	-10.53
H	602.30	QP	20.88	18.40	39.27	46.00	-6.73

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

9.4.2 Measurement results: frequency above 1GHz

EUT : 3000
Test Condition : GFSK mode at channel 0

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4804	PK	V	35.1	38.54	69.44	-	72.88	74	-1.12
4804	AV	V	35.1	38.54	69.44	-30.75	42.13	74	-11.87
7206	PK	V	33.0	44.60	47.21	-	58.81	54	-15.19
7206	AV	V	33.0	44.60	47.21	-30.75	28.06	74	-25.94
9608	PK	V	32.7	49.30	40.63	-	57.23	54	-16.77
9608	AV	V	32.7	49.30	40.63	-30.75	26.48	74	-27.52
4804	PK	H	35.1	38.54	64.03	-	67.47	54	-6.53
4804	AV	H	35.1	38.54	64.03	-30.75	36.72	74	-17.28
7206	PK	H	33.0	44.60	41.78	-	53.38	54	-20.62
7206	AV	H	33.0	44.60	41.78	-30.75	22.63	74	-31.37
9608	PK	H	32.7	49.30	34.01		50.61	54	-23.39
9608	AV	H	32.7	49.30	34.01	-30.75	19.86	74	-34.14

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : GFSK mode at channel 39

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4882	PK	V	35.1	38.54	68.70	-	72.14	74	-1.86
4882	AV	V	35.1	38.54	68.70	-30.75	41.39	54	-12.61
7323	PK	V	33.0	44.6	47.03	-	58.63	74	-15.37
7323	AV	V	33.0	44.6	47.03	-30.75	27.88	54	-26.12
9764	PK	V	32.7	49.3	45.65	-	62.25	74	-11.75
9764	AV	V	32.7	49.3	45.65	-30.75	31.50	54	-22.50
4882	PK	H	35.1	38.54	66.47	-	69.91	74	-4.09
4882	AV	H	35.1	38.54	66.47	-30.75	39.16	54	-14.84
7323	PK	H	33.0	44.6	46.40	-	58.00	74	-16.00
7323	AV	H	33.0	44.6	46.40	-30.75	27.25	54	-26.75
9764	PK	H	32.7	49.3	42.43	-	59.03	74	-14.97
9764	AV	H	32.7	49.3	42.43	-30.75	28.28	54	-25.72

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : GFSK mode at channel 78

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4960	PK	V	35.1	38.54	62.34	-	65.78	74	-8.22
4960	AV	V	35.1	38.54	62.34	-30.75	35.03	54	-18.97
7440	PK	V	33.0	44.60	49.83	-	61.43	74	-12.57
7440	AV	V	33.0	44.60	49.83	-30.75	30.68	54	-23.32
9920	PK	V	32.7	49.30	45.13	-	61.73	74	-12.27
9920	AV	V	32.7	49.30	45.13	-30.75	30.98	54	-23.02
4960	PK	H	35.1	38.54	62.68	-	66.12	74	-7.88
4960	AV	H	35.1	38.54	62.68	-30.75	35.37	54	-18.63
7440	PK	H	33.0	44.60	48.32	-	59.92	74	-14.08
7440	AV	H	33.0	44.60	48.32	-30.75	29.17	54	-24.83
9920	PK	H	32.7	49.30	42.18	-	58.78	74	-15.22
9920	AV	H	32.7	49.30	42.18	-30.75	28.03	54	-25.97

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : π/4-DPSK mode at channel 0

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4804	PK	V	35.1	38.54	68.18	-	71.62	74	-2.38
4804	AV	V	35.1	38.54	68.18	-30.73	40.89	54	-13.11
7206	PK	V	33.0	44.60	42.65	-	54.25	74	-19.75
7206	AV	V	33.0	44.60	42.65	-30.73	23.52	54	-30.48
9608	PK	V	32.7	49.30	42.07	-	58.67	74	-15.33
9608	AV	V	32.7	49.30	42.07	-30.73	27.94	54	-26.06
4804	PK	H	35.1	38.54	62.95	-	66.39	74	-7.61
4804	AV	H	35.1	38.54	62.95	-30.73	35.66	54	-18.34
7206	PK	H	33.0	44.60	44.01	-	55.61	74	-18.39
7206	AV	H	33.0	44.60	44.01	-30.73	24.88	54	-29.12
9608	PK	H	32.7	49.30	35.19	-	51.79	74	-22.21
9608	AV	H	32.7	49.30	35.19	-30.73	21.06	54	-32.94

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : π/4-DPSK mode at channel 39

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4882	PK	V	35.1	38.54	67.79	-	71.23	74	-2.77
4882	AV	V	35.1	38.54	67.79	-30.73	40.50	54	-13.50
7323	PK	V	33.0	44.60	47.30	-	58.90	74	-15.10
7323	AV	V	33.0	44.60	47.30	-30.73	28.17	54	-25.83
9764	PK	V	32.7	49.30	47.76	-	64.36	74	-9.64
9764	AV	V	32.7	49.30	47.76	-30.73	33.63	54	-20.37
4882	PK	H	35.1	38.54	65.97	-	69.41	74	-4.59
4882	AV	H	35.1	38.54	65.97	-30.73	38.68	54	-15.32
7323	PK	H	33.0	44.60	47.11	-	58.71	74	-15.29
7323	AV	H	33.0	44.60	47.11	-30.73	27.98	54	-26.02
9764	PK	H	32.7	49.30	42.56	-	59.16	74	-14.84
9764	AV	H	32.7	49.30	42.56	-30.73	28.43	54	-25.57

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : π/4-DPSK mode at channel 78

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4960	PK	V	35.1	38.54	61.75	-	65.19	74	-8.81
4960	AV	V	35.1	38.54	61.75	-30.73	34.46	54	-19.54
7440	PK	V	33.0	44.60	46.73	-	58.33	74	-15.67
7440	AV	V	33.0	44.60	46.73	-30.73	27.60	54	-26.40
9920	PK	V	32.7	49.30	44.83	-	61.43	74	-12.57
9920	AV	V	32.7	49.30	44.83	-30.73	30.70	54	-23.30
4960	PK	H	35.1	38.54	61.16	-	64.60	74	-9.40
4960	AV	H	35.1	38.54	61.16	-30.73	33.87	54	-20.13
7440	PK	H	33.0	44.60	46.15	-	57.75	74	-16.25
7440	AV	H	33.0	44.60	46.15	-30.73	27.02	54	-26.98
9920	PK	H	32.7	49.30	39.65	-	56.25	74	-17.75
9920	AV	H	32.7	49.30	39.65	-30.73	25.52	54	-28.48

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : 8-DPSK mode at channel 0

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4804	PK	V	35.1	38.54	66.83	-	70.27	74	-3.73
4804	AV	V	35.1	38.54	66.83	-30.73	39.54	54	-14.46
7206	PK	V	33.0	44.60	44.81	-	56.41	74	-17.59
7206	AV	V	33.0	44.60	44.81	-30.73	25.68	54	-28.32
9608	PK	V	32.7	49.30	41.67	-	58.27	74	-15.73
9608	AV	V	32.7	49.30	41.67	-30.73	27.54	54	-26.46
4804	PK	H	35.1	38.54	63.63	-	67.07	74	-6.93
4804	AV	H	35.1	38.54	63.63	-30.73	36.34	54	-17.66
7206	PK	H	33.0	44.60	43.80	-	55.40	74	-18.60
7206	AV	H	33.0	44.60	43.80	-30.73	24.67	54	-29.33
9608	PK	H	32.7	49.30	36.14	-	52.74	74	-21.26
9608	AV	H	32.7	49.30	36.14	-30.73	22.01	54	-31.99

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : 8-DPSK mode at channel 39

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4882	PK	V	35.1	38.54	66.69		70.13	74	-3.87
4882	AV	V	35.1	38.54	66.69	-30.73	39.40	54	-14.60
7323	PK	V	33.0	44.60	49.36		60.96	74	-13.04
7323	AV	V	33.0	44.60	49.36	-30.73	30.23	54	-23.77
9764	PK	V	32.7	49.30	43.33		59.93	74	-14.07
9764	AV	V	32.7	49.30	43.33	-30.73	29.20	54	-24.80
4882	PK	H	35.1	38.54	65.22		68.66	74	-5.34
4882	AV	H	35.1	38.54	65.22	-30.73	37.93	54	-16.07
7323	PK	H	33.0	44.60	46.54		58.14	74	-15.86
7323	AV	H	33.0	44.60	46.54	-30.73	27.41	54	-26.59
9764	PK	H	32.7	49.30	39.74		56.34	74	-17.66
9764	AV	H	32.7	49.30	39.74	-30.73	25.61	54	-28.39

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

EUT : 3000
Test Condition : 8-DPSK mode at channel 78

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4960	PK	V	35.1	38.54	61.91	-	65.35	74	-8.65
4960	AV	V	35.1	38.54	61.91	-30.73	34.62	54	-19.38
7440	PK	V	33.0	44.60	46.25	-	57.85	74	-16.15
7440	AV	V	33.0	44.60	46.25	-30.73	27.12	54	-26.88
9920	PK	V	32.7	49.30	46.66	-	63.26	74	-10.74
9920	AV	V	32.7	49.30	46.66	-30.73	32.53	54	-21.47
4960	PK	H	35.1	38.54	61.81	-	65.25	74	-8.75
4960	AV	H	35.1	38.54	61.81	-30.73	34.52	54	-19.48
7440	PK	H	33.0	44.60	47.43	-	59.03	74	-14.97
7440	AV	H	33.0	44.60	47.43	-30.73	28.30	54	-25.70
9920	PK	H	32.7	49.30	39.88	-	56.48	74	-17.52
9920	AV	H	32.7	49.30	39.88	-30.73	25.75	54	-28.25

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor + Duty Cycle Correction Factor
3. The frequency measured ranges from 1GHz to 25GHz.
4. Duty Cycle Correction Factor: Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

10. Emission on the band edge §FCC 15.247(d)

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.

10.1 Test setup & procedure

Please refer to the clause 9.2 of this report.

10.2 Test Result

GFSK Mode						
Channel	Measurement Freq. Band (MHz)	Detector	Average Factor (dB)	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (Low)	2310-2410	PK	-	59.39	74	-14.61
		AV	-30.75	28.64	54	-25.36
78 (High)	2475-2500	PK	-	68.84	74	-5.16
		AV	-30.75	38.09	54	-15.91

Remark: Duty Cycle Correction Factor = -30.75 dB
Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

π/4-DPSK Mode						
Channel	Measurement Freq. Band (MHz)	Detector	Average Factor (dB)	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (Low)	2310-2410	PK	-	58.63	74	-15.37
		AV	-30.73	27.90	54	-26.10
78 (High)	2475-2500	PK	-	72.33	74	-1.67
		AV	-30.73	41.60	54	-12.40

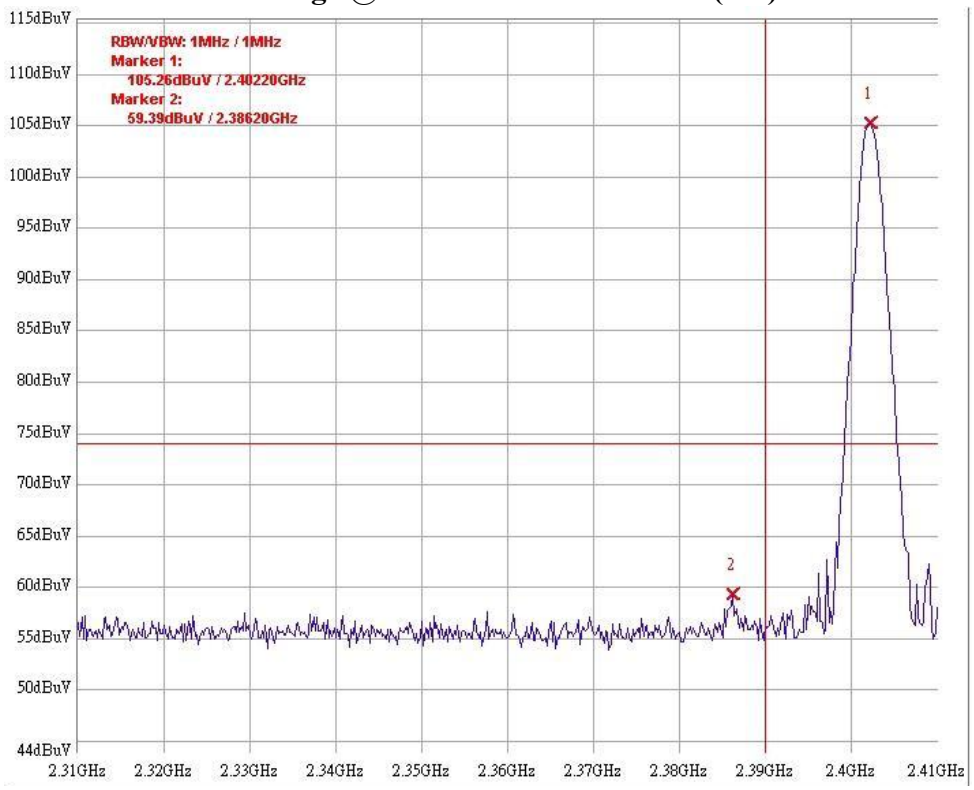
Remark: Duty Cycle Correction Factor = -30.73 dB
Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

8-DPSK Mode						
Channel	Measurement Freq. Band (MHz)	Detector	Average Factor (dB)	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (Low)	2310-2410	PK	-	59.11	74	-14.89
		AV	-30.73	28.38	54	-25.62
78 (High)	2475-2500	PK	-	71.84	74	-2.16
		AV	-30.73	41.11	54	-12.89

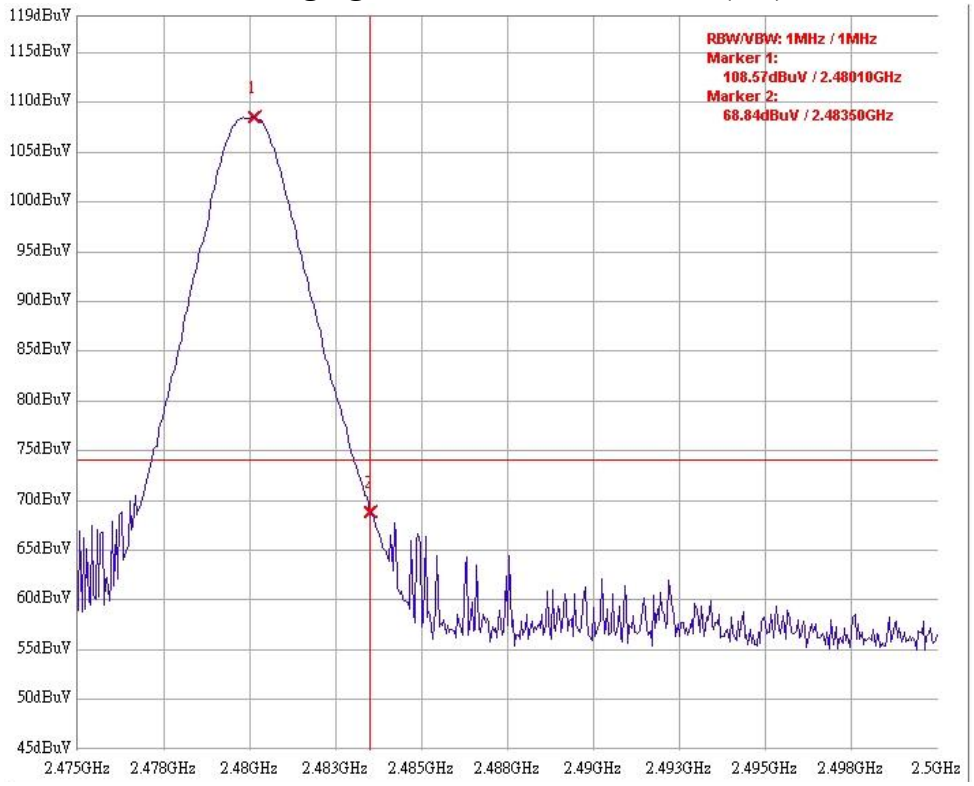
Remark: Duty Cycle Correction Factor = -30.73 dB
Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

Please see the plot below.

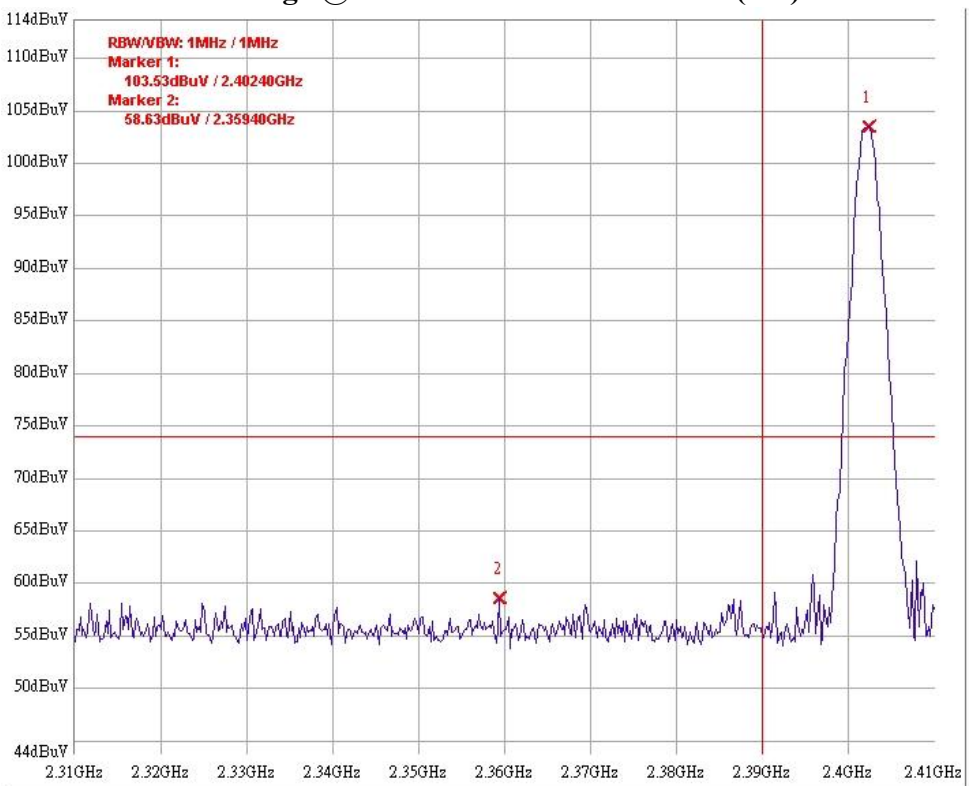
Band edge @ GFSK mode Channel 0 (PK)



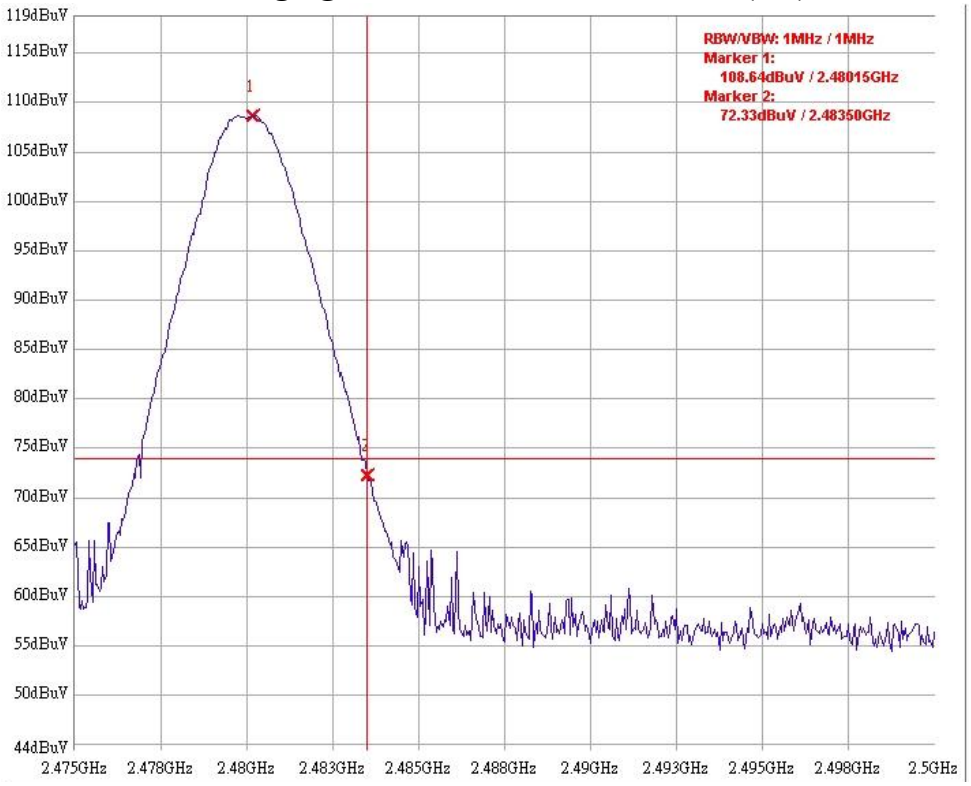
Band edge @ GFSK mode Channel 78 (PK)



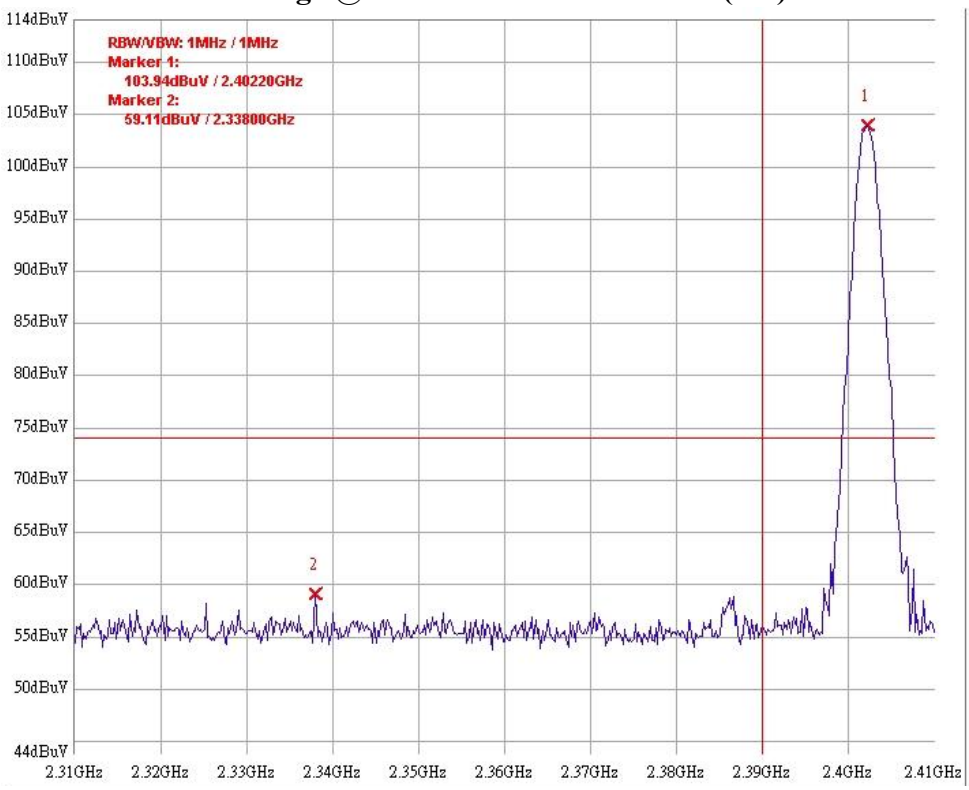
Band edge @ π/4-DPSK mode Channel 0 (PK)



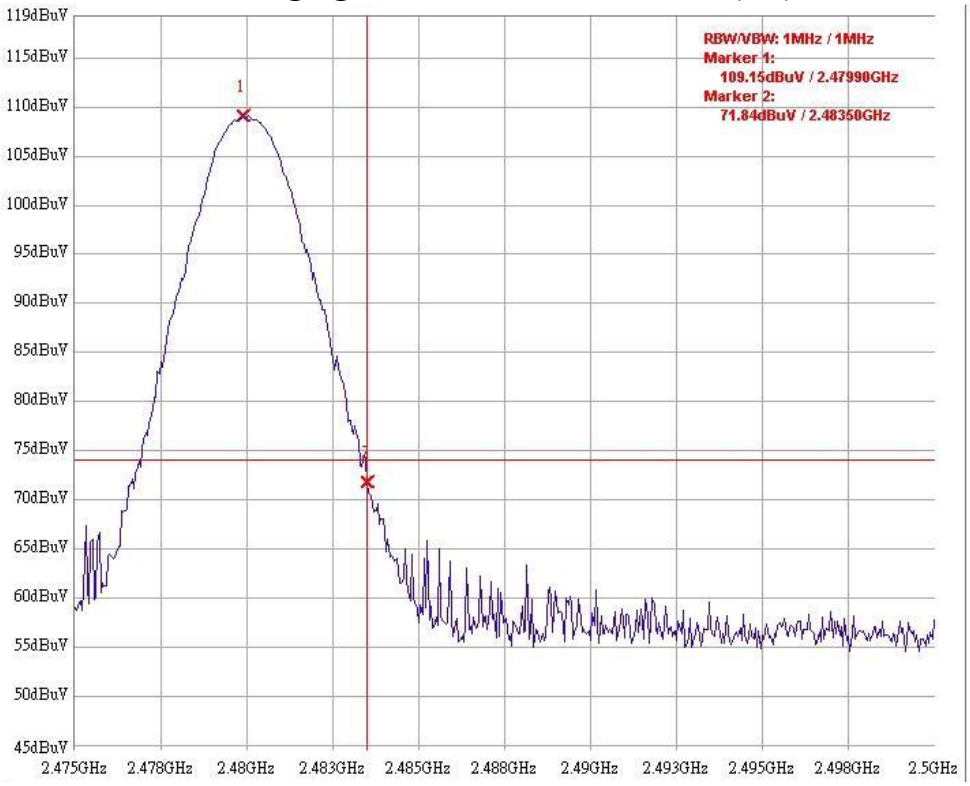
Band edge @ π/4-DPSK mode Channel 78 (PK)



Band edge @ 8-DPSK mode Channel 0 (PK)



Band edge @ 8-DPSK mode Channel 78 (PK)

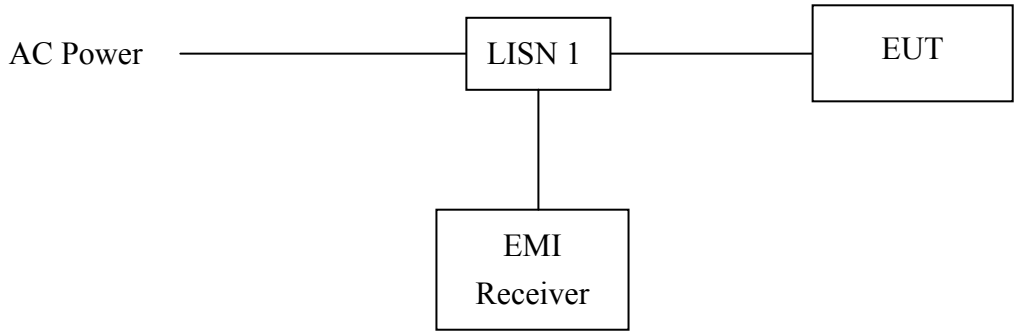


11. Power Line Conducted Emission test §FCC 15.207

11.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa

11.2 Test setup & procedure



The test procedure was according to ANSI C63.4/2003.

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50uH coupling impedance with 50 ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9 kHz.

The EUT configuration please refer to the "Conducted set-up photo.pdf".

11.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

11.4 Uncertainty of Conducted Emission

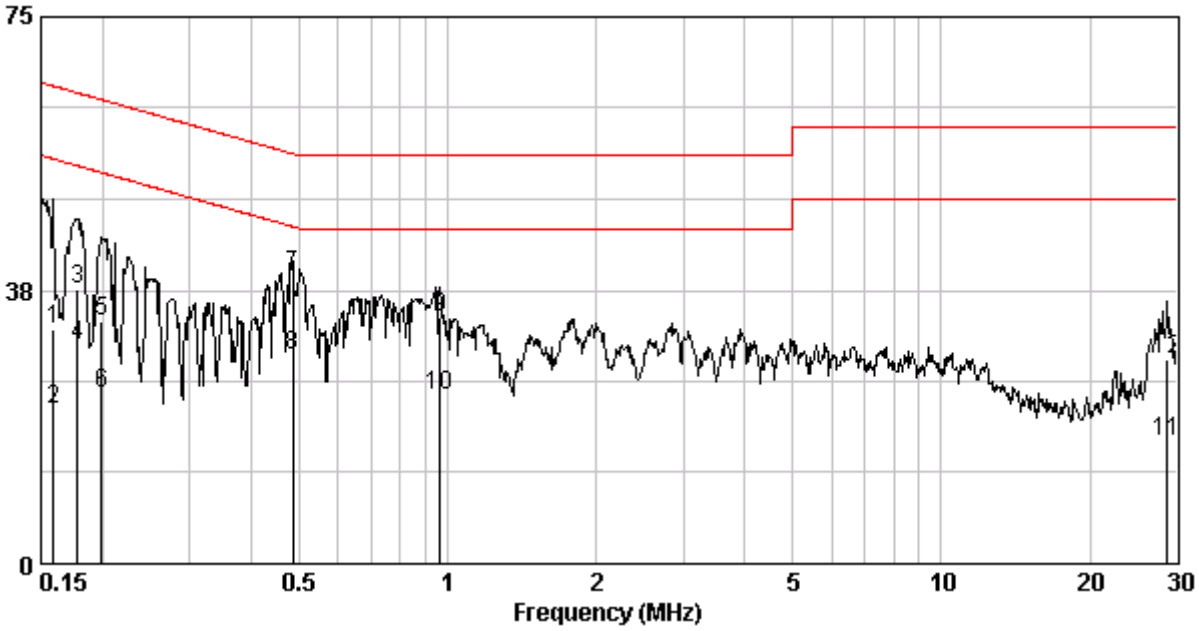
Expanded uncertainty (k=2) of conducted emission measurement is ±2.786 dB.

11.5 Power Line Conducted Emission test data

Phase: Line
Model No.: 3000
Operating mode: Charging mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.159	0.11	32.20	65.52	21.03	55.52	-33.32	-34.49
0.178	0.11	37.66	64.59	29.95	54.59	-26.93	-24.64
0.199	0.11	33.32	63.67	23.45	53.67	-30.35	-30.22
0.486	0.14	39.66	56.23	28.61	46.23	-16.57	-17.62
0.963	0.16	33.73	56.00	23.20	46.00	-22.27	-22.80
28.755	1.24	28.13	60.00	16.89	50.00	-31.87	-33.11

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: 3000
Operating mode: Charging mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.152	0.15	41.18	65.91	28.14	55.91	-24.73	-27.77
0.178	0.15	38.51	64.59	29.07	54.59	-26.08	-25.52
0.201	0.15	35.27	63.58	25.48	53.58	-28.31	-28.10
0.227	0.16	32.70	62.57	22.36	52.57	-29.87	-30.21
0.489	0.18	33.01	56.19	21.43	46.19	-23.18	-24.76
28.755	0.88	23.33	60.00	12.40	50.00	-36.67	-37.60

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)